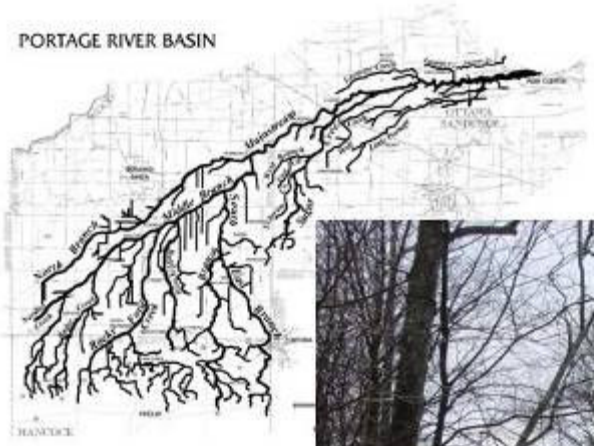
Portage River Watershed Plan

July, 2013



Hancock, Ottawa Sandusky Seneca and Wood Counties, Ohio

Prepared

In Collaboration with:

The TMACOG Portage River Basin Council

Toledo Metropolitan Area Council of Governments

300. Martin Luther King Jr., Drive Ste 300

P.O. Box 9508

Toledo, Ohio 43697-9508

Phone: 419-241-9155

www.tmacog.org

Contact Information

Portage River Watershed Coordinator
Kurt Erichsen, P.E.
kurt@tmacog.org
Toledo Metropolitan Area Council of Governments
(TMACOG)
300 Martin Luther King Jr. Drive, Ste 300
P.O. Box 9508
Toledo, Ohio 43604
Phone: (419) 241-9155
Fax: (419) 241-9116
www.tmacog.org

In Cooperation with:

Ohio DNR
Ohio EPA

Hancock County
Ottawa County
Sandusky County
Wood County

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Plan Endorsement

This plan was financed through a grant from the Ohio Department of Natural Resources (ODNR), Division of Soil and Water Resources, for the Ohio Watershed Coordinator Grant Program, in partnership with the Ohio Environmental Protection Agency (Ohio EPA) and the Toledo Metropolitan Area Council of Governments (TMACOG).

Development and completion of this watershed document is done in accordance with the Ohio EPA guidance and Appendix 8 – Outline of a Watershed Plan – for the overall purpose to restore and maintain the chemical, physical, and biological integrity of waterways within the Portage River watershed, an objective of the Clean Water Act of 1972.

The watershed plan document must be submitted to the State of Ohio agencies of the Ohio Department of Natural Resources and the Ohio Environmental Protection Agency for approval and endorsement.

Furthermore, local stakeholder approval and support of the Portage Watershed Plan is required to pursue implementation of water quality goals and objectives. Stakeholder support of water quality in the Portage watershed for future generations is indicated below.

Executive Summary

As established by the Clean Water Act, the waters of the United States must achieve water quality standards for fishable and swimmable waters under the guidelines of the United States Environmental Protection Agency.

To achieve water quality standards in the State of Ohio, the Ohio Environmental Protection Agency in partnership with the Ohio Department of Natural Resources provided funding for the Watershed Coordinator program. A Coordinators work is focused on a single watershed and its attainment of water quality in accordance to State of Ohio standards.

Between 2007 and 2013, the Portage River Watershed Coordinator in partnership with residents and members of the Portage River Basin Council, created the watershed plan to achieve water quality standards in the Portage. For the first time a comprehensive inventory was organized to identify the physical, chemical and biological health of the eighteen smaller watersheds of the river.

The entire Portage River basin includes 18 small watersheds also known as "14-digit HUCs." These 18 watersheds cover 581 square miles. The inventories result from local resident support, concern over current watershed issues and are areas having the greatest potential for restoration and protection.

All nine inventories claim several river miles of Full Attainment status indicating sections of high water quality. Because the Portage watershed is 86 percent agricultural land use – the river miles not reaching attainment status suffer from stormwater runoff of sediments and nutrients. Channelization of the river system is a residual of the 1846 Ohio Drainage laws to ditch and drain the Great Black Swamp of NW Ohio for settlement – thereby creating prime agricultural farmland and the largest economic base for Ohio.

Overall the watershed is good in many stream reaches, with some tributaries, especially smaller streams, impaired due to siltation, bacteria, nutrients, and/or loss of habitat. Watershed goals are designed to reduce water quality impairments while supporting agriculture, recreation, and the many benefits the river brings to the community. The plan recommends restoration projects and use of best management practices to address water quality impairments. Examples of impairments and restoration projects are given below.

	Example Restoration Project
High bacteria (*E. coli*) levels	Repair / replace malfunctioning or obsolete home sewage treatment systems (HSTSs) Extend public sewers to eliminate HSTSs Upgrade public sewerage systems Manure management practices to livestock runoff out of streams
Habitat alteration Sedimentation / siltation	Protect and restore floodplains Agricultural buffer strips between a farm field and the stream Riparian habitat along streams
Nutrient enrichment (nitrates, phosphates)	**Water Quality Impairment**
All	Educational workshops and programs on best management practices for land owners, public officials, and stakeholders

Implementation of projects related to public sewerage systems or household sewage treatment systems may be carried out under regulatory programs of county Health Departments or Ohio EPA. Projects related to agricultural practices or habitat should be implemented on a voluntary basis with the willing support of the property owner. This plan supports financial incentives to carry out these projects.

Restoring water quality impairments in the Portage River watersheds will protect public health by reducing pathogens in the river, improve the river's water quality, reduce nutrient loadings that result in toxic algae blooms in Lake Erie, enhance the river's natural beauty, and recreation along the Portage.

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Distribution List

The local political jurisdictions and organizations will be notified about the availability of the *Portage River Watershed Plan* by letter and provided with its address on the TMACOG website http://www.tmacog.org/prbc.htm. On request, copies of the plan will be provided on CD or paper.

City of Bowling Green
City of Fostoria
City of Port Clinton
Hancock County Commissioners
Hancock County Engineer
Hancock County Health Department
Hancock County Park District
Hancock County SWCD
Natural Resources Conservation Service
Northwestern Water & Sewer District
Ohio State University Extension
Ottawa County Commissioners
Ottawa County Engineer
Ottawa County Health Department
Ottawa County Park District
Ottawa County SWCD
Sandusky County Commissioners
Sandusky County Engineer
Sandusky County Health Department
Sandusky County Park District
Sandusky County SWCD
Seneca County Commissioners
Seneca County Engineer
Seneca County Health Department
Seneca County Park District
Seneca County SWCD

Village of Arcadia
Village of Bairdstown
Village of Bloomdale
Village of Bradner
Village of Cygnet
Village of Elmore
Village of Gibsonburg
Village of Hoytville
Village of Jerry City
Village of McComb
Village of North Baltimore
Village of Oak Harbor
Village of Pemberville
Village of Portage
Village of Risingsun
Village of Van Buren
Village of Wayne
Village of West Millgrove
Village of Woodville
Wood County Commissioners
Wood County Engineer
Wood County Health Department
Wood County Park District
Wood County SWCD

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Chapter One

1.1 Characteristics

The Portage River watershed is comprised of twelve major river branches or waterways that ultimately converge downstream to form into a single Mainstem of the Portage River. The final mainstem of the river begins at RM 35.41 at the Village of Pemberville, Wood County and ends at RM 0 at the mouth of the Portage as it empties into Lake Erie at the City of Port Clinton, Ottawa County.

The Portage River Mainstem is 60.6 river miles in length and drains a basin land area of 581 square miles. The seven major river branches that converge to create the mainstem are the North Branch, Middle Branch, South Branch, East Branch, Rocky Ford Creek, Needles Creek and Sugar Creek. The Portage River Estuarine Zone begins about RM 15.7 just after Sugar Creek converges with the Portage Mainstem as it flows into Lake Erie. The Portage River drains the land area of five northwest Ohio counties that include Hancock, Ottawa, Seneca, Sandusky, and Wood counties. Portions of 33 townships, 22 municipal areas and three county park districts govern land use and other activities in the watershed.

Figure 1: Ohio's 45 Watershed Units

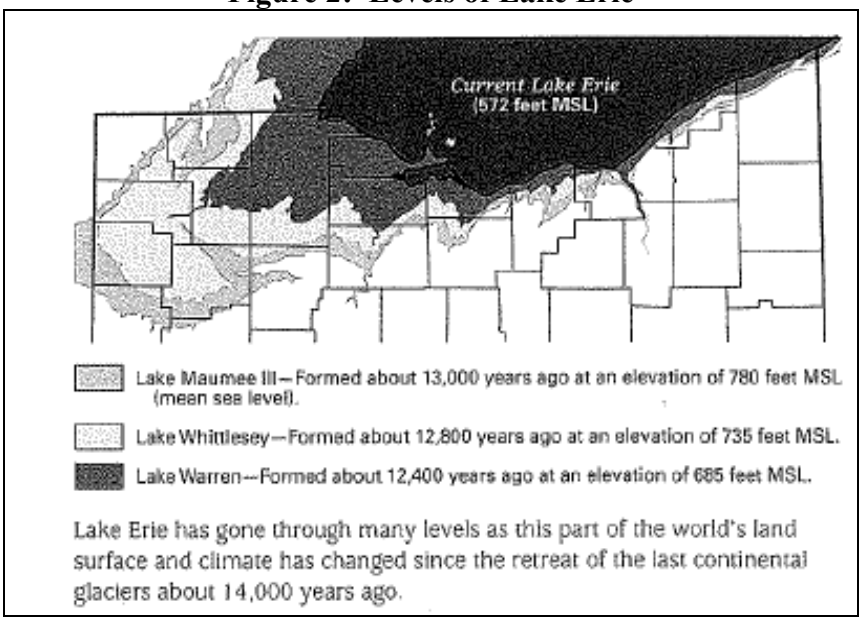
The State of Ohio has forty-five (45) watershed units identified by the Hydrologic Unit Code (HUC), an eight-digit classification number system designed and implemented within the United States by the U. S. Geological Survey (USGS).
The eight-digit HUC number for the Cedar-Portage watershed is 04100010.

The unique character of the Portage basin is a direct result of the last retreating glacial movement to occur 10,000 to 12,000 years ago. The melting retreat of a glacier deposits tons of debris of stone, rock, soil and sediments collected for centuries within the glacial ice as it moved across continents. During a melt cycle the debris is deposited in a ridge as glacial runoff and forms a glacial moraine upon the land. This natural ridge deposit on

the land surface functions as a watershed boundry, upon the flatness of the land scraped by the glacier's movement.

A result of the historical glacial movement is the formation of the Great Lakes Basin, the great northern marsh lands and swamp areas, which left a geographical signature across the scoured flatland right up to the ground ridge of glacial moraines.

Figure 2: Levels of Lake Erie

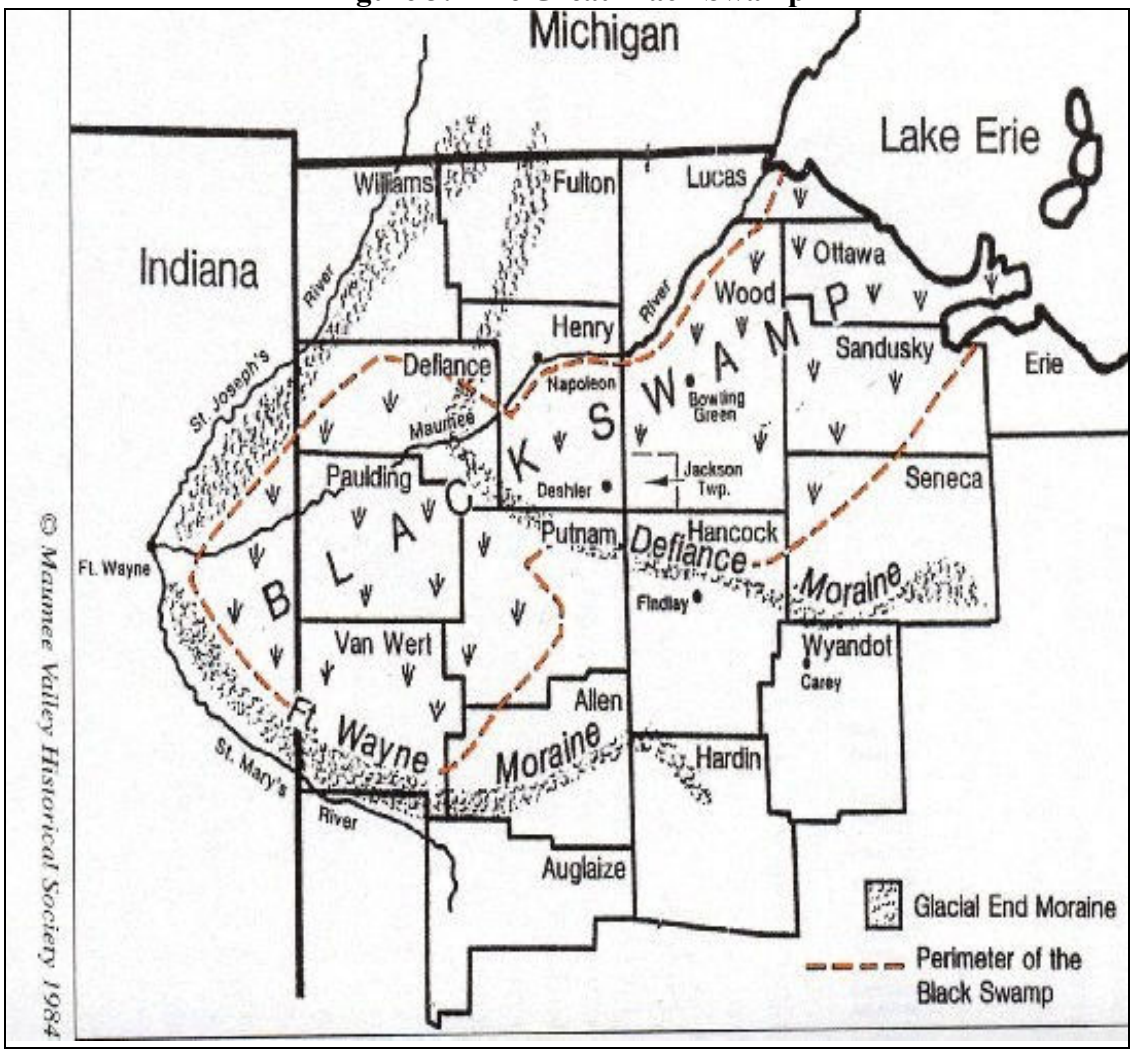


Source: ODNR, Ohio Geology Newsletter, 2008, No. 1

The details from the past are vital to understanding this watershed. The Portage is situated at the very heart of the historic Great Black Swamp. The swamp has been logged of its virgin timbers. The prairies and savannas were eliminated from the landscape. The first drainage laws were adopted in 1841 – 1859 and resulted in the Great Black Swamp being drained dry. The marsh and swamp land areas were owned by the State of Ohio at the time it entered the Union on March 1, 1803 as the 17th state. The marsh and swamp land were an obstacle in the settlement of a large land area of the state. During the settlement years land was valued if habitable and converted to farm land.

The first ditching laws were intended to interest individuals to drain swampy marsh lands owned by the state. Upon draining the land surface, the individual would be deeded ownership of the land from the state. This method urged the pioneer settlement of northwest Ohio. The initial years of ditching for land drainage were slow as ditches were dug with shovels, barges, and manual labor. But that changed with the invention of the steam engine and the steam traction ditcher, invented by James B. Hill in the late 1880s. Then, later models were built with the internal combustion engine by 1908 and diesel fueled engines by 1920. By the 1940s the ditch and tile industry began to decline in product use and production.

Figure 3: The Great Black Swamp



Source: Black Swamp Conservancy webpage

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Figure 4: The Ohio Historical Society-Marker Number 2-35

(Location 41 27.079'N, 84 18.022"W in Archbold, Ohio 43502 in Fulton County, on location of Northwest State Community College)

Photo Credit to Christopher Light, November 2, 2007

Figure 5: Side two of Ohio Historical Marker.

Photo Credit to Christopher Light, November 2, 2007

Figure 6: Traction Ditching Machine

(steam-driven ditcher [No. 88]) survives and is on display at the Hancock Historical Museum in Findlay, OH)

Photo from the Ohio Historical Marker 2-35 "Draining the Great Black Swamp").

1.2 Overview of the River

The Portage River is one of northwest Ohio's principal rivers. It drains most of the Great Black Swamp area, which hindered settlement and development of northwest Ohio until the 1830s and long after the rest of the state. Most of the ditches and small streams that flow into the Portage, and even parts of its major tributaries, are man-made streams. Without these ditches, a great portion of the area, especially in Wood County, had little or no drainage. The lakes, swamps, and thick forests that resulted were the Great Black Swamp. The Portage was named the *"R.* du Portage" in 1754 by a French military engineer, Joseph Gaspard Chaussegross deLery, probably because exploring the river required frequent portages. Early English maps translated this name to "the Carrying River" or even "the Carrion River." The name has since reverted to the original French. There is evidence that the mouth of the Portage evolved to shift its location over time. DeLery's 1754 map shows the Portage bending sharply to the west as it approaches Lake Erie, with its mouth in what is now the Ottawa National Wildlife Refuge in Erie Township. Much further back in history, the mouth of the Portage was in West Harbor, between Danbury and Catawba Island Townships in Ottawa County.

Today, the Portage River basin is mostly farmland. The Great Black Swamp, when drained, has become some of Ohio's most productive agricultural ground. It is used mainly for row crop production of field corn, soybeans, and winter wheat; but also has significant production of tomatoes, other truck farm vegetables, and livestock. Agriculture, which requires drainage, is the backbone of the economy.

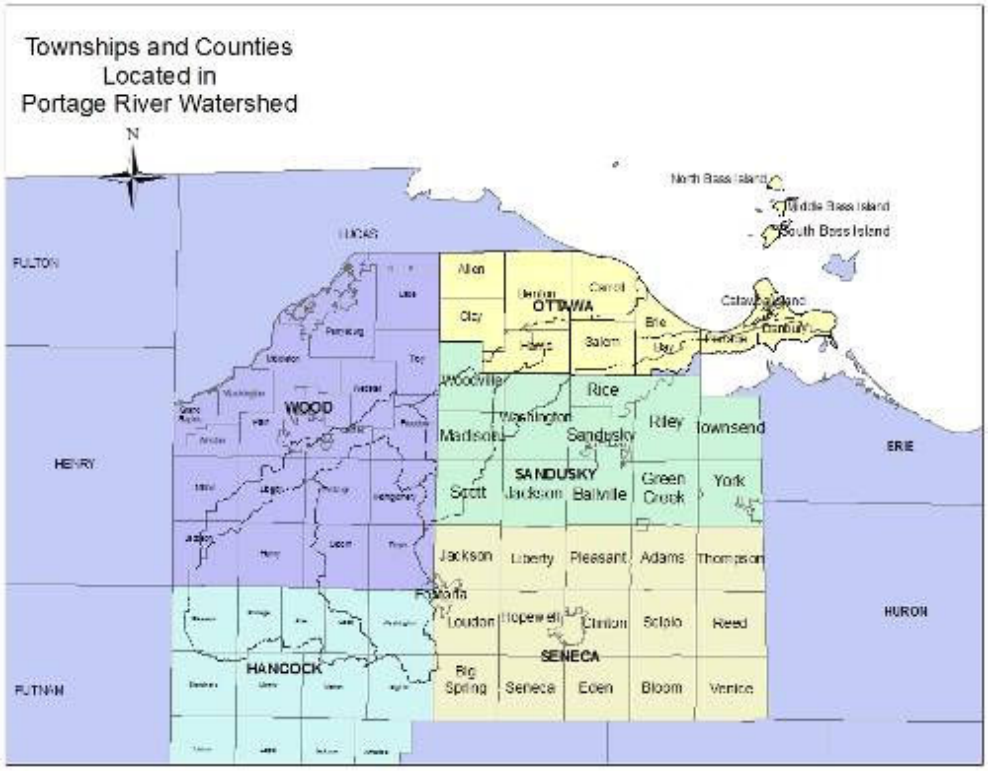
most of the area's business and industry. Water and sewer service is one of the basic requirements for bringing jobs into the area.

Chapter Two

2.1 Administrative Boundaries

The Portage watershed drains 581 square miles of the land area in five northwest Ohio counties that include Hancock (26.58% in watershed), Ottawa (27.85%), Seneca (0.24%), Sandusky (20.45%), and Wood (48.85%) counties. The Portage River is a direct tributary flowing into western Lake Erie at the City of Port Clinton, in Ottawa County. The headwaters of the Portage begin in the northern half of Hancock County at the north edge of the City of Findlay. The Portage mouth flows into Lake Erie at the City of Port Clinton, Ottawa County. There are seven major river branches, the North Branch, Middle Branch, South Branch, Needles Creek, East Branch, Rocky Ford, and Sugar Creek that converge into the Mainstem at river mile 35.41 at the Village of Pemberville, Wood County. The Portage River Estuarine Zone begins about RM 15.7 just downstream of Sugar Creek's confluence with the Portage Mainstem. Here the character of the river transforms physically to lacustrine riverine as the Portage Mainstem ebbs and flows with the fresh water of Lake Erie. The Great Lakes are considered by many as a national treasure to be protected and preserved as one of the greatest sources of freshwater on Earth. Therefore, the Portage water quality is important to the health of Lake Erie.

Figure 7: Townships and Counties Located in Portage River Watershed



The Portage River watershed contains numerous local governments located in the 5 (five) county boundaries of the watershed drainage area for portions of Hancock, Ottawa, Sandusky, Seneca and Wood counties. A total of 33 townships comprise the total drainage area of the five counties indicated within the watershed boundary shown in Table 1.

Table 1: Townships of the Portage Watershed

County	Hancock	Ottawa	Sandusky	Seneca	Wood
	(7)	(8)	(4)	(3)	(11)
Townships Land area within and drained by the Portage	Pleasant Twp	Harris Twp	Scott Twp	Jackson Twp	Webster Twp
	Portage Twp	Benton Twp	Madison Twp	Loudon Twp	Center Twp
	Allen Twp	Salem Twp	Woodville Twp	Big Spring Twp	Freedom Twp
	Cass Twp	Erie Twp	Washington Twp		Montgomery Twp
	Washington Twp	Bay Twp			Portage Twp
	Marion Twp	Portage Twp			Liberty Twp
	Biglick Twp	Danbury Twp			Milton Twp
		Catawba Island			Jackson Twp
					Henry Twp
					Bloom Twp
					Perry Twp

The largest incorporated areas are on the perimeter of the watershed and include the City of Bowling Green (2007 Census: 29,884), the City of Fostoria (13,123) and the City of Port Clinton (6,198). Incorporated areas have authority to regulate land use, while counties possess the authority to regulate land use in unincorporated areas.

Table 2: Incorporated Cities and Villages in the Portage Watershed

County	Hancock	Ottawa	Sandusky	Seneca	Wood
	(3)	(4)	(3)	(1)	(13)
Incorporated **Villages and Cities**	Village of Arcadia	Village of Elmore	Village of Woodville	City of Fostoria	Village of Bairdstown
	Village of McComb	Village of Oak Harbor	Village of Gibsonburg		Village of Bradner
	Village of Van Buren	City of Port Clinton	Village of Lindsey		Village of Bloomdale
		Village of Marblehead			Village of Cygnet
					Village of Hoytville
					Village of Jerry City
					Village of North Baltimore
					Village of Pemberville
					Village of Portage
					Village of Risingsun
					Village of Wayne
					Village of West Millgrove
					City of Bowling Green

Table 3: Unincorporated Areas

County	Hancock	Ottawa	Sandusky	Seneca	Wood
	(4)	(5)	(2)	(0)	(22)
Unincorporated areas drained by the Portage River	**Unincorporated areas drained by the Portage basin**				
	Deweyville	Foxhaven	Busy Corners		Bays
	Mortimer	Gem Beach	Rollersville		Bloom Center*
	Portage Center	Lacarne			Christy*
	West Independence	Lakeside			Cloverdale*
					Denver*
					Digby*
					Ducat*
					Eagleville*
					Galatea
					Hammansburg
					Hatton
					Mermill
					Mungen*
					New Rochester
					Perry Center*
					Rudolph
					Scotch Ridge
					Six Points*
					Township School Scotch Ridge
					Trombley*
					Wingston*
					Woodside*

*Villages that no longer exist. Most were oil boom towns

2.2 Special Districts per County

Many organizational districts are located within the watershed area and work in partnership for water quality. Special districts include parks, schools, conservancy, sewer, soil and water, agriculture, and regional planning organizations, and are listed by county.

Hancock County

Hancock Park District
Hancock County Solid Waste Management District
Hancock Soil & Water Conservation District
OSU Extension Center at Lima
OSU Extension Hancock County
Hancock County Health Department, Environmental Health Division

Ottawa County

Ottawa County Park District, Elmore, OH
OSU Extension Ottawa County, Oak Harbor, OH
OSU Extension Sea Grant, Port Clinton, OH

Ottawa County Community Improvement Corp., Oak Harbor, OH
Ottawa County Water & Sewer District
Ottawa Soil & Water Conservation District, Oak Harbor, OH
Ottawa-Sandusky-Seneca Solid Waste District, Fremont, OH
Put-in-Bay Township Port Authority
Ottawa County Health Department, Environmental Health Division
Ottawa County Regional Planning
Ottawa County Engineer
Ottawa County Visitors Bureau

Sandusky County

Sandusky County Park District, Fremont, OH
OSU Extension Sandusky County
Sandusky County Economic Development Corp.
Sandusky Soil & Water Conservation District, Fremont, OH
USDA Natural Resources Conservation Service, Fremont, OH
Sandusky County Health Department, Environmental Health Division

Seneca County

Seneca County Park District, Tiffin OH
Fostoria Economic Development Corp., Fostoria, OH
OSU Extension Seneca County, Tiffin, OH
Ottawa-Sandusky-Seneca Solid Waste District, Tiffin, OH
Seneca Soil & Water Conservation District

Wood County

Wood County - Northwestern Water & Sewer District
Wood County Park District
Black Swamp Conservancy
Natural Resources Conservation Service
Northwest Ohio Regional Economic Development Assn. (NORED)
OARDC Northwest Ag Research Station, Custar, OH
OSU Extension Wood County, Bowling Green, OH
Ohio Farm Bureau – Lucas, Wood, Sandusky & Ottawa Counties, Luckey, OH
Wood County Economic Development Commission
Wood County Solid Waste Management District
Wood Soil & Water Conservation District
Wood County Health Department, Environmental Health Division
Wood County Regional Planning
Wood County Engineer

2.3 School Districts

Hancock County Schools

Arcadia Local Schools, Arcadia, OH
McComb Local Schools, McComb, OH
Van Buren Local Schools, Van Buren, OH

Ottawa County Schools

Benton-Carroll-Salem Local School District, Oak Harbor, OH
Danbury Local School, Marblehead, OH
Port Clinton City School District, Port Clinton, OH

Sandusky County Schools

Fremont City Schools, Fremont, OH
Gibsonburg Exempted Village Schools, Gibsonburg, OH
Lakota Local Schools, Risingsun, OH
Woodmore Local Schools, Woodville, OH

Wood County Schools

Bowling Green School District
Eastwood Local Schools
Elmwood Local Schools
North Baltimore Local Schools
Wood County Educational Service Center

Colleges and Universities

Bowling Green State University, Bowling Green, OH

2.4 Special Designations

National and state wilderness or park areas are found along the Lake Erie coastal areas and further inland along the Portage waterways.

- ODNR Little Portage River Wilderness Area, 407 acres, Ottawa County
- Van Buren State Park, 251 land acres, 45 water acres, Hancock county
- East Harbor State Park, 1831 land acres, Lake Erie, Ottawa County
- Marblehead Lighthouse State Park, 9 land acres, Lake Erie. The oldest lighthouse in continuous operation on the Great Lakes since 1822.
- Lakeside Daisy State Nature Preserve, 19 land acres, Ottawa County

- Meadowbrook Nature Preserve, 110 acres, 31 acres of wetland, Danbury Township, Marblehead, Ottawa County
- Catawba Island State Park, Ottawa County
- Magee Marsh, Ottawa County
- Ottawa National Wildlife Refuge, Ottawa County
- Toussaint Creek Wildlife Area, Ottawa County
- Dempsey Wildlife Area, Ottawa County
- Lake Erie Coastal Trail Scenic Bikeway

Due to the regional migratory waterfowl and bird paths of this region, a further list of the natural areas is compiled based on facilities and acreage per county even if located outside the Portage watershed. The facilities and acreage include State Parks, Forests, Nature Preserves, and Wildlife Areas.

Hancock County
Facilities: 4
Acreage: 644

Ottawa County
Facilities: 22
Acreage: 5,448

Sandusky County
Facilities: 9
Acreage: 3,584

Wood County
Facilities: 6
Acreage: 659

2.5 PHASE II STORMWATER

Polluted stormwater runoff is commonly transported through Municipal Separate Storm Sewer Systems (MS4s), from which it is often discharged untreated into local waterbodies. To prevent harmful pollutants from being washed or dumped into an MS4, operators must obtain a NPDES permit and develop a stormwater management program (U.S. EPA)

- Phase I, issued in 1990, requires *medium* and *large* cities or certain counties with populations of 100,000 or more to obtain NPDES permit coverage for their stormwater discharges.
- Phase II, issued in 1999, requires regulated small MS4s in urbanized areas, as well as small MS4s outside the urbanized areas that are designated by the permitting authority, to obtain NPDES permit coverage for their stormwater discharge.

There are two Phase II stormwater communities in the Portage watershed: the cities of Bowling Green and Fostoria. Additional details regarding MS4 permits are available on the Ohio EPA website link http://www.epa.state.oh.us/dsw/permits/MS4_baseline.pdf

A good general weblink for the Ohio stormwater program, including construction stormwater permits is http://www.epa.state.oh.us/dsw/storm/index.html.

2.6 DEMOGRAPHICS

The demographic county profiles of the Portage watershed include Hancock, Ottawa, Sandusky, and Wood. The Seneca county profile land area within the Portage watershed includes only a small urban portion of the City of Fostoria and minimal agricultural land area along the Seneca-Hancock County line within the East Branch of the Portage watershed.

The largest age group in Hancock, Sandusky, and Wood counties is between 25-44 years of age.

The median age in population is between 32.6 and 41 years of age. Wood County has the youngest age group and Ottawa County the oldest median age group of 41 years of age and the largest age population of 45-64 years.

Table 4: Population, Age and Median Age

Population - Age Portage River Watershed				
	Hancock	**Ottawa**	**Sandusky**	**Wood**
Total Population	71,295	40,985	61,792	121,065
Largest Age Population	25-44 years	45-64 years	25-44 years	25-44 years
Median Age	36	41	37.3	32.6
SOURCE: Ohio Department of Development, based on 2000 Census data				

A projected population growth is estimated for Hancock and Wood counties from 2010 to 2020. Wood County has the largest land area and population within the watershed and is projected to see a greater population increase of 7.6% by 2020 shown in Table 5. Hancock County projects a 5.3% (+3,880) individual increase of population by 2020.

Table 5: Population and Projection 1990 to 2030

1990 Population and Projection to 2030					
Census Year	**1990**	**2000**	**2010**	**2020**	**2030**
Hancock	65,536	71,295	74,183	76,909	79,035
Ottawa	40,029	40,985	40,795	40,269	38,522
Sandusky	61,963	61,792	59,941	57,903	56,416
Wood	113,269	121,065	127,019	133,326	141,877

Table 6: Projected Population

County	Approx % of County in the Watershed	Population 2007 (Estimated)	Population 2000	Population % Change 2000-2007	Greater Than 3.0% Growth	Population 2020 (Projected)	Population 2020 (Projected)	Anticipated Change 2005-2020
Hancock	26.58%	74,204	71,295	3.9%	(+)	76,910	5.3%	3,880

County	Approx % of County in the Watershed	Population 2007 (Estimated)	Population 2000	Population % Change 2000-2007	Greater Than 3.0% Growth	Population 2020 (Projected)	Population 2020 (Projected)	Anticipated Change 2005-2020
Wood	48.85%	125,399	121,065	3.5%	(+)	133,330	7.6%	9,370
Seneca	0.24%	56,705	58,686	-3.5%	(-)	54,260	-5.7%	-3,300
Sandusky	20.45%	60,997	61,792	-1.3%	(-)	57,900	-5.2%	-3,160
Ottawa	27.85%	41,084	40,985	0.2%	(-)	40,270	-1.7%	-580

U.S. Census Bureau 2007

Population estimates for Ottawa and Sandusky counties have peaked and county population totals are projected to decline between the years of 2010 to 2020.

Sandusky is projected to experience a -5.2% decline of (-3,160) individuals by 2020. Projections for Ottawa County indicate a -1.7% or (-580) population decline.

The greater than three percent growth in population of Wood and Hancock is thought to be connected with the growth and economic patterns in and around the City of Bowling Green (Wood) and the City of Findlay (Hancock).

Education Demographics

The larger education attainment numbers for Hancock and Wood counties can be attributed to state college facilities in both counties: the University of Findlay and Bowling Green State University.

Hancock and Wood have the largest populations of individuals 25 years and over. A greater number of individuals in Wood County education generate the larger percentage of individuals with college degrees. This could be in relationship to Bowling Green State University.

Hancock and Sandusky counties have the highest rate of high school graduates.

Table 7: Education Attainment

Education Attainment								
	Hancocl	%	Ottawa	%	Sandusky	%	Wood	%
Persons 25 years and over	45,871	100	28,829	100	40,565	100	71,551	100
No High School Diploma	5,308	11.6	4,569	15.8	7,252	17.9	8,150	11.4
High School Graduate	18,637	40.6	11,655	40.4	17,744	43.7	24,887	34.8
Some College, No degree	8,699	19.0	5,859	20.3	7,800	19.2	14,602	20.4
Associate's degree	3,295	7.2	2,128	7.4	2,946	7.3	5,177	7.2
Bachelor's degree	6,528	14.2	3,043	10.6	3,145	7.8	11,347	15.9
Master's degree or higher	3,404	7.4	1,575	5.5	1,678	4.1	7,388	10.3

Wood has the highest number of public (47) and non-public (9) schools with the highest enrollment (17,541) and (1,504). Hancock and Sandusky schools generate a higher graduation rate (95.5%) and (91.8%) respectively.

Table 8: Education Profile

Education Profile				
	Hancock	Ottawa	Sandusky	Wood
Public Schools	32	21	24	47
-Enrollment	11,300	6,242	10,023	17,541
Non-Public Schools	2	2	7	9
-Enrollment	594	178	1,159	1,504
Graduation Rate	95.5	94.4	91.8	91.3

Employment and Income

Employment numbers between the years of 2000-2010 from the U.S. Census data are indicated below.

Table 9: Employment 2000-2009

Employment 2000 - 2009								
	Hancock		Ottawa		Sandusky		Wood	
	2000	2009	2000	2009	2000	2009	2000	2009
Civilian Labor Force	37,504	40,200	20,677	21,500	31,845	33,400	66,552	68,300
Employed	36,393	36,100	19,830	18,600	30,489	29,400	62,448	60,800
Unemployed Rate	2.0%	10.3%	2.6%	13.7%	2.8%	12.0%	4.3%	10.9%
Source: Ohio Department of Development http://www.development.ohio.gov/research/files/s0.htm								

Employment and income indicators reveal that three-quarters of the employed population between the ages of 18 – 64 have a median household income of $40,000 to $45,000 earned mostly through farming.

Table 10: Employment and Income Indicators

Employment and Income Indicators						
County	**Population 2000**	**2000 Persons Age 18-64 %**	**2000 Persons Age 18-64 Pop.**	**2002 Economic Nonfarm Employment**	**1999 Median Household Income**	**1999 Persons Below Poverty Level**
Hancock	71,295	74.3%	52,955	1,344	$43,856	7.5%
Ottawa	40, 985	76.7%	31,443	828	$44,224	5.9%
Sandusky	61,792	73.8%	45,624	1,051	$40,584	7.5%
Wood	121,065	76.3%	92,381	2,065	$44,442	9.6%

Housing numbers indicate Wood has the newest housing stock median year built as 1971 with the highest median value of $120,000, and also the largest total number (47,488) of housing units per county.

Sandusky County has the oldest median year housing stock dated at 1954 in the $99,100 median value, and the greatest owner occupancy of 70.7% with the lowest percent (5.9%) of new housing built between 1995 to March 2000.

Ottawa County has the highest vacant housing, (35.5%) which could be related to the summer cottage industry associated with the lake shore vacation homes.

An interesting relationship to water quality is found in the large demographic number of older homes built from 1939 (or earlier) to 1960. For all four counties the total number of homes built before 1960 is 58,058 homes. New sewage rules were not introduced until the 1960s. This number of homes was constructed likely without sufficient home sewage treatment systems, unless these older systems have been replaced in the past ten years. Systems installed today have a life span of 20-30 years if maintained, so any system installed before the 1960s, if not tapped into a municipal sewer system, has likely failed and become a source of non-point pollution.

Table 11: Housing Units and Year Structure Built 1939 to 2000

Housing Demographics								
Housing Units	Hancock	%	Ottawa	%	Sandusky	%	Wood	%
Total	29,785	100.0	25,532	100.0	25,253	100.0	47,468	100.0

Housing Demographics								
Housing Units	Hancock	%	Ottawa	%	Sandusky	%	Wood	%
Housing Units								
Occupied housing units	27,898	93.7	16,474	64.5	23,717	93.9	45,172	95.2
Owner Occupied	20,404	68.5	13,287	52.0	17,851	70.7	31,892	67.2
Renter Occupied	7,494	25.2	3,187	12.5	5.866	23.2	13,280	28.0
Vacant housing units	1,887	6.3	9,058	35.5	1,536	6.1	2,296	4.8
Year Structure Built	Hancock	%	Ottawa	%	Sandusky	%	Wood	%
Total housing units	29,785	100.0	25,532	100.0	25,253	100.0	47,468	100.0
Built 1995 to March 2000	3,237	10.9	2,581	10.01	1,481	5.9	4,505	9.5
Built 1990 to 1994	1,698	5.7	1,789	7.0	1,388	5.5	3,425	7.2
Built 1980 to 1989	2,547	8.6	3,530	13.8	2,047	8.1	5,815	12.3
Built 1970 to 1979	4,627	15.5	3,330	13.0	3,288	13.0	10,899	23.0
Built 1960 to 1969	3,842	12.9	3,146	12.3	2,295	9.1	5,510	11.6
Year Structure Built	Hancock	%	Ottawa	%	Sandusky	%	Wood	%
Built 1950 to 1959	3,942	13.2	3,424	13.4	3,701	14.7	4,920	10.4
Built 1940 to 1949	1,853	6.2	2,123	8.3	1,950	7.7	2,580	5.4
Built 1939 or earlier	8,039	27.0	5,609	22.0	9,103	36.0	9,814	20.7
Median year built	**1963**		**1965**		**1954**		**1971**	

Housing Demographics								
Housing Units	Hancock	%	Ottawa	%	Sandusky	%	Wood	%
Median value	$100,400		$113,000		$90,100		$120,000	

2.6.1 Geographic Locator

To achieve water quality goals in the watershed, a special framework or map system is used to locate and manage water resources, similar to how a roadmap or atlas allows us to geographically locate and navigate the roadway system through cities and states. A national Watershed Boundary Dataset (WBD) using *Hydrologic Unit Code* (HUC) is the geographic map for hydrology established in the 1970s by the U.S. Geological Survey (USGS). The Natural Resources Conservation Service (NRCS) further developed the system into smaller land units to map our national, state and local surface water runoff to designated points such as oceans, lakes, ponds, rivers, streams, creeks, ditches, and wetlands.

Hydrology is the science dealing with the properties, distribution, and circulation of water for the planet Earth. The water cycle stages are evaporation into the atmosphere, transport, condensation, precipitation by rain or snow, infiltration of groundwater into soil and underlying rocks, and surface water runoff. Water runoff seeks the lowest point on a surface, and is drawn by gravity to the oceans, which are at sea level. The water cycle is a closed system that functions within the Earth's atmosphere. Water moves around the world, changes forms, but has no other interferences; what is in the system stays equal and only changes form. The same water the dinosaurs used millions of years ago is the same water and the same quantity we use today because the water or hydrologic cycle is a closed system. The movement of water from the ocean through the air to the land and back to the ocean remains the same. Additional water science can be found at the USGS website: http://ga.water.usgs.gov/edu/watercyclestreamflow.html and the U.S. EPA weblink at: http://www.epa.gov/bioindicators/html/ecoregions/html

Figure 8: Water Resource Regions of the U. S.

One way to identify the geographic extent of watershed planning efforts is to consult the USGS map of hydrologic units. A hydrologic unit is part of a watershed mapping classification system showing various areas of land that can contribute surface water runoff to designated outlet points, such as lakes or stream segments. USGS designates drainage areas as sub-watersheds (including smaller drainages) numbered with 14-digit hydrologic unit codes (HUCs), nested within waters (11-digit HUCs). These are combined into larger drainage areas called sub-basins (eight digits), basins (six digits), and sub-regions (four digits), which make up the large regional drainage basins (two digits).

In order to establish a national Watershed Boundary Dataset (WBD) the new 12-digit HUC replaces the 14-digit layer. The new coding system was revised to provide greater consistency across state boundaries, and watershed size. This provides a national code that better works with technologies of Geographical Information Systems (GIS) satellite remote sensing images and newer forms of aerial photography.

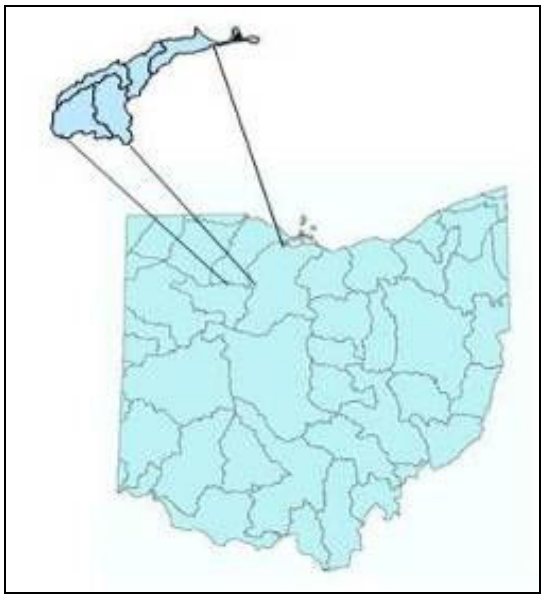
Please visit http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/history.html for more information on the 12 – and 14-digit HUCs and the "datagateway" site that contains the data base for the national WBD.

The Portage River watershed is located in northwest Ohio and drains directly into Lake Erie of the Great Lakes. Therefore, the hierarchical search for the Portage River

watershed is found in association with the Cedar-Portage Watershed – HUC 04100010.

- Cedar-Portage, 04100010 (Subbasin)
- Western Lake Erie, 041000 (Basin)
- Western Lake Erie, 0410 (Subregions)
- Great Lakes, 04 (Region)

Figure 9: Ohio Eight-digit Hydrologic Unit Code



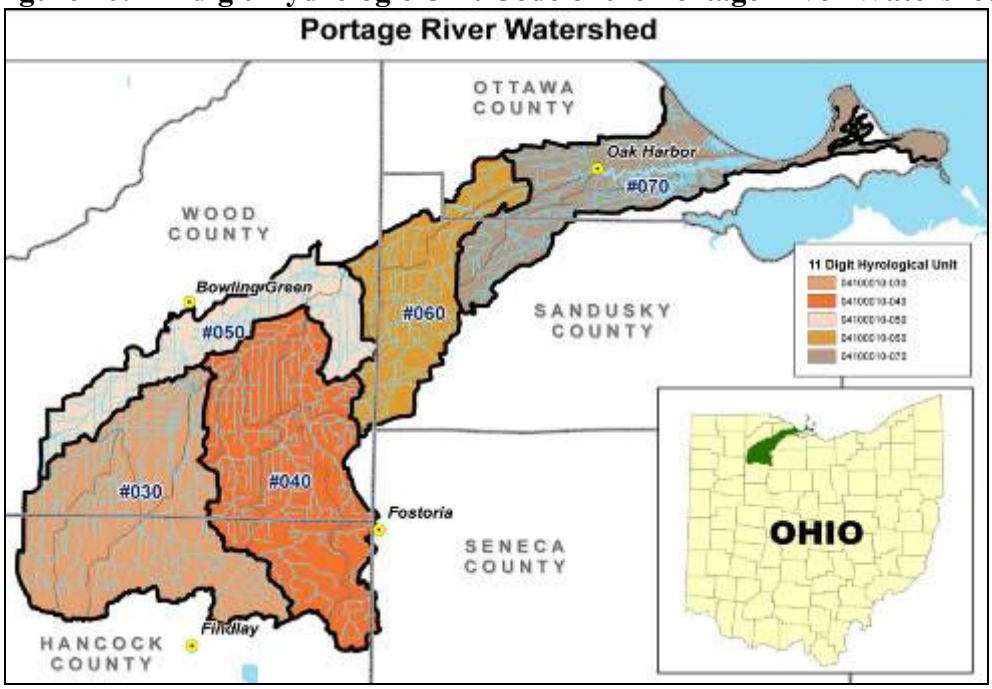
The eight-digit hydrologic unit code for the Portage watershed is 04100010.

Watershed Name: Cedar-Portage
USGS Cataloging Unit: 04100010

INSERT:
The location of the Portage River watershed, *within* the 04100010 Cedar-Portage hydrologic unit code. A total of forty-five (45) watershed units (8-digit) are located in Ohio.

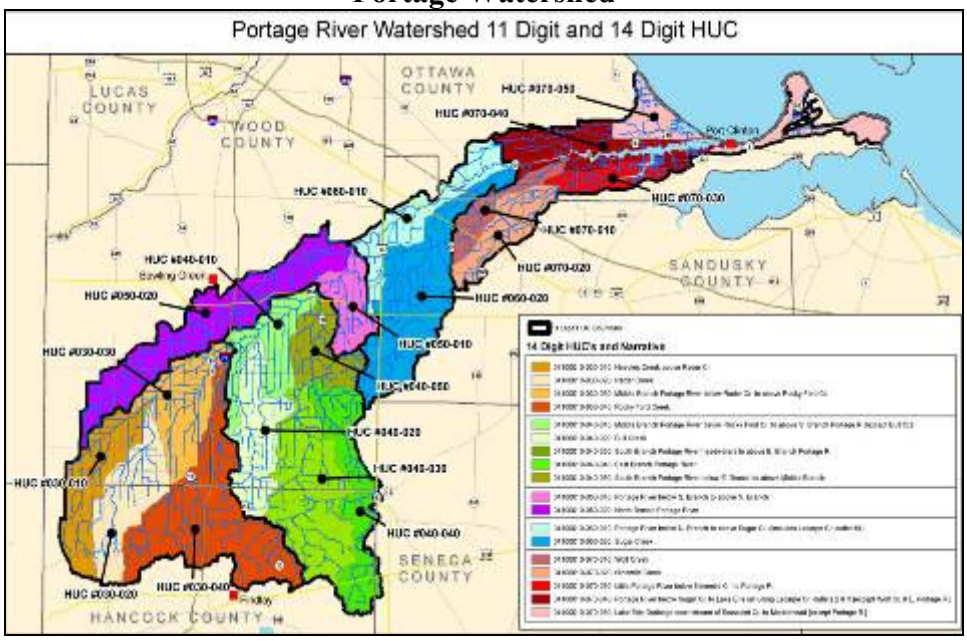
The following maps show the Portage River sub-basin within the Cedar-Portage hydrologic unit identified by the USGS. The watershed is then shown as the 11-digit watersheds and finally sized down to the 14-digit sub-watersheds, which drain the related land area surrounding the Portage River and its tributaries.

Figure 10: 11-digit Hydrologic Unit Code of the Portage River Watershed



The map below provides a view of the subwatershed areas defined by the smallest 14-digit hydrologic unit within the national hydrologic dataset. Larger maps can be found in the appendix.

Figure 11: 14-Digit Hydrologic Unit Codes at the Portage Watershed



A narrative table of all the tributaries and branches of the Portage is shown in Table 12 and indicate the waterway name and 14-digit identity code. The table does not include the

unnamed tributaries (UNT) or county ditches. There are eighteen (18) 14-Digit Hydrologic Unit Codes in the Portage watershed, listed in the following table.

Table 12: Narrative description and number for Portage subwatersheds

Narrative of Hydrologic Unit Code for Portage River	14-digit HUC
Needles Creek above Rader Creek	04100010-030-010
Rader Creek	04100010-030-020
Middle Branch Portage River below Rader Cr. To above Rocky Ford Cr.	04100010-030-030
Rocky Ford Creek	04100010-030-040
Middle Branch Portage River below Rocky Ford Cr. To above S. Branch Portage R. (except Bull Cr.)	04100010-040-010
Bull Creek	04100010-040-020
South Branch Portage River headwaters to above E. Branch Portage R.	04100010-040-030
East Branch Portage River	04100010-040-040
South Branch Portage River below E. Branch to above Middle Branch	04100010-040-050
Portage River below S. Branch to above N. Branch	04100010-050-010
North Branch Portage River	04100010-050-020
Portage River below N. Branch to above Sugar Cr. (includes Lacarpe Cr. Outlet #4)	04100010-060-010
Sugar Creek	04100010-060-020
Wolf Creek	04100010-070-010
Ninemile Creek	04100010-070-020
Little Portage River below Ninemile Cr. To Portage R.	04100010-070-030
Portage River below Sugar Cr. To Lake Erie including Lacarpe Cr. Outlets 2 & 3 (except Wolf Cr. & L. Portage Rd.)	04100010-070-040
Lake Erie Drainage downstream of Toussaint Cr. To Marblehead (except Portage R.)	04100010-070-050

Figure 12: Great Lakes Watershed

The Portage Watershed is located within Ohio's 4th, 5th, and 9th Congressional Districts. The figure on the following pages shows location of the Congressional Districts, as well as the Ohio House and Senate Districts.

Figure 13: 2013 Michigan & Ohio House Districts

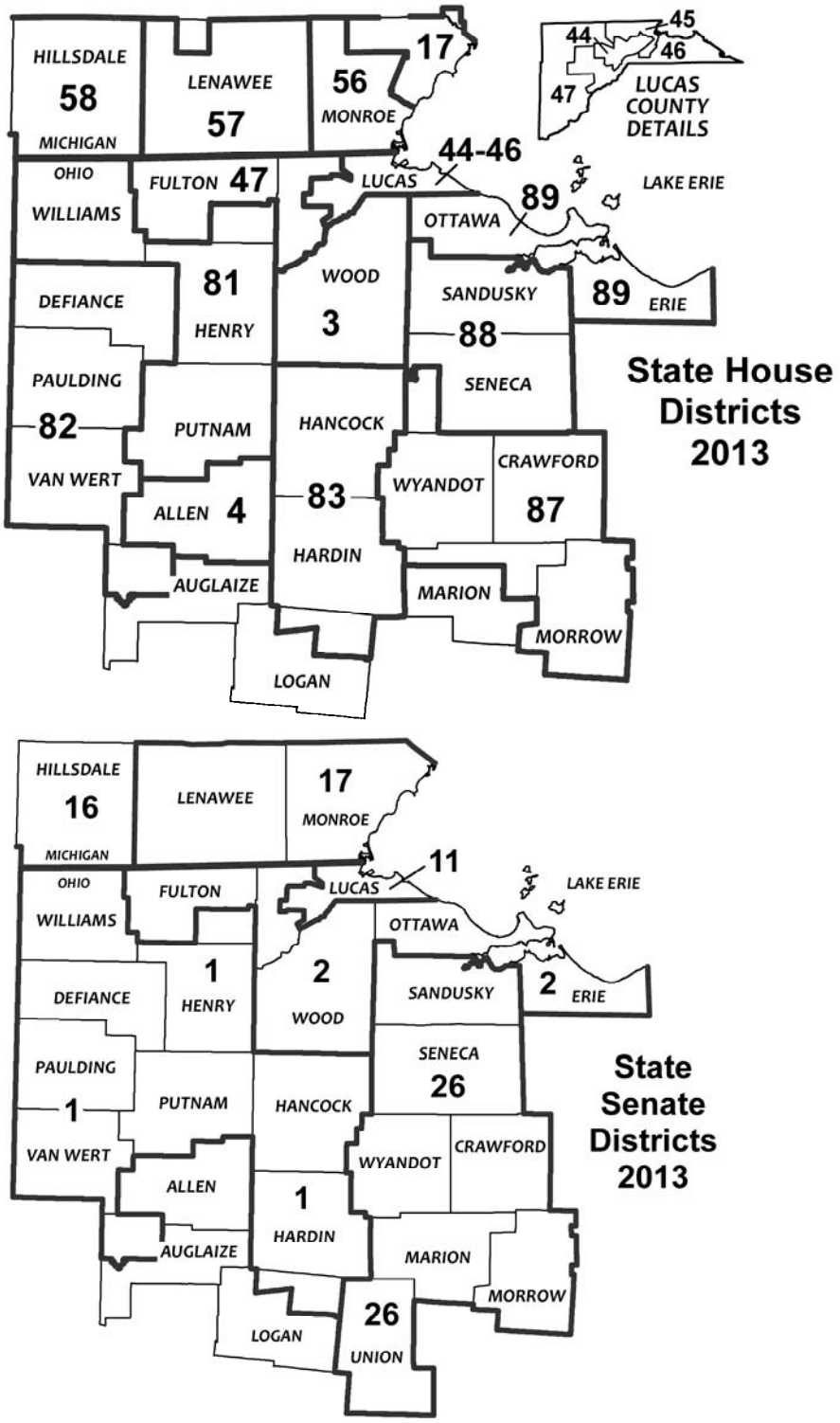
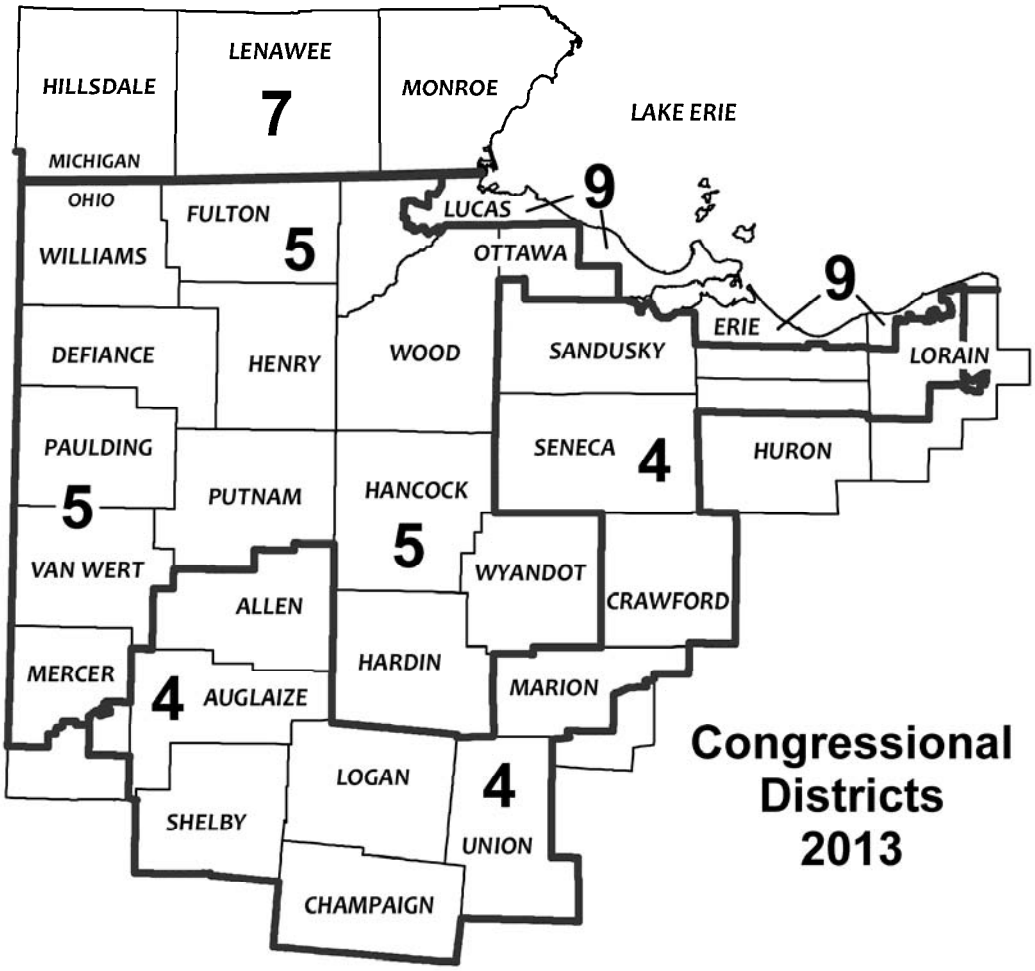


Figure 14: Ohio Congressional Districts
REGION



2.7 Historic Flood Events

Several damaging flood events have occurred in the Portage River watershed, the earliest mentioned in 1910. Flooding on the Portage is not a new phenomenon, but with continued development in and near the floodplain, the potential for damage from a given flood has increased over time. More information on historic flood events and stream gages may be found in Chapter 4.

Chapter Three

3.1 Plan Development

3.1.1 Watershed Partners

The Portage River Basin Council (PRBC) formed in 1994 to serve as a network for protecting and enhancing the resources that the river offers. The Council is about bringing citizens, businesses, governments, landowners, and agricultural operators together, to find solutions for a solid agricultural economy with healthy and productive natural resources that enhance and protect water quality.

In its 19 years of existence, the PRBC and its members have worked together on many projects for the Portage to promote responsible stewardship of the river, while working to improve water quality in the watershed.

The Council meets three times annually and is comprised of approximately 40 members from the public and private sector, operating under the following mission statement:

Mission Statement:

> The goal of the Council is to protect and improve the environmental and water quality of the Portage River Basin by establishing processes and working groups within the Portage River Basin Council to implement the goals set by *The Portage River: A Resource Worth Protecting*, June 1997. Our objectives are to provide assistance, coordination, and planning by furnishing administrative support and participating in the Portage River Basin Council Subcommittees.

The goal of the Portage River Basin Council is to find solutions to water quality issues. The Council's role is to:

- Work with the counties and municipalities to identify environmental infrastructure needs. The Council should help supply environmental and financial data to support construction grant or loan applications
- Find ways to improve the effectiveness of home septic systems, especially by encouraging proper maintenance
- Work with farmers to continue and expand the use of conservation practices, and to find ways of reducing pesticide use
- Encourage natural habitat areas along streams without compromising agricultural productivity
- Serve as a public outreach and educational body to help citizens and public officials understand environmental issues as they affect the Portage

Stakeholders and Partners Providing Input to this Watershed Plan Through the Portage River Basin Council

Meeting agendas and meeting minutes are distributed to the all stakeholders and partners. The following is a list of active council members who participated in preparation of this watershed plan, over a 5-year period. Additionally, Portage River Basin Council meeting packets were sent regularly to 88 watershed stakeholders.

Kevin Joyce	Black Swamp Conservancy
Doug Clark	Bowling Green
Melinda Huntley	Coastal Ohio
D J Mears	Lucas County
Ken Fallows	Lucas County Sustainability Commission
Kenneth Ault	Montgomery Township Trustee
Jerry Greiner	Northwestern Water & Sewer District
Darrell Opfer	Oak Harbor
Jocelyn Henderson	ODNR
Katie McKibben	OEPA
Pat Tebbe	OEPA
Jerry Bingham	Ottawa County
Steve Arndt	Ottawa County
Jim Sass	Ottawa County Commissioner
Ron Lajti	Ottawa County Engineer
Virginia Park	Ottawa County Recorder
Carol Benner	Ottawa Soil & Water Conservation
Gene Steele	Pemberville Citizen
Debbie Hymore-Tester	Port Clinton
Mary Dennis	Sandusky County Health Department
Gordon Bowman	Village of Pemberville
Mearl Guthrie	Wood County Citizen
Glenn Agner	Wood County Drainage Engineer
Ray Huber	Wood County Engineer
Brad Espen	Wood County Health Department
Paul Hagen	Wood County Health Department
David Steiner	Wood County Planning Commission
David Housholder	Wood County Trustee
Nikki Kale	Wood Soil & Water Conservation Dist.
Jim Carter	Wood SWCD

Chapter 5 includes detailed problem statements and action tables for each subwatershed (HUC). The projects in these sections were developed in consultation with key county-level stakeholder agencies.

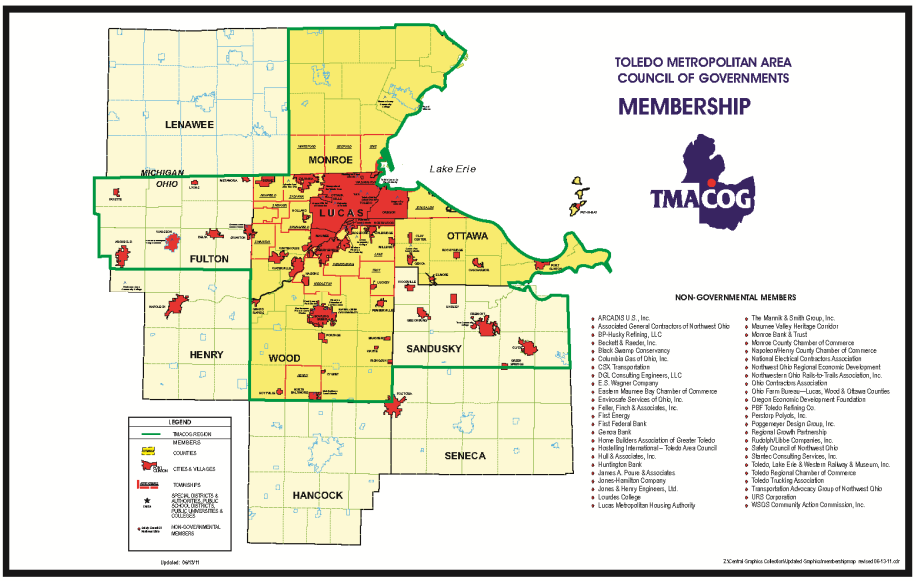
Direct county meetings were held that included, at a minimum, the Soil and Water Conservation District, Health Department, and County Engineer. Meetings were held for Hancock, Ottawa, Sandusky, and Wood counties.

During the preparation of this plan there were four (4) council and five (5) committees of the TMACOG Executive Committee:

1)	Environmental Council	1)	Finance, Audit, Administration Committee
2)	Transportation Council	2)	Leadership Development Committee
3)	Growth Strategies Council	3)	Membership Committee
4)	Commuter Services Council	4)	Communications Committee
		5)	Long Range Planning & Resource Development Committee

The Executive Committee appoints the president who leads the staff. Chairs of the councils and committees are nominated by TMACOG's Leadership Development Committee and appointed by TMACOG's chair. The members volunteer or are nominated to serve on any of the four councils or five committees and are appointed by the chair. There is also a Board of Trustees, whose members are selected by caucuses at an annual meeting of the General Assembly. On both the Board of Trustees and on councils and committees, some seats are reserved for specific jurisdictions to ensure that member representation includes the entire region and all levels of government. While non-governmental members may serve on any council or committee, officers must be elected officials and agency bylaws ensure that governmental members maintain voting majority and the leadership role.

Figure 15: Membership map of TMACOG



The Executive Committee is composed of the three officers, the chairs of councils and committees, and at-large members. This committee and the Board of Trustees propose and approve an annual budget and

the annual work program of TMACOG. They provide oversight and leadership. The Executive Committee selects a president to lead the staff.
The paid staff – 23 people in 2011 increased by interns and consultants who work on specific projects – include environmental, transportation, and urban planners, civil engineers, people who work in GIS and data modeling, and a variety of support people. The staff works to implement the plans of members, provides the technical support and expertise required for planning, and monitors federal, state, and local regulations to assist members with compliance.

The Council has identified five subcommittees that meet on a regular basis. The subcommittees serve as technical assistance committees to bring about change in the watershed. The five subcommittees are as follows:

3.2 Portage River Basin Council (PRBC)

Goal:
To protect and improve the environmental and water quality of the Portage River Basin by establishing processes and working groups within the Portage River Basin Council to implement the goals set by *A Resource Worth Protecting*. During the preparation of this watershed plan, the Portage River Basin Council functioned with several active subcommittees. After the plan's completion, they are no longer active.

Objective:
- Provide assistance, coordination, and planning by furnishing administrative support and participating in the Portage River Basin Council (PRBC) subcommittees
- Maintain the Portage River Basin Council to address environmental and natural resource issues of the Portage River Basin
- Coordinate quarterly meetings of the Portage River Basin Council

Portage River Planning Committee

Goal:
Convene a "Committee of the Whole" to conduct watershed planning for the Portage River Basin; develop projects and identify funding sources to carry out the goals of the Portage River Basin Council

Objectives:
- Develop a comprehensive watershed plan for the Portage River Basin for state endorsement from the Portage River Watershed Restoration Action Strategy report
- Participate in the development of the Portage River total maximum daily load (TMDL) during the three-year process which began with water quality assessment in 2008

Portage River Education Committee

Goal:
To make communities aware of the benefits of the Portage River ecosystem and promote stewardship of the river

Objective:

- Conduct programs for teachers and students to educate them on the uses of the river:
- Portage River Basin Education Project - Student Congress
- Recruit additional schools to participate in student water testing activities
- Secure funding for education project

Portage River Stormwater Committee

Goal:
To develop solutions and projects to provide adequate drainage, reduce flooding, benefit the natural habitat and improve and protect water quality in the Portage River Basin.

Objectives:

- Work with local jurisdictions and agencies to implement floodplain protection and stormwater control ordinances and regulations recommended by the Portage River Hydrological Study (June, 2002)
- Categorize project ideas for soil and erosion control through the Great Lakes basin program.
- Work with local jurisdictions to construct structural projects recommended by the study and identify funding sources to leverage grants
- Utilize hydrological study data to develop and implement flood reduction projects, including upstream stormwater storage through recommended restoration of oxbow and floodplain connections
- Secure funding for projects through the Federal Emergency Management Agency (FEMA), Ohio EPA 319 (EPA§319), Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), NatureWorks and additional funding sources

Portage River Public Relations & Outreach Committee

Goal:
To establish programs and events to increase watershed awareness, encourage public involvement and education to protect and improve the Portage River ecosystem, including quality recreation areas, natural habitat areas, and wildlife corridors along the Portage waterways.

Objectives:

- Design new brochure to promote watershed and increase public awareness
- Identify research projects with BGSU environmental students
- Implement programs/events to increase public education and watershed awareness of the Portage River by involving local agencies, communities, universities and volunteers
- Coordinate PRBC projects with community festivals and local events
- Increase public awareness with construction tours on demonstration projects, such as the two-stage ditch projects
- Identify new locations for canoe and kayak access points

- Contact the Chamber of Commerce locations within the watershed
- Meet with the historical society groups in the watershed
- Continue discussion for a whitewater park in watershed

- Work with local agencies for funding and recreation projects
- Work with Ohio EPA coordinators to promote public involvement in the Portage River TMDL process

Portage River Wastewater Committee

Goal:
To ensure high quality public wastewater treatment and promote good onsite sewage treatment

Objectives:
- Review and update critical sewage areas
- Provide input to the Ohio Department of Health (ODH) and Ohio EPA for proposed sewage rules
- Work with Ohio EPA and County Health Departments to encourage National Pollution Discharge Elimination System (NPDES) compliance
- Develop a project addressing onsite sewage treatment issues:
- Educating homeowners, government officials, contractors, and health department staff on the proper installation and maintenance of systems
- Document the level and mechanism of input health departments have on subdivision design standards and site reviews in each county
- Investigate potential pharmaceutical collection program in watershed, in partnership with health departments, Ottawa-Sandusky-Seneca Solid Waste District and Ohio EPA.
- Develop schedule and ideas for potential site visits to hold a 2009-10 Portage River Watershed Wastewater Tour event.
- Coordinate water quality data with Northwest Ohio Water Quality Workgroup, BGSU and PRBC for the watershed plan and potential project funding

Chapter Four

4.1 Watershed Inventory

4.1.1 Topography-Ecoregion

The Portage River basin lies entirely within the Huron/Erie Lake Plain (HELP) Level III Ecoregion of the conterminous United States (EPA, Ecoregions and Watersheds) located in northwest Ohio and southeast Michigan. The Huron/Erie Lake Plain ecoregion is a broad, fertile, nearly flat plain punctuated by relic sand dunes, beach ridges, and end moraines. Originally, soil drainage was typically poorer than in the adjacent Eastern Corn Belt Plains, and elm-ash swamp and beech forests were dominant. Oak savanna was typically restricted to sandy, well-drained dunes and beach ridges. Today, most of the areas has been cleared and artificially drained and contains highly productive farms producing corn, soybeans, livestock, and vegetables; urban and industrial areas are also extensive. Stream habitat and quality have been degraded by channelization, ditching, and agricultural activities (EPA, 2007).

Figure 16: Level III Co-regions of the Conterminous U.S.

See **Appendix Z** for larger view.

The soils of the watershed are poorly to very poorly drained and consist of parent material derived from glacial tills and lacustrine deposits associated with the Wisconsin glacial era. The glacial till is predominantly in the form of ground moraine that overlies limestone bedrock. The thickness of the glacial drift varies from about 25 meters to only a few centimeters. The uppermost bedrock strata consist of Silurian dolomite and dolomitic limestone. The predominant soil associations in the watershed area include the clay rich Hoytville, Toledo, and Sloan soils. These poorly drained soils are in the humic gley family that developed in fine textured calcareous glacial till. The Toledo association is characterized by silty clay and clay which contains fine layers of sand or silty materials. The Sloan series occurs along most of the streams in the study area. These are dark-colored soils that formed in alluvium derived from calcareous Wisconsin glacial till (U.S. Department of Agriculture 1966). The soils contain high amounts of organic matter and provide some of the most productive farmland in the state (Ohio EPA, 1995). The soils of the basin are predominantly tight, very fine-grained clay. Drainage tile has been installed in most of the agricultural land, due to the naturally poor drainage in these soils. The sediment deposits found in most of the streams are also predominantly fine grained, due to both the soils in the watershed and the flat streambed slopes that result in slow stream flow velocities that allow this sediment to settle out

.

Descriptions for topology and geology are taken from the "*Ground Water Pollution Potential*" reports for each county as completed by the Ohio Department of Natural Resources, Division of Water Resources. Reports were completed between 1990 and 1994 to rank areas of ground water in each county and its vulnerability for contamination. Additional information including the DRASTIC mapping system can be found at the ODNR website under the Division of Water Resources at http://www.dnr.state.oh.us/.

4.1.2 Hancock County

Generally, the topography in Hancock County is flat to gently rolling with slopes ranging from 0% to 2%. The low relief is due, in part, to the extensive cover of glacial ground moraines. Relief occurs in the vicinity of the Defiance and Fort Wayne Moraines where slopes ranging from 2% to 6% are common. Steeper slopes with a DRASTIC range of 6% to 12%, and 12% to 18% are limited to escarpments found along streams and rivers that have cut into the surrounding glacial deposits. Bedrock highs are mainly in the southwestern and southeastern parts of the county.

The surface slopes generally from north to south, the highest elevation is in the southwest corner of the county at the Hardin county line in Orange Township, and lowest is next to Rader Creek in Pleasant Township, in the northwestern part. The elevation ranges from 715 to 955 feet above sea level.

4.1.3 Ottawa County

The topography of Ottawa County is nearly level to gently rolling with slopes ranging from 0% to 2%. The low relief is due in part to the fact that Ottawa County is part of an extensive Pleistocene glacial lake complex that extends across much of northern Ohio. A combination of wave action and sediment deposition during various former water level stages of the lake successfully planed down and buried any previous topography that may have existed in the region.

Some topographic relief does occur in areas where rivers and streams have cut down into the lake plain deposits, producing topographic slopes commonly ranging from 2 to 6%. However, considerable relief does occur in Catawba, Danbury, and Put-in-Bay Townships where steep slopes with a range of 6 to 12% are found because of the rise of the carbonate bedrock in the area. Steep cliffs are often encountered in these townships where wave activity along the lake shore is currently cutting into the bedrock (ODNR, 1994).

West of Port Clinton, the surface is flat and is little elevated above Lake Erie. Shallow stream valleys are to a depth ranging from 15-25 feet. The low limestone ridges, or knolls, rise 5 to 15 feet above the general level to break the evenness of the landscape. East of Port Clinton the relief is undulating or gently rolling. It is generally level along the lakefront and rises gently inland, except in Catawba Township and at the eastern end of Marblehead Peninsula where limestone bedrock protrudes above the surrounding plain.

4.1.4 Sandusky County

Sandusky County is nearly flat topography throughout the county. There are beach ridges in the southeastern and southwestern parts of the county; the areas next to the Sandusky River; and in the bedrock highs, mainly in the western and southeastern parts.

The surface slopes generally from south to north, the highest elevation is in the southeast corner of the county, and lowest is next to Sandusky Bay, in the northern part. The elevation ranges from 575 to 810 feet above sea level (Soil Survey of Sandusky County, 1987).

4.1.5 Wood County

The topography of Wood County is flat to gently rolling with slopes ranging from 0%-2% dominating the county. The low relief is a result of Wood County's location within an extensive Pleistocene glacial lake complex that extends across much of northern Ohio. The flat topography appears to be the result of a combination of glacial advancement and

deposition which buried the former pre-glacial topography followed by a period of wave activity and sediment deposition associated with the glacial lake complex.

Some topographic relief does occur in areas where rivers and streams have cut down into lake plain deposits causing slopes of 2-6%. Other sources of relief occur along the Maumee River where erosion along with successive lake stages has created steep river terraces with slopes from 6-18% (Klotz, 1981 and ODNR, 1994).

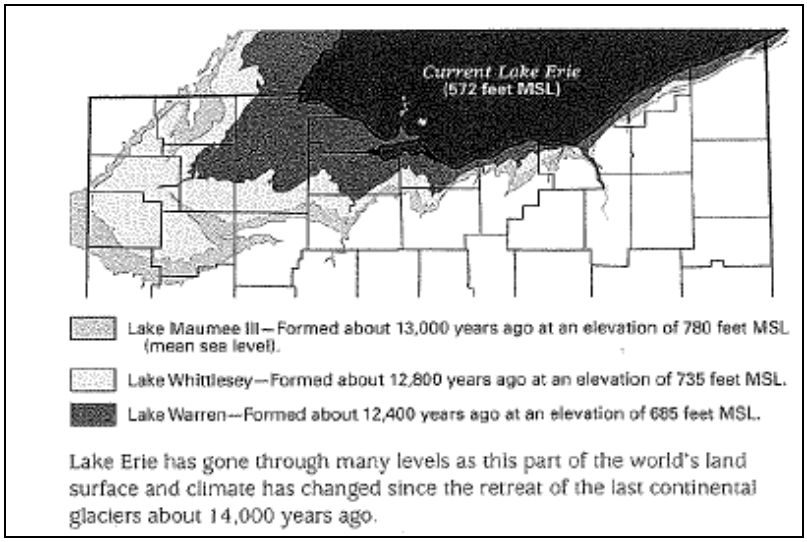
Other sources of topographic relief in Wood County occur along the beach ridges and sand dunes where slope ranges of 2% to 6% were often encountered on the best developed land forms.

4.2 GEOLOGY

4.2.1 Wood County

Wood County is located in the northwest portion of Ohio and contains 391,386.72 acres or 611.54 square miles of land and lies entirely within the area known as Lake Whittlesey and Lake Warren within the glacial lake plain. Lake Whittlesey formed about 12,800 years ago at an elevation of 735 feet mean sea level (MSL) during the retreat of the last continental glaciers about 14,000 years ago. As glacial lake waters receded, Lake Warren formed about 12,400 years ago at an elevation of 685 feet MSL as illustrated below.

Figure 17: Geologic Changes to Lake Erie



Source: ODNR, Ohio Geology Newsletter, 2008, No.1

Wood County is underlain by a relatively flat-lying sequence of Paleozoic sedimentary rock consisting primarily of dolomite from the Silurian and Devonian Systems. Silurian bedrock beneath Wood County consists of two groups, the Lockport and the Salina. Devonian bedrock in Wood County consists of the Dundee Limestone which overlies the Detroit River group.

The Silurian bedrock beneath Wood County is generally comprised of a micro-crystalline brown to gray argillaceous dolomite. Anhydrite and shale is interbedded with the dolomite in certain localities throughout the northwestern region of the state (Janssens, 1977, ODNR, 1994).

The bedrock structure of Wood County was influenced by a large regional structure referred to as the Findlay Arch. The arch, a geologic structure resulting from differential subsidence along two major basinal areas in the region (the Michigan Basin to the northwest and the Appalachian Basin to the southeast), influenced the present configuration of bedrock formations in Ohio. The Findlay Arch splits from the Cincinnati Arch in west-central Ohio and trends northeast towards Ontario, Canada, passing along the eastern margin of Wood County.

A large northward-trending fault, the Bowling Green Fault, is believed to have formed in response to stresses caused by vertical uplift of the region. The fault appears to start somewhere in southeastern Hancock County and trends north through the county towards Michigan. Near the city of Findlay, displacement of as much as 100 feet is reported to have occurred along the fault, greatly altering the stratigraphic sequence of formations east and west of the fault line (ODNR, 1970, ODNR, 1994).

During the glacial period, ice sheets of both the Illinoian and Wisconsin Age advanced and retreated over the area. As the ice sheets retreated, a large lake was formed. This glacial lake leveled the till plain. Consequently, the county is now typified by level or nearly level expanses, broken only by sand ridges that formed during the glacial period, by high areas underlain by limestone, and by breaks along river and streams.

Many areas within Wood County, mainly in the eastern regions, have bedrock near the surface. This bedrock originated as a thick lime mud deposit at the bottom of the ocean. Today, the location and depth of bedrock relative to the surface is critical to appropriate land use. The City of Bowling Green and Villages of Luckey, Pemberville, West Millgrove, Risingsun, Bloomdale, Cygnet, North Baltimore, and the City of Fostoria all include tracts of land that consist of bedrock. One advantage of bedrock is that it provides a sound base for the foundations of large buildings such as factories or office parks. However, these areas contain soils that are less productive for agriculture and quite unsuitable for residential development due to high costs for excavation of solid rock for basements, septic systems, and water and sewer lines.

During the ice ages, the ice deposited unconsolidated, pebbly clay called glacial till. This glacial till composes a majority of the clay of the flat areas in Wood County. There are two different layers of till. The first layer of till deposited by the glacier has a relatively high percentage of sand and pebbles. However, the last glacial advance deposited a till that has a very high content of clay and very few pebbles. Usually, above the clay till is the sand. In Wood County, the sand extends off to the west-southwest as long, low ridges (also known as sand smears). Rainwater seeps down through the sand, but does not seep into the impermeable clay till below, thus saturating the sand. As a result, in the areas of thick sand, the hills and the ridges remain dry while the low ground is wet and boggy.

4.2.2 Hancock County

Hancock County is underlain by a relatively flat-lying sequence of Paleozoic sedimentary rocks consisting primarily of dolomite from the Silurian System. Bedrock beneath Hancock County consists of four formations: the Lockport Dolomite, the Greenfield Dolomite, the Tymochtee Dolomite, and undifferentiated Salina Group Dolomite.

The Silurian bedrock beneath Hancock County is generally comprised of a microcrystalline brown to gray argillaceous dolomite. Anhydrite and shale are interbedded with the dolomite in certain localities throughout the northwestern region of the state (Janssens, 1977, ODNR, 1994).

The bedrock formations of Hancock County lie on top of a large regional structure referred to as the Findlay Arch. The arch, a geologic structure resulting from tectonic forces, influenced the present configuration of bedrock formations in Ohio. The Findlay Arch splits from the Cincinnati Arch in west-central Ohio and trends northeastward towards Ontario, Canada.

A large northward trending fault, the Bowling Green Fault, is believed to have formed in response to stresses caused by vertical uplift of the region. The fault appears to start somewhere in southeastern Hancock County and trends north through the county towards Michigan. Near Findlay, displacement of as much as 100 feet is reported to have occurred along the fault, greatly altering the stratigraphic sequence of formations east and west of the fault line (ODNR, 1970, 1994).

4.2.3 Ottawa County

Ottawa County is underlain by a relatively flat-lying sequence of Paleozoic sedimentary rocks consisting primarily of dolomite from the Silurian and Devonian Systems. Silurian bedrock beneath Ottawa County consists of three formations: the Lockport Dolomite, the

Salina Group Dolomite (undifferentiated), and the Bass Islands Dolomite (Janssens, 1977, ODNR, 1994). The eastern half of Danbury Township is underlain by Devonian bedrock comprised of three formations: the Amhurstberg Dolomite, the Lucas Dolomite, and the Columbus Limestone (Sparling, 1965)

.

The Silurian bedrock beneath Ottawa County is generally comprised of a microcrystalline brown to gray argillaceous dolomite. Anhydrite and shale is often interbedded with the dolomite throughout the northwestern region of the state (Janssens, 1977). The Devonian carbonates consist of brown, sparsely fossiliferous, microcrystalline dolomite except for the upper portion of the Columbus Limestone which is typically brown, cherty, fossiliferous dolomitic limestone to calcitic limestone. Bedding thicknesses range from thin-bedded to massive (Sparling, 1965).

The bedrock structure of Ottawa County is influenced by a large regional structure referred to as the Findlay Arch. The arch, a geologic structure resulting from differential subsidence along two major basinal areas in the region (the Michigan Basin to the northwest and the Appalachian Basin to the southeast), influenced the present configuration of bedrock formations in Ohio. The Findlay Arch splits from the Cincinnati Arch in west-central Ohio and trends northeast through Allen and Clay Townships of western Ottawa County into Ontario, Canada. The bedrock beneath Ottawa County is generally flat-lying along the axis of the Findlay Arch and dips gently upon the flank of the arch at approximately one degree to two degrees east toward the Appalachian Basin (Hosfeld, 1984).

Extensive large-scale jointing (fracture surfaces) in the bedrock of Ottawa County is believed to have resulted from extensional forces created by the differential subsidence of the Michigan and Appalachian Basins (Armstrong, 1976). The systematic jointing in the bedrock produced fracture traces or lineaments that are clearly evident on aerial photos despite the cover of glacial drift in the region (Snyder, 1989). The average trend of the fracture traces are 60 degrees NE and 65 degrees NW and have indirectly influenced the shapes of the Bass Islands. The significance of fracture traces and lineaments is that they are surficially detectable signs of fractured, porous bedrock that can potentially produce high-yielding water wells (Kessler, 1986) or provide potential escape routes for contaminants from waste management areas (ODNR, 1994).

4.2.4 Sandusky County

Bedrock formations underlying Sandusky County are comprised of Devonian and Silurian aged limestones and dolomites. The carbonate units, which reach thicknesses of several hundred feet in western Sandusky County, represent the regional aquifer. Both the limestones and dolomites were deposited in shallow seas and coastal regions. Porosity in these units is largely controlled by complex networks of fractures and joints. Dissolution

of gypsum, anhydrite, and calcite along discrete zones (i.e. fractures, bedding planes, and bioturbated beds) also greatly enhances the porosity and permeability of these formations.

The youngest unit is the Devonian Age, Columbus Limestone, which is found in the extreme southeastern corner of Sandusky County. This resistant unit forms the prominent ridge of the Columbus Cuesta. In the Bellevue-Castalia regions, this unit features the most spectacular karst topography in Ohio. A karst terrain has distinctive characteristics of relief and drainage resulting from the dissolution of limestone or dolomite by the action of surface and ground water. Karst terrain typically has a well-developed underground drainage network ranging from fractures and minor solution channels to caverns with subterranean streams. Dolines (sinkholes), springs, sinking streams, ponors (swallow holes), and caves are surface expressions related to the underground drainage network. Tintera (1980) and Norris (1982) have carefully documented the sinkholes and collapse features in the area. Sikora (1975) and Kihn (1988) discussed the complicated ground water flow systems in this karst region (ODNR, 1990).4.3

4.3 Soils

Soil characteristic are key information in the environmental assessment of a watershed. Soil types tell us the erodibility of topsoil, infer whether an area may be a wetland and able to support hydrophytic vegetation, and indicate a property's ability to provide onsite sewage treatment.

State and federal agencies provide soils data online. Ohio DNR's Lake Erie GIS Map Viewer (http://www.dnr.state.oh.us/website/ocm_gis/mapviewer_app/) provides viewable, searchable and downloadable soil information to target and priorize watershed BMPs for Ottawa, Sandusky and Wood counties. Information for Seneca and Hancock counties can be obtained from SSURGO at http://soildatamart.nrcs.usda.gov/Survey.aspx?State=OH and http://websoilsurvey.nrcs.usda.gov/app/.

4.3.1 Hancock County

Approximately 141.1 square miles of the Portage River Basin is in Hancock County. The Portage River drains 26.5% of Hancock County. The topography area of Hancock County draining to the Portage watershed is near level on the lake plain and on parts of the till plan to undulating in the morainic areas. There are some moderately steep areas on the moraines and along stream escarpments. Topography has affected the formation of soils in Hancock County chiefly through its effect on the action of water on or in the soil. Topography controls and modifies the active factors of soil formation through its control of runoff, erosion, depth of water table, internal drainage, leaching and accumulation and removal of organic matter. A large amount of organic matter in the very poorly drained soils is mainly a result of topographic position. These soils remain wet for long periods and more organic material accumulates.

Three soil associations are present within the watershed and are poorly drained clays, loams, and glacial till deposit. The soils are formed from till, lacustrine modified till, outwash sand and gravel associated with Wisconsin Glaciation, and from recent alleviation. More than 90% of soils in Hancock County are affected by seasonal wetness.

1. Hoytville Association
    - Makes up 11% of the county
    - Deep, very poorly drained soils that have a clay subsoil; on the lake plain
    - Consists of 75% Hoytville and 25% minor soils
    - Major limitation: seasonally high water table; undrained areas are usually wet and swampy for long period during winter and spring.
2. Mermill-Millgrove – Digby Association
    - Makes up 9% of the county
    - Deep, very poorly drained and somewhat poorly drained soils that have a subsoil or sandy clay loan to clay loan; on outwash plains and beach ridges
    - These soils occur in three different parts of the county and the relative proportion differs in each.
    - The northern part of county within the Portage watershed is characterized by narrow beach ridges made up of poorly drained Digby, well drained Belmore, and moderately well drained Haney; and poorly drained Millgrove and Mermill adjacent to these beach ridges.
3. Blount-Pewamo Association
    - Makes up 63% of the county
    - Deep, somewhat poorly drained and very poorly drained soils that have a subsoil of clay to heavy silty clay loan; on the glacial till plain
    - 50% somewhat poorly drained Blount soils, 32% very poorly drained Pewamo soils, and 18% minor soils which range from moderately well drained to very poorly drained
    - Major limitation: excessive wetness, seasonal high water table, slow or moderately slow permeability.

4.3.2 Ottawa County

Approximately 101.0 square miles of the Portage River Basin is in Ottawa County. The Portage River drains 39.6% of Ottawa County. The topography of Ottawa County is nearly level to sloping. West of Port Clinton, the surface is flat and is little elevated above Lake Erie. Shallow stream valleys are to a depth ranging from 15-25 feet. The low limestone ridges, or knolls, rise 5 to 15 feet above the general level to break the evenness of the landscape. East of Port Clinton the relief is undulating or gently rolling. It is generally level along the lakefront and rises gently inland, except in Catawba Township

and at the eastern end of Marblehead Peninsula where limestone bedrock protrudes above the surrounding plain. The eastern portion of Ottawa County drains to the Portage River, which flows northeast and drains directly into Lake Erie. Five major soil associations are identified in Ottawa County and all are located in the watershed. The most common is Toledo association, a poorly drained clayey glacial lakebed sediment and glacial till.

1. Castalia-Milton association –
   - Moderately deep, nearly level and gently sloping
   - Well-drained soils formed in dominantly loamy and clayey material over dolomitic limestone bedrock
2. Hoytville-Nappanee association –
   - Deep, nearly level, very poorly drained and somewhat poorly drained soils formed in silty and clayey glacial till
3. Lenawee-Kibbie-Colwood association –
   - Deep, nearly level, very poorly drained and somewhat poorly drained soils formed in silty, loamy, and sandy glacial lakebed deposits.
4. Toledo association –
   - Deep, nearly level, very poorly drained soils formed in clayey glacial lakebed sediments
5. Toledo-Nappanee association –
   - Deep, nearly level, very poorly drained and somewhat poorly drained soils formed in clayey glacial lakebed sediments and glacial till.

4.3.3 Sandusky County

Approximately 83.6 square miles of the Portage River Basin is in Sandusky County. The Portage River drains 20.4% of Sandusky County. Sandusky County is nearly flat topography throughout the county. There are beach ridges in the southeastern and southwestern parts of the county. Soils in the Portage watershed of the county are sandy, silty, clay loam soils, which are very poorly drained and somewhat poorly drained. These soils have a seasonal high water table near or above the surface and are ponded during periods of heavy rain with permeability slow. Sandusky soils in the watershed include Nappanee, Glynwood, Castalia, Hoytville, Kibbee, Lenawee, Millsdale, Dunbridge, Mermill, Paulding, Toledo, and Haskins.

4.3.4 Seneca County

A small portion of the Portage is in Seneca County: approximately 1.4 square miles of the Portage River Basin is in Seneca County, comprising 0.2% of that county. The Seneca County area of the Portage is within the City of Fostoria.

4.3.5 Wood County

The Portage River is the largest drainage basin of Wood County and drains 283.6 square miles, or 45.9% of the county. The secondary basin is the Maumee River basin which drains 31.3% of the county.

Wood County soils are comprised of 5 main associations:

1. **Hoytville Association**- Very poorly drained, dark colored soils in finely grained gritty till on broad flats.
   - This association is a broad, flat expanse of dark colored soils and small, slightly higher areas of lighter colored soils. Hoytville soils comprise 80% of the soil in Wood County. The nearly level, very poorly drained, dark-colored Hoytville soils make up about 80 percent of this association. These soils developed in glacial till. They are associated with the nearly level, very poorly drained, dark-colored Mermill soils, which developed in sandy material underlain by clay. Both soils are deep and are highly productive. Small areas of Nappanee, St. Clair, Digby, and Haskins soils are also occur in this association.
   - The soils in this association are used primarily for cash crops. Grain is the principal crop, but some specialty crops are also grown.
   - Adequate drainage is the principal management need. Maintenance of good tilth is a problem on the Hoytville, Nappanee, and St. Clair soils. The sandy soils need additions of organic matter.

2. **Toledo association** – Very poorly drained, dark-colored soils in fine-grained, highly sorted lake sediments on broad flats
   - This association is a flat expanse of dark-gray soils and small, slightly higher areas of light-colored soils. It occurs in the northern part of the county and makes up about 5 percent of the acreage.
   - About 80 percent of this association consists of the very poorly drained, dark-colored Toledo soils. These soils developed in lake-laid clay. They are deep and are highly productive. The somewhat poorly drained, light-colored Fulton soils occur as small, nearly level or gently sloping, slightly elevated areas. They also developed in lake-laid clay, but they are less productive and more difficult to drain than the Toledo soils, and they erode readily if cultivated.
   - The farms in this association are scattered among residential areas, commercial developments, and areas of idle land held for investment purposes. Grain is the principal cash crop, but specialty crops are also grown.
   - Adequate drainage is the principal management need. The maintenance of tilth is also important.

3. **Belmore association-** Nearly level to gently sloping, well-drained to excessively drained, light-colored soils on elongated beach ridges

- This soil association is characterized by elongated ridges of sandy and gravel soils on an otherwise flat landscape. It occurs in the southern part of the county and totals about 1 percent of the county.
- About 95 percent of this association is occupied by the well-drained to excessively drained Belmore soils. The rest consists of small areas of the moderately well drained Haney soils and the somewhat poorly drained Digby soils. All of these soils are on narrow ridges, which are remnants of lake beaches. They are underlain by material that contains a large amount of coarse sand and gravel. Their potential productivity is medium.
- The soils in this association are high in content of sand and tend to be droughty. Thus, maintenance of the organic-matter content is important.
- The ridges have good natural drainage, and the crests have been used as sites for roads and homes since the county was first settled. Truck and orchard crops are grown in addition to the other principal crops of the county.

4. **Wauseon-Ottokee-Spinks association** – Nearly level, very poorly drained, dark-colored sandy soils and gently sloping, somewhat poorly drained, light-colored sandy soils
   - This association is characterized by highly contrasting areas of rolling, light-colored sandy soils and nearly level, poorly drained, dark-colored soils. These soils formed in lake-laid sands. Most areas are scattered across the central part of the county, but there is a small area in the extreme northern part. This association covers about 12 percent of the county.
   - The soils in this association occur in complex patterns. The very poorly drained, dark-colored Wauseon soils, which occur in level or depressed areas, make up about 25 percent of the acreage; the well-drained to moderately well drained, light-colored sandy Ottokee and Spinks soils make up about 25 percent; the somewhat poorly drained, light-colored Rimer and Tedrow soils, over clay, make up about 25 percent; and the Seward, Ottokee, and Colwood soils make up the rest. In places the Wauseon and Ottokee soils are underlain by clay. Potential productivity ranges from very high on the Wauseon and Colwood soils to low on the gently sloping Spinks soils.
   - The soils in this association are used primarily for cash grain crops. Spring grain generally is not grown on the light-colored soils, because of the hazard of wind erosion.

5. **Millsdale-Randolph-Romeo association** – Gently sloping soils that are shallow to limestone.
   - This association consists of relatively small areas of shallow soils that are low in productivity and that are used principally for woods or pasture. These areas are scattered among larger areas of more productive soils in the eastern half of the county. The soils range from well-drained to very poorly drained and are underlain by limestone at a depth of 10 to 42

inches. Also, there are numerous glacial stones and fragments of limestone on the surface. This association covers about 2 percent of the county.

- The dark-colored, very poorly drained Millsdale soils make up about 20 percent of the association; the lighter colored, somewhat poorly drained Randolph soils about 20 percent; and the well-drained, moderately dark colored Romeo soils about 20 percent. The Milton, Joliet, Dunbridge, and Ritchey soils make up other percentages. The Romeo soils are very shallow to bedrock.
- Most of this association is used for pasture or woods. The deeper soils are used to grow cash grain crops, but crops are often damaged during periods of drought because of the low moisture-supplying capacity.
- Shallowness to limestone is the most limiting factor in this association. Drainage is difficult because the soils are shallow.

4.4 Glacial History

The glacial geology began approximately 2 million years ago when the Pleistecone Epoch commenced with a series of continental glaciers covering the northern half of North America. Four major glacial advances: the Nebraskan (oldest), Kansan, Illinoian, and Wisconsinan (youngest) are known to have occurred in North America during the Pleistocene Epoch. In Ohio, evidence exists for three glacial periods; the pre-Illinoian, which includes the Kansan and possibly the Nebraskan periods but is not reliably dated (Norton et al., 1983); the Illinoian, which occurred at least 120,000 years ago; and the Wisconsinan, which occurred between 70,000 and 10,000 years ago (Fullerton, 1986).

Continental glaciation greatly altered much of Ohio's preglacial landscape by burying its tertiary topographic relief and drainage systems beneath a mantle of unconsolidated clastic deposits. This mantle consists of both sorted and unsorted deposits of clay, silt, sand, and gravel (Ground Water Pollution Potential of Hancock, County, Ohio).

The formation of the Portage River headwater streams are directly influenced by the glacial end moraine in Hancock County and the bedrock topography of the Portage watershed. The Ohio Department of Natural Resources, Division of Geological Survey has created geological and glacial maps of Ohio that provide us a greater understanding of the Ohio land-surface today and why northwestern Ohio is so flat and such a vital region of rich agricultural soils. Additional graphics can be found in the appendix of this watershed plan.

4.5 Rare, Threatened and Endangered Species

The Ohio Natural Heritage Database is maintained by the Division of Natural Areas and Preserves, ODNR. The following list of rare plants, lichens and mosses is listed by the entire county land area to acknowledge the ecological richness of the Huron-

Erie Lake Plain Region. The geographical locations of species present in the Portage drainage basin are highlighted in grey and remain in alphabetical order by scientific name for easy reference.

In Chapter 5 of the HUC14 subwatershed description is a species identification,

Table 13: Rare, Threatened, and Endangered Species

Hancock County

Number of rare plant species for this county: 4
As of 06/04/2008

Scientific Name	Common Name	Last Observed	State Status	Federal Status
Anemone cylindrica	Prairie Thimbleweed	1977	T	
Arabis hirsuta var. adpressipilis	Southern Hairy Rock Cress	1978	P	
Carex alopecoidea	Northern Fox Sedge	1960	E	
Ulmus thomasii	Rock Elm	2008	T	

P=Potentially Threatened, T=Threatened, E=Endangered, X=Presumed Extirpated,
FT=Federally Threatened, FE=Federally Endangered.

Sandusky County

Number of rare plant species for this county: 11
As of 06/05/2008

Scientific Name	Common Name	Last Observed	State Status	Federal Status
Acorus americanus	American Sweet-flag	2005	P	
Cypripedium candidum	White Lady's-slipper	1995	E	
Descurainia pinnata	Tansy Mustard	1960	P	
Hedyotis nigricans	Narrow-leaved Summer Bluets	1980	P	
Juncus balticus	Baltic Rush	1960	P	
Moehringia lateriflora	Grove Sandwort	1991	P	
Packera paupercula	Balsam Squaw-weed	1992	T	
Platanthera leucophaea	Prairie Fringed Orchid	2002	T	FT
Sphenopholis obtusata var. obtusata	Prairie Wedge Grass	1992	T	
Triglochin palustris	Marsh Arrow-grass	1959	P	
Viola nephrophylla	Northern Bog Violet	1967	E	

P=Potentially Threatened, T=Threatened, E=Endangered, X=Presumed Extirpated,
FT=Federally Threatened, FE=Federally Endangered.

Seneca County

Number of rare plant species for this county: 16
As of 06/05/2008

Scientific Name	Common Name	Last Observed	State Status	Federal Status
Lichens: *Collema crispum*	Crinkled Jelly Lichen	1962	X	
Vascular Plants:				
Betula pumila	Swamp Birch	1994	T	
Carex alata	Broad-winged Sedge	2004	P	
Carex bebbii	Bebb's Sedge	1999	P	
Carex cryptolepis	Little Yellow Sedge	2007	P	
Carex lasiocarpa	Slender Sedge	1993	P	
Carex pseudocyperus	Northern Bearded Sedge	2004	E	
Carex viridula	Little Green Sedge	1990	P	
Cypripedium candidum	White Lady's-slipper	1994	E	
Eleocharis engelmannii	Engelmann's Spike-rush	1969	E	
Eleocharis quinqueflora	Few-flowered Spike-rush	2004	T	
Phragmites australis ssp. americanus	American Reed Grass	2006	T	
Potamogeton gramineus	Grass-like Pondweed	1986	E	
Rhynchospora alba	White Beak-rush	2007	P	
Spiranthes lucida	Shining Ladies'-tresses	1980	P	
Woodwardia areolata	Netted Chain Fern	2006	P	

P=Potentially Threatened, T=Threatened, E=Endangered, X=Presumed Extirpated,
FT=Federally Threatened, FE=Federally Endangered.

Ottawa County

Number of rare plant species for this county: 69

As of 06/04/2008 *shaded rows are species found within the watershed

Scientific Name	Common Name	Last Observed	State Status	Federal Status
Lichens: *Xanthoria elegans*	Elegant Sunburst Lichen	2002	E	
Mosses: *Tortella inclinata*	Curved Tortella	1992	E	
Vascular Plants:	American Sweet-flag	1971	P	

Scientific Name	Common Name	Last Observed	State Status	Federal Status
Acorus americanus				
Ammophila breviligulata	American Beach Grass	1986	T	
Anemone cylindrica	Prairie Thimbleweed	1970	T	
Arabis drummondii	Drummond's Rock Cress	1995	E	
Arabis hirsuta var. adpressipilis	Southern Hairy Rock Cress	1981	P	
Artemisia campestris	Beach Wormwood	1967	T	
Astragalus canadensis	Canada Milk-vetch	1979	T	
Cakile edentula	Inland Sea Rocket	2007	P	
Calamintha arkansana	Limestone Savory	1998	T	
Campanula rotundifolia	Harebell	2004	T	
Carex atherodes	Wheat Sedge	1996	P	
Carex aurea	Golden-fruited Sedge	1996	T	
Carex bebbii	Bebb's Sedge	2004	P	
Carex brevior	Tufted Fescue Sedge	2002	T	
Carex cephaloidea	Thin-leaved Sedge	2007	T	
Carex garberi	Garber's Sedge	1998	E	
Carex sprengelii	Sprengel's Sedge	2002	T	
Carex viridula	Little Green Sedge	1998	P	
Ceanothus herbaceus	Prairie Redroot	1980	X	
Chenopodium leptophyllum	Slender Goosefoot	1974	X	
Cornus rugosa	Round-leaved Dogwood	1968	P	
Corydalis sempervirens	Rock-harlequin	1973	P	
Cuscuta coryli	Hazel Dodder	1968	X	
Cyperus diandrus	Low Umbrella-sedge	2004	P	
Cyperus schweinitzii	Schweinitz' Umbrella-sedge	2005	T	
Descurainia pinnata	Tansy Mustard	1997	P	
Draba reptans	Carolina Whitlow-grass	1996	T	
Eleocharis compressa	Flat-stemmed Spike-rush	1998	T	
Eleocharis geniculata	Caribbean Spike-rush	1997	E	
Eleocharis ovata	Ovate Spike-rush	1995	E	
Elymus trachycaulus	Bearded Wheat Grass	1964	T	

Scientific Name	Common Name	Last Observed	State Status	Federal Status
Equisetum variegatum	Variegated Scouring-rush	1967	E	
Euphorbia polygonifolia	Seaside Spurge	2007	P	
Hedeoma hispida	Rough Pennyroyal	1990	P	
Hedyotis nigricans	Narrow-leaved Summer Bluets	2005	P	
Juncus alpinus	Alpine Rush	1997	P	
Juncus balticus	Baltic Rush	1994	P	
Lilium philadelphicum	Wood lily	1971	E	
Minuartia michauxii	Rock Sandwort	2000	P	
Myriophyllum sibiricum	American Water-milfoil	1972	T	
Nuphar variegata	Bullhead-lily	2004	E	
Oenothera oakesiana	Oakes' Evening-primrose	2007	P	
Oenothera parviflora	Small-flowered Evening-primrose	2005	P	
Packera paupercula	Balsam Squaw-weed	2000	T	
Panicum philadelphicum	Philadelphia Panic Grass	2005	E	
Panicum tuckermanii	Tuckerman's Panic Grass	1991	T	
Platanthera leucophaea	Prairie Fringed Orchid	2007	T	FT
Populus balsamifera	Balsam Poplar	1964	E	
Potamogeton natans	Floating Pondweed	1980	P	
Potamogeton richardsonii	Richardson's Pondweed	1980	P	
Potamogeton zosteriformis	Flat-stemmed Pondweed	2003	P	
Potentilla arguta	Tall Cinquefoil	1989	E	
Potentilla paradoxa	Bushy Cinquefoil	1981	T	
Ranunculus fascicularis	Early buttercup	1996	P	
Rosa blanda	Smooth Rose	1980	T	
Sagittaria cuneata	Wapato	2004	T	
Sagittaria montevidensis	Southern Wapato	2005	P	
Sagittaria rigida	Deer's tongue Arrowhead	1998	P	
Schoenoplectus purshianus	Pursh's Bulrush	1997	P	
Schoenoplectus smithii	Smith's Bulrush	1988	E	
Sisyrinchium mucronatum	Narrow-leaved Blue-eyed-grass	1998	E	

Scientific Name	Common Name	Last Observed	State Status	Federal Status
Spiranthes magnicamporum	Great Plains Ladies'-tresses	2006	P	
Tetraneuris herbacea	Lakeside Daisy	1994	E	FT
Triplasis purpurea	Purple Sand Grass	2005	P	
Ulmus thomasii	Rock Elm	2002	T	
Viola nephrophylla	Northern Bog Violet	2002	E	
Zizania aquatica	Wild Rice	1984	T	

P=Potentially Threatened, T=Threatened, E=Endangered, X=Presumed Extirpated,
FT=Federally Threatened, FE=Federally Endangered.

Wood County

Number of rare plant species for this county: 48

As of 06/05/2008. *shaded rows are species found within the watershed

Scientific Name	Common Name	Last Observed	State Status	Federal Status
Vascular Plants: *Agalinis skinneriana*	Skinner's-foxglove	1993	E	
Amelanchier sanguinea	Rock Serviceberry	1987	P	
Androsace occidentalis	Western Rock-jasmine	1992	T	
Anemone cylindrica	Prairie Thimbleweed	1997	T	
Arabis hirsuta var. adpressipilis	Southern Hairy Rock Cress	1981	P	
Arabis lyrata	Lyre-leaved Rock Cress	1968	T	
Aureolaria pedicularia var. ambigens	Prairie Fern-leaved False Foxglove	2002	E	
Carex atherodes	Wheat Sedge	1993	P	
Carex aurea	Golden-fruited Sedge	1970	T	
Carex bicknellii	Bicknell's Sedge	1970	T	
Carex conoidea	Field Sedge	1993	T	
Carex crus-corvi	Raven-foot Sedge	1969	P	
Carex formosa	Handsome Sedge	1958	X	
Comptonia peregrina	Sweet-fern	1962	E	
Conyza ramosissima	Bushy Horseweed	1997	T	
Cuscuta pentagona	Five-angled Dodder	1969	T	
Descurainia pinnata	Tansy Mustard	1992	P	

Scientific Name	Common Name	Last Observed	State Status	Federal Status
Eleocharis compressa	Flat-stemmed Spike-rush	1981	T	
Gentiana puberulenta	Prairie Gentian	2001	E	
Hedeoma hispida	Rough Pennyroyal	2000	P	
Helianthemum bicknellii	Plains Frostweed	1983	T	
Helianthemum canadense	Canada Frostweed	1996	T	
Hesperostipa spartea	Porcupine Grass	1987	T	
Hieracium umbellatum	Canada Hawkweed	1970	T	
Juncus greenei	Greene's Rush	1991	T	
Krigia virginica	Virginia Dwarf-dandelion	1996	P	
Lechea minor	Thyme-leaved Pinweed	1969	T	
Lechea pulchella	Leggett's Pinweed	1996	T	
Lilium philadelphicum	Wood Lily	1970	E	
Lithospermum caroliniense	Plains Puccoon	1996	T	
Lupinus perennis	Wild Lupine	2007	P	
Moehringia lateriflora	Grove Sandwort	1997	P	
Monarda punctata	Dotted Horsemint	1997	E	
Opuntia humifusa	Common Prickly Pear	1997	P	
Panicum leibergii	Leiberg's Panic Grass	1993	T	
Poa saltuensis ssp. languida	Weak Spear Grass	1968	P	
Prenanthes racemosa	Prairie Rattlesnake-root	1969	T	
Prunus nigra	Canada Plum	2007	E	
Ranunculus fascicularis	Early Buttercup	1963	P	
Rosa blanda	Smooth Rose	2007	T	
Salix petiolaris	Slender Willow	1970	T	
Scleria pauciflora	Few-flowered Nut-rush	1969	P	
Scleria triglomerata	Tall Nut-rush	1970	P	
Sphenopholis obtusata var. obtusata	Prairie Wedge Grass	1970	T	
Spiranthes magnicamporum	Great Plains Ladies'-tresses	1983	P	
Triphora trianthophora	Three-birds Orchid	2004	P	
Ulmus thomasii	Rock Elm	2007	T	

Scientific Name	Common Name	Last Observed	State Status	Federal Status
Vernonia fasciculata	Prairie Ironwood	1988	P	

4.6 Invasive nonnative species (and their potential impacts)

The following is a direct download of information from ODNR website, accessed on 10/1/2009.

Many invasive, non-native plants were introduced to the United States for legitimate, well-intentioned purposes, while others were brought in by accident. Those that were able to tolerate a broad range of conditions, reproduce quickly, and disperse widely, have become well-established and are often costly to control and impossible to eradicate. Of the more than 3,000 species of plants known to occur in Ohio, approximately 25% (700-800 species) are non-native. These species were not known to occur in Ohio prior to substantial European settlement, approximately 1750. At least 60 of these species are now well-established in Ohio's natural habitats and threaten Ohio's native biodiversity by displacing native plants diversity with monocultures and altering the food web important for wildlife that depends on a variety of native plants for food and habitat.

All natural habitats in Ohio are impacted by invasive plants. In woodlands, species such as garlic mustard, Amur honeysuckle, Japanese stilt-grass, Japanese honeysuckle, and tree-of-heaven are displacing native wildflowers, tree and shrub seedlings. In wetlands, purple loosestrife, narrow-leaved cattail, Phragmites, reed canary grass, flowering-rush, and glossy buckthorn disrupt native plant communities. Grasslands are threatened by numerous invasive plants including autumn-olive, multiflora rose, Canada thistle, smooth brome, common and cut-leaved teasel, yellow and white sweet-clover.

Invasive plants can be controlled using a variety of different techniques, depending on the population size of the invasive plant and the tools available (public vs. private property). Typically, land managers and landowners use a combination of mechanical methods (e.g., cutting, pulling, mowing), herbicide application, water level control (in wetlands), prescribed burning, and biological control. The Division of Wildlife uses all these techniques to control invasive plants on its wildlife areas (ODNR, website 10/1/2009) Ohio's Top Ten Invasive Non-Native Plants (ODNR)

- Japanese Knotweed
- Japanese Honeysuckle
- Autumn Olive
- Buckthorns
- Purple Loosestrife
- Common Reed or Phragmites
- Reed Canary Grass
- Garlic Mustard

- Multiflora Rose
- Bush Honeysuckles

ODNR website:
http://www.dnr.state.oh.us/Home/wild_resourcessubhomepage/dealing_with_wildlifeplaceholder/InvasiveNuisanceSpecieslandingpage/terrestrialnuisancewildlife/resourcesmgtplansinvasives/tabid/5825/Default.aspx

Aquatic invasive nonnative species for the Great Lakes region include the Round Goby, Eurasian Ruffe, and Zebra Mussel. These invasive aquatic species are serious threats to water ecosystems that displace native fish by eating eggs and taking over habitat. Invasives usually spawn more often and survive in poor water quality. Invasives are a threat to sport and commercial fishing because they compete with native species for food and habitat.

4.7 Water Resources

4.7.1 Climate and Precipitation

Rainfall in the Portage Basin averages about 32 inches annually over most of the watershed, but averages up to 36 inches per year in the headwaters located in northern Hancock County. Snow, rain, sleet, and hail define measurable precipitation amounts. June and July are the wettest months on average for the state with an average of 4 inches precipitation each month. Typically, the driest months are January and February with about 2 inches of precipitation in the form of snow, rain, and mixed conditions. However, in February 2007 some of the worst flooding occurred in the Portage watershed.
Some weather storms approach from the northeast and can present special problems in the estuarine area along Lake Erie. High winds from these northeastern storms push lake levels higher, which in turn raise the Portage water levels in the river estuarine at the mouth of the river. However, most weather storms do track from southwest to northeast, but the Portage River levels can be influenced by changing lake effects.

Sandusky County has a thirty-year (1951-1980) average annual precipitation of 32.78 inches (U.S. Department of Commerce, 1982). Mean annual temperature for the Fremont area over the same period was 50.43ºF. This climate is typical for north central Ohio adjacent to Lake Erie.

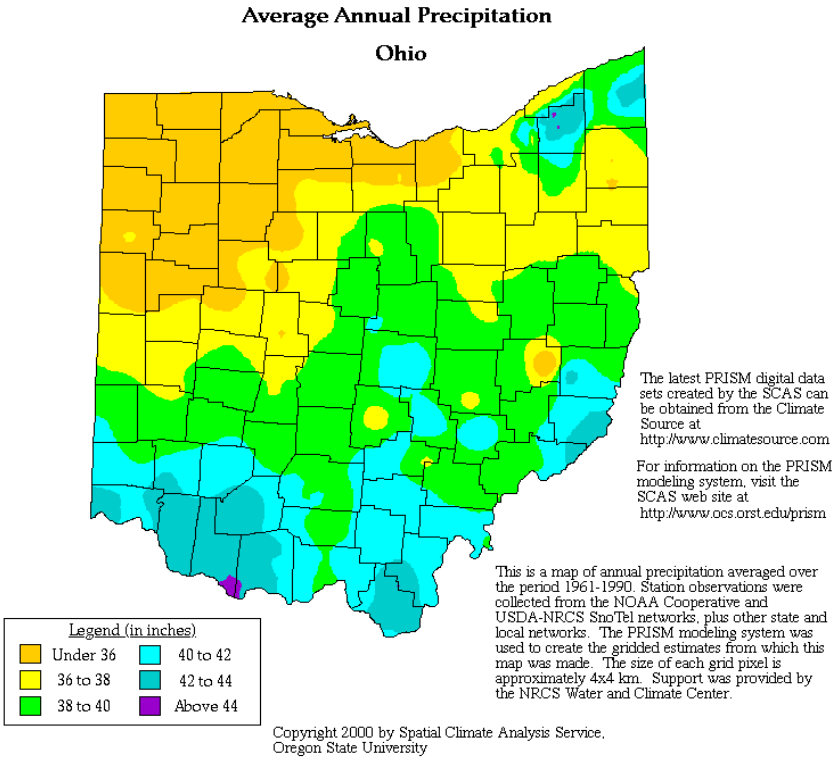
The climate of **Ottawa County** is typical of the temperate mid-continent region, characterized by a wide range between summer and winter temperatures and moderate amounts of precipitation. The average monthly precipitation at the U.S. Weather Bureau Station at Put-In-Bay, South Bass Island for the thirty-year period from 1961 to 1990 ranged between 1.50 inches for February and 3.52 inches for August (U.S. Department of Commerce, 1992). The average annual precipitation for the county was 31.68 inches (U.S. Department of Commerce, 1992). The average annual temperature range for the

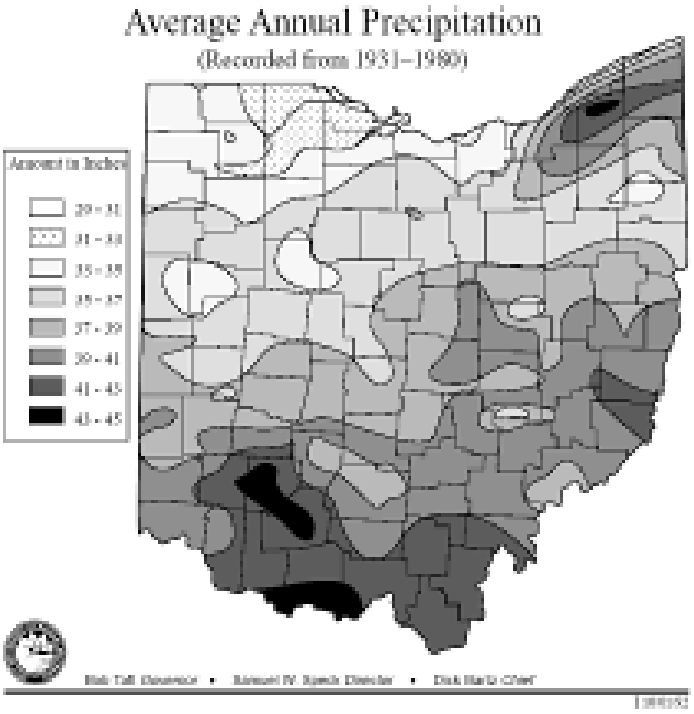
same thirty-year period was between 30.1° F (January) and 81.5° F (July) with an average annual temperature of 56.8° F (U.S. Department of Commerce, 1992).

Wood County climate is typical of the temperate mid-continent region, characterized by a wide range between summer and winter temperatures and moderate amounts of precipitation. The average monthly precipitation at the U.S. Weather Bureau Station at Bowling Green for the thirty year period from 1961 to 1990 ranged between 1.51 inches for February and 3.98 inches for July. The average annual precipitation for the county was 32.77 inches. The average annual temperature range for the same 30-year period was between 31.0° F (January) and 84.6° F (July) with an average annual temperature of 59.6° F (U.S. Department of Commerce, 1992).

Hancock County In winter, the average temperature is 26.0F and the average daily minimum temperature is 18.7 degrees. The lowest temperature on record, which occurred at Findlay on January 19, 1994, is -20 degrees. In summer, the average temperature is 70.9 degrees and the average daily maximum temperature is 81.4 degrees. The highest recorded temperature, which occurred on June 25, 1988, is 104 degrees. The average annual precipitation is about 36.29 inches. Of this, 20.7 inches, or 57 percent, usually falls in May through October. The growing season for most crops falls within this period. The heaviest 1-day rainfall on record was 6.25 inches on September 1, 1959. Thunderstorms occur on about 37 days each year, and most occur between May and August. The average seasonal snowfall is about 29 inches. The greatest snow depth at any one time during the period of record was 23 inches. On the average, 45 days of the year have at least one inch of snow on the ground. The number of such days varies greatly from year to year. The heaviest one-day snowfall on record was 15.2 inches on January 31, 1982.

Figure 18: Average Annual Precipitation





For larger view of maps see Appendix TSurface Water

4.7.2 Wetlands

Ottawa County has more than 10,000 acres in large privately owned wetlands. It also is the home of Winous Point Shooting Club, the oldest hunt club in North America. There are approximately 55 smaller private wetlands that total more than 2500 acres scattered through Portage, Erie, Bay, Carroll, Salem, Danbury, and Benton Townships.

Other wildlife areas in the watershed include the Little Portage Wildlife Area, Darby Marsh, managed by Ottawa National Wildlife Refuge, which sits along the shores of Lake Erie near Port Clinton, and Meadowbrook Nature Preserve in Danbury Township with 110 acres of preserve with 31 acres of wetlands.

Wood, Hancock, and Sandusky County wetlands are mapped in the eight-digit Portage River Watershed Wetland Area map in **Appendix K**.

4.7.3 Streams

The Portage River has twelve tributaries or branches that flow into the Portage River Mainstem as identified by the *Gazetteer of Ohio Streams*. The geographical index list of Ohio streams provides the stream name and elevation fall of that tributary drainage area. Each of these tributaries are subwatersheds of the Portage Mainstem. The South Branch and Middle Branch tributaries are further reduced into smaller (HUC-14) watersheds as the elevation and drainage patterns change before reaching the confluence of the Portage Mainstem. The *Gazetteer of Ohio Streams* does not include the headwaters from Hancock County.

Table 14: Gazetteer Index of the Portage River

Portage River Watershed									
Stream Name	**Ohio Stream Code**	**Flows Into**	**County @ Mouth**	**Length (miles)**	**Elev. (source)**	**Elev. (mouth)**	**Avg. Fall (ft/mile)**	**Drains (sq. mile)**	**Comment**
Portage	112	Lake Erie	Ottawa	60.0	777	573	3.3	581	Incl. South Branch
Little Portage R.	112.01	Portage River	Ottawa	14	618	574	3.1	32.5	Incl. Ninemile Creek
Ninemile Creek	112.0101	Little Portage River	Ottawa	10.2	618	577	4	24	
Lacarpe Creek	112.02	Portage River	Ottawa	12.5	610	574	2.8	13.9	Intermittent stream
Wolf Creek	112.03	Portage River	Ottawa	7	615	576	5.5	13	
Sugar	112.04	Portage	Ottawa	17.8	690	577	6.3	59	

Portage River Watershed									
Stream Name	**Ohio Stream Code**	**Flows Into**	**County @ Mouth**	**Length (miles)**	**Elev. (source)**	**Elev. (mouth)**	**Avg. Fall (ft/mile)**	**Drains (sq. mile)**	**Comment**
Creek		River							
South Branch Portage River	112.05	Portage River	Wood	27.5	777	634	5.2	335	
Middle Branch Portage River	112.0501	S. Branch Portage River	Wood	27.8	733	652	2.9	225	Incl. Needles Creek
Bull Creek	112.050101	Middle Br. Portage River	Wood	14.3	767	666	7	30	
Rocky Ford	112.050102	Middle Br. Portage River	Wood	22.9	811	669	6.2	73.1	
Needles Creek	112.050103	Middle Br. Portage River	Wood	10.7	733	689	4.1	32.8	
East Branch Portage River	112.0502	South Br. Portage River	Wood	17.2	789	677	6.5	35.8	
North Branch Portage River	112.06	Portage River	Wood	25.8	688	634	2	59.1	
Source: Gazetteer of Ohio Streams, August 2001									

Figure 19: Portage River Watershed 14-digit Hydrologic Unit Code Maps

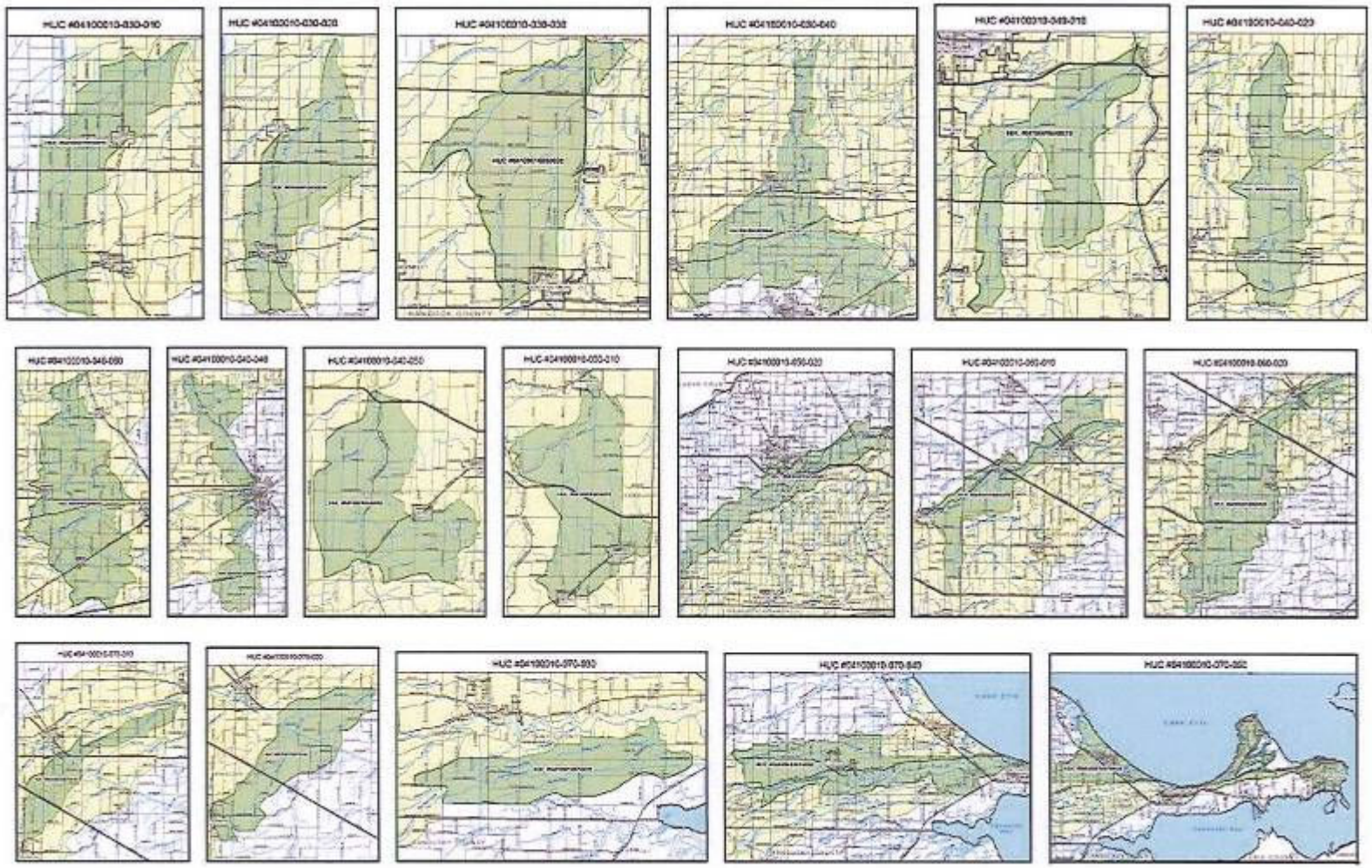


Table 15: Watershed Land and Water Areas

Sub-watershed Name	Sub-watershed Number 14-DIGIT HUC	Land Area (Acres)	Water Area (Acres)	Total Area (Acres)
Needles Creek above Rader Creek	04100010-030-010	20,094	5	20,099
Rader Creek	04100010-030-020	20,841	24	20,865
Middle Branch Portage River below Rader Creek to above Rocky Ford Creek	04100010-030-030	19,988	76	20,065
Rocky Ford Creek	04100010-030-040	46,456	303	46,759
Middle Branch Portage River below Rocky Ford Cr. to Above S. Branch Portage R. (except Bull Cr.)	04100010-040-010	16,747	19	16,766
Bull Creek	04100010-040-020	19,206	11	19,217
South Branch Portage River headwaters to above Middle Branch	04100010-040-030	34,522	47	34,569
East Branch Portage River	04100010-040-040	22,387	428	22,815
South Branch Portage River below E. Branch to above Middle Branch	04100010-040-050	13,151	14	13,165
Portage River below S. Branch to above N. Branch	04100010-050-010	11,028	99	11,127
North Branch Portage River	04100010-050-020	37,739	95	37,834
Portage River below N. Branch to above Sugar Cr. (includes Lacarpe Cr. Outlet #4)	04100010-060-010	17,679	315	17,994
Sugar Creek	04100010-060-020	37,410	298	37,708
Wolf Creek	04100010-070-010	8,302	25	8,328
Ninemile Creek	04100010-070-020	12,624	135	12,759
Little Portage River below Ninemile Cr. To Portage R.	04100010-070-030	7,753	227	7,980
Portage River below Sugar Cr. To Lake Erie including Lacarpe Cr. Outlets 2&3 (except Wolf Cr. & L. Portage Rd.)	04100010-070-040	20,448	2,487	22,935
Lake Erie Drainage downstream of Toussaint Cr. To Marblehead (except Portage R.)	04100010-070-050	18,460	584	19,044

Problem statements, goals, and recommended actions can be found in the Subwatershed Inventory section of this plan.

4.7.4 Historic Flood Events

Several damaging flood events have occurred in the Portage River watershed, the earliest mentioned in 1910. Flooding on the Portage is not a new phenomenon, but with continued development in and near the floodplain, the potential for damage from a given flood has increased over time.

The flood event generally considered to be the worst to occur in the Portage River Basin was the flood of March 1913, which is also considered the worst flood on record for most of northwest Ohio. Following already heavy rainfall on March 13-15 and 20-21, two days of heavy rain on March 26 and 27 produced record flooding. The peak discharge was later estimated by the USGS to be 17,000 cubic feet per second (CFS), which would be expected to occur on average about once every 500 years. There was apparently no loss of life, but damage to property and livestock was considerable (Portage Hydrologic Report, 2002).

The USGS has operated a stream gage (#04195500) on the Portage River at Woodville since 1928. Recorded stream flow data are available from 1928 to the present, except for the period from December 1935 to October 1939. The USGS also began operation of another stream gage (#04195820) on the Portage River at Elmore in August 1998. There were also two additional stream gages in the Portage Basin that have been discontinued: on the Portage River at Pemberville (#04194500) with data from 1930-35, and on the North Branch near Bowling Green (#04195000) with data from 1924-32. Records of daily stream flows are published annually by the USGS.

The highest recorded peak discharge recorded at the Woodville gage since the 1913 flood was 11,500 cfs, occurring on February 15, 1950. However, the most serious flood since 1913 was probably the flood that occurred on February 12, 1959. About three inches of rain fell within a 24-hour period on ground that was frozen, allowing less water to infiltrate into the soil and producing a larger volume of runoff. The peak discharge at Woodville was 7,490 cfs, and the flooding was worsened by the presence of ice jams along the Portage River. More recently, damaging floods have occurred in 1990 (10,400 cfs), 1997 (9,810 cfs), 1998 (11,400 cfs), and 1999 (8,600 cfs).

Table 16: USGS Stream Gauges in the Portage

USGS Stream Gauge No.	Location	Begin-End Date	Drainage Area	Stream/River Site	Status	Datum of Gauge
04194500	41 22 44, 83 28 34 Wood County	1931-1935	337 sq. mi.	Portage R @ Pemberville	Discontinued	
04195000	41 23 20, 83 33 40	1923-1932	45.1 sq. mi.	North Branch @ Bowling	Discontinued	655 ft. above sea

USGS Stream Gauge No.	Location	Begin-End Date	Drainage Area	Stream/River Site	Status	Datum of Gauge
	Wood County			Green		level
04195500	41 26 58, 83 21 41 NAD27 Sandusky County	1928-9/30/2008 (Except from 12/1935 to 10/1939)	428 sq. mi.	Portage R @ Pemberville	Discontinued	614.75 ft. above sea level
04195820	41 29 28, 83 13 29 NAD 27 Ottawa County	Aug. 1998 to Present	494 sq. mi.	Portage R @ Elmore	Real-Time USGS	580 feet above sea level NGVD29
All gauges located downstream but for (04195000) North Branch 1924-1932. REMARK: Station #04195820=Flow supplemented by water imported from Maumee River Basin for municipal supply for the city of Bowling Green 30 mi upstream. The importation of this water began Sept. 1, 1951. See station 04195500 for monthly diversion figures.						
http://waterdata.usgs.gov/nwis/nwisman?						

A number of historical stream gage sites may be found by searching gage data on the USGS website. The majority of the sites contain a few years of stream data but not enough long-term data to establish trends independent of weather fluctuations, yet they hold an interest and value to our connection with the river. Historical data can hold clues and insight for direction of modern data collection on our local and state waterways. For instance, what prompted the USGS to install gage sites at these locations, and could benefits be found in re-establishing these gage sites? How does stream gage data on the Portage River contribute to the water quality research of Lake Erie and the Great Lakes region? The following table provides the site number, name, coordinate location, drainage area, and dates of operation.

Table 17: Historical Stream Gage Locations in the Portage River Watershed

Historical Stream Gage Locations in the Portage River Watershed								
Agency	County	Site no.	Site Name	Latitude	Longitude	Drainage size (sq mi)	From	To
USGS	WOOD	4194300	Middle Branch Portage River at Mermill OH	41 17 55	83 39 02	74.8	8/17/1965	8/24/1971
USGS	WOOD	4194310	Middle Branch Portage River near Portage OH	41 20 19	83 33 10	217	4/17/1969	4/2/1975
USGS	WOOD	4194362	South Branch Portage River near Jerry City	41 62 22	83 30 57	54	11/29/1994	8/25/2009

Historical Stream Gage Locations in the Portage River Watershed								
Agency	County	Site no.	Site Name	Latitude	Longitude	Drainage size (sq mi)	From	To
USGS	WOOD	4194400	South Branch Portage River near Six Points OH	41 18 41	83 30 36	99.5	8/17/1965	8/21/1974
USGS	WOOD	4194500	Portage River near Pemberville OH	41 22 44	83 28 34	337	8/1/1930	9/30/1935
USGS	WOOD	4195000	North Branch Portage River near Bowling Green OH	41 23 20	83 33 40	45.1	11/10/1923	9/30/1932
USGS	WOOD	4195061	North Branch Portage River at Scotch Ridge OH	41 24 05	83 31 19	48.8	1/31/2002	8/25/2009
USGS	SANDUSKY	4195500	Portage River at Woodville OH	41 26 58	83 21 41	428	8/1/1928	9/30/2008
USGS	SANDUSKY	4195600	Portage River at Railroad Bridge at Woodville OH	41 26 58	83 21 29	428	10/1/1950	9/30/1953
USGS	OTTAWA	4195800	Portage River at Elmore OH	41 28 37	83 17 44	-	10/6/1970	4/17/1974
USGS	OTTAWA	4195820	Portage River near Elmore OH	41 29 28	83 13 29	494	8/1/1998	10/6/2009
USGS	OTTAWA	4195825	Lacarpe Creek near Oak Harbor OH	41 31 15	83 12 11	2.95	11/12/1987	9/30/1992
USGS	OTTAWA	4195830	Bayou Ditch near Oak Harbor OH	41 30 48	83 11 01	2.82	12/17/1987	9/30/1992
SOURCE: http://waterdata.usgs.gov/nwis/nwisman?								

4.7.5 Low Flow

Streamflow characteristics are used by engineers and low-flow stream data is important for water-resource managers for issues that include properly designed hydro structures, bridges, habitat assessments, industrial or municipal supply or waste disposal structures. Knowing the amount of flow in a stream is critical for making decisions about water resources and preventing actions that are potentially harmful to water quality and aquatic life. Many agencies use the low flow characteristics such as the minimum 7-day average streamflow within a 10-year reoccurrence interval ($7Q_{10}$), or the harmonic mean flow as target conditions or thresholds for making regulatory decisions.

The Portage River watershed has one USGS long-term continuous-record streamflow-gaging station (04195500) at Woodville, Ohio. The information shown below is provided as listed in the *USGS (U.S. Geological Survey) Low-Flow Characteristics of Streams in Ohio through Water Year 1997 – Water Resource Investigation Report, 01-4140*.

04195500 Portage River at Woodville, Ohio

LOCATION: Lat 41º 26' 58", long 83º21' 41", in sec. 28, T. 6 N., R. 13 E., Sandusky County, Hydrologic Unit 04100010, on left bank at upstream side of bridge on U.S. Highway 20 in Woodville, 600 ft downstream from unnamed right bank tributary, and 10.3 mi upstream from Sugar Creek.

DRAINAGE AREA: 428 mi^2.

TRIBUTARY TO: Lake Erie.

STREAMFLOW DATA USED: October 1951 to September 1997.

REMARKS: Flow supplemented by water imported from Maumee River Basin for municipal supply for city of Bowling Green 16 mi upstream. The importation of this water began Sept. 1, 1951.

SELECTED STREAMFLOW CHARACTERISTICS:

	Portage River Basin
• Harmonic mean flow	
• Average streamflow	345 ft^3/s (46 years)
• Minimum daily streamflow	1.8 ft^3/s

Table 18: Magnitude and Frequency of Low Flows for Indicated Periods

Period	Number of consecutive days	Streamflow (ft^3/s) for indicated recurrence interval (years)				
		2	5	10	20	50
Apr.-Mar.	1	6.4	3.9	3.0	2.5	1.9
	7	7.5	4.8	3.8	3.2	2.6
	30	10	6.3	5.3	4.8	4.4
	90	22	10	7.6	6.2	5.2
May-Nov.	1	6.5	4.0	3.1	2.5	2.0
	7	7.5	4.9	4.0	3.4	2.8
	30	10	6.5	5.5	5.0	4.6
	90	23	11	8.0	6.6	5.5

Period	Number of consecutive days	Streamflow (ft^3/s) for indicated recurrence interval (years)				
		2	5	10	20	50
Dec.-Feb.	1	25	11	6.6	4.3	2.5
	7	31	13	8.1	5.3	3.2
	30	68	24	13	8.3	4.7
	90	414	166	88	48	22
Sep.-Nov.	1	6.7	4.0	3.1	2.7	2.3
	7	8.1	4.9	4.0	3.5	3.0
	30	13	7.1	5.6	4.9	4.3
	90	59	19	11	6.6	3.9

Table 19: Duration of Daily Flow for Indicated Periods

Period	Streamflow (ft^3/s) that was equaled or exceeded for the indicated percentage of time												
	98	95	90	85	80	75	70	60	50	40	30	20	10
Apr.-Mar.	5.3	7.4	10	13	17	22	29	48	79	123	203	378	895
May-Nov.	4.7	6.6	8.3	10	12	14	17	24	37	58	93	165	412
Dec.-Feb.	5.8	9.2	16	25	34	43	54	81	119	178	281	524	1260
Sep.-Nov.	3.7	5.2	6.9	8.2	9.4	11	12	16	21	29	46	91	293

Additional data and technique analysis about low flow data can be found in the full report. A copy of the report can be purchased from the USGS or downloaded at the USGS website http://oh/water/.usgs.gov/reports/wrir/wrir01-4140.pdf.

4.7.6 Tributary Use Designation, Ohio Water Quality Standards

Each water body in the state is assigned one or more *aquatic life habitat* use designations. The waters of the Portage River are designated "Warmwater Habitat" (WWH) and are capable of supporting and maintaining a balanced, integrated, adaptive community of warmwater aquatic organisms having a species composition, diversity, and functional organization based upon the ninetieth percentile of all sites within the Huron/Erie lake plans ecoregions (2008 Integrated Water Quality Monitoring and Assessment Report).

Two smaller tributaries of the Rocky Ford Creek just outside the Hancock County landfill are designated "Limited Resource Water" meaning these waters are found to lack the potential for any resemblance of aquatic life or biological habitat. The ability for aquatic life or fish to survive in these degraded waters is severely limited.

Tributary use designations also apply to *water supply* and *recreational use* standards of the Portage waterways. The Portage provides water supply for *public drinking water* (North Baltimore, McComb, Fostoria), *agricultural*, and *industrial* processing plants. Recreational uses include *bathing, primary contact,* and *secondary contact* uses (Poe Ditch and Fenburg tributary 1 & 2).

The Ohio EPA has released the 2010 Integrated Report, with fulfills the State's reporting for the federal Clean Water Act and more information can be found at the Ohio EPA, Division of Water website page at: http://www.epa.state.oh.us/dsw/tmdl/2010IntReport/index.aspx.

4.7.7 Lakes and Reservoirs

The largest lake in the Portage watershed is Van Buren Lake located at Van Buren State Park on the Rocky Ford Branch of the Portage River in northern Hancock County. Smaller, private lakes named within the watershed include Mottram Lake, Mosier Lake, Lamberjack Lake, Daugherty Lake, and Aldrich Pond.

Municipal reservoirs include North Baltimore, McComb Upground and Fostoria Reservoir, both located in northern Hancock County in the Portage headwaters.

Table 20: Lakes and Reservoirs

Watershed	Name	Area - Acres
04100010001863	Van Buren Lake	53
	Toussaint Marsh	5
04100010001851	Motram Lake	18
04100010001859	Mosier Lake	88
04100010001868	McComb Upground	6
04100010001853	Lamberjack Lake	45
04100010001861	Lake LaComte Fostoria Reservoir	128
04100010001857	Daugherty Lake	12
	Darby Marsh	66
04100010001789	Aldrich Pond	34

Source: Appendices to the Year 2000 Ohio Water Resource Inventory
http://epa.ohio.gov/portals/35/documents/Ohio305b2000_app.pdf

4.8 Groundwater

4.8.1 Aquifers

The aquifers that lie within the Portage watershed are located in the generally flat-lying Eastern Lake Plains Section of the Central Lowlands Physiographic Province (Fenneman, 1938; ODNR Water Resources). Ground water yields are varied and depend on the type of aquifers located in the four-county basin area of the watershed.

The groundwater and aquifer facts are reported directly from the *Ground Water Pollution Potential Report* of Hancock, Ottawa, Sandusky, and Wood counties. The GWPP reports were prepared by the Ohio Department of Natural Resources, Division of Water, Water Resources Section between the years of 1990 and 1994. Further details in the GWPP report include descriptions of the hydrogeologic setting charts and schematic breakdowns as mapped for each county. For more detailed pollution potential index calculations for each county setting, please see the full report text. A copy can be viewed or downloaded at the Ohio Department of National Resources website http://www.dnr.state.oh.us/HomePage/tabid/3252/Default.aspx.

4.8.2 Depth to Water

The depth to water factor was primarily evaluated using information from water well logs on file at the Ohio Department of Natural Resources, Division of Water. Approximately 10,000 water well logs are on file for Sandusky County. The Ground-Water Resources Map of Sandusky County (Schmidt, 1980) and the study of Breen (1989) provided useful information on depth to water. The theses of Palumbo (1974), Sikora (1975), Hoover (1982), and Kihn (1988) also provided useful data. Depth to water in most of Sandusky County is relatively shallow. Depth to water west of the Sandusky River is generally under fifteen feet except for a few isolated bedrock highs. Depths under 30 feet are

common in the deltaic areas of central Sandusky County. Depths to water in areas adjacent to major streams are almost always less than 15 feet. Depths to water above 30 feet are found in portions of the buried valley just east of Fremont and along the beach ridges to the northeast of Clyde. Depth to water in the area of the Columbus Escarpment near Bellevue varies from 50 feet to over 110 feet. The potentiometric surface undergoes tremendous fluctuations in this region, both seasonally, and from year to year. Sikora (1975), Kihn (1988), and Breen (1989) discuss the complex hydro-geology of the Bellevue region. The average water depth in the majority of wells was used to determine the depth to water in this region. There are regions of flowing water wells where the depth to water is very shallow (less than 5 feet). The area roughly north of State Route 412 and east of Green Creek has numerous flowing (artesian) wells in addition to springs and seeps. The region just west of Clyde trending northwards toward the turnpike also contains a significant number of flowing wells. The number of flowing wells developed in sand & gravel and limestone is almost equal. Technically, the artesian wells could have been considered confined aquifers, which would have given an average depth of 60 feet based on the depth to the top of the aquifer. However, there was evidence from well logs that the entire thickness of unconsolidated deposits is saturated. In addition, one must take into account the natural high water table, poor surface drainage, and overall environmental sensitivity of the area. For this reason the 0-5 feet (DRASTIC rating of 10) was utilized.

4.8.3 Net Recharge

The net recharge factor was evaluated using many criteria including, topography, vadose zone material, soil type and annual precipitation values. Net recharge is the amount of water (precipitation) that infiltrates and replenishes the aquifers; however, most precipitation is lost to runoff and evapotranspiration. Precipitation averages about 33 inches per year for Sandusky County (U.S. Department of Commerce, 1982); the amount of this total actually available as recharge varies considerably throughout the County. An average recharge value of 4-7 inches per year was assigned for the majority of Sandusky County, particularly western and central Sandusky County. This value was utilized, in part, as a result of Pettyjohn and Henning's (1979) study which specified an average recharge of 4.5-6.0 inches per year for the Sandusky River basin. Smith and Voytek (1989) also used this value for neighboring Seneca County. This recharge value considers the permeable nature of typical sandy loam and high shrink-swell (aggregated) clay soils, and the flat, low-lying topography which generally has low runoff. Recharge rates in the (7Ec) Alluvium over Sedimentary Rocks (limestone) setting varied from 4-7 inches per year to 7-10 inches per year depending upon the thickness of the alluvium, and the relative coarseness of the alluvial deposits. In the areas of the (7F) Glacial Lake Deposits setting, a recharge value of 2-4 inches per year was utilized, primarily due to the extremely clayey, impermeable nature of these deposits. This lower recharge value was also used in the areas of discharging (flowing) wells as the overall ground water flow gradient toward the surface. Sandusky County also contains many areas with high average recharge values. Some segments of the Sandusky River and other major streams were found to be hydraulically connected to the underlying aquifers. An average recharge value of 7-10 inches per year was assigned to these areas. The numerous locations where bedrock is shallow (close to the surface) in western Sandusky County were also assigned

a recharge of 7-10 inches per year. The region of highly solutioned karst limestone in southeastern Sandusky County was assigned overall high recharge values. The ability for water to move through the network of solution channels and fractures accounts for the greater (and more rapid) recharge. Internal surface drainage in the area (i.e. through sinkholes) causes high recharge to the aquifer. Precipitation runs off the land surface and into sinkholes instead of draining into streams leading from the vicinity. Additionally, the Bellevue region historically has had numerous drainage wells drilled as drains for stormwater and sanitary waste disposal (Division of Water, 1961; Sikora, 1975, and Hoover, 1982). These drainage wells tend to augment the natural recharge and drainage. Where the overlying cover of till was thin (<15 feet) a recharge value greater than 10-inches per year (DRASTIC rating 9) was assigned to the karst region. A recharge value of 7-10 inches per year was assigned where the overlying till was over 15 feet thick.

4.8.4 Aquifer Media

In Sandusky County, the carbonate (limestone and dolomite) bedrock comprises the regional aquifer. The vast majority of domestic wells and all of the municipal and industrial wells are developed in these units. Locally, wells developed in sand and gravel is suitable for domestic needs. Sand and gravel deposits developed for domestic use are most commonly found in the region between Green Springs and Clyde and the area between White's Landing and Vickery. The primary data source for determining the aquifer media were the water well logs on file at the ODNR Division of Water. Other sources included Division of Water (1970), Schmidt (1980), and the studies of Sikora (1975), Hoover (1982), Kihn (1988), and Breen (1989).

The aquifer media rating for the bedrock varied significantly across the county. The aquifer characteristics of the carbonates vary both between units and within individual units. The Columbus Limestone in southeastern Sandusky County was considered a true karst limestone and given a rating of 10 based on the network of solution features. The rocks of the Detroit River Group and the uppermost portions of the Salina Formation were evaluated as massive limestone and were given a rating of 9. These rocks lack some of the true karst characteristics of the Columbus Limestone, but still possess some major solution pathways and contain appreciable amounts of water. The vast majority of the Salina Formation is a massive limestone and was given a rating of 8. The Salina tends to be highly fractured; ancestral and modern drainage systems commonly align themselves with the fracture trends. The Salina underlies the buried valley area and may have experienced more intensive erosion of its surface by glacial melt-water. While the overlying sands and gravels in the valley are not necessarily good producers and may be difficult to develop, they are hydraulically connected with the Salina and help supply water to the bedrock. Conversely, along the valley walls, the Salina probably recharges the sand and gravel lenses. The degree of interconnection between the units is complex and important. The massive Lockport Dolomite is generally considered the lowest yielding carbonate unit in Sandusky County (Division of Water, 1970; Schmidt, 1980). The vuggy and fractured zones in the Lockport are not as continuous as those in the Salina and Detroit River units. The Lockport was given a rating of 7 throughout western Sandusky County. Smith and Voytek (1989) rated a small portion of the Lockport as an 8

where it underlies the Sandusky River due to a higher degree of fracturing. This narrow zone of increased fracturing extends northward to Fremont. The sand and gravel units were typically not evaluated as the local aquifer. Except in a few limited areas, it was difficult to ascertain the continuity of the sand and gravel units. Based upon available well log data, separation of discontinuous lenses from major producing layers was difficult. In many areas where sand and gravel was noticeable in the well logs, the well was developed in the underlying bedrock. Development in the bedrock may reflect the well driller's preference for a guaranteed water supply in bedrock. The unconsolidated units do seem to noticeably fine northwards, particularly within the buried valley. The most important reason for not emphasizing sand and gravel as an aquifer was that the carbonates in the region carry a much higher aquifer rating and hydrologic conductivity than the overlying sand and gravel units. Although the carbonates represent the true regional aquifer, the sand and gravel units are hydraulically connected to the underlying bedrock. Therefore, once a contaminant enters the sand and gravel, it will eventually enter the regional bedrock aquifer which would in turn serve as a medium for further contaminant transport. In other words, the underlying (bedrock) aquifer is more sensitive and is much more significant over a larger area.

Sand and gravel was rated as an aquifer in a few localized areas. In the Green Springs vicinity, sands and gravels within the Buried Valley (7D) hydrogeologic setting were given an aquifer rating of 6 (Smith and Voytek, 1989). These sand and gravel deposits appear to be relatively continuous; however, they are not particularly coarse or thick. Adjacent to the buried valley, the sand and gravels become less laterally continuous and more lens-like in nature. The Sand and Gravel Interbedded in Glacial Till hydrogeologic setting (7Af) was utilized for these deposits and an aquifer media rating of 5 was assigned. The sand and gravel within the beach ridge deposits served as a limited aquifer just west of Bellevue and in neighboring Seneca County (Smith and Voytek, 1989). These sand and gravel deposits were given an aquifer rating of 8.

4.8.5 Hancock County

In northwest Ohio, the thick sequence of carbonate bedrock from the Devonian and Silurian Periods comprises a vast regional aquifer that serves as a primary source of ground water for the counties in this region (ODNR, 1970). Hancock County lies near the center of this regional aquifer. The hydrogeologic system of Hancock County consists of the regional carbonate aquifer buried by deposits of glacial till. The regional carbonate aquifer underlies all of Hancock County and serves as a primary source of ground water for much of the county's rural population. Ground water within the carbonate aquifer occurs in a network of interconnected fractures, bedding planes, and solution channels. Yields to individual wells drilled into the carbonate aquifer are highly variable, depending upon the number of fractures and solution channels intersected by the well bore.

Yields to wells in the eastern half of the county generally range up to 100 gallons per minute. Well yields for the western half of the county can range from 100 to 500 gallons

per minute. Well yields for the karstic Limestone Ridge in east-central Hancock County can range up to 700 gallons per minute (Schmidt, 1981; ODNR, 1970).

A potentiometric surface map of the carbonate aquifer for Hancock County (ODNR, 1970) shows a general northwest-trending slope, indicating regional ground water flow from sources of recharge in central Ohio towards zones of discharge along Lake Erie.

Overlying the bedrock aquifer of Hancock County is a mantle of glacial till. Generally, glacial till is not considered an aquifer because of its high clay-silt content and its low hydraulic conductivity, making it a poor source of ground water. However, weathered glacial till often has an interconnected network of vertical fractures which can impart an enhanced capability for ground water flow or contaminant migration (Freeze and Cherry, 1979). In addition, glacial till often contains intermittent water-bearing pockets of sand and gravel which serve as a source of recharge to the carbonate aquifer, and are a source of ground water for some domestic wells. Other potential sources of ground water include outwash deposits, beach ridges and alluvial deposits along the southern margin of the Defiance Moraine.

4.8.6 Sandusky County

The Columbus Limestone is an excellent, high-yielding aquifer due to the degree of solutioning along fractures, the number of fractures, and the presence of porous "vuggy" zones. Ground water yields from 500-1000+ gallons per minute are obtainable from large diameter wells (Ohio Department of Natural Resources, Division of Water, 1970; Schmidt, 1980; Hoover, 1982). Flow through the solution channels can be quite rapid (Sikora, 1975 and Kihn, 1988). Recharge rates to the aquifer are very high and water level fluctuations are pronounced and common (Kihn, 1988 and Breen, 1989).

4.8.7 Ottawa County

In northwest Ohio, the thick sequence of carbonate bedrock from the Devonian and Silurian Periods comprises a vast regional aquifer that serves as a primary source of ground water for the counties in this region (ODNR, 1970). Ottawa County lies near the northeastern corner of this regional aquifer. The hydrogeologic system of Ottawa County consists of the regional carbonate aquifer buried by unconsolidated glacial deposits. The regional carbonate aquifer underlies all of Ottawa County and serves as a primary source of ground water for much of the county's rural population. Ground water within the dolomite of the carbonate aquifer occurs in a network of interconnected fractures, bedding planes, and solution channels. Yields to individual wells drilled into the carbonate aquifer are highly variable, depending upon the number of fractures and solution channels intersected by the well bore.

Yields to wells in the Devonian carbonate bedrock of eastern Ottawa County are generally low with known ranges up to 25 gallons per minute. However, potential well yields for the Silurian carbonate bedrock are generally higher with known ranges of 500+

gallons per minute occurring. Well yields in western Ottawa County are generally lower with potential yields up to 100 gallons per minute. Well yields in the karst terrain of the Bass Islands and Catawba Island region can potentially range up to 500 gallons per minute (Schmidt, 1986; Kessler, 1986).

Potentiometric surface maps of the carbonate aquifer for the mainland of Ottawa County show a general northeastward trending slope, indicating regional ground water flow from sources of recharge in northern Ohio towards zones of discharge along Lake Erie (Hosfeld, 1984; Snyder, 1989). The potentiometric surface for Danbury Township, Catawba Island Township, and the Bass Islands is generally symmetrical with the respect to the shape of the various land masses, indicating the principal source of recharge to the aquifer is from infiltration of precipitation through the soil and bedrock of the land mass, creating a ground water mound. Ground water discharge for these areas is generally symmetrically outward from the land mass into adjacent Lake Erie or Sandusky Bay.

Overlying the bedrock aquifer of Ottawa County is a mantle of glacial till and lacustrine deposits. Glacial till and lake bed deposits are not considered an aquifer because of their high clay-silt content and low hydraulic conductivities making them a poor source of ground water. However, weathered glacial till commonly has an interconnected network of vertical fractures which can impart an enhanced capability for ground water flow and contaminant migration through the till (Ruland, et al., 1991; Hendry, 1982; Williams and Farvolden, 1967). In addition, glacial till often contains intermittent water-bearing pockets of sand and gravel which serve as a source of recharge to the carbonate aquifer and a source of ground water for some domestic wells. Other potential sources of ground water include the buried valley outwash deposits of Danbury Township.

4.8.8 Wood County

In northwest Ohio, the thick sequence of Silurian and Devonian carbonate bedrock comprise a vast regional aquifer that serves as the primary source of ground water for the counties in this region (ODNR, 1970). Wood County lies near the northern margin of this regional aquifer. The hydrogeologic system of Wood County consists of the regional carbonate aquifer buried by deposits of glacial till and lacustrine deposits. The regional carbonate aquifer underlies all of Wood County and serves as a primary source of ground water for much of the county's rural population. Ground water within the dolomite of the carbonate aquifer occurs in a network of interconnected fractures, bedding planes, and solution channels. Yields to individual wells drilled into the carbonate aquifer are highly variable, dependent upon the number of fractures and solution channels intersected by the well bore. Yields to wells installed into the carbonate aquifer typically range from 10 to 20 gallons per minute; however, yields from 100 to 500 gallons per minute have been produced in certain locations of the county, generally by large municipal or industrial wells (Hallfrisch, 1986).

Potentiometric surface maps of the carbonate aquifer for Wood County (Breen, 1989; Paulson, 1981) show a general northward-trending gradient, indicating regional ground water flow from sources of recharge in northern Ohio towards zones of discharge along Lake Erie and the Maumee River. The potentiometric surface maps also indicate areas of greater recharge to the carbonate aquifer occur where the soil cover is thin or absent. Small groundwater mounds are formed in these areas because precipitation can quickly infiltrate and recharge the aquifer through the thin soil cover. Example areas include Bowling Green, Luckey, Stony Ridge, and Pemberville.

Overlying the bedrock aquifer of Wood County is a mantle of glacial drift comprised generally of glacial till and lake bed deposits. Generally, these deposits are not considered an aquifer because of their high clay-silt content and low hydraulic conductivity, making them a poor source of ground water. However, weathered glacial till often has an interconnected network of vertical fractures which can impart an enhanced capability for ground water flow or contaminant migration (Ruland, et al., 1991; Hendry, 1982; Williams and Farvolden, 1967). In addition, glacial till often contains intermittent water-bearing pockets of sand and gravel which serve as a source of recharge to the carbonate aquifer and a source of ground water for some domestic wells. Other potential sources of ground water include buried outwash deposits, beach ridges, and alluvial deposits along the various river courses in the county.

4.8.9 Source Water Assessment and Protection Plans (SWAP)

Source Water Assessment and Protection plans are created to inventory all known or identified potential contaminant sources within the drinking water protection area and then to implement protective strategies to better protect the drinking water source (Ohio EPA, 2003)

Source water protection link with Ohio EPA for additional information.
http://epa.ohio.gov/ddagw/swap.aspx

Recommendations from the SWAP include controlling runoff from agricultural areas; early warning and emergency response plan for spills, repair or replace failed septic systems from homes and businesses, review potential impacts from wastewater plant sludge field applications within the drinking water source protection area and Corridor Management Zone (CMZ). Work to establish or expand education outreach to increase awareness of the drinking water source protection area and encourage best management practices to prevent contamination of reservoirs.

Communities in the Portage watershed dependant on surface water for their drinking water supply are the City of Fostoria, the Village of North Baltimore, and the Village of McComb.

The **Village of McComb** "Drinking Water Consumer Confidence Report" (CCR) for 2009 is an annual report to the consumer on the health and quality of the community drinking water supply. The Ohio EPA requires water sampling for contaminates (bacteria, inorganic, synthetic organic, volatile organic) and to monitor throughout the year. The CCR indicates typical sources of contaminants from soil runoff, discharge of waste products, erosion, fertilizer runoff and leaching of failed or failing home sewage treatment systems (HSTS). The 2008 and 2009 reports indicate no violations or high levels of contaminants in the water samples. Greater detail on potential sources of contamination and steps to protect the drinking water supply will be part of a future inventory of Rader Creek 14-digit HUC 04100010-030-020.

The **City of Fostoria** operates a community public water system that serves a population of approximately 14,000 people and also provides water to the Village of Arcadia (PWS #3200903) with a population of 537. The water treatment system obtains its water from the East Branch of the Portage River. The system also has three groundwater wells that currently serve as the back-up source for the City. Current average production is about 2.2 million gallons per day (Ohio EPA, 2003). The greatest potential sources of contamination to surface or ground water sources in the source water protection zones are inadequate wastewater treatment that include failing onsite septic systems and the transportation network. Potential source of contamination may occur through vehicular accidents that release hazardous materials. The City of Fostoria SWAP documents approximately 24 miles of roads and 4.4 miles of gas lines traverse the protection area, creating a total of 13 roads and three gas line crossings of the East Branch of the Portage River or its tributaries. Approximately 1.7 miles of roads and 0.2 of gas lines are within 100 feet of a stream. Approximately 13 of the road crossings and three of the gas line crossings occur within the corridor management zone (Ohio EPA, 2003).

Protective strategies efforts promoted by the City of Fostoria would include best management practices to control the stormwater runoff from agricultural lands and livestock grazing pastures. Source water protection strategies would be aimed at controlling pesticides, nitrates, phosphorus and microorganisms such as fecal coliform bacteria. Greater detail on potential sources of contamination and steps to protect the drinking water supply are continued in the Chapter 5 inventory of the East Branch Portage River 14-digit HUC 04100010-040-040.

The **Village of North Baltimore** draws surface water from Rocky Ford Creek as the source of drinking water for a population of approximately 3,300 people. There are 24 potential contaminant sources present in the drinking water source protection area. Only seven of these sources are within the corridor management zone and one is within the emergency management zone (Ohio EPA, 2004).

Transportation routes are potential sources of contamination through vehicular accidents that could release hazardous materials. The following information is from the Ohio EPA, 2004 *Drinking Water Source Assessment for the Village of North Baltimore.*

- Approximately 133 miles of roads and 21 miles of rail lines traverse the protection area, creating a total of 87 road and 16 rail crossings of Rocky Ford Creek or its tributaries.
- Approximately five miles of roads and a half mile of rail are within 100 feet of a stream. Approximately 67 of the road crossings and 11 of the rail crossings occur within the corridor management zone.
- Extensive petroleum and natural gas production within the protection area and the corridor management zone is also considered a potential source of contamination to surface and ground waters. A total of 2,063 oil/gas wells are located in the Village of North Baltimore protection area, of which 489 are found within the corridor management zone. Approximately 0.6 miles of gas lines are within 100 feet of a stream. Approximately 14 of the gas line crossings occur within the corridor management zone.

Details of potential steps to protect the drinking water supply are continued in the Chapter 5 inventory of the Rocky Ford Creek 14-digit HUC 04100010-030-040.

4.8.9 DRASTIC Maps

Groundwater –

The potential for contamination of this important underground resource is a great concern to many. The sensitivity of the groundwater to local sources of contamination is determined and rated by DRASTIC maps as described below:

Inherent within each geologic setting are the physical characteristics which effect the groundwater pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:

D – Depth to Water
R – Net Recharge
A – Aquifer Media
S – Soil Media
T – Topography
I – Impact of the Vadose Zone Media
C – Conductivity (Hydraulic) of the Aquifer
(ODNR, 1994)

The Ohio Department of Natural Resources, Division of Water, Water Resources Section is the responsible agency to map the states groundwater resources. A summary of the DRASTIC mapping process is taken directly from a groundwater pollution potential report for accuracy:

The system chosen for implementation of a ground water pollution potential mapping program in Ohio, DRASTIC was developed by the National Water Well Association for the United States Environmental Protection Agency. A detailed discussion of this system can be found in Aller et al., (1987).

The DRASTIC mapping system allows the pollution potential of any area to be evaluated systematically using existing information. The vulnerability of an area to contamination is a combination of hydrogeologic factors, anthropogenic influences, and sources of contamination in any given area. The DRASTIC system focuses only on those hydrogeologic factors which influence ground water pollution potential. The system consists of two major elements: the designation of mappable units, termed hydrogeologic settings, and the superposition of a relative rating system to determine pollution potential.

The application of DRASTIC to an area requires the recognition of a set of assumptions made in the development of the system. DRASTIC evaluates the pollution potential of an area, assuming a contaminant with the mobility of water, introduced at the surface, and flushed into the ground water by precipitation. Most important, DRASTIC cannot be applied to areas smaller than one-hundred acres in size and is not intended or designed to replace site-specific investigations.

The groundwater pollution potential reports with DRASTIC maps are available on the Ohio Department of Natural Resources website at www.odnr.com. Click to the Division of Soil and Water Resources; Ground Water Mapping & Technical Services; Ground Water Pollution Potential map availability. Click on a County of interest to arrive at the webpage for downloads of PDF maps/reports for Ground Water Pollution Potential Reports and DRASTIC maps per County, including GIS shape files. Here is an example of a link for the Hancock County report and map:

http://ohiodnr.com/Portals/7/gwppmaps/pdf_printmap_wreport/hancock_pp_report_wmap.pdf

Ground water pollution potential analysis in Ottawa County resulted in eight hydrogeologic settings identified with computed ground water pollution potential indexes ranging from 88 to 220.

Sandusky County is crossed by a buried valley that contains sands and gravels overlain by tills that has a moderate vulnerability to contamination. Beach ridges and areas of shallow bedrock also exhibit a relatively high vulnerability. Eight hydrogeologic settings were identified in Sandusky County with computed ground water pollution potential indexes ranging from 99 to 197 for general DRASTIC and 122 to 218 for pesticide DRASTIC.

Eight hydrogeologic settings were identified in Hancock County with ground water pollution potential indexes ranging from 91 to 188.

Wood County was identified with nine hydrogeologic settings for potential of ground water pollution indexes ranging from 63 to 198.

Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index, the greater the vulnerability to contamination (ODNR, 1994).

4.9 Land Use

The Portage River Watershed land use is predominantly agricultural, with over three quarters of the land in crop production. About 6% is forested and 10% urban. While the Portage watershed itself is mostly agricultural, it is not far from cities in the watershed (Fostoria, Bowling Green, Port Clinton), and several nearby outside the watershed (Findlay, Fremont, Sandusky, Toledo). Some urban areas are development related to the cities.

Table 21: Land Cover Descriptions

Sub-watershed	Urban		Forest		Pasture		Cropland		Other		Total	
	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres
04100100030-010	5.8%	1,161	1.3%	257	0.4%	86	92.4%	18,580	0.1%	14	100.0%	20,098
04100100030-020	8.0%	1,666	2.2%	462	0.2%	45	89.5%	18,668	0.1%	24	100.0%	20,865
04100100030-030	8.4%	1,680	4.1%	827	1.0%	193	86.0%	17,247	0.6%	119	100.1%	20,066
04100100030-040	10.7%	5,010	7.3%	3,393	0.3%	163	80.8%	37,777	0.9%	415	100.0%	46,758
04100100040-010	6.3%	1,051	3.3%	554	2.2%	377	87.9%	14,742	0.3%	42	100.0%	16,766
04100100040-020	6.5%	1,249	4.2%	807	0.4%	68	88.7%	17,048	0.2%	44	100.0%	19,216
04100100040-030	6.2%	2,137	4.8%	1,666	0.5%	174	88.3%	30,511	0.2%	80	100.0%	34,568
04100100040-040	12.1%	2,756	5.2%	1,190	0.8%	182	79.5%	18,147	2.4%	540	100.0%	22,815
04100100040-050	6.4%	844	8.1%	1,070	0.3%	39	83.6%	11,011	1.5%	200	99.9%	13,164
04100100050-010	8.2%	917	5.7%	638	0.9%	100	83.8%	9,324	1.3%	147	99.9%	11,126
04100100050-020	10.9%	4,128	5.1%	1,912	0.2%	84	82.9%	31,360	0.9%	351	100.0%	37,835
04100100060-010	12.8%	2,309	9.6%	1,725	1.0%	188	72.7%	13,088	3.8%	684	99.9%	17,994
04100100060-020	9.0%	3,397	10.0%	3,772	0.6%	217	78.4%	29,558	2.0%	764	100.0%	37,708
04100100070-010	9.5%	789	14.5%	1,208	2.4%	201	72.8%	6,063	0.8%	66	100.0%	8,327
04100100070-020	11.5%	1,465	9.6%	1,230	2.5%	314	74.8%	9,545	1.6%	206	100.0%	12,760
04100100070-030	5.1%	410	4.9%	391	0.6%	48	67.5%	5,383	21.9%	1,749	100.0%	7,981
04100100070-040	13.8%	3,164	4.7%	1,073	0.9%	200	60.9%	13,974	19.7%	4,524	100.0%	22,935
04100100070-050	43.9%	8,353	7.2%	1,370	0.0%	0	21.8%	4,155	27.1%	5,166	100.0%	19,044
All HUCs	**10.9%**	**42,486**	**6.0%**	**23,545**	**0.7%**	**2,679**	**78.5%**	**306,181**	**3.9%**	**15,135**	**100.0%**	**390,026**

4.10 HOME SEWAGE TREATMENT SYSTEMS

Each of the four county Health Departments of the Portage watershed - Hancock, Sandusky, Ottawa, and Wood - has completed a Home Sewage Treatment System Plan (HSTS). All four county HSTS plans were submitted to and received approved endorsement from the Ohio EPA in 2004.

The HSTS plans are an inventory of home septic systems in the county with an inspection program to ensure adequate maintenance and function of home systems. The inventory is based on the number of septic permits on file at the county health departments and the number of households. Very few sewage disposal regulations were in effect prior to 1950. Permits on file at county health departments date back to the 1960s, but there is minimal information and some county records were destroyed due to natural disaster events. In the 1970s improved regulations and record filing standards kept pace with health standards for local sewage rules in the 1980s and 1990s and as recent as 2008. As regulations become more stringent, household sewage permits became required by state law to be filed with the health departments.

The difference between total numbers of households versus sewage disposal permits on file is an indicator of the number of (older) households with likely failed home septic systems. The expected operational span of a home septic system is 20-30 years if properly installed, operated, and maintained. Systems installed before the 1970s are classified as failed systems due to the known life span of a system and current regulations. Earlier systems were installed with direct discharge to the nearest waterway, ditch, or field tile and these systems still exist. But expanded education on water quality in partnership with county health departments have worked to inform local leaders and residents about the concerns for a safe drinking water supply and public safety related to water resources.

Rural households outside of a municipal wastewater treatment system are dependent on individual home sewage treatment systems. Installation of a HSTS requires a site evaluation, application, sewage treatment system installation permit, and approval from the county health department.

Much of the soils in the Portage watershed are poorly drained soils that are not favorable for leach fields and off lot discharging systems. There are many systems which discharge into area waterways, thereby contributing to surface and ground water pollution.

The purpose of the Home Sewage Treatment System Plan is to outline a countywide system for identification, inventory, and correction of badly maintained, malfunctioning, and failing home sewage treatment systems, constituting illicit discharge into the Portage

waterways, in order to protect the environment, water quality, and the health of the public.

Critical areas within the Portage watershed were identified using HSTS inventory numbers of outdated, failed home septic systems contributing illicit discharges within the Portage watershed. The critical areas were determined by population density, lack of permits on file and proximity to Portage waterways per the county health departments. This information combined with the organic and nutrient enrichment pollution impairments listed by the Ohio EPA, 2004 Integrated Report inspired a 319 grant proposal in FY2005 to replace seventy-five (75) failed home sewage treatment systems in partnership with county health departments and cost-share with homeowners. The 319 replacement program eliminated 9 million gal/yr of direct discharge of organic enrichment and harmful microbes from the Portage River.

Figure 20: Replacement HSTS 2008

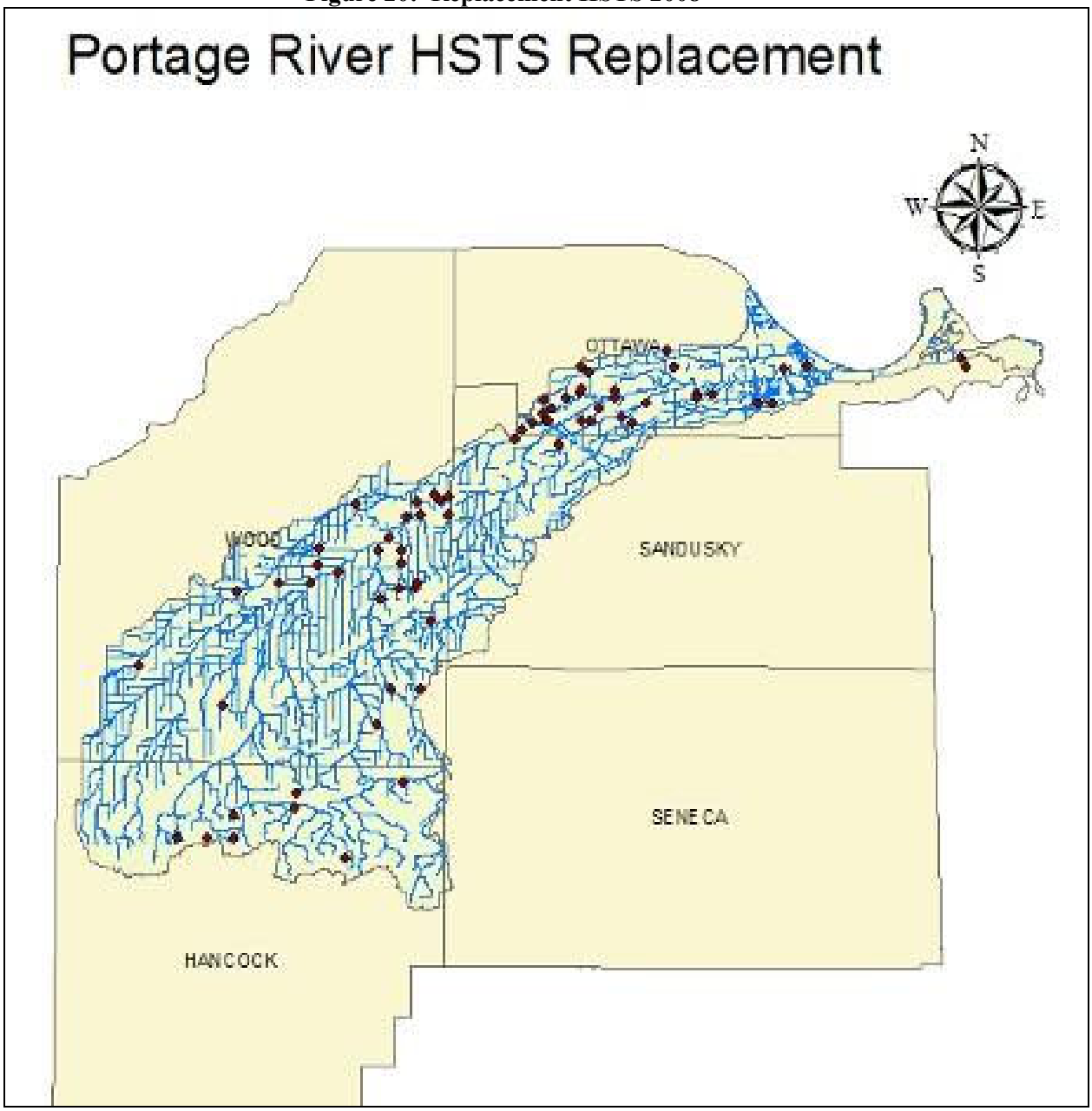


Table 22: Home Sewage Treatment System Permits per County

Home Sewage Treatment System Permits per County						
	Residential units served by HSTS	Total systems without permits	Newer systems with permits	Approximate total of potential failed systems	Homes accessible to sanitary system hook up	Potential individual replacement on-lot systems
Hancock	608	389	219	389	100	289
Ottawa	11,300	1,800	550	1,770	-	-
Sandusky	2,243	1,133	590	771	-	-
Wood	47,468	7,018	6,833	7,018	-	-
Source: Hancock, Ottawa, Sandusky, Wood County Home Sewage Treatment Plans, 2004						

4.10.1 Hancock County

Subwatersheds in Hancock County include the East Branch, South Branch, Needles and Rader Creeks, Middle Branch and Rocky Ford Branch of the Portage River watershed. Within these subwatershed areas in Hancock County the health department has identified a total of 608 homes. The number of newer systems with a permit on file is 219 homes. The 389 remaining households without permits were reviewed for accessibility to municipal sanitary system hook ups and 100 homes have potential to connect to nearby sanitary systems. For the remaining 289 potentially failed systems, homeowners are responsible for individual on-lot system replacement.

4.10.2 Sandusky County

The Sugar Creek subwatershed is a tributary to the Portage River, located in Woodville, Scott, Madison, and Washington townships, with approximately 1,374 households. The Health Department has no records of any permits for sewage disposal systems for 1,021 households, or seventy-five (75%) percent of the households. Of the twenty-five (25%) percent of permits on record (353 permits), one hundred forty-one (141) of these sewage systems were installed before 1983.

The Portage Mainstem RM 26.4 to RM 32.1 flows through Sandusky County and has approximately 869 households in the watershed. The Health Department has permits on file for two hundred thirty-seven (237) sewage disposal systems, or twenty-seven (27%) percent. Of those two hundred thirty-seven (237) sewage systems, one hundred twelve (112) systems were installed before 1983. For six hundred thirty-two (632) households, or seventy-three (73%) percent of the households, there are no records for the sewage disposal systems.

There is little data about the water quality available on the lower Sandusky River or Portage River Watershed. Due to large agricultural uses in this watershed, aquifer habitat is being adversely impacted from habitat problems. However, organic enrichment and dissolved oxygen problem, rated as the third major cause of impairment, followed by elevated concentrations of ammonia, nutrients and metals may be associated with sources of improperly treated sewage.

4.10.3 Ottawa County

As the Portage River flows through Ottawa County from southwest to northeast to Lake Erie there are three main roadways of residential homes that are parallel with the riverbanks. A majority of homes along these main roadways have HSTS permits older than 36 years or have no permit on record, indicting a probable impact on the water quality of the Portage River. There is also a major subdivision of approximately 266 homes adjacent to the Portage River. A number of the sewage systems serving these homes because of the small size of the lots, (50'x100') are subsurface sand filters or aeration systems.

As indicated in the Ottawa County HSTS plan, there are 400 (33.8%) sewage systems installed 20 to 36 years ago, 351 (29.7%) sewage permits less than 20 years old, and 431 (36.5%) are older than 36 years old or have no record of a sewage system.

Critical septic areas within the Portage River watershed were identified by household population of unsewered households per acre within the 14-digit subwatersheds. The priority areas were located in 14-digit HUCs and these critical septic areas correspond to lack of sanitary sewer service within the Portage watershed.

A list of critical areas within the Portage watershed are indicated in the Areawide Water Quality Management Plan (the 208 Plan) and areas confirmed by the Ottawa County Health Department.

4.10.4 Wood County

Wood County is the largest land area of the watershed. The number of residential units in Wood County is 47,468 residences and 14,590 or 21.95% are served by septic systems. Of those septic systems 6,833 (46.8%) are on file at the WCHD. The number of residential units built before 1970 is 22,824 or 48.1% and the number of residential units served by septic systems is 14,590. This indicates an estimated number of septic systems approaching the lifespan limit of 30 years are 7,018 or 48% of all home septic systems in the county.

The TMACOG Areawide Water Quality Management Plan is a comprehensive document required by Section 208 of the Clean Water Act of 1972. Within this Areawide Water Quality Management Plan, Facility Planning Areas (FPAs) were established. An FPA is essentially a current or proposed sanitary sewer service area. FPAs may be municipalities and surrounding developed areas to unsewered areas that need to determine how to improve the existing sewage situation, whether to continue depending on individual septic systems, construct a new wastewater treatment plant, or join an existing wastewater treatment facility.

4.11 Cultural Resources

The cultural characteristics of the Portage River area are provided from the *Western Lake Erie Basin Study Portage Watershed Assessment,* December 1, 2008 written by the U.S. Army Corps of Engineers for the "multi-purpose/multi-objective evaluation of the Western Lake Erie Basin (WLEB) and Watersheds".

The collection of Cultural Resources is recent and text and tables has been replicated from the above named source in its entirety to insert into this Portage River watershed document.

Significance: The National Historic Preservation Act of 1966 (16 U.S.C. 470 et seq.) defines historic properties as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP). The term includes artifacts, records, and remains that are located within such properties. The term also includes properties of traditional religious and cultural importance to an Indian tribe that meet NRHP criteria. Under Section 106 of the Act, federal agencies, with direct or indirect jurisdiction over proposed federal or federally assisted undertakings, take into account effects on historic properties. In consultation with the State Historic Preservation Office (i.e., Ohio Historical Society), Indian tribes and other interested parties, the federal agency makes a determination of significance of potentially affected historic properties and a determination of effect. A determination of adverse effect may require further studies, the development of a mitigation plan, and data recovery or architectural recordation.

Historic Properties: The NRHP lists numerous historic properties within the watershed

Table 23: National Register of Historic Places

Title	Address	City	Date Listed	Comments
Carroll Township Hall	Toussaint E. Rd. and Behlman Rd.	Oak Harbor	1990	
Catawba Island Wine Company	3845 Wine Cellar Rd.	Port Clinton	1983	Also known as Mon Ami Restaurant & Historic Winery
Clemons, Alexander House	133 Clemons St.	Marblehead	1987	Also known as Old Stone House Bed and Breakfast Inn
First Congressional Church	802 Prairie St.,	Marblehead	200	Also known as First United Church of Christ, Congregational
Gill-Luchsinger-Bahnsen House and Barn	426 E. 4th St.	Port Clinton	1992	
Lakeside Historic District	Roughly bounded by Lake Erie, RR Tracks, Poplar, and Oak Aves.	Lakeside	1983	Also known as Lakeside "on Lake Erie"
Marblehead Lighthouse	OH 163	Marblehead	1969	Also known as Sandusky Bay Lighthouse
Ohio State Rt. 51 Bridge over the Portage River	OH 51 over the Portage River	Elmore	1994	Also known as structure N0. 6201202
Ottawa County Courthouse	W. 4th and Madison Sts.	Port Clinton	1974	
Port Clinton City Hall	Adams St.	Port Clinton	2000	
St. Thomas Episcopal Church	214 E. Second St.	Port Clinton	1999	
Wolcott, Benajah, House	9999 E. Bay Shore Rd.	Lakeside-Marblehead	1991	
Cronenwett, George, House	606 W. Main St.	Woodville	1978	
Layman, Christopher C. Law Office	212 W. First St.	Woodville	1986	
Overmeyer-Waggoner-	654 S. Main St.	Lindsey	1983	

Title	Address	City	Date Listed	Comments
Roush Farm				
Boom Town Historic District	Roughly bounded by W. Wooster, S. Church, N. Grove, N. Maple, and Buttonwood	Bowling Green	1987	
Dodge Site	Address Restricted	Bowling Green	1978	Also known as 33-WO-9
Floral Hall	City Park on Conneaut Ave.	Bowling Green	1982	Also known as Needle Hall
Graham, William, House	7056 Jerry City Rd.	Wayne	1984	Also known as Graham-Reynolds House
Main Street Historic District	Main and Wooster Sts.	Bowling Green	1980	
North Baltimore Town Hall	207 North Main St.	North Baltimore	1981	
U.S. Post Office	305 N. Main St.	Bowling Green	1979	
Wood County Courthouse and Jail	200 E. Court St.	Bowling Green	1974	
Wood County Home and Infirmary	S. of Bowling Green at 13660 County Home Rd.	Bowling Green	1979	Also known as Wood County Historical Museum; Adam Phillips Park
Dana Marcus, House	707 N. County Line St.	Fostoria	1980	Also known as Elwood Kimes House
Fostoria Mausoleum	702 Van Buren St.	Fostoria	1978	

Archeological Sites: The Ohio Historic Society maintains databases of all known historic and prehistoric properties with archeological significance. On the basis of the watershed's topographical characteristics, it is likely that any such sites would be associated with ridges and other upland areas to avoid the wet ground characteristics that historically dominated much of the landscape. Specific details on archeological sites can be accessed if and when additional detail is required.

During the summer of 2003 a prehistoric archaeological site was discovered. The discovery of a human burial site and remains of a prehistoric settlement were uncovered on a construction site in Ottawa County near the town of Danbury. Please visit the Danbury Site on the Cleveland Museum of Natural History website at the following address. The site includes photos, descriptions and placement drawings of the human burial site.

http://www.cmnh.org/site/ResearchandCollections/Archaeology/Research/GeneralAudienceNontechnical/DanburySite.aspx

Native American Interests: The table below lists federally-recognized Native American Nations with an historic presence/prospective interest in the western Lake Erie basin.

Table 24: American Indian Nations with interest in the Western Lake Erie Basin

Nation	Tribal Names
Delaware	Delaware Nation, Oklahoma
Miami	Miami Tribe of Oklahoma
Chippewa/Ojibwa	1. Bad River Band of the Lake Superior Tribe of Chippewa Indians of the Bad River Reservation, Wisconsin 2. Bay Mills Indian Community, Michigan

Nation	Tribal Names
	3. Keweenaw Bay Indian Community, Michigan 4. Lac Courte Oreilles Band of Lake Superior Chippewa Indians of Wisconsin 5. Red Cliff Band of Lake Superior Chippewa Indians of Wisconsin 6. Red Lake Band of Chippewa Indians, Minnesota 7. St. Croix Chippewa Indians of Wisconsin 8. Sokaogon Chippewa Community, Wisconsin 9. Turtle Mountain Band of Chippewa Indians of North Dakota
Ottawa	1. Little River Band of Ottawa Indians, Michigan 2. Little Traverse Bay Bands of Odawa Indians, Michigan 3. Ottawa Tribe of Oklahoma
Potawatomi	1. Citizen Potawatomi Nation, Oklahoma 2. Forest County Potawatomi Community, Wisconsin 3. Hannahville Indian Community, Michigan 4. Huron Potawatomi, Inc., Michigan 5. Match-e-be-nash-she-wish Band of Pottawatomi Indians of Michigan 6. Pokagon Band of Potawatomi Indians, Michigan and Indiana 7. Prairie Band of Potawatomi Nation, Kansas
Seneca	1. Seneca Nation of New York 2. Seneca-Cayuga Tribe of Oklahoma 3. Tonawanda Band of Seneca Indians of New York
Shawnee	1. Absentee-Shawnee Tribe of Indians of Oklahoma 2. Eastern Shawnee Tribe of Oklahoma 3. Shawnee Tribe, Oklahoma
Wyandotte	Wyandotte Nation, Oklahoma

Tribal names reflect the list of federally recognized tribes as currently listed by the Bureau of Indian Affairs. These names may vary from the official name attributed by each individual government.

Please refer to the Background/Historical Information section in Chapter Two, which provides a historical review of previous water quality efforts in the Portage watershed. The project descriptions of previous and complementary efforts include annual events for 15-years, since the inception of the Portage River Basin Council and its working subcommittees. Annual events include presentations of student water sampling at the Portage River Student Congress and community volunteers for the Portage River Clean-ups. A variety of water quality efforts have occurred through strong watershed partnerships and TMACOG.

Current water quality efforts are focused on the Portage Watershed Plan. Portage River Basin Council members seek endorsement of pollution problem statements, goals and tasks to remedy point and non-point source water quality impairments in the watershed. The Council is working to educate residents and form partnerships for best management practices throughout the watershed to attain water quality standards.

Chapter Five

5.1 Watershed Restoration & Protection Goals

The objective of the watershed plan is to build an inventory of land and water resources for the Portage River watershed. A watershed inventory provides information about the water quality at the local watershed level. Information at the local levels of the watershed includes the physical integrity of the stream, the connection to floodplain function, and the ability to identify the chemical integrity of the water. The state of Ohio water quality standards set the level of chemical and biological health of the state's water. The standards for aquatic life, for populations of fish and bug indices are excellent indicators to measure the water quality or health of our waterways. Good water in the streams is connected to our drinking water from ground wells and water drawn from surface water in streams, reservoirs, and lakes.

The plan evaluates water quality and natural resource data, and recommends specific, targeted projects. The data evaluation shows which stream segments meet clean water standards. For those not meeting standards, the evaluation shows us why. The purpose of recommended projects is to protect good habitat and clean water where they exists, and restore them where they do not.

Implementation of projects related to public sewerage systems or household sewage treatment systems may be carried out under regulatory programs of county Health Departments or Ohio EPA. Projects related to agricultural practices or habitat should be implemented on a voluntary basis with the willing support of the property owner. This plan supports financial incentives to carry out these projects.

Restoring water quality impairments in the Portage River watersheds will protect public health by reducing pathogens in the river, improve the river's water quality, reduce nutrient loadings that result in toxic algae blooms in Lake Erie, enhance the river's natural beauty, and recreation along the Portage.

5.2 Portage River Basin Council: Background and History

Many watershed activities and projects have occurred during the 17 years the Portage River Basin Council (PRBC) has been active with watershed residents and stakeholders. There have been annual river clean ups and education/outreach events as well as the collection of physical water quality data and reports on watershed protection. Previous planning documents exist prior to this watershed plan, but were not designed to meet the current watershed inventory and protection equal to the 14-digit (or 12-digit) hydrologic units. However, historical data of the Portage watershed is a beneficial resource in the design of this watershed management plan.

Portage River Cleanups the Council annually organized community volunteers to pick up trash along the Portage and its tributaries. Cleanups were conducted at several sites along the river, all on the same day. In 2003 the 9th Annual Portage River Clean Up was held with volunteers removing more than 1,700 pounds of debris from the river.

Portage River Tours The Council has organized tours of the river to enhance education of our partner stakeholders in their efforts to protect it. The audience includes elected officials, other community leaders, and the media. Featured stops on the tour include agricultural conservation sites, home sewage disposal systems meeting current standards, and wastewater treatment facilities that have been improved to protect the river.

The Portage River Education Project Bowling Green State University along with Wood and Ottawa County SWCDs lead in coordinating annual Portage River stream sampling programs with middle school and high school students in the watershed area. In the fall, students tested the river water, and conducted a survey of macro-invertebrates to understand the river's environmental health. In the spring, students from all the schools met in a Student Congress to present and compare their results at a Student Congress at Bowling Green State University.

A special commendation should go to the Sugar Creek Protection Society, a group of residents along this Portage River tributary, who volunteer their time to maintain the stream and remove log jams.

Reports and Projects Over the past eight years various studies have been conducted in the Portage River watershed to identify and inventory the potential pollution sources in the basin. The reports have evaluated the chemical, physical, and biological integrity of the watershed and placed the causes and sources of point and non-point contributors that impair water quality in the basin. The Portage watershed is scheduled for a comprehensive TMDL assessment in the year 2008. However, the following reports provide a summary of the watershed monitoring activities accomplished to date. These reports are maintained in the Portage resource library at TMACOG for general access.

The *Portage River Basin Water Quality Study,* November 1995, reported 16 licensed sewage treatment plants in the Portage basin, there are 58 package plants that physically exist but not all are in active use, and over 11,000 septic systems. There are 19 package plants that are in active use but do not have NPDES permits. The package plant numbers have substantially improved since 1995. Many have been eliminated, and Ohio EPA rarely permits new one to be installed.

At the time of this study, 10 communities in the area had sewage systems that discharged untreated or partially treated sewage during wet weather. Many of these discharges have been corrected with stakeholder commitment. This report also identified high concentrations of septic system contamination into the waterways, along with agricultural runoff of fertilizers and sediment. The fertile, level agricultural lands typical of the geological structure of this region require a ditch and channel system to continually drain, not only the agricultural land, but residential and urban land areas as well. During

decades of agricultural practice, the ditches and channel system has been widened, deepened, and straightened with the idea of moving stormwater runoff downstream as quickly as possible. The intent of this study was to find ways for productive natural habitat to co-exist with productive agricultural business. In addition, this report contains a comprehensive historical account of the physical and cultural development of the Portage River basin.

In December 1995, the Ohio EPA completed the first technical report, *Biological and Water Quality Study of the Portage River and Selected Tributaries* for the Portage basin. This was the first report on the biological health of the river. In 1990, biological criteria were added to the Ohio Water Quality Standards. The biological health of fish and macro-invertebrates combined with chemical levels, were important methods of assessment for water quality in the Portage Basin. The first Index of Biotic Integrity (IBI), Modified Index of Well-Being (MIWB), Invertebrate Community Index (ICI), and Qualitative Habitat Evaluation Index (QHEI) were sampled. Most locations of the basin attained the full Warmwater Habitat (WWH) designation. Significant areas of non-attainment were found in the East Branch Portage River and Rocky Ford due to pollution impacts from wastewater treatment plants, unsewered areas, agricultural runoff, and habitat modifications.

The Portage River Basin Council working with Toledo Metropolitan Area Council of Governments, published *The Portage River: A Resource Worth Protecting*, June 1997. This report contains a historic and current land use overview of the river basin and the resources it provides for drinking water, storm and treated wastewater disposal, agricultural drainage, recreation, and tourism. It covers the current state of the river including fishes and their environment as an indicator of good or poor water quality. Half of the report highlights environmental issues for the Portage, such as agriculture, home sewage disposal, and combined sewers. It provides an inventory and progress report in a readable and comprehensive format to inform and educate the public.

The *Volunteer Stream Corridor Survey* was completed in January, 1999 and funded by local member governments and a Special Coastal Environmental Grant from the Ohio EPA. This project was completed with the input, assistance, skill, and physical labor of 96 volunteers and the support of the Portage River Basin Council to survey the physical characteristics of several stream corridors of tributaries to the Portage River. The surveys collected information on stream bank erosion, stream obstructions, and point source pollution as well as channel width and depth, stream bank vegetation and adjacent land use information. The information obtained from a survey of this nature in conjunction with the Ohio EPA's biological assessment of the river, it was thought, would provide valuable information about the health of the river system, and could be used as a basis for prioritizing future efforts. This effort would also provide residents within the Portage River watershed an opportunity to learn more about their river through firsthand experience. In total, 22 separate surveys gathered information on 29 stream segments, on over 17 miles of stream corridors. The surveys were conducted over the fall of 1997 and the spring and summer of 1998. Information from these surveys was entered into a computer database and used to produce maps of each segment representing the findings

of the surveys. The information gathered in the surveys included:

- Stream Obstructions
- Stream Bank Erosion
- Point Source Discharges
- Stream and Bank Litter
- Channel Width and Depth
- Stream Bank Vegetation
- Adjacent Land Use

The information gathered as part of this effort will be used by the PRBC to prioritize those areas of the watershed needing further attention. It will serve as a guide to determine where best management practices and funding efforts will be most effective.

In 1999-2000 the stakeholders and the Portage River Basin Council applied for and received a $300,000 Ohio EPA 319 project grant for the *Portage River Watershed Improvement Program*, with supporting in-kind matching funds to offer cost share incentives to landowners.

Completed Portage River Improvement project under an EPA "319" grant include:

- Installed 106.6 miles of filter strips
- Replaced 330 drainage tile headers to reduce erosion
- Pumped out 149 septic systems
- Conducted homeowner education program on septic system maintenance
- Replaced two failing septic systems with alternative design systems
- Total payments to residents: $196,876. Total in-kind match: $212,568.

The Portage River Hydrologic Study, June 2002, was funded through a grant from the Lake Erie Protection Fund, four participating counties, and additional funding from the Ohio Emergency Management Agency. The Portage River Basin Council sought to address flooding and drainage problems occurring within the Portage Basin, but in a manner that also considered the environmental quality of the watershed and contributed to the attainment of its streams' designated uses. The report includes hydrologic data on stream flow, existing drainage, flooding, and channel stability and biological conditions along most of the watershed major streams. The study was performed under the guidance of the Portage River Hydrologic Study Management Team, consisting of the County Engineers of Hancock, Ottawa, Sandusky, and Wood counties; and representatives of the City of Fostoria, TMACOG, the Wood County Planning Commission, the Ohio Environmental Protection Agency (Ohio EPA), and Bowling Green State University. The consultant team included:

- Finkbeiner, Pettis & Strout, Inc. of Toledo, responsible for the overall study.
- Oxbow River & Stream Restoration, Inc. of Delaware, Ohio, responsible for the assessment of stream channel stability and riparian biological conditions.
- The University of Toledo Lake Erie Research Center, responsible for remote sensing analysis of satellite imagery and preparation of the Geographic Information System (GIS) of the Portage Basin.

The scope and focus of this study was on the areas experiencing the most problems with flooding and drainage. The results of the hydrologic report have identified problem areas of the Portage basin along with proposed recommendation and solutions. Some of these recommendations have been addressed and restoration projects are under construction, while other completed projects are being monitored.

$389,138 Ohio EPA 319 Grant, ***Portage River Watershed Home Sewage Treatment Systems Replacement Program,*** July 1, 2005 thru August 30, 2008. The success of this grant project was overwhelming. Initial grant funds were budgeted to replace 54 failed home septic systems in the watershed. The program was so popular that education/outreach funds were reallocated for an additional 21 systems for a project total of 75 replacement systems installed in critical areas of watershed, and eliminated 9 million gal/yr of direct discharge of human sewage into the Portage.

ODNR **Ohio Watershed Coordinator Grant Program**, 2007-2010. Development of the Portage River Watershed Plan is on-target for submittal to ODNR and Ohio EPA. **TMDL** in progress 2008-2011.

Western Lake Erie Basin Study, Portage Watershed Assessment, December 1, 2008, U.S. Army Corps of Engineers. The Portage watershed is part of the Western Lake Erie Basin study in connection with the Great Lakes Remediation plan.

Channel Stability and Stream Biological Conditions

A total of 21 sites were selected within the basin for detailed evaluation and documentation in the 2002 Hydrological Study. The sites selected for assessment were chosen because of their proximity to existing Ohio EPA biological assessment locations. These sites highlight the characteristics and primary issues associated with stream management within the Portage River watershed.

A brief summary of the key findings that relate to stream conditions are as follows:

- Aquatic life use attainment statistics from the last Ohio EPA assessment (1994) showed that 52% of sampling locations were in full attainment, 9% were in partial

attainment, and 39% were in non-attainment of Warmwater Habitat designation. Those sites meeting OEPA Warmwater Habitat criteria tended to be streams with larger drainages that also had access to their floodplain and a wooded riparian corridor.

- The available habitat (as reflected in Qualitative Habitat Evaluation Index scores) and the demonstrated performance of the biological communities suggest that the Warmwater Habitat criterion is a realistic and realizable goal throughout the Portage River watershed.
- Channel stability as measured by the Pfankuch channel stability evaluation showed that none of the sampling locations scored good for stability, 67% (14 of 21) scored fair, and 33% (7 of 21) scored poor. The low channel stability scores were primarily due to the instability of channel bottom materials and, in places, unstable lower stream banks. The stability of the upper banks graded higher at most locations.

The primary impairments or concerns for channel stability included:

- Entrenched channels with no access to a floodplain to relieve energy of high flows
- Changing watershed hydrology and lack of stormwater controls
- Over-wide channel bottoms
- Channel bottoms dominated by fine sediment
- Over-steep streambanks (2:1 or steeper side slopes)
- Debris dams

The primary impairments or concerns for stream biology included:

- Glide dominated channels with little variation in depth or velocity
- Severely embedded channels – i.e., too much fine sediment on channel bottom
- Not enough coarse material to produce good riffle habitat
- Little or no habitat for fish or macro-invertebrates
- Lack of energy (stream power) to facilitate recovery
- Point source impacts, primarily from organic enrichment and low levels of dissolved oxygen
- Low summer and fall stream flows caused by drainage, water removals and reservoir management

5.3 Hydrologic Unit Codes

Nationwide, watersheds are identified by the United States Geological Survey (USGS) as a consistent numbering system called Hydrologic Unit Codes, or HUCs. Throughout this plan, you will see a watershed identified in this manner simply called a "HUC." You will see references to HUCs with different numbers of digits — 8, 10, 11, 12, 14.

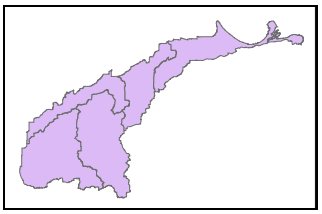
The HUC numbering system is hierarchical. The fewer digits in a HUC, the larger the watershed. Adding more digits makes the watershed reference smaller and more specific.

The entire Portage River Basin is one 8-digit HUC, (04100010). There are five (5) sub-basins of (11-digit HUCs) that divide the watershed as distinct waterway features that flow into the Portage.

04100010-030 Needles Creek, Rader Creek, Middle Branch, Rocky Ford Creek
04100010-040 Middle Branch, Bull Creek, South Branch, East Branch
04100010-050 North Branch, Portage River
04100010-060 Portage Main-stem, Sugar Creek
04100010-070 Wolf Creek, Ninemile Creek, Little Portage River, Portage Mainstem to Lake Erie, Lake Erie drainage to Marblehead.

The smaller the subwatershed description, the greater detail, and survey accuracy of the well-being of the Portage River water resources. The smaller 11-digit subwatershed gives a geographic location of land use for preliminary descriptions of the water resource. The area is further reduced into *smaller* watershed land areas (drainage basins) for even greater detail of a land and water resource inventory. The *smaller* watershed drainage areas are identified with 14-digit numbers. *Therefore, the smaller land drainage area is identified with the larger hydrologic unit code number*. The Portage watershed land area has eighteen (18) subwatersheds of the 14-digit hydrological unit code (HUC) located within the five (5) 11-digit HUCs.

Figure 21: Portage watershed hydrologic unit codes

14-digit HUC	11-digit HUC	8-digit HUC
04100010-030-010	04100010-030	04100010 
04100010-030-020		
04100010-030-030		
04100010-030-040		
04100010-040-010	04100010-040	
04100010-040-020		
04100010-040-030		
04100010-040-040		
04100010-040-050	04100010-050	
04100010-050-010		
04100010-050-020		
04100010-060-010	04100010-060	
04100010-060-020		
04100010-070-010	04100010-070	
04100010-070-020		
04100010-070-030		
04100010-070-040		
04100010-070-050		

Complete inventories, problem statements, goals/objectives, and recommended actions can be found in the Subwatershed Inventory Section of this watershed plan, at the end of Chapter 5, for each of these 14-digit HUCs.

The 14-digit HUCs work for planning and implementation purposes. The physical, biological, habitat, and land use characteristics that occur in the watershed are identified at the smallest subwatershed level. The watershed plan works in greater detail than previous watershed documents, to address the physical characteristics, inventory spreadsheets, water quality assessment, livestock inventory, land use, nutrient management, and specific natural or man-made structures.

Besides the 11- and 14-digit HUCs, you will see references to 10- and 12-digit HUCs. 10/12s are in principle the same as 11/14s, but a new numbering system that went into effect during the preparation of this plan. The Portage Watershed Plan is based on 11/14-digit HUCs, though equivalent 10/12 designations are given for convenience when referred to newer data. The "crosswalk," or equivalency table between the two systems is given below.

Figure 22: Portage River Watershed 11/14 and 10/12 Digit HUC Equivalency Table

Old HUC No.	Old HUC Name	New HUC No.	New HUC Name
04100010 030	Middle Branch (headwaters to below Rocky Ford)	04100010 01	Rocky Ford-Middle Branch Portage River
04100010 030 010	Needles Creek above Rader Cr.	04100010 01 02	Needles Creek
04100010 030 020	Rader Creek	04100010 01 01	Rader Creek
04100010 030 030	Middle Branch Portage River below Rader Cr. to above Rocky Ford Cr.	04100010 01 04	Town of Rudolph-Middle Branch Portage River
04100010 030 040	Rocky Ford Creek	04100010 01 03	Rocky Ford
04100010 040	Middle Branch (below Rocky Ford to below S.Branch)	04100010 02	South Branch Portage River-Middle Branch Portage River
04100010 040 010	Middle Branch Portage River below Rocky Ford Cr. to above S. Branch Portage R. [except Bull Cr.]	04100010 02 05	Cessna Ditch-Middle Branch Portage River
04100010 040 020	Bull Creek	04100010 02 01	Bull Creek
04100010 040 030	South Branch Portage River headwaters to above E. Branch Portage R.	04100010 02 03	Town of Bloomdale-South Branch Portage River
04100010 040 040	East Branch Portage River	04100010 02 02	East Branch Portage River
04100010 040 050	South Branch Portage River below E. Branch to above Middle Branch	04100010 02 04	Rhodes Ditch-South Branch Portage River
04100010 050	Portage R. (below confluence of So.& Middle Branches to below N.Branch)	04100010 03	Upper Portage River
04100010 050 010	Portage River below S. Branch to above N. Branch	04100010 03 02	Town of Pemberville-Portage River
04100010 050 020	North Branch Portage River	04100010 03 01	North Branch Portage River
04100010 060	Portage River (below North Branch to below Sugar Cr.)	04100010 04	Middle Portage River
04100010 060 010	Portage River below N. Branch to above Sugar Cr. (includes Lacarpe Cr. outlet #4)	04100010 04 02	Larcarpe Creek Outlet #4-Portage River
04100010 060 020	Sugar Creek	04100010 04 01	Sugar Creek
04100010 070	Portage R. (below Sugar Cr. to Lake Erie & Lake Erie Tribs [below Toussaint Cr. to Marblehead])	04100010 05	Lower Portage River-Frontal Lake Erie
04100010 070 010	Wolf Creek	04100010 05 02	Portage River
04100010 070 020	Ninemile Creek	04100010 05 01	Little Portage River
04100010 070 030	Little Portage River below Ninemile Cr. to Portage R.	04100010 05 01	Little Portage River
04100010 070 040	Portage River below Sugar Cr. to Lake Erie including Lacarpe Cr. outlets 2 & 3 [except Wolf Cr. & L. Portage R.]	04100010 05 02	Portage River
04100010 070 050	Lake Erie Drainage downstream of Toussaint Cr. to Marblehead [except Portage R.]	04100010 05 03	Lacarpe Creek-Frontal Lake Erie

5.4 WATER QUALITY IMPAIRMENTS

The main source of water quality information is the Ohio EPA "303(d)" list and the Integrated Report. This document is a semi-annual report on the quality of Ohio's waterways; the Integrated Report identifies whether streams meet water quality standards based on five criteria (aquatic life, recreation, drinking water, human health, and fish tissue). A stream that does not meet one or more of these criteria is said to be "impaired." Ohio EPA conducts intensive stream sampling and analysis by conducting Total Maximum Daily Load (TMDL) testing. A TMDL study identifies stream impairments, and the causes and sources of those impairments.

Table 25: List of Prioritized Impaired Waters

303(d) List of Prioritized Impaired Waters Ohio 2008 Integrated Report							
AU 11-digit HUC	Size	Aquatic Use	Recreation Use	Drinking Water Use	Fish Tissue	**AU Category**	**Priority Points**
04100010-030	168.6	Y	Y	U	U	**5**	**6**
04100010-060	87.1	Y	N	NONE	Y	**5**	**5**
04100010-070	111.3	Y	N	NONE	Y	**5**	**3**
04100010-050	77.2	U	N	NONE	Y	**5**	**3**
04100010-040	166.7	Y	U	U	U	**5**	**1**
Source: 2008 Integrated Water Quality Monitoring and Assessment Report							

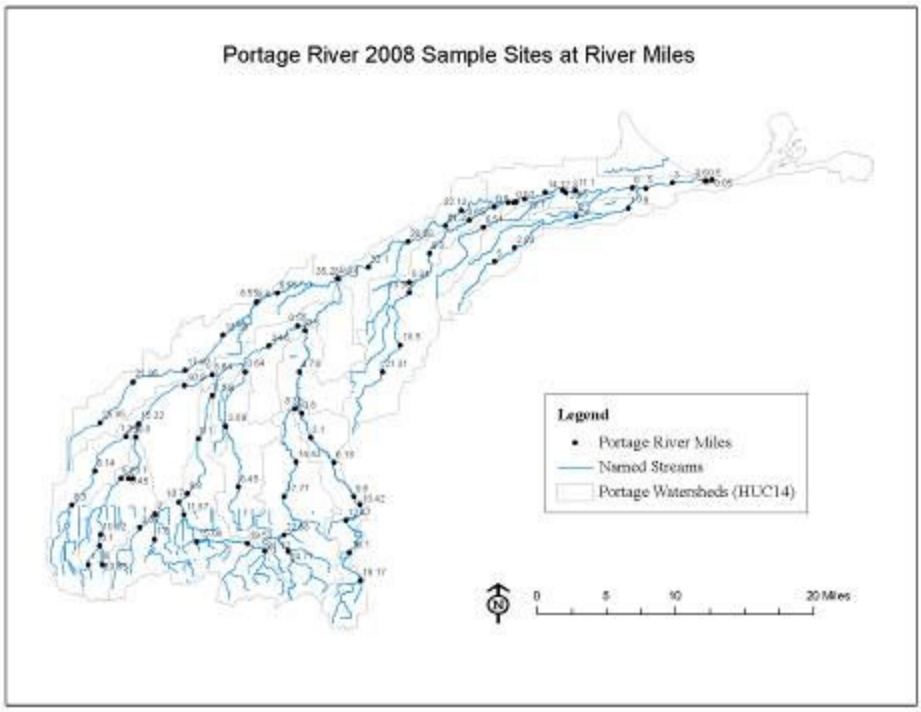
The value of the above table is found in the ranking of the assessment unit "Category" and "Priority Points." The category Five (5) is water impaired or threatened, indicating a TMDL assessment is needed to identify the health of that hydrologic waterway.

All five of the 11-digit hydrologic unit code watersheds of the Portage River have received a category Five (5) rating, indicating impaired or threatened waterways that require TMDL testing to evaluate the health of the waterway in line with the designated uses for 1) aquatic life habitat 2) water supply and 3) recreation. Are the Portage waterways fishable, swimmable, and drinkable to meet the guidelines of the Clean Water Act? If not, then how do we get there and if they are, how do we protect a healthy resource?

If a hydrological unit is rated a category 5 for impairment and needs the water quality test of a TMDL, the category 5 is also rated with priority points based on the use designation and the level of pollution impairment in relationship to that use designation, i.e., public drinking water use impairment, recreation use impairment, human health use impairment (fish tissue contaminations), aquatic life use impairment. Again, simply put, are the waters of the Portage, fishable, swimmable and drinkable without hazards and sickness to living organisms from the smallest aquatic animal to humans?

Priority points can number between 1 and 20 for a Five (5) assessment unit. The greater the number of points indicates a more serious impairment condition. Looking at **Table 23** of the 303(d) list of impaired Portage River waterways, ***Integrated Water Quality Monitoring and Assessment Report, Ohio EPA*** the southwestern area of the watershed that include headwaters and drinking water sources received six priority points for that hydrologic area.

Figure 21: Portage River Sample Sites



5.5 Watershed Restoration Targets

Ohio EPA completed the draft Portage River Watershed TMDL in 2011 (http://www.epa.ohio.gov/dsw/tmdl/PortageRiverTMDL.aspx) using 2008 sampling data. Part of the function of a TMDL is to assess current nutrient loads, and target reductions needed for streams of the watershed to achieve water quality standards. Phosphorus is the key nutrient for Lake Erie loadings, with reductions needed to reduce eutrophication and eliminate harmful algal blooms.

Nitrate and sediment load reductions are needed as well as phosphorus load reductions to meet water quality standards, to remove impairments for aquatic life and public drinking water supply uses in particular. The load reduction goals for this plan are based on phosphorus targets recommended by the 2011 TMDL report. Achieving these reduction targets will require a variety of best management practices (BMPs) by many stakeholders. While the BMPs recommended by this plan will be designed to meet the TMDL phosphorus reduction targets, they will also achieve substantial reductions in nitrate, sediment, and bacterial loadings

Ohio EPA provided TMACOG with summary phosphorus load reduction numbers for each HUC (Ohio EPA Division of Surface Water, personal communication). The following table shows current phosphorus loading, and needed reductions. The terms for allowable phosphorus loading are “wasteload allocation” when referring to point sources (i.e., wastewater treatment plants), and “load allocation” for all other sources — agricultural runoff, stream modifications, urban runoff, septic systems, and unpermitted package sewage treatment plants. TMACOG added to the table by showing the total nonpoint source reduction target for each HUC in pounds of total phosphorus per year.

Table 26: Total Phosphorus Load Reduction Targets

HUC 14	HUC 12	Total Existing Load, kg Phosphorus / day	Existing Nonpoint Source Load, kg P/d	Existing Point Source Load, kg P/d	Wasteload Allocation (point sources), kg P/d	Load Allocation (nonpoint sources), kg P/d	Total NPS Target Reduction, lb P/year
4100010030020	04100010 01 01	9.1	4.4	6.4	1.5	1.2	2,531.9
4100010030010	04100010 01 02	6.7	6.4	0.4	0.1	3.9	2,022.3
4100010030040	04100010 01 03	15.0	11.6	7.5	3.6	6.4	4,149.8
4100010030030	04100010 01 04	3.9	3.9	0.0	0.0	2.5	1,176.4
4100010040020	04100010 02 01	6.1	5.8	0.3	0.3	3.5	1,850.3
4100010040040	04100010 02 02	22.7	3.7	31.5	31.2	0.0	2,978.9
4100010040030	04100010 02 03	12.6	11.9	0.9	0.9	7.2	3,791.5
4100010040050	04100010 02 04	6.4	6.1	0.6	0.2	3.9	1,766.9
4100010040010	04100010 02 05	4.5	4.5	0.0	0.0	2.9	1,359.9
4100010050020	04100010 03 01	42.8	9.4	38.8	19.0	0.0	7,533.5
4100010050010	04100010 03 02	2.8	1.4	2.1	0.5	1.4	2.0
4100010060020	04100010 04 01	15.1	5.6	16.3	2.1	3.6	1,564.6
4100010060010	04100010 04 02	6.4	1.2	5.3	2.8	1.2	0.5
4100010040040, 4100010040030	04100010 05 01	7.1	7.1	0.0	0.0	2.5	3,699.2
4100010040050, 4100010050020	04100010 05 02	18.0	2.8	15.1	1.0	0.1	2,168.4

Source: Ohio EPA, 2011

Following this narrative are a series of individual watershed assessments for the 14-digit Portage River HUCs. These assessments detail the background, provide maps and data, and describe water uses and use impairments. As shown in the above table, there are two cases where a pair of 14 digit watersheds was defined as a single 12 digit watershed. In these cases, the pairs of 14 digit watersheds are combined in single watershed assessments.

At the end of each HUC, there is a series of problem statements. These describe the use impairments, and set goals and objectives to address them. The problem statements conclude with tables recommending projects or practices to achieve the load reduction goals, estimated load reductions form each practice, and costs. Habitat and agricultural best management practices do not include the acquisition of land or the value of crops that would otherwise be grown. Depending on funding program, these considerations may qualify as in-kind matching funds.

The BMPs for each HUC are designed to address the impairments of that watershed. The following outline summarizes BMPs commonly recommended in many of the HUCs:

HSTS – repair or replace home sewage treatment systems that have failed or were not designed to meet today's standards. Upgrading these systems will reduce loadings of bacteria (*E. coli*), phosphorus, and nitrate. In 2008 statewide study conducted by the Ohio Department of Health (Ohio Department of Health, *Survey of Household Sewage Treatment Systems Operation and*

Failure Rates in Ohio) concluded that Northwest Ohio reported the largest percentage of failing systems statewide, at 26%. To reduce the high number of stream sampling sites failing bacterial water quality standards, replacement of many failed systems will be necessary; this plan recommends a target of 10% of total systems. Load reduction calculations assume that failed systems provide no treatment. Loadings are based on the constituents of typical domestic sewage (US EPA, *Design Manual Onsite Wastewater Treatment and Disposal Systems* and Water Pollution Control Federation *Manual of Practice #8: Wastewater Treatment Plant Design*). Replacement costs for conventional systems average around $10,000; mound or active treatment systems, where required, may be $15,000-$20,000.

Package Plants – approximately half of the privately owned small sewage treatment plants in the watershed are not regulated under NPDES permits. Those that are permitted must meet effluent quality standards. Permitting the unpermitted package plants with phosphorus limits would reduce phosphorus loadings. Load reductions for this plan are based on all package plants achieving a phosphorus effluent standard of 3 ppm. Load reductions are based on the constituents of typical domestic sewage with a phosphorus reduction process added to the 3 ppm standard. A specific inventory of unpermitted package plants is used; it is assumed that the flow rate is the same as the design capacity. As these plants are unpermitted, no data are available for actual flow rate or nutrient discharges. Costs are based on purchase and installation of phosphorus removal equipment (pump, electric hookup, timer, drip tube, small storage tank) and one year's worth of chemical supply. The annual costs of chemicals, delivery, and maintenance are not included.

Habitat and Oxbow Restoration – restoring natural stream design and riparian vegetation will improve QEHI scores and aquatic life use indexes. These practices will also reduce loadings for phosphorus, nitrate, and sediment. Costs are based on ODNR data (riparian restoration and two-stage ditches), and the 2002 Finkbeiner, Pettis, & Strout *Portage River Hydrological Study*, adjusted for inflation. Oxbow restoration load reductions were calculated using the erosion rates (tons of sediment/acre/year) for each sub-watershed. Erosion rates were gathered from Michigan State Universities *High Impact Targeting* online tool [http://35.9.116.206/hit2/home.htm]. Three assumptions were made in determining load reductions: 1) a 1000 ft. segment of restoration treats 500 acres of runoff, 2) for every ton of sediment there are two lbs. of phosphorus and 4 lbs. of nitrogen [U.S. EPA Region 5 model], and 3) an oxbow reduces sediment loadings by 21 percent [Powell Creek TMDL]. The same assumptions were used for over-wide/two-stage ditch load reduction estimates. Habitat restoration load reductions were estimated using the U.S. EPA Region 5 spreadsheet model "bank stabilization" tab. The lateral recession rate was assumed to be 0.3 – severe – as restoration projects would likely occur on streams of this category or worse. Restoration of streams with higher severity lateral recession rates will increase the nutrient reductions further.

Wetland Restoration – wetland restoration helps mimic natural hydrological functions in watersheds and promotes habitat improvements. Strategically restoring wetlands in watersheds will improve water quality and reduce the negative effects of non-point source runoff as wetlands help to regulate flows. Wetland restoration load reduction rates were estimated using the NRCS Nutrient Tracking Tool and were calculated assuming 100 acres of land is converted entirely to wetlands.

Agricultural BMPs – the USDA Natural Resources Conservation Service recommends many agricultural practices to protect topsoil, retain nutrients on fields, and manage water. Some BMPs are already widely used in the Portage River watershed, notably conservation tillage. Some practices are used, but could be used more extensively. Other practices are not commonly used, but may benefit this watershed. Most BMPs reduce loadings of phosphorus, nitrate, and sediment. Additionally, where needed in the watershed, some practices are designed to reduce bacteria loadings from manure. Reduction calculations are based on models recommended by EPA and NRCS, using soil, tillage, slope, and other data for the given watershed. BMP costs are based on NRCS 2011 EQIP cost share rates for Wood County.

BMP load reductions (all methods assume either a Hoytville silty clay loam or Hoytville clay loam soil and a slope of less than 1-2 percent – these soils are the two most widely found soils in the Portage watershed):

- Cover Crop – the use of plants such as daikon radishes or grasses in between corn, soybean, or other main crops will help prevent sediment loss and return nutrients to the soil. Sediment loss rates per acre per year were calculated using the Michigan State University *High Impact Targeting* online tool. The estimated erosion rate reduction of 88 percent was taken from the Powell Creek TMDL. Reductions in phosphorus and nitrogen were estimated using the U.S. EPA Region 5 spreadsheet model for sediment to phosphorus and nitrogen ratios.
- Controlled Drainage – controlled drainage allows the farmer to raise lower water levels to crops as needed. This is accomplished with drainage outlet water control structures in tiled fields or fields with drainage ditches. Load reduction rates of 35% and 45% for phosphorus and nitrogen, respectively, were taken from a publication by North Carolina State University Department of Soil Science [http://www.soil.ncsu.edu/publications/BMPs/drainage.html].
- Permanent Hay/Pasture – land converted from farmland to permanent hay or pasture land prevents soil erosion. The U.S. EPA Region 5 Model spreadsheet was used to determine reductions from hay/pasture. Inputs to the Region 5 Model come from RUSLE calculations.
- Riparian Buffers – vegetated strips between streams/ditches and farm fields provides a buffer for runoff. Vegetation helps regulate flows, remove nutrients and other pollutants from runoff, and reduce streambank erosion. The NRCS Nutrient Tracking Tool was used to estimate reductions in each sub-watershed. An assumed buffer of thirty feet was used as this is the minimum recommendation for streams.
- Filter Strips – similar to riparian buffers, filter strips, which are typically a type of grass, provide a buffer between farmland and other structures (e.g. neighboring farms, streams, roads, parcels, etc.). Loading rates calculated for 100 acres of land with the assumption that 100 acres has an 8500 ft perimeter. Load reduction estimates were then calculated for 100 linear feet using the NRCS Nutrient Tracking Tool and assuming a 20 ft strip.
- Conservation Tillage – conservation tillage, also known as no-till, is a recommended practice to promote soil health and proper soil structure. Tilling soil disturbs natural microbial and worm functions that help aerate and provide additional nutrients to the soil. By continuously not tilling, soil structure remains intact providing adequate drainage and

nutrients. The NRCS Nutrient Tracking Tool was used to determine the load reductions from this practice.

Stream Fencing – livestock general will step and drink in streams when other water sources are not available. Stream fencing prevents livestock from entering streams where they may contaminate the stream/ditch with E. coli bacteria from manure. It also eliminates a source of stream bank and stream bed erosion. Load reductions were calculated using the NRCS Nutrient Tracking Tool. The assumptions for the model inputs were that there are two dairy cows for every acre of grazing land; 100 acres would be 200 dairy cows. It was also assumed that the cows were in the stream for five hours per day prior to the BMP implementation and after implementation were prevented from using the stream. Fencing practices to eliminate animal access to a stream may need to include providing an alternate drinking water source for livestock.

Outreach, Education, and Management – programs and projects that inform stakeholders and the general public about water quality of the Portage, increase our knowledge of the watershed, or build the capacity of stakeholders to protect clean water are all beneficial. While they do not immediately result in nutrient reductions, they will improve stewardship in the future. Cost estimates are based on input from participating partners.

Basin-wide Projects – some projects recommended in the watershed assessments by their nature apply to entire counties, or the entire Portage River Basin. These are usually outreach, education, research, data management/GIS, or management projects, which do not affect near-term nutrient load reduction targets. These projects are listed in just one HUC although they may apply to multiple HUCs; they are so noted. Cost estimates are based on input from participating partners.

It is important to note that while specific best management practices are recommended, this plan calls for flexibility in their application. Calculations are based on combinations of individual practices; there are literally thousands of different permutations that could meet the load reduction and habitat restoration targets. Final selection will and should depend on site-specific recommendations of the implementing agencies (SWCD, NRCS, and County Engineer) and acceptability to the property owner.

Presently the NRCS favors suites of BMPs. As more information becomes available, the preferred selection of practices is likely to change. In recent years the resurgence of harmful algal blooms has been a cause of great concern for Lake Erie. In the past it was thought that phosphorus attached to soil particles, and by controlling sediment, phosphorus could be controlled. Current research on algal blooms indicates that soluble phosphorus controls are needed. Presently agricultural practices to control soluble phosphorus are lacking; it seems likely that they will be developed in the near future.

Other changes in ecology and agricultural practices may be less predictable. It is the intent of this plan to support emerging technologies and new practices, and not be strictly committed to numbers developed for 2011 BMPs.

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NEEDLES CREEK ABOVE RADER CREEK

04100010 030 010

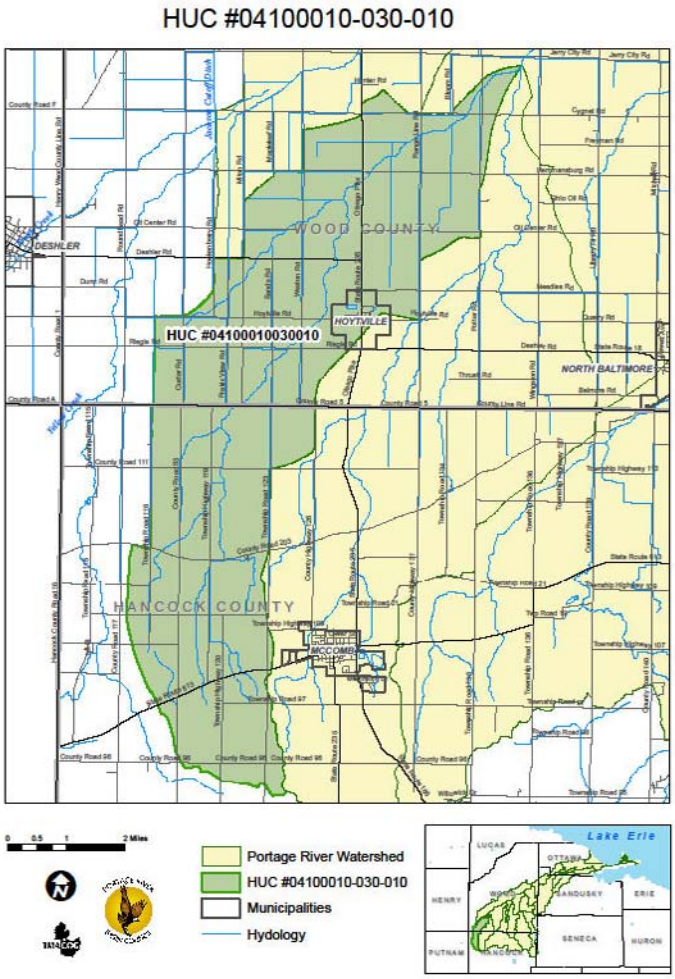
04100010 01 02 (New 12-digit HUC & Name: Needles Creek)

Length: 10.7 miles
Elevation at Mouth: 689
Elevation at Source: 733
Fall: 4.1 (ft/mi)
Drainage area: 32.8 sq. mi.

Ohio Topographic Quadrangle 7.5 minute (1:24,000)

Bowling Green South
North Baltimore
Hoytville
McComb

Urban Areas:
Village of Hoytville



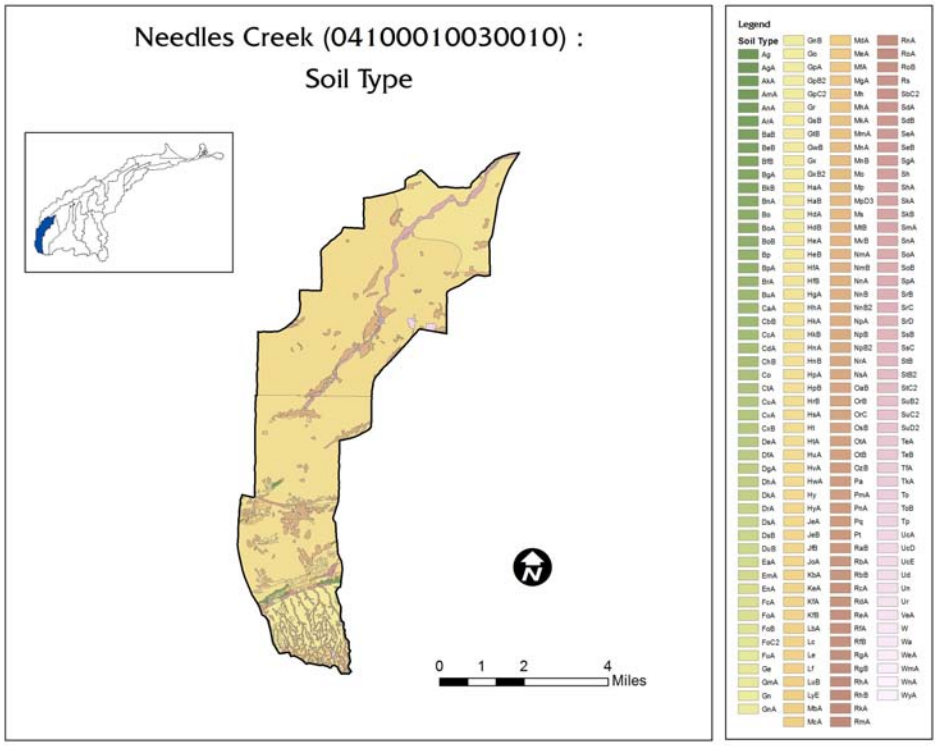
Geology

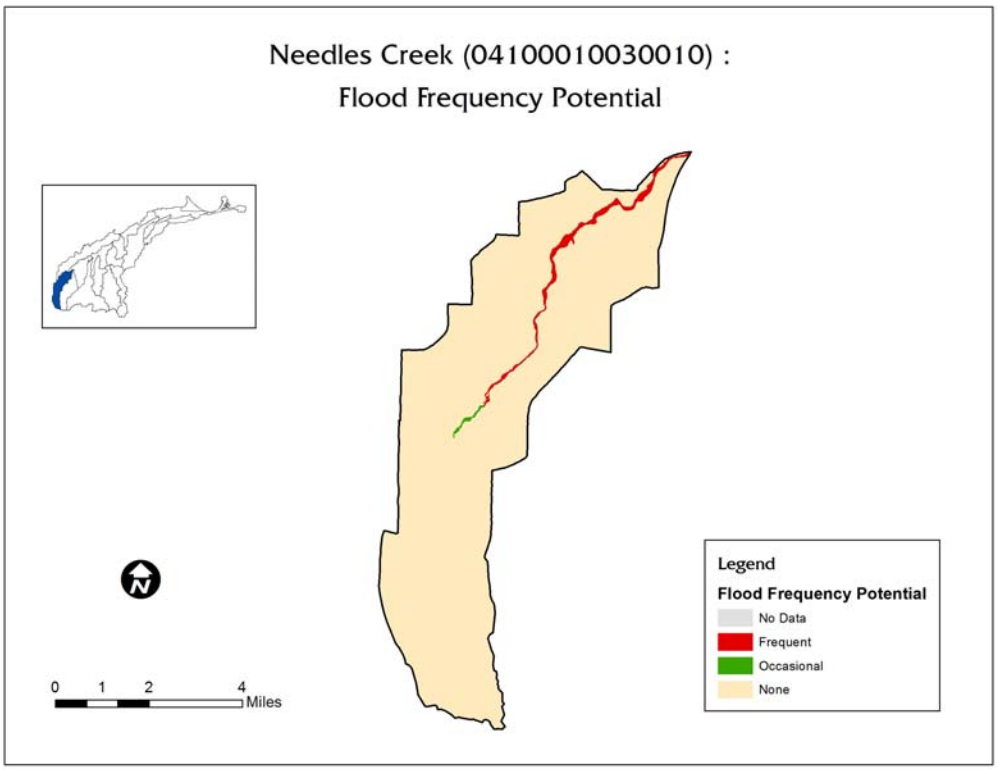
The subwatershed is located within the glacial lake plain entirely within the HELP ecoregion. During the glacial period, ice sheets of both the Illinoian and Wisconsin Age advanced and retreated over the area. As the ice sheets retreated, a large lake was formed. This glacial lake leveled the till plain. Consequently, Wood County is now typified by level or nearly level, expanses, broken only by sand ridges formed during the glacial period, by high areas underlain by limestone and by breaks along river and streams. Hancock County has nearly level undulating topography, except where the Portage watershed is located in the northern half of the county. Here the glacial moraines present the only elevation between 700 and 800 feet to provide fall. The elevation is formed from glacial till, lacustrine modified till, outwash sand, and gravel associated with the Wisconsin Glaciation.

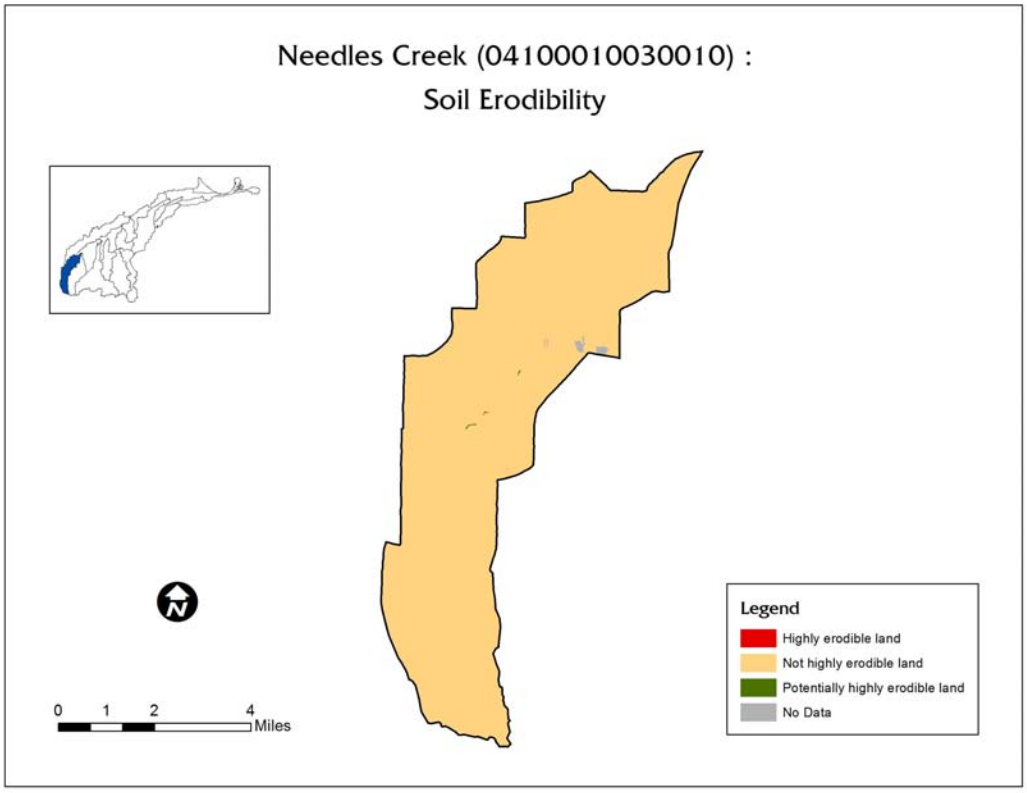
Soils

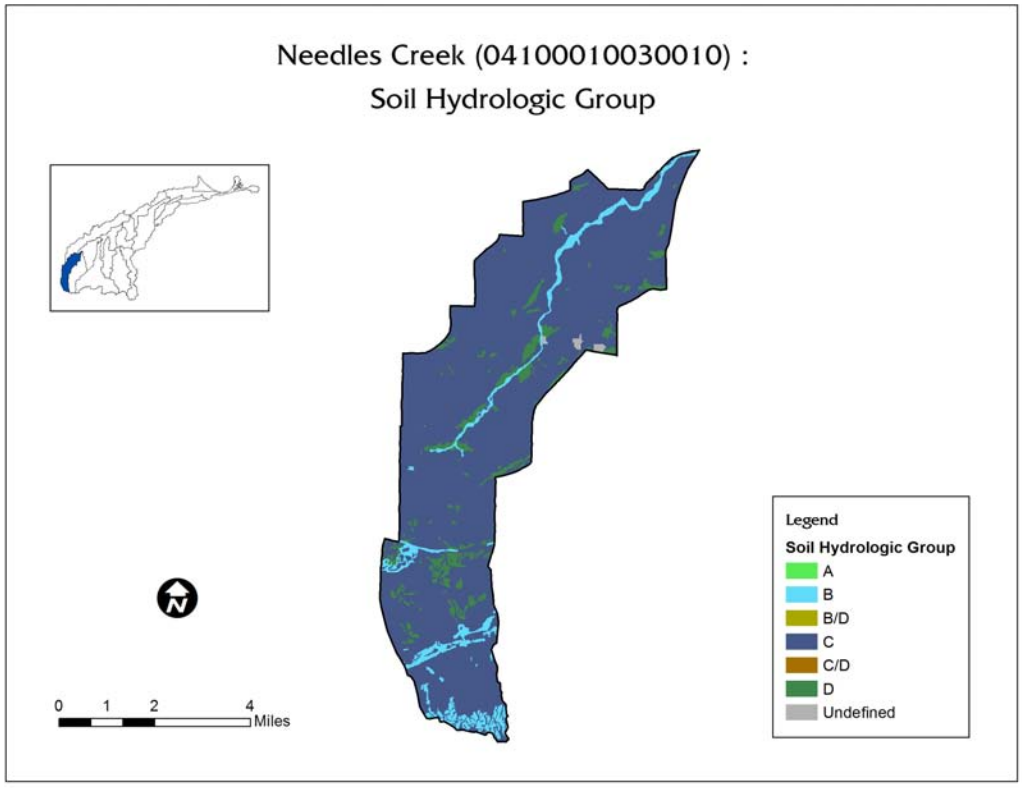
The predominant soil within the Needles Creek subwatershed is Hoytville, silty clay or silty clay loam. Hoytville soils comprise more than three-quarters of the HUC's soils: they are group "C," very poorly drained and not highly erodible. However, when drained, they are prime farmland.

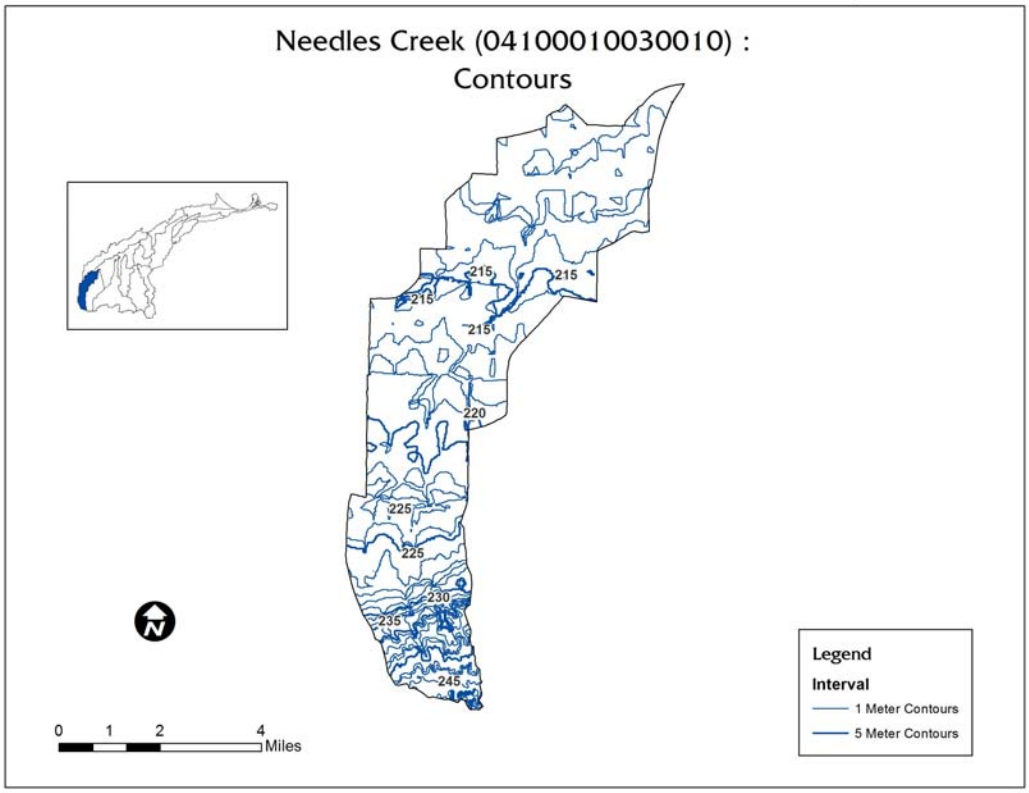
Major Soil Groups		
030-010		
Hoytville	Sum Acres	15,718
	Percent	78.07%
Nappanee	Sum Acres	1,190
	Percent	5.91%
Glynwood	Sum Acres	1,076
	Percent	5.35%
Pewamo	Sum Acres	459
	Percent	2.28%
Sloan	Sum Acres	411
	Percent	2.04%
Haskins	Sum Acres	324
	Percent	1.61%
Jenera	Sum Acres	249
	Percent	1.24%
Mermill	Sum Acres	233
	Percent	1.16%

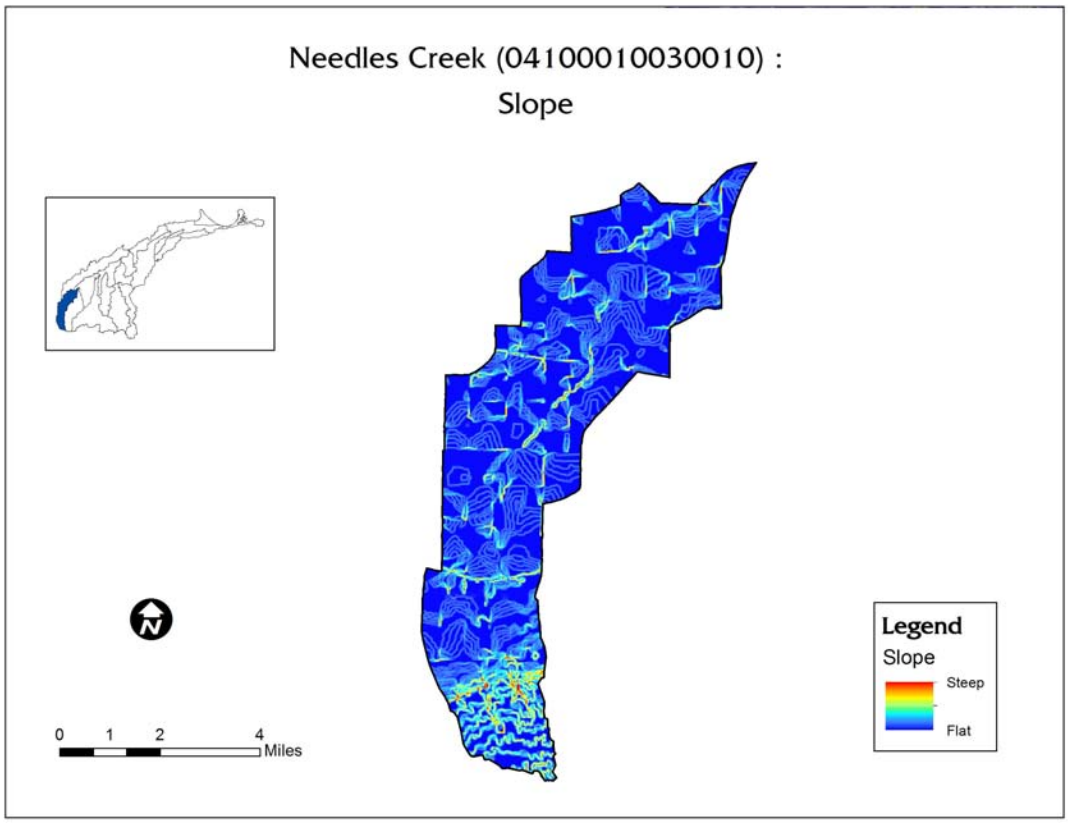

Needles Creek (04100010030010) :
Soil Type
0 1 2 4
Miles
Legend
Soil Type

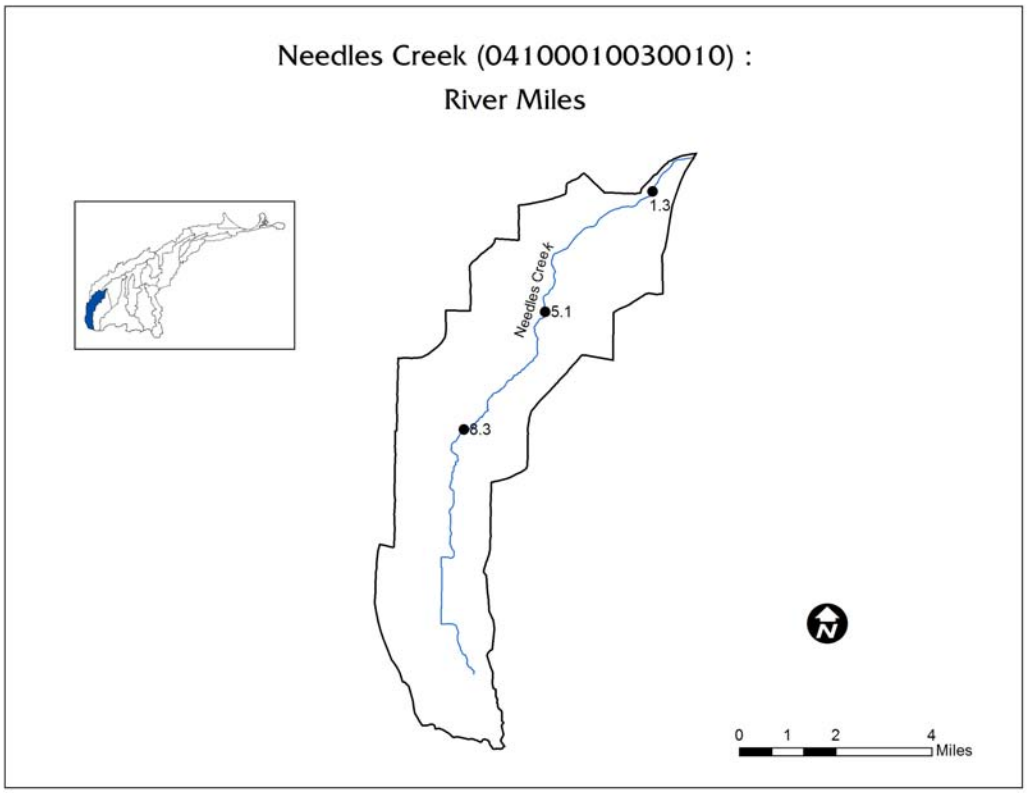

Needles Creek (04100010030010) :
Flood Frequency Potential
0 1 2 4
Miles
Legend
Flood Frequency Potential
No Data
Frequent
Occasional
None


Needles Creek (04100010030010) :
Soil Erodibility
Legend
Highly erodible land
Not highly erodible land
Potentially highly erodible land
No Data
0 1 2 4
Miles


Needles Creek (04100010030010) :
Soil Hydrologic Group
Legend
Soil Hydrologic Group
A
B
B/D
C
C/D
D
Undefined
0 1 2 4
Miles


Needles Creek (04100010030010) :
Contours
215
215
215
215
220
225
225
230
235
245
0 1 2 4
Miles
Legend
Interval
1 Meter Contours
5 Meter Contours


Needles Creek (04100010030010) :
Slope
0 1 2 4
Miles
Legend
Slope
Steep
Flat



The Soil Hydrologic Group map indicates the *Hydrologic soil groups* based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately course texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the

surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (**A/D, B/D, or C/D),** the first letter is for drained areas and the second is for undrained areas.

Rare, Threatened, Endangered Species

The North Branch subwatershed HUC14 04100010 050 020 provides habitat for numerous species of plants, animals and mussels. Most of these species are *threatened* or *potentially threatened*.

Rare, Threatened, Endangered Species

Common Name	*Scientific Name*	Last Observed	State Status
Five-angled Dodder	Cuscuta pentagona	1969-08	T
Western Banded Killifish	Fundulus diaphanus menona	1999-07-27	E
Western Banded Killifish	Fundulus diaphanus menona	2005-09-08	E

T=Threatened, P=Potentially Threatened, E=Endangered, X=Presumed Extirpated, SC=Species of Concern

The Ohio EPA 2008 report also documents the find of seven different species of freshwater mussels found in Needles Creek at RM 1.25 as listed below. A local freshwater mussel guide can be obtained from the Lucas Soil and Water Conservation District at http://co.lucas.oh.us/LSWCD/urban.asp or http://www.farmertodd.com/musselguide.

Mussel Species in Needles Creek

Stream River Miles	Common Mussel Name	*Scientific Name*	Observed	Status
1.25	Cylindrical Papershell	*Anodontoides ferussacianus*	2008	—
1.25	Wabash Pigtoe	*Fusconaia flava*	2008	—
1.25	Fat Mucket	*Lampsilis radiate luteola*	2008	—
1.25	White Heelsplitter	*Lasmigona complanata complanata*	2008	—
1.25	Giant Floater	*Pyganodon grandis grandis*	2008	—
1.25	Creeper	*Strophitus undalatus undalatus*	2008	—
1.25	Lilliput	*Toxolasma parvus*	2008	—
Source: Freshwater Mussels of the Maumee Drainage 2nd Edition. Grabarkiewicz, J., and Crail, T.		**Source:** Ohio EPA Technical Report EAS/2010-4-4		

The Western Banded Killifish (Fundulus diaphanous menorah) once thought extirpated from the Portage River basin was collected in fish community assessments in Needles Creek and Bull Creek.

A biological relationship exists between the western banded killifish and white heelsplitter and black sandshell mussels. The western banded killifish is a known host fish for the reproduction of two mussel species found in Needles Creek. The black sandshell mussel is a threatened species in the state of Ohio.

"…unionids filter water, removing suspended matter from the water column and influencing nutrient cycles. In addition, through the use of a muscular "foot", mussels move about and burrow into stream and lake bottoms, oxygenating substrates and mixing sediments" (Freshwater Mussels of the Maumee Drainage, 2nd Edition).

HUC 8 – 04100010 (Portage River)									
HUC 10 – 0410001001 (Rocky Ford-Middle Branch Portage River)									
HUC 12 – 04100010 01 02 (New 12-digit HUC & Name: Needles Creek)									
HUC 14 – 04100010 030 010 (Needles Creek above Rader Creek)									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
4	2008	300511	Needles Creek @ Hancock / Wood County Line Rd.	8.35	11.3	WWH	Partial	Low flow Alterations	alterations, Direct
5	2008	S01P30	Needles Creek N of Hoytville @ St. Rt. 18	5.14	17.0	WWH	Full	-	
6	2008	S01S48	Needles Creek Ne Of Hoytville @ Cygnet Rd.	1.25	32.0	WWH	Partial	Direct Habitat Alterations, Low flow alterations, Sedimentation/Siltation	Channelization, Non-irrigated Crop Production

Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010.

Water Resources

Surface Water

Designated Use for aquatic life is warm-water habitat (WWH). **Recreation Use** assessment is Class B at all three sampling locations. That determines the acceptable E. Coli colony numbers as shown below in a summary table taken from the Ohio 2010 Integrated Report, Section F: Evaluating Beneficial Use: Recreation, p. F-1.

Recreational Use Attainment							
Location	RM	Rec Use PCR Class	Number of Samples	**E. coli Standard:** Mean <126 (A), or <161 (B) and Maximum Sample ≤ 298 (A) or ≤ 523 (B)		Attainment Status	Sources of Bacteria
				Mean	Max		
Needles Ck At Hancock-Wood County Line Rd	8.35	B	4	618	4800	Non	CAFO; HSTS; Agric.
Needles Ck At Sr 18	5.14	B	3	859	5900	Non	HSTS; Agric.
Needles Ck At Cygnet Rd	1.25	B	4	388	10000	Non	CAFO; HSTS; Agric.

Aquatic Life Use Assessment				
Location	**RM**	**Drainage Area**	**Aquatic Life Use**	**Attainment Status**
Needles Creek @ Hancock/Wood County Line Rd.	8.3	11.3	WWH	Partial
Needles Creek N of Hoytville @ St. Rt. 18	5.1	17.0	WWH	Full
Needles Creek NE of Hoytville @ Cygnet Rd.	1.2	32.0	WWH	Partial
Source: Ohio EPA 2012 Integrated Report: http://wwwapp.epa.ohio.gov/dsw/ir2012/search.html				

Macro-invertebrate Communities

Stream RM	Dr. Ar. (sq. mi.)	Data Codes	Qual. Taxa	EPT QI./Total	Sensitive Taxa QI./Total	Density QI./Qt.	CW Taxa	Predominant Organisms on the Natural Substrates With Tolerance Category(ies)	ICI[a]	Narrative Evaluation
8.35	11.3	-	39	8	3	M	0	Blackflies (F), midges (T,F), caddisflies (F)	-	Fair
5.14	17.0	-	39	10	5	M	0	Hydropsychid caddisflies (F), midges (F,T), blackflies (F)	-	Marg. Good
1.25	32	9	44	7	11	-	0	Water boatmen (F), beetles (F), midges (F)	-	Fair

Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010 http://epa.ohio.gov/dsw/tmdl/PortageToussaintRivers.aspx

Public Drinking Water Supply Assessment

HUC	Reporting Category	Cause of Impairment	Nitrate Watch List	Pesticide Watch List
04100010 01 02	No active intakes	None	No	No

Fish Tissue Assessment

HUC	Reporting Category	Causes of Impairment	PCB Concentration
04100010 01 02	3	None	

Water Quality Monitoring Results: Ohio EPA 1994 and 2008

Date	River Mile	IBI	ICI	MiWB	QHEI	STATUS
1995	1.3/ --	28^{ns}		8.8	25.0	Good/fair
2008	*8.35*	*34*	*F**	*N/A*	*30.5*	*Partial*
2008	*5.14*	*$\underline{26}^{ns}$*	*MG^{ns}*	*N/A*	*44.5*	*Full*
2008	*1.25*	*38*	*F**	*8.7*	*45.5*	*Partial*

a - River Mile (RM) represents the Point of Record (POR) for the station, not the actual sampling RM.
b - MIwb is not applicable to headwater stream with drainage areas ≤20 mi^2.
c - A narrative evaluation of the qualitative sample based on attributes such as EPT taxa richness, number of sensitive taxa, and community composition was used when quantitative data was not available or considered unreliable. VP=Very Poor, P=Poor, LF=Low Fair, F=Fair, MG=Marginally Good, G=Good, VG=Very Good, E=Exceptional
d - Attainment is given for the proposed status when a change is recommended. Aquatic life use in superscript.
ns - Nonsignificant departure from biocriteria (≤4 IBI or ICI units, or ≤0.5 MIwb units).
* - Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.
Sources: Biological and Water Quality Study of the Portage River Basin, Ohio EPA 1995, Table 13; Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010 http://epa.ohio.gov/dsw/tmdl/PortageToussaintRivers.aspx

General narrative ranges assigned to QHEI scores.				
Narrative Rating		QHEI Range		
		Headwaters (≤ sq mi)	Larger Streams	Lacustuary
Excellent		≤ 70	≤ 75	≤ 80
Good		55 to 69	60 to 74	60 to 80
Fair		43 to 54	45 to 59	45 to 59
Poor		30 to 42	30 to 44	30 to 44
Very Poor		<30	<30	<30

1995 OEPA Assessments

In 1995, Needles Creek was sampled at RM 1.3 (Cygnet Road). The sampling site was a channelized, grass banked ditch. Despite the poor habitat this site had a diverse community with mayflies and fingernail clams abundant in all of the habitats sampled. The narrative assessment was marginally good.

Needles Creek is a channelized ditch. Pioneering species accounted for 64.1 % of the fish community. Needles Creek exhibited continuous flow and an average depth of approximately 10 cm, and thus had a more balanced fish community. The western banded killifish, a state endangered species, was collected in Needles Creek.

2008 OEPA Assessments

Macro-invertebrate communities collected from Needles Creek in 2008 were not meeting (RM 8.35 and RM 1.25) or marginally (RM 5.14) meeting WWH expectations, characterized by sensitive taxa (3-11) diversity and predominance of primarily facultative taxa. Seven species of freshwater mussels were found. Observed impairments of this stream were low flow alterations, habitat alterations, and siltation.

The two-stage channel constructed near Needles Creek RM 8.35 was judged inadequate in channel width and size of constructed benches to provide aquatic life use benefits in the form of adequate habitat for macroinvertebrates. Future projects may need additional width in order to act as adequate depositional areas for sediment and nutrients to improve water quality. Incorporation of habitat features to benefit aquatic life should be considered if attainment of WWH criteria is a goal in future two-stage channel projects.

*EPT Taxa Richness is the number of Ephemeroptera (mayfly), Plecoptera (stonefly), and Trichopera (caddisfly) taxa in a sample.

Values range from 0 to 12, with high values indicating less organic pollution. EPT are most diverse in natural streams and decline with increasing watershed disturbance.

Biological Criteria Benchmarks

Biological Criteria					Lacustuary Benchmarks[1]				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
IBI-	50	28	20	18	N/A	N/A	N/A	N/A	N/A

Biological Criteria					Lacustuary Benchmarks[1]				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
Headwaters									
IBI-Wading	50	32	22	18	N/A	N/A	N/A	N/A	N/A
IBI-Boat	48	34	20	16	50	42	31	17	<17
MIwb-Wading	9.4	7.3	5.6	4.5	N/A	N/A	N/A	NA	N/A
MIwb-Boat	9.6	8.6	5.7	5.0	10	8.6	5.6	2.8	<2.8
ICI	46	34	22	8	52	42	25	12	<12

[1] **Proposed Lacustuary scoring breakpoints. These have not yet been adopted into rule.**

Ground Water

There are no municipal areas within this subwatershed that rely on groundwater for drinking water. Individual residences obtain water from Hoytville, which uses surface water supplied by the City of Bowling Green through Northwestern Water and Sewer District from the Maumee River, or from household private wells.

DRASTIC MAP

The sensitivity of the groundwater to local sources of contamination is determined and rated by **DRASTIC** maps as described below:

Inherent within each geologic setting are the physical characteristics which effect the groundwater pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:

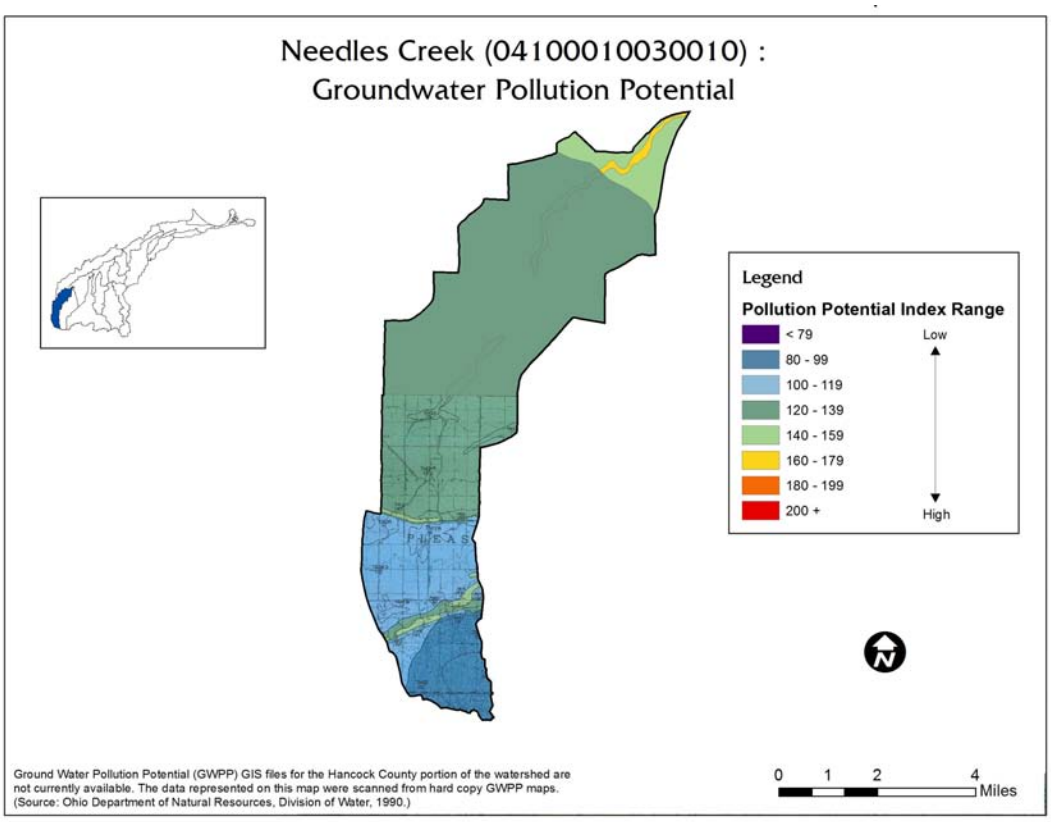
D – Depth to Water
R – Net Recharge
A – Aquifer Media
S – Soil Media
T – Topography
I – Impact of the Vadose Zone Media
C – Conductivity (Hydraulic) of the Aquifer (ODNR, 1994)

Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index then the greater the vulnerability to contamination (ODNR, 1994).

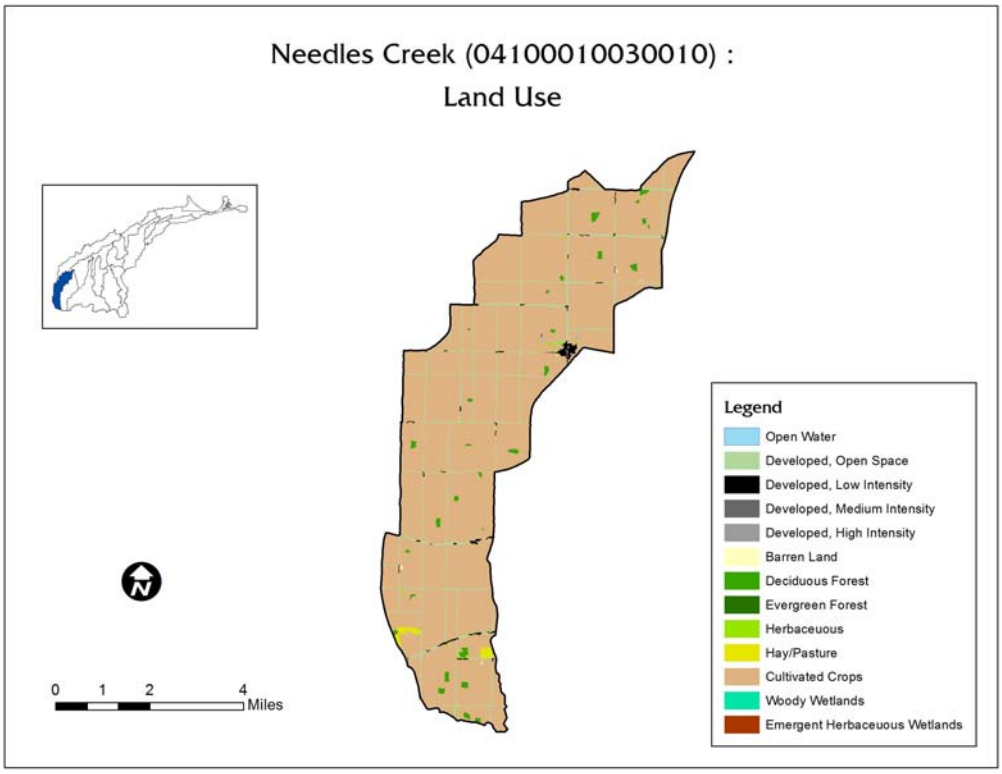
All of Wood County was identified with nine hydro-geologic settings for potential of ground water pollution indexes ranging from 63 to 198 as it relates to the Ground Water Pollution Potential. For Hancock County, DRASTIC data maps were not available.

The average ground water pollution index potential for the Wood County portion of the Needles Creek watershed is 140 with a range of 121-161. In Hancock County, for which GIS data are not available, the range is about 80-140.

The Ohio Department of Natural Resources, Division of Water, Water Resources Section is the responsible agency to map groundwater resources throughout the state. Greater detail on DRASTIC maps for the Portage can be found in Chapter 4 of the watershed plan.



Sub-watershed (04100010)		
030-010		
Land Use	**Percent**	**Acres**
Urban	5.8%	1,161
Forest	1.3%	257
Pasture	0.4%	86
Cropland	92.4%	18,580
Other	0.1%	14
Total Acres	100%	20,098


Needles Creek (04100010030010) :
Land Use
Legend
Open Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Deciduous Forest
Evergreen Forest
Herbaceuous
Hay/Pasture
Cultivated Crops
Woody Wetlands
Emergent Herbaceuous Wetlands
0 1 2 4
Miles

Livestock Inventory HUC 4100010030010							
Type of Animal		**Hancock**	**Ottawa**	**Sandusky**	**Seneca**	**Wood**	**Estimates for HUC**
Percent of County in HUC		2.6%	0.0%	0.0%	0.0%	2.8%	
Cattle	Farms	129	89	167	264	144	**7**
	Animals	4,233	1,523	4,612	10,096	6,287	**289**
Hogs	Farms	51	15	37	62	30	**2**
	Animals	32,343	3,639	5,591	42,808	39,469	**1,967**
Horses	Farms	105	63	132	72	128	**6**
	Animals	844	444	772	463	1,004	**51**
Poultry	Farms	49	22	41	62	47	**3**
	Animals	NA	779	1,042	4,283	NA	**NA**
Sheep	Farms	32	12	41	61	21	**1**
	Animals	1,134	335	765	2,770	21	**30**
Total							20
							2,326

Source: 2007 Census of Agriculture http://www.agcensus.usda.gov/

Point Sources

Municipal

- Hoytville WWTP (2PA00083), Northwestern Water and Sewer District

The Hoytville WWTP was built in 1990 with an average daily design flow of 0.036 mgd. OEPA data shows an average flow of 0.946 mgd when discharging, 0.022 mgd on a daily average, and a peak flow of 0.968 mgd during the period of 2004-2009. The plant is a three-cell controlled discharge lagoon system that discharges to Needles Creek only during high flow. The collection is via a Septic Tank Effluent Gravity system that uses small diameter gravity pipes and on-lot septic tanks to capture solids. The Northwestern Water and Sewer District owns and operates the system.

Package Plants

None

Industrial

None

Non-Point Sources:

Critical Sewage Areas

- Deweyville (Hancock County) - Approximately 16 homes; 3 permits newer than 1986; no permits older than 1986
- TR 97/TR 120 §§27, 28, 33, 34 of Pleasant Township (Hancock County) - Approximately 12 homes; 7 permits newer than 1986; no permits older than 1986

CAFOs

- Reyskens Dairy

Reyskens Dairy was granted a permit to expand from 1,800 mature dairy cows to 2,000 in June 2012, and increase the volume of liquid waste storage by 10.78 million gallons.

Reyskens currently has the capacity to store 22.5 million gallons of liquid manure and about 70,000 cubic feet of solid manure. It plans to build a small barn to house 135 cows and reconfigure the stall layout in three existing barns to accommodate 65 additional cows. The dairy also plans to build two storage ponds to capture the wash water from the milk house and contaminated stormwater.[1]

Estimates of HSTSs				
Watershed	**Housing Units without sewers**	**Est. Unsewered Population (2010)**	**Unsewered Housing Units per acre**	**Unsewered Population per acre**
04100010030010	238	606	0.012	0.030

Sources: 2010 Census data and TMACOG "208" Plan. Analysis identifies approximate number of housing units without sewers in each watershed as an estimate of number of HSTSs.

Aquatic Life Use Impairments	
Causes	**Sources**
Siltation/Sediment	Channelization
Direct habitat alterations	Nonirrigated crop production
Low flow alterations	
Source: Ohio 2012 Integrated Report, Watershed Assessment Unit Summary	

Water Supply:

Public Water System	Population Served	Primary Water Source
Hoytville (Northwestern Water and Sewer District)	303	Bowling Green – Maumee River

1 *Toledo Blade* 6/2/2012 http://www.toledoblade.com/local/2012/06/02/v-7.html

Water Quality Impairments

The OEPA Integrated Report assesses each watershed's attainment status for 1) Public Drinking Water Supply, 2) Recreation, 3) Human Health, 4) Aquatic Life, and 5) Fish Tissue. The Integrated Report identifies causes and sources of impairments where watersheds are not in attainment with water quality standards.

Background:

Needles Creek is a largely channelized stream, with very little woods or stream bank vegetation. The waterway follows straightened channels through agricultural fields for 35.38 miles, with 4.20 miles of riparian buffers.

Ohio EPA sampled at three locations on Needles Creek, finding the stream in partial attainment of aquatic life standards at RM 1.2 (Cygnet Rd) and at RM 8.3 (the Hancock County line). A middle site, RM 5.1 (SR 18) was in full attainment. Similarly, the macroinvertebrate scores (ICI) were "fair" at the upstream and downstream sites but "marginally good" at the middle site. RM 1.25 is also the location of seven different mussel species. The habitat score was poor at the upstream site RM 8.35 and fair at 5.14 and 1.25.

Areas of non-attainment are related to agricultural practices: low flow alterations, direct habitat alterations, and siltation/sediment.

Problem Statement #1: (Bacteria)

The water quality of the North Branch subwatershed is impaired by elevated measurements of E. coli bacteria. The Portage TMDL data collected by Ohio EPA in 2008 indicate that all three of the HUC's sampling sites are in non-attainment for E. coli.

In this HUC are an estimated 238 HSTS; by density of onsite systems, this the least densely populated HUC. This watershed includes no package plants, and two Critical Sewage Areas, both in Pleasant Township of Hancock County.

Goal 1.1: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 1.5 million gallons of HSTS effluent annually

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 23 systems
- Deweyville Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- TR 97/TR 120 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Bacteria	1.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$345,000	Wood & Hancock County Health Dept., TMACOG, Ohio EPA	2013 - 2022	Replace or upgrade 10% of watershed's HSTS or 23 systems	1.5 million gallons/year sewage discharge eliminated
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Hancock County Health Department, Hancock County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$10,208	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA	2013-2018	Deweyville Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Hancock County Health Department, Hancock County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$7,656	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA	2013-2018	TR 97/TR 120 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals

Problem Statement #2: (Nutrients: phosphorus and nitrate)

Of the three aquatic life sampling sites in this HUC under the TMDL, Ohio EPA cites agricultural-related impairments for two, finding the downstream site (RM 1.2) and a headwater site (RM 8.3) in partial attainment. The TMDL reports total phosphorus levels over the target of 0.08 mg/l at RM 5.14 (0.103 mg/l) and RM 8.35 (0.12 mg/l). NO_3+NO_2 also exceeds its 1.0 mg/l target at all three sites (2.07 @ RM 8.35, 1.55 @ RM 5.14, and 1.56 @ RM 1.25).

Goal 2.1: Meet TMDL target for phosphorus load reduction by 123 and nitrate load by 519 lb./year from HSTS

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 23 systems

Goal 2.2: Meet TMDL target for phosphorus load reduction by 1,935 and nitrate load by 4,865 lb./year from agricultural practices

Objectives:

- 1,000 acres of cover crops
- 400 acres of controlled drainage
- 400 acres of permanent hay
- 500 acres of riparian buffers
- 50 acres of restored wetlands
- 500 LF of stream restoration
- 750 LF of overwide / 2-stage ditch reconstruction
- 7044 acres under NRCS 590/1 Nutrient Mgt
- 3019 acres under NRCS 590/3 Nutrient Mgt
- 10000 acres of filter strips
- 500 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Nutrients (phosphorus and nitrate)	2.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$345,000	Wood & Hancock County Health Dept., TMACOG, Ohio EPA	2013 - 2022	Replace or upgrade 10% of watershed's HSTS or 23 systems	Reduce phosphorus load by 123 and nitrate load by 519 lb/year
	2.2	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$60,000	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	1,000 acres of cover crops	Reduce phosphorus load by 1,109 and nitrate load by 2,218 lb/year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$188,400	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	400 acres of controlled drainage	Reduce phosphorus load by 176 and nitrate load by 454 lb/year
	2.2	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$112,000	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	400 acres of permanent hay	Reduce phosphorus load by 260 and nitrate load by 520 lb/year
	2.2	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$350,000	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	500 acres of riparian buffers	Reduce phosphorus load by 90 and nitrate load by 180 lb/year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$255,312	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	50 acres of restored wetlands	Reduce phosphorus load by 8 and nitrate load by 52 lb/year
	2.2	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$174,000	Wood & Hancock SWCD, Wood & Hancock co Engineer, NRCS, farmers	2013-2027 in phases	500 LF of stream restoration	Reduce phosphorus load by 19 and nitrate load by 38 lb/year
	2.2	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$66,750	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	750 LF of overwide / 2-stage ditch reconstruction	Reduce phosphorus load by 99 and nitrate load by 198 lb/year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Seek cooperators for Nutrient Management NRCS 590 Level 1 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management NRCS 590 Level 1 BMPs with farmers	$140,886	Wood & Hancock SWCD, NRCS, farmers	2013-2022	7,044 acres under NRCS 590/1 Nutrient Mgt	NA
	2.2	♦Seek cooperators for Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with farmers	$120,759	Wood & Hancock SWCD, NRCS, farmers	2013-2022	3,019 acres under NRCS 590/3 Nutrient Mgt	NA
	2.2	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$1,377	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	10,000 acres of filter strips	Reduce phosphorus load by 100 and nitrate load by 190 lb/year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Identify & prioritize fields suited for Conservation Tillage BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Conservation Tillage BMP with farmer	$7,500	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	500 acres of conservation tillage	Reduce phosphorus load by 74 and nitrate load by 1,015 lb/year

Problem Statement #3: (Siltation/Sedimentation)

The TMDL cites sedimentation/siltation as a cause of impairment generally for the watershed and specifically at RM 1.2.

Goal 3.1: Reduce sedimentation impairments by decreasing sediment load by 1,054 lb./year from agricultural practices

Objectives:

- 1,000 acres of cover crops
- 400 acres of controlled drainage
- 400 acres of permanent hay
- 500 acres of riparian buffers
- 50 acres of restored wetlands
- 500 LF of stream restoration
- 750 LF of overwide / 2-stage ditch reconstruction
- 10,000 acres of filter strips
- 500 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Sedimentation	3.1	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$60,000	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	1,000 acres of cover crops	Reduce sediment load by 554 lb./year
	3.1	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$188,400	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	400 acres of controlled drainage	Reduce sediment load by 202 lb./year
	3.1	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$112,000	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	400 acres of permanent hay	Reduce sediment load by 132 lb./year
	3.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$350,000	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	500 acres of riparian buffers	Reduce sediment load by 045 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$255,312	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	50 acres of restored wetlands	Reduce sediment load by 1 lb./year
	3.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$174,000	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	500 LF of stream restoration	Reduce sediment load by 19 lb./year
	3.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$66,750	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	750 LF of overwide / 2-stage ditch reconstruction	Reduce sediment load by 50 lb./year
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$1,377	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	10,000 acres of filter strips	Reduce sediment load by 50 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$7,500	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	500 acres of conservation tillage	Reduce sediment load by 2 lb./year

Problem Statement #4: (Habitat Alteration)

The OEPA TMDL characterizes Needles Creek as a largely channelized stream consisting of constructed ditches with little habitat. Alteration of habitat is given as an impairment at RM 8.35 and 1.25, implying that restoration is most needed in the creek below RM 5.14 and in the headwater tributaries. The QHEI score results were fair at RM 5.14 and 1.25 and poor at 8.35.

Goal 4.1: 550 acres of habitat restoration and 1250 linear feet of stream corridor restoration practices

Objectives:

- 500 acres of riparian buffers
- 50 acres of restored wetlands
- 500 LF of stream restoration
- 750 LF of overwide / 2-stage ditch reconstruction

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Habitat Impairment	4.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$350,000	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	500 acres of riparian buffers	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$255,312	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	50 acres of restored wetlands	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$174,000	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	500 LF of stream restoration	Load reductions provided in nutrient and sediment tables

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	4.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$66,750	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	750 LF of overwide / 2-stage ditch reconstruction	Load reductions provided in nutrient and sediment tables

Rader Creek

04100010 030 020

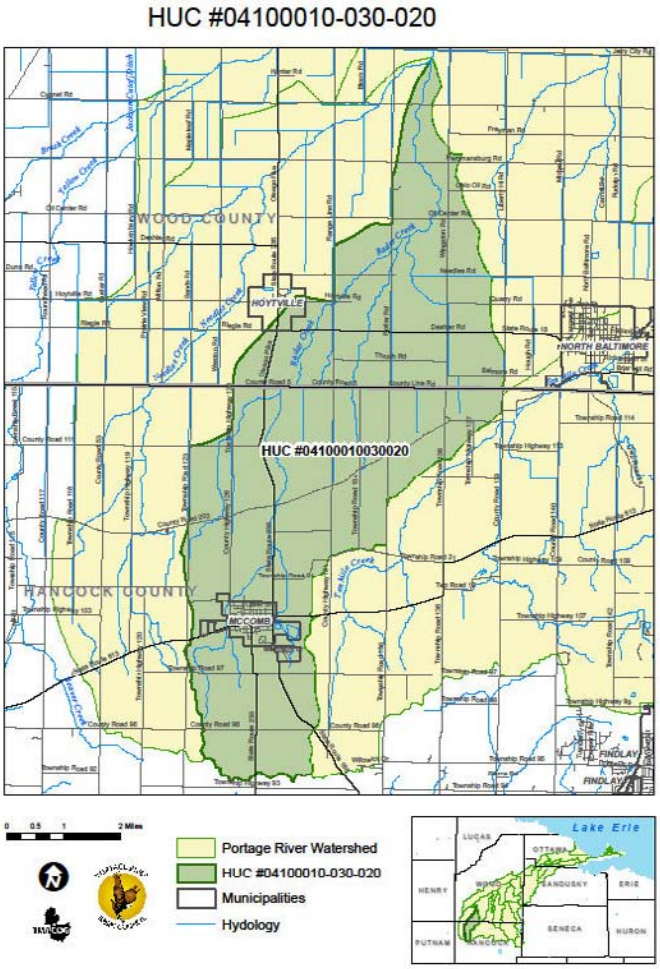
04100010 01 01 (New 12-digit & Name: Rader Creek)

Length: 14.3 miles
Elevation at Mouth: 689 feet
Elevation at Source: 812 feet
Fall: 6.3 (ft/mi)
Drainage area: 32.6 sq. mi.

Ohio Topographic Quadrangle 7.5 minute (1:24,000)

- Bowling Green South
- North Baltimore
- Hoytville
- McComb

Urban Areas:
Village of McComb



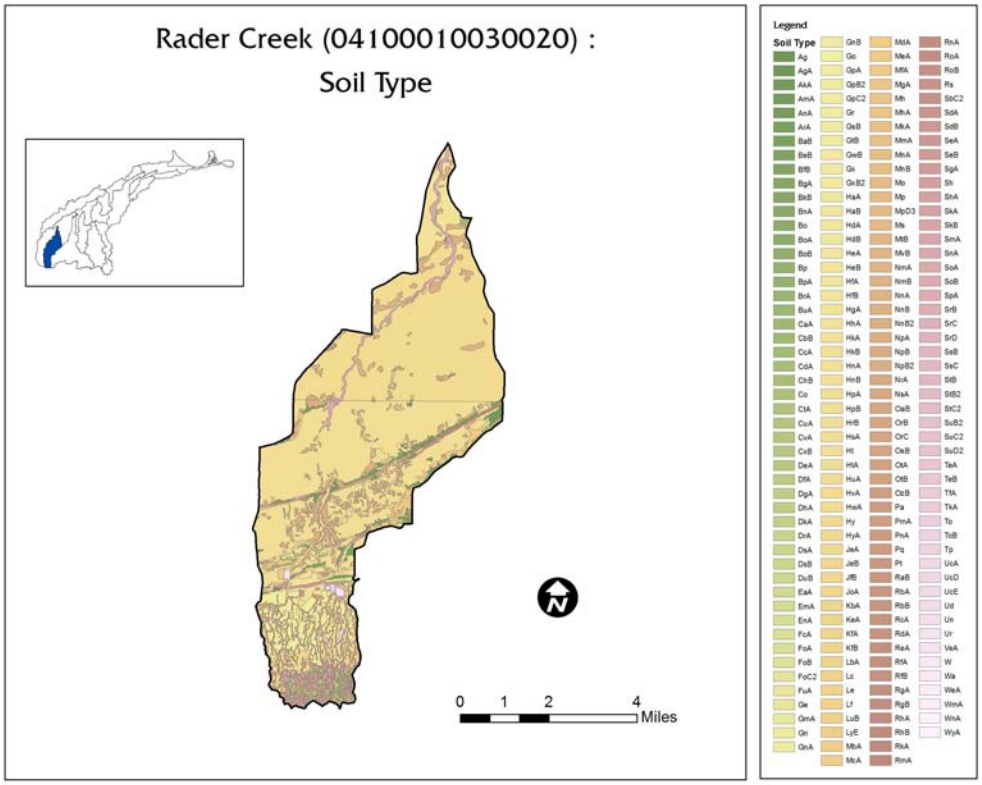
Geology

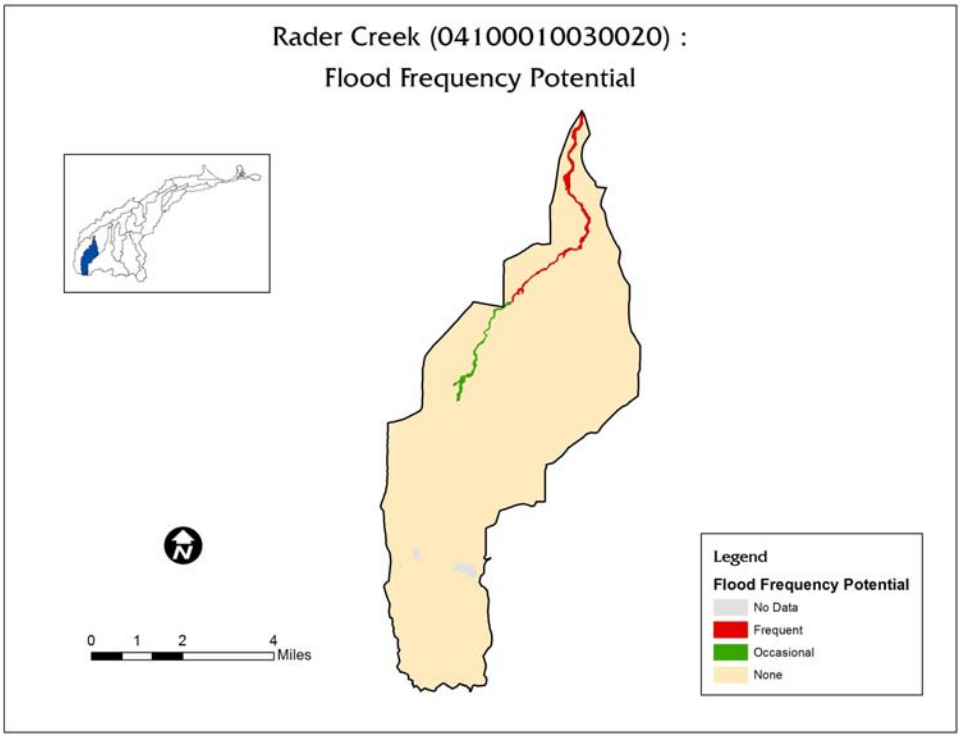
Rader Creek is a headwater stream geographically located in northwest Hancock County and southwest Wood County as it flows across both county lines. Rader Creek converges with Needles Creek in Section 5, Henry Township, Wood County to form the start of the Middle Branch Portage River (RM 15.50). The headwaters of Rader Creek originate southeast of McComb, Ohio in Hancock County and provide drinking water for the village reservoirs. The topography of Rader Creek is 2% to 6% slopes as a result of the glacial Defiance End Moraine. The glacial moraine formation is what physically separates the Portage River headwaters from the Blanchard River watershed in northern Hancock County. The remaining topography is generally flat to gently–rolling with slopes ranging 0% to 2%. The low relief is due, in part, to the extensive cover of glacial ground moraines. The subwatershed geology is a cover of loose glacial deposit overlying flat sedimentary rocks. The entire northern margin of the county is located in the Eastern Lake Plains section of the Central Lowlands (Fenneman, 1938) (ODNR, 1994).

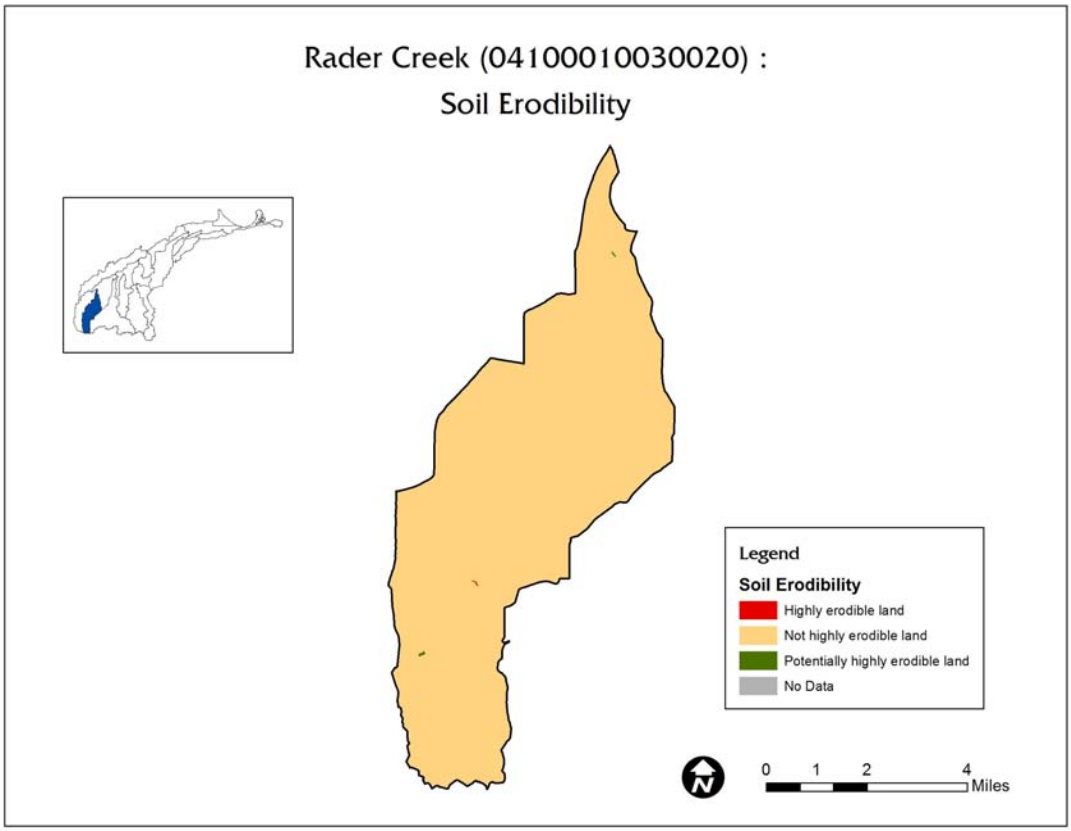
Soils

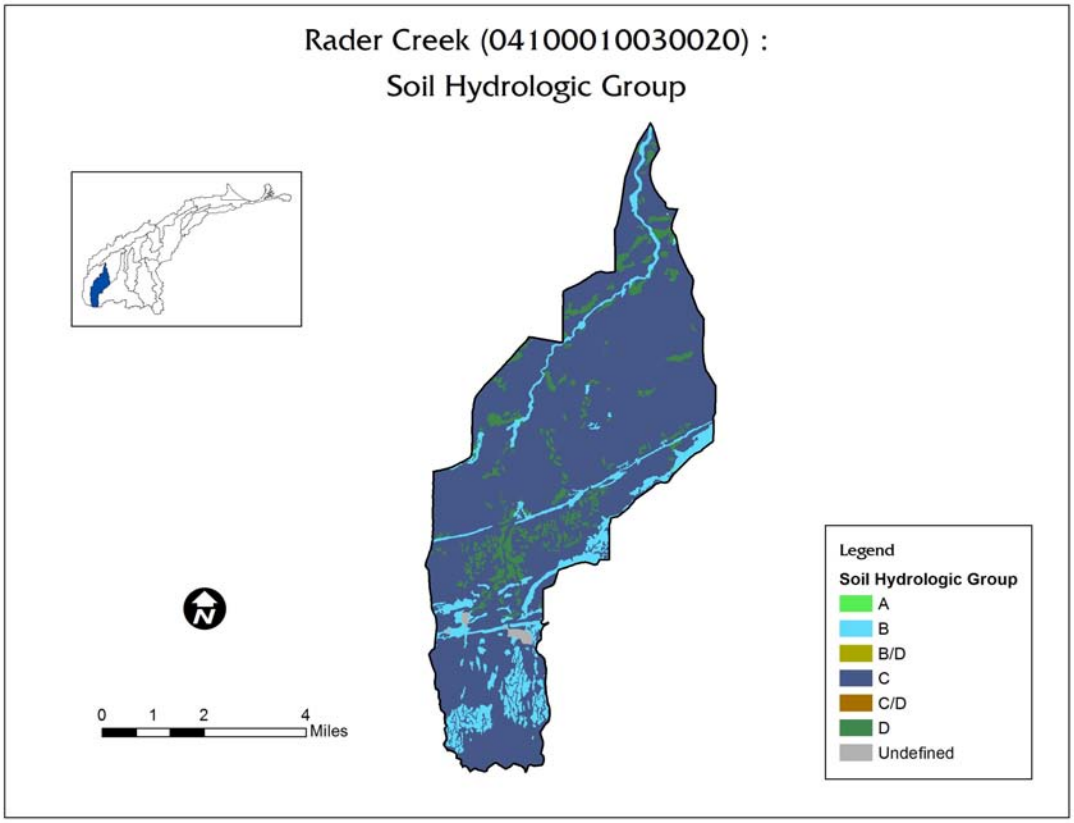
The predominant soil within the Rader Creek subwatershed is Hoytville, silty clay or silty clay loam. Hoytville soils comprise nearly two-thirds of the HUC's soils: they are group "C," very poorly drained and not highly erodible. However, when drained, they are prime farmland.

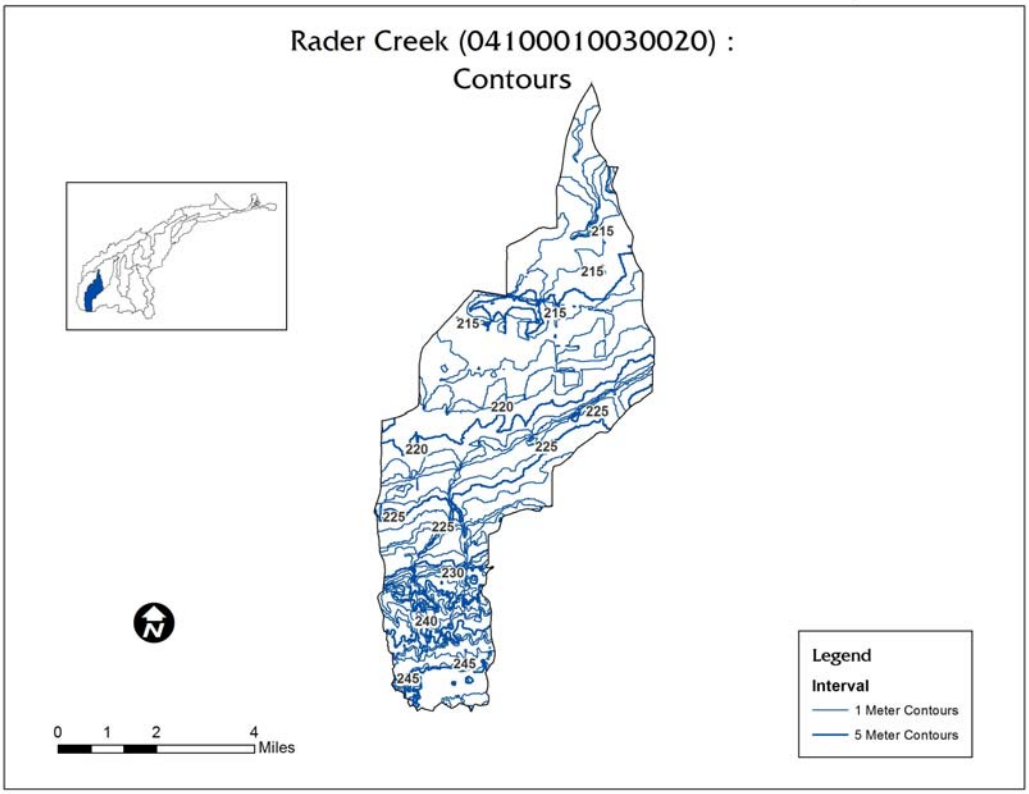
Major Soil Groups		
030-020		
Hoytville	Sum Acres	13,525
	Percent	64.76%
Nappanee	Sum Acres	1,497
	Percent	7.17%
Glynwood	Sum Acres	1,058
	Percent	5.06%
Pewamo	Sum Acres	976
	Percent	4.67%
Mermill	Sum Acres	523
	Percent	2.51%
Haskins	Sum Acres	470
	Percent	2.25%
Aurand	Sum Acres	401
	Percent	1.92%
Houcktown	Sum Acres	365
	Percent	1.75%
Jenera	Sum Acres	363
	Percent	1.74%
Sloan	Sum Acres	323
	Percent	1.55%

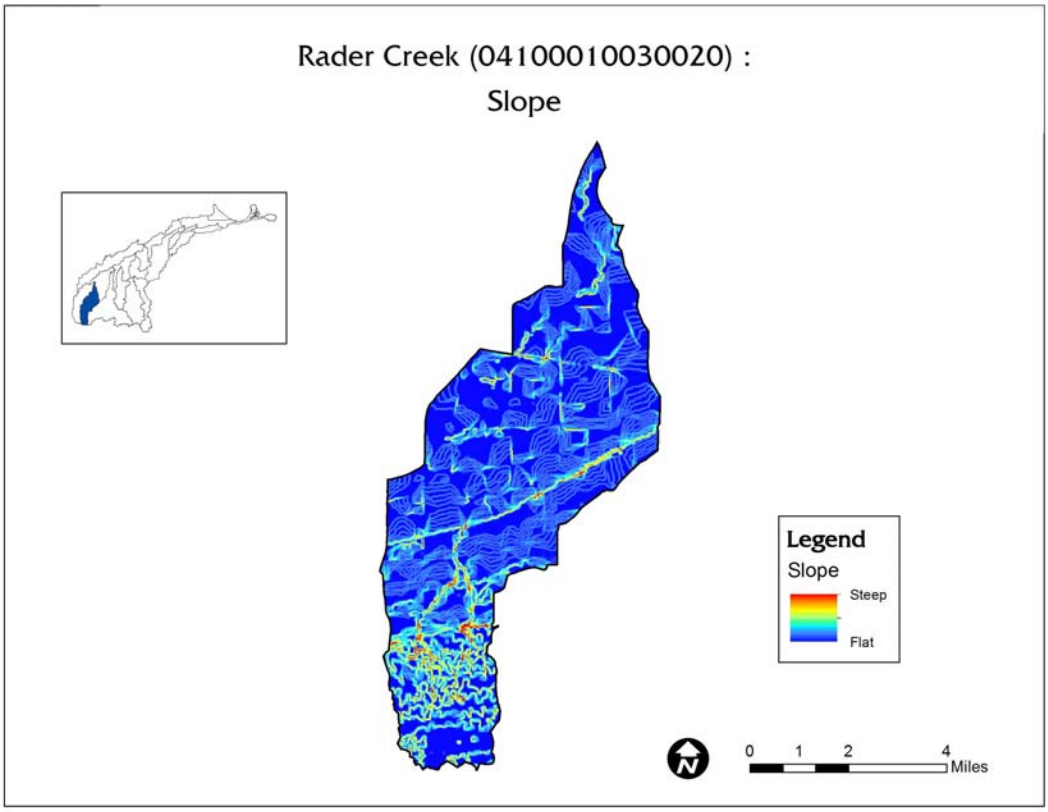

Rader Creek (04100010030020) :
Soil Type
0 1 2 4
Miles
Legend
Soil Type

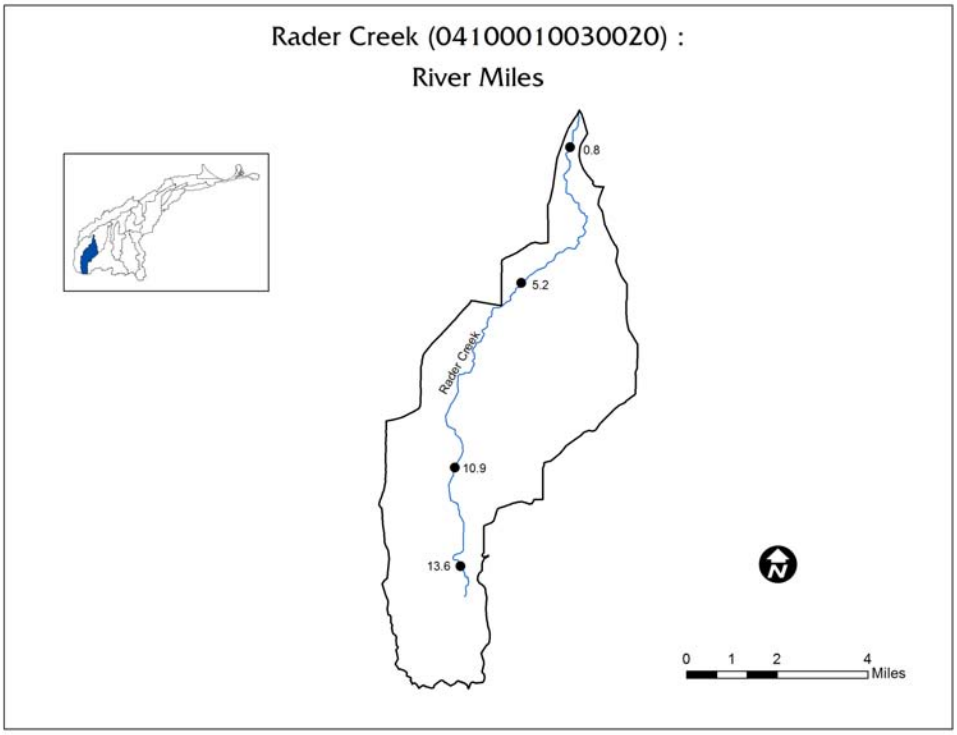

Rader Creek (04100010030020) :
Flood Frequency Potential
0 1 2 4
Miles
Legend
Flood Frequency Potential
No Data
Frequent
Occasional
None


Rader Creek (04100010030020) :
Soil Erodibility
Legend
Soil Erodibility
Highly erodible land
Not highly erodible land
Potentially highly erodible land
No Data
0 1 2 4
Miles


Rader Creek (04100010030020) :
Soil Hydrologic Group
Legend
Soil Hydrologic Group
A
B
B/D
C
C/D
D
Undefined
0 1 2 4
Miles


Rader Creek (04100010030020) :
Contours
215
215
215
215
220
220
225
225
225
225
230
240
245
245
Legend
Interval
1 Meter Contours
5 Meter Contours
0 1 2 4
Miles


Rader Creek (04100010030020) :
Slope
Legend
Slope
Steep
Flat
0 1 2 4
Miles



The Soil Hydrologic Group map indicates the *Hydrologic soil groups* based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately course texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (**A/D, B/D, or C/D),** the first letter is for drained areas and the second is for undrained areas.

Rare, Threatened, Endangered Species

The Western Banded Killifish, an endangered species in Ohio, is found in half the length of Rader Creek.

Rare, Threatened, Endangered Species			
Common Name	***Scientific Name***	**Last Observed**	**State Status**
Western Banded Killifish	Fundulus diaphanus menona	1997-09-12	E
T=Threatened, P=Potentially Threatened, E=Endangered, X=Presumed Extirpated, SC=Species of Concern			

Species of fresh water mussels were observed here also. Mussel species found were the Wabash Pigtoe, Fat Mucket, White Heelsplitter, Giant Floater, Maple Leaf, and Lilliput.

Mussel Species in Rader Creek

Stream River Miles	**Common Mussel Name**	***Scientific Name***	**Observed**	**Status**
0.8	Wabash Pigtoe	*Fusconaia flava*	2008	—
0.8	Fat Mucket	*Lampsilis radiate luteola*	2008	—
0.8	White Heelsplitter	*Lasmigona complanata complanata*	2008	—
0.8	Giant Floater	*Pyganodon grandis grandis*	2008	—
0.8	Mapleleaf	*Quadrula quadrula*	2008	—
0.8	Lilliput	*Toxolasma parvus*	2008	—
Source: Freshwater Mussels of the Maumee Drainage 2nd Edition. Grabarkiewicz, J., and Crail, T.		**Source:** Ohio EPA Technical Report EAS/2010-4-4		

HUC 8 – 04100010 (Portage River)									
HUC 10 – 0410001001 (Rocky Ford-Middle Branch Portage River)									
HUC 12 – 041000100101 (Rader Creek)									
HUC 14 – 04100010030020 (Rader Creek)									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
1	2008	S01s26	Rader Creek N of McComb @ Co. Rd. 203	10.92	7.3	WWH	Partial	Ammonia (Total), Oxygen, Dissolved, Nitrate/Nitrite (Nitrite + Nitrate As N), Phosphorus (Total), pH	Municipal Point Source Discharges, Channelization, Non-Irrigated Crop Production
2	2008	S01s24	Rader Creek E of Hoytville @ Needles Rd.	5.20	18.1	WWH	Full	—	—
3	2008	201109	Rader Creek Cygnet Rd. near mouth	0.80	32.1	WWH	Full	—	—

Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010.

Water Resources

Surface Water

Petition ditch projects are ongoing on this stream and remain under maintenance. In 2002, the Hancock Soil & Water Conservation District became the responsible county department for existing programs. The channelized stream is primarily used for agricultural drainage. Under the maintenance program, the stream banks are kept clear of riparian vegetation and trees. There is very little development along the banks of this agricultural stream.

Inventory Totals: 50 miles of stream/waterway measured in the Rader Creek subwatershed. Of the 50 stream miles, 38 miles are channelized, leaving 12 miles of natural steam, mainly in the headwaters. Another 12 miles is exclusive road side ditches or lateral ditches designed to drain to Rader Creek. In those 50 waterway miles in the subwatershed, 10 river miles have riparian vegetation.

Designated Use for aquatic life is warm-water habitat (WWH). **Recreation Use** assessment is Class B at seven of the sampling locations, and C for one tributary location. That determines the acceptable E. Coli colony numbers as shown below in a summary table taken from the Ohio 2010 Integrated Report, Section F: Evaluating Beneficial Use: Recreation, p. F-1.

Recreational Use Attainment							
Location	RM	Rec Use PCR Class	Number of Samples	**E. coli Standard:** Mean <126 (A), or <161 (B) and Maximum Sample ≤ 298 (A) or ≤ 523 (B) Mean	Max	Attainment Status	Sources of Bacteria
Algire Ck At Main St	1.78	B	4	1058	6700	Non	Golf course
Algire Ck Nr Mouth Adj At Sr 235 Farm	0.10	B	5	2883	53000	Non	McComb WWTP; HSTS
Rader Ck At McComb Reservoir Access Rd.	13.55	B	5	1241	6600	Non	
Rader Ck At Cr 203	10.92	B	5	521	22000	Non	McComb WWTP; HSTS; Agric.
Rader Ck At Needles Rd	5.20	B	5	475	7300	Non	HSTS; Agric.
Rader Ck At Cygnet Rd	0.80	B	5	683	6000	Non	HSTS; Agric.
Rader Ck Trib (4.37) At Needles Rd	0.45	B	5	602	3100	Non	Agric.
Rader Ck Trib (4.03) At Needles Rd	0.70	C	3	176	1000	Full	

Aquatic Life Use Assessment				
Location	**RM**	**Drainage Area**	**Aquatic Life Use**	**Attainment Status**
Rader Creek N of McComb @ Co. Rd. 203	10.9	7.3	WWH	Partial
Rader Creek E of Hoytville @ Needles Rd.	5.2	18.1	WWH	Full
Rader Creek Near Mouth @ Cygnet Rd.	0.8	32.1	WWH	Full
Source: Ohio EPA 2012 Integrated Report: http://wwwapp.epa.ohio.gov/dsw/ir2012/search.html				

Macro-invertebrate Communities

Stream RM	Dr. Ar. (sq. mi.)	Data Codes	Qual. Taxa	EPT QI./Total	Sensitive Taxa QI./Total	Density QI./Qt.	CW Taxa	Predominant Organisms on the Natural Substrates With Tolerance Category(ies)	ICI[a]	Narrative Evaluation
10.92	7.3	-	37	6	1	L-M	0	Midges (T,F), baetid mayflies (F), flatworms (F)	-	Low Fair
5.20	18.1	-	49	12	7	M	0	Hydropsychid caddisflies (F), baetid mayflies (F), midges (F,T)	-	Marg. Good
0.80	32.1	8	60	13 / 14	16 / 21	L	0	Petrophila moth larvae (MI), water boatmen (F), midges (F)	(26)	Marg. Good

Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010 http://epa.ohio.gov/dsw/tmdl/PortageToussaintRivers.aspx

Public Drinking Water Supply Assessment

HUC	Reporting Category	Cause of Impairment	Nitrate Watch List	Pesticide Watch List
04100010 01 01	3i	None	No	No

Fish Tissue Assessment

HUC	Reporting Category	Causes of Impairment	PCB Concentration
04100010 01 01	3i	None	

The 2010 Integrated Water Quality Monitoring and Assessment Report for Waterbody Use designation for Rader Creek is Warmwater Habitat (WWH) for aquatic life habitats. Water supply designations are agricultural and industrial water supply and primary contact recreation use.

Water Quality Monitoring Results: Ohio EPA 1994 and 2008

River Mile	Date	IBI	ICI	MiWB	QHEI	STATUS
10.92	2008	46	LF^{*}	N/A	37.5	**PARTIAL**
5.20	2008	38	MG^{NS}	N/A	35.0	**FULL**
0.80	2008	39	MG^{NS}	8.7	40.5	**FULL**

a - River Mile (RM) represents the Point of Record (POR) for the station, not the actual sampling RM.
b - MIwb is not applicable to headwater stream with drainage areas $\leq$20 mi^2.
c - A narrative evaluation of the qualitative sample based on attributes such as EPT taxa richness, number of sensitive taxa, and community composition was used when quantitative data was not available or considered unreliable. VP=Very Poor, P=Poor, LF=Low Fair, F=Fair, MG=Marginally Good, G=Good, VG=Very Good, E=Exceptional
d - Attainment is given for the proposed status when a change is recommended. Aquatic life use in superscript.
ns - Nonsignificant departure from biocriteria ($\leq$4 IBI or ICI units, or $\leq$0.5 MIwb units).
* - Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.
Sources: Biological and Water Quality Study of the Portage River Basin, Ohio EPA 1995, Table 13; Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010 http://epa.ohio.gov/dsw/tmdl/PortageToussaintRivers.aspx

General narrative ranges assigned to QHEI scores.

Narrative Rating		QHEI Range		
		Headwaters (≤ sq mi)	Larger Streams	Lacustuary
Excellent		≤ 70	≤ 75	≤ 80
Good		55 to 69	60 to 74	60 to 80
Fair		43 to 54	45 to 59	45 to 59
Poor		30 to 42	30 to 44	30 to 44
Very Poor		<30	<30	<30

2008 OEPA Assessments

The macroinvertebrate community collected from the headwaters of Rader Creek (RM 10.92) was not meeting WWH expectations with low sensitive taxa (1) diversity and predominance of primarily facultative taxa. Observed impairments to this station were attributed to the McComb Village WWTP (discharges into Algire Creek), channelization, siltation, and possibly low flow. Communities improved at downstream stations into the marginally good range with sensitive taxa (7-16) diversity. Six species of freshwater mussels were found at the downstream station (RM 0.8).

Biological Criteria Benchmarks

Biological Criteria					**Lacustuary Benchmarks[1]**				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
IBI-Headwaters	50	28	20	18	N/A	N/A	N/A	N/A	N/A
IBI-Wading	50	32	22	18	N/A	N/A	N/A	N/A	N/A
IBI-Boat	48	34	20	16	50	42	31	17	<17
MIwb-Wading	9.4	7.3	5.6	4.5	N/A	N/A	N/A	NA	N/A
MIwb-Boat	9.6	8.6	5.7	5.0	10	8.6	5.6	2.8	<2.8
ICI	46	34	22	8	52	42	25	12	<12

[1] **Proposed Lacustuary scoring breakpoints. These have not yet been adopted into rule.**

Ground Water

Source Water Assessment Plan (SWAP)

Located in the Rader Creek subwatershed, the Village of McComb operates a community public water system (#3200411) that serves a population of about 1,700 people. The source is surface water taken from Rader Creek.

Source Water Assessment and Protection (SWAP) plans are created to inventory all known or identified potential contaminant sources within the drinking water protection area, and then to implement protective strategies to better protect the drinking water source (Ohio EPA 2003).

Source water protection link with Ohio EPA for additional information: http://epa.ohio.gov/ddagw/swap.aspx.

Recommendations from the SWAP include controlling runoff from agricultural areas; early warning and emergency response plan for spills, repair, or replace failed septic systems from homes and businesses, review potential impacts from wastewater plant sludge field applications within the drinking water

source protection area and Corridor Management Zone (CMZ). Establish or expand education outreach to increase awareness of the drinking water source protection area and encourage best management practices to prevent contamination of reservoirs.

The Village of McComb "Drinking Water Consumer Confidence Report" (CCR) for 2009 is an annual report to the consumer on the health and quality of the community drinking water supply. The Ohio EPA requires water sampling for contaminates (bacteria, inorganic, synthetic organic, volatile organic) and to monitor throughout the year. The CCR indicates typical sources of contaminants from soil runoff, discharge of waste products, erosion fertilizer runoff, and leaching of failed or failing home sewage treatment systems (HSTS). The 2008 and 2009 reports indicate no violations or high levels of contaminants in the water samples.

For well users in the headwaters of Rader Creek groundwater is found in the glacial deposits and moraines, which are more than 55 feet thick and where the principle aquifer of limestone bedrock lies below. Interbedded in the thick glacial till are thin flow lines of sand and gravel. The area north of the Village of McComb has ground water yields of 100 to 500 gallons per minute which may be drawn from limestone/dolomite at depths less than 250 feet.

McComb's drinking water protection area and corridor management zone and its emergency management zone shown in the two following figures.

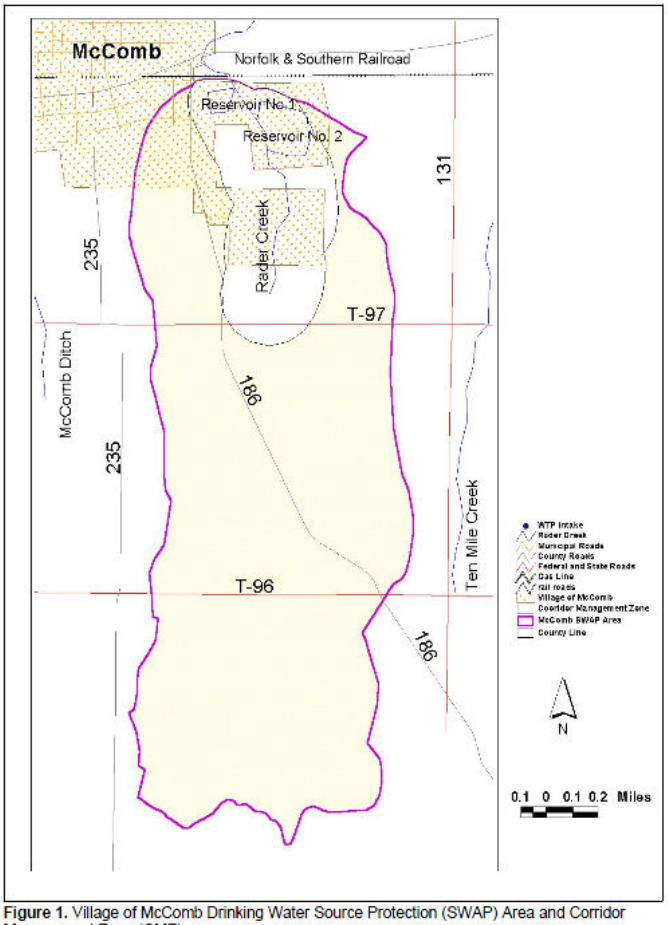
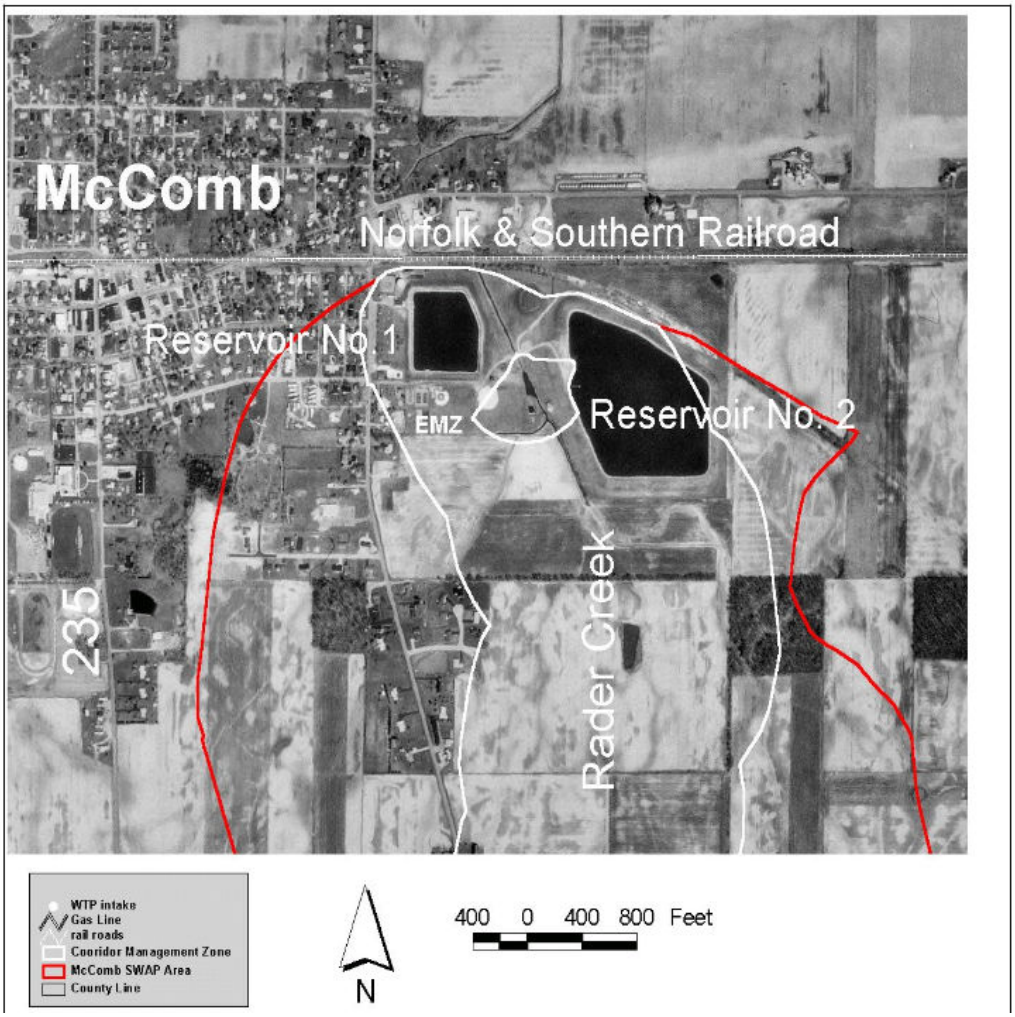


Figure 1. Village of McComb Drinking Water Source Protection (SWAP) Area and Corridor Management Zone (CMZ)



For the purposes of source water assessments, all surface waters are considered to be susceptible to contamination. By their nature surface waters are accessible and can be readily contaminated by chemicals and pathogens, with relatively short travel times from source to the intake. Based on the information compiled for this assessment, the McComb drinking water source protection area is susceptible to agricultural runoff, gas stations, and wastewater treatment plant sludge application on agricultural fields. Judging by the location of the closed McComb Village landfill, it appears that the leachate would not impact the water treatment plant intake. However, ground water flow does not always follow surface contours and a more detailed study of the ground water may be necessary to confirm this prediction.

Source water protection efforts for the Village of McComb should focus on controlling agricultural runoff and runoff from cattle grazing pastures, with particular attention to sources of pesticides, nitrates, phosphorus, and microorganisms such as fecal coliform bacteria.[2]

2 *Drinking Water Source Assessment for the Village of McComb*, Ohio EPA 2003

DRASTIC MAP

The sensitivity of the groundwater to local sources of contamination is determined and rated by **DRASTIC** maps as described below:

Inherent within each geologic setting are the physical characteristics which effect the groundwater pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:

D – Depth to Water
R – Net Recharge
A – Aquifer Media
S – Soil Media
T – Topography
I – Impact of the Vadose Zone Media
C – Conductivity (Hydraulic) of the Aquifer (ODNR, 1994)

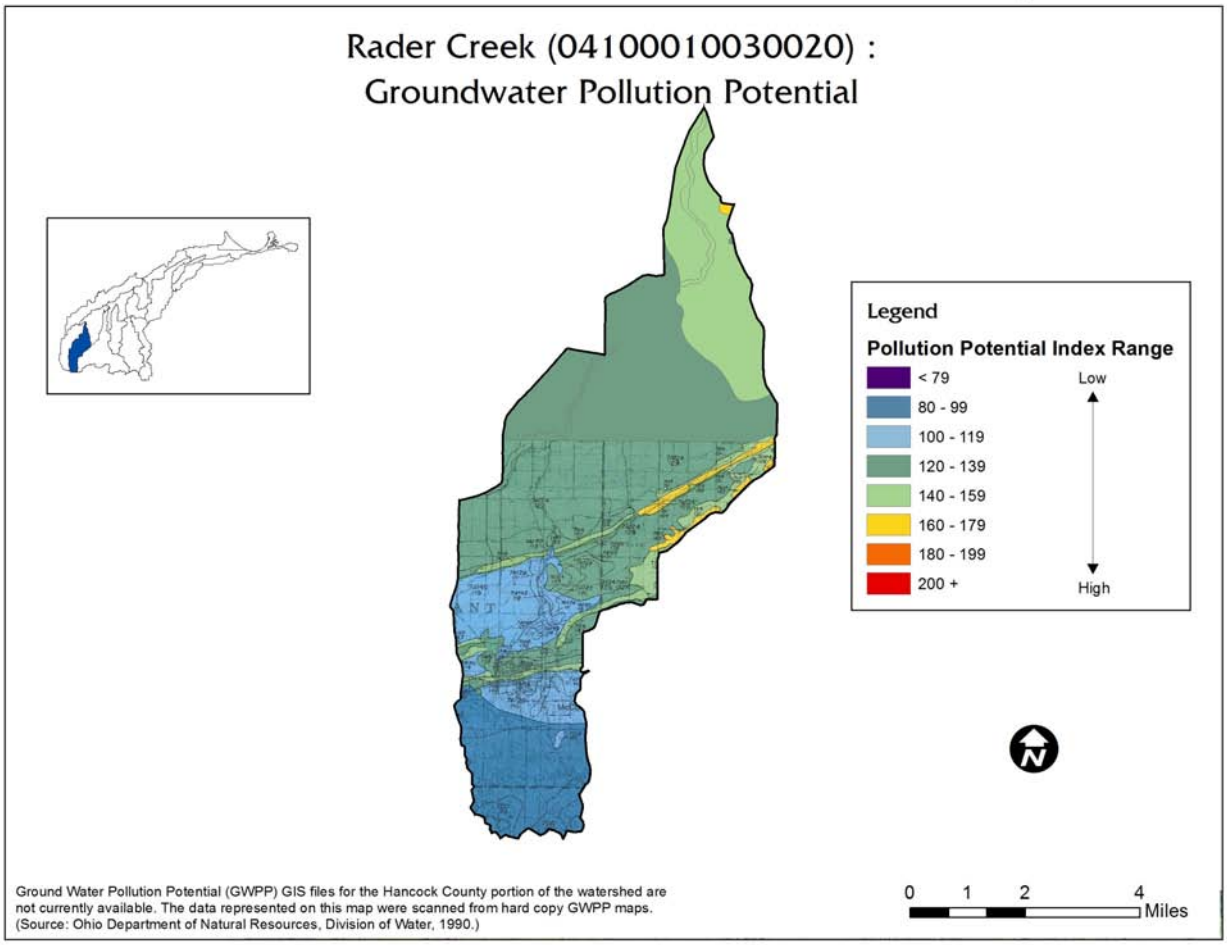
The DRASTIC system indicates the groundwater pollution potential index for Rader Creek is moderately low to moderate in areas of sand/gravel interbedded in general till and in areas of moraines. Groundwater pollution potential vulnerability indexes range from 80 to 120 within Rader Creek. The highest pollution potential within Hancock County is 180 to 199.

The groundwater pollution potential reports with DRASTIC maps are available on the Ohio Department of Natural Resources website at www.odnr.com. Click to the Division of Soil and Water Resources; Ground Water Mapping & Technical Services; Ground Water Pollution Potential map availability. Click on a County of interest to arrive at the webpage for downloads of PDF maps/reports for Ground Water Pollution Potential Reports and DRASTIC maps per County, including GIS shape files. Here is an example of a link for the Hancock County report and map:

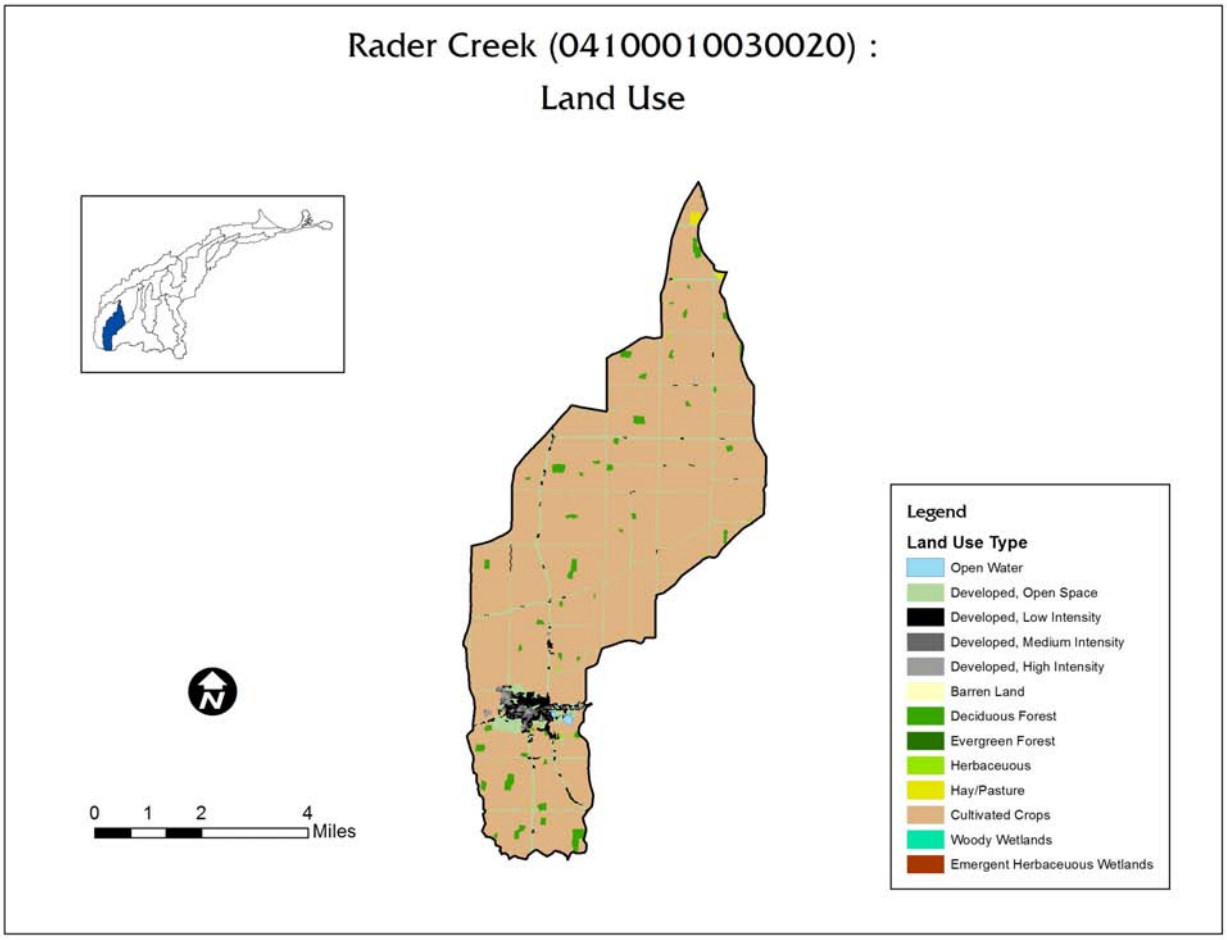
http://ohiodnr.com/Portals/7/gwppmaps/pdf_printmap_wreport/hancock_pp_report_wmap.pdf

The average ground water pollution index potential for the Wood County portion of the Rader Creek watershed is 147 with a range of 121-169. In Hancock County, for which GIS data are not available, the range is about 80-140.

The Ohio Department of Natural Resources, Division of Water, Water Resources Section is the responsible agency to map groundwater resources throughout the state. Greater detail on DRASTIC maps for the Portage can be found in Chapter 4 of the watershed plan.



Sub-watershed (04100010)		
030-020		
Land Use	**Percent**	**Acres**
Urban	8.0%	1,666
Forest	2.2%	462
Pasture	0.2%	45
Cropland	89.5%	18,668
Other	0.1%	24
Total Acres	100%	20,865


Rader Creek (04100010030020) :
Land Use
0 1 2 4
Miles
Legend
Land Use Type
Open Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Deciduous Forest
Evergreen Forest
Herbaceuous
Hay/Pasture
Cultivated Crops
Woody Wetlands
Emergent Herbaceuous Wetlands

Livestock Inventory							
HUC 4100010030020							
Type of Animal		**Hancock**	**Ottawa**	**Sandusky**	**Seneca**	**Wood**	**Estimates for HUC**
Percent of County in HUC		3.8%	0.0%	0.0%	0.0%	2.0%	
Cattle	Farms	129	89	167	264	144	**8**
	Animals	4,233	1,523	4,612	10,096	6,287	**287**
Hogs	Farms	51	15	37	62	30	**3**
	Animals	32,343	3,639	5,591	42,808	39,469	**2,023**
Horses	Farms	105	63	132	72	128	**7**
	Animals	844	444	772	463	1,004	**52**
Poultry	Farms	49	22	41	62	47	**3**
	Animals	NA	779	1,042	4,283	NA	**NA**
Sheep	Farms	32	12	41	61	21	**2**
	Animals	1,134	335	765	2,770	21	**43**
Total							21
							2,383
Source: 2007 Census of Agriculture http://www.agcensus.usda.gov/							

Point Sources

Municipal

- Village of McComb – Water Treatment Plant (WTP) 2IT00017

Discharges to Rader Creek at Park Drive South, McComb, Ohio.

- Village of McComb WWTP (2PB00002)

A minor discharger, originally constructed in 1937, then upgraded in 1970 and again in 1989, the plant had its last major modification in 2002. The McComb Waste Water Treatment Plant is a secondary treatment facility, which consists of a comminuter, degritting clarigester, a plastic media trickling filter followed by separate stage biological nitrification, secondary clarification, post-aeration and UV disinfection.

Final effluent is discharged to Algire Creek, a tributary to Rader Creek at 600 Scott Street in the Village of McComb. Prior to disposal, digested sludge is discharged to sand beds for drying. The plant has a design flow of 0.388 MGD and a hydraulic capacity of 0.720 MGD. The McComb WWTP serves a population of 1800 and also receives about 25% of its influent from Hearthside Foods Company, which manufactures crackers and cookies.

The collection system is 70% separate sewers, and 30% combined sewers, with 1 bypass (Outfall 002) and 3 overflows (Outfalls 003, 004, 005) to Algire Creek. All flow to the plant is by gravity.

During 2008, monthly DMR data submitted by the McComb WWTP documented 23 permit violations: 9 for fecal coliform, 8 for ammonia (NH3-N), 2 each for total suspended solids (TSS) and dissolved oxygen (D.O.), and 1 each for oil and grease (O&G) and maximum pH (Ohio EPA, March 2010).

- Rader Creek Wastewater Treatment Plant (2PG00117), Northwestern Water and Sewer District

The Rader Creek wastewater treatment facility was built in 2010 to serve parts of Jackson and Henry Township, and specifically the CSX intermodal facility and associated businesses. The plant is designed to be expandable to accommodate future economic development. The wastewater plant is an extended aeration plant with a capacity of 5,000 gpd, currently treating about 2,000 gpd. Treated effluent discharges to Cloyce Wells Ditch, a tributary of Rader Creek.

Package Plants

None

Industrial

- CSX Northwest Ohio Trans-Shipment Terminal, 2IT00017

Non-Point Sources:

Critical Sewage Areas

- SR 613 E of McComb: Pleasant Township §§1, 2, 11, 12, 13, 14, 23, 24, 25, 26, 27, 35 (Hancock County) – 77 homes with 46 permits from 1981-present. 21 of the 46 are replacement permits.

CAFOs

None

Estimates of HSTSs				
Watershed	**Housing Units without sewers**	**Est. Unsewered Population (2010)**	**Unsewered Housing Units per acre**	**Unsewered Population per acre**
04100010030020	881	2,229	0.042	0.107
Sources: 2010 Census data and TMACOG "208" Plan. Analysis identifies approximate number of housing units without sewers in each watershed as an estimate of number of HSTSs.				

Aquatic Life Use Impairments	
Causes	**Sources**
Nitrate/Nitrite	Municipal point sources
Dissolved Oxygen	Non-irrigated crop production
pH	Channelization
Total Phosphorus	
Sedimentation/Siltation	
Source: Ohio 2012 Integrated Report, Watershed Assessment Unit Summary	

Water Supply:

Public Water System	Population Served	Primary Water Source
Village of McComb	1,700	Surface – Rader Creek

Water Quality Impairments

The OEPA Integrated Report assesses each watershed's attainment status for 1) Public Drinking Water Supply, 2) Recreation, 3) Human Health, 4) Aquatic Life, and 5) Fish Tissue. The Integrated Report identifies causes and sources of impairments where watersheds are not in attainment with water quality standards.

Background:

Rader Creek is a largely channelized stream designed to provide agricultural drainage. Ohio EPA sampled three sites for aquatic life parameters and eight for recreational use. The aquatic life sites were at RM 0.8 (Cygnet Rd), 5.2 (Needles Rd), and 10.92 Hancock CR 203. The two downstream sites were in full attainment of aquatic standards with "marginally good" ICI scores. The headwater site was in partial attainment, with a "low fair" ICI. The habitat score was "poor" at all three sites.

For bacterial sampling, eight sites were tested: two on Algire Creek, four on Rader Creek itself, and two on Rader Creek tributaries. Seven of the sites were considered "class B" recreation sites, and all in non-attainment. One site, considered "class C" recreation, was a Rader Creek tributary entering at RM 4.37. It was in full attainment.

Causes and sources of impairments are agriculture (sediment/siltation, channelization, crop production) and sewage related (nutrients, DO, a specific citation of municipal point sources).

Problem Statement #1: (Bacteria)

The water quality of the Rader Creek subwatershed is impaired by elevated measurements of E. coli bacteria. The Portage TMDL data collected by Ohio EPA in 2008 indicate that 7 of the HUC's 8 sampling sites are in non-attainment for E. coli.

In this HUC are an estimated 881 HSTS; by density of onsite systems, this is one of the five most populated HUCs. This area includes no package plants, but one Critical Sewage Area (SR 613 E of McComb in Hancock County).

Goal 1.1: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 5.6 million gallons of HSTS effluent annually

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 88 systems
- SR 613 E of McComb Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Bacteria	1.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$1,320,000	Wood & Hancock County Health Dept., TMACOG, Ohio EPA	2013 - 2022	Replace or upgrade 10% of watershed's HSTS or 88 systems	5.6 million gallons/year sewage discharge eliminated
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Hancock County Health Department, Hancock County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$49,126	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA	2013-2018	SR 613 E of McComb Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals

Problem Statement #2: (Nutrients: phosphorus and nitrate)

Of the three aquatic life sampling sites in this HUC under the TMDL, two are in attainment (RM 0.8 and 5.2), and one in partial attainment (RM 10.92). Impairments, all at RM 10.92, include NO_3+NO_2 and phosphorus, including agricultural sources and specifically citing municipal point source. All Rader Creek sites sampled for total phosphorus or NO_3+NO_2 exceed the targets for both; in many cases, substantially.

Goal 2.1: Meet TMDL target for phosphorus load reduction by 469 and nitrate load by 1,984 lb./year from HSTS

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 88 systems

Goal 2.2: Meet TMDL target for phosphorus load reduction by 2,188 and nitrate load by 5,586 lb./year from agricultural practices

Objectives:

- 1,100 acres of cover crops
- 500 acres of controlled drainage
- 400 acres of permanent hay
- 750 acres of riparian buffers
- 75 acres of restored wetlands
- 600 LF of stream restoration
- 900 LF of overwide / 2-stage ditch reconstruction
- 7,308 acres under NRCS 590/1 Nutrient Mgt

- 3,132 acres under NRCS 590/3 Nutrient Mgt
- 11,000 acres of filter strips
- 600 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Nutrients (phosphorus and nitrate)	2.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$1,320,000	Wood & Hancock County Health Dept., TMACOG, Ohio EPA	2013 - 2022	Replace or upgrade 10% of watershed's HSTS or 88 systems	Reduce phosphorus load by 469 and nitrate load by 1,984 lb/year
	2.2	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$66,000	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	1,100 acres of cover crops	Reduce phosphorus load by 1,220 and nitrate load by 2,440 lb/year
	2.2	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$235,500	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	500 acres of controlled drainage	Reduce phosphorus load by 221 and nitrate load by 567 lb/year
	2.2	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$112,000	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	400 acres of permanent hay	Reduce phosphorus load by 260 and nitrate load by 520 lb/year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$525,000	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	750 acres of riparian buffers	Reduce phosphorus load by 135 and nitrate load by 270 lb/year
	2.2	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$382,968	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	75 acres of restored wetlands	Reduce phosphorus load by 12 and nitrate load by 78 lb/year
	2.2	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$208,800	Wood & Hancock SWCD, Wood & Hancock co Engineer, NRCS, farmers	2013-2027 in phases	600 LF of stream restoration	Reduce phosphorus load by 23 and nitrate load by 46 lb/year
	2.2	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$80,100	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	900 LF of overwide / 2-stage ditch reconstruction	Reduce phosphorus load by 119 and nitrate load by 238 lb/year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Seek cooperators for Nutrient Management NRCS 590 Level 1 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management NRCS 590 Level 1 BMPs with farmers	$146,155	Wood & Hancock SWCD, NRCS, farmers	2013-2022	7,308 acres under NRCS 590/1 Nutrient Mgt	NA
	2.2	♦Seek cooperators for Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with farmers	$125,276	Wood & Hancock SWCD, NRCS, farmers	2013-2022	3,132 acres under NRCS 590/3 Nutrient Mgt	NA
	2.2	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$1,515	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	11,000 acres of filter strips	Reduce phosphorus load by 110 and nitrate load by 209 lb/year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Identify & prioritize fields suited for Conservation Tillage BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Conservation Tillage BMP with farmer	$9,000	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	600 acres of conservation tillage	Reduce phosphorus load by 88 and nitrate load by 1,218 lb/year

Problem Statement #3: (Siltation/Sedimentation)

The TMDL cites sedimentation/siltation as a cause of impairment, its sources being channelization and crop production. The two lower sampling points (RM 5.2 and 10.9) are in attainment. The headwater site at RM 10.9 being in partial attainment implies the greatest sedimentation/siltation impairment in the upstream half of the creek and headwater tributaries.

Goal 3.1: Reduce sedimentation impairments by decreasing sediment load by 1,202 lb./year from agricultural practices

Objectives:

- 1,100 acres of cover crops
- 500 acres of controlled drainage
- 400 acres of permanent hay
- 750 acres of riparian buffers
- 75 acres of restored wetlands
- 600 LF of stream restoration
- 900 LF of overwide / 2-stage ditch reconstruction
- 11,000 acres of filter strips
- 600 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Sedimentation	3.1	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$66,000	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	1,100 acres of cover crops	Reduce sediment load by 609 lb./year
	3.1	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$235,500	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	500 acres of controlled drainage	Reduce sediment load by 252 lb./year
	3.1	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$112,000	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	400 acres of permanent hay	Reduce sediment load by 132 lb./year
	3.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$525,000	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	750 acres of riparian buffers	Reduce sediment load by 68 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$382,968	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	75 acres of restored wetlands	Reduce sediment load by 1 lb./year
	3.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$208,800	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	600 LF of stream restoration	Reduce sediment load by 23 lb./year
	3.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$80,100	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	900 LF of overwide / 2-stage ditch reconstruction	Reduce sediment load by 60 lb./year
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$1,515	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	11,000 acres of filter strips	Reduce sediment load by 55 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$9,000	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	600 acres of conservation tillage	Reduce sediment load by 2 lb./year

Problem Statement #4: (Habitat Alteration)

The OEPA TMDL cites channelization as a source of impairment, and generally characterizes Rader Creek as a largely channelized stream with little habitat. The QHEI scores rate as poor at all three sampling locations.

Goal 4.1: 825 acres of habitat restoration and 1,500 linear feet of stream corridor restoration practices

Objectives:

- 750 acres of riparian buffers
- 75 acres of restored wetlands
- 600 LF of stream restoration
- 900 LF of overwide / 2-stage ditch reconstruction

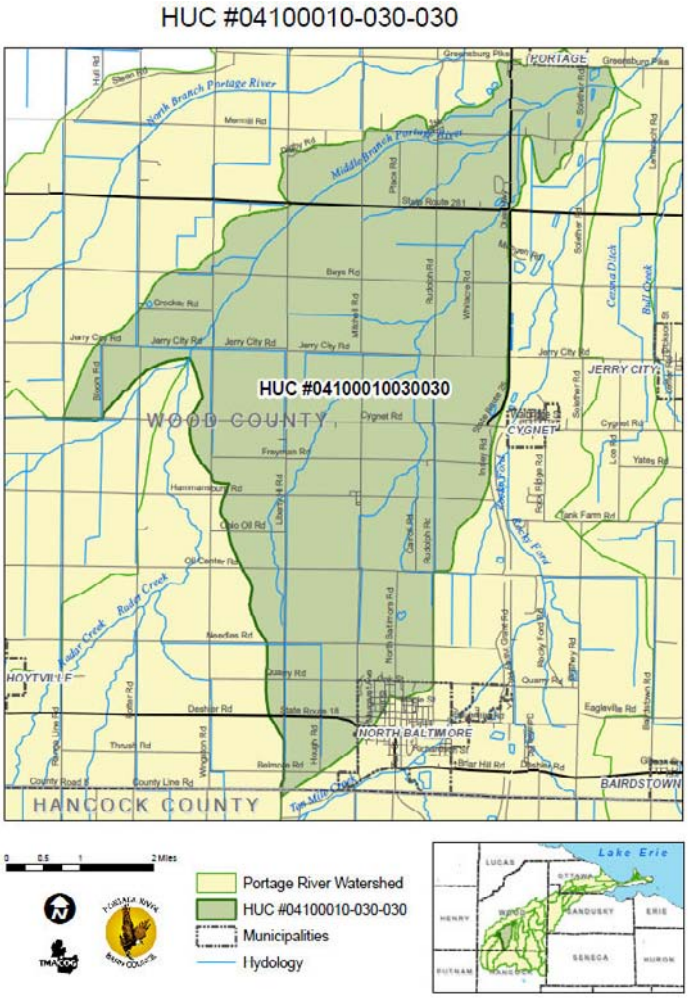
Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Habitat Impairment	4.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$525,000	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	750 acres of riparian buffers	Load reductions provided in nutrient and sediment tables

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	4.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$382,968	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	75 acres of restored wetlands	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$208,800	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	600 LF of stream restoration	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$80,100	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	900 LF of overwide / 2-stage ditch reconstruction	Load reductions provided in nutrient and sediment tables

MIDDLE BRANCH PORTAGE RIVER BELOW RADER CR. TO ABOVE ROCKY FORD CREEK

04100010 030-030
04100010 01 04 (New 12-digit HUC & Name: Town of Rudolph-Middle Branch)

Length: 7.27 miles
Elevation at Mouth: 672 feet
Elevation at Source: 688 feet
Grade: 2.20 ft/mi
Drainage Area: 31.1 square miles



Ohio Topographic Quadrangle 7.5 minute (1:24,000)

- Jerry City
- Bowling Green South
- North Baltimore

Urban Areas:
North Baltimore

Geology

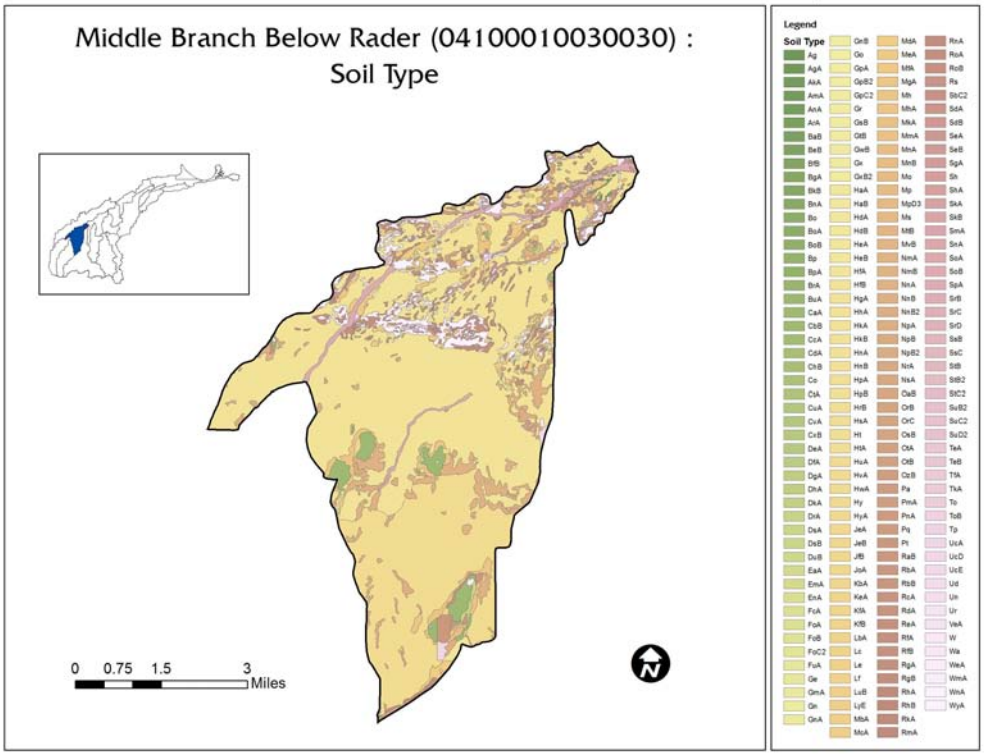
The subwatershed is located within the glacial lake plain entirely within the HELP ecoregion. During the glacial period, ice sheets of both the Illinoian and Wisconsin Age advanced and retreated over the area. As the ice sheets retreated, a large lake was formed. This glacial lake leveled the till plain. Consequently, Wood County is now typified by level or nearly level, expanses, broken only by sand ridges formed during the glacial period, by high areas underlain by limestone and by breaks along river and streams.

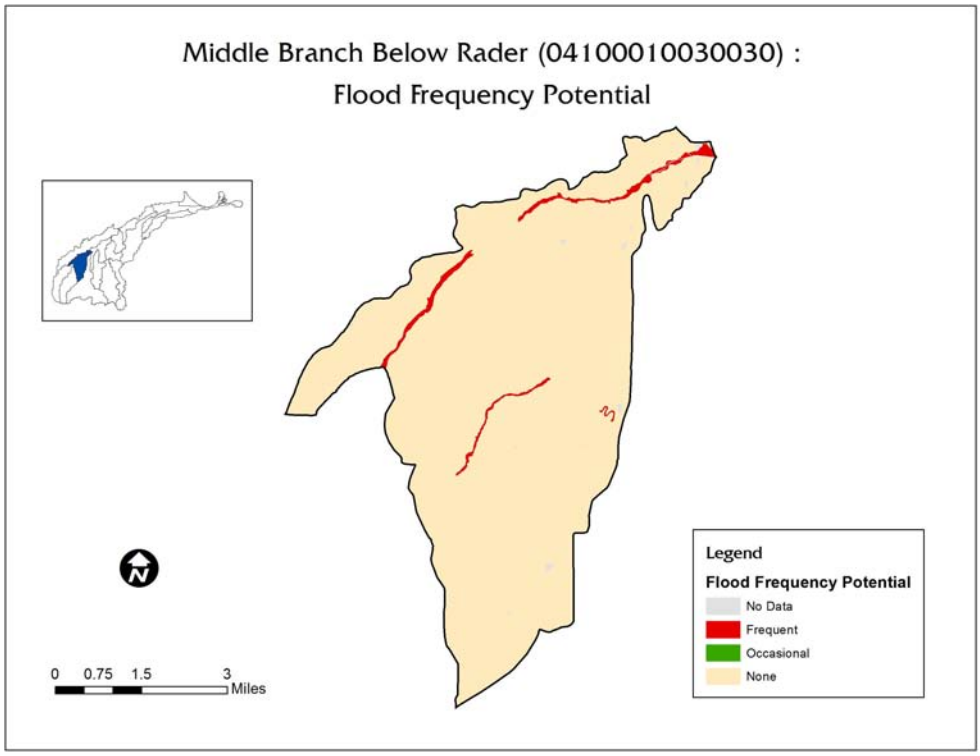
Soils

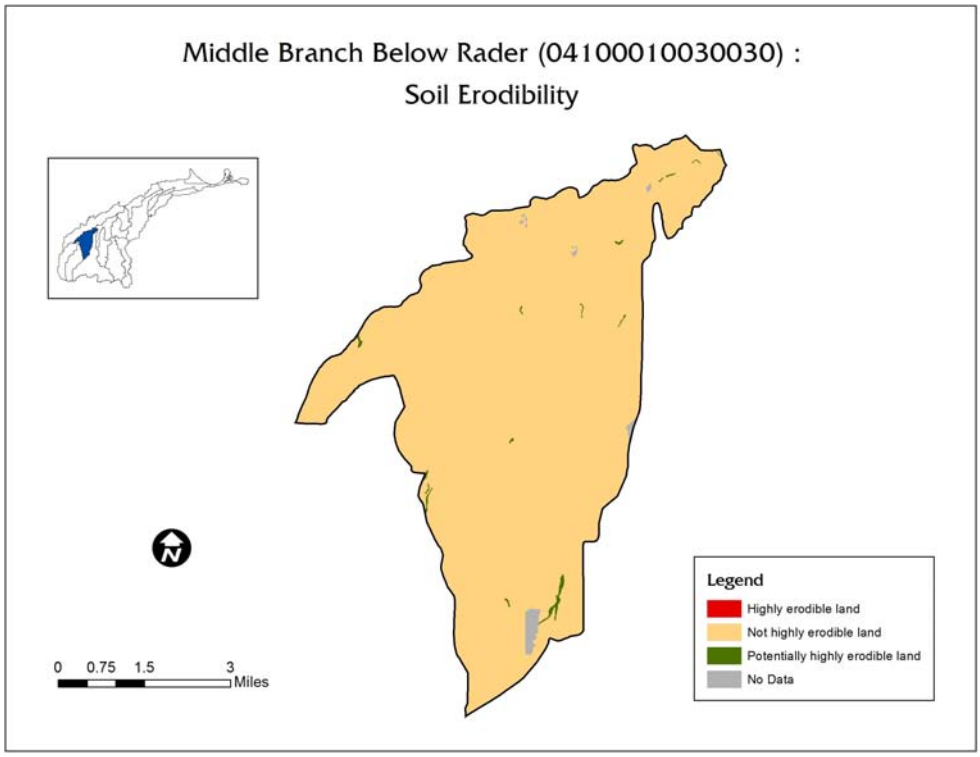
There are two dominant soil associations present in HUC 04100010 030 030 Middle Branch. The Hoytville (HgA) clay loam and Hoytville (HvA) silty clay soil associations have 0 to 1% slope and are very poorly drained soils. These soils are not highly erodible

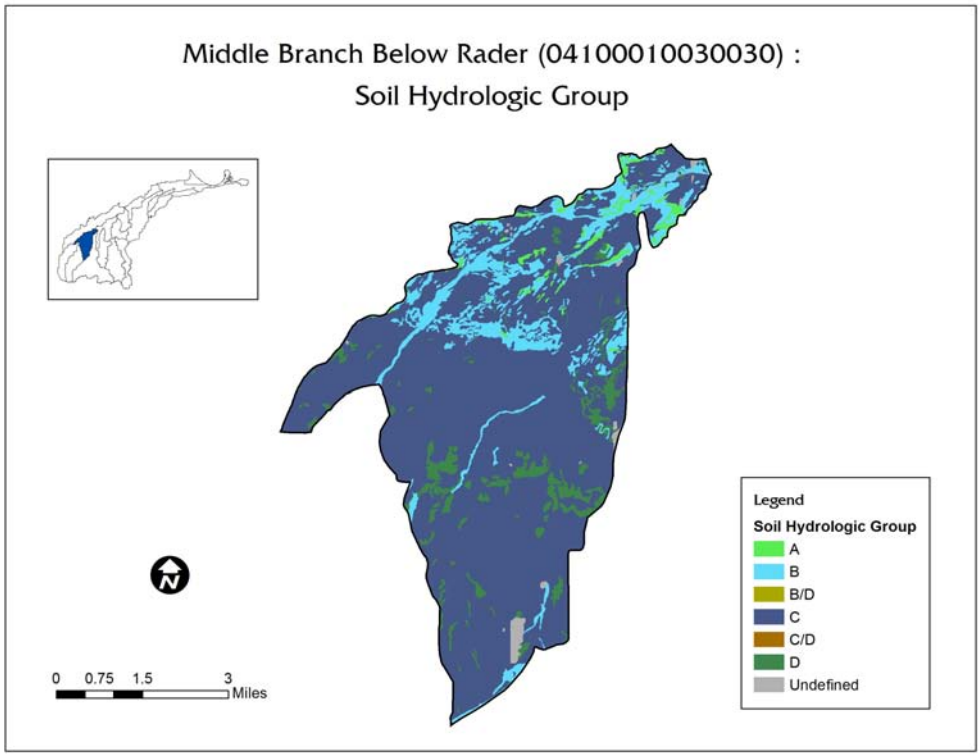
which is very good for stream water quality and biological standards. These soils are also prime farmland if drained.

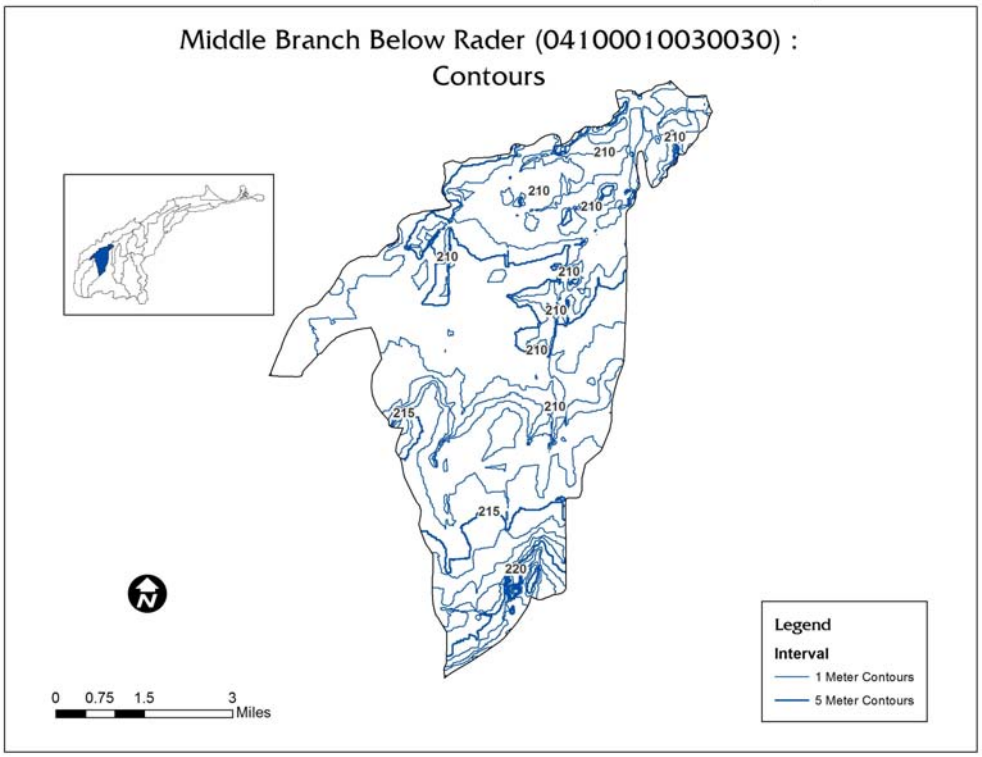
Major Soil Groups		
030-030		
Hoytville	Sum Acres	14,193
	Percentage	70.67%
Nappanee	Sum Acres	1,168
	Percentage	5.82%
Wauseon	Sum Acres	955
	Percentage	4.76%
Mermill	Sum Acres	662
	Percentage	3.30%
Rimer	Sum Acres	588
	Percentage	2.93%
Millsdale	Sum Acres	419
	Percentage	2.09%
Castalia	Sum Acres	417
	Percentage	2.08%
Sloan	Sum Acres	365
	Percentage	1.82%
Ottokee	Sum Acres	325
	Percentage	1.62%
Seward	Sum Acres	269
	Percentage	1.34%

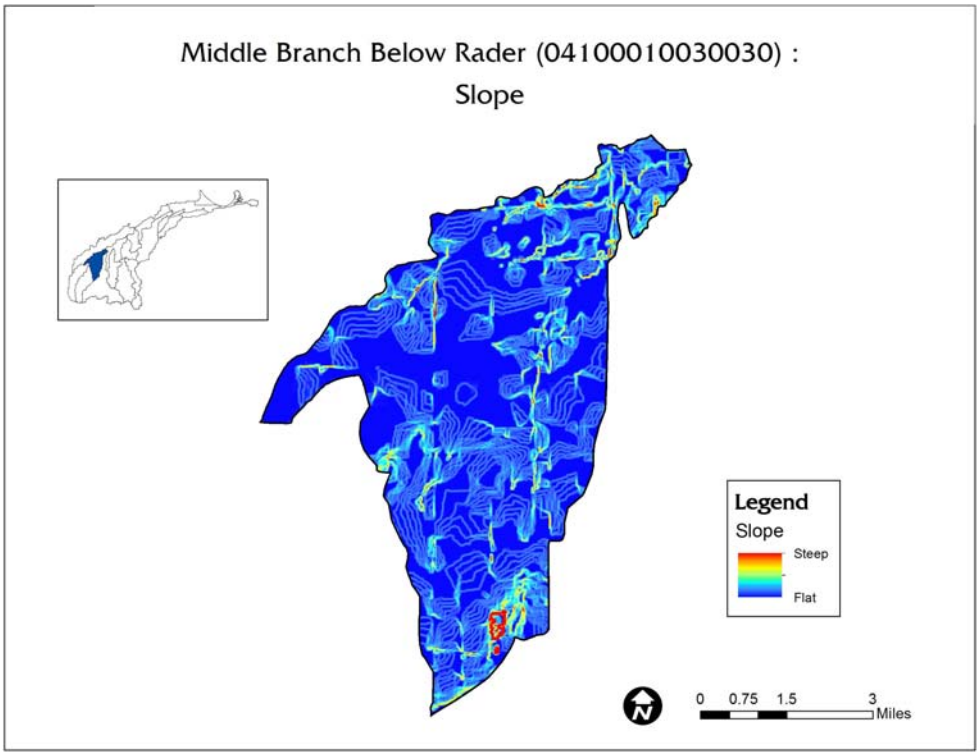

Middle Branch Below Rader (04100010030030) :
Soil Type
0 0.75 1.5 3
Miles
Legend
Soil Type

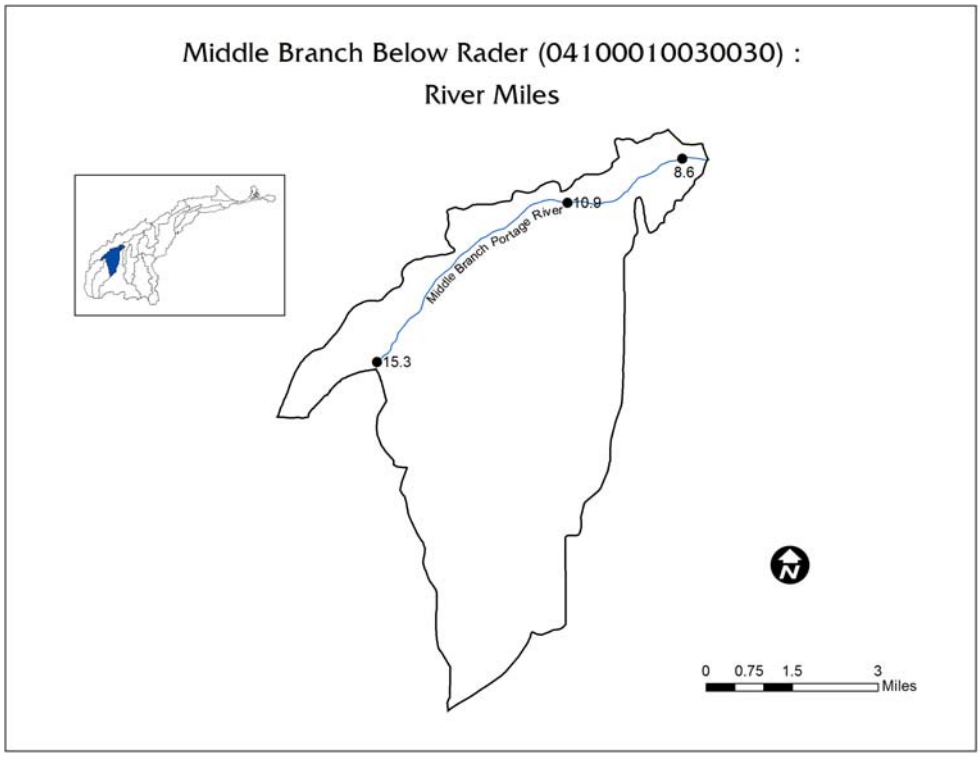

Middle Branch Below Rader (04100010030030) :
Flood Frequency Potential
0 0.75 1.5 3
Miles
Legend
Flood Frequency Potential
No Data
Frequent
Occasional
None


Middle Branch Below Rader (04100010030030) :
Soil Erodibility
Legend
Highly erodible land
Not highly erodible land
Potentially highly erodible land
No Data
0 0.75 1.5 3
Miles


Middle Branch Below Rader (04100010030030) :
Soil Hydrologic Group
Legend
Soil Hydrologic Group
A
B
B/D
C
C/D
D
Undefined
0 0.75 1.5 3
Miles


Middle Branch Below Rader (04100010030030) :
Contours
210
215
220
Legend
Interval
1 Meter Contours
5 Meter Contours
0 0.75 1.5 3
Miles


Middle Branch Below Rader (04100010030030) :
Slope
Legend
Slope
Steep
Flat
0 0.75 1.5 3
Miles



The Soil Hydrologic Group map indicates the *Hydrologic soil groups* based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately course texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (**A/D, B/D, or C/D),** the first letter is for drained areas and the second is for undrained areas.

Rare, Threatened, Endangered Species

Several rare, threatened, or endangered species are found in this section of the Middle Branch.

Rare, Threatened, Endangered Species			
Common Name	***Scientific Name***	**Last Observed**	**State Status**
Bushy Horseweed	Conyza ramosissima	2008-10-15	P
Canada Plum	Prunus nigra	2008-04-24	E
Early Buttercup	Ranunculus fascicularis	1963-05	T
Four-toed Salamander	Hemidactylium scutatum	1963-04-20	SC
Lyre-leaved Rock Cress	Arabis lyrata	1958-05	E
Lyre-leaved Rock Cress	Arabis lyrata	1963-05	E
Porcupine Grass	Hesperostipa spartea	1987-06	E
Prairie Ironweed	Vernonia fasciculata	1988-08-09	T
River Redhorse	Moxostoma carinatum	1997-09-16	SC
Sweet-fern	Comptonia peregrina	1962-07	E
Upland Sandpiper	Bartramia longicauda	1985-07-03	T
Western Banded Killifish	Fundulus diaphanus menona	1997-09-18	E
Western Banded Killifish	Fundulus diaphanus menona	1997-09-16	E
Wild Lupine	Lupinus perennis	2007-05-31	P
Wood Lily	Lilium philadelphicum	1966-07	E

T=Threatened, P=Potentially Threatened, E=Endangered, X=Presumed Extirpated, SC=Species of Concern

Six different species of mussels were observed in HUC 01400010 030 030

Mussel Species in the Middle Branch of the Portage River				
Stream River Miles	**Common Mussel Name**	***Scientific Name***	**Observed**	**Status**
15.32	Cylindrical Papershell	*Anodontoides ferrussacianus*	2008	—
15.32, 10.9, 8.64	Wabash Pigtoe	*Fusconaia flava*	2008	—
15.32, 10.9, 8.64	Fat Mucket	*Lampsilis radiata luteola*	2008	—

15.32, 10.9, 8.64	White Heelsplitter	*Lasmigona complanata*	2008	—
15.32, 8.64	Giant Floater	*Pyganodon grandis*		
15.32, 10.9	Creeper	*Strophitus undulates*	2008	—
Source: Freshwater Mussels of the Maumee Drainage 2nd Edition. Grabarkiewicz, J., and Crail, T.		**Source:** Ohio EPA Technical Report EAS/2010-4-4		

HUC 8 – 04100010 (Portage River)									
HUC 10 – 0410001001 (Rocky Ford-Middle Branch Portage River)									
HUC 12 – 041000100104 (Town of Rudolph-Middle Branch Portage River)									
HUC 14 – 04100010030030 (Middle Branch Portage River below Rader Cr. to above Rocky Ford Cr.)									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
17	2008	S01K09	M. Br. Portage R. @ Jerry City Rd.	15.32	64.0	WWH	Full	-	-
18	2008	201099	M. Br. Portage R. At Rudolph @ Rudolph Rd.	10.90	73.0	WWH	Full	Comment – Though biological indicators were in full attainment of the WWH aquatic life use, organic enrichment (sewage and sewage fungus) was noted downstream from the bridge and is likely attributable to failing on-site treatment systems.	
19	2008	S01S44	M. Br. Portage R. Upst. Rocky Ford @ Solether Rd.	8.64	95.0	WWH	Full	-	-

Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010.

Water Resources

Surface Water

There are 7.27 river miles in the section of the Middle Branch Portage River as identified between the confluence with Rader Creek @ RM 15.50 located just west of Jerry City Rd. and Wingston Rd. to the downstream confluence with the Rocky Ford @ RM 8.23 just east of Interstate 75 at Greensburg Pike.

The 7.27 miles of the Middle Branch are under a maintained ditch petition with the Wood County Engineer. Within the subwatershed is 20 miles of drainage channels that includes agricultural and roadside that empty into the 7.27 mile length of the Middle Branch Portage River. Of the 27 miles of drainage channel, 7.5 miles have riparian vegetation along the banks of the waterway. While the soils present are of the non-erodible type, there is approximately 16 miles of stream bank identified where riparian buffer would benefit wildlife habitat and protect water quality.

The largest density of residential area not connected to any municipal wastewater system is near the unincorporated town of Rudolph. The 2008 water quality testing found this subwatershed in full attainment of the state standards, but also reported organic enrichment downstream, likely attributable to failing on-site treatment systems.

Designated Use for aquatic life is warm-water habitat (WWH). **Recreation Use** assessment is Class B. **Recreation Use** assessment is Class B at all three sampling

locations. That determines the acceptable E. coli colony numbers as shown below in a summary table.

Recreational Use Attainment							
Location	RM	Rec Use PCR Class	Number of Samples	**E. coli Standard:** Mean <126 (A), or <161 (B) and Maximum Sample ≤ 298 (A) or ≤ 523 (B) Mean	Max	Attainment Status	Sources of Bacteria
M Br Portage R At Jerry City Rd	15.32	B	5	697	6800	Non	HSTS; Rader/Needles Cks.
M Br Portage R At Rudolph Rd	10.90	B	5	531	7900	Non	HSTS; Rudolph
M Br Portage R Ust Rocky Ford At Solether Rd	8.64	B	5	510	13000	Non	HSTS; Agric.

Aquatic Life Use Assessment				
Location	**RM**	**Drainage Area**	**Aquatic Life Use**	**Attainment Status**
M. Br. Portage R. @ Jerry City Rd.	15.3	64.0	WWH	Full
M. Br. Portage R. At Rudolph @ Rudolph Rd.	10.9	73.0	WWH	Full
M. Br. Portage R. Upst. Rocky Ford @ Solether Rd.	8.6	95.0	WWH	Full
Source: Ohio EPA 2012 Integrated Report: http://wwwapp.epa.ohio.gov/dsw/ir2012/search.html				

Macro-invertebrate Communities

Stream RM	Dr. Ar. (sq. mi.)	Data Codes	Qual. Taxa	EPT QI./Total	Sensitive Taxa QI./Total	Density QI./Qt.	CW Taxa	Predominant Organisms on the Natural Substrates With Tolerance Category(ies)	ICI[a]	Narrative Evaluation
15.32	64	6,8	48	12 / 13	12 / 18	L / 67	0	Hydroptilid caddisflies (F), midges (F), flatworms (F)	(24)	Marg. Good
10.9	73	8,13	51	16 / 17	19 / 22	M-H / 397	0	Hydropsychid caddisflies (F), flatworms (F)	(24)	Good
8.64	95	8	50	19 / 20	19 / 22	M / 251	0	Hydropsychid caddisflies (F,MI), flatworms (F), midges (F)	(26)	Good

Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010 http://epa.ohio.gov/dsw/tmdl/PortageToussaintRivers.aspx

Public Drinking Water Supply Assessment

HUC	Reporting Category	Cause of Impairment	Nitrate Watch List	Pesticide Watch List
04100010 01 04	No active intakes	None	No	No

Fish Tissue Assessment

HUC	Reporting Category	Causes of Impairment	PCB Concentration
04100010 01 04	3	None	

Middle Branch Portage River Below Rader Cr. To Above Rocky Ford Creek
04100010 030 030 – 04100010 01 04

Water Quality Monitoring Results: Ohio EPA 1994 and 2008						
River Mile	**Date**	**IBI**	**ICI**	**MiWB**	**QHEI**	**STATUS**
8.64	2008	42	(26)	8.9	52.5	Full
10.9	2008	29	(24)	7.4	50.0	Full
15.32	2008	36	(24)	8.6	30.0	Full

a - River Mile (RM) represents the Point of Record (POR) for the station, not the actual sampling RM.
b - MIwb is not applicable to headwater stream with drainage areas ≤20 mi^2.
c - A narrative evaluation of the qualitative sample based on attributes such as EPT taxa richness, number of sensitive taxa, and community composition was used when quantitative data was not available or considered unreliable. VP=Very Poor, P=Poor, LF=Low Fair, F=Fair, MG=Marginally Good, G=Good, VG=Very Good, E=Exceptional
d - Attainment is given for the proposed status when a change is recommended. Aquatic life use in superscript.
ns - Nonsignificant departure from biocriteria (≤4 IBI or ICI units, or ≤0.5 MIwb units).
Sources: Biological and Water Quality Study of the Portage River Basin, Ohio EPA 1995, Table 13; Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010 http://epa.ohio.gov/dsw/tmdl/PortageToussaintRivers.aspx

General narrative ranges assigned to QHEI scores.				
Narrative Rating		QHEI Range		
		Headwaters (≤ sq mi)	Larger Streams	Lacustuary
Excellent		≤ 70	≤ 75	≤ 80
Good		55 to 69	60 to 74	60 to 80
Fair		43 to 54	45 to 59	45 to 59
Poor		30 to 42	30 to 44	30 to 44
Very Poor		<30	<30	<30

2008 OEPA Assessments

Macroinvertebrate communities sampled in the Middle Branch Portage River were evaluated as marginally good to exceptional. Eight species of freshwater mussels were found, including the state species of concern Truncilla truncata (Deertoe). Potential impacts to the biotic integrity of this stream were habitat alterations, siltation, organic enrichment immediately downstream from the Rudolph Road bridge (RM 10.9), high water temperatures, and organic enrichment from dumped soybeans at the Solether Road bridge (RM 8.64).

Failing HSTS and unsewered areas, such as the extensive sewage discharge immediately downstream from Rudolph Road into the Middle Branch Portage River, contributed to nutrient and organic enrichment. The sources should be identified and coordination should occur with the appropriate county health departments to correct the problems.

Biological Criteria Benchmarks

Biological Criteria					**Lacustuary Benchmarks[1]**				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
IBI-Headwaters	50	28	20	18	N/A	N/A	N/A	N/A	N/A
IBI-Wading	50	32	22	18	N/A	N/A	N/A	N/A	N/A
IBI-Boat	48	34	20	16	50	42	31	17	<17
MIwb-Wading	9.4	7.3	5.6	4.5	N/A	N/A	N/A	NA	N/A
MIwb-Boat	9.6	8.6	5.7	5.0	10	8.6	5.6	2.8	<2.8

Biological Criteria					Lacustuary Benchmarks[1]				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
ICI	46	34	22	8	52	42	25	12	<12

[1] **Proposed Lacustuary scoring breakpoints. These have not yet been adopted into rule.**

Ground Water

There are no municipal areas within this subwatershed that rely on groundwater for drinking water. Individual residences obtain water from North Baltimore, which uses surface water from Rocky Ford Creek, or from household private wells.

DRASTIC MAP

The sensitivity of the groundwater to local sources of contamination is determined and rated by **DRASTIC** maps as described below:

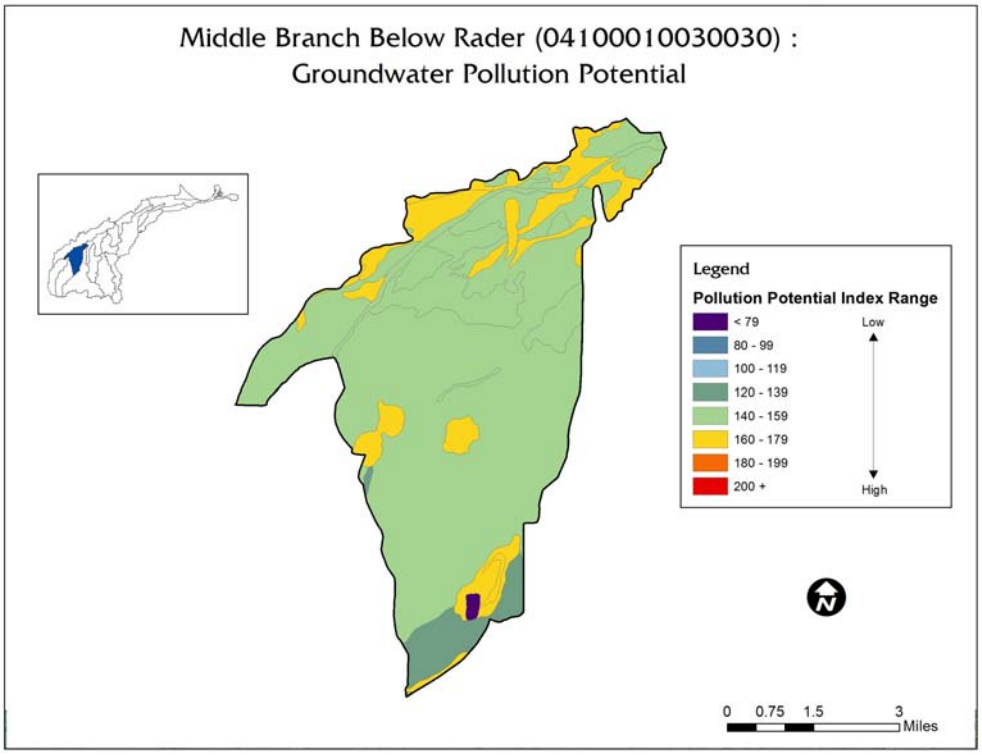
Inherent within each geologic setting are the physical characteristics which effect the groundwater pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:

D – Depth to Water
R – Net Recharge
A – Aquifer Media
S – Soil Media
T – Topography
I – Impact of the Vadose Zone Media
C – Conductivity (Hydraulic) of the Aquifer (ODNR, 1994)

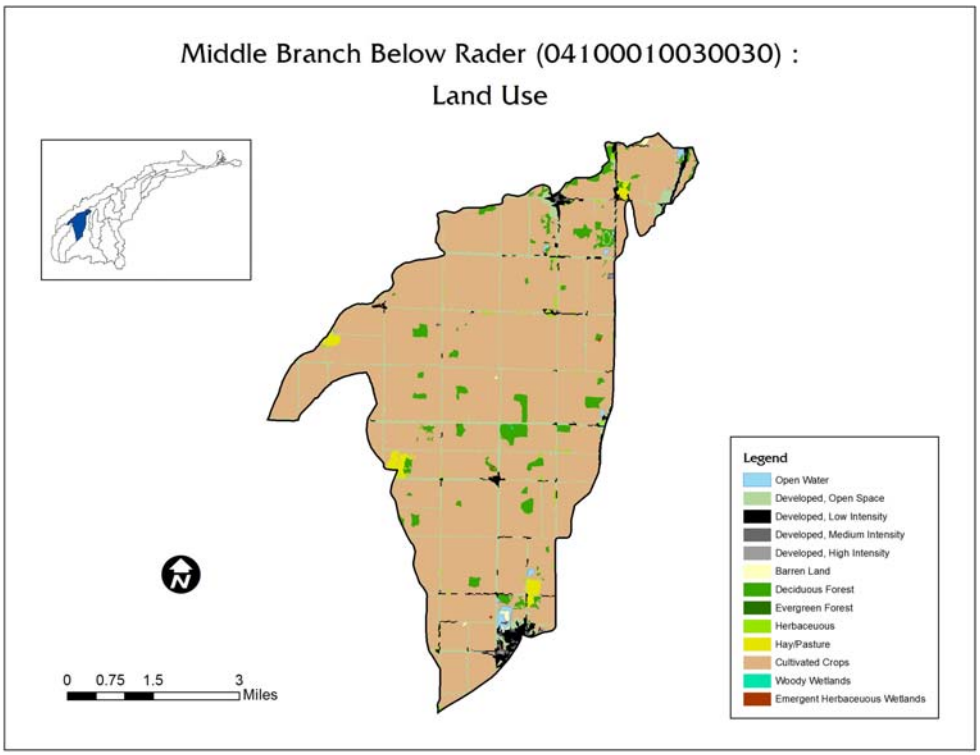
Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index then the greater the vulnerability to contamination (ODNR, 1994).

The average ground water pollution index potential for the Wood County portion of the Middle Branch below Rader Creek watershed is 155 with a range of 129-178.

The Ohio Department of Natural Resources, Division of Water, Water Resources Section is the responsible agency to map groundwater resources throughout the state. Greater detail on DRASTIC maps for the Portage can be found in Chapter 4 of the watershed plan.



Sub-watershed (04100010)		
030-030		
Land Use	**Percent**	**Acres**
Urban	8.37%	1,680
Forest	4.12%	827
Pasture	0.96%	193
Cropland	85.95%	17,247
Other	0.59%	119
Total Acres	100.00%	20,066



Livestock Inventory							
HUC 4100010030030							
Type of Animal		**Hancock**	**Ottawa**	**Sandusky**	**Seneca**	**Wood**	**Estimates for HUC**
Percent of County in HUC		0.0%	0.0%	0.0%	0.0%	5.1%	
Cattle	Farms	129	89	167	264	144	**7**
	Animals	4,233	1,523	4,612	10,096	6,287	**319**
Hogs	Farms	51	15	37	62	30	**2**
	Animals	32,343	3,639	5,591	42,808	39,469	**2,004**
Horses	Farms	105	63	132	72	128	**6**
	Animals	844	444	772	463	1,004	**51**
Poultry	Farms	49	22	41	62	47	**2**
	Animals	NA	779	1,042	4,283	NA	**NA**
Sheep	Farms	32	12	41	61	21	**1**
	Animals	1,134	335	765	2,770	21	**1**
Total							19
							2,393

Source: 2007 Census of Agriculture http://www.agcensus.usda.gov/

Point Sources

Municipal

None

Package Plants

None

Industrial

- Hanson Aggregates-North Baltimore Quarry, 2IJ00035

Non-Point Sources:

Critical Sewage Areas

- Hammansburg (Wood County)
- South Rudolph (Wood County)
- Mermill (Wood County)

CAFOs

None

Estimates of HSTSs				
Watershed	**Housing Units without sewers**	**Est. Unsewered Population (2010)**	**Unsewered Housing Units per acre**	**Unsewered Population per acre**
04100010030030	529	1,288	0.026	0.064

Sources: 2010 Census data and TMACOG "208" Plan. Analysis identifies approximate number of housing units without sewers in each watershed as an estimate of number of HSTSs.

Aquatic Life Use Impairments	
Causes	**Sources**
None listed	None listed
Source: Ohio 2012 Integrated Report, Watershed Assessment Unit Summary	

Water Supply:

Public Water System	Population Served	Primary Water Source
None		

Water Quality Impairments

The OEPA Integrated Report assesses each watershed's attainment status for 1) Public Drinking Water Supply, 2) Recreation, 3) Human Health, 4) Aquatic Life, and 5) Fish Tissue. The Integrated Report identifies causes and sources of impairments where watersheds are not in attainment with water quality standards.

Background:

The Middle Branch of the Portage is formed by the confluence or Needles and Rader Creeks in Henry Township. Much of the watershed area is drained by tributaries that are designed for agricultural drainage. The HUC includes part of the village of North Baltimore, and also the unincorporated town of Rudolph.

Ohio EPA sampled three stations in this HUC, all of them on the mainstem of the Middle Branch (the largest stream), but none on the smaller or headwater tributaries. Sampling points were at RM 8.64 (Solether Rd, above the confluence of the Rocky Ford), 10.9 (Rudolph Rd), and 15.32 (Jerry City Rd). All three sites were in full attainment for aquatic life standards, and in non-attainment for bacteria. The two lower sites had "good" macroinvertebrate (ICI) scores while the upstream site (15.32) was "marginally good."

The good aquatic life use attainment scores on the mainstem of the Middle Branch do not necessarily mean that its tributaries, had they been sampled, would have also been in attainment. Generally the Portage TMDL found headwater streams less likely to be in attainment than the larger streams. Despite the attainment scores of the mainstem sites, agricultural BMPs to reduce sediment and nutrient loads from the headwater tributaries would still be beneficial.

The OEPA TMDL did not find causes or sources of impairments, but did note channel modification at Solether Road and Jerry City Roads. The habitat score at RM 15.32 (Jerry City Road) was poor, and fair at 10.9 and 8.64.

Problem Statement #1: (Bacteria)

The water quality of the Middle Branch below Rader Creek is impaired by elevated measurements of E. coli bacteria. The Portage TMDL data collected by Ohio EPA in 2008 indicate that all three of the HUC's sampling sites are in non-attainment for E. coli. The TMDL cites failed HSTS as the causes of impairment due to high E. coli bacteria levels.

In this HUC are an estimated 529 HSTS; by density of onsite systems, this is one of the less populated HUCs. This area includes no package plants. It contains three Critical Sewage Areas: Hammansburg, South Rudolph, and Mermill, all in Wood County.

Goal 1.1: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 3.3 million gallons of HSTS effluent annually

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 52 systems
- Hammansburg Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in

- South Rudolph Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- Mermill Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Bacteria	1.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$780,000	Wood & Hancock County Health Dept, TMACOG, Ohio EPA	2013 - 2022	Replace or upgrade 10% of watershed's HSTS or 52 systems	3.3 million gallons/year sewage discharge eliminated
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Wood County Health Department, Northwestern Water and Sewer District ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$21,660	Wood County Health Department, Northwestern Water and Sewer District, OEPA	2013-2018	Hammansburg Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Wood County Health Department, Northwestern Water and Sewer District ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$28,500	Wood County Health Department, Northwestern Water and Sewer District, OEPA	2013-2018	South Rudolph Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Wood County Health Department, Northwestern Water and Sewer District ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$11,400	Wood County Health Department, Northwestern Water and Sewer District, OEPA	2013-2018	Mermill Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals

Problem Statement #2: (Nutrients: phosphorus and nitrate)

Of the three aquatic life sampling sites in this HUC under the TMDL, all are in attainment. Accordingly, no impairments are cited. However, the TMDL reports total phosphorus geometric mean values slightly above the target of 0.1 ppm (0.16 ppm @ RM 15.32, 0.11 ppm @ RM 10.90). NO_3+NO_2 values are also slightly above the target at all three sites. This plan does set goals for P reduction for this HUC in order

to reduce overall loadings to Lake Erie. Additionally, BMPs to address bacteria (see above) and habitat issues (see below) will achieve nutrient load reductions.

Goal 2.1: Meet TMDL target for phosphorus load reduction by 277 and nitrate load by 1173 lb/year from HSTS

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 52 systems

Goal 2.2: Meet TMDL target for phosphorus load reduction by 996 and nitrate load by 2,557 lb/year from agricultural practices

Objectives:

- 500 acres of cover crops
- 200 acres of controlled drainage
- 150 acres of permanent hay
- 300 acres of riparian buffers
- 25 acres of restored wetlands
- 300 LF of stream restoration
- 400 LF of overwide / 2-stage ditch reconstruction
- 7,025 acres under NRCS 590/1 Nutrient Mgt
- 3,011 acres under NRCS 590/3 Nutrient Mgt
- 5,000 acres of filter strips
- 300 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Nutrients (phosphorus and nitrate)	2.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$780,000	Wood & Hancock County Health Dept, TMACOG, Ohio EPA	2013 - 2022	Replace or upgrade 10% of watershed's HSTS or 52 systems	Reduce phosphorus load by 277 and nitrate load by 1173 lb./year
	2.2	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$30,000	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	500 acres of cover crops	Reduce phosphorus load by 581 and nitrate load by 1,162 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$94,200	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	200 acres of controlled drainage	Reduce phosphorus load by 92 and nitrate load by 238 lb./year
	2.2	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$42,000	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	150 acres of permanent hay	Reduce phosphorus load by 098 and nitrate load by 195 lb./year
	2.2	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$210,000	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	300 acres of riparian buffers	Reduce phosphorus load by 048 and nitrate load by 096 lb./year
	2.2	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$127,656	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	25 acres of restored wetlands	Reduce phosphorus load by 17 and nitrate load by 24 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$104,400	Wood & Hancock SWCD, Wood & Hancock co Engineer, NRCS, farmers	2013-2027 in phases	300 LF of stream restoration	Reduce phosphorus load by 11 and nitrate load by 23 lb./year
	2.2	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$35,600	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	400 LF of overwide / 2-stage ditch reconstruction	Reduce phosphorus load by 55 and nitrate load by 111 lb./year
	2.2	♦Seek cooperators for Nutrient Management NRCS 590 Level 1 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management NRCS 590 Level 1 BMPs with farmers	$140,508	Wood & Hancock SWCD, NRCS, farmers	2013-2022	7,025 acres under NRCS 590/1 Nutrient Mgt	NA

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Seek cooperators for Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with farmers	$120,435	Wood & Hancock SWCD, NRCS, farmers	2013-2022	3,011 acres under NRCS 590/3 Nutrient Mgt	NA
	2.2	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$689	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	5,000 acres of filter strips	Reduce phosphorus load by 50 and nitrate load by 100 lb./year
	2.2	♦Identify & prioritize fields suited for Conservation Tillage BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Conservation Tillage BMP with farmer	$4,500	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	300 acres of conservation tillage	Reduce phosphorus load by 44 and nitrate load by 609 lb./year

Problem Statement #3: (Siltation/Sedimentation)

The TMDL found all sampling sites in full attainment of aquatic life criteria, but cited habitat issues (see below). BMPs to address habitat will result in sediment load reductions.

Goal 3.1: Reduce sedimentation impairments by decreasing sediment load by 560 lb/year from agricultural practices

Objectives:

- 500 acres of cover crops
- 200 acres of controlled drainage
- 150 acres of permanent hay
- 300 acres of riparian buffers
- 25 acres of restored wetlands
- 300 LF of stream restoration
- 400 LF of overwide / 2-stage ditch reconstruction
- 5,000 acres of filter strips
- 300 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Sedimentation	3.1	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$30,000	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	500 acres of cover crops	Reduce sediment load by 291 lb./year
	3.1	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$94,200	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	200 acres of controlled drainage	Reduce sediment load by 106 lb./year
	3.1	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$42,000	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	150 acres of permanent hay	Reduce sediment load by 50 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$210,000	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	300 acres of riparian buffers	Reduce sediment load by 24 lb./year
	3.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$127,656	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	25 acres of restored wetlands	Reduce sediment load by 25 lb./year
	3.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$104,400	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	300 LF of stream restoration	Reduce sediment load by 11 lb./year
	3.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$35,600	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	400 LF of overwide / 2-stage ditch reconstruction	Reduce sediment load by 28 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$689	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	5,000 acres of filter strips	Reduce sediment load by 25 lb./year
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$4,500	Wood & Hancock SWCD, NRCS, farmers	2013-2027 in phases	300 acres of conservation tillage	Reduce sediment load by 1 lb./year

Problem Statement #4: (Habitat Alteration)

The OEPA TMDL cites QHEI habitat scores of poor at RM 15.32, and fair at 10.9 and 8.64. Habitat restoration BMPs will improve these scores.

Goal 4.1: 325 acres of habitat restoration and 700 linear feet of stream corridor restoration practices

Objectives:

- 300 acres of riparian buffers
- 25 acres of restored wetlands
- 300 LF of stream restoration
- 400 LF of overwide / 2-stage ditch reconstruction

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Habitat Impairment	4.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$210,000	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	300 acres of riparian buffers	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$127,656	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	25 acres of restored wetlands	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$104,400	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	300 LF of stream restoration	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$35,600	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2013-2027 in phases	400 LF of overwide / 2-stage ditch reconstruction	Load reductions provided in nutrient and sediment tables

Rocky Ford Creek

04100010 030-040
04100010 01 03 (New 12-digit HUC & Name: Rocky Ford)

Length: 22.9 miles
Elevation at Mouth: 669 feet
Elevation at Source: 811 feet
Fall: 6.2 (ft/mi)
Drainage area: 73.5 sq. mi.

Ohio Topographic Quadrangle 7.5 minute (1:24,000)

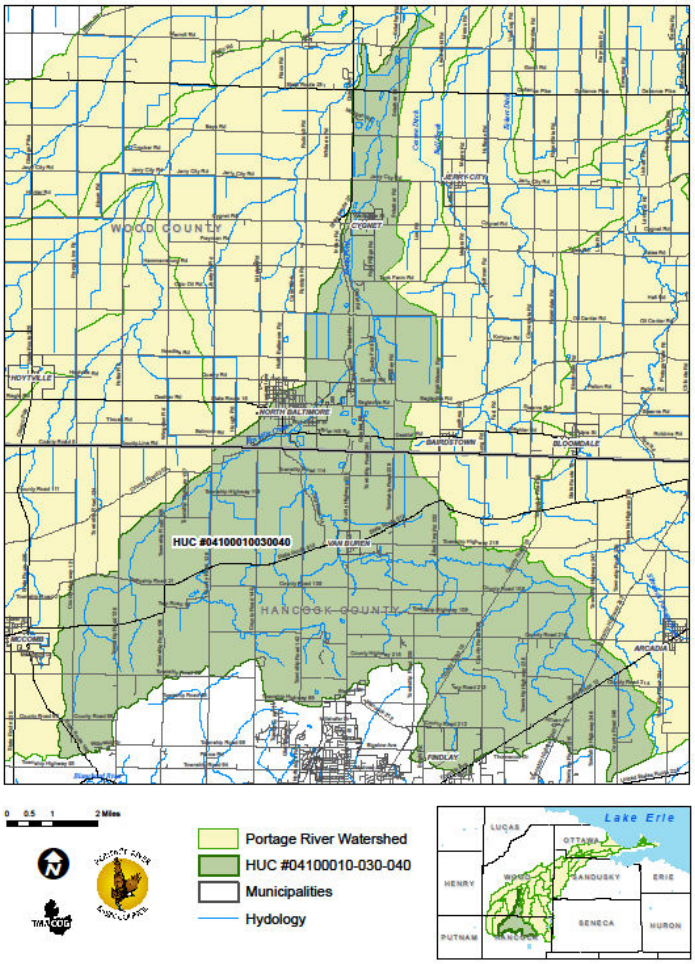
- Findlay
- Arcadia
- North Baltimore
- Bloomdale
- McComb
- Bowling Green South
- Jerry City

Urban Areas:
Van Buren

North Baltimore

Cygnet

HUC #04100010-030-040



Geology

The subwatershed is located within the glacial lake plain of Lake Erie. During the glacial period, ice sheets of both the Illinoian and Wisconsin Age advanced and retreated over the area. As the ice sheets retreated, a large lake was formed. This glacial lake leveled the till plain. Consequently, Wood County is now typified by level or nearly level, expanses, broken only by sand ridges formed during the glacial period, by high areas underlain by limestone and by breaks along river and streams. Hancock County has nearly level undulating topography, except where the Portage watershed is located in the northern half of the county. Here the glacial moraines present the only elevation between 700 and 800 feet to provide fall. The elevation is formed from glacial till, lacustrine modified till, outwash sand, and gravel associated with the Wisconsin Glaciation.

The headwaters of Rocky Ford Creek originate in both central Hancock County. The topography is generally flat except at the southern, or headwater, end of the watershed of where the glacial Defiance End Moraine forms a divide between the Portage and the Blanchard.

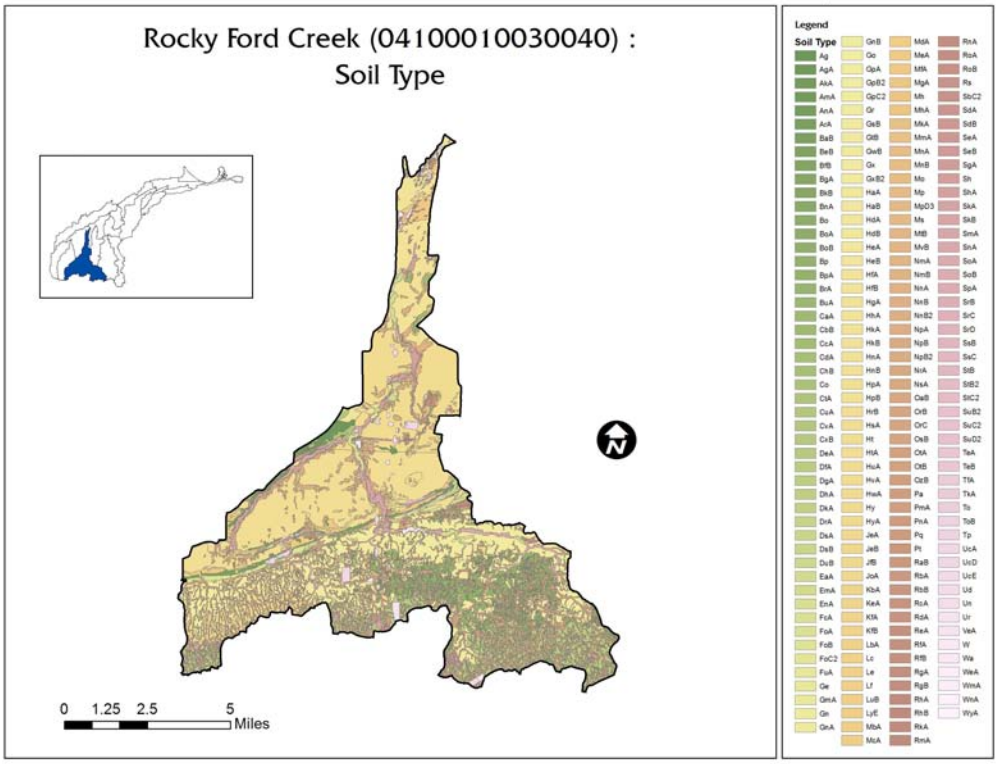
Soils

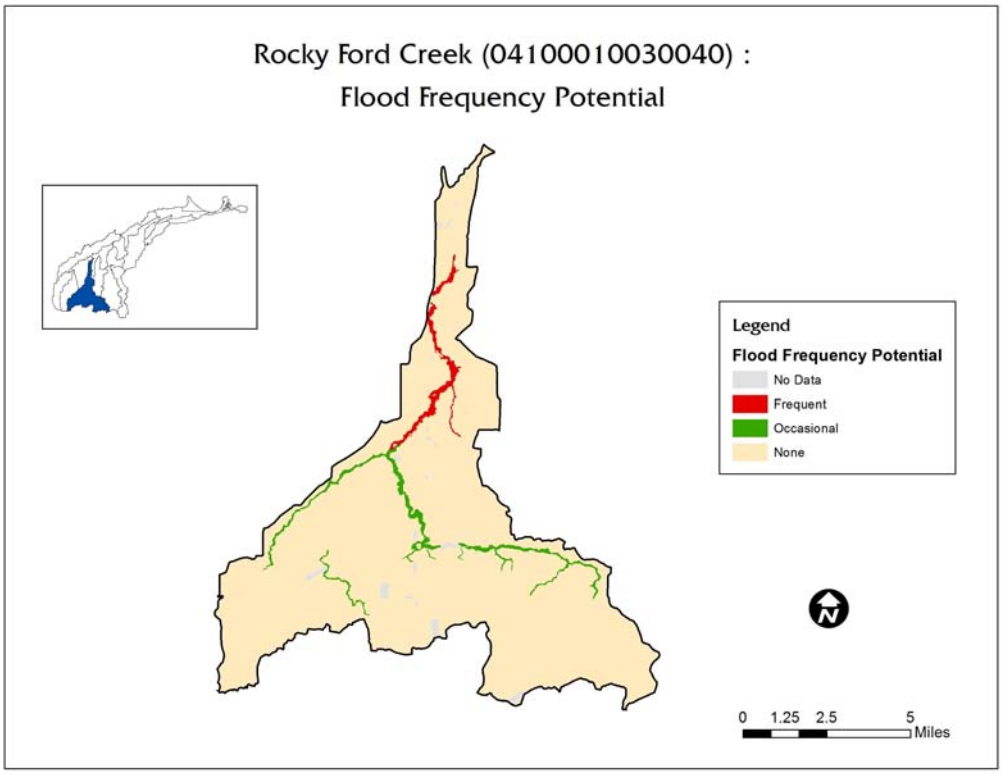
Unlike neighboring HUCs, the Rocky Ford's soils are not predominantly Hoytville. It is still the most common soil type, but comprises less than 30% of the land area. Jointly, Glynwood and Pewamo are equally common in this watershed.

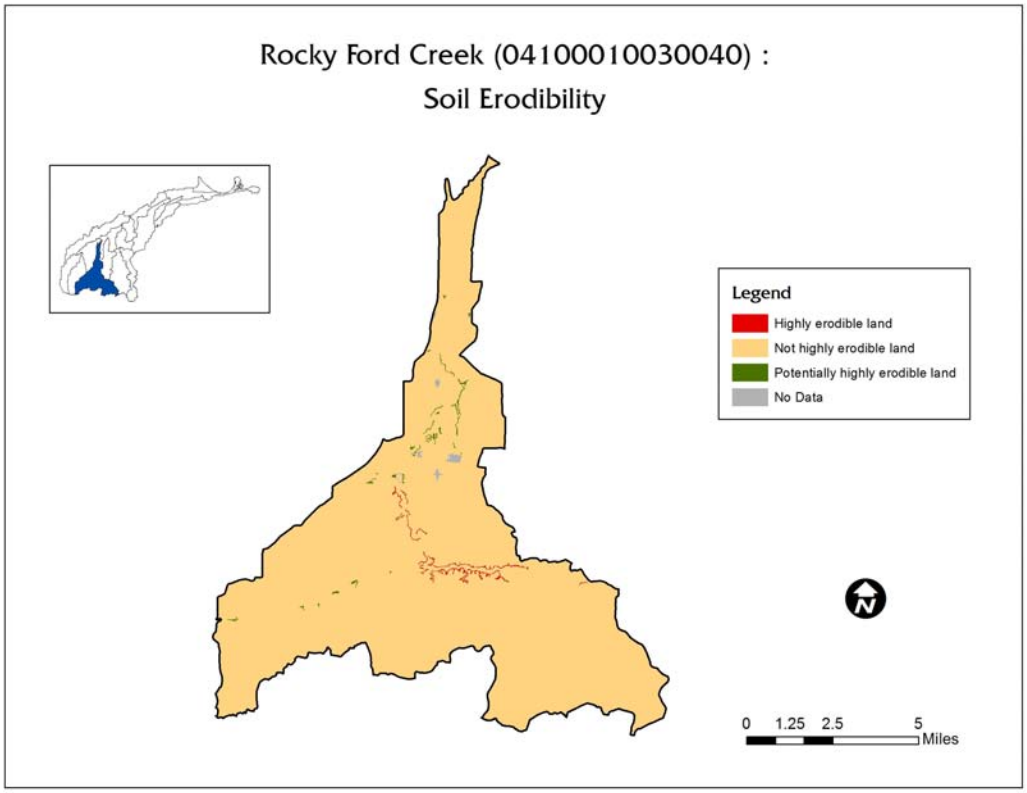
Hoytville soils are silty clay, clay loam, or silty clay loam. They are very poorly drained, but prime farmland when they are drained. Hoytville soils are generally flat, and dominant in the north and central, downstream, portion of the HUC. Most Wood county soils are Hoytville, as are in flat Hancock County areas.

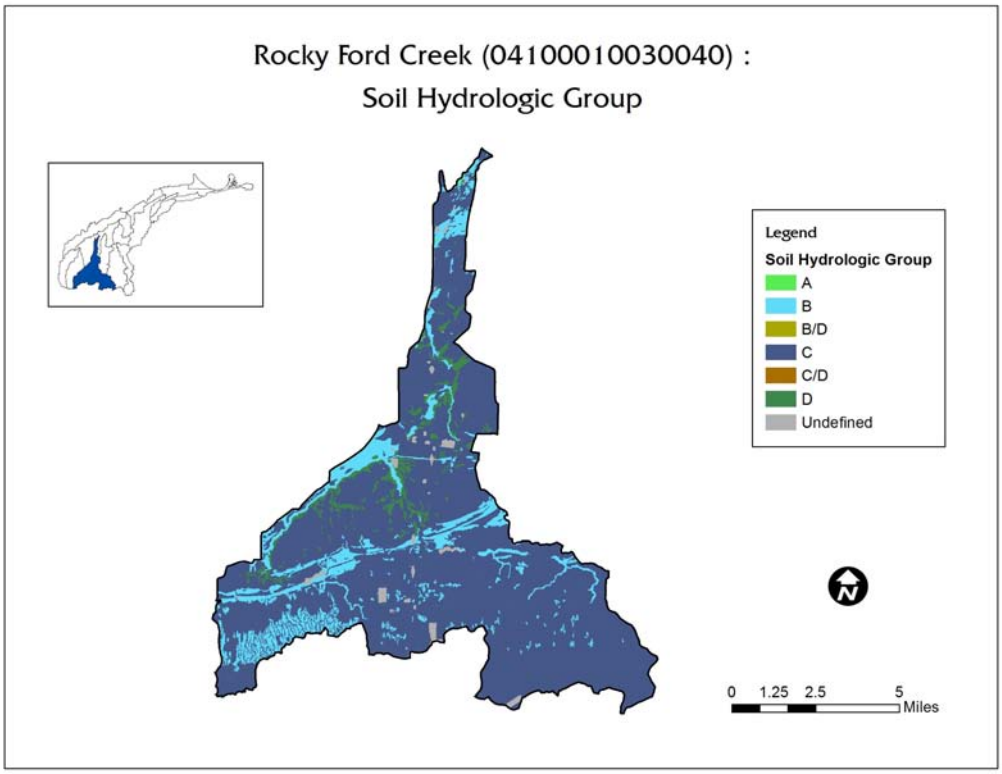
The most common Glynwood soil is the Glynwood-Blount-Houcktown complex. It is moderately well drained and considered prime farm land. Its slopes range from 1-4%; these soils are common in the hilly area at the south edge of the HUC that forms the divide between the Portage and the Blanchard. Pewamo silty clay loam is found in the same general area, but is a very poorly drained, flat soil. Pewamo is also prime farmland when drained.

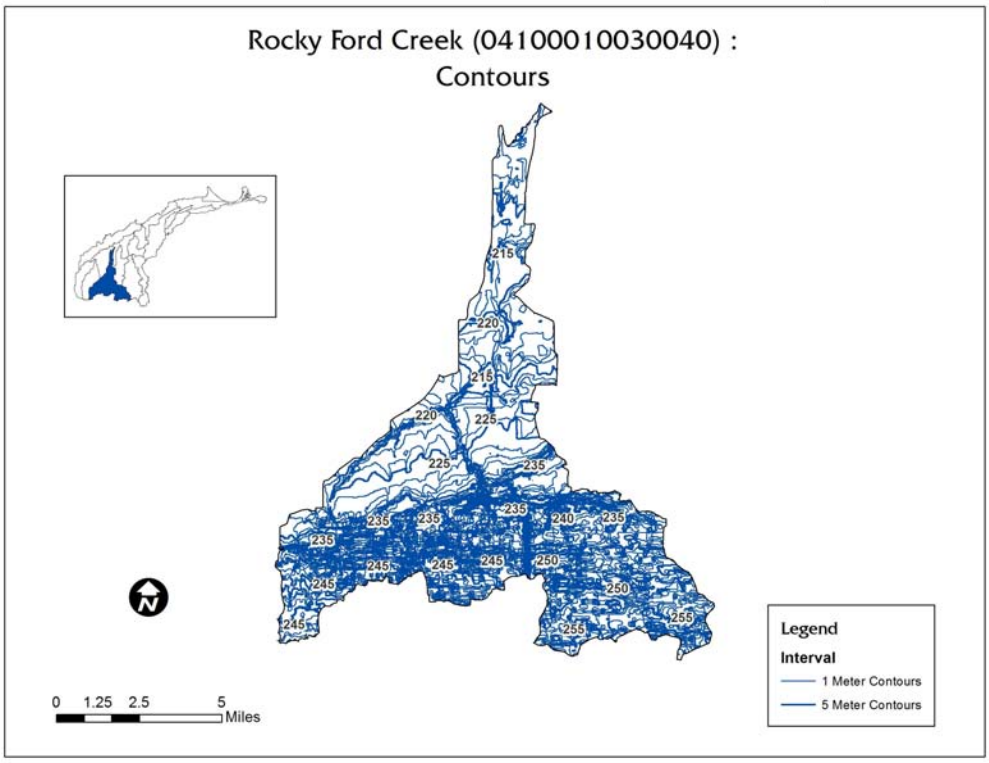
Major Soil Groups		
030-040		
Hoytville	Sum Acres	13,562
	Percentage	28.96%
Glynwood	Sum Acres	7,628
	Percentage	16.29%
Pewamo	Sum Acres	7,475
	Percentage	15.96%
Blount	Sum Acres	3,185
	Percentage	6.80%
Del Rey	Sum Acres	3,009
	Percentage	6.43%
Nappanee	Sum Acres	1,804
	Percentage	3.85%
Houcktown	Sum Acres	1,141
	Percentage	2.44%
Mermill	Sum Acres	1,093
	Percentage	2.33%
Jenera	Sum Acres	839
	Percentage	1.79%
Sloan	Sum Acres	738
	Percentage	1.58%


Rocky Ford Creek (04100010030040) :
Soil Type
0 1.25 2.5 5
Miles
Legend
Soil Type


Rocky Ford Creek (04100010030040) :
Flood Frequency Potential
Legend
Flood Frequency Potential
No Data
Frequent
Occasional
None
0 1.25 2.5 5
Miles


Rocky Ford Creek (04100010030040) :
Soil Erodibility
Legend
Highly erodible land
Not highly erodible land
Potentially highly erodible land
No Data
0 1.25 2.5 5
Miles


Rocky Ford Creek (04100010030040) :
Soil Hydrologic Group
Legend
Soil Hydrologic Group
A
B
B/D
C
C/D
D
Undefined
0 1.25 2.5 5
Miles


Rocky Ford Creek (04100010030040) :
Contours
215
220
215
220
225
225
235
235
235
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240
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245
245
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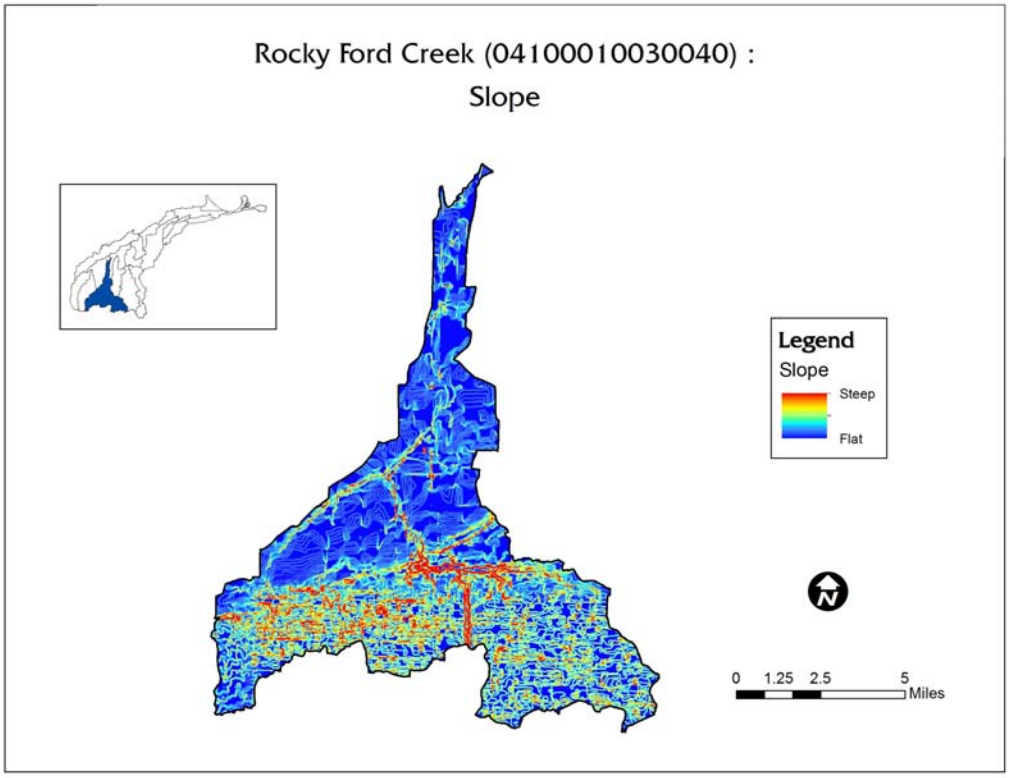
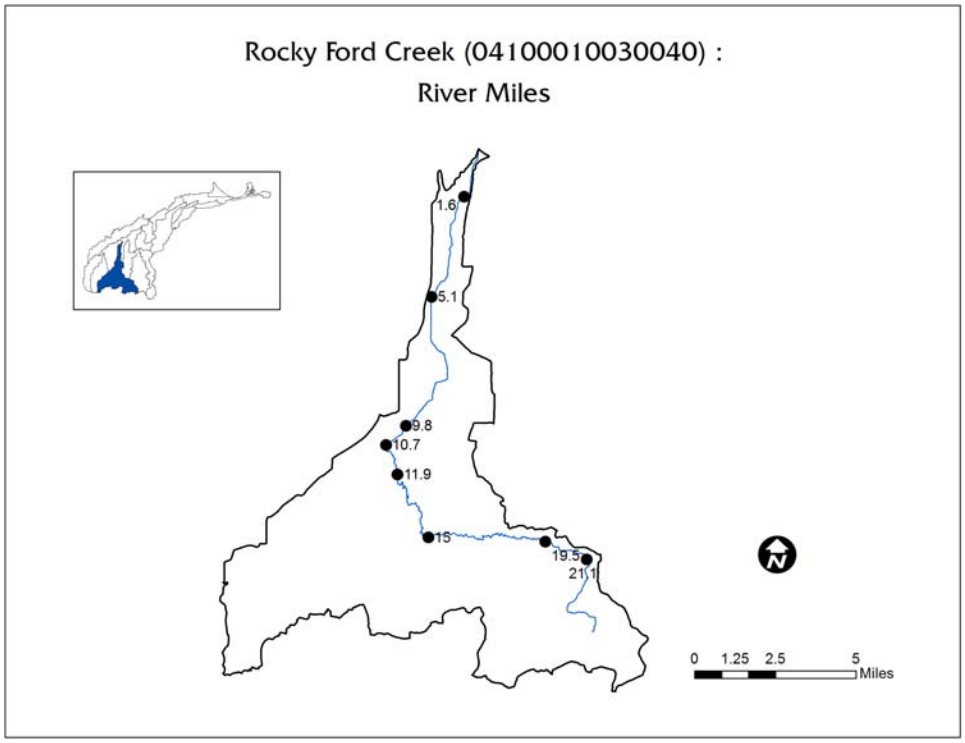
245
250
245
250
245
255
255
Legend
Interval
1 Meter Contours
5 Meter Contours
0 1.25 2.5 5
Miles


Rocky Ford Creek (04100010030040) :
Slope
Legend
Slope
Steep
Flat
0 1.25 2.5 5
Miles



The Soil Hydrologic Group map indicates the *Hydrologic soil groups* based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately course texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (**A/D, B/D, or C/D),** the first letter is for drained areas and the second is for undrained areas.

Rare, Threatened, Endangered Species

A collection of rare, threatened, endangered, species of concern of fresh water mussel species, fish, plants and animal find successful habitat and water quality to locate in the Rocky Ford subwatershed HUC14-04100010 030 030.

Rare, Threatened, Endangered Species

Common Name	*Scientific Name*	Last Observed	State Status
Rock Elm	Ulmus thomasii	2008-10-20	P
Virginia Rail	Rallus limicola	1985-06	SC
Virginia Rail	Rallus limicola	1974	SC
Western Banded Killifish	Fundulus diaphanus menona	1978-09-08	E

T=Threatened, P=Potentially Threatened, E=Endangered, X=Presumed Extirpated, SC=Species of Concern

Mussel Species in Rocky Ford Creek

Stream River Miles	Common Mussel Name	*Scientific Name*	Observed	Status
1.59	Fat Mucket	*Lampsilis radiate luteola*	2008	—
5.10	White Heelsplitter	*Lasmigona complanata complanata*	2008	—
1.59, 5.10, 9.80, 11.87, 15.04	Giant Floater	*Pyganodon grandis grandis*	2008	—
1.59	Mapleleaf	*Quadrula quadrula*	2008	—
1.59, 9.80	Creeper	*Strophitus undalatus undalatus*	2008	—
Source: Freshwater Mussels of the Maumee Drainage 2nd Edition. Grabarkiewicz, J., and Crail, T.		**Source:** Ohio EPA Technical Report EAS/2010-4-4		

HUC 8 – 04100010 (Portage River)									
HUC 10 – 0410001001 (Rocky Ford-Middle Branch Portage River)									
HUC 12 – 041000100103 (Rocky Ford)									
HUC 14 – 04100010 030-040 (Rocky Ford Creek)									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
7	2008	S01K12	Rocky Ford Creek Nw Of Arcadia @ Co. Rd. 109	21.12	7.6	WWH	Non	Sedimentation/Siltation	Non-irrigated Crop Production
8	2008	S01K11	ROCKY FORD CREEK SW Of BLOOMVILLE @ CO. RD. 18	19.53	16.2	WWH	Non	Sedimentation/Siltation	Non-irrigated Crop Production
9	2008	S01S06	Rocky Ford Creek Dst. Van Buren Lake @	15.04	23.0	WWH	Partial	Low flow alterations	Van Buren Lake impoundment

HUC 8 – 04100010 (Portage River)									
HUC 10 – 0410001001 (Rocky Ford-Middle Branch Portage River)									
HUC 12 – 041000100103 (Rocky Ford)									
HUC 14 – 04100010 030-040 (Rocky Ford Creek)									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
			Co. Rd. 220						
10	2008	S01S05	Rocky Ford Creek Upst. North Baltimore @ Twp. Rd. 114	11.87	31.0	WWH	Partial	Sedimentation/Siltation	Non-irrigated Crop Production
11	2008	S01S04	Rocky Ford Creek Upst N. Baltimore WWTP @ E. Broadway St.	9.82	57.0	WWH	Partial	Low flow alterations	Non-irrigated Crop Production
12	2008	S01P28	Rocky Ford Creek W Of Cygnet @ Cygnet Rd.	5.10	66.0	WWH	Partial	Sedimentation/Siltation, Direct Habitat Alterations	Non-irrigated Crop Production
13	2008	300372	Rocky Ford @ Solether Rd.	1.59	72.0	WWH	Full	-	-
14	2008	S01K13	Trib. To Rocky Ford Creek (10.75) @ Tr 112	3.57	8.9	WWH	Full	-	-
15	2008	201105	Trib. To Rocky Ford Creek (10.75) @ Cr 139 (Dst Fenburg #2)	2.00	18.7	WWH	Full	-	-
16	2008	201106	Trib. To Rocky Ford Creek Adj Cr 139	1.80	7.5	WWH	Full	-	-

Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010.

Water Resources

Surface Water

Designated Use for aquatic life is warm-water habitat (WWH). **Recreation Use** assessment is Class B at most locations, and Scr at three tributary sites.

Recreational Use Attainment							
Location	RM	Rec Use PCR Class	Number of Samples	**E. coli Standard:** Mean <126 (A), or <161 (B) and Maximum Sample ≤ 298 (A) or ≤ 523 (B) Mean	Max	Attainment Status	Sources of Bacteria
Rocky Ford Trib (10.75) At Tr 112	3.57	Scr	4	495	1200	Non	HSTS
Rocky Ford Trib (10.75) At	2.00	Scr	5	544	1800	Non	HSTS

Recreational Use Attainment							
Location	RM	Rec Use PCR Class	Number of Samples	**E. coli Standard:** Mean <126 (A), or <161 (B) and Maximum Sample ≤ 298 (A) or ≤ 523 (B) Mean	Max	Attainment Status	Sources of Bacteria
Cr 139 (Dst Fenburg #2)							
Trib To Rocky Ford Trib (10.75/1.99) Adj Cr 139 (Ust Fenburg #2)	1.80	Scr	5	910	2500	Non	HSTS
Rocky Ford At Cr 109	21.12	B	4	620	1100	Non	HSTS; Agric.
Rocky Ford At Cr 18	19.53	B	5	324	1300	Non	HSTS; Agric.
Rocky Ford At Cr 220 (Main St) - Dst Van Buren Lake	15.04	B	3	82	200	Full	
Rocky Ford At Tr 114	11.87	B	5	178	610	Non	HSTS; Van Buren; Agric.
Rocky Ford At Sr 18	10.74	B	5	689	2600	Non	HSTS; golf course
Rocky Ford Ust N Baltimore WWTP At E Broadway St	9.82	B	5	480	1500	Non	CSOs
Rocky Ford At Cygnet Rd	5.10	B	5	228	1200	Non	HSTS ; N. Baltimore WWTP
Rocky Ford At Solether Rd	1.59	B	4	499	1200	Non	HSTS; Agric.

Aquatic Life Use Assessment				
Location	**RM**	**Drainage Area**	**Aquatic Life Use**	**Attainment Status**
Rocky Ford Creek NW Of Arcadia @ Co. Rd. 109	21.1	7.6	WWH	Non
Rocky Ford Creek Sw Of Bloomville @ Co. Rd. 18	19.5	16.2	WWH	Non
Rocky Ford Creek Dst. Van Buren Lake @ Co. Rd. 220	15.0	23.0	WWH	Partial
Rocky Ford Creek Upst. North Baltimore @ Twp. Rd. 114	11.9	31.0	WWH	Partial
Rocky Ford Creek Upst N. Baltimore WWTP @ E. Broadway St.	9.8	57.0	WWH	Partial
Rocky Ford Creek W Of Cygnet @ Cygnet Rd.	5.1	66.0	WWH	Partial
Rocky Ford Creek @ Solether Rd.	1.6	72.0	WWH	Full
Trib. To Rocky Ford Creek (10.75) @ Tr 112	3.6	8.9	WWH	Full
Trib. To Rocky Ford Creek (10.75) @ Cr 139 (Dst Fenburg #2)	2.0	18.7	WWH	Full
Trib. To Rocky Ford Creek (10.75/1.99) Adj Cr 139	1.8	7.5	WWH	Full
Source: Ohio EPA 2012 Integrated Report: http://wwwapp.epa.ohio.gov/dsw/ir2012/search.html				

Macro-invertebrate Communities

Stream RM	Dr. Ar. (sq. mi.)	Data Codes	Qual. Taxa	EPT QI./Total	Sensitive Taxa QI./Total	Density QI./Qt.	CW Taxa	Predominant Organisms on the Natural Substrates With Tolerance Category(ies)	ICI[a]	Narrative Evaluation
21.12	7.6	-	37	3	7	L-M	1	Midges (T,F), blackflies (F)	-	Low Fair
19.53	16.2	-	34	7	6	L-M	0	Midges (T,F,MI), hydropsychid caddisflies (F), blackflies (F)	-	Fair
15.04	23.0	9	37	4	3	L-M	0	Midges (MI,F,MT), oligochaete worms (T)	-	Low Fair
11.87	31	8	45	5 / 5	6 / 9	L / 104	0	Midges (T,MI), hydropsychid caddisflies (F), fingernail clams (F)	20	
9.80	57	-	46	7	8	L-M	0	Flatworms (F), midges (F), mosquito larvae (F)	-	Fair
5.10	66	8	36	9 / 11	8 / 13	L-M / 214	0	Midges (MT,F), heptageniid mayflies (F)	26	
1.59	72	8	59	18 / 18	17 / 24	M-H / 475	0	Hydropsychid caddisflies mayflies (F), flatworms (F)	34	
3.57	8.9	-	48	11	6	M	0	Hydropsychid caddisflies (F), midges (T,F), baetid mayflies (F)	-	Marg. Good
2.00	18.7	-	51	19	12	M	0	Hydropsychid caddisflies mayflies (F), midges (T,MT,F)	-	Good
1.80	7.5	-	36	10	8	L-M	0	Midges (F), hydropsychid caddisflies (F), blacklies (F)	-	Marg. Good

Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010 http://epa.ohio.gov/dsw/tmdl/PortageToussaintRivers.aspx

Public Drinking Water Supply Assessment

HUC	Reporting Category	Cause of Impairment	Nitrate Watch List	Pesticide Watch List
04100010 01 03	3i	None	No	No

Fish Tissue Assessment			
HUC	Reporting Category	Causes of Impairment	PCB Concentration
04100010 01 03	3	None	

Water Quality Monitoring Results: Ohio EPA 1994 and 2008						
River Mile	Date	IBI	ICI	MiWB	QHEI	STATUS
8.9	1993	28^{ns}		6.9^{ns}	-	Fair/Poor
10.7	1993	24*		6.0*	-	Fair/Poor
5.2, 5.1	1994	36	16*	7.2 ^{ns}	38.5	Fair/M. Good
7.5	1994		42			VG
9.8, 9.5	1994	26*	4*, 14*	6.8 ^{ns}	42.5	Poor/Fair
10.8	1994	22*		7.0 ^{ns}	35.5	Fair/Poor
1.59	2008	39	34	9.0	46.0	Full
5.10	2008	35	26*	7.6	35.0	Partial
9.80	2008	44	F*	8.7	70.5	Partial
11.87	2008	30	20*	7.0^{ns}	42.0	Partial
15.04	2008	36	LF*	7.8	66.0	Partial
19.53	2008	22*	F*	N/A	58.0	Non
21.12	2008	18*	LF*	N/A	39.5	Non

a - River Mile (RM) represents the Point of Record (POR) for the station, not the actual sampling RM.
b - MIwb is not applicable to headwater stream with drainage areas ≤20 mi^2.
c - A narrative evaluation of the qualitative sample based on attributes such as EPT taxa richness, number of sensitive taxa, and community composition was used when quantitative data was not available or considered unreliable. VP=Very Poor, P=Poor, LF=Low Fair, F=Fair, MG=Marginally Good, G=Good, VG=Very Good, E=Exceptional
d - Attainment is given for the proposed status when a change is recommended. Aquatic life use in superscript.
ns - Nonsignificant departure from biocriteria (≤4 IBI or ICI units, or ≤0.5 MIwb units).
* - Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.
Sources: Biological and Water Quality Study of the Portage River Basin, Ohio EPA 1995, Tables 12 & 13; Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010 http://epa.ohio.gov/dsw/tmdl/PortageToussaintRivers.aspx

General narrative ranges assigned to QHEI scores.				
Narrative Rating		QHEI Range		
		Headwaters (≤ sq mi)	Larger Streams	Lacustuary
Excellent		≤ 70	≤ 75	≤ 80
Good		55 to 69	60 to 74	60 to 80
Fair		43 to 54	45 to 59	45 to 59
Poor		30 to 42	30 to 44	30 to 44
Very Poor		<30	<30	<30

1995 OEPA Assessments

Overall habitat quality was poor, as with a mean QHEI score of 43.1, which would be expected to limit the performance of the biological community. Recent channelization, a non-existent or narrow riparian buffer strip, and intensive agricultural land use practices have resulted in degraded instream habitat. The characteristics of modified habitats evident at most locations were siltation and substrate embeddedness, little or no sinuosity, poor channel development, and sparse instream cover. Only the most upstream location (RM 15.2) no longer exhibited evidence of previous channelization and exhibited positive habitat attributes.

Rocky Ford had long stretches of dry stream bottom downstream from Van Buren Reservoir (RM 15.1) the result of no water being released. Consequently the macroinvertebrate community was fair, reflecting poor habitat conditions. At RM 10.2 (Water Street) organisms abundant in the pool margin were mayflies, flatworms, and limpet snails. Isopods and crayfish were also common. The narrative assessment was fair. Sediments in the vicinity of unsewered discharges and a CSO were black or blackish-gray with a septic odor.

The macroinvertebrate community downstream from the North Baltimore CSOs (RM 9.8) was severely degraded. The water was gray with a septic odor and the sediments were black and oily. Red midges were present in the pools, and tolerant pouch snails (Physella) predominated in the margins. Several tolerant midges were also present.

The habitat improved downstream from Eagleville Rd. due to the largely intact riparian corridor upstream and downstream from the WWTP (RM 9.5). There was good flow, and the water was clear. Downstream from the WWTP, no oily sediments or septic odors were observed and a mixed community of midges predominated in the riffle-run habitats. Species indicative of good water quality appeared, although the community did not meet the WWH criterion and was rated as fair.

At Tank Farm Road (RM 7.5), Rocky Ford met the WWH ICI criterion, rated "very good." Mayflies were collected along with sensitive midges However, large numbers of flatworms and isopods were present, possibly the result of unsewered discharges. An 18 to 24-inch pipe with an intermittent gray discharge was discoloring the stream at the sampling site.

The sample at RM 5.1 was collected downstream from an unsewered discharge at Cygnet Rd. The macroinvertebrate did not meet WWH criterion. Sewage fungus was present; dark oily sediments were present in the margins, and a septic odor was present. The highly tolerant midge comprised nearly 27% of the organisms collected.

At Bays Road (RM 2.9) Rocky Ford was channelized and consisted of a deep, wide, and silty ditch with no sinuosity. There was a fairly diverse macroinvertebrate community with moderate numbers of caddisflies, mayflies, and riffle beetles in the riffle-run habitat. Three bivalve mollusks were present. Despite the habitat limitations the macroinvertebrate community marginally met the WWH criterion.

Water appropriation for drinking water supply and the North Baltimore CSOs were the sources associated with the degraded fish community at two locations (RMs 10.8 and 9.8). Pollution-tolerant and pioneering species comprised 75% and 74%, respectively, of the fish. Rocky Ford is impounded at RM 15.3 to create a public water supply reservoir

(Van Buren Lake). All flow was retained by the reservoir during the summer-fall sampling period, resulting in very low flows upstream from the North Baltimore WWTP. Sludge deposits were observed downstream from the CSOs which discharge at Eagleville Rd. and near RM 10.1 in North Baltimore. Stream flow was reestablished by the North Baltimore WWTP discharge, which allowed the fish community to recover.

2008 OEPA Assessments

Macroinvertebrate communities sampled in Rocky Ford Creek were generally not meeting expectations and were characterized by low EPT (3-9) and sensitive taxa (3-8) diversity and predominance of primarily facultative and tolerant taxa. Observed impairments to the biotic integrity of this stream were habitat alterations, siltation, and low flow (at RMs 15.04, 9.8). The community improved into the good range at Solether Road (RM 1.59) with increased EPT (18) and sensitive taxa (17) diversity; however, relatively high abundance of tolerant taxa (14.6%) was an indication of continuous impact. The two unnamed tributaries sampled were supporting communities that were marginally meeting or meeting WWH expectations with EPT diversity ranging from 10 to 19 and sensitive taxa diversity from 6 to 12. Potential impacts to their biotic integrity were habitat alteration and siltation.

Siltation from agricultural activities contributed to the low IBI score at Rocky Ford Creek RMs 21.1 and 19.5. Pollution-tolerant fish comprised between 86-95% of the fish community at each Rocky Ford Creek site.

The quality of the fish community of Rocky Ford Creek has improved over time, though agricultural activities, Van Buren Lake, and the North Baltimore sanitary system continue to cause degradation to the aquatic community. The headwaters of Rocky Ford Creek (RMs 21.12 and 19.53) showed evidence of channelization and siltation from the surrounding agricultural land use. The low quality habitat resulted in poor fish community scores in the headwaters. However, fish community scores generally increased in a downstream direction, with all of the lower sites meeting IBI and MIwb WWH biocriteria, which had not occurred with historical sampling. Improved habitat conditions are likely responsible for the improved fish community scores, as North Baltimore has addressed CSOs, by eliminating one CSO and proceeding with plans to eliminate the other in 2014. The improved habitat conditions are natural recovery processes from recent channelization activities noted in 1994.

Biological Criteria Benchmarks

Biological Criteria					**Lacustuary Benchmarks[1]**				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
IBI-Headwaters	50	28	20	18	N/A	N/A	N/A	N/A	N/A
IBI-Wading	50	32	22	18	N/A	N/A	N/A	N/A	N/A

Biological Criteria					Lacustuary Benchmarks[1]				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
IBI-Boat	48	34	20	16	50	42	31	17	<17
MIwb-Wading	9.4	7.3	5.6	4.5	N/A	N/A	N/A	NA	N/A
MIwb-Boat	9.6	8.6	5.7	5.0	10	8.6	5.6	2.8	<2.8
ICI	46	34	22	8	52	42	25	12	<12

[1] **Proposed Lacustuary scoring breakpoints. These have not yet been adopted into rule.**

Ground Water

There is one municipality within this subwatershed that relies on groundwater for drinking water: the Village of Cygnet. In other parts of the watershed, individual residences obtain water from Van Buren, which uses surface water supplied by the City of Findlay[3] from the Blanchard River, from North Baltimore, which uses surface water from Rocky Ford Creek, or from household private wells.

Source Water Assessment Plan (SWAP)

Both the Village of Cygnet and the Village of North Baltimore operate public water systems in this watershed. Cygnet draws its source from groundwater, which North Baltimore draws its supply from Rocky Ford Creek.

Cygnet Water System

The Village of Cygnet serves 700 residents with drinking water. The system includes three wells, providing 69,000 gallons per day. The wells draw from a Silurian age carbonate bedrock aquifer in a potential karst region. Ohio's potential karst regions are carbonate aquifers that are covered by less than 25 feet of glacial material and typically exhibit surficial karst features, such as sinkholes. The aquifer is covered by 6-8 feet of low-permeability material, which provides minimal protection from contamination. Depth to water in this aquifer is 7 to 10 feet below the ground surface.

Soils in the area are clays which are very poorly drained, but thin, meaning that some of the rainfall and snowmelt will infiltrate into the soil, instead of running off or ponding. The topography is generally flat with low relief. Ground water in this area is replenished by the gradual flow of water underground from higher to lower elevations and by precipitation that infiltrates through the soil. In northwest Ohio the regional ground water flow direction is primarily towards Lake Erie. In karst settings, however, local flow direction is highly variable and is influenced by fracture orientation. Since detailed information on local fracture orientation is unavailable, flow direction cannot be accurately determined.

3 http://www.ci.findlay.oh.us/?id=78

Cygnet has prepared a Drinking Water Source Protection Plan that was endorsed by Ohio EPA in 2012.

To protect the ground water aquifer source of drinking water, a protection area buffer is delineated for the land area surrounding the wellheads. The drinking water source protection area for Cygnet`s well is shown in the following figure. It shows two areas, one inside the other. The "inner protection zone" is the area that provides ground water within one year of pumping. A chemical spill in this zone poses a greater threat to the drinking water, so this area warrants more stringent protection. The "outer protection zone" is the additional area that contributes water when the well is pumped for five years. Together, they comprise the drinking water source protection area.

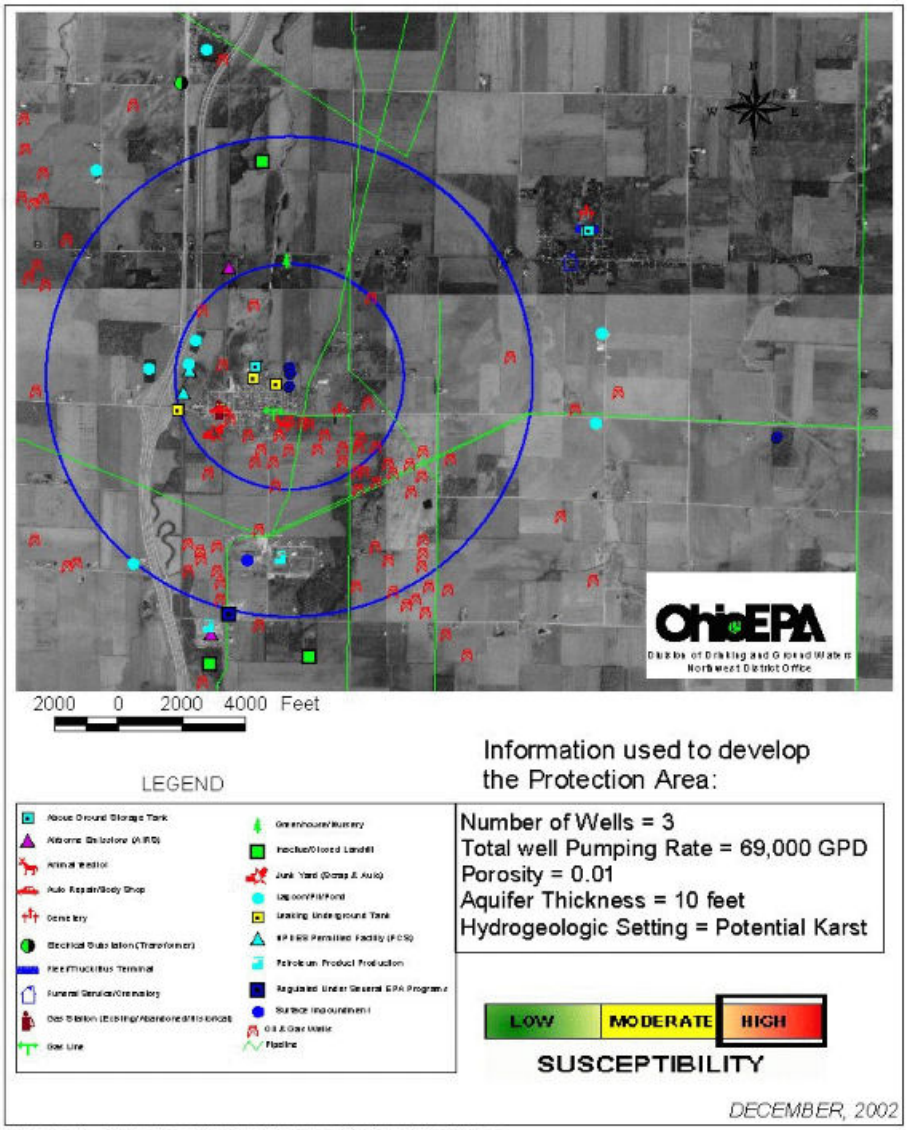


Figure 2. Drinking Water Source Protection Area for the Village of Cygnet Public Water System Identification # 8700612

Within the source water protection area an inventory was conducted by the Ohio EPA and village personnel to identify all *potential* sources of contamination which could reach ground water levels.

Cygnet has a high susceptibility to contamination to the drinking water for several reasons. The source water assessment plan (SWAP) identified three indicators of high susceptibility to contamination

- The well is located in a sensitive potential karst area;
- The well is open between approximately 30 and greater than 200 feet in the fractured limestone and the depth to water is less than 15 feet below the ground surface
- Potential contaminant sources exist within the protection area.

This does not mean that the aquifer will become contaminated, only that under the existing conditions ground water could become impacted by potential contaminant sources.

North Baltimore Water System

The Village of North Baltimore serves 3,400 residents with drinking water. The village's intake draws surface water from Rocky Ford Creek, with a capacity of 1,660,000 gallons per day, and providing 566,000 gallons per day in 2004.

The Drinking Water Source Protection Area for a stream is the area upstream of the water intake. The protection area is divided into corridor and emergency management zones. North Baltimore's drinking water protection area and corridor management zone and its emergency management zone shown in the two following figures.

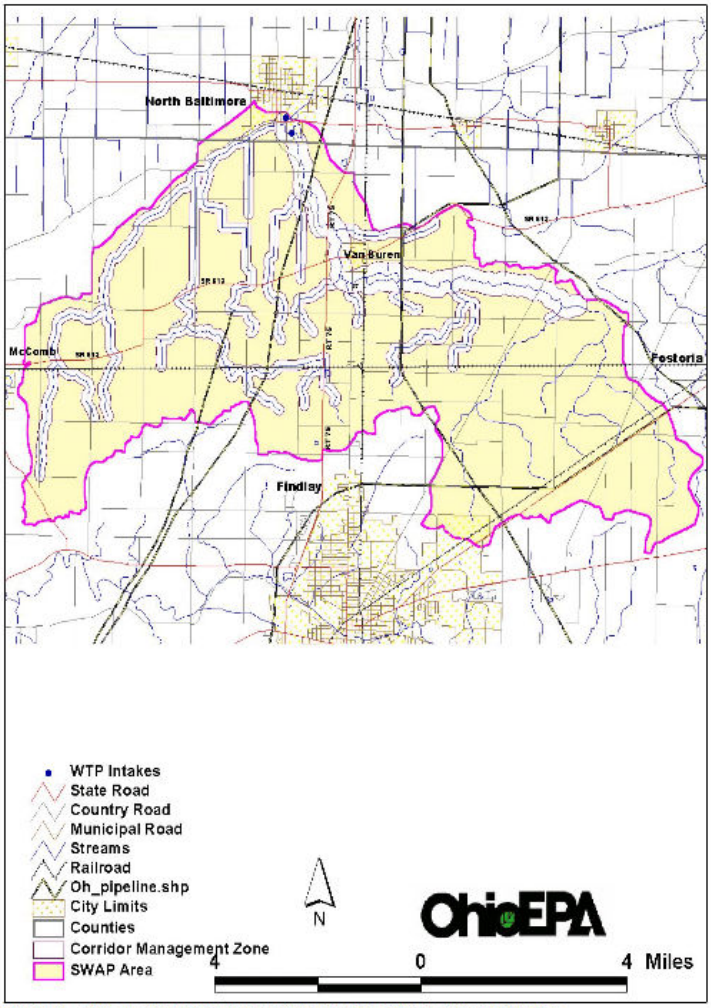


Figure 1 – Village of North Baltimore Drinking Water Source Protection Area

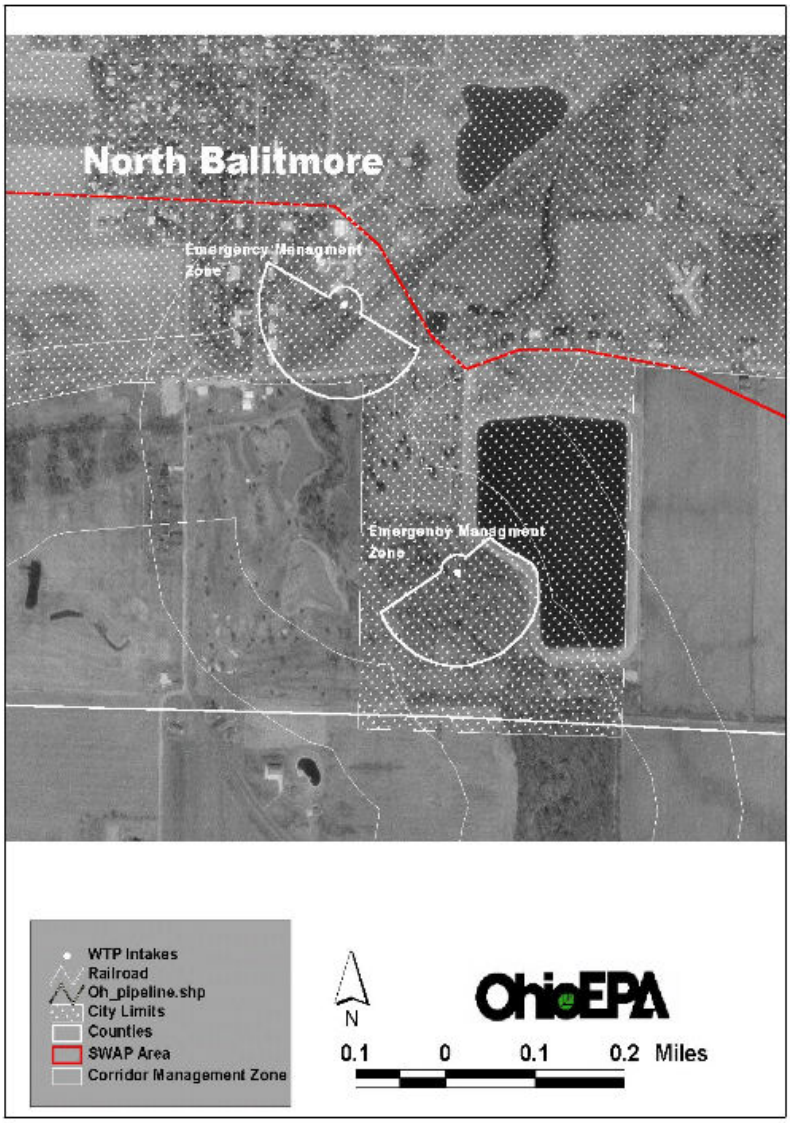


Figure 2 – Emergency Management Zone for the Village of North Baltimore

The Corridor Management Zone is an area along streams and tributaries within the source water assessment area that warrants delineation, inventory, and management. Typically, this zone runs a total of ten miles upstream from the intake, and includes the tributaries that drain into it. The zone is 1,000 feet wide on each side of the Rocky Ford Creek mainstem and 500 feet wide on each side of any tributaries. The Emergency Management Zone is an area in the immediate vicinity of the surface water intake in which the public water system operator has little or no time to respond to a spill. The boundary of the emergency management zone is delineated in cooperation with the water supplier. Figure 2 shows the boundary of the emergency management zone for the Village of North Baltimore Public Water System. North Baltimore's Emergency Management Zone is an area in the immediate vicinity of the Rocky Ford Creek intake structure and the upland reservoirs. This zone is defined as a semicircle that extends 500 feet upstream and 100 feet downstream of the intake.

North Baltimore compliance monitoring data for treated drinking water from 1991-2002 revealed that the system had no health based or maximum contaminant level violations. North Baltimore participated in the Ohio EPA Pesticide Special Study (1995-1999). Low levels of several pesticides were detected in the finished water, indicating an impact from land use activities within the watershed.

For the purposes of source water assessments, all surface waters are considered to be susceptible to contamination. By their nature surface waters are accessible and can be readily contaminated by chemicals and pathogens, with relatively short travel times from the source to the intake. North Baltimore's drinking water source protection area is susceptible to agricultural runoff, storm water runoff, gas stations and other commercial sources, new home construction activities, oil and gas wells, active and inactive landfills, and wastewater discharges.

Source water protection efforts for the Village of North Baltimore should focus on controlling agricultural runoff and runoff from cattle grazing pastures; with particular attention to sources of pesticides, nitrates, phosphorus, and microorganisms such as fecal coliform bacteria.[4]

DRASTIC MAP

The sensitivity of the groundwater to local sources of contamination is determined and rated by **DRASTIC** maps as described below:

> Inherent within each geologic setting are the physical characteristics which effect the groundwater pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:
>
> **D** – Depth to Water
> **R** – Net Recharge
> **A** – Aquifer Media
> **S** – Soil Media
> **T** – Topography
> **I** – Impact of the Vadose Zone Media
> **C** – Conductivity (Hydraulic) of the Aquifer (ODNR, 1994)

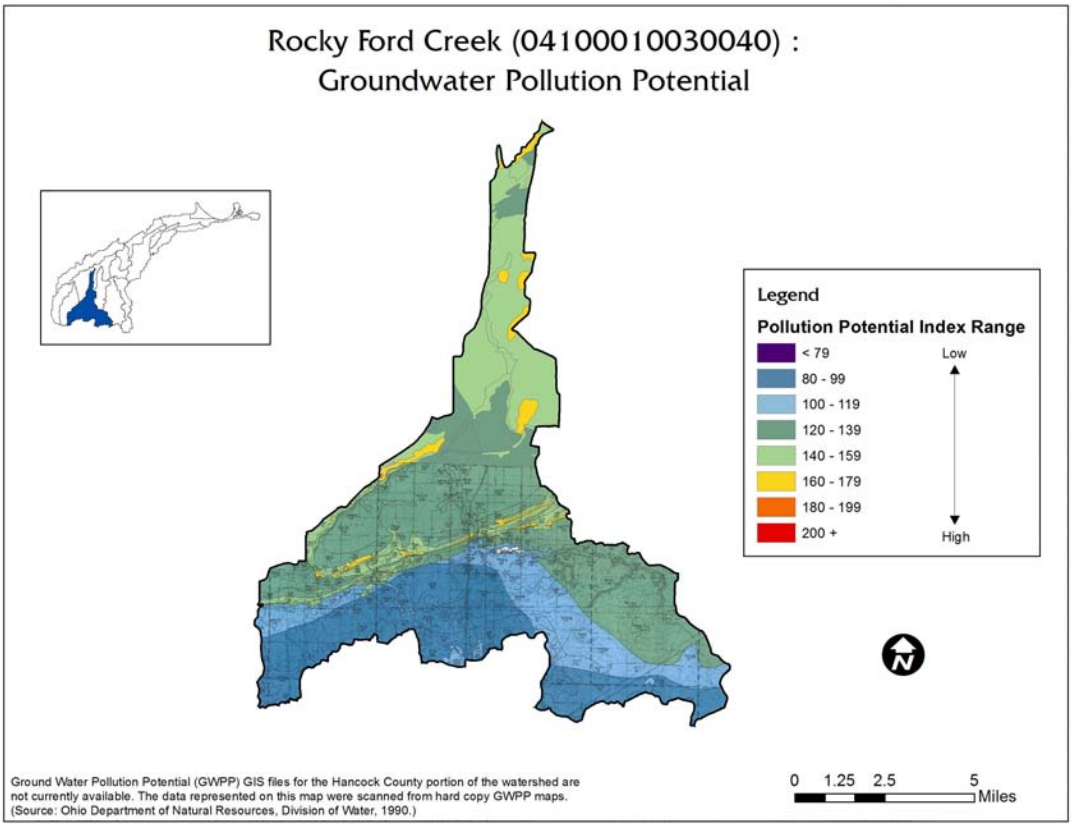
Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index then the greater the vulnerability to contamination (ODNR, 1994).

All of Wood County was identified with nine hydro-geologic settings for potential of ground water pollution indexes ranging from 63 to 198 as it relates to the Ground Water Pollution Potential of Wood County map on page 10. The DRASTIC system indicates the groundwater pollution potential index for Rocky Ford Creek is moderately low to moderate in areas of sand/gravel interbedded in general till and in areas of moraines.

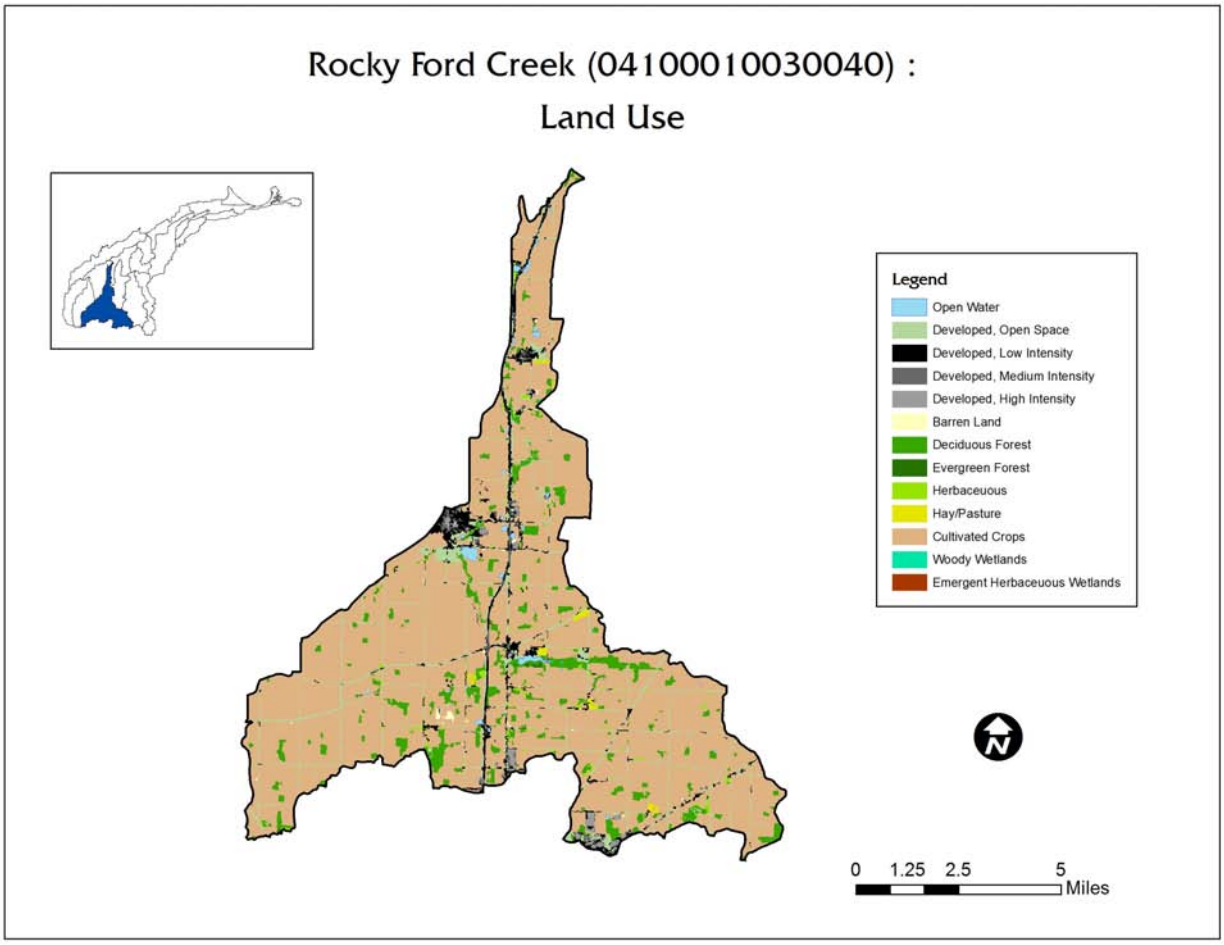
4 *Drinking Water Source Assessment for the Village of North Baltimore*, Ohio EPA 2004

The average ground water pollution index potential for the Wood County portion of the Needles Creek watershed is 149 with a range of 121-169. In Hancock County, for which GIS data are not available, the range is about 80-140.

The Ohio Department of Natural Resources, Division of Water, Water Resources Section is the responsible agency to map groundwater resources throughout the state. Greater detail on DRASTIC maps for the Portage can be found in Chapter 4 of the watershed plan.



Sub-watershed (04100010)		
030-040		
Land Use	**Percent**	**Acres**
Urban	10.7%	5,010
Forest	7.3%	3,393
Pasture	0.3%	163
Cropland	80.8%	37,777
Other	0.9%	415
Total Acres	100%	46,758


Rocky Ford Creek (04100010030040) :
Land Use
Legend
Open Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Deciduous Forest
Evergreen Forest
Herbaceuous
Hay/Pasture
Cultivated Crops
Woody Wetlands
Emergent Herbaceuous Wetlands
0 1.25 2.5 5
Miles

Livestock Inventory							
HUC 4100010030040							
Type of Animal		**Hancock**	**Ottawa**	**Sandusky**	**Seneca**	**Wood**	**Estimates for HUC**
Percent of County in HUC		10.6%	0.0%	0.0%	0.0%	2.7%	
Cattle	Farms	129	89	167	264	144	**18**
	Animals	4,233	1,523	4,612	10,096	6,287	**620**
Hogs	Farms	51	15	37	62	30	**6**
	Animals	32,343	3,639	5,591	42,808	39,469	**4,501**
Horses	Farms	105	63	132	72	128	**15**
	Animals	844	444	772	463	1,004	**117**
Poultry	Farms	49	22	41	62	47	**6**
	Animals	NA	779	1,042	4,283	NA	**NA**
Sheep	Farms	32	12	41	61	21	**4**
	Animals	1,134	335	765	2,770	21	**121**
Total							49
							5,286

Source: 2007 Census of Agriculture http://www.agcensus.usda.gov/

Point Sources

Municipal

- Cygnet WWTP, 2PA00000, Northwestern Water and Sewer District

The Cygnet/Jerry City WWTP is a lagoon facility with an average daily capacity of 0.09 mgd. At the time of construction 1995, there were 220 customers in Cygnet and 172 in Jerry City. The plant was designed to allow 50% growth in both towns. OEPA data shows an average flow of 1.502 mgd and a peak flow of 1.700 mgd during the period of 2004-2007. The Cygnet sewer system was completed in 1995, and Jerry City's in 1996. Both are conventional gravity sewer systems.

- North Baltimore WWTP, 2PB00033

The North Baltimore WWTP is a 0.8 mgd trickling filter plant. OEPA data shows an average flow of 0.779 mgd and a peak flow of 1.445 mgd during the period of 2004-2009. I/I was a serious problem, causing bypassing. In 1997, in-house improvements to two overflow structures reduced CSO discharges by 60% during a rain event. In 2000, North Baltimore constructed a 200,000 gallon sludge holding tank to provide 180 days' storage capacity. The Village constructed new sludge dewatering facility in 2009.

The collection system uses combined sewers with 1 overflow. The Village plans to eliminate the remaining CSO in 2014. Effluent is discharged to Rocky Ford Creek.

Package Plants

- Cedar Tree Estates, 3000 gpd, Active
- Cedar Tree Estates, 6000 gpd, Active
- Crown Inn Motel, 23,400 gpd, Inactive
- Ernie's Carryout, 2,000 gpd, Active
- Hope Temple, 1,380 gpd, Active
- KOA Kampground (Kampin Korner), 40,000, Inactive
- Shady Lakes MHP, Active
- Sunoco, 1,500 gpd, Inactive
- Sunrise Apartments, 6,000 gpd, Active
- Van Buren School, 18,000 gpd, Active
- Van Buren Volunteer Fire Department, 1,000 gpd, Active

Industrial

- Mid-Valley Pipeline Co Cygnet Transfer Station, 2II00003

Discharge from the Mid Valley Pipeline Cygnet Facility wastewater treatment works located at 5152 Rockridge Road, Cygnet, Ohio, Wood County and discharging to tributary to Rocky Ford Creek.

A large oil spill occurred in Rocky Ford in February, 2009 after the stream survey for the TMDL was completed by Ohio EPA. On February 19, 2009 a pipeline carrying crude oil between Texas and Toledo broke on the tank farm site near Cygnet. Oil migrated through field tiles into a tributary of Rocky Ford Creek and on into the Middle Branch Portage River. Mid-Valley Pipeline and Sunoco Logistics and local state and federal agencies responded and spill containment was attempted along 15.7 miles of the river channel between Cygnet and Pemberville. There was no wildlife damage attributed to the spill due to the winter season, and there were no significant impacts noted during the remainder of the year.

Remediation efforts initially involved deploying sorbent booms, excavation of contaminated soil and thermal bank remediation to destroy oily product on the stream bank vegetation. Initial containment and cleanup were hampered by cold and windy conditions. Rain and snow in the first three days led to bank full flows in the river and steep slippery banks on the Middle Branch after the water receded. Ongoing cleanup includes permanent repair of the 22-inch pipeline, continual monitoring of siphon dams at the tank farm site and land farm remediation of the petroleum contaminated soils (U.S. EPA, 2009, Ohio EPA).

- BP Pipelines NA Cygnet Tank Farm, 2IG00022
- Air Products and Chemicals Inc, 2IN00041
- Hancock County Sanitary Landfill, 2IN00146

Non-Point Sources:

Critical Sewage Areas

- Areas within a mile of Van Buren State Park, which has a recreational lake behind a low-head dam — Hancock County, Allen Township §§ 7, 8, 12, 13, 17, 18 and Cass Township §§ 9, 16. The area includes about 209 houses with 117 permits before 1986 and 37 after.
- CR 203 E of CR 139
- TR 19/CR 139
- Van Buren-Findlay
- Shady Lake Camp
- TR 218 E of TR 229 to TR 232
- CR 109 W of CR 236, Cass Township §§16, 21 – 18 older houses; 7 permits newer than 1986, and 2 older.
- CR 216 E of Mortimer: §§ 19, 30 of Allen Township – 29 older homes with discharging systems
- CR 216 & TR 238 Cass Township §§22, 23, 26, 27 – Approximately 19 older homes; 11 with permits newer than 1986, and 2 older.
- TR 215 §§29-30 of Allen Township – approximately 14 older homes
- TR 213 E of CR 18, §33 of Cass Township – Approximately 12 older homes; 4 with permits newer than 1986, and 1 older.
- TR 243/TR 215 in §§35 and 36 of Cass Township – About 40 older homes with discharging systems.
- TR 108 - Allen Township – three groups of older homes, in total 30, with discharging systems, both sides of I-75
- TR 215 & CR236 in §§27, 28 or Cass Township – 22 older homes on both sides of 236. Seven have permits newer than 1986 and none older.

CAFOs

Naomi Dairy, Inactive[5]

Estimates of HSTSs				
Watershed	**Housing Units without sewers**	**Est. Unsewered Population (2010)**	**Unsewered Housing Units per acre**	**Unsewered Population per acre**
04100010030040	1,768	4,480	0.038	0.096

Sources: 2010 Census data and TMACOG "208" Plan. Analysis identifies approximate number of housing units without sewers in each watershed as an estimate of number of HSTSs.

Aquatic Life Use Impairments	
Causes	**Sources**
Sedimentation/Siltation	Nonirrigated crop production
Low-Flow alterations	Dam or impoundment
Direct Habitat Alterations	Channelization

5 Bowling Green *Sentinel-Tribune* 28 June 2011, http://www.sent-trib.com/front-page/mega-dairy-near-weston-is-closing

Aquatic Life Use Impairments	
Causes	**Sources**
Source: Ohio 2012 Integrated Report, Watershed Assessment Unit Summary	

Water Supply:

Public Water System	Population Served	Primary Water Source
Cygnet	597	Groundwater
North Baltimore	3,432	Surface water - Rocky Ford Creek

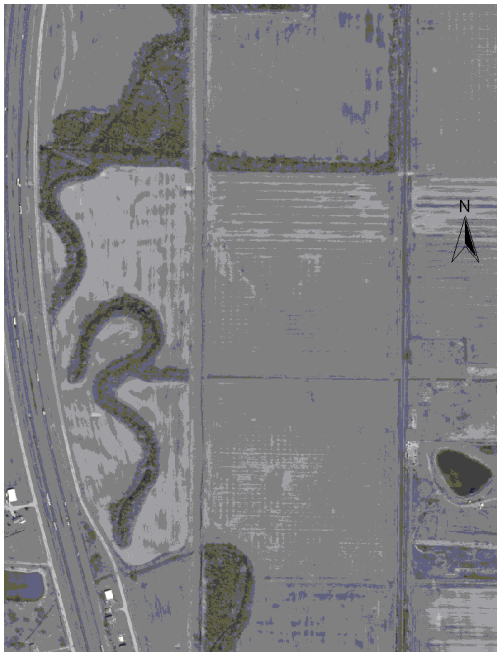
Water Quality Impairments

The OEPA Integrated Report assesses each watershed's attainment status for 1) Public Drinking Water Supply, 2) Recreation, 3) Human Health, 4) Aquatic Life, and 5) Fish Tissue. The Integrated Report identifies causes and sources of impairments where watersheds are not in attainment with water quality standards.

Background:

The Rocky Ford Creek watershed has the greatest land use changes of the Portage River HUCs. The north/south Interstate-75 freeway straddles the Rocky Ford in southern Wood County. When I-75 was constructed, the Rocky Ford tributary of the Portage River was channelized and rerouted. The results are seen on aerial maps indicating the numerous and sizeable oxbows now cut-off from the ditch channel that is now the river system between RM 5.0 and RM 8.0 in the Cygnet area

The subwatershed is crossed by oil and gas pipelines to transport product to the Midwest from the Texas gulf coast refineries as lines converge and pass through the Cygnet area. Land use change from oil and gas utility operations have occurred at closed pipeline operations between Cygnet and North Baltimore along I-75. Petroleum storage tanks have been removed. While some of the land area is left fallow and regenerates on its own, other locations were reclaimed as industrial office locations and one field returned to a type of agriculture use. Gravel pits from historical quarry areas have been redeveloped to agriculture, residential and recreational water use.



The Rocky Ford subwatershed has approximately 145 miles of waterway either in the form of channelized stream (74 miles), road-side ditch (49 miles) or natural sinuous stream with riparian buffers present (50 miles). Most

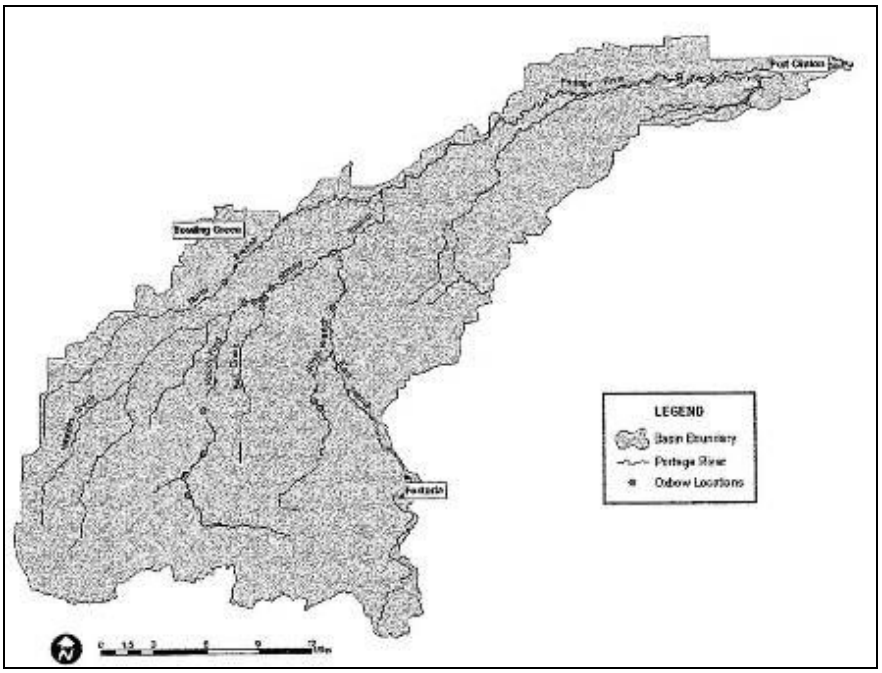
buffered areas are located between RM 1.0 and RM 16.0 from the Rocky Ford confluence with the Middle Branch to the Van Buren State Park Lake area. The benefit of riparian buffers is reflected in the 2008 water quality sampling of the area. While the downstream RM 1.59 was in full attainment and reached partial attainment at RM 5.10 through RM15.04 the unprotected headwaters of the Rocky Ford are in non-attainment due to channelizing and siltation.

Several oxbows along the length of the Rocky Ford from northern Hancock County to Mermill between RM 2.4 and 12.1 still retain water and possibly function as wetland. The *Portage River Hydrological Study,*(Finkbeiner, Pettis, & Strout 2002: Floodplain Acquisition, Wetland Restoration, Natural River Restoration Techniques, page 88.) recommends the restoration of the oxbows on the Rocky Ford for retention of high flows and to provide areas for sediments to settle out before reaching the main river channel.

The recommendation for the wooded corridor with access to its floodplain is a proposal to enhance approximately 14,400 linear feet of channel at five locations. A natural river restoration would be to develop the riffle-pool sequence to enhance fish and macro invertebrate habitat with increased depth diversity, variability in channel velocities and reduced channel embeddedness. A beneficial solution includes the land purchase or conservation easements of permanent 500-foot wooded corridors that retain and store flood waters, create more stable stream channel to reduce erosion and sediments. In 2002, the total project cost was estimated to be $8,213,000. The following table and map shows potential oxbow restoration sites identified by the Portage River Hydrological Study.

Potential Oxbow Restoration Sites

HUC	Stream	River Mile	Location	Number of Oxbows	Oxbow Length (feet)	Area, acres
4100010030040	Rocky Ford Creek	2.4-2.7	Between Bays Road and State Route 281	1	2,500	11.5
4100010030040	Rocky Ford Creek	11.9-12.1	Between I-75 and Wood-Hancock County Line	1	2,000	9.2
4100010030040	Rocky Ford Creek	5.2-6.3	Between Tank Farm and Cygnet Roads	1	6,000	27.5
4100010030040	Rocky Ford Creek	8.8-9.1	Downstream of Quarry Road	1	2,100	9.6
4100010030040	Rocky Ford Creek	10.4-10.6	Downstream of State Route 18	1	1,800	8.3



Source: Portage River Hydrologic Study, 2002

For the TMDL, Ohio EPA sampled many sites. They included eleven locations for bacteria, ranging from RM 21.12 at CR 109 in Hancock County to RM 1.6 at Solether Rd. Of those sites, three were on tributaries. Aquatic life sampling was conducted at ten sites, including the three tributaries.

All but one of the sites was in non-attainment for bacteria. The site in attainment was RM 15.04 below Van Buren dam, a Class B stream. For aquatic life sampling, there is a clear pattern. The upstream headwater sites (RM 21.1 at CR 109 RM 19.5 at CR 18) were in non-attainment. The mid-reach sites (RM 15.0 at CR 220, RM 11.9 at TR 114, RM 9.8 at E Broadway in North Baltimore, and RM 5.1 at Cygnet Rd) were in partial attainment. The downstream site (RM 1.6 at Solether Road) was in full attainment. The tributary sites (Fenburg Ditch, entering at RM 10.75) were also in full attainment.

The data indicate that the stream's ability to support life improves as the creek gets larger. Macroinvertebrate habitat quality increased downstream as well: low fair at RM 21.12, fair at 19.53, low fair at RM 15.04, fair at RM 9.8, marginally good at RM 3.57, good at RM 2.0, and marginally good at 1.8.

Habitat scores show less of a pattern. Generally the middle reach sites (9.8, 15.04, and 19.53) rated as good. The upstream and downstream sites, and one in the middle-reach, were "poor" (1.59, 5.10, 11.87, and 21.12). For Fenburg Ditch, habitat at RM 1.8 was fair while the other two sites were poor. In tally for the HUC: 3 sites "good," 2 "fair," and 5 "poor."

Impairments cited in the TMDL were related to agriculture and/or habitat modification: sediment/siltation, low-flow alterations, direct habitat alterations, crop production, and the Van Buren dam.

Problem Statement #1: (Bacteria)

The water quality of the Rocky Ford Creek subwatershed is impaired by elevated measurements of E. coli bacteria. The Portage TMDL data collected by Ohio EPA in 2008 indicate that 8 of the HUC's 12 sampling sites are in non-attainment for E. coli. The TMDL cites failed HSTS and CSOs as the causes of impairment due to high E. coli bacteria levels.

In this HUC are an estimated 1,768 HSTS. This watershed includes eleven package plants. Of these eight are in use, and none are permitted. There are ten Critical Sewage Areas, all in Hancock County. There is one CSO area tributary to this HUC. North Baltimore's CSOs discharged to Rocky Ford Creek when these samples were taken. The Water Street CSO was eliminated in 2012, and the Broadway CSO is scheduled for elimination in 2014.

Goal 1.1:

Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 11.2 million gallons of HSTS effluent annually

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 176 systems
- Van Buren State Park 1 mile radius Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- CR 203 E of CR 139 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- TR 19/CR 139 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- Van Buren-Findlay Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- Shady Lake Camp Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- TR 218 E of TR 229 to TR 232 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- CR 109 W of CR 236 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- CR 216 E of Mortimer Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- CR 216 & TR 238 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- TR 215 §§29-30 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- TR 213 E of CR 18 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in

- TR 243/TR 215 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- TR 108 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- TR 215 & CR236 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in

Goal 1.2: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 13.7 million gallons of package plant effluent annually

Objectives:

- Upgrade 8 package plant(s). Effluent quality meets effluent standards

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Bacteria	1.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$2,640,000	Wood & Hancock County Health Dept., TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 176 systems	11.2 million gallons/year sewage discharge eliminated
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Hancock County Health Department, Hancock County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$133,342	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA	2013-2018	Van Buren State Park 1 mile radius Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Hancock County Health Department, Hancock County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey	$5,000	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA	2013-2018	CR 203 E of CR 139 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
		findings					
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Hancock County Health Department, Hancock County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$5,000	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA	2013-2018	TR 19/CR 139 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Hancock County Health Department, Hancock County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$151,844	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA	2013-2018	Van Buren-Findlay Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Hancock County Health Department, Hancock County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$5,000	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA	2013-2018	Shady Lake Camp Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Hancock County Health Department, Hancock County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$5,742	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA	2013-2018	TR 218 E of TR 229 to TR 232 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Hancock County Health Department, Hancock County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$11,484	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA	2013-2018	CR 109 W of CR 236 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Hancock County Health Department, Hancock County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$18,502	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA	2013-2018	CR 216 E of Mortimer Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Hancock County Health Department, Hancock County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations	$12,122	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA	2013-2018	CR 216 & TR 238 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
		based on survey findings					
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Hancock County Health Department, Hancock County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$8,932	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA	2013-2018	TR 215 §§29-30 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Hancock County Health Department, Hancock County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$7,656	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA	2013-2018	TR 213 E of CR 18 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Hancock County Health Department, Hancock County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$25,520	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA	2013-2018	TR 243/TR 215 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Hancock County Health Department, Hancock County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$19,140	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA	2013-2018	TR 108 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Hancock County Health Department, Hancock County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$14,036	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA	2013-2018	TR 215 & CR236 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.2	♦Test package plant effluent for phosphorus ♦Set effluent standard in existing or new NPDES permit(s) ♦Enforce upgrades for phosphorus removal as needed	$28,800	Ohio EPA	2012-2017	Upgrade 8 package plant(s). Effluent quality meets effluent stds	13.7 million gallons/year effluent improved

Problem Statement #2: (Nutrients: phosphorus and nitrate)

Of the ten aquatic life sampling sites in this HUC under the TMDL, Ohio EPA cites 4 in attainment (RM 1.6, 3.6, 2.0, 1.8), 4 in partial attainment (RM 15.0, 11.9, 9.8, 5.1), and 2 in non-attainment (RM 21.1 and 19.5). The downstream sites where the creek is larger provide the best habitat; the smaller headwater streams have the most impaired.

Goal 2.1:

Meet TMDL target for phosphorus load reduction by 938 and nitrate load by 3,969 lb/year from HSTS

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 176 systems

Goal 2.2: Meet TMDL target for phosphorus load reduction by 797 and nitrate load by 3,853 lb/year from package plants

Objectives:

- Upgrade 8 package plant(s). Effluent quality meets effluent stds

Goal 2.3: Meet TMDL target for phosphorus load reduction by 2,488 and nitrate load by 5,746 lb/year from agricultural practices

Objectives:

- 250 acres of cover crops
- 50 acres of controlled drainage
- 100 acres of permanent hay
- 300 acres of riparian buffers
- 500 LF of restored oxbows
- 25 acres of restored wetlands
- 200 LF of stream restoration
- 200 LF of overwide / 2-stage ditch reconstruction
- 16,383 acres under NRCS 590/1 Nutrient Mgt
- 7,021 acres under NRCS 590/3 Nutrient Mgt
- 1,000 acres of filter strips
- 300 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Nutrients (phosphorus and nitrate)	2.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$2,640,000	Wood & Hancock County Health Dept, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 176 systems	Reduce phosphorus load by 938 and nitrate load by 3,969 lb./year
	2.2	♦Test package plant effluent for phosphorus ♦Set effluent standard in existing or new NPDES permit(s) ♦Enforce upgrades for phosphorus removal as needed	$28,800	Ohio EPA	2012-2017	Upgrade 8 package plant(s). Effluent quality meets effluent stds	Reduce phosphorus load by 797 and nitrate load by 3,853 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$15,000	Wood & Hancock SWCD, NRCS, farmers	2012-2027 in phases	250 acres of cover crops	Reduce phosphorus load by 1,562 and nitrate load by 3,124 lb./year
	2.3	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$23,550	Wood & Hancock SWCD, NRCS, farmers	2012-2027 in phases	50 acres of controlled drainage	Reduce phosphorus load by 124 and nitrate load by 320 lb./year
	2.3	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$28,000	Wood & Hancock SWCD, NRCS, farmers	2012-2027 in phases	100 acres of permanent hay	Reduce phosphorus load by 65 and nitrate load by 130 lb./year
	2.3	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$210,000	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2012-2027 in phases	300 acres of riparian buffers	Reduce phosphorus load by 87 and nitrate load by 174 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Evaluate oxbow site(s) with Wood Co Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$136,785	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	500 LF of restored oxbows	Reduce phosphorus load by 373 and nitrate load by 746 lb./year
	2.3	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$127,656	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2012-2027 in phases	25 acres of restored wetlands	Reduce phosphorus load by 22 and nitrate load by 221 lb./year
	2.3	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$69,600	Wood & Hancock SWCD, Wood & Hancock co Engineer, NRCS, farmers	2012-2027 in phases	200 LF of stream restoration	Reduce phosphorus load by 8 and nitrate load by 15 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$17,800	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2012-2027 in phases	200 LF of overwide / 2-stage ditch reconstruction	Reduce phosphorus load by 149 and nitrate load by 298 lb./year
	2.3	♦Seek cooperators for Nutrient Management NRCS 590 Level 1 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management NRCS 590 Level 1 BMPs with farmers	$327,667	Wood & Hancock SWCD, NRCS, farmers	2012-2022	16,383 acres under NRCS 590/1 Nutrient Mgt	NA
	2.3	♦Seek cooperators for Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with farmers	$280,857	Wood & Hancock SWCD, NRCS, farmers	2012-2022	7,021 acres under NRCS 590/3 Nutrient Mgt	NA

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$138	Wood & Hancock SWCD, NRCS, farmers	2012-2027 in phases	1,000 acres of filter strips	Reduce phosphorus load by 54 and nitrate load by 109 lb./year
	2.3	♦Identify & prioritize fields suited for Conservation Tillage BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Conservation Tillage BMP with farmer	$4,500	Wood & Hancock SWCD, NRCS, farmers	2012-2027 in phases	300 acres of conservation tillage	Reduce phosphorus load by 44 and nitrate load by 609 lb./year

Problem Statement #3: (Siltation/Sedimentation)

The TMDL cites sedimentation/siltation as a cause of impairment at four sampling sites (RM 21.12, 19.53, 11.87, 5.10). The impaired sites are located in the central or headwater sections of the watershed. BMPs will be needed to reduce sedimentation/siltation.

Goal 3.1: Reduce sedimentation impairments by decreasing sediment load by 1,309 lb/year from agricultural practices

Objectives:

- 250 acres of cover crops
- 50 acres of controlled drainage
- 100 acres of permanent hay
- 300 acres of riparian buffers
- 500 LF of restored oxbows
- 25 acres of restored wetlands
- 200 LF of stream restoration
- 200 LF of overwide / 2-stage ditch reconstruction
- 1,000 acres of filter strips
- 300 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Sedimentation	3.1	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$15,000	Wood & Hancock SWCD, NRCS, farmers	2012-2027 in phases	250 acres of cover crops	Reduce sediment load by 781 lb./year
	3.1	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$23,550	Wood & Hancock SWCD, NRCS, farmers	2012-2027 in phases	50 acres of controlled drainage	Reduce sediment load by 142 lb./year
	3.1	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$28,000	Wood & Hancock SWCD, NRCS, farmers	2012-2027 in phases	100 acres of permanent hay	Reduce sediment load by 33 lb./year
	3.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$210,000	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2012-2027 in phases	300 acres of riparian buffers	Reduce sediment load by 44 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Evaluate oxbow site(s) with Wood Co Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$136,785	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	500 LF of restored oxbows	Reduce sediment load by 186 lb./year
	3.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$127,656	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2012-2027 in phases	25 acres of restored wetlands	Reduce sediment load by 12 lb./year
	3.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$69,600	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2012-2027 in phases	200 LF of stream restoration	Reduce sediment load by 8 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$17,800	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2012-2027 in phases	200 LF of overwide / 2-stage ditch reconstruction	Reduce sediment load by 75 lb./year
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$138	Wood & Hancock SWCD, NRCS, farmers	2012-2027 in phases	1,000 acres of filter strips	Reduce sediment load by 27 lb./year
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$4,500	Wood & Hancock SWCD, NRCS, farmers	2012-2027 in phases	300 acres of conservation tillage	Reduce sediment load by 1 lb./year

Problem Statement #4: (Habitat Alteration)

The OEPA TMDL gives QHEI classifications of the watershed's middle reach sites (9.8, 15.04, and 19.53) as good. The upstream and downstream sites, and one in the middle-reach, were "poor" (1.59, 5.10, 11.87, and 21.12). For Fenburg Ditch, habitat at RM 1.8 was fair while the other two sites were poor. In tally for the HUC: 3 sites "good," 2 "fair," and 5 "poor." The watershed's streams would benefit from habitat BMPs.

Goal 4.1: 325 acres of habitat restoration and 14,800 linear feet of stream corridor restoration practices

Objectives:

- 300 acres of riparian buffers
- 500 LF of restored oxbows
- 25 acres of restored wetlands
- 200 LF of stream restoration
- 200 LF of overwide / 2-stage ditch reconstruction

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Habitat Impairment	4.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$210,000	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2012-2027 in phases	300 acres of riparian buffers	Load reductions provided in nutrient and sediment tables
	4.1	♦Evaluate oxbow site(s) with Wood Co Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$136,785	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	500 LF of restored oxbows	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$127,656	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2012-2027 in phases	25 acres of restored wetlands	Load reductions provided in nutrient and sediment tables

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	4.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$69,600	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2012-2027 in phases	200 LF of stream restoration	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$17,800	Wood & Hancock SWCD, Wood & Hancock Co Engineer, NRCS, farmers	2012-2027 in phases	200 LF of overwide / 2-stage ditch reconstruction	Load reductions provided in nutrient and sediment tables

MIDDLE BRANCH PORTAGE RIVER BELOW ROCKY FORD CREEK TO ABOVE SOUTH BRANCH PORTAGE RIVER (EXCEPT BULL CREEK)

04100010 040 010 (14- digit HUC)

04100010 02 05 (New 12-digit HUC & Name: Cessna Ditch-Middle Branch Portage River)

Length: 8.2 river miles

Elevation at source: 674 feet

Elevation at mouth: 654 feet

Gradient: 2.4 ft/mile

Drainage Area: 30.0 Sq. miles

Ohio Topographic Quadrangle 7.5 minute (1:24,000):

- Bowling Green South
- North Baltimore
- Jerry City
- Bloomdale

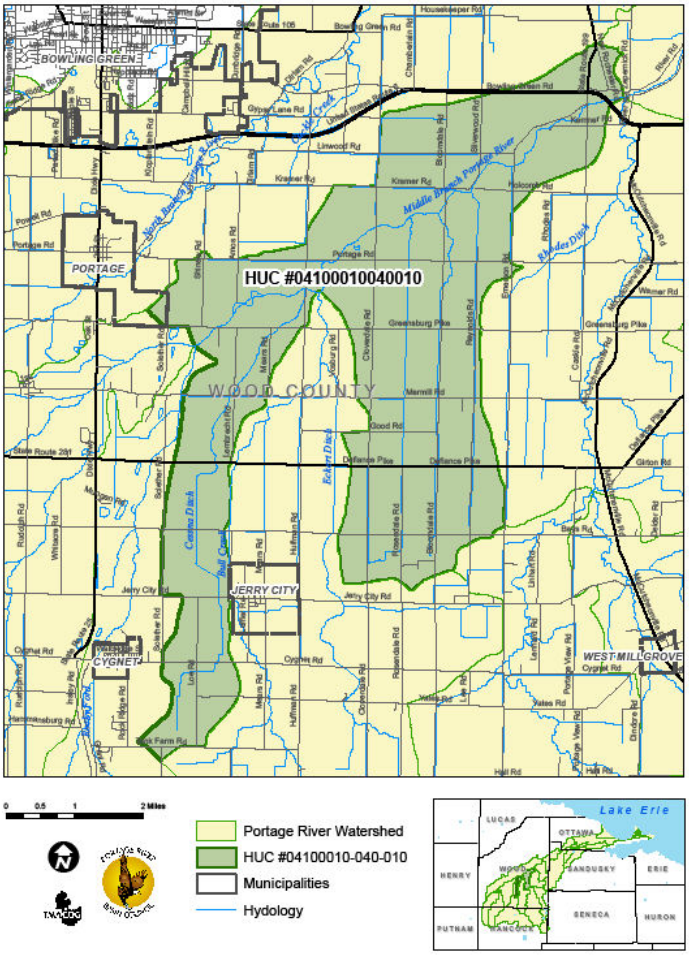
Urban Areas:

New Rochester

Jerry City

Interstate 75 Exchange in Bowling Green

HUC #04100010-040-010



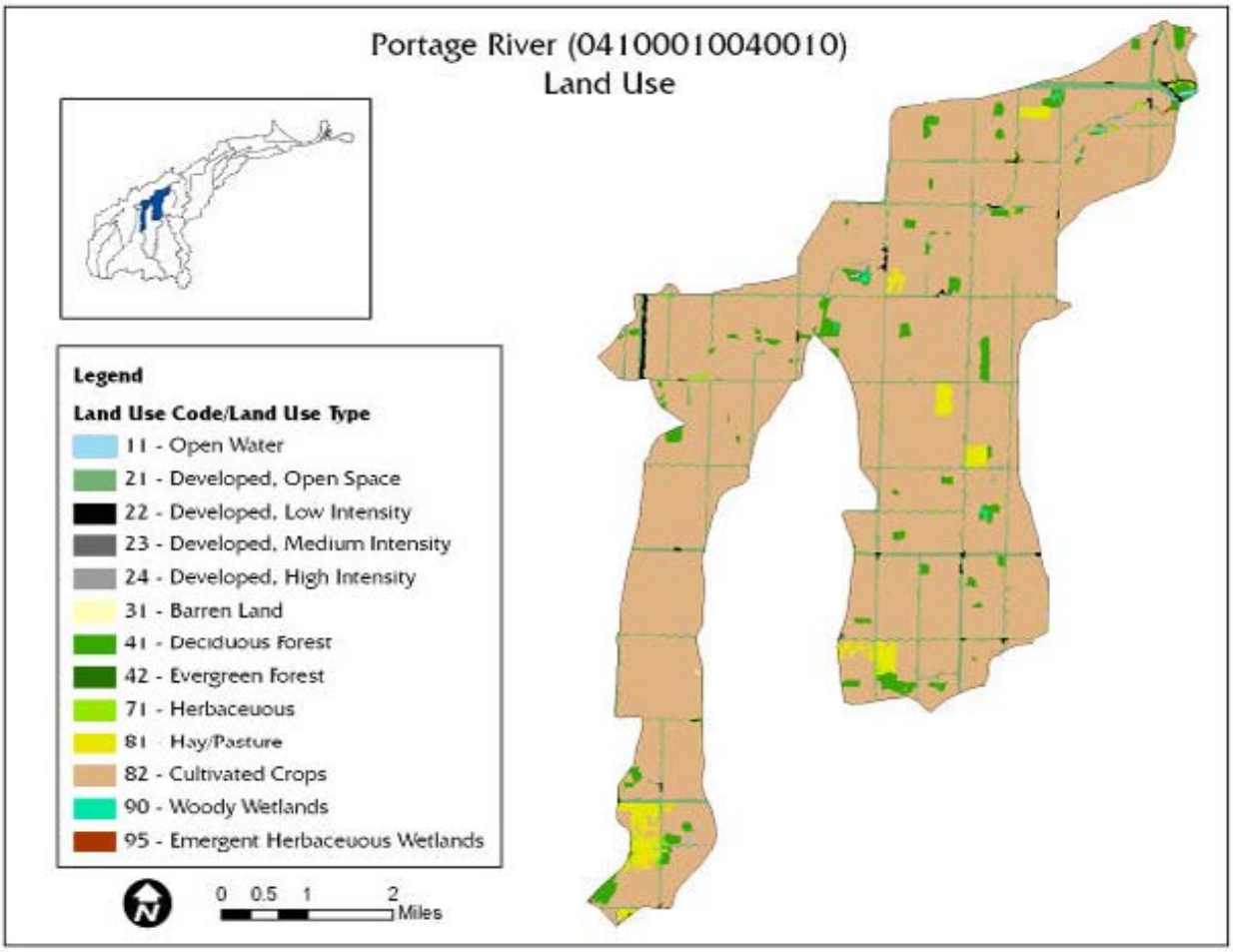
Geology

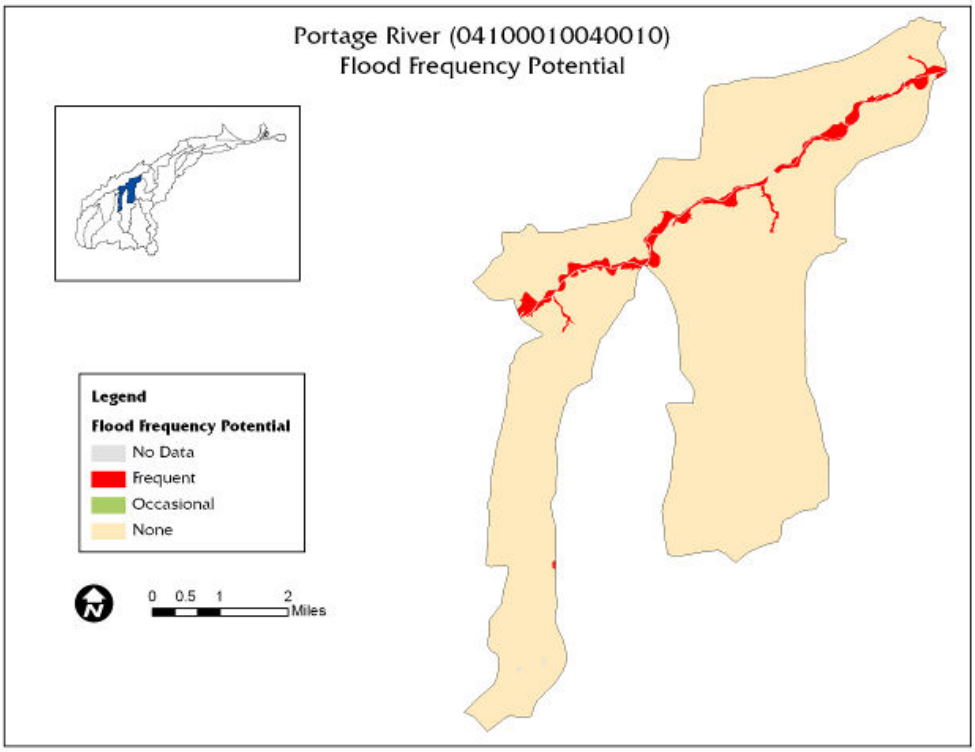
Wood County is located in the generally flat-lying Eastern Lake Plains Section of the Central Lowlands Physiographic Province (Fenneman, 1938). The county is covered by a variable thickness of glacial till, lacustrine deposits and outwash. These unconsolidated glacial deposits are underlain by a relatively flat-lying sequence of Paleozoic sedimentary rocks consisting primarily of dolomite from the Silurian and Devonian Systems (ODNR, 1994).

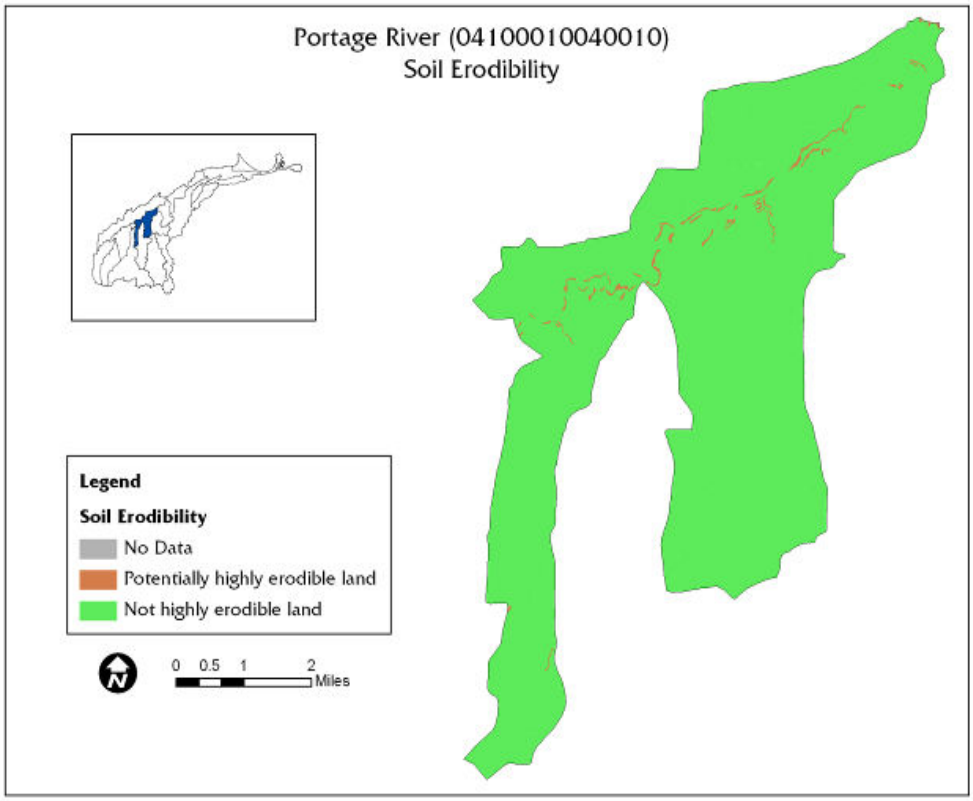
Soils

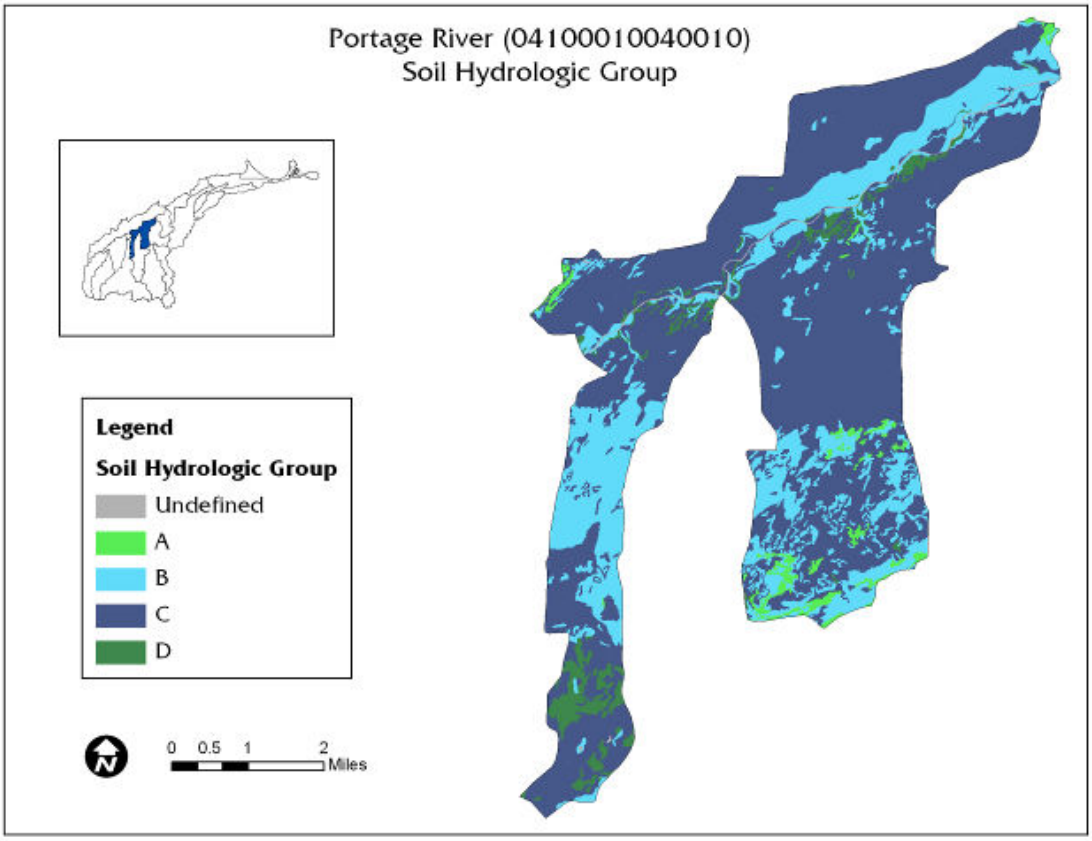
The predominant soil in the Middle Branch HUC14 04100010 040-010 is Hoytville clay loam, 0 to 1 percent slopes (HgA) that covers 4,024 hectares and the second dominant soil association is Mermill-Aurand complex, 0 to 1 percent slopes (MfA) that covers 736 hectares of this subwatershed. The Hoytville Association is a very poorly drained, dark colored soils in finely grained gritty till on broad flats. This association is a broad, flat expanse of dark colored soils and small, slightly higher areas of lighter colored soils. Hoytville soils comprise 80% of the soil in Wood County. The nearly level, very poorly drained, dark-colored Hoytville soils make up about 80 percent of this association. These soils developed in glacial till. They are associated with the nearly level, very poorly drained, dark-colored Mermill soils, which developed in sandy material underlain by clay. Both soils are deep and are highly productive. Small areas of Nappanee, St. Clair, Digby and Haskins soils also occur in this association.

Major Soil Groups		
040-010		
Hoytville	Sum Acres	9,944
	Percentage	58.98%
Mermill	Sum Acres	2,154
	Percentage	12.77%
Seward	Sum Acres	740
	Percentage	4.39%
Rimer	Sum Acres	731
	Percentage	4.34%
Nappanee	Sum Acres	640
	Percentage	3.80%
Colwood	Sum Acres	490
	Percentage	2.91%
Wauseon	Sum Acres	375
	Percentage	2.23%
Ottokee	Sum Acres	319
	Percentage	1.89%


Portage River (04100010040010)
Land Use
Legend
Land Use Code/Land Use Type
11 - Open Water
21 - Developed, Open Space
22 - Developed, Low Intensity
23 - Developed, Medium Intensity
24 - Developed, High Intensity
31 - Barren Land
41 - Deciduous Forest
42 - Evergreen Forest
71 - Herbaceuous
81 - Hay/Pasture
82 - Cultivated Crops
90 - Woody Wetlands
95 - Emergent Herbaceuous Wetlands
0 0.5 1 2
Miles


Portage River (04100010040010)
Flood Frequency Potential
Legend
Flood frequency Potential
No Data
Frequent
Occasional
None
0 0.5 1 2
Miles


Portage River (04100010040010)
Soil Erodibility
Legend
Soil Erodibility
No Data
Potentially highly erodible land
Not highly erodible land
0 0.5 1 2
Miles



The Soil Hydrologic Group map indicates the *Hydrologic soil groups* based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms (Wood County Soil Survey, March 2005). The following soil group descriptions are directly from the Wood County Soil Survey, page 241.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

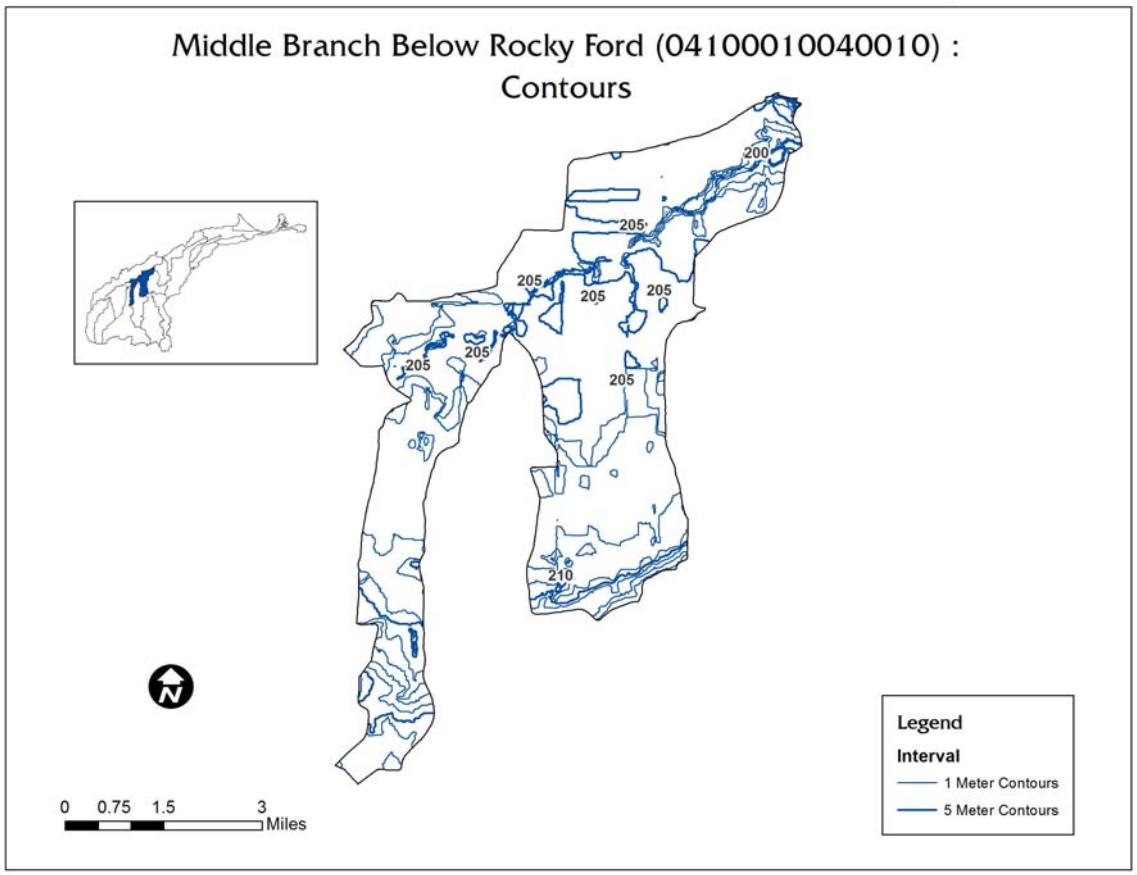
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately course texture. These soils have a moderate rate of water transmission.

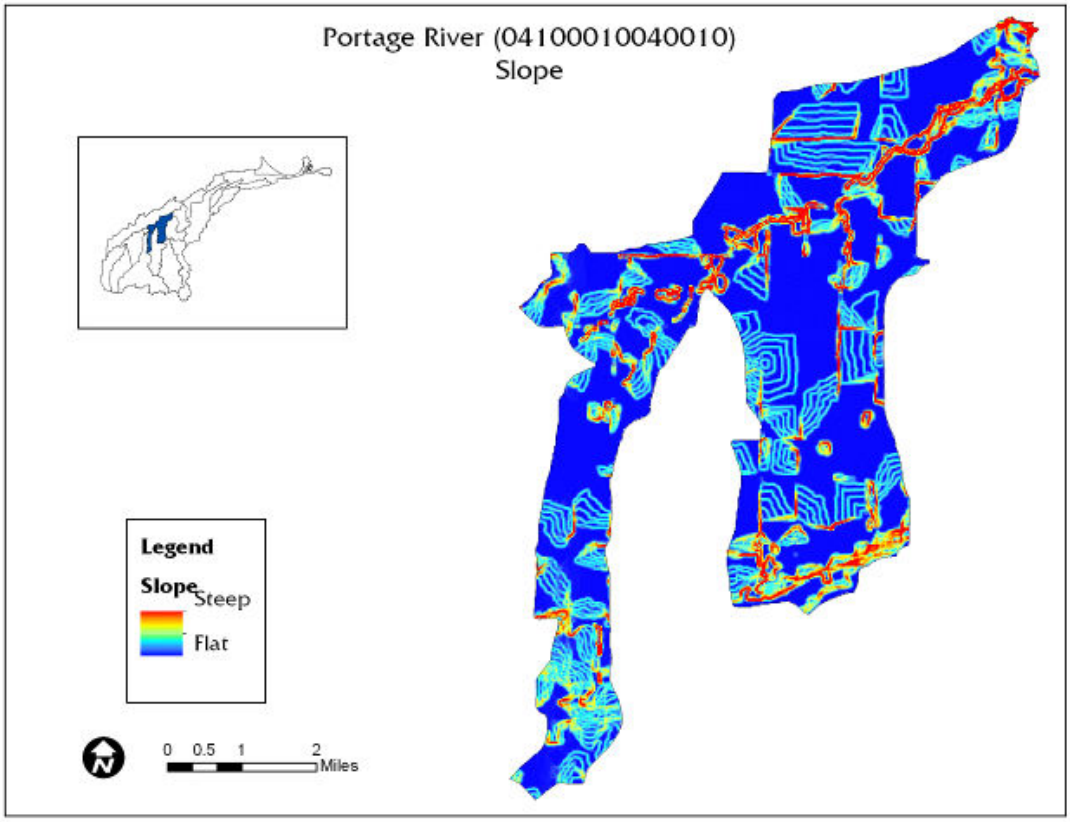
Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

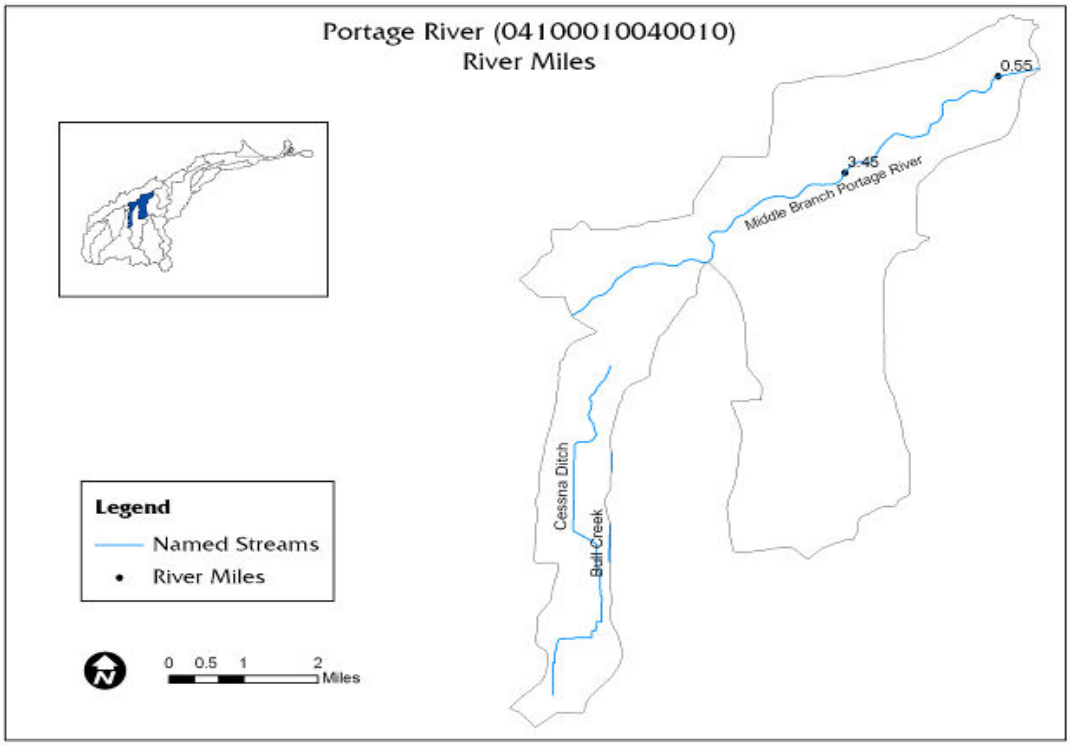
Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table,

soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (**A/D, B/D, or C/D),** the first letter is for drained areas and the second is for undrained areas.




Portage River (04100010040010)
Slope
Legend
Slope
Steep
Flat
0 0.5 1 2
Miles


Portage River (04100010040010)
River Miles
0.55
3.45
Middle Branch Portage River
Cessna Ditch
Bull Creek
Legend
Named Streams
River Miles
0 0.5 1 2
Miles

Rare, Threatened, Endangered Species

The Full Attainment status in this segment of the Middle Branch Portage River provides a habitat environment for eight difference species of fresh water mussels, four species of rare plants and habitat for the (threatened/endangered) Western Banded Killifish. The Western Branded Killifish is the host fish for some fresh water mussel species.

Rare, Threatened, Endangered Species			
Common Name	***Scientific Name***	**Last Observed**	**State Status**
Bald Eagle	*Haliaeetus leucocephalus*	2010	T
Bushy Horseweed	*Conyza ramosissima*	1997-10-09	P
Canada Plum	*Prunus nigra*	1958-05	E
Common Prickly Pear	*Opuntia humifusa*	2008-05-27	P
Handsome Sedge	*Carex formosa*	1958-06-10	X
Rough Pennyroyal	*Hedeoma hispida*	1997-10-09	P
Western Banded Killifish	*Fundulus diaphanus menona*	1997-09-25	E
Western Banded Killifish	*Fundulus diaphanus menona*	1997-09-23	E
Western Banded Killifish	*Fundulus diaphanus menona*	1997-09-16	E
Western Rock-jasmine	*Androsace occidentalis*	2008-05-27	T

T=Threatened, P=Potentially Threatened, E=Endangered, X=Presumed Extirpated, SC=Species of Concern

Mussel Species

Stream River Miles	Common Mussel Name	*Scientific Name*	Observed	Status
3.45	Wabash Pigtoe Fat Mucket Giant Floater Creeper Deertoe	*Fusconaia flava* *Lampsilis radiate luteola* *Pyganodon grandis* *Strophitus undulates* *Truncilla truncata (SC)*	2008 2008 2008 2008 2008	 SC
0.55	Cylindrical Papershell Wabash Pigtoe Fat Mucket White Heelsplitter Fragile Papershell Giant Floater Creeper Deertoe	*Anodontoides ferrussacianus* *Fusconaia flava* *Lampsilis radiate luteola* *Lasmigona complanata* *Leptodea fragilis* *Pyganodon grandis* *Strophitus undulates* *Truncilla truncata (SC)*	2008 2008 2008 2008 2008 2008 2008 2008	 SC

Water Resources

Surface Water

"The **Ohio Integrated Water Quality Monitoring and Assessment Report** indicates the general condition of Ohio's waters and identifies waters that are not meeting water quality goals. The report satisfies the Clean Water Act requirements for both Section 305(b) water quality reports and Section 303(d) lists of impaired waters." The Ohio 2010 Integrated Report can be located at the Ohio EPA webpage at: http://www.epa.state.oh.us/dsw/tmdl/OhioIntegratedReport.aspx

The Ohio 2010 Integrated Report website offers downloads of data and individual chapters. Individual river information on the health of water quality in Ohio, as well as Lake Erie near shore water standards can be obtained for human health use, aquatic life (fish and aquatic insects), chemical concerns for drinking water and recreation uses such as swimming and boating in our state's water.

If water quality standards are not met according to indicators set for that water body, the water quality is then determined to be ***impaired***. The goal is to identify the cause and source of the pollutant(s) which impair(s) that water and to restore it to ***attainment*** status. If the water quality is healthy (full attainment) then methods are employed to protect the healthy water from any possible future contaminates.

The Portage River in this HUC is designated use for **warm-water habitat** (WWH) **aquatic use**. The **Recreation Use** assessment is Class B. That determines the acceptable E. Coli colony numbers as shown below in a summary table taken from the Ohio 2010 Integrated Report, Section F: Evaluating Beneficial Use: Recreation, p. F-1.

Summary of the recreation use assessment methods.		
Bathing Waters		
Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method Summary
E. coli	Seasonal geometric mean *E. coli* content* based on samples from the recreation season within a calendar year is 126 cfu/100 ml; single sample maximum is 235 cfu/100 ml.	Applied to the three Lake Erie shoreline assessment units, exceedence of the geometric mean bathing water criterion or an exceedence of the single sample maximum for more than 10% of the recreation season is considered an impairment of the bathing water use.
Primary Contact and Secondary Contact		
Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method Summary
E. coli	Seasonal geometric mean *E. coli* content* based on samples from the recreation season within a calendar year is: **Primary Contact Waters** Class A: 126 cfu/100 ml Class B: 161 cfu/100 ml	Applied to streams and inland lakes. Data from a recreation season are assessed on a site-by-site basis and compared to the applicable geometric mean *E. coli* criterion whenever more than one sample result is available for a watershed assessment unit. Assessment units are considered to be in full attainment if all sites assessed within the assessment unit meet the applicable

Summary of the recreation use assessment methods.		
	Class C: 206 cfu/100 ml **Secondary Contact Waters** 1030 cfu/100 ml	geometric mean criterion and in non-attainment if one or more sites assessed within the assessment unit exceed the applicable geometric mean criterion.

*** *E. coli* concentrations are expressed in colony forming units (cfu) per 100 milliliters (ml)**

All E. coli values are expressed as colony forming units (CFU) per 100 ml of water. Two sample sites were selected in this HUC by the Ohio EPA during the 2006-2008 *Biological and Water Quality Study of the Portage River Basin,* March 2010.

HUC 8 – 04100010 (Portage River)									
HUC 10 – 04100010-02 (South Branch Portage River - Middle Branch Portage River)									
HUC 12 – 04100010-02-05 (Cessna Ditch- Middle Branch Portage River)									
HUC 14 – 04100010-040-010 (Middle Branch Portage River below Rocky Ford Creek to above South Branch Portage River (except Bull Creek)									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
19	2008	S01K08	M. Br. Portage R. @ Bloomdale Rd.	3.45	216.0	WWH	Full	None listed	None listed
20	2008	S99Q04	M. Br. Portage R. near New Rochester @ Caskie Rd.	0.50	224.0	WWH	Full	None listed	None listed

Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010.

Recreational Use Attainment						
Location	RM	Rec Use PCR Class	Number of Samples	E. coli Geometric **Mean <161** and Single Sample Maximum ≤ 523	Attainment Status	Sources of Bacteria
Middle Br. Portage R. @ Bloomdale Rd.	3.45	B	5	118 mean 340 max	FULL	-
Middle Br. Portage R. @ Caskie Rd.	0.55	B	7	181 mean 20000 max	NON	HSTS; Agriculture

Aquatic Life Use Assessment				
Middle Br. Portage R. @ Bloomdale Rd.	3.45	216	WWH	Full
Middle Br. Portage R. @ Caskie Rd.	0.55	224	WWH	Full

Macro-invertebrate Communities										
Stream RM	**Dr. Ar. (sq. mi.)**	**Data Codes**	**Qual. Taxa**	**EPT QI./Total**	**Sensitive Taxa QI./Total**	**Density QI./Qt.**	**CW Taxa**	**Predominant Organisms on the Natural Substrates With Tolerance Category(ies)**	**ICI[a]**	**Narrative Evaluation**
3.45	216	15	60	17/21	26/30	L-M/520	0	Riffle beetles (F), heptageniid mayflies (MI), midges (MI,F)	48	-
0.55	224	15	71	25/26	30/34	M-H/644	0	Hydropsychid caddisflies (F,MI), baetid mayflies (F), flatworms (F)	44	-

Source: Ohio EPA, 2008

Public Drinking Water Supply Assessment				
HUC	**Reporting Category**	**Cause of Impairment**	**Nitrate Watch List**	**Pesticide Watch List**
Middle Branch Portage River below Rocky Ford Creek to above South Branch Portage River 04100010 040 010	NA	None	No	No

Fish Tissue Assessment			
HUC	**Reporting Category**	**Causes of Impairment**	**PCB Concentration**
Middle Branch Portage River below Rocky Ford Creek to above South Branch Portage River 04100010 040 010	3i	None	

Water Quality Monitoring Results: Ohio EPA 1994 and 2008						
River Mile	**Date**	**IBI**	**ICI**	**MIwb**	**QHEI**	**STATUS**
3.45	*2008*	*44*	*48*	*9.1*	*37.5*	*FULL*
0.55	*2008*	*42*	*44*	*8.2*	*53.5*	*FULL*
The above fish community indices are from samples collected in the Portage River study area in 1994, 1985 and 1983. MIwb and IBI scores are Mean scores and compared to Ecoregional Biocriteria for the HELP.						
	2008					

a - River Mile (RM) represents the Point of Record (POR) for the station, not the actual sampling RM.
b - MIwb is not applicable to headwater stream with drainage areas ≤20 mi^2.
c - A narrative evaluation of the qualitative sample based on attributes such as EPT taxa richness, number of sensitive taxa, and community composition was used when quantitative data was not available or considered unreliable. VP=Very Poor, P=Poor, LF=Low Fair, F=Fair, MG=Marginally Good, G=Good, VG=Very Good, E=Exceptional
d - Attainment is given for the proposed status when a change is recommended. Aquatic life use in superscript.
ns - Nonsignificant departure from biocriteria (≤4 IBI or ICI units, or ≤0.5 MIwb units).
* - Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.
Italic: 2008 TMDL scores in review.

General narrative ranges assigned to QHEI scores.				
Narrative Rating		QHEI Range		
		Headwaters (≤ sq mi)	Larger Streams	Lacustuary
Excellent		≤ 70	≤ 75	≤ 80
Good		55 to 69	60 to 74	60 to 80
Fair		43 to 54	45 to 59	45 to 59
Poor		30 to 42	30 to 44	30 to 44
Very Poor		<30	<30	<30

Biological Criteria Benchmarks

Biological Criteria					**Lacustuary Benchmarks[1]**				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
IBI-Headwaters	50	28	20	18	N/A	N/A	N/A	N/A	N/A
IBI-Wading	50	32	22	18	N/A	N/A	N/A	N/A	N/A
IBI-Boat	48	34	20	16	50	42	31	17	<17
MIwb-Wading	9.4	7.3	5.6	4.5	N/A	N/A	N/A	NA	N/A
MIwb-Boat	9.6	8.6	5.7	5.0	10	8.6	5.6	2.8	<2.8
ICI	46	34	22	8	52	42	25	12	<12

[1] Proposed Lacustuary scoring breakpoints. These have not yet been adopted into rule.

Ground Water

There are no municipal areas within this subwatershed that rely on groundwater for drinking water, but only individual households with private wells.

DRASTIC MAP

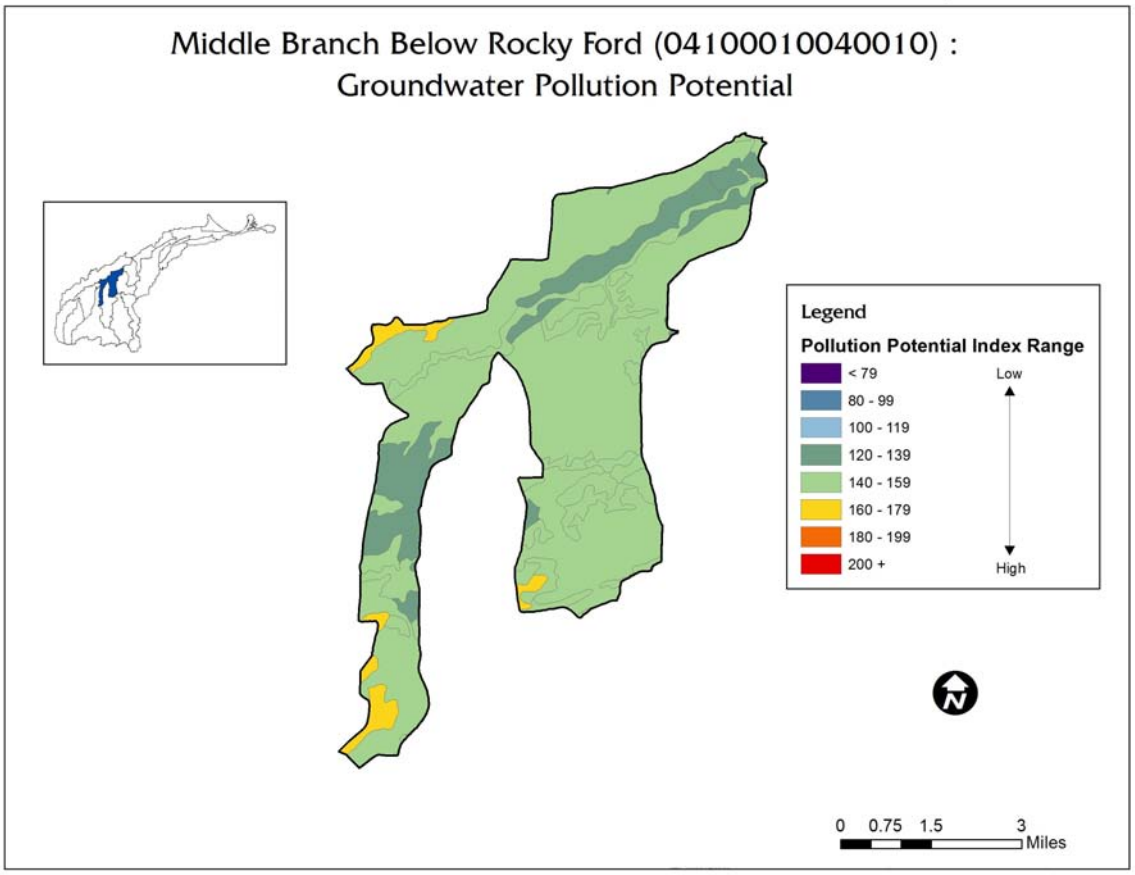
The sensitivity of the groundwater to local sources of contamination is determined and rated by **DRASTIC** maps as described below:

> Inherent within each geologic setting are the physical characteristics which effect the groundwater pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:
>
> **D** – Depth to Water
> **R** – Net Recharge
> **A** – Aquifer Media
> **S** – Soil Media
> **T** – Topography
> **I** – Impact of the Vadose Zone Media
> **C** – Conductivity (Hydraulic) of the Aquifer (ODNR, 1994)

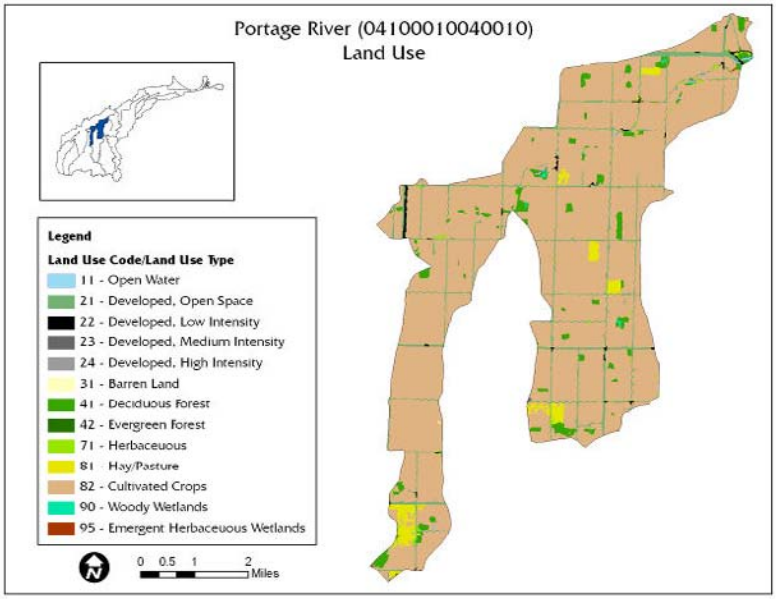
Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index, the greater the vulnerability to contamination (ODNR, 1994).

The average ground water pollution index potential for the Wood County portion of the Middle Branch watershed between Rocky Ford and the South Branch is 151 with a range of 126-169. In Hancock County, for which GIS data are not available, the range is about 120-180.

The Ohio Department of Natural Resources, Division of Water, Water Resources Section is the responsible agency to map groundwater resources throughout the state. Greater detail on DRASTIC maps for the Portage can be found in Chapter 4 of this watershed plan.



Sub-watershed (04100010-02-05)		
040-010		
Land Use	**Percent**	**Acres**
Urban	6.3%	1,051
Forest	3.3%	554
Pasture	2.2%	377
Cropland	87.9%	14,742
Other	0.3%	42
Total Acres	100%	16,766



Livestock Inventory							
HUC 4100010040010							
Type of Animal		**Hancock**	**Ottawa**	**Sandusky**	**Seneca**	**Wood**	**Estimates for HUC**
Percent of County in HUC		0.0%	0.0%	0.0%	0.0%	4.3%	
Cattle	Farms	129	89	167	264	144	**6**
	Animals	4,233	1,523	4,612	10,096	6,287	**268**
Hogs	Farms	51	15	37	62	30	**1**
	Animals	32,343	3,639	5,591	42,808	39,469	**1,682**
Horses	Farms	105	63	132	72	128	**5**
	Animals	844	444	772	463	1,004	**43**
Poultry	Farms	49	22	41	62	47	**2**
	Animals	NA	779	1,042	4,283	NA	**NA**
Sheep	Farms	32	12	41	61	21	**1**
	Animals	1,134	335	765	2,770	21	**1**
Total							16
							2,009

Source: 2007 Census of Agriculture http://www.agcensus.usda.gov/

Point Sources

Municipal

- None

Package Plants

- Edgewood Inn

Industrial

- Green Dairy

Non-Point Sources

Critical Sewage Areas:

- None

Estimates of HSTSs				
Watershed	**Housing Units without sewers**	**Est. Unsewered Population (2000)**	**Unsewered Housing Units per acre**	**Unsewered Population per acre**
04100010040010	302	834	0.018	0.049
Sources: 2000 Census data and TMACOG "208" Plan. Analysis identifies approximate number of housing units without sewers in each watershed as an estimate of number of HSTSs.				

Aquatic Life Use Impairments	
Causes	**Sources**
None listed	None listed
Source: Ohio 2010 Integrated Report, Watershed Assessment Unit Summary	

Water Supply

Public Water System	Population Served	Primary Water Source
None		

Water Quality Impairments

The OEPA Integrated Report assesses each watershed's attainment status for 1) Public Drinking Water Supply, 2) Recreation, 3) Human Health, 4) Aquatic Life, and 5) Fish Tissue. The Integrated Report identifies causes and sources of impairments where watersheds are not in attainment with water quality standards.

Background:

The Middle Branch Portage River is sectioned into several hydrologic units as related to elevation and first order streams that flow into the upstream Middle Branch before becoming the Mainstem Portage. The elevation levels within HUC 04100010-040-010 reflect the change in bedrock geology. This section of the river is subject to the largest area of flooding on the Middle Branch. Elevation here drops from the elevated height of the glacial end moraine situated in northern Hancock county and southern Wood County. The gradient is less and the result is greater ponding or flooding on the Middle Branch especially in the wide-flat area between Rocky Ford RM 8.23 and Bull Creek RM 6.10. This 2-mile

location has the widest expanse of flooding. But the entire section-length of Middle Branch 040-010 floods more than any other area of the Portage River within Wood County and all due to elevation and gravity.

The entire 8.23 river miles of 040-010 are maintained ditch petitions. Some bends in the river do remain. Nineteen oxbows (river bends) have been either detached from the river or filled. The Middle Branch was straightened within the 8.23 river mile course from New Rochester, in Freedom Township in Wood County to the confluence with Rocky Ford Creek (RM 8.23) in Portage Township just east of Interstate 75 southeast of the Village of Portage.

There are unique challenges and points of interest to this hydrological unit. Drainage ditches flow to the 040-010 Middle Branch from 8.10 miles away. The map shows the length of Cessna Ditch and many other north/south ditches draining to the Middle Branch.

Green Dairy at Bloomdale and Portage roads is a large confined animal feeding operation with drainage to the Middle Branch. Points of interest include the 1858 historical lakes that remained from the Great Black Swamp and eventually drained for agriculture.

Bowling Green State University students, in partnership with the Wood County Health Department have conducted water quality sample sites in the Portage watershed since 2001. Two test sites are located in this Middle Branch watershed within the ditch system that flows into the Middle Branch Portage River.

Problem Statement 1: (Bacteria)

The water quality of the Middle Branch subwatershed is impaired by elevated measurements of E. coli bacteria in the waterway. The Portage TMDL data collected by Ohio EPA in 2008 indicates that 1 of the HUC's 2 sampling sites is in non-attainment for E. coli. Elevated measurements of E. coli bacteria were measured at RM 0.55 at Caskie Rd. near New Rochester and State Highway 6. Of 7 samples, the mean was 181 colonies, and the maximum was 20,000. The upstream site, RM 3.45 at Bloomdale Road was in attainment for bacteria levels. The high E. coli bacteria values are cause of impairment from bacterial source contributions of failed HSTS discharging incompletely or treated to the Middle Branch.

In this HUC are an estimated 302 HSTS; by density of onsite systems, this is one of the most rural HUCs. This area includes one package plant (unpermitted), but no CSO areas, or Critical Sewage Area. HSTS priorities for this watershed should focus on the river below Bloomdale Road (RM 3.45) and tributaries entering the Middle Branch below that point.

Goal 1.1: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 1.9 million gallons of HSTS effluent annually.

Objective : Replace or upgrade 10% of watershed's HSTS or 30 systems

Goal 1.2: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 1.1 million gallons of package plant effluent annually

Objective: Upgrade 1 package plant(s). Effluent quality meets P standards

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Bacteria	1.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$450,000	County Health Dept, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 30 systems	1.9 million gallons/year sewage discharge eliminated
	1.2	♦Test package plant effluent for phosphorus ♦Set effluent standard in existing or new NPDES permit(s) ♦Enforce upgrades for phosphorus removal as needed	$3,600	Ohio EPA	2012-2017	Upgrade 1 package plant(s). Effluent quality meets effluent stds	1.1 million gallons/year effluent improved

Problem Statement 2: (Nutrients)

The Ohio EPA TMDL found both sampling sites in this HUC to meet Aquatic Life attainment standards. However, the TDL also found that the nutrient loadings from this watershed are excessive for use attainment. The Portage TMDL recommends a total phosphorus load allocation of 2.85 kg/day, requiring a nonpoint source load reduction of 1,360 lb P/year. HSTS systems should be addressed as noted above and agricultural BMPs used throughout the HUC to reduce nutrient loadings.

Goal 2.1: Meet TMDL target for phosphorus load reduction by 160 and nitrate load by 676 lb/year from HSTS.

Objective: Replace or upgrade 10% of watershed's HSTS or 30 systems.

Goal 2.2: Meet TMDL target for phosphorus load reduction by 64 and nitrate load by 309 lb/year from package plants.

Objective: Upgrade 1 package plant(s). Effluent quality meets P standards.

Goal 2.3: Meet TMDL target for phosphorus load reduction by 1,144 and nitrate load by 4,338 lb/year from agricultural practices.

Objectives:

- 1,500 acres of cover crops
- 700 acres of controlled drainage
- 700 acres of permanent hay
- 2000 LF of restored oxbows
- 5897 acres under NRCS 590/1 Nutrient Management
- 2527 acres under NRCS 590/3 Nutrient Management
- 200 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Nutrients (phosphorus and nitrate)	2.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$450,000	County Health Dept, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 30 systems	Reduce phosphorus load by 160 and nitrate load by 676 lb./year
	2.2	♦Test package plant effluent for phosphorus ♦Set effluent standard in existing or new NPDES permit(s) ♦Enforce upgrades for phosphorus removal as needed	$3,600	Ohio EPA	2012-2017	Upgrade 1 package plant(s). Effluent quality meets effluent stds	Reduce phosphorus load by 64 and nitrate load by 309 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$90,000	SWCD, NRCS, farmers	2012-2027 in phases	1,500 acres of cover crops	Reduce phosphorus load by 1083 and nitrate load by 2,160 lb./year
	2.3	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$329,700	SWCD, NRCS, farmers	2012-2027 in phases	700 acres of controlled drainage	Reduce phosphorus load by 203 and nitrate load by 542 lb./year
	2.3	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$196,000	SWCD, NRCS, farmers	2012-2027 in phases	700 acres of permanent hay	Reduce phosphorus load by 455 and nitrate load by 910 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Evaluate oxbow site(s) with county Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$547,140	Wood SWCD, Wood County Engineer, NRCS, farmers	2012-2027 in phases	2000 LF of restored oxbows	Reduce phosphorus load by 172 and nitrate load by 344 lb./year
	2.3	♦Seek cooperators for Nutrient Management NRCS 590 Level 1 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management NRCS 590 Level 1 BMPs with farmers	$117,946	SWCD, NRCS, farmers	2012-2022	5897 acres under NRCS 590/1 Nutrient Mgt	NA
	2.3	♦Seek cooperators for Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with farmers	$101,096	SWCD, NRCS, farmers	2012-2022	2527 acres under NRCS 590/3 Nutrient Mgt	NA

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize fields suited for Conservation Tillage BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Conservation Tillage BMP with farmer	$3,000	SWCD, NRCS, farmers	2012-2027 in phases	200 acres of conservation tillage	Reduce phosphorus load by 29 and nitrate load by 406 lb./year

Problem Statement #3: (Siltation/Sedimentation)

Both sampling sites in this HUC are in attainment with Aquatic Life standards. As such, the TMDL does not list any specific sedimentation impairments for this HUC. However, the HUC does have a phosphorus reduction target. Practices to meet that goal will offer the additional benefit of sediment reduction, which will protect water quality and habitat for the HUC and the Portage River on the whole.

Goal 3.1:

Reduce sedimentation impairments by decreasing sediment load by 1,089 lb/year from agricultural practices.

Objectives:

- 1,500 acres of cover crops
- 700 acres of controlled drainage
- 700 acres of permanent hay
- 2000 LF of restored oxbow
- 200 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Sedimentation	3.1	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$90,000	SWCD, NRCS, farmers	2012-2027 in phases	1,500 acres of cover crops	Reduce sediment load by 540 lb./year
	3.1	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$329,700	SWCD, NRCS, farmers	2012-2027 in phases	700 acres of controlled drainage	Reduce sediment load by 231 lb./year
	3.1	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$196,000	SWCD, NRCS, farmers	2012-2027 in phases	700 acres of permanent hay	Reduce sediment load by 231 lb./year
	3.1	♦Evaluate oxbow site(s) with county Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$547,140	Wood SWCD, Wood County Engineer, NRCS, farmers	2012-2027 in phases	2000 LF of restored oxbows	Reduce sediment load by 86 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$3,000	SWCD, NRCS, farmers	2012-2027 in phases	200 acres of conservation tillage	Reduce sediment load by 1 lb./year

Problem Statement #4: (Habitat)

Both sampling sites in this HUC are in attainment with Aquatic Life standards. As such, the TMDL does not list any specific habitat impairments for this HUC. However, the HUC does have a phosphorus reduction target, and there are cutoff oxbows in this HUC that may be amenable to restoration. Practices to meet that goal will offer the additional benefit protecting water quality and habitat for the HUC and the Portage River on the whole, and should support improved IBI, ICI, and QHEI scores.

Goal 4.1:

10500 linear feet of stream corridor restoration practices.

Objective:

- 2000 LF of restored oxbows

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	4.1	♦Evaluate oxbow site(s) with county Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$547,140	Wood SWCD, Wood County Engineer, NRCS, farmers	2012-2027 in phases	2000 LF of restored oxbows	Load reductions provided in nutrient and sediment tables

Bull Creek

04100010 040 020 (14 – digit HUC)
04100010 02 01 (New 12-digit HUC & Name: Bull Creek)

Length: 14.3 miles -- 70.73 miles of roadway ditches.

Drains: 30 square miles

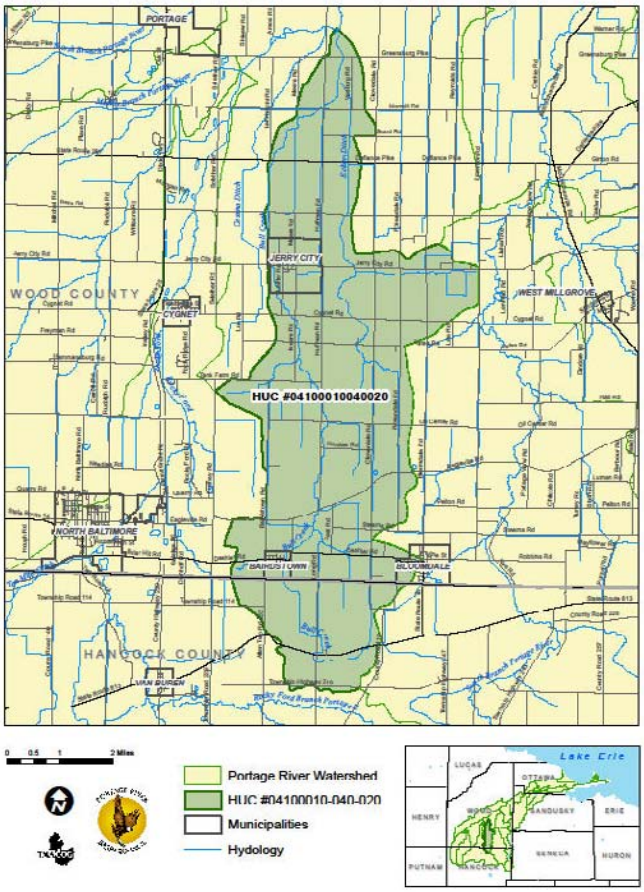
Elevation Source: 767 ft. 8.132 miles of riparian buffer present.

Elevation Mouth: 666 ft.
Average fall (ft./mile) is 7
Ohio Topographic Quadrangle 7.5 minute (1:24,000):

- Jerry City
- North Baltimore,
- Bloomdale

Urban areas:
Village of Jerry City (2008 pop. 469)
Village of Bairdstown (pop. 125)
Village of Bloomdale (pop. 709)

HUC #04100010-040-020



Geology

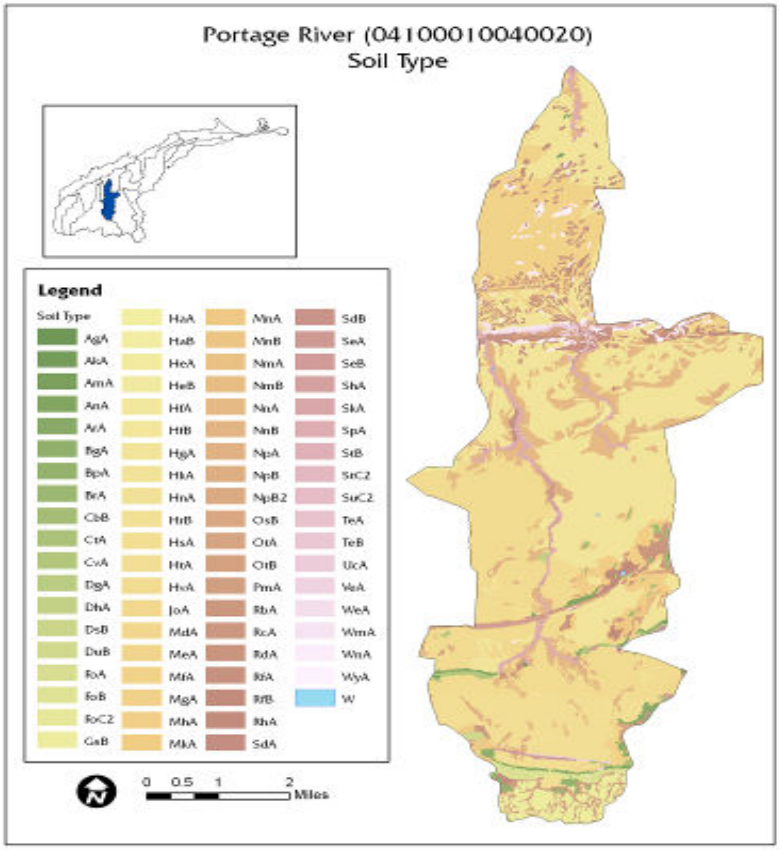
Hancock and Wood Counties have nearly level to undulating topography, entirely within the HELP ecoregion. The soils are formed from till, lacustrine modified till, outwash sand and gravel associated with Wisconsin Glaciations and from recent alleviation.

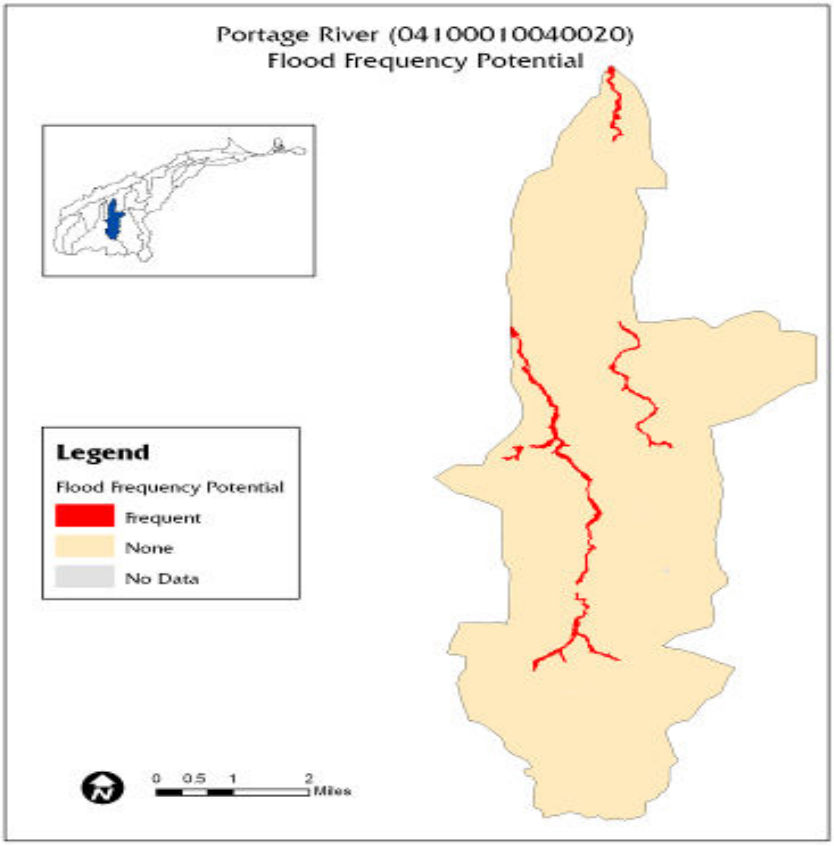
Soils

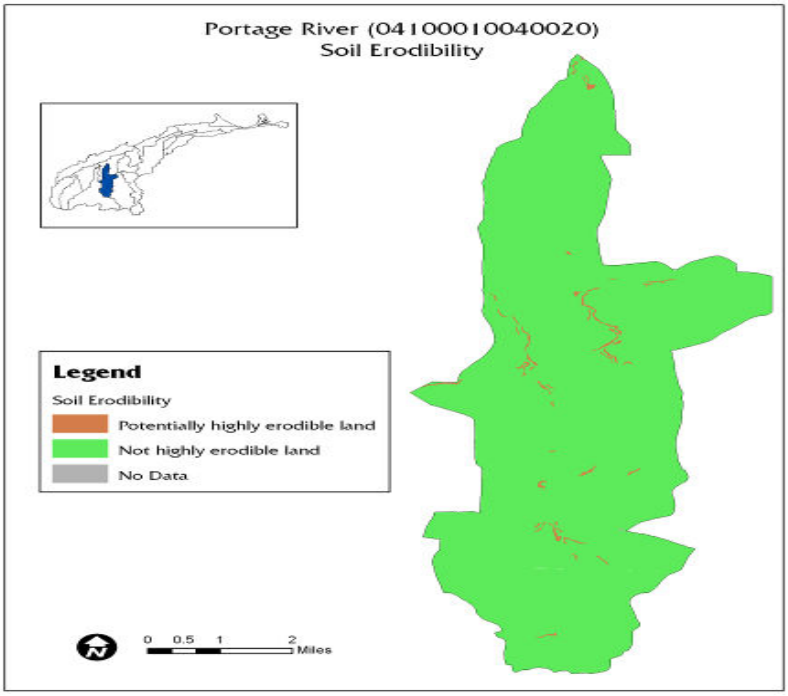
The predominant soil in the Bull Creek HUC14 04100010 040 020 is Hoytville clay loam, 0 to 1 percent slopes (HgA) 2,447 hectares of coverage. The second dominant soil type is Hoytville silty clay, 0 to 1 percent slopes (HvA) of 1,439 hectares of coverage. Both soil associations are very poorly drained soils, but if drained, are prime farmland soils. The northwest area of Bull Creek located in Portage Township, Sections 21 and 28 formed a historical lake last seen one-hundred and fifty years ago on 1858 Wood county

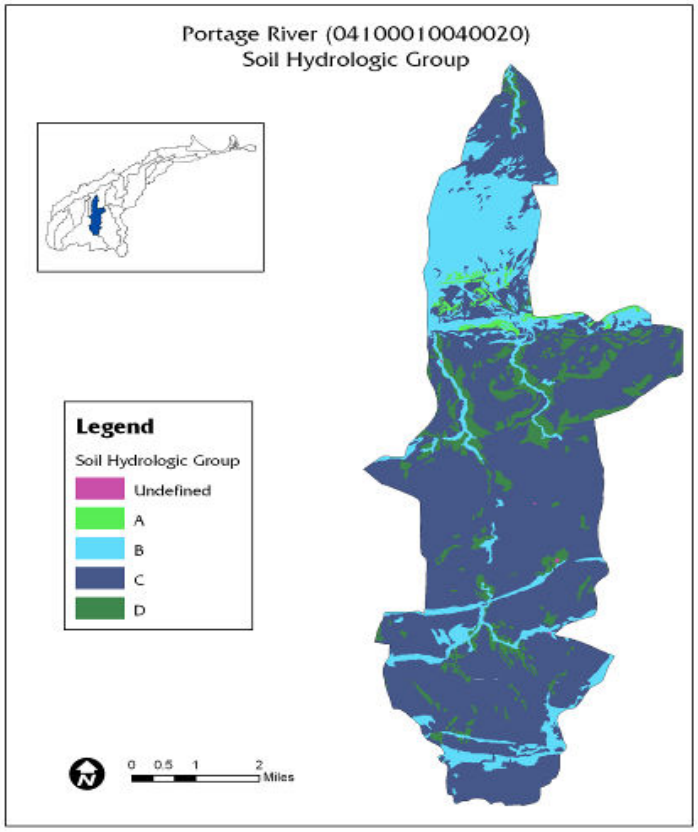
historical maps. The dominant soil for this historical location is unique to the Bull Creek subwatershed is Mermill-Aurand complex (MfA), 0 to 1 percent slopes of very poorly drained, fine-loamy soil. Also considered prime farmland if drained and not highly erodible land.

Major Soil Groups		
040-020		
Hoytville	Sum Acres	9,601
	Percentage	58.75%
Mermill	Sum Acres	2,012
	Percentage	12.31%
Nappanee	Sum Acres	1,669
	Percentage	10.22%
Millsdale	Sum Acres	460
	Percentage	2.82%
Rimer	Sum Acres	418
	Percentage	2.56%
Sloan	Sum Acres	358
	Percentage	2.19%
Wauseon	Sum Acres	291
	Percentage	1.78%
Seward	Sum Acres	290
	Percentage	1.78%


Portage River (04100010040020)
Soil Type
Legend
Soil Type
AgA
AkA
AmA
AnA
AvA
BgA
BpA
BrA
CbB
CtA
CvA
DgA
DhA
DsB
DuB
FoA
FoB
FoC2
GaB
HaA
HaB
HcA
HeB
HfA
HfB
HgA
HkA
HnA
HrB
HsA
HtA
HvA
JoA
MdA
MeA
MfA
MgA
MhA
MkA
MnA
MnB
NmA
NmB
NnA
NnB
NpA
NpB
NpB2
OsB
OtA
OtB
PmA
RbA
RcA
RdA
RfA
RfB
RhA
SdA
SdB
SeA
SeB
ShA
SkA
SpA
StB
StC2
SuC2
TeA
TeB
UcA
VeA
WeA
WmA
WnA
WyA
W
0 0.5 1 2
Miles


Portage River (04100010040020)
Flood Frequency Potential
Legend
Flood Frequency Potential
Frequent
None
No Data
0 0.5 1 2
Miles


Portage River (04100010040020)
Soil Erodibility
Legend
Soil Erodibility
Potentially highly erodible land
Not highly erodible land
No Data
0 0.5 1 2
Miles



The Soil Hydrologic Group map indicates the *Hydrologic soil groups* based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms (Wood County Soil Survey, March 2005). The following soil group descriptions are directly from the Wood County Soil Survey, page 241.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

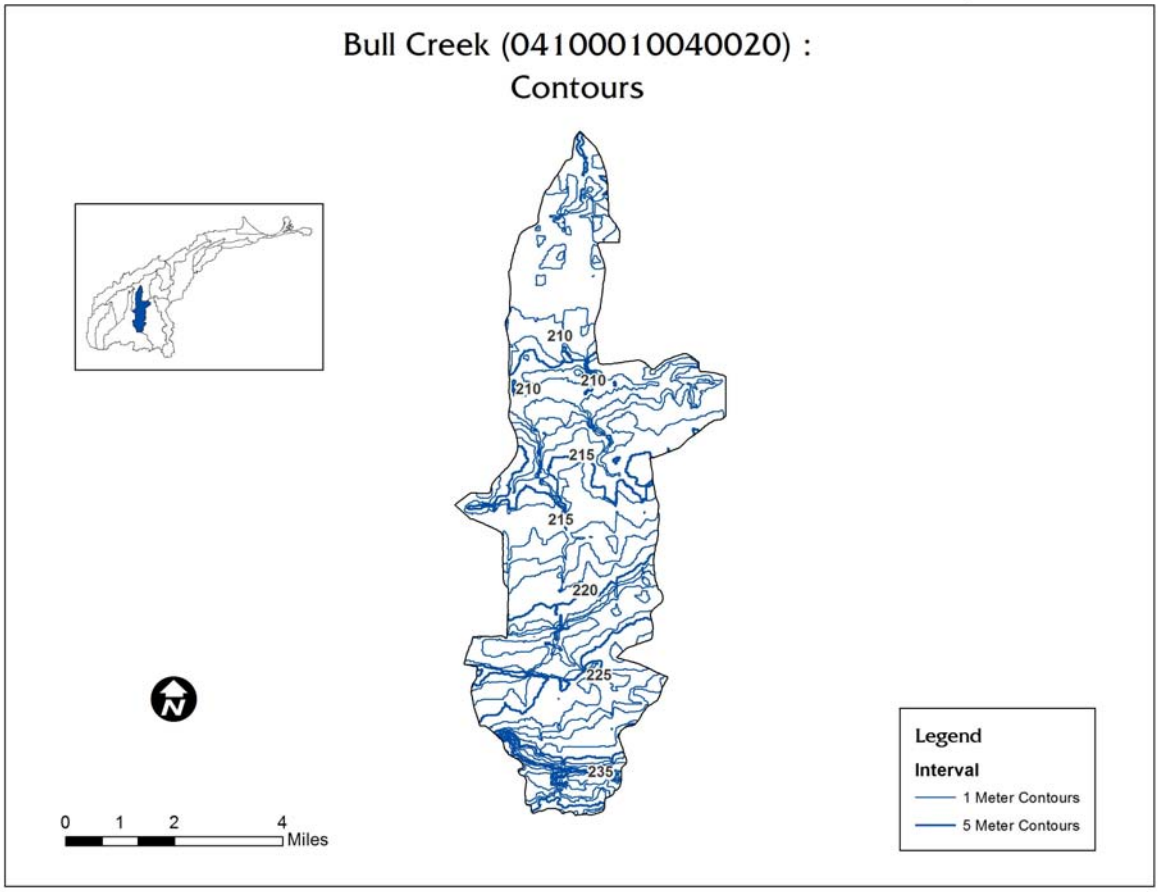
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately course texture. These soils have a moderate rate of water transmission.

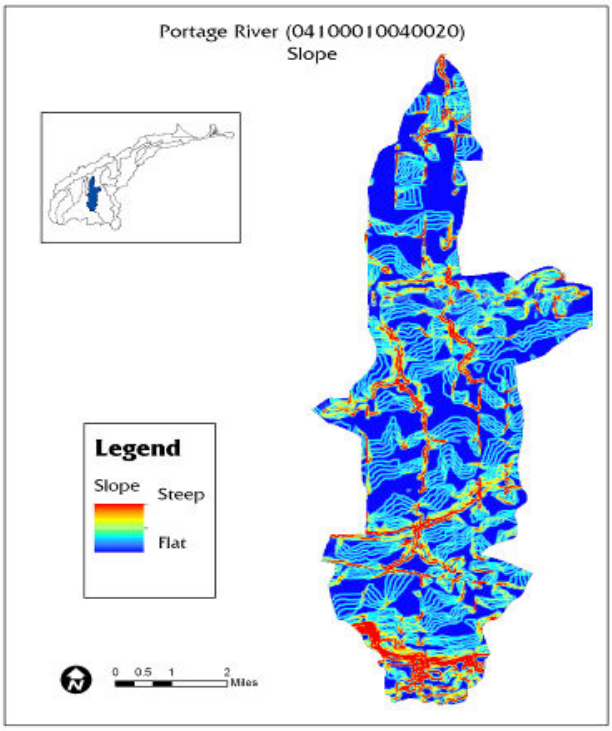
Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of

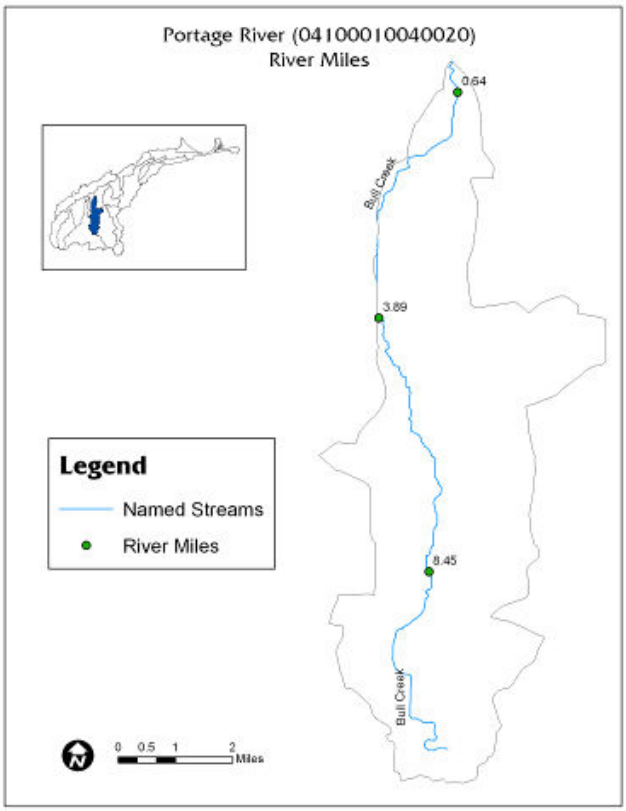
moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (**A/D, B/D, or C/D),** the first letter is for drained areas and the second is for undrained areas.




Portage River (04100010040020)
Slope
Legend
Slope
Steep
Flat
0 0.5 1 2
Miles


Portage River (04100010040020)
River Miles
0.64
Bull Creek
3.89
8.45
Bull Creek
Legend
Named Streams
River Miles
0 0.5 1 2
Miles

Rare, Threatened, Endangered Species

Located within the Bull Creek HUC14 04100010 040 020 are several threatened and endangered species which seek the habitat and water quality of Bull Creek subwatershed. The Western Banded Killifish (Fundulus diaphanous menona), an endangered fish species is found in the downstream reaches of Bull Creek along with six different species of fresh water mussels. Mussel species found in Bull Creek include; Cylindrical Papershell, Wabash Pigtoe, Fat Mucket, White Heelsplitter, Giant Floater and Lilliput. Two threatened plant species in Bull Creek are the Bushy Horseweed (Conyza ramosissina) plant last seen in 1997 and Rock Elm (Ulmus thomasil) plant, last observed in the year 2006.

Rare, Threatened, Endangered Species			
Common Name	***Scientific Name***	**Last Observed**	**State Status**
Bushy Horseweed	*Conyza ramosissima*	1997-08-13	P
Rock Elm	*Ulmus thomasii*	2006-12-20	P
Western Banded Killifish	*Fundulus diaphanus menona*	1997-09-23	E
Western Banded Killifish	*Fundulus diaphanus menona*	2002-05-07	E

T=Threatened, P=Potentially Threatened, E=Endangered, X=Presumed Extirpated, SC=Species of Concern

Mussel Species

Stream River Miles	**Common Mussel Name**	***Scientific Name***	**Observed**	**Status**
8.45	None			
3.89	None			
0.64	Cylindrical Papershell Wabash Pigtoe Fat Mucket White Heelsplitter Giant Floater Lilliput	*Anodontoides ferrussacianus* *Fusconaia flava* *Lampsilis radiata luteola* *Lasmigona complanata* *Pyganodon grandis* *Toxolasma parvum*	2008	

SC=Species of Concern Ohio EPA

Water Resources

Surface Water

"The **Ohio Integrated Water Quality Monitoring and Assessment Report** indicate the general condition of Ohio's waters and identifies waters that are not meeting water quality goals. The report satisfies the Clean Water Act requirements for both Section 305(b) water quality reports and Section 303(d) lists of impaired waters." The Ohio 2010

Integrated Report can be located at the Ohio EPA webpage at:
http://www.epa.state.oh.us/dsw/tmdl/OhioIntegratedReport.aspx

The Ohio 2010 Integrated Report website offers downloads of data and individual chapters. Individual river information on the health of water quality in Ohio, as well as Lake Erie near shore water standards can be obtained for human health use, aquatic life (fish and aquatic insects), chemical concerns for drinking water and recreation uses such as swimming and boating in our state's water.

If water quality standards are not met according to indicators set for that water body, the water quality is then determined to be ***impaired***. The goal is to identify the cause and source of the pollutant(s) which impair(s) that water and to restore it to ***attainment*** status. If the water quality is healthy (full attainment) then methods are employed to protect the healthy water from any possible future contaminates.

Bull Creek is designated use for **warm-water habitat** (WWH) **aquatic use**. The **Recreation Use** assessment is Class B. That determines the acceptable E. Coli colony numbers as shown below in a summary table taken from the Ohio 2010 Integrated Report, Section F: Evaluating Beneficial Use: Recreation, p. F-1.

Summary of the recreation use assessment methods.		
Bathing Waters		
Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method Summary
E. coli	Seasonal geometric mean *E. coli* content* based on samples from the recreation season within a calendar year is 126 cfu/100 ml; single sample maximum is 235 cfu/100 ml.	Applied to the three Lake Erie shoreline assessment units, exceedence of the geometric mean bathing water criterion or an exceedence of the single sample maximum for more than 10% of the recreation season is considered an impairment of the bathing water use.
Primary Contact and Secondary Contact		
Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method Summary
E. coli	Seasonal geometric mean *E. coli* content* based on samples from the recreation season within a calendar year is: **Primary Contact Waters** Class A: 126 cfu/100 ml Class B: 161 cfu/100 ml	Applied to streams and inland lakes. Data from a recreation season are assessed on a site-by-site basis and compared to the applicable geometric mean *E. coli* criterion whenever more than one sample result is available for a watershed assessment unit. Assessment units are considered to be in full attainment if all

Summary of the recreation use assessment methods.		
Bathing Waters		
	Class C: 206 cfu/100 ml **Secondary Contact Waters** 1030 cfu/100 ml	sites assessed within the assessment unit meet the applicable geometric mean criterion and in non-attainment if one or more sites assessed within the assessment unit exceed the applicable geometric mean criterion.

*** *E. coli* concentrations are expressed in colony forming units (cfu) per 100 milliliters (ml)**

HUC 8 – 04100010 (Portage River)									
HUC 10 – 04100010-02 (South Branch Portage River - Middle Branch Portage River)									
HUC 12 – 04100010 02 01 (Bull Creek)									
HUC 14 - 04100010-040-020 Bull Creek									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
62	2008	S01K10	Bull Creek Ne Of Bairdstown @ Eagleville Rd	8.45	8.3	WWH	Partial	Direct habitat alterations, Siltation	Non-irrigated crop production, Channelization
63	2008	S99Q05	Bull Creek @ Jerry City Rd.	3.90	3.90	WWH	Full	None listed	None listed
64	2008	S01S45	Bull Creek Near Mouth @ Greensburg Pike	0.64	29.8	WWH	Full	None listed	None listed

Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010.

Recreational Use Attainment

Location	RM	Recreation Use for Primary Contact Recreation waters (PCR) Class	Number of Samples	E. coli Geometric **Mean <161** and Single Sample Maximum ≤ 523 Value For Class B (recreation use intensity)	Attainment Status	Sources of Bacteria
Bull Creek Ne Of Bairdstown @ Eagleville Rd	8.45	B	5	231 mean 470 max	NON	HSTS; Agric.
Bull Creek @ Jerry City Rd.	3.90	B	5	834 mean 5200 max	NON	Package Plant ; HSTS; Jerry City
Bull Creek Near Mouth @ Greensburg Pike	0.64	B	5	410 mean 530 max	NON	HSTS; Agric.

Aquatic Life Use Assessment

Location	RM	Drainage Area	Aquatic Life Use	Attainment

				Status
Bull Creek Ne Of Bairdstown @ Eagleville Rd	8.45	8.3	WWH	Partial
Bull Creek @ Jerry City Rd.	3.90	3.90	WWH	Full
Bull Creek Near Mouth @ Greensburg Pike	0.64	29.8	WWH	Full

Macro-invertebrate Communities

Stream RM	Dr. Ar. (sq. mi.)	Data Codes	Qual. Taxa	EPT QI./Total	Sensitive Taxa QI./Total	Density QI./Qt.	CW Taxa	Predominant Organisms on the Natural Substrates With Tolerance Category(ies)	ICI[a]	Narrative Evaluation
8.45	8.3	-	37	8	8	M	0	Sowbugs (F), flatworms (F), midges (T,F,MI)	-	Fair
3.90	3.90	-	52	15	12	M	0	Caddisflies (F), mayflies (F,MI), midges (F,MI)	-	Good
0.64	29.8	-	62	16	17	L	0	Water boatmen (F), beetles (F), flatworms (F)	-	Good

Source: Ohio EPA, 2008

Public Drinking Water Supply Assessment

HUC	Reporting Category	Cause of Impairment	Nitrate Watch List	Pesticide Watch List
Bull Creek 04100010-040-020	NA	None	No	No

Fish Tissue Assessment

HUC	Reporting Category	Causes of Impairment	PCB Concentration
Bull Creek 04100010-040-020	3	None	

Water Quality Monitoring Results: Ohio EPA 1994 and 2008						
River Mile	**Date**	**IBI**	**ICI**	**MIwb**	**QHEI**	**STATUS**
0.6/0.6	1994	24*	MG	7.5	24.5	NON
The above fish community indices are from samples collected in the Portage River study area in 1994, 1985 and 1983. MIwb and IBI scores are Mean scores and compared to Ecoregional Biocriteria for the HELP.						
8.45	*2008*	*34*	*F**	*N/A*	*43.5*	*PARTIAL*
3.89	*2008*	*42*	*G*	*N/A*	*56.5*	*FULL*
0.64	*2008*	*38*	*G*	*9.1*	*40.5*	*FULL*

a - River Mile (RM) represents the Point of Record (POR) for the station, not the actual sampling RM.
b - MIwb is not applicable to headwater stream with drainage areas ≤20 mi^2.
c - A narrative evaluation of the qualitative sample based on attributes such as EPT taxa richness, number of sensitive taxa, and community composition was used when quantitative data was not available or considered unreliable. VP=Very Poor, P=Poor, LF=Low Fair, F=Fair, MG=Marginally Good, G=Good, VG=Very Good, E=Exceptional
d - Attainment is given for the proposed status when a change is recommended. Aquatic life use in superscript.
ns - Nonsignificant departure from biocriteria (≤4 IBI or ICI units, or ≤0.5 MIwb units).
* - Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.
Italic: 2008 TMDL scores in review.

General narrative ranges assigned to QHEI scores.				
Narrative Rating		QHEI Range		
		Headwaters (≤ sq. mi)	Larger Streams	Lacustuary
Excellent		≤ 70	≤ 75	≤ 80
Good		55 to 69	60 to 74	60 to 80
Fair		43 to 54	45 to 59	45 to 59
Poor		30 to 42	30 to 44	30 to 44
Very Poor		<30	<30	<30

Biological Criteria Benchmarks

Biological Criteria					**Lacustuary Benchmarks[1]**				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
IBI-Headwaters	50	28	20	18	N/A	N/A	N/A	N/A	N/A
IBI-Wading	50	32	22	18	N/A	N/A	N/A	N/A	N/A
IBI-Boat	48	34	20	16	50	42	31	17	<17
MIwb-Wading	9.4	7.3	5.6	4.5	N/A	N/A	N/A	NA	N/A
MIwb-Boat	9.6	8.6	5.7	5.0	10	8.6	5.6	2.8	<2.8
ICI	46	34	22	8	52	42	25	12	<12

[1] **Proposed Lacustuary scoring breakpoints. These have not yet been adopted into rule.**

Ground Water

There are no municipal areas within this subwatershed that rely on groundwater for drinking water, but only individual households with private wells.

DRASTIC MAP

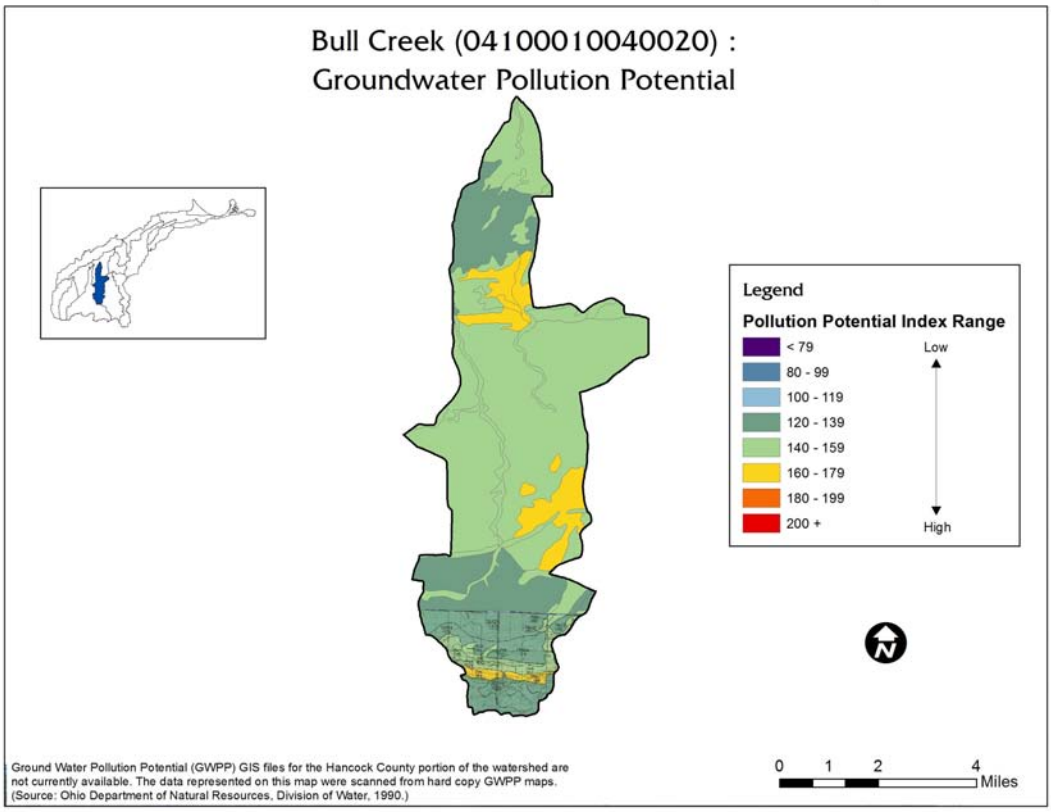
The sensitivity of the groundwater to local sources of contamination is determined and rated by **DRASTIC** maps as described below:

> Inherent within each geologic setting are the physical characteristics which effect the groundwater pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:
>
> **D** – Depth to Water
> **R** – Net Recharge
> **A** – Aquifer Media
> **S** – Soil Media
> **T** – Topography
> **I** – Impact of the Vadose Zone Media
> **C** – Conductivity (Hydraulic) of the Aquifer (ODNR, 1994)

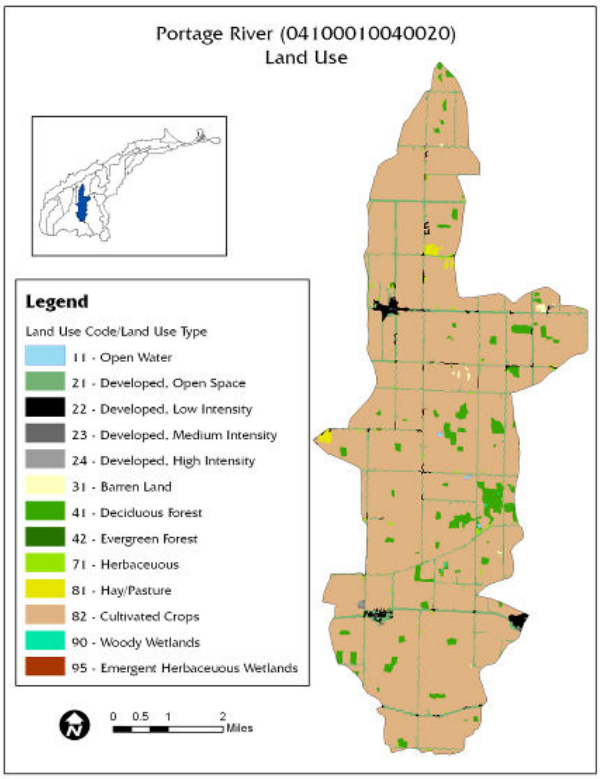
Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index, the greater the vulnerability to contamination (ODNR, 1994).

The average ground water pollution index potential for the Wood County portion of the Bull Creek watershed is 151 with a range of 126-169. In Hancock County, for which GIS data are not available, the range is about 120-180.

The Ohio Department of Natural Resources, Division of Water, Water Resources Section is the responsible agency to map groundwater resources throughout the state. Greater detail on DRASTIC maps for the Portage can be found in Chapter 4 of this watershed plan.



Sub-watershed (04100010-02-01)		
040-020		
Land Use	**Percent**	**Acres**
Urban	6.5%	1,249
Forest	4.2%	807
Pasture	0.4%	68
Cropland	88.7%	17,048
Other	0.2%	44
Total Acres	100%	19,216



Livestock Inventory							
HUC 4100010040020							
Type of Animal		**Hancock**	**Ottawa**	**Sandusky**	**Seneca**	**Wood**	**Estimates for HUC**
Percent of County in HUC		0.8%	0.0%	0.0%	0.0%	0.0%	
Cattle	Farms	129	89	167	264	144	**1**
	Animals	4,233	1,523	4,612	10,096	6,287	**36**
Hogs	Farms	51	15	37	62	30	**0**
	Animals	32,343	3,639	5,591	42,808	39,469	**273**
Horses	Farms	105	63	132	72	128	**1**
	Animals	844	444	772	463	1,004	**7**
Poultry	Farms	49	22	41	62	47	**0**
	Animals	NA	779	1,042	4,283	NA	**NA**
Sheep	Farms	32	12	41	61	21	**0**
	Animals	1,134	335	765	2,770	21	**10**
Total							3
							319

Source: 2007 Census of Agriculture http://www.agcensus.usda.gov/

Point Sources

Municipal

- None

The village of Jerry City is served by the Cygnet wastewater treatment plant, which discharges treated effluent to Rocky Ford Creek.

Package Plants

- Elmwood High School (2PT00038)

Elmwood Local School District, Elmwood School Wastewater Treatment Plant located at 7650 Jerry City Road, Bloomdale, Ohio, Wood County and discharging to a tributary to Eckert Ditch. Application No. OH130621. Issue Date: April 4, 2008. Effective Date May 1, 2008. Expiration Date: April 30, 2013.

Non-Point Sources

Critical Sewage Areas:

- Bairdstown (Wood County)

Estimates of HSTSs				
Watershed	**Housing Units without sewers**	**Est. Unsewered Population (2000)**	**Unsewered Housing Units per acre**	**Unsewered Population per acre**
04100010040020	450	1,187	0.023	0.062

Sources: 2000 Census data and TMACOG "208" Plan. Analysis identifies approximate number of housing units without sewers in each watershed as an estimate of number of HSTSs.

Bairdstown has no public sewerage system; sewage treatment is provided by individual septic systems. The soils are Hoytville clay over shallow bedrock, and are poorly suited for leaching fields. There is one package plant in the facility planning area that is no longer in use.

Aquatic Life Use Impairments	
Causes	**Sources**
Direct habitat alterations	Channelization
Sedimentation/siltation	Nonirrigated crop production
Source: Ohio 2010 Integrated Report, Watershed Assessment Unit Summary	

Water Supply

Public Water System	Population Served	Primary Water Source
None		

Water Quality Impairments

The OEPA Integrated Report assesses each watershed's attainment status for 1) Public Drinking Water Supply, 2) Recreation, 3) Human Health, 4) Aquatic Life, and 5) Fish Tissue. The Integrated Report identifies causes and sources of impairments where watersheds are not in attainment with water quality standards.

Background:

The headwaters of Bull Creek begin in northern Hancock County, Sections 9, 10, 11 of Cass Township. In Hancock County the subsurface drainage occurs in the surrounding agricultural fields, but the first surface channel for headwater drainage appears approximately two-tenths of a mile south of State Route 613 and just north of Township Highway 218 in Hancock County. Conservation practices are in place on this headwater location in agricultural fields. Elevation at this headwater site is 767 feet above sea level which is among the highest elevation measurements in the Portage watershed.

Bull Creek is largely channelized through Hancock County and southern Wood County with a number of conservation practices in place for water quality. There are several forested wetlands in which Bull Creek flows through and some degree of sediment removal is likely occurring. The mouth of Bull Creek converges with the Middle Branch Portage River at RM 6.10. On Bull Creek, RM 0.0 through RM 0.9 is forested riparian that has two oxbows cut from the main flow of Bull Creek. The stream elevation is at its lowest in the first river miles and floods frequently. The 100-year flood plain extends 2.2 river miles upstream from the confluence with the Middle Branch Portage River as well as 0.6 river miles of flooding upstream on the Eckert Ditch due to the elevation change and change in geological bedrock. Eckert Ditch is 8.0 river miles in length and reaches from Section 15 in Portage Township to Section 10 in Bloom Township, Wood County.

Bull Creek, over its length of 14.3 river miles, has three obvious levels of elevation change from the headwaters in northern Hancock County to the mouth of Bull Creek in Wood County. The first elevation change is from the highest headwater to just north of Bairdstown. Another drop in elevation occurs north of Jerry City. Between north of Bays Rd. and South of Mermill Rd., just west of Huffman and east of Lembrecht is another one foot drop in elevation that is the remnant of the Great Black Swamp. Wood County historical maps of 1858 indicate an ancient lake was still in existence. Between Mermill Rd. at RM 2.0 and the confluence with the Middle Branch Portage River the last elevation drop to 666 feet occurs. A review of Bull Creek watershed on the county aerial

photography reveal the elimination of seven oxbows located between the mouth of Bull Creek to upstream (UST) RM 1.7 at Mermill and Huffman Rd.

The headwaters of Bull Creek begin in northern Hancock County, Sections 9, 10, 11 of Cass Township. In Hancock County the subsurface drainage occurs in the surrounding agricultural fields, but the first surface channel for headwater drainage appears approximately two-tenths of a mile south of State Route 613 and just north of Township Highway 218 in Hancock County. Conservation practices are in place on this headwater location in agricultural fields. Elevation at this headwater site is 767 feet above sea level which is among the highest elevation measurements in the Portage watershed.

The Bull Creek subwatershed is largely in agricultural land use, with small urban area for the villages of Jerry City, Bairdstown, and Bloomdale and roadway ditches. The preliminary TMDL results from sampling conducted by Ohio EPA in 2008 indicate that Bull Creek achieved full attainment status from its mouth at the Middle Branch and upstream just north of the Village of Jerry City. Sampling done at RM 0.64 at Greensburg Pike and RM 3.89 at Jerry City Rd received full attainment status, while further upstream at RM 8.45 and Huffman Rd. a partial attainment was achievement. The cause for partial attainment was direct alteration to habitat, resulting in excess siltation of the water course. The source for the non-point source pollution is row-crop production and channelization of the waterway.

The final six miles of Bull Creek to the headwaters is fairly well-protected by riparian conservation and best management practices. However, within the six river miles there are miles of lateral ditches that empty into Bull Creek, which include agricultural, urban roadway and 3.5 miles of railroad line. Both sides of the railroad have drainage ditches that connect to Bull Creek so this is equal to 7 miles of drainage that is capable of receiving and transporting pollutants. The lateral drainage systems should be examined for conservation and BMP implementation within Bloom Township, Wood County.

Problem Statement 1: (Bacteria)

The water quality of the Bull Creek subwatershed is impaired by elevated measurements of E. coli bacteria. The Portage TMDL data collected by Ohio EPA in 2008 indicates that all three of the HUC's sampling sites are in non-attainment for E. coli. Ohio EPA lists failed HSTS and a package plant as the sources of impairments.

In this HUC are an estimated 450 HSTS; by density of onsite systems, this is one of the most rural HUCs. This area includes one package plant (permitted), but no CSO areas, and one Critical Sewage Area (Bairdstown). HSTS priorities for this watershed should start with the critical area, which accounts for about 50 of the HUC's HSTS.

Goal 1.1: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 2.9 million gallons of HSTS effluent annually.

Objective:

- Replace or upgrade 10% of watershed's HSTS or 45 systems
- Failed or inadequate HSTS repaired, replaced, or sewered.

Goal 1.2: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 11.0 million gallons of package plant effluent annually.

Objective:

- Upgrade 1 package plant(s). Effluent quality meets P standards.

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Bacteria	1.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$675,000	County Health Dept, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 45 systems	2.9 million gallons/year sewage discharge eliminated
	1.1	♦Prioritize and schedule Bairdstown sanitary survey ♦Define study area with OEPA, County Health Department, & NWWS ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$145,920	Ohio EPA, County Health Department, Northwestern Water and Sewer District, TMACOG	2014-2017	Bairdstown failed or inadequate HSTS repaired, replaced, or sewered	Included in HSTS totals
	1.2	♦Test package plant effluent for phosphorus ♦Set effluent standard in existing or new NPDES permit(s) ♦Enforce upgrades for phosphorus removal as needed	$3,600	Ohio EPA	2012-2017	Upgrade 1 package plant(s). Effluent quality meets effluent stds	11.0 million gallons/year effluent improved

Problem Statement 2: (Nutrients)

The Ohio EPA TMDL found two of three sampling sites in this HUC to meeting Aquatic Life attainment standards, and the third (Eagleville Road) in partial attainment. The TMDL also found that the nutrient loadings from this watershed are excessive for use attainment. The Portage TMDL recommends a total phosphorus load allocation of 3.52 kg/day, requiring a nonpoint source load reduction of 1,850 lb. P/year. HSTS systems should be addressed as noted above. Agricultural BMPs should be focused at or above Eagleville Road (RM 8.45), including tributaries that enter Bull Creek above that point.

Goal 2.1: Meet TMDL target for phosphorus load reduction by 240 and nitrate load by 1,015 lb./year from HSTS.

Objective: Replace or upgrade 10% of watershed's HSTS or 45 systems.

Goal 2.2: Meet TMDL target for phosphorus load reduction by 640 and nitrate load by 3092 lb./year from package plants.

Objective: Upgrade 1 package plant(s). Effluent quality meets P standards.

Goal 2.3: Meet TMDL target for phosphorus load reduction by 975 and nitrate load by 3,201 lb./year from agricultural practices.

Objectives:

- 625 acres of cover crops
- 400 acres of controlled drainage
- 600 acres of permanent hay
- 250 acres of riparian buffers
- 700 LF of restored oxbows
- 10 acres of restored wetlands
- 250 LF of stream restoration
- 1000 LF of overwide / 2-stage ditch reconstruction
- 6728 acres under NRCS 590/1 Nutrient Mgt
- 2883 acres under NRCS 590/3 Nutrient Mgt
- 2000 acres of filter strips
- 200 acres of conservation tillage.

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Nutrients (phosphorus and nitrate)	2.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$675,000	County Health Dept, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 45 systems	Reduce phosphorus load by 240 and nitrate load by 1,015 lb/year
	2.2	♦Test package plant effluent for phosphorus ♦Set effluent standard in existing or new NPDES permit(s) ♦Enforce upgrades for phosphorus removal as needed	$3,600	Ohio EPA	2012-2017	Upgrade 1 package plant(s). Effluent quality meets effluent stds	Reduce phosphorus load by 640 and nitrate load by 3092 lb/year
	2.3	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$37,500	SWCD, NRCS, farmers	2012-2027 in phases	625 acres of cover crops	Reduce phosphorus load by 528 and nitrate load by 1056 lb/year
	2.3	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$188,400	SWCD, NRCS, farmers	2012-2027 in phases	400 acres of controlled drainage	Reduce phosphorus load by 136 and nitrate load by 344 lb/year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$168,000	SWCD, NRCS, farmers	2012-2027 in phases	600 acres of permanent hay	Reduce phosphorus load by 390 and nitrate load by 780 lb/year
	2.3	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$175,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	250 acres of riparian buffers	Reduce phosphorus load by 085 and nitrate load by 170 lb/year
	2.3	♦Evaluate oxbow site(s) with County Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$191,499	Wood SWCD, Wood County Engineer, NRCS, farmers	2012-2027 in phases	700 LF of restored oxbows	Reduce phosphorus load by 085 and nitrate load by 170 lb/year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$51,062	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	10 acres of restored wetlands	Reduce phosphorus load by 0 and nitrate load by 0 lb/year
	2.3	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$87,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	250 LF of stream restoration	Reduce phosphorus load by 10 and nitrate load by 19 lb/year
	2.3	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$89,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	1000 LF of overwide / 2-stage ditch reconstruction	Reduce phosphorus load by 101 and nitrate load by 202 lb/year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Seek cooperators for Nutrient Management NRCS 590 Level 1 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management NRCS 590 Level 1 BMPs with farmers	$134,558	SWCD, NRCS, farmers	2012-2022	6728 acres under NRCS 590/1 Nutrient Mgt	NA
	2.3	♦Seek cooperators for Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with farmers	$115,336	SWCD, NRCS, farmers	2012-2022	2883 acres under NRCS 590/3 Nutrient Mgt	NA
	2.3	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$275	SWCD, NRCS, farmers	2012-2027 in phases	2000 acres of filter strips	Reduce phosphorus load by 14 and nitrate load by 30 lb/year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize fields suited for Conservation Tillage BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Conservation Tillage BMP with farmer	$3,000	SWCD, NRCS, farmers	2012-2027 in phases	200 acres of conservation tillage	Reduce phosphorus load by 29 and nitrate load by 406 lb/year

Problem Statement #3: (Siltation/Sedimentation)

Two of the three sampling sites in this HUC are in attainment with Aquatic Life standards; the third (Eagleville Road) is in partial attainment. Ohio EPA gives impairment causes as habitat alteration and sedimentation, and sources as channelization and crop production. Agricultural BMPs should be focused at or above Eagleville Road (RM 8.45), including tributaries that enter Bull Creek above that point.

Goal 3.1:

Reduce sedimentation impairments by decreasing sediment load by 760 lb./year from agricultural practices.

Objectives:

- 625 acres of cover crops
- 400 acres of controlled drainage
- 600 acres of permanent hay
- 250 acres of riparian buffers
- 700 LF of restored oxbows
- 10 acres of restored wetlands
- 250 LF of stream restoration
- 1000 LF of overwide / 2-stage ditch reconstruction
- 2000 acres of filter strips
- 200 acres of conservation tillage.

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Habitat Impairment	4.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$175,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	250 acres of riparian buffers	Load reductions provided in nutrient and sediment tables
	4.1	♦Evaluate oxbow site(s) with County Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$191,499	Wood SWCD, Wood County Engineer, NRCS, farmers	2012-2027 in phases	700 LF of restored oxbows	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$51,062	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	10 acres of restored wetlands	Load reductions provided in nutrient and sediment tables

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	4.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$87,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	250 LF of stream restoration	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$89,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	1000 LF of overwide / 2-stage ditch reconstruction	Load reductions provided in nutrient and sediment tables

Problem Statement #4: (Habitat)

Two of the three sampling sites in this HUC are in attainment with Aquatic Life standards; the third (Eagleville Road) is in partial attainment. Ohio EPA gives impairment causes as habitat alteration and sedimentation, and sources as channelization and crop production. Agricultural and habitat restoration BMPs should be focused at or above Eagleville Road (RM 8.45), including tributaries that enter Bull Creek above that point.

Goal 4.1:

260 acres of habitat restoration and 1950 linear feet of stream corridor restoration practices.

Objective:

- 250 acres of riparian buffers
- 700 LF of restored oxbows

- 10 acres of restored wetlands
- 250 LF of stream restoration
- 1000 LF of overwide / 2-stage ditch reconstruction.

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Habitat Impairment	4.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$175,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	250 acres of riparian buffers	Load reductions provided in nutrient and sediment tables
	4.1	♦Evaluate oxbow site(s) with County Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$191,499	Wood SWCD, Wood County Engineer, NRCS, farmers	2012-2027 in phases	700 LF of restored oxbows	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland	$51,062	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	10 acres of restored wetlands	Load reductions provided in nutrient and sediment tables

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
		Restoration with landowner					
	4.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$87,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	250 LF of stream restoration	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$89,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	1000 LF of overwide / 2-stage ditch reconstruction	Load reductions provided in nutrient and sediment tables

SOUTH BRANCH PORTAGE RIVER HEADWATERS TO ABOVE EAST BRANCH PORTAGE RIVER

04100010 040 030 - (14 – digit HUC)

04100010 02 03 (New 12-digit HUC & Name: Town of Bloomdale-South Branch Portage River)

Length: 27.5 miles

Elevation at Mouth: 634 feet

Elevation at Source: 777 feet

Drainage Area: 335 square miles

Fall: 5.2 (ft/mi)

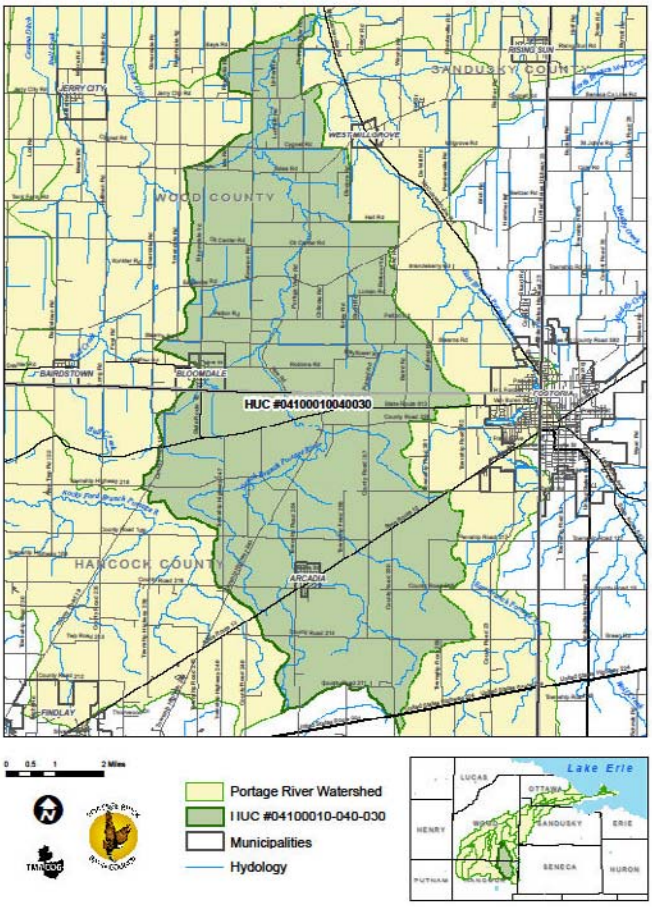
Ohio Topographic Quadrangle 7.5 minute (1:24,000):

- Jerry City
- Bradner
- Bloomdale
- Fostoria
- Arcadia
- Alvada

Urban Area:
Village of Bloomdale, Wood County (2008 pop. 709)

Village of Arcadia, Hancock County (2008 pop. 564)

HUC #04100010-040-030



Geology

The subwatershed is located within the glacial lake plain entirely within the HELP ecoregion. During the glacial period, ice sheets of both the Illinoian and Wisconsin Age advanced and retreated over the area. As the ice sheets retreated, a large lake was formed. This glacial lake leveled the till plain. Consequently, Wood County is now typified by level or nearly level, expanses, broken only by sand ridges formed during the glacial period, by high areas underlain by limestone and by breaks along river and streams. Hancock County has nearly level undulating topography, except where the Portage watershed is located in the northern half of the county. Here the glacial moraines present

the only elevation between 700 and 800 feet to provide fall. The elevation is formed from glacial till, lacustrine modified till, outwash sand and gravel associated with the Wisconsin Glaciation.

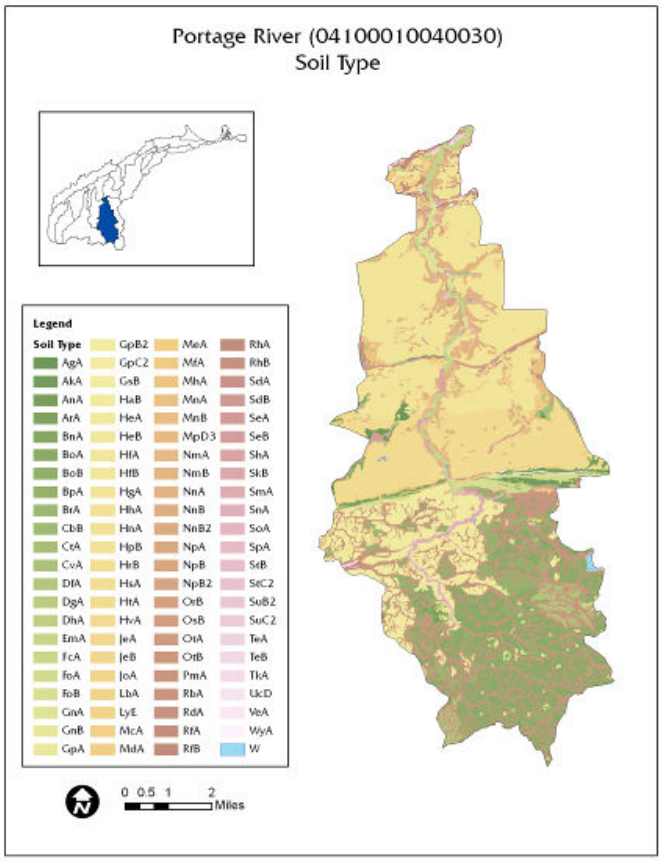
Soils

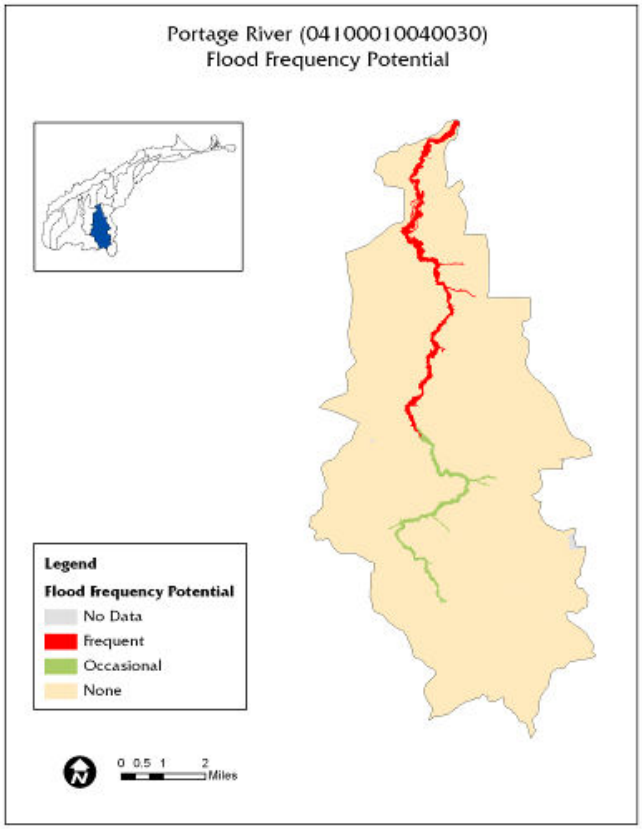
The soils for the South Branch Portage River HUC14 04100010 040-030 are largely dominated by two soil associations for this watershed of 53.6 square miles. The soils almost follow the county line between Hancock and Wood counties as the line of glacial till and bedrock formed. The dominant soil is Hoytville clay loam, 0 to 1 percent slopes (HgA) to cover 3,011 hectares. The second dominant soil association is Pewamo silty clay loam, 0 to 1 percent slopes (PmA) of 2,157 hectares of the South Branch.

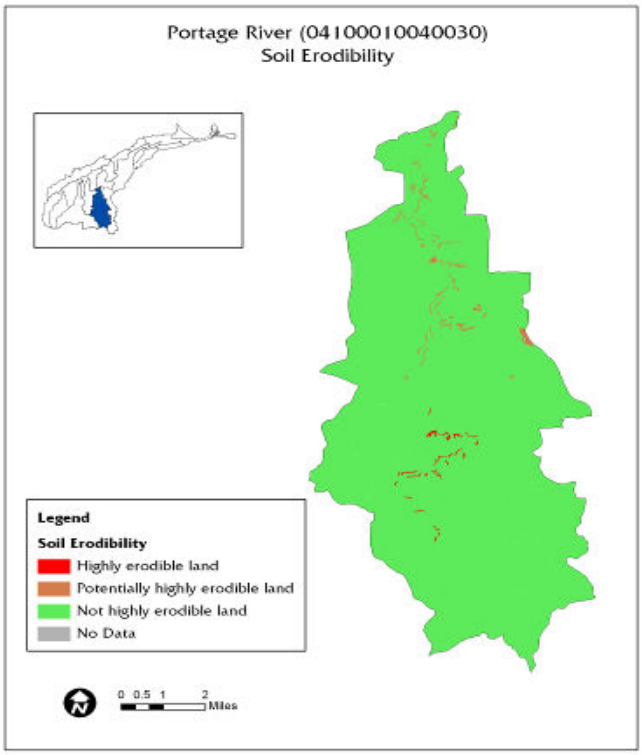
Hoytville soils cover broad, nearly level, very poorly drained, dark-colored Hoytville soils make up about 80 percent of this association. These soils developed in glacial till. They are associated with the nearly level, very poorly drained, dark-colored Mermill soils, which developed in sandy material underlain by clay. Both soils are deep and are highly productive. Small areas of Nappanee, St. Clair, Digby, and Haskins soils also occur in this association.

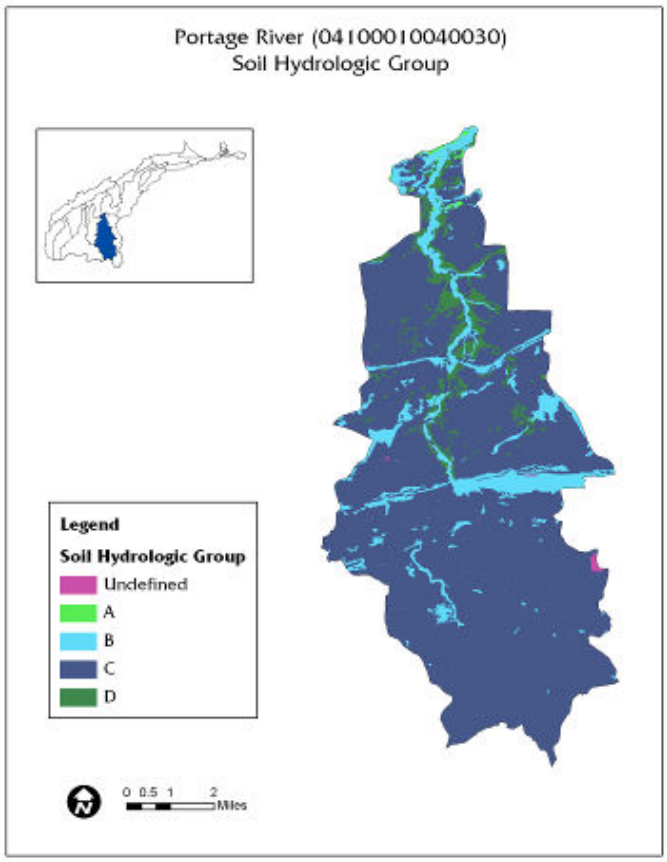
The Blount-Pewamo Association makes up 63% of Hancock County. Pewamo is deep, somewhat poorly drained and very poorly drained soils that have a subsoil of clay to heavy silty clay loam; on the glacial till plain. 50% somewhat poorly drained Blount soils, 32% very poorly drained Pewamo soils, and 18% minor soils which range from moderately well drained to very poorly drained. Major limitations are excessive wetness, seasonal high water table, slow or moderately slow permeability.

Major Soil Groups		
040-030		
Hoytville	Sum Acres	11,835
	Percentage	34.20%
Blount	Sum Acres	6,176
	Percentage	17.85%
Pewamo	Sum Acres	5,330
	Percentage	15.40%
Glynwood	Sum Acres	3,523
	Percentage	10.18%
Nappanee	Sum Acres	1,793
	Percentage	5.18%
Mermill	Sum Acres	789
	Percentage	2.28%
Haskins	Sum Acres	529
	Percentage	1.53%
Del Rey	Sum Acres	454
	Percentage	1.31%


Portage River (04100010040030)
Soil Type
Legend
Soil Type
AgA
AkA
AnA
ArA
BnA
BoA
BoB
BpA
BrA
CbB
CtA
CvA
DfA
DgA
DhA
EmA
FcA
FoA
FoB
GnA
GnB
GpA
GpB2
GpC2
GsB
HaB
HeA
HeB
HfA
HfB
HgA
HhA
HnA
HpB
HrB
HsA
HtA
HvA
JeA
JeB
JoA
LbA
LyE
McA
MdA
MeA
MfA
MhA
MnA
MnB
MpD3
NmA
NmB
NnA
NnB
NnB2
NpA
NpB
NpB2
OrB
OsB
OtA
OtB
PmA
RbA
RdA
RfA
RfB
RhA
RhB
SdA
SdB
SeA
SeB
ShA
SkB
SmA
SnA
SoA
SpA
StB
StC2
SuB2
SuC2
TeA
TeB
TkA
UcD
VeA
WyA
W
0 0.5 1 2
Miles


Portage River (04100010040030)
Flood Frequency Potential
Legend
Flood frequency Potential
No Data
Frequent
Occasional
None
0 0.5 1 2
Miles


Portage River (04100010040030)
Soil Erodibility
Legend
Soil Erodibility
Highly erodible land
Potentially highly erodible land
Not highly erodible land
No Data
0 0.5 1 2
Miles



The Soil Hydrologic Group map indicates the *Hydrologic soil groups* based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms (Wood County Soil Survey, March 2005). The following soil group descriptions are directly from the Wood County Soil Survey, page 241.

The four hydrologic soil groups are:

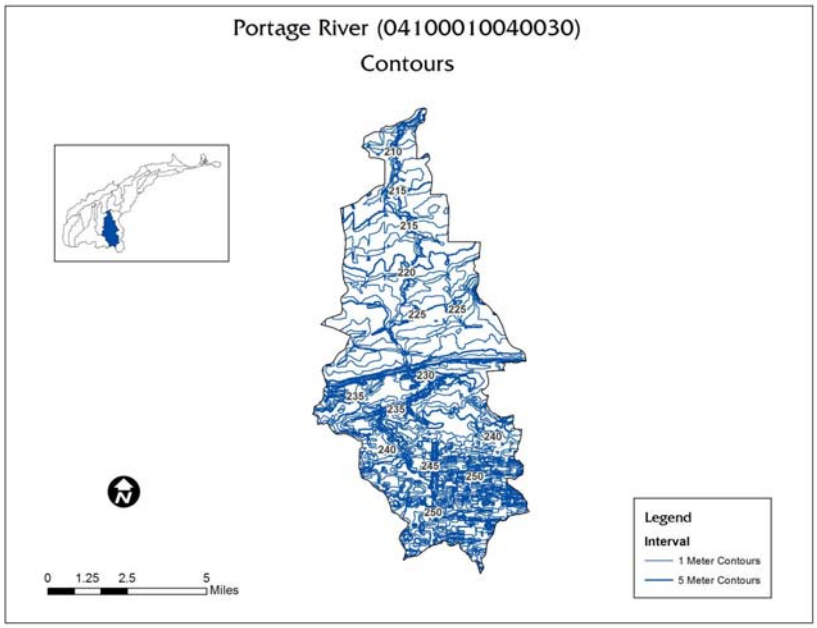
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

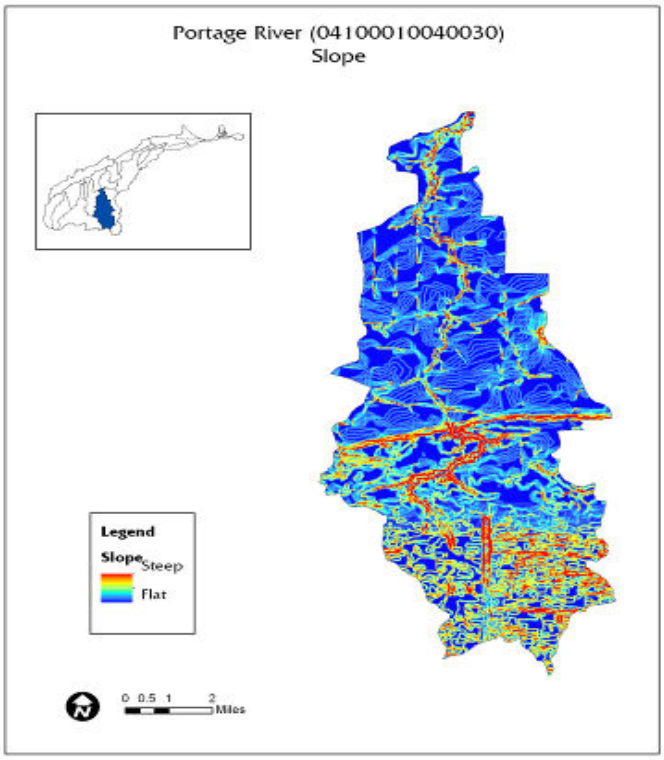
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately course texture. These soils have a moderate rate of water transmission.

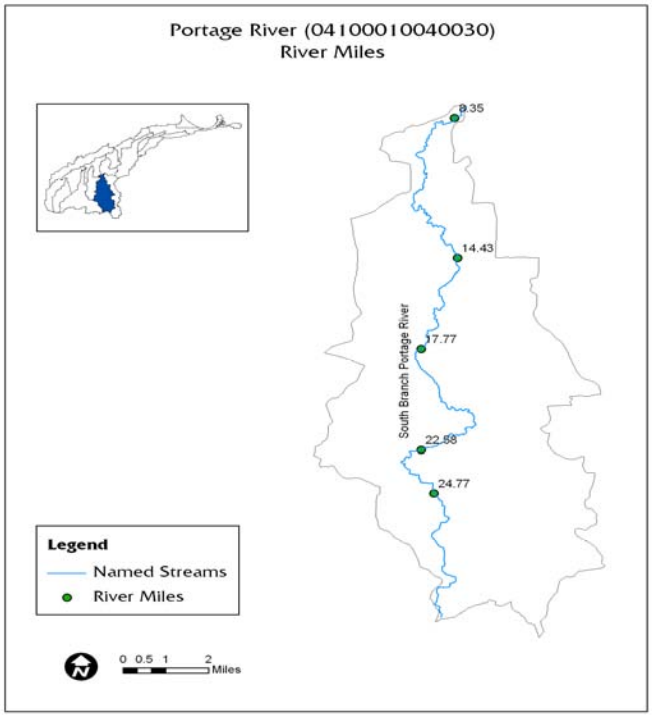
Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (**A/D, B/D, or C/D),** the first letter is for drained areas and the second is for undrained areas.




Portage River (04100010040030)
Slope
Legend
Slope
Steep
Flat
0 0.5 1 2
Miles


Portage River (04100010040030)
River Miles
9.35
14.43
17.77
22.68
24.77
South Branch Portage River
Legend
Named Streams
River Miles
0 0.5 1 2
Miles

Rare, Threatened, Endangered Species

There are no reports of rare, threatened or endangered plant or animal species located in this subwatershed of the South Branch Portage River. However, a collection of fresh water mussel species does exist in HUC 04100010 040 030. These mussel species were recently located in 2008 during the water quality study and include the Cylindrical Papershell, Wabash Pigtoe, and Giant Floater.

Rare, Threatened, Endangered Species			
Common Name	***Scientific Name***	**Last Observed**	**State Status**
None			

T=Threatened, P=Potentially Threatened, E=Endangered, X=Presumed Extirpated, SC=Species of Concern

Mussel Species

Stream River Miles	**Common Mussel Name**	***Scientific Name***	**Observed**	**Status**
24.77	Cylindrical Papershell	*Anodontoides ferrussacianus*	2008	
22.58	None			
17.77	Cylindrical Papershell Giant Floater	*Anodontoides ferrussacianus* *Pyganodon grandis*	2008	
14.43	Cylindrical Papershell Giant Floater	*Anodontoides ferrussacianus* *Pyganodon grandis*	2008	
8.35	Wabash Pigtoe Giant Floater	*Fusconaia flava* *Pyganodon grandis*	2008	

SC=Species of Concern Ohio EPA

Water Resources

Surface Water

"The **Ohio Integrated Water Quality Monitoring and Assessment Report** indicate the general condition of Ohio's waters and identifies waters that are not meeting water quality goals. The report satisfies the Clean Water Act requirements for both Section 305(b) water quality reports and Section 303(d) lists of impaired waters." The Ohio 2010 Integrated Report can be located at the Ohio EPA webpage at: http://www.epa.state.oh.us/dsw/tmdl/OhioIntegratedReport.aspx

The Ohio 2010 Integrated Report website offers downloads of data and individual chapters. Individual river information on the health of water quality in Ohio, as well as Lake Erie near shore water standards can be obtained for human health use, aquatic life (fish and aquatic insects), chemical concerns for drinking water and recreation uses such as swimming and boating in our state's water.

If water quality standards are not met according to indicators set for that water body, the water quality is then determined to be ***impaired***. The goal is to identify the cause and source of the pollutant(s) which impair(s) that water and to restore it to ***attainment*** status. If the water quality is healthy (full attainment) then methods are employed to protect the healthy water from any possible future contaminates.

The South Branch Portage River waterway is designated use for **warm-water habitat** (WWH) **aquatic use**. The **Recreation Use** assessment is Class B. That determines the acceptable E. Coli colony numbers as shown below in a summary table taken from the Ohio 2010 Integrated Report, Section F: Evaluating Beneficial Use: Recreation, p. F-1.

Summary of the recreation use assessment methods.		
Bathing Waters		
Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method Summary
E. coli	Seasonal geometric mean *E. coli* content* based on samples from the recreation season within a calendar year is 126 cfu/100 ml; single sample maximum is 235 cfu/100 ml.	Applied to the three Lake Erie shoreline assessment units, exceedence of the geometric mean bathing water criterion or an exceedence of the single sample maximum for more than 10% of the recreation season is considered an impairment of the bathing water use.
Primary Contact and Secondary Contact		
Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method Summary
E. coli	Seasonal geometric mean *E. coli* content* based on samples from the recreation season within a calendar year is: **Primary Contact Waters** Class A: 126 cfu/100 ml Class B: 161 cfu/100 ml Class C: 206 cfu/100 ml **Secondary Contact Waters** 1030 cfu/100 ml	Applied to streams and inland lakes. Data from a recreation season are assessed on a site-by-site basis and compared to the applicable geometric mean *E. coli* criterion whenever more than one sample result is available for a watershed assessment unit. Assessment units are considered to be in full attainment if all sites assessed within the assessment unit meet the applicable geometric mean criterion and in non-attainment if one or more sites assessed within the assessment unit exceed the applicable geometric mean criterion.

*** *E. coli* concentrations are expressed in colony forming units (cfu) per 100 milliliters (ml)**

HUC 8 – 04100010 (Portage River)									
HUC 10 – 04100010-02 (South Branch Portage River - Middle Branch Portage River)									
HUC 12 – 04100010 02 03 (Town of Bloomdale-South Branch Portage River)									
HUC 14 — 04100010 040 030 South Branch Portage River headwaters to above East Branch Portage River									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
20	2008	S01K06	S. Br. Portage R. NW Of Arcadia @ Co. Rd. 109	24.77	7.0	WWH	Non	Direct habitat alterations, Siltation, High TDS	Non-irrigated crop production, Channelization, Legacy oil and gas drilling
21	2008	S01K06	S. Br. Portage R. Se Of Bloomdale @ Twp. Rd. 218	22.58	17.0	WWH	Partial	Siltation Organic enrichment (sewage) biological indicators	Non-irrigated crop production, Channelization, On-site treatment systems
22	2008	S01K05	S. Br. Portage R. Ne OF Bloomdale @ Stearns Rd.	17.77	29.5	WWH	Full	None listed	None listed
23	2008	S01K04	S. Br. Portage R. Ne Of Bloomville @ Hall Rd	14.43	34.0	WWH	Full	None listed	None listed
24	2008	S01P10	S. Br. Portage R. Upst. East Branch @ Portage View Rd.	8.35	54.0	WWH	Full	None listed	None listed

Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010.

Recreational Use Attainment

Location	RM	Recreation Use for Primary Contact Recreation waters (PCR) Class	Number of Samples	E. coli Geometric **Mean <161** and Single Sample Maximum ≤ 523 Value For Class B (recreation use intensity)	Attainment Status	Sources of Bacteria
S. Br. Portage R. NW Of Arcadia @ Co. Rd. 109	24.77	B	5	603 mean 12,000 max	NON	HSTS; Arcadia
S. Br. Portage R. Se Of	22.58	B	5	554 mean 21,000 max	NON	HSTS; Agric

Recreational Use Attainment						
Bloomdale @ Twp. Rd. 218						
S. Br. Portage R. Ne OF Bloomdale @ Stearns Rd.	17.77	B	5	1,080 mean 13,000 max	NON	HSTS; Bloomdale WWTP; Agric.
S. Br. Portage R. Ne Of Bloomville @ Hall Rd	14.43	B	5	476 mean 10,000 max	NON	HSTS; Agric.
S. Br. Portage R. Upst. East Branch @ Portage View Rd.	8.35	B	5	1,224 mean 6,900 max	NON	HSTS; Agric.

Aquatic Life Use Assessment				
Location	**RM**	**Drainage Area**	**Aquatic Life Use**	**Attainment Status**
S. Br. Portage R. NW Of Arcadia @ Co. Rd. 109	24.77	7.0	WWH	Non
S. Br. Portage R. Se Of Bloomdale @ Twp. Rd. 218	22.58	17.0	WWH	Partial
S. Br. Portage R. Ne OF Bloomdale @ Stearns Rd.	17.77	29.5	WWH	Full
S. Br. Portage R. Ne Of Bloomville @ Hall Rd	14.43	34.0	WWH	Full
S. Br. Portage R. Upst. East Branch @ Portage View Rd.	8.35	54.0	WWH	Full

Macro-invertebrate Communities										
Stream RM	**Dr. Ar. (sq. mi.)**	**Data Codes**	**Qual. Taxa**	**EPT QI./Total**	**Sensitive Taxa QI./Total**	**Density QI./Qt.**	**CW Taxa**	**Predominant Organisms on the Natural Substrates With Tolerance Category(ies)**	**ICI[a]**	**Narrative Evaluation**
24.77	7.0	-	37	1	5	L	0	Midges (T,F,MI)	-	Poor
22.58	17.0	-	27	4	4	L	0	Midges (T,F), baetid mayflies (F)	-	Low Fair
17.77	29.5	-	38	5 / 5	9 / 12	L-M / 471	0	Flatworms (F)	30	
14.43	34.0	15	34	6 / 9	6 /14	L / 135	1	Hydropsychid caddisflies (F), sowbugs (F), midges (MI,F)	38	
8.35	54.0	8	35	9 / 9	9 / 14	L / 69	0	Sow bugs (F),	(20)	Marg.

Macro-invertebrate Communities										
								heptageniid mayflies (F)		Good

Source: Ohio EPA, 2008

Public Drinking Water Supply Assessment				
HUC	**Reporting Category**	**Cause of Impairment**	**Nitrate Watch List**	**Pesticide Watch List**
South Branch Portage River headwaters to above East Branch Portage River 04100010 040 030	3i	None	No	No

Fish Tissue Assessment			
HUC	**Reporting Category**	**Causes of Impairment**	**PCB Concentration**
South Branch Portage River headwaters to above East Branch Portage River 04100010 040 030	3i	None	

Water Quality Monitoring Results: Ohio EPA 1994 and 2008						
River Mile	**Date**	**IBI**	**ICI**	**MIwb**	**QHEI**	**STATUS**
8.35/8.35	1995	30 ns	F*	7.6	56.5	PARTIAL
The above fish community indices are from samples collected in the Portage River study area in 1994, 1985 and 1983. MIwb and IBI scores are Mean scores and compared to Ecoregional Biocriteria for the HELP.						
24.77	*2008*	*28*	*P**	*N/A*	*48.0*	***NON***
22.58	*2008*	*38*	*LF**	*N/A*	*56.0*	*PARTIAL*
17.77	*2008*	*34*		*7.1^{ns}*	*64.5*	*FULL*
14.43	*2008*	*35*	*38*	*7.6*	*63.5*	*FULL*
8.35	*2008*	*41*	*MG^{ns}*	*8.2*	*60.5*	*FULL*

a - River Mile (RM) represents the Point of Record (POR) for the station, not the actual sampling RM.
b - MIwb is not applicable to headwater stream with drainage areas ≤20 mi^2.
c - A narrative evaluation of the qualitative sample based on attributes such as EPT taxa richness, number of sensitive taxa, and community composition was used when quantitative data was not available or considered unreliable. VP=Very Poor, P=Poor, LF=Low Fair, F=Fair, MG=Marginally Good, G=Good, VG=Very Good, E=Exceptional
d - Attainment is given for the proposed status when a change is recommended. Aquatic life use in superscript.
ns - Nonsignificant departure from biocriteria (≤4 IBI or ICI units, or ≤0.5 MIwb units).
* - Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.
Italic: 2008 TMDL scores in review.

General narrative ranges assigned to QHEI scores.				
Narrative Rating		QHEI Range		
		Headwaters (≤ sq mi)	Larger Streams	Lacustuary
Excellent		≤ 70	≤ 75	≤ 80
Good		55 to 69	60 to 74	60 to 80
Fair		43 to 54	45 to 59	45 to 59
Poor		30 to 42	30 to 44	30 to 44
Very Poor		<30	<30	<30

Biological Criteria Benchmarks

Biological Criteria					Lacustuary Benchmarks[1]				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
IBI-Headwaters	50	28	20	18	N/A	N/A	N/A	N/A	N/A
IBI-Wading	50	32	22	18	N/A	N/A	N/A	N/A	N/A
IBI-Boat	48	34	20	16	50	42	31	17	<17
MIwb-Wading	9.4	7.3	5.6	4.5	N/A	N/A	N/A	NA	N/A
MIwb-Boat	9.6	8.6	5.7	5.0	10	8.6	5.6	2.8	<2.8
ICI	46	34	22	8	52	42	25	12	<12

[1] **Proposed Lacustuary scoring breakpoints. These have not yet been adopted into rule.**

The results indicate the cause and sources of pollution to surface water have a direct relationship to the attainment status for survival of warm water habitat within a watershed assessment unit.

Ground Water

Source Water Assessment Plan (SWAP)

The Village of Bloomdale has a public water system serving 750 people.

Bloomdale pumps approximately 80,000 gallons per day from five wells located on the south side of the community east of the Village park. To protect the ground water aquifer source of drinking water, a protection area buffer is delineated for the land area surrounding the wellheads. The protection area is established to help protect the drinking water supply from pollution contaminants.

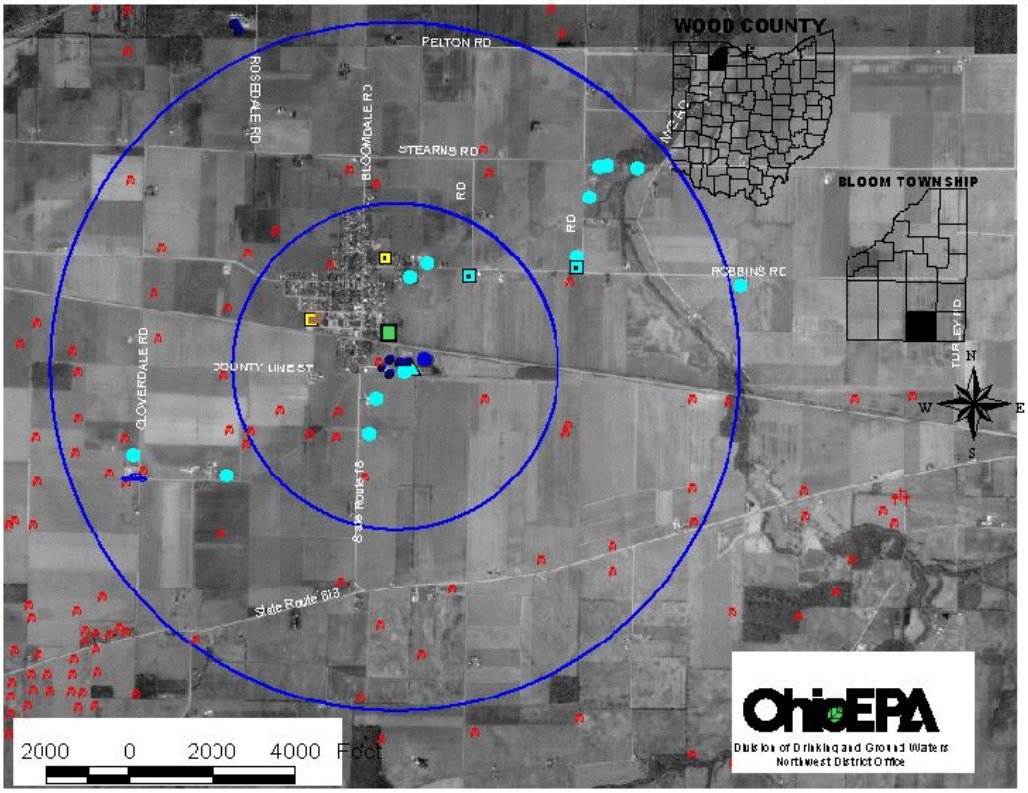
Within the source water protection area an inventory was conducted by the Ohio EPA and village personnel to identify all *potential* sources of contamination which could reach

ground water levels. Bloomdale has a high susceptibility to contamination to the drinking water for several reasons. The source water assessment plan (SWAP) identified indicators of high susceptibility to contamination

- Water quality data indicates nitrate levels above the concentration of concern;
- The well is located in a geologically sensitive carbonate aquifer typically associated with karst features;
- The carbonate aquifer is covered by less than 25 feet of glacial material;
- The depth to water is less than 30 feet below the ground surface; and
- Potential contaminant sources exist within the protection area.

Ohio EPA notes that, "At this time, there is evidence indicating the quality of water provided by The Village of Bloomdale has been impacted. Samples collected at the Village of Bloomdale between 8/3/1993 and 7/21/1999 contained nitrate above the concentration of concern of 2 mg/L on eight occasions, with concentrations ranging from 2.77 to 4.18 mg/L. This indicates a manmade influence but, these concentrations are well below the federal and state drinking water standard of 10 mg/L. However, in water quality analyses conducted after 7/21/1999, nitrate concentrations have consistently been below the concentration of concern."

Bloomdale's Drinking Water Source Protection Area is shown in the following figure (Ohio EPA, Drinking Water Source Assessment for the Village of Bloomdale, 2002).



LEGEND

- Above Ground Storage Tank
- Car,Boat/Camper Dealer
- Cemetery
- Inactive/Closed Landfill
- Lagoon/Pit/Pond
- Leaking Underground Tank
- NPDES Permitted Facility (PCS)
- Pesticide -Producing Facility (SSTS)
- Plastics/Synthetics Producer
- Surface Impoundment
- Oil & Gas wells

Information used to develop the Protection Area:

Number of Wells = 5
Total well Pumping Rate = 80,000 GPD
Porosity = 0.01
Aquifer Thickness = 10 feet
Hydrogeologic Setting = Potential Karst

LOW | MODERATE | HIGH

SUSCEPTIBILITY

AUGUST, 2002

DRASTIC MAP

The sensitivity of the groundwater to local sources of contamination is determined and rated by **DRASTIC** maps as described below:

Inherent within each geologic setting are the physical characteristics which effect the groundwater pollution potential. These characteristics or factors identified during the development of the DRASTIC system include

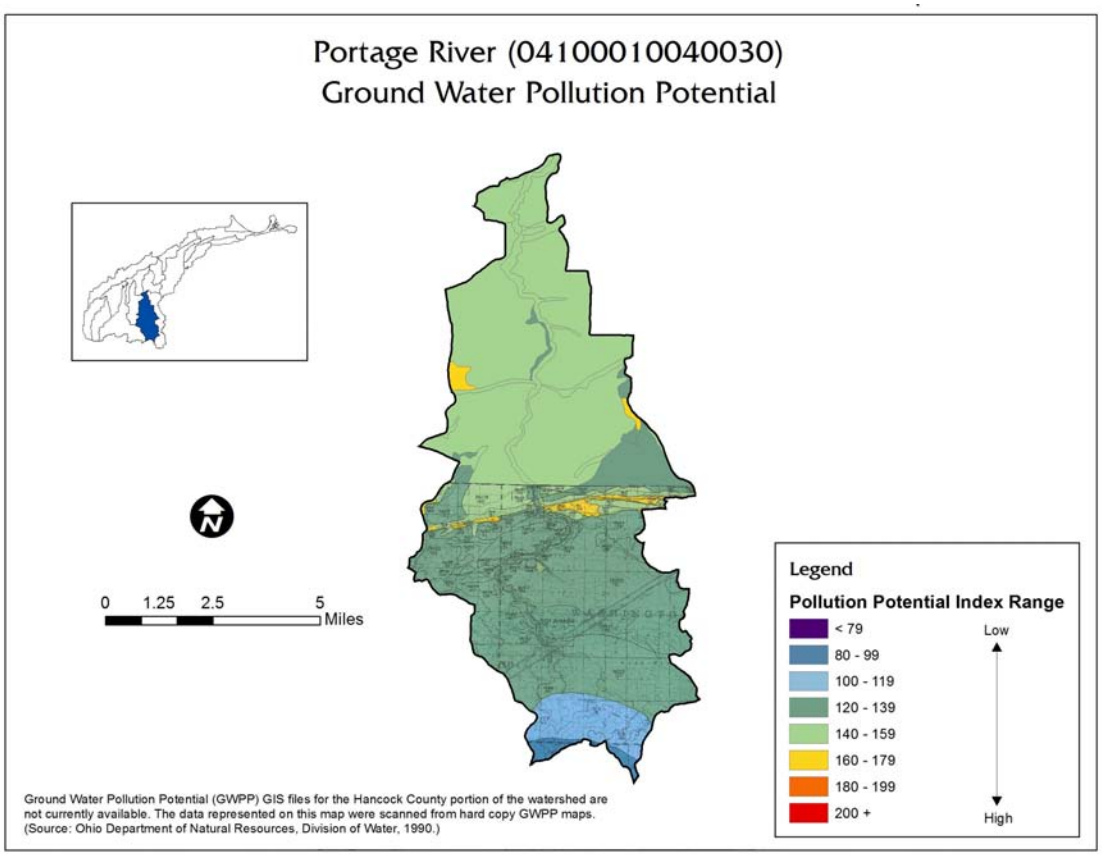
:

D – Depth to Water
R – Net Recharge
A – Aquifer Media
S – Soil Media
T – Topography
I – Impact of the Vadose Zone Media
C – Conductivity (Hydraulic) of the Aquifer (ODNR, 1994)

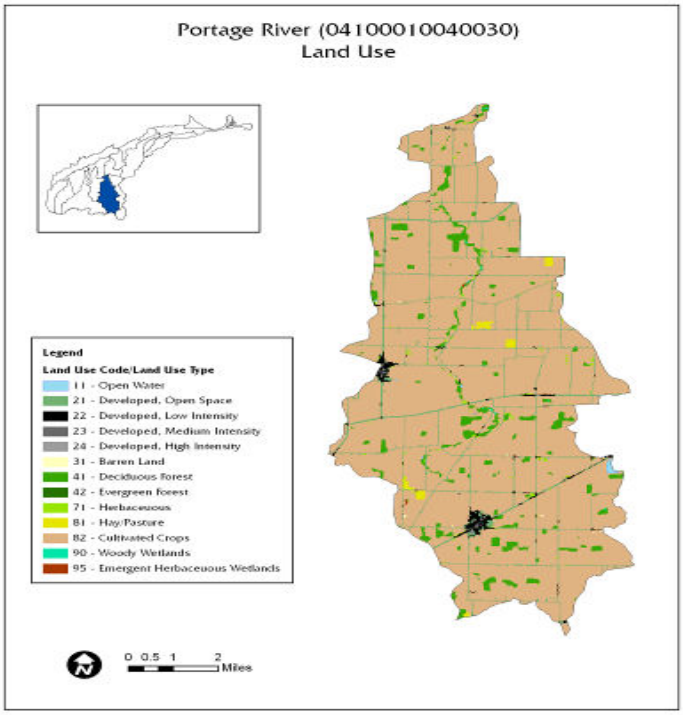
Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index, the greater the vulnerability to contamination (ODNR, 1994).

The average ground water pollution index potential for the Wood County portion of the South Branch watershed above the East Branch is 147 with a range of 122-169. In Hancock County, for which GIS data are not available, the range is about 80-180.

The Ohio Department of Natural Resources, Division of Water, Water Resources Section is the responsible agency to map groundwater resources throughout the state. Greater detail on DRASTIC maps for the Portage can be found in Chapter 4 of this watershed plan.



Sub-watershed (04100010-02-03)		
040-030		
Land Use	**Percent**	**Acres**
Urban	6.2%	2,137
Forest	4.8%	1,666
Pasture	0.5%	174
Cropland	88.3%	30,511
Other	0.2%	80
Total Acres	100%	34,568



Livestock Inventory							
HUC 4100010040030							
Type of Animal		**Hancock**	**Ottawa**	**Sandusky**	**Seneca**	**Wood**	**Estimates for HUC**
Percent of County in HUC		5.5%	0.0%	0.0%	0.0%	4.0%	
Cattle	Farms	129	89	167	264	144	**13**
	Animals	4,233	1,523	4,612	10,096	6,287	**485**
Hogs	Farms	51	15	37	62	30	**4**
	Animals	32,343	3,639	5,591	42,808	39,469	**3,363**
Horses	Farms	105	63	132	72	128	**11**
	Animals	844	444	772	463	1,004	**87**
Poultry	Farms	49	22	41	62	47	**5**
	Animals	NA	779	1,042	4,283	NA	**NA**

Livestock Inventory							
HUC 4100010040030							
Sheep	Farms	32	12	41	61	21	**3**
	Animals	1,134	335	765	2,770	21	**64**
Total							35
							3,969

Source: 2007 Census of Agriculture http://www.agcensus.usda.gov/

Point Sources

Municipal

- Bloomdale WWTP (2PA00074)
- Bloomdale WTP (2IW00040)

Package Plants

- Aeraland

Non-Point Sources

Critical Sewage Areas:

- N Side SR 12 at CR109 – 14 houses, Priority 3 (Hancock County)
- SE Corner 261/218 – 7 houses, Priority 3 (Hancock County)

Estimates of HSTSs				
Watershed	**Housing Units without sewers**	**Est. Unsewered Population (2000)**	**Unsewered Housing Units per acre**	**Unsewered Population per acre**
04100010040030	796	2,064	0.023	0.06

Sources: 2000 Census data and TMACOG "208" Plan. Analysis identifies approximate number of housing units without sewers in each watershed as an estimate of number of HSTSs.

Aquatic Life Use Impairments	
Causes	**Sources**
Direct habitat alterations	Channelization
Organic enrichment (sewage) biological indicators	Nonirrigated crop production
Sedimentation/siltation	On-site treatment systems
Total dissolved solids	Petroleum/natural gas activities
Source: Ohio 2010 Integrated Report, Watershed Assessment Unit Summary	

Water Supply

Public Water System	Population Served	Primary Water Source
Bloomdale	750	Ground

Water Quality Impairments

The OEPA Integrated Report assesses each watershed's attainment status for 1) Public Drinking Water Supply, 2) Recreation, 3) Human Health, 4) Aquatic Life, and 5) Fish Tissue. The Integrated Report identifies causes and sources of impairments where watersheds are not in attainment with water quality standards.

Background:

The headwaters of the South Branch River begin in northern Hancock County in the higher elevations of the Portage watershed atop the glacial end moraine. Some areas of the river have substantial wooded riparian while other areas are channelized and cleared of vegetation. Stream flow can be intermittent, which can result in low water quality data. The 1995 data was good to marginal and the preliminary 2008 TMDL scores indicate the headwaters to be Non- to Partial Attainment status due to low QHEI scores that result in low biological scores. Primarily the low scores result from the sediment in the waterway.

Farther downstream at Hall Road RM 14.43 the South Branch reaches Full Attainment status with a 63.5 QHEI score and again the stream is in Full Attainment at Portage View Road RM 8.35 at 60.5 QHEI.

A physical stream survey was done by members of the PRBC in 1997 along three location of the South Branch Portage River. At all locations, numerous log jams were reported as well as prevalent bank erosion rated as moderate to severe.

The 100-year floodplain model reaches upstream to RM 23.3 approximately 3-miles north of Arcadia. The location is section 13, Cass Township, Hancock County from the confluence with the Middle Branch in New Rochester.

Problem Statement 1: (Bacteria)

The water quality of the South Branch subwatershed is impaired by elevated measurements of E. coli bacteria. The Portage TMDL data collected by Ohio EPA in 2008 indicates that all five of the HUC's sampling sites are in non-attainment for E. coli. Ohio EPA lists failed HSTS as sources of impairments in all cases.

In this HUC are an estimated 796 HSTS; by density of onsite systems, this is one of the most rural HUCs. This area includes one package plant (unpermitted), but no CSO areas,

and two Critical Sewage Areas. they are the north side of SR 12 at CR109, which includes about 14 houses, and the SE Corner of 261/218. The Hancock County Health Department rates both as "Priority 3," meaning "scattered groups of older homes … there are few permits on file for these areas. … It is assumed that systems installed before 1986 and systems not identified with a permit are discharging systems." (Hancock County HSTS Plan 2004)

Goal 1.1: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 5.0 million gallons of HSTS effluent annually.

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 79 systems.
- N Side SR 12 at CR109 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- SE Corner 261/218 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in.

Goal 1.2: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 3.0 million gallons of package plant effluent annually.

Objective:

- Upgrade 1 package plant(s). Effluent quality meets P standards.

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Bacteria	1.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$1,185,000	Wood County Health Department, Hancock County Health Department, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 79 systems	5.0 million gallons/year sewage discharge eliminated

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	1.1	♦Prioritize and schedule sanitary survey ♦ N Side SR 12 at CR109 ♦Define study area with OEPA, Hancock County Health Department, Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$6,380	Hancock County Health Department, Hancock County Sanitary Engineer, City of Fostoria, OEPA	2018-23	N Side SR 12 at CR109 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦SE Corner 261/218 ♦Define study area with OEPA, Hancock County Health Department, Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$4,466	Hancock County Health Department, Hancock County Sanitary Engineer, City of Fostoria, OEPA	2018-23	SE Corner 261/218 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.2	♦Test package plant effluent for phosphorus ♦Set effluent standard in existing or new NPDES permit(s) ♦Enforce upgrades for phosphorus removal as needed	$3,600	Ohio EPA	2012-2017	Upgrade 1 package plant(s). Effluent quality meets effluent stds	3.0 million gallons/year effluent improved

Problem Statement 2: (Nutrients)

The Ohio EPA TMDL found three of five sampling sites in this HUC to meeting Aquatic Life attainment standards. The three sites in attainment are at Portage View, Hall, and Sterns Roads. The site at Township Road 218 southeast of Bloomdale was in partial attainment, with sources given as HSTS, crop production, and channelization. The site at County Road 109 was in non-attainment, with crop production, channelization, and legacy oil and gas drilling cited as sources. The Portage TMDL recommends a total phosphorus load allocation of 7.22 kg/day, requiring a nonpoint source load reduction of

3,792 lb P/year, the third highest of the Portage River HUCs. HSTS systems should be addressed as noted above. Agricultural BMPs should be applied throughout the watershed, with priority for habitat restoration BMPs at or above Township Road 218 (RM 22.58), including tributaries that enter the South Branch above that point.

Goal 2.1: Meet TMDL target for phosphorus load reduction by 421 and nitrate load by 1,781 lb/year from HSTS.

Objective: Replace or upgrade 10% of watershed's HSTS or 79 systems.

Goal 2.2: Meet TMDL target for phosphorus load reduction by 176 and nitrate load by 850 lb/year from package plants.

Objective: Upgrade 1 package plant(s). Effluent quality meets P stds.

Goal 2.3: Meet TMDL target for phosphorus load reduction by 3,196 and nitrate load by 12,524 lb/year from agricultural practices.

Objectives:

- 2,200 acres of cover crops
- 730 acres of controlled drainage
- 1600 acres of permanent hay
- 600 acres of riparian buffers
- 400 LF of restored oxbows
- 50 acres of restored wetlands
- 1000 LF of stream restoration
- 3000 LF of overwide / 2-stage ditch reconstruction
- 12104 acres under NRCS 590/1 Nutrient Mgt
- 5188 acres under NRCS 590/3 Nutrient Mgt
- 10000 acres of filter strips
- 600 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Nutrients (phosphorus and nitrate)	2.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$1,185,000	Wood County Health Department, Hancock County Health Department, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 79 systems	Reduce phosphorus load by 421 and nitrate load by 1,781 lb./year
	2.2	♦Test package plant effluent for phosphorus ♦Set effluent standard in existing or new NPDES permit(s) ♦Enforce upgrades for phosphorus removal as needed	$3,600	Ohio EPA	2012-2017	Upgrade 1 package plant(s). Effluent quality meets effluent stds	Reduce phosphorus load by 176 and nitrate load by 850 lb./year
	2.3	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$132,000	SWCD, NRCS, farmers	2012-2027 in phases	2,200 acres of cover crops	Reduce phosphorus load by 3098 and nitrate load by 6204 lb./year
	2.3	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$343,830	SWCD, NRCS, farmers	2012-2027 in phases	730 acres of controlled drainage	Reduce phosphorus load by 409 and nitrate load by 1051 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$448,000	SWCD, NRCS, farmers	2012-2027 in phases	1600 acres of permanent hay	Reduce phosphorus load by 1040 and nitrate load by 2080 lb./year
	2.3	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$420,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	600 acres of riparian buffers	Reduce phosphorus load by 204 and nitrate load by 408 lb./year
	2.3	♦Evaluate oxbow site(s) with County Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$109,428	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	400 LF of restored oxbows	Reduce phosphorus load by 67 and nitrate load by 134 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$255,312	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	50 acres of restored wetlands	Reduce phosphorus load by 19 and nitrate load by 144 lb./year
	2.3	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$348,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	1000 LF of stream restoration	Reduce phosphorus load by 38 and nitrate load by 77 lb./year
	2.3	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$267,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	3000 LF of overwide / 2-stage ditch reconstruction	Reduce phosphorus load by 504 and nitrate load by 1008 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Seek cooperators for Nutrient Management NRCS 590 Level 1 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management NRCS 590 Level 1 BMPs with farmers	$242,086	SWCD, NRCS, farmers	2012-2022	12104 acres under NRCS 590/1 Nutrient Mgt	NA
	2.3	♦Seek cooperators for Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with farmers	$207,502	SWCD, NRCS, farmers	2012-2022	5188 acres under NRCS 590/3 Nutrient Mgt	NA
	2.3	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$1,377	SWCD, NRCS, farmers	2012-2027 in phases	10000 acres of filter strips	Reduce phosphorus load by 100 and nitrate load by 200 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize fields suited for Conservation Tillage BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Conservation Tillage BMP with farmer	$9,000	SWCD, NRCS, farmers	2012-2027 in phases	600 acres of conservation tillage	Reduce phosphorus load by 88 and nitrate load by 1218 lb./year

Problem Statement #3: (Siltation/Sedimentation)

Three of the five sampling sites in this HUC are in attainment with Aquatic Life standards. The two upstream sites, at Township Road 218 and County Road 109, are in partial attainment and non-attainment, respectively. Ohio EPA gives impairment causes as channelization in both cases, and causes for both include sedimentation / siltation. Agricultural BMPs should be applied throughout the watershed, with priority for habitat restoration BMPs at or above Township Road 218 (RM 22.58), including tributaries that enter the South Branch above that point.

Goal 3.1:

Reduce sedimentation impairments by decreasing sediment load by 3,028 lb/year from agricultural practices.

Objectives:

- 2,200 acres of cover crops
- 730 acres of controlled drainage
- 1600 acres of permanent hay
- 600 acres of riparian buffers
- 400 LF of restored oxbows
- 50 acres of restored wetlands
- 1000 LF of stream restoration
- 3000 LF of overwide / 2-stage ditch reconstruction
- 10000 acres of filter strips
- 600 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Sedimentation	3.1	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$132,000	SWCD, NRCS, farmers	2012-2027 in phases	2,200 acres of cover crops	Reduce sediment load by 1,540 lb./year
	3.1	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$343,830	SWCD, NRCS, farmers	2012-2027 in phases	730 acres of controlled drainage	Reduce sediment load by 467 lb./year
	3.1	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$448,000	SWCD, NRCS, farmers	2012-2027 in phases	1600 acres of permanent hay	Reduce sediment load by 528 lb./year
	3.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$420,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	600 acres of riparian buffers	Reduce sediment load by 102 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Evaluate oxbow site(s) with County Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$109,428	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	400 LF of restored oxbows	Reduce sediment load by 34 lb./year
	3.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$255,312	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	50 acres of restored wetlands	Reduce sediment load by 4 lb./year
	3.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$348,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	1000 LF of stream restoration	Reduce sediment load by 38 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$267,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	3000 LF of overwide / 2-stage ditch reconstruction	Reduce sediment load by 252 lb./year
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$1,377	SWCD, NRCS, farmers	2012-2027 in phases	10000 acres of filter strips	Reduce sediment load by 100 lb./year
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$9,000	SWCD, NRCS, farmers	2012-2027 in phases	600 acres of conservation tillage	Reduce sediment load by 2 lb./year

Problem Statement #4: (Habitat)

Three of the five sampling sites in this HUC are in attainment with Aquatic Life standards. The two upstream sites, at Township Road 218 and County Road 109, are in partial attainment and non-attainment, respectively. Ohio EPA gives impairment sources as channelization in both cases, and lists direct habitat alternations as a cause of impairment for the furthest upstream site. Habitat restoration BMPs should be focused at

or above Township Road 218 (RM 22.58), with priority for the headwater streams at or above County Road 109 (RM 24.77).

Goal 4.1:

650 acres of habitat restoration and 4400 linear feet of stream corridor restoration practices.

Objective:

- 600 acres of riparian buffers
- 400 LF of restored oxbows
- 50 acres of restored wetlands
- 1000 LF of stream restoration
- 3000 LF of overwide / 2-stage ditch reconstruction

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Habitat Impairment	4.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$420,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	600 acres of riparian buffers	Load reductions provided in nutrient and sediment tables
	4.1	♦Evaluate oxbow site(s) with County Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$109,428	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	400 LF of restored oxbows	Load reductions provided in nutrient and sediment tables

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	4.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$255,312	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	50 acres of restored wetlands	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$348,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	1000 LF of stream restoration	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$267,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	3000 LF of overwide / 2-stage ditch reconstruction	Load reductions provided in nutrient and sediment tables

East Branch Portage River

04100010 040 040 (14 – digit HUC)
04100010 02 02 (New 12-digit HUC & Name: East Branch Portage River)

Length: 23.0 miles

Elevation Mouth: 677 feet

Elevation at Source: 789 feet

Average Fall: 6.5 (ft./mile)

Drainage Area: 35.8 sq. mi.

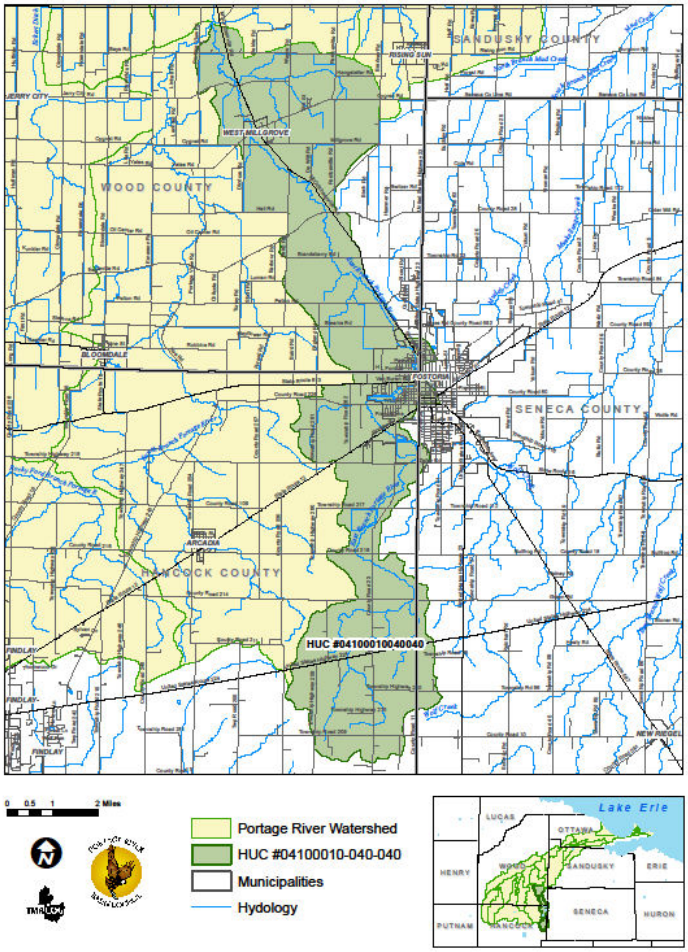
USGS Quads:

- Jerry City
- Bradner
- Bloomdale
- Fostoria
- Alvada

Urban Areas: Village of West Millgrove

City of Fostoria

HUC #04100010-040-040



Geology

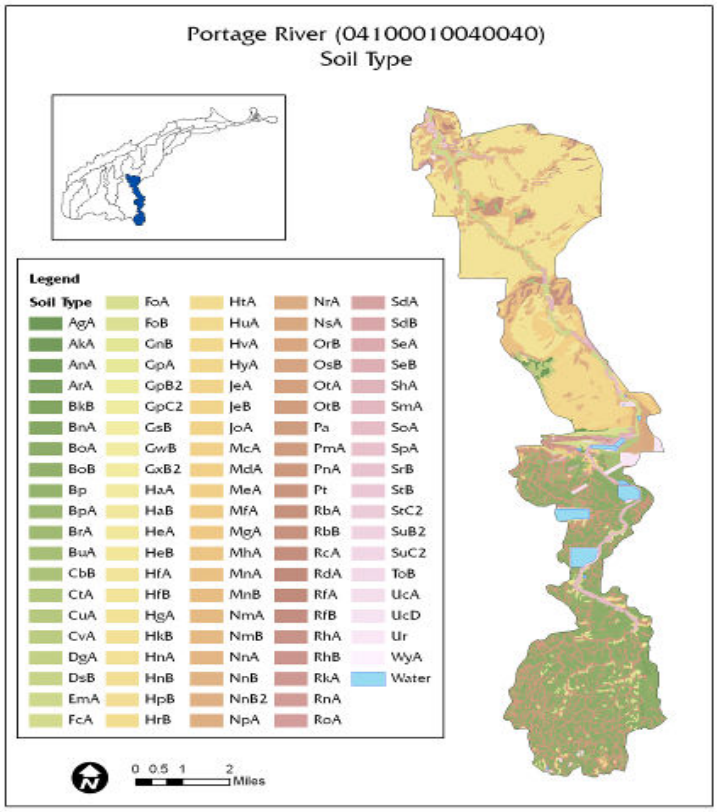
The East Branch Portage River is located in Wood County with the headwaters of the East Branch located in Hancock County with 789 feet in elevation that provides 112 feet of fall to the confluence of the East Branch and South Branch in Wood County. The lake plain geology is the result of the Wisconsinan glaciations. Beach ridges located near headwater streams in southern Wood County and Hancock County mark the shorelines of various stages of Glacial Lake Maumee (NRCS/USDA, 2007. Ohio EPA, 2008)

Soils

The two dominant soil associations present in the East Branch HUC14 04100010 040 040 subwatershed are Hoytville clay loam, 0 to 1 percent slopes (HgA) of 2,214 hectares and Blount silt loam, 0 to 2 percent slopes (BoA) that covers 1,728 hectares of the subwatershed. The soils are formed from till, lacustrine modified till, outwash sand and

gravel associated with Wisconsin Glaciation, and from recent alleviation. These soils types are affected by seasonal wetness are very poorly drained soils that have clay subsoil to heavy silty clay loam, on the glacial till plain.

Major Soil Groups		
040-040		
Hoytville	Sum Acres	6,865
	Percentage	30.02%
Blount	Sum Acres	6,075
	Percentage	26.57%
Pewamo	Sum Acres	2,894
	Percentage	12.65%
Nappanee	Sum Acres	1,388
	Percentage	6.07%
Mermill	Sum Acres	740
	Percentage	3.24%
Water	Sum Acres	415
	Percentage	1.82%
Eel	Sum Acres	388
	Percentage	1.70%
Millsdale	Sum Acres	379
	Percentage	1.66%


Portage River (04100010040040)
Soil Type
Legend
Soil Type
AgA
AkA
AnA
ArA
BkB
BnA
BoA
BoB
Bp
BpA
BrA
BuA
CbB
CtA
CuA
CvA
DgA
DsB
EmA
FcA
FoA
FoB
GnB
GpA
GpB2
GpC2
GsB
GwB
GxB2
HaA
HaB
HeA
HeB
HfA
HfB
HgA
HkB
HnA
HnB
HpB
HrB
HtA
HuA
HvA
HyA
JeA
JeB
JoA
McA
MdA
MeA
MfA
MgA
MhA
MnA
MnB
NmA
NmB
NnA
NnB
NnB2
NpA
NrA
NsA
OrB
OsB
OtA
OtB
Pa
PmA
PnA
Pt
RbA
RbB
RcA
RdA
RfA
RfB
RhA
RhB
RkA
RnA
RoA
SdA
SdB
SeA
SeB
ShA
SmA
SoA
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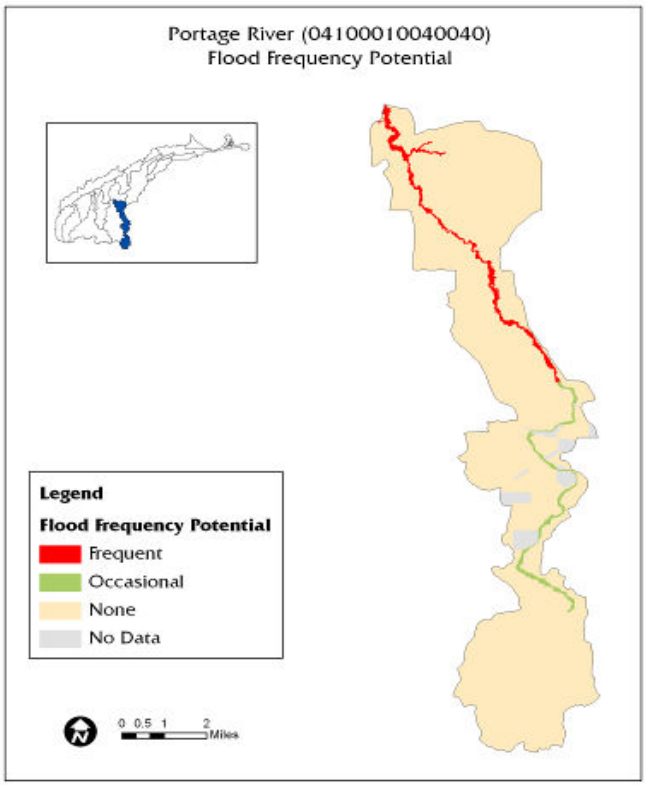
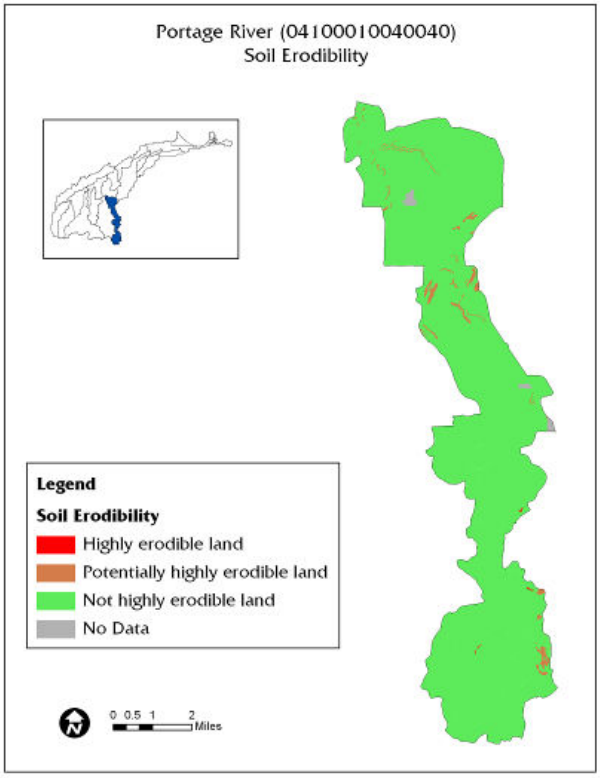
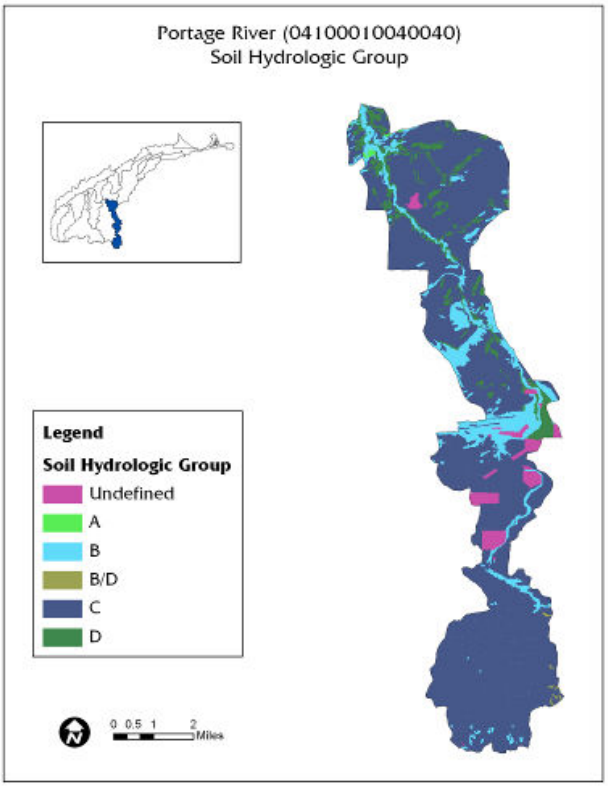
WyA
Water
0 0.5 1 2
Miles


Portage River (04100010040040)
Flood Frequency Potential
Legend
Flood Frequency Potential
Frequent
Occasional
None
No Data
0 0.5 1 2
Miles


Portage River (04100010040040)
Soil Erodibility
Legend
Soil Erodibility
Highly erodible land
Potentially highly erodible land
Not highly erodible land
No Data
0 0.5 1 2
Miles


Portage River (04100010040040)
Soil Hydrologic Group
Legend
Soil Hydrologic Group
Undefined
A
B
B/D
C
D
0 0.5 1 2
Miles

The Soil Hydrologic Group map indicates the *Hydrologic soil groups* based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms (Wood County Soil Survey, March 2005). The following soil group descriptions are directly from the Wood County Soil Survey, page 241.

The four hydrologic soil groups are:

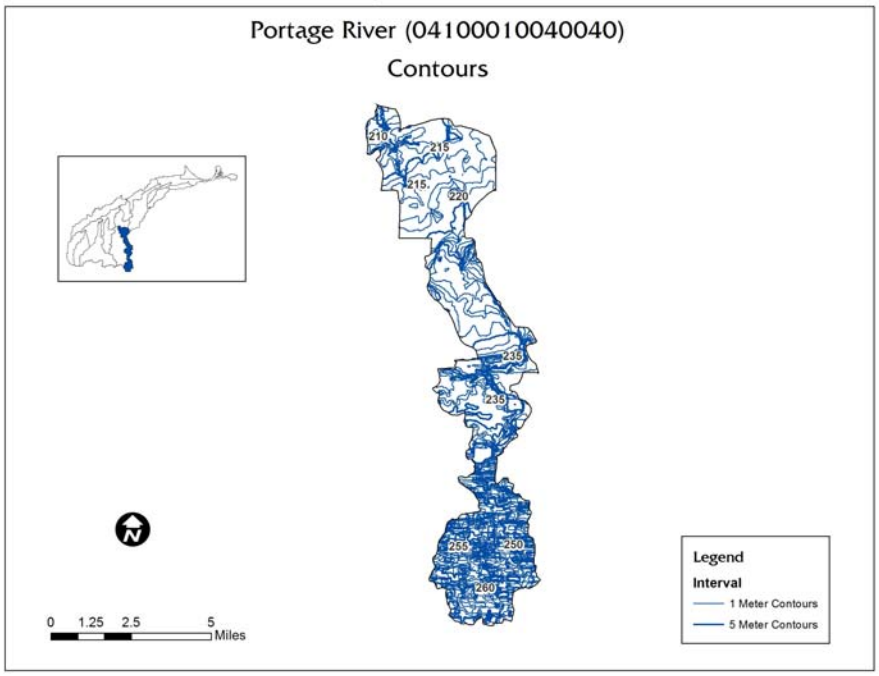
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

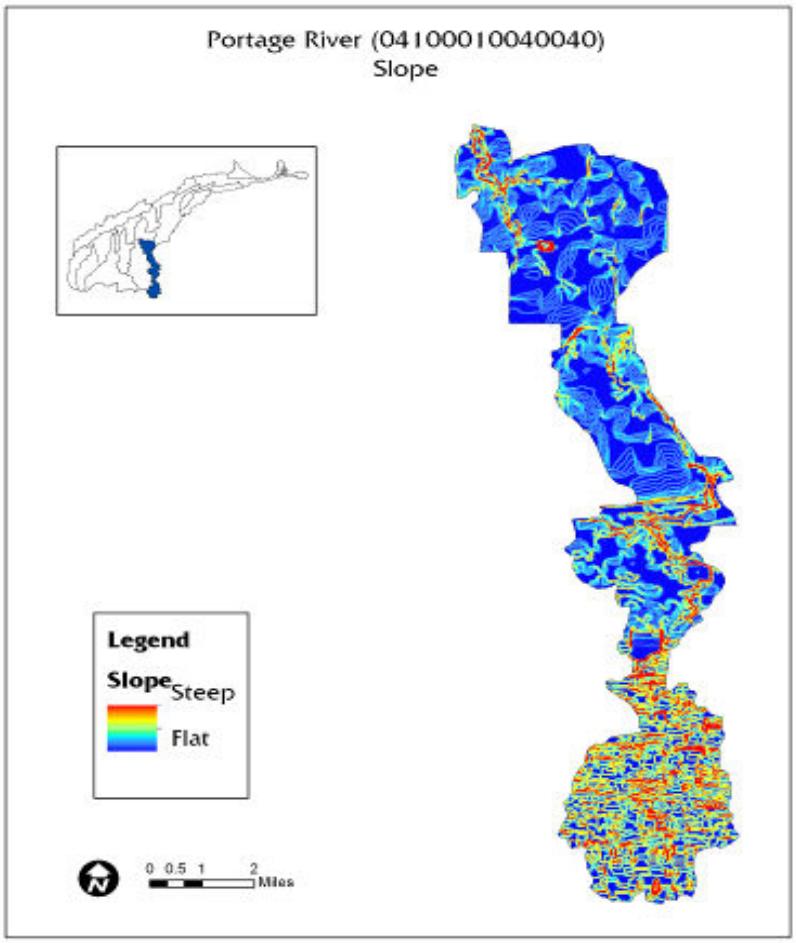
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately course texture. These soils have a moderate rate of water transmission.

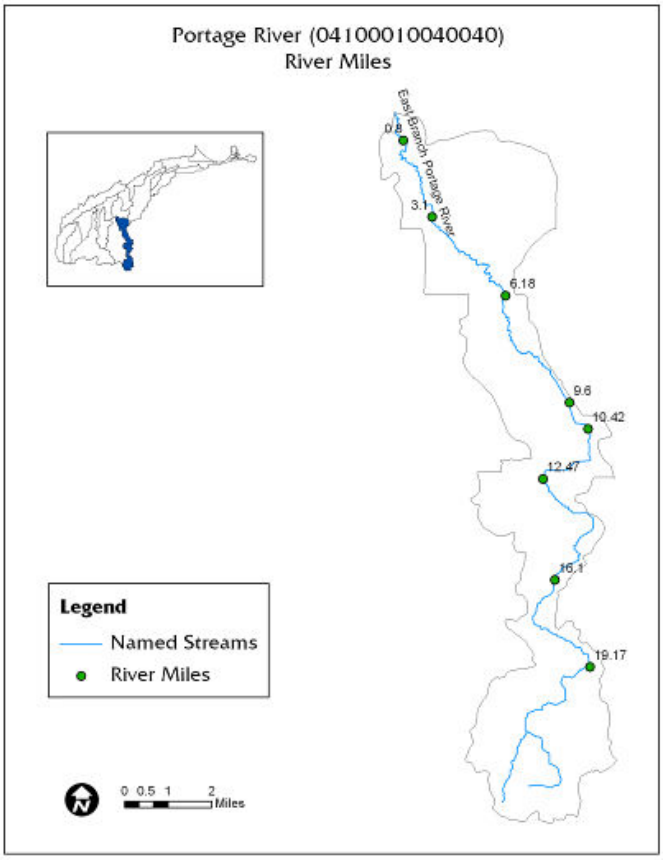
Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (**A/D, B/D, or C/D),** the first letter is for drained areas and the second is for undrained areas.


Portage River (04100010040040)
Contours
210
215
215
220
230
235
255
250
260
0 1.25 2.5 5
Miles
Legend
Interval
1 Meter Contours
5 Meter Contours


Portage River (04100010040040)
Slope
Legend
Slope
Steep
Flat
0 0.5 1 2
Miles



Rare, Threatened, Endangered Species

No rare, threatened, or endangered species have been observed in the East Branch of the Portage River. The only fresh water mussel species found in this subwatershed is one Lilliput mussel towards the headwater area.

Rare, Threatened, Endangered Species			
Common Name	***Scientific Name***	**Last Observed**	**State Status**
None			

T=Threatened, P=Potentially Threatened, E=Endangered, X=Presumed Extirpated, SC=Species of Concern

Mussel Species

Stream River Miles	Common Mussel Name	*Scientific Name*	Observed	Status
19.17	None			
16.10	None			
12.47	Lilliput	*Toxolasma parvum*	2008	
10.42	None			
9.60	None			
6.18	None			

Stream River Miles	Common Mussel Name	*Scientific Name*	Observed	Status
3.10	None			
0.80	None			

SC=Species of Concern **Ohio EPA**

Water Resources

Surface Water

"The **Ohio Integrated Water Quality Monitoring and Assessment Report** indicate the general condition of Ohio's waters and identifies waters that are not meeting water quality goals. The report satisfies the Clean Water Act requirements for both Section 305(b) water quality reports and Section 303(d) lists of impaired waters." The Ohio 2010 Integrated Report can be located at the Ohio EPA webpage at: http://www.epa.state.oh.us/dsw/tmdl/OhioIntegratedReport.aspx

The Ohio 2010 Integrated Report website offers downloads of data and individual chapters. Individual river information on the health of water quality in Ohio, as well as Lake Erie near shore water standards can be obtained for human health use, aquatic life (fish and aquatic insects), chemical concerns for drinking water and recreation uses such as swimming and boating in our state's water.

If water quality standards are not met according to indicators set for that water body, the water quality is then determined to be ***impaired***. The goal is to identify the cause and source of the pollutant(s) which impair(s) that water and to restore it to ***attainment*** status. If the water quality is healthy (full attainment) then methods are employed to protect the healthy water from any possible future contaminates.

The East Branch Portage River waterway is designated use for **warm-water habitat** (WWH) **aquatic use**. The **Recreation Use** assessment is Class B. That determines the acceptable E. Coli colony numbers as shown below in a summary table taken from the Ohio 2010 Integrated Report, Section F: Evaluating Beneficial Use: Recreation, p. F-1.

Summary of the recreation use assessment methods.		
Bathing Waters		
Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method Summary
E. coli	Seasonal geometric mean *E. coli* content* based on samples from the recreation season within a	Applied to the three Lake Erie shoreline assessment units, exceedence of the geometric mean bathing water criterion or an exceedence of the single sample

Summary of the recreation use assessment methods.		
Bathing Waters		
	calendar year is 126 cfu/100 ml; single sample maximum is 235 cfu/100 ml.	maximum for more than 10% of the recreation season is considered an impairment of the bathing water use.
Primary Contact and Secondary Contact		
Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method Summary
E. coli	Seasonal geometric mean *E. coli* content* based on samples from the recreation season within a calendar year is: **Primary Contact Waters** Class A: 126 cfu/100 ml Class B: 161 cfu/100 ml Class C: 206 cfu/100 ml **Secondary Contact Waters** 1030 cfu/100 ml	Applied to streams and inland lakes. Data from a recreation season are assessed on a site-by-site basis and compared to the applicable geometric mean *E. coli* criterion whenever more than one sample result is available for a watershed assessment unit. Assessment units are considered to be in full attainment if all sites assessed within the assessment unit meet the applicable geometric mean criterion and in non-attainment if one or more sites assessed within the assessment unit exceed the applicable geometric mean criterion.

*** *E. coli* concentrations are expressed in colony forming units (cfu) per 100 milliliters (ml)**

HUC 8 – 04100010 (Portage River)									
HUC 10 – 04100010-02 (South Branch Portage River - Middle Branch Portage River)									
HUC 12 – 04100010 02 02 (East Branch Portage River)									
HUC 14 – East Branch Portage River 04100010-040-040									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
27	2008	S01K21	E. Br. Portage R. S Of Fostoria @ Twp. Rd. 214	19.17	9.4	WWH	Non	Low flow alterations, Organic and nutrient enrichment, Siltation	Non-irrigated crop production, Manure runoff
28	2008	300373	E. Br. Portage R. @ Twp. Rd. 217	16.10	12.3	WWH	Partial	Low flow alterations, Siltation	Non-irrigated crop production, Channelization
29	2008	S01S30	E. Br. Portage R. At Fostoria @ Co. Rd. 226	12.47	12.3	WWH	Full	None listed	None listed
30	2008	300512, S01P02	E. Br. Portage R. At Fostoria,	10.38, 10.42	12.3	WWH	Non	Organic enrichment	Fostoria's CSOs

HUC 8 – 04100010 (Portage River)									
HUC 10 – 04100010-02 (South Branch Portage River - Middle Branch Portage River)									
HUC 12 – 04100010 02 02 (East Branch Portage River)									
HUC 14 – East Branch Portage River 04100010-040-040									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
			Upst. Portage Park						
31	2008	S01P03	E. Br. Portage R. @ Stearns Rd.	9.60	18.7	WWH	Non	Ammonia-N, Nitrate/Nitrite	Fostoria's WWTP and CSOs
32	2008	S01P05	E. Br. Portage R. NW Of Fostoria @ Eagleville Rd.	6.18	23.0	WWH	Full	None listed	None listed
33	2008	S01P07	E. Br. Portage R. NW Of Fostoria @ Cygnet Rd.	3.10	26.0	WWH	Full	None listed	None listed
34	2008	S01P09	E. Br. Portage R. Nr Mouth @ Bays Rd.	0.80	35.5	WWH	Full	None listed	None listed

Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010.

Recreational Use Attainment						
Location	RM	Recreation Use for Primary Contact Recreation waters (PCR) Class	Number of Samples	E. coli Geometric **Mean <161** and Single Sample Maximum ≤ 523 Value For Class B (recreation use intensity)	Attainment Status	Sources of Bacteria
E. Br. Portage R. S Of Fostoria @ Twp. Rd. 214	19.17	B	3	773 mean 1,400 max	NON	HSTS; Agric.
E. Br. Portage R. @ Twp. Rd. 217	16.10	B	3	407 mean 1,000 max	NON	HSTS; Agric.
E. Br. Portage	12.47	B	5	46 mean	FULL	

Recreational Use Attainment

Location	RM	Recreation Use for Primary Contact Recreation waters (PCR) Class	Number of Samples	E. coli Geometric **Mean <161** and Single Sample Maximum ≤ 523 Value For Class B (recreation use intensity)	Attainment Status	Sources of Bacteria
R. At Fostoria @ Co. Rd. 226				300 max		
E. Br. Portage R. At Fostoria, Upst. Portage Park	10.38, 10.42	B	5	1,145 mean 2,000 max	NON	CSOs; Urban area
E. Br. Portage R. @ Stearns Rd.	9.60	B	5	1,758 mean >10,000 max	NON	HSTS ; Fostoria WWTP
E. Br. Portage R. NW Of Fostoria @ Eagleville Rd.	6.18	B	5	654 mean 1,200 max	NON	HSTS; Agric.
E. Br. Portage R. NW Of Fostoria @ Cygnet Rd.	3.10	B	5	2,118 mean >200,000 max	NON	CSOs; Urban area
E. Br. Portage R. Nr Mouth @ Bays Rd.	0.80	B	5	868 mean 1,800 max	NON	HSTS; Agric.

Aquatic Life Use Assessment

Location	RM	Drainage Area	Aquatic Life Use	Attainment Status
E. Br. Portage R. S Of Fostoria @ Twp. Rd. 214	19.17	9.4	WWH	Non
E. Br. Portage R. @ Twp. Rd. 217	16.10	12.3	WWH	Partial
E. Br. Portage R. At Fostoria @ Co. Rd. 226	12.47	12.3	WWH	Full
E. Br. Portage R. At Fostoria, Upst. Portage Park	10.38, 10.42	12.3	WWH	Non
E. Br. Portage R. @ Stearns Rd.	9.60	18.7	WWH	Non
E. Br. Portage R. NW Of Fostoria @ Eagleville Rd.	6.18	23.0	WWH	Full
E. Br. Portage R. NW Of Fostoria @ Cygnet Rd.	3.10	26.0	WWH	Full
E. Br. Portage R. Nr Mouth @ Bays Rd.	0.80	35.5	WWH	Full

Macro-invertebrate Communities										
Stream RM	**Dr. Ar. (sq. mi.)**	**Data Codes**	**Qual. Taxa**	**EPT QI./Total**	**Sensitive Taxa QI./Total**	**Density QI./Qt.**	**CW Taxa**	**Predominant Organisms on the Natural Substrates With Tolerance Category(ies)**	**ICI[a]**	**Narrative Evaluation**
19.17	9.4	-	43	9	6	L	0	Sow bugs (F), blackflies (F), caddisflies (F)	-	Fair
16.10	12.3	-	34	5	5	L-M	0	Sow bugs (F), midges (MI,F), snails (T)	-	Low Fair
12.47	12.3	-	41	10	4	M-H	0	Midges (T,F), hydropsychid caddisflies (F), blackflies (F)	-	Marg. Good
10.38, 10.42	12.3	-	38	4	1	L	1	Oligochaete worms (T), midges (F), hydropsychid caddisflies (F)	-	Low Fair
9.60	18.7	-	33	2	0	L-M	1	Oligochaete worms (T), midges (MT,F), hydropsychid caddisflies (F)	-	Poor
6.18	23.0	-	35	6 / 7	3 / 8	M / 629	0	Baetid mayflies (F), hydropsychid caddisflies (F), flatworms (F)	42	
3.10	26.0	-	46	10 / 10	8 / 14	M / 380	0	Baetid mayflies (F), hydropsychid caddisflies (F), midges (F)	42	
0.80	35.5	-	28	7 / 7	8 / 15	L / 548	0	Mayflies (F), midges (MI,F), hydropsychid caddisflies (F)	42	

Source: Ohio EPA, 2008

Public Drinking Water Supply Assessment				
HUC	**Reporting Category**	**Cause of Impairment**	**Nitrate Watch List**	**Pesticide Watch List**
East Branch Portage River 04100010-040-040	3i	None	Yes	No

Fish Tissue Assessment			
HUC	**Reporting Category**	**Causes of Impairment**	**PCB Concentration**
East Branch Portage River 04100010-040-040	5	PCBs	26 ppb

Water Quality Monitoring Results: Ohio EPA 1994 and 2008						
River Mile	**Date**	**IBI**	**ICI**	**MIwb**	**QHEI**	**STATUS**
17.3	1988	20* Poor	-	-	24.0	
12.6	1988	21* Poor	-	-	59.5	
11.3	1988	21* Poor	-	-	49.5	
10.4	1988	12* V. Poor	-	-	51.5	
10.2	1988	12* Poor	-	-	59.5	
6.2	1988	12* V. Poor	-	0.9*	76.5	
0.8	1988	23*Fair/Poor	-	6.5*	53.0	
17.6	1994	17* V. Poor	-	-	31.0	
12.5	1994	22* Poor	-	-	53.0	
10.4	1994	18* Poor	-	-	50.5	
10.2	1994	15* V. Poor	-	-	52.0	
9.1	1994	12* V. Poor	-	-	31.0	
4.9	1994	24* V. Poor/Poor	-	4.8*	48.0	
0.8	1994	29^{ns}	-	7.4	63.0	
The above fish community indices are from samples collected in the Portage River study area in 1994, 1985 and 1983. MIwb and IBI scores are Mean scores and compared to Ecoregional Biocriteria for the HELP.						
19.17	*2008*	*20**	*F**	*N/A*	*43.0*	**NON**
16.10	*2008*	*26^{ns}*	*LF**	*N/A*	*47.5*	PARTIAL
12.47	*2008*	*28*	*MG^{ns}*	*N/A*	*51.0*	FULL
10.42	*2008*	*22**	*LF**	*N/A*	*58.5*	**NON**
9.60	*2008*	*22**	*P**	*N/A*	*47.5*	**NON**
6.18	*2008*	*29*	*42*	*6.9^{ns}*	*78.5*	FULL
3.10	*2008*	*32*	*42*	*7.1^{ns}*	*68.0*	FULL
0.80	*2008*	*40*	*-*	*8.0*	*60.0*	

a - River Mile (RM) represents the Point of Record (POR) for the station, not the actual sampling RM.
b - MIwb is not applicable to headwater stream with drainage areas ≤20 mi^2.
c - A narrative evaluation of the qualitative sample based on attributes such as EPT taxa richness, number of sensitive taxa, and community composition was used when quantitative data was not available or considered unreliable. VP=Very Poor, P=Poor, LF=Low Fair, F=Fair, MG=Marginally Good, G=Good, VG=Very Good, E=Exceptional
d - Attainment is given for the proposed status when a change is recommended. Aquatic life use in superscript.
ns - Nonsignificant departure from biocriteria (≤4 IBI or ICI units, or ≤0.5 MIwb units).
* - Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.
Italic: 2008 TMDL scores in review.

General narrative ranges assigned to QHEI scores.				
Narrative Rating		QHEI Range		
		Headwaters (≤ sq mi)	Larger Streams	Lacustuary
Excellent		≤ 70	≤ 75	≤ 80
Good		55 to 69	60 to 74	60 to 80
Fair		43 to 54	45 to 59	45 to 59
Poor		30 to 42	30 to 44	30 to 44
Very Poor		<30	<30	<30

Biological Criteria Benchmarks

Biological Criteria					Lacustuary Benchmarks[1]				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
IBI-Headwaters	50	28	20	18	N/A	N/A	N/A	N/A	N/A
IBI-Wading	50	32	22	18	N/A	N/A	N/A	N/A	N/A
IBI-Boat	48	34	20	16	50	42	31	17	<17
MIwb-Wading	9.4	7.3	5.6	4.5	N/A	N/A	N/A	NA	N/A
MIwb-Boat	9.6	8.6	5.7	5.0	10	8.6	5.6	2.8	<2.8
ICI	46	34	22	8	52	42	25	12	<12

[1] **Proposed Lacustuary scoring breakpoints. These have not yet been adopted into rule.**

Ground Water

There are no municipal areas within this subwatershed that rely on groundwater for drinking water. The City of Fostoria draws its water from the East Branch; in the rest of the watershed, individual households use private wells.

DRASTIC MAP

The sensitivity of the groundwater to local sources of contamination is determined and rated by **DRASTIC** maps as described below:

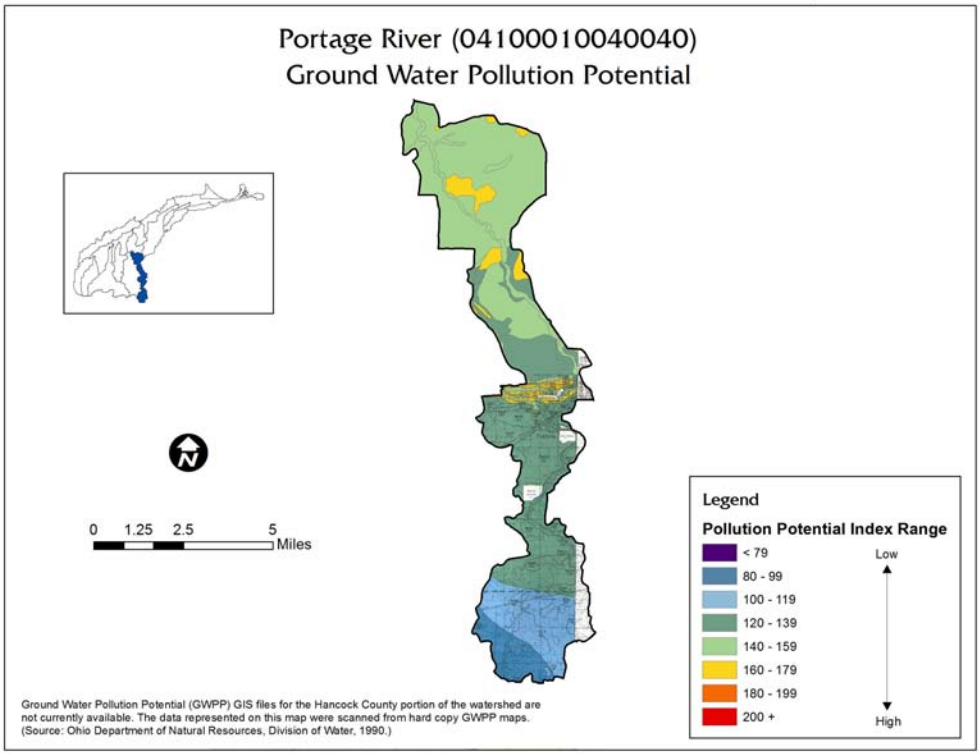
Inherent within each geologic setting are the physical characteristics which effect the groundwater pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:

D – Depth to Water
R – Net Recharge
A – Aquifer Media
S – Soil Media
T – Topography
I – Impact of the Vadose Zone Media
C – Conductivity (Hydraulic) of the Aquifer (ODNR, 1994)

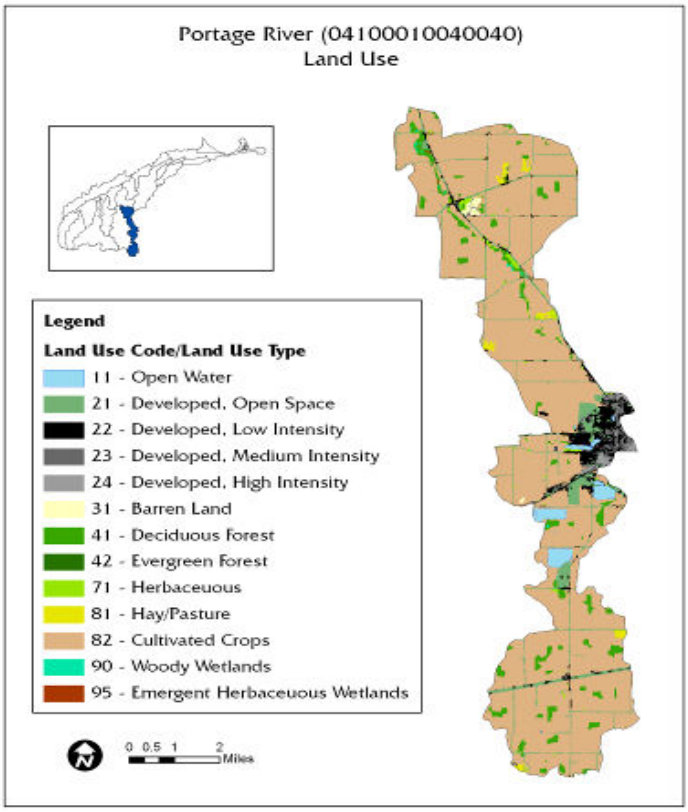
Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index, the greater the vulnerability to contamination (ODNR, 1994).

The average ground water pollution index potential for the Wood County portion of the East Branch watershed is 150 with a range of 122-169. In Hancock County, for which GIS data are not available, the range is about 80-180.

The Ohio Department of Natural Resources, Division of Water, Water Resources Section is the responsible agency to map groundwater resources throughout the state. Greater detail on DRASTIC maps for the Portage can be found in Chapter 4 of this watershed plan.



Sub-watershed (04100010-02-02)		
040-040		
Land Use	**Percent**	**Acres**
Urban	12.1%	2,756
Forest	5.2%	1,190
Pasture	0.8%	182
Cropland	79.5%	18,147
Other	2.4%	540
Total Acres	100%	22,815



Livestock Inventory							
HUC 4100010040040							
Type of Animal		**Hancock**	**Ottawa**	**Sandusky**	**Seneca**	**Wood**	**Estimates for HUC**
Percent of County in HUC		3.1%	0.0%	0.0%	0.2%	2.9%	
Cattle	Farms	129	89	167	264	144	**9**
	Animals	4,233	1,523	4,612	10,096	6,287	**337**
Hogs	Farms	51	15	37	62	30	**3**
	Animals	32,343	3,639	5,591	42,808	39,469	**2,250**
Horses	Farms	105	63	132	72	128	**7**
	Animals	844	444	772	463	1,004	**56**
Poultry	Farms	49	22	41	62	47	**3**
	Animals	NA	779	1,042	4,283	NA	**NA**
Sheep	Farms	32	12	41	61	21	**2**
	Animals	1,134	335	765	2,770	21	**43**
Total							23
							2,667

Source: 2007 Census of Agriculture http://www.agcensus.usda.gov/

Point Sources

Municipal

- Fostoria WWTP (2PD00031)

Package Plants

- Neo-Wood Products | NWP Manufacturing

Industrial

- Gerken Materials Inc. - West Millgrove Quarry (2IJ00089)
- Archer Daniels Midland Co (2II00036)
- BP Oil Pipeline Co Fostoria Tank Farm (2IG00017)

Non-Point Sources

Critical Sewage Areas:

- West Millgrove pop. 177 (Wood County)
- Hatton, 12 houses (Wood County)
- CR 216 E of CR 23 – 15 houses, Priority 3 (Hancock County)
- SR 613 Washington Township §2: 9 houses, Priority 3 (Hancock County)
- West Independence, Biglick Township §§1-2: 14 houses, Priority 3 (Hancock County)
- Washington Township §§11-12: 59 houses, Priority 2 (Hancock County)

Estimates of HSTSs				
Watershed	**Housing Units without sewers**	**Est. Unsewered Population (2000)**	**Unsewered Housing Units per acre**	**Unsewered Population per acre**
04100010040040	813	2,097	0.036	0.092

Sources: 2000 Census data and TMACOG "208" Plan. Analysis identifies approximate number of housing units without sewers in each watershed as an estimate of number of HSTSs.

Aquatic Life Use Impairments	
Causes	**Sources**
Ammonia (total)	Channelization
Low flow alterations	Combined sewer overflows
nitrate/nitrite	Manure runoff
Nutrient eutrophication biological indicators	Municipal point source discharges
Organic enrichment (sewage) biological indicators	Nonirrigated crop production
Sedimentation/siltation	
Source: Ohio 2010 Integrated Report, Watershed Assessment Unit Summary	

Water Supply

Public Water System	Population Served	Primary Water Source
Fostoria	15,000	Surface: East Branch

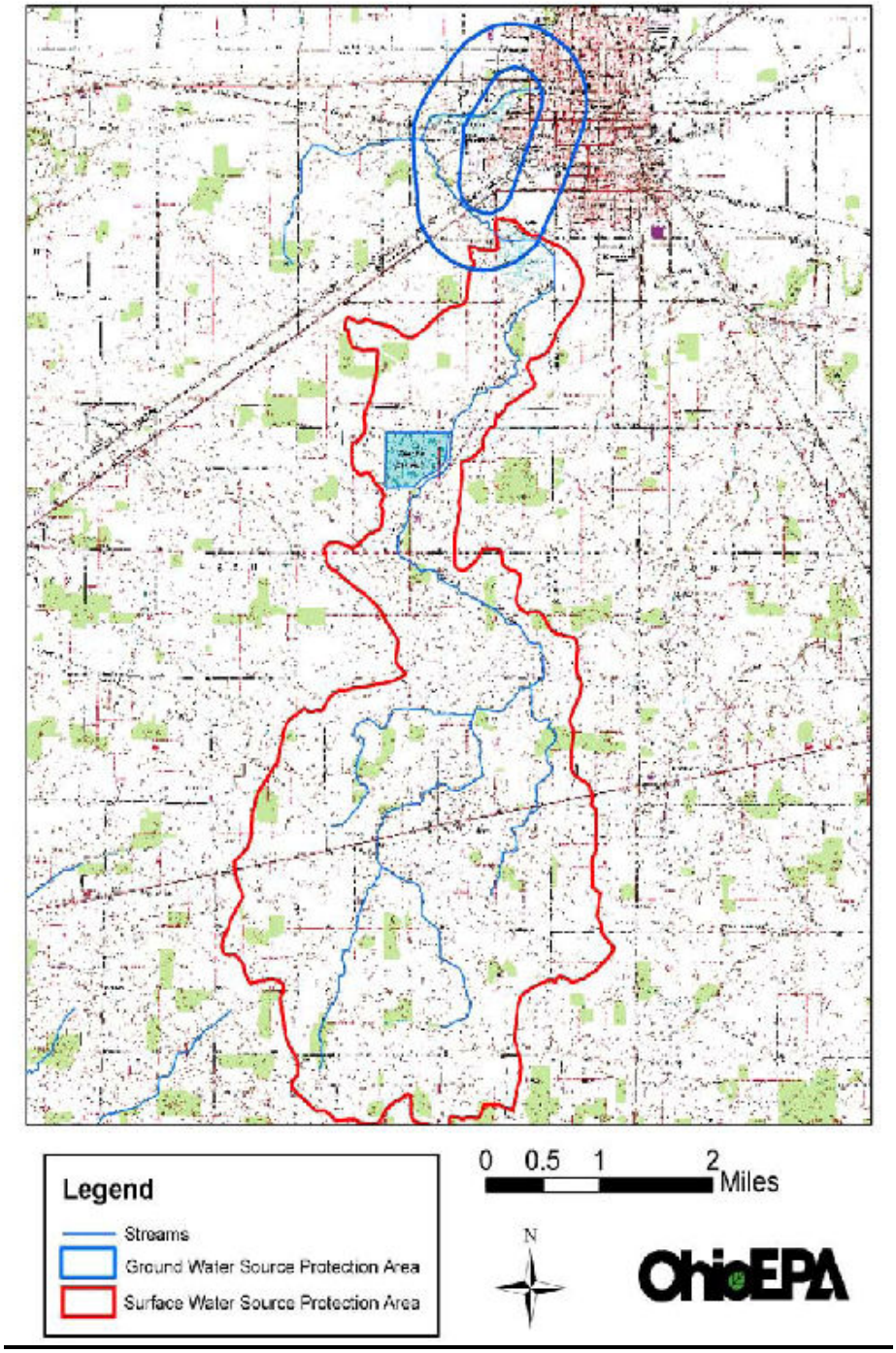
Source Water Assessment Plan (SWAP)

The City of Fostoria has a public water system serving 15,000, which includes the Village of Arcadia. The intake draws water from the East Branch of the Portage River. The Drinking Water Source Assessment for the City of Fostoria (Ohio EPA, 2003) defines a Drinking Water Source Protection Area, as well as Corridor Management Zone, and an Emergency Management Zone,

The protection area is established to help protect the drinking water supply from pollution contaminates. Within the source water protection area the SWAP provides an inventory of all potential sources of contamination which could reach the water supply. The SWAP notes that "the City of Fostoria's protection area is susceptible to contamination from agricultural runoff, feed lot runoff, gas line rupture, unsewered areas (including failed septic systems), composting facility runoff and waste water treatment (package plant) discharges. In addition, the source water is susceptible to contamination through motor vehicle accidents or spills at sites where the corridor zone is crossed by roads or underground gas lines." The SWAP rates susceptibility of the ground water to contamination as moderate. The report recommends protection activities in the areas of Education and Outreach, Coordination with Existing Activities, Emergency Response Planning, Water Quality Monitoring, Zoning Ordinances, Regulatory Compliance, Unsewered Areas, Future Development, Agricultural Activities, and Transportation Routes.

The 2010 Integrated Report Public Drinking Water Supply Assessment places the East Branch on a nitrate watch list. Measures to reduce nitrate loadings in this watershed upstream of the intake, notably from HSTSs and agricultural practices, would be appropriate.

Fostoria's Drinking Water Source Protection Area is shown in the following figure (Ohio EPA, Drinking Water Source Assessment for the City of Fostoria, January 2003).



Water Quality Impairments

The OEPA Integrated Report assesses each watershed's attainment status for 1) Public Drinking Water Supply, 2) Recreation, 3) Human Health, 4) Aquatic Life, and 5) Fish Tissue. The Integrated Report identifies causes and sources of impairments where watersheds are not in attainment with water quality standards.

Background:

The East Branch Portage River has point source pollution from the City of Fostoria's wastewater plant and CSOs. Non-point source pollution contributes to the headwaters, upstream of Fostoria with surface run-off of organic nutrients, manure runoff, siltation, and channel-flow alterations.

The headwaters form south of Fostoria in the elevated area of northern Hancock County, where the entire river system in Hancock is ditch maintained throughout agricultural land and forested wood lots.

Nine miles of the East Branch from its river mouth RM 0.0 to RM 6.18 are in Full Attainment, as well as RM 12.47. The remaining fourteen miles of the East Branch are in non-attainment and a small section of river in partial attainment of Ohio's water quality standards.

Downstream of Fostoria, between RM 10.1 and RM 9.0 at Pelton Rd., the stream is classified as in non-attainment for fish, macro invertebrates and physical habitat of the stream. This stream reach is maintained, and includes Fostoria's sewerage system outfalls. The City of Fostoria is developing its Long Term Control Plan estimates needed sewerage improvements between $40-$50 million.

The Village of West Millgrove is not sewered and depends on home septic systems. In 2009 the Ohio EPA issued orders for installation of sewers, which will be completed in 2012. The installation of sewers will help eliminate the bacteria pollution impact to the East Branch Portage River.

Along the East Branch headwaters in Hancock County from RM 19.17 and RM 16.10 is none and partial attainment. This area is upstream of the Fostoria water supply reservoir; the stream is on OEPA's nitrate watch list.

Problem Statement #1: (Bacteria)

The water quality of the East Branch subwatershed is impaired by elevated measurements of E. coli bacteria in the waterway. The Portage TMDL data collected by Ohio EPA in 2008 indicates that 7 of the HUC's 8 sampling sites are in non-attainment for E. coli. The

TMDL cites failed HSTS, CSOs, and the Fostoria WWTP as the causes of impairment due to high E. coli bacteria levels.

In this HUC are an estimated 813 HSTS. In comparison with other HUCs, the density of onsite systems is moderate. This area includes one package plant (unpermitted), but no CSO areas, and six Critical Sewage Areas. they are West Millgrove (sewers under construction and expected to be completed in 2012), Hatton (12 houses, Wood County), CR 216 E of CR 23 (15 houses, Priority 3 Hancock County), SR 613 in Washington Township §2 (9 houses, Priority 3 Hancock County), West Independence in Biglick Township §§1-2 (14 houses, Priority 3 Hancock County), and Washington Township §§11-12 (59 houses, Priority 2 Hancock County). The Hancock County Health Department defines "Priority 2" as areas where "water quality impairment has been documented by the Hancock County Health Department and the Ohio Environmental Protection Agency." "Priority 3," is defined as "scattered groups of older homes … there are few permits on file for these areas. … It is assumed that systems installed before 1986 and systems not identified with a permit are discharging systems." (Hancock County HSTS Plan 2004).

Goal 1.1: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 5.2 million gallons of HSTS effluent annually.

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 81 systems
- West Millgrove sewers completed and all structures tapped in
- Hatton Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- CR 216 E of CR 23 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- SR 613 Washington Township §2 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- West Independence Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- Washington Township §§11-12 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in.

Goal 1.2: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 0.7 million gallons of package plant effluent annually.

Objectives:

Upgrade 1 package plant(s). Effluent quality meets P standards.

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Bacteria	1.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$1,215,000	County Health Dept, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 81 systems	5.2 million gallons/year sewage discharge eliminated
	1.1	♦Construct sewers for West Millgrove Critical Sewage Area ♦Project is under orders	$2,500,000	Northwestern Water and Sewer District	2012	West Millgrove sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦ Hatton ♦Define study area with OEPA, Wood County Health Department, Northwestern Water and Sewer District ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$13,680	Wood County Health Department, Northwestern Water and Sewer District, Village of Risingsun, OEPA	2018-23	Hatton Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦ CR 216 E of CR 23 ♦Define study area with OEPA, Hancock County Health Department, Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$9,570	Hancock County Health Department, Hancock County Sanitary Engineer, City of Fostoria, OEPA	2018-23	CR 216 E of CR 23 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	1.1	♦Prioritize and schedule sanitary survey ♦ SR 613 Washington Township §2 ♦Define study area with OEPA, Hancock County Health Department, Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$5,742	Hancock County Health Department, Hancock County Sanitary Engineer, City of Fostoria, OEPA	2018-23	SR 613 Washington Township §2 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦ West Independence, Biglick Township §§1-2 ♦Define study area with OEPA, Hancock County Health Department, Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$8,932	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA	2018-23	West Independence Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦ Washington Township §§11-12 ♦Define study area with OEPA, Hancock County Health Department, Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$37,642	Hancock County Health Department, Hancock County Sanitary Engineer, City of Fostoria, OEPA	2012-18	Washington Township §§11-12 Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	1.2	♦Test package plant effluent for phosphorus ♦Set effluent standard in existing or new NPDES permit(s) ♦Enforce upgrades for phosphorus removal as needed	$3,600	Ohio EPA	2012-2017	Upgrade 1 package plant(s). Effluent quality meets effluent stds	0.7 million gallons/year effluent improved

Problem Statement 2: (Nutrients)

The Ohio EPA TMDL found four of eight sampling sites in this HUC to meeting Aquatic Life attainment standards. The sites in attainment are at Bays Road (RM 0.8), Cygnet Road (RM 3.1), Eagleville Road (RM 6.18), and County Road 226 (RM 12.47). The non-attainment sites are at Stearns Road (RM 9.6), Portage Park (RM 10.4), and Township Road 214 (RM 19.17). The remaining site, at Township Road 217 (RM 16.1) is in partial attainment. Sources of impairment for the upstream sites in Hancock County (Township Roads 214 and 217) are crop production and channelization, and causes being low flow alteration and siltation. The next downstream site (County Road 226) is in attainment. Downstream of that, causes and sources of impairment indicate impacts from Fostoria and its combined sewer system. Below Fostoria, starting at Eagleville Road, the stream is again in attainment. The Portage TMDL recommends a total phosphorus load allocation of 0 kg/day, requiring a nonpoint source load reduction of 2,979 lb. P/year, the fifth highest of the Portage River HUCs. HSTS systems should be addressed as noted above. Agricultural BMPs should be applied throughout the watershed, with priority for habitat restoration BMPs at or above Township Road 217, including tributaries that enter the South Branch above that point.

Goal 2.1: Meet TMDL target for phosphorus load reduction by 432 and nitrate load by 1,826 lb./year from HSTS.

Objective: Replace or upgrade 10% of watershed's HSTS or 81 systems.

Goal 2.2: Meet TMDL target for phosphorus load reduction by 43 and nitrate load by 206 lb./year from package plants.

Objective: Upgrade 3 package plant(s). Effluent quality meets P stds.

Goal 2.3: Meet TMDL target for phosphorus load reduction by 2,520 and nitrate load by 9,433 lb./year from agricultural practices.

Objectives:

- 3,200 acres of cover crops
- 800 acres of controlled drainage
- 2050 acres of permanent hay
- 250 acres of riparian buffers
- 20 acres of restored wetlands
- 2000 LF of stream restoration
- 500 LF of overwide / 2-stage ditch reconstruction
- 7999 acres under NRCS 590/1 Nutrient Mgt
- 3428 acres under NRCS 590/3 Nutrient Mgt
- 7000 acres of filter strips
- 500 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Nutrients (phosphorus and nitrate)	2.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$1,215,000	County Health Dept, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 81 systems	Reduce phosphorus load by 432 and nitrate load by 1,826 lb./year
	2.2	♦Test package plant effluent for phosphorus ♦Set effluent standard in existing or new NPDES permit(s) ♦Enforce upgrades for phosphorus removal as needed	$3,600	Ohio EPA	2012-2017	Upgrade 1 package plant(s). Effluent quality meets effluent stds	Reduce phosphorus load by 43 and nitrate load by 206 lb./year
	2.3	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$192,000	SWCD, NRCS, farmers	2012-2027 in phases	3,200 acres of cover crops	Reduce phosphorus load by 2310 and nitrate load by 4608 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$376,800	SWCD, NRCS, farmers	2012-2027 in phases	800 acres of controlled drainage	Reduce phosphorus load by 232 and nitrate load by 592 lb./year
	2.3	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$574,000	SWCD, NRCS, farmers	2012-2027 in phases	2050 acres of permanent hay	Reduce phosphorus load by 1333 and nitrate load by 2665 lb./year
	2.3	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$175,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	250 acres of riparian buffers	Reduce phosphorus load by 78 and nitrate load by 155 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$102,125	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	20 acres of restored wetlands	Reduce phosphorus load by 7 and nitrate load by 89 lb./year
	2.3	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$696,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	2000 LF of stream restoration	Reduce phosphorus load by 77 and nitrate load by 153 lb./year
	2.3	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$44,500	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	500 LF of overwide / 2-stage ditch reconstruction	Reduce phosphorus load by 43 and nitrate load by 86 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Seek cooperators for Nutrient Management NRCS 590 Level 1 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management NRCS 590 Level 1 BMPs with farmers	$159,982	SWCD, NRCS, farmers	2012-2022	7999 acres under NRCS 590/1 Nutrient Mgt	NA
	2.3	♦Seek cooperators for Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with farmers	$137,127	SWCD, NRCS, farmers	2012-2022	3428 acres under NRCS 590/3 Nutrient Mgt	NA
	2.3	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$964	SWCD, NRCS, farmers	2012-2027 in phases	7000 acres of filter strips	Reduce phosphorus load by 70 and nitrate load by 70 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize fields suited for Conservation Tillage BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Conservation Tillage BMP with farmer	$7,500	SWCD, NRCS, farmers	2012-2027 in phases	500 acres of conservation tillage	Reduce phosphorus load by 74 and nitrate load by 1015 lb./year

Problem Statement #3: (Siltation/Sedimentation)

The Ohio EPA TMDL found four of eight sampling sites in this HUC meeting Aquatic Life attainment standards. The sites with impairments related to siltation / sedimentation are at Township Road 214 (non-attainment) and Township Road 217 (partial attainment). Agricultural BMPs should be applied throughout the watershed, with priority for habitat restoration BMPs at or above Township Road 217, including tributaries that enter the South Branch above that point.

Goal 3.1:

Reduce sedimentation impairments by decreasing sediment load by 2,254 lb./year from agricultural practices.

Objectives:

- 3,200 acres of cover crops
- 800 acres of controlled drainage
- 2050 acres of permanent hay
- 250 acres of riparian buffers
- 20 acres of restored wetlands
- 2000 LF of stream restoration
- 500 LF of overwide / 2-stage ditch reconstruction
- 7000 acres of filter strips
- 500 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Sedimentation	3.1	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$192,000	SWCD, NRCS, farmers	2012-2027 in phases	3,200 acres of cover crops	Reduce sediment load by 1,152 lb./year
	3.1	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$376,800	SWCD, NRCS, farmers	2012-2027 in phases	800 acres of controlled drainage	Reduce sediment load by 264 lb./year
	3.1	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$574,000	SWCD, NRCS, farmers	2012-2027 in phases	2050 acres of permanent hay	Reduce sediment load by 677 lb./year
	3.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$175,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	250 acres of riparian buffers	Reduce sediment load by 40 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$102,125	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	20 acres of restored wetlands	Reduce sediment load by 1 lb./year
	3.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$696,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	2000 LF of stream restoration	Reduce sediment load by 77 lb./year
	3.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$44,500	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	500 LF of overwide / 2-stage ditch reconstruction	Reduce sediment load by 22 lb./year
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$964	SWCD, NRCS, farmers	2012-2027 in phases	7000 acres of filter strips	Reduce sediment load by 0 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$7,500	SWCD, NRCS, farmers	2012-2027 in phases	500 acres of conservation tillage	Reduce sediment load by 2 lb./year

Goal 4.1:

270 acres of habitat restoration 2500 linear feet of stream corridor restoration practices.

Objectives:

- 250 acres of riparian buffers
- 20 acres of restored wetlands
- 2000 LF of stream restoration
- 500 LF of overwide / 2-stage ditch reconstruction

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Habitat Impairment	4.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$175,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	250 acres of riparian buffers	Load reductions provided in nutrient and sediment tables

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	4.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$102,125	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	20 acres of restored wetlands	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$696,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	2000 LF of stream restoration	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$44,500	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	500 LF of overwide / 2-stage ditch reconstruction	Load reductions provided in nutrient and sediment tables

South Branch Portage River below East Branch to above Middle Branch

04100010 040 050 (14 – digit HUC)
04100010 02 04 (New 12-digit HUC & Name: Rhodes Ditch-South Branch Portage River)

Length: 7.79 River Miles

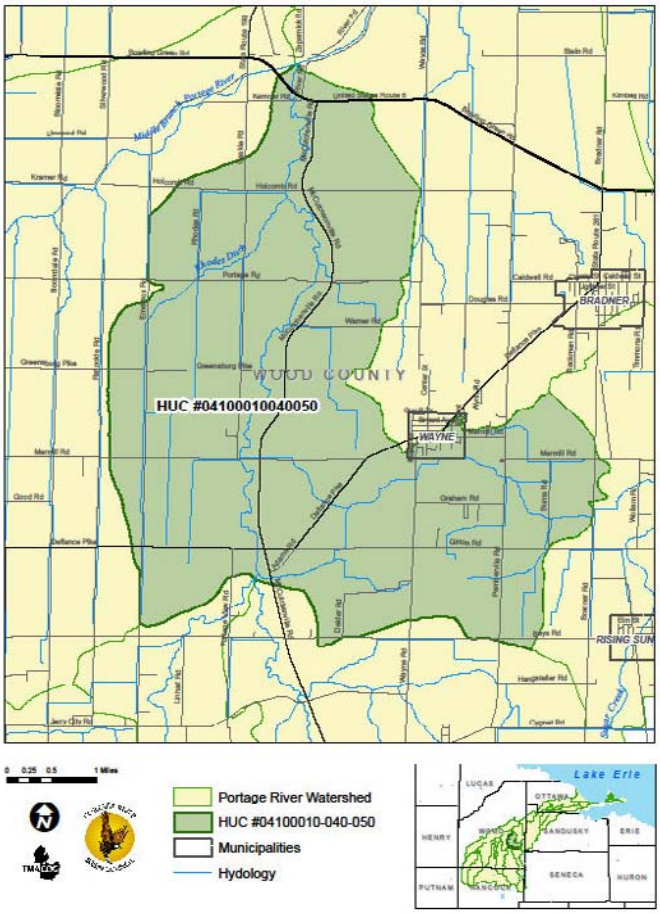
Elevation at Mouth: 0.0 RM is 654.24 ft.

Elevation at confluence of South and East Branch @ RM 7.79 is 679.33 ft.
Drainage Area: 264 square miles

USGS Quads:
- Jerry City
- Bradner

Urban Area:
Village of Wayne (2008 pop. 855)

HUC #04100010-040-050



Geology

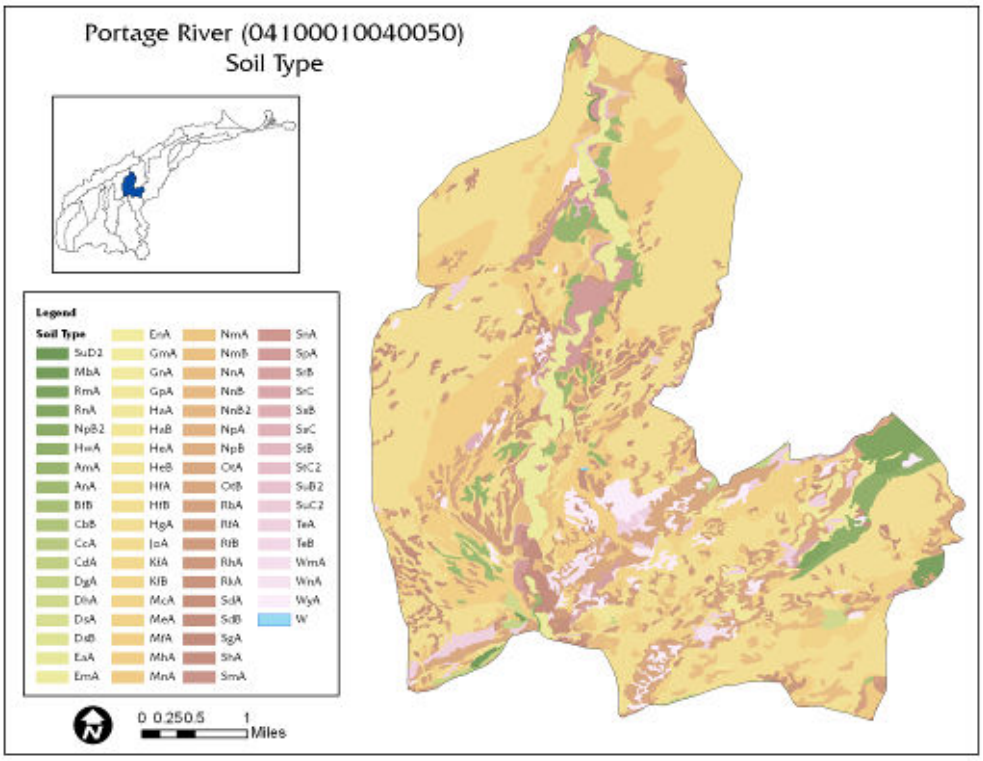
This subwatershed is located in Wood County in the generally flat-lying Eastern Lake Plains Section of the Central Lowlands Physiographic Province (Fenneman, 1938). The county is covered by a variable thickness of glacial till, lacustrine deposits and outwash. These unconsolidated glacial deposits are underlain by a relatively flat-lying sequence of Paleozoic sedimentary rocks consisting primarily of dolomite from the Silurian and Devonian Systems (ODNR, 1994).

Soils

The predominant soil in the South Branch Portage River below the East Branch HUC14 04100010 040 050 is Hoytville clay loam, 0 to 1 percent slopes (HgA) that covers 2,223 hectares and the second dominant soil association is Mermill-Aurand complex, 0 to 1 percent slopes (MfA) that covers 708 hectares in the subwatershed. The Hoytville Association is a very poorly drained, dark colored soil in finely grained gritty till on broad flats. This association is a broad, flat expanse of dark colored soils and small,

slightly higher areas of lighter colored soils. Hoytville soils comprise 80% of the soil in Wood County. The nearly level, very poorly drained, dark-colored Hoytville soils make up about 80 percent of this association. These soils developed in glacial till. They are associated with the nearly level, very poorly drained, dark-colored Mermill soils, which developed in sandy material underlain by clay. Both soils are deep and are highly productive. Small areas of Nappanee, St. Clair, Digby and Haskins soils also occur in this association.

Major Soil Groups		
040-050		
Hoytville	Sum Acres	5,631
	Percentage	42.73%
Mermill	Sum Acres	2,372
	Percentage	18.00%
Ottokee	Sum Acres	985
	Percentage	7.47%
Rimer	Sum Acres	610
	Percentage	4.63%
Nappanee	Sum Acres	540
	Percentage	4.09%
Wauseon	Sum Acres	451
	Percentage	3.42%
Eel	Sum Acres	448
	Percentage	3.40%
Seward	Sum Acres	402
	Percentage	3.05%


Portage River (04100010040050)
Soil Type
Legend
Soil Type
SuD2
MbA
RmA
RnA
NpB2
HwA
AmA
AnA
BlB
CbB
CcA
CdA
DgA
DhA
DsA
DtB
EaA
EmA
EnA
GmA
GnA
GpA
HaA
HaB
HeA
HeB
HlA
HlB
HgA
JoA
KlA
KlB
McA
MeA
MfA
MhA
MnA
NmA
NmB
NnA
NnB
NnB2
NpA
NpB
OtA
OtB
RbA
RlA
RlB
RhA
RkA
SdA
SdB
SgA
ShA
SmA
SnA
SpA
SrB
SrC
SsB
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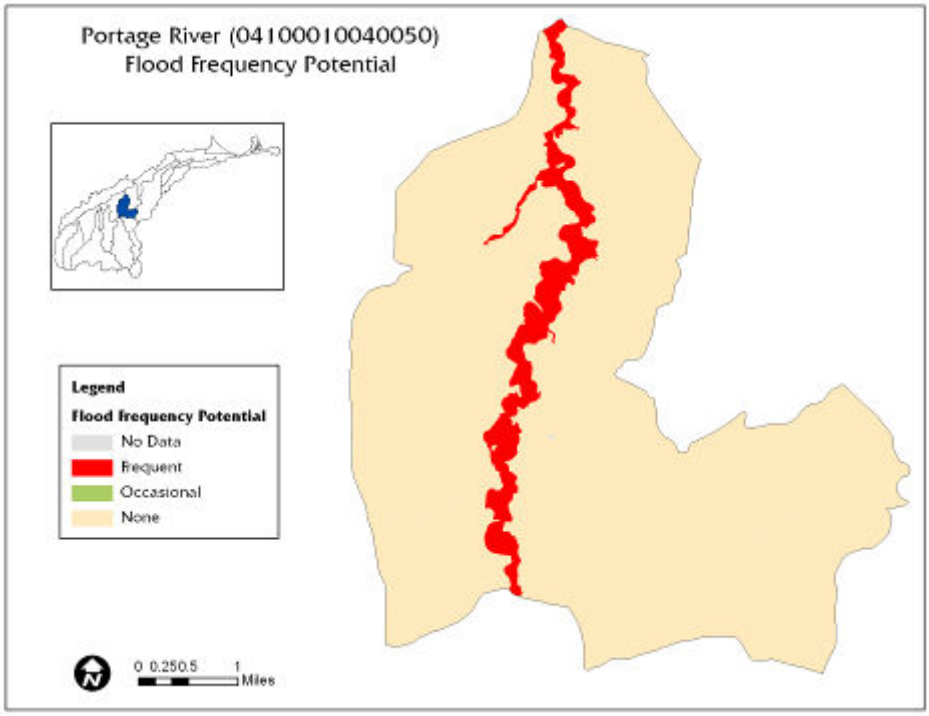
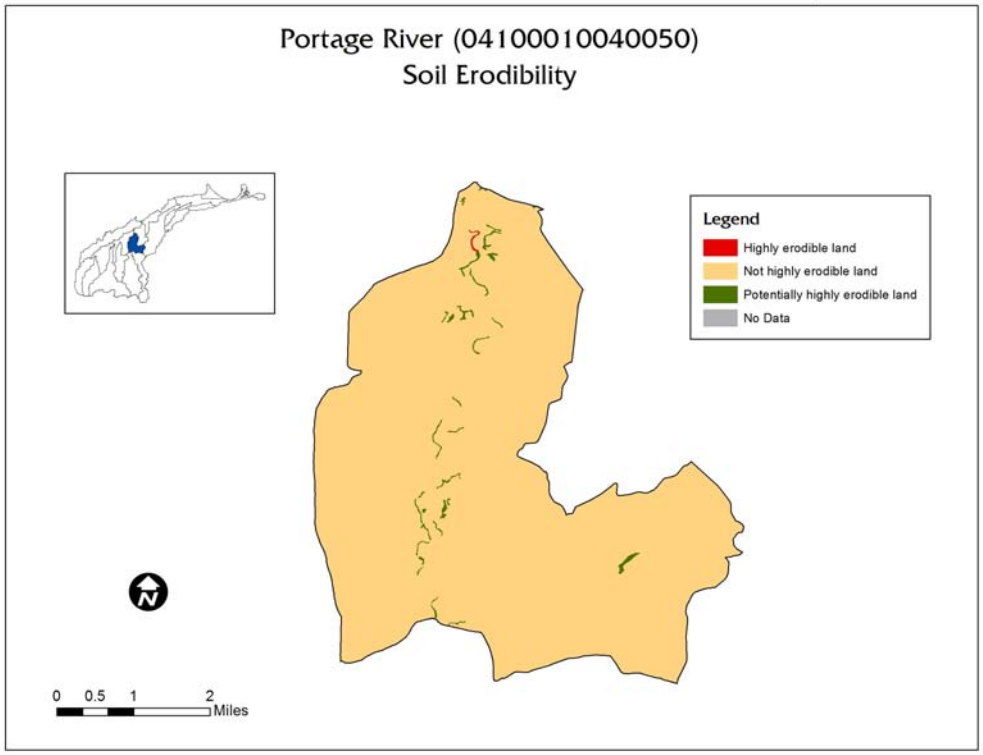
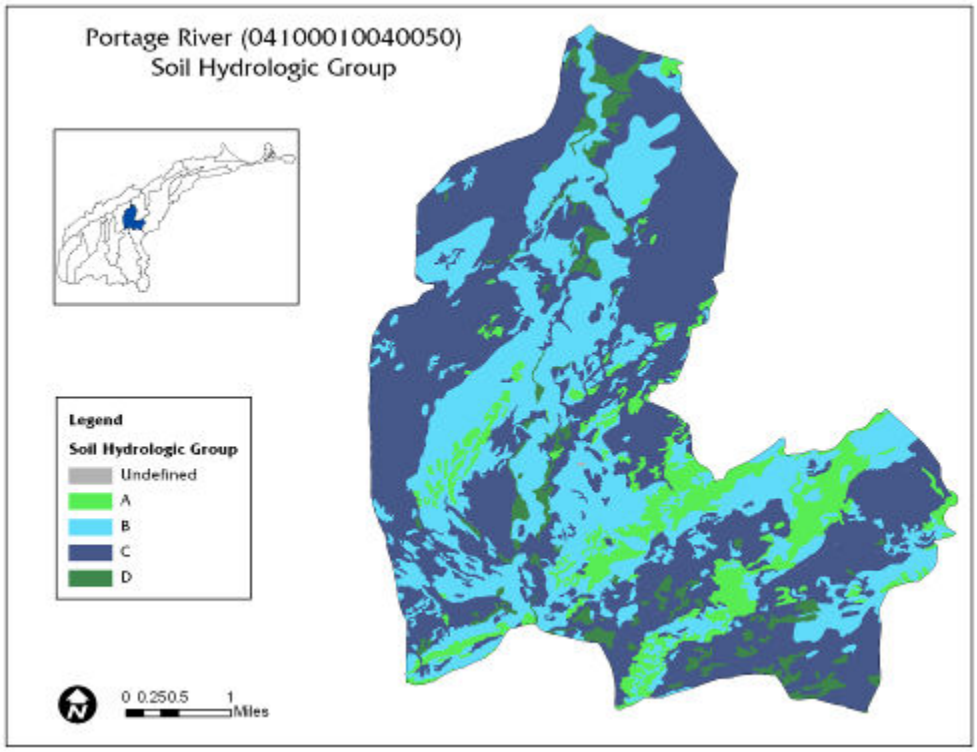
0 0.250.5 1
Miles


Portage River (04100010040050)
Flood Frequency Potential
Legend
Flood frequency Potential
No Data
Frequent
Occasional
None
0 0.250.5 1
Miles





The Soil Hydrologic Group map indicates the *Hydrologic soil groups* based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water

infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms (Wood County Soil Survey, March 2005). The following soil group descriptions are directly from the Wood County Soil Survey, page 241.

The four hydrologic soil groups are:

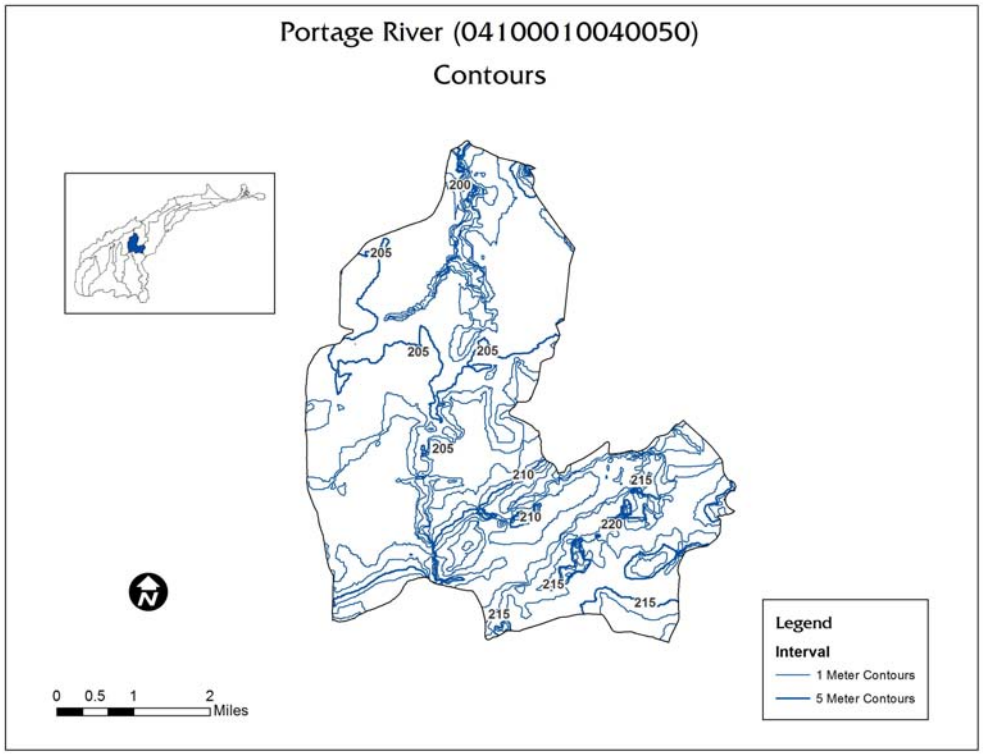
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

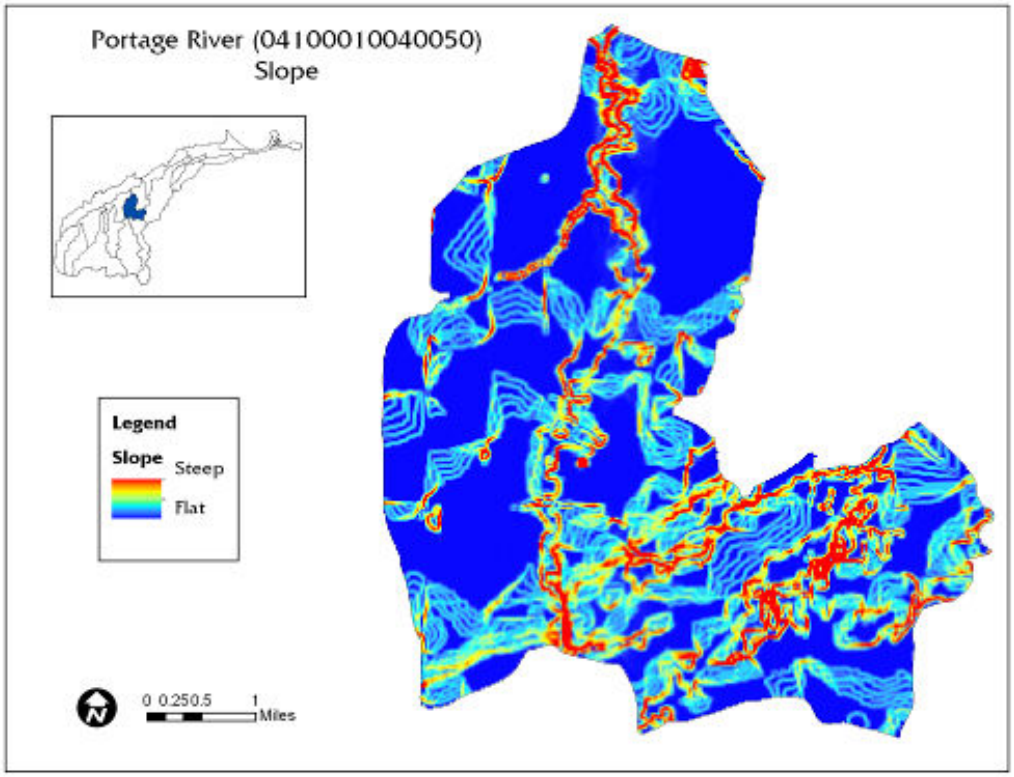
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately course texture. These soils have a moderate rate of water transmission.

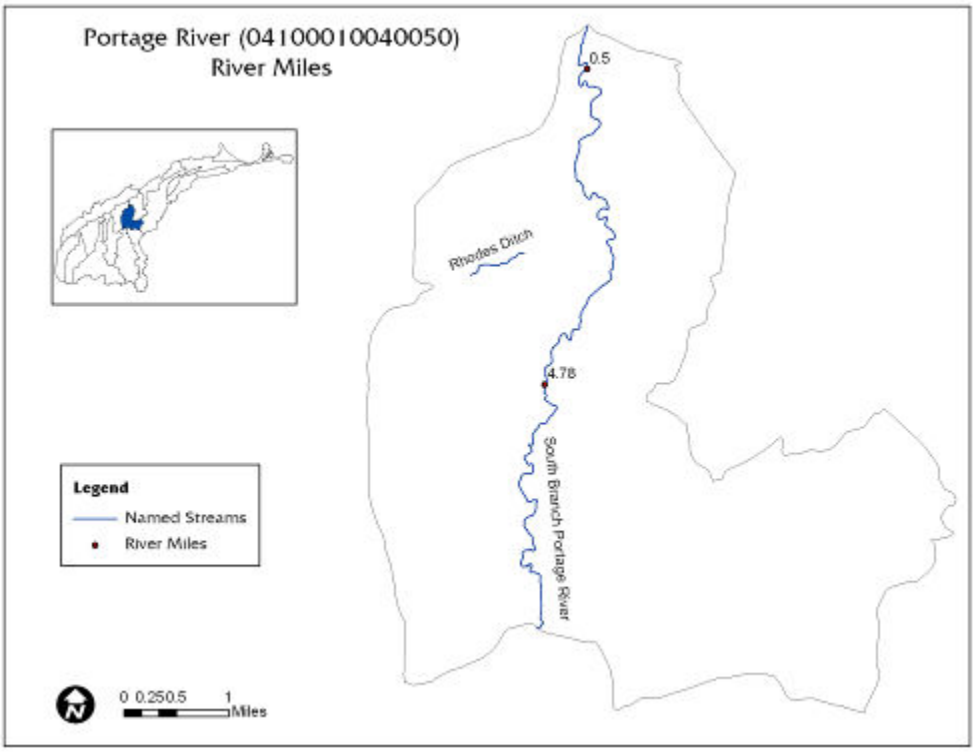
Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (**A/D, B/D, or C/D),** the first letter is for drained areas and the second is for undrained areas.


Portage River (04100010040050)
Contours
200
205
205
205
205
210
210
215
220
215
215
215
Legend
Interval
1 Meter Contours
5 Meter Contours
0 0.5 1 2
Miles


Portage River (04100010040050)
Slope
Legend
Slope
Steep
Flat
0 0.250.5 1
Miles



Rare, Threatened, Endangered Species

The South Branch subwatershed is habitat to one endangered and two protected plant species, and several species of mussels.

Rare, Threatened, Endangered Species

Common Name	*Scientific Name*	Last Observed	State Status
Canada Plum	*Prunus nigra*	2008-05-27	E
Common Prickly Pear	*Opuntia humifusa*	1978-10	P
Common Prickly Pear	*Opuntia humifusa*	1978-10	P

T=Threatened, P=Potentially Threatened, E=Endangered, X=Presumed Extirpated, SC=Species of Concern

Mussel Species in HUC14-04100010-050-010

Stream River Miles	Common Mussel Name	*Scientific Name*	Observed	Status
4.78	Giant Floater	*Pyganodon grandis*	2008	
0.50	Wabash Pigtoe Fat Mucket White Heelsplitter Giant Floater	*Fusconaia flava* *Lampsilis radiate luteola* *Lasmigona complanata* *Pyganodon grandis*	2008 2008 2008 2008	

SC=Species of Concern Ohio EPA

Water Resources

Surface Water

"The **Ohio Integrated Water Quality Monitoring and Assessment Report** indicate the general condition of Ohio's waters and identifies waters that are not meeting water quality goals. The report satisfies the Clean Water Act requirements for both Section 305(b) water quality reports and Section 303(d) lists of impaired waters." The Ohio 2010 Integrated Report can be located at the Ohio EPA webpage at: http://www.epa.state.oh.us/dsw/tmdl/OhioIntegratedReport.aspx

The Ohio 2010 Integrated Report website offers downloads of data and individual chapters. Individual river information on the health of water quality in Ohio, as well as Lake Erie near shore water standards can be obtained for human health use, aquatic life (fish and aquatic insects), chemical concerns for drinking water and recreation uses such as swimming and boating in our state's water.

If water quality standards are not met according to indicators set for that water body, the water quality is then determined to be ***impaired***. The goal is to identify the cause and source of the pollutant(s) which impair(s) that water and to restore it to ***attainment*** status. If the water quality is healthy (full attainment) then methods are employed to protect the healthy water from any possible future contaminates.

The South Branch Portage River is designated use for **warm-water habitat** (WWH) **aquatic use**. The **Recreation Use** assessment is Class B. That determines the acceptable E. Coli colony numbers in water samples using the geometric mean <161 or a single sample maximum value ≤ 298. The regulatory description for recreation use assessment is shown below in a summary table taken from the Ohio 2010 Integrated Report, Section F: Evaluating Beneficial Use: Recreation, p. F-1.

Summary of the recreation use assessment methods.		
Bathing Waters		
Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method Summary
E. coli	Seasonal geometric mean *E. coli* content* based on samples from the recreation season within a calendar year is 126 cfu/100 ml; single sample maximum is 235 cfu/100 ml.	Applied to the three Lake Erie shoreline assessment units, exceedence of the geometric mean bathing water criterion or an exceedence of the single sample maximum for more than 10% of the recreation season is considered an impairment of the bathing water use.
Primary Contact and Secondary Contact		
Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method Summary

Summary of the recreation use assessment methods.		
Bathing Waters		
Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method Summary
E. coli	Seasonal geometric mean *E. coli* content* based on samples from the recreation season within a calendar year is: **Primary Contact Waters** Class A: 126 cfu/100 ml Class B: 161 cfu/100 ml Class C: 206 cfu/100 ml **Secondary Contact Waters** 1030 cfu/100 ml	Applied to streams and inland lakes. Data from a recreation season are assessed on a site-by-site basis and compared to the applicable geometric mean *E. coli* criterion whenever more than one sample result is available for a watershed assessment unit. Assessment units are considered to be in full attainment if all sites assessed within the assessment unit meet the applicable geometric mean criterion and in non-attainment if one or more sites assessed within the assessment unit exceed the applicable geometric mean criterion.

*** *E. coli* concentrations are expressed in colony forming units (cfu) per 100 milliliters (ml)**

HUC 8 – 04100010 (Portage River)									
HUC 10 – 04100010-02 (South Branch Portage River-Middle Branch Portage River)									
HUC 12 – 04100010-02-04 (Rhodes Ditch-South Branch Portage River)									
HUC 14 – 04100010040-050 (South Branch Portage River below East Branch to above Middle Branch)									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
17	2008	S01P14	South Branch Portage R. @ Greenburg Pike	4.78	100.0	WWH	Full	None listed	None listed
18	2008	S01S19	South Branch Portage R. near New Rochester @ Kenner Rd.	0.50	110.	WWH	Full	None listed	None listed

Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010.

Recreational Use Attainment						
Location	RM	Recreation Use for Primary Contact Recreation waters (PCR) Class	Number of Samples	E. coli Geometric **Mean <161** and Single Sample Maximum ≤ 298 Value	Attainment Status	Sources of Bacteria
South Br. Portage R. @ Greensburg Pike	4.78	B	5	645 mean 8500 max	NON	HSTS; Wayne WWTP; Southside Packers

Recreational Use Attainment

Location	RM	Recreation Use for Primary Contact Recreation waters (PCR) Class	Number of Samples	E. coli Geometric **Mean <161** and Single Sample Maximum ≤ 298 Value	Attainment Status	Sources of Bacteria
South Br. Portage R. @ Kemner Rd.	0.50	B	7	420 mean 3600 max	NON	HSTS: Agric.

Aquatic Life Use Assessment

Location	RM	Drainage Area	Aquatic Life Use	Attainment Status
South Br. Portage R. @ Greensburg Pike	4.78	100.0	WWH	**FULL**
South Br. Portage R. @ Kemner Rd.	0.50	110.0	WWH	FULL

Macro-invertebrate Communities

Stream RM	Dr. Ar. (sq. mi.)	Data Codes	Qual. Taxa	EPT QI./Total	Sensitive Taxa QI./Total	Density QI./Qt.	CW Taxa	Predominant Organisms on the Natural Substrates With Tolerance Category(ies)	ICI[a]	Narrative Evaluation
4.78	100	-	40	9/9	9/16	M/383	0	Hydropsychid caddisflies (F), baetid mayflies (F), midges (F, MI, T)	36	-
0.50	110	-	61	16/18	23/29	M/723	0	Baetid mayflies (F), hydropsychid caddisflies (F), midges (MI,F)	46	-

Source: Ohio EPA, 2008

Public Drinking Water Supply Assessment

HUC	Reporting Category	Cause of Impairment	Nitrate Watch List	Pesticide Watch List
South Branch Portage River below East Branch to above Middle Branch 04100010-040-050	NA	None	No	No

Fish Tissue Assessment			
HUC	**Reporting Category**	**Causes of Impairment**	**PCB Concentration**
South Branch Portage River below East Branch to above Middle Branch 04100010-040-050	3i	None	

Water Quality Monitoring Results: Ohio EPA 1994 and 2008						
River Mile	**Date**	**IBI**	**ICI**	**MIwb**	**QHEI**	**STATUS**
None	1994					
The above fish community indices are from samples collected in the Portage River study area in 1994, 1985 and 1983. MIwb and IBI scores are Mean scores and compared to Ecoregional Biocriteria for the HELP.						
4.78	*2008*	*37*	*36*	*9.2*	*65.0*	*FULL*
0.50	*2008*	*41*	*46*	*7.8*	*71.0*	*FULL*

a - River Mile (RM) represents the Point of Record (POR) for the station, not the actual sampling RM.
b - MIwb is not applicable to headwater stream with drainage areas ≤20 mi^2.
c - A narrative evaluation of the qualitative sample based on attributes such as EPT taxa richness, number of sensitive taxa, and community composition was used when quantitative data was not available or considered unreliable. VP=Very Poor, P=Poor, LF=Low Fair, F=Fair, MG=Marginally Good, G=Good, VG=Very Good, E=Exceptional
d - Attainment is given for the proposed status when a change is recommended. Aquatic life use in superscript.
ns - Nonsignificant departure from biocriteria (≤4 IBI or ICI units, or ≤0.5 MIwb units).
* - Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.
Italic: 2008 TMDL scores in review.

General narrative ranges assigned to QHEI scores.				
Narrative Rating		QHEI Range		
		Headwaters (≤ sq mi)	Larger Streams	Lacustuary
Excellent		≤ 70	≤ 75	≤ 80
Good		55 to 69	60 to 74	60 to 80
Fair		43 to 54	45 to 59	45 to 59
Poor		30 to 42	30 to 44	30 to 44
Very Poor		<30	<30	<30

Biological Criteria Benchmarks

Biological Criteria					Lacustuary Benchmarks[1]				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
IBI-Headwaters	50	28	20	18	N/A	N/A	N/A	N/A	N/A
IBI-Wading	50	32	22	18	N/A	N/A	N/A	N/A	N/A
IBI-Boat	48	34	20	16	50	42	31	17	<17

Biological Criteria					Lacustuary Benchmarks[1]				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
MIwb-Wading	9.4	7.3	5.6	4.5	N/A	N/A	N/A	NA	N/A
MIwb-Boat	9.6	8.6	5.7	5.0	10	8.6	5.6	2.8	<2.8
ICI	46	34	22	8	52	42	25	12	<12

[1] **Proposed Lacustuary scoring breakpoints. These have not yet been adopted into rule.**

Ground Water

Source Water Assessment Plan (SWAP)

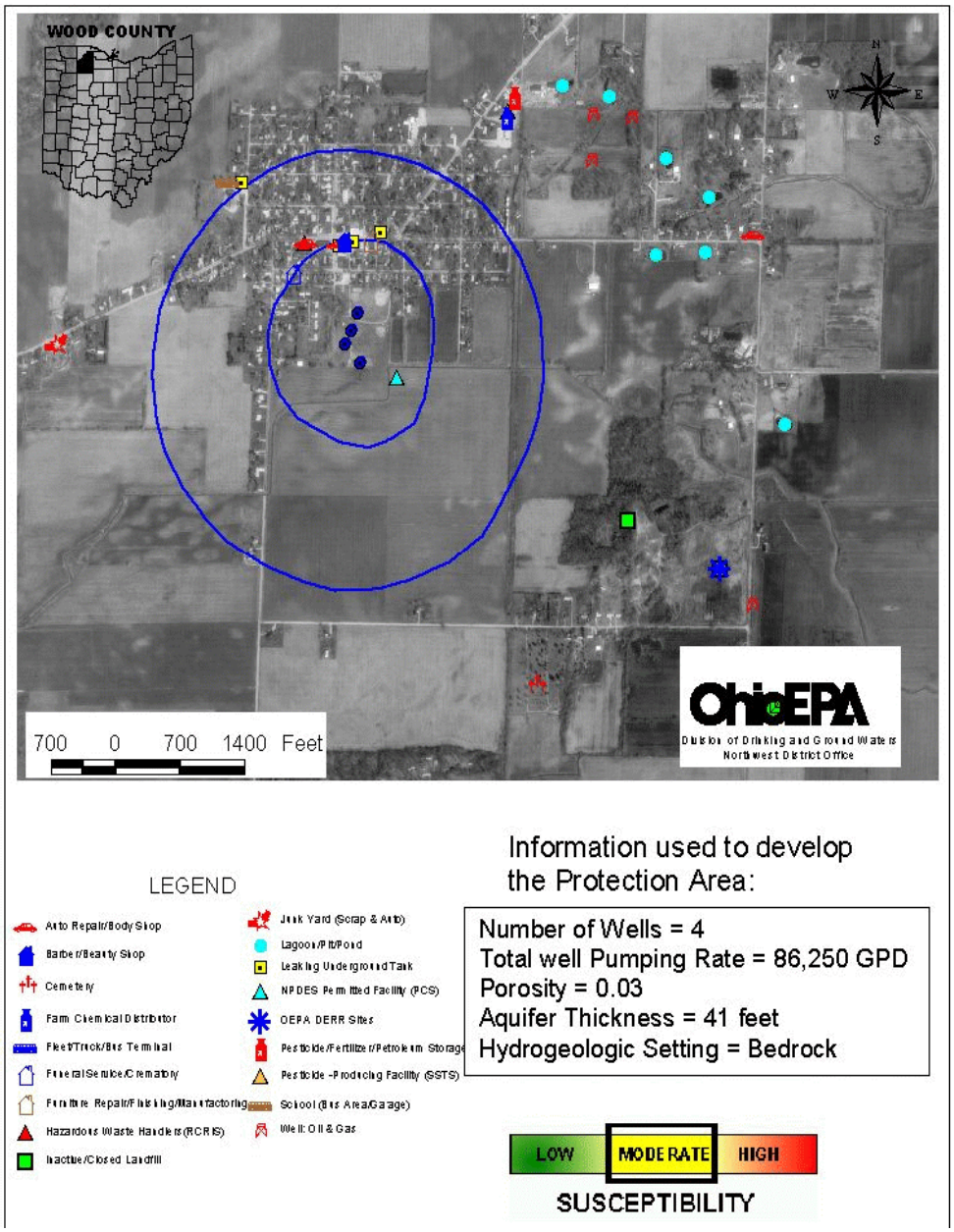
The Village of Wayne has a public water system serving 840. Four wells provide ground water to meet the village needs for drinking water. A protection zone is established around the wellheads for the land area surrounding the wellheads. The protection area is established to help protect the drinking water supply from pollution contaminates.

Within the source water protection area an inventory was conducted by the Ohio EPA and village personnel to identify all potential sources of contamination which could reach ground water levels.

The Wayne SWAP indicates that the village's source of drinking water has a moderate susceptibility to contamination due to:

- Presence of a thick protective layer of clay overlying the aquifer,
- Significant depth (over 27 feet below ground surface) of the aquifer.
- No evidence to suggest that ground water has been impacted by any significant levels of chemical contaminants from human activities, and
- Presence of significant potential contaminant sources in the protection area.

Wayne's Drinking Water Source Protection Area is shown in the following figure (Ohio EPA, Drinking Water Source Assessment for the Village of Wayne, January 2003).



DRASTIC MAP

The sensitivity of the groundwater to local sources of contamination is determined and rated by **DRASTIC** maps as described below:

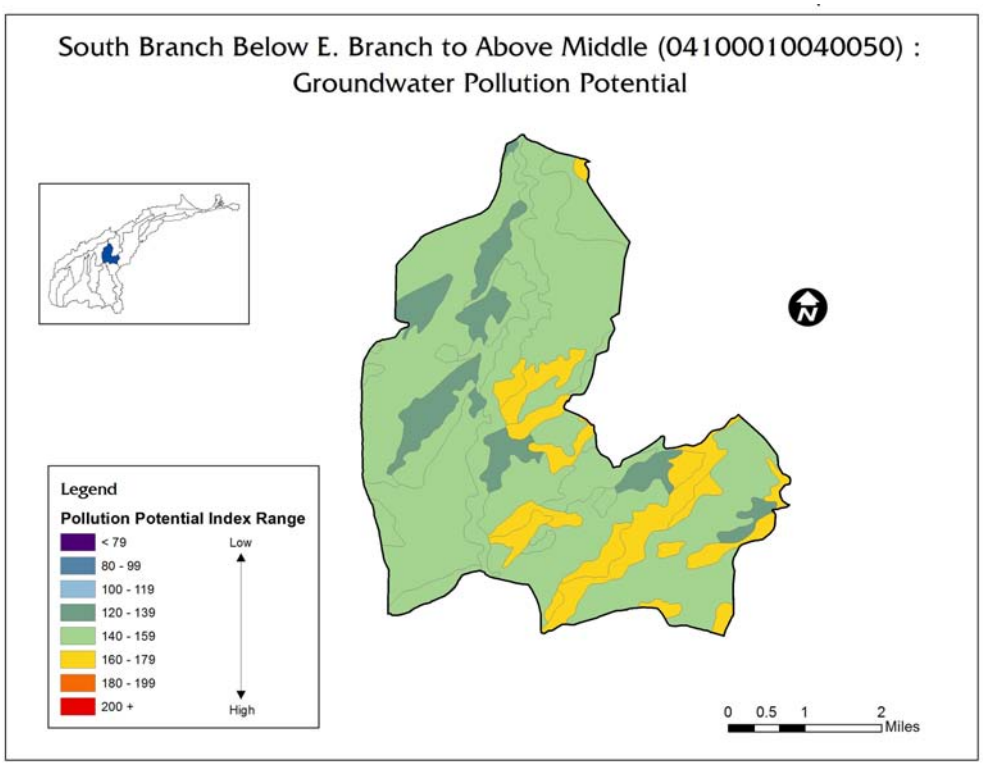
Inherent within each geologic setting are the physical characteristics which effect the groundwater pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:

D – Depth to Water
R – Net Recharge
A – Aquifer Media
S – Soil Media
T – Topography
I – Impact of the Vadose Zone Media
C – Conductivity (Hydraulic) of the Aquifer (ODNR, 1994)

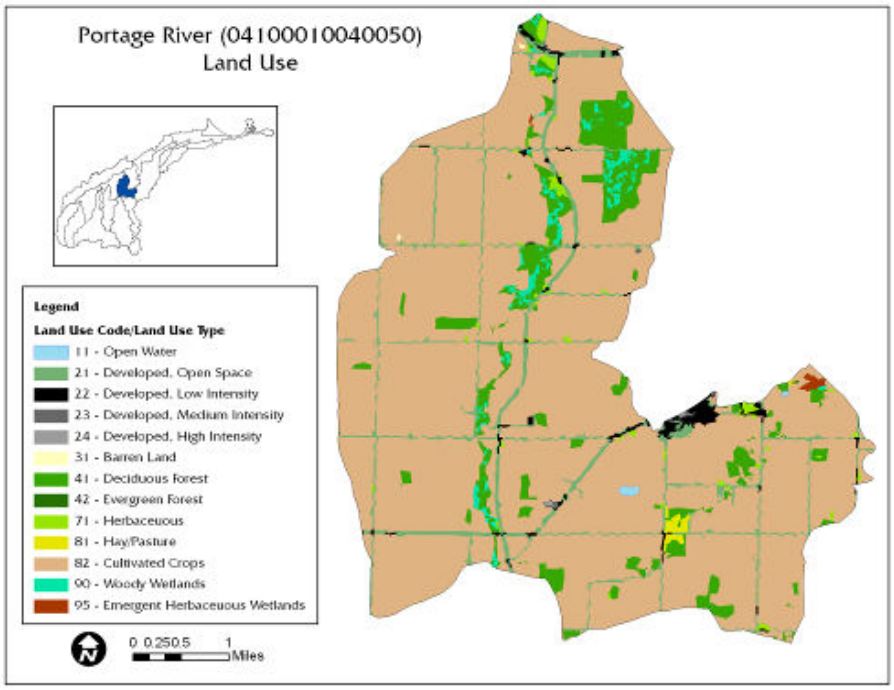
Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index, the greater the vulnerability to contamination (ODNR, 1994).

The average ground water pollution index potential for the South Branch watershed between the East Branch and South Branch is 154 with a range of 136-171.

The Ohio Department of Natural Resources, Division of Water, Water Resources Section is the responsible agency to map groundwater resources throughout the state. Greater detail on DRASTIC maps for the Portage can be found in Chapter 4 of this watershed plan.



Sub-watershed (04100010-02-04)		
040-050		
Land Use	**Percent**	**Acres**
Urban	6.4%	844
Forest	8.1%	1,070
Pasture	0.3%	39
Cropland	83.6%	11,011
Other	1.5%	200
Total Acres	100%	13,164



Livestock Inventory							
HUC 4100010040050							
Type of Animal		**Hancock**	**Ottawa**	**Sandusky**	**Seneca**	**Wood**	**Estimates for HUC**
Percent of County in HUC		0.0%	0.0%	0.0%	0.0%	3.3%	
Cattle	Farms	129	89	167	264	144	**5**
	Animals	4,233	1,523	4,612	10,096	6,287	**209**
Hogs	Farms	51	15	37	62	30	**1**
	Animals	32,343	3,639	5,591	42,808	39,469	**1,315**
Horses	Farms	105	63	132	72	128	**4**
	Animals	844	444	772	463	1,004	**33**
Poultry	Farms	49	22	41	62	47	**2**

Livestock Inventory							
HUC 4100010040050							
	Animals	NA	779	1,042	4,283	NA	**NA**
Sheep	Farms	32	12	41	61	21	**1**
	Animals	1,134	335	765	2,770	21	**1**
Total							12
							1,570
Source: 2007 Census of Agriculture http://www.agcensus.usda.gov/							

Point Sources

Municipal

- Wayne WWTP (2PA00071)
- Wayne WTP (2IX00090)

Package Plants

- Southside Packers (inactive)

Non-Point Sources

Critical Sewage Areas:

- None

Estimates of HSTSs				
Watershed	**Housing Units without sewers**	**Est. Unsewered Population (2000)**	**Unsewered Housing Units per acre**	**Unsewered Population per acre**
04100010040050	392	1,041	0.03	0.079
Sources: 2000 Census data and TMACOG "208" Plan. Analysis identifies approximate number of housing units without sewers in each watershed as an estimate of number of HSTSs.				

Aquatic Life Use Impairments	
Causes	**Sources**
None listed	None listed
Source: Ohio 2010 Integrated Report, Watershed Assessment Unit Summary	

Water Supply

Public Water System	Population Served	Primary Water Source
Wayne	840	Ground

Water Quality Impairments

The OEPA Integrated Report assesses each watershed's attainment status for 1) Public Drinking Water Supply, 2) Recreation, 3) Human Health, 4) Aquatic Life, and 5) Fish Tissue. The Integrated Report identifies causes and sources of impairments where watersheds are not in attainment with water quality standards.

Background:

This watershed has elevation which forms a natural river valley with wide forested bottom lands, which are only found in the South Branch and East Branch of the Portage River watershed. The South Branch flows into the Middle Branch Portage River at RM 40.83 at the elevation of 654 feet, at New Rochester, Freedom Township, in Wood County.

Historic water quality data for this watershed do not exist. In 2008 the Ohio EPA conducted two water quality sample sites for the TMDL study. Sample sites located at RM 0.50 and RM 4.78 report water quality in the South Branch is in full attainment for the state of Ohio Water Quality Standards.

The South Branch is a good example of clean water in balance with agricultural land use. The greater sloped elevation to the river valley and function as a floodplain provide a natural woodland-vegetated buffer to reduce nutrient loadings to the river. The result is vegetation and timber growth on the bottom riparian lands which buffer and protect the river system. The widths of riparian buffer range from a minimum of 86-ft. to 126-ft. at RM 4.7 to the largest riparian/buffer width of 1,800 ft. at RM 3.6.

In addition, the stream has elevation to create gravity flow and quality water habitat of pools, glides, runs, and riffles for water currents and habitat niches necessary for aquatic animals to feed, rest and spawn. Vegetation cover, leaf litter, woody debris, root wads, and substrate sands, gravel, cobbles and boulders, all provide a physical integrity to the stream environment to produce a quality water resource.

Problem Statement 1: (Bacteria)

The water quality of the South Branch subwatershed is impaired by elevated measurements of E. coli bacteria. The Portage TMDL data collected by Ohio EPA in

2008 indicates both of the HUC's sampling sites are in non-attainment for E. coli. Ohio EPA lists failed HSTS as sources of impairments in all cases.

In this HUC are an estimated 392 HSTS; by density of onsite systems, this is a fairly rural HUC. This area includes one package plant (unpermitted and not presently in use), but no CSO areas, or Critical Sewage Areas.

Goal 1.1: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 2.5 million gallons of HSTS effluent annually.

Objective:

- Replace or upgrade 10% of watershed's HSTS or 39 systems.

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Bacteria	1.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$585,000	Wood County Health Dept, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 39 systems	2.5 million gallons/year sewage discharge eliminated

Problem Statement 2: (Nutrients)

The Ohio EPA TMDL found both sampling sites in this HUC to meeting Aquatic Life attainment standards. However, the Portage TMDL recommends a total phosphorus load allocation of 3.89 kg/day, requiring a nonpoint source load reduction of 1,767 lb. P/year. HSTS systems should be addressed as noted above. Agricultural BMPs should be applied throughout the watershed.

Goal 2.1: Meet TMDL target for phosphorus load reduction by 208 and nitrate load by 879 lb./year from HSTS.

Objective: Replace or upgrade 10% of watershed's HSTS or 39 systems.

Goal 2.2: Meet TMDL target for phosphorus load reduction by 1,572 and nitrate load by 5,919 lb./year from agricultural practices.

Objectives:

- 1,200 acres of cover crops
- 800 acres of controlled drainage

- 1000 acres of permanent hay
- 500 LF of restored oxbows
- 4609 acres under NRCS 590/1 Nutrient Mgt
- 1975 acres under NRCS 590/3 Nutrient Mgt
- 8000 acres of filter strips
- 200 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Nutrients (phosphorus and nitrate)	2.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$585,000	Wood County Health Dept, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 39 systems	Reduce phosphorus load by 208 and nitrate load by 879 lb./year
	2.2	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$72,000	Wood SWCD, NRCS, farmers	2012-2027 in phases	1,200 acres of cover crops	Reduce phosphorus load by 1457 and nitrate load by 2916 lb./year
	2.2	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$376,800	Wood SWCD, NRCS, farmers	2012-2027 in phases	800 acres of controlled drainage	Reduce phosphorus load by 384 and nitrate load by 992 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$280,000	Wood SWCD, NRCS, farmers	2012-2027 in phases	1000 acres of permanent hay	Reduce phosphorus load by 650 and nitrate load by 1300 lb./year
	2.2	♦Evaluate oxbow site(s) with Wood Co Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$136,785	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	500 LF of restored oxbows	Reduce phosphorus load by 73 and nitrate load by 145 lb./year
	2.2	♦Seek cooperators for Nutrient Management NRCS 590 Level 1 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management NRCS 590 Level 1 BMPs with farmers	$92,173	Wood SWCD, NRCS, farmers	2012-2022	4609 acres under NRCS 590/1 Nutrient Mgt	NA

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Seek cooperators for Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with farmers	$79,006	Wood SWCD, NRCS, farmers	2012-2022	1975 acres under NRCS 590/3 Nutrient Mgt	NA
	2.2	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$1,102	Wood SWCD, NRCS, farmers	2012-2027 in phases	8000 acres of filter strips	Reduce phosphorus load by 88 and nitrate load by 160 lb./year
	2.2	♦Identify & prioritize fields suited for Conservation Tillage BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Conservation Tillage BMP with farmer	$3,000	Wood SWCD, NRCS, farmers	2012-2027 in phases	200 acres of conservation tillage	Reduce phosphorus load by 29 and nitrate load by 406 lb./year

Problem Statement #3: (Siltation/Sedimentation)

The Ohio EPA TMDL found both sampling sites in this HUC to meeting Aquatic Life attainment standards. However, the Portage TMDL recommends a reduction in total phosphorus load, and the BMPs to achieve that reduction will offer the additional benefit

of a reduction in siltation / sedimentation. These practices will help retain the HUC's aquatic life attainment status.

Goal 3.1:

Reduce sedimentation impairments by decreasing sediment load by 1,567 lb./year from agricultural practices.

Objectives:

- 1,200 acres of cover crops
- 800 acres of controlled drainage
- 1000 acres of permanent hay
- 500 LF of restored oxbows
- 8000 acres of filter strips
- 200 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Sedimentation	3.1	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$72,000	Wood SWCD, NRCS, farmers	2012-2027 in phases	1,200 acres of cover crops	Reduce sediment load by 720 lb./year
	3.1	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$376,800	Wood SWCD, NRCS, farmers	2012-2027 in phases	800 acres of controlled drainage	Reduce sediment load by 440 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$280,000	Wood SWCD, NRCS, farmers	2012-2027 in phases	1000 acres of permanent hay	Reduce sediment load by 330 lb./year
	3.1	♦Evaluate oxbow site(s) with Wood Co Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$136,785	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	500 LF of restored oxbows	Reduce sediment load by 36 lb./year
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$1,102	Wood SWCD, NRCS, farmers	2012-2027 in phases	8000 acres of filter strips	Reduce sediment load by 40 lb./year
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$3,000	Wood SWCD, NRCS, farmers	2012-2027 in phases	200 acres of conservation tillage	Reduce sediment load by 1 lb./year

Problem Statement #4: (Habitat)

The Ohio EPA TMDL found both sampling sites in this HUC to meeting Aquatic Life attainment standards. However, there is one cutoff oxbow in this HUC that may be amenable to restoration (Finkbeiner, Pettis, & Strout 2002). Restoring the former oxbow would help retain the HUC's aquatic life attainment status.

Goal 4.1:

500 linear feet of stream corridor restoration practices.

Objective:

- 500 LF of restored oxbows

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	4.1	♦Evaluate oxbow site(s) with Wood Co Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$136,785	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	500 LF of restored oxbows	Load reductions provided in nutrient and sediment tables

PORTAGE RIVER BELOW SOUTH BRANCH TO ABOVE NORTH BRANCH

04100010 050 010 (14 – digit HUC)
04100010 03 02 (New 12-digit HUC & Name: Town of Pemberville-Portage River)

Length: 5.62 miles

Elevation at mouth: 635 feet

Elevation at source: 716 feet

Drainage area: 353.0

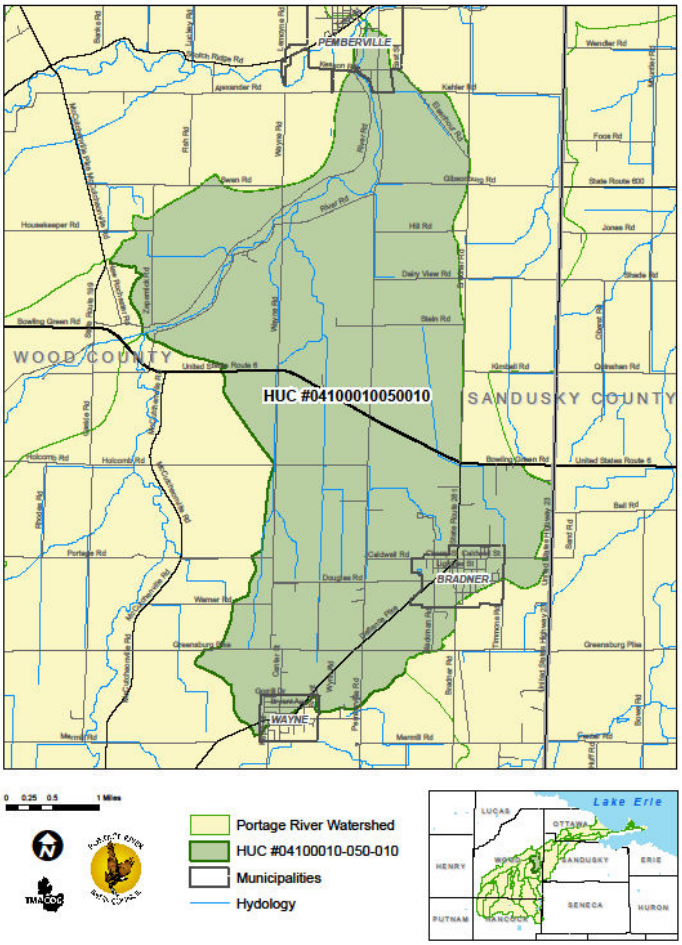
Assessment Unit Size:18.1 square miles

Ohio Topographic Quadrangle 7.5 minute (1:24,000)

- Bradner
- Pemberville
- Jerry City
- Elmore

Urban areas:
Village of Bradner
Village of Wayne
Village of Pemberville

HUC #04100010-050-010



Geology

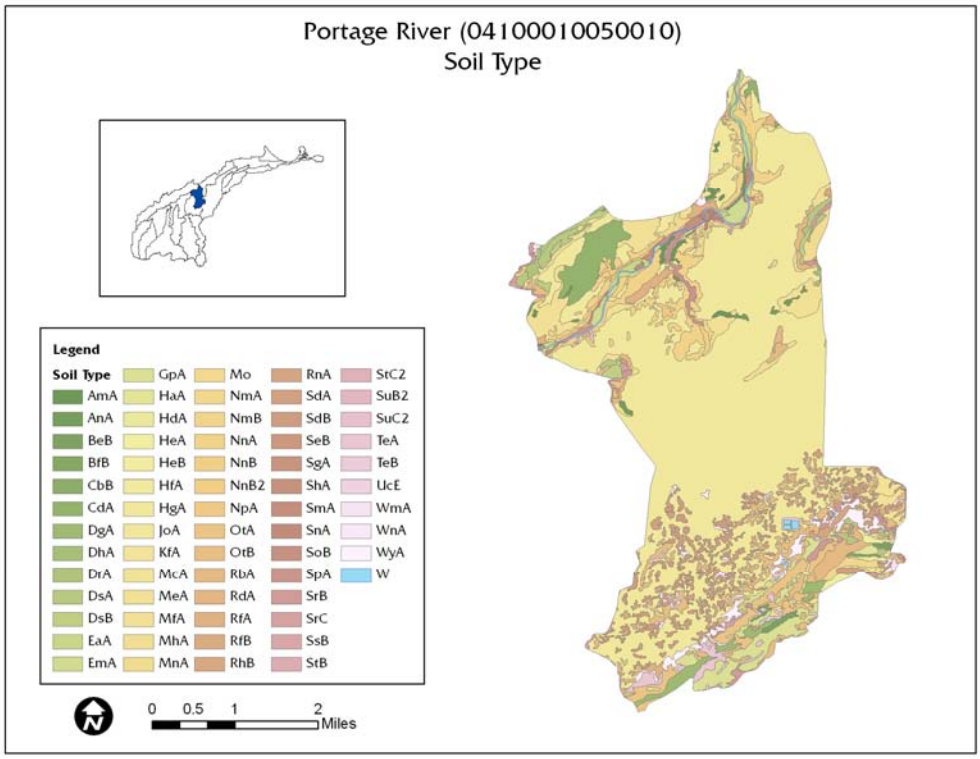
The Portage River HUC14 04100010 050-010 subwatershed is below the South Branch to above the North Branch Portage River and is located in Wood County in the generally flat-lying Eastern Lake Plains Section of the Central Lowlands Physiographic Province (Fenneman, 1938). The county is covered by a variable thickness of glacial till, lacustrine deposits and outwash. These unconsolidated glacial deposits are underlain by a relatively flat-lying sequence of Paleozoic sedimentary rocks consisting primarily of dolomite from the Silurian and Devonian Systems (ODNR, 1994).

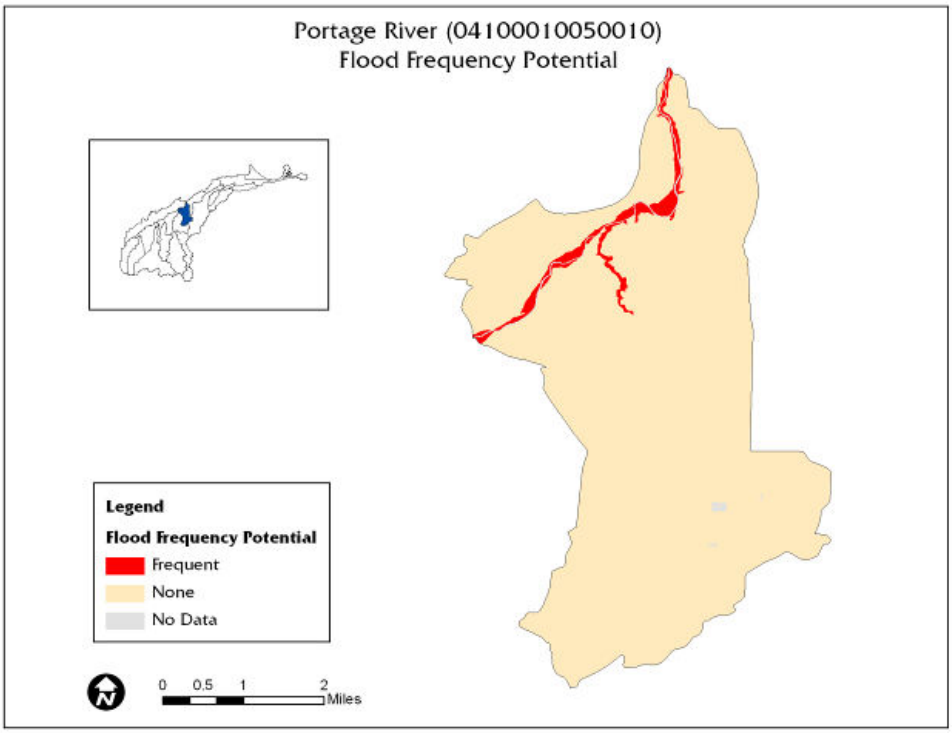
Soils

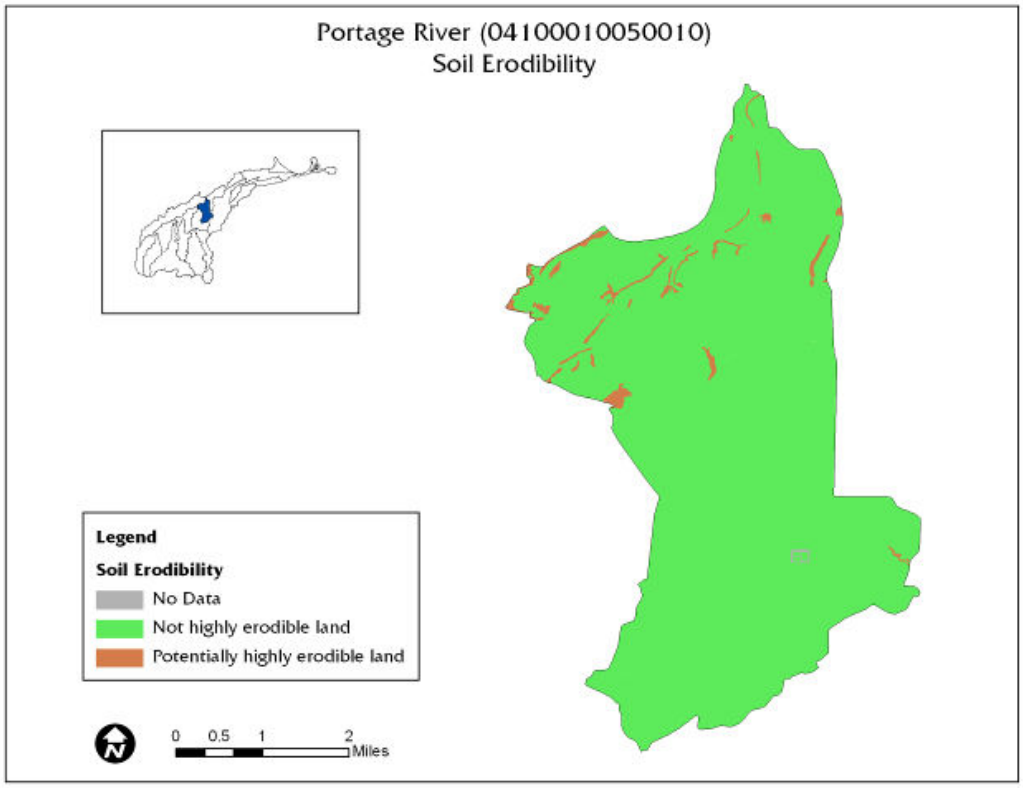
The two dominant soils for HUC14 04100010 050 010 are Hoytville clay loam, 0 to 1 percent slopes (HgA) with 2,558 hectares of coverage and Nappanee loam, 0 to 2 percent slopes (NnA) with 226 hectares of coverage. The Nappanee loam soils form on flats and rises on lake plains. These are dark

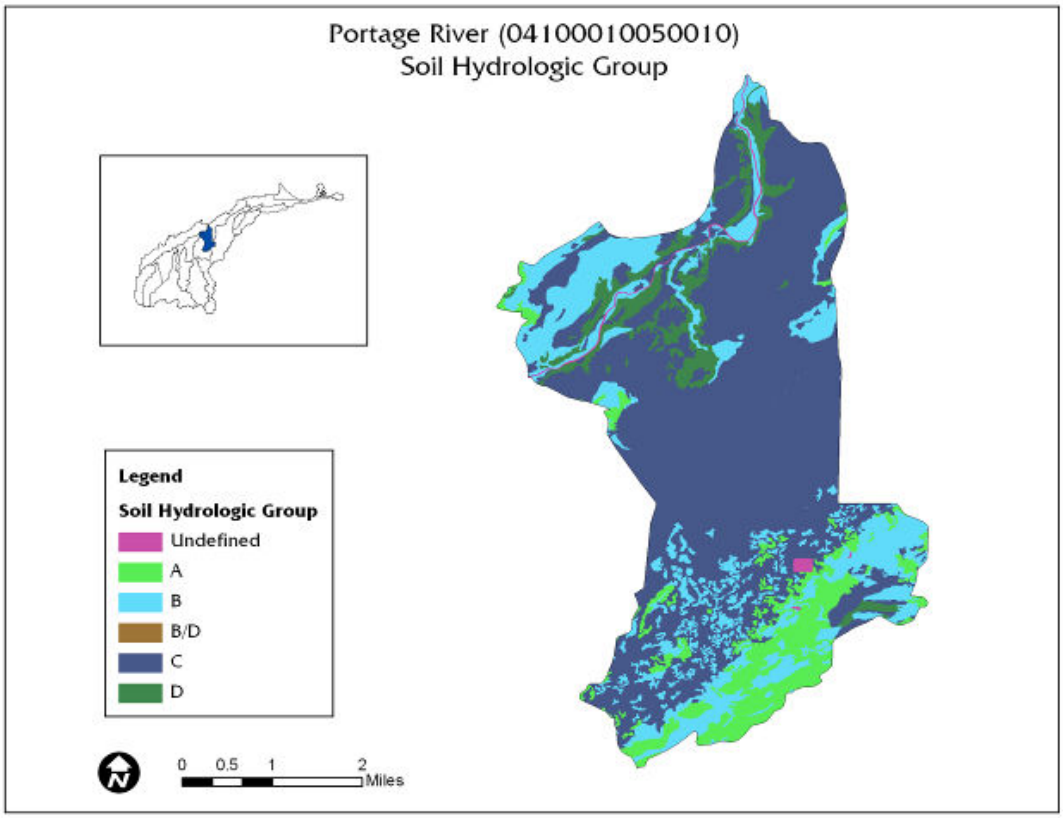
colored surface soils of clay loam, silt loam, silty clay loam, or sandy loam surface and somewhat poorly drained soils. This is prime farmland if drained. The restricted permeability of this soil limits the absorption and proper treatment of the effluent from septic systems. The seasonal high water table in areas of this soil greatly limits the absorption and proper treatment of the effluent from septic systems. Costly measures may be needed to lower the water table in the area of the absorption field (Soil Survey of Wood County, 2005).

Major Soil Groups		
050-010		
Hoytville	Sum Acres	6,321
	Percentage	54.97%
Nappanee	Sum Acres	763
	Percentage	6.64%
Ottokee	Sum Acres	659
	Percentage	5.73%
Seward	Sum Acres	596
	Percentage	5.19%
Mermill	Sum Acres	580
	Percentage	5.04%
Granby	Sum Acres	319
	Percentage	2.78%
Colwood	Sum Acres	251
	Percentage	2.19%
Wauseon	Sum Acres	247
	Percentage	2.15%


Portage River (04100010050010)
Soil Type
Legend
Soil Type
AmA
AnA
BeB
BfB
CbB
CdA
DgA
DhA
DrA
DsA
DsB
EaA
EmA
GpA
HaA
HdA
HeA
HeB
HfA
HgA
JoA
KfA
McA
MeA
MfA
MhA
MnA
Mo
NmA
NmB
NnA
NnB
NnB2
NpA
OtA
OtB
RbA
RdA
RfA
RfB
RhB
RnA
SdA
SdB
SeB
SgA
ShA
SmA
SnA
SoB
SpA
SrB
SrC
SsB
StB
StC2
SuB2
SuC2
TeA
TeB
UcE
WmA
WnA
WyA
W
0 0.5 1 2
Miles


Portage River (04100010050010)
Flood Frequency Potential
Legend
Flood Frequency Potential
Frequent
None
No Data
0 0.5 1 2
Miles





The Soil Hydrologic Group map indicates the *Hydrologic soil groups* based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the

soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms (Wood County Soil Survey, March 2005). The following soil group descriptions are directly from the Wood County Soil Survey, page 241.

The four hydrologic soil groups are:

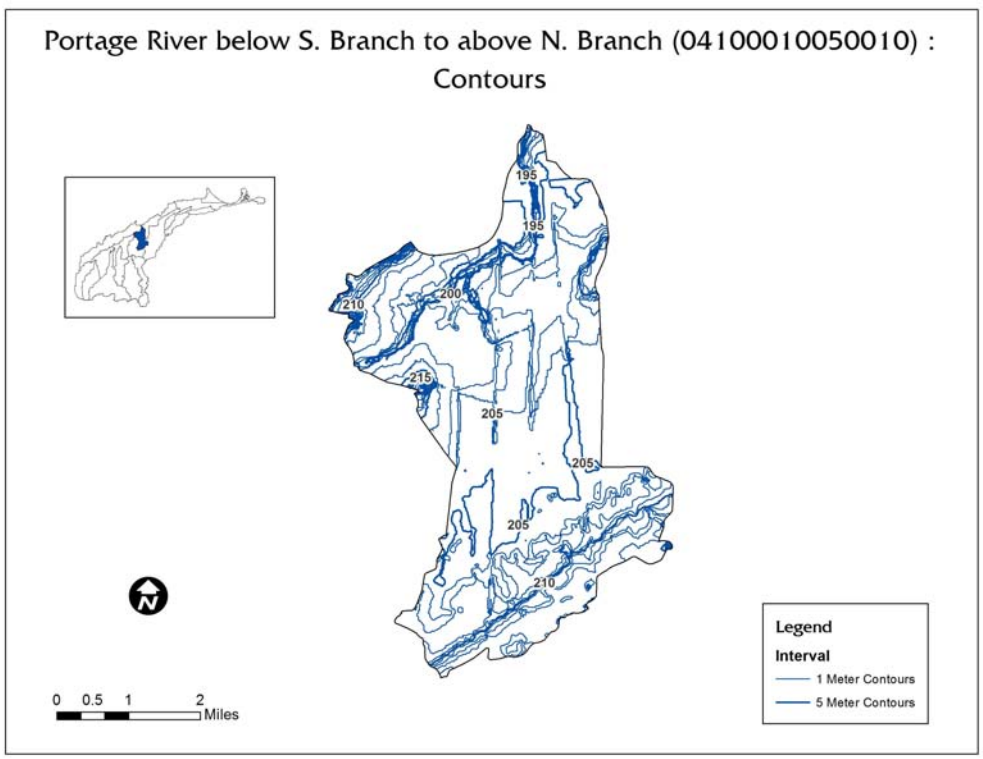
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

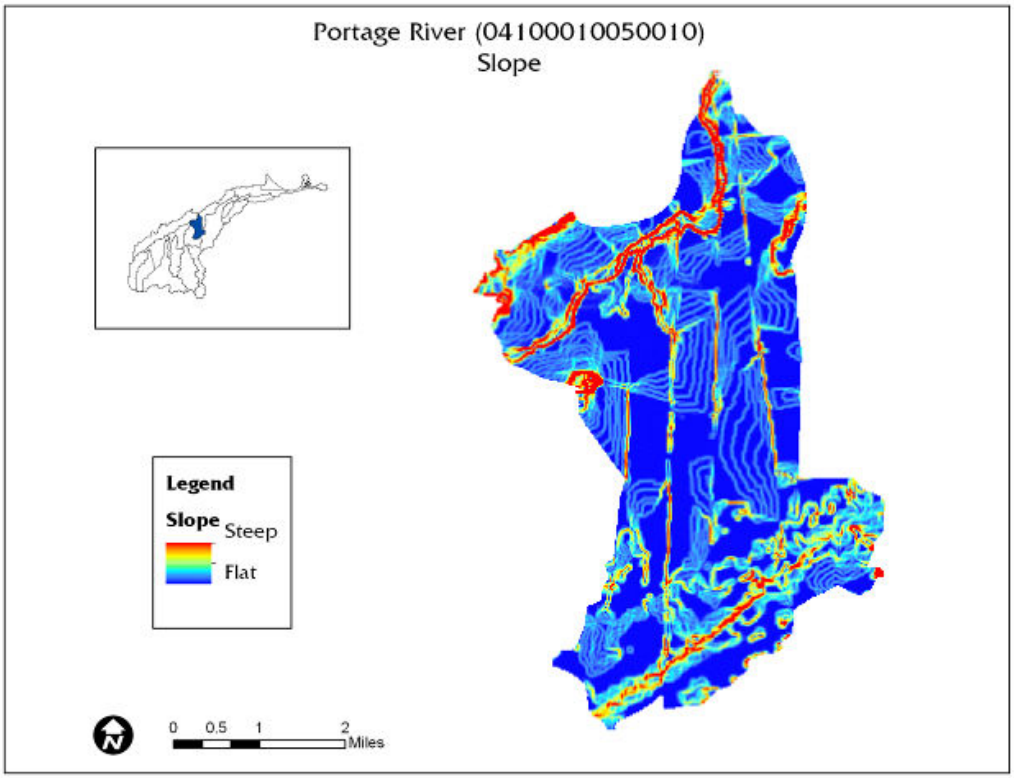
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately course texture. These soils have a moderate rate of water transmission.

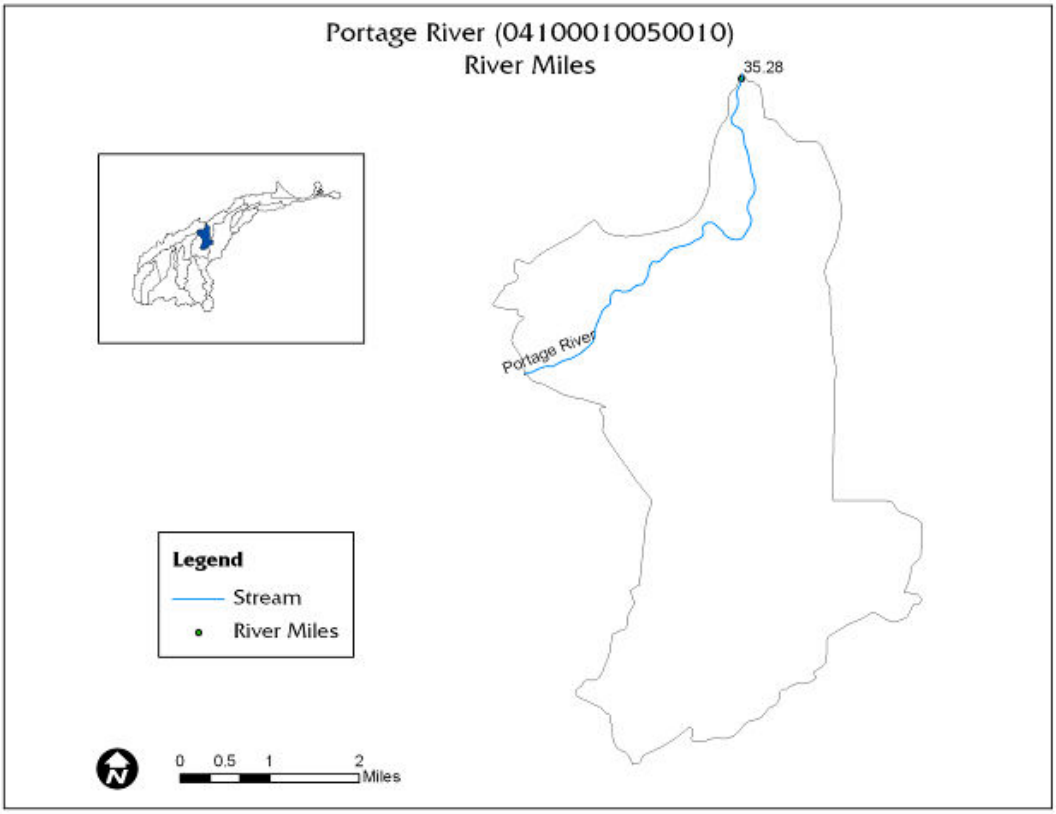
Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (**A/D, B/D, or C/D),** the first letter is for drained areas and the second is for undrained areas.




Portage River (04100010050010)
Slope
Legend
Slope
Steep
Flat
0 0.5 1 2
Miles


Portage River (04100010050010)
River Miles
35.28
Portage River
Legend
Stream
River Miles
0 0.5 1 2
Miles

Rare, Threatened, Endangered Species

HUC14 04100010-050-010 subwatershed is habitat to three *Threatened* plant species, one *Potentially Threatened* species and one species *Presumed Extirpated*. The species collection was located east of New Rochester on the Middle Branch Portage River. Additional information is available through the Ohio Department of Natural Resources, Division of Natural Areas and Preserves webpage at: http://ohiodnr.com/Home/Home/tabid/867/Default.aspx

Rare, Threatened, Endangered Species			
Common Name	***Scientific Name***	**Last Observed**	**State Status**
Bald Eagle	*Haliaeetus leucocephalus*	2010	T
Bushy Horseweed	*Conyza ramosissima*	1997-10-09	P
Bushy Horseweed	*Conyza ramosissima*	1997-08-08	P
Canada Plum	*Prunus nigra*	1958-05	E
Common Prickly Pear	*Opuntia humifusa*	1992-04	P
Common Prickly Pear	*Opuntia humifusa*	2008-05-27	P
Flat-stemmed Spike-rush	*Eleocharis compressa*	1981-05	P
Handsome Sedge	*Carex formosa*	1958-06-10	X
Rough Pennyroyal	*Hedeoma hispida*	1997-10-09	P
Tansy Mustard	*Descurainia pinnata*	1992-07	P
Western Rock-jasmine	*Androsace occidentalis*	2008-05-27	T

T=Threatened, P=Potentially Threatened, E=Endangered, X=Presumed Extirpated, SC=Species of Concern

Mussel Species in HUC14-04100010-050-010

Stream River Miles	Common Mussel Name	*Scientific Name*	Observed	Status
RM 35.28 @ Pemberville @ Bridge Street	Wabash Pigtoe	*Fasconaia flava*	2008	
	Fat Mucket	*Lampsilis radiate luteola*	2008	
	White Heelsplitter	*Lasmigona complanata*	2008	
	Giant Floater	*Pyganodon grandis*	2008	
	Maple leaf	*Quadrula quadrula*	2008	
	Deertoe	*Truncilla truncata (SC)*	2008	State=SC

SC=Species of Concern Ohio EPA

Water Resources

Surface Water

"The **Ohio Integrated Water Quality Monitoring and Assessment Report** indicate the general condition of Ohio's waters and identifies waters that are not meeting water quality goals. The report satisfies the Clean Water Act requirements for both Section 305(b) water quality reports and Section 303(d) lists of impaired waters." The Ohio 2010 Integrated Report can be located at the Ohio EPA webpage at: http://www.epa.state.oh.us/dsw/tmdl/OhioIntegratedReport.aspx

The Ohio 2010 Integrated Report website offers downloads of data and individual chapters. Individual river information on the health of water quality in Ohio, as well as Lake Erie near shore water standards can be obtained for human health use, aquatic life (fish and aquatic insects), chemical concerns for drinking water and recreation uses such as swimming and boating in our state's water.

If water quality standards are not met according to indicators set for that water body, the water quality is then determined to be ***impaired***. The goal is to identify the cause and source of the pollutant(s) which impair(s) that water and to restore it to ***attainment*** status. If the water quality is healthy (full attainment) then methods are employed to protect the healthy water from any possible future contaminates.

The Middle Branch Portage River HUC12-04100010 03 02 waterway is designated use for **warm-water habitat** (WWH) **aquatic use**. The **Recreation Use** assessment is Class A. That determines the acceptable E. Coli colony numbers as shown below in a summary table taken from the Ohio 2010 Integrated Report, Section F: Evaluating Beneficial Use: Recreation, p. F-1.

Summary of the recreation use assessment methods.		
Bathing Waters		
Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method Summary
E. coli	Seasonal geometric mean *E. coli* content* based on samples from the recreation season within a calendar year is 126 cfu/100 ml; single sample maximum is 235 cfu/100 ml.	Applied to the three Lake Erie shoreline assessment units, exceedence of the geometric mean bathing water criterion or an exceedence of the single sample maximum for more than 10% of the recreation season is considered an impairment of the bathing water use.
Primary Contact and Secondary Contact		
Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method Summary
E. coli	Seasonal geometric mean *E. coli* content* based on samples from the recreation season within a calendar year is: **Primary Contact Waters** Class A: 126 cfu/100 ml Class B: 161 cfu/100 ml Class C: 206 cfu/100 ml **Secondary Contact Waters** 1030 cfu/100 ml	Applied to streams and inland lakes. Data from a recreation season are assessed on a site-by-site basis and compared to the applicable geometric mean *E. coli* criterion whenever more than one sample result is available for a watershed assessment unit. Assessment units are considered to be in full attainment if all sites assessed within the assessment unit meet the applicable geometric mean criterion and in non-attainment if one or more sites assessed within the assessment unit exceed the applicable geometric mean criterion.

*** *E. coli* concentrations are expressed in colony forming units (cfu) per 100 milliliters (ml)**

All E. coli values are expressed as colony forming units (CFU) per 100 ml of water. One sample site was selected in the Portage River HUC12 04100010 03 02 by the Ohio EPA during the 2006-2008 *Biological and Water Quality Study of the Portage River Basin,* March 2010.

HUC 8 – 04100010 (Portage River)									
HUC 10 – 04100010 03 (Upper Portage River)									
HUC 12 – 04100010 03 02 (Town of Pemberville-Portage River)									
HUC 14 – 04100010 050 010 (Portage River below S. Branch to above N. Branch)									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
1	2008	S01S36	Portage River @ Pemberville @ Bridge St.	35.28	353.0	WWH	FULL	None	None

Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010.

Recreational Use Attainment

Location	RM	Recreation Use for Primary Contact Recreation waters (PCR) Class	Number of Samples	E. coli Geometric **Mean <126** and Single Sample Maximum ≤ 235 Value For Class A (recreation use intensity)	Attainment Status	Sources of Bacteria
Portage River @ Bridge Street	35.28	A	7	238/9200	**NON**	HSTS

Aquatic Life Use Assessment

Location	RM	Drainage Area	Aquatic Life Use	Attainment Status
Portage River @ Bridge Street	35.28	353.0	WWH	**FULL**

Macro-invertebrate Communities

Stream RM	Dr. Ar. (sq. mi.)	Data Codes	Qual. Taxa	EPT QI./Total	Sensitive Taxa QI./Total	Density QI./Qt.	CW Taxa	Predominant Organisms on the Natural Substrates With Tolerance Category(ies)	ICI[a]	Narrative Evaluation
35.28	353	-	72	16/18	27/33	H/3794	0	Hydropsychid caddisflies (F,MI), flatworms (F), baetid mayflies (F)	36	Moderately embedded substrates.

Source: Ohio EPA, 2008

Public Drinking Water Supply Assessment

HUC	Reporting Category	Cause of Impairment	Nitrate Watch List	Pesticide Watch List
Portage River below South Branch to above North Branch	NA	None	No	No

04100010-050-010				

Fish Tissue Assessment

HUC	Reporting Category	Causes of Impairment	PCB Concentration
Portage River below South Branch to above North Branch 04100010-050-010	5h	None	

Water Quality Monitoring Results: Ohio EPA 1994 and 2008

River Mile	Date	IBI	ICI	MIwb	QHEI	STATUS
35.8	1994	32	48	8.7	55.0	Good/Fair
35.6	1994	34	-	8.4	61.5	Good/Marginally Good
35.0	1994	38	-	9.1	65.0	Very Good/Good
34.8	1994	33	36	7.6	59.0	Marginally Good
The above fish community indices are from samples collected in the Portage River study area in 1994, 1985 and 1983. MIwb and IBI scores are Mean scores and compared to Ecoregional Biocriteria for the HELP.						
35.28	***2008***	*39*	*36*	*7.8*	*53.0*	*Good*

a - River Mile (RM) represents the Point of Record (POR) for the station, not the actual sampling RM.
b - MIwb is not applicable to headwater stream with drainage areas ≤20 mi^2.
c - A narrative evaluation of the qualitative sample based on attributes such as EPT taxa richness, number of sensitive taxa, and community composition was used when quantitative data was not available or considered unreliable. VP=Very Poor, P=Poor, LF=Low Fair, F=Fair, MG=Marginally Good, G=Good, VG=Very Good, E=Exceptional
d - Attainment is given for the proposed status when a change is recommended. Aquatic life use in superscript.
ns - Nonsignificant departure from biocriteria (≤4 IBI or ICI units, or ≤0.5 MIwb units).
* - Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.
Italic: 2008 TMDL scores in review.

General narrative ranges assigned to QHEI scores.

Narrative Rating	QHEI Range		
	Headwaters (≤ sq mi)	Larger Streams	Lacustuary
Excellent	≤ 70	≤ 75	≤ 80
Good	55 to 69	60 to 74	60 to 80
Fair	43 to 54	45 to 59	45 to 59
Poor	30 to 42	30 to 44	30 to 44
Very Poor	<30	<30	<30

Biological Criteria Benchmarks

Biological Criteria					Lacustuary Benchmarks[1]				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
IBI-Headwaters	50	28	20	18	N/A	N/A	N/A	N/A	N/A
IBI-Wading	50	32	22	18	N/A	N/A	N/A	N/A	N/A
IBI-Boat	48	34	20	16	50	42	31	17	<17
MIwb-Wading	9.4	7.3	5.6	4.5	N/A	N/A	N/A	NA	N/A
MIwb-Boat	9.6	8.6	5.7	5.0	10	8.6	5.6	2.8	<2.8
ICI	46	34	22	8	52	42	25	12	<12

[1] **Proposed Lacustuary scoring breakpoints. These have not yet been adopted into rule.**

The results indicate the cause and sources of pollution to surface water have a direct relationship to the attainment status for survival of warm water habitat within a watershed assessment unit.

Row crop production is 83.8% of the land use within this watershed assessment unit of the Portage River. The potential exists for runoff contributions of sediment, nutrients and bacteria to enter the river system. Therefore, cover crop rotations and conservation tillage practices are encouraged by the soil and water districts working with Natural Resource Conservation Service as well as the Farm Service Bureau to provide financial benefits to agriculture operators to install these practices.

Ground Water

Source Water Assessment Plan (SWAP)

The Village of Pemberville has a public water system serving 1,300 people. A Carbonate bedrock **aquifer** provides ground water to eight wells, located in three separate well fields, within Pemberville. The village pumps 129,800 gallons per day to serve its residents' needs.

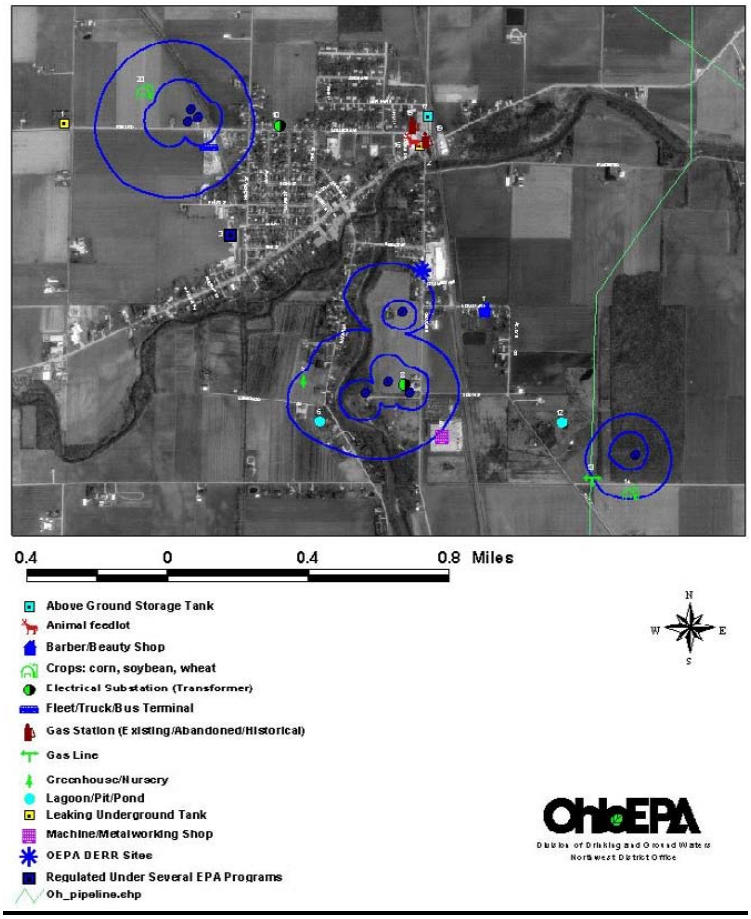
To protect the ground water aquifer source of drinking water, a protection area buffer is delineated for the land area surrounding the wellheads. The protection area is established to help protect the drinking water supply from pollution contaminates seen on this Ohio EPA map.

Within the source water protection area an inventory was conducted by the Ohio EPA and village personnel to identify all *potential* sources of contamination which could reach ground water levels. Pemberville has a high susceptibility to contamination to the drinking water for several reasons. The source water assessment plan (SWAP) identified four indicators of high susceptibility to contamination

- Depth to water in the bedrock aquifer is 25 feet or less below ground surface;
- Wells are located in a sensitive potential karst area;
- Potential contaminant sources exist within the protection area;
- The wells are open between approximately 25 and greater than 100 feet in the fractured carbonate and the depth to water is less than 25 feet below the ground surface.

1.

Pemberville's Drinking Water Source Protection Area is shown in the following figure (Ohio EPA, Drinking Water Source Assessment for the Village of Pemberville, 2002).



"This does not mean that the aquifer will become contaminated, only that under the existing conditions ground water could become impacted by potential contaminant sources" (Drinking Water Source Assessment for Village of Pemberville (PWS ID# 8701712)), Ohio EPA, September 2002.

DRASTIC MAP

The sensitivity of the groundwater to local sources of contamination is determined and rated by **DRASTIC** maps as described below:

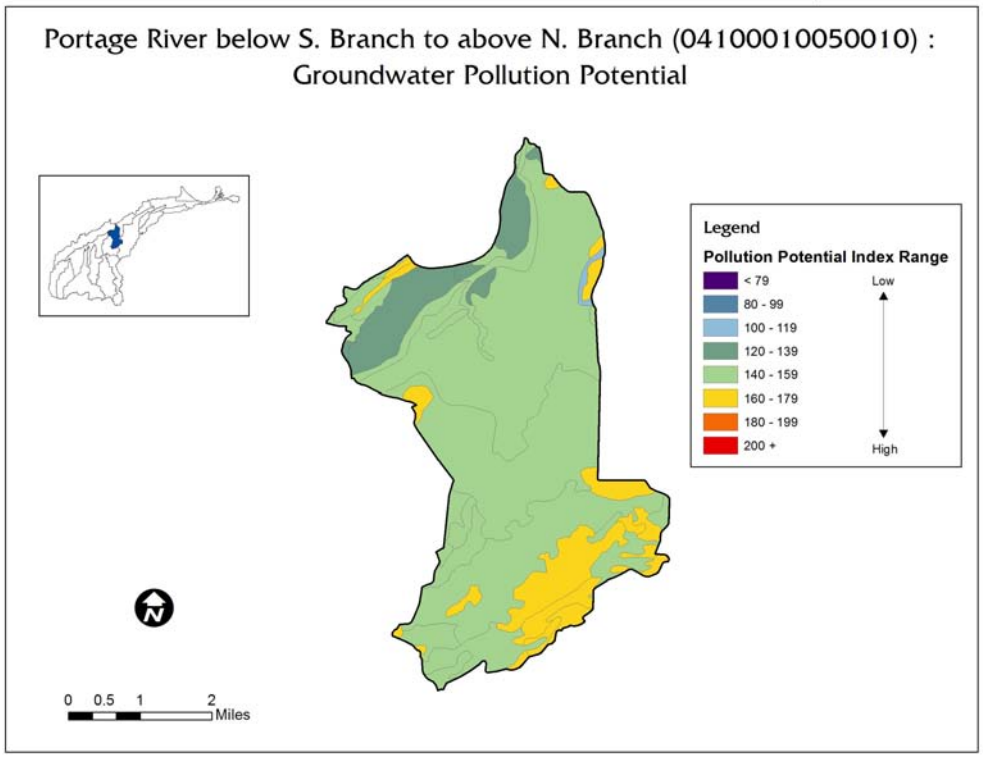
Inherent within each geologic setting are the physical characteristics which effect the groundwater pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:

D – Depth to Water
R – Net Recharge
A – Aquifer Media
S – Soil Media
T – Topography
I – Impact of the Vadose Zone Media
C – Conductivity (Hydraulic) of the Aquifer (ODNR, 1994)

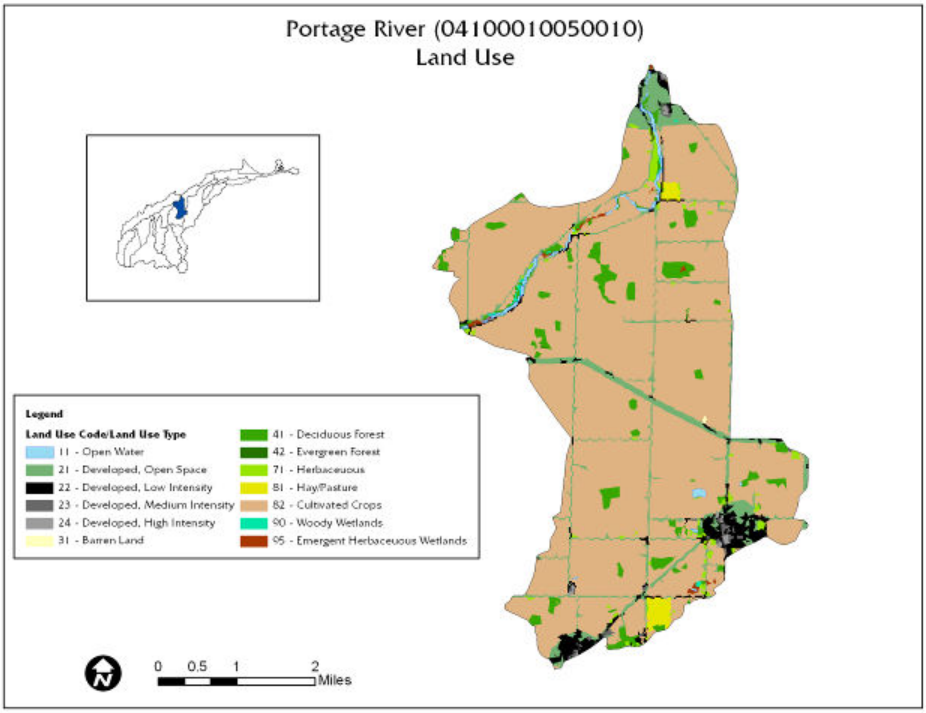
Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index, the greater the vulnerability to contamination (ODNR, 1994).

The average ground water pollution index potential for the Portage River watershed between the North Branch and South Branch is 152 with a range of 106-171.

The Ohio Department of Natural Resources, Division of Water, Water Resources Section is the responsible agency to map groundwater resources throughout the state. Greater detail on DRASTIC maps for the Portage can be found in Chapter 4 of this watershed plan.



Sub-watershed (04100010-03-02)		
050-010		
Land Use	**Percent**	**Acres**
Urban	8.2%	917
Forest	5.7%	638
Pasture	0.9%	100
Cropland	83.8%	9,324
Other	1.3%	147
Total Acres	100%	11,126



Livestock Inventory							
HUC 4100010050010							
Type of Animal		**Hancock**	**Ottawa**	**Sandusky**	**Seneca**	**Wood**	**Estimates for HUC**
Percent of County in HUC		0.0%	0.0%	0.0%	0.0%	2.9%	
Cattle	Farms	129	89	167	264	144	**4**
	Animals	4,233	1,523	4,612	10,096	6,287	**183**
Hogs	Farms	51	15	37	62	30	**1**
	Animals	32,343	3,639	5,591	42,808	39,469	**1,147**
Horses	Farms	105	63	132	72	128	**4**
	Animals	844	444	772	463	1,004	**29**
Poultry	Farms	49	22	41	62	47	**1**
	Animals	NA	779	1,042	4,283	NA	**NA**
Sheep	Farms	32	12	41	61	21	**1**
	Animals	1,134	335	765	2,770	21	**1**
Total							11
							1,370
Source: 2007 Census of Agriculture http://www.agcensus.usda.gov/							

Point Sources

Municipal

- Bradner WWTP (2PA00077)

Industrial

- Reed Air Products (2IC00058)

Package Plants

- None

Non-Point Sources

Critical Sewage Areas:

- None

Estimates of HSTSs				
Watershed	**Housing Units without sewers**	**Est. Unsewered Population (2000)**	**Unsewered Housing Units per acre**	**Unsewered Population per acre**
04100010050010	528	1,407	0.046	0.122
Sources: 2000 Census data and TMACOG "208" Plan. Analysis identifies approximate number of housing units without sewers in each watershed as an estimate of number of HSTSs.				

Aquatic Life Use Impairments	
Causes	**Sources**
None listed	None listed
Source: Ohio 2010 Integrated Report, Watershed Assessment Unit Summary	

Water Supply

Public Water System	Population Served	Primary Water Source
None		

Water Quality Impairments

The OEPA Integrated Report assesses each watershed's attainment status for 1) Public Drinking Water Supply, 2) Recreation, 3) Human Health, 4) Aquatic Life, and 5) Fish Tissue. The Integrated Report identifies causes and sources of impairments where watersheds are not in attainment with water quality standards.

Background:

Water quality impairments have not been identified in the past due to lack of water sample data collected in this subwatershed. No historical data or inventory of the physical, biological or chemistry data for this subwatershed exist, other than one sample test site conducted by the Ohio EPA in 1994 at RM 35.29 for conventional water chemistry. The sample from the bridge in Pemberville on Bridge Street, which is the furthest downstream location in this subwatershed, is upstream of the Pemberville WWTP. The 2008 TMDL water sampling conducted by Ohio EPA used the same testing site with Full Attainment result for aquatic life use attainment status for the Huron Erie Lake Plain (HELP) ecoregion. If biological impairment had occurred, the cause and source of the impairment would be recorded. Biotic (aquatic bugs) communities are measured by the Index of Biotic Integrity (IBI), Modified Index of Well Being (MIwb), and the (fish) Invertebrate Community Index (ICI). The ability of the physical habitat that supports the biotic community is measured by the Qualitative Habitat Evaluation Index (QHEI).

The Middle Branch Portage River is 5.62 river miles in length between the Village of Pemberville (RM 35.21) and New Rochester (RM 40.83) in Wood County. Three municipalities are located on the higher elevations at the north and south boundaries of this subwatershed: Bradner (2008 pop. 1,158), Wayne (2008 pop. 855) and Pemberville (2008 pop. 1,358). Outside of these communities, much of the subwatershed is served by individual home septic systems.

In 2009 the Villages of Bradner and Pemberville were awarded American Recovery and Reinvestment Act (ARRA) funding for sewer project upgrades. Pemberville's funding was for a new wastewater plant with capacity to treat wet weather flows, eliminating CSOs. The Ohio EPA biological and water quality study in 1995 stated that pollutant loadings from CSO or plant bypasses represent an additional and potential significant source of pollutants not accounted for when these discharges are released into the Portage River.

In addition, "Total mean effluent volume reported by discharges throughout the basin can account for as much as 25 percent of the flow in the Portage Mainstem during low flows." (Ohio EPA, December 1995). In 1994, the total effluent discharged into the Portage River was 15.31 million gallons per day (MGD).

The highest point of elevation is in Bradner at 702 feet, and the lowest elevation is 635 feet, located at the mouth of the Middle Branch RM 35.21 in Pemberville as the Middle Branch converges with the North Branch to form the Mainstem of the Portage River.

A total of 46 miles of ditches drain this subwatershed into just 5.62 river miles of the Middle Branch Portage River. Thirty-two (32) miles of drainage ditch are maintained and fourteen (14) miles of ditch system are not maintained with a chance of recovery to a natural channel.

Further assessment of the ditch system, should include an inventory of tiled fields. An update of agricultural conservation practices should be collected for future revision of this watershed plan and evaluated in relationship to water quality monitoring results.

Entering the Middle Branch at RM 38.25 is a large natural wooded ravine existing for a length of four river miles, which then converts to a maintained ditch system with no riparian coverage for the headwaters.

Because of the acres of woodlots and streamside forests in this subwatershed an educational workshop series is recommended for landowners. The Portage watershed has a strong focus on agricultural land use management practices to protect and improve water quality. Woodlots and forest have their own unique management practices that are beneficial to both the landowners and the quality of the water. Forest or timber management of streamside forests can be managed for the most profit as a timber crop and still provide beneficial use to the river system. Streamside forests stabilizing the stream banks against erosion, shade the water to reduce temperature to maintain a high oxygen level for aquatic life, take up nutrients, filter pollutants, and retain water for vegetation. Great quantities of water are held within the timber canopy and root systems of woodlots.

The Ohio State University and OSU Extension Service have fact sheets on crop tree management and Best Management Practice guidelines for logging woodlots. One important erosion control BMP for logging in Ohio, recommends a 25-foot no-cut or light-cut zone measured from the top of the stream bank. Also, the United States Internal Revenue Service has Tax Form T (Timber), which is exclusive to timber tax benefits. There are unique financial benefits and tax incentives in proper woodlot and forest management that benefit a landowner financially and also benefit the land and water resources. A series of workshops with regional case studies is recommended for the watershed area. The workshops can inform landowners how to obtain crop estimates and high payment for quality stumpage, as well as how to conduct a method of sealed bids to obtain the highest dollar for their timber crop. Information will also protect landowners against clear cutting, which reduces future profits on quality hardwoods. Many family farms have kept their land for generations of agricultural production. Woodlots along the Portage River can provide profit and habitat benefits for years to come.

The 5.62 river miles of the Middle Branch and the 4 miles of wooded ravine at RM 38.25 are identified as the 100-year floodplain for the subwatershed. The land area should be examined for any riparian or stream bank erosion or floodplain restoration and considered for land conservation easement for the floodplain area.

Forested land area (as well as ravine topography) is very limited in the subwatershed and a few parcels serve the drainage area of one of the longest ditches (south to north) before emptying into the Middle Branch through the large ravine system at RM 38.25. The landowners could be contacted for cost-share benefits with the Wood County Soil & Water Conservation District and ODNR Division of Forestry to implement conservation practices at this location. Forest/timber management in the subwatershed would enhance habitat for eagles and other raptors. Currently two eagle nests are located in this subwatershed.

The lack of data about the water quality for the entire HUC and its headwaters indicates there is monitoring work to be done. Additional sample sites should be established on the river between RM 35.21 and RM 40.83 and sample sites started in the headwater area. A majority of this subwatershed is

unsewered except for the municipal areas of Pemberville, Bradner and Wayne. A working partnership with the Wood County Health Department has been long established and benefitted the Portage River watershed in past water quality projects. A GIS project to locate and inventory HSTS permits was initiated at the health department. The recommendation is to continue the inventory project within this HUC (and the Portage watershed) to locate those potentially failed home septic systems that likely drain off-lot into the system of 46 miles of drainage ditches in this basin.

The Middle Branch has good riparian vegetation between RM 35.21 and RM 40.83. Evidence on aerial photos indicates the man-made relocation of the riverbed from agricultural land to parcel boundaries to maximize use of agricultural acreage. Old oxbows and natural river relocation is most apparent through agricultural fields located between RM 36.8 and RM 37.5 at Pemberville Road and Gibsonburg Road with potential for restoration or conservation easements. About one-half mile (0.50) west of Wayne Road is a large area of river rapids at RM 39.0. The location should be further investigated for the cause (natural or man-made) and targeted as a site for water quality testing if there is access to the river.

Problem Statement #1: (Bacteria)

The water quality of the North Branch subwatershed is impaired by elevated measurements of E. coli bacteria in the waterway. The Portage TMDL data collected by Ohio EPA in 2008 indicates that the HUC's sole sampling site is in non-attainment for E. coli. The TMDL cites failed HSTS as the causes of impairment due to high E. coli bacteria levels.

In this HUC are an estimated 528 HSTS; by density of onsite systems, this is a fairly populated HUCs. This area includes no package plants, Critical Sewage Areas, or CSO areas.

Goal 1.1:

Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 3.3 million gallons of HSTS effluent annually.

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 52 systems.

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Bacteria	1.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$780,000	Wood County Health Dept, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 52 systems	3.3 million gallons/year sewage discharge eliminated

Problem Statement #2: (Nutrients: phosphorus and nitrate)
The Ohio EPA TMDL found the sampling site in this HUC meeting Aquatic Life attainment standards. However, the Portage TMDL recommends a total phosphorus load allocation of 1.35 kg/day, requiring a nonpoint source load reduction of 2 lb. P/year. HSTS systems should be addressed as noted above due to recreational non-attainment. Agricultural BMPs should be encouraged to maintain the attainment standard and help reduce loadings to Lake Erie.

Goal 2.1: Maintain the TMDL target for phosphorus with a load reduction of 277 and nitrate load of 1,173 lb./year from HSTS.

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 52 systems.

Goal 2.2: Reduce nutrient loadings and maintain the HUC's attainment status by agricultural nutrient management practices.

Objectives:

- 4021 acres under NRCS 590/1 Nutrient Management.
- 1723 acres under NRCS 590/3 Nutrient Management.

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Nutrients (phosphorus and nitrate)	2.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$780,000	Wood County Health Dept, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 52 systems	Reduce phosphorus load by 277 and nitrate load by 1,173 lb./year
	2.2	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$0	Wood SWCD, NRCS, farmers	2012-2027 in phases	0,000 acres of cover crops	Reduce phosphorus load by 0,000 and nitrate load by 00,000 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$0	Wood SWCD, NRCS, farmers	2012-2027 in phases	00 acres of controlled drainage	Reduce phosphorus load by 00 and nitrate load by 00 lb./year
	2.2	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$0	Wood SWCD, NRCS, farmers	2012-2027 in phases	00 acres of permanent hay	Reduce phosphorus load by 00 and nitrate load by 00 lb./year
	2.2	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$0	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	00 acres of riparian buffers	Reduce phosphorus load by 00 and nitrate load by 00 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Evaluate oxbow site(s) with Wood Co Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$0	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	00 LF of restored oxbows	Reduce phosphorus load by 00 and nitrate load by 00 lb./year
	2.2	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$0	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	0 acres of restored wetlands	Reduce phosphorus load by 0 and nitrate load by 0 lb./year
	2.2	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$0	Wood SWCD, Wood co Engineer, NRCS, farmers	2012-2027 in phases	0 LF of stream restoration	Reduce phosphorus load by 0 and nitrate load by 0 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$0	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	0 LF of overwide / 2-stage ditch reconstruction	Reduce phosphorus load by 0 and nitrate load by 0 lb./year
	2.2	♦Seek cooperators for Nutrient Management NRCS 590 Level 1 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management NRCS 590 Level 1 BMPs with farmers	$80,421	Wood SWCD, NRCS, farmers	2012-2022	4,021 acres under NRCS 590/1 Nutrient Mgt	NA
	2.2	♦Seek cooperators for Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with farmers	$68,932	Wood SWCD, NRCS, farmers	2012-2022	1,723 acres under NRCS 590/3 Nutrient Mgt	NA

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$0	Wood SWCD, NRCS, farmers	2012-2027 in phases	00 acres of filter strips	Reduce phosphorus load by 00 and nitrate load by 00 lb./year
	2.2	♦Identify & prioritize fields suited for Conservation Tillage BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Conservation Tillage BMP with farmer	$0	Wood SWCD, NRCS, farmers	2012-2027 in phases	00 acres of conservation tillage	Reduce phosphorus load by 00 and nitrate load by 00 lb./year

Problem Statement #3: (Education, Information, and Management)

Successful implementation of nutrient load reduction or habitat restoration projects depend on informed stakeholders who understand and support restoration goals. In many areas that understanding and support is lacking. The over-reaching goal of this section is to lay the groundwork for future implementation by building understanding in the affected community. Specific problems are recommended for action:

- Water quality data do not exist for this subwatershed except for one sampling point on the mainstem. There are no baseline data for the headwaters or the upstream area of the subwatershed to establish watershed planning goals for this HUC.
  Historically in this subwatershed water quality, habitat, and biota data have been collected at only one site. The headwaters are comprised of 46 miles of drainage ditch, with limited vegetative habitat. QHEI, biota, and water chemistry tests would be needed to determine whether the headwater streams meet attainment criteria for warm-water habitat streams.

Local stakeholder groups established through the high schools, community organizations and public groups can sign-up to obtain training and conduct scheduled monitoring between RM 35.21 and RM 40.83 as well as sites to be determined within the headwater area. The 2008 TMDL sample study indicates full attainment status for the watershed's one sampling point on the mainstem in Pemberville. Credible water quality data collection are needed to maintain attainment and identify any nutrient, bacteria, sediment, or habitat issues in the headwaters of this HUC.

- The acres of woodlots have declined, particularly within riparian areas between RM 35.21 and RM 40.83 between New Rochester and Pemberville. These reductions have resulted in a decrease in the QHEI from the lower 60s in 1994 to the lower 50s in 2008. This decrease QHEI index may explain the 'moderately embedded substrates' noted in the 2008 water quality monitoring results from Ohio EPA. The protection of streamside forests in these stream reaches would increase the QHEI score and improve water quality.
- Woodland management workshops would benefit landowners understand the environmental benefits of riparian woodlots. Landowners would learn to plan woodlot harvest to maximize a financial return through planned timber yield and sale by a bid process. The use of tax shelters and timber management can provide for their security or family inheritance, as well as wildlife habitat, recreation, and increase species diversity.

Goal 3.1: Establish and conduct ongoing volunteer water quality monitoring program for this HUC.

Objective: Program establishes ongoing monitoring program for the watershed which improves the public's and agencies' knowledge of its water quality.

Goal 3.2: Workshop educates land owners on effective and financially beneficial woodlot management.

Objective: Program raises understanding and skills of landowners in environmental and financial benefits of woodlots.

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Information and Education	3.1	♦ Seek funding for sampling equipment. ♦ Recruit volunteer monitors. ♦ Conduct volunteer training workshop with Ohio EPA to train volunteers. ♦ Promote project through press releases and local newsletters and high schools. ♦ Start monitoring and report data to the (GLOBE) public access site. ♦ Project Management Team meets with Ohio EPA to determine sample sites. ♦ Obtain equipment and test regimen. ♦ Conduct chemical, physical and biological monitoring. ♦ Report data to GLOBE and Ohio EPA ♦ Plan any remediation.	$15,000 startup and $10,000 annually	Wood SWCD; PRBC; TMACOG; Ohio EPA; GLRI; OEEF; ODNR, YSI for monitor equipment. Local Sponsorship. School districts in watershed.	2012-2017	Program establishes ongoing monitoring program for the watershed which improves the public's and agencies' knowledge of its water quality	NA
Information and Education	3.2	♦ Establish a Steering Committee to organize workshop event details. ♦ Seek funds to hold event and provide woodland management resource notebooks of facts, sources of assistance and resources. ♦ Conduct on-site tour. ♦Promote event through local sponsorships.	$30,000	Wood County SWCD; OSU Extension, NRCS, TMACOG; Ohio EPA, Black Swamp Conservancy, ODNR Forestry, land owners	2013-2018	Program raises understanding and skills of landowners in environmental and financial benefits of woodlots	NA

NORTH BRANCH PORTAGE RIVER

04100010 050 020 (14 – digit HUC)
04100010 03 01 (New 12-digit HUC & Name: North Branch Portage River)

Length: 28.5 miles

Elevation at Mouth: 634 feet

Elevation at Source: 704 feet

Gradient: 2.0 ft/mile

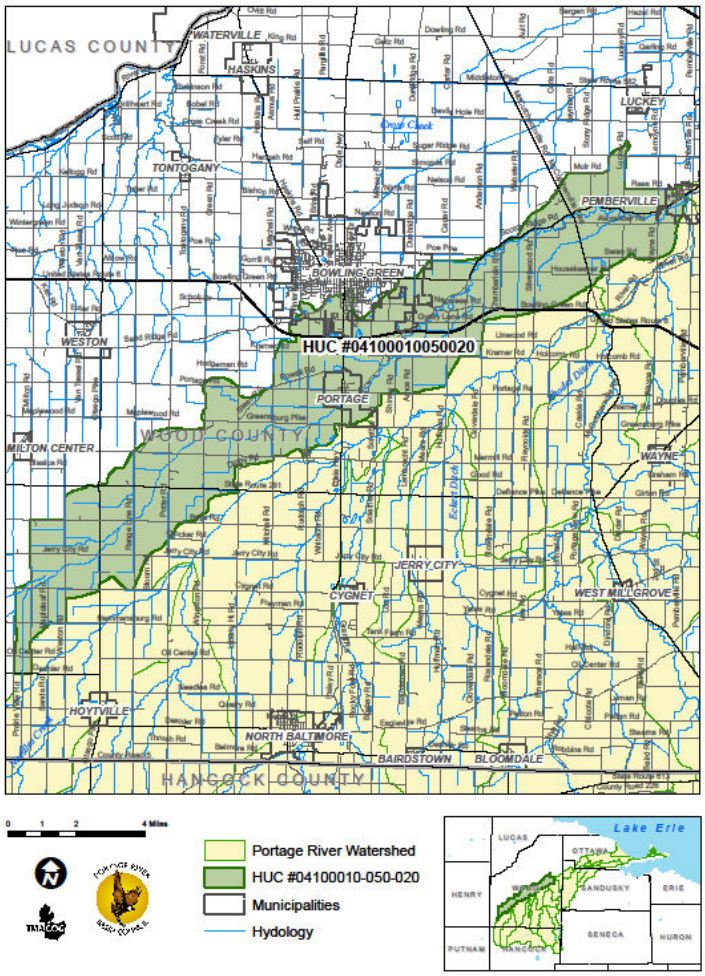
Drainage Area: 60.20 sq. miles

Ohio Topographic Quadrangle 7.5 minute (1:24,000)

- Hoytville
- Weston
- Bowling Green South
- Jerry City
- Dunbridge
- Pemberville

Urban Areas:
City of Bowling Green
Village of Pemberville
Village of Portage

HUC #04100010-050-020



Land use is very urban near the City of Bowling Green, Ohio and Interstate 75 and very rural in the headwaters of the North Branch in Jackson Township, Wood County.

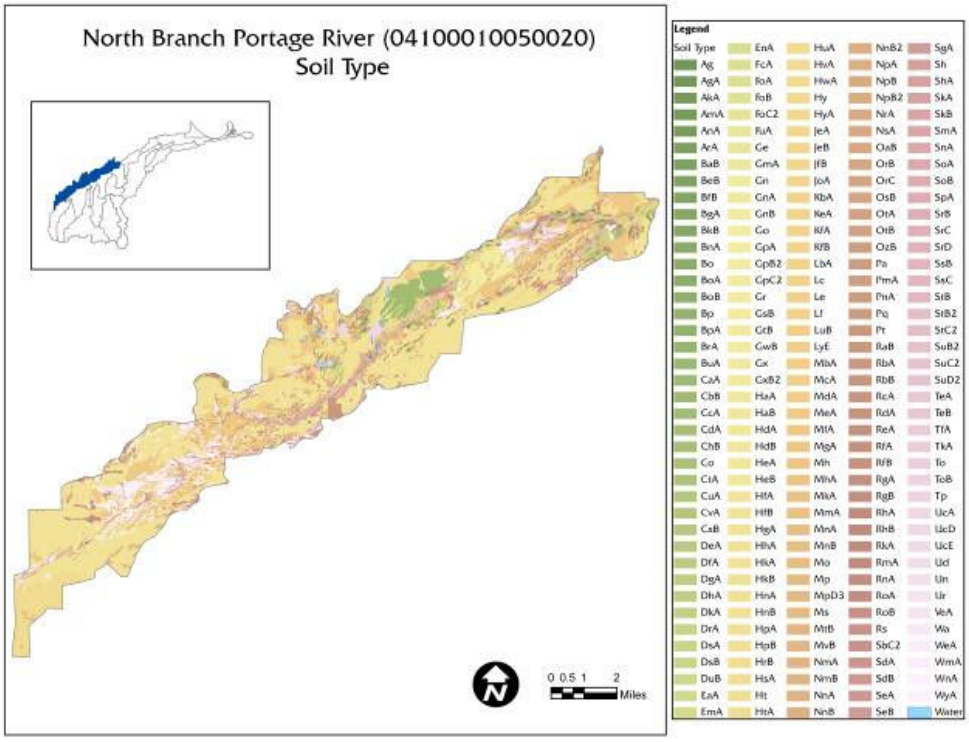
Geology

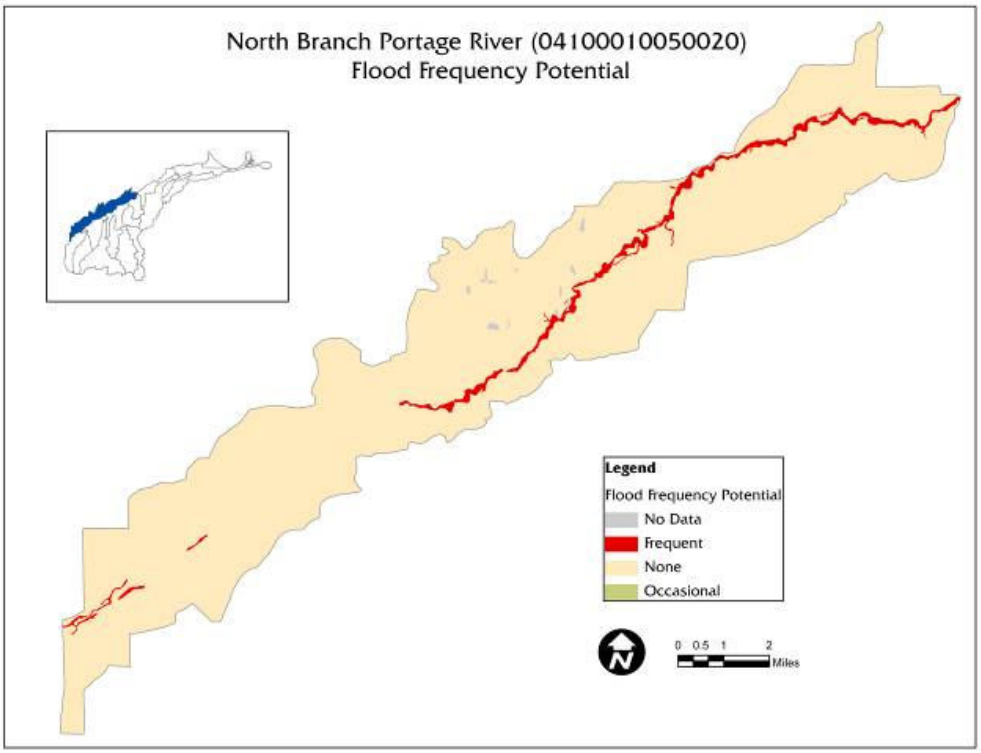
Bedrock geology of Wood County is underlain by a relatively flat-lying sequence of Paleozoic sedimentary rocks consisting primarily of dolomite from the Silurian and Devonian Systems. Silurian bedrock beneath Wood County consists of two groups, the Lockport and the Salina. Devonian bedrock in Wood County consists of the Dundee Limestone which overlies the Detroit River group (Ground Water Pollution Potential Report No. 21, ODNR).

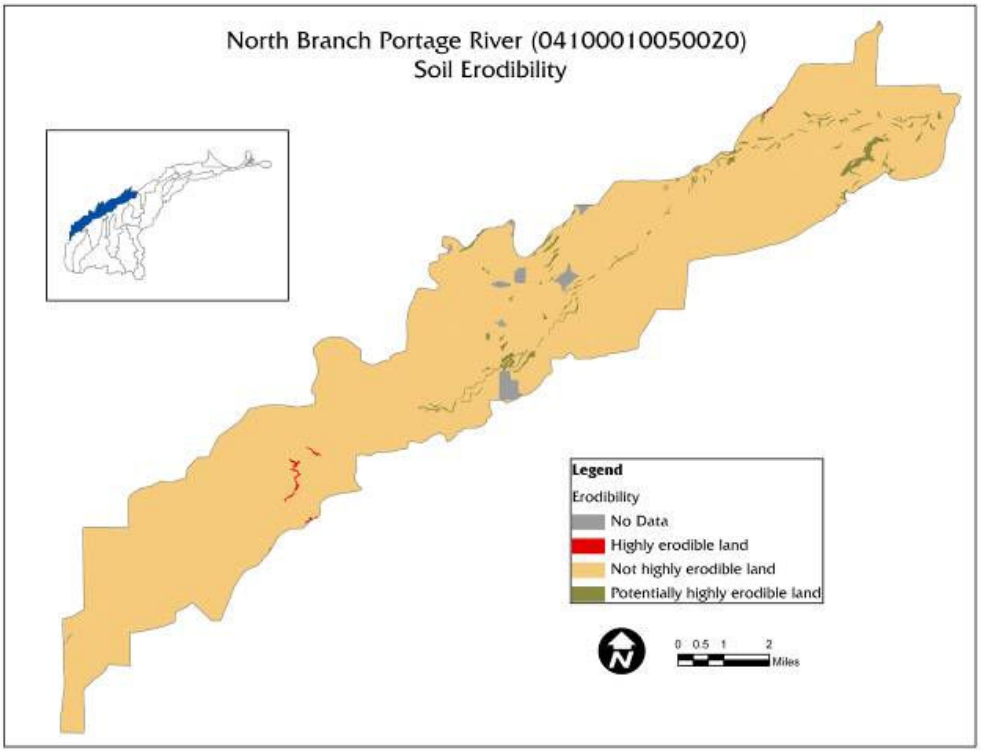
Soils

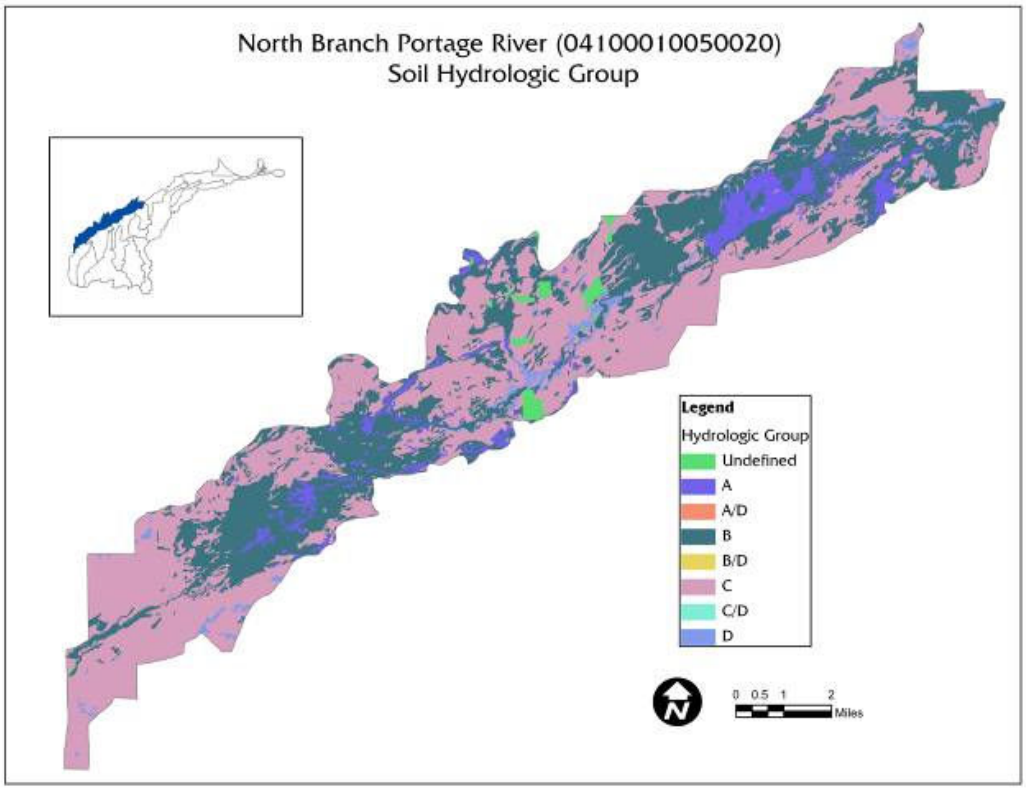
The predominant soil within the North Branch subwatershed HUC14 04100010 050 020 is Hoytville clay loam, 0 to 1 percent slopes (HgA) extending over 6,406 hectares. A second dominant soil is Mermill sandy clay loam, 0 to 1 percent slopes (MeA) representing over 1,399 hectares of the North Branch Portage River.

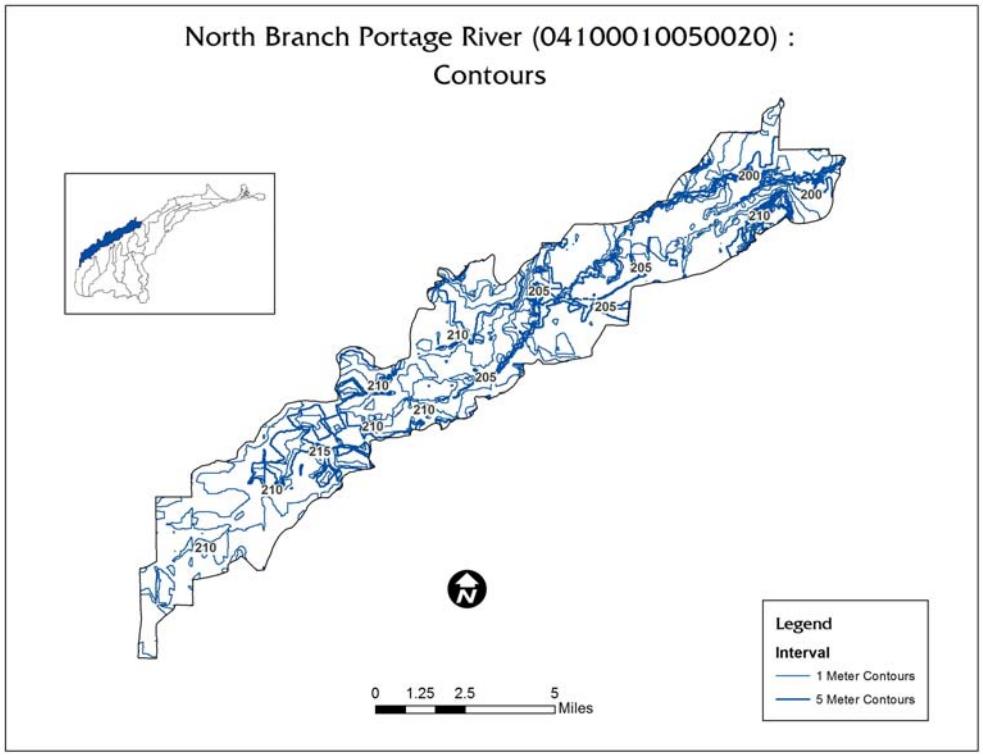
Major Soil Groups		
050-020		
Hoytville	Sum Acres	17,184
	Percentage	45.30%
Mermill	Sum Acres	6,322
	Percentage	16.67%
Wauseon	Sum Acres	2,836
	Percentage	7.48%
Rimer	Sum Acres	1,304
	Percentage	3.44%
Ottokee	Sum Acres	1,138
	Percentage	3.00%
Colwood	Sum Acres	1,113
	Percentage	2.93%
Granby	Sum Acres	1,081
	Percentage	2.85%
Nappanee	Sum Acres	824
	Percentage	2.17%

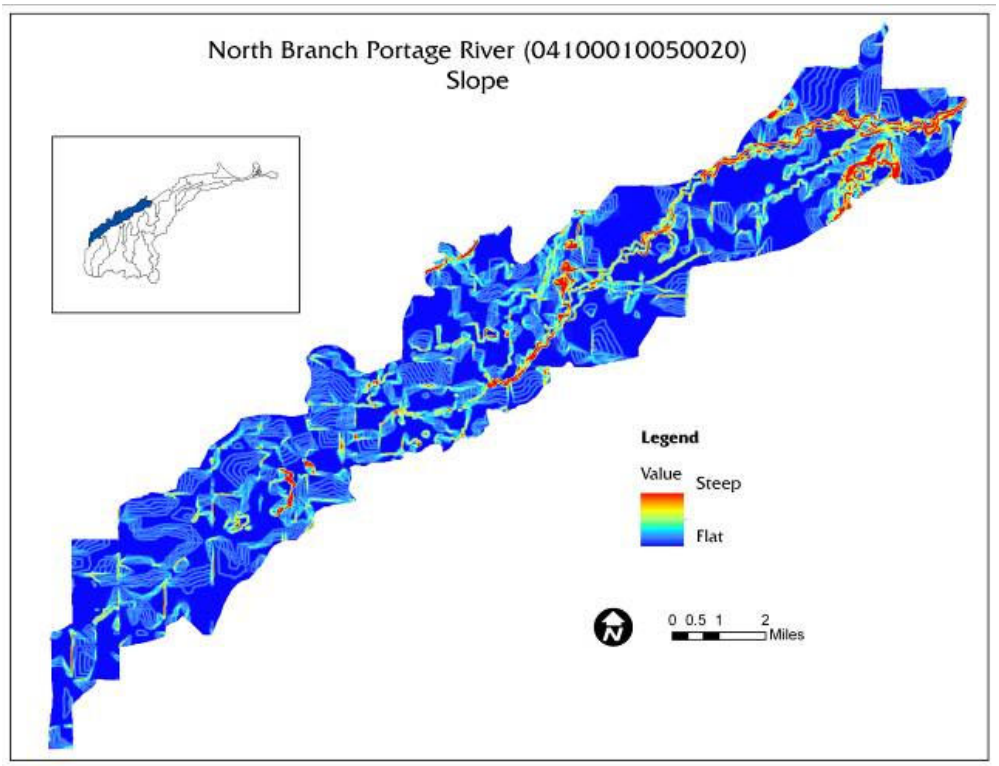

North Branch Portage River (04100010050020)
Soil Type
Legend
Soil Type
Ag
AgA
AkA
AmA
ArA
ArA
BaB
BeB
BfB
BgA
BkB
BnA
Bo
BoA
BoB
Bp
BpA
BrA
BuA
CaA
CbB
CcA
CdA
ChB
Co
CtA
CuA
CvA
CxB
DeA
DfA
DgA
DhA
DkA
DrA
DsA
DsB
DuB
EaA
EmA
EnA
FcA
FoA
FoB
FoC2
FuA
Ge
GmA
Gn
GnA
GnB
Go
GpA
GpB2
GpC2
Gr
GsB
GtB
GwB
Gx
GxB2
HaA
HaB
HdA
HdB
HeA
HeB
HfA
HfB
HgA
HhA
HkA
HkB
HnA
HnB
HpA
HpB
HrB
HsA
Ht
HtA
HuA
HvA
HwA
Hy
HyA
JeA
JeB
JfB
JoA
KbA
KeA
KfA
KfB
LbA
Lc
Le
Ll
LuB
LyE
MbA
McA
MdA
MeA
MfA
MgA
Mh
MhA
MkA
MmA
MnA
MnB
Mo
Mp
MpD3
Ms
MtB
MvB
NmA
NmB
NnA
NnB
NnB2
NpA
NpB
NpB2
NrA
NsA
OaB
OrB
OrC
OsB
OtA
OtB
OzB
Pa
PmA
PnA
Pq
Pr
RaB
RbA
RbB
RcA
RdA
ReA
RfA
RfB
RgA
RgB
RhA
RhB
RkA
RmA
RnA
RoA
RoB
Rs
SbC2
SdA
SdB
SeA
SeB
SgA
Sh
ShA
SkA
SkB
SmA
SnA
SoA
SoB
SpA
SrB
SrC
SrD
SsB
SsC
StB
StB2
StC2
SuB2
SuC2
SuD2
TeA
TeB
TfA
TkA
To
ToB
Tp
UcA
UcD
UcE
Ucl
Un
Ur
VeA
Wa
WeA
WmA
WnA
WyA
Water
0 0.5 1 2
Miles

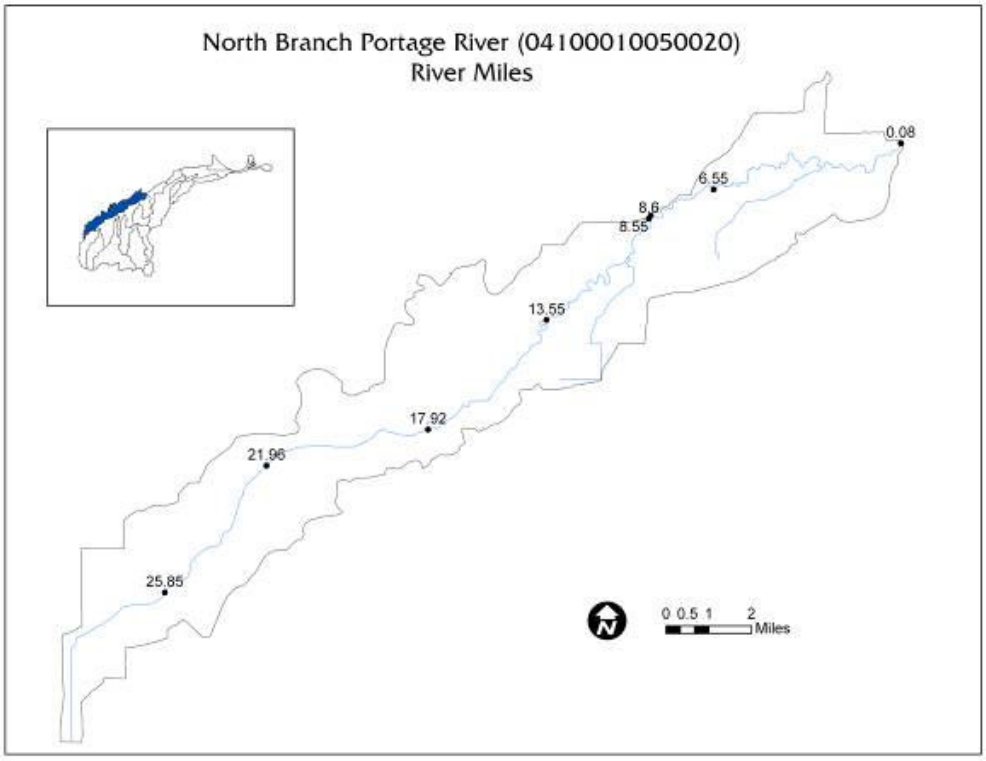

North Branch Portage River (04100010050020)
Flood Frequency Potential
Legend
Flood frequency Potential
No Data
Frequent
None
Occasional
0 0.5 1 2
Miles


North Branch Portage River (04100010050020)
Soil Erodibility
Legend
Erodibility
No Data
Highly erodible land
Not highly erodible land
Potentially highly erodible land
0 0.5 1 2
Miles


North Branch Portage River (04100010050020)
Soil Hydrologic Group
Legend
Hydrologic Group
Undefined
A
A/D
B
B/D
C
C/D
D
0 0.5 1 2
Miles


North Branch Portage River (04100010050020) :
Contours
200
200
210
205
205
205
210
205
210
210
210
215
210
210
Legend
Interval
1 Meter Contours
5 Meter Contours
0 1.25 2.5 5
Miles


North Branch Portage River (04100010050020)
Slope
Legend
Value
Steep
Flat
0 0.5 1 2
Miles



The Soil Hydrologic Group map indicates the *Hydrologic soil groups* based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms (Wood County Soil Survey, March 2005). The following soil group descriptions are directly from the Wood County Soil Survey, page 241.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately course texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential,

soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (**A/D, B/D, or C/D),** the first letter is for drained areas and the second is for undrained areas.

Rare, Threatened, Endangered Species

The North Branch subwatershed HUC14 04100010 050 020 provides habitat for numerous species of plants, animals and mussels. Most of these species are *threatened* or *potentially threatened*.

Rare, Threatened, Endangered Species

Common Name	*Scientific Name*	Last Observed	State Status
Bushy Horseweed	*Conyza ramosissima*	1997-08-08	P
Bushy Horseweed	*Conyza ramosissima*	2008-10-15	P
Bushy Horseweed	*Conyza ramosissima*	2009-07-06	P
Canada Frostweed	*Helianthemum canadense*	1987-05-23	T
Canada Frostweed	*Helianthemum canadense*	1996-06-06	T
Canada Hawkweed	*Hieracium umbellatum*	1970-08	T
Canada Plum	*Prunus nigra*	2007-05-31	E
Common Prickly Pear	*Opuntia humifusa*	1978-10	P
Common Prickly Pear	*Opuntia humifusa*	1992-04	P
Early Buttercup	*Ranunculus fascicularis*	1963-05	T
Flat-stemmed Spike-rush	*Eleocharis compressa*	1981-05	P
Four-toed Salamander	*Hemidactylium scutatum*	1963-04-20	SC
Grove Sandwort	*Moehringia lateriflora*	1996-06-06	P
Grove Sandwort	*Moehringia lateriflora*	1997-08-08	P
Leggett's Pinweed	*Lechea pulchella*	1996-09-09	T
Lyre-leaved Rock Cress	*Arabis lyrata*	1958-05	E
Northern Harrier	*Circus cyaneus*	1985-06	E
Plains Puccoon	*Lithospermum caroliniense*	1996-06-06	T
Porcupine Grass	*Hesperostipa spartea*	1987-06	E

Rare, Threatened, Endangered Species

Common Name	*Scientific Name*	Last Observed	State Status
Prairie Fern-leaved False Foxglove	*Aureolaria pedicularia var. ambigens*	2002-10-03	E
Prairie Ironweed	*Vernonia fasciculata*	1988-08-09	T
Prairie Thimbleweed	*Anemone cylindrica*	1997-08-08	T
Prairie Thimbleweed	*Anemone cylindrica*	1996-09-09	T
Smooth Rose	*Rosa blanda*	2007-05-30	T
Southern Hairy Rock Cress	*Arabis hirsuta var. adpressipilis*	1981-05	P
Sweet-fern	*Comptonia peregrina*	1962-07	E
Virginia Dwarf-dandelion	*Krigia virginica*	1996-06-06	T
Wild Lupine	*Lupinus perennis*	2007-05-31	P
Wood Lily	*Lilium philadelphicum*	1966-07	E

T=Threatened, P=Potentially Threatened, E=Endangered, X=Presumed Extirpated, SC=Species of Concern

Mussel Species in North Branch Portage River

Stream River Miles	Common Mussel Name	*Scientific Name*	Observed	Status
17.92	Fat Mucket White Heelsplitter Fragile Papershell Giant Floater Creeper Pond Horn	*Lampsilis radiate luteola* *Lasmigona complanata* *Leptodea fragilis* *Pyganodon grandis* *Strophitus undulates* *Uniomerus tetralasmus (T)*	2008 2008 2008 2008 2008 2008	T
13.55	Fat Mucket	*Lampsilis radiate luteola*	2008	

HUC 8 – 04100010 (Portage River)									
HUC 10 – 0410001003 (Upper Portage River)									
HUC 12 – 041000100301 (North Branch Portage River)									
HUC 14 – 04100010050020 (North Branch Portage River)									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
1	2008	S01K03	N. BR Portage R. 4 MI. N of Hoytville @ Jerry City Rd.	25.85	8.1	WWH	Non	Direct Habitat Alterations, Oxygen, Dissolved, Phosphorus (Total), Sedimentation/Siltation	Non-irrigated Crop Production, Channelization
2	2008	S01K02	N. BR. Portage R. W of Rudolf @ Mermill Rd.	21.96	14.3	WWH	Partial	Sedimentation/Siltation, Direct Habitat Alterations	Channelization, Non-irrigated Crop Production
3	2008	S01S40	N.BR. Portage R. SW of Portage @	17.92	24.0	WWH	FULL	-	-

HUC 8 – 04100010 (Portage River)									
HUC 10 – 0410001003 (Upper Portage River)									
HUC 12 – 041000100301 (North Branch Portage River)									
HUC 14 – 04100010050020 (North Branch Portage River)									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
			Rudolph Rd.						
4	2008	S01S11	N. BR. Portage R. SE of Bowling Green @ Linwood Rd.	13.55	34.0	WWH	Partial	Sedimentation/Siltation	Non-irrigated Crop Production, Channelization
5	2008	S01K01	N. Branch Portage R. Just upst. Poe Ditch (ADJ SR 105)	8.60	41.0	WWH	Non	Sedimentation/Siltation	Channelization, Non-irrigated Crop Production
6	2008	S01S10	N. Br. Portage R. @ Silverwood Rd.	6.55	48.0	WWH	Partial	Nitrate/Nitrite (Nitrite + Nitrate as N), Phosphorus (Total), Sedimentation/Siltation	Channelization, Non-irrigated Crop Production, Municipal Point Source Discharges
7	2008	500520	N. Br. Portage R. at Pemberville @ River Rd.	0.08	53.01	WWH	FULL	-	-
HUC 12 – 0410001000302 (Town of Pemberville-Portage River)									
8	2008	S01S36	Portage R. @ Pemberville @ Bridge St.	35.28	353.0	WWH	FULL	-	-

Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010.

Water Resources

Surface Water

The headwaters of the North Branch are channelized and maintained under county ditch petitions. The channelizing begins at the Jackson Cutoff Ditch in Jackson Township to the Village of Portage, located just south of the City of Bowling Green. The river channel is a trapezoidal ditch without significant floodplains. There are cutoff oxbows that retain surface water runoff. These are located between the Village of Portage and Interstate 75 where the North Branch Portage River was modified for construction of the north-south interstate highway and traveler rest areas on both sides of the interstate.

Designated Use for aquatic life is warm-water habitat (WWH). **Recreation Use** assessment is Class B at most sampling locations, but is Class A at two. That determines the acceptable E. Coli colony numbers as shown below in a summary table taken from the Ohio 2010 Integrated Report, Section F: Evaluating Beneficial Use: Recreation, p. F-1.

Recreational Use Attainment						
Location	RM	Rec Use PCR Class	Number of Samples	E. coli Geometric **Mean <126 (A), or <161 (B)** and Single Sample Maximum ≤ 298 (A) or ≤ 523 (B)	Attainment Status	Sources of Bacteria
N BR Portage R @ Jerry City Rd.	25.85	B	5	125 & 650	FULL	
N BR Portage R @ Mermill Rd.	21.96	B	5	207 & 700	**NON**	HSTS: Agric.
N BR Portage R @ Rudolph Rd.	17.92	B	5	287 & 610	**NON**	HSTS
N BR Portage R @ Linwood Rd.	13.55	B	5	383 & 520	**NON**	HSTS; Agric.
N BR Portage R @ Bowling Green Rd.	9.74	B	4	796 & 1200	**NON**	HSTS; Package Plants; Hartung Bros.
N BR Portage R Just UST Poe Ditch (Adj SR 105)	8.60	B	1	N/A & 850	**NON**	HSTS
N BR Portage R @ Bowling Green WWTP Mix Zone	8.55	B	5	575 & 2800	**NON**	HSTS; Bowling Green WWTP; Agriculture
N BR Portage R @ Silverwood Rd.	6.55	A	5	746 & 1400	**NON**	HSTS
N BR Portage R @ River Rd	0.08	A	7	295 & 2300	**NON**	HSTS
Poe Ditch DST Bowling Green WWTP Outfall 001	2.42	B	4	374 & 2200	**NON**	Bowling Green WWTP

Aquatic Life Use Assessment				
Location	**RM**	**Drainage Area**	**Aquatic Life Use**	**Attainment Status**
N BR Portage R 4 mi N of Hoytville @ Jerry City Rd.	25.85	8.1	WWH	**NON**
N BR Portage R W of Rudolph @ Mermill Rd.	21.96	14.3	WWH	Partial
N BR Portage R SW of Portage @ Rudolph Rd.	17.92	24.0	WWH	**FULL**
N BR Portage R SE of Bowling Green @ Linwood Rd.	13.55	34.0	WWH	Partial
N BR Portage R. Just UST Poe Ditch (ADJ SR 105)	8.60	41.0	WWH	**NON**
N BR Portage R @ Silverwood Rd.	6.55	48.0	WWH	Partial
N BR Portage R @ Pemberville @ River	0.08	59.1	WWH	**FULL**

Aquatic Life Use Assessment				
Location	**RM**	**Drainage Area**	**Aquatic Life Use**	**Attainment Status**
Rd.				

Macro-invertebrate Communities										
Stream RM	**Dr. Ar. (sq. mi.)**	**Data Codes**	**Qual. Taxa**	**EPT QI./Total**	**Sensitive Taxa QI./Total**	**Density QI./Qt.**	**CW Taxa**	**Predominant Organisms on the Natural Substrates With Tolerance Category(ies)**	**ICI[a]**	**Narrative Evaluation**
25.85	8.1	-	25	1	1	L	0	Beetles (F), water boatmen (F), midges (VT,T)	-	Poor
21.96	14.3	-	39	6	4	L	0	Midges (T,F)	-	Low Fair
17.92	24.0	5,8	51	8/9	7/12	L/200	0	Midges (MI,MT), burrowing mayflies (MI)	30	
13.55	34	8	26	7/10	5/11	L/55	0	Heptageniid mayflies (F)	26	
8.60	41	8	19	2/2	2/7	L/16	0	Crayfish (F), water boatmen (F), scuds (F)	8	
6.55	48	-	46	6/6	4/11	L-M/191	0	Midges (T,MI,F)	26	
0.08	59.01	-	38	11	10	L	0	Hydropsychid caddisflies (F,MI), midges (F)	-	Marg. Good

Source: Ohio EPA, 2008

Public Drinking Water Supply Assessment				
HUC	**Reporting Category**	**Cause of Impairment**	**Nitrate Watch List**	**Pesticide Watch List**
North Branch Portage River 04100010-050-020	NA	None	No	No

Fish Tissue Assessment			
HUC	**Reporting Category**	**Causes of Impairment**	**PCB Concentration**
North Branch Portage River 04100010-050-020	5	PCBs	195 ppb

Water Quality Monitoring Results: Ohio EPA 1994 and 2008						
River Mile	**Date**	**IBI**	**ICI**	**MiWB**	**QHEI**	**STATUS**
1.3/0.7	1994	40	MG	8.4	59.5	n/a
6.6/5.0	1994	32	44	7.0^{ns}	29.0	n/a
- /17.9	1994	-	P*	-	-	n/a
0.08	*2008*	*38*	*MG^{ns}*	*7.0^{ns}*	*64.5*	***FULL***
6.55	*2008*	*35*	*26**	*8.0*	*38.0*	*Partial*
8.60	*2008*	*40*	*8**	*7.2^{ns}*	*31.5*	*Non*
13.55	*2008*	*41*	*-*	*6.9^{ns}*	*43.0*	*n/a*
17.92	*2008*	*31*	*-*	*7.5*	*34.0*	*n/a*
21.96	*2008*	*34*	*LF**	*n/a*	*25.5*	*Partial*
25.85	*2008*	*22.**	*P**	*n/a*	*29.0*	*Non*

a - River Mile (RM) represents the Point of Record (POR) for the station, not the actual sampling RM.
b - MIwb is not applicable to headwater stream with drainage areas ≤20 mi^2.
c - A narrative evaluation of the qualitative sample based on attributes such as EPT taxa richness, number of sensitive taxa, and community composition was used when quantitative data was not available or considered unreliable. VP=Very Poor, P=Poor, LF=Low Fair, F=Fair, MG=Marginally Good, G=Good, VG=Very Good, E=Exceptional
d - Attainment is given for the proposed status when a change is recommended. Aquatic life use in superscript.
ns - Nonsignificant departure from biocriteria (≤4 IBI or ICI units, or ≤0.5 MIwb units).
* - Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.
Italic: 2008 TMDL scores in review.

General narrative ranges assigned to QHEI scores.				
Narrative Rating		QHEI Range		
		Headwaters (≤ sq mi)	Larger Streams	Lacustuary
Excellent		≤ 70	≤ 75	≤ 80
Good		55 to 69	60 to 74	60 to 80
Fair		43 to 54	45 to 59	45 to 59
Poor		30 to 42	30 to 44	30 to 44
Very Poor		<30	<30	<30

Biological Criteria Benchmarks

Biological Criteria					Lacustuary Benchmarks[1]				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
IBI-Headwaters	50	28	20	18	N/A	N/A	N/A	N/A	N/A
IBI-Wading	50	32	22	18	N/A	N/A	N/A	N/A	N/A
IBI-Boat	48	34	20	16	50	42	31	17	<17
MIwb-Wading	9.4	7.3	5.6	4.5	N/A	N/A	N/A	NA	N/A
MIwb-Boat	9.6	8.6	5.7	5.0	10	8.6	5.6	2.8	<2.8
ICI	46	34	22	8	52	42	25	12	<12

[1] **Proposed Lacustuary scoring breakpoints. These have not yet been adopted into rule.**

The results indicate the cause and sources of pollution to surface water with a direct relationship to the attainment status that can be achieved for warm water habitat within the watershed assessment units.

Agriculture is the largest land use practice at 82.9% within the North Branch and a contributor of sediment, nutrients and bacteria into the river system, although it does not have to be this way. Conservation and tillage practices are encouraged through the soil and water districts working with Natural Resource Conservation Service as well as the Farm Service Bureau to provide financial benefits to agriculture operators to install these practices.

Ground Water

Source Water Assessment Plan (SWAP)

The Village of Pemberville has a public water system serving 1,300 people. A Carbonate bedrock **aquifer** provides ground water to eight wells, located in three separate well fields, within Pemberville. The village pumps 129,800 gallons per day to serve its residents' needs.

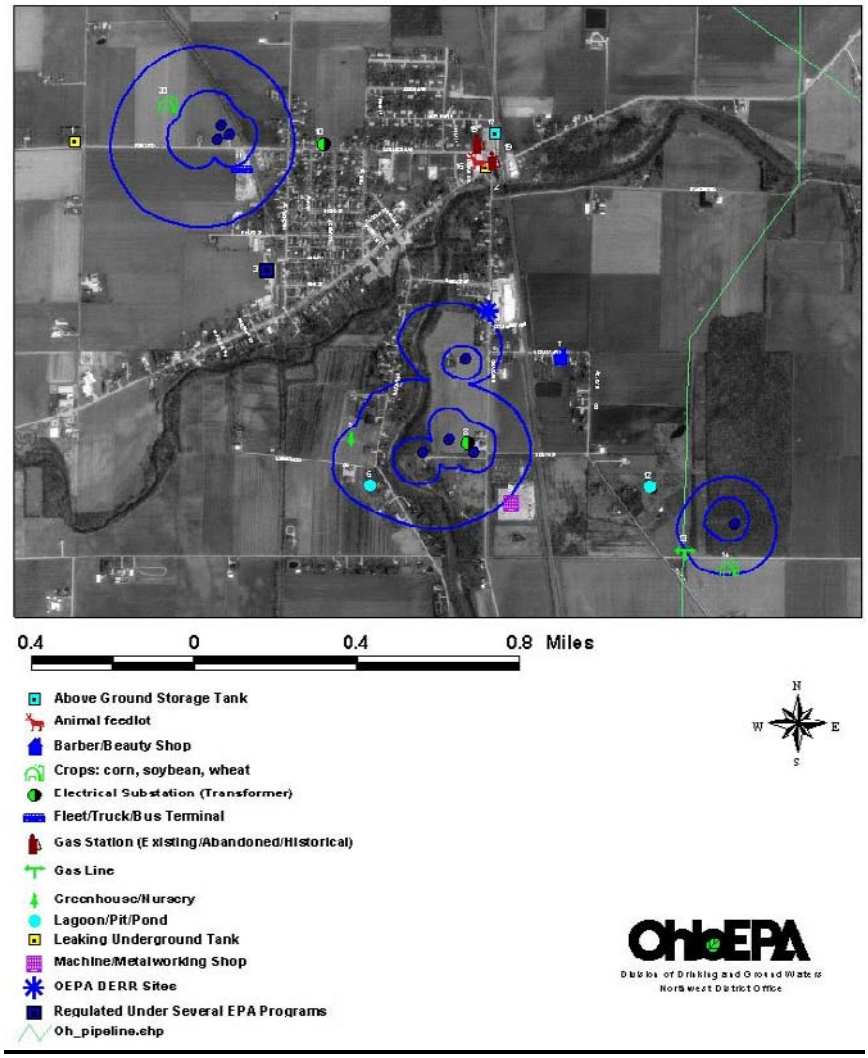
To protect the ground water aquifer source of drinking water, a protection area buffer is delineated for the land area surrounding the wellheads. The protection area is established to help protect the drinking water supply from pollution contaminates seen on this Ohio EPA map.

Within the source water protection area an inventory was conducted by the Ohio EPA and village personnel to identify all *potential* sources of contamination which could reach ground water levels. Pemberville has a high susceptibility to contamination to the drinking water for several reasons. The source water assessment plan (SWAP) identified four indicators of high susceptibility to contamination

- Depth to water in the bedrock aquifer is 25 feet or less below ground surface;
- Wells are located in a sensitive potential karst area;

- Potential contaminant sources exist within the protection area;
- The wells are open between approximately 25 and greater than 100 feet in the fractured carbonate and the depth to water is less than 25 feet below the ground surface.

Pemberville's Drinking Water Source Protection Area is shown in the following figure (Ohio EPA, Drinking Water Source Assessment for the Village of Pemberville, 2002).



DRASTIC MAP

The sensitivity of the groundwater to local sources of contamination is determined and rated by **DRASTIC** maps as described below:

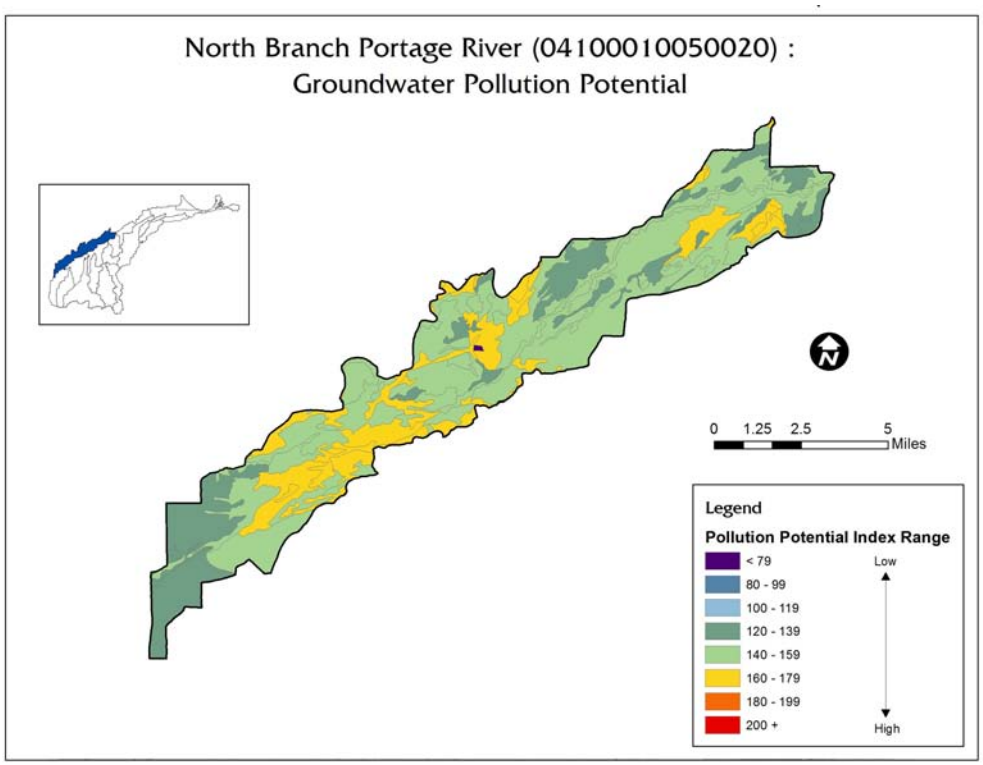
Inherent within each geologic setting are the physical characteristics which effect the groundwater pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:

D – Depth to Water
R – Net Recharge
A – Aquifer Media
S – Soil Media
T – Topography
I – Impact of the Vadose Zone Media
C – Conductivity (Hydraulic) of the Aquifer (ODNR, 1994)

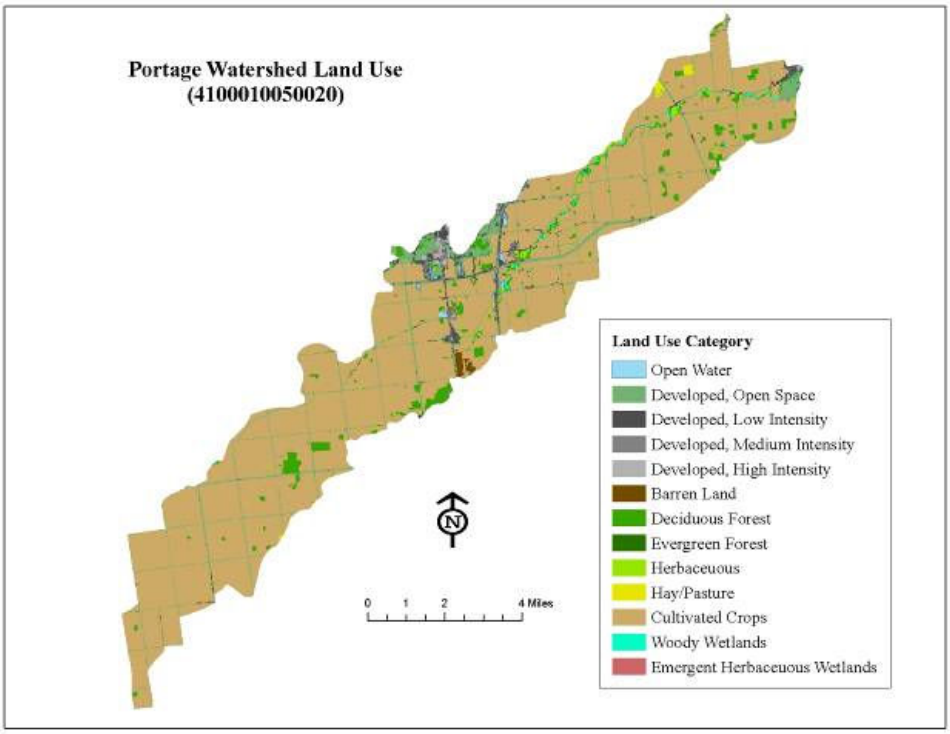
Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index then the greater the vulnerability to contamination (ODNR, 1994).

All of Wood County was identified with nine hydro-geologic settings for potential of ground water pollution indexes ranging from 63 to 198 as it relates to the Ground Water Pollution Potential of Wood County map on page 10. The average ground water pollution index potential for the North Branch watershed is 153 with a range of 125-178.

The Ohio Department of Natural Resources, Division of Water, Water Resources Section is the responsible agency to map groundwater resources throughout the state. Greater detail on DRASTIC maps for the Portage can be found in Chapter 4 of the watershed plan.



Sub-watershed (04100010-03-01)		
050-020		
Land Use	**Percent**	**Acres**
Urban	10.9%	4,128
Forest	5.1%	1,912
Pasture	0.2%	84
Cropland	82.9%	31,360
Other	0.9%	351
Total Acres	100%	37,835



Livestock Inventory							
HUC 4100010050020							
Type of Animal		**Hancock**	**Ottawa**	**Sandusky**	**Seneca**	**Wood**	**Estimates for HUC**
Percent of County in HUC		0.0%	0.0%	0.0%	0.0%	9.6%	
Cattle	Farms	129	89	167	264	144	**14**
	Animals	4,233	1,523	4,612	10,096	6,287	**603**
Hogs	Farms	51	15	37	62	30	**3**
	Animals	32,343	3,639	5,591	42,808	39,469	**3,784**
Horses	Farms	105	63	132	72	128	**12**
	Animals	844	444	772	463	1,004	**96**
Poultry	Farms	49	22	41	62	47	**5**

Livestock Inventory							
HUC 4100010050020							
Type of Animal		**Hancock**	**Ottawa**	**Sandusky**	**Seneca**	**Wood**	**Estimates for HUC**
	Animals	NA	779	1,042	4,283	NA	**NA**
Sheep	Farms	32	12	41	61	21	**2**
	Animals	1,134	335	765	2,770	21	**2**
Total							35
							4,519
Source: 2007 Census of Agriculture http://www.agcensus.usda.gov/							

Point Sources

Municipal

- Bowling Green (2PD00009)

Package Plants

- Country Side MHP (2PY00071)
- Klopfenstein Apartment Complex

Industrial

- Hartung Brothers Tank Farm (2IH00114)
- Precision Aggregates II LLC (2IJ00088)
- Stoneco Inc Portage Plant (2IJ00025)
- Mid-Wood Inc (2IN00187)

Poe Ditch located east of City of Bowling Green designed to receive effluent from **Bowling Green Wastewater Treatment Plant (2PD00009),** which drains into the North Branch (RM 8.6) at Anderson Road and SR 105. The plant has an average design capacity of 10.0 mgd, with a peak capacity of 20 mgd, with some plant facilities designed for 30 mgd.

Precision Aggregate II LC (21J00088) a lime stone quarry has two discharge outlets. One, to a railroad ditch on the North Branch at RM 16.5 and the second to the Middle Branch Portage River. **Stoneco Inc. Portage Plant (2IJ00025)** is an operating quarry located in the Village of Portage with 3 million gallon per day discharge from a pump to a railroad ditch flowing into the North Branch within RM 16.5.

Mid-Wood Inc (2IN00187) an agricultural grain and supply cooperative discharges near RM 13.55. **Hartung Brothers Tank Farm (2IH00114)** is permitted to discharge uncontaminated storm water only to the Gypsy Lane Road drainage ditch draining to the North Branch Portage River at RM 11.85.

Non-Point Sources:

Critical Sewage Areas

- Kramer/Huffman – about 28-33 houses (Wood County), upstream of monitoring point at RM 8.55

Estimates of HSTSs				
Watershed	**Housing Units without sewers**	**Est. Unsewered Population (2000)**	**Unsewered Housing Units per acre**	**Unsewered Population per acre**
04100010050020	2,561	5,810	0.068	0.153

Sources: 2000 Census data and TMACOG "208" Plan. Analysis identifies approximate number of housing units without sewers in each watershed as an estimate of number of HSTSs.

Aquatic Life Use Impairments	
Causes	**Sources**
Direct habitat alterations	Channelization
Nitrate/nitrite (nitrite + nitrate as N)	Municipal point source discharges
Oxygen, dissolved	Nonirrigated crop production
Phosphorus (total)	
Sedimentation/siltation	
Source: Ohio 2010 Integrated Report, Watershed Assessment Unit Summary	

Water Supply:

Public Water System	Population Served	Primary Water Source
Pemberville	1,300	Ground

Water Quality Impairments

The OEPA Integrated Report assesses each watershed's attainment status for 1) Public Drinking Water Supply, 2) Recreation, 3) Human Health, 4) Aquatic Life, and 5) Fish Tissue. The Integrated Report identifies causes and sources of impairments where watersheds are not in attainment with water quality standards.

Background:

The North Branch watershed is 82.9% agricultural land use and 10.9% urban land use located south of Bowling Green and 24 ditch miles of runoff from Interstate 75 and State Route 6 interchange, which drain to the North Branch between RM 18 and RM 7.5.

Significant channel modifications to the headwaters of the North Branch river system have involved the straightening and removal of vegetation under ditch maintenance. The Jackson Cut-off Ditch No. 1947 is nine miles long and constructed between 1878 and 1879. The North Branch Portage River was cut off from "Ditch 12" (Yellow Creek) and Brush Creek which drained 65,000 acres from Henry, Putnam, and Hancock counties; these areas now drain to the Maumee River instead. The Jackson Cut-off Ditch was petitioned by Adam Waltman and others in 1859 and granted by the Commissioners in May 1861.

Today the headwater of the North Branch Portage River is that eastern boundary of the Jackson Cut-off Ditch in Jackson Township. The North Branch Portage River is maintained under ditch petition; it flows northeast to the southern edge of Bowling Green, Ohio, south of State Route 6 at Interstate 75. For construction of the Interstate, the river was again straightened leaving behind old oxbows. Finally, the North Branch flows under SR 6 through natural floodplains that remain. Sinuous river curves flow to reach its confluence with the Middle Branch Portage River in Pemberville to form the Mainstem of the Portage River.

Additional channelizing is found at I-75 in the area of the north and south rest stops located between Kramer and Portage roads. The sinuous river bends were removed from the North Branch Portage River around the location of the Wood County Historical Museum but retain access to its flood plain.

The headwaters from RM 28.5 to the Wood County Historical Museum at State Route 6 at RM 12.5 have been straightened through ditch maintenance petitions. In 2008 the TMDL sampling conducted four test sites between RM 28.5 and RM 13.55 and found to be non-attainment or partial attainment. Impairments range from nutrient enrichment, sedimentation, and loss of habitat/vegetation. There remain very few woodlots in the subwatershed, which are classified as forested wetlands.

In 2009 the North Branch was dipped out under ditch petition from the Village of Portage at RM 16.70 to State Route 281 at RM 23.1, with additional dip-out work planned from State Route 281 (RM 23.1) to the headwater at State Route 18 (RM 28.5+). A State of Ohio threatened mussel species, Pond Horn, (*Unimerus tetralasmus)* was found alive in ditch spoils on the bank side at RM 21.1 and reported to ODNR Wildlife and the County Engineer's office. Other common mussel shells were also found in the dip-out spoils. During the windshield survey, three Great Blue Herons were seen in the river as well as two large turtles, sizeable fish, frogs, and schools of minnows.

The North Branch from Jackson Cutoff ditch to the ODNR Wildlife Conservation area on Weston Road in Jackson Township is 6,400 feet in length. The 70-acre Wildlife Conservation area contributes 3,460 feet of riparian riverbank to upstream of the water sample site at Otsego Road and Jerry City Road.

Two tributaries drain into the North Branch. At RM 2.6 the first tributary is Yankey Creek and Cuckle Creek enters the North Branch at RM 10.2 at Dirlam Road and Cuckle Creek Road.

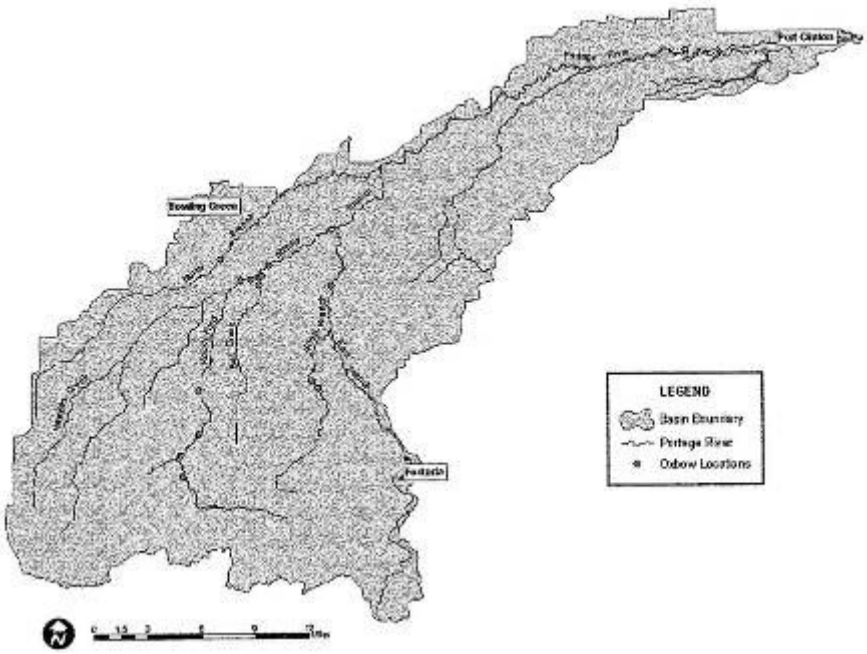
The high E. coli bacteria values are noted by Ohio EPA as causes of impairment from a combination of failed home septic treatment systems (HSTS) and improper field application practices of manure spreading on agricultural fields between RM 25.85 at Jerry City Road to Greensburg Pike and Rudolph Roads at RM 17.92.

Several oxbows between RM 15.5 and 12.5 still retain water and possibly function as wetland. The **Portage River Hydrological Study, 2002** recommends the restoration of the oxbows on the North Branch for retention of high flows and to provide areas for sediments to settle out before reaching the main river channel.

The **Hydrological Study, 2002** includes a recommendation for the North Branch of the Portage adjacent to Wood County Historical Society (Floodplain Acquisition, Wetland Restoration, Natural River Restoration Techniques), page 88. The recommendation for the wooded corridor with access to its floodplain is a proposal to enhance approximately 7,500 linear feet of channel from Interstate 75 to U.S. Route 6. A natural river restoration would be to develop the riffle-pool sequence to enhance fish and macro invertebrate habitat with increased depth diversity, variability in channel velocities and reduced channel embeddedness. A beneficial solution includes the land purchase or conservation easements of permanent 500-foot wooded corridors that retain and store flood waters, create more stable stream channel to reduce erosion and sediments. In 2002, the total project cost was estimated to be $725,000. The following table and map shows potential oxbow restoration sites identified by the Portage River Hydrological Study.

Potential Oxbow Restoration Sites

HUC	Stream	River Mile	Location	Number of Oxbows	Oxbow Length (feet)	Area, acres
4100010050020	North Branch	15.08	North Branch Between Portage Road and I-75	1	3,000	13.8



Source: Portage River Hydrologic Study, 2002

The remaining length of the North Branch Portage River from RM 12.5 to RM 0.0 at Pemberville remains a natural sinuous river with access to its floodplains and heavy riparian banks and lowlands. Still largely agricultural land use with two tributaries draining to the North Branch. Cuckle Creek enters at RM 10.2 and Yankey Creek at RM 2.6.

TMDL sampling in 2008 reported full attainment at RM 0.08 at Pemberville, partial attainment at RM 6.55 and non-attainment at RM 8.60 at Poe Ditch which receives the effluent from the Bowling Green Wastewater Treatment Plant (2PD00009). Failed home sewage treatment systems are known sources of impact on water quality. The Wood County Health Department has completed a county HSTS Plan that identifies an area of concern at Kramer Rd. and Huffman Rd. There are approximately 12 homes with aging aeration systems with off-lot drainage flowing into Cuckle Creek. This tributary connects to roadside ditches and reaches the North Branch between RM 12 and RM 11.

Threats to the lower portion of the river come from landowners who place fill along the banks of the North Branch to reduce bank erosion and reduce floodwaters, but these actions only serve to reduce the channel width and increase flow velocity. The downstream area meanders close to State Route 105 and does breach the roadway at lower elevations during high flows. In addition, the surface runoff from agricultural fields flows from north to south to reach the river and several point runoffs have deep, swift flows that close the roadway to vehicle traffic.

High levels of phosphorus-T and nitrate/nitrite have been measured in the Ohio EPA TMDL water quality testing program in 2008. Agriculture is a major source of fertilizers (nitrogen) along with an increase in concentrated livestock and poultry farming. The leaching of failed home sewage treatment systems into groundwater and excess fertilize runoffs from fields into the waterways as nitrate/nitrite is

very soluble in water and mobile in the environment. Water contaminated with nitrate is very difficult and costly to treat. Nitrates are naturally present in soil water and food and a normal component of the human diet. However, the primary health effect is ingestion of more than the "safe daily dose" for babies and adults before reaction with hemoglobin in the blood creating methemoglobin which decreases the oxygen transported in the blood. When less oxygen is transported from the lungs to the body tissues, a condition known as methemoglobinemia develops in the blood. A normal level of methemoglobin in the blood is (0.5 to 2%). When this level increases to 10%, the skin and lips can take on a bluish tinge (cyanosis), and levels about 25% can cause weakness and a rapid pulse. At levels above 50 to 60%, a person can lose consciousness, go into a coma, and die. Infants are much more sensitive than adults to nitrates/nitrites, and essentially all deaths from nitrate/nitrite poisoning have been in infants. Long-term exposure to lower levels of nitrates and nitrites can cause diuresis (an increase in the amount of urine, and starchy deposits and hemorrhaging of the spleen). (Argonne National Laboratory, EVS, *Human Health Fact Sheet, August 2005).*

Problem Statement #1: (Bacteria)

The water quality of the North Branch subwatershed is impaired by elevated measurements of E. coli bacteria. The Portage TMDL data collected by Ohio EPA in 2008 indicate that 9 of the HUC's 10 sampling sites are in non-attainment for E. coli. The TMDL cites failed HSTS as the causes of impairment due to high E. coli bacteria levels.

In this HUC are an estimated 2,561 HSTS; by density of onsite systems, this is one of the most populated HUCs. This area includes one package plant (permitted), and one Critical Sewage Area (Kramer/Huffman – about 28-33 houses upstream of monitoring point at RM 8.55). The Kramer/Huffman area is under order for sewers. There is one CSO area tributary to this HUC. Bowling Green's CSO discharge is to Poe Ditch, which enters the North Branch at RM 8.55.

Goal 1.1: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 16.4 million gallons of HSTS effluent annually

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 256 systems
- Kramer / Huffman sewers completed and all structures tapped in

Goal 1.2: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 3.5 million gallons of package plant effluent annually

Objectives:

- Upgrade 2 package plant(s). Effluent quality meets P standards.

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Bacteria	1.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$3,840,000	Wood County Health Dept, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 256 systems	16.4 million gallons/year sewage discharge eliminated
	1.1	♦Construct sewers for Kramer / Huffman Critical Sewage Area ♦Project is under orders	$400,000	Northwestern Water and Sewer District, Wood County Health Department	2013	Kramer / Huffman sewers completed and all structures tapped in	Included in HSTS totals
	1.2	♦Test package plant effluent for phosphorus ♦Set effluent standard in existing or new NPDES permit(s) ♦Enforce upgrades for phosphorus removal as needed	$7,200	Ohio EPA	2012-2017	Upgrade 2 package plant(s). Effluent quality meets effluent stds	3.5 million gallons/year effluent improved

Problem Statement #2: (Nutrients: phosphorus and nitrate)

Of the seven aquatic life sampling sites in this HUC under the TMDL, Ohio EPA cites two with nutrient impairments. RM 25.85 (Jerry City Rd) is classified as nonattainment, and RM 6.55 (Silverwood) is classified as partial attainment. With a target phosphorus level of 0.08 mg/l, five sites (RM 25.85, 9.64, 8.55, 6.55, 0.08) have exceedence based on the geometric mean of 4-9 samples. The TMDL sets a nonpoint phosphorus load reduction target for this HUC of 7,534 lb/year — by far the highest target for any Portage River HUC. The data also shows nitrate exceedence at four sampling sites (RM 8.55, 6.55, 0.08, and mainstem 35.28) — three of which also have phosphorus exceedence.

Of particular note and concern is the river stretch from 9.64 (Bowling Green Road) to 8.55 (Linwood). At RM 9.64, the upstream end, the mean of four samples was 0.14 ppm phosphorus, and at RM 8.55 the mean of five samples was 0.47 ppm — a sharp spike. At RM 6.55 the phosphorus level was about the same, declining to 0.29 ppm at RM 0.08. At this time the source(s) of this sudden spike are uncertain, though several theories have been put forth.

In this HUC are an estimated 2,561 HSTS; only one Portage River HUC contains more onsite systems. This area includes two package plants (one permitted, one not), part of Bowling Green's CSO service area, and one Critical Sewage Area (Kramer-Huffman, 28-33 houses).

This HUC should receive high priority for projects and practices to reduce nutrient loadings.

Goal 2.1: Meet TMDL target for phosphorus load reduction by 1,365 and nitrate load by 5,773 lb/year from HSTS.

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 256 systems
-

Goal 2.2: Meet TMDL target for phosphorus load reduction by 203 and nitrate load by 979 lb/year from package plants

Objectives:

- Permit and upgrade 2 package plant(s)

Goal 2.3: Meet TMDL target for phosphorus load reduction by 5,977 and nitrate load by 27,159 lb/year from agricultural practices.

Objectives:

- 3,800 acres of cover crops
- 800 acres of controlled drainage
- 2000 acres of permanent hay
- 725 acres of riparian buffers
- 3000 LF of restored oxbows
- 50 acres of restored wetlands
- 2500 LF of stream restoration
- 1900 LF of overwide / 2-stage ditch reconstruction
- 13267 acres under NRCS 590/1 Nutrient Mgt
- 5686 acres under NRCS 590/3 Nutrient Mgt
- 17000 acres of filter strips
- 500 acres of conservation tillage
- Farmers reduce nutrient application rates because they are applying only what the crops need based on GPS-linked soil tests

Goal 2.4: Identify unknown major sources of phosphorus and nitrate

Objectives:

- Identify and address source(s) of phosphorus spike between RM 9.64 and 8.55

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Nutrients (phosphorus and nitrate)	2.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$3,840,000	Wood County Health Dept, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 256 systems	Reduce phosphorus load by 1,365 and nitrate load by 5,773 lb./year
	2.2	♦Test package plant effluent for phosphorus ♦Set effluent standard in existing or new NPDES permit(s) ♦Enforce upgrades for phosphorus removal as needed	$7,200	Ohio EPA	2012-2017	Upgrade 2 package plant(s). Effluent quality meets effluent stds	Reduce phosphorus load by 203 and nitrate load by 979 lb./year
	2.3	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$228,000	Wood SWCD, NRCS, farmers	2012-2027 in phases	3,800 acres of cover crops	Reduce phosphorus load by 8,694 and nitrate load by 17,404 lb./year
	2.3	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$376,800	Wood SWCD, NRCS, farmers	2012-2027 in phases	800 acres of controlled drainage	Reduce phosphorus load by 728 and nitrate load by 1,872 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$560,000	Wood SWCD, NRCS, farmers	2012-2027 in phases	2,000 acres of permanent hay	Reduce phosphorus load by 1,300 and nitrate load by 2,600 lb./year
	2.3	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$507,500	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	725 acres of riparian buffers	Reduce phosphorus load by 218 and nitrate load by 435 lb./year
	2.3	♦Evaluate oxbow site(s) with Wood Co Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$820,710	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	3,000 LF of restored oxbows	Reduce phosphorus load by 819 and nitrate load by 1,638 lb./year
	2.3	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$255,312	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	50 acres of restored wetlands	Reduce phosphorus load by 23 and nitrate load by 286 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$870,000	Wood SWCD, Wood co Engineer, NRCS, farmers	2012-2027 in phases	2,500 LF of stream restoration	Reduce phosphorus load by 96 and nitrate load by 191 lb./year
	2.3	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$169,100	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	1,900 LF of overwide / 2-stage ditch reconstruction	Reduce phosphorus load by 519 and nitrate load by 1037 lb./year
	2.3	♦Seek cooperators for Nutrient Management NRCS 590 Level 1 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management NRCS 590 Level 1 BMPs with farmers	$265,342	Wood SWCD, NRCS, farmers	2012-2022	13,267 acres under NRCS 590/1 Nutrient Mgt	NA

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Seek cooperators for Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with farmers	$227,436	Wood SWCD, NRCS, farmers	2012-2022	5,686 acres under NRCS 590/3 Nutrient Mgt	NA
	2.3	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$2,342	Wood SWCD, NRCS, farmers	2012-2027 in phases	17,000 acres of filter strips	Reduce phosphorus load by 340 and nitrate load by 680 lb./year
	2.3	♦Identify & prioritize fields suited for Conservation Tillage BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Conservation Tillage BMP with farmer	$7,500	Wood SWCD, NRCS, farmers	2012-2027 in phases	500 acres of conservation tillage	Reduce phosphorus load by 74 and nitrate load by 1,015 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Select suitable GPS-Variable Rate Application Technology (VRT) unit with tractor auto-steer with each SWCD ♦Seek funding for equipment ♦SWCDs purchase equipment with competitive bids ♦Set rules & rental rates of equipment for farmers ♦Promote rental of equipment and benefits of VRT through workshops, field days ♦Rent equipment to farmers to promote use of GPS-VRT ♦This project applies to all HUCs	$1,000,000	SWCDs, NRCS, farmers	2012-2017	Farmers rent units from SWCDs for fertilizer application based on actual need from soil tests with GPS	NA
	2.4	♦Field survey of all outfalls between RM 9.64 and 8.55 ♦Test outfalls, tributaries, and river at multiple locations ♦Evaluate test results to determine source(s) of phosphorus spike	$300,000	OEPA, Wood County agencies, City of Bowling Green. TMACOG	2012 - 2015	Identify and address source(s) of phosphorus spike between RM 9.64 and 8.55	NA

Problem Statement #3: (Siltation/Sedimentation)

The TMDL cites five sampling sites with sedimentation / siltation impairments. Many channel modifications to the river are contributing siltation due to row-crop production, stream bank erosion and channelization. The river channel is embedded with excess silts and sediments in the upstream and lower reaches of the North Branch. Substantial modification and relocation of the channel occurred when the interstate highway was built. The North Branch area most affected by channel relocation is along the interstate corridor and rest areas and continues adjacent to the Wood County Historical Center & Museum on County Home Road.

In the headwater area between RM 25.85 (Jerry City Rd) and RM 17.92 (Rudolph Rd) is channelized; stream banks, without riparian vegetation, are subject to erosion. The headwater area is predominantly in

row-crop production of corn and soybeans with some established filter strip practices in place. Silty loam soils along the lower reaches of the North Branch River banks have eroded, becoming unstable and contribute sediments to the river.

Goal 3.1:

Reduce sedimentation impairments by decreasing sediment load by 6,881 lb/year from agricultural practices.

Objectives:

- 3,800 acres of cover crops
- 800 acres of controlled drainage
- 2000 acres of permanent hay
- 725 acres of riparian buffers
- 3000 LF of restored oxbows
- 50 acres of restored wetlands
- 2500 LF of stream restoration
- 1900 LF of overwide / 2-stage ditch reconstruction
- 17000 acres of filter strips
- 500 acres of conservation tillage.

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Sedimentation	3.1	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$228,000	Wood SWCD, NRCS, farmers	2012-2027 in phases	3,800 acres of cover crops	Reduce sediment load by 4,332 lb./year
	3.1	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$376,800	Wood SWCD, NRCS, farmers	2012-2027 in phases	800 acres of controlled drainage	Reduce sediment load by 832 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$560,000	Wood SWCD, NRCS, farmers	2012-2027 in phases	2,000 acres of permanent hay	Reduce sediment load by 660 lb./year
	3.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$507,500	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	725 acres of riparian buffers	Reduce sediment load by 109 lb./year
	3.1	♦Evaluate oxbow site(s) with Wood Co Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$820,710	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	3,000 LF of restored oxbows	Reduce sediment load by 411 lb./year
	3.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$255,312	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	50 acres of restored wetlands	Reduce sediment load by 9 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$870,000	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	2500 LF of stream restoration	Reduce sediment load by 96 lb./year
	3.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$169,100	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	1900 LF of overwide / 2-stage ditch reconstruction	Reduce sediment load by 260 lb./year
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$2,342	Wood SWCD, NRCS, farmers	2012-2027 in phases	17,000 acres of filter strips	Reduce sediment load by 170 lb./year
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$7,500	Wood SWCD, NRCS, farmers	2012-2027 in phases	500 acres of conservation tillage	Reduce sediment load by 2 lb./year

Problem Statement #4: (Habitat Alteration)

The OEPA TMDL cites two of the sampling sites in this HUC with direct habitat alteration impairments. RM 25.85 (Jerry City Rd) is in non-attainment for aquatic life criteria, and RM 6.55 (Silverwood) is in partial attainment.

Priorities for stream restoration and habitat practices should be focused in stretches of the river that can improve QHEI and aquatic life scores at these sites. These areas are upstream of Silverwood, including Cuckle Creek and the small tributaries and ditches that flow into the North Branch. Oxbows between RM 15.5 and 12.5 were cut off from the main river channel during construction of highways which still retain water and may function as wetlands. The *Portage River Hydrological Study*, 2002 recommends the restoration of oxbows to function as retention area during high flows and to slow stream velocity to reduce erosion contributions to the river channel. The North Branch near the Wood County Historical Museum may have potential for stream channel restoration using conservation easements. The area may also have the potential for establishment of forested wetlands

The other TMDL site with habitat alteration impairments is the furthest upstream site at Jerry City Road. Ditches and headwater tributaries above RM 25.85 should be given priority for habitat restoration practices.

Goal 4.1:

775 acres of habitat restoration 7400 linear feet of stream corridor restoration practices

Objectives:

- 725 acres of riparian buffers
- 3000 LF of restored oxbows
- 50 acres of restored wetlands
- 2500 LF of stream restoration
- 1900 LF of overwide / 2-stage ditch reconstruction

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Habitat Impairment	4.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$507,500	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	725 acres of riparian buffers	Load reductions provided in nutrient and sediment tables

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	4.1	♦Evaluate oxbow site(s) with Wood Co Engineer for restoration feasibility ♦Discuss potential restoration with landowner ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Oxbow Restoration with landowner	$820,710	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	3,000 LF of restored oxbows	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$255,312	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	50 acres of restored wetlands	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$870,000	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	2,500 LF of stream restoration	Load reductions provided in nutrient and sediment tables

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	4.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$169,100	Wood SWCD, Wood Co Engineer, NRCS, farmers	2012-2027 in phases	1,900 LF of overwide / 2-stage ditch reconstruction	Load reductions provided in nutrient and sediment tables

Problem Statement #5: (Education, Information, and Management)

Successful implementation of nutrient load reduction or habitat restoration projects depend on informed stakeholders who understand and support restoration goals. In many areas that understanding and support is lacking. The over-reaching goal of this section is to lay the groundwork for future implementation by building understanding in the affected community. Several specific problems are recommended for action:

- Working with local agencies to prepare this watershed plan, inaccuracies in the GIS maps used by state and federal agencies of streams and even watershed boundaries were discovered. Considering the large number of ditches in the Portage River Watershed, the omission of many and mis-routing of others isn't surprising. Using incorrect drainage maps can lead to incorrect conclusions about pollutant sources. Correcting the stream maps for actual drainage will result in changes to the HUC boundaries as well. This is true of agricultural areas, but it is especially true of where storm sewer routing can determine de facto HUC boundaries. The local agencies and their personnel work closely with drainage systems, and can provide valuable information, and should be incorporated into GIS maps. Digitizing storm sewer maps under MS4 requirements may create opportunities for correcting actual drainage areas within cities. Bowling Green and Fostoria are the only MS4 communities in the Portage watershed, but both are on watershed boundaries.

- The Portage River Education Project is a "Project Green" (Mitchell & Stapp, *Field Manual for Water Quality Monitoring: an Environmental Education Program for Schools* 1993) stream testing program for high schools. It includes chemical and biological testing at sites near the schools. After participating schools conducted sampling, they met together for a Student Congress to compare results and participate in educational programming. In recent years the project has flagged, especially the Student Congress, as resources for testing and field trips diminished. The need to for environmental education remains, but it may be necessary to reinvent the program with new approaches and partnerships, and identify ongoing financial support.

- With 90% of the Portage River's TMDL sampling sites failing bacterial standards, it is evident that sewage is a major contributor to impairment in the watershed. The general public does not have a clear understanding of how municipal wastewater plants protect clean water, why sewer rates are going up sharply to pay for CSOs, and why properly operating septic systems are needed.

- The TMDL nonpoint phosphorus load reduction target for the entire river basin is over 36,000 lb/year, much of which will need to be accomplished through improved agricultural practices. Controlled drainage systems are an innovative BMP that may bring substantial water quality improvements by retaining nutrient-rich field drainage water for use by crops during dry periods. Remotely operated drainage controls may be very practical and encourage effective use. New ideas need local demonstration so that land owners can see how they work before implementing them.

- Management of HSTSs could be improved by taking advantage of interagency, integrated GIS/database technology. All four counties maintain some or all HSTS records electronically, in HDIS (a FoxPro application), Access, or Excel. Some older records exist only on paper. HSTSs that predate permitting requirements may not have any records. Relating the Health Departments' HSTS electronic records with GIS files from other county agencies — sewer lines from the County Sanitary Engineer and parcels from the Auditor — could provide the Health Departments and Sanitary Engineers with effective tools for managing HSTSs. Examples of potential uses include:
-
    - Parcels with houses where sewers are available but have not tapped
    - Parcels with houses with no record of a HSTS (system probably more than forty years old)
    - Identify systems over a given age or of a certain design (aerators, subsurface sand filters) and areas where systems should be inspected
    - Maintain email list with scheduled reminders to have septic tanks pumped out, or other maintenance performed

- Each county Health Department has an HSTS Plan that identifies onsite sewage needs and priorities. These plans should be updated regularly to reflect current data and changing site conditions and state regulations. The Hancock, Ottawa, Sandusky, and Wood County HSTS Plans were all last updated in 2004.

- There are several large dairy CAFO facilities (some not presently in operation) in the watershed. Manure from operating CAFOs is applied to agricultural fields. TMDL data show that 90% of sampling sites fail E. coli standards. Potential impacts of manure applications on stream bacteria levels are unknown, in part, because there is no public record of applications. Better information is needed to determine any impact on surface water quality of application of manure to cropland from CAFOs in the watershed. The Ohio Lake Erie Phosphorus Task Force (http://www.epa.ohio.gov/dsw/lakeerie/ptaskforce/index.aspx) calls for information for better

decision making regarding strategies for reducing nutrient delivery to the western Lake Erie basin. CAFOs are a potential source that is not well understood.

- The current Portage River Watershed Plan covers 9 of the basins 18 14-digit HUCs. Completing the Plan will require developing detailed inventories, maps, problem statements, goals, and objectives for the remaining 9 HUCs.

Goal 5.01: Correct stream and HUC GIS maps using local detailed knowledge.

Objective: Revision and formal agency acceptance of maps with corrected ditch channels and actual watershed boundaries

Goal 5.02: Teach high school students the ecology of the Portage River

Objective: Annual stream testing program conducted by every watershed high school

Goal 5.03: Inform the public about the impact of sewage on the Portage

Objective: Provide public with information on sewage sources — municipal and HSTS, and why it's an important issue for the Portage. Coverage by print, broadcast, and social media.

Goal 5.04: Show farmers the viability of controlled drainage systems

Objective: Demonstration of advanced controlled drainage system leads to adoption by farmers

Goal 5.05: Show farmers the benefits and use of GPS-VRT nutrient management

Objective: Farmers use GPS-VRT to apply only nutrients required for crops, based on GPS soil tests

Goal 5.06: Computerize all HSTS records and use GIS as a management tool

Objective: Health Departments manage HSTS records electronically. Use GIS to identify systems that may have failed or should be inspected due to age, design, or discharge

Goal 5.06: Conduct study on feasibility of HSTS Management District

Objective: Determine whether an HSTS Management District could be an effective mechanism for operating and maintaining onsite sewage treatment systems.

Goal 5.06: Update information on HSTSs, policies, and priorities

Objective: Health Department uses the HSTS plan to identify needs and priorities for HSTS inspection and maintenance, and sanitary surveys of potential problem areas.

Goal 5.09: Assess of edge of field runoff and subsurface drainage for agricultural fields fertilized with dairy CAFO manure, and the impact of no-till conservation practices on contamination of surface waters by dissolved reactive phosphorus.

Objective: Definitive conclusions regarding conditions and factors that determine the amount and sources of nutrient delivery related to dairy CAFOs.

Goal 5.10: Complete Watershed Action Plan for entire Portage River basin.

Objective: Add goals, objectives, problem statements for the remaining HUCs: 04100010-030-010, 04100010-030-020, 04100010-030-030, 04100010-030-040, 04100010-070-010, 04100010-070-020, 04100010-070-030, 04100010-070-040, 04100010-070-050.

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Information	5.01	♦Secure funding to update maps ♦Form Project Management Team with County Engineers to update maps ♦Select consultant to update stream and watershed shape files (competitive process) ♦Provide consultant with current shape files, LIDAR data, and best county drainage maps ♦County Engineers check & verify updated maps ♦Submit updated files to ODNR, USDA, USGS		County Engineers and SWCDs of all 5 counties, cities (storm sewer maps), ODNR, USDA, USGS, TMACOG, GIS consultant	2012-2020	Revision and formal agency acceptance of maps with corrected ditch channels and actual watershed boundaries	NA

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Education	5.02	♦Convene Education Committee of schools, SWCDs, BGSU ♦Set watershed-wide educational goals ♦Develop new program ♦Identify activities and actors ♦Seek participation from watershed schools ♦Seek start-up funding for equipment ♦Seek ongoing sponsorships to sustain program	$100,000 start up and $75,000 annually	School districts and teachers, SWCD education staff of all 5 counties, BGSU, TMACOG	2012-2015	Annual stream testing program conducted by every watershed high school	NA
Education	5.03	♦Develop program and agenda on watershed sewage (bacteria) issues with PRBC ♦Confirm speakers and presentations ♦Secure venue ♦Arrange tour (travel) logistics ♦Develop press kit and media materials ♦Outreach through media for event invitations and coverage of issues	$2,500	City of Bowling Green, Wood County Health Department, Portage River Basin Council	2012 - 2015	Provide public with information on sewage sources — municipal and HSTS, and why it's an important issue for the Portage. Coverage by print, broadcast, and social media.	NA

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Education	5.04	♦Seek funding for solar powered, remotely programmed controlled drainage system ♦Install system at OARDC near Hoytville ♦Organize educational field day events to demonstrate the system ♦Publicize field days through media, and using newsletters of SWCDs, agricultural organizations ♦OARDC is in the Needles Creek HUC: education programs apply to all HUCs	$800,000	OARDC, OSU Extension, all 5 SWCDs, NRCS	2012-2016	Demonstration of advanced controlled drainage system leads to adoption by farmers	NA
Education	5.05	♦Seek funding for GPS-based variable rate technology (VRT) fertilizer mgt program ♦Each SWCD forms partnership with fertilizer providers active in county ♦Develop educational programs for farmers on benefits and use of VRT ♦Plan and publicize field days and winter mtgs ♦Hold the field days / mtgs ♦SWCDs continue working with farmers to promote use of GPS-VRT	$2,500 per SWCD per year, 3 years	Grain Elevators, Co-ops (fertilizer providers), Hancock, Ottawa, Sandusky, Wood SWCDs, NRCS, farmers, TMACOG	2013-2016	Farmers use GPS-VRT to apply only nutrients required for crops, based on GPS soil tests	NA

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Information & Management	5.06	♦Seek funding to computerize HSTS records ♦Select consultant (competitive process) scan paper records, expand / convert existing databases, like HD data with Auditor and Sanitary Engr GIS files as needed ♦Integrate HD data with county GIS management system ♦Provide HDs with necessary software and hardware to use HSTS GIS system ♦Train HD personnel ♦HDs conduct critical area analysis / prioritization with system ♦This project applies to all HUCs - implement for full counties	$500,000 per county	Health Departments, Sanitary Engineers, and Auditors of Hancock, Ottawa, Sandusky, and Wood Counties; TMACOG	2012-2017	Health Departments manage HSTS records electronically. Use GIS to identify systems that may have failed or should be inspected due to age, design, or discharge	NA
Management	5.07	♦ Seek funding for Management District feasibility study ♦ Form Project Management Team of stakeholders ♦ Select potential Management District area(s) ♦ Develop operational plan (with legal review) ♦ Develop financial plan, rates, services ♦ Hold public meetings with district residents and affected agencies ♦ Present recommendations to Board that would oversee District	$500,000	County Sanitary Engineers, Health Departments, Ohio EPA, TMACOG	2012-2022	Conduct HSTS Management District feasibility study	NA

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Information & Management	5.08	♦Seek funding to update Wood County HSTS Plan ♦HD, Northwestern Water and Sewer District, OEPA, TMACOG update WQ data and critical areas ♦HD update HSTS plan ♦Submit Plan to HD Board for formal approval	$50,000 per county	Wood County Health Department, Northwestern Water and Sewer District, TMACOG	2012-2017	Health Department uses the HSTS plan to identify needs and priorities for HSTS inspection and maintenance, and sanitary surveys of potential problem areas.	NA
Information & Education	5.09	♦Develop sampling plan; site identification ♦Test water samples relative to agricultural fields with CAFO manure application for soluble reactive phosphorus, nitrate + nitrite, ammonia, E. coli ♦Compare with fields that have different levels of application of dairy cow manure, and other types of nutrient fertilizer, with specific agricultural practices such as conservation till / no-till and conventional tillage.	$50,000 annually	BGSU, Wood County Health Department, Wood SWCD, TMACOG, Ohio EPA, farmers, Ohio Department of Agriculture, the Northwest OARDC, Northwest Ohio Water Quality Workgroup	2006-2016	Definitive conclusions regarding conditions and factors that determine the amount and sources of nutrient delivery related to dairy CAFOs	NA

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Information & Management	5.10	♦ Seek funding / Portage River Basin Council support for completing of 9 remaining HUCs ♦ Prepare inventories and maps based on established format ♦ Develop load reduction parameters and for the additional HUCs ♦ Calculate quantities of BMPs, costs, and resulting load reductions ♦ Incorporate 9 remaining HUCs into WAP document ♦ Seek ODNR / OEPA endorsement ♦ See stakeholder endorsement ♦ Seek formal TMACOG adoption	$50,000	TMACOG, all Portage River Basin Council members	2012-2014	Definitive conclusions regarding conditions and factors that determine the amount and sources of nutrient delivery related to dairy CAFOs	NA

PORTAGE RIVER BELOW NORTH BRANCH TO ABOVE SUGAR CREEK

(includes Lacarpe Creek outlet #4)
04100010 060 010 (14 – digit HUC)
04100010 04 02 New 12-digit HUC & Name: Lacarpe Creek Outlet #4-Portage River

Length: 17.7 River Miles

Elevation Downstream: 577 feet

Elevation Upstream: 634 feet

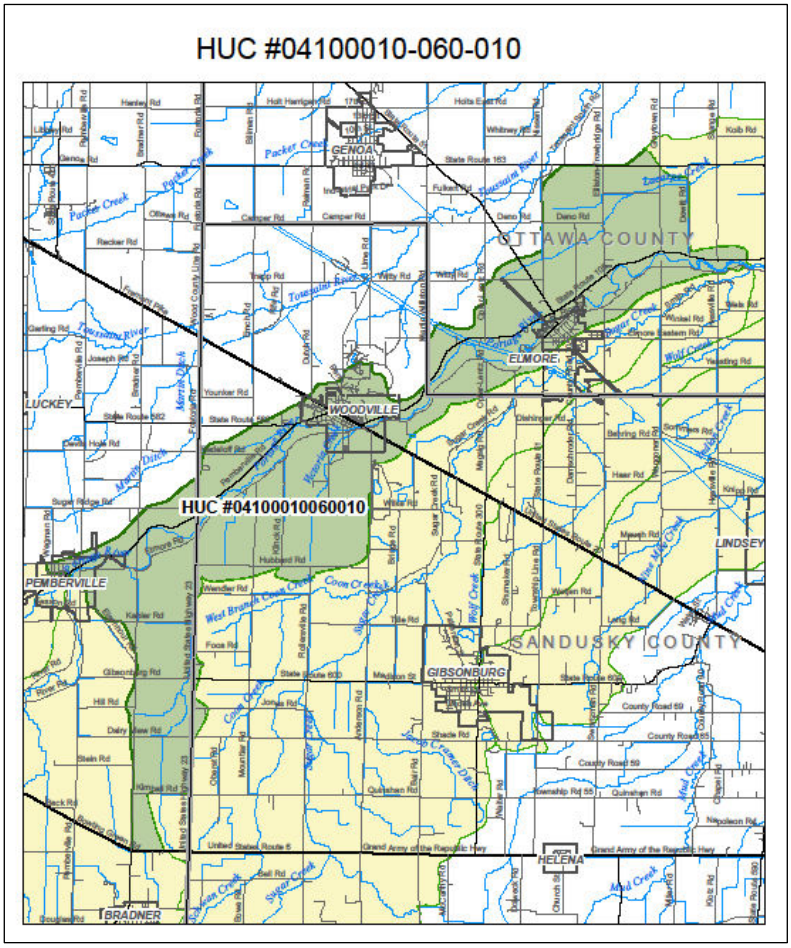
Fall: 3.35 feet

Drainage area: 27.9 square miles

Ohio Topographic Quadrangle 7.5-minute (1:24,000)

- Pemberville
- Bradner
- Elmore
- Genoa
- Oak Harbor
- Lindsey

Urban areas:
Village of Pemberville
Village of Woodville
Village of Elmore



Geology

Bedrock formations underlying Sandusky County are comprised of Devonian and Silurian aged limestones and dolomites. These carbonate units, which reach thicknesses of several hundred feet in the western Sandusky County area of the Portage River, represent the regional aquifer. Sandusky County has a karst terrain with distinctive characteristics of relief and drainage resulting from the dissolution of limestone or dolomite by the action of surface and ground water. Karst terrain typically has a well-developed underground drainage network ranging from fractures and minor solution channels to caverns with subterranean streams.

The most recent glacial stage, the Wisconsinan, left evidence of deposits of till, sand and gravel. Till is an unconsolidated, poorly-sorted, non-stratified (layered) mixture of clay, silt, sand and gravel directly deposited by ice. Till thickness averages under 20 feet in western Sandusky County (Larsen, 1984a,b.). Much of the original thickness of the till deposited in Sandusky

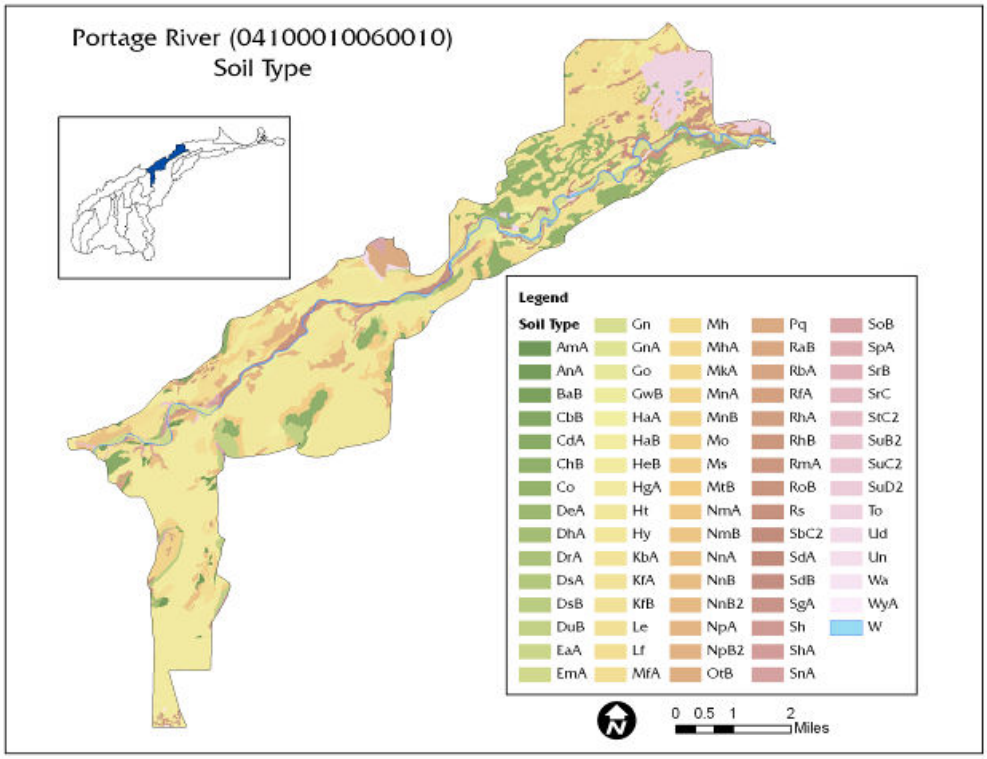
County was removed by subsequent glaciations and by wave activity associated with post glacial lakes.

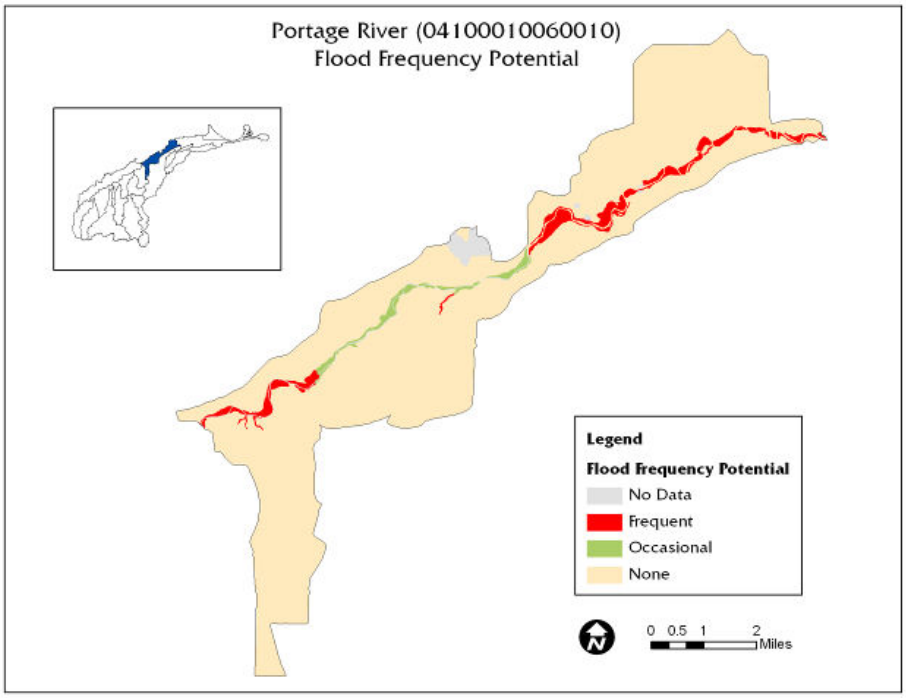
The original land surface created by till deposition in Sandusky County is largely obscured by lake deposits or was eroded by wave action. Classical till features such as ground moraine or end moraines are not detectable in Sandusky County. The will surface may be referred to as wave-planed till or water-modified till (Forsyth, 1965). Wave erosion (Angle, 1988a) is probably largely responsible for the abundance of shallow and exposed bedrock in Sandusky County (Ground Water Pollution Potential Report No. 19, ODNR, 1990).

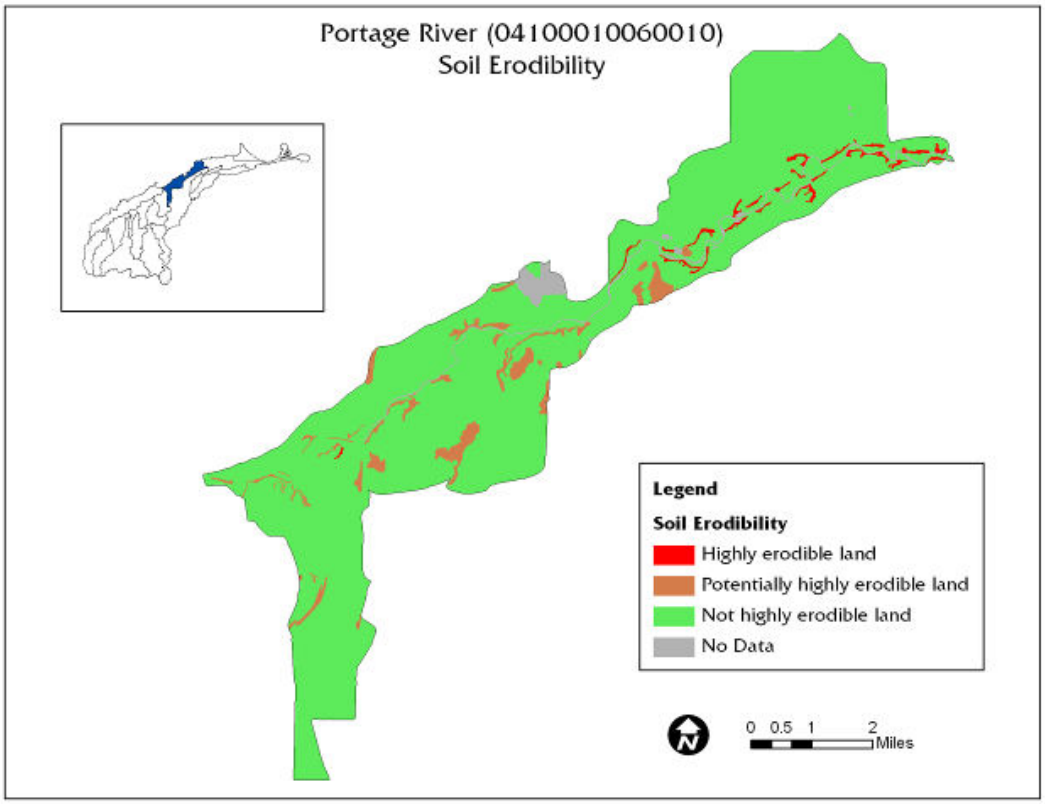
Soils

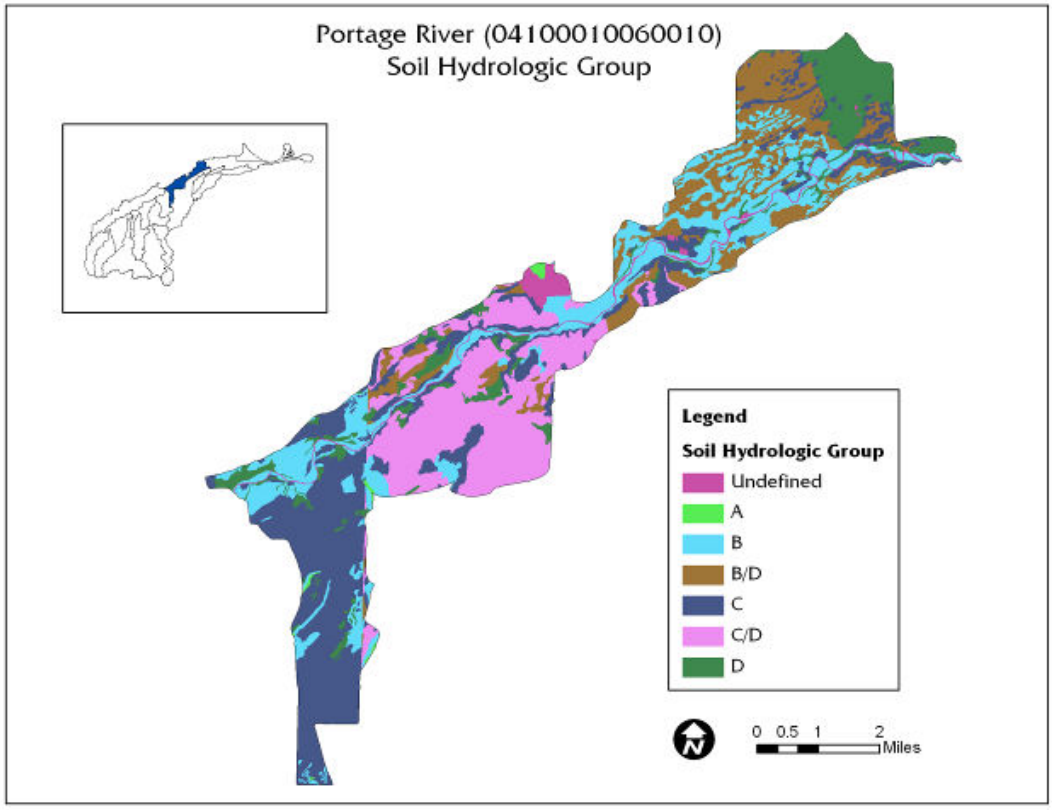
The two dominant soils of HUC14 04100010 060 010 are Hoytville silty clay loam (Ht) with coverage over 1,332 hectares and the Hoytville clay loam, 0 to 1 percent slopes (HgA) measuring 1,135 hectares of coverage.

Major Soil Groups		
060-010		
Hoytville	Sum Acres	6,293
	Percentage	34.88%
Kibbie	Sum Acres	1,873
	Percentage	10.38%
Lenawee	Sum Acres	1,679
	Percentage	9.31%
Colwood	Sum Acres	985
	Percentage	5.46%
Nappanee	Sum Acres	811
	Percentage	4.49%
Toledo	Sum Acres	752
	Percentage	4.17%
Mermill	Sum Acres	661
	Percentage	3.66%
Haskins	Sum Acres	623
	Percentage	3.45%


Portage River (04100010060010)
Soil Type
Legend
Soil Type
AmA
AnA
BaB
CbB
CdA
ChB
Co
DeA
DhA
DrA
DsA
DsB
DuB
EaA
EmA
Gn
GnA
Go
GwB
HaA
HaB
HeB
HgA
Ht
Hy
KbA
KfA
KfB
Le
Lf
MfA
Mh
MhA
MkA
MnA
MnB
Mo
Ms
MtB
NmA
NmB
NnA
NnB
NnB2
NpA
NpB2
OtB
Pq
RaB
RbA
RfA
RhA
RhB
RmA
RoB
Rs
SbC2
SdA
SdB
SgA
Sh
ShA
SnA
SoB
SpA
SrB
SrC
StC2
SuB2
SuC2
SuD2
To
Ud
Un
Wa
WyA
W
0 0.5 1 2
Miles


Portage River (04100010060010)
Flood Frequency Potential
Legend
Flood Frequency Potential
No Data
Frequent
Occasional
None
0 0.5 1 2
Miles


Portage River (04100010060010)
Soil Erodibility
Legend
Soil Erodibility
Highly erodible land
Potentially highly erodible land
Not highly erodible land
No Data
0 0.5 1 2
Miles


Portage River (04100010060010)
Soil Hydrologic Group
Legend
Soil Hydrologic Group
Undefined
A
B
B/D
C
C/D
D
0 0.5 1 2
Miles

The Soil Hydrologic Group map indicates the *Hydrologic soil groups* based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms (Wood County Soil Survey, March 2005). The following soil group descriptions are directly from the Wood County Soil Survey, page 241.

The four hydrologic soil groups are:

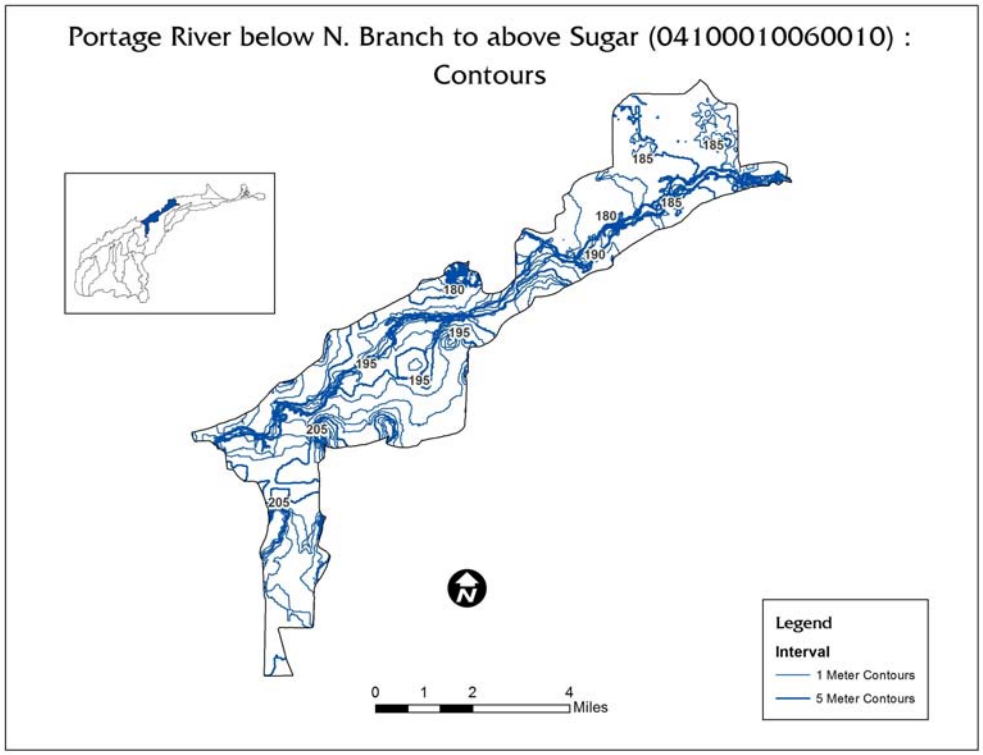
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

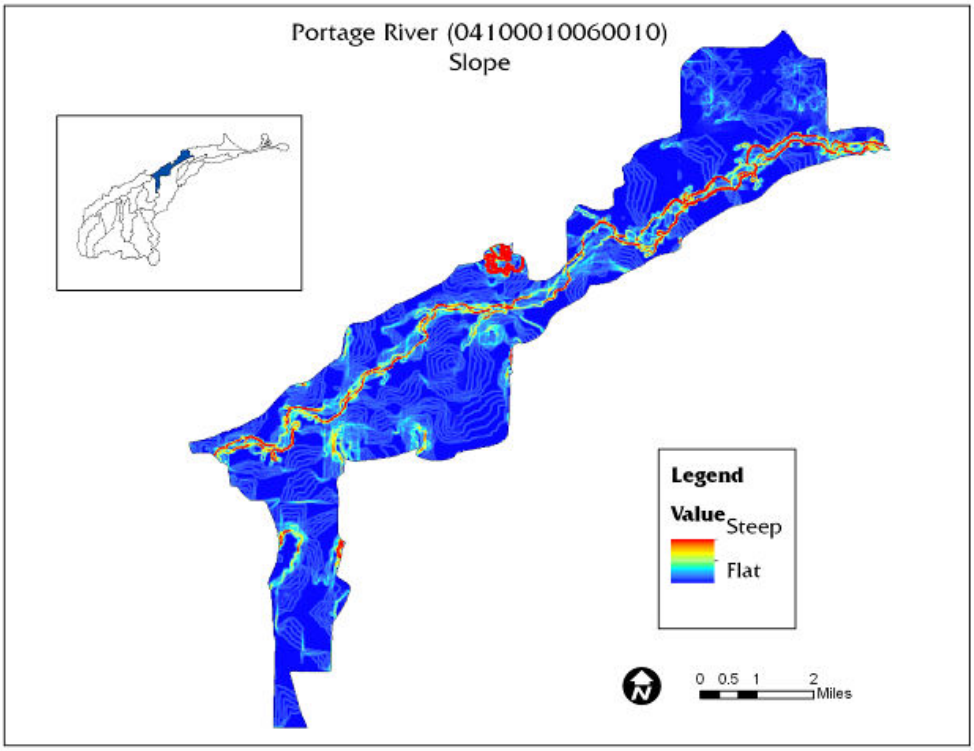
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately course texture. These soils have a moderate rate of water transmission.

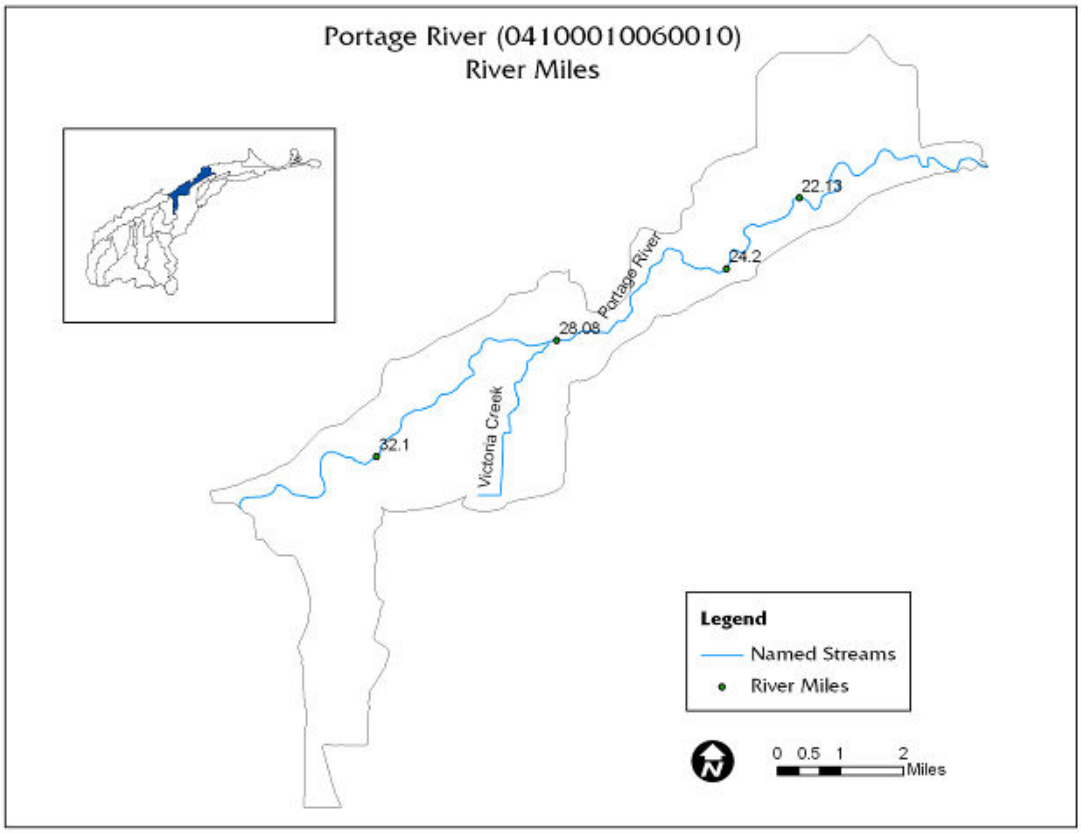
Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (**A/D, B/D, or C/D),** the first letter is for drained areas and the second is for undrained areas.


Portage River below N. Branch to above Sugar (04100010060010) :
Contours
185
185
185
180
190
180
195
195
195
205
205
Legend
Interval
1 Meter Contours
5 Meter Contours
0 1 2 4
Miles


Portage River (04100010060010)
Slope
Legend
Value
Steep
Flat
0 0.5 1 2
Miles



Rare, Threatened, Endangered Species

HUC14 04100010 060 010 provides habitat for numerous species of plants, animals and mussels. Most of these species are *threatened* or *potentially threatened* or *endangered.*

Rare, Threatened, Endangered Species

Common Name	*Scientific Name*	Last Observed	State Status
Bald Eagle	*Haliaeetus leucocephalus*	2010	T
Bald Eagle	*Haliaeetus leucocephalus*	2010	T
Bushy Horseweed	*Conyza ramosissima*	1997-08-08	P
Deertoe	*Truncilla truncata*	2003-08-25	SC
Western Banded Killifish	*Fundulus diaphanus menona*	1994-09-07	E

T=Threatened, P=Potentially Threatened, E=Endangered, X=Presumed Extirpated, SC=Species of Concern

Mussel Species in HUC 12-04100010 04 02 Lacarpe Creek Outlet #4-Portage River

Stream River Miles	Common Mussel Name	*Scientific Name*	Observed	Status
17.92	Fat Mucket	*Lampsilis radiate luteola*	2008	
	White Heelsplitter	*Lasmigona complanata*	2008	
	Fragile Papershell	*Leptodea fragilis*	2008	
	Giant Floater	*Pyganodon grandis*	2008	
	Creeper	*Strophitus undulates*	2008	
	Pond Horn	*Uniomerus tetralasmus (T)*	2008	T

Attainment Status associated with Cause and Source of Impairments

HUC 8 – 04100010 (Portage River)									
HUC 10 – 04100010 04 (Middle Portage River)									
HUC 12 – 04100010 04 02 (Lacarpe Creek Outlet #4-Portage River)									
HUC 14 – 04100010 060 010 (Portage River below N. Branch to above Sugar Cr. (includes Lacarpe Cr. Outlet #4)									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
8	2008	S01S12	Portage R. DST Pemberville @ U.S. RT. 23	32.10	420.0	WWH	Full	-	-
9	2008	500510	Portage R. at Woodville @ U.S. RT. 20	28.08	428.0	WWH	Full	-	-
10	2008	S02S20	Portage R. UPST Elmore @ Ohio Turnpike	24.10	430.0	WWH	Full	-	-
11	2008	300581	Portage R. DST Elmore WWTP	22.10	432.0	WWH	Partial	Direct Habitat Alterations	Channelization
Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010.									

Water Resources

Surface Water

"The **Ohio Integrated Water Quality Monitoring and Assessment Report** indicate the general condition of Ohio's waters and identifies waters that are not meeting water quality goals. The report satisfies the Clean Water Act requirements for both Section 305(b) water quality reports and Section 303(d) lists of impaired waters." The latest Ohio 2010 Integrated Report can be located at the Ohio EPA webpage at: http://www.epa.state.oh.us/dsw/tmdl/OhioIntegratedReport.aspx

The Ohio 2010 Integrated Report website is very user friendly with section downloads as needed. It is a public document designed for easy access. Individual river information on the health of water quality in Ohio, as well as Lake Erie near shore water standards can be obtained for human health use, aquatic life (fish and aquatic insects), chemical concerns for drinking water and recreation uses such as swimming and boating in our state's water. Our goal is to achieve fishable and swimmable waters. When the health of our waterways provide fish we can eat and water we can safely swim in – then healthy, safe water will also benefit our community populations, their industries and jobs, and our agricultural food supply. Economies also benefit and thrive because of healthy water at the local level all the way to the global level of our planet Earth and the health of this natural resource. We are responsible for our own backyards and how

we treat the land and water we interact with every day. Every State has water quality standards established to maintain or to restore waterways to a status of fishable and swimmable waters.

If water quality standards are not met according to indicators set for that water body, the water quality is then determined to be ***impaired***. The goal is to identify the cause and source of the pollutant (s) which impair(s) that water and to restore it to ***attainment*** status. If the water quality is healthy (full attainment) then methods are employed to protect the healthy water from any possible future contaminates.

The Portage River HUC12-04100010 04 02 waterway is designated use for **Aquatic Use warm-water habitat** (WWH). The **Recreation Use** assessment is Class A for this river. That determines the acceptable E. Coli colony numbers as shown below in a summary table taken from the Ohio 2010 Integrated Report, Section F: Evaluating Beneficial Use: Recreation, p. F-1.

Summary of the recreation use assessment methods.		
Bathing Waters		
Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method Summary
E. coli	Seasonal geometric mean *E. coli* * content based on samples from the recreation season within a calendar year is 126 cfu/100 ml; single sample maximum is 235 cfu/100 ml.	Applied to the three Lake Erie shoreline assessment units, exceedence of the geometric mean bathing water criterion or an exceedence of the single sample maximum for more than 10% of the recreation season is considered an impairment of the bathing water use.
Primary Contact and Secondary Contact		
Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method Summary
E. coli	Seasonal geometric mean *E. coli* content* based on samples from the recreation season within a calendar year is: **Primary Contact Waters** Class A: 126 cfu/100 ml Class B: 161 cfu/100 ml Class C: 206 cfu/100 ml **Secondary Contact Waters** 1030 cfu/100 ml	Applied to streams and inland lakes. Data from a recreation season are assessed on a site-by-site basis and compared to the applicable geometric mean *E. coli* criterion whenever more than one sample result is available for a watershed assessment unit. Assessment units are considered to be in full attainment if all sites assessed within the assessment unit meet the applicable geometric mean criterion and in non-attainment if one or more sites assessed within the assessment unit exceed the applicable geometric mean criterion.

***E. coli* concentrations are expressed in colony forming units (cfu) per 100 milliliters (ml) of water.**

Class A (lakes and popular padding streams) - Geometric Mean <126 Single Sample Maximum Value ≤298

Class B (most streams; those that are not Class A or C) – Geometric Mean <161 Single Sample Maximum Value ≤523

Class C (streams that support infrequent recreation (e.g. wading)) – Geometric Mean <206 Single Sample Maximum Value ≤940

Recreational Use Attainment

Location	RM	Rec Use PCR Class	Number of Samples	E. coli Geometric **Mean <126** and Single Sample Maximum ≤ 235 Value	Attainment Status	Sources of Bacteria
Portage R. at US 23	32.10	A	7	112 & 7400	FULL	
Portage R at US 20 Woodville	28.08	A	9	232 & 2700	**NON**	HSTS; CSOs
Portage R at I80/90 Ohio Turnpike	24.10	A	7	225 & 4900	**NON**	HSTS; Woodville WWTP & CSOs
Portage R DST Elmore WWTP Outfall 001	22.13	A	7	157 & 6800	**NON**	HSTS; Elmore WWTP; Package Plant

Aquatic Life Use Assessment

Location	RM	Drainage Area	Aquatic Life Use	Attainment Status
Portage R. DST Pemberville @ U.S. RT. 23	32.10	420.0[W]	WWH	Full
Portage R. at Woodville @ U.S. RT 20	28.08	428.0[W]	WWH	Full
Portage R. UPST Elmore @ Ohio Turnpike	24.10	430.0[W]	WWH	Full
Portage R. DST Elmore WWTP	22.10	432.0[W]	WWH	Partial

Source: Division of Surface Water, Watershed Assessment Unit Summary, 2010 Ohio Integrated Report

Macro invertebrate Communities

04100010-060-010

Stream RM	Dr. Ar. (sq. mi.)	Data Codes	Qual. Taxa	EPT QI./Total	Sensitive Taxa QI./Total	Density QI./Qt.	CW Taxa	Predominant Organisms on the Natural Substrates With Tolerance Category(ies)	ICI[a]	Narrative Evaluation
32.10	420	-	57	20/23	20/31	M/711	0	Hydropsychid caddisflies (F,MI), baetid mayflies (F), flatworms (F)	46	
27.40	429	-	59	20/21	24/30	M/757	0	Hydropsychid caddisflies (F,MI), baetid mayflies (F), midges (F)	42	
24.80	430	-	62	16	21	M	0	Caddisflies (F,MI), mayflies (F,MI), flatworms (F)	-	Good

22.10	432	13,15	45	10/16	17/31	L/255	0	Elimia snails (MI), hydroptilid caddisflies (F), midges (F)	34	

Source: Ohio EPA, 2008

Public Drinking Water Supply Assessment				
HUC	**Reporting Category**	**Cause of Impairment**	**Nitrate Watch List**	**Pesticide Watch List**
Portage River below North Branch to above Sugar Creek 04100010 060 010	NA	None	No	No

Fish Tissue Assessment			
HUC	**Reporting Category**	**Causes of Impairment**	**PCB Concentration**
Portage River below North Branch to above Sugar Creek 04100010 060 010	5h	None	

Water Quality Monitoring Results: Ohio EPA 1994 and 2008						
River Mile	**Date**	**IBI**	**ICI**	**MiWB**	**QHEI**	**STATUS**
34.8	1994	33	36	7.6	59.0	FULL - V. Good/M. Good
34.6	1994	36	38	8.5	63.0	FULL - Good/M/Good
29.5	1994	34	40	9.0	63.5	FULL
27.7	1994	34	50	8.2	65.5	FULL
24.2	1994	38	28*	7.9	81.0	PARTIAL
22.2	1994	29	32	6.8	43.5	FULL
22.1	1994	28	50	7.1	57.5	FULL
32.10	2008	43	46	8.0	54.0	FULL
28.08	2008	42	42	7.9	42.5	FULL
24.20	2008	36	G	9.0	68.5	FULL
22.10	2008	35	34	6.5*	48.5	PARTIAL

a - River Mile (RM) represents the Point of Record (POR) for the station, not the actual sampling RM.
b - MIwb is not applicable to headwater stream with drainage areas ≤20 mi^2.
c - A narrative evaluation of the qualitative sample based on attributes such as EPT taxa richness, number of sensitive taxa, and community composition was used when quantitative data was not available or considered unreliable. VP=Very Poor, P=Poor, LF=Low Fair, F=Fair, MG=Marginally Good, G=Good, VG=Very Good, E=Exceptional
d - Attainment is given for the proposed status when a change is recommended. Aquatic life use in superscript.
ns - Nonsignificant departure from biocriteria (≤4 IBI or ICI units, or ≤0.5 MIwb units).
* - Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.
Italic: 2008 TMDL scores in review.

Benchmark Score Tables

General narrative ranges assigned to QHEI scores.				
Narrative Rating		QHEI Range		
		Headwaters (≤ sq mi)	Larger Streams	Lacustuary
Excellent		≤ 70	≤ 75	≤ 80
Good		55 to 69	60 to 74	60 to 80
Fair		43 to 54	45 to 59	45 to 59
Poor		30 to 42	30 to 44	30 to 44
Very Poor		<30	<30	<30

Biological Criteria Benchmarks

Biological Criteria					**Lacustuary Benchmarks[1]**				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
IBI-Headwaters	50	**28**	20	18	N/A	N/A	N/A	N/A	N/A
IBI-Wading	50	**32**	22	18	N/A	N/A	N/A	N/A	N/A
IBI-Boat	48	**34**	20	16	50	42	31	17	<17

MIwb-Wading	9.4	**7.3**	5.6	4.5	N/A	N/A	N/A	NA	N/A
MIwb-Boat	9.6	**8.6**	5.7	5.0	10	8.6	5.6	2.8	<2.8
ICI	46	**34**	22	8	52	42	25	12	<12

[1] **Proposed Lacustuary scoring breakpoints. These have not yet been adopted into rule.**

Ohio's water quality standards, set forth in Chapter 3745-1 of the Ohio Administrative Code (OAC) includes four major components:

- beneficial use designations,
- narrative "free froms",
- numeric criteria, and
- Antidegradation provisions

The Water Quality Standards Program webpage is located at the Ohio EPA, Division of Surface Water website. Additional information and research details that are user-friendly to access include OAC Chapters for Ohio Rivers, lakes and "free froms" with word definitions at: http://www.epa.state.oh.us/dsw/wqs/index.aspx

Ground Water

Source Water Assessment Plan (SWAP)

The Village of Pemberville, the Village of Woodville, the Village of Elmore as well as many of the communities in the Portage watershed draw their drinking water supply from wells supplied by ground water of the Portage watershed. The ground water is recharged by surface water percolating down through the soil structure and by drainage and runoff from impermeable surfaces. Public water systems are protected with a partnership of community leaders and the Ohio EPA by plan and design of source water assessment plans for public wellheads and groundwater zones.

A source water assessment plan (SWAP) is conducted for the land area surrounding the wellheads. A protection area is established to help protect the drinking water supply from any potential pollution contaminates from the land surface or seepage into the wellhead zone.

Within the source water protection area an inventory is conducted by the Ohio EPA and village personnel to identify *all potential* sources of contamination which could reach ground water levels. Susceptibility analysis is conducted and communities are rated as high, medium or low susceptibility to their ground water resource. Several indicators can account for a high threat to pollution contaminates that relate to geologic structure below ground, the depth of the ground water from the surface and the potential contaminates that exist on the surface.

The management methods of conservation applied in agricultural areas also benefits residential urban areas in protecting ground water resources relied on for public drinking water supply. The

best management practices for agriculture runoff and urban storm water runoff are protective strategies against potential contaminant sources to surface water and groundwater wells.

The Village of Elmore has a low susceptibility to potential contamination because geologically a thick protective layer of clay overlies the aquifer supply. However, protective strategies are implemented to preserve and protect the well areas.

The Village of Woodville is a community public water system that voluntarily completed their drinking water source assessment under the Wellhead Protection Program. The Susceptibility Analysis indicates a moderate susceptibility to potential contamination as completed by Ohio EPA and the Village Wellhead Protection Plan was completed by the Toledo Metropolitan Area Council of Governments in 1994.

The Village of Pemberville has a public water system serving 1,300 people. A Carbonate bedrock **aquifer** provides ground water to eight wells, located in three separate well fields, within Pemberville. The village pumps 129,800 gallons per day to serve its residents needs and has a high susceptibility to contamination to the drinking water for several reasons. The source water assessment plan (SWAP) identified four indicators of high susceptibility to contamination;

- Depth to water in the bedrock aquifer is 25 feet or less below ground surface;
- Wells are located in a sensitive potential karst area;
- Potential contaminant sources exist within the protection area;
- The wells are open between approximately 25 and greater than 100 feet in the fractured carbonate and the depth to water is less than 25 feet below the ground surface.

Please see the Ohio EPA, Division of Drinking and Ground Water, Public Water Systems webpage at http://www.epa.state.oh.us/ddagw/pws.aspx for more information on drinking water and source water protection plans or contact your local community leaders.

The Drinking Water Source Protection Areas for Elmore, Woodville, and Pemberville, are shown in the following figures (Drinking Water Source Assessments for the Villages of Elmore, Woodville, and Pemberville, Ohio EPA 2010, TMACOG 1994, and Ohio EPA 2002 respectively).

Legend

- Above Ground Storage Tank
- Auto Repair/Body Shop
- Barber/Beauty Shop
- Cemetery
- Food Processor
- Gas Station (Existing/Abandoned)
- Hardware/Lumber/Parts Store
- Garage (Municipal)
- Leaking Underground Tank
- Machine/Metalworking Shop
- Medical/Dental Office/Clinic
- NPDES Permitted Facility (PCS)
- Other Commercial Source
- PCE Facility (PADS)
- Petroleum Product Production
- Plastics/Synthetics Producer
- Recycling Facility
- Salt Storage Area
- Active Wells
- Inner Management Zones
- Outer Management Zones

Feet
0 440 880 1,760

Protection Area Data

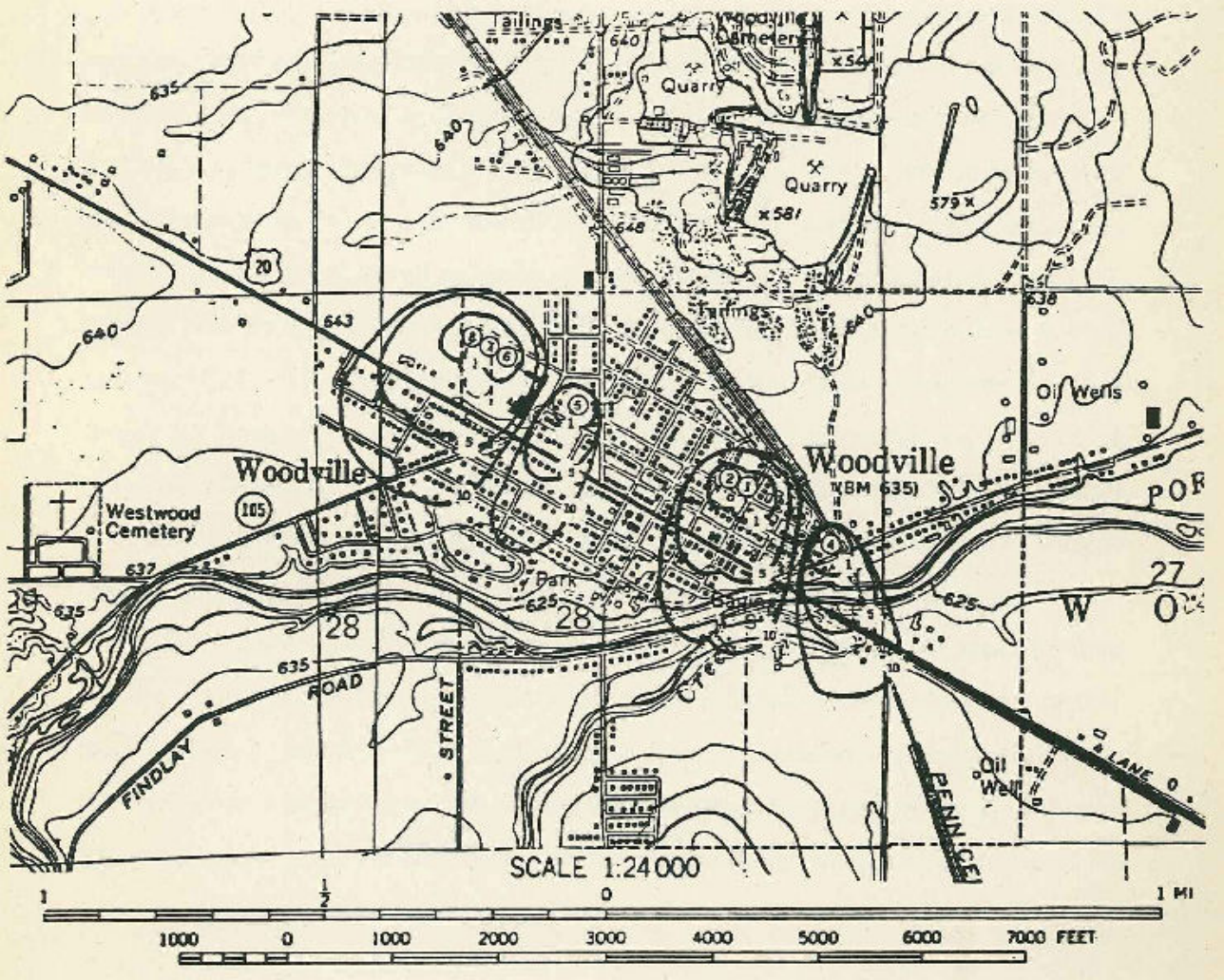
Number of Wells = 4
Total Well Pumping Rate = 129,000 GPD
Porosity = 0.03
Aquifer Thickness = 352 feet
Hydrogeologic Setting = Carbonate Aquifer
Primary Land Use = Residential

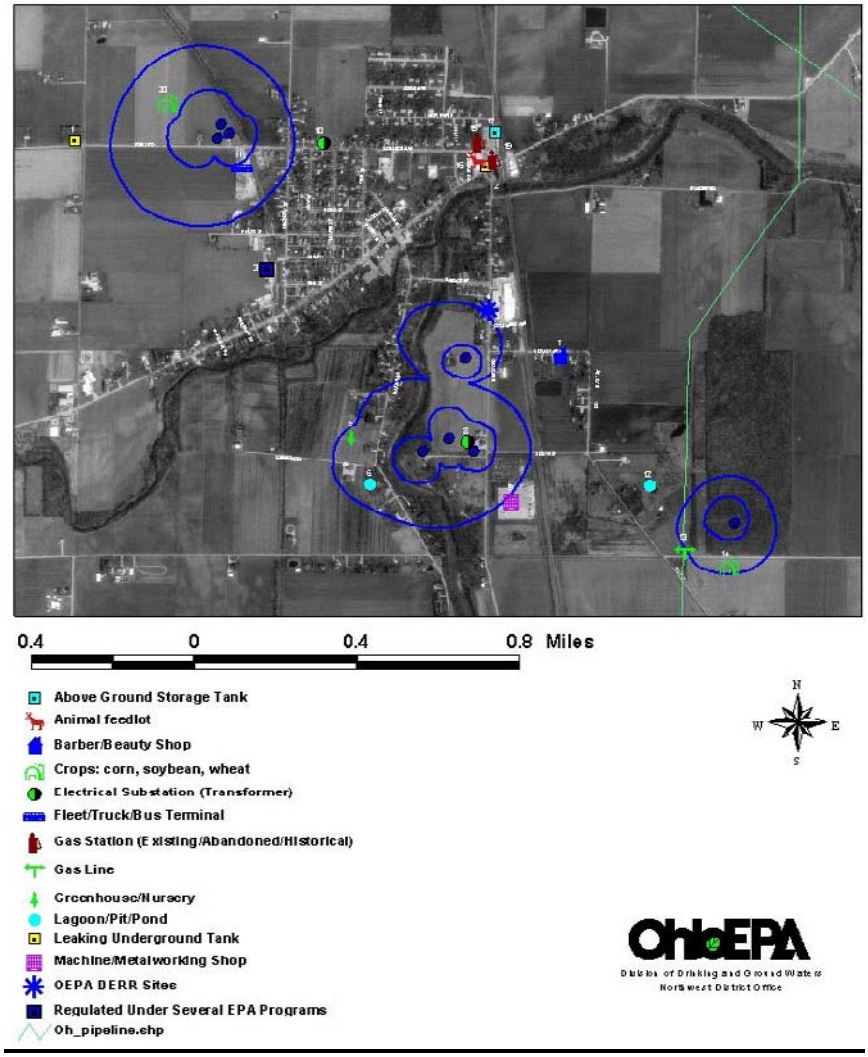
LOW | MODERATE | HIGH

SUSCEPTIBILITY

OhioEPA
Division of Drinking and Ground Waters

DATE: February 2010


Tailings
Quarry
Quarry
Woodville
Woodville
(BM 635)
Westwood
Cemetery
Park
Oil Wells
Oil
Well
FINDLAY
ROAD
STREET
PENNSYLVANIA
LANE
SCALE 1:24000
1 MI
7000 FEET



DRASTIC MAP

The sensitivity of the groundwater to local sources of contamination is determined and rated by **DRASTIC** maps as described below:

Inherent within each geologic setting are the physical characteristics which effect the groundwater pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:

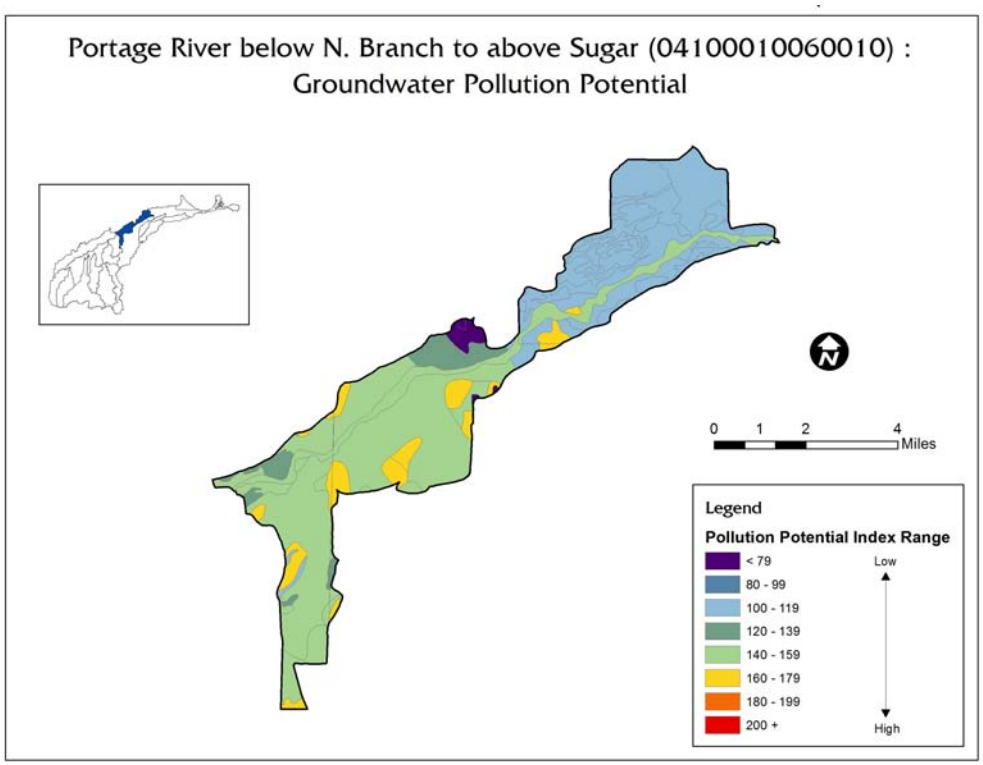
D – Depth to Water
R – Net Recharge
A – Aquifer Media
S – Soil Media
T – Topography
I – Impact of the Vadose Zone Media
C – Conductivity (Hydraulic) of the Aquifer (ODNR, 1994)

Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index, the greater the vulnerability to contamination (ODNR, 1994).

The average ground water pollution index potential for the Portage River watershed between the North Branch and Sugar Creek is 138 with a range of 105-171. The watershed includes sensitive karst areas in Sandusky County.

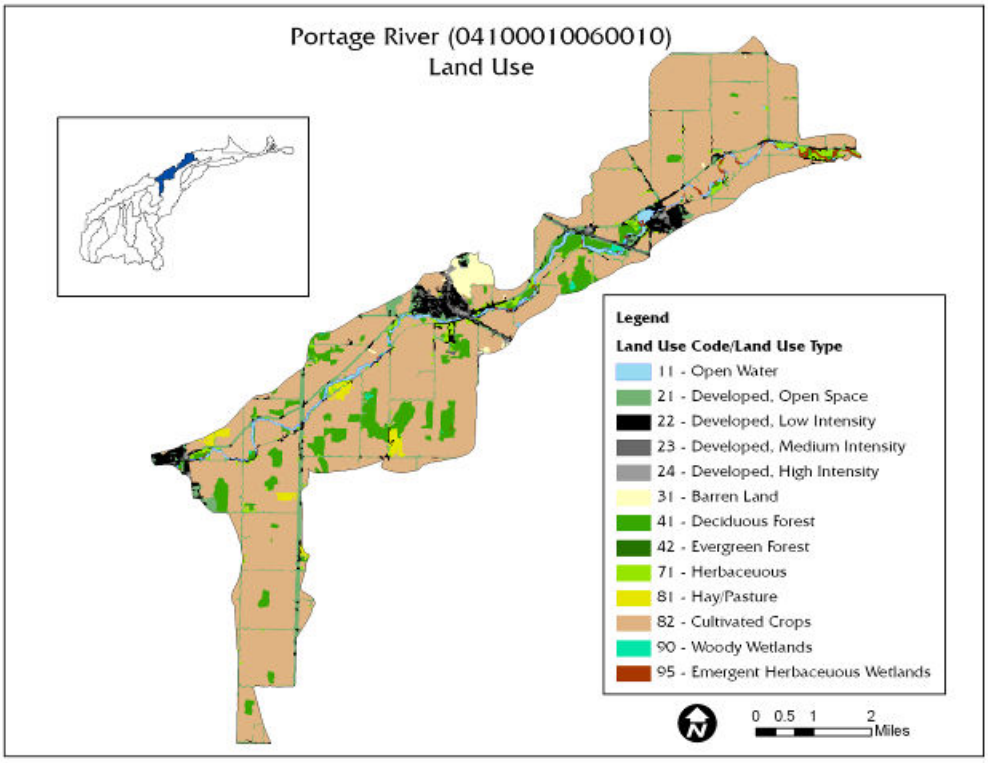
The Ohio Department of Natural Resources, Division of Water, Water Resources Section is the responsible agency to map groundwater resources throughout the state. Greater detail on DRASTIC maps for the Portage can be found in Chapter 4 of this watershed plan.

In addition, groundwater pollution potential reports with DRASTIC maps are available on the Ohio Department of Natural Resources website at http://www.dnr.state.oh.us/default/tabid/3541/Default.aspx.



Sub-watershed (04100010-04-02)		
060-010		
Land Use	**Percent**	**Acres**
Urban	12.8%	2,309
Forest	9.6%	1,725
Pasture	1.0%	188
Cropland	72.7%	13,088
Other	3.8%	684

Total Acres	100%	17,994



Livestock Inventory							
HUC 4100010060010							
Type of Animal		**Hancock**	**Ottawa**	**Sandusky**	**Seneca**	**Wood**	**Estimates for HUC**
Percent of County in HUC		0.0%	4.1%	2.5%	0.0%	1.2%	
Cattle	Farms	129	89	167	264	144	**10**
	Animals	4,233	1,523	4,612	10,096	6,287	**254**
Hogs	Farms	51	15	37	62	30	**2**
	Animals	32,343	3,639	5,591	42,808	39,469	**756**
Horses	Farms	105	63	132	72	128	**7**
	Animals	844	444	772	463	1,004	**50**
Poultry	Farms	49	22	41	62	47	**2**
	Animals	NA	779	1,042	4,283	NA	**NA**
Sheep	Farms	32	12	41	61	21	**2**
	Animals	1,134	335	765	2,770	21	**33**
Total							23
							1,083

Source: 2007 Census of Agriculture http://www.agcensus.usda.gov/

Point Sources:

Municipal

- Woodville WWTP (2PB00052) municipal, discharge to Portage River.
- Elmore STP (2PB00051) municipal, discharge to Portage River.
- Pemberville WWTP (2PB00012) municipal, discharge to main branch Portage River.

Package Plants

- Area Aggregates / Olen (2IJ00097)
- Carmeuse Lime Millersville (2IJ00032)
- Elmore Ohio Turnpike Maintenance Building
- Green Valley MHP (2PY00059)
- Matlack Trucking Co.
- Munson Transportation

Non-Point Sources:

Critical Sewage Areas

- Portage below N. Br (Sandusky County)

Estimates of HSTSs				
Watershed	**Housing Units without sewers**	**Est. Unsewered Population (2000)**	**Unsewered Housing Units per acre**	**Unsewered Population per acre**
04100010060010	1,271	3,216	0.071	0.178

Sources: 2000 Census data and TMACOG "208" Plan. Analysis identifies approximate number of housing units without sewers in each watershed as an estimate of number of HSTSs.

Aquatic Life Use Impairments	
Causes	**Sources**
Direct habitat alterations	Channelization
Source: Ohio 2010 Integrated Report, Watershed Assessment Unit Summary	

Water Supply:

Public Water System	Population Served	Primary Water Source
None		

Water Quality Impairments

The OEPA Integrated Report assesses each watershed's attainment status for 1) Public Drinking Water Supply, 2) Recreation, 3) Human Health, 4) Aquatic Life, and 5) Fish Tissue. The Integrated Report identifies causes and sources of impairments where watersheds are not in attainment with water quality standards.

Background:

The Portage River measures 17.7 miles from the confluence with the North Branch @ RM 35.21 in Pemberville, to Sugar Creek at RM 17.50 located one half river mile west of SR 590 and just west of Brush Wellman in Harris Township, Ottawa County. The Portage Mainstem continues downstream to Oak Harbor, Port Clinton, and Lake Erie.

This 17.7 river mile segment of the Portage Mainstem flows across three counties (Wood, Sandusky, and Ottawa) and flows through the three municipal jurisdictions; the Village of Pemberville (pop. 1,353), the Village of Woodville (1,972) and the Village of Elmore (1,378). The Portage waterway also receives the wastewater effluent from the wastewater treatment plants for Pemberville, Woodville, and Elmore. The three treatment plants contribute nutrient loadings to the river, subject to limitations set by their NPDES permits.

The Martin Marietta stone quarry is located in the subwatershed north of Woodville. Otherwise the majority land use is agricultural.

It is this 17.7 mile stretch of river that has open scenic river banks, a variety of riparian vegetation and access to the floodplains along the river. The river channel has been modified in some locations and several oxbows exist within riparian forest areas of the river bottom lands. The Mainstem of the Portage River begins at river mile 35.21 (RM) at Pemberville at the confluence of the Middle Branch and North Branch.

There is one petitioned ditch in Sandusky County for this portion of the river, located on Victoria Creek which enters the Portage River @ RM 28.21 at Woodville south of SR 20.

Victoria Creek enters the Portage River @ River Mile 28.21 in Woodville, Ohio south of SR 20

Best management practices should be included in any future parcel development for stormwater retention or detention along the Portage waterway. This location along the Portage River is included in the *TMACOG Areawide Water Quality Management Plan,* and identified as a "Critical Urbanizing Watershed" based on population growth > 5% and having at least two watershed impairments that are characteristic of urban runoff.

Based on the growth of population and future demands for development especially along waterways; this plan recommends conservation development and riparian corridor preservation in the Portage River watershed.

Proper protection of the natural stream banks will preserve the land area from erosion and loss of property. Conservation easements are beneficial in protecting the land area and necessary floodplains for elevated river levels which protect public and private property and infrastructure. There are recommended and preferred methods of bank stabilization against erosion that protect the resources and property owners downstream. Using rock and debris fill to stabilize the banks of the waterway narrows the river channel which in turn, increases the flow rate that leads to further bank scouring and erosion of the stream banks, only compounding the problem.

The average channel width is 48 feet with an average water depth of 47 inches in the center of the stream. Several outlets of point source pollution, including sewage were identified in the

river channel by volunteers during the volunteer stream corridor survey in 1999. The banks do have severe to moderate erosion and an accumulation of stream litter along the banks. Tufts of grass and debris have been reported in tree branches to a height of 5 to 10 feet above stream level, indicating an area of high water during times of runoff and flooding.

Within Woodville Township, Sandusky County, just south of Woodville is a proposed confined animal feeding operation. The economic recession has delayed construction of the operation for an unknown period of time, but the Ohio EPA has approved a NPDES permit for proposed construction plans.

Portage River streambank habitat alterations both upstream (UST) and downstream (DST) of Elmore, Ohio. Potential locations for stream bank restoration and conservation easements.

Schedel Arboretum and Gardens is located on this subwatershed, quite literally as the Portage River flows directly through the beautiful Schedel Gardens. The Arboretum is also a strong partner for education with the PRBC Education Committee. Teacher training for water quality sampling with students has taken place on the Schedel property.

Potential Impairments:

This stretch of the Portage includes four 2008 TMDL sampling points. Three of them, all but the furthest downstream, are in full attainment for aquatic life criteria. The downstream site, below Elmore at the wastewater treatment plant, is in partial attainment. All but the furthest upstream are in non-attainment for recreational use.

The stream meets aquatic life criteria at Pemberville, Woodville, and the Turnpike, but not below Elmore. The TMDL specifically cites "impacts resulting from straightening, dredging, and the entrenchment within levees or pilot channels of natural river systems" in this mile stretch. In this section, the QHEI score drops from 68.5 to 48.5, the MIWB from 9.0 to 6.5, and the ICI from 42 (RM 28) to 34.

Portage River sampling data show that the river is in attainment for recreation use (measured by bacteria levels) at river mile 32.1 (US 23 below Pemberville), but not in attainment at the next three sampling points: river mile 28.08 (Woodville), 24.10 (Ohio Turnpike), and The high levels of bacteria reported between RM 28.08 and RM 22.13 (Elmore). The Integrated Report attributes the high bacteria levels between Woodville and Elmore to combined sewer overflows from both villages in combination with failed HSTSs. The Sandusky County Health Department includes most of the HUC in that county within a Critical Sewage Area boundary, indicating the known or suspected presence of failed HSTSs. The village WWTPs all had combined sewer overflows in 2008. Since the TMDL sampling, all three have made significant infrastructure improvements to reduce sewage overflows. Pemberville has replaced its wastewater treatment plant, Woodville is separating its sewers, and Elmore replaced a sanitary sewer interceptor and trunk main.

Failed HSTSs and the package plants continue to be likely sources. There are 65 residential sites built along both sides of the six miles of river bank in Wood, Sandusky and Ottawa counties. Testing of HSTSs is needed to identify individual systems that have failed. The concentration of bacteria was present when TMDL sampling occurred in 2008 and the CSO facilities were likely major contributors of bacteria at that time.

The Woodville sewerage system includes 17 combined sewer outflow points. In 2007, Ohio EPA approved the Woodville Long Term Control Plan for improvements to the wastewater treatment system and plant. The LTCP is for a three-phase, ten-year program of sewer separations (TMACOG Areawide Water Quality Management Plan). Three phases of construction will be completed in 2011, 2012 and 2013.

There are two low-head dams in this HUC. One is at approximately RM 24.6, upstream of the Turnpike bridge. The other is in the center of Elmore, near RM 22.5, and has been breached. While these dams are not considered causes of impairments, their removal could help with assimilation of wasteload, stream re-aeration, and fish migration.

Projects in this HUC should focus on reduction of bacteria levels, and stream habitat improvements to increase the QHEI score between river miles 24.1 (Turnpike) and 22.1 (Elmore STP).

Problem Statement #1: (Bacteria)

The water quality of the Portage from Pemberville to Elmore is impaired by elevated measurements of E. coli bacteria. The Portage TMDL data collected by Ohio EPA in 2008 indicate that 3 of the HUC's 4 sampling sites are in non-attainment for E. coli. The TMDL cites failed HSTS, Woodville CSOs, the Elmore WWTP, and package plants as the causes of impairment due to high E. coli bacteria levels.

In this HUC are an estimated 1,271 HSTS; by density of onsite systems, this is one of the most populated HUCs. This area includes six package plant (three permitted, three unpermitted), and one Critical Sewage Area (Portage below the North Branch in Sandusky County). There are three municipal wastewater plants in the watershed: Pemberville, Woodville, and Elmore. Three plants have or had significant CSO and/or wastewater treatment issues. Pemberville separated its sewers in 1999 and completed a new wastewater plant in 2011. Woodville has funding to separate all of its combined sewers and anticipates completion in 2013. Elmore completed sewer separation in 2000, and installed a replacement sanitary sewer interceptor in 2009 that eliminated an SSO; Elmore plans to replace its wastewater plant at an estimated cost of $4.8 million, but does not yet have the funding. Pemberville and Elmore have both completed improvements since the 2008 TMDL sampling.

Goal 1.1: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 8.1 million gallons of HSTS effluent annually.

Objectives

- Replace or upgrade 10% of watershed's HSTS or 127 systems
- Portage River Mainstem watershed in Sandusky County Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in

Goal 1.2: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 7.2 million gallons of package plant effluent annually.

Objectives

- Upgrade 6 package plant(s). Effluent quality meets P standards.

Goal 1.3: Reduce E. coli loadings from municipal wastewater systems to meet recreational bacteria water standards.

Objectives

- Eliminate Woodville CSOs
- Install new Elmore WWTP to meet effluent standards.
- Install Ohio Avenue Sanitary Pump Station and Force Main Replacement to reduce SSO

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Bacteria	1.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$1,905,000	County Health Dept, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 127 systems	8.1 million gallons/year sewage discharge eliminated
	1.1	♦Prioritize and schedule sanitary survey ♦ Portage River Mainstem watershed in Sandusky County ♦Define study area with OEPA, County Health Department, Northwestern Water and Sewer District ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$328,718	Sandusky County Health Department, Sandusky County Sanitary Engineer, OEPA	2012-22	Portage River Mainstem watershed in Sandusky County Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.2	♦Test package plant effluent for phosphorus ♦Set effluent standard in existing or new NPDES permit(s) ♦Enforce upgrades for phosphorus removal as needed	$21,600	Ohio EPA	2012-2017	Upgrade 6 package plant(s). Effluent quality meets effluent stds	7.2 million gallons/year effluent improved
	1.3	♦ Complete Woodville sewer separation Phase I ♦ Complete Woodville sewer separation Phase II ♦ Complete Woodville sewer separation Phase III	$5,607,858	Village of Woodville	2012-2013	Eliminate Woodville CSOs	NA

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	1.3	♦ Secure funding for new WWTP ♦ Design new WWTP ♦ Construct new WWTP ♦ Put new facility into operation	$4,747,340	Village of Elmore	2012-2017	Install new Elmore WWTP to meet effluent standards	NA
	1.3	♦ Secure funding for pump station and force main replacement ♦ Design pump station ♦ Construct pump station ♦ Put new facility into operation	$324,000	Village of Elmore	2012-2017	Install Ohio Avenue Sanitary Pump Station and Force Main Replacement to reduce SSO	NA

Problem Statement #2: (Nutrients: phosphorus and nitrate)
The Ohio EPA TMDL found 3 of the 4 sampling sites in this HUC to meet Aquatic Life attainment standards. The Portage TMDL recommends a total phosphorus load allocation of 1.19 kg/day, requiring a nonpoint source load reduction of 1 lb P/year. HSTS systems should be addressed as noted above due to recreational non-attainment. Agricultural BMPs should be encouraged to maintain the attainment standard and help reduce loadings to Lake Erie.

Goal 2.1: Maintain the TMDL target for phosphorus with a load reduction of 677 and nitrate load of 2,864 lb/year from HSTS.

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 127 systems.

Goal 2.2: Maintain the TMDL target for phosphorus with a load reduction of 420 and nitrate load of 2031 lb/year from package plants.

Objectives:

- Upgrade 6 package plant(s). Effluent quality meets effluent stds.

Goal 2.3: Maintain the TMDL target for phosphorus by upgrading municipal wastewater plants to meet effluent standards.

Objectives:

- Eliminate Woodville CSOs
- Install new Elmore WWTP to meet effluent standards.
- Install Ohio Avenue Sanitary Pump Station and Force Main Replacement to reduce SSO

Goal 2.4: Maintain the TMDL target for phosphorus with a load reduction of 144 and nitrate load of 417 lb/year from agricultural practices.

Objectives:

- 200 acres of riparian buffers
- 25 acres of restored wetlands
- 250 LF of overwide / 2-stage ditch reconstruction
- 6308 acres under NRCS 590/1 Nutrient Mgt
- 2703 acres under NRCS 590/3 Nutrient Mgt.

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Nutrients (phosphorus and nitrate)	2.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$1,905,000	County Health Dept, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 127 systems	Reduce phosphorus load by 677 and nitrate load by 2,864 lb./year
	2.2	♦Test package plant effluent for phosphorus ♦Set effluent standard in existing or new NPDES permit(s) ♦Enforce upgrades for phosphorus removal as needed	$21,600	Ohio EPA	2012-2017	Upgrade 6 package plant(s). Effluent quality meets effluent stds	Reduce phosphorus load by 420 and nitrate load by 2,031 lb./year
	2.3	♦ Complete Woodville sewer separation Phase I ♦ Complete Woodville sewer separation Phase II ♦ Complete Woodville sewer separation Phase III	$5,607,858	Village of Woodville	2012-2013	Eliminate Woodville CSOs	NA
	2.3	♦ Secure funding for new WWTP ♦ Design new WWTP ♦ Construct new WWTP ♦ Put new facility into operation	$4,747,340	Village of Elmore	2012-2017	Install new Elmore WWTP to meet effluent standards	NA

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦ Secure funding for pump station and force main replacement ♦ Design pump station ♦ Construct pump station ♦ Put new facility into operation	$324,000	Village of Elmore	2012-2017	Install Ohio Avenue Sanitary Pump Station and Force Main Replacement to reduce SSO	NA
	2.4	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$140,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	200 acres of riparian buffers	Reduce phosphorus load by 104 and nitrate load by 208 lb./year
	2.4	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$127,656	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	25 acres of restored wetlands	Reduce phosphorus load by 0 and nitrate load by 0 lb./year
	2.4	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$22,250	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	250 LF of overwide / 2-stage ditch reconstruction	Reduce phosphorus load by 35 and nitrate load by 69 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.4	♦Seek cooperators for Nutrient Management NRCS 590 Level 1 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management NRCS 590 Level 1 BMPs with farmers	$126,153	SWCD, NRCS, farmers	2012-2022	6,308 acres under NRCS 590/1 Nutrient Mgt	NA
	2.4	♦Seek cooperators for Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with farmers	$108,131	SWCD, NRCS, farmers	2012-2022	2,703 acres under NRCS 590/3 Nutrient Mgt	NA

Problem Statement #3: (Siltation/Sedimentation)

The Ohio EPA TMDL found three of four sampling sites in this HUC to meeting Aquatic Life attainment standards. The Portage downstream of the Elmore WWTP outfall site (RM 22.13) was reported as partial attainment, but sedimentation / siltation was not given as a cause or source. Agricultural BMPs should be applied throughout the watershed, with priority for habitat restoration BMPs at or above RM 22.13. These BMPs will improve habitat and have the added benefit of maintaining the HUC's attainment with respect to sediment load.

Goal 3.1:

Reduce sedimentation impairments by decreasing sediment load by 71 lb/year from agricultural practices.

Objectives:

- 200 acres of riparian buffers
- 25 acres of restored wetlands
- 250 LF of overwide / 2-stage ditch reconstruction.

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$140,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	200 acres of riparian buffers	Reduce sediment load by 52 lb./year
	3.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$127,656	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	25 acres of restored wetlands	Reduce sediment load by 0 lb./year
	3.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$22,250	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	250 LF of overwide / 2-stage ditch reconstruction	Reduce sediment load by 17 lb./year

Problem Statement #4: (Habitat)

The Ohio EPA TMDL found three of four sampling sites in this HUC to meeting Aquatic Life attainment standards. The Portage downstream of the Elmore WWTP outfall site (RM 22.13) was reported as partial attainment, with the cause of impair being channelization, and the source direct habitat alternation. Habitat restoration BMPs should be focused at or above RM 22.13, including tributaries that enter the South Branch above that point.

Goal 4.1: 600 acres of habitat restoration and 500 linear feet of stream corridor restoration practices.

Objectives:

- 200 acres of riparian buffers
- 25 acres of restored wetlands
- 250 LF of overwide / 2-stage ditch reconstruction.

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Habitat Impairment	4.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$140,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	200 acres of riparian buffers	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$127,656	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	25 acres of restored wetlands	Load reductions provided in nutrient and sediment tables

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	4.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$22,250	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	250 LF of overwide / 2-stage ditch reconstruction	Load reductions provided in nutrient and sediment tables

SUGAR CREEK

4100010 060 020 (14 – digit HUC)
04100010 04 01 (New 12-digit HUC & Name: Sugar Creek)

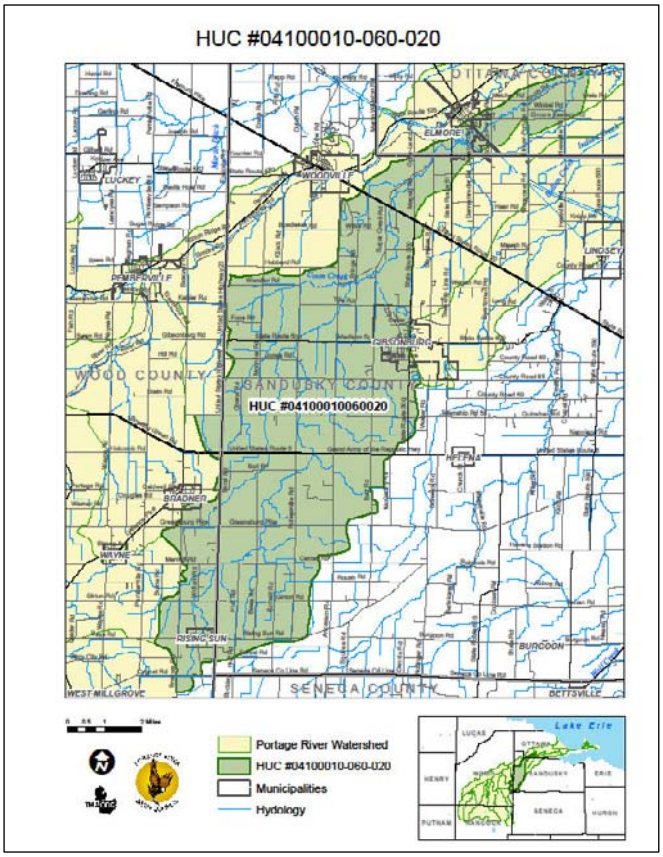
Length: 17.8 miles

Elevation Source: 690 feet

Elevation Mouth: 577 feet

Average fall: 6.3 (ft/mile)

Drains: 59 sq. miles



Ohio Topographic Quadrangles 7.5 minute (1:24,000)

- Pemberville
- Elmore
- Lindsey
- Helena
- Bradner

Urban areas:
Villages of Elmore, Ottawa County (2007 pop. 1,378)
Village of Gibsonburg, Sandusky County (2,452)
Village of Bradner, Wood County (1,160)
Village of Risingsun
Wood County (608)

Geology

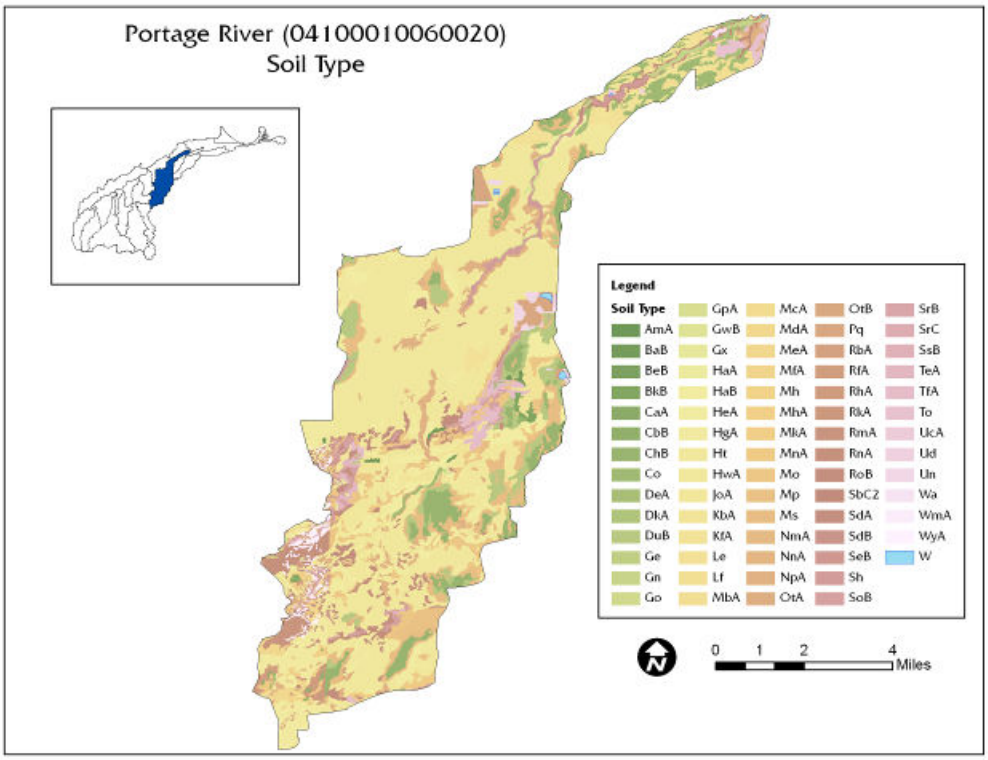
The South Branch HUC14 04100010 050-010 subwatershed is located in Wood County in the generally flat-lying Eastern Lake Plains Section of the Central Lowlands Physiographic Province (Fenneman, 1938). The county is covered by a variable thickness of glacial till, lacustrine deposits and outwash. These unconsolidated glacial deposits are underlain by a relatively flat-lying sequence of Paleozoic sedimentary rocks consisting primarily of dolomite from the Silurian and Devonian Systems (ODNR, 1994).

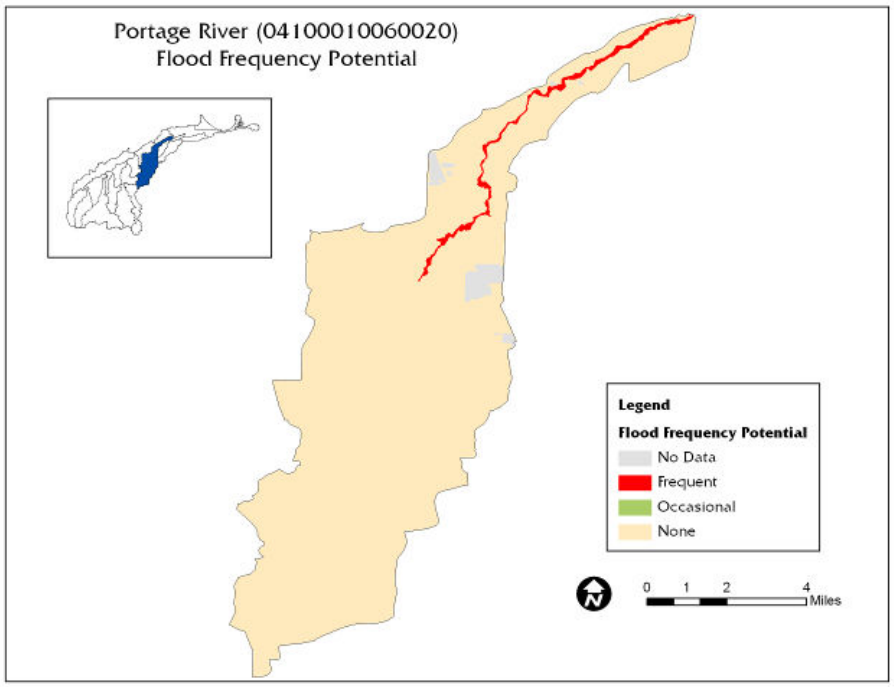
Soils

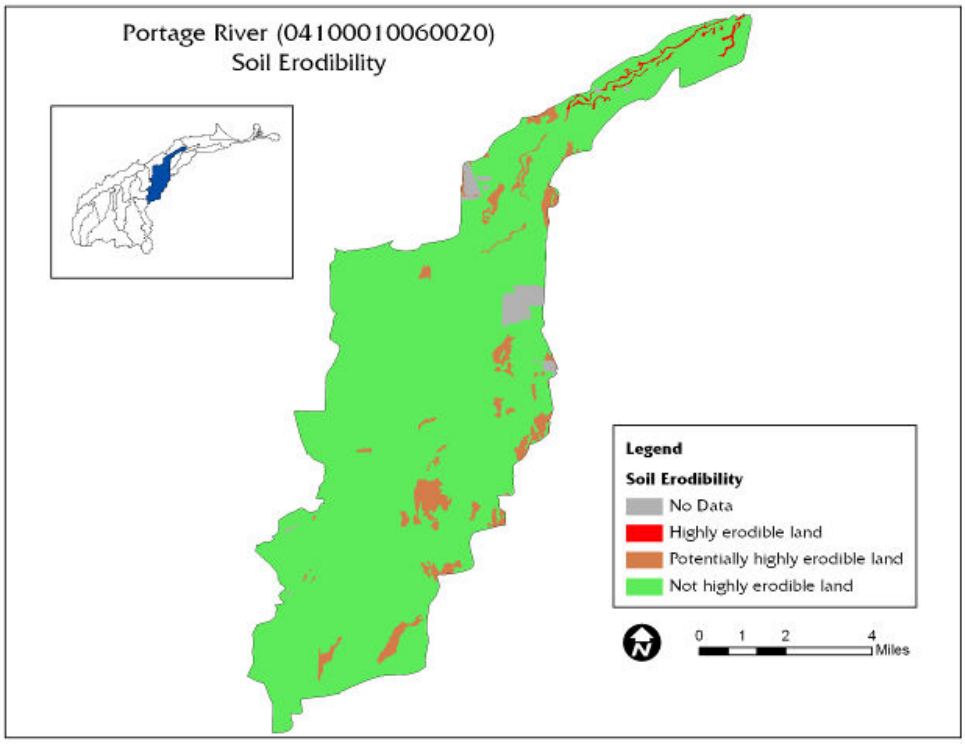
Sandy, silty, clay loan soils, which are very poorly drained and somewhat poorly drained. Seasonal high water table near or above the surface and ponded during periods of heavy rains. Permeability is slow. HUC 04100010-060-010 watershed drains land of four counties; Ottawa, Sandusky, Seneca and Wood. The largest land area is in Sandusky County. Here the soils in the watershed include Nappanee, Glynwood, Castalia, Hoytville, Kibbee, Lenawee, Millsdale, Dunbridge, Mermill, Paulding, Toledo and Haskins soil associations.

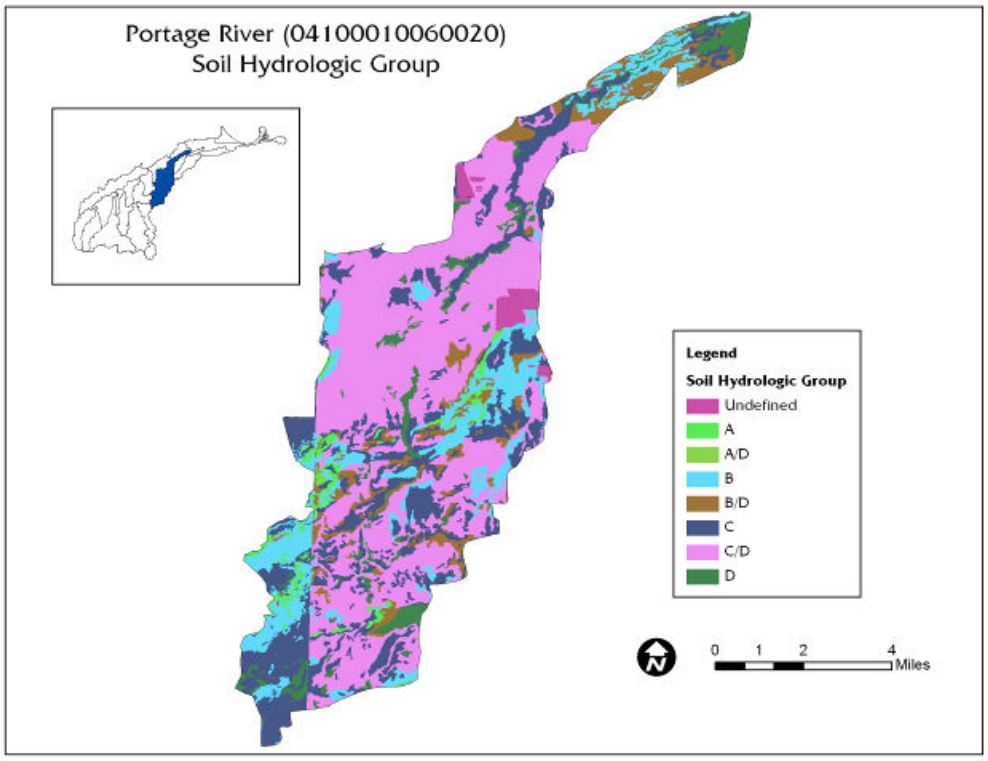
The dominant soil is Hoytville silty clay loam (Ht) covering 6,085 hectares and Haskins sandy loam, 1 to 4 percent slopes (HaB) with 1,054 hectares of coverage.

Major Soil Groups		
060-020		
Hoytville	Sum Acres	16,670
	Percentage	44.14%
Haskins	Sum Acres	2,698
	Percentage	7.14%
Millsdale	Sum Acres	2,411
	Percentage	6.38%
Mermill	Sum Acres	2,042
	Percentage	5.41%
Castalia	Sum Acres	1,780
	Percentage	4.71%
Dunbridge	Sum Acres	1,498
	Percentage	3.97%
Nappanee	Sum Acres	1,272
	Percentage	3.37%
Kibbie	Sum Acres	1,232
	Percentage	3.26%


Portage River (04100010060020)
Soil Type
Legend
Soil Type
AmA
BaB
BeB
BkB
CaA
CbB
ChB
Co
DeA
DkA
DuB
Ge
Gn
Go
GpA
GwB
Gx
HaA
HaB
HeA
HgA
Ht
HwA
JoA
KbA
KfA
Le
Lf
MbA
McA
MdA
MeA
MfA
Mh
MhA
MkA
MnA
Mo
Mp
Ms
NmA
NnA
NpA
OtA
OtB
Pq
RbA
RfA
RhA
RkA
RmA
RnA
RoB
SbC2
SdA
SdB
SeB
Sh
SoB
SrB
SrC
SsB
TeA
TfA
To
UcA
Ud
Un
Wa
WmA
WyA
W
0 1 2 4
Miles


Portage River (04100010060020)
Flood Frequency Potential
Legend
Flood Frequency Potential
No Data
Frequent
Occasional
None
0 1 2 4
Miles





The Soil Hydrologic Group map indicates the *Hydrologic soil groups* based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water

infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms (Wood County Soil Survey, March 2005). The following soil group descriptions are directly from the Wood County Soil Survey, page 241.

The four hydrologic soil groups are:

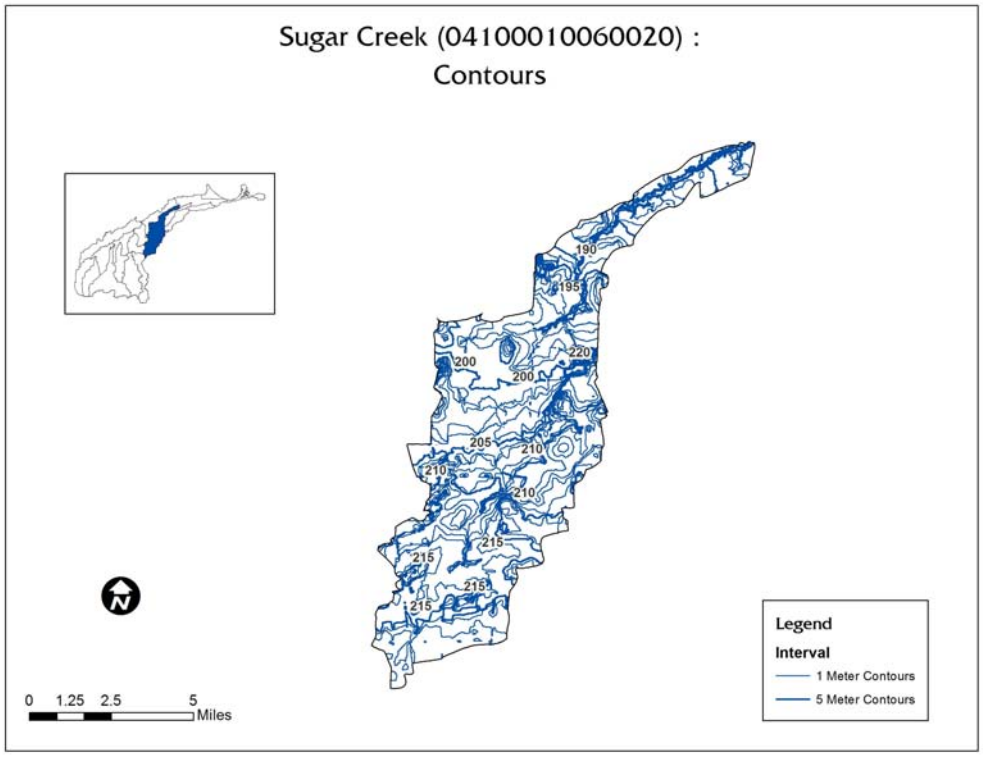
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

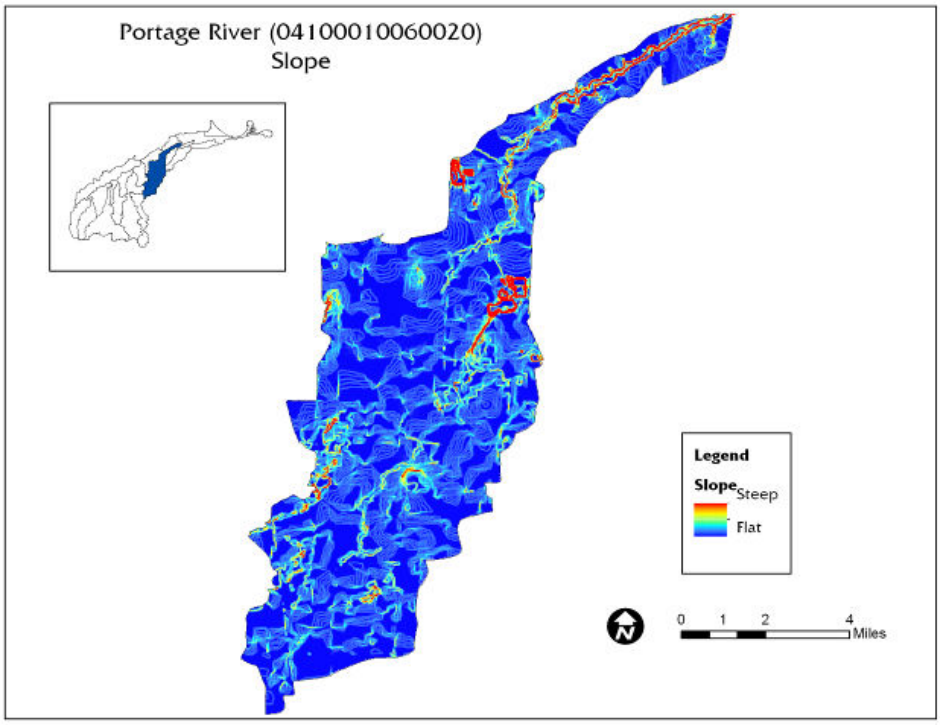
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately course texture. These soils have a moderate rate of water transmission.

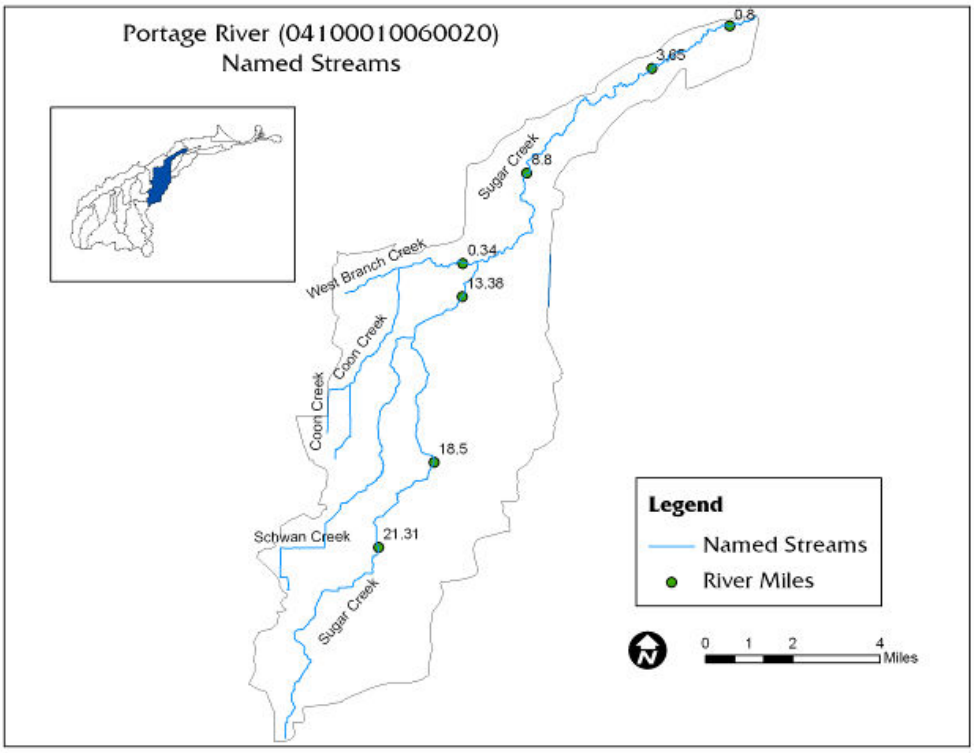
Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (**A/D, B/D, or C/D),** the first letter is for drained areas and the second is for undrained areas.




Portage River (04100010060020)
Slope
Legend
Slope
Steep
Flat
0 1 2 4
Miles


Portage River (04100010060020)
Named Streams
0.8
3.85
8.8
Sugar Creek
West Branch Creek
0.34
13.38
Coon Creek
Coon Creek
18.5
Schwan Creek
21.31
Sugar Creek
Legend
Named Streams
River Miles
0 1 2 4
Miles

Rare, Threatened, Endangered Species

HUC14 04100010 060 020 provides habitat for numerous species of plants, animals and mussels. Most of these species are *threatened* or *potentially threatened*. Protected areas include Aldrich Pond.

Rare, Threatened, Endangered Species			
Common Name	***Scientific Name***	**Last Observed**	**State Status**
Bald Eagle	*Haliaeetus leucocephalus*	2010	T
Canada Plum	*Prunus nigra*	2007-08-15	E
Canada Plum	*Prunus nigra*	2008-05-02	E
Golden-fruited Sedge	*Carex aurea*	1970-06	P
Golden-fruited Sedge	*Carex aurea*	2009-06-16	P
Raven-foot Sedge	*Carex crus-corvi*	1969-09	P
Rough Pennyroyal	*Hedeoma hispida*	2000-05-24	P
Rough Pennyroyal	*Hedeoma hispida*	1970-06-07	P
Western Meadowlark	*Sturnella neglecta*	1985-07	SI

T=Threatened, P=Potentially Threatened, E=Endangered, X=Presumed Extirpated, SC=Species of Concern

Mussel Species

Stream River Miles	Common Mussel Name	*Scientific Name*	Observed	Status
13.38	White Heelsplitter Cylindrical Papershell	*Lasmigona complanata* *Anodontoides ferrussacianus*	2008 2008	
3.65	Cylindrical Papershell Fat Mucket White Hellsplitter Fragile Papershell Pyganodon grandis	*Anodontoides ferrussacianus* *Lampsilis radiate luteola* *Lasmigona complanata* *Leptodea fragilis* *Pyganodon grandis*	2008 2008 2008 2008 2008	
Coon Creek 0.34	Lilliput	*Toxolasma parvum*	2008	

Attainment Status associated with Cause and Source of Impairments

HUC 8 – 04100010 (Portage River)									
HUC 10 – 04100010 04 (Middle Portage River)									
HUC 12 – 04100010 04 01 (Sugar Creek)									
HUC 14 – 04100010 060 020 (Sugar Creek)									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
1	2008	S02K05	Sugar Creek E of Bradner @ Greensburg Pike	21.31	12.0	WWH	Full	-	-
2	2008	S01092	Sugar Creek W of Helena @	18.50	17.0	WWH	Full	-	-

HUC 8 – 04100010 (Portage River)									
HUC 10 – 04100010 04 (Middle Portage River)									
HUC 12 – 04100010 04 01 (Sugar Creek)									
HUC 14 – 04100010 060 020 (Sugar Creek)									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
			U.S. RT. 6						
3	2008	S02S26	Sugar Creek W of Gibsonburg @ Anderson Rd.	13.38	35.0	WWH	Full	-	-
4	2008	S02S25	Sugar Creek SE of Woodville @ U.S. RT. 20	8.90	51.0	WWH	Full	-	-
5	2008	S02P01	Sugar Creek 1 MI. E of Elmore @ Elmore Eastern Rd.	3.65	56.0	WWH	Full	-	-
6	2008	300371	Sugar Creek @ Hessville Rd.	0.80	58.0	WWH	Full	-	-
7	2008	S02K06	Coon Creek S of Woodville @ Co. Rd. 32 (Anderson Rd.)	0.34	7.8	WWH	Partial	Nutrient/Eutrophication Biological Indicators, Sedimentation/Siltation, Direct Habitat Alterations	Non-irrigated Crop Production, Channelization.
Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010.									

Water Resources

Surface Water-

Designated Use for aquatic life is warm-water habitat (WWH). Recreation use assessment is Class B. That determines the acceptable E. Coli colony numbers as shown below in a summary table taken from the *Ohio 2010 Integrated Report,* Section F: Evaluating Beneficial Use: Recreation, p. F-1.

Summary of the recreation use assessment methods.		
Bathing Waters		
Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method Summary
E. coli	Seasonal geometric mean *E. coli* content* based on samples from the recreation season within a calendar year is 126 cfu/100 ml; single sample maximum is 235 cfu/100 ml.	Applied to the three Lake Erie shoreline assessment units, exceedence of the geometric mean bathing water criterion or an exceedence of the single sample maximum for more than 10% of the recreation season is considered an impairment of the bathing water use.
Primary Contact and Secondary Contact		

Indicator	Criterion (Table 7-13, OAC 3745-1-07)	Assessment Method Summary
E. coli	Seasonal geometric mean *E. coli* content* based on samples from the recreation season within a calendar year is: **Primary Contact Waters** Class A: 126 cfu/100 ml Class B: 161 cfu/100 ml Class C: 206 cfu/100 ml **Secondary Contact Waters** 1030 cfu/100 ml	Applied to streams and inland lakes. Data from a recreation season are assessed on a site-by-site basis and compared to the applicable geometric mean *E. coli* criterion whenever more than one sample result is available for a watershed assessment unit. Assessment units are considered to be in full attainment if all sites assessed within the assessment unit meet the applicable geometric mean criterion and in non-attainment if one or more sites assessed within the assessment unit exceed the applicable geometric mean criterion.

*** *E. coli* concentrations are expressed in colony forming units (cfu) per 100 milliliters (ml)**

All E. coli values are expressed as colony forming units (CFU) per 100 ml of water. Two sample sites were selected in this HUC by the Ohio EPA during the 2006-2008 *Biological and Water Quality Study of the Portage River Basin,* March 2010.

Elevated bacteria levels of E. coli were measured in each of the seven sample sites for Sugar Creek that is responsible (cause) for the non-attainment status for recreational use in this waterway. The sources of bacteria in the Sugar Creek relate to the number of failed home sewage treatment systems as well as sources from agricultural and municipal wastewater treatment plants.

Recreational Use Attainment						
Location	RM	Rec Use PCR Class	Number of Samples	E. coli Geometric **Mean <161** and Single Sample Maximum ≤ 523	Attainment Status	Sources of Bacteria
Coon CK @ CR 32 Anderson Rd)	0.34	B	5	296 & 3100	**NON**	HSTS: Package Plant: Agric.
Sugar CK @ Greensburg Pike	21.31	B	5	1026 & 9000	**NON**	HSTS; CAFO: Agric.
Sugar CK at U.S. 6	18.50	B	5	619 & 3800	**NON**	HSTS; Agric.
Sugar CK at CR 32 (Anderson Rd.)	13.38	B	5	338 & 8300	**NON**	HSTS; Agric.
Sugar CK at U.S. 20	8.90	B	5	403 &3100	**NON**	HSTS; Gibsonburg WWTP; Agric.
Sugar CK at Elmore Eastern RD.	3.65	B	5	210 & 1300	**NON**	HSTS; Golf course
Sugar CK at Hessville RD.	0.80	B	7	379 & 2400	**NON**	HSTS

Aquatic Life Use Assessment

Location	RM	Drainage Area	Aquatic Life Use	Attainment Status
Sugar Creek E of Bradner @ Greensburg Pike	21.31	12.0[H]	WWH	Full
Sugar Creek W of Helena @ US RT 6	18.5	17.0[H]	WWH	Full
Sugar Creek W of Gibsonburg @ Anderson Road	13.38	35.0[W]	WWH	Full
Sugar Creek SE of Woodville @ US RT 20	8.90	51.0[W]	WWH	Full
Sugar Creek 1 MI. E of Elmore @ Elmore-Eastern Road	3.65	56.0[W]	WWH	Full
Sugar Creek @ Hessville Road	0.8	58.0[W]	WWH	Full
Coon Creek S of Woodville @ Co. Rd. 32 (Anderson Road)	0.34	7.8[H]	Undesignated/Recommend WWH	Partial

Source: Division of Surface Water, Watershed Assessment Unit Summary, 2010 Ohio Integrated Report

Macro invertebrate Communities

Stream RM	Dr. Ar. (sq. mi.)	Data Codes	Qual. Taxa	EPT QI./Total	Sensitive Taxa QI./Total	Density QI./Qt.	CW Taxa	Predominant Organisms on the Natural Substrates With Tolerance Category(ies)	ICI[a]	Narrative Evaluation
21.31	12.0	-	51	11	9	M	0	Caddisflies (F), sowbugs(F), midgets (T,MI)	-	Marg. Good
18.50	17.0	-	51	15	10	M-H	0	Caddisflies (F), baetid mayflies (F), sowbugs (F)	-	Good
13.38	35	-	51	14/19	17/28	M/519	0	Riffle beetles (F), Helicopsyche caddisflies (MI)	52	
8.80	51	-	49	15/16	14/19	M/531	0	Baetid mayflies (F), hydropsychid caddisflies (F), riffle beetles (F)	42	
3.65	56	-	41	10	13	L	0	Baetid mayflies (F), oligochaete worms (T)	-	Marg. Good
0.80	58	15	35	10/12	9/21	L/77	0	Mayflies(F), riffle beetles (F)	38	
Coon Creek 0.34	7.8	-	44	4	10	M	0	Midges (F,T,MI), blackflies (F), Physella snails (T)	-	Low Fair

Source: Ohio EPA, 2008

Public Drinking Water Supply Assessment

HUC	Reporting Category	Cause of Impairment	Nitrate Watch List	Pesticide Watch List

Sugar Creek 4100010-060-020	NA	None	No	No

Fish Tissue Assessment			
HUC	**Reporting Category**	**Causes of Impairment**	**PCB Concentration**
Sugar Creek 4100010-060-020	3i	None	

Ohio EPA 1994 and 2008 Water Quality Monitoring Results						
River Mile	**Date**	**IBI**	**ICI**	**MiWB**	**QHEI**	**STATUS**
13.4	1994	32	-	8.1	44.5	Good/Fair
8.9	1994	36	-	8.6	63.5	Good/Marginally Good
Coon Creek 0.34	*2008*	*28*	*LF**	N/A	*30.5*	*Partial*
0.80	*2008*	*42*	*38*	*7.2^{ns}*	*69.0*	*Full*
3.65	*2008*	*49*	*MG^{ns}*	*8.0*	*64.5*	*Full*
8.80	*2008*	*42*	*42*	*7.2^{ns}*	*67.0*	*Full*
13.38	*2008*	*35*	*52*	*8.7*	*38.0*	*Full*
18.50	*2008*	*32*	*G*	*N/A*	*38.5*	*Full*
21.31	2008	30	MG^{ns}	N/A	34.5	*Full*

a - River Mile (RM) represents the Point of Record (POR) for the station, not the actual sampling RM.
b - MIwb is not applicable to headwater stream with drainage areas ≤20 mi^2.
c - A narrative evaluation of the qualitative sample based on attributes such as EPT taxa richness, number of sensitive taxa, and community composition was used when quantitative data was not available or considered unreliable. VP=Very Poor, P=Poor, LF=Low Fair, F=Fair, MG=Marginally Good, G=Good, VG=Very Good, E=Exceptional
d - Attainment is given for the proposed status when a change is recommended. Aquatic life use in superscript.
ns - Non-significant departure from biocriteria (≤4 IBI or ICI units, or ≤0.5 MIwb units).
* - Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.
Italic: 2008 TMDL scores in review.

Benchmark Score Tables

General narrative ranges assigned to QHEI scores.				
Narrative Rating		QHEI Range		
		Headwaters (≤ sq mi)	Larger Streams	Lacustuary
Excellent		≤ 70	≤ 75	≤ 80
Good		55 to 69	60 to 74	60 to 80
Fair		43 to 54	45 to 59	45 to 59
Poor		30 to 42	30 to 44	30 to 44
Very Poor		<30	<30	<30

Biological Criteria Benchmarks

Biological Criteria		Lacustuary Benchmarks[1]
	Huron Erie Lake Plain (HELP)	

Index-Site Type	EWH	WWH	MWH	LRW	Exceptional	Good	Fair	Poor	Very Poor
IBI-Headwaters	50	**28**	20	18	N/A	N/A	N/A	N/A	N/A
IBI-Wading	50	**32**	22	18	N/A	N/A	N/A	N/A	N/A
IBI-Boat	48	**34**	20	16	50	42	31	17	<17
MIwb-Wading	9.4	**7.3**	5.6	4.5	N/A	N/A	N/A	NA	N/A
MIwb-Boat	9.6	**8.6**	5.7	5.0	10	8.6	5.6	2.8	<2.8
ICI	46	**34**	22	8	52	42	25	12	<12

[1] **Proposed Lacustuary scoring breakpoints. These have not yet been adopted into rule.**

Ground Water

Source Water Assessment Plan (SWAP)

To protect the ground water aquifer, a protection area buffer is delineated for the land area surrounding the wellheads. The protection area is established to help protect the drinking water supply from pollution contaminates.

Source Water Assessment Plans within the Sugar Creek HUC14-04100010-060-020

- Elmore has a plan – **LOW** susceptibility
- Bradner has a plan – **HIGH** susceptibility
- Gibsonburg has a plan – **HIGH** susceptibility

Within the source water protection area an inventory was conducted by the Ohio EPA and village personnel to identify all *potential* sources of contamination which could reach ground water levels. Bradner and Gibsonburg have high susceptibility levels due to the presence of volatile organic compounds within the wellhead area and wells are located in sensitive potential karst areas that threaten contamination to the ground water aquifers. The source water assessment plan (SWAP) identifies and indicates the geologic structure of soil types, the depths to bedrock and limestone fractures which present high susceptibility potentials to contamination.

The Village of Elmore has a low susceptibility to contamination based on wellhead locations and land use. The SWAP enhances the protection strategies for these areas in Elmore.

All Public Water Systems are required by law to provide an annual Consumer Confidence Report (CCR) to the public. Any contaminants or a risk to human health found in data collected in the wellheads is reported on the CCR. The CCR is one or two pages of user-friendly information and includes contact information for state authorities.

Recently the Village of Gibsonburg detected benzene levels in one of the six wellheads that provide drinking water to the residents. At the end of 2010, that well was officially closed and

capped. Despite great efforts from local and state officials, the source of the pollutant contaminate have not been identified or located due to karst and limestone fractures. When contamination was detected, officials responded immediately to the situation to protect and inform the public.

The Drinking Water Source Protection Areas for Elmore, Bradner, and Gibsonburg, are shown in the following figures (Drinking Water Source Assessments for the Villages of Elmore, Bradner, and Gibsonburg, Ohio EPA 2010, 2002, and 2011 respectively).

Legend

- Above Ground Storage Tank
- Auto Repair/Body Shop
- Barber/Beauty Shop
- Cemetery
- Food Processor
- Gas Station (Existing/Abandoned)
- Hardware/Lumber/Parts Store
- Garage (Municipal)
- Leaking Underground Tank
- Machine/Metalworking Shop
- Medical/Dental Office/Clinic
- NPDES Permitted Facility (PCS)
- Other Commercial Source
- PCE Facility (PADS)
- Petroleum Product Production
- Plastics/Synthetics Producer
- Recycling Facility
- Salt Storage Area
- Active Wells
- Inner Management Zones
- Outer Management Zones

Feet
0 440 880 1,760

Protection Area Data

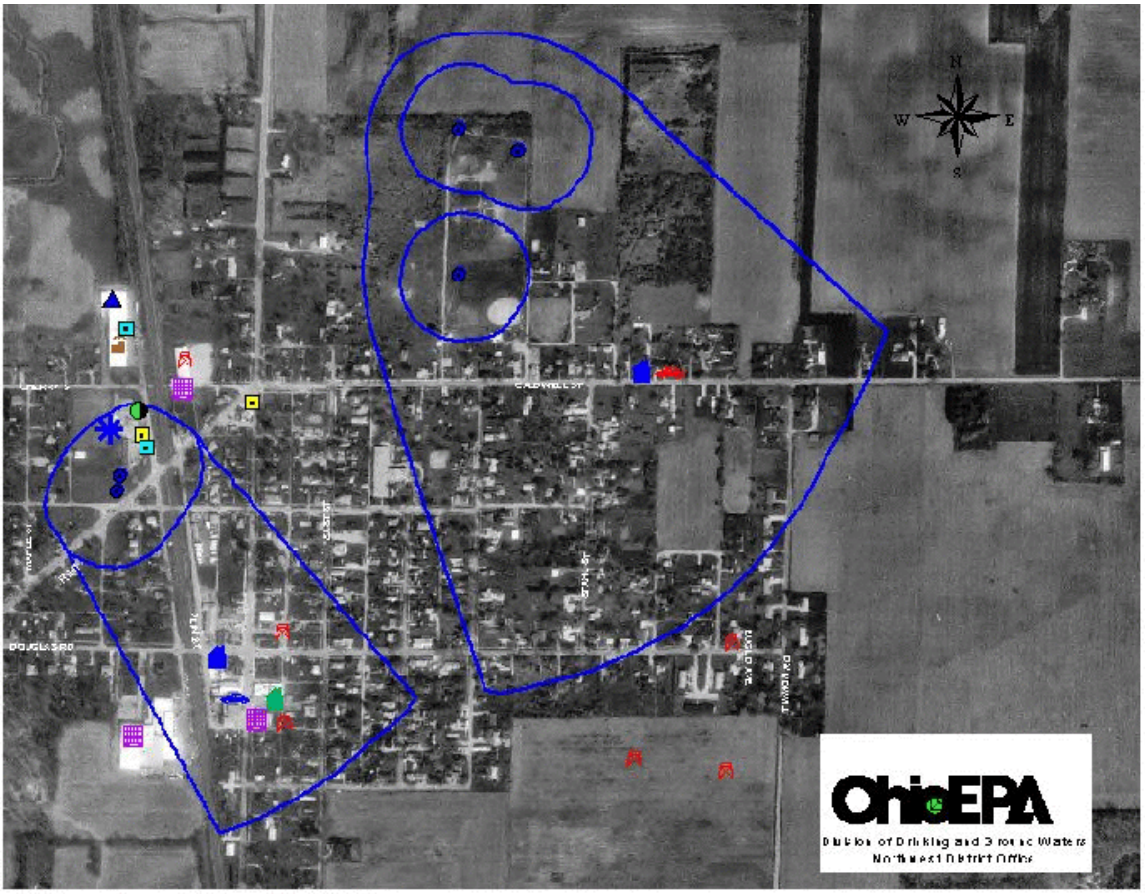
Number of Wells = 4
Total Well Pumping Rate = 129,000 GPD
Porosity = 0.03
Aquifer Thickness = 352 feet
Hydrogeologic Setting = Carbonate Aquifer
Primary Land Use = Residential

LOW | MODERATE | HIGH

SUSCEPTIBILITY

Ohio EPA
Division of Drinking and Ground Waters

DATE: February 2010



400 0 400 800 Feet

- Above Ground Storage Tank
- Auto Repair/Body Shop
- Barber/Beauty Shop
- Car/Boat/Camper Dealer
- Electrical Substation (Transformer)
- Laundromat
- Leaking Underground Tank
- Machine/Metalworking Shop
- OEPA DERR Sites
- Plastics/Synthetics Producer
- Toxic Release Inventory (TRI)
- Oil & Gas wells

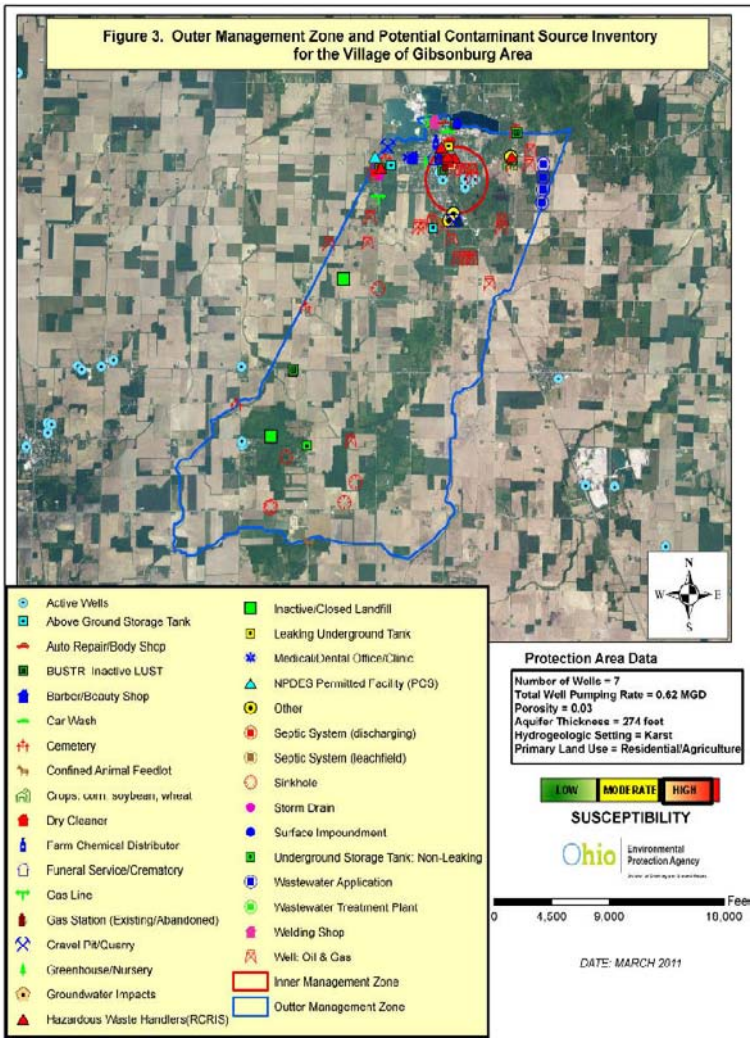
Information used to develop the Protection Area:

Number of Wells = 5
Total well Pumping Rate = 114,320 GPD
Porosity = 0.15
Aquifer Thickness = feet
Hydrogeologic Setting = Bedrock

LOW | MODERATE | HIGH

SUSCEPTIBILITY

SEPTEMBER, 2002



DRASTIC MAP

The sensitivity of the groundwater to local sources of contamination is determined and rated by **DRASTIC** maps as described below:

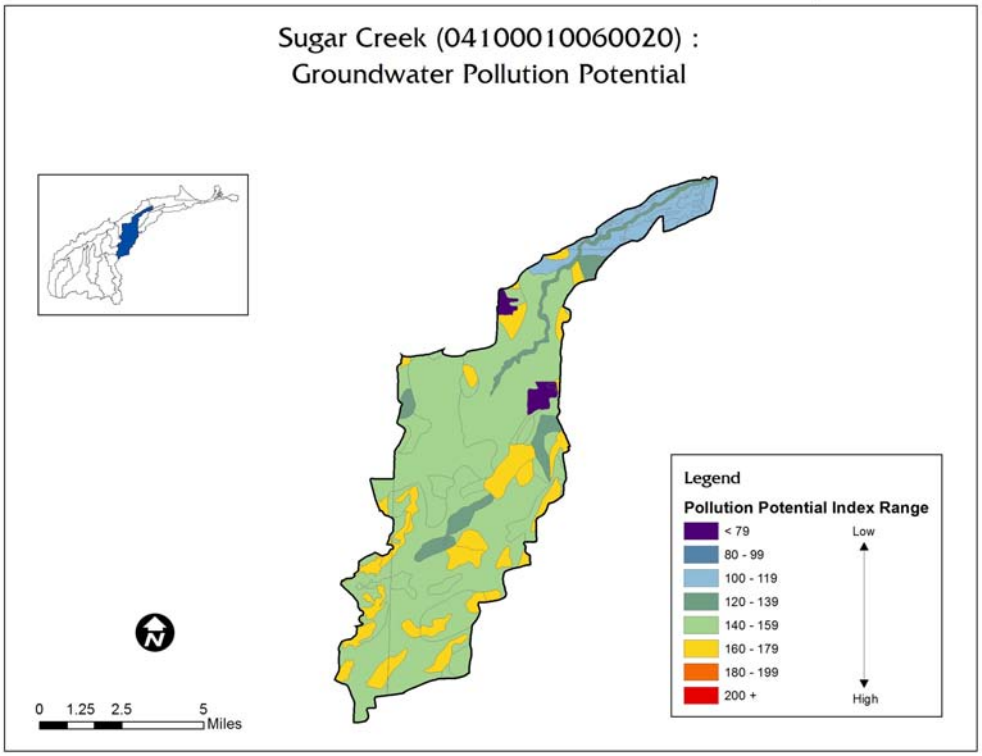
Inherent within each geologic setting are the physical characteristics which effect the groundwater pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:

D – Depth to Water
R – Net Recharge
A – Aquifer Media
S – Soil Media
T – Topography
I – Impact of the Vadose Zone Media
C – Conductivity (Hydraulic) of the Aquifer (ODNR, 1994)

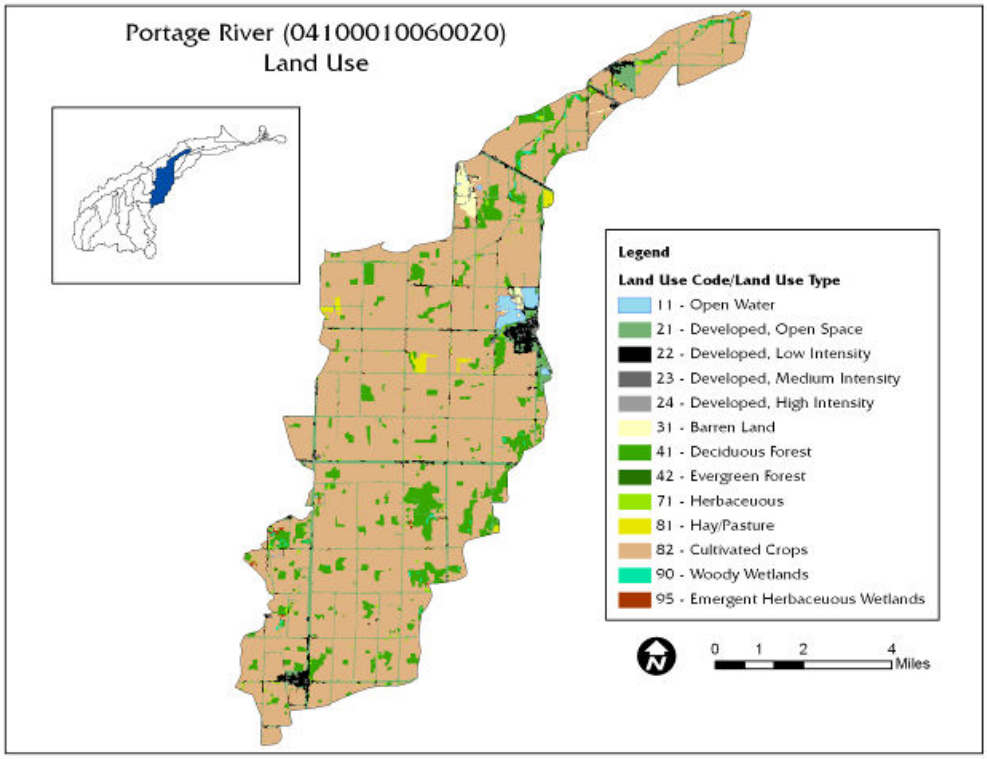
Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index, the greater the vulnerability to contamination (ODNR, 1994).

The average ground water pollution index potential for the Sugar Creek watershed is 147 with a range of 100-176.

The Ohio Department of Natural Resources, Division of Water, Water Resources Section is the responsible agency to map groundwater resources throughout the state. Greater detail on DRASTIC maps for the Portage can be found in Chapter 4 of the watershed plan.



Sub-watershed (04100010-04-01)		
060-020		
Land Use	**Percent**	**Acres**
Urban	9.0%	3,397
Forest	10.0%	3,772
Pasture	0.6%	217
Cropland	78.4%	29,558
Other	2.0%	764
Total Acres	100%	37,708



Livestock Inventory							
HUC 4100010060020							
Type of Animal		**Hancock**	**Ottawa**	**Sandusky**	**Seneca**	**Wood**	**Estimates for HUC**
Percent of County in HUC		0.0%	1.6%	11.8%	0.0%	1.0%	
Cattle	Farms	129	89	167	264	144	**23**
	Animals	4,233	1,523	4,612	10,096	6,287	**635**
Hogs	Farms	51	15	37	62	30	**5**
	Animals	32,343	3,639	5,591	42,808	39,469	**1,133**
Horses	Farms	105	63	132	72	128	**18**
	Animals	844	444	772	463	1,004	**109**
Poultry	Farms	49	22	41	62	47	**6**
	Animals	NA	779	1,042	4,283	NA	**NA**
Sheep	Farms	32	12	41	61	21	**5**
	Animals	1,134	335	765	2,770	21	**96**
Total							57
							1,933
Source: 2007 Census of Agriculture http://www.agcensus.usda.gov/							

Point Sources

Municipal

- Gibsonburg WWTP (2PA00005)
- Risingsun WWTP (2PA00094)

Package Plants

- Atlas Engine Works Inc. (2IS00003)
- Ports Petroleum Fuel Mart #767 (2PR00190)
- Rollersville Tavern
- Twin Maples MHP (2PY00069)
- US 6 23 Retail Sales, Inc (2PR00202)

Non-Point Sources:

Critical Sewage Areas

- Sugar Creek (Sandusky County)
- Bays – Bradner Roads (Wood County)

Estimates of HSTSs				
Watershed	**Housing Units without sewers**	**Est. Unsewered Population (2000)**	**Unsewered Housing Units per acre**	**Unsewered Population per acre**
04100010060020	1,501	3,951	0.04	0.105

Sources: 2000 Census data and TMACOG "208" Plan. Analysis identifies approximate number of housing units without sewers in each watershed as an estimate of number of HSTSs.

Aquatic Life Use Impairments	
Causes	**Sources**
Direct habitat alterations	Channelization
Nutrient/eutrophication biological indicators	Nonirrigated crop production
Sedimentation/siltation	
Source: Ohio 2010 Integrated Report, Watershed Assessment Unit Summary	

Water Supply:

Public Water System	Population Served	Primary Water Source
Bradner	1,100	Ground
Elmore	1,378	Ground
Gibsonburg	2,452	Ground

Water Quality Impairments

The OEPA Integrated Report assesses each watershed's attainment status for 1) Public Drinking Water Supply, 2) Recreation, 3) Human Health, 4) Aquatic Life, and 5) Fish Tissue. The Integrated Report identifies causes and sources of impairments where watersheds are not in attainment with water quality standards.

Background:

The Sugar Creek watershed of 62.2 square miles drains the land area of four counties and is only one of two Portage 14-digit HUC to do so. As a result of crossing county lines, the land area and waterways are subject to the jurisdictions of those counties.

The upstream and downstream characteristics of this watershed are very different from each other. The headwaters and main land area of the HUC lies in Sandusky County and 48.7 miles of ditches are maintained by the Sandusky Soil and Water Conservation District. The maintained area is in the larger headwater portion of the HUC. The waterway has been channelized and river banks cleared for agricultural land use.

Sugar Creek north of Forbose Road is maintained by the Sugar Creek Protection Society, a grassroots group of neighbors, to retain its riparian habitat. The group has maintained the stream by agreement with their County Commissioners.

The greatest challenge for Sugar Creek is the continued protection of the natural habitat in the downstream areas of the stream before reaching the Portage River. Conservation easement protection is recommended for the riparian areas of the lower reaches of Sugar Creek.

Sugar Creek subwatershed is located in Woodville, Scott, Madison, and Washington Townships, Sandusky County. This area has approximately 1,374 households. The Health Department has no records of any permits for HSTSs for 1,020 households, or seventy-five (75%) percent of the households. Of the twenty-five (25%) percent of permits on record (353 permits), one hundred forty-one (141) of these sewage systems were installed before 1983 (Sandusky County HSTS Plan, 2003).

Soils in this area are rated severe for sewage disposal systems. There are large areas where the soil depth to fractured limestone is Shallow (0-40" of soil depth). There is potential for the installation of on-lot household sewage treatment systems, with careful design planning. (Sandusky County HSTS Plan, 2003). The Sandusky County Health Department has designated most of the Sandusky County portion of the watershed as a Critical Sewage Area.

HSTS Systems within the Sugar Creek subwatershed			
		Permits	
Total households over 4 township area within Sugar Creek watershed boundary.	**1,374**		
Number of households **with** permits on record at Sandusky County Health Department.		**354**	
Number of households **without** household sewage permits.			**1,020**
Of those 354 households with permits on file, the number of permits issued **after 1983** is: As of 2011 some of these systems are already 28-yrs old with a high rate for failure due to age, type and soils. The State of Ohio Department of Health estimates today that 25% of permitted systems are in some degree of failure. The average life of a well-maintained home sewage treatment system with a routine pump-out schedule is estimated between 20 – 30 years of operation.		**141**	
(354 system permits minus 141 permits issued AFTER 1983) Equals 213 permits issued BEFORE 1983. Historically, systems in place before the 1980s were connected to agricultural field tile systems which drain to the ditch, then to the river.			**213**
Estimate of failed household sewage systems now contributing E. coli bacteria, nitrogen, ammonia and other pollutants to the waterway:			**1,233**

Elevation at Bradner and Cygnet Roads, the creek's source is 717 feet above sea-level. At CR 115 (Forbose Rd.) the lower terminus of the two channels, the elevation is 647, while at the creek's confluence with the Portage River, the elevation is less than 600. In many areas, Sugar Creek flows over glacial boulders and limestone bedrock which aerate the water.

The water quality of Sugar Creek was assessed in 1994 for its aquatic life use attainment status, habitat, macro invertebrate community, fish community, and to determine an area of degradation value and this data was reported in the Ohio EPA's *Biological and Water Quality Study of the Portage River Basin.* Sampling was conducted at river mile 13.4 at the Anderson Road in Madison Township and RM 8.8/8.9 at State Route 20 in Woodville Township, Sandusky County. The creek reached full attainment status for warm water habitat at both sites. Data below:

Year	River Mile	Fish/Invertebrate	IBI	MIwb	ICI	QHEI	Attainment Status	Comment
1994	13.4	Anderson Rd.	32	8.1	Marginally	44.5	Full	Nonpoint

					good			source
1994	8.9/8.8	State Route 20	36	8.6	Marginally good	63.5	Full	Nonpoint source
2008	13.4	Anderson Rd.	35	8.7	52	38.0		
2008	8.9/8.8	State Route 20	42	7.2	42	67.0		

In 1994, EPA noted that although the site at RM 13.4 had been channelized there was fairly good rifle development. An abundance of aquatic macrophytes appeared to assimilate the nutrient load and minimize the effect of silt on the micro invertebrates. There were three different bivalve mollusk species present and nine pollution tolerant taxa present. The Qualitative Community Tolerance Value (QCTV) score was 38.9 which exceed the 75th percentile for HELP ecoregion reference sites. Macro invertebrate community performance was very good.

The effects of nonpoint source pollution on the macro invertebrate community were evident at RM 8.8 (downstream of the channelized section). Despite improved habitat, community changes in response to increased nutrient enrichment were evident. High densities of caddisflies and fingernail clams were present in the riffle and red midges and fingernail clams predominated in the runs. Also several tolerant species (Leeches) were present. The QCTV decreased to 35.6 and the community was rated very well.

Dissolved oxygen concentrations meet the warmwater habitat standard of 4.0 mg/l. Low dissolved oxygen indicates the increased level of nutrient enrichment in the water that consumes water oxygen levels. High nutrient enrichment is a strong indicator of nonpoint source pollution from stormwater runoff of agricultural fields and home sewage system failure. Habitat and riparian stream buffers would greatly benefit the upstream reaches of Sugar Creek as well as the use of cover crops and controlled drainage systems.

The headwaters of Sugar Creek originate from drainage areas in and around the Risingsun. The Northwestern Water and Sewer District completed a conventional gravity/forcemain sewer system and WWTP in 2008. As the drainage pattern enlarges through the agricultural land into Sandusky, County the headwater drainage become ditch maintained by agreement between the landowner and the Sandusky Soil and Water Conservation District. The maintenance includes removal of trees. Also, there are miles of stream/ditch banks that are plowed row crops, up to the banks of the waterway, void of any best management or conservation practice for erosion, sediments control or riparian habitat. The area would benefit from cover crop rotations and controlled drainage systems to eliminate excessive nonpoint source contributions into Sugar Creek.

The following information about wastewater treatment facilities in this subwatershed is taken from the *TMACOG Areawide Water Quality Management Plan*. Additional information can be found on-line at http://www.tmacog.org/Environment/208currentplan/TMACOG_AWQMP.pdf

The Village of Gibsonburg owns and operates wastewater treatment facilities and collection system within the corporate limits. The Gibsonburg WWTP present facility is an oxidation ditch facility with aerobic digestion, chlorination/dechlorination, and sludge drying beds. Its rated capacity is 0.5 mgd average daily and 1.23 mgd peak daily. In 2009, the average daily flow was .379 mgd as compared to the average daily flow of .471 mgd in 2007 which was before the Hurlbut Ditch Relocation project. The sewers were designed as a combined system, using existing storm sewers and septic tanks. The septic tank effluent discharges to the combined sewer system; the village is responsible for the handling of septage. The septic tanks reduce the strength of raw sewage by settling out solids; BOD_5 is about 125 ppm. Effluent discharges to Hurlbut Ditch and Dromm Ditch/Wolf Creek, both Portage River tributaries. The sewer system has two CSOs and a 1.748 million gallon overflow retention basin. The basin is aerated for a design storm of 0.25 inches/hour.

In 2007 Ohio EPA approved the Village's Combined Sewer System Long Term Control Plan. The study found that the great majority of combined sewerage overflows came from the West Branch CSO. A large part of the extraneous flow comes from 584 acres of agricultural land south of the village. This area drains to Hurlbut Ditch; and the flow from the ditch enters the combined sewer system, overloading the West Branch CSO area. Hurlbut Ditch was re-routed around the village so that these flows do not enter the sewer and will greatly reduce extraneous flows.

The first project to implement the Combined Sewer System Long Term Control Plan was completed in 2008. This first phase was to re-route Hurlbut Ditch around the west side of the village, eliminating its flows from the combined sewer system. The project cost was $1.68 million.

Before completion of the Hurlbut Ditch Relocation which was identified as Phase 1 of the Village's CSO Long-Term Control Plan, the wastewater treatment facility did not have additional capacity. The average daily flow upon completion of Phase 1 (2009) is .379 mgd which equals approximately .100 mgd of available capacity.

The second phase, completed in 2010, included new storm sewers on Yeasting and Madison Streets (west side) and on Madison, Main, Ohio, and Wilson Streets and Windsor Lane at a cost of $1,815,000.

With removal of Hurlbut Ditch flows from the sanitary system, Ohio EPA is requiring the Village to submit a revised Long Term Control Plan by May of 2012. The revised Long Term Control Plan will be based on new flow data, now that the system does not have to handle stormwater from Hurlbut Ditch.

The future needs for Gibsonburg are to update and implement its Long Term Control Plan, due in May 2012. The amended Long Term Control Plan schedule calls for the village to complete funding applications in late 2012, design in 2013, and complete construction in 2014.

The 208 plan recommends for Sandusky County to install sanitary sewers to serve the unincorporated Rodriguez Street area.

Village of Bradner owns and operates wastewater treatment facilities, and collection system within the corporate limits. The Bradner WWTP present facility is a three-cell lagoon facility, built in 1988. It is a controlled discharge lagoon, meaning it does not discharge continuously, nor does it discharge every day. The system uses conventional gravity sewers. In 2009, Bradner received 75% ARRA funding on a $389,000 upgrade of five lift stations.

The subwatershed would benefit from best management practices for sediment control, riparian restoration and cover crop rotations between RM 10.0 and 22.0. Along the twelve miles of river there are various woodlands on one side of the stream and a few locations of wide stream bed which could benefit from sediment and erosion practices. Some wood lands may benefit from forest management plans and conservation easements.

Other recommendations include:

- Partner with Soil & Water Conservation Districts to implement agricultural best management practices between RM 10.4 to 14.5 to decrease nutrient runoff along maintained waterways.
- Seek landowners to contribute acreage for conservation and wildlife conservation in the headwaters of Sugar Creek to connect to conservation habitat plots already established between RM 25.0 to 23.0.
- Work with livestock producers of a small grazing beef herd to install streambank fencing and BMP measures to protect 53,599 lineal feet of streambank between RM 18.5 and 23.0.

HUC14-04100010-060-020 also has a segment of stream that is not designated as a specific aquatic life use standard. The recent release of the Ohio EPA 2008 water sample data indicates a recommendation for a warm-water habitat (WWH) designated use. The sample site at river mile 0.34 on Coon Creek, south of Woodville @ CR 32 (Anderson Rd.) is currently in Partial Attainment status.

At the downstream of Sugar Creek before it converges with the Portage River, elevated measurements of Atrazine were collected in water data at RM 0.08. A measurement of 6.79 exceeds the MCL for drinking water and/or the WQ criteria, for samples collected in June 2008 Details are available in the OHIO EPA Technical Report EAS/2010-4-4.

Sugar Creek RM 21.31 phosphorus count is 3 times higher than the standard. (TMDL, 2010. p.39).

Problem Statement #1: (Bacteria)

The water quality the Sugar Creek subwatershed is impaired by elevated measurements of E. coli bacteria. The Portage TMDL data collected by Ohio EPA in 2008 indicate that all 7 of the HUC's sampling sites are in non-attainment for E. coli. The TMDL cites failed HSTS, package plants, and the Gibsonburg WWTP as the causes of impairment due to high E. coli bacteria levels.

In this HUC are an estimated 1,501 HSTS; by density of onsite systems, this is a moderately populated HUC. This area includes five package plant (four permitted, one unpermitted), and two Critical Sewage Areas (Sugar Creek in Sandusky County bounded by US 23, County Road 41, and County Road 32), and the Bays & Bradner Road area in Wood County. The latter is under orders to install sewers; it is anticipated the area will connect to the Risingsun system.

There are two municipal wastewater plants in the HUC. The Risingsun plant was built in 2008, connecting nearly 700 residents to a sewer who previously had used onsite systems. As sewer taps were connected after completion of the plant, this improvement may post-date the 2008 TMDL samples.

Gibsonburg has a combined sewer system; its Long Term Control Plan was completed in 2007. The first project was to reroute Hurlbut Ditch in 2009, eliminating a substantial groundwater flow from the sanitary system. The second phase, completed in 2010, was construction of new storm sewers on Yeasting and Madison Streets (west side) and on Madison, Main, Ohio, and Wilson Streets and Windsor Lane, reducing stormwater flows into the sanitary sewers. Additional CSO improvements may be needed, possibly including an equalization facility for the wastewater plant. Cost figures are not yet available.

Goal 1.1: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 9.6 million gallons of HSTS effluent annually.

Objectives

- Replace or upgrade 10% of watershed's HSTS or 150 systems
- Bays / Bradner sewers completed and all structures tapped in
- Sugar Creek watershed in Sandusky County Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in.

Goal 1.2: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 9.3 million gallons of package plant effluent annually.

Objectives

- Upgrade 5 package plant(s). Effluent quality meets effluent standards.

Goal 1.3: Reduce E. coli loadings from municipal wastewater systems to meet recreational bacteria water standards.

Objectives

- Implement Gibsonburg Long Term Control Plan to meet effluent standards

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Bacteria	1.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$2,250,000	County Health Dept, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 150 systems	9.6 million gallons/year sewage discharge eliminated
	1.1	♦Construct sewers for Bays / Bradner Rd Critical Sewage Area ♦Project is under orders	Included in West Millgrove project	Northwestern Water and Sewer District, Wood County Health Department	2014	Bays / Bradner sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦ Sugar Creek watershed Critical Area in Sandusky County ♦Define study area with OEPA, Wood County Health Department, Northwestern Water and Sewer District ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$526,702	Sandusky County Health Department, Sandusky County Sanitary Engineer, OEPA	2012-22	Sugar Creek watershed in Sandusky County Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.2	♦Test package plant effluent for phosphorus ♦Set effluent standard in existing or new NPDES permit(s) ♦Enforce upgrades for phosphorus removal as needed	$18,000	Ohio EPA	2012-2017	Upgrade 5 package plant(s). Effluent quality meets effluent stds	9.3 million gallons/year effluent improved

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	1.3	♦ Secure funding for new WWTP ♦ Implement Long Term Control Plan	NA	Village of Gibsonburg	NA	Implement Gibsonburg Long Term Control Plan to meet effluent standards	NA

Problem Statement #2: (Nutrients: phosphorus and nitrate)

The Ohio EPA TMDL found 6 of the 7 sampling sites in this HUC to meet Aquatic Life attainment standards. The Portage TMDL recommends a total phosphorus load allocation of 3.62 kg/day, requiring a nonpoint source load reduction of 1,565 lb P/year. HSTS systems should be addressed as noted above due to recreational non-attainment. The Sugar Creek sampling sites were all in attainment; the site on Coon Creek at County Road 32 was in partial attainment with nutrient eutrophication given as a cause of impairment. Agricultural BMPs should be applied throughout the watershed, with priority for habitat restoration BMPs in the Coon Creek subwatershed.

Goal 2.1: Meet TMDL target for phosphorus load reduction by 800 and nitrate load by 3,382 lb/year from HSTS.

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 150 systems
- Bays / Bradner sewers completed and all structures tapped in
- Sugar Creek watershed in Sandusky County Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in.

Goal 2.2: Meet TMDL target for phosphorus load reduction by 544 and nitrate load by 2629 lb/year from package plants.

Objectives:

- Upgrade 5 package plant(s). Effluent quality meets effluent standards.

Goal 2.3: Meet TMDL target for phosphorus by upgrading municipal wastewater plants to meet effluent standards.

Objectives:

- Implement Gibsonburg Long Term Control Plan to meet effluent standards.

Goal 2.4: Meet TMDL target for phosphorus load reduction by 228 and nitrate load by 1,143 lb/year from agricultural practices.

Objectives:

- 200 acres of cover crops
- 50 acres of controlled drainage
- 50 acres of permanent hay
- 150 acres of riparian buffers
- 25 acres of restored wetlands
- 250 LF of stream restoration
- 250 LF of overwide / 2-stage ditch reconstruction
- 13206 acres under NRCS 590/1 Nutrient Mgt
- 5660 acres under NRCS 590/3 Nutrient Mgt
- 1500 acres of filter strips
- 200 acres of conservation tillage. \

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Nutrients (phosphorus and nitrate)	2.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$2,250,000	County Health Dept, TMACOG, Ohio EPA	2012 - 2022	Replace or upgrade 10% of watershed's HSTS or 150 systems	Reduce phosphorus load by 800 and nitrate load by 3,382 lb./year
	2.1	♦Construct sewers for Bays / Bradner Rd Critical Sewage Area ♦Project is under orders	Included in West Millgrove project	Northwestern Water and Sewer District, Wood County Health Department	2014	Bays / Bradner sewers completed and all structures tapped in	Included in HSTS totals
	2.1	♦Prioritize and schedule sanitary survey ♦ Sugar Creek watershed Critical Area in Sandusky County ♦Define study area with OEPA, Wood County Health Department, Northwestern Water and Sewer District ♦Conduct sanitary survey ♦Issue recommendations	$526,702	Sandusky County Health Department, Sandusky County Sanitary Engineer, OEPA	2012-22	Sugar Creek watershed in Sandusky County Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
		based on survey findings					
	2.2	♦Test package plant effluent for phosphorus ♦Set effluent standard in existing or new NPDES permit(s) ♦Enforce upgrades for phosphorus removal as needed	$18,000	Ohio EPA	2012-2017	Upgrade 5 package plant(s). Effluent quality meets effluent stds	Reduce phosphorus load by 544 and nitrate load by 2629 lb./year
	2.3	♦ Secure funding for new WWTP ♦ Implement Long Term Control Plan	NA	Village of Gibsonburg	NA	Implement Gibsonburg Long Term Control Plan to meet effluent standards	NA
	2.4	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$12,000	SWCD, NRCS, farmers	2012-2027 in phases	200 acres of cover crops	Reduce phosphorus load by 162 and nitrate load by 324 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.4	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$23,550	SWCD, NRCS, farmers	2012-2027 in phases	50 acres of controlled drainage	Reduce phosphorus load by 16 and nitrate load by 42 lb./year
	2.4	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$14,000	SWCD, NRCS, farmers	2012-2027 in phases	50 acres of permanent hay	Reduce phosphorus load by 33 and nitrate load by 65 lb./year
	2.4	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$105,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	150 acres of riparian buffers	Reduce phosphorus load by 45 and nitrate load by 90 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.4	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$127,656	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	25 acres of restored wetlands	Reduce phosphorus load by 15 and nitrate load by 134 lb./year
	2.4	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$87,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	250 LF of stream restoration	Reduce phosphorus load by 10 and nitrate load by 19 lb./year
	2.4	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$22,250	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	250 LF of overwide / 2-stage ditch reconstruction	Reduce phosphorus load by 24 and nitrate load by 48 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.4	♦Seek cooperators for Nutrient Management NRCS 590 Level 1 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management NRCS 590 Level 1 BMPs with farmers	$264,129	SWCD, NRCS, farmers	2012-2022	13206 acres under NRCS 590/1 Nutrient Mgt	NA
	2.4	♦Seek cooperators for Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with farmers	$226,396	SWCD, NRCS, farmers	2012-2022	5660 acres under NRCS 590/3 Nutrient Mgt	NA
	2.4	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$207	SWCD, NRCS, farmers	2012-2027 in phases	1500 acres of filter strips	Reduce phosphorus load by 15 and nitrate load by 15 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.4	♦Identify & prioritize fields suited for Conservation Tillage BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Conservation Tillage BMP with farmer	$3,000	SWCD, NRCS, farmers	2012-2027 in phases	200 acres of conservation tillage	Reduce phosphorus load by 29 and nitrate load by 406 lb./year

Problem Statement #3: (Siltation/Sedimentation)

The Ohio EPA TMDL found 6 of the 7 sampling sites in this HUC to meet Aquatic Life attainment standards. The Sugar Creek sampling sites were all in attainment; the site on Coon Creek at County Road 32 was in partial attainment with sedimentation/siltation given as a cause of impairment, and crop production and channelization as sources. Agricultural BMPs should be applied throughout the watershed, with priority for habitat restoration BMPs in the Coon Creek subwatershed.

Goal 3.1:

Reduce sedimentation impairments by decreasing sediment load by 170 lb/year from agricultural practices.

Objectives:

- 200 acres of cover crops
- 50 acres of controlled drainage
- 50 acres of permanent hay
- 150 acres of riparian buffers
- 25 acres of restored wetlands
- 250 LF of stream restoration
- 250 LF of overwide / 2-stage ditch reconstruction
- 1500 acres of filter strips
- 200 acres of conservation tillage.

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Sedimentation	3.1	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$12,000	SWCD, NRCS, farmers	2012-2027 in phases	200 acres of cover crops	Reduce sediment load by 80 lb./year
	3.1	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$23,550	SWCD, NRCS, farmers	2012-2027 in phases	50 acres of controlled drainage	Reduce sediment load by 19 lb./year
	3.1	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$14,000	SWCD, NRCS, farmers	2012-2027 in phases	50 acres of permanent hay	Reduce sediment load by 17 lb./year
	3.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$105,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	150 acres of riparian buffers	Reduce sediment load by 23 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$127,656	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	25 acres of restored wetlands	Reduce sediment load by 4 lb./year
	3.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$87,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	250 LF of stream restoration	Reduce sediment load by 10 lb./year
	3.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$22,250	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	250 LF of overwide / 2-stage ditch reconstruction	Reduce sediment load by 12 lb./year
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$207	SWCD, NRCS, farmers	2012-2027 in phases	1500 acres of filter strips	Reduce sediment load by 0 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$3,000	SWCD, NRCS, farmers	2012-2027 in phases	200 acres of conservation tillage	Reduce sediment load by 1 lb./year

Problem Statement #4: (Habitat)

The Ohio EPA TMDL found 6 of the 7 sampling sites in this HUC to meet Aquatic Life attainment standards. The Sugar Creek sampling sites were all in attainment; the site on Coon Creek at County Road 32 was in partial attainment with direct habitat alternation given as a cause of impairment, and crop production and channelization as sources. Agricultural BMPs should be applied throughout the watershed, with priority for habitat restoration BMPs in the Coon Creek subwatershed.

Goal 4.1:

175 acres of habitat restoration and 500 linear feet of stream corridor restoration practices.

Objectives:

- 150 acres of riparian buffers
- 25 acres of restored wetlands
- 250 LF of stream restoration
- 250 LF of overwide / 2-stage ditch reconstruction.

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Habitat Impairment	4.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$105,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	150 acres of riparian buffers	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$127,656	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	25 acres of restored wetlands	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$87,000	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	250 LF of stream restoration	Load reductions provided in nutrient and sediment tables

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	4.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$22,250	SWCD, County Engineer, NRCS, farmers	2012-2027 in phases	250 LF of overwide / 2-stage ditch reconstruction	Load reductions provided in nutrient and sediment tables

Lower Portage River

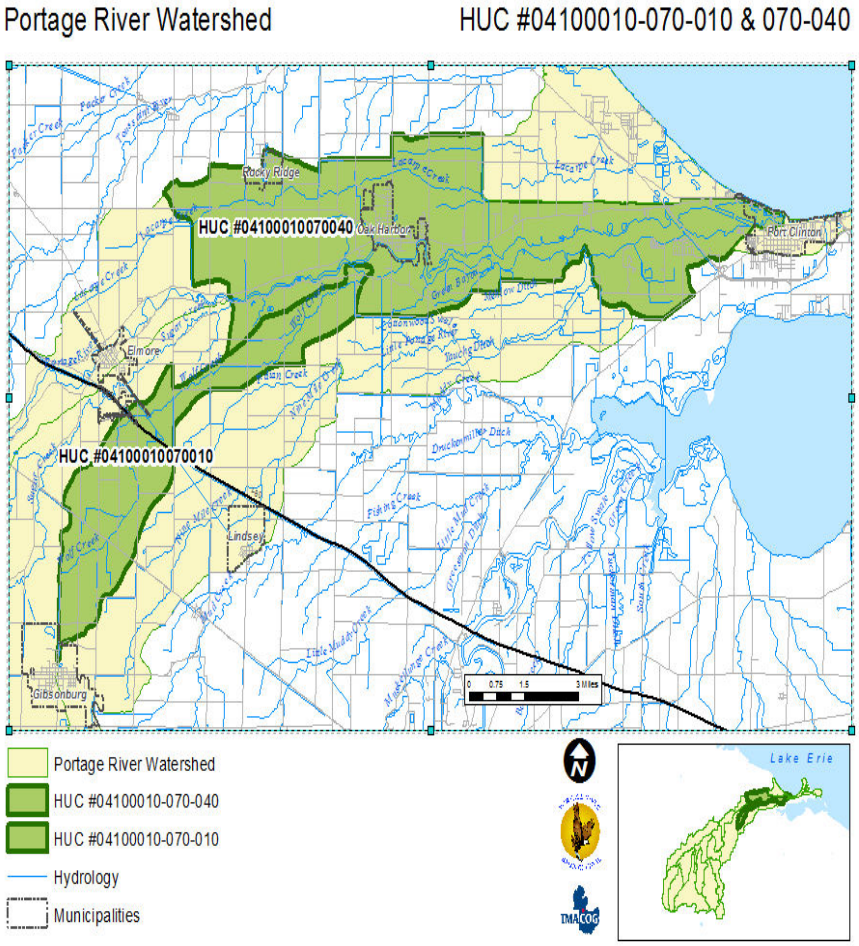
04100010 070-010 and 04100010 070-040 (14 – digit HUC)
04100010 05-02 (New 12-digit HUC)

Length: 26.47 miles
Elevation at Source: 680
Elevation at Mouth: 575
Average Fall (ft/mile): 3.97
Drainage Area: 48.9 square miles

Ohio Topographic Quadrangle 7.5 minute (1:24,000)

- Elmore
- Lindsey
- Genoa
- Oak Harbor
- Lacarne
- Port Clinton

Urban Areas:
Gibsonburg
Oak Harbor
Rocky Ridge
Port Clinton



Geology

Ottawa County lies entirely within the Huron/Erie Lake Plan (HELP) Eco-region. The HELP region is very flat having little relief; the soils are poorly to very poorly drained and consist of parent material derived from glacial tills and lacustrine deposits associated with the Wisconsin glacial era. The glacial till is predominantly in the form of ground moraine overlies limestone bedrock. The thickness of the glacial drift varies from about 25 meters to only a few centimeters. The uppermost bedrock strata consist of Silurian dolomite and dolomitic limestone.

Bedrock formations underlying Sandusky County are comprised of Devonian and Silurian aged limestones and dolomites. These carbonate units, which reach thicknesses of several hundred feet in the western Sandusky County area of the Portage River, represent the regional aquifer. Sandusky County has a karst terrain with distinctive characteristics of relief and drainage resulting from the dissolution of limestone or dolomite by the action of surface and ground

water. Karst terrain typically has a well-developed underground drainage network ranging from fractures and minor solution channels to caverns with subterranean streams.

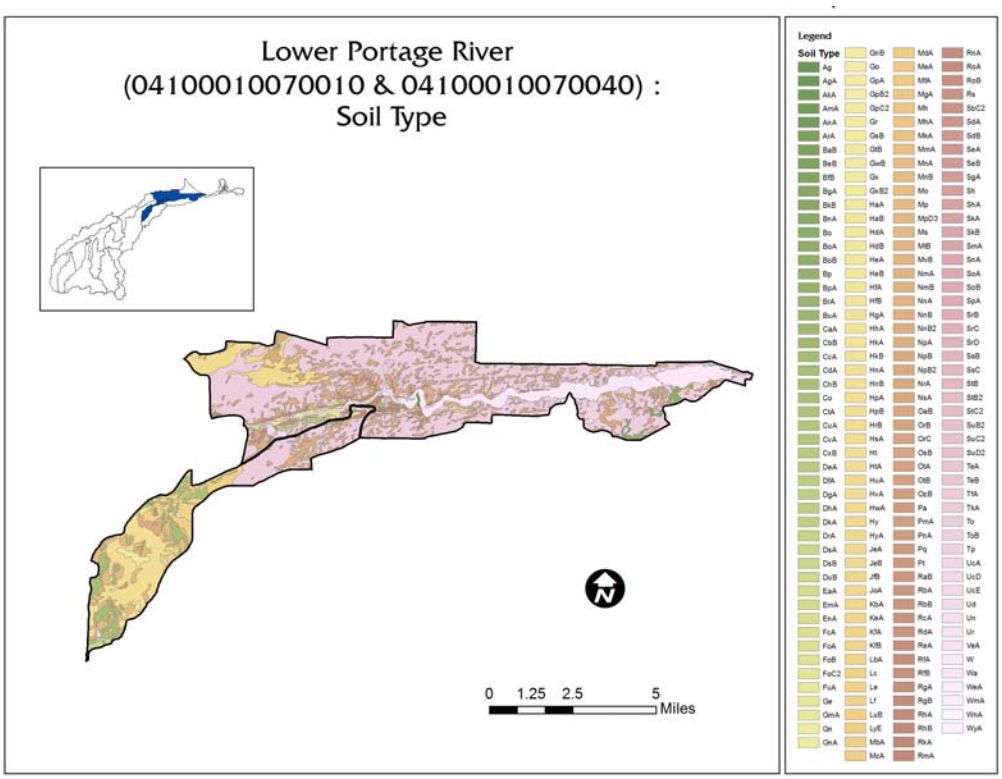
The most recent glacial stage, the Wisconsinan, left evidence of deposits of till, sand and gravel. Till is an unconsolidated, poorly-sorted, non-stratified (layered) mixture of clay, silt, sand and gravel directly deposited by ice. Till thickness averages under 20 feet in western Sandusky County (Larsen, 1984a,b.). Much of the original thickness of the till deposited in Sandusky County was removed by subsequent glaciations and by wave activity associated with post glacial lakes.

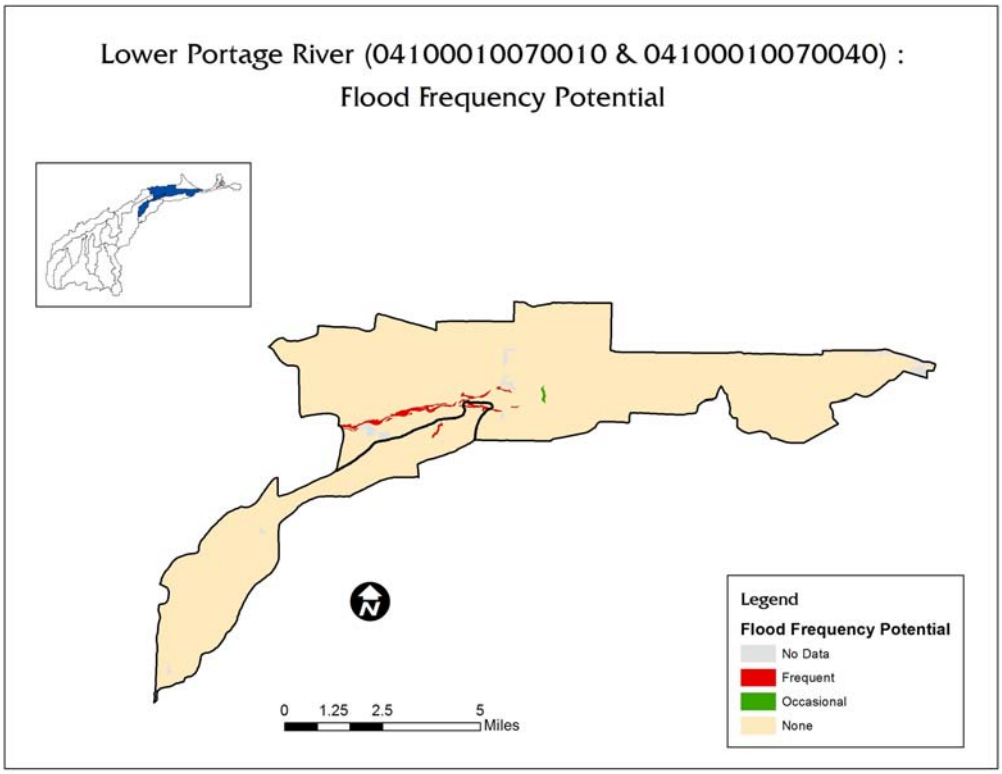
The original land surface created by till deposition in Sandusky County is largely obscured by lake deposits or was eroded by wave action. Classical till features such as ground moraine or end moraines are not detectable in Sandusky County. The will surface may be referred to as wave-planed till or water-modified till (Forsyth, 1965). Wave erosion (Angle, 1988a) is probably largely responsible for the abundance of shallow and exposed bedrock in Sandusky County (Ground Water Pollution Potential Report No. 19, ODNR, 1990).

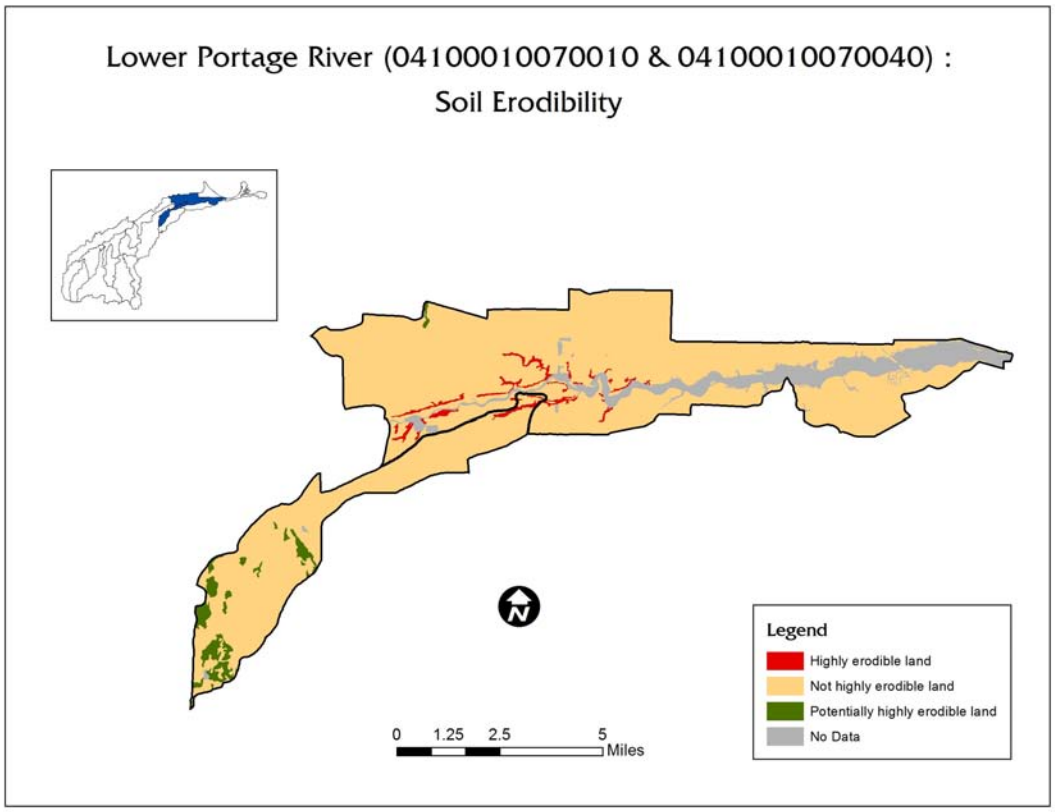
Soils

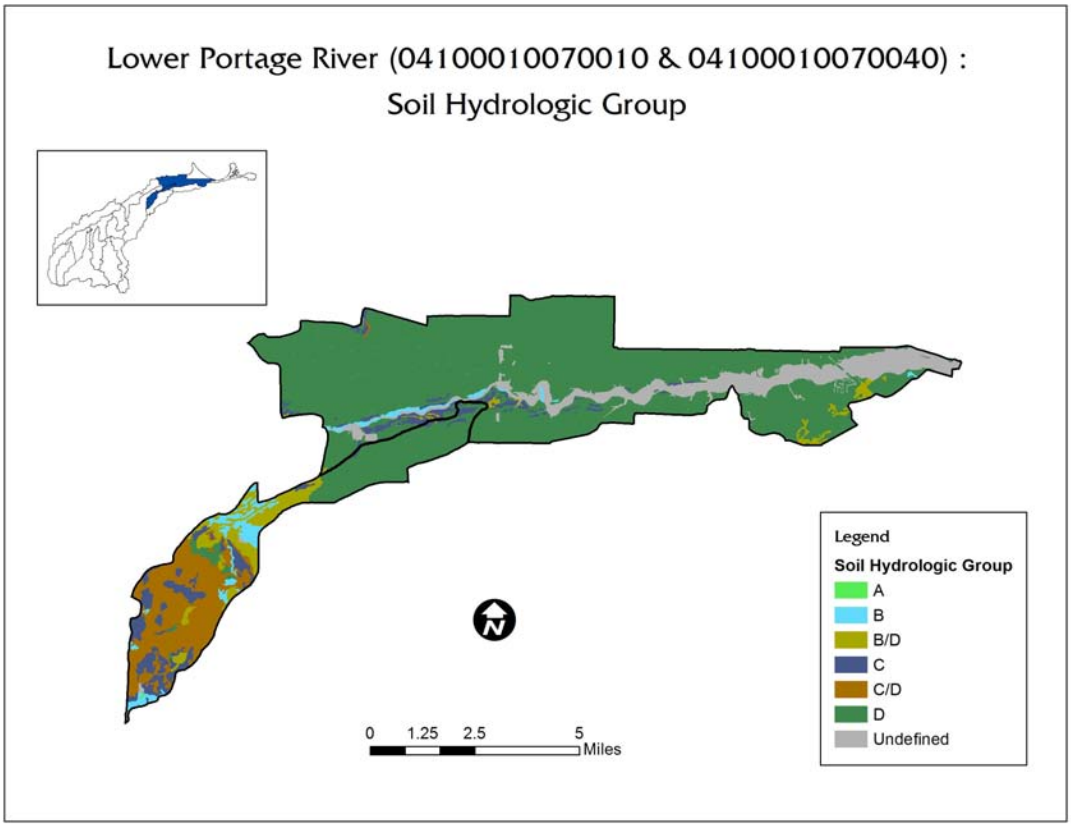
The three predominant soils within the Lower Portage subwatershed are Toledo, Nappanee, and Hoytville. They are all fine grained, flat, somewhat to very poorly drained, and either C/D soils (Hoytville) or D (Nappanee, Toledo). They are not highly erodible, and are considered prime farm land when drained.

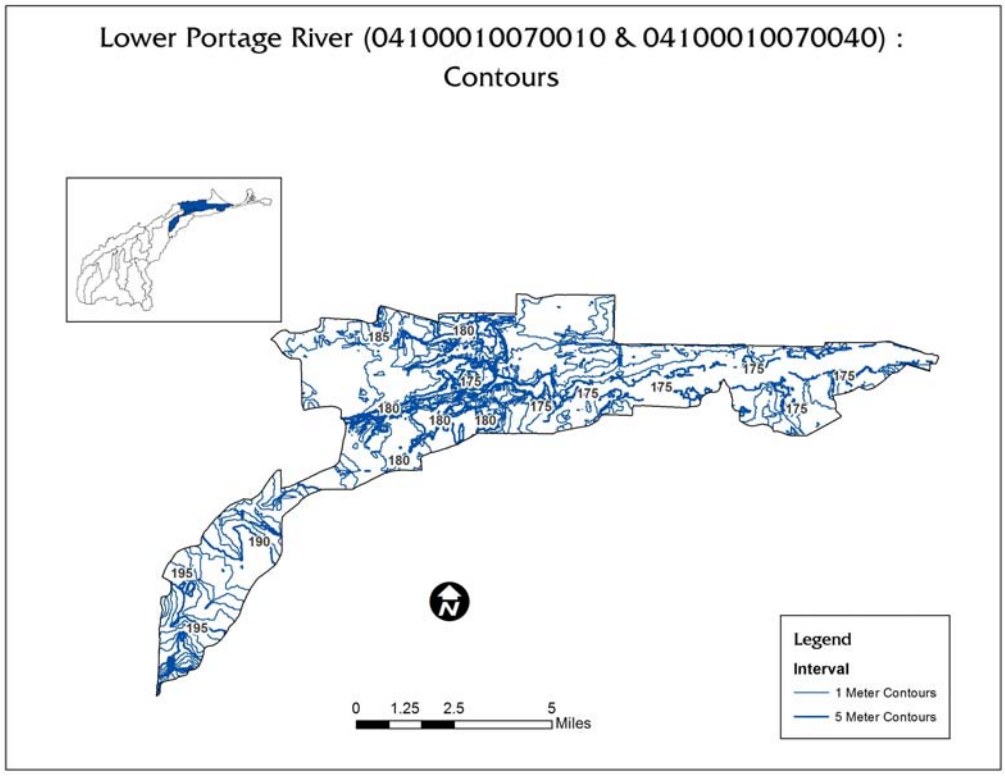
Major Soil Groups		
070-010 & 070-040		
Toledo	Sum Acres	14,144
	Percentage	45.15%
Nappanee	Sum Acres	4,978
	Percentage	15.89%
Hoytville	Sum Acres	3,448
	Percentage	11.01%
Millsdale	Sum Acres	1,009
	Percentage	3.22%
Lenawee	Sum Acres	796
	Percentage	2.54%
Castalia	Sum Acres	747
	Percentage	2.38%
Haskins	Sum Acres	625
	Percentage	2.00%
St. Clair	Sum Acres	522
	Percentage	1.67%

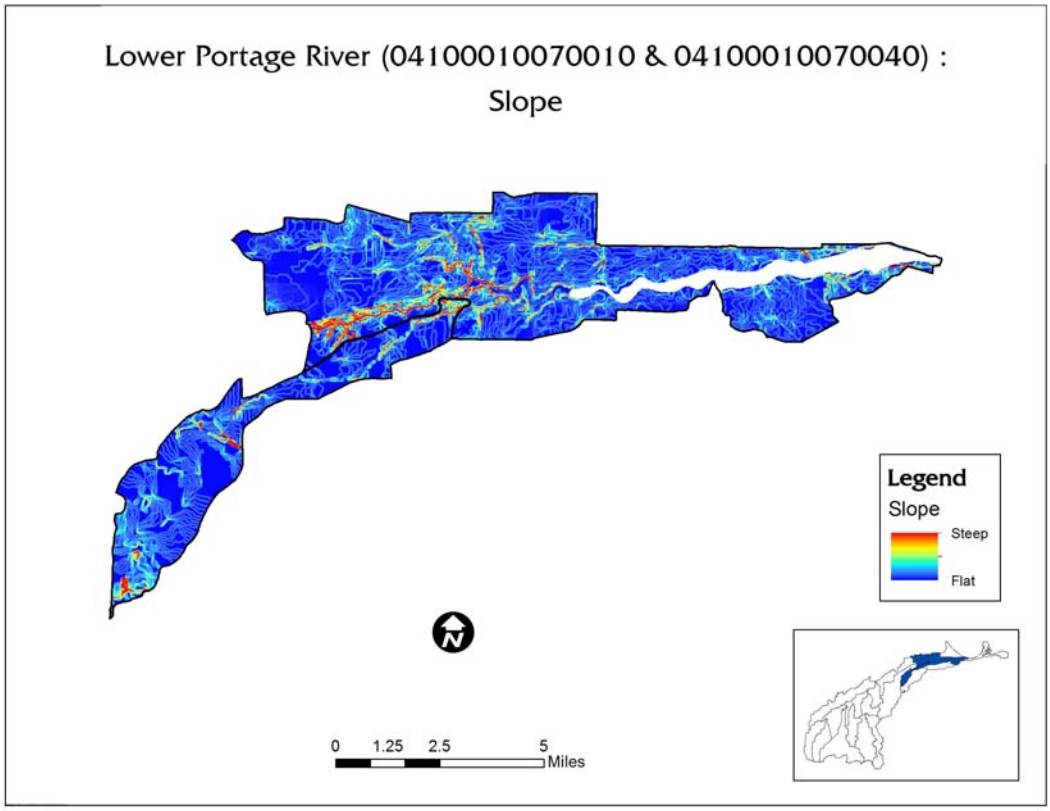

Lower Portage River
(04100010070010 & 04100010070040) :
Soil Type
0 1.25 2.5 5
Miles
Legend
Soil Type

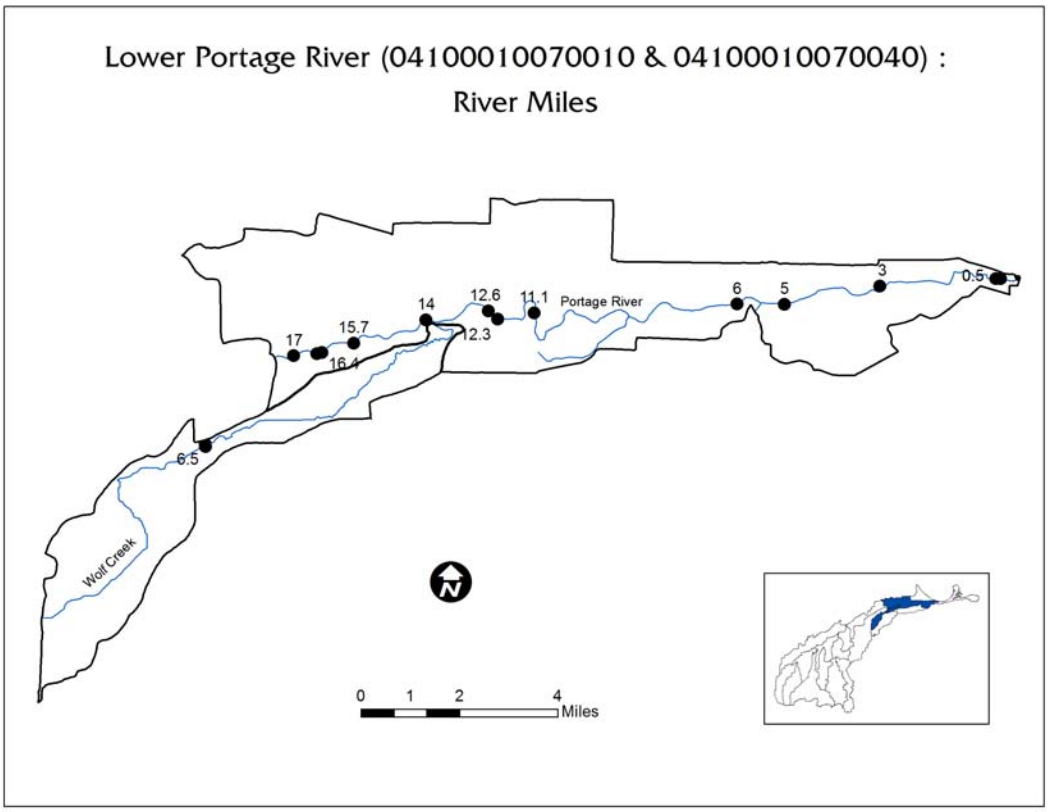

Lower Portage River (04100010070010 & 04100010070040) :
Flood Frequency Potential
0 1.25 2.5 5
Miles
Legend
Flood Frequency Potential
No Data
Frequent
Occasional
None


Lower Portage River (04100010070010 & 04100010070040) :
Soil Erodibility
Legend
Highly erodible land
Not highly erodible land
Potentially highly erodible land
No Data
0 1.25 2.5 5
Miles


Lower Portage River (04100010070010 & 04100010070040) :
Soil Hydrologic Group
Legend
Soil Hydrologic Group
A
B
B/D
C
C/D
D
Undefined
0 1.25 2.5 5
Miles


Lower Portage River (04100010070010 & 04100010070040) :
Contours
185
180
175
190
195
Legend
Interval
1 Meter Contours
5 Meter Contours
0 1.25 2.5 5
Miles


Lower Portage River (04100010070010 & 04100010070040) :
Slope
Legend
Slope
Steep
Flat
0 1.25 2.5 5
Miles



The Soil Hydrologic Group map indicates the *Hydrologic soil groups* based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately course texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (**A/D, B/D, or C/D),** the first letter is for drained areas and the second is for undrained areas.

Rare, Threatened, Endangered Species

A number of rare, threatened, or endangered species may be found in the Lower Portage subwatershed HUC14 04100010 070 010 and -040. Of particular note are bald eagle sitings, and three endangered species.

Rare, Threatened, Endangered Species

Common Name	*Scientific Name*	Last Observed	State Status
Bald Eagle	Haliaeetus leucocephalus	2010	T
Bald Eagle	Haliaeetus leucocephalus	2010	T
American Bittern	Botaurus lentiginosus	1977	E
Bald Eagle	Haliaeetus leucocephalus	2010	T
Bald Eagle	Haliaeetus leucocephalus	2010	T
Bald Eagle	Haliaeetus leucocephalus	2010	T
Bald Eagle	Haliaeetus leucocephalus	2010	T
Blanding's Turtle	Emydoidea blandingii	1980-07	T
Deertoe	Truncilla truncata	1977-08	SC
Eastern Foxsnake	Pantherophis gloydi	1983	SC
Eastern Pondmussel	Ligumia nasuta	1977-08	E
Fawnsfoot	Truncilla donaciformis	1977-08	T
Fawnsfoot	Truncilla donaciformis	1964-08	T
Gadwall	Anas strepera	1983-07-29	SI
Green-winged Teal	Anas crecca	1984-06-21	SI
King Rail	Rallus elegans	1983-08	E
Least Bittern	Ixobrychus exilis	1984-06-16	T
Least Bittern	Ixobrychus exilis	1987-07-21	T
Purple Wartyback	Cyclonaias tuberculata	1961-07	SC
Redhead	Aythya americana	1984-06	SI
Ruddy Duck	Oxyura jamaicensis	1983-05-29	SI
Schweinitz' Umbrella-sedge	Cyperus schweinitzii	1967-08	T
Schweinitz' Umbrella-sedge	Cyperus schweinitzii	1967-07-12	T
Sora Rail	Porzana carolina	1984-06	SC

Rare, Threatened, Endangered Species

Common Name	*Scientific Name*	Last Observed	State Status
Thamnophis Sirtalis	Melanistic garter snake	2000-05-07	SC
Threehorn Wartyback	Obliquaria reflexa	1978-11	T
Virginia Rail	Rallus limicola	1987-07	SC
Virginia Rail	Rallus limicola	1984-06	SC

T=Threatened, P=Potentially Threatened, E=Endangered, X=Presumed Extirpated, SC=Species of Concern

Mussel Species in Lower Portage River

Stream River Miles	Common Mussel Name	*Scientific Name*	Observed	Status
15.70, 17.03	White Heelsplitter	*Lasmigona complanata*	2008	—
15.70, 17.03	Fragile Papershell	*Leptodea fragilis*	2008	—
15.70, 17.03	Pink Heelsplitter	*Potamilus alatus*	2008	—
15.70, 17.03	Giant Floater	*Pyganodon grandis grandis*	2008	—
15.70, 17.03	Mapleleaf	*Quadrula quadrula*	2008	—
17.03	Lilliput	*Toxolasma parvus*	2008	—
17.03	Fawnsfoot	*Truncilla donaciformis*	2008	Threatened
17.03	Deertoe	*Truncilla truncata*	2008	Species of Concern
Source: Freshwater Mussels of the Maumee Drainage 2nd Edition. Grabarkiewicz, J., and Crail, T.		**Source:** Ohio EPA Technical Report EAS/2010-4-4		

HUC 8 – 04100010 (Portage River)									
HUC 10 – 0410001005 (Lower Portage River-Frontal Lake Erie)									
HUC 12 – 041000100502 (Portage River)									
HUC 14 – 04100010070010, 040 (Wolf Creek, Portage River below Sugar Cr. to Lake Erie including Lacarpe Cr. outlets 2 & 3)									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
5	2008	S02P08	Portage R. 4 Mi. N Of Lindsey @ St. Rt. 590	17.03	495.0	WWH	Full	-	-
6	2008	S02S03	Portage R. @ Hyde Run (Brush Wellman) Mixing Zone	16.53	496.0	WWH		-	-
7	2008	S02S17	Portage R. Dst. Slemmerportage	15.70	496.0	WWH	Full	-	-
8	2008	S02P06	Portage R. At Oak Harbor @ Sr 19	12.55	516.0	WWH	Non	Sediment Screening Value (Exceedence), Nutrient/Eutrophication Biological Indicators, Sedimentation/Siltation	Industrial Point Source Discharge, Upstream Source
9	2008	S02S14	Portage R. Dst. Oak Harbor WWTP, Adj. Oak Ridge Drive	11.10	518.0	WWH	Non	Sediment Screening Value (Exceedence), Sedimentation/Siltation, Nutrient/Eutrophication Biological Indicators	Industrial Point Source Discharge, Upstream Source
10	2008	S99Q01	Portage R. 0.4	5.90	540.0	WWH	Non	Nutrient/Eutrophication	Upstream

HUC 8 – 04100010 (Portage River)									
HUC 10 – 0410001005 (Lower Portage River-Frontal Lake Erie)									
HUC 12 – 041000100502 (Portage River)									
HUC 14 – 04100010070010, 040 (Wolf Creek, Portage River below Sugar Cr. to Lake Erie including Lacarpe Cr. outlets 2 & 3)									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
			Miles Upst. L. Portage R.					Biological Indicators, Sedimentation/Siltation	Source

Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010.

Water Resources

Surface Water

Designated Use for aquatic life is warm-water habitat (WWH). **Recreation Use** assessment is Class A at all locations on the mainstem, but is Class B on the tributary streams. That determines the acceptable E. Coli colony numbers as shown below in a summary table.

Recreational Use Attainment							
Location	RM	Rec Use PCR Class	Number of Samples	**E. coli Standard:** Mean <126 (A), or <161 (B) and Maximum Sample ≤ 298 (A) or ≤ 523 (B) Mean	Max	Attainment Status	Sources of Bacteria
Portage R At Sr 590	17.03	A	7	363	4800	Non	HSTS
Portage R At Hyde Run (Brush Wellman) Mix Zone	16.53	A	7	457	6800	Non	HSTS; Brush Wellman
Portage R Dst Slemmer-Portage Rd	15.70	A	7	215	6700	Non	HSTS; Agric.
Portage R Adj Sr 105	14.02	A	7	334	2500	Non	HSTS; Agric.
Portage R At Sr 19	12.55	A	7	1811	6500	Non	HSTS
Portage R Adj Oak Ridge Dr	11.10	A	7	339	7000	Non	HSTS; Oak Harbor WWTP
Portage R 0.5 Miles Ust Little Portage R	6.00	A	7	8	410	Full	Municipal Point Source Discharges, Channelization, Non-irrigated Crop Production
Portage R Ust Port Clinton WWTP	0.58	A	7	13	54	Full	
Portage R Dst Port Clinton WWTP Outfall 001	0.50	A	6	17	140	Full	
Hyde Run (Brush Wellman Trib 16.54) At Portage R So Rd	0.02	B	4	1745	25000	Non	Brush Wellman
Wolf Ck At Yeasting Rd.	6.51	B	5	2578	10000	Non	HSTS; Agric.; Gibsonburg WWTP

Aquatic Life Use Assessment				
Location	**RM**	**Drainage Area**	**Aquatic Life Use**	**Attainment Status**
Portage R. 4 Mi. N Of Lindsey @ St. Rt. 590	17.0	495.0	WWH	Full
Portage R. Dst. Slemmer-Portage Rd.	15.7	496.0	WWH	Full
Portage R. At Oak Harbor @ St. Rt. 19	12.6	516.0	WWH	Non
Portage R. Dst. Oak Harbor WWTP, Adj. Oak Ridge Drive	11.1	518.0	WWH	Non
Portage R. 0.4 Miles Upst. L. Portage R.	5.9	540.0	WWH	Non
Wolf Creek Se Of Elmore @ Yeasting Rd.	6.5	9.2	WWH	Non
Source: Ohio EPA 2012 Integrated Report: http://wwwapp.epa.ohio.gov/dsw/ir2012/search.html				

Macro-invertebrate Communities										
Stream RM	**Dr. Ar. (sq. mi.)**	**Data Codes**	**Qual. Taxa**	**EPT QI./Total**	**Sensitive Taxa QI./Total**	**Density QI./Qt.**	**CW Taxa**	**Predominant Organisms on the Natural Substrates With Tolerance Category(ies)**	**ICI[a]**	**Narrative Evaluation**
17.03	495	13	63	20 / 22	28 / 37	L / 669	0	Caddisflies (F,MI), baetid Petrophila moth larvae (MI)	44	
16.53	496	8,13, 21	41	14 / 17	15 / 25	L / 119	0	Elimia snails (MI), Petrophila moth larvae (MI), mayflies (MI,F)	38	
15.70	496	8	47	12 / 19	19 / 28	L / 103	0	Petrophila moth larvae (MI), Elimia snails (MI)	38	
12.63	516	8,11	29	4 / 5	1 / 3	L / 1558	0	Midges (MT,F), damselflies (F)	26L	
11.10	518	8,11	37	3 / 3	3 / 3	L / 2124	0	Midges (MT), flatworms (F), bryozoans (F)	20L	
6.00	540	8,11	30	4 / 4	2 / 3	L / 2017	0	Midges (MT,T), snails (T), bryozoans (F)	18L	
Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010 http://epa.ohio.gov/dsw/tmdl/PortageToussaintRivers.aspx										

Public Drinking Water Supply Assessment				
HUC	**Reporting Category**	**Cause of Impairment**	**Nitrate Watch List**	**Pesticide Watch List**
040100010 05-02	No active intakes	None	No	No

Fish Tissue Assessment			
HUC	**Reporting Category**	**Causes of Impairment**	**PCB Concentration**
040100010 05-02	5	PCBs	129 ppb

Water Quality Monitoring Results: Ohio EPA 1994 and 2008						
River Mile	**Date**	**IBI**	**ICI**	**MiWB**	**QHEI**	**STATUS**
16.5/16.5-*south* [b]	1994	31	34	7.9	--	*Brush Wellman mixing zone*
-- /16.5-north	1994	--	30	--	--	FULL Opposite Brush Cr.
16.2/ --	1994	33[ns]	--	8.3[ns]	68.0	FULL Dst. Brush Wellman
Portage River Estuarine Zone – Interim Criteria for Lake Erie Estuaries						
13.3/13.8	1994	37	16*	9.8	64.5	PARTIAL Ust. Oak Harbor WWTP
12.3	1994	37	6*	9.8	51.5	**NON** Dst. Oak Harbor WWTP
5.9/6.8	1994	23*	6*	6.4*	49.0	**NON** Near mouth of L. Portage
0.6/0.7	1994	31[ns]	10*	8.4	52.5	**NON** Ust. Port Clinton WWTP
0.2/0.1	1994	33	18[ns]	8.4	57.0	FULL Dst. Port Clinton WWTP
16.53	2008	32	38	N/A	N/A	Brush Wellman Mix Zone
15.70	2008	38	38	8.6	47.5	FULL
12.55	2008	31*	26*	9.0	38.5	**NON**
11.10	2008	33*	20*	9.5	32.5	**NON**
6.00	2008	22*	18*	6.9*	26.0	**NON**

a - River Mile (RM) represents the Point of Record (POR) for the station, not the actual sampling RM.
b - MIwb is not applicable to headwater stream with drainage areas ≤20 mi^2.
c - A narrative evaluation of the qualitative sample based on attributes such as EPT taxa richness, number of sensitive taxa, and community composition was used when quantitative data was not available or considered unreliable. VP=Very Poor, P=Poor, LF=Low Fair, F=Fair, MG=Marginally Good, G=Good, VG=Very Good, E=Exceptional
d - Attainment is given for the proposed status when a change is recommended. Aquatic life use in superscript.
ns - Nonsignificant departure from biocriteria (≤4 IBI or ICI units, or ≤0.5 MIwb units).
* - Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.
Diagonal Shading: Lacustuary sites assessed with Lacustuary metrics and breakpoints.
Sources: Biological and Water Quality Study of the Portage River Basin, Ohio EPA 1995, Tables 12 & 13; Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010 http://epa.ohio.gov/dsw/tmdl/PortageToussaintRivers.aspx

General narrative ranges assigned to QHEI scores.				
Narrative Rating		QHEI Range		
		Headwaters (≤ sq mi)	Larger Streams	Lacustuary
Excellent		≤ 70	≤ 75	≤ 80
Good		55 to 69	60 to 74	60 to 80
Fair		43 to 54	45 to 59	45 to 59
Poor		30 to 42	30 to 44	30 to 44
Very Poor		<30	<30	<30

1995 OEPA Assessments

In 1995 OEPA electrofished the Portage River mainstem from river mile 35.8 to 0.2. Except where noted, the narrative addresses the mainstem of the Portage as a whole, not just the river below RM 16.5.

Species predominating in percent composition by numbers were central stoneroller (32.2%), bluntnose minnow (10.5%), spotfin shiner (7.6%) and greenside darter (6.1 %). Excluding the estuarine segment, fish species predominating in percent composition by weight were common carp (23.2%), smallmouth bass (16.4%), golden redhorse (9.6%), and central stoneroller (7.8%).

The abundance of common carp, stonerollers, and bluntnose minnows is indicative of organic enrichment. Several metrics of the IBI were consistently low. Because the Portage River has extensive areas of bedrock and a very low gradient, riffles are poorly developed Consequently, habitat is limited. The consistently poor performance of these three metrics at all locations suggests overall water quality is degraded. The abundance of species moderately tolerant of pollution indicates that the degraded water quality is linked to nonpoint sources and organic enrichment, and a lack of discernible impairment downstream from point source discharges.

Discharges from Brush Wellman appeared to have minimal impact on the fish community of the Portage River mainstem. However, this reach is in the transitional zone between the lake influenced and free flowing portions of the river. The IBI scores were influenced by changes in the species composition associated with estuarine conditions, specifically the decline in the number of sucker species and increases in omnivores (i.e., gizzard shad) as opposed to changes caused by increases in tolerant species.

Macroinvertebrate samples on both banks of the mainstem at RM 16.5 evaluated the Brush Wellman discharge. These sites were in the portion of the river influenced by Lake Erie where current slows and increased deposition of sediment occurs. The south site, located downstream from the Brush Wellman discharge, met the WWH criterion with an ICI score of 34. The two Caddisfly species frequently inhabit low-flow habitats, and the bryozoan population increased markedly in the estuarine environment. Pollution-tolerant flatworms and Oligochaete also increased in abundance, implying that not all community changes were solely habitat related. The north site had a similar community (ICI = 30) with a slightly higher density and higher percentage of pollution-sensitive mayflies and caddisflies.

The performance of the fish community in the estuarine portion of the mainstem met or exceeded the interim Lake Erie estuary criteria at all mainstem sites except RM 5.6. The one site sampled in the Little Portage River (RM 0.6) also did not meet the criteria. The percentage of individual fish exhibiting DELT anomalies increased in the estuarine segment, especially between RM 13.3 and 5.6. The predominant type of anomalies observed were eroded fins and lesions, suggesting that the fish community may have periodically been stressed by low or marginal levels of dissolved oxygen.

Historical accounts of drowned river mouths in the Western Basin of Lake Erie indicate that submerged aquatic macrophytes, particularly eel grass (Vallisneria american), covered the bottom of the these broad, shallow river mouths. Beds of macrophytes in Sandusky Bay were present in the 1950s, but were largely extirpated by the end of the 1960s coincident with the advent of intensive agricultural practices and increased runoff. The importance of submerged aquatic vegetation to aquatic community integrity, fisheries yields, and waterfowl is well

documented for marine estuaries in the southeastern United States. Similar efforts are needed if the drowned river mouths in Lake Erie are to be restored.

2008 OEPA Biological assessment: Macro-invertebrate Community

In 2008, IBI and MIwb scores mirrored results in 1994, with a drop in scores within the Brush Wellman mix zone (RM 16.53), and upstream of Little Portage River (RM 6.0). During the summer of 2008, Woodville and Oak Harbor continued to have CSOs, and Elmore has a raw sewage bypass that will not be eliminated until 2013. However, specifically within the lacustuary portion of the river, IBI scores dropped below WWH at three locations from downstream State Route 19 (RM 12.55) to upstream Little Portage River (RM 6.0). In 1994, the only lacustuary IBI score below WWH expectations was near the Little Portage River (RM 5.6). Improvements addressing WWTP and CSO issues are needed within each municipality along the Portage River mainstem in order for the fish community to meet WWH expectations in the future.

There were declines in EPT and sensitive taxa diversities and ICI scores downstream from Brush Wellman (RM 16.54). However, the general composition of the community downstream from the Woodville WWTP did not change substantially, the sampling locations downstream from the Elmore WWTP and Brush Wellman were limited by lack of riffle and strong run habitats, and the station downstream from Brush Wellman was starting to be affected by the upstream most reach of the lacustuary. No significant impact was attributed to these dischargers. The community collected from the Brush Wellman mixing zone (RM 16.53) was evaluated as good and did not exhibit significant indications of toxicity. The communities sampled in the lacustuary were all performing below expectations. The communities were characterized by low diversity and high numbers of the tolerant midges. No significant impact was evident from the Oak Harbor WWTP which discharges at RM 12.03.

Two of the seven sites within the Lower Portage River HUC (041000100502) were in full attainment and one site was not assessed for the aquatic life use designation as it was a mix zone sample. Recent and historical discharges from Brush Wellman were found to contribute to sediment exceedence values and sedimentation/siltation which contributed to non-attainment of the WWH aquatic life use designation throughout the lower reach of the Portage River. Nutrient eutrophication from surrounding agricultural activities also contributed to non-attainment.

The extent of the consumption advisory on the Portage River mainstem extends from RM 16.4 to the mouth and is more restrictive than in years past. The PCB contamination may be attributable to legacy contamination in the sediments from Brush Wellman. PCB contamination below Brush Wellman was documented both in 1994 and 2008 sampling, though no PCBs were documented upstream of Brush Wellman. Channel catfish and common carp collected near RM 12.5 in 2008 had similar concentrations of PCBs as similar sized channel catfish and common carp in the lower reaches. This indicates that the fish, especially those with a limited home range, may have taken up the contaminants from within the Portage River mainstem itself, and not Lake Erie.

Biological Criteria Benchmarks

Biological Criteria					Lacustuary Benchmarks[1]				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
IBI-Headwaters	50	28	20	18	N/A	N/A	N/A	N/A	N/A
IBI-Wading	50	32	22	18	N/A	N/A	N/A	N/A	N/A
IBI-Boat	48	34	20	16	50	42	31	17	<17
MIwb-Wading	9.4	7.3	5.6	4.5	N/A	N/A	N/A	NA	N/A
MIwb-Boat	9.6	8.6	5.7	5.0	10	8.6	5.6	2.8	<2.8
ICI	46	34	22	8	52	42	25	12	<12

[1] **Proposed Lacustuary scoring breakpoints. These have not yet been adopted into rule.**

Ground Water

There is one municipality partly within this subwatershed that relies on groundwater for drinking water: the Village of Gibsonburg, which has a source water protection area in a neighboring HUC. In most of the watershed, including the Village of Rocky Ridge, individual residences obtain water from household private wells. The Village of Oak Harbor and the City of Port Clinton, along with many township areas in the eastern part of the HUC, are served by the Ottawa County Regional Water System.

Source Water Assessment Plan (SWAP)

The Ottawa County Regional Water System serves a population of 14,500 people. The water intake is in Lake Erie near the mouth of the Portage River. Plant design capacity is 9 million gallons in 2013.

For the purposes of source water assessments, all surface waters are considered to be susceptible to contamination. By their nature surface waters are accessible and can be easily contaminated by chemicals and pathogens. Also, compared to ground water, they tend to move swiftly, so an upstream spill may rapidly arrive at the public drinking water intake with little warning or time to prepare.

The Ottawa County Regional Water System is susceptible to contamination from municipal wastewater treatment discharges, industrial wastewater discharges, runoff from residential and urban areas, contaminated river sediments, and accidental releases and spills from rail and vehicular traffic as well as from commercial shipping operations and recreational boating. On-shore potential sources that may impact the Ottawa County Regional Water System source water include discharges from natural processes such as erosion, water runoff from developed areas, and home sewage disposal system discharges. The Ottawa County Regional Water System Critical Assessment Zone is shown in the following figure.

Figure 1 - Ottawa County Regional Water Supply Critical Assessment Zone and Potential Influence Zone

Ohio EPA encourages Ottawa County to take a leading role in developing and implementing a Drinking Water Source Protection Plan. It should address education, emergency response measures that are in place and/or need to be developed, and protective strategies designed to reduce the likelihood of water quality impacts from the identified potential contaminant sources.

Source water protection efforts in the Critical Assessment Zone should focus on continued monitoring of Lake Erie water quality and spills. The water system should provide education to consumers, local municipal officials and businesses on strategies to reduce contaminated storm water runoff. The water system may consider supporting prohibitions or limitations on oil and gas exploration in Lake Erie where it could directly impact the quality of the source water.[6]

DRASTIC MAP

The sensitivity of the groundwater to local sources of contamination is determined and rated by **DRASTIC** maps as described below:

> Inherent within each geologic setting are the physical characteristics which effect the groundwater pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:

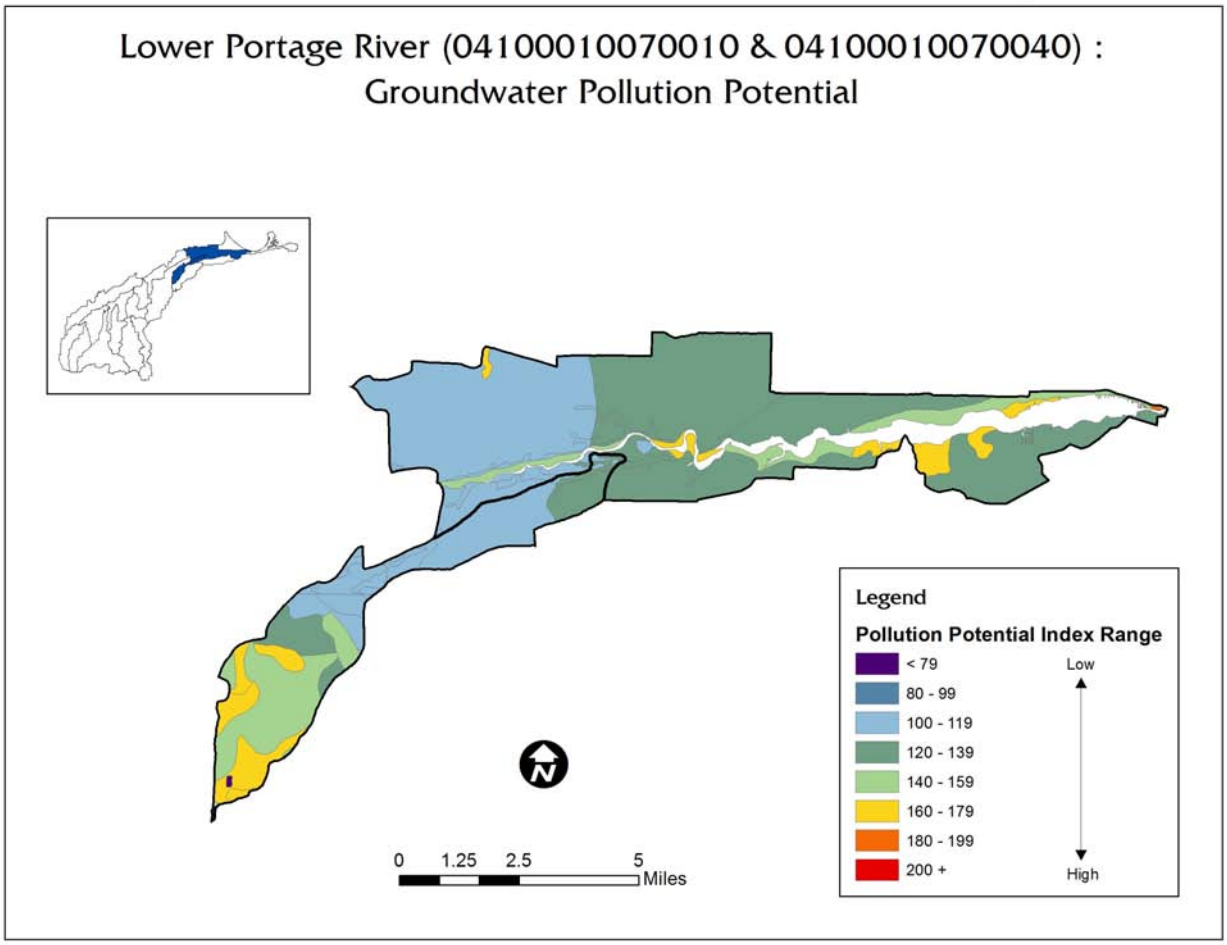
6 *Drinking Water Source Assessment for the Ottawa County Regional Water System*, Ohio EPA 2003

D – Depth to Water
R – Net Recharge
A – Aquifer Media
S – Soil Media
T – Topography
I – Impact of the Vadose Zone Media
C – Conductivity (Hydraulic) of the Aquifer (ODNR, 1994)

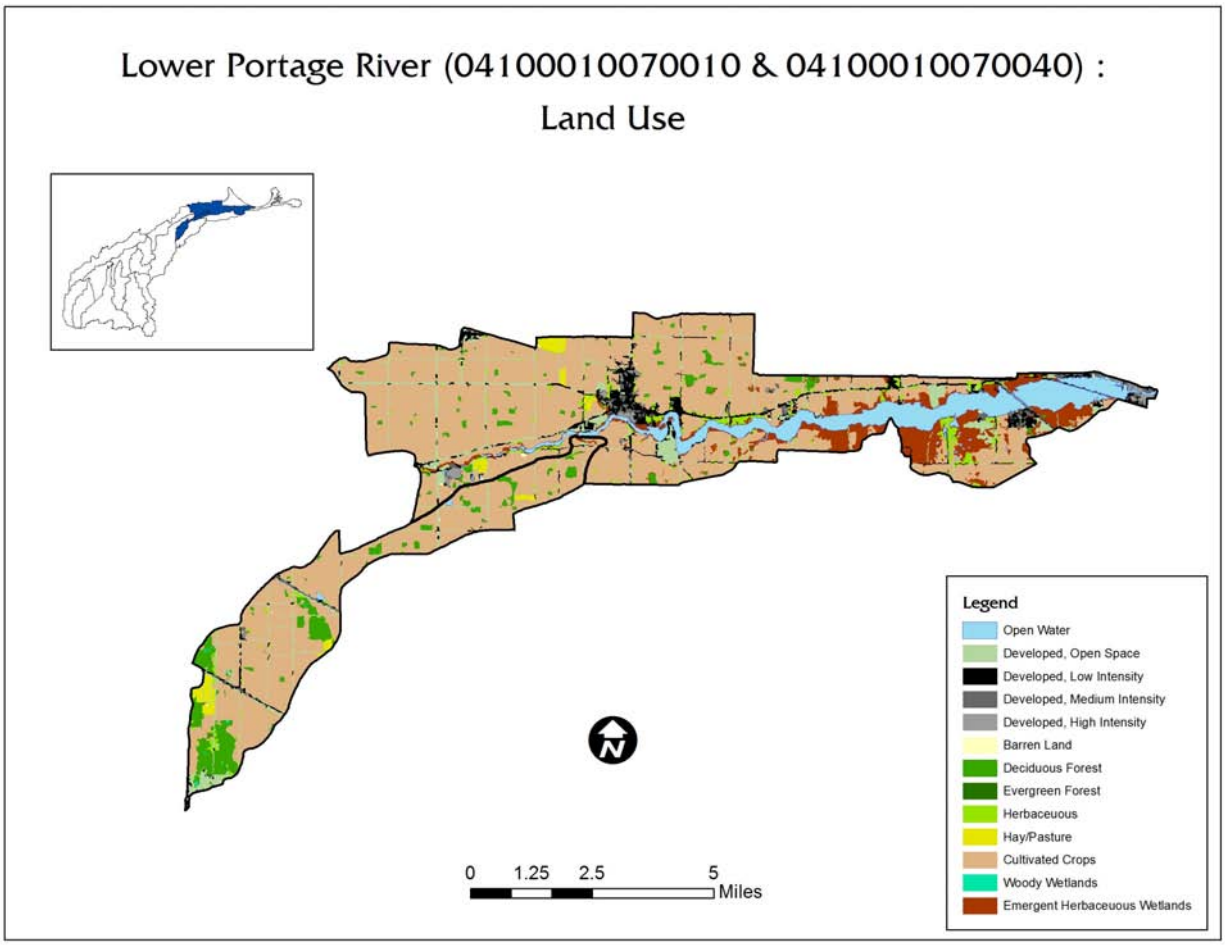
Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index then the greater the vulnerability to contamination (ODNR, 1994).

The average ground water pollution index potential for the Lower Portage River watershed below Sugar Creek (HUC 70-040) is 134 with a range of 100-192. For the Wolf Creek watershed (HUC 70-010), the average is 119 with a range of 100 to 169.

The Ohio Department of Natural Resources, Division of Water, Water Resources Section is the responsible agency to map groundwater resources throughout the state. Greater detail on DRASTIC maps for the Portage can be found in Chapter 4 of the watershed plan.



Sub-watershed (04100010)		
070-010 and 070-040		
Land Use	**Percent**	**Acres**
Urban	12.6%	3,953
Forest	7.3%	2,281
Pasture	1.3%	401
Cropland	64.1%	20,036
Other	14.7%	4,590
Total Acres	100%	31,263



Livestock Inventory							
HUC 4100010070010 & 4100010070040							
Type of Animal		**Hancock**	**Ottawa**	**Sandusky**	**Seneca**	**Wood**	**Estimates for HUC**
Percent of County in HUC		0.0%	16.0%	2.0%	0.0%	0.0%	
Cattle	Farms	129	89	167	264	144	**18**
	Animals	4,233	1,523	4,612	10,096	6,287	**335**
Hogs	Farms	51	15	37	62	30	**3**
	Animals	32,343	3,639	5,591	42,808	39,469	**692**
Horses	Farms	105	63	132	72	128	**13**
	Animals	844	444	772	463	1,004	**86**
Poultry	Farms	49	22	41	62	47	**4**
	Animals	NA	779	1,042	4,283	NA	**NA**
Sheep	Farms	32	12	41	61	21	**3**
	Animals	1,134	335	765	2,770	21	**69**
Total							40
							1,154

Source: 2007 Census of Agriculture http://www.agcensus.usda.gov/

Point Sources

Municipal

- Oak Harbor WWTP, 2PB00032

The Oak Harbor WWTP is a trickling filter plant with an average flow capacity of 0.735 mgd. OEPA data shows an average flow of 0.678 mgd, and a peak flow of 7.333 mgd during the period of 2004-2009. The treatment processes include primary settling, pre-aeration, trickling filters, final settling, and ultra-violet disinfection. The peak capacity whole meeting effluent standards is 2.16 mgd. The peak hydraulic capacity is 4.33 mgd at which rate 2.16 mgd receives complete treatment, and the additional 2.17 mgd receives primary treatment and disinfection. Sludge handling facilities have been upgraded. The new facilities, completed in 2000, include aerobic digestion and a belt filter press. Class B Sludge may be applied to farm land, disposed of in a solid waste landfill, or taken to another municipal wastewater treatment plant.

In 1990, Oak Harbor completed major storm sewer improvements, to separate storm runoff from the sanitary sewer system. Four major storm sewers were built: Locust Street, from Main to the Portage River; Finke Street, its entire length to the river; Toussaint Street from Walnut to the river; and Locust from North Railroad Street to Lacarpe Creek.

- Port Clinton WWTP, 2PD00014

Port Clinton has an activated sludge plant which experiences heavy I/I flows. The treatment plant began expansion with the completion of Phase I in 2004. Phase I included new primary treatment, chlorination, and the Actiflo system. The design average daily flow rate is 2.0 mgd;

the plant has a peak daily design for secondary treatment of 4.0 mgd, and a peak daily flow rate of 24 mgd for their Actiflo system. OEPA data shows an average flow of 1.843 mgd, and a peak flow of 17.110 mgd during the period of 2004-2009.

The Port Clinton system experiences heavy I/I flows; the purpose of the Actiflo system is to enable the plant 'to treat as much storm flow as possible up to 24 MGD and meet permit requirements under high flow conditions. The extraneous water results in overflows from the system's CSO into the Portage River. Duckbill valves which stopped the inflow from high lake levels were installed on the CSOs in the late 90s, decreasing peak flows by about 1 mgd. The amount of inflow the system receives is influenced by the lake level. Dechlorination facilities were added to the plant in 1995.

The wastewater plant underwent an extensive upgrade and capacity expansion to treat wet weather capacity. It included new headworks, and added an Actiflo system capable of handling 24 total mgd. It provides screening, flocculation, settling, and disinfection to flows beyond the plant's treatment capacity. Normal daily flow is sent directly to secondary treatment while the Actiflo system is used for' during wet weather flows. Additionally, biological treatment, final clarifiers, and sludge handling were expanded.

Port Clinton is under a consent decree with US EPA for its CSOs. In 2000, Port Clinton eliminated two CSOs, is not accepting new sewer taps in the combined sewer area, and installed flap valves on all remaining regulators. In 2003 the pump stations were upgraded, with new pumps and controls, greater capacity. In 2004, Jackson Drive CSO regulator was eliminated, leaving the Port Clinton system with one CSO point, at Adams Street.

- Elmore WWTP, 2PB00051

The Elmore WWTP discharges five miles upstream of this HUC, at RM 22.13. It is of note because a new replacement WWTP is under construction and scheduled for completion in mid-2013. The new plant will eliminate sewage bypasses, and should make a substantial improvement in Portage River water quality.[7]

Package Plants

- Brush-Wellman, 2IE00000, 30,000 (sewage), Active
- Chet's Place Campground, 2PR00234, 3,500 gpd, Active
- Eb's Place Tavern, 4,200 gpd, Active
- Erie Island Resort & Marina, 2PS00008, 110,000 gpd, Active
- Erie Township School, 1,875 gpd, Inactive
- Johnny's Resort/Recreational Camp, 2PR00150, 12,500, Active
- Next Level Auto, 5,000 gpd, Active
- Portage Cove MHP, 8,000 gpd, Active
- Portage Pointe Condos/Oak Harbor Golf Course, 2PR00127, 12,000 gpd, Active
- Portage View Mobile Home Park, 2PY00056, 12,500 gpd, Active
- Spinnaker Bay Yacht/Beach Club, 2PR00100, 20,000 gpd, Active

7 *News-Messenger* 12/20/2012 "Sewer plant could be done June 30"

Industrial

- Brush Wellman Inc, 2IE00000

Non-Point Sources:

Critical Sewage Areas

- Erie Twp: SR 163 and Richey Road (see 70-50)
- Lacarne
- Waterford Place
- SR 19 N of Oak Harbor to Salem-Carroll Road
- Behlman
- SR 19 S of Oak Harbor
- Rocky Ridge

CAFOs

None

Estimates of HSTSs				
Watershed	**Housing Units without sewers**	**Est. Unsewered Population (2010)**	**Unsewered Housing Units per acre**	**Unsewered Population per acre**
04100010070010	272	587	0.033	0.070
04100010070040	1,658	3,286	0.072	0.143
04100010 05 02 (total of above)	1,930	3,873	0.062	0.124

Sources: 2010 Census data and TMACOG "208" Plan. Analysis identifies approximate number of housing units without sewers in each watershed as an estimate of number of HSTSs.

Aquatic Life Use Impairments	
Causes	**Sources**
Nutrient/eutrophication biological indicators	Channelization
Phosphorus (total)	Industrial point source discharge
Sediment screening value (exceedence)	Municipal point source discharges
Sedimentation/siltation	Nonirrigated crop production
Source: Ohio 2012 Integrated Report, Watershed Assessment Unit Summary	

Water Supply:

Public Water System	Population Served	Primary Water Source
Oak Harbor	2,759	Ottawa County Regional Water – Lake Erie

Water Quality Impairments

The OEPA Integrated Report assesses each watershed's attainment status for 1) Public Drinking Water Supply, 2) Recreation, 3) Human Health, 4) Aquatic Life, and 5) Fish Tissue. The Integrated Report identifies causes and sources of impairments where watersheds are not in attainment with water quality standards.

Background:

The Lower Portage River HUC is a unique watershed in that it includes the lacustrine area of the Portage. In Ottawa County, near Oak Harbor, the Portage reaches the level of Lake Erie. Within this segment of the Portage River Mainstem is the river's transitional zone between the free-flowing river and the waters of Lake Erie.

The riverine or estuarine transition zone is dependent on the year and the water level of Lake Erie and the Great Lakes. In 1985 the water level of Lake Erie was approximately one foot higher than in 1994, which moved the estuarine effect further upstream in 1985. The riffle habitat that was exposed downstream from RM 16.9 in 1994 was absent in 1985 (Ohio EPA, 1995).

The entire length of the Mainstem in the 070-040 HUC flows between RM 17.50 and RM 0.0 and is greater than the riverine or estuarine transition zone. The HUC begins at RM 17.50 where Sugar Creek 060-020 (full attainment) enters the Portage Mainstem, which is just upstream of Brush Wellman, Inc. (02IE00000) and its eight outfalls into the Portage River between RM 16.30 to RM 16.90.

The mouth of the Portage River Mainstem (RM 0.0) flows into Lake Erie at Port Clinton. The elevation of Lake Erie is 569.2 feet or 173.5 meters above sea level (ASL) and the mouth of the Portage as it flows into Lake Erie also measures 569.2 feet (173.5 meters) above sea level.

Wolf Creek is a major tributary of the Lower Portage with headwaters located at the northern edge of the Village of Gibsonburg, Sandusky County, which flow northeast into Ottawa County to reach the Portage River Mainstem at RM 13.2 just west of the Village of Oak Harbor, located in Salem Township, Ottawa County. Wolf Creek drains all agricultural land area with the only urban area the Village of Oak Harbor.

The tributary is 14.5 river miles in length with riparian buffer present on about half of the banks while approximately half of the creek is without vegetative cover. Within the fourteen river miles of Wolf Creek there are twenty lateral ditches that drain into Wolf Creek before it converges with the Portage River.

The OEPA Portage River TMDL summarizes the mainstem habitat: "The Portage River mainstem had good to fair habitat quality at six locations, with poor to very poor habitat quality

at four locations due to excessive silt from channel modifications and agricultural activities. Tributaries of the Portage River exhibited poor to very poor habitat quality at 47% of the sampling locations. Channel modifications from urban and agricultural activities resulted in excessively embedded substrates, high silt loads and often sparse instream cover and poor riparian corridor quality." (page 109)

Ohio EPA sampled in this HUC at six locations for aquatic life parameters, and at eleven for bacteria. Aquatic life sample stations included five sites on the mainstem: RM 17 at SR 590, RM 15.7 at Slemmer-Portage Rd, RM 12.6 at SR 19, at RM 11.1 below the Oak Harbor WWTP, and at RM 5.9 above the confluence of the Little Portage. One site was on Wolf Creek at RM 6.5 at Yeasting Road SE of Elmore. The two most upstream sites on the mainstem, RM 17.0 and 15.7, were in full attainment. The other four sites were in non-attainment.

Of the eleven sites tested for bacteria, nine were on the mainstem, ranging from 17.03 to RM 0.50 downstream of the Port Clinton WWTP, near the mouth. Tributaries sampled were Hyde Run (Brush-Wellman discharge) and Wolf Creek (same site as aquatic life sampling). Eight of the eleven sites were in non-attainment for bacteria. The three in full attainment were Class A streams, RM 6.0 above the mouth of the Little Portage, and RMs 0.58 & 0.50 above and below the Port Clinton WWTP.

The physical habitat score (QHEI) declines steadily in this reach of the river. It is good at RM 17, fair at 15.7, poor at 12.55 and 11.1, and very poor at 6.0.

Source and causes of impairments cited include industrial and municipal point source, agriculture, and nutrients.

There are many potential sources of fecal bacteria affecting different parts of the HUC:

- Elmore is upstream of the HUC, so any impacts could affect the upstream stations in the HUC. These sites are in non-attainment for bacteria.
- Gibsonburg's wastewater effluent enters through Wolf Creek at RM 13.2. The Portage is in non-attainment for bacteria above and below this point.
- Oak Harbor's wastewater effluent enters near SR 19, RM 12.6. The Portage is in non-attainment for bacteria above and below this point.
- There are many package plants and Critical Sewage areas in the HUC, mostly below RM 12.6. The Portage is in attainment for bacteria from RM 6 to 0.5, which can be attributed to lake dilution.
- Septic systems are a potential impact throughout the watershed.

PCBs at 129 ppb were an additional impairment in this HUC. The OEPA TMDL (page v) notes: "In addition, legacy and potential ongoing PCB contamination within the sediments and fish of the Portage River are likely in part attributable to Brush Wellman. PCBs were again detected in a water sample of Hyde Run in 2008, so it is recommended that PCB monitoring be reinstated in the NPDES permit."

Problem Statement #1: (Bacteria)

The water quality of the Lower Portage subwatershed is impaired by elevated measurements of E. coli bacteria. The Portage TMDL data collected by Ohio EPA in 2008 indicate that eight of the HUC's 11 sampling sites are in non-attainment for E. coli. The TMDL cites failed HSTS as the causes of impairment due to high E. coli bacteria levels.

In this HUC are an estimated 1,930 HSTS. This area includes active package plants, of seven are permitted. There are seven Critical Sewage Areas. High numbers of HSTS, package plants, CSAs, and the Elmore WWTP discharge coupled with most of the sampling sites failing bacteria standards indicate sewage problems in this HUC.

Goal 1.1: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 12.3 million gallons of HSTS effluent annually

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 193 systems
- Lacarne Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- Waterford Place sewers completed and all structures tapped in
- SR 19 N of Oak Harbor to Salem-Carroll Road Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- Behlman sewers completed and all structures tapped in
- SR 19 S of Oak Harbor Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in
- Rocky Ridge sewers completed and all structures tapped in

Goal 1.2: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 79.5 million gallons of package plant effluent annually

Objectives:

- Upgrade 10 package plant(s). Effluent quality meets effluent stds

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Bacteria	1.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$2,880,000	Ottawa & Sandusky County Health Dept, TMACOG, Ohio EPA	2013 - 2022	Replace or upgrade 10% of watershed's HSTS or 193 systems	12.3 million gallons/year sewage discharge eliminated

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Ottawa County Health Department, Ottawa County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$120,840	Ottawa County Health Department, Ottawa County Sanitary Engineer, OEPA	2013-2018	Lacarne Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Construct sewers for Waterford Place Critical Sewage Area	$1,100,000	Ottawa County Sanitary Engineer, Oak Harbor	2016	Waterford Place sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Ottawa County Health Department, Ottawa County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$13,680	Ottawa County Health Department, Ottawa County Sanitary Engineer, OEPA, Oak Harbor	2013-2018	SR 19 N of Oak Harbor to Salem-Carroll Road Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Construct sewers for Behlman Critical Sewage Area	$381,000	Ottawa County Sanitary Engineer, Oak Harbor	2021	Behlman sewers completed and all structures tapped in	Included in HSTS totals

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Ottawa County Health Department, Ottawa County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$31,920	Ottawa County Health Department, Ottawa County Sanitary Engineer, OEPA, Oak Harbor	2013-2018	SR 19 S of Oak Harbor Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦Construct sewers for Rocky Ridge Critical Sewage Area		Ottawa County Sanitary Engineer, Rocky Ridge	2020	Rocky Ridge sewers completed and all structures tapped in	Included in HSTS totals
	1.2	♦Test package plant effluent for phosphorus ♦Set effluent standard in existing or new NPDES permit(s) ♦Enforce upgrades for phosphorus removal as needed	$36,000	Ohio EPA	2013-2017	Upgrade 10 package plant(s). Effluent quality meets effluent stds	79.5 million gallons/year effluent improved

Problem Statement #2: (Nutrients: phosphorus and nitrate)

Of the six aquatic life sampling sites in this HUC under the TMDL, Ohio EPA cites two in full attainment (RM 17.0 and 15.7), and the four downstream sites in non-attainment. Nutrient eutrophication and phosphorus are listed as causes of impairment. TMDL data show NO_3+NO_2 levels exceeding target concentrations at six sites, and at three sites for phosphorus.

Goal 2.1:

Meet TMDL target for phosphorus load reduction by 1,024 and nitrate load by 4,329 lb/year from HSTS

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 193 systems

Goal 2.2: Meet TMDL target for phosphorus load reduction by 4,642 and nitrate load by 22,441 lb/year from package plants

Objectives:

- Upgrade 10 package plant(s). Effluent quality meets effluent standards

Goal 2.3: Meet TMDL target for phosphorus load reduction by 534 and nitrate load by 1,524 lb/year from agricultural practices

Objectives:

- 250 acres of cover crops
- 50 acres of controlled drainage
- 50 acres of permanent hay
- 100 acres of riparian buffers
- 20 acres of restored wetlands
- 200 LF of stream restoration
- 10,947 acres under NRCS 590/1 Nutrient Mgt
- 4,692 acres under NRCS 590/3 Nutrient Mgt
- 1,000 acres of filter strips
- 200 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Nutrients (phosphorus and nitrate)	2.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$2,880,000	Ottawa & Sandusky County Health Dept, TMACOG, Ohio EPA	2013 - 2022	Replace or upgrade 10% of watershed's HSTS or 193 systems	Reduce phosphorus load by 1,024 and nitrate load by 4,329 lb./year
	2.2	♦Test package plant effluent for phosphorus ♦Set effluent standard in existing or new NPDES permit(s) ♦Enforce upgrades for phosphorus removal as needed	$36,000	Ohio EPA	2013-2017	Upgrade 10 package plant(s). Effluent quality meets effluent stds	Reduce phosphorus load by 4,642 and nitrate load by 22,441 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$15,000	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	250 acres of cover crops	Reduce phosphorus load by 378 and nitrate load by 757 lb./year
	2.3	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$23,550	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	50 acres of controlled drainage	Reduce phosphorus load by 30 and nitrate load by 77 lb./year
	2.3	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$14,000	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	50 acres of permanent hay	Reduce phosphorus load by 33 and nitrate load by 65 lb./year
	2.3	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$70,000	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	100 acres of riparian buffers	Reduce phosphorus load by 30 and nitrate load by 60 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$102,125	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	20 acres of restored wetlands	Reduce phosphorus load by 13 and nitrate load by 117 lb./year
	2.3	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$69,600	Ottawa & Sandusky SWCD, Ottawa & Sandusky co Engineer, NRCS, farmers	2013-2027 in phases	200 LF of stream restoration	Reduce phosphorus load by 8 and nitrate load by 15 lb./year
	2.3	♦Seek cooperators for Nutrient Management NRCS 590 Level 1 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management NRCS 590 Level 1 BMPs with farmers	$218,940	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2022	10,947 acres under NRCS 590/1 Nutrient Mgt	NA

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Seek cooperators for Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with farmers	$187,663	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2022	4,692 acres under NRCS 590/3 Nutrient Mgt	NA
	2.3	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$138	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	1,000 acres of filter strips	Reduce phosphorus load by 14 and nitrate load by 26 lb./year
	2.3	♦Identify & prioritize fields suited for Conservation Tillage BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Conservation Tillage BMP with farmer	$3,000	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	200 acres of conservation tillage	Reduce phosphorus load by 29 and nitrate load by 406 lb./year

Problem Statement #3: (Siltation/Sedimentation)

The TMDL cites sedimentation/siltation as a cause of impairment and non-irrigated crop production and channelization as sources, specifically at RM 12.55, 11.10, and 5.90.

Goal 3.1: Reduce sedimentation impairments by decreasing sediment load by 275 lb/year from agricultural practices

Objectives:

- 250 acres of cover crops
- 50 acres of controlled drainage
- 50 acres of permanent hay
- 100 acres of riparian buffers
- 20 acres of restored wetlands
- 200 LF of stream restoration
- 1,000 acres of filter strips
- 200 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Sedimentation	3.1	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$15,000	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	250 acres of cover crops	Reduce sediment load by 189 lb./year
	3.1	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$23,550	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	50 acres of controlled drainage	Reduce sediment load by 34 lb./year
	3.1	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$14,000	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	50 acres of permanent hay	Reduce sediment load by 17 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$70,000	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	100 acres of riparian buffers	Reduce sediment load by 15 lb./year
	3.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$102,125	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	20 acres of restored wetlands	Reduce sediment load by 5 lb./year
	3.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$69,600	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	200 LF of stream restoration	Reduce sediment load by 8 lb./year
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$138	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	1,000 acres of filter strips	Reduce sediment load by 07 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$3,000	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	200 acres of conservation tillage	Reduce sediment load by 1 lb./year

Problem Statement #4: (Habitat Alteration)

The OEPA TMDL determined QHEI scores for four sites in 2008. RM 15.70 scored "fair," RM 12.55 and 11.10 scored "poor," and RM 6.00 was "very poor."

Goal 4.1: 120 acres of habitat restoration and 200 linear feet of stream corridor restoration practices

Objectives:

- 100 acres of riparian buffers
- 20 acres of restored wetlands
- 200 LF of stream restoration

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Habitat Impairment	4.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$70,000	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	100 acres of riparian buffers	Load reductions provided in nutrient and sediment tables

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	4.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$102,125	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	20 acres of restored wetlands	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$69,600	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	200 LF of stream restoration	Load reductions provided in nutrient and sediment tables

Problem Statement #5: (Recreation)

There is an unmet demand for public recreation access to Lower Portage River. It is an underserved river for boating access, with no public sites in a twelve mile reach.

Goal 5.1: Establish public access for canoes and kayaks

Objectives:

- Acquire, design, construct canoe/kayak access at Pemberville, Woodville, Elmore, Oak Harbor, and Port Clinton

Goal 5.2: Establish a water trail between Pemberville and the mouth of the Portage

Objectives:

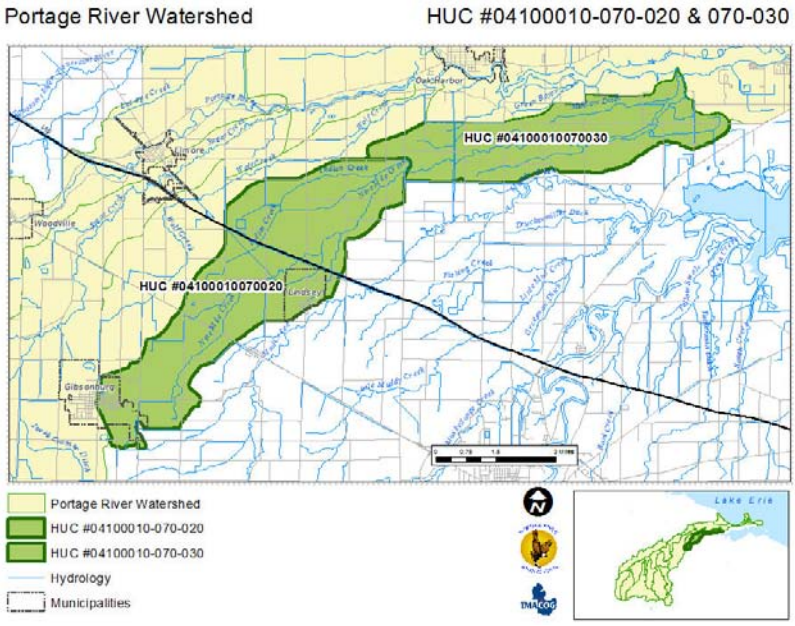
- Establish a water trail connecting the Portage River canoe/kayak access points at the five communities

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Recreation	5.1	♦Develop funding proposals and plans ♦Secure funding for access facilities ♦Select and acquire access points ♦Prepare facility designs ♦Construct facilities	$750,000	Pemberville, Woodville, Elmore, Oak Harbor, Port Clinton, ODNR	2013 - 2020	Establishment of public access facilities for canoes, kayaks	NA
Recreation	5.2	♦Stakeholders meet to decide creation of water trail ♦Secure funding ♦Prepare water trail plan ♦Solicit sponsors for water trail and materials (eg resource guide) ♦Prepare Portage River canoe/kayak map and resource guide	$150,000	Pemberville, Woodville, Elmore, Oak Harbor, Port Clinton, Wood, Ottawa, and Sandusky County Parks, Wood and Ottawa SWCD, TMACOG, ODNR	2015 - 2020	Creation of Water Trail and recognition by ODNR	NA

LITTLE PORTAGE RIVER

04100010 070-020 and 04100010 070-030 (14 – digit HUC)
04100010 05 01(New 12-digit HUC)

Length: 18.28 miles
Elevation at Mouth: 575
Elevation at Source: 645
Gradient: 3.83 ft/mile
Drainage Area: 32.63 sq mi



Ohio Topographic Quadrangle
7.5 minute (1:24,000)

- Lacarne
- Elmore
- Lindsey
- Helena
- Wightmans Grove

Urban Areas:
Gibsonburg
Lindsey

Geology

Ottawa County lies entirely within the Huron/Erie Lake Plan (HELP) Eco-region. The HELP region is very flat having little relief; the soils are poorly to very poorly drained and consist of parent material derived from glacial tills and lacustrine deposits associated with the Wisconsin glacial era. The glacial till is predominantly in the form of ground moraine overlies limestone bedrock. The thickness of the glacial drift varies from about 25 meters to only a few centimeters. The uppermost bedrock strata consist of Silurian dolomite and dolomitic limestone.

Bedrock formations underlying Sandusky County are comprised of Devonian and Silurian aged limestones and dolomites. These carbonate units, which reach thicknesses of several hundred feet in the western Sandusky County area of the Portage River, represent the regional aquifer. Sandusky County has a karst terrain with distinctive characteristics of relief and drainage resulting from the dissolution of limestone or dolomite by the action of surface and ground water. Karst terrain typically has a well-developed underground drainage network ranging from fractures and minor solution channels to caverns with subterranean streams.

The most recent glacial stage, the Wisconsinan, left evidence of deposits of till, sand and gravel. Till is an unconsolidated, poorly sorted, non-stratified (layered) mixture of clay, silt, sand and gravel directly deposited by ice. Till thickness averages under 20 feet in western Sandusky County (Larsen, 1984 a,b.). Much of the original thickness of the till deposited in Sandusky

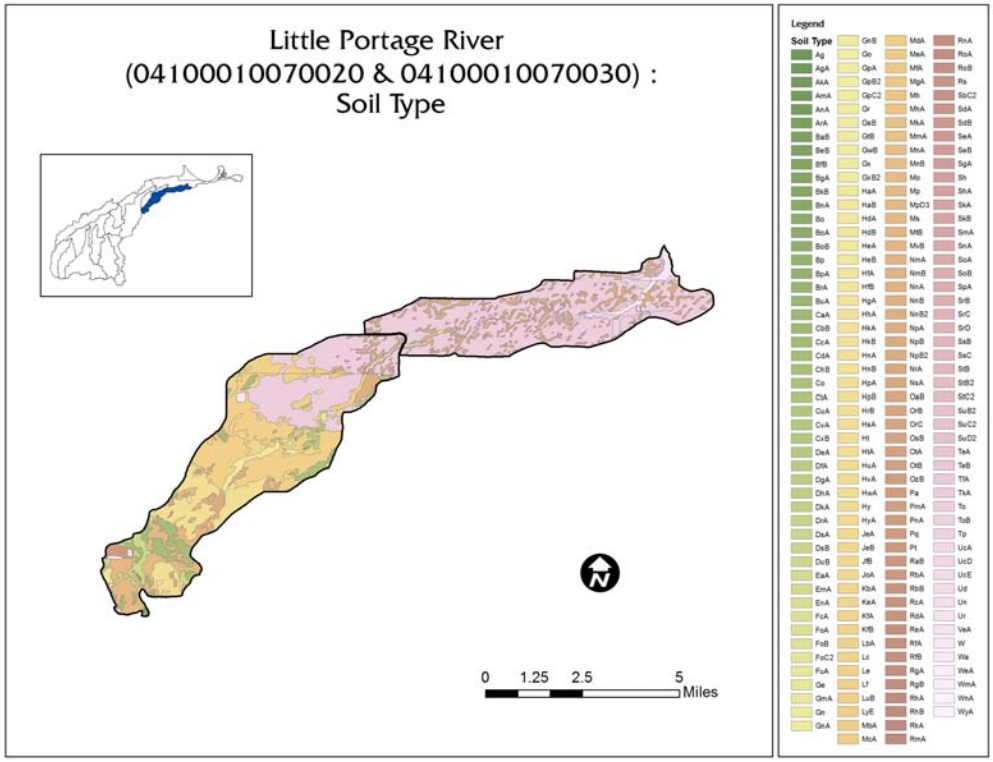
County was removed by subsequent glaciations and by wave activity associated with post glacial lakes.

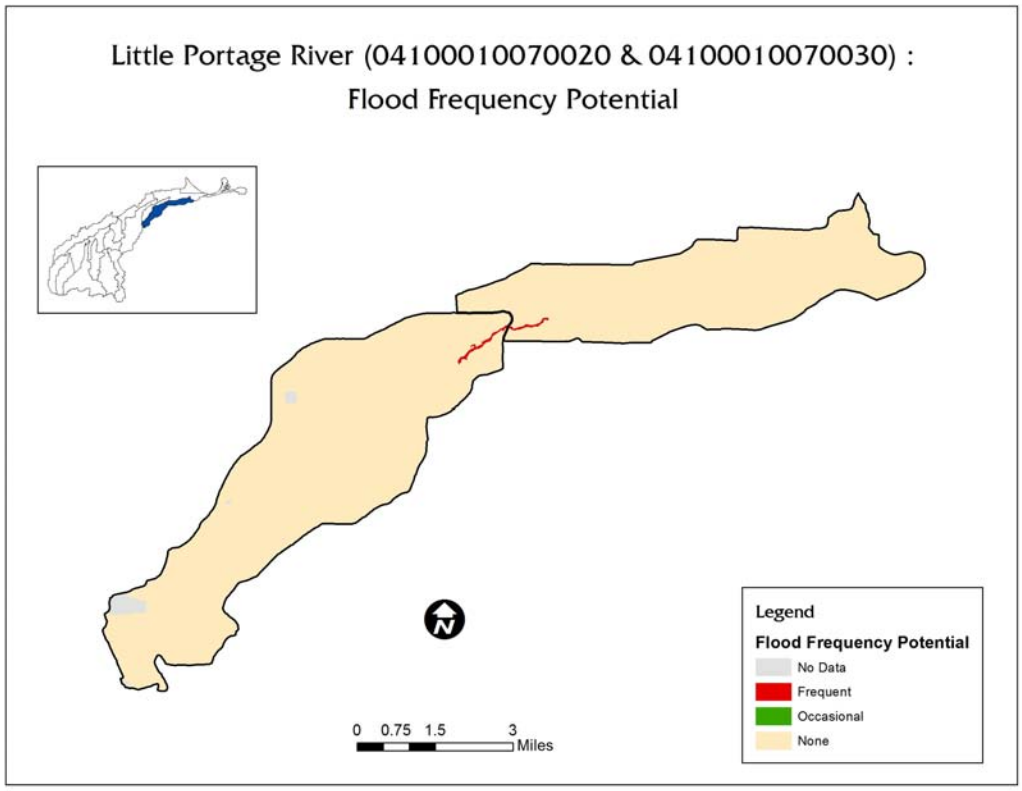
The original land surface created by till deposition in Sandusky County is largely obscured by lake deposits or was eroded by wave action. Classical till features such as ground moraine or end moraines are not detectable in Sandusky County. The will surface may be referred to as wave-planed till or water-modified till (Forsyth, 1965). Wave erosion (Angle, 1988a) is probably largely responsible for the abundance of shallow and exposed bedrock in Sandusky County (Ground Water Pollution Potential Report No. 19, ODNR, 1990).

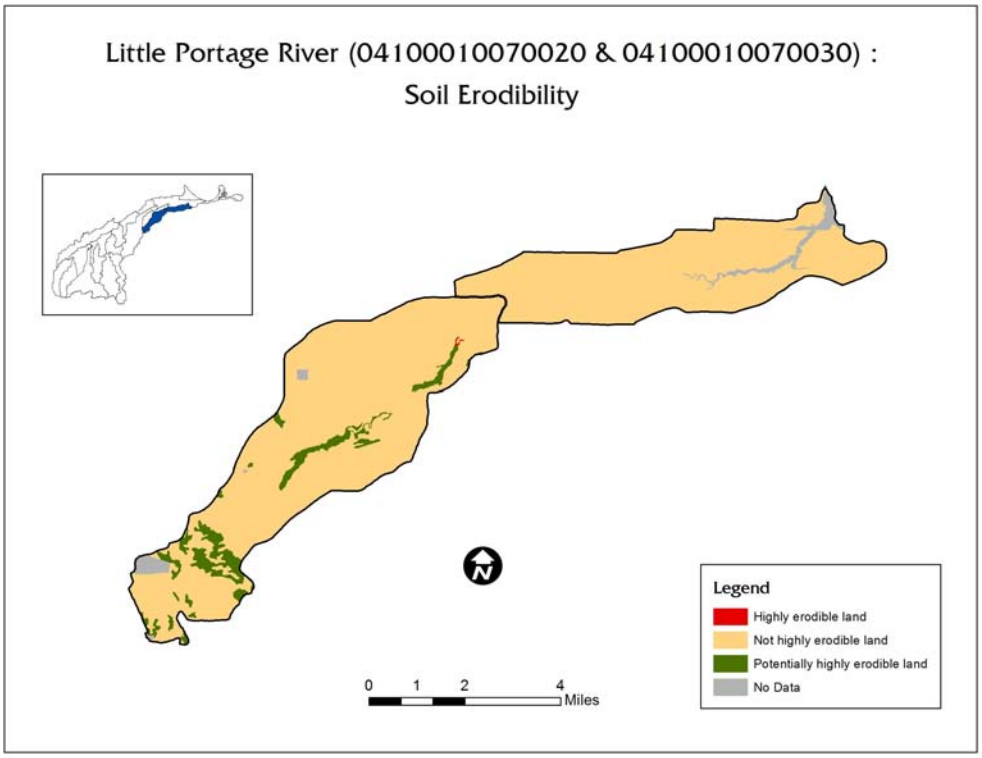
Soils

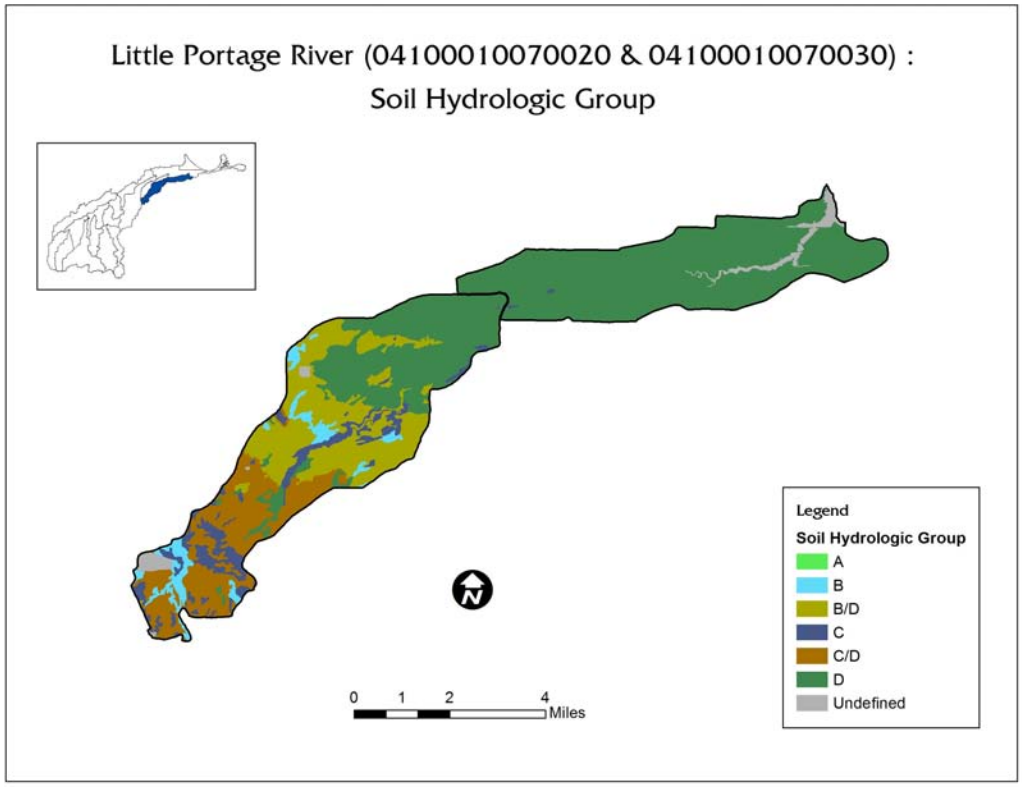
The four predominant soils within the Little Portage subwatershed are Toledo, Lenawee, Nappanee, and Hoytville. They are all fine grained, flat, somewhat to very poorly drained, and either C/D soils (Hoytville), B/D (Lenawee), or D (Nappanee, Toledo). They are not highly erodible, and are considered prime farm land when drained.

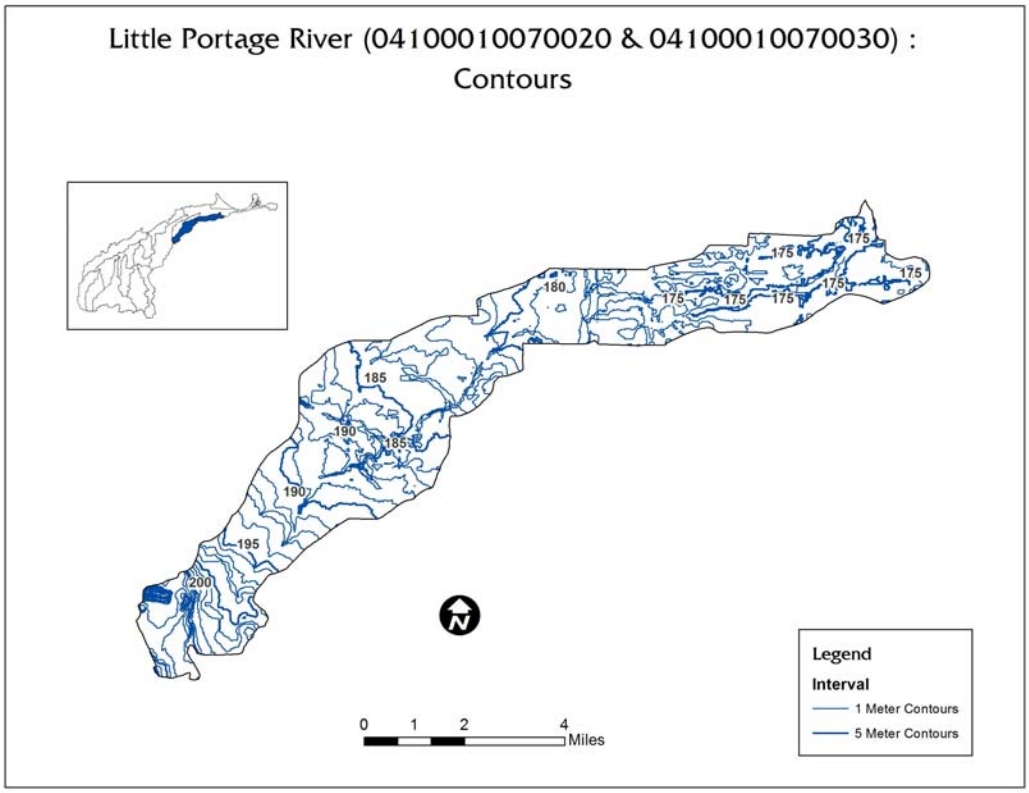
Major Soil Groups		
070-020 & 070-030		
Toledo	Sum Acres	9,141
	Percentage	44.05%
Lenawee	Sum Acres	3,348
	Percentage	16.13%
Nappanee	Sum Acres	2,301
	Percentage	11.09%
Hoytville	Sum Acres	1,650
	Percentage	7.95%
Millsdale	Sum Acres	1,254
	Percentage	6.04%
Castalia	Sum Acres	638
	Percentage	3.07%
Kibbie	Sum Acres	376
	Percentage	1.81%
Dunbridge	Sum Acres	364
	Percentage	1.76%

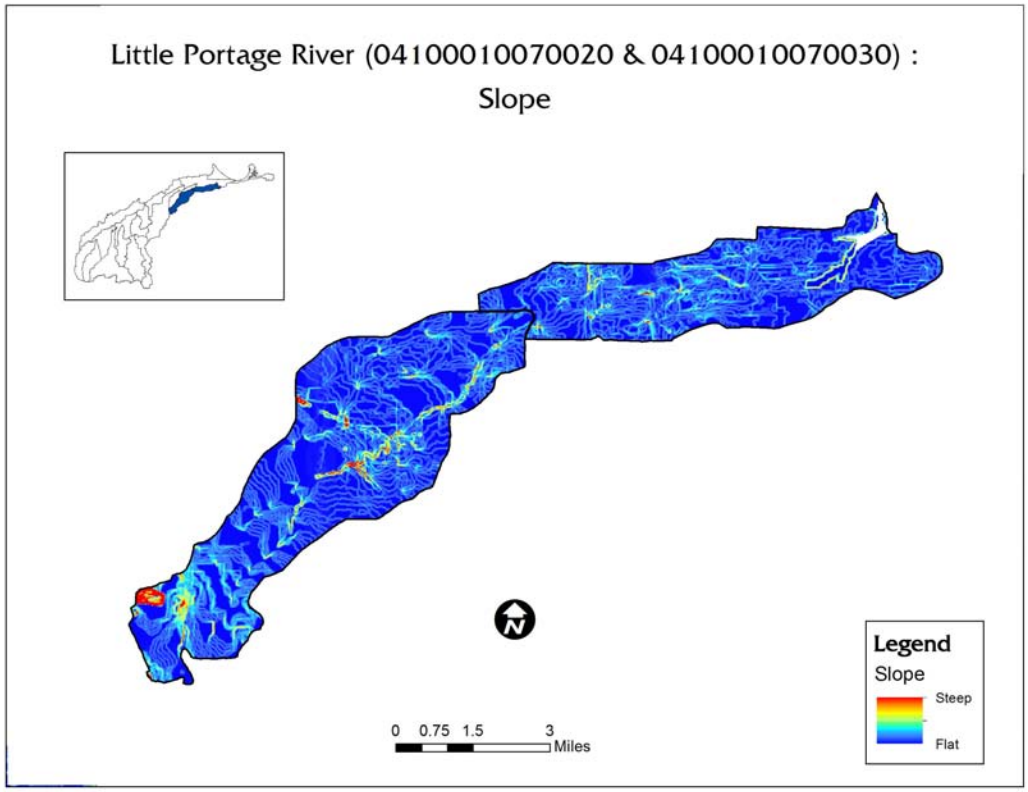

Little Portage River
(04100010070020 & 04100010070030) :
Soil Type
0 1.25 2.5 5
Miles
Legend
Soil Type

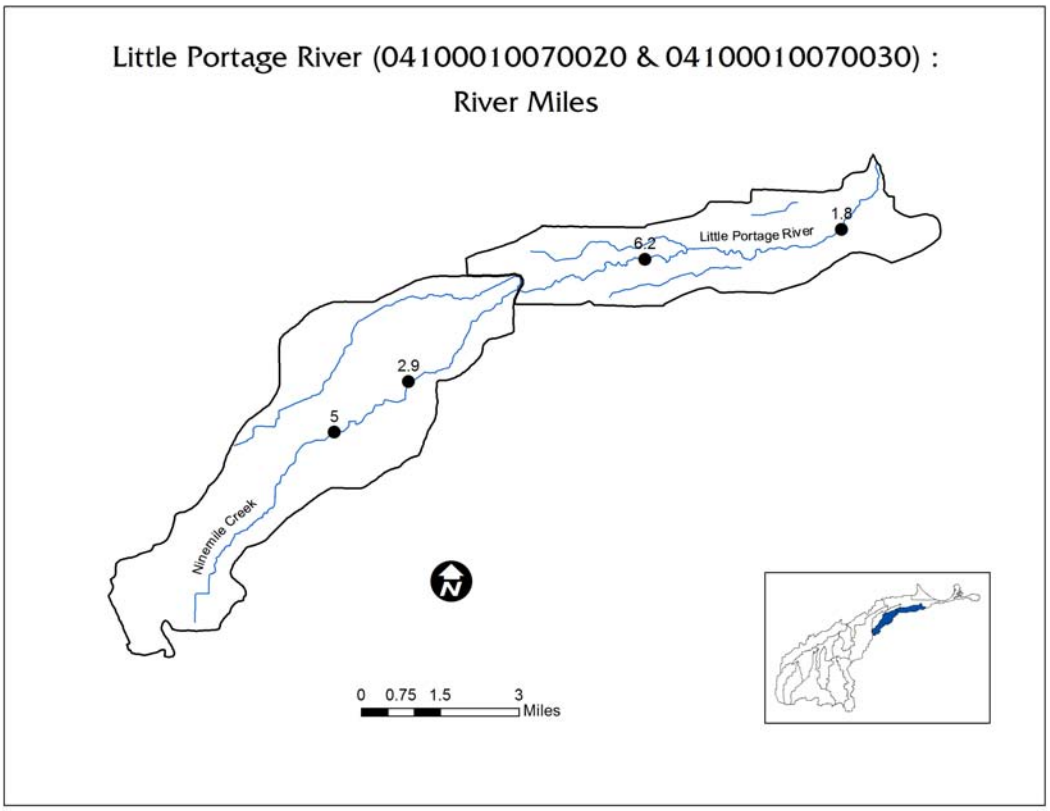

Little Portage River (04100010070020 & 04100010070030) :
Flood Frequency Potential
0 0.75 1.5 3
Miles
Legend
Flood Frequency Potential
No Data
Frequent
Occasional
None


Little Portage River (04100010070020 & 04100010070030) :
Soil Erodibility
Legend
Highly erodible land
Not highly erodible land
Potentially highly erodible land
No Data
0 1 2 4
Miles


Little Portage River (04100010070020 & 04100010070030) :
Soil Hydrologic Group
Legend
Soil Hydrologic Group
A
B
B/D
C
C/D
D
Undefined
0 1 2 4
Miles


Little Portage River (04100010070020 & 04100010070030) :
Contours
175
180
185
190
195
200
Legend
Interval
1 Meter Contours
5 Meter Contours
0 1 2 4
Miles


Little Portage River (04100010070020 & 04100010070030) :
Slope
Legend
Slope
Steep
Flat
0 0.75 1.5 3
Miles



The Soil Hydrologic Group map indicates the *Hydrologic soil groups* based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately course texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (**A/D, B/D, or C/D),** the first letter is for drained areas and the second is for undrained areas.

Rare, Threatened, Endangered Species

The Little Portage subwatershed HUC14 04100010 070 020 and -030 provides habitat for several rare, threatened, or endangered species, four of which are threatened, and two endangered.

Rare, Threatened, Endangered Species

Common Name	*Scientific Name*	Last Observed	State Status
Bald Eagle	Haliaeetus leucocephalus	2010	T
Western Meadowlark	Sturnella neglecta	1985-07	SI
American Bittern	Botaurus lentiginosus	1977	E
Bald Eagle	Haliaeetus leucocephalus	2010	T
Blanding's Turtle	Emydoidea blandingii	1980-07	T
Eastern Foxsnake	Pantherophis gloydi	1983	SC
Gadwall	Anas strepera	1983-07-29	SI
Green-winged Teal	Anas crecca	1984-06-21	SI
King Rail	Rallus elegans	1983-08	E
Least Bittern	Ixobrychus exilis	1984-06-16	T
Ruddy Duck	Oxyura jamaicensis	1983-05-29	SI
Sora Rail	Porzana carolina	1984-06	SC
Thamnophis Sirtalis	Melanistic garter snake	2000-05-07	SC
Virginia Rail	Rallus limicola	1984-06	SC

T=Threatened, P=Potentially Threatened, E=Endangered, X=Presumed Extirpated, SC=Species of Concern

Mussel Species in the Little Portage River

Stream River Miles	Common Mussel Name	*Scientific Name*	Observed	Status
6.20	White Heelsplitter	*Lasmigona complanata complanata*	2008	—
6.20	Giant Floater	*Pyganodon grandis grandis*	2008	—
Source: Freshwater Mussels of the Maumee Drainage 2nd Edition. Grabarkiewicz, J., and Crail, T.		**Source:** Ohio EPA Technical Report EAS/2010-4-4		

HUC 8 – 04100010 (Portage River)									
HUC 10 – 0410001005 (Lower Portage River-Frontal Lake Erie)									
HUC 12 – 041000100501 (Little Portage River)									
HUC 14 – 04100010070020 & 030 (Ninemile Creek, Little Portage River below Ninemile Cr. to Portage R.)									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
1	2008	S02P04	L. Portage R. 2 Mi. S Of Oak Harbor @	6.20	21.2	WWH	Partial	Sedimentation/Siltation	Non-irrigated Crop Production, Channelization

HUC 8 – 04100010 (Portage River)									
HUC 10 – 0410001005 (Lower Portage River-Frontal Lake Erie)									
HUC 12 – 041000100501 (Little Portage River)									
HUC 14 – 04100010070020 & 030 (Ninemile Creek, Little Portage River below Ninemile Cr. to Portage R.)									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
			Co. Rd. 169						
2	2008	S02S23	L. Portage R. S Of Lacarne @ Co. Rd. 17	1.79	30.0	WWH	Non	Sedimentation/Siltation, Nutrient/Eutrophication Indicators	Biological
3	2008	S02K02	Ninemile Creek Nw Of Lindsey @ TR 92 (Hessville Rd)	5.00	7.9	WWH	Partial	Low flow alterations, Nutrient/Eutrophication Biological Indicators, Direct Habitat Alterations, Sedimentation/Siltation	Non-irrigated Channelization
4	2008	S02K01	Ninemile Creek N Of Lindsey @ Co. Rd. 141 (Dunmyer Rd.)	2.93	9.6	WWH	Partial	Low flow alterations, Direct Habitat Alterations, Sedimentation/Siltation	Channelization, Non-irrigated Crop Production

Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010.

Water Resources

Surface Water

Designated Use for aquatic life is warm-water habitat (WWH). **Recreation Use** assessment is Class B. That determines the acceptable E. coli colony numbers as shown below in a summary table.

Recreational Use Attainment							
Location	RM	Rec Use PCR Class	Number of Samples	**E. coli Standard:** Mean <126 (A), or <161 (B) and Maximum Sample ≤ 298 (A) or ≤ 523 (B)		Attainment Status	Sources of Bacteria
				Mean	Max		
Little Portage R At Cr 169	6.20	B	5	1888	4600	Non	HSTS; Agric.
Little Portage R At Cr 17	1.79	B	6	84	590	Full	
Ninemile Ck At TR 92 (Hessville Rd)	5.00	B	4	1151	9600	Non	HSTS; Agric.
Ninemile Ck At Cr 141 (Dunmyer Rd)	2.93	B	4	555	5700	Non	HSTS; Agric.

Aquatic Life Use Assessment				
Location	**RM**	**Drainage Area**	**Aquatic Life Use**	**Attainment Status**
L. Portage R. 2 Mi. S Of Oak Harbor @ Co. Rd. 169	6.2	21.2	WWH	Partial
L. Portage R. S Of Lacarne @ Co. Rd. 17	1.8	30.0	WWH	Non
Ninemile Creek Nw Of Lindsey @ TR 92 (Hessville Rd)	5.0	7.9	WWH	Partial
Ninemile Creek N Of Lindsey @ Co. Rd. 141 (Dunmyer Rd.)	2.9	9.6	WWH	Partial
Source: Ohio EPA 2012 Integrated Report: http://wwwapp.epa.ohio.gov/dsw/ir2012/search.html				

Macro-invertebrate Communities										
Stream RM	**Dr. Ar. (sq. mi.)**	**Data Codes**	**Qual. Taxa**	**EPT QI./Total**	**Sensitive Taxa QI./Total**	**Density QI./Qt.**	**CW Taxa**	**Predominant Organisms on the Natural Substrates With Tolerance Category(ies)**	**ICI[a]**	**Narrative Evaluation**
6.20	21.2	8	37	4 / 5	5 / 5	L / 240	0	Midges (MT,T,MI), phantam midges (T)	20	
1.79	30	8,11	32	3 / 3	0 / 0	M / 2730	0	Water boatmen (F), damselflies (F), Scuds (F)	14L	
5.00	7.9	-	41	5	6	M	0	Midges (T,F), blackflies (F)	-	Low Fair
2.93	9.6	-	34	4	2	L-M	0	Midges (T), fingernail clams (F)	-	Low Fair
Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010 http://epa.ohio.gov/dsw/tmdl/PortageToussaintRivers.aspx										

Public Drinking Water Supply Assessment				
HUC	**Reporting Category**	**Cause of Impairment**	**Nitrate Watch List**	**Pesticide Watch List**
040100010 05-01	No active intakes	None	No	No

Fish Tissue Assessment			
HUC	**Reporting Category**	**Causes of Impairment**	**PCB Concentration**
040100010 05-01	5h	None	

Water Quality Monitoring Results: Ohio EPA 1994 and 2008						
River Mile	**Date**	**IBI**	**ICI**	**MiWB**	**QHEI**	**STATUS**
Little Portage River @ RM 0.6	1994	18*	--	4.1*	--	NON At Mouth
Little Portage River Road CR 169 RM 6.2	2008	21 [W]	31	7.1[ns]	20*	33.0
Little Portage River Road CR 17 RM 1.79	2008	30 [B]	23	7.7	14	43.5
Ninemile Creek @ Hessville Road RM 5.0	2008	7.8 [H]	24[ns]	N/A	LF*	26.0
Ninemile Creek @ Dunmyer Road RM 2.93	2008	8.7 [H]	30	N/A	LF*	43.5

a - River Mile (RM) represents the Point of Record (POR) for the station, not the actual sampling RM.
b - MIwb is not applicable to headwater stream with drainage areas ≤20 mi^2.
c - A narrative evaluation of the qualitative sample based on attributes such as EPT taxa richness, number of sensitive taxa, and community composition was used when quantitative data was not available or considered unreliable. VP=Very Poor, P=Poor, LF=Low Fair, F=Fair, MG=Marginally Good, G=Good, VG=Very Good, E=Exceptional
d - Attainment is given for the proposed status when a change is recommended. Aquatic life use in superscript.
ns - Nonsignificant departure from biocriteria (≤4 IBI or ICI units, or ≤0.5 MIwb units).
* - Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.
Sources: Biological and Water Quality Study of the Portage River Basin, Ohio EPA 1995, Tables 12 & 13; Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010 http://epa.ohio.gov/dsw/tmdl/PortageToussaintRivers.aspx

General narrative ranges assigned to QHEI scores.				
Narrative Rating		QHEI Range		
		Headwaters (≤ sq mi)	Larger Streams	Lacustuary
Excellent		≤ 70	≤ 75	≤ 80
Good		55 to 69	60 to 74	60 to 80
Fair		43 to 54	45 to 59	45 to 59
Poor		30 to 42	30 to 44	30 to 44
Very Poor		<30	<30	<30

2008 OEPA Assessments

Little Portage River RM 1.79 was a lacustuary site which received IBI=21 and MIwb=7.7 scores. These poor to fair fish scores were reflective of the siltation and nutrient/organic enrichment attributed to the upstream agricultural land use. Top carnivores comprised only 9% of the fish community and no cyprinid species were collected.

Macroinvertebrate communities collected from Wolf Creek, Little Portage River, and Ninemile Creek were not meeting WWH expectations and were characterized by low EPT and sensitive taxa diversity. Impairments to the biotic integrity of these streams included habitat alteration, siltation, and nutrient enrichment. The downstream station on Little Portage River (RM 1.79) was a Lake Erie lacustuary and was likely impacted by siltation and nutrient enrichment.

Three of the four sites within Little Portage River HUC (041000100501) were in partial attainment due to sedimentation/siltation and often low flow alterations and direct habitat alterations from channelization and non-irrigated crop production. Little Portage River RM 1.79 was in non-attainment due to sedimentation/siltation and excess nutrients/eutrophication associated with non-irrigated crop production.

Biological Criteria Benchmarks

Biological Criteria					Lacustuary Benchmarks[1]				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
IBI-Headwaters	50	28	20	18	N/A	N/A	N/A	N/A	N/A
IBI-Wading	50	32	22	18	N/A	N/A	N/A	N/A	N/A
IBI-Boat	48	34	20	16	50	42	31	17	<17
MIwb-Wading	9.4	7.3	5.6	4.5	N/A	N/A	N/A	NA	N/A
MIwb-Boat	9.6	8.6	5.7	5.0	10	8.6	5.6	2.8	<2.8
ICI	46	34	22	8	52	42	25	12	<12

[1] **Proposed Lacustuary scoring breakpoints. These have not yet been adopted into rule.**

Ground Water

There are two municipalities within this subwatershed that rely on groundwater for drinking water: the Village of Gibsonburg, and the Village of Lindsey. In most of the watershed individual residences obtain water from household private wells.

Source Water Assessment Plan (SWAP)

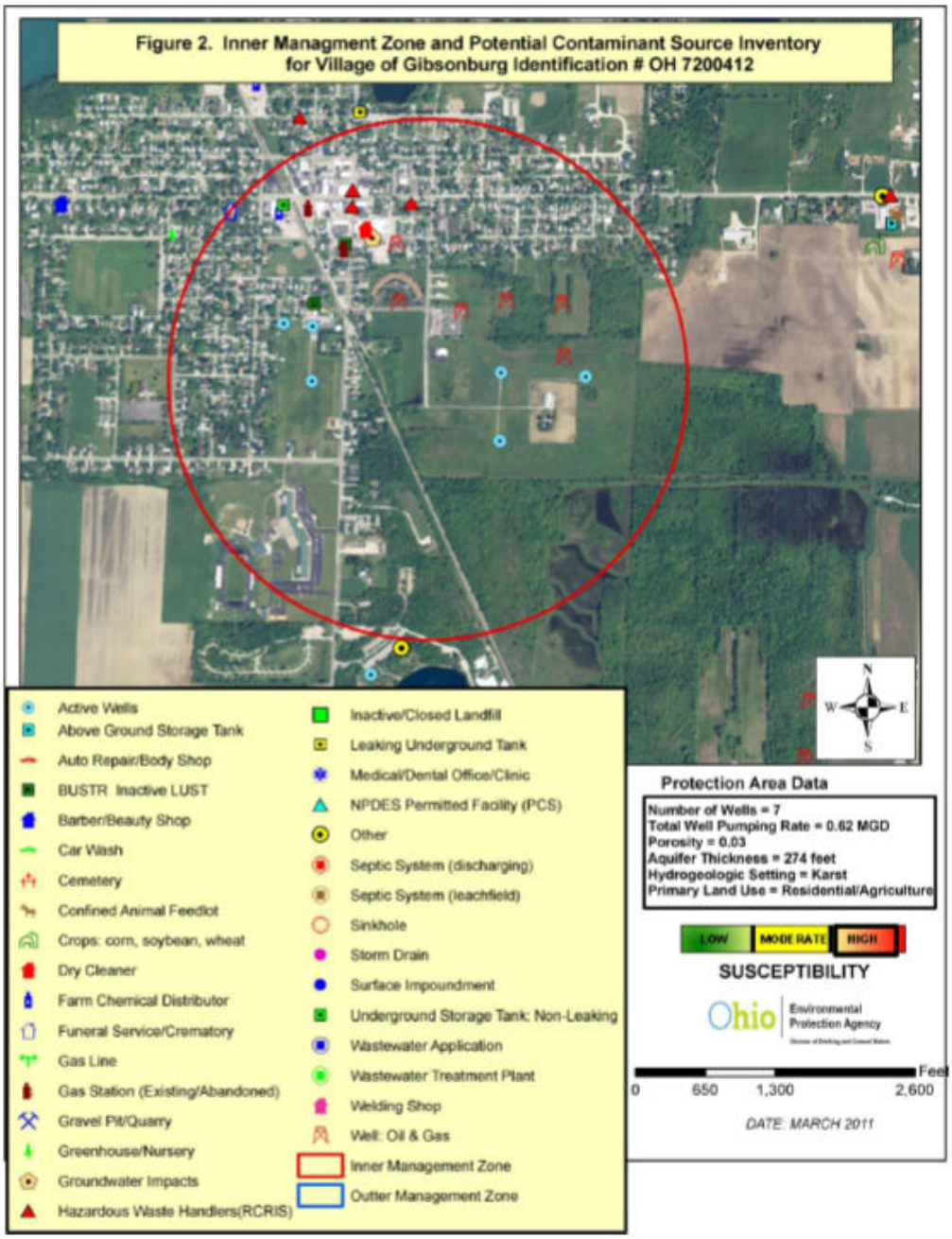
Both the Villages of Gibsonburg and the Lindsey operate public water systems in this watershed. Both draw their source from groundwater.

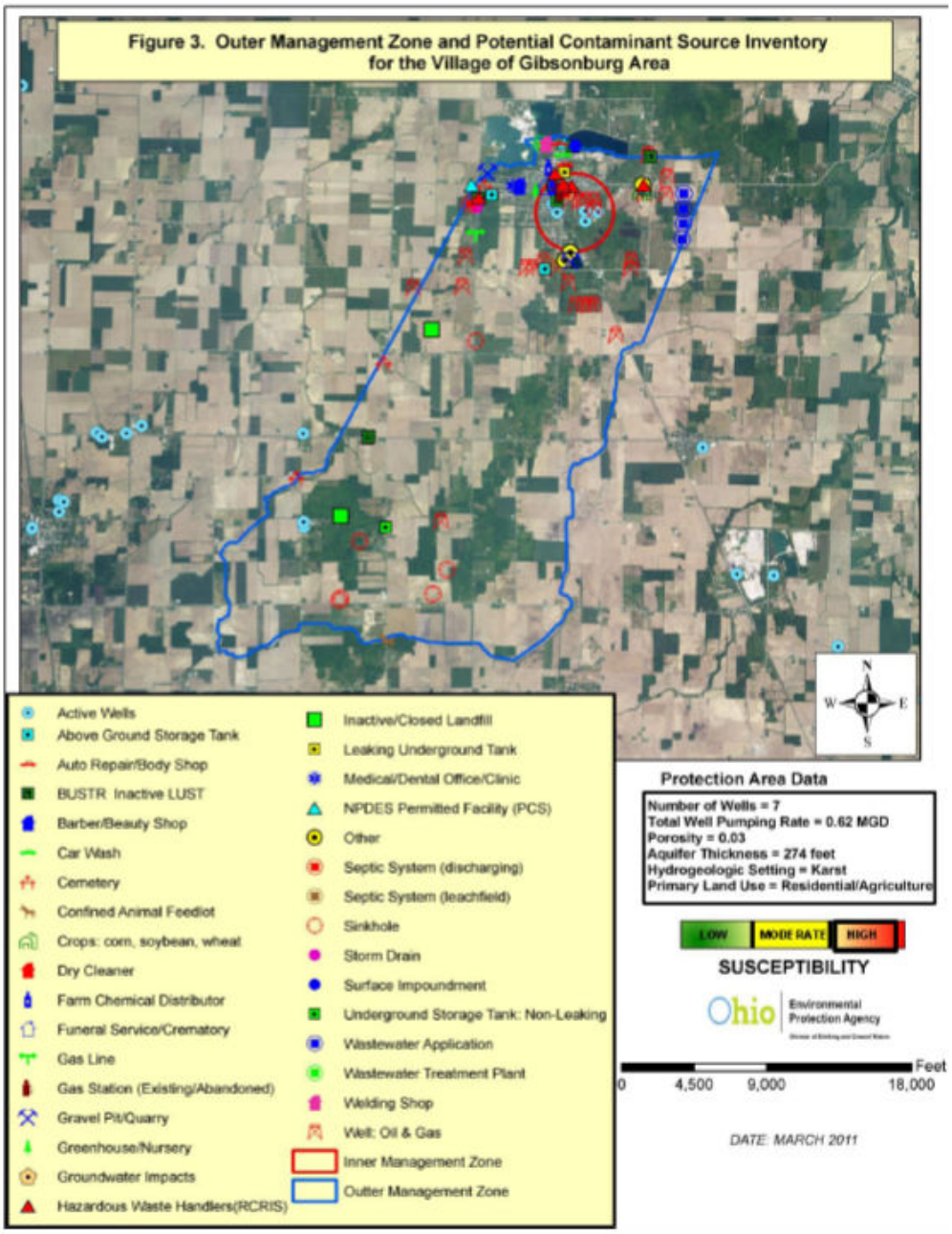
Gibsonburg Water System

The Village of Gibsonburg operates a community public water system serving 2,450 residents. The system uses six wells that pump approximately 400,000 gallons of water per day from a carbonate bedrock aquifer located in a potential karst region. Ohio's potential karst regions are carbonate aquifers that are covered by less than 25 feet of glacial material and typically exhibit surficial karst features, such as sinkholes. The aquifer is covered by 5-13 feet of low-permeability material, which provides minimal protection from contamination. Depth to water in this aquifer is 5 to 38 feet below the ground surface.

Soils in the area are sandy clay and silty clay loams which range from moderately well-drained to poorly drained, meaning that amount of the rainfall and snowmelt that will infiltrate into the soil varies across the area. The topography is generally flat with a low relief. Groundwater in this area is replenished by the gradual flow of water underground from higher to lower elevations and by approximately 4 to 7 inches per year of precipitation that infiltrates through the soil. In northwest Ohio the regional ground water flow direction is primarily towards Lake Erie. In karst settings, however, local flow direction is highly variable and is influenced by fracture orientation.

The protection area for Gibsonburg is shown in the following two figures. They show two areas, one inside the other. The "inner protection zone" is closer to the water supply wells and a chemical spill in this zone poses a greater threat to the drinking water, so this area warrants more stringent protection. The "outer protection zone" is the additional area that contributes water to pumped wells within a longer time frame. Together, they comprise the drinking water source protection area.





This assessment indicates that the Village of Gibsonburg's source of drinking water has a high susceptibility to contamination because:

- The water quality results indicated the presence of three volatile organic compounds implying a pathway exists from the ground surface to the aquifer;
- The well is located in a sensitive potential karst area;
- The well is open between approximately 25 and greater than 100 feet in the fractured limestone and the depth to water is less than 10 feet below the ground surface; and
- Potential contaminant sources exist within the protection area.

Protective strategies are activities that help protect a drinking water source from becoming contaminated. Ohio EPA encourages Gibsonburg to develop and implement an effective Drinking Water Source Protection Plan. Ongoing implementation of the plan will help protect the Village of Gibsonburg's valuable drinking water resources for current and future generations.

Gibsonburg's drinking water source protection area overlaps the drinking water source protection areas of White Star Picnic Area, White Star Concession, White Star Ice Cream, and Cactus Flats Campground. Ohio EPA recommends these public water systems work cooperatively together to protect this shared resource.[8]

Lindsey Water System

Village of Lindsey operates a community public water system serving 539 people. It uses two wells that pump approximately 60,000 gallons of water per day from an aquifer located in a potential karst region. Ohio's potential karst regions are carbonate aquifers that are covered by less than 25 feet of glacial material and typically exhibit surficial karst features, such as sinkholes. The aquifer is covered by 20-22 feet of low-permeability material, which provides significant protection from contamination. Depth to water in this aquifer is 20 to 22 feet below the ground surface.

Soils in the area are silty clay loams to silt loams which are very poorly to somewhat poorly drained, meaning that much of the rainfall and snowmelt will not infiltrate into the soil, instead it will run off or pond. The topography is generally flat with no relief. Groundwater in this area is replenished by the gradual flow of water underground from higher to lower elevations. In northwest Ohio the regional ground water flow direction is primarily towards Lake Erie. In karst settings, however, local flow direction is highly variable and is influenced by fracture orientation.

Lindsey's drinking water source protection area is shown in the following figure; it is a large protection area because the aquifer is in the potential karst region. This figure shows two areas, one inside the other. The "inner protection zone" is the area that provides groundwater to Lindsey's well within one year of pumping. A chemical spill in this zone poses a greater threat to the drinking water, so this area warrants more stringent protection. The "outer protection zone" is the additional area that contributes water when the well is pumped for five years. Together, they comprise the drinking water source protection area.

8 *Drinking Water Source Assessment for the Village of Gibsonburg,* Ohio EPA 2011

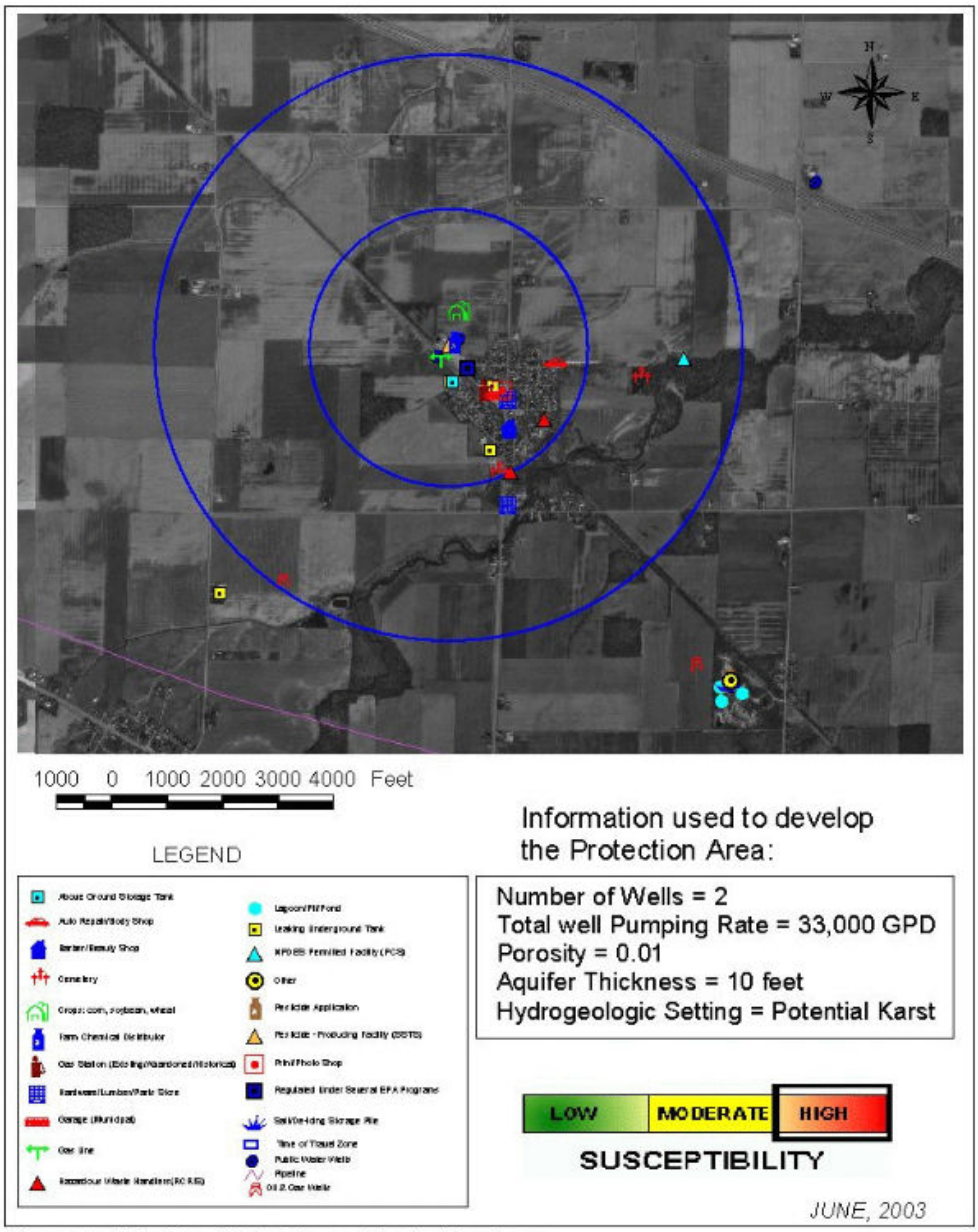


Figure 2. Drinking Water Source Protection Area for the Village of Lindsey Public Water System Identification # 7200512

This assessment indicates that the Village of Lindsey's source of drinking water has a high susceptibility to contamination because the well is in a sensitive potential karst area, and because potential contaminant sources exist within the protection area. This does not mean that the aquifer will become contaminated, only that under the existing conditions ground water could become impacted by potential contaminant sources.

Protective strategies are activities that help protect a drinking water source from becoming contaminated. Ohio EPA encourages Lindsey to develop and implement an effective Drinking

Water Source Protection Plan. Ongoing implementation of the plan will help protect the Village of Lindsey's valuable drinking water resources for current and future generations.[9]

DRASTIC MAP

The sensitivity of the groundwater to local sources of contamination is determined and rated by **DRASTIC** maps as described below:

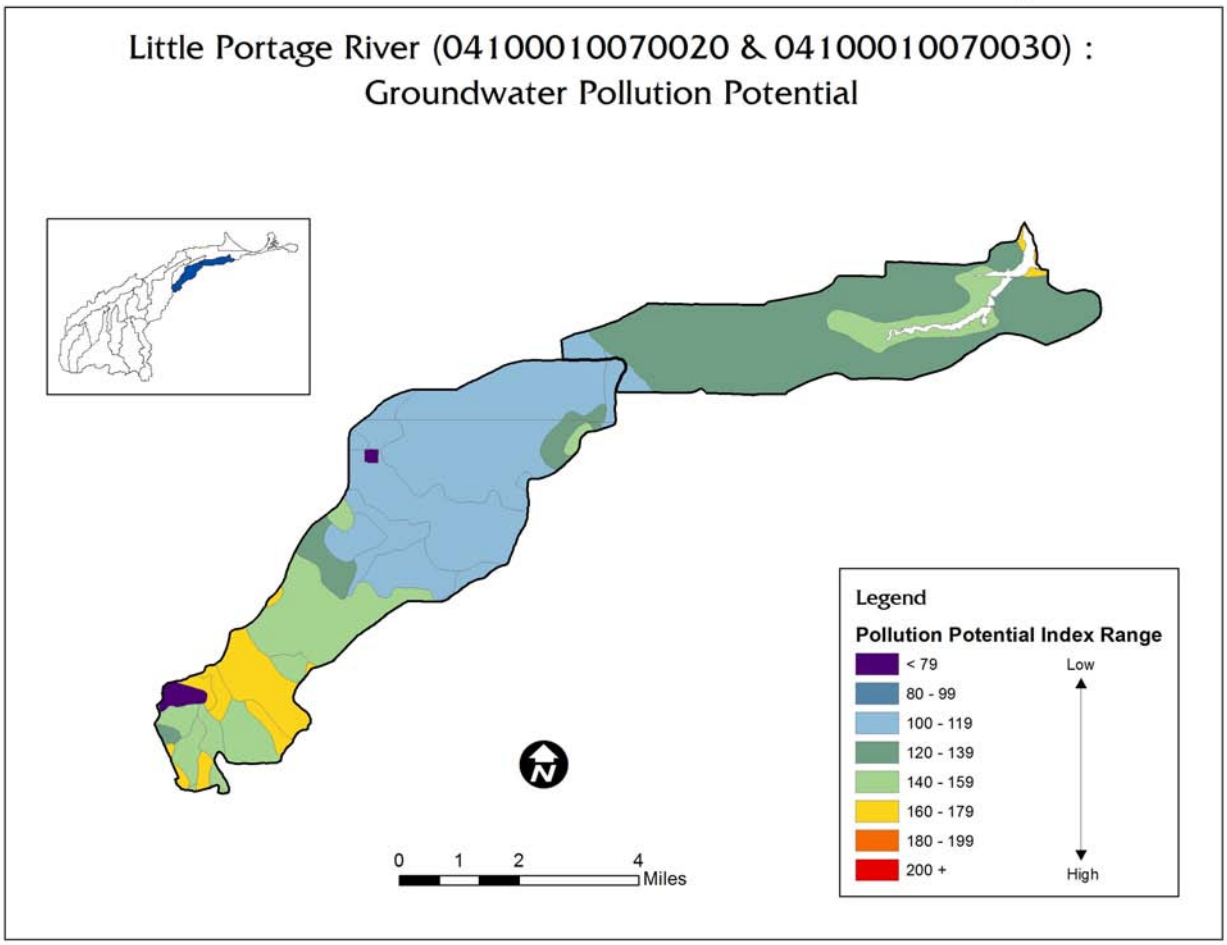
> Inherent within each geologic setting are the physical characteristics which effect the groundwater pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:
>
> **D** – Depth to Water
> **R** – Net Recharge
> **A** – Aquifer Media
> **S** – Soil Media
> **T** – Topography
> **I** – Impact of the Vadose Zone Media
> **C** – Conductivity (Hydraulic) of the Aquifer (ODNR, 1994)

Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index then the greater the vulnerability to contamination (ODNR, 1994).

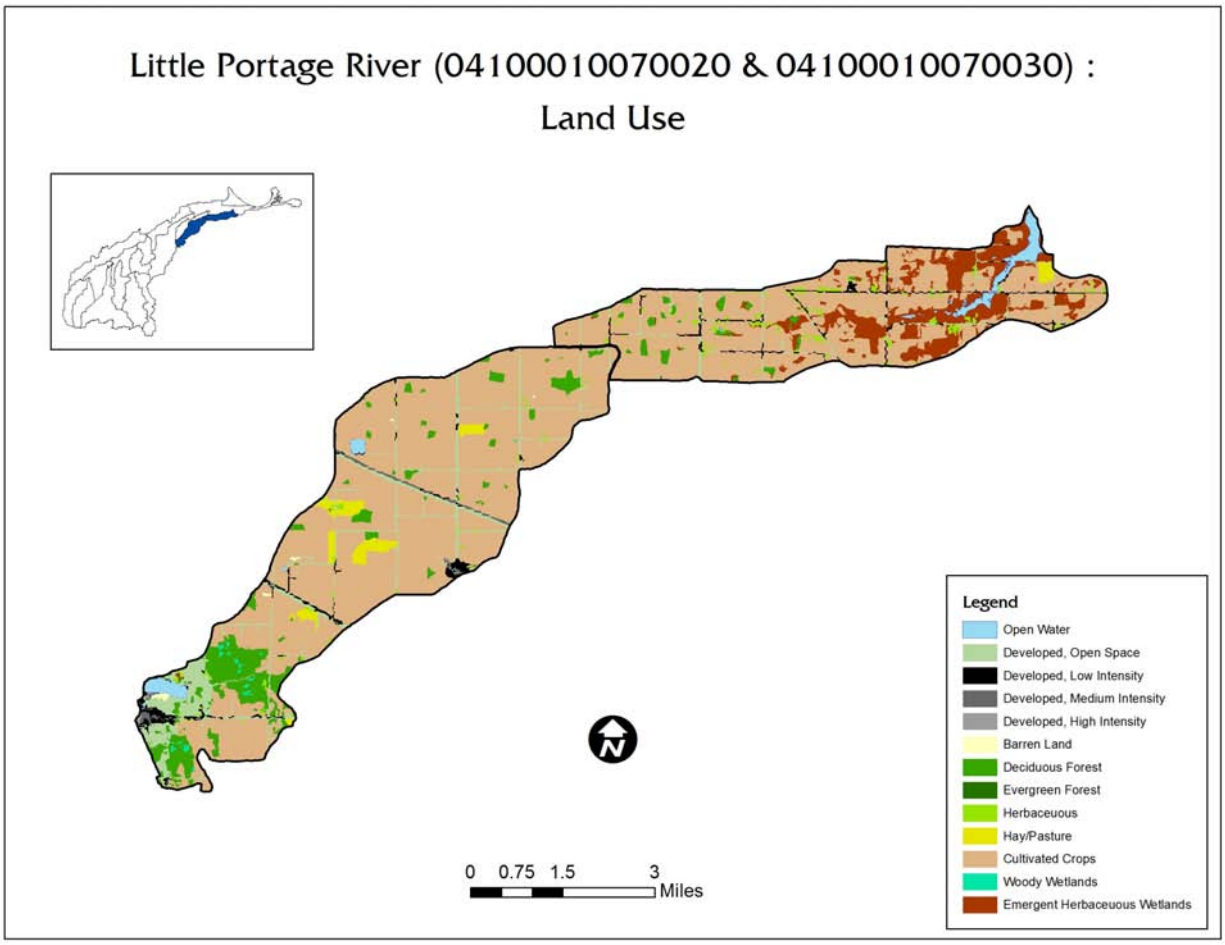
The average ground water pollution index potential for the Little Portage River watershed (HUC 70-030) is 135 with a range of 108-172. For the Ninemile Creek watershed (HUC 70-020), the average is 127 with a range of 100 to 169. The watershed includes sensitive karst areas in Sandusky County.

The Ohio Department of Natural Resources, Division of Water, Water Resources Section is the responsible agency to map groundwater resources throughout the state. Greater detail on DRASTIC maps for the Portage can be found in Chapter 4 of the watershed plan.

9 *Drinking Water Source Assessment for the Village of Lindsey,* Ohio EPA 2003



Sub-watershed (04100010)		
070-020 and 070-030		
Land Use	**Percent**	**Acres**
Urban	9.0%	1,876
Forest	7.8%	1,621
Pasture	1.7%	361
Cropland	72.0%	14,928
Other	9.4%	1,954
Total Acres	100%	20,740


Little Portage River (04100010070020 & 04100010070030) :
Land Use
Legend
Open Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Deciduous Forest
Evergreen Forest
Herbaceuous
Hay/Pasture
Cultivated Crops
Woody Wetlands
Emergent Herbaceuous Wetlands
0 0.75 1.5 3
Miles

Livestock Inventory							
HUC 4100010070020 & 4100010070030							
Type of Animal		**Hancock**	**Ottawa**	**Sandusky**	**Seneca**	**Wood**	**Estimates for HUC**
Percent of County in HUC		0.0%	6.1%	4.1%	0.0%	0.0%	
Cattle	Farms	129	89	167	264	144	**12**
	Animals	4,233	1,523	4,612	10,096	6,287	**283**
Hogs	Farms	51	15	37	62	30	**2**
	Animals	32,343	3,639	5,591	42,808	39,469	**453**
Horses	Farms	105	63	132	72	128	**9**
	Animals	844	444	772	463	1,004	**59**
Poultry	Farms	49	22	41	62	47	**3**
	Animals	NA	779	1,042	4,283	NA	**NA**
Sheep	Farms	32	12	41	61	21	**2**
	Animals	1,134	335	765	2,770	21	**52**
Total							29
							824

Source: 2007 Census of Agriculture http://www.agcensus.usda.gov/

Point Sources

Municipal

- Lindsey WWTP, 2PA00024

The Lindsey WWTP is located in the Muddy Creek watershed (041000111404), and discharges to that stream, a tributary of Sandusky Bay. More than half of the plant's service area, however, is in the Little Portage watershed.

The Lindsey treatment plant is a 0.215 mgd extended aeration facility, with tertiary sand filters. OEPA data shows an average flow of 0.069 mgd, and a peak flow of 1.500 mgd during the period of 2004-2009. In 2003 chlorine disinfection of final effluent was replaced by ultraviolet.

Lindsey's NPDES permit cites poor plant performance and a statement that excessive inflow/infiltration is a cause. The permit compliance schedule cites collection system surcharges and overflows, hydraulic overloading of the lift stations, and hydraulic overloadings of the wastewater treatment plant.

In early 2008, supervision and licensing sign-off responsibility for the Lindsey WWTP was transferred to a licensed WWTP operator from the Sandusky County Sanitary Engineering Dept. Lindsey's WWTP operating results have improved as a result.

Smoke testing was conducted in Nov. 2007, identifying an I/I source. A program of storm sewer replacement to eliminate the I/I source was developed, consisting of four annual phases starting in 2009. The four phases include replacement of 923' of storm sewer to eliminate leaks into the

sanitary sewer and reduce I/I. The first phase was completed in 2009, the second; which included 350 feet of storm sewer and two catch basins was completed in 2010.

Package Plants

None

Industrial

None

Non-Point Sources:

Critical Sewage Areas

- Rodriguez Street, Sandusky County, near Gibsonburg

CAFOs

None

Estimates of HSTSs				
Watershed	**Housing Units without sewers**	**Est. Unsewered Population (2010)**	**Unsewered Housing Units per acre**	**Unsewered Population per acre**
04100010070020	410	1,107	0.032	0.087
04100010070030	310	695	0.039	0.087
04100010 05 01 (total of above)	720	1,802	0.035	0.087

Sources: 2010 Census data and TMACOG "208" Plan. Analysis identifies approximate number of housing units without sewers in each watershed as an estimate of number of HSTSs.

Aquatic Life Use Impairments	
Causes	**Sources**
Direct habitat alterations	Channelization
Low flow alterations	Nonirrigated crop production
Nutrient/eutrophication biological indicators	
Sedimentation/siltation	
Source: Ohio 2012 Integrated Report, Watershed Assessment Unit Summary	

Water Supply:

Public Water System	Population Served	Primary Water Source
Gibsonburg	2,581	Groundwater
Lindsey	446	Groundwater

Water Quality Impairments

The OEPA Integrated Report assesses each watershed's attainment status for 1) Public Drinking Water Supply, 2) Recreation, 3) Human Health, 4) Aquatic Life, and 5) Fish Tissue. The Integrated Report identifies causes and sources of impairments where watersheds are not in attainment with water quality standards.

Background:

The Little Portage HUC incorporates two HUC-14 watersheds that drain parts of Ottawa and Sandusky Counties. The upstream watershed is Ninemile Creek, which joins the Little Portage at RM 9.1. Ninemile Creek and its main tributary, Indian Creek, flowing in from the southwest, from Sandusky County.

The Little Portage flows into the mainstem from the south, at RM 6.0. The confluence is in the lacustrine reach of the Portage. ODNR manages the Portage River Wildlife Access, and the Little Portage State Wildlife area in this low-lying part of the watershed.

The OEPA TMDL includes sampling at two stations on the Little Portage (RM 6.2 at CR 169 and RM 1.8 at CR 17) and two on Ninemile Creek (RM 5.0 at Hessville Rd, RM 2.9 at Dunmyer Rd). The 2008 sampling results showed phosphorus levels of 0.124 ppm exceeding the 0.1 ppm target at RM 1.79 on the Little Portage. The other three sites had no exceedences.

On the Little Portage, the upstream site was in partial attainment for aquatic life, "low fair" for macroinvertebrate habitat, "poor" for QHEI, and in non-attainment for bacteria. The downstream site was in non-attainment both aquatic life but full attainment for bacteria. Its ICI and QHEI scores were the same as the upstream site.

On Ninemile Creek, both sites were in partial attainment for aquatic life, non-attainment for bacteria, and poor for QHEI. The TMDL notes "extremely high E. coli counts" on Ninemile Creek from an unknown source (page 80).

Impairments cited by the TMDL are for habitat modification and agricultural practices: direct habitat alterations, low flow alterations, nutrient/eutrophication, sedimentation/siltation, channelization, and nonirrigated crop production. Nutrients could be from agriculture, municipal wastewater effluent, package plants, HSTS, or a combination.

Problem Statement #1: (Bacteria)

The water quality of the Little Portage subwatershed is impaired by elevated measurements of E. coli bacteria. The Portage TMDL data collected by Ohio EPA in 2008 indicate that three of the HUC's four sampling sites are in non-attainment for E. coli. The TMDL cites failed HSTS as the causes of impairment due to high E. coli bacteria levels.

In this HUC are an estimated 720 HSTS. This watershed includes no package plants, but one Critical Sewage Area — Rodriguez Street, which is adjacent to Gibsonburg.

Goal 1.1: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 4.6 million gallons of HSTS effluent annually

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 72 systems
- Rodriguez Street sewers completed and all structures tapped in
- E coli counts in Ninemile Creek reduced by eliminating sources

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Bacteria	1.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$1,080,000	Ottawa & Sandusky County Health Dept, TMACOG, Ohio EPA	2013 - 2022	Replace or upgrade 10% of watershed's HSTS or 72 systems	4.6 million gallons/year sewage discharge eliminated
	1.1	♦Construct sewers for Rodriguez Street Critical Sewage Area		Sandusky County Sanitary Engineer, Gibsonburg	2015	Rodriguez Street sewers completed and all structures tapped in	Included in HSTS totals
	1.1	♦ Sample Ninemile Creek & tributaries, and investigate HSTS to identify source(s) of high E. coli counts (cited TMDL p 80) ♦Recommend actions to eliminate bacteria sources		Ohio EPA, Sandusky County Health Department	2013 - 2022	E coli counts in Ninemile Creek reduced by eliminating sources	Included in HSTS totals

Problem Statement #2: (Nutrients: phosphorus and nitrate)

Of the four aquatic life sampling sites in this HUC under the TMDL, Ohio EPA found three sites in partial attainment (RM 6.20 on the Little Portage, 5.00, and 2.93 on Ninemile), and one in non-attainment (RM 1.79 on the Little Portage). Nutrient/eutrophication biological indicators are cited as causes, and phosphorus levels exceeded the target concentration at Little Portage RM 1.79. Phosphorus reductions throughout the watershed remain important to reduce overall loadings to Lake Erie. Additionally, BMPs to address bacteria (see above) and habitat issues (see below) will achieve nutrient load reductions.

Goal 2.1: Meet TMDL target for phosphorus load reduction by 384 and nitrate load by 1,624 lb./year from HSTS

Objectives:

- Replace or upgrade 10% of watershed's HSTS or 72 systems

Goal 2.2: Meet TMDL target for phosphorus load reduction by 3,470 and nitrate load by 8,196 lb./year from agricultural practices

Objectives:

- 2,000 acres of cover crops
- 600 acres of controlled drainage
- 1,000 acres of permanent hay
- 400 acres of riparian buffers
- 35 acres of restored wetlands
- 400 LF of stream restoration
- 400 LF of overwide / 2-stage ditch reconstruction
- 7,269 acres under NRCS 590/1 Nutrient Mgt
- 3,115 acres under NRCS 590/3 Nutrient Mgt
- 1,500 acres of filter strips
- 600 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Nutrients (phosphorus and nitrate)	2.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$1,080,000	Ottawa & Sandusky County Health Dept, TMACOG, Ohio EPA	2013 - 2022	Replace or upgrade 10% of watershed's HSTS or 72 systems	Reduce phosphorus load by 384 and nitrate load by 1,624 lb./year
	2.2	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$120,000	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	2,000 acres of cover crops	Reduce phosphorus load by 2,288 and nitrate load by 4,576 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$282,600	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	600 acres of controlled drainage	Reduce phosphorus load by 273 and nitrate load by 702 lb./year
	2.2	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$280,000	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	1,000 acres of permanent hay	Reduce phosphorus load by 650 and nitrate load by 1,300 lb./year
	2.2	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$280,000	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	400 acres of riparian buffers	Reduce phosphorus load by 78 and nitrate load by 156 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$178,718	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	35 acres of restored wetlands	Reduce phosphorus load by 8 and nitrate load by 74 lb./year
	2.2	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$139,200	Ottawa & Sandusky SWCD, Ottawa & Sandusky co Engineer, NRCS, farmers	2013-2027 in phases	400 LF of stream restoration	Reduce phosphorus load by 15 and nitrate load by 31 lb./year
	2.2	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$35,600	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	400 LF of overwide / 2-stage ditch reconstruction	Reduce phosphorus load by 55 and nitrate load by 109 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Seek cooperators for Nutrient Management NRCS 590 Level 1 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management NRCS 590 Level 1 BMPs with farmers	$145,389	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2022	7,269 acres under NRCS 590/1 Nutrient Mgt	NA
	2.2	♦Seek cooperators for Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with farmers	$124,619	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2022	3,115 acres under NRCS 590/3 Nutrient Mgt	NA
	2.2	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$207	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	1,500 acres of filter strips	Reduce phosphorus load by 15 and nitrate load by 30 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.2	♦Identify & prioritize fields suited for Conservation Tillage BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Conservation Tillage BMP with farmer	$9,000	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	600 acres of conservation tillage	Reduce phosphorus load by 88 and nitrate load by 1,218 lb./year

Problem Statement #3: (Siltation/Sedimentation)

The TMDL cites sedimentation/siltation as a cause of impairment at all four sampling sites, and nonirrigated crop production and channelization as sources.

Goal 3.1: Reduce sedimentation impairments by decreasing sediment load by 1,880 lb./year from agricultural practices

Objectives:

- 2,000 acres of cover crops
- 600 acres of controlled drainage
- 1,000 acres of permanent hay
- 400 acres of riparian buffers
- 35 acres of restored wetlands
- 400 LF of stream restoration
- 400 LF of overwide / 2-stage ditch reconstruction
- 1,500 acres of filter strips
- 600 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Sedimentation	3.1	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$120,000	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	2,000 acres of cover crops	Reduce sediment load by 1,144 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$282,600	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	600 acres of controlled drainage	Reduce sediment load by 312 lb./year
	3.1	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$280,000	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	1,000 acres of permanent hay	Reduce sediment load by 330 lb./year
	3.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$280,000	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	400 acres of riparian buffers	Reduce sediment load by 39 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$178,718	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	35 acres of restored wetlands	Reduce sediment load by 2 lb./year
	3.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$139,200	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	400 LF of stream restoration	Reduce sediment load by 15 lb./year
	3.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$35,600	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	400 LF of overwide / 2-stage ditch reconstruction	Reduce sediment load by 27 lb./year
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$207	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	1,500 acres of filter strips	Reduce sediment load by 8 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$9,000	Ottawa & Sandusky SWCD, NRCS, farmers	2013-2027 in phases	600 acres of conservation tillage	Reduce sediment load by 2 lb./year

Problem Statement #4: (Habitat Alteration)

The OEPA TMDL cites direct habitat alterations and channelization as causes and sources of impairment, and specifically on Ninemile Creek. The Little Portage QHEI scores in 2008 were "very poor," and the Ninemile Creek scores were "low fair."

Goal 4.1: 435 acres of habitat restoration and 800 linear feet of stream corridor restoration practices

Objectives:

- 400 acres of riparian buffers
- 35 acres of restored wetlands
- 400 LF of stream restoration
- 400 LF of overwide / 2-stage ditch reconstruction

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Habitat Impairment	4.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$280,000	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	400 acres of riparian buffers	Load reductions provided in nutrient and sediment tables

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	4.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$178,718	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	35 acres of restored wetlands	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$139,200	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	400 LF of stream restoration	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$35,600	Ottawa & Sandusky SWCD, Ottawa & Sandusky Co Engineer, NRCS, farmers	2013-2027 in phases	400 LF of overwide / 2-stage ditch reconstruction	Load reductions provided in nutrient and sediment tables

Lacarpe Creek – Frontal Lake Erie

04100010 070-050 (14 – digit HUC)
04100010 05 03 (New 12-digit HUC)

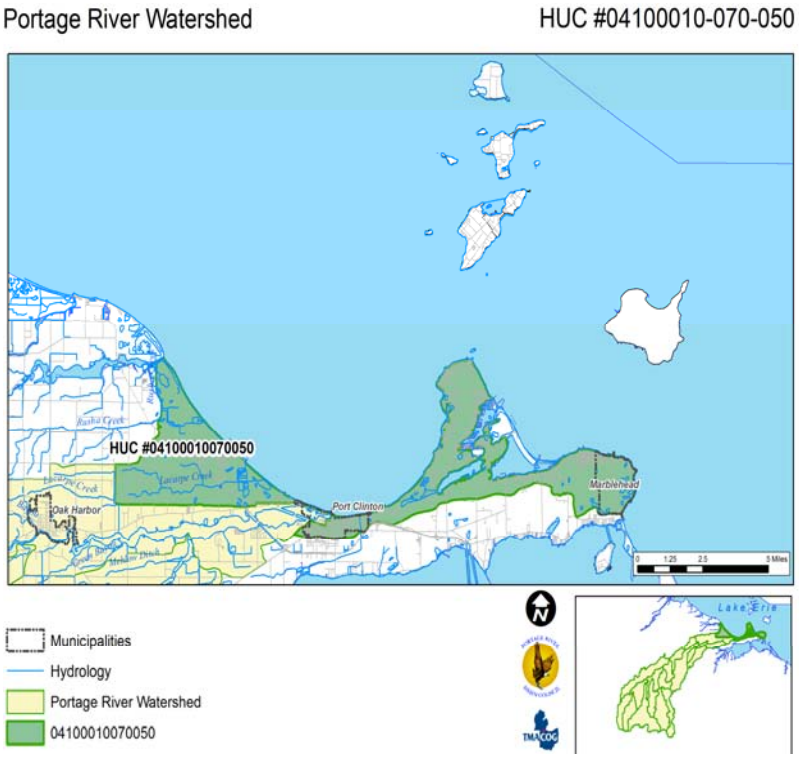
Elevation at Mouth: 575 (Lake Erie)

Gradient: NA: HUC includes several streams flowing into the lake separately

Drainage Area: 40.30 sq mi.

Ohio Topographic Quadrangle 7.5 minute (1:24,000)

Urban Areas:
Port Clinton



Geology

The topography of Ottawa County is nearly level to sloping. West of Port Clinton, the surface is flat and is little elevated above Lake Erie. Shallow stream valleys are to a depth ranging from 15-25 feet. The low limestone ridges, or knolls, rise five to 15 feet above the general level to break the evenness of the landscape. East of Port Clinton the relief is undulating or gently rolling. It is generally level along the lakefront and rises gently inland, except in Catawba Island Township and at the eastern end of Marblehead Peninsula where limestone bedrock protrudes above the surrounding plain.

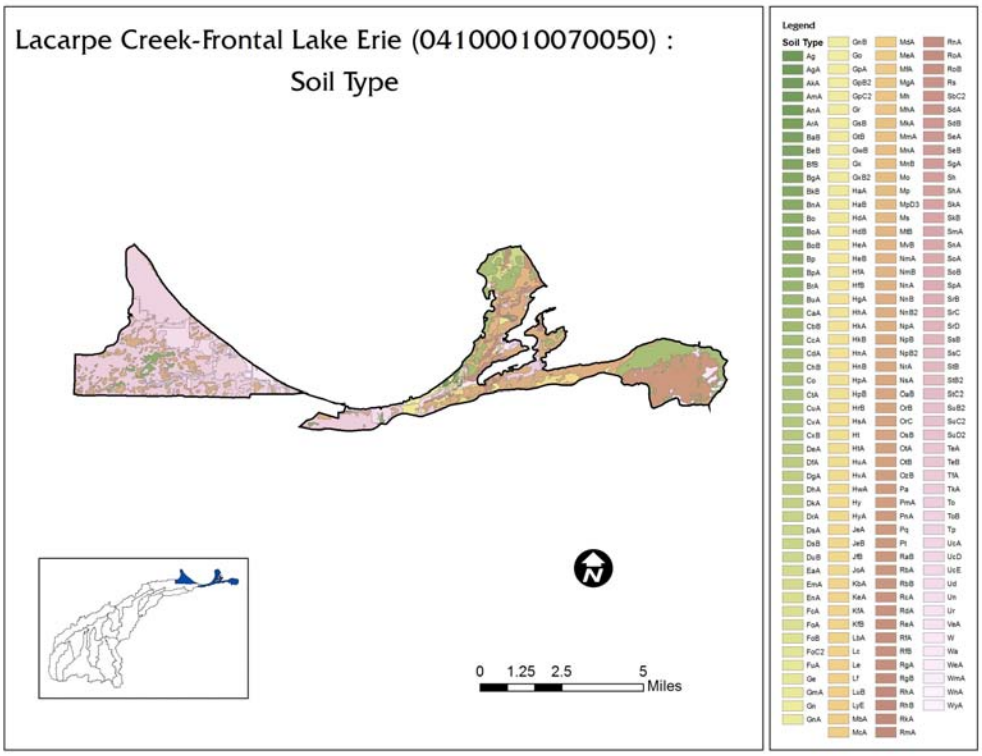
Ottawa County lies entirely within the Huron/Erie Lake Plan (HELP) Eco-region. The HELP region is very flat having little relief; the soils are poorly to very poorly drained and consist of parent material derived from glacial tills and lacustrine deposits associated with the Wisconsin glacial era. The glacial till is predominantly in the form of ground moraine overlies limestone bedrock. The thickness of the glacial drift varies from about 25 meters to only a few centimeters. The uppermost bedrock strata consist of Silurian dolomite and dolomitic limestone.

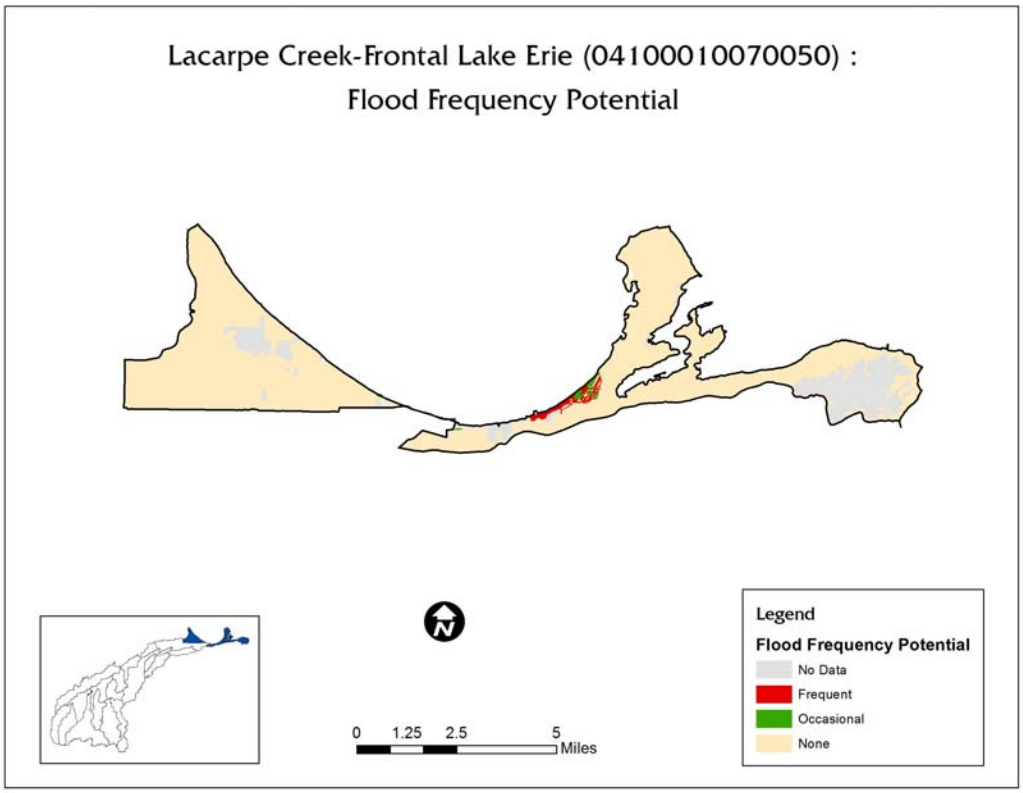
Soils

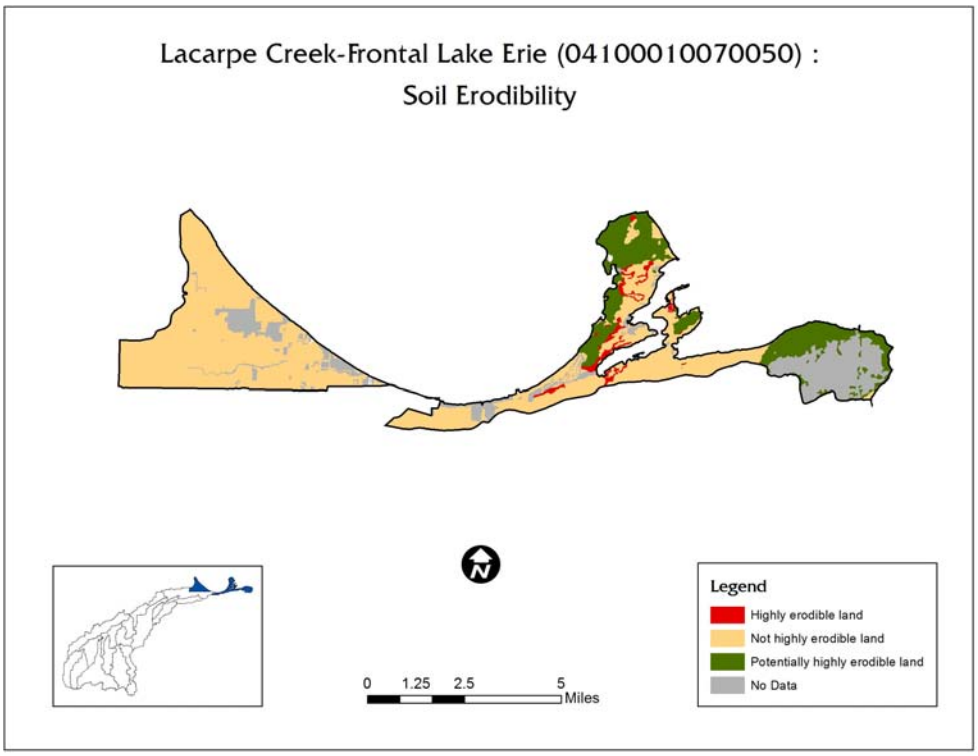
The three predominant soils within the Lacarpe / Lake Erie Frontal subwatershed are Toledo, Nappanee, and Castalia. Toledo soils are very poorly drained "D" soils. If drained they are prime farmland; ponded areas are not prime. Nappanee is somewhat poorly drained silty clay loam with slopes to 3%. It is not highly erodible and considered prime farmland if drained. Castalia soils

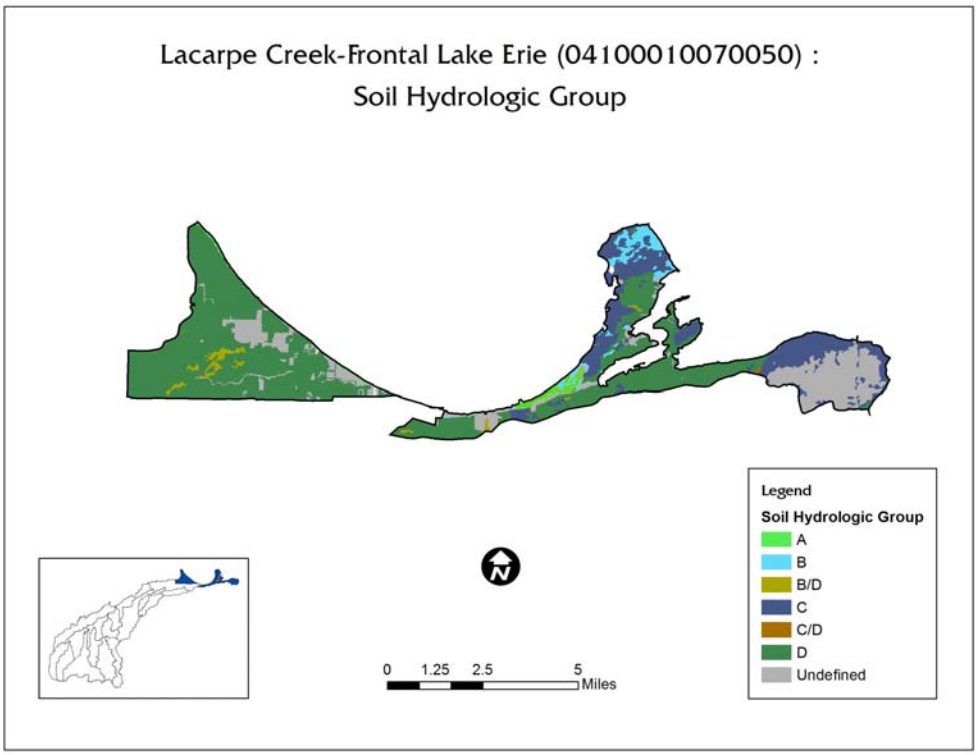
are well-drained stony fine sandy loam with 1-6% slopes. They are potentially erodible and not considered prime farmland. The next two soil classifications reflect urbanization or excavation.

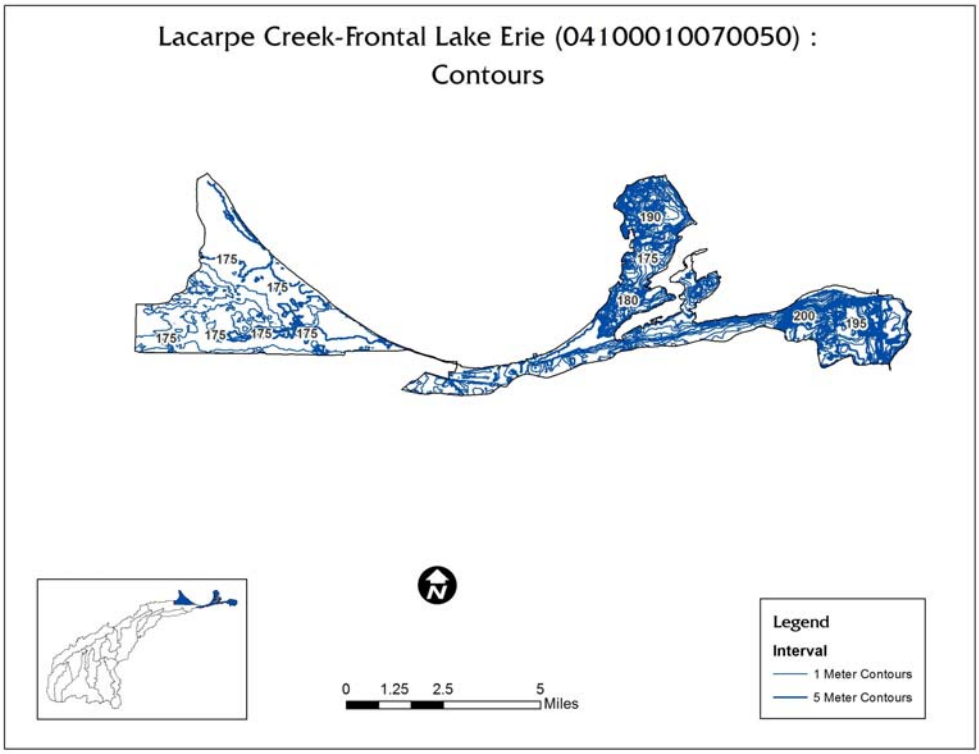
Major Soil Groups		
070-050		
Toledo	Sum Acres	7,140
	Percentage	37.24%
Nappanee	Sum Acres	3,282
	Percentage	17.12%
Castalia	Sum Acres	2,031
	Percentage	10.59%
Pits	Sum Acres	1,716
	Percentage	8.95%
Udorthents	Sum Acres	1,045
	Percentage	5.45%
Milton	Sum Acres	773
	Percentage	4.03%
St. Clair	Sum Acres	425
	Percentage	2.22%
Hoytville	Sum Acres	402
	Percentage	2.10%
Haskins	Sum Acres	299
	Percentage	1.56%

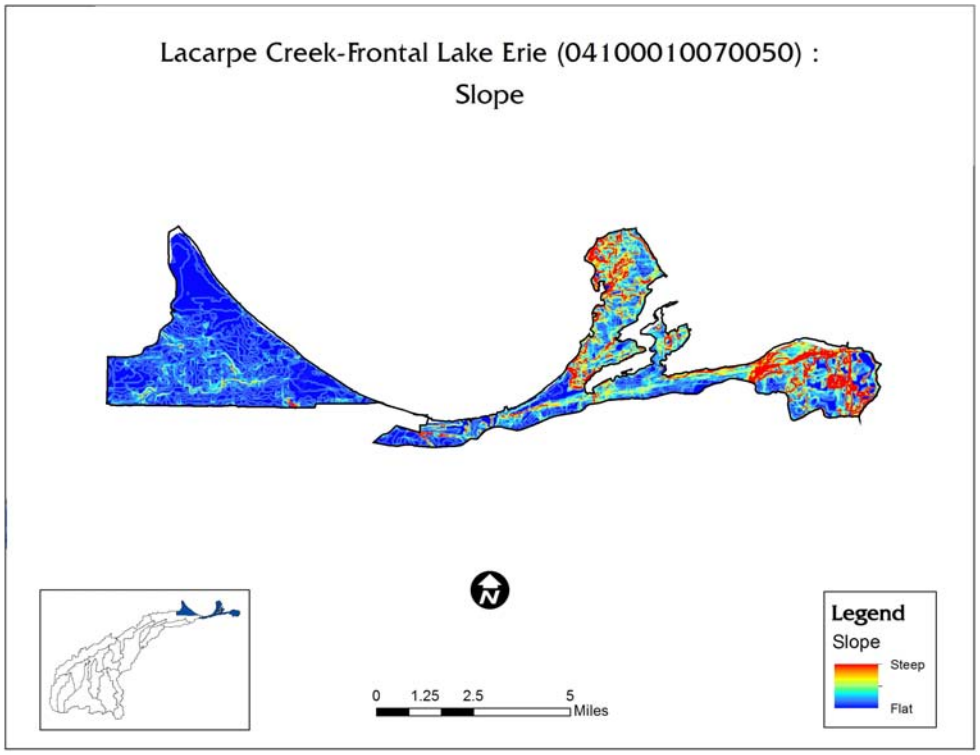


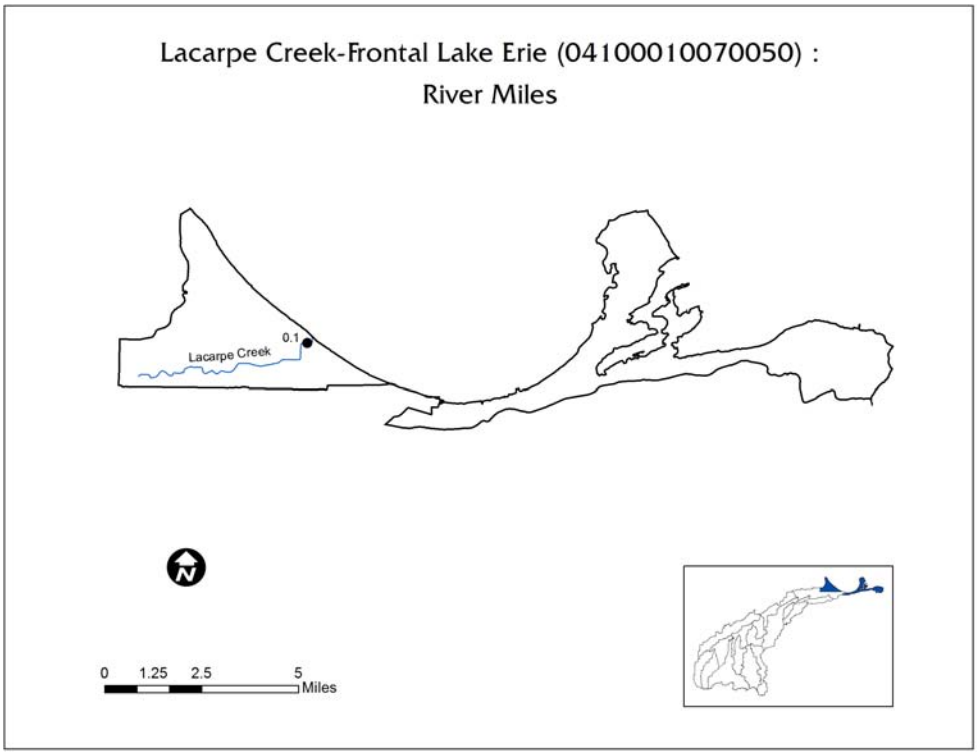

Lacarpe Creek-Frontal Lake Erie (04100010070050) :
Flood Frequency Potential
0 1.25 2.5 5
Miles
Legend
Flood Frequency Potential
No Data
Frequent
Occasional
None


Lacarpe Creek-Frontal Lake Erie (04100010070050) :
Soil Erodibility
0 1.25 2.5 5
Miles
Legend
Highly erodible land
Not highly erodible land
Potentially highly erodible land
No Data


Lacarpe Creek-Frontal Lake Erie (04100010070050) :
Soil Hydrologic Group
Legend
Soil Hydrologic Group
A
B
B/D
C
C/D
D
Undefined
0 1.25 2.5 5
Miles


Lacarpe Creek-Frontal Lake Erie (04100010070050) :
Contours
190
175
180
200
195
175
175
175
175
175
175
Legend
Interval
1 Meter Contours
5 Meter Contours
0 1.25 2.5 5
Miles





The Soil Hydrologic Group map indicates the *Hydrologic soil groups* based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water

infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately course texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (**A/D, B/D, or C/D),** the first letter is for drained areas and the second is for undrained areas.

Rare, Threatened, Endangered Species

The Lacarpe Creek – Frontal Lake Erie subwatershed HUC14 04100010 070 050 provides habitat for numerous rare, threatened, or endangered species.

Rare, Threatened, Endangered Species			
Common Name	***Scientific Name***	**Last Observed**	**State Status**
Alpine Rush	Juncus alpinoarticulatus	1986-07	P
Alpine Rush	Juncus alpinoarticulatus	1979-10-27	P
Alpine Rush	Juncus alpinoarticulatus	1968-09	P
Alpine Rush	Juncus alpinoarticulatus	1986-05-10	P
Alpine Rush	Juncus alpinoarticulatus	1986-07	P
Alpine Rush	Juncus alpinoarticulatus	1996-08-28	P
Alpine Rush	Juncus alpinoarticulatus	1994-08-29	P
Alpine Rush	Juncus alpinoarticulatus	2009-05-12	P
Alpine Rush	Juncus alpinoarticulatus	2009-05-12	P

Rare, Threatened, Endangered Species			
Common Name	***Scientific Name***	**Last Observed**	**State Status**
Alpine Rush	Juncus alpinoarticulatus	2009-05-19	P
American Water-milfoil	Myriophyllum sibiricum	1972-06	T
Badger	Taxidea taxus	1971-10-20	SC
Bald Eagle	Haliaeetus leucocephalus	2010	T
Bald Eagle	Haliaeetus leucocephalus	2010	T
Bald Eagle	Haliaeetus leucocephalus	2010	T
Bald Eagle	Haliaeetus leucocephalus	2010	T
Bald Eagle	Haliaeetus leucocephalus	2010	T
Bald Eagle	Haliaeetus leucocephalus	2010	T
Balsam Squaw-weed	Packera paupercula	1996-06-18	T
Balsam Squaw-weed	Packera paupercula	1990-06	T
Balsam Squaw-weed	Packera paupercula	1997-05-27	T
Balsam Squaw-weed	Packera paupercula	1998-05-13	T
Balsam Squaw-weed	Packera paupercula	2008-05-29	T
Balsam Squaw-weed	Packera paupercula	2009-05-12	T
Balsam Squaw-weed	Packera paupercula	2009-05-12	T
Balsam Squaw-weed	Packera paupercula	2009-05-19	T
Baltic Rush	Juncus balticus	1969-08	P
Baltic Rush	Juncus balticus	1980-08	P
Baltic Rush	Juncus balticus	1989-06-14	P
Baltic Rush	Juncus balticus	1970-08	P
Baltic Rush	Juncus balticus	2009-05-19	P
Baltic Rush	Juncus balticus	2009-05-18	P
Black Sandshell	Ligumia recta	1965-05	T
Blanding's Turtle	Emydoidea blandingii	1980-07	T
Blanding's Turtle	Emydoidea blandingii	1980-07	T
Caribbean Spike-rush	Eleocharis geniculata	1996-08-28	E
Caribbean Spike-rush	Eleocharis geniculata	1996-06-18	E
Caribbean Spike-rush	Eleocharis geniculata	1994-07-10	E
Caribbean Spike-rush	Eleocharis geniculata	2009-08-26	E
Carolina Whitlow-grass	Draba reptans	1996-05-09	T
Curved Tortella	Tortella inclinata	1992-06	E
Deertoe	Truncilla truncata	1977-08	SC

Rare, Threatened, Endangered Species			
Common Name	***Scientific Name***	**Last Observed**	**State Status**
Deertoe	Truncilla truncata	1968-07	SC
Early Buttercup	Ranunculus fascicularis	1981-04	T
Early Buttercup	Ranunculus fascicularis	2011-05-06	T
Early Buttercup	Ranunculus fascicularis	1981-04	T
Early Buttercup	Ranunculus fascicularis	1996-05-09	T
Eastern Foxsnake	Pantherophis gloydi	1980-08-03	SC
Eastern Foxsnake	Pantherophis gloydi	1980-07-07	SC
Eastern Foxsnake	Pantherophis gloydi	1980-07-01	SC
Eastern Foxsnake	Pantherophis gloydi	1998-06-28	SC
Eastern Foxsnake	Pantherophis gloydi	1980-07	SC
Eastern Pondmussel	Ligumia nasuta	1968-07	E
Eastern Pondmussel	Ligumia nasuta	1977-08	E
Fawnsfoot	Truncilla donaciformis	1968-07	T
Fawnsfoot	Truncilla donaciformis	1977-08	T
Flat-stemmed Spike-rush	Eleocharis compressa	1998-06-23	P
Flat-stemmed Spike-rush	Eleocharis compressa	1998-05-13	P
Flat-stemmed Spike-rush	Eleocharis compressa	2009-05-19	P
Flat-stemmed Spike-rush	Eleocharis compressa	1986-07	P
Flat-stemmed Spike-rush	Eleocharis compressa	1967-07	P
Flat-stemmed Spike-rush	Eleocharis compressa	2008-05-29	P
Flat-stemmed Spike-rush	Eleocharis compressa	2009-05-12	P
Flat-stemmed Spike-rush	Eleocharis compressa	2009-05-12	P
Flat-stemmed Spike-rush	Eleocharis compressa	2009-05-19	P
Garber's Sedge	Carex garberi	1983-05-11	E
Garber's Sedge	Carex garberi	1990-06-06	E
Garber's Sedge	Carex garberi	1998-05-13	E
Garber's Sedge	Carex garberi	1996-06-18	E
Garber's Sedge	Carex garberi	1981-05	E
Garber's Sedge	Carex garberi	1986-05	E
Garber's Sedge	Carex garberi	2009-05-12	E

Rare, Threatened, Endangered Species			
Common Name	***Scientific Name***	**Last Observed**	**State Status**
Garber's Sedge	Carex garberi	2009-05-12	E
Garber's Sedge	Carex garberi	2009-05-19	E
Garber's Sedge	Carex garberi	2008-05-29	E
Golden-fruited Sedge	Carex aurea	1979-07	P
Golden-fruited Sedge	Carex aurea	2009-05-12	P
Golden-fruited Sedge	Carex aurea	2009-08-07	P
Golden-fruited Sedge	Carex aurea	2009-05-18	P
Great Plains Ladies'-tresses	Spiranthes magnicamporum	1980-09	P
Great Plains Ladies'-tresses	Spiranthes magnicamporum	1986-10	P
Great Plains Ladies'-tresses	Spiranthes magnicamporum	1979-09	P
Great Plains Ladies'-tresses	Spiranthes magnicamporum	1988-09	P
Great Plains Ladies'-tresses	Spiranthes magnicamporum	1970-09	P
Great Plains Ladies'-tresses	Spiranthes magnicamporum	2006-09-16	P
Harebell	Campanula rotundifolia	1979-07	T
Harebell	Campanula rotundifolia	1977-05-25	T
Harebell	Campanula rotundifolia	1977-05	T
Hoary Willow	Salix candida	2006-09-16	P
Inland Sea Rocket	Cakile edentula	1993-09	P
Inland Sea Rocket	Cakile edentula	1979-07	P
Inland Sea Rocket	Cakile edentula	1979-09	P
Inland Sea Rocket	Cakile edentula	1979-09	P
Inland Sea Rocket	Cakile edentula	2009-08-21	P
Lakeside Daisy	Tetraneuris herbacea	2010-05-20	E
Lakeside Daisy	Tetraneuris herbacea	2010-05-20	E
Lakeside Daisy	Tetraneuris herbacea	2010-05-20	E
Lakeside Daisy	Tetraneuris herbacea	2009-05	E
Lakeside Daisy	Tetraneuris herbacea	2009-05	E
Lakeside Daisy	Tetraneuris herbacea	2009-05	E
Limestone Savory	Calamintha arkansana	1987-07-07	T
Limestone Savory	Calamintha arkansana	1998-06-23	T
Limestone Savory	Calamintha arkansana	1973-08-29	T
Limestone Savory	Calamintha arkansana	1996-06-18	T
Limestone Savory	Calamintha arkansana	1996-06-18	T

Rare, Threatened, Endangered Species			
Common Name	***Scientific Name***	**Last Observed**	**State Status**
Limestone Savory	Calamintha arkansana	1979-07-24	T
Limestone Savory	Calamintha arkansana	1968-08-10	T
Limestone Savory	Calamintha arkansana	1989-06-14	T
Lindheimer's Panic Grass	Panicum lindheimeri	2010-07-10	T
Little Green Sedge	Carex viridula	1998-06-23	P
Little Green Sedge	Carex viridula	1998-05-13	P
Little Green Sedge	Carex viridula	1990-06	P
Little Green Sedge	Carex viridula	1996-06-18	P
Little Green Sedge	Carex viridula	1994-07-10	P
Little Green Sedge	Carex viridula	2008-05-29	P
Little Green Sedge	Carex viridula	2009-05-12	P
Little Green Sedge	Carex viridula	2009-05-12	P
Little Green Sedge	Carex viridula	2009-05-19	P
Low Umbrella-sedge	Cyperus diandrus	1979-09	P
Low Umbrella-sedge	Cyperus diandrus	1968-09	P
Marsh Arrow-grass	Triglochin palustris	2008-05-29	P
Narrow-leaved Blue-eyed-grass	Sisyrinchium mucronatum	1997-05-27	E
Narrow-leaved Blue-eyed-grass	Sisyrinchium mucronatum	1998-05-13	E
Narrow-leaved Blue-eyed-grass	Sisyrinchium mucronatum	1970-05	E
Narrow-leaved Blue-eyed-grass	Sisyrinchium mucronatum	1995-05-27	E
Narrow-leaved Blue-eyed-grass	Sisyrinchium mucronatum	2008-05-29	E
Narrow-leaved Blue-eyed-grass	Sisyrinchium mucronatum	2009-05-12	E
Narrow-leaved Blue-eyed-grass	Sisyrinchium mucronatum	2009-05-15	E
Narrow-leaved Summer Bluets	Hedyotis nigricans	1996-07-15	P
Narrow-leaved Summer Bluets	Hedyotis nigricans	1979-07	P
Narrow-leaved Summer Bluets	Hedyotis nigricans	1986-07	P
Narrow-leaved Summer Bluets	Hedyotis nigricans	1996-07-15	P
Narrow-leaved Summer Bluets	Hedyotis nigricans	1998-06-23	P
Narrow-leaved Summer Bluets	Hedyotis nigricans	1980-09	P

Rare, Threatened, Endangered Species			
Common Name	***Scientific Name***	**Last Observed**	**State Status**
Narrow-leaved Summer Bluets	Hedyotis nigricans	1989-06-14	P
Narrow-leaved Summer Bluets	Hedyotis nigricans	2005-09-25	P
Philadelphia Panic Grass	Panicum philadelphicum	2005-09-21	E
Philadelphia Panic Grass	Panicum philadelphicum	2005-09-25	E
Pocketbook	Lampsilis ovata	1976-04	E
Pocketbook	Lampsilis ovata	1962-07	E
Prairie Redroot	Ceanothus herbaceus	1970-08	X
Prairie Redroot	Ceanothus herbaceus	1980-10	X
Prairie Thimbleweed	Anemone cylindrica	1970-07	T
Purple Sand Grass	Triplasis purpurea	1979-09	P
Purple Sand Grass	Triplasis purpurea	1979-09	P
Purple Sand Grass	Triplasis purpurea	2010-08-31	P
Purple Wartyback	Cyclonaias tuberculata	1965-05	SC
Purple Wartyback	Cyclonaias tuberculata	1961-07	SC
Rock Sandwort	Minuartia michauxii	2000-05-27	P
Rock Sandwort	Minuartia michauxii	1981-05-21	P
Rock Sandwort	Minuartia michauxii	1990-06-06	P
Rock Sandwort	Minuartia michauxii	1987-12-17	P
Rock Sandwort	Minuartia michauxii	2009-05-19	P
Rock Sandwort	Minuartia michauxii	2009-05-19	P
Rough Pennyroyal	Hedeoma hispida	1990-06-06	P
Schweinitz' Umbrella-sedge	Cyperus schweinitzii	1967-08	T
Schweinitz' Umbrella-sedge	Cyperus schweinitzii	2010-08-31	T
Seaside Spurge	Euphorbia polygonifolia	1990-08	P
Seaside Spurge	Euphorbia polygonifolia	1979-09	P
Seaside Spurge	Euphorbia polygonifolia	1979-09	P
Seaside Spurge	Euphorbia polygonifolia	2009-08-21	P
Small-flowered Evening-primrose	Oenothera parviflora	2005-09-25	P
Smith's Bulrush	Schoenoplectus smithii	1969-09-08	E

Rare, Threatened, Endangered Species			
Common Name	***Scientific Name***	**Last Observed**	**State Status**
Smooth Rose	Rosa blanda	1980-06	T
Smooth Rose	Rosa blanda	1980-06	T
Smooth Rose	Rosa blanda	1980-07	T
Smooth Rose	Rosa blanda	1970-08	T
Smooth Rose	Rosa blanda	2009-05-18	T
Southern Hairy Rock Cress	Arabis hirsuta var. adpressipilis	1981-05	P
Southern Wapato	Sagittaria montevidensis	1973-07-14	P
Tall Cinquefoil	Potentilla arguta	1989-06-14	E
Tall Cinquefoil	Potentilla arguta	1980-07	E
Tall Cinquefoil	Potentilla arguta	1970-07	E
Tall Cinquefoil	Potentilla arguta	2009-08-07	E
Thamnophis Sirtalis	Melanistic garter snake	1980-07	SC
Thamnophis Sirtalis	Melanistic garter snake	1989-05	SC
Threehorn Wartyback	Obliquaria reflexa	1968-07	T
Threehorn Wartyback	Obliquaria reflexa	1978-11	T
Tufted Fescue Sedge	Carex brevior	2008-05-29	T
Tufted Fescue Sedge	Carex brevior	1990-05-19	T
Tufted Fescue Sedge	Carex brevior	2009-05-19	T
Variegated Scouring-rush	Equisetum variegatum	1967-08	E
Virginia Rail	Rallus limicola	1987-07	SC

T=Threatened, P=Potentially Threatened, E=Endangered, X=Presumed Extirpated, SC=Species of Concern

Mussel Species in Lacarpe Creek

Stream River Miles	Common Mussel Name	*Scientific Name*	Observed	Status
No sampling was conducted in this assessment unit in 2008 and there is no recent historical data available.				

HUC 8 – 04100010 (Portage River)									
HUC 10 – 0410001005 (Lower Portage River-Frontal Lake Erie)									
HUC 12 – 041000100503 (Lacarpe Creek-Frontal Lake Erie)									
HUC 14 – 04100010070050 (Lake Erie Drainage downstream of Toussaint Cr. to Marblehead [except Portage R.])									
Site	Year	Station Code	Station	River Mile	Drainage (sq. mi.)	ALU	Attain Status	Cause	Source
No sampling was conducted in this assessment unit in 2008 and there is no recent historical data available.									

Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010.

Water Resources

Surface Water

Lacarpe Creek is designated as Limited Resource Water aquatic life habitat and Secondary Contact recreation from its headwaters to Tettau Rd. (RM 2.6) based on a field assessment. From RM 2.6 to the mouth it's designated as Warmwater aquatic life habitat and Primary Contact recreation based on the 1978 Water Quality Standards, but has not been field verified. The recreation contact standard determines the acceptable E. coli colony numbers.

Recreational Use Attainment						
Location	RM	Rec Use PCR Class	Number of Samples	**E. coli Standard:** Mean <126 (A), or <161 (B) and Maximum Sample ≤ 298 (A) or ≤ 523 (B) Mean Max	Attainment Status	Sources of Bacteria
No sampling was conducted in this assessment unit in 2008 and there is no recent historical data available.						

Aquatic Life Use Assessment				
Location	**RM**	**Drainage Area**	**Aquatic Life Use**	**Attainment Status**
No sampling was conducted in this assessment unit in 2008 and there is no recent historical data available.			None listed	**None listed**
Source: Ohio EPA 2012 Integrated Report: http://wwwapp.epa.ohio.gov/dsw/ir2012/search.html				

Macro-invertebrate Communities										
Stream RM	**Dr. Ar. (sq. mi.)**	**Data Codes**	**Qual. Taxa**	**EPT QI./Total**	**Sensitive Taxa QI./Total**	**Density QI./Qt.**	**CW Taxa**	**Predominant Organisms on the Natural Substrates With Tolerance Category(ies)**	**ICI[a]**	**Narrative Evaluation**
No sampling was conducted in this assessment unit in 2008 and there is no recent historical data available.										
Source: Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010 http://epa.ohio.gov/dsw/tmdl/PortageToussaintRivers.aspx										

Public Drinking Water Supply Assessment				
HUC	**Reporting Category**	**Cause of Impairment**	**Nitrate Watch List**	**Pesticide Watch List**
040100010 05-03	No active	None	No	No

	intakes			

Fish Tissue Assessment			
HUC	Reporting Category	Causes of Impairment	PCB Concentration
040100010 05-03	5h	None	

Water Quality Monitoring Results: Ohio EPA 1994 and 2008						
River Mile	Date	IBI	ICI	MiWB	QHEI	STATUS
No sampling was conducted in this assessment unit in 2008 and there is no recent historical data available.						

a - River Mile (RM) represents the Point of Record (POR) for the station, not the actual sampling RM.
b - MIwb is not applicable to headwater stream with drainage areas ≤20 mi^2.
c - A narrative evaluation of the qualitative sample based on attributes such as EPT taxa richness, number of sensitive taxa, and community composition was used when quantitative data was not available or considered unreliable. VP=Very Poor, P=Poor, LF=Low Fair, F=Fair, MG=Marginally Good, G=Good, VG=Very Good, E=Exceptional
d - Attainment is given for the proposed status when a change is recommended. Aquatic life use in superscript.
ns - Nonsignificant departure from biocriteria (≤4 IBI or ICI units, or ≤0.5 MIwb units).
* - Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.
Sources: Biological and Water Quality Study of the Portage River Basin, Ohio EPA 1995, Tables `12 & 13; Biological and Water Quality Study of the Portage River Basin, Ohio EPA Technical Report EAS/2010-4-4, March 2010 http://epa.ohio.gov/dsw/tmdl/PortageToussaintRivers.aspx

General narrative ranges assigned to QHEI scores.				
Narrative Rating		QHEI Range		
		Headwaters (≤ sq mi)	Larger Streams	Lacustuary
Excellent		≤ 70	≤ 75	≤ 80
Good		55 to 69	60 to 74	60 to 80
Fair		43 to 54	45 to 59	45 to 59
Poor		30 to 42	30 to 44	30 to 44
Very Poor		<30	<30	<30

OEPA Assessments

Ohio EPA did not collect any samples in this HUC in either 1994 or 2008.

Biological Criteria Benchmarks

Biological Criteria					Lacustuary Benchmarks[1]				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	EWH	WWH	MWH	LRW	Exceptional	Good	Fair	Poor	Very Poor
IBI-	50	28	20	18	N/A	N/A	N/A	N/A	N/A

Biological Criteria					Lacustuary Benchmarks[1]				
	Huron Erie Lake Plain (HELP)								
Index-Site Type	**EWH**	**WWH**	**MWH**	**LRW**	**Exceptional**	**Good**	**Fair**	**Poor**	**Very Poor**
Headwaters									
IBI-Wading	50	32	22	18	N/A	N/A	N/A	N/A	N/A
IBI-Boat	48	34	20	16	50	42	31	17	<17
MIwb-Wading	9.4	7.3	5.6	4.5	N/A	N/A	N/A	NA	N/A
MIwb-Boat	9.6	8.6	5.7	5.0	10	8.6	5.6	2.8	<2.8
ICI	46	34	22	8	52	42	25	12	<12

[1] **Proposed Lacustuary scoring breakpoints. These have not yet been adopted into rule.**

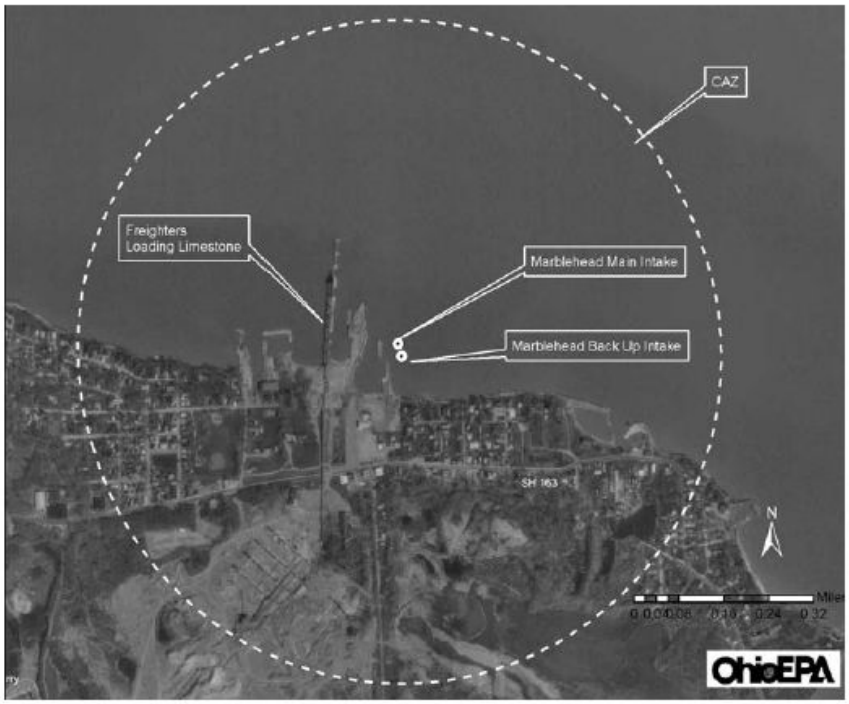
Ground Water

There are no municipalities within this watershed that rely on groundwater for drinking water. The village of Marblehead provides drinking water to its residents, and the Ottawa County Regional Water System supplies most of the rest of the HUC, including the City of Port Clinton. Both systems draw raw water from Lake Erie. Areas without public water service rely on individual residences' household private wells. The Ottawa County Regional system's protection area is in a neighboring HUC.

Source Water Assessment Plan (SWAP)

The Village of Marblehead operates a community public water system that serves a population of approximately 900 people and has 594 service connections. The water treatment system obtains its water from Lake Erie. Total plant design capacity is 0.288 million gallons per day.

The Drinking Water Source Protection Area and Critical Assessment Zone (CAZ) for Marblehead is shown in the following figure. Threats to Lake Erie include contamination from municipal sewage treatment plants, industrial wastewater, and home sewage disposal system discharges, air contaminant deposition, combined sewer overflows, runoff from residential, agricultural and urban areas, oil and gas production and mining operations, open water dredge disposal operations, as well as accidental releases and spills, especially from commercial shipping operations and recreational boating. The ferry line that connects Kelly's Island to Marblehead is close to the Marblehead drinking water intake.



Summary Figure - Village of Marblehead Drinking Water Source Protection Area

The ultimate goal of source water assessment is implementation of protective strategies that will better protect the drinking water source. Strategies for protecting the Village of Marblehead drinking water source, Lake Erie, include an effective and efficient emergency response plan as well as a plan to educate the responsible parties of potential contaminant sources.

Future development and a change in land use practices may impact the ecological health of the Lake Erie watershed. This valuable water system should be protected to avoid further degradation of water quality by point and nonpoint sources of pollution.

For the purposes of source water assessments, all surface waters are accessible and can be readily contaminated by chemicals and pathogens, with relatively short travel times from source to the intake. The Marblehead Critical Assessment Zone is susceptible to contamination from numerous sources: roadways, recreational and commercial boating activities, sewage treatment plants, industrial wastewater, home sewage disposal systems, air contaminant deposition, stormwater from agricultural and urban areas, as well as accidental releases and spills.

While the source water for the Village of Marblehead is considered susceptible to contamination, historically, the Marblehead Public Water System has effectively treated this source water to meet drinking water quality standards.[10]

DRASTIC MAP

The sensitivity of the groundwater to local sources of contamination is determined and rated by **DRASTIC** maps as described below:

10 *Drinking Water Source Assessment for the Village of Marblehead,* Ohio EPA ca. 2003

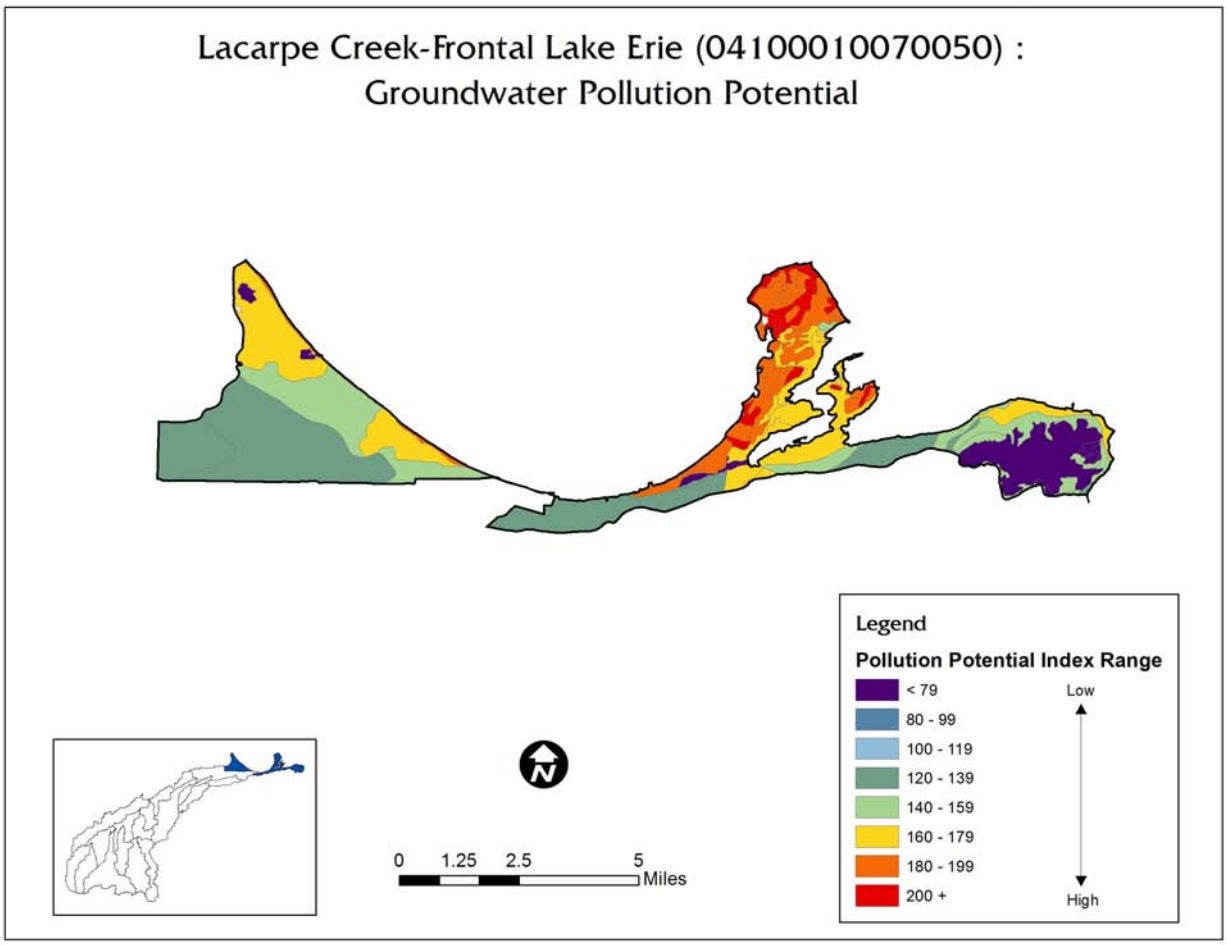
Inherent within each geologic setting are the physical characteristics which effect the groundwater pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:

D – Depth to Water
R – Net Recharge
A – Aquifer Media
S – Soil Media
T – Topography
I – Impact of the Vadose Zone Media
C – Conductivity (Hydraulic) of the Aquifer (ODNR, 1994)

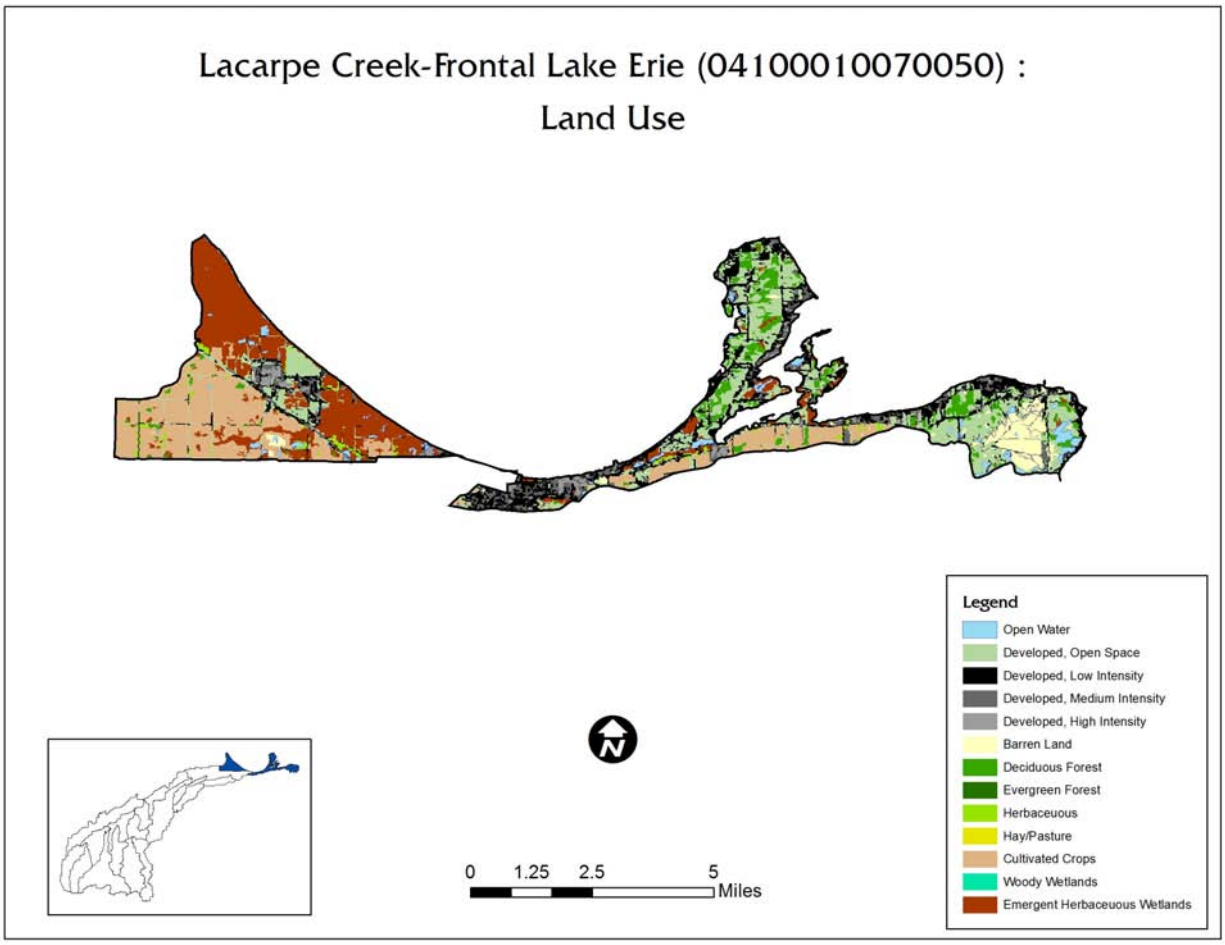
Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index then the greater the vulnerability to contamination (ODNR, 1994).

The average ground water pollution index potential for the Lacarpe Creek / Lake Erie frontal watersheds is 173 with a range of 123-212.

The Ohio Department of Natural Resources, Division of Water, Water Resources Section is the responsible agency to map groundwater resources throughout the state. Greater detail on DRASTIC maps for the Portage can be found in Chapter 4 of the watershed plan.



Sub-watershed (04100010)		
070-050		
Land Use	**Percent**	**Acres**
Urban	43.9%	8,353
Forest	7.2%	1,370
Pasture	0.0%	0
Cropland	21.8%	4,155
Other	27.1%	5,166
Total Acres	100%	19,044


Lacarpe Creek-Frontal Lake Erie (04100010070050) :
Land Use
Legend
Open Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Deciduous Forest
Evergreen Forest
Herbaceuous
Hay/Pasture
Cultivated Crops
Woody Wetlands
Emergent Herbaceuous Wetlands
0 1.25 2.5 5
Miles

Livestock Inventory							
HUC 4100010070050							
Type of Animal		**Hancock**	**Ottawa**	**Sandusky**	**Seneca**	**Wood**	**Estimates for HUC**
Percent of County in HUC		0.0%	11.7%	0.0%	0.0%	0.0%	
Cattle	Farms	129	89	167	264	144	**10**
	Animals	4,233	1,523	4,612	10,096	6,287	**179**
Hogs	Farms	51	15	37	62	30	**2**
	Animals	32,343	3,639	5,591	42,808	39,469	**427**
Horses	Farms	105	63	132	72	128	**7**
	Animals	844	444	772	463	1,004	**52**
Poultry	Farms	49	22	41	62	47	**3**
	Animals	NA	779	1,042	4,283	NA	**NA**
Sheep	Farms	32	12	41	61	21	**1**
	Animals	1,134	335	765	2,770	21	**39**
Total							24
							681
Source: 2007 Census of Agriculture http://www.agcensus.usda.gov/							

Point Sources

Municipal

- Catawba Island/Portage Township WWTP, 2PJ00004
- Put-In-Bay WWTP, 2PA00067

Package Plants

In July 2013 there were 9 package sewage treatment plants in this HUC. Plants that are not in use are marked as "inactive."

- Bayshore Inn, 2PR00164, 8,300 gpd, Active
- Perry House, 2,500 gpd, Active
- Sunset Inn, 9,000 gpd, Inactive
- Transmissions Unlimited, 500 gpd, Active
- Wagon Wheel Trailer Court, 2PY00084, 7,500 gpd, Active
- Wharf Lounge, 2PR00167, 7,000 gpd, Active
- White Caps Campground, 6,000 gpd, Active
- White Caps Motel & Trailer Park, 7,500 gpd, Active
- Willow Beach Trailer Park, 2PY00085, 9,000 gpd, Active

Industrial

- Erie Industrial Park LLC, 2IF00006
- Port Clinton Landfill Inc, 2IN00116

Non-Point Sources:

Critical Sewage Areas

- Erie Township: SR 163 and Richey Road
- East Harbor Road

CAFOs

None

Estimates of HSTSs				
Watershed	**Housing Units without sewers**	**Est. Unsewered Population (2010)**	**Unsewered Housing Units per acre**	**Unsewered Population per acre**
04100010070050	1,028	1,668	0.092	0.105

Sources: 2010 Census data and TMACOG "208" Plan. Analysis identifies approximate number of housing units without sewers in each watershed as an estimate of number of HSTSs using the HUC-14 watershed delineation.

Aquatic Life Use Impairments	
Causes	**Sources**
None listed	None listed
Source: Ohio 2012 Integrated Report, Watershed Assessment Unit Summary	

Water Supply:

Public Water System	Population Served	Primary Water Source
Port Clinton	6,056	Ottawa County Regional Water – Lake Erie
Marblehead	903	Marblehead WTP - Lake Erie

Water Quality Impairments

The OEPA Integrated Report assesses each watershed's attainment status for 1) Public Drinking Water Supply, 2) Recreation, 3) Human Health, 4) Aquatic Life, and 5) Fish Tissue. The

Integrated Report identifies causes and sources of impairments where watersheds are not in attainment with water quality standards.

Background:

The Lacarpe-Lake Erie HUC differs from the other watersheds in that it drains directly to Lake Erie, and not to the Portage River. The watershed has potential for coastal habitat. Pollutants in the watershed do not directly impact the Portage River, but may have an impact on Lake Erie coastal waters. Sampling data for this HUC are largely absent, as it was excluded from both the 1994 and 2008. Monitoring is scheduled for 2023 with a TMDL in 2026.

Lacarpe Creek is the one major stream in the HUC. The stream parallels the Portage in Ottawa County, flowing eastwardly to Lake Erie, which it enters in Erie Township, west of Port Clinton. Lacarpe Creek functions for agricultural drainage. The stream has been cut off in several places to drain south, directly into the Portage River. Only the section of Lacarpe downstream of the last cutoff drains to Lake Erie. The cutoff portions are not included in this HUC.

This HUC differs from the other Portage watersheds in its land use. It is more than 40% "urban" and has just over 20% in agricultural production.

Lacking TMDL water quality or habitat data, some inferences can still be drawn.

1. Improved and expanded coastal habitat would reduce nutrient and sediment loadings reaching Lake Erie
2. Although the agricultural land use in this HUC is much less than other HUCs, BMPs should be promoted and encouraged. Nutrient runoff from these lands would not have very far to go to reach Lake Erie, so reducing runoff will directly benefit the lake.
3. Preserving and expanding coastal wetlands would raise QHEI and ICI scores, providing habitat for fish and bird life, and strengthening hunting, fishing, and eco-tourism opportunities which are so important to the local economy. The numerous rare, threatened, and endangered species found in this HUC speaks to the opportunity.
4. With a number of package sewage treatment plants and over 1,000 HSTS it is likely that streams and the Lake Erie nearshore will not meet bacteria standards. The Ohio Department of Health[11] reported that the Camp Perry beach was posted with advisories for high bacteria levels 52 days in 2012 (out of the 98 day season from Memorial Day to Labor Day), and 40 days at Port Clinton City Beach. These compare with 16 days at the Maumee Bay State Park Lake Erie beaches. Connecting package plants and HSTS to available sewers should be a high priority in this HUC.
5. The Ottawa County Health Department and Ohio EPA NW District Office[12] conducted a preliminary visit to the Lakeshore – SR 163 area in 2012. Through visual / odor observations, obvious sewage was found in a catch basin, and discharging to the Portage River at an outfall. Sanitary surveys and formal water testing have not yet been done.

11 http://publicapps.odh.ohio.gov/BeachGuardPublic/SearchResults.aspx?instatepark=False&beachtype=PUB_PUB_ACC

12 Personal communication, Ottawa County Health Department March 2013

Problem Statement #1: (Bacteria)

The water quality of nearshore Lake Erie and the Lake Erie Islands is impacted by elevated measurements of E. coli bacteria. The Portage TMDL does not include data for this HUC, but other testing programs contribute documentation.

There are an estimated 1,028 HSTS in the HUC. There are nine package sewage treatment plants (four permitted) in the watershed. The HUC has two Critical Sewage Areas: a section of Erie Township along SR 163 and Richey Road, and East Harbor Road just east of Port Clinton. The 2010 census data indicate 268 households in the SR 163/Richey critical area. Without the documentation of a TMDL, sanitary surveys and the ODNR beach sampling data provide strong evidence of significant sewage and fecal bacteria issues related to this HUC.

Goal 1.1: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 19.2 million gallons of HSTS effluent annually

Objectives:

- Replace or upgrade 300 of watershed's HSTS
- Determine & document need for public sanitary sewers in Lakeshore Drive area

East Harbor Road Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in

Goal 1.2: Reduce E. coli loadings to meet recreational bacteria water standards by eliminating 19.5 million gallons of package plant effluent annually

Objectives:

- Eliminate 8 active package plants with public sewer connections

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Bacteria	1.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$4,500,000	Ottawa & Sandusky County Health Dept, TMACOG, Ohio EPA	2013 - 2022	Replace or upgrade 300 of watershed's HSTS	19.2 million gallons/year sewage discharge eliminated
	1.1	♦Conduct sanitary survey and water quality testing for Lakeshore Drive area ♦Define study area with OEPA, Ottawa County Health Department, Ottawa County Sanitary Engineer ♦Conduct sanitary survey ♦Issue		Ottawa County Health Dept, Ottawa County Sanitary Engineer, Port Clinton, Ohio EPA, TMACOG	2013 - 2020	Determine & document need for public sanitary sewers in Lakeshore Drive area	Included in HSTS totals

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
		recommendations based on survey findings					
	1.1	♦Prioritize and schedule sanitary survey ♦Define study area with OEPA, Ottawa County Health Department, Ottawa County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$10,260	Ottawa County Health Department, Ottawa County Sanitary Engineer, OEPA	2013-2018	East Harbor Road Critical Area HSTS repaired / replaced, or sewers completed and all structures tapped in	Included in HSTS totals
	1.2	♦Connect Lakeshore Drive area package plants to public sewer		Ohio EPA	2013-2017	Eliminate 8 active package plants with public sewer connections	19.5 million gallons/year effluent improved

Problem Statement #2: (Nutrients: phosphorus and nitrate)

The water quality of nearshore Lake Erie and the Lake Erie Islands is likely to be impacted by elevated nutrient loads from this HUC. The Portage TMDL does not include data for this HUC, but other testing programs contribute documentation.

There are an estimated 1,759 HSTS, 38 package sewage treatment plants, and four Critical Sewage Areas in this HUC. Without the documentation of a TMDL, sanitary surveys and the ODNR beach sampling data provide strong evidence of significant sewage issues related to this HUC, which make high nutrient levels likely.

Agricultural practices in the HUC are similar to its neighbors (70-10/70-40 and 70-20/70-30) which have nutrient exceedences. Agricultural BMPs are recommended as the average per-acre rates for BMPs of these neighboring HUCs.

Goal 2.1: Meet TMDL target for phosphorus load reduction by 2,736 and nitrate load by 12,259 lb/year from HSTS and package plants

Objectives:

- Replace or upgrade 300 of watershed's HSTS
- Determine & document need for public sanitary sewers in Lakeshore Drive area

Goal 2.2: Meet TMDL target for phosphorus load reduction by 1,137 and nitrate load by 5,494 lb/year from package plants (included in 2.1 totals)

Objectives:

- Eliminate 8 active package plants with public sewer connections

Goal 2.3: Meet TMDL target for phosphorus load reduction by 459 and nitrate load by 1,130 lb/year from agricultural practices

Objectives:

- 320 acres of cover crops
- 94 acres of controlled drainage
- 153 acres of permanent hay
- 69 acres of riparian buffers
- 7 acres of restored wetlands
- 79 LF of stream restoration
- 59 LF of overwide / 2-stage ditch reconstruction
- 3,832 acres under NRCS 590/1 Nutrient Mgt
- 1,916 acres under NRCS 590/3 Nutrient Mgt
- 320 acres of filter strips
- 108 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Nutrients (phosphorus and nitrate)	2.1	♦Identify target HSTS areas ♦Identify failed HSTS ♦Test HSTS to confirm failure ♦Enforce repair or replacement ♦Secure funding assistance as needed	$4,500,000	Ottawa & Sandusky County Health Dept, TMACOG, Ohio EPA	2013 - 2022	Replace or upgrade 300 of watershed's HSTS	19.2 million gallons/year sewage discharge eliminated
	2.1	♦Conduct sanitary survey and water quality testing for Lakeshore Drive area ♦Define study area with OEPA, Ottawa County Health Department, Ottawa County Sanitary Engineer ♦Conduct sanitary survey ♦Issue recommendations based on survey findings	$0	Ottawa County Health Dept, Ottawa County Sanitary Engineer, Port Clinton, Ohio EPA, TMACOG	2013 - 2020	Determine & document need for public sanitary sewers in Lakeshore Drive area	Included in HSTS totals
	2.2	♦Connect Lakeshore Drive area package plants to public sewer	$0	Ohio EPA	2013-2017	Eliminate 8 active package plants with public sewer connections	Included in HSTS totals
	2.3	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$19,204	Ottawa SWCD, NRCS, farmers	2013-2027 in phases	320 acres of cover crops	Reduce phosphorus load by 287 and nitrate load by 575 lb/year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$44,069	Ottawa SWCD, NRCS, farmers	2013-2027 in phases	94 acres of controlled drainage	Reduce phosphorus load by 33 and nitrate load by 86 lb/year
	2.3	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$42,748	Ottawa SWCD, NRCS, farmers	2013-2027 in phases	153 acres of permanent hay	Reduce phosphorus load by 99 and nitrate load by 198 lb/year
	2.3	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$48,243	Ottawa SWCD, Ottawa Co Engineer, NRCS, farmers	2013-2027 in phases	69 acres of riparian buffers	Reduce phosphorus load by 10 and nitrate load by 21 lb/year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$36,429	Ottawa SWCD, Ottawa Co Engineer, NRCS, farmers	2013-2027 in phases	7 acres of restored wetlands	Reduce phosphorus load by 1 and nitrate load by 7 lb/year
	2.3	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$27,398	Ottawa SWCD, Ottawa co Engineer, NRCS, farmers	2013-2027 in phases	79 LF of stream restoration	Reduce phosphorus load by 3 and nitrate load by 6 lb/year
	2.3	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$5,260	Ottawa SWCD, Ottawa Co Engineer, NRCS, farmers	2013-2027 in phases	59 LF of overwide / 2-stage ditch reconstruction	Reduce phosphorus load by 06 and nitrate load by 13 lb/year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Seek cooperators for Nutrient Management NRCS 590 Level 1 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management NRCS 590 Level 1 BMPs with farmers	$76,641	Ottawa SWCD, NRCS, farmers	2013-2022	3,832 acres under NRCS 590/1 Nutrient Mgt	NA
	2.3	♦Seek cooperators for Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with meetings, newsletters, technical assistance ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Nutrient Management: GPS/VRT NRCS 590 Level 3 BMPs with farmers	$76,641	Ottawa SWCD, NRCS, farmers	2013-2022	1,916 acres under NRCS 590/3 Nutrient Mgt	NA
	2.3	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$44	Ottawa SWCD, NRCS, farmers	2013-2027 in phases	320 acres of filter strips	Reduce phosphorus load by 3 and nitrate load by 05 lb/year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	2.3	♦Identify & prioritize fields suited for Conservation Tillage BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Conservation Tillage BMP with farmer	$1,624	Ottawa SWCD, NRCS, farmers	2013-2027 in phases	108 acres of conservation tillage	Reduce phosphorus load by 16 and nitrate load by 220 lb/year

Problem Statement #3: (Siltation/Sedimentation)

Agricultural practices in the HUC are similar to its neighbors (70-10/70-40 and 70-20/70-30). For both of these HUCs, the TMDL lists sedimentation/siltation as a cause of impairment, and nonirrigated crop production and channelization as sources. Agricultural BMPs are recommended as the average per-acre rates for BMPs of these neighboring HUCs.

Goal 3.1: Reduce sedimentation impairments by decreasing sediment load by 246 lb/year from agricultural practices

Objectives:

- 320 acres of cover crops
- 94 acres of controlled drainage
- 153 acres of permanent hay
- 69 acres of riparian buffers
- 7 acres of restored wetlands
- 79 LF of stream restoration
- 59 LF of overwide / 2-stage ditch reconstruction
- 320 acres of filter strips
- 108 acres of conservation tillage

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Sedimentation	3.1	♦Identify & prioritize fields suited for Cover Crop BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Cover Crop BMPs with farmer	$19,204	Ottawa SWCD, NRCS, farmers	2013-2027 in phases	320 acres of cover crops	Reduce sediment load by 144 lb./year
	3.1	♦Identify & prioritize fields suited for Controlled Drainage BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Controlled Drainage BMPs with farmer	$44,069	Ottawa SWCD, NRCS, farmers	2013-2027 in phases	94 acres of controlled drainage	Reduce sediment load by 38 lb./year
	3.1	♦Identify & prioritize fields suited for Permanent Hay BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Permanent Hay BMPs with farmer	$42,748	Ottawa SWCD, NRCS, farmers	2013-2027 in phases	153 acres of permanent hay	Reduce sediment load by 50 lb./year
	3.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$48,243	Ottawa SWCD, Ottawa Co Engineer, NRCS, farmers	2013-2027 in phases	69 acres of riparian buffers	Reduce sediment load by 05 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$36,429	Ottawa SWCD, Ottawa Co Engineer, NRCS, farmers	2013-2027 in phases	7 acres of restored wetlands	Reduce sediment load by 00 lb./year
	3.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$27,398	Ottawa SWCD, Ottawa Co Engineer, NRCS, farmers	2013-2027 in phases	79 LF of stream restoration	Reduce sediment load by 3 lb./year
	3.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$5,260	Ottawa SWCD, Ottawa Co Engineer, NRCS, farmers	2013-2027 in phases	59 LF of overwide / 2-stage ditch reconstruction	Reduce sediment load by 03 lb./year
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$44	Ottawa SWCD, NRCS, farmers	2013-2027 in phases	320 acres of filter strips	Reduce sediment load by 1 lb./year

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	3.1	♦Identify & prioritize fields suited for Filter Strip BMP and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Filter Strip BMP with farmer	$1,624	Ottawa SWCD, NRCS, farmers	2013-2027 in phases	108 acres of conservation tillage	Reduce sediment load by 0 lb./year

Problem Statement #4: (Habitat Alteration)

Agricultural practices in the HUC are similar to its neighbors (70-10/70-40 and 70-20/70-30). For these HUCs, the TMDL lists habitat alteration as a cause of impairment, and channelization as a source for both. Both HUCs have QHEI scores that range from "fair" to "very poor." Agricultural BMPs are recommended as the average per-acre rates for BMPs of the neighboring HUCs.

Goal 4.1: 76 acres of habitat restoration and 138 linear feet of stream corridor restoration practices

Objectives:

- 69 acres of riparian buffers
- 7 acres of restored wetlands
- 79 LF of stream restoration
- 59 LF of overwide / 2-stage ditch reconstruction

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
Habitat Impairment	4.1	♦Identify & prioritize stream segments suited for Riparian Buffers BMPs and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Riparian Buffers BMPs with farmer	$48,243	Ottawa SWCD, Ottawa Co Engineer, NRCS, farmers	2013-2027 in phases	69 acres of riparian buffers	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize areas suited for Wetland Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Wetland Restoration with landowner	$36,429	Ottawa SWCD, Ottawa Co Engineer, NRCS, farmers	2013-2027 in phases	7 acres of restored wetlands	Load reductions provided in nutrient and sediment tables
	4.1	♦Identify & prioritize stream segments suited for Stream Restoration and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Stream Restoration with landowner	$27,398	Ottawa SWCD, Ottawa Co Engineer, NRCS, farmers	2013-2027 in phases	79 LF of stream restoration	Load reductions provided in nutrient and sediment tables

Pollutant (cause of impairment)	Goal	Action	Resources	How	Time Frame	Performance Indicator	Load Reduction
	4.1	♦Identify & prioritize stream segments suited for Overwide or 2-Stage Ditches and potential cooperators ♦Secure landowner commitment ♦Seek grant funding and match ♦Cost share Overwide or 2-Stage Ditches with landowner	$5,260	Ottawa SWCD, Ottawa Co Engineer, NRCS, farmers	2013-2027 in phases	59 LF of overwide / 2-stage ditch reconstruction	Load reductions provided in nutrient and sediment tables

Chapter Six

6.1 Coastal Nonpoint Pollution Control

In this chapter, the reader will find a review of the applicability of management measures specified in the Coastal Nonpoint Pollution Control Program and implementation strategies to address those measures within the Portage River watershed. Many objectives address more than one management measure. To simplify this review process, only primary objectives are listed for each measure. A table at the end of this chapter identifies where overlap in the objective strategies exist.

This chapter was prepared utilizing sections from The Ohio Coastal Nonpoint Pollution Control Plan and other Northwest Ohio watersheds, including Old Woman Creek (http://www.firelandstributaries.net/actionplan.html) and the Blanchard River - The Outlet / Lye Creek Watershed (http://www.blanchardriver.org/action-plan/). TMACOG thanks them for their guidance and permission to draw upon their materials.

The Coastal Nonpoint Pollution Control Program (CNPCP) is a nonpoint source management program specified for restoring and protecting coastal waters from specific categories of nonpoint source pollution. Administered by the ODNR Division of Soil and Water Resources, the Division requires Watershed Action Plans being developed for Lake Erie watersheds under the Watershed Coordinator Grant Program to include implementation strategies to address management measures identified within CNPCP.

The Portage River watershed is a sub-basin of the greater Lake Erie watershed. As such, the land use and overall health of the watershed has direct impact on the integrity of Lake Erie. Although the Portage River is mostly an agricultural watershed, there is suburban development in unincorporated areas surrounding municipalities, notably Bowling Green, Port Clinton, and Fostoria. Management measurements in this section will address both agricultural and urbanized areas of the entire watershed including household sewage treatment systems.

Applicable Management Measures

- New Development
- Watershed Protection
- Site Development
- Existing Development
- New Household Treatment Systems
- Household Sewage Treatment Systems (HSTS)
- Planning, Siting, Developing Road, Highways, and Bridges
- Bridges (Local Only)
- Road, Highway, and Bridge Operation and Maintenance (excludes Inter and Intrastate)
- Road, Highway, and Bridge Runoff Systems (excludes Inter and Intrastate only)

- Operation and Maintenance Program for Existing Modified Channels - Protect Surface Water and Restore In-Stream and Riparian Habitat
- Eroding Streambanks and Shorelines

Non-Applicable Management Measures

- Road, Highway, and Bridge Operation and Maintenance (Inter and Intrastate only)
- Road, Highway, and Bridge Runoff Systems (Inter and Intrastate only)
- Dams- Protection of Surface Water Quality and In-Stream and Riparian Habitat

Inter and Intrastate highways, and bridges maintained by ODOT or the Ohio Turnpike Commission are considered an MS4 by the Ohio EPA and thus must comply with the NPDES Phase II program. All areas under a Phase II permit are considered exempt from the CNPCP. Although these transportation corridors transect the watershed, they will not be addressed in this section. Information about ODOT's Stormwater Management Program can be accessed at http://www.dot.state.oh.us/stormwater/Pages/default.aspx, a copy of the Ohio Turnpike Commission Stormwater Management Plan can be accessed at http://www.ohioturnpike.org/about/storm_water/. The Van Buren State Park dam is the only man-made impoundment in the Portage River watershed to impact surface water quality, in-stream and riparian habitat that is covered by the management measure addressing dams.

6.2 New Development Management Measure

This management measure is intended to accomplish the following:

1. decrease the erosive potential of increased runoff volumes and velocities associated with development-induced changes in hydrology
2. remove suspended solids and associated pollutants entrained in runoff that result from activities occurring during and after development;
3. retain hydrological conditions to closely resemble those of the predisturbance condition; and
4. preserve natural systems including in-stream habitat.

Most of the Portage River Basin is not covered by Municipal Separate Storm Sewer System (MS4) permits. MS4 coverage in Portage River counties is as follows:

- The City of Findlay is covered by an MS4 permit, administered by the municipality. It does not apply to unincorporated areas of the county, and does not affect the Portage River Basin.
- Portions of Ottawa County contiguous with the Toledo Metropolitan area are covered by MS4 permits. These include portions of Allen and Clay Townships. The townships are co-permittees with the County for their MS4 permits, administered by the Ottawa Soil and Water Conservation District. These MS4 permits do not apply directly to areas of the Portage River basin.
- There are no MS4 permits in Sandusky County.

- Portions of Wood County contiguous with the Toledo Metropolitan area are covered by MS4 permits. These include portions of Lake, Middleton, and Perrysburg Townships, the villages of Millbury and Walbridge, and the cities of Northwood, Perrysburg, and Rossford. The three townships are co-permittees with the County for their MS4 permits, administered by the Wood County Engineer's Office. These MS4 permits do not apply directly to areas of the Portage River basin. Within the Portage, the cities of Bowling Green and Fostoria are subject to MS4 permits, which are administered by the municipalities under Stormwater Management Plans.

Besides MS4 permits, Ohio EPA stormwater regulations apply throughout the state. New development that disturbs one acre or more of soil is subject to regulation under construction site general permits: please see http://epa.ohio.gov/dsw/permits/gplist.aspx. General permits require management measures to prepare and implement Stormwater Pollution Prevention Plans, and employ construction and management measures to control runoff of sediment and pollutants.

The TMACOG "208" Areawide Water Quality Management Plan Stormwater Management Chapter identifies Critical Urbanizing Watersheds, which are defined as having growth rates greater than 5% and two or aquatic life use impairments that may be related to urban stormwater runoff. These 14-digit HUCs in the Portage River Basin are:

Portage Watersheds Identified as Critical Urbanizing Watersheds	
HUC_14	Watershed Name
4100010030010	Needles Creek above Rader Cr.
4100010030040	Rocky Ford Creek
4100010040020	Bull Creek
4100010040030	South Branch Portage River headwaters to above E. Branch Portage R.
4100010050020	North Branch Portage River
4100010060010	Portage River below N. Branch to above Sugar Cr. (includes Lacarpe Cr. outlet #4)

Objectives

- Expand understanding of the environmental impacts of stormwater by local officials and the development community

Strategies

- Hold one educational event for public officials and professionals to increase knowledge of stormwater program significance and steps initiating a stormwater program

- Identification of local and regional watershed approach stormwater trainings.
- Hold workshop for local officials and the development community on economic and environmental advantages of low impact development, use of green infrastructure, and conservation development design.

6.3 Watershed Protection Management Measure

The purpose of this management measure is to reduce the generation of nonpoint source pollutants and to mitigate the impacts of urban runoff and associated pollutants that result from new development or redevelopment, including the construction of new and relocated roads, highways, and bridges. The measure is intended to provide general goals for States and local governments to use in developing comprehensive programs for guiding future development and land use activities in a manner that will prevent and mitigate the effects of nonpoint source pollution.
Develop a watershed protection program to:

1. Avoid conversion, to the extent practicable, of areas that are particularly susceptible to erosion and sediment loss;
2. Preserve areas that provide important water quality benefits and/or are necessary to maintain riparian and aquatic biota; and
3. Site development, including roads, highways, and bridges, to protect to the extent practicable the natural integrity of waterbodies and natural drainage systems.

To accomplish the goals of this measure, the members of the PRBC will utilize several strategies to protect critical areas to maintain water quality in the Portage River and work with local communities to guide development in a way that is ecologically and economically sustainable.

6.4 Agricultural Best Management Practices

The majority of the land use throughout the watershed is agricultural. Each county Assoil and Water Conservation District conducts active technical assistance programs in support of agricultural BMPs in conjunction with USDA-NRCS, USDA-FSA, and Ohio State University Extension. These agencies implement/administer assistance/cost share programs such as EQUIP, CAP and CREP, and work with farmers to prepare comprehensive nutrient management plans (CNMPs). These programs all support effective stewardship and control of sediment and nutrient loadings to the Portage River. Of special note:

- OSU Extension contributes a regular column on Agricultural BMPs to the *Bowling Green Sentinel-Tribune*.
- All SWCDs of the watershed publish regular newsletters and conduct other outreach/educational programs to promote conservation and BMPs.

6.5 Floodplain Protection And Riparian Zones

Practices to preserve the function of floodplains and reduce nonpoint source pollution are encouraged and implemented throughout the watershed. The Portage River basin is susceptible to flooding in many areas, especially in Wood County. Maintaining floodplain function is important both for flood control and environmental protection. Floodplains at the same time provide habitat and reduce nutrient loading.

- Wood County has implemented rules that require that all portions of Special Flood Hazard Areas that are altered due to development be replaced by creating additional floodplains at the development site. The regulations are administered by the County Planning Commission: http://www.co.wood.oh.us/planning/PDF/FloodplainRegs%20_Oct2004.pdf
- The Black Swamp Conservancy preserves natural areas throughout northwest Ohio through direct ownership, conservation easements, or agricultural easements, currently totaling more than 10,000 acres: http://www.blackswamp.org/BSC_Easements.html. The BSC also conducts educational and outreach programs on habitat preservation.

6.6 Watershed-based Planning

The Portage River Basin Council is a partnership through TMACOG of local governments, nonprofits, and businesses. The Council coordinates educational, conservation, and environmental programs among stakeholders of the watershed. The Council, through TMACOG staff, will maintain the Watershed Plan and guide its implementation through project development

Objectives

- Expand use of floodplain protection and riparian zones
- Maintain, update, and expand and implement the watershed plan
- Implement the watershed plan through project development
- Land conservation through easements and land acquisition with willing landowners

Strategies

- Enact floodplain protection regulations and compensatory cut/fill requirements by all jurisdictions of the watershed
- Implement retention/detention regulations for new development that disturbs one acre or more of soil.
- Expand the watershed plan by completing problem statements and implementation strategies for the remaining 9 HUCs
- Conduct the Portage River Student Congress program annually to teach high school students about water quality and habitat. Expand the program to include all high schools of the river basin.
- Work with the Black Swamp Conservancy to preserve habitat and natural areas

6.7 SITE DEVELOPMENT

The goal of this management measure is to reduce the generation of nonpoint source pollution and to mitigate the impacts of urban runoff and associated pollutants from all site development.
Plan, design, and develop sites to:

1. Protect areas that provide important water quality benefits and/or are particularly susceptible to erosion and sediment loss;
2. Limit increases of impervious areas, except where necessary;
3. Limit land disturbance activities such as clearing and grading, and cut and fill to reduce erosion and sediment loss; and
4. Limit disturbance of natural drainage features and vegetation.

As stated in the New Development Management Measure, most of the Portage River Basin is covered by pre and post-construction stormwater management regulations through Ohio EPA General Permits. Education and training outreach are needed for public officials and the development community in non-MS4 areas. The most effective agencies to conduct these programs are the County Engineers and SWCD offices, especially where those agencies conduct programs for MS4 areas.

The SWCD could provide a technical assistance role trough assessment of potential environmental impacts of a proposed development. The Hancock, Sandusky, and Wood SWCDs would require capacity building to do so, not having provided this function in the past; all SWCDs would require staff support and funding. Technical expertise of the SWCDs would provide local communities insight to additional governing regulatory considerations developed through state and federal programs and provide alternative stormwater techniques to reduce run-off pollution potential of the finished development. SWCDs would need to formalize technical assistance agreements with local communities and or the governing agencies for the site plan review process.

Similarly, a coordinating role could be played by the TMACOG Stormwater Coalition, which presently covers only MS4 communities. It could be expanded to non-MS4 areas to assist with education, outreach, and training. Presently the Stormwater Coalition has one member that is not an MS4 community.

Objectives

- Build capacity at SWCDs to conduct site plan reviews process to include environmental considerations (wetlands, riparian corridors, TMDL reports, etc.)
- Expand stormwater outreach, education, and training programs to cover non-MS4 areas of the Portage River Basin

Strategies

- Hold educational events for public officials and professionals to increase knowledge of stormwater program significance and steps initiating a stormwater program

6.8 EXISTING DEVELOPMENT MANAGEMENT

The purpose of this management measure is to protect or improve surface water quality by the development and implementation of watershed management programs. The goals of the Site Development, Existing Development, and Watershed Protection Management Measures are intended to be complementary and the measures should be used within a comprehensive framework to reduce nonpoint source pollution.

Maintenance of water quality becomes increasingly difficult as areas of impervious surface increase and urbanization occurs. For the purpose of this guidance, urbanized areas are those areas where the presence of "man-made" impervious surfaces results in increased peak runoff volumes and pollutant loadings that permanently alter one or more of the following: stream channels, natural drainage ways, and in-stream and adjacent riparian habitat so that predevelopment aquatic flora and fauna are eliminated or reduced to unsustainable levels and predevelopment water quality has been degraded. Increased bank cutting, streambed scouring, siltation damaging to aquatic flora and fauna, increases in water temperature, decreases in dissolved oxygen, changes to the natural structure and flow of the stream or river, and the presence of anthropogenic pollutants that are not generated from agricultural activities, in general, are indications of urbanization.

Protection of water quality in urbanized areas is difficult because of a range of factors. These factors include diverse pollutant loadings, large runoff volumes, limited areas suitable for surface water runoff treatment systems, high implementation costs associated with structural controls, and the destruction or absence of buffer zones that can filter pollutants and prevent the destabilization of streambanks and shorelines.

Comprehensive watershed planning facilitates integration of source reduction activities and treatment strategies to mitigate the effects of urban runoff. Through the use of watershed management, States and local governments can identify local water quality objectives and focus resources on control of specific pollutants and sources. Watershed plans typically incorporate a combination of nonstructural and structural practices.

An important nonstructural component of many watershed management plans is the identification and preservation of buffers and natural systems. These areas help to maintain and improve surface water quality by filtering and infiltrating urban runoff. In areas of existing development, natural buffers and conveyance systems may have been altered as urbanization occurred. Where possible and appropriate, additional impacts to these areas should be minimized and if degraded, the functions of these areas restored. The establishment and protection of buffers, however, is most appropriate along surface waterbodies and their tributaries where water quality and the biological integrity of the

water body are dependent on the presence of an adequate buffer/riparian area. Buffers may be necessary where the buffer/riparian area (1) reduces significant NPS pollutant loadings, (2) provides habitat necessary to maintain the biological integrity of the receiving water, and (3) reduces undesirable thermal impacts to the water body.

Where existing development precludes the use of effective nonstructural controls, structural practices may be the only suitable option to decrease the NPS pollution loads generated from developed areas. In such situations, a watershed plan can be used to integrate the construction of new surface water runoff treatment structures and the retrofit of existing surface water runoff management systems.

Retrofitting is a process that involves the modification of existing surface water runoff control structures or surface water runoff conveyance systems, which were initially designed to control flooding, not to serve a water quality improvement function. By enlarging existing surface water runoff structures, changing the inflow and outflow characteristics of the device, and increasing detention times of the runoff, sediment and associated pollutants can be removed from the runoff. Retrofit of structural controls, however, is often the only feasible alternative for improving water quality in developed areas. Where the presence of existing development or financial constraints limits treatment options, targeting may be necessary to identify priority pollutants and select the most appropriate retrofits.

Once key pollutants have been identified, an achievable water quality target for the receiving water should be set to improve current levels based on an identified objective or to prevent degradation of current water quality. Extensive site evaluations should then be performed to assess the performance of existing surface water runoff management systems and to pinpoint low-cost structural changes or maintenance programs for improving pollutant-removal efficiency. Where flooding problems exist, water quality controls should be incorporated into the design of surface water runoff controls. Available land area is often limited in urban areas, and the lack of suitable areas will frequently restrict the use of conventional pond systems. In heavily urbanized areas, sand filters or water quality inlets with oil/grit separators may be appropriate for retrofits because they do not limit land usage.

Develop and implement watershed management programs to reduce runoff pollutant concentrations and volumes from existing development:

Identify priority local and/or regional watershed pollutant reduction opportunities, e.g., improvements to existing urban runoff control structures;
Contain a schedule for implementing appropriate controls;

Limit destruction of natural conveyance systems; and

Where appropriate, preserve, enhance, or establish buffers along surface waterbodies and their tributaries.

The predominant land use of the Portage River basin is agricultural. Besides municipalities, development in the watershed includes rural residential and subdivisions, especially along road fronts. In conjunction to reducing stormwater related impacts within the urbanized area of the watershed, the Portage River Basin Council partners will seek out individual partnerships with local landowners to protect and enhance riparian best management practices, including filter strips, floodplains, and habitat.

Objectives

- Reduce surface water runoff pollution loadings from areas where development has already occurred;
- Limit surface water runoff volumes in order to minimize sediment loadings resulting from the erosion of streambanks and other natural conveyance systems; and
- Preserve, enhance, or establish buffers that provide water quality benefits along waterbodies and their tributaries.

Strategies

- Enact floodplain protection regulations and compensatory cut/fill requirements by all jurisdictions of the watershed
- Seek and work with land owners for voluntary implementation of riparian BMPs including filter strips, riparian corridors, stream restoration, restoration of cutoff oxbows
- Preserve natural areas through voluntary acquisition or conservation easements

6.9 New On-Site Disposal Systems (OSDS)

The purpose of this management measure is to protect the Coastal Zone Management Area from pollutants discharged by HSTS. The measure requires that HSTS be sited, designed, and installed so that impacts to waterbodies will be reduced, to the extent practicable. Factors such as soil type, soil depth, depth to water table, rate of sea level rise, and topography must be considered in siting and installing conventional HSTS.
Inventories of home septic systems were completed by Hancock, Sandusky, Ottawa and Wood Counties in 2004 through their HSTS plans. The HSTS plans include guidance to meet the requirements of this management measure. County health departments operating in the Portage River watershed continually work to improve site evaluation and inspection programs that meet the Coastal NPS Management Plan Measures to insure that all new and replacement HSTS are located, designed, installed and operated to prevent discharges to surface or ground waters.

Effective January 1, 2007 the Ohio Department of Health implemented new sewage treatment system rules. These regulations set statewide standards for the design,

operation, and maintenance of onsite systems, referred to as Sewage Treatment Systems (STS) or "Household STSs" (HSTS). The regulations create a new category, "Small Flow Onsite Sewage Treatment System," or SFOSTS. These systems are defined as STSs that are not household units, treat less than 1,000 gallons of sewage per day. They do not require EPA NPDES permits because their design includes soil absorption systems as part of the treatment process, and do not discharge off-lot

Effective July 1, 2007 most aspects of the new sewage regulations were suspended; the suspension was effective until July 1, 2009. The legislation also directed a Technical Advisory Committee to actively pursue and consider new, innovative and cost-effective technologies for household sewage treatment systems, and conduct pilot projects to assess their effectiveness. In 2011, this process was underway. Updates on the state sewage treatment system rules can be found on the Ohio Department of Health's website at www.odh.ohio.gov Current HSTS rules are posted on at http://codes.ohio.gov/oac/3701-29.

New on-site construction for HSTS systems within the watershed are administered as described by each county within the Portage watershed. No private sewage treatment system shall be installed, maintained, or operated on any property accessible to a public sanitary sewerage system. A connecting point to the public sewer from the foundation wall of any structure with plumbing drains along the shortest direct line distance is within a specified distance. That specified distance is 200 feet unless a different figure is given for individual criteria for each county.

Objectives

- Ensure that new HSTS are located, designed, installed, operated, inspected, and maintained to prevent the discharge of pollutants to the surface of the ground and to the extent practicable reduce the discharge of pollutants into ground waters that are closely hydrologically connected to surface waters
- Wherever possible, use HSTS designs that do not discharge off lot. Minimize use of mechanical equipment that is subject to failure or can cause the system to malfunction as a result of homeowner neglect.
- Direct placement of HSTS away from unsuitable areas.

Strategies

- Discourage the installation of garbage disposals to reduce hydraulic and nutrient loadings
- Where low-volume plumbing fixtures have not been installed in new developments or redevelopments, reduce total hydraulic loadings to the HSTS by 25 percent.
- Implement HSTS inspection schedules for preconstruction, construction, and post construction.
- Direct placement of HSTS away from unsuitable areas. Where HSTS placement in unsuitable areas is not practicable, ensure that the HSTS is designed or sited at a density so as not to adversely affect surface waters

or ground water that is closely hydrologically connected to surface water. Unsuitable areas include, but are not limited to, areas with poorly or excessively drained soils; areas with shallow water tables or areas with high seasonal water tables; areas overlaying fractured bedrock that drain directly to ground water; areas within floodplains; or areas where nutrient and/or pathogen concentrations in the effluent cannot be sufficiently treated or reduced before the effluent reaches sensitive waterbodies;

- Establish protective setbacks from surface waters, wetlands, and floodplains for conventional as well as alternative HSTS. The lateral setbacks should be based on soil type, slope, hydrologic factors, and type of HSTS. Where uniform protective setbacks cannot be achieved, site development with HSTS so as not to adversely affect waterbodies and/or contribute to a public health nuisance;
- Establish protective separation distances between HSTS system components and groundwater which is closely hydrologically connected to surface waters. The separation distances should be based on soil type, distance to ground water, hydrologic factors, and type of HSTS;
- Where conditions indicate that nitrogen-limited surface waters may be adversely affected by excess nitrogen loadings from ground water, place a high priority for sanitary surveys, elimination of off-lot discharging systems, and tapping HSTS where sewers are available.

Hancock County

In the case of new construction, areas that are unsuitable will be denied an installation permit. The Hancock County Board of Health does not issue permits for new construction within a 100 year flood plain; in areas with less than four feet of naturally occurring soil over bedrock; in soils that are unsuitable; or in wet soils where suitable tile draining is not provided. Alternative sewage systems may be approved for problem areas.

All new construction sites must have a suitable area for complete replacement of the home sewage treatment system. This replacement area shall be designated on the site evaluation application.

Ottawa County

The Ottawa County General Health District Uniform Home Sewage Disposal Regulations and Ohio Administrative Code (OAC) 3701-29 regulate the sewage treatment requirements for household sewage treatment systems, including permitting, operation, engineering, and design specifications; registration of installers and sewage tank cleaners; abandonment of household sewage treatment systems; and variances.

The OCGHD will continually work to implement a site evaluation and inspection program that meets management measures set by the Ohio Coastal Nonpoint Source

Management Program and to prescribe new and replacement HSTSs that will be located, designed, installed and operated to prevent discharges to surface or ground waters.

Sandusky County

Sewage treatment design will be based on the soil evaluation. This will ensure that this sewage treatment will be located, designed, and installed to prevent the discharge of pollutants to the surface of the ground and to reduce the discharge of pollutants into ground waters.

Residences are required to tap into an available public sanitary sewer that the Board of Health has determined to be accessible. The Board of Health will make a determination on a lot-by-lot basis, depending on DMA's accessibility assessment, 208 Facility Planning Area, whether the site is in a Critical Sewage Area, density of housing units, and environmentally sensitive areas.

Areas that are unsuitable will be denied an installation permit. The Sandusky County Board of Health does not issue permits for new construction within a 100 year flood plain; in areas with less than four feet of naturally occurring soil over bedrock; in soils that are unsuitable; or in wet soils where suitable tile draining is not provided.

All new construction sites must have a suitable area for complete replacement of the home sewage treatment system. This replacement area shall be designated on the installation permit.

Wood County

All new and replacement HSTS installed or altered are issued an installation or alteration permit under the authority of Ohio Administrative Code Section 3701-29-04 and the Wood County Health Department Home Sewage System Disposal Regulations. All septic tank cleaners are registered annually.

In order for the Wood County General Health District to implement a corrective action plan to assure compliance with the existing codes and regulations, including, but not limited to regulations of Wood County Board of Health, Ohio Department of Health and Ohio EPA and Coastal Management Measures, and to assure there are no negative impacts on water quality in Wood County. The Wood County Board of Health will continually work to improve site evaluation and inspection programs that meet the Coastal NPS Management Plan Measures to insure that all new and replacement HSTS are located, designed, installed and operated to prevent discharges to surface or ground waters.

Residences are required to tap into a public sewer when the structure is within 400 feet and the sewer is available and accessible.

Operating Home Sewage Treatment Systems

The purpose of this management measure is to minimize pollutant loadings from operating HSTS. This management measure requires that HSTS be modified, operated, repaired, and maintained to reduce nutrient and pathogen loadings in order to protect and enhance surface waters. In the past, it has been a common practice to site conventional HSTS in coastal areas that have inadequate separation distances to ground water, fractured bedrock, sandy soils, or other conditions that prevent or do not allow adequate treatment of HSTS-generated pollutants. Eutrophication in surface waters has also been attributed to the low nitrogen reductions provided by conventional HSTS designs.

County/Local Boards of Health identify Critical Sewage Areas (CSAs). They are areas with concentrations of failed or failing onsite sewage systems, based on sampling results, complaints received by the Health Department; or areas with suspected failures based on Health Department observations and best professional judgment.

- Priority areas for Ohio EPA and Health Departments to conduct sanitary surveys.
- Priority areas for inspection and increased maintenance of onsite systems until such time as a central public sanitary sewerage system is in place.
- Priority areas for public sanitary sewers or innovative community onsite sewage treatment systems to replace concentrations of individual systems. For CSAs where a public sanitary sewerage system is the best alternative, the priority order for construction may be affected by the availability of financial assistance.
- Priority areas for financial assistance to homeowners for installing public sanitary sewers.

The County Health Departments and the TMACOG 208 Plan identify Critical Sewage Areas.

Critical Sewage Areas
Hancock County
NAME
Deweyville
Shawtown
TR 97/TR 120
SR 613 E of McComb
CR 203 E of CR 139
TR 19/CR 139
Van Buren-Findlay
Shady Lake Camp
TR 218 E of TR 229 to TR 232
CR 109 W of CR 236
CR 216/TR 238
TR 215/CR236
TR 213 E of CR 18
TR 243/TR 215

Critical Sewage Areas
Hancock County
NAME
SR 12/CR109
TR 218/TR 261
CR 216 E of CR 23
SR 18 W of Fostoria

Critical Sewage Areas
Ottawa County
NAME
Curtice
Williston
SR 19 S of Oak Harbor
Waterford Place
SR 19 N of Oak Harbor to Salem-Carroll Road
Behlman
Clay Twp Near Genoa
Clay Twp Near Genoa
South Bass Island
South Bass Island
Locust Point
Johnson's Island
SR 269 in Danbury Twp
Englebeck Road
Rocky Ridge
Erie Twp: SR 163 and Richey Road
Portage Twp south shore, sections 7, 8, and 9
Middle Bass Island
Port Clinton Eastern Road
Lacarne
East Harbor Road
Toussaint River Association

Critical Sewage Areas
Sandusky County
NAME
Toussaint Creek
Portage below S. Br
Portage below N. Br
Sugar Creek
Woodland Hts
Muncie Hollow
White's Landing

Critical Sewage Areas
Sandusky County
NAME
Wightman's Grove
Rambo Rd
Hessville
Vickery
Hayes/53
Timpe / Twp Line / Cole
Green Cr Limerick Rd
Country Club Estates
Barkshire Hills
Wooded Acres Campgrounds
West State Street
Christina Drive
Four Mile House Road
Rodriguez Street
Millersville

Critical Sewage Areas
Wood County
NAME
SR 64 N of King
King Road / RR
Stony Ridge
Bairdstown
Otsego along river
Dowling
Dunbridge
Sugar Ridge
Kramer/Huffman
Hammansburg
Curtice/Bradner
Five Point
Hatton
Johnson's Subdivision
Mermill
Maurer's MHP
J&T MHP
South Rudolph

The Wood, Hancock, Sandusky, and Ottawa County Health Districts currently have the authority to initiate an Operations and Maintenance Program that requires residents to

have a service contract for operating and maintaining their system properly. However, all the county health departments do not have a central digital database of existing systems in their respective county which has halted the progress of this program. Most inspection of presumed failing HSTS is by complaint or in response to several consistent water contamination advisories obtained from a water quality monitoring program. Creation of this database would streamline the review process of maintenance and performance of existing systems and reduce costly source investigation.

Objectives

- Identify HSTS and package plants that have failed or that do not meet current standards
- Eliminate HSTS and package plants by tapping into available sewers
- Inspect HSTS and package plants to ensure adequate operation and maintenance
- Conduct sanitary surveys for CSAs

Strategies

- Where conditions indicate that nitrogen-limited surface waters may be adversely affected by excess nitrogen loadings from ground water, place a high priority for sanitary surveys, elimination of off-lot discharging systems, and tapping HSTS where sewers are available.
- Evaluate the feasibility of HSTS management districts
- Repair, upgrade, or replace 10% HSTS placing priorities on systems that have failed or are designed to discharge off-lot, are more than 20 years old.
- Complete computer GIS-databases of HSTS in the Wood, Hancock, Sandusky and Ottawa County
- Evaluate performance of all package sewage treatment plants
- Issue NPDES permits to package plants that do not already have them
- Evaluate the need and feasibility of placing phosphorus limits on package plants

6.10 Planning, Siting and Developing Roads and Highways (Local Only)

The best time to address control of NPS pollution from roads and highways is during the initial planning and design phase. New roads and highways should be located with consideration of natural drainage patterns and planned to avoid encroachment on surface waters and wet areas. Where this is not possible, appropriate controls will be needed to minimize the impacts of NPS runoff on surface waters.

Plan, site, and develop roads and highways to:

1. Protect areas that provide important water quality benefits or are particularly susceptible to erosion or sediment loss;
2. Limit land disturbance such as clearing and grading and cut and fill to reduce erosion and sediment loss; and
3. Limit disturbance of natural drainage features and vegetation.

To address this issue pollution prevention and habitat loss minimization should be performed in the form of proper stormwater regulations and zoning setbacks. State and federal routes are constructed under ODOT's Storm Water Management Plan.

6.11 Bridges (Local Only)

This measure requires that NPS runoff impacts on surface waters from bridge decks be assessed and that appropriate management and treatment be employed to protect critical habitats, wetlands, fisheries, shellfish beds, and domestic water supplies. The siting of bridges should be a coordinated effort among the States, the FHWA, the U.S. Coast Guard, and the Army Corps of Engineers. Locating bridges in coastal areas can cause significant erosion and sedimentation, resulting in the loss of wetlands and riparian areas. Additionally, since bridge pavements are extensions of the connecting highway, runoff waters from bridge decks deliver pollutant loadings. Whenever practical, bridge structures should be located to avoid crossing over sensitive fisheries and shellfish-harvesting areas to prevent washing polluted runoff through scuppers into the waters below.

This management measure is intended to be applied by States to new, relocated, and rehabilitated bridge structures in order to control erosion, streambed scouring, and surface runoff from such activities. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this management measure and will have some flexibility in doing so. The application of management measures by States is described more fully in Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. http://www.epa.gov/owow/nps/MMGI/Chapter4/ch4-7b.html

Bridge projects are subject to several permits through state and federal agencies. The Corps of Engineers administers permits pertaining to waterways and wetlands; Ohio DNR addresses floodplain permitting requirements. Wetland permits through Ohio EPA may also be required. Bridges on County and Township roads that are not funded by ODOT are subject to OEPA construction site stormwater permits where more than one acre of soil is disturbed: http://www.epa.ohio.gov/LinkClick.aspx?fileticket=y8Ff9MECTVQ%3d&tabid=3466.

By contrast, bridge projects funded by ODOT are subject to the requirements of ODOT's Stormwater Management Plan.

6.12 Operation and Maintenance of Roads, Highways and Bridges

This management measure is intended to be applied by States to existing, restored, and rehabilitated roads, highways, and bridges. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this management measures and will have some flexibility in doing so. The application of measures by States is described more fully in Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. Areas under Stormwater Phase II permit requirements are exempt. http://www.epa.gov/owow/nps/MMGI/Chapter4/ch4-7e.html. ODOT has instituted its stormwater management plan to fulfill these requirements (http://www.dot.state.oh.us/stormwater/Pages/default.aspx).

Runoff Systems for Roads, Highways, and Bridges - Develop and implement runoff management systems for existing roads, highways, and bridges to reduce runoff pollutant concentrations and volumes entering surface waters. This measure requires that operation and maintenance systems include the development of retrofit projects, where needed, to collect NPS pollutant loadings from existing, reconstructed, and rehabilitated roads, highways, and bridges. Poorly designed or maintained roads and bridges can generate significant erosion and pollution loads containing heavy metals, hydrocarbons, sediment, and debris that run off into and threaten the quality of surface waters and their tributaries. In areas where such adverse impacts to surface waters can be attributed to adjacent roads or bridges, retrofit management projects to protect these waters may be needed (e.g., installation of structural or nonstructural pollution controls). Retrofit projects can be located in existing rights-of-way, within interchange loops, or on adjacent land areas. Areas with severe erosion and pollution runoff problems may require relocation or reconstruction to mitigate these impacts.

Runoff management systems are a combination of nonstructural and structural practices selected to reduce nonpoint source loadings from roads, highways, and bridges. These systems are expected to include structural improvements to existing runoff control structures for water quality purposes; construction of new runoff control devices, where necessary to protect water quality; and scheduled operation and maintenance activities for these runoff control practices. Typical runoff controls for roads, highways, and bridges include vegetated filter strips, grassed swales, detention basins, constructed wetlands, and infiltration trenches. Establish schedules for implementing appropriate controls.

Maintenance of transportation corridors within the Portage River watershed is performed by the either ODOT, the Ohio Turnpike Commission, the County Engineer, or local township. These agencies, particularly ODOT and the Ohio Turnpike Commission, must follow good housekeeping measures for reducing nonpoint pollution in relation to general maintenance of the roads as part of their NPDES Phase II permit obligations. To expand the best management measures of roadway maintenance to include township roads and County roads, the PRBC partners will assist the local townships and the County Engineer in reviewing current operation standards and methods and provide suggestions for improving good housekeeping practices to reduce water pollution.

In addition to improving good housekeeping practices, the PRBC will review with stakeholders the Emergency spill response plan for the watershed, on request. Portage River has several major transportation corridors transecting the watershed used to transport hazardous materials. When a spill occurs, countermeasures such as a spill control boom will be placed at communities with strategic bridge crossings to contain hazardous materials that could negatively impact the river from the result of an accidental spill.

The Ohio Department of Transportation describes the applicable waterways permits (http://www.dot.state.oh.us/Divisions/Planning/Environment/Ecological_Resources_Permits/WATERWAY_PERMITS/Pages/default.aspx):

> Transportation projects that impact rivers, streams and/or wetlands require a permit or combination of permits. The permits are required in accordance with state and federal laws and regulations. Pertinent laws include: Sections 401 and 404 of the Clean Water Act, Sections 9 and 10 of the Rivers and Harbors Act, and Ohio's Isolated Wetland Law. The regulatory agencies that may require permits include: United States Army Corps of Engineers (USACE), Ohio Environmental Protection Agency (Ohio EPA), and United States Coast Guard (USCG) and may include the following permit types: USACE 404 individual permits, USACE 404 nationwide permits, USACE Section 10 permits, 401 water quality certifications, USCG Section 9 bridge permits, and Ohio EPA isolated wetland permits.

Floodplains are regulated under FEMA requirements (http://www.dot.state.oh.us/Divisions/Planning/Environment/Ecological_Resources_Permits/FLOODPLAINS/Pages/default.aspx):

> … in compliance with the National Flood Insurance Program (NFIP) that is administered by the Federal Emergency Management Agency (FEMA). … the requirement to consider all feasible alternatives to avoid encroachment on the base 100-year floodplain may call for significant modifications to the design of a project. The Ohio Department of Natural Resources (ODNR) Division of Water's Floodplain Management Program's mission is to provide leadership to

local governments, state agencies and interested parties toward cooperative management of Ohio's floodplains to ensure the reduction of flood damage and the recognition of the floodplain's natural benefit.

Objectives

- Review current transportation corridor maintenance operation practices performed by local governments within the watershed
- Develop Emergency Spill Response Plan for the entire watershed
- Identify priority and watershed pollutant reduction opportunities (e.g., improvements to existing urban runoff control structures
- Establish schedules for implementing appropriate controls.

6.13 Runoff Systems for Roads, Highways, and Bridges

Runoff Systems for Roads, Highways, and Bridges - Develop and implement runoff management systems for existing roads, highways, and bridges to reduce runoff pollutant concentrations and volumes entering surface waters.

This measure requires that operation and maintenance systems include the development of retrofit projects, where needed, to collect NPS pollutant loadings from existing, reconstructed, and rehabilitated roads, highways, and bridges. Poorly designed or maintained roads and bridges can generate significant erosion and pollution loads containing heavy metals, hydrocarbons, sediment, and debris that runoff into and threaten the quality of surface waters and their tributaries. In areas where such adverse impacts to surface waters can be attributed to adjacent roads or bridges, retrofit management projects to protect these waters may be needed (e.g., installation of structural or nonstructural pollution controls). Retrofit projects can be located in existing rights-of-way, within interchange loops, or on adjacent land areas. Areas with severe erosion and pollution runoff problems may require relocation or reconstruction to mitigate these impacts.

Runoff management systems are a combination of nonstructural and structural practices selected to reduce nonpoint source loadings from roads, highways, and bridges. These systems are expected to include structural improvements to existing runoff control structures for water quality purposes; construction of new runoff control devices, where necessary to protect water quality; and scheduled operation and maintenance activities for these runoff control practices. Typical runoff controls for roads, highways, and bridges include vegetated filter strips, grassed swales, detention basins, constructed wetlands, and infiltration trenches. Establish schedules for implementing appropriate controls.

This management measure is intended to be applied by States to existing, resurfaced, restored, and rehabilitated roads, highways, and bridges that contribute to adverse effects in surface waters. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in

conformity with this management measure and will have some flexibility in doing so. The application of management measures by States is described more fully in Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. Areas under Stormwater Phase II permit requirements are exempt. http://www.epa.gov/owow/nps/MMGI/Chapter4/ch4-7f.html

Although most pollutant loading occurring in the Portage River is a result of agricultural runoff, there are several bridge crossings were concentrated flows have eroded the streambank. Responsible agencies (ODOT, the Turnpike, County Engineers, and townships) implement stormwater improvements to protect the bank and reduce sediment loading to the creek and develop associated costs for implementing various control features as required by MS4 permits.

Objectives

- Identify priority and watershed pollutant reduction opportunities (e.g., improvements to existing urban runoff control structures; and
- Establish schedules for implementing appropriate controls.

6.14 Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters).

The purpose of this management measure is to ensure that the planning process for new hydromodification projects addresses changes to physical and chemical characteristics of surface waters that may occur as a result of the proposed work. Implementation of this management measure is intended to occur concurrently with the implementation of Channelization and Channel Modification (Instream and Riparian Habitat Restoration) measures. For existing projects, the purpose of this management measure is to ensure that the operation and maintenance program uses any opportunities available to improve the physical and chemical characteristics of the surface waters. Changes created by channelization and channel modification activities are problematic if they unexpectedly alter environmental parameters to levels outside normal or desired ranges. The physical and chemical characteristics of surface waters that may be influenced by channelization and channel modification include sediment, turbidity, salinity, temperature, nutrients, dissolved oxygen, oxygen demand, and contaminants.

This management measure is intended to be applied by States to public and private channelization and channel modification activities in order to prevent the degradation of physical and chemical characteristics of surface waters from such activities. This management measure applies to any proposed channelization or channel modification projects, including levees, to evaluate potential changes in surface water characteristics,

as well as to existing modified channels that can be targeted for opportunities to improve the surface water characteristics necessary to support desired fish and wildlife. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with management measures and will have some flexibility in doing so. The application of this management measure by States is described more fully in Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. http://www.epa.gov/owow/nps/MMGI/Chapter6/ch6-2a.html#Description.

Objectives

- Evaluate, with numerical models for some situations, the types of NPS pollution related to instream changes and watershed development.
- Address some types of NPS problems stemming from instream changes or watershed development with a combination of nonstructural and structural practices.

6.15 Channelization and Channel Modification (In-stream and Riparian Habitat Restoration)

The purpose of this management measure is to correct or prevent detrimental changes to in-stream and riparian habitat from the impacts of channelization and channel modification projects. Implementation of this management measure is intended to occur concurrently with the implementation of Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters) measures.

Contact between floodwaters and overbank soil and vegetation can be increased by a combination of setback levees and use of compound-channel designs. Levees set back away from the streambank (setback levees) can be constructed to allow for overbank flooding, which provides surface water contact to important streamside areas (including wetlands and riparian areas). Additionally, setback levees still function to protect adjacent property from flood damage. Compound-channel designs consist of an incised, narrow channel to carry surface water during low (base)-flow periods, a staged overbank area into which the flow can expand during design flow events, and an extended overbank area, sometimes with meanders, for high-flow events. Planting of the extended overbank with suitable vegetation completes the design.

Preservation of ecosystem benefits can be achieved by site-specific design to obtain predefined optimum or existing ranges of physical environmental conditions. Mathematical models can be used to assist in site-specific design. In-stream and riparian habitat alterations caused by secondary effects can be evaluated by the use of models and other decision aids in the design process of a channelization and channel modification activity. After using models to evaluate secondary effects, restoration programs can be established.

This management measure pertains to surface waters where channelization and channel modification have altered or have the potential to alter instream and riparian habitat such that historically present fish or wildlife are adversely affected. This management measure is intended to apply to any proposed channelization or channel modification project to determine changes in instream and riparian habitat and to existing modified channels to evaluate possible improvements to instream and riparian habitat. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with management measures and will have some flexibility in doing so. The application of this management measure by States is described more fully in Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce

Objectives

- Evaluate, with numerical models for some situations, the types of NPS pollution related to instream changes and watershed development.
- Restoration of riparian corridors, floodplains, and oxbows

6.16 Dams – Protection of Surface Water Quality and Riparian Habitat

The purpose of this management measure is to protect the quality of surface waters and aquatic habitat in reservoirs and in the downstream portions of rivers and streams that are influenced by the quality of water contained in the releases (tail waters) from reservoir impoundments. Impacts from the operation of dams to surface water quality and aquatic and riparian habitat should be assessed and the potential for improvement evaluated. Additionally, new upstream and downstream impacts to surface water quality and aquatic and riparian habitat caused by the implementation of practices should also be considered in the assessment. The overall program approach is to evaluate a set of practices that can be applied individually or in combination to protect and improve surface water quality and aquatic habitat in reservoirs, as well as in areas downstream of dams. Then, the program should implement the most cost-effective operations to protect surface water quality and aquatic and riparian habitat and to improve the water quality and aquatic and riparian habitat where economically feasible.

This management measure is intended to be applied by states to dam operations that result in the loss of desirable surface water quality, and of desirable instream and riparian habitat. Dams are defined as constructed impoundments which are either:

- 25 feet or more in height and greater than 15 acre-feet in capacity, or

- 6 feet or more in height and greater than 50 acre-feet in capacity.
  -

This measure does not apply to projects that fall under NPDES jurisdiction. This measure also does not apply to the extent that its implementation under state law is precluded under California v. Federal energy regulatory commission, 110 s. Ct. 2024 (1990) (addressing the supersedence of state instream flow requirements by federal flow requirements set forth in FERC licenses for hydroelectric power plants under the federal power act) http://www.epa.gov/owow/nps/mmgi/chapter6/ch6-3c.html.

6.17 Eroding Streambanks and Shorelines.

Several streambank and shoreline stabilization techniques will be effective in controlling coastal erosion wherever it is a source of nonpoint pollution. Techniques involving marsh creation and vegetative bank stabilization ("soil bioengineering") will usually be effective at sites with limited exposure to strong currents or wind-generated waves. In other cases, the use of engineering approaches, including beach nourishment or coastal structures, may need to be considered. In addition to controlling those sources of sediment input to surface waters which are causing NPS pollution, these techniques can halt the destruction of wetlands and riparian areas located along the shorelines of surface waters. Once these features are protected, they can serve as a filter for surface water runoff from upland areas, or as a sink for nutrients, contaminants, or sediment already present as NPS pollution in surface waters.

This management measure is intended to be applied by States to eroding shorelines in coastal bays and to eroding streambanks in coastal rivers and creeks. The measure does not imply that all shoreline and streambank erosion must be controlled. Some amount of natural erosion is necessary to provide the sediment for beaches in estuaries and coastal bays, for point bars and channel deposits in rivers, and for substrate in tidal flats and wetlands. The measure, however, applies to eroding shorelines and streambanks that constitute an NPS problem in surface waters. It is not intended to hamper the efforts of any States or localities to retreat rather than to harden the shoreline. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this measure and will have some flexibility in doing so. The application of management measures by States is described more fully in Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. http://www.epa.gov/owow/nps/MMGI/Chapter6/ch6-4.html.

The Portage River Basin Council and partners will seek financial assistance to stabilize the eroding bank through stream channel and floodplain restoration.

Objectives

- Stabilize streambanks by implementing BMPs listed in the HUC Problem Statements in Chapter 5

Strategies

- riparian restoration
- floodplain and wetland preservation and restoration
- agricultural filter and buffer strips

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
Site plan reviews to include environmental considerations (wetlands, riparian corridors, TMDL)		X	X				X									2013 - ongoing	$40,000		county plan commissions, engineers, township zoning boards
Adoption of Riparian and Wetland Setback Regulations		X	X					X								2013-2020	$36,000		county plan commissions, engineers, emergency management agencies, floodplain administrators
Comprehensive planning for the Portage Watershed using Balanced Growth Principles	X	X	X	X			X	X						X		2015-2025	$500,000		County plan commissions; county, municipal, and township elected officials, TMACOG

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
Land conservation through easements and land acquisition: update land use plans to identify preservation areas		X	X	X										X		2015-2025	$250,000		County Plan Commissions, Park Districts, Black Swamp Conservancy
Identify opportunities and develop cost / benefit report for stormwater retrofits in applicable areas of the watershed			X	X												2013-2020	$75,000		County Engineers, TMACOG Stormwater Coalition
Riparian Buffer Restoration		X		X							X	X		X		2013-2027	$3,215,743	X	County Engineers, SWCDs
Oxbow restoration		X		X							X	X		X		2013-2027	$1,942,347	X	County Engineers, SWCDs
Wetland restoration		X		X							X	X		X		2013-2027	$2,027,863	X	County Engineers, SWCDs

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
Stream restoration		X		X							X	X		X		2013-2027	$2,880,998	X	County Engineers, SWCDs
Overwide / 2 Stage Ditch program		X		X							X	X		X		2013-2027	$855,210	X	County Engineers, SWCDs
Deweyville sanitary survey, 30-10					X	X										2013-2018	$10,208	X	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA
TR 97/TR 120 sanitary survey, 30-10					X	X										2013-2018	$7,656	X	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA
SR 613 E of McComb sanitary survey, 30-20					X	X										2013-2018	$49,126	X	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
Hammansburg sanitary survey, 30-30					X	X										2013-2018	$21,660	X	Wood County Health Department, Northwestern Water and Sewer District, OEPA
South Rudolph sanitary survey, 30-30					X	X										2013-2018	$28,500	X	Wood County Health Department, Northwestern Water and Sewer District, OEPA
Mermill sanitary survey, 30-30					X	X										2013-2018	$11,400	X	Wood County Health Department, Northwestern Water and Sewer District, OEPA
Van Buren State Park 1 mile radius Critical Area sanitary survey, 30-40					X	X										2013-2018	$133,342	X	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
CR 203 E of CR 139 sanitary survey, 30-40					X	X										2013-2018	$5,000	X	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA
TR 19/CR 139 sanitary survey, 30-40					X	X										2013-2018	$5,000	X	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA
Van Buren-Findlay sanitary survey, 30-40					X	X										2013-2018	$151,844	X	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA
Shady Lake Camp sanitary survey, 30-40					X	X										2013-2018	$5,000	X	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
TR 218 E of TR 229 to TR 232 sanitary survey, 30-40					X	X										2013-2018	$5,742	X	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA
CR 109 W of CR 236 sanitary survey, 30-40					X	X										2013-2018	$11,484	X	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA
CR 216 E of Mortimer sanitary survey, 30-40					X	X										2013-2018	$18,502	X	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA
CR 216 & TR 238 sanitary survey, 30-40					X	X										2013-2018	$12,122	X	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
TR 215 §§29-30 sanitary survey, 30-40					X	X										2013-2018	$8,932	X	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA
TR 213 E of CR 18 sanitary survey, 30-40					X	X										2013-2018	$7,656	X	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA
TR 243/TR 215 sanitary survey, 30-40					X	X										2013-2018	$25,520	X	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA
TR 108 sanitary survey, 30-40					X	X										2013-2018	$19,140	X	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
TR 215 & CR236 sanitary survey, 30-40					X	X										2013-2018	$14,036	X	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA
Bairdstown sanitary survey, 40-20					X	X										2014-2017	$145,920	X	Ohio EPA, County Health Department, Northwestern Water and Sewer District, TMACOG
Sanitary survey N Side SR 12 at CR109, 40-30					X	X										2018-23	$6,380	X	Hancock County Health Department, Hancock County Sanitary Engineer, City of Fostoria, OEPA
Sanitary survey SE Corner 261/218, 40-30					X	X										2018-23	$4,466	X	Hancock County Health Department, Hancock County Sanitary Engineer, City of Fostoria,

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
																			OEPA
Sanitary survey Hatton, 40-40					X	X										2018-23	$19,380	X	Wood County Health Department, Northwestern Water and Sewer District, Village of Risingsun, OEPA
Sanitary survey CR 216 E of CR 23, 40-40					X	X										2018-23	$9,570	X	Hancock County Health Department, Hancock County Sanitary Engineer, City of Fostoria, OEPA

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
Sanitary survey SR 613 Washington Township §2, 40-40					X	X										2018-23	$5,742	X	Hancock County Health Department, Hancock County Sanitary Engineer, City of Fostoria, OEPA
Sanitary survey West Independence, Biglick Township §§1-2, 40-40					X	X										2018-23	$8,932	X	Hancock County Health Department, Hancock County Sanitary Engineer, OEPA
Sanitary survey Washington Township §§11-12, 40-40					X	X										2012-18	$37,642	X	Hancock County Health Department, Hancock County Sanitary Engineer, City of Fostoria, OEPA

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
Construct sewers for Kramer / Huffman Critical Sewage Area, 50-20						X										2013	$400,000	X	Northwestern Water and Sewer District, Wood County Health Department
Sanitary survey Portage River Mainstem watershed in Sandusky County, 60-10					X	X										2012-22	$328,718	X	Sandusky County Health Department, Sandusky County Sanitary Engineer, OEPA
Sanitary survey Sugar Creek watershed Critical Area in Sandusky County, 60-20					X	X										2012-22	$526,702	X	Sandusky County Health Department, Sandusky County Sanitary Engineer, OEPA
Lacarne sanitary survey, 70-10/70-40					X	X										2013-2018	$120,840	X	Ottawa County Health Department, Ottawa County Sanitary Engineer, OEPA

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
Waterford Place sanitary sewers, 70-10/70-40						X										2016	$1,100,000	X	Ottawa County Sanitary Engineer, Oak Harbor
SR 19 N of Oak Harbor to Salem-Carroll Road sanitary survey, 70-10/70-40					X	X										2013-2018	$13,680	X	Ottawa County Health Department, Ottawa County Sanitary Engineer, OEPA, Oak Harbor
Behlman sanitary sewers, 70-10/70-40						X										2021	$381,000	X	Ottawa County Sanitary Engineer, Oak Harbor
SR 19 S of Oak Harbor sanitary survey, 70-10/70-40					X	X										2013-2018	$31,920	X	Ottawa County Health Department, Ottawa County Sanitary Engineer, OEPA, Oak Harbor
Rocky Ridge sanitary sewers, 70-10/70-40						X										2020	$0	X	Ottawa County Sanitary Engineer, Rocky Ridge

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
Rodriguez Street sanitary sewers, 70-20/70-30						X										2015	$0	X	Sandusky County Sanitary Engineer, Gibsonburg
Lakeshore Drive area sanitary survey, 70-50						X										2013 - 2020	$0	X	Ottawa County Health Dept, Ottawa County Sanitary Engineer, Port Clinton, Ohio EPA, TMACOG
East Harbor sanitary survey, 70-50						X										2013-2018	$10,260	X	Ottawa County Health Department, Ottawa County Sanitary Engineer, OEPA
Eliminate 9 package plants with public sewer connections, 70-50						X										2013-2017	$0	X	Ohio EPA

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
Develop an education campaign for proper maintenance of HSTS and use of low-flow plumbing fixtures to reduce discharge of pollutants					X	X										2013-2015	$20,000		All four Health Departments, TMACOG
Review transportation corridor maintenance operation practices performed by townships									X							2013-2015			County Engineers, Townships
Investigate to see if there is a need for an Emergency Spill Response Plan for the entire watershed									X	X						2015			County Emergency Management Agencies

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
Identify opportunities and develop cost / benefit analysis report for stormwater retrofits for inter / intrastate transportation infrastructure transecting the watershed for the purpose of reducing run-off related pollution										X						2014-2015	$50,000		ODOT, County Engineers
Collaboration of watershed approach related stormwater trainings and notification to local officials and appropriate agency staff.	X						X	X								Ongoing			County Engineers, SWCDs, TMACOG

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
Expand good housekeeping measures of North Wood County MS4 area to Portage Watershed									X							2013-2020	$50,000		County Engineers, SWCDs, TMACOG
Watershed volunteer monitoring 4100010050010 / 04100010 03 02	X	X	X	X	X	X										2012-2017	$15,000 startup and $10,000 annually	X	Wood SWCD; PRBC; TMACOG; Ohio EPA; GLRI; OEEF; ODNR, YSI for monitor equipment. Local Sponsorship. School districts in watershed.
Woodlot education program	X	X	X	X							X	X		X		2013-2018	$30,000	X	Wood County SWCD; OSU Extension, NRCS, TMACOG; Ohio EPA, Black Swamp Conservancy, ODNR Forestry,

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
																			land owners
Update HUC and stream GIS files / maps		X					X									2012-2020	$0	X	County Engineers and SWCDs of all 5 counties, cities (storm sewer maps), ODNR, USDA, USGS, TMACOG, GIS consultant
Portage River Education Project		X														2012-2015	$100,000 start up and $75,000 annually	X	School districts and teachers, SWCD education staff of all 5 counties, BGSU, TMACOG

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
Educational program on bacteria impacts on Portage		X	X	X	X	X										2012 - 2015	$2,500	X	City of Bowling Green, Wood County Health Department, Portage River Basin Council
Controlled drainage demonstration project		X									X	X		X		2012-2016	$800,000	X	OARDC, OSU Extension, all 5 SWCDs, NRCS
HSTS databases with links to auditors' GIS systems					X	X										2012-2017	$500,000 per county	X	Health Departments, Sanitary Engineers, and Auditors of Hancock, Ottawa, Sandusky, and Wood Counties; TMACOG

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
HSTS Management District feasibility study					X	X										2012-2022	$500,000	X	County Sanitary Engineers, Health Departments, Ohio EPA, TMACOG
Update County HSTS Plans					X	X										2012-2017	$50,000 per county	X	Wood County Health Department, Northwestern Water and Sewer District, TMACOG
Bacteria field studies		X			X	X										2012-2014	$50,000	X	TMACOG, all Portage River Basin Council members
Establish public access for canoes and kayaks	X		X	X										X		2013 - 2020	$750,000	X	Pemberville, Woodville, Elmore, Oak Harbor, Port Clinton, ODNR

Strategies	Coastal Non-Point Pollution Control Program Management Measure															Implementation			
	New Development	Watershed Protection	Site Development	Existing Development	New HSTS	Operating HSTS	Planning, Sitting, Developing Roads and Highways	Bridges	Operation and Maintenance of Roads, Highways, and Bridges	Run-off Systems for Roads, Highways, and Bridges	Channelization and Channel Modification (Physical and Chemical Characteristics of Surface Waters)	Channelization and Channel Modification (In -stream and Riparian Habitat)	Dams - Protection of Water Quality and Riparian Habitat	Eroding Streambanks and Shorelines		Timeline	Cost (estimates)	Reference WAP Chapter 5	Lead Agencies
Establish a water trail between Pemberville and the mouth of the Portage				X										X		2015 - 2020	$150,000	X	Pemberville, Woodville, Elmore, Oak Harbor, Port Clinton, Wood, Ottawa, and Sandusky County Parks, Wood and Ottawa SWCD, TMACOG, ODNR

Chapter Seven

7.1 Evaluation and Revision

The overall goal of this plan is to protect and restore the environmental integrity of the Portage River and its tributaries. Chapter 5 includes a detailed list of projects to accomplish these goals.

7.7.1 Plan Monitoring and Evaluation

The Portage River Basin Council will provide ongoing oversight for implementation and monitoring of these goals. Monitoring should tack several key questions:

- What watershed projects have been undertaken and completed?
- What environmental results have they achieved?
- Are the remaining objectives (projects) still relevant and adequate to meet water quality goals?
- What changes are needed to fulfill the plan's goals?
- Implementation of the watershed plan and its objectives will be coordinated through the Portage River Basin Council. Meetings of the council will include discussion of potential projects and consensus building toward project development.

TMACOG staff will coordinate a semi-annual watershed report, given available resources. It will include a survey of watershed stakeholders and provide a list and status of implementation projects. The watershed report will coordinate with the semi-annual Ohio EPA Integrated Report (IR) (http://www.epa.state.oh.us/dsw/tmdl/2012IntReport/index.aspx). The report will summarize any changes or new information from the current IR.

Updates of the Portage Watershed Plan will also be coordinated with updates of the TMACOG "208" *Areawide Water Quality Management Plan*. The 208 Plan is updated and re-certified once every one to three years, depending on funding and need. The 208 Plan provides much of the data used in preparing the Portage River plan. It identifies capital improvement needs for public sanitary sewerage systems, inventories package sewage treatment plants, and provides HSTS data.

7.1.2 Plan Revision

The Portage River Basin Council will review the overall progress of implementation. The council update goals, objectives, and problem statements as needed. The council will evaluate the need for an update of the full plan after six years, based on the first three semi-annual watershed reports; the council may initiate an update sooner if it decides that there is a need.

The detailed project lists in the HUC problem statements of this document were made possible by the recent completion of a TMDL by Ohio EPA. A plan update should be initiated following the completions of future TMDLs. The TMDL was key to setting phosphorus and bacteria reduction targets necessary to meet water quality standards. Future TMDLs are likely to change these targets, and the watershed plan should be updated accordingly.

Watershed plan updates are also likely to be needed to incorporate changes to recommended best management practices. At this writing in 2011 it has become clear that soluble phosphorus is a significant factor in Lake Erie's harmful algal blooms. It is anticipated that the emphasis in agricultural BMPs will need to shift to soluble, rather than just particulate, phosphorus control (http://www.epa.ohio.gov/dsw/lakeerie/ptaskforce/index.aspx). As BMPs are researched and developed to address soluble phosphorus better, they should be incorporated into this plan.

7.1.3 Public Involvement

Watershed Plan is a working document for the members of the Portage River Basin Council and subcommittees. Active members include the local officials and citizens of Portage basin communities. Because the PRBC is a subcommittee of the Toledo Metropolitan Area Council of Governments (TMACOG) and is supported by regional members of the Council of Governments, the active stakeholder's involvement is on-going and designed to be long-term for environmental information and education.

TMACOG will use several outlets to keep the Portage River Watershed Plan in front of the general public. They include:

- Regular Portage River Basin Council meetings include community representatives as described above.
- Portage River Basin Council and watershed issues are highlighted in TMACOG's *Big Picture* newsletter, which is posted on the TMACOG website and distributed to 3,000 public officials in 15 northwest Ohio and southeast Michigan counties.
- TMACOG will coordinate with the SWCDs of the watershed for inclusion of Portage River information in their newsletters.

- The Portage River Basin Council materials are posted on the TMACOG website http://www.tmacog.org/prbc.htm.
- TMACOG staff attends and gives reports at county meetings (e.g., Townships, Mayors, and SWCDs).
- TMACOG maintains an extensive media contact list throughout the region, and will issue press releases watershed issues.

Formal approval of this plan and any updates starts with the Portage River Basin Council, through which the content is developed and undergoes stakeholder input. The review and approval process for the plan within TMACOG follows this process:

- The Portage River Basin Council develops the plan. When complete, staff prepares a draft resolution; the council recommends its approval to the TMACOG Environmental Council, to which it reports.
- The Portage River Basin Council representative on the TMACOG Environmental Council introduces the resolution and asks for approval. The Environmental Council recommends approval to the TMACOG Board of Trustees, to which it reports.
- The TMACOG Board of Trustees is the main policy body. Its members consist of elected officials and other representatives of TMACOG members. Board of Trustees acts on the resolution recommended by Environmental Council and gives final adoption on behalf of the agency.

APPENDICES

APPENDIX A

ACRONYMS

Acronyms

BMP	Best Management Practices
CAFO	Concentrated Animal Feeding Operations
CFS	Cubic Feet Per Second
CSO	Combined Sewer Overflow
DO	Dissolved Oxygen
EPA	U.S. Environmental Protection Agency
GIS	Geographic Information Systems
HD	Health Department
HELP	Huron Erie Lake Plain
HSTS	Home Sewage Treatment Systems
HUC	Hydrological Unit Code
IBI	Index Biotic Integrity
ICI	Invertebrate Complete Index
LTCR	Long – Term Continuous Record
MIWB	Modified Index of Well Being
NRCS	Natural Resource Conservation Service
ODNR	Ohio Department of Natural Resources
OEEF	Ohio Environmental Education Fund
OEPA	Ohio Environmental Protection Agency
OHIO EPA	Ohio Environmental Protection Agency
OSU	Ohio State University
PRBC	Portage River Basin Council
QCTV	Qualitative Community Tolerance Value
QHEI	Quality Habitat Evaluation Index
RM	River Mile
SWAP	Source Water Assessment Plan
SWCD	Soil & Water Conservation District
TMACOG	Toledo Metropolitan Area Council of Governments
TMDL	Total Daily Maximum Load
UNT	UnNamed Tributary
USGS	United States Geological Survey
WBD	Watershed Boundary Dataset
WQ	Water Quality
WWTP	Waste Water Treatment Plant

APPENDIX B

BY LAWS OF THE TOLEDO METROPOLITAN AREA COUNCIL OF GOVERNMENTS

BYLAWS
OF THE
TOLEDO METROPOLITAN AREA COUNCIL OF GOVERNMENTS

PREAMBLE:

It is hereby affirmed that:

A. The local governments - counties, cities, villages, townships, public school districts, public universities and colleges, and special districts and authorities - which represent and serve the citizens of the Toledo metropolitan region of northwest Ohio and southeast Michigan, and the private sector stakeholders of that region, have common opportunities, issues, and problems that transcend their individual jurisdictions;
B. The destinies of each of the above groups rest with the interrelated and collective voluntary cooperation of the family of local governments, the private sector stakeholders that comprise the region to meet broader, regional concerns that can only be solved through cooperative and coordinated regional approaches.
C. It is vital to retain local home rule and to strengthen the capabilities of each unit of government by combining resources to meet areawide challenges that may be beyond the capacity of individual units of government.

DEFINITIONS

A. Toledo Metropolitan Area Council of Governments (TMACOG) - A voluntary association organized on May 31, 1968 and established under Chapter 167 of the Ohio Revised Code and the Michigan Urban Cooperation Act No. 7 of 1967 (Ex. Sess.). It is comprised of local governments, public school districts, public universities and colleges, special districts and authorities, and private sector stakeholders in northwest Ohio and southeast Michigan.
B. Governmental Members - Counties, cities, townships, villages, public school districts, public universities and colleges, and special districts and authorities that have joined TMACOG.
C. Non-governmental Members - Major institutions, such as private schools, private universities or colleges, businesses, hospitals, chambers of commerce, or other industrial, commerce, or business organizations, and private non-profit corporations that have joined TMACOG.
D. Representatives - Persons who represent members on the General Assembly.
E. Trustees - Persons who represent members on the Board of Trustees.
F. Executive Committee - Core leadership committee for TMACOG consisting of 12-17 members authorized to act on behalf of the Board of Trustees.
G. Alternates - Persons who serve on the Board of Trustees in the trustees' absence.
H. Elected Officials - Persons elected by popular vote or persons appointed to fill vacancies in such offices as defined in Chapter 124 of the Ohio Revised Code.

I. PURPOSE

FUNCTIONS AND METHODS

A. TMACOG fosters regional progress through networks of public and private partnerships.
B. TMACOG serves as a forum for assessing and acting on regional issues and problems through cooperative efforts by formulating policies, plans, and programs, and facilitating actions that are common and regional; that are cost effective and efficient for the region; and that contribute to the effectiveness of local government and the quality of life enjoyed by citizens of the region.
C. TMACOG provides a forum for regional governance; networks for local government officials; information and data; facilitation of partnerships on issues; convening of transportation stakeholders and having a role in the provision of transportation services; facilitation and provision of support for the coordination of land use planning across jurisdictions within the region; design and coordination of improvement of environmental quality within the region; and membership services to assist in making the members more effective and cost efficient. TMACOG is not a government, nor does it seek to become one.

II. POWERS AND DUTIES

A. TMACOG Shall:

1. Study regional issues and problems common to its member governments as it deems appropriate, including, but not limited to, matters affecting health, safety, welfare, education, economic conditions, and regional development;
2. Promote cooperative arrangements and coordinate action between and among its member governments, the private sector stakeholders, other agencies of local or state governments, and the federal government;
3. Make recommendations for review and action to members and to non-member governments and public agencies, the private sector, and other organizations that perform functions within the region;
4. Promote cooperative agreements and contracts among its members and non-member governments, governmental agencies, and the private sector stakeholders within the region;
5. Perform studies, collect data, develop regional plans and programs, and engage in such other activities as the president finds necessary or desirable within the context of the policies, plans, and programs approved by the General Assembly, the Board of Trustees, and the Executive Committee for the solution of regional issues and problems;
6. Carry out its responsibilities as the Regional Planning and Development Organization (RPDO) for Ohio Planning Region 4B, as certified by the Ohio Department of Development;

7. Carry out its responsibilities as the Metropolitan Planning Organization (MPO) pursuant to 23 U.S.C. § 134 and 49 U.S.C. § 1600, et seq.;
8. Carry out its responsibilities as the Areawide Water Quality Planning Agency for the U.S. Environmental Protection Agency pursuant to 33 U.S.C. § 1251, et seq. and other applicable provisions of the United States Code;
9. Perform any and all acts appropriate, necessary, or incidental to the furtherance or accomplishment of the foregoing purposes.

B. <u>TMACOG May:</u>

1. Review, evaluate, comment upon, and make recommendations relative to the planning and programming, and the location, financing, and scheduling of public facility projects within the region and affecting the development of the area;
2. Act as an area wide agency to perform comprehensive planning for the programming, locating, financing, and scheduling of public facility projects within the region and affecting the development of the area and for other proposed land development or uses, which projects or uses have public metropolitan-wide, regional or inter- jurisdictional significance;
3. Act as an agency for coordinating local public policies and activities affecting the development of the region or area based on metropolitan-wide or regional comprehensive planning and programming; and
4. Perform such other functions and duties capable of being performed by the members and necessary or desirable for dealing with problems of mutual concern, upon appropriate action of the General Assembly, the Board of Trustees, or the Executive Committee.

C. The authority granted to TMACOG in Section II (A) and (B) or in any agreement between members thereof shall not displace any existing municipal, county, regional, or other planning commission or planning agency in the exercise of its statutory powers.

<u>III. MEMBERSHIP</u>

A. <u>ELIGIBILITY</u>

1. The following groups are automatically eligible for TMACOG membership:
   a. Ohio counties - Lucas, Wood, Fulton, Sandusky, and Ottawa;
   b. Michigan counties - Monroe;
   c. All cities, townships, villages, public school districts, public universities and colleges, and special districts and authorities located partially or wholly within the counties set forth in (a) and (b) above; and
   d. The Governor of Ohio, or his/her designee, and the Governor of Michigan, or his/her designee.
2. The following groups may apply for TMACOG membership, subject to the approval of the Executive CommitteeGovernmental units beyond the boundaries of the area in 1 (a & b).

a. Special districts and authorities and public school districts, public universities, and colleges, beyond the boundaries of the governmental units in 1 (a & b).
b. Major institutions, such as private schools, private universities or colleges, businesses, hospitals, chambers of commerce, or other industrial, commerce, or business organizations, and private non-profit corporations.

B. CONDITIONS

To become a member an eligible entity shall:

1. Formally enter into an agreement with TMACOG to commit to support and endorse the purpose of TMACOG,
2. Pay the annual membership fee, and
3. Agree to remain a member of TMACOG for at least two years.

C. WITHDRAWAL

A member may withdraw upon sixty (60) days written notice to TMACOG. Members who withdraw prior to completing two (2) years membership will not obtain a refund of their membership fees.

D. MEMBER PARTICIPATION IN TMACOG

1. Each governmental member of TMACOG will designate one representative to sit on the TMACOG General Assembly, unless a representative for a particular member is otherwise designated in these Bylaws.
2. Each governmental member shall have one representative, and that representative may represent only that member.

IV. POLICY BODIES

TMACOG shall have three policy bodies: a General Assembly, a Board of Trustees, and an Executive Committee.

A. THE GENERAL ASSEMBLY

1. Representation

a. Governmental representatives - Each governmental member of TMACOG shall have one voting representative on the General Assembly, who shall be an elected official or an appointed executive directly responsible to local elected officials.
    1) The Mayor of the City of Toledo, or his/her designate shall be the governmental representative for Toledo.
    2) The Presidents of the Boards of County Commissioners shall be the governmental representatives for member counties.
b. Non-governmental representatives - Each year, non-governmental members will caucus to nominate a list of prospective representatives and

alternates. The president shall set the date and time for the caucus and ensure that proper facilities and notices for the caucus are provided. The caucus will nominate an equal number of representatives and alternates for the General Assembly. From these nominations the governmental representatives shall elect non-governmental representatives and alternates, provided that the non-governmental representatives constitute no more than forty (40) percent of the entire General Assembly.

2. Responsibilities

Proposing, initiating, or taking any action to further the purpose of TMACOG. The powers reserved to the General Assembly include:

a. Adopting or amending the TMACOG Bylaws;
b. Adopting the long term goals and objectives for TMACOG;
c. Adopting criteria for TMACOG membership;
d. Electing the TMACOG chair, vice chair, and second vice chair.

3. Officers

a. Election - The chair, vice chair and second vice chair shall be elected officials of member jurisdictions of TMACOG.
b. Officers are trustees - The chair, vice chair, and second vice chair shall automatically be trustees, irrespective of any requirements under Section IV(B), (2), or (3).
c. The chair, vice chair, and second vice chair shall serve in the same capacity for the General Assembly, Board of Trustees and Executive Committee.
d. Term of Office - Terms shall be for one year or until a successor is duly elected, provided the officer remains eligible under article IV, A, 3, a.
e. Vacancies - Upon a vacancy occurring in the office of chair, the vice chair shall assume the position of chair for the balance of the unexpired term. Upon a vacancy occurring in the office of vice chair, the second vice chair shall assume the position of vice chair for the balance of the unexpired term. Upon a vacancy occurring in the office of second vice chair, the Board of Trustees shall elect a new second vice chair to serve the balance of the unexpired term.

4. Meetings

The General Assembly shall meet at least once a year at the call of its chair or at the request of the Board of Trustees.

5. Routine Voting

a. A measure before the General Assembly shall be adopted only if it receives the affirmative vote of a majority of the quorum.
b. At the procedural motion of any General Assembly representative present, any specific matter before the General Assembly shall be

decided by a majority of the votes cast on a weighted basis, distributed according to the Policy and Table of Representation adopted by the Board of Trustees as of 30 June each year.

6. Quorum - A Quorum of the General Assembly shall consist of a simple majority of the total voting representatives.

B. BOARD OF TRUSTEES

1. **Representation** - Representation on the Board of Trustees is granted according to the type of government and type of membership. The number of trustees per member is as follows:
   a. Counties: The President of the Board of County Commissioners shall serve as trustee for each member county. Each member county shall have one trustee, except for Lucas County and Wood County, which shall also be represented by the County Engineers.
   b. Toledo: The Mayor of the City of Toledo shall serve as trustee for the City of Toledo.
   c. Other Cities: There shall be three (3) trustees, selected by all cities excluding Toledo.
   d. Villages: There shall be five (5) trustees selected by all villages.
   e. Townships: There shall be five (5) trustees selected by all townships.
   f. Special Districts and Authorities, Public School Districts, Public Universities and Colleges: There shall be up to six (6) trustees, selected as follows:
      1) The Toledo Area Regional Transit Authority shall have one (1) trustee if it is participating in the urban transportation planning process pursuant to 23 U.S. C. § 134 and 49 U.S. C. § 1600 et seq.,
      2) The Toledo-Lucas County Port Authority shall have one (1) trustee if it is participating in the urban transportation planning process pursuant to 23 U. S.C. § 134 and 4 U.S. C. § 1600 et seq.,
      3) Park and recreation districts and authorities shall have one (1) trustee,
      4) Public School Districts (grades k-12) shall have one (1) trustee, and
      5) Public universities and colleges shall have one (1) trustee, and
      6) All other special districts and authorities shall (together) have one (1) trustee.
   g. Non-governmental Members: There shall be up to thirteen (13) trustees.
   h. Governor of Ohio: The Governor or his/her designee shall be a trustee.
   i. Immediate Past Chair: The immediate past chair of TMACOG shall be a trustee without alternate, provided that this individual otherwise continues to represent a qualified member of TMACOG.

2. **Selection of Trustees -** Unless otherwise stated, all trustees shall be selected from among the representatives seated on the General Assembly.
    a. Governmental members - Each member (other than counties, the City of Toledo and The Governor of Ohio) shall classify itself into the appropriate category set forth in B.1. c-g above. Each category of members will caucus annually to select its trustee(s) for the following year. The president shall set the date and time for the caucus and shall ensure that proper facilities and notices for the caucus are provided in the appropriate manner.
    b. Non-governmental members – Non-governmental members will caucus and recommend up to thirteen (13) proposed trustees from its list of proposed non-governmental representatives, as directed in Article IV(A)(1)(b), subject to the approval of the governmental representatives.

B. **Alternate Trustees** - each member shall be entitled to select alternates as authorized in these by-laws.
    c. Selection of alternates for governmental members - Alternates shall be elected or appointed officials of jurisdictions that are members of TMACOG.
        (1) The Boards of Commissioners of Lucas and Wood Counties shall each select two (2) alternates for each county, one of whom shall be an elected official. The Boards of Commissioners of all other counties shall each select one (1) alternate.
        (2) The Mayor of the City of Toledo shall select two (2) alternates, one of whom shall be an elected official.
    d. Selection of alternates for all other members: For all remaining members, an equal number of alternates as trustees shall be selected from the General Assembly by the same method used to select trustees.
        (1) Alternate members selected by a caucus of General Assembly members, shall be selected as a body, rather than selected and assigned on a one-to-one basis to individual Board of Trustees members.
        (2) Authority of alternates - A duly selected alternate may vote on matters before the Board of Trustees only when the duly selected trustee is not in attendance. In the event that neither the selected trustee nor the alternate can attend the meeting, then no other individual shall have the right to represent them or cast votes in their behalf.

4. **Terms of Office**
    a. Trustees and alternates selected by caucus - Each trustee and alternate selected by caucus shall serve for a term of one-year, to commence on the date of selection.

b. Members and alternates not selected by caucus shall serve until a successor is duly selected.

5. <u>Vacancies on the Board of Trustees</u>

When a vacancy occurs, the vacancies shall be filled from the alternates as follows:

a. For those member governments whose trustees are automatically chosen (i.e., counties, certain authorities, and the City of Toledo), the member shall notify TMACOG of the vacancy, and shall select a successor within (30) thirty days.

b. For those trustees chosen by caucus, the member shall notify TMACOG of the vacancy within thirty (30) days, and the Executive Committee shall be responsible for filling the vacancy from the alternates within that caucus at its next meeting.

6. <u>Ex-Officio Members</u>

a. The state and federal governments may have ex-officio, non-voting trustees on the Board of Trustees. These trustees shall be selected by the chair at the recommendation of the Executive Committee and the agency which they represent.

b. Ex-officio trustees shall not have alternates.

7. <u>Responsibilities: the Board of Trustees shall:</u>

a. Adopt the TMACOG annual budget and membership fee schedules;

b. Propose the five year program of long term goals and objectives to the General Assembly;

c. Adopt the Annual Work Program; and

d. Adopt and thereby recommend to its General Assembly TMACOG policies, plans, and programs, and any amendments thereto.

8. <u>Meetings</u>

The Board of Trustees shall meet at least quarterly, at the call of the chair, at the direction of the General Assembly, or at the request of ten voting members of the Board of Trustees.

9. <u>Voting</u>

a. Unless otherwise so moved, any measure before the Board of Trustees shall be adopted only when it receives an affirmative vote of a majority of the quorum.

b. At the procedural motion of any trustee present, any specific matter before the Board of Trustees shall be decided by a majority of the votes cast on a weighted basis, distributed according to the Policy and Table of Representation adopted by the Board of Trustees as of 30 June each year.

10. Quorum - A quorum of the Board of Trustees shall consist of any of the following:

a. A simple majority of the total number of trustees,
b. Forty percent of the total number of trustees if either the Toledo or Lucas County trustees is present, or
c. One-third of the total number of trustees if both the Toledo and Lucas County trustees are present.

C. EXECUTIVE COMMITTEE

1. Membership - The Executive Committee is the core leadership of TMACOG and provides opportunities for developing regional leadership. The committee shall consist of no fewer than twelve (12) and no more than seventeen (17) members, constituted as follows:

a. The TMACOG chair, vice chair, and second vice chair.
b. The TMACOG chair will appoint the chairs and vice chairs from each of TMACOG's four (4) programmatic councils and five (5) administrative committees as defined in Section X of these Bylaws, upon recommendation of their respective committees. A programmatic council or administrative committee vice chair may attend an Executive Committee meeting, and vote, in the absence of said council or committee chair.
c. All programmatic council and administrative committee chairs and vice chairs will be from TMACOG member jurisdictions or organizations.
d. The TMACOG chair shall appoint a representative of the City of Toledo and Lucas County if not represented under a or b above.
e. The immediate past chair of TMACOG shall be a member of the Executive Committee.
f. The TMACOG chair may appoint other members to promote balanced representation from the region, the types of members, and the activities under way, within TMACOG.
g. At large Executive Committee members shall have no alternate or proxy.

2. Authority - The Executive Committee is authorized to act on behalf of TMACOG in each month when the Board of Trustees and/or the General Assembly does not

meet. The Executive Committee shall be governed by Operating Procedures which are to be approved by the Board of Trustees.

3. <u>Responsibilities</u> -The Executive Committee shall:

a. Propose an annual budget and membership fee schedule to the Board of Trustees;
b. Propose the Annual Work Program to the Board of Trustees;
c. Review and make recommendation to the Board of Trustees on policies, plans and programs and any amendments thereto;
d. Handle all routine matters;
e. Appoint, manage, review, and remove the president;
f. Annually review the TMACOG Personnel Policies and Procedures Manual, including fixing of salary ranges of staff members;
g. Approve, by resolution, contractual arrangements between TMACOG and other private and public agencies, including the federal and state governments, and such a resolution by the Executive Committee will be sufficient to authorize a designated official of TMACOG to execute such agreement or contracts;
h. Serve as financial control body and receive funds for TMACOG;
i. Coordinate the processes by which necessary funding resources are secured and invested;
j. Recruit, approve, orient and maintain membership;
k. Interpret and communicate the TMACOG mission and its activities with the members, committee membership, and the broader community;
l. Provide for the development of and opportunities for leadership within the organization;
m. Develop and monitor the program of long-term goals and objectives of the organization, evaluate the progress being made toward their achievement, and make recommendations to the Board of Trustees and the General Assembly to update and amend the program; and
n. Propose, initiate, or take any other such action as may be appropriate to undertake the purpose of TMACOG and its long-term goals.

4. <u>Meetings</u>

The Executive Committee shall meet at least monthly, except in the months in which the Board of Trustees and/or the General Assembly meets. The chair, vice chair, second vice chair or at least five (5) members of the committee may call emergency meetings of the committee.

5. <u>Voting</u>

a. Unless otherwise so moved as provided in paragraph b hereof, any measure before the Executive Committee shall be adopted when it

receives an affirmative vote of a majority of the quorum.

b. At the procedural motion of any executive committee members present, any matter before the Executive Committee shall be decided by a majority of the votes of the participating governments on a weighted basis, according to the Policy and Table of Representation adopted by the Board of Trustees as of 30 June each year.

6. **Quorum** – A quorum of the Executive Committee shall consist of any of the following:
    a. A simple majority of the total number of Executive Committee members,
    b. Forty percent of the total number of Executive Committee members if either the Toledo or Lucas County committee member is present, or
    c. One-third of the total number of Executive Committee members if both the Toledo and Lucas County committee members are present.

V. PROGRAM ACTIVITIES

A. The General Assembly shall periodically adopt and update a long range program which outlines the goals and objectives of the organization and outlines strategies and a time frame to meet these objectives.
B. The Board of Trustees shall annually adopt a work program designed to meet the goals of the long term program which outlines the objectives to be met, the work to be accomplished, and the products anticipated to be produced during that year.
C. TMACOG may enter into whatever cooperative program activities the membership or specific members shall select in accordance with an intergovernmental agreement.

VI. STAFF

TMACOG shall have a staff as may be necessary to implement the program of TMACOG. TMACOG's personnel policies and procedures will be consistent with all current laws.

A. TMACOG shall have a president who will be appointed by the Executive Committee and may be removed by the Executive Committee. The president shall:
    1. Implement the policies, plans, and programs of TMACOG as adopted by the General Assembly, the Board of Trustees, and the Executive Committee.
    2. Serve as the fiscal officer and is authorized to receive, deposit, invest, and disburse the funds of TMACOG. The president may designate a staff member to perform the responsibilities of the fiscal officer in his absence.
    3. Administer all staff operations, including management and the hiring and discharging of all staff employees subject to TMACOG's Personnel Policies and Procedures Manual, which shall be reviewed annually by the Executive Committee.

VII. FINANCE

A. FISCAL YEAR

The fiscal year of TMACOG shall commence on July 1 and shall terminate on June 30 of the following calendar year.

B. BUDGET ADOPTION AND MEMBERSHIP FEES

The TMACOG budget shall be adopted by the Board of Trustees on or before the first day of the first month of each fiscal year unless otherwise stipulated by the chair of TMACOG. Upon adoption of the annual budget, the Board of Trustees shall fix the membership fees for all members in amounts sufficient to provide the funds required by the budget. Membership fees shall be based upon population and assessed valuation. Membership fees shall be due and payable the first day of the first month of the following calendar year. Any member entering into a membership agreement for the first time during a calendar year may have its membership fees (fixed by the Board of Trustees) prorated for a partial year. The Executive Committee shall establish policies on membership delinquency. The status of a delinquent member shall be referred to the Executive Committee for appropriate action.

C. AUDIT

The Board of Trustees and staff shall cooperate in the performance of an annual audit by the Auditor of the State of Ohio in accordance with applicable provisions of the Ohio Revised Code or, where permitted by law, by an independent certified public accounting firm. Report of such audit shall be made available to members of TMACOG.

VIII. PARLIAMENTARY AUTHORITY

The rules contained in Robert's Rules of Order, Revised shall govern the meetings of TMACOG except where such rules are inconsistent with these bylaws or special rules of order which may be adopted by the policy body or committee in question.

IX. AMENDMENT OF BYLAWS

These Bylaws may be amended at a meeting of the General Assembly, provided that such amendment has been presented at a meeting of the Board of Trustees at least

thirty (30) days prior to the meeting and has been submitted to each member government at least fifteen (15) days prior to the meeting.

X. COUNCILS AND COMMITTEES

A. There shall be four (4) programmatic councils and five (5) administrative committees, whose participants shall be appointed by the chair based upon recommendation of the respective committees. The chair's appointments shall be ratified by the Board of Trustees (or the Executive Committee in those months in which the Board of Trustees does not meet). These nine councils/committees shall be responsible to the Executive Committee. Committee membership must include, but not be restricted to, trustees and representatives, and may also include organizations and persons who are not members, representatives or trustees of TMACOG, pursuant to Section X of these bylaws.

   Each council and committee shall be governed by Operating Procedures which are to be approved by the Board of Trustees. Each committee shall meet regularly or at appointed intervals and undertake studies concerning problems and programs applicable to their individual assignments and areas of concern.

   1. The councils and committees are as follows:
      a. Environmental Council,
      b. Transportation Council,
      c. Growth Strategies Council,
      d. Commuter Services Council,
      e. Finance, Audit, and Administration Committee,
      f. Leadership Development Committee, which shall also act as the nominating committee,
      g. Membership Committee,
      h. Communications Committee,
      i. Long Range Planning and Resource Development Committee.
   2. The chair shall be authorized to appoint such other special purpose committees, ad hoc committees, task forces or subcommittees as are required to further the mission of TMACOG.

Adopted: May 1968
Amended: December 1969
Amended: September 1970
Amended: January 1972
Amended: July 1973
Amended: July 1974
Amended: December 1975
Amended: December 1978
Amended: July 1979
Amended: January 1982

Amended: January 1989
Amended: July 1993
Amended: January 1994
Amended: January 1995
Amended: January 1996
Amended: January 15, 1998
Amended: January 29, 2001
Amended: January 31, 2002
Amended: July 18, 2002
Amended: January 30, 2003
Amended: January 31, 2005
Amended: January 29, 2008

APPENDIX C

PORTAGE RIVER
BASIN COUNCIL
ANNUAL WORK PLAN 2009

PORTAGE RIVER BASIN COUNCIL ANNUAL WORK PLAN 2009

Portage River Basin Council (PRBC)

Goal:
To protect and improve the environmental and water quality of the Portage River Basin by establishing processes and working groups within the Portage River Basin Council to implement the goals set by A Resource Worth Protecting.

Objective:
Provide assistance, coordination, and planning by furnishing administrative support and participating in the Portage River Basin Council subcommittees

Portage River Planning Committee

Goal:
A "Committee of the Whole" to conduct watershed planning for the Portage River Basin; develop projects and identify funding sources to carry out the goals of the Portage River Basin Council.

Objectives:
Develop a Comprehensive Watershed Plan for the Portage Basin for Ohio EPA endorsement from the Portage River Watershed Restoration Action Strategy report
Complete the fifteen (15) Ohio Coastal NPS Management Measures for the Portage watershed as a contract deliverable to the office of Ohio Coastal Management under grant contract number L768 306-11

Portage River Education Committee

Goal:
To make communities aware of the benefits of the Portage River ecosystem and promote stewardship of the river.

Objective:
Conduct programs for teachers and students to educate them on the uses of the river:
Portage River Basin Education Project - Student Congress
Recruit additional schools to participate in student water testing activities
Secure funding for education project

Portage River Stormwater Committee

Goal:
To develop solutions and projects to provide adequate drainage, reduce flooding, benefit the natural habitat and improve and protect water quality in the Portage River Basin.

Objectives:
Work with local jurisdictions and agencies to implement floodplain protection and stormwater control ordinances and regulations recommended by the Portage River Hydrological Study (June, 2002)
Categorize project ideas for soil and erosion control through the Great Lakes basin program.
Work with local jurisdictions to construct structural projects recommended by the study and identify funding sources to leverage grants
Utilize hydrological study data to develop and implement flood reduction projects, including upstream stormwater storage through recommended restoration of oxbow and floodplain connections
Secure funding for projects through the Federal Emergency Management Agency (FEMA), Ohio EPA 319 (EPA§319), Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), Natureworks and additional funding sources

Portage River Public Relations & Outreach Committee

Goal:
To establish programs and events to increase watershed awareness, encourage public involvement and education to protect and improve the Portage River ecosystem, including quality recreation areas, natural habitat areas and wildlife corridors along the Portage waterways.

Objectives:
Design new brochure to promote watershed and increase public awareness
Identify research projects with BGSU environmental students
Implement programs/events to increase public education and watershed awareness of the Portage River by involving local agencies, communities, universities and volunteers
Coordinate PRBC projects with community festivals and local events
Increase public awareness with construction tours on demonstration projects, such as the two-stage ditch projects
Identify new locations for canoe and kayak access points
Investigate scenic river designations for sections of the Portage River
Contact the Chamber of Commerce locations within the watershed
Meet with the historical society groups in the watershed
Continue discussion for a whitewater park in watershed
Work with local agencies for funding and recreation projects

Portage River Wastewater Committee

Goal:
To ensure high quality public wastewater treatment and promote good onsite sewage treatment.

Objectives:
Complete Ohio EPA 319 project grant; "Portage River Watershed Home Sewage Treatment Systems Replacement Program"
Replace or upgrade a total of fifty-four (54) home sewage treatment systems, consisting of fifty-two (52) conventional and two (2) alternative systems
Review and update critical home sewage disposal areas
Provide input to the Ohio Department of Health (ODH) and Ohio EPA for proposed sewage rules
Work with Ohio EPA to encourage National Pollution Discharge Elimination System (NPDES) compliance
Develop a project addressing onsite sewage treatment issues:
Demonstrating new designs that reduce off-site discharges
Educating homeowners, government officials, contractors, and health department staff on the proper installation and maintenance of systems
Document the level and mechanism of input Health Departments have on subdivision design standards and site reviews in each County
Meet with Ohio EPA staff to identify gaps and opportunities for improvement in state programs

APPENDIX D

WATER RESOURCE QUALITY

Water Resource Quality

"Clean water is important to Ohio's economy and standard of living.
Ohio is an economically important and diverse state with strong agriculture, manufacturing, and service industries. Ohio is also a water-rich state bounded by Lake Erie on the north and the Ohio River on the south, with more than 25,000 miles of named and designated streams and rivers within its borders. The suitability of these waters to support society's needs for water supplies and recreation is critical to sustaining Ohio's economy and the standard of living of Ohio citizens. Surface waters – rivers, streams, lakes - provide the majority of water used for public drinking water; for recreation such as swimming, boating, and fishing; and for industrial uses including manufacturing, power generation, irrigation, and mining."

Ohio 2008 Integrated Water Quality Monitoring & Assessment Report
http://www.epa.state.oh.us/dsw/tmdl/OhioIntegratedReport.html
The 2008 Integrated Water Quality Monitoring and Assessment Report
was approved by U.S. EPA on May 5, 2008.

Clean Water Act
Point and Non-point Source

Water Use Designations for Portage River

Aquatic Life Habitat in the Portage River watershed is:

Warmwater Habitat (WWH) – Water bodies capable of supporting and maintaining a balanced, integrated and adaptive community of warmwater aquatic organisms. The typical assemblages of fish and invertebrates are present. This is the baseline regulatory requirements in line with the Clean Water Act "fishable goal" expectations.

Water Supply

Based on language fround in the Clean Water Act, Ohio EPA recognized three categories of water supply terms:

Public – Waters that with convential treatment will be suitable for human intake and meet federal regulations for drinking water.

Agriculture – Waters that are suitable for irrigation and livestock watering without treatment.

Industrial – Waters that are suitable for commercial and industrial uses with our without treatment.

Recreation

Based on language found in the Clean Water Act, Ohio EPA recognized three categories of recreational uses.

Bathing Waters – Waters that during the recreational season are suitable for swimming where a life guard and/or bathhouse facilities are present.

Primary Contact – Waters that during the recreational season are suitable for full-body contact recreation swimming, canoeing and scuba diving.

Secondary Contact – Waters that during the recreational season are suitable for partial body contact recreation such as but not limited to wading.

3745-1-07 Water use designations and statewide criteria.
(A) Water quality standards contain two distinct elements: designated uses; and numerical or narrative criteria designed to protect and measure attainment of the uses.
(1) Each water body in the state is assigned one or more aquatic life habitat use designations. Each water body may be assigned one or more water supply use designations and/or one recreational use designation. These use designations are defined in paragraph (B) of this rule. Water bodies are assigned use designations in rules 3745-1-08 to 3745-1-32 of the Administrative Code. In addition, water bodies are assigned designations as described in paragraphs (B)(1)(a), (B)(1)(c), (B)(3)(a), (B)(4)(a) and (B)(4)(b) of this rule and in the anti degradation rule (rule 3745-1-05 of the Administrative Code). (2) Statewide chemical-specific criteria for the support of use designations are presented in this rule. Additional chemical-specific criteria applicable within the lake Erie drainage basin are contained in rules 3745-1-31 and 3745-1-33 of the Administrative Code. Additional chemical-specific criteria applicable within the Ohio river drainage basin are contained in rules 3745-1-32 and 3745-1-34 of the Administrative Code. Additional chemical-specific criteria may be derived as described in rules 3745-1-36, 3745-1-37, 3745-1-38 and 3745-1-39 of the Administrative Code. The most stringent chemical-specific criteria associated with any one of the use designations assigned to a water body will apply to that water body. (3) The chemical-specific criteria listed in this rule

APPENDIX E

NPDES - PORTAGE RIVER

NPDES - In the PORTAGE RIVER		
Yacht Port Beach Condominium Homeowners Association	127 W. Perry Street, Port Clinton, Ohio, Ottawa County and discharging to Lake Erie in accordance	Application No. OH0126489 Issue Date: February 28, 2007 Effective Date: April 1, 2007 Expiration Date: March 31, 2012
Bird's Nest Resort	1371 Langram Road, South Bass Island, Put-in-Bay Township, Ottawa County and discharging to Lake Erie	Application No. OH0135861 Issue Date: March 2, 2005 Effective Date: April 1, 2005 Expiration Date: March 31, 2010
Brush Wellman, Inc.	14710 West Portage River South Road, Elmore, Ohio, Ottawa County and discharging to the Portage River and Hyde Run	Application No. OH0002518 Issue Date: June 10, 2008 Effective Date: July 1, 2008 Expiration Date: January 31, 2013
Chet's Place Campground	7154 West Harbor Road, Salem Township, Ohio, Ottawa County and discharging to the Portage River	Application No. OH0138517 Issue Date: September 22, 2006 Effective Date: November 1, 2006 Expiration Date: October 31, 2011
Ottawa County Commissioners Danbury Township WWTP	5783 Von Glahn Road, Ohio, Ottawa County and discharging to Sandusky Bay in accordance	Application No. OH0053660 Issue Date: June 27, 2008 Effective Date: August 1, 2008 Expiration Date: January 31, 2013
FirstEnergy Nuclear Operating Company	Davis-Besse Nuclear Power Station located at 5501 North State Route 2, Oak Harbor, Ohio, Ottawa County	Application No. OH0003786 Issue Date: August 14, 2006

NPDES - In the PORTAGE RIVER		
	and discharging to Lake Erie, Navarre Marsh and the Toussaint River	Effective Date: September 1, 2006 Expiration Date: April 30, 2011
Village of Elmore	discharge from wastewater treatment works located 715 Rice Street, Elmore, Ohio, Ottawa County and discharging to the Portage River	Application No. OH0021261 Issue Date: June 10, 2008 Effective Date: July 1, 2008 Expiration Date: June 30, 2013
Erie Islands Resort & Marina	wastewater treatment works located at 4495 West Darr-Hoppfinger Road, Port Clinton, Ohio, Ottawa County and discharging to Portage River	Application No. OH0102229 Issue Date: October 31, 2006 Effective Date: December 1, 2006 Expiration Date: November 30, 2011
Green Valley Mobile Home Park	wastewater treatment works located at 1795 Elliston-Trowbridge Road, Harris Township, Ohio, Ottawa County and discharging to an unnamed tributary to Portage River	Application No. OH0135429 Issue Date: June 15, 2004 Effective Date: July 1, 2004 Expiration Date: June 30, 2009
Johnny's Resort & Recreational Camp	wastewater treatment works located at 3901 West Johnny's Place, Port Clinton, Ohio, Ottawa County, and discharging to the Portage River	Application No. OH0126926 Issue Date: July 12, 2006 Effective Date: August 1, 2006 Expiration Date: July 31, 2011
Lafarge North America - Marblehead Quarry	wastewater treatment works located at 831 South Quarry Road, Marblehead, Ohio, Ottawa County and discharging to Lake Erie	Application No. OH0001406 Issue Date: May 1, 2006 Effective Date: June 1, 2006 Expiration Date: May 31, 2011

NPDES - In the PORTAGE RIVER		
Village of Marblehead Water Treatment Plant	Water Treatment Plant wastewater treatment works located at 106 Water Street, Marblehead, Ohio, Ottawa County and discharging to Lake Erie	Application No. OH0053368 Issue Date: July 29, 2005 Effective Date: September 1, 2005 Expiration Date: August 31, 2010
Miller Boat Line, Inc.	wastewater treatment works located at Langram Road, Put-in-Bay Township, Ohio, Ottawa County and discharging to Lake Erie	Application No. OH0126977 Issue Date: October 22, 2004 Effective Date: December 1, 2004 Expiration Date: November 30, 2009
Village of Oak Harbor	wastewater treatment works located at 355 East Harbor, Oak Harbor, Ohio, Ottawa County and discharging to the Portage River	Application No. OH0026841 Issue Date: June 8, 2007 Effective Date: July 1, 2007 Expiration Date: June 30, 2012
Ottawa County Regional Water Treatment Plant	Water Treatment Plant wastewater treatment works located at County Road 52 and Limestahl Road, Port Clinton, Ohio, Ottawa County and discharging to Portage River	Application No. OH0122157 Issue Date: June 8, 2005 Effective Date: July 1, 2005 Expiration Date: June 30, 2010
Port Clinton Landfill	wastewater treatment works located at 530 North Camp Road, Port Clinton, Ohio, Ottawa County and discharging to Lacarpe Creek and the Portage River	Application No. OH0102326 Issue Date: June 1, 2005 Effective Date: July 1, 2005 Expiration Date: June 30, 2010
City of Port Clinton	Wastewater Treatment Plant wastewater treatment works located at 100	Application No. OH0052876 Issue Date:

NPDES - In the PORTAGE RIVER		
	North Jackson Street, Port Clinton, Ohio, Ottawa County and discharging to Portage River	February 12, 2007 Effective Date: March 1, 2007 Expiration Date: July 31, 2010
Board of Commissioners Ottawa County	wastewater treatment works located at 1209 NW Catawba Road, Port Clinton, Ohio, Ottawa County and discharging to Lake Erie	Application No. OH0095435 Issue Date: December 23, 2005 Effective Date: February 1, 2006 Expiration Date: January 31, 2011
Portage Pointe Condominiums - Oak Harbor Gold Club	wastewater treatment works located at 10433 County Road 17, Oak Harbor, Ohio, Ottawa County, and discharging to the Portage River	Application No. OH0125661 Issue Date: July 3, 2006 Effective Date: August 1, 2006 Expiration Date: July 31, 2011
United States Gypsum Company	wastewater treatment works located at Lake Street, Gypsum, Ohio, Ottawa County and discharging to Sandusky Bay	Application No. OH0031046 Issue Date: May 30, 2008 Effective Date: July 1, 2003 Expiration Date: June 30, 2008
Yacht Port Beach Condominium Homeowners Association	wastewater treatment works located at 127 W. Perry Street, Port Clinton, Ohio, Ottawa County and discharging to Lake Erie	Application No. OH0126489 Issue Date: February 28, 2007 Effective Date: April 1, 2007 Expiration Date: March 31, 2012
SANDUSKY COUNTY		
Area Rock, LLC	wastewater treatment works located at 873 East Main Street, Woodville, Ohio, Sandusky County and discharging to	Application No. OH0135488 Issue Date: August 6, 2004 Effective Date:

NPDES - In the PORTAGE RIVER		
	Sugar Creek	September 1, 2004 Expiration Date: August 31, 2009
Atlas Industries, Inc.	wastewater treatment works located at 1520 County Road 42, Gibsonburg, Ohio, Sandusky County and discharging to Tributary to Sugar Creek	Application No. OH0052418 Issue Date: April 6, 2005 Effective Date: May 1, 2005 Expiration Date: April 30, 2010
Carmeuse Lime Inc. Woodville Plant	wastewater treatment works located at 659 Anderson Road., Woodville, Ohio, Sandusky County and discharging to Portage River	Application No. OH0002500 Issue Date: June 24, 2003 Effective Date: August 1, 2003 Expiration Date: July 31, 2008
Village of Gibsonburg	wastewater treatment works located at Cedar Street, Gibsonburg, Ohio, Sandusky County and discharging to Hurlbut Ditch and State Route 300 Ditch,	Application No. OH0029122 Issue Date: June 13, 2007 Effective Date: July 1, 2007 Expiration Date: June 30, 2012
Village of Woodville	wastewater treatment works located at 437 Port Clinton Road, Woodville, Ohio, Sandusky County and discharging to the Portage River	Application No. OH0020591 Issue Date: June 27, 2008 Effective Date: August 1, 2008 Expiration Date: July 31, 2013
SENECA COUNTY		
City of Fostoria	WWTP wastewater treatment works located at 1301 Perrysburg Road, Fostoria, Ohio, Seneca County and discharging to East Branch of Portage River	Application No. OH0052744 Issue Date: June 21, 2004 Effective Date: August 1, 2004 Expiration Date: July 31, 2009
WOOD COUNTY		

NPDES - In the PORTAGE RIVER		
Air Products and Chemicals, Inc	wastewater treatment works located at 2384 Grant Road, North Baltimore, Ohio, Wood County and discharging to an unnamed tributary to Rocky Ford Creek	Application No. OH0038491 Issue Date: April 30, 2008 Effective Date: June 1, 2008 Expiration Date: May 31, 2013
Village of Bloomdale	wastewater treatment works located at 404 South Main, Bloomdale, Ohio, Wood County and discharging to Stove Ditch	Application No. OH0095176 Issue Date: April 27, 2006 Effective Date: June 1, 2006 Expiration Date: May 31, 2011
Village of Bloomdale	Water Treatment Plant wastewater treatment works located at 210 Main St, Bloomdale, Ohio, Wood County and discharging to an unnamed tributary to Stove Ditch	Application No. OH0138444 Issue Date: October 19, 2006 Effective Date: December 1, 2006 Expiration Date: November 30, 2011
City of Bowling Green	Bowling Green WPCF wastewater treatment works located at 901 N Dunbridge Rd, Bowling Green, Ohio, Wood County and discharging to Poe Ditch	Application No. OH0024139 Modification Issue Date: January 7, 2008 Modification Effective Date: March 1, 2008 Expiration Date: December 31, 2010
BP Products Company NA	Cygnet Tank Farm wastewater treatment works located at 12716 Tank Farm Rd, Cygnet, Ohio, Wood County and discharging to Rocky Ford Creek	Application No. OH0078247 Issue Date: April 9, 2009 Effective Date: May 1, 2009 Expiration Date: April 30, 2014
Village of Bradner	WWTP wastewater treatment	Application No.

NPDES - In the PORTAGE RIVER		
	works located at Cherry Street, between Maple Street and East Park Lane, Bradner, Ohio, Wood County and discharging to Unnamed Tributary to Portage River	OH0047554 Issue Date: October 5, 2005 Effective Date: November 1, 2005 Expiration Date: October 31, 2010
Village of Cygnet	wastewater treatment works located at North end of Washington St., Cygnet, Ohio, Wood County and discharging to Rocky Ford Creek	Application No. OH0029327 Issue Date: April 10, 2008 Effective Date: May 1, 2008 Expiration Date: April 30, 2013
Eastwood Local Board of Education	Eastwood Local Board of Education wastewater treatment works located at 4800 Sugar Ridge Road, Pemberville, Ohio, Wood County and discharging to unnamed tributary to Martin Ditch	Application No. OH0126551 Issue Date: May 5, 2006 Effective Date: June 1, 2006 Expiration Date: May 31, 2011
Elmwood Local School District	Elmwood School Wastewater Treatment Plant located at 7650 Jerry City Road, Bloomdale, Ohio, Wood County and discharging to a tributary to Eckert Ditch	Application No. OH0130621 Issue Date: April 4, 2008 Effective Date: May 1, 2008 Expiration Date: April 30, 2013
MacRitchie Materials, Inc.	discharge from the wastewater treatment works located at 6126 South Main, West Millgrove, Ohio, Wood County and discharging to an unnamed ditch tributary to the East Branch of the Portage River	Application No. OH0125547 Issue Date: February 26, 2004 Effective Date: April 1, 2004 Expiration Date: March 31, 2009
Hanson Aggregates Midwest Inc	discharge from the Hanson Aggregates North Baltimore wastewater treatment works located at West Cherry Street, North Baltimore, Ohio, Wood County	Application No. OH0003492 Issue Date: June 30, 2006 Effective Date: August 1, 2006

NPDES - In the PORTAGE RIVER		
	and discharging to an unnamed tributary to the Middle Branch Portage River	Expiration Date: July 31, 2011
Hartung Brothers, Inc	discharge from the Hartung Brothers Tank Farm wastewater treatment works located at S Dunbridge N of Gypsy Lane, Bowling Green, Ohio, Wood County and discharging to the Gypsy Lane Road drainage ditch and then to the Portage River	Application No. OH0138576 Issue Date: May 1, 2007 Effective Date: June 1, 2007 Expiration Date: May 31, 2012
Village of Hoytville	discharge from the Village of Hoytville wastewater treatment works located at Hoytville Road, Hoytville, Ohio, Wood County and discharging to Needles Creek	Application No. OH0095257 Issue Date: July 29, 2005 Effective Date: September 1, 2005 Expiration Date: August 31, 2010
Maurer Mobile Home Court, Inc.	discharge from the wastewater treatment works located at 18330 Brim Rd, Plain Township, Ohio, Wood County and discharging to Grassy Creek Diversion Channel via SR 25 drainage tile	Application No. OH0078450 Issue Date: April 25, 2007 Effective Date: June 1, 2007 Expiration Date: May 31, 2012
Sunoco Pipeline L.P.	discharge from the Mid Valley Pipeline Cygnet Facility wastewater treatment works located at 5152 Rockridge Road, Cygnet, Ohio, Wood County and discharging to tributary to Rocky Ford Creek	Application No. OH0078841 Issue Date: June 30, 2008 Effective Date: August 1, 2008 Expiration Date: July 31, 2013
Mid-Wood, Inc	discharge from the Mid-Wood, Inc wastewater treatment works located at 12818 East Gypsy Lane Rd, Bowling Green, Ohio, Wood County and discharging to an unnamed tributary to the Middle Branch Portage River	Application No. OH0125334 Issue Date: June 9, 2008 Effective Date: July 1, 2008 Expiration Date: June 30, 2013

NPDES - In the PORTAGE RIVER		
Village of North Baltimore	discharge from the North Baltimore Water Treatment Plant wastewater treatment works located at 226 High Street, North Baltimore, Ohio, Wood County and discharging to Rocky Ford Creek	Application No. OH0041637 Issue Date: August 3, 2005 Effective Date: September 1, 2005 Expiration Date: August 31, 2010
Village of North Baltimore	discharge from the North Baltimore wastewater treatment works located at 806 E. Broadway, North Baltimore, Ohio, Wood County and discharging to Rocky Ford Creek	Application No. OH0020117 Issue Date: October 15, 2008 Effective Date: November 1, 2008 Expiration Date: October 31, 2013
Village of Pemberville	discharge from the Village of Pemberville wastewater treatment works located at 591 East Front Street, Pemberville, Ohio, Wood County and discharging to the main stem of the Portage River	Application No. OH0026972 Issue Date: April 24, 2003 Effective Date: June 1, 2003 Expiration Date: May 31, 2008
Precision Aggregates	discharge from the Precision Aggregates wastewater treatment works located at 12583 Greensburg Pike, Portage, Ohio, Wood County and discharging to the North and Middle Branches of the Portage River	Application No. OH0125385 Issue Date: May 4, 2007 Effective Date: June 1, 2007 Expiration Date: May 31, 2012
Reed Air Products Group	discharge from the Reed Air Products Group wastewater treatment works located at 120 Plin Street, Bradner, Ohio, Wood County and discharging to the Portage River via a storm sewer	Application No. OH0078468 Issue Date: February 13, 2008 Effective Date: March 1, 2008 Expiration Date: February 28, 2013
Northwestern Water and Sewer District	discharge from the Risingsun wastewater treatment works located in Risingsun, Ohio, Wood County and discharging to Sugar	Application No. OH0138649 Issue Date: December 13, 2006

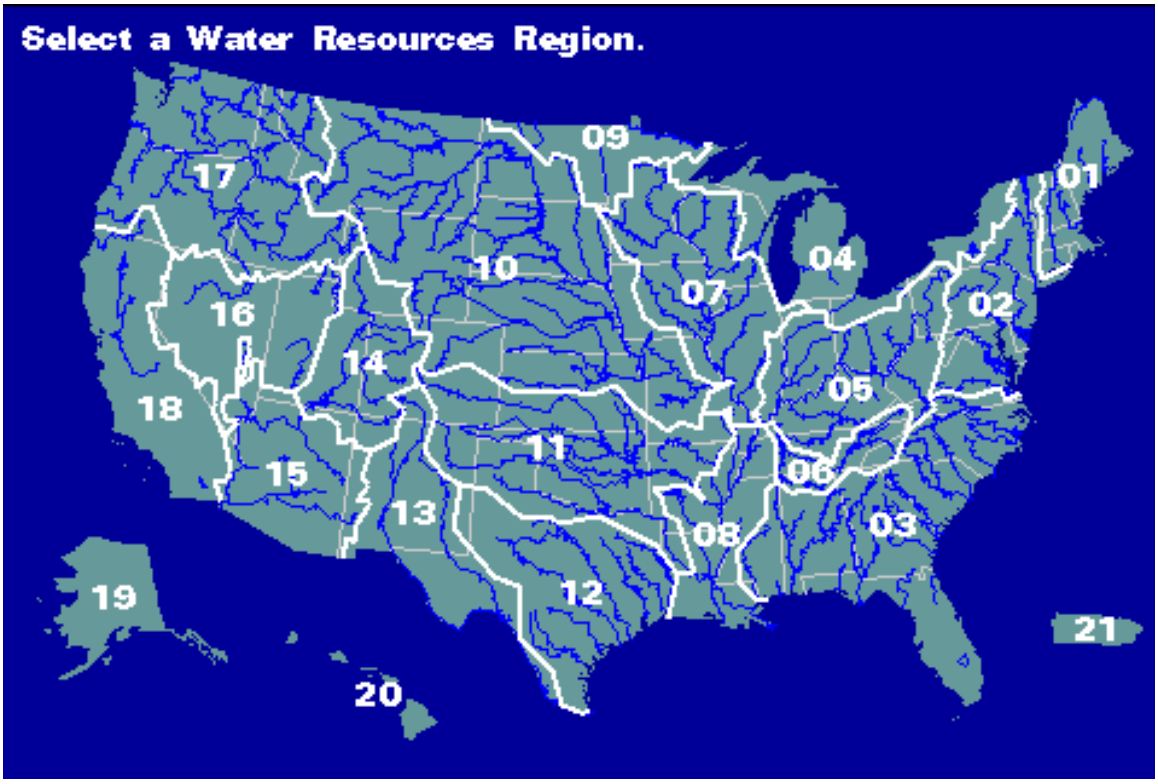
NPDES - In the PORTAGE RIVER		
	Creek	Effective Date: January 2, 2007 Expiration Date: December 31, 2011
Stoneco, Inc	discharge from the Stoneco, Portage Quarry wastewater treatment works located at 11580 South Dixie Highway, Portage, Ohio, Wood County and discharging to a railroad ditch tributary to the North Branch Portage Riverr	Application No. OH0003549 Issue Date: July 10, 2008 Effective Date: August 1, 2008 Expiration Date: July 31, 2013
Village of Wayne	discharge from the Wayne WTP wastewater treatment works located at 205 S Center, Wayne, Ohio, Wood County and discharging to the Portage River via South Wayne Ditch	Application No. OH0102296 Issue Date: July 9, 2008 Effective Date: August 1, 2008 Expiration Date: July 31, 2013
Village of Wayne	discharge from the Wayne wastewater treatment works located at South Wayne Road, Wayne, Ohio, Wood County and discharging to South Wayne Ditch which is tributary to S Branch Portage River	Application No. OH0058190 Issue Date: June 16, 2008 Effective Date: August 1, 2008 Expiration Date: July 31, 2013
Wood County Board of Commissioners	discharge from the Wood County Landfill wastewater treatment works located at 15320 Tontogany Rd, Bowling Green, Ohio, Wood County and discharging to Norris Euler Ditch	Application No. OH0102466 Issue Date: June 20, 2008 Effective Date: August 1, 2008 Expiration Date: July 31, 2013
HANCOCK COUNTY		
BP Oil Pipeline Company	discharge from the BP Oil Pipeline Company - Fostoria Tank Farm wastewater treatment works located at 22782 State Route 12, Fostoria, Ohio, Hancock County and discharging to East	Application No. OH0002526 Issue Date: March 1, 2006 Effective Date: April 1, 2006 Expiration Date:

NPDES - In the PORTAGE RIVER		
	Branch of Portage River	March 31, 2011
Hancock County Landfill (Hancock County Board of Commissioners)	discharge from the Hancock County Landfill wastewater treatment works located at Section 23 - Allen Township Road 107, Allen Township, Ohio, Hancock County and discharging to an unnamed tributary of Rocky Ford Creek	Application No. OH0116602 Issue Date: May 9, 2006 Effective Date: June 1, 2006 Expiration Date: May 31, 2011
Village of McComb	discharge from the Village of McComb wastewater treatment works located at 600 Scott Street McComb, Ohio, Hancock County and discharging to Algire Creek	Application No. OH0026263 Issue Date: June 21, 2007 Effective Date: August 1, 2007 Expiration Date: July 31, 2012
Village of McComb	discharge from the Village of McComb Water Treatment Plant wastewater treatment works located at Park Drive South, McComb, Ohio, Hancock County and discharging to Rader Creek	Application No. OH0042081 Modification Issue Date: January 1, 2006 Modification Effective Date: March 1, 2006 Expiration Date: October 31, 2010
Pilot Travel Centers LLC #360	discharge from the Pilot Travel Centers LLC #360 wastewater treatment works located at 11471 State Route 613 West, Van Buren, Ohio, Hancock County and discharging to a tributary of Rocky Ford Creek	Application No.: OH0119521 Issue Date: June 17, 2008 Effective Date: August 1, 2008 Expiration Date: July 31, 2013

APPENDIX F

WATER RESOURCE REGIONS

The first level of classification divides the Nation into 21 major geographic area, or regions.



Source: U.S. Department of Interior, United States Geological Survey

Region 01 New England
Region 02 Mid-Atlantic
Region 03 South Atlantic-Gulf
Region 04 Great Lakes
Region 05 Ohio
Region 06 Tennessee
Region 07 Upper Mississippi
Region 08 Lower Mississippi
Region 09 Souris-Red-Rainy
Region 10 Missouri
Region 11 Arkansas-White-Red
Region 12 Texas-Gulf
Region 13 Rio Grande
Region 14 Upper Colorado
Region 15 Lower Colorado
Region 16 Great Basin
Region 17 Pacific Northwest
Region 18 California
Region 19 Alaska (Old numbering system)
Region 20 Hawaii
Region 21 Caribbean

APPENDIX G

ODNR ENDANGERED SPECIES

WILDLIFE THAT ARE CONSIDERED TO BE ENDANGERED, THREATENED, SPECIES OF CONCERN, SPECIAL INTEREST, EXTIRPATED, OR EXTINCT IN OHIO

January 2009

The Division of Wildlife's mission is to conserve and improve the fish and wildlife resources and their habitats, and promote their use and appreciation by the public so that these resources continue to enhance the quality of life for all Ohioans. The Division has legal authority over Ohio's fish and wildlife, which includes about 56 species of mammals, 200 species of breeding birds, 84 species and subspecies of amphibians and reptiles, 170 species of fish, 100 species of mollusks, and 20 species of crustaceans. In addition, there are thousands of species of insects and other invertebrates which fall under the Division's jurisdiction. Furthermore, Ohio law grants authority to the chief of the Division to adopt rules restricting the taking or possession of native wildlife threatened with statewide extirpation and to develop and periodically update a list of endangered species (Ohio Revised Code 1531.25).

The status of native wildlife species is very important to the Division. While the listing process identifies individual wildlife species needing protection, it also serves as a powerful tool in the Division's planning process. It provides direction for the allocation of personnel time and funds in Division programs and projects.

The first list of Ohio's endangered wildlife was adopted in 1974 and included 71 species. An extensive examination of the list is conducted every five years. The Division seeks input from our staff along with other noted professional and amateur wildlife experts across Ohio. In 2001, as part of our comprehensive management plan, the Division initiated a reevaluation of the endangered species list. During this process, the need for an additional state-list category was recognized and has been designated as "Special Interest." The name of the previous special interest category has been changed to "Species of Concern," but retains its original definition.

Therefore in addition to endangered, the Division uses five other categories: threatened, species of concern, special interest, extirpated, and extinct, to further define the status of selected wildlife. These categories and the species contained within them are dynamic and will be revised as our knowledge of the status of Ohio's wildlife evolves.

Definitions of these categories, a summary of the numbers of species and subspecies in each category, and the list of species and subspecies in each category follow:

ENDANGERED - A native species or subspecies threatened with extirpation from the state. The danger may result from one or more causes, such as habitat loss, pollution, predation, interspecific competition, or disease.

THREATENED - A species or subspecies whose survival in Ohio is not in immediate jeopardy, but to which a threat exists. Continued or increased stress will result in its becoming endangered.

SPECIES OF CONCERN - A species or subspecies which might become threatened in Ohio under continued or increased stress. Also, a species or subspecies for which there is some concern but for which information is insufficient to permit an adequate status evaluation. This category may contain species designated as a furbearer or game species but whose statewide population is dependent on the quality and/or quantity of habitat and is not adversely impacted by regulated harvest.

SPECIAL INTEREST - A species that occurs periodically and is capable of breeding in Ohio. It is at the edge of a larger, contiguous range with viable population(s) within the core of its range. These species have no federal endangered or threatened status, are at low breeding densities in the state, and have not been recently released to enhance Ohio's wildlife diversity. With the exception of efforts to conserve occupied areas, minimal management efforts will be directed for these species because it is unlikely to result in significant increases in their populations within the state.

EXTIRPATED - A species or subspecies that occurred in Ohio at the time of European settlement and that has since disappeared from the state.

EXTINCT - A species or subspecies that occurred in Ohio at the time of European settlement and that has since disappeared from its entire range.

APPENDIX H

OHIO INVASIVE PLANT SPECIES

OHIO'S INVASIVE PLANT SPECIES

The majority of invasive plant species in Ohio's natural areas are non-native. Of the more than 700 non-native plant species in Ohio, approximately 60 species threaten natural areas. The following three categories separate the species by their invasiveness in Ohio.

TARGETED SPECIES: These species have a state-wide distribution, are the most invasive in Ohio's natural areas, and are the most difficult to control. These species were chosen as the focus for the Division's Ohio EPA Environmental Education grant in 1999-2000.

WELL-ESTABLISHED INVASIVES: The distribution and invasiveness of these species are state-wide or regional within Ohio. These species pose moderate to serious threats to natural areas in Ohio.

WATCH LIST: These species are very invasive in natural areas in neighboring states and are a potential threat in Ohio. The current distribution of these species may be limited, but should be monitored.

TARGETED SPECIES

Common Name	Scientific Name
Autumn-olive	*Elaeagnus umbellata*
Buckthorn, glossy	*Rhamnus frangula*
Buckthorn, European or common	*Rhamnus cathartica*
Common reed grass *	*Phragmites australis*
Garlic mustard	*Alliaria petiolata*
Honeysuckle, amur	*Lonicera maackii*
Honeysuckle, Japanese	*Lonicera japonica*
Honeysuckle, Morrow	*Lonicera morrowii*
Honeysuckle, Tatarian	*Lonicera tatarica*
Japanese knotweed	*Polygonum cuspidatum*
Multiflora rose	*Rosa multiflora*
Purple loosestrife	*Lythrum salicaria*
Reed canary grass *	*Phalaris arundinacea*

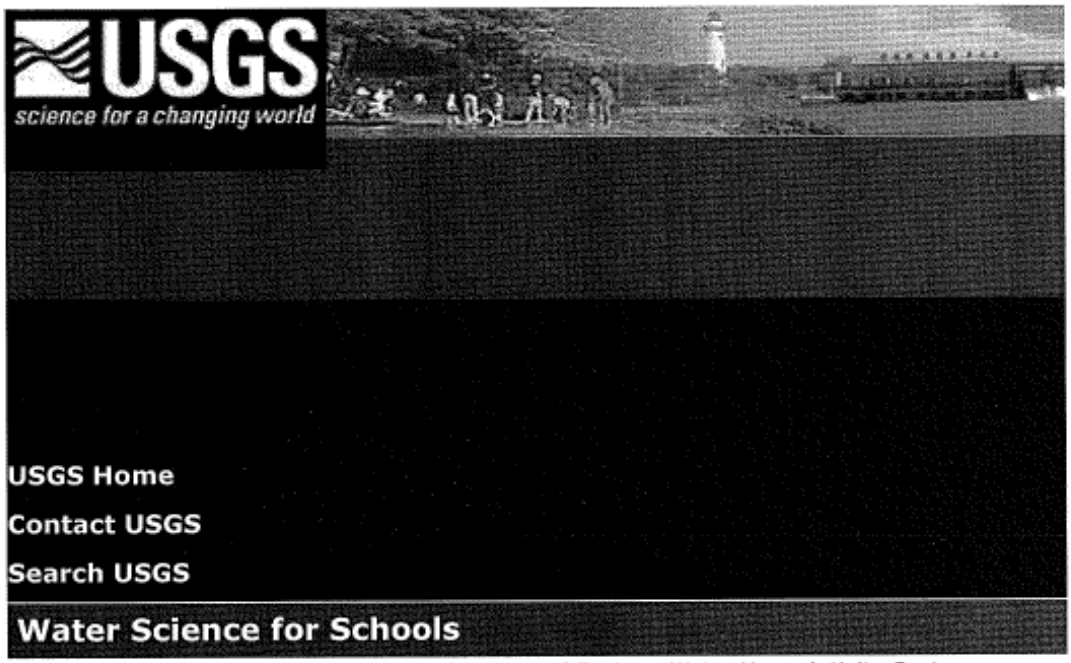
*these species may have native and non-native strains

WELL-ESTABLISHED INVASIVES

Common Name	Scientific Name
Air-potato	*Dioscorea batatas*
Asian bittersweet	*Celastrus orbiculatus*
Bouncing bet	*Saponaria officinalis*
Canada thistle	*Cirsium arvense*
Cattail, hybrid	*Typha Xglauca*
Cattail, narrow-leaved	*Typha angustifolia*
Celandine, lesser	*Ranunculus ficaria*
Crown-vetch	*Coronilla varia*
Curly pondweed	*Potamogeton crispus*
Dame's rocket	*Hesperis matronalis*
Day-lily	*Hemerocallis fulva*
European cranberry-bush	*Viburnum opulus* var. *opulus*

APPENDIX I

USGS WATER SCIENCE GLOSSARY OF TERMS



Water Science Glossary of Terms

Here's a list of water-related terms that might help you understand our site better. It is compiled from a number of sources and should not be considered an "official" U.S. Geological Survey water glossary. A detailed water glossary is kept by the Water Quality Association, and an **extremely detailed** water dictionary is offered by the Nevada Division of Water Resources).

A | B | C | D | E | F | G | H | I | K | L | M | N | O | P | R | S | T | U | V | W | X | Y

Top

A

acequia--acequias are gravity-driven waterways, similar in concept to a flume. Most are simple ditches with dirt banks, but they can be lined with concrete. They were important forms of irrigation in the development of agriculture in the American Southwest. The proliferation of cotton, pecans and green chile as major agricultural staples owe their progress to the acequia system.

acid--a substance that has a pH of less than 7, which is neutral. Specifically, an acid has more free hydrogen ions (H^+) than hydroxyl ions (OH^-).

acre-foot (acre-ft)--the volume of water required to cover 1 acre of land (43,560 square feet) to a depth of 1 foot. Equal to 325,851 gallons or 1,233 cubic meters.

alkaline--sometimes water or soils contain an amount of alkali (strongly basic) substances sufficient to raise the pH value above 7.0 and be harmful to the growth of crops.

alkalinity--the capacity of water for neutralizing an acid solution.

alluvium--deposits of clay, silt, sand, gravel, or other particulate material that has been deposited by a stream or other body of running water in a streambed, on a flood plain, on a delta, or at the base of a mountain.

appropriation doctrine--the system for allocating water to private individuals used in most Western states. The doctrine of Prior Appropriation was in common use throughout the arid west as early settlers and miners began to develop the land. The prior appropriation doctrine is based on the concept of "First in Time, First in Right." The first person to take a quantity of water and put it to Beneficial Use has a higher priority of right than a subsequent user. Under drought conditions, higher priority users are satisfied before junior users receive water. Appropriative rights can be lost through nonuse; they can also be sold or transferred apart from the land. Contrasts with Riparian Water Rights.

aquaculture--farming of plants and animals that live in water, such as fish, shellfish, and algae.

aqueduct--a pipe, conduit, or channel designed to transport water from a remote source, usually by gravity.

aquifer--a geologic formation(s) that is water bearing. A geological formation or structure that stores and/or transmits water, such as to wells and springs. Use of the term is usually restricted to those water-bearing formations capable of yielding water in sufficient quantity to constitute a usable supply for people's uses.

aquifer (confined)--soil or rock below the land surface that is saturated with water. There are layers of impermeable material both above and below it and it is under pressure so that when the aquifer is penetrated by a well, the water will rise above the top of the aquifer.

aquifer (unconfined)--an aquifer whose upper water surface (water table) is at atmospheric pressure, and thus is able to rise and fall.

artesian water--ground water that is under pressure when tapped by a well and is able to rise above the level at which it is first encountered. It may or may not flow out at ground level. The pressure in such an aquifer commonly is called artesian pressure, and the formation containing artesian water is an artesian aquifer or confined aquifer. See *flowing well*

artificial recharge--an process where water is put back into ground-water storage from surface-water supplies such as irrigation, or induced infiltration from streams or wells.

Top

B

base flow--sustained flow of a stream in the absence of direct runoff. It includes natural and human-induced streamflows. Natural base flow is sustained largely by ground-water discharges.

base--a substance that has a pH of more than 7, which is neutral. A base has less free hydrogen ions (H^+) than hydroxyl ions (OH^-).

bedrock--the solid rock beneath the soil and superficial rock. A general term for solid rock that lies beneath soil, loose sediments, or other unconsolidated material.

Top

C

capillary action--the means by which liquid moves through the porous spaces in a solid, such as soil, plant roots, and the capillary blood vessels in our bodies due to the forces of adhesion, cohesion, and surface tension. Capillary action is essential in carrying substances and nutrients from one place to another in plants and animals.

commercial water use--water used for motels, hotels, restaurants, office buildings, other commercial facilities, and institutions. Water for commercial uses comes both from public-supplied sources, such as a county water department, and self-supplied sources, such as local wells.

condensation--the process of water vapor in the air turning into liquid water. Water drops on the outside of a cold glass of water are condensed water. Condensation is the opposite process of evaporation.

consumptive use--that part of water withdrawn that is evaporated, transpired by plants, incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the immediate water environment. Also referred to as water consumed.

conveyance loss--water that is lost in transit from a pipe, canal, or ditch by leakage or evaporation. Generally, the water is not available for further use; however, leakage from an irrigation ditch, for example, may percolate to a ground-water source and be available for further use.

cubic feet per second (cfs)--a rate of the flow, in streams and rivers, for example. It is equal to a volume of water one foot high and one foot wide flowing a distance of one foot in one second. One "cfs" is equal to 7.48 gallons of water flowing each second. As an example, if your car's gas tank is 2 feet by 1 foot by 1 foot (2 cubic feet), then gas flowing at a rate of 1 cubic foot/second would fill the tank in two seconds.

Top

D

desalination--the removal of salts from saline water to provide freshwater. This method is becoming a more popular way of providing freshwater to populations.

discharge--the volume of water that passes a given location within a given period of time. Usually expressed in cubic feet per second.

domestic water use--water used for household purposes, such as drinking, food preparation, bathing, washing clothes, dishes, and dogs, flushing toilets, and watering lawns and gardens. About 85% of domestic water is delivered to homes by a public-supply facility, such as a county water department. About 15% of the Nation's population supply their own water, mainly from wells.

drainage basin--land area where precipitation runs off into streams, rivers, lakes, and reservoirs. It is a land feature that can be identified by tracing a line along the highest elevations between two areas on a map, often a ridge. Large drainage basins, like the area that drains into the Mississippi River contain thousands of smaller drainage basins. Also called a "watershed."

drip irrigation--a common irrigation method where pipes or tubes filled with water slowly drip onto crops. Drip irrigation is a low-pressure method of irrigation and less water is lost to evaporation than high-pressure spray irrigation.

drawdown--a lowering of the ground-water surface caused by pumping.

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E

effluent--water that flows from a sewage treatment plant after it has been treated.

erosion--the process in which a material is worn away by a stream of liquid (water) or air, often due to the presence of abrasive particles in the stream.

estuary--a place where fresh and salt water mix, such as a bay, salt marsh, or where a river enters an ocean.

evaporation--the process of liquid water becoming water vapor, including vaporization from water surfaces, land surfaces, and snow fields, but not from leaf surfaces. See transpiration

evapotranspiration--the sum of evaporation and transpiration.

Top

F

flood--An overflow of water onto lands that are used or usable by man and not normally covered by water. Floods have two essential characteristics: The inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river, stream, lake, or ocean.

flood, 100-year--A 100-year flood does not refer to a flood that occurs once every 100 years, but to a flood level with a 1 percent chance of being equaled or exceeded in any given year.

flood plain--a strip of relatively flat and normally dry land alongside a stream, river, or lake that is covered by water during a flood.

flood stage--The elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

flowing well/spring--a well or spring that taps ground water under pressure so that water rises without pumping. If the water rises above the surface, it is known as a flowing well.

freshwater, freshwater--water that contains less than 1,000 milligrams per liter (mg/L) of dissolved solids; generally, more than 500 mg/L of dissolved solids is undesirable for drinking and many industrial uses.

Top

G

gage height--the height of the water surface above the gage datum (zero point). Gage height is often used interchangeably with the more general term, stage, although gage height is more appropriate when used with a gage reading.

gaging station--a site on a stream, lake, reservoir or other body of water where observations and hydrologic data are obtained. The U.S. Geological Survey measures stream discharge at gaging stations.

geyser--a geothermal feature of the Earth where there is an opening in the surface that contains superheated water that periodically erupts in a shower of water and steam.

giardiasis--a disease that results from an infection by the protozoan parasite Giardia Intestinalis, caused by drinking water that is either not

filtered or not chlorinated. The disorder is more prevalent in children than in adults and is characterized by abdominal discomfort, nausea, and alternating constipation and diarrhea.

glacier--a huge mass of ice, formed on land by the compaction and recrystallization of snow, that moves very slowly downslope or outward due to its own weight.

greywater--wastewater from clothes washing machines, showers, bathtubs, hand washing, lavatories and sinks.

ground water--(1) water that flows or seeps downward and saturates soil or rock, supplying springs and wells. The upper surface of the saturate zone is called the water table. (2) Water stored underground in rock crevices and in the pores of geologic materials that make up the Earth's crust.

ground water, confined--ground water under pressure significantly greater than atmospheric, with its upper limit the bottom of a bed with hydraulic conductivity distinctly lower than that of the material in which the confined water occurs.

ground-water recharge--inflow of water to a ground-water reservoir from the surface. Infiltration of precipitation and its movement to the water table is one form of natural recharge. Also, the volume of water added by this process.

ground water, unconfined--water in an aquifer that has a water table that is exposed to the atmosphere.

Top

H

hardness--a water-quality indication of the concentration of alkaline salts in water, mainly calcium and magnesium. If the water you use is "hard" then more soap, detergent or shampoo is necessary to raise a lather.

headwater(s)--(1) the source and upper reaches of a stream; also the upper reaches of a reservoir. (2) the water upstream from a structure or point on a stream. (3) the small streams that come together to form a river. Also may be thought of as any and all parts of a river basin except the mainstream river and main tributaries.

hydroelectric power water use--the use of water in the generation of electricity at plants where the turbine generators are driven by falling water.

hydrologic cycle--the cyclic transfer of water vapor from the Earth's surface via evapotranspiration into the atmosphere, from the atmosphere via precipitation back to earth, and through runoff into streams, rivers, and lakes, and ultimately into the oceans.

Top

I

impermeable layer--a layer of solid material, such as rock or clay, which does not allow water to pass through.

industrial water use--water used for industrial purposes in such industries as steel, chemical, paper, and petroleum refining. Nationally, water for industrial uses comes mainly (80%) from self-supplied sources, such as a local wells or withdrawal points in a river, but some water comes from public-supplied sources, such as the county/city water department.

infiltration--flow of water from the land surface into the subsurface.

injection well--refers to a well constructed for the purpose of injecting treated wastewater directly into the ground. Wastewater is generally forced (pumped) into the well for dispersal or storage into a designated aquifer. Injection wells are generally drilled into aquifers that don't deliver drinking water, unused aquifers, or below freshwater levels.

irrigation--the controlled application of water for agricultural purposes through manmade systems to supply water requirements not satisfied by rainfall. Here's a quick look at some types of irrigation systems.

irrigation water use--water application on lands to assist in the growing of crops and pastures or to maintain vegetative growth in recreational lands, such as parks and golf courses.

Top

K

kilogram--one thousand grams.

kilowatthour (KWH)--a power demand of 1,000 watts for one hour. Power company utility rates are typically expressed in cents per kilowatt-hour.

Top

L

leaching--the process by which soluble materials in the soil, such as salts, nutrients, pesticide chemicals or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

lentic waters--ponds or lakes (standing water).

levee--a natural or manmade earthen barrier along the edge of a stream, lake, or river. Land alongside rivers can be protected from flooding by levees.

livestock water use--water used for livestock watering, feed lots, dairy operations, fish farming, and other on-farm needs.

lotic waters--flowing waters, as in streams and rivers.

Top

M

maximum contaminant level (MCL)--the designation given by the U. S. Environmental Protection Agency (EPA) to water-quality standards promulgated under the Safe Drinking Water Act. The MCL is the greatest amount of a contaminant that can be present in drinking water without causing a risk to human health.

milligram (mg)--One-thousandth of a gram.

milligrams per liter (mg/l)--a unit of the concentration of a constituent in water or wastewater. It represents 0.001 gram of a constituent in 1 liter of water. It is approximately equal to one part per million (PPM).

million gallons per day (Mgd)--a rate of flow of water equal to 133,680.56 cubic feet per day, or 1.5472 cubic feet per second, or 3.0689 acre-feet per day. A flow of one million gallons per day for one year equals 1,120 acre-feet (365 million gallons).

mining water use--water use during quarrying rocks and extracting minerals from the land.

municipal water system--a water system that has at least five service connections or which regularly serves 25 individuals for 60 days; also called a public water system

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Top

N

nephelometric turbidity unit (NTU)--unit of measure for the turbidity of water. Essentially, a measure of the cloudiness of water as measured by a nephelometer. Turbidity is based on the amount of light that is reflected off particles in the water.

NGVD--National Geodetic Vertical Datum. (1) As corrected in 1929, a vertical control measure used as a reference for establishing varying elevations. (2) Elevation datum plane previously used by the Federal Emergency Management Agency (FEMA) for the determination of flood elevations. FEMA current uses the North American Vertical Datum Plane.

NGVD of 1929--National Geodetic Vertical Datum of 1929. A geodetic datum derived from a general adjustment of the first order level nets of the United States and Canada. It was formerly called "Sea Level Datum of 1929" or "mean sea level" in the USGS series of reports. Although the datum was derived from the average sea level over a period of many years at 26 tide stations along the Atlantic, Gulf of Mexico, and Pacific Coasts, it does not necessarily represent local mean sea level at any particular place.

non-point source (NPS) pollution--pollution discharged over a wide land area, not from one specific location. These are forms of diffuse pollution caused by sediment, nutrients, organic and toxic substances originating from land-use activities, which are carried to lakes and streams by surface runoff. Non-point source pollution is contamination that occurs when rainwater, snowmelt, or irrigation washes off plowed fields, city streets, or suburban backyards. As this runoff moves across the land surface, it picks up soil particles and pollutants, such as nutrients and pesticides.

Top

O

organic matter--plant and animal residues, or substances made by living organisms. All are based upon carbon compounds.

osmosis--the movement of water molecules through a thin membrane. The osmosis process occurs in our bodies and is also one method of desalinating saline water.

outfall--the place where a sewer, drain, or stream discharges; the outlet or structure through which reclaimed water or treated effluent is finally discharged to a receiving water body.

oxygen demand--the need for molecular oxygen to meet the needs of biological and chemical processes in water. Even though very little oxygen will dissolve in water, it is extremely important in biological and

chemical processes.

Top

P

pH--a measure of the relative acidity or alkalinity of water. Water with a pH of 7 is neutral; lower pH levels indicate increasing acidity, while pH levels higher than 7 indicate increasingly basic solutions.
View a diagram about pH.

particle size--the diameter, in millimeters, of suspended sediment or bed material. Particle-size classifications are:
[1] Clay—0.00024-0.004 millimeters (mm);
[2] Silt—0.004-0.062 mm;
[3] Sand—0.062-2.0 mm; and
[4] Gravel—2.0-64.0 mm.

parts per billion--the number of "parts" by weight of a substance per billion parts of water. Used to measure extremely small concentrations.

parts per million--the number of "parts" by weight of a substance per million parts of water. This unit is commonly used to represent pollutant concentrations.

pathogen--a disease-producing agent; usually applied to a living organism. Generally, any viruses, bacteria, or fungi that cause disease.

peak flow--the maximum instantaneous discharge of a stream or river at a given location. It usually occurs at or near the time of maximum stage.

per capita use--the average amount of water used per person during a standard time period, generally per day.

percolation--(1) The movement of water through the openings in rock or soil. (2) the entrance of a portion of the streamflow into the channel materials to contribute to ground water replenishment.

permeability--the ability of a material to allow the passage of a liquid, such as water through rocks. Permeable materials, such as gravel and sand, allow water to move quickly through them, whereas unpermeable material, such as clay, don't allow water to flow freely.

point-source pollution--water pollution coming from a single point, such as a sewage-outflow pipe.

polychlorinated biphenyls (PCBs)--a group of synthetic, toxic

industrial chemical compounds once used in making paint and electrical transformers, which are chemically inert and not biodegradable. PCBs were frequently found in industrial wastes, and subsequently found their way into surface and ground waters. As a result of their persistence, they tend to accumulate in the environment. In terms of streams and rivers, PCBs are drawn to sediment, to which they attach and can remain virtually indefinitely. Although virtually banned in 1979 with the passage of the Toxic Substances Control Act, they continue to appear in the flesh of fish and other animals.

porosity--a measure of the water-bearing capacity of subsurface rock. With respect to water movement, it is not just the total magnitude of porosity that is important, but the size of the voids and the extent to which they are interconnected, as the pores in a formation may be open, or interconnected, or closed and isolated. For example, clay may have a very high porosity with respect to potential water content, but it constitutes a poor medium as an aquifer because the pores are usually so small.

potable water--water of a quality suitable for drinking.

precipitation--rain, snow, hail, sleet, dew, and frost.

primary wastewater treatment--the first stage of the wastewater-treatment process where mechanical methods, such as filters and scrapers, are used to remove pollutants. Solid material in sewage also settles out in this process.

prior appropriation doctrine--the system for allocating water to private individuals used in most Western states. The doctrine of Prior Appropriation was in common use throughout the arid West as early settlers and miners began to develop the land. The prior appropriation doctrine is based on the concept of "First in Time, First in Right." The first person to take a quantity of water and put it to beneficial use has a higher priority of right than a subsequent user. The rights can be lost through nonuse; they can also be sold or transferred apart from the land. Contrasts with riparian water rights.

public supply--water withdrawn by public governments and agencies, such as a county water department, and by private companies that is then delivered to users. Public suppliers provide water for domestic, commercial, thermoelectric power, industrial, and public water users. Most people's household water is delivered by a public water supplier. The systems have at least 15 service connections (such as households, businesses, or schools) or regularly serve at least 25 individuals daily for

at least 60 days out of the year.

public water use--water supplied from a public-water supply and used for such purposes as firefighting, street washing, and municipal parks and swimming pools.

Top

R

rating curve--A drawn curve showing the relation between gage height and discharge of a stream at a given gaging station.

recharge--water added to an aquifer. For instance, rainfall that seeps into the ground.

reclaimed wastewater--treated wastewater that can be used for beneficial purposes, such as irrigating certain plants.

recycled water--water that is used more than one time before it passes back into the natural hydrologic system.

reservoir--a pond, lake, or basin, either natural or artificial, for the storage, regulation, and control of water.

return flow--(1) That part of a diverted flow that is not consumptively used and returned to its original source or another body of water. (2) (Irrigation) Drainage water from irrigated farmlands that re-enters the water system to be used further downstream.

return flow (irrigation)--irrigation water that is applied to an area and which is not consumed in evaporation or transpiration and returns to a surface stream or aquifer.

reverse osmosis--(1) (Desalination) The process of removing salts from water using a membrane. With reverse osmosis, the product water passes through a fine membrane that the salts are unable to pass through, while the salt waste (brine) is removed and disposed. This process differs from electrodialysis, where the salts are extracted from the feedwater by using a membrane with an electrical current to separate the ions. The positive ions go through one membrane, while the negative ions flow through a different membrane, leaving the end product of freshwater. (2) (Water Quality) An advanced method of water or wastewater treatment that relies on a semi-permeable membrane to separate waters from pollutants. An external force is used to reverse the normal osmotic process resulting in the solvent moving from a solution of higher concentration to one of lower concentration.

riparian water rights--the rights of an owner whose land abuts water. They differ from state to state and often depend on whether the water is a river, lake, or ocean. The doctrine of riparian rights is an old one, having its origins in English common law. Specifically, persons who own land adjacent to a stream have the right to make reasonable use of the stream. Riparian users of a stream share the streamflow among themselves, and the concept of priority of use (Prior Appropriation Doctrine) is not applicable. Riparian rights cannot be sold or transferred for use on nonriparian land.

river--A natural stream of water of considerable volume, larger than a brook or creek.

runoff--(1) That part of the precipitation, snow melt, or irrigation water that appears in uncontrolled surface streams, rivers, drains or sewers. Runoff may be classified according to speed of appearance after rainfall or melting snow as direct runoff or base runoff, and according to source as surface runoff, storm interflow, or ground-water runoff. (2) The total discharge described in (1), above, during a specified period of time. (3) Also defined as the depth to which a drainage area would be covered if all of the runoff for a given period of time were uniformly distributed over it.

Top

S

saline water--water that contains significant amounts of dissolved solids.

Here are our parameters for saline water:
Fresh water - Less than 1,000 parts per million (ppm)
Slightly saline water - From 1,000 ppm to 3,000 ppm
Moderately saline water - From 3,000 ppm to 10,000 ppm
Highly saline water - From 10,000 ppm to 35,000 ppm

secondary wastewater treatment--treatment (following primary wastewater treatment) involving the biological process of reducing suspended, colloidal, and dissolved organic matter in effluent from primary treatment systems and which generally removes 80 to 95 percent of the Biochemical Oxygen Demand (BOD) and suspended matter. Secondary wastewater treatment may be accomplished by biological or chemical-physical methods. Activated sludge and trickling filters are two of the most common means of secondary treatment. It is accomplished by bringing together waste, bacteria, and oxygen in trickling filters or in the activated sludge process. This treatment removes floating and settleable solids and about 90 percent of the oxygen-demanding substances and suspended solids. Disinfection is the final stage of secondary treatment.

sediment--usually applied to material in suspension in water or recently deposited from suspension. In the plural the word is applied to all kinds of deposits from the waters of streams, lakes, or seas.

sedimentary rock--rock formed of sediment, and specifically: (1) sandstone and shale, formed of fragments of other rock transported from their sources and deposited in water; and (2) rocks formed by or from secretions of organisms, such as most limestone. Many sedimentary rocks show distinct layering, which is the result of different types of sediment being deposited in succession.

sedimentation tanks--wastewater tanks in which floating wastes are skimmed off and settled solids are removed for disposal.

self-supplied water--water withdrawn from a surface- or ground-water source by a user rather than being obtained from a public supply. An example would be homeowners getting their water from their own well.

seepage--(1) The slow movement of water through small cracks, pores, Interstices, etc., of a material into or out of a body of surface or subsurface water. (2) The loss of water by infiltration into the soil from a canal, ditches, laterals, watercourse, reservoir, storage facilities, or other body of water, or from a field.

septic tank--a tank used to detain domestic wastes to allow the settling of solids prior to distribution to a leach field for soil absorption. Septic tanks are used when a sewer line is not available to carry them to a treatment plant. A settling tank in which settled sludge is in immediate contact with sewage flowing through the tank, and wherein solids are decomposed by anaerobic bacterial action.

settling pond (water quality)--an open lagoon into which wastewater contaminated with solid pollutants is placed and allowed to stand. The solid pollutants suspended in the water sink to the bottom of the lagoon and the liquid is allowed to overflow out of the enclosure.

sewage treatment plant--a facility designed to receive the wastewater from domestic sources and to remove materials that damage water quality and threaten public health and safety when discharged into receiving streams or bodies of water. The substances removed are classified into four basic areas:
[1] greases and fats;
[2] solids from human waste and other sources;
[3] dissolved pollutants from human waste and decomposition products; and

[4] dangerous microorganisms.
Most facilities employ a combination of mechanical removal steps and bacterial decomposition to achieve the desired results. Chlorine is often added to discharges from the plants to reduce the danger of spreading disease by the release of pathogenic bacteria.

sewer--a system of underground pipes that collect and deliver wastewater to treatment facilities or streams.

sinkhole--a depression in the Earth's surface caused by dissolving of underlying limestone, salt, or gypsum. Drainage is provided through underground channels that may be enlarged by the collapse of a cavern roof.

solute--a substance that is dissolved in another substance, thus forming a solution.

solution--a mixture of a solvent and a solute. In some solutions, such as sugar water, the substances mix so thoroughly that the solute cannot be seen. But in other solutions, such as water mixed with dye, the solution is visibly changed.

solvent--a substance that dissolves other substances, thus forming a solution. Water dissolves more substances than any other, and is known as the "universal solvent".

specific conductance--a measure of the ability of water to conduct an electrical current as measured using a 1-cm cell and expressed in units of electrical conductance, i.e., Siemens per centimeter at 25 degrees Celsius. Specific conductance can be used for approximating the total dissolved solids content of water by testing its capacity to carry an electrical current. In water quality, specific conductance is used in ground water monitoring as an indication of the presence of ions of chemical substances that may have been released by a leaking landfill or other waste storage or disposal facility. A higher specific conductance in water drawn from downgradient wells when compared to upgradient wells indicates possible contamination from the facility.

spray irrigation--an common irrigation method where water is shot from high-pressure sprayers onto crops. Because water is shot high into the air onto crops, some water is lost to evaporation.

storm sewer--a sewer that carries only surface runoff, street wash, and snow melt from the land. In a separate sewer system, storm sewers are completely separate from those that carry domestic and commercial

wastewater (sanitary sewers).

stream--a general term for a body of flowing water; natural water course containing water at least part of the year. In hydrology, it is generally applied to the water flowing in a natural channel as distinct from a canal.

streamflow--the water discharge that occurs in a natural channel. A more general term than runoff, streamflow may be applied to discharge whether or not it is affected by diversion or regulation.

subsidence--a dropping of the land surface as a result of ground water being pumped. Cracks and fissures can appear in the land. Subsidence is virtually an irreversible process.

surface tension--the attraction of molecules to each other on a liquid's surface. Thus, a barrier is created between the air and the liquid.

surface water--water that is on the Earth's surface, such as in a stream, river, lake, or reservoir.

suspended sediment--very fine soil particles that remain in suspension in water for a considerable period of time without contact with the bottom. Such material remains in suspension due to the upward components of turbulence and currents and/or by suspension.

suspended-sediment concentration--the ratio of the mass of dry sediment in a water-sediment mixture to the mass of the water-sediment mixture. Typically expressed in milligrams of dry sediment per liter of water-sediment mixture.

suspended-sediment discharge--the quantity of suspended sediment passing a point in a stream over a specified period of time. When expressed in tons per day, it is computed by multiplying water discharge (in cubic feet per second) by the suspended-sediment concentration (in milligrams per liter) and by the factor 0.0027.

suspended solids--solids that are not in true solution and that can be removed by filtration. Such suspended solids usually contribute directly to turbidity. Defined in waste management, these are small particles of solid pollutants that resist separation by conventional methods.

Top

T

tertiary wastewater treatment--selected biological, physical, and chemical separation processes to remove organic and inorganic substances that resist conventional treatment practices; the additional treatment of effluent beyond that of primary and secondary treatment methods to obtain a very high quality of effluent. The complete wastewater treatment process typically involves a three-phase process: (1) First, in the primary wastewater treatment process, which incorporates physical aspects, untreated water is passed through a series of screens to remove solid wastes; (2) Second, in the secondary wastewater treatment process, typically involving biological and chemical processes, screened wastewater is then passed a series of holding and aeration tanks and ponds; and (3) Third, the tertiary wastewater treatment process consists of flocculation basins, clarifiers, filters, and chlorine basins or ozone or ultraviolet radiation processes.

thermal pollution--a reduction in water quality caused by increasing its temperature, often due to disposal of waste heat from industrial or power generation processes. Thermally polluted water can harm the environment because plants and animals can have a hard time adapting to it.

thermoelectric power water use--water used in the process of the generation of thermoelectric power. Power plants that burn coal and oil are examples of thermoelectric-power facilities.

transmissibility (ground water)--the capacity of a rock to transmit water under pressure. The coefficient of transmissibility is the rate of flow of water, at the prevailing water temperature, in gallons per day, through a vertical strip of the aquifer one foot wide, extending the full saturated height of the aquifer under a hydraulic gradient of 100-percent. A hydraulic gradient of 100-percent means a one foot drop in head in one foot of flow distance.

transpiration--process by which water that is absorbed by plants, usually through the roots, is evaporated into the atmosphere from the plant surface, such as leaf pores. See evapotranspiration.

Tributary--a smaller river or stream that flows into a larger river or stream. Usually, a number of smaller tributaries merge to form a river.

turbidity--the amount of solid particles that are suspended in water and that cause light rays shining through the water to scatter. Thus, turbidity makes the water cloudy or even opaque in extreme cases. Turbidity is measured in nephelometric turbidity units (NTU).

Top

U

unsaturated zone--the zone immediately below the land surface where the pores contain both water and air, but are not totally saturated with water. These zones differ from an aquifer, where the pores are saturated with water.

Top

W

wastewater--water that has been used in homes, industries, and businesses that is not for reuse unless it is treated.

wastewater-treatment return flow--water returned to the environment by wastewater-treatment facilities.

water cycle--the circuit of water movement from the oceans to the atmosphere and to the Earth and return to the atmosphere through various stages or processes such as precipitation, interception, runoff, infiltration, percolation, storage, evaporation, and transportation.

water quality--a term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

water table--the top of the water surface in the saturated part of an aquifer.

water use--water that is used for a specific purpose, such as for domestic use, irrigation, or industrial processing. Water use pertains to human's interaction with and influence on the hydrologic cycle, and includes elements, such as water withdrawal from surface- and ground-water sources, water delivery to homes and businesses, consumptive use of water, water released from wastewater-treatment plants, water returned to the environment, and instream uses, such as using water to produce hydroelectric power.

watershed--the land area that drains water to a particular stream, river, or lake. It is a land feature that can be identified by tracing a line along the highest elevations between two areas on a map, often a ridge. Large watersheds, like the Mississippi River basin contain thousands of smaller watersheds.

watthour (Wh)--an electrical energy unit of measure equal to one watt of power supplied to, or taken from, an electrical circuit steadily for one hour.

well (water)--an artificial excavation put down by any method for the

purposes of withdrawing water from the underground aquifers. A bored, drilled, or driven shaft, or a dug hole whose depth is greater than the largest surface dimension and whose purpose is to reach underground water supplies or oil, or to store or bury fluids below ground.

withdrawal--water removed from a ground- or surface-water source for use.

Top

X

xeriscaping--a method of landscaping that uses plants that are well adapted to the local area and are drought-resistant. Xeriscaping is becoming more popular as a way of saving water at home.
More on xeriscaping: Colorado WaterWise Council

Top

Y

yield--mass per unit time per unit area

Some of this information is courtesy of the the Nevada Division of Water Resources.

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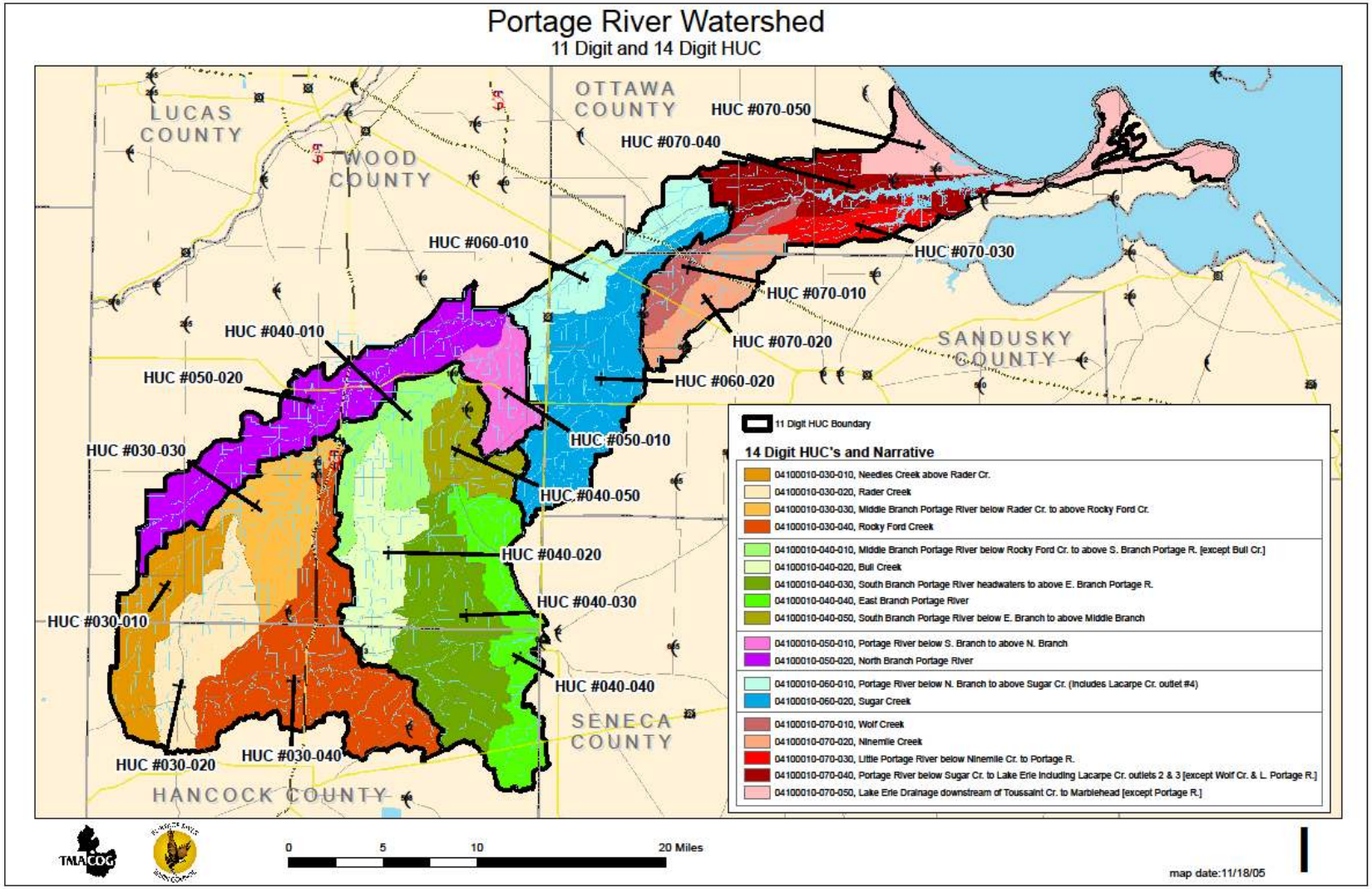
USA.gov

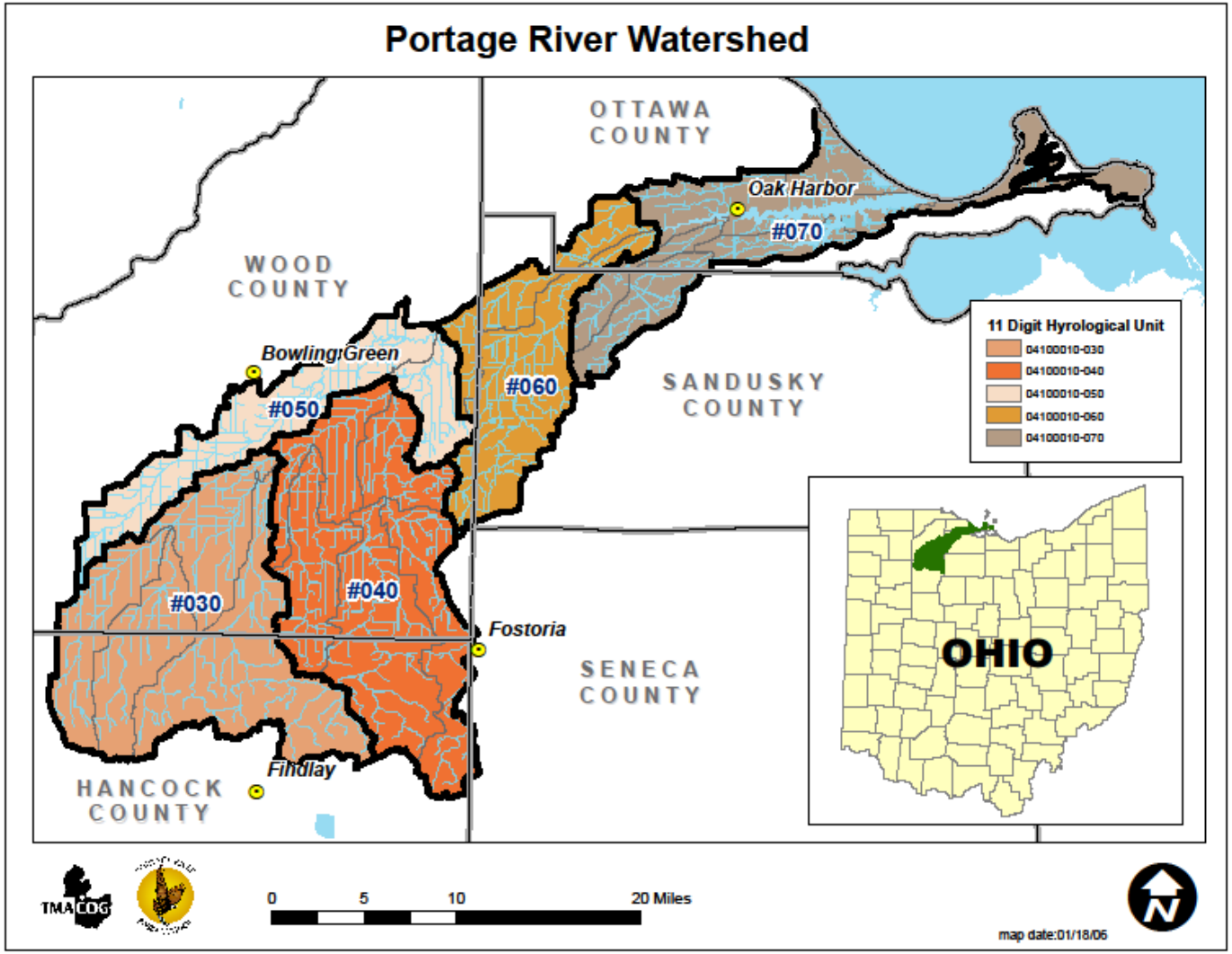
TAKE PRIDE IN AMERICA

APPENDIX J

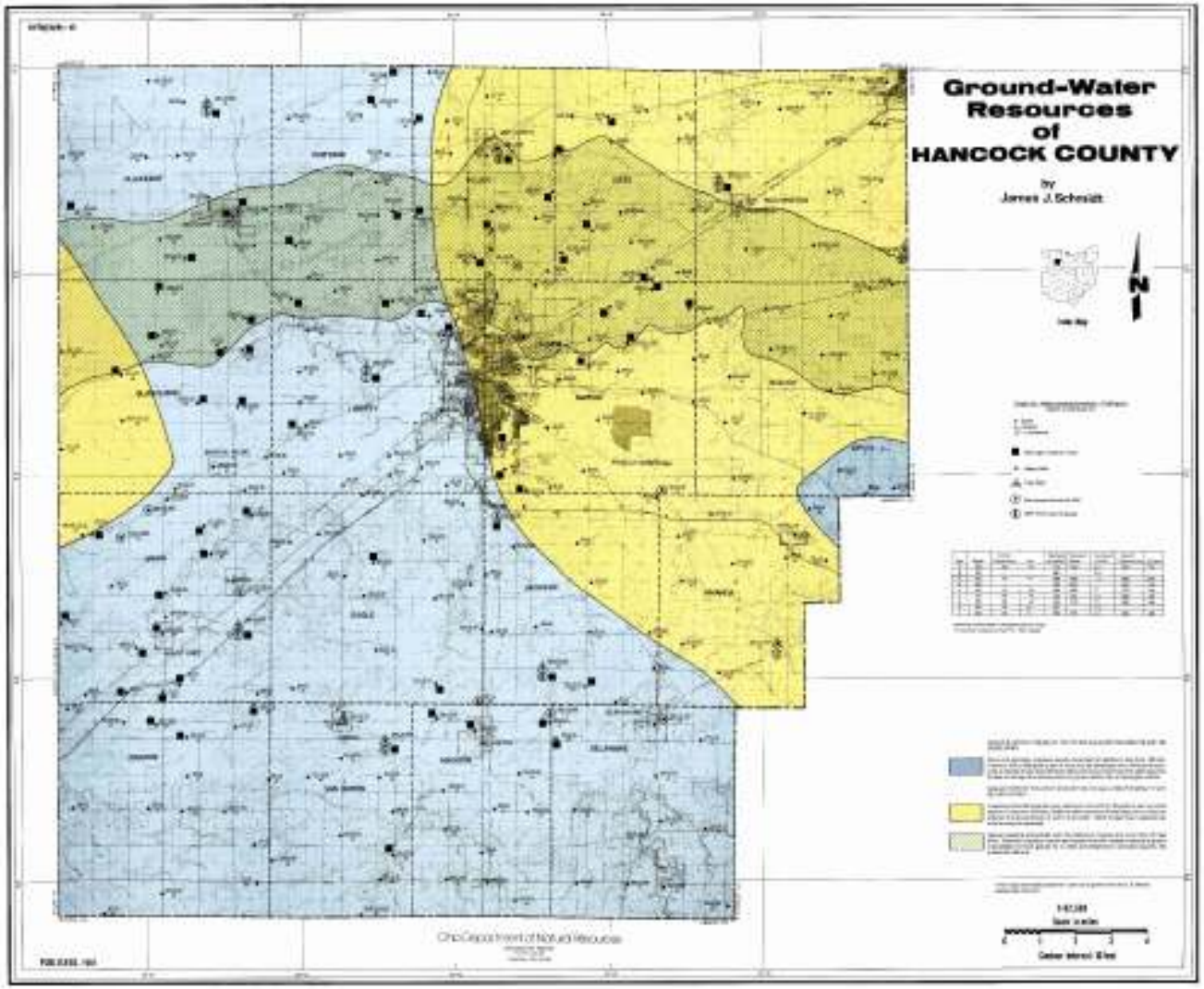
WATERSHED MAPS



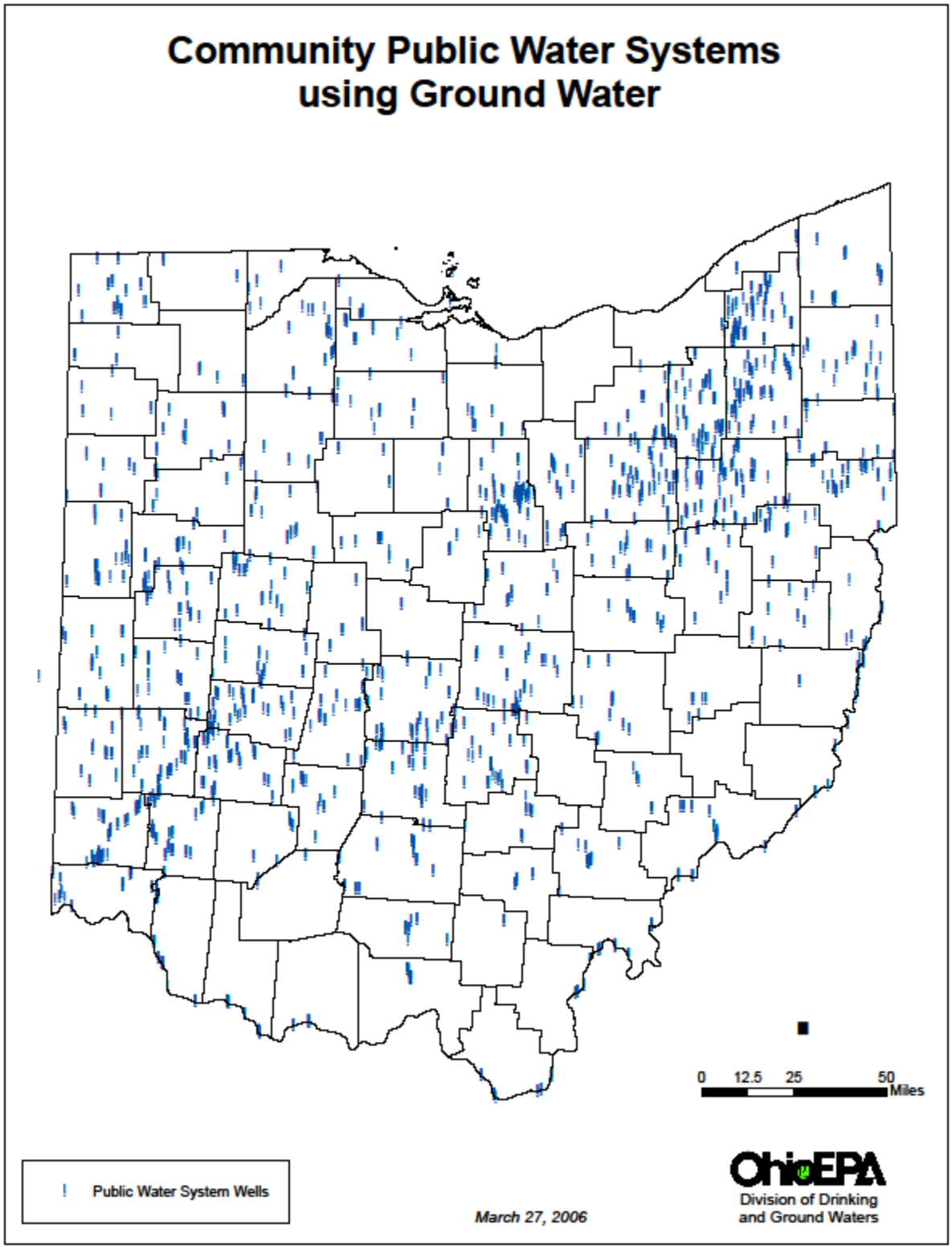
MAP A: Portage River Watershed Atlas Map



MAP B: Portage 11 Digit HUC

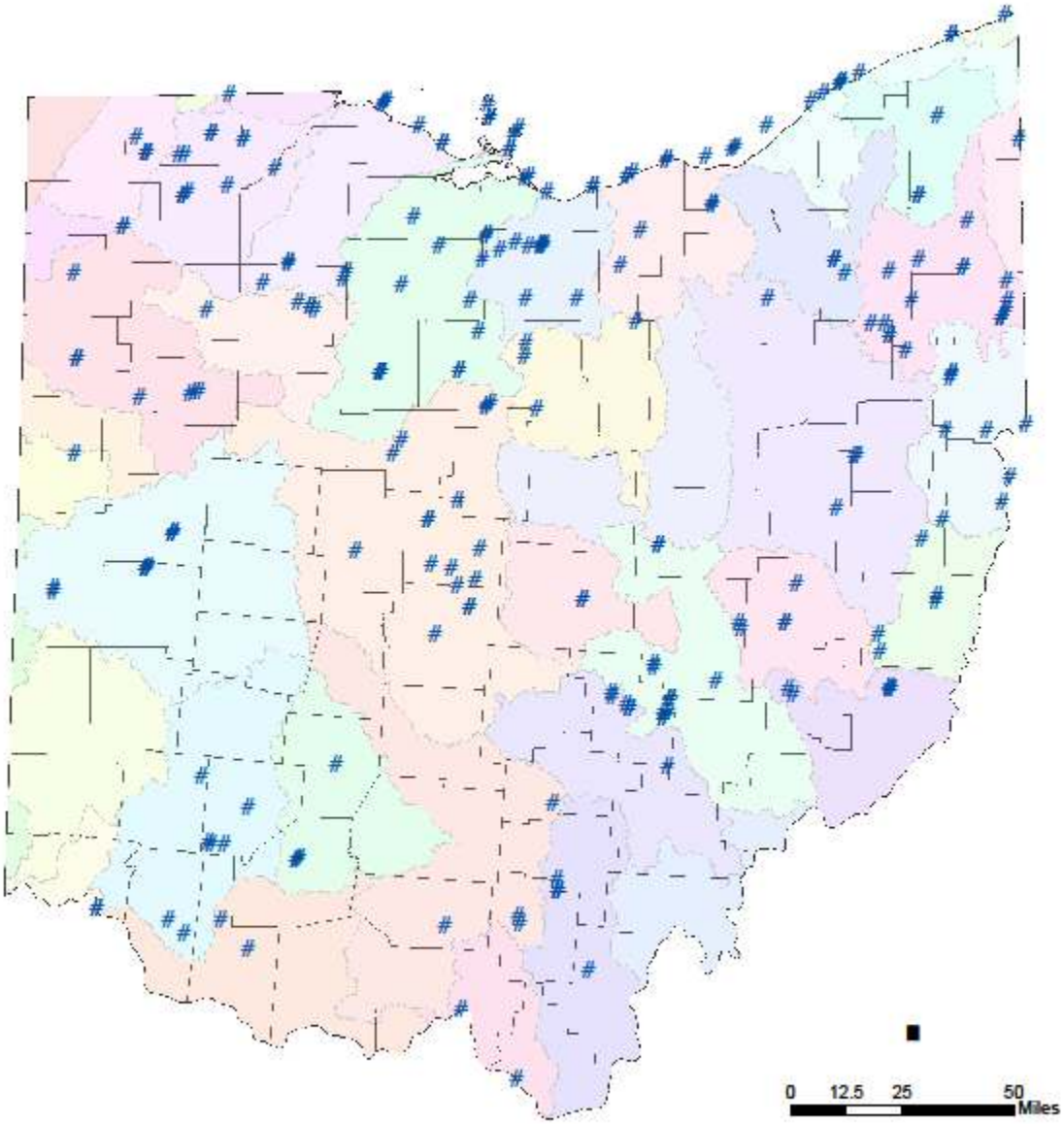


MAP C: Ground Water Resources of Hancock County



MAP D: Community Public Water Systems Using Ground Water

Public Water Systems with Surface Water Intakes by Major Watershed



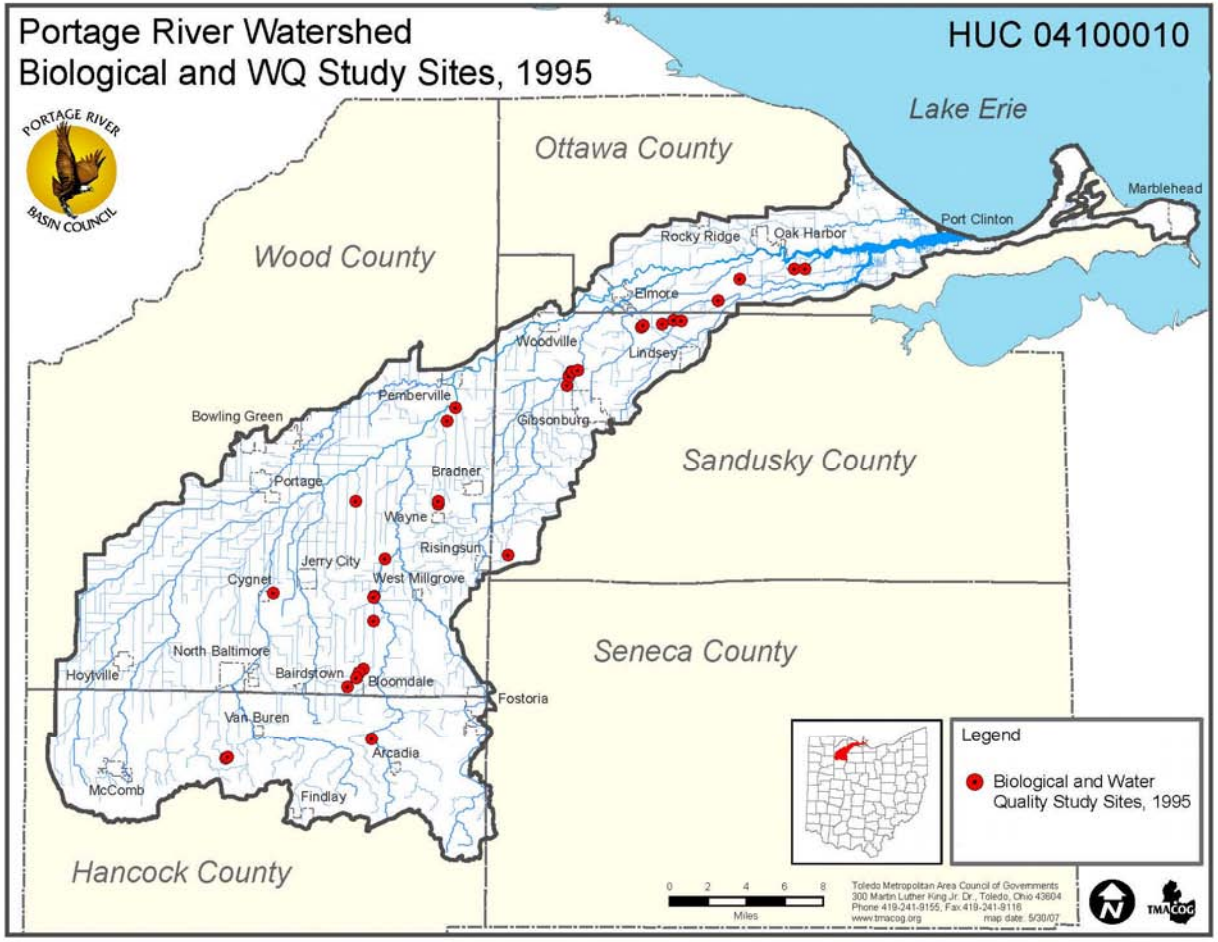
Public Water System Surface Intakes

March 27, 2006

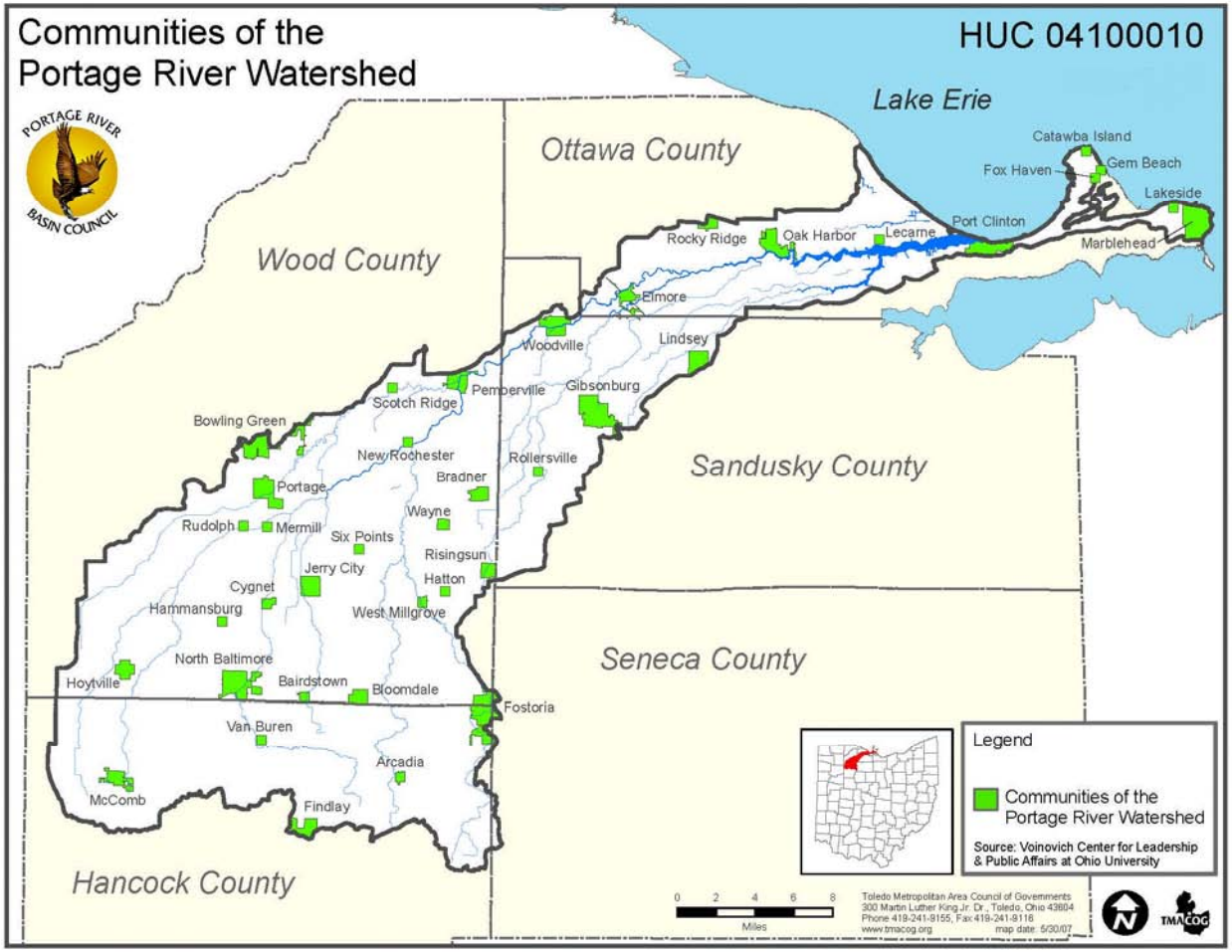
OhioEPA
Division of Drinking and Ground Waters

APPENDIX K

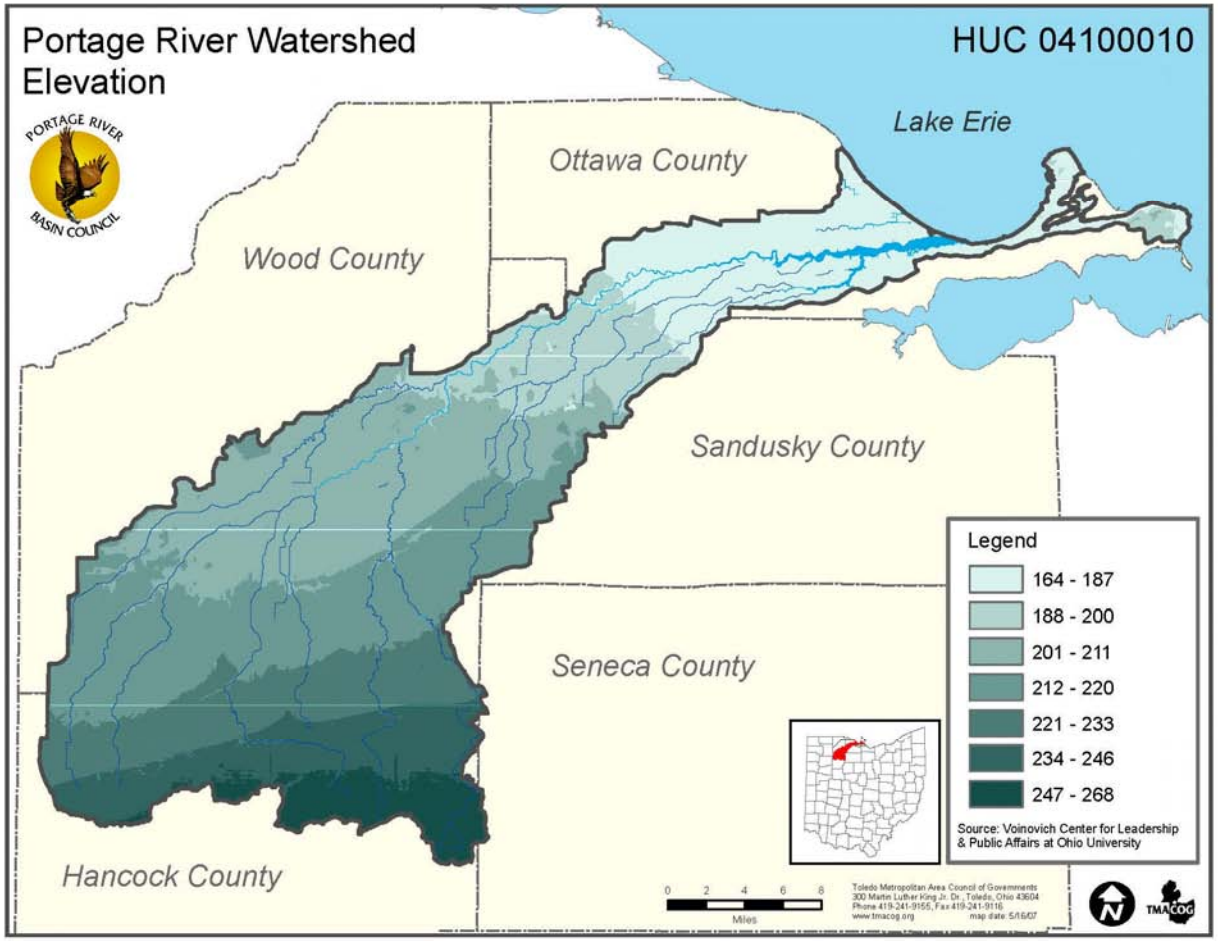
8-DIGIT MAPS



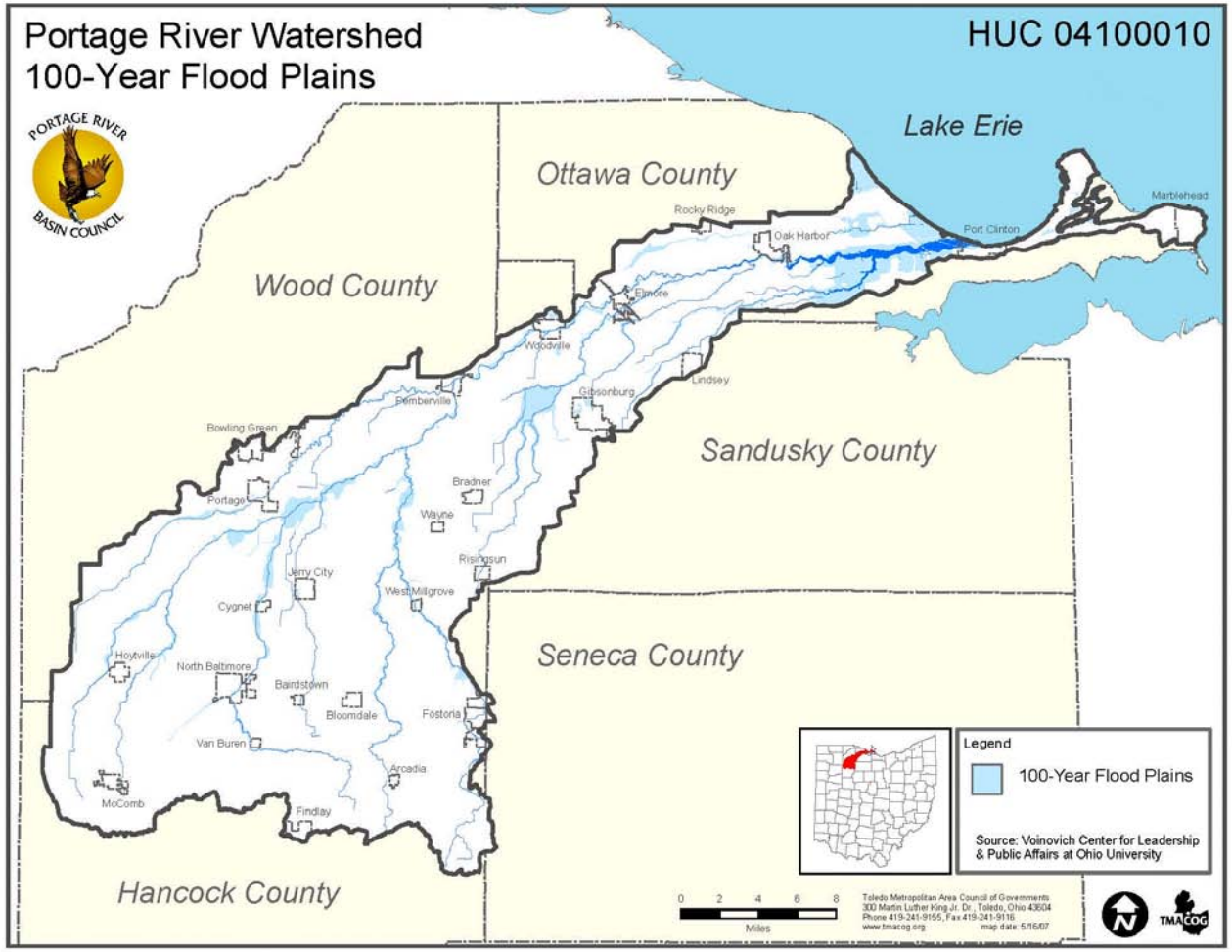
MAP A: Biological and WQ Study Sites, 1995



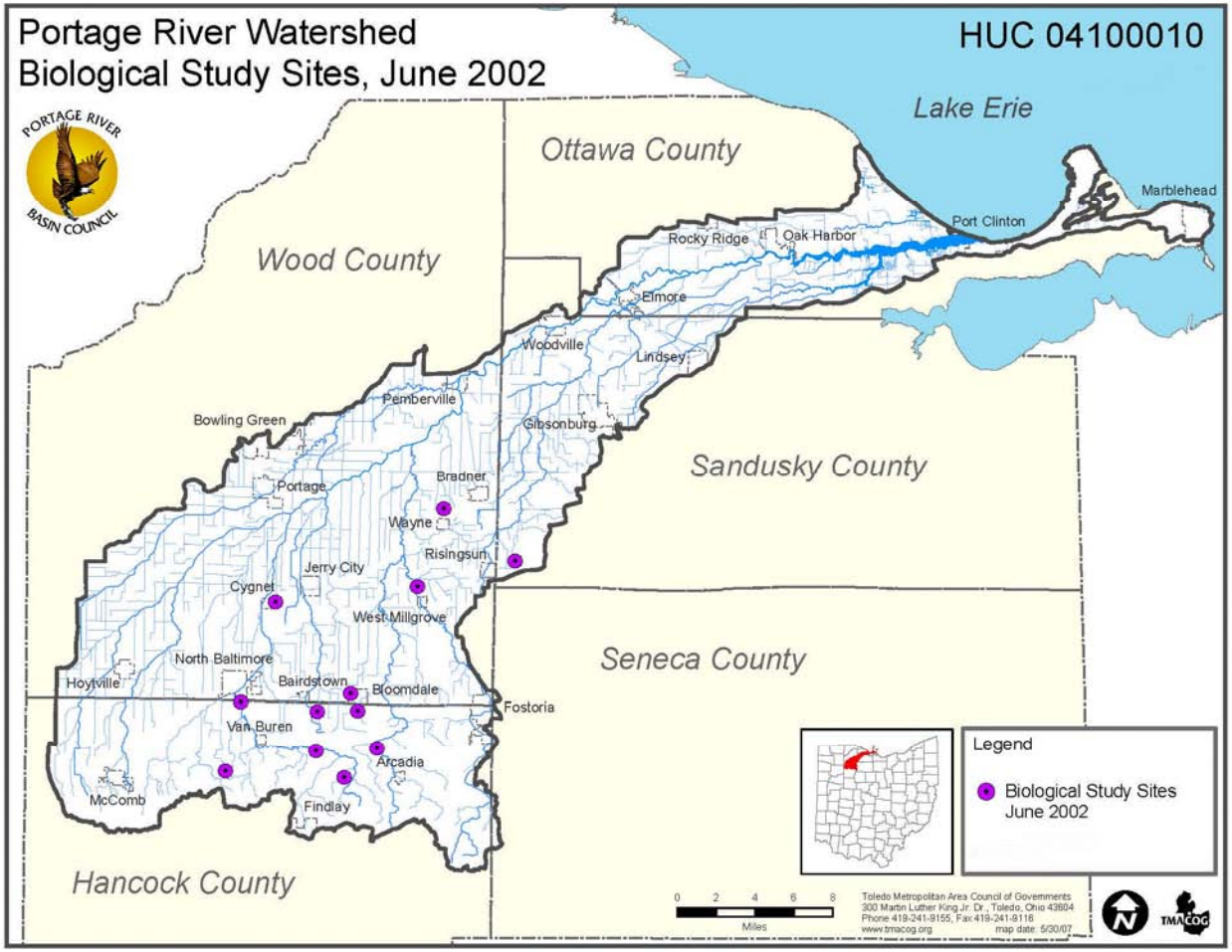
MAP B: Communities of the Portage River Watershed



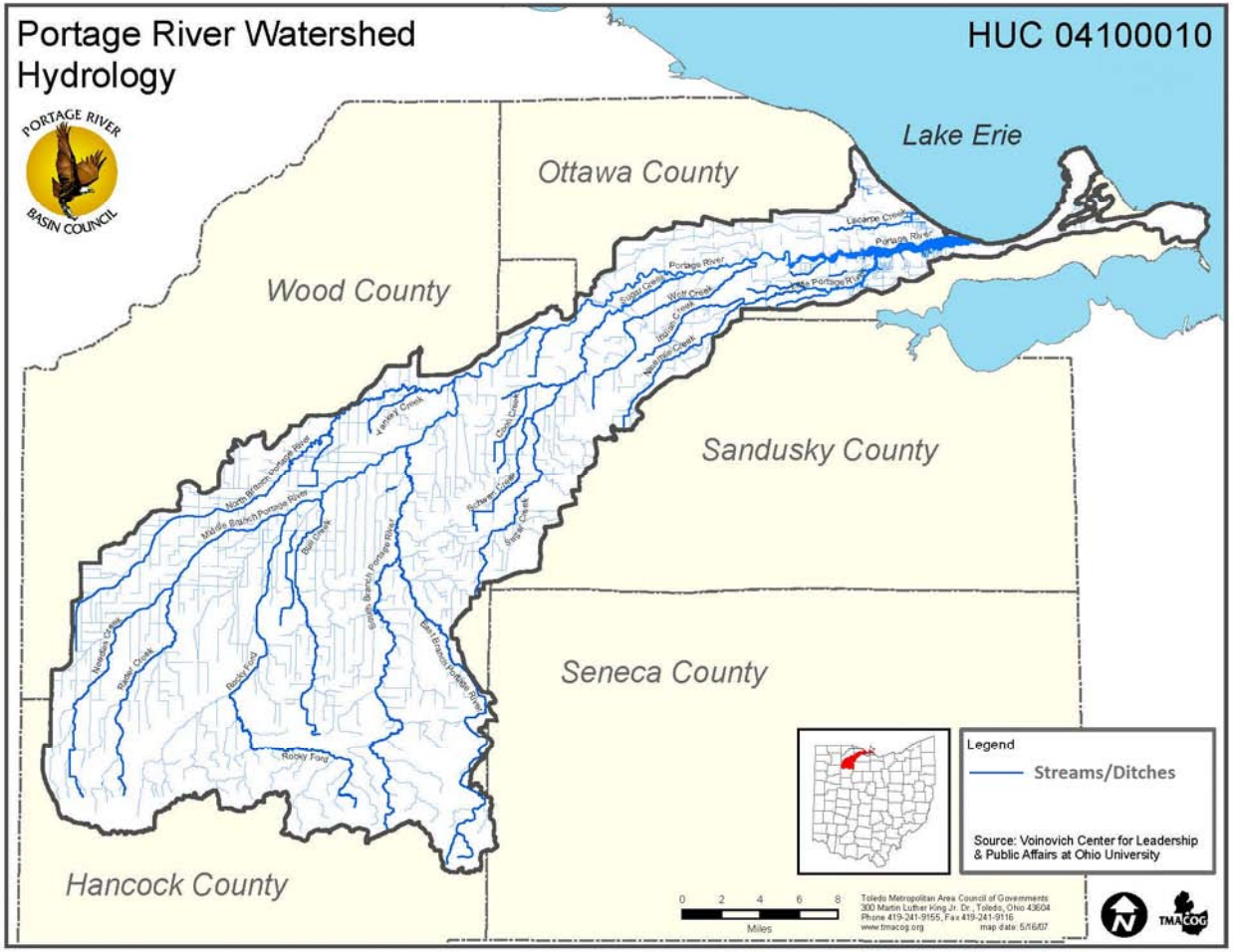
MAP C: Elevation of the Watershed



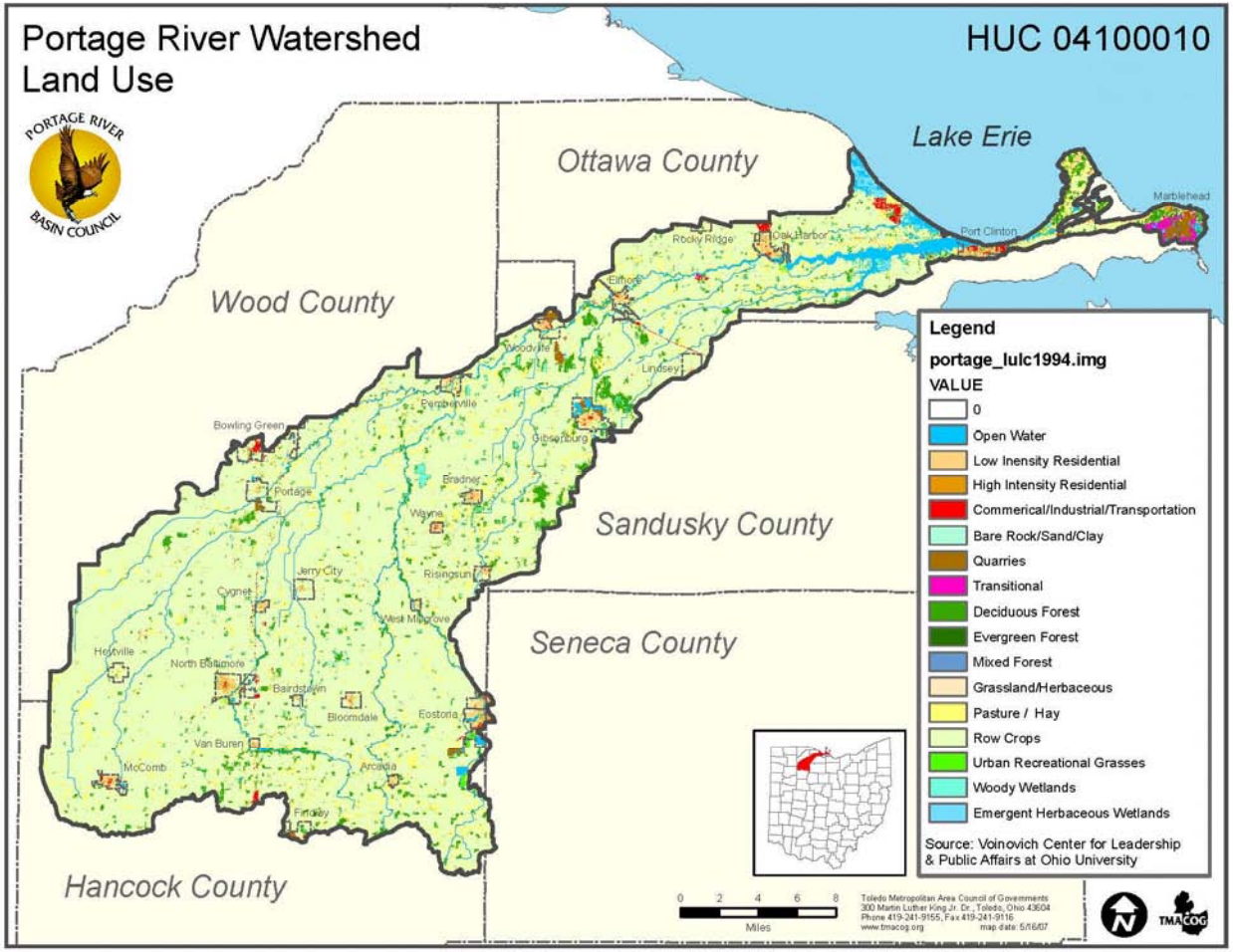
MAP D: Portage River Watershed 100-Year Flood Plains



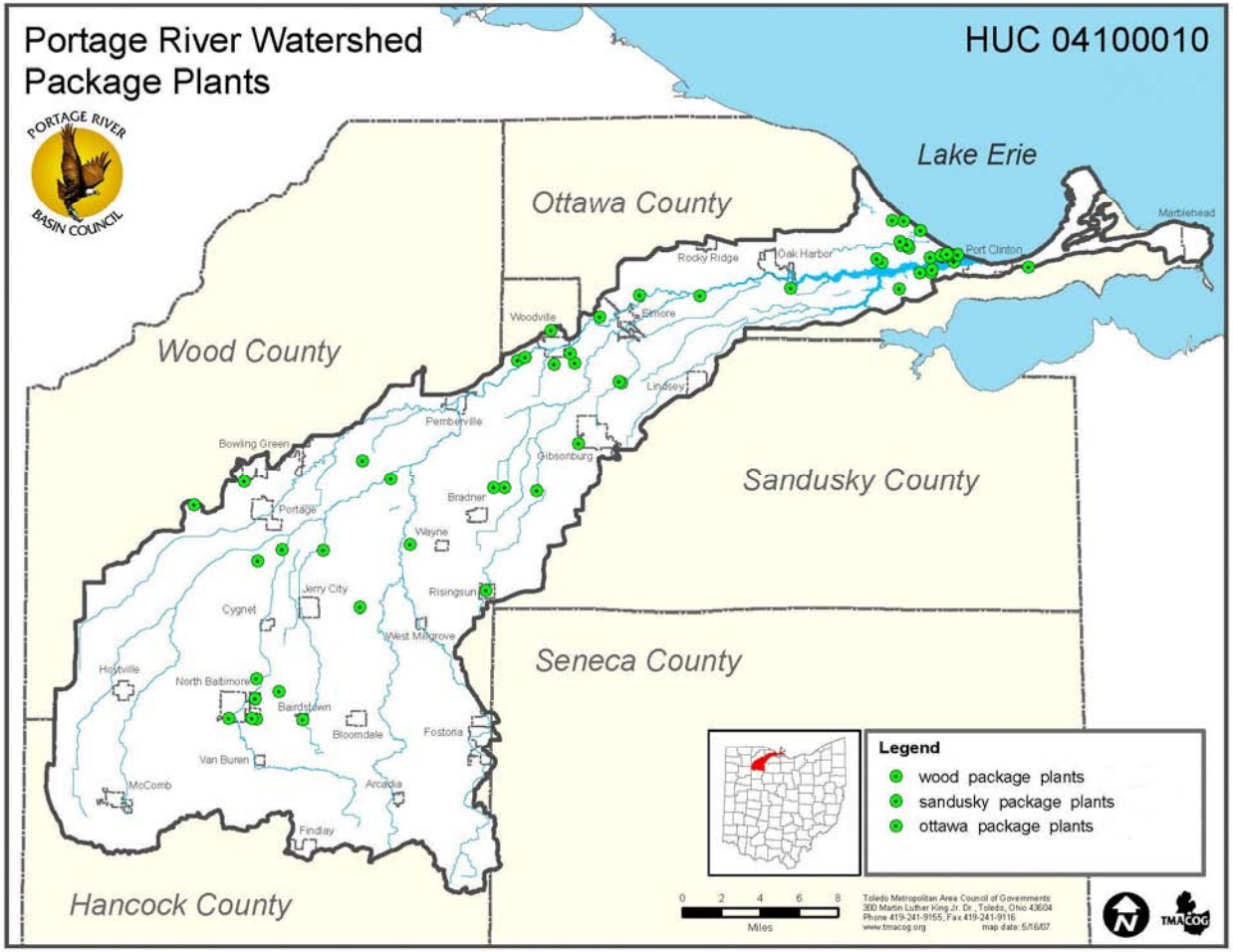
MAP E: Portage River Watershed Biological Study Sites, June 2002



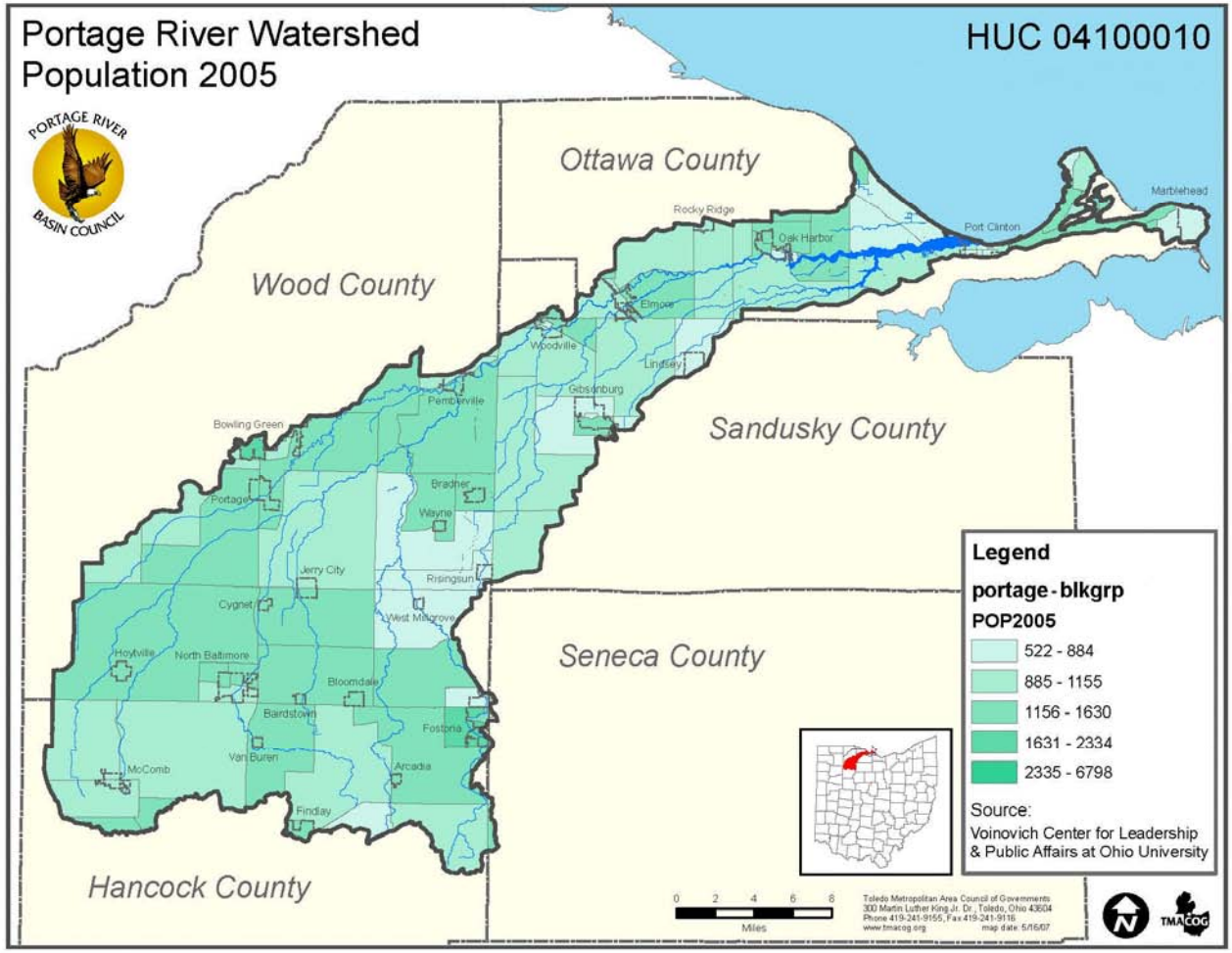
MAP F: Portage River Watershed Hydrology



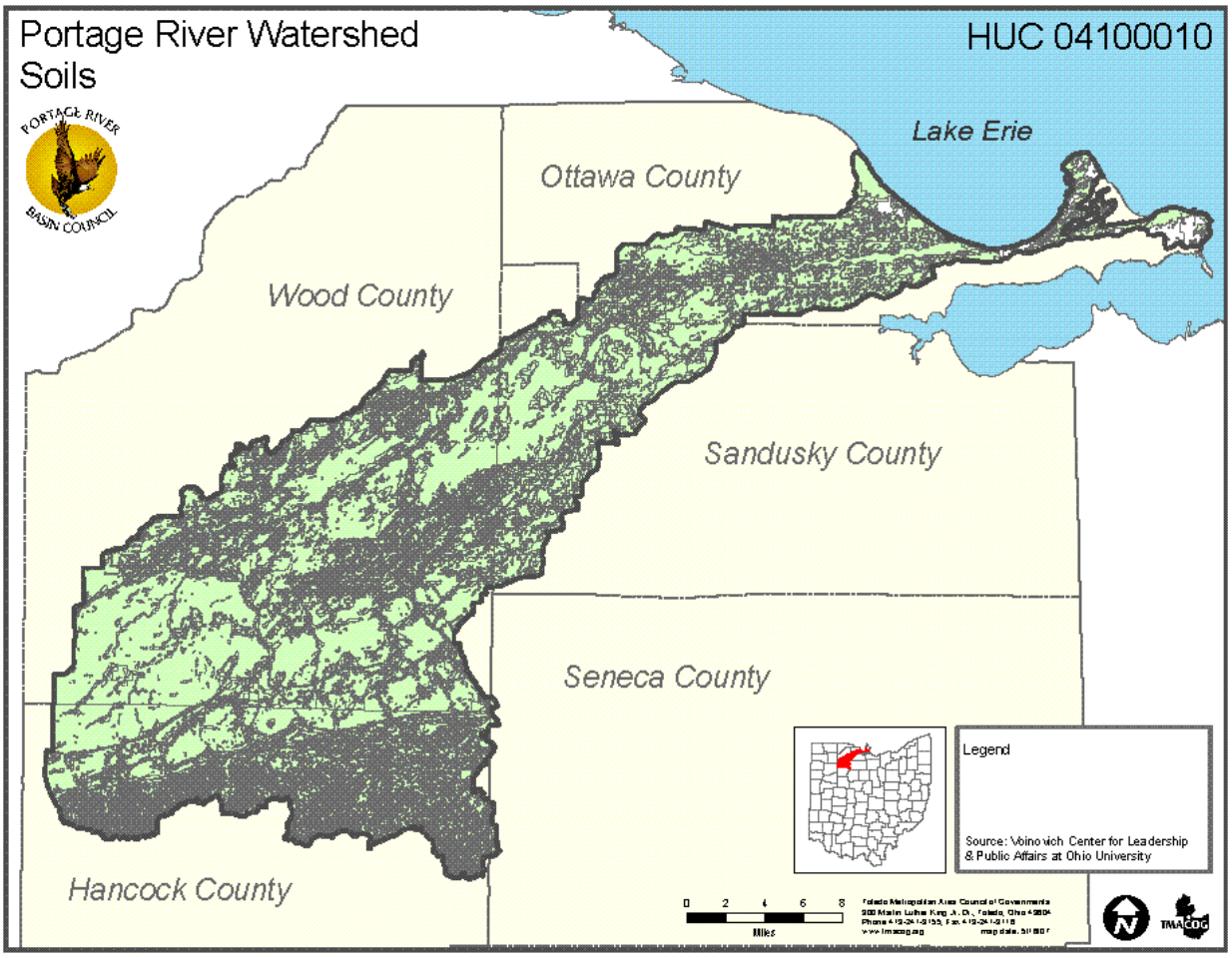
MAP G: Portage River Watershed Land Use



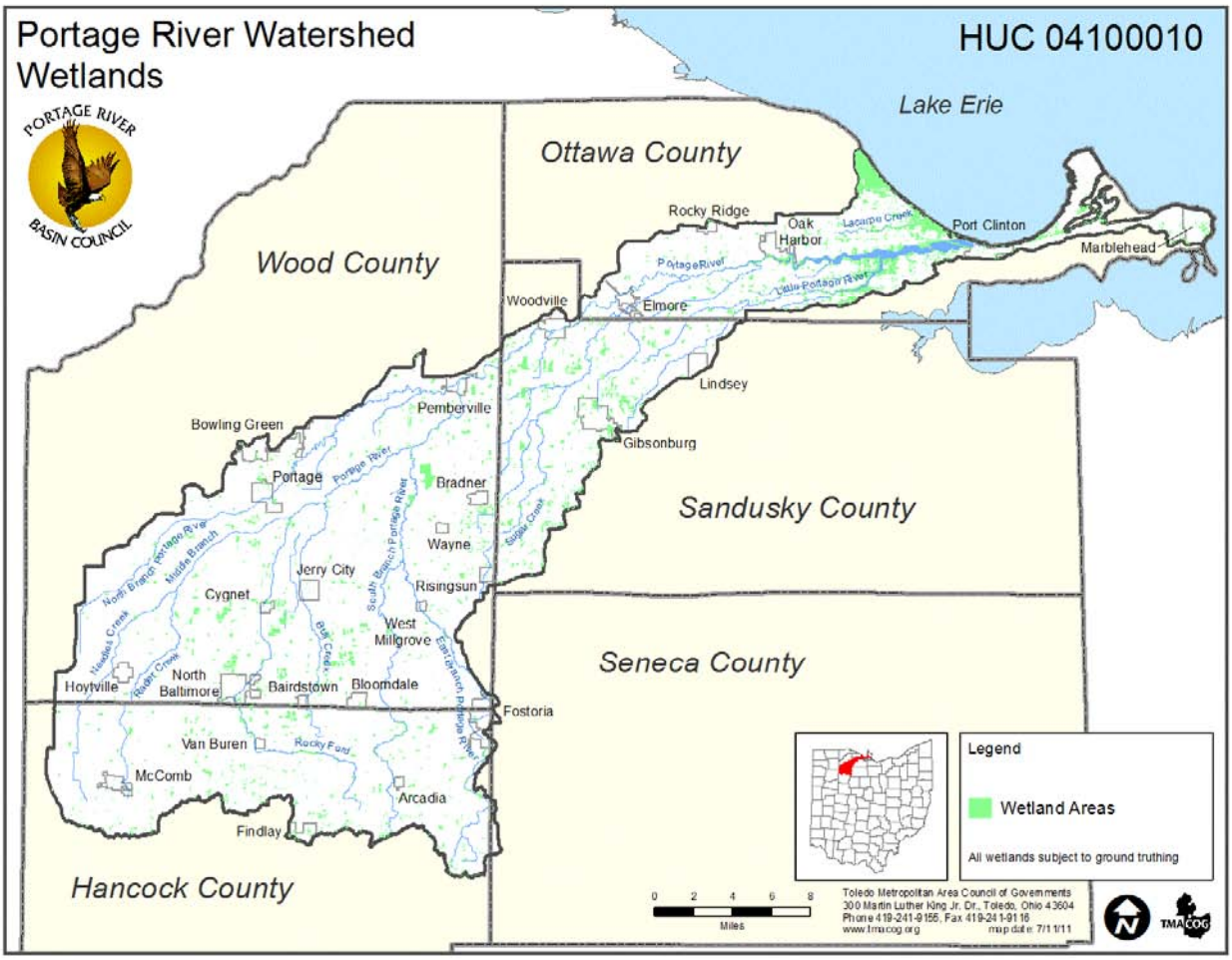
MAP H: Portage River Watershed Package Plants



MAP I: Portage River Watershed Population 2005



MAP J: Portage River Watershed Soils



MAP K: Portage River Wetlands

APPENDIX L

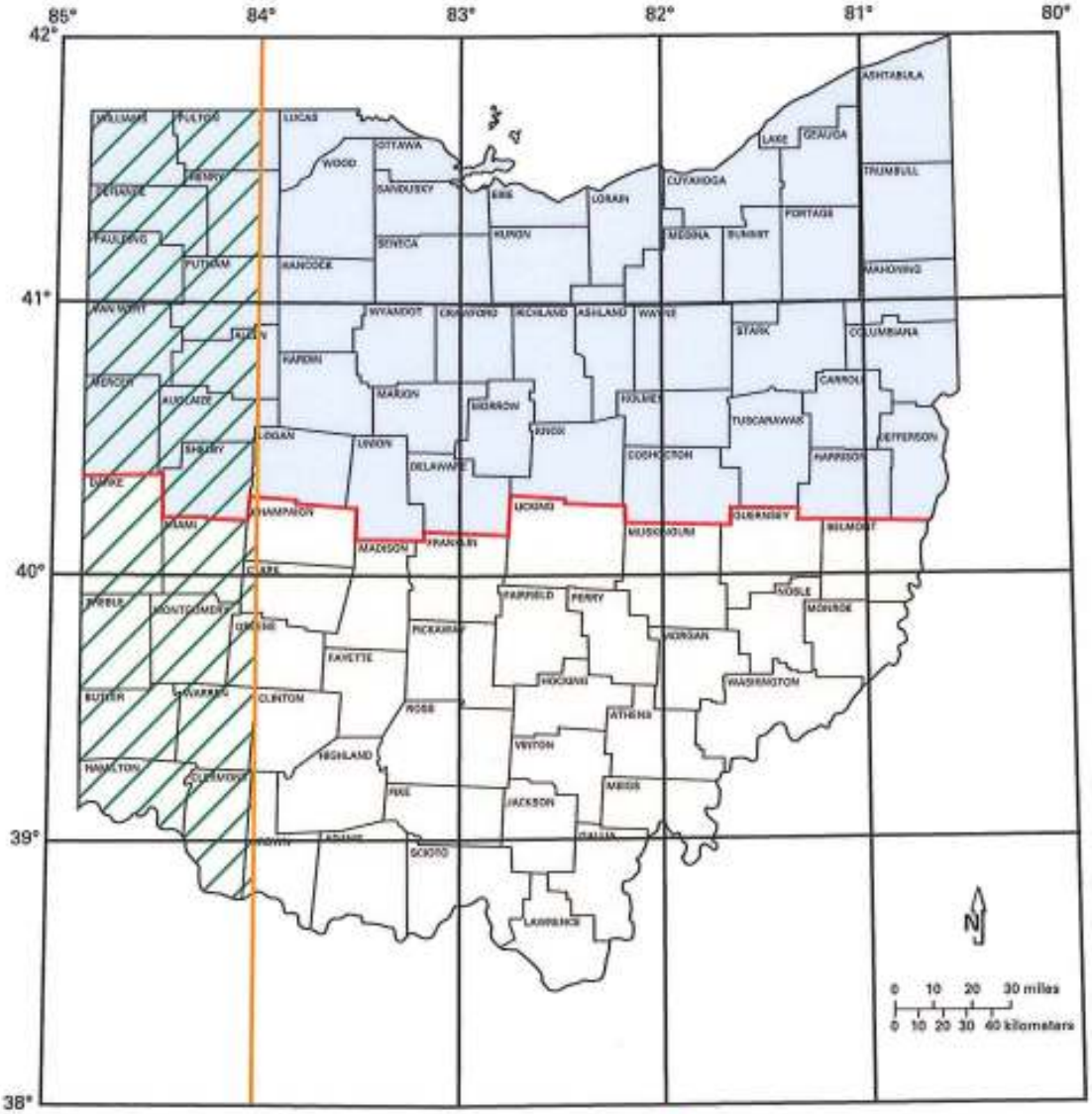
COORDINATE SYSTEMS USED IN OHIO

STATE OF OHIO
Ted Strickland, Governor

DEPARTMENT OF NATURAL RESOURCES
Sean D. Logan, Director

DIVISION OF GEOLOGICAL SURVEY
Lawrence H. Wickstrom, Chief

LATITUDE-LONGITUDE GRID, UTM ZONE BOUNDARY, AND STATE PLANE COORDINATE SYSTEM ZONE BOUNDARY



	UTM ZONE 16	UTM ZONE 17
STATE PLANE NORTH		
STATE PLANE SOUTH		

COMMON COORDINATE SYSTEMS USED IN OHIO

Use of a coordinate system is necessary to define a position on our spherical Earth. The accompanying map illustrates the coverage and boundaries of three of the most commonly used systems in Ohio. The best known and most commonly used system of reference coordinates is **latitude and longitude.** Lines of longitude (meridians) are a series of 360 circles around the Earth that pass through the North and South Poles. Lines of latitude (parallels) run east-west parallel to the Equator; there are 90 lines of latitude in each hemisphere, north and south. Latitude and longitude are measured in degrees (°), minutes (′), and seconds (″). Ohio lies between 80° and 85° west longitude and between 38° and 42° north latitude. To use this geographic coordinate system, measurements and computations must be performed using angular units and relationships because it is a network of gridlines placed around a sphere.

Rectangular coordinate systems use different methods to represent (project) Earth's three-dimensional spherical shape on a two-dimensional reference grid. Rectangular coordinate systems involve less complicated calculations of distance, area, and position. However, the projection methods used cause distortions of the Earth's surface by stretching or compressing shape, area, or scale. The two most commonly used projection systems in this area are the *Lambert* and *Transverse Mercator,* both of which have varying scale but retain the proper shape of the mapped surface.

The state plane coordinate system was introduced in the 1930's to allow the entire conterminous United States to be mapped on a set of flat surfaces with very little local distortion. The size and orientation of each state determines how many zones are used and which projection provides the least distortion. Two Lambert projection zones cover Ohio: a north zone and a south zone. Measurements are in feet and, within each zone, are all positive. The boundary between the two zones follows county lines as depicted on the accompanying map.

The Universal Tranverse Mercator (UTM) coordinate system was developed by the U.S. Department of Defense for global military operations. The UTM system consists of 60 north-south zones arranged around the globe. Each zone is 6° of longitude wide. The zones are numbered from west to east beginning at the 180th meridian, and within each zone all coordinates are positive values. UTM measurements commonly are in meters, although these can be converted to feet. Ohio lies within a portion of zones 16 and 17 as depicted on the accompanying map.

Most maps being produced by the Ohio Division of Geological Survey today are prepared electronically. The most common coordinate system used by the Survey in its digital mapping systems is the state plane coordinate system. For statewide maps, the south zone of the state plane system is extended over the entire state. When using the Survey's digital map products, it is important to obtain the accompanying metadata files that explain the coordinate system, scale, and projection used in creating the map. Most digital mapping systems provide easy methods for converting between different projections and coordinate systems.

APPENDIX M

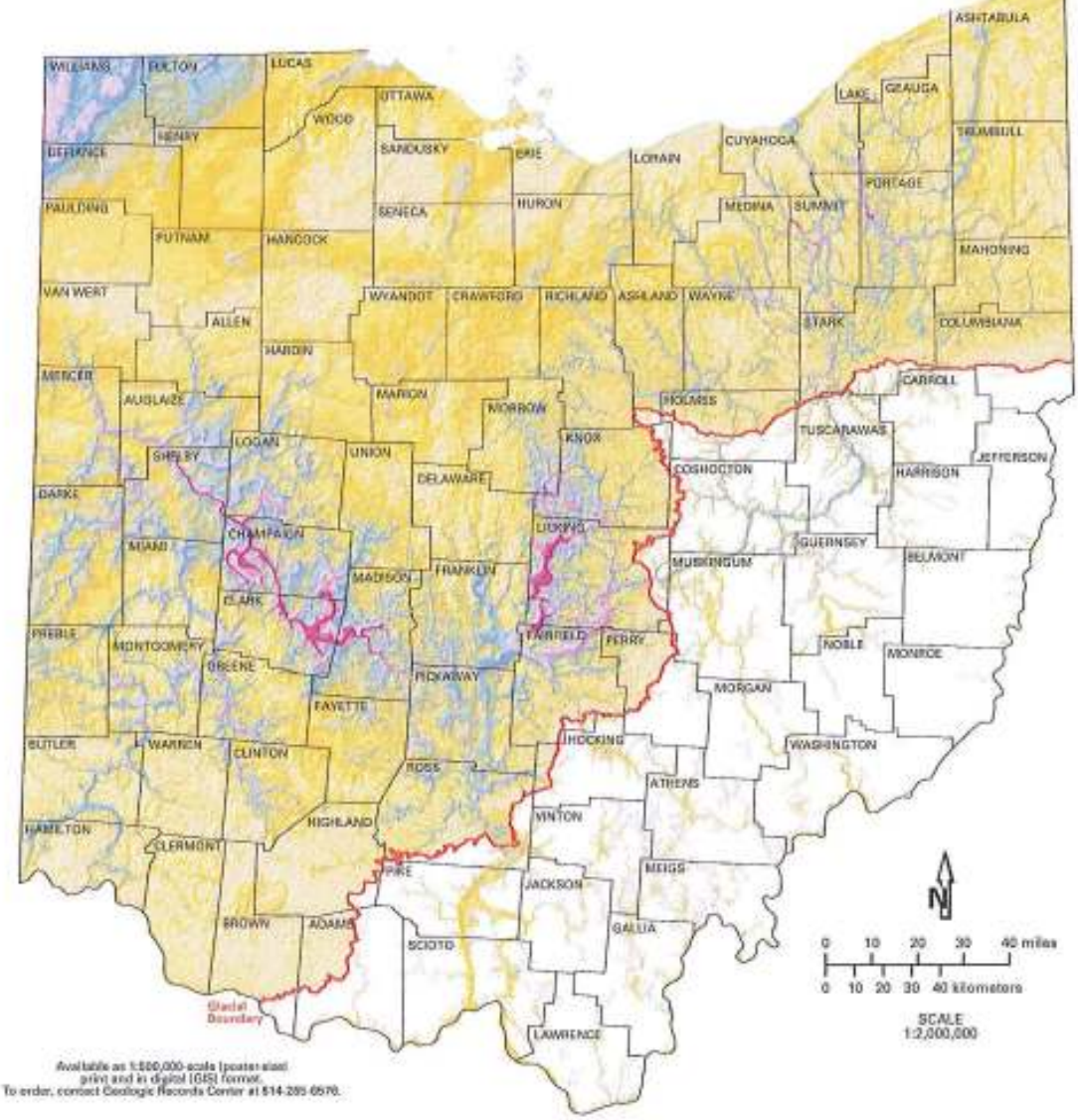
DRIFT MAP

STATE OF OHIO
Bob Taft, Governor

DEPARTMENT OF NATURAL RESOURCES
Samuel W. Speck, Director

DIVISION OF GEOLOGICAL SURVEY
Thomas M. Berg, Chief

SHADED DRIFT-THICKNESS MAP OF OHIO



Available as 1:500,000-scale (poster-size) print and in digital (GIS) format.
To order, contact Geologic Records Center at 614-265-6576.

EXPLANATION

Thickness (in feet) of drift in glaciated areas and some non-glaciated areas along glacial boundary, and of outwash and glaciolacustrine deposits in sediment-filled valleys beyond the glacial boundary.

0 - 20	51 - 80	121 - 160	211 - 260	331 - 440
21 - 50	81 - 120	161 - 210	261 - 330	441 - 726

SHADED DRIFT-THICKNESS MAP OF OHIO

INTRODUCTION

The drift-thickness map of Ohio depicts the thickness and distribution of glacially derived sediments (called drift) and post-glacial stream sediments overlying the buried bedrock surface. This map was produced by subtracting bedrock-surface elevations from land-surface elevations to produce a residual map of drift thickness. Colors portray thickness intervals of glacial and modern sediments, which can range up to several hundred feet.

Prior to the onset of continental glaciation in the Early Pleistocene Epoch, approximately 1.8 million years before present, the Ohio landscape was dominated by rolling hills and deeply incised, mature rivers and streams. A reduced version of the Division of Geological Survey's Shaded-Bedrock Topography map of Ohio (fig. 1) reveals some aspects of this old land surface. Erosion and deposition by Ice-Age continental glaciers advancing into northern and western Ohio produced a low-relief land surface compared to the unglaciated, high-relief land surface of southeastern Ohio (fig. 2). Comparing the shaded elevation map (fig. 2) with the shaded bedrock-topography map (fig. 1) reveals the dramatic impact of glaciation on the state's current landscape.

Drift thickness in western and northern Ohio (fig. 3) is highly variable, a consequence of numerous geologic factors acting in combination or alone. In some areas, drift has been deposited on a relatively flat bedrock surface and changes in drift thickness are primarily the result of variations in the amount of glacial material deposited. In other areas, drift has infilled a deeply incised buried-bedrock surface, and changes in drift thickness are primarily the result of variations in bedrock-surface elevation. In still other instances, the drift surface parallels the underlying bedrock surface to produce areas of relatively uniform drift thickness.

Distinct, narrow linear patterns of thick drift in western and central Ohio are the result of deep incisions in the underlying limestone and dolomite bedrock by a large, northwest flowing drainage system, the Teays Valley system, that existed prior to and during early glaciations (fig. 1). The main Teays Valley entered the state at Wheelersburg (Scioto County), where remnants of the Teays Valley are still evident on the modern land surface. At Chillicothe (Ross County), the valley disappears under glacial sediments which cover western Ohio. However, the valley continues north, below the surface, to Circleville (Pickaway County) and then northwest to Mercer County where the valley exits the state into Indiana. Early southward-advancing glaciers blocked the north-flowing river system of the Teays and created immense lakes in southeastern Ohio.

In northeastern Ohio, narrow thick-drift areas south of Lake Erie were also preglacial bedrock valleys. These valleys were partially filled with thick deposits of till and glaciolacustrine (glacial lake) sediment and then re-excavated by later northward-flowing rivers such as the Cuyahoga River and the East Branch of Rocky River.

In northwestern Ohio, repeated scouring of the relatively soft bedrock surface by glacial ice flowing southwestward from the Lake Erie Basin destroyed most pre-existing drainage systems. In this part of Ohio, the bedrock surface is smooth and the upper surface of the drift has been planed off by wave action and deposition by a post-glacial, high-level ancestral Lake Erie. In the extreme northwest corner of Ohio, in Williams County and portions of Defiance County, drift thickens considerably because of numerous moraines that formed along the northwestern edge of the Erie Lobe.

In western Ohio, draping linear features of thick drift, called ridge moraines, formed along the temporarily stationary ice-front as glacial sediment was released from the ice. These ribbons of thick drift define the lateral dimensions of glacial ice lobes, particularly those of the last Wisconsinan ice sheet (figure 4). Many ridge moraines in western and northeastern Ohio have a draped appearance because south-flowing ice, impeded by bedrock highlands, moved more easily along major lowlands. The numerous resistant bedrock highlands in northeastern Ohio caused ridge moraines to be especially arcuate and closely stacked.

Southeastern Ohio is unglaciated and devoid of ice-deposited sediment (glacial till). Many southeast Ohio valleys, however, carried

FIGURE 1.—Shaded bedrock-topography map of Ohio showing the sculpted bedrock surface that lies beneath glacial drift in northern and western Ohio and the land surface in unglaciated southeastern Ohio. Note the surface expression of the Teays Valley System south of the glacial boundary (arrow), the location of the main Teays Valley (between yellow dashed lines), the area of smooth bedrock topography, and the area of re-excavated preglacial bedrock valleys in northeastern Ohio. (W = Wheelersburg, C = Circleville, CH = Chillicothe) (modified from Ohio Division of Geological Survey, 2003).

FIGURE 2.—Shaded elevation map of the land surface of Ohio with glacial boundary. Note the smooth landscape of glaciated northern and western Ohio compared to the high-relief landscape of unglaciated southeastern Ohio (modified from Powers, Laine, and Pavey, 2002).

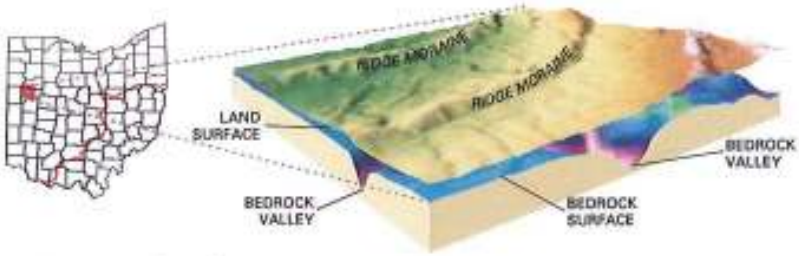


FIGURE 3.—Schematic cross section of glacial drift overlying the bedrock surface. Note areas where drift thickness is controlled by thickening of glacial sediment over a relatively flat bedrock surface, by drift infilling bedrock valleys, or by fluctuations in both the land surface and the bedrock surface. Also note areas where valleys in the buried-bedrock surface are not evident on the land surface (illustration by Donovan M. Powers).

huge volumes of glacial meltwater away from the ice front and toward the Ohio River. In the process, many of these valleys were at times made deeper by the erosive force of fast-flowing meltwater streams, and at other times were partially filled with sediment. Some valleys in unglaciated Ohio contain thick deposits of clay and silt that accumulated on the bottoms of lakes that formed when glacial ice blocked the flow of rivers or when rapidly accumulating meltwater sediments blocked the mouths of smaller tributaries.

METHODS

Two digital data layers are required to generate the drift-thickness map: the surface-elevation layer and the bedrock-topography layer. Drift thickness is calculated by subtracting the bedrock-topography elevation from the land surface elevation. The bedrock-topography component is one of the products resulting from a multi-year effort by the ODNR, Division of Geological Survey to map the bedrock geology of Ohio. Bedrock-topography maps are required to determine the relief on the bedrock surface beneath thick layers of glacial drift. Bedrock-topography maps were created by the Division of Geological Survey for all 788 7½-minute topographic quadrangles in the state as part of a process to produce accurate bedrock-geology maps for glaciated portions of Ohio and for those areas beyond the glacial boundary where valleys are infilled with sediment. Data concentration and contour intervals on the original, hand-drawn bedrock-topography maps vary widely across the state in response to changing geologic and topographic conditions. These data consist mainly of water-well logs on file at the ODNR, Division of Water, supplemented by outcrop data, Ohio Department of Transportation bridge-boring data, and oil-and-gas-well data. During the course of mapping, over 162,000 data points were interpreted for bedrock-surface elevation and in some cases drift thickness. These points were plotted on maps and used as control for the bedrock-topography lines. Individual 24,000-scale bedrock-topography maps are available from the Division's Geologic Records Center.

Elevation contours and data points from the 788 bedrock-topography maps were digitized and compiled for the glaciated portions of the state and for the valleys beyond the glacial boundary containing significant accumulations of sediment deposited during and after glaciation. The bedrock-topography contours were digitally converted in an ArcGIS environment to create a continuous grid model (60 meter grid spacing). A statewide compilation map and digital dataset of the bedrock topography of Ohio (modified from Ohio Division of Geological Survey, 2003) are available from the Division of Geological Survey.

Uncolored areas of southeastern Ohio represent extensive portions of unglaciated Ohio where the land surface and the bedrock surface are essentially the same. On the original maps in these areas, bedrock-topography lines were restricted to the buried-valley portions of the map and were not drawn in upland portions.

The second component needed to create the drift-thickness map, the land-surface topography, is based largely on data derived from the U.S. Geological Survey's National Elevation Dataset (30 meter grid spacing). These data have been modified extensively by the Ohio Division of Geological Survey to replace some anomalous errors that are inherent in portions of the National Elevation Dataset. A statewide compilation map and digital dataset of the shaded elevation of Ohio (modified from Powers, Laine, and Pavey, 2002) are available from the Division of Geological Survey.

A grid of the digitized bedrock-topography contours was subtracted from a grid of the land-surface Digital Elevation Model to derive a third grid (60 meter grid spacing) representing the thickness of the drift. This grid surface was shaded from the northwest, slightly above the horizon, to produce the appearance of a three-dimensional surface.

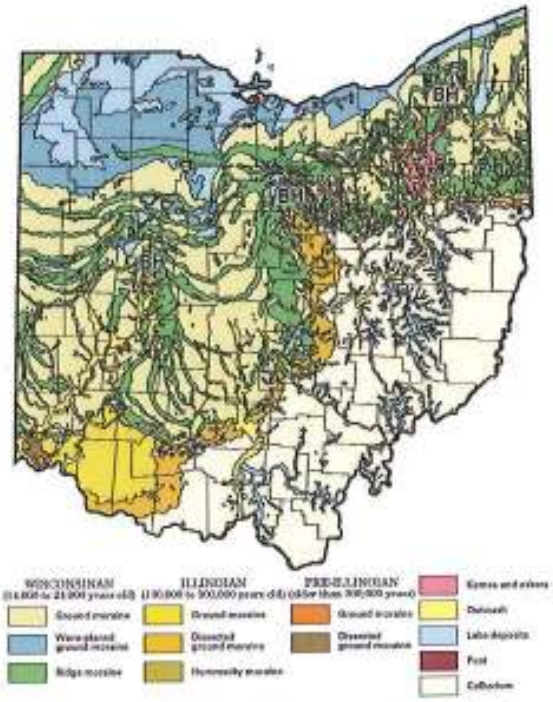


FIGURE 4.—Glacial map of Ohio showing the distribution of glacial sediments and their relative ages. Note glaciated northern and western Ohio, unglaciated southeastern Ohio, and the position of ridge moraines and the lake deposits and wave-planed ground moraine of the Lake Erie Basin. Bedrock highlands (BH) impeded the southward advance of glacial ice causing the moraines to form a lobate configuration (illustration by Lisa Van Doren; modified from Pavey and others, 1999).

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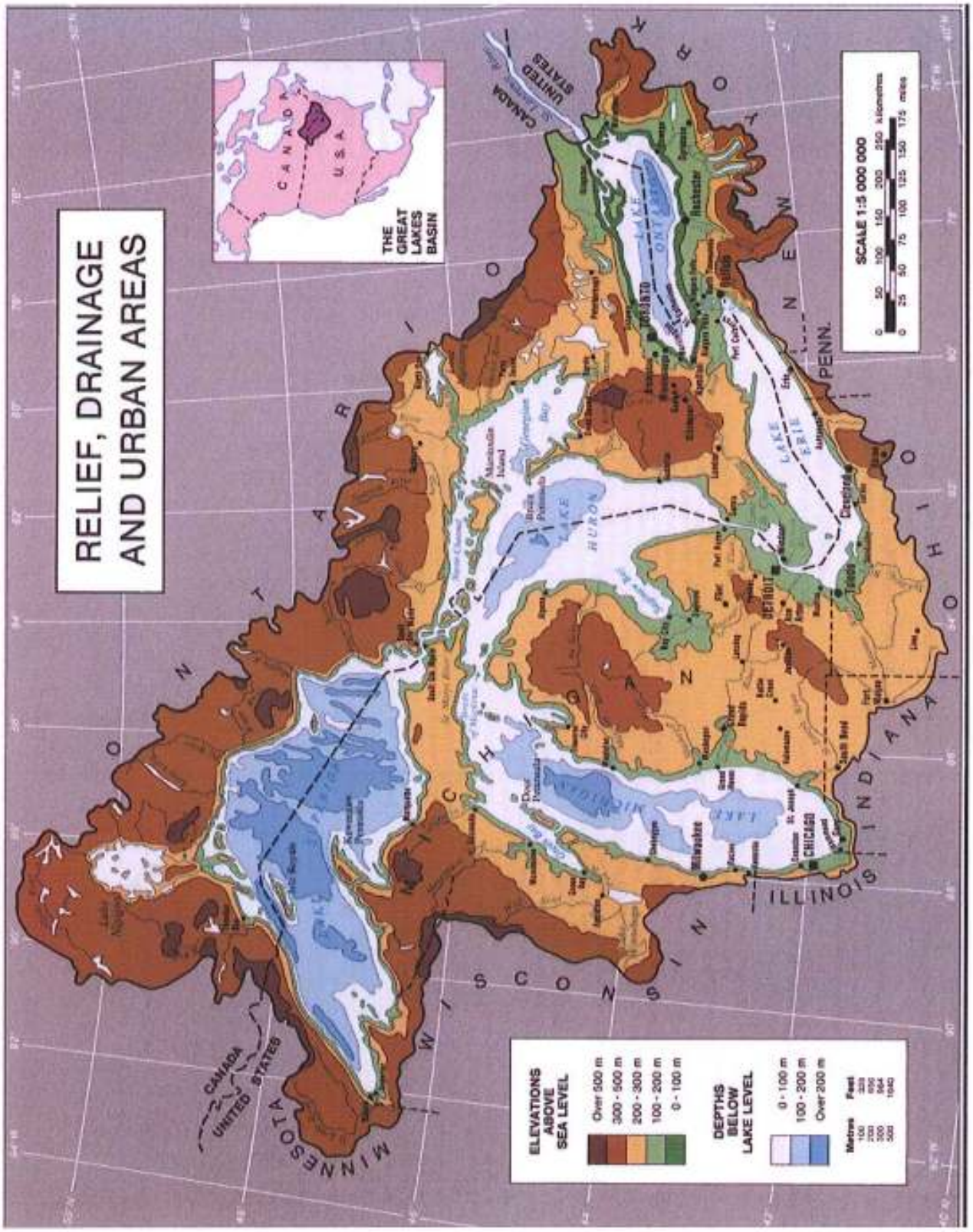
Ohio Division of Geological Survey, 2003 (revised 2004), Shaded bedrock-topography of Ohio (ver. 1.1): Ohio Division of Geological Survey Map BG-3, scale 1:500,000.

Pavey, R. R., Goldthwait, R. P., Brockman, C. S., Hull, D. N., Swinford, E. M., and Van Horn, R. G., 1999, Quaternary Geology of Ohio: Ohio Division of Geological Survey Map 2, scale 1:500,000.

Powers, D. M., Laine, J. F., and Pavey, R. R., 2002 (revised 2003), Shaded elevation map of Ohio: Ohio Division of Geological Survey MG-1, scale 1:500,000.

APPENDIX N

ELEVATION OF GREAT LAKES


RELIEF, DRAINAGE AND URBAN AREAS
THE GREAT LAKES BASIN
CANADA
U.S.A.
CANADA
UNITED STATES
ONTARIO
QUEBEC
MINNESOTA
WISCONSIN
MICHIGAN
ILLINOIS
INDIANA
OHIO
PENN.
NEW YORK
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
LAKE ONTARIO
TORONTO
Buffalo
Rochester
Toledo
Cleveland
Detroit
Milwaukee
CHICAGO
Duluth
Thunder Bay
Sault Ste. Marie
Bruce Peninsula
Manitoulin Island
Door Peninsula
SCALE 1:5 000 000
0 50 100 150 200 250 kilometres
0 25 50 75 100 125 150 175 miles
ELEVATIONS ABOVE SEA LEVEL
Over 500 m
300 - 500 m
200 - 300 m
100 - 200 m
0 - 100 m
DEPTHS BELOW LAKE LEVEL
0 - 100 m
100 - 200 m
Over 200 m
Metres Feet
100 328
200 656
300 984
500 1640

APPENDIX O

GEO FACTS #23

OHIO GEOLOGY

GEOFACTS No. 23

OHIO DEPARTMENT OF NATURAL RESOURCES • DIVISION OF GEOLOGICAL SURVEY

A BRIEF SUMMARY OF THE GEOLOGIC HISTORY OF OHIO

GEOLOGIC PERIOD (age, years ago[1])	SETTING	LIFE FORMS	ROCK TYPES	ECONOMIC PRODUCTS
Quaternary (1.6 million-present)	Two-thirds of Ohio was covered by mile-thick ice during glacial periods.	many large mammals such as mastodons, mammoths, giant beavers, and ground sloths, as well as modern plants and animals, including humans	glacial till, clay, silt, sand, gravel; form the surface sediments in northern and western Ohio	common clay products (clay); material for road construction and cement (sand and gravel) [Sand and gravel are also important aquifers.]
Mesozoic & Tertiary (248-1.6 million)	Ohio was above sea level and weathering erosion, and nondeposition prevailed.	no known record, but dinosaurs probably roamed Ohio during the Mesozoic		
Permian (286-248 million)	In early Permian time, southeastern Ohio was a coastal-plain swamp. Ohio lay about 5° north of the Equator. The swamp eventually was filled by influx of deltaic sand and mud. Later Permian time was characterized by uplift and erosion.	sparse freshwater fossils such as snails, clams, fishes; marine fossils rare; sparse land fossils include plants, amphibians, reptiles	sandstone, shale, freshwater limestone, coal; form the surface rocks in southeasternmost Ohio	crushed stone (limestone); electric power (coal)
Pennsylvanian (325-286 million)	Ohio in Pennsylvanian time was a relatively flat coastal-plain swamp in equatorial latitudes. Fluctuations in sea level resulted in alternating terrestrial, freshwater, and marine deposits.	land plants abundant; terrestrial and freshwater life included amphibians, reptiles, freshwater clams; marine life included crinoids, snails, cephalopods, brachiopods, fishes; trilobites rare	sandstone, conglomerate, shale, clay, limestone, coal, flint, ironstone; form the surface rocks in eastern Ohio	building stone, crushed stone for construction and industrial uses such as glass manufacturing, oil and gas (sandstone); crushed stone for construction and cement (limestone); pottery and common clay products (shale and clay); electric power (coal) [In the 1800's Ohio was a major iron-producing state.]
Mississippian (360-325 million)	In latest Devonian and early Mississippian time, dark organic muds gave way to fluvial and deltaic silts and sands. Ohio lay in equatorial latitudes. In late Mississippian time, a shallow sea deposited limy sediments. During latest Mississippian time the seas retreated, leaving a sparse rock record.	brachiopods, clams, crinoids, fishes; land plants increasingly abundant	sandstone, siltstone, conglomerate, shale, limestone; form the surface rocks in northwestern and east-central Ohio	building stone, crushed stone for construction and industrial uses, oil and gas (sandstone); crushed stone for construction and cement (limestone); common clay products (shale) [Ohio has been a major producer of building stone from the Mississippian Berea Sandstone for over 150 years.]
Devonian (410-360 million)	Most of Ohio was dry land during early Devonian time, although the sea still covered eastern Ohio. Ohio was in equatorial latitudes. In Middle Devonian time, warm, shallow seas deposited limy sediments. Layers of muddy sediments and some volcanic ash in late Middle Devonian time signaled renewed volcanic activity and mountain building east of Ohio. In late Devonian time, the Ohio sea became stagnant; circulation was poor, and the water was generally anoxic (lacking oxygen). Thick layers of black, organic-rich, uranium-bearing mud were deposited in these "stinking seas."	coral reefs, bryozoans, brachiopods, trilobites, cephalopods, clams, crinoids, ostracodes; first major appearance of sharks and bony fishes in Middle Devonian; true land plants appear	limestone, dolomite, shale, sandstone; form the surface rocks in northwestern Ohio, through central Ohio, and along the Lake Erie shore	crushed stone for construction and cement, aglime (limestone and dolomite); synfuels and natural gas (shale, sandstone, and limestone)

continued ⇨

GEOLOGIC PERIOD (age, years ago)	SETTING	LIFE FORMS	ROCK TYPES	ECONOMIC PRODUCTS
Silurian (440-410 million)	At the beginning of Silurian time, Ohio was dry land subject to erosion. Then warm, shallow seas returned. Ohio lay 20° south of the Equator. Middle Silurian seas were deeper and covered Ohio; reef environments were common. Late Silurian seas were shallower and formed evaporite (salt-bearing) basins in northern Ohio.	coral reefs abundant, also echinoderms, clams, brachiopods, cephalopods	limestone, dolomite, shale, gypsum; form the surface rocks in western Ohio; salt and sandstone (eastern Ohio) present in the subsurface	crushed stone for construction and cement, aglime, oil and gas (limestone, dolomite, and sandstone); road salt (salt); wallboard (gypsum)
Ordovician (505-440 million)	A warm, shallow sea (deeper in eastern Ohio) similar to the Bahamas covered Ohio, which lay 20° south of the Equator. The western part of Ohio, at times, emerged as low muddy islands. Limy sediments were dominant. Volcanic activity and mountain building to the east of Ohio produced periodic layers of ash over the entire state and muddy deltaic sediments in eastern Ohio. The sea deepened in later Ordovician time, covering all of the state. At the close of Ordovician time, continental glaciation in the southern hemisphere lowered sea level and the seas retreated.	bryozoans abundant, also brachiopods, cephalopods, trilobites, horn corals, snails, clams, echinoderms, graptolites	limestone, shale; form the surface rocks in southwestern Ohio; dolomite in subsurface	crushed stone (limestone); oil and gas (limestone, shale) [In 1884 the first giant U.S. oil field was discovered in Ordovician rocks in northwestern Ohio.] [Ohio is world famous for its fossiliferous Ordovician rocks in the Cincinnati area.] [Limestone in the Cincinnati area formerly was a source of building stone.]
Cambrian (570-505 million)	Marine seas gradually flooded the Precambrian land surface and covered Ohio by late Cambrian time, initially depositing sands, then silts, muds, and limy muds. Ohio lay 10° south of the Equator. Toward the end of Cambrian time, limy sediments accumulated in a shallow marine sea in an arid climate.	marine life abundant, but few fossils known from Ohio because knowledge is limited to core samples; trilobites reached their peak diversity in the late Cambrian	sandstone, shale, dolomite; present in subsurface only	oil and gas (sandstone, dolomite)
Precambrian (4.6 billion-544 million)	Between 1.4 and 990 million years ago, volcanic activity, crustal rifting, and filling of basins formed by rifting took place. Between 990 and 880 million years ago, a mountain range formed in eastern Ohio. Between 880 and 544 million years ago, these mountains were eroded, reducing the landscape to a gently rolling surface.	none known from Ohio; algae and lower invertebrates found in areas other than Ohio	igneous, metamorphic, and metasedimentary rocks; present only at great depths—2,500 to 13,000 feet beneath the surface	no current production

[1]Time assignments are based on U. S. Geological Survey.

The Division of Geological Survey GeoFacts Series is available on the World Wide Web: http://www.ohiodnr.com/geosurvey/

• This GeoFacts compiled by staff of Division of Geological Survey • Revised July 2001 •

Ted Strickland, Governor Sean D. Logan, Director Lawrence H. Wickstrom, Chief

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APPENDIX P

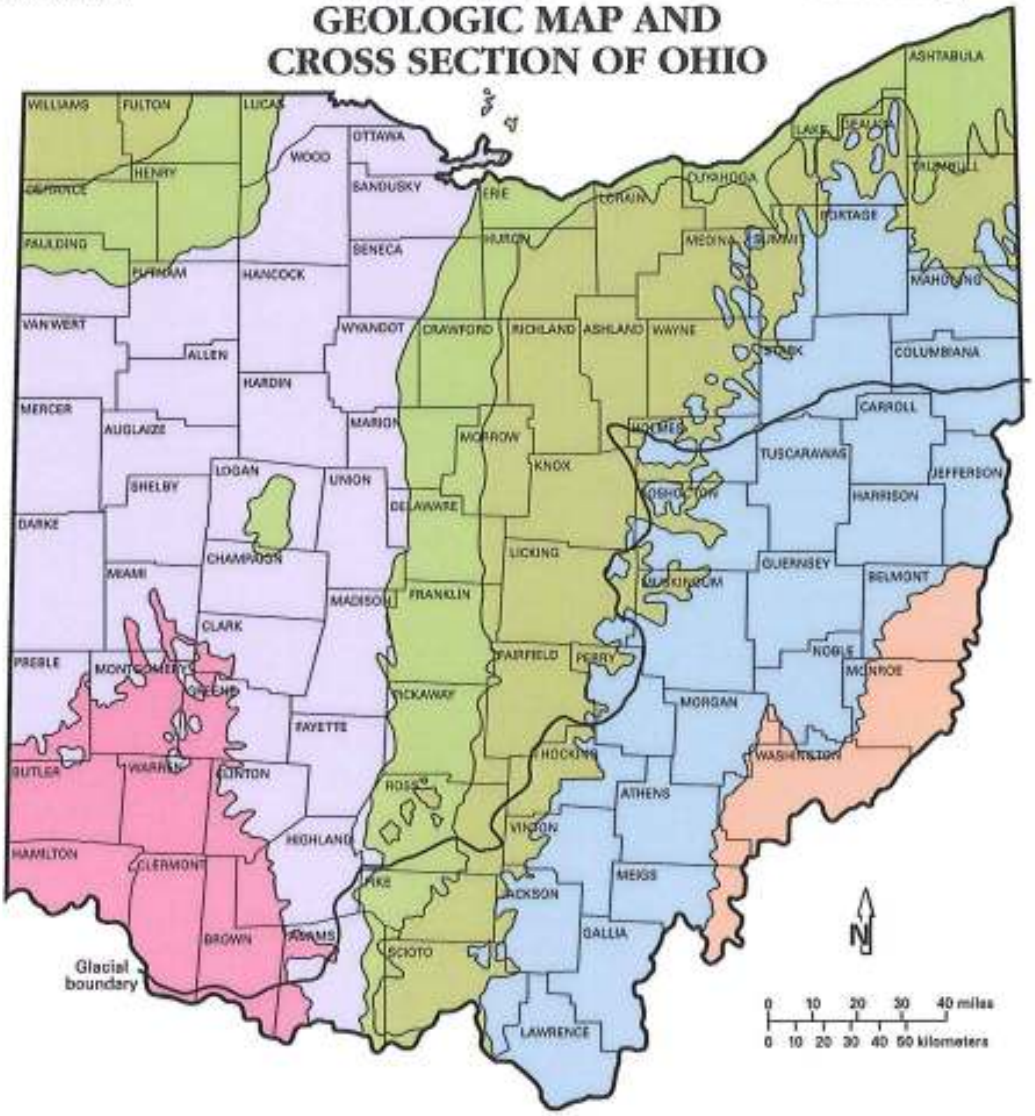
GEOLOGIC MAP

STATE OF OHIO
Bob Taft, Governor

DEPARTMENT OF NATURAL RESOURCES
Samuel W. Speck, Director

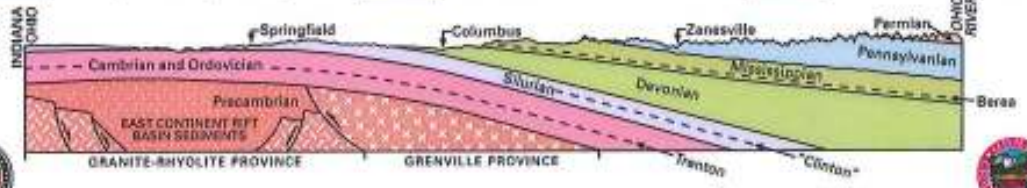
DIVISION OF GEOLOGICAL SURVEY
Thomas M. Berg, Chief

GEOLOGIC MAP AND CROSS SECTION OF OHIO



GEOLOGIC SYSTEM (million years before present)

Permian (286-245)	Mississippian (360-320)	Silurian (438-408)
Pennsylvanian (320-286)	Devonian (408-360)	Ordovician (505-438)



APPENDIX Q

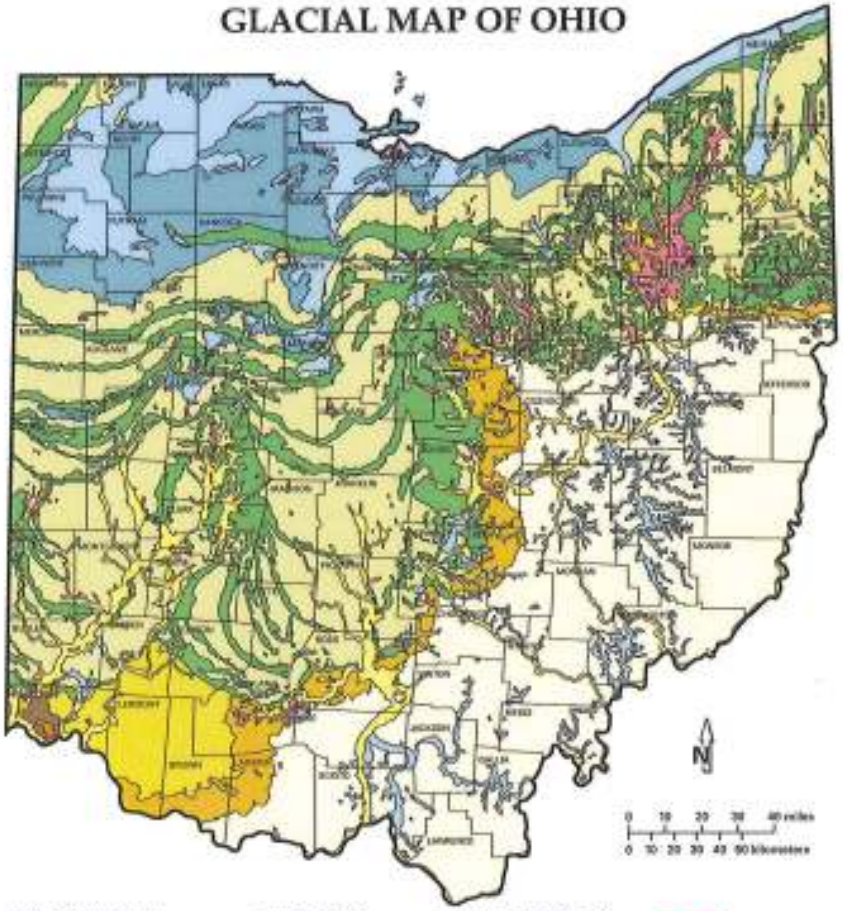
GLACIAL MAP OF OHIO

STATE OF OHIO
Bob Taft, Governor

DEPARTMENT OF NATURAL RESOURCES
Samuel W. Speck, Director

DIVISION OF GEOLOGICAL SURVEY
Thomas M. Berg, Chief

GLACIAL MAP OF OHIO



WISCONSINAN (14,000 to 24,000 years old)
- Ground moraine
- Wave-planed ground moraine
- End moraine

ILLINOIAN (130,000 to 300,000 years old)
- Ground moraine
- Dissected ground moraine
- Hummocky moraine

PRE-ILLINOIAN (older than 300,000 years)
- Ground moraine
- Dissected ground moraine

- Kames and eskers
- Outwash
- Lake deposits
- Peat
- Colluvium

APPENDIX R

PORT CLINTON SEDIMENT

Space photography of sediments in Portage River reaching Lake Erie at Port Clinton, OH.

APPENDIX S

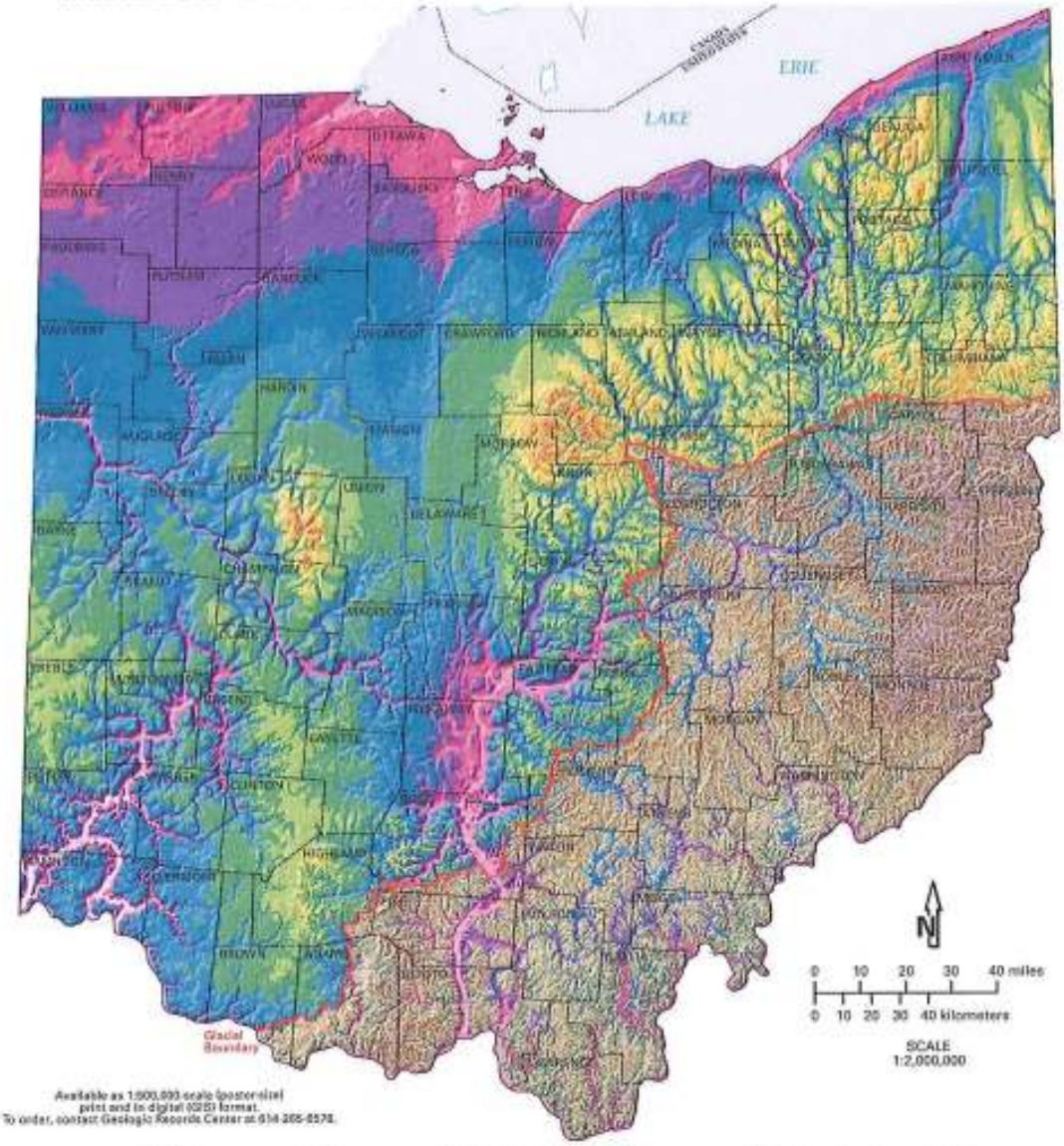
BEDROCK TOPOGRAPHY

STATE OF OHIO
Bob Taft, Governor

DEPARTMENT OF NATURAL RESOURCES
Samuel W. Speck, Director

DIVISION OF GEOLOGICAL SURVEY
Thomas M. Berg, Chief

SHADED BEDROCK-TOPOGRAPHY MAP OF OHIO



Available as 1:500,000 scale (poster-size) print and in digital (GIS) format.
To order, contact Geologic Records Center at 614-265-6576.

Bedrock-topography	Elevation	Land surface
	1401-1500	
	1301-1400	
	1201-1300	
	1101-1200	
	1001-1100	
	901-1000	
	801-900	
	701-800	
	601-700	
	501-600	
	401-500	
	301-400	

Elevation in feet above sea level

SHADED BEDROCK-TOPOGRAPHY MAP OF OHIO

The shaded bedrock-topography map of Ohio depicts the configuration and elevation of the bedrock surface. In southeastern Ohio, the bedrock surface coincides with present-day land-surface topography and is depicted by earth-tone hues to represent elevation intervals. In glaciated western and northern Ohio, the bedrock surface is buried under mainly glacial sediments that can be several-hundred-feet thick. The land surface in this region was smoothed by glaciation (figure 1) and masks a complexly dissected, underlying bedrock surface. This dissected bedrock surface is the result of erosion before, during, and after glaciation. Spectral hues depict elevation intervals on the buried-bedrock surface and show the bedrock surface as if the overlying glacial sediment were removed.

Prior to and during glaciation, the north-flowing Teays River system dominated surface-water drainage patterns in western and southern Ohio (figure 2). Water flow direction in the main Teays valley was north from Wheelersburg (Scioto County) to Circleville (Pickaway County) and then northwest to Mercer County where the Teays Valley exited the state. Remnants of the Teays Valley are distinct on the present land surface in southern Ohio and form a continuous valley on the buried-bedrock surface across western Ohio. Modern rivers and streams still occupy portions of this valley system. Water flow in the Teays River system was disrupted by early glaciations as southward-advancing glaciers blocked outlets of the north-flowing river system. Drainageways, both large and small, were abandoned or filled with sediment as ice advanced and retreated.

In northwestern Ohio, the generally smooth buried-bedrock surface is the result of repeated scouring by glacial ice advancing westward out of the Lake Erie basin. Another distinctly scoured bedrock surface is in the Grand River Lobe (figure 2) in northeastern Ohio where smooth north-south trending valleys mirror ice-flow direction. South of the scour-dominated surface of northern Ohio, the bedrock surface has been sculpted by water to create a distinct drainage pattern (figure 2). Large volumes of glacial meltwater eroded the bedrock surface, widening and deepening existing valleys of the Teays system and creating new valleys. Some modern rivers and creeks flow in unusually wide valleys; evidence that far greater volumes of water generated from melting glaciers once flowed in these valleys. Flow direction in other valleys has been reversed as glacial ice or glacial sediments blocked formerly northward and westward flowing streams.

Southeastern Ohio is unglaciated and devoid of ice-deposited sediment (glacial till). However, many river valleys in southeast Ohio did carry glacial meltwater away from the ice front and toward the Ohio River. In the process, many of these valleys were at times made deeper by the erosive force of fast-flowing meltwater streams, and at other times partially filled with sediment. Some valleys in unglaciated Ohio contain thick deposits of clay and silt that accumulated on the bottoms of lakes that formed when glacial ice blocked the flow of rivers or when rapidly accumulating meltwater sediments blocked the mouths of rivers.

This map is one of the results of a 7-year effort by the ODNR, Division of Geological Survey to map the bedrock geology of Ohio. Bedrock-topography maps are essential to producing accurate bedrock-geology maps of glaciated Ohio and of partially buried valleys beyond the glacial limit. Bedrock-topography maps were created for all 788 7.5-minute topographic quadrangles in the state and are available from the Division's Geologic Records Center. Some pre-existing county bedrock-topography maps (1:62,500 scale) and data were photographically enlarged to 1:24,000 scale, revised, and utilized in the compilation of 1:24,000-scale, bedrock-topography maps. Data concentration and contour intervals on the original maps vary widely across the state in response to changing geologic and topographic conditions. Data consists mainly of water-well logs on file at the ODNR, Division of Water, supplemented by outcrop data, Ohio Department of Transportation bridge-boring data, and oil-and-gas-well data.

Elevation contours and over 138,000 data points from the 788 bedrock-topography maps were digitized and compiled for the glaciated portions of the state and for the major valleys beyond the glacial boundary containing significant accumulations of sediment deposited during and after glaciation. The bedrock-topography contours were digitally converted in the ARC GIS environment into a continuous grid model (60 meter grid spacing). This surface was shaded from the northwest slightly above the horizon to produce the appearance of a three-dimensional surface.

The land surface represents the topography of the bedrock surface in southeastern Ohio (excluding valleys beyond the glacial boundary) and in some glaciated areas near the glacial limit where meltwater sediments are thin or absent. Land-surface topography is based largely on data derived from the U.S. Geological Survey's National Elevation Dataset (30 meter grid spacing).

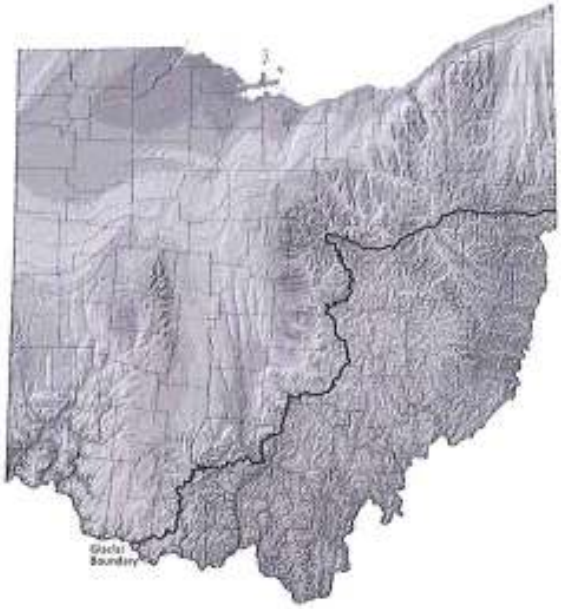


FIGURE 1.—Shaded elevation map of Ohio with the glacial boundary. Note the smooth landscape of glaciated northern and western Ohio compared to the high-relief landscape of unglaciated southeastern Ohio.

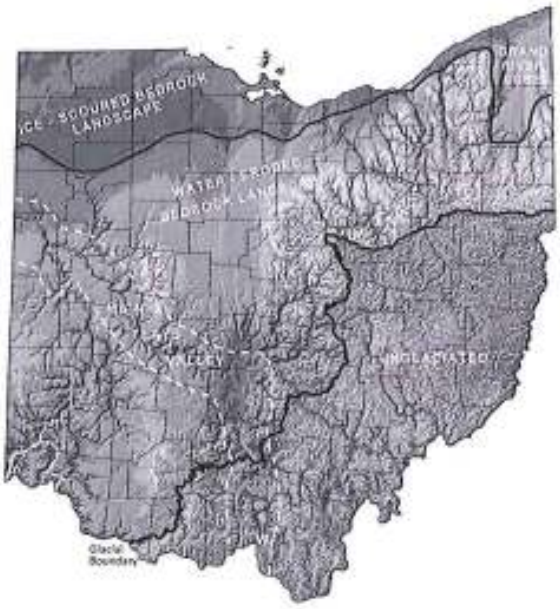


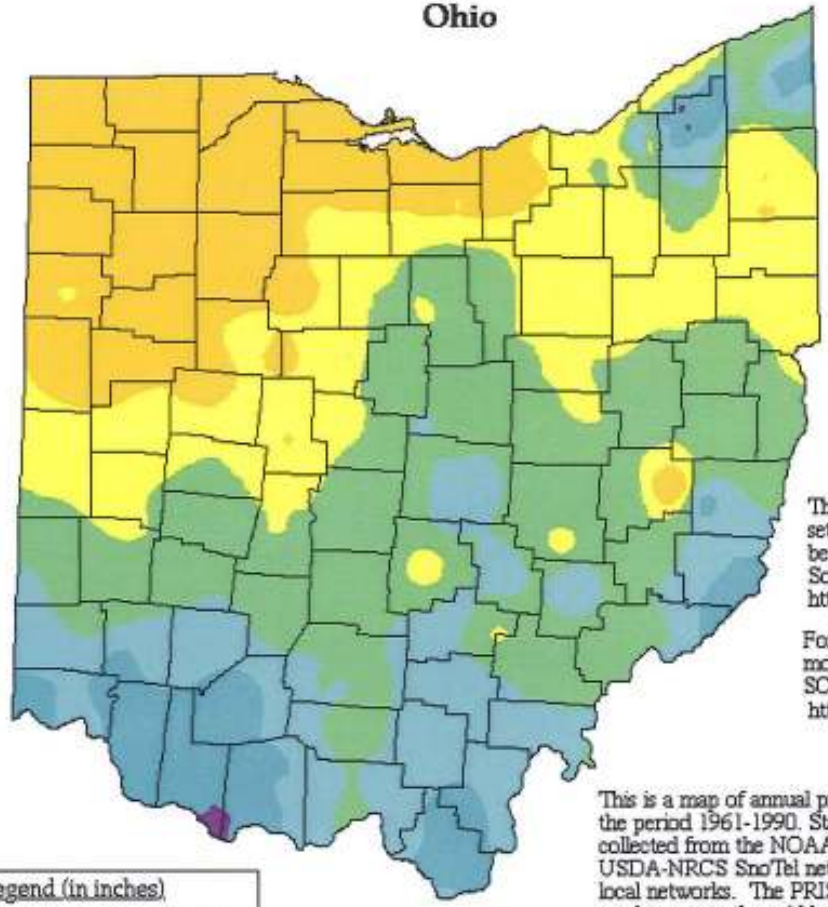
FIGURE 2.—Bedrock-topography map of Ohio showing the extent of the main Teays valley, the unglaciated portion of the state, and the ice-scoured and water-eroded portions of glaciated Ohio (C = Circleville, W = Wheelersburg).

APPENDIX T

ANNUAL PRECIPITATION OF OHIO

Average Annual Precipitation

Ohio



The latest PRISM digital data sets created by the SCAS can be obtained from the Climate Source at http://www.climatesource.com

For information on the PRISM modeling system, visit the SCAS web site at http://www.ocs.orst.edu/prism

This is a map of annual precipitation averaged over the period 1961-1990. Station observations were collected from the NOAA Cooperative and USDA-NRCS SnoTel networks, plus other state and local networks. The PRISM modeling system was used to create the gridded estimates from which this map was made. The size of each grid pixel is approximately 4x4 km. Support was provided by the NRCS Water and Climate Center.

Legend (in inches)

- Under 36
- 36 to 38
- 38 to 40
- 40 to 42
- 42 to 44
- Above 44

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APPENDIX U

PHYSIOGRAPHIC REGIONS OF OHIO

STATE OF OHIO
Ted Strickland, Governor

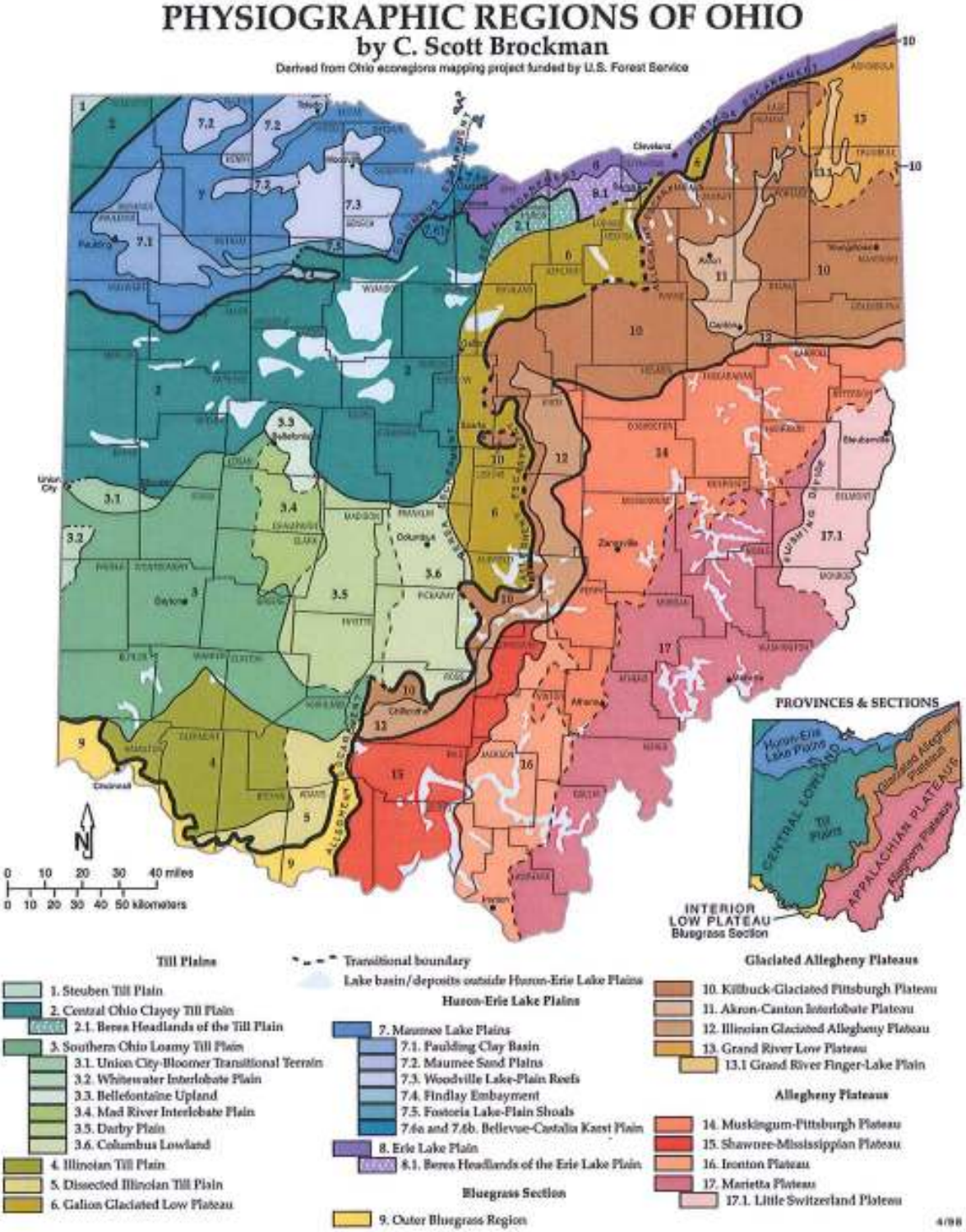
DEPARTMENT OF NATURAL RESOURCES
Sean D. Logan, Director

DIVISION OF GEOLOGICAL SURVEY
Lawrence H. Wickstrom, Chief

PHYSIOGRAPHIC REGIONS OF OHIO

by C. Scott Brockman

Derived from Ohio ecoregions mapping project funded by U.S. Forest Service



PHYSIOGRAPHIC REGIONS OF OHIO

Major Divisions	Provinces	Sections *	DISTINGUISHING CHARACTERISTICS OF REGIONS & DISTRICTS	GEOLOGY	BOUNDARIES
INTERIOR PLAINS	CENTRAL LOWLAND	Till Plains	**1. Steuben Till Plain.** Hummocky terrain with rolling hills, interspersed flats and closed depressions; wetlands, few streams, deranged drainage; only a small part of the region is in Ohio; elevation 950'-1100', moderately low relief (60')	Wisconsinan-age (latest Ice-Age) loamy till from a northern source (Saginaw glacial lobe) over Mississippian-age Coldwater Shale	Southeast: edge of Wabash Moraine
			2. Central Ohio Clayey Till Plain. Surface of clayey till; well-defined moraines with intervening flat-lying ground moraine and intermorainal lake basins; no boulder belts; about a dozen silt-, clay- and till-filled lake basins range in area from a few to 200 square miles; few large streams; limited sand & gravel outwash; elevation 700'-1150', moderate relief (160')	Clayey, high-lime Wisconsinan-age till from a northeastern source (Erie glacial lobe) and lacustrine materials over Lower Paleozoic-age carbonate rocks and, in the east, shales; loess thin to absent	North: Lake Plain, northeast: limit of Berea Sandstone, east: Berea Escarpment; south: Powell and Union City/Bloomer Moraines; northern segment boundaries: Wabash Moraine and lake plain
			2.1. Berea Headlands of the Till Plain. Gently rolling to flat terrain of thin drift descending to Lake Erie; punctuated by more than 20 streamlined "whalebacks" of Berea Sandstone, 0.5 to 2.5 miles long, 30'-60' high, somewhat poorly drained; elevation 800'-1000', low relief (20')	Thin, clayey, medium-lime Wisconsinan-age till over resistant Mississippian-age Berea Sandstone	South: limit of Berea Sandstone; elsewhere: Berea Escarpment and/or margin of highest Pleistocene lake
			3. Southern Ohio Loamy Till Plain. Surface of loamy till; end and recessional moraines, commonly associated with boulder belts, between relatively flat-lying ground moraine, cut by steep-valleyed large streams; stream valleys filled with outwash and alternate between broad floodplains and narrows; buried valleys common; elevation 530'-1150', moderate relief (200')	Loamy, high-lime Wisconsinan-age till, outwash, and loess over Lower Paleozoic-age carbonate rocks and, in the east, shales	East: Berea and Allegheny Escarpments; north: Powell and Union City/Bloomer Moraines; south: limit of Wisconsinan-age till
			3.1. Union City-Bloomer Transitional Terrain. Well-defined moraines with low-relief, hummocky ground moraine like the Central Ohio Clayey Till Plain to the north; loamy till with loess cap like Southern Ohio Loamy Till Plain to the south; elevation 920'-1075', moderately low relief (30')	Loamy, high-lime Wisconsinan-age till with thin loess cap over Silurian-age dolomites	North: Bloomer Moraine and limit of loamy till; south: Union City Moraine
			3.2. Whitewater Interlobate Plain. An upland between two converging glacial lobes with hummocky moraines, moraine complexes, kames, boulder belts, and broad outwash trains/plains; contains highest elevations in Indiana (1257') and in adjacent Ohio counties (1240'); elevation in Ohio 980'-1240', moderate relief (150')	Loamy, high-lime Wisconsinan-age till and sand and gravel outwash over resistant Silurian-age carbonate rocks (north) and less resistant Ordovician-age shales and limestones (south)	North: limit of Knightstown/Farmersville Moraines and kame fields; east: high, dissected hills draining to Whitewater River
			3.3. Bellefontaine Upland. Moderately high relief (250') dissected topography with moraine complexes, boulder belts, high-gradient major streams, caves and sinkholes; few glacial depressions/kettles compared to surrounding areas; elevation 1160'-1549', includes highest elevation in Ohio (Campbell Hill, 1549')	Loamy, high-lime Wisconsinan-age till over generally deeply buried Silurian- to Devonian-age carbonate rocks and Ohio Shale	North: areas with hilltops above 1200'; elsewhere: hilltops above about 1300'
			3.4. Mad River Interlobate Plain. Area between two major converging glacial lobes with extensive outwash, outwash terraces, and bordering moraines; springs and cool, ground-water-fed surface waters; elevation 800'-1350', moderate relief (200')	Loamy, high-lime Wisconsinan-age till and sand and gravel outwash over Silurian- to Devonian-age carbonate rocks and Ohio Shale	East and north: rear edge of Cable Moraine Complex; south: outwash to Clifton Gorge; west: western edge of Mad River Outwash
			3.5. Darby Plain. Moderately low relief (25'), broadly hummocky ground moraine with several broad, indistinct recessional moraines; between hummocks are broad, poorly drained swales which held wet prairies/meadows in pioneer days; few large streams; elevation 750'-1100'	Loamy, high-lime Wisconsinan-age till and sparse outwash over Silurian- and Devonian-age carbonate rocks and Ohio Shale in the southeast	South and west: front of Roseville and rear of Cable Moraines; north: Powell Moraine; east: increasing eastward slope (see 3.6)
			3.6. Columbus Lowland. Lowland surrounded in all directions by relative uplands, having a broad regional slope toward the Scioto Valley; many larger streams, elevation 600'-850' (950' near Powell Moraine), moderately low relief (25')	Loamy, high-lime (west) to medium-lime (east) Wisconsinan-age till and extensive outwash in Scioto Valley over deep Devonian- to Mississippian-age carbonate rocks, shales, and siltstones	North: Powell Moraine; east and south: Berea and/or Allegheny Escarpments; west: flatter and higher Darby Plain
			4. Illinoian Till Plain. Rolling ground moraine of older till generally lacking ice-constructional features such as moraines, kames, and eskers; many buried valleys; modern valleys alternating between broad floodplains and bedrock gorges; elevation 600'-1100', moderately low relief (50')	Silt-loam, high-lime, Illinoian-age till with loess cap; soils leached several feet; underlain by Ordovician- and Silurian-age carbonate rocks and calcareous shales	North: Wisconsinan glacial margin (Cuba and Hartwell Moraines); elsewhere: limit of common till-covered hillslopes
			5. Dissected Illinoian Till Plain. Hilly former till plain in which glacial deposits have been eroded from many valley sides; relatively high stream density; elevation 600'-1340', moderate relief (200')	Hilltops of high-lime Illinoian-age till with loess cap; slopes of bedrock- and till-derived colluvium and Ordovician- and Silurian-age carbonate rocks and calcareous shales	East: maximum glacial margin; elsewhere: limit of general absence of till on hillslopes
			6. Gallon Glaciated Low Plateau. Rolling upland transitional between the gently rolling Till Plain and the hilly Glaciated Allegheny Plateau; mantled with thin to thick drift; elevation 800'-1400', moderate relief (100')	Medium- to low-lime Wisconsinan-age till over Mississippian-age shales and sandstones	North: limit of Berea Sandstone; west: Berea Escarpment; south and east: Allegheny Escarpment
		Huron-Erie Lake Plains	**7. Maumee Lake Plains.** Flat-lying Ice-Age lake basin with beach ridges, bars, dunes, deltas, and clay flats; contained the former Black Swamp; slightly dissected by modern streams; elevation 570'-860', very low relief (5')	Pleistocene-age silt, clay, and wave-planed clayey till over Silurian- and Devonian-age carbonate rocks and shales	Northeast: Lake Erie; elsewhere: margin of highest Pleistocene lake
			7.1. Paulding Clay Basin. Nearly flat lacustrine plain; most clayey of all Lake Plain subregions; low-gradient, highly meandering streams; easily ponded soils; elevation 700'-725', extremely low relief (less than 5')	Pleistocene-age lacustrine clay over clay till and Silurian-age dolomites	Northeast: subdued ("drowned") remnant of Defiance Moraine; elsewhere: limit of lacustrine clay
			7.2. Maumee Sand Plains. Lacustrine plain mantled by sand; includes low dunes, inter-dunal pans, beach ridges, and sand sheets of glacial lakebores; well to poorly drained, elevation 600'-800', very low relief (10')	Late Wisconsinan-age sand over clay till and lacustrine deposits; Silurian- and Devonian-age carbonate rocks and shales buried deeply	Limit of sandy deposits and/or low dunes
			7.3. Woodville Lake-Plain Reefs. Very low relief (10') lacustrine plain with low dunes and lake-margin features, punctuated by more than 75 ancient bedrock reefs rising 10' to 40' above the level of the plain and ranging in area from 0.1 to 3.0 square miles, the oblong reefs are thinly draped with drift; elevation 600'-775'	Thin to absent Wisconsinan-age wave-planed clay till, lacustrine deposits, and sand over Silurian-age reefal Lockport Dolomite	Limit of thinly mantled Lockport Dolomite (Bowling Green Fault to the west and the Defiance Moraine to the south)
			7.4. Findlay Embayment. Very low relief (10'), broadly rolling lacustrine plain; embayment of ancestral Lake Erie in which relatively coarse lacustrine sediments collected; elevation 775'-800'	Silty to gravelly Wisconsinan-age lacustrine deposits and wave-planed clayey till over Silurian-age Lockport Dolomite	West: 775' beach ridge; north: Defiance Moraine; south: margin of highest Pleistocene lake level
			7.5. Fostoria Lake-Plain Shoals. Portion of the Defiance Moraine lightly eroded by shallow Lake Maumee with low north-south trending hillocks and shallow, closed depressions; many sandy areas; elevation 750'-825', low relief, decreasing westward (10'-15')	Silty to gravelly Wisconsinan-age lacustrine deposits and wave-planed clay till over deeply covered Silurian-age dolomite	South and east: unmodified Defiance Moraine; elsewhere: very low-relief lake plain
			7.6a and 7.6b. Bellevue-Castalia Karst Plain. Hummocky plain of rock knobs and numerous sinkholes, large solution features, and caves; large springs; thinly mantled by drift; region straddles both Lake Plain (7.6a) and Till Plain (7.6b); 7.6a has greatest relief of any Lake Plain region (25'); elevation 570'-825'	Columbus and Delaware Limestones overlain by thin clay till in 7.6b, and thin silty and sandy Wisconsinan-age lacustrine deposits and wave-planed clay till in 7.6a	Limit of thinly mantled Columbus and Delaware Limestones, which is marked in the west by the Columbus Escarpment
			8. Erie Lake Plain. Edge of very low-relief (10') Ice-Age lake basin separated from modern Lake Erie by shoreline cliffs; major streams in deep gorges; elevation 570'-800'	Pleistocene-age lacustrine sand, silt, clay, and wave-planed till over Devonian- and Mississippian-age shales and sandstones	North: Lake Erie; south: margin of highest Pleistocene lake
			8.1 Berea Headlands of the Erie Lake Plain. Portion of the Erie Lake Plain underlain by resistant Berea Sandstone; several large sandstone headlands jut into the Ice-Age lake basin, contains several streamlined "whalebacks" of Berea Sandstone, 0.5 to 2.0 miles long, 20'-35' high; poorly drained, elevation 670'-800', very low relief (10')	Thin lacustrine deposits over thin, wave-planed, clayey, medium-lime Wisconsinan age till; underlain by resistant Berea Sandstone	North: portion of Lake Plain underlain by soft shales; south: margin of highest Pleistocene lake
	INT. LOW PLATEAUS	Bluegrass Section	**9. Outer Bluegrass Region.** Moderately high relief (300') dissected plateau of carbonate rocks; in east, caves and other karst features relatively common; in west, thin, early drift caps narrow ridges; elevation 455'-1120'	Ordovician- and Silurian-age dolomites, limestones, and calcareous shales; thin pre-Wisconsinan drift on ridges in west; silt-loam colluvium	Eastern segment: maximum glacial margin and high eastern ridges capped by noncarbonate rocks; connected by Ohio River bluffs to western segment which is bounded by nondissected till plain
APPALACHIAN HIGHLANDS	APPALACHIAN PLATEAUS	Glaciated Allegheny (Southern New York) Plateaus	**10. Killbuck-Glaciated Pittsburgh Plateau.** Ridges and flat uplands generally above 1200', covered with thin drift and dissected by steep valleys; valley segments alternate between broad drift-filled and narrow rock-walled reaches; elevation 600'-1505', moderate relief (200')	Thin to thick Wisconsinan-age clay to loam till over Mississippian- and Pennsylvanian-age shales, sandstones, conglomerates and coals	West and north: resistant sandstones of the Allegheny and Portage Escarpments; south and east: Wisconsinan glacial margin
			11. Akron-Canton Interlobate Plateau. Hummocky area between two converging glacial lobes dominated by kames, kame terraces, eskers, kettles, kettle lakes, and bogs/fens; deranged drainage with many natural lakes; elevation 900'-1200', moderate relief (200')	Sandy Wisconsinan-age and older drift over Devonian- to Pennsylvanian-age sandstones, conglomerates and shales	Limit of common, sandy ice-contact features and deposits
			12. Illinoian Glaciated Allegheny Plateau. Dissected, rugged hills; loess and older drift on ridgetops, but absent on bedrock slopes; dissection similar to unglaciated regions of the Allegheny Plateau; elevation 600'-1400', moderate relief (200')	Colluvium and Illinoian-age till over Devonian- to Pennsylvanian-age shales, siltstones and sandstones	North and west: Wisconsinan glacial margin; south and east: Illinoian (maximum) glacial margin
			13. Grand River Low Plateau. Gently rolling ground and end moraine having thin to thick drift; poorly drained areas and wetlands relatively common; elevation 760'-1200', low relief (20') except near Grand River Valley (200')	Clayey, low-lime Wisconsinan-age till over deeply buried, soft Devonian-age shales and near-surface Mississippian-age sandstones and shales	North: Portage Escarpment; south and west: Defiance Moraine; southeast: increasing relief from proximity of buried Pennsylvanian-age sandstones
			13.1. Grand River Finger-Lake Plain. Very low relief (10') lake deposits in steep-sided troughs (200' relief) within the Grand River Low Plateau; cut by glacial and stream erosion; extensive wetlands; elevation 800'-900'	Surficial lacustrine clay and drift over deeply buried, soft Devonian-age shales	Margins of steeply sloping troughs containing the Grand River and parts of Rock and Mosquito Creeks
		Allegheny (Kanawha) Plateaus	**14. Muskingum-Pittsburgh Plateau.** Moderately high to high relief (300'-600') dissected plateau having broad major valleys that contain outwash terraces, and tributaries with lacustrine terraces; medium-grained bedrock sequences coarser than those in Marietta Plateau (17) but finer than those in Ironton Plateau (16); remnants of ancient Teays-age drainage system uncommon; elevation 650'-1400'	Mississippian and Pennsylvanian-age siltstones, shales, sandstones and economically important coals and claystones; Wisconsinan-age sand, gravel, and lacustrine silt; silt-loam colluvium	North and west: maximum glacial margin; southeast: transition to finer grained bedrock; southwest: transition to coarser grained bedrock
			15. Shawnee-Mississippian Plateau. High relief (400'-800'), highly dissected plateau of coarse and fine grained rock sequences; most rugged area in Ohio; remnants of ancient lacustrine clay-filled Teays drainage system are extensive in lowlands, absent in uplands; elevation 490'-1340'	Devonian- and Mississippian-age shales, siltstones, and locally thick sandstones; Pleistocene-age sandy outwash in Scioto River; Teays-age Minford Clay; silt-loam and channery colluvium	North: Maximum glacial margin; west: carbonate bedrock; east: limit of Mississippian-age bedrock
			16. Ironton Plateau. Moderately high relief (300') dissected plateau; coarser grained coal-bearing rock sequences more common than in other regions of the Allegheny Plateau; common lacustrine clay-filled Teays Valley remnants; elevation 515'-1060'	Pennsylvanian-age (Pottsville, Allegheny and Conemaugh Groups) cycles of sandstones, siltstones, shales and economically important coals; Pleistocene (Teays)-age Minford Clay; silt-loam and channery colluvium	West: limit of common Pennsylvanian-age bedrock; north and east: gradation to finer rock sequences
			17. Marietta Plateau. Dissected, high-relief (generally 350', to 600' near Ohio River) plateau; mostly fine-grained rocks; red shales and red soils relatively common; landslides common; remnants of ancient lacustrine clay-filled Teays drainage system common; elevation 515'-1400'	Pennsylvanian-age Upper Conemaugh Group through Permian-age Dunkard Group cyclic sequences of red and gray shales, and siltstones, sandstones, limestones and coals; Pleistocene (Teays)-age Minford Clay; red and brown silty-clay loam colluvium; landslide deposits	North and west: transition to medium-grained Lower Conemaugh rocks; east: Flushing Divide
			17.1. Little Switzerland Plateau. Highly dissected, high-relief (generally 450', to 750' along Ohio River) plateau; mostly fine-grained rocks; red shales and red soils relatively common; landslides common; high-gradient shale-bottomed streams subject to flash flooding; no remnants of ancient Teays drainage system; elevation 540'-1400'	Similar to Marietta Plateau but lacking Pleistocene (Teays)-age Minford Clay	North: transition to medium-grained rocks; west and south: Flushing Divide; east: Ohio River

* Section names modified from Fenneman (1938, 1946).

APPENDIX V

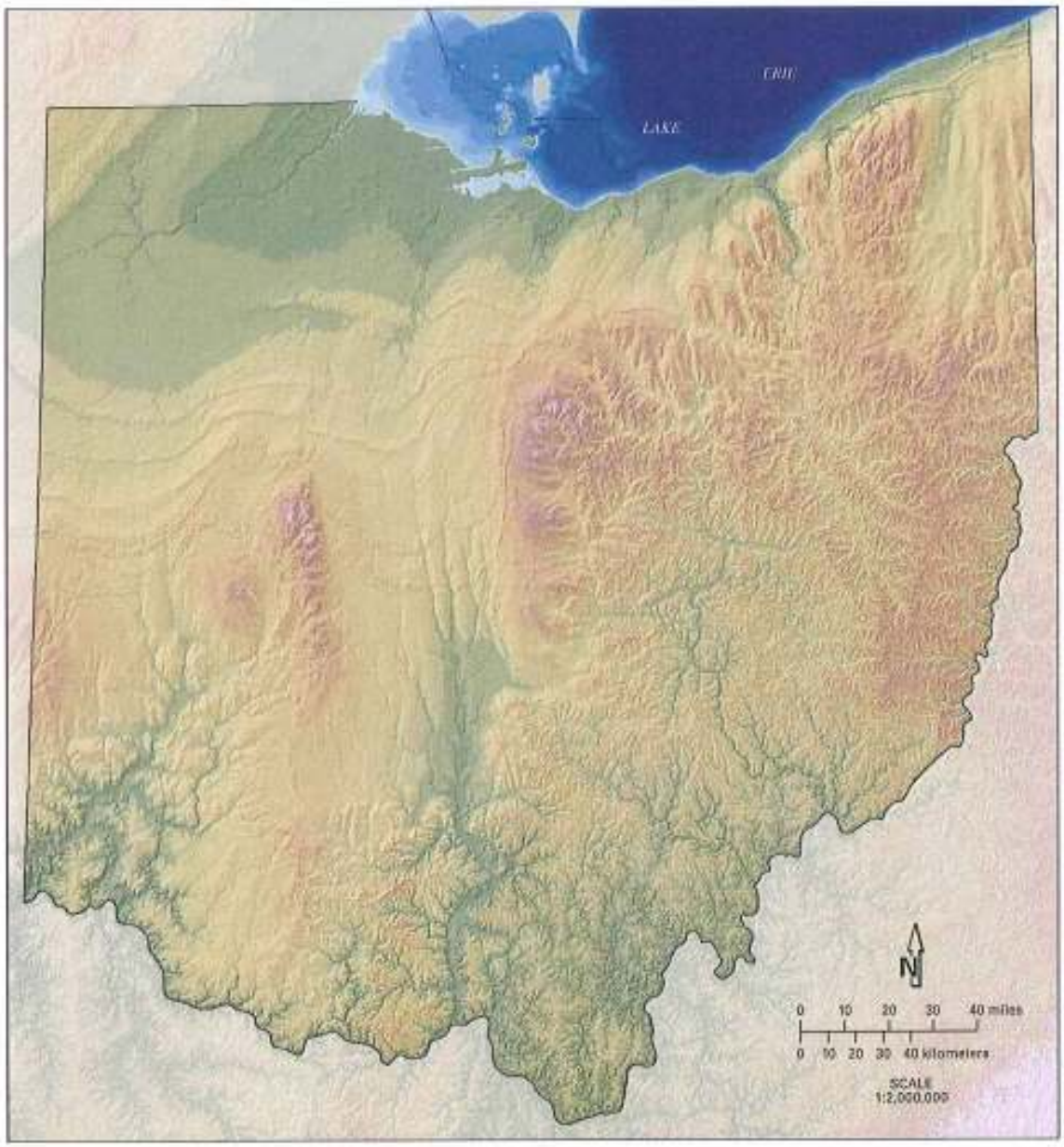
ELEVATION MAP OF OHIO

STATE OF OHIO
Bob Taft, Governor

DEPARTMENT OF NATURAL RESOURCES
Samuel W. Speck, Director

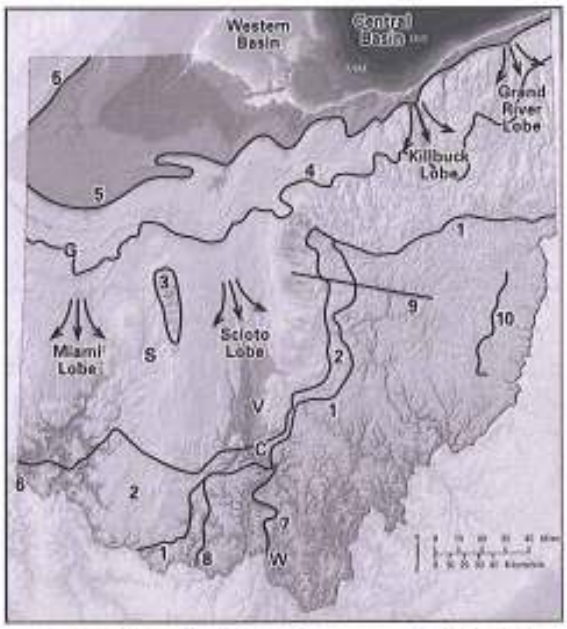
DIVISION OF GEOLOGICAL SURVEY
Thomas M. Berg, Chief

SHADED ELEVATION MAP OF OHIO



SHADED ELEVATION MAP

This map depicts the topographic relief of Ohio's landscape using color to represent elevation intervals. The colorized topography has been digitally shaded from the northwest slightly above the horizon to give the appearance of a three-dimensional surface. The map is based on elevation data from the U.S. Geological Survey's National Elevation Dataset; the grid spacing for the data is 30 meters. Lake Erie water depths are derived from National Oceanic and Atmospheric Administration data. This digitally derived map shows details of Ohio's topography unlike any map of the past. Some of Ohio's more striking topographic features are outlined on the inset map below and described in the following paragraphs.



Direction of ice flow in glacial lobes

C = Chillicothe
G = Grand Lake St. Marys
S = Springfield
V = Circleville
W = Wheelersburg

1 *Glacial boundary*—Continental ice sheets several thousand feet thick sculpted about two-thirds of Ohio's landscape and, upon melting, deposited material formerly incorporated in or beneath the ice. This boundary marks the southernmost known extent of glacial ice in Ohio. Topography in the glaciated portion of Ohio is smooth compared to the highly dissected, unglaciated part of Ohio. The glacial boundary in eastern Ohio is further north than the boundary in western Ohio because the erosion-resistant bedrock hills in eastern Ohio impeded southward glacial advances. The glacial boundary in central and southwestern Ohio typically represents the maximum advance of Illinoian-age (130,000-300,000 years ago) glaciers. The east-west-oriented boundary in northeastern Ohio represents the maximum advance of Wisconsinan-age (14,000-24,000 years ago) glaciers.

2 *Illinoian till areas*—Thin till (an unsorted mixture of glacially deposited clay, silt, sand, and cobbles) of Illinoian age is at the surface in a 10- to 40-mile-wide belt between the Illinoian and Wisconsinan maximum advances. Terrain in this belt is typically transitional between the generally flat Wisconsinan till plains to the north and west and the dissected, unglaciated bedrock to the southeast. The surface deposits in this belt are characterized by loess (wind-blown silt) over thin till on ridge tops and thick colluvium (weathered bedrock) on slopes.

3 *Ohio's highest elevation*—An upland area known as the Bellefontaine Outlier covers portions of Champaign, Logan, and Union Counties in west-central Ohio. The outlier is an erosional remnant of Devonian-age limestone, dolomite, and shale that lies 25 miles west of the main outcrop belt of Devonian-age rock in Franklin and Delaware Counties in central Ohio. The outlier is mantled by up to 160 feet of till, which adds to the outlier's height. Campbell Hill, the highest elevation in Ohio at 1,549 feet above sea level, is on the outlier. The higher, more resistant bedrock of the outlier impeded the southward-advancing glaciers, causing them to split into two lobes, the Miami Lobe on the west and the Scioto Lobe on the east. Ridges of thick accumulations of glacial material, called moraines, drape around the outlier and are distinct features on the map. Some moraines in Ohio are more than 200 miles long. Two other glacial lobes, the Killbuck and the Grand River Lobes, are present in the northern and northeastern portions of the state.

4 *Eastern Continental Divide*—A continental drainage divide extends east-west across northern Ohio. Surface water north of this divide flows northward to Lake Erie, eventually over Niagara Falls into Lake Ontario, and into the Atlantic Ocean. Surface water south of the divide flows south to the Ohio River, the Mississippi River, and eventually into the Gulf of Mexico. The divide follows the crests of glacial moraines in western Ohio. In north-central and northeastern Ohio, the divide follows bedrock-controlled hills and glacial valleys containing thick glacial-lake deposits.

5 *Ancient Lake Maumee shoreline*—About 14,000 years ago, the last continental ice sheet retreated northward across Ohio. The St. Lawrence Seaway was blocked by glacial ice, and glacial meltwater created lakes in front of the ice. A large lake, called Lake Maumee, formed in the general position of Lake Erie but extended over a much larger portion of northwestern Ohio. Ancient Lake Maumee water levels were about 230 feet higher than modern Lake Erie, and drained westward into the Wabash River system. The shoreline of ancient Lake Maumee had a series of sandy beaches and beach scarps, much like portions of Lake Erie today. The ancient sandy beaches are visible on the map as long, thin ridges on the surrounding flat lake terrain. Other beach ridges formed as the water level receded in stages before rising to its current level of approximately 572 feet above sea level. Lake Erie is the shallowest of the Great Lakes and has three basins: the western (averages 30 feet in depth), central (averages 60 feet in depth), and eastern (not shown on map; averages 80 feet in depth; maximum depth is about 212 feet).

6 *Ohio's lowest elevation*—The lowest surface elevation in Ohio is about 455 feet above sea level and is located where the Ohio River exits the state at the extreme southwestern corner of Ohio.

7 *Teays River valley*—The ancient Teays River flowed across Ohio before and during the earliest Ice Age. A north-south-trending remnant of the Teays River valley in south-central Ohio is distinctly visible on this map. From its headwaters in North Carolina, the Teays River flowed northwest across Virginia and West Virginia and entered Ohio in the area of present-day Wheelersburg. The Teays River cut a wide, curving valley as it flowed northward through southern Ohio. This valley, partially filled with clay, silt and sand, contains only a small stream today and remains clearly visible on the map as far as Chillicothe. North of Chillicothe, the valley is buried beneath hundreds of feet of glacial sediment but can be traced using well data to Circleville; the buried valley then turns northwestward, passing beneath Springfield and Grand Lake St. Marys and into eastern Indiana. In parts of western Ohio, the valley lies beneath 700 feet of glacially derived material. The valley commonly is about 200 to 300 feet deep and has steep to near-vertical walls.

8 *Allegheny Escarpment*—Beyond the glacial boundary, the Allegheny Escarpment of southern Ohio marks a distinct change in topography. The land surface changes abruptly from the flatter, lower terrain in the west, which is underlain by soft carbonate rocks, to the higher, steeper terrain in the east, which is underlain by shale and sandstone. To the north, the escarpment was affected by glaciation, making it a less distinct topographic feature. The Allegheny Escarpment corresponds to a slight increase in the dip (tilt) of the rock layers as they descend eastward into the Appalachian Basin.

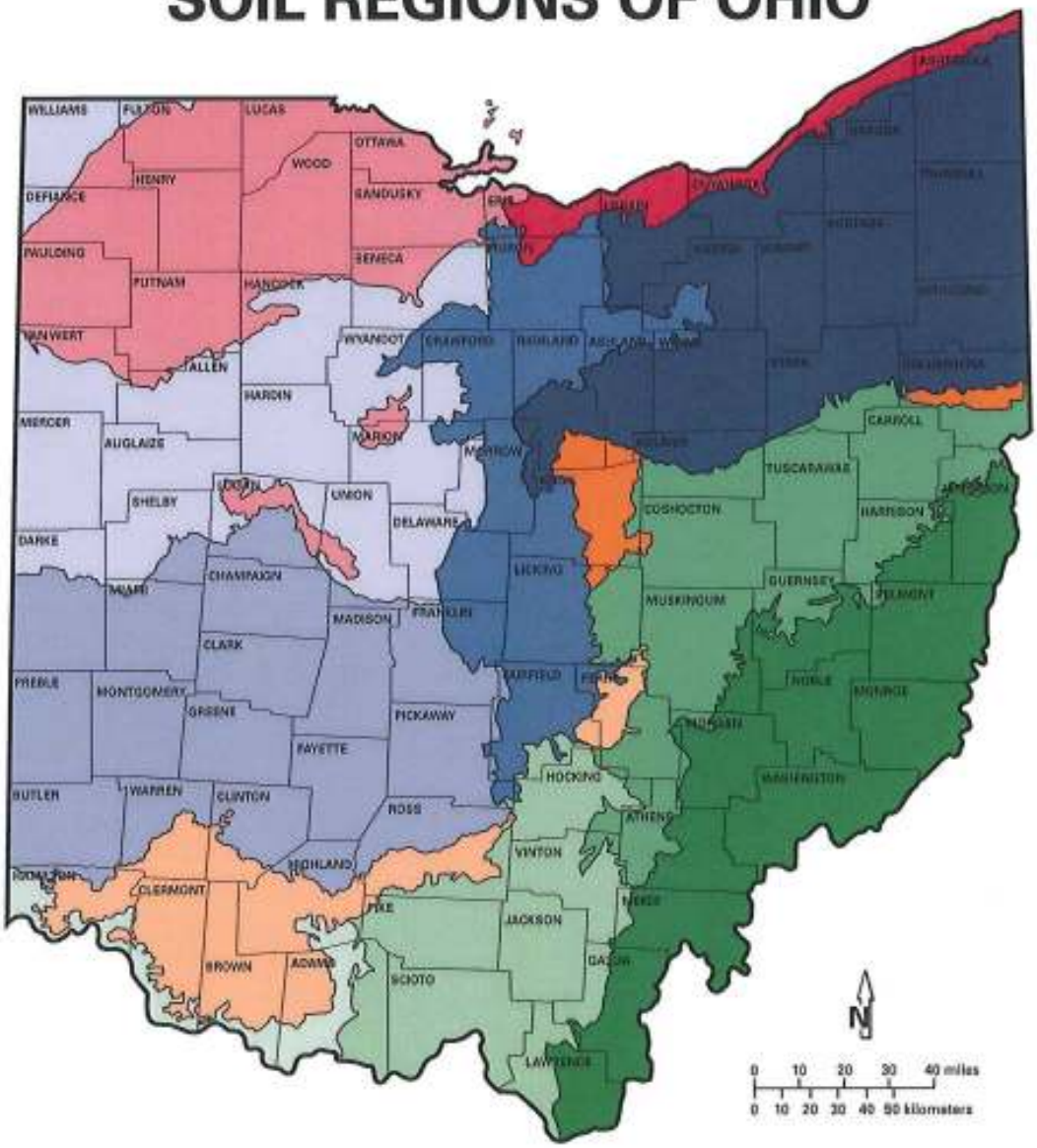
9 *Surface lineament*—A west-northwest-trending lineament (a linear topographic feature on the Earth's surface) across east-central Ohio is distinctly visible on the map. The Walhonding River and a portion of the Muskingum River flow in portions of this linear topographic depression. Although poorly understood, this feature, which is referred to as the Coshocton Fracture Zone, has been attributed to fractures in the surface bedrock that are possibly related to faults present deeper in the subsurface.

10 *Flushing Divide*—A sharp, north-northeast-trending, ridgelike feature in eastern Ohio is the Flushing Drainage Divide, named after the Belmont County village of Flushing, where it is well developed. Surface water west of the divide flows westward into a series of low-gradient creeks, such as the Sandy, Conotton, and Stillwater, and then to the Tuscarawas River. Surface water east of the divide flows eastward into a series of high-gradient, rapidly down-cutting creeks that flow into the Ohio River. The ridge is at an elevation of about 1,260 to 1,280 feet above sea level and separates two old Teays-era drainage basins.

APPENDIX W

SOIL REGIONS
OF OHIO

SOIL REGIONS OF OHIO



LEGEND*

1 Hoytville-Nappanee-Paulding-Toledo

2 Conotton-Conneaut-Allis

3 Blount-Pewamo-Glynwood

4 Miamian-Kokomo-Eldean

5 Bennington-Cardington-Centerburg

6 Mahoning-Canfield-Rittman-Chili

7 Clermont-Rossmoyne-Avonburg-Cincinnati

8 Westmoreland-Homewood-Loudonville

9 Eden-Bratton-Brushcreek

10 Shelocta-Brownsville-Latham-Steinsburg

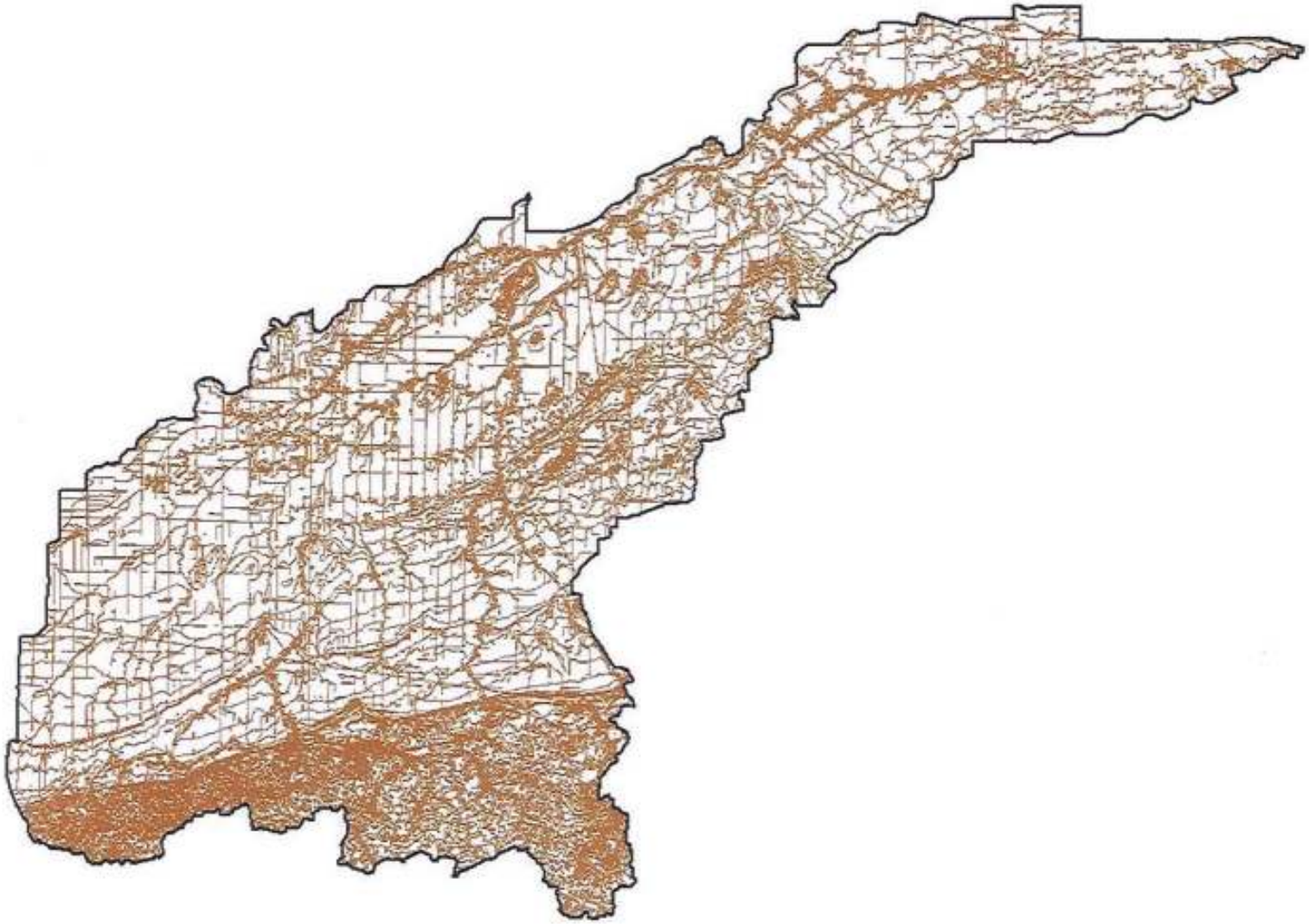
11 Coshocton-Westmoreland-Berks

12 Gilpin-Upshur-Lowell-Guernsey

*Soil regions are identified by the names of the soil series that are common in that region

APPENDIX X

TOPOGRAPHY OF THE PORTAGE RIVER



APPENDIX Y

ECOREGIONS OF THE UNITED STATES

http://www.epa.gov/bioindicators/html/usecoregions.html
Last updated on Tuesday, November 17th, 2009.

Biological Indicators of Watershed Health

Ecoregions of the United States

Environmental resources research, assessment, monitoring, and, ultimately, management usually require appropriate spatial structures. Ecoregion frameworks are well suited to these purposes. Ecoregions are defined as areas of relative homogeneity in ecological systems and their components. Factors associated with spatial differences in the quality and quantity of ecosystem components, including soils, vegetation, climate, geology, and physiography, are relatively homogeneous within an ecoregion. Ecoregions separate different patterns of human stresses on the environment and different patterns in the existing and attainable quality of environmental resources. They have proven to be an effective aid for inventorying and assessing national and regional environmental resources, for setting regional resource management goals, and for developing biological criteria and water quality standard.

Learn more about:

- Ecoregion Maps & GIS Resources
- Level III Ecoregions
- Level IV States of Ecoregions
- Ecological Regions within the Mid-Atlantic
- Alaska Ecoregion Mapping [Exit Disclaimer]
- Ecoregions of Indiana and Ohio
- Forest Service Ecoregions [Exit Disclaimer]
- Natural Regions of Texas
- Ecoregions of the Red River Valley, Minnesota [Exit Disclaimer]

The approach we have used to compile ecoregion maps is based on the premise that ecological regions can be identified by analyzing the patterns and composition of biotic and abiotic phenomena that affect or reflect differences in ecosystem quality and integrity. These phenomena include geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. We do not begin by treating any one phenomena with more weight than any other. Rather, we look for patterns of coincidence between geographic phenomena that cause or reflect differences in ecosystem characteristics.

Figure

For more information on the maps above, visit the Commission for Environmental Cooperation (CEC) Ecological Regions of North America.

The relative importance of each factor varies from one ecological region to another, regardless of the hierarchical level. Because of possible confusion with other meanings of terms for different levels of ecological regions, a Roman numeral classification scheme has been adopted for this effort. Level I is the coarsest level, dividing North America into 15 ecological regions. At level II, the continent is subdivided into 52 classes, and at level III, the continental United States contains 98 ecoregions. Level IV ecological regions are further subdivisions of level III units. The exact number of ecological regions at each hierarchical level is still changing slightly as the framework undergoes development at the international, national, and local levels.

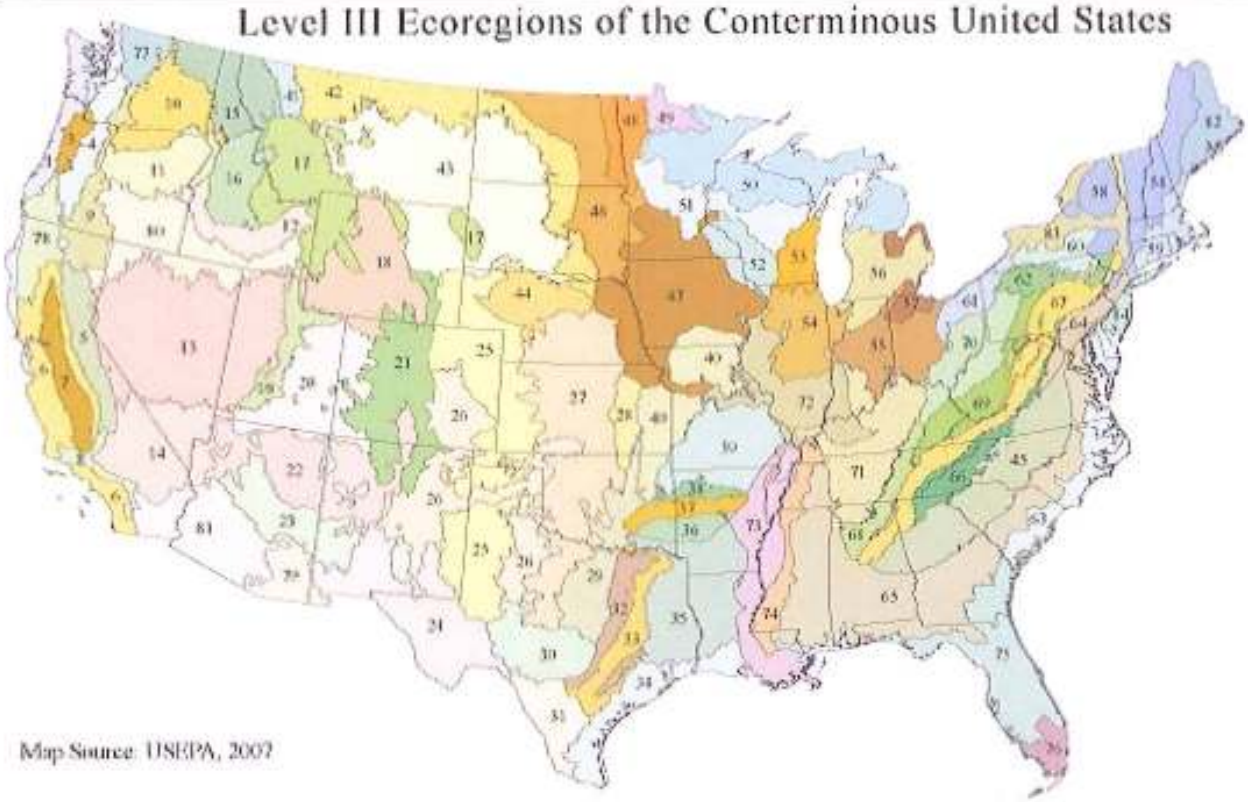
Text from this page taken from: Level III and IV Ecoregions of Pennsylvania and the Blue Ridge Mountains, the Ridge and Valley, and the Central Appalachians of Virginia, West Virginia, and Maryland by Alan J. Woods[1], James M. Omernik[2], and Douglas D. Brown3. June, 1996 (Addenda May, 1999) U.S. Environmental Protection Agency National Health and Environmental Effects Research Laboratory 200 SW 35th Street Corvallis, Oregon 97333[1]. Dynamac Corporation[2], U.S. Environmental Protection Agency[3], U.S. Forest Service.

Maps provided by Alan Woods and James Omernik.

APPENDIX Z

LEVEL III ECOREGIONS
OF THE
UNITED STATES

Level III Ecoregions of the Conterminous United States



Map Source: USEPA, 2007

1 Coast Range
2 Puget Lowland
3 Willamette Valley
4 Cascades
5 Sierra Nevada
6 Southern and Central California Chaparral and Oak Woodlands
7 Central California Valley
8 Southern California Mountains
9 Eastern Cascades Slopes and Foothills
10 Columbia Plateau
11 Blue Mountains
12 Snake River Plain
13 Central Basin and Range
14 Mojave Basin and Range
15 Northern Rockies
16 Idaho Batholith
17 Middle Rockies
18 Wyoming Basin
19 Wasatch and Uinta Mountains
20 Colorado Plateaus
21 Southern Rockies
22 Arizona/New Mexico Plateau
23 Arizona/New Mexico Mountains
24 Chihuahuan Deserts
25 High Plains
26 Southwestern Tablelands
27 Central Great Plains
28 Flint Hills
29 Cross Timbers
30 Edwards Plateau
31 Southern Texas Plains
32 Texas Blackland Prairies
33 East Central Texas Plains
34 Western Gulf Coastal Plain
35 South Central Plains
36 Ouachita Mountains
37 Arkansas Valley
38 Boston Mountains
39 Ozark Highlands
40 Central Irregular Plains
41 Canadian Rockies
42 Northwestern Glaciated Plains
43 Northwestern Great Plains
44 Nebraska Sand Hills
45 Piedmont
46 Northern Glaciated Plains
47 Western Corn Belt Plains
48 Lake Agassiz Plain
49 Northern Minnesota Wetlands
50 Northern Lakes and Forests
51 North Central Hardwood Forests
52 Driftless Area
53 Southeastern Wisconsin Till Plains
54 Central Corn Belt Plains
55 Eastern Corn Belt Plains
56 Southern Michigan/Northern Indiana Drift Plains
57 Huron/Erie Lake Plains
58 Northeastern Highlands
59 Northeastern Coastal Zone
60 Northern Appalachian Plateau and Uplands
61 Erie Drift Plain
62 North Central Appalachians
63 Middle Atlantic Coastal Plain
64 Northern Piedmont
65 Southeastern Plains
66 Blue Ridge
67 Ridge and Valley
68 Southwestern Appalachians
69 Central Appalachians
70 Western Allegheny Plateau
71 Interior Plateau
72 Interior River Valleys and Hills
73 Mississippi Alluvial Plain
74 Mississippi Valley Loess Plains
75 Southern Coastal Plain
76 Southern Florida Coastal Plain
77 North Cascades
78 Klamath Mountains
79 Madrean Archipelago
80 Northern Basin and Range
81 Sonoran Basin and Range
82 Laurentian Plains and Hills
83 Eastern Great Lakes and Hudson Lowlands
84 Atlantic Coastal Pine Barrens