GRAND LAKE/WABASH
WATERSHED ALLIANCE

Grand Lake St. Marys/Wabash River

Watershed Action Plan

Endorsed May 14, 2008
Resubmitted with format changes December 31, 2008
Resubmitted December 31, 2009, after stakeholder review

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The Grand Lake/Wabash Watershed Alliance is a partnership between the Darke Soil and Water Conservation District, the Auglaize Soil and Water Conservation District, the Mercer Soil and Water Conservation District, and the City of Celina.

The 2009 Grand Lake/Wabash Watershed Alliance Joint Board of Supervisors

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The Grand Lake/Wabash Watershed Alliance Nondiscrimination Policy:

The Grand Lake/Wabash Watershed Alliance prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, and marital or familial status. (Not all prohibited bases apply to all programs)

This organization adheres to the nondiscrimination policies of the US Department of Agriculture, Natural Resources Conservation Service, the Ohio Department of Natural Resources, Division of Soil and Water, and Mercer County, Ohio.

This watershed action plan has been fully endorsed on May 14, 2008, by the Ohio Department of Natural Resources and the Ohio Environmental Protection Agency. This plan not only includes the new Wabash River Watershed information, but also includes updates to the previously endorsed Grand Lake St. Marys watershed action plan. This is a full, comprehensive plan for the Grand Lake/Wabash River Watershed.

This watershed action plan was resubmitted to ODNR and OEPA on December 31, 2008, with changes to the format and updates on objectives. This plan was originally written unconventionally. This change is format is in efforts to make the format of this watershed action plan similar to others across the state.

This watershed action plan is reviewed annually by the stakeholders. During the 2009 review, stakeholders requested several of the objectives be improved. This was due to meeting several of the objectives and the interests of the stakeholders. No objectives were decreased. After these improvements to the objective section, the plan was resubmitted to the ODNR and OEPA on December 31, 2009.

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EXECUTIVE SUMMARY

Mission Statement

The mission of the Grand Lake/Wabash Watershed Alliance is to improve the quality of life by promoting stewardship of the natural resources in the Grand Lake/Wabash River Watershed.

There is a trend of increasing human use of the watershed's land and water resources; these activities can impact the watershed and the lake in negative ways. Consideration must be given to these impacts so that the land, the lake, and the river basin can remain enjoyable and productive far into the future. To this end, the Grand Lake/Wabash Watershed Alliance has developed this watershed action plan, both to address issues that the watershed may face in the future, and to reduce the pollution potential from existing situations to improve the quality of life for the watershed residents and visitors.

Physical setting

The Grand Lake/Wabash River watershed is located in west-central Ohio. Approximately 80% of the watershed is located in southern Mercer County, 10% of the watershed is in western Auglaize County, and the remaining 10% of the watershed in located in northern Darke County. The entire watershed covers approximately 312 square miles (200,000 ac) of which 21 square miles (13,500 ac), consists of the Grand Lake St. Marys basin.

The Grand Lake St. Marys watershed is a unique watershed in that it overlies two major drainage basins. Approximately 60% of the watershed lies west of the drainage divide and has an historical Ohio River drainage via Beaver Creek to the Wabash River. The remaining 40% of the watershed historically drained to the St. Marys River and on to the Maumee River to Lake Erie. Since the current drainage to Lake Erie is through a feeder canal, and discharge volume is estimated to be as little as 10% of the lake outflow, the watershed is considered to be a part of the larger Wabash River Hydrologic Unit, and is administered as such by state and federal agencies. This fact was part of the final decision to combine the Grand Lake St. Marys Watershed Project and the Wabash Watershed Project in January of 2005, creating the Grand Lake/Wabash Watershed Alliance.

INTRODUCTION

1.1 History

Grand Lake St. Marys

Grand Lake St. Marys has long been an interest point of western Ohio. Construction for the lake began in early 1837 and was intended to primarily be used as a feeder for the Miami & Erie Canal. The workers constructing the lake basin were paid $0.35 per diem and also were provided with a jigger of whiskey for the prevention of malaria. According to some local historians, the idea that the lake was dug is simply untrue; —the water was already here. They diked up the southern end of the swamp". Many workers were drawn from far and near to work on the project and after completion, a good portion of them remained in the area, settled with their families, and began farming the land. Taking nearly ten years, the basin was completed in 1841 with an original acreage of over 17,000 acres and an estimated cost near $528 million.

The Miami and Erie Canal brought industry to the area, lowered freight prices and supplied the local residents with a thriving income. Deliveries of goods and visitors from both Toledo and Cincinnati were nearly around the clock. However, soon came the railroads and the transportation of both travelers and items was made more rapid and cost effective. The lake was no longer needed as a feeder to the canal. It wouldn't be too long before the lake provided the area with another boom of interest and income.

In the late 1880's oil was discovered near St Marys and on January 24, 1891 in the St Marys Argus it was printed that —It is said that an oil well derrick has this week been put up on the reservoir, three or four hundred feet from the shore at the northeast corner. Verily, the days of the reservoir are numbered". This was the first noted evidence of an offshore oil well and would continue to be so for over 100 years. Not long after the first derrick went up, several more followed, dotting the countryside and taking up farmland. At first, farmers were naïve about leasing the ground to the oilmen and selling the rights. An example of an early lease reads —For the term of 99 years, the consideration $100, to be paid at the expiration of ten years, IF oil was found". It didn't take long before the landowners learned the proper value of the oil leases. For instance leasees were soon being paid approximately $1,000 when drilling began, $1,000 when oil was discovered and up to one third of the oil pulled from the site. Two of the most successful oilmen of the area were averaging over 3,000 barrels of oil per day. All that is left of the oil boom is a small pile of rock at the site where the last producing derrick was located.

Another bit of local folklore surrounding the lake area is the legend of how the lake was named. The lake's name list includes Mercer Reservoir, Celina Lake, Celina Grand Lake, Lake St Marys, Grand Reservoir and finally Grand Lake St Marys. The legend of the area involves two men being selected; one from Celina, the other from St Marys, and given the task of naming the lake. Furthermore, legend has it that the gentleman from St Marys provided mass amounts of alcohol to the gentleman from Celina finally tricking him into agreeing on naming the lake after St Marys. In the end, several local authorities hold that the legend is purely a legend with no truth behind it.

The lake has attracted visitors from throughout the region from the very beginning. These tourists come to enjoy the recreational opportunities, including boating, fishing, and the numerous festivals and events in the lake area. Places in and around the lake have been filled in to better accommodate the recreational aspect of the area. This has led to the massive loss of water acreage estimated to be at least 3,500 acres. Construction of parks and other attractions included dance halls, athletic parks, fishing areas and even small scale water parks. By today's standards, tourism plays a vital role in the economic success of both Auglaize and Mercer counties. For instance, in the year 2007 the travel and tourism industry in Mercer and Auglaize counties had an estimated income of $47,570,838.00 and supported approximately 2,378 jobs.

The Wabash River

The Wabash River begins in Northern Darke County near the Mercer-Darke County Line. The Wabash was first explored in 1669 by a French man named La Salle and was named "Oubache", for the Indian word meaning "white." This was due to the river's clarity in Huntington County, Indiana where the river bottom is limestone. It had been used prior to La Salle's exploration by the Native Americans and traders between the Great Lakes and the Gulf of Mexico. Once the river was under French control, the river connected many settlements ranging from the lower Great Lakes to the Mississippi River. In the early 1990's, Indiana General Assembly and Indiana Department of Natural Resources worked together to establish the Wabash River Corridor Commission to preserve the Wabash River and promote heritage conservation and proper development.

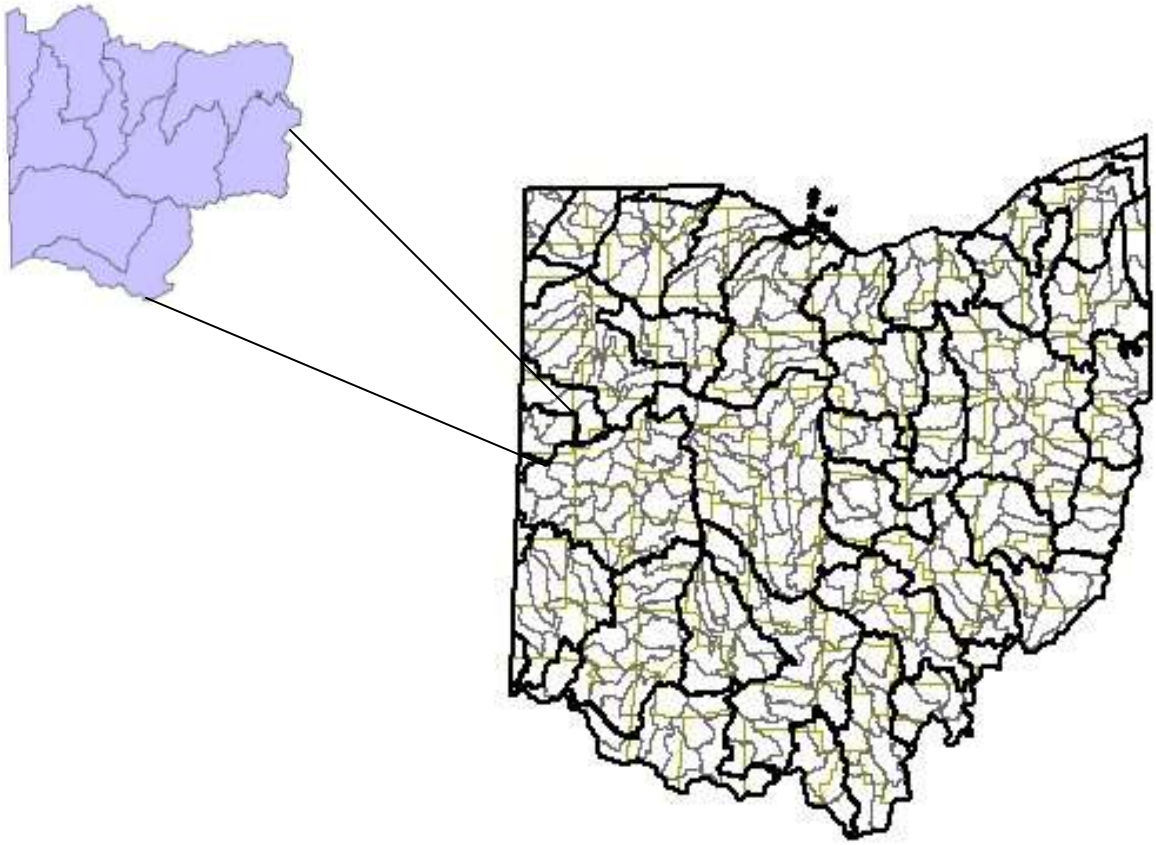
The Wabash River (excluding its tributaries) flows only approximately 43 miles within Ohio, where it enters Indiana and travels approximately 500 miles to the Ohio River. The Wabash flows from its beginning in west-central Ohio to the state of Indiana where it crosses nearly the entire state. The Wabash then enters the Ohio River near southwest Indiana, just south of Evansville.

From the earliest settlers in the area, agriculture has been a mainstay in every portion of the watershed. As more and more people settled in the area due to completion of Grand Lake St Marys, success of the canal system or the discovery of oil, families were started and continued in the farming lifestyle. Agriculture still proves to be social, cultural, and economic staple in the watershed and very important when dealing with water quality and the protection of the water resources.

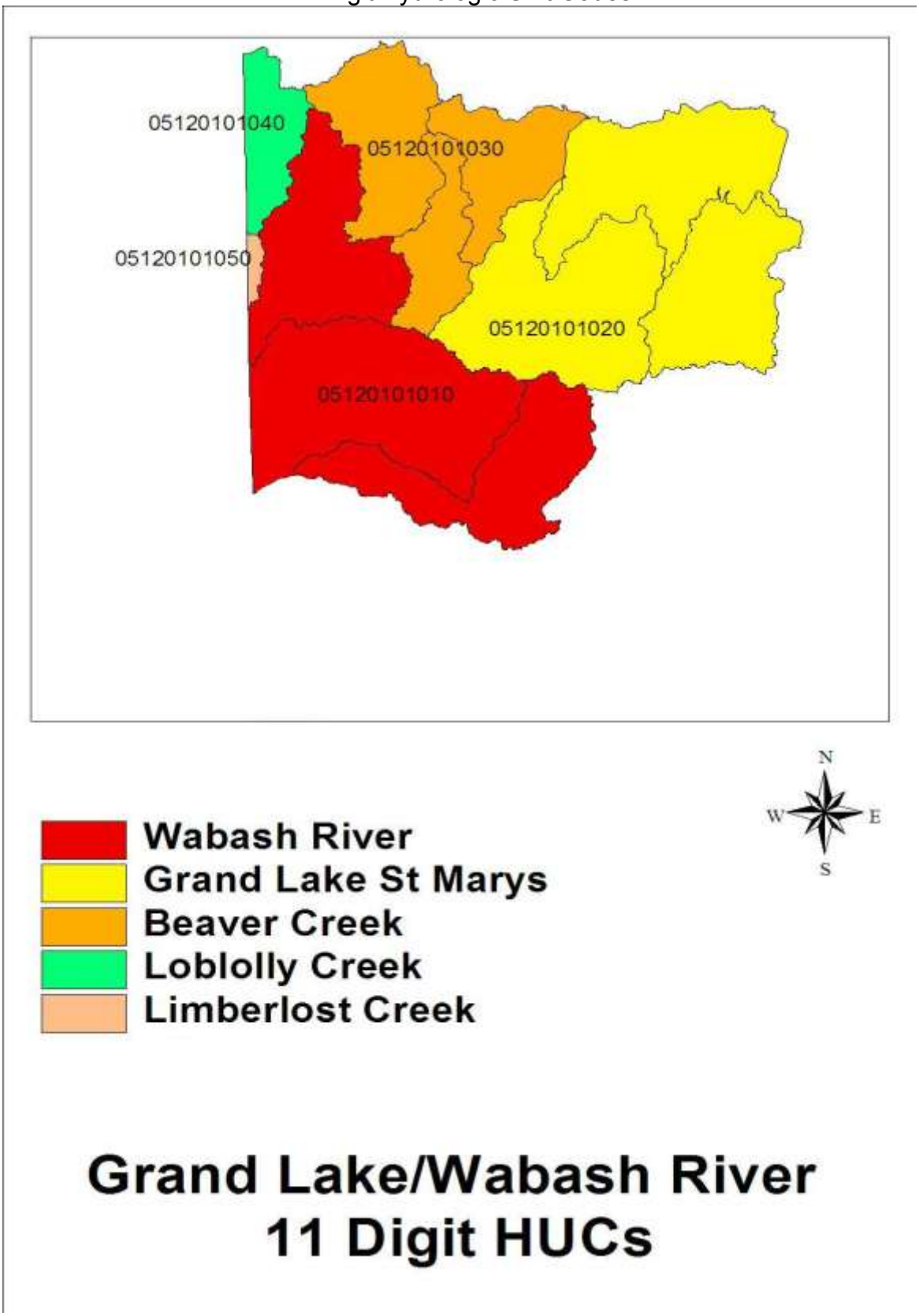
1.2 Administrative Boundaries

The Grand Lake/Wabash watershed consists of nearly 13,500 acres of lake and approximately 193,000 acres of land which primarily drains to the Ohio River. The watershed spans portions of Auglaize (10%), Darke (10%) and Mercer (80%) counties and can be considered as a tributary to both the Ohio River drainage Basin and the Lake Erie drainage Basin. Outflow from Grand Lake St. Marys' west spillway drains to Beaver Creek and then to the Wabash River. The outflow from the east embankment sluice gate drains to the St. Marys River via the Miami & Erie canal system. This outflow has been estimated at or below 20% thus, the Grand Lake St. Marys watershed is administered as a portion of the Wabash River Hydrologic Unit Code (HUC) 05120101 at both federal and state levels. The following maps indicate the HUC 8, HUC 11 and HUC 14 codes for associated drainage units in the Grand Lake/Wabash watershed.

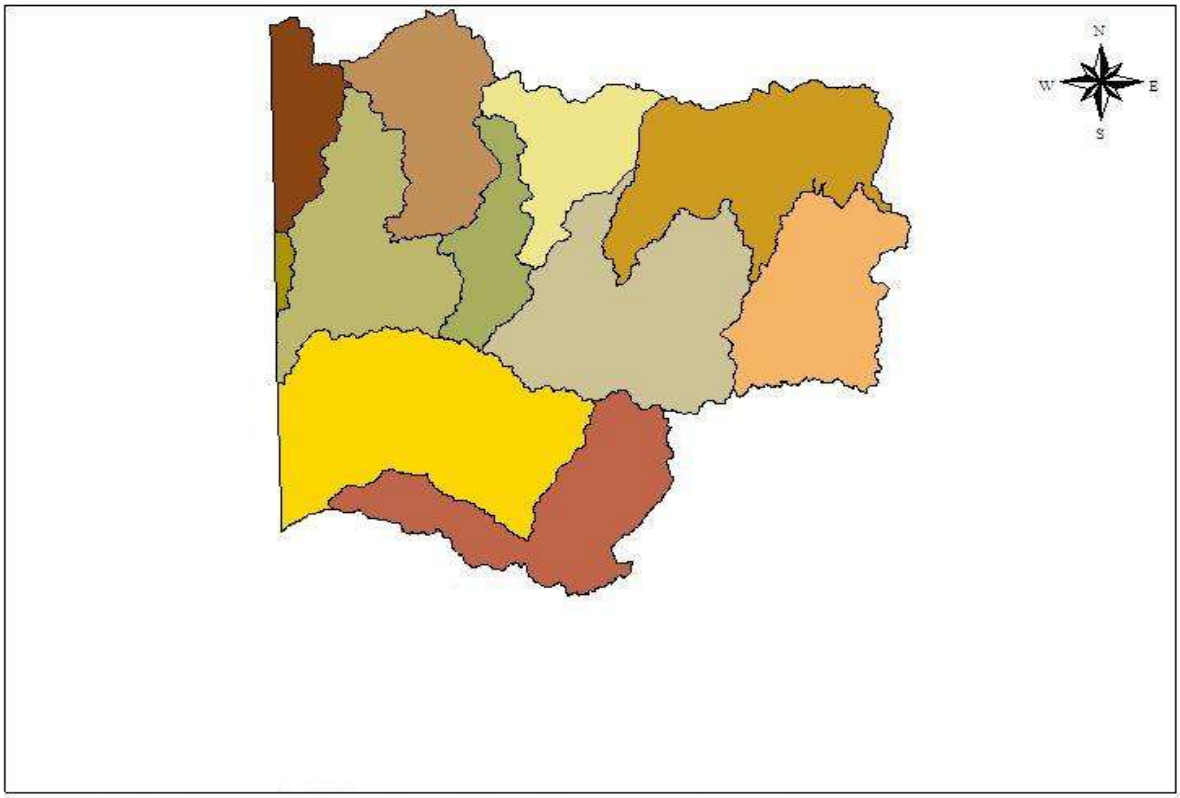
MAP 1
Wabash River 8-Digit Hydrologic Unit Code Location



Map 2
11-Digit Hydrologic Unit Codes



Map 3
14-Digit Hydrologic Unit Codes



- Wabash Headwaters to below Bear Creek
- Wabash R above Bear Cr below Stony Cr
- Wabash R below Stony Cr above Beaver Cr
- Chickasaw & Barnes Crs
- Coldwater & Beaver Crs
- N Shore/Lake/Grassy & Monroe/Up Prairie Cr Up Barnes Cr
- Beaver Cr from Grand Lake to above Little Beaver Cr
- Little Beaver Creek
- Beaver Cr below Little Beaver to Wabash R
- Wabash R below Beaver to New Corydon
- Limberlost Cr Headwaters to below Bull Cr (IN)

Grand Lake/Wabash River Watershed
14 Digit HUCs

14-digit HUCs

Wabash Headwaters to below Bear Creek	05120101-010-010
Wabash River above Bear Cr below Stony Creek	05120101-010-020
Wabash River below Stony Cr above Beaver Creek	05120101-010-030
Chickasaw and Barnes Creeks	05120101-020-010
Coldwater and Beaver Creeks	05120101-020-020
N Shore/Grassy Monroe/ Prairie Creeks	05120101-020-030
Beaver Creek from Grand Lake to above Little Beaver Creek	05120101-030-010
Little Beaver Creek	05120101-030-020
Beaver Creek below Little Beaver to Wabash River	05120101-030-030
Wabash River below Little Beaver Creek to New Corydon	05120101-040-010
Limberlost Creek Headwaters to below Bull Creek	05120101-050-050

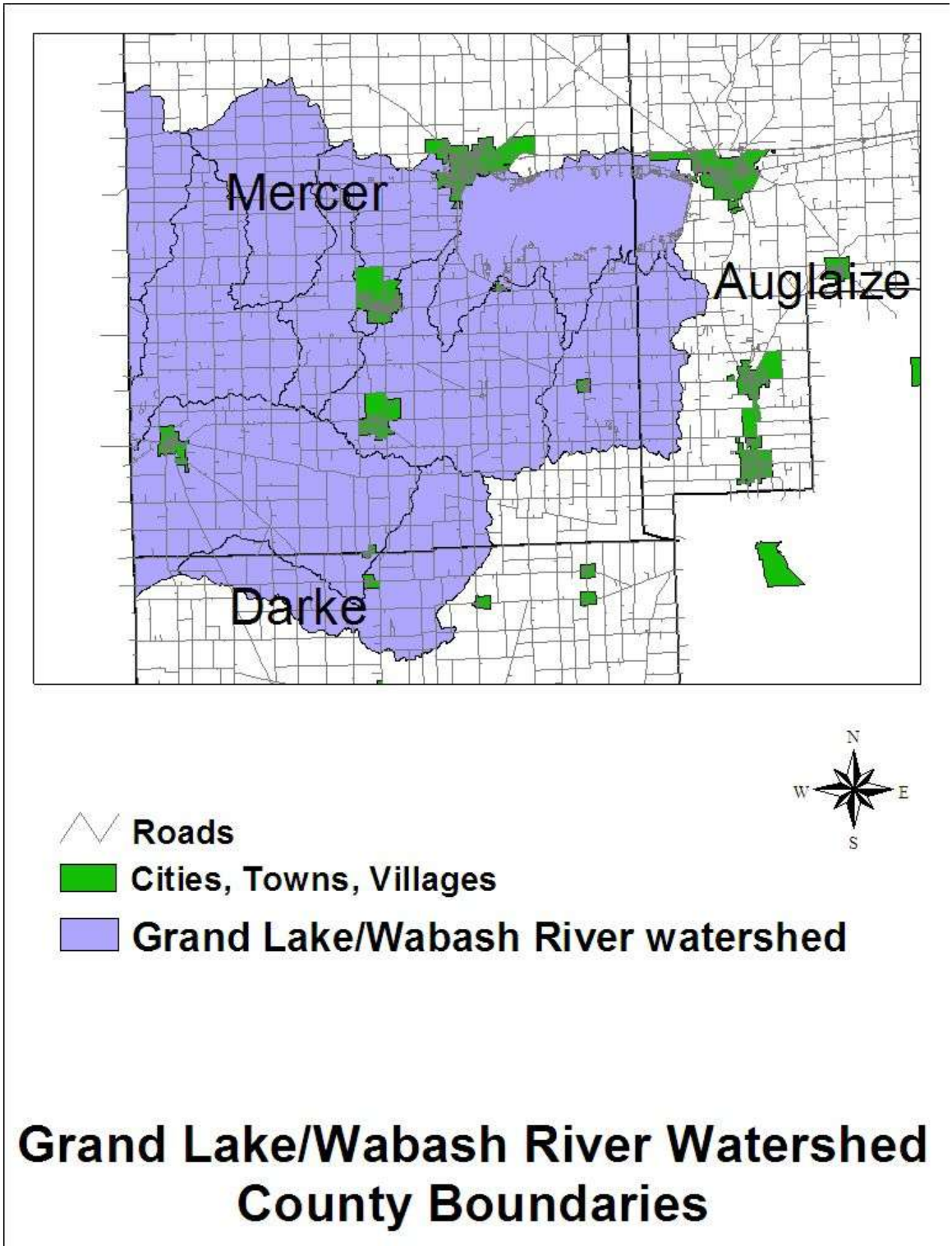
The Grand Lake/Wabash watershed contains numerous levels of local governments, including portions of Butler, Franklin, Gibson, Granville, Hopewell, Liberty, Marion, Jefferson, Recovery, and Washington townships in Mercer County. Small portions of German, Jackson, Noble, and St. Marys townships in Auglaize County and Allen, Mississinawa, and Wabash townships in Darke County are also included in the watershed. The Grand Lake/Wabash River watershed also contains a portion of the City of Celina and the City of St. Marys.

Several villages located entirely in the watershed are: Chickasaw, Coldwater, Ft. Recovery, Montezuma, and St. Henry. Several non-incorporated areas include: Carthagena, Cassella, Cranberry, Durbin, Macedon, Maria Stein, Philothea, Sebastian, Sharpsburg, St. Anthony, St. Johns, St. Joseph, St. Peter, St. Rose, Wabash and Wendelin.

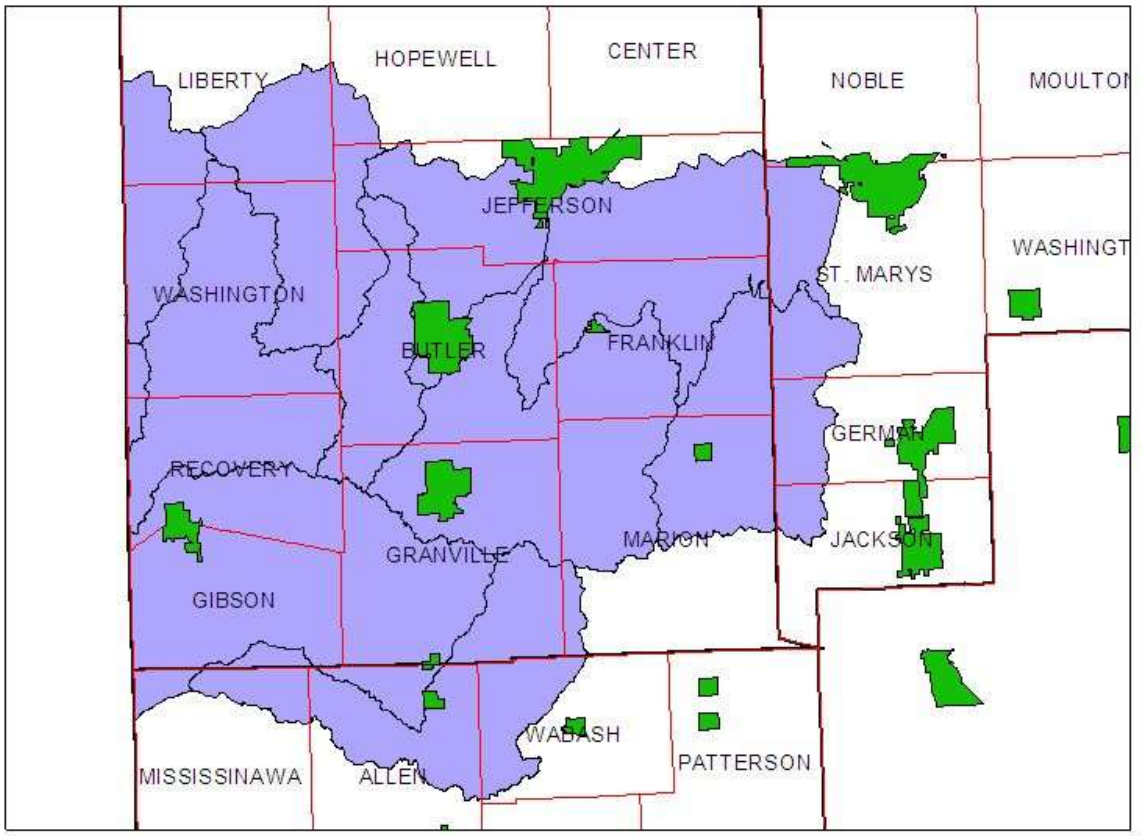
The Auglaize portion of the watershed has no sizeable cities, villages, or non-incorporated areas. However, the City of St. Marys, and the Villages of New Bremen and Minster are located just outside of the eastern watershed border. Burkettsville and New Weston are the two Darke County villages that are located within the boundaries of the watershed.

The maps on the following pages show the watershed with the boundaries of the counties, townships, cities, and villages; sewer districts; township zoning; and school districts within the Grand Lake/Wabash watershed boundaries.

MAP 4
County Boundaries



MAP 5
Township Boundaries



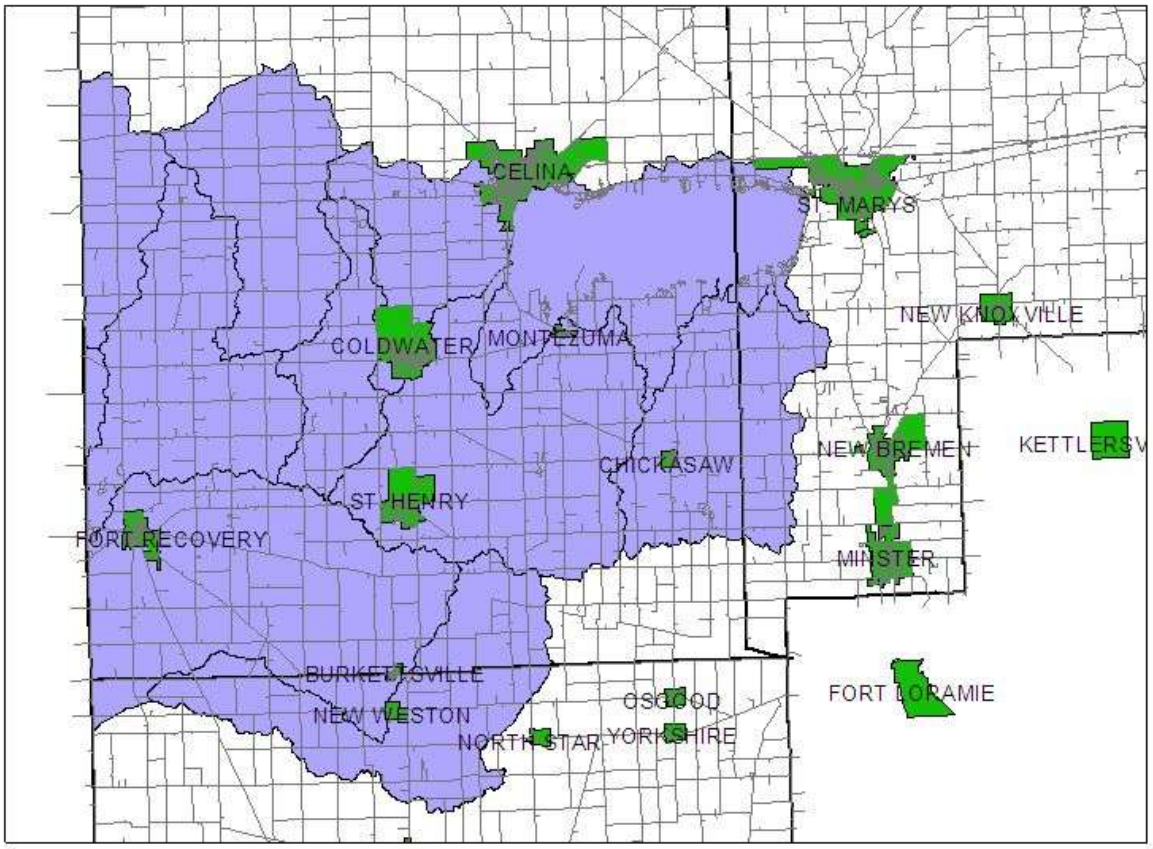
Cities, Towns, Villages

Township Boundaries

Grand Lake/Wabash River watershed

Grand Lake/Wabash River Watershed Township Boundaries

MAP 6
Cities, Towns and Villages



Roads

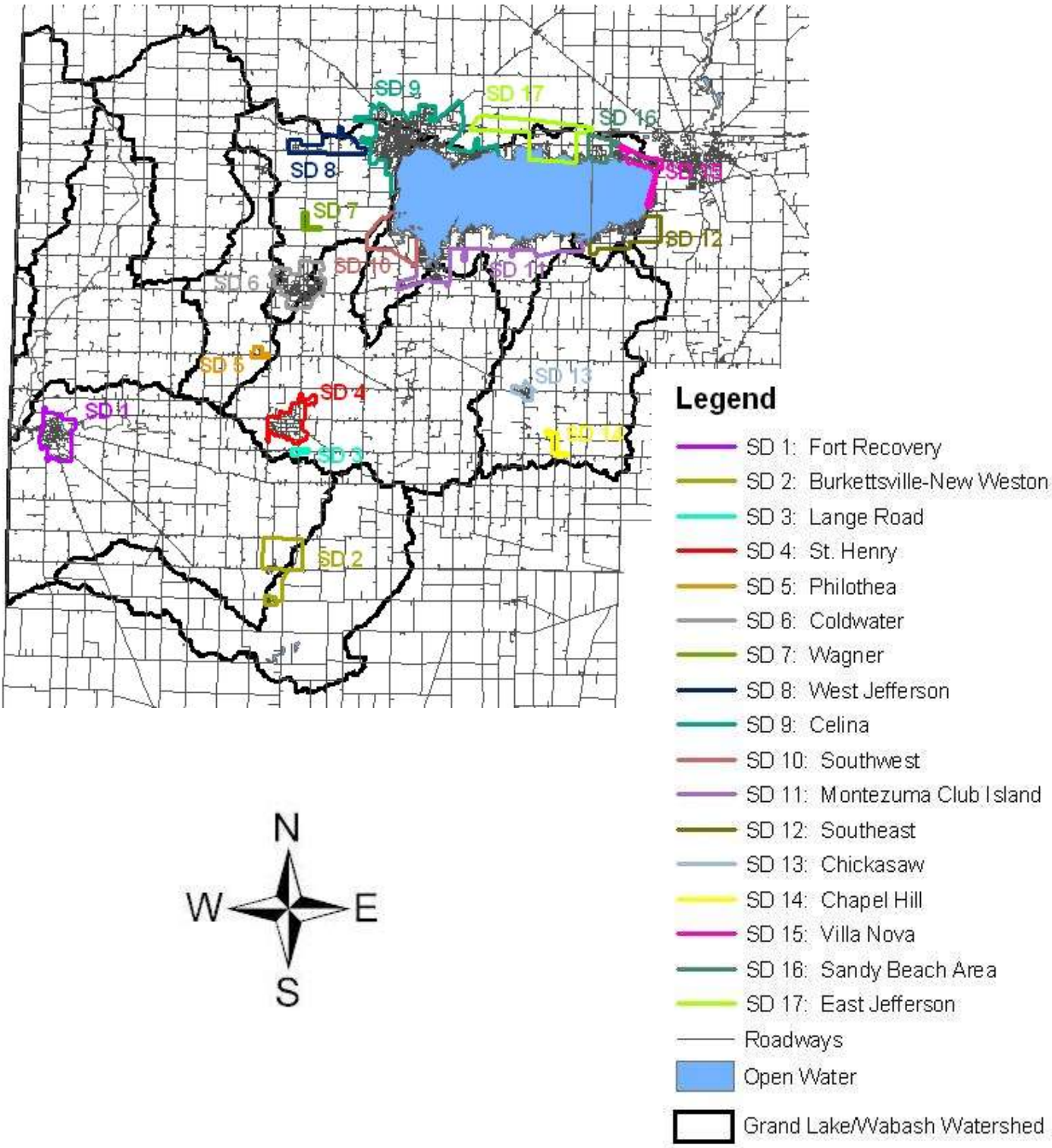
Cities, Towns, Villages

Grand Lake/Wabash River watershed

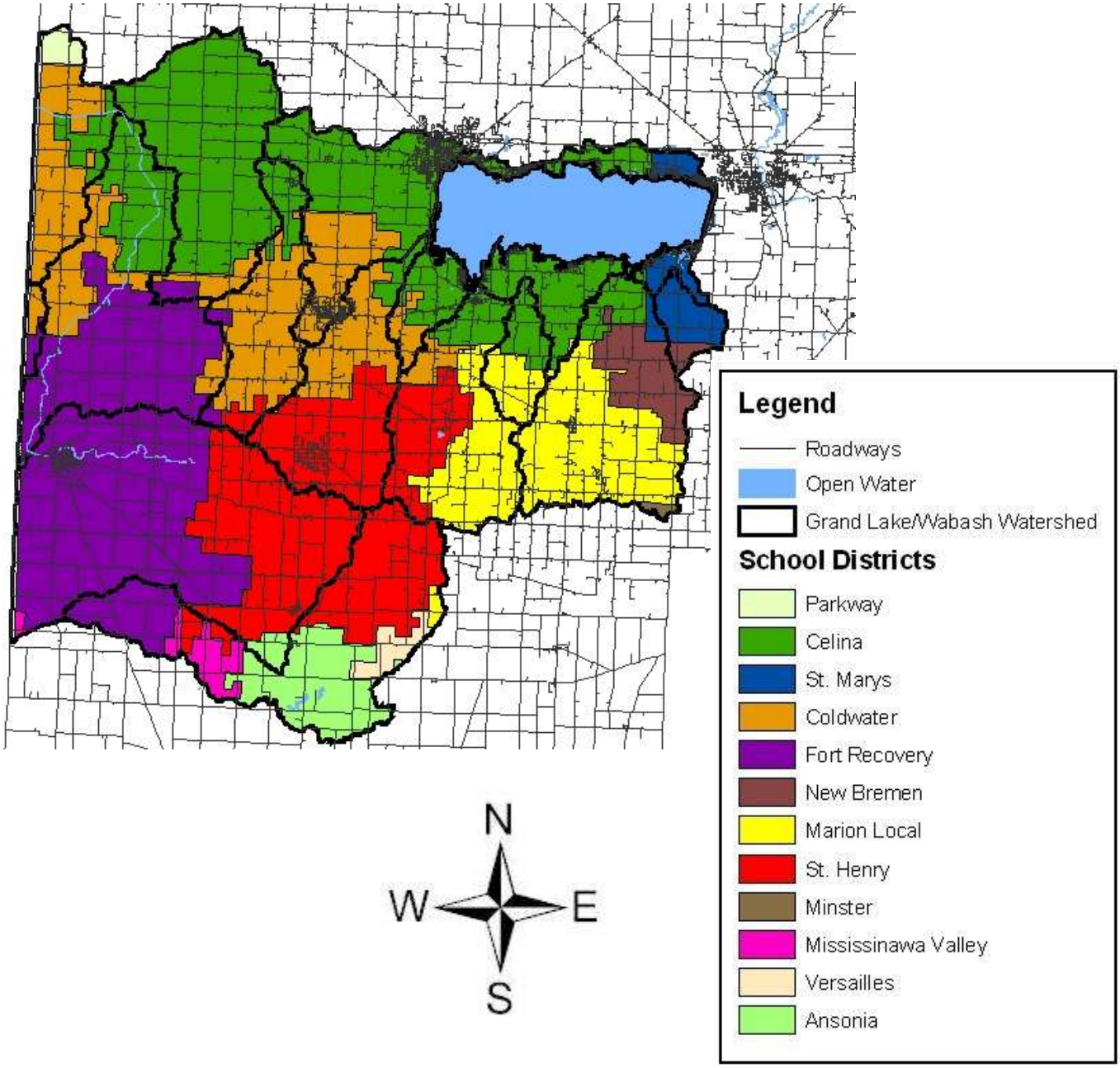
Grand Lake/Wabash River Watershed
Cities, Towns, Villages

The map below shows the sanitary sewer districts that are located within the Grand Lake/Wabash River watershed. The map includes the centralized sewer systems within the corporation limits of the City of Celina, the Village of St. Henry, the Village of Ft. Recovery, the Village of Coldwater and the Village of Chickasaw.

Map 7
Sewer Districts



MAP 8
School Districts



1.3 Demographics

Auglaize, Darke and Mercer counties are very similar when referring to the demographics of the watershed. The three counties have seen a steady increase in their populations for the last few years. The tables below show a few representative categories that give an overview of the status of the watershed. The information for the tables in this section was obtained from the Ohio State University Data Center at the website: http://osuedc.org/current/main.php and/or the United States Bureau of Census.

TABLE 1

Median Age Auglaize, Darke and Mercer Counties, Ohio			
COUNTY	Auglaize	Darke	Mercer
Total Population	46,611	53,309	40,924
Largest Age Population	35-44 years	35-44 years	35-44 years
Median Age	36	37	36

*Data is based on 2000 Census

According to the aforementioned website, the population for Mercer and Auglaize counties is projected to rise throughout the years, nearing or surpassing 50,000 people in each county in the year 2030. However, the opposite is true for Darke County as projections through the year 2030 is a decline in population to nearly 52,000 citizens.

The table on the following page shows information gathered by Richard Hupman & Associates, supplemented by additional information, regarding the populations of Auglaize, Darke and Mercer Counties and the associated percentage of increase per decade. Populations of cities or villages in the township are included in the township population total. For example, the population for New Bremen is included in the total population for German township. A similar table has been developed for the population trend in Darke County, including percentage of population increase or decrease over the decades.

Data used for the table was collected from the United States Bureau of Census, Population of County Subdivisions. This is also the source of the data used to create the second table showing the population in 1990 and comparing it with the population in 2000. The percentages indicate the population increase or decrease from the previous decade.

TABLE 2

POPULATION and PERCENT CHANGE, 1950-2000 STATE OF OHIO, AUGLAIZE, DARKE AND MERCER COUNTIES, and OTHER SELECTED JURISDICTIONS							
CENSUS YEAR **JURISDICTION**	**1950 Population**	**1960 Pop. (% Change)**	**1970 Pop. (% Change)**	**1980 Pop. (% Change)**	**1990 Pop. (% Change)**	**2000 Pop. (% Change)**	**1950-2000 % Change**
OHIO	7,946,627	9,706,397 (+22%)	10,652,017 (+10%)	10,797,630 (+1%)	10,847,115 (+0.5%)	11,353,140 (+5%)	43%
AUGLAIZE CO	**30,637**	**36,147 (+18%)**	**38,602 (+7%)**	**42,554 (+10%)**	**44,585 (+5%)**	**46,611 (+4.5%)**	**52%**
GERMAN TWP	2,293	2,769 (+21%)	2,976 (+7%)	3,171 (+7%)	3,400 (+7%)	3,831 (+13%)	67%
NEW BREMEN	1,541	1,972 (+28%)	2,185 (+11%)	2,393 (+10%)	2,570 (+7%)	2,909 (+13%)	89%
JACKSON TWP	2,401	2,889 (+20%)	3,130 (+8%)	3,298 (+5%)	3,415 (+4%)	3,577 (+5%)	49%
MINSTER	1,728	2,193 (+27%)	2,405 (+10%)	2,557 (+6%)	2,650 (+4%)	2,794 (+5.4%)	62%
ST. MARYS TWP	8,106	9,970 (+23%)	10,438 (+5%)	11,214 (+7%)	11,562 (+3%)	11,600 (+0.3%)	43%
ST. MARYS	6,208	7,737 (+25%)	7,699 (-0.5%)	8,414 (+9%)	8,441 (+0.3%)	8,342 (-1%)	34%
MERCER CO	**28,311**	**32,559 (+15%)**	**35,558 (+9%)**	**38,334 (+8%)**	**39,443 (+3%)**	**40,924 (+4%)**	**44.6%**
BUTLER TWP	3,505	4,256 (+21%)	5,337 (+25%)	6,049 (+13%)	6,181 (+2%)	6,459 (+4.5%)	84%
COLDWATER	2,217	2,766 (+25%)	3,533 (+28%)	4,220 (+19%)	4,335 (+3%)	4,482 (+3.4%)	102%
FRANKLIN TWP	1,166	1,369 (+14%)	1,606 (+17%)	1,790 (+15%)	2,126 (+19%)	2,302 (+8%)	97%
MONTEZUMA	299	287 (-4%)	260 (-10%)	200 (-23%)	199 (-0.5%)	191 (-4%)	-36%
GIBSON TWP	1,586	1,872 (+18%)	1,826 (-2%)		1,855	1,869 (+0.8%)	18%

POPULATION and PERCENT CHANGE, 1950-2000 STATE OF OHIO, AUGLAIZE, DARKE AND MERCER COUNTIES, and OTHER SELECTED JURISDICTIONS							
FORT RECOVERY (PART)	828	999 (+21%)	810 (-19%)		956	997 (+4.3%)	20%
GRANVILLE TWP	2,295	2,912 (+27%)	3,326 (+14%)	3,591 (+8%)	3,615 (+0.7%)	3,885 (+7%)	69%
ST. HENRY	715	978 (+37%)	1,276 (+30)	1,596 (+25%)	1,907 (+20%)	2,271 (+19%)	218%
HOPEWELL TWP	845	910 (+8%)	961 (+6%)		968	1,066 (+10%)	26%
JEFFERSON TWP	7,784	9,885 (+27%)	10,904 (+10%)	12,151 (+11%)	12,983 (+7%)	13,231 (+2%)	70%
CELINA	5,703	7,659 (+34)	8,072 (+5%)	9,137 (+13%)	9,650 (+6%)	10,303 (+7%)	81%
LIBERTY TWP	1,178	1,002 (-15%)	997 (-0.5%)		964	917 (-5%)	-22%
MARION TWP	2,199	2,554 (+16%)	2,699 (+6%)	2,753 (+2%)	2,784 (+1%)	2,969 (+6.6%)	35%
CHICKASAW	166	275 (+66%)	326 (+19%)	381 (+17%)	378 (-0.7%)	364 (-3.7%)	119%
RECOVERY TWP	1,305	1,335 (+2%)	1,531 (+15%)		1,381	1,550 (+12%)	19%
FORT RECOVERY (PART)	408	438 (+7%)	337 (-23%)		375	401 (15%)	-2%
WASHINGTON TWP	1,188	1,188 (0%)	1,261 (+6%)		1,259	1,218 (-3%)	3%
DARKE CO	**41,799**	**45,612 (+9%)**	**49,141 (+8%)**	**55,096 (+12%)**	**53,619 (-3%)**	**53,309(-0.6%)**	**27%**
ALLEN TWP	1,325	1,526 (+15%)	1,517 (-0.6%)	1,441 (-5%)	1,457(+1%)	1,158(-20%)	-13%
BURKETTSVILLE	211	290 (+37%)	279 (-3.4%)	295 (+6%)	268 (-9%)	254 (-5%)	20%
NEW WESTON	136	146 (+7%)	174 (+19%)	184 (+6%)	148 (-20%)	135(-9%)	0%
ROSSBURG	203	295 (+45%)	275 (+7%)	260 (-5%)	250 (-4%)	224 (-10%)	10%

POPULATION and PERCENT CHANGE, 1950-2000 STATE OF OHIO, AUGLAIZE, DARKE AND MERCER COUNTIES, and OTHER SELECTED JURISDICTIONS							
REMAINDER	775	795 (+3%)	789 (-0.8%)	702 (-11%)	791 (+12%)	545 (-31%)	-30%
MISSISSINAWA TWP	926	885 (-4%)	848 (-4%)	855 (+0.8%)	795 (-7%)	779 (-2%)	-16%
WABASH TWP	981	1,055 (+7%)	1,022 (-3%)	958 (-6%)	931 (-3%)	934 (+0.3%)	-5%
NORTH STAR	166	169 (+2%)	296 (+75%)	254 (+14%)	246 (+3%)	209 (-15%)	25%
REMAINDER	815	886 (+8%)	726 (-6%)	704 (+3%)	685 (-3%)	725 (-6%)	-11%
THREE COUNTY TOTAL	**100,747**	**114,318 (+13.5%)**	**123,301 (+8%)**	**136,794 (+11%)**	**137,647 (+0.6%)**	**140,844 (+2%)**	**40%**

As shown in the table below and the table on the previous page, nearly all of the areas located within or near the watershed have experienced an increase in population over the last decade, 1990-2000. There are some minor fluctuations in population seasonally. In Mercer County alone there are approximately 458 housing units that are labeled as seasonal, recreational or occasional use. There are an additional 159 units in Auglaize county and 114 units in Darke County in the same category.

Table 3

Population and Percent Change 1990-2000

JURISDICTION	CENSUS YEAR Population	2000 Pop (% change)
DARKE CO	**53,619**	**53,309 (-0.6%)**
ALLEN TWP	1,347	1,078 (-20%)
BURKETTSVILLE	268	254 (-5%)
NEW WESTON	148	135 (-9%)
ROSSBURG	250	224 (-10%)
MISSISSINAWA TWP	796	779 (-2%)
WABASH TWP	931	934 (+0.3%)
NORTH STAR	246	209 (-15%)
OHIO	10,847,115	11,353,140 (+5%)
AUGLAIZE CO	**44,585**	**46,611 (+4.5%)**
GERMAN TWP	3,400	3,831 (+13%)
NEW BREMEN	2,570	2,909 (+13%)
JACKSON TWP	3,415	3,577 (+5%)
MINSTER	2,650	2,794 (+5.4%)
ST. MARYS TWP	11,562	11,600 (+0.3%)
ST. MARYS	8,441	8,342 (-1%)
MERCER CO	**39,443**	**40,924 (+4%)**
BUTLER TWP	6,181	6,459 (+4.5%)
COLDWATER	4,335	4,482 (+3.4%)
FRANKLIN TWP	2,126	2,302 (+8%)
MONTEZUMA	199	191 (-4%)
GIBSON TWP	1,855	1,869 (+0.8%)
FT RECOVERY (PART)	956	904 (-5.4%)
GRANVILLE TWP	3,615	3,885 (+7%)
ST HENRY	1,907	2,271 (+19%)
HOPEWELL TWP	968	1,066 (+10%)
JEFFERSON TWP	12,983	13,231 (+2%)
CELINA	9,650	10,303 (+7%)
LIBERTY TWP	964	917 (-5%)
MARION TWP	2,784	2,969 (+6.6%)
CHICKASAW	378	364 (-3.7%)
RECOVERY TWP	1,381	1,550 (+12%)
FT RECOVERY (PART)	375	369 (-2%)
WASHINGTON TWP	1,259	1,218 (-3%)
THREE COUNTY TOTAL	**137,647**	**140,844 (+2.5%)**

TABLE 3 (continued)

The Education Indicators table shows the enrollment statistics for both public and non-public schools in those counties. Also included are the graduation rates county wide, and the highest degree completed for the population over 25 years of age.

Table 4

Education Indicators Auglaize, Darke and Mercer Counties, Ohio			
EDUCATION	Auglaize	Darke	**Mercer**
Public Schools	22	21	**21**
Enrollment	8,483	10,595	**8,622**
Non public Schools	2	2	**1**
Enrollment	327	138	**176**
Graduation Rate	95.8%	94.3%	**96.7%**
Last Completed Degree (pop 25yrs+)			
High school (or some higher)	85.6%	82.9%	**83.8%**
Bachelor's Degree (or some higher)	**13.4%**	**10.1%**	**12.6%**

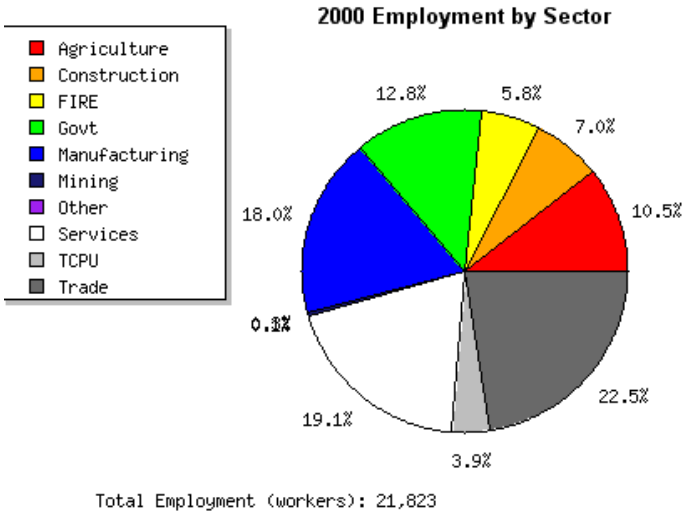
The Employment and Income table below reports the median income, along with the unemployment rates for the previous four years.

Table 5

Employment and Income Indicators Auglaize, Darke and Mercer Counties, Ohio			
Employment and Income	Auglaize	Darke	Mercer
Median Per Capita Income	$19,593	$18,670	$18,531
Unemployment Rate			
2004	5.1%	6.0%	4.5%
2003	5.2%	6.6%	4.6%
2002	5.8%	6.2%	5.2%
2001	4.3%	4.3%	4.5%
2000	3.3%	3.9%	4.0%

This pie chart shows that for Mercer County 22.5% of the workforce is located in the Trade Industry, which includes both wholesale and retail trade. Another 19% is associated with services such as education, health and social services. The third largest employer, with 12.8% of the eligible workers is the Government offices located in the county. Agricultural workers account for approximately 10.5% of the Mercer county employed.

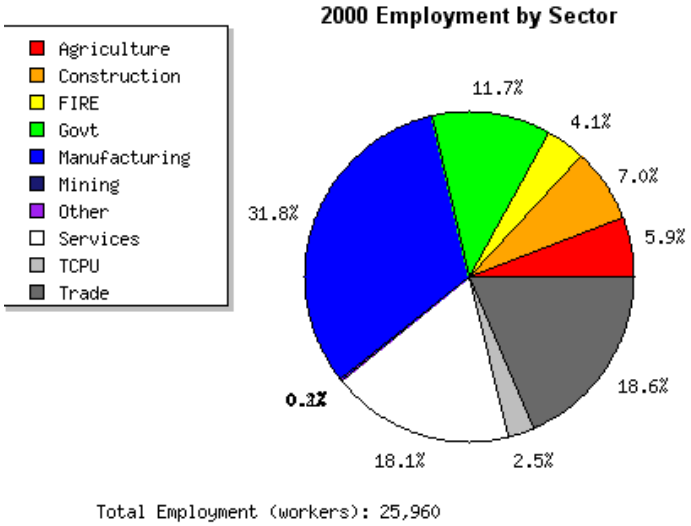
Figure 1: Mercer County Employment Statistics



Source: OSU Extension Data Center / www.osuedc.org

The Auglaize County employment statistics closely resemble those of Mercer County, as seen below. A small difference is noticed regarding the Manufacturing and trade sectors. Manufacturing in Auglaize county accounts for 31.8% of workers, ranking first overall, while the trade sector ranks second with 18.6% of eligible workers. Third and fourth highest percentages, 18.1% and 11.7%, respectively are the Services industry and the Governmental employees.

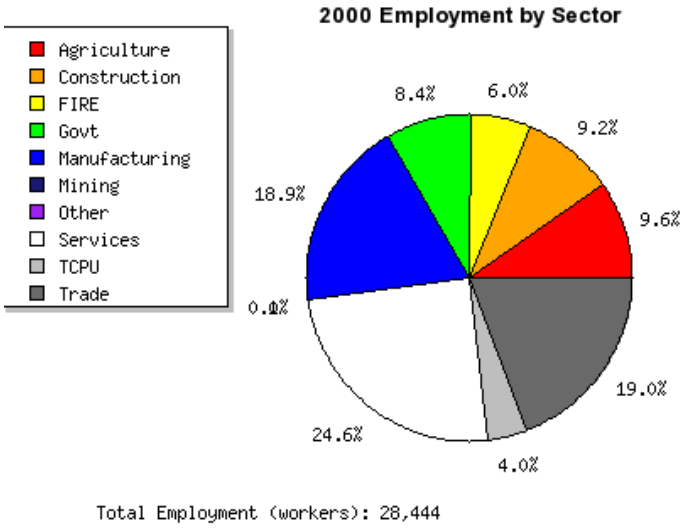
Figure 2: Auglaize County Employment Statistics



Source: OSU Extension Data Center / www.osuedc.org

This pie chart shows that for Darke County 24.6% of the workforce is associated with services such as education, health and social services. Another 19.0% is located in the Trade Industry, which includes both wholesale and retail trade. The third largest employer, with 18.9% of the eligible workers is the manufacturing industry located in the county. Agricultural workers account for approximately 9.6% of the Darke County employed.

Figure 3: Darke County Employment Statistics



Another important industry that seemingly overlaps the industries mentioned above is the Travel and Tourism industry. Due to the location of Grand Lake St. Marys, Mercer and Auglaize counties have a joint county Convention and Visitors Bureau which works to bring events to the area, as well as promotes local events, attractions, and resources at other major travel and tourism events. An example of the economic impact travel and tourism has on the two county area follows.

According to the Auglaize/Mercer Convention and Visitors Bureau, the travel industry bases its formula for the economic impact of tourism upon the area by utilizing the following formula:

- 3 times the amount for room rental will be spent on gasoline, oil and automotive supplies.
- 3.5 times the amount for room rental will be spent on restaurants and clubs.
- 0.81 times the room rental will be spent for entertainment and recreation.
- 1.21 times the room rental will be spent on general retail sales.
- The total number of jobs that tourism supports is calculated by multiplying the spending by 0.00005.

Table 6

Economic Impact of Tourism in Auglaize and Mercer Counties

Years	***2004***	***2005***	***2006***	***2007***
Total Room Sales	$ 4,933,655	$ 5,144,802	$ 5,370,339	$ 4,996,937
Gasoline, Oil, Auto Repairs, Auto Sales	$ 14,800,965	$ 15,434,406	$ 16,111,017	$ 14,990,811
Restaurants & Clubs	$ 17,267,792	$ 18,006,807	$ 18,796,186	$ 17,489,279
Entertainment & Recreation	$ 3,996,260	$ 4,167,289	$ 4,349,975	$ 4,047,518
General Retail Purchases	$ 5,969,722	$ 6,225,220	$ 6,498,110	$ 6,046,293
Total Tourism Income	**$ 46,968,394**	**$ 48,978,524**	**$ 51,125,626**	**$ 47,570,838**
Jobs Supported by Tourism Dollars	2348	2448	2556	2378

Source: Donna Grube, Director, Auglaize/Mercer Convention and Visitors Bureau. Written correspondence to GLSM watershed project.

The agricultural industry is another major component of the economic base for the watershed. As detailed below the value of the food and agricultural industry affects more that those that farm. The following information was provided by Ohio Farm Bureau.

Auglaize County	Darke County	Mercer County
Agriculture contributes $477.5 million in output and employs nearly 5,000 people in Auglaize County.	Agriculture contributes $598.6 million in output and employs 6,400 people in Darke County.	Agriculture contributes $621.7 million in output and employs 6,500 people in Mercer County.
Crop production represents 51% of production agriculture in Auglaize County.	Livestock and poultry production represents over 67% of production agriculture in Darke County.	Livestock and poultry production represents over 78% of production agriculture in Mercer County.
Dannon, G A Wintzer & Son, and *Hoge Lumber Company* are major food and forestry processors located in Auglaize County.	*Creative Cabinet Systems, Keller Grain & Feed, Weaver Brothers, and Whiteford Food Products* are major food and forestry processing businesses located in Darke County.	*Basic Grain Products, Cooper Farms, and Fort Recovery Equity Exchange* are food processing businesses located in Mercer County.
212,000 acres of land are farmed in Auglaize County.	346,000 acres of land are farmed in Darke County.	273,000 acres of land are farmed in Mercer County.
Auglaize County Farmers produce over 3.5 million bushels of corn, 2.5 million bushels of soybeans, 20,500 cattle, 41,300 hogs, and 92.6 million pounds of milk.	Darke County farmers produce over 7.8 million bushels of corn, 4.1 million bushels of soybeans, 27,500 cattle, 126,500 hogs, and 138.8 million pounds of milk.	Mercer County farmers produce over 4.4 million bushels of corn, 2.9 million bushels of soybeans, 41,900 cattle, 145,200 hogs, and 314.5 million pounds of milk.
Among Ohio's counties, Auglaize ranks 8th in hogs, 11th in wheat harvested, 13th in milk production, and 17th in cattle.	Among Ohio's counties, Darke ranks 2nd in hogs, 5th in soybean production and processed tomatoes, 6th in cattle, 7th in corn harvested, and 8th in milk production.	Among Ohio's counties, Mercer ranks 1st in hogs, 2nd in cattle and milk production, 8th in oats harvested, and 12th in wheat production.
Cash receipts from marketing of farm commodities totaled nearly $85 million.	Cash receipts from marketing of farm commodities totaled over $226.3 million.	Cash receipts from marketing of farm commodities totaled over $282.5 million.
In Auglaize County, food and forestry processing accounted for $313.2 million in total output.	In Darke County, food and forestry processing accounted for $128.2 million in total output.	In Mercer County, food and forestry processing accounted for $171 million in total output.

1.4 Past Attempts at Watershed Protection

There have been several projects and studies completed on the subject of how to protect and/or enhance the Grand Lake/Wabash River watershed. These range from studying the avian species of the Grand Lake St Marys area, as Clarence Clark and James Sipe did in 1960 with *Birds of the Lake St Marys Area: An Annotated Check List and Migration Dates*, to the current efforts undertaken by the GLWWA Watershed Project‘s Joint Board of Supervisors.

Several early reports account management techniques that were utilized to ensure the Grand Lake St. Marys was a successful fishery for the sportsmen. These reports focused on techniques such as providing the proper habitat for the fish and other wildlife and the stocking of species within the lake. From there, the 1980‘s would provide the next crucial study, document and actions taken to protect the lake and the citizens who used the lake for recreation.

The United States Geological Survey, the US EPA, Army Corps of Engineer‘s, Ohio Department of Natural Resources, and other similar agencies have produced reports, studies, and suggestions on the status of the watershed, how to reduce the degradation occurring, and why it is important to protect the resources of the area.

In more recent years, Ohio EPA conducted water quality sampling in the summer of 1999 to provide a more comprehensive look at the quality of the Grand Lake/Wabash watershed. Samples taken from these sites indicate potential locations and sources of the non-point source pollution that has had such an impact on the watershed. The watershed project continues to use this sampling data as a tool when discussing the importance of watershed protection.

The watershed project also utilized a consulting firm, Richard Hupman & Associates, to complete an inventory of the Grand Lake St. Marys watershed, funded through an ODNR Canal Lakes Grant. The document was completed in 1999 and contains numerous tables, charts, and graphs that present and interprets the findings of the inventory, provides vast amounts of background information on various portions of the study, and also provides a section on findings and recommendations for the watershed. This document has been valuable for the production of this action plan and other documents, funding applications and information materials produced by the watershed project. The document proved to be extremely valuable for the production of the original Grand Lake St. Marys Watershed Management Plan that was endorsed in 2005. The entire report can be obtained by contacting the Grand Lake/Wabash Watershed Alliance office or the Mercer Soil and Water Conservation District office.

In August of 2004, Ohio EPA Region 5, in conjunction with Tetra Tech, Inc., a consulting firm in Cleveland, Ohio, finalized a Total Maximum Daily Load (TMDL) Report for the Wabash River watershed. The report was completed to attain water quality standards and determine designated uses for the Wabash River in Mercer County, Ohio. The report identified total phosphorus, nitrate-nitrite and total suspended solids as major

pollutants of the Wabash River and its tributaries. Target levels for the three pollutants were established based on various methodologies. The TMDL report was especially valuable during the development of this watershed action plan. The entire TMDL report can be obtained from Ohio EPA's website or by contacting the Grand Lake/Wabash Watershed Alliance office or the Mercer Soil and Water Conservation District office.

A similar report was completed by Ohio EPA for the Grand Lake St. Marys and Beaver Creek watersheds. Sampling data for the TMDL report was collected during July of 1999 to June of 2006. Ohio EPA held a public outreach meeting on the TMDL results in February of 2007. The finalized report includes similar information as the TMDL completed for the Wabash River and was finalized August 27, 2007. The entire report can be obtained from the Ohio EPA's website or by contacting the Grand Lake/Wabash Watershed Alliance office or the Mercer Soil and Water Conservation District office. The information from the draft report has proved to be especially valuable during the creation of this watershed action plan.

Furthermore, local agencies in Mercer, Darke, and Auglaize counties, such as the Health Departments, OSU Extension, Soil and Water Conservation Districts, Natural Resource Conservation Service, and many other citizen based organizations, are continuously searching for funding, resources, and information to provide to stakeholders regarding water quality protection. Several publications and events have been produced and conducted in an attempt to provide education and insight as to how individuals can make small changes for the betterment of the watershed, the waterways, Grand Lake St. Marys and the Wabash River.

1.0 WATERSHED PROJECT DEVELOPMENT

2.1 Mission

The mission of the Grand Lake/Wabash Watershed Alliance is to improve the quality of life by promoting stewardship of the natural resources in the Grand Lake/Wabash River watershed. The project objectives are:

1) *To promote wise management of nutrients and chemicals from all sources.*

2) *To reduce agricultural, construction site, shoreline, and streambank soil erosion and sedimentation.*

3) *To promote comprehensive water quality enhancement and protection.*

4) *To educate and develop better understanding and cooperation among all citizens, partners, stakeholders who live, work or recreate in the watershed.*

5) *To utilize and promote proper water management techniques to minimize damage caused by flooding within the watershed.*

The mission statement was developed in as a combination of the mission of the Grand Lake St. Marys Watershed Project and the Wabash Watershed Alliance. The advisory group discussed the need for a mission statement that reflected the needs of the lake environment as well as the river environment. It was stated by one of the advisory board members that the group should consider who the group was serving, and the purpose of the group. It was also advised that the group consider the mission statement to be a statement of the reason for being and how the group‘s goal would be described to others in the community. Those representing the two originally individual watershed groups expressed interest in seeing a melding of the mission statements as opposed to creating an entirely new mission. Members also discussed the importance of stressing the quality of life and the quality of the water within the watershed. This mission statement remains the guiding statement as the watershed alliance develops newsletters, grant proposals and public presentations.

2.2 Public Involvement

Public Involvement was a central key to developing the original Grand Lake St. Marys Watershed Project Management Plan. A series of surveys were distributed to sets of stakeholders throughout the first year. Specific surveys were mailed to participants in the first year of the Precision Nutrient Application/ Grid Sampling cost share program, attendees of the Celina Water Treatment Plant's Open House, and they were included in an issue of the quarterly newsletter. These participants were surveyed on what the perceived pollution problems were in the watershed, how often they used the lake as a resource, farming practices on their land, and interest in other programs offered by the watershed project. Submission of completed surveys was high from all survey categories and information has been compiled and reported to the Joint Board of Supervisors. All comments have been taken into consideration when developing new project goals, ideas and grant proposals. Education materials have also been developed as a result of information being requested at a high level.

A series of subwatershed meetings was conducted during the summer and fall of 2002 for portions of the Grand Lake St. Marys watershed. This helped us to reach people in their own areas and provide them with an opportunity to interact with residents and neighbors of their subwatershed. Topics for discussion during the course of the meeting included; What is a watershed, Developing a Management Plan, Grand Lake St. Marys Watershed information; and information specifically relevant to the sub-watershed where the meeting took place. After information was provided, each attendee was asked to write comments, questions, concerns and both positive and negative issues related to what they have seen or experienced in the area. The potential or perceived pollution problems were then listed, discussed, and prioritized by the group. Discussion is also encouraged on how to enhance the positive actions that were mentioned during the evening. General informational requests or concerns were also addressed at the end of the evening.

The Grand Lake/Wabash Watershed Alliance has employed a similar method for the development of this watershed action plan. This plan includes all of the new information for the Wabash River watershed as well as updated information for the Grand Lake St. Marys portion of the watershed. Ideas from the original watershed management plan have been incorporated into this plan and were used to develop the action plans for the remaining Wabash River watershed. Three different stakeholder meetings (open to the public) were held to discuss goals and objectives for the plan along with the general watershed information (including TMDL results). Attendance at the meetings included a broad spectrum of people, particularly county commissioners, farmers, lake interest groups, municipality representatives, water and wastewater treatment plant representatives, farm bureau, local health departments, SWCD representatives and many more. Surveys were conducted at each of the meetings, and a survey was sent in the Winter 2007 newsletter. Local citizens associated with the topic areas were called on to provide assistance in various ways. They provided insight on specific BMP's, proofread pertinent information, or spoke at events to promote the watershed and its programs. Attempts were made to obtain a broad spectrum of advice and

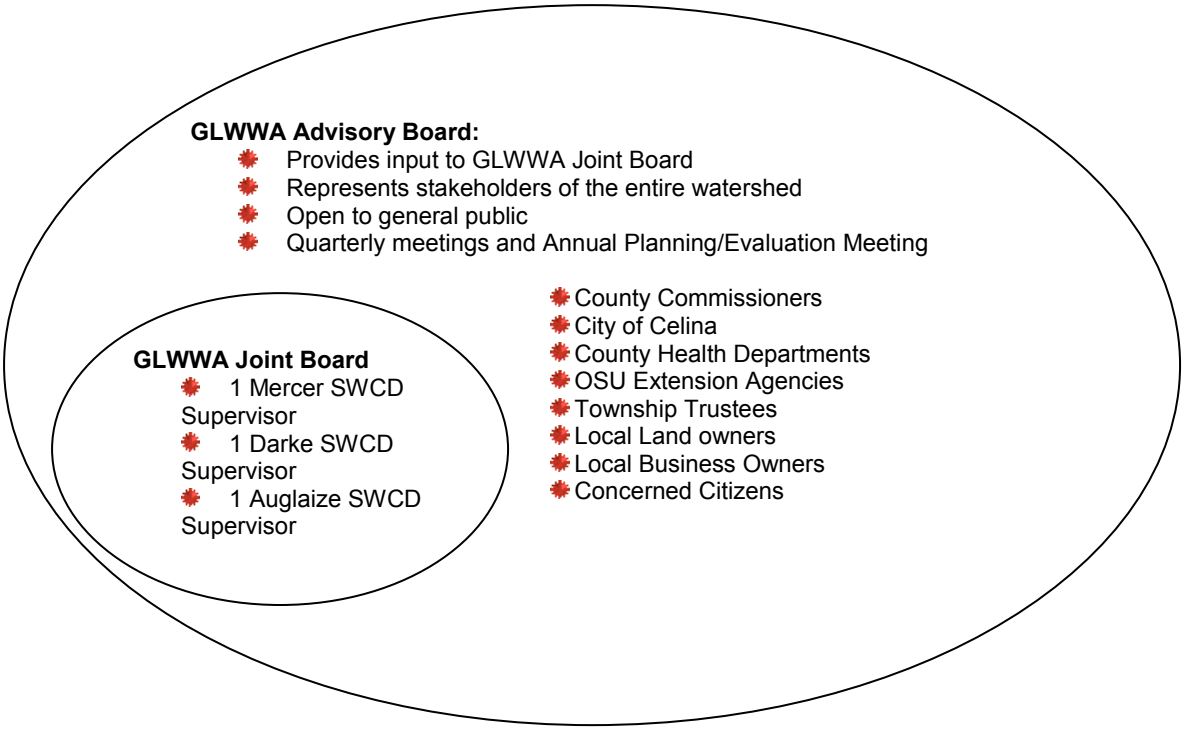
opinions regarding developing new programs and to evaluate the success of both current and past programs offered by the alliance.

2.3 GLWWA Organizational Structure

The Grand Lake/Wabash Watershed Alliance is a partnership of Mercer, Darke and Auglaize Counties, and the City of Celina, directed by a Joint Board of Supervisors, consisting of one representative from Mercer SWCD, one representative from Auglaize SWCD and one representative from Darke SWCD.

The Joint Board of Supervisors provides oversight for programmatic decisions such as grant applications and objectives, day to day operations and budgetary items. Input and direction from the watershed coordinator is strongly encouraged and utilized when making decisions regarding the watershed project. The watershed project also receives suggestions and insight from the Advisory Board. Final programmatic and fiscal decisions are made with a majority vote by the Joint Board of Supervisors. Personnel related decisions are made by the Mercer SWCD Board with guidance from the GLWWA Joint Board.

The following is an organizational diagram, which provides a pictorial setup for the alliance.



The office for the watershed project is currently housed with the Mercer Soil and Water Conservation District. This provides the benefit of shared resources, close proximity to other natural resource departments and the ability to collaborate on development and implementation of protection efforts.

The funding for the watershed project comes in several forms, including federal, state and local resources. The GLWWA watershed project received a six-year ODNR Watershed Coordinator Grant, which provided primary funding for salary and fringe benefits; a CWA Section 319 grant from Ohio EPA, which provided funding for several cost share programs and educational components; a 319 Operations Support Grant, which provided funding to help alleviate a portion of the associated costs with implementing a 319 grant; an ODNR-DSWC state pollution abatement cost share grant, and other smaller grants that provided funding for short term or one-time events. This funding has allowed the project to produce informational brochures, newsletters, provide BMP cost share and incentive payments for conservation efforts, purchase equipment, and provide funding for a full time coordinator position.

Funding similar to the above is always sought by the watershed project. In 2007 the watershed project applied for and will be receiving a watershed coordinator implementation grant. This grant is for a watershed coordinator‘s salary. Match for this grant was provided by the City of Celina and Auglaize, Darke and Mercer County Commissioners. This grant is provided by the Ohio Department of Natural Resources and 319 grant funds through Ohio EPA. This is a three year grant and after the three years, it is expected by ODNR and OEPA that the watershed project will be self-sufficient.

The watershed project is a partner with many other organizations, stakeholders, and agencies that work together to protect and enhance various aspects related to and directly involving Grand Lake St. Marys, the Wabash River and its tributary streams.

2.4 Partnership

This plan was developed primarily by the Grand Lake/Wabash Watershed Project with added assistance provided by the members of the Advisory Board, partnering agencies and those otherwise involved in the development and/or implementation of the programs to be offered by the watershed project.

The following is provided as a listing of other agencies, groups, and partners that will be crucial in the implementation and evaluation of this plan. We certainly will not be able to list everyone that has partnered with the project to protect and enhance Grand Lake St. Marys and the Wabash River.

Auglaize County Commissioners: The Commissioners have generously provided a significant portion of the local match required for the Watershed Coordinator grant. They will continue to cooperate with the GLWWA to promote the use of conservation practices on the land within Auglaize County. The Commissioners will also encourage the county and community planning agencies to plan land management within the best interests of the respective watershed and natural resources.

Darke County Commissioners: The Commissioners have also generously provided a significant portion of the local match required for the Watershed Coordinator grant. They will continue to cooperate with the GLWWA to promote the use of conservation practices on the land within Darke County. The Commissioners will also encourage the county and community planning agencies to plan land management within the best interests of the respective watershed and natural resources.

Mercer County Commissioners: The Commissioners have also generously provided a significant portion of the local match required for the Watershed Coordinator grant. They will continue to cooperate with the GLWWA to promote the use of conservation practices on the land within Mercer County. The Commissioners will also encourage the county and community planning agencies to plan land management within the best interests of the respective watershed and natural resources.

City of Celina: The City of Celina has also provided a significant portion of the local match for the Watershed Coordinator grant. The working partnership will continue as the need for clean drinking water is imperative. As the City of Celina strives to meet stormwater requirements and has developed long term plans for lake side beautification, there will be many opportunities for education, outreach and community involvement in understanding the impact that we all have on our surroundings, and how vital that is to protecting the natural resources and the health of the residents of the city.

The following agencies have agreed to provide assistance when possible regarding the promotion of new programs and projects, public outreach and education, design and implementation of individual practices or structures, and general technical assistance per area of expertise.

Auglaize County Engineer‘s Office

Auglaize County Farm Bureau

Auglaize County Health Department

Auglaize Soil and Water Conservation District

Coldwater Young Farmers

Darke County Engineer‘s Office

Darke County Farm Bureau

Darke County Health Department

Darke Soil and Water Conservation District

Lake Improvement Association

Marion Young Farmers

Mercer County Engineer‘s Office

Mercer County Farm Bureau

Mercer County Farm Service Agency

Mercer County Health Department

Mercer Soil and Water Conservation District

Natural Resources Conservation Service

Ohio State University Extension, Auglaize County

Ohio State University Extension, Darke County

Ohio State University Extension, Mercer County

The GLWWA operational documents, such as the Bylaws (including voting procedures and decision making process guidelines), Job Description, and Memorandum of Understanding with the Mercer Soil and Water Conservation District, can be found in Appendix B.

3.0 WATERSHED DESCRIPTION

3.1 Topography

The majority of the GLWWA watershed lies in the Central Lowland physio-geographic province, and more specifically in the Indiana and Ohio Till Plain section. Throughout the watershed, the relief is nearly level with some gentle sloping areas, with the greatest elevation found at approximately 1,070 ft mean sea level (msl) in the watershed's southwest corner near the Mercer-Darke County Line.

~~"M~~ercer County is a part of two continental watersheds. The Ohio-Erie Divide crosses the county in a general east-west direction and is partly oriented to the Wabash moraine through its central extension in the county. North of this divide, the county is mostly drained into Lake Erie by the St. Marys River and its tributaries. … Grand Lake lies across the Ohio-Erie divide. It is an artificially created body of water 13,500 acres in size, two-thirds of which is in Mercer County. The lake was created by damming each end of a long, narrow swale to provide water for the Ohio-Erie Canal system. It drains to Lake Erie from the east and to the Ohio River from the west by Beaver Creek, a major tributary of the Wabash River in Mercer County." [Priest, T.C. 1979]

Historical and current topographical maps of Ohio and each county can be found at the following website: http://historical.maptech.com/statemap.cfm?stateabr=OH.

MAP 9

STATE OF OHIO
Bob Taft, Governor

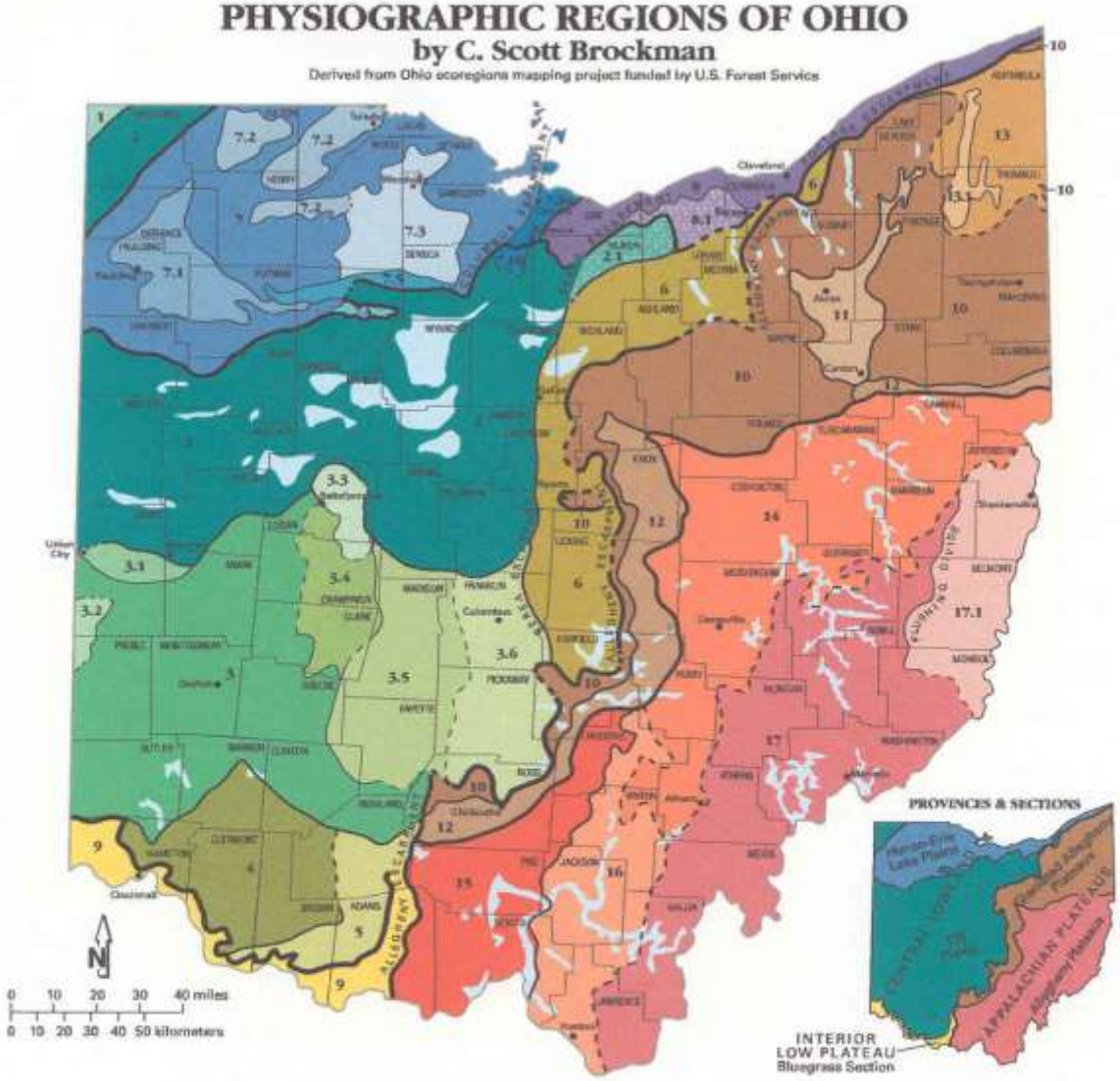
DEPARTMENT OF NATURAL RESOURCES
Samuel W. Speck, Director

DIVISION OF GEOLOGICAL SURVEY
Thomas M. Berg, Chief

PHYSIOGRAPHIC REGIONS OF OHIO

by C. Scott Brockman

Derived from Ohio ecoregions mapping project funded by U.S. Forest Service



Till Plains

- 1. Steuben Till Plain
- 2. Central Ohio Clayey Till Plain
  - 2.1. Berea Headlands of the Till Plain
- 3. Southern Ohio Loamy Till Plain
  - 3.1. Union City-Bloomer Transitional Terrain
  - 3.2. Whitewater Interlobate Plain
  - 3.3. Bellefontaine Upland
  - 3.4. Mad River Interlobate Plain
  - 3.5. Darby Plain
  - 3.6. Columbus Lowland
- 4. Illinoian Till Plain
- 5. Dissected Illinoian Till Plain
- 6. Galion Glaciated Low Plateau

Transitional boundary

Lake basin/deposits outside Huron-Erie Lake Plains

Huron-Erie Lake Plains

- 7. Maumee Lake Plains
  - 7.1. Paulding Clay Basin
  - 7.2. Maumee Sand Plains
  - 7.3. Woodville Lake-Plain Reefs
  - 7.4. Findlay Embayment
  - 7.5. Fostoria Lake-Plain Shoals
  - 7.6a and 7.6b. Bellevue-Castalia Karst Plain
- 8. Erie Lake Plain
  - 8.1. Berea Headlands of the Erie Lake Plain

Bluegrass Section

- 9. Outer Bluegrass Region

Glaciated Allegheny Plateaus

- 10. Killbuck-Glaciated Pittsburgh Plateau
- 11. Akron-Canton Interlobate Plateau
- 12. Illinoian Glaciated Allegheny Plateau
- 13. Grand River Low Plateau
  - 13.1 Grand River Finger-Lake Plain

Allegheny Plateaus

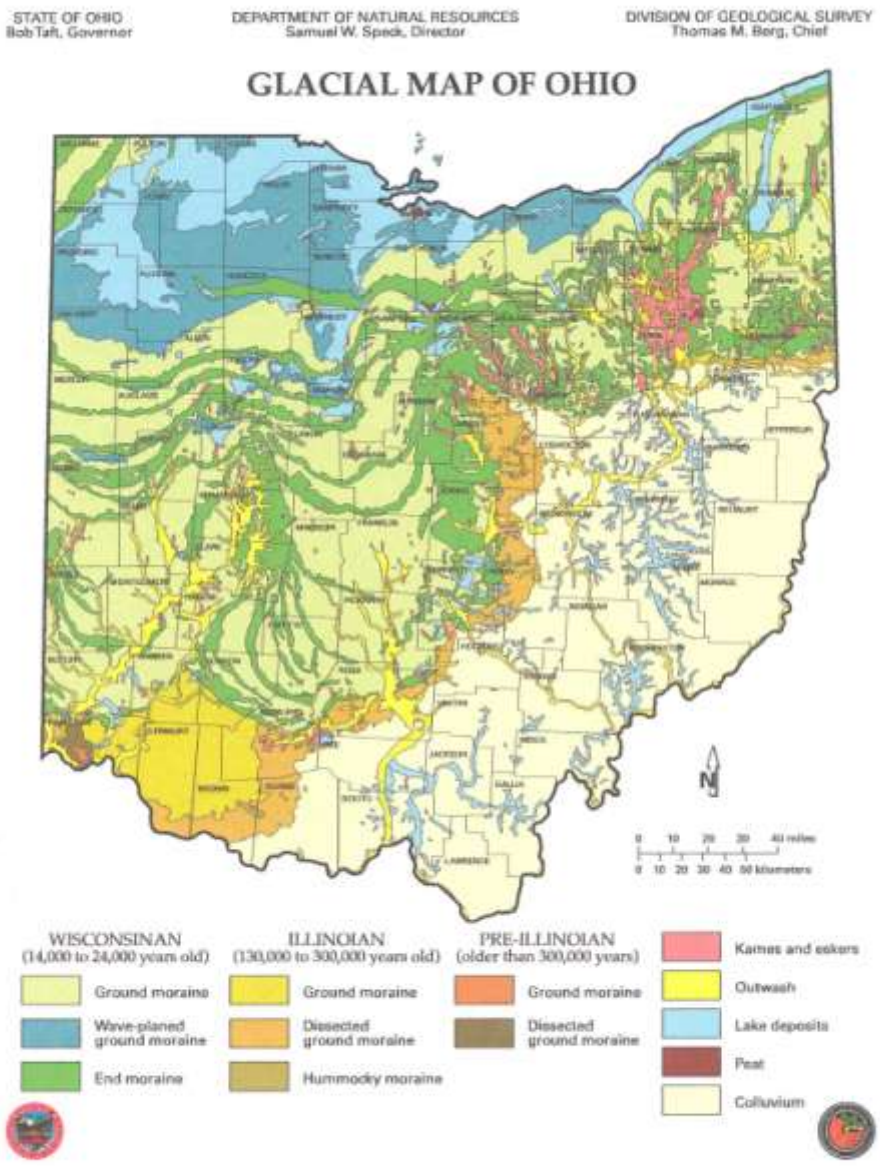
- 14. Muskingum-Pittsburgh Plateau
- 15. Shawnee-Mississippian Plateau
- 16. Ironton Plateau
- 17. Marietta Plateau
  - 17.1. Little Switzerland Plateau

4/98

3.2 Geology

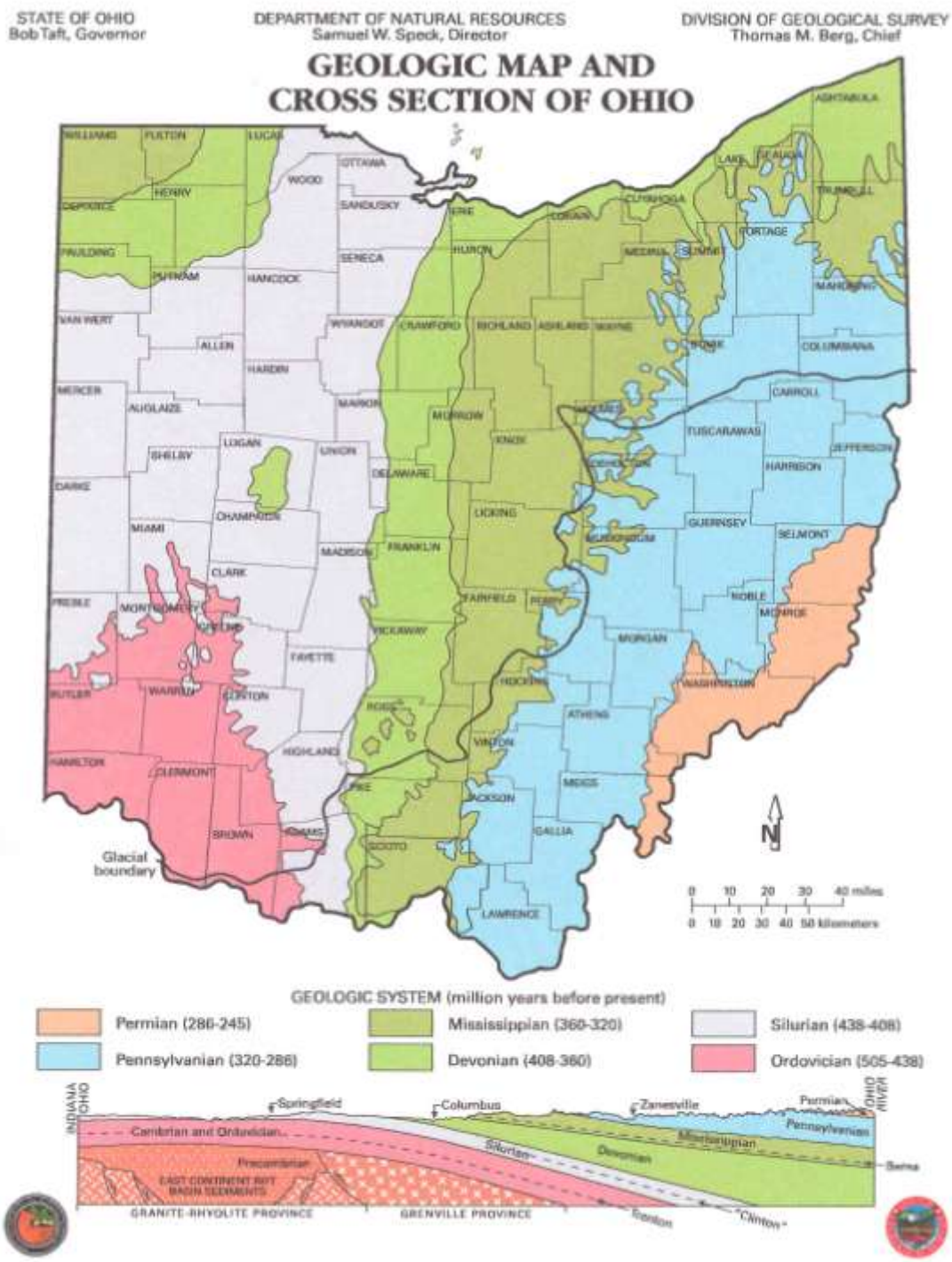
The watershed has been covered three times by glaciers, the most recent coverage by the Wisconsin advance (14,000 to 24,000 years old). The geology of the area is composed of glacial tills, clayey or silty materials deposited by water, and silty materials deposited by wind. Till materials contain a high percentage of limestone and dolomite, both fines and pebbles, and igneous rock transported from the north. Sub-soils in the watershed are classified as having permeabilities of slow to moderately slow due to their clayey nature.

MAP 10



The above illustration depicts the glacial advances and deposits in Ohio.

MAP 11


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
Glacial boundary
N
0 10 20 30 40 miles
0 10 20 30 40 50 kilometers
GEOLOGIC SYSTEM (million years before present)
Permian (286-245)
Pennsylvanian (320-286)
Mississippian (360-320)
Devonian (408-360)
Silurian (438-408)
Ordovician (505-438)
INDIANA
OHIO
WEST VIRGINIA
Springfield
Columbus
Zanesville
Permian
Pennsylvanian
Mississippian
Devonian
Silurian
Cambrian and Ordovician
Precambrian
EAST CONTINENT RIFT BASIN SEDIMENTS
GRANITE-RHYOLITE PROVINCE
GRENVILLE PROVINCE
Trenton
Clinton
Berea

3.3 Soils

Primary soil associations for the watershed consist of Blount-Pewamo association in the area south and west of the lake and the majority of the lake's shoreline, and a large portion of Blount-Glynwood association, found in more sloping areas in the southern and western portion of the watershed and portions of the lake's northern shoreline. Areas directly surrounding much of the Wabash River consist of the Shoals-Genesee association. Also present in smaller amounts are the Montgomery-McGary, Defiance-Wabasha, Millgrove-Digby-Gallman and Sloan associations. Highly erodible land is more common in the Blount Glynwood association, and hydric soils are more common in the Blount-Pewamo association. The following descriptions of these soil associations and included soil types are taken from the —Soil Survey of Mercer County, Ohio" published by the USDA Soil Conservation Service in 1979:

Blount-Pewamo: *Level, nearly level and gently sloping, somewhat poorly drained and very poorly drained soils formed in glacial till.* This map unit makes up about 62 percent of the county. It is about 50 percent Blount soils, 40 percent Pewamo soils, and 10 percent soils of minor extent. Blount soils are poorly drained, nearly level and gently sloping, medium textured soils on slight rises, low knolls, and foot slopes. Permeability is slow or moderately slow, and runoff is slow and medium. Pewamo soils are very poorly drained, level and nearly level, moderately fine textured and fine textured soils in depressions. Permeability is moderately slow and runoff is very slow. Some areas are ponded. Both soils have a seasonal high water table near the surface. The major soils are used for cash grain farming in the northern part of the county and for cash grain and livestock farming in the southern part. Corn, soybeans, wheat, oats, hay, pasture grasses, and tomatoes are the principal crops. The soils have good potential for farming and woodland. The potential is poor for building site development and sanitary facilities and fair or poor for most recreational uses. The seasonal high water table is the main limitation for most uses. Maintaining the tilth of both soils and controlling erosion on the gently sloping Blount soils are also major concerns for farming. The moderately slow or slow permeability severely limits these soils for such uses as septic tank effluent fields. Low strength limits building site development.

Blount-Glynwood: *Nearly level to sloping, somewhat poorly drained and moderately well drained soils formed in glacial till.* This map unit makes up about 25 percent of the county. It is about 45 percent Blount soils, 35 percent Glynwood soils and 20 percent soils of minor extent. Blount soils are somewhat poorly drained, nearly level and gently sloping, medium textured soils on flats, low knolls, and foot slopes. Permeability is slow or moderately slow, and runoff is slow and medium. The seasonal high water table is near the surface. Glynwood soils are moderately well drained, gently sloping and sloping, medium textured soils on knolls and side slopes along drainageways. Permeability is slow, and runoff is medium and rapid. The seasonal high water table is between depths of 24 and 36 inches. The major soils are used mainly for cash grain and livestock farming and woodland. Corn soybeans, wheat, oats, hay, and pasture grasses are the principal crops. The soils have good and fair potential for farming. They have fair or poor potential for building site development and sanitary facilities. The potential is good for woodland and fair for recreational development. The main limitation of these soils is the erosion hazard, especially on the sloping to steep Morley soils. Also, the Blount soils are wet. They dry out more slowly in spring than Glynwood soils and are not suited to grazing early in spring or to crops that are planted early in spring. Glynwood soils are better suited than Blount soils to building site developments. Both soils are poorly suited to such sanitary facilities as septic tank effluent fields because of the slow or moderately slow permeability.

Although the following five associations are of much smaller extent on the Mercer County general Soil Map, they identify the location of distinctly different soils adjacent to streams.

The Montgomery-McGary association consists of level, nearly level, and gently sloping, very poorly drained and somewhat poorly drained soils formed in lake-deposited clay and silt. These soils are most common in the portions near the lake in the Coldwater Creek and Grassy/Monroe Creeks subwatersheds. These soils are also present in the Wabash Headwaters to below Bear Creek, the Wabash River above Bear Creek below Stony Creek and the Beaver Creek from Grand Lake to above Little Beaver Creek subwatersheds.

The Defiance-Wabasha association consists of level and nearly level, somewhat poorly drained and very poorly drained soils formed mainly in fine textured and moderately fine textured recent alluvium. These soils are most common on floodplains in the lower part of Beaver Creek subwatershed. These soils are also present along portions of Beaver Creek and the Wabash River in the Beaver Creek from Grand Lake to above Little Beaver Creek, Beaver Creek below Little Beaver to Wabash River and Wabash River below Beaver Creek to New Corydon subwatersheds.

The Shoals-Genesee associations consists of level and nearly level, somewhat poorly drained and well drained soils formed in medium textured and moderately course textured recent alluvium. These soils are common on floodplains in the Coldwater Creek subwatershed upstream from the confluence of Coldwater and Burntwood Creeks. The Shoals-Genesee association is also present along a large percentage of the floodplains along the Wabash River throughout the watershed as well as along a portion of Little Beaver Creek.

The Sloan association consists of level and nearly level, very poorly drained soils formed in moderately coarse textured to moderately fine textured recent alluvium. Sloan soils are most common on floodplains in the Beaver Creek subwatershed downstream from the confluence of Beaver and Montezuma Creeks.

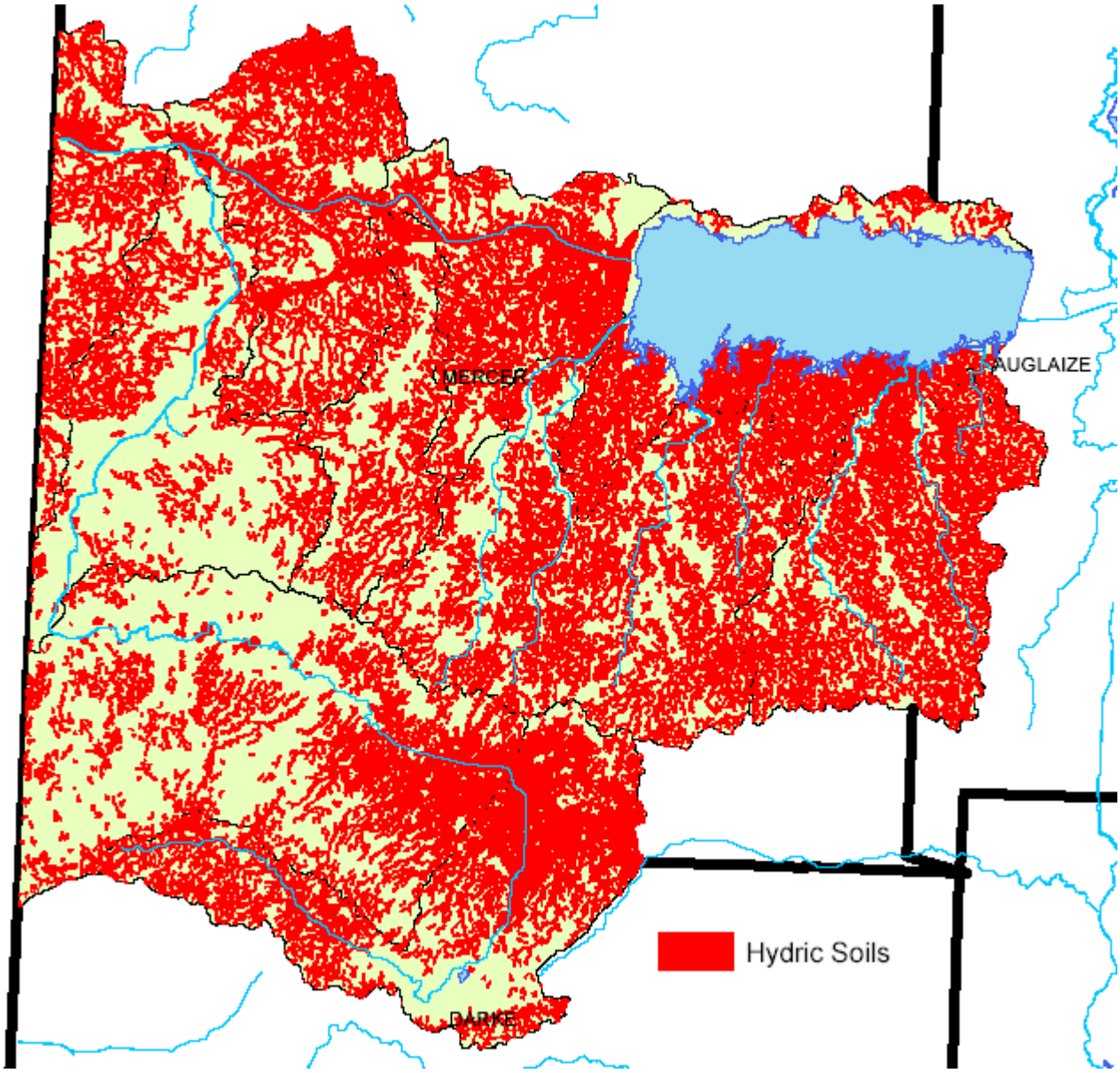
The Millgrove-Digby-Gallman association consists of level, nearly level, and gently sloping, very poorly drained to well drained soils formed in glacial outwash. These soils are most common along Big Run Creek, Beaver Creek and Little Beaver Creek in the Beaver Creek below Little Beaver to Wabash River and Little Beaver Creek subwatersheds.

Hydric soils are formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part of the soil. These soils are typically considered poorly drained with a high water table. Hydric soils are well suited for farming practices, assuming good subsurface drainage is provided. However, these soils are very well suited for vegetation growth and wildlife habitat. The

Lake Erie CREP wetland restoration practice requires that sites outside the 100-year flood plain include at least 50 percent hydric soils. Therefore, areas with hydric soils are well suited for wetland construction and/or restoration.

Map 12 illustrates the hydric soils within the watershed. There are approximately 54,270 total acres of hydric soils in the watershed. This data was derived from the 2004 Soil Data Mart and provided by the Ohio Department of Natural Resources – Division of Soil and Water. The hydric soil types include: Montgomery, Muskego, Pewamo, Lippincott, Patton, Defiance, Edwards, Millgrove, MIllsdale, Olentangy, Sloan and Wabasha.

MAP 12
Hydric Soils



3.4 Biological Features

3.4.1 Rare, Threatened, and Endangered Species

The following page shows a map of the recorded rare and/or endangered species for the Upper Wabash Watershed. This map was developed by Butch Grieszmer, Ecological Analyst with ODNR's Division of Natural Areas and Preserves. In the associated letter, Mr. Grieszmer writes that —There are no existing or proposed state nature preserves at the project site. We are also unaware of any unique ecological sites, geologic features, breeding or non-breeding animal concentrations, champion trees, state forests, scenic rivers, or wildlife areas within the project area". The letter goes on to state that —Our inventory program has not completely surveyed Ohio and relies on information supplied by many individuals and organizations. Therefore, a lack of records for any particular area is not a statement that rare species or unique features are absent from that area. Although we inventory all types of plant communities, we only maintain records on the highest quality areas. Also we do not have data for Ohio wetlands." [Grieszmer, 2003]

The table associated with the map lists the ID number as shown on map, the Scientific name of the species indicated, the common name of the species, a date when the species was last observed and the corresponding information was submitted to the department, the current state listing status and the current federal listing status. A key to the status abbreviations is found below.

State Status:	E	~	Endangered
	P	~	Potentially Threatened (Plants)
	SC	~	Special Concern (animals)
	T	~	Threatened
Federal Status:	FT	~	Federally Threatened

MAP 13
Rare & Endangered Species, Upper Wabash Watershed

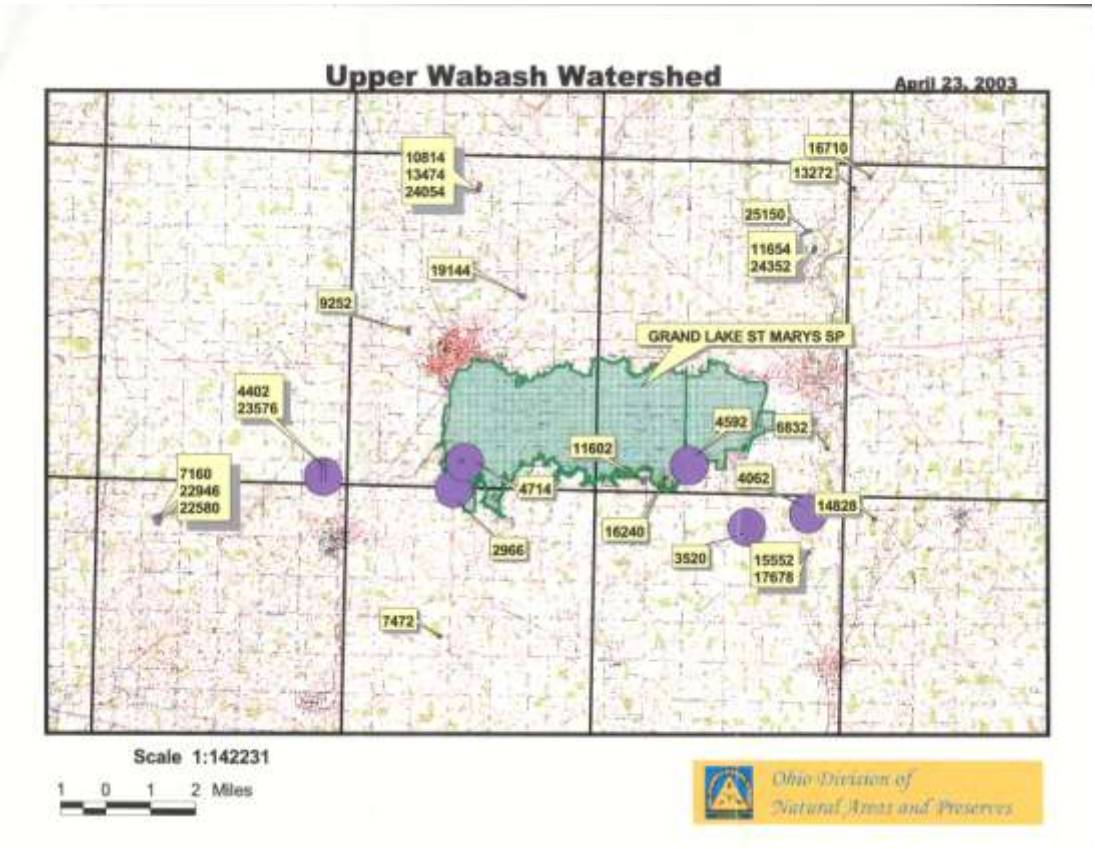


Table 7
Rare & Endangered Species, Upper Wabash Watershed

FEATURE_ID	SNAME	SCOMNAME	LASTOBS	STATE_STAT	FEDERAL_ST
2966	TURKEY VULTURE ROOST		1973-00		
3520	TRILLIUM RECURVATUM	PRAIRIE WAKE-ROBIN	1987-05	P	
4062	TRILLIUM RECURVATUM	PRAIRIE WAKE-ROBIN	1987-05	P	
4402	ARENARIA LATERIFLORA	GROVE SANDWORT	1991-05	P	
4592	LOPHOTOCARPUS CALYCINUS	SOUTHERN WAPATO	1967-09	P	
4714	HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	2000-06	E	LT
6832	TRILLIUM RECURVATUM	PRAIRIE WAKE-ROBIN	1985-05	P	
7160	GREAT BLUE HERON COLONY		1989-05		
7472	ACCIPITER STRIATUS	SHARP-SHINNED HAWK	1987-07	SC	
10814	ARENARIA LATERIFLORA	GROVE SANDWORT	1991-06	P	
11654	VITIS CINEREA	PIGEON GRAPE	1989-08	P	
13272	VITIS CINEREA	PIGEON GRAPE	1985-10	P	
13474	CAREX CRUS-CORVI	RAVEN-FOOT SEDGE	1991-06	T	
14828	TRILLIUM RECURVATUM	PRAIRIE WAKE-ROBIN	1986-05	P	
16710	VITIS CINEREA	PIGEON GRAPE	1989-08	P	
15552	ARENARIA LATERIFLORA	GROVE SANDWORT	1985-05	P	
16240	GREAT BLUE HERON COLONY		1989-11		
16674	GREAT BLUE HERON COLONY		1991-04		
17678	TRILLIUM RECURVATUM	PRAIRIE WAKE-ROBIN	1985-05	P	
22946	PLATANTHERA FLAVA	TUBERCLED REIN ORCHID	1990-06	P	
24054	CAREX CRUS-CORVI	RAVEN-FOOT SEDGE	1989-07	T	
19144	MIXED EMERGENT MARSH		1989-08		
9252	OAK-HICKORY FOREST		1989-09		
11602	MAPLE-ASH-OAK SWAMP		1989-08-31		
23576	OAK-MAPLE FOREST		1989-10		
22580	BEECH-OAK-RED MAPLE FOREST		1989-05		
25150	FLOODPLAIN FOREST		1989-08-25		
24352	BUTTONBUSH SHRUB SWAMP		1989-08		

3.4.2 Invasive, Nonnative Species

It has been estimated that approximately 25 percent of Ohio's flora is considered to be alien species, also referred to as exotic or non-native species. Introduction of such species can be intentional, for a specified use or aesthetic value; or accidental, brought into the area by wildlife. Many of the non-native species are seemingly harmless and can add to the diversity of the area, finding and supporting various niches in the habitat. According to ODNR's Division of Natural Areas and Preserves, there are more than 700 species of non-native species in Ohio.

However, some alien species are classified as invasive due to their ability to rapidly grow, reproduce and overtake the surrounding area by oppressing the growth of the more common floral species. Another major problem with invasive plants is attributed to the lack of natural predators or natural control measures in the "invaded" areas. "The division (ODNR-DNAP) has compiled a list of more than 60 plants that are currently impacting nature preserves, wildlife areas, parks and forests throughout the state. Some of the top invasive non-native plants include; bush honeysuckles (Amur, Morrow and Tatarian), buckthorn (glossy and common), garlic mustard, purple loosestrife, common reed grass, reed canary grass, autumn olive, multiflora rose, Japanese honeysuckle, narrow-leaved cattail, Canada thistle and tree-of-heaven" More detailed information on invasive species can be found at the ODNR Division of Natural Areas and Preserves' website: (www.dnr.state.oh.us/dnap/invasive/default.htm)

The potential impacts of non-natives and invasive species are unlimited in nature. Managers of natural areas across the country may spend an exorbitant amount of man hours and dollars to control the invasive species. The non-native invasive species may also eliminate other important native species by out-competing them for water, nutrients and space.

The watershed also needs to consider the control of noxious weeds when dealing with agricultural issues. Noxious weeds are determined to be noxious if "They possess one or more of the following attributes: 1) aggressive competition with cultivated plants; 2) toxicity to livestock; 3) natural habitat degradation; 4) threat to public health, safety, or navigation" (Rose, 1998).

Plants that have been determined to be noxious and are also prohibited are listed below.

Shatter Cane	Russian Thistle
Johnsongrass	Wild Parsnip
Wild Carrot (Queen Anne's lace)	Oxeye Daisy
Wild Mustard	Grapevines
Canada Thistle	Poison Hemlock
Cressleaf groundsel	Musk Thistle
Purple loosestrife	Mile-A-Minute Weed

3.4.3 Flora and Fauna

(Entire section taken from the ―Grand Lake St Marys Watershed Protection Project" report prepared by R. Hupman & Assoc., Dayton OH July 1999)

Terrestrial

The beech-maple forests that covered the Ohio till plains in pre-settlement times have long since disappeared and been replaced by agricultural uses in Auglaize and Mercer counties and the Grand Lake watershed (USCoE, 1981). Based on 1994 aerial photos, only about 3% of the watershed is wooded today, mostly in relatively small, scattered parcels. In 1979, as part of the 1981 Flood Survey report by the Corps of Engineers, a study of the vegetation at locations around the Lake, along tributaries, and in upland areas was conducted. Of the ten sites sampled, five were near the lake shore, three focused on Beaver, Coldwater and Prairie Creeks, and two were upland areas.

Although the Grand Lake watershed has lost most of its wooded areas, a sufficient variety of plant species remains as canopy, understory and ground cover to provide habitat for an impressive array of terrestrial, amphibious, and aquatic animal life.

Rick Jasper, Assistant Wildlife Manager at the Ohio Department of Natural Resources' Division of Wildlife District 5 office in Xenia, Ohio, provided the following list of species found in Auglaize and Mercer Counties:

MAMMALS
Badger
Beaver
Big Brown Bat
Coyote
Deer Mouse
Eastern Chipmunk
Eastern Mole
Eastern Pipistrel
Fox Squirrel
Gray Squirrel
Gray Fox
Ground Hog
Indiana Bat (range of)
Keen Myotis
Least Weasel
Little Brown Bat
Long-tailed Weasel
Meadow Vole
Mink
Muskrat
Opposum
Pine Vole
Prairie Vole
Raccoon
Red Fox
Red Bat
Red Squirrel
Short-tailed Shrew

MAMMALS
Striped Skunk
Thirteen Lined Ground Squirrel
White Footed Mouse
White Tailed Deer

SKINKS
Five-lined

SALAMANDERS
Eastern Tiger
Marbled
Red Back
Red-spotted
Small-mouthed
Spotted

SNAKES
Black Rat Snake
Blue Racer
Brown Snake
Garter Snake
Hognose
Milk Snake
Northern Water Snake

FROGS and TOADS
American Toad
Bullfrog
Chorus Frog
Cricket Frog
Fowler's Toad
Gray Tree Frog
Green Frog
Northern Leopard Frog
Pickerel Frog
Plains Leopard Frog
Spring Peepers
Wood Frog

TURTLES
Eastern Box
Map
Painted
Snapping
Soft Shell
Stinkpot

Southern Bog Lemming
Star-nosed Mole
Queen Snake

In addition to the wildlife listed above, bird life abounds in the Grand Lake area. Writing for the Ohio Department of Natural Resources' Division of Wildlife, Clarence Clark of the Division and James Sipe of St Marys prepared Publication 350, Birds of the Grand Lake St Marys Area. There is no publication date to be found on this soft-cover book, but the latest date in the list of sources is 1967. The study lists 290 varieties ranging from humming birds to the Bald Eagle plus five additional —hybrids and exotics." Mr. Jasper of the District 5 Wildlife office believes that this inventory of 290 is still fairly accurate and reports that three varieties indicated by Clark and Sipe to have nearly disappeared from the area by the late 60's, the Bald Eagle, Osprey, and Snow goose, can now be found there again.

The Ohio Department of Natural Resources' Division of Natural Areas and Preserves maintains records of plant and animal species in the state that are of special significance for one or more reasons. Known as the National Heritage Data Base Record, this body of information makes possible the identification of such species for particular geographic area. In the Grand Lake watershed, ODNR's 1997 records show the following:

- High Quality Plant Communities
  - Oak-hickory Forest
  - Mixed emergent marsh
  - Maple-oak-ash swamp

- Significant Natural Features
  - Great Blue Heron colonies (2)
  - Turkey Vulture roost

- Special Interest Species
  - Sharp-shinned hawk

- Potentially Threatened Plant Species
  - Swamp cottonwood
  - Prairie wake robin

- Threatened Plant Species
  - Southern wapato
  - Grove Sandwort

- Endangered Species
  - Bald eagle (recently removed from list)
  - Indiana Bat (range of)

Significant Natural Features are areas that should not be destroyed for a particular reason; in this case, habitat for herons and turkey vultures. Special Interest Species are those that might become threatened under continued or increased stress or for which there is concern but insufficient information for an adequate status evaluation. Potentially Threatened Plant Species applies to 1) plants that do not qualify in Ohio but are proposed federal threatened or endangered species; 2) imperiled plants that could become threatened in the foreseeable future; and/or 3) plants believed to be declining at a significant rate throughout all or large portions of the state. Threatened Species are those whose survival is not in immediate jeopardy, but which will become threatened with extirpation or total disappearance from Ohio.

Aquatic

One of the most frequently cited reports on Grand Lake, Lake St Marys and its Management provides a detailed and fascinating historical look at the Lake's plants, fishes and other aquatic life. Regarding aquatic vegetation, author Clarence Clark first addresses phytoplankton summarizing the results of survey work by Lee S. Roach in the mid-1930s. The 1981 Corps of Engineers Survey Report states —Algal densities for the period 1932-1936 averaged 4.5 blue-greens per milliliter, 15.9 greens per milliliter, and 129 diatoms per milliliter. The most productive year was 1935, when algal densities were at least five times those of other years."

There appears to have been little, if any, additional research on lake vegetation until the mid-1970s. In the spring, summer, and fall of 1973, as a part of the National Eutrophication Survey, samples were taken from Grand Lake. Phytoplankton/algal densities were measured in May, August, and October, and the Lake was found to be eutrophic, i. e., rich in dissolved nutrient, at that time. The report says, —It ranked seventh in overall trophic quality when the 20 Ohio lakes were compared…Survey limnologists reported heavy algal blooms…in May." In 1975, the U. S. Geological Survey (U.S.G.S.) again studied phytoplankton in the Lake. In samplings in May and August, blue-green algae were predominant. The Corps of Engineers report brings the results of all these efforts together in this statement: —Since Roach's studies in the 1930s phytoplankton density has increased by three to four orders of magnitude in Grand Lake St Marys, and the taxonomic composition has changed from diatom to a blue-green algae dominated community, indicative of eutrophication."

Following the oil-producing period in its history, Grand Lake began to emerge as a recreational center, a trend that gained momentum with it 1949 designation as a state park and continues at a rapid pace today. Sport fishing was among the earliest and most popular recreational activities. Clark documents in great detail the composition of the fish population taken by test netting in each of fifteen years between 1932-1955. A total f 19 species were taken, with the major 15 species being black crappie, white crappie, channel catfish, shad, carp, quill back, bullhead, bluegill, largemouth bass, white sucker, pumpkinseed sunfish, yellow perch, goldfish, golden shiner, and northern pike. In most years, the take of black and white crappies made up – often by far – the largest percentage of total species collected, a circumstance substantiated by creek

surveys from 1946 through 1955, when they composed from 58% to more that 80% of the total catch, which also included channel cat, bullheads, bluegills, carp, and largemouth bass.

The Clark report provides significant detail on the various species found in the Lake such as age, length, weight, growth rates, fluctuations in populations, and other characteristics, as well as information on fish parasites, fish kills, competition among fish populations, and management factors such as stocking, regulations, rough fish removal, and habitat improvement. The focus of the entire study is to recommend how best to manage the Lake and its resources to maximize sport fishing.

The character of the Grand Lake watershed has changed dramatically in the 150-odd years since the work of constructing it as a feeder lake for the Miami-Erie Canal was underway. From the sparsely populated area of deep forests and wet prairie land of those days, the watershed and it environs have been transformed into an agriculturally and industrially productive region accented by lively communities and centered on one of Ohio‘s most popular water-based recreational areas. As the foregoing paragraphs show, however, the viability and appeal of the Grand Lake area‘s natural environment are still enriched today by its abundant plant and animal life—life that depends for its continued existence on protecting the area‘s water resources.

*** Note: It was suggested by reviewers that <u>Cottontail Rabbit</u> and <u>Wild Turkey</u> be added to the list of species found in Auglaize and Mercer counties, as they were absent from the list provided by Rick Jasper.**

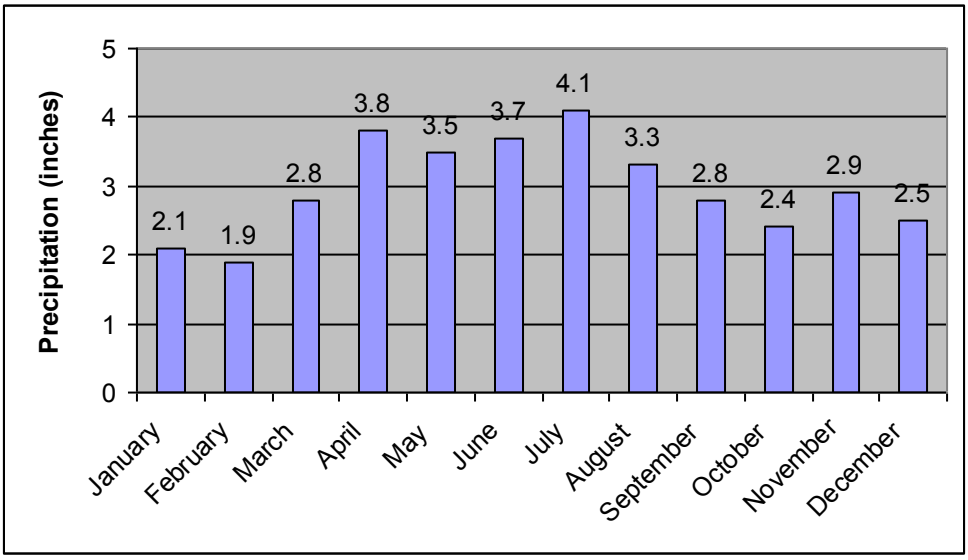
3.5 Water Resources

The following sections will provide general information regarding the water resources of the Mercer, Darke and Auglaize county area. More detailed information such as use designations, drainage areas, riparian corridor status, operations, etc. can be found in the individual subwatershed sections.

3.5.1 Climate and Precipitation

Climate for the Grand Lake/Wabash River watershed is typical for the area. An average of 35.8 inches of precipitation falls per year, with nearly 60% falling between the months of April and September. The average seasonal snowfall is 36 inches, and the average 24-hour temperature for the years 1961 to 1990 is 51.1 °F. Most climate information for counties in Ohio can be obtained via World Climate (www.worldclimate.com). Weather Station Celina 3 NE, Mercer County, Greenville Water Treatment Plant, Darke County and St Marys 3 W, Auglaize County can be obtained. The chart below indicates the average monthly precipitation levels for the years 1956 – 1995 utilizing data collected from the Mercer County weather station.

Figure 4: Average monthly precipitation 1956 – 1995



3.5.2 Surface Water

3.5.2.1 Wetlands

The map on the following page shows areas considered to be suitable for wetlands based on presence of hydric soils. Both forested and non-forested wetlands account for approximately 1,436 acres or 2.24 square miles of the entire watershed. This constitutes a total of 0.7% of the watershed. Local interest groups within Auglaize, Darke and Mercer counties are continuously putting forth efforts to protect, restore, and/or create wetlands. To name a few, they include local chapters of Pheasants Forever, Ducks Unlimited, and numerous Sportsman's Associations. Ohio EPA Section 319 Grant Funds have also been expended to help restore and create wetlands associated with wildlife attraction, wetland ecosystem awareness and education, and water treatment.

The data for this map was gathered from several sources, primarily from the Ohio Department of Natural Resources – Geographic Information Management Systems website, located at www.dnr.state.oh.us/gims. This site also provides valuable information, in downloadable format, regarding oil and gas well locations, floodplains, land cover and watersheds for each county in Ohio.

MAP 14
Wetland Locations

N
W
E
S

Legend
Open Water
Grand Lake/Wabash Watershed
Wetlands
Upland Areas
Woods-Hydric
Open Water
Shallow Marsh
Shrub Wetland
Wet Meadow
Farmed Wetland

3.5.2.2 Streams

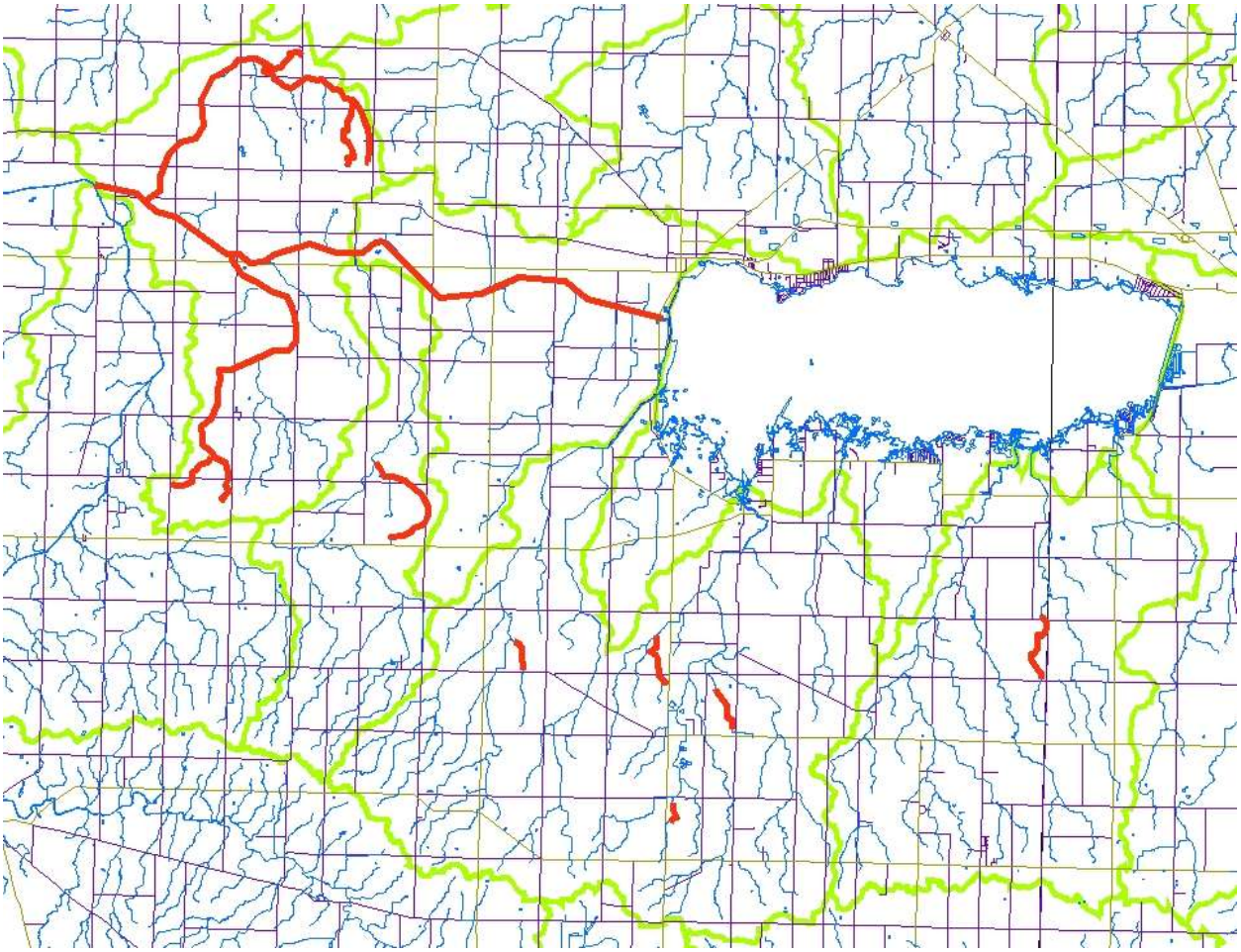
Grand Lake St. Marys is primarily fed by eight named streams. These streams are 1) Coldwater Creek; 2) Beaver Creek; 3) Chickasaw Creek; 4) Barnes Creek; 5) Little Chickasaw Creek; 6) Prairie Creek; 7) Grassy Creek; and 8) Monroe Creek. There is also a small amount of overland drainage from the northern area of the lake. The Wabash River is fed by these primary tributary streams: 1) Bear Creek; 2) Beaver Creek; 3) Crab Branch; 4) Fort Creek; 5) Little Beaver Creek; 6) Scherman Ditch; 7) Stony Creek; 8) Threemile Creek; 9) Toti Creek; 10) Twomile Creek; and 11) Ward Ditch. Each of these creeks/areas corresponds with the subwatersheds of the Grand Lake/Wabash Watershed and will be discussed in greater detail in their respective sections of this action plan.

Many of these creeks fit the category of channelized agricultural drainage. These drainage areas have been created to handle water from tile and ditch projects. The projects have been developed to produce land which will be profitable for the farmer. The projects have been designed to move water from the fields quickly to allow the fields to dry and crops to flourish. This practice is important for the farmers to make a profit.

A second important practice for farming is pest control. Many of the agricultural ditches and streams have some form of weed control. This may be done by spraying or by mowing. This practice is important for the farmer to have a successful crop. Over 90 percent of the combined watershed is agricultural land predominately maintained by farmers.

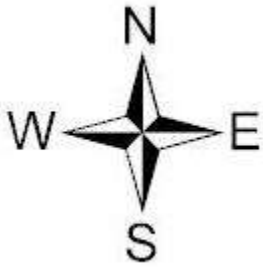
A small percentage of the ditch projects in the watershed are a part of Mercer County Ditch Maintenance. According to the Mercer County Engineer‘s Office, the ditches have typically been sprayed annually. This practice was not done in 2007 and will not be continued in the future due to the cost. If necessary, the ditches will be dipped out, however, this has not been done on a regular basis. The ditches will be dipped only if they fill with sediment in the future. If ditch maintenance continues on this track, the banks will begin to grow woody vegetation which will provide cover to cool the water. This vegetation will also provide bank stability. The location of ditches on county maintenance can be seen on the following page.

MAP 15
Ditch Maintenance Locations



Legend

Ditch Maintenance
Grand Lake/Wabash Watershed



Auglaize County maintains only one side ditch in the watershed at this time. This ditch was constructed through the ditch petition program and is located in St. Marys Township. The 2007 inventory of Auglaize County Ditches can be found in Appendix I. Ditches in or adjacent to the watershed are highlighted in green, the only ditch on county maintenance is mentioned above.

Darke County does not do any ditch maintenance in the watershed. Any maintenance done in Darke County is completed by the Wabash River Conservancy District. This group works on problems along the Wabash River Main Stem as they see fit. The Conservancy works to prevent erosion of banks and promote functioning waterways. They also maintain several dry dams and water control structures. Pictures of these sites can be seen in Appendix J.

Stream channel, floodplain connectivity, and riparian corridor status have been investigated and mapped so as to guide efforts in restoration and protection of the streams and creeks draining to Grand Lake St. Marys and the Wabash River. The riparian corridor maps of each subwatershed in section 4.0 indicate areas of stream segments where there are less than 10 feet, 10 to 40 feet and more than 40 feet of vegetation on the streambanks.

An info-graphic was produced by Ohio EPA to depict results from the 1999 sampling season. This can be found in Appendix E. Items such as lake condition, stream health, chemical water quality and biological integrity are described or graphed within this document.

The topic of redirecting agriculture ditches is not well received in the Grand Lake/Wabash River watersheds. The land is predominately agriculture and farming along curves or using farm land for riparian areas or two stage ditches is not considered economical by landowners. There is, however, one particular township that has started to purchase and preserve farmland.

Franklin Township in Mercer County has returned a tiled farm field to a wetland area and is working on several other property purchases and restoration projects. They are working with Pheasants Forever, GLWWA, Mercer County Soil and Water Conservation District and local businesses on their projects. They are also forming a greenspace management group and have partnered with the GLWWA on a Litter grant. One of their projects includes a piece of property that contains a channelized agricultural ditch, which has the potential for stream restoration. The Franklin Township Trustees agree this would be a good project, and if funding can be procured, this property will be a demonstration site for the ideal stream restoration and wetland habitat project. The site will have public access and is adjacent to properties where the public can view channelized agriculture ditches and manmade lake channels to compare to the restored stream.

As this project progresses there will be times for the public to see the water quality and habitat improvement of stream restoration. These events may be combined with a county wide tour or field day to observe best management practices.

3.5.2.3 Drinking Water Source Assessment

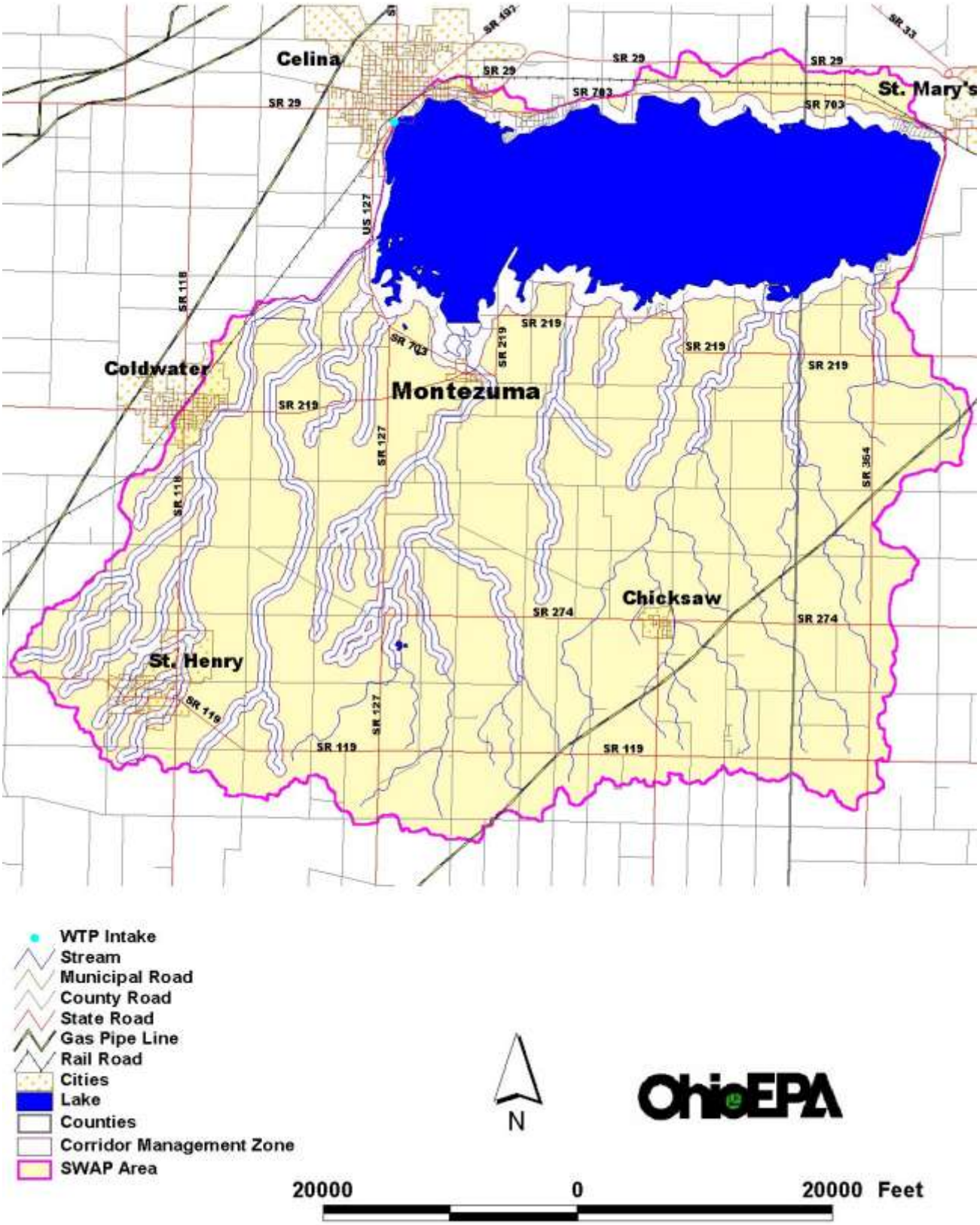
The Drinking Water Source Assessment for the City of Celina was drafted in July of 2003 by Dana Martin-Hayden and Janet Hageman, Ohio EPA Division of Surface water and Amy Klei, Ohio EPA, Division of Drinking and Ground Waters, Central Office. According to this report, —Several pesticides (alachlor, atrazine, metolochlor, simazine, and cyanazine) and nitrates have been detected in the finished water indicating an impact from land use activities within the Grand Lake watershed". It also mentions that the City of Celina is having difficulties complying with maximum contaminant levels of Total Trihalomethanes (TTHMs) which is a byproduct of chlorine disinfection. This by-product of water treatment (TTHMs) is of a carcinogenic nature (cancer causing). This difficulty has been attributed to the high levels of total organic carbon present in the lake.

The City of Celina's drinking water source has been shown to be susceptible to pollution from sources such as —agricultural runoff, industrial and commercial sources, home construction runoff, oil and gas production activities, unsewered areas, waste water treatment plant discharges, combined sewer overflows, airports and landfills". Further protection may be accomplished by Education and outreach, coordination with existing activities, zoning ordinances, water quality monitoring and emergency response planning.

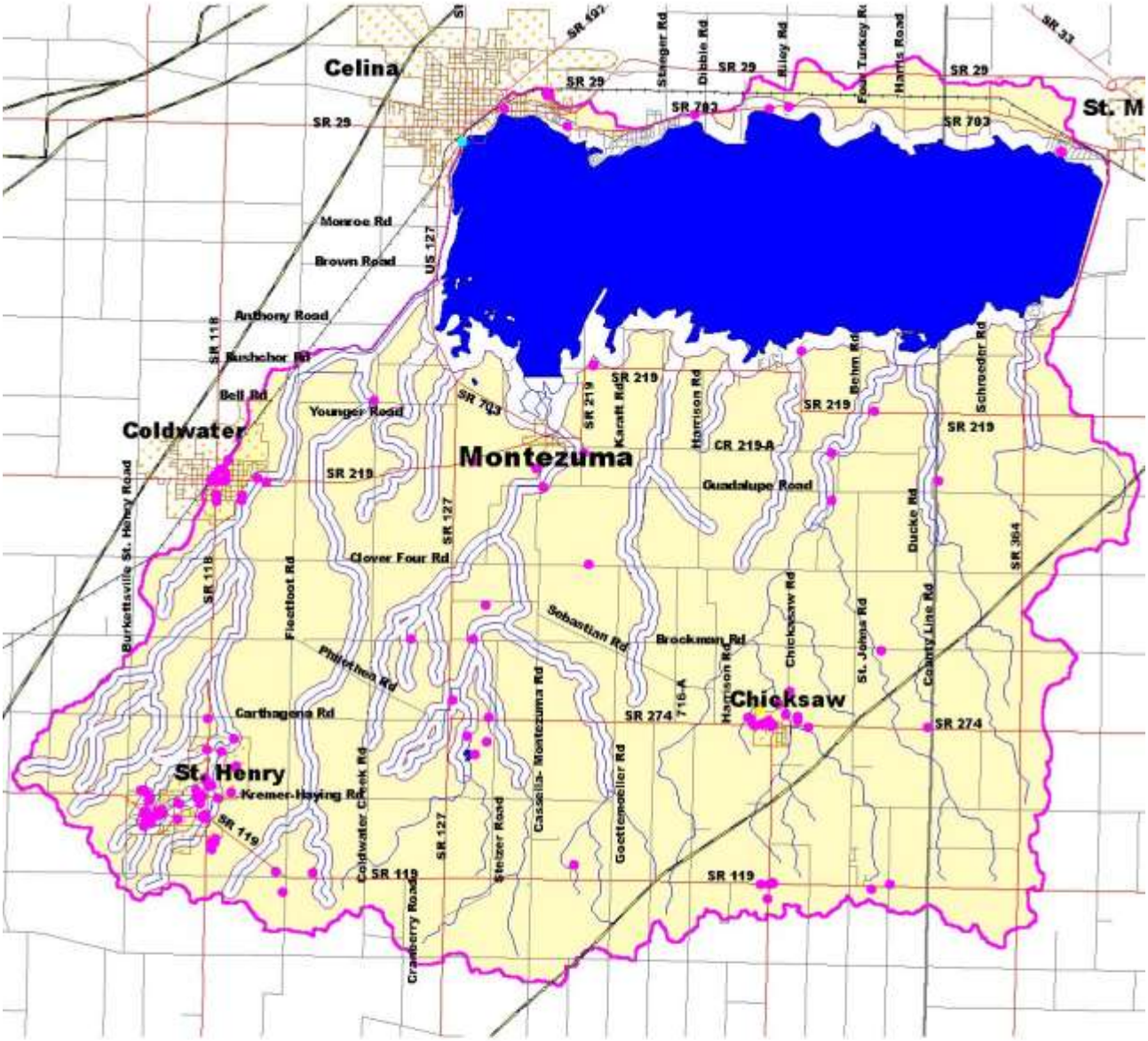
According to the assessment, —Source water protection efforts for the City of Celina should focus on controlling agricultural runoff and runoff from cattle grazing pastures; with particular attention to sources of pesticides, nitrates, phosphorus, and microorganisms such as fecal coliform bacteria".

The entire document can be obtained from the Grand Lake/Wabash Watershed Alliance or the Mercer Soil and Water Conservation District office. In the legend portion of all maps, the abbreviation WTP indicates the Water Treatment Plant intake pipe and the Corridor Management Zone is defined as: —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 Grand Lake mainstem and 500 feet wide on each side of any tributaries."The City of Celina is continuing to make improvements on its water treatment system. In 2008, they installed an activated granulated carbon system. This has lowered their TTHM level to a point of attainment. They have continued to look for innovative ways to improve their drinking water source. One of these ideas include having a dredge line pumping over 3 miles to dewatering lagoons and eventually building islands across the lake with dredge material. They are looking for federal funding for this project.

MAP 16
City of Celina Drinking Water Source Protection (SWAP) Area
and Corridor Management Zone


Celina
St. Mary's
Coldwater
Montezuma
Chicksaw
St. Henry
SR 29
SR 703
SR 219
SR 274
SR 119
SR 118
US 127
SR 127
SR 354
SR 33
WTP Intake
Stream
Municipal Road
County Road
State Road
Gas Pipe Line
Rail Road
Cities
Lake
Counties
Corridor Management Zone
SWAP Area
N
OhioEPA
20000
0
20000 Feet

MAP 17
Potential Contaminant Sources in the City of Celina Corridor Management Zone (Full View)



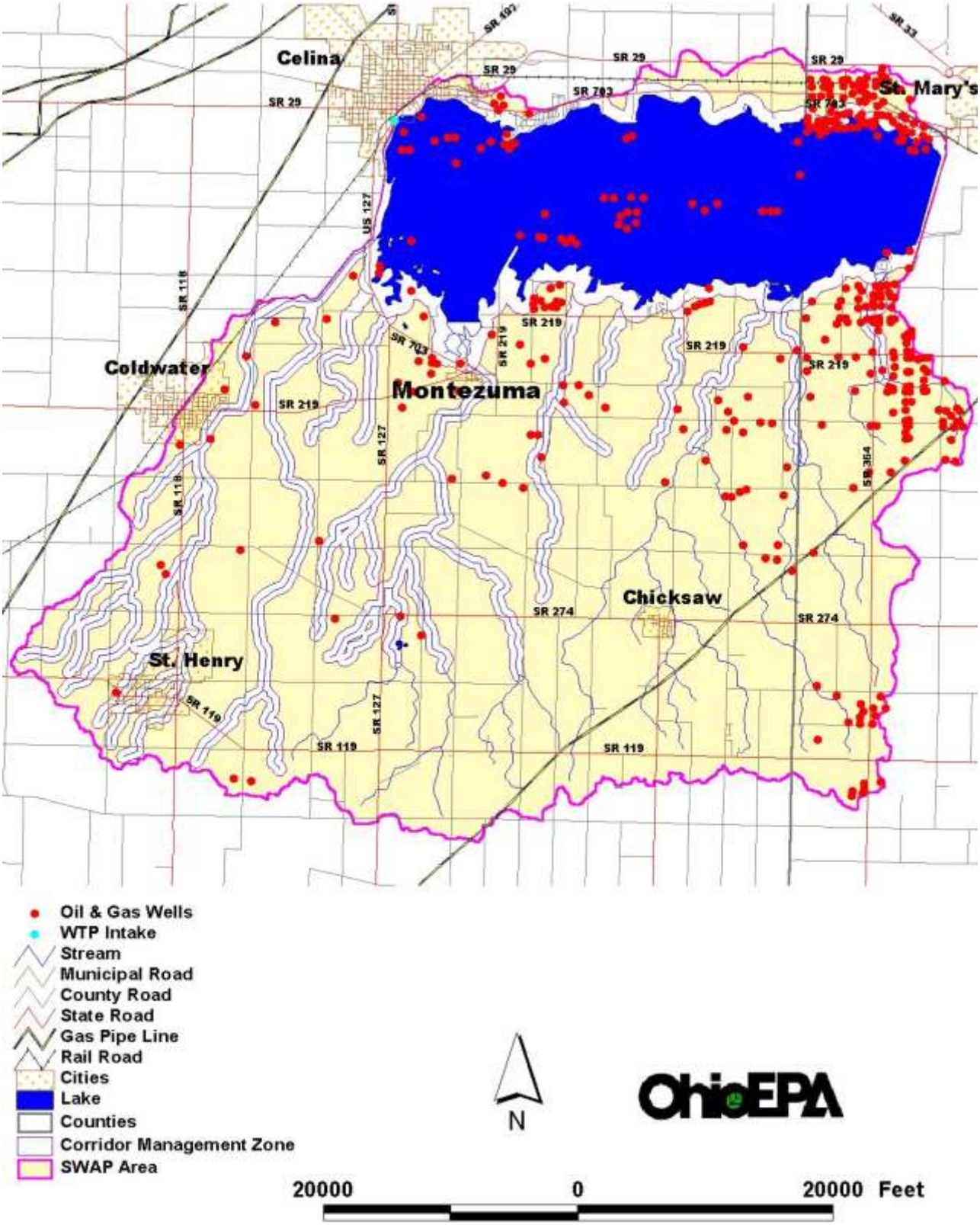
- Potential Contaminant Source
- WTP Intake
- Stream
- Municipal Road
- County Road
- State Road
- Gas Pipe Line
- Rail Road
- Lake
- Counties
- Corridor Management Zone
- SWAP Area

N

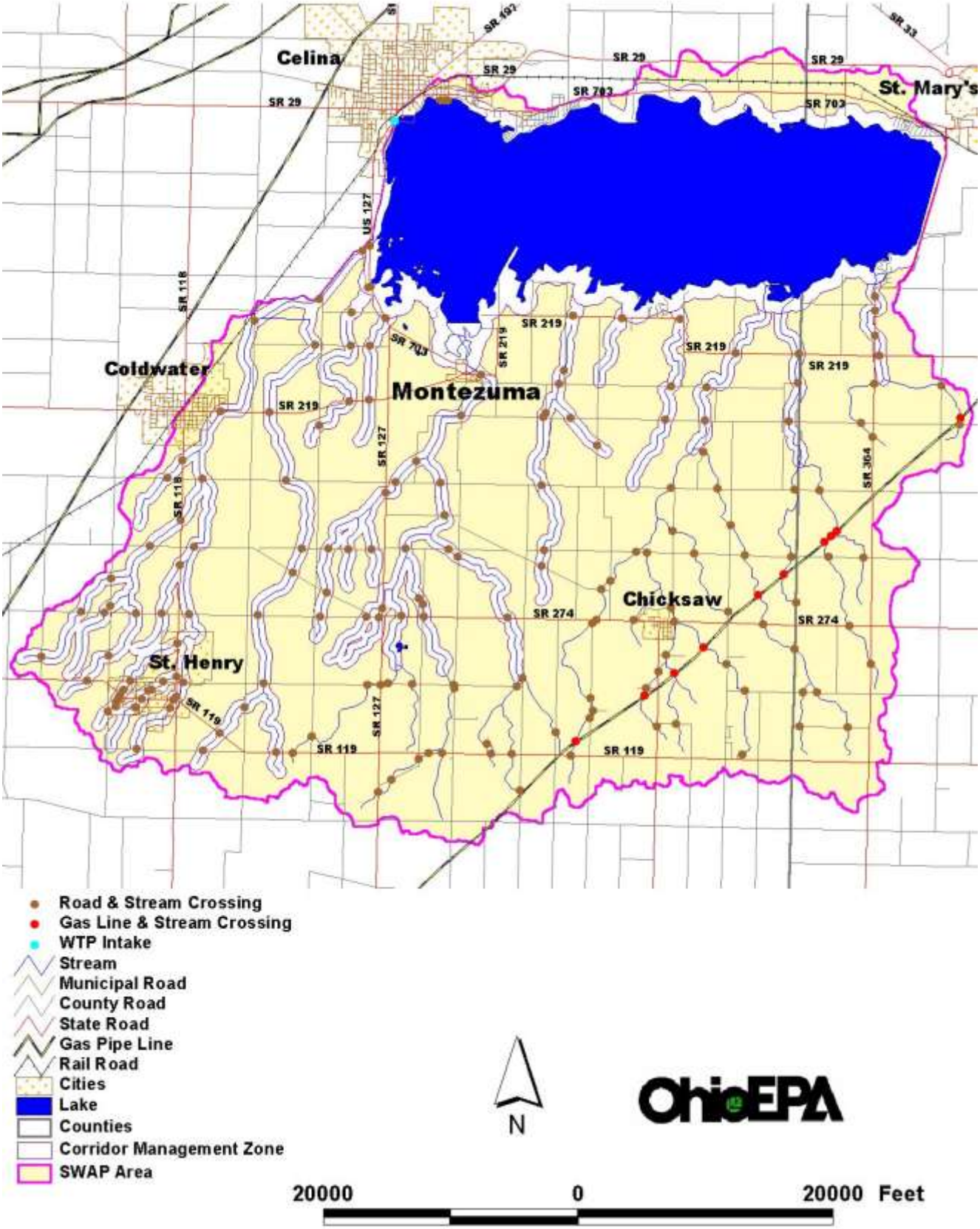
OhioEPA

20000 0 20000 Feet

MAP 18
Oil and Gas Wells in the City of Celina Drinking Water Source Protection (SWAP) Area


Celina
St. Mary's
Coldwater
Montezuma
Chicksaw
St. Henry
SR 29
SR 703
SR 219
SR 274
SR 119
SR 127
US 127
SR 118
SR 354
SR 33
SR 492
Oil & Gas Wells
WTP Intake
Stream
Municipal Road
County Road
State Road
Gas Pipe Line
Rail Road
Cities
Lake
Counties
Corridor Management Zone
SWAP Area
N
OhioEPA
20000
0
20000 Feet

MAP 19
Road and Gas Line Stream Crossings


Celina
St. Mary's
Coldwater
Montezuma
Chicksaw
St. Henry
SR 29
SR 703
SR 492
SR 33
US 127
SR 118
SR 219
SR 127
SR 364
SR 274
SR 119
Road & Stream Crossing
Gas Line & Stream Crossing
WTP Intake
Stream
Municipal Road
County Road
State Road
Gas Pipe Line
Rail Road
Cities
Lake
Counties
Corridor Management Zone
SWAP Area
N
OhioEPA
20000
0
20000 Feet

3.5.3 Groundwater

3.5.3.1 Aquifers

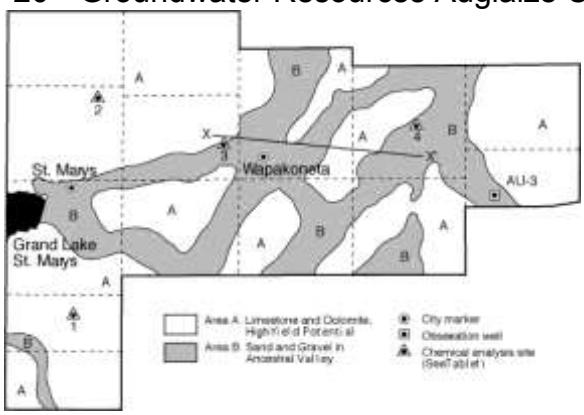
An aquifer is best described as an underground reservoir that is capable of providing enough water to support a well, also having the ability to transmit, store, and receive water. Auglaize, Darke and Mercer Counties are atop several layers of dolomite and limestone creating a vast carbonate aquifer. These formations can be as old as 450 million years and are covered by a glacial till layer which may date back 20,000 years.

All three counties have an extensive reach of the ancestral Teays Valley, a pre-glaciation drainage pattern cut into the underlying limestone. Screened wells in these areas can produce a sufficient domestic water supply of 10-25 gallons per minute (gpm).

Yields in the limestone and dolomite areas can produce water supplies well over 400 gpm at depths ranging below 300 ft. At depths of 150 ft and above adequate supplies for farm and domestic use can be obtained.

The Ohio Department of Natural Resources, Division of Water monitors one well in each county. The figures below depict the locations and specific information for each of those wells.

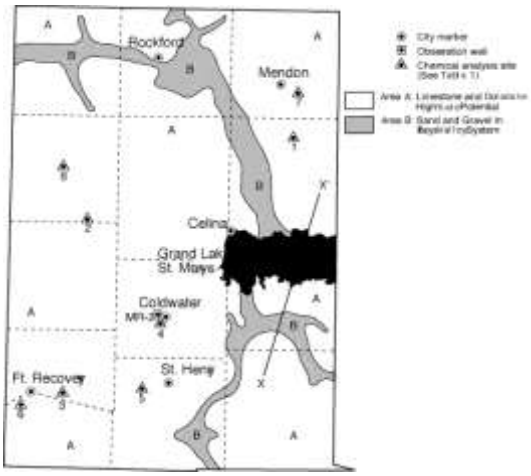
MAP 20 Groundwater Resources Auglaize County, Ohio



- Observation Well AU-3
- Constructed in limestone/dolomite
- Depth = 380 ft
- Depth to bedrock = 52
- Lowest recorded level: 11.9 ft below surface in February 1977
- Highest recorded level: 4.3 ft below surface in April 1991

(modified from J.J.Schmidt, ODNR Division of Water, by R.A. Roberts).

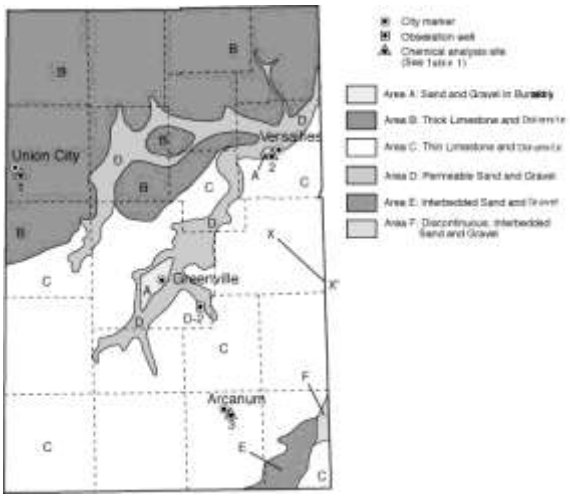
MAP 21 Groundwater Resources Mercer County, Ohio



- Observation Well MR-2
- Constructed in limestone/dolomite
- Depth = 253 ft
- Depth to limestone = 37 ft
- Lowest recorded level: 81.6 ft below surface in September 1988
- Highest recorded level: 60.1 ft below surface in February 1967

(modified from K.S. Crowell, ODNR Division of Water, by R.A. Roberts

MAP 22 Groundwater Resources Darke County, Ohio



- Observation well D-2
- Constructed in sand and gravel
- Depth = 70 ft
- Depth to limestone = 110 ft
- Lowest recorded level: 20.9 ft below surface in April 1992
- Highest recorded level: 16.7 ft below surface in March 1991

(modified from J.M Raab, ODNR Division of Water, by J. Humphreys).

3.5.3.2 Groundwater pollution potential

In recent times, it has become more and more apparent that the local water resources are in great need of both management, such as withdrawal limits, and well placement, but also protection from pollutants and contamination. For this reason, the Ohio Department of Natural Resources, Division of Water, was given the task of creating an evaluation/ranking system to determine the potential for pollutants to reach the groundwater in each of the counties in Ohio. Following this, color coded maps were created, also showing the potential for groundwater pollution. The intent for these maps and evaluation systems is that they be used by local planners or managers to better site locations of businesses, homes, or other operations so as to reduce the potential of contamination.

The Grand Lake/Wabash River watershed consists of three ranges in similar proportions. The south shoreline of Grand Lake St Marys can be categorized in the "moderately high" (140-159 range); the north shoreline of Grand Lake St Marys, the area encompassing Montezuma, Carthagena, and Chickasaw and southeastern Mercer County and northeastern Darke County lie in the region evaluated as "moderate" (120-139); and the southwestern section of the watershed lie in the "moderately low" (100-119) range. The full Groundwater Pollution Potential maps for Auglaize, Darke and Mercer counties can be obtained by contacting the Mercer Soil and Water Conservation District.

3.5.4 Public Wastewater Treatment Systems

There are 12 Ohio EPA permitted wastewater treatment plants (WWTP), within the boundaries of the Grand Lake/Wabash River watershed. They include the following: (1) the Celina WWTP, discharging to Beaver Creek; (2) the Chapel Hill Subdivision WWTP, discharging to Chickasaw Creek; (3) the Village of Chickasaw WWTP, discharging to Chickasaw Creek; (4) the Coldwater WWTP, discharging to Hardin Creek; (5) the Fort Recovery WWTP, discharging to the Wabash River; (6) the Marion Local Schools WWTP, discharging to Chickasaw Creek; (7) the Mercer Co. Comm. Wagner WWTP, discharging to Hardin Creek; (8) the Mercer Co. Home WWTP, discharging to Beaver Creek; (9) the Montezuma Club Island WWTP, discharging to Beaver Creek; (10) the Northwood WWTP, discharging to an unnamed tributary of Grand Lake; (11) the Philothea SD WWTP, discharging to Little Beaver Creek; and (12) the St. Henry WWTP, discharging to Coldwater Creek. Intermittent discharges occur from these facilities which utilize a system of facultative lagoons for treatment of the wastewaters.

3.5.4.1 NPDES Permit Discharges

There are 12 additional individual NPDES permits on file with Ohio EPA, according to their April 2005 list. Seven of those 12 are industrial discharge permits, three are indirect discharge permits and one is a public discharge. The industrial discharges include: (1) BP Amoco Oil Corp Bulk; (2) CW Services Bulk Plant; (3) Celina Landfill, Inc.; (4) Chickasaw WTP; (5) Fort Recovery Industries, Inc.; (6) Pax Machine Works, Inc.; and (7) Stoneco, Inc. Karch Quarry. The three indirect discharge permits include: (1) Celina Aluminum Precision Technology, Inc.; (2) Cooper Farms Processing; and (3) Qualitec Metal Finishers. The public discharge is the Elks Club #2170 South. In addition, there are approximately 37 general NPDES permits issued within the Grand Lake/Wabash Watershed on file with Ohio EPA, dated January 2007.

3.5.4.2 Home Sewage Treatment Systems

The significant portion of the population of the Grand Lake/Wabash River watershed relies on a home sewage treatment system (HSTS) for wastewater elimination and treatment. According to the 2000 census data, there are 14,756 housing units in Mercer County, of which approximately 9,884 are served by centralized sewer systems. This leaves an approximate number of 4,872 home sewage treatment systems to be dealt with accordingly.

The predominate form of HSTS in the watershed is a subsurface sand filter system. This system employs a septic tank, in which solids settle out of the effluent, a distribution box directing the liquid into perforated tiles, and a sand —bed" approximately two feet deep. The sand bed is used to allow treatment above the soil, since soils with slow permeability and seasonal saturation in the subsoil dominate the watershed. Beneficial micro-organisms, which further breakdown the wastewater, build up a layer known as a biomat. The sand in the bed clarifies the water as the water passes through, and at the end of the process, the bacteria and suspended solids have been greatly reduced.

The second highest grouping falls in the "pre-regulation" time period. These homes were built long before installation permits and inspections were required. When considering soil types of the watershed and the life-span of the treatment systems, logic can suggest that many of these systems are failing to treat the wastewater effectively. In recent time, however, a significant number of these systems have been upgraded to a more capable treatment system.

The Ohio Department of Health issued new septic system regulations which took effect on January 1, 2007. Under these new rules, all new homes or proposed residential developments will require the following items: (1) a detailed soil profile description; (2) a topographic map with one-foot contour lines; (3) a detailed sewage system design plan; and (4) septic system installers must take a State competency test and acquire continuing education credits. Off-lot discharging sewage systems will be highly restricted, as new lots must be capable of supporting on-lot soil absorption systems. Two feet of separation between the seasonal perched water table and the sewage infiltrative surface will be required. Existing septic systems that are operational will not be required to upgrade their septic systems to the new design requirements; however failing systems will be required to upgrade.

The potential pollution effects of home sewage treatment systems grow as the number of systems in a given area increases, especially in areas that have clusters or groups of 10 or more systems. In the past few years there have been numerous cluster areas that have had centralized sewer systems installed. These areas include: (1) the Village of Chickasaw; (2) Philothea; (3) Burkettsville; and (4) New Weston. The Mercer County Commissioners/Sanitary Department are also in the planning stages of installing five centralized sewer systems in five areas throughout the watershed. These areas include: (1) Maria Stein/St. Johns; (2) East Jefferson Township; (3) Menchhofer Woods and Fleetfoot Road; (4) Wagner subdivision; and (5) South of St. Henry near Burkettsville-St. Henry Road and Lange Road.

The following table depicts the Ohio EPA Division of Surface Water: Regulated Point Sources, and permit numbers, found in the Grand Lake/Wabash River watershed.

Table 8

Ohio EPA Division of Surface Water: Regulated Point Sources		
Facility Name	Ohio EPA Permit Number	Discharges to
BP Amoco Oil Corp	2IN00180	Wabash River
Celina Aluminum Precision	2DP00007	Grand Lake St. Marys
Celina Landfill, Inc.	2IN00125	Beaver Creek
Celina Municipal WTP	2IW00030	Beaver Creek
Celina WWTP	2PD00033	Beaver Creek
Chapel Hill WWTP	2PG00103	Chickasaw Creek
Chickasaw WTP	2IY00013	Chickasaw Creek
Chickasaw WWTP	2PA00088	Chickasaw Creek
Coldwater WWTP	2PB00013	Hardin Creek
Cooper Farms Processing	2DP00010	Coldwater Creek
CW Services Bulk Plant	2IN00210	Hardin Creek
Elks Club No. 2170 S	2PR00184	Beaver Creek
Ft. Recovery Industries, Inc.	2IC00001	Wabash River
Ft. Recovery WWTP	2PA00030	Wabash River
Marion Local School District	2PT00022	Chickasaw Creek
Mercer Co. Home WWTP	2PG00104	Beaver Creek
Mercer Co. Comm. Wagner WWTP	2PR00101	Hardin Creek
Montezuma Club Island WWTP	2PH00015	Beaver Creek
Northwood WWTP	2PG00106	Unnamed Trib of GLSM
Pax Machine Works, Inc.	2IS00070	Hardin Creek
Philothea SD WWTP	2PG00113	Little Beaver Creek
Qualitec Metal Finishers	2DP00041	Grand Lake St. Marys
St. Henry WWTP	2PB00027	Coldwater Creek
Stoneco, Inc. Karch Quarry	2IJ00017	Little Beaver Creek

3.6 Land Use

As shown by the table below, the three predominant land uses for the Grand Lake/Wabash watershed are 1) cropland; 2) Grand Lake itself; and 3) deciduous forest. The table sorts the data in several capacities such as number of acres per land use, square miles per land use, percent of the total watershed area (including the lake). These numbers are beneficial in determining potential sources of pollutants in the watershed. They are also valuable at targeting education and implementation of various BMPs. This table was based on information provided by ODNR Division of Information Technology, Geographic Information Management Systems data developed in 1994.

3.6.1 Impervious Surfaces

By inferring from the table and the more descriptive listing on the previous page, it can be estimated that nearly the entire watershed has a pervious land cover or land use. The total acreage for cropland, deciduous forest, wetlands, pasture, shrub, brush, orchards and ponds totals nearly 180,235 acres of seemingly pervious surfaces out of a total watershed area of 193,482 acres, including the lake. This equates to 93% pervious surfaces in the Grand Lake/Wabash River watershed.

Table 9

Land Use/Land Cover for Grand Lake/Wabash Watershed

Land Use/Land Cover	Acres	Square Miles	% of Total Watershed
Cropland	155,294	242.65	80.3%
Residential	4,750	7.42	2.5%
Deciduous Forest	9,263	14.47	4.8%
Farmsteads/Confined Feeding Operations	5,114	7.99	2.6%
Other Urban (ind., comm., educ., rel, etc.)	3,262	5.10	1.7%
Brush/Shrub	852	1.33	0.4%
Undeveloped	123	0.19	0.1%
Wetlands (forested & non-forested)	1,436	2.24	0.7%
Grand Lake St. Marys	12,970	20.27	6.7%
Other Water (ponds, rivers, etc.)	420	0.66	0.2%
TOTAL	**193,482**	**302.32**	**100.0%**

ODNR, Raymond M. Lohrer, Mercer County Land Use/Land Cover. 1994 www.dnr.ohio.gov/gims
ODNR, Raymond M. Lohrer, Auglaize County Land Cover. 1994 www.dnr.ohio.gov/gims
ODNR, Raymond M. Lohrer, Darke County Land Cover. 1994 www.dnr.ohio.gov/gims

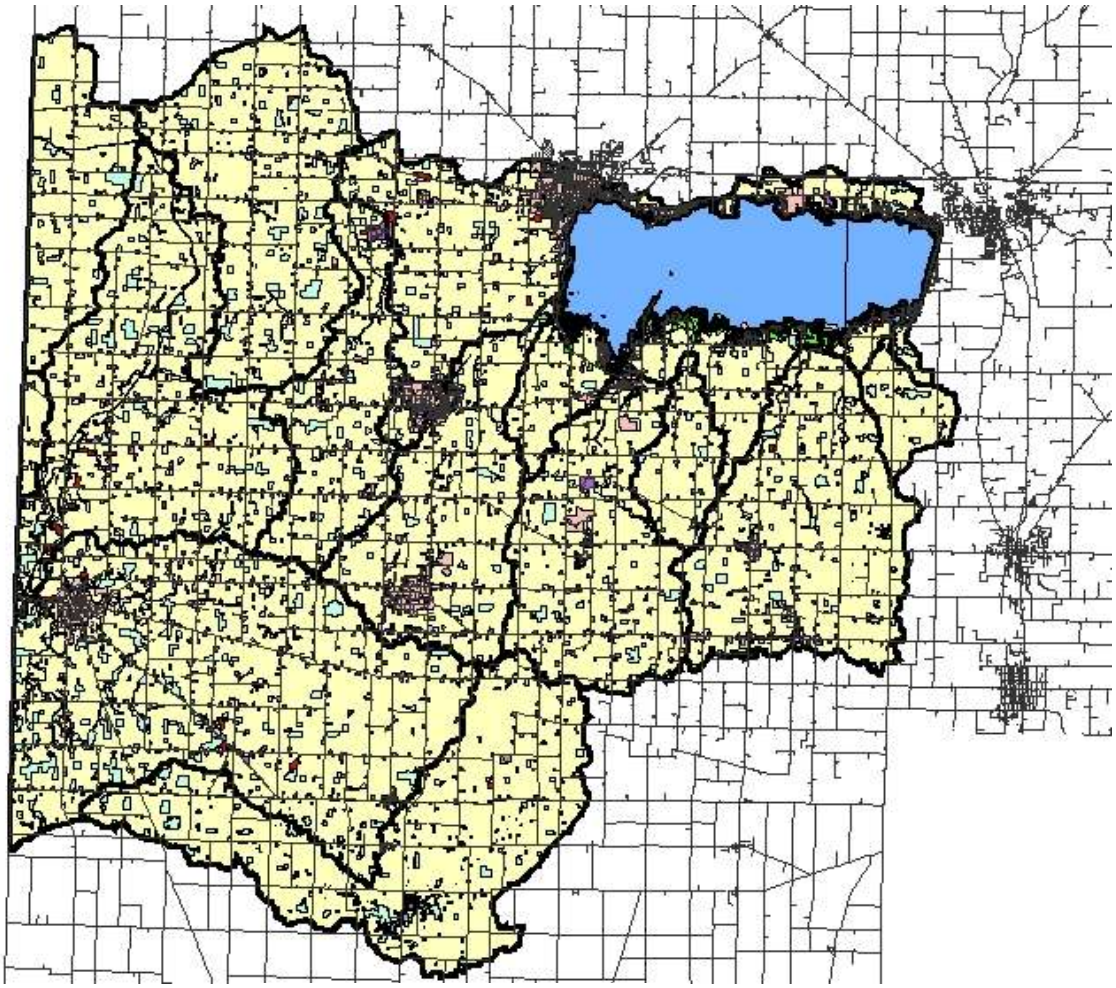
3.6.2 Phase 2 Stormwater Communities

The City of Celina is the only Phase 2 Stormwater Community within the Grand Lake/Wabash watershed. The small municipal separate storm sewer system (MS4) is required to maintain a National Pollutant Discharge Elimination System (NPDES) permit from Ohio EPA. The purpose of the MS4 program is to reduce the amount of pollutants entering storm sewers. The NPDES permit must include best management practices and measurable goals for the MS4. There are also additional restrictions on construction activities including a disturbance area of greater than one (1) acre. All such activities are required to obtain a NPDES permit before any disturbance activities take place. These permits and regulations are important to the Grand Lake/Wabash watershed as sedimentation has been listed as the greatest source of pollution to the lake. An important note to make is that as the soil is eroded and sediment enters the streams and waterways, a form of phosphorus, orthophosphate, is adsorbed to the clay particles in the sediment. It is this orthophosphate that remain available to plants and animals, leading to increased algal growth and eutrophication of the lake (Healthy Water, Healthy People Testing Kit Manual. The Watercourse. Montana State University. Pg 37. 2002.).

A listing of recommendations for the reduction of sedimentation of Grand Lake St. Marys, the Wabash River and their tributary streams can be found in the section titled Watershed Impairments starting on page 274. Please be aware that this is by no means a complete listing and that documents from the Ohio Environmental Protection Agency, and the Auglaize, Darke and Mercer County Engineer's offices should be consulted to obtain site and area specific recommendations for sediment and erosion control.

More information on the stormwater and construction permit requirements can be obtained by visiting www.epa.gov/npdes/stormwater .

MAP 23
Land Use



Legend

Grand Lake/Wabash Watershed

Roadways

Land Use

Cropland

Urban

Farmsteads

Shrub_Brush

Deciduous Forest

Open Water

Wetlands

Barren/Undeveloped

N

W E

S

3.6.3 Agriculture

According to the 2005 Ohio Department of Agriculture/USDA National Agricultural Statistics Service Annual Report, the agricultural sector of Mercer and Darke Counties ranks in the top 10 of 88 counties for nearly all major areas of both grain and livestock production. Auglaize county producers also place in the top 20 of 88 counties for the same considerations. While the watershed does not wholly include both counties, the watershed portion of each county is representative of the remainder of that county's profile.

Table 10

General Farm Structure			
	Auglaize	Darke	Mercer
Number of Farms	1,000	1,740	1,250
Average Farm Size	211 ac	191 ac	211 ac
Total Land in Farms	211,000 ac	333,000 ac	264,000 ac
Commercial Grain Storage	4,751,000 bu	7,857,000 bu	4,425,000 bu

The table below shows each county's rankings in major commodity production and sales for the year 2005.

Table 11

2005 Commodity Production Rankings			
Livestock	Auglaize	Darke	Mercer
All Cattle and Calves	21	5	2
Milk Cows	11	7	2
All Hogs and Pigs	6	2	1
All Sheep and Lambs	25	12	22
Crops			
Corn for Grain	17	1	5
Soybeans	18	1	14
Wheat	9	13	7
Oats	--	--	3
All Hay	39	33	14
Proc. Tomatoes	--	5	--

3.6.4 Water

Water is a major land cover in the Grand Lake/Wabash watershed, as nearly seven percent of the entire watershed consists of Grand Lake St. Marys. A total of 12,970 acres is the lake proper, seven percent of the watershed, while an additional 420 acres, 0.2% of the watershed, are in the category of ponds or wide streams. The watershed also has many intermittent streams and narrow tributaries that add to the total.

3.6.5 Wetlands

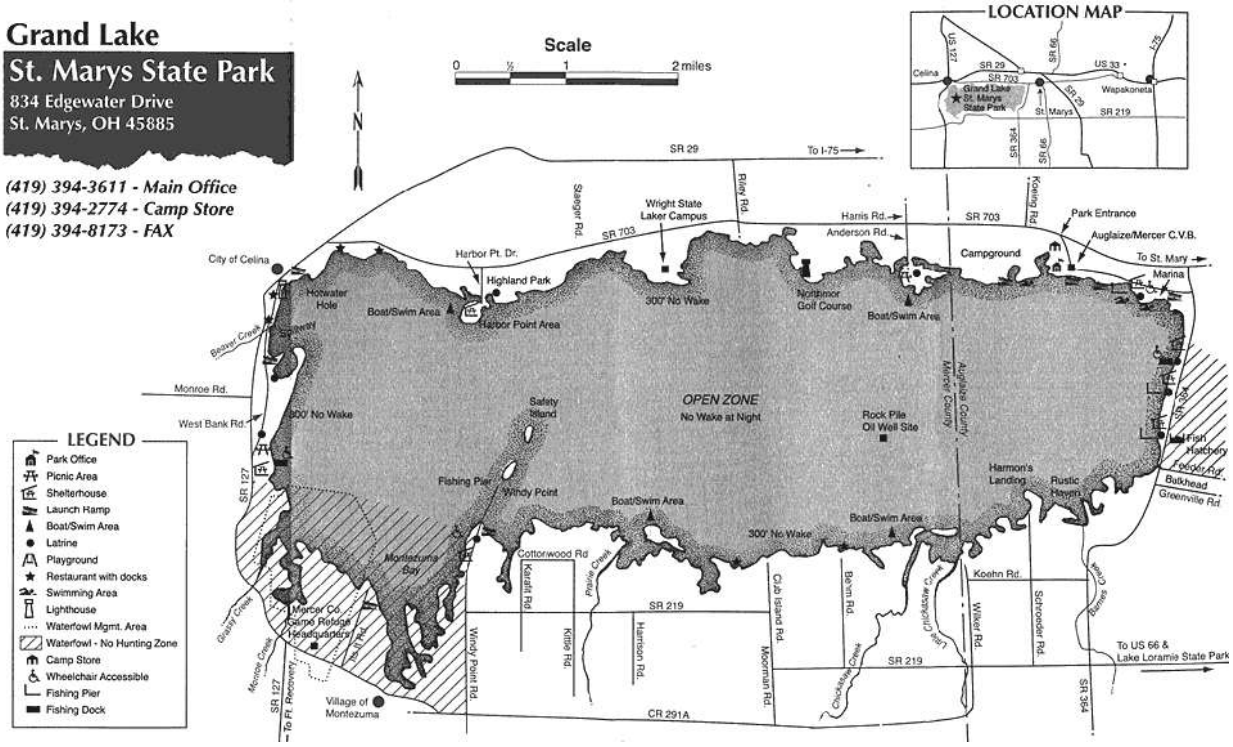
Both forested and non-forested wetlands account for 1,436 acres or 2.24 square miles in the watershed. This constitutes a total of 0.7% of the watershed, not including the acreage occupied by Grand Lake St. Marys. Many local interest groups within Mercer, Darke Auglaize counties are continuously putting efforts into protecting, restoring, and/or creating wetlands. To name a few, they include Pheasants Forever, Ducks Unlimited, Sportsman‘s Associations, the Lake Improvement Association and the Franklin Township Green Space Committee. Ohio EPA Section 319 Grant Funds have also been expended to help restore and create wetlands associated with wildlife attraction, wetland ecosystem awareness and education, and water treatment. This is an important task as more and more residential development is constructed altering flow to the wetlands, or destroying them with erosion of sediments and construction debris.

3.6.6 Protected Lands

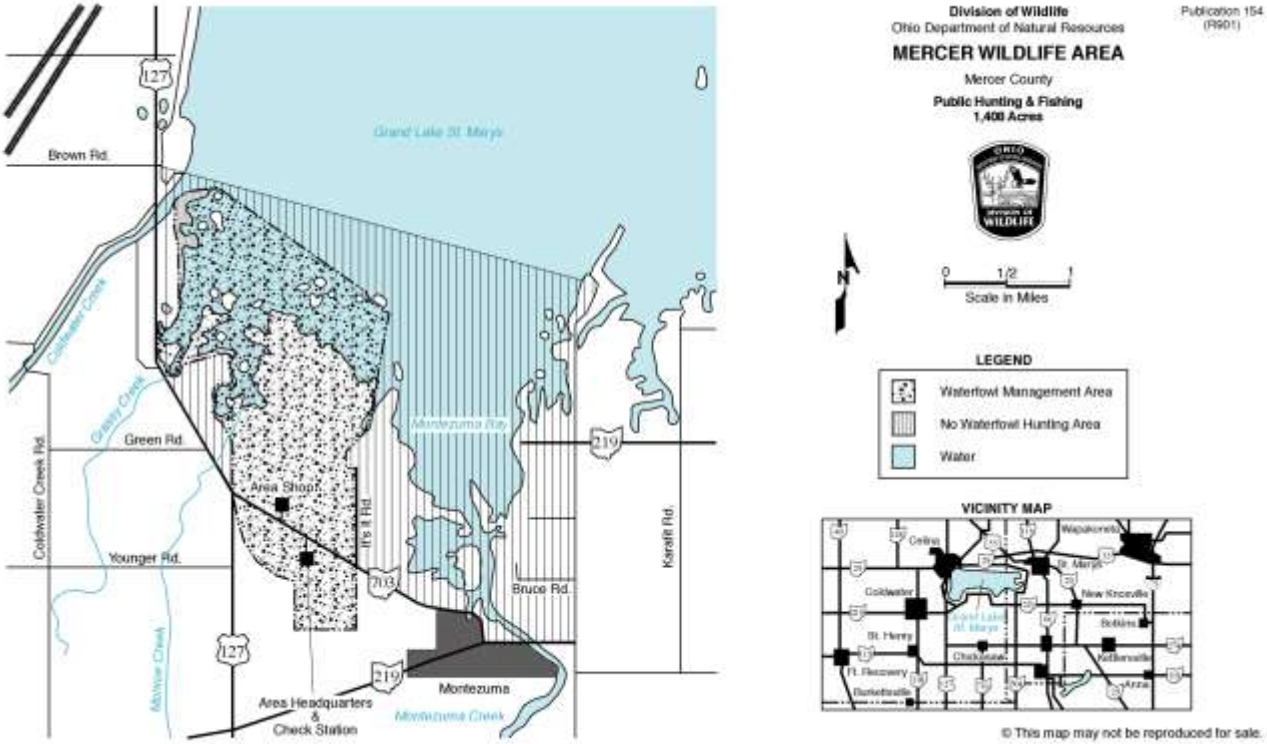
Grand Lake St. Marys State Park

The map found below shows the areas of land surrounding Grand Lake St. Marys that collectively make up the Grand Lake St. Marys State Park. The map is available at the following website:
http://www.dnr.ohio.gov/parks/parkmaps/grandlakestmarys.gif

MAP 24


Grand Lake
St. Marys State Park
834 Edgewater Drive
St. Marys, OH 45885
(419) 394-3611 - Main Office
(419) 394-2774 - Camp Store
(419) 394-8173 - FAX
Scale
0 ½ 1 2 miles
N
LOCATION MAP
LEGEND
Park Office
Picnic Area
Shelterhouse
Launch Ramp
Boat/Swim Area
Latrine
Playground
Restaurant with docks
Swimming Area
Lighthouse
Waterfowl Mgmt. Area
Waterfowl - No Hunting Zone
Camp Store
Wheelchair Accessible
Fishing Pier
Fishing Dock
SR 29
To I-75
Wright State Laker Campus
Harris Rd.
Anderson Rd.
SR 703
Park Entrance
Auglaize/Mercer C.V.B.
To St. Mary
Marina
Campground
City of Celina
Harbor Pt. Dr.
Highland Park
Hotwater Hole
Boat/Swim Area
Harbor Point Area
300' No Wake
Northmor Golf Course
Boat/Swim Area
Monroe Rd.
West Bank Rd.
Safety Island
OPEN ZONE
No Wake at Night
Rock Pile Oil Well Site
Auglaize County
Mercer County
Fish Hatchery
Fergey Rd.
Bulkhead
Greenville Rd.
Harmon's Landing
Rustic Haven
Fishing Pier
Windy Point
Boat/Swim Area
Boat/Swim Area
Montezuma Bay
Cottonwood Rd
Mercer Co. Camp Ridge Headquarters
Koehn Rd.
SR 219
Windy Point Rd.
Kitter Rd.
Harrison Rd.
Moorman Rd.
Club Island Rd.
Baum Rd.
Wilker Rd.
Schroeder Rd.
To US 66 & Lake Loramie State Park
Village of Montezuma
CR 291A
SR 364
SR 127
To Ft. Recovery

MAP 25



The map of the Mercer Wildlife area can be viewed at the following website: http://www.dnr.ohio.gov/wildlife/pdf/pub154.pdf

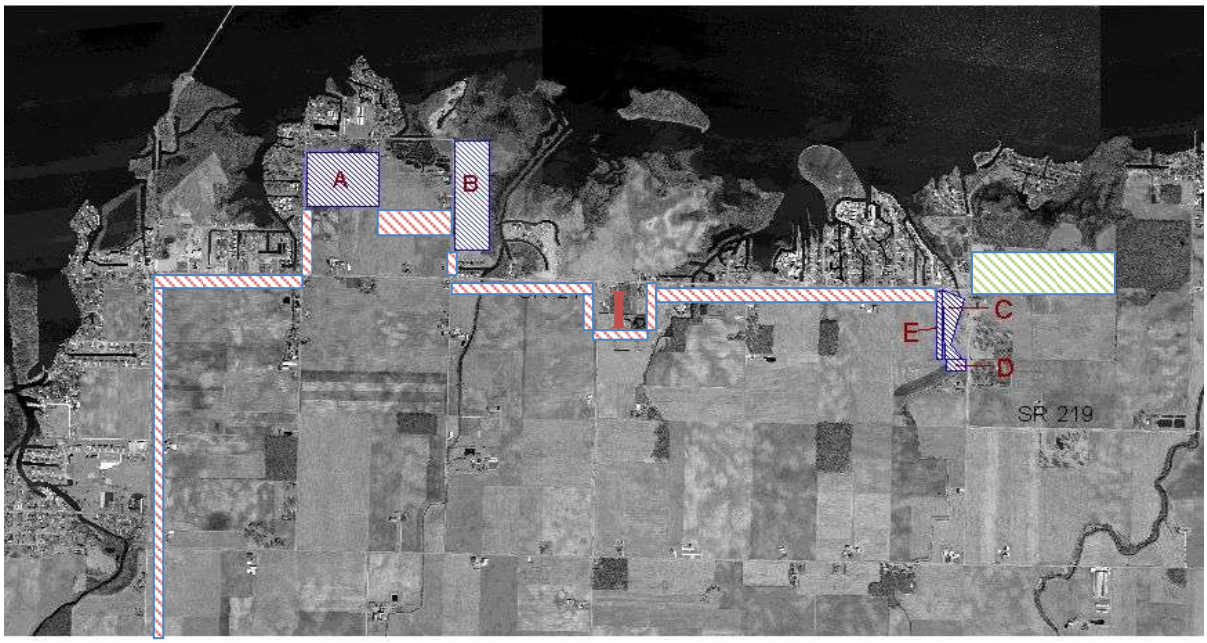
The reverse of the map, publication 154, describes the purpose of the wildlife area:

—The rapid increase in human population and the development of the lake for recreational uses have imposed many restrictions on the wildlife community. The primary purpose of the wildlife area is to act as a refuge, providing resting and feeding areas for local and migrant wildlife. The waterfowl management area provides the largest and one of the few remaining areas around the lake that is free from human disturbance.

The Canada goose management program began in 1956. Nesting and migrant goose populations have increased steadily since that time. Wildlife management activities have included development and management of grain crops and meadow, primarily for nesting and migrant waterfowl. Trees and shrubs have been maintained along the lakeshore to prevent erosion. Seven ponds have been constructed on the area to increase nesting sites and area utilization by waterfowl.

Waterfowl production has been enhanced by the use of several hundred wood duck nest boxes and Canada goose nesting structures on the management area and in shallow waters around Lake St. Marys."

MAP 26
Franklin Township Greenspace Areas



The above map shows the properties in Franklin Township that were purchased by the township trustees. These purchases fall into line with the Franklin Township Community and Land Use Plan that was developed in 2000. The full plan can be viewed at the following website:

www.franklintownship-mercercounty.org

A: The Franklin Township Nature Park: 33.77 acres that consists of a paved trail and plastic/wood trail combination, wetlands, wooded and grass areas. Additional wetlands have been constructed, and there are plans for native grasses and additional trees. This includes a trail through the area and a wildlife viewing area overlooking the wetlands.

B: Prairie Creek Nature Park: 37.098 acres. This area was purchased and used an a dredge material relocation area for the state park. It has been reclaimed and functions as wildlife habitat.

C, D & E: The Strasburg Nature Park: 6.393 acres include a paved trail, and consists of a stream with wooded and grass areas. Additional trees were planted in

2004 and long term plans include the development of grass walkways through the property and additional plantings for water quality and wildlife habitat.

F: Franklin Township Recreational Trail (marked in blue and red stripes): This trail connects Montezuma to the Club Island area by a paved trail. This trail winds throughout many different nature areas, totaling almost 10 miles. Expansion is planned to complete the bicycle trail circumferencing Grand Lake St. Marys.

G: Gilliland Property (green striped area): This nature area has grassed paths throughout the 80.182 acres of wildlife habitat. Shrubs have been planted marking the trails and more plantings are planned. An information kiosk is planned for near the parking area of this land.

H: Recreational Trail Montezuma Extension (to the west of the pictured area):This trail is planned to be extended through Montezuma, past Kozy Campground to the ODNR Nature Preserve. Funds are being researched for wetland restoration, stream restoration and reforestation throughout this area.

I: Gaston Property: A portion of this area has already been purchased. On this area a bicycle path was installed complete with a bridge over Prairie Creek. With this construction some reforestation has been completed and more is planned. This property consists of wetlands, wooded and grass areas. Long term plans will include planting of additional trees and native grasses and the preservation of wildlife habitat.

J: Auglaize County Connection: This section of the recreational trail would complete a bicycle trail around Grand Lake St. Marys. This is planned for east of the pictured area. Funds are being researched, along with potential for stream and wetland restoration in this area.

MAP 27
Baker‘s Woods, Mercer County, Ohio

The highlighted area is a 47.2 tract of forested area owned by the Ohio Department of Natural Resources, Division of Natural Areas and Preserves. Baker Woods has the potential to be a valuable resource for education and protection efforts. Baker Woods State Nature Preserve is not a site open to the public. If you are interested in visiting the site, a permit application will need to be submitted to the Division. Although permits cannot be processed on-line, an application can be downloaded from (http://www.dnr.state.oh.us/dnap/permits/default.htm) and then mailed or faxed to the division. Please allow at least two weeks for processing.

Further information regarding the site comes from ODNR: Division of Natural Areas and Preserves‘ Directory of Ohio's State Nature Preserves:

—Although small in size, Baker Woods is a high-quality, old growth forest remnant. The 47-acre site was donated to the division in 1982. Large specimens of oaks, hickories and maples dominate the forest canopy. Much of the woods is wet during the growing season. Two state-listed species occur at Baker Woods. Best time to visit is autumn or early spring-- before the mosquitoes emerge. Located in Butler Township in Mercer County. No facilities.”

3.7 Cultural, Historical, and Recreational Resources

There are many cultural, historical and recreational resources located within the boundaries of the Grand Lake/Wabash Watershed. A few of those resources are listed below with descriptions provided by the Visitors Guide entitled —Discover Ohio's Other Great Lake & So Much More" produced by the Auglaize and Mercer Counties Convention and Visitors Bureau.

Fort Recovery State Museum and Monument Park: Museum features Anthony Wayne's legion and the two Indian battles fought there. Also shown is a typical 1790's Native American and one of the largest collections of Indian Artifacts in the state of Ohio. On the grounds are two reconstructed blockhouses, a connecting stockade and the Greenville Treaty Line marker. Fort Recovery is the site of two of the most dramatic Indian battles in American history. The first was the devastating defeat of General Arthur St. Clair in 1791 and the second, the successful defense of the fort by General —Mad" Anthony Wayne in 1794. President William Howard Taft signed a bill in 1908 to authorize a monument in honor of the soldiers who died serving under St. Clair and Anthony Wayne. Congress approved the bill in 1910 and work was begun in 1912. A 103-foot monument stands to remember the 900+ soldiers that died there and an oak tree to remember the Native Americans. The base of the monument holds the bones of the fallen soldiers who died in the battles. The nine-foot tall statue depicts a frontiersman facing west to the beautiful unsettled land into which he triumphed. Other attractions are a log home, blacksmith shop, historical walkway, local walk-by museum and a state park.

Maria Stein Heritage Museum: Located on the second floor of the former convent building, this museum interprets the German settlements of southern Auglaize and Mercer Counties and the history of the Sisters of the Precious Blood.

National Marian Shrine of the Holy Relics: The shrine contains approximately 1,000 relics of the saints and is the second largest collection of its type in the United States. Built in 1890, the shrine and the adjacent former convent were placed on the National Register of Historic Places in 1976.

Land of the Cross Tipped Churches: In July of 1979, over sixty buildings representing the German Catholic settlements of southern Auglaize and Mercer Counties, as well as portions of northern Darke and Shelby Counties, were placed on a National Register of Historic Places. Consisting of churches, schools, rectories, and convents, this grouping is symbolic of the cultural and historical uniqueness of the region. Today, most of these structures remain to remind us of the hard work and dedication of these early settlers as they built the Miami-Erie Canal and forged a new life on the area's rich and productive farmland. A drive along this Ohio Scenic Byway through the rural countryside follows the quaint churches with their cross tipped —spires to heaven" and includes stops at the focal points of the region: the former convent at Maria Stein, St Augustine Church – the original Mother Church of the area at Minster and St Charles center, the magnificent and impressive seminary at Carthagena.

St Charles Center: This magnificent former seminary rests on 500 acres. Begun in 1861 by Missionaries of the Precious Blood, the current structure is a late gothic revival building. The awesome facility features a 370-foot frontage and is topped by a five story octagonal dome.

Wright State University Lake Campus: Located on the north shore of Grand Lake St. Marys, the Lake Campus became a branch of Wright State University, Dayton in June of 1969. The Lake Campus provides pre-baccalaureate and technical education at the associate degree level. Bachelor's degrees in Early Childhood Education and organizational Leadership are available. A BSN completion program is offered for registered nurses. A new weekend MBA program is offered for working professionals. Other master level programs provided include Education and Educational Leadership.

Grand Lake St Marys State Park: The lake itself and much of its perimeter was dedicated as an Ohio State Park in 1949. The park currently provided 210 campsites (135 with electric). A —campers only" swimming beach and boat tie-ups are available within the campground. Horseshoe pits, sand volleyball, basketball, a tennis court, bicycle rentals, a 9 hole putt-putt course and a camp store are available within the campground. The park also has two public swimming beaches as well as swimming areas for boaters. Picnic areas with tables and grills are located in scenic areas around the lake. The East Bank/Villanova area has several shelter houses available on a reservation basis. Boat dock rentals are available through the State Park Office. Hunting is permitted in designated areas. There are seasonal duck blinds available by lottery through ODNR. Constructed as a feeder lake for the Miami-Erie Canal, Grand Lake St Mary, at its completion in 1845 was the largest manmade lake in the world. The feeder reservoir was formed by raising two walls of earth, from ten to twenty-five feet high, called the East and West embankments. These walls formed a high basin to retain water. The reservoir rests on the summit between the Ohio River and Lake Erie. Now Ohio's largest inland lake, Grand Lake St Marys is a primary recreational area offering a variety of activities for the whole family. With over 13,500 acres and 52miles of shoreline (much of it accessible to the public), Ohio's Other Great Lake provides many opportunities for picnicking, swimming, fishing, boating and camping.

Boating: Grand Lake St Marys is open zoned for skiing and has unlimited horsepower for power boating. A 300-foot —nowake" zone provides for safety and shoreline protection. There are five state operated launch ramps providing boaters access to the lake. Private launch ramps are also available at marinas along the shallow shoreline. Sailing and jet skiing are very popular on this grand lake and rentals are available at area marinas.

Fishing: Fishing is a year around affair on Grand Lake St. Marys. Since the lake is shallow (average 6-7 feet depth), it warms quickly in the spring activating largemouth bass and large catches of bluegills and crappies. There are professionally run and organized fishing tournaments held every year. The lake is considered one of the finest —panfishing" areas in the state, with good populations of crappies and yellow perch. The last few years have shown increases in the perch population and anglers report

record catches. Walleye fry and fingerlings have been stocked and a significant population is developing with good sized walleye reported being caught.

State Fish Hatchery: One of only six hatcheries in the state of Ohio, the St. Marys site is the only one that raises yellow perch and largemouth bass. Other species raised at the St. Marys site include channel catfish, fathead minnows, walleye and saugeye.

Golf Courses: Elks Club – 18 holes, driving range; Northmoor Golf – 18 holes, driving range; Fox's Den – 18 holes, driving range.

Marinas: Bayview Sun & Snow Marina; D&W Marina; Kozy Marina; Ohio Marine Inc.; St. Marys East Bank Marina; Windy Point Marina.

Other local areas of interest near to the watershed and also found in the Visitors Guide include The Miami-Erie Canal Towpath, St. Marys Memorial Park, Celina-Coldwater bike Path, Route 703 Bike Path, Auglaize and Mercer Counties Historical Museums; and many others, too numerous to mention. For more information on any of these sites, please visit the Auglaize and Mercer Counties Convention and Visitors Bureau at www.seemore.org .

3.8 Complementary Efforts for Water Quality Protection

3.8.1 Ohio EPA Section 319 Grant

In 2000, the Grand Lake St. Marys Watershed Project was awarded an Ohio EPA Section 319(h) grant from the Environmental Protection Agency. This grant's primary goal is to provide implementation funding for projects to reduce the amount non-point source pollution entering the waterways in Ohio. Thus, the project goal was simply put, —To improve water resource quality in the Grand Lake St. Marys Watershed by reducing nonpoint source pollution." This grant contained several objectives ranging from educational components (brochures, public events, media releases, etc), construction of wetlands, watershed boundary signs, GPS soil sampling and strip tillage incentive payments. The majority of cost share provided to local stakeholders is only a fraction of the total cost or value of the practice. The participants, on average, provide at least half, if not more, than the cost of the practice. This grant ended in mid-2004.

3.8.2 Watershed Coordinator Grant

Relatively soon after being awarded the 319 grant from Ohio EPA, the Grand Lake St. Marys watershed project was awarded with a Watershed Coordinator Grant from ODNR. This grant provides a great portion of the funding necessary to employ a full-time coordinator to oversee the day-to-day operations of a watershed project. The grant funds decrease by 10% per each of the six years, making the position increasingly dependent on local funding each year. The grant funding began in early 2001 and is set to be completed in late 2006. A similar grant was awarded to the Wabash Watershed Alliance in 2002. In early 2005, the Grand Lake St. Marys watershed project joined with the Wabash Watershed Alliance to form the Grand Lake/Wabash Watershed Alliance under one watershed coordinator. The grant funding was completed at the conclusion of 2008.

In 2008 the watershed coordinator applied for a watershed coordinator implementation grant. This grant will fund the watershed coordinator salary for three years starting in 2009. This grant is from the Ohio Department of Natural Resources and the Ohio EPA through 319 grant funds. The local funding is committed by Mercer County, Darke County, Auglaize County, and the City of Celina. The GLWWA plans to continue the watershed coordinator position as long as there is funding available. The watershed coordinator has plans to meet with all government groups in the watersheds in 2009. The goal of these meetings will be to generate interest in funding the watershed coordinator's position when the grant concludes.

3.8.3 State Pollution Abatement Grant

The Ohio Department of Natural Resources, Division of Soil and Water Conservation awarded $26,356.50 to the Grand Lake St. Marys Watershed Project in April of 2000. These funds were awarded to provide cost share opportunities for the practices of Feedlot Runoff Control, to reduce the volume of lot runoff entering animal waste holding

ponds and lagoons, and Sprayer Upgrade, upgrading spray equipment to low drift technology which reduces aerial movement of sprayed materials by providing a more controlled spray pattern.

Some changes were made in the scope of the grant and the funding was opened up to any practice approved by the Division of Soil and Water Conservation for pollution abatement. Funding from this grant was also utilized to for emergency hauling of animal waste during the July, 2003 flooding. This act prevented thousands of gallons of animal waste from entering the waterways and Grand Lake St. Marys. Other practices that were implemented include the construction of animal waste holding ponds, milkhouse waste filter area, and a mortality composting facility. In 2006, a cover crop demonstration program was implemented with remaining funds in the Grand Lake/Wabash Watershed. Approximately 112 acres of cover crops were planted, including, oilseed radish, annual ryegrass, rye, oats and winter wheat.

3.8.4 Chickasaw Creek Watershed and Nutrient Management Program

The Ohio State University Research Foundation was awarded a Clean Water Act, Section 319 Grant to implement an incentive program to establish 50 acres of filter strips along streams, establish tile line water flow control on 30 acres, eliminate direct discharge of millhouse waste water from three dairy milkhouses, establish four on-farm manure composting facilities, and develop a manure brokerage in the Chickasaw Creek subwatershed of the Grand Lake St. Marys watershed.

Grant accomplishments included installing 55.34 acres of grass filter strips; installing tile risers to prohibit liquid manure from entering Chickasaw Creek; and over 8,690 acres of crop land was soil tested for nutrient analysis.

Total Project Cost:	$201,284.85
Federal :	$106,624.85
State:	$ 58,096.00
Local:	$ 36,564.00

The Auglaize County SWCD was involved in a very similar grant regarding objectives. The budget listing for that grant was as follows:

Total Project Cost:	$ 72,773.56
Federal :	$ 36,648,56
State:	$ 29,955.00
Local:	$ 6,170.00

3.8.5 GLSM Filter Strip/Dredge Material Reuse Project

The Auglaize Soil and Water Conservation District and the Ohio Department of Natural Resources partnered to reduce the sediment entering into Grand Lake St. Marys tributaries by 50,000 tons per year; to determine if dredge sediment can enhance crop production; and to determine if cropland application is a viable alternative for dredge

material reuse. Results of this exact project are not available, but several dredge material relocation areas have been returned to cropland.

Project cost was $40,000 of State (ODNR) funds.

3.8.6 Sediment Trap Construction

In the early fall of 2006, the construction of sediment traps began on the tributaries to Grand Lake St. Marys. The sediment traps are designed to slow the water entering the lake to allow sediment to settle from the water in the trap area. To date, five traps have been constructed. Sediment traps are located on Barnes Creek, Chickasaw Creek, Beaver Creek, Riley Bay Creek and an unnamed tributary near Strasburg Park. These traps were constructed by the Grand Lake St. Marys State Park and will be monitored by the state park with assistance from local volunteers.

So far monitoring results have been across the board. Some traps showed they were continuing to fill, while others actually started to empty. The State Park has decided to continue the monitoring for at least one more year before any decisions are made regarding the success of these sediment traps. The monitoring results can be found in Appendix K.

3.8.7 Conservation Innovation Grant 2007

In 2007 and 2008 the watershed project received a grant from the Natural Resources Conservation Service. This grant was to do an experiment on dewatering manure with geotextile tubes. The objective was to determine if the practice was economical. Tubes were utilized at a swine finishing facility and at a dairy facility. The final report of this grant recommended a full scale experiment needs to be completed before this practice could be relied upon for daily manure management. The report also stated that the practice was sound, the tubes worked as expected. All partners in the project were asked to submit their economic feasibility conclusions. Two partners showed that the geotextile tubes are not economically feasible at this time. The last partner is publishing their report in February 2009. The final watershed project grant report can be viewed by contacting the watershed coordinator.

3.8.8 2007 and 2008 Agriculture Incentive Program

Senator Keith Faber secured $100,000 for agriculture incentives in 2007 and 2008 for the Grand Lake St. Marys watershed. Both years these funds were allocated and a waiting list for funds was created. These funds were used for cost share for agricultural best management practices. The goal of the program was to assist a producer to try a practice for a year or two; then as they saw that the practice worked well for them, they would implement that practice on other fields without any incentive or cost share. These programs helped put in over 2,000 acres of cover crops, over 70 acres of hayland buffers and many other best management practices.

3.8.9 Conservation Innovation Grant 2008

In 2007, the watershed coordinator worked with the Grand Lake St. Marys State Park and submitted a grant application to use geotextile tubes as shoreline protection in Grand Lake St. Marys. The lake is a shallow lake susceptible to wind and current erosion. The grant application was accepted and the project schedule is ready to begin when the weather and water conditions are correct. This grant will help to protect 800 feet of shoreline and a natural wetland near Windy Point, a popular section of the State Park. Matching funds for this grant were provided by a $25,000 capital budget request by Senator Keith Faber, the Mercer County Soil and Water Conservation District, Grand Lake St. Marys State Park and local interest groups.

3.8.10 Environmental Quality Incentive Program Demonstration Project 2008

In 2008, USDA provided a demonstration project administered by NRCS in the Grand Lake St. Marys watershed. This demonstration project provided cost share for 5 manure management structures, over 1,670 acres of cover crops and over 700 acres of hayland buffers. Over 55 producers in Auglaize and Mercer Counties participated in the demonstration project. This project will provide cost share for the cover crops and hayland buffers to be in used for three years.

3.8.11 Other Grants Received

Other miscellaneous grants received include:
ODNR Step Outside grant for conservation camps
ONDR Watershed Education mini-grant for lawn fertilizer workshop and awareness
ODNR Watershed Education mini-grant for storm drain marking
ODNR Watershed Education mini-grant for teacher‘s workshop

3.9 Total Maximum Daily Load Studies

3.9.1 Wabash River

US EPA finalized the Wabash River Total Maximum Daily Load (TMDL) report in 2004. The study defines the Wabash River watershed as a warmwater habitat (WWH). WWH is the use designation that defines the typical warmwater assemblage of aquatic organisms for Ohio Rivers and streams and represents the principal restoration target for the majority of the water resource management efforts in the state. The TMDL report determined that the watershed does not meet its use designation in any assessment unit. It goes on to state that —The Wabash River is one of the most degraded watersheds in the State. Its priority ranking for TMDL development is high on the 2002 Section 303(d) list."

The data collected during the TMDL process shows that the watershed is impacted by non-point source pollution as well as a minor municipal source. Non point sources listed include: (1) nonirrigated crop production; (2) animal feeding operations; (3) channelization (agriculture); (4) removal of riparian vegetation; and (5) streambank destabilization.

Target levels for nitrate-nitrite, total phosphorus and total suspended solids were developed based on the WWH use designation. The target level for nitrate-nitrite is 1.5 mg/L, the target level for total phosphorus is 0.17 mg/L and the target level for total suspended solids is 32.0 mg/L. Data collected showed that the total phosphorus concentration was routinely exceeded, particularly during the summer months due to low flow conditions and increased sunlight. Data collected also indicated that the nitrate-nitrite levels were occasionally exceeded, again with the highest values occurring during the summer months. Sampling indicated that the total suspended solids target was exceeded during most of the spring, summer and winter.

The Soil Water Assessment Tool was used to allocate loads to determine what implementation measures could be taken to decrease the input levels of sediment and nutrients. The modeling showed that reductions of total phosphorus are needed 10 months out the year and reductions of nitrate-nitrite and total suspended solids are need throughout the year. Specific reductions are outlined in the TMDL report. Implementation procedures are not specifically outlined in the TMDL report; in fact, it states that implementation procedures shall be outlined in this watershed action plan. It also states that efforts to implement best management practices should be continued by the GLWWA.

3.9.2 Grand Lake St. Marys/Beaver Creek

Ohio EPA has finalized the TMDL report for the Grand Lake St. Marys and Beaver Creek watersheds. The final report was released during the fall of 2007. The information described below has been taken from the draft report, which was released to the public on June 15, 2007.

Grand Lake St. Marys itself has been designated as an exceptional warmwater habitat (EEWH). The Grand Lake St. Marys and Beaver Creek watersheds have been designated as a WWH. The EEWH designation for Grand Lake St. Marys has been given due to the Environmental Protection Agency's guidelines that indicate —All public and private lakes, except upground reservoirs, are designated as Exceptional Warmwater habitat…Publicly owned lakes are also designated State Resource Waters (SRW)."

Data shows that the lake is impacted by non-point source pollution, which occurs from direct runoff and via tributary input. Because the predominate land use within the watershed is agricultural, much of the non-point source pollution is attributed to agricultural activities. Some sources listed include: (1) stream channelization; (2) riparian vegetation removal; (3) stream bank destabilization; (4) runoff from animal feeding operations; and (5) unsewered areas and failing septic systems.

TMDL levels and load reductions were determined for many different areas of the watershed under high flow, mid-range flow and low flow conditions. The three parameters identified as pollutants include, total phosphorus, nitrate nitrogen and fecal coliform. The report shows required reductions as high as 100% in some areas. Generally speaking, the required load reductions are higher during high flow conditions, but are still significant during low flow conditions.

The report also outlines specific agricultural best management practices that can assist in the reduction of nutrient loading. It shows an estimated reduction of total suspended solids, total nitrogen, total phosphorus and fecal coliform for each BMP. Both TMDL reports can be viewed at the Grand Lake/Wabash Watershed Alliance office or can be viewed online at http://www.epa.state.oh.us/dsw/tmdl/BeaverCreekWabashTMDL.html.

3.10 Lake Trophic State Index

A frequently used biomass-related trophic state indices is that of Carlson (1977). It is relatively simple to use, requires a minimum of data, and is generally easy to understand, both in theory and use. It is numerical, but the traditional nutrient-related trophic state categories fit into the scheme. It seems to be ideal for use in volunteer programs.

We define trophic state as the total weight of living biological material (*biomass*) in a waterbody at a specific location and time. Time and location-specific measurements can be aggregated to produce waterbody-level estimations of trophic state. Trophic state is understood to be the biological response to forcing factors such as nutrient additions (Naumann, 1919, 1929), but the effect of nutrients can be modified by factors such as season, grazing, mixing depth, etc.

In accordance with the definition of trophic state given above, the trophic state index (TSI) of Carlson (1977) uses algal biomass as the basis for trophic state classification. Three variables, chlorophyll pigments, Secchi depth, and total phosphorus, independently estimate algal biomass.

Carlson, R.E. and J. Simpson. 1996. *A Coordinator's Guide to Volunteer Lake Monitoring Methods*. North American Lake Management Society. 96 pp.

4.0 SUBWATERSHED INFORMATION

4.1 Grand Lake St. Marys Subwatersheds

4.1.1 Coldwater Creek

The Coldwater Creek subwatershed drains the western border of the Grand Lake St. Marys drainage basin. The entire subwatershed is located in Mercer County. The acres, square miles and percent of sub-watershed are shown below. The Coldwater Creek Subwatershed, according to percentages, is the third largest of the seven subwatersheds draining to Grand Lake St. Marys. Of the entire Grand/Lake Wabash Watershed, it is the sixth largest of fifteen subwatersheds.

TABLE 12

COLDWATER CREEK	
Acreage	12,366
Square Miles	19.32
% of Grand Lake Watershed Total Land Area	21.0%
% of Grand Lake/Wabash Watershed Total Land Area	6.9%

Water Quality Status

Coldwater Creek, composed of the upper, west fork and lower sections, and including Burntwood Creek has been designated as a warm water habitat (WWH). This aquatic life use designation has been established by the EPA and based on recent data sampling, the water resource is shown as not meeting that use designation, or in a "non-attainment" status. Furthermore, the Coldwater Creek subwatershed has been shown to be NPS impacted. Suspected or proven impacts to these streams include: non-irrigated crop production, animal feeding operations, channelization, removal of riparian vegetation and stream bank destabilization. Definitions and criteria for these descriptives can be found in Appendix C- Aquatic life use designations and assessment terms.

Ohio EPA is currently completing a TMDL report for Beaver Creek and Grand Lake St. Marys, which is in process of being finalized. The draft report calls for phosphorus, nitrate and fecal coliform reduction upwards of 80% to 90% within the Coldwater Creek subwatershed. Detailed information on the sampling results and recommended load reductions can be found in the draft report of the 2007 Ohio EPA TMDL report, which can be obtained by contacting the watershed project office.

Water Supplies and Discharges

There are two community water supplies located in the Coldwater Creek subwatershed. These supplies are the Village of Coldwater and the Village of St. Henry. Also located in the subwatershed is one transient non-community public water supply, which is the VFW Post #5135. Additionally, there is one indirect discharge permit issued to Cooper Farms Processing Facility.

The Village of St Henry Wastewater Treatment Plant (WWTP) discharges to Coldwater Creek as does the stormwater from both the Village of St Henry (draining to three intermittent tributaries) and the eastern and southern portions of the Village of Coldwater.

Based on recent aerial photographs, areas where 10 or more household wastewater treatment and disposal systems were present in close proximity were identified. As with any individual treatment system operating in an area with poorly drained soils, the effects of the effluent on the receiving water body is a concern. These effects grow as the number of systems in a given area increases, thus clusters or groups of 10 or more systems has been used to analyze the potential effects of those systems on the water quality. Regarding Coldwater Creek subwatershed, there were a total of six clusters identified comprised of 75 individual treatment systems.

Highly Erodible Land

Map 27A at the end of this subsection illustrates the highly erodible land locations within the Coldwater Creek subwatershed. Of the seven subwatersheds within the Grand Lake St. Marys watershed, Coldwater Creek ranks third highest in the amount of highly erodible land present within the subwatershed. The highly erodible land information was developed from the 2003 online NRCS Soil Data Mart.

Riparian Corridor Status

The chart on the following page shows the riparian corridor status for the Coldwater Creek subwatershed. The chart indicates the number of miles of each drainage unit that has various widths of tree canopy, or riparian corridor. The numbers account for both sides of the streams; therefore, the number of actual stream miles is half of that shown. The divisions are less than 10 feet in total width, 10 to 40 feet in total width, and greater than 40 feet in total width. The chart is also divided into perennial and intermittent streams under each of the corridor width column headings. MAP 28 illustrates the stream sections under each division.

The chart shows that with a total of 41.08 miles of stream network, the Coldwater Creek subwatershed has 16.18 miles of stream with less than 10 feet of canopy and vegetation, 3.03 miles of stream with 10 to 40 feet canopy and vegetation, and 21.87

miles of stream with greater than 40 feet of canopy and vegetation. The Coldwater Creek subwatershed has the largest number of stream miles within the Grand Lake St. Marys Watershed, which is 29.3%. Of the entire Grand Lake/Wabash Watershed, this subwatershed has the sixth highest number of stream miles, which is 5.8%.

TABLE 13
Riparian Corridor Status

COLDWATER CREEK										
RIPARIAN STATUS	TREE CANOPY <10' IN TOTAL WIDTH			TREE CANOPY 10 to 40' IN WIDTH			TREE CANOPY >40' IN WIDTH			TOTAL STREAM MILES
	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	
	5.80	10.38	16.18	2.46	0.57	3.03	7.54	14.33	21.87	41.08
% of Subwatershed Total	14.1%	25.3%	39.4%	6.0%	1.4%	7.4%	18.4%	34.9%	53.2%	100.0%
% of Grand Lake Watershed Total	4.1%	7.4%	11.5%	1.8%	0.4%	2.2%	5.4%	10.2%	15.6%	29.3%
% of Grand Lake/Wabash Watershed Total	0.8%	1.5%	2.3%	0.3%	0.1%	0.4%	1.1%	2.0%	3.1%	5.8%

Operations and Animal Units

The table on the following page shows the number of operations and the animal units by species for the Coldwater Creek subwatershed. According to the table, there are seven poultry operations, 14 dairy operations, six hog operations, 24 beef operations and four horse operations within the entire subwatershed. The Coldwater Creek subwatershed ranks eighth within the entire Grand Lake/Wabash River Watershed when considering the total number of operations with 55 or 5.6%. Animal units within the subwatershed ranks sixth of 15 with 4.8%.

Totals of animal units for each species are also listed on the table. The inventory for this subwatershed was completed during March of 2007. At the time of the inventory animal units were determined by the number of animals present. Although this is not a 1:1 ratio for all species, it is for beef cattle. The following chart shows the number of each type of animal that makes up 1,000 animal units.

Animal Type	1,000 Animal Unit Equivalent
Beef Cattle	1,000
Dairy Cattle	700
Hogs (over 55 lbs)	2,500
Turkeys	55,000
Layer Chickens	82,000
Pullet Chickens	125,000
Sheep	10,000
Horses	500

TABLE 14
Operations and Animal Units

COLDWATER CREEK														
ANIMAL TYPE	POULTRY		DAIRY		HOG		BEEF		OTHER		TOTAL		Total as % of Grand Lake Watershed	
	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s
# Farms and Animals	4 (Trky) 3	10,385 545	14	2,214	6	1,140	24	2,147	(sheep) (hrs) 4	0 46	55	16,478	18.5%	15.7%
% of subwatershed total	12.7%	66.3%	25.5%	13.4%	10.9%	6.9%	43.6%	13.0%	7.3%	0.3%	100.0%	100.0%		
Total as % of Grand Lake Watershed	2.3%	10.4%	4.7%	2.1%	2.0%	1.1%	8.1%	2.0%	1.3%	0.0%	18.5%	15.7%		
Total as % of Grand Lake/Wabash Watershed	0.71%	3.20%	1.42%	0.65%	0.61%	0.33%	2.43%	0.63%	0.40%	0.01%	5.56%	4.82%		

Manure Production

After considering the number of livestock operations and animal units present in the watershed, it is only fitting to consider the by-products of these animals. The table on the opposite page is used to represent the manure and nutrient production for the Coldwater Creek drainage area. The Coldwater Creek subwatershed ranks sixth overall, of 15, in terms of manure production per annum. Approximately 99,524 tons of manure is produced annually. The remainder of the columns on the table indicates the approximate pounds of nutrients contained in that manure. Nitrogen, potassium, and phosphate, are all important to the agricultural community and are provided to the crops via manure or commercial fertilizer applications.

These nutrients are also important in regards to water quality. According to the table, in the Coldwater Creek subwatershed, the amount of phosphorus that is contained in the manure produced annually would need to be applied at 124 pounds per acre. The table below indicates the average crop removal rates for phosphorus for the major crops produced in the watershed. Values were obtained from the Ohio Agronomy Guide.

CROP	P_2O_5 REMOVAL (lb/ac)
Alfalfa (6T)	80
Corn (150 bu) Grain	55
Corn (25 T) Silage	80
Soybean (50 bu)	40
Wheat (75 bu) Grain	48

Considerations are given to the nutrient phosphorus due to its importance to crop production and the problems associated with the relationship between excessive phosphorus applications and degradation of water quality. Because much of the poultry manure is brokered out of the watershed, it seemed important to reflect the nutrient values assuming that 70% of the poultry manure is moved to locations outside the watershed. Local manure haulers estimated this value to be 90%; however, to be conservative, 70% was assumed for this plan. Under this assumption, the amount of phosphorus that is contained in the manure produced annually in this subwatershed would need to be applied at 63 pounds per acre.

What this seems to indicate throughout the watershed is that according to manure production and crop removal rates for limiting nutrient factors, there are not enough acres for proper manure application methods. The caveat on this statement is that the numbers are best estimates, variations in soil types and tilth can vary throughout the fields which may increase, or decrease, crop removal rates, and more importantly, some of the manure produced in each of the subwatershed may be applied to acreages outside of that subwatershed, or even outside of the Grand Lake St Marys watershed. It should be noted that several producers own or rent land both in the Grand Lake St Marys watershed and in neighboring watersheds such as Loramie Creek, Wabash River, or the St Marys River.

TABLE 15
Manure and Nutrient Production

COLDWATER CREEK						
Manure Production	Tons Raw Manure/Year	Lbs. N per Year	Lbs. K_2O per Year	Lbs. P_2O_5 per Year	Acres Cropland	Lbs. P_2O_5 per Crop Acre
	99,524	1,686,340	1,059,470	1,268,956	10,271	124
Less 70% Poultry Manure**	72,867	971,303	694,543	652,040	10,271	63
Approximate $ Value Per Year		$370,995	$158,921	$253,791		
Total Nutrient Value Per Year = $783,707						

**Based on conversations with poultry manure brokers, it was estimated that at least 70% of the poultry manure is brokered out of the watershed.

The dollar values associated with each nutrient were obtained from OSU Extension Bulletin 604-06, "Ohio Livestock Manure Management Guide." The value for nitrogen is estimated at $0.22 per pound, the value for P_2O_5 is $0.20 per pound and the value for K_2O is $0.15 per pound.

Distance Between Livestock Operations and Streams

The table on the following page shows the distance between various livestock operations located in the Coldwater Creek subwatershed and the waterways that drain to Coldwater Creek and eventually Grand Lake St. Marys. It can be assumed that the greater the distance between a livestock operation and a water system, the potential of pollution from the operation reaching the stream is lessened.

Of notable interest is the number of all livestock operations located less than 1,000 feet from the waterbody. In this particular subwatershed, out of 55 operations, 36 operations, or 65.5%, fall into the category. Also, 19 operations, 34.5%, are in within 2,000 feet and there are no operations less than 3,000 feet from the nearest stream.

TABLE 16
Livestock Operations and Proximity to Streams

COLDWATER CREEK																		
ANIMAL TYPE	POULTRY			DAIRY			HOG			BEEF			OTHER			TOTAL		
	Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream		
	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'
	5	2	0	10	4	0	3	3	0	15	9	0	3	1	0	36	19	0
% of Subwatershed Total	9.1%	3.6%	0.0%	18.2%	7.3%	0.0%	5.5%	5.5%	0.0%	27.3%	16.4%	0.0%	5.5%	1.8%	0.0%	65.5%	34.5%	0.0%

Non-Point Source Pollution Potential

In order to provide a comparison of the pollution potential of each of the 15 subwatersheds, a ranking system for each of the main potential pollution sources was developed. These potential sources are stream miles with less than 10 feet of vegetation, the number of livestock or poultry operations less than 1,000 feet from a stream, the tons of raw manure produced yearly, the pounds of phosphorus per cropland acre available from the manure, the number of household wastewater disposal systems contained in clusters of ten or more) and the number of homes built pre-1973. Values of 1(less potential) to 10 (great potential) were given based on ranges shown in the table of the following page. Indicator scores are then summed to obtain a total pollution potential score for the subwatershed.

Subwatershed pollution potential scores can range from a maximum of 60 points to a minimum of six points. The Coldwater Creek subwatershed ranks seventh out of 15, with 55% of the maximum points for pollution potential. Most significantly for the subwatershed is the number of household disposal systems in groups of 10 or more and the number of livestock operations less than 1,000 feet from a stream. Coldwater Creek subwatershed scored eight points out of 10 for both indicators.

NONPOINT SOURCE POLLUTION POTENTIAL SCORING MATRIX

MAXIMUM DRAINAGE UNIT SCORE = 60 (Highest Pollution Potential)

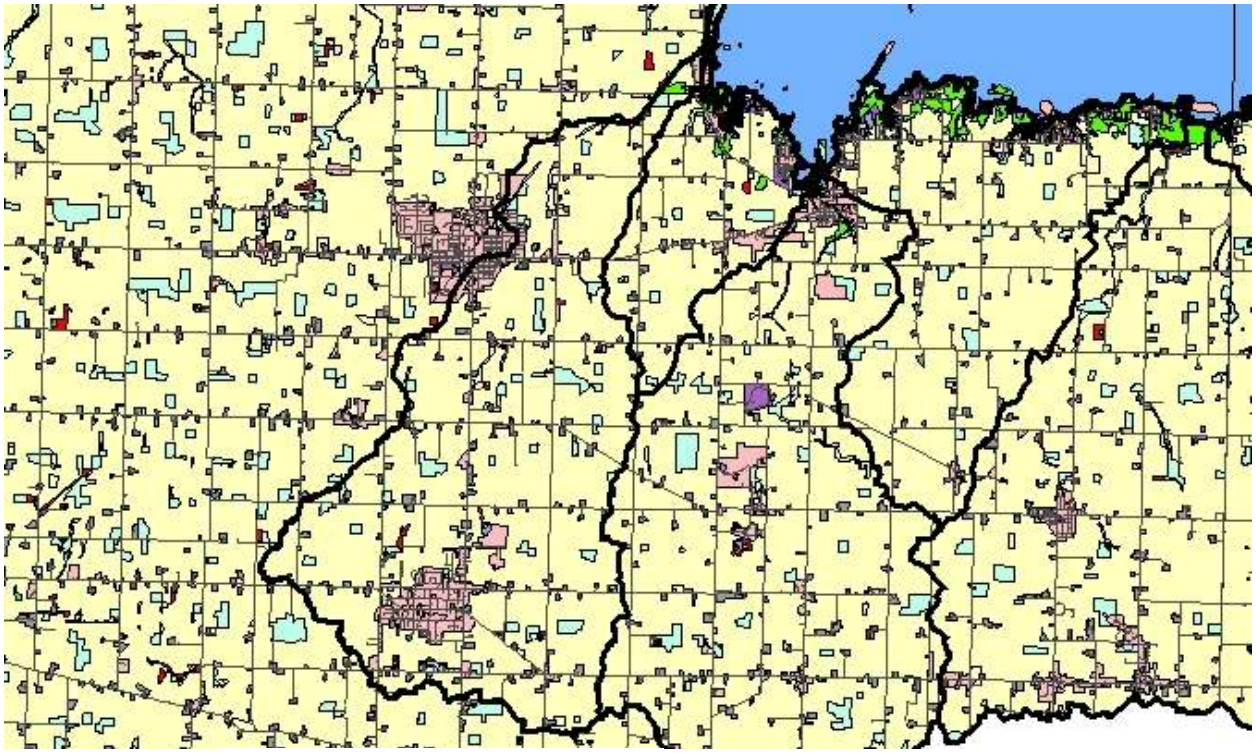
SCORE	Stream Miles with <10' Vegetation	Operations <1,000' to stream	Tons Raw Manure per Year	Lbs. P_2O_5 per Crop Acre	Household Disposal Systems in Groups	No. Homes Built pre-1973
10	72.00+	46+	180,000+	225+	90+	226+
9	64.00 - 71.99	41 - 45	160,000 - 179,999	200 - 224	80 - 89	201 -225
8	56.00 - 63.99	36 - 40	140,000 - 159,999	175 - 199	70 - 79	176 -200
7	48.00 - 55.99	31 - 35	120,000 - 139,999	150 - 174	60 - 69	151 - 175
6	40.00 - 47.99	26 - 30	100,000 - 119,999	125 - 149	50 - 59	126 - 150
5	32.00 - 39.99	21 - 25	80,000 - 99,999	100 - 124	40 - 49	101 - 125
4	24.00 - 31.99	16 - 20	60,000 - 79,999	75- 99	30 - 39	76 - 100
3	16.00 - 23.99	11 - 15	40,000 - 59,999	50 - 74	20 - 29	51 - 75
2	8.00 - 15.99	6 - 10	20,000 - 39,999	25 - 49	10 - 19	26 - 50
1	0.00 - 7.99	0 - 5	0 - 19,999	0 - 24	0 - 10	0 - 25

MINIMUM DRAINAGE UNIT SCORE = 6 (Lowest Pollution Potential)

TABLE 17
NPS Pollution Potential

COLDWATER CREEK							
SUBWATERSHED ATTRIBUTE	Stream Miles with <10' Vegetation SCORE	Operations <1,000' to stream SCORE	Tons Raw Manure per Year SCORE	Lbs. P_2O_5 per Crop Acre SCORE	Household Disposal Systems in Groups SCORE	No. Homes Built pre-1973 SCORE	TOTAL SCORE
	3	8	5	3	8	6	33

MAP 28
Coldwater Creek Land Use



Legend

Grand Lake/Wabash Watershed

Roadways

Land Use

Cropland

Urban

Farmsteads

Shrub_Brush

Deciduous Forest

Open Water

Wetlands

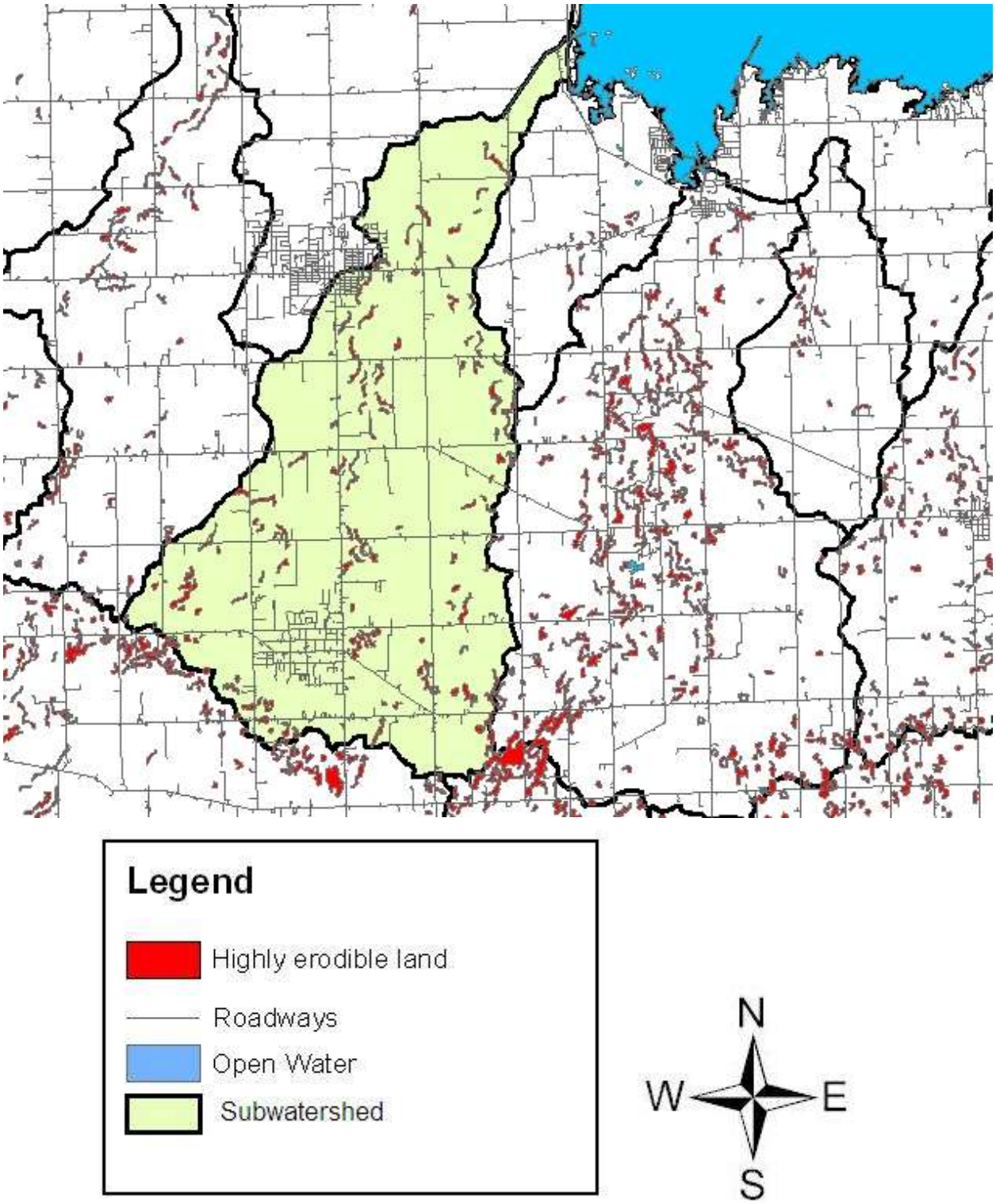
Barren/Undeveloped

N

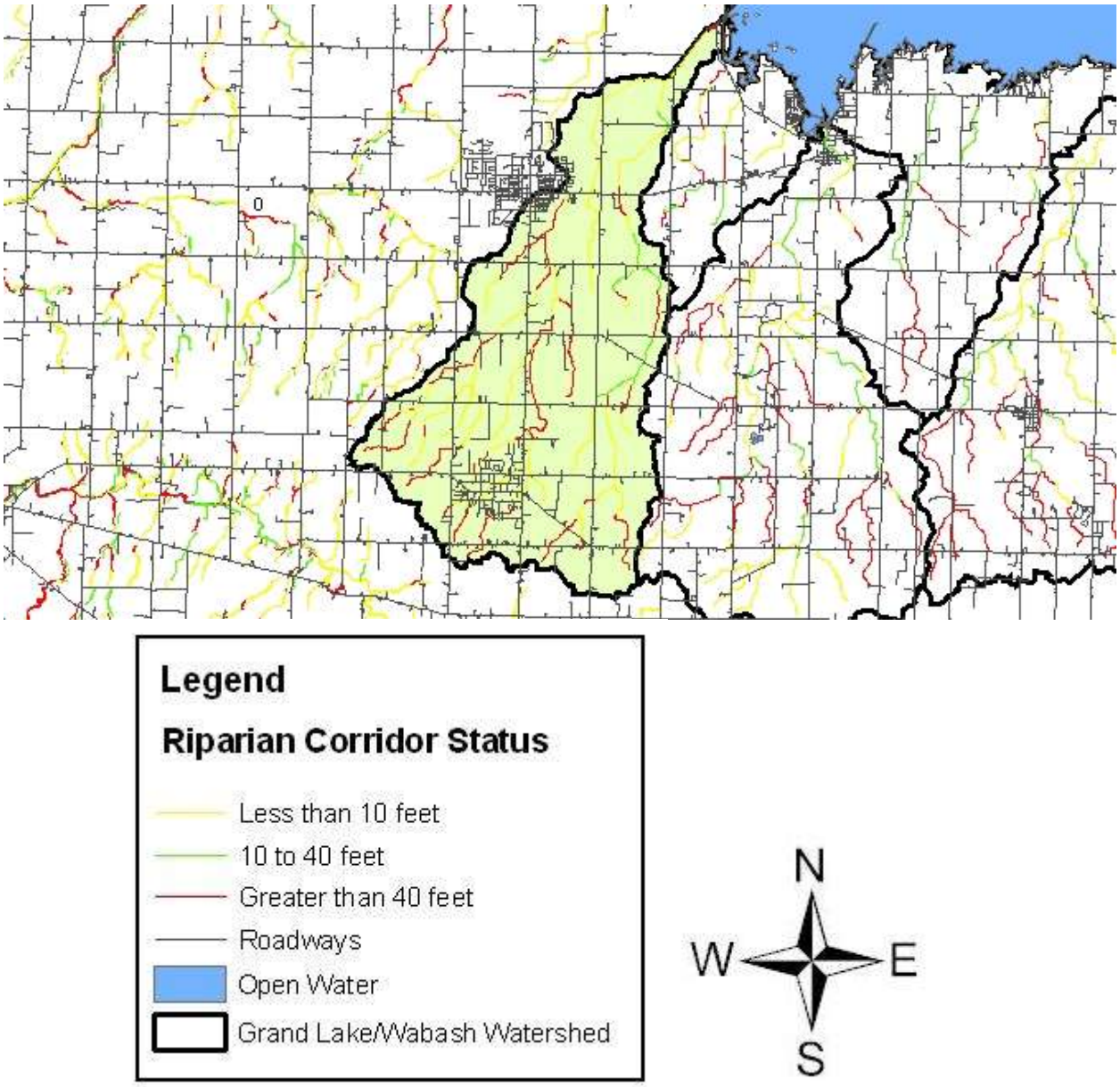
W E

S

MAP 29
Coldwater Creek Highly Erodible Land



MAP 30
Coldwater Creek Riparian Corridor Status



4.1.2 Grassy/Monroe Creeks

The Grassy and Monroe Creeks drain a small portion of the Grand Lake St. Marys drainage basin along the southwestern edge of the lake. The entire subwatershed is located in Mercer County. The acres, square miles and percent of sub-watershed are shown below. The Grassy/Monroe Creeks subwatershed, according to percentages, is the second smallest of the seven subwatersheds draining to Grand Lake St. Marys. Of the entire Grand/Lake Wabash Watershed, it is the thirteenth largest of fifteen subwatersheds.

TABLE 18

GRASSY/MONROE CREEKS	
Acreage	3,164
Square Miles	4.94
% of Grand Lake Watershed Total Land Area	5.4%
% of Grand Lake/Wabash Watershed Total Land Area	1.8%

Water Quality Status

Grassy and Monroe Creeks have been designated as a warm water habitat (WWH). This aquatic life use designation has been established by the EPA and based on recent data sampling, the water resource is shown as not meeting that use designation, or in a "non-attainment" status. Furthermore, the subwatershed has been shown to be NPS impacted. Suspected or proven impacts to these streams include: non-irrigated crop production, animal feeding operations, channelization, removal of riparian vegetation and stream bank destabilization. Definitions and criteria for these descriptives can be found in Appendix C- Aquatic life use designations and assessment terms.

Ohio EPA is currently completing a TMDL report for Beaver Creek and Grand Lake St. Marys, which is in process of being finalized. The draft report does not call for specific load reductions in the Grassy/Monroe Creeks subwatershed; however, it does call for load reductions of phosphorus, nitrate and fecal coliform in the surrounding subwatersheds. Detailed information on the sampling results and recommended load reductions can be found in the draft report of the 2007 Ohio EPA TMDL report, which can be obtained by contacting the watershed project office.

Water Supplies and Discharges

There are no community water supplies currently located within the boundaries of the Grassy/Monroe subwatershed. There are, however, five transient non-community water supplies, which are TSC Store #240, Its It Landing PWS, Kozy Campground, Kozy Campground Well #2, and the Montezuma Bay Resort. S & K Products is listed as the

only non-transient, non-community public water supplier in this subwatershed, and there are no Ohio EPA NPDES discharge permitted facilities located in this subwatershed.

Based on recent aerial photographs, areas where 10 or more household wastewater treatment and disposal systems were present in close proximity were identified. As with any individual treatment system operating in an area with poorly drained soils, the effects of the effluent on the receiving water body is a concern. These effects grow as the number of systems in a given area increases, thus clusters or groups of 10 or more systems has been used to analyze the potential effects of those systems on the water quality. Regarding Grassy/Monroe Creeks subwatershed, there were no clusters identified.

Highly Erodible Land

Map 30 at the end of this subsection illustrates the highly erodible land locations within the Grassy/Monroe Creeks subwatershed. Of the seven subwatersheds within the Grand Lake St. Marys watershed, Grassy/Monroe Creeks ranks sixth highest in the amount of highly erodible land present within the subwatershed. The highly erodible land information was developed from the 2003 online NRCS Soil Data Mart.

Riparian Corridor Status

The chart on the following page shows the riparian corridor status for the Grassy/Monroe Creeks subwatershed. The chart indicates the number of miles of each drainage unit that has various widths of tree canopy, or riparian corridor. The numbers account for both sides of the streams; therefore, the number of actual stream miles is half of that shown. The divisions are less than 10 feet in total width, 10 to 40 feet in total width, and greater than 40 feet in total width. The chart is also divided into perennial and intermittent streams under each of the corridor width column headings. MAP 31 illustrates the stream sections under each division.

The chart shows that with a total of 4.43 miles of stream network, the Grassy/Monroe Creeks subwatershed has 1.36 miles of stream with less than 10 feet of canopy and vegetation, 1.36 miles of stream with 10 to 40 feet canopy and vegetation, and 1.71 miles of stream with greater than 40 feet of canopy and vegetation. The Grassy/Monroe Creeks subwatershed has the second least number of stream miles within the Grand Lake St. Marys Watershed, which is 3.2%. Of the entire Grand Lake/Wabash Watershed, this subwatershed has the second lowest number of stream miles, which is 0.6%.

TABLE 19
Riparian Corridor Status

GRASSY/MONROE CREEKS										
RIPARIAN STATUS	TREE CANOPY <10' IN TOTAL WIDTH			TREE CANOPY 10 to 40' IN WIDTH			TREE CANOPY >40' IN WIDTH			TOTAL STREAM MILES
	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	
	0.19	1.17	1.36	0.00	1.36	1.36	0.19	1.52	1.71	4.43
% of Subwatershed Total	0.5%	2.8%	3.3%	0.0%	3.3%	3.3%	0.5%	3.7%	4.2%	10.8%
% of Grand Lake Watershed Total	0.1%	0.8%	1.0%	0.0%	1.0%	1.0%	0.1%	1.1%	1.2%	3.2%
% of Grand Lake/Wabash Watershed Total	0.0%	0.2%	0.2%	0.0%	0.2%	0.2%	0.0%	0.2%	0.2%	0.6%

Operations and Animal Units

The table on the following page shows the number of operations and the animal units by species for the Grassy/Monroe Creeks subwatershed. According to the table, there are two poultry operations, four dairy operations, two hog operations, four beef operations and two horse operations within the entire subwatershed. The Grassy/Monroe Creeks subwatershed ranks twelfth within the entire Grand Lake/Wabash River Watershed when considering the total number of operations with 14 or 1.42%. Animal units within the subwatershed ranks thirteenth of 15 with 0.8%.

Totals of animal units for each species are also listed on the table. The inventory for this subwatershed was completed during February and March of 2007. At the time of the inventory animal units were determined by the number of animals present. Although this is not a 1:1 ratio for all species, it is for beef cattle. The following chart shows the number of each type of animal that makes up 1,000 animal units.

Animal Type	1,000 Animal Unit Equivalent
Beef Cattle	1,000
Dairy Cattle	700
Hogs (over 55 lbs)	2,500
Turkeys	55,000
Layer Chickens	82,000
Pullet Chickens	125,000
Sheep	10,000
Horses	500

TABLE 20
Operations and Animal Units

GRASSY/MONROE CREEKS														
ANIMAL TYPE	POULTRY		DAIRY		HOG		BEEF		OTHER		TOTAL		Total as % of Grand Lake Watershed	
# Farms and Animals	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s
	0 (Trky) 2	0 327	4	543	2	1,360	4	480	(sheep) (hrs) 2	0 10	14	2,720	4.7%	2.6%
% of subwatershed total	14.3%	12.0%	28.6%	20.0%	14.3%	50.0%	28.6%	17.6%	14.3%	0.4%	100.0%	100.0%		
Total as % of Grand Lake Watershed	0.7%	0.3%	1.3%	0.5%	0.7%	1.3%	1.3%	0.5%	0.7%	0.0%	4.7%	2.6%		
Total as % of Grand Lake/Wabash Watershed	0.20%	0.10%	0.40%	0.16%	0.20%	0.40%	0.40%	0.14%	0.20%	0.00%	1.42%	0.80%		

Manure Production

After considering the number of livestock operations and animal units present in the watershed, it is only fitting to consider the by-products of these animals. The table on the opposite page is used to represent the manure and nutrient production for the Grassy/Monroe Creeks drainage area. The Grassy/Monroe Creeks subwatershed ranks twelfth overall, of 15, in terms of manure production per annum. Approximately 22,394 tons of manure is produced annually. The remainder of the columns on the table indicates the approximate pounds of nutrients contained in that manure. Nitrogen, potassium, and phosphate, are all important to the agricultural community and are provided to the crops via manure or commercial fertilizer applications.

These nutrients are also important in regards to water quality. According to the table, in the Grassy/Monroe Creeks subwatershed, the amount of phosphorus that is contained in the manure produced annually would need to be applied at 92 pounds per acre. The table below indicates the average crop removal rates for phosphorus for the major crops produced in the watershed. Values were obtained from the Ohio Agronomy Guide.

CROP	P_2O_5 REMOVAL (lb/ac)
Alfalfa (6T)	80
Corn (150 bu) Grain	55
Corn (25 T) Silage	80
Soybean (50 bu)	40
Wheat (75 bu) Grain	48

Considerations are given to the nutrient phosphorus due to its importance to crop production and the problems associated with the relationship between excessive phosphorus applications and degradation of water quality. Because much of the poultry manure is brokered out of the watershed, it seemed important to reflect the nutrient values assuming that 70% of the poultry manure is moved to locations outside the watershed. Local manure haulers estimated this value to be 90%; however, to be conservative, 70% was assumed for this plan. Under this assumption, the amount of phosphorus that is contained in the manure produced annually in this subwatershed would need to be applied at 73 pounds per acre.

What this seems to indicate throughout the watershed is that according to manure production and crop removal rates for limiting nutrient factors, there are not enough acres for proper manure application methods. The caveat on this statement is that the numbers are best estimates, variations in soil types and tilth can vary throughout the fields which may increase, or decrease, crop removal rates, and more importantly, some of the manure produced in each of the subwatershed may be applied to acreages outside of that subwatershed, or even outside of the Grand Lake St Marys watershed. It should be noted that several producers own or rent land both in the Grand Lake St Marys watershed and in neighboring watersheds such as Loramie Creek, Wabash River, or the St Marys River.

TABLE 21
Manure and Nutrient Production

GRASSY/MONROE CREEKS						
Manure Production	Tons Raw Manure/Year	Lbs. N per Year	Lbs. K_2O per Year	Lbs. P_2O_5 per Year	Acres Cropland	Lbs. P_2O_5 per Crop Acre
	22,394	295,381	230,222	205,703	2,225	92
Less 70% Poultry Manure**	20,277	245,213	194,448	161,674	2,225	73
Approximate $ Value Per Year		$64,984	$34,533	$41,141		
Total Nutrient Value Per Year = $140,658						

**Based on conversations with poultry manure brokers, it was estimated that at least 70% of the poultry manure is brokered out of the watershed.

The dollar values associated with each nutrient were obtained from OSU Extension Bulletin 604-06, "Ohio Livestock Manure Management Guide." The value for nitrogen is estimated at $0.22 per pound, the value for P_2O_5 is $0.20 per pound and the value for K_2O is $0.15 per pound.

Distance Between Livestock Operations and Streams

The table on the following page shows the distance between various livestock operations located in the Grassy/Monroe Creeks subwatershed and the waterways that drain to Grassy and Monroe Creeks and eventually Grand Lake St. Marys. It can be assumed that the greater the distance between a livestock operation and a water system, the potential of pollution from the operation reaching the stream is lessened.

Of notable interest is the number of all livestock operations located less than 1,000 feet from the waterbody. In this particular subwatershed, out of 14 operations, six operations, or 42.9%, fall into the category. Also, four operations, 28.6%, are within 2,000 feet and the remaining 28.6%, four operations, are less than 3,000 feet from the nearest stream.

TABLE 22

Livestock Operations and Proximity to Streams

GRASSY/MONROE CREEKS																		
ANIMAL TYPE	POULTRY			DAIRY			HOG			BEEF			OTHER			TOTAL		
	Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream		
	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'
	1	1	0	1	2	1	1	0	1	3	0	1	0	1	1	6	4	4
% of Subwatershed Total	7.1%	7.1%	0.0%	7.1%	14.3%	7.1%	7.1%	0.0%	7.1%	21.4%	0.0%	7.1%	0.0%	7.1%	7.1%	42.9%	28.6%	28.6%

Non-Point Source Pollution Potential

In order to provide a comparison of the pollution potential of each of the 15 subwatersheds, a ranking system for each of the main potential pollution sources was developed. These potential sources are stream miles with less than 10 feet of vegetation, the number of livestock or poultry operations less than 1,000 feet from a stream, the tons of raw manure produced yearly, the pounds of phosphorus per cropland acre available from the manure, the number of household wastewater disposal systems contained in clusters of ten or more) and the number of homes built pre-1973. Values of 1(less potential) to 10 (great potential) were given based on ranges shown in the table of the following page. Indicator scores are then summed to obtain a total pollution potential score for the subwatershed.

Subwatershed pollution potential scores can range from a maximum of 60 points to a minimum of six points. The Grassy/Monroe Creeks subwatershed ranks twelfth out of 15, with 20% of the maximum points for pollution potential.

NONPOINT SOURCE POLLUTION POTENTIAL SCORING MATRIX

MAXIMUM DRAINAGE UNIT SCORE = 60 (Highest Pollution Potential)

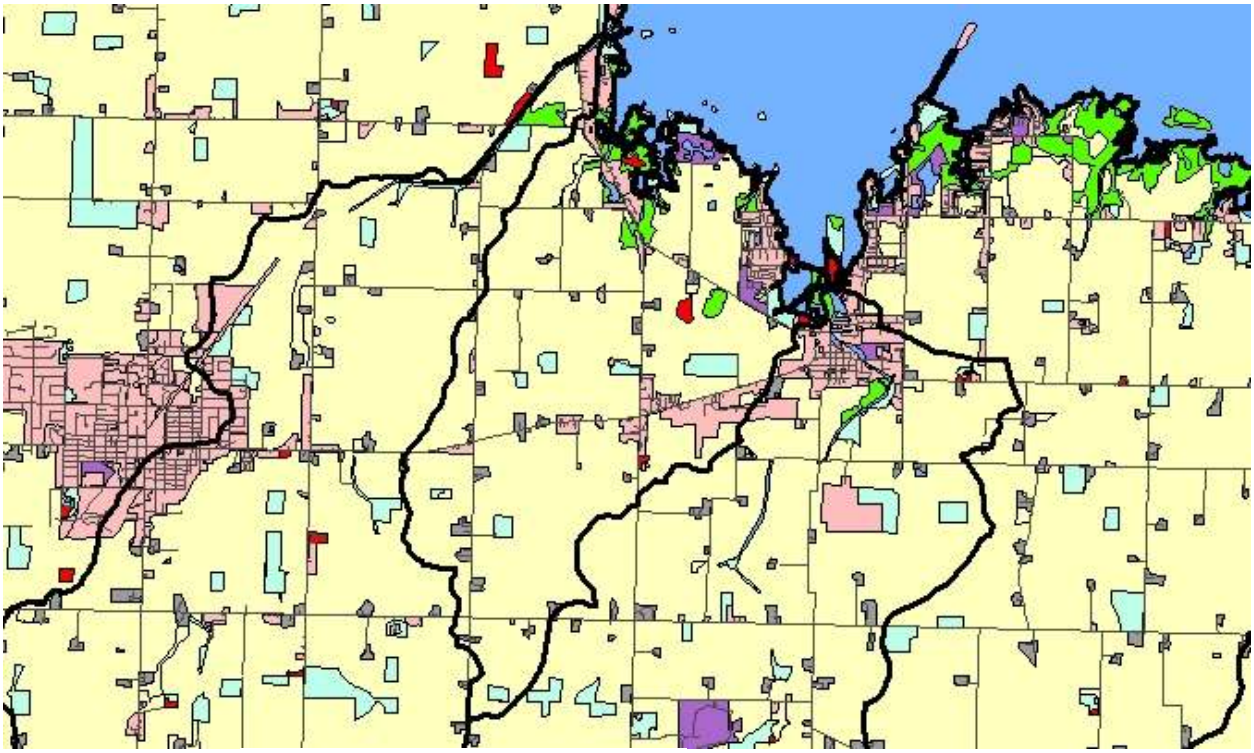
SCORE	Stream Miles with <10' Vegetation	Operations <1,000' to stream	Tons Raw Manure per Year	Lbs. P_2O_5 per Crop Acre	Household Disposal Systems in Groups	No. Homes Built pre-1973
10	72.00+	46+	180,000+	225+	90+	226+
9	64.00 - 71.99	41 - 45	160,000 - 179,999	200 - 224	80 - 89	201 -225
8	56.00 - 63.99	36 - 40	140,000 - 159,999	175 - 199	70 - 79	176 -200
7	48.00 - 55.99	31 - 35	120,000 - 139,999	150 - 174	60 - 69	151 - 175
6	40.00 - 47.99	26 - 30	100,000 - 119,999	125 - 149	50 - 59	126 - 150
5	32.00 - 39.99	21 - 25	80,000 - 99,999	100 - 124	40 - 49	101 - 125
4	24.00 - 31.99	16 - 20	60,000 - 79,999	75- 99	30 - 39	76 - 100
3	16.00 - 23.99	11 - 15	40,000 - 59,999	50 - 74	20 - 29	51 - 75
2	8.00 - 15.99	6 - 10	20,000 - 39,999	25 - 49	10 - 19	26 - 50
1	0.00 - 7.99	0 - 5	0 - 19,999	0 - 24	0 - 10	0 - 25

MINIMUM DRAINAGE UNIT SCORE = 6 (Lowest Pollution Potential)

TABLE 23
NPS Pollution Potential

GRASSY/MONROE CREEKS							
SUBWATERSHED ATTRIBUTE	Stream Miles with <10' Vegetation SCORE	Operations <1,000' to stream SCORE	Tons Raw Manure per Year SCORE	Lbs. P_2O_5 per Crop Acre SCORE	Household Disposal Systems in Groups SCORE	No. Homes Built pre-1973 SCORE	TOTAL SCORE
	1	2	2	3	1	3	12

MAP 31
Grassy/Monroe Land Use



Legend

Grand Lake/Wabash Watershed

Roadways

Land Use

Cropland

Urban

Farmsteads

Shrub_Brush

Deciduous Forest

Open Water

Wetlands

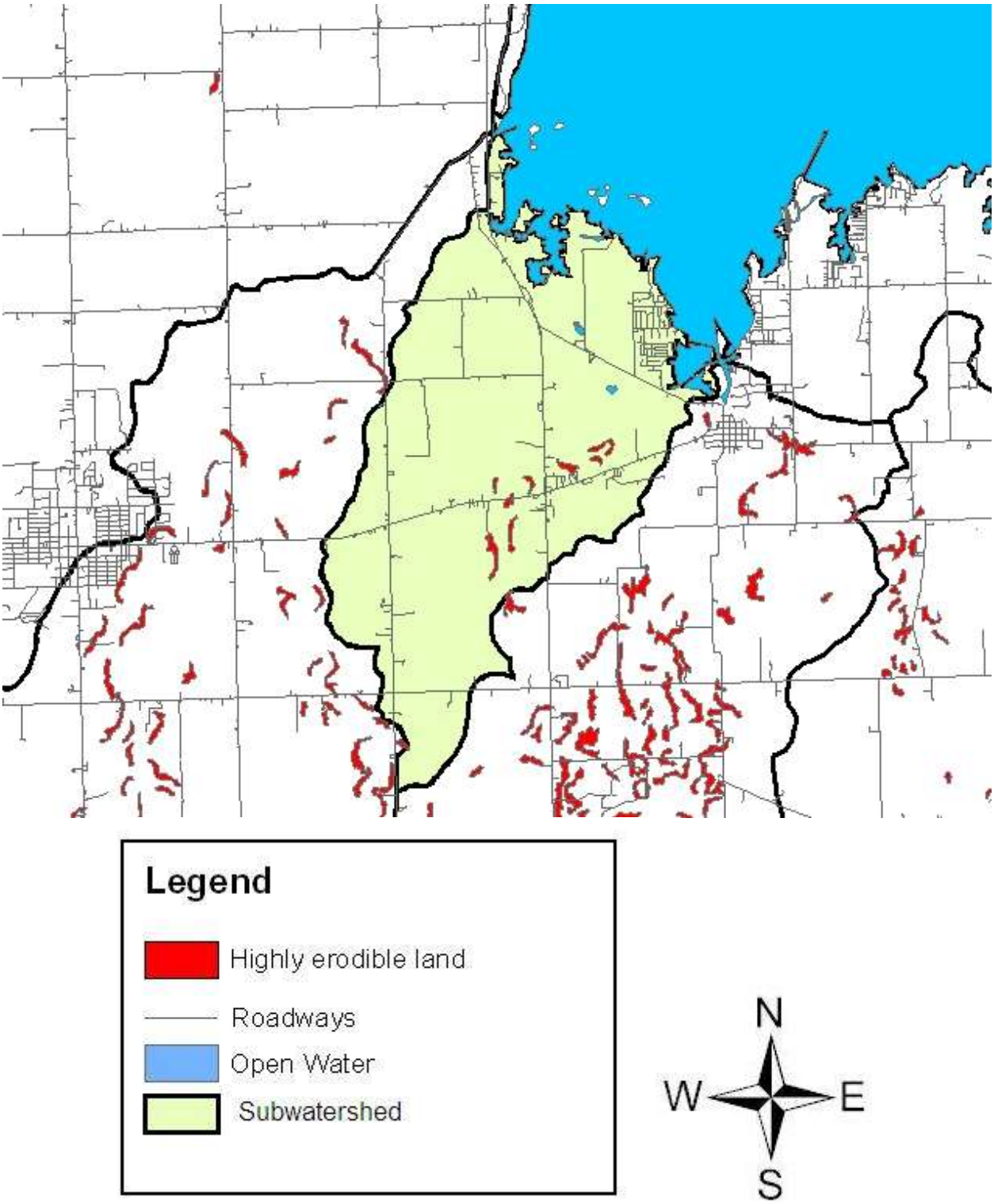
Barren/Undeveloped

N

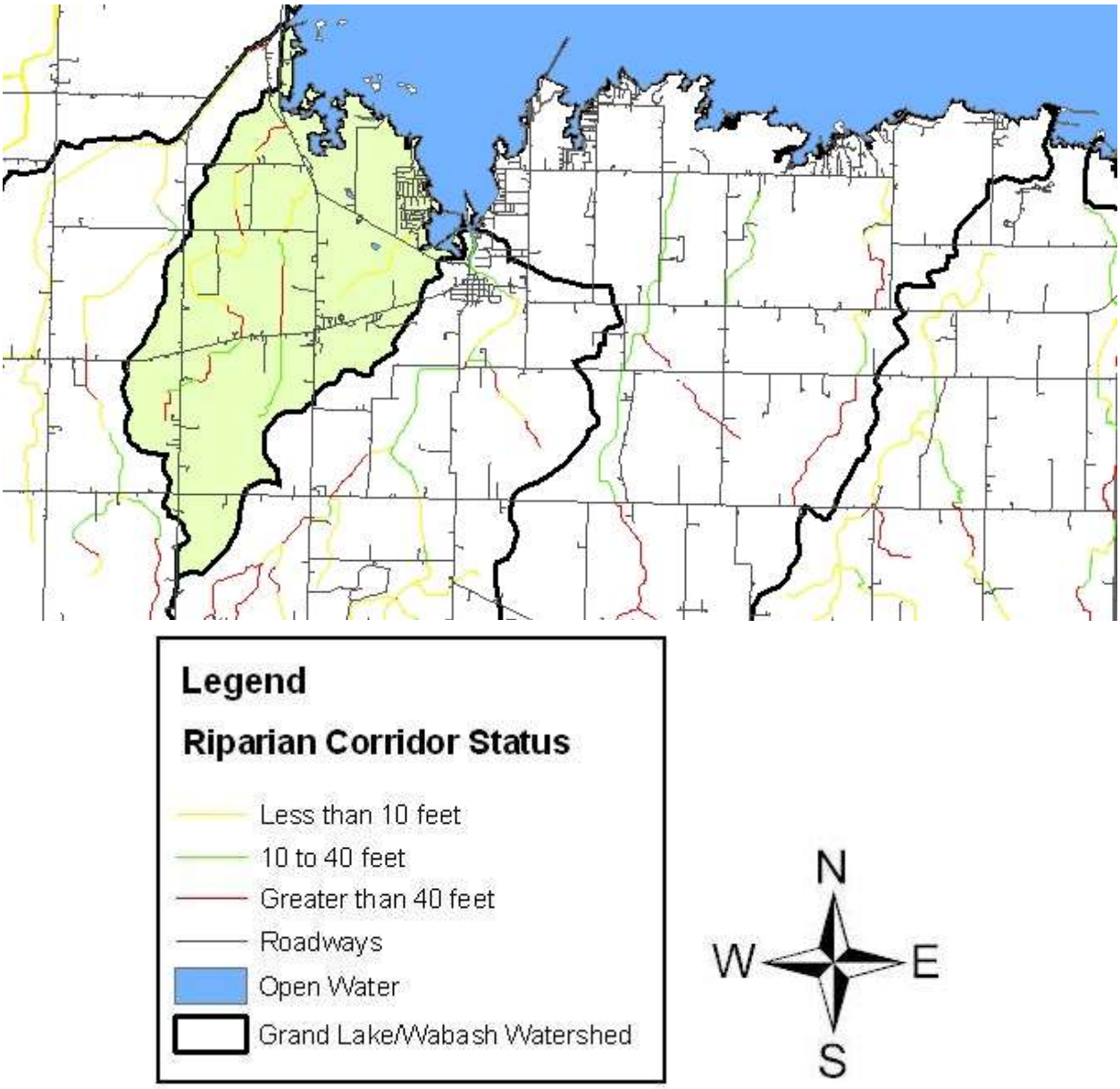
W E

S

MAP 32
Grassy/Monroe Highly Erodible Land



MAP 33
Grassy/Monroe Riparian Corridor Status



4.1.3 Beaver Creek

The Beaver Creek subwatershed drains a large portion of the Grand Lake St. Marys drainage basin, south of the lake. The subwatershed is located entirely in Mercer County. The acres, square miles and percent of subwatershed are shown below. The Beaver Creek subwatershed, according to percentages, is the second largest of the seven subwatersheds draining to Grand Lake St. Marys. Of the entire Grand Lake/Wabash Watershed, it is the eighth largest of fifteen subwatersheds.

TABLE 24

BEAVER CREEK	
Acreage	13,059
Square Miles	20.40
% of Grand Lake Watershed Total Land Area	21.1%
% of Grand Lake/Wabash Watershed Total Land Area	7.3%

Water Quality Status

Beaver Creek, composed of the Dahlinghaus Ditch, Upper and Lower Beaver and the Montezuma Creeks has been designated as a warm water habitat (WWH). This aquatic life use designation has been established by the EPA and based on recent data sampling, the water resource is shown as not meeting that use designation or in a "non-attainment" status. Furthermore, Beaver Creek has been shown to be NPS impacted. Suspected or proven impacts to these streams include: non-irrigated crop production, animal feeding operations, channelization, removal of riparian vegetation and stream bank destabilization. Definitions and criteria for these descriptives can be found in Appendix C- Aquatic life use designations and assessment terms.

Ohio EPA is currently completing a TMDL report for Beaver Creek and Grand Lake St. Marys, which is in process of being finalized. The draft report calls for phosphorus, nitrate and fecal coliform reduction upwards of 80% to 90% within the Beaver Creek subwatershed. Detailed information on the sampling results and recommended load reductions can be found in the draft report of the 2007 Ohio EPA TMDL report, which can be obtained by contacting the watershed project office.

The Celina municipal waste landfill is located in the Beaver Creek subwatershed. The landfill began operation in 1971. The landfill utilizes leachate collection and monitoring wells for both the old and the new sections. The Old Bunker Hill Landfill site was utilized as a general purpose landfill and used to dispose of septic tank wastewater. The landfill ceased operation in 1969 and there are currently no monitoring of the leachate. Montezuma Creek runs adjacent to this site. This site is also listed on the Ohio EPA's master sites list.

Water Supplies and Discharges

There is currently one community water supply located at St. Charles Seminary, and servicing approximately 75 people. Also located in the subwatershed are 10 transient non-community water supplies, Park Grand Resort, Arnies Corner & Drive Thru, Elks Club #2170-South, Starlight Drive-In Theater, Doc's Inn PWS, Niekamp Farm & Flea Market PWS, Bucks Inn PWS, Zuma Thru/Sunset Laundry/Car Wash PWS, Lake Shore Resort and Northmoor Landings. Furthermore, a non-transient non-community water supply is also located at the Franklin Elementary School. The Montezuma-Club Island WWTP, the Celina Landfill, Inc. and the Elks Club #2170-South are regulated by the Ohio EPA and are permitted to discharge to Beaver Creek.

Based on recent aerial photographs, areas where 10 or more household wastewater treatment and disposal systems were present in close proximity were identified. As with any individual treatment system operating in an area with poorly drained soils, the effects of the effluent on the receiving water body is a concern. These effects grow as the number of systems in a given area increases, thus clusters or groups of 10 or more systems has been used to analyze the potential effects of those systems on the water quality. Regarding Beaver Creek subwatershed, there were a total of five clusters identified, comprised of 92 individual systems.

Highly Erodible Land

Map 33 at the end of this subsection illustrates the highly erodible land locations within the Beaver Creek subwatershed. Of the seven subwatersheds within the Grand Lake St. Marys watershed, Beaver Creek ranks highest in the amount of highly erodible land present within the subwatershed. The highly erodible land information was developed from the 2003 online NRCS Soil Data Mart.

Riparian Corridor Status

The chart on the following page shows the riparian corridor status for the Beaver Creek subwatershed. The chart indicates the number of miles of each drainage unit that has various widths of tree canopy or riparian corridor. The divisions are less than 10 feet in total width, 10' to 25' in total width, and greater than 25' in total width. The chart is also divided into perennial and intermittent streams under each of the corridor width column headings. MAP 34 illustrates the stream sections under each division.

The chart shows that with a total of 35.61 miles of stream network, the Beaver Creek subwatershed has 12.68 miles of stream with less than 10' of canopy and vegetation, 7.16 miles of stream with 10 to 40 feet of canopy and vegetation, and 15.77 miles of stream with greater than 40 feet of riparian corridor. Overall, the Beaver Creek subwatershed has the third largest number of stream miles at 35.61, 25.4%, of the total stream miles for the Grand Lake St. Marys watershed. Of the entire Grand Lake/Wabash Watershed, this subwatershed has the eight highest number of stream miles at 5.0%.

TABLE 25

Riparian Corridor Status

BEAVER CREEK										
RIPARIAN STATUS	TREE CANOPY <10' IN TOTAL WIDTH			TREE CANOPY 10 to 40' IN WIDTH			TREE CANOPY >40' IN WIDTH			TOTAL STREAM MILES
	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	
	3.33	9.35	12.68	6.10	1.06	7.16	3.61	12.16	15.77	35.61
% of Subwatershed Total	8.1%	22.8%	30.9%	14.8%	2.6%	17.4%	8.8%	29.6%	38.4%	86.7%
% of Grand Lake Watershed Total	2.4%	6.7%	9.0%	4.3%	0.8%	5.1%	2.6%	8.7%	11.2%	25.4%
% of Grand Lake/Wabash Watershed Total	0.5%	1.3%	1.8%	0.9%	0.2%	1.0%	0.5%	1.7%	2.2%	5.0%

Operations and Animal Units

The table on the following page shows the number of operations and the animal units by species for the Beaver Creek subwatershed. According to the table, there are 15 poultry operations, 22 dairy operations, 25 hog operations, 25 beef operations and 4 horse operations within the entire subwatershed. The Beaver Creek subwatershed ranks fourth within the entire Grand Lake/Wabash River Watershed when considering the total number of operations with 91 or 9.2%. Animal units within the subwatershed ranks fourth of 15 with 9.1%.

Totals of animal units for each species are also listed on the table. The inventory for this subwatershed was completed during February and March of 2007. At the time of the inventory animal units were determined by the number of animals present. Although this is not a 1:1 ratio for all species, it is for beef cattle. The following chart shows the number of each type of animal that makes up 1,000 animal units.

Animal Type	1,000 Animal Unit Equivalent
Beef Cattle	1,000
Dairy Cattle	700
Hogs (over 55 lbs)	2,500
Turkeys	55,000
Layer Chickens	82,000
Pullet Chickens	125,000
Sheep	10,000
Horses	500

TABLE 26
Operations and Animal Units

BEAVER CREEK														
ANIMAL TYPE	POULTRY		DAIRY		HOG		BEEF		OTHER		TOTAL		Total as % of Grand Lake Watershed	
	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s
# Farms and Animals	5 (Trky) 10	10,829 1,855	22	3,471	25	11,616	25	3,310	(sheep) (hrs) 4	0 34	91	31,115	30.5%	29.6%
% of subwatershed total	16.5%	40.8%	24.2%	11.2%	27.5%	37.3%	27.5%	10.6%	4.4%	0.1%	100.0%	100.0%		
Total as % of Grand Lake Watershed	5.0%	12.1%	7.4%	3.3%	8.4%	11.0%	8.4%	3.1%	1.3%	0.0%	30.5%	29.6%		
Total as % of Grand Lake/Wabash Watershed	1.52%	3.71%	2.22%	1.02%	2.53%	3.40%	2.53%	0.97%	0.40%	0.01%	9.20%	9.11%		

Manure Production

After considering the number of livestock operations and animal units present in the watershed, it is only fitting to consider the by-products of these animals. The table on the opposite page is used to represent the manure and nutrient production for the Beaver Creek drainage area. The Beaver Creek subwatershed ranks fourth overall, of 15, in terms of manure production per annum. Approximately 191,231 tons of manure is produced annually. The remainder of the columns on the table indicates the approximate pounds of nutrients contained in that manure. Nitrogen, potassium, and phosphate, are all important to the agricultural community and are provided to the crops via manure or commercial fertilizer applications.

These nutrients are also important in regards to water quality. According to the table, in the Beaver Creek subwatershed, the amount of phosphorus that is contained in the manure produced annually would need to be applied at 196 pounds per acre. The table below indicates the average crop removal rates for phosphorus for the major crops produced in the watershed. Values were obtained from the Ohio Agronomy Guide.

CROP	P_2O_5 REMOVAL (lb/ac)
Alfalfa (6T)	80
Corn (150 bu) Grain	55
Corn (25 T) Silage	80
Soybean (50 bu)	40
Wheat (75 bu) Grain	48

Considerations are given to the nutrient phosphorus due to its importance to crop production and the problems associated with the relationship between excessive phosphorus applications and degradation of water quality. Because much of the poultry manure is brokered out of the watershed, it seemed important to reflect the nutrient values assuming that 70% of the poultry manure is moved to locations outside the watershed. Local manure haulers estimated this value to be 90%; however, to be conservative, 70% was assumed for this plan. Under this assumption, the amount of phosphorus that is contained in the manure produced annually in this subwatershed would need to be applied at 126 pounds per acre.

What this seems to indicate throughout the watershed is that according to manure production and crop removal rates for limiting nutrient factors, there are not enough acres for proper manure application methods. The caveat on this statement is that the numbers are best estimates, variations in soil types and tilth can vary throughout the fields which may increase, or decrease, crop removal rates, and more importantly, some of the manure produced in each of the subwatershed may be applied to acreages outside of that subwatershed, or even outside of the Grand Lake St Marys watershed. It should be noted that several producers own or rent land both in the Grand Lake St Marys watershed and in neighboring watersheds such as Loramie Creek, Wabash River, or the St Marys River.

TABLE 27
Manure and Nutrient Production

BEAVER CREEK						
Manure Production	Tons Raw Manure/Year	Lbs. N per Year	Lbs. K_2O per Year	Lbs. P_2O_5 per Year	Acres Cropland	Lbs. P_2O_5 per Crop Acre
	191,231	3,040,048	2,051,924	2,192,945	11,181	196
Less 70% Poultry Manure**	154,960	2,059,148	1,532,661	1,410,762	11,181	126
Approximate $ Value Per Year		$668,811	$307,789	$438,589		
Total Nutrient Value Per Year =	$1,415,188					

**Based on conversations with poultry manure brokers, it was estimated that at least 70% of the poultry manure is brokered out of the watershed.

The dollar values associated with each nutrient were obtained from OSU Extension Bulletin 604-06, "Ohio Livestock Manure Management Guide." The value for nitrogen is estimated at $0.22 per pound, the value for P_2O_5 is $0.20 per pound and the value for K_2O is $0.15 per pound.

Distance Between Livestock Operations and Streams

The table on the following page shows the distance between various livestock operations located in the Beaver Creek subwatershed and the waterways that drain to Beaver Creek and eventually Grand Lake St. Marys. It can be assumed that the greater the distance between a livestock operation and a water system, the potential of pollution from the operation reaching the stream is lessened.

Of notable interest is the number of all livestock operations located less than 1,000 feet from the waterbody. In this particular subwatershed, out of 89 operations, 45 operations, or 50.6%, fall into the category. Also, 25 operations, 28.1%, are within 2,000 feet and the remaining 21.3%, 19 operations, are less than 3,000 feet from the nearest stream.

TABLE 28
Livestock Operations and Proximity to Streams

BEAVER CREEK																		
ANIMAL TYPE	POULTRY			DAIRY			HOG			BEEF			OTHER			TOTAL		
	Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream		
	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'
	10	4	1	10	6	6	12	6	7	12	9	4	1	0	1	45	25	19
% of Subwatershed Total	11.2%	4.5%	1.1%	11.2%	6.7%	6.7%	13.5%	6.7%	7.9%	13.5%	10.1%	4.5%	1.1%	0.0%	1.1%	50.6%	28.1%	21.3%

Non-Point Source Pollution Potential

In order to provide a comparison of the pollution potential of each of the 15 subwatersheds, a ranking system for each of the main potential pollution sources was developed. These potential sources are stream miles with less than 10 feet of vegetation, the number of livestock or poultry operations less than 1,000 feet from a stream, the tons of raw manure produced yearly, the pounds of phosphorus per cropland acre available from the manure, the number of household wastewater disposal systems contained in clusters of ten or more) and the number of homes built pre-1973. Values of 1(less potential) to 10 (great potential) were given based on ranges shown in the table of the following page. Indicator scores are then summed to obtain a total pollution potential score for the subwatershed.

Subwatershed pollution potential scores can range from a maximum of 60 points to a minimum of six points. The Beaver Creek subwatershed ranks third (tie) out of 15, with 73.3% of the maximum points for pollution potential. Most significantly for the subwatershed is the number of household disposal systems in groups of 10 or more and the tons of raw manure produced per year. The Beaver Creek subwatershed scored the maximum points for both indicators.

NONPOINT SOURCE POLLUTION POTENTIAL SCORING MATRIX

MAXIMUM DRAINAGE UNIT SCORE = 60 (Highest Pollution Potential)

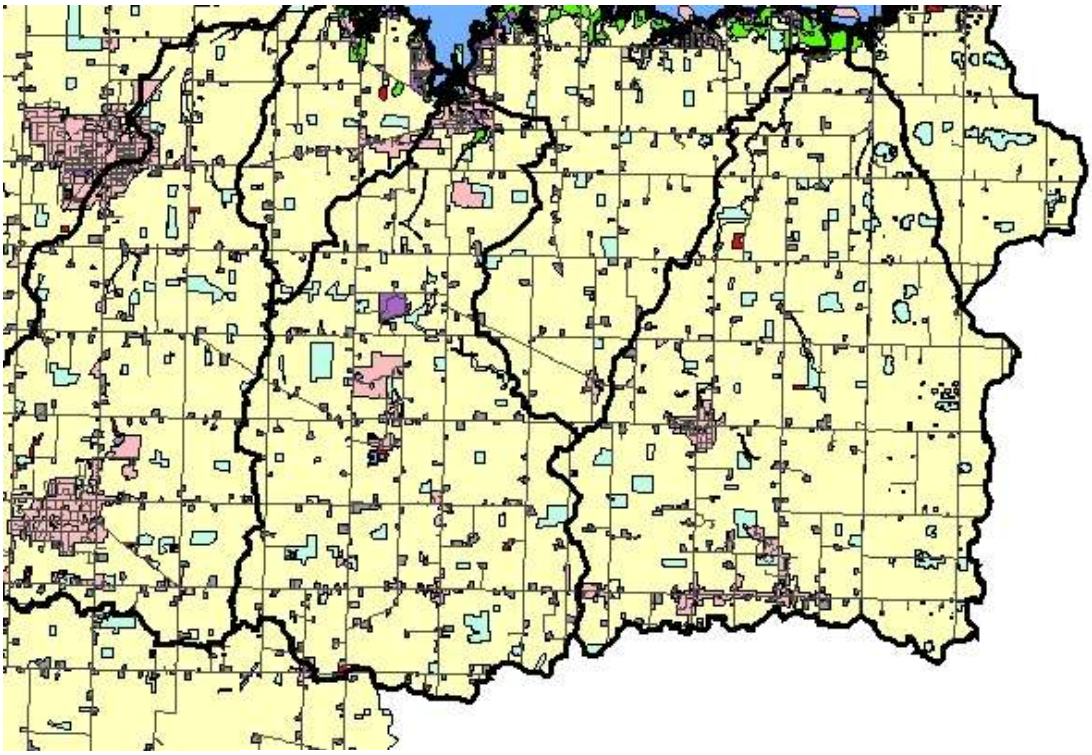
SCORE	Stream Miles with <10' Vegetation	Operations <1,000' to stream	Tons Raw Manure per Year	Lbs. P_2O_5 per Crop Acre	Household Disposal Systems in Groups	No. Homes Built pre-1973
10	72.00+	46+	180,000+	225+	90+	226+
9	64.00 - 71.99	41 - 45	160,000 - 179,999	200 - 224	80 - 89	201 -225
8	56.00 - 63.99	36 - 40	140,000 - 159,999	175 - 199	70 - 79	176 -200
7	48.00 - 55.99	31 - 35	120,000 - 139,999	150 - 174	60 - 69	151 - 175
6	40.00 - 47.99	26 - 30	100,000 - 119,999	125 - 149	50 - 59	126 - 150
5	32.00 - 39.99	21 - 25	80,000 - 99,999	100 - 124	40 - 49	101 - 125
4	24.00 - 31.99	16 - 20	60,000 - 79,999	75- 99	30 - 39	76 - 100
3	16.00 - 23.99	11 - 15	40,000 - 59,999	50 - 74	20 - 29	51 - 75
2	8.00 - 15.99	6 - 10	20,000 - 39,999	25 - 49	10 - 19	26 - 50
1	0.00 - 7.99	0 - 5	0 - 19,999	0 - 24	0 - 10	0 - 25

MINIMUM DRAINAGE UNIT SCORE = 6 (Lowest Pollution Potential)

TABLE 29
NPS Pollution Potential

BEAVER CREEK							
SUBWATERSHED ATTRIBUTE	Stream Miles with <10' Vegetation SCORE	Operations <1,000' to stream SCORE	Tons Raw Manure per Year SCORE	Lbs. P_2O_5 per Crop Acre SCORE	Household Disposal Systems in Groups SCORE	No. Homes Built pre-1973 SCORE	TOTAL SCORE
	2	9	10	6	10	7	44

MAP 34
Beaver Creek Land Use



Legend

Grand Lake/Wabash Watershed

Roadways

Land Use

Cropland

Urban

Farmsteads

Shrub_Brush

Deciduous Forest

Open Water

Wetlands

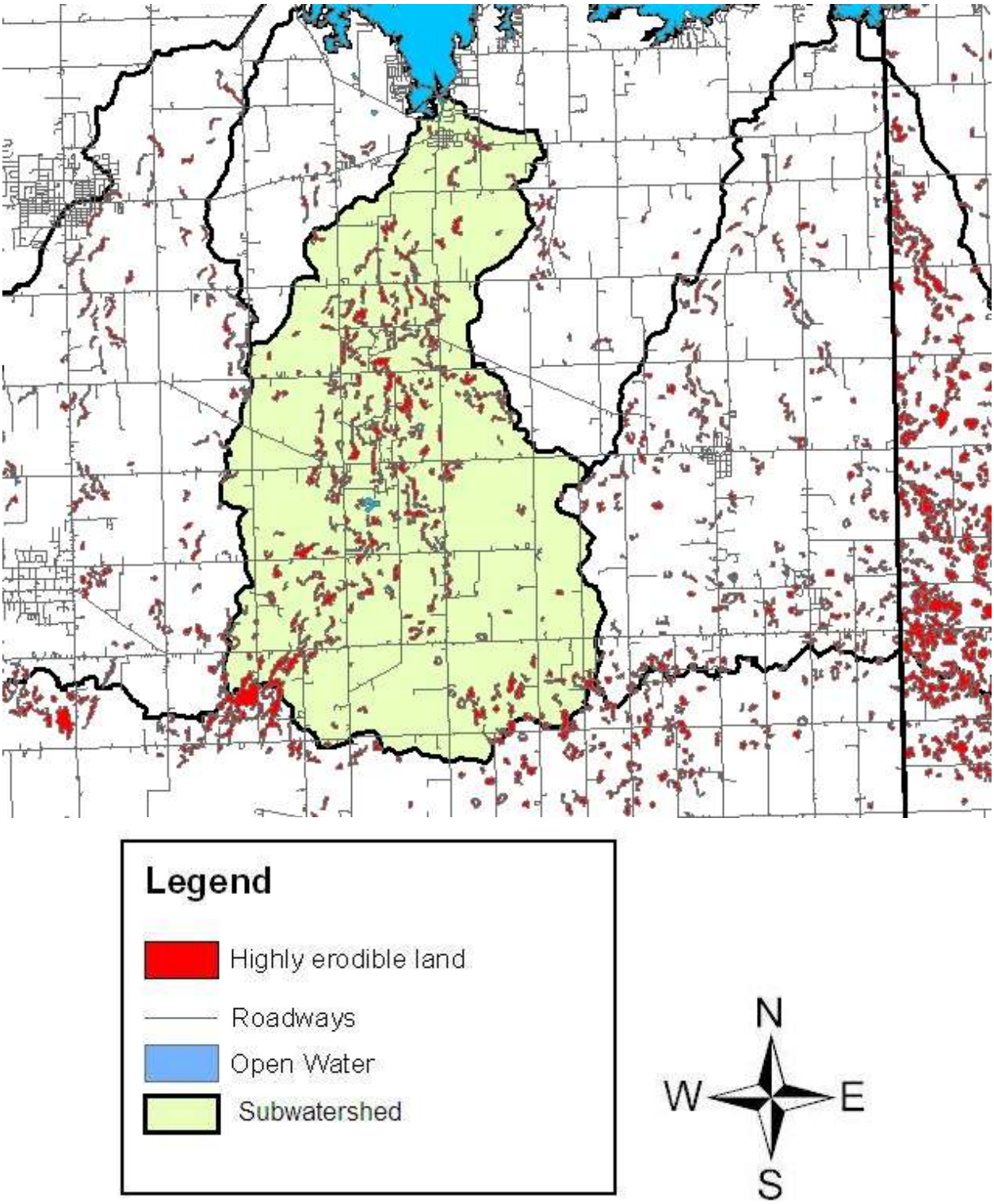
Barren/Undeveloped

N

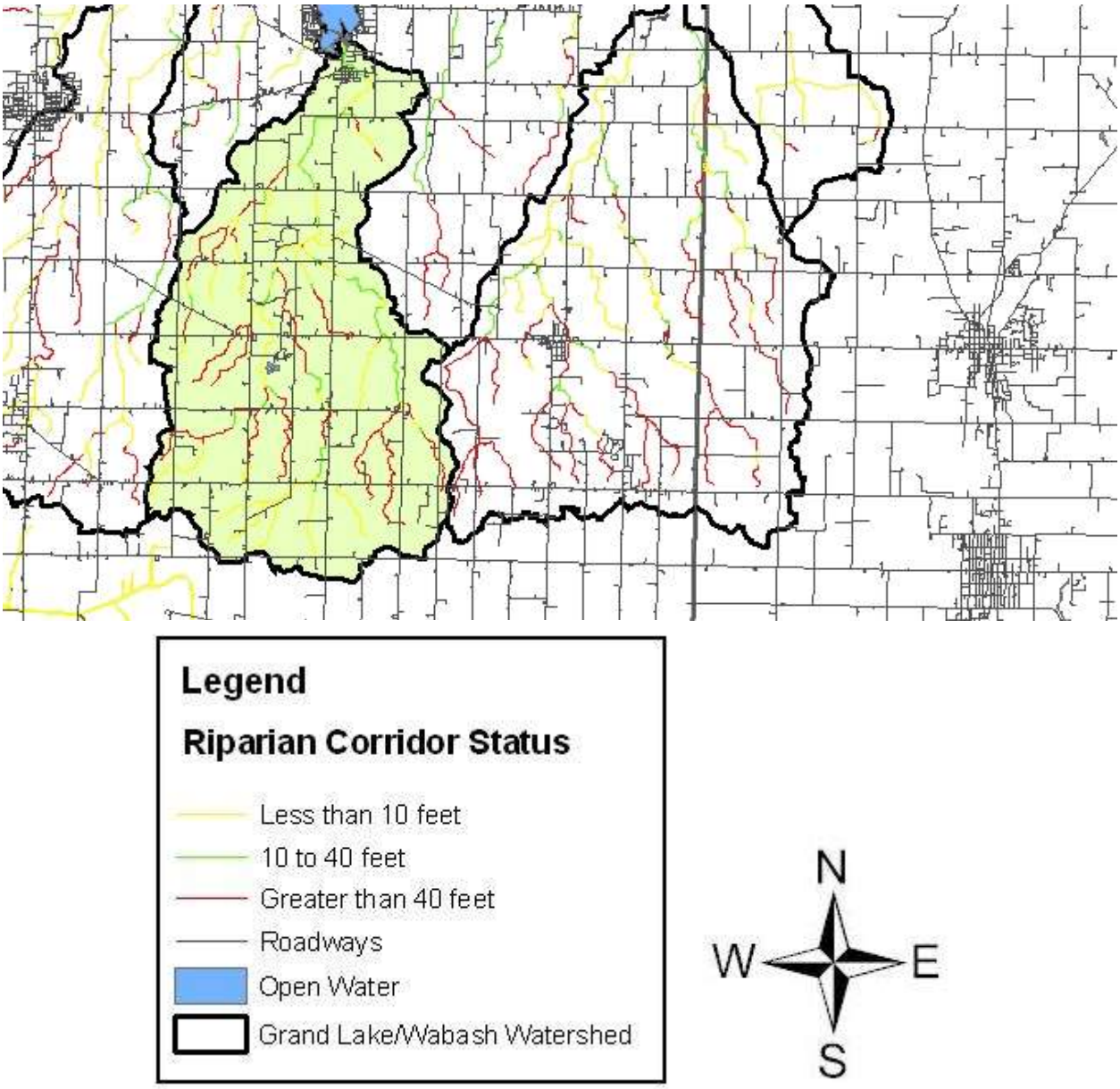
W E

S

MAP 35
Beaver Creek Highly Erodible Land



MAP 36
Beaver Creek Riparian Corridor Status



4.1.4 Prairie Creek

The Prairie Creek subwatershed drains the central portion of the Grand Lake St. Marys watershed, directly south of the lake. The entire subwatershed is located in Mercer County. The acres, square miles and percent of subwatershed are shown below. The Prairie Creek subwatershed, according to percentages, is the fourth largest of seven subwatersheds draining to Grand Lake St Marys. Of the entire Grand Lake/Wabash Watershed, it is the eleventh largest of 15 subwatersheds.

TABLE 30

PRAIRE CREEK	
Acreage	7,675
Square Miles	11.99
% of Grand Lake Watershed Total Land Area	13.0%
% of Grand Lake/Wabash Watershed Total Land Area	4.3%

Water Quality Status

Prairie Creek, composed of the Upper and Lower Prairie Creeks, has been designated as a warm water habitat (WWH). This aquatic life use designation has been established by the EPA and based on recent data sampling, the water resource is shown as not meeting that use designation, or in a “non-attainment” status. Furthermore, the Prairie Creek subwatershed has been shown to be NPS impacted. Suspected or proven impacts to these streams include: non-irrigated crop production, animal feeding operations, channelization, removal of riparian vegetation and stream bank destabilization. Definitions and criteria for these descriptives can be found in Appendix C- Aquatic life use designations and assessment terms.

Ohio EPA is currently completing a TMDL report for Beaver Creek and Grand Lake St. Marys, which is in process of being finalized. The draft report calls for phosphorus, nitrate and fecal coliform reduction upwards of 80% to 90% within the Prairie Creek subwatershed. Detailed information on the sampling results and recommended load reductions can be found in the draft report of the 2007 Ohio EPA TMDL report, which can be obtained by contacting the watershed project office.

Water Supplies and Discharges

There are currently two community water supplies located within the Prairie Creek subwatershed, Club Island Association and Grand Lake Mobile Home Park. There are 15 transient non-community water supplies, including: Woodhaven MHP PWS, Cottonwood Park, Bayview Water Association, Behm’s Landing A PWS, Sunny Side Inn, Shingle Shack Restaurant, Doss Landing, Duckfoot-Arnold Landing, Bayview Sun & Snow, Beach Point Billiards, Lee’s Landing PWS, D & W Marina, Behms Landing

Restaurant STU1 & STU 2, ODNR Grand Lake St. Marys State Park and Behm's Landing B PWS. No non-transient non-community supplies and no registered discharges are listed with Ohio EPA.

Based on recent aerial photographs, areas where 10 or more household wastewater treatment and disposal systems were present in close proximity were identified. As with any individual treatment system operating in an area with poorly drained soils, the effects of the effluent on the receiving water body is a concern. These effects grow as the number of systems in a given area increases, thus clusters or groups of 10 or more systems has been used to analyze the potential effects of those systems on the water quality. Regarding Prairie Creek subwatershed, there was one cluster identified comprised of 32 individual treatment systems.

Highly Erodible Land

Map 36 at the end of this subsection illustrates the highly erodible land locations within the Prairie Creek subwatershed. Of the seven subwatersheds within the Grand Lake St. Marys watershed, Prairie Creek ranks lowest in the amount of highly erodible land present within the subwatershed. The highly erodible land information was developed from the 2003 online NRCS Soil Data Mart.

Riparian Corridor Status

The chart on the following page shows the riparian corridor status for the Prairie Creek subwatershed. The chart indicates the number of miles of each drainage unit that has various widths of tree canopy, or riparian corridor. The numbers account for both sides of the streams; therefore, the number of actual stream miles is half of that shown. The divisions are less than 10 feet in total width, 10 to 40 feet in total width, and greater than 40 feet in total width. The chart is also divided into perennial and intermittent streams under each of the corridor width column headings. MAP 37 illustrates the stream sections under each division.

The chart shows that with a total of 10.12 miles of stream network, the Prairie Creek subwatershed has 5.16 miles of stream with less than 10 feet of canopy and vegetation, 4.13 miles of stream with 10 to 40 feet canopy and vegetation and 0.83 miles of stream with greater than 40 feet of canopy and vegetation. The Prairie Creek subwatershed has the fourth largest number of stream miles within the Grand Lake St. Marys Watershed, which is 7.2%. Of the entire Grand Lake/Wabash Watershed, this subwatershed has the eleventh highest number of stream miles, which is 1.4%.

TABLE 31
Riparian Corridor Status

PRAIRIE CREEK										
RIPARIAN STATUS	TREE CANOPY <10' IN TOTAL WIDTH			TREE CANOPY 10 to 40' IN WIDTH			TREE CANOPY >40' IN WIDTH			TOTAL STREAM MILES
	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	
	0.00	5.16	5.16	2.58	1.55	4.13	0.00	0.83	0.83	10.12
% of Subwatershed Total	0.0%	12.6%	12.6%	6.3%	3.8%	10.1%	0.0%	2.0%	2.0%	24.6%
% of Grand Lake Watershed Total	0.0%	3.7%	3.7%	1.8%	1.1%	2.9%	0.0%	0.6%	0.6%	7.2%
% of Grand Lake/Wabash Watershed Total	0.0%	0.7%	0.7%	0.4%	0.2%	0.6%	0.0%	0.1%	0.1%	1.4%

Operations and Animal Units

The table on the following page shows the number of operations and the animal units by species for the Prairie Creek subwatershed. According to the table, there are no poultry operations, 10 dairy operations, 16 hog operations 12 beef operations, one horse operation and one sheep operation within the entire subwatershed. The Prairie Creek subwatershed ranks ninth within the entire Grand Lake/Wabash River Watershed when considering the total number of operations with 40 or 4.04%. Animal units within the subwatershed ranks ninth of 15 with 2.75%.

Totals of animal units for each species are also listed on the table. The inventory for this subwatershed was completed during February and March of 2007. At the time of the inventory animal units were determined by the number of animals present. Although this is not a 1:1 ratio for all species, it is for beef cattle. The following chart shows the number of each type of animal that makes up 1,000 animal units.

Animal Type	1,000 Animal Unit Equivalent
Beef Cattle	1,000
Dairy Cattle	700
Hogs (over 55 lbs)	2,500
Turkeys	55,000
Layer Chickens	82,000
Pullet Chickens	125,000
Sheep	10,000
Horses	500

TABLE 32
Operations and Animal Units

PRAIRIE CREEK														
ANIMAL TYPE	POULTRY		DAIRY		HOG		BEEF		OTHER		TOTAL		Total as % of Grand Lake Watershed	
# Farms and Animals	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s
	0 (Trky)	0 0	10	1,550	16	6,080	12	1,750	(sheep) 1 (hrs) 1	1 4	40	9,385	13.4%	8.9%
% of subwatershed total	0.0%	0.0%	25.0%	16.5%	40.0%	64.8%	30.0%	18.6%	5.0%	0.1%	100.0%	100.0%		
Total as % of Grand Lake Watershed	0.0%	0.0%	3.4%	1.5%	5.4%	5.8%	4.0%	1.7%	0.7%	0.0%	13.4%	8.9%		
Total as % of Grand Lake/Wabash Watershed	0.00%	0.00%	1.01%	0.45%	1.62%	1.78%	1.21%	0.51%	0.20%	0.00%	4.04%	2.75%		

Manure Production

After considering the number of livestock operations and animal units present in the watershed, it is only fitting to consider the by-products of these animals. The table on the opposite page is used to represent the manure and nutrient production for the Prairie Creek drainage area. The Prairie Creek subwatershed ranks ninth overall, of 15, in terms of manure production per annum. Approximately 69,191 tons of manure is produced annually. The remainder of the columns on the table indicates the approximate pounds of nutrients contained in that manure. Nitrogen, potassium, and phosphate, are all important to the agricultural community and are provided to the crops via manure or commercial fertilizer applications.

These nutrients are also important in regards to water quality. According to the table, in the Prairie Creek subwatershed, the amount of phosphorus that is contained in the manure produced annually would need to be applied at 90 pounds per acre. The table below indicates the average crop removal rates for phosphorus for the major crops produced in the watershed. Values were obtained from the Ohio Agronomy Guide.

CROP	**P_2O_5 REMOVAL (lb/ac)**
Alfalfa (6T)	80
Corn (150 bu) Grain	55
Corn (25 T) Silage	80
Soybean (50 bu)	40
Wheat (75 bu) Grain	48

Considerations are given to the nutrient phosphorus due to its importance to crop production and the problems associated with the relationship between excessive phosphorus applications and degradation of water quality.

What this seems to indicate throughout the watershed is that according to manure production and crop removal rates for limiting nutrient factors, there are not enough acres for proper manure application methods. The caveat on this statement is that the numbers are best estimates, variations in soil types and tilth can vary throughout the fields which may increase, or decrease, crop removal rates, and more importantly, some of the manure produced in each of the subwatershed may be applied to acreages outside of that subwatershed, or even outside of the Grand Lake St Marys watershed. It should be noted that several producers own or rent land both in the Grand Lake St Marys watershed and in neighboring watersheds such as Loramie Creek, Wabash River, or the St Marys River.

TABLE 33
Manure and Nutrient Production

PRAIRIE CREEK						
Manure Production	Tons Raw Manure/Year	Lbs. N per Year	Lbs. K_2O per Year	Lbs. P_2O_5 per Year	Acres Cropland	Lbs. P_2O_5 per Crop Acre
	69,191	820,159	656,192	548,275	6,095	90
Less 70% Poultry Manure**	69,191	820,159	656,192	548,275	6,095	90
Approximate $ Value Per Year		$180,435	$98,429	$109,655		
Total Nutrient Value Per Year =	$388,519					

**There is no poultry in the Prairie Creek subwatershed.

The dollar values associated with each nutrient were obtained from OSU Extension Bulletin 604-06, "Ohio Livestock Manure Management Guide." The value for nitrogen is estimated at $0.22 per pound, the value for P_2O_5 is $0.20 per pound and the value for K_2O is $0.15 per pound.

Distance Between Livestock Operations and Streams

The table on the following page shows the distance between various livestock operations located in the Prairie Creek subwatershed and the waterways that drain to Prairie Creek and eventually Grand Lake St. Marys. It can be assumed that the greater the distance between a livestock operation and a water system, the potential of pollution from the operation reaching the stream is lessened.

Of notable interest is the number of all livestock operations located less than 1,000 feet from the waterbody. In this particular subwatershed, out of 40 operations, 21 operations, or 52.5%, fall into the category. Also, 10 operations, 25.0%, are within 2,000 feet and the remaining 22.5%, nine operations, are less than 3,000 feet from the nearest stream.

TABLE 34
Livestock Operations and Proximity to Streams

PRAIRIE CREEK																		
ANIMAL TYPE	POULTRY			DAIRY			HOG			BEEF			OTHER			TOTAL		
	Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream		
	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'
	0	0	0	5	3	2	7	5	4	7	2	3	2	0	0	21	10	9
% of Subwatershed Total	0.0%	0.0%	0.0%	12.5%	7.5%	5.0%	17.5%	12.5%	10.0%	17.5%	5.0%	7.5%	5.0%	0.0%	0.0%	52.5%	25.0%	22.5%

Non-Point Source Pollution Potential

In order to provide a comparison of the pollution potential of each of the 15 subwatersheds, a ranking system for each of the main potential pollution sources was developed. These potential sources are stream miles with less than 10 feet of vegetation, the number of livestock or poultry operations less than 1,000 feet from a stream, the tons of raw manure produced yearly, the pounds of phosphorus per cropland acre available from the manure, the number of household wastewater disposal systems contained in clusters of ten or more) and the number of homes built pre-1973. Values of 1(less potential) to 10 (great potential) were given based on ranges shown in the table of the following page. Indicator scores are then summed to obtain a total pollution potential score for the subwatershed.

Subwatershed pollution potential scores can range from a maximum of 60 points to a minimum of six points. The Prairie Creek subwatershed ranks tenth out of 15, with 36.7% of the maximum points for pollution potential.

NONPOINT SOURCE POLLUTION POTENTIAL SCORING MATRIX

MAXIMUM DRAINAGE UNIT SCORE = 60 (Highest Pollution Potential)

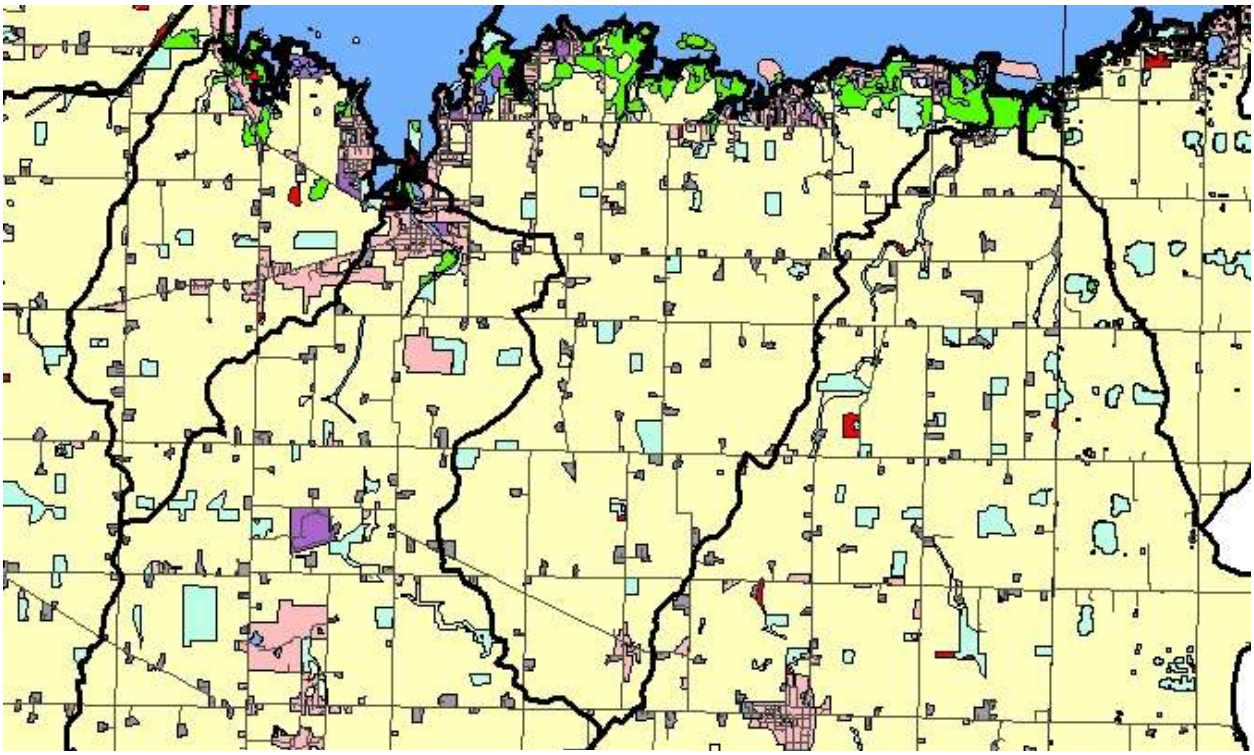
SCORE	Stream Miles with <10' Vegetation	Operations <1,000' to stream	Tons Raw Manure per Year	Lbs. P_2O_5 per Crop Acre	Household Disposal Systems in Groups	No. Homes Built pre-1973
10	72.00+	46+	180,000+	225+	90+	226+
9	64.00 - 71.99	41 - 45	160,000 - 179,999	200 - 224	80 - 89	201 -225
8	56.00 - 63.99	36 - 40	140,000 - 159,999	175 - 199	70 - 79	176 -200
7	48.00 - 55.99	31 - 35	120,000 - 139,999	150 - 174	60 - 69	151 - 175
6	40.00 - 47.99	26 - 30	100,000 - 119,999	125 - 149	50 - 59	126 - 150
5	32.00 - 39.99	21 - 25	80,000 - 99,999	100 - 124	40 - 49	101 - 125
4	24.00 - 31.99	16 - 20	60,000 - 79,999	75- 99	30 - 39	76 - 100
3	16.00 - 23.99	11 - 15	40,000 - 59,999	50 - 74	20 - 29	51 - 75
2	8.00 - 15.99	6 - 10	20,000 - 39,999	25 - 49	10 - 19	26 - 50
1	0.00 - 7.99	0 - 5	0 - 19,999	0 - 24	0 - 10	0 - 25

MINIMUM DRAINAGE UNIT SCORE = 6 (Lowest Pollution Potential)

TABLE 35
NPS Pollution Potential

PRAIRIE CREEK							
SUBWATERSHED ATTRIBUTE	Stream Miles with <10' Vegetation SCORE	Operations <1,000' to stream SCORE	Tons Raw Manure per Year SCORE	Lbs. P_2O_5 per Crop Acre SCORE	Household Disposal Systems in Groups SCORE	No. Homes Built pre-1973 SCORE	TOTAL SCORE
	1	5	4	4	4	4	22

MAP 37
Prairie Creek Land Use



Legend

Grand Lake/Wabash Watershed

Roadways

Land Use

Cropland

Urban

Farmsteads

Shrub_Brush

Deciduous Forest

Open Water

Wetlands

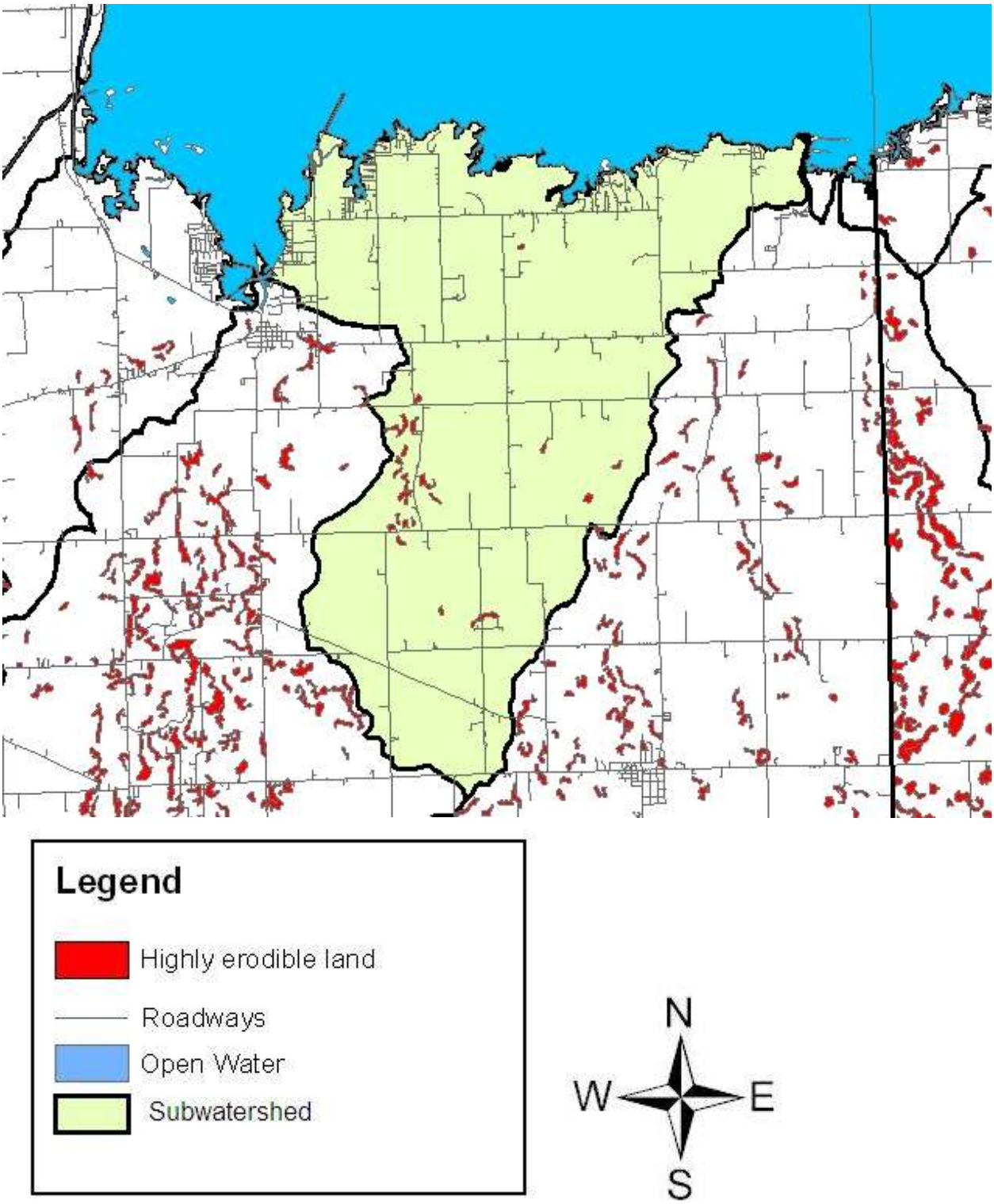
Barren/Undeveloped

N

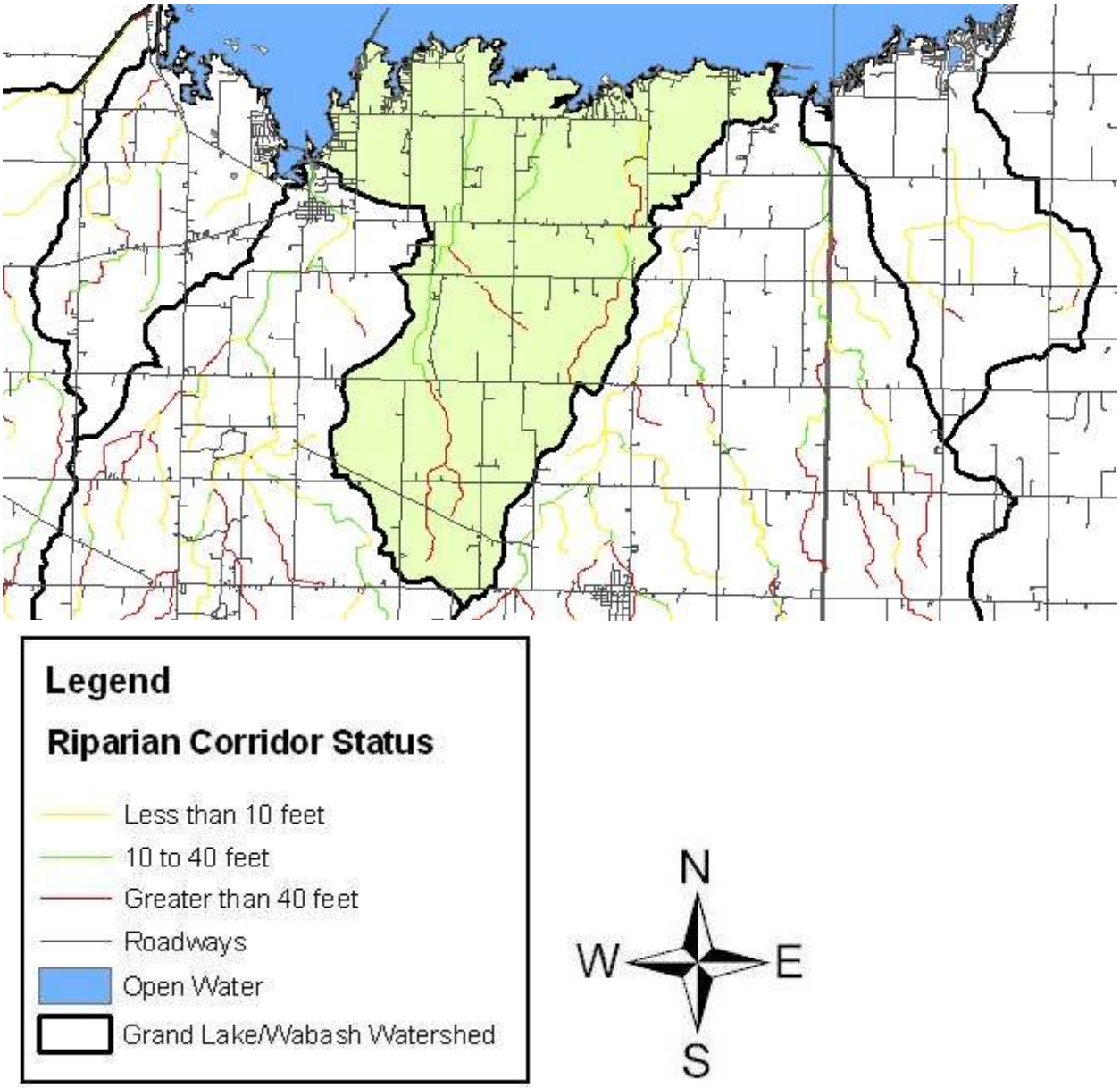
W E

S

MAP 38
Prairie Creek Highly Erodible Land



MAP 39
Prairie Creek Riparian Corridor Status



4.1.5 Chickasaw Creek

The Chickasaw Creek subwatershed drains the lower eastern area of the Grand Lake St Marys drainage basin. The majority of the subwatershed is located in Mercer County and the remainder is located in Auglaize County. The acres, square miles and percent of sub-watershed are shown below. The Chickasaw Creek Subwatershed, according to percentages, is the largest of the seven subwatersheds draining to Grand Lake St. Marys. Of the entire Grand/Lake Wabash Watershed, it is the fourth largest of fifteen subwatersheds.

TABLE 36

CHICKASAW CREEK	
Acreage	16,322
Square Miles	25.50
% of Grand Lake Watershed Total Land Area	27.7%
% of Grand Lake/Wabash Watershed Total Land Area	9.1%

Water Quality Status

Chickasaw Creek, composed of the East Fork and Little Chickasaw Creek drainage units has been designated as a warm water habitat (WWH). This aquatic life use designation has been established by the EPA and based on recent data sampling, the water resource is shown as not meeting that use designation, or in a “non-attainment” status. Furthermore, the Chickasaw Creek subwatershed has been shown to be NPS impacted. Suspected or proven impacts to these streams include: non-irrigated crop production, animal feeding operations, channelization, removal of riparian vegetation and stream bank destabilization. Definitions and criteria for these descriptives can be found in Appendix C- Aquatic life use designations and assessment terms.

Ohio EPA is currently completing a TMDL report for Beaver Creek and Grand Lake St. Marys, which is in process of being finalized. The draft report calls for phosphorus, nitrate and fecal coliform reduction upwards of 50% to 90% within the Chickasaw Creek subwatershed. Detailed information on the sampling results and recommended load reductions can be found in the draft report of the 2007 Ohio EPA TMDL report, which can be obtained by contacting the watershed project office.

Water Supplies and Discharges

Two community water supplies, the Village of Chickasaw, and the Hecht’s Landing Mobile Home Park, are located within the boundaries of the Chickasaw Creek subwatershed. There are also eight transient non-community water supplies, including: Spiritual Center of Maria Stein, American Legion Post #571, Knights of St. Johns PWS,

Hecht's Landing #1 Well PWS, Hecht's Landing #2 Well PWS, Korner Kafe, Schwieterman Family Physicians, Inc. and Maria Stein Center. Two non-transient non-community water supplies, Marion Local Elementary and Marion Local High School are also located in the subwatershed.

There are four Ohio EPA regulated point source discharges; the Chapel Hill Subdivision WWTP, the Chickasaw WTP, the Chickasaw WWTP and the Marion Local School District located in the drainage area. The Wenning Animal Hospital also operates as non-regulated discharger and the stormwater from the Village of Chickasaw also discharges to Chickasaw Creek.

Based on recent aerial photographs, areas where 10 or more household wastewater treatment and disposal systems were present in close proximity were identified. As with any individual treatment system operating in an area with poorly drained soils, the effects of the effluent on the receiving water body is a concern. These effects grow as the number of systems in a given area increases, thus clusters or groups of 10 or more systems has been used to analyze the potential effects of those systems on the water quality. Regarding Chickasaw Creek subwatershed, there is one cluster identified comprised of approximately 35 individual treatment systems.

Highly Erodible Land

Map 39 at the end of this subsection illustrates the highly erodible land locations within the Chickasaw Creek subwatershed. Of the seven subwatersheds within the Grand Lake St. Marys watershed, Chickasaw Creek ranks second highest in the amount of highly erodible land present within the subwatershed. The highly erodible land information was developed from the 2003 online NRCS Soil Data Mart.

Riparian Corridor Status

The chart on the following page shows the riparian corridor status for the Chickasaw Creek subwatershed. The chart indicates the number of miles of each drainage unit that has various widths of tree canopy, or riparian corridor. The numbers account for both sides of the streams; therefore, the number of actual stream miles is half of that shown. The divisions are less than 10 feet in total width, 10 to 40 feet in total width, and greater than 40 feet in total width. The chart is also divided into perennial and intermittent streams under each of the corridor width column headings. MAP 40 illustrates the stream sections under each division.

The chart shows that with a total of 40.39 miles of stream network, the Chickasaw Creek subwatershed has 20.34 miles of stream with less than 10 feet of canopy and vegetation, 5.84 miles of stream with 10 to 40 feet canopy and vegetation, and 14.21 miles of stream with greater than 40 feet of canopy and vegetation. The Chickasaw Creek subwatershed has the second highest number of stream miles within the Grand Lake St. Marys Watershed, which is 28.8%. Of the entire Grand Lake/Wabash Watershed, this subwatershed has the seventh highest number of stream miles, which is 5.7%.

TABLE 37
Riparian Corridor Status

CHICKASAW CREEK										
RIPARIAN STATUS	TREE CANOPY <10' IN TOTAL WIDTH			TREE CANOPY 10 to 40' IN WIDTH			TREE CANOPY >40' IN WIDTH			TOTAL STREAM MILES
	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	
	0.42	19.92	20.34	3.11	2.73	5.84	6.98	7.23	14.21	40.39
% of Subwatershed Total	1.0%	48.5%	49.5%	7.6%	6.6%	14.2%	17.0%	17.6%	34.6%	98.3%
% of Grand Lake Watershed Total	0.3%	14.2%	14.5%	2.2%	1.9%	4.2%	5.0%	5.2%	10.1%	28.8%
% of Grand Lake/Wabash Watershed Total	0.1%	2.8%	2.9%	0.4%	0.4%	0.8%	1.0%	1.0%	2.0%	5.7%

Operations and Animal Units

The table on the following page shows the number of operations and the animal units by species for the Chickasaw Creek subwatershed. According to the table, there are 12 poultry operations, 19 dairy operations, 23 hog operations, 31 beef operations and one sheep operation within the entire subwatershed. The Chickasaw Creek subwatershed ranks fifth within the entire Grand Lake/Wabash River Watershed when considering the total number of operations with 86 or 8.7%. Animal units within the subwatershed ranks third of 15 with 12.9%.

Totals of animal units for each species are also listed on the table. The inventory for this subwatershed was completed during February and March of 2007. At the time of the inventory animal units were determined by the number of animals present. Although this is not a 1:1 ratio for all species, it is for beef cattle. The following chart shows the number of each type of animal that makes up 1,000 animal units.

Animal Type	1,000 Animal Unit Equivalent
Beef Cattle	1,000
Dairy Cattle	700
Hogs (over 55 lbs)	2,500
Turkeys	55,000
Layer Chickens	82,000
Pullet Chickens	125,000
Sheep	10,000
Horses	500

TABLE 38
Operations and Animal Units

CHICKASAW CREEK														
ANIMAL TYPE	POULTRY		DAIRY		HOG		BEEF		OTHER		TOTAL		Total as % of Grand Lake Watershed	
	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s
# Farms and Animals	10 (Trky) 2	24,678 327	19	3,750	23	11,280	31	3,925	(sheep) 1 (hrs)	0 0	86	43,961	28.9%	41.8%
% of subwatershed total	14.0%	56.9%	22.1%	8.5%	26.7%	25.7%	36.0%	8.9%	1.2%	0.0%	100.0%	100.0%		
Total as % of Grand Lake Watershed	4.0%	23.8%	6.4%	3.6%	7.7%	10.7%	10.4%	3.7%	0.3%	0.0%	28.9%	41.8%		
Total as % of Grand Lake/Wabash Watershed	1.21%	7.32%	1.92%	1.10%	2.33%	3.30%	3.13%	1.15%	0.10%	0.00%	8.70%	12.87%		

Manure Production

After considering the number of livestock operations and animal units present in the watershed, it is only fitting to consider the by-products of these animals. The table on the opposite page is used to represent the manure and nutrient production for the Chickasaw Creek drainage area. The Chickasaw Creek subwatershed ranks third overall, of 15, in terms of manure production per annum. Approximately 230,268 tons of manure is produced annually. The remainder of the columns on the table indicates the approximate pounds of nutrients contained in that manure. Nitrogen, potassium, and phosphate, are all important to the agricultural community and are provided to the crops via manure or commercial fertilizer applications.

These nutrients are also important in regards to water quality. According to the table, in the Chickasaw Creek subwatershed, the amount of phosphorus that is contained in the manure produced annually would need to be applied at 211 pounds per acre. The table below indicates the average crop removal rates for phosphorus for the major crops produced in the watershed. Values were obtained from the Ohio Agronomy Guide.

CROP	**P_2O_5 REMOVAL (lb/ac)**
Alfalfa (6T)	80
Corn (150 bu) Grain	55
Corn (25 T) Silage	80
Soybean (50 bu)	40
Wheat (75 bu) Grain	48

Considerations are given to the nutrient phosphorus due to its importance to crop production and the problems associated with the relationship between excessive phosphorus applications and degradation of water quality. Because much of the poultry manure is brokered out of the watershed, it seemed important to reflect the nutrient values assuming that 70% of the poultry manure is moved to locations outside the watershed. Local manure haulers estimated this value to be 90%; however, to be conservative, 70% was assumed for this plan. Under this assumption, the amount of phosphorus that is contained in the manure produced annually in this subwatershed would need to be applied at 119 pounds per acre.

What this seems to indicate throughout the watershed is that according to manure production and crop removal rates for limiting nutrient factors, there are not enough acres for proper manure application methods. The caveat on this statement is that the numbers are best estimates, variations in soil types and tilth can vary throughout the fields which may increase, or decrease, crop removal rates, and more importantly, some of the manure produced in each of the subwatershed may be applied to acreages outside of that subwatershed, or even outside of the Grand Lake St Marys watershed. It should be noted that several producers own or rent land both in the Grand Lake St Marys watershed and in neighboring watersheds such as Loramie Creek, Wabash River, or the St Marys River.

TABLE 39
Manure and Nutrient Production

CHICKASAW CREEK						
Manure Production	Tons Raw Manure/Year	Lbs. N per Year	Lbs. K_2O per Year	Lbs. P_2O_5 per Year	Acres Cropland	Lbs. P_2O_5 per Crop Acre
	230,268	3,970,601	2,475,822	3,021,093	14,290	211
Less 70% Poultry Manure**	173,127	2,404,848	1,715,269	1,698,961	14,290	119
Approximate $ Value Per Year		$873,532	$371,373	$604,219		
Total Nutrient Value Per Year =	$1,849,124					

**Based on conversations with poultry manure brokers, it was estimated that at least 70% of the poultry manure is brokered out of the watershed.

The dollar values associated with each nutrient were obtained from OSU Extension Bulletin 604-06, "Ohio Livestock Manure Management Guide." The value for nitrogen is estimated at $0.22 per pound, the value for P_2O_5 is $0.20 per pound and the value for K_2O is $0.15 per pound.

Distance Between Livestock Operations and Streams

The table on the following page shows the distance between various livestock operations located in the Chickasaw Creek subwatershed and the waterways that drain to Chickasaw Creek and eventually Grand Lake St. Marys. It can be assumed that the greater the distance between a livestock operation and a water system, the potential of pollution from the operation reaching the stream is lessened.

Of notable interest is the number of all livestock operations located less than 1,000 feet from the waterbody. In this particular subwatershed, out of 86 operations, 41 operations, or 47.7%, fall into the category. Also, 22 operations, 25.6%, are in within 2,000 feet and the remaining 26.7%, 23 operations, are less than 3,000 feet from the nearest stream.

TABLE 40
Livestock Operations and Proximity to Streams

CHICKASAW CREEK																		
ANIMAL TYPE	POULTRY			DAIRY			HOG			BEEF			OTHER			TOTAL		
	Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream		
	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'
	5	5	2	11	4	4	11	3	9	14	10	7	0	0	1	41	22	23
% of Subwatershed Total	5.8%	5.8%	2.3%	12.8%	4.7%	4.7%	12.8%	3.5%	10.5%	16.3%	11.6%	8.1%	0.0%	0.0%	1.2%	47.7%	25.6%	26.7%

Non-Point Source Pollution Potential

In order to provide a comparison of the pollution potential of each of the 15 subwatersheds, a ranking system for each of the main potential pollution sources was developed. These potential sources are stream miles with less than 10 feet of vegetation, the number of livestock or poultry operations less than 1,000 feet from a stream, the tons of raw manure produced yearly, the pounds of phosphorus per cropland acre available from the manure, the number of household wastewater disposal systems contained in clusters of ten or more) and the number of homes built pre-1973. Values of 1(less potential) to 10 (great potential) were given based on ranges shown in the table of the following page. Indicator scores are then summed to obtain a total pollution potential score for the subwatershed.

Subwatershed pollution potential scores can range from a maximum of 60 points to a minimum of six points. The Chickasaw Creek subwatershed ranks fifth out of 15, with 68.3% of the maximum points for pollution potential. Most significantly for the subwatershed is the tons of raw manure generated per year and the number of homes built prior to 1973. The Chickasaw Creek subwatershed scored the maximum amount of points for both indicators.

NONPOINT SOURCE POLLUTION POTENTIAL SCORING MATRIX

MAXIMUM DRAINAGE UNIT SCORE = 60 (Highest Pollution Potential)

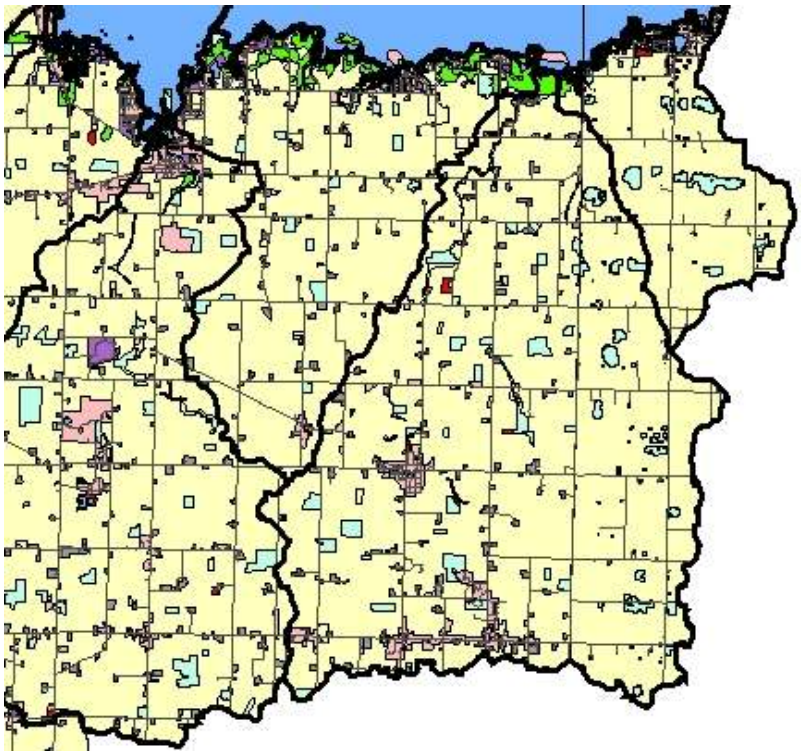
SCORE	Stream Miles with <10' Vegetation	Operations <1,000' to stream	Tons Raw Manure per Year	Lbs. P_2O_5 per Crop Acre	Household Disposal Systems in Groups	No. Homes Built pre-1973
10	72.00+	46+	180,000+	225+	90+	226+
9	64.00 - 71.99	41 - 45	160,000 - 179,999	200 - 224	80 - 89	201 -225
8	56.00 - 63.99	36 - 40	140,000 - 159,999	175 - 199	70 - 79	176 -200
7	48.00 - 55.99	31 - 35	120,000 - 139,999	150 - 174	60 - 69	151 - 175
6	40.00 - 47.99	26 - 30	100,000 - 119,999	125 - 149	50 - 59	126 - 150
5	32.00 - 39.99	21 - 25	80,000 - 99,999	100 - 124	40 - 49	101 - 125
4	24.00 - 31.99	16 - 20	60,000 - 79,999	75- 99	30 - 39	76 - 100
3	16.00 - 23.99	11 - 15	40,000 - 59,999	50 - 74	20 - 29	51 - 75
2	8.00 - 15.99	6 - 10	20,000 - 39,999	25 - 49	10 - 19	26 - 50
1	0.00 - 7.99	0 - 5	0 - 19,999	0 - 24	0 - 10	0 - 25

MINIMUM DRAINAGE UNIT SCORE = 6 (Lowest Pollution Potential)

TABLE 41
NPS Pollution Potential

CHICKASAW CREEK							
SUBWATERSHED ATTRIBUTE	Stream Miles with <10' Vegetation SCORE	Operations <1,000' to stream SCORE	Tons Raw Manure per Year SCORE	Lbs. P_2O_5 per Crop Acre SCORE	Household Disposal Systems in Groups SCORE	No. Homes Built pre-1973 SCORE	TOTAL SCORE
	3	9	10	5	4	10	41

MAP 40
Chickasaw Creek Land Use



Legend

Grand Lake/Wabash Watershed

Roadways

Land Use

Cropland

Urban

Farmsteads

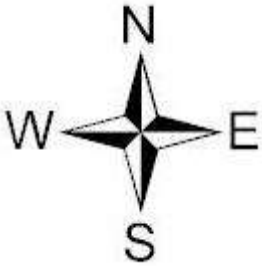
Shrub_Brush

Deciduous Forest

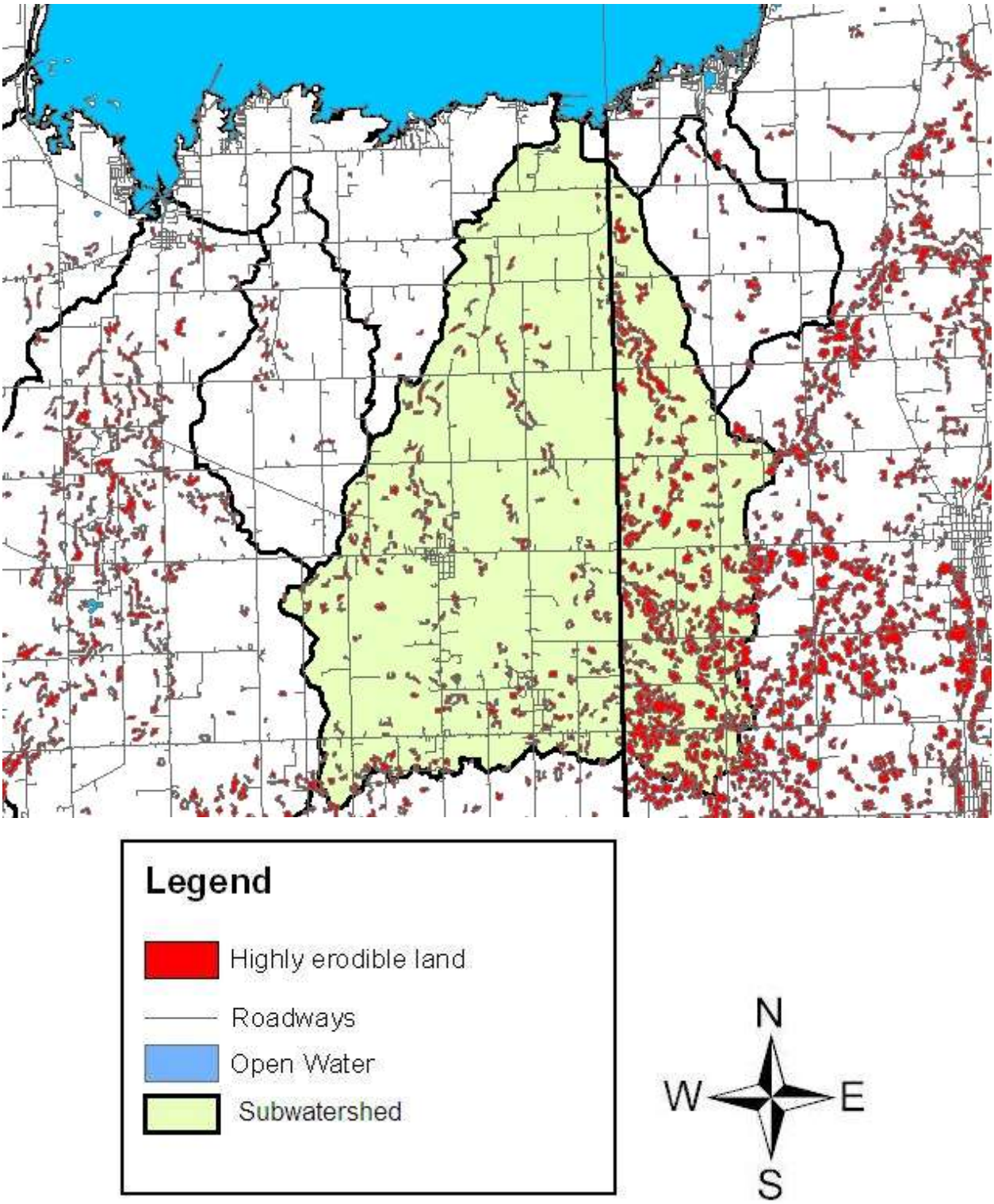
Open Water

Wetlands

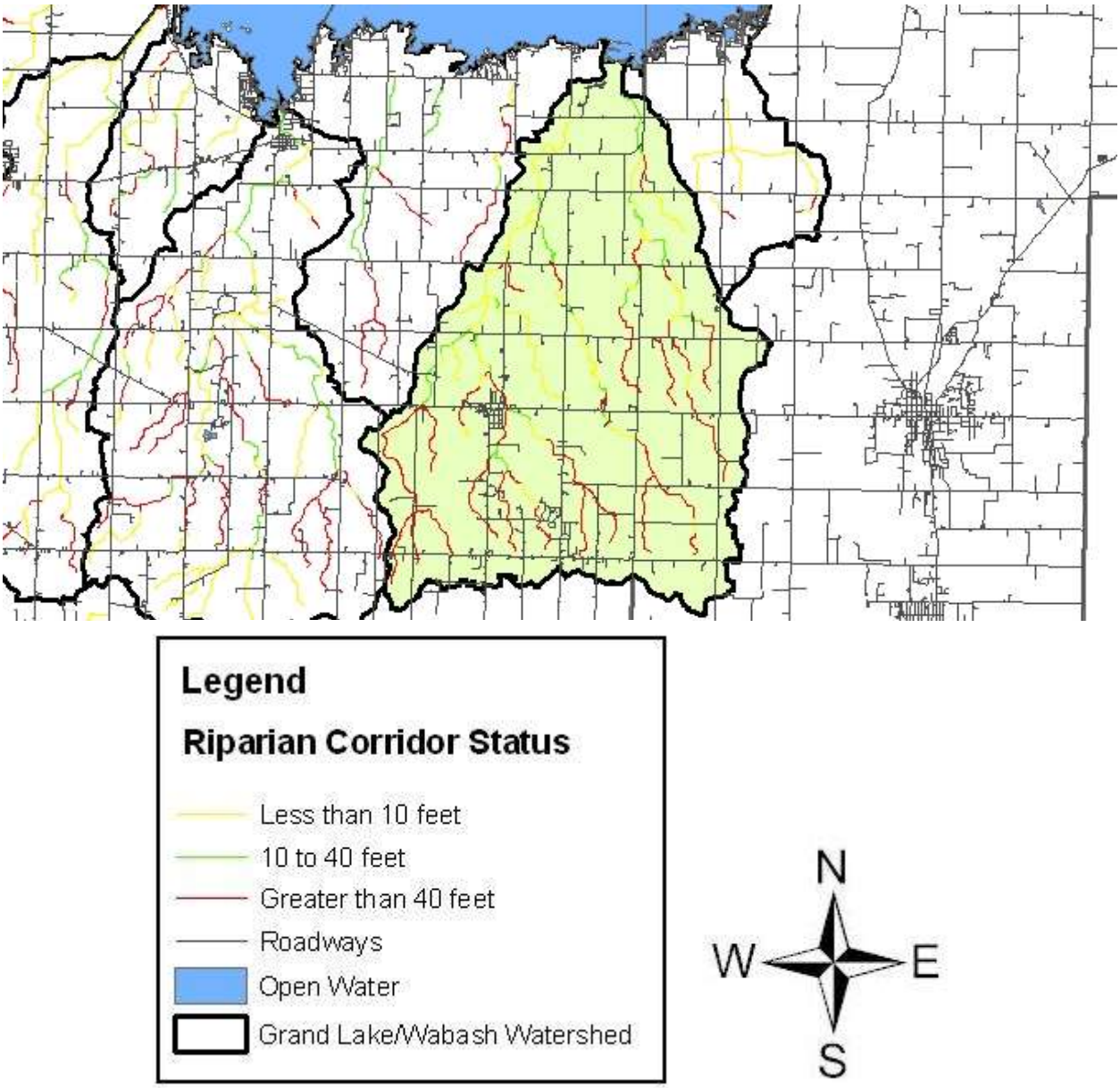
Barren/Undeveloped



MAP 42
Chickasaw Creek Highly Erodible Land



MAP 42
Chickasaw Creek Riparian Corridor Status



4.1.6 Barnes Creek

The Barnes Creek subwatershed drains the north eastern portion of the Grand Lake St. Marys drainage basin. The majority of the subwatershed is located in Auglaize County and the remainder is located in Mercer County. The acres, square miles and percent of sub-watershed are shown below. The Barnes Creek Subwatershed, according to percentages, is the fifth largest of the seven subwatersheds draining to Grand Lake St. Marys. Of the entire Grand/Lake Wabash Watershed, it is the twelfth largest of fifteen subwatersheds.

TABLE 42

BARNES CREEK	
Acreage	3,486
Square Miles	5.45
% of Grand Lake Watershed Total Land Area	5.9%
% of Grand Lake/Wabash Watershed Total Land Area	1.9%

Water Quality Status

Barnes Creek, composed of lower and upper Barnes Creeks has been designated as a warm water habitat (WWH). This aquatic life use designation has been established by the EPA and based on recent data sampling, the water resource is shown as not meeting that use designation, or in a “non-attainment” status. Furthermore, the Barnes Creek subwatershed has been shown to be NPS impacted. Suspected or proven impacts to these streams include: non-irrigated crop production, animal feeding operations, channelization, removal of riparian vegetation and stream bank destabilization. Definitions and criteria for these descriptives can be found in Appendix C- Aquatic life use designations and assessment terms.

Ohio EPA is currently completing a TMDL report for Beaver Creek and Grand Lake St. Marys, which is in process of being finalized. The draft report calls for phosphorus, nitrate and fecal coliform reductions ranging from 17 to 90% within the Barnes Creek subwatershed. Detailed information on the sampling results and recommended load reductions can be found in the draft report of the 2007 Ohio EPA TMDL report, which can be obtained by contacting the watershed project office.

Water Supplies and Discharges

There is one transient non-community water supply located in the Barnes Creek area and that is the Rustic Haven Camp Ground. There are currently no community or non-transient non-community water supplies in this particular subwatershed, and there are no Ohio EPA regulated point source discharges.

Based on recent aerial photographs, areas where 10 or more household wastewater treatment and disposal systems were present in close proximity were identified. As with any individual treatment system operating in an area with poorly drained soils, the effects of the effluent on the receiving water body is a concern. These effects grow as the number of systems in a given area increases, thus clusters or groups of 10 or more systems has been used to analyze the potential effects of those systems on the water quality. Regarding Barnes Creek subwatershed, there were no clusters identified.

Highly Erodible Land

Map 42 at the end of this subsection illustrates the highly erodible land locations within the Barnes Creek subwatershed. Of the seven subwatersheds within the Grand Lake St. Marys watershed, Barnes Creek ranks fifth highest in the amount of highly erodible land present within the subwatershed. The highly erodible land information was developed from the 2003 online NRCS Soil Data Mart.

Riparian Corridor Status

The chart on the following page shows the riparian corridor status for the Barnes Creek subwatershed. The chart indicates the number of miles of each drainage unit that has various widths of tree canopy, or riparian corridor. The numbers account for both sides of the streams; therefore, the number of actual stream miles is half of that shown. The divisions are less than 10 feet in total width, 10 to 40 feet in total width, and greater than 40 feet in total width. The chart is also divided into perennial and intermittent streams under each of the corridor width column headings. MAP 43 illustrates the stream sections under each division.

The chart shows that with a total of 7.27 miles of stream network, the Barnes Creek subwatershed has 0.42 miles of stream with less than 10 feet of canopy and vegetation, zero miles of stream with 10 to 40 feet canopy and vegetation, and 6.85 miles of stream with greater than 40 feet of canopy and vegetation. The Barnes Creek subwatershed has the fifth highest number of stream miles within the Grand Lake St. Marys Watershed, which is 5.2%. Of the entire Grand Lake/Wabash Watershed, this subwatershed has the twelfth highest number of stream miles, which is 1.0%.

TABLE 43
Riparian Corridor Status

BARNES CREEK										
RIPARIAN STATUS	TREE CANOPY <10' IN TOTAL WIDTH			TREE CANOPY 10 to 40' IN WIDTH			TREE CANOPY >40' IN WIDTH			TOTAL STREAM MILES
	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	
	0.00	0.42	0.42	0.00	0.00	0.00	3.25	3.6	6.85	7.27
% of Subwatershed Total	0.0%	1.0%	1.0%	0.0%	0.0%	0.0%	7.9%	8.8%	16.7%	17.7%
% of Grand Lake Watershed Total	0.0%	0.3%	0.3%	0.0%	0.0%	0.0%	2.3%	2.6%	4.9%	5.2%
% of Grand Lake/Wabash Watershed Total	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.5%	0.5%	1.0%	1.0%

Operations and Animal Units

The table on the following page shows the number of operations and the animal units by species for the Barnes Creek subwatershed. According to the table, there are no poultry operations, four dairy operations, one hog operation, four beef operations and one horse operation within the entire subwatershed. The Barnes Creek subwatershed ranks thirteenth within the entire Grand Lake/Wabash River Watershed when considering the total number of operations with 10 or 1.0%. Animal units within the subwatershed ranks fourteenth of 15 with 0.41%.

Totals of animal units for each species are also listed on the table. The inventory for this subwatershed was completed during March of 2007. At the time of the inventory animal units were determined by the number of animals present. Although this is not a 1:1 ratio for all species, it is for beef cattle. The following chart shows the number of each type of animal that makes up 1,000 animal units.

Animal Type	1,000 Animal Unit Equivalent
Beef Cattle	1,000
Dairy Cattle	700
Hogs (over 55 lbs)	2,500
Turkeys	55,000
Layer Chickens	82,000
Pullet Chickens	125,000
Sheep	10,000
Horses	500

TABLE 44
Operations and Animal Units

BARNES CREEK														
ANIMAL TYPE	POULTRY		DAIRY		HOG		BEEF		OTHER		TOTAL		Total as % of Grand Lake Watershed	
	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s
# Farms and Animals	0 (Trky)	0 0	4	643	1	400	4	355	(sheep) (hrs) 1	0 0	10	1,398	3.4%	1.3%
% of subwatershed total	0.0%	0.0%	40.0%	0.0%	10.0%	28.6%	40.0%	25.4%	10.0%	0.0%	100.0%	0.0%		
Total as % of Grand Lake Watershed	0.0%	0.0%	1.3%	0.6%	0.3%	0.4%	1.3%	0.3%	0.3%	0.0%	3.4%	1.3%		
Total as % of Grand Lake/Wabash Watershed	0.00%	0.00%	0.40%	0.19%	0.10%	0.12%	0.40%	0.10%	0.10%	0.00%	1.01%	0.41%		

Manure Production

After considering the number of livestock operations and animal units present in the watershed, it is only fitting to consider the by-products of these animals. The table on the opposite page is used to represent the manure and nutrient production for the Barnes Creek drainage area. The Barnes Creek subwatershed ranks fourteenth overall, of 15, in terms of manure production per annum. Approximately 15,146 tons of manure is produced annually. The remainder of the columns on the table indicates the approximate pounds of nutrients contained in that manure. Nitrogen, potassium, and phosphate, are all important to the agricultural community and are provided to the crops via manure or commercial fertilizer applications.

These nutrients are also important in regards to water quality. According to the table, in the Barnes Creek subwatershed, the amount of phosphorus that is contained in the manure produced annually would need to be applied at 32 pounds per acre. The table below indicates the average crop removal rates for phosphorus for the major crops produced in the watershed. Values were obtained from the Ohio Agronomy Guide.

CROP	**P_2O_5 REMOVAL (lb/ac)**
Alfalfa (6T)	80
Corn (150 bu) Grain	55
Corn (25 T) Silage	80
Soybean (50 bu)	40
Wheat (75 bu) Grain	48

Considerations are given to the nutrient phosphorus due to its importance to crop production and the problems associated with the relationship between excessive phosphorus applications and degradation of water quality.

TABLE 45
Manure and Nutrient Production

BARNES CREEK						
Manure Production	Tons Raw Manure/Year	Lbs. N per Year	Lbs. K_2O per Year	Lbs. P_2O_5 per Year	Acres Cropland	Lbs. P_2O_5 per Crop Acre
	15,156	163,458	131,178	90,900	2,875	32
Less 70% Poultry Manure**	15,156	163,458	131,178	90,900	2,875	32
Approximate $ Value Per Year		$35,961	$19,677	$18,180		
Total Nutrient Value Per Year =	$73,818					

**There is no poultry in the Barnes Creek subwatershed.

The dollar values associated with each nutrient were obtained from OSU Extension Bulletin 604-06, "Ohio Livestock Manure Management Guide." The value for nitrogen is estimated at $0.22 per pound, the value for P_2O_5 is $0.20 per pound and the value for K_2O is $0.15 per pound.

Distance Between Livestock Operations and Streams

The table on the following page shows the distance between various livestock operations located in the Barnes Creek subwatershed and the waterways that drain to Barnes Creek and eventually Grand Lake St. Marys. It can be assumed that the greater the distance between a livestock operation and a water system, the potential of pollution from the operation reaching the stream is lessened.

Of notable interest is the number of all livestock operations located less than 1,000 feet from the waterbody. In this particular subwatershed, out of 10 operations, one operation, or 10.0%, fall into the category. Also, three operations, 30.0%, are in within 2,000 feet and the remaining 60.0%, six operations, are less than 3,000 feet from the nearest stream.

TABLE 46
Livestock Operations and Proximity to Streams

BARNES CREEK																		
ANIMAL TYPE	POULTRY			DAIRY			HOG			BEEF			OTHER			TOTAL		
	Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream		
	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'
	0	0	0	0	1	3	0	1	0	1	0	3	0	1	0	1	3	6
% of Subwatershed Total	0.0%	0.0%	0.0%	0.0%	10.0%	30.0%	0.0%	10.0%	0.0%	10.0%	0.0%	30.0%	0.0%	10.0%	0.0%	10.0%	30.0%	60.0%

Non-Point Source Pollution Potential

In order to provide a comparison of the pollution potential of each of the 15 subwatersheds, a ranking system for each of the main potential pollution sources was developed. These potential sources are stream miles with less than 10 feet of vegetation, the number of livestock or poultry operations less than 1,000 feet from a stream, the tons of raw manure produced yearly, the pounds of phosphorus per cropland acre available from the manure, the number of household wastewater disposal systems contained in clusters of ten or more) and the number of homes built pre-1973. Values of 1(less potential) to 10 (great potential) were given based on ranges shown in the table of the following page. Indicator scores are then summed to obtain a total pollution potential score for the subwatershed.

Subwatershed pollution potential scores can range from a maximum of 60 points to a minimum of six points. The Barnes Creek subwatershed ranks fourteenth out of 15, with 13.3% of the maximum points for pollution potential.

NONPOINT SOURCE POLLUTION POTENTIAL SCORING MATRIX

MAXIMUM DRAINAGE UNIT SCORE = 60 (Highest Pollution Potential)

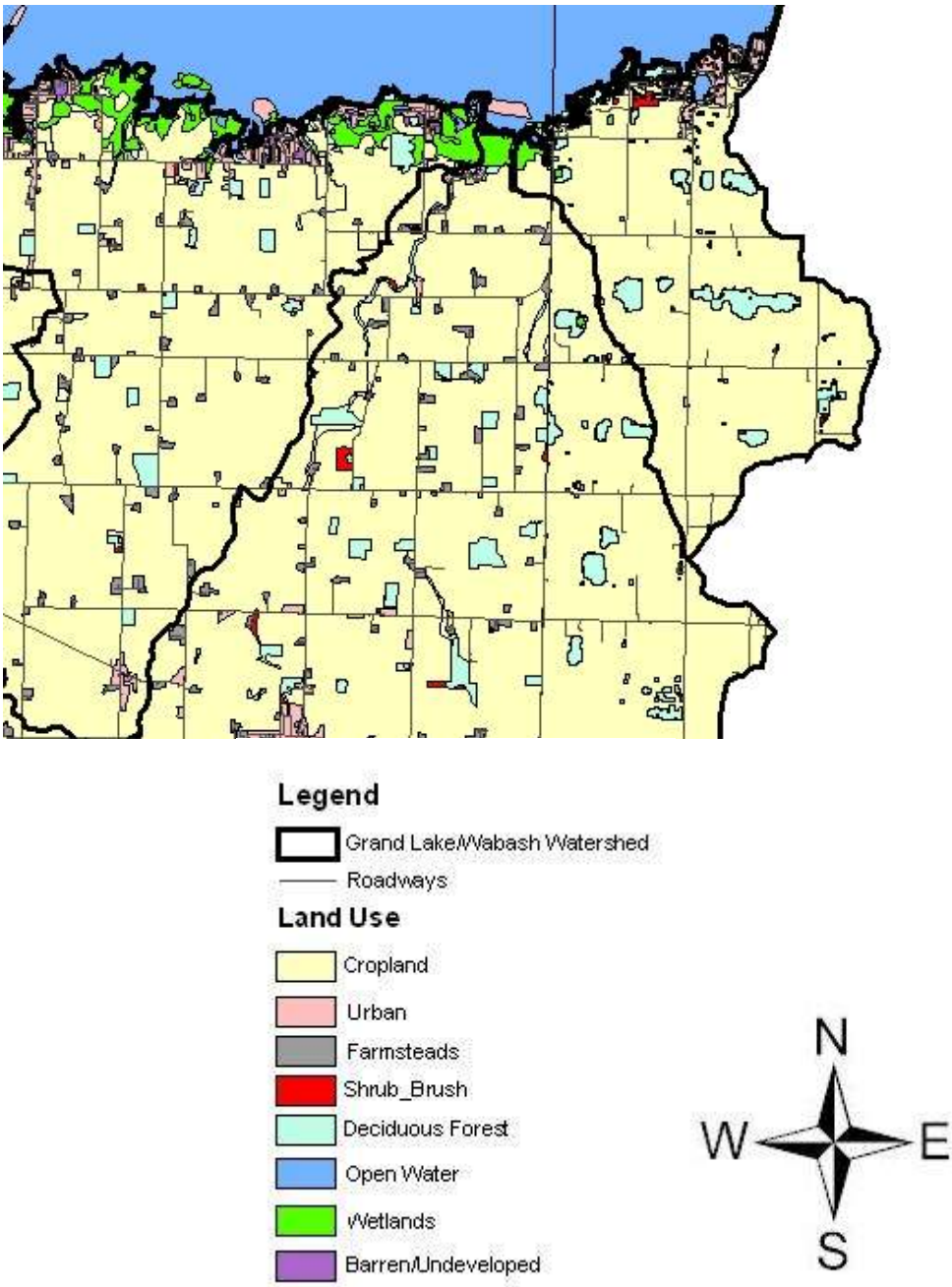
SCORE	Stream Miles with <10' Vegetation	Operations <1,000' to stream	Tons Raw Manure per Year	Lbs. P_2O_5 per Crop Acre	Household Disposal Systems in Groups	No. Homes Built pre-1973
10	72.00+	46+	180,000+	225+	90+	226+
9	64.00 - 71.99	41 - 45	160,000 - 179,999	200 - 224	80 - 89	201 -225
8	56.00 - 63.99	36 - 40	140,000 - 159,999	175 - 199	70 - 79	176 -200
7	48.00 - 55.99	31 - 35	120,000 - 139,999	150 - 174	60 - 69	151 - 175
6	40.00 - 47.99	26 - 30	100,000 - 119,999	125 - 149	50 - 59	126 - 150
5	32.00 - 39.99	21 - 25	80,000 - 99,999	100 - 124	40 - 49	101 - 125
4	24.00 - 31.99	16 - 20	60,000 - 79,999	75- 99	30 - 39	76 - 100
3	16.00 - 23.99	11 - 15	40,000 - 59,999	50 - 74	20 - 29	51 - 75
2	8.00 - 15.99	6 - 10	20,000 - 39,999	25 - 49	10 - 19	26 - 50
1	0.00 - 7.99	0 - 5	0 - 19,999	0 - 24	0 - 10	0 - 25

MINIMUM DRAINAGE UNIT SCORE = 6 (Lowest Pollution Potential)

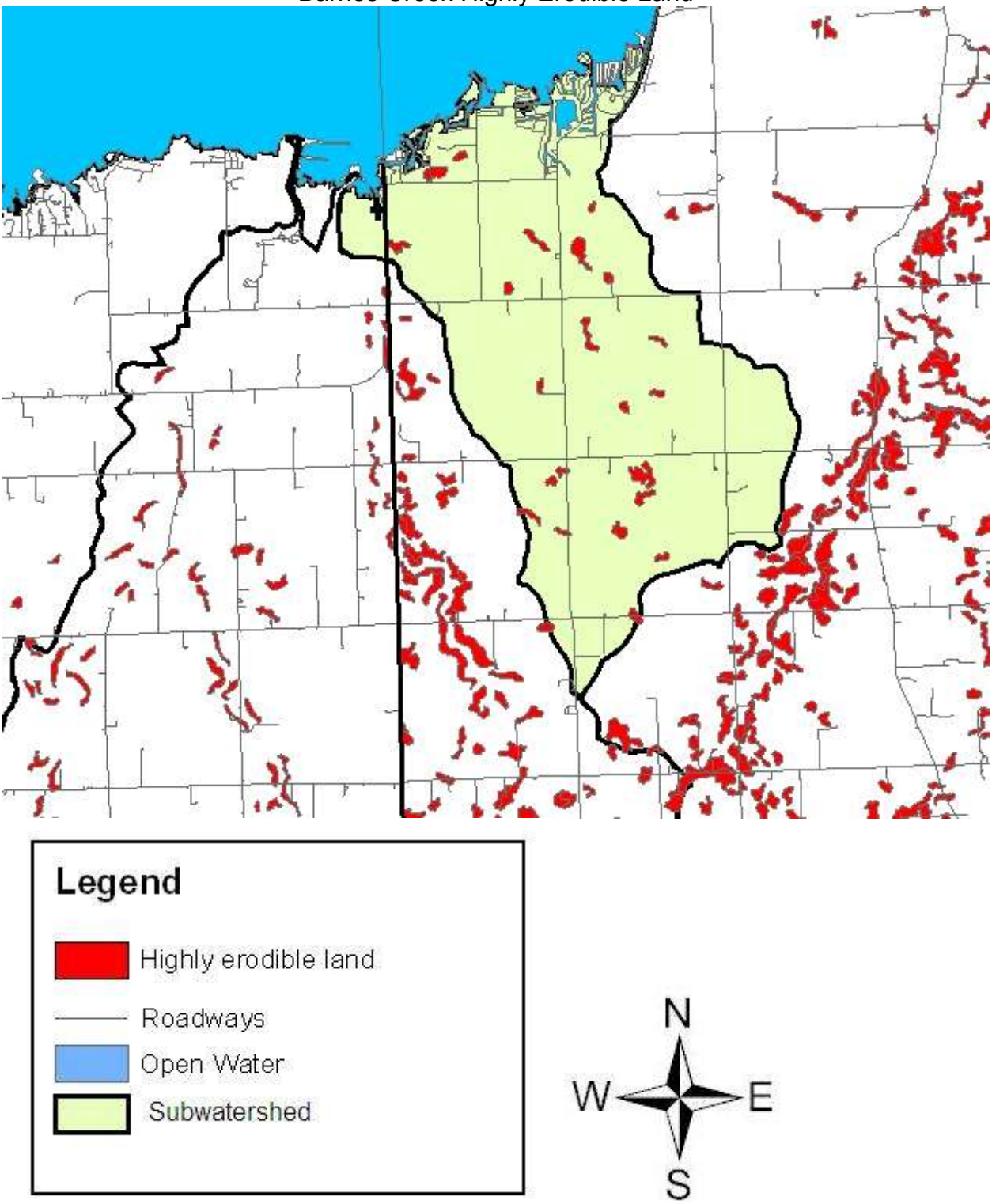
TABLE 47
NPS Pollution Potential

BARNES CREEK							
SUBWATERSHED ATTRIBUTE	Stream Miles with <10' Vegetation SCORE	Operations <1,000' to stream SCORE	Tons Raw Manure per Year SCORE	Lbs. P_2O_5 per Crop Acre SCORE	Household Disposal Systems in Groups SCORE	No. Homes Built pre-1973 SCORE	TOTAL SCORE
	1	1	1	2	1	2	8

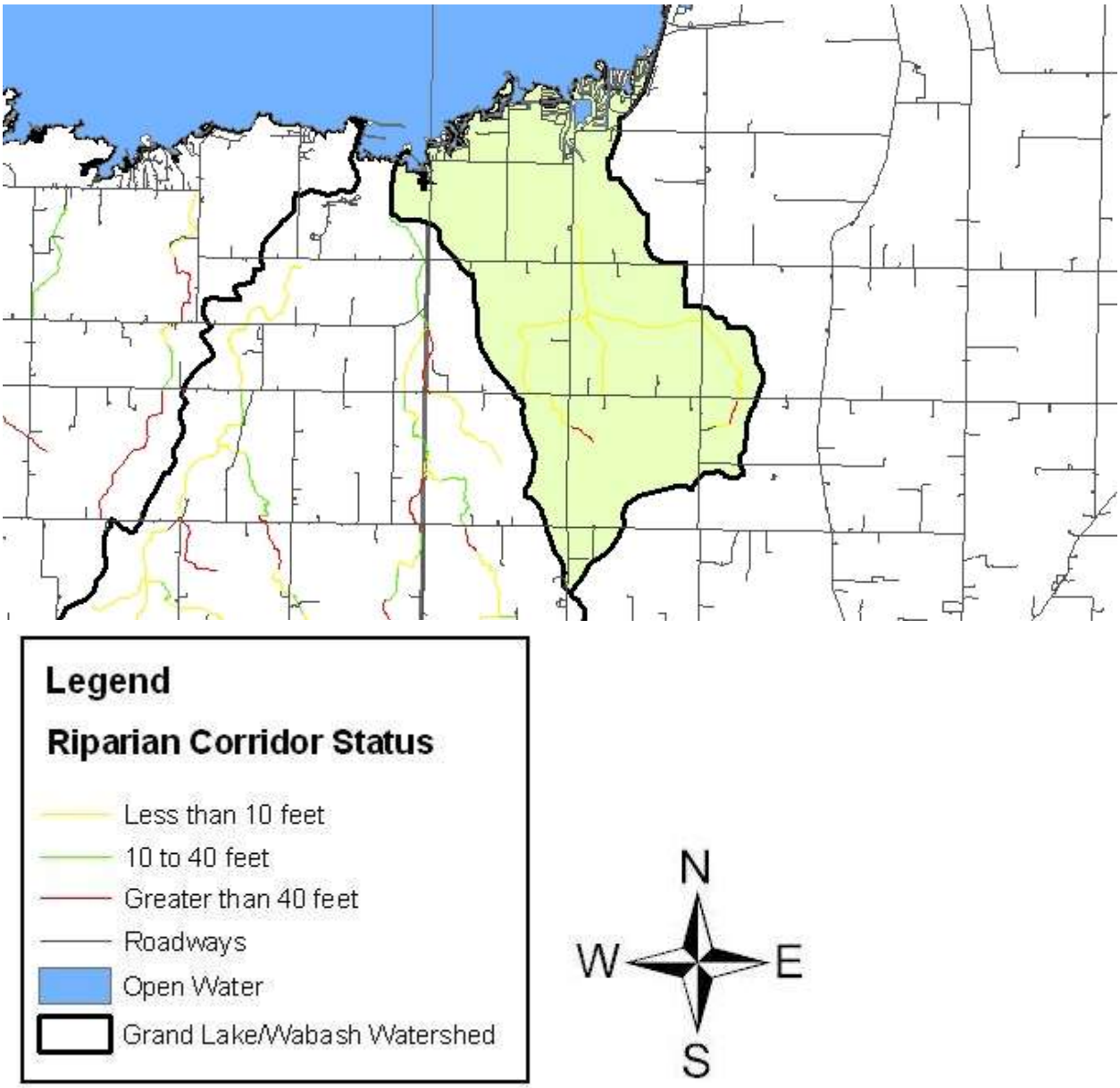
MAP 43
Barnes Creek Land Use



MAP 44
Barnes Creek Highly Erodible Land



MAP 45
Barnes Creek Riparian Corridor Status



4.1.7 North Lake Shore

The North Shore subwatershed drains the entire northern portion of the Grand Lake St. Marys drainage basin. The majority of the subwatershed is located in Mercer County, and the remainder is located in Auglaize County. The acres, square miles, and percent of subwatershed are shown below. The North Shore subwatershed, according to percentages, is the smallest subwatershed draining to Grand Lake St. Marys. Of the entire Grand/Lake Wabash Watershed, it is the fourteenth largest of fifteen subwatersheds.

TABLE 48

NORTH LAKE SHORE	
Acreage	3,486
Square Miles	5.45
% of Grand Lake Watershed Total Land Area	5.9%
% of Grand Lake/Wabash Watershed Total Land Area	1.9%

Water Quality Status

The North Shore subwatershed has been identified as a warm water habitat (WWH). Specific sampling in the North Shore subwatershed has not been completed, but this aquatic life use designation has been inferred from information established by Ohio EPA stating that the entire watershed does not meet its use designation, or is in a "non-attainment" status. It is further assumed that the North Shore subwatershed is NPS impacted. Suspected or proven impacts to these streams include: non-irrigated crop production, animal feeding operations, channelization, removal of riparian vegetation and stream bank destabilization. Definitions and criteria for these descriptives can be found in Appendix C- Aquatic life use designations and assessment terms.

Ohio EPA is currently completing a TMDL report for Beaver Creek and Grand Lake St. Marys, which is in process of being finalized. The draft report does not call for specific load reductions in the North Shore subwatershed; however, it does call for load reductions of phosphorus, nitrate and fecal coliform in the surrounding subwatersheds. Detailed information on the sampling results and recommended load reductions can be found in the draft report of the 2007 Ohio EPA TMDL report, which can be obtained by contacting the watershed project office.

Water Supplies and Discharges

There are two community water supplies are located in the North Shore area; the City of St Marys and Northwood Homeowners Association. Regarding the transient non-

community water supplies, five are present; Northmoor Landings, Carter Lumber Co., Grand Slam, Lake Drive In, and the Northmoor Golf LLC.

There is one regulated discharger is located on the North Shore, the Northwood Sanitary Sewer Subdistrict WWTP and three non-regulated dischargers; the Idlewild Subdivision, Kozy Marina-Northmoor Mobile Home Park, and the Chakeres Lake Drive In Theatre. Ohio EPA has also issued an indirect discharge permit to Celina Aluminum Precision Technology, Inc and Qualitec Metal Finishers.

Based on recent aerial photographs, areas where 10 or more household wastewater treatment and disposal systems were present in close proximity were identified. As with any individual treatment system operating in an area with poorly drained soils, the effects of the effluent on the receiving water body is a concern. These effects grow as the number of systems in a given area increases, thus clusters or groups of 10 or more systems has been used to analyze the potential effects of those systems on the water quality. Regarding the North Shore subwatershed, no clusters were identified.

Highly Erodible Land

Map 45 at the end of this subsection illustrates the highly erodible land locations within the North Lake Shore subwatershed. Of the seven subwatersheds within the Grand Lake St. Marys watershed, North Lake Shore ranks fourth highest in the amount of highly erodible land present within the subwatershed. The highly erodible land information was developed from the 2003 online NRCS Soil Data Mart.

Riparian Corridor Status

The chart on the following page shows the riparian corridor status for the North Shore subwatershed. The chart indicates the number of miles of each drainage unit that has various widths of tree canopy, or riparian corridor. The numbers account for both sides of the streams; therefore, the number of actual stream miles is half of that shown. The divisions are less than 10 feet in total width, 10 to 40 feet in total width, and greater than 40 feet in total width. The chart is also divided into perennial and intermittent streams under each of the corridor width column headings. MAP 46 illustrates the stream sections under each division.

The chart shows that with a total of 1.48 miles of stream network, the North Shore subwatershed has 0.91 miles of stream with less than 10 feet of canopy and vegetation, zero miles of stream with 10 to 40 feet canopy and vegetation, and 0.57 miles of stream with greater than 40 feet of canopy and vegetation. The North Shore subwatershed has the lowest number of stream miles within the Grand Lake St. Marys Watershed, which is 1.1%. Of the entire Grand Lake/Wabash Watershed, this subwatershed has the lowest number of stream miles, which is 0.2%.

TABLE 49
Riparian Corridor Status

NORTH LAKE SHORE										
RIPARIAN STATUS	TREE CANOPY <10' IN TOTAL WIDTH			TREE CANOPY 10 to 40' IN WIDTH			TREE CANOPY >40' IN WIDTH			TOTAL STREAM MILES
	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	
	0.00	0.91	0.91	0.00	0.00	0.00	0.00	0.57	0.57	1.48
% of Subwatershed Total	0.0%	2.2%	2.2%	0.0%	0.0%	0.0%	0.0%	1.4%	1.4%	3.6%
% of Grand Lake Watershed Total	0.0%	0.6%	0.6%	0.0%	0.0%	0.0%	0.0%	0.4%	0.4%	1.1%
% of Grand Lake/Wabash Watershed Total	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.2%

Operations and Animal Units

The table on the following page shows the number of operations and the animal units by species for the North Shore subwatershed. According to the table, there are no poultry operations, one dairy operation, no hog operations and one beef operation within the entire subwatershed. The North Shore subwatershed ranks last within the entire Grand Lake/Wabash River Watershed when considering the total number of operations with two or 0.2%. Animal units within the subwatershed ranks last of 15 with 0.04%.

Totals of animal units for each species are also listed on the table. The inventory for this subwatershed was completed during March of 2007. At the time of the inventory animal units were determined by the number of animals present. Although this is not a 1:1 ratio for all species, it is for beef cattle. The following chart shows the number of each type of animal that makes up 1,000 animal units.

Animal Type	1,000 Animal Unit Equivalent
Beef Cattle	1,000
Dairy Cattle	700
Hogs (over 55 lbs)	2,500
Turkeys	55,000
Layer Chickens	82,000
Pullet Chickens	125,000
Sheep	10,000
Horses	500

TABLE 50
Operations and Animal Units

NORTH LAKE SHORE														
ANIMAL TYPE	POULTRY		DAIRY		HOG		BEEF		OTHER		TOTAL		Total as % of Grand Lake Watershed	
	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s
# Farms and Animals	0 (Trky)	0 0	1	93	0	0	1	35	(sheep) (hrs)	0 0	2	128	0.7%	0.1%
% of subwatershed total	0.0%	0.0%	50.0%	72.6%	0.0%	0.0%	50.0%	27.4%	0.0%	0.0%	100.0%	100.0%		
Total as % of Grand Lake Watershed	0.0%	0.0%	0.3%	0.1%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.7%	0.1%		
Total as % of Grand Lake/Wabash Watershed	0.00%	0.00%	0.10%	0.03%	0.00%	0.00%	0.10%	0.01%	0.00%	0.00%	0.20%	0.04%		

Manure Production

After considering the number of livestock operations and animal units present in the watershed, it is only fitting to consider the by-products of these animals. The table on the opposite page is used to represent the manure and nutrient production for the North Shore drainage area. The North Shore subwatershed ranks last overall, of 15, in terms of manure production per annum. Approximately 1,750 tons of manure is produced annually. The remainder of the columns on the table indicates the approximate pounds of nutrients contained in that manure. Nitrogen, potassium, and phosphate, are all important to the agricultural community and are provided to the crops via manure or commercial fertilizer applications.

These nutrients are also important in regards to water quality. According to the table, in the North Shore subwatershed, the amount of phosphorus that is contained in the manure produced annually would need to be applied at eight pounds per acre. The table below indicates the average crop removal rates for phosphorus for the major crops produced in the watershed. Values were obtained from the Ohio Agronomy Guide.

CROP	**P_2O_5 REMOVAL (lb/ac)**
Alfalfa (6T)	80
Corn (150 bu) Grain	55
Corn (25 T) Silage	80
Soybean (50 bu)	40
Wheat (75 bu) Grain	48

Considerations are given to the nutrient phosphorus due to its importance to crop production and the problems associated with the relationship between excessive phosphorus applications and degradation of water quality.

TABLE 51
Manure and Nutrient Production

NORTH LAKE SHORE						
Manure Production	Tons Raw Manure/Year	Lbs. N per Year	Lbs. K_2O per Year	Lbs. P_2O_5 per Year	Acres Cropland	Lbs. P_2O_5 per Crop Acre
	1,750	18,001	14,441	8,831	1,176	8
Less 70% Poultry Manure**	1,750	18,001	14,441	8,831	1,176	8
Approximate $ Value Per Year		$3,960	$2,166	$1,766		
Total Nutrient Value Per Year =	$7,892					

**There is no poultry in the North Lake Shore subwatershed.

The dollar values associated with each nutrient were obtained from OSU Extension Bulletin 604-06, "Ohio Livestock Manure Management Guide." The value for nitrogen is estimated at $0.22 per pound, the value for P_2O_5 is $0.20 per pound and the value for K_2O is $0.15 per pound.

Distance Between Livestock Operations and Streams

The table on the following page shows the distance between various livestock operations located in the North Shore subwatershed. It can be assumed that the greater the distance between a livestock operation and a water system, the potential of pollution from the operation reaching the stream is lessened.

Of notable interest is the number of all livestock operations located less than 1,000 feet from the waterbody. In this particular subwatershed, out of two operations, both are less than 3,000 feet from the nearest stream.

TABLE 52

Livestock Operations and Proximity to Streams

NORTH LAKE SHORE																		
ANIMAL TYPE	POULTRY			DAIRY			HOG			BEEF			OTHER			TOTAL		
	Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream		
	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'
	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	2
% of Subwatershed Total	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%

Non-Point Source Pollution Potential

In order to provide a comparison of the pollution potential of each of the 15 subwatersheds, a ranking system for each of the main potential pollution sources was developed. These potential sources are stream miles with less than 10 feet of vegetation, the number of livestock or poultry operations less than 1,000 feet from a stream, the tons of raw manure produced yearly, the pounds of phosphorus per cropland acre available from the manure, the number of household wastewater disposal systems contained in clusters of ten or more) and the number of homes built pre-1973. Values of 1(less potential) to 10 (great potential) were given based on ranges shown in the table of the following page. Indicator scores are then summed to obtain a total pollution potential score for the subwatershed.

Subwatershed pollution potential scores can range from a maximum of 60 points to a minimum of six points. The North Shore subwatershed ranks last out of 15, with 11.7% of the maximum points for pollution potential.

NONPOINT SOURCE POLLUTION POTENTIAL SCORING MATRIX

MAXIMUM DRAINAGE UNIT SCORE = 60 (Highest Pollution Potential)

SCORE	Stream Miles with <10' Vegetation	Operations <1,000' to stream	Tons Raw Manure per Year	Lbs. P_2O_5 per Crop Acre	Household Disposal Systems in Groups	No. Homes Built pre-1973
10	72.00+	46+	180,000+	225+	90+	226+
9	64.00 - 71.99	41 - 45	160,000 - 179,999	200 - 224	80 - 89	201 -225
8	56.00 - 63.99	36 - 40	140,000 - 159,999	175 - 199	70 - 79	176 -200
7	48.00 - 55.99	31 - 35	120,000 - 139,999	150 - 174	60 - 69	151 - 175
6	40.00 - 47.99	26 - 30	100,000 - 119,999	125 - 149	50 - 59	126 - 150
5	32.00 - 39.99	21 - 25	80,000 - 99,999	100 - 124	40 - 49	101 - 125
4	24.00 - 31.99	16 - 20	60,000 - 79,999	75- 99	30 - 39	76 - 100
3	16.00 - 23.99	11 - 15	40,000 - 59,999	50 - 74	20 - 29	51 - 75
2	8.00 - 15.99	6 - 10	20,000 - 39,999	25 - 49	10 - 19	26 - 50
1	0.00 - 7.99	0 - 5	0 - 19,999	0 - 24	0 - 10	0 - 25

MINIMUM DRAINAGE UNIT SCORE = 6 (Lowest Pollution Potential)

TABLE 53
NPS Pollution Potential

NORTH LAKE SHORE							
SUBWATERSHED ATTRIBUTE	Stream Miles with <10' Vegetation SCORE	Operations <1,000' to stream SCORE	Tons Raw Manure per Year SCORE	Lbs. P_2O_5 per Crop Acre SCORE	Household Disposal Systems in Groups SCORE	No. Homes Built pre-1973 SCORE	TOTAL SCORE
	1	1	1	1	1	2	7

MAP 46
North Shore Land Use

Legend

Grand Lake/Wabash Watershed

Roadways

Land Use

Cropland

Urban

Farmsteads

Shrub_Brush

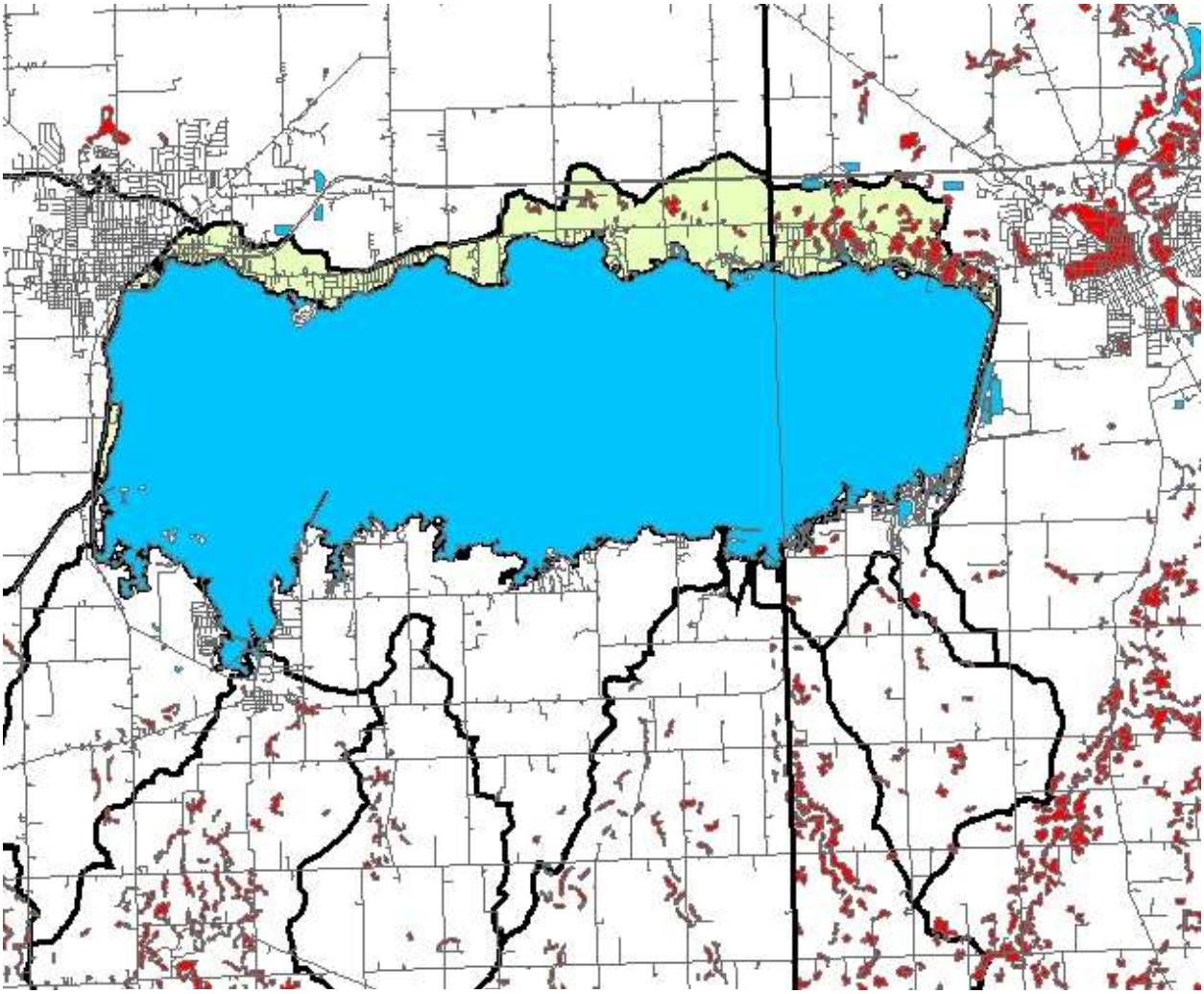
Deciduous Forest

Open Water

Wetlands

Barren/Undeveloped

MAP 47
North Shore Highly Erodible Land



Legend

- Highly erodible land
- Roadways
- Open Water
- Subwatershed

N
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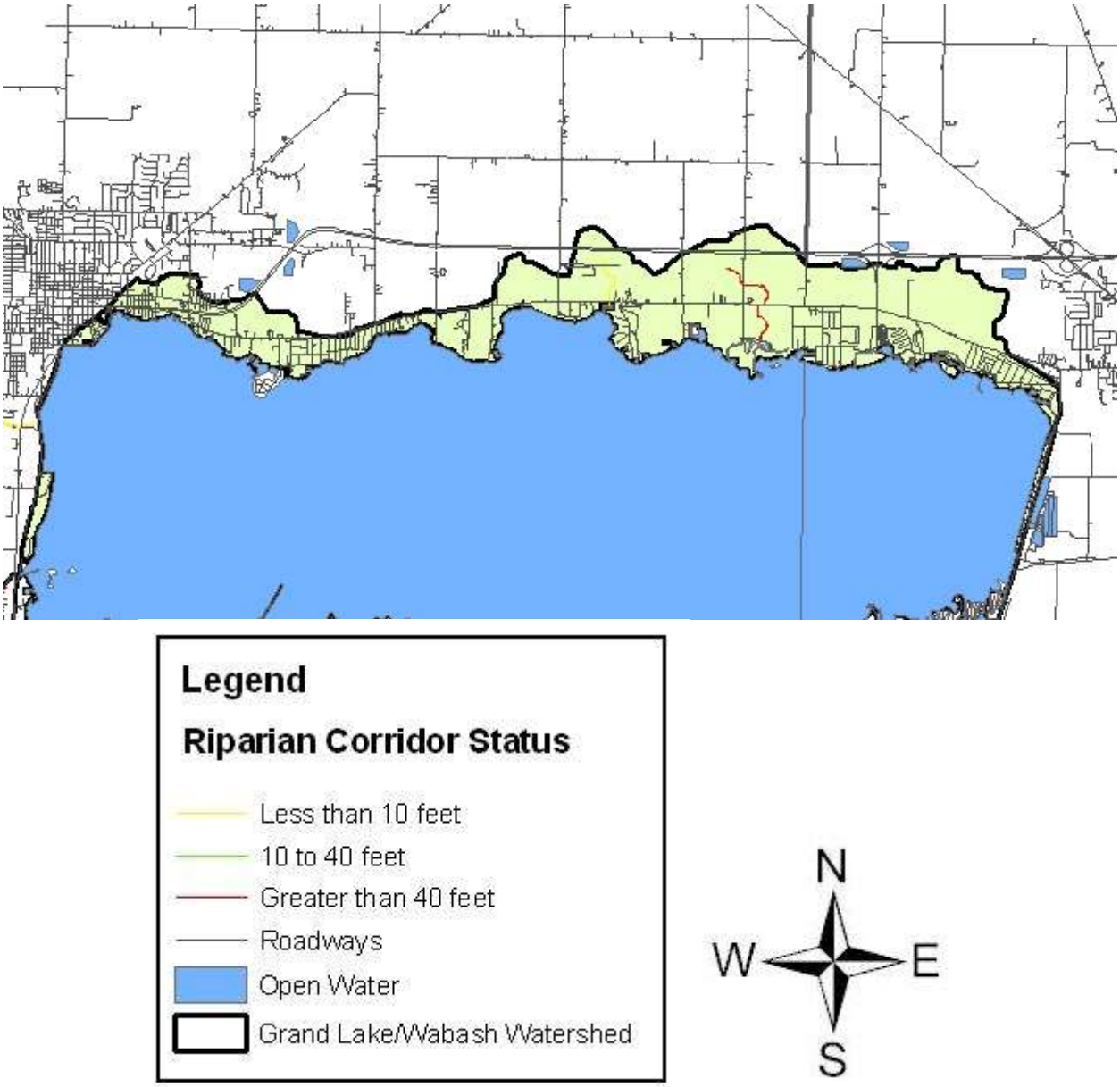
MAP 48
North Shore Riparian Corridor Status



4.2 Wabash River Subwatersheds

4.2.1 Wabash River Headwaters to below Bear Creek

The Wabash River Headwaters to below Bear Creek subwatershed drains a southern portion of the Wabash watershed and the area that drains to Bear Creek. The majority of the subwatershed is located in Darke County, and the remainder is located in Mercer County. The acres, square miles, and percent of subwatershed are shown below. The Wabash River Headwaters to below Bear Creek subwatershed, according to percentages, is the third largest of the eight subwatersheds draining to the Wabash River. Of the entire Grand/Lake Wabash Watershed, it is the third largest of fifteen subwatersheds.

TABLE 54

WABASH RIVER HEADWATERS TO BELOW BEAR CREEK	
Acreage	20,190
Square Miles	31.55
% of Wabash Watershed Total Land Area	16.7%
% of Grand Lake/Wabash Watershed Total Land Area	11.2%

Water Quality Status

The Wabash River Headwaters to below Bear Creek has been designated as a warm water habitat (WWH). This aquatic life use designation has been established by Ohio EPA, and based on recent data sampling, the water resource is shown as not meeting that use designation, or in a “non-attainment” status. Furthermore, the subwatershed is shown as NPS impacted. Suspected or proven impacts to these streams include: Agriculture-crop production, confined animal feeding operations, on-site wastewater treatment systems, channelization, removal of riparian vegetation and streambank destabilization. Definitions and criteria for these descriptives can be found in Appendix C aquatic life use designations and assessment terms.

A TMDL report for the Wabash River watershed was finalized by US EPA in August of 2004. The report showed that on average, all samples collected in this subwatershed were over the recommended total phosphorus level of 0.17 mg/L. On average, 50% of the samples were over the recommended nitrate-nitrite level of 1.5 mg/L, and 67% of the samples were over the recommended total suspended solids level of 32 mg/L.

Water Supplies and Discharges

There are no community water supplies within the Wabash Headwaters to below Bear Creek subwatershed, no Ohio EPA regulated point source discharge, no non-transient non-community water supplies, no transient non-community water supplies and no Ohio EPA regulated point source discharges.

Based on recent aerial photographs, areas where 10 or more household wastewater treatment and disposal systems were present in close proximity was determined. As with any individual treatment system operating in an area with poorly drained soils, the effects of the effluent on the receiving water body is a concern. These effects grow as the number of systems in a given area increases, thus clusters or groups of 10 or more systems has been used to analyze the potential effects of those systems on the water quality. Regarding the Wabash River Headwaters to below Bear Creek subwatershed, there were a total of two clusters identified comprised of 21 individual treatment systems.

Highly Erodible Land

Map 48 at the end of this subsection illustrates the highly erodible land locations within the Wabash River Headwaters to below Bear Creek subwatershed. Of the eight subwatersheds within the Wabash River watershed, Wabash River Headwaters to below Bear Creek ranks seventh in the amount of highly erodible land present within the subwatershed. The highly erodible land information was developed from the 2003 online NRCS Soil Data Mart.

Riparian Corridor Status

The chart on the following page shows the riparian corridor status for the Wabash River Headwaters to below Bear Creek subwatershed. The chart indicates the number of miles that has various widths of tree canopy, or riparian corridor. The numbers account for both sides of the streams; therefore, the number of actual stream miles is half of that shown. The divisions are less than 10 feet in total width, 10 feet to 40 feet in total width, and greater than 40 feet in total width. The chart is also divided into perennial and intermittent streams under each of the corridor width column headings. MAP 49 illustrates the stream sections under each division.

The chart shows that with a total of 108.56 miles of stream network, the Wabash River Headwaters to below Bear Creek subwatershed has 86.54 miles of stream with less than 10 feet of canopy and vegetation, 5.18 miles of stream with 10 feet to 40 feet canopy and vegetation, and 16.84 miles of stream with greater than 40 feet of canopy and vegetation. Overall, the Wabash River Headwaters to below Bear Creek subwatershed has the second highest number of stream miles within the Wabash River Watershed, which is 19.2%. Of the entire Grand Lake/Wabash Watershed, this subwatershed has the second highest number of stream miles, which is 15.4%.

TABLE 55

Riparian Corridor Status

WABASH RIVER HEADWATERS TO BELOW BEAR CREEK										
RIPARIAN STATUS	TREE CANOPY <10' IN TOTAL WIDTH			TREE CANOPY 10 to 40' IN WIDTH			TREE CANOPY >40' IN WIDTH			TOTAL STREAM MILES
	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	
	25.55	60.99	86.54	2.39	2.79	5.18	5.21	11.63	16.84	108.56
% of Subwatershed Total	23.5%	56.2%	79.7%	2.2%	2.6%	4.8%	4.8%	10.7%	15.5%	100.0%
% of Wabash Watershed Total	4.5%	10.8%	15.3%	0.4%	0.5%	0.9%	0.9%	2.1%	3.0%	19.2%
% of Grand Lake/Wabash Watershed Total	3.6%	8.6%	12.3%	0.3%	0.4%	0.7%	0.7%	1.6%	2.4%	15.4%

Operations and Animal Units

The table on the following page shows the number of operations and the animal units by species for the Wabash River Headwaters to below Bear Creek subwatershed. According to the table, there are 23 poultry operations, 20 dairy operations, 19 hog operations, 27 beef operations and four horse and sheep operations within the entire subwatershed. The Wabash River Headwaters to below Bear Creek subwatershed ranks third within the entire Grand Lake/Wabash River Watershed when considering the total number of operations with 93 or 9.4%. Animal units within the subwatershed ranks second of 15 with 18.0%.

Totals of animal units for each species are also listed on the table. The inventory for this subwatershed was completed during November of 2006. At the time of the inventory animal units were determined by the number of animals present. Although this is not a 1:1 ratio for all species, it is for beef cattle. The following chart shows the number of each type of animal that makes up 1,000 animal units.

Animal Type	1,000 Animal Unit Equivalent
Beef Cattle	1,000
Dairy Cattle	700
Hogs (over 55 lbs)	2,500
Turkeys	55,000
Layer Chickens	82,000
Pullet Chickens	125,000
Sheep	10,000
Horses	500

Table 56
Operations and Animal Units

WABASH HEADWATERS TO BELOW BEAR CREEK														
ANIMAL TYPE	POULTRY		DAIRY		HOG		BEEF		OTHER		TOTAL		Total as % of Wabash Watershed	
# Farms and Animals	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s
	13 (Trky) 10	42,509 2,945	20	3,493	19	10,408	27	2,020	(sheep) 1 (hrs) 3	0.5 20	93	61,395	13.5%	26.0%
% of subwatershed total	24.7%	74.0%	21.5%	5.7%	20.4%	17.0%	29.0%	3.3%	4.3%	0.0%	100.0%	100.0%		
Total as % of Wabash Watershed	3.3%	19.2%	2.9%	1.5%	2.7%	4.4%	3.9%	0.9%	0.6%	0.0%	13.5%	26.0%		
Total as % of Grand Lake/Wabash Watershed	2.33%	13.30%	2.02%	1.02%	1.92%	3.05%	2.73%	0.59%	0.40%	0.01%	9.40%	17.97%		

Manure Production

After considering the number of livestock operations and animal units present in the subwatershed, it is only fitting to consider the by-products of these animals. The table on the opposite page is used to represent the manure and nutrient production for the Wabash River Headwaters to below Bear Creek drainage area. The subwatershed ranks second overall, of 15, in terms of manure production per annum. Approximately 283,025 tons of manure is produced annually. The remainder of the columns on the table indicates the approximate pounds of nutrients contained in that manure. Nitrogen, potassium, and phosphate, are all important to the agricultural community and are provided to the crops via manure or commercial fertilizer applications.

These nutrients are also important in regards to water quality. According to the table, in the Wabash River Headwaters to below Bear Creek subwatershed, the amount of phosphorus that is contained in the manure produced annually would need to be applied at 242 pounds per acre. The table below indicates the average crop removal rates for phosphorus for the major crops produced in the watershed. Values were obtained from the Ohio Agronomy Guide.

CROP	P_2O_5 REMOVAL (lb/ac)
Alfalfa (6T)	80
Corn (150 bu) Grain	55
Corn (25 T) Silage	80
Soybean (50 bu)	40
Wheat (75 bu) Grain	48

Considerations are given to the nutrient phosphorus due to its importance to crop production and the problems associated with the relationship between excessive phosphorus applications and degradation of water quality. Because much of the poultry manure is brokered out of the watershed, it seemed important to reflect the nutrient values assuming that 70% of the poultry manure is moved to locations outside the watershed. Local manure haulers estimated this value to be 90%; however, to be conservative, 70% was assumed for this plan. Under this assumption, the amount of phosphorus that is contained in the manure produced annually in this subwatershed would need to be applied at 106 pounds per acre.

What this seems to indicate throughout the watershed is that according to manure production and crop removal rates for limiting nutrient factors, there are not enough acres for proper manure application methods. The caveat on this statement is that the numbers are best estimates, variations in soil types and tilth can vary throughout the fields which may increase, or decrease, crop removal rates, and more importantly, some of the manure produced in each of the subwatersheds may be applied to acreages outside of that subwatershed, or even outside of the Grand Lake/Wabash watershed. It should be noted that several producers own or rent land both in the Grand Lake/Wabash watershed and in neighboring watersheds such as Loramie Creek or the St Marys River.

Table 57
Manure and Nutrient Production

WABASH HEADWATERS TO BELOW BEAR CREEK						
Manure Production	Tons Raw Manure/Year	Lbs. N per Year	Lbs. K_2O per Year	Lbs. P_2O_5 per Year	Acres Cropland	Lbs. P_2O_5 per Crop Acre
	283,025	5,856,410	3,359,027	4,543,160	18,756	242
Less 70% Poultry Manure**	168,975	2,741,516	1,791,105	1,992,375	18,756	106
Approximate $ Value Per Year		$1,288,410	$503,854	$908,632		
Total Nutrient Value Per Year =	$2,700,896					

**Based on conversations with poultry manure brokers, it was estimated that at least 70% of the poultry manure is brokered out of the watershed.

The dollar values associated with each nutrient were obtained from OSU Extension Bulletin 604-06, "Ohio Livestock Manure Management Guide." The value for nitrogen is estimated at $0.22 per pound, the value for P_2O_5 is $0.20 per pound and the value for K_2O is $0.15 per pound.

Distance Between Livestock Operations and Streams

The table on the following page shows the distance between various livestock operations located in the Wabash River Headwaters to below Bear Creek subwatershed and the waterways that drain to the Wabash River. It can be assumed that the greater the distance between a livestock operation and a water system, the potential of pollution from the operation reaching the stream is lessened.

Of notable interest is the number of all livestock operations located less than 1,000 feet from the waterbody. In this particular subwatershed, out of 93 operations, 43 operations, or 46.2%, fall into the category. Also, 32 operations, 34.4%, are in within 2,000 feet and the remaining 19.4%, 18 operations, are less than 3,000 feet from the nearest stream.

Table 58
Livestock Operations and Proximity to Streams

WABASH RIVER HEADWATERS TO BELOW BEAR CREEK																		
ANIMAL TYPE	POULTRY			DAIRY			HOG			BEEF			OTHER			TOTAL		
	Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream		
	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'
	16	5	2	8	8	4	8	4	7	9	14	4	2	1	1	43	32	18
% of Subwatershed Total	17.2%	5.4%	2.2%	8.6%	8.6%	4.3%	8.6%	4.3%	7.5%	9.7%	15.1%	4.3%	2.2%	1.1%	1.1%	46.2%	34.4%	19.4%

Non-Point Source Pollution Potential

In order to provide a comparison of the pollution potential of each of the 15 subwatersheds, a ranking system for each of the main potential pollution sources was developed. These potential sources are stream miles with less than 10 feet of vegetation, the number of livestock or poultry operations less than 1,000 feet from a stream, the tons of raw manure produced yearly, the pounds of phosphorus per cropland acre available from the manure, the number of household wastewater disposal systems contained in clusters of ten or more) and the number of homes built pre-1973. Values of 1(less potential) to 10 (great potential) were given based on ranges shown in the table of the following page. Indicator scores are then summed to obtain a total pollution potential score for the subwatershed.

Subwatershed pollution potential scores can range from a maximum of 60 points to a minimum of six points. The Wabash River Headwaters to below Bear Creek subwatershed ranks of third (tie) out of 15, with 73.3% of the maximum points for pollution potential. Most significantly for the subwatershed is the number of stream miles with less than 10 feet of vegetation on the streambanks and the tonnage of raw manure generated per year. Wabash River Headwaters to below Bear Creek subwatershed scored the maximum points for both indicators and scored the second highest amount of points for the number of operations within 1,000 feet of streams.

NONPOINT SOURCE POLLUTION POTENTIAL SCORING MATRIX

MAXIMUM DRAINAGE UNIT SCORE = 60 (Highest Pollution Potential)

SCORE	Stream Miles with <10' Vegetation	Operations <1,000' to stream	Tons Raw Manure per Year	Lbs. P_2O_5 per Crop Acre	Household Disposal Systems in Groups	No. Homes Built pre-1973
10	72.00+	46+	180,000+	225+	90+	226+
9	64.00 - 71.99	41 - 45	160,000 - 179,999	200 - 224	80 - 89	201 -225
8	56.00 - 63.99	36 - 40	140,000 - 159,999	175 - 199	70 - 79	176 -200
7	48.00 - 55.99	31 - 35	120,000 - 139,999	150 - 174	60 - 69	151 - 175
6	40.00 - 47.99	26 - 30	100,000 - 119,999	125 - 149	50 - 59	126 - 150
5	32.00 - 39.99	21 - 25	80,000 - 99,999	100 - 124	40 - 49	101 - 125
4	24.00 - 31.99	16 - 20	60,000 - 79,999	75- 99	30 - 39	76 - 100
3	16.00 - 23.99	11 - 15	40,000 - 59,999	50 - 74	20 - 29	51 - 75
2	8.00 - 15.99	6 - 10	20,000 - 39,999	25 - 49	10 - 19	26 - 50
1	0.00 - 7.99	0 - 5	0 - 19,999	0 - 24	0 - 10	0 - 25

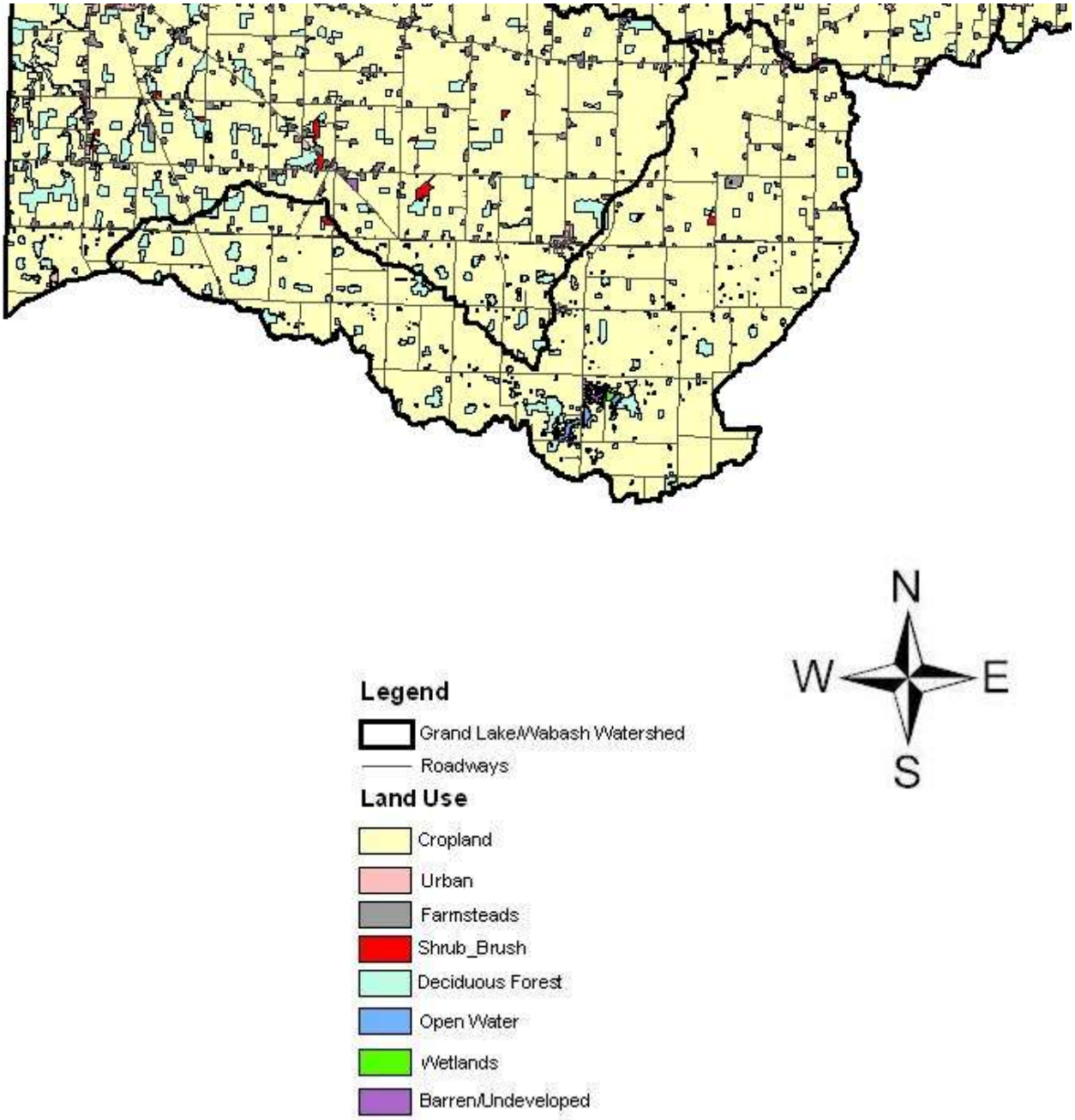
MINIMUM DRAINAGE UNIT SCORE = 6 (Lowest Pollution Potential)

TABLE 59
NPS Pollution Potential

WABASH HEADWATERS TO BELOW BEAR CREEK							
SUBWATERSHED ATTRIBUTE	Stream Miles with <10' Vegetation SCORE	Operations <1,000' to stream SCORE	Tons Raw Manure per Year SCORE	Lbs. P_2O_5 per Crop Acre SCORE	Household Disposal Systems in Groups SCORE	No. Homes Built pre-1973 SCORE	TOTAL SCORE
	10	9	10	5	3	7	44

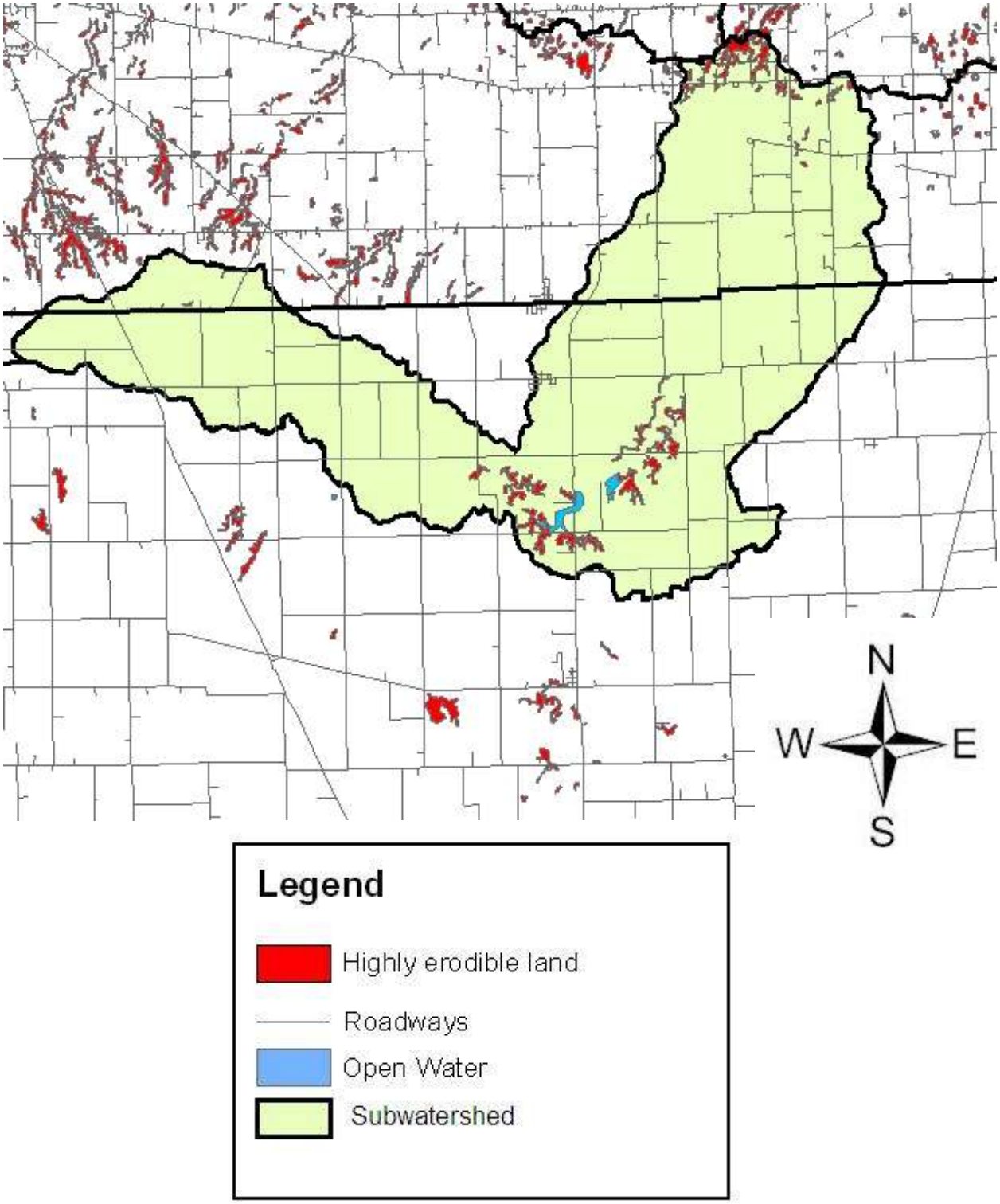
MAP 49

Wabash River Headwaters to below Bear Creek Land Use



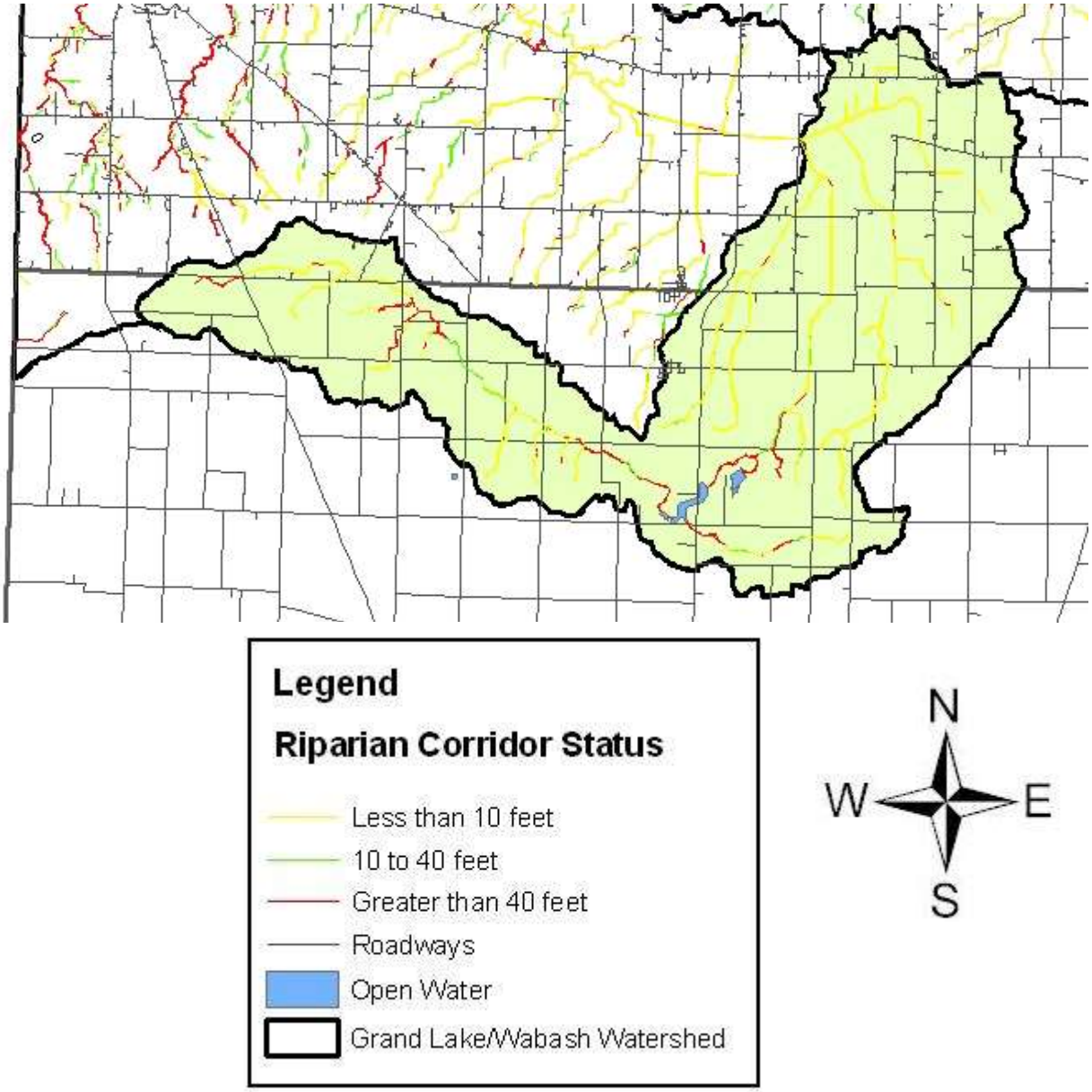
MAP 50

Wabash River Headwaters to below Bear Creek Highly Erodible Land



MAP 51

Wabash River Headwaters to below Bear Creek Riparian Corridor Status



4.2.2 Wabash River above Bear Creek below Stony Creek

The Wabash River above Bear Creek below Stony Creek subwatershed drains a large portion of southern side of the Wabash watershed. The majority of the subwatershed is located in Mercer County, and a small portion is located in Darke County. The acres, square miles, and percent of subwatershed are shown below. The Wabash River above Bear Creek below Stony Creek subwatershed, according to percentages, is the largest of the eight subwatersheds draining to the Wabash River. Of the entire Grand/Lake Wabash Watershed, it is the largest of fifteen subwatersheds.

TABLE 60

WABASH RIVER ABOVE BEAR CREEK BELOW STONY CREEK	
Acreage	33,347
Square Miles	52.10
% of Wabash Watershed Total Land Area	27.6%
% of Grand Lake/Wabash Watershed Total Land Area	18.6%

Water Quality Status

The Wabash River above Bear Creek below Stony Creek has been designated as a warm water habitat (WWH). This aquatic life use designation has been established by Ohio EPA, and based on recent data sampling, the water resource is shown as not meeting that use designation, or in a “non-attainment” status. Furthermore, the subwatershed is shown as NPS impacted. Suspected or proven impacts to these streams include: Agriculture-crop production, confined animal feeding operations, on-site wastewater treatment systems, channelization, removal of riparian vegetation and streambank destabilization. Definitions and criteria for these descriptives can be found in Appendix C aquatic life use designations and assessment terms.

A TMDL report for the Wabash River watershed was finalized by US EPA in August of 2004. The report showed that on average, all samples collected in this subwatershed were over the recommended total phosphorus level of 0.17 mg/L. On average, 33% of the samples were over the recommended nitrate-nitrite level of 1.5 mg/L, and 67% of the samples were over the recommended total suspended solids level of 32 mg/L.

Water Supplies and Discharges

There is one community water supply within the Wabash River above Bear Creek below Stony Creek subwatershed, the village of Fort Recovery. There are eight transient non-community water supplies, including; American Legion Post #345, Burkettsville Park PWS, Neil’s Restaurant & Bar, the Ranch Tavern, Saint Joe Store, VFW Post #6515 PWS, the Wagon Wheel Nite Club and Wendelin Tavern. Additionally, there is one non-transient, non-community water supply, Fort Recovery Industries.

Three Ohio EPA regulated point source discharges within this subwatershed include; Fort Recovery Industries, Inc., Fort Recovery WWTP and BP Amoco Oil Corporation.

Based on recent aerial photographs, areas where 10 or more household wastewater treatment and disposal systems were present in close proximity was determined. As with any individual treatment system operating in an area with poorly drained soils, the effects of the effluent on the receiving water body is a concern. These effects grow as the number of systems in a given area increases, thus clusters or groups of 10 or more systems has been used to analyze the potential effects of those systems on the water quality. Regarding the Wabash River above Bear Creek below Stony Creek subwatershed, there were a total of four clusters identified comprised of 52 individual treatment systems.

Highly Erodible Land

Map 51 at the end of this subsection illustrates the highly erodible land locations within the Wabash River above Bear Creek below Stony Creek subwatershed. Of the eight subwatersheds within the Wabash River watershed, Wabash River above Bear Creek below Stony Creek ranks first in the amount of highly erodible land present within the subwatershed. The highly erodible land information was developed from the 2003 online NRCS Soil Data Mart.

Riparian Corridor Status

The chart on the following page shows the riparian corridor status for the Wabash River above Bear Creek below Stony Creek subwatershed. The chart indicates the number of miles that has various widths of tree canopy, or riparian corridor. The numbers account for both sides of the streams; therefore, the number of actual stream miles is half of that shown. The divisions are less than 10 feet in total width, 10 feet to 40 feet in total width, and greater than 40 feet in total width. The chart is also divided into perennial and intermittent streams under each of the corridor width column headings. MAP 52 illustrates the stream sections under each division.

The chart shows that with a total of 181.63 miles of stream network, the Wabash River above Bear Creek below Stony Creek subwatershed has 98.36 miles of stream with less than 10 feet of canopy and vegetation, 33.09 miles of stream with 10 feet to 40 feet canopy and vegetation, and 50.18 miles of stream with greater than 40 feet of canopy and vegetation. Overall, the Wabash River above Bear Creek below Stony Creek subwatershed has the highest number of stream miles within the Wabash River Watershed, which is 32.2%. Of the entire Grand Lake/Wabash Watershed, this subwatershed has the highest number of stream miles, which is 25.8%.

TABLE 61

Riparian Corridor Status

WABASH RIVER ABOVE BEAR CREEK BELOW STONY CREEK SUBWATERSHED										
RIPARIAN STATUS	TREE CANOPY <10' IN TOTAL WIDTH			TREE CANOPY 10 to 40' IN WIDTH			TREE CANOPY >40' IN WIDTH			TOTAL STREAM MILES
	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	
	16.43	81.93	98.36	6.53	26.56	33.09	14.97	35.21	50.18	181.63
% of Subwatershed Total	9.0%	45.1%	54.2%	3.6%	14.6%	18.2%	8.2%	19.4%	27.6%	100.0%
% of Wabash Watershed Total	2.9%	14.5%	17.4%	1.2%	4.7%	5.9%	2.7%	6.2%	8.9%	32.2%
% of Grand Lake/Wabash Watershed Total	2.3%	11.6%	13.9%	0.9%	3.8%	4.7%	2.1%	5.0%	7.1%	25.8%

Operations and Animal Units

The table on the following page shows the number of operations and the animal units by species for the Wabash River above Bear Creek below Stony Creek subwatershed. According to the table, there are 98 poultry operations, 40 dairy operations, 43 hog operations, 58 beef operations and 11 horse and sheep operations within the entire subwatershed. The Wabash River above Bear Creek below Stony Creek subwatershed ranks first within the entire Grand Lake/Wabash River Watershed when considering the total number of operations with 250 or 25.3%. Animal units within the subwatershed ranks first of 15 with 29.9%.

Totals of animal units for each species are also listed on the table. The inventory for this subwatershed was completed during October and November of 2006. At the time of the inventory animal units were determined by the number of animals present. Although this is not a 1:1 ratio for all species, it is for beef cattle. The following chart shows the number of each type of animal that makes up 1,000 animal units.

Animal Type	1,000 Animal Unit Equivalent
Beef Cattle	1,000
Dairy Cattle	700
Hogs (over 55 lbs)	2,500
Turkeys	55,000
Layer Chickens	82,000
Pullet Chickens	125,000
Sheep	10,000
Horses	500

Table 62
Operations and Animal Units

WABASH RIVER ABOVE BEAR CREEK BELOW STONY CREEK														
ANIMAL TYPE	POULTRY		DAIRY		HOG		BEEF		OTHER		TOTAL		Total as % of Wabash Watershed	
# Farms and Animals	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s
	50 (Trky) 48	69,277 11,182	40	5,179	43	12,136	58	4,473	(sheep) 4 (hrs) 7	6 30	250	102,282	36.2%	43.2%
% of subwatershed total	39.2%	78.7%	16.0%	5.1%	17.2%	11.9%	23.2%	4.4%	4.4%	0.0%	100.0%	100.0%		
Total as % of Wabash Watershed	14.2%	34.0%	5.8%	2.2%	6.2%	5.1%	8.4%	1.9%	1.6%	0.0%	36.2%	43.2%		
Total as % of Grand Lake/Wabash Watershed	9.91%	23.55%	4.04%	1.52%	4.35%	3.55%	5.86%	1.31%	1.11%	0.01%	25.28%	29.93%		

Manure Production

After considering the number of livestock operations and animal units present in the subwatershed, it is only fitting to consider the by-products of these animals. The table on the opposite page is used to represent the manure and nutrient production for the Wabash River above Bear Creek below Stony Creek drainage area. The subwatershed ranks first overall, of 15, in terms of manure production per annum. Approximately 503,909 tons of manure is produced annually. The remainder of the columns on the table indicates the approximate pounds of nutrients contained in that manure. Nitrogen, potassium, and phosphate, are all important to the agricultural community and are provided to the crops via manure or commercial fertilizer applications.

These nutrients are also important in regards to water quality. According to the table, in the Wabash River above Bear Creek below Stony Creek subwatershed, the amount of phosphorus that is contained in the manure produced annually would need to be applied at 305 pounds per acre. The table below indicates the average crop removal rates for phosphorus for the major crops produced in the watershed. Values were obtained from the Ohio Agronomy Guide.

CROP	P_2O_5 REMOVAL (lb/ac)
Alfalfa (6T)	80
Corn (150 bu) Grain	55
Corn (25 T) Silage	80
Soybean (50 bu)	40
Wheat (75 bu) Grain	48

Considerations are given to the nutrient phosphorus due to its importance to crop production and the problems associated with the relationship between excessive phosphorus applications and degradation of water quality. Because much of the poultry manure is brokered out of the watershed, it seemed important to reflect the nutrient values assuming that 70% of the poultry manure is moved to locations outside the watershed. Local manure haulers estimated this value to be 90%; however, to be conservative, 70% was assumed for this plan. Under this assumption, the amount of phosphorus that is contained in the manure produced annually in this subwatershed would need to be applied at 124 pounds per acre.

What this seems to indicate throughout the watershed is that according to manure production and crop removal rates for limiting nutrient factors, there are not enough acres for proper manure application methods. The caveat on this statement is that the numbers are best estimates, variations in soil types and tilth can vary throughout the fields which may increase, or decrease, crop removal rates, and more importantly, some of the manure produced in each of the subwatersheds may be applied to acreages outside of that subwatershed, or even outside of the Grand Lake/Wabash watershed. It should be noted that several producers own or rent land both in the Grand Lake/Wabash watershed and in neighboring watersheds such as Loramie Creek or the St Marys River.

Table 63
Manure and Nutrient Production

WABASH RIVER ABOVE BEAR CREEK BELOW STONY CREEK						
Manure Production	Tons Raw Manure/Year	Lbs. N per Year	Lbs. K_2O per Year	Lbs. P_2O_5 per Year	Acres Cropland	Lbs. P_2O_5 per Crop Acre
	503,909	10,659,868	6,305,234	8,526,877	27,943	305
Less 70% Poultry Manure**	276,928	4,644,907	3,050,530	3,475,907	27,943	124
Approximate $ Value Per Year		$2,345,171	$945,785	$1,705,375		
Total Nutrient Value Per Year = $4,996,332						

**Based on conversations with poultry manure brokers, it was estimated that at least 70% of the poultry manure is brokered out of the watershed.

The dollar values associated with each nutrient were obtained from OSU Extension Bulletin 604-06, "Ohio Livestock Manure Management Guide." The value for nitrogen is estimated at $0.22 per pound, the value for P_2O_5 is $0.20 per pound and the value for K_2O is $0.15 per pound.

Distance Between Livestock Operations and Streams

The table on the following page shows the distance between various livestock operations located in the Wabash River above Bear Creek below Stony Creek subwatershed and the waterways that drain to the Wabash River. It can be assumed that the greater the distance between a livestock operation and a water system, the potential of pollution from the operation reaching the stream is lessened.

Of notable interest is the number of all livestock operations located less than 1,000 feet from the waterbody. In this particular subwatershed, 181 operations, or 72.7%, fall into the category. Also, 42 operations, 16.9%, are in within 2,000 feet and the remaining 10.4%, 26 operations, are less than 3,000 feet from the nearest stream.

Table 64
Livestock Operations and Proximity to Streams

WABASH RIVER ABOVE BEAR CREEK BELOW STONY CREEK																		
ANIMAL TYPE	POULTRY			DAIRY			HOG			BEEF			OTHER			TOTAL		
	Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream		
	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'
	71	20	7	30	3	7	29	8	5	44	9	5	7	2	2	181	42	26
% of Subwatershed Total	28.5%	8.0%	2.8%	12.0%	1.2%	2.8%	11.6%	3.2%	2.0%	17.7%	3.6%	2.0%	2.8%	0.8%	0.8%	72.7%	16.9%	10.4%

Non-Point Source Pollution Potential

In order to provide a comparison of the pollution potential of each of the 15 subwatersheds, a ranking system for each of the main potential pollution sources was developed. These potential sources are stream miles with less than 10 feet of vegetation, the number of livestock or poultry operations less than 1,000 feet from a stream, the tons of raw manure produced yearly, the pounds of phosphorus per cropland acre available from the manure, the number of household wastewater disposal systems contained in clusters of ten or more) and the number of homes built pre-1973. Values of 1(less potential) to 10 (great potential) were given based on ranges shown in the table of the following page. Indicator scores are then summed to obtain a total pollution potential score for the subwatershed.

Subwatershed pollution potential scores can range from a maximum of 60 points to a minimum of six points. The Wabash River above Bear Creek below Stony Creek subwatershed ranks of first out of 15, with 85% of the maximum points for pollution potential. Most significantly for the subwatershed is the number of stream miles with less than 10 feet of vegetation on the streambanks, the tonnage of raw manure generated per year, the number of operations within 1000 feet of streams and the number of homes built pre-1973. Wabash River above Bear Creek below Stony Creek subwatershed scored the maximum points for all four indicators.

NONPOINT SOURCE POLLUTION POTENTIAL SCORING MATRIX

MAXIMUM DRAINAGE UNIT SCORE = 60 (Highest Pollution Potential)

SCORE	Stream Miles with <10' Vegetation	Operations <1,000' to stream	Tons Raw Manure per Year	Lbs. P_2O_5 per Crop Acre	Household Disposal Systems in Groups	No. Homes Built pre-1973
10	72.00+	46+	180,000+	225+	90+	226+
9	64.00 - 71.99	41 - 45	160,000 - 179,999	200 - 224	80 - 89	201 -225
8	56.00 - 63.99	36 - 40	140,000 - 159,999	175 - 199	70 - 79	176 -200
7	48.00 - 55.99	31 - 35	120,000 - 139,999	150 - 174	60 - 69	151 - 175
6	40.00 - 47.99	26 - 30	100,000 - 119,999	125 - 149	50 - 59	126 - 150
5	32.00 - 39.99	21 - 25	80,000 - 99,999	100 - 124	40 - 49	101 - 125
4	24.00 - 31.99	16 - 20	60,000 - 79,999	75- 99	30 - 39	76 - 100
3	16.00 - 23.99	11 - 15	40,000 - 59,999	50 - 74	20 - 29	51 - 75
2	8.00 - 15.99	6 - 10	20,000 - 39,999	25 - 49	10 - 19	26 - 50
1	0.00 - 7.99	0 - 5	0 - 19,999	0 - 24	0 - 10	0 - 25

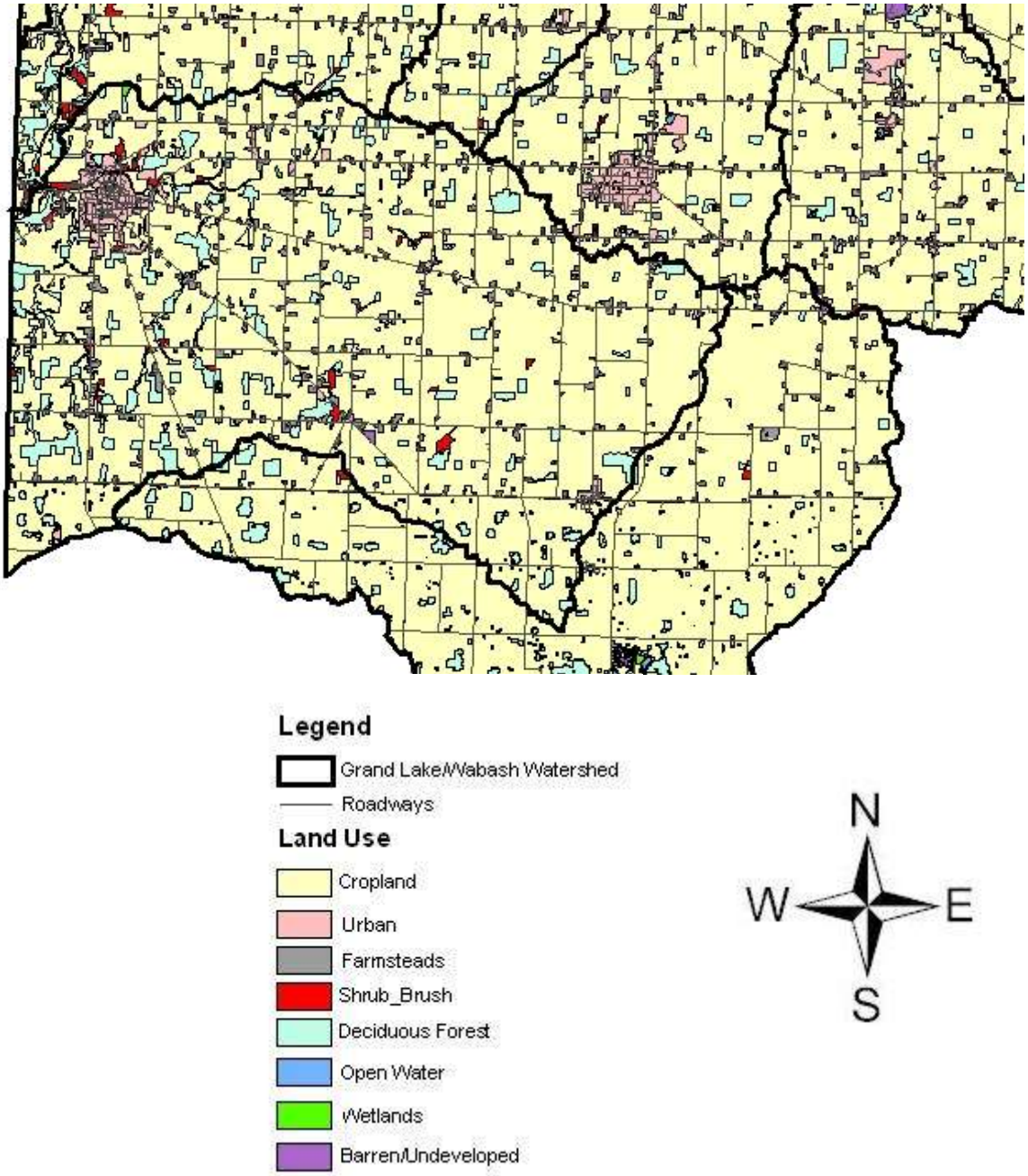
MINIMUM DRAINAGE UNIT SCORE = 6 (Lowest Pollution Potential)

TABLE 65
NPS Pollution Potential

WABASH RIVER ABOVE BEAR CREEK BELOW STONY CREEK							
SUBWATERSHED ATTRIBUTE	Stream Miles with <10' Vegetation SCORE	Operations <1,000' to stream SCORE	Tons Raw Manure per Year SCORE	Lbs. P_2O_5 per Crop Acre SCORE	Household Disposal Systems in Groups SCORE	No. Homes Built pre-1973 SCORE	TOTAL SCORE
	10	10	10	5	6	10	51

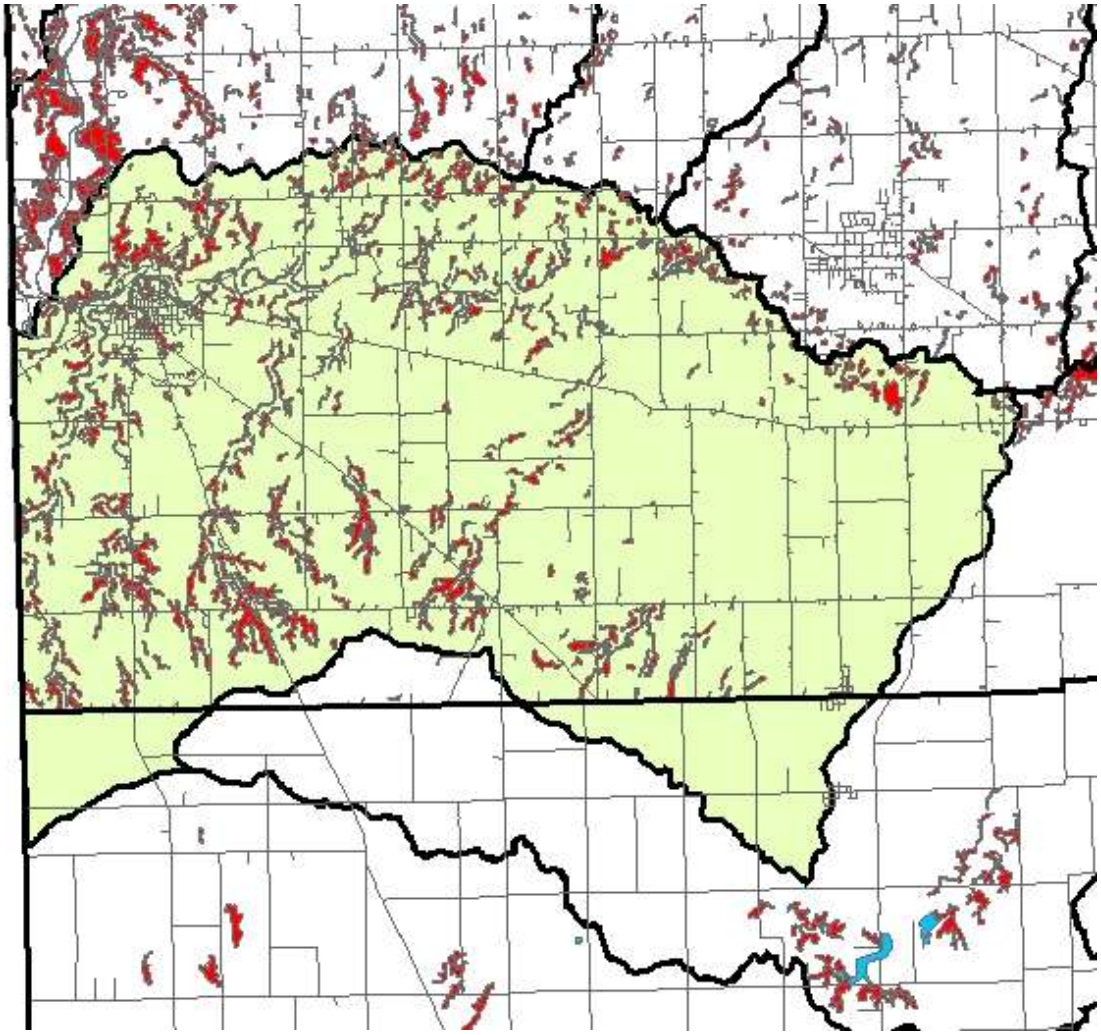
MAP 52

Wabash River above Bear Creek below Stony Creek Land Use



MAP 53

Wabash River above Bear Creek below Stony Creek Highly Erodible Land



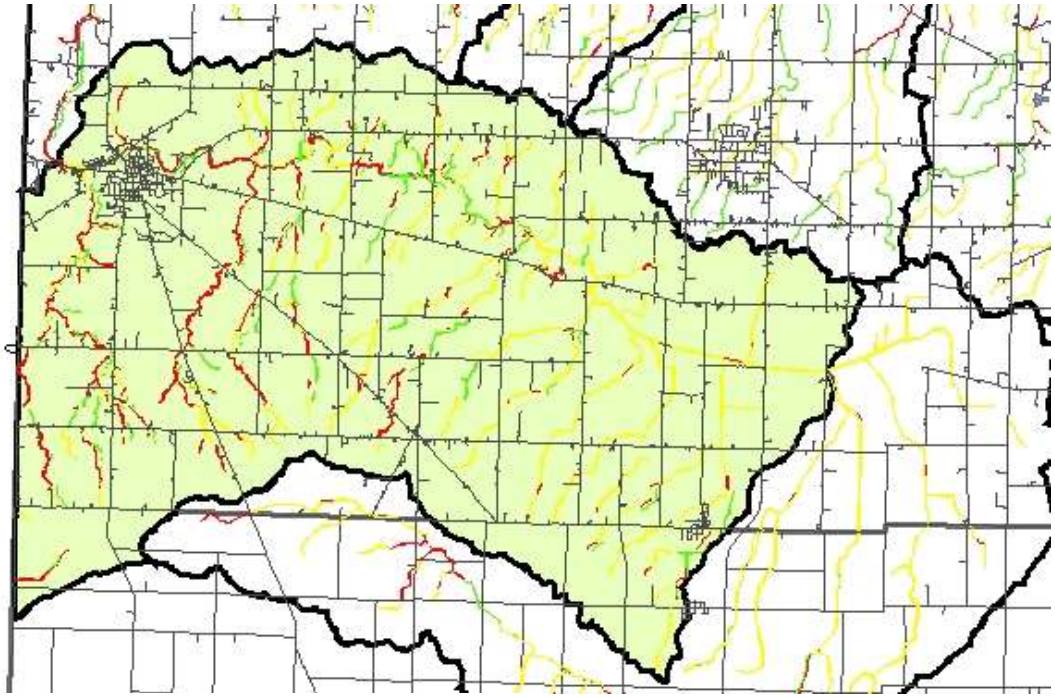
Legend

- Highly erodible land
- Roadways
- Open Water
- Subwatershed

N
W E
S

MAP 54

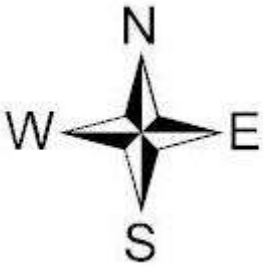
Wabash River above Bear Creek below Stony Creek Riparian Corridor Status



Legend

Riparian Corridor Status

- Less than 10 feet
- 10 to 40 feet
- Greater than 40 feet
- Roadways
- Open Water
- Grand Lake/Wabash Watershed



4.2.3 Wabash River below Stony Creek above Beaver Creek

The Wabash River below Stony Creek above Beaver Creek subwatershed drains the northern area of the Wabash River drainage basin. The entire subwatershed is located in Mercer County. The acres, square miles, and percent of subwatershed are shown below. The Wabash River below Stony Creek above Beaver Creek subwatershed, according to percentages, is the second largest of the eight subwatersheds draining to the Wabash River. Of the entire Grand/Lake Wabash Watershed, it is the second largest of fifteen subwatersheds.

TABLE 66

WABASH RIVER BELOW STONY CREEK ABOVE BEAVER CREEK	
Acreage	20,640
Square Miles	32.25
% of Wabash Watershed Total Land Area	17.1%
% of Grand Lake/Wabash Watershed Total Land Area	11.5%

Water Quality Status

The Wabash River below Stony Creek above Beaver Creek has been designated as a warm water habitat (WWH). This aquatic life use designation has been established by Ohio EPA, and based on recent data sampling, the water resource is shown as not meeting that use designation, or in a “non-attainment” status. Furthermore, the subwatershed is shown as NPS impacted. Suspected or proven impacts to these streams include: Agriculture-crop production, confined animal feeding operations, on-site wastewater treatment systems, channelization, removal of riparian vegetation and streambank destabilization. Definitions and criteria for these descriptives can be found in Appendix C aquatic life use designations and assessment terms.

A TMDL report for the Wabash River watershed was finalized by US EPA in August of 2004. The report showed that on average, all samples collected in this subwatershed were over the recommended total phosphorus level of 0.17 mg/L. On average, 50% of the samples were over the recommended nitrate-nitrite level of 1.5 mg/L, and 14% of the samples were over the recommended total suspended solids level of 32 mg/L.

Water Supplies and Discharges

There are no community water supplies within the Wabash River below Stony Creek above Beaver Creek subwatershed, no Ohio EPA regulated point source discharges, no non-transient non-community water supplies and no transient non-community water supplies.

Based on recent aerial photographs, areas where 10 or more household wastewater treatment and disposal systems were present in close proximity was determined. As

with any individual treatment system operating in an area with poorly drained soils, the effects of the effluent on the receiving water body is a concern. These effects grow as the number of systems in a given area increases, thus clusters or groups of 10 or more systems has been used to analyze the potential effects of those systems on the water quality. Regarding the Wabash River Below Stony Creek Above Beaver Creek subwatershed, there were a total of four clusters identified comprised of 60 individual treatment systems.

Highly Erodible Land

Map 54 at the end of this subsection illustrates the highly erodible land locations within the Wabash River Below Stony Creek Above Beaver Creek subwatershed. Of the eight subwatersheds within the Wabash River watershed, Wabash River Below Stony Creek Above Beaver Creek ranks second highest in the amount of highly erodible land present within the subwatershed. The highly erodible land information was developed from the 2003 online NRCS Soil Data Mart.

Riparian Corridor Status

The chart on the following page shows the riparian corridor status for the Wabash River below Stony Creek above Beaver Creek subwatershed. The chart indicates the number of miles that has various widths of tree canopy, or riparian corridor. The numbers account for both sides of the streams; therefore, the number of actual stream miles is half of that shown. The divisions are less than 10 feet in total width, 10 feet to 40 feet in total width, and greater than 40 feet in total width. The chart is also divided into perennial and intermittent streams under each of the corridor width column headings. MAP 55 illustrates the stream sections under each division.

The chart shows that with a total of 91.74 miles of stream network, the Wabash River below Stony Creek above Beaver Creek subwatershed has 48.58 miles of stream with less than 10 feet of canopy and vegetation, 21.02 miles of stream with 10 feet to 40 feet canopy and vegetation, and 22.14 miles of stream with greater than 40 feet of canopy and vegetation. Overall, the Wabash River below Stony Creek above Beaver Creek subwatershed has the third highest number of stream miles within the Wabash River Watershed, which is 16.2%. Of the entire Grand Lake/Wabash Watershed, this subwatershed has the third highest number of stream miles, which is 13.0%.

TABLE 67

Riparian Corridor Status

WABASH RIVER BELOW STONY CREEK ABOVE BEAVER CREEK										
RIPARIAN STATUS	TREE CANOPY <10' IN TOTAL WIDTH			TREE CANOPY 10 to 40' IN WIDTH			TREE CANOPY >40' IN WIDTH			TOTAL STREAM MILES
	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	
	16.98	31.60	48.58	9.82	11.20	21.02	11.93	10.21	22.14	91.74
% of Subwatershed Total	18.5%	34.4%	53.0%	10.7%	12.2%	22.9%	13.0%	11.1%	24.1%	100.0%
% of Wabash Watershed Total	3.0%	5.6%	8.6%	1.7%	2.0%	3.7%	2.1%	1.8%	3.9%	16.2%
% of Grand Lake/Wabash Watershed Total	2.4%	4.5%	6.9%	1.4%	1.6%	3.0%	1.7%	1.4%	3.1%	13.0%

Operations and Animal Units

The table on the following page shows the number of operations and the animal units by species for the Wabash River below Stony Creek above Beaver Creek subwatershed. According to the table, there are 19 poultry operations, 15 dairy operations, 27 hog operations, 62 beef operations and 10 horse and sheep operations within the entire subwatershed. The Wabash River below Stony Creek above Beaver Creek subwatershed ranks second within the entire Grand Lake/Wabash River Watershed when considering the total number of operations with 133 or 13.5%. Animal units within the subwatershed ranks fifth of 15 with 8.7%.

Totals of animal units for each species are also listed on the table. The inventory for this subwatershed was completed during October and November of 2006. At the time of the inventory animal units were determined by the number of animals present. Although this is not a 1:1 ratio for all species, it is for beef cattle. The following chart shows the number of each type of animal that makes up 1,000 animal units.

Animal Type	1,000 Animal Unit Equivalent
Beef Cattle	1,000
Dairy Cattle	700
Hogs (over 55 lbs)	2,500
Turkeys	55,000
Layer Chickens	82,000
Pullet Chickens	125,000
Sheep	10,000
Horses	500

Table 68
Operations and Animal Units

WABASH RIVER BELOW STONY CREEK ABOVE BEAVER CREEK														
ANIMAL TYPE	POULTRY		DAIRY		HOG		BEEF		OTHER		TOTAL		Total as % of Wabash Watershed	
# Farms and Animals	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s
	10 (Trky) 9	9,239 2,400	15	1,236	27	13,320	62	3,394	(sheep) 1 (hrs) 9	3 74	133	29,665	19.2%	12.5%
% of subwatershed total	14.3%	39.2%	11.3%	4.2%	20.3%	44.9%	46.6%	11.4%	7.5%	0.3%	100.0%	100.0%		
Total as % of Wabash Watershed	2.7%	4.9%	2.2%	0.5%	3.9%	5.6%	9.0%	1.4%	1.4%	0.0%	19.2%	12.5%		
Total as % of Grand Lake/Wabash Watershed	1.92%	3.41%	1.52%	0.36%	2.73%	3.90%	6.27%	0.99%	1.01%	0.02%	13.45%	8.68%		

Manure Production

After considering the number of livestock operations and animal units present in the subwatershed, it is only fitting to consider the by-products of these animals. The table on the opposite page is used to represent the manure and nutrient production for the Wabash River below Stony Creek above Beaver Creek drainage area. The subwatershed ranks fifth overall, of 15, in terms of manure production per annum. Approximately 167,028 tons of manure is produced annually. The remainder of the columns on the table indicates the approximate pounds of nutrients contained in that manure. Nitrogen, potassium, and phosphate, are all important to the agricultural community and are provided to the crops via manure or commercial fertilizer applications.

These nutrients are also important in regards to water quality. According to the table, in the Wabash River below Stony Creek above Beaver Creek subwatershed, the amount of phosphorus that is contained in the manure produced annually would need to be applied at 121 pounds per acre. The table below indicates the average crop removal rates for phosphorus for the major crops produced in the watershed. Values were obtained from the Ohio Agronomy Guide.

CROP	**P_2O_5 REMOVAL (lb/ac)**
Alfalfa (6T)	80
Corn (150 bu) Grain	55
Corn (25 T) Silage	80
Soybean (50 bu)	40
Wheat (75 bu) Grain	48

Considerations are given to the nutrient phosphorus due to its importance to crop production and the problems associated with the relationship between excessive phosphorus applications and degradation of water quality. Because much of the poultry manure is brokered out of the watershed, it seemed important to reflect the nutrient values assuming that 70% of the poultry manure is moved to locations outside the watershed. Local manure haulers estimated this value to be 90%; however, to be conservative, 70% was assumed for this plan. Under this assumption, the amount of phosphorus that is contained in the manure produced annually in this subwatershed would need to be applied at 77 pounds per acre.

What this seems to indicate throughout the watershed is that according to manure production and crop removal rates for limiting nutrient factors, there are not enough acres for proper manure application methods. The caveat on this statement is that the numbers are best estimates, variations in soil types and tilth can vary throughout the fields which may increase, or decrease, crop removal rates, and more importantly, some of the manure produced in each of the subwatersheds may be applied to acreages outside of that subwatershed, or even outside of the Grand Lake/Wabash watershed. It should be noted that several producers own or rent land both in the Grand Lake/Wabash watershed and in neighboring watersheds such as Loramie Creek or the St Marys River.

Table 69
Manure and Nutrient Production

WABASH RIVER BELOW STONY CREEK ABOVE BEAVER CREEK						
Manure Production	Tons Raw Manure/Year	Lbs. N per Year	Lbs. K_2O per Year	Lbs. P_2O_5 per Year	Acres Cropland	Lbs. P_2O_5 per Crop Acre
	167,028	2,802,833	1,903,854	2,141,849	17,744	121
Less 70% Poultry Manure**	130,794	1,840,427	1,371,460	1,364,676	17,744	77
Approximate $ Value Per Year		$616,623	$285,578	$428,370		
Total Nutrient Value Per Year =	$1,330,571					

**Based on conversations with poultry manure brokers, it was estimated that at least 70% of the poultry manure is brokered out of the watershed.

The dollar values associated with each nutrient were obtained from OSU Extension Bulletin 604-06, "Ohio Livestock Manure Management Guide." The value for nitrogen is estimated at $0.22 per pound, the value for P_2O_5 is $0.20 per pound and the value for K_2O is $0.15 per pound.

Distance Between Livestock Operations and Streams

The table on the following page shows the distance between various livestock operations located in the Wabash River below Stony Creek above Beaver Creek subwatershed and the waterways that drain to the Wabash River. It can be assumed that the greater the distance between a livestock operation and a water system, the potential of pollution from the operation reaching the stream is lessened.

Of notable interest is the number of all livestock operations located less than 1,000 feet from the waterbody. In this particular subwatershed, of 133 operations, 75 operations, or 56.4%, fall into the category. Also, 37 operations, 27.8%, are in within 2,000 feet and the remaining 15.8%, 21 operations, are less than 3,000 feet from the nearest stream.

Table 70
Livestock Operations and Proximity to Streams

WABASH RIVER BELOW STONY CREEK ABOVE BEAVER CREEK																		
ANIMAL TYPE	POULTRY			DAIRY			HOG			BEEF			OTHER			TOTAL		
	Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream		
	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'
	14	3	2	8	3	4	13	9	5	35	19	8	5	3	2	75	37	21
% of Subwatershed Total	10.5%	2.3%	1.5%	6.0%	2.3%	3.0%	9.8%	6.8%	3.8%	26.3%	14.3%	6.0%	3.8%	2.3%	1.5%	56.4%	27.8%	15.8%

Non-Point Source Pollution Potential

In order to provide a comparison of the pollution potential of each of the 15 subwatersheds, a ranking system for each of the main potential pollution sources was developed. These potential sources are stream miles with less than 10 feet of vegetation, the number of livestock or poultry operations less than 1,000 feet from a stream, the tons of raw manure produced yearly, the pounds of phosphorus per cropland acre available from the manure, the number of household wastewater disposal systems contained in clusters of ten or more) and the number of homes built pre-1973. Values of 1(less potential) to 10 (great potential) were given based on ranges shown in the table of the following page. Indicator scores are then summed to obtain a total pollution potential score for the subwatershed.

Subwatershed pollution potential scores can range from a maximum of 60 points to a minimum of six points. The Wabash River below Stony Creek above Beaver Creek subwatershed ranks second out of 15, with 75% of the maximum points for pollution potential. Most significantly for the subwatershed is the number of operations within 1000 feet of streams. Wabash River below Stony Creek above Beaver Creek subwatershed scored the maximum points for this indicator and scored the second highest amount of points for the number of homes built pre-1973.

NONPOINT SOURCE POLLUTION POTENTIAL SCORING MATRIX

MAXIMUM DRAINAGE UNIT SCORE = 60 (Highest Pollution Potential)

SCORE	Stream Miles with <10' Vegetation	Operations <1,000' to stream	Tons Raw Manure per Year	Lbs. P_2O_5 per Crop Acre	Household Disposal Systems in Groups	No. Homes Built pre-1973
10	72.00+	46+	180,000+	225+	90+	226+
9	64.00 - 71.99	41 - 45	160,000 - 179,999	200 - 224	80 - 89	201 -225
8	56.00 - 63.99	36 - 40	140,000 - 159,999	175 - 199	70 - 79	176 -200
7	48.00 - 55.99	31 - 35	120,000 - 139,999	150 - 174	60 - 69	151 - 175
6	40.00 - 47.99	26 - 30	100,000 - 119,999	125 - 149	50 - 59	126 - 150
5	32.00 - 39.99	21 - 25	80,000 - 99,999	100 - 124	40 - 49	101 - 125
4	24.00 - 31.99	16 - 20	60,000 - 79,999	75- 99	30 - 39	76 - 100
3	16.00 - 23.99	11 - 15	40,000 - 59,999	50 - 74	20 - 29	51 - 75
2	8.00 - 15.99	6 - 10	20,000 - 39,999	25 - 49	10 - 19	26 - 50
1	0.00 - 7.99	0 - 5	0 - 19,999	0 - 24	0 - 10	0 - 25

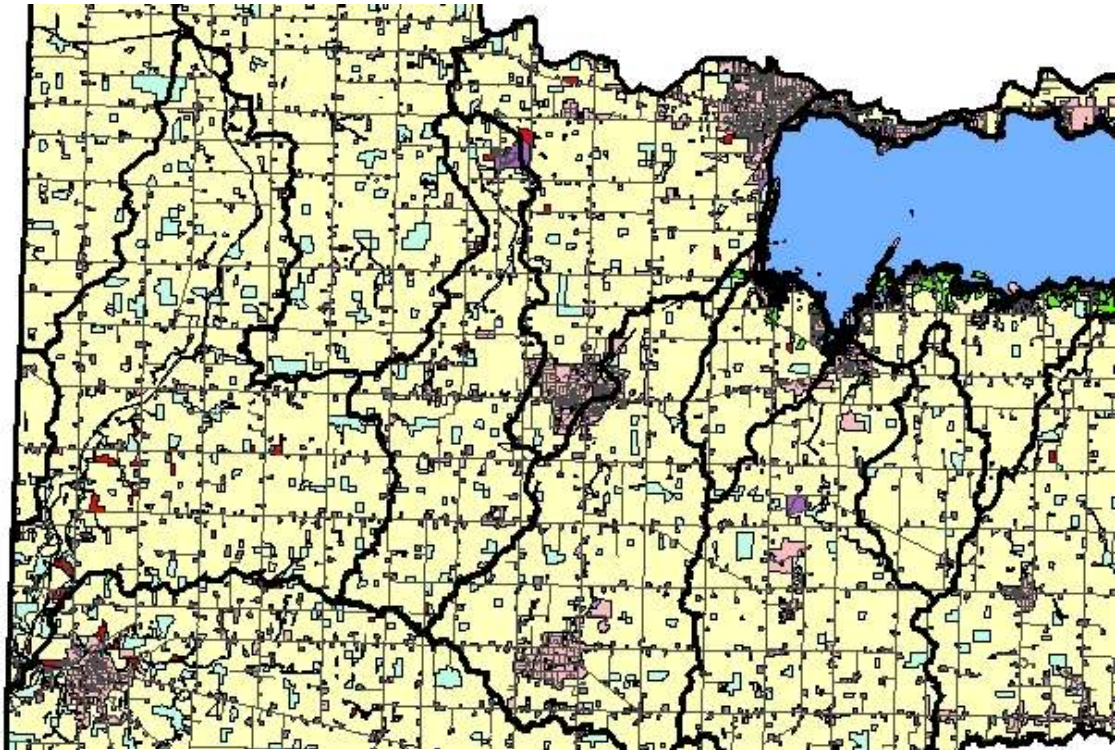
MINIMUM DRAINAGE UNIT SCORE = 6 (Lowest Pollution Potential)

TABLE 71
NPS Pollution Potential

WABASH RIVER BELOW STONY CREEK ABOVE BEAVER CREEK							
SUBWATERSHED ATTRIBUTE	Stream Miles with <10' Vegetation SCORE	Operations <1,000' to stream SCORE	Tons Raw Manure per Year SCORE	Lbs. P_2O_5 per Crop Acre SCORE	Household Disposal Systems in Groups SCORE	No. Homes Built pre-1973 SCORE	TOTAL SCORE
	7	10	8	4	7	9	45

MAP 55

Wabash River below Stony Creek above Beaver Creek Land Use



Legend

Grand Lake/Wabash Watershed

Roadways

Land Use

Cropland

Urban

Farmsteads

Shrub_Brush

Deciduous Forest

Open Water

Wetlands

Barren/Undeveloped

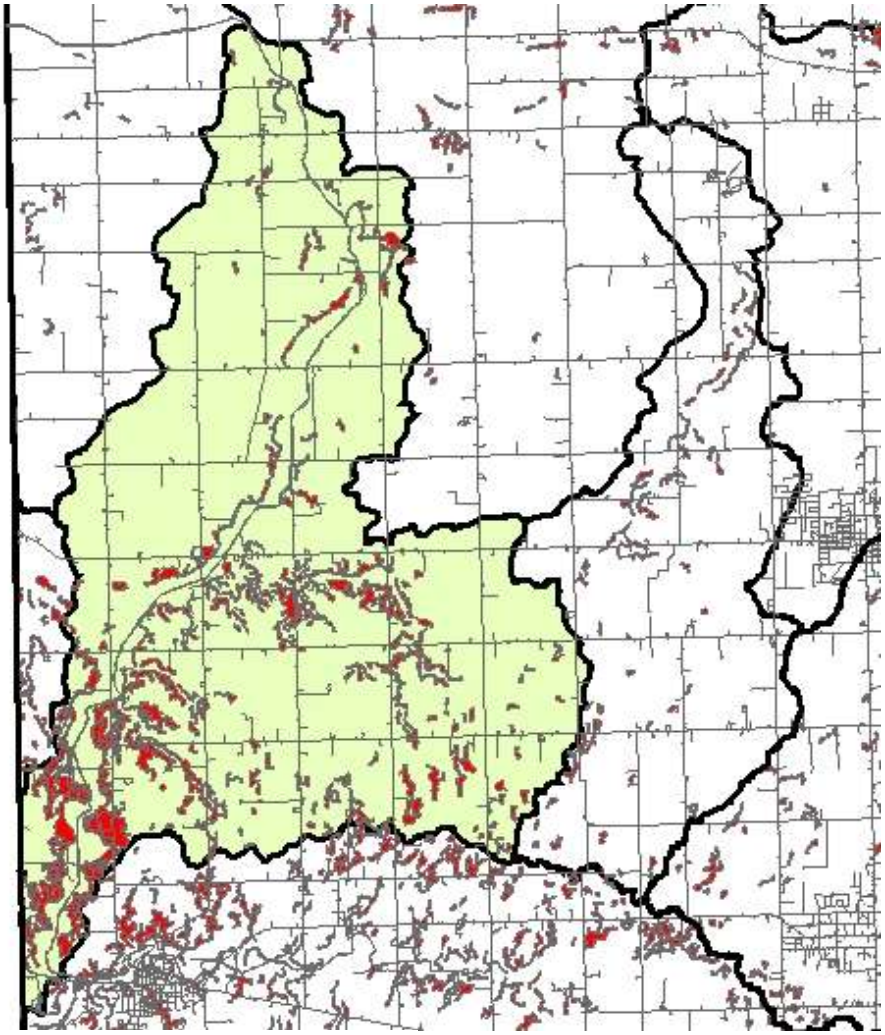
N

W E

S

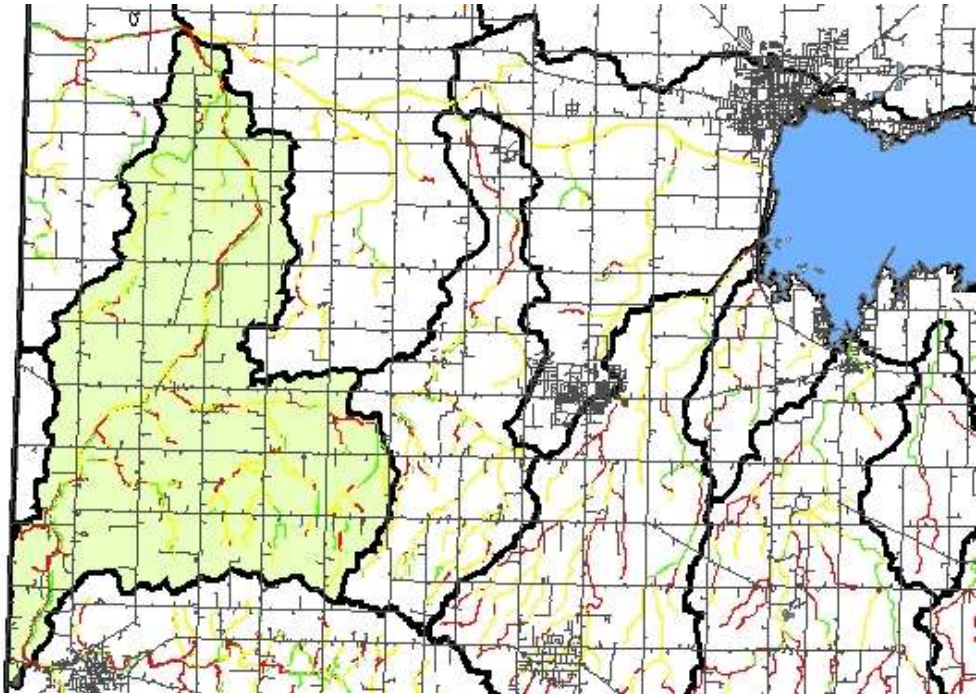
MAP 56

Wabash River below Stony Creek above Beaver Creek Highly Erodible Land



MAP 57

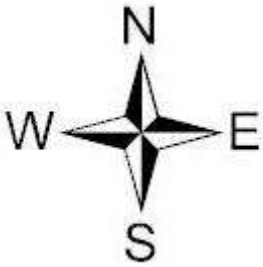
Wabash River below Stony Creek above Beaver Creek Riparian Corridor Status



Legend

Riparian Corridor Status

- Less than 10 feet
- 10 to 40 feet
- Greater than 40 feet
- Roadways
- Open Water
- Grand Lake/Wabash Watershed



4.2.4 Beaver Creek from Grand Lake to above Little Beaver Creek

The Beaver Creek from Grand Lake to Above Little Beaver Creek subwatershed drains the eastern area of the Wabash River drainage basin, directly west of Grand Lake St. Marys. The entire subwatershed is located in Mercer County. The acres, square miles, and percent of subwatershed are shown below. The Beaver Creek from Grand Lake to Above Little Beaver Creek subwatershed, according to percentages, is the fifth largest of the eight subwatersheds draining to the Wabash River. Of the entire Grand/Lake Wabash Watershed, it is the seventh largest of fifteen subwatersheds.

TABLE 72

BEAVER CREEK FROM GRAND LAKE TO ABOVE LITTLE BEAVER CREEK	
Acreage	12,347
Square Miles	19.29
% of Wabash Watershed Total Land Area	10.2%
% of Grand Lake/Wabash Watershed Total Land Area	6.9%

Water Quality Status

The Beaver Creek from Grand Lake to Above Little Beaver Creek subwatershed has been designated as a warm water habitat (WWH). This aquatic life use designation has been established by Ohio EPA, and based on recent data sampling, the water resource is shown as not meeting that use designation, or in a “non-attainment” status. Furthermore, the subwatershed is shown as NPS impacted. Suspected or proven impacts to these streams include: non-irrigated crop production, animal feeding operations, channelization, removal of riparian vegetation and stream bank destabilization. Definitions and criteria for these descriptives can be found in Appendix C aquatic life use designations and assessment terms.

A TMDL report for the Wabash River watershed was finalized by US EPA in August of 2004. Ohio EPA is also completing a TMDL report for Beaver Creek and Grand Lake St. Marys, which is currently in process of being finalized. The 2004 report showed that on average, all samples collected in this subwatershed were over the recommended total phosphorus level of 0.17 mg/L. On average, 80% of the samples were over the recommended nitrate-nitrite level of 1.5 mg/L, and 40% of the samples were over the recommended total suspended solids level of 32 mg/L. The draft TMDL report currently being completed calls for an 86% reduction in phosphorus, a 12% reduction in nitrate and a 34% reduction in fecal coliform for this subwatershed.

Water Supplies and Discharges

There are is one community water supply within the Beaver Creek from Grand Lake to above Little Beaver Creek subwatershed, the City of Celina. There are two transient

non-community water supplies, Lefeld Implement, Inc. and ODOT-Mercer County Garage PWS, and there is one non-transient non-community water supply, Pax Machine Works, Inc.

There are seven Ohio EPA regulated point source discharges, including; the Celina Municipal WTP, the Celina WWTP, the Coldwater WWTP, CW Services Bulk Plant, the Mercer County Home WWTP, the Mercer Couny Community Wagner WWTP and Pax Machine Works, Inc.

Based on recent aerial photographs, areas where 10 or more household wastewater treatment and disposal systems were present in close proximity was determined. As with any individual treatment system operating in an area with poorly drained soils, the effects of the effluent on the receiving water body is a concern. These effects grow as the number of systems in a given area increases, thus clusters or groups of 10 or more systems has been used to analyze the potential effects of those systems on the water quality. Regarding the Beaver Creek from Grand Lake to Above Little Beaver Creek subwatershed, there were a total of ten clusters identified comprised of 178 individual treatment systems.

Highly Erodible Land

Map 57 at the end of this subsection illustrates the highly erodible land locations within the Beaver Creek from Grand Lake to Above Little Beaver Creek subwatershed. Of the eight subwatersheds within the Wabash River watershed, Beaver Creek from Grand Lake to Above Little Beaver Creek ranks last in the amount of highly erodible land present within the subwatershed. The highly erodible land information was developed from the 2003 online NRCS Soil Data Mart.

Riparian Corridor Status

The chart on the following page shows the riparian corridor status for the Beaver Creek from Grand Lake to Above Little Beaver Creek subwatershed. The chart indicates the number of miles that has various widths of tree canopy, or riparian corridor. The numbers account for both sides of the streams; therefore, the number of actual stream miles is half of that shown. The divisions are less than 10 feet in total width, 10 feet to 40 feet in total width, and greater than 40 feet in total width. The chart is also divided into perennial and intermittent streams under each of the corridor width column headings. MAP 58 illustrates the stream sections under each division.

The chart shows that with a total of 39.14 miles of stream network, the Beaver Creek from Grand Lake to Above Little Beaver Creek subwatershed has 30.62 miles of stream with less than 10 feet of canopy and vegetation, 5.26 miles of stream with 10 feet to 40 feet canopy and vegetation, and 3.26 miles of stream with greater than 40 feet of canopy and vegetation. Overall, the Beaver Creek from Grand Lake to Above Little Beaver Creek subwatershed has the sixth highest number of stream miles within the Wabash River Watershed, which is 6.9%. Of the entire Grand Lake/Wabash Watershed, this subwatershed has the ninth highest number of stream miles, which is 5.6%.

TABLE 73

Riparian Corridor Status

BEAVER CREEK FROM GRAND LAKE TO ABOVE LITTLE BEAVER CREEK										
RIPARIAN STATUS	TREE CANOPY <10' IN TOTAL WIDTH			TREE CANOPY 10 to 40' IN WIDTH			TREE CANOPY >40' IN WIDTH			TOTAL STREAM MILES
	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	
	11.11	19.51	30.62	0.00	5.26	5.26	0.65	2.61	3.26	39.14
% of Subwatershed Total	28.4%	49.8%	78.2%	0.0%	13.4%	13.4%	1.7%	6.7%	8.3%	100.0%
% of Wabash Watershed Total	2.0%	3.5%	5.4%	0.0%	0.9%	0.9%	0.1%	0.5%	0.6%	6.9%
% of Grand Lake/Wabash Watershed Total	1.6%	2.8%	4.3%	0.0%	0.7%	0.7%	0.1%	0.4%	0.5%	5.6%

Operations and Animal Units

The table on the following page shows the number of operations and the animal units by species for the Beaver Creek from Grand Lake to Above Little Beaver Creek subwatershed. According to the table, there are two poultry operations, two dairy operations, three hog operations, 17 beef operations and 11 horse and sheep operations within the entire subwatershed. The Beaver Creek from Grand Lake to Above Little Beaver Creek subwatershed ranks tenth within the entire Grand Lake/Wabash River Watershed when considering the total number of operations with 35 or 3.5%. Animal units within the subwatershed ranks eleventh of 15 with 1.4%.

Totals of animal units for each species are also listed on the table. The inventory for this subwatershed was completed during October of 2006. At the time of the inventory animal units were determined by the number of animals present. Although this is not a 1:1 ratio for all species, it is for beef cattle. The following chart shows the number of each type of animal that makes up 1,000 animal units.

Animal Type	1,000 Animal Unit Equivalent
Beef Cattle	1,000
Dairy Cattle	700
Hogs (over 55 lbs)	2,500
Turkeys	55,000
Layer Chickens	82,000
Pullet Chickens	125,000
Sheep	10,000
Horses	500

Table 74
Operations and Animal Units

BEAVER CREEK FROM GRAND LAKE TO ABOVE LITTLE BEAVER CREEK														
ANIMAL TYPE	POULTRY		DAIRY		HOG		BEEF		OTHER		TOTAL		Total as % of Wabash Watershed	
# Farms and Animals	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s
	1 (Trky) 1	640 327	2	229	3	2,820	17	865	(sheep) 1 (hrs) 10	1 48	35	4,930	5.1%	2.1%
% of subwatershed total	5.7%	19.6%	5.7%	4.6%	8.6%	57.2%	48.6%	17.5%	31.4%	1.0%	100.0%	100.0%		
Total as % of Wabash Watershed	0.3%	0.4%	0.3%	0.1%	0.4%	1.2%	2.5%	0.4%	1.6%	0.0%	5.1%	2.1%		
Total as % of Grand Lake/Wabash Watershed	0.20%	0.28%	0.20%	0.07%	0.30%	0.83%	1.72%	0.25%	1.11%	0.01%	3.54%	1.44%		

Manure Production

After considering the number of livestock operations and animal units present in the subwatershed, it is only fitting to consider the by-products of these animals. The table on the opposite page is used to represent the manure and nutrient production for the Beaver Creek from Grand Lake to Above Little Beaver Creek drainage area. The subwatershed ranks eleventh overall, of 15, in terms of manure production per annum. Approximately 30,783 tons of manure is produced annually. The remainder of the columns on the table indicates the approximate pounds of nutrients contained in that manure. Nitrogen, potassium, and phosphate, are all important to the agricultural community and are provided to the crops via manure or commercial fertilizer applications.

These nutrients are also important in regards to water quality. According to the table, in the Beaver Creek from Grand Lake to Above Little Beaver Creek subwatershed, the amount of phosphorus that is contained in the manure produced annually would need to be applied at 37 pounds per acre. The table below indicates the average crop removal rates for phosphorus for the major crops produced in the watershed. Values were obtained from the Ohio Agronomy Guide.

CROP	**P_2O_5 REMOVAL (lb/ac)**
Alfalfa (6T)	80
Corn (150 bu) Grain	55
Corn (25 T) Silage	80
Soybean (50 bu)	40
Wheat (75 bu) Grain	48

Considerations are given to the nutrient phosphorus due to its importance to crop production and the problems associated with the relationship between excessive phosphorus applications and degradation of water quality. Because much of the poultry manure is brokered out of the watershed, it seemed important to reflect the nutrient values assuming that 70% of the poultry manure is moved to locations outside the watershed. Local manure haulers estimated this value to be 90%; however, to be conservative, 70% was assumed for this plan. Under this assumption, the amount of phosphorus that is contained in the manure produced annually in this subwatershed would need to be applied at 29 pounds per acre.

Table 75
Manure and Nutrient Production

BEAVER CREEK FROM GRAND LAKE TO ABOVE LITTLE BEAVER CREEK						
Manure Production	Tons Raw Manure/Year	Lbs. N per Year	Lbs. K_2O per Year	Lbs. P_2O_5 per Year	Acres Cropland	Lbs. P_2O_5 per Crop Acre
	30,783	459,003	332,066	328,475	8,916	37
Less 70% Poultry Manure**	27,199	359,830	277,952	259,943	8,916	29
Approximate $ Value Per Year		$100,981	$49,810	$65,695		
Total Nutrient Value Per Year = $216,485						

**Based on conversations with poultry manure brokers, it was estimated that at least 70% of the poultry manure is brokered out of the watershed.

The dollar values associated with each nutrient were obtained from OSU Extension Bulletin 604-06, "Ohio Livestock Manure Management Guide." The value for nitrogen is estimated at $0.22 per pound, the value for P_2O_5 is $0.20 per pound and the value for K_2O is $0.15 per pound.

Distance Between Livestock Operations and Streams

The table on the following page shows the distance between various livestock operations located in the Beaver Creek from Grand Lake to Above Little Beaver Creek subwatershed and the waterways that drain to the Wabash River. It can be assumed that the greater the distance between a livestock operation and a water system, the potential of pollution from the operation reaching the stream is lessened.

Of notable interest is the number of all livestock operations located less than 1,000 feet from the waterbody. In this particular subwatershed, of 35 operations, 11 operations, or 31.4%, fall into the category. Also, nine operations, 25.7%, are in within 2,000 feet and the remaining 42.9%, 15 operations, are less than 3,000 feet from the nearest stream.

Table 76
Livestock Operations and Proximity to Streams

BEAVER CREEK FROM GRAND LAKE TO ABOVE LITTLE BEAVER CREEK																		
ANIMAL TYPE	POULTRY			DAIRY			HOG			BEEF			OTHER			TOTAL		
	Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream		
	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'
	1	0	1	1	0	1	0	2	1	6	5	6	3	2	6	11	9	15
% of Subwatershed Total	2.9%	0.0%	2.9%	2.9%	0.0%	2.9%	0.0%	5.7%	2.9%	17.1%	14.3%	17.1%	8.6%	5.7%	17.1%	31.4%	25.7%	42.9%

Non-Point Source Pollution Potential

In order to provide a comparison of the pollution potential of each of the 15 subwatersheds, a ranking system for each of the main potential pollution sources was developed. These potential sources are stream miles with less than 10 feet of vegetation, the number of livestock or poultry operations less than 1,000 feet from a stream, the tons of raw manure produced yearly, the pounds of phosphorus per cropland acre available from the manure, the number of household wastewater disposal systems contained in clusters of ten or more) and the number of homes built pre-1973. Values of 1(less potential) to 10 (great potential) were given based on ranges shown in the table of the following page. Indicator scores are then summed to obtain a total pollution potential score for the subwatershed.

Subwatershed pollution potential scores can range from a maximum of 60 points to a minimum of six points. The Beaver Creek from Grand Lake to Above Little Beaver Creek subwatershed ranks ninth out of 15, with 46.7% of the maximum points for pollution potential. Most significantly for the subwatershed is the number of household disposal systems in groups. Beaver Creek from Grand Lake to Above Little Beaver Creek subwatershed scored the maximum points for this indicator.

NONPOINT SOURCE POLLUTION POTENTIAL SCORING MATRIX

MAXIMUM DRAINAGE UNIT SCORE = 60 (Highest Pollution Potential)

SCORE	Stream Miles with <10' Vegetation	Operations <1,000' to stream	Tons Raw Manure per Year	Lbs. P_2O_5 per Crop Acre	Household Disposal Systems in Groups	No. Homes Built pre-1973
10	72.00+	46+	180,000+	225+	90+	226+
9	64.00 - 71.99	41 - 45	160,000 - 179,999	200 - 224	80 - 89	201 -225
8	56.00 - 63.99	36 - 40	140,000 - 159,999	175 - 199	70 - 79	176 -200
7	48.00 - 55.99	31 - 35	120,000 - 139,999	150 - 174	60 - 69	151 - 175
6	40.00 - 47.99	26 - 30	100,000 - 119,999	125 - 149	50 - 59	126 - 150
5	32.00 - 39.99	21 - 25	80,000 - 99,999	100 - 124	40 - 49	101 - 125
4	24.00 - 31.99	16 - 20	60,000 - 79,999	75- 99	30 - 39	76 - 100
3	16.00 - 23.99	11 - 15	40,000 - 59,999	50 - 74	20 - 29	51 - 75
2	8.00 - 15.99	6 - 10	20,000 - 39,999	25 - 49	10 - 19	26 - 50
1	0.00 - 7.99	0 - 5	0 - 19,999	0 - 24	0 - 10	0 - 25

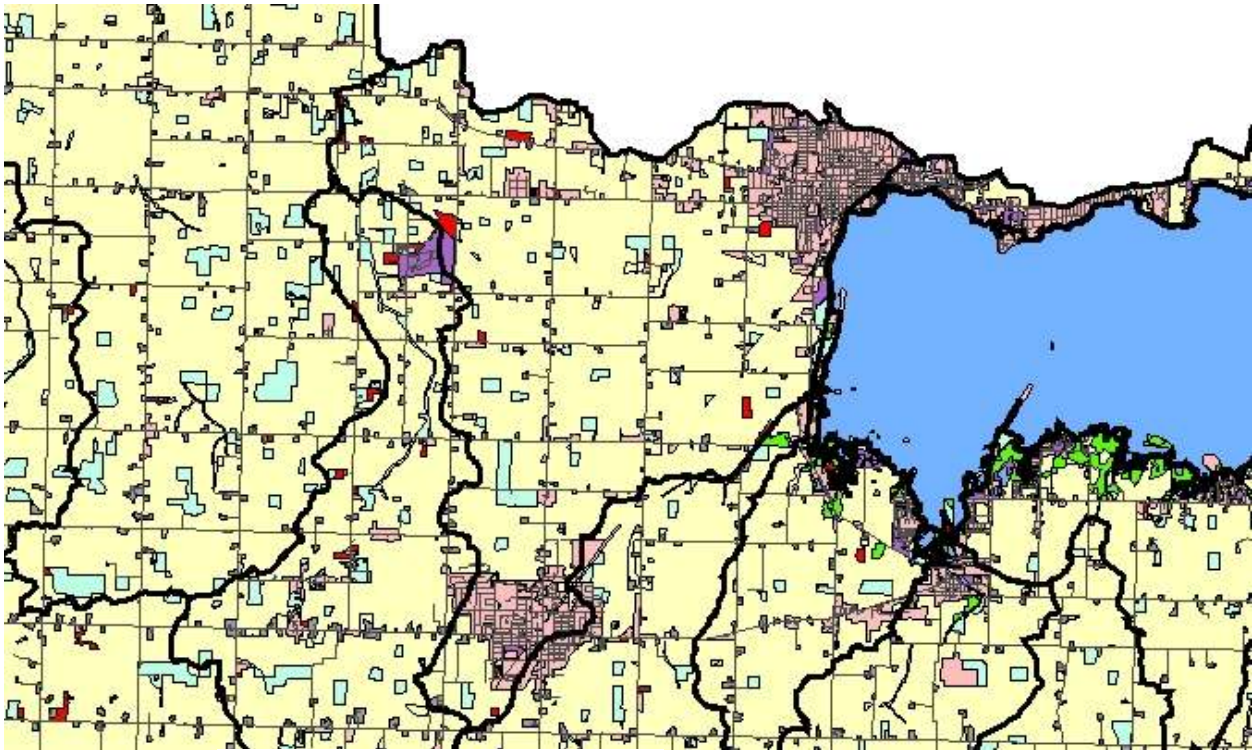
MINIMUM DRAINAGE UNIT SCORE = 6 (Lowest Pollution Potential)

TABLE 77
NPS Pollution Potential

BEAVER CREEK FROM GRAND LAKE TO ABOVE LITTLE BEAVER CREEK							
SUBWATERSHED ATTRIBUTE	Stream Miles with <10' Vegetation SCORE	Operations <1,000' to stream SCORE	Tons Raw Manure per Year SCORE	Lbs. P_2O_5 per Crop Acre SCORE	Household Disposal Systems in Groups SCORE	No. Homes Built pre-1973 SCORE	TOTAL SCORE
	4	3	2	2	10	7	28

MAP 58

Beaver Creek from Grand Lake to above Little Beaver Creek Land Use



Legend

Grand Lake/Wabash Watershed

Roadways

Land Use

Cropland

Urban

Farmsteads

Shrub_Brush

Deciduous Forest

Open Water

Wetlands

Barren/Undeveloped

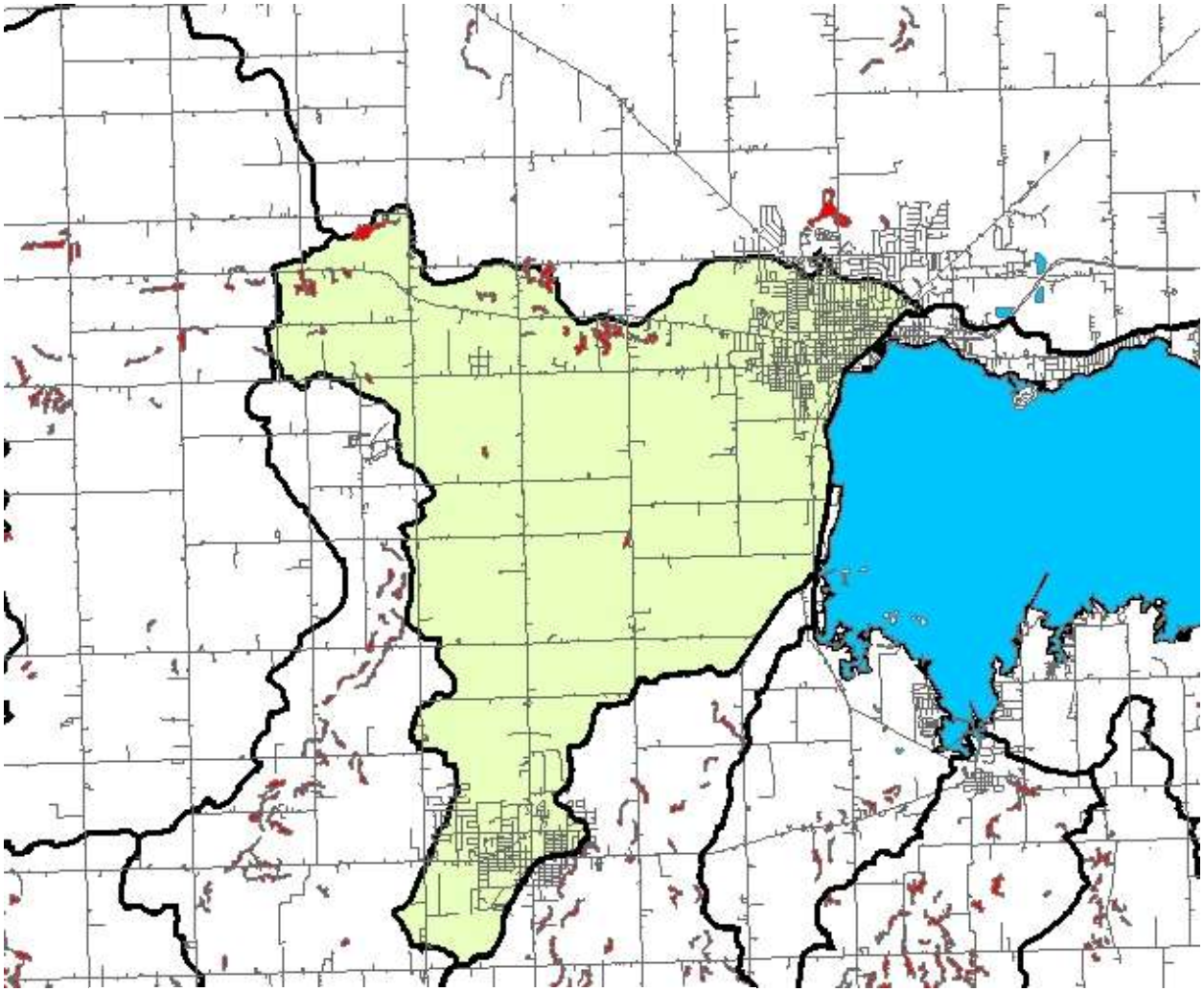
N

W E

S

MAP 59

Beaver Creek from Grand Lake to above Little Beaver Creek Highly Erodible Land

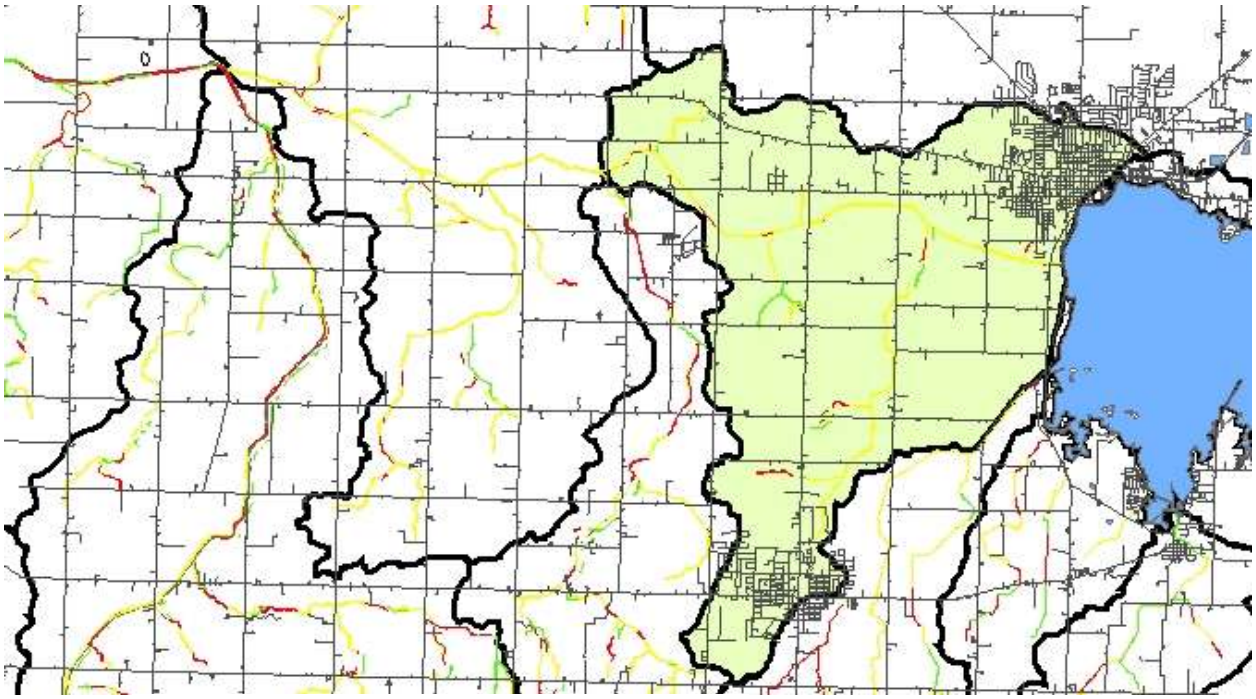


Legend

- Highly erodible land
- Roadways
- Open Water
- Subwatershed

N
W E
S

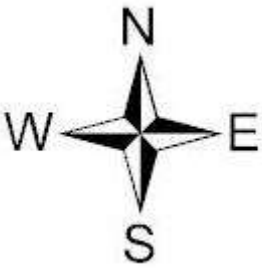
MAP 60
Beaver Creek from Grand Lake to above Little Beaver Creek Riparian Corridor Status



Legend

Riparian Corridor Status

- Less than 10 feet
- 10 to 40 feet
- Greater than 40 feet
- Roadways
- Open Water
- Grand Lake/Wabash Watershed



4.2.5 Little Beaver Creek

The Little Beaver Creek subwatershed drains the Little Beaver Creek watershed and is in the center portion of the Wabash River drainage basin. Little Beaver Creek enters Beaver Creek prior to Beaver Creek entering the Wabash River. The entire subwatershed is located in Mercer County. The acres, square miles, and percent of subwatershed are shown below. The Little Beaver Creek subwatershed, according to percentages, is the sixth largest of the eight subwatersheds draining to the Wabash River. Of the entire Grand/Lake Wabash Watershed, it is the ninth largest of fifteen subwatersheds.

TABLE 78

LITTLE BEAVER CREEK	
Acreage	9,092
Square Miles	14.2
% of Wabash Watershed Total Land Area	7.5%
% of Grand Lake/Wabash Watershed Total Land Area	5.1%

Water Quality Status

The Little Beaver Creek subwatershed has been designated as a warm water habitat (WWH). This aquatic life use designation has been established by Ohio EPA, and based on recent data sampling, the water resource is shown as not meeting that use designation, or in a “non-attainment” status. Furthermore, the subwatershed is shown as NPS impacted. Suspected or proven impacts to these streams include: non-irrigated crop production, animal feeding operations, channelization, removal of riparian vegetation and stream bank destabilization. Definitions and criteria for these descriptives can be found in Appendix C aquatic life use designations and assessment terms.

A TMDL report for the Wabash River watershed was finalized by US EPA in August of 2004. Ohio EPA is also completing a TMDL report for Beaver Creek and Grand Lake St. Marys, which is currently in process of being finalized. The 2004 report showed that on average, all samples collected in this subwatershed were over the recommended total phosphorus level of 0.17 mg/L. On average, 50% of the samples were over the recommended nitrate-nitrite level of 1.5 mg/L, and 100% of the samples were over the recommended total suspended solids level of 32 mg/L. The draft TMDL report currently being completed calls for a 92% reduction in phosphorus, a 0% reduction in nitrate and a 55% reduction in fecal coliform for this subwatershed.

Water Supplies and Discharges

There are no community water supplies within the Little Beaver Creek subwatershed. There is one transient non-community water supply, Philothea Country Club, and there is one non-transient non-community water supply, Hemmelgarn & Sons, Inc. PWS.
There are two Ohio EPA regulated point source discharges, the Philothea SD WWTP and Stoneco, Inc. Karch Quarry.

Based on recent aerial photographs, areas where 10 or more household wastewater treatment and disposal systems were present in close proximity was determined. As with any individual treatment system operating in an area with poorly drained soils, the effects of the effluent on the receiving water body is a concern. These effects grow as the number of systems in a given area increases, thus clusters or groups of 10 or more systems has been used to analyze the potential effects of those systems on the water quality. Regarding the Little Beaver Creek subwatershed, there were a total of five clusters identified comprised of 115 individual treatment systems.

Highly Erodible Land

Map 60 at the end of this subsection illustrates the highly erodible land locations within the Little Beaver Creek subwatershed. Of the eight subwatersheds within the Wabash River watershed, Little Beaver Creek ranks third highest in the amount of highly erodible land present within the subwatershed. The highly erodible land information was developed from the 2003 online NRCS Soil Data Mart.

Riparian Corridor Status

The chart on the following page shows the riparian corridor status for the Little Beaver Creek subwatershed. The chart indicates the number of miles that has various widths of tree canopy, or riparian corridor. The numbers account for both sides of the streams; therefore, the number of actual stream miles is half of that shown. The divisions are less than 10 feet in total width, 10 feet to 40 feet in total width, and greater than 40 feet in total width. The chart is also divided into perennial and intermittent streams under each of the corridor width column headings. MAP 61 illustrates the stream sections under each division.

The chart shows that with a total of 55.44 miles of stream network, the Little Beaver Creek subwatershed has 38.73 miles of stream with less than 10 feet of canopy and vegetation, 6.47 miles of stream with 10 feet to 40 feet canopy and vegetation, and 10.24 miles of stream with greater than 40 feet of canopy and vegetation. Overall, the Little Beaver Creek subwatershed has the fifth highest number of stream miles within the Wabash River Watershed, which is 9.8%. Of the entire Grand Lake/Wabash Watershed, this subwatershed has the fifth highest number of stream miles, which is 7.9%.

TABLE 79

Riparian Corridor Status

LITTLE BEAVER CREEK										
RIPARIAN STATUS	TREE CANOPY <10' IN TOTAL WIDTH			TREE CANOPY 10 to 40' IN WIDTH			TREE CANOPY >40' IN WIDTH			TOTAL STREAM MILES
	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	
	11.89	26.84	38.73	2.88	3.59	6.47	6.58	3.66	10.24	55.44
% of Subwatershed Total	21.4%	48.4%	69.9%	5.2%	6.5%	11.7%	11.9%	6.6%	18.5%	100.0%
% of Wabash Watershed Total	2.1%	4.8%	6.9%	0.5%	0.6%	1.1%	1.2%	0.6%	1.8%	9.8%
% of Grand Lake/Wabash Watershed Total	1.7%	3.8%	5.5%	0.4%	0.5%	0.9%	0.9%	0.5%	1.5%	7.9%

Operations and Animal Units

The table on the following page shows the number of operations and the animal units by species for the Little Beaver Creek subwatershed. According to the table, there are three poultry operations, 17 dairy operations, 14 hog operations, 23 beef operations and five horse and sheep operations within the entire subwatershed. The Little Beaver Creek subwatershed ranks seventh within the entire Grand Lake/Wabash River Watershed when considering the total number of operations with 62 or 6.3%. Animal units within the subwatershed ranks eighth of 15 with 3.2%.

Totals of animal units for each species are also listed on the table. The inventory for this subwatershed was completed during October and November of 2006. At the time of the inventory animal units were determined by the number of animals present. Although this is not a 1:1 ratio for all species, it is for beef cattle. The following chart shows the number of each type of animal that makes up 1,000 animal units.

Animal Type	1,000 Animal Unit Equivalent
Beef Cattle	1,000
Dairy Cattle	700
Hogs (over 55 lbs)	2,500
Turkeys	55,000
Layer Chickens	82,000
Pullet Chickens	125,000
Sheep	10,000
Horses	500

Table 80
Operations and Animal Units

LITTLE BEAVER CREEK														
ANIMAL TYPE	POULTRY		DAIRY		HOG		BEEF		OTHER		TOTAL		Total as % of Wabash Watershed	
# Farms and Animals	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s
	2 (Trky) 1	1,445 218	17	2,543	14	5,088	23	1,660	(sheep) 2 (hrs) 3	33 26	62	11,013	9.0%	4.7%
% of subwatershed total	4.8%	15.1%	27.4%	23.1%	22.6%	46.2%	37.1%	15.1%	8.1%	0.5%	100.0%	100.0%		
Total as % of Wabash Watershed	0.4%	0.7%	2.5%	1.1%	2.0%	2.2%	3.3%	0.7%	0.7%	0.0%	9.0%	4.7%		
Total as % of Grand Lake/Wabash Watershed	0.30%	0.49%	1.72%	0.74%	1.42%	1.49%	2.33%	0.49%	0.51%	0.02%	6.27%	3.22%		

Manure Production

After considering the number of livestock operations and animal units present in the subwatershed, it is only fitting to consider the by-products of these animals. The table on the opposite page is used to represent the manure and nutrient production for the Little Beaver Creek drainage area. The subwatershed ranks eighth overall, of 15, in terms of manure production per annum. Approximately 85,575 tons of manure is produced annually. The remainder of the columns on the table indicates the approximate pounds of nutrients contained in that manure. Nitrogen, potassium, and phosphate, are all important to the agricultural community and are provided to the crops via manure or commercial fertilizer applications.

These nutrients are also important in regards to water quality. According to the table, in the Little Beaver Creek subwatershed, the amount of phosphorus that is contained in the manure produced annually would need to be applied at 88 pounds per acre. The table below indicates the average crop removal rates for phosphorus for the major crops produced in the watershed. Values were obtained from the Ohio Agronomy Guide.

CROP	P_2O_5 REMOVAL (lb/ac)
Alfalfa (6T)	80
Corn (150 bu) Grain	55
Corn (25 T) Silage	80
Soybean (50 bu)	40
Wheat (75 bu) Grain	48

Considerations are given to the nutrient phosphorus due to its importance to crop production and the problems associated with the relationship between excessive phosphorus applications and degradation of water quality. Because much of the poultry manure is brokered out of the watershed, it seemed important to reflect the nutrient values assuming that 70% of the poultry manure is moved to locations outside the watershed. Local manure haulers estimated this value to be 90%; however, to be conservative, 70% was assumed for this plan. Under this assumption, the amount of phosphorus that is contained in the manure produced annually in this subwatershed would need to be applied at 76 pounds per acre.

What this seems to indicate throughout the watershed is that according to manure production and crop removal rates for limiting nutrient factors, there are not enough acres for proper manure application methods. The caveat on this statement is that the numbers are best estimates, variations in soil types and tilth can vary throughout the fields which may increase, or decrease, crop removal rates, and more importantly, some of the manure produced in each of the subwatersheds may be applied to acreages outside of that subwatershed, or even outside of the Grand Lake/Wabash watershed. It should be noted that several producers own or rent land both in the Grand Lake/Wabash watershed and in neighboring watersheds such as Loramie Creek or the St Marys River.

Table 81
Manure and Nutrient Production

LITTLE BEAVER CREEK						
Manure Production	Tons Raw Manure/Year	Lbs. N per Year	Lbs. K_2O per Year	Lbs. P_2O_5 per Year	Acres Cropland	Lbs. P_2O_5 per Crop Acre
	85,575	1,094,876	816,338	694,794	7,875	88
Less 70% Poultry Manure**	80,757	958,589	748,653	596,364	7,875	76
Approximate $ Value Per Year		$240,873	$122,451	$138,959		
Total Nutrient Value Per Year =	$502,282					

**Based on conversations with poultry manure brokers, it was estimated that at least 70% of the poultry manure is brokered out of the watershed.

The dollar values associated with each nutrient were obtained from OSU Extension Bulletin 604-06, "Ohio Livestock Manure Management Guide." The value for nitrogen is estimated at $0.22 per pound, the value for P_2O_5 is $0.20 per pound and the value for K_2O is $0.15 per pound.

Distance Between Livestock Operations and Streams

The table on the following page shows the distance between various livestock operations located in the Little Beaver Creek subwatershed and the waterways that drain to the Wabash River. It can be assumed that the greater the distance between a livestock operation and a water system, the potential of pollution from the operation reaching the stream is lessened.

Of notable interest is the number of all livestock operations located less than 1,000 feet from the waterbody. In this particular subwatershed, of 62 operations, 43 operations, or 70.5%, fall into the category. Also, 10 operations, 16.4%, are in within 2,000 feet and the remaining 13.1% are less than 3,000 feet from the nearest stream.

Table 82
Livestock Operations and Proximity to Streams

LITTLE BEAVER CREEK																		
ANIMAL TYPE	POULTRY			DAIRY			HOG			BEEF			OTHER			TOTAL		
	Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream		
	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'
	2	0	1	15	2	0	8	3	2	14	5	4	4	0	1	43	10	8
% of Subwatershed Total	3.3%	0.0%	1.6%	24.6%	3.3%	0.0%	13.1%	4.9%	3.3%	23.0%	8.2%	6.6%	6.6%	0.0%	1.6%	70.5%	16.4%	13.1%

Non-Point Source Pollution Potential

In order to provide a comparison of the pollution potential of each of the 15 subwatersheds, a ranking system for each of the main potential pollution sources was developed. These potential sources are stream miles with less than 10 feet of vegetation, the number of livestock or poultry operations less than 1,000 feet from a stream, the tons of raw manure produced yearly, the pounds of phosphorus per cropland acre available from the manure, the number of household wastewater disposal systems contained in clusters of ten or more) and the number of homes built pre-1973. Values of 1(less potential) to 10 (great potential) were given based on ranges shown in the table of the following page. Indicator scores are then summed to obtain a total pollution potential score for the subwatershed.

Subwatershed pollution potential scores can range from a maximum of 60 points to a minimum of six points. The Little Beaver Creek subwatershed ranks sixth out of 15, with 63.3% of the maximum points for pollution potential. Most significantly for the subwatershed is the number of household disposal systems in groups. Little Beaver Creek subwatershed scored the maximum points for this indicator and also scored the second highest point value for the number of operations within 1,000 feet of a stream.

NONPOINT SOURCE POLLUTION POTENTIAL SCORING MATRIX

MAXIMUM DRAINAGE UNIT SCORE = 60 (Highest Pollution Potential)

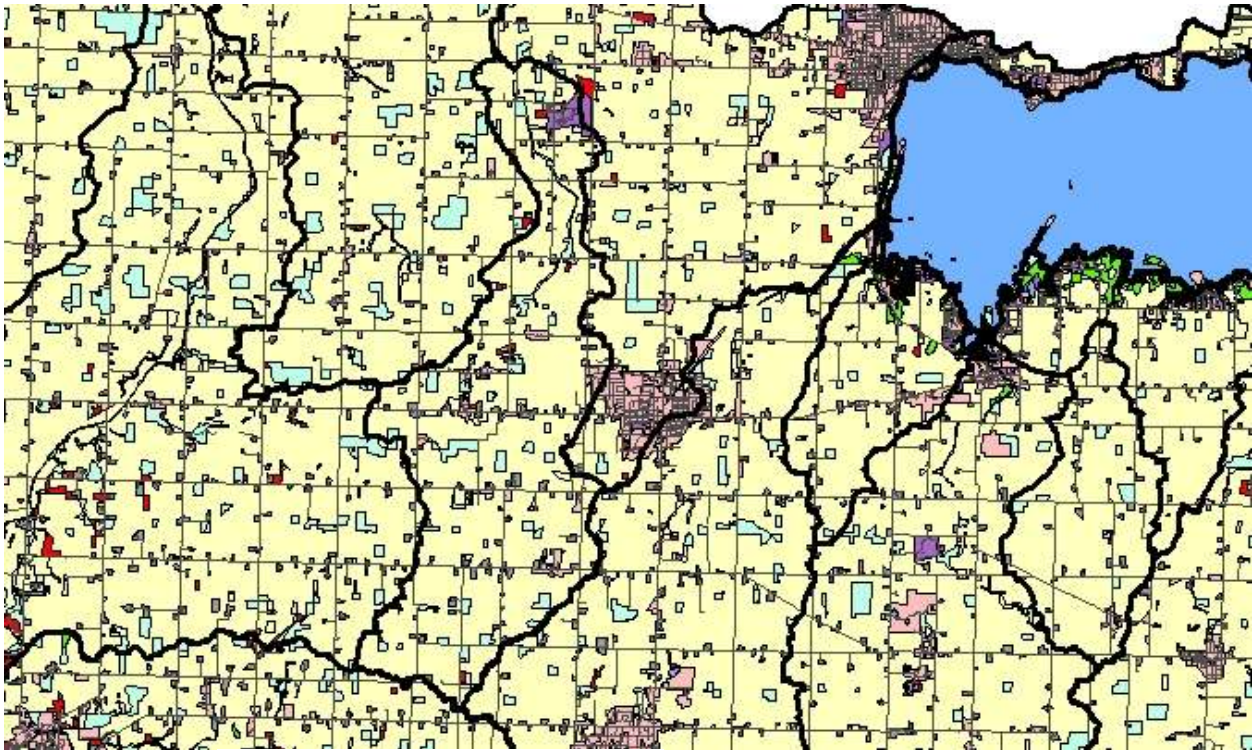
SCORE	Stream Miles with <10' Vegetation	Operations <1,000' to stream	Tons Raw Manure per Year	Lbs. P_2O_5 per Crop Acre	Household Disposal Systems in Groups	No. Homes Built pre-1973
10	72.00+	46+	180,000+	225+	90+	226+
9	64.00 - 71.99	41 - 45	160,000 - 179,999	200 - 224	80 - 89	201 -225
8	56.00 - 63.99	36 - 40	140,000 - 159,999	175 - 199	70 - 79	176 -200
7	48.00 - 55.99	31 - 35	120,000 - 139,999	150 - 174	60 - 69	151 - 175
6	40.00 - 47.99	26 - 30	100,000 - 119,999	125 - 149	50 - 59	126 - 150
5	32.00 - 39.99	21 - 25	80,000 - 99,999	100 - 124	40 - 49	101 - 125
4	24.00 - 31.99	16 - 20	60,000 - 79,999	75- 99	30 - 39	76 - 100
3	16.00 - 23.99	11 - 15	40,000 - 59,999	50 - 74	20 - 29	51 - 75
2	8.00 - 15.99	6 - 10	20,000 - 39,999	25 - 49	10 - 19	26 - 50
1	0.00 - 7.99	0 - 5	0 - 19,999	0 - 24	0 - 10	0 - 25

MINIMUM DRAINAGE UNIT SCORE = 6 (Lowest Pollution Potential)

TABLE 83
NPS Pollution Potential

LITTLE BEAVER CREEK							
SUBWATERSHED ATTRIBUTE	Stream Miles with <10' Vegetation SCORE	Operations <1,000' to stream SCORE	Tons Raw Manure per Year SCORE	Lbs. P_2O_5 per Crop Acre SCORE	Household Disposal Systems in Groups SCORE	No. Homes Built pre-1973 SCORE	TOTAL SCORE
	5	9	5	4	10	5	38

MAP 61
Little Beaver Creek Land Use



Legend

Grand Lake/Wabash Watershed

Roadways

Land Use

Cropland

Urban

Farmsteads

Shrub_Brush

Deciduous Forest

Open Water

Wetlands

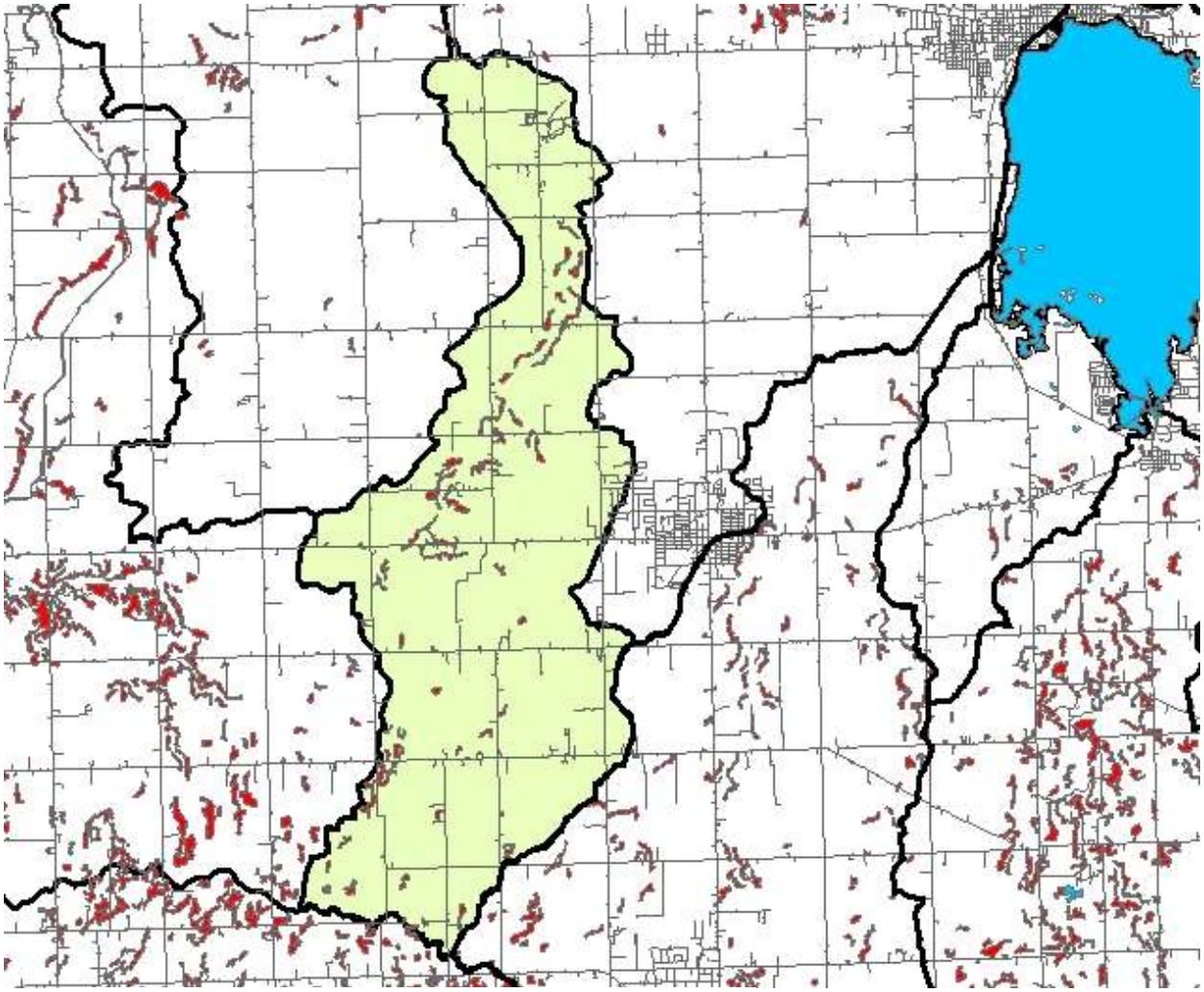
Barren/Undeveloped

N

W E

S

MAP 62
Little Beaver Creek Highly Erodible Land

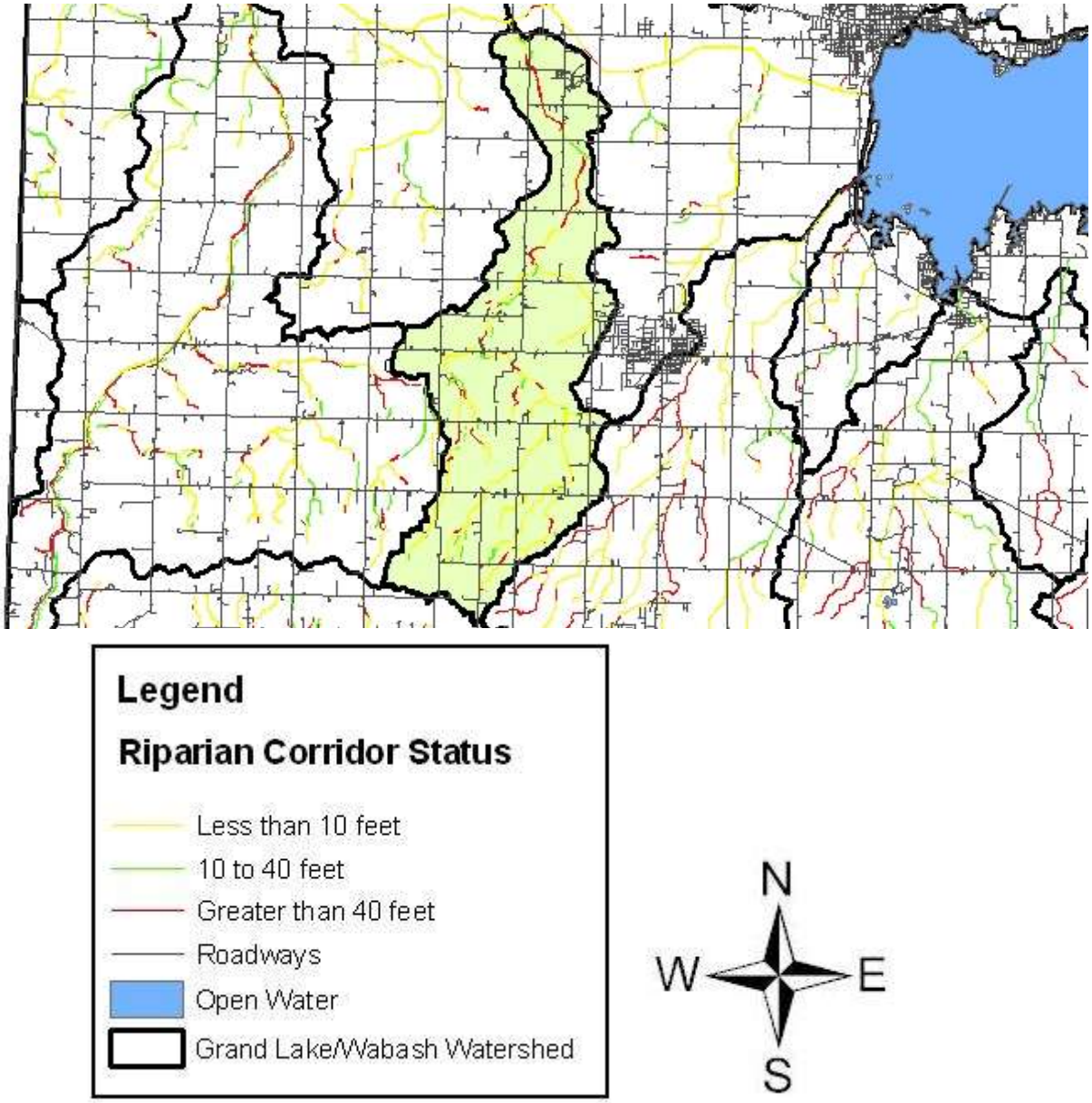


Legend

- Highly erodible land
- Roadways
- Open Water
- Subwatershed

N
W E
S

MAP 63
Little Beaver Creek Riparian Corridor Status



4.2.6 Beaver Creek below Little Beaver Creek to Wabash River

The Beaver Creek below Little Beaver Creek to Wabash River subwatershed drains the western portion of the Beaver Creek watershed prior to Beaver Creek's entrance into the Wabash River. It is in the north-central portion of the Wabash River drainage basin. The entire subwatershed is located in Mercer County. The acres, square miles, and percent of subwatershed are shown below. The Beaver Creek below Little Beaver Creek to Wabash River subwatershed, according to percentages, is the fourth largest of the eight subwatersheds draining to the Wabash River. Of the entire Grand/Lake Wabash Watershed, it is the fifth largest of fifteen subwatersheds.

TABLE 84

BEAVER CREEK BELOW LITTLE BEAVER CREEK TO WABASH RIVER	
Acreage	16,077
Square Miles	25.1
% of Wabash Watershed Total Land Area	13.3%
% of Grand Lake/Wabash Watershed Total Land Area	8.9%

Water Quality Status

The Beaver Creek below Little Beaver Creek to Wabash River subwatershed has been designated as a warm water habitat (WWH). This aquatic life use designation has been established by Ohio EPA, and based on recent data sampling, the water resource is shown as not meeting that use designation, or in a "non-attainment" status. Furthermore, the subwatershed is shown as NPS impacted. Suspected or proven impacts to these streams include: non-irrigated crop production, animal feeding operations, channelization, removal of riparian vegetation and stream bank destabilization. Definitions and criteria for these descriptives can be found in Appendix C aquatic life use designations and assessment terms.

A TMDL report for the Wabash River watershed was finalized by US EPA in August of 2004. Ohio EPA is also completing a TMDL report for Beaver Creek and Grand Lake St. Marys, which is currently in process of being finalized. The 2004 report showed that on average, 50 percent of the samples collected in this subwatershed were over the recommended total phosphorus level of 0.17 mg/L. On average, 50% of the samples were over the recommended nitrate-nitrite level of 1.5 mg/L, and 50% of the samples were over the recommended total suspended solids level of 32 mg/L. The draft TMDL report currently being completed calls for a 32% reduction in phosphorus, a 44% reduction in nitrate and a 90% reduction in fecal coliform for this subwatershed.

Water Supplies and Discharges

There are no community water supplies within the Beaver Creek below Little Beaver Creek to Wabash River subwatershed, no Ohio EPA regulated point source discharge, no non-transient non-community water supplies, no transient non-community water supplies and no Ohio EPA regulated point source discharges.

Based on recent aerial photographs, areas where 10 or more household wastewater treatment and disposal systems were present in close proximity was determined. As with any individual treatment system operating in an area with poorly drained soils, the effects of the effluent on the receiving water body is a concern. These effects grow as the number of systems in a given area increases, thus clusters or groups of 10 or more systems has been used to analyze the potential effects of those systems on the water quality. Regarding the Beaver Creek below Little Beaver Creek to Wabash River subwatershed, there were a total of two clusters identified comprised of 29 individual treatment systems.

Highly Erodible Land

Map 63 at the end of this subsection illustrates the highly erodible land locations within the Beaver Creek below Little Beaver Creek to Wabash River subwatershed. Of the eight subwatersheds within the Wabash River watershed, Beaver Creek below Little Beaver Creek to Wabash River ranks sixth highest in the amount of highly erodible land present within the subwatershed. The highly erodible land information was developed from the 2003 online NRCS Soil Data Mart.

Riparian Corridor Status

The chart on the following page shows the riparian corridor status for the Little Beaver Creek subwatershed. The chart indicates the number of miles that has various widths of tree canopy, or riparian corridor. The numbers account for both sides of the streams; therefore, the number of actual stream miles is half of that shown. The divisions are less than 10 feet in total width, 10 feet to 40 feet in total width, and greater than 40 feet in total width. The chart is also divided into perennial and intermittent streams under each of the corridor width column headings. MAP 64 illustrates the stream sections under each division.

The chart shows that with a total of 58.62 miles of stream network, the Beaver Creek below Little Beaver Creek to Wabash River subwatershed has 51.05 miles of stream with less than 10 feet of canopy and vegetation, 2.46 miles of stream with 10 feet to 40 feet canopy and vegetation, and 5.11 miles of stream with greater than 40 feet of canopy and vegetation. Overall, the Beaver Creek below Little Beaver Creek to Wabash River subwatershed has the fourth highest number of stream miles within the Wabash River Watershed, which is 10.4%. Of the entire Grand Lake/Wabash Watershed, this subwatershed has the fourth highest number of stream miles, which is 8.3%.

TABLE 85

Riparian Corridor Status

BEAVER CREEK BELOW LITTLE BEAVER CREEK TO WABASH RIVER										
RIPARIAN STATUS	TREE CANOPY <10' IN TOTAL WIDTH			TREE CANOPY 10 to 40' IN WIDTH			TREE CANOPY >40' IN WIDTH			TOTAL STREAM MILES
	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	
	20.81	30.24	51.05	0.07	2.39	2.46	1.61	3.5	5.11	58.62
% of Subwatershed Total	35.5%	51.6%	87.1%	0.1%	4.1%	4.2%	2.7%	6.0%	8.7%	100.0%
% of Wabash Watershed Total	3.7%	5.4%	9.0%	0.0%	0.4%	0.4%	0.3%	0.6%	0.9%	10.4%
% of Grand Lake/Wabash Watershed Total	3.0%	4.3%	7.2%	0.0%	0.3%	0.3%	0.2%	0.5%	0.7%	8.3%

Operations and Animal Units

The table on the following page shows the number of operations and the animal units by species for the Beaver Creek below Little Beaver Creek to Wabash River subwatershed. According to the table, there are seven poultry operations, six dairy operations, 18 hog operations, 36 beef operations and 17 horse and sheep operations within the entire subwatershed. The Beaver Creek below Little Beaver Creek to Wabash River subwatershed ranks sixth within the entire Grand Lake/Wabash River Watershed when considering the total number of operations with 84 or 8.5%. Animal units within the subwatershed ranks seventh of 15 with 4.5%.

Totals of animal units for each species are also listed on the table. The inventory for this subwatershed was completed during October of 2006. At the time of the inventory animal units were determined by the number of animals present. Although this is not a 1:1 ratio for all species, it is for beef cattle. The following chart shows the number of each type of animal that makes up 1,000 animal units.

Animal Type	1,000 Animal Unit Equivalent
Beef Cattle	1,000
Dairy Cattle	700
Hogs (over 55 lbs)	2,500
Turkeys	55,000
Layer Chickens	82,000
Pullet Chickens	125,000
Sheep	10,000
Horses	500

Table 86
Operations and Animal Units

BEAVER CREEK BELOW LITTLE BEAVER CREEK TO WABASH RIVER														
ANIMAL TYPE	POULTRY		DAIRY		HOG		BEEF		OTHER		TOTAL		Total as % of Wabash Watershed	
# Farms and Animals	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s
	5 (Trky) 2	2,735 436	6	721	18	9,340	36	2,172	(sheep) 4 (hrs) 13	6 100	84	15,511	12.2%	6.6%
% of subwatershed total	8.3%	20.4%	7.1%	4.7%	21.4%	60.2%	42.9%	14.0%	20.2%	0.7%	100.0%	100.0%		
Total as % of Wabash Watershed	1.0%	1.3%	0.9%	0.3%	2.6%	3.9%	5.2%	0.9%	2.5%	0.0%	12.2%	6.6%		
Total as % of Grand Lake/Wabash Watershed	0.71%	0.93%	0.61%	0.21%	1.82%	2.73%	3.64%	0.64%	1.72%	0.03%	8.49%	4.54%		

Manure Production

After considering the number of livestock operations and animal units present in the subwatershed, it is only fitting to consider the by-products of these animals. The table on the opposite page is used to represent the manure and nutrient production for the Beaver Creek below Little Beaver Creek to Wabash River drainage area. The subwatershed ranks seventh overall, of 15, in terms of manure production per annum. Approximately 89,394 tons of manure is produced annually. The remainder of the columns on the table indicates the approximate pounds of nutrients contained in that manure. Nitrogen, potassium, and phosphate, are all important to the agricultural community and are provided to the crops via manure or commercial fertilizer applications.

These nutrients are also important in regards to water quality. According to the table, in the Beaver Creek below Little Beaver Creek to Wabash River subwatershed, the amount of phosphorus that is contained in the manure produced annually would need to be applied at 68 pounds per acre. The table below indicates the average crop removal rates for phosphorus for the major crops produced in the watershed. Values were obtained from the Ohio Agronomy Guide.

CROP	**P_2O_5 REMOVAL (lb/ac)**
Alfalfa (6T)	80
Corn (150 bu) Grain	55
Corn (25 T) Silage	80
Soybean (50 bu)	40
Wheat (75 bu) Grain	48

Considerations are given to the nutrient phosphorus due to its importance to crop production and the problems associated with the relationship between excessive phosphorus applications and degradation of water quality. Because much of the poultry manure is brokered out of the watershed, it seemed important to reflect the nutrient values assuming that 70% of the poultry manure is moved to locations outside the watershed. Local manure haulers estimated this value to be 90%; however, to be conservative, 70% was assumed for this plan. Under this assumption, the amount of phosphorus that is contained in the manure produced annually in this subwatershed would need to be applied at 54 pounds per acre.

Table 87
Manure and Nutrient Production

BEAVER CREEK BELOW LITTLE BEAVER CREEK TO WABASH RIVER						
Manure Production	Tons Raw Manure/Year	Lbs. N per Year	Lbs. K_2O per Year	Lbs. P_2O_5 per Year	Acres Cropland	Lbs. P_2O_5 per Crop Acre
	89,394	1,297,469	948,098	978,455	14,350	68
Less 70% Poultry Manure**	80,460	1,059,250	820,237	781,110	14,350	54
Approximate $ Value Per Year		$285,443	$142,215	$195,691		
Total Nutrient Value Per Year =	$623,349					

**Based on conversations with poultry manure brokers, it was estimated that at least 70% of the poultry manure is brokered out of the watershed.

The dollar values associated with each nutrient were obtained from OSU Extension Bulletin 604-06, "Ohio Livestock Manure Management Guide." The value for nitrogen is estimated at $0.22 per pound, the value for P_2O_5 is $0.20 per pound and the value for K_2O is $0.15 per pound.

Distance Between Livestock Operations and Streams

The table on the following page shows the distance between various livestock operations located in the Beaver Creek below Little Beaver Creek to Wabash River subwatershed and the waterways that drain to the Wabash River. It can be assumed that the greater the distance between a livestock operation and a water system, the potential of pollution from the operation reaching the stream is lessened.

Of notable interest is the number of all livestock operations located less than 1,000 feet from the waterbody. In this particular subwatershed, of 84 operations, 32 operations, or 38.1%, fall into the category. Also, 20 operations, 23.8%, are in within 2,000 feet and the remaining 38.1%, 32 operations, are less than 3,000 feet from the nearest stream.

Table 88
Livestock Operations and Proximity to Streams

BEAVER CREEK BELOW LITTLE BEAVER CREEK TO WABASH RIVER																		
ANIMAL TYPE	POULTRY			DAIRY			HOG			BEEF			OTHER			TOTAL		
	Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream		
	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'
	3	1	3	2	1	3	4	8	6	15	7	14	8	3	6	32	20	32
% of Subwatershed Total	3.6%	1.2%	3.6%	2.4%	1.2%	3.6%	4.8%	9.5%	7.1%	17.9%	8.3%	16.7%	9.5%	3.6%	7.1%	38.1%	23.8%	38.1%

Non-Point Source Pollution Potential

In order to provide a comparison of the pollution potential of each of the 15 subwatersheds, a ranking system for each of the main potential pollution sources was developed. These potential sources are stream miles with less than 10 feet of vegetation, the number of livestock or poultry operations less than 1,000 feet from a stream, the tons of raw manure produced yearly, the pounds of phosphorus per cropland acre available from the manure, the number of household wastewater disposal systems contained in clusters of ten or more) and the number of homes built pre-1973. Values of 1(less potential) to 10 (great potential) were given based on ranges shown in the table of the following page. Indicator scores are then summed to obtain a total pollution potential score for the subwatershed.

Subwatershed pollution potential scores can range from a maximum of 60 points to a minimum of six points. The Beaver Creek below Little Beaver Creek to Wabash River subwatershed ranks eighth out of 15, with 51.7% of the maximum points for pollution potential. Most significantly for the subwatershed is the number of stream miles with less than 10 feet of vegetation and the number of operations within 1,000 feet of a stream. Beaver Creek below Little Beaver Creek to Wabash River subwatershed scored seven out of 10 points for both of these indicators.

NONPOINT SOURCE POLLUTION POTENTIAL SCORING MATRIX

MAXIMUM DRAINAGE UNIT SCORE = 60 (Highest Pollution Potential)

SCORE	Stream Miles with <10' Vegetation	Operations <1,000' to stream	Tons Raw Manure per Year	Lbs. P_2O_5 per Crop Acre	Household Disposal Systems in Groups	No. Homes Built pre-1973
10	72.00+	46+	180,000+	225+	90+	226+
9	64.00 - 71.99	41 - 45	160,000 - 179,999	200 - 224	80 - 89	201 -225
8	56.00 - 63.99	36 - 40	140,000 - 159,999	175 - 199	70 - 79	176 -200
7	48.00 - 55.99	31 - 35	120,000 - 139,999	150 - 174	60 - 69	151 - 175
6	40.00 - 47.99	26 - 30	100,000 - 119,999	125 - 149	50 - 59	126 - 150
5	32.00 - 39.99	21 - 25	80,000 - 99,999	100 - 124	40 - 49	101 - 125
4	24.00 - 31.99	16 - 20	60,000 - 79,999	75- 99	30 - 39	76 - 100
3	16.00 - 23.99	11 - 15	40,000 - 59,999	50 - 74	20 - 29	51 - 75
2	8.00 - 15.99	6 - 10	20,000 - 39,999	25 - 49	10 - 19	26 - 50
1	0.00 - 7.99	0 - 5	0 - 19,999	0 - 24	0 - 10	0 - 25

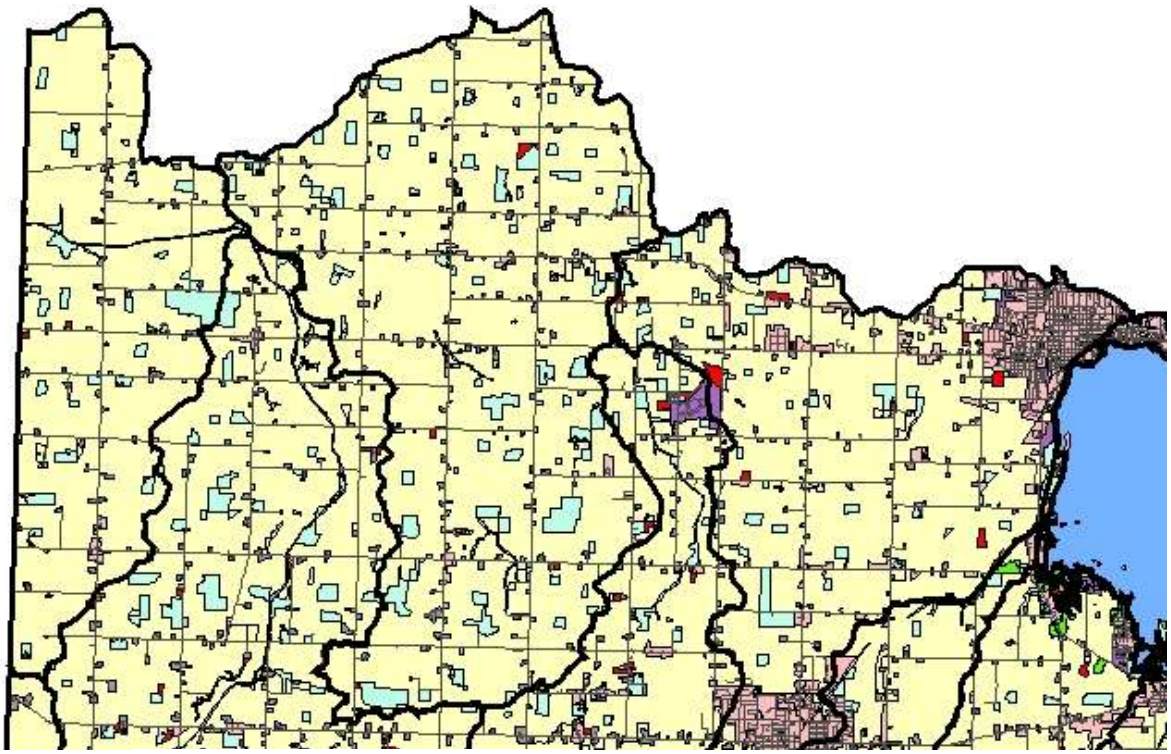
MINIMUM DRAINAGE UNIT SCORE = 6 (Lowest Pollution Potential)

TABLE 89
NPS Pollution Potential

BEAVER CREEK BELOW LITTLE BEAVER CREEK TO WABASH RIVER							
SUBWATERSHED ATTRIBUTE	Stream Miles with <10' Vegetation SCORE	Operations <1,000' to stream SCORE	Tons Raw Manure per Year SCORE	Lbs. P_2O_5 per Crop Acre SCORE	Household Disposal Systems in Groups SCORE	No. Homes Built pre-1973 SCORE	TOTAL SCORE
	7	7	5	3	3	6	31

MAP 64

Beaver Creek below Little Beaver Creek to Wabash River Land Use



Legend

Grand Lake/Wabash Watershed

Roadways

Land Use

Cropland

Urban

Farmsteads

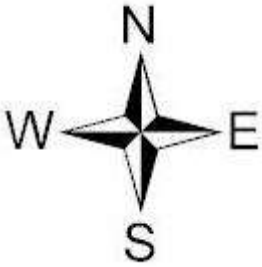
Shrub_Brush

Deciduous Forest

Open Water

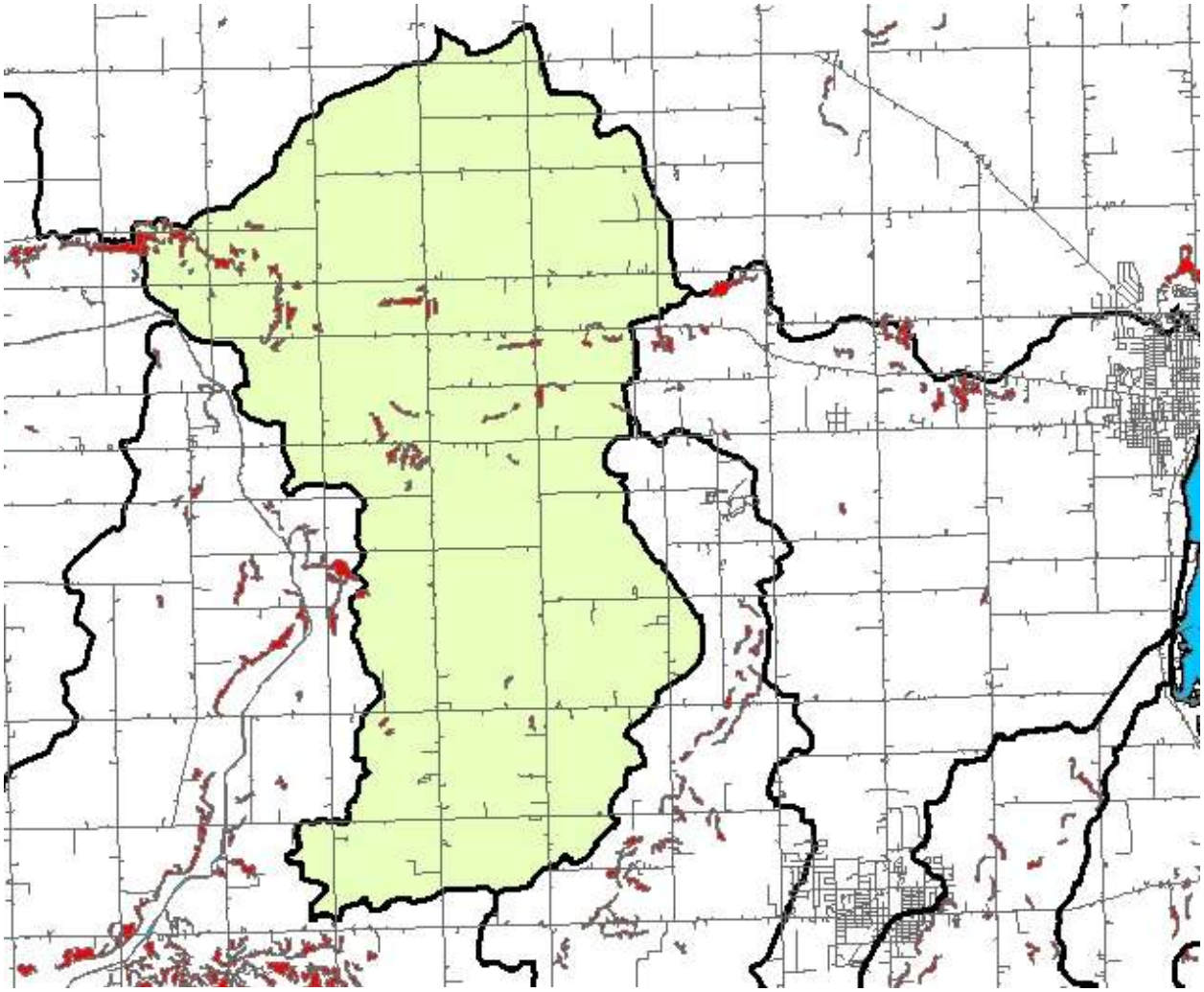
Wetlands

Barren/Undeveloped



MAP 65

Beaver Creek below Little Beaver Creek to Wabash River Highly Erodible Land



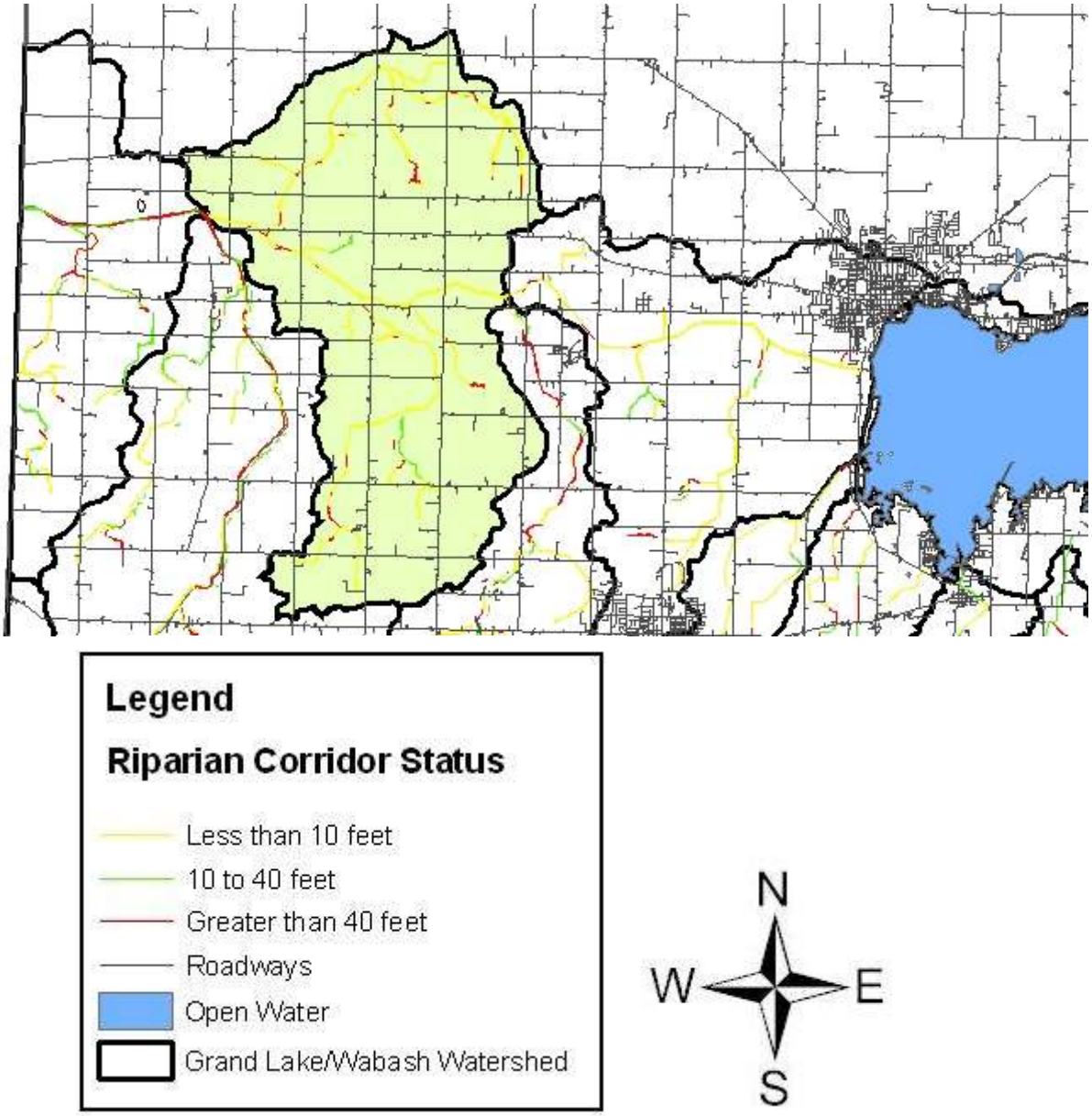
Legend

- Highly erodible land
- Roadways
- Open Water
- Subwatershed

N
W E
S

MAP 66

Beaver Creek below Little Beaver Creek to Wabash River Riparian Corridor Status



4.2.7 Wabash River below Beaver Creek to New Corydon

The Wabash River below Beaver Creek to New Corydon subwatershed drains the northwestern portion of the Wabash watershed prior to the river's entrance into Indiana. The subwatershed is located entirely in Mercer County. The acres, square miles, and percent of subwatershed are shown below. The Wabash River below Beaver Creek to New Corydon subwatershed, according to percentages, is the seventh largest of the eight subwatersheds draining to the Wabash River. Of the entire Grand/Lake Wabash Watershed, it is the tenth largest of fifteen subwatersheds.

TABLE 90

WABASH RIVER BELOW BEAVER CREEK TO NEW CORYDON	
Acreage	8,084
Square Miles	12.63
% of Wabash Watershed Total Land Area	6.7%
% of Grand Lake/Wabash Watershed Total Land Area	4.5%

Water Quality Status

The Wabash River below Beaver Creek to New Corydon has been designated as a warm water habitat (WWH). This aquatic life use designation has been established by Ohio EPA, and based on recent data sampling, the water resource is shown as not meeting that use designation, or in a "non-attainment" status. Furthermore, the subwatershed is shown as NPS impacted. Suspected or proven impacts to these streams include: Agriculture-crop production, confined animal feeding operations, on-site wastewater treatment systems, channelization, removal of riparian vegetation and streambank destabilization. Definitions and criteria for these descriptives can be found in Appendix C aquatic life use designations and assessment terms.

A TMDL report for the Wabash River watershed was finalized by US EPA in August of 2004. The report showed that on average, all samples collected in this subwatershed were over the recommended total phosphorus level of 0.17 mg/L. On average, 50% of the samples were over the recommended nitrate-nitrite level of 1.5 mg/L, and 100% of the samples were over the recommended total suspended solids level of 32 mg/L.

Water Supplies, Withdrawals, and Discharges

There are no community water supplies within the Wabash River below Beaver Creek to New Corydon subwatershed. There is one transient non-community water supply, the Pit Stop Tavern. There are no Ohio EPA regulated point source discharges in the subwatershed.

Based on recent aerial photographs, areas where 10 or more household wastewater treatment and disposal systems were present in close proximity was determined. As

with any individual treatment system operating in an area with poorly drained soils, the effects of the effluent on the receiving water body is a concern. These effects grow as the number of systems in a given area increases, thus clusters or groups of 10 or more systems has been used to analyze the potential effects of those systems on the water quality. Regarding the Wabash River below Beaver Creek to New Corydon subwatershed, there were a total of one cluster identified comprised of 18 individual treatment systems.

Highly Erodible Land

Map 66 at the end of this subsection illustrates the highly erodible land locations within the Wabash River below Beaver Creek to New Corydon subwatershed. Of the eight subwatersheds within the Wabash River watershed, Wabash River below Beaver Creek to New Corydon ranks fourth highest in the amount of highly erodible land present within the subwatershed. The highly erodible land information was developed from the 2003 online NRCS Soil Data Mart.

Riparian Corridor Status

The chart on the following page shows the riparian corridor status for the Wabash River below Beaver Creek to New Corydon subwatershed. The chart indicates the number of miles that has various widths of tree canopy, or riparian corridor. The numbers account for both sides of the streams; therefore, the number of actual stream miles is half of that shown. The divisions are less than 10 feet in total width, 10 feet to 40 feet in total width, and greater than 40 feet in total width. The chart is also divided into perennial and intermittent streams under each of the corridor width column headings. MAP 67 illustrates the stream sections under each division.

The chart shows that with a total of 24.3 miles of stream network, the Wabash River below Beaver Creek to New Corydon subwatershed has 9.95 miles of stream with less than 10 feet of canopy and vegetation, 8.00 miles of stream with 10 feet to 40 feet canopy and vegetation, and 6.35 miles of stream with greater than 40 feet of canopy and vegetation. Overall, the Wabash River Headwaters to below Bear Creek subwatershed has the seventh highest number of stream miles within the Wabash River Watershed, which is 4.3%. Of the entire Grand Lake/Wabash Watershed, this subwatershed has the tenth highest number of stream miles, which is 3.4%.

TABLE 91

Riparian Corridor Status

WABASH RIVER BELOW BEAVER CREEK TO NEW CORYDON										
RIPARIAN STATUS	TREE CANOPY <10' IN TOTAL WIDTH			TREE CANOPY 10 to 40' IN WIDTH			TREE CANOPY >40' IN WIDTH			TOTAL STREAM MILES
	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	
	0.19	9.76	9.95	1.89	6.11	8.00	3.36	2.99	6.35	24.30
% of Subwatershed Total	0.8%	40.2%	40.9%	7.8%	25.1%	32.9%	13.8%	12.3%	26.1%	100.0%
% of Wabash Watershed Total	0.0%	1.7%	1.8%	0.3%	1.1%	1.4%	0.6%	0.5%	1.1%	4.3%
% of Grand Lake/Wabash Watershed Total	0.0%	1.4%	1.4%	0.3%	0.9%	1.1%	0.5%	0.4%	0.9%	3.4%

Operations and Animal Units

The table on the following page shows the number of operations and the animal units by species for the Wabash River below Beaver Creek to New Corydon subwatershed. According to the table, there are five poultry operations, four dairy operations, three hog operations, 12 beef operations and three horse and sheep operations within the entire subwatershed. The Wabash River below Beaver Creek to New Corydon subwatershed ranks eleventh within the entire Grand Lake/Wabash River Watershed when considering the total number of operations with 27 or 2.7%. Animal units within the subwatershed ranks tenth of 15 with 2.5%.

Totals of animal units for each species are also listed on the table. The inventory for this subwatershed was completed during October and November of 2006. At the time of the inventory animal units were determined by the number of animals present. Although this is not a 1:1 ratio for all species, it is for beef cattle. The following chart shows the number of each type of animal that makes up 1,000 animal units.

Animal Type	1,000 Animal Unit Equivalent
Beef Cattle	1,000
Dairy Cattle	700
Hogs (over 55 lbs)	2,500
Turkeys	55,000
Layer Chickens	82,000
Pullet Chickens	125,000
Sheep	10,000
Horses	500

Table 92
Operations and Animal Units

WABASH RIVER BELOW BEAVER TO NEW CORYDON														
ANIMAL TYPE	POULTRY		DAIRY		HOG		BEEF		OTHER		TOTAL		% of Wabash Watershed	
# Farms and Animals	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s
	2 (Trky) 3	5,623 764	4	600	3	480	12	995	(sheep) (hrs) 3	0 8	27	8,470	3.9%	3.6%
% of subwatershed total	18.5%	75.4%	14.8%	7.1%	11.1%	5.7%	44.4%	11.7%	11.1%	0.1%	100.0%	100.0%		
Total as % of Wabash Watershed	0.7%	2.7%	0.6%	0.3%	0.4%	0.2%	1.7%	0.4%	0.4%	0.0%	3.9%	3.6%		
Total as % of Grand Lake/Wabash Watershed	0.51%	1.87%	0.40%	0.18%	0.30%	0.14%	1.21%	0.29%	0.30%	0.00%	2.73%	2.48%		

Manure Production

After considering the number of livestock operations and animal units present in the subwatershed, it is only fitting to consider the by-products of these animals. The table on the opposite page is used to represent the manure and nutrient production for the Wabash River below Beaver Creek to New Corydon drainage area. The subwatershed ranks tenth overall, of 15, in terms of manure production per annum. Approximately 46,886 tons of manure is produced annually. The remainder of the columns on the table indicates the approximate pounds of nutrients contained in that manure. Nitrogen, potassium, and phosphate, are all important to the agricultural community and are provided to the crops via manure or commercial fertilizer applications.

These nutrients are also important in regards to water quality. According to the table, in the Wabash River below Beaver Creek to New Corydon subwatershed, the amount of phosphorus that is contained in the manure produced annually would need to be applied at 99 pounds per acre. The table below indicates the average crop removal rates for phosphorus for the major crops produced in the watershed. Values were obtained from the Ohio Agronomy Guide.

CROP	P_2O_5 REMOVAL (lb/ac)
Alfalfa (6T)	80
Corn (150 bu) Grain	55
Corn (25 T) Silage	80
Soybean (50 bu)	40
Wheat (75 bu) Grain	48

Considerations are given to the nutrient phosphorus due to its importance to crop production and the problems associated with the relationship between excessive phosphorus applications and degradation of water quality. Because much of the poultry manure is brokered out of the watershed, it seemed important to reflect the nutrient values assuming that 70% of the poultry manure is moved to locations outside the watershed. Local manure haulers estimated this value to be 90%; however, to be conservative, 70% was assumed for this plan. Under this assumption, the amount of phosphorus that is contained in the manure produced annually in this subwatershed would need to be applied at 44 pounds per acre.

What this seems to indicate throughout the watershed is that according to manure production and crop removal rates for limiting nutrient factors, there are not enough acres for proper manure application methods. The caveat on this statement is that the numbers are best estimates, variations in soil types and tilth can vary throughout the fields which may increase, or decrease, crop removal rates, and more importantly, some of the manure produced in each of the subwatersheds may be applied to acreages outside of that subwatershed, or even outside of the Grand Lake/Wabash watershed. It should be noted that several producers own or rent land both in the Grand Lake/Wabash watershed and in neighboring watersheds such as Loramie Creek or the St Marys River.

Table 93
Manure and Nutrient Production

WABASH RIVER BELOW BEAVER CREEK TO NEW CORYDON						
Manure Production	Tons Raw Manure/Year	Lbs. N per Year	Lbs. K_2O per Year	Lbs. P_2O_5 per Year	Acres Cropland	Lbs. P_2O_5 per Crop Acre
	46,886	897,457	552,477	718,562	7,232	99
Less 70% Poultry Manure**	29,424	438,521	303,702	321,538	7,232	44
Approximate $ Value Per Year		$197,440	$82,872	$143,712		
Total Nutrient Value Per Year = $424,024						

**Based on conversations with poultry manure brokers, it was estimated that at least 70% of the poultry manure is brokered out of the watershed.

The dollar values associated with each nutrient were obtained from OSU Extension Bulletin 604-06, "Ohio Livestock Manure Management Guide." The value for nitrogen is estimated at $0.22 per pound, the value for P_2O_5 is $0.20 per pound and the value for K_2O is $0.15 per pound.

Distance Between Livestock Operations and Streams

The table on the following page shows the distance between various livestock operations located in the Wabash River below Beaver Creek to New Corydon subwatershed and the waterways that drain to the Wabash River. It can be assumed that the greater the distance between a livestock operation and a water system, the potential of pollution from the operation reaching the stream is lessened.

Of notable interest is the number of all livestock operations located less than 1,000 feet from the waterbody. In this particular subwatershed, out of 27 operations, 11 operations, or 40.7%, fall into the category. Also, five operations, 18.2%, are in within 2,000 feet and the remaining 40.7%, 11 operations, are less than 3,000 feet from the nearest stream.

Table 94
Livestock Operations and Proximity to Streams

WABASH RIVER BELOW BEAVER TO NEW CORYDON																		
ANIMAL TYPE	POULTRY			DAIRY			HOG			BEEF			OTHER			TOTAL		
	Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream		
	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'
	4	0	1	1	0	3	0	0	3	5	5	2	1	0	2	11	5	11
% of Subwatershed Total	14.8%	0.0%	3.7%	3.7%	0.0%	11.1%	0.0%	0.0%	11.1%	18.5%	18.5%	7.4%	3.7%	0.0%	7.4%	40.7%	18.5%	40.7%

Non-Point Source Pollution Potential

In order to provide a comparison of the pollution potential of each of the 15 subwatersheds, a ranking system for each of the main potential pollution sources was developed. These potential sources are stream miles with less than 10 feet of vegetation, the number of livestock or poultry operations less than 1,000 feet from a stream, the tons of raw manure produced yearly, the pounds of phosphorus per cropland acre available from the manure, the number of household wastewater disposal systems contained in clusters of ten or more) and the number of homes built pre-1973. Values of 1(less potential) to 10 (great potential) were given based on ranges shown in the table of the following page. Indicator scores are then summed to obtain a total pollution potential score for the subwatershed.

Subwatershed pollution potential scores can range from a maximum of 60 points to a minimum of six points. The Wabash River below Beaver Creek to New Corydon subwatershed ranks of eleventh out of 15, with 23.3% of the maximum points for pollution potential.

NONPOINT SOURCE POLLUTION POTENTIAL SCORING MATRIX

MAXIMUM DRAINAGE UNIT SCORE = 60 (Highest Pollution Potential)

SCORE	Stream Miles with <10' Vegetation	Operations <1,000' to stream	Tons Raw Manure per Year	Lbs. P_2O_5 per Crop Acre	Household Disposal Systems in Groups	No. Homes Built pre-1973
10	72.00+	46+	180,000+	225+	90+	226+
9	64.00 - 71.99	41 - 45	160,000 - 179,999	200 - 224	80 - 89	201 -225
8	56.00 - 63.99	36 - 40	140,000 - 159,999	175 - 199	70 - 79	176 -200
7	48.00 - 55.99	31 - 35	120,000 - 139,999	150 - 174	60 - 69	151 - 175
6	40.00 - 47.99	26 - 30	100,000 - 119,999	125 - 149	50 - 59	126 - 150
5	32.00 - 39.99	21 - 25	80,000 - 99,999	100 - 124	40 - 49	101 - 125
4	24.00 - 31.99	16 - 20	60,000 - 79,999	75- 99	30 - 39	76 - 100
3	16.00 - 23.99	11 - 15	40,000 - 59,999	50 - 74	20 - 29	51 - 75
2	8.00 - 15.99	6 - 10	20,000 - 39,999	25 - 49	10 - 19	26 - 50
1	0.00 - 7.99	0 - 5	0 - 19,999	0 - 24	0 - 10	0 - 25

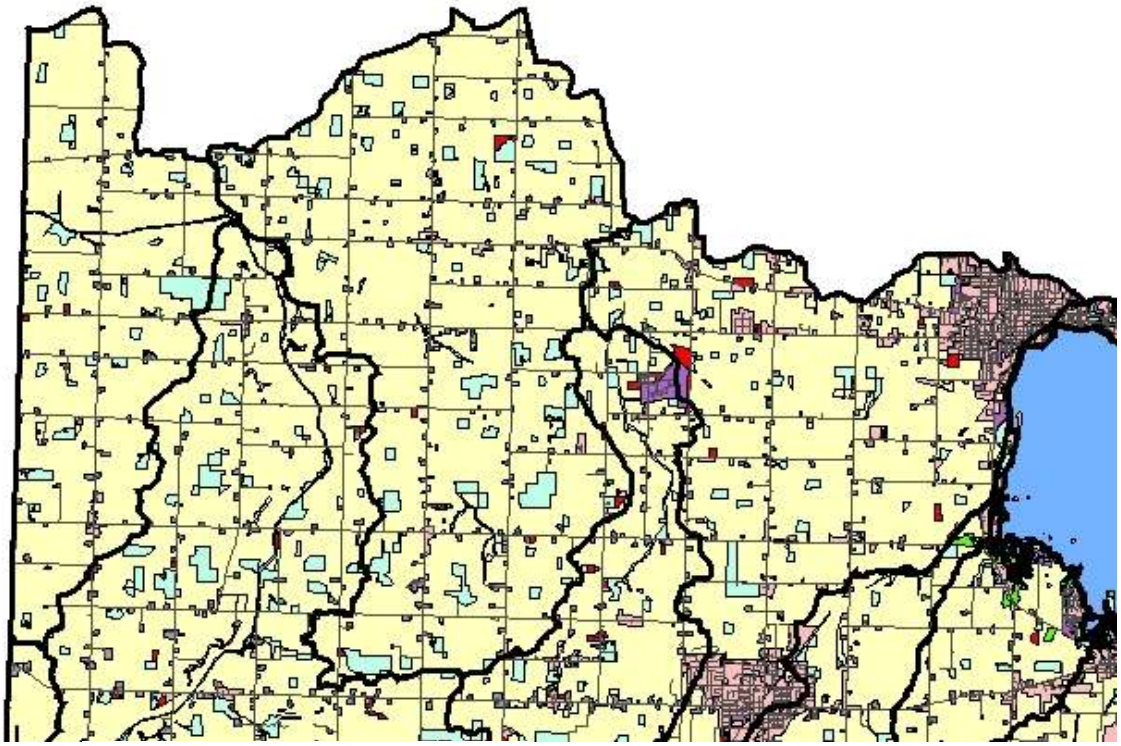
MINIMUM DRAINAGE UNIT SCORE = 6 (Lowest Pollution Potential)

TABLE 95
NPS Pollution Potential

WABASH RIVER BELOW BEAVER CREEK TO NEW CORYDON							
SUBWATERSHED ATTRIBUTE	Stream Miles with <10' Vegetation SCORE	Operations <1,000' to stream SCORE	Tons Raw Manure per Year SCORE	Lbs. P_2O_5 per Crop Acre SCORE	Household Disposal Systems in Groups SCORE	No. Homes Built pre-1973 SCORE	TOTAL SCORE
	2	3	2	2	2	3	14

MAP 67

Wabash River below Beaver Creek to New Corydon Land Use



Legend

Grand Lake/Wabash Watershed

Roadways

Land Use

Cropland

Urban

Farmsteads

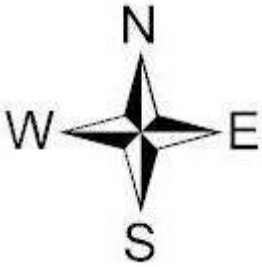
Shrub_Brush

Deciduous Forest

Open Water

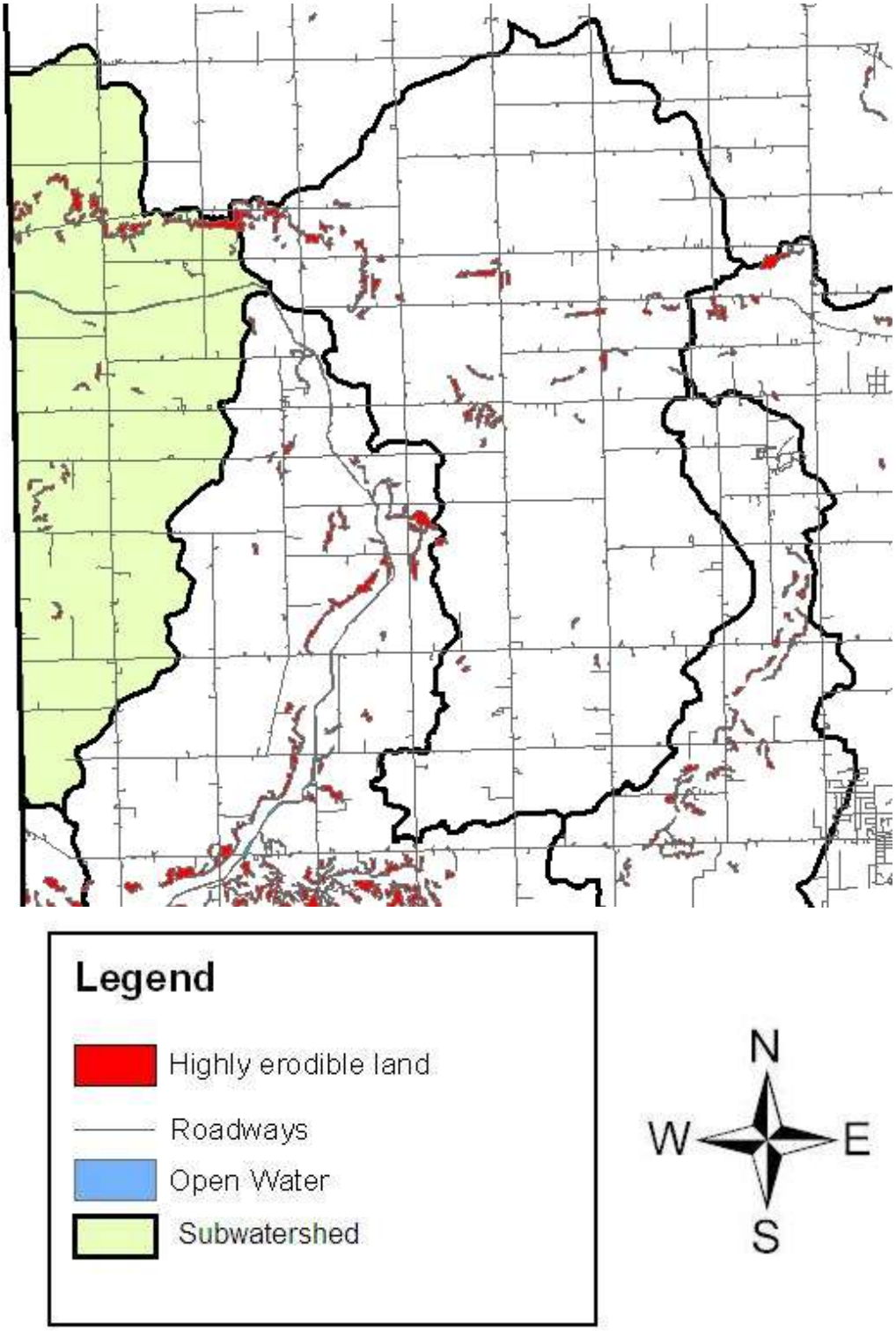
Wetlands

Barren/Undeveloped



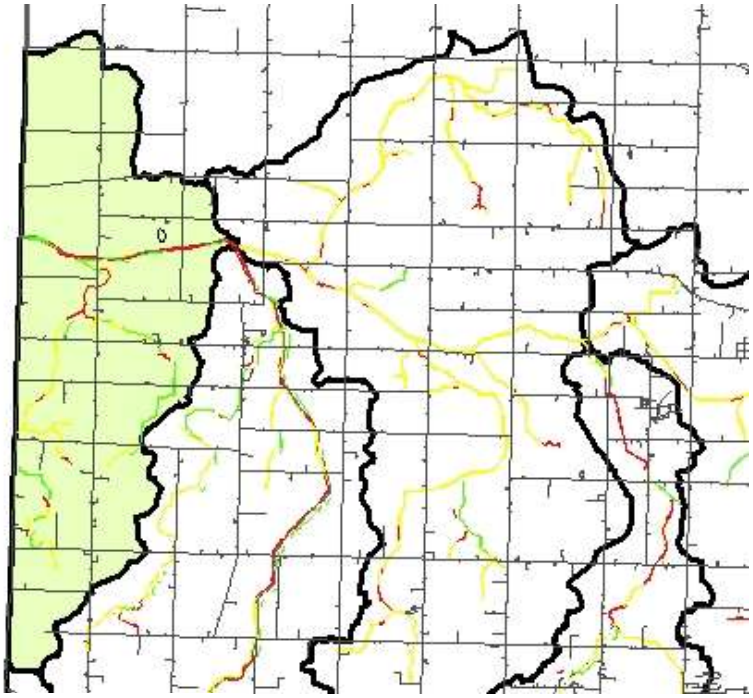
MAP 68

Wabash River below Beaver Creek to New Corydon Highly Erodible Land



MAP 69

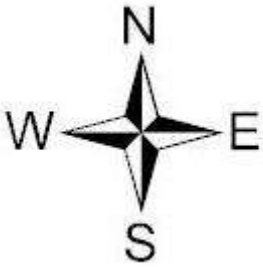
Wabash River below Beaver Creek to New Corydon Riparian Corridor Status



Legend

Riparian Corridor Status

- Less than 10 feet
- 10 to 40 feet
- Greater than 40 feet
- Roadways
- Open Water
- Grand Lake/Wabash Watershed



4.2.8 Limberlost Creek Headwaters to below Bull Creek (IN)

The Limberlost Creek Headwaters to below Bull Creek (IN) subwatershed drains a small west-central portion of the Limberlost Creek which eventually enters the Wabash River in Indiana. The subwatershed is located entirely in Mercer County. The acres, square miles, and percent of subwatershed are shown below. The Limberlost Creek Headwaters to below Bull Creek (IN) subwatershed, according to percentages, is the smallest of the eight subwatersheds draining to the Wabash River. Of the entire Grand/Lake Wabash Watershed, it is the smallest of fifteen subwatersheds.

TABLE 96

LIMBERLOST CREEK HEADWATERS TO BELOW BULL CREEK (IN)	
Acreage	927
Square Miles	1.44
% of Wabash Watershed Total Land Area	0.8%
% of Grand Lake/Wabash Watershed Total Land Area	0.5%

Water Quality Status

The Limberlost Creek Headwaters to below Bull Creek (IN) subwatershed has been designated as a warm water habitat (WWH). This aquatic life use designation has been established by Ohio EPA, and based on recent data sampling, the water resource is shown as not meeting that use designation, or in a “non-attainment” status. Furthermore, the subwatershed is shown as NPS impacted. Suspected or proven impacts to these streams include: Agriculture-crop production, confined animal feeding operations, on-site wastewater treatment systems, channelization, removal of riparian vegetation and streambank destabilization. Definitions and criteria for these descriptives can be found in Appendix C aquatic life use designations and assessment terms.

Although a TMDL report for the Wabash River watershed was finalized by US EPA in August of 2004, this subwatershed was not administered as part of the Ohio Wabash Watershed.

Water Supplies, Withdrawals, and Discharges

There are no community water supplies within the Limberlost Creek Headwaters to below Bull Creek (IN) subwatershed, no Ohio EPA regulated point source discharge, no non-transient non-community water supplies, no transient non-community water supplies and no Ohio EPA regulated point source discharges.

There are no areas within the Limberlost Creek Headwaters to below Bull Creek (IN) where 10 or more household wastewater treatment and disposal systems are present in close proximity.

Highly Erodible Land

Map 69 at the end of this subsection illustrates the highly erodible land locations within the Limberlost Creek Headwaters to below Bull Creek (IN) subwatershed. Of the eight subwatersheds within the Wabash River watershed, Limberlost Creek Headwaters to below Bull Creek (IN) ranks fifth highest in the amount of highly erodible land present within the subwatershed. The highly erodible land information was developed from the 2003 online NRCS Soil Data Mart.

Riparian Corridor Status

The chart on the following page shows the riparian corridor status for the Limberlost Creek Headwaters to below Bull Creek (IN) subwatershed. The chart indicates the number of miles that has various widths of tree canopy, or riparian corridor. The numbers account for both sides of the streams; therefore, the number of actual stream miles is half of that shown. The divisions are less than 10 feet in total width, 10 feet to 40 feet in total width, and greater than 40 feet in total width. The chart is also divided into perennial and intermittent streams under each of the corridor width column headings. MAP 70 illustrates the stream sections under each division.

The chart shows that with a total of 5.40 miles of stream network, the Limberlost Creek Headwaters to below Bull Creek (IN) subwatershed has 3.06 miles of stream with less than 10 feet of canopy and vegetation, 2.05 miles of stream with 10 feet to 40 feet canopy and vegetation, and 0.29 miles of stream with greater than 40 feet of canopy and vegetation. Overall, the Limberlost Creek Headwaters to below Bull Creek (IN) subwatershed has the lowest number of stream miles within the Wabash River Watershed, which is 1.0%. Of the entire Grand Lake/Wabash Watershed, this subwatershed has the third lowest number of stream miles, which is 0.8%.

TABLE 97

Riparian Corridor Status

LIMBERLOST CREEK HEADWATERS TO BELOW BULL CREEK (IN)										
RIPARIAN STATUS	TREE CANOPY <10' IN TOTAL WIDTH			TREE CANOPY 10 to 40' IN WIDTH			TREE CANOPY >40' IN WIDTH			TOTAL STREAM MILES
	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	PEREN-NIAL	INTER-MITTENT	SUB-TOTAL	
	0.00	3.06	3.06	0.00	2.05	2.05	0.00	0.29	0.29	5.40
% of Subwatershed Total	0.0%	56.7%	56.7%	0.0%	38.0%	38.0%	0.0%	5.4%	5.4%	100.0%
% of Wabash Watershed Total	0.0%	0.5%	0.5%	0.0%	0.4%	0.4%	0.0%	0.1%	0.1%	1.0%
% of Grand Lake/Wabash Watershed Total	0.0%	0.4%	0.4%	0.0%	0.3%	0.3%	0.0%	0.0%	0.0%	0.8%

Operations and Animal Units

The table on the following page shows the number of operations and the animal units by species for the Limberlost Creek Headwaters to below Bull Creek (IN) subwatershed. According to the table, there is one poultry operation, two dairy operations, two hog operations, one beef operation and one sheep operation within the entire subwatershed. The Limberlost Creek Headwaters to below Bull Creek (IN) subwatershed ranks fourteenth within the entire Grand Lake/Wabash River Watershed when considering the total number of operations with seven or 0.71%. Animal units within the subwatershed ranks twelfth of 15 with 0.95%.

Totals of animal units for each species are also listed on the table. The inventory for this subwatershed was completed during October of 2006. At the time of the inventory animal units were determined by the number of animals present. Although this is not a 1:1 ratio for all species, it is for beef cattle. The following chart shows the number of each type of animal that makes up 1,000 animal units.

Animal Type	1,000 Animal Unit Equivalent
Beef Cattle	1,000
Dairy Cattle	700
Hogs (over 55 lbs)	2,500
Turkeys	55,000
Layer Chickens	82,000
Pullet Chickens	125,000
Sheep	10,000
Horses	500

Table 98
Operations and Animal Units

LIMBERLOST CREEK HEADWATERS TO BELOW BULL CREEK (IN)														
ANIMAL TYPE	POULTRY		DAIRY		HOG		BEEF		OTHER		TOTAL		Total as % of Wabash Watershed	
# Farms and Animals	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s	# OPER.	# A.U.s
	1 (Trky)	2,098 0	2	500	2	440	1	200	(sheep) 1 (hrs)	5 0	7	3,243	1.0%	1.4%
% of subwatershed total	14.3%	64.7%	28.6%	15.4%	28.6%	13.6%	14.3%	6.2%	14.3%	0.2%	100.0%	100.0%		
Total as % of Wabash Watershed	0.1%	0.9%	0.3%	0.2%	0.3%	0.2%	0.1%	0.1%	0.1%	0.0%	1.0%	1.4%		
Total as % of Grand Lake/Wabash Watershed	0.10%	0.61%	0.20%	0.15%	0.20%	0.13%	0.10%	0.06%	0.10%	0.00%	0.71%	0.95%		

Manure Production

After considering the number of livestock operations and animal units present in the subwatershed, it is only fitting to consider the by-products of these animals. The table on the opposite page is used to represent the manure and nutrient production for the Limberlost Creek Headwaters to below Bull Creek (IN) drainage area. The subwatershed ranks thirteenth of 15 in terms of manure production per annum. Approximately 18,224 tons of manure is produced annually. The remainder of the columns on the table indicates the approximate pounds of nutrients contained in that manure. Nitrogen, potassium, and phosphate, are all important to the agricultural community and are provided to the crops via manure or commercial fertilizer applications.

These nutrients are also important in regards to water quality. According to the table, in the Limberlost Creek Headwaters to below Bull Creek (IN) subwatershed, the amount of phosphorus that is contained in the manure produced annually would need to be applied at 272 pounds per acre. The table below indicates the average crop removal rates for phosphorus for the major crops produced in the watershed. Values were obtained from the Ohio Agronomy Guide.

CROP	**P_2O_5 REMOVAL (lb/ac)**
Alfalfa (6T)	80
Corn (150 bu) Grain	55
Corn (25 T) Silage	80
Soybean (50 bu)	40
Wheat (75 bu) Grain	48

Considerations are given to the nutrient phosphorus due to its importance to crop production and the problems associated with the relationship between excessive phosphorus applications and degradation of water quality. Because much of the poultry manure is brokered out of the watershed, it seemed important to reflect the nutrient values assuming that 70% of the poultry manure is moved to locations outside the watershed. Local manure haulers estimated this value to be 90%; however, to be conservative, 70% was assumed for this plan. Under this assumption, the amount of phosphorus that is contained in the manure produced annually in this subwatershed would need to be applied at 141 pounds per acre.

What this seems to indicate throughout the watershed is that according to manure production and crop removal rates for limiting nutrient factors, there are not enough acres for proper manure application methods. The caveat on this statement is that the numbers are best estimates, variations in soil types and tilth can vary throughout the fields which may increase, or decrease, crop removal rates, and more importantly, some of the manure produced in each of the subwatersheds may be applied to acreages outside of that subwatershed, or even outside of the Grand Lake/Wabash watershed. It should be noted that several producers own or rent land both in the Grand Lake/Wabash watershed and in neighboring watersheds such as Loramie Creek or the St Marys River.

Table 99
Manure and Nutrient Production

LIMBERLOST CREEK HEADWATERS TO BELOW BULL CREEK (IN)						
Manure Production	Tons Raw Manure/Year	Lbs. N per Year	Lbs. K_2O per Year	Lbs. P_2O_5 per Year	Acres Cropland	Lbs. P_2O_5 per Crop Acre
	18,224	308,467	188,974	226,928	833	272
Less 70% Poultry Manure**	13,552	180,934	127,310	117,147	833	141
Approximate $ Value Per Year		$67,863	$28,346	$45,386		
Total Nutrient Value Per Year = $141,594						

**Based on conversations with poultry manure brokers, it was estimated that at least 70% of the poultry manure is brokered out of the watershed.

The dollar values associated with each nutrient were obtained from OSU Extension Bulletin 604-06, "Ohio Livestock Manure Management Guide." The value for nitrogen is estimated at $0.22 per pound, the value for P_2O_5 is $0.20 per pound and the value for K_2O is $0.15 per pound.

Distance Between Livestock Operations and Streams

The table on the following page shows the distance between various livestock operations located in the Limberlost Creek Headwaters to below Bull Creek (IN) subwatershed and the waterways that drain to the Wabash River. It can be assumed that the greater the distance between a livestock operation and a water system, the potential of pollution from the operation reaching the stream is lessened.

Of notable interest is the number of all livestock operations located less than 1,000 feet from the waterbody. In this particular subwatershed, out of seven operations, three operations, or 42.9%, fall into the category. Also, one operation, 14.3%, is in within 2,000 feet and the remaining 42.9%, three operations, are less than 3,000 feet from the nearest stream.

Table 100
Livestock Operations and Proximity to Streams

LIMBERLOST CREEK HEADWATERS TO BELOW BULL CREEK (IN)																		
ANIMAL TYPE	POULTRY			DAIRY			HOG			BEEF			OTHER			TOTAL		
	Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream			Distance to Stream		
	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'	<1000'	<2000'	<3000'
	1	0	0	0	0	2	1	1	0	0	0	1	1	0	0	3	1	3
% of Subwatershed Total	14.3%	0.0%	0.0%	0.0%	0.0%	28.6%	14.3%	14.3%	0.0%	0.0%	0.0%	14.3%	14.3%	0.0%	0.0%	42.9%	14.3%	42.9%

Non-Point Source Pollution Potential

In order to provide a comparison of the pollution potential of each of the 15 subwatersheds, a ranking system for each of the main potential pollution sources was developed. These potential sources are stream miles with less than 10 feet of vegetation, the number of livestock or poultry operations less than 1,000 feet from a stream, the tons of raw manure produced yearly, the pounds of phosphorus per cropland acre available from the manure, the number of household wastewater disposal systems contained in clusters of ten or more) and the number of homes built pre-1973. Values of 1(less potential) to 10 (great potential) were given based on ranges shown in the table of the following page. Indicator scores are then summed to obtain a total pollution potential score for the subwatershed.

Subwatershed pollution potential scores can range from a maximum of 60 points to a minimum of six points. The Limberlost Creek Headwaters to below Bull Creek (IN) subwatershed ranks of thirteenth out of 15, with 18.3% of the maximum points for pollution potential.

NONPOINT SOURCE POLLUTION POTENTIAL SCORING MATRIX

MAXIMUM DRAINAGE UNIT SCORE = 60 (Highest Pollution Potential)

SCORE	Stream Miles with <10' Vegetation	Operations <1,000' to stream	Tons Raw Manure per Year	Lbs. P_2O_5 per Crop Acre	Household Disposal Systems in Groups	No. Homes Built pre-1973
10	72.00+	46+	180,000+	225+	90+	226+
9	64.00 - 71.99	41 - 45	160,000 - 179,999	200 - 224	80 - 89	201 -225
8	56.00 - 63.99	36 - 40	140,000 - 159,999	175 - 199	70 - 79	176 -200
7	48.00 - 55.99	31 - 35	120,000 - 139,999	150 - 174	60 - 69	151 - 175
6	40.00 - 47.99	26 - 30	100,000 - 119,999	125 - 149	50 - 59	126 - 150
5	32.00 - 39.99	21 - 25	80,000 - 99,999	100 - 124	40 - 49	101 - 125
4	24.00 - 31.99	16 - 20	60,000 - 79,999	75- 99	30 - 39	76 - 100
3	16.00 - 23.99	11 - 15	40,000 - 59,999	50 - 74	20 - 29	51 - 75
2	8.00 - 15.99	6 - 10	20,000 - 39,999	25 - 49	10 - 19	26 - 50
1	0.00 - 7.99	0 - 5	0 - 19,999	0 - 24	0 - 10	0 - 25

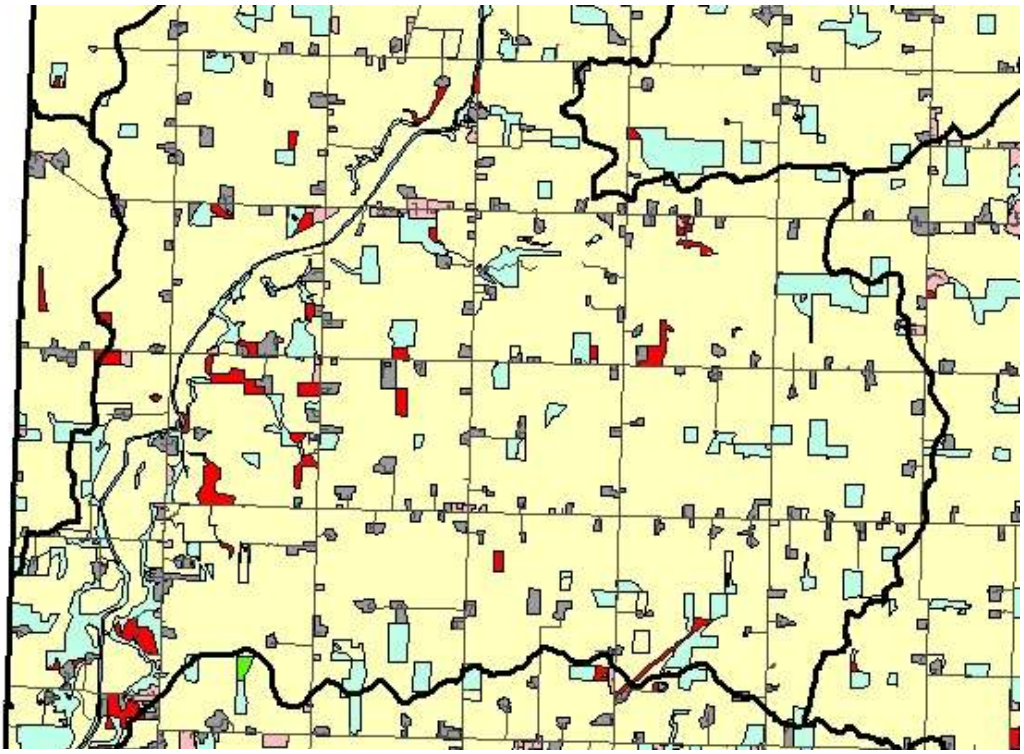
MINIMUM DRAINAGE UNIT SCORE = 6 (Lowest Pollution Potential)

TABLE 101
NPS Pollution Potential

LIMBERLOST CREEK HEADWATERS TO BELOW BULL CREEK (IN)							
SUBWATERSHED ATTRIBUTE	Stream Miles with <10' Vegetation SCORE	Operations <1,000' to stream SCORE	Tons Raw Manure per Year SCORE	Lbs. P_2O_5 per Crop Acre SCORE	Household Disposal Systems in Groups SCORE	No. Homes Built pre-1973 SCORE	TOTAL SCORE
	1	1	1	6	1	1	11

MAP 70

Limberlost Creek Headwaters to below Bull Creek (IN) Land Use



Legend

Grand Lake/Wabash Watershed

Roadways

Land Use

Cropland

Urban

Farmsteads

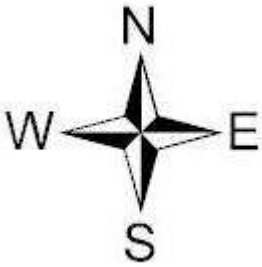
Shrub_Brush

Deciduous Forest

Open Water

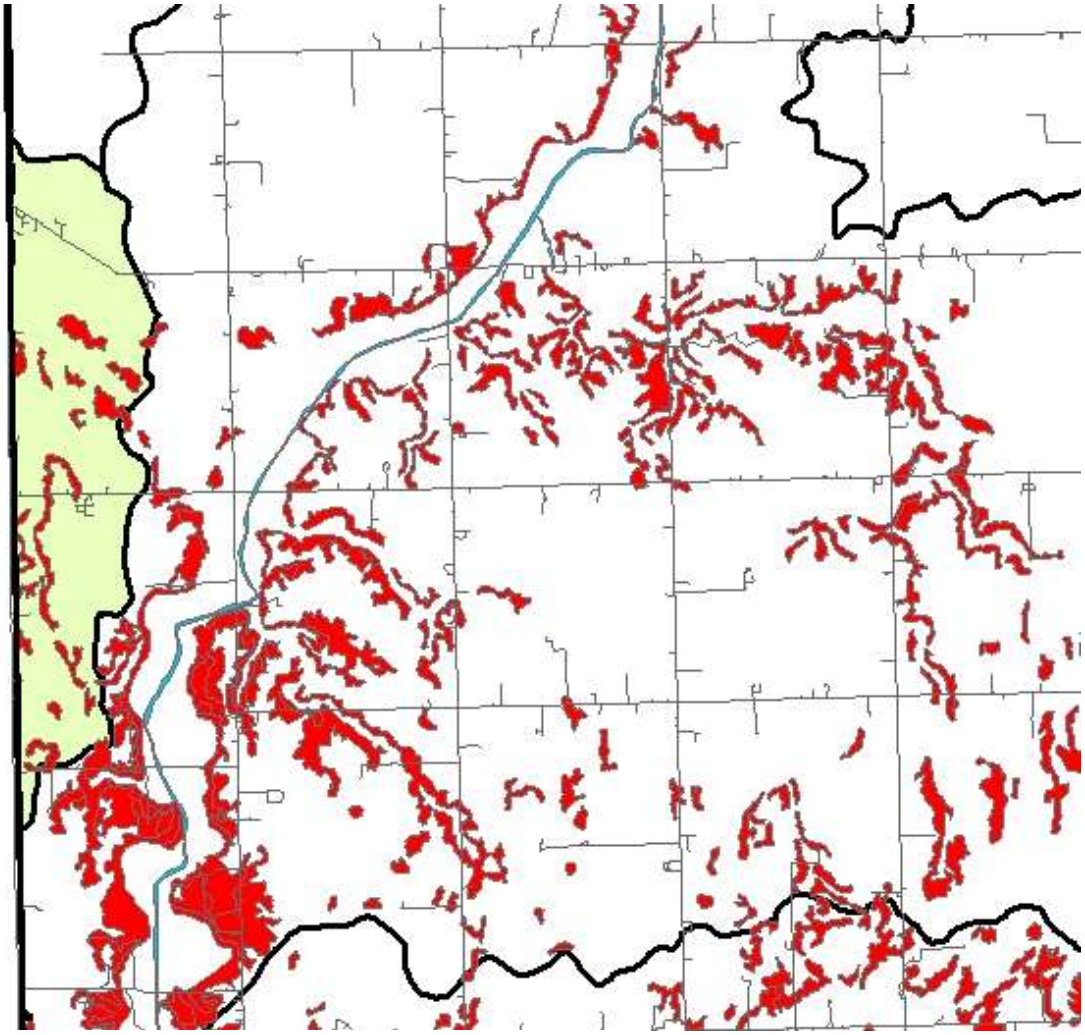
Wetlands

Barren/Undeveloped



MAP 71

Limberlost Creek Headwaters to below Bull Creek (IN) Highly Erodible Land



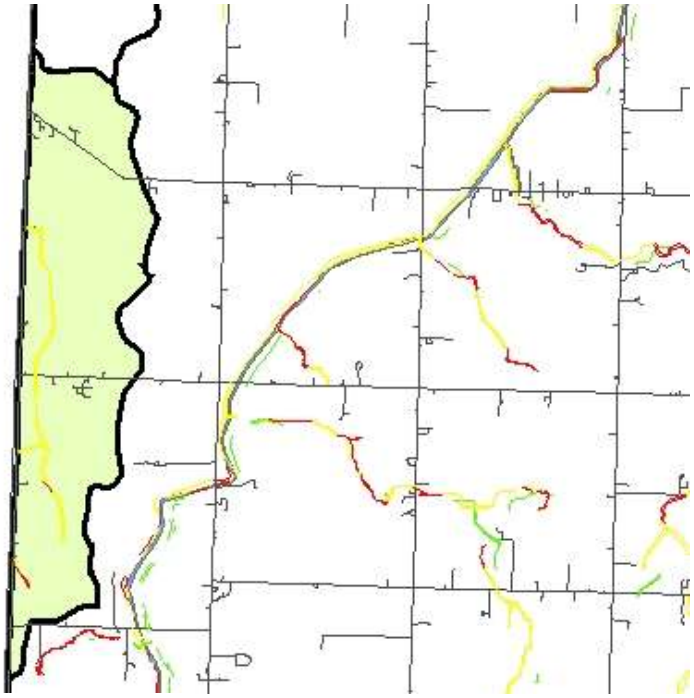
Legend

- Highly erodible land
- Roadways
- Open Water
- Subwatershed

N
W E
S

MAP 72

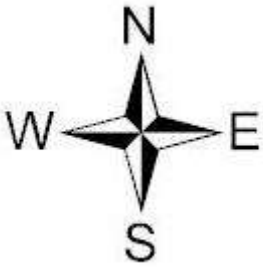
Limberlost Creek Headwaters to below Bull Creek (IN) Riparian Corridor Status



Legend

Riparian Corridor Status

- Less than 10 feet
- 10 to 40 feet
- Greater than 40 feet
- Roadways
- Open Water
- Grand Lake/Wabash Watershed



5.0 WATERSHED IMPAIRMENTS

When looking at the lists of possible causes and sources of impairments found in the 305(b) and the 303(d) documents, it can be assumed that these causes and sources are found throughout the entire watershed. For the purpose of developing sections to define impairments and to develop the restoration and protection goals and objectives, it is being recognized that the prior statement is true.

Therefore, it is recognized that the causes of impairments relating to the Grand Lake/Wabash River watershed are non-priority organics, turbidity, siltation, and other habitat alterations. Sources listed that lead to one or several of the impairments are non-irrigated crop production, animal feeding operation runoff, channelization (agriculture), removal of riparian vegetation, streambank destabilization, and onsite wastewater systems (septic tanks). The objectives that are developed will pertain throughout the watershed, but minor targeting will have to occur to provide some sort of methodology for implementation.

Efforts to target implementation/protection projects will be by subwatershed. Utilizing the subwatershed pollution potential rankings and stakeholder input will ease the process of determining what projects and subwatersheds will be matched. For each applicable task, a targeted subwatershed or group of subwatersheds have been listed for implementation priority (e.g. – the subwatershed with the largest cluster of home sewage treatment systems will be targeted for septic/sewage related improvements).

This section has been completed in a somewhat unconventional manner, yet the best manner for the Grand Lake/Wabash River Watershed. The Total Maximum Daily Load (TMDL) reports that have been developed for the entire Grand Lake/Wabash River watershed were used to develop the objectives listed in the section. The objectives are focused towards moving the watershed into attainment status for aquatic life by meeting the load reductions listed in the TMDL report. These TMDL reports can be found at http://www.epa.state.oh.us/dsw/tmdl/BeaverCreekWabashTMDL.html and http://www.epa.state.oh.us/dsw/tmdl/WabashRiverTMDL.html
New in 2008 was a set of data and facts from the Wabash River TMDL, this can be located on the internet with the above documents. An info graphic from the Ohio EPA for the Wabash River and a fact sheet for the Beaver Creek and Grand Lake St. Marys Watershed TMDL Report are located in Appendix E.

The following pages list the recognized impairments, sources and potentials for reducing the pollutant loadings per subwatershed or waterbody. They are broken into smaller sections including the following: (1) Project and Objective Statements which outlines the area of focus for the goal (2) Project Method that provides a brief overview of how the goal can be achieved; (3) Location that outlines the area that will achieve the most water quality improvement; (4) Load Reductions that calculates an approximate sediment and nutrient reduction, if applicable; (5) Resources that provide a partial listing of who may help accomplish the task or what actions need to be taken; (5) Education/Information that describes public outreach and evaluation methods; and (6)

Funding that outlines potential funding sources that may be utilized to complete the project. Some of the tasks are in a simplified format and do not require further breakdown into those sections.

Objective statements and ideas in this section were developed using various methods. Many of the goals, tasks and resources have been discussed in brainstorming sessions directly related to project development and grant ideas. Sessions were held with various groups of stakeholders such as community leaders, education, technical, and general subwatershed meetings. There are also some comments that were provided at public meetings, via personal contact, or in survey format.

As goals and objectives are moved into implementation, every effort will be made to ensure all stakeholders that need to be involved are being informed of meetings, ideas and efforts. While it is not guaranteed that every potential partner has been listed for each objective, efforts will be made to include all parties necessary in planning, implementing and evaluating.

The Grand Lake/Wabash River Watershed is impacted by excessive siltation due to over land runoff from several sources in both the agricultural and non-agricultural settings. Grand Lake St. Marys has been proven to be severely impacted by excessive nutrients that enter its waterways and the lake itself. These nutrients provide suitable conditions for a nearly constant blue-green algae bloom which greatly affects the quality of the water.

The continued practice of hydro-modification has an adverse impact on the potential for aquatic biota to thrive in the tributaries to Grand Lake and the Wabash River. Although this practice may have a benefit to subsurface tile drainage, it has a devastating impact on the organisms in the area.

There are also several other ideas that were brought out in public meetings or conversations on some relatively low cost, low intensity measure that have the potential to protect or enhance the quality of the area.

The overall goals that are intended to be reached by implementing the following objectives include: (1) to reduce soil erosion and sediment laden runoff from entering Grand Lake St. Marys, the Wabash River and their tributaries; (2) to decrease the amount of nutrients entering Grand Lake St. Marys, the Wabash River and their tributaries; and (3) to reduce the nutrient and pathogen loadings caused by animal and human waste entering Grand Lake St. Marys, the Wabash River and their tributaries.

A table similar to the following was requested by OEPA. This table shows general causes of impairment, action item (Objective) targets and an estimated cost of completing the Objectives of the WAP.

Cause #1	Cause #2	Action Item	Target	Unit	Estimated 2008	Estimated 2009
Bacteria	Nutrients	**Centralized Sewer**	**4**	**systems**	$487,600	$480,000
Nutrients	Sediment	**Cover Crops**	4,000	**acres**	$1,019,340	$1,002,240
Sediment	Nutrients	**conservation tillage**	**5,000**	**site**	$101,322	$669,241
Sediment	Nutrients	**Construction Site Runoff**	**All**	**acres**	$681,896	$668,216
Nutrients	Sediment	**Filter Areas**	**500**	**acres**	$173,250	$174,660
Nutrients	Sediment	**Filter strips or riparian buffers**	**300**	**acres**	$162,810	$161,640
Nutrients	Sediment	**Lawn Fertilizer Reduction**	**300**	**lawns**	$6,930	$6,816
Nutrients	Bacteria	**Manure Management Techonology**	**2**	**technology**	$231,000	$710,000
Bacteria	Nutrients	**Milkhouse Wastewater (based on total milkhouses)**	**All**	**system**	$180,645	$215,625
Nutrients	Bacteria	**NMP's (based on acres in watershed)**	**35 percent**	**NMP or CNMP**	$192,935,400	$189,275,100
Bacteria	Nutrients	**Septic Systems**	**50**	**lineal feet**	$577,500	$639,000
Sediment	Nutrients	**Streambank Protection (lineal feet)**	**1,000**	**lineal feet**	$4,399,500	$3,299,500
Sediment	Nutrients	**Shoreline Protection (lineal feet)**	**6,000**	**lineal feet**	$687,800	$2,973,800
Nutrients	Sediment	**Tile Control Structures**	**100**	**Structure**	$1,277,133	$1,274,283
Nutrients	Sediment	**Wetlands**	**60**	**acres**	$128,870,726	$128,865,026
				Total	**$331,792,851**	**$330,415,146**

6.0 OBJECTIVES FOR MEETING GOALS

The following objectives are listed in table form following the 15 Objectives. The graphs list specific objectives with numeric targets for each 14-digit hydrologic code in the Grand Lake St. Marys and Wabash River watersheds. A cost estimate for each is also included. Since this plan was originally completed in an unconventional manner, several graphs are included for watersheds smaller than the 14-digit code.

OBJECTIVE 1- Cover Crops

Problem Statement:
Movement of sediment and nutrients from crop fields through the watershed contributes to the degredated state of the Wabash River and the hypereutrophic state of Grand Lake St. Marys. Phosphorous and other nutrients attach to the sediment particles and are carried downstream. Over 70 percent of the watershed is agricultural land, the majority of which is conventionally tilled. This leaves loose soil exposed to all weather elements, including the freeze/thaw cycles that typically create the majority of sediment laden runoff.
According to the US EPA TMDL study for the Wabash River the State Line Sampling site shows zero to 50 percent of the samples were above the target level for total suspended solids (TSS) during the winter months. During times of typical tillage, 75 to 100 percent of the samples were above the target level. TSS was not sampled in the TMDL study of the Grand Lake watershed.

Objective Statement:
Establish winter cover crops on 4,000 acres within the Grand Lake/Wabash River watershed within three years and maintain utilization of cover crops on each farm the following winter.

Project Methods:
Planting winter cover crops meets one of the requirements of NRCS Standard 633 for winter manure application guidelines. Land application of manure during the winter months is discouraged; however, if it becomes necessary, it is strongly recommended that best management practices be followed. Producers anticipating a need to land apply manure during the winter should plant a minimum of 20 acres of cover crops in an area that meets all requirements of NRCS Standard 633. They will then have a designated area for hauling manure each winter. Additionally, winter cover crops prevent soil erosion on bare fields during the freeze/thaw cycles in the winter months.

Target Locations:
Areas selected for cover crops will be based on livestock producers need to land apply manure during the winter months and their willingness to participate. Based on the livestock inventory for each subwatershed, the following likely target areas were identified:

1) Wabash River above Bear Creek below Stony Creek subwatershed
2) Wabash River below Stony Creek above Beaver Creek subwatershed
3) Little Beaver Creek subwatershed
4) Chickasaw Creek subwatershed
5) Beaver Creek subwatershed
6) Wabash Headwaters to below Bear Creek subwatershed
7) Beaver Creek below Little Beaver Creek to Wabash River subwatershed

Potential participants will first be ranked based on a number of criteria including: (1) the number of days of manure storage; (2) the location of the facility; and (3) any additional conservation practices installed on the farm.

Load Reductions:
Actual load reductions are dependent on each field upon which a winter cover crop is planted. Assuming that each 20-acre field is the same, the following total sediment and nutrient reductions were calculated:

1) Total sediment reduction = 13,500 tons
2) Total phosphorus reduction = 15,700 pounds
3) Total nitrogen reduction = 31,450 pounds

Resources:
ODNR, SWCD, Farm Service Agency, Ohio State University Extension and local certified crop advisors will assist in accomplishing this objective.

Education/Information:
A detailed load reduction for individual fields will be completed as fields are enrolled into a winter cover crop program. Workshops can be held to demonstrate the effectiveness of winter cover crops. Articles will be printed in local newspapers and newsletters highlighting the benefits of cover crops for winter manure application and for the prevention of topsoil loss. An emphasis will be placed on the importance of following NRCS Standard 633 for winter manure application.

Funding:
A program that would provide approximately $60 per acre incentive for planting winter cover crops that are not to be harvested could be developed to offset the cost of seed and planting. A $200,000 line item secured by Senator Keith Faber allowed for two years of Agriculture Incentives in the Grand Lake watershed. The average incentive payment for cover crops in the 2007 program was $48 per acre. See below for the status of this program. Ohio State University Extension is currently conducting studies on different types of cover crops and may be a potential funding source. An application for a cover crop program paid for by the U.S. Fish and Wildlife Grant has been submitted by Ohio State University Extension. Other potential funding sources include federal, state and local grants. A committee which includes Indiana participants has

been formed for the Wabash River Watershed. The ultimate goal of this group is to fund programs and projects.

Status: Environmental Quality Incentive Program Demonstration Project participants planted 1,678 acres in 2008 and the 2007 and 2008 Agriculture Incentive Program participants planted an additional over 1,000 acres each year. The EQUIP Demonstration Project will last three years and the Agriculture Incentive Program concluded March 1, 2009. These programs are only in the Grand Lake St. Marys Watershed. These programs satisfied this objective for the Chickasaw and Beaver Creek target areas. At a Public Advisory Board meeting on December 15, 2009, stakeholders in the watershed recommended to leave the Chickasaw and Beaver Creek subwatersheds as target areas. They also recommended the total number of acres be doubled from 2,000 to 4,000.

OBJECTIVE 2 – Conservation Tillage

Problem Statement:
Movement of sediment and nutrients from crop fields through the watershed contributes to the degredaded state of the Wabash River and the hypereutrophic state of Grand Lake St. Marys. Phosphorous and other nutrients attach to the sediment particles and are carried downstream. Over 70 percent of the watershed is agricultural land, the majority of which is conventionally tilled. The main reason farmers use conventional tillage is to incorporate manure into the soil. This tillage mixes the soil and holds the manure nutrients in place.
According to the US EPA TMDL study for the Wabash River the State Line Sampling site shows 75 to 100 percent of the samples were above the target level for total suspended solids (TSS) during typical months of conventional tillage. TSS was not sampled in the TMDL study of the Grand Lake watershed.

Objective Statement:
Establish conservation tillage on 5,000 acres of cropland throughout the watershed in five years.

Project Methods:
Work to establish conservation tillage on all cropland, particularly highly erodible land, to decrease the amount of nutrients attached to sediment entering waterways and streams. Incentives for employing conservation tillage could be administered to cover equipment rentals or annual crop income or a payment system that pays for the difference in yield results for the first three years of using conservation tillage methods (as compared to the previous three years, could also be introduced). Incentives can be given to encourage farmers to use reduced tillage on cropland not receiving manure.

Target Locations:
The entire watershed will be considered eligible for conservation tillage. Priority may be given to areas of highly erodible land and according to TMDL results. Based on those two factors for each subwatershed, the following likely target areas were identified:

1) Wabash River above Bear Creek below Stony Creek subwatershed
2) Beaver Creek subwatershed
3) Chickasaw Creek subwatershed
4) Coldwater Creek subwatershed
5) Little Beaver Creek

Potential participants will first be ranked according to several criteria and will achieve a higher status when converting from conventional tillage to a form of conservation tillage, enrolling a large number of highly erodible acres, enrolling sloping soil acreage, and area's proximity to streams or the lake.

Load Reductions:
Actual load reductions are dependent on each field upon which conservation tillage is implemented. Assuming that each field is the same, the following total sediment and nutrient reductions were calculated:

1) Total sediment reduction = 3,150 tons
2) Total phosphorus reduction = 5,850 pounds
3) Total nitrogen reduction = 10,900 pounds

Resources:
This will be accomplished with the assistance of SWCD, NRCS, OSU Extension, Farm Service Agency staff, local certified crop advisors, local implement dealers and local landowners that are familiar with conservation tillage.

Education/Information:
As fields are enrolled or converted to conservation tillage, estimated load reductions will be calculated for each field. Monitoring will be completed prior to the implementation of conservation tillage. Field days or workshops can be held every two to three years to demonstrate equipment and results. Articles will be submitted to local media highlighting the benefits to landowners and water quality.

Funding:
The Water Pollution Control Loan Fund through Ohio EPA is available to be used to finance the purchase of conservation tillage equipment through low-interest loans. The application has been submitted. Incentive or assurance payments would have to be administered through federal, state or local grant opportunities. A committee which includes Indiana participants has been formed for the Wabash River Watershed. The ultimate goal of this group is to fund programs and projects.

Status: Two applications have been received and returned to the producer so they can proceed to the bank. Both of these applications were for no-till drills. These applications were in the Grand Lake St. Marys Watershed. At a Public Advisory Board meeting on December 15, 2009, stakeholders in the watershed recommended to eliminate the focus on just highly erodible soil. Therefore; wording was changed in the target section of this objective. The new wording opens the objective to all areas of the watershed, but leaves the highly erodible land as a target. Also at this meeting it was recommended that the status of this objective be researched and documented more effectively.

OBJECTIVE 3 – CNMPs and MNPs

Problem Statement:
Excessive nutrients such as phosphorous and nitrates are a large contributor to the hypereutrophic state of Grand Lake St. Marys and the degradated state of the Wabash River. Section 4.0 shows that many of the subwatersheds have more manure nutrients produced than available cropland to properly utilize those manure nutrients. Many of the livestock farms utilize traditional manure holding systems and have limited manure storage capacity. It has been estimated that 80% of livestock operations within the watershed currently do not have a Comprehensive Nutrient Management Plan (CNMP) or any form of Nutrient Management Plan. This often results in land application of manure during less than ideal conditions. The Nutrient Management Plan being processed at the state level. It is expected to be used by more producers than a CNMP.
The OEPA TMDL study of Beaver Creek and Grand Lake St. Marys Watersheds shows loading statistics for these areas. Beaver Creek study results show the need for a 97 percent reduction of nitrates and a 93 percent reduction for phosphorous during high flow scenarios. During other flow scenarios the need for reduction varied from actable levels to a 76 percent reduction for nitrates and between 28 and 79 percent reductions for phosphorous.
The US EPA TMDL study of the Wabash River watershed also shows the need for reduction of phosphorous and nitrates. Other than the months of May and October; phosphorous loads need to be reduced by 48 to 85 percent. For nitrates the load needs to be reduced by 67 to 76 percent.

Objective Statement:
Develop and encourage the use of CNMPs or NMPs for 35% of all acres in the watershed.

Project Methods:
CNMPs and NMPS can be created for any producer throughout the year. CNMPs and NMPs outline manure and commercial fertilizer applications for each livestock producer based on soil sampling results and manure sampling results. These documents suggest best management practices be followed. They also contain an emergency management plan and are an excellent way to keep records of field application. The local SWCDs can create these documents free of charge to producers within their county. Raising awareness of the benefits of CNMPs and NMPs through presentations and local media at least twice per year will be completed. The importance of updating CNMPs and NMPs will also be included.

Target Locations:
CNMPs or NMPs are needed throughout the watersheds.

Load Reductions:
There are currently no tools available to calculate the load reductions from the use of a CNMP or NMP. The benefits to each livestock producer following a CNMP or NMP

created for their farm are obvious. CNMPs or NMPS account for soil conditions and the nutrient content of the operation's manure. Following the CNMP or NMP prevents over application of manure and commercial fertilizer, it details setbacks from sensitive land features, outlines a plan for emergency spills and encourages proper record keeping.

Resources:
SWCD staff will create and update CNMPs and NMPs free of charge. The Environmental Quality Incentive Program (EQIP) program provides incentives up to $1,500 (depending on farm size) to livestock producers who sign up for CNMPs.

Education/Information:
Educational information, such as brochures can be sent to livestock producers on an annual basis to remind them of the benefits of having a CNMP or NMP. Articles in local newspapers, radio and newsletters can also highlight the importance of a CNMP or NMP for each farm. Presentations to local farming groups will encourage the use of CNMPs or NMPs as an excellent manure management tool.

Funding:
Minimal funding is needed to meet this objective as the local SWCD offices will create a CNMP or NMP for a producer free of charge. USDA-NRCS provides incentives to producers who sign up for CNMPs through the EQIP program. A committee which includes Indiana participants has been formed for the Wabash River Watershed. The ultimate goal of this group is to fund programs and projects.

Status: The SWCD offices do CNMPs and NMPs as requested. The number varies annually. The Mercer Office has done at least 4 CNMPs for the Grand Lake St. Marys and Wabash River watersheds since the WAP was endorsed.

OBJECTIVE 4 – Tile Control Structures

Problem Statement:
Excessive nutrients such as phosphorous and nitrates are a large contributor to the hypereutrophic state of Grand Lake St. Marys and the degradated state of the Wabash River. Section 4.0 shows that many of the subwatersheds have more manure nutrients produced than available cropland to properly utilize those manure nutrients. Many of the livestock farms utilize traditional manure holding systems and have limited manure storage capacity. This often results in land application of manure during less than ideal conditions. The proper utilization of tile control structures will lower the chance of manure nutrients reaching streams.
The OEPA TMDL study of Beaver Creek and Grand Lake St. Marys Watersheds shows loading statistics for these areas. Beaver Creek study results show the need for a 97 percent reduction of nitrates and a 93 percent reduction for phosphorous during high flow scenarios. During other flow scenarios the need for reduction varied from actable levels to a 76 percent reduction for nitrates and between 28 and 79 percent reductions for phosphorous.
The US EPA TMDL study of the Wabash River watershed also shows the need for reduction of phosphorous and nitrates. Other than the months of May and October, phosphorous loads need to be reduced by 48 to 85 percent. For nitrates the load need to be reduced by 67 to 76 percent.

Objective Statement:
Install 100 tile control structures on exiting tiles to monitor water exiting tiles, particularly during manure application periods. These structures will be used in combination with tile plugs.

Project Methods:
A 75% cost-share program (up to $2,000 per structure) will be available to landowners to purchase and install tile control structures and tile plugs at strategic locations. More than one structure can be installed per landowner; however, it will be the landowner's responsibility to install and maintain all control structures. These structures are typically more effective than tile stops or tile plugs alone, which usually have failure rates near 50 percent due to improper installation and operation. Tile control structures allow for easy clean up of manure if it has migrated to tile lines by pumping the manure-laden water out of the structure to a safe location.

Target Locations:
Priority will be given to livestock producers that apply liquid manure to their fields. Priority will also be given to producers that have a CNMP written or are willing to have a CNMP written. Based on the livestock inventory and TMDL results, the following priority areas were identified:

1) Wabash River above Bear Creek below Stony Creek subwatershed

2) Chickasaw Creek subwatershed
3) Beaver Creek subwatershed
4) Coldwater Creek subwatershed
5) Wabash River Headwaters to below Bear Creek subwatershed
6) Beaver Creek above Little Beaver Creek to Wabash River subwatershed

Load Reductions:
There is no tool currently available to calculate load reductions from the installation of tile control structures. However, the benefits are clear. Containment of potential manure-laden runoff will allow that runoff to be managed properly prior to entering waters of the State.

Resources:
ODNR, SWCD and the Farm Service Agency will assist in accomplishing this objective by promoting the idea and benefits of tile control structures.

Education/Information:
Stream sampling will be collected prior to the installation of the tile control structure and after the installation of the structure, preferably during a period of manure application. After a few tile control structures are installed and monitored, a field day or workshop will be held to demonstrate the benefits of the structures. Visual monitoring, including photo documentation, will also be conducted during manure application periods. Local media will also be utilized to highlight the benefits of tile control structures.

Funding:
The total cost of meeting this objective is $250,000. The 75% cost share program allows for $50,000 in landowner expenses and $200,000 in other funds. Tile control structures were offered as an option with the 2007 Agriculture Incentive Program. This program was a state line item for agriculture best management practices in the Grand Lake watershed. This program paid 75% or $1,500, whichever was the lesser value. These project funds could come from federal grant opportunities such as EPA Section 319(h) grants or state grant opportunities. A committee which includes Indiana participants has been formed for the Wabash River Watershed. The ultimate goal of this group is to fund programs and projects.

Status: The 2007 and 2008 Agriculture Incentive Program provided cost share for tile control structures in the Grand Lake St. Marys Watershed. Several producers took advantage of this cost share. In 2007, three structures were installed in the Chickasaw subwatershed. In 2008, several more applications were made. Only one of these was installed, others are planned for installation in 2009 and 2010. These structures are in the Chickasaw and Barnes Creek subwatersheds. Starting in 2010 there will be cost share available through a 319 OEPA grant for tile control structures. This cost share is only available in the Grand Lake St. Marys watersheds.

OBJECTIVE 5 – Direct Discharge Milkhouse Wastewater

Problem Statement:
There are currently no permitted dairy facilities in the watershed, but there are approximately 180 non-permitted dairy facilities according to the 2006 livestock inventory. These facilities all have milkhouse wastewater and it is handled in a variety of ways. Two proper handling examples are: capturing the wastewater in the manure holding area or treating the wastewater. Facilities that do not properly handle milkhouse wastewater are allowing it to flow into the watershed untreated. This wastewater can contain ammonia, nitrates, phosphorous, detergents, manure, milk solids and various micro-organisms. All of these items are detrimental to the watershed.

Objective Statement:
Identify dairy operations that currently directly discharge milkhouse wastewater within the watershed and have them install a storage facility or treatment facility (i.e., holding pond, treatment wetland, treatment filter strip, etc.). All systems should be installed within five years.

Project Method:
Water used to wash down milking parlors should be treated as wastewater. Facilities that do not collect their milkhouse wastewater more than likely have a tile connected to their drain that directly discharges to a nearby ditch or stream. Over five years, attempts will be made to identify those facilities and recommend a storage or treatment structure. Constructed wetlands have been used in the past for this application and seem to work well. Other past projects included treatment filter strips, holding ponds and irrigation systems.

Target Locations:
An attempt will be made to identify ALL dairy operations that currently have no facilities to store or treat milkhouse wastewater.

Load Reductions:
There is no tool available to calculate load reductions installing a holding pond, treatment wetland or treatment filter strip. However, the benefits are clear. Containment or treatment of milkhouse wastewater is eliminating a direct source of pollution.

Resources:
ODNR, SWCD and the Farm Service Agency will assist in accomplishing this objective by promoting the idea and benefits of containing or treating milkhouse wastewater.

Education/Information:
Stream sampling will be collected prior to the installation of the storage/treatment structure and after the installation of the structure to directly measure the load reductions. Local media will also be utilized to inform the public on the necessity of containing milkhouse wastewater. If and when specific dairy operations are identified,

personal contacts will be made to inform them of the necessary actions and advise on funding opportunities and availability.

Funding:
Funding for these systems is available through EQIP and potential grant opportunities could be a funding source as well. It is possible this practice would be a section of a 319 grant application. The construction of treatment wetlands is estimated to cost $10,000 to $15,000 per dairy operation. Holding pond construction would be a much higher cost. Assuming that there are approximately 25 facilities that need an upgrade of their milkhouse wastewater management, the total cost of meeting this objective could range from $250,000 to $1,250,000. A committee which includes Indiana participants has been formed for the Wabash River Watershed. The ultimate goal of this group is to fund programs and projects.

Status: The 2008 Agriculture Incentive Program offered cost share for the installation of a system to treat directly discharging milkhouse wastewater. One producer took advantage of this cost share. Their system is in place and functioning well. They are located in the Beaver Creek subwatershed. Also available for direct discharge milkhouses in the lake watershed is a 319 OEPA grant. This grant provides cost share for treatment systems.

OBJECTIVE 6 – Manure Management Technology

Problem Statement:
The Grand Lake St. Marys and Wabash River watersheds have a high concentration of livestock. Section 4.0 shows that many of the subwatersheds have more manure nutrients produced than available cropland to properly utilize those manure nutrients. Often acres which do not need the nutrients will receive manure, resulting in nutrient laden runoff. These excess phosphorous and nitrates are a large contributor to the hypereutrophic state of the lake and the degradated state of the Wabash River.

The OEPA TMDL study of Beaver Creek and Grand Lake Watersheds shows loading statistics for these areas. Beaver Creek study results show the need for a 97 percent reduction of nitrates and a 93 percent reduction for phosphorous during high flow scenarios. During other flow scenarios the need for reduction varied from actable levels to a 76 percent reduction for nitrates and between 28 and 79 percent reductions for phosphorous

The US EPA TMDL study of the Wabash River watershed also shows the need for reduction of phosphorous and nitrates. Other than the months of May and October phosphorous loads need to be reduced by 48 to 85 percent. For nitrates the load needs to be reduced by 67 to 76 percent.

Objective Statement:
Encourage the use of best management practices for manure management, brokering manure to fields which receive commercial fertilizer and incorporate manure management and/or treatment technologies on at least two livestock farms within the Grand Lake St. Marys and Wabash River watersheds and demonstrate the effectiveness of the practice to the public.

Project Method:
Encouraging the use of manure best management practices includes making available information on winter manure application, manure nutrient testing, the cash value of manure, dry stack versus liquid storage, brokering manure and other topics. One way of doing this is making the Water Pollution Control Loan Fund available to any producer working in the watershed. This fund provides the producer with a low-interest loan for purchasing a piece of equipment related to water quality protection.

There are many technologies currently available for the treatment of manure or the reduction of manure. One available, well-researched option is the geotextile tube. Liquid manure is pumped into the tube while being mixed with flocculants and conditioners. The tube then allows solids to be held back while releasing the liquid portion. The liquid can be used to irrigate growing crops. The solids remaining in the bag are then more easily transported and applied to land application sites. The solids may also have some market value as fertilizer.

Another option is to separate solids from liquid manure via mechanical separation technologies. Solids can then be composted and land applied or sold as fertilizer. The liquid portion would have to be handled as manure; however, options may exist that reduce nutrient levels enough to irrigate the liquid on growing crops.

Both of these technologies have been demonstrated on farms in the Chickasaw Creek subwatershed. It was found that these technologies are not typically economically feasible for the farmer. The experiments have captured the interest of the public and carbon credit traders. It is possible with the addition of funding from trading carbon credits; the practices may become profitable for the farmer.

Other manure management technologies include producing fuel, electricity, bedding and marketable materials from the manure. Tyra-tech is interested in putting together a co-op for this type of project. Due to the size of the farms in the watersheds, a co-op is the most cost feasible solution.

At the Public Advisory Board meeting on December 15, 2009, farmers requested adding brokering manure to field which receive commercial fertilizer and brokering manure in general. Brokering poultry manure is an accepted practice across the watershed. This manure is economical to truck long distances. Brokering other manure is not done on a regular basis in the watershed.

At the Public Advisory Board meeting on December 15, 2009, and through personal contacts stakeholders brought up several different manure treatment technologies. Stakeholders have been reading about different technologies some of which are: irrigating, side dressing hog manure, doing multiple applications with less volume, removing the smell and generating electricity, bedding and by products.

Target Locations:
This project can be implemented on any livestock farm managing liquid manure. Priority areas identified based on livestock inventory include:

1) Wabash River above Bear Creek below Stony Creek subwatershed
2) Chickasaw Creek subwatershed

Load Reductions:
There is currently no tool available to calculate load reductions from these technologies; however, sampling of the liquid exiting a geotextile tube (utilizing hog manure) has shown up to a 98% reduction in ammonia and up to a 99% reduction in phosphorus. The manure will become more solid and more transportable and can then be trucked out of the watershed. Irrigating wastewater on growing crops will reduce the potential of runoff, as the crops will uptake the nutrients.

Resources:
ODNR, SWCD, NRCS, Farm Service Agency staff and manure management experts will assist with implementing this objective.

Education/Information:
Results from this objective will be documented and displayed for public education. Photos will be taken of the project to highlight the benefits of the technology. Field days or workshops will be conducted to demonstrate the benefits as well. Local media will be used often to inform the public of the progress of the technology.

Funding:
Federal, State and local grant opportunities will be needed to implement this objective. In 2007 a Conservation Innovation Grant for using geotextile tubes for manure dewatering was received and completed. A committee which includes Indiana participants has been formed for the Wabash River Watershed. The ultimate goal of this group is to fund programs and projects.

Status: The final results of Conservation Innovation Grant determined the geotextile tubes performed as expected. These are a useful tool for dewatering manure. At the time of the final grant report, it was not economical to switch a farm to geotextile tubes for handling manure. In conjunction with this grant was a dairy producer who chose to install a separator for the liquid dairy manure. At the finish of the grant, the separator was working well and milk production had increased. This separator was installed in the Chickasaw Watershed. At a Public Advisory Board meeting on December 15, 2009, farmers stated they were interested in adding brokering manure and installing treatment systems to this objective.

OBJECTIVE 7 – Filter Strips or Riparian Buffers

Problem Statement:
Sediment and nutrients are considered the top contributors to the hypereutrophication state of Grand Lake St. Marys and the degredated state of the Wabash River. Stream bank instability and lack of biological diversity is primarily due to channelization (agriculture drainage improvements) and the removal of riparian vegetation. Straight channels especially those lacking riparian vegetation are subject to erosion when farming practices are occurring up to the streambank's edge.

According to the OEPA's TMDL report for Grand Lake St. Marys, 60 to 65 percent of the sediment could be stopped with filter strips and riparian buffers. US EPA TMDL report for the Wabash River notes the nutrient concentrations are multiplied due to the reduction and elimination of natural habitat surrounding the stream. This same report shows a need for 70 to 86 percent reduction of TSS in the Wabash River Watershed.

Objective Statement:
Establish 300 acres of filter strips or riparian buffers (82.5 miles of streambank) within the Grand Lake/Wabash Watershed at an average width of 30 feet within five years.

Project Methods:
Many different options will be available to local landowners. The first option is to enroll in traditional Farm Bill programs such as the Conservation Reserve Program (CRP) or the Conservation Reserve Enhancement Program (CREP). These filter strips consist of either a blend of warm season grasses or cool season grasses. The CRP and CREP programs also have a riparian buffer option available to landowners. Due to the high concentration of livestock in the area, another option will be made available to landowners. Making hay off of filter strips will be a highly attractive option to producers needing hay for their operations and will make them more likely to install a filter strip on their land. The use of conservation easements will be highly encouraged to ensure the protection of riparian areas.

Target Locations:
Based on the number of stream miles with less than 10 feet of protection and considering landowner willingness to install the practice, the following acreages were estimated:

1) 85 acres in the Wabash River above Bear Creek below Stony Creek subwatershed
2) 70 acres in the Wabash River Headwaters to below Bear Creek subwatershed
3) 40 acres in the Wabash River below Stony Creek above Beaver Creek subwatershed
4) 40 acres in the Beaver Creek below Little Beaver Creek to Wabash River subwatershed
5) 35 acres in the Chickasaw Creek subwatershed
6) 30 acres in the Coldwater Creek subwatershed

For available non-Farm Bill programs, applicants will be ranked based on a number of selection criteria and will receive more points when additional conservation practices are being implemented on their farm.

Load Reductions:
Actual load reductions are dependent on each field upon which a filter strip is installed. Assuming that a 1.0-acre filter strip can treat approximately 45 acres of drainage area, the following total sediment and nutrient reductions were calculated:

4) Total sediment reduction = 7,300 tons
5) Total phosphorus reduction = 16,000 pounds
6) Total nitrogen reduction = 30,000 pounds

Resources:
NRCS, Farm Service Agency staff, ODNR Division of Wildlife, Pheasants Forever, the Wabash Conservancy District and the Lake Improvement Association will provide additional incentives on existing Farm Bill Programs.

Education/Information:
A detailed load reduction for individual fields will be completed as fields are enrolled into the programs. Articles will be printed in local newspapers and newsletters highlighting the benefits of filter strips and riparian buffers, not only as a conservation practice but as a farming safety option as well. The local SWCD offices promote the planting of riparian areas by their annual tree sales. It will be recommended that established riparian areas be protected by a conservation easement.

Funding:
The CRP and CREP programs are available for continuous sign up through the local USDA Farm Service Agency. For the option of haying filter strips, programs will be set up through available federal, state and local grant opportunities. In the 2007 Agriculture Incentive Program over 50 acres of hay filter strips were entered into a five year contract. This program was made possible through a state line item secured by Senator Keith Faber. Many grant opportunities provide for the protection of riparian areas through conservation easements. A committee which includes Indiana participants has been formed for the Wabash River Watershed. The ultimate goal of this group is to fund programs and projects.

Status: The 2007 and 2008 Agriculture Incentive Program provided cost share on the installation of filter strips and riparian buffers. These areas will be left in place a minimum of 5 years. This program was available in the Grand Lake St. Marys watershed. Subwatersheds where these were installed included Chickasaw, Prairie, Beaver, Coldwater and Barnes Creek. These programs included over 60 acres of filters strips. Also providing cost share in 2008 was the EQIP Demonstration Project for the Grand Lake St. Marys watershed. Over 700 acres of filter strips were installed with this program.

OBJECTIVE 8 – Filter Areas

Problem Statement:
Sediment and nutrients are considered the top contributors to the hypereutrophic state of Grand Lake St. Marys and the degredated state of the Wabash River Watershed. Annually Grand Lake St. Marys State Park employees dredge over 100,000 cubic yards of sediment out of the lake. This dredging is done only for boater safety reasons, and does not come close to offsetting the amount of sediment entering the lake. The sediment comes from farm fields, stream banks, construction sites and other non-point sources.

According to the OEPA's TMDL report for Grand Lake St. Marys, 60-65 percent of this sediment could be stopped with filter strips. US EPA TMDL report for the Wabash River notes the nutrient concentrations are multiplied due to the reduction and elimination of natural habitat surrounding the stream. This same report shows a need for 70 to 86 percent reduction of TSS in the Wabash River Watershed.

Objective Statement:
Establish 500 acres of filter areas around tile inlets, receivers, road ditches and other sensitive areas within the Grand Lake/Wabash Watershed at an average width of 30 feet within five years.

Project Method:
Many different options will be available to local landowners. The first option is to enroll in traditional Farm Bill programs such as the Conservation Reserve Program (CRP) or the Conservation Reserve Enhancement Program (CREP). The CP-33 program (quail buffers), available through CRP, can be used to establish filter areas around field borders. Many farms within the watershed have already installed CP-33 buffers on their land. CREP has programs available for all types of warm season grass or cool season grass filter areas. Due to the high concentration of livestock in the area, another option will be made available to landowners. Making hay off of filter areas will be a highly attractive option to producers needing hay for their operations and will make them more likely to install a filter area on their land.

Target Locations:
The locations chosen for installation will be those areas with severe encroachment or erosion near receivers.

For available non-Farm Bill programs, applicants will be ranked based on a number of selection criteria and will receive more points when additional conservation practices are being implemented on their farm.

Load Reductions:
Actual load reductions are dependent on each field upon which a filter area is installed. Assuming that a 1.0-acre filter area can treat approximately 45 acres of drainage area, the following total sediment and nutrient reductions were calculated:

1) Total sediment reduction = 11,740 tons
2) Total phosphorus reduction = 22,650 pounds
3) Total nitrogen reduction = 42,200 pounds

Resources:
NRCS, Farm Service Agency staff, ODNR Division of Wildlife, Pheasants Forever and the Lake Improvement Association will provide additional incentives on existing Farm Bill Programs.

Education/Information:
A detailed load reduction for individual fields will be completed as fields are enrolled into the programs. Articles will be printed in local newspapers and newsletters highlighting the benefits of filter areas near road ditches and receivers, not only as a conservation practice but as a farming safety option as well.

Funding:
The CRP and CREP programs are available for continuous sign up through the local USDA Farm Service Agency. For the option of haying filter areas, programs will be set up through available federal, state and local grant opportunities. . A committee which includes Indiana participants has been formed for the Wabash River Watershed. The ultimate goal of this group is to fund programs and projects.

Status: The 2007 and 2008 Agriculture Incentive Program provided cost share for producers to install filter areas. These areas will remain in place for a minimum of 5 years. Producers in the Beaver and Chickasaw Creek watersheds took advantage of this program.

OBJECTIVE 9 – Shoreline Protection

Problem Statement:
Grand Lake St. Marys is a manmade lake, built by damming both ends of a low lying area and cutting down trees. This construction has produced a shallow body of water, which is prone to significant waves on a windy day. Significant waves are also created on heavy boat traffic days. These waves are direct contributors to shoreline erosion. Shoreline erosion adds sediment to the lake and takes away valuable protection of the land. The shorelines of Grand Lake St. Marys protect many natural wetlands and habitat areas that provide many benefits to fish and wildlife species. These wetlands provide valuable benefits to the bald eagle's nesting and feeding habitat in the area. These wetlands also provide critical habitat for 36 state-listed threatened and endangered species (16 avian, 3 mammal, 9 reptile and amphibians, and eight moths and butterfly species). The wetlands have many benefits to local fish populations (e.g., crappies, bluegills, perch, largemouth bass, and catfish), including valuable spawning and rearing habitat. Wetlands act as kidneys to improve water quality and help retain flood waters to lessen its impacts locally. The wetlands around Grand Lake St. Marys need to be protected in order to ensure adequate habitat for the diversity of species that use them.

Objective Statement:
Stabilize 6,000 lineal feet of Grand Lake St. Marys shoreline that are prone to erosion, prioritizing those areas directly adjacent to naturally occurring wetlands within five years.

Project Methods:
The use of a geotextile tube for stabilization is the preferred method. The tubes will be filled with dredge material while also stabilizing the banks of highly eroded areas. It is recommended that the tubes be protected with rip-rap or another engineered method to prevent damage to the tubes.

Target Locations:
Sites will be chosen based on severity of erosion and the location of naturally occurring wetlands.

Load Reductions:
It is estimated that approximately 540 tons of sediment, 620 pounds of phosphorus and 1,240 pounds of nitrogen can be prevented from entering the lake by implementing this measure.

Resources:
Grand Lake St. Marys State Park, ODNR, SWCD, NRCS and the City of Celina's technical resources will be used to identify locations and suggest site-specific techniques.

Education/Information:

Tours will be held to demonstrate the success of the project to encourage the continuation of the stabilization method. Visual monitoring, including photo documentation, of the stabilization sites will be conducted on a semi-annual basis for five years to document the sustainability of the stabilization method.

Funding:
Potential sources of funding for the project include: (1) federal grant opportunities; (2) state grant opportunities; or (3) interest projects through the City of Celina. At this time a geotextile tube shoreline protection project is planned for 2009. This project will be partially funded by state capitol moneys directed to Grand Lake St. Marys State Park.
The remaining portion of the project is projected to be paid through local fundraising and a 2008 Conservation Innovation Grant.

Status: In 2007, the Grand Lake St. Marys State Park installed 2,000 feet of shoreline protection. In 2008, a grant was received to utilize geotextile tubes for shoreline protection. These will be installed when the water level is cooperative. This project will be near Windy Point and will protect a natural wetland. This is in the Prairie Creek subwatershed. The geotextile tubes have been filled and are protecting 700 feet of shoreline. Willow staking is planned for spring 2010.
At the Public Advisory Board meeting on December 15, 2009, Brian Miller, assistant state park manager, reported the parks installed an estimated 8,200 feet of shoreline protection since the WAP was endorsed. He suggested adding an additional 6,000 feet to the WAP. He stated this corresponds to their plans at the park. Therefore even though the Objective has been met, it now reflects this additional footage.

OBJECTIVE 10 – Streambank Protection

Problem Statement:
Sedimentation is a large contributor to the hypereutrophic state of Grand Lake St. Marys and the degredated state of the Wabash River. Lack of biological diversity also contributes to the states of these water bodies. Streambank instability and lack of biological diversity is primarily due to channelization (agricultural drainage improvements) and the removal of riparian vegetation. Channelized streams change little along their length, lack features such as riffles and pools and have minimal variation in flow characteristics causing reduced biological diversity. Straight channels especially those lacking riparian vegetation are subject to erosion when farming practices are occurring up to the streambank's edge.

According to the OEPA's TMDL report for Grand Lake St. Marys, 60-65 percent of this sediment could be stopped with filter strips. US EPA TMDL report for the Wabash River notes the nutrient concentrations are multiplied due to the reduction and elimination of natural habitat surrounding the stream. This same report shows a need for 70 to 86 percent reduction of TSS in the Wabash River Watershed. These reductions are created through modeling and cannot fully account for the destruction of natural habitat. This type of habitat is necessary to fully restore the water quality.

Objective Statement:
Stabilize 2,000 linear feet of streambank that is prone to erosion using natural stream design techniques within five years.

Project Methods:
Many project methods can be used to achieve this objective. Two-stage ditch design, natural stream channel design, bio-engineering techniques or re-sloping stream banks to allow high flow to enter a wetland area to allow for settling of sediment are all feasible options for achieving this objective. It is also intended to improve the ecological habitat of the improved streams.

Target Locations:
Sites will be chosen based on the willingness of landowners, the rate and severity of erosion and based on engineering judgment. 1,000 feet chosen for stabilization will be located in the Wabash River watershed and 1,000 feet will be located in the Grand Lake St. Marys watershed. It is preferred that the 1,000 feet in each watershed be continuous if possible.

Load Reductions:
It is estimated that approximately 144 tons of sediment, 166 pounds of phosphorus and 331 pounds of nitrogen will be prevented from entering tributaries by implementing this measure.

Resources:

ODNR, SWCD, NRCS technical resources will be used to identify locations and suggest site-specific techniques.

Education/Information:
Tours will be held to demonstrate the success of the projects to encourage the continuation of the stabilization method(s) used. Visual monitoring, including photo documentation, of the stabilization sites will be conducted on a semi-annual basis for five years to document the sustainability of the stabilization method. In-stream monitoring will also be completed to measure habitat improvements and nutrient loading reductions.

Funding:
Potential sources of funding for projects include; federal, state or local grant opportunities. Smaller projects may be accomplished by local work groups, but to complete the continuous 1,000 feet, a grant holds more potential. A committee which includes Indiana participants has been formed for the Wabash River Watershed. The ultimate goal of this group is to fund programs and projects.

Status: In 2008 a 319 Grant was submitted to Ohio EPA. Streambank protection was included in this application. . This grant was for the Wabash Headwaters to below Bear Creek. OEPA recommended this grant be moved to the Grand Lake St. Marys watershed, Mercer SWCD did so. Also in 2008 the Lake Development Corporation offered to partner with a producer in the Grand Lake St. Marys watershed to protect a section of streambank. Neither of these streambank protection projects are considering using natural stream design. Franklin Township, in the Grand Lake St. Marys watershed, is developing a nature area and recreational trail system. They have property that may be a possibility for a natural stream design project. The watershed project is currently partnering with them on several other smaller projects. At the Public Advisory Board meeting on December 15, 2009, stakeholders recommended several possible sites for natural stream design. The watershed coordinator plans to follow up on these possibilities.

OBJECTIVE 11 – Wetlands

Problem Statement:
Wetlands act as kidneys to improve water quality and help retain flood waters to lessen its impacts locally. Wetlands provide critical habitat for 36 state-listed threatened and endangered species (16 avian, 3 mammal, 9 reptile and amphibians, and eight moths and butterfly species. Wetlands have many benefits to local fish populations (e.g., crappies, bluegills, perch, largemouth bass, and catfish), including valuable spawning and rearing habitat. Drainage paths throughout the watersheds have been altered from their natural state through channelization and an increase in urban areas. These practices have reduced the number of wetlands in the watershed.

According to the OEPA's TMDL report for Grand Lake St. Marys, 60-65 percent of the sediment load could be stopped with filter strips. US EPA TMDL report for the Wabash River notes the nutrient concentrations are multiplied due to the reduction and elimination of natural habitat surrounding the stream. This same report shows a need for 70 to 86 percent reduction of TSS in the Wabash River Watershed. These reductions are created through modeling and cannot fully account for the destruction of natural habitat. This type of habitat is necessary to fully restore the water quality. Preservation of natural wetlands is necessary and creation of functional wetlands is a positive step towards water quality restoration.

Objective Statement:
Construct or restore 60 acres of functional wetlands within five years to allow for filtration of nutrients and settling of sediment.

Project Methods:
Encourage participation in existing federally funded enrollment programs for the construction or restoration of wetlands and seek additional incentives to enhance the benefits of landowners involved. Creating conditions that allow for high water events to enter wetland areas, allowing for retention and/or detention areas will enable plants to uptake nutrients and sediment to settle.

Target Locations:
Priority areas for wetlands are those located directly adjacent to Grand Lake St. Marys, the Wabash River and their tributaries. CRP, CREP and the Wildlife Habitat Incentive Program (WHIP) have specific soil type requirements for land to be enrolled in the programs; therefore, locations will be dependent upon meeting those requirements as well.

Load Reductions:
Load reductions will be calculated as landowners enroll their land or existing wetlands are identified. Studies have shown that constructed wetlands can achieve a 70 to 85 percent reduction in total phosphorus, up to a 90 percent reduction in total nitrogen and up to an 86% reduction in sediment.

Resources:
ODNR, SWCD, NRCS, Ohio EPA and Farm Service Agency personnel will assist in accomplishing this objective.

Education/Information:
Pre and post wetland restoration or construction water quality monitoring will be completed at reference points to provide data on changes in water quality. Indications of reductions in nutrients and sediment post wetland restoration or construction will provide progress towards meeting TMDL attainment objectives. Articles to local newspapers, radio and newsletters will highlight the benefits of wetlands in flood prevention, wildlife habitat and water quality.

Funding:
Funding for these systems is available through CRP, CREP or WHIP. Potential grant opportunities could be a funding source as well. The approximate cost of construction of wetlands is estimated to be between $3,000 and $10,000 per acre depending on the site. The total cost of meeting this objective will range from $180,000 to $600,000. A committee which includes Indiana participants has been formed for the Wabash River Watershed. The ultimate goal of this group is to fund programs and projects.

Status: In 2008, the Mercer County SWCD assisted in the installation of a wetland in the Beaver Creek subwatershed. This wetland is 4 acres. They also assisted in the installation of a wetland in the Wabash River watershed above Bear Creek below Stony Creek. This wetland is 5.9 acres. Also in 2008, the GLWWA has requested the Army Corps hold a public hearing to oppose the destruction of wetlands near the banks of Grand Lake St. Marys. Army Corps and OEPA approved for the destruction of these wetlands in 2009 and at the time of this revision, Cisco Realty is trying to sell the mitigated wetlands. The developers do not want to pay the taxes on the mitigated area, according to the realtor.
At the Public Advisory Board meeting on December 15, 2009, Mercer and Darke SWCD reported wetlands were being constructed in the watershed, but not at a pace to meet this objective in 5 years.

OBJECTIVE 12 – Construction Sites

Problem Statement:
Sediment is a large contributor to the hypereutrophic state of Grand Lake St. Marys and the degredated state of the Wabash River. The sediment is carried from farm fields, streambanks and construction sites. Towns and industry are constantly growing throughout the watershed, including subdivisions and industrial parks. Franklin Township covers the south edge of Grand Lake St. Marys and is considered the fastest growing area of Mercer County. Construction in these areas is typically done by small contractors or family businesses, who often do not implement proper sediment and erosion control measures.

Objective Statement:
Ensure that proper sediment and erosion controls are being utilized on construction sites throughout the Grand Lake/Wabash River watershed.

Project Methods:
Construction sites larger than one acre are required to follow Ohio EPA regulations for construction stormwater control, which includes developing a stormwater pollution prevention plan for each site. Construction sites larger than five acres are required to implement additional best management practices to ensure that stormwater is protected. Raising awareness of the importance of sediment and erosion controls to local planning commissions, developers, contractors and the Builder's Association will be completed through presentations, mailings and local media.

Target Locations:
Areas of focus will include those developing areas directly adjacent to Grand Lake St. Marys, the Wabash River and their tributaries.

Load Reductions:
There is no tool currently available to calculate load reductions from construction site sediment and erosion controls. The benefits from items such as silt fence, sediment traps, detention basins and seeding and mulching are obvious and should be included in any construction site's stormwater pollution prevention plan.

Resources:
Cooperation with City and Regional Planning Commissions, County Engineers, Township Trustees, Ohio EPA, developers and contractors is necessary to meet this objective.

Education/Information:
Educational information, such as brochures will be sent to local developers and contractors on an annual basis to remind them of the importance of sediment and erosion controls. Ohio EPA publishes various materials on construction stormwater controls that will also be shared with developers and contractors. Demonstrations on the different construction stormwater best management practices will inform local

developers and contractors. A construction site inspection program will be created utilizing local volunteers to observe violations of Ohio EPA regulations. Articles in local newspapers, radio and newsletters will also highlight the benefits of sediment and erosion controls.

Funding:
Potential sources of funding for the project include state and local grant opportunities for workshops and educational materials. A committee which includes Indiana participants has been formed for the Wabash River Watershed. The ultimate goal of this group is to fund programs and projects.

Status: In 2007 and 2008 the watershed coordinator visited the County Zoning Board meeting. She took educational posters generated by USEPA. She was ensured that all of these best management practices were being met. The GLWWA has also worked with OEPA to attempt to bring construction sites into compliance in 2008 and 2009. Also in 2008 and 2009 the GLWWA put up a display at the local home show. This display included information on water quality, construction and residential best management practices. In 2009 all local builders and construction company owners were invited to tour the Mercer County Jail Construction Site. This site did a large number of construction best management practices.
At the December 15, 2009, Public Advisory Board meeting stakeholders suggested bringing this Objective to the Joint Board for further discussion. Also completed in 2009 was a Balanced Growth Watershed Grant Application to the Lake Erie Commission. This grant was to put priority designation on areas of agriculture, residences and conservation. This grant application was denied.

OBJECTIVE 13 – Lawn and Garden Fertilizer Reduction

Problem Statement:
Lawn and garden fertilization is popular throughout the watershed. It is typically done by the homeowner or by one of at least five active lawn fertilization companies in the Grand Lake/Wabash Watershed area. Lawn and garden fertilization should be done properly as to not cause harm to the watershed. The two primary nutrient needs of lawn and garden fertilization are phosphorous and nitrogen. These two nutrients are also top contributors to the hypereutrophic state of Grand Lake St. Marys and the degradated state of the Wabash River Watershed. Throughout the watersheds, lawn and garden fertilization is done without analyzing which nutrients the soil needs to support a healthy lawn.

Objective Statement:
Reduce over application of phosphorus and nitrogen on 300 lawns and gardens by assisting with residential lawn and garden nutrient sampling to evaluate the needs of individual lawns and gardens prior to the application of fertilizers and chemicals.

Project Methods:
Provide homeowners with assistance to perform lawn and garden soil sampling. Samples will be analyzed by a qualified laboratory to determine nutrients needed and proper application rates. This will provide homeowners with the necessary tools to avoid over application of nutrients and chemicals that have the potential to runoff into waters of the State. Workshops will be held to demonstrate proper soil sampling techniques as well as proper lawn and garden fertilization techniques.

Target Locations:
All homeowners within the watershed will be eligible to apply for the program. However, those potential participants that are closest to Grand Lake St. Marys, the Wabash River or their tributaries will receive priority. Homeowners that have attended a workshop on lawn and garden fertilization techniques will also receive priority.

Load Reductions:
As lawns and gardens are sampled and nutrient analyses have been completed, the difference between what was normally applied and the recommendations for application will be the savings or load reduction for this objective.

Resources:
OSU Extension, SWCD offices, local chemical application companies, nurseries, soil testing laboratories and the Lake Improvement Association will encourage landowners to complete soil sampling and analysis and provide recommendations prior to nutrient application.

Education/Information:
A successful workshop was held during July of 2007 and an unsuccessful workshop was held in 2008. Materials demonstrating the proper soil sampling and fertilization

techniques were distributed at the workshops. Workshop times and locations were announced through the local media. No workshop was held in 2009. A cost-share program was held all 3 years, testing 142 lawns. A similar cost-share program is planned for 2009, including a workshop. **Funding:**
In early 2007, an ODNR Watershed Education mini-grant was received to hold a workshop demonstrating proper soil sampling and lawn fertilization techniques. The grant covered the cost of the workshop, materials needed for the workshop and a fair display. GLWWA contributed $300 and the Lake Improvement Association contributed $300 towards a cost-share program for soil sampling. A similar funding schedule was be used for an additional workshop in 2008. A committee which includes Indiana participants has been formed for the Wabash River Watershed. The ultimate goal of this group is to fund programs and projects.

Status: The 2007 workshop had about 35 attendees and over 60 samples were brought in throughout the year. In 2008 the workshop did not have many attendees, but 36 soil samples were submitted. No workshop was held in 2009, but the cost share program was successful. A total of 142 soil samples have been completed over the 3 years. A cost share program and workshop is planned for 2010. At the Public Advisory Board meeting on December 15, 2009, stakeholders suggested requesting cost share for at least 158 samples and adding every lawn and garden with stream or lake frontage to the Objective.

OBJECTIVE 14 – Septic Systems

Problem Statement:
Sediment, excessive nutrients and pathogens contribute to the degradated state of Grand Lake St. Marys and the Wabash River. Pathogens are generated from domestic and wild animal waste, as well as from human waste. The watersheds are predominately rural housing, with over 4,000 private septic systems. Many of the private septic systems are outdated and not maintained. Often when homeowners experience septic system malfunctions, direct routing of septic lines to surface water occurs.

Objective Statement:
Replace 50 failed or compromised septic systems within the watershed. Systems will be upgraded to an on-lot, no discharge system such as the mound system, elevated leachfield system, etc.

Project Methods:
Promote the replacement of failing or compromised septic systems through a 50% cost-share program (up to $7,000 per homeowner). Providing a cost-share program for the replacement of failed or compromised septic systems will provide some monetary relief for homeowners. The cost-share program will also allow homeowners the option of tying into a centralized sewer system, if available in their area. Newly constructed homes would not be eligible for cost-share.

Target Locations:
Priority areas were identified based on the number of homes built prior to 1973, as older homes are more likely to have failing septic systems. The subwatersheds include:

1) Wabash River above Bear Creek below Stony Creek subwatershed
2) Chickasaw Creek subwatershed
3) Wabash River below Stony Creek above Beaver Creek subwatershed
4) Beaver Creek subwatershed
5) North Shore subwatershed

Load Reductions:
Non-functioning septic systems are a direct threat to water quality. Often when a system is not working properly, landowners will tie a tile directly to the nearby stream, bypassing the treatment system. By replacing these septic systems, a reduction in fecal coliform and phosphorus would be significant.

Resources:
County health departments, county sanitation departments, SWCD offices and Ohio EPA will need to be involved and provide insight on regulations and requirements for all options.

Education/Information:

Funding availability and the cooperation of all involved agencies will be integral factors of the success of this objective. Coordinated efforts between all involved agencies will assist in prioritizing the most needed areas. Samples taken nearby each failing septic system will be taken prior to the installation of the new system and following the installation to demonstrate the necessity of replacing failing or compromised septic systems.

Funding:
Assuming the 50% cost-share is maxed out in each instance, the total cost of meeting this objective is $700,000. The 50% cost share program allows for $350,000 in landowner expenses and $350,000 in other funds. These project funds could come from federal grant opportunities such as US EPA grants or state grant opportunities. The county health departments will be contacted and any funding opportunities they suggest will be investigated. The WPCL Fund application was sent in and low interest loans became available January 1, 2008. A committee which includes Indiana participants has been formed for the Wabash River Watershed. The ultimate goal of this group is to fund programs and projects.
In 2009, OEPA recommended the moving of a 319 grant to the Grand Lake St. Marys watershed. This grant includes cost-share for 18 septic systems. It is a three year grant, requiring cash match.

Status: One application has been processed for the WPCL Fund. This system is located in the Coldwater Creek subwatershed. It was to improve an existing system, so that it would be in compliance. In 2007 and 2008 over three times the goal of 50 systems in the Grand Lake St. Marys and Wabash River Watersheds were replaced. This was due to the change in septic system rules. Rules are not yet final; the Health Departments are working on temporary rules. At the request of the Public Advisory Board, the GLWWA is partnering with the Mercer County Health Department in 2009 to provide a septic system self-assessment. In 2008, it was recognized that even though the objective has been met, there are still systems that may be directly discharging in the watershed.
At the December 15, 2009, Public Advisory Board meeting, stakeholders suggested adding an additional 50 systems to this objective. The Objective has been reached, but the stakeholders see a need for at least 50 more systems to be replaced.

OBJECTIVE 15 – Centralized Sewer

Problem Statement:
Sediment, excessive nutrients and pathogens contribute to the degradated state of Grand Lake St. Marys and the Wabash River. Pathogens are generated from domestic and wild animal waste, as well as human waste. The watersheds are predominately rural housing, with over 4,000 private septic systems. There are also several small villages and dwelled areas throughout the watershed. Typically concentrated housing areas with 10 or more homes experience failing septic systems due to the close proximity of those systems.

Objective Statement:
Discontinue the use of home sewage treatment systems in concentrated residential areas by connecting those areas to centralized sewer systems.

Project Methods:
Connect densely populated areas within the watershed to a centralized sewer system within the next 10 years.

Target Locations:

1) St. Joseph (Wabash River above Bear Creek below Stony Creek subwatershed)
2) Wabash (Wabash River below Stony Creek above Beaver Creek subwatershed)
3) St. Anthony (Wabash River below Beaver Creek to New Corydon subwatershed)
4) Cassella (Beaver Creek subwatershed)

Load Reductions:
Septic systems that are operating in close proximity often do not work properly. Non-functioning septic systems are a direct threat to water quality. Often when a system is not working properly, landowners will tie a tile directly to the nearby stream, bypassing the treatment system. By replacing these septic systems with a centralized sewer system, a reduction in fecal coliform and phosphorus would be significant.

Resources:
County commissioners, township trustees, county health departments, county sanitation departments and Ohio EPA will need to be involved and provide insight on regulations and requirements for all options.

Education/Information:
Funding availability, the willingness of area residents and the cooperation of all involved agencies will be integral factors of the success of this objective. Coordinated efforts between all involved agencies will assist in prioritizing the most needed areas. Samples taken nearby the populated areas will be taken prior to sewer installation and following the sewer installation to demonstrate the necessity of centralized sewer systems in densely populated areas.

Funding:
Funding for system installations could come from grants for infrastructure improvements for the county. Several villages have been successful at completing Community Development Block Grants, which may be a possible source of funding. A committee which includes Indiana participants has been formed for the Wabash River Watershed. The ultimate goal of this group is to fund programs and projects.

Status: The CDBG grants have been used to improve drainage in several of the villages throughout the watershed. This may have improved the sewer systems, but there is no definite correlation. Currently the Mercer County Commissioners are still considering a central sewer system to extend to Cassella. The other target areas are not in their priority of projects. In 2009, federal stimulus funds provided a grant to install central sewer throughout several sections of the watershed. None of the target areas are included in these systems. At the December 15, 2009, Public Advisory Board meeting, stakeholders suggested the Joint Board formally bring these target areas to the Mercer County Community Development Office.

Other Objectives:

1) Promote the installation of grassed waterways in areas of evident gully erosion.

2) Encourage the continued enrollment in federal programs such as CRP, CREP, EQIP and WHIP.

3) Encourage the use of retention or detention basins in developing areas, and provide education on rain gardens and rain barrels to residential stakeholders.

4) Continued educational programs, such as workshops, field days, tours, etc. on the following (but not limited to) topics:

    a. Stormwater drain protection
    b. Preferential pathways for liquid manure
    c. Discourage littering
    d. Discourage open burning along streams/ditches

5) Continue to work with other local interest groups to secure land through direct land purchase or purchase of conservation easements with deed restrictions for development rights to protect or restore natural areas and greenspace in the watershed.

6) Although dredging is a maintenance activity, it is encouraged that dredging be completed on a much larger scale once this watershed action plan is fully implemented. Current dredging activities are not nearly enough to remove all sediment that has already settled in the lake.

7) Conduct surveys of local farmers regarding their use of starter fertilizer to determine and educate on the need of starter fertilizer based on soil nutrient levels.

8) Continue investigation and pursue funds for logical in-lake treatment systems

9) Continue investigation and pursue funds for in-stream sediment trapping systems

Tables similar to the following were requested by OEPA. This gives an overview of the estimated cost of the Objectives in the watershed action plan. These tables were created from the previously listed Objectives. All numbers were derived from the watershed descriptions and Objectives. These tables show general causes of impairment, action item (Objective) targets and an estimated cost of completing the Objectives of the WAP.

A full description of the table format is listed below:

- The hydrologic unit code is listed in the upper left hand corner of the table. Some tables do not have a hydrologic unit code in this box. These tables refer to a watershed that is smaller than the conventional hydrologic unit codes. The original Grand Lake St. Marys watershed action plan was completed in an unconventional manner, using watersheds smaller than the conventional hydrologic unit code.
- Continuing down the left hand column of the table is a list of the watershed action plan Objectives. These are listed in alphabetical order. Each table contains the same list.
- The second box on the top row of the table is the watershed title.
- Below the watershed title is the priority rank of the watershed for each of the respective Objectives. This rank was pulled from the Objectives section of the watershed action plan. If the watershed is not ranked, it is noted as such. If the watershed needs action in only certain areas, this is also noted.
- The third box on the top row of the table is the watershed acres, with one exception. In the NMP's row this column lists the number of livestock facilities in the watershed. These numbers are taken from the watershed descriptions in the watershed action plan.
- The fourth box on the top row of the table is the total amount listed in the Objective. This amount includes action throughout the Grand Lake St. Marys and Wabash River Watersheds. This number is taken directly from the Objective section of the watershed action plan.
- The fifth box on the top row of the table is the percent of the Grand Lake St. Marys and Wabash River watersheds that this specific watershed represents.
- The sixth box on the top row of the table is the percent of the Grand Lake St. Marys or Wabash River watershed.
- The seventh box on the top row of the table is labeled "% Objective." This column was derived by multiplying the Objective Total by the % watershed. This gives the amount of the Objective that may fall in the watershed.
- The eighth box on the top row of the table is labeled Target. This is the target amount for the watershed and the Objective. This amount was derived by rounding the amount in the previous column.
- The second to last box on the top row of the table is labeled "Unit." This column labels the Target column, making the numbers an actual amount.
- The last column gives an estimated cost to complete the Target column. This number was completed with information from the watershed action plan Objectives.

- The box in the bottom right hand corner of the table is the total estimated cost to complete the Objectives in the watershed. This is a summation of the rows above this box.
- All items on the table in **bold are directly from the watershed action plan**. Numbers which are not in bold are estimated and/or calculated amounts.

bold letters are titles and numbers from watershed action plan, not calculations

All plain text are estimates from the watershed action plan.

TABLE 102 – 05120101-020-010 - Chickasaw and Barnes Creeks

05120101-020-010	Chickasaw and Barnes Creeks	acres	Objective total	% watershed	% Wabash	% Objective	Target	Unit	Total Cost
Centralized Sewer	**not ranked**	**19,808**	**40**	**20.60%**	**44.80%**	**8.24**	**8**	**systems**	$82,400.00
Conservation Tillage	**3**	**19,808**	**5,000**	**20.60%**	**44.80%**	**1030**	**1,030**	**acres**	$185,400.00
Construction Site Runoff	**need on creek and shoreline**	**19,808**	**1**	**20.60%**	**44.80%**	**0.206**	**0**	**site**	$103.00
Cover Crops	**4**	**19,808**	**4,000**	**11.00%**	**33.60%**	**440**	**440**	**acres**	$79,200.00
Filter Areas	**all need**	**19,808**	**500**	**20.60%**	**44.80%**	**103**	**103**	**acres**	$30,900.00
Filter strips or riparian buffers	**5**	**19,808**	**300**	**20.60%**	**44.80%**	**61.8**	**62**	**acres**	$18,540.00
Lawn Fertilizer Reduction	**need on creek and shoreline**	**19,808**	**300**	**20.60%**	**44.80%**	**61.8**	**62**	**lawns**	$1,236.00
Manure Management Technology	**2**	**19,808**	**2**	**20.60%**	**44.80%**	**0.412**	**0**	**technology**	$41,200.00
Milkhouse Wastewater (based on total milkhouses)	**all direct discharges**	**19,808**	**15**	**10.11%**	**31.10%**	**1.5165**	**2**	**system**	$15,165.00
CNMP's and/or NMP's	**all need**	**19,808**	**35**	**20.60%**	**44.80%**	**35%**	**6,933**	**acres**	$20,798,400.00
Septic Systems	**2**	**19,808**	**50**	**20.60%**	**44.80%**	**10.3**	**10**	**systems**	$103,000.00
Shoreline Protection (lineal feet)	**not ranked**	**19,808**	**6,000**	**15.00%**	**15.00%**	**900**	**900**	**lineal feet**	$450,000.00
Streambank Protection (lineal feet)	**not ranked**	**19,808**	**1,000**	**16.00%**	**48.70%**	**487**	**487**	**lineal feet**	$243,500.00
Tile Control Structures	**2**	**19,808**	**100**	**20.60%**	**44.80%**	**20.6**	**21**	**Structure**	$30,900.00
Wetlands	**need on creek and shoreline**	**19,808**	**60**	**20.60%**	**44.80%**	**12.36**	**12**	**acres**	$61,800.00
									$22,141,744.00

TABLE 103 – 05120101-020-020 – Coldwater and Beaver Creeks

05120101-020-020	Coldwater and Beaver Creeks	acres	Objective total	% watershed	% Wabash	% Objective	Target	Unit	Total Cost
Centralized Sewer	4	25,425	40	14.20%	42.10%	5.68	6	systems	$56,800.00
Conservation Tillage	2	25,425	5,000	14.20%	42.10%	710	710	acres	$127,800.00
Construction Site Runoff	need on creek and shoreline	25,425	8,000	14.20%	42.10%	1136	1,136	site	$568,000.00
Cover Crops	5	25,425	4,000	14.20%	42.10%	568	568	acres	$102,240.00
Filter Areas	all need	25,425	600	14.20%	42.10%	85.2	85	acres	$25,560.00
Filter strips or riparian buffers	6	25,425	600	14.20%	42.10%	85.2	85	acres	$25,560.00
Lawn Fertilizer Reduction	need on creek and shoreline	25,425	300	14.20%	42.10%	42.6	43	lawns	$852.00
Manure Management Technology	not ranked	25,425	36	14.20%	42.10%	5.112	5	technology	$511,200.00
Milkhouse Wastewater (based on total milkhouses)	all direct discharges	25,425	36	16.10%	51.50%	5.796	6	system	$57,960.00
CNMP's and/or NMP's	all need	25,425	35	14.20%	42.10%	35%	8,899	acres	$26,696,250.00
Septic Systems	4	25,425	100	14.20%	42.10%	14.2	14	systems	$142,000.00
Shoreline Protection (lineal feet)	not ranked	25,425	2,000	10.00%	10.00%	200	200	lineal feet	$100,000.00
Streambank Protection (lineal feet)	not ranked	25,425	12,000	14.20%	42.10%	5052	5,052	lineal feet	$2,526,000.00
Tile Control Structures	3	25,425	100	14.20%	42.10%	14.2	14	Structure	$21,300.00
Wetlands	need on creek and shoreline	25,425	60	14.20%	42.10%	8.52	9	acres	$42,600.00
									$31,004,122.00

TABLE 104 – 05120101-020-030 – North Shore/Grassy/Monroe/Prairie Creeks

05120101-020-030	North Shore/Grassy/Monroe/ Prairie Creeks	acres	Objective total	% watershed	% Wabash	% Objective	Target	Unit	Total Cost
Centralized Sewer	not ranked	14,325	40	11.60%	20.70%	4.64	5	systems	$46,400.00
Conservation Tillage	not ranked	14,325	5,000	11.60%	20.70%	580	580	acres	$104,400.00
Construction Site Runoff	need on creek and shoreline	14,325	1	11.60%	20.70%	0.116	0	site	$58.00
Cover Crops	not ranked	14,325	4,000	11.60%	20.70%	464	464	acres	$83,520.00
Filter Areas	all need	14,325	500	11.60%	20.70%	58	58	acres	$17,400.00
Filter strips or riparian buffers	3	14,325	300	11.60%	20.70%	34.8	35	acres	$10,440.00
Lawn Fertilizer Reduction	need on creek and shoreline	14,325	300	11.60%	20.70%	34.8	35	lawns	$696.00
Manure Management Technology	not ranked	14,325	2	11.60%	20.70%	0.232	0	technology	$23,200.00
Milkhouse Wastewater (based on total milkhouses)	all direct discharges	14,325	15	11.60%	20.70%	1.74	2	system	$17,400.00
CNMP's and/or NMP's	all need	14,325	35	11.60%	20.70%	35%	5,014	acres	$15,041,250.00
Septic Systems	not ranked	14,325	50	11.60%	20.70%	5.8	6	systems	$58,000.00
Shoreline Protection (lineal feet)	not ranked	14,325	6,000	75.00%	75.00%	4500	4,500	lineal feet	$2,250,000.00
Streambank Protection (lineal feet)	not ranked	14,325	1,000	11.60%	20.70%	207	207	lineal feet	$103,500.00
Tile Control Structures	not ranked	14,325	100	11.60%	20.70%	11.6	12	Structure	$17,400.00
Wetlands	need on creek and shoreline	14,325	60	11.60%	20.70%	6.96	7	acres	$34,800.00
									$17,808,464.00

TABLE 105 – 05120101-020-010 – Barnes Creek

	Barnes	acres	Objective total	% watershed	% Wabash	% Objective	Target	Unit	Total Cost
Centralized Sewer	not ranked	3,486	40	11.50%	17.10%	4.6	5	systems	$46,000.00
Conservation Tillage	not ranked	3,486	5,000	11.50%	17.10%	575	575	acres	$103,500.00
Construction Site Runoff	need on creek and shoreline	3,486	1	11.50%	17.10%	0.115	0	site	$57.50
Cover Crops	not ranked	3,486	4,000	1.90%	5.90%	76	76	acres	$13,680.00
Filter Areas	all need	3,486	500	11.50%	17.10%	57.5	58	acres	$17,250.00
Filter strips or riparian buffers	not ranked	3,486	300	11.50%	17.10%	34.5	35	acres	$10,350.00
Lawn Fertilizer Reduction	need on creek and shoreline	3,486	300	11.50%	17.10%	34.5	35	lawns	$690.00
Manure Management Technology	not ranked	3,486	2	11.50%	17.10%	0.23	0	technology	$23,000.00
Milkhouse Wastewater (based on total milkhouses)	all direct discharges	3,486	15	1.01%	3.40%	0.1515	0	system	$1,515.00
CNMP's and/or NMP's	all need	3,486	35	11.50%	17.10%	35%	1,220	acres	$3,660,300.00
Septic Systems	not ranked	3,486	50	11.50%	17.10%	5.75	6	systems	$57,500.00
Shoreline Protection (lineal feet)	not ranked	3,486	6,000	10.00%	10.00%	600	600	lineal feet	$300,000.00
Streambank Protection (lineal feet)	not ranked	3,486	1,000	6.90%	21.00%	210	210	lineal feet	$105,000.00
Tile Control Structures	not ranked	3,486	100	11.50%	17.10%	11.5	12	Structure	$17,250.00
Wetlands	need on creek and shoreline	3,486	60	11.50%	17.10%	6.9	7	acres	$34,500.00
									$4,390,592.50

TABLE 106 – 05120101-020-020 – Beaver Creek

	Beaver	acres	Objective total	% watershed	% Wabash	% Objective	Target	Unit	Total Cost
Centralized Sewer	4	13,059	40	7.30%	21.10%	2.92	3	systems	$29,200.00
Conservation Tillage	2	13,059	5,000	7.30%	21.10%	365	365	acres	$65,700.00
Construction Site Runoff	need on creek and shoreline	13,059	1	7.30%	21.10%	0.073	0	site	$36.50
Cover Crops	5	13,059	4,000	7.30%	21.10%	292	292	acres	$52,560.00
Filter Areas	all need	13,059	500	7.30%	21.10%	36.5	37	acres	$10,950.00
Filter strips or riparian buffers	not ranked	13,059	300	7.30%	21.10%	21.9	22	acres	$6,570.00
Lawn Fertilizer Reduction	need on creek and shoreline	13,059	300	7.30%	21.10%	21.9	22	lawns	$438.00
Manure Management Technology	not ranked	13,059	2	7.30%	21.10%	0.146	0	technology	$14,600.00
Milkhouse Wastewater (based on total milkhouses)	all direct discharges	13,059	22	9.20%	30.50%	2.024	2	system	$20,240.00
CNMP's and/or NMP's	all need	13,059	35	7.30%	21.10%	35%	4,571	acres	$13,711,950.00
Septic Systems	4	13,059	50	7.30%	21.10%	3.65	4	systems	$36,500.00
Shoreline Protection (lineal feet)	not ranked	13,059	6,000	5.00%	5.00%	300	300	lineal feet	$150,000.00
Streambank Protection (lineal feet)	not ranked	13,059	1,000	7.30%	21.10%	211	211	lineal feet	$105,500.00
Tile Control Structures	3	13,059	100	7.30%	21.10%	7.3	7	Structure	$10,950.00
Wetlands	need on creek and shoreline	13,059	60	7.30%	21.10%	4.38	4	acres	$21,900.00
									$14,237,094.50

TABLE 107 – 05120101-020-010 – Chickasaw Creek

	Chickasaw	acres	Objective total	% watershed	% Wabash	% Objective	Target	Unit	Total Cost
Centralized Sewer	not ranked	16,322	40	9.10%	27.70%	3.64	4	systems	$36,400.00
Conservation Tillage	3	16,322	5,000	9.10%	27.70%	455	455	acres	$81,900.00
Construction Site Runoff	need on creek and shoreline	16,322	1	9.10%	27.70%	0.091	0	site	$45.50
Cover Crops	4	16,322	4,000	9.10%	27.70%	364	364	acres	$65,520.00
Filter Areas	all need	16,322	500	9.10%	27.70%	45.5	46	acres	$13,650.00
Filter strips or riparian buffers	5	16,322	300	9.10%	27.70%	27.3	35	acres	$10,500.00
Lawn Fertilizer Reduction	need on creek and shoreline	16,322	300	9.10%	27.70%	27.3	27	lawns	$546.00
Manure Management Technology	2	16,322	2	9.10%	27.70%	0.182	0	technology	$18,200.00
Milkhouse Wastewater (based on total milkhouses)	all direct discharges	16,322	19	9.10%	27.70%	1.729	2	system	$17,290.00
CNMP's and/or NMP's	all need	16,322	35	9.10%	27.70%	35%	5,713	acres	$17,138,100.00
Septic Systems	2	16,322	50	9.10%	27.70%	4.55	5	systems	$45,500.00
Shoreline Protection (lineal feet)	not ranked	16,322	6,000	5.00%	5.00%	300	300	lineal feet	$150,000.00
Streambank Protection (lineal feet)	not ranked	16,322	1,000	9.10%	27.70%	277	277	lineal feet	$138,500.00
Tile Control Structures	2	16,322	100	9.10%	27.70%	9.1	9	Structure	$13,650.00
Wetlands	need on creek and shoreline	16,322	60	9.10%	27.70%	5.46	5	acres	$27,300.00
									$17,757,101.50

TABLE 108 – 05120101-020-020 – Coldwater Creek

HUC	Coldwater	acres	Objective total	% watershed	% Grand Lake	% Objective	Target	Unit	Total Cost
Centralized Sewer	not ranked	12,366	40	6.90%	21.00%	2.76	3	systems	$27,600.00
Conservation Tillage	4	12,366	5,000	6.90%	21.00%	345	345	acres	$62,100.00
Construction Site Runoff	need on creek and shoreline	12,366	1	6.90%	21.00%	0.069	0	site	$34.50
Cover Crops	not ranked	12,366	4,000	6.90%	21.00%	276	276	acres	$49,680.00
Filter Areas	all need	12,366	500	6.90%	21.00%	34.5	35	acres	$10,350.00
Filter strips or riparian buffers	6	12,366	300	6.90%	21.00%	20.7	30	acres	$9,000.00
Lawn Fertilizer Reduction	need on creek and shoreline	12,366	300	6.90%	21.00%	20.7	21	lawns	$414.00
Manure Management Technology	not ranked	12,366	2	6.90%	21.00%	0.138	0	technology	$13,800.00
Milkhouse Wastewater (based on total milkhouses)	all direct discharges	12,366	14	6.90%	21.00%	0.966	1	system	$9,660.00
CNMP's and/or NMP's	all need	12,366	35	6.90%	21.00%	35%	4,328	acres	$12,984,300.00
Septic Systems	not ranked	12,366	50	6.90%	21.00%	3.45	3	systems	$34,500.00
Shoreline Protection (lineal feet)	not ranked	12,366	6,000	5.00%	5.00%	300	300	lineal feet	$150,000.00
Streambank Protection (lineal feet)	not ranked	12,366	1,000	6.90%	21.00%	210	210	lineal feet	$105,000.00
Tile Control Structures	4	12,366	100	6.90%	21.00%	6.9	7	Structure	$10,350.00
Wetlands	need on creek and shoreline	12,366	60	6.90%	21.00%	4.14	4	acres	$20,700.00
									$13,487,488.50

TABLE 109 – 05120101-020-030 – Grassy/Monroe Creeks

	Grassy/Monroe	acres	Objective total	% watershed	% Grand Lake	% Objective	Target	Unit	Total Cost
Centralized Sewer	not ranked	3,164	40	5.40%	1.80%	2.16	2	systems	$21,600.00
Conservation Tillage	not ranked	3,164	5,000	5.40%	1.80%	270	270	acres	$48,600.00
Construction Site Runoff	need on creek and shoreline	3,164	1	5.40%	1.80%	0.054	0	site	$27.00
Cover Crops	not ranked	3,164	4,000	5.40%	1.80%	216	216	acres	$38,880.00
Filter Areas	all need	3,164	500	5.40%	1.80%	27	27	acres	$8,100.00
Filter strips or riparian buffers	not ranked	3,164	300	5.40%	1.80%	16.2	40	acres	$12,000.00
Lawn Fertilizer Reduction	need on creek and shoreline	3,164	300	5.40%	1.80%	16.2	16	lawns	$324.00
Manure Management Technology	not ranked	3,164	2	5.40%	1.80%	0.108	0	technology	$10,800.00
Milkhouse Wastewater (based on total milkhouses)	all direct discharges	3,164	4	5.40%	1.80%	0.216	0	system	$2,160.00
CNMP's and/or NMP's	all need	3,164	35	5.40%	1.80%	35%	1,107	acres	$3,322,200.00
Septic Systems	not ranked	3,164	50	5.40%	1.80%	2.7	3	systems	$27,000.00
Shoreline Protection (lineal feet)	not ranked	3,164	6,000	15.00%	15.00%	900	900	lineal feet	$450,000.00
Streambank Protection (lineal feet)	not ranked	3,164	1,000	5.40%	1.80%	18	18	lineal feet	$9,000.00
Tile Control Structures	not ranked	3,164	100	5.40%	1.80%	5.4	5	Structure	$8,100.00
Wetlands	need on creek and shoreline	3,164	60	5.40%	1.80%	3.24	3	acres	$16,200.00
									$3,974,991.00

TABLE 110 – 05120101-020-030 – Prairie Creek

	Prairie	acres	Objective total	% watershed	% Wabash	% Objective	Target	Unit	Total Cost
Centralized Sewer	not ranked	7,675	40	4.30%	13.00%	1.72	2	systems	$17,200.00
Conservation Tillage	not ranked	7,675	5,000	4.30%	13.00%	215	215	acres	$38,700.00
Construction Site Runoff	need on creek and shoreline	7,675	1	4.30%	13.00%	0.043	0	site	$21.50
Cover Crops	not ranked	7,675	4,000	4.30%	13.00%	172	172	acres	$30,960.00
Filter Areas	all need	7,675	500	4.30%	13.00%	21.5	22	acres	$6,450.00
Filter strips or riparian buffers	3	7,675	300	4.30%	13.00%	12.9	13	acres	$3,870.00
Lawn Fertilizer Reduction	need on creek and shoreline	7,675	300	4.30%	13.00%	12.9	13	lawns	$258.00
Manure Management Technology	not ranked	7,675	2	4.30%	13.00%	0.086	0	technology	$8,600.00
Milkhouse Wastewater (based on total milkhouses)	all direct discharges	7,675	10	4.30%	13.00%	0.43	0	system	$4,300.00
CNMP's and/or NMP's	all need	7,675	35	4.30%	13.00%	35%	2,686	acres	$8,058,750.00
Septic Systems	not ranked	7,675	50	4.30%	13.00%	2.15	2	systems	$21,500.00
Shoreline Protection (lineal feet)	not ranked	7,675	6,000	30.00%	30.00%	1800	1,800	lineal feet	$900,000.00
Streambank Protection (lineal feet)	not ranked	7,675	1,000	4.30%	13.00%	130	130	lineal feet	$65,000.00
Tile Control Structures	not ranked	7,675	100	4.30%	13.00%	4.3	4	Structure	$6,450.00
Wetlands	need on creek and shoreline	7,675	60	4.30%	13.00%	2.58	3	acres	$12,900.00
									$9,174,959.50

TABLE 111 – 05120101-020-030 – North Lake Shore

	North Lake Shore	acres	Objective total	% watershed	% Wabash	% Objective	Target	Unit	Total Cost
Centralized Sewer	not ranked	3,486	40	1.90%	5.90%	0.76	1	systems	$7,600.00
Conservation Tillage	not ranked	3,486	5,000	1.90%	5.90%	95	95	acres	$17,100.00
Construction Site Runoff	need on shoreline and channels	3,486	1	1.90%	5.90%	0.019	0	site	$9.50
Cover Crops	not ranked	3,486	4,000	1.90%	5.90%	76	76	acres	$13,680.00
Filter Areas	all need	3,486	500	1.90%	5.90%	9.5	10	acres	$2,850.00
Filter strips or riparian buffers	not ranked	3,486	300	1.90%	5.90%	5.7	6	acres	$1,710.00
Lawn Fertilizer Reduction	need on shoreline and channels	3,486	300	1.90%	5.90%	5.7	6	lawns	$114.00
Manure Management Technology	not ranked	3,486	2	1.90%	5.90%	0.038	0	technology	$3,800.00
Milkhouse Wastewater (based on total milkhouses)	all direct discharges	3,486	1	1.90%	5.90%	0.019	0	system	$190.00
CNMP's and/or NMP's	all need	3,486	35	1.90%	5.90%	35%	1,220	acres	$3,660,300.00
Septic Systems	5	3,486	50	1.90%	5.90%	0.95	1	systems	$9,500.00
Shoreline Protection (lineal feet)	not ranked	3,486	6,000	30.00%	30.00%	1800	1,800	lineal feet	$900,000.00
Streambank Protection (lineal feet)	not ranked	3,486	1,000	1.90%	5.90%	59	59	lineal feet	$29,500.00
Tile Control Structures	not ranked	3,486	100	1.90%	5.90%	1.9	2	Structure	$2,850.00
Wetlands	not ranked	3,486	60	1.90%	5.90%	1.14	1	acres	$5,700.00
									$4,654,903.50

TABLE 112 – 05120101-010-010 – Wabash Headwaters to below Bear Creek

HUC 05120101-010-010	Wabash Headwaters to below Bear Creek	acres	Objective total	% watershed	% Wabash	% Objective	Target	Unit	Total Cost
Centralized Sewer	not ranked	20,190	40	11.20%	16.70%	4.48	4	systems	$44,800.00
Cover Crops	6	20,190	4,000	11.20%	16.70%	448	448	acres	$80,640.00
conservation tillage	not ranked	20,190	5,000	11.20%	16.70%	560	560	acres	$100,800.00
Construction Site Runoff	not ranked	20,190	1	11.20%	16.70%	0.112	0	site	$56.00
Filter Areas	all need	20,190	500	11.20%	16.70%	56	56	acres	$16,800.00
Filter strips or riparian buffers	not ranked	20,190	300	11.20%	16.70%	33.6	70	acres	$21,000.00
Lawn Fertilizer Reduction	not ranked	20,190	300	11.20%	16.70%	33.6	34	lawns	$672.00
Manure Management Technology	not ranked	20,190	2	11.20%	16.70%	0.224	0	technology	$22,400.00
Milkhouse Wastewater (based on total milkhouses)	all direct discharges	20,190	40	4.04%	5.80%	1.616	2	system	$16,160.00
CNMP's or NMP's	all need	20,190	35	6.40%	13.50%	35%	7,067	acres	$21,199,500.00
Septic Systems	not ranked	20,190	50	11.20%	16.70%	5.6	6	systems	$56,000.00
Streambank Protection (lineal feet)	not ranked	20,190	1,000	11.20%	16.70%	167	167	lineal feet	$83,500.00
Tile Control Structures	5	20,190	100	11.20%	16.70%	11.2	11	Structure	$16,800.00
Wetlands	not ranked	20,190	60	11.20%	16.70%	6.72	7	acres	$33,600.00
									$21,692,728.00

TABLE 113 – 05120101-010-020 – Wabash River above Bear Creek below Stony Creek

05120101-010-020	Wabash River above Bear Creek below Stony Creek	acres	Objective total	% watershed	% Wabash	% Objective	Target	Unit	Total Cost
Centralized Sewer	1	33,347	40	25.00%	33.00%	10	10	systems	$100,000.00
conservation tillage	1	33,347	5,000	18.60%	27.60%	930	930	acres	$167,400.00
Construction Site Runoff	need on river	33,347	1	18.60%	27.60%	0.186	0	site	$93.00
cover crops	1	33,347	4,000	18.60%	27.60%	744	744	acres	$133,920.00
Filter Areas	all need	33,347	500	18.60%	27.60%	93	93	acres	$27,900.00
Filter strips or riparian buffers	1	33,347	300	18.60%	27.60%	55.8	85	acres	$25,500.00
Lawn Fertilizer Reduction	need on river	33,347	300	18.60%	27.60%	55.8	56	lawns	$1,116.00
Manure Management Technology	not ranked	33,347	2	18.60%	27.60%	0.372	0	technology	$37,200.00
Milkhouse Wastewater (based on total milkhouses)	all direct discharges	33,347	40	18.60%	27.60%	7.44	7	system	$74,400.00
CNMP's or NMP's	all need	33,347	35	18.60%	27.60%	35%	11,671	acres	$35,014,350.00
Septic Systems	1	33,347	50	18.60%	27.60%	9.3	9	systems	$93,000.00
Streambank Protection (lineal feet)	not ranked	33,347	1,000	18.60%	27.60%	276	276	lineal feet	$138,000.00
Tile Control Structures	1	33,347	100	18.60%	27.60%	18.6	19	Structure	$27,900.00
Wetlands	need on river	33,347	60	18.60%	27.60%	11.16	11	acres	$55,800.00
									$35,896,579.00

TABLE 114 – 05120101-010-030 – Wabash River below Stony Creek above Beaver Creek

05120101-010-030	Wabash River below Stony Creek above Beaver Creek	acres	Objective total	% watershed	% Wabash	% Objective	Target	Unit	Total Cost
Centralized Sewer	2	20,640	40	11.50%	17.10%	4.6	5	systems	$46,000.00
Conservation Tillage	not ranked	20,640	5,000	11.50%	17.10%	575	575	acres	$103,500.00
Construction Site Runoff	need on river	20,640	1	11.50%	17.10%	0.115	0	site	$57.50
Cover Crops	2	20,640	4,000	11.50%	17.10%	460	460	acres	$82,800.00
Filter Areas	all need	20,640	500	11.50%	17.10%	57.5	58	acres	$17,250.00
Filter strips or riparian buffers	3	20,640	300	11.50%	17.10%	34.5	40	acres	$12,000.00
Lawn Fertilizer Reduction	need on river	20,640	300	11.50%	17.10%	34.5	35	lawns	$690.00
Manure Management Technology	not ranked	20,640	2	11.50%	17.10%	0.23	0	technology	$23,000.00
Milkhouse Wastewater (based on total milkhouses)	all direct discharges	20,640	15	11.50%	17.10%	1.725	2	system	$17,250.00
CNMP's and/or NMP's	all need	20,640	35%	11.50%	17.10%	35%	7,224	NMP	$21,672,000.00
Septic Systems	3	20,640	50	11.50%	17.10%	5.75	6	systems	$57,500.00
Streambank Protection (lineal feet)	not ranked	20,640	1,000	11.50%	17.10%	171	171	lineal feet	$85,500.00
Tile Control Structures	not ranked	20,640	100	11.50%	17.10%	11.5	12	Structure	$17,250.00
Wetlands	need on river	20,640	60	11.50%	17.10%	6.9	7	acres	$34,500.00
									$22,169,297.50

TABLE 115 – 05120101-030-010 – Beaver Cr. from Grand Lake to above Little Beaver Cr.

05120101-030-010	Beaver Creek from Grand Lake to above Little Beaver Creek	acres	Objective total	% watershed	% Wabash	% Objective	Target	Unit	Total Cost
Centralized Sewer	not ranked	12,347	40	6.90%	10.20%	2.76	3	systems	$27,600.00
Conservation Tillage	not ranked	12,347	5,000	6.90%	10.20%	345	345	acres	$62,100.00
Construction Site Runoff	need on creek	12,347	1	6.90%	10.20%	0.069	0	site	$34.50
Cover Crops	not ranked	12,347	4,000	6.90%	10.20%	276	276	acres	$49,680.00
Filter Areas	not ranked	12,347	500	6.90%	10.20%	34.5	35	acres	$10,350.00
Filter strips or riparian buffers	not ranked	12,347	300	6.90%	10.20%	20.7	21	acres	$6,300.00
Lawn Fertilizer Reduction	need on creek	12,347	300	6.90%	10.20%	20.7	21	lawns	$414.00
Manure Management Technology	not ranked	12,347	2	6.90%	10.20%	0.138	0	technology	$13,800.00
Milkhouse Wastewater (based on total milkhouses)	all direct discharges	12,347	2	6.90%	10.20%	0.138	0	system	$1,380.00
CNMP's and/or NMP's	all need	12,347	35	6.90%	10.20%	35%	4,321	acres	$12,964,350.00
Septic Systems	not ranked	12,347	50	6.90%	10.20%	3.45	3	systems	$34,500.00
Streambank Protection (lineal feet)	not ranked	12,347	1,000	6.90%	10.20%	102	102	lineal feet	$51,000.00
Tile Control Structures	not ranked	12,347	100	6.90%	10.20%	6.9	7	Structure	$10,350.00
Wetlands	need on creek	12,347	60	6.90%	10.20%	4.14	4	acres	$20,700.00
									$13,252,558.50

TABLE 116 – 05120101-030-020 – Little Beaver Creek

05120101-030-020	Little Beaver Creek	acres	Objective total	% watershed	% Wabash	% Objective	Target	Unit	Total Cost
Centralized Sewer	not ranked	9,092	40	5.10%	7.50%	2.04	2	systems	$20,400.00
Conservation Tillage	5	9,092	5,000	5.10%	7.50%	255	255	acres	$45,900.00
Construction Site Runoff	need on creek	9,092	1	5.10%	7.50%	0.051	0	site	$25.50
Cover Crops	not ranked	9,092	4,000	5.10%	7.50%	204	204	acres	$36,720.00
Filter Areas	not ranked	9,092	500	5.10%	7.50%	25.5	26	acres	$7,650.00
Filter strips or riparian buffers	not ranked	9,092	300	5.10%	7.50%	15.3	21	acres	$6,300.00
Lawn Fertilizer Reduction	need on creek	9,092	300	5.10%	7.50%	15.3	15	lawns	$306.00
Manure Management Technology	not ranked	9,092	2	5.10%	7.50%	0.102	0	technology	$10,200.00
Milkhouse Wastewater (based on total milkhouses)	all direct discharges	9,092	17	5.10%	7.50%	0.867	1	system	$8,670.00
CNMP's and/or NMP's	all need	9,092	35	5.10%	7.50%	35%	3,182	acres	$9,546,600.00
Septic Systems	not ranked	9,092	50	5.10%	7.50%	2.55	3	systems	$25,500.00
Streambank Protection (lineal feet)	not ranked	9,092	1,000	5.10%	7.50%	75	75	lineal feet	$37,500.00
Tile Control Structures	not ranked	9,092	100	5.10%	7.50%	5.1	5	Structure	$7,650.00
Wetlands	need on creek	9,092	60	5.10%	7.50%	3.06	3	acres	$15,300.00
									$9,768,721.50

TABLE 117 – 05120101-030-030 – Beaver Cr. below Little Beaver Cr. to Wabash River

05120101-030-030	Beaver Creek below Little Beaver to Wabash River	acres	Objective total	% watershed	% Wabash	% Objective	Target	Unit	Total Cost
Centralized Sewer	not ranked	16,077	40	8.90%	13.30%	3.56	4	systems	$35,600.00
Conservation Tillage	not ranked	16,077	5,000	8.90%	13.30%	445	445	acres	$80,100.00
Construction Site Runoff	need on creek	16,077	1	8.90%	13.30%	0.089	0	site	$44.50
Cover Crops	7	16,077	4,000	8.90%	13.30%	356	356	acres	$64,080.00
Filter Areas	need on creek	16,077	500	8.90%	13.30%	44.5	45	acres	$13,350.00
Filter strips or riparian buffers	4	16,077	300	8.90%	13.30%	26.7	40	acres	$12,000.00
Lawn Fertilizer Reduction	need on creek	16,077	300	8.90%	13.30%	26.7	27	lawns	$534.00
Manure Management Technology	not ranked	16,077	2	8.90%	13.30%	0.178	0	technology	$17,800.00
Milkhouse Wastewater (based on total milkhouses)	all direct discharges	16,077	6	8.90%	13.30%	0.534	1	system	$5,340.00
CNMP's and/or NMP's	all need	16,077	35	8.90%	13.30%	35%	5,627	acres	$16,880,850.00
Septic Systems	not ranked	16,077	50	8.90%	13.30%	4.45	4	systems	$44,500.00
Streambank Protection (lineal feet)	not ranked	16,077	1,000	8.90%	13.30%	133	133	lineal feet	$66,500.00
Tile Control Structures	6	16,077	100	8.90%	13.30%	8.9	9	Structure	$13,350.00
Wetlands	need on creek	16,077	60	8.90%	13.30%	5.34	5	acres	$26,700.00
									$17,260,748.50

TABLE 118 – 05120101-040-010 – Wabash River below Little Beaver Cr. to New Corydon

05120101-040-010	Wabash River below Little Beaver Creek to New Corydon	acres	Objective total	% watershed	% Wabash	% Objective	Target	Unit	Total Cost
Centralized Sewer	3	8,084	40	4.50%	6.70%	1.8	2	systems	$18,000.00
Conservation Tillage	not ranked	8,084	5,000	4.50%	6.70%	225	225	acres	$40,500.00
Construction Site Runoff	need on river	8,084	1	4.50%	6.70%	0.045	0	site	$22.50
Cover Crops	not ranked	8,084	4,000	4.50%	6.70%	180	180	acres	$32,400.00
Filter Areas	need on river	8,084	500	4.50%	6.70%	22.5	23	acres	$6,750.00
Filter strips or riparian buffers	not ranked	8,084	300	4.50%	6.70%	13.5	40	acres	$12,000.00
Lawn Fertilizer Reduction	need on river	8,084	300	4.50%	6.70%	13.5	14	lawns	$270.00
Manure Management Technology	not ranked	8,084	2	4.50%	6.70%	0.09	0	technology	$9,000.00
Milkhouse Wastewater (based on total milkhouses)	all direct discharges	8,084	4	4.50%	6.70%	0.18	0	system	$1,800.00
CNMP's and/or NMP's	all need	8,084	35	4.50%	6.70%	35%	2,829	acres	$8,488,200.00
Septic Systems	not ranked	8,084	50	4.50%	6.70%	2.25	2	systems	$22,500.00
Streambank Protection (lineal feet)	not ranked	8,084	1,000	4.50%	6.70%	67	67	lineal feet	$33,500.00
Tile Control Structures	not ranked	8,084	100	4.50%	6.70%	4.5	5	Structure	$6,750.00
Wetlands	need on river	8,084	60	4.50%	6.70%	2.7	3	acres	$13,500.00
									$8,685,192.50

TABLE 119 – 05120101-050-050 – Limberlost Creek Headwaters to below Bull Creek

05120101-050-050	Limberlost Creek Headwaters to below Bull Creek	acres	Objective total	% watershed	% Wabash	% Objective	Target	Unit	Total Cost
Centralized Sewer	not ranked	927	40	0.50%	0.80%	0.2	0	systems	$2,000.00
Conservation Tillage	not ranked	927	5,000	0.50%	0.80%	25	25	acres	$4,500.00
Construction Site Runoff	not ranked	927	1	0.50%	0.80%	0.005	0	site	$2.50
Cover Crops	not ranked	927	4,000	0.50%	0.80%	20	20	acres	$3,600.00
Filter Areas	not ranked	927	500	0.50%	0.80%	2.5	3	acres	$750.00
Filter strips or riparian buffers	not ranked	927	300	0.50%	0.80%	1.5	40	acres	$12,000.00
Lawn Fertilizer Reduction	not ranked	927	300	0.50%	0.80%	1.5	2	lawns	$30.00
Manure Management Technology	not ranked	927	2	0.50%	0.80%	0.01	0	technology	$1,000.00
Milkhouse Wastewater (based on total milkhouses)	all direct discharges	927	2	0.50%	0.80%	0.01	0	system	$100.00
CNMP's and/or NMP's	all need	927	35	0.50%	0.80%	35%	324	acres	$973,350.00
Septic Systems	not ranked	927	50	0.50%	0.80%	0.25	0	systems	$2,500.00
Streambank Protection (lineal feet)	not ranked	927	1,000	0.50%	0.80%	8	8	lineal feet	$4,000.00
Tile Control Structures	not ranked	927	100	0.50%	0.80%	0.5	1	Structure	$750.00
									$1,004,582.50

7.0 METHODS OF EVALUATION

For the purpose of evaluating the success of each objective, assessment will rely heavily on the success of volunteer water quality monitoring at reference points throughout the Grand Lake/Wabash River watershed. These reference points will be determined based on the location of installed best management practice and overlapping tributary stream confluences and road crossings. All samples collected will follow a methodology detailed in a Quality Assurance Protection Plan that will be completed by the end of 2007. It is intended that at least two persons involved in the volunteer monitoring program will be trained as Qualified Data Collectors. These two persons will be responsible for training additional volunteers, in accordance with Ohio EPA's credible data collection program. This training schedule, along with the Quality Assurance Protection Plan, will ensure proper sampling techniques and the validity of samples and results.

The preferred method of water quality sampling will be to collect a grab sample that can then be sent to a qualified water quality laboratory for testing. However, this method is dependent upon the funding available for the implementation of each objective. Documented flow levels, weather conditions and sampling locations will possibly allow for the direct comparison of collected data to TMDL data. If TMDL data is not available for certain sampling locations, samples will be collected prior to the installation of a best management practice to ensure that accurate baseline data is available.

Potential load reductions that were included for each objective are only estimates that are utilized in an attempt to indicate the enormous variation that can occur when installing and implementing best management practices. As objectives are implemented, efforts will be made to further quantify load reductions based on site-specific information such as soil type, slope and crop rotation. It is difficult to apply this specific information to several thousand acres in each subwatershed. As fields are enrolled in best management programs, site-specific information will be entered into load reduction spreadsheets to determine more accurate sediment and nutrient load reductions.

This watershed action plan was developed with a five-year time frame in mind, with a few longer-term objectives. Therefore, it is recommended that this watershed action plan be reviewed at a minimum of every five years. However, specific sections or objectives may need to be reviewed or revised on a shorter time frame. Amendments to this document will be included as appendices with references made within the text of the document.

As stream segments are found to be in attainment for their aquatic use designations, every effort will be made to protect the water quality. As landowners enroll into best management programs, they will realize the benefits of land stewardship and protecting water quality. It is hoped that enrolled landowners will then spread the word that good land stewardship and protection of water quality is a necessity.

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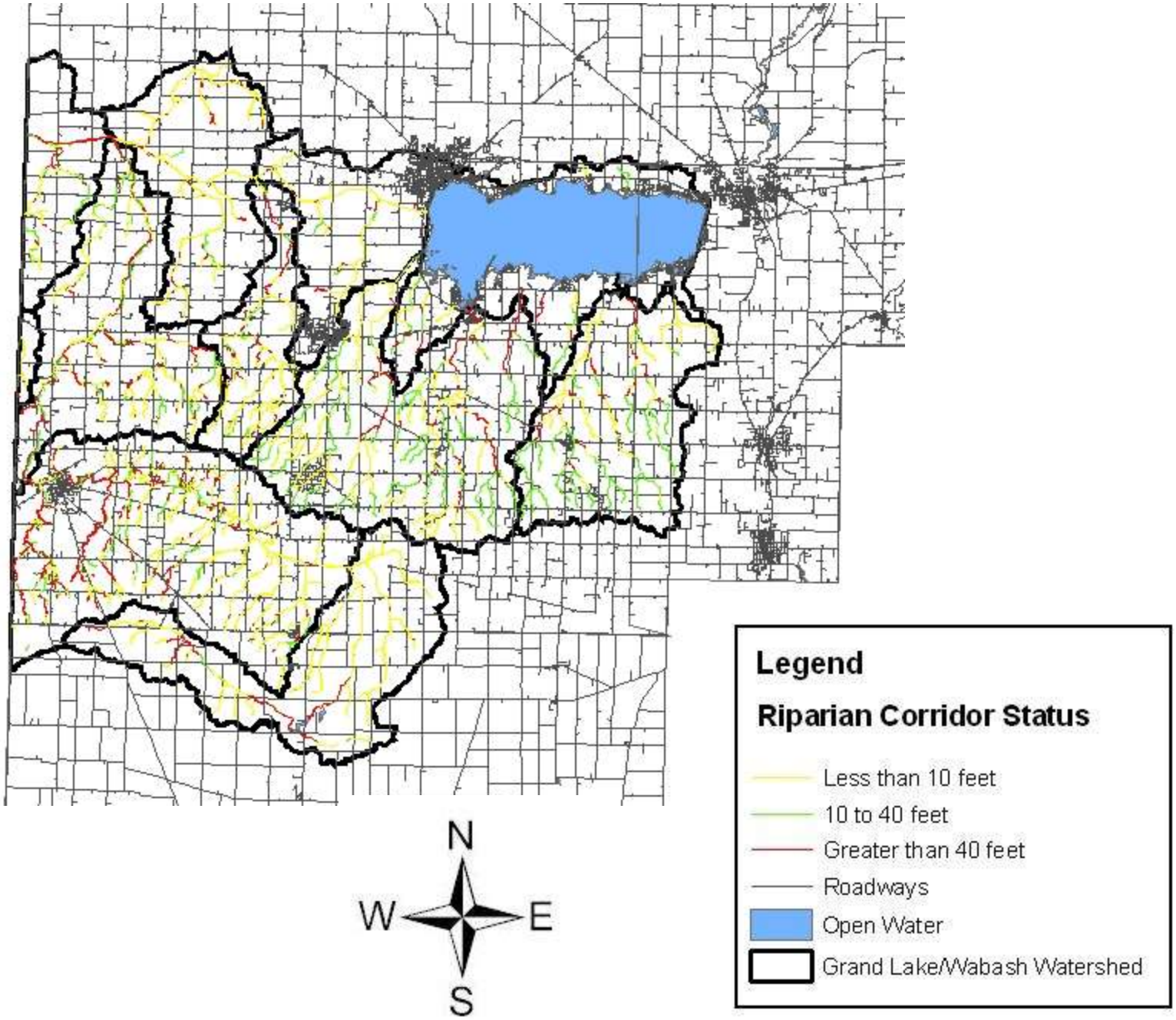
APPENDICES

Appendix A ~ Riparian Corridor Status for Grand Lake/Wabash River Watershed


Legend
Riparian Corridor Status
Less than 10 feet
10 to 40 feet
Greater than 40 feet
Roadways
Open Water
Grand Lake/Wabash Watershed
N
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Appendix B ~ Operational Documents

GRAND LAKE/WABASH WATERSHED ALLIANCE BYLAWS

ARTICLE I - TITLE, AREA, PARTNERS

Title

The title of the organization shall be Grand Lake/Wabash Watershed Alliance

(GLWWA).

Project Area

The project area to be served by the Grand Lake/Wabash Watershed Alliance shall include portions of Auglaize, Darke, and Mercer Counties. Project area will be the Grand Lake and the Wabash River Watershed in Ohio.

Partners

The organization is being formed as a partnership, joining together watershed stakeholders, local firms, organizations, institutions, corporations, government units and agencies with a common mission and purpose. This organization shall be formed for community education and outreach, scientific research, resource conservation, and economic development for public enhancement and be a not for profit organization.

ARTICLE II - MISSION & OBJECTIVES

Mission

The mission of the Grand Lake/Wabash Watershed Alliance is to improve the quality of life by promoting stewardship of the natural resources in the Grand Lake/Wabash River Watershed. The project objectives are:

1) To promote wise management of nutrients and chemicals from all sources.
2) To reduce agricultural, construction site, shoreline, and streambank soil erosion and sedimentation.
3) To promote comprehensive water quality enhancement and protection.
4) To educate and develop better understanding and cooperation among all citizens, partners, and stakeholders who live, work, or recreate in the watershed.
5) To utilize and promote proper water management techniques to minimize damage caused by flooding within the watershed.

ARTICLE III - JOINT BOARD & OFFICERS

Joint Board

At the January Auglaize, Darke, and Mercer Soil and Water Conservation District meetings, representatives will be appointed by their respective SWCD'S. The Auglaize, Darke and Mercer SWCD's will appoint one member each to serve on the Joint Board and act as a liaison between the Joint Board and their respective District Boards. One

alternate from each county shall be selected to serve in place of the appointed members to assure equal participation. The Joint Board shall meet monthly unless the coordinator and chairman determine there is no business to be transacted that month.

Officers

Officers of the Grand Lake/Wabash Watershed Alliance Joint Board of Supervisors will serve a one-year term, which will begin at the January Meeting. In case of death, resignation or disability of any officer, the Joint Board will appoint his/her successor.

Chairman

Nominations for chairman shall come from the Joint Board of Supervisors. Duties of the chairman shall be to determine the regular meeting schedule, preside over all meetings, call special meetings, determine an agenda for the meeting, appoint committees, perform all acts and duties usually performed by an executive and presiding officer, and sign all membership agreements and other such papers of the organization as he/she may be authorized to sign by the Joint Board on its behalf.

Vice Chairman

Nominations for vice chairman shall come from the Joint Board of Supervisors. The vice chairman will perform the duties of the chairman in his/her absence. Duties of the vice-chairman will also be to direct the activities of all the committees and work groups.

Secretary/Treasurer and Fiscal Agent

Nominations for treasurer shall come from the Joint Board of Supervisors. The Secretary/Treasurer shall have general charge and supervision of the financial records and serve as the Fiscal Agent. He/she will be responsible for handling receipts and disbursements of all monies of the organization. He/she shall serve, mail, or deliver all notices required by law and shall make a full report of all matters and business pertaining to this office to the members at the meetings or at such other times as the chairman directs him/her to do so. The Secretary/Treasurer shall keep a complete record of all of all meetings of the board, and update the membership roster as needed. He/she will be responsible for mailing the agenda and notifying the membership and invited guests as to upcoming meetings. He/she is also expected to mail minutes from each meeting to the membership prior to the meeting that is scheduled to follow. He/she shall attest the chairman's signature on all necessary documents and papers pertaining to the organization. He/she shall make all reports as required by law and perform other such duties as required by the organization. Upon election of successor, the Secretary/Treasurer shall turn over all books and property belonging to the organization that he/she may have in his/her possession. The Secretary/Treasurer will cooperate with the chairman in an audit of the financial records. These responsibilities may be designated to the watershed coordinator and/or staff of the Mercer SWCD.

ARTICLE IV - FISCAL YEAR, MEMBERSHIP & VOTING

Fiscal Year

The fiscal year of the organization shall begin the first day of January of each year and end December 31st of each year.

Membership and Voting

The Grand Lake/Wabash Watershed Alliance shall have an Advisory Board with membership extended to any landowner, resident, firm, agency, organization, institution, corporation, stakeholder or governmental unit interested in promoting the wise management of the watershed's resources. The Advisory Board makes recommendations to the Joint Board, upon request of the Joint Board, and has no final decision making authority.

The Grand Lake/Wabash Watershed Alliance prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs or marital status. Members will be reviewed annually to assure a diverse representation. All members will serve without pay.

During any meeting, a quorum shall be required to conduct business. A quorum is defined as two out of the three Joint Board members.

ARTICLE V - WORK GROUPS

To assist in the direction and aid in the mission of the Grand Lake/Wabash Watershed Alliance, the following work groups are established: 1) Funding, 2) Public Relations & Education, 3) Technical. Other work groups may be established upon request of the Advisory Board. At the first regular meeting annually of each fiscal year, the Joint Board shall ask for work group representatives. Each work group shall establish its own rules and procedures for conducting business.

ARTICLE VI - MEETINGS

Regular meetings of the Advisory Board shall be conducted monthly in conjunction with meetings of the Joint Board or at the discretion of the Joint Board. Special meetings will be scheduled at the discretion of the chairman or Watershed Coordinator. An annual planning meeting will be conducted each year to assist in the direction of the project.

ARTICLE VII - FINANCIAL PROVISIONS

The Grand Lake/Wabash Watershed Alliance may accept, receive and expend funds from local, state, federal and private grants, or any other donations. Mercer County Civic Foundation shall be the recipient and holder of 501 (c) 3 funds. All funds will be recorded and reported by the elected Secretary/Treasurer of the Joint Board. All funds shall be deposited in a bank of the Grand Lake/Wabash Watershed Alliance Joint Board's choice. All deposits will be made to "Grand Lake/Wabash Watershed Alliance". The watershed coordinator will be permitted to seek pre-approval of funding for specific watershed activities. The Joint Board shall allot a $200 per month discretionary spending limit to the watershed coordinator for administrative and other unexpected watershed activity costs.

ARTICLE VIII - AMENDMENTS & DISSOLUTION

The bylaws may be repealed or amended by 2/3-majority vote of the full Grand Lake/Wabash Watershed Alliance Joint Board at any regular or special meeting called

for that purpose, provided that a written notice is given to the public 15 days prior to that meeting. In the event of dissolution of the Grand Lake/Wabash Watershed Alliance, the remaining assets of the project shall be distributed according to a 2/3 vote of the Joint Board.

Nothing in this section is intended to alter in any manner the requirements that the Grand Lake/Wabash Watershed Alliance must follow to comply with Ohio's Open Meeting Law.

MERCER COUNTY

An Equal OpportunityEmployer

POSITION DESCRIPTION

Agency:	Soil & Water Conservation District	**Unit:**	Technical
Name:	Theresa May	**Position Title**	Grand Lake/Wabash Watershed Coordinator
Class Title:		**Class Number:**	
Dept./Div.:		**Civil Service Status:**	
Reports To:	**Administrative:** District Admin. **Technical:** Joint Board of Supervisors	**Employment Status:**	Full-time
Pay:	Resolution	**FLSA Status:**	Non-exempt

JOB RESPONSIBILITIES: **In addition to the following, performs other related duties as required.**

Under general direction, responsible for organizing watershed planning, education, and watershed plan implementation to protect a local water resource; networks with agencies, organizations and citizens on a multi-jurisdictional basis; responsible for establishing a permanent local water resource restoration or protection program.

QUALIFICATIONS: **An example of acceptable qualifications:**

Bachelors Degree in environmental sciences, natural resources, biological science, agriculture, water resources or a related field supplemented by relevant work experience and training or experience in public relations such as speech and communication, journalism and report writing.

LICENSURE OR CERTIFICATION REQUIREMENTS:

Valid Ohio driver's license.

EQUIPMENT OPERATED: **The following are examples only and are not intended to be all inclusive.**

Office equipment (e.g., telephone, copy machine, fax machine, calculator/adding machine, etc.); personal computer, scanner, digital camera, motor vehicle, GPS, water monitoring equipment, surveying equipment.

This position description in no manner states or implies that these are the only duties and responsibilities to be performed by the position incumbent. The essential functions of the position identified on subsequent pages are for purposes of 42 USC 12101. My signature below signifies that I have reviewed and understand the contents of my position description.

Rick Mallebrugh — 8/25/06
(Approval of Appointing Authority) (Date)

Theresa A. May — 8-18-06
(Employee Signature) (Date)

ADOPTED: 5 / 11 / 06	REVISION # ___ : ___ / ___ / ___	APPROVED BY: ___

MERCER COUNTY

An Equal OpportunityEmployer

POSITION DESCRIPTION

Agency:	Soil & Water Conservation District	**Unit:**	Technical
Name:		**Position Title**	Grand Lake/Wabash Watershed Coordinator
Class Title:		**Class Number:**	
Supervisor's Title:	**Administrative:** District Admin.	**Number:**	
	Technical: Joint Board of Supervisors		
Supervises:	None		

JOB DESCRIPTION AND WORKER CHARACTERISTICS:

JOB DUTIES: In order of importance

ESSENTIAL FUNCTIONS OF THE POSITION:

50% (1) Responsible for organizing watershed planning, education, and watershed plan implementation to protect a local water resource; builds public support for the Grand Lake/Wabash Watershed Alliance (GLWWA) including recruitment of new stakeholders and promotion of activities in the watershed; works toward making stakeholders aware of their water resources and the issues that impact water quality; assumes responsibility for implementation of the Watershed Coordinator grant; working with the stakeholders, creates an inventory of the watershed (defines the area, assesses the quality of the water resource, and examines the human and ecological features that affect the quality of the water resource), creates an action plan, and implements and evaluates these actions; prepares and submits all necessary reports required by SWCD, NRCS, FSA, ODNR, OFSWCD, OSWCC, and OEPA; makes field visits to plan, design, and coordinate watershed activities with landowners/users in the Grand Lake/Wabash Watershed projects; creates an informational and educational awareness program to gain wider support for implementations of the Grand Lake/Wabash Watershed projects; prepares and maintains a local watershed management plan for the area; must be able to supervise and perform environmental water monitoring; compiles sampling data to determine where the problems are, then determines a way to fix the problem; performs flood plain surveying; creates goals and develops solutions followed by an action plan; prepares technical information and progress reports; participates with Ohio EPA in coordinating the watershed planning process with the Total Maximum Daily Load (TMDL) project for the Grand Lake/Wabash watershed.

Knowledge of:	(108), (129), (205), (230), (253), (260),* (261),* (440), (441), (443), (445), (497).
Skill in:	(905), (910), (958), (960).
Ability to:	(608), (614), (654), (657), (661), (684), (724), (744), (745), (768).

Agency:	Soil & Water Conservation District	**Unit:**	Technical
Name:		**Position Title:**	Grand Lake/Wabash Watershed Coordinator
Class Title:		**Class Number:**	

25% (2) Networks with agencies, organizations and citizens on a multi-jurisdictional basis; facilitates partnership meetings of the stakeholders and offers the best possible scientific data about the water resource; acts as a primary leader and coordinator between local government agencies, thus developing a strong working relationship; establishes rapport with state and local legislators/political leaders; acts as project representative with partnering agencies in establishing long range plans, goals, and projects for the Grand Lake/Wabash Watershed and reports to the Joint Board; organizes and conducts effective meetings; attends all regularly scheduled Joint Board meetings, plus other meetings, training sessions, and workshops as deemed necessary by the Joint Board and/or the Mercer SWCD Board; attends training sessions offered by Ohio EPA, ODNR, Ohio State University Extension, and the Ohio Watershed Academy.

Knowledge of: (260),* (261),* (381), (384).*
Ability to: (608), (614), (684), (744), (745).

25% (3) Responsible for establishing a permanent local water resource restoration or protection program; will establish and nurture organizational development so that the project can continue long-term; responsible for budget preparation; helps secure local support to finance plan implementation, program maintenance, and strengthen the watershed organization; becomes familiar with the USDA, Natural Resource Conservation Service's technical and planning aspects needed to implement 319 grants; prepares grant applications for continued funding and prepares reports as necessary for grantors; works harmoniously with fellow employees and the Joint Board of Supervisors in a continuing effort to achieve annual and long-term goals of the Watershed Project.

Knowledge of: (104), (255), (260),* (261),* (381), (384),* (497).
Skill in: (905), (910).
Ability to: (608), (610), (614), (633), (654), (657), (659), (684), (724), (744), (745).

(4) Meets all job safety requirements and all applicable OSHA safety standards that pertain to essential functions; demonstrates regular and predictable attendance; must maintain required licenses and/or certifications.

OTHER DUTIES AND RESPONSIBILITIES:

Performs other duties as assigned.

MERCER COUNTY

An Equal OpportunityEmployer

POSITION DESCRIPTION

Agency:	Soil & Water Conservation District	**Unit:**	Technical
Name:		**Position Title:**	Grand Lake/Wabash Watershed Coordinator
Class Title:		**Class Number:**	

MINIMUM ACCEPTABLE CHARACTERISTICS: **(*indicates developed after employment)**

Knowledge of: (104) budgeting; (108) inventory control; (129) education techniques; (205) surveying techniques; (230) geographical layout of jurisdiction; (253) safety practices and procedures; (255) government grant programs; (260) agency goals and objectives;* (261) agency policies and procedures;* (381) public relations; (384) community resources and services;* (440) agriculture; (441) agronomy; (443) biology; (445) chemistry; (497) project management.

Skill in: (905) computer operation; (910) use of modern office equipment; (958) motor vehicle operation; (960) use or operation of GPS and surveying equipment.

Ability to: (608) deal with many variables and determine specific action; (610) apply management principles to solve agency problems; (614) exercise independent judgment and discretion; (633) calculate fractions, decimals, and percentages; (654) prepare accurate documentation; (657) compile and prepare reports; (659) write instructions and specifications; (661) use proper research methods to gather data; (684) communicate effectively; (724) maintain records according to established procedures; (744) handle sensitive inquiries from and contacts with officials and general public; (745) develop and maintain effective working relationships; (768) travel to and gain access to work site.

Nicole L. Hawk 18-18-06

Signature of Agency Representative / Date

MEMORANDUM OF UNDERSTANDING

between the

Mercer Soil and Water Conservation District and the

Grand Lake/Wabash Watershed Alliance

This Memorandum of Understanding is between the Board of the Mercer Soil and Water Conservation District, State of Ohio, hereinafter called the "District Board", located at 220 West Livingston Street, Suite 1**,** Celina, Ohio 45822 and the Board of the Grand Lake/Wabash Watershed Alliance, hereinafter called the Joint Board, located at 220 West Livingston Street, Suite 1, Attn: GLWWA, Celina, Ohio 45822. It is effective on the 19th day of May, 2005*,* and establishes a basic agreement between these two Boards.

STATEMENT OF ORGANIZATION'S PURPOSE

The District Board has been organized pursuant to the Soil and Water Conservation District Laws of Ohio, Chapter 1515 of the Ohio Revised Code, as a governmental subdivision of the State as evidenced by its certificate of due organization. It is prepared to exercise, within its boundaries, public powers as authorized by that law, as amended and supplemented.

The Joint Board is a Board of Supervisors that has been duly organized under Ohio Revised Code § 1515.17. It is prepared to exercise, within its boundaries, public powers as authorized by that law, as amended and supplemented.

The District Board has adopted a program outlining its long-term soil and water conservation and resource-use objectives. The District Board is engaged in carrying out this program.

The District Board has available services, facilities, and funds from Federal, State, local, and private sources for use in carrying on its work.

The Joint Board has available certain GLWWA moneys to further its goals and objectives, in compliance with the requirements of the grants involved.

MEMORANDUM PURPOSE

This specific memorandum is put forth for the purpose of defining the arrangement between the District Board and the Joint Board under which the District Board will employ, house, supervise, and support the activities of a GLWWA Coordinator. **This memorandum is not a contract for employment of any kind, express or implied.**

1. The Joint Board shall formulate the GLWWA Coordinator vacancy announcement, when appropriate, that will be used only upon acceptance by both Boards.
2. Both Boards agree that the Joint Board will be authorized to interview and recommend selections for the GLWWA Coordinator position to the District Board; and
3. The District Board will advertise for the GLWWA Coordinator position when vacant, accept applications for the GLWWA Coordinator position, and hire a GLWWA Coordinator as a District Board employee and accept the duties and responsibilities as employer; and
4. Both Boards agree that a GLWWA Coordinator will be chosen that is acceptable to both Boards; and
5. The Joint Board will create overall program objectives for the Grand Lake/Wabash Watershed Alliance, solicit community and stakeholder input, lead development of a draft plan for submission to the state, and otherwise comply with all grant requirements. The Joint Board will keep the District Board informed of its overall program objectives. The Joint Board will also set the initial salary level of the GLWWA Coordinator based upon the salary range of the coordinator position as determined by the District Board and commensurate with the qualifications of the candidate it is attempting to attract, and shall recommend a person to fill the GLWWA Coordinator position. Once the initial salary level is set by the Joint Board, the employing District Board shall determine merit and annual

pay increases and other benefits consistent with how these matters are handled for the District Board's other employees. The Joint Board shall make recommendations to the District Board on merit and annual pay increases and other benefits, but the District Board is under no obligation to follow merit and annual wage and benefit recommendations by the Joint Board. Both Boards agree that the GLWWA Coordinator is an employee of the District Board and will be subject to the District Board's supervision and discipline as are all of its other employees; and

6. The District Board shall provide supervision, technical support, office space, and necessary non-computer office equipment for GLWWA Coordinator as approved by the District Board; and

7. The Boards agree that they will comply with a three-part Annual Performance Evaluation as follows:

   a. The Joint Board will review the program objectives of the watershed project (project scope, work plan, accomplishments) and the GLWWA Coordinator's performance in assisting the Joint Board to move the water quality project forward, as well as any other standards of performance the Joint Board set. Once this review is complete, the results will be forwarded to the District Board; and

   b. The District Board, as the GLWWA Coordinator's employer, will conduct a performance review of the GLWWA Coordinator per the District Board's employment policy. This review will be based upon the program objectives from the Joint Board's review and the District Board's knowledge of the

GLWWA Coordinator's day-to-day activities as the GLWWA Coordinator's employer; and

c. The completed review by the District Board should be returned to the Chair of the Joint Board within one week of its completion to keep all parties communicating. If the Joint Board has any questions or problems regarding the employee's review, both Boards will meet and work out any disagreements to the best of their ability.

8. The Joint Board shall pay the GLWWA Coordinator's salary out of the GLWWA Account, which is a sub account of the District's Special Fund Account, and the District will transfer county commitment share of the GLWWA funds from the Mercer County Commissioner's appropriation to the Special Fund, along with local partners commitment share plus any other funds designated for the project, and up to 80% of the state match funds for the project, but always in a manner to insure that the salary and benefits can be paid to the GLWWA Coordinator as appropriate; and

9. The Joint Board shall reimburse the GLWWA Coordinator for travel expenses consistent with the District Board's travel policy and within the funding capacity of the Joint Board; and

10. The Joint Board shall provide computer and necessary software for the GLWWA Coordinator's use during the length of the project; and

11. The District Board shall provide fiscal and secretarial services and provide an employee to take minutes at all Joint Board meetings. A draft of the previous

Joint Board meeting minutes shall be provided to the GLWWA Coordinator prior to next Joint Board meeting; and

12. The GLWWA Coordinator shall have use of District Board printers, copiers, vehicles, and other District Board equipment; and

13. Either Board may investigate and make recommendations concerning issues involved in future amendments to this MOU and the GLWWA Coordinator job description. The recommendations must be approved by both Boards in writing to become effective; and

14. The Boards further agree that the GLWWA Coordinator shall be subject to the discipline of the District Board, up to and including termination, as are all other District Board employees; and

15. The GLWWA Coordinator will attend and participate in District Board meetings as the coordinator's schedule allows. Both Boards agree that the GLWWA Coordinator will be instructed to provide reports to either Board at the request of that Board or by other staff of that Board; and

16. The District Board will allow the GLWWA Coordinator to work a flexible schedule with the understanding that the GLWWA Coordinator will follow the District Employment Policy, the same as other District Board employees; and

17. The GLWWA Coordinator will be the primary public contact for information regarding the Joint Board and its programs. Information for release to the media about the GLWWA must either be approved by the Joint Board or the GLWWA Coordinator; and

18. The Boards agree that the GLWWA Coordinator along with other District Board employees may assist each other in the performance of their duties when so doing advances the goals of both the District Board and the Joint Board; and

19. It is understood that both Boards must comply with the public records law for the State of Ohio and will cooperate fully with each other in fulfilling their responsibilities under those laws; and

20. It is understood by the Boards that in the event either Board is audited, both Boards will cooperate fully in providing necessary information to comply with the audit; and, in the event of an audit finding, shall cooperate fully in correcting and implementing changes to prevent future findings.

21. Both Boards agree that the execution of this MOU supercedes any previous MOU signed by the Board of the Mercer SWCD and any other Joint Board or Alliance including, but not limited to, the MOU's signed with the Grand Lake St. Marys Watershed Project and with the Wabash Watershed Alliance.

AGREEMENT REVIEW AND TERMINATION

1. This MOU shall be reviewed by both Boards annually to determine if clarifications or amendments are necessary. It may also be amended at any time by written agreement of the Boards; and

2. Terms of this agreement, unless extended by mutual consent, shall be for one year from the date of execution, and shall be renewed annually unless thirty (30) days written notice has been given by either Board to the other; and

3. This MOU may be terminated at any time by either Board with sixty (60) days notice to the other Board.

DISTRIBUTION OF EQUIPMENT AND SUPPLIES UPON TERMINATION OF THIS AGREEMENT:

1. Supplies and equipment purchased with GLWWA funds will be retained by the Joint Board. If the termination of this Agreement is due to the dissolution of the Joint Board, then the supplies and equipment shall be distributed according to a 2/3 vote of the Joint Board; and

2. Supplies and equipment purchased with District Board funds will be retained by the District Board.

Mercer Soil and Water Conservation District:

By: *(Rick Muhlenkamp)* Chairman

This agreement was officially approved by resolution at a meeting of the District Board of Supervisors on February 10, 2005.

Board of the Grand Lake/Wabash Watershed Alliance:

By: *(Dan Nisonger)* Vice Chairman

This agreement was officially approved by resolution at a meeting of the Joint Board May 19, 2005.

Appendix C ~ Aquatic Life Use Designations

Taken from A Guide to Developing Local Watershed Action Plans in Ohio produced by Ohio EPA, Division of Surface Water, June, 1997.

Exceptional Warmwater Habitat is the most biologically productive environment. These waters support unusual and exceptional assemblages of aquatic organisms, which are characterized by a high diversity of species, particularly those that are highly intolerant and/or rare, threatened, endangered or special status. This use represents a protection goal for water resource management efforts dealing with Ohio's best water resources. The standards for ammonia and dissolved oxygen are more stringent than in the other use designations.

Warmwater Habitat defines the typical warmwater assemblage of aquatic organisms for Ohio rivers and streams. It is the principle restoration target for the majority of water resource management efforts in Ohio. Criteria vary by ecoregion and site type.

Modified Warmwater Habitat applies to streams with extensive and irretrievable physical habitat modifications. The biological criteria for warmwater habitat are not attainable. The activities contributing to the modified warmwater habitat designation have been sanctioned and permitted by state or federal law. The representative aquatic assemblages are generally composed of species that are tolerant to low dissolved oxygen, silt, nutrient enrichment and poor habitat quality. The ammonia and dissolved oxygen standards are less stringent than warmwater habitat. There are three subcategories:

> **Modified Warmwater Habitat-A** for those streams affected by acidic mine runoff;
> **Modified Warmwater Habitat-C** for those streams heavily channelized; and
> **Modified Warmwater Habitat-I** for those streams extensively impounded.

The biocriteria are set separately for each subcategory.

Limited Resource Water applies to streams that have drainage areas of less then three square miles and either may lack water on a recurring annual basis, or have been irretrievably altered to the extent that no appreciable assemblages of aquatic life can be supported ; no formal biological criteria are established for the designation.

Limited Warmwater Habitat was adopted in 1978 as a temporary variance mechanism for individual segments that had point source discharge problems and as a result could not meet Clean Water Act goals. This designation is being phased out.

Seasonal Salmonid Habitats are Lake Erie tributaries that support periodic runs of salmonids during the spring, summer and/or fall.

Coldwater Habitat describes waters that support assemblages of coldwater organisms and/or those that are stocked with salmonids with the intent of providing a fishery on a year round basis; it should not be confused with the Seasonal Salmonid.

Appendix D ~ List of Abbreviations and Acronyms

Ac	Acre(s)
AU	Animal Unit
BMP	Best Management Practice
bu.	Bushel
CAFO	Confined Animal Feeding Operation
Co.	County
Comm.	Commercial
CNMP	Comprehensive Nutrient Management Plan
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CWA	Clean Water Act
DNAP	Division of Natural Areas and Preserves (ODNR)
DRASTIC	**D**epth to water; net **R**echarge; **A**quifer media; **S**oil media; **T**opography; **I**mpact of the vadose zone; hydraulic **C**onductivity
DSWC	Division of Soil and Water Conservation (ODNR)
Educ.	Educational
EEWH	Exceptional Warmwater Habitate
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentive Program
Est	Estimated
ft	foot/feet
ft/mi	feet per mile
FSA	Farm Service Agency
GLSM	Grand Lake St. Marys
gpm	gallons per minute
GPS	Global Positioning Satellite
Govt	Government
GLWWA	Grand Lake/Wabash Watershed Alliance
HEL	Highly Erodible Land
HSTS	Home Sewage Treatment System
HUC	Hydrologic Unit Code

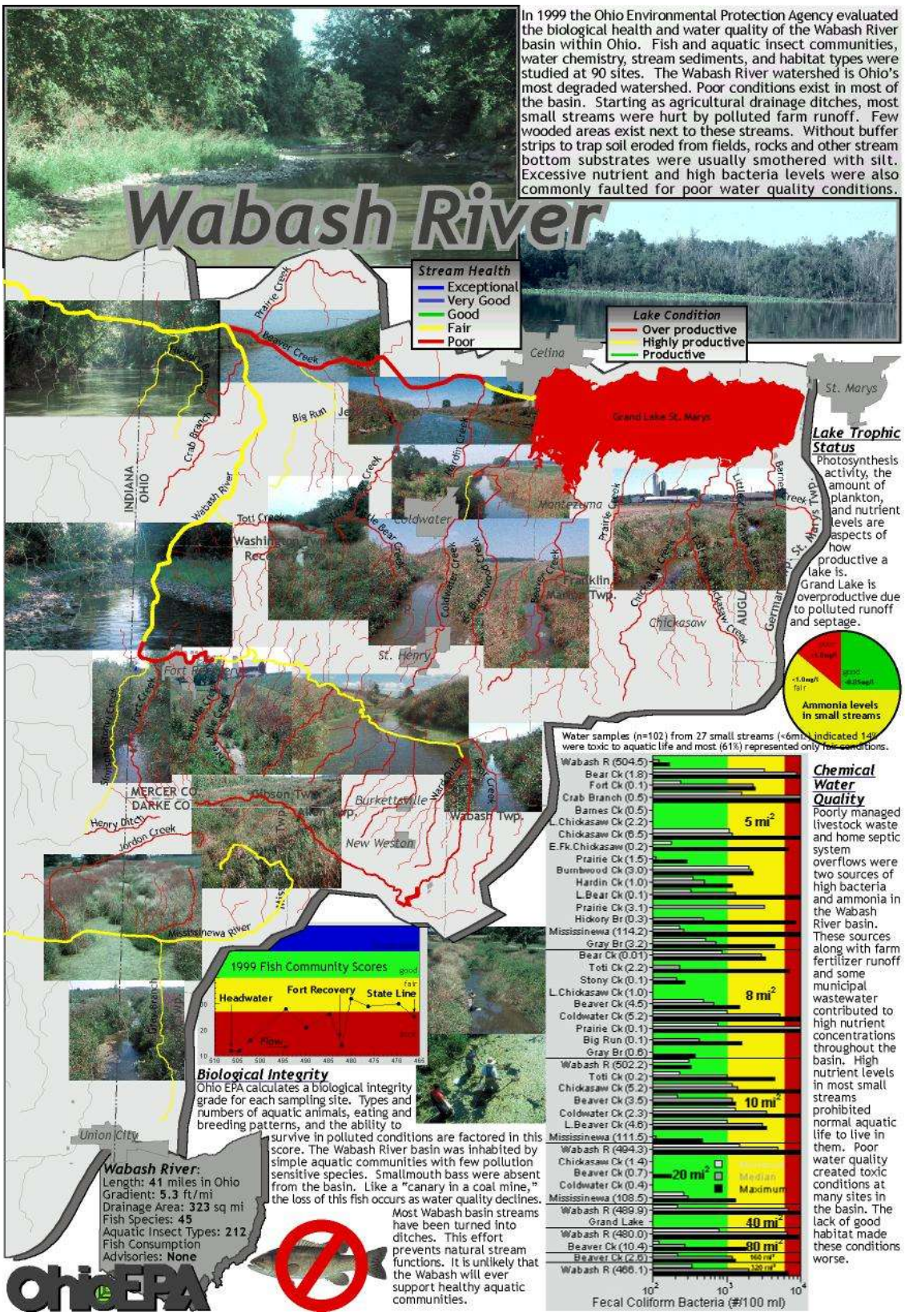
Ind.	Industrial
IN	Indiana
K_2O	Potassium
lb/ac	Pound per acre
lbs.	Pounds
LCI	Lake Condition Index
msl	Mean Sea Level
MS4	Municipal Separate Storm Sewer System
N	Nitrogen
NRCS	Natural Resources Conservation District
NPDES	National Pollutant Discharge Elimination System
ODNR	Ohio Department of Natural Resources
ODH	Ohio Department of Health
Oper.	Operation
OSU	Ohio State University
OSUE	Ohio State University Extension
P_2O_5	Phosphorus
Past.	Pasture
pop	Population
Relig.	Religious
RM	River Mile
sq. mi.	Square Mile
SWAP	Source Water Assessment Plan
SWCD	Soil and Water Conservation District
T	Ton
TMDL	Total Maximum Daily Load
TTHM	Total Trihalomethanes
trib	Tributary
TSI	Trophic State Index
TSP	Technical Service Provider
Twp	Township

USDA	United States Department of Agriculture
USGS	United States Geological Survey
USLE	Universal Soil Loss Equation
WHIP	Wildlife Habitat Incentive Program
WPCLF	Water Pollution Control Loan Fund
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant
WWH	Warmwater Habitat

Appendix E ~ Maps and Infographs

Wabash River

In 1999 the Ohio Environmental Protection Agency evaluated the biological health and water quality of the Wabash River basin within Ohio. Fish and aquatic insect communities, water chemistry, stream sediments, and habitat types were studied at 90 sites. The Wabash River watershed is Ohio's most degraded watershed. Poor conditions exist in most of the basin. Starting as agricultural drainage ditches, most small streams were hurt by polluted farm runoff. Few wooded areas exist next to these streams. Without buffer strips to trap soil eroded from fields, rocks and other stream bottom substrates were usually smothered with silt. Excessive nutrient and high bacteria levels were also commonly faulted for poor water quality conditions.



Lake Trophic Status

Photosynthesis activity, the amount of plankton, and nutrient levels are aspects of how productive a lake is. Grand Lake is overproductive due to polluted runoff and septage.

Chemical Water Quality

Poorly managed livestock waste and home septic system overflows were two sources of high bacteria and ammonia in the Wabash River basin. These sources along with farm fertilizer runoff and some municipal wastewater contributed to high nutrient concentrations throughout the basin. High nutrient levels in most small streams prohibited normal aquatic life to live in them. Poor water quality created toxic conditions at many sites in the basin. The lack of good habitat made these conditions worse.

Biological Integrity

Ohio EPA calculates a biological integrity grade for each sampling site. Types and numbers of aquatic animals, eating and breeding patterns, and the ability to survive in polluted conditions are factored in this score. The Wabash River basin was inhabited by simple aquatic communities with few pollution sensitive species. Smallmouth bass were absent from the basin. Like a "canary in a coal mine," the loss of this fish occurs as water quality declines. Most Wabash basin streams have been turned into ditches. This effort prevents natural stream functions. It is unlikely that the Wabash will ever support healthy aquatic communities.

Wabash River:
Length: **41** miles in Ohio
Gradient: **5.3** ft/mi
Drainage Area: **323** sq mi
Fish Species: **45**
Aquatic Insect Types: **212**
Fish Consumption Advisories: **None**

Ohio EPA

OhioEPA
State of Ohio Environmental Protection Agency

Fact Sheet

October 2007

Beaver Creek and Grand Lake St. Marys Watershed TMDL Report

What are the essential facts?

- *Ohio EPA studied the Beaver Creek and Grand Lake St. Marys watershed and found water quality problems at all of the locations measured.*
- *The watershed can make progress towards restoration with practical, economical actions.*
- *You may review the work to date.*
- *Improving the streams and lake depends on the participation of the watershed's residents.*

What is the significance of this report? *The Beaver Creek and Grand Lake St. Marys Watershed TMDL Report is a tool that will include local ideas from the endorsed watershed action plan to help improve and maintain water quality and habitat in the watershed.*

What is a watershed? *A watershed is the land area from which surface runoff drains into a specific body of water.*

Where is the Beaver Creek and Grand Lake St. Marys watershed?

The Beaver Creek and Grand Lake St. Marys (Beaver-GLSM) watershed is located in west central Ohio in portions of Auglaize and Mercer counties that were impounded in 1845 to make the state's largest inland lake. It is a subwatershed of the Wabash River, which has its headwaters in eastern Indiana and western Ohio. The watershed drains 171 square miles.

An estimated 25,000 citizens reside in the Grand Lake St. Marys and Beaver Creek watershed year round, with nearly 11,500 people living in the City of Celina, which draws drinking water from the lake. The population expands in the summer months with vacationers at the state park and various religious and youth camps.

- Overall, the land use in the Beaver-GLSM watershed is 80.5 percent row crop and pasture land, 12 percent wetlands or open water, 4 percent forested, and 3 percent urban/residential.

- According to the agricultural statistics, there are 295,400 "animal units" of hogs, poultry and cows in the watershed.

- Recreational opportunities abound in the watershed with camping, fishing, boating and hunting on or in the vicinity of Grand Lake St. Marys. There are two bike paths, and several religious historical sites on the south side of the lake.

To focus its work, Ohio EPA divided the watershed into two areas: the eastern portion draining into Grand Lake St. Marys and the western portion draining into Beaver Creek downstream of the lake (see map on page 2).

Monitoring tributary to Grand Lake St. Marys during winter thaw

Appendix F ~ Work Plan January 2008 through December 2008

Insert Work Plan 2008

Appendix G ~ Home Sewage Treatment System Plan, Mercer County

Mercer County Health Department
Household Sewage Operation and Maintenance Program

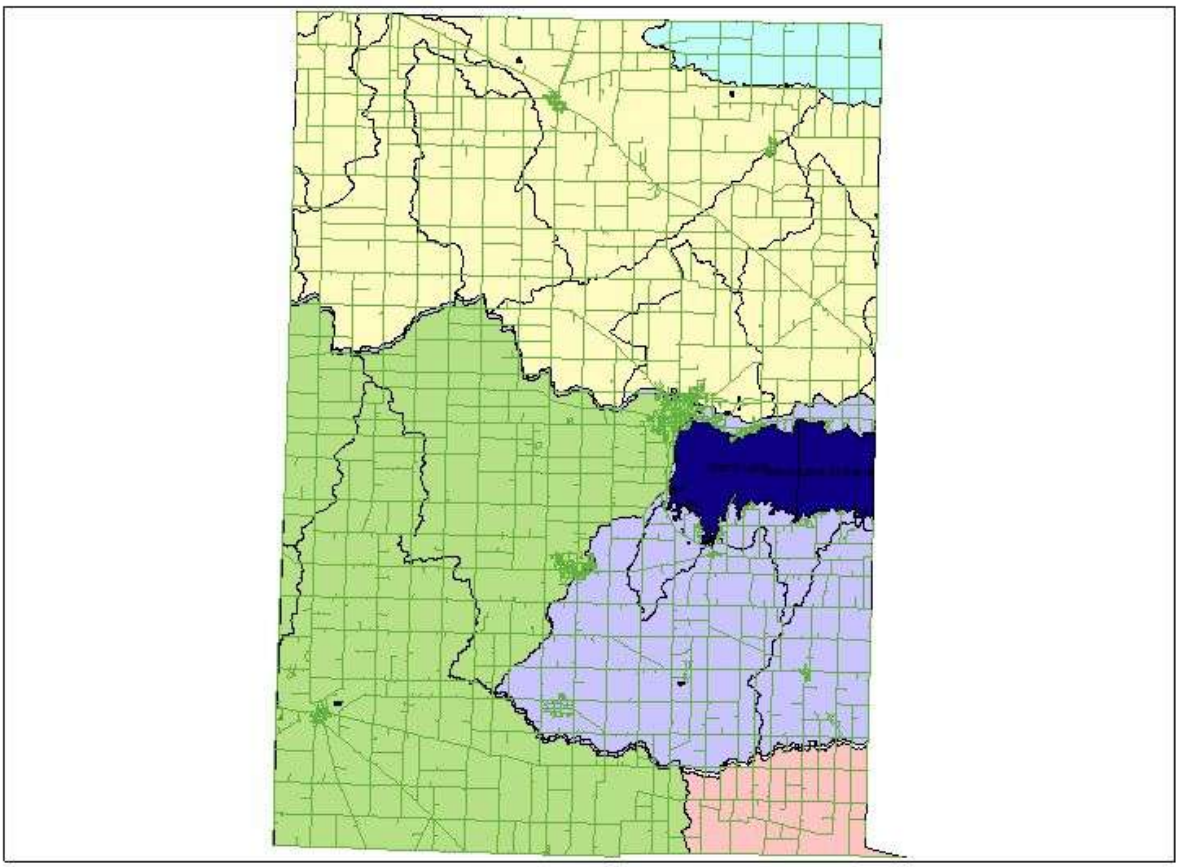
Abstract

Please note that with the inception of new HSTS regulations at the beginning of 2007, this plan may be outdated. However, recently the Ohio House of Representatives introduced a bill (HB 110) that would rescind the new laws and revert back to the old laws. This plan will be updated once the Ohio Department of Health has issued final regulations or when a decision has been reached on HB 110. The general information contained in the plan is still applicable to improving water quality in our watershed.

Mercer County currently has a large number of residential units utilizing home sewage treatment systems (HSTS). Water quality sampling, individual nuisance complaints and knowledge of the area indicate that a relatively high percentage of these systems are at risk of failing or are currently failing to effectively treat household wastewater. If the system fails in the treatment of residential sewage and gray water, the health of the residents of Mercer County, and the surrounding environment may be adversely impacted.

This operation and maintenance plan will serve as the long range plan for the Mercer County Health Department (MCHD) as it prepares for new regulations from the Ohio Department of Health, and as it becomes more proactive and aggressive in the protection of the residents of Mercer County and the natural resources of the area.

As a result of increased awareness and concern with water quality in the county, the MCHD has agreed to create this plan and investigate possible materials and methods for the development of educational outreach, and pollution prevention via investigation of existing systems, information tracking, and addressing pollution issues as they arise. These components may be accomplished with the assistance of other county agencies and/or interested parties, and will rely heavily on an educational outreach program directed to the citizens of the county. It will be important that the public be aware of actions taken by the MCHD to ensure the health and safety of the county. These goals and objectives will be discussed in further detail in later portions of this plan.



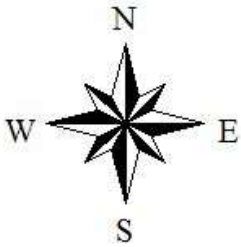
Loramie Creek Watershed

Little Auglaize River

Wabash River

St Marys River

Grand Lake St Marys watershed



Mercer County Watersheds

Introduction

General Information

The purpose of the MCHD Home Sewage Treatment System Plan is to provide the outline for the long range planning efforts to step closer to the desired goal of HSTS pollution elimination. The main focus of this plan is to develop procedures for the inventory of current systems in the county and to develop a method for corrective action to be taken when a failed system is encountered. It is also a goal to create a computerized database for tracking newly installed systems, systems that have been inspected, and nuisance complaints received.

The MCHD serves approximately 41,000 people in the 14 townships in Mercer County. According to 2000 census data, there are 14,756 housing units in the county, of which, approximately 9,884 units are served by a centralized sewer system. This leaves an approximate number of 4,872 residential units utilizing home sewage treatment systems. The MCHD has records on approximately 2,949 HST systems installed in the county since 1973, representing 61% of the total. The remaining 39% were installed prior to 1973. The functional life of a home sewage treatment system is highly dependent on the amount of routine maintenance and care the system's owner devotes to it, but generally speaking, the maximum life expectancy of a system is approximately 30 years. Due to this life expectancy, systems of great concern would be those that were installed prior to 1973. Also of concern are systems more than 10 years old which have not been inspected or maintained properly.

The water resources in Mercer County have been proven to be impacted by several forms of nonpoint source pollution. Nonpoint source pollution is pollution that originates from a source that is difficult to identify. For example, it may be known that sediment comes from a disturbed site; however, it is very difficult to pinpoint the exact site where the soil eroded. Other types of nonpoint source pollution include nutrients, chemicals, pathogens, and salts.

The water quality of Grand Lake St. Marys is a significant health concern due to the fact that is the primary drinking water source for the City of Celina and serves nearly 11,000 people, with an average daily production of 1.205 million gallons per day. Another health related concern is the amount of recreation that takes place on the lake. Failing septic systems can result in pathogens being introduced to streams draining to Grand Lake St. Marys. The Grand Lake St. Marys State Park collects near beach samples every two weeks to test for harmful bacteria that may indicate contamination and cause human health problems. These sampling results are sent to the Ohio Department of Health to be analyzed. If the geometric mean of 5 beach water samples reaches 126 colonies of E. coli per 100 mL of water, ODH will contact the state park officials to post warning signs at the public swimming beaches warning swimmers of the potential health hazards. All of the results are posted at the ODH website: www.odh.state.oh.us/ODHPrograms/BEACH/sample.htm

For the health of the citizens and visitors of Mercer County, the MCHD has developed this plan to evaluate and address the pollution potential regarding home sewage treatment systems and the contribution of pollutants to the streams, tributaries, lake, and rivers that lie within the borders of Mercer County. It is important to protect the integrity of the water resources of Mercer County for future generations.

Program History:

Mercer County has seen steady growth in population and construction activities over the last fifty years, with a noticeable jump in new home construction in the late 1980's, and early 1990's. Currently, the Mercer County Subdivision Regulations require at least 1 acre with at least 150 feet of road frontage. With the ease of obtaining 1 acre lots, "strip developments" have become commonplace. In areas where clusters of these 1 acre developed lots are present, discharging septic systems substantially increase the loading of pollutants to receiving streams.

Beginning in 1972, the Water Pollution Control Board from Ohio EPA imposed a residential construction regulation for the area with surface drainage to Grand Lake St Marys. Residences constructed at that time were required to install on-lot (non-discharging) sewage treatment systems. At that time, the Mercer County Health Department expanded those on-lot sewage disposal requirements across the entire county. Treatment systems installed during that time period consisted mainly of septic tanks followed by leaching tile fields.

After a short period of time, the MCHD began receiving reports that many of those systems were not working properly. Instead of the wastewater percolating through the soil, effluent was bubbling up on top of the ground. Many times homeowners would take it upon themselves to "solve" the problem by tapping one of their leach lines, creating a relief overflow into a neighboring field tile. A second alternative was to by-pass the leach field entirely by connecting a pipe directly from the septic tank to a neighboring field tile with an eventual discharge to a nearby stream.

In 1985, after a centralized sewer system was installed along the southern edge of Grand Lake St. Marys, Ohio EPA revised the Orders to include only the area within one mile of Grand Lake St. Marys itself. These residences are required to tie in to the sewer system, thus eliminating any septic system discharge in that vicinity.

Current MCHD Operation and Maintenance Program

Mercer County has continued to see population increases over the last 10 years. With an increase in population comes the need for additional housing units, additional home sewage treatment systems, and additional protection of the water resources. The Ohio Department of Health has also recognized the need for an increase in the effectiveness and efficiency in the treatment of household wastewater. Thus, there have been several regulations entered into law that deal with individual home sewage treatment systems.

One significant change occurring in 1977, required the county health departments to begin keeping adequate records regarding the systems that were being installed. Also included in this new regulation was a provision for county health departments to issue permits to install individual treatment systems. Therefore, the MCHD has little to no information on record regarding any home sewage treatment systems that were installed prior to the enactment of this requirement. In the instance of a nuisance complaint or other investigation in the area, information concerning the septic system may have been collected and recorded at that time.

A Permit to Install (PTI) a household sewage treatment system (Appendix B) is currently required for all landowners wishing to install an HSTS. Before a PTI can be issued, the property must be inspected by a registered sanitarian. During the inspection, items such as the proximity of the proposed sewage system to any existing or proposed drinking water wells, existing or proposed buildings, property lines, surface water bodies, known flood prone areas, and location of drainage tiles are taken into consideration.

If distance requirements between these items can be met, and site conditions are favorable, a sewage system permit is issued to the property owner upon receipt of proper fee. If site conditions are unfavorable, adjustments to the system may be made. These adjustments have included creation of a two-step secondary treatment feature, with a chlorinator on the eventual discharge. Conditions prompting such adjustments have included areas in which drainage systems are poor or nonexistent.

The permit to install is accompanied with a site sketch showing the placement of the system relative to the house and other structures or items listed above. This allows homeowners and sanitarians to locate a residential sewage system years in the future when an occasion calls for locating the system. Such occasions may include the sale of the property, the need for system maintenance or replacement, or a remodeling project to the home. Future plans for the MCHD include the development of a computerized database system, into which such information can be placed and more easily obtained. Septic system permits are recorded and maintained in the MCHD office for the purpose of collecting information on the treatment system such as type of system, location of system, if complaints have been received and investigated, repairs to the system, etc.

Once permits are issued to the landowner, installation of the sewage system can begin. Before the system is backfilled with soil, an MCHD sanitarian will perform a final inspection of the system to ensure that it was installed to the specifications outlined on the permit. The final inspection report form can be found in Appendix C.

Limitations and considerations to Installing and properly operating HSTS

Topography:

The highest elevation found in Mercer County is near the Mercer/Darke County line in Gibson Township, with an elevation of approximately 1,070 feet above sea level. At approximately 780 feet above sea level, the area where the St. Marys River reaches Van Wert County is the lowest elevation in Mercer County. The southern third of Mercer County can be classified as having a gently sloping to sloping relief, while the northern two thirds are classified as nearly level to gently sloping.

Soil Types:

The major soil types of Mercer County are Blount and Pewamo soils in the northern portions and Blount and Glynwood in the southern region. When referencing the Soil Survey of Mercer County, the Blount Pewamo map unit is considered to have the following characteristics: "The potential is poor for building site development and sanitary facilities…" and that "The moderately slow or slow permeability severely limits these soils for such uses as septic tank effluent fields."

The Blount-Glynwood map unit is similar in its limitations as "Both soils are poorly suited to such sanitary facilities as septic tank effluent fields because of the slow or moderately slow permeability."

The heavy clay soil conditions throughout Mercer County do not adequately support soil absorption systems, as was demonstrated during the time period when on-lot systems were required in the area. Therefore, when the special connection ban was lifted after installation of sanitary sewer around the lake in the early 1980's, the MCHD began using subsurface sand filters as secondary treatment. This system design continues to the present time. A description of a typical subsurface sand filter can be found on page 22.

Water Supply:

In recent times, it has become more apparent that the local water resources are in great need of both management, such as withdrawal limits, and well placement, as well as protection from pollutants and contamination. For this reason, the Ohio Department of Natural Resources, Division of Water, was given the task of creating an evaluation/ranking system to determine the potential for pollutants to reach the groundwater in each of the counties in Ohio. Following this, color coded maps were created, also showing the potential for groundwater pollution.

The intent for these maps and evaluation systems to be utilized by local planners or managers to better site locations of potential businesses, homes, or other operations so as to reduce the potential for contamination of groundwater supplies. When referring to Mercer County, there are two main areas that are classified as having a high potential

for groundwater pollution. These high risk areas follow the St. Marys River and the Wabash River streambeds.

With the exception of the City of Celina, the majority of the residents of Mercer County rely on private wells for drinking water. Therefore, these residents also depend on a functioning HSTS to properly treat their household wastewater so as to reduce the potential of drinking well contamination by improperly treated wastewater.

Land Uses:

Areas in Mercer County that are currently connected to centralized sewer or similar treatment facilities are referenced on Map 7 on page 10 of the main document. The main document also indicates areas of clusters of 10 or more HSTSs, which were used to indicate a potential for pollution in the area. In order to properly utilize this data, this type of inventory would need to be completed for the remainder of Mercer County.

When looking at the year structures were built, the majority of the structures are pre-1939 while 74% of all structures in the county were built prior to 1980. The areas where the most population and land use change can be observed are in Marion, Butler, and Center Townships. This was concluded based on the number of recent (1990 to present) permits for installation of an HSTS issued by the MCHD for new installations. The areas witnessing the most growth correspond to areas of current population concentrations. As housing additions are built and villages grow, there is reason to believe that eventually, some new development areas could be annexed into the centralized systems. This would eliminate the private treatment system, thus eliminating the potential for discharge of untreated wastewater into a nearby stream.

In a similar fashion, the areas where the least number of new structures requiring an HSTS are located in Blackcreek, Franklin, and Liberty Townships.

Demographics/Socioeconomics:

The tables below indicate the population trends and the projected populations for Mercer County, Ohio. Both of the tables show a trend of overall population increase for the county, thus the need for new residential structures and septic treatment systems for those new structures.

Year	Population
1860	14,104
1870	17,254
1880	21,808
1890	27,220
1900	28,021
1910	27,536
1920	26,872
1930	25,096
1940	26,256
1950	28,311
1960	32,559
1970	35,265
1980	38,334
1990	39,443
2000	40,924

Year	Population
2000	40,924
2005	41,335
2010	41,834
2015	42,626
2020	43,572
2025	44,821
2030	45,957

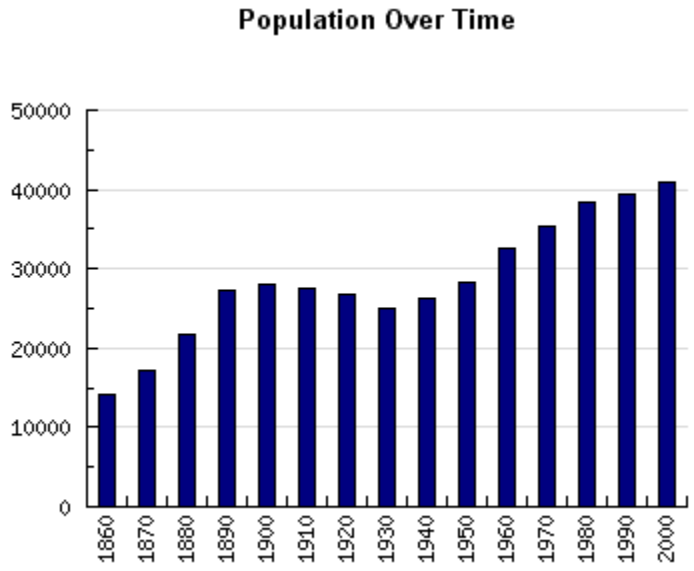
Source: Ohio Department of Development, Office of Strategic Research
Graphs produced dynamically by JpGraph
questions/comments to datacenter@osuedc.org
Extension Data Center, Dept of HCRD, The Ohio State University

Mercer County (Ohio) - Population by Government Units - 2000

Mercer County	40924
Black Creek township	631
Butler township	6459
Coldwater village	4482
Remainder of Butler township	1977
Center township	1082
Dublin township	2254
Rockford village	1126
Remainder of Dublin township	1128
Franklin township	2303
Montezuma village	191
Remainder of Franklin township	2112
Gibson township	1869
Fort Recovery village (part)	872
Remainder of Gibson township	997
Granville township	3885
Burkettsville village (part)	180
St. Henry village	2271
Remainder of Granville township	1434

Hopewell township	1066
Jefferson township	13231
Celina city (part)	10303
Remainder of Jefferson township	2928
Liberty township	917
Marion township	2969
Chickasaw village	364
Remainder of Marion township	2605
Recovery township	1550
Fort Recovery village (part)	401
Remainder of Recovery township	1149
Union township	1490
Mendon village	697
Remainder of Union township	793
Washington township	1218
Wayne township	0
Celina city (part)	0

The graph below is a visual representation of the population change from 1860 through the census of 2000. Although there were some instances when the population of Mercer County decreased, it is shown that there has been a general trend of increase in population.



Source: Ohio Department of Development, Office of Strategic Research
Graphs produced dynamically by JpGraph
questions/comments to datacenter@osuedc.org
Extension Data Center, Dept of HCRD, The Ohio State University

The table below was also developed using data obtained from the Ohio State University Data Center. This table shows the number of all individuals in each township that were below the poverty level in 1999. The first column indicates the respective township. The second column includes all individuals, regardless of age group including the number of individuals in incorporated and unincorporated areas. For example, the Granville township population includes those below poverty level residing in the village of St Henry. The third column indicates those individuals that were 18 years or older at that time. This table was included in the plan to indicate the percentage of the population in Mercer County potentially needing outside funding sources to remediate failing septic systems.

Township	Individuals (any age group)	Individuals (18 yrs & over)
Black Creek	38	28
Butler	374	269
Center	22	22
Dublin	109	78
Franklin	67	56
Gibson	54	35
Granville	114	69
Hopewell	7	7
Jefferson	1443	874
Liberty	23	23
Marion	132	122
Recovery	27	27
Union	111	77
Washington	50	44

Source: Ohio Department of Development, Office of Strategic Research
Graphs produced dynamically by JpGraph
questions/comments to datacenter@osuedc.org
Extension Data Center, Dept of HCRD, The Ohio State University

Areas of Mercer County serviced by sewage treatment

The map on the following page shows the areas in Mercer County that are part of a centralized sewer or package treatment facility. In general, those areas are also the outlines of the various municipalities or villages within the county. The individual watersheds are also depicted in various colorations. Following the map, are descriptions of each facility.

The National Pollutant Discharge Elimination System (NPDES) is administered by the Division of Surface Water in the Ohio EPA. Permits are required for all dischargers and moreover, the wastewater treatment plants (WWTP) and water treatment plants (WTP). The following are descriptions of individual wastewater facilities that serve residents of Mercer County.

Ft Recovery WWTP

This facility is regulated by Ohio EPA permit #2PA00030*JD and is located west of North First Street. The current permit became effective on April 1, 2007 and expires on March 31, 2012. It was constructed in 1973 and consists of a series of two facultative lagoons. Plans are in place to add a third lagoon for aeration treatment prior to discharge. Final effluent discharges to the Wabash River at RM 483.30. The collection system includes both combined and separate sewers and has two lift stations. Included in the Village's Long Term Control Plan for dealing with CSOs are plans to separate the combined systems as street reconstructions or upgrades take place. The permit outlines a schedule to complete CSO separation projects, with all separations complete by January of 2019.

The facility is designed to treat 0.25 million gallons per day (mgd), has a hydraulic capacity of 1.08 mgd, and an annual average discharge of 0.08 mgd. Actual average daily flow is 0.12 mgd which provides ability to add new units as the village experiences population growth.

Celina WWTP

This facility is regulated by Ohio EPA permit #2PD00033*OD and is located at 1125 South Elm Street. The current permit became effective on March 1, 2007 and expires on January 31, 2012. Sewage treatment has been provided in the city since 1938 when an activated sludge plan was constructed to provide secondary treatment as a design flow of 0.9 mgd. This plant was expanded in 1963 to a design flow of 2.5 mgd. Another major upgrade was completed in 1994 consisting of an East and West end sewer trunk. Treatment now includes an emergency bypass at the head of the plant, a coarse bar screen, fine mechanical screen, and aerated grit-grease removal chamber, two oxidation ditches, two final settling tanks, a post aeration unit, and ultraviolet disinfection. The oxidation ditches provide nitrification and remove oxygen demanding substances by activated sludge aeration. The bio-solids are then run through a centrifugal dewater process and finally land applied.

The collection system consists of separate sewers with fourteen lift stations. Final effluent discharges into Beaver Creek at RM 10.18. The facility is designed to treat 2.5 mgd, has a hydraulic capacity of 15.0 mgd, and an annual average discharge of 2.272 mgd. Less than 10% of the hydraulic load is from industrial sources. Celina does not currently operate under an approved Ohio EPA pretreatment program.

Coldwater WWTP

This facility is regulated by Ohio EPA permit # 2PB00013*GD and is located at 605 Bell Road. The current permit became effective on December 1, 2002 and expires on

November 30, 2007. Sewage treatment has been provided in the village since 1940 when a trickling filter plant was constructed to provide secondary treatment at a design flow of 0.35 mgd. The existing facility was constructed in 1990 and designed to treat 0.9 mgd. It consists of a comminutor, grit chamber, two aerated lagoons, and a final polishing lagoon with a controlled discharge. The discharge of effluent is only allowed when stream flow is greater than 1 cubic foot per second (cfs). The collection system consists of separate sewer with two lift stations and five SSOs. Final effluent discharges to Hardin Creek at RM 3.90 and an average annual discharge of 100 million gallons per year.

St Henry WWTP

This facility is regulated by Ohio EPA permit number 2PB00027 and is located north of Cooper Avenue. The current permit became effective July 1, 2000 and expires on June 30, 2005. Sewage treatment has been provided in the village since 1964 when an activated sludge plant was constructed to provide secondary treatment at a design flow of 0.019 mgd. The existing facility was constructed in 1988 and designed to treat 0.78 mgd. It consists of a comminutor, grit chamber, two aerated lagoons, and a final polishing lagoon with a controlled discharge. The discharge of effluent in only allowed when stream flow is greater than 1 cfs. If this criterion is met a total of 90 gpm can be discharged for every cfs. The collection system consists of separate sewer with three lift stations. Final effluent discharges into Coldwater Creek at RM 8.90. Plans are underway for a 2005 project to add a fourth lagoon with 65mg capacity to increase detention time for the water.

Mercer County Home WWTP

This facility is regulated by Ohio EPA permit 2PG00104*ED and is located at 4871 State Route 29 just west of Celina. The current permit became effective on May 1, 2007 and expires on July 31, 2010. It has been in operation since 1975, was significantly upgraded and expanded in 1990, and is maintained by the Mercer County Commissioners, Sanitary Engineering Department. The adjacent Silver Lakes Subdivision is included in the service area. The treatment system consists of a flow equalization tank, diversion box, aeration tanks, a sludge holding tank, surface sand filters, and a chlorination-dechlorination tank. Sludge is transported to the Montezuma Club Island WWTP for disposal. The collection system consists of separate sewers with one lift station. Final effluent flows into a tile that discharges to Beaver Creek at RM 8.26. The facility is designed to treat 0.032 mgd, has a hydraulic capacity of 0.080 mgd, and an annual average discharge of 0.013mgd.

Wagner Subdivision WWTP

This facility is regulated by Ohio EPA permit 2PR00101*CD and is located on St Anthony Road at State Route 118 just north of Coldwater. The current permit became effective on October 1, 2006 and expires on September 30, 2011. It has been in operation since 1969, was significantly upgraded and expanded in 1992, and is maintained by the Mercer County Commissioners, Sanitary Engineering Department. The treatment system consists of a trash trap, aeration tank, settling tank, surface sand filters, and a chlorination tank. Sludge is transported to the Montezuma Club Island

WWTP for disposal. The collection system consists of separate gravity sewers. The adjacent Homan Subdivision is included in the service area. Final effluent discharges to an unnamed tributary at RM 0.60 and then is confluent with Hardin Creek at RM 2.48. The facility is designed to treat 0.01 mgd and has an annual average discharge of 0.008 mgd.

Montezuma Club Island WWTP

This facility is regulated by Ohio EPA permit 2PH00015 and is located at 6590 Guadalupe Road just south of Celina. The current permit became effective on July 1, 2000 and expires on June 30, 2005. The facility was constructed in 1986 and designed to treat 0.37 mgd. Treatment consists of a comminutor, grit chamber, and a series of three facultative lagoons with a controlled discharge. The discharge of effluent is only allowed when stream flow is greater than 1 cfs. If this criterion is met a total of 90 gpm can be discharged for every cfs. The collection system consists of separate sewers with seven lift stations. Final effluent discharges to Beaver Creek at RM 4.00.

Chapel Hill Subdivision WWTP

This facility is regulated by Ohio EPA permit 2PG00103 and is located at 2365 St Johns Road in Maria Stein. The current permit became effective on July 1, 2000 and expires on June 30, 2005. It has been in operation since 1976, was significantly upgraded and expanded in 1994, and is maintained by the Mercer County Commissioners, Sanitary Engineering Department. The adjacent Lochtefelds Addition and Marion Township Industrial Park are included in the service area. The treatment system consists of a trash trap, flow equalization tanks, diversion box, aeration tanks, a sludge holding tank, surface sand filters, and a chlorination-dechlorination tank. Sludge is transported to the Montezuma Club Island WWTP for disposal. The collection system consists of separate gravity sewers. Final effluent discharges to Tangeman Ditch at RM 1.66. The facility is designed to treat 0.07 mgd, has a hydraulic capacity of 0.078 mgd, and an annual average discharge of 0.014 mgd.

Northwood Sanitary Sewer Subdistrict WWTP

This facility is regulated by Ohio EPA permit 2PG00106 and is located at 8233 State Route 703 just east of Celina. The current permit became effective on July 1, 2000 and expires on June 30, 2005. It has been in operation since 1940, was significantly upgraded and expanded in 1988, and is maintained by the Mercer County Commissioners, Sanitary Engineering Department. The treatment system consists of a settling tank (converted Imhoff tanks), recirculation basin, trickling filter, surface sand filters, and chlorination-dechlorination. Sludge is transported to the Montezuma Club Island WWTP for disposal. The collection system consists of separate sewers with one lift station. Final effluent discharges to an unnamed tributary at RM 1.70. The facility is designed to treat 0.05 mgd, has a hydraulic capacity of 0.10 mgd, and an annual average discharge of 0.03 mgd.

Marion Local School District

This facility is regulated by Ohio EPA permit 2PT00022 and is located at 1901 State Route 716 in Maria Stein. The current permit became effective on October 1, 1999 and

expires on September 30, 2004. (At time of plan development, permit application has been submitted to OEPA, however, final permit has not been received by the school.) It began operation in 1998 and consists of a trash trap, flow equalization tanks, diversion box, aeration tanks, a sludge holding tank, surface sand filters, and a chlorination-dechlorination tank. The system is designed to treat 0.025 mgd and serves approximately 975 students. Effluent discharges to Voskuhl Ditch at RM 1.30.

Village of Mendon WWTP

This facility is regulation by Ohio EPA permit 2PA00058*DD and is located Northwest of N Washington Street. The current permit became effective on September 1, 2003 and expires on August 28, 2008. It was constructed in 1968 and consists of a series of three facultative lagoons. There are no plans to change treatment at this time. Final effluent discharges to St. Marys River. The collection system is a closed system with one lift station. The facility is designed to treat 0.1 mgd, has a hydraulic capacity of 0.558 mgd, and an average discharge of 0.10mgd. Actual average daily flow is 0.070mgd which provides ability to add new units as the village experiences population growth. The systems serves 286 units and is at 70% capacity. The Village of Mendon's five year plan is to incorporate a CMOS program.

Village of Rockford WWTP

This facility is regulated by Ohio EPA permit #2PD00001 and is located on the Southwest corner of State Route 117 and State Route 118. The facility was constructed in 1986 and consists of three lagoons with chlorine contact and step aeration. The sanitary sewer collection system is separate from the storm water collection system and utilizes one lift station. It currently serves 510 units, which represents 60% of its operating capacity. The facility is designed to treat 0.250 mgd, has a hydraulic capacity of 1.000 mgd, and an average annual discharge of 0.149 mgd.

Deerfield Subdivision Package Plant

This facility is not currently regulated by an Ohio EPA permit. The facility is located on Shelley Road, just West of US Route 127. The facility's treatment components are under review by Ohio EPA, with some upgrades necessary before the facility can be issued a permit. This facility is currently in operation. It serves 5 residences in the Deerfield Subdivision.

Countryside Subdivision Package Plant

This facility is not currently regulated by an Ohio EPA permit. The facility is located on Fast Road, just West of US Route 127. The facility's treatment components are currently under review by the Ohio EPA, with some upgrades necessary before the facility can be issued a permit. The facility is currently in operation. It serves 3 residences in the Countyside Subdivision.

Water Quality:

Water bodies in Mercer County have been proven to be adversely impacted as a result of discharging septic systems. Pollutants such as nitrates, phosphates, and potentially

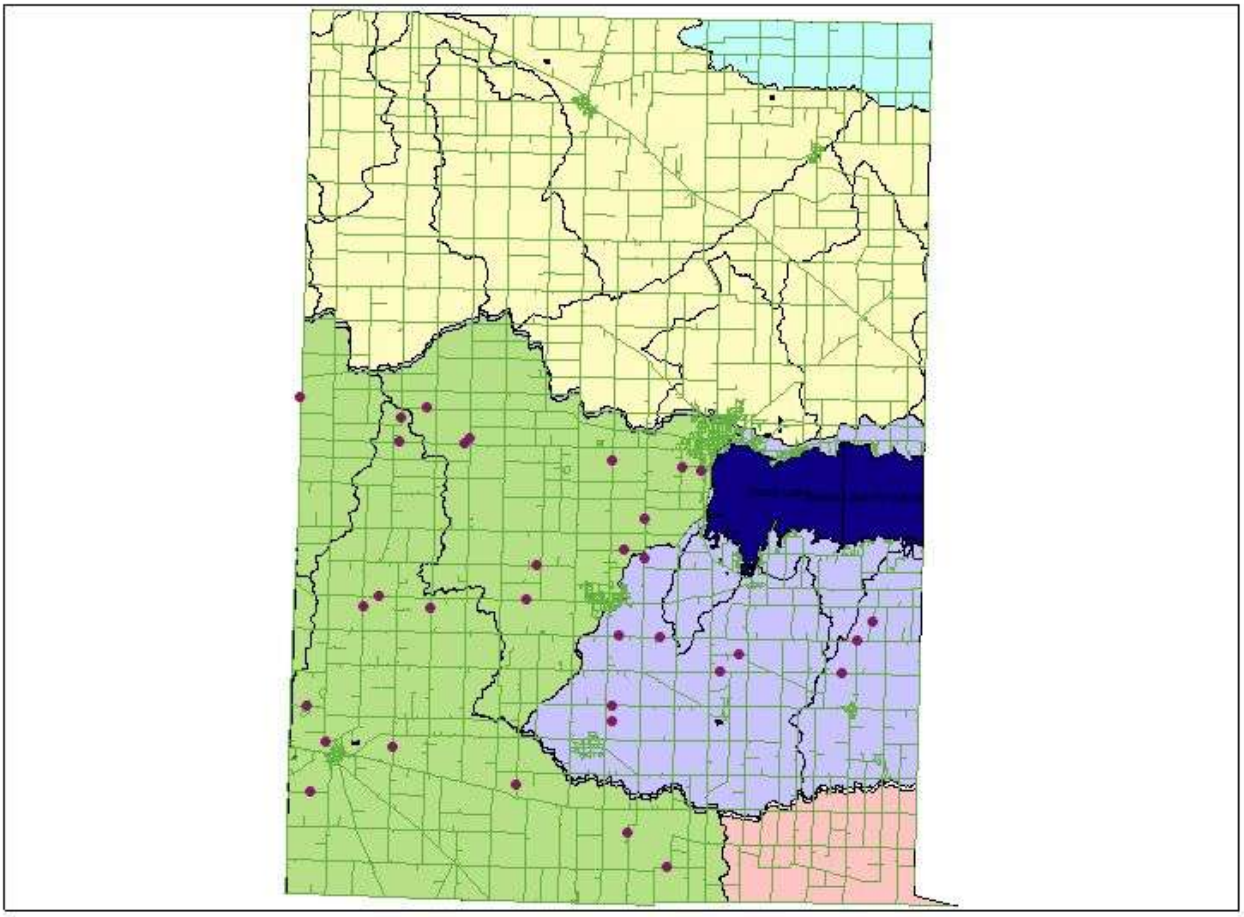
pathogenic bacteria are added to the receiving water bodies by untreated or improperly treated septage. This poses not only a risk to aquatic life, but also to human health.

Nitrates are highly soluble and can infiltrate private wells posing the greatest threat to infants, elderly residents or pregnant women, causing Methemoglobinemia, also known as “Blue Baby Syndrome”. This creates a lack of oxygen, resulting in a bluish tint to the veins and skin. Another impact associated with an over abundance of Nitrates is eutrophication of the water body. Eutrophication is a process undergone by lakes and ponds by which an increased amount of plant and algal growth occurs due to increased amounts of usable nutrients. This process continues as the plants then die and decay, reducing the amount of dissolved oxygen available to other plants and animals.

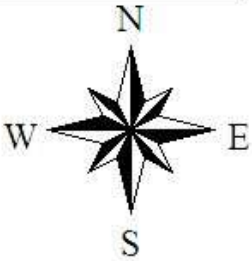
Phosphate/Phosphorus is the primary food source for blue-green algae. This adversely impacts the county as Grand Lake St. Marys is in a constant state of algal bloom and has been described as “hyper-eutrophic”. The process of eutrophication is described above and is also sped up by the addition of phosphorus into the watershed through lawn fertilizers, soil erosion and animal and human wastes. Furthermore, the wetland systems that have historically served as the storage facilities for phosphorus are being destroyed for construction and development or farmland.

Bacterial organisms also stem from human waste and can not only impair the quality of the water but also place humans at risk if the water is used for consumption or recreation. Some bacteria are pathogenic in nature, thus they can cause disease or toxic symptoms in humans and animals. Fecal coliform bacteria originate in the intestinal tract of warm blooded animals. Realizing this, fecal coliform bacteria are transmitted from the intestinal tract to the water resource via feces from animals and/or humans. Several locations in the county have been sampled by Ohio EPA for fecal coliform and violations or exceedences have resulted. The waterbodies where violations and exceedences were observed are mapped on the following page.

- Wabash River: RM 494.26; RM 489.90; RM 484.73; RM 482.15; RM 479.99; RM 476.05; RM 469.53; RM 466.10
- Mississinewa River: RM 114.24
- Bear Creek: RM 1.84; RM 0.01
- Fort Creek: RM 1.54
- Toti Creek: RM 2.11; RM 0.24
- Crab Branch: RM 0.45
- Hickory Branch: RM 0.29
- Beaver Creek: RM 10.30; RM 9.65; RM 7.49; RM 2.65
- Hardin Creek: RM 3.25; RM 1.01
- Little Beaver Creek: RM 4.70
- Little Bear Creek: RM 0.007
- Big Run: RM 0.12
- Prairie Creek: RM 0.10
- Coldwater Creek: RM 9.33; RM 8.54; RM 6.42; RM 3.51
- Burntwood Creek: RM 3.08
- Beaver Creek (GLSM): RM 6.87; RM 5.91
- Chickasaw Creek: RM 6.50; RM 5.28
- East Fork Chickasaw Creek: RM 0.16



Fecal coliform violation or exceedence



Loramie Creek
Little Auglaize River
Wabash River
St Marys River
Grand Lake St Marys Watershed

Fecal coliform violations and exceedences

Home Sewage Treatment System Concerns

The MCHD serves approximately 41,000 people in the 14 townships in Mercer County. According to 2000 census data, there are 14,756 housing units in the county, of which, approximately 9,884 units are served by a centralized sewer system. This leaves an approximate number of 4,872 residential units utilizing home sewage treatment systems. The MCHD has records on approximately 2,949 HST systems installed in the county since 1973, representing 61% of the total. The remaining 39% were installed prior to 1973. The functional life of a home sewage treatment system is highly dependent on the amount of routine maintenance and care the system's owner devotes to it, but generally speaking, the maximum life expectancy of a system is approximately 30 years. Due to this life expectancy, systems of greatest concern would be those that were installed prior to 1973.

Types of home sewage systems in Mercer County

There are currently three main types of septic systems found in Mercer County; Subsurface sandfilter, leach field, and Aerator systems. The basic septic system consists of a septic tank, which acts as a settling chamber, and a secondary treatment component.

Subsurface Sand Filter: As the water flows out of the septic tank, it enters a distribution box, and finally enters four perforated tiles. The effluent wastewater is then leached into a layer of approximately two (2) feet of filter sand. Gradually, beneficial micro-organisms form a bio-film around individual sand particles. As the wastewater flows through the sand filter and bio-film, the micro-organisms further break down the contents of the effluent, allowing the sand to serve as a clarifier for the system. By the time the effluent has percolated through the filter sand and bio-film, reaching the collection tile at the bottom of the filter, the bacteria, nutrients, and suspended solid content of the wastewater has been greatly reduced.

Leaching Tile Field: Leaching tile field systems are used to disperse the liquid portion of household sewage into the soils surrounding the home. Typically, 8-12 lines, or fingers, are trenched into the soil near the house. These lines may reach over 100 feet in length and contain perforated plastic tile, surrounded by 12 inches or more of gravel. Under ideal conditions the water fills the gravel trench and is absorbed by the surrounding soils. When functioning correctly, these systems do not discharge any water into the surrounding streams, tiles, or ditches. Leach lines can often be located by identifying heavy, green growth of lawn grass in the yard.

Aerator: Home aeration systems are conceptually similar to large city wastewater treatment plants that have been miniaturized to treat individual household sewage flows. These units use an electric motor to blow or stir air into a sewage filled holding tank. Highly efficient aerobic bacteria then consume the human waste and reduce organic material and disease causing bacteria. A specially designed filter removes any remaining solids before the treated water is discharged into a tile, stream, or drainage

ditch. While somewhat expensive to operate and maintain, these systems perform effective treatment of the sewage waste. Problems do arise with these systems during power outages, motor failures or intentional shut offs.

Alternative home sewage treatment systems

Wetland Systems: Wetland sewage treatment systems are an alternative for the problem of sewage treatment and disposal. There are two design types of wetland treatment systems: constructed wetlands and free water constructed wetlands. Both systems utilize vegetation to uptake the nutrients and bacteria found in household wastewater.

The Mercer County Health Department has experimented with the free water constructed wetland as a sewage treatment alternative. The free water constructed wetland consists of a septic holding tank with an in-tank effluent filter followed by a submerged inlet into a surface water body specially designed for promotion of wetland plant life. The free water constructed wetland treats wastewater by uptake of nutrients and organic matter by the wetland plants themselves, and by the microscopic aquatic animals and insects which live amongst the wetland plant stems. In this way, the organics introduced by the septic tank become a food source for organisms living in the wetland, forming a food chain which moves energy through the wetland. This process leaves the water greatly reduced in numbers of fecal bacteria, BOD, ammonia and suspended solids at the overflow area of the wetland.

Constructed wetlands are based on a different design. The constructed wetland consists of a septic tank, which settles out solids, followed by two wetland cells, set in series. The cells consist of shallow, rectangular excavations filled with pea gravel and wetland plants. The wastewater flows through the pea gravel and the root/stem systems of the wetland plants to promote increased nutrient and organic uptake in the primary cell. Some water will also be eliminated through the process of evaporation due to increased surface area and evapo-transpiration via wetland plants. If any water remains after flowing through both wetland cells, it may be discharged to a small leaching system, or filter strip to further protect against discharging to stream or waterway.

Mound Systems: Although the Mercer County Health Department has not permitted any mound soil absorption systems, this type of system remains to be a viable option for sewage treatment and disposal in areas where no other treatment options exist. Typically, such situations would be defined as areas in which drainage for sand filters is non-existent, and soil conditions are so extreme that normal soil absorption system (leaching system) installation cannot be completed.

A mound system consists of a septic settling tank, a dosing chamber and a sand filled mound. The septic tank allows solids to settles out of suspension, with the liquids passing on to the dosing chamber. The dosing chamber contains a pump which forces the liquid through a distribution network of small diameter perforated tile, evenly spaced

over the top of the sand filled mound. The liquid filters through the sand, eventually forming a beneficial bio-film over the sand particles, similar to the subsurface sand filter. The liquid continues to percolate through the system until reaching the native topsoil. The native topsoil is of better quality than the underlying clay soil layer, which is typical of Mercer County. The mound is designed to allow for a total of 4 feet of treatment material before reaching the "limiting layer" which in most cases in Mercer County, would be the hard clay layer. If the hard clay layer was measured to be at 24 inches below grade, then the mound would need to have at least 24 inches of sand fill.

Mound systems require more oversight and maintenance by the homeowner due to the motorized pump contained in the dosing chamber. Also, a concern with the mound system is the eventual treated water disposal. According to scientific research, once the wastewater reaches the limiting layer (after it has passed through the 4 feet of treatment material), it can be considered "treated". However, this water must be disposed of, or absorbed into the ground. The limiting layer may not allow this absorption process and cause pooling with leakage onto the surface of the ground.

Public complaints regarding HSTSs

The MCHD does not currently inspect or evaluate individual treatment systems unless there has been a nuisance or water quality complaint. Once a complaint has been received, a sanitarian with the health department will make every attempt to contact and arrange a site visit with the owner or owners of the residence(s) in question. In the instance that the potential contributor is located in a cluster of homes, all of the homes in the area will be investigated. A Nuisance Complaint Investigation form can be found in Appendix D.

During the investigation of a nuisance complaint, the local watershed will be visually determined by the sanitarian or by the Mercer Soil and Water Conservation District for a more technical watershed determination. Any households within this watershed are determined to be a potential contributor to the water quality problem.

The first step in the investigation process involves consulting the PTI records on file at the MCHD. If permits can be located on the households in question, determinations are made regarding the likelihood of each household contributing to the problem. Such determinations depend on age of the home, age of septic system, and the size and design of the system.

The next step in the investigation process involves contacting and visiting each of the households that are potential contributors to complete a dye test. The tracing dye test involves the sanitarian placing a non-toxic dye into a toilet in the home. The problem area is then observed for the next 24-48 hours. If the tracing dye appears in the stream, the tested household is found to have an illicit discharge to the stream, and is considered to be a contributor.

The remainder of the residences in the problem watershed is tested in this manner to ensure that all contributors are identified. Once identified through a positive dye test, orders are placed on the property owners to make necessary corrections to their sewage systems. These corrections may include a total replacement of the sewage system, or just a partial replacement of the sewage system. In certain cases where sewage has surfaced and it can be easily determined that in no way could other households be contributing to the problem, a dye test may not be necessary.

Existing Authorities and Tools for Corrective Action

Before correction action orders are issued, a site inspection of the property is performed. The site inspection will usually determine what type of septic system is currently being utilized at the property. A determination can then be made on the necessary repairs required to eliminate the sewage nuisance. For example, a household may have a septic tank that is in good condition and of good capacity, and may only need a replacement of the secondary treatment portion of the system. Or, as in most cases, both the primary and secondary portions of the septic system need to be replaced. The site inspection also involves a determination on where the replacement septic system will be positioned. In determining location, the following factors are observed: distance to a drinking water well, distance to the house or any buildings, distance to the property line, and topography. Distance requirements are set forth in the Ohio Administrative Code 3701-28 (Private Water System Rules), and Mercer County Sanitary Regulations 16 and 20. A copy of the Mercer County Sanitary Regulations can be found in Appendix E.

A septic permit through the Mercer County Health Department must be obtained by the homeowner if such repairs require replacement of either the septic tank or the secondary treatment portion of the system. With the permit, the homeowner must state the name of the contractor performing the required repairs so that the Health Department can determine that the contractor is licensed to perform the necessary work. The Mercer County Health Department maintains a licensing program for contractors performing work within Mercer County on household septic systems. The homeowner does, however, have the option of performing the work themselves, eliminating the need for a contractor's license. Upon completion of the repairs, the Mercer County Health Department is required to perform a final inspection of the work completed.

If the homeowner does not voluntarily move to correct the sewage nuisance, enforcement is then deemed necessary. Ohio Administrative Code 3701-29 (Household Sewage Disposal Rules) and Mercer County Sanitary Regulations 13-22 and 26, and Ohio Revised Code 3701.01 give the Mercer County Health Department the authority to order the abatement of the sewage nuisance by the means outlined and determined through the site inspection. A time frame for compliance is set by the Board of Health. If no compliance is achieved by the original deadline, second and final time allowance may be set. If still no compliance is achieved, the Mercer County Board of Health may choose to prosecute and file a complaint in a court of law against the

offender, or to perform the necessary repairs and certify the costs to the offender's property taxes, as outlined in Ohio Revised Code 3707.02. The circumstances of individual cases, in part, help to determine which avenue of abatement is followed.

Known impacts to streams

Evidence of the known impact failing septic systems have on local waters can be viewed on an info-graphic produced by Ohio EPA. This info-graphic is based on the sampling results obtained in the summer of 1999 throughout the Wabash and the Grand Lake St Marys watersheds. According to the info-graphic, "Poorly managed livestock waste and home septic system overflows were two sources of high bacteria and ammonia in the Wabash River basin. These sources along with farm fertilizer runoff and some municipal wastewater contributed to high nutrient concentrations throughout the basin. High nutrient levels in most small streams prohibited normal aquatic life to live in them. Poor water quality created toxic conditions at many sites in the basin."
This can all be viewed at the following website:
www.epa.state.oh.us/dsw/documents/wabash2001_infographic.pdf.

Critical Areas

In planning for upgrades and replacements of failing home sewage treatment systems, it is important to select a highly critical area to focus the personnel and financial resources as they become available. For Mercer County, the critical areas can be defined with several considerations regarding the real or potential impact to water resources and human health. These areas were selected due to the current status of water quality in all assessed and sampled areas.

Recreational areas
Sampling conducted by Ohio EPA in the summer of 1999 shows that the Wabash River drainage area, including the Grand Lake St Marys watershed, is one of the most degraded watersheds in the state of Ohio. This is, in part, due to illicit discharges of improperly treated household wastewater into nearby streams and even the lake itself. There have also been numerous violations and exceedances for fecal coliform bacteria in streams draining into GLSM.

Drinking water sources
This all is especially important when considering the primary uses of the lake. There is a high recreational use including swimming, boating and fishing. As these are primary contact activities, it is important to severely reduce or eliminate all bacterial loadings into that particular watershed. The City of Celina also currently obtains drinking water from the Grand Lake St Marys, requiring numerous phases of pre-treatment due to high concentrations of organics in the raw water. The City of Celina has been fined by Ohio EPA and is currently under orders to reduce the concentration of Tri-halo-methane (THMs) in the finished product. By reducing the organic loading to the lake itself, this could reduce the amount of chlorination required for production of drinking water and reduce the amount of THMs in the finished product.

Areas of concentration
Perhaps, one of the most effective methods of removing bacterial loadings would be to reduce the areas of concentration via sewer extensions, installation of package plants, or upgrades of on-lot treatment systems. Richard Hupman & Associates, an environmental consulting firm, completed an inventory of the Grand Lake St Marys watershed to identify the areas of 10 or more residential home sewage treatment systems. This inventory will need to be completed for the remainder of Mercer County to properly utilize and analyze this data. Water quality monitoring, both chemical and biological, can be completed at each cluster outlet area to determine an overall Qualitative Habitat and Environmental Index (QHEI) score for that stream segment, and will indicate which segments are in attainment or non-attainment status for the Aquatic Life Use Designation. These designations are determined and set forth by Ohio EPA and descriptions of the Aquatic Life Use Designations can be found in Appendix G.

Previous nuisance areas
Any area in Mercer County that has previously been proven to have illicit residential wastewater discharges creating a nuisance situation is to be considered a critical area. This would also include areas that were previously sampled by Ohio EPA resulting in a violation or an exceedence for fecal coliform bacteria.

Critical areas are shown on a collective map which can be viewed in Appendix G.

Goals

It is a goal of the Mercer County Health Department to develop a GIS-based computer database of issued sewage systems, and existing systems, installed in Mercer County. A system such as this would allow visual information about geographic locations of septic systems to be combined with specific data about that septic system (components, site layouts, etc…). Once established, a system such as this would more clearly present potential problem areas, such as areas of septic system clusters. Attention could then be focused on periodic visual monitoring of these areas for occurrences of public health nuisances.

Upon discovery of public health nuisances, it is our goal to establish a link from the problem to the source of the problem. Once the link is established, the end-goal would be to facilitate a repair or replacement of the problem septic system. These upgrades would happen on a case-by-case basis, over a period of time, until gradually a large percentage of problem systems would be located and upgraded. This GIS system could then be expanded to benefit other programs of the health department, such as private water systems, epidemiological studies, and nuisance complaints.

Another goal of the Mercer County Health Department is to increase public awareness and the education level of county residents regarding their septic systems. If residents of Mercer County can develop a sense of ownership and responsibility regarding their part in water quality, problems could be headed off much sooner. Points to be stressed to residents include:

- What is a septic system and what happens when the toilet is flushed
- What not to flush
- How to locate the septic system
- What components a proper septic system contains
- How to maintain the system
- What types of pollutants and pathogens household sewage contains

An additional item to stress to residents would be the importance of an inspection and pumping of the septic system prior to purchasing or selling a home in an unsewered area. Both parties involved would have a vested interest in knowing the current status of the system. This assurance of the home sewage treatment system is just as important as knowing the current status of the plumbing, heating/cooling and the roof on the home.

The MCHD will work with local groups to pursue sources of financial assistance for homeowners wishing to upgrade or replace their residential septic system. This can be accomplished with the assistance of the Ohio EPA-DEFA water pollution control loan fund low interest loan program, which has already been authorized for Mercer County. An agreement was entered into between the Ohio EPA-DEFA and the Mercer County

Combined Health District in July of 2000. Other state and/or federal grants obtained by either the MCHD or a partner organization would also be pursued.

Completion of the areas of concentration inventory and mapping will also need to be completed in order to properly implement this long range plan. These areas can be geo-referenced in map and database form. Number of systems present, previous nuisance complaints, orders for corrective action, proximity to stream, recreational water body and drinking water source will also be noted in the database and map. This information can be utilized to determine where efforts and funding can be focused, the areas that would best be served with sewer extensions and/or construction of package plants.

Working partnerships will also focus on investigating and evaluating alternative and experimental treatment systems to gain a better understanding of the practicality and efficiency of those systems in this particular area. Water quality monitoring of nearby streams and waterways will provide both a qualitative and quantitative look at the effects of any repairs, replacements or upgrades to individual septic systems.

As new rules and regulations are passed into law, the MCHD will review and update personnel assignments and staffing needs in order to properly address the requirements.

Staff and Board members will continue to explore educational opportunities to ensure that personnel are aware of new practices and technologies regarding the treatment of residential sewage.

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Tracking and Documenting

A computerized database is being developed which will include information on type of system on the property, permitting, installation, relevant complaints and inspections and other important information on the home sewage treatment systems in Mercer County. Sections can also be added to the database as systems are upgraded or replaced and the associated water quality impacts observed or documented. As stated in the goals section of this document, a GIS based program would further allow for geo-referencing of the above information as well.

Reporting, implementing and tracking of grant objectives will be determined as grant applications are developed and grant funding obtained. Reviews of current situations will guide personnel responsibilities for the above activities. Documents for applications or enrollments into programs offered will be developed as needed or as programs are developed.

Environmental monitoring will be completed such that water quality sampling will be completed pre and post upgrade and/or replacement, regular interval and long term monitoring will be completed on alternative or experimental systems installed in Mercer County, and regular interval water quality monitoring at sites where nuisance complaints have been received. QHEI scores and water quality monitoring results will also be logged into the database being maintained through the Mercer County Health Department.

Appendix A

List of Abbreviations

BOD ~ Biological Oxygen Demand

cfs ~ Cubic feet per second

CSO ~ Combined Sewer Overflow

DEFA ~ Division of Environmental and Financial Assistance

EPA ~ Environmental Protection Agency

gpm ~ gallons per minute

HSTS ~ Home Sewage Treatment System

MCHD ~ Mercer County Health Department

mgd ~ million gallons per day

NPDES ~ National Pollution Discharge Elimination System

PTI ~ Permit to Install

QHEI ~ Qualitative Habitat Environmental Index

RM ~ River Mile

SSO ~ Sanitary Sewer Overflow

WWTP ~ Waste Water Treatment Plant

Appendix B

Installation and Operation Permit
For
Household Sewage Disposal System

Mercer County-Celina City Health Department 220 W Livingston St, B 152 Celina, Ohio 45822	**Installation and Operation Permit** **Household Sewage Disposal System**

Property owner _____ Address _____

Hereby applies for a permit to install and operate a household sewage disposal system located at:
_____

In _____Township.

Contractor to install household sewage disposal system _____

I agree to comply with the regulations of the Ohio Sanitary Code governing the installation and operation of household sewage disposal systems. I understand the health commissioner or his representative may inspect the household swage disposal system or any part thereof at any reasonable time. Further, I understand this permit may be revoked at any time for failure to comply with the provisions of the regulations.

Further agree, I will call at least 24 hours advance notice, for a final inspection and approval of the Mercer County Health Department of this installation prior to its being covered with earth.

I understand that approval of this system does not constitute an assurance that the proposed system will operate in compliance with all Ohio laws and regulations. Therefore, additional treatment facilities shall be installed upon orders of the Mercer County Health Department, if necessary.

I further understand that I am solely responsible for the operation of my household sewage disposal system; therefore, I realize that the contractor and the Mercer County Health Department cannot be held responsible for the operation of my household sewage disposal system or any part thereof.

I shall abandon the household sewage disposal system and make necessary and proper connection to a sanitary sewer when the same becomes accessible.

Date _____ **Signature** _____

Risers must be provided on the septic tank.
All household drains must be connected to the sewage disposal system.

Site Evaluation

Size of building site _____ acres Number of bedrooms _____
Off lot discharge? Yes ____ No ____
If yes, which direction will the effluent flow _____
How far is it to an open ditch or stream _____

Date of site inspection _____ Sanitarian _____

Site approved _____ **Site Disapproved** _____

Permit Issued _____ Septic tank size requirement _____

Permit Number _____ Leach field size requirement _____

Fee $ _____ Filter bed size requirement _____

Appendix C

Final Inspection for the installation and operation
Of a household sewage disposal system

Mercer County-Celina City Health Dept. 220 W Livingston Street, B152 Celina, Ohio 45822	**FINAL INSPECTION FOR THE INSTALLATION AND OPERATION OF A HOUSEHOLD SEWAGE DISPOSAL SYSTEM**

PROPERTY OWNER _____

MAILING ADDRESS _____ **SITE ADDRESS** _____

_____ _____

HEREBY INSTALLED AND WILL OPERATE A SEWAGE DISPOSAL SYSTEM LOCATED AT: _____

_____

IN _____ TOWNSHIP. CONTRATOR_____

PERMIT ISSUED _____ SEPTIC TANK _____

PERMIT NUMBER_____ LEACHING_____

FEE $ _____ FILTER BED_____

SKETCH OF THE SEWAGE DISPOSAL SYSTEM INSTALLED:

IT IS RECOMMENDED THAT THE HOMEOWNERHAVE THE SEPTIC TANK PUMPED OUT EVERY THREE TO FIVE YEARS BY A LICENSED CONTRACTOR

SYSTEM APPROVED: YES _____ NO _____

DATE OF FINAL INSPECTION _____ SANITARIAN _____

Appendix D

Nuisance Complaint Investigation

Nuisance Complaint Investigation

Date Complaint Received:	Time Complaint Received:
Complaint: Name _____ Address _____ _____ Phone _____	Person Causing Nuisance: Name _____ Address _____ _____ Phone _____
Nuisance caused by: _____ _____ _____	Location of nuisance: _____ _____ _____
Date of Investigation:	Time of Investigation:

Is the Nuisance Public Health Nuisance: Yes _____ No _____

If yes; what must be done to eliminate nuisance:

_____

_____

_____

Action taken:

_____

_____

_____

Date of Re-inspection:	Time of Re-inspection:

Results noted:

_____

_____

_____

Investigated by:	

Appendix E

Regulations for the Mercer County-Celina City General Health District, Ohio

Regulations
for the
Mercer County-Celina City
General Health District, Ohio

Regulations deemed necessary for the protection of the public health, safety and welfare of the Citizens of the Mercer County-Celina City General Health District, not otherwise controlled by the laws of Ohio, or the regulations of the Public Health Council of Ohio.

Resolved by the Board of Health of the Mercer County-Celina City General Health District, Ohio.

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REGULATION 1. ADOPTION:

The Board of Health of the mercer County-Celina City General Health District hereby adopts this and the following Regulations and declares the same, with such additions and amendments as may hereafter be made, to be the Regulations of the Mercer County-Celina City General Health District and shall apply to all places and persons in said District.

REGULATION 2. CHARGE OF ENFORCEMENT:

The Health Commissioner of the Mercer County-Celina City General Health District, or his agents, shall be charged with the enforcement of the following Regulations that are set forth for the protection of the health of the inhabitants of the Mercer County-Celina City General Health District, Ohio.

REGULATION 3. RATS, RODENTS, INSECTS, FLIES AND MOSQUITOES:
No person shall own, keep or maintain any building or buildings, lot, ground, piece of ground, any shelter of any description, pool, any body of water, ditch, stream, pond, drains, sewer, sewage water, paper, liter, garbage, offal, manure, lumber, wood in any condition or conditions that favors, encourages the harboring, nesting, breeding of rats, rodents, insects, flies, or mosquitoes.

REGULATION 4. ORDERS TO IMPROVE WATER SUPPLIES:
A water supply, for dinking and culinary purposes, which is found to be impure or subject to contamination by reason of unsatisfactory location, protection, or construction, and dangerous to the Public Health, is hereby declared to be a nuisance and the Board of Health shall order the owner of such water supply to abandon it and make it unavailable for use, or to make improvements, corrections, and changes so as to provide a water supply not subject to contamination: and the time for compliance with such order shall be fixed.

REGULATION 5. ABANDONED WATER SUPPLIES:
When a well, spring, or other sources of water supply is abandoned on account of its impurity or in accordance with an order of the Health Commissioner, or his agent, no person shall use it as a receptacle for night soil, garbage, hose slops, or other putrescrible or filthy substance. It shall be sealed or plugged if possible, and filled to the ground surface with clay, earth, concrete, or other suitable impervious material, or otherwise made unavailable as a source of water supply.

REGULATION 6. PERMITS FOR PRIVIES AND PRIVY VAULTS:
No person shall install or change a privy or privy vaults or a chemical privy tank until the location and construction plans have been approved by the Local Department of Health and a written permit has been issued be said Department.

REGULATION 7. SPECIFICATIONS FOR PRIVIES AND PRIVY VAULTS:
The construction of a privy and privy vault shall be as follows: The privy shall be provided with a water-tight vault or other water-tight receptacle which shall be of not less than five-hundred (500) gallons capacity: provided, however, that with the permission of the Health Commissioner, or his agent, the vault may be constructed with an open or porous bottom to permit leaching away of the liquid contents, if the vault is located not less than one-hundred (100) feet from any water supply used for dinking and culinary purposes, and at a location such that the liquids leaching from the vault will not discharge at the ground surface or into a sink hole, crevice, or other rock or shale formation. Not water tight privy or privy vault shall be located less then thirty (30) feet from any well, spring or cistern used for dinking purposes, and then only with the permission of the Health Commissioner, or his agent, twenty (20) feet from any building or human occupancy or street line or less than five (5) feet from any lot or alley line. The construction of the vault superstructure shall be such as to prevent access to the vault by flies, insects, rats, chickens, and other fowls and animals. The design of the privy vault and superstructure shall be in accordance with or equal to the recommendations of The Public Health Council of the State of Ohio or the Local Department of Health.

REGULATION 8. CHEMICAL PRIVY TANK:
For the purpose of these Regulations a chemical privy tank shall be construed to be a receptacle supplied regularly with a sufficient amount of caustic or other chemical substance to sterilize and deodorize the contents completely and continuously. This definition does not include the chemical commode or other portable receptacle. The requirements for a privy and privy vault in REGULATIONS6 and 7 shall apply to a chemical privy tank and superstructure for the same, except that such chemical privy tank and superstructure may be located adjacent to a dwelling but without a direct entrance therefrom.

REGULATION 9. PRIVIES PROHIBITED, ABANDONED PRIVIES:
No person shall install a privy, privy vault or chemical privy tank on property accessible to a sanitary sewer. Whenever an approved public sanitary sewer is made available, any privy, privy vault, or chemical privy tank on such property shall be abandoned and connections shall be made direct from the building to the sewer. An abandoned privy vault or chemical privy tank shall be thoroughly cleaned, disinfected and filled to the ground surface with earth, ashes, or other suitable filling material.

REGULATION 10. CLEANING OF PRIVY VAULTS AND CHEMICAL PRIVY TANKS:
Privy vaults and chemical privy tanks shall be cleaned as often as necessary so as to prevent their becoming a nuisance. The vault or tank shall not be permitted to become filled to the top. The cleaning of a privy vault or chemical privy tank and the removal of the contents thereof, shall be done at such times and in such manner as the Health Commissioner shall specify. No person shall remove or permit or cause to be removed the contents of a privy vault or chemical privy tank without a written permit from the Local Department of Health; except that a scavenger having a permit, as hereinafter provided, may be considered authorized to do such work without an additional permit. Such permit shall state the conditions under which such removal and disposal shall be made.

REGULATION 11. DISPOSAL OF HOUSE SLOPS:
No person shall discharge or permit to be discharged urine, fecal matter, contents of a chemical commode, kitchen wastes, laundry wastes, bath waters, slop sink drainage, or other household wastes onto the surface of the ground or into a street, road, alley, open excavation, abandoned well or cistern, storm water sewer, land drain ditch, water course, or body of water. Such wastes shall be buried in a suitable place, deposited in a privy vault or chemical privy tank, or discharged into an approved sewer or an approved sewage system.

REGULATION 12. DISCHARGE OF SEWAGE PROHIBITED:
No person shall discharge, or permit or cause to be discharges, untreated sewage, the overflow, drainage, or contents of a sewage tank or other putrescible, impure or offensive wastes onto the surface f the ground or other open area, or into any street, road, alley, open excavation, storm water sewer, land drain ditch, water course or body of water unless a written permit therefore has been obtained from the Local Department of Health. No person shall discharge, or permit or cause to be discharged, untreated sewage, the overflow, drainage, or contents of a sewage tank or other putrescible, impure or offensive wastes into an abandoned water supply well, spring or cistern, or into a natural or artificial well, sink hold, crevice, or other opening extending into limestone, sandstone, or other rock r shale formation.

REGULATION 13. SEWER CONNECTIONS REQURIED; ABANDONED SEWAGE DISPOSAL EQUIPMENT:
No sewage disposal device or equipment shall be installed on property accessible to an approved public sanitary sewerage system. Whenever an approved public sanitary sewerage system is made available, any sewage disposal device or equipment on such property shall be abandoned and the sewage discharged directly from the building to the said sewerage system through a properly constructed house sewer without passage through the sewage tank or other treatment device. Roof water, cistern overflow, or surface or subsoil drainage shall not be discharged into a sanitary sewer or to any other approved sewage disposal equipment as hereinbefore specified. An abandoned septic tank or other device or equipment for the treatment or disposal of sewage shall be thoroughly cleaned and disinfected and filled to the ground surface with earth, ashes, or other suitable filling material.

REGULATION 14. WRITTEN APPLICATION AND PERMIT REQUIRED FOR SUCH SEWAGE DISPOSAL SYSTEMS:
No person shall connect or cause to be connected any plumbing with any sewer, sewage tank, or their sewage disposal device without first having filed a written application and having obtained a written permit from the Local Department of Health, provided however, that where the connection is to be made to an approved public sanitary sewage system, a permit should be obtained form the authority having charge of such sewerage system. A separate permit shall be obtained for each sewage disposal installation and for each alteration and addition thereto. The permit shall specify accurately the extent of and manner in which the installation, alteration, or addition shall be made.

REGULATION 15. EXPIRATION OF PERMITS:
All permits are good for a continuous performance of the work named thereon: permits shall automatically expire when work ceases for a period of ninety (90) days, without good and reasonable cause for same, but shall naturally expire upon completion of work and final inspection of same for which it was issued.

REGULATION 16. PLOT PLAN:
When an application is made for a permit for the installation, alteration, or addition to of a sewage disposal system, a plot plan shall be submitted giving dimensions of the lot, location of the dwelling, location of all sources of water supply within fifty (50) feet of the proposed sewage installation.

REGULATION 17. INSPECTION REQUIRED:
All work authorized by the permit issued shall be inspected by the Health Commissioner, or his agent.
The work shall be left uncovered and convenient for inspection, and notification shall be given the Local Department of Health not less then forty-eight (48) hours in advance that the work is ready for inspection. Any work not meting the requirements of these Regulations shall not be put to any use until it has been altered and has received final approval.

REGUALTION 18. HOUSE SEWER:
The house sewer extending from the building to the sewage tank shall be not less then four (4) inches in diameter and shall be constructed of extra heavy cast iron soil pipe with caulked lead joints, or of first grade (best quality) vitrified clay sewer pipe with bituminous joints or equal, or of asbestos-cement pipe and joints as approved by the Ohio Board of Building Standards. Not traps shall be installed in the house sewer. No house sewer shall be located less than ten (10) feet from any water service line, well, spring, cistern, or other source of water supply.

REGULATION 19. SEWAGE DISPOSAL DEVICES:
The waste water drainage from water closets, urinals, lavatories, bath tubs, laundry machines, cellar floor drains and other similar plumbing fixtures shall be connected to the house sewer and in places where an approved public sanitary sewerage system is not available or accessible, the house sewer shall drain to an approved type of sewage, or septic tank the overflow from which shall discharge to an approved leaching or filtering device, except in instances where written permission has been given by the Local Department of Health for other means of sewage disposal as herein-be-fore provided in REGULATION 10.

REGULATION 20. SEWAGE OR SEPTIC TANK:
The sewage or septic tank shall be of not less then five-hundred (500) gallons liquid capacity and the design, construction and location shall conform to the recommended standards of any of the following, the Public Health Service of the Federal Security Agency (FHA), Veterans Administration (VA), The Public Health Council of the State of Ohio, or the Local Department of Health. A sewage or septic tank should be located fifty (50)feet or more from any well, spring or cistern used for drinking and culinary purposes, but in no instances shall a sewage r septic tank be located less than thirty (30) feet from any well, spring or cistern used for drinking and culinary purposes, and then only with the permission of the Health Commissioner, or his agent, ten (10) feet from any building of human occupancy or street line or less than five (5) feet from any lot or alley line.

REGULATION 21. CLEANING OF SEWAGE OR SEPTIC TANKS:
All sewage or septic tanks shall be cleaned as often as necessary to prevent the discharge of excessive solids through the overflow. In no instance shall more than one-half (1/2) of the liquid capacity of the sewage or septic tank be allowed to become filled with sludge, scum, or other solid matter. Sewage or septic tanks shall be cleaned and contents disposed of as hereinafter provided in REGULATION 25.

REGULATION 22. LEACHING AND FILTERING DEVICES:
The leaching and filtering devices shall conform in design and construction to the recommended standards of any f the following, the Public Health Service of the Federal Security Agency (FHA), Veterans Administration (VA), the Public Health Council of the State of Ohio, or the Local Department of Health. A leaching or filtering device shall be located not less then fifty (50) feet from any well, spring or cistern used for drinking and culinary purposes, except with the permission of the Health Commissioner, or his agent. Under topographic, ground water or subsoil conditions considered to be unfavorable by the Local Department of Health , a distance greater than fifty (50) feet between a leaching or filtering device and a well, spring or cistern may be required. A leaching device will only be permitted where the subsoil is free from rock or shale formation and is sufficiently porous to facilitate the absorption of the effluent from the sewage or septic tank, and then only after the completion of a satisfactory percolation test. Where rock, shale and non-porous soil conditions are encountered, secondary treatment of the sewage effluent by a filtering device shall be required.

REGULATION 23. GARBAGE AND OFFAL:
No person shall place or deposit of permit to be placed or deposited garbage, offal or any other putrescible refuse of vegetable, animal, fish, or fowl origin in any street, alley, road, open excavation, abandoned well or cistern, ditch, stream or body of water or on the surface of the ground or in any other manner deemed improper by the Local Department of Health; provided, however, that his Regulation shall not prohibit the deposition of such waste on the surface of the ground for the purpose of feeding annuals and fowls as hereinafter provided. Unless disposed of immediately after production, such wastes shall be stored in water tight metal containers with tight fitting lids and upon removal from such containers shall be properly disposed of in a manner to avoid the creation of a nuisance or the pollution of a water supply, or by a general system of collection and disposal approved by the Health Commissioner, or his agent of the Local Department of Health.

REGULATION 24. COLLECTION AND DISPOSAL:
Unless a general system of collection and disposal of garbage is satisfactory to the Health Commissioner, or his agent and authorized as provided in REGULATION 25, such wastes shall be disposed of by the producer by burial, burning, feeding, or reduction.

Section 1.
If burial is practices, it shall be by a land-fill method (trench and fill), satisfactory to the Health Commissioner, or his agent, or the wastes shall be deposited in an excavated trench not less than ne (1) foot or more than two (2) feet in depth and covered immediately with a layer of earth not less than six (6) inches in thickness. Burial shall be at an isolated location satisfactory to the Local Department of Health.
Section 2.
If burning is practiced, the wastes shall be destroyed by a hot fire in a furnace or stove and in such a manner and place as to avoid escape of offensive odors or creating a nuisance in any other manner or way.
Section 3.
If feeding is practiced, it must be carried out as provided in the Revised Code of Ohio and at a location or place satisfactory to the Health Commissioner, or his agent, and the location or place shall at all times be maintained in such a manner so as not to create a nuisance in any form.
Section 4.
If reduction is practiced, the wastes shall be cooked in an enclosed container and suitable provisions shall be made to avoid escape of offensive odors and waste liquids in cooking and drying.

REGULATION 25. PERMITS FOR SCAVENGERS AND GARBAGE COLLECTORS:
No person shall engage in the collection and removal of the contents of privy vaults or sewage tanks, swill, garbage, rubbish or offal until a permit therefore is obtained from the Health Commissioner, or his agent. The permit shall be issued for such periods of time deemed advisable by the Local Department of Health and shall state the conditions under which the material shall be removed and the method of disposal. Any permit may be revoked at any time by the Local Department of Health for sufficient cause.

REGULATION 26. NUISANCE:
Where a nuisance, as defined in Section 3767.13 of the Revised Code of Ohio, is found in any building or upon any ground or premises, a written order to abate such nuisance shall be given by the Board of Health to the owner or occupant of such buildings or premises. The time for compliance therewith shall be specified in the order.

REGULATION 27. UNSPECIFIED:
All other matters and conditions pertaining to Public Health and sanitations within the jurisdiction of the Board of Health of the Mercer County-Celina City General Health District, Ohio, not specifically enumerated in these Regulations shall be governed and regulation according to eh Administrative Code, the Sanitary Code of The Public Health Council of the State of Ohio and the Sanitary Regulations and Standards of the Department of Agriculture of the State of Ohio.

REGULATION 28. PENALTY FOR VIOLATIONS:
Whoever violates any provision of this chapter, or any order or Regulation of the Board of Health made in pursuance therof: or obstructs or interferes with the execution of such order, or willfully or illegally omits to obey such order, shall be fined not to exceed one-hundred (100) dollars or imprisoned for not to exceed ninety (90) days, or both; but shall not be imprisoned under this section for the first offense, and the prosecution shall always be as

and for a first offense, unless the affidavit upon which the prosecution is instituted contains the allegation that the offense is a second or repeated offense. (Section 3707.99 C, of the Revised Code of Ohio.)

REGULATION 29. UNCONSTITUTIONALITY CLAUSES:
That each Regulation, one (1) to twenty-nine (29), both inclusive and every part thereof is hereby declared to be an independent Regulation, and a part of a Regulation, and the holding of any Regulation, or part thereof to be unconstitutional, void, or ineffective for any cause, shall not effect the validity or constitutionality of any other Regulation or part thereof. Should any section, paragraph, sentence, clause or phrase of the regulations be declared unconstitutional or invalid for any reason, the remainder of said Regulations shall not be effected thereby.

These Regulations were passed and adopted by the Board of Health of the Mercer County-Celina City General Health District, Ohio, at its regular meeting on July 7, 1958,and shall be in full force and effect immediately upon their publication as provided by Law.

Signed:
A. J. Rawers, M. D. Secretary

Signed:
Herman H. Leugers President

Appendix F

Aquatic Life Use Designations

Taken from A Guide to Developing Local Watershed Action Plans in Ohio produced by Ohio EPA, Division of Surface Water, June, 1997.

Exceptional Warmwater Habitat is the most biologically productive environment. These waters support unusual and exceptional assemblages of aquatic organisms, which are characterized by a high diversity of species, particularly those that are highly intolerant and/or rare, threatened, endangered or special status. This use represents a protection goal for water resource management efforts dealing with Ohio's best water resources. The standards for ammonia and dissolved oxygen are more stringent than in the other use designations.

Warmwater Habitat defines the typical warmwater assemblage of aquatic organisms for Ohio rivers and streams. It is the principle restoration target for the majority of water resource management efforts in Ohio. Criteria vary by ecoregion and site type.

Modified Warmwater Habitat applies to streams with extensive and irretrievable physical habitat modifications. The biological criteria for warmwater habitat are not attainable. The activities contributing to the modified warmwater habitat designation have been sanctioned and permitted by state or federal law. The representative aquatic assemblages are generally composed of species that are tolerant to low dissolved oxygen, silt, nutrient enrichment and poor habitat quality. The ammonia and dissolved oxygen standards are less stringent than warmwater habitat. There are three subcategories:

Modified Warmwater Habitat-A for those streams affected by acidic mine runoff;
Modified Warmwater Habitat-C for those streams heavily channelized; and
Modified Warmwater Habitat-I for those streams extensively impounded.

The biocriteria are set separately for each subcategory.

Limited Resource Water applies to streams that have drainage areas of less then three square miles and either may lack water on a recurring annual basis, or have been irretrievably altered to the extent that no appreciable assemblages of aquatic life can be supported ; no formal biological criteria are established for the designation.

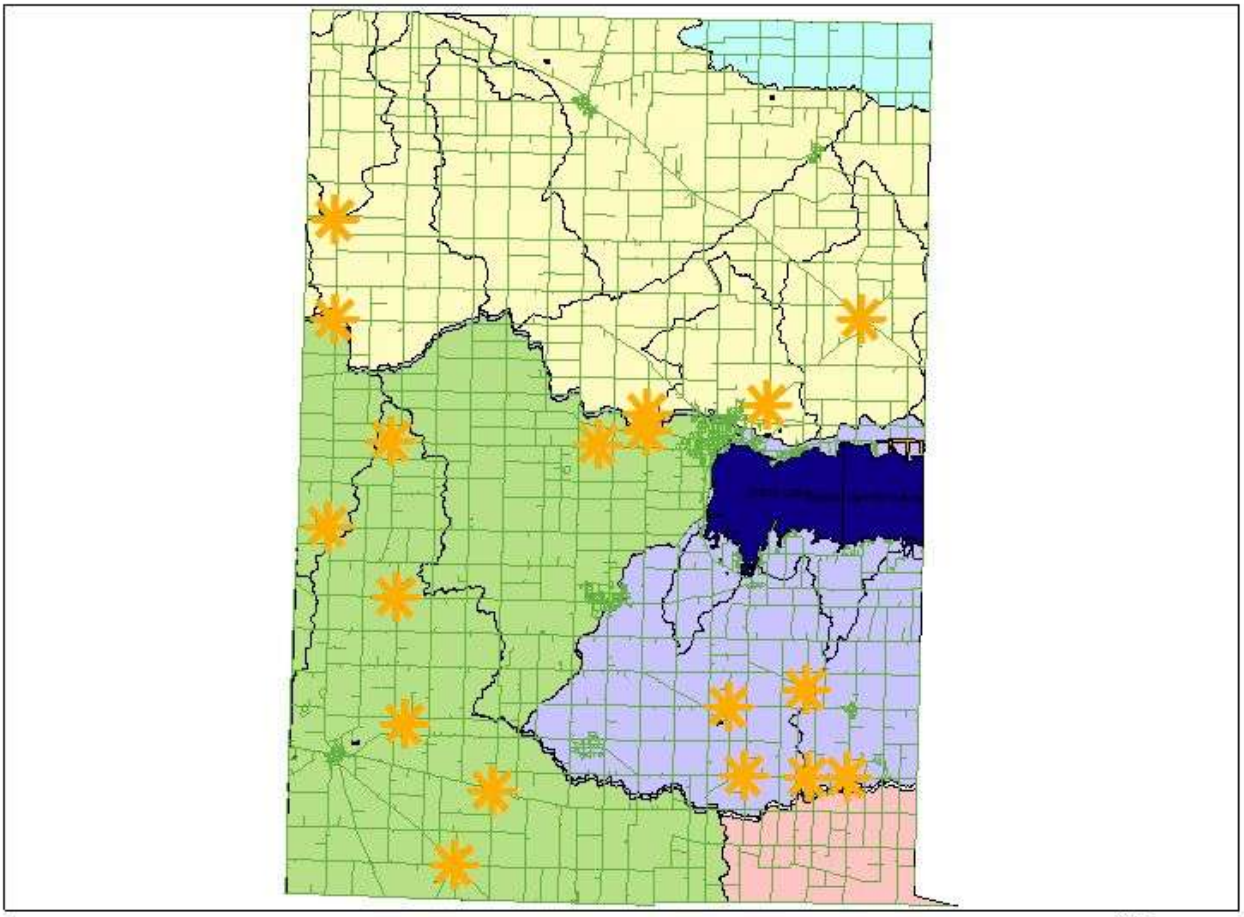
Limited Warmwater Habitat was adopted in 1978 as a temporary variance mechanism for individual segments that had point source discharge problems and as a result could not meet Clean Water Act goals. This designation is being phased out.

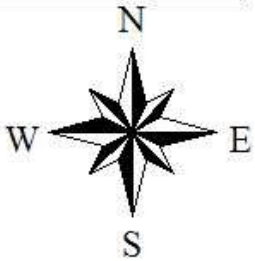
Seasonal Salmonid Habitats are Lake Erie tributaries that support periodic runs of salmonids during the spring, summer and/or fall.

Coldwater Habitat describes waters that support assemblages of coldwater organisms and/or those that are stocked with salmonids with the intent of providing a fishery on a year round basis; it should not be confused with the Seasonal Salmonid.

Appendix G

Critical Areas Map





Loramie Creek

Little Auglaize River

Wabash River

St Marys River

Grand Lake St Marys Watershed

Mercer County Watersheds

Appendix H ~ Local Endorsement Signature Pages

GRAND LAKE/WABASH
WATERSHED ALLIANCE

220 West Livingston Street, Suite 1
Celina, Ohio 45822
(419) 586-3289 (phone)
(419) 586-9599 (fax)

Grand Lake St. Marys/Wabash River
Watershed Action Plan
LOCAL Supporting Organizations/Individuals

Signing this plan signifies your concurrence of the contents of this Watershed Action Plan.

Organization	Printed Name/Title	Signature
GLMC	Linda Conover (Chair)	Linda Conover
Northwood Homeowners Assn	Gerald Conover (Pres)	Gerald Conover
Lake Improvement Assoc.	Bill Ringo, President	Bill Ringo
78 House Rep.	John Adams	[illegible]
State Rep 77	Jim Zehringer	Jim Zehringer
Mercer Co Commissioner	Jerry Laffin	Jerry Laffin
Lake Improvement Assn.	Belinda Froning Secretary	Belinda Froning
Lake Improvement Assn.	Jeffrey L. Ossler	Jeffrey L. Ossler
Lake Improvement Assoc.	Robert Froning Treasurer	Robert Froning
Lake Development Lake Improvement	Robert Grimm	Robert Grimm
Lake Improvement Ass	David Mayer Trustee	David Mayer
Lake Dev Corp	Matt Schwiegerman	Matt Schwiegerman
Com. Development	Kip Wright	Kip Wright
St. Marys Chamber	Kelly Kill	Kelly Kill, Exec Dir.
Aug-Mer CVB	Donna Gribe	Donna Gribe
CVB	Jeni Bertke	Jeni Bertke

GRAND LAKE/WABASH
WATERSHED ALLIANCE

220 West Livingston Street, Suite 1
Celina, Ohio 45822
(419) 586-3289 (phone)
(419) 586-9599 (fax)

Grand Lake St. Marys/Wabash River
Watershed Action Plan
LOCAL Supporting Organizations/Individuals

Signing this plan signifies your concurrence of the contents of this Watershed Action Plan.

Organization	Printed Name/Title	Signature
FSA-USDA	Christopher Gillis Director	
ILWP	Frank Phillips	
LIA	Tony Fielding	
Auglaize County Commissioners	Doug Spencer	
Commissioner	Bob Nuding	BOB NUDING
LDC		J. DON DAVIS
St Marys Boat Club	Commodore	G. Schumacher
Farm Bureau	THERESA HOWICK	Theresa Howick
MERCER CO. COMMISSIONER	JOHN E. BRUNS	John E. Bruns
LIA	Tom Rampe P.E.	Thomas R Rampe
PHEASANTS FOREVER	WILLIAM R. KLAPKE	Wm. R. K
RETIRED	DAVID BRUNSWICK	
ALWSD	ALLEN IMWALLE	Allen Imwalle
State Park	Craig A. Morton Park Man.	
SWCD	Dr. Don Fisher	
SWCD	Robert Pohlman	

GRAND LAKE/WABASH WATERSHED ALLIANCE

220 West Livingston Street, Suite 1
Celina, Ohio 45822
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Organization	Printed Name/Title	Signature
SWCD	RICK MUHLENKAMP	
NRCS	Jim Will D.C.	
CITY OF ST. MARYS	GREG FREEWALT MAYOR	
CITY of ST. MARYS	TODD HEAGLE/DEV. DIRECTOR	
Wright State U.	Bob Hickey	
L.D.C. PRES.	JAMES DABBELT	
Mercer Co Sanitary	Kent Hinton	
LDC	Doug Temple	
LDC	Owen V Hall	
LDC		FRANK C. MURRAY
LDC	Greg Schromm	
LDC	Julie Miller, WSU BEC Dir.	
Community Dev. Services	Ron Puthoff	
East Bank Marina	Dan & Brenda Manning	
OSUE	Todd F. Mangen	
LIA	Vic Woodall	

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Grand Lake St. Marys/Wabash River

Watershed Action Plan

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Organization	Printed Name/Title	Signature
Mercer Co. Health Dept.	Chris Miller, Sanitarian	[illegible] R.S.
Top of Ohio RC&D	Jerry Laffin, Chairperson	Jerry Laffin

Appendix I ~ Auglaize County Ditch Maintenance

2007 DITCH INVENTORY

DITCH	LOCATION	ACCOUNT #	WATERSHED	TILE (miles)	OPEN (miles)	W.WAY (miles)	YEAR BLT	TOTAL COST	CONTRACTOR	AGENCY
BAILEY	CLA-14	400	3864	0.00	4.85	0.00	1974	$ 64,072.07	CLARK	COUNTY
BARNES	VMS	401	1480	0.23	1.23	0.00	1973	$ 23,337.73	KUBA	SCS
BEELER # 1	DUC-9	402	210	0.35	0.00	0.00	1980	$ 11,934.49	TRI-CO	COUNTY
BLACKHOOF	DUC-13	403	10442	0.00	0.78	0.00	1975	$ 16,585.02	MARTIN	COUNTY
BLACKHOOF #2	DUC-13	403		0.00	0.55	0.00	1995		SCHAUB	GROUP
GREVE	CLA-22	404	181	0.35	0.00	0.35	1986	$ 8,124.68	GENE TOPP	SCS
BRACKNEY	CLA-4	405	1900	0.66	2.30	0.00	1980	$ 55,937.32	METZGER & CROOKS	COUNTY
GRASSLEY LINK	LOG-9	406	2598	0.00	2.65	0.00	1985	$ 41,964.99	ROSENGARTEN	COUNTY
MOORMAN	UNI-6	407	79	0.71	0.00	0.00	1987	$ 12,294.82	SANDKUHL	COUNTY
CLEAR CREEK	WAS-14	408	8011	0.00	3.97	0.00	1976	$ 82,915.12	CLARK	COUNTY
COOK	STM-4	409	1914	1.27	1.00	0.00	1981	$ 184,396.74	SCHWIETERMAN & CROOKS	COUNTY
CRAFT #1	NOB-7	410	738	0.00	0.63	0.00	1975	$ 6,358.50	BLANK	SCS
CRIDER	DUC-34	411	11	0.28	0.00	0.00	1982	$ 13,783.81	GASSER	COUNTY
DABBELT	NOB-28	412	354	0.19	0.57	0.00	1979	$ 16,594.14	BRITENRICKER	SCS
WATERMAN	STM-1	413	15	0.15	0.00	0.06	1986	$ 7,659.12	BERNING & HOELSCHER	COUNTY
DOERING	MOU-14	414	339	0.00	0.44	0.00	1976	$ 2,967.00	SCHAUB	SCS
DOSHE	NOB-30	415	596	1.38	1.07	0.00	1976	$ 10,350.25	BRITENRICKER	SCS
EMERSON	UNI-33	416	223	0.00	0.15	0.00	1976	$ 1,727.38	COOK	COUNTY
FRAZIER # 1	DUC-3	417	175	0.01	0.00	0.00	1968	$ 2,107.50	SOMMERS	COUNTY
FRAZIER # 2	DUC-4	418	966	0.00	0.46	0.00	1970	$ 2,791.95	FEW	COUNTY
GRASSLEY	LOG-9	419	1030	0.00	1.19	0.00	1978	$ 14,128.79	KUBA	COUNTY
GUTMAN # 1	CLA-15	420	237	0.07	0.24	0.07	1982	$ 10,125.00	KUBA	SCS
HAUFHAUS	JAC-25	421	749	0.00	1.33	0.00	1980	$ 11,828.26	SCHWIETERMAN	SCS
HEIDT	STM-23	422	929	0.00	1.02	0.00	1960	$ 6,619.77	DEERHAKE	COUNTY
HEINRICH	WAS-6	423	125	0.24	0.00	0.00	1981	$ 9,930.50	SCHWIETERMAN	COUNTY
HEMMERT	PUS-29	424	266	0.00	0.75	0.00	1979	$ 8,004.00	BRITENRICKER	SCS
HOWELL	WAY-4	425	5072	0.20	8.84	0.18	1980	$ 131,339.07	CLARK	SCS
HUNT	MOU-7	426	208	0.28	0.00	0.28	1973	$ 12,239.82	HOWARD	COUNTY
DAVIS JOINT	UNI-6	427	73	0.16	0.00	0.00	1985	$ 6,829.21	SANDKUHL	COUNTY
GRUBBS	LOG-34	428	431	0.00	0.11	0.00	1987	$ 2,634.50	ROSENGARTEN	SCS
KAISER	JAC-20	429	1039	0.00	1.37	0.00	1983	$ 21,521.48	CROOKS	COUNTY
KAUFMAN	STM-3	430	364	0.00	0.73	0.00	1973	$ 6,502.75	KUBA	COUNTY
KLAUS	SAL-23	431	37	0.06	0.00	0.00	1983	$ 1,916.25	BRUNS	COUNTY
WARNER	STM-25	432	332	0.15	0.00	0.00	2002	$ 15,268.32	SCHWIETERMAN	SCS
HENGSTLER	MOU-32	433	70	0.44	0.00	0.20	1987	$ 13,818.48	ART HAEHN	COUNTY
KLOSTERMAN	MOU-30	434	240	0.00	0.57	0.00	1977	$ 2,945.00	BRITENRICKER	SCS
LOTRIDGE # 1	UNI-34	435	63	0.06	0.00	0.00	1983	$ 1,876.00	BERNING	COUNTY
LHAMON	NOB-27	436	200	0.00	1.00	0.00	1975	$ 13,816.40	BRITENRICKER	COUNTY
MCNAME-PETERSEN BR	DUC-31	437	299	0.00	0.41	0.00	1973	$ 3,415.52	FEW	COUNTY
MCNAME-PHILLIPS BR	LOG-1	438	911	0.00	1.18	0.00	1972	$ 9,452.79	COOK	COUNTY
METZ	UNI-24	439	9646	0.00	8.41	0.00	1969	$ 67,803.08	KUBA	SCS

2007 DITCH INVENTORY

DITCH	LOCATION	ACCOUNT #	WATERSHED	TILE (miles)	OPEN (miles)	W.WAY (miles)	YEAR BLT	TOTAL COST	CONTRACTOR	AGENCY
MOELLER	GER-16	440	139	0.13	0.00	0.13	1981	$ 6,963.60	BAYLESS	COUNTY
MOSLER	DUC-34	441	7	0.01	0.00	0.00	1979	$ 316.00	REICHERT	COUNTY
PLACE	LOG-28	442	692	0.00	1.69	0.00	1976	$ 16,476.68	BLANK	SCS
VORNHOLT	STM-19	443	244	0.01	0.44	0.00	1987	$ 13,907.50	ROSENGARTEN	COUNTY
PORTER-LATERAL	WAY-3	444	882	0.06	1.16	0.00	1982	$ 27,179.47	GASSER	COUNTY
POTTS	NOB-13	445	606	0.00	1.33	0.00	1979	$ 10,953.00	MACK	SCS
PUSHETA	CLA-21	446	7345	0.35	5.07	0.35	1978	$ 132,383.82	CLARK & SOMMERS	COUNTY
RAMGA	LOG-35	447	527	0.01	0.68	0.00	1983	$ 9,861.09	GASSER	COUNTY
SEIBERT	SAL-3	448		0.00	0.28	0.00	1980		KUBA	GROUP
REICHELDERFER	DUC-33	449	755	0.00	1.27	0.00	1968	$ 7,080.80	SCHWIETERMAN	COUNTY
RITCHIE # 1	UNI-17	450	106	0.21	0.83	0.00	1973	$ 5,468.03	COOK	COUNTY
ROEDIGER # 1	MOU-28	451	480	0.12	0.54	0.00	1974	$ 17,257.10	KUBA	COUNTY
ROHRBAUGH-SEVERT #1	NOB-25	452	975	0.00	2.28	0.00	1980	$ 21,926.66	BRITENRICKER	SCS
ST. JOE	UNI-25	453	3132	0.00	3.27	0.00	1960	$ 22,455.11	HOWELL	COUNTY
ST. JOHNS	CLA-5	454	4	0.11	0.00	0.00	1982	$ 7,129.21	GASSER	COUNTY
SWARTZ-POHLMAN	SAL-21	455	230	1.02	0.00	0.00	1970	$ 7,432.67	DAVENPORT	COUNTY
SELLERS # 1	DUC-2	456	554	0.27	0.00	0.27	1976	$ 19,660.50	JAUERT	COUNTY
SHAFFER	SAL-36	457	597	0.00	0.57	0.00	1980	$ 4,804.00	MACK	SCS
SHEARER # 1	DUC-18	458	1178	0.00	0.80	0.00	1960	$ 12,727.86	WICAL	COUNTY
SIX MILE	MOU-20	459	844	0.00	0.64	0.00	1960	$ 6,421.64	DEERHAKE	COUNTY
SPRAGUE	DUC-32	460	744	0.00	0.09	0.00	1959	$ 2,855.39	MILLER	COUNTY
SPRAY	SAL-5	461	262	0.00	0.25	0.00	1969	$ 2,825.76	SCHWIETERMAN	COUNTY
SWARTZ JOINT (LOGAN CO.)	GOS-7	462	589	0.00	1.22	0.00	1976	$ 10,882.26	BRITENRICKER	COUNTY
THRUSH	UNI-36	463	2155	0.05	3.46	0.00	1982	$ 40,331.23	CROOKS	COUNTY
KANTNER	STM-5	464	18	0.15	0.03	0.00	1973	$ 8,221.59	AUGLAIZE COUNTY	COUNTY
WALLACE FORK # 1	WAY-22	465	3134	0.00	3.82	0.00	1981	$ 43,749.60	GASSER	SCS
WAESCH	STM-16	466	382	0.00	0.39	0.00	1982	$ 6,437.50	JAUERT	SCS
WARMAN #1	NOB-21	467	2567	0.00	5.29	0.00	1978	$ 57,611.67	KUBA	COUNTY
WERNER #1	SAL-4	468	635	0.00	1.13	0.00	1978	$ 8,205.00	BRITENRICKER	SCS
WESTBAY	PUS-14	469	18	0.13	0.00	0.00	1983	$ 5,095.19	SANDKUHL	COUNTY
WIERWILLE	WAS-4	470	560	0.00	0.50	0.00	1983	$ 6,696.00	KUBA	SCS
WRIGHT # 1	SAL-27	471	1198	0.00	1.74	0.00	1960	$ 14,110.40	COOK	COUNTY
WUEBKER	GER-13	472	442	0.35	0.19	0.00	1980	$ 14,414.04	TRI-CO	COUNTY
YOUNG	LOG-31	473	524	1.20	0.00	0.43	1984	$ 36,625.48	TRI-CO	COUNTY
HERBST	MOU-20	474	183	0.00	0.14	0.00	1983	$ 2,338.80	SCHAUB	SCS
BLASE	STM-30	475	700	0.38	0.25	0.08	1983	$ 27,748.52	SCHWEITERMAN	SCS
FLEDDERJOHANN	STM-14	476	287	0.00	0.08	0.00	1984	$ 706.30	TOPP	SCS
SELLERS # 2	DUC-1	477	91	0.78	0.00	0.00	1984	$ 21,755.98	SCHWEITERMAN	COUNTY
BUSH #1	CLA-7	478	371	0.18	0.09	0.00	1984	$ 8,436.66	KAHLIG	SCS
KAECK	PUS-21	479	197	0.30	0.06	0.21	1983	$ 12,082.26	TRI-CO	SCS
MCCUNE	NOB-7	480	77	0.75	0.00	0.00	1984	$ 4,473.90	BRUNS	COUNTY

2007 DITCH INVENTORY

DITCH	LOCATION	ACCOUNT #	WATERSHED	TILE (miles)	OPEN (miles)	W.WAY (miles)	YEAR BLT	TOTAL COST	CONTRACTOR	AGENCY
MEYER #1	STM-9	481	220	0.56	0.00	0.00	1984	$ 22,286.00	TRI-CO	SCS
MILLER	DUC-16	482	217	0.00	0.45	0.00	1984	$ 5,518.57	CALVELAGE	SCS
GOSSARD VILLA NOVA	STM-5	483	4	0.20	0.00	0.00	1984	$ 12,378.77	SOMMERS	COUNTY
MALLORY	SAL-33	484	1068	0.00	1.21	0.00	1985	$ 17,475.75	CALVELAGE	SCS
CLAUSE	SAL-35	485	2820	0.00	0.43	0.00	1985	$ 5,611.02	CALVELAGE	SCS
GEIGER-DOSECK	NOB-35	486	213	0.00	0.80	0.00	1985	$ 15,691.31	THEOBALD	COUNTY
MUCHINNIPPI	WAY-20	487	11480	0.00	5.94	0.00	1983	$ 92,406.66	KUBA	SCS
SCHULTZ	MOU-32	488	312	0.00	0.72	0.00	1985	$ 9,995.84	CALVELAGE	SCS
SIMMS-MINNICH	MOU-27	489	637	0.00	0.96	0.00	1985	$ 10,717.70	GASSER	SCS
SWARTZ JT W/VAN WERT	SAL-21	490	2094	0.00	3.43	0.00	1984	$ 32,468.19	LIEBRECHT	COUNTY
RITCHIE # 2	CLA-24	491	585	1.00	0.18	0.00	1985	$ 31,381.18	SANDKUHL	SCS
THIEMAN	JAC-28	492	1099	0.94	0.00	0.00	1985	$ 73,143.00	BRUNS	COUNTY
DOORLEY	MOU-28	493	370	1.04	0.25	0.00	1986	$ 24,797.48	TRI-CO	COUNTY
HUFFMAN RUN #1	UNI-27	494	143	0.33	0.00	0.08	1986	$ 14,311.82	TRI-CO	COUNTY
ROEDIGER # 2	MOU-24	495	169	0.26	0.08	0.00	1986	$ 7,237.61	SANDKUHL	SCS
HENKENER	WAS-14	496	401	0.58	0.59	0.00	1986	$ 14,907.07	SANDKUHL	SCS
BASHORE	NOB-23	497	342	0.00	0.95	0.00	1986	$ 16,240.62	ROSENGARTEN	SCS
HABERKAMP	WAS-20	498	225	0.00	0.27	0.00	1986	$ 5,715.00	SCHAUB	COUNTY
MILE CREEK	JAC-7	499	5631	0.00	1.34	0.00	1983	$ 64,981.75	CLARK	COUNTY
BAUER	UNI-19	700	94	0.28	0.09	0.00	1987	$ 12,355.65	SCHWIETERMAN	SCS
FOLTZ	LOG-5	701	692	0.00	1.93	0.00	1987	$ 35,906.50	ROSENGARTEN	SCS
HAGUE	MOU-36	702	24	0.06	0.00	0.00	1987	$ 4,138.20	SANDKUHL	COUNTY
HECHT	NOB-33	703	123	0.26	0.00	0.00	1987	$ 6,400.56	SCHWEITERMAN	SCS
HUSSEY	NOB-19	704	2421	0.00	1.79	0.00	1987	$ 35,285.40	B&L	SCS
RITTER	MOU-13	705	343	0.51	0.00	0.00	1987	$ 8,893.90	METZGER	SCS
VIRGINIA CREEK	UNI-5	706	4258	0.57	1.89	0.00	1987	$ 64,024.48	B&L	SCS
WERNER #2	SAL-33	707	993	0.00	0.69	0.00	1987	$ 12,908.80	THEOBALD	SCS
WIERTH	GER-10	708	3175	0.00	2.77	0.00	1987	$ 70,213.77	GASSER	COUNTY
WRIGHT #2	SAL-27	709	185	0.00	0.55	0.00	1987	$ 8,934.30	THEOBALD	SCS
BENZING	SAL-6	710	579	0.48	0.68	0.00	1988	$ 24,318.45	KAHLIG	SCS
CRAFT #2	NOB-18	711	489	1.35	0.00	0.00	1988	$ 57,580.33	KAHLIG	SCS
CRIDER #2		712								
CROW	MOU-13	713	183	0.28	0.08	0.00	1988	$ 7,645.33	METZGER	SCS
TODD	LOG-4	714	248	0.51	0.00	0.00	1989	$ 14,564.89	SANDKUHL	SCS
TULLEY	UNI-8	715	308	0.33	0.00	0.33	1988	$ 12,378.77	BUXTON	COUNTY
WISSMAN #1	LOG-6	716	797	0.12	0.63	0.00	1989	$ 17,823.39	CALVELAGE	SCS
TAYLOR	MOU-16	717	160	0.19	0.00	0.11	1989	$ 8,443.10	SANDKUHL	SCS
FISHER	MOU-29	718	68	0.00	0.30	0.00	1989	$ 4,002.33	CALVELAGE	SCS
TROTTER	LOG-4	719	312	0.13	0.00	0.00	1990	$ 6,347.23	KAHLIG / B&L	SCS
SPANGLER	GOS-27	720	134	0.00	0.48	0.00	1989	$ 6,560.00	REICHERT	GROUP
CLOVER	NOB-35	721	797	1.80	1.82	0.00	1990	$ 50,493.15	B&L	SCS

2007 DITCH INVENTORY

DITCH	LOCATION	ACCOUNT #	WATERSHED	TILE (miles)	OPEN (miles)	W.WAY (miles)	YEAR BLT	TOTAL COST	CONTRACTOR	AGENCY
OPPERMAN	PUS-19	722	80	0.44	0.00	0.00	1990	$ 5,426.30	SCHWIETERMAN	GROUP
SCHNEIDER	DUC-33	723	162	0.76	0.14	0.00	1990	$ 102,747.00	SCHAUB	COUNTY
AKERS	WAY-14	724	3282	0.27	7.14	0.00	1991	$ 103,021.41	J/B MAINTENANCE	SCS
HOLTHAUS	LOG-4	725	193	0.45	0.00	0.06	1990	$ 10,608.74	METZGER	SCS
WERLING	PUS-12	726	135	0.46	0.00	0.00	1990	$ 7,847.29	TOPP	SCS
GUTMAN #2	CLA-15	727	200	0.44	0.00	0.00	1990	$ 12,996.60	TOPP	SCS
WALLACE FORK #2	WAY-11	728	1174	0.27	1.26	0.00	1994	$ 83,354.81	C.SCHWEIT. & MCADAMS	COUNTY
WAYNESFIELD WEST	WAY-20	729		0.87	0.07	0.27	1990	$ 72,447.00	SCHAUB	COUNTY
MIAMI & ERIE CANAL	JAC-34	730	2284	0.00	1.97	0.00	1992	$ 90,000.00	ROSENGARTEN	COUNTY
GRAY-HARROD	GOS-31	731	513	0.00	0.28	0.00	1991	$ 15,520.87	WILLIAMS	SCS
KRITES	DUC-29	732	12	0.03	0.00	0.05	1992	$ 3,566.31	SCHAUB	COUNTY
POND VIEW ESTATES - POND	NOB-27	733	40	0.51	0.00	0.00	1992	$ 3,000.00	ARNETT	COUNTY-SUBDIVISION
ROHRBAUGH-SEVERT #2	NOB-36	734	259	0.32	0.00	0.00	1992	$ 13,204.12	KAHLIG	SCS
KNAPKE	JAC-30	735	649	1.38	0.11	0.00	1992	$ 77,364.16	HEITKAMP	SCS
EGLEY	SAL-25	736	1986	0.00	1.78	0.00	1993	$ 50,396.71	ROSENGARTEN	SCS
EISERT	PUS-21	737	460	0.00	1.30	0.00	1992	$ 10,832.99	CALVELAGE	SCS
NEELEY	STM-16	738	583	0.00	0.68	0.00	1992	$ 13,881.86	ROSENGARTEN	SCS
BEENER	STM-5	739	9	0.22	0.00	0.03	1992	$ 7,284.70	COUNTY	COUNTY
DOSECK # 2	NOB-34	740	229	0.00	0.31	0.00	1993	$ 5,565.48	ALL PURPOSE	COUNTY
PRICE	CLA-6	741	80	0.00	0.00	0.11	1992	$ 3,391.58	REICHERT	COUNTY
EISLEY	LOG-29	742	517	0.00	0.68	0.00	1994	$ 14,748.93	ROSENGARTEN	SCS
ALLMAN	STM-17	743	673	0.52	0.25	0.00	1993	$ 48,257.74	HEITKAMP	SCS
ELSASS	CLA-19	744	269	0.00	0.71	0.00	1995	$ 15,926.84	B&L	SCS
COMUS	STM-5	745	4	0.08	0.00	0.08	1994	$ 14,155.00	JOHNSON	COUNTY
LIMBERT	PUS-24	746	508	0.22	0.00	0.00	1993	$ 12,446.62	SCHWIETERMAN	SCS
SANTOMIERI	PUS-28	747	193	0.00	0.27	0.00	1994	$ 2,838.00	MATT SCHWIETERMAN	GROUP
BERGMAN-WERNER	NOB-9	748	389	1.17	0.00	0.00	1994	$ 65,005.66	KAHLIG	SCS
OWL CREEK - HEADAPOHL	WAS-13	749	204	0.00	0.22	0.00	1995	$ 9,975.45	SCHAUB	GROUP
KUEST	GER-17	750	454	1.55	0.00	0.00	1996	$ 53,782.95	KAHLIG	SCS
ROGERS	CLA-8	751	77	0.62	0.00	0.00	1996	$ 20,671.06	SCHWEITERMAN	SCS
VONDENHUEVEL	GER-17	752	463	0.45	0.09	0.00	1995	$ 39,333.44	HEITKAMP	SCS
KELLERMEYER	STM-14	753	367	0.00	0.16	0.00	1995	$ 3,496.80	REICHERT	GROUP
MEYER # 2	STM-9	754	30	0.02	0.00	0.00	1996	$ 644.00	GENE TOPP	COUNTY
COGAN	NOB-32	755	115	0.00	0.27	0.00	1996	$ 2,929.80	ODOT	GROUP
EVANS	UNI-34	756	110	0.17	0.00	0.00	1996	$ 10,816.25	SCHWEITERMAN	COUNTY
SCHAUB	DUC-22	757	84	0.00	0.30	0.00	1996	$ 12,200.50	ROSENGARTEN	COUNTY
SPENCER-GRAY	GOS-31	758	186	0.59	0.00	0.00	1996	$ 22,761.20	KAHLIG	SCS
ROHRBAUGH-SEVERT # 3	NOB-36	759	266	0.35	0.00	0.00	1996	$ 18,397.20	SCHWIETERMAN	SCS
HABERKAMP-JETT	WAS-21	760	266	0.46	0.06	0.00	1996	$ 24,062.68	GERDING	SCS
SPRINGER-SIMMS	MOU-22	761	212	0.19	0.00	0.00	1996	$ 8,187.85	GERDING	SCS
HUFFMAN RUN #2	UNI-17	762	1598	0.00	3.40	0.00	1997	$ 39,784.73	REICHERT	COUNTY

DITCH	LOCATION	ACCOUNT #	WATERSHED	TILE (miles)	OPEN (miles)	W.WAY (miles)	YEAR BLT	TOTAL COST	CONTRACTOR	AGENCY
WIESENMAYER	CLA-19	763	511	0.49	1.13	0.00	1997	$ 41,557.91	B&L/KAHLIG + COUNTY	SCS
SPENCER-BROWN	GOS-6	764	269	0.26	0.00	0.00	1997	$ 12,739.28	KAHLIG	GROUP
KERR	VMS	765	2226	0.00	3.49	0.00	1997	$ 33,674.73	MCADAMS	SCS
HEIDT #2	STM-23	766	263	0.15	0.00	0.00	1998	$ 8,095.98	SCHWIETERMAN	GROUP
WILDERNESS TRAILS - POND	DUC-20	767	36	0.75	0.00	0.00	1996	$ 31,500.00	SCHAUB/GALLESPIE	COUNTY-SUBDIVISION
BEELER #2	DUC-9	768	166	0.17	0.00	0.00	1998	$ 16,155.25	HEMLEBEN	COUNTY
RUCK	PUS-15	769	65	0.23	0.00	0.12	1998	$ 17,264.98	HEMLEBEN	COUNTY
SCHAUB-HELMLINGER	CLA-28	770	385	0.50	0.06	0.00	1998	$ 30,533.70	SCHWIETERMAN	GROUP
FLEDDERJOHANN-HEIDT	STM-23	771	329	1.13	0.00	0.00	1998	$ 32,098.32	SCHWIETERMAN	SCS
IMWALLE-LHAMON	NOB-28	772	176	0.82	0.00	0.00	1998	$ 25,017.67	SCHWIETERMAN	SCS
PRAIRIE CREEK	LOG-	773	8362	0.00	5.08	0.00	1998	$ 65,899.85	MCADAMS	COUNTY
HUENKE	STM-33	774	603	0.00	1.04	0.00	1999	$ 29,651.89	SCHAUB + COUNTY	SCS
BUSH #2	CLA-5	775	192	0.65	0.00	0.00	1999	$ 30,882.50	SCHWIETERMAN	COUNTY
KILGER	NOB-17	776	410	0.64	0.72	0.00	1999	$ 40,940.32	KENT BYRNE EXCAVATING	COUNTY
HEINTZ	CLA-30	777	305	1.09	0.00	0.00	1999	$ 66,110.09	SCHWIETERMAN	SCS
BUCK	STM-11	778	308	0.56	0.00	0.00	1999	$ 30,919.92	MARIA STEIN TRENCHING	SCS
KEMMANN	SAL-4	779	167	0.62	0.00	0.00	1999	$ 38,545.55	SCHWIETERMAN	SCS
RAPP-KILL	LOG-6	780	434	0.42	0.00	0.00	1999	$ 29,290.33	SCHWIETERMAN + COUNTY	SCS
BERG-BAUER	UNI-29	781	321	1.22	0.10	0.00	2000	$ 78,159.35	SCHWIETERMAN	SCS
CISCO	NOB-20	782	1204	0.00	1.31	0.00	2000	$ 32,661.30	ROSENGARTEN	SCS
SHIPP	CLA-23	783	166	0.28	0.00	0.00	2000	$ 13,259.16	SCHWIETERMAN	GROUP
WISSMAN #2	LOG-7	784	416	0.86	0.00	0.00	2000	$ 64,384.53	MARIA STEIN TRENCHING	SCS
DRY RUN	PUS-12	785	394	0.00	0.60	0.00	2000	$ 11,440.00	SCHAUB	GROUP
HAUSS	DUC-10	786	114	0.40	0.00	0.00	2000	$ 23,962.09	SCHWIETERMAN	SCS
BREWER	NOB-	787	232	0.20	0.00	0.25	2000	$ 33,132.04	SCHWIETERMAN	COUNTY
SUDMAN	STM-1	788	318	0.00	0.30	0.32	2000	$ 15,908.54	MCADAMS	COUNTY
MOELLER #2	GER-15	789	128	0.17	0.00	0.00	2000	$ 7,153.00	TOPP	COUNTY
KOHLER #1	WAS-3	790	368	0.00	0.18	0.00	2001	$ 3,593.00	REICHERT	GROUP
KOHLER #2	WAS-3	791	166	0.00	0.51	0.00	2001	$ 5,927.60	REICHERT	GROUP
KOHLER #3	WAS-3	792	210	0.00	0.73	0.00	2001	$ 13,807.98	REICHERT	GROUP
EGLEY #2	SAL-23	793	789	0.00	0.97	0.00	2001	$ 28,551.45	TOPP	COUNTY
STEINEMAN	JAC-33	794	218	1.02	0.00	0.00	2001	$ 57,375.02	MARVIN KAHLIG	SCS
COPELAND	CLA-2	795	482	1.00	0.15	0.00	2001	$ 62,572.50	GERDING	COUNTY
BENZING #2	NOB-7	796	331	1.00	0.00	0.00	2001	$ 52,286.68	SCHWIETERMAN	SCS
SCHOLL	LOG-30	797	265	0.92	0.00	0.00	2001	$ 34,198.78	MARIA STEIN TRENCHING	SCS
BILLS	MOU-32	798	250	0.55	0.10	0.00	2001	$ 27,747.11	GALLASPIE	SCS
ST. MARYS RIVER	STM-10	799		0.00	23.00	0.00	1996	$ 795,830.37	FLEMING	SCS
WINNERS	JAC-31	800	945	1.14	0.19	0.00	1993	$ 83,752.17	KAHLIG	SCS
KAISER #2	JAC-20	801	347	0.46	0.00	0.00	2002	$ 38,366.20	SCHWIETERMAN	GROUP
SPRAY #2	SAL-5	802	233	0.15	0.00	0.12	2002	$ 9,442.16	GALLASPIE	SCS
BLEW	STM-6	803	132	1.47	0.00	0.14	2002	$ 132,785.00	GERDING DITCHING	COUNTY

2007 DITCH INVENTORY

DITCH	LOCATION	ACCOUNT #	WATERSHED	TILE (miles)	OPEN (miles)	W.WAY (miles)	YEAR BLT	TOTAL COST	CONTRACTOR	AGENCY
SMITH	DUC	804	54	0.24	0.00	0.16	2003	$ 15,765.00	SAND RIDGE EXCAVATING	SCS
COOK #2	STM	805	222	0.13	0.21	0.10	2003	$ 19,890.05	SAND RIDGE EXCAVATING	COUNTY
VOGEL	NOB	806	58	0.24	0.00	0.00	2003	$ 12,190.00	SCHWIETERMAN	SCS
KING	PUS	807	280	0.75	0.00	0.00	2004	$ 47,019.29	SCHWIETERMAN	SCS
KELLY	MOU	808	265	0.26	0.00	0.00	2004	$ 20,557.00	SCHWIETERMAN	SCS
WARMAN #2	NOB	809	231	0.12	0.00	0.00	2004	$ 10,389.00	SCHWIETERMAN	SCS
DANAHER	SAL	810	504	0.39	0.00	0.00	2004	$ 53,051.72	SCHWIETERMAN	COUNTY
PARKER	STM	811	29	0.37	0.00	0.00	2004	$ 54,513.50	SUTTER EXCAVATING	COUNTY
KNUEVE	PUS	812	174	0.57	0.00	0.00	2004	$ 24,880.19	VTF EXCAVATING	SCS
SOUTH RIDGE SUBDIVISION POND	DUC	813	0	0.00	0.00	0.00	2004	$ 20,000.00	BINKLEY-HUT DEVELOPERS	COUNTY-SUBDIVISION
SUMMERCHASE SUBDIVISION	DUC	814	0	0.00	0.00	0.00	2006	$ 20,000.00	BINKLEY-HUT DEVELOPERS	COUNTY-SUBDIVISION
WERST	MOU	815	77	0.57	0.00	0.25	2004	$ 26,005.91	GERDING DITCHING	SCS
SELLERS #3	DUC	816	73	0.46	0.00	0.00	2004	$ 21,376.00	GERDING DITCHING	COUNTY
LOTRIDGE	UNI	817	565	2.42	0.00	0.00	2004	$ 131,377.28	GERDING DITCHING	SCS
MUSSER	CLA	818	197	0.50	0.00	0.00	2004	$ 32,235.28	GERDING DITCHING	COUNTY
ALLMAN #2	STM	819	494	0.96	0.00	0.00	2005	$ 66,928.66	VTF EXCAVATING	SCS
SCHLEGELMILCH	STM	820	111	0.73	0.00	0.00	2005	$ 29,997.08	GENE TOPP	SCS
DOWNEY	SAL	821	188	0.22	0.10	0.00	2005	$ 19,333.11	VTF EXCAVATING	SCS
GRUBBS #2	LOG	822	421	0.90	0.00	0.00	2005	$ 46,793.29	VTF EXCAVATING	SCS
REICHELDERFER #2	DUC	823	325	0.26	0.00	0.00	2005	$ 19,810.51	GALLASPIE	SCS
OAKWOOD DRIVE	STM	824	5	0.11	0.00	0.00	2005	$ 8,490.00	SUTTER EXCAVATING	COUNTY
WILKER	STM	825	82.7	0.19	0.00	0.00	2006	$ 12,967.99	SCHWIETERMAN	SCS
SOMMER	JAC	826	206.117	0.65	0.00	0.00	2006	$ 48,955.39	SCHWIETERMAN	SCS
HENSCHEN	WAS	8XX	221	0.50	0.68	0.00	2007	$ 60,087.09	VTF EXCAVATING	SCS
NIELSEN	WAY	8XX	94.42	0.41	0.22	0.00	2007	$ 29,265.86	SAND RIDGE EXCAVATING	COUNTY
SHAW	UNI	8XX	325	1.30	0.00	0.12	2007	$ 87,750.25	BIDDING	COUNTY
ARNOLD	NOB	8XX	76.66	0.40	0.00	0.00	2007	$ 20,279.97	BIDDING	SCS
RAMGA #2	ON GOING	SCS								
IOOF DITCH	ON GOING	SCS								
HOLLMAN	ON-GOING	COUNTY								
RON SPENCER	ON-GOING	COUNTY								
STONER	ON GOING	COUNTY								
FREEMAN	ON-GOING	COUNTY								
WAYNESFIELD SCHOOL	ON-GOING	COUNTY								
SIMMS RUN	ON-GOING	COUNTY								
ZINK (EISERT EXTENSION)	ON-GOING	COUNTY								
BARNT	ON-GOING	COUNTY								

DITCH	LOCATION	ACCOUNT #	WATERSHED	TILE (miles)	OPEN (miles)	W.WAY (miles)	YEAR BLT	TOTAL COST	CONTRACTOR	AGENCY
			TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL		
			WATERSHED	TILE	OPEN	WATERWAY	MAINTAINED	ASSESSED		
			(ACRES)	(MILES)	(MILES)	(MILES)	MILEAGE			
			183090.897	71.37	181.00	5.31	257.68	$ 6,870,374.11		

Appendix J ~ Wabash Conservancy District Maintenance

Appendix K ~ Sediment Trap Monitoring Chart

Sediment Trap Tracking					
Trap Location	Date Constructed	Monitor Date		Notes	
		Sediment Depth			
Barnes Creek	9/21/2006	2/10/2007	4/23/2007	2/10/2007	
South end (20' north of south stakes)		none	32"	Clear water	
Center (east of propane tank next to garage)		13"	13"	8 - 10" of ice	
North end (20' south of north stakes)		7"	22"		
Beaver Creek	1/5/2007	2/10/2007	5/1/2007	2/10/2007	5/1/2007
South end (20 yrds north of south stake)		16"	12"	Very odd green water color water	Hard sandy bottom throughout creek
Center (west of Nick Jutte's porch)		2"	22"	8 - 10" of ice	Good depth from sediment trap north to bridge at St Rt 219
North end (20 yrds south of north stake)		4"	14"		
Big Chickasaw Creek	12/15/2006	2/10/2007	5/14/2007	2/10/2007	
South end (1st telephone pole south of St Rt 219)		none	9"	Clear water	
Center (mouth of newest channel to the south)		26"	3"	8 - 10" of ice	
North (mouth of newest channel to the north)		54"	13"		
Riley Bay Creek	1/22/2007	2/10/2007		2/10/2007	
South end (private property sign on west side)		60"		4th sample taken out in Riley Bay 80" silt	
Center (south edge of west boat dock)		60"		Silt coming in from lake	
North end (tree on west near boat ramp)		62"		Need to take multiple soundings throughout Riley Bay	
Strasburg Park Creek	8/??/2007	2/10/2007	5/3/2007	2/10/2007	5/3/2007
South end (10 yrds north of west tree)		24"	5"	Clear water	26" - 28" of sediment south of St Rt 219 were it had been dug a couple of yrs ago
Center (15 yrds south of south sounding)		19"	12"	8- 10" ice	
North end (due west of grey shed doors)		13"	7"		

Appendix L ~ Amendments (reserved)

GRAND LAKE/WABASH
WATERSHED ALLIANCE

Watershed Action Plan

Endorsed May 14, 2008

GRAND LAKE/WABASH
WATERSHED ALLIANCE

Watershed Action Plan

Endorsed May 14, 2008

GRAND LAKE/WABASH
WATERSHED ALLIANCE

Watershed Action Plan

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