Nine-Element Nonpoint Source Implementation Strategy (NPS-IS) for Blierdofer Ditch HUC-12 (04100004 02 03)

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Acronyms and Abbreviations

The acronyms and abbreviations below are commonly used by organizations working to restore Ohio's watersheds and are found throughout this NPS-IS document.

Numbers	
§319	Section 319 of the Clean Water Act
A	
ALU	Aquatic Life Use
B	
BMP	Best Management Practice
C	
CAFF	Confined Animal Feeding Facility
CRP	Conservation Reserve Program
CSA	Critical Sewage Area
CTIC	Conservation Tillage Information Center
D	
DAP	Domestic Action Plan
E	
EPT	*Ephemeroptera, Trichoptera* and *Plecoptera* – sensitive macroinvertebrate species
EQIP	Environmental Quality Incentives Program
F	
FLS	Federally Listed Species
G	
GLC	Great Lakes Commission
GLRI	Great Lakes Restoration Initiative
GLWQA	Great Lakes Water Quality Agreement
H	
H2Ohio	H2Ohio Initiative (Ohio state funding mechanism for water quality improvement)
HAB	Harmful Algal Bloom
HELP	Huron-Erie Lake Plains Ecoregion
HSTS	Home Sewage Treatment System
HUC	Hydrologic Unit Code
I	
IBI	Index of Biotic Integrity
ICI	Invertebrate Community Index
IJC	International Joint Commission

M

MIwb	Modified Index of Well Being
MTA	Million Tons per Annum
MWH	Modified Warmwater Habitat

N

NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NPS-IS	Nonpoint Source-Implementation Strategy
NRCS-USDA	Natural Resources Conservation Service-United States Department of Agriculture

O

ODA	Ohio Department of Agriculture
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
OLEC	Ohio Lake Erie Commission

P

PAD-US	Protected Areas Database of the United States

Q

QHEI	Qualitative Habitat Evaluation Index

R

RM	River Mile

S

STEPL	Spreadsheet Tool for Estimating Pollutant Loads
SWCD	Soil and Water Conservation District

T

TMACOG	Toledo Metropolitan Area Council of Governments
TMDL	Total Maximum Daily Load
TSD	Technical Support Document

U

USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

W

WAP	Watershed Action Plan
WLEB	Western Lake Erie Basin
WQS	Water Quality Standards (Ohio Administrative Code 3745-1)
WRP	Wetland Reserve Program
WWH	Warmwater Habitat

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CHAPTER 1: INTRODUCTION

The **Blierdofer Ditch Hydrologic Unit Code (HUC)-12 (04100004 02 03)** is located in the central portion of Mercer County, Ohio and contains a watershed of 14.57 square miles (Figure 1). The **Blierdofer Ditch HUC-12** contains Blierdofer Ditch, an approximately 4.5 mile-long stream[1] that flows northward through Mercer County to Twelvemile Creek, a larger tributary to the St. Marys River. The watershed is primarily rural, and land use is dominated by cultivated crop land (~72%). The **Blierdofer Ditch HUC-12** has recently been identified as a priority watershed within the Western Lake Erie Basin (WLEB) for watershed planning and nutrient reduction efforts due to the estimated loadings of total phosphorus and dissolved reactive (soluble) phosphorus that flows into the tributaries of the Maumee River and eventually, Lake Erie.

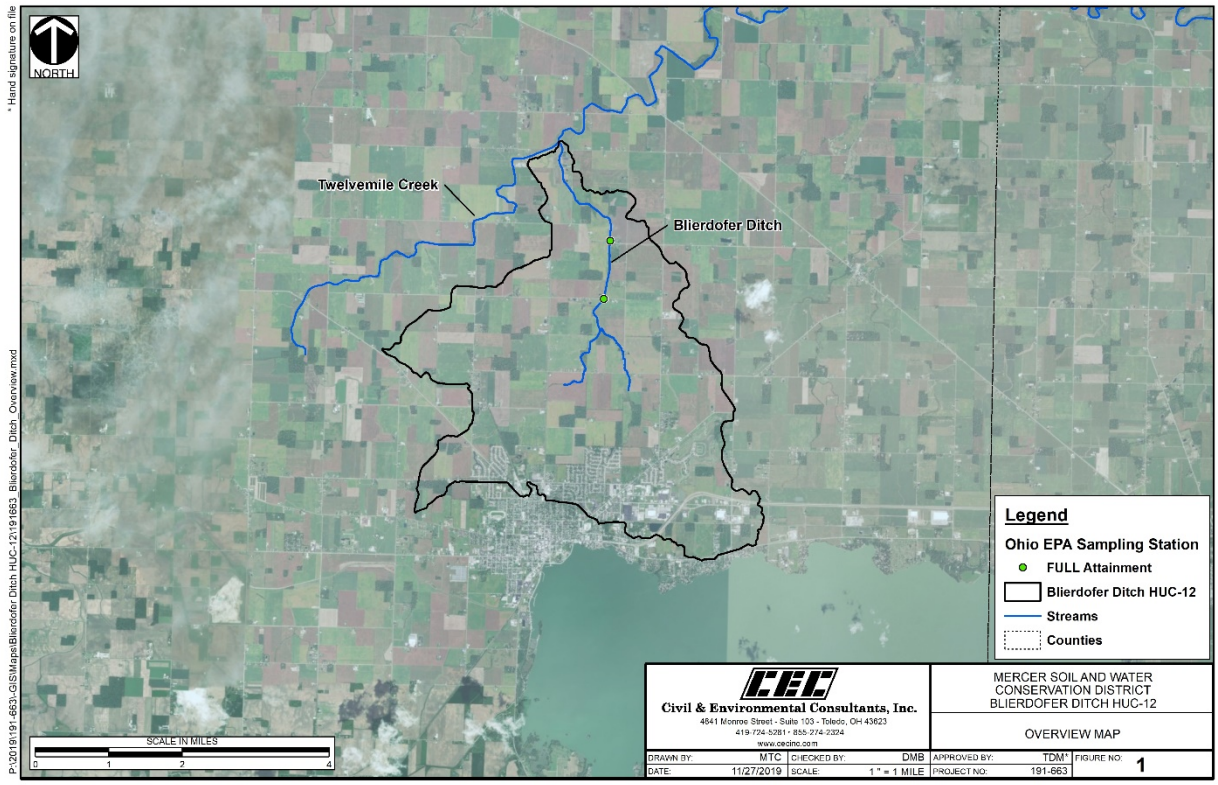


Figure 1: Blierdofer Ditch HUC-12 Overview

While watershed plans could be all-inclusive inventories, the US Environmental Protection Agency (USEPA) identified nine critical elements to include in strategic planning documents for impaired waters. To ease implementation of projects addressing nonpoint source (NPS) management and habitat restoration, current federal and state NPS and habitat restoration funding opportunities require strategic watershed plans incorporate these nine key elements, concisely to HUC-12 watersheds. In addition, the development of Nine-Element Nonpoint Source Implementation Strategies (NPS-IS) is critical to the efforts focused on implementing Ohio's Domestic Action Plan (DAP) to reduce total spring

[1] The *ODNR Gazetteer of Ohio Streams* (ODNR, 2001) lists Blierdofer Ditch as 3.0 miles in length; however, when compared to the *OEPA River Miles Index* interactive map (online), Blierdofer Ditch extends to approximately 4.5 miles in length.

nutrient loadings to Lake Erie by 40% by the year 2025, with aspirations to reach a 20% reduction by 2020 (OLEC, 2018). The development of NPS-IS across the entire WLEB will address NPS pollution by accounting for both near-field (within stream/watershed) and far-field (loadings to Lake Erie) effects. The *Blierdofer Ditch HUC-12 NPS-IS* is one of three plans sponsored and developed by the Mercer Soil and Water Conservation District (SWCD) under a grant from the Ohio Lake Erie Commission (OLEC).

1.1 Report Background

The Ohio Environmental Protection Agency (OEPA) has historically supported watershed based planning in many forms (OEPA, 2016). In 1997, OEPA issued guidance for the development of Watershed Action Plans (WAPs), which typically covered larger watersheds (HUC-10 to HUC-8 size). The WAPs included an outline and checklist to ensure USEPA's nine elements were included within each plan. The USEPA issued new guidance in 2013 and concluded Ohio's interpretation for WAP development did not adequately address critical areas, nor did it include an approach that detailed the nine elements at the project level (OEPA, 2016). In response, OEPA developed a new template for watershed planning in the form of a NPS-IS, ensuring NPS pollution is addressed at a finer resolution and that individual projects listed within each plan include each of the nine elements. The first NPS-IS plans were approved in 2017. Over time, these plans have evolved to not only address in-stream (near-field) water quality impairment from NPS pollution, but they also address reductions in nutrient loadings to larger bodies of water (far-field), particularly in the WLEB.

Because the St. Marys River flows through both Indiana and Ohio, assessment and planning efforts are often separated at the state line. A Total Maximum Daily Load (TMDL) study was conducted in Indiana, and the TMDL report was released in 2006. Formal watershed planning within the St. Marys River began as a result of this TMDL effort and led to the formation of the St. Marys River Watershed Steering Committee, spearheaded by the Allen County (Indiana) SWCD. The *St. Marys River Watershed Management Plan* was then developed for the Indiana portion of the watershed and approved in 2009. In 2015, OEPA sampled the St. Marys River and tributaries as an initial step in TMDL modeling for the Ohio portion of the watershed. The Ohio TMDL report has not yet been released.

In 2018, all subwatersheds (HUC-12s) within the Ohio portions of the St. Marys HUC-8, the Auglaize HUC-8 (including the Ottawa River, Little Auglaize River and Little Flatrock Creek), the Blanchard HUC-8 (including Eagle Creek) and the Platter Creek HUC-12 were recommended for designation as a "Watershed in Distress" due to relatively higher concentrations of phosphorus in surface waters contributing to harmful algal bloom (HAB) occurrence in Lake Erie. These waterways were found to have flow-weighted mean concentrations of phosphorus two or more times the phosphorus loading goals set forth by the Great Lakes Water Quality Agreement (GLWQA) and the

Sediments and nutrients flow within tributaries to eventually reach the Maumee River and Lake Erie

subsequent DAP developed by the State of Ohio (ODA, 2018). In 2019, the proposal to designate these watersheds as distressed was removed from state consideration. Focus is now on developing NPS-IS for these subwatersheds in preparation for basin-wide targeted nutrient reduction efforts. The coordination of this NPS-IS for the **Blierdofer Ditch HUC-12**, along with several other subwatersheds in both Mercer and Van Wert County, is the first formal planning effort within the Ohio portion of the St. Marys watershed.

Removal of NPS impairments and reduction in overall nutrient loss within the **Blierdofer Ditch HUC-12** is crucial to the attainment of aquatic life use (ALU) standards within Blierdofer Ditch, as well as reduction in severity, extent and occurrence of HABs within the WLEB. Within the **Blierdofer Ditch HUC-12**, one waterway has been assessed by the OEPA. Blierdofer Ditch is in *Full Attainment* of its Modified Warmwater Habitat (MWH) ALU at both of its sampling locations. While no near-field impairment is recognized within this subwatershed; however, land use activities within the watershed have severely altered instream habitat, and high nutrient loadings contribute to large-scale impairment within Lake Erie. This NPS-IS will be used to strategically identify and outline key projects that should be implemented within the **Blierdofer Ditch HUC-12** to address management of NPS issues that have both near-field and far-field impacts.

1.2 Watershed Profile & History

The WLEB is composed of approximately 7,000,000 acres across the tri-state area of Ohio, Indiana and Michigan (Figure 2). The largest direct tributary to the WLEB is the Maumee River, flowing 137 miles through 18 counties in Indiana and Ohio. The WLEB watershed is broken into several subbasins at the HUC-8 level, including the St. Joseph, St. Marys, Auglaize, Blanchard, Tiffin, Ottawa-Stony, River Raisin, Cedar-Portage, Upper Maumee and Lower Maumee watersheds. The St. Marys HUC-8 (04100004) wholly contains the St. Marys River (~101 miles) from its headwaters in Auglaize County, Ohio to where its confluence with the St. Joseph River in Fort Wayne, Indiana forms the beginning of the Maumee River. The St. Marys HUC-8 contains a watershed of 794 square miles (508,618 acres) throughout Shelby, Auglaize, Mercer and Van Wert counties in Ohio and Allen, Wells and Adams counties in eastern Indiana. Larger tributaries to the St. Marys River include Kopp Creek, Twelvemile Creek, Blue Creek and Black Creek. The St. Marys HUC-8 is further divided into six smaller watersheds along its course, one of which is the *Twelvemile Creek-St. Marys River HUC-10 (04100004 02).*

The *Twelvemile Creek-St. Marys River HUC-10* has a drainage area of 115.19 square miles or 73,719 acres (Figure 3). Approximately 18 miles of the St. Marys River are contained within the *Twelvemile Creek-St. Marys River HUC-10* from river mile (RM) 89.1 where Fourmile Creek and Sixmile Creek empty into the river to the mouth of Twelvemile Creek at RM 71.4. Land use within the *Twelvemile Creek-St. Marys River HUC-10* is mainly agricultural and rural. Concentrated population centers are relatively small. The largest municipality in the watershed is Celina with a population of 10,400; however, only a portion of the city is contained within the *Twelvemile Creek-St. Marys River HUC-10* (US Census Bureau, 2010).

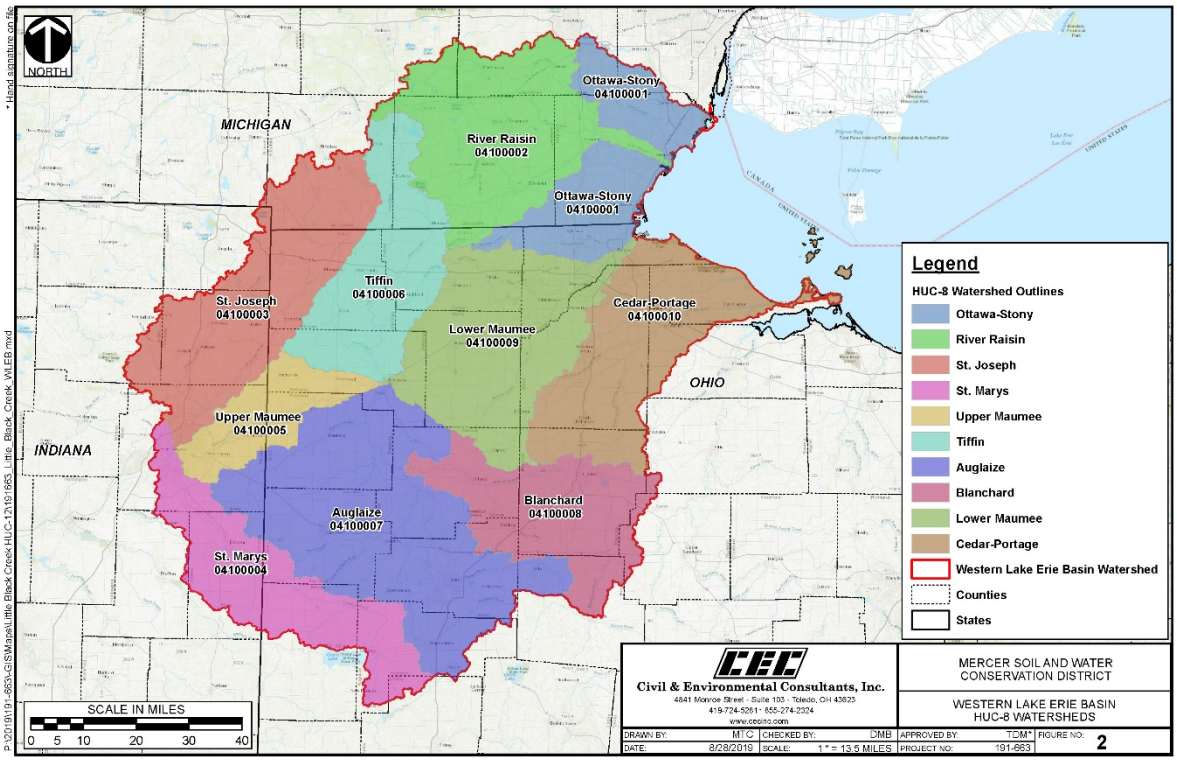


Figure 2: Western Lake Erie Basin Watershed

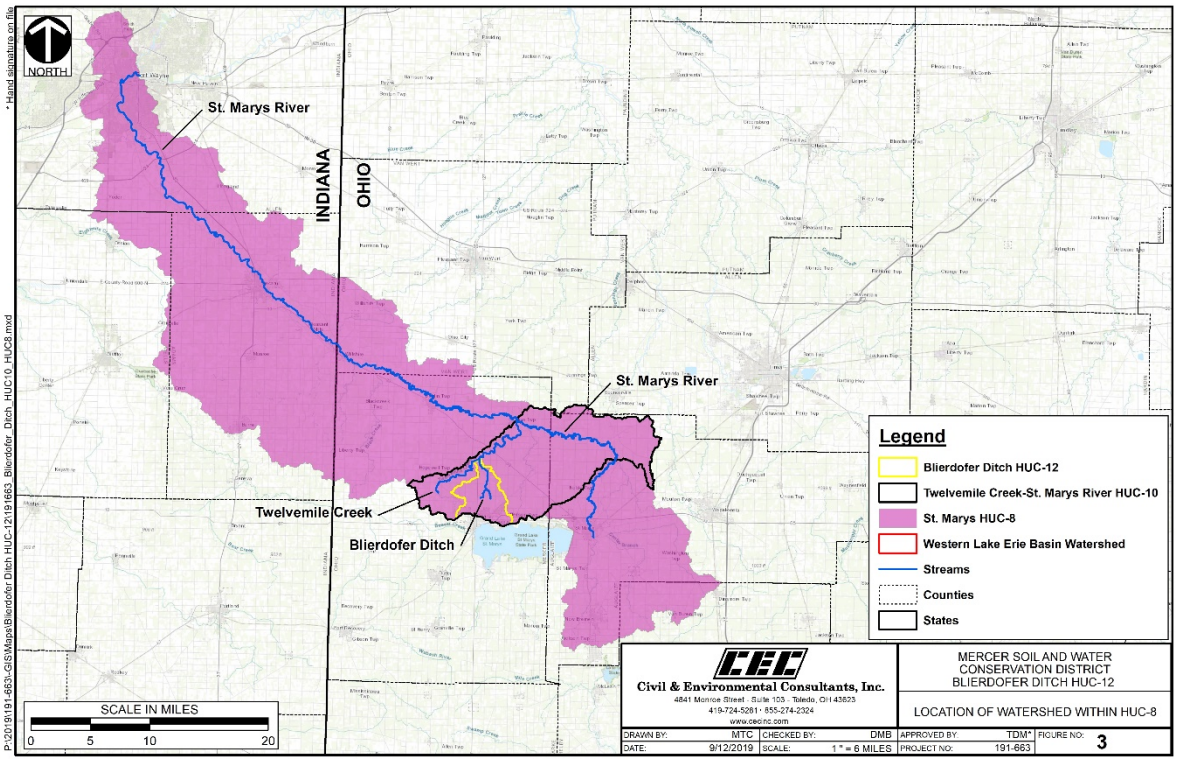


Figure 3: Location of the Blierdofer Ditch HUC-12

The *Twelvemile Creek-St. Marys River HUC-10* contains five HUC-12 watersheds, one of which is the **Blierdofer Ditch HUC-12.** The **Blierdofer Ditch HUC-12** wholly contains Blierdofer Ditch, a 4.5 mile-long stream that enters Twelvemile Creek at approximately RM 7.9. The Blierdofer Ditch watershed is similar in land use setting and characteristics as the overall larger HUC-10 watershed, supporting mostly agricultural land use.

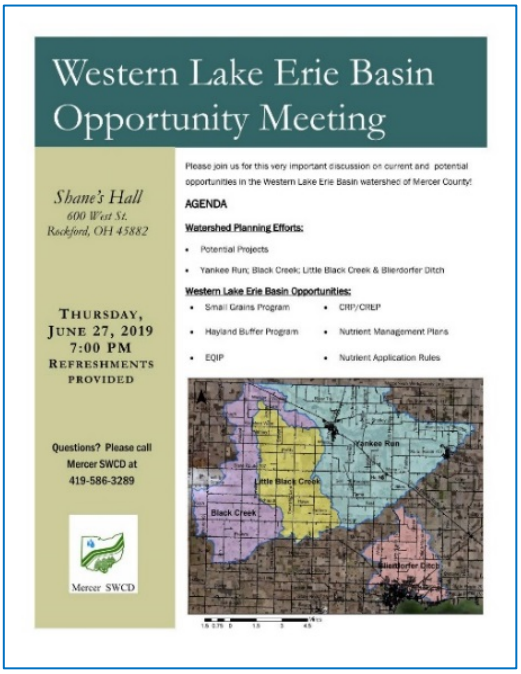
1.3 Public Participation and Involvement

Watershed planning is best accomplished by collaboration and input from a diverse group of entities, including governmental agencies, private businesses, academia, non-profit groups, neighborhood organizations, agricultural landowners, producers and service providers, as well as the public at large. Mercer SWCD is dedicated to providing local leadership in the conservation and wise use of soil, water and related resources through a balanced cooperative program that protects, restores and improves those resources.

Mercer SWCD frequently partners with other county agencies, particularly with Mercer County's Community and Economic Development Agency – Agricultural Solutions (Ag Solutions). Ag Solution's mission is to identify and eliminate, through the use of technology and environmentally sound farming practices, agricultural factors that are negatively impacting the environmental health of all Mercer County Watersheds, while also enhancing the vibrant, prosperous farming economy that is an integral part of the local community. Both Mercer SWCD and Ag Solutions have been active leaders in watershed planning, project development and solution implementation. Their recent planning and implementation efforts have focused in the Grand Lake St. Marys region, and through development of this NPS-IS for the **Blierdofer Ditch HUC-12,** both organizations recognize the need to expand their efforts into the WLEB portion of the county.

Chapters 1, 2 and 3 of this NPS-IS were primarily prepared using the *Biological and Water Quality Study of the St. Marys River and Tributaries, 2015, Technical Report EAS/2018-11-01* (OEPA, 2018b) and the *2018 Ohio Integrated Report* (OEPA, 2018a*).* Project information for Chapter 4 was compiled by collaborative meetings with organizational stakeholders, community partners and local landowners.

Mercer SWCD held a public meeting regarding NPS-IS development and current state and federal agricultural programs on June 27, 2019 in Rockford to engage area landowners and organizational stakeholders in the planning process. In addition, Mercer SWCD solicited individual input from potential cooperating landowners and stakeholder organizations working within the **Blierdofer Ditch HUC-12**, such as the Mercer County



Stakeholder outreach in Mercer County

Engineers Office and Mercer County Health Department, the City of Celina Public Utilities, as well as those that work regionally throughout the WLEB, including Mercer Landmark, the Ohio Farm Bureau, The Nature Conservancy, The West Central Land Conservancy, Black Swamp Conservancy, Maumee Valley Conservancy District and the Ohio Department of Natural Resources (ODNR).

CHAPTER 2: HUC-12 WATERSHED CHARACTERIZATION AND ASSESSMENT SUMMARY

2.1 Summary of HUC-12 Watershed Characterization

2.1.1 Physical and Natural Features

The **Blierdofer Ditch HUC-12** is a subwatershed within the greater *Twelvemile Creek-St. Marys River HUC-10*. The *Twelvemile Creek-St. Marys River HUC-10* is comprised of five HUC-12 watersheds; this document focuses on the #03 hydrologic unit—the **Blierdofer Ditch HUC-12**. The largest stream within this subwatershed is Blierdofer Ditch, an approximately 4.5 mile-long stream that flows northward to meet Twelvemile Creek. In total, Blierdofer Ditch drains 14.57 square miles (9,323 acres) and has an average fall of 5.7 ft/mile (ODNR, 2001).

The largest tributary to Blierdofer Ditch is Green Ditch, which enters Blierdofer Ditch from the south near its headwaters. Flowing from the City limits of Celina, Green Ditch drains an area of approximately 3.5 square miles and has an average fall of 5 ft/mile (ODNR, 2001; USGS, 2019b). Including the length of Blierdofer Ditch, almost 25 miles of streams and ditches are within the boundaries of the **Blierdofer Ditch HUC-12**. Of the ~25 miles of waterways within the **Blierdofer Ditch HUC-12**, most are maintained under Mercer County's Ditch Maintenance program.

The physiography of the **Blierdofer Ditch HUC-12** is defined by features from glacial activity of Wisconsinan time. As the Erie ice lobe advanced and retreated, the Ft. Wayne and Wabash Moraines were deposited, truncating the northern and southern boundaries, respectively, of many tributaries to the St. Marys River along the middle stretch of the river (OEPA, 2018b). Soils within the **Blierdofer Ditch HUC-12** are mainly fine-grained and are predominantly the Pewamo Silty Clay Loam (Figure 4). These soils are derived mainly from lacustrine deposits and lake-planed moraine, consist of clayey silts and sand and are typically poorly drained (OEPA, 2018b).

Stream gradients are low in the HELP Ecoregion

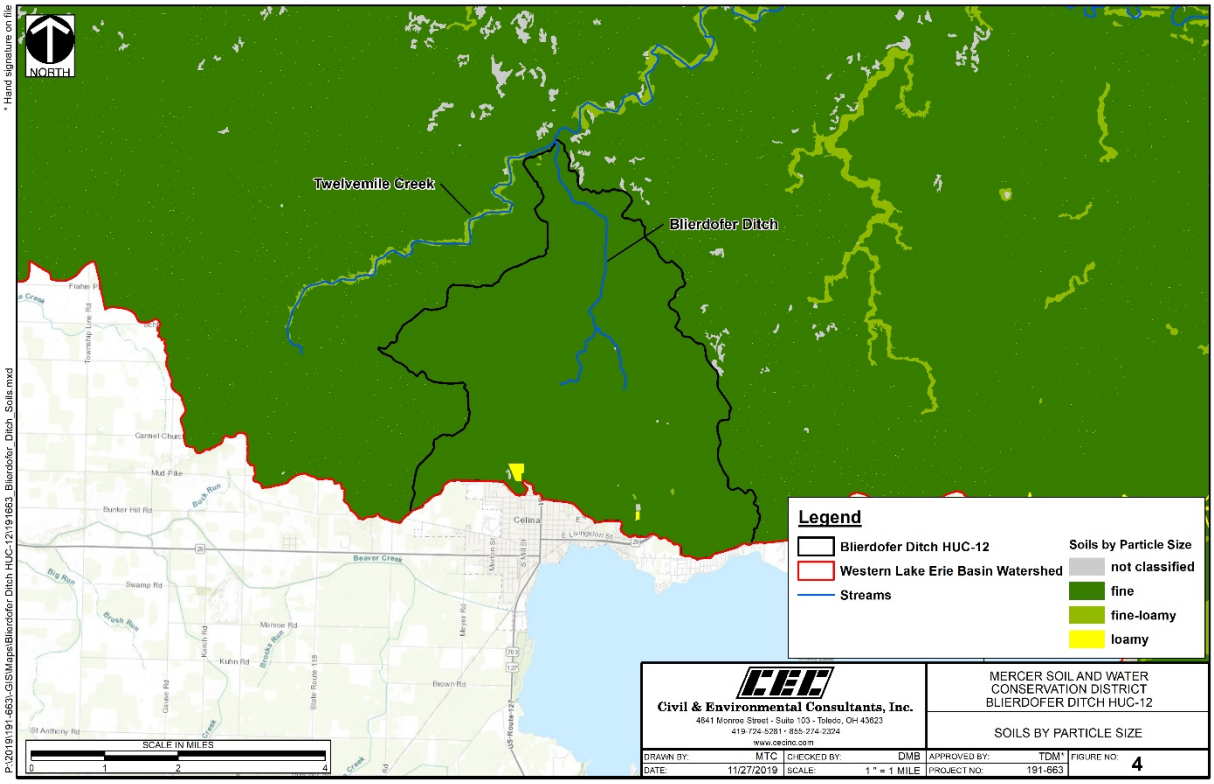


Figure 4: Soils Classified by Particle Size

The **Blierdofer Ditch HUC-12** is wholly contained within the Huron-Erie Lake Plains (HELP) ecoregion. The ecoregion is characterized by a broad and nearly level lake plain, with extensive lacustrine and still-water deposits (OEPA, 2018b). Stream gradients within the HELP ecoregion are typically low, and adjacent lands are typically poorly drained. Settlement in this poorly drained area prompted the necessity for a vast system of drainage networks. Nearly 70% of streams within the HELP ecoregion have been channelized or hydrologically modified to varying degrees for drainage conveyance (OEPA, 2018b). Elm-ash swamp and beech forests were typical in the HELP ecoregion prior to settlement (USEPA, 2013). Wetland areas are now sparse throughout the **Blierdofer Ditch HUC-12** (Figure 5). Today, the ecoregion is characterized by extensive corn, soybean, vegetable and livestock production.

Row crop production is prevalent in Mercer County

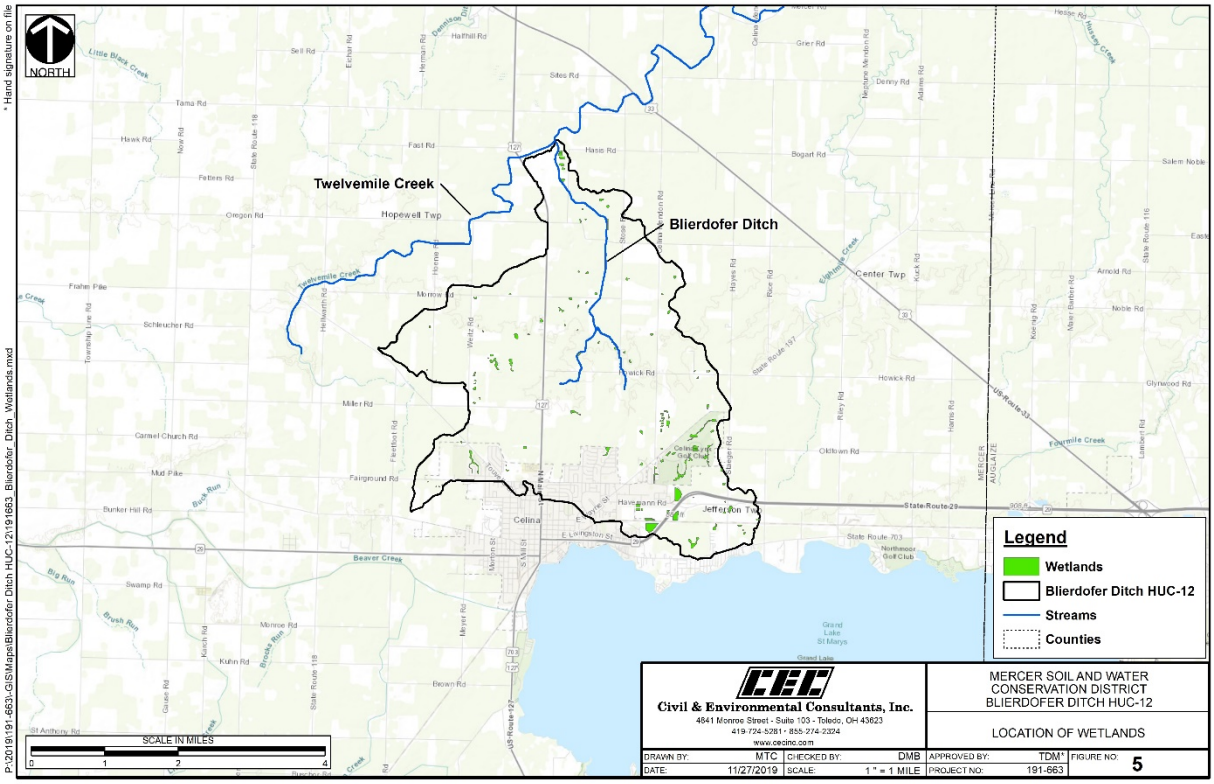


Figure 5: Wetlands within the Blierdofer Ditch HUC-12

Currently, there are no National Pollutant Discharge Elimination System (NPDES) permitted facilities located within the **Blierdofer Ditch HUC-12**, nor are there any Ohio Department of Agriculture (ODA)-permitted Confined Animal Feeding Facilities (CAFFs) located within the watershed. A small number of livestock operations within the watershed include mostly swine and turkeys; however, these numbers are growing. Several new turkey barns have been built over the last few year years. An estimate of the number of animals existing in the **Blierdofer Ditch HUC-12** can be found in Table 1.

Table 1: Estimated Animal Counts in the Blierdofer Ditch HUC-12

Livestock Type	Number of Farms	Animal Units
Swine	1	N/D
Turkey	2	545

(Source: Mercer SWCD)

NOTES
N/D No data available

Outside of Celina, the population within the **Blierdofer Ditch HUC-12** is sparse, estimated at 700, with 284 housing units (TMACOG, 2018). Small, residential developments are clustered along Weitz Rd/Miller Rd, Celina-Mendon Rd, Morrow Rd and Hasis Rd (Figure 6). In 2018, the Toledo Metropolitan Area Council of Governments (TMACOG) concluded a study of locations and densities of home sewage treatment systems (HSTS) throughout the WLEB. Within Mercer County, the residential area near Weitz Rd/Miller Rd was identified as a Critical Sewage Area (CSA), in which larger-scale efforts should be

initiated to address failing HSTS and/or potentially establish sewer service. The Mercer County Comprehensive Plan noted the need for addressing failing HSTS throughout the county, as well as the need to continue expansion of the County's sewer subdistricts in populated residential areas (WSU, 2013).

Specific landmarks and features within this watershed include:

- Old Celina Dump
- Celina Lynx Golf Club
- VanTilburg Farms (feed/grain mill)
- Several cemeteries
- City of Celina, urbanized
- Recreational parks and athletic fields

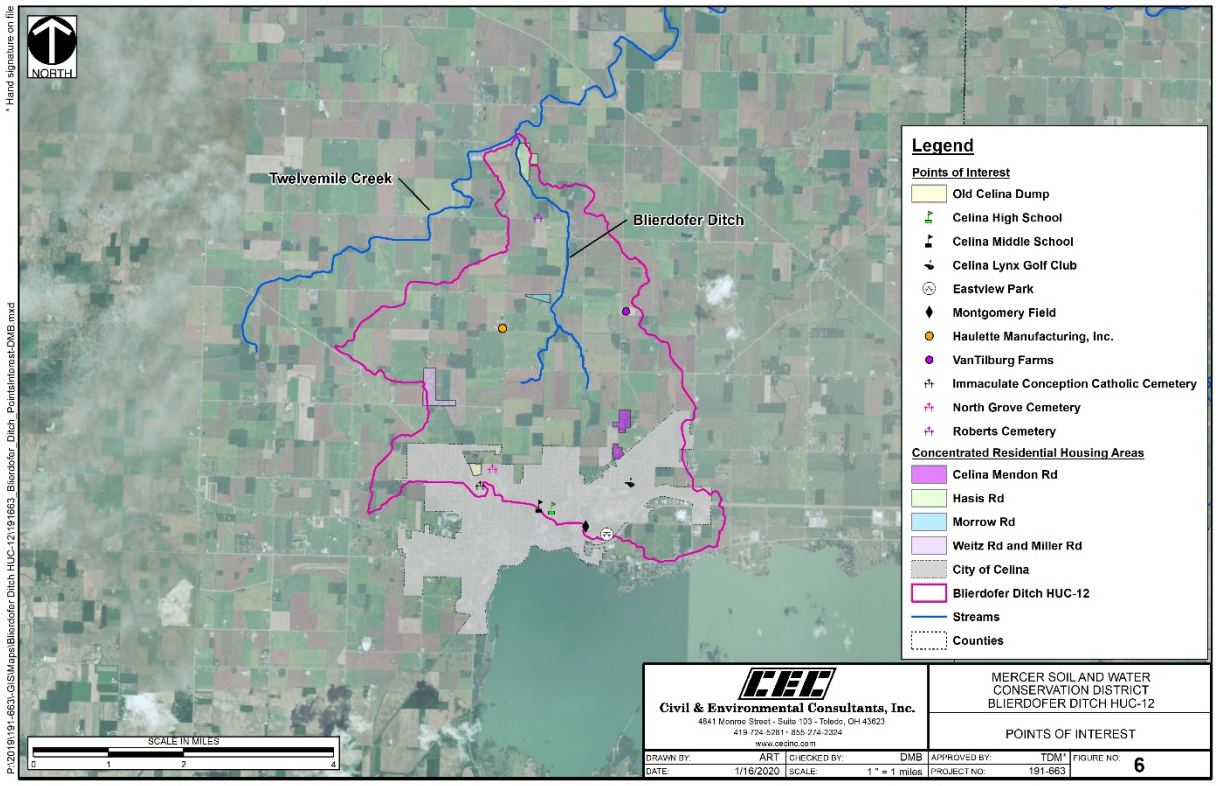


Figure 6: Points of Interest in the Blierdofer Ditch HUC-12

2.1.2 Land Use and Protection

Land use within the **Blierdofer Ditch HUC-12** is largely rural, but the southern portion of the subwatershed is urbanized (Figure 7). The dominant land use activity within the **Blierdofer Ditch HUC-12** is cultivated crop production (72%), with residential areas covering the next largest portion of the watershed (20%) (Table 2).

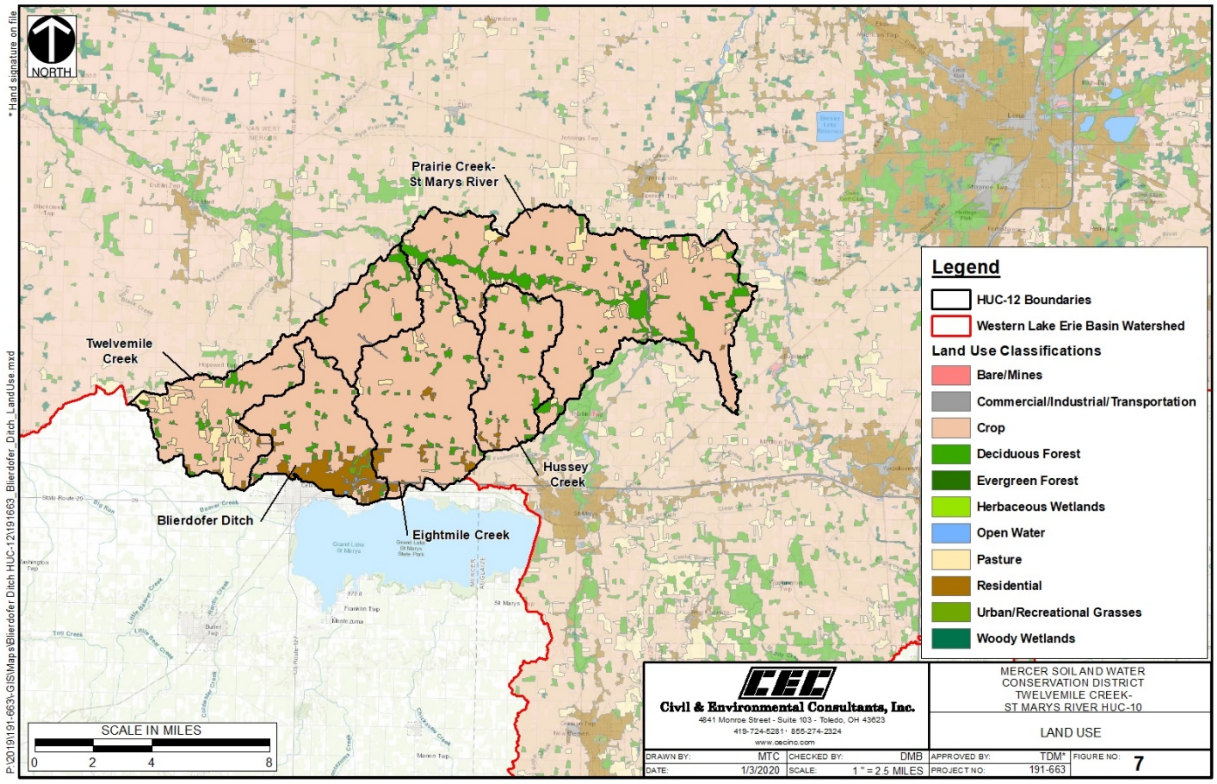


Figure 7: Land Use in the Twelvemile Creek-St. Marys River HUC-10

Table 2: Land Use Classifications in the Blierdofer Ditch HUC-12

Land Use	Blierdofer Ditch HUC-12 (04100004 02 03)		
	Area (mi^2)	Area (acres)	% Watershed Area
Commercial/Industrial/Transportation	0.10	65.38	0.70%
Crop	10.46	6,695.08	71.79%
Deciduous Forest	0.71	453.00	4.87%
Open Water	0.03	21.16	0.23%
Pasture	0.08	52.37	0.56%
Residential	2.97	1,898.25	20.37%
Urban/Recreational Grasses	0.22	138.03	1.48%
Total	**14.57**	**9,323.27**	**100.00%**

(Source: Homer, 2015)

The City of Celina falls within the Urbanized Area definition by the US Census Bureau (Figure 8). Celina covers an area of approximately 5.4 square miles, of which 52% is within the boundaries of the **Blierdofer Ditch HUC-12**. Stormwater within Celina is collected under a Municipal Separate Storm Sewer System (MS4) permit. These stormwater systems do not connect with water treatment systems; therefore oil, grease, pesticides, herbicides, dirt and grit are carried directly to waterways and have a high potential to negatively impact water quality (OEPA, 2009).

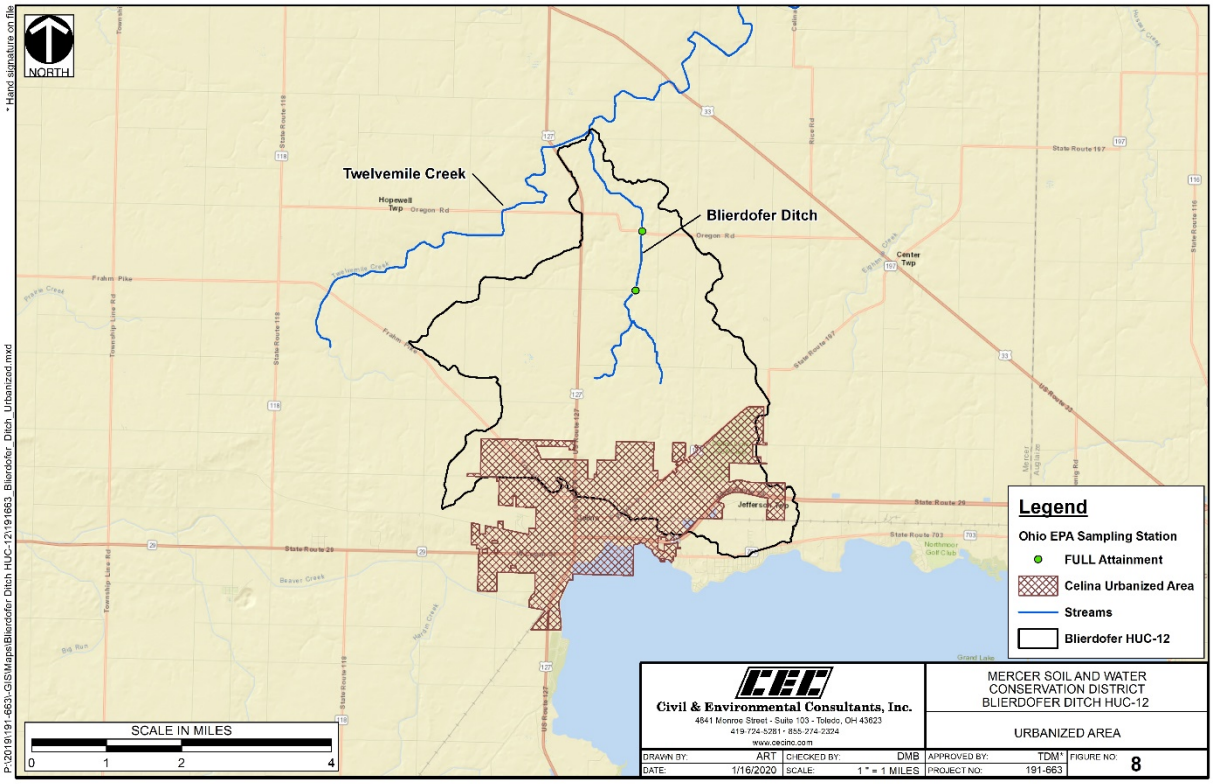


Figure 8: Celina Urbanized Area

Three parks and protected areas are listed for this watershed in the United States Geological Survey's (USGS) Protected Areas Database of the United States (PAD-US) (Figure 9). In total, 363 acres are protected, though only two of these areas are on public land (Table 3). Two threatened or endangered species are listed for Mercer County by the US Fish and Wildlife Service (USFWS) (Table 4). Blierdofer Ditch is not currently listed in Appendix A of the *Ohio Mussel Survey Protocol*, indicating that mussels may be present, but the Federally Listed Species (FLS) on USFWS's listing are not expected to be found (ODNR, 2018).

Table 3: Parks and Protected Lands in Blierdofer Ditch HUC-12

Name	Acreage	Description
Eastview Park	51	Local park with playground equipment, athletic fields and shelters
Celina Lynx Golf Club	290	Public golf course
Private lands	22	Private lands held in the Wetland Reserve Program (WRP) for conservation purposes

(Source: USGS, 2019a)

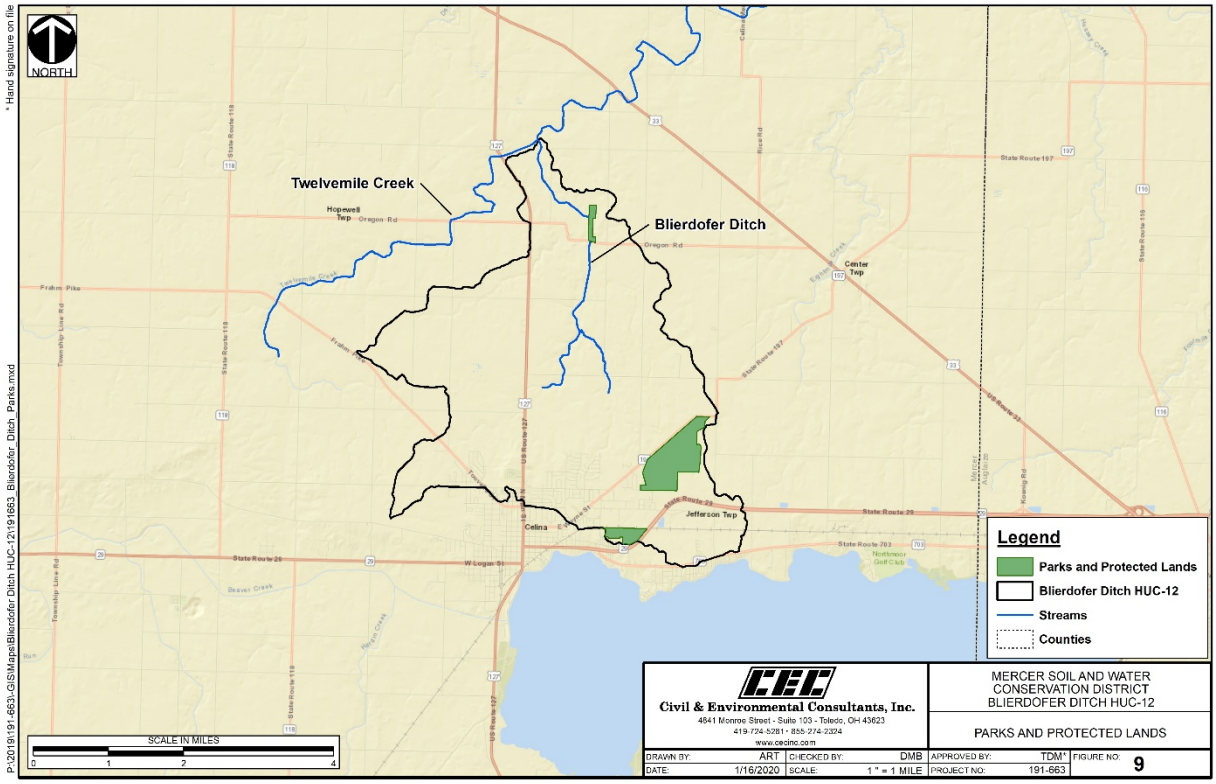


Figure 9: Parks and Protected Lands in Blierdofer Ditch HUC-12

Table 4: Threatened and Endangered Species in Mercer County

Species	Status	Habitat Characteristics
Indiana bat (*Myotis sodalis*)	Endangered	Hibernates in caves and mines and forages in small stream corridors with well-developed riparian woods, as well as upland forests
Northern long-eared bat (*Myotis septentrionalis*)	Threatened	Hibernates in caves and mines and swarms in surrounding wooded areas in autumn; roosts and forages in upland forests during late spring and summer

(Source: USFWS, 2018)

Most land within the **Blierdofer Ditch HUC-12** is privately owned; therefore, knowledge of conservation practices may be limited. Some conservation practices, such as the use of conservation tillage, can be estimated from crop tillage transects from prior years. These tillage tracts include areas in the WLEB watershed within Mercer County. Over time, the use of conservation tillage has increased. During a five-year period spanning from 2006-2010, conservation tillage was observed on an average of 60% of fields annually during Conservation Technology Information Center (CTIC) surveys conducted in the month of June. Data from June surveys in 2016-2018 indicate conservation tillage has increased to an average use on 66% of fields (personal communication, Mercer SWCD, August 14, 2019).

Summary data provided by the OEPA regarding the use of the Environmental Quality Incentives Program (EQIP) within the **Blierdofer Ditch HUC-12** indicated no certifications of practices occurred after March 30, 2017 (R. Wilson, personal communication, June 13, 2019). Since 2008, Mercer SWCD has assisted

local landowners in the **Blierdofer Ditch HUC-12** in the installation of 2,254 linear feet of grassed waterways, covering 2.1 acres and draining surface water from 974.2 row crop acres. In addition, three Conservation Reserve Program (CRP) wetlands have been created, totaling 34.3 wetland/upland grass acres (15.1 acres pool), draining agricultural runoff from 336 acres. Future nutrient reduction projects implemented through this NPS-IS and available state and federal programming will be compiled to track progress made towards nutrient reduction and conservation goals across the **Blierdofer Ditch HUC-12** and the greater WLEB watershed.

2.2 Summary of HUC-12 Biological Trends

The OEPA sampled the **Blierdofer Ditch HUC-12** in 2015, as documented in the *Biological and Water Quality Study of the St. Marys River and Tributaries, 2015, Technical Report EAS/2018-11-01* (OEPA, 2018b). This report serves as the Technical Support Document (TSD) for the TMDL study for the St. Marys River, which is still under agency preparation. All sample sites of this assessment unit were verified to be MWH segments.

A summary of the sample locations and their biological status in the **Blierdofer Ditch HUC-12** is provided in Table 5. For reference, water quality standards (WQS) for the HELP Ecoregion are presented in Table 6.

Table 5: Biological Indices Scores for Sites in Blierdofer Ditch HUC-12

Blierdofer Ditch HUC-12 (04100004 02 03)							
River Mile	**Drainage Area (mi^2)**	**IBI**	**MIwb[a]**	**ICI[b]**	**QHEI**	**Attainment Status**	**Location**
Blierdofer Ditch (MWH)							
2.50 [H]	6.4	36	N/A	F	42.8	Full	Morrow Rd.
1.70 [H]	10.5	32	N/A	MG	28	Full	N. of Celina @ Oregon Rd.

(Source: OEPA, 2018b)

NOTES

IBI Index of Biotic Integrity

a The Modified Index of Well Being (MIwb) is not applicable to headwater sites (drainage ≤20 mi^2).

ICI Invertebrate Community Index

b Narrative evaluation used in lieu of ICI (G=Good; MG=Marginally Good; H Fair =High Fair; F=Fair; L Fair=Low Fair; P=Poor; VP=Very Poor).

QHEI Qualitative Habitat Evaluation Index

H Headwater sample

N/A Not applicable

Table 6: Water Quality Standards for the Huron-Erie Lake Plains Ecoregion

HELP Ecoregion	MWH Standards[a]			WWH WQS Standards		
	Wading	Headwater	Boat	Wading	Headwater	Boat
IBI	22	20	20/22	32	28	34
MIwb	5.6	N/A	5.7/5.7	7.3	N/A	8.6
ICI	22	22	22	34	34	34
QHEI[b]	43.5	43.5	43.5	60	60	60

(Source: OEPA, 2013b)

NOTES

WQS Water quality standards

WWH Warmwater Habitat

a Modified Warmwater Habitat (MWH) standards are dependent on type of MWH. MWH-C (due to channelization) is listed first; MWH-I (due to impoundment) is listed second. All MWH streams in this NPS-IS are MWH-C, unless otherwise noted.

b QHEI is not criteria included in Ohio WQS; however, it has been shown to be highly correlated with the health of aquatic communities. In general, sites scoring 60 or above support healthy aquatic assemblages indicative of WWH. For modified warmwater habitats, Ohio EPA suggests a score of 43.5 for the support of tolerant aquatic assemblages (Ohio EPA, 2013b).

N/A MIwb not applicable to headwaters sampling locations with drainage areas ≤ 20 mi^2.

Fishes (Modified Index of Well-Being (MIwb] & Index of Biotic Integrity [IBI])

In general, fish communities performed well in all headwater sites sampled in the St. Marys watershed in 2015, as only one site showed impairment, attributed to wastewater effluent. Within Blierdofer Ditch, fish communities performed well, both exceeding attainment values for MWH and achieving values similar to warmwater habitat (WWH)-designated streams.

Macroinvertebrates (Invertebrate Community Index [ICI])

In 2015, ICI scores ranged between fair and marginally good within Blierdofer Ditch. While the macroinvertebrates performed well enough to meet MWH standards, it is important to note that many habitat attributes within Blierdofer Ditch typically contribute to macroinvertebrate impairment in streams within the HELP ecoregion (high embeddedness, lack of riffle, etc.).

Habitat (via Qualitative Habitat Evaluation Index [QHEI])

Ohio EPA sampling crews documented various water quality and habitat attributes during the QHEI assessment in the summer of 2015 (Table 7). QHEI was measured at a total of 25 sampling locations that were located in the HELP Ecoregion throughout the St. Marys watershed. Two of these locations were in Blierdofer Ditch. In general, habitat in the HELP tributaries was severely degraded, with an average QHEI score of 41.25 (n=25). The habitat in Blierdofer scored above this HELP average at one site (RM 2.50), but scored well below this average at a downstream location (RM 1.70). Most HELP tributaries have not recovered from extensive hydromodification, and low stream power and silt-clay soil composition in upland areas have prevented the reestablishment of positive stream features (OEPA, 2018b).

Table 7: QHEI Matrix with WWH and MWH Attribute Totals for Sites in the Blierdofer Ditch HUC-12

Blierdofer Ditch HUC-12 (04100004 02 03)																																
Key QHEI Components			WWH Attributes											MWH Attributes																		
														High Influence							Moderate Influence											
River Mile	QHEI Score	Gradient (ft/mi)	Not Channelized or Recovered	Boulder/Cobble/Gravel Substrate	Silt Free Substrates	Good/Excellent Development	Moderate/High Sinuosity	Extensive/Moderate Cover	Fast Current/Eddies	Low/Normal Embeddedness	Max Depth >40 cm	Low/Normal Embeddedness	WWH Attributes	Channelized/No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse/No Cover	Max Depth <40 cm	High Influence Modified Attributes	Recovering Channel	Heavy/Moderate Silt Cover	Sand Substrate (Boat)	Hardpan Substrate Origin	Fair/Poor Development	Low Sinuosity	Only 1 or 2 Cover Types	Intermediate/Poor Pools	No Fast Current	High/Moderate Embeddedness	High/Moderate Riffle Embeddedness	No Riffle	Moderate Influence MWM Attributes
Blierdofer Ditch (MWH)																																
2.5	42.8	2.76											0				•	•	2	•	•		•	•	•			•	•	•	•	9
1.7	28.0	4.85											0	•	•	•	•	•	5		•		•	•	•	•		•	•		•	8

(Source: OEPA, 2018b)

NOTES
QHEI Qualitative Habitat Evaluation Index
WWH Warmwater Habitat
MWH Modified Warmwater Habitat

Strong correlations exist between habitat attributes and a stream's ability to support healthy aquatic assemblages (OEPA, 1999). The presence of certain attributes are shown to have a larger negative impact on fish and macroinvertebrate communities. Streams designated as MWH should exhibit no more than six total MWH habitat attributes; additionally, no more than two of those six should be of high-influence (OEPA, 2013b). No sampling locations within the **Blierdofer Ditch HUC-12** met this target, with total MWH attributes ranging from 11-13 among the two sites. Like many other streams within the HELP ecoregion, the habitat within Blierdofer Ditch was severely degraded.

2.3 Summary of HUC-12 Pollution Causes and Associated Sources

As listed in the 2018 *Biological and Water Quality Study of the St. Marys River and Tributaries*, the OEPA has determined that no biological impairments exist within the **Blierdofer Ditch HUC-12** (Table 8). However, the presence and persistence of HABs within Lake Erie has shown the need for reduced NPS pollution, particularly in regards to phosphorus, throughout the entire WLEB watershed.

Table 8: Causes and Sources of Impairments for Sampling Locations in the Blierdofer Ditch HUC-12

Blierdofer Ditch HUC-12 (04100004 02 03)				
River Mile	**Primary Cause(s)**	**Primary Source(s)**	**Attainment Status**	**Location**
Blierdofer Ditch (MWH)				
2.50[H]	--	--	Full	Morrow Rd.
1.70[H]	--	--	Full	N. of Celina @ Oregon Rd.

(Source: OEPA, 2018b)

NOTES
H Headwater sample

The OEPA has estimated spring phosphorus loadings from individual subwatersheds throughout the greater WLEB watershed. These estimates also include a breakdown of estimated loads from contributing sources of NPS pollutants, such as agricultural lands/activities, developed/urban lands, failing HSTS and natural sources (Table 9). Efforts to reduce nutrients from each of these contributing sources will focus on reaching the 40% reduction goal outlined by Annex 4 of the GLWQA and the Ohio DAP.

Table 9: Estimated Spring Nutrient Loadings from Contributing NPS Sources in the Blierdofer Ditch HUC-12

	Agricultural Load (lbs)	**Developed/Urban Load (lbs)**	**Natural Load (lbs)**	**HSTS Load (lbs)**	**NPS Total (lbs)**
Current Estimates*	6,300	960	<100	180	7,500
Target Estimates*	3,800	600	<100	110	4,500

(Source: R. Wilson, personal communication, June 21, 2019)

NOTES
**Estimated using two significant figures*

2.4 Additional Information for Determining Critical Areas and Developing Implementation Strategies

Assessment data from the 2015 TMDL sampling event and data referenced in the 2018 *Biological and Water Quality Study of the St. Marys River and Tributaries, 2015, Technical Report EAS/2018-11-01* and the *2018 Integrated Report* were used in the development of this NPS-IS (OEPA, 2018a; OEPA, 2018b). Any additional documents and/or studies created by outside organizations that were used as supplemental information to develop this NPS-IS are referenced in Chapter 5 (Works Cited), as appropriate.

CHAPTER 3: CRITICAL AREA CONDITIONS & RESTORATION STRATEGIES

3.1 Overview of Critical Areas

Overall, two sampling sites are located in the **Blierdofer Ditch HUC-12**, both of which are located in Blierdofer Ditch. The aquatic communities at both locations are in *Full Attainment* of the MWH designation. While near-field impairment is not currently of concern within this watershed, land use activities do still contribute to far-field impairment in Lake Erie. Actions implemented to address far-field effects do also have a positive impact on near-field aquatic communities and help maintain WQS attainment within the **Blierdofer Ditch HUC-12**.

Critical areas have been identified to address far-field effects of nutrients in Lake Erie, the end receiving waterbody of drainage from the **Blierdofer Ditch HUC-12** (Figure 10)**.** As outlined by the OEPA, nutrient reduction targets have been set for contributing sources of phosphorus. At this time, nutrient reduction strategies and projects have been identified for three critical areas contributing to far-field impairment (Table 10). Additional critical areas may be developed in subsequent versions of this NPS-IS.

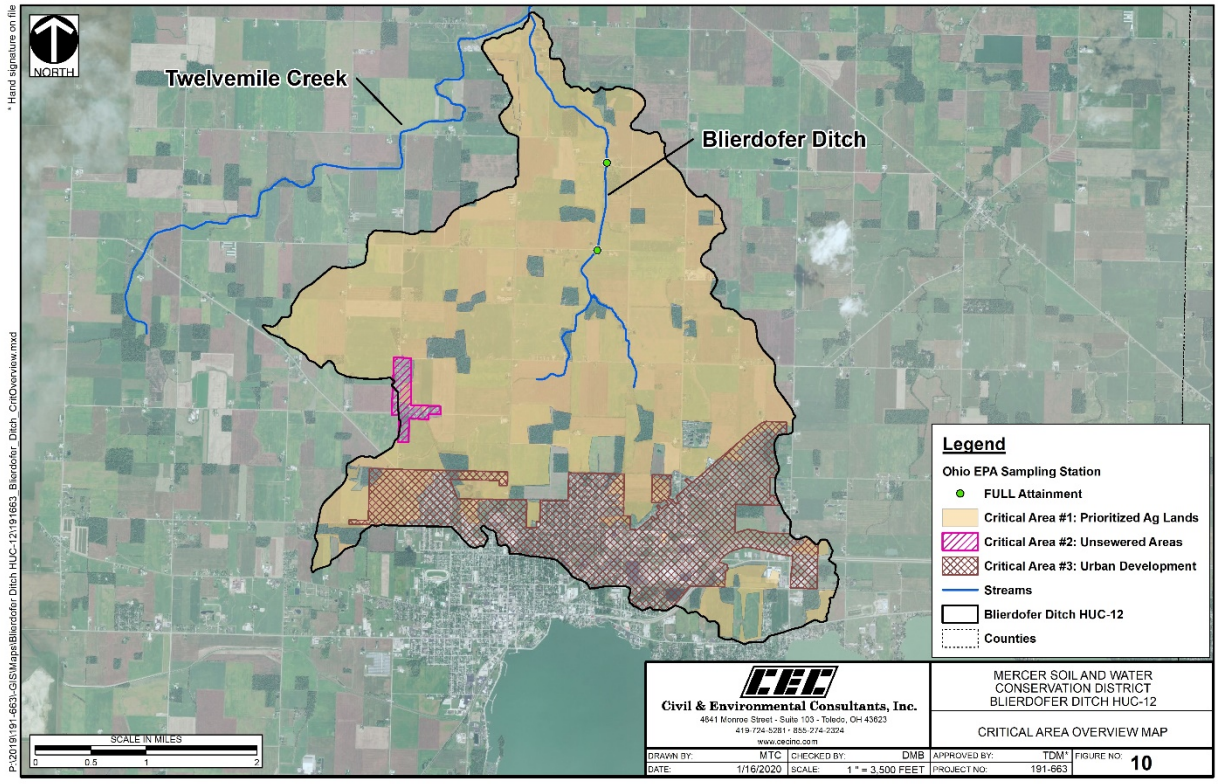


Figure 10: Blierdofer Ditch HUC-12 Critical Area Overview

Table 10: Blierdofer HUC-12 Critical Area Descriptions

Critical Area Number	Critical Area Description	Impairments Addressed
1	Nutrient Reduction in Prioritized Agricultural Lands	Far-field (Lake Erie)
2	Nutrient Reduction in Unsewered Areas	Far-field (Lake Erie)
3	Nutrient Reduction in Urban Development	Far-field (Lake Erie)

3.2 Critical Area #1: Conditions, Goals & Objectives for Nutrient Reduction in Prioritized Agricultural Lands

3.2.1 Detailed Characterization

Ohio's Nutrient Mass Balance Study (OEPA, 2018c) estimated 88% of the nutrient loadings to Lake Erie via the Maumee River were primarily from nonpoint sources, related to land use activities, with only small contributions from failing HSTS and NPDES permitted facilities. This estimate is consistent with several other studies. Given the dominance of agricultural land use throughout the greater WLEB watershed, the use of best management practices (BMPs) are recommended for agricultural operations to minimize nutrient loss to local waterways and drainage ditches through surface and tile flow. While BMPs are encouraged on all agricultural lands, certain lands are more prone to nutrient loss than others and are prioritized for BMP implementation. *Critical Area #1* contains prioritized agricultural lands throughout the entire **Blierdofer Ditch HUC-12** (Figure 11).

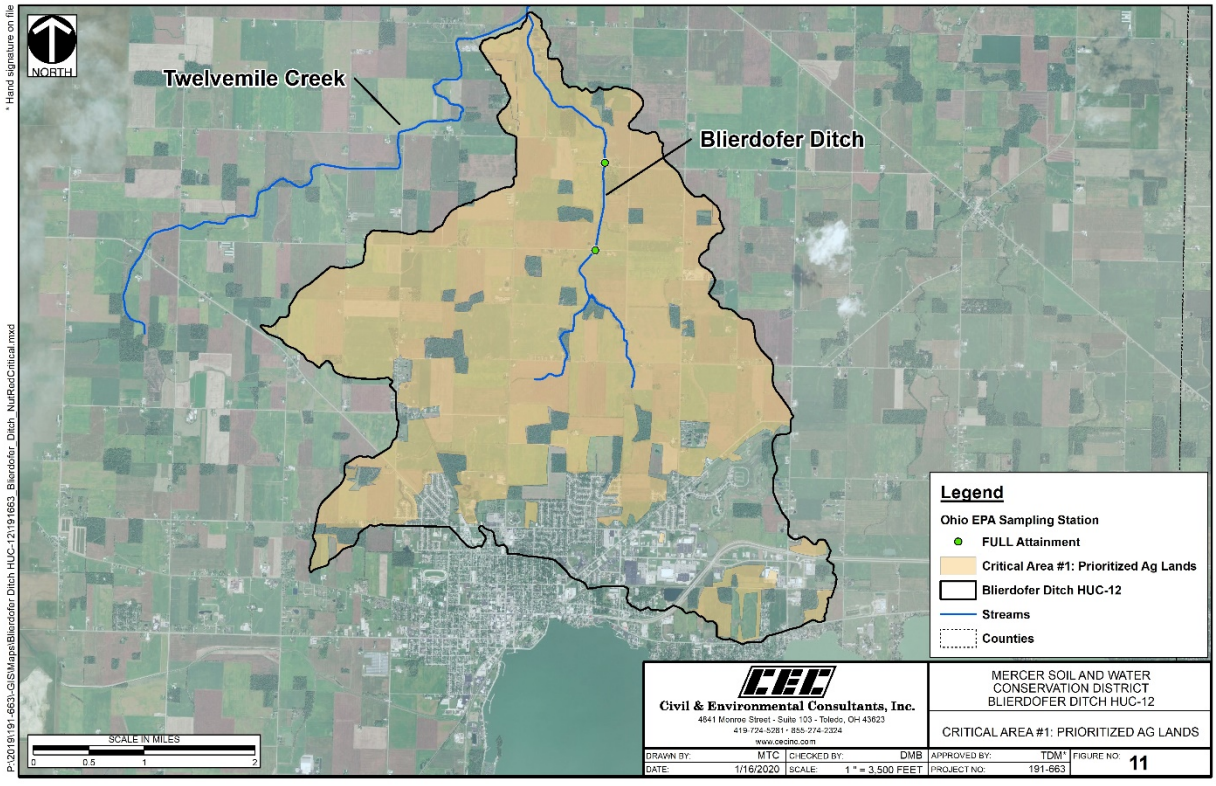


Figure 11: Blierdofer Ditch HUC-12 Critical Area #1

Of the 6,695 crop acres in the **Blierdofer Ditch HUC-12**, prioritized lands are operations that meet one or more of the following criteria:

- Lands directly adjacent to streams or drainage waterways;
- Lands without a current (<3 years) nutrient management plan;
- Lands with high soil phosphorus levels (>40 ppm Mehlich); and/or,
- Lands with recurrent gully erosion.

3.2.2 Detailed Biological Conditions

Fish community data for the two sampling locations within **Blierdofer Ditch HUC-12** are summarized below (Table 11). Analysis of the abundance, diversity and pollution tolerance of existing fish species found by OEPA at each sampling location, in relation to the corresponding QHEI score, aids in the identification of causes and sources of impairment. The fish communities at both sampling locations scored well above the MWH WQS for IBI (goal for headwater sites = 20). Habitat scores fell short of expected scores to support MWH communities (QHEI target = 43.5), which is common in streams within the HELP ecoregion. These streams, typically channelized, often do not recover enough to show positive stream habitat attributes, particularly when drainage maintenance is ongoing in these areas. While the fish communities at both sites are in attainment, pollution tolerant species are still abundant within Blierdofer Ditch, as evidenced by the presence of species such as creek chub and green sunfish in notable amounts.

Table 11: Critical Area #1 – Fish Community and Habitat Data

Blierdofer Ditch HUC-12 (04100004 02 03)							
RM	**Drainage Area (mi^2)**	**Total Species**	**QHEI**	**IBI**	**MIwb[a]**	**Predominant Species (Percent of Catch)**	**Narrative Evaluation**
Blierdofer Ditch (MWH)							
2.50 [H]	6.4	19	42.8	36	N/A	Central stoneroller (25%), creek chub (20%), green sunfish (16%)	Marginally Good
1.70 [H]	10.5	16	28	32	N/A	Green sunfish (57%), common carp (7%), tadpole madtom (7%)	Fair

(Source: OEPA, 2018b)

NOTES
QHEI Qualitative Habitat Evaluation Index
IBI Index of Biotic Integrity
a The Modified Index of Well Being (MIwb) is not applicable to headwater sites (drainage ≤20 mi^2).
H Headwater sample
N/A Not applicable

Characteristics of the aquatic macroinvertebrate community for the Blierdofer Ditch sampling locations in *Critical Area #1* are summarized below (Table 12). Again, analysis of the abundance, diversity, and pollution tolerance of existing aquatic macroinvertebrates (bugs) found by OEPA at these sampling locations, related to QHEI scores, can aid in the identification of causes and sources of impairment. The macroinvertebrate communities at RM 2.50 received a qualitative score of Fair, which generally equates

to a numerical score between 14 and 28, with a mean of 21, falling within the nonsignificant departure range for MWH attainment (ICI goal = 22). Macroinvertebrate communities at this site were limited by a number of MWH attributes, including poor substrate and lack of riffles. Macroinvertebrate communities at RM 1.70, though receiving a qualitative score of Marginally Good, performed well despite the number of MWH habitat attributes (MWH high influence=5; MWH low-influence=8). Between the two sites, *Ephemeroptera* (mayfly), *Plecoptera* (stonefly) and *Trichoptera* (caddisfly) (EPT) species ranged between six (RM 2.50) to eight (RM 1.70).

Table 12: Critical Area #1 – Macroinvertebrate Community Data

Blierdofer Ditch HUC-12 (04100004 02 03)		
RM	**ICI Score-Narrative[a]**	**Predominant Species (Tolerance Categories)**
Blierdofer Ditch (MWH)		
2.50 H	N/A – Fair 0 sensitive taxa	Turbellaria (F), Caddisflies (F), Beetles (F, MT), Midges (F, T)
1.70 H	N/A – Marginally Good 2 sensitive taxa	Bryozoan (F), Isopods (T), Mayflies (F), Midges (F, T)

(Source: Ohio EPA, 2018b)

NOTES

a Narrative evaluation used in lieu of ICI (G=Good; MG=Marginally Good; F=Fair; L Fair=Low Fair; P=Poor; VP=Very Poor).

H Headwater sample

Tolerance Categories: VT=Very Tolerant, T=Tolerant, MT=Moderately Tolerant, F=Facultative, MI=Moderately Intolerant, I=Intolerant.

3.2.3 Detailed Causes and Associated Sources

The two sampling locations within the **Blierdofer Ditch HUC-12** are in *Full Attainment* of the MWH designation. While biological impairment within this critical area at a near-field level is not currently of concern, an analysis of the QHEI scoring shows a substantial presence of high- and moderate-influence MWH habitat attributes throughout these headwater tributaries in the St. Marys region. Many of these habitat attributes (i.e., heavy/moderate silt cover, channelization with no recovery, high embeddedness, etc.) are likely a result of land use activities, which are mainly agricultural operations within the watershed.

From a far-field perspective, agricultural land use activities contribute to excessive nutrient loadings to Lake Erie that result in eutrophication and the formation of HABs. The use of a variety of BMPs on private agricultural lands, at both in-field and edge-of-field locations can help reduce the amount and concentration of nutrient-laden surface runoff and tile drainage. Many BMPs can not only address reduction of nutrients in surface and drainage water, but they can also simultaneously address the loss of sediment from agricultural lands, which contributes to sediment-covered substrates in local waterways. In addition, a reduction of sediment loss to local waterways can also reduce nutrient loss to near-field and far-field waterbodies, as nutrients will also adsorb to sediment particles, potentially becoming dissolved at a later time. The implementation of BMPs on agricultural lands that are prone to sediment and nutrient loss serves as a benefit for both near-field and far-field waterbodies.

3.2.4 Outline Goals and Objectives for the Critical Area

The overarching goal of any NPS-IS is to improve water quality scores or meet nutrient reduction goals in order to remove a waterbody's impairment status. Agricultural land use activities in *Critical Area #1* contribute to far-field impairment through excessive nutrient loss (phosphorus) to local waterways that flow to Lake Erie. Through the GLWQA Annex 4 and the subsequent DAP for the State of Ohio, nutrient target loads have been set for the Maumee River, which is the largest contributing waterbody to the WLEB and is fed by the St. Marys River, to which Twelvemile Creek is a tributary and Blierdofer Ditch a secondary tributary. These phosphorus target loads have been set at levels that are 40% lower than the current estimated loadings. Ohio's Nutrient Mass Balance Study has also shown that a large portion of the nutrient load to Lake Erie occurs during springtime rains (OEPA, 2018c).

Many objectives within the **Blierdofer Ditch HUC-12** align with the priorities of the H2Ohio Initiative, a water quality initiative with a focus on phosphorus reduction. This program will provide economic incentives to producers who develop nutrient management plans for their fields and implement effective and cost-efficient BMPs that include: soil testing, variable rate fertilization, subsurface nutrient application, manure incorporation, conservation crop rotation, cover crops, drainage water management structures, two-stage ditch construction, edge of field buffers and headwaters and coastal wetlands that reduce agricultural runoff (H2Ohio, 2019).

Goals

The OEPA has modeled nutrient loadings associated with various land uses and sources within each HUC-12 in the Maumee River Basin, and has set phosphorus reduction goals for each associated source, based upon springtime load estimates. To achieve the desired phosphorus reduction from agricultural land use in the **Blierdofer Ditch HUC-12**, the following goal has been established:

Goal 1. Reduce springtime phosphorus loading contributions in *Critical Area #1* to a level at or below 3,800 lbs/year (40% reduction).
NOT ACHIEVED: Current spring load contribution is estimated to be 6,300 lbs/year.

Objectives

In order to make substantive progress toward the achievement of the springtime phosphorus load reduction goal of 2,500 lbs for the **Blierdofer Ditch HUC-12**, effort must commence on more widespread implementation, according to the following objectives within *Critical Area #1.*

Objective 1: Reduce erosion and nutrient loss through the installation of grassed waterways that receive/treat surface water from at least 500 acres.

Objective 2: Reduce nutrient loss from subsurface tile drainage through the installation of drainage water management structures and/or saturated buffers that drain at least 400 acres.

Objective 3: Implement nutrient management planning on at least 3,800 additional acres[2].

Objective 4: Create, enhance and/or restore at least 80 acres of wetlands for treatment of agricultural runoff and/or nutrient reduction purposes from 2,000 total agricultural acres.

Objective 5: Plant cover crops on at least 2,700 additional acres annually[3].

Objective 6: Install at least two miles (10,560 linear feet) of two-stage ditch design to create functional floodplain bench.

These objectives will be directed towards implementation on prioritized agricultural lands and are estimated to reach the phosphorus spring load reduction goal (Table 13). Additional conservation activities within the **Blierdofer HUC-12**, both on priority and secondary lands, may also make incremental progress towards phosphorus reduction goals. The implementation of BMPs included in these objectives, as well as BMPs implemented through federal and state programs and other voluntary efforts will be tracked to monitor progress towards phosphorus reduction goals within the watershed.

Table 13: Estimated Nutrient Loading Reductions from Each Objective

Objective Number	Best Management Practice	Total Acreage Treated	Estimated Annual Phosphorus Load Reduction (lbs)	Estimated Spring Phosphorus Load Reduction (lbs)
1	Grassed Waterways[a]	500	225	145
2	Drainage Water Management Structures and Saturated Buffers	400	190	125
3	Nutrient Management (Planning and Implementation)[b]	3,800	1,825	1,180
4	Wetlands[c]	2,000[d]	1,050	685
5	Cover Crops	2,700	420	275
6	Two Stage Ditch	550[e]	145	95
TOTAL		9,950*	3,855	2,505

(Source Model: Spreadsheet Tool for Estimating Pollutant Loads (STEPL), Version 4.4, (USEPA, 2019))

NOTES

a Grassed Waterways phosphorus reduction efficiency estimated from reference values listed in OSUE, 2018.

b Nutrient Management consists of "managing the amount (rate), source, placement (method of application) and timing of plant nutrients and soil amendments to budget, supply and conserve nutrients for plant production; to minimize agricultural nonpoint source pollution of surface and groundwater resources; to properly utilize manure or organic byproducts as a plant nutrient source; to protect air quality by reducing odors, nitrogen emissions (ammonia, oxides of nitrogen) and the formation of atmospheric particulates; and/or to maintain or improve the physical, chemical and biological condition of soil," as defined by the STEPL guidance documents (Tetra Tech, 2018).

[2] Approximately 685 acres are covered under certified nutrient management plans in the Blierdofer Ditch HUC-12.

[3] Cover crops are estimated to be planted on approximately 5% of agricultural fields currently. Cover crop plantings are not dependent upon grant funding.

c *Phosphorus load reduction for wetlands was calculated using the estimated 5-year average cropland nutrient yield in the Maumee River watershed from 2013-2017 (1.05 lbs/acre phosphorus), provided by Heidelberg University National Center for Water Quality Research.*

d *If drainage water is routed through restored/created wetlands, it is assumed a 50% reduction in phosphorus from total nutrient yield for the drainage area, with a 25:1 ratio of drainage area to the receiving wetland. For this objective of 80 wetland acres, total drainage area is 2,000 acres.*

e *One linear foot of two-stage ditch design is estimated to treat 0.052 acres, based upon the watershed total cropland acres (~6,695), drained by ~24 miles of waterways. This drainage area will change, based upon specific project areas.*

* *Total acreage treated exceeds number of agricultural land acres within watershed. More than one BMP may be implemented within fields.*

Water quality monitoring is an integral part of the project implementation process. Both project-specific and routinely scheduled monitoring will be conducted to determine progress towards meeting the goals (i.e., water quality standards and nutrient reduction targets). Through an adaptive management process, the aforementioned objectives will be reevaluated and modified as necessary. Objectives may be added to make further progress towards attainment or reduction goals, or altered, as a systems approach of multiple BMPs can accelerate the improvement of water quality conditions. The *Nonpoint Source Management Plan Update* (OEPA, 2013a) will be utilized as a reevaluation tool for its listing of all eligible NPS management strategies to consider including:

- Urban Sediment and Nutrient Reduction Strategies;
- Altered Stream and Habitat Restoration Strategies;
- Nonpoint Source Reduction Strategies; and,
- High Quality Waters Protection Strategies.

3.3 Critical Area #2: Conditions, Goals & Objectives for Nutrient Reduction from HSTS in Blierdofer Ditch HUC-12

3.3.1 Detailed Characterization

Ohio's Nutrient Mass Balance Study (OEPA, 2018c) estimated a small percentage (4%) of the nutrient loadings to Lake Erie via the Maumee River were from contributions from failing HSTS (OEPA, 2018a). This estimate is consistent with estimates from several other studies. The OEPA has modeled nutrient loadings associated with various land uses and sources within each HUC-12 in the Maumee River Basin, and has set phosphorus reduction goals for each associated source, including failing or inefficient HSTS, based upon springtime load estimates. *Critical Area #2* contains a cluster of homes near the intersection of Miller Rd. and Weitz Rd., as well as approximately 21 unmapped, unsewered households with compromised HSTS within the **Blierdofer Ditch HUC-12** (Figure 12).

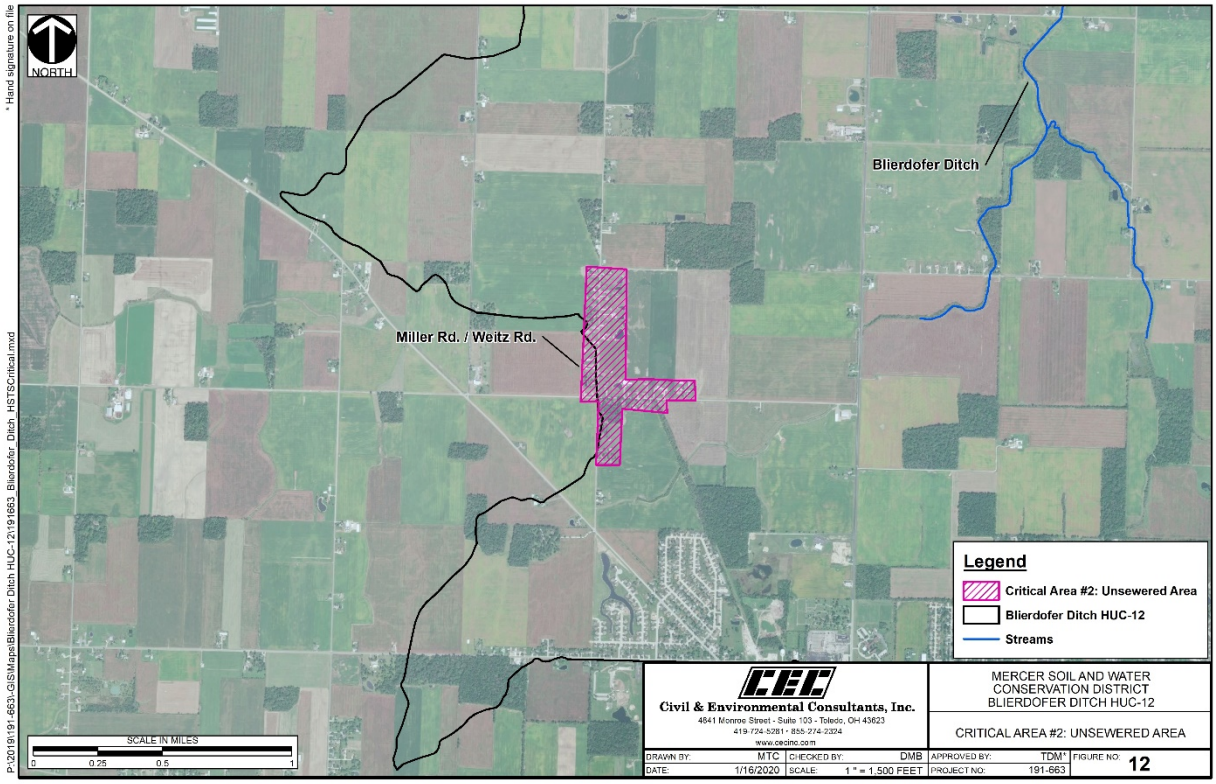


Figure 12: Blierdofer Ditch HUC-12 Critical Area #2

The cluster of homes located along Miller Rd. and Weitz Rd. covers an area of approximately 87 acres. TMACOG (2018) estimates approximately 40 homes are unsewered in this area. The headwaters to Blierdofer Ditch is approximately one mile to the west of this critical area.

3.3.2 Detailed Biological Conditions

Biological data do not exist for this critical area, as no streams or open ditches that flow directly through *Critical Area #2* have been assessed by the OEPA.

3.3.3 Detailed Causes and Associated Sources

In 2018, TMACOG identified the area surrounding Miller Rd. and Weitz Rd. as a CSA, an area of dense housing/business units within an unsewered area. Sanitary sewer improvements or efforts undertaken to repair failing or inefficient HSTS within CSAs and through a case-by-case basis throughout the **Blierdofer Ditch HUC-12** will not only prevent the distribution of human waste into the environment, but would also help contribute to progress on meeting overall WLEB nutrient reduction goals set by the GLWQA and Ohio's DAP.

3.3.4 Outline Goals and Objectives for the Critical Area

The overarching goal of any NPS-IS is to improve water quality scores or meet nutrient reduction goals in order to remove a waterbody's impairment status. Elimination of HSTS nutrient contributions should be addressed to reduce the amount of fecal materials and nutrients introduced to the environment and

local waterways. In order to meet the 40% overall nutrient reduction goals of the Ohio DAP, reductions in nutrient contributions from failing HSTS should also be considered. Using current estimates from the OEPA Division of Surface Water, springtime phosphorus load contributions from HSTS should be no more than 110 lbs. Current estimates are 180 lbs., resulting in the need of an overall reduction by 70 lbs.

Goals

The OEPA has modeled nutrient loadings associated with various land uses and sources within each HUC-12 in the Maumee River Basin, and has set phosphorus reduction goals for each associated source, based upon springtime load estimates. To achieve the desired phosphorus reduction from HSTS in the **Blierdofer Ditch HUC-12**, the following goal has been established:

Goal 1. Reduce springtime phosphorus loading contributions in *Critical Area #2* to a level at or below 110 lbs/year (40% reduction).
NOT ACHIEVED: Current springtime load contribution is estimated to be 180 lbs/year.

TMACOG's HSTS study (2018) estimated the annual phosphorus load from the entire **Blierdofer Ditch HUC-12** to be 0.19 metric tons per annum (MTA), with a total household count of 284. Using these numbers, an average household's yearly Total phosphorus contribution in this watershed is 0.00067 MTA, equivalent to 1.48 lbs per year within the **Blierdofer Ditch HUC-12**. Using TMACOG's estimate of at least 40 households in this CSA, phosphorus loads could be reduced by 59 lbs annually, accounting for approximately 39 lbs for the springtime load. Approximately 21 additional failing HSTS outside of the identified CSA would need to be replaced to fully meet the 70 lb springtime load reduction target. Sanitary sewer connection to isolated or sparsely populated areas is not likely.

Objectives

In order to make substantive progress toward the achievement of the springtime phosphorus load reduction goal of 70 lbs for the **Blierdofer Ditch HUC-12**, effort must commence on more widespread implementation, according to the following objectives within *Critical Area #2.*

Objective 1: Reduce HSTS contributions through replacement efforts or sanitary sewer infrastructure connection for at least 40 households in the area near Miller Rd. and Weitz Rd.

Objective 2: Reduce HSTS contributions through replacement efforts for at least 21 unmapped, unclustered households on an individualized, case-by-case basis.

Water quality monitoring is an integral part of the project implementation process. Both project-specific and routinely scheduled monitoring will be conducted to determine progress towards meeting the goals (i.e., water quality standards and nutrient reduction targets). Through an adaptive management process, the aforementioned objectives will be reevaluated and modified as necessary. Objectives may be added to make further progress towards attainment or reduction goals, or altered, as a systems approach of multiple BMPs can accelerate the improvement of water quality conditions. The *Nonpoint Source Management Plan Update* (OEPA, 2013a) will be utilized as a reevaluation tool, as well as other

state and federal agency resources for its listing of all eligible NPS management and nutrient reduction strategies to consider including:

- Urban Sediment and Nutrient Reduction Strategies;
- Altered Stream and Habitat Restoration Strategies;
- Nonpoint Source Reduction Strategies; and,
- High Quality Waters Protection Strategies.

3.4 Critical Area #3: Conditions, Goals & Objectives for Nutrient Reduction in the Urbanized Area in Blierdofer Ditch HUC-12

3.4.1 Detailed Characterization

In urban environments, NPS contributions to stormwater runoff can come from a variety of sources, including fertilizers, detergents, leaves and detritus, wild and domesticated animal excrement, lubricants, sediment erosion, and organic and inorganic decomposition processes (Carpenter *et. al*, 1998; Burton and Pitt, 2001). Stormwater runoff (and its associated pollutants) in the city of Celina directly enter local waterways, with no opportunity for treatment prior to discharge, since the city operates under a MS4 permit.

The abundance of impervious surface and underutilization of stormwater detention throughout the **Blierdofer Ditch HUC-12** contributes to flashy flows in both Blierdofer Ditch and other tributary ditches in times of heavy rains, exacerbating streambank erosion in downstream areas. Actions taken to reduce and retain stormwater flows will not only decrease the occurrence of erosive, flashy flows, but will help in the retention of nutrients that eventually reach Lake Erie.

Impervious surface in Celina

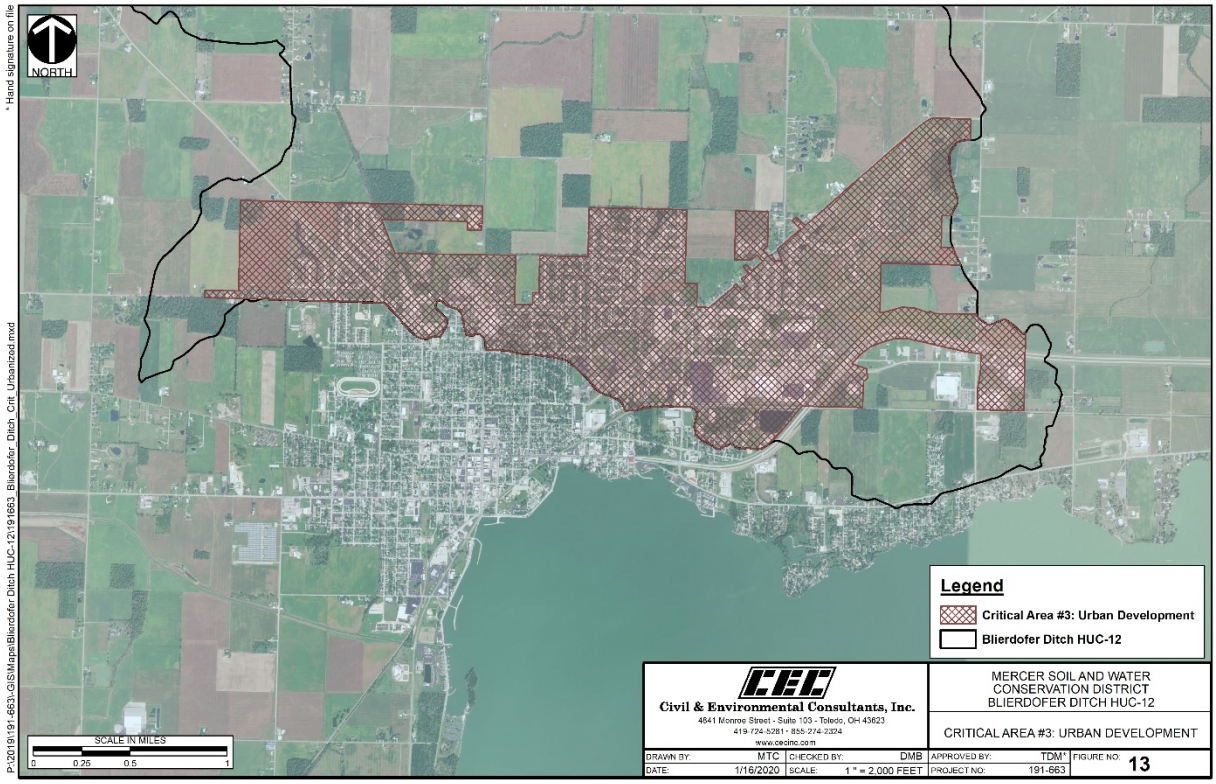


Figure 13: Blierdofer Ditch HUC-12 Critical Area #3

The urbanized area of Celina is approximately 3,421 acres, of which 1,781 acres are contained within the **Blierdofer Ditch HUC-12**. This urbanized area is split between two watersheds: the Lake Erie watershed in the northern portion (contained within **Blierdofer Ditch HUC-12**) and the Wabash River watershed in the southern portion. The northern portion of Celina is mainly residential development, with localized pockets of commercial facilities, such as Walmart, Goodwill and other smaller stores.

3.4.2 Detailed Biological Conditions

Biological data do not exist for this critical area, as no streams or open ditches that flow directly through *Critical Area #3* have been assessed by the OEPA.

3.4.3 Detailed Causes and Associated Sources

Compared with natural land cover, shallow and deep infiltration and evapotranspiration decreases, while surface runoff increases (USEPA, 2003). When watersheds have as little as 10% impervious surface, studies have shown not only does runoff increase substantially, but pollutant loads also increase (CWP, 1998). Urbanized lands (residential, commercial/industrial/transportation, etc.) account for over 20% of the land use within the **Blierdofer Ditch HUC-12**, most of which falls within the urbanized area of Celina.

The Ohio Lake Erie Phosphorus Task Force recognized that urban stormwater runoff poses a larger threat to local impacts than to far-field impacts to Lake Erie; however, efforts should be made to reduce

phosphorus loadings in urban stormwater where possible (OEPA, 2010). Like agricultural BMPs, urban stormwater BMPs and the use of green infrastructure techniques have both a benefit to near-field and far-field aquatic communities.

3.4.4 Outline Goals and Objectives for the Critical Area

The overarching goal of any NPS-IS is to improve water quality scores or meet nutrient reduction goals in order to remove a waterbody's impairment status. In order to meet the 40% overall nutrient reduction goals of the Ohio DAP, reductions in nutrient contributions from urbanized areas should also be considered. Using current estimates from the OEPA Division of Surface Water, springtime phosphorus load contributions from developed lands in the **Blierdofer Ditch HUC-12** should be no more than 600 lbs. Current estimates are 960 lbs., resulting in the need of an overall reduction by 360 lbs.

Goals

The OEPA has modeled nutrient loadings associated with various land uses and sources within each HUC-12 in the Maumee River Basin, and has set phosphorus reduction goals for each associated source, based upon springtime load estimates. To achieve the desired phosphorus reduction from developed lands in the **Blierdofer Ditch HUC-12**, the following goal has been established:

Goal 1. Reduce springtime phosphorus loading contributions in *Critical Area #3* to a level at or below 600 lbs/year (40% reduction).
NOT ACHIEVED: Current springtime load contribution is estimated to be 960 lbs/year.

Objectives

In order to make substantive progress toward the achievement of the springtime phosphorus load reduction goal of 360 lbs for the **Blierdofer Ditch HUC-12**, effort must commence on more widespread implementation, according to the following objectives within *Critical Area #3.*

Objective 1: Reduce stormwater inputs and impacts in the subwatershed by implementing green infrastructure projects within *Critical Area #3* that retain, detain, and/or treat runoff from at least 400 acres of urbanized impermeable surfaces (i.e., parking lots, roads, etc.).

Objective 2: Treat urban runoff in-stream through the restoration of floodplains or the creation of floodplain benches along at least one mile (5,280 linear feet) of ditches and streams flowing through or immediately downstream of urban areas.

Water quality monitoring is an integral part of the project implementation process. Both project-specific and routinely scheduled monitoring will be conducted to determine progress towards meeting the goals (i.e., water quality standards and nutrient reduction targets). Through an adaptive management process, the aforementioned objectives will be reevaluated and modified as necessary. Objectives may be added to make further progress towards attainment or reduction goals, or altered, as a systems

approach of multiple BMPs can accelerate the improvement of water quality conditions. The *Nonpoint Source Management Plan Update* (OEPA, 2013a) will be utilized as a reevaluation tool, as well as other state and federal agency resources for its listing of all eligible NPS management and nutrient reduction strategies to consider including:

- Urban Sediment and Nutrient Reduction Strategies;
- Altered Stream and Habitat Restoration Strategies;
- Nonpoint Source Reduction Strategies; and,
- High Quality Waters Protection Strategies.

CHAPTER 4: PROJECTS AND IMPLEMENTATION STRATEGY

Projects and evaluation needs identified for the **Blierdofer Ditch HUC-12** are based upon identified causes and associated sources of NPS pollution. Over time, these critical areas will need to be reevaluated to determine progress towards meeting restoration, attainment and nutrient reduction goals. Time is an important variable in measuring project success and overall status when using biological indices as a measurement tool. Some biological systems may show fairly quick response (i.e., one season), while others may take several seasons or years to show progress towards recovery. In addition, reasons for the impairment other than those associated with NPS sources may arise. Those issues will need to be addressed under different initiatives, authorities or programs that may or may not be accomplished by the same implementers addressing the NPS issues.

Implementation of practices described in this NPS-IS plan will also contribute to nutrient load reduction (specifically the 40% reduction in phosphorus load) to protect and restore use attainment in Lake Erie. Nutrient load reduction efforts are consistent with the Lake Erie Collaborative Agreement through the International Joint Commission (IJC) and Ohio's DAP (OLEC, 2018).

For the **Blierdofer Ditch HUC-12** there are three *Project and Implementation Strategy Overview Tables* (subsection 4.1, 4.2, 4.3). Future versions of this NPS-IS may include subsequent sections as more critical areas are refined and more projects become developed to meet the requisite objectives within a critical area. The projects described in the *Overview Table* have been prioritized using the following three-step prioritization method:

Priority 1 — Projects that specifically address one or more of the listed Objectives for the Critical Area.

Priority 2 — Projects where there is land-owner willingness to engage in projects that are designed to address the cause(s) and source(s) of impairment or where there is an expectation that such potential projects will improve water quality in the **Blierdofer Ditch HUC-12**.

Priority 3 — In an effort to generate interest in projects, an information and education campaign will be developed and delivered. Such outreach will engage citizens to spark interest by stakeholders to participate and implement projects like those mentioned in Priority 1 and 2.

Project Summary Sheets (PSS) are in subsection 4.1.1, 4.2.1 and 4.3.1; these provide the essential nine elements for short-term and/or next step projects that are in development and/or in need of funding. As projects are implemented and new projects developed, these sheets will be updated. Any new PSS created will be submitted to the state of Ohio for funding eligibility verification (i.e., all nine elements are included).

4.1 Critical Area #1 Project and Implementation Strategy Overview Tables

Table 14: Blierdofer Ditch HUC-12 (04100004 02 03) — Critical Area #1							
Goal	**Objective**	**Project #**	**Project Title (EPA Criteria g)**	**Lead Organization (EPA criteria d)**	**Time Frame (EPA Criteria f)**	**Estimated Cost (EPA Criteria d)**	**Potential/Actual Funding Source (EPA Criteria d)**
Urban Sediment and Nutrient Reduction Strategies							
Altered Stream and Habitat Restoration Strategies							
Agricultural Nonpoint Source Reduction Strategies							
1	3	1	Agricultural BMPs – Nutrient Management Planning	Mercer SWCD/ Mercer Ag Solutions	Short (1-3 yrs)	$55,000	Ohio EPA §319, GLRI, H2Ohio, GLC, NRCS-USDA CRP
1	5	2	Agricultural BMPs – Cover Crops	Mercer SWCD/ Mercer Ag Solutions	Short (1-3 yrs)	$84,000	H2Ohio, GLRI, GLC, NRCS-USDA CRP
1	4,6	3	Agricultural and Urban Nutrient Reduction and Restoration (also cross-referenced in *Critical Area #3*)	Mercer SWCD/ Mercer Ag Solutions	Short (1-3 yrs)	$350,000-$400,000	Ohio EPA §319, GLRI, H2Ohio, GLC, NRCS-USDA CRP
1	6	4	Howick Farm Two-Stage Ditch (also cross-referenced in *Critical Area #3)*	Mercer SWCD/ Mercer Ag Solutions	Short (1-3 yrs)	$150,000-$175,000	Ohio EPA §319, GLRI, H2Ohio, GLC, NRCS-USDA CRP
High Quality Waters Protection Strategies							
Other NPS Causes and Associated Sources of Impairment							

4.1.1 Project Summary Sheet(s)

The Project Summary Sheets provided below were developed based on the actions or activities needed to achieve nutrient reduction targets in the **Blierdofer Ditch HUC-12**. These projects are considered next step or priority/short term projects and are considerably ready to implement. Medium and longer-term projects will not have a Project Summary Sheet, as these projects are not ready for implementation or need more thorough planning.

Table 15: Critical Area #1 – Project #1		
Nine Element Criteria	**Information needed**	**Explanation**
n/a	**Title**	Agricultural BMPs – Nutrient Management Planning
criteria d	**Project Lead Organization & Partners**	Mercer Soil and Water Conservation District; Mercer County Ag Solutions
criteria c	**HUC-12 and Critical Area**	Blierdofer Ditch HUC-12 (04100004 02 03) – *Critical Area #1*
criteria c	**Location of Project**	Private landowners within critical area – exact location not disclosed
n/a	**Which strategy is being addressed by this project?**	Agricultural Nonpoint Source Reduction
criteria f	**Time Frame**	Short (1-3 years)
criteria g	**Short Description**	Create nutrient management plans
criteria g	**Project Narrative**	Mercer SWCD will work with local landowners in prioritized agricultural lands to create nutrient management plans for 2,000 acres that meet one or more criteria for prioritized agricultural lands within the Blierdofer Ditch HUC-12. This project summary sheet may be combined with other project summary sheets to form a singular project, which could be delivered as a program, according to funding source, timing considerations and identification of landowner needs.
criteria d	**Estimated Total cost**	$80,000
criteria d	**Possible Funding Source**	Ohio EPA §319, GLRI, H2Ohio, GLC, NRCS-USDA CRP
criteria a	**Identified Causes and Sources**	Cause: Nutrient loadings, leading to far-field impacts Source: Agricultural land use activities
criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?**	Objective #3: Implement nutrient management planning on at least 3,800 acres.

Table 15: Critical Area #1 – Project #1		
Nine Element Criteria	**Information needed**	**Explanation**
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Objective #3: Implement nutrient management planning on at least 2,000 acres of 3,800 acres (53%). Goals: The overall goal in *Critical Area #1* is to reduce estimated total spring phosphorus loads. Current estimates indicate 6,300 lbs. of phosphorus in the spring load is attributed to agricultural land use activities. In order to meet the GLWQA nutrient reduction goals, spring loadings must be reduced by 40%, or 2,500 lbs. It is expected that this project will cause a decrease in spring phosphorus loadings by 631 lbs, or 25%.
	Part 3: Load Reduced?	Estimated annual reduction: 1672 #N/year; 971 #P/year; sediment reduction not applicable
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	It is generally unrealistic to monitor load reduction from individual agricultural practices; however, ambient monitoring is conducted throughout the WLEB by organizations such as OEPA, NOAA, and Heidelberg University. These entities will continue long term monitoring on various tributaries in the Maumee basin to track load reduction trends. In addition, Mercer SWCD will conduct follow-up activities, as deemed necessary, to document nutrient management plan implementation.
criteria e	**Information and Education**	Project information and funding availability will be advertised on the Mercer SWCD website and through other outreach means (announcements in newsletters, newspapers, field days and other regularly occurring meetings). Targeted announcements will be sent via direct mailings, and Mercer SWCD will engage in individual landowner discussions regarding BMP implementation and available assistance, if initial participation is low. On-going and post-project implementation accomplishments will be promoted through similar venues, media and discussions.

Table 16: Critical Area #1 – Project #2		
Nine Element Criteria	**Information needed**	**Explanation**
n/a	**Title**	Agricultural BMPs – Cover Crops
criteria d	**Project Lead Organization & Partners**	Mercer Soil and Water Conservation District; Mercer County Ag Solutions
criteria c	**HUC-12 and Critical Area**	Blierdofer Ditch HUC-12 (04100004 02 03) – *Critical Area #1*
criteria c	**Location of Project**	Private landowners – exact locations not disclosed
n/a	**Which strategy is being addressed by this project?**	Agricultural Nonpoint Source Reduction
criteria f	**Time Frame**	Short (1-3 years)
criteria g	**Short Description**	Cost share program to implement cover crop plantings.
criteria g	**Project Narrative**	Mercer SWCD will administer a cost-share program to local landowners in prioritized agricultural lands to plant cover crops on at least 1,000 acres annually for three years. Landowners will enroll no less than 10 acres minimally, and the maximum amount enrolled by one operation will not exceed 400 acres. Cost-share will pay out at $25 per acre.
criteria d	**Estimated Total cost**	$84,000 ($28,000 annually)
criteria d	**Possible Funding Source**	H2Ohio, GLRI, GLC, NRCS-USDA CRP, EQIP
criteria a	**Identified Causes and Sources**	Cause: Nutrient loadings, leading to far-field impacts Source: Agricultural land use activities
criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?**	Objective #5: Plant cover crops on at least 8,600 acres annually, resulting in plantings of at least 8,170 additional acres.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Objective #5: Plant cover crops on at least 1,000 acres of 8,600 acres annually, resulting in plantings of at least 8,170 additional acres (12%). Goals: The overall goal in *Critical Area #1* is to reduce estimated total spring phosphorus loads. Current estimates indicate 16,000 lbs. of phosphorus in the spring load is attributed to agricultural land use activities. In order to meet the GLWQA nutrient reduction goals, spring loadings must be reduced by 40%, or 6,400 lbs. It is expected that this project will cause a decrease in spring phosphorus loadings by 91 lbs, or 1.4%.
	Part 3: Load Reduced?	Estimated annual reduction: 1,380 #N/year; 140 #P/year; 41 tons sediment/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	Mercer SWCD will verify cover crop plantings. It is generally unrealistic to monitor load reduction from individual agricultural practices; however, ambient monitoring is conducted throughout the WLEB by organizations such as OEPA, NOAA, and Heidelberg University. These entities will continue long term monitoring on various tributaries in the Maumee basin to track load reduction trends.

Table 16: Critical Area #1 – Project #2		
Nine Element Criteria	**Information needed**	**Explanation**
criteria e	**Information and Education**	Project information and funding availability will be advertised on the Mercer SWCD website and through other outreach means (announcements in newsletters, newspapers, field days and other regularly occurring meetings). Targeted announcements will be sent via direct mailings, and Mercer SWCD will engage in individual landowner discussions regarding BMP implementation and available assistance. On-going and post-project implementation accomplishments will be promoted through similar venues, media and discussions.

Table 17: Critical Area #1 – Project #3		
Nine Element Criteria	**Information needed**	**Explanation**
n/a	**Title**	Agricultural and Urban Nutrient Reduction and Restoration
criteria d	**Project Lead Organization & Partners**	Mercer Soil and Water Conservation District; Mercer County Ag Solutions
criteria c	**HUC-12 and Critical Area**	Blierdofer Ditch HUC-12 (04100004 02 03) – *Critical Area #1 and Critical Area #3*
criteria c	**Location of Project**	Latitude: 40.568956; Longitude: -84.583121
n/a	**Which strategy is being addressed by this project?**	Agricultural Nonpoint Source Reduction Urban Sediment and Nutrient Reduction
criteria f	**Time Frame**	Short (1-3 years)
criteria g	**Short Description**	This project will consist of a 2-acre wetland restoration and a 1,700 linear foot two-stage ditch improvement on private property adjacent to the City of Celina, Ohio.
criteria g	**Project Narrative**	This project will consist of a wetland restoration and a two-stage ditch improvement on private property adjacent to the City of Celina, Ohio. These two practices will be directly adjacent to each other, in order to maximize capacity for water treatment and sediment and nutrient attenuation and will address both agricultural and urban nutrient reduction. Approximately 160 acres of a residential development drain to a ditch via 36-inch and 24-inch pipe through an old railroad bed. Drainage water has since cut two eroded ditches along either side of the railroad bed. Agricultural lands directly adjacent to the eroded ditches are subjected to flooding and heavy erosion due to excessive runoff from the developed area with no retention time. Two-stage ditch design will occur along 1,700 linear foot section of the ditch to decrease erosion, create capacity within the stream and create a functional floodplain bench for the attenuation of nutrients and sediment. In addition, a two-acre wetland will be created adjacent to the two stage ditch to accommodate overflow and further retain sediments and nutrients. This project will also include a perpetual conservation easement to be held by the Mercer Soil and Water Conservation District so that the land will remain privately-owned. Due to the project's immediate downstream location from an urban residential development, as well as its location within a critical agricultural land, the project is applicable to both the treatment of urban stormwater runoff and agricultural runoff.
criteria d	**Estimated Total cost**	$350,000 - $400,000
criteria d	**Possible Funding Source**	Ohio EPA §319, GLRI, H2Ohio, GLC, NRCS-USDA CRP
criteria a	**Identified Causes and Sources**	Cause: Nutrient loadings, leading to far-field impacts Source: Agricultural land use activities and urban development activities

Table 17: Critical Area #1 – Project #3		
Nine Element Criteria	**Information needed**	**Explanation**
criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?**	*Critical Area #1* – Objective #4: Create, enhance and/or restore at least 80 acres of wetlands for treatment of agricultural runoff and/or nutrient reduction purposes from 2,000 total agricultural acres. *Critical Area #1* – Objective #6: Install at least two miles (10,560 linear feet) of two-stage ditch design to create a functional floodplain bench. *Critical Area #3* – Objective #2: Treat urban runoff in-stream through the restoration of floodplains or the creation of floodplain benches along at least one mile (5,280 linear feet) of ditches and streams flowing through or immediately downstream of urban areas.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	*Critical Area #1* – Objective #4: Create, enhance and/or restore at least 2 acres of 80 acres of wetlands for treatment of agricultural runoff and/or nutrient reduction purposes from 2,000 total agricultural acres (2.5% and 26 lbs P/year). *Critical Area #1* – Objective #6: Install at least 0.32 miles (1,700 linear feet) of two miles (10,560 linear feet) of two-stage ditch design to create a functional floodplain bench (16% and 22 lbs P/year). *Critical Area #3* – Objective #2: Treat urban runoff in-stream through the restoration of floodplains or the creation of floodplain benches along at least 0.32 miles (1,700 linear feet) of one mile (5,280 linear feet) of ditches and streams flowing through or immediately downstream of urban areas (40% and 22 lbs P/year). Goals: The overall goal in *Critical Area #1 and Critical Area #3* is to reduce estimated total spring phosphorus loads. Current estimates indicate 6,300 lbs of phosphorus in the spring load is attributed to agricultural land use activities and 960 lbs of phosphorus in the spring load is attributed to urban land use activities. In order to meet the GLWQA nutrient reduction goals, spring loadings must be reduced by 40%, or 2,860 lbs. It is expected that this project will cause a decrease in spring phosphorus loadings by 44 lbs, or 1.5%.
	Part 3: Load Reduced?	Estimated annual reduction: 1,229 #N/year; 68 #P/year; 12.1 tons sediment/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	Mercer SWCD will design and verify installation of the wetland and two stage ditch. It is generally unrealistic to monitor load reduction from individual agricultural practices; however, ambient monitoring is conducted throughout the WLEB by organizations such as OEPA, NOAA, and Heidelberg University. These entities will continue long term monitoring on various tributaries in the Maumee basin to track load reduction trends.
criteria e	**Information and Education**	Project information will be shared at the Mercer SWCD annual meeting and in their brochure of accomplishments. Project highlights will also be shared on social media and/or Mercer SWCD's website.

Table 18: Critical Area #1 – Project #4		
Nine Element Criteria	**Information needed**	**Explanation**
n/a	**Title**	Howick Farm Two Stage Ditch
criteria d	**Project Lead Organization & Partners**	Mercer Soil and Water Conservation District; Mercer County Ag Solutions
criteria c	**HUC-12 and Critical Area**	Blierdofer Ditch HUC-12 (04100004 02 03) – *Critical Area #1 and Critical Area #3*
criteria c	**Location of Project**	Latitude: 40.570703; Longitude: -84.534470
n/a	**Which strategy is being addressed by this project?**	Agricultural Nonpoint Source Reduction Urban Sediment and Nutrient Reduction
criteria f	**Time Frame**	Short (1-3 years)
criteria g	**Short Description**	This project will create 2,900 linear feet of two-stage ditch.
criteria g	**Project Narrative**	This project will consist of a two-stage ditch improvement on private property just north of the City of Celina, Ohio. The project location has a watershed of ~300 acres, of which approximately half is urban land and half is agricultural land. Two-stage ditch design will occur along a 2,900 linear foot section of the ditch to decrease erosion, create capacity within the stream and create a functional floodplain bench for the attenuation of nutrients and sediment. This project will also include a perpetual conservation easement to be held by the Mercer Soil and Water Conservation District so that the land will remain privately-owned. Due to the project's location within critical agricultural land, as well as its mixed land use watershed, the project is applicable to both the treatment of urban stormwater runoff and agricultural runoff.
criteria d	**Estimated Total cost**	$150,000 - $175,000
criteria d	**Possible Funding Source**	Ohio EPA §319, GLRI, H2Ohio, GLC, NRCS-USDA CRP
criteria a	**Identified Causes and Sources**	Cause: Nutrient loadings, leading to far-field impacts Source: Agricultural land use activities and urban development activities
criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?**	*Critical Area #1* – Objective #6: Install at least two miles (10,560 linear feet) of two-stage ditch design to create a functional floodplain bench. *Critical Area #3* – Objective #2: Treat urban runoff in-stream through the restoration of floodplains or the creation of floodplain benches along at least one mile (5,280 linear feet) of ditches and streams flowing through or immediately downstream of urban areas.

Table 18: Critical Area #1 – Project #4		
Nine Element Criteria	**Information needed**	**Explanation**
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	*Critical Area #1* – Objective #6: Install at least 0.55 miles (2,900 linear feet) of two miles (10,560 linear feet) of two-stage ditch design to create a functional floodplain bench (28% and 79 lbs P/year). *Critical Area #3* – Objective #2: Treat urban runoff in-stream through the restoration of floodplains or the creation of floodplain benches along at least 0.55 (2,900 linear feet) of one mile (5,280 linear feet) of ditches and streams flowing through or immediately downstream of urban areas (55% and 79 lbs P/year). Goals: The overall goal in *Critical Area #1 and Critical Area #3* is to reduce estimated total spring phosphorus loads. Current estimates indicate 6,300 lbs of phosphorus in the spring load is attributed to agricultural land use activities and 960 lbs of phosphorus in the spring load is attributed to urban land use activities. In order to meet the GLWQA nutrient reduction goals, spring loadings must be reduced by 40%, or 2,860 lbs. It is expected that this project will cause a decrease in spring phosphorus loadings by 51 lbs, or 1.8%.
	Part 3: Load Reduced?	Estimated annual reduction: 1,418 #N/year; 79 #P/year; 14 tons sediment/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	Mercer SWCD will design and verify installation of the two stage ditch. It is generally unrealistic to monitor load reduction from individual agricultural practices; however, ambient monitoring is conducted throughout the WLEB by organizations such as OEPA, NOAA, and Heidelberg University. These entities will continue long term monitoring on various tributaries in the Maumee basin to track load reduction trends.
criteria e	**Information and Education**	Project information will be shared at the Mercer SWCD annual meeting and in their brochure of accomplishments. Project highlights will also be shared on social media and/or Mercer SWCD's website.

4.2 Critical Area #2 Project and Implementation Strategy Overview Table

Table 19: Blierdofer Ditch HUC-12 (04100004 02 03) — Critical Area #2							
Goal	**Objective**	**Project #**	**Project Title (EPA Criteria g)**	**Lead Organization (EPA criteria d)**	**Time Frame (EPA Criteria f)**	**Estimated Cost (EPA Criteria d)**	**Potential/Actual Funding Source (EPA Criteria d)**
Urban Sediment and Nutrient Reduction Strategies							
Altered Stream and Habitat Restoration Strategies							
High Quality Waters Protection Strategies							
Other NPS Causes and Associated Sources of Impairment							
1	1,2	-	HSTS Replacement and/or Sanitary Sewer Infrastructure	TBD	TBD	TBD	TBD

At this time, no short-term projects have been identified for *Critical Area #2*; therefore, no Project Summary Sheets are included.

4.3 Critical Area #3 Project and Implementation Strategy Overview Table

Table 20: Blierdofer Ditch HUC-12 (04100004 02 03) — Critical Area #3							
Goal	**Objective**	**Project #**	**Project Title (EPA Criteria g)**	**Lead Organization (EPA criteria d)**	**Time Frame (EPA Criteria f)**	**Estimated Cost (EPA Criteria d)**	**Potential/Actual Funding Source (EPA Criteria d)**
Urban Sediment and Nutrient Reduction Strategies							
1	1	1	Agricultural and Urban Nutrient Reduction and Restoration (also cross-referenced in *Critical Area #1*)	Mercer SWCD/ Mercer Ag Solutions	Short (1-3 yrs)	$350,000-$400,000	Ohio EPA §319, GLRI, H2Ohio, GLC, NRCS-USDA CRP
1	1	2	RAF Celina Project	Mercer SWCD/ Mercer Ag Solutions	Short (1-3 yrs)	$100,000-$125,000	Ohio EPA §319, GLRI, H2Ohio, GLC
1	2	3	Howick Farm Two Stage Ditch (also cross-referenced in *Critical Area #3)*	Mercer SWCD/ Mercer Ag Solutions	Short (1-3 yrs)	$150,000-$175,000	Ohio EPA §319, GLRI, H2Ohio, GLC, NRCS-USDA CRP
Altered Stream and Habitat Restoration Strategies							
High Quality Waters Protection Strategies							
Other NPS Causes and Associated Sources of Impairment							

Table 21: Critical Area #3 – Project #1		
Nine Element Criteria	**Information needed**	**Explanation**
n/a	**Title**	Agricultural and Urban Nutrient Reduction and Restoration
criteria d	**Project Lead Organization & Partners**	Mercer Soil and Water Conservation District; Mercer County Ag Solutions
criteria c	**HUC-12 and Critical Area**	Blierdofer Ditch HUC-12 (04100004 02 03) – *Critical Area #1 and Critical Area #3*
criteria c	**Location of Project**	Latitude: 40.568956; Longitude: -84.583121
n/a	**Which strategy is being addressed by this project?**	Agricultural Nonpoint Source Reduction Urban Sediment and Nutrient Reduction
criteria f	**Time Frame**	Short (1-3 years)
criteria g	**Short Description**	This project will consist of a 2-acre wetland restoration and a 1,700 linear foot two-stage ditch improvement on private property adjacent to the City of Celina, Ohio.
criteria g	**Project Narrative**	This project will consist of a wetland restoration and a two-stage ditch improvement on private property adjacent to the City of Celina, Ohio. These two practices will be directly adjacent to each other, in order to maximize capacity for water treatment and sediment and nutrient attenuation and will address both agricultural and urban nutrient reduction. Approximately 160 acres of a residential development drain to a ditch via 36-inch and 24-inch pipe through an old railroad bed. Drainage water has since cut two eroded ditches along either side of the railroad bed. Agricultural lands directly adjacent to the eroded ditches are subjected to flooding and heavy erosion due to excessive runoff from the developed area with no retention time. Two-stage ditch design will occur along 1,700 linear foot section of the ditch to decrease erosion, create capacity within the stream and create a functional floodplain bench for the attenuation of nutrients and sediment. In addition, a two-acre wetland will be created adjacent to the two stage ditch to accommodate overflow and further retain sediments and nutrients. This project will also include a perpetual conservation easement to be held by the Mercer Soil and Water Conservation District so that the land will remain privately-owned. Due to the project's immediate downstream location from an urban residential development, as well as its location within a critical agricultural land, the project is applicable to both the treatment of urban stormwater runoff and agricultural runoff.
criteria d	**Estimated Total cost**	$350,000 - $400,000
criteria d	**Possible Funding Source**	Ohio EPA §319, GLRI, H2Ohio, GLC, NRCS-USDA CRP
criteria a	**Identified Causes and Sources**	Cause: Nutrient loadings, leading to far-field impacts Source: Agricultural land use activities and urban development activities

Table 21: Critical Area #3 – Project #1		
Nine Element Criteria	**Information needed**	**Explanation**
criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?**	*Critical Area #1* – Objective #4: Create, enhance and/or restore at least 80 acres of wetlands for treatment of agricultural runoff and/or nutrient reduction purposes from 2,000 total agricultural acres. *Critical Area #1* – Objective #6: Install at least two miles (10,560 linear feet) of two-stage ditch design to create a functional floodplain bench. *Critical Area #3* – Objective #2: Treat urban runoff in-stream through the restoration of floodplains or the creation of floodplain benches along at least one mile (5,280 linear feet) of ditches and streams flowing through or immediately downstream of urban areas.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	*Critical Area #1* – Objective #4: Create, enhance and/or restore at least 2 acres of 80 acres of wetlands for treatment of agricultural runoff and/or nutrient reduction purposes from 2,000 total agricultural acres (2.5% and 26 lbs P/year). *Critical Area #1* – Objective #6: Install at least 0.32 miles (1,700 linear feet) of two miles (10,560 linear feet) of two-stage ditch design to create a functional floodplain bench (16% and 22 lbs P/year). *Critical Area #3* – Objective #2: Treat urban runoff in-stream through the restoration of floodplains or the creation of floodplain benches along at least 0.32 miles (1,700 linear feet) of one mile (5,280 linear feet) of ditches and streams flowing through or immediately downstream of urban areas (40% and 22 lbs P/year). Goals: The overall goal in *Critical Area #1 and Critical Area #3* is to reduce estimated total spring phosphorus loads. Current estimates indicate 6,300 lbs of phosphorus in the spring load is attributed to agricultural land use activities and 960 lbs of phosphorus in the spring load is attributed to urban land use activities. In order to meet the GLWQA nutrient reduction goals, spring loadings must be reduced by 40%, or 2,860 lbs. It is expected that this project will cause a decrease in spring phosphorus loadings by 44 lbs, or 1.5%.
	Part 3: Load Reduced?	Estimated annual reduction: 1,229 #N/year; 68 #P/year; 12.1 tons sediment/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	Mercer SWCD will design and verify installation of the wetland and two stage ditch. It is generally unrealistic to monitor load reduction from individual agricultural practices; however, ambient monitoring is conducted throughout the WLEB by organizations such as OEPA, NOAA, and Heidelberg University. These entities will continue long term monitoring on various tributaries in the Maumee basin to track load reduction trends.
criteria e	**Information and Education**	Project information will be shared at the Mercer SWCD annual meeting and in their brochure of accomplishments. Project highlights will also be shared on social media and/or Mercer SWCD's website.

Table 22: Critical Area #3 – Project #2		
Nine Element Criteria	**Information needed**	**Explanation**
n/a	**Title**	RAF Celina Project
criteria d	**Project Lead Organization & Partners**	Mercer Soil and Water Conservation District; Mercer County Ag Solutions
criteria c	**HUC-12 and Critical Area**	Blierdofer Ditch HUC-12 (04100004 02 03) – *Critical Area #3*
criteria c	**Location of Project**	Latitude: 40.558107, Longitude: -84.540485
n/a	**Which strategy is being addressed by this project?**	Urban Sediment and Nutrient Reduction
criteria f	**Time Frame**	Short (1-3 years)
criteria g	**Short Description**	This project will consist of a 2-acre stormwater wetland and parking lot rain garden within the City of Celina, Ohio.
criteria g	**Project Narrative**	This project will consist of the design and construction of a stormwater wetland. The wetland area will be approximately 2 acres in size and drains an impervious area of approximately 50 acres. In addition, a rain garden will be installed within the site's parking lot for further stormwater treatment and bioretention. Rain garden placement could occur on either the northeast or southside of the parking lot and would serve to improve the open ditch currently adjacent to the lot at either of those locations. Native plant assemblages with high capacities for water uptake will be chosen to establish the wetlands and rain garden to maximize stormwater treatment and create native habitat for the urban fauna.
criteria d	**Estimated Total cost**	$100,000 - $125,000
criteria d	**Possible Funding Source**	Ohio EPA §319, GLRI, H2Ohio, GLC
criteria a	**Identified Causes and Sources**	Cause: Nutrient loadings, leading to far-field impacts Source: Urban development land use activities
criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?**	Objective #1: Reduce stormwater inputs and impacts in the subwatershed by implementing green infrastructure projects within *Critical Area #3* that retain, detain, and/or treat runoff from at least 400 acres of urbanized impermeable surfaces (i.e., parking lots, roads, etc.).
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Objective #1: Reduce stormwater inputs and impacts in the subwatershed by implementing green infrastructure projects within *Critical Area #3* that retain, detain, and/or treat runoff from at least 50 acres of 400 acres of urbanized impermeable surfaces (i.e., parking lots, roads, etc.) (12.5% and 16 lbs P/year). Goals: The overall goal in *Critical Area #3* is to reduce estimated total spring phosphorus loads. Current estimates indicate 960 lbs of phosphorus in the spring load is attributed to urban land use activities. In order to meet the GLWQA nutrient reduction goals, spring loadings must be reduced by 40%, or 360 lbs. It is expected that this project will cause a decrease in spring phosphorus loadings by 7 lbs, or 1.9%.
	Part 3: Load Reduced?	Estimated annual reduction: 71 #N/year; 16 #P/year; 10,275 mg/L of total suspended solids/year

Table 22: Critical Area #3 – Project #2		
Nine Element Criteria	**Information needed**	**Explanation**
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	Mercer SWCD will design and verify installation of the stormwater wetland and rain garden. It is generally unrealistic to monitor load reduction from individual agricultural practices; however, ambient monitoring is conducted throughout the WLEB by organizations such as OEPA, NOAA, and Heidelberg University. These entities will continue long term monitoring on various tributaries in the Maumee basin to track load reduction trends.
criteria e	**Information and Education**	Project information will be shared at the Mercer SWCD annual meeting and in their brochure of accomplishments. Project highlights will also be shared on social media and/or Mercer SWCD's website.

Table 23: Critical Area #3 – Project #3		
Nine Element Criteria	**Information needed**	**Explanation**
n/a	**Title**	Howick Farm Two Stage Ditch
criteria d	**Project Lead Organization & Partners**	Mercer Soil and Water Conservation District; Mercer County Ag Solutions
criteria c	**HUC-12 and Critical Area**	Blierdofer Ditch HUC-12 (04100004 02 03) – *Critical Area #1 and Critical Area #3*
criteria c	**Location of Project**	Latitude: 40.570703; Longitude: -84.534470
n/a	**Which strategy is being addressed by this project?**	Agricultural Nonpoint Source Reduction Urban Sediment and Nutrient Reduction
criteria f	**Time Frame**	Short (1-3 years)
criteria g	**Short Description**	This project will create 2,900 linear feet of two-stage ditch.
criteria g	**Project Narrative**	This project will consist of a two-stage ditch improvement on private property just north of the City of Celina, Ohio. The project location has a watershed of ~300 acres, of which approximately half is urban land and half is agricultural land. Two-stage ditch design will occur along a 2,900 linear foot section of the ditch to decrease erosion, create capacity within the stream and create a functional floodplain bench for the attenuation of nutrients and sediment. This project will also include a perpetual conservation easement to be held by the Mercer Soil and Water Conservation District so that the land will remain privately-owned. Due to the project's location within critical agricultural land, as well as its mixed land use watershed, the project is applicable to both the treatment of urban stormwater runoff and agricultural runoff.
criteria d	**Estimated Total cost**	$150,000 - $175,000
criteria d	**Possible Funding Source**	Ohio EPA §319, GLRI, H2Ohio, GLC, NRCS-USDA CRP
criteria a	**Identified Causes and Sources**	Cause: Nutrient loadings, leading to far-field impacts Source: Agricultural land use activities and urban development activities
criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?**	*Critical Area #1* – Objective #6: Install at least two miles (10,560 linear feet) of two-stage ditch design to create a functional floodplain bench. *Critical Area #3* – Objective #2: Treat urban runoff in-stream through the restoration of floodplains or the creation of floodplain benches along at least one mile (5,280 linear feet) of ditches and streams flowing through or immediately downstream of urban areas.

Table 23: Critical Area #3 – Project #3		
Nine Element Criteria	**Information needed**	**Explanation**
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	*Critical Area #1* – Objective #6: Install at least 0.55 miles (2,900 linear feet) of two miles (10,560 linear feet) of two-stage ditch design to create a functional floodplain bench (28% and 79 lbs P/year). *Critical Area #3* – Objective #2: Treat urban runoff in-stream through the restoration of floodplains or the creation of floodplain benches along at least 0.55 (2,900 linear feet) of one mile (5,280 linear feet) of ditches and streams flowing through or immediately downstream of urban areas (55% and 79 lbs P/year). Goals: The overall goal in *Critical Area #1 and Critical Area #3* is to reduce estimated total spring phosphorus loads. Current estimates indicate 6,300 lbs of phosphorus in the spring load is attributed to agricultural land use activities and 960 lbs of phosphorus in the spring load is attributed to urban land use activities. In order to meet the GLWQA nutrient reduction goals, spring loadings must be reduced by 40%, or 2,860 lbs. It is expected that this project will cause a decrease in spring phosphorus loadings by 51 lbs, or 1.8%.
	Part 3: Load Reduced?	Estimated annual reduction: 1,418 #N/year; 79 #P/year; 14 tons sediment/year
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	Mercer SWCD will design and verify installation of the two stage ditch. It is generally unrealistic to monitor load reduction from individual agricultural practices; however, ambient monitoring is conducted throughout the WLEB by organizations such as OEPA, NOAA, and Heidelberg University. These entities will continue long term monitoring on various tributaries in the Maumee basin to track load reduction trends.
criteria e	**Information and Education**	Project information will be shared at the Mercer SWCD annual meeting and in their brochure of accomplishments. Project highlights will also be shared on social media and/or Mercer SWCD's website.

CHAPTER 5: WORKS CITED

Burton, G.A. Jr., and R. Pitt. 2001. *Stormwater Effects Handbook: A Tool Box for Watershed Managers, Scientists, and Engineer*s. CRC Press, Inc., Boca Raton, FL.

Carpenter, S.R., N.F. Caraco, D.L. Correll, R.W. Howarth, A.N. Sharpley and V.N. Smith. 1998. Nonpoint Pollution of Surface Waters with Phosphorus and Nitrogen. *Ecology Applications*, vol. 8, p.559.

Center for Watershed Protection (CWP). 1998. *Rapid Watershed Planning Handbook*. Ellicott City, Md.

H2Ohio Initiative (H2Ohio). 2019. http://h2.ohio.gov/governor-dewine-announces-h2ohio-water-quality-plan/. Accessed January 9, 2020.

Homer, C.G. *et al.* 2015. Completion of the 2011 National Land Cover Database for the conterminous United States- Representing a decade of land cover change information. *Photogrammetric Engineering and Remote Sensing,* v. 81, no. 5, p. 345 – 354.

International Joint Commission (IJC). 2012. *The Great Lakes Water Quality Agreement (GLWQA) Nutrients (Annex 4).* https://binational.net/annexes/a4/. Accessed August 27, 2019.

Ohio Department of Agriculture (ODA). 2018. *Distressed Watershed Designation Analysis Selected Western Lake Erie Basin Watersheds.* https://agri.ohio.gov/wps/portal/gov/oda/divisions/soil-and-water-conservation/forms/lewshdindistressanalysis. Accessed August 21, 2019.

Ohio Department of Natural Resources (ODNR). 2001. *Gazetteer of Ohio Streams*. 2nd Edition. https://minerals.ohiodnr.gov/Portals/minerals/pdf/industrial%20minerals/gazetteer_ohio_streams.pdf. Accessed July 26, 2019.

Ohio Department of Natural Resources (ODNR). 2018. *Ohio Mussel Survey Protocol, updated April 2018*. https://wildlife.ohiodnr.gov/portals/wildlife/pdfs/licenses%20&%20permits/OH%20Mussel%20Survey%20Protocol.pdf. Accessed August 27, 2019.

Ohio Environmental Protection Agency (OEPA). 1999. *Association between Nutrients, Habitat and the Aquatic Biota of Ohio's Rivers and Streams*. https://www.epa.ohio.gov/portals/35/lakeerie/ptaskforce/AssocLoad.pdf. Accessed September 13, 2019.

Ohio Environmental Protection Agency (OEPA). 2009. *Total Maximum Daily Loads for the Swan Creek Watershed.* https://epa.ohio.gov/portals/35/tmdl/SwanCreekTMDL_final_oct09_wo_app.pdf. Accessed January 8, 2020.

Ohio Environmental Protection Agency (OEPA). 2010. *Ohio Lake Erie Phosphorus Task Force Final Report Executive Summary.* https://www.epa.state.oh.us/portals/35/lakeerie/ptaskforce/Task_Force_Final_Executive_Summary_April_2010.pdf. Accessed January 10, 2020.

Ohio Environmental Protection Agency (OEPA). 2013a. *Nonpoint Source Management Plan Update (FY2014-2019)*. http://www.epa.ohio.gov/portals/35/nps/nps_mgmt_plan.pdf. Accessed October 3, 2019.

Ohio Environmental Protection Agency (OEPA). 2013b. *Total Maximum Daily Loads for the Ottawa River (Lima Area) Watershed*. https://epa.ohio.gov/Portals/35/tmdl/OttawaLima_Report_Final.pdf. Accessed August 27, 2019.

Ohio Environmental Protection Agency (OEPA). 2016. *Guide to Developing Nine-Element Nonpoint Source Implementation Strategic Plans in Ohio.* https://epa.ohio.gov/Portals/35/nps/319docs/NPS-ISPlanDevelopmentGuidance816.pdf. Accessed June 2, 2019.

Ohio Environmental Protection Agency (OEPA). 2018a. *2018 Ohio Integrated Report.* https://www.epa.ohio.gov/dsw/tmdl/OhioIntegratedReport#123145148-2018. Accessed June 1, 2019.

Ohio Environmental Protection Agency (OEPA). 2018b. *Biological and Water Quality Study of the St. Marys River and Tributaries, 2015, Technical Report EAS/2018-11-01.* https://epa.ohio.gov/Portals/35/tmdl/TSD/St.%20Marys/St%20Marys_TSD_FINAL.pdf. Accessed June 17, 2019.

Ohio Environmental Protection Agency (OEPA). 2018c. *Nutrient Mass Balance Study for Ohio's Major Rivers*. https://epa.ohio.gov/Portals/35/documents/Nutrient%20Mass%20Balance%20Study%202018_Final.pdf. Accessed October 3, 2019.

Ohio Environmental Protection Agency (OEPA). 2019. *River Miles Index Interactive Map*. https://www.arcgis.com/apps/webappviewer/index.html?id=4f93b8e37d4640a6ab3ac43d2914d25e. Accessed August 23, 2019.

Ohio Lake Erie Commission (OLEC). 2018. *State of Ohio's Domestic Action Plan 1.1.* https://lakeerie.ohio.gov/Portals/0/Ohio%20DAP/DAP%201-1%20FINAL%202018-08-27.pdf. Accessed May 23, 2019.

Ohio State University Extension (OSUE). 2018. *A Field Guide to Identifying Critical Resource Concerns and Best Management Practices for Implementation*. Bulletin 969. College of Food, Agricultural, and Environmental Sciences.

St. Marys River Watershed Project and the Allen County SWCD. 2009. *St. Mary's River Watershed Management Plan*. https://www.in.gov/idem/nps/3199.htm. Accessed September 4, 2019.

Tetra Tech, Inc. 2018. *BMP Descriptions for STEPL and Region 5 Models.* http://it.tetratech-ffx.com/steplweb/models$docs.htm. Accessed November 22, 2019.

Toledo Metropolitan Area Council of Governments. 2018. *Water Quality §604(b) Work Program, 208 Plan Maintenance and Targeted Water Quality Planning Final Report, FFY16 Allotment.* http://www.tmacog.org/WQ/Wastewater/604b_2018/Nutrient_Source_Inventory_Final_Report.pdf. Accessed September 24, 2019.

United States Census Bureau. 2010. *Celina, OH.* https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml?src=bkmk. Accessed August 17, 2019.

United States Environmental Protection Agency (USEPA). 2003. *Protecting Water Quality from Urban Runoff.* https://www3.epa.gov/npdes/pubs/nps_urban-facts_final.pdf. Accessed January 9, 2020.

United States Environmental Protection Agency (USEPA). 2013. *Primary Distinguishing Characteristics of Level III Ecoregions of the Continental United States.* https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states. Accessed August 17, 2019.

United States Environmental Protection Agency (USEPA). 2019. *Spreadsheet Tool for Estimating Pollutant Load (STEPL), Version 4.4*. http://it.tetratech-ffx.com/steplweb/. Accessed July 18, 2019.

United States Fish and Wildlife Service (USFWS). 2018. *Ohio – County Distribution of Federally-Listed Endangered, Threatened and Proposed Species, updated January 29.* https://www.fws.gov/midwest/endangered/lists/ohio-cty.html. Accessed September 15, 2019.

United States Geological Survey (USGS). 2019a. *Protected Areas Database of the United States (PAD-US).* https://maps.usgs.gov/padus/. Accessed September 15, 2019.

United States Geological Survey (USGS). 2019b. *StreamStats: Streamflow Statistics and Spatial Analysis Tools for Water-Resources Applications.* https://www.usgs.gov/mission-areas/water-resources/science/streamstats-streamflow-statistics-and-spatial-analysis-tools?qt-science_center_objects=0#qt-science_center_objects. Accessed September 15, 2019.

Wright State University (WSU). 2013. *2013 Mercer County Comprehensive Plan*. https://www.mercercountyohio.org/wp-content/uploads/bsk-pdf-manager/2018/09/2013Comprehensive-Plan.pdf. Accessed September 15, 2019.