

# **Nine- Element Nonpoint Source Implementation Strategic Plan (NPS- IS plan)**

**Grand Lake St. Marys:  
Chickasaw Creek 05120101-0201  
Version 1.0 4-27-2017**

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## Acknowledgements

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## Chapter 1: Introduction

The Chickasaw Creek HUC-12 (05120101-0201) drains a large portion of the Grand Lake St. Marys drainage basin, south of the lake in Mercer County, with a small portion in the southeast corner located in Auglaize County, Ohio. Grand Lake St. Marys is the source for drinking water in the City of Celina, Ohio. It lies just west of Little Chickasaw Creek HUC-12 (05120101-0204) and east of Prairie Creek HUC-12 (05120101-0204) and Beaver Creek HUC-12 (05120101-0202). The Chickasaw Creek watershed is 18.60 square miles in size, and is the smallest of the four 12 digit HUC watersheds within the Grand Lake St. Marys watershed. (WAP 2015) The watershed is made up of primarily intensive row cropping and livestock agriculture, but also includes a spiritual center, an American Legion, a feed mill, Marion Local School District, Chickasaw Village, and several residential areas.

In October of 2016, Mercer County Soil and Water Conservation District was awarded an Ohio EPA FY17 Section 319(h) Watershed Plan Update Project Grant to develop the NPS-IS for Beaver Creek and Chickasaw Creek HUC-12 watersheds. This NPS-IS for Chickasaw Creek HUC-12 will meet the U.S. EPA's nine minimum elements of a watershed plan for impaired waters.

### 1.1 Report Background

This NPS-IS was created to be one of the first watershed plans in Mercer County to create a document including nine elements and a strategic plan for the Chickasaw Creek HUC-12. The Chickasaw Creek watershed, located in the Grand Lake St. Marys (GLSM) watershed, was designated as distressed beginning January 18, 2011 due to severe algal blooms associated with phosphorous and nitrate loading into the lake, which is a public drinking water source. The distressed designation is based on Ohio Administrative Code (OAC) 1501:15-5. This created a primary interest for focusing on agricultural and residential run-off. Having nonpoint source management projects identified, when implemented, will have measureable impacts on water quality in the Chickasaw Creek HUC-12.

## Chickasaw Creek Watershed



Figure 1: River Mile Map of Chickasaw Creek HUC-12 South of Grand Lake St. Marys. (WAP 2015)

The Chickasaw Creek HUC-12 is a part of the Watershed Action Plan for Grand Lake St. Marys and the Wabash River, which was fully endorsed on May 14, 2008 by ODNR and Ohio EPA. This action plan was developed to promote stewardship of the natural resources in the Grand Lake/Wabash River Watersheds as more land and water resources were being used by humans. With the change of program focus, this NPS-IS is created to guide a more specific region in addressing nonpoint source pollution issues for the Grand Lake St. Marys watershed.

### 1.2 Watershed Profile and History

The distressed watershed of GLSM consists of nearly 13,500 acres of lake and 58,880 acres of land. The Chickasaw Creek HUC-12, which is a portion of the GLSM watershed, is

11,919 acres in size. The watershed includes the East Fork and Chickasaw Creek. There is a total of nearly 28.64 miles of stream network as mapped in Figure 1. A portion of the east half of the GLSM watershed, which includes Little Chickasaw Creek is in Auglaize County, Ohio. The remaining portion of the distressed watershed is located in Mercer County, Ohio. (WAP 2015)

Beginning at Grand Lake St. Marys and going upstream, Chickasaw Creek flows beside Mercer Development (Hecht’s Landing) and continues several miles southwest to the first divide located just west of Botkins Road and south of Guadalupe Road. From here, East Fork goes southeast several miles entering Auglaize County. At the first divide of Chickasaw Creek near Botkins Road, Chickasaw Creek continues southwest toward the Village of Chickasaw where the next major break takes place north of Brockman Road. The main branch continues on the east side of Chickasaw where it becomes much smaller with other small divides to where it is no longer a named creek near Maria Stein. (Mercer County Auditor)

Chickasaw Creek watershed has a significant portion of land in cropland. Approximately 87 percent is in row crop, pasture/hay (8%), deciduous forest (3%), and residential/other (2%) land uses. Figure 7 shows a detailed map of the land uses. This significant portion of cropland is also utilized for livestock manure applications. (Ohio EPA, 2007)

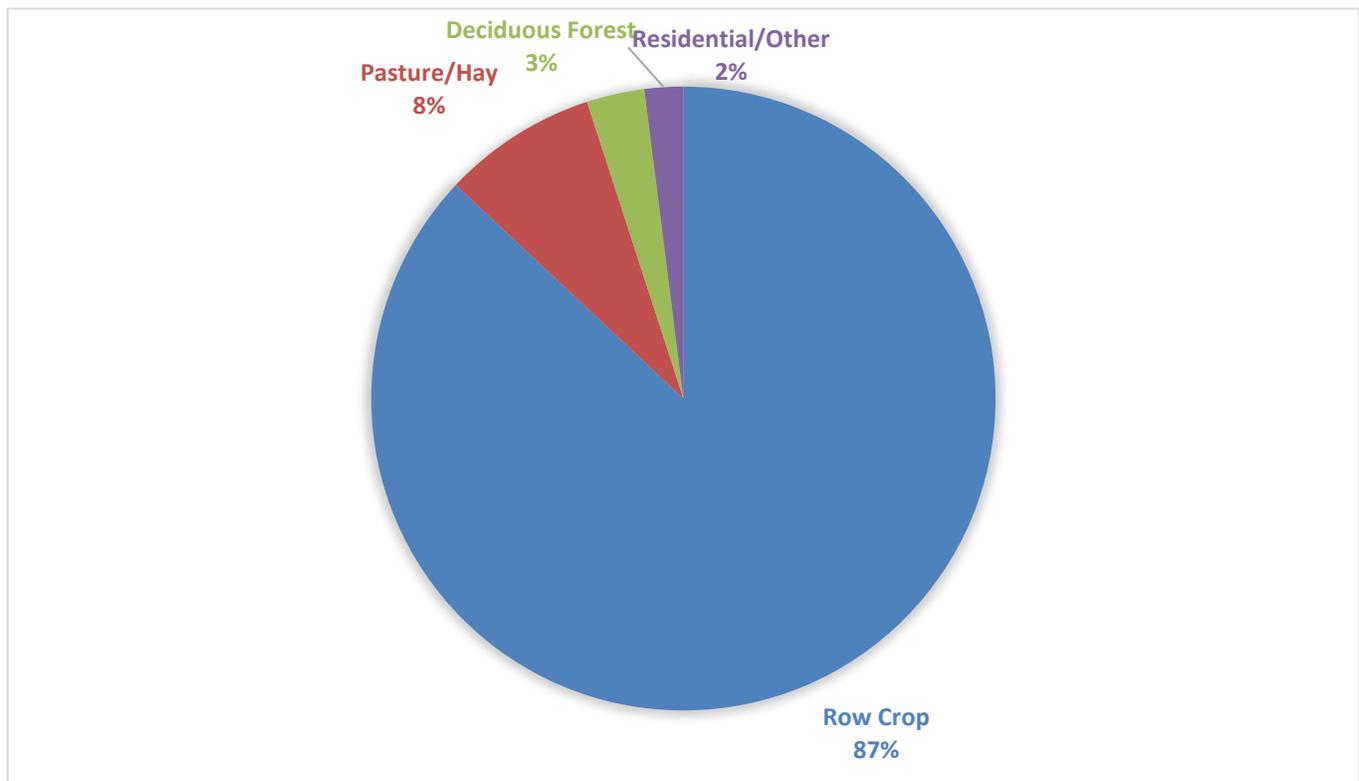


Figure 2: Pie Chart Demonstrating Land Use in the Chickasaw Creek Watershed

There has been a long history of livestock farms in the area being composed of dairy, growing steers, swine, chickens, and turkeys. Many small farms have been maintained in their own family for several decades with their kids and grandkids taking over the farm. This has kept a strong community of livestock farmers in the GLSM watershed. Farm expansion has also continued, to allow for the support of these growing families' needs.

Recreational activities in the Chickasaw Creek HUC-12 include many opportunities of camping, fishing, boating, and hunting on or in the vicinity. Also several religious historical sites are located within the watershed. (Ohio EPA, 2007)



*Monitoring tributary to Grand Lake St. Marys during winter thaw.*

Figure 3: Monitoring a Creek in Grand Lake St. Marys

### 1.3 Public Participation and Involvement

It is important to have diverse involvement in developing restoration plans for a watershed. This should not only include farmers, but businesses, non-profit groups, organizations and the general public. In recent years, there have been many water quality improvement projects completed within the Chickasaw Creek HUC-12. These projects include an increase in cover crops and managing resource concerns on livestock farms.

The attention on Grand Lake St. Marys has increased greatly since the watershed was declared distressed on January 18, 2011. The lake has long been a point of interest in western Ohio. Tourism and job creation are of great significance to the community. Due to the presence of microcystin toxin, warnings were first posted at the lake in May of 2009. Tourism dropped significantly from 2009 to 2011. However, there has been a steady increase in tourism since, with the 2015 tourism totals surpassing the totals of 2008, the year prior to the public notification system of microcystin toxin. These

warnings have put a spotlight on agriculture, with a focus on manure and fertilizer management along with maintaining soil test phosphorus levels within acceptable levels.

Mercer County Soil and Water Conservation District (SWCD) has long been working closely with livestock farmers in developing Comprehensive Nutrient Management Plans (CNMP). With these plans, livestock operations producing 350 tons or 100,000 gallons of manure annually are required to keep an updated plan. The development of a CNMP requires a comprehensive engineering and conservation planning resource assessment of current site conditions. Management options and structural alternatives are developed to address resource concerns identified during the assessment. All CNMPs are approved by a certified conservation planner. Each CNMP must include Environmental Compliance for the planned system and may be comprised of six possible elements:

1. Manure and Wastewater Handling and Storage - a technical element
2. Land Treatment Practices - a technical element
3. Nutrient Management (planned for three future years) a technical element
4. Record Keeping (non-technical element)
5. Feed Management – a technical element (optional, as needed)
6. Other Utilization Options – a technical element for manure not applied to land (optional, as needed)

The Lake Improvement Association (LIA) is an organization that has worked to promote lake tourism and participation from the community in order to improve water quality in the GLSM watershed. The LIA has been in existence since 1947 and has strong membership support. They have partnered with several other agencies on many projects throughout the years and were significantly involved in the development of this plan.

In 2010, a group of farmers within the GLSM watershed came together to look for innovative solutions to improve water quality from an agriculture perspective. This Ag Solutions group met monthly for several years and heard many water quality and manure management technology presentations. They also conducted several trials with different technologies. Participation declined over time; however, the Mercer County Commissioners recognized the importance of keeping agriculture strong in the area and funded a full-time Agriculture Solutions Coordinator position. This position was hired in early 2016, and several projects are currently on-going and many technologies are being researched. The Ag Solutions Coordinator was also significantly involved in the development of this plan.

The Lake Restoration Commission (LRC) was formed in December of 2009 to pioneer the initiative dedicated to fostering the regional cooperation and resources needed for the environmental renewal and sustainability to the lake. The initial efforts primarily focused on identifying the proven scientific strategies and technological solutions able to solve

the environmental crisis in GLSM. The LRC has developed treatment trains on two of the tributaries to GLSM, and a treatment train will be constructed and established on Beaver Creek during 2017. The treatment train for the Beaver Creek HUC-12 will be the third constructed on tributaries draining to GLSM. Early stages of planning for a treatment train to filter water from Chickasaw Creek are underway.

Many agricultural BMP's and projects have been installed as a result of the distressed watershed rules. In the Chickasaw Creek HUC-12, animal operations were a target of concern. All milk house wastewater is now contained, collected, and/or treated. All livestock operations have a minimum of four months of manure storage, with most having six months of storage. This was done in conjunction with complying with the manure application ban starting in January of 2013. The current distressed watershed rules state that no application of manure or fertilizer shall occur between December 15 and March 1<sup>st</sup>. During all other times of the year, manure applications must be completed following NRCS Practice Standard 590.

Two public interest surveys were conducted to gain input from stakeholders about nonpoint source pollution recovery projects. First, a survey was conducted and distributed by Mercer County Ag Solutions in November 2016 to gauge the interest in potential projects. This survey was distributed to an estimated 100 farmers. There was a 22% response rate. Figure 4 shows the results of the survey. Generally speaking, approximately 70% of those who responded would have an interest in participating in the projects outlined in this plan. On January 30, 2017 a public meeting was held with 15 producers from the area in attendance. Future projects were discussed and the results from the land owners corresponded with Figure 4 results.

### Farmer Survey Results

	YES	Maybe, with more information	No	N/A
Would you install a manure nutrient removal technology if a grant would cover all capital costs, and if operating costs were less than a penny per gallon?	36.8%	36.8%	5.3%	21.1%
Would you participate in a program that would pay you to incorporate all nutrients applied to your fields?	42.9%	33.3%	4.8%	19.0%

Would you participate in a program to reduce soil test phosphorus if your levels are over 200 lb/acre? This would include no additional phosphorus application and an intensive cropping system.	28.6%	23.8%	9.5%	38.1%
Would you be interested in a stream restoration project if you have a creek running through your land?	28.6%	38.1%	14.3%	19.0%
Would you be willing to learn more about composting penpack manure?	50.0%	5.0%	25.0%	20.0%

Figure 4: Survey Results Received from Farmers for Changing Management Practices.

## Chapter 2: Chickasaw Creek HUC-12 Watershed Characterization and Assessment Summary

### 2.1 Summary Watershed Characterization for Chickasaw Creek HUC-12

#### 2.1.1 Physical and Natural Features

The Grand Lake St. Marys HUC-10 watershed is comprised of four 12-digit HUCs. This document is focused on the Chickasaw Creek HUC-12 which has direct contact of river flow to Grand Lake St. Marys. It lies just west of Little Chickasaw Creek HUC-12 (05120101-0204) and east of Prairie Creek HUC-12 (05120101-0204) and Beaver Creek HUC-12 (05120101-0202). Those HUC-12's also have direct river flows to Grand Lake St. Marys. (WAP 2015)

Agriculture is a significant portion of the Chickasaw Creek HUC-12 with corn, soybeans, wheat, and alfalfa in rotation. The area has flat topography, fertile soil, and good drainage. The farmers have consistently used these resources to produce crop and livestock yields at or near the top for all Ohio counties. The majority of cropland is subsurface drained with systematically-patterned tiles. The area is relatively flat, however, of the watersheds in the GLSM watershed, Chickasaw Creek has the second highest amount of highly erodible land, according to 2003 NRCS online soil data mart. (WAP 2015)

Specific landmarks and features of this watershed include:

- Spiritual Center of Maria Stein

- American Legion Post #571
- Knights of St. Johns Hall
- Hecht’s Landing #1
- Marion Local School District

Many parts of the small streams have become impaired due to stream channelization, drainage tiles, loss of floodplains, and loss of streamside vegetation. These factors have degraded the creeks and GLSM. When streams are widened and deepened, they contribute excess soil to the stream, which destroys habitat for fish and other aquatic life. This has threatened many aquatic species due to habitat degradation.

Causes	Sources
Direct Habitat Alteration	Non-irrigated crop production (NPS)
Nitrate/Nitrite	Animal feeding operations (NPS)
Phosphorus	Channelization – agriculture (NPS)
Sedimentation	Removal of riparian vegetation – agriculture (NPS)
	Stream bank destabilization – agriculture (NPS)

Figure 5: Causes and Sources of NPS in Chickasaw Creek HUC-12 (05120101-0201)

According to the latest TMDL report, nutrient loading, nitrogen, and total phosphorous are significant nonpoint pollutants that impact the watershed and Grand Lake St. Marys, both economically and environmentally. Because pastureland and row crops are the dominant land cover in the watershed, many of the probable sources of impairment in this watershed are tied to agricultural practices. As these practices encroach on riparian and in-stream habitats, habitat may be altered through stream channelization, riparian vegetation removal, and subsequent stream bank destabilization. Without the natural filtering capabilities of a healthy, vegetated riparian buffer, natural floodplain, or wetland, runoff from pasturelands/row crops carries pathogens and nutrients from recent manure and fertilizer applications directly into streams. There are numerous small Animal Feeding Operations and larger Concentrated Animal Feeding Operations in this watershed that are also noted sources of nutrients and pathogens. Animals grazing near streams can be a direct source, while runoff from these operations’ pastures, holding areas, and manure application fields can also be a significant nonpoint source. This is especially true in the absence of effective manure management plans and appropriately

sized waste storage facilities. (TMDL, GLSM 2007) While this statement was true in 2007, this is no longer the case within the Chickasaw Creek HUC-12. All livestock operations generating over 350 tons or 100,000 gallons of manure annually maintain a current Comprehensive Nutrient Management Plan and have a minimum of 120 days of manure storage. This is consistent with the distressed watershed rules for GLSM.

Another source of pathogen and nutrient impairment in the Chickasaw Creek and Grand Lake St. Marys watershed comes from human waste. Unsewered areas with failing septic systems are of serious concern as untreated sanitary wastewater from residential areas is discharged directly into streams. A cluster of houses known as St. Rose is currently using home septic systems. There are future plans to connect these households to the Chickasaw WWTP.

GLSM receives direct flow from the Chickasaw Creek HUC-12. With nearly 13,000 acres of lake, GLSM is currently in non-attainment status for drinking water. Chickasaw Creek HUC-12 is one of four 12-digit HUC's that deliver water to GLSM, therefore, is not the only source of nutrient impairment. Because GLSM is a source for drinking water, there is a serious need to improve the water quality in GLSM. This plan will reference many times that the improvements made in the Chickasaw Creek HUC-12 will improve the overall nutrient and sediment loading of GLSM. The Grand Lake Saint Marys public water system intake for the City of Celina continues to be heavily impacted by microcystin toxin. For 2015, the mean microcystin concentration was 60 ug/L with a maximum observed value of 185 ug/L on 9/21/15. 50 sample results were greater than 1.0 ug/L. Threshold exceedances have occurred every year since the lake was first sampled in 2009 (Ohio Water Quality Report 2016).

Cause	Sources
Nitrate/ Nitrite	Agricultural Run-off (NPS)
Phosphorous	Unsewered Residential Areas (NPS)
Fecal Coliform	Industrial Sources (PS)
Sedimentation	WWTP Discharges (PS)

Figure 6: Causes and Sources of GLSM Warmwater Habitat Attainment Status (HUC 05120101-0204)

### 2.1.2 Land Use and Protection

Figure 7 shows the land use is dominantly cropland. Looking at Figure 8 below, the three predominant land uses for the Grand Lake/Wabash Watershed are 1) cropland; 2)

developed areas; and 3) Grand Lake St. Marys itself. This table includes areas outside the Beaver Creek and GLSM watershed; however, the percentages are a very similar comparison to the Chickasaw Creek HUC-12 watershed's land uses. The table sorts the data in several capacities such as number of acres per land use, square miles per land use, and percent of the total watershed area (including the lake). These numbers are beneficial in determining potential sources of pollutants in the watershed. They are also valuable at targeting education and implementation of various best management practices. This table is based on information provided by National Land Cover Database updated in 2011. (WAP 2015)

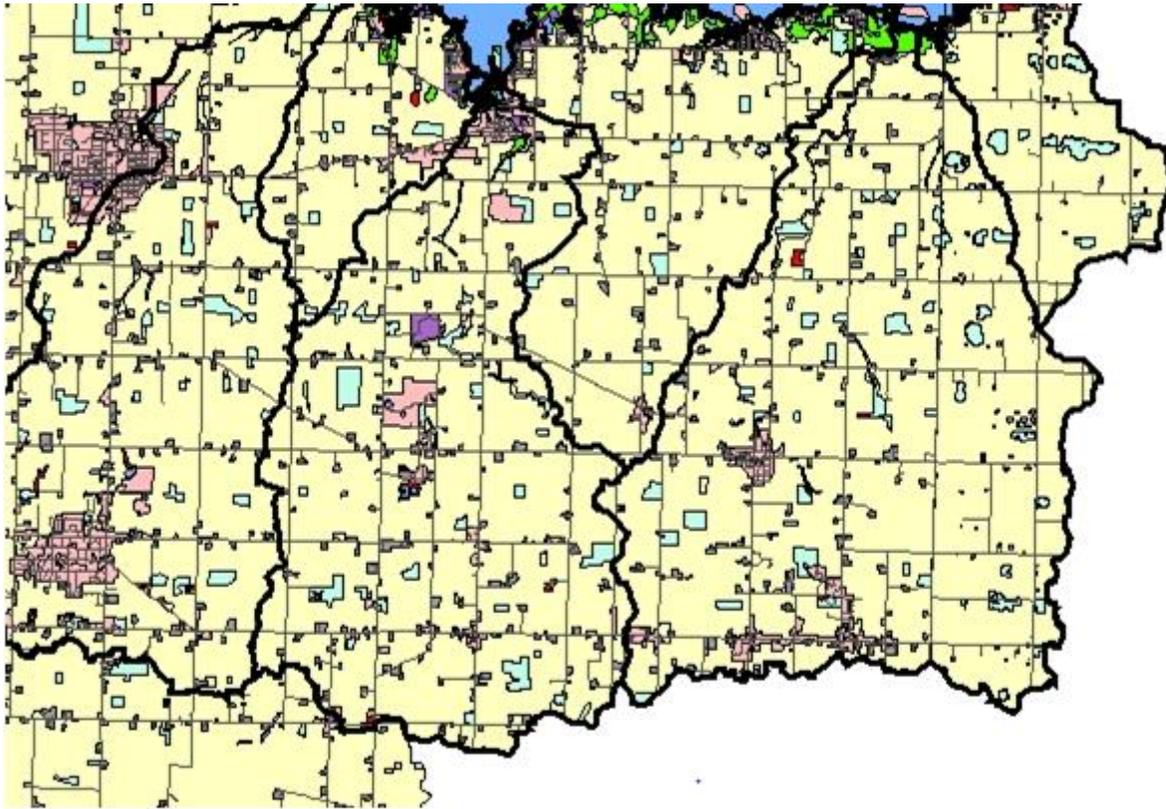


Figure 7: Land Use Map of Grand Lake St. Marys and Surrounding Areas (WAP 2015)

### Legend

 Grand Lake/Wabash Watershed

 Roadways

### Land Use

 Cropland

 Urban

 Farmsteads

 Shrub\_Brush

 Deciduous Forest

 Open Water

 Wetlands

 Barren/Undeveloped



Land Use/Land Cover	Acres	Square Miles	% of Total Watershed
Cropland (Pasture and Cultivated Crops)	144,950	226.49	77.6%
Developed Area	17,929	28.01	9.6%
Forest	7348	11.48	3.9%
Brush/Shrub (Shrub and Grassland)	2343	3.66	1.25%
Undeveloped (Barren)	106	0.17	0.06%
Wetlands (forested & non-forested)	906	1.42	0.49%
Open Surface Water	13096	20.46	7.2%
<b>TOTAL</b>	<b>186,678</b>	<b>291.68</b>	<b>100.0%</b>

Figure 8: Land Use/ Cover for GLSM and Wabash Watershed (WAP 2015)

To illustrate the importance of agriculture in Mercer County, the United States Department of Agriculture (USDA) reported the total market value of agricultural products sold in 2012 was \$596 million. This statistic ranked Mercer County 1st of the Ohio's 88 counties, and 69th of the 3,079 United States' counties. Approximately 74.3% of the total value of agricultural products sold in 2012 was directly related to sale of

livestock, poultry, and their products, also ranking Mercer County 1st in the State and 54th nationally. Net cash farm income of operation was \$192.1 million or \$159,061 per farm, on average (Mercer Co Comp Plan 2013).

CHICKASAW CREEK										
RIPARIAN STATUS	TREE CANOPY < 10' IN TOTAL WIDTH			TREE CANOPY 10 TO 40' IN WIDTH			TREE CANOPY >40' IN WIDTH			TOTAL STREAM MILES
	PERENNIAL	INTERMITTENT	SUB-TOTAL	PERENNIAL	INTERMITTENT	SUB-TOTAL	PERENNIAL	INTERMITTENT	SUB-TOTAL	
	0	12.65	12.65	2.16	2.73	4.89	5.84	5.26	11.1	28.64
% Of Subwatershed Total	0.00%	44.17%	44.17%	7.54%	9.53%	17.07%	20.39%	18.37%	38.76%	100.00%
% of Grand Lake Watershed Total	0.00%	26.74%	22.17%	15.16%	37.55%	22.72%	27.07%	13.07%	17.96%	20.40%

Figure 9: Riparian Corridor Status for the Chickasaw Creek (WAP 2015)

Figure 9 summarizes the riparian status of both the intermittent and perennial streams within the Chickasaw Creek and Little Chickasaw watersheds. It shows the stream miles of both categories along with percentages of the Chickasaw Creek watershed and the entire GLSM watershed while also showing the approximate distances of canopy on each type of stream. These areas over time have slowly lost tree cover due to row crop agriculture. The information in Figure 8 is from the original WAP in 2007 that was created for GLSM and Wabash Watersheds. The original WAP was based off a 14-digit HUC, where Chickasaw Creek and Little Chickasaw Creek were combined. The data from Little Chickasaw Creek was removed to create Figure 9.

## 2.2 Summary of HUC-12 Biological Trends

In 2007, Ohio EPA sampled the Beaver Creek and GLSM watersheds. The Beaver Creek and GLSM watersheds drain approximately 171 square miles and include two Assessment Units; Grand Lake St. Marys and tributaries, and Beaver Creek downstream of Grand Lake St. Marys to mouth. The assessment unit of Beaver Creek in this EPA study is not a part of the Chickasaw Creek HUC-12 that is being focused on in this plan. This Beaver Creek is downstream of GLSM to the west. However, for the purpose of this plan, the Chickasaw Creek HUC-12 is a part of the Ohio EPA TMDL study completed in 2007 as part of the GLSM watershed. (TMDL GLSM 2007)

The Chickasaw Creek HUC-12 is currently designated as a warm water habitat. A summary of the Chickasaw Creek HUC-12's biological status are provided in figures 10 and 11.

RIVER MILE Fish/Invert.	IBI	MIwb	ICI	QHEI	Attainment Status
<i>Chickasaw Creek (04-522)</i>					
<i>Eastern Corn Belt Plains WWH (Existing)/MWH proposed</i>					
5.4	<u>20</u> *	NA	F*	28.5	NON/NON
4.2	<u>22</u> *	NA	F*	35.5	NON/Partial
1.3 <sup>A</sup>	29*	7.9 <sup>ns</sup>	<u>VP</u> *	24.5	NON/NON

<sup>A</sup> Boat sampling method

\* Indicates significant departure from applicable WWH biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.

<sup>ns</sup> Nonsignificant departure from biocriteria (≤4 IBI or ICI units or ≤0.5 MIwb units)

<sup>flow</sup> Performance limited by lack of water

Notes:

- The Modified Index of Well-Being (MIwb) is not applicable (NA) to headwater site types
- A qualitative narrative evaluation used when quantitative data were not available or unreliable due to current velocities less than 0.3 fps flowing over the artificial substrates (P = Poor, F = Fair, MG = Marginally Good, G = Good, VG = Very Good, E = Exceptional)
- Use attainment status based on one organism group is parenthetically expressed

Narrative ranges and WWH biocriteria (bold) for Ohio ecoregions. Exception (EWH biocriteria), very good (EWH nonsignificant departure), poor and very poor evaluations are common statewide. For WWH, the ranges of marginally good and nonsignificant departure are the same (except in HELP).

IBI			MIwb		ICI	Narrative Evaluation
Headwater	Wading	Boat	Wading	Boat	All	
50-60	50-60	48-60	≥9.4	≥9.6	46-60	Exceptional
46-49	46-49	44-47	8.9-9.3	9.1-9.5	42-44	Very Good
<i>Eastern Corn Belt Plains</i>						
<b>40-45</b>	<b>40-45</b>	<b>42-43</b>	<b>8.3-8.8</b>	<b>8.5-9.0</b>	<b>36-40</b>	Good
36-39	36-39	38-41	7.8-8.2	8.0-8.4	32-34	Marginally Good
28-35	28-35	26-37	5.9-7.7	6.4-7.9	14-30	Fair
18-27	18-27	16-25	4.5-5.8	5.0-6.3	2-12	Poor
12-17	12-17	12-15	0-4.4	0-4.9	<2	Very Poor

Figure 10: Attainment of Biological Criteria for Sites Sampled in the Wabash River and GLSM Basin (TMDL GLSM 2007)

In a warm water habitat, the following scores are needed to meet attainment status:

- IBI: 40
- ICI: 36
- MIwb: 8.3
- QHEI: 60

Chickasaw Creek (CAFO2) TMDL		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
Pollutant	TMDL Component	75.38 cfs	11.73 cfs	4.15 cfs	1.34 cfs	0.39 cfs
Total Phosphorus (kg/day)	Current Load	296.27	11.48	5.86	6.95	2.32
	<b>TMDL= LA+WLA+MOS</b>	<b>14.75</b>	<b>2.30</b>	<b>0.81</b>	<b>0.26</b>	<b>0.08</b>
	LA	13.58	1.76	0.34	0.08	0.076
	WLA: Marion Local Schools WWTP	0.09	0.09	0.09	0.09	0
	WLA: Chapel Hill WWTP	0.08	0.08	0.08	0.08	0
	WLA: Chickasaw WWTP	0.26	0.26	0.26	0	0
	WLA: MS4	n/a	n/a	n/a	n/a	n/a
	Total WLA	0.43	0.43	0.43	0.17	0
	MOS (5%)	0.74	0.11	0.04	0.01	0.004
	<b>TMDL Reduction (%)</b>	<b>95%</b>	<b>81%</b>	<b>87%</b>	<b>96%</b>	<b>97%</b>
Nitrate Nitrogen (kg/day)	Current Load	11,679	447	112	No Data	No Data
	<b>TMDL= LA+WLA+MOS</b>	<b>184</b>	<b>29</b>	<b>10</b>	<b>3</b>	<b>1</b>
	LA	170	23	4	2.84	0.95
	WLA: Marion Local Schools WWTP	1	1	1	0	0
	WLA: Chapel Hill WWTP	1	1	1	0	0
	WLA: Chickasaw WWTP	3	3	3	0	0
	WLA: MS4	n/a	n/a	n/a	n/a	n/a
	Total WLA	5	5	5	0	0
	MOS (5%)	9	1	1	0.16	0.05
	<b>TMDL Reduction (%)</b>	<b>98%</b>	<b>94%</b>	<b>91%</b>	No Data	No Data

Figure 11: Loading Statistics for the Chickasaw Creek HUC-12 (TMDL GLSM 2007)

The TMDL study shows there is a significant improvement needed to meet the TMDL. Data from 2007 TMDL indicates total phosphorous and nitrate reductions are to be 81% or greater across all flow regimes.

It has been several years since recent studies have been done. With the large amount of agricultural best management practices that have been implemented over the last several years, it is assumed that levels have improved. There has been some expansion of livestock operations; however these expansions are required to have current nutrient management plans and manure storage. With these changes, and future nonpoint source pollution restoration projects; a future assessment will be carried out to determine more current water quality before and after a project takes place.

Since the last TMDL was completed in 2007, many BMP's and projects have been installed due to the distressed watershed rules (OAC 1501:15-5). In the Chickasaw Creek HUC-12, animal operations are a target of concern. All milk house waste water is now contained, collected, and/or treated on all 17 dairy operations. Silage leachate collection from silage storage facilities was a target project in 2014. Seven operations in the Chickasaw Creek HUC-12 have modified their operation to collect and store silage leachate to avoid it to tile exposure. All 41 livestock operations have a minimum of four months of manure storage, with most having six months of storage. These storages were completed in conjunction with complying with the manure application ban starting in January of 2013. The current distressed watershed rules state that no application of manure or fertilizer shall occur between December 15 and March 1<sup>st</sup>. During all other times of the year, manure applications must be completed following NRCS Practice Standard 590. Several household septic systems were also improved and inspected since the completion of the TMDL in 2007.

### 2.3 Summary of NPS Pollution Causes and Associated Sources for Chickasaw Creek HUC-12

Causes	Sources
Direct Habitat Alteration	Non-irrigated crop production (NPS)
Nitrate/Nitrite	Animal feeding operations (NPS)
Phosphorus	Channelization – agriculture (NPS)
Sedimentation	Removal of riparian vegetation – agriculture (NPS)
	Streambank destabilization – agriculture (NPS)

Figure 12: Causes and Sources of NPS pollution in Chickasaw Creek HUC-12

The 2007 TMDL data for the Chickasaw Creek HUC-12 determines that biological impairments are tied to agricultural practices. Figure 12 above illustrates the sources all being related to agriculture. As these agricultural practices encroach on riparian and in-stream habitats, habitat may be altered through stream channelization, riparian vegetation removal, and subsequent stream bank destabilization. Without the natural filtering capabilities of a healthy, vegetated riparian buffer, runoff from pasturelands/row crops carries pathogens and nutrients from recent manure and fertilizer applications directly into streams. Riparian areas and streams can be improved with practices like two-stage ditch installations as shown in Figure 13. Figure 13 illustrates a natural forming

floodplain, which can provide benefits such as flood attenuation, sediment sink, pollution assimilation and shade for a low flow channel.

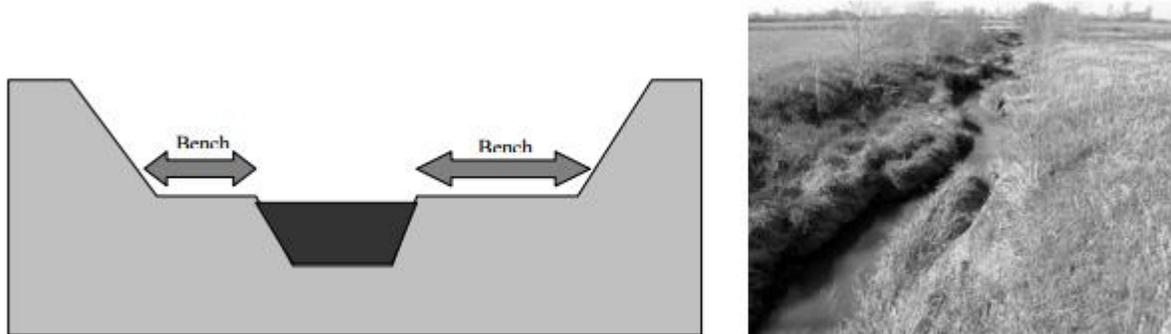


Figure 13: Graphical depiction of a two-stage ditch (left) and photo (right) that was taken in Wood County, Ohio. Notice the slight meander pattern along the ditch bottom in the picture.

There are numerous small Animal Feeding Operations (AFOs) in this watershed that are also noted sources of nutrients and pathogens. Animals grazing near streams can be a direct source, while runoff from these operations' pastures, holding areas, and manure application fields can also be a significant nonpoint source. Over many years of manure production, the soil test phosphorous levels have been built up in some areas to levels over 200 pounds per acre. This is especially true in the absence of effective manure management plans and appropriately sized waste storage facilities. (WAP 2015) However, since the inception of the distressed watershed rules (OAC 1501:15-5), all livestock operations generating more than 350 tons or 100,000 gallons of manure per year are maintaining a current comprehensive nutrient management plan and have a minimum of 120 days of manure storage. The implementation of these practices has had an impact on water quality within the GLSM watershed.

Pathogen and nutrient loading from failed home sewage treatment systems and nutrient loading from point sources are also contributing to the non-attainment status of the Chickasaw Creek HUC-12. Within the watershed, residential areas that remain unsewered are a cluster of houses in St. Rose.

Figure 14 below shows how the scores were obtained for Figure 15, the NPS pollution potential. This figure allows for a better understanding of the intensity of nonpoint source pollution in the Chickasaw Creek HUC-12 and on which areas to focus.

## NONPOINT SOURCE POLLUTION POTENTIAL SCORING MATRIX

MAXIMUM DRAINAGE UNIT SCORE = 60 (Highest Pollution Potential)

MINIMUM DRAINAGE UNIT SCORE = 6 (Lowest Pollution Potential)

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

Figure 14: Chickasaw Creek HUC-12 Scoring Matrix Chart for NPS Pollution (WAP 2015)

# NPS Pollution Potential

CHICKASAW CREEK							
SUBWATERSHED ATTRIBUTE	Stream Miles with <10' Vegetation SCORE	Operations <1,000' to stream SCORE	Tons Raw Manure per Year SCORE	Lbs. P <sub>2</sub> O <sub>5</sub> per Crop Acre SCORE	Household Disposal Systems in Groups SCORE	No. Homes Built pre- 1973 SCORE	TOTAL SCORE
	3	9	10	5	4	10	41

Figure 15: Chickasaw Creek HUC-12 Score for NPS Pollution using Scoring Matrix Chart (WAP 2015)

## 2.4 Additional Information for Determining Critical Areas and Developing Implementation Strategies for Chickasaw Creek HUC-12

There are several groups and agencies that work in the Chickasaw Creek HUC-12 to improve water quality. The Lake Improvement Association has played an active role in promoting activities on and around GLSM. There have been partners on many water quality improvement projects that will promote a cleaner GLSM HUC-12 (05120101-0204) which ultimately generates tourism. The Mercer County Ag Solutions Coordinator has also worked, and is currently working to develop plans for creating ways to restore streams and watercourses by lowering nutrient and sediment loading into Chickasaw Creek and subsequently to GLSM.

### 2.4.1 Phosphorous Levels Assessment Data

By using information provided by livestock farmers for their Comprehensive Nutrient Management Plans, it is known there are cropland fields with high phosphorous soil tests. Due to the amount of livestock in the watershed, it is appropriate to assume that there are more nutrients produced than the crops can utilize each year. A portion of the nutrients are moved out of the watershed; however, years of over-application of manure

have created a concern of high legacy soil test levels. Prior to the 1990's, animal manure was viewed as a waste, not a fertilizer, and the nutrient value of the manure was not counted when devising a field's nutrient budget. Using these facts and figures, it has helped to aid in creating critical areas for this NPS-IS Plan.

<b>CHICKASAW CREEK</b>						
		Lbs. N per Year	Lbs. K <sub>2</sub> O per Year	Lbs. P <sub>2</sub> O <sub>5</sub> per Year	Acres Cropland	Lbs. P <sub>2</sub> O <sub>5</sub> per Crop Acre
Manure Production-Tons	158,233	3,302,510	2,637,644	3,048,025	10,400	293
Less 90% Poultry Manure**	123,972	1,418,157	1,164,422	958,106	10,400	92
Approximate \$ Value Per Year		\$1,221,929	\$791,293	\$853,447		
Total Nutrient Value Per Year = \$2,866,669						

\*\* Based on conversations with poultry manure brokers, it is estimated that at least 90% of the poultry manure is brokered out of the watershed.

Figure 16: Manure and Nutrient Production in Chickasaw Creek HUC-12 (WAP 2015, Mercer SWCD)

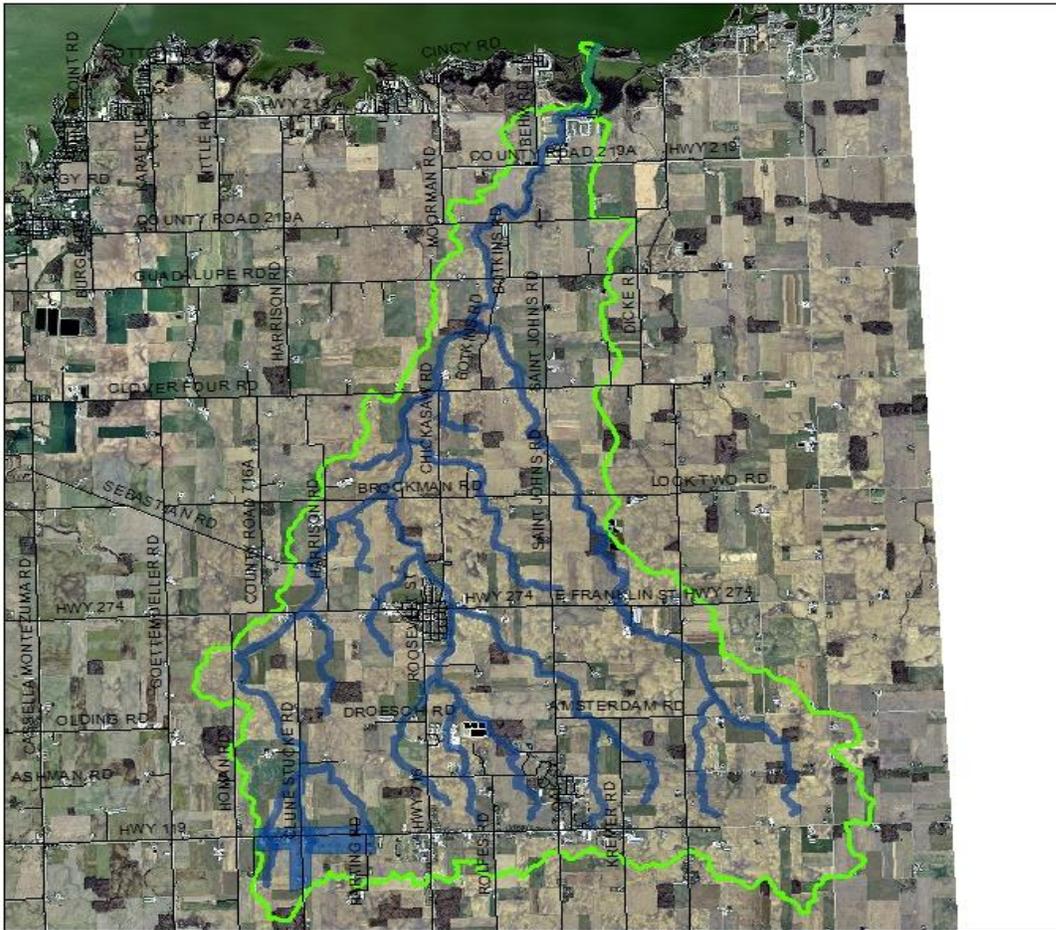
The amount of manure produced in Chickasaw Creek HUC-12, shown in Figure 16, is estimated from the 2007 WAP. The dollar values associated with each nutrient were obtained from local commercial fertilizer costs in 2016. The value for nitrogen is estimated at \$0.37 per pound, the value for P<sub>2</sub>O<sub>5</sub> is \$0.28 per pound, and the value of K<sub>2</sub>O is \$0.30 per pound.

## **Chapter 3: Critical Area Conditions and Restoration Strategies for Chickasaw Creek HUC-12**

### **3.1 Overview of Critical Areas**

The entire Chickasaw Creek HUC-12 is in non-attainment of its warm water habitat aquatic life use designation. The Chickasaw Creek HUC-12 is also part of the watershed for a public drinking water source for the City of Celina in GLSM HUC-12 (05120101-0204). The Chickasaw Creek HUC-12 watershed has greater issues related to agricultural use than urban. The stream alterations in this watershed have been modified to remove the majority of riparian vegetation. The stream bank destabilization has also been an impairment related to agriculture. Farmers are row cropping close to the edge of the stream, removing any buffer between the field and the stream. The highly concentrated area of animal facilities within the critical areas also causes impairments of nitrate/nitrite, phosphorous, and sediment loading. There are two critical areas defined in this watershed to improve these impairments.

# Chickasaw Creek HUC-12



## Legend

- Critical Area 2
- Critical Area 1

0 0.5 1 2 3 4 Miles

N

Figure 17: Chickasaw Creek HUC-12 Critical Areas

\*\*\*Critical Area 1 includes approximately 10,000 acres of cropland. The initial focus in Critical Area 1 will be on the approximate 5,000 acres that have a soil test phosphorus value below 100 lb/acre (50 ppm) Bray P1. This is recorded in the current nutrient management planning documents at Mercer Soil and Water Conservation District.

## 3.2 Critical Area 1: Conditions, goals and objectives for Chickasaw Creek HUC-12

### 3.2.1 Detailed Characterization

The area defined in Chickasaw Creek HUC-12 as Critical Area 1 is targeted towards all cropland acres. However, the initial focus for Critical Area 1 will be on acres below 100 lb/acre (50 ppm) Bray P1 phosphorus test. These areas are receiving nutrient amendments and the objective is to ensure that manure and fertilizer nutrients are incorporated to allow for soil bonding. Studies conducted by both Ohio State University and Heidelberg College have shown that the incorporation of nutrients can reduce phosphorus runoff by up to 90%. By offering a performance reimbursement, farmers will be able to conduct a more thorough analysis of how nutrients are being applied to their fields. Mercer SWCD and Ag Solutions will be able to verify and document the farmers incorporation strategies.

In combination with nutrient incorporation, a future focus will also include NPS pollution that is leaving cropland through artificial drainage and surface water. These additional practices will include:

- Drainage water management systems
- Increased use of filter strips/ waterways
- Saturated buffers
- Wetlands
- Soil test phosphorus reduction strategies

Under the distressed watershed rules for GLSM, producers are required to collect soil tests a minimum of every three years, and at a minimum rate of one per 25 acres. The farmers have data to show which farms are in need of additional nutrients, and which farms have a high legacy soil test phosphorus value. However, the requirement to enforce the need for soil testing is if the producer generates 350 tons or 100,000 gallons of manure or more per year. This does allow some facilities to avoid soil testing on their farms. However, agriculture has evolved over the years, and farmers find soil testing beneficial to their operation and are highly likely to engage in soil testing. A current soil test is the starting point for any cropland to meet Critical Area 1 criteria. (Mercer SWCD)

Other areas of the Chickasaw Creek HUC-12's 11,919 acres that may not have soil testing are the woodlands, pastures, residential communities, and Marion Local School District. These land uses account for several hundred acres. After many years of working with producers in the watershed and getting to know their farms and field activities, Mercer

SWCD approximates that seventy five percent of the acres in the Chickasaw Creek HUC-12 have a recent soil test (less than 2-3 years). Based on information gathered at public meetings and farmer surveys during the development of this plan, there is approximately 650-1300 acres within Critical Area 1 that have soil test phosphorus levels over 200 lb/acre (100 ppm). Some acres are unknown, and approximately 5,000 acres are in an agronomic range that can receive phosphorus as crops remove nutrients. The end objective is to reduce the amount of phosphorus leaching into waters and streams. Therefore, the distance to streams and management of tile flow are an important role in the likelihood of leaching phosphorus. It is also important to assist livestock facilities in managing nutrients produced by transporting and applying manure to areas of cropland that need nutrients. (Mercer SWCD)

### 3.2.2 Detailed Biological Conditions

Figure 18 below shows the different habitat quality on a measured level at different river miles on Chickasaw Creek. The information is the most current that is available and is from the 2007 Ohio EPA TMDL.

RIVER MILE Fish/Invert.	IBI	MIwb	ICI	QHEI	Attainment Status
<b>Chickasaw Creek (04-522)</b>					
<i>Eastern Corn Belt Plains WWH (Existing)/MWH proposed</i>					
5.4	<u>20*</u>	NA	F*	28.5	NON/NON
4.2	<u>22*</u>	NA	F*	35.5	NON/Partial
1.3 <sup>A</sup>	29*	7.9 <sup>ns</sup>	<u>VP*</u>	24.5	NON/NON
<b>East Fork Chickasaw Creek (04-521)</b>					
<i>Eastern Corn Belt Plains WWH (Existing)/Primary Headwater proposed</i>					
0.2	<u>24*</u>	NA	F*	34.0	NON/deferred
<sup>A</sup> Boat sampling method <sup>*</sup> Indicates significant departure from applicable WWH biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the Poor or Very Poor range. <sup>ns</sup> Nonsignificant departure from biocriteria (≤4 IBI or ICI units or ≤0.5 MIwb units) <sup>flow</sup> Performance limited by lack of water					

Figure 18: Habitat data for Chickasaw Creek HUC-12 (Ohio EPA)

### 3.2.3 Detailed Causes and Associated Sources

Sources of impairment are outlined from the 2007 Ohio EPA TMDL. Crop production and animal feeding operations create nutrient loading into waterways. The animal feeding operations range in size and design. Creating the cause of Critical Area 1 mainly comes from the many years of manure application from these sites onto cropland that cannot remove enough nutrients to equal the amount applied. The areas were created from

livestock farms that have a history dating back over one hundred years. This sets up the example that the manure generated at the animal feeding operations was typically applied to fields closest to the structures. The available technology for land application of manure was very limited, and farmers desired to spread manure as quickly and effectively as possible. Manure was considered a waste and its nutrient value was not considered when applied to the land.

In the Chickasaw Creek HUC-12 and GLSM watershed there are several contributing causes and sources associated with crop production and animal feeding facilities in Critical Area 1:

Causes	Sources
Direct Habitat Alteration	Non-irrigated crop production (NPS)
Nitrate/Nitrite	Animal feeding operations (NPS)
Phosphorus	Channelization – agriculture (NPS)
Sedimentation	Removal of riparian vegetation – agriculture (NPS)
	Streambank destabilization – agriculture (NPS)

Figure 19: Causes and Sources of Chickasaw Creek HUC-12 with Critical Area 1

Projects that address the above attributes will have a positive effect on the attributes of NPS pollution in the Chickasaw Creek HUC-12.

Subwatershed (0512010102)	Stream	Location (Monitoring Station)	Total Phosphorus (kg/day)	Flow Regime				
				High Flows 0-10	Moist Conditions 10-40	Mid- Range Flows 40-60	Dry Conditions 60-90	Low Flows 90-100
010	Chickasaw Creek	At Mercer County Road 219-A (CAFO2)	Current Load	296.27	11.48	5.86	6.95	2.32
			% Reduction	-95%	-81%	-87%	-96%	-97%
			<b>TMDL= LA+WLA+MOS</b>	<b>14.75</b>	<b>2.30</b>	<b>0.81</b>	<b>0.26</b>	<b>0.08</b>
			LA	13.58	1.76	0.34	0.08	0.08
			WLA: Marion Local Schools WWTP	0.09	0.09	0.09	0.09	0
			WLA: Chapel Hill WWTP	0.08	0.08	0.08	0.08	0
			WLA: Chickasaw WWTP	0.26	0.26	0.26	0	n/a*
			WLA: MS4	n/a	n/a	n/a	n/a	n/a
			MOS (5%)	0.74	0.11	0.04	0.01	0

Figure 20: Phosphorous Loads at Monitoring Locations, 2007 TMDL (Ohio EPA)

Subwatershed (0512010102)	Stream	Location (Monitoring Station)	Nitrate Nitrogen (kg/day)	Flow Regime				
				High Flows 0-10	Moist Conditions 10-40	Mid- Range Flows 40-60	Dry Conditions 60-90	Low Flows 90-100
010	Chickasaw Creek	At Mercer County Road 219-A (CAFO2)	Current Load	11,679	447	112	No Data	No Data
			% Reduction	-98%	-94%	-91%	No Data	No Data
			<b>TMDL= LA+WLA+MOS</b>	<b>184</b>	<b>29</b>	<b>10</b>	<b>3</b>	<b>1</b>
			LA	170	23	6	2.84	0.95
			WLA: Marion Schools WWTP	1	1	1	0	0
			WLA: Chapel Hill WWTP	1	1	1	0	0
			WLA: Chickasaw WWTP	3	3	3	0	n/a*
			WLA: MS4	n/a	n/a	n/a	n/a	n/a
			MOS (5%)	9	1	1	0.16	0.05

Figure 21: Nitrate Nitrogen Loads and Reductions Needed at Monitoring Locations during 2007 TMDL (Ohio EPA)

The 2007 TMDL loading data was used as the basis for load reduction calculations in this plan. There was one monitoring location on Chickasaw Creek included in the 2007 TMDL report. A weighted average of all flow regimes was used to determine the loading per year to Chickasaw Creek in 2007. The entire GLSM watershed was declared “distressed” in 2011, and therefore, a number of practices were installed as a result. These practices are outlined in chapter 2.2 of Biological trends. It is assumed that these practices resulted in a 25% drop in total phosphorus loading and a 10% reduction in nitrate-nitrogen loading. This estimated percentage is also conservatively based on research data collected by the USGS monitoring station on Chickasaw Creek. Figure 22 shows the total phosphorus loading and goals, and Figure 23 shows the nitrate-nitrogen loading and goals.

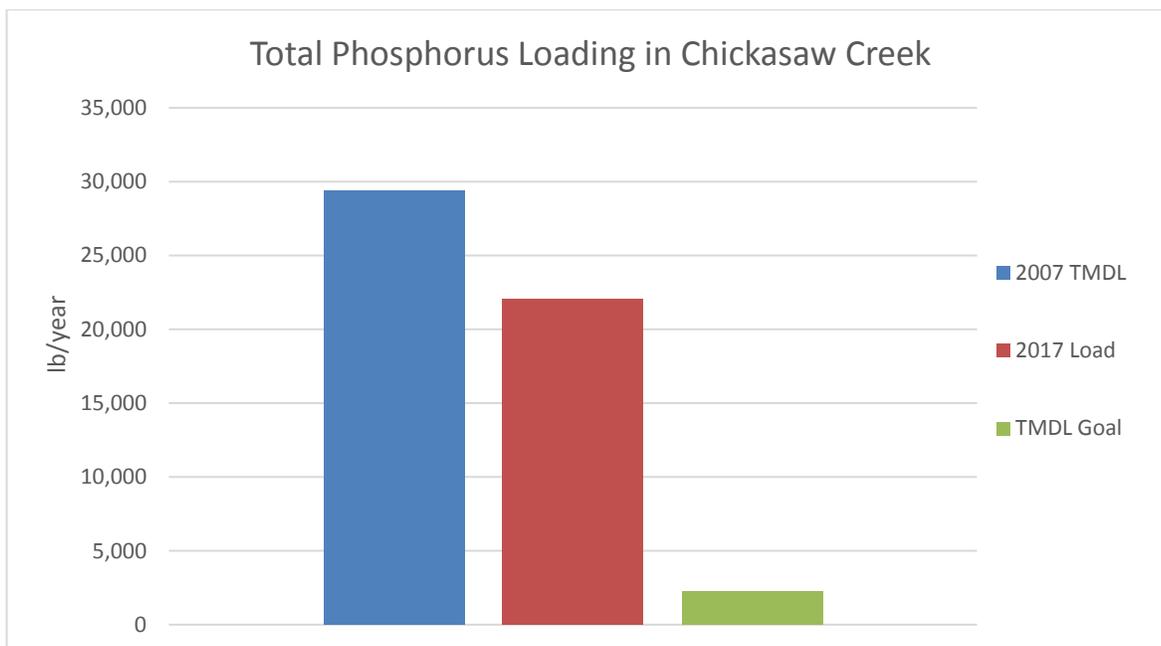


Figure 22: Total Phosphorous Loading of Chickasaw Creek HUC-12

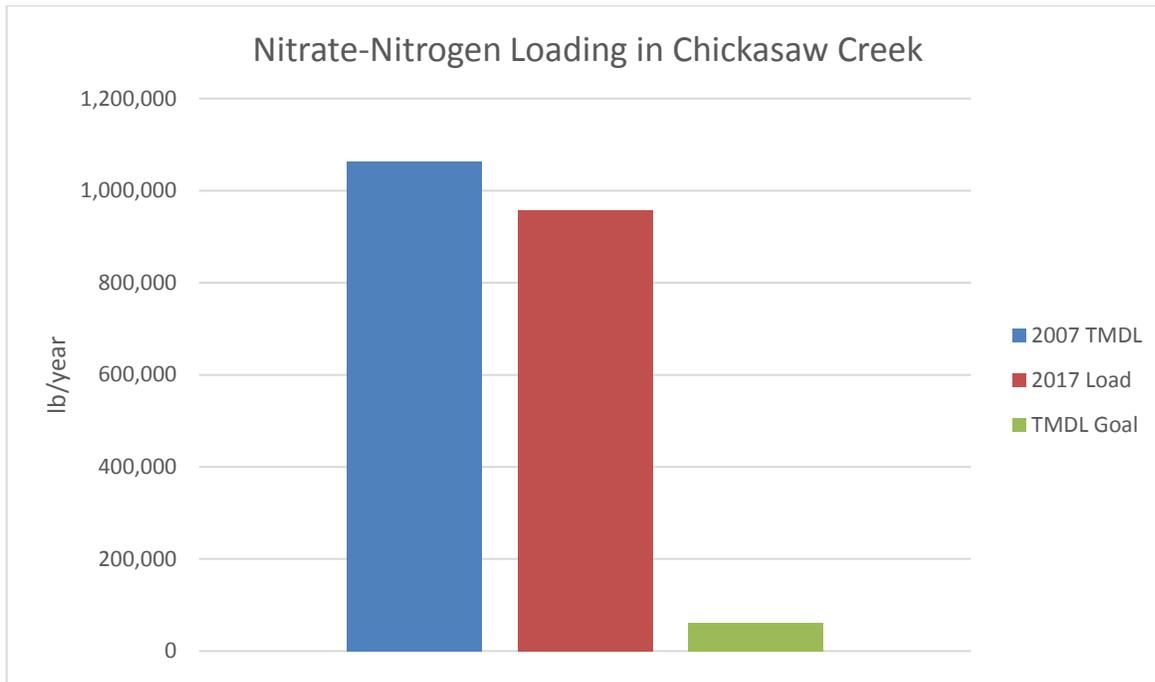


Figure 23: Nitrogen Loading of Chickasaw Creek HUC-12

### 3.2.4 Outline Goals and Objectives for the Critical Area 1

As explained in detail above, Critical Area 1 is primarily impaired based upon nutrient and sediment loading due to areas of high concentration of animal feeding facilities and the land application of manure. Therefore, the focus areas in Critical Area 1 will be addressed in the following order:

1. The approximately 5,000 acres that have a soil test less than 100 lb/ac (50 ppm) Bray P1, to ensure that nutrients are adequately incorporated into the soil, and applied at crop removal nutrient balance.
2. Approximately 30 livestock headquarter facilities, particularly dairy and cattle facilities, will also be an initial focus area within Critical Area 1. These facilities will be encouraged to use alternative manure management strategies.
3. 650-1,300 acres that have a soil test greater than 200 lb/ac (100 ppm) Bray P1 will be the secondary focus to modify practices on those acres to eliminate phosphorus application and implement an intensive cropping system. Edge of field practices will also be combined with this focus, including the following parameters:
  - When evaluating these acres, field directly adjacent to an open ditch will rank as a higher NPS pollution potential due to surface runoff.
  - A significant majority of the cropland in Critical Area 1 has artificial drainage. In the absence of edge of field conservation practices, this extensively row

- crop landscape contributes high sediment loading during runoff and drainage events.
- Soluble phosphorus, sediment-bound phosphorus, nitrogen (in the form of nitrate and ammonia) and sediment are carried to surface waters and contribute to the NPS-loading the Chickasaw Creek watershed.

With sampling sites in nearby watersheds that have similar landscape and history of livestock production, phosphorous loading is a relevant factor in Grand Lake St. Marys. This in turn has a greater impact on the lake creating future algal blooms and keeping the adjacent GLSM HUC-12 in non-attainment status for drinking water. In order to address the impact of nutrient loading into the streams and eventually into Grand Lake St. Marys, Critical Area 1 will first focus on areas of cropland receiving nutrients to ensure incorporation within the soil takes place to reduce NPS pollution. This puts the initial focus on a concentrated amount of land in Critical Area 1 that has the greater NPS pollution. Over time, however, additional acres will also be included in projects to continue reductions of nutrient impairment to meet the overall goals and objectives of this plan.

#### Goals for Critical Area 1

The overall nonpoint source restoration goals of any NPS-IS plan is to improve IBI, MIwb, ICI, and QHEI scores so that the partial or non-attainment status can achieve full attainment of the designated aquatic life use for that water body. The first step to reaching this result is to reduce nutrients leaving the soil via surface run-off and tile discharge. (WAP 2015)

Goal 1: Achieve average IBI score of 40 at monitoring sites. Currently at 24.

Goal 2: Achieve average MIwb score of 8.3 at monitoring sites. Currently is at 7.9.

Goal 3: Achieve average ICI score of 36 at monitoring sites. Currently a poor rating.

Goal 4: Achieve average QHEI score of 60 at monitoring sites. Currently at 30.

Goal 5: Reduce nitrate-nitrogen levels by 391,000 lbs. /year in streams and creeks within Critical Area 1.

Goal 6: Reduce phosphorous levels by 11,800 lbs. /year in streams and creeks within Critical Area 1.

Goal 7: To reduce microcystin toxin levels below 1.0 µg/L in Grand Lake Saint Marys so that non-attainment drinking water use designation can be removed. *This goal will be cross-referenced with goals of the GLSM Lake Adaptive Management Plan (currently under development).*

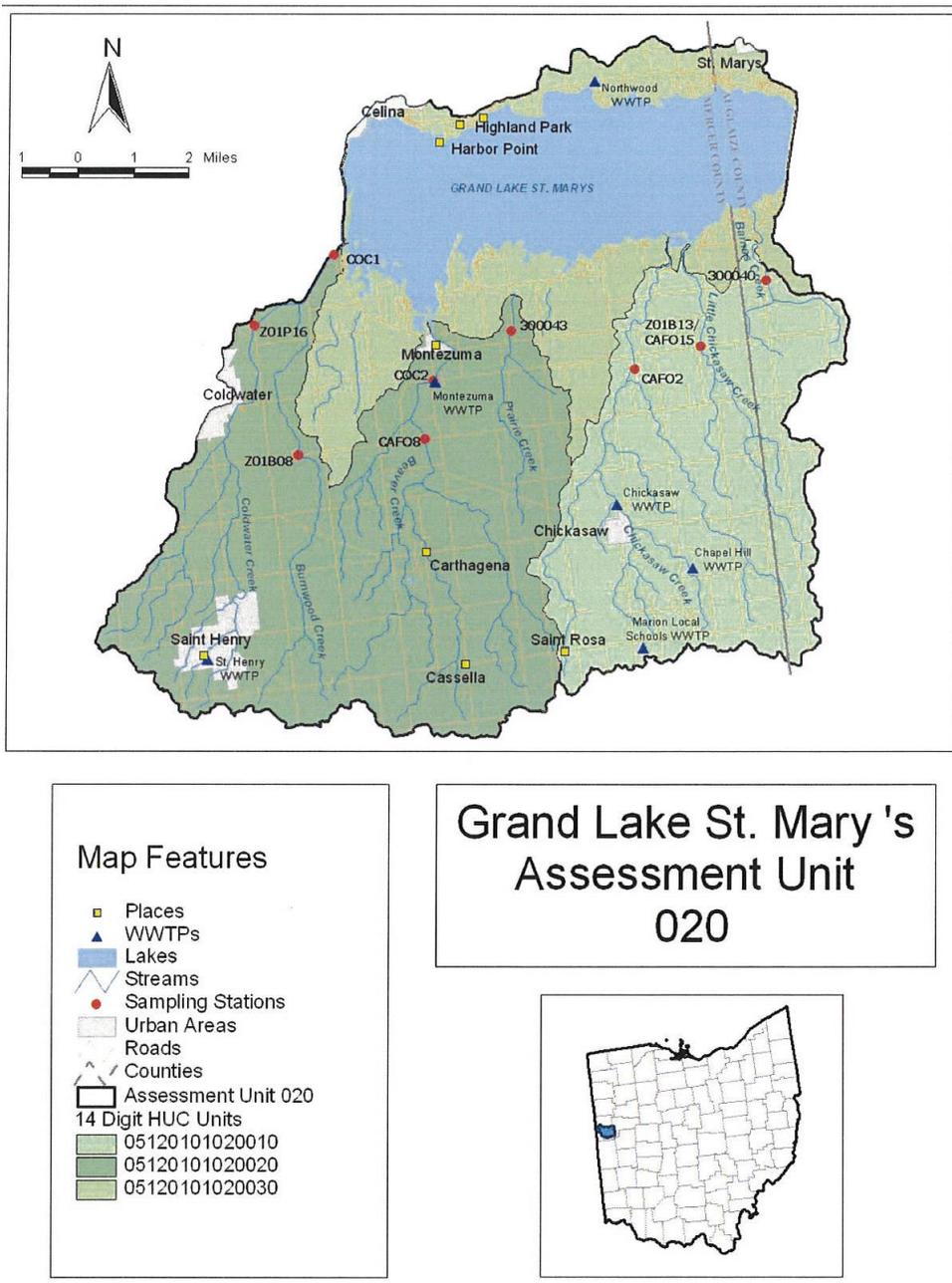


Figure 24: 2007 Ohio EPA Sampling Locations (Ohio EPA)

### Objectives

In order to achieve the overall nonpoint source restoration goal of reducing phosphorous and nitrogen levels to help gain full attainment status in Chickasaw Creek HUC-12, the following objectives that address nutrient loading need to be achieved in Critical Area 1.

These objectives are the prioritized management measures and practices in Critical Area 1 and will be the primary objectives as projects are developed to improve the NPS impacts in this Critical Area.

Objective 1: Enroll 5,000 acres of cropland within the watershed in a nutrient placement program that requires all fertilizer amendments to be incorporated.

Objective 2: Compost drystack manure on a minimum of 16 farms with an average of 500 tons of manure at each farm per year for 3 years, with the intent that composting becomes a permanent, on-farm practice.

Objective 3: Enroll 5,000 acres of cropland with a soil test over 100 lb/acre (50 ppm) Bray P-1 into a phosphorus reduction program to reduce the soil test value to below 80 lb/acre Bray P-1.

Objective 4: Install 150 controlled drainage structures as part of a drainage water management system.

Objective 5: Install 40 saturated buffer components onto new or retrofitted drainage water management systems.

Objective 6: Install 70 blind inlets to control surface drainage loading inputs into tile drainage systems.

Objective 7: Implement controlled drainage water management systems to manage water draining from 5,500 acres of cropland.

Objective 8: Utilize swine manure separation/nutrient concentration technologies at three swine farms within the watershed.

Objective 9: Process two million gallons of swine manure using manure separation/nutrient concentration technologies.

Objective 1 will focus on cropland acres under 80 lb/ ac Bray P1 soil test and utilizing nutrient application to maintain agronomic soil levels. With incorporation required on this cropland, a reduction of 50% phosphorous run-off and 40 % less nitrogen run-off will occur when incorporated versus leaving it on surface after application. With 5,000 acres involved in this program, 5,300 lbs of phosphorus and 184,000 lbs of nitrogen will be reduced as run-off.

Objective 2 focuses on manure produced in the watershed that is in a stackable form. It can be transported in its current form, however, utilizing composting techniques; the

total volume of manure can be decreased by nearly 50%. Also generates a more usable form of manure to be land applied and utilized in areas outside of the watershed needing nutrients for crops.

Objective 3 will be achieved by intensive cropping systems and no phosphorous application on a total of 5,000 acres. Currently, cropland in Beaver Creek HUC-12 receives manure application containing phosphorous on a regular basis due to location of manure produced. By focusing on soil test levels of phosphorous, a reduction plan can be put in place to lower soil test levels to an agronomic level below 80lb/ acre Bray P1. According to the Ohio Lake Erie Phosphorous Task Force II Report, there will be an approximate 20% phosphorus load reduction by changing land use and bringing soil test phosphorus into the optimum range. The causes of nitrate-nitrogen and phosphorous pollution are a target of concern along with the sources of confined animal feeding operations and crop production.

Objectives 4, 5, 6, and 7 will all involve controlling water from surface and tile flow, as well as, filtering the water through structures put in place. Improving base flow conditions and water management will make the objectives together achieve a total phosphorous load reduction of 3,200 lbs per year and a nitrogen load reduction of 207,000 lbs per year.

Objectives 8 and 9 will focus on liquid manure processing. Using nutrient concentration technologies, liquid manure will be separated into different forms in order to put up to 90% of the phosphorous into a concentrated form with a smaller volume able to be transported out of the watershed economically to an area of cropland requiring phosphorous inputs. The remaining nutrients in the manure left behind can continue to be land applied and utilized as crop uptake.

*As these objectives are implemented, water quality monitoring will be conducted to determine progress toward meeting the identified goals. These objectives and goals will be reevaluated and modified in future versions of this implementation strategy.*

As these objectives are implemented, water quality monitoring (both project related and regularly scheduled monitoring) will be conducted to determine progress toward meeting the identified goals (i.e., water quality standards). These objectives will be reevaluated and modified if determined to be necessary. For instance; many agricultural BMPs can be “stacked” (a systems approach) that will also incrementally improve the quality and quantity of runoff and drainage waters and in-stream water quality.



The area defined as Critical Area 2 in Chickasaw Creek HUC-12 is targeted towards the measurable streams and a 100-foot riparian area on each side of the streams within the Chickasaw Creek HUC-12. This accounts for 28.64 miles of stream area. Critical Area 2 also includes a clustered area of homes that are currently using home septic systems. Chickasaw Creek is in non-attainment status for its warmwater habitat aquatic life use designation. A significant factor of the causes of non-attainment is the agricultural use maintained as drainage. This creates a very low gradient Rosgen type “F-6” Stream. An F-6 stream type indicates severe channel incision, poor substrate quality, stagnant glide like low flow characteristics, poor flood plain, and poor buffer diversity and density. With Critical Area 2 being all throughout the watershed, areas are influenced by stream and contributing waterways across many acres. It is also likely the upstream areas listed in Critical Area 1 are also contributing to the non-attainment status of the Chickasaw Creek HUC-12.

Using the rationale described in the *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* (U.S. EPA, 2008)(section 10.3.4): “In general, management practices are implemented immediately adjacent to the waterbody or upland to address the sources of pollutant loads.” With the majority of land intensively row cropped for crop production, many areas can improve sediment and nutrient loss due to drainage and nutrient loss. Figure 23 below is an example of row cropped agriculture alongside channelized streams in Chickasaw Creek HUC-12



Figure 26: Image of Chickasaw Creek.

### 3.3.2 Detailed Biological Conditions

Little biological data is specified for Critical Area 2, however being within Critical Area 1, the habitat data that is known is provided above in Figure 17. The non-attainment status for the Chickasaw Creek HUC-12 is also valid for Critical Area 2.

### 3.3.3 Detailed Causes and Associated Sources

The focus on Critical Area 2 from Ohio EPA during the 2007 TMDL is channelization, removal of riparian vegetation, and stream bank destabilization. These are all factors sourced from agriculture. A large portion of the cropland has subsurface drainage. Critical Area 2 is focused on these stream areas to rebuild and regain attainment status. Figures 10 and 17 show the results at County Road 219A, which is where Critical Area 2 begins. The results from Figure 10 and 17 shows the sampling results for phosphorous and nitrates that were detected in the creek. As stated in Critical area 1, all of the livestock manure applications create the concern of nutrient loading to these same streams. With less vegetation on stream banks, and high nonpoint source pollution levels of nutrients going into the water, it creates an environment hard to support fish life. (Ohio EPA, 2007)

### 3.3.4 Outline Goals and Objectives for the Critical Area

As explained in detail above, Critical Area 2 is primarily impaired based upon sedimentation of channel incision and agricultural drainage. There are nearly 29 miles of streams included in Critical Area 2. The streams range in size and would be suited well for potential projects. There are areas of stream that show channelization has occurred and that there are significant impacts from agricultural drainage. Household septic systems are a concern, and a concentrated area of homes is a potential for future centralized sewage systems to be combined with Chickasaw WWTP. Critical Area 2 was defined as a larger contiguous area to try and address the additional sediment load that is suspected to be coming from the tributary ditches.

#### Goals for Critical Area 2

Goals in place are to achieve the overall nonpoint source restoration of reducing phosphorous and nitrogen levels with less sedimentation and channelization in streams. The big picture follows downstream to Grand Lake St. Marys to protect over 13,000 acres of lake from harmful algal blooms and sedimentation build up. To help gain full attainment status in Chickasaw Creek HUC-12, the following objectives that address sedimentation and channelization need to be achieved in Critical Area 2.

Goal 1: Achieve average IBI score of 40 at monitoring sites. Currently at 24.

Goal 2: Achieve average MIwb score of 8.3 at monitoring sites. Currently is at 7.9.

Goal 3: Achieve average ICI score of 36 at monitoring sites. Currently a poor rating.

Goal 4: Achieve average QHEI score of 60 at monitoring sites. Currently at 30.

Goal 5: Reduce nitrate-nitrogen levels by 146,000 lbs/year in streams and creeks within Critical Area 2.

Goal 6: Reduce Phosphorous levels by 3,500 lbs/year in streams and creeks within Critical Area 2.

### Objectives

In order to achieve the overall nonpoint source restoration goal of reducing sediment, phosphorous, and nitrogen levels to gain full attainment status in the Chickasaw Creek HUC-12, the following objectives that address sedimentation and nutrient loading need to be achieved in Critical Area 2. These objectives are the prioritized management measures and practices in Critical Area 2 and will be the primary objectives as projects are sought out and/or developed to improve the NPS impacts in this Critical Area. It should also be noted that achievement of the objectives described for Critical Area 1 (upstream) should also show improvement in Critical Area 2.

Objective 1: Restore 30,000 linear feet of stream channel with flood plain that incorporates wetlands and riparian buffers that allow access of high flow runoff to a functional floodplain bench.

Objective 2: Install one centralized sewer system within the watershed, and thereby eliminating 50 individual home sewage treatment systems.

Objective 1 will allow the restoration of stream and riparian corridor through the use of in-stream wetlands and/or riparian buffers to increase access of high flow runoff water to a functional floodplain bench. It is estimated that 3,000 lbs of phosphorus loading will be reduced and 142,000 lbs. of nitrogen loading will be reduced per year. These numbers are conservatively estimated and are consistent with the 2007 TMDL, which cites an 80% reduction in nitrogen and a 78% reduction in phosphorus with the implementation of riparian buffers

Objectives 2 and 3 will be achieved by installing a centralized sewer system for the area of St Rose that will be treated by a local wastewater treatment plant. Load reductions are estimated at 500 lbs of phosphorous and 1,100 lbs of nitrogen per year. These load reductions are based on an assumption from Swann (2001) of 22 lb/year of nitrogen and 6.9 lb/year of phosphorus discharged per average failing septic system.

Projects that address the above attributes will have a positive effect on the attributes of NPS pollution in the Chickasaw Creek HUC-12.

As these objectives are implemented, water quality monitoring (both project related and regularly scheduled monitoring) will be conducted to determine progress toward meeting the identified goals (i.e., water quality standards). These objectives will be reevaluated and modified if determined to be necessary. For instance; many agricultural BMPs can be “stacked” (a systems approach) that will also incrementally improve the quality and quantity of runoff and drainage waters and in-stream water quality.

When reevaluating, the committee will reference the Ohio EPA Nonpoint Source Management Plan Update (Ohio EPA, 2013), which has a complete 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

## Chapter 4: Projects and Implementation Strategy

### 4.1 Overview Tables and Project Sheets for Critical Areas

Below are the projects and evaluation needs believed to be necessary to remove the impairments to the Chickasaw Creek HUC-12 as a result of the identified cause and associated sources of nonpoint source pollution. Because the attainment status is based on biological conditions, it will be necessary to periodically reevaluate the status of the critical area to determine if the implemented projects are sufficient to achieve restoration. Time is an important factor to consider when measuring project success and overall status. Biological systems in some cases can show response fairly quickly (i.e. one season); other systems may take longer (i.e., several seasons, years) to show recovery. There may also be reasons other than nonpoint source pollution for the impairment. Those issues will need to be addressed under different initiatives, authorities or programs

which may or may not be accomplished by the same implementers addressing the nonpoint source pollution issues.

For the Chickasaw Creek HUC-12, there are two Project and Implementation Strategy Overview Tables (subsection 4.2.1 and 4.3.1). Each critical area only has one primary cause and associated source of nonpoint source impairment. If another nonpoint source impairment is identified for one of the existing critical areas, it will be explained and added to that critical area's table. If a new impairment is determined that has a different critical area, a new table will be created for that new critical area. The projects described in the Overview Tables have been prioritized using the following three-step prioritized 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 causes and sources of impairment or where there is an expectation that such potential projects will improve water quality in Chickasaw Creek.
- 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 4.2.2 and 4.3.2. These PSS 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 are developed, these sheets will be updated. Any new PPS created will be submitted to the state of Ohio for funding eligibility verification (i.e., all nine elements are included).

## 4.2 Critical Area 1: Overview Table and Project Sheets for Chickasaw Creek HUC-12

The information included in the Critical Area 1 Overview Table is a condensed overview of all identified projects needed for nonpoint source restoration of the Chickasaw Creek HUC-12 Critical Area 1. Project Summary Sheets are included for short term projects or any project that is considering seeking funding in the near future. Only those projects with complete Project Summary Sheets will be considered for state and federal NPS program funding.

#### 4.2.1 Critical Area 1: Project and Implementation Strategy Overview Table

The Chickasaw Creek HUC-12 Critical Area 1 is based on non-attainment status of aquatic life use designation and nutrient and sedimentation loading from cropland. The Critical area 1 Overview Table provides a quick summary of what needs to be done, where, and what problem (cause/source) will be addressed and includes projects at all levels of development (i.e. concept, need funding, in progress). This overview table is intended to show a prioritized path toward the restoration of the Chickasaw Creek HUC-12.

**Critical Area 1: Project Overview Table for Chickasaw Creek HUC-12 (05120101-0201)**

<b>Goal</b>	<b>Objective</b>	<b>Project #</b>	<b>Project Title (EPA Criteria g)</b>	<b>Lead Organization (criteria d)</b>	<b>Time Frame (EPA Criteria f)</b>	<b>Estimated Cost (EPA Criteria d)</b>	<b>Potential/Actual Funding Source (EPA Criteria d)</b>
<b>Urban Sediment and Nutrient Reduction Strategies</b>							
<b>Altered Stream and Habitat Restoration Strategies</b>							
1,2,3,4,5,6,7	3,4,5,6	1	Phosphorous Reduction and Edge of Field Practice Plan	Mercer SWCD	Medium	\$500,000	USDA- CIG, EPA 319, EQIP, SWIF, CRP
<b>Agricultural Nonpoint Source Reduction Strategies</b>							
1,2,3,4,5,6,7	3,4,5,6	1	Phosphorous Reduction and Edge of Field Practice Plan	Mercer SWCD	Medium	\$500,000	USDA- CIG, EPA 319, EQIP, SWIF, CRP
1,2,3,4,5,6,7	1	2	Nutrient Incorporation Strategy	Mercer SWCD	Short	\$300,000	USDA-CIG, EPA 319
6,7	8,9	3	Nutrient Removal Technology Project	Mercer County Ag Solutions	Medium	\$500,000	USDA VAPG, CIG
5,6,7	2	4	On farm Manure Composting	Mercer SWCD	Short	\$200,000	USDA VAPG, CIG, EQIP
<b>High Quality Waters Protection Strategies</b>							
<b>Other NPS Causes and Associated Sources of Impairment</b>							

### Section 4.2.2 Critical Area 1 Project Summary Sheet(s)

The Project Summary Sheets provided below were developed based on action or activities needed to restore the cropland to minimize nutrient loading from high soil test phosphorous. These projects are considered next step or priority/short term projects. Medium and longer term projects will most likely not have a summary sheet, as these projects are not ready for implementation. The project summary sheets will be mostly the priority or short term project that are ready to implement, or at least those projects have been more thoroughly planned.

### Critical Area 1: Project 1

Nine Element Criteria	Information needed	Explanation
n/a	Title	Nutrient Incorporation
criteria d	Project Lead Organization & Partners	Mercer County SWCD; Mercer County Ag Solutions
criteria c	HUC-12 and Critical Area	Chickasaw Creek HUC-12 (05120101-0201) Cropland areas
criteria c	Location of Project	Chickasaw Creek HUC-12, south of Grand Lake St Marys- Cropland
n/a	Which strategy is being addressed by this project?	Agricultural Nonpoint Source Reduction Strategy
criteria f	Time Frame	Short (1-3 years)
criteria g	Short Description	Enroll approximately 2,000 acres of cropland into a three year commitment of incorporating all nutrients applied to enrolled cropland fields and also requiring a soil test that shows the need for the fertilizer or manure amendment.
criteria g	Project Narrative	Chickasaw Creek HUC-12 is a highly populated area with livestock concentration of Dairy, Beef, Poultry, and Hogs. Encouraging farmers that have historically applied nutrients on the surface to incorporate the applied nutrients immediately so that there is immediate contact with the soil can be achieved through a performance based reimbursement.  If enrolled, the field will need a current soil test to show the need for nutrients. A manure test will also be needed demonstrate the amount of nutrients to be applied with an intended rate of application. The method of application and type of incorporation will be documented. Verification of the types of nutrient applied and that it was incorporated by Mercer SWCD. By promoting the incorporation of nutrients, according to Heidelberg University research, up to a 50% reduction in phosphorous runoff can be achieved. It is also assumed that the incorporation of nutrients will achieve a 40% reduction in nitrogen runoff.

		A performance reimbursement will be put towards per acre of risk reduction. Local match will include SWCD time to ensure compliance with the program, local and state funding sources, and producer in-kind match consisting of time and material.
criteria d	Estimated Total cost	\$300,000
criteria d	Possible Funding Source	Ohio EPA 319(h) (if eligible); USDA-CIG
criteria a	Identified Causes and Sources	Cause: Nutrient Loading Sources: Channelization and non irrigated crop production.
criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?	With the goal being: to raise IBI score above 40. (currently 24), to raise MIwb score above 8.3 (currently 7.9), to raise ICI score to 36 (currently a poor rating), and raise QHEI score from 30 to 60. Also, to reduce microcystin toxin levels in GLSM to bring it into drinking water attainment status.  With numerous livestock facilities in the watershed, it is necessary to apply manure to cropland. In this project 2,000 acres will be enrolled which is approximately 20% of the cropland acres in Chickasaw Creek HUC-12. Those acres will be croplands that are requiring nutrients in a form of manure or commercial fertilizer that will be incorporated and in turn reduce nutrient loading.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Goals: There is recognition that there is lag time associated with nonpoint source-related projects and stream response. However, measured stream nitrate and phosphorous levels can be directly impacted after rain events if the nutrients applied are incorporated. The goal of this project is to reach 1,000 acres of cropland, which equates to approximately 10% of the Chickasaw Creek HUC-12 total cropland. This equates to just under 20% of the overall objective of implementing the practice within the Chickasaw Creek HUC-12. With participation of these acres targeted towards those making a change in their management practices, it is estimated that there will be a 10.5% (2119 lbs/ P out of 20,105 lbs /P goal) phosphorus reduction and a 7.9% (73,626 lbs /N out of 932,974 lbs /N goal) nitrogen reduction. As these nutrient loads are reduced, it is expected QHEI, IBI, ICI, and MIwb scores will increase.
	Part 3: Load Reduced?	Estimated: 2,119 lbs P/year, 73,626 lbs N/year
criteria i	How will the effectiveness of this project in addressing the NPS impairment be measured?	Staff from OEPA-DSW Ecological Assessment Unit will perform both pre and post project monitoring to determine progress (through IBI, ICI, and QHEI) from non to full attainment. At closest downstream river mile of these practices, a water sample will be taken during average stream flows to monitor nutrient levels. OEPA watershed-wide monitoring is expected to be conducted again in the summer of 2022.
criteria e	Information and Education	This project will be promoted with public meetings to inform producers, press releases, news articles, social media and personal contacts from Mercer SWCD to eligible producers. Overall reduction results will be shared with the public as well.

## Critical Area 1: Project 2

Nine Element Criteria	Information needed	Explanation
n/a	Title	On Farm Manure Composting
criteria d	Project Lead Organization & Partners	Mercer County SWCD
criteria c	HUC-12 and Critical Area	Chickasaw Creek HUC-12 (05120101-0201)
criteria c	Location of Project	Chickasaw Creek HUC-12, south of Grand Lake St Marys. Interested landowners that produce manure in a stackable form and have a need to export their manure out of the watershed.
n/a	Which strategy is being addressed by this project?	Agricultural Nonpoint Source Reduction Strategy
criteria f	Time Frame	Short (1-3 years)
criteria g	Short Description	Stackable, penpack manure, (dairy, steer, heifer, etc) will be stored in compost piles at the farm it is produced. Using a piece of equipment such as a compost turner, rotate the pile of manure several times per week for a period of approximately three months to allow the manure to naturally digest into a smaller volume and drier material. This creates the opportunity for the manure to be transported outside the watershed to areas of cropland needing nutrients. The material volume will be reduced by approximately 50% and moisture reduced by 30-40%, therefore, reducing total weight significantly.
criteria g	Project Narrative	<p>Chickasaw Creek HUC-12 has approximately 30 operations producing manure that is stored in a dry, stackable form. Some of this manure is in the range of 60-70% moisture. The amount of time and money to transport the manure tends to get costly with great distances.</p> <p>Composting is a natural process that has been used for many decades when dealing with dead animals and manure in order to condense the volume of material into a smaller form to be land applied. Composting manure has become increasingly efficient by utilizing machinery to stir up the manure to get air into the pile and speed up the process. This project will allow Mercer SWCD to acquire the equipment to do this process and serve as an education piece for farmers. The equipment would be available to use for rent on up to ten different operations and a performance reimbursement to each producer of finished ton of compost. The producers of manure could use the equipment to process the manure they produce at their farm. After a few months, the finished compost, rich in nutrients, can then be economically moved to cropland in need of the nutrients outside of the watershed.</p> <p>This pilot installation will spark interest to engage other livestock producers and show them the benefits of composting while allowing a high volume of manure to be processed. It is assumed that by removing these nutrients from the watershed, an overall 20% reduction of in-stream phosphorus loads will occur.</p>

criteria d	Estimated Total cost	\$200,000
criteria d	Possible Funding Source	USDA VAPG, USDA-CIG, EQIP
criteria a	Identified Causes and Sources	Causes: Nutrient Loading Sources: Confined animal feeding operations (NPS)
criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?	Reducing phosphorous applications to cropland that is at or above maintenance level for crop removal is an important objective of this plan. In order to meet the Chickasaw Creek HUC-12 balance of nutrients produced through livestock operations, as shown in Figure 15, 225,000 lbs. of P2O5 will need to be exported out of the watershed per year. This is using the Tri-State Fertility Guide's crop removal values and by assuming a typical crop rotation utilized in the Chickasaw Creek HUC-12. With known values of P2O5 in each type of animal manure and the amount produced, the surplus of phosphorus is calculated. It is assumed that by transporting this phosphorus out of the watershed, there will be a 20% in-stream phosphorus load reduction, as the nutrient would have typically been applied to cropland above the Tri-State Fertilizer Guide's recommended phosphorus levels.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Goals: There is recognition that there is lag time associated with nonpoint source-related projects and stream response. However, by completing this project, approximately 50,000 lbs of P2O5 and 75,000 lbs. of Nitrogen will be transported out of the watershed each year. This equates to 4.8% (980 lbs/ P out of 20,105 lbs P goal) phosphorus reduction and a 6% (57,000 lbs /N out of 932,974 lbs /N goal) nitrogen reduction towards the overall objective of implementing this practice within the Chickasaw Creek HUC-12. The end result will be more sustainable phosphorous levels that can be maintained or lowered in order to lessen NPS pollution. This project will also encourage a wider adoption of the practice by other livestock producers, or potentially garner an interest from a local cooperative that could develop a centralized composting system for manure to be dropped off.
	Part 3: Load Reduced?	Estimated: 980 lbs P/ year, 57,000 lbs. N/ year
criteria i	How will the effectiveness of this project in addressing the NPS impairment be measured?	Mercer SWCD and Mercer County Ag Solutions will monitor the manure production of the operation to achieve the goals of transporting enough phosphorus to areas needing nutrients to meet a crop removal balance in Chickasaw Creek HUC-12. Records of raw manure weight and volume will be estimated along with final compost weights and volumes. It will also be verified that the compost will be applied on land needing nutrients, with a soil test to prove the nutrient need. OEPA watershed-wide monitoring is expected to be conducted again in the summer of 2022.
criteria e	Information and Education	This project will be promoted with public meetings to inform producers, press releases, news articles, social media and personal contacts from Mercer SWCD to eligible producers. Overall reduction results will be shared with the public as well. A public informational meeting will be held to inform and educate eligible producers the details and requirements of the project.

## **Section 4.3 Critical Area 2: Overview Table and Project Sheets for middle reach of Chickasaw Creek HUC-12**

The information included in the Critical Area 1 Overview Table is a condensed overview of all identified projects needed for nonpoint source restoration of the Chickasaw Creek HUC-12 Critical Area 1. Project Summary Sheets are included for short term projects or any project that is considering seeking funding in the near future. Only those projects with complete Project Summary Sheets will be considered for state and federal NPS program funding.

### **4.3.1 Critical Area 2: Project and Implementation Strategy Overview Table**

The Chickasaw Creek HUC-12 Critical Area 2 is based on non-attainment status of aquatic life use designation and nutrient and sedimentation loading. The Critical Area 2 Overview Table provides a quick summary of what needs to be done, where, and what problem (cause/ source) will be addressed and includes projects at all levels of development (i.e. concept, need funding, in progress). This over view table is intended to show a prioritized path toward the restoration of the Chickasaw Creek HUC-12.

**Critical Area 2: Project Overview Table for Chickasaw Creek HUC-12 (05120101-0201)**

<b>Goal</b>	<b>Objective</b>	<b>Project #</b>	<b>Project Title (EPA Criteria g)</b>	<b>Lead Organization (criteria d)</b>	<b>Time Frame (EPA Criteria f)</b>	<b>Estimated Cost (EPA Criteria d)</b>	<b>Potential/Actual Funding Source (EPA Criteria d)</b>
<b>Urban Sediment and Nutrient Reduction Strategies</b>							
1,2,3,4,5,6	2	2	St. Rose Centralized Sewer System	Mercer County	Short	\$1,000,000	WPCLF; RPIG
<b>Altered Stream and Habitat Restoration Strategies</b>							
1,2,3,4,5,6	1	1	In Stream wetlands and Buffers	Mercer SWCD	Short	\$600,000	Ohio EPA 319, SWIF, EQIP, CRP
<b>Agricultural Nonpoint Source Reduction Strategies</b>							
<b>High Quality Waters Protection Strategies</b>							
<b>Other NPS Causes and Associated Sources of Impairment</b>							

## Critical Area 2: Project 1

Nine Element Criteria	Information needed	Explanation
n/a	Title	In Stream wetlands and Buffers
criteria d	Project Lead Organization & Partners	Mercer County SWCD
criteria c	HUC-12 and Critical Area	Chickasaw Creek HUC-12 (05120101-0201)
criteria c	Location of Project	Chickasaw Creek HUC-12
n/a	Which strategy is being addressed by this project?	Altered Stream and Habitat Restoration Strategies with Riparian Buffer
criteria f	Time Frame	Short (1-3 years)
criteria g	Short Description	This project will increase the amount of buffers along streams and also includes the establishment of in-stream wetlands in some areas of the creeks. Once constructed, the project will enhance the quality of in-stream and riparian habitat and reduce sediment and phosphorous loads in Chickasaw Creek within Critical Area 2.
criteria g	Project Narrative	This project will improve in-stream and riparian habitat quality along Chickasaw Creek within Critical Area 2. 4,000 linear feet of stream will be restored with in-stream wetlands and/or buffer areas. Stabilization of stream channel and banks will be put in place and increasing quality of habitat for fish and macro invertebrates. The project will enhance the quality of in-stream and riparian habitat and reduce sediment and phosphorous loads in Chickasaw Creek. It will also restore the stream's connectivity to a functional floodplain.
criteria d	Estimated Total cost	\$600,000
criteria d	Possible Funding Source	EPA 319, SWIF, EQIP, CRP
criteria a	Identified Causes and Sources	Cause: Nutrient Loading/ sedimentation Source: agricultural drainage, nutrient applications, channelization
criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?	<p>With the goal being: to raise IBI score above 40. (currently 24), to raise MIwb score above 8.3 (currently 7.9), to raise ICI score to 36 (currently at a poor rating), and raise QHEI score from 30 to 60. Also, reduce microcystin toxin levels in GLSM to bring it into drinking water attainment status.</p> <p>Objective 1 of 30,000 linear feet of flood plain bench and buffers installed in Critical Area 2 will be approximately 20% of the river miles within Critical Area 2. These areas will buffer and filter nutrient run-off from agricultural land.</p>

	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	Plans for project 2 include 4,000 ft of river mile redeveloped, which corresponds to 13% of Objective 1. There is recognition that there is lag time associated with nonpoint source- related projects and measured stream response. With respect to the goals in critical area 2, the main driver is the QHEI score and nutrient loading into the Beaver Creek HUC-12 and eventually Grand Lake St Marys. A total of 1.6% (328 lbs/ P out of 20,105 lbs /P goal) phosphorus reduction and a 1.6% (73,626 lbs /N out of 932,974 lbs /N goal) towards meeting the overall TMDL goal will be reduced. As these nutrients are reduced it is expected QHEI, IBI, ICI, and MIwb scores will increase.
	Part 3: Load Reduced?	Estimated: 328lbs P/ year, 15,272 lbs N/ Year
criteria i	How will the effectiveness of this project in addressing the NPS impairment be measured?	Staff from OEPA-DSW Ecological Assessment Unit will perform both pre and post project monitoring to determine progress (through IBI, ICI, and QHEI) from non to full attainment. OEPA watershed-wide monitoring is expected to be conducted again in the summer of 2022.
criteria e	Information and Education	Mercer SWCD will develop outreach materials, and tours of the site to promote how a watershed can be improved and achieve water quality while maintaining drainage.

## Critical Area 2: Project 2

Nine Element Criteria	Information needed	Explanation
n/a	Title	St. Rose Centralized Sewer
criteria d	Project Lead Organization & Partners	Mercer County Sanitary Department & Mercer County Community & Economic Development
criteria c	HUC-12 and Critical Area	Chickasaw Creek HUC-12 (05120101-0201)
criteria c	Location of Project	Chickasaw Creek HUC-12 7447 St. Rt. 119 Maria Stein OH
n/a	Which strategy is being addressed by this project?	Urban Sediment and Nutrient Reduction Strategy
criteria f	Time Frame	Short (1-3 years)
criteria g	Short Description	This project will replace 50 failing home septic systems with centralized sewer, that will be treated by the Chickasaw Wastewater Treatment Plant. Once constructed, the project will reduce phosphorous and nitrate-nitrogen loads in Chickasaw Creek within Critical Area 2.

criteria g	Project Narrative	St. Rose is a residentially-dense area within the Chickasaw Creek HUC-12 that remains unsewered. Approximately 5034 homes are clustered within the St. Rose area, which lies within Critical Area 2. Future engineering is planned to develop and construct this centralized sewer system. The intention is to apply for grants and obtain a permit for construction within 3 years.
criteria d	Estimated Total cost	\$600,000
criteria d	Possible Funding Source	Ohio RPIG; Ohio EPA WPCLF
criteria a	Identified Causes and Sources	Cause: Nutrient and Pathogen Loading Source: Residential failing/non-functioning septic systems
criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?	The goals are to raise the IBI score above 40 (currently 24), to raise MIwb score above 8.3 (currently 7.9), to raise ICI score to 36 (currently at a poor rating), and to raise QHEI score from 30 to 60 at Depweg Road. Reducing nitrate, nitrite, and phosphorous levels will strengthen the quality of streams and the end result will be to obtain a full attainment status for the Chickasaw Creek HUC-12.
	Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?	This project will result in an approximate 1.7% (350 lbs/ P out of 20,105 lbs /P goal) phosphorus reduction and a .1% (1,100 lbs /N out of 932,974 lbs /N goal) nitrogen reduction for the Chickasaw Creek HUC-12 of the current loading outlined in the TMDL report as well. This project will satisfy nearly 60% of Critical Area 2, Objective 3.
	Part 3: Load Reduced?	Estimated: 350 lbs P/year and 1,100 lbs N/year
criteria i	How will the effectiveness of this project in addressing the NPS impairment be measured?	A water sample will be taken down stream of the project area before the project begins; then each year after in same location during similar flows for the following five years to be sent off to a certified lab. OEPA watershed-wide monitoring is expected to be conducted again in the summer of 2022.
criteria e	Information and Education	The local media will publicize this project during construction bidding and during construction itself. Social media will also be used to update the public on the status of this project. Focusing on an impairment source other than agriculture is important in the social aspect of watershed improvement.

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# Appendices

## Appendix A: Acronyms and Abbreviations

The acronyms and abbreviations below are commonly used by organizations working to restore Ohio's watersheds; many of which are included in the NPS-IS plan.

### A

AOC            Area of Concern

### B

BMP            Best Management Practice

### D

DNR            Department of Natural Resources

### H

HUC            Hydrologic Unit Code

### I

ICI            Invertebrate Community Index

### M

MIwb          Modified Index of Well Being

MWH          Modified Warmwater Habitat

### O

ODA            Ohio Department of Agriculture

ODNR          Ohio Department of Natural Resources

OEPA          Ohio Environmental Protection Agency

### Q

QHEI          Qualitative Habitat Evaluation Index

### S

SWCD Soil and Water Conservation District

I

TMDL Total Maximum Daily Load

U

USDA United States Department of Agriculture

USEPA United States Environmental Protection Agency

W

WAP Watershed Action Plan

WWH Warm Water Habitat

WWTP Waste Water Treatment Plant

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