Source Implementation Strategy Plan: Lower Meander Creek HUC 12-050301030703

Meander Reservoir Dam with Meander Water Gatehouse in the background

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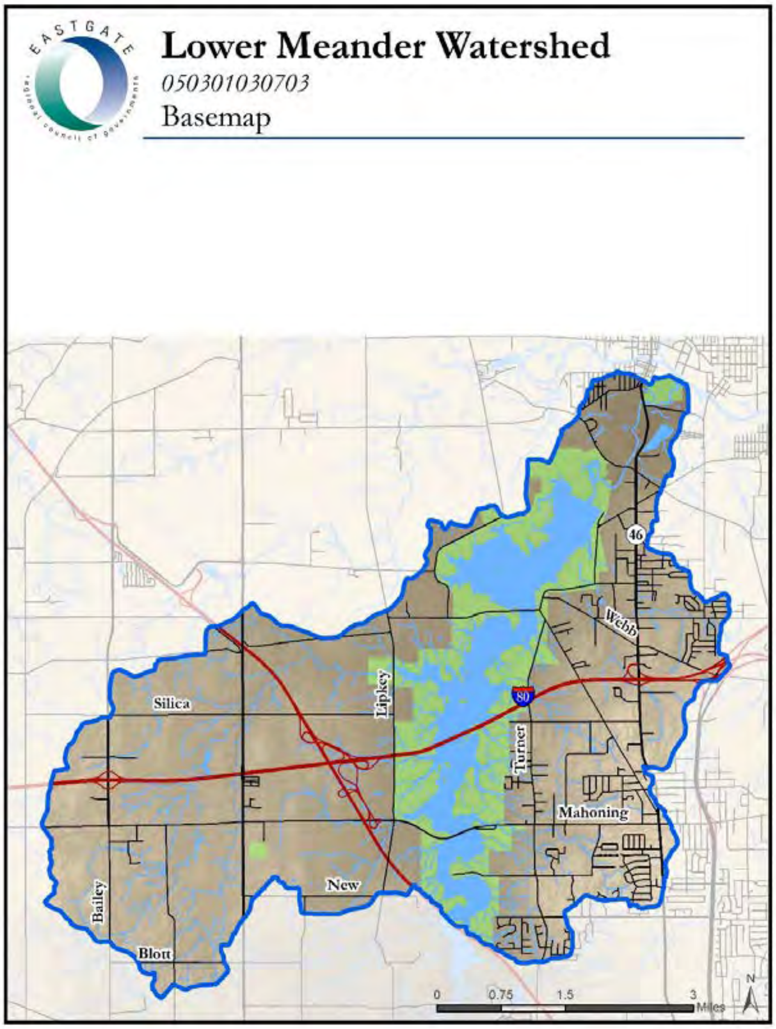
Chapter 1: Introduction to the Lower Meander Creek HUC-12

The ***Lower Meander Creek, Hydrologic Unit Code (HUC)-12: 050301030703***, is in Mahoning County, Northeast Ohio. The watershed is a subwatershed of the *Meander Creek watershed (HUC-8: 0503010307)*. The Meander Creek watershed houses a surface drinking water source, Meander Reservoir. The Lower Meander Creek houses more than three-fourths of the reservoir.

Figure 1: Lower Meander Creek



Eastgate Regional Council of Governments (Eastgate) and Meander Water recognize protecting the reservoir goes well beyond the boundaries of the reservoir. Eastgate and Meander Water have taken the lead in developing the Nonpoint Source Pollution Implementation Strategy (NPS-IS) plan for the Meander Watershed.

1.1 Report Background

This NPS-IS will enhance the Mahoning Valley Sanitary District's (MVSD) reservoir protection efforts established under the Meander Water Source Water Protection Plan (SWPP) and endorsed by the Ohio Environmental Protection Agency (Ohio EPA) in March 2009. The Lower Meander Creek HUC-12 NPS-IS plan will address nonpoint sources pollution issues within the drainage area that can keep the reservoir off the Ohio EPA's "watch list" for impaired source waters. This plan will meet the State and Federal nonpoint source funding requirements closely tied to strategic implementation planning requirements of the United States Environmental Protection Agency's (U.S. EPA) nine minimum elements of a watershed plan for impaired waters.

The Meander SWPP identified sensitive water courses leading into Meander Reservoir and developed strategies to reduce the risk of contamination and sedimentation to the Meander Reservoir. A SWPP's scope is limited to an established radius surrounding a drinking water source's intake. According to the Ohio EPA's *Developing Source Water Protection Plans for Public Drinking Water Systems Using Inland Surface Waters* guide, "a watershed action plan and a source water protection plan can appear similar on the surface but differ significantly on a more detailed level." (Ohio Environmental Protection Agency, 2009, pp. 1-3)

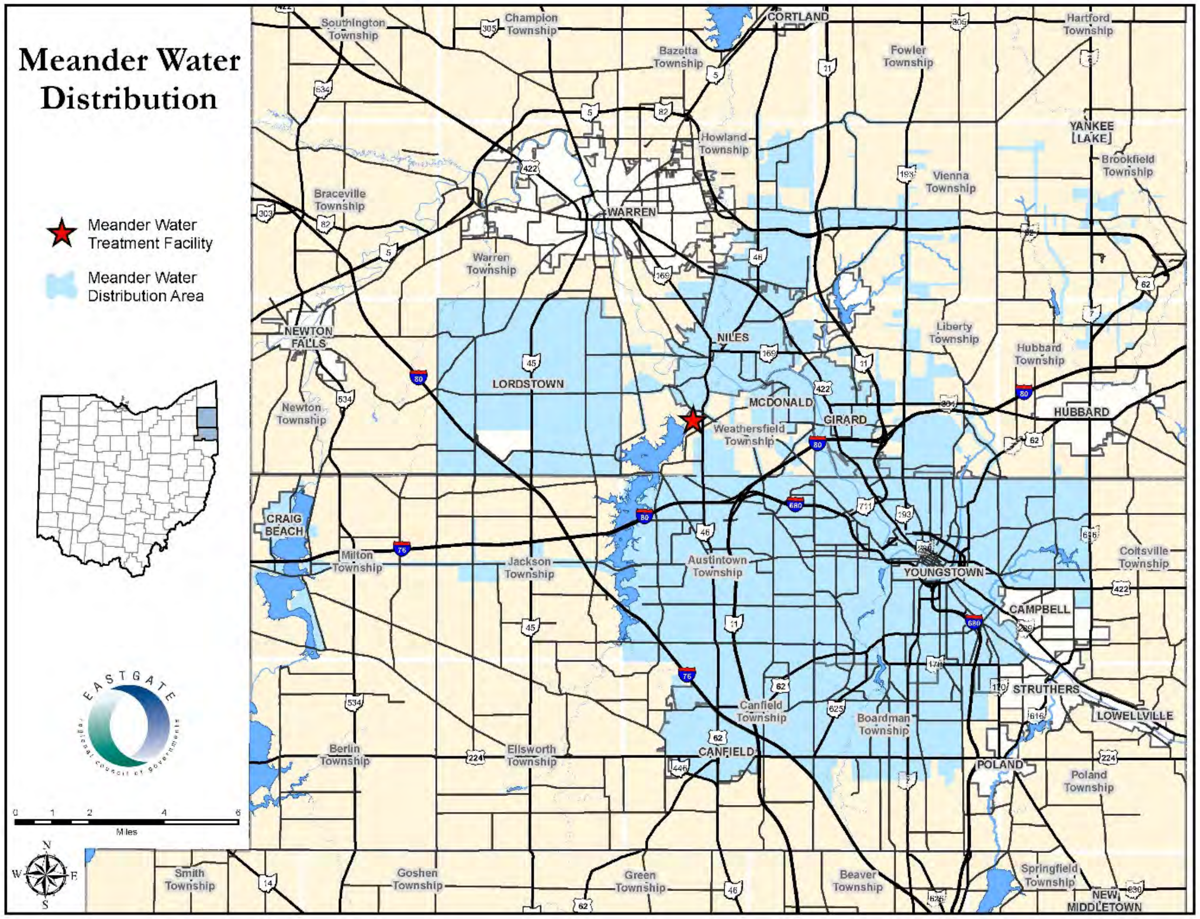
"A watershed action plan and source water protection plan can appear similar on the surface but differ significantly on a more detailed level."

> *"For public water systems that draw water from a stream segment that is being addressed by a WAP, Ohio EPA strongly recommends trying to incorporate drinking water protection activities into the WAP. In many cases, the actions necessary to address impacted water quality will also protect sources of drinking water.*
>
> *To determine whether an existing watershed action plan adequately addresses source water protection, source water protection planners should review the document against the checklist located in Appendix A. This may quickly identify items that are inadequately addressed by the watershed action plan. Reviewers should bear in mind, however, that a watershed action plan and a source water protection plan can appear similar on the surface but differ significantly on a more detailed level. For example, any watershed action plan will address some level of public education/outreach, but the materials may not emphasize the importance of the stream as a source of drinking water. Most watershed action plans will address monitoring the surface water but the sampling sites may be too sparse, or too distant from the public water system's intake or storage reservoirs. The sampling plan may not*

include contaminants that are a concern primarily for drinking water (such as nitrate and pesticides)." (ibid)

This plan will expand beyond the confines of the SWPP and identify the watershed's contributions towards water quality impairments by identifying the causes and sources of impairment and develop the Best Management Practices (BMP) beyond Meander Water's responsibilities to protect the largest drinking water source of Mahoning and Trumbull Counties.

Figure 2: Meander Water Distribution Area



1.2 Watershed Profile and History

The Lower Meander Creek HUC-12 is a part of the greater Meander Creek Watershed which drains 55,360 acres (86.5 square miles) in Mahoning County (MC) and Trumbull County (TC) and contains 145 square (sq.) mile watershed. The headwaters of Meander Creek are in Goshen and Green Townships, MC. The mainstem of Meander Creek flows east-northeast from the northeast corner of Goshen Township through the northwest corner of Green Township and into southern Ellsworth Township. As Meander Creek flows north, the east branch of Meander Creek enters from the east and about one mile further the west branch enters from the west, just south of West Akron-Canfield Road (State Route (SR) 224). This marks the border line between the Upper Meander Creek subwatershed and Middle Meander Creek subwatershed. Meander Creek continues north-northeast through Ellsworth Township, until North Fork Creek joins Meander Creek, north of N. Palmyra Road. Cutting through the southeast corner of Jackson Township, Meander Creek crosses into Austintown Township and converges with Sawmill Creek. At this point, Meander Creek becomes Meander Reservoir. The seven-mile-long reservoir reaches its impoundment and transforms back into Meander Creek. In the City of Niles, Meander Creek ends its 20.4-mile journey and joins the Mahoning River (River Mile (RM) 30.27). Interstate 76 (I-76) crosses Meander Creek Reservoir from southeast to northwest at the dividing boundary between the Middle and Lower subwatersheds. The Lower Meander Creek's span can be seen in Figure 3.

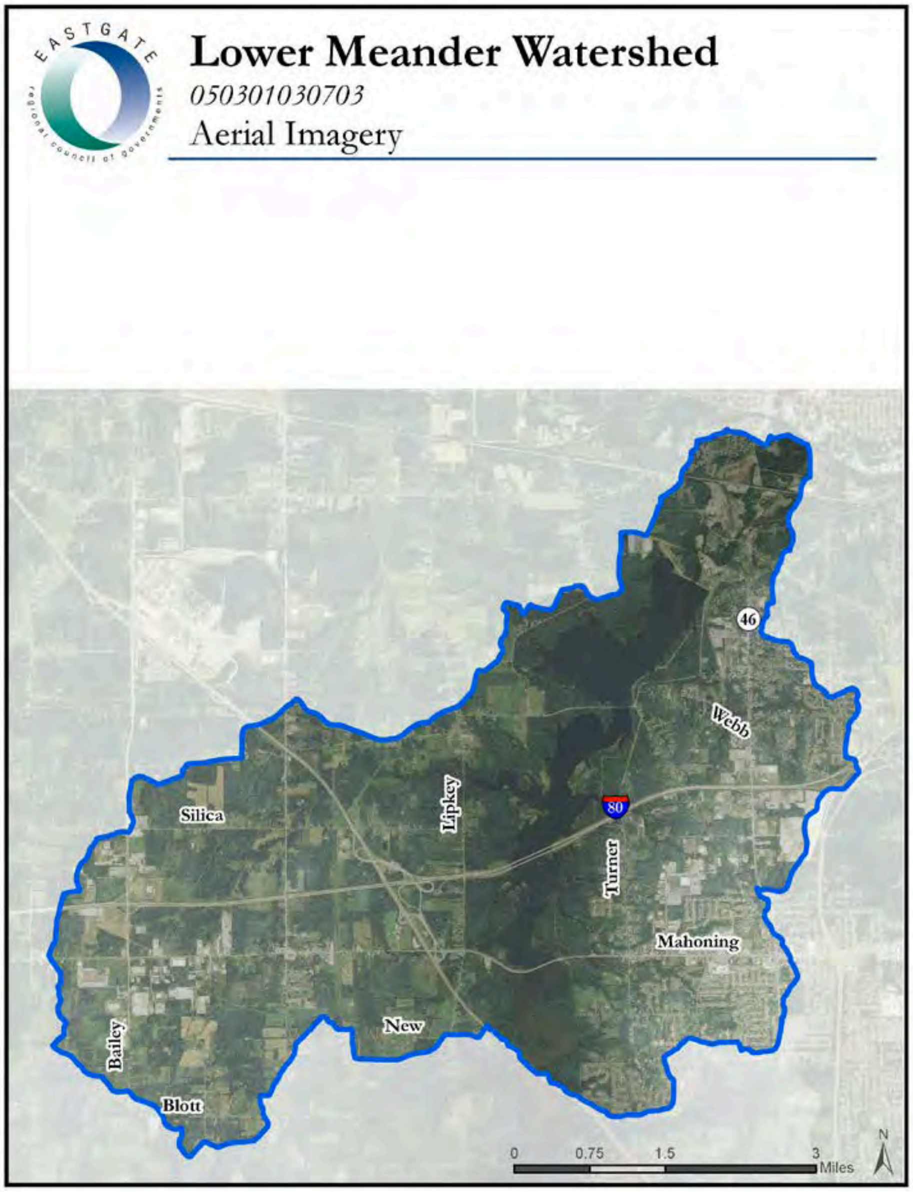
Table 1: Lower Meander Creek HUC Location

Location	Longitude	Latitude
Meander Creek Watershed	80.831802 W	41.061001 N
Lower Meander Creek	80.818589 W	41.115312 N

Table 2: Lower Meander Creek HUC Outline

Level	HUC	Name
Region	05	Ohio
Sub-region	0503	Upper Ohio
Accounting Unit	050301	Upper Ohio-Beaver
Cataloguing Unit	05030103	Meander Creek- Mahoning River
Sub-watershed	050301030703	Lower Meander Creek

Figure 3: Lower Meander Creek Aerial



The Lower Meander Creek incorporates several townships and municipalities:

- Mahoning County (24.72 miles^2 of watershed)
  - Jackson Township (14.97 miles^2)
  - Austintown Township (9.75 miles^2)

- Trumbull County (5.93 miles^2)
  - Weathersfield Township (4.45 miles^2)
  - Village of Lordstown (0.46 miles^2)
  - City of Niles (1.02 miles^2)

The Meander Creek is a fitting name for the watershed's mainstem due to its meandering nature throughout Mahoning County. The western watershed has remained rural in nature, but development overtime into urbanized Austintown Township and Mineral Ridge (Weathersfield Township). However, nothing could have more of an impact on the watershed's history than the drowning of a town, Ohltown, to create the Meander Reservoir.

Founded in 1816 by Michael Ohl, Ohltown was a coal mining town located in both Weathersfield and Austintown Townships. However, in 1920 a petitioning effort was underway to develop the MVSD to provide communities along the Mahoning River, such as Youngstown and Niles, with a safe drinking water source. After the district formed, the decision to dam up Meander Creek was made. In 1929 the Mineral Ridge dam was built in Meander Residential homes in Ohltown were purchased and/or relocated prior to the dam's construction. Outside of historical records, historical structures such as the Strock Stone House are the only remnants providing evidence to the existence of Ohltown.

1.3 Public Participation and Involvement

The development of the Meander Creek Watershed Action Plan was led by the Western Reserve Land Conservancy in partnership with the Alliance for Watershed Action and Resource Education (AWARE), Meander Water, and Eastgate. Additional stakeholders were invited to participate in the planning process and have been partners in developing the NPS-IS plan.

Introductory meetings were held for residents on November 16, 2010 and governing agencies officials on November 30, 2010. A watershed community meeting was held in Ellsworth Township in March of 2010. The meetings introduced the watershed planning process, defined the role each official and resident has in the plan, and discussed and identified initial areas of concerns within the watershed. Stakeholders met in 2016 to further define the environmental issues and/or concerns within the watershed and to identify solutions to address them.

Chapter 2: Meander Creek Watershed Characterization and Assessment Summary

2.1 Summary of Watershed Characterization for Lower Meander Creek HUC-12

The Lower Meander Creek HUC-12 is oriented in a south to north direction and expands east and west of the Meander Reservoir. Meander Creek is the main stream within the HUC-12. Utilizing the reservoir as the center of the HUC-12, the watershed extends west into eastern Jackson Township and east into western Austintown Township, Mahoning County. The watershed then drains north into the southeastern corner of the Village of Lordstown, western region of Weathersfield township, and the southern tip of the City of Niles, Trumbull County.

The Meander Reservoir's elevation is 905 feet above sea level and drops to 842 feet in the southern part of the City of Niles, where Meander Creek meets the Mahoning River. The reservoir has 40 miles of shoreline and a capacity to hold 11billion-gallons of water.

2.1.1 Physical and Natural Features

The Lower Meander Creek Watershed is within the Erie/Ontario Drift and Lake Plain eco-region (Low Lime Drift Plain) where vegetation typically includes hardwood, beech-maple, and elm-ash forests. The bedrock underlying the watershed is primarily from the Pennsylvanian Period, but bedrock from the Mississippian Period is present in the northernmost portion of the watershed. Principal rock types associated with these periods and associated with Eastern/Northeastern Ohio include shale, sandstone, coal, clay, and limestone. Sedimentary deposits from the Mississippian and Pennsylvanian Periods resulted in an estimated 1,790 feet of rock today. Together, the Mississippian and Pennsylvanian Periods are referred as the Carboniferous Period because large coal beds (carbon) laid down during this time. In addition to coal, the geologic history of the area supported the formation of shale, sandstone, limestone, and conglomerates (Ohio History Central, 2005).

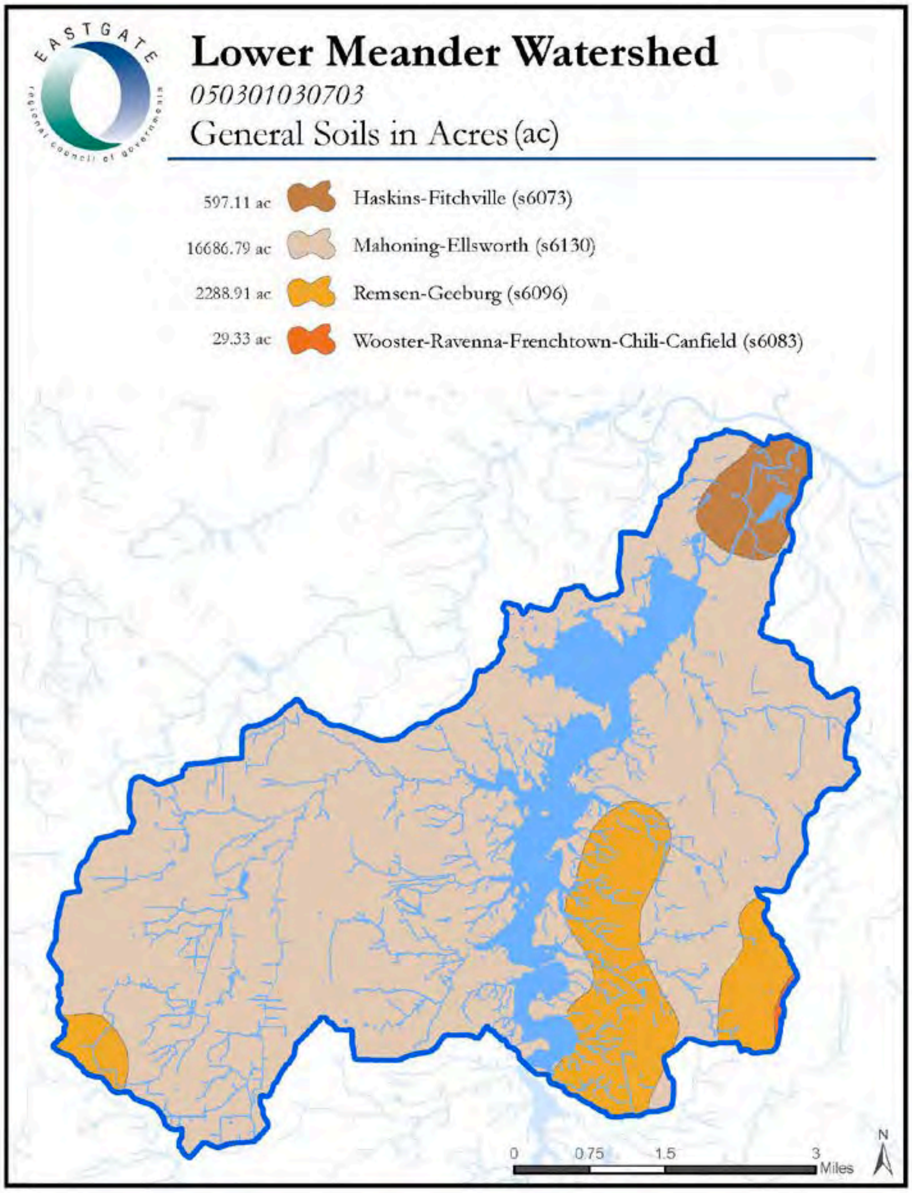
The Lower Meander Creek Watershed is in the glaciated Allegheny Plateau region of the Appalachian Highlands. Specifically, it is in the Killbuck-Glaciated Pittsburgh Plateau within the Allegheny Plateau region. The Killbuck-Glaciated Pittsburgh Plateau is composed of ridges and flat uplands generally above 1,200 feet, covered by thin drift and dissected by steep valleys. Valley segments alternate between broad drift-filled and narrow rock-walled reaches with elevations between 600 feet and 1,505 feet with moderate relief around 200 feet (Ohio Division of Geological Survey, 1998). A more indepth discussion about the eatershed's glacial and geologic history can be found by reading the ground water pollution potential report for Mahoning County, by Michael P. Angel.

Soils in the Meander Creek watershed are mainly Mahoning-Ellsworth association (s6130). It is the largest soil association in the watershed and covers 29,459 acres. Mahoning-Ellsworth soils are nearly level to gently sloping and moderately well drained to poorly drained soils. They are of medium fertility and are used for crops, but difficult to manage. They have a high-water table in the winter and spring, particularly Mahoning soils, and dry out slowly. Ellsworth soils have fewer limitations for building than Mahoning soils, but both are poorly suited to use as fields for disposing of effluent from septic tanks. Mahoning soils are 39% of the association and Ellsworth soils are 30% of the association. Table 3 summarizes the soil associations found in the watershed, while Figure 4 Illustrates the soil associations.

Table 3: Lower Meander Creek Soil Associations

Map Unit Symbol	Soil Association	Acres	Percent of Watershed
S6130	Mahoning-Ellsworth	16,686.79	85.12
s6096	Remsen-Geeburg	2,288.91	11.68
s6073	Haskins-Fitchville	597.11	3.05
s6083	Wooster-Ravenna-Frenchtown-Chili-Canfield	29.33	0.15
	Total	19,602.14	100%

Figure 4: Lower Meander Creek Soil Associations

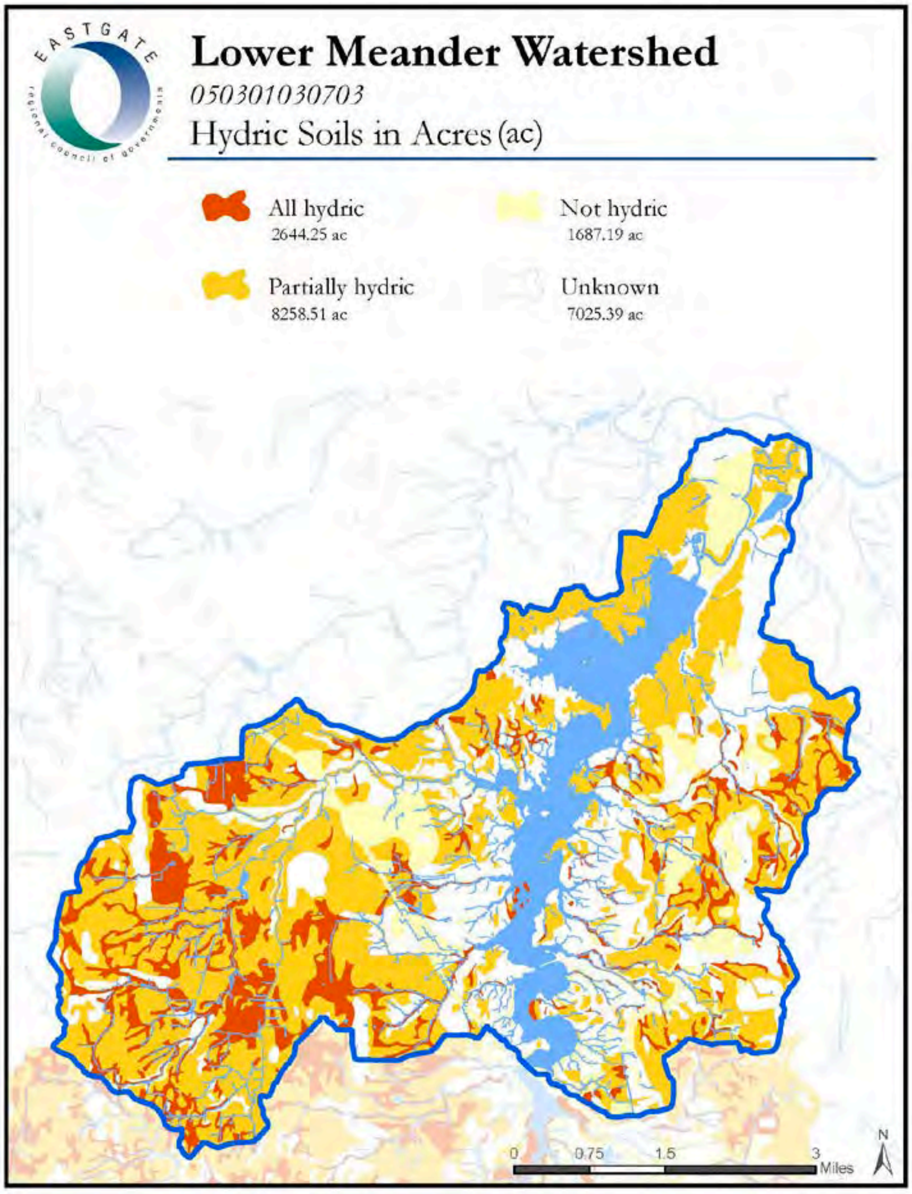


Hydric soils are important to note due to their association with wetlands. The presence of hydric soil is one of three indicators required for an area to be designated as a wetland. Hydric soils support the growth of hydrophytic vegetation, a second required wetland indicator. It is important to note wetlands have hydric soils, but not all hydric soils contain wetlands. However, not all areas classified as "hydric" exhibit hydric characteristics. Hydric soils pose limitations due to their high-water table and poor drainage but can be and are developed. Hydric soils drained and developed are still classified as "hydric soil" because of how the soil was initially formed. Without long term saturation however, the soil loses the typical characteristics caused by anaerobic conditions (Mitsch & Gosselink, 2000). Table 4 lists the HUC12's hydric soils and Figure 5 illustrates their location within the watershed.

Table 4: Lower Meander Creek Hydric Soils

Soil Association	Acres	Percent of Watershed
All Hydric	2,644.25	13.48
Partially Hydric	8,258.51	42.10
Not Hydric	1,687.19	8.60
Unknown	7,025.39	35.82
Total	19,615.34	100%

Figure 5: Lower Meander Creek Hydric Soils



The Lower Meander Creek watershed contains a total of 58.06 miles of streams. The Gazetteer of Ohio Streams only recognizes Morrison Run. Other streams are locally recognized and include: West Branch Morrison Run, Sulfur Run, Superior Run, Turner Run, 7 Mile Run, Alina Rae Run, and North Jackson Ditch. Table 5 lists the streams, while Figure 6 and Figure 7 illustrate the streams and their drainage areas.

Table 5: Lower Meander Creek Named Streams

Tributary	Length	Drainage Area	Floodplain Access	Sinuosity	Entrenchment
7 Mile Run	1.43 mi	7.40 mi^2	Yes	Natural	Unknown
Alina Rae Run	0.61 mi	3.77 mi^2	Partial	Natural	Unknown
Morrison Run	9.3 mi	0.63 mi^2	Yes	Natural/ Channelized	Unknown
Sawmill Creek	5.8 mi	0.33 mi^2	Yes	Natural	Unknown
Sulfur Run	2.78 mi	2.97 mi^2	Yes	Natural/ Channelized	Unknown

Figure 6: Lower Meander Creek Stream Types

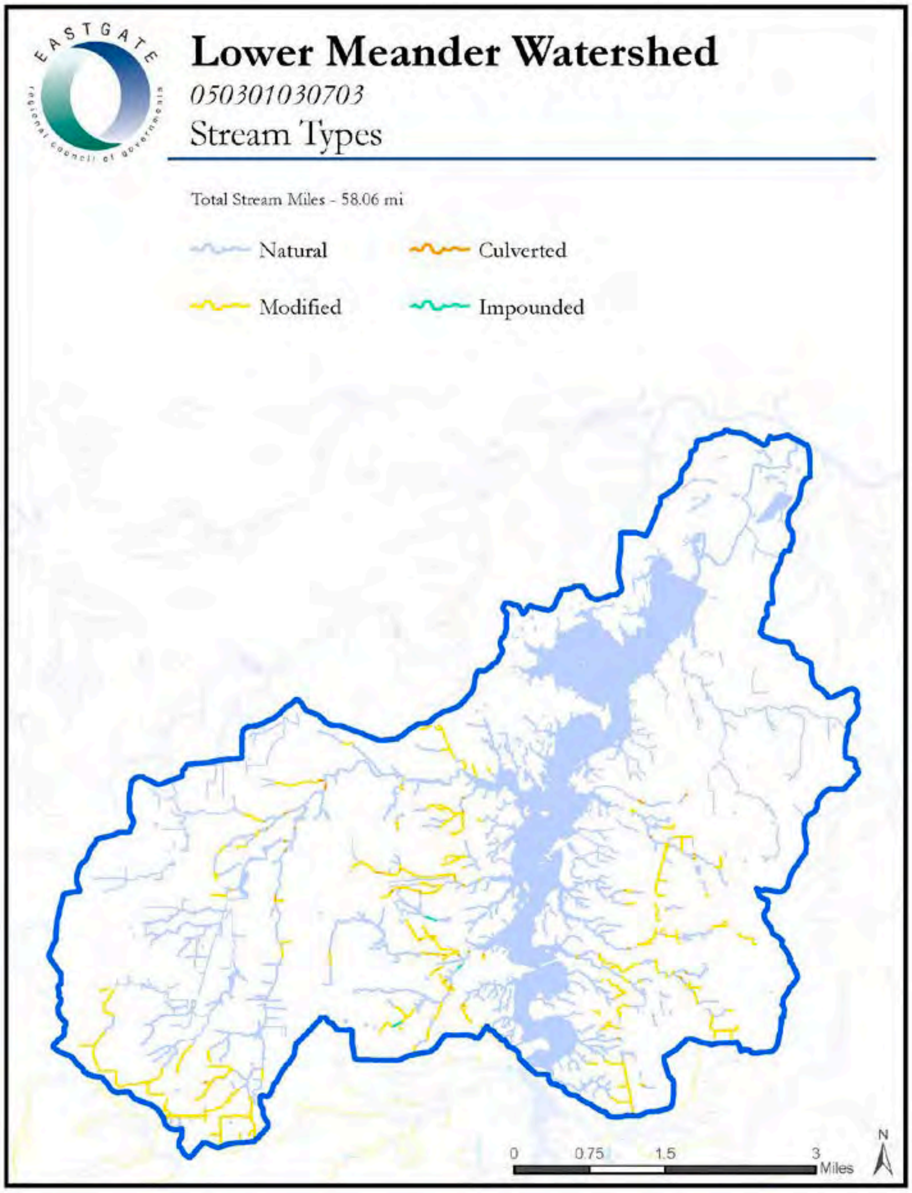
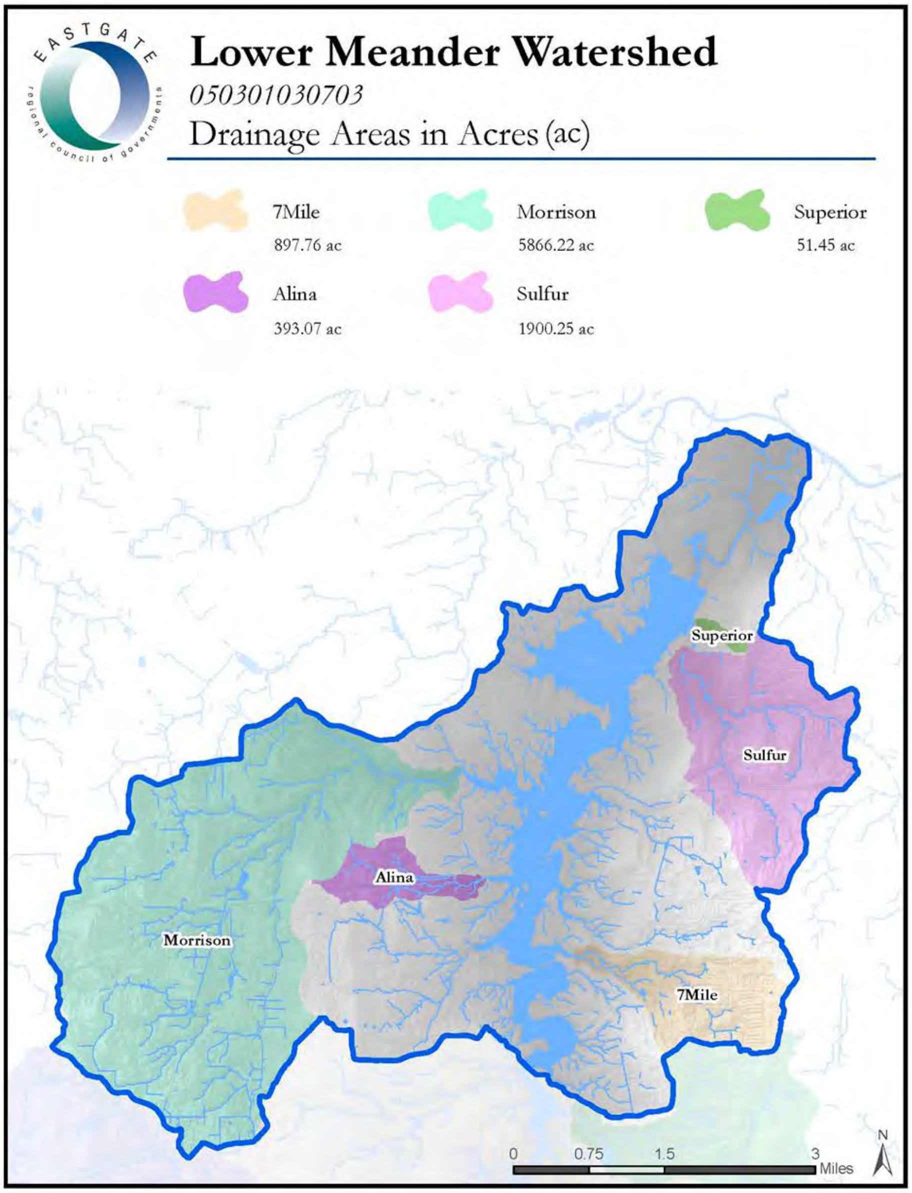


Figure 7: Lower Meander Creek Stream Drainage Areas



2.1.2 Land Use and Protection

A review of aerial photography illustrates the vast difference in the watershed's land use. The Meander Reservoir serves as the divide between three vastly different landscapes. Aerial imagery shows agricultural lands dominate the western areas of the HUC-12 but contains a small commercial hub. Lands east of the reservoir are mainly residential and commercial in nature and industrial lands dominate the area north of the reservoir.

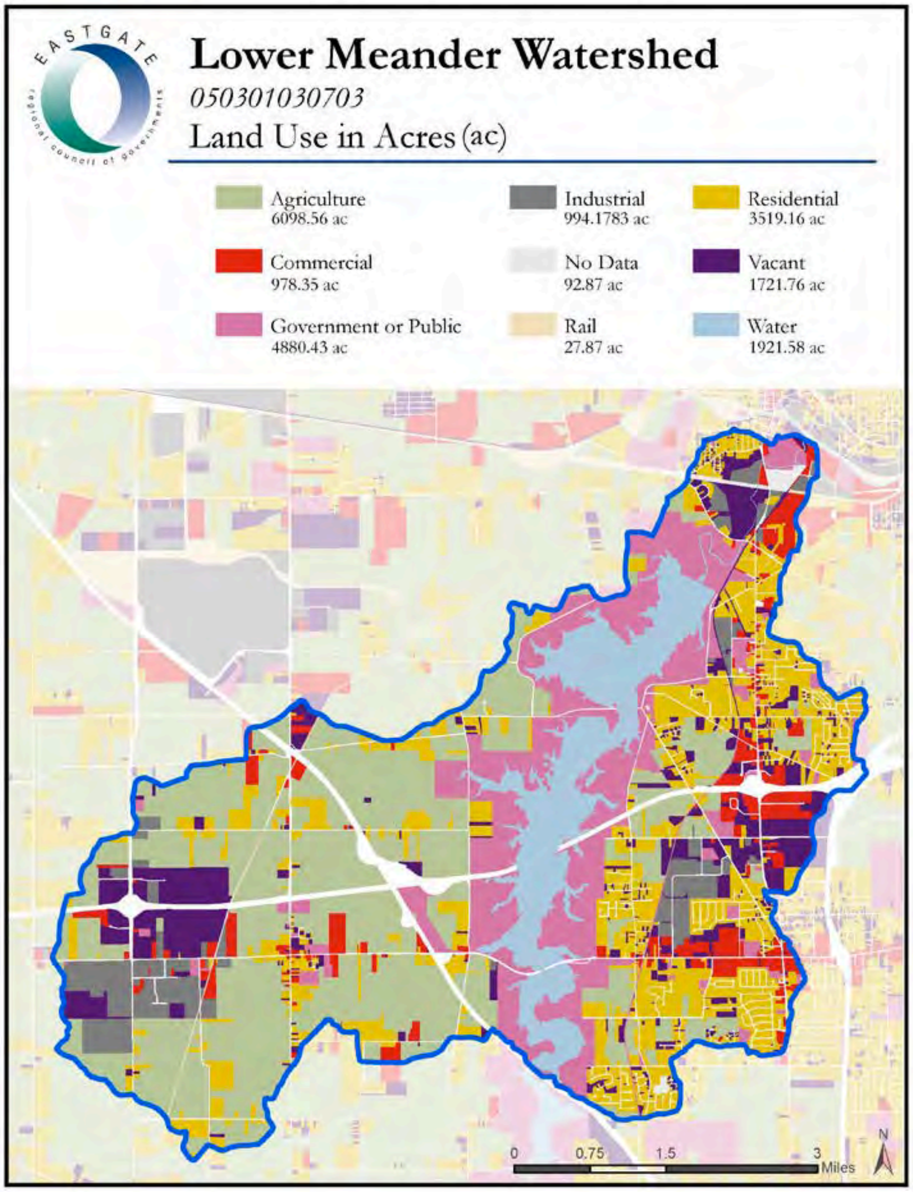
Table 6 was developed using taxation land use parcel data from the Mahoning County Auditor. Three land use classifications dominate the Lower Meander Creek HUC-12: agriculture, government/public, and residential. According to the data, agricultural land (30%) characterizes the western half of the HUC-12 comprising of 6,098.56 acres. Governmental agencies or publicly accessible lands comprise 4,880.43 acres or 24%. Most of the lands under the government/public lands classification are those owned and managed by the MVSD. Residential land comprises 17.39% or 3,519.16 acres and is mainly located east of the reservoir and below the reservoir's dam (northwest corner of the HUC-12). Figure 8 illustrates the land uses within the Lower Meander Creek.

Table 6: Lower Meander Creek Land Use Classification

Land Use Classification	Acres	Percent of watershed
Agriculture	6,098.56	30.14%
Commercial	978.35	4.84%
Government or Public	4,880.43	24.12%
Industrial	994.18	4.91%
No Data	92.87	0.46%
Rail	27.87	0.14%
Residential	3,519.16	17.39%
Vacant	1,721.76	8.51%
Water	1,921.58	9.50%
Total	20,34.77	

Commercial and industrial lands make up a small portion of the land use (9.75% total) but are notable due to the potential nonpoint pollution sources and their pollution potential as they relate to the Meander Reservoir SWPP. The commercial and industrial corridors are centered around or proximity to the region's major highway corridors/interchanges: the Ohio Turnpike, Bailey Road, I-76/80, and SR 46. These major corridors experience large daily freight/truck and vehicular traffic volumes due to their proximity to freight transfer areas, commerce parks, and commercial development.

Figure 8: Lower Meander Creek Land Use



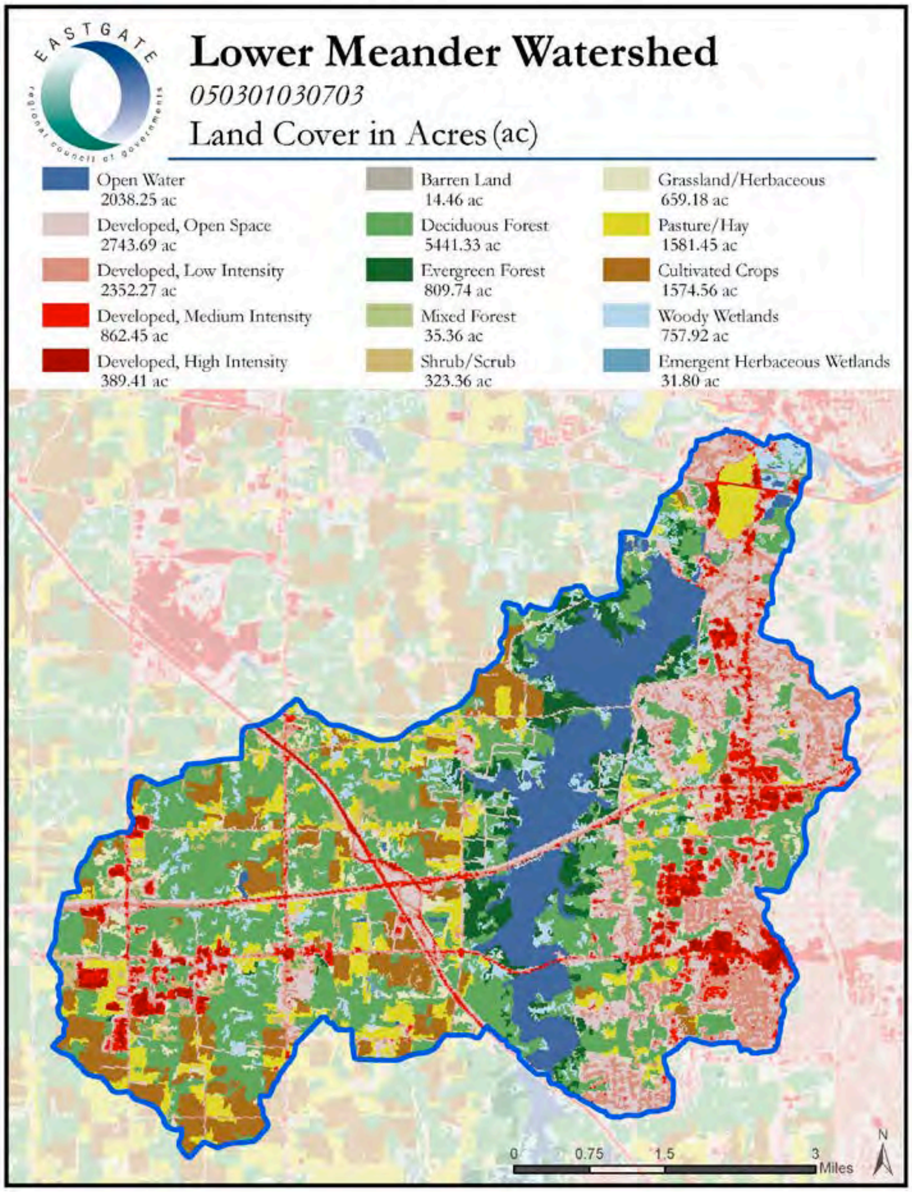
2.1.2.1 Land Cover

According to the 2011 National Land Cover Database, the HUC-12 is primarily development (open space, low/medium/high intensity), deciduous forest, and agriculture lands. The Land Cover classification breaks down the developed category into subcategories to align it with impervious products present. Thus, land cover represents more accurate thematic descriptions of HUC-12's land surface. Table 7 lists the land cover categories within the watershed, while Figure 9 illustrates their location.

Table 7: Lower Meander Creek Land Cover

Land Cover Classification	Acres	Percent of watershed
Open Water	2,038.25	10.39%
Developed, Open Space	2,743.69	13.99%
Developed, Low Intensity	2,352.27	11.99%
Developed, Medium Intensity	862.45	4.40%
Developed, High Intensity	389.41	1.99%
Barren Land	14.46	0.07%
Deciduous Forest	5,441.33	27.74%
Evergreen Forest	809.74	4.13%
Mixed Forest	35.36	0.18%
Shrub/Scrub	323.36	1.65%
Grassland/Herbaceous	659.18	3.36%
Pasture/Hay	1,581.45	8.06%
Cultivated Crops	1,574.56	8.03%
Woody Wetlands	757.92	3.86%
Emergent Herbaceous Wetlands	31.8	0.16%
Total	19,615.23	

Figure 9: Lower Meander Creek Land Cover



2.2.2.1 Urban/Developed

Urban lands are the most abundant land cover within the Lower Meander HUC-12 with a total of 6,348 acres (22.23%) and are east of the Meander Reservoir. Two Small Municipal Separate Storm Sewer System (MS4) regulated communities exist within the Lower Meander Creek HUC-12: Mahoning County and Trumbull County. Both counties have Memorandums of Understanding (MOUs) with townships within their respective jurisdictions: Austintown Township (Mahoning County), Weathersfield township (Trumbull County) and the city of Niles (Trumbull County). These communities include established residential neighborhoods and commercial developments. The industrial portion of the watershed exists below the Meander Reservoir but extends north along the Meander Creek mainstem into the City of Niles and towards the confluence with the Mahoning River.

2.3.2.1 Agriculture

Agriculture/rural acreage with characterize (pasture and hay and cultivated crops) land west of the Meander Reservoir and is 6,099 acres of the entire HUC12. The 2012 Census of Agriculture reports 578 total farms in Mahoning County and 888 farms in Trumbull County. According to the Mahoning County Ohio State University (OSU) Extension Office and the watershed's Soil and Water Conservation District (SWCD) personnel, the primary crops in the Meander Creek Watershed are corn, winter wheat, soybean and hay (foyage).

2.4.2.1 Land Protection

The MVSD owns and manages approximately 5,570 acres of land within the Lower Meander Creek Watershed. Approximately 3,127.5 acres of the total is coniferous and deciduous trees. The forested buffer is fenced off and public access is prohibited. The restricted area represents an excellent example of preserved floodplain, riparian, and other protection measures for the freshwater system.

> *MVSD owns and manages 5,570 acres buffer surrounding the reservoir, 3,127.5 acres of which is coniferous and deciduous trees. This buffer is fenced off and public access is prohibited.*

2.5.2.1 Storm Water

Stormwater is problematic because it carries chemicals, nutrients, sediment and other debris directly into a nearby stream. Untreated water has detrimental effects on surface waters, especially drinking water sources. Stormwater discharges are considered point source discharges and thus, require coverage thorough the National Pollution Discharge Elimination System (NPDES) permit. Stormwater discharges from the watershed's urbanized townships, Austintown and Weathersfield, are regulated by the Ohio EPA's Small MS4 program and therefore, have NPDES Permit Storm Water General Permit

Coverage authorization to discharge to surface waters of Ohio. The U.S. EPA defines an urbanized boundary as “a densely settled core of census tracts and/or census blocks that have population of at least 50,000, along with adjacent territory containing non-residential urban land uses as well as territory with low population density included to link outlying densely settled territory with the densely settled core. It is a calculation used by the Bureau of the Census to determine the geographic boundaries of the most heavily developed and dense urban areas”. Therefore, controlling storm water runoff from rural areas is difficult on a regional level. Rural storm water control, especially from agricultural fields and/or pastures, relies on voluntary, individual conservation plans. The local National Resource Conservation Service (NRCS) assists private landowners and SWCDs with technical assistance in planning and carrying out conservation activities and programs.

> *The U.S. EPA defines an urbanized boundary as “a densely settled core of census tracts and/or census blocks that have population of at least 50,000, along with adjacent territory containing non-residential urban land uses as well as territory with low population density included to link outlying densely settled territory with the densely settled core.”*

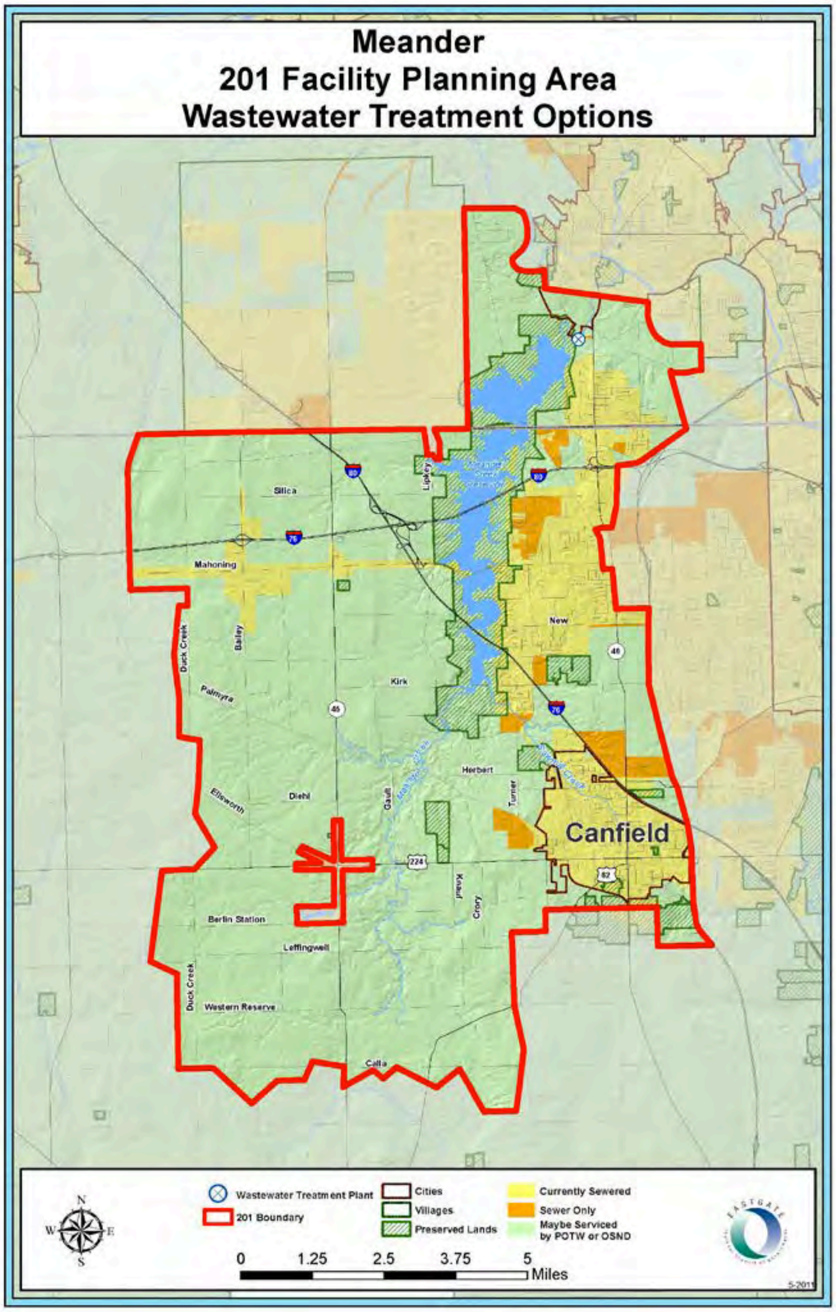
Through their respective permits, each permit holder is required to develop a Storm Water Management Plan (SWMP) detailing BMPs for implementation to minimize the discharge of pollutants from the sewer system. Both townships are covered under an MOU with their respective county permit holder. Rural communities, such as Jackson Township, are not regulated by the Ohio EPA’s storm water permit program because the generally do not meet the U.S. EPA’s definition of an urbanized area.

2.6.2.1 Wastewater Infrastructure

The Meander Wastewater Treatment Plant (WWTP) is located within the Lower Meander Creek HUC-12, below the reservoir. The WWTP is owned by the Mahoning County Commissioners and is operated and maintained by the Mahoning County Sanitary Engineer’s (MCSE) Department. The WWTP discharges below the reservoir and into the mainstem of Meander Creek. This WWTP treats waste generated from portions of Austintown and Weathersfield township. Sanitary sewer infrastructure exists within the commercial areas of Jackson township, specifically within the SR 45/Mahoning Avenue/County Road (CR)18 corridor and the Bailey Road/Mahoning Avenue/CR 18/I-80 corridor. Figure 10 illustrates the region serviced by the Meander WWTP. Areas in “yellow” are serviced by sanitary sewer but may still include dwellings not yet tied into sewer. The “orange” colored areas are those where sanitary sewer is the only method to treat wastewater. Lastly, all areas in green are serviced by individual home sewage treatment systems (HSTS) but may be sewered should the infrastructure become available.

A 72-inch sanitary sewer pipe crosses over the Meander Reservoir carrying wastewater from the City of Canfield to the Meander WWTP. The City of Canfield is outside the Lower Meander Creek HUC12, but untreated sewage from the city still poses a threat to Meander's water quality should the infrastructure become faulty. Too numerous to mention are the number of HSTSs used in the rural areas for wastewater treatment. Most HSTS systems are conventional systems that utilize leach fields for wastewater/grey water treatment via the gravel and soil. Some HSTS's may be off lot discharging systems that discharge treated (via chlorination/UV light) grey water into a nearby ditch or stream.

Figure 10: Meander 201 Facility Planning Area



2.7.2.1 Protected Lands

There are currently 4,497.33 acres of protected lands within the Meander Creek Watershed. The Clean Ohio Conservation Fund funded protection of 21.302 acres of that total. There are no lands within the watershed under protection by a private foundation or land trust.

- Mahoning Valley Sanitary District - The District owns 5,500 acres of lands surrounding the entire reservoir and portions of Meander Creek within the Middle subwatershed. The lands were reforested with 4 million evergreens and serves as a fish and wildlife refuge in which public access is prohibited.
- Trumbull County MetroParks- Owns 136 acres of green space 1 mile upstream of Meander Creek's confluence with the Mahoning River.
- Jackson Park- Jackson Park is a newly developed, 12-acre park located behind the Jackson Township Administration Building in Mahoning County
- Liberty Park- Jackson Township, Mahoning County, is a public recreational park with baseball fields and a playground.

2.8.2.1 Reservoir Protection Strategies

The MVSD's mission is *"preserving the public health and the natural environment while providing a safe and reliable supply of potable water. The employees of the Mahoning Valley Sanitary District are well trained in order to serve the Mahoning Valley community in the most efficient, courteous way possible in providing quality service."* Public access to the reservoir and recreational activities (i.e. boating, fishing) are prohibited by the MVSD.

> MVSD's mission is to "*preserving the public health and the natural environment while providing a safe and reliable supply of potable water. The employees of the Mahoning Valley Sanitary District are well trained in order to serve the Mahoning Valley community in the most efficient, courteous way possible in providing quality service.*

In spring of 2006 the Ohio Department of Transportation (ODOT) began an $86.7 million, multiyear project to widen I-80 between the Ohio Turnpike and the SR46/11 interchange. A portion of project consisted of widening and replacement of the 2,500 ft. twin bridges over the Meander Reservoir and installing two dirt and clay spill containment basins to protect the reservoir. These basins, sized to contain a 100-year storm event, were a first for ODOT and gained industry attention for the unique integration and design to keep hazardous material spills from entering the reservoir. The system consists of two sloped containment basins located at low points of the westbound and eastbound side of the reservoir's bridges. Within each basin integrates a "serpentine" ditch that slows the flow of water or liquids before entering the reservoir via a pipe and valve.

Under normal rainfall conditions, stormwater is conveyed from the bridge deck into the basins via a series of inlets, pipes, and roadside ditches and swales. From the basin, it is discharged into the reservoir. In the event of a hazardous spill, liquids follow the same serpentine path, while two emergency shut off valves prevent the materials from entering the reservoir. Emergency response authorities have a 30-minute window from when a spill occurs to reach the associated basin and close its shutoff valve.

Photo 1: Aerial view of Westbound Meander Reservoir Spill Containment Basin

Photo 3: Meander Reservoir Spill Containment Basin
Photo Credit: Tracy Boulian, The Plain Dealer.

2.2 Biological Trends Summary for Meander Creek Watershed HUC-12

Each water body in the state is assigned one or more aquatic life habitat use designations and may be assigned one or more water supply use designation and one recreational use designation. According to Ohio Administrative Code (OAC) 3745-1-25, Table 25-1, the Meander Creek mainstem and all other segments have a warm water habitat (WWH) aquatic life use designation (ALU) and are further designated public, agricultural, and industrial use supplies with primary contact recreation.

The Ohio EPA surveyed a total of four stream sites within the Lower Meander Creek HUC-12, two sites in 2011 and two sites in 2013. Three of the four stream sites were either in partial or nonattainment of the watershed's aquatic life use designation and located below the reservoir's dam and spillway. The fourth stream site is in full attainment and is a tributary to the reservoir.

2.2.1 Modified Index of Well- Being (MIwb) and Index of Biotic Integrity (IBI) Conditions

The watershed below the reservoir is mostly in non and/or partial attainment of its WWH aquatic life use designation. The fish communities present were fair to marginally good, indicative of pollutant tolerant species such as Pumpkinseed, Yellow Perch, Gizzard Shad, and Creek Chub. A small population of Northern Pike and Walleye were found in Meander Creek, close to the confluence with the Mahoning River. This reach of Meander Creek is heavily influenced by the reservoir's dam and spillway, which restricts the flow Meander Creek's water. Further compounding the biology is the presence of poor stream substrate types- moderate to heavily silted and embedded artificial, sand, gravel and muck substrates.

The reservoir's tributary was in full attainment and contained a healthy combination of "best" substrate types: boulder/slabs, boulders, cobble, gravel, sand and bedrock. The two predominate substrates were cobble and gravel. These substrates had normal levels of silt and embeddedness, thus sustaining good fish populations.

2.2.2 Invertebrate Community Index (ICI)- Macroinvertebrate

As with the fish communities, the macroinvertebrate (bug) community below the reservoir's dam and spillway is reflective of poor water quality conditions. Overall observations indicate poor to low fair quality of bug communities as proven by the presence of amphipods, zebra mussels, midges, flatworms, blackflies, and hydropsychids. As previously stated, this reach is heavily influenced by the reservoir's dam and spillway, which restricts the flow Meander Creek's water. Further compounding the biology is the presence of poor stream substrate types- moderate to heavily silted and embedded artificial, sand, gravel and muck substrates.

Macroinvertebrate information for the tributary is not available due to its' drainage area being less than 20mi^2.

2.3 Summary of Lower Meander Creek Watershed Pollution Causes and Sources

The 2011 and 2013 surveys identified the following causes of stream impairment: nutrient/organic enrichment, low dissolved oxygen, direct habitat alterations, flow regime alterations, biological indicators, and bottom deposits. Associated sources of the impairments include the reservoir's dam and municipal point source discharges.

2.4 Additional Information for Determining Critical Areas and Developing Implementation Strategies

The Ohio EPA's 2016 Integrated Report's (IR) Section H- Evaluating Beneficial Use: Public Drinking Water Supply discusses public drinking water supply (PDWS) beneficial use assessments. Value of these water supplies, Ohio connects the Clean Water Act (CWA) and Safe Drinking Water Act (SDWA) activities to leverage programs accessible to clean up and protect drinking water sources.

The Ohio EPA surveyed the Meander Reservoir for nitrate, pesticide, and algae (cyanotoxin) indicators and results were based primarily on treated water quality data and, on a limited basis, other Ohio EPA source water quality data and external sources. The information used to form the results include public water system treatment information, intake location, number and type of reservoirs and water quality data.

Source water quality is assessed by comparing in-stream and applicable treated water quality data to U.S. EPA established numeric chemical water quality criteria[1] for the following indicators: nitrates, pesticides, *Cryptosporidium*, and other contaminants. Assessments for each indicator will identify one of three categories: Impaired, Full Attainment, and Not Assessed- Insufficient Data. A review of Section H-3's summary (Table H-3, p. H-22) indicates the Meander Water PDWS is in full support of its use designation (as a drinking water source) and in full attainment/support for the Nitrate Indicator. Insufficient data was recorded for both pesticide and algae indicators. The following table, H-1, was extracted from the 2016 IR, Section H-3, to illustrate the criteria used in determining attainment status.

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[1] Ohio EPA 2016IR, Section H, p. H-3.

Table H-1. PDWS attainment determination[2]

Applies to ambient and treated water quality data from 2010 through December 2015.

Indicator	Impaired Conditions
Nitrate	☐ Two or more excursions[a] above 10.0 mg/L within the 5-year period
Pesticides	☐ Annual average exceeds WQ criteria (atrazine = 3.0 µg/L)
Other Contaminants	☐ Annual average exceeds WQ criteria
Algae: Cyanotoxins[b]	☐ Two or more excursions[a] above the state drinking water thresholds (microcystins = 1.0 µg/L) within the 5-year period
Cryptosporidium[c]	☐ Annual average exceeds WQ criterion (1.0 oocysts/L)
Indicator	**Full Attainment Conditions**
Nitrate	☐ No more than one excursion[a] above 10.0 mg/L within the 5-year period
Pesticides	☐ Annual average does not exceed the WQ criteria (atrazine = 3.0 µg/L)
Other Contaminants	☐ Annual average does not exceed the WQ criteria
Algae: Cyanotoxins	☐ No more than one excursion[a] above the state drinking water thresholds (microcystins = 1.0 µg/L) within the 5-year period
Cryptosporidium	☐ Annual average does not exceed the WQ criterion
Indicator	**"Watch List" Conditions**
Nitrate	☐ Maximum instantaneous value > 8 mg/L (80% of WQ criterion)
Pesticides	☐ Running quarterly average ≥ WQ criteria ☐ Maximum instantaneous value ≥ 4x WQ criteria
Other Contaminants	☐ Maximum instantaneous value ≥ WQ criteria
Algae: Cyanotoxins	☐ Maximum instantaneous value ≥ 50% of the state drinking water thresholds
Cryptosporidium	☐ Annual average ≥ 0.075 oocysts/L

a Excursions must be at least 30 days apart in order to capture separate or extended source water quality events.

b Impaired conditions based on source water detections at inland public water systems and detections at public water system intakes for Lake Erie source waters. Cyanotoxins include: microcystins, saxitoxins, anatoxin-a and cylindrospermopsin.

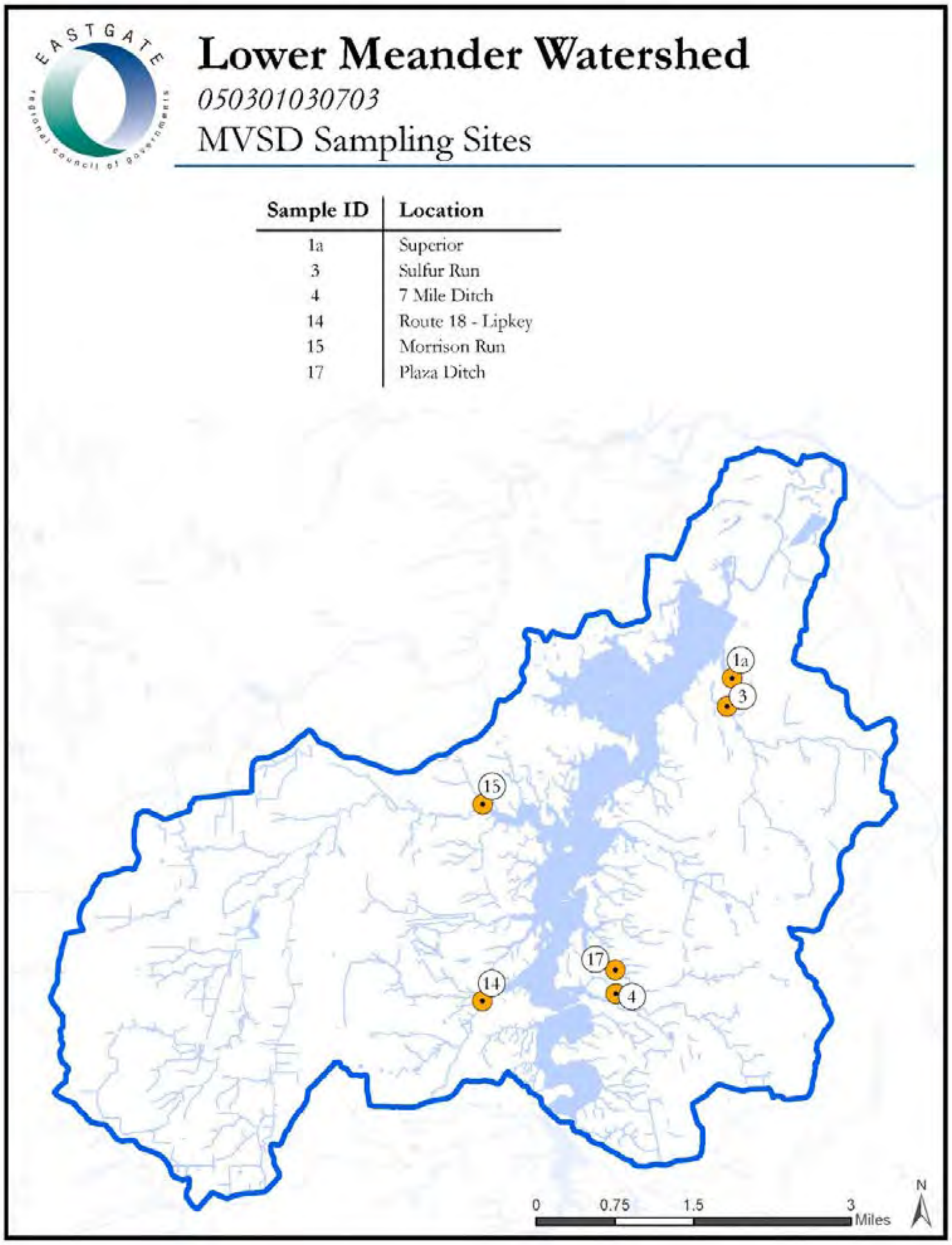
c Impaired conditions for *Cryptosporidium* are based on water quality criteria that Ohio EPA intends to develop.

[2] Ohio 2016 IR, Section H, p. H-5

2.4.1 Meander Water Assessment Data

Meander Water monitors its raw water (as per requirements) and streams throughout the watershed. Raw water is monitored daily for pH, turbidity, alkalinity, hardness, fluoride and manganese. Raw water samples are sampled monthly for chlorides, and periodically for phosphates, iron and chemical oxygen demand. During the spring, raw water is additionally sampled for common synthetic organic compounds. Meander Water also surveys monthly 6 stream sites in the Lower Meander Creek HUC12 for pH, turbidity, alkalinity, total hardness, and *E. coli*.

Figure 11: Meander Water Sampling Locations



2.4.2 The Mahoning Valley Sanitary District Drinking Water Source Protection Plan

The MVSD developed a SWPP for Meander Reservoir in 2008 to meet the requirements of Ohio's SWPP. The plan was ultimately endorsed by the State of Ohio in March 2009 and updated in 2015.

The Meander SWPP identifies drinking water protection areas within the vicinity of the treatment plant's raw water intake. This protection area is defined as the drainage are upstream of the point where Meander Water withdraws water from the reservoir. The protection area encompasses an area of 86.5 square miles. This area is further subdivided into a corridor management zone (CMZ) and emergency management zone (EMZ) as detailed below:

*"The **Corridor Management Zone**, (CMZ) is the area within 1,000 feet of each bank of Meander Creek Reservoir, starting from the intake and extending to a point approximately 4 miles upstream of the reservoir, approximately 10 miles from the intake. The corridor management zone also includes tributaries of Meander Creek Reservoir. On tributaries, the width of the corridor management zone is 500 feet from each bank. The length of the corridor management zone on a tributary is 10 stream miles from the intake. For example, a tributary four miles in length that enters the reservoir six miles upstream of the intake would be completely within the corridor management zone. A tributary stream entering eight miles from the intake would have only two miles of its stream length within the corridor management zone.*

*The **Emergency Management Zone, (EMZ)** is defined as an area in the immediate vicinity of the surface water intake in which the public water system operator has little or no time to respond to a spill. The boundary of the emergency management zone is delineated in cooperation with the water supplier. Figure 6 shows the boundary of the emergency management zone for the MVSD Public Water System. The corridor and emergency management zones are the focus of field and windshield surveys to inventory potential contaminant sources.*

In the immediate area of the EMZ is a tributary known as Sulfur Run. This tributary allows for the drainage of an area that was formerly mined which contributes sub surface drainage. Efforts should be made to monitor and develop a specific site plan to combat any potential source of contamination from this tributary."

Plan stakeholders identified potential threats or contaminant sources to the reservoir and then provides protective strategies and best management practices to reduce the risk of source water contamination. A copy of Meander Water's Drinking Water Source Protection Plan can be found on Meander Water's website.

2.4.3 Collegiate Studies involving the Lower Meander Creek Watershed

The Meander Reservoir and the Meander Watershed is studied and written about by many professors and graduate students from Youngstown State University (YSU). Their documents cover topics including stream restoration, wetland mitigation, water quality, and taste and odor problems in Meander's finished water. These documents will steer the plan's implementation strategies and providing project specific locations.

<u>YSU Faculty and Graduate Student Wetland Mitigation Plan for Meander Creek Watershed</u>

A wetland mitigation plan was prepared by YSU Civil and Environmental Engineer professor, Dr. Scott C. Martin, Ph. D., P.E. and students, Scott Airato and Susheel Kolwalkar, identifying current wetlands in the Mill Creek, Yellow Creek and Meander Creek watersheds. Their study then identified target parcels within each watershed where conditions were right for wetland mitigation. Geographic Information System (GIS) used the Ohio Wetland Inventory (OWI) and National Wetland Inventory (NWI) data to identify areas within the watersheds dominated by hydric soils, flat topography, and suitable land cover. GIS screened and ranked parcels containing high potential for mitigation. The parcels were then mapped out according to watershed and a spreadsheet of parcel information was created.

<u>YSU master's thesis on techniques to identify wetland and stream restoration opportunities in Meander Creek</u>

Susheel Kolwalkar (2003) wrote a master's thesis on developing a technique to identify wetland mitigation and stream restoration opportunities in Meander Creek, Mill Creek, and Yellow Creek using GIS-based data and two metrics from the Ohio EPA's Qualitative Habitat Evaluation Index (QHEI)- riparian width and floodplain quality. The study built upon graduate student Scott Airato's 2002 master's thesis, *"Development of a GIS-based Procedure to Identify Wetland Mitigation opportunities in Mill Creek, Yellow Creek, and Meander Creek Watersheds"*. Airato's developed an algorithm to facilitate rapid searches of large tracts of land for potential mitigation and then used GIS to narrow the identification down to smaller tracts. The GIS screened land characteristics for hydric soil domination, flat topography, and suitable land cover. The result of Airato's study created an inventory of "candidate parcels". Candidate parcels were further ranked based on the probability to support the development of a wetland. Kolwalkar's applied Airato's algorithm to additional areas within the watersheds. Kolwalkar's applied a ranking system based on quantifying three factors of wetland mitigation success:

1) Hydrology;
2) Hydric Soils; and
3) Environment capable of supporting hydrophobic vegetation.

The stream restoration component of the project utilized, Ohio EPA's QHEI metrics, GIS overlay, and field observations to identify stream segments for restoration potential. The average scores for riparian width (right and left bank values) and flood plain value were combined forming a composite score. Scores for each value were divided into three categories: poor, moderate, and excellent. Those areas with low composite scores are a result of human disturbances, channelization, and diversion, clearing of riparian vegetation and development within the floodplain. The following maps are from Kolwalkar's thesis to illustrate findings:

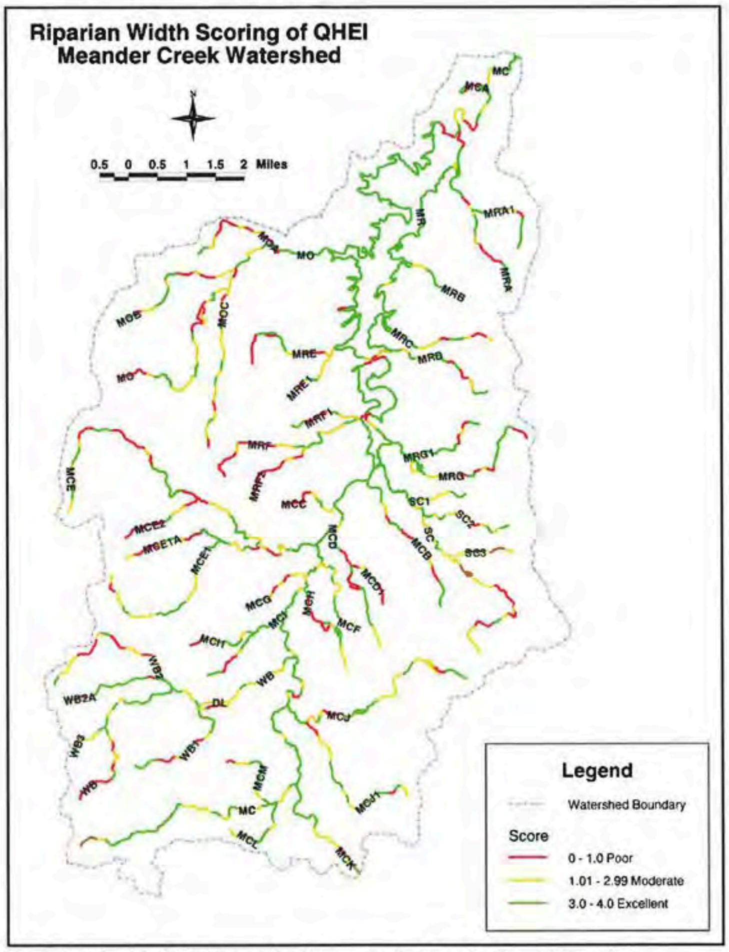


Figure 4. Riparian Width Scores for Streams in the Meander Creek Watershed.

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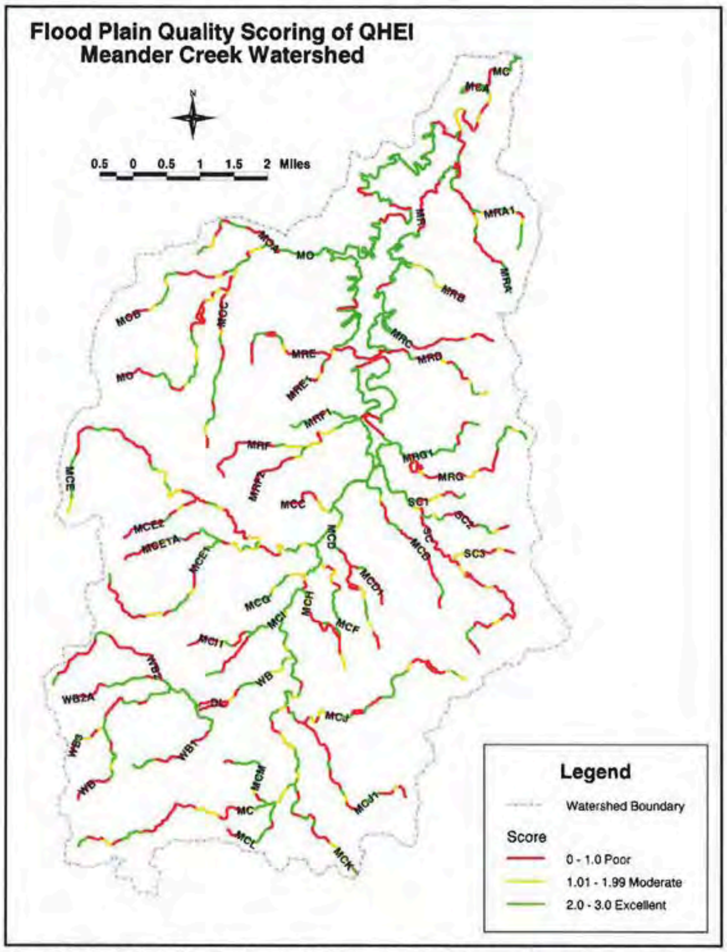


Figure 7. Flood Plain Quality Scores for Streams in the Meander Creek Watershed.

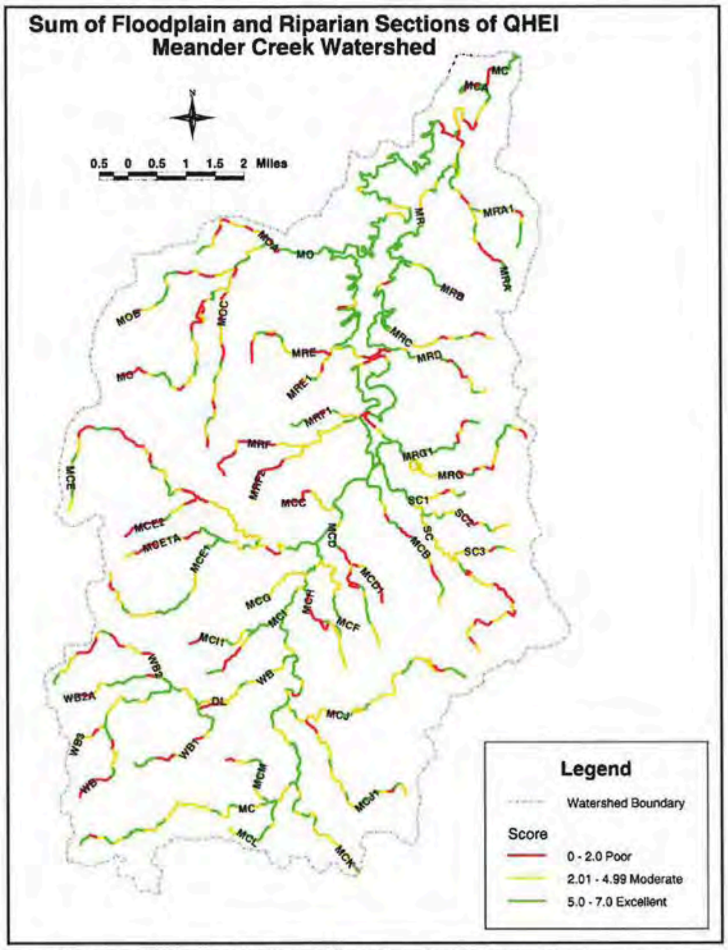


Figure 10. Sum of Riparian Width and Flood Plain Quality Scores for Streams in the Meander Creek Watershed.

YSU Masters Degree Thesis explores nutrient loadings from Meander Creek watershed tributaries

YSU student, Nazia Mughis-Sohrawardy 's master's thesis was part of a larger study to determine the cause of taste and odor problems in Youngstown's water supply and propose solutions through reservoir monitoring and watershed management. The purpose was to make preliminary estimates of annual export rates of several chemical and physical constituents from the Meander Creek watershed. The approach taken was to establish flow-gaging stations on all major tributaries to Meander Creek Reservoir and monitor these tributaries for several parameters related to the growth of *Synura petersenii*. The parameters monitored were suspended solids, total and soluble phosphorus, silica, and two forms of nitrogen, i.e. ammonia and nitrate.

YSU's Preliminary stream restoration plan for Meander Creek

YSU's Dr. Scott Martin prepared a stream restoration plan for Mill Creek, Yellow Creek, and Meander Creek in 2003. Stream restoration recommendations stem from the rankings developed in Kolwalkar thesis. Dr. Martin' s plan outlined stream restoration planning steps, restoration process, and available restoration techniques.

YSU studies on the presence of the algae, Synura petersenii

YSU professors, Dr. Scott Martin, Ph.D., P.E and Lauren Schroeder, Ph. D, and graduate students Christiana Christou, studied the Meander Reservoir's water quality for many years. One major issue presenting itself is the presence of an algae, *Synura petersenii*. Although not a harmful, it causes a "cucumber" taste and odor in the Meander's finished water. Several studies were performed to determine the cause and environmental factors promoting the algal growth behind the taste and cucumber odor in the Meander Water's finished drinking water. One study concluded the Meander Reservoir and Meander Creek tributaries are impacted by moderate water quality impairment from nonpoint source pollution, primarily from sediments and nutrients (nitrogen and phosphorus), and secondarily by bacteria and heavy metals. Study results indicate reservoir nutrient loadings increased over time due to development. However, the study did not find conclusive evidence explaining how increased nutrient loadings produced larger populations of the algae and thus, cucumber odor occurrences in Meander's finished water. YSU professors and graduate students inventoried the land uses, stream and channel conditions, and water quality resources to look at the algae's growth as it relates to nutrient loading into Meander Reservoir from the increased development. *S.petersenii* algae was analyzed again, examining core samples of the reservoir's bottom to study diatom remains in reservoir sediment to reconstruct past water quality conditions and to determine when changes occurred in the reservoir's water chemistry. After performing a series of studies, it was determined nuisance densities of *S.petersenii* may have been a result of improving water quality. As nutrient levels and turbidity decreased in the reservoir, due to the implementation of watershed BMPs, the occurrence of *S.petersenii* decreased. Both studies provide watershed BMP recommendations to enhance and protect Meander Reservoir's water quality. Though these recommendations are not site specific, they provide guidance for this plan's implementation strategies.

Chapter 3: Critical Area Conditions and Restoration Strategies

As the title implies, a Nine-Element NPS-IS Plan is limited to nonpoint source pollution issues. Based on the Ohio EPA's 2013 survey results the causes and sources of impairment at sites in nonattainment are point source related. However, numerous streams and tributaries within the Lower Meander Creek do not have water quality data, but still play a role in the reservoir's water quality.

According to Ohio EPA's Nonpoint Source Implementation Strategic Plan guide, critical areas in Ohio include "an area identified as having healthy waters that need protected from degradation by nonpoint source pollutants such as nutrients and sediment; especially those areas seriously threatened by the rapid conversion of countryside to developments" (p.10). A review of Section H-3's summary of PDWS assessment (Table H-3, p. H-22) results indicates the Meander Water PDWS is in full support of its use designation (as a drinking water source) and is overall in full attainment/support (Nitrate Indicator). Based on the 2016 IR, the nature of surface waters, the number of direct reservoir tributaries, and the fact Meander Reservoir is a public drinking water supply, the entire reservoir is identified as a critical area.

3.1 Overview of Critical Areas

Without additional monitoring in the HUC 12, it is difficult to determine what critical issues exist. However, if the plan utilizes land use information, one can assume urban runoff, agricultural runoff, failing HSTS, roadways, channelization, and lack of riparian buffers create issues within the HUC 12.

The overarching goal for the entire Lower Meander HUC-12 is to maintain the Safe Drinking Water Standards of the public drinking water supply. The watershed's overall objective will be to implement projects addressing the goal of reducing tributary and reservoir nutrient and sediment loads. Goals and Objectives will overlap and reinforce the source water protective strategies stated in Meander Water's SWPP, beginning on page 34. Implementation objectives for this goal include:

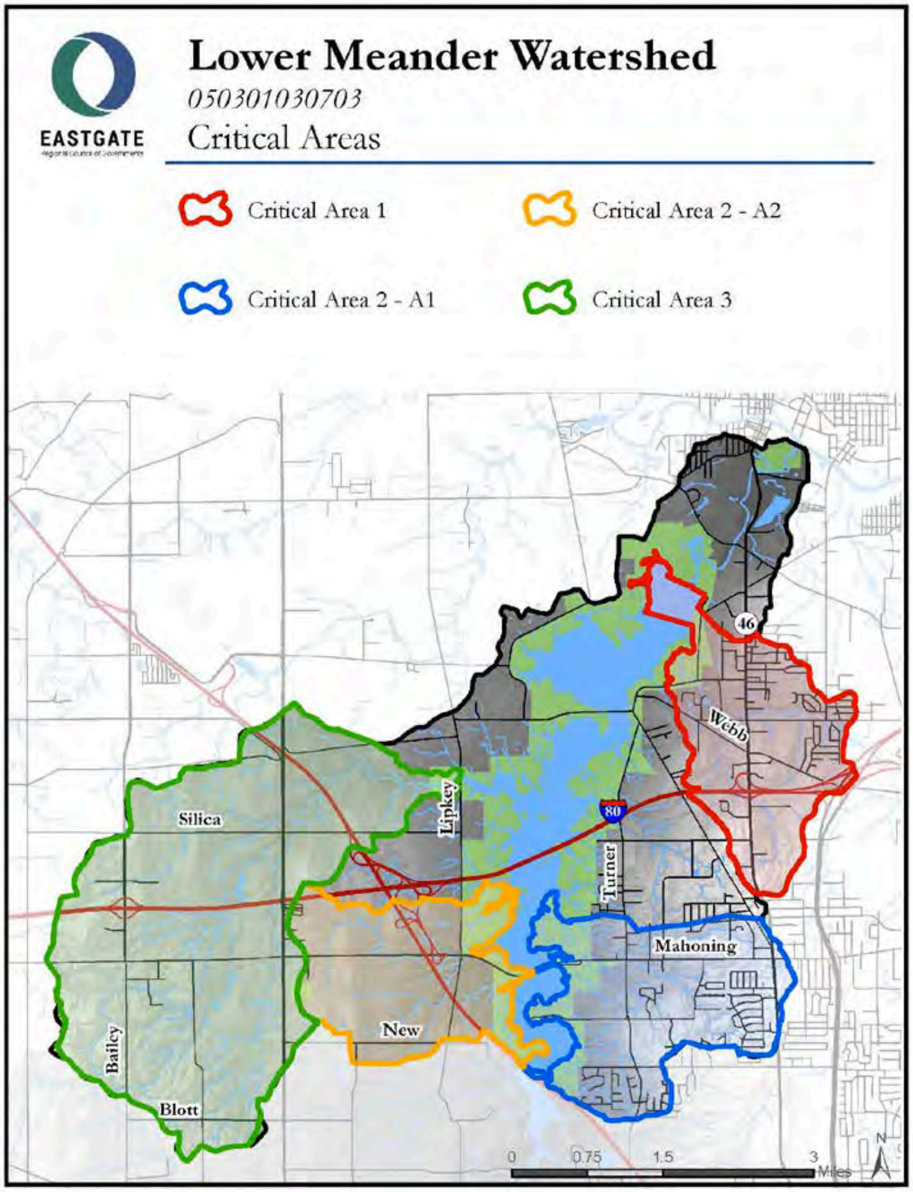
The overarching goal for the entire Lower Meander HUC-12 is to maintain the Safe Drinking Water Standards of the public drinking water supply.

1) Nutrient load reduction- agricultural BMPs, urban BMPs, repair/replace failing HSTS; and
2) Stream stabilization- establish riparian buffers, agriculture conservation planning.

The practices, when installed properly, will help the water supply maintain microcystin, pesticide, nitrate, and phosphorus levels to PDWS full attainment status. As more water quality monitoring data becomes available, additional critical areas may be identified in subsequent versions of this NPS-IS plan.

The Lower Meander Creek NPS-IS plan identified three critical areas based on land use information and their direct relationship to reservoir. Figure 12 illustrates the Lower Meander Creek HUC 12 Critical Areas.

Figure 12: Lower Meander HUC12 Critical Areas



3.2 Critical Area 1: Meander Reservoir's Emergency Management Zone

3.2.1 Critical Area 1: Detailed Characterization

Critical Area 1 includes the drainage basins Superior and Sulphur Run located southeast of Meander Water's raw water intake and subsequently the EMZ. Both streams are direct tributaries to Meander Reservoir. Sulphur Run and Superior have tributaries that were straightened or encapsulated due to surrounding development. Their drainage basins include Phase II communities with a mix of industrial, commercial, and residential land use. Storm water quantity and quality are major factors in this area due to the series of retention ponds, outfalls, and infrastructure conveyance systems. A major feature to point out is the inclusion of the major transportation hub, I-76 and SR 46 interchange. This interchange experiences high vehicular, fleet, and freight traffic from places west of Mahoning County, the Ohio Turnpike, and traveling onto destinations east of Ohio. Industries and commercial establishments catering to the freight industry and travelers, i.e. truck stops, gas stations, and restaurants, surround the interchange.

The EMZ is defined as an area in the immediate vicinity of the surface water intake in which the public water system operator has little or no time to respond to a spill. The boundary of the emergency management zone is delineated in cooperation with the water supplier. Figure 6 shows the boundary of the emergency management zone for the MVSD Public Water System. The corridor and emergency management zones are the focus of field and windshield surveys to inventory potential contaminant sources. Negative water quality effects from historic mining operations (acid mine drainage) are of concern for this area. However, an acid mine drainage abatement plan is not available for this area. Table 8 lists the land cover for this area, while Table 9 summarizes the land use.

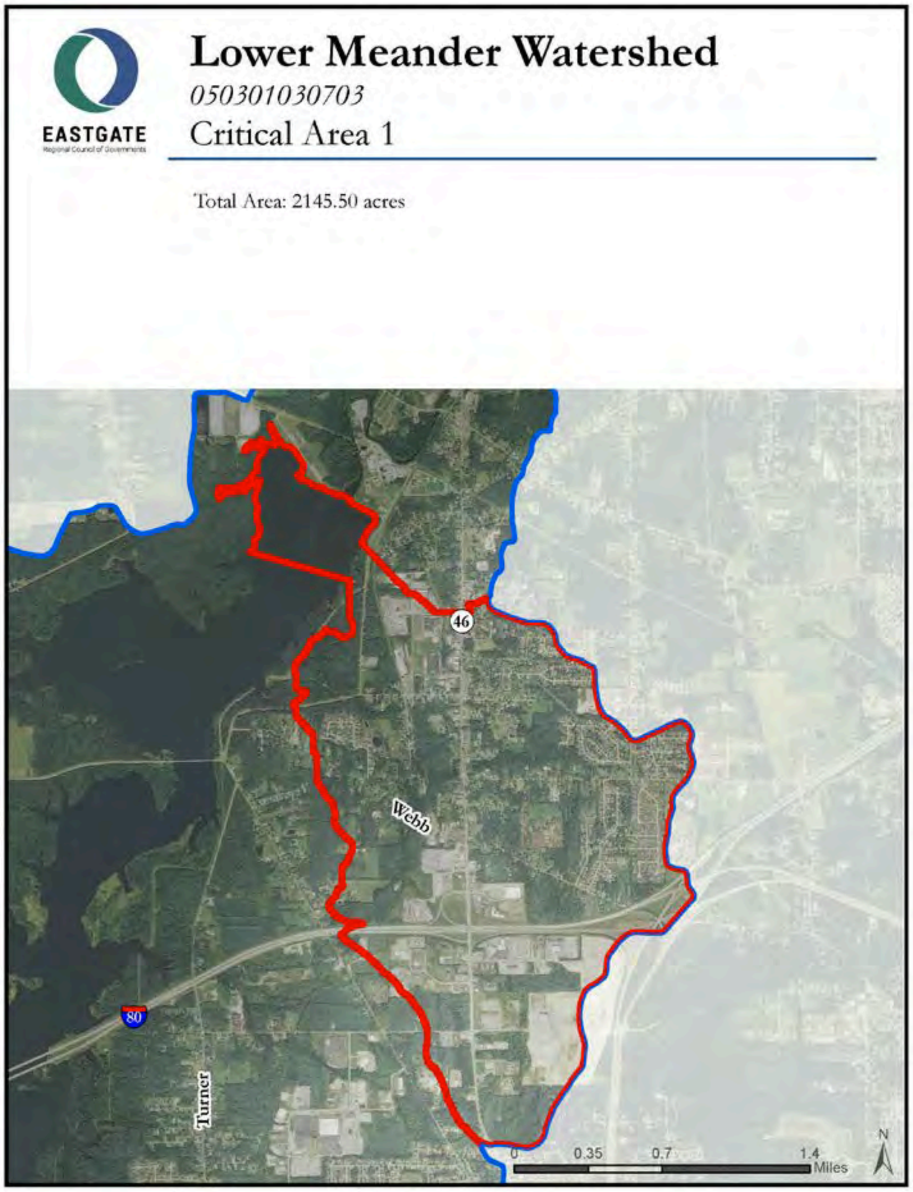
Table 8: Critical Area 1 Land Cover

CATEGORY	ACRES
Open Water	149.23
Developed, Open Space	644.28
Developed, Low Intensity	534.19
Developed, Medium Intensity	200.38
Developed, High Intensity	71.17
Deciduous Forest	379.18
Evergreen Forest	28.47
Mixed Forest	0.89
Shrub/Scrub	22.91
Grassland/Herbaceous	48.04
Pasture/Hay	33.36
Cultivated Crops	4.67
Woody Wetlands	30.25
Emergent Herbaceous Wetlands	1.11

Table 9: Critical Area 1 Land Use

CATEGORY	ACRES
Agriculture	170.80
Commercial	258.74
Government or Public	347.15
Industrial	47.99
No Data	6.48
Residential	664.28
Vacant	394.63
Water	145.01

Figure 13: Lower Meander Creek - Critical Area 1



3.2.2 Critical Area 1: Detailed Biological Conditions

There is currently no biological or invertebrate sampling data available for this critical area.

3.2.3 Critical Area 1: Detailed Causes and Associated Sources

When water quality data is not present for a HUC 12, a model can be run to provide pollutant load information. Modeling programs exist to estimate the nutrient and sediment loadings for a watershed, when empirical data is absent. The Spreadsheet Tool for Estimating Pollutant Load (STEPL) program developed by the U.S. EPA was utilized to estimate nitrogen, phosphorus, and sediment pollutant loadings and estimate load reductions with both urban and agricultural best management practices. However, the model should not be in lieu of actual monitoring. The STEPL model, estimates the following amount of nutrients and sediment runoff annually:

- Nitrogen: 7,509 lbs./year
- Phosphorus: 1,157 lbs./year
- Sediment: 192 t/year

When Nitrogen and phosphorus concentrations are adjusted to reflect water quality-based concentrations (Ohio EPA's concentration research relating to aquatic life concentrations) of 0.1 mg/L phosphorus and 1.1 mg/L in non-forested areas, the amounts are:

- Nitrogen: 7,284 lbs./year
- Phosphorus: 1,141 lbs./year

Therefore, the drainage basin receives an excess of 225 lbs./year of Nitrogen and 16 lbs./year of phosphorus.

Based on aerial coverage and land use information, the excess concentrations from Critical Area 1 stem from:

- Channelization
- Lack of riparian buffers
- Failing HSTS
- Urban storm water runoff
- Development

3.2.4 Critical Area 1: Outline Goals and Objectives

The proximity of land adjacent to Meander Reservoir and the raw water intake determine this area in need of high protection. Safe and clean drinking water is critical to Meander Water and it 220,000 customers in Mahoning and Trumbull Counties. The Meander SWPP identifies protective strategies for source water protection should include:

Safe and clean drinking water is critical to Meander Water and its 220,000 customers in Mahoning and Trumbull Counties.

- Education and outreach;
- Zoning Ordinances;
- Stormwater programs; and
- Riparian Easements/land acquisition/buffer zones.

Ohio EPA water quality standards are developed to "protect water quality to the extent public water systems can meet the finished water SDWA standards utilizing only conventional treatment" (2016 IR, Ohio EPA). Furthermore, the goals and objectives for this NPS-IS plan are designed to ensure reservoir water quality conditions remain in full attainment and therefore, keep the reservoir from being placed on the Ohio EPA's "watch list" for impacted PDWS. To continue achieving full attainment, the NPS-IS plan will focus on decreasing nutrient and sediment loads entering the reservoir.

<u>*Goals*</u>

Goal 1. Reduce nitrogen by more than 225 lbs./year. Currently the drainage area receives 7,284 lbs./year of nitrogen from surrounding land uses. NOT ACHIEVED

Goal 2. Reduce the amount of phosphorus by more than 16 lbs./year. According to the STEPL model, the critical area receives 1,141 lbs./year. NOT ACHIEVED

Goal 3. Maintain microsystin levels below drinking water standard for children (0.3 µg[3]/L) at the drinking water intake. Meander Reservoir's microsystin levels have remained below the state drinking water thresholds within the 5-year period. ACHIEVED

[3] Algae: Cyanotoxins impaired conditions are those where two or more excursions are above the state drinking water thresholds (microcystins=1.0 µg/L) within the 5-year period. IR 2016, Section H, Table H-1.

Goal 4. Maintain Meander Reservoir's water quality conditions and remain absent from the Ohio EPA's source water's "watch list". Currently the reservoir does not contain conditions placing it on the Ohio EPA's "watch list". ACHIEVED

Indicator	"Watch List" conditions
Nitrate	Maximum instantaneous value >8 mg/L (80% of WQ criteria
Pesticides	Running Quarterly average ≥ WQ criteria Maximum instantaneous value ≥ 4x WQ criteria
Other Contaminants	Maximum instantaneous value ≥ WQ criteria
Algae: Cyanotoxis	Maximum instantaneous value ≥ 50% of the state drinking water threshold
Cryptosporidium	Annual average ≥ 0.075 oocysts/L

Commented [SD1]: Cite Ohio 2016 Integrated Report, Table H-1 PDWS attainment determination

Objectives

To achieve the overarching goal of maintaining drinking water attainment standards for the reservoir, the following nutrients and sediment load reductions need to be achieved. Because of the chemical nature and origin, management measures indicated for nitrogen loading are mimicked to reduce phosphorus loading in the watershed.

Objective 1: Establish riparian buffers along 500 linear feet of stream bank within commercial areas with a minimum 30' buffer on each side.

Objective 2: Promote the use of biofiltration on 65 acres of commercial properties.

The objectives listed will be evaluated for effectiveness and modified as necessary. When reevaluating, implementing stakeholders will be encouraged to consult the Ohio EPA's Nonpoint Source Management Plan Update (Ohio EPA, 2013) document. This document contains a comprehensive listing of eligible NPS management strategies to consider, including:

- Urban Sediment and Nutrient Reduction Strategies;
- Altered Stream and Habitat Restoration Strategies; and
- Nonpoint Source Nutrient Reduction Strategies.

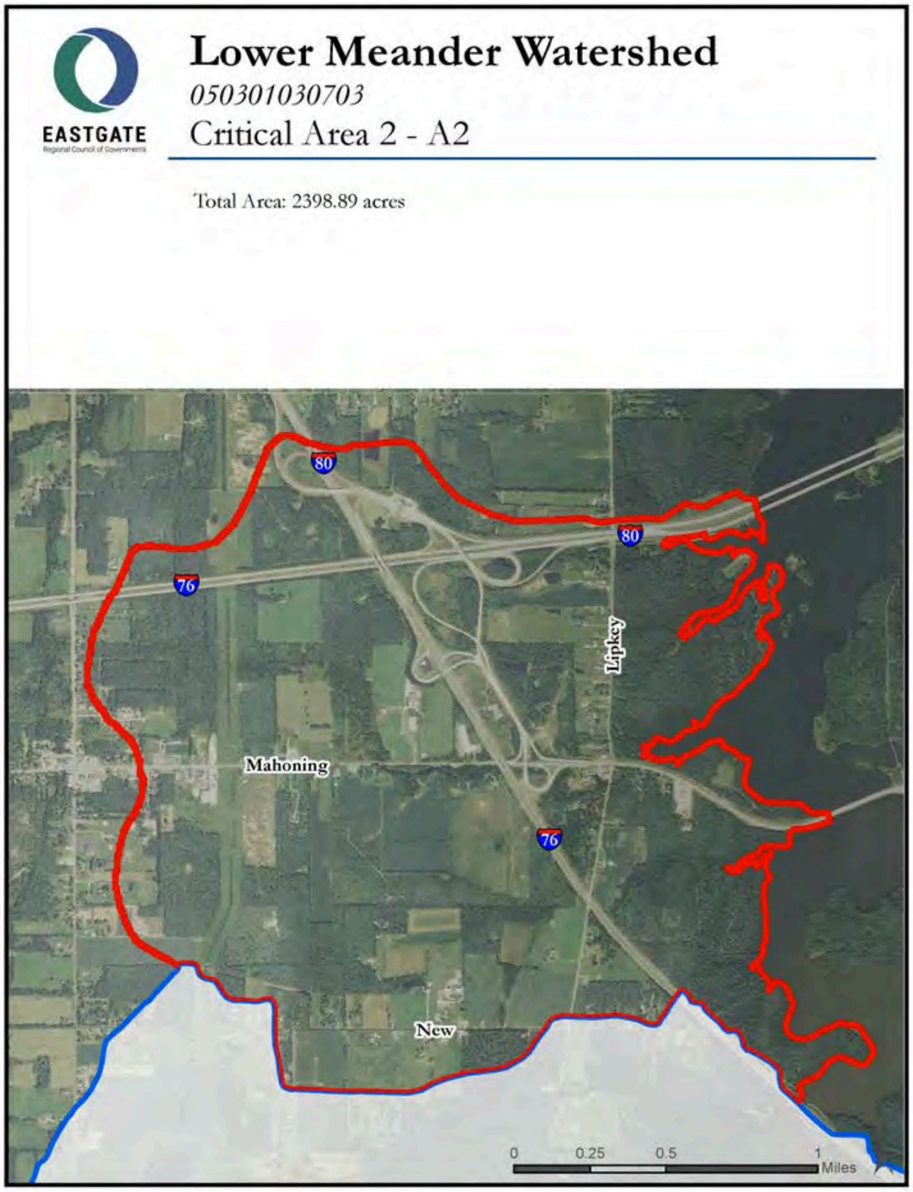
3.3 Critical Area 2: Meander Reservoir's Corridor Management Zone

3.3.1 Critical Area 2: Detailed Characterization

Critical Area 2 includes riparian areas within 1,000 feet of each bank of Meander Creek Reservoir, starting from the intake and extending to a point approximately 4 miles upstream of the reservoir approximately 10 miles from the intake. The corridor management zone includes tributaries to Meander Creek Reservoir where the width of the CMZ's riparian area is 500 feet from each bank and 10 stream miles from the intake. This zone contains a significant amount of land owned by MVSD. Erosion and sediment loading, along with land protection from negative water quality impacts such as home and commercial septic discharges, oil and gas wells, agricultural practices and urban runoff are of concern for this area. Critical Area 2 is a compilation of two vastly different drainage basins and landscapes and is further broken up into 2-A1 and 2-A2.

Figure 14: Lower Meander Creek- Critical Area 2-A1

Figure 15: Lower Meander Creek- Critical Area 2-A2



Critical Area 2-A1

Critical Area 2-A1 contains the urbanized, Phase II community of Austintown Township, and tributary, 7 Mile Run. Table 10 lists the land cover for this area, while Table 11 summarizes the land use.

Table 10: Critical Area 2-A1 Land Cover

CATEGORY	ACRES
Open Water	28.02
Developed, Open Space	533.97
Developed, Low Intensity	623.59
Developed, Medium Intensity	163.46
Developed, High Intensity	94.74
Deciduous Forest	578.45
Evergreen Forest	65.83
Mixed Forest	4.00
Shrub/Scrub	8.23
Grassland/Herbaceous	53.37
Pasture/Hay	99.41
Cultivated Crops	34.25
Woody Wetlands	54.93
Emergent Herbaceous Wetlands	1.33

Table 11: Critical Area 2-A1 Land Use

CATEGORY	ACRES
Agriculture	286.84
Commercial	236.30
Government or Public	463.73
Industrial	28.65
No Data	13.11
Residential	977.86
Vacant	164.15
Water	11.60

Critical Area 2-A2

Critical Area 2-A2 includes an unknown tributary to Meander Reservoir and is rural in nature. The site includes the Ohio Turnpike/ I-80 interchange and extends west and south of the interchange. Table 12 lists land cover for this area, while Table 13 summarizes the land use.

Table 12: Critical Area 2-A2 Land Cover

CATEGORY	ACRES
Open Water	44.92
Developed, Open Space	166.13
Developed, Low Intensity	125.43
Developed, Medium Intensity	59.16
Developed, High Intensity	4.45
Deciduous Forest	678.30
Evergreen Forest	131.44
Mixed Forest	5.12
Shrub/Scrub	35.81
Grassland/Herbaceous	91.40
Pasture/Hay	296.01
Cultivated Crops	269.54
Woody Wetlands	76.50
Emergent Herbaceous Wetlands	11.56

Table 13: Critical Area 2-A2: Land Use

CATEGORY	ACRES
Agriculture	1076.19
Commercial	109.63
Government or Public	428.87
Industrial	3.86
No Data	0.78
Residential	220.12
Vacant	36.88
Water	26.10

3.3.2 Critical Area 2: Detailed Biological Conditions

There is currently no biological or invertebrate sampling data available for this critical area.

3.3.3 Critical Area 2: Detailed Causes and Associated Sources

The STEPL model was utilized to estimate pollutant loadings and load reductions for both drainage areas within Critical Area 2.

Critical Area 2-A1

The U.S. EPA's STEPL tool estimates the following amount of nutrients and sediment runoff annually:

- Nitrogen: 7,861 lbs./year
- Phosphorus: 1,232 lbs./year
- Sediment: 244 t/year

When Nitrogen and phosphorus concentrations are adjusted to reflect water quality-based concentrations (Ohio EPA's concentration research relating to aquatic life concentrations) of 0.1 mg/L phosphorus and 1.1 mg/L nitrogen in non-forested areas, the amounts are:

- Nitrogen: 7,412 lbs./year
- Phosphorus: 1,194 lbs./year

Therefore, the drainage basin receives an excess of 449 lbs./year of nitrogen and 38 lbs./year of phosphorus. Based on aerial coverage and land use information, the excess concentrations from Critical Area 2- A1, may stem from:

- Lack of riparian buffers
- Urban storm water runoff
- Development

The Meander SWPP identifies protective strategies for source water protection. The plan states protection efforts should include:

- Education and outreach;
- Zoning Ordinances
- Stormwater programs
- Riparian Easements/land acquisition/buffer zones

Projects addressing the excess loadings will have a positive effect on water quality within streams entering Meander Reservoir.

Critical Area 2-A2

The STEPL tool estimated Critical Area 2-A2 receives the following amount of nutrients and sediment runoff annually:

- Nitrogen: 5,431 lbs./year
- Phosphorus: 1,099 lbs./year
- Sediment: 488 t/year

When Nitrogen and phosphorus concentrations are adjusted to reflect water quality-based concentrations (Ohio EPA's concentration research relating to aquatic life concentrations) of 0.1 mg/L phosphorus and 1.1 mg/L nitrogen in non-forested areas, the amounts are:

- Nitrogen: 4,093 lbs./year
- Phosphorus: 953 lbs./year

Therefore, the drainage basin receives an excess of 1,338 lbs./year of Nitrogen and 146 lbs./year of phosphorus. Based on aerial coverage and land use information, the sources of excess concentrations are from:

- Lack of riparian buffers
- Agricultural runoff
- Failing HSTS

Projects addressing the excess loadings will have a positive effect on water quality within streams entering Meander Reservoir.

3.3.4 Critical Area 2: Outline Goals and Objectives

Critical Area 2-A1: Goals

Goal 1. Reduce nitrogen by more than 449 lbs./year. According to the STEPL model the drainage area receives 7,412 lbs./year of nitrogen from surrounding land uses. NOT ACHIEVED

Goal 2. Reduce the amount of phosphorus by more than 38 lbs./year. According to the STEPL model, the drainage area receives 1,194 lbs./year. NOT ACHIEVED

Goal 3. Maintain microsystin levels below drinking water standard for children (0.3 µg[4]/L) at the drinking water intake. Meander Reservoir's microsystin levels have remained below the state drinking water thresholds within the 5-year period. ACHIEVED

Critical Area 2-A1: Objectives

To achieve the overarching goal of maintaining drinking water attainment standards, the following objectives for nutrient and sediment load reductions in Critical Area 2- A1 need to be achieved. Because of the chemical nature and origin, management measures indicated for nitrogen loadings are mimicked to reduce phosphorus loading in the watershed.

Objective 1: Establish riparian buffers along 1,600 linear feet of stream bank (800' left bank, 800' right bank) on commercial properties with a minimum 30' buffer on each side.

Objective 2: Install rain gardens on 66 acres of residential properties.

[4] Algae: Cyanotoxins impaired conditions are those where two or more excursions are above the state drinking water thresholds (microcystins=1.0 µg/L) within the 5-year period. IR 2016, Section H, Table H-1.

The objectives listed may be evaluated for effectiveness and modified as necessary. When reevaluating, the implementing stakeholders will be encouraged to consult the Ohio EPA's Nonpoint Source Management Plan Update (Ohio EPA, 2013) document. This document contains a comprehensive listing of eligible NPS management strategies to consider, including:

- Urban Sediment and Nutrient Reduction Strategies;
- Altered Stream and Habitat Restoration Strategies; and
- Nonpoint Source Nutrient Reduction Strategies.

Critical Area 2-A2: Goals

Goal 1. Reduce nitrogen by more than 1,338 lbs./year. According to the STEPL model the drainage area receives 4,093 lbs./year of nitrogen from surrounding land uses. NOT ACHIEVED

Goal 2. Reduce the amount of phosphorus by more than 146 lbs./year. According to the STEPL model, the drainage area receives 953 lbs./year. NOT ACHIEVED

Goal 3. Maintain microsystin levels below drinking water standard for children (0.3 µg[5]/L) at the drinking water intake. Meander Reservoir's microsystin levels have remained below the state drinking water thresholds within the 5-year period. ACHIEVED

Critical Area 2-A2: Objectives

To achieve the overarching goal of maintaining drinking water attainment standards for the reservoir, the following objectives reducing nutrients and sediment loads within Critical Area 2- A1 need to be achieved. Because of the chemical nature and origin, management measures indicated for nitrogen loadings are mimicked to reduce phosphorus loading in the watershed.

Objective 1: Establish grassed filter strips (minimum 30' wide on each bank) along 1,000 linear feet of stream bank within commercial areas.

Objective 2: Establish grassed filter strips (minimum 30' wide on each bank) on 135 acres of cropland.

Objective 3: Establish spill containment measures

[5] Algae: Cyanotoxins impaired conditions are those where two or more excursions are above the state drinking water thresholds (microcystins=1.0 µg/L) within the 5-year period. IR 2016, Section H, Table H-1.

The objectives listed may be evaluated for effectiveness and modified as necessary. When reevaluating, the implementing stakeholders will be encouraged to consult the Ohio EPA's Nonpoint Source Management Plan Update (Ohio EPA, 2013) document. This document contains a comprehensive listing of eligible NPS management strategies to consider, including:

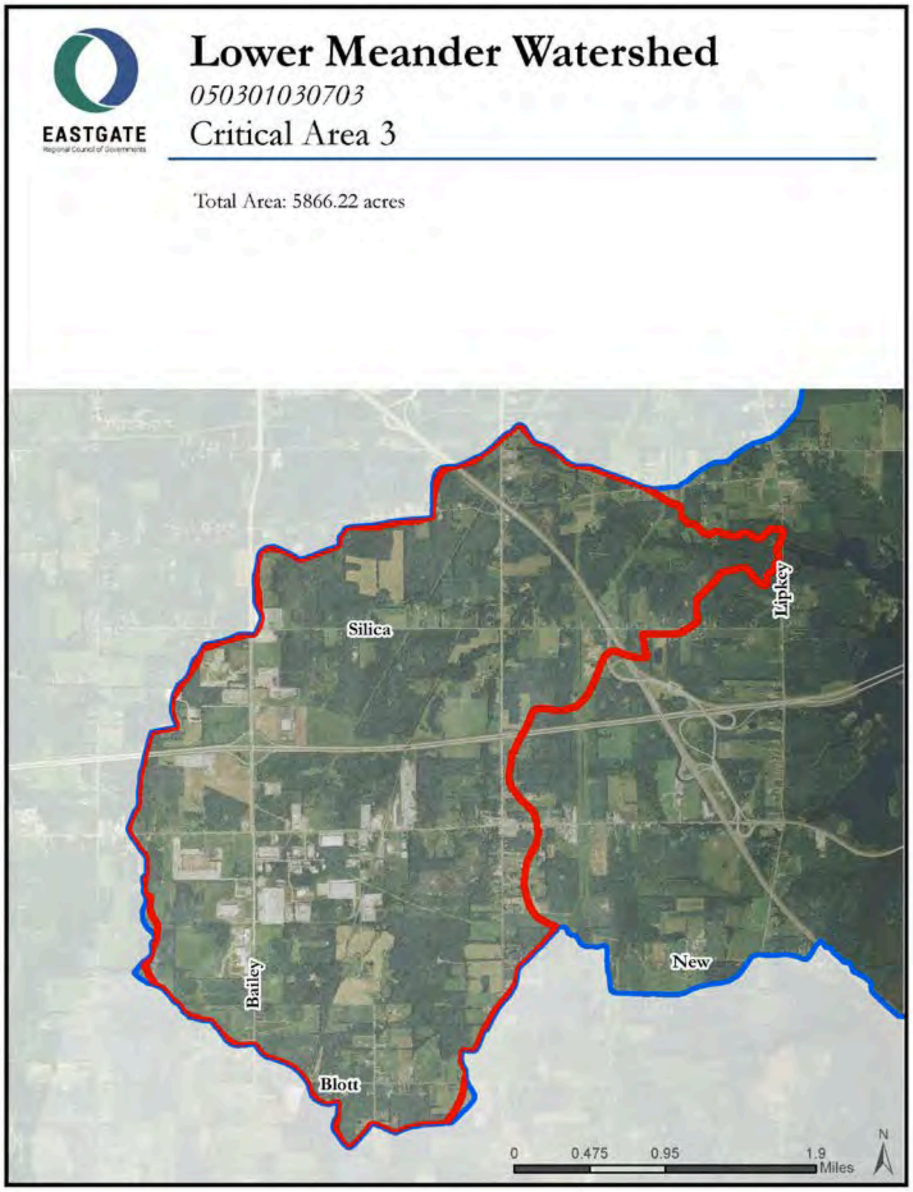
- Altered Stream and Habitat Restoration Strategies; and
- Nonpoint Source Nutrient Reduction Strategies.

3.4 Critical Area 3: Morrison Run

3.4.1 Critical Area 3: Detailed Characterization

Critical Area 3 is defined as the Morrison Run drainage basin. Morrison Run is the largest drainage basin in the Lower Meander HUC12, draining 5,866 acres (9.3 sq. miles) in Jackson Township. This area contains a mix of industrial, commercial, and agricultural land uses. The area is home to the following major freight corridors: I-76/ I-80, Bailey Road and I-76 and the Ohio Turnpike. These interchanges experiences high fleet and freight traffic due to the presence of FedEx's Ground, Macy's Distribution Center, and proximity to the General Motors Car Assembly Plant in Lordstown.

Figure 16: Lower Meander Creek- Critical Area 3



3.4.2 Detailed Biological Conditions

The Ohio EPA surveyed Morrison Run in 2011 and found it in Full Attainment of Ohio's Aquatic Life Use standards. Table 8 identifies the IBI, MIwb, ICI and QHEI scores for Morrison Run.

Table 14: Morrison Run Aquatic Life Use Attainment

Stream Segment Location (sample year)	River Mile	Drainage Area	IBI	MIwb	ICI[b]	QHEI (Habitat)	Status
Morrison Run near mouth, west of Lipkey Road (2011)	0.12	9.30[H]	40	n/a	E	74.0	FULL

Projects retaining nutrient and sediment loads and protecting the current full attainment status of Morrison Run will enable the stream to continue meeting its WWH standard.

3.4.3 Critical Area 3: Detailed Causes and Associated Sources

Even though Critical Area 3 is in full attainment, the possibility exists for nutrient and sediment loadings to increase over time making the stream fall into partial or nonattainment. The STEPL model estimated pollutant loadings and load reductions for Critical Area 3.

Utilizing the U.S. EPA's STEPL tool, the drainage area receives approximately the following amount of nutrients and sediment runoff annually:

- Nitrogen: 15,367 lbs./year
- Phosphorus: 3,067 lbs./year
- Sediment: 1,253 t/year

When Nitrogen and phosphorus concentrations are adjusted to reflect water quality-based concentrations (Ohio EPA's concentration research relating to aquatic life concentrations) of 0.1 mg/L phosphorus and 1.1 mg/L nitrogen in non-forested areas, the amounts are:

- Nitrogen: 11,887 lbs./year
- Phosphorus: 2,644 lbs./year

Therefore, the drainage basin receives an excess of 3,480 lbs/year of Nitrogen and 423 lbs./year of phosphorus. Based on aerial coverage and land use information, the excess concentrations from Critical Area 3, stem from:

- Lack of riparian buffers
- Agricultural storm water runoff
- Development

Projects addressing the excess loadings will have a positive effect on water quality within Morrison Run.

3.4.4 Critical Area 3: Goals and Objectives

Critical Area 3 is the largest and most diverse drainage basin in the Lower Meander Creek HUC12. The goals and objectives for Critical Area 3 will be developed to ensure the drainage basin continues to meet full attainment of its WWH aquatic life use designation.

Goals

Goal 1. Reduce nitrogen by more than 3,480 lbs./year. According to the STEP-L model, the watershed currently receives 11,887 lbs./year of nitrogen. NOT ACHIEVED

Goal 2. Reduce the amount of Phosphorus by more than 423 lbs./year. According to the STEP-L model, the watershed currently receives 2,644 lbs./year of phosphorus. NOT ACHIEVED

Goal 3. Maintain Meander Reservoir's full attainment conditions. ACHIEVED

Indicator	"Watch List" conditions*
Nitrate	Maximum instantaneous value >8 mg/L (80% of WQ criteria
Pesticides	Running Quarterly average ≥ WQ criteria Maximum instantaneous value ≥ 4x WQ criteria
Other Contaminants	Maximum instantaneous value ≥ WQ criteria
Algae: Cyanotoxis	Maximum instantaneous value ≥ 50% of the state drinking water threshold
Cryptosporidium	Annual average ≥ 0.075 oocysts/L

*2016 IR Table H-1: Ohio Environmental Protection Agency, 2016

Objectives

To achieve the overarching goal of maintaining drinking water attainment standards for the reservoir and full attainment of its WWH designation, the following objectives reducing nutrients and sediment loads within Critical Area 3 need to be achieved. Because of the chemical nature and origin, management measures indicated for nitrogen loadings are mimicked to reduce phosphorus loading in the watershed.

Objective 1: Establish grassed waterways (NRCS Standard 412) on 232 acres of farmlands.

Objective 2: Incorporate minimally invasive tillage practices, such as No Till/ Strip Tillage (NRCS Standard 329), on 115 acres of croplands.

Objective 3: Establish treatment filter areas (Per Ohio-NRCS FOTG Standard 393) along 1,000 linear feet of stream within the critical area.

Objective 4: Establish infiltration basin facilities on 100 acres of undeveloped commercial properties as they undergo site development.

The objectives listed may be evaluated for effectiveness and modified as necessary. When reevaluating, the implementing stakeholders will be encouraged to consult the Ohio EPA's Nonpoint Source Management Plan Update (Ohio EPA, 2013) document. This document contains a comprehensive listing of eligible NPS management strategies to consider, including:

- Urban Sediment and Nutrient Reduction Strategies;
- Altered Stream and Habitat Restoration Strategies; and
- Nonpoint Source Nutrient Reduction Strategies.

Chapter 4: Projects and Implementation Strategy

The Lower Meander Creek HUC 12 NPSIS plan does not include any projects and/or implementation strategies currently. Any future conceptual projects for consideration for the *Overview Table* need to be developed based on the following three priorities:

Priority 1 Projects supporting the protection of the safe drinking water standards water quality for Meander Reservoir.

Priority 2 Projects maintaining Meander Reservoir's water quality conditions so that it remains absent from the Ohio EPA's source water's "watch list".

Priority 3 Projects that maintain the full attainment status of Morrison Run's WWH designation.

One factor contributing to the lack of projects is the fact stream and reservoir monitoring results from the Ohio EPA suggest the Lower Meander HUC 12 does not have nonpoint source related issues. The second factor is the lack of stream monitoring data from other tributaries, namely those in the identified critical areas. It is recommended additional sampling be performed to gain a better understanding of watershed water quality issues. If monitoring takes place and nonpoint source impairments are identified for one of the existing critical areas or a new critical area is identified, it will be added to this document and table.

4.1 Overview Tables and Project Sheets for Critical Areas

Stakeholders have not identified any short, medium, or long-term projects for implementation.

4.2 Lower Meander Creek HUC 12 Project and Implementation Strategy Overview Table

When applicable, Project Summary Sheets are included for short term projects or any project for which funding may be sought. Only projects with completed Project Summary Sheets are eligible for US EPA/Ohio EPA funding opportunities. Stakeholders have not identified any short, medium, or long-term projects for implementation. Only projects with complete Project Summary Sheets will be considered for state and federal NPS program funding.

4.2.1 Critical Areas: Project Summary Sheets

Aside from educational opportunities, stakeholder have not identified projects. As stakeholder become more engaged and bring forth project, Project Summary Sheets will be added.

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