Marsh Creek- Frontal Lake Erie
HUC-12: 041100030501
Nine-Element
Nonpoint Source Implementation Strategic Plan (NPS-IS)

Version 1.0
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Acknowledgements

Written by Maurine Orndorff
Watershed Coordinator, Lake County Soil & Water Conservation District
125 E. Erie Street, Painesville OH 44077
morndorff@lakecountyohio.gov; 440.350.5863

With assistance from:

- Nick Agins, Lake County Soil & Water Conservation District
- Brian Ashurst, City of Mentor
- Ron Balog, Grand River Village
- Jim Bissell, Cleveland Museum of Natural History
- Amy Brennan, Chagrin River Watershed Partners
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- Chad Edgar, Lake County Soil & Water Conservation District
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- John Gregov, CT Consultants
- George Hadden, Lake County Engineer
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- Laura Kramer Kuns, Lake County General Health District
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- Bob Martin, City of Mentor
- Tim Miller, Director, Lake County Stormwater Management Department
- Kelly Nasca, Sierra Club
- David Radachy, Lake County Planning & Community Development
- Brett Rodstrom, Western Reserve Land Conservancy
- Al Saari, Lake County Sanitary Engineer
- Jim Sayles, CT Consultants
- Russ Schaedlich, City of Painesville
- Lisa Schlag, Sierra Club
- Tom Sorge, Environmental Specialist, Ohio Department of Transportation
- Dennis Yurkovich, Lake County Deputy Sanitary Engineer
- Bill Zawiski, Ohio EPA
- Bob Zeitz, Mentor Marsh Board
- Christina Znidarsic, Chagrin River Watershed Partners

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Chapter 1: Introduction

1.1 Report Background

The Marsh Creek-Frontal Lake Erie Nine-Element Nonpoint Source Implementation Strategic (NPS-IS) Plan reflects the vision for this watershed, to protect, steward and enhance the environmental, social and economic assets of the watershed and related communities for the benefit of present and future generations.

The plan was created to restore and maintain the chemical, physical and biological integrity of water bodies within the watershed and to access funding from USEPA, Ohio EPA and other granting entities for those purposes.

1.2 Watershed Profile & History

The Marsh Creek-Frontal Lake Erie Watershed is located in north-central Lake County in Northeast Ohio (Figure 1). The Hydrologic Unit Code (HUC)-12 is 041100030501. It encompasses the Marsh Creek, Blackbrook, Two Town, and Lake Erie Direct between Grand River and Mentor Marsh subwatersheds. The watershed drains 28.3 square miles. All watersheds drain directly into Lake Erie (Figure 3).

The HUC-12 watershed contains all of Mentor-on-the-Lake (988.1 ac) and portions of City of Eastlake (597.5 ac), City of Willoughby (1,060.3 ac), City of Mentor (11,656.3 ac), Grand River Village (196.6 ac), City of Painesville (964.1 ac), Painesville Township (1,372 ac) and Concord Township (731.4 ac) (Figure 4).

All of the communities in the watershed are members of the Lake County Stormwater Management Department (SMD) and meet the National Pollution Discharge Elimination System (NPDES) requirements through the county program. All of the member communities are Level Two, enabling them to utilize the services of the Lake County SMD for all six minimum control measures, and receive funding assistance to maintain and upgrade the storm sewer infrastructure within the community.

Figure 1: Location of Watershed

Prior to European settlement, the watershed was mostly forested with a mixed oak forest. Following early settlement, many of the forests were cleared for agricultural production, and the areas with poorly drained soils were drained with subsurface drainage and ditches. Portions of channels were dredged and straightened to improve water flow. The primary agricultural industry was nursery production, and Mentor used to be known as the Rose Capitol of the World. Population growth from the Cleveland Metropolitan Area to the west has displaced most of the agricultural operations, which have moved to eastern Lake County townships. 84% of the watershed is urban land use, 12% is forest lands and 3% is in agricultural uses.

The watershed contains the Mentor Marsh, an 868 acre exceptional natural marshland within the watershed (Figure 5). The Mentor Marsh is a wooded wetland/swamp complex that formed in an abandoned channel of the Grand River and was isolated from Lake Erie by the accretion of beach sand. It is the largest marsh in Northeast Ohio and is an important habitat for birds, fish and aquatic invertebrates. In 1966, Mentor Marsh received national recognition when it became one of the first areas in the country to be designated as a National Natural landmark by the United States Department of the Interior. On May 19, 1970, the Ohio General Assembly passed the Natural Areas Act, which

formulated procedures by which unique natural sites could be preserved for present and future generations. This authorized the Ohio Department of Natural Resources to establish a statewide system of nature preserves to serve as living sanctuaries for scientific, educational and aesthetic purposes. Mentor Marsh was one of the first four natural areas to be incorporated into the state nature preserve system. On May 10, 1973, 619 acres of the marsh were dedicated as an interpretive state nature preserve by the Cleveland Museum of Natural History, the first Ohio property owner to dedicate its property under the Natural Areas Act.

The marsh ecosystem has changed dramatically in recent history, with the development of salt brine wells and a salt landfill within the marsh in the 1950's. The salt contamination has caused a transition from the swamp forest and wetland vegetation to predominantly Common Reed (*Phragmites australis*), a salt-tolerant invasive species.

The 868 acre Mentor Marsh is an integral resource of the watershed. It is a wooded wetland/swamp complex that formed in an abandoned channel of the Grand River and was isolated from Lake Erie by the accretion of beach sand. It is the largest marsh in northeast Ohio and provides nesting grounds for birds, spawning areas for fish and habitat for aquatic invertebrates. It has transitioned from a wooded wetland to one composed largely of Common Reed (*Phragmites*) because of salt infusion from mining and disposal in the watershed.

Several streams drain to the Marsh: Marsh Creek- which is the largest, and Blackbrook Creek. The marsh has two surface water outlets and the direction of flow within the marsh is not well known. Seiches occur regularly and alter the flow directions in the marsh. A seiche is a short-term and rapid fluctuation that occurs on the Great Lakes due to wind or storm surges, which push the water level up at one end of the lake and make it drop at the opposite end. Seiche comes from the French word meaning "to sway back and forth".

The Mentor Lagoons are another feature of the marsh and create a distinctive mark on the landscape (Figure 2). The area was partially developed in the early 1920's by local wealthy residents, as a "Venice of the North". It was never completed and serves today as a marina owned by the City of Mentor.

Figure 2: Mentor Lagoons (circa 1957)

Figure 3: Watersheds within the HUC 12

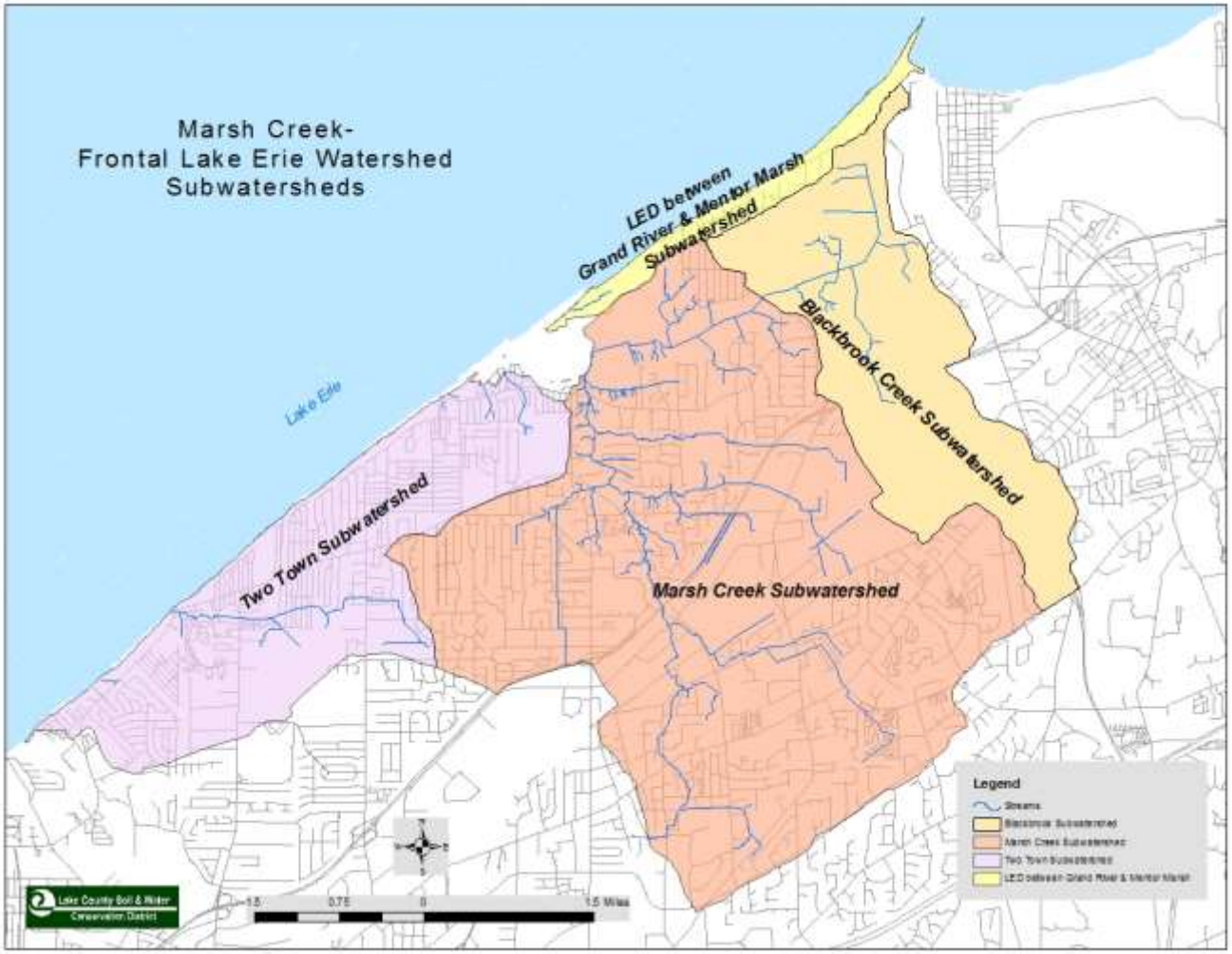


Figure 4: Watershed Communities

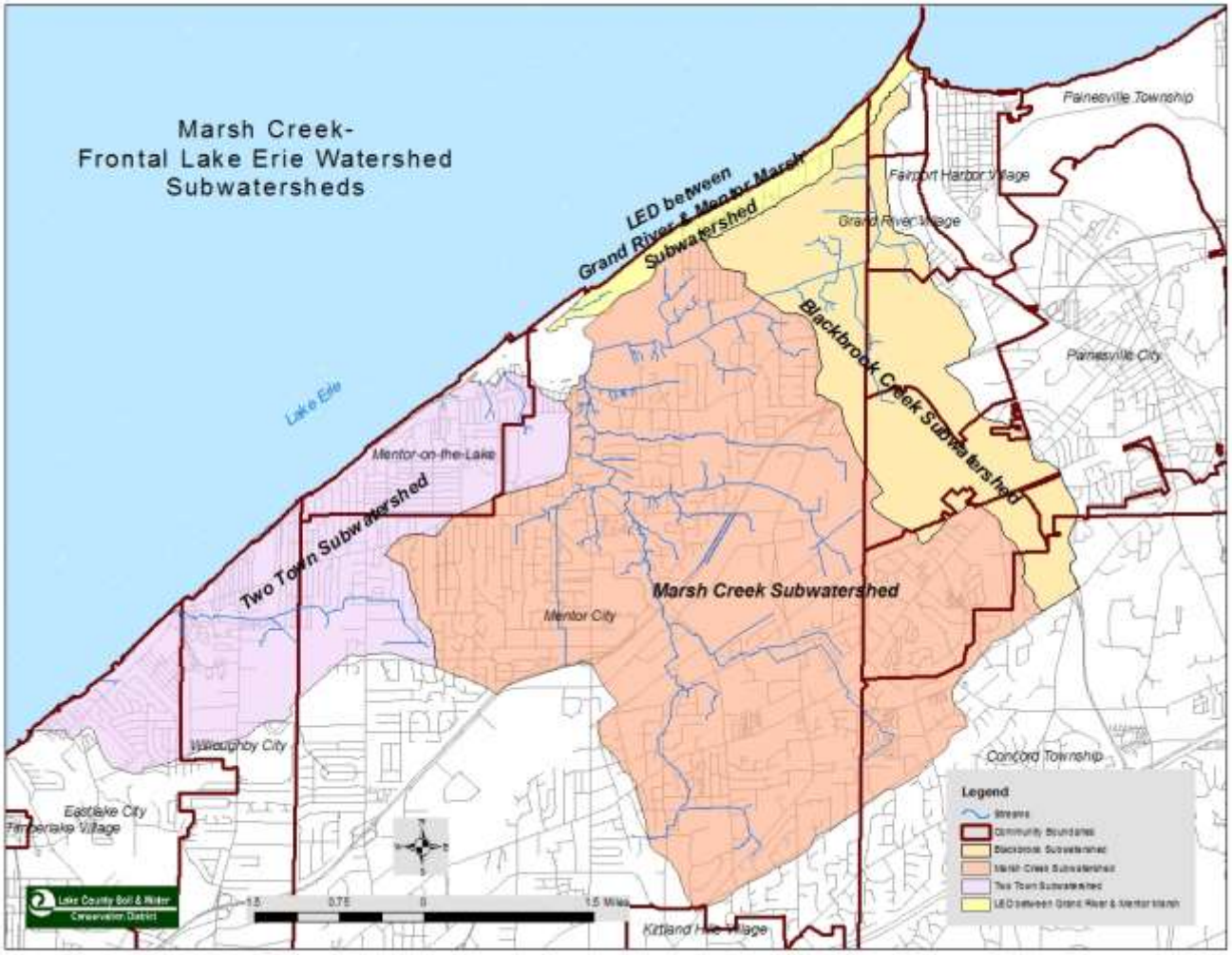
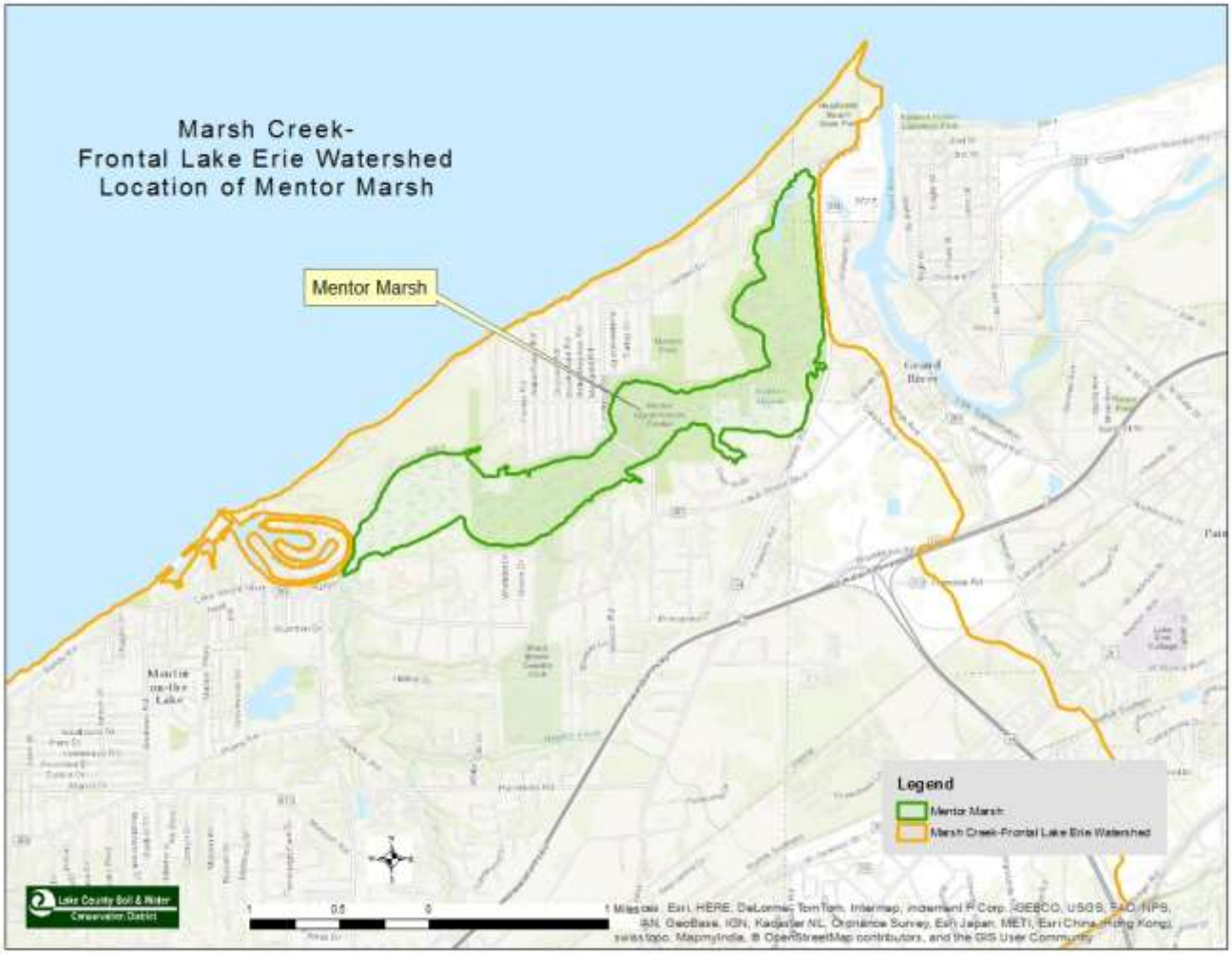


Figure 5: Location of Mentor Marsh



1.3 Public Participation and Involvement

This watershed action plan was created with the input of members of the community, local officials, state and local agencies. The stakeholder group included:

1. Watershed residents
2. Local businesses: CT Consultants
3. Community organizations: Sierra Club
4. Local and State government agencies: Ohio EPA, Lake County General Health District, Lake County Engineer, Lake County Stormwater Management District, Lake County Planning & Community Development, Lake County Soil & Water Conservation District, Lake County Sanitary Engineer, City of Mentor, Ohio State University Extension/Sea Grant, Painesville Township, The City of Painesville, Northeast Ohio Areawide Coordinating Agency, Ohio Department of Transportation, Village of Grand River, City of Eastlake, Concord Township and MARC members
5. Educational institutions: Cleveland Museum of Natural History,
6. Non-Governmental organizations: Chagrin River Watershed Partners, Western Reserve Land Conservancy

Chapter 2: HUC-12 Watershed Characterization and Assessment Summary

2.1 Summary of HUC-12 Watershed Characterization

2.1.1 Physical and Natural Features

A brief set of descriptive data follows.

Population

1980	52,291
1990	55,989
2000	60,594

People

Rural	20
Urban	60,600
Agricultural	0
In Labor Force	33,996

Education

Enrolled K-12	11,719
Enrolled College	2,683
Completed <9th	22,190
Completed HS diploma or GED	13,794
Some college	9,984
Associates degree	2,813
Bachelor's degree	6,353
Graduate degree	3,005

Households

Average Size	2.6
Average Income	$62,668

Soil Resources

Prime farmland	15,588.5 ac
Highly erodible land	7,343.5 ac
Frequently flooded	1170 ac
Hydric	4,855 ac
Soil Drainage	
Well	3,332 ac
Moderately well	711 ac
Somewhat poorly	7,303 ac
Poorly drained	3,957 ac

Water Resources

100 year floodplain	2,769 ac
Wetlands (2007)	1,156 ac
Ponds & lakes	829 ac
Streams & rivers	33 ac
Approx. number of water wells	180
Highly sensitive to groundwater contamination	18,112 ac
Ohio EPA permitted CSOs	0

Land Use and Environment

Conservation & recreation land	1,981 ac
Ohio EPA NPDES industrial & municipal discharge permits	3

Dams	3		
Ecological region:	Erie Lake Plain, Erie Gorges		

Land Use (acres)	**1994**	**2001**	**2009**
Agriculture	3,292	1,282	512
Water	1,351	2,542	239
Urban	3,263	10,764	15,204
Forest	9,640	3,471	2,086
Barren	26	0	29
Shrub/scrub	459	71	0

Ohio EPA Aquatic Life Use Designation	
Coldwater Habitat (CWH)	0
Exceptional Warmwater Habitat (EWH)	0
Warmwater Habitat (WWH)	11.9

Source: 2011 ERIN Watershed Report

Topography

The watershed is located in the Lake Plain physiographic region. A small part of the southern extent of the watershed is on the escarpment or end moraine belt that marks the boundary between the Lake Plain region and the Allegheny Plateau. The Lake Plain is characterized by glacial sediment overlaying Devonian shale, ranging from fine sand, silt and clay. The Lake Plain is relatively flat and is poorly drained in most places. The elevation ranges from 780 feet above sea level in the southern watershed boundary on the Allegheny Plateau to 580 feet along the Lake Erie shoreline, a change of 200 feet (Figure 6).

Figure 6: Topography

Geology & Glacial History

The Marsh Creek-Frontal Lake Erie Watershed is in the glaciated plateau of Ohio and underlain by the Lake Plain (Figure 7). The Lake Plain averages 4 miles in width. It is relatively level and characterized by poor drainage, except where there are beach remnants from ancient lakes. Early Lake Erie was more than 200 feet higher than it is today. As the glaciers retreated, lower outlets were uncovered by the melting ice and the lake decreased in size and elevation. The beach ridge deposits that were left behind are the location of the progressively lower shorelines.

Three sandy and gravelly ridges, from earlier higher lake levels parallel the present Lake Erie shoreline, are identifiable by the three major roads running in an east-west direction- North Ridge (ancient Lake Warren), Middle Ridge and South Ridge/Johnny Cake Ridge (ancient Lake Whittlesey) Roads. The South ridge road- Johnny Cake Ridge Road ridge is the approximate boundary between the lake plain and the Portage Escarpment. These beach-dune ridges were early Native American trails and were important in the European settlement of the region because of their sandy, slightly elevated ground, which provided well-drained, nearly level areas for roads and homesites.
The watershed is underlain by Chagrin Shale bedrock of Devonian age, part of the Paleozoic area which lasted about 416 to 2.8 million years ago. The gray shales and siltstones of the Chagrin Shale

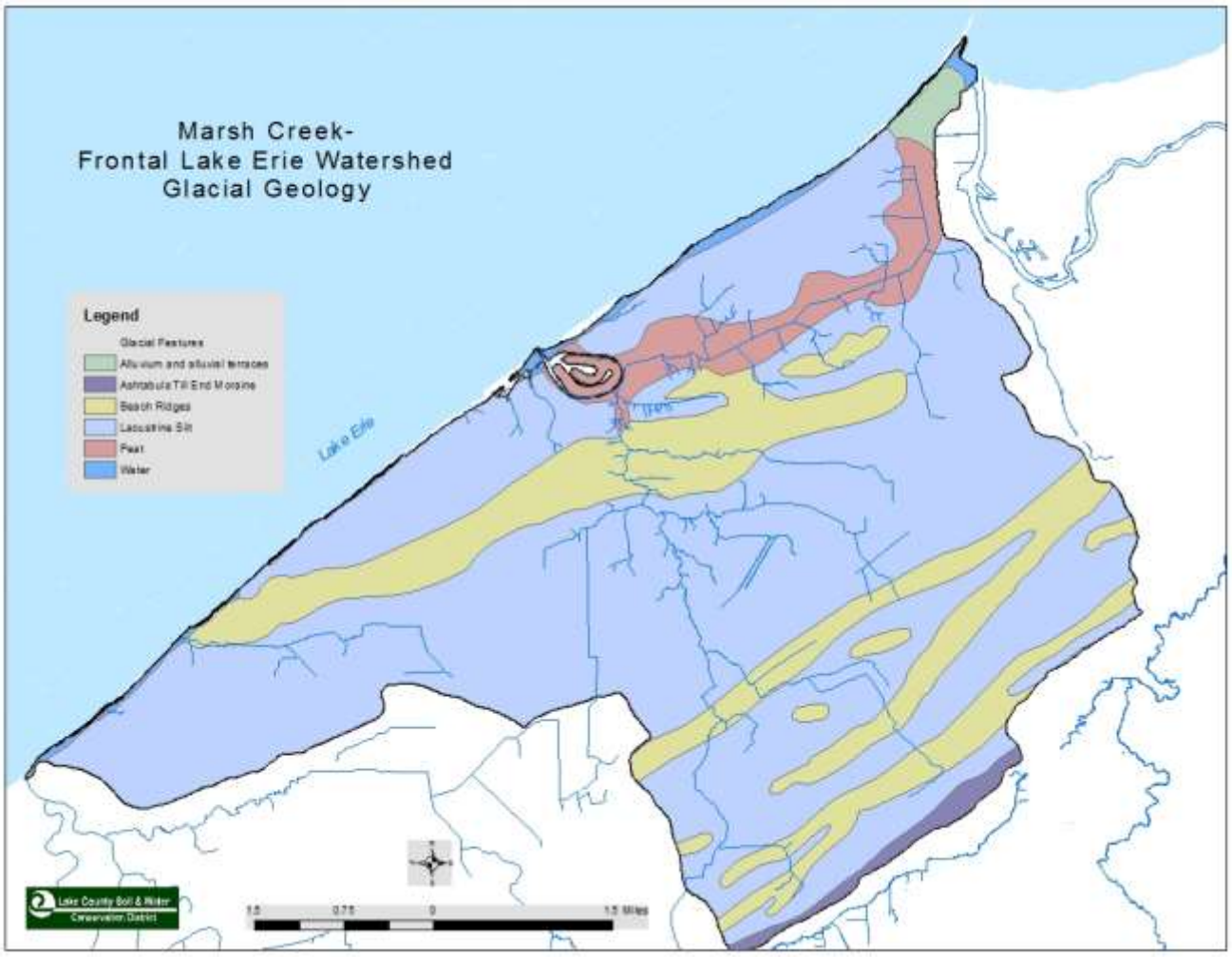
were deposited as sea-bottom muds in alternating layers which were compressed over time into shale and siltstone. The Chagrin Shale bedrock is close to the surface in some areas and exposed in some stream beds.

The last glacial advance into the watershed (and Ohio) was the Ashtabula advance, which occurred in a narrow belt along Lake Erie. This advance deposited the Ashtabula Till, which contains a high proportion of ground-up shale from the bottom of the lake. Ashtabula Till is calcareous, silty, clayey and somewhat pebbly. The sand content is less than 20 percent, the clay content is generally about 35 percent and the silt content is generally greater than 50 percent. This high silt content distinguishes the Ashtabula Till from all other tills in Ohio, which have less than 50 percent silt content. The Ashtabula Till ranges from thick wedges to thin veneers over earlier tills. On the Lake Plain, lacustrine silt and clay overlie the Ashtabula Till in large areas.

The Lake Plain is characterized by ephemeral and low quality Warmwater streams.

The Watershed is underlain by rock formations that contain Marcellus and Utica oil shales, deeper resources that can be mined through hydraulic fracturing- more commonly called “fracking”. Large amounts of water are needed in the drilling process, and the potential for environmental degradation can be high if proper regulations are not implemented for this emerging industry in Ohio.

Figure 7: Glacial Geology



Soils

The soils in the watershed reflect the glacial history of the region and can be divided into four categories: soils on the lake plain and offshore bars; soils on beach ridges, terraces and offshore bars; soils on flood plains, terraces and marshes; and soils on till plains (Figure 8). Refer to the Soil Survey of Lake County, Ohio for more information about the soils and their properties.

More than 76% of the soils have severe limitations for development because of seasonal wetness.

Five soil types are designated by the United States Department of Agriculture (USDA) as "unique and of local importance" for agricultural production:

- Elnora loamy fine sand
- Granby sandy loam
- Kingsville fine sand
- Otisville gravelly loamy sand
- Stafford loamy fine sand

Three soil types are designated Prime Farmland and Special because they have sandy textures favorable for specialized nursery production.

The agricultural industry has been historically important and continues to be an important economic driver and measure of the quality of life in Lake County. Agricultural land use in the watershed has declined from 3,877 acres in 1994 to 1,770 acres in 2009, a drop of 45%.

Soil drainage characteristics information is essential for siting Best Management Practices (BMPs) so that they will work properly. BMPs such as rain gardens and pervious pavers that are based on infiltration are best suited for well drained soils (in shades of green, Figure 9), whereas wetlands and on-site storage BMPs should be utilized in hydric soils (in shades of blue, Figure 9).

Figure 8: Soils

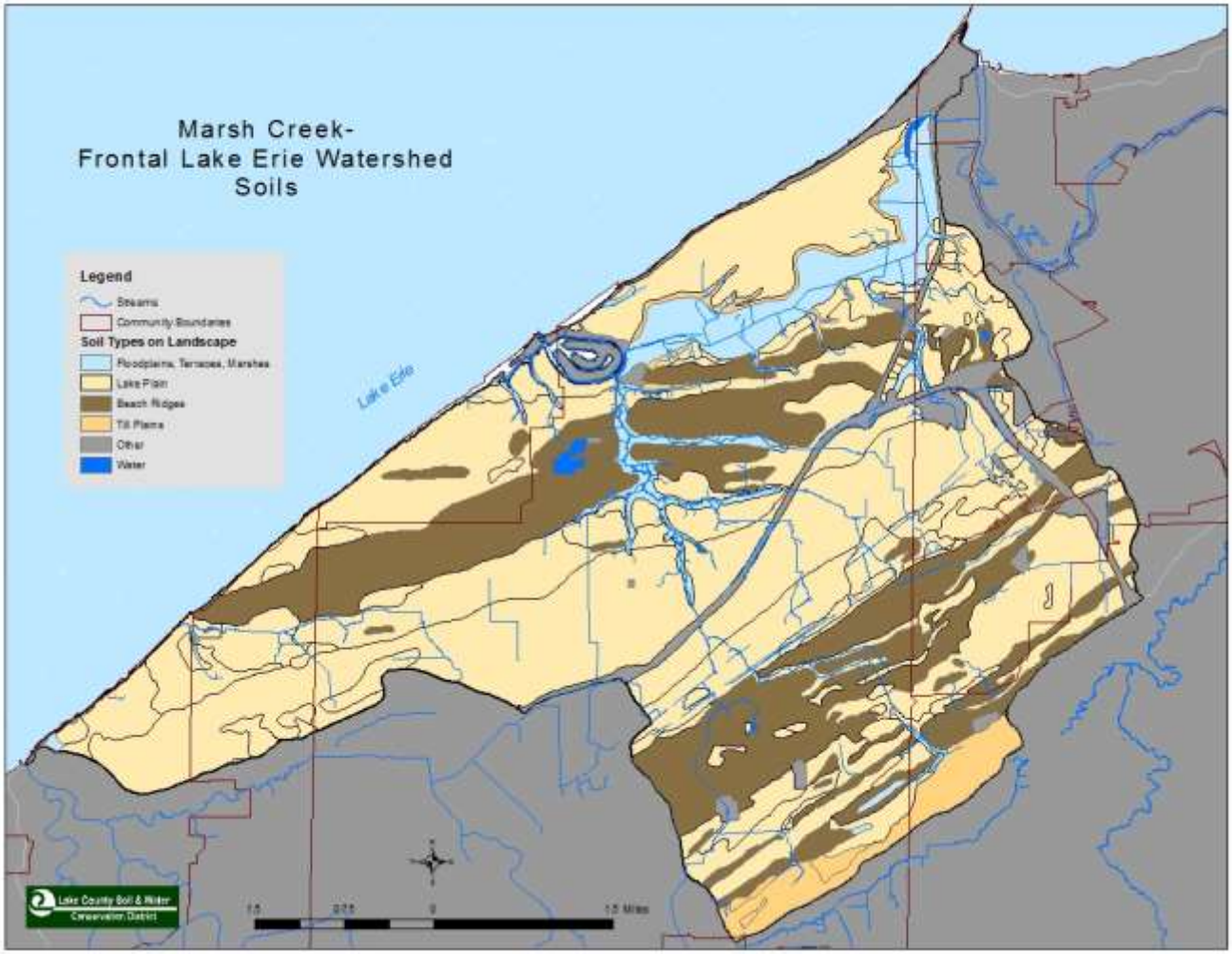
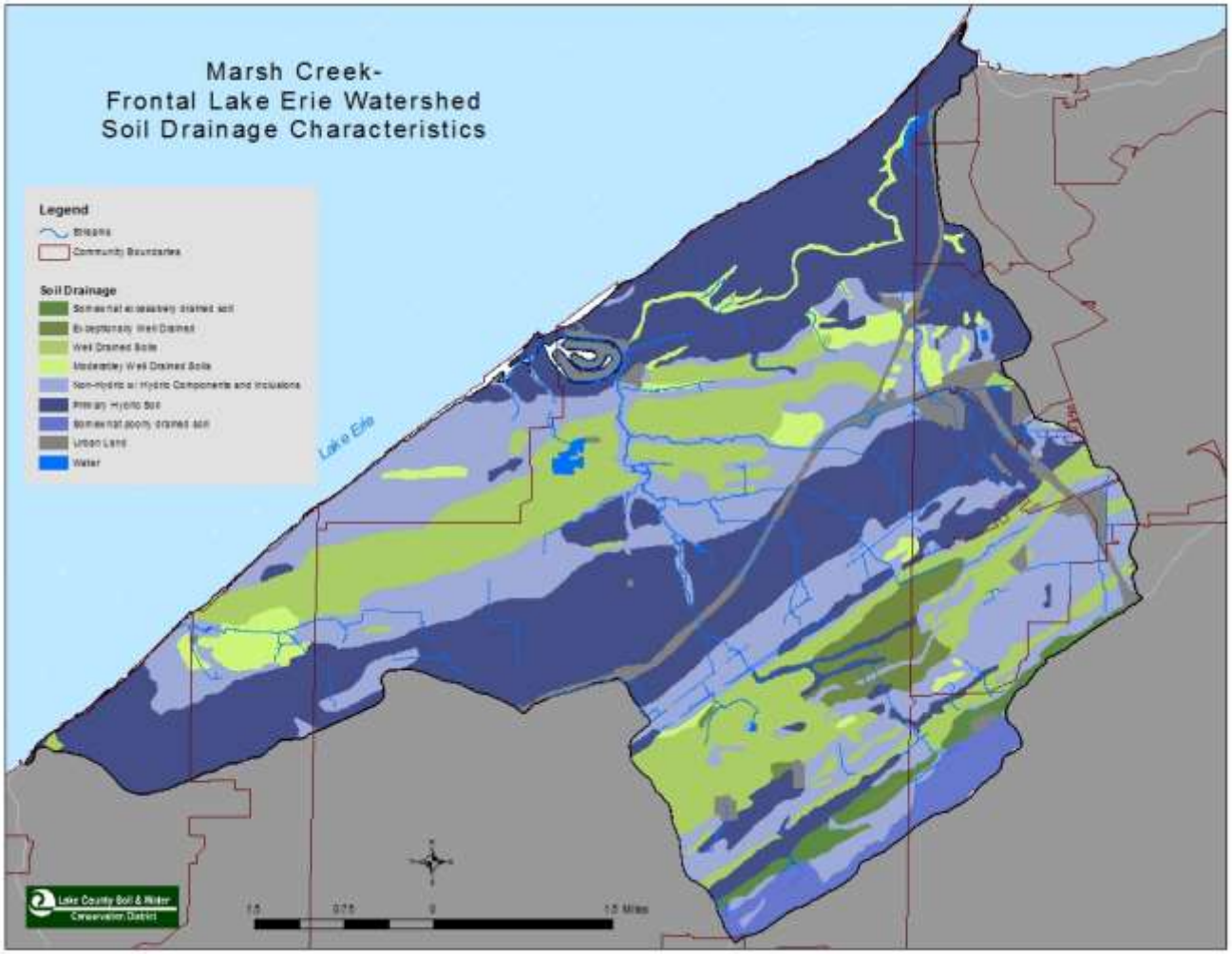


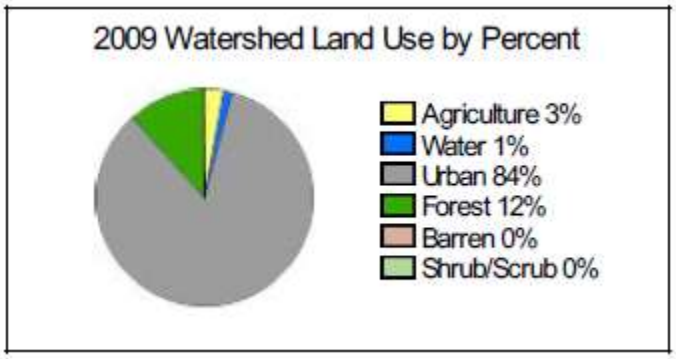
Figure 9: Soil Drainage Characteristics



2.1.2 Land Use and Protection

The ERIN Watershed Report delineated 84% of the land use as urban in 2009, with forest the next highest percentage at 12% and agriculture at 3% (Figure 10).

Figure 10: Land Use Percentage (ERIN Watershed Report 2009)



14% of the land is publicly owned, though a large portion of that (53%) is protection of Mentor Marsh lands (Figure 11).

Figure 11: Public and Protected Lands

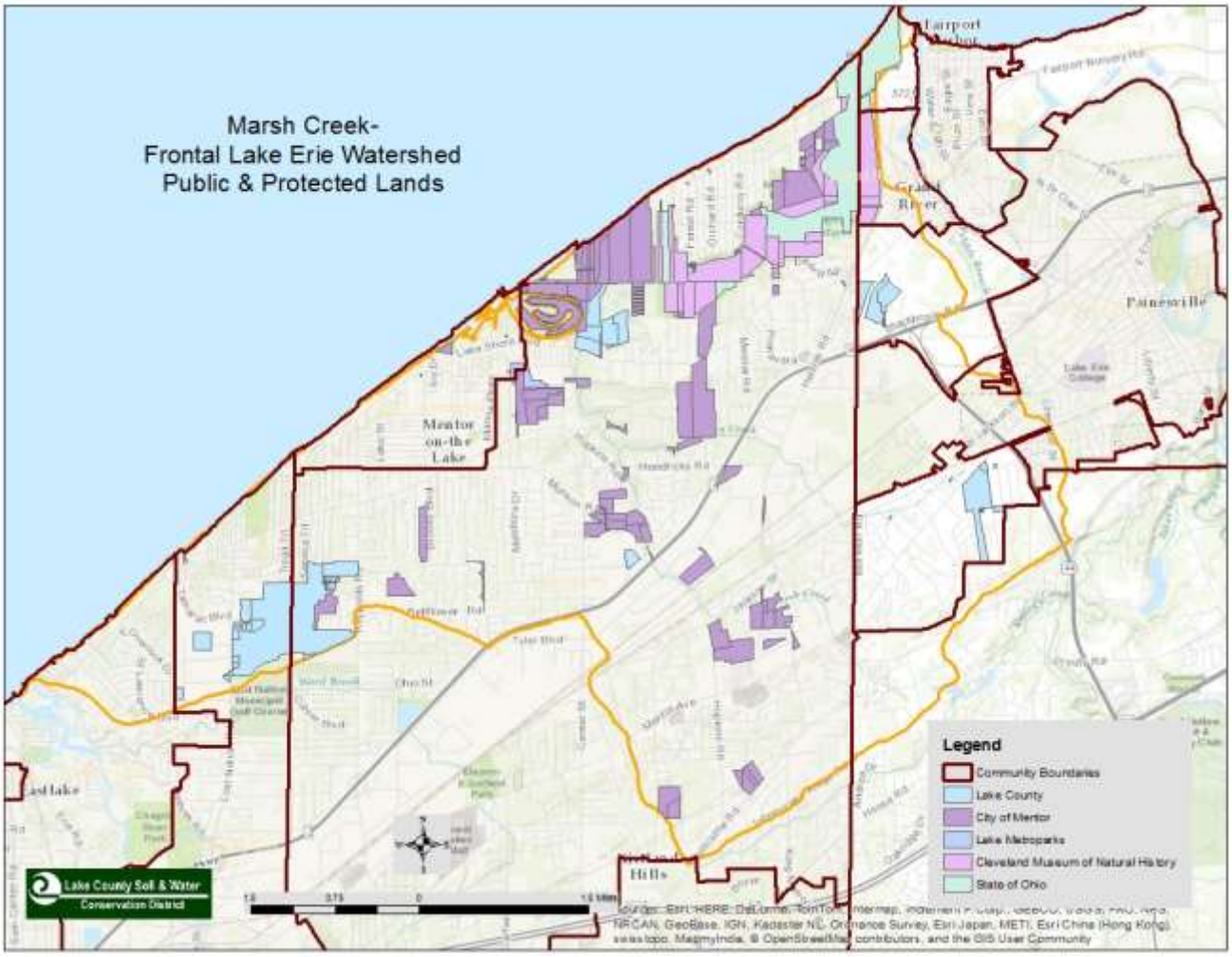


Figure 12: **Orthophoto of Watershed**

The watershed is nearly completely developed, as is apparent from an orthophoto view (Figure 12). Imperviousness of a watershed has an effect on the physical and biological characteristics of a stream. Increases in impervious cover cause decreases in conditions. Channel instability will occur when the impervious area is greater than 10%. Sharp declines in macroinvertebrate diversity occur when imperviousness is greater than 8%. (Vulnerability Analysis report, Center for Watershed Protection, 2002.) U.S. Geological Survey StreamStats data show the imperviousness in selected subwatersheds as follows:

- Marsh Creek- 25.7%
- Blackbrook Creek- 23.8%
- Two Town Creek- 25.4 %

All of them are at least two times greater than the balance point. Opportunities for retrofits with green infrastructure should be utilized wherever possible.

Dams

The 2009 ERIN Watershed Report states that there are 3 dams in the watershed, however the stakeholders have identified only one, which is on Marsh Creek north of Hendricks Road and south of Lakeshore Boulevard (Figure 13).

Figure 13: Dam Location

2.2 Summary of HUC-12 Biological Trends

The Ohio EPA has designated 11.9 miles of Warmwater Habitat in the Marsh Creek-Frontal Lake Erie Watershed.

There is no TMDL (Total Maximum Daily Load) for the watershed. The EPA's 2014 Integrated Report reported the Aquatic Life Use Assessment as Impaired; TMDL needed.

The Marsh Creek-Frontal Lake Erie Watershed is on the Section 303(d) List of Prioritized Impaired Waters in the Ohio 2010 Integrated Report. The assessment categories are shown in Figure 13, where 3 means "Use Attainment Unknown", 5 means "Impaired; TMDL needed", h means "historical data", and x means "Retained from 2008 IR (interim report)". A TMDL was projected to be done in 2017.

Figure 14: Section 303(d) List

Human Health	*Recreation*	*Aquatic Life*
3	3	5hx

EPA 2015 Field Sampling, Draft Data

Marsh Creek was sampled by the EPA in the 2015 field season (Figure 16). Marsh Creek was found to be in non-attainment in the draft of causes/sources (Figure 15), causing- in part, this subwatershed to be designated as the Critical Area for this plan.

Figure 15: Marsh Creek WWH Aquatic Life Use (Draft)

Mile	**IBI**	**ICI**	**QHEI**	**Attainment Status**
1.5	26	Low/Fair	61.5	**NON**
.2		Poor		

Figure 16: Marsh Creek 2015 Ohio EPA Sampling Sites

EPA 2010 Integrated Watershed Report
The 2010 report stated that "the overall status of this waterbody is Impaired" (Figure 17).

Figure 17: Water Quality Assessment for Reporting Year 2010

Designated Use	Designated Use Group	Status
Aquatic Life Use	Fish, Shellfish and Wildlife Protection And Propagation	**Impaired**

Headwater Habitat Evaluation Index
Lake SWCD worked with the EPA to develop and collect Headwater Habitat Evaluation Index (HHEI) data for Lake County watersheds to establish a baseline database of existing conditions. HHEI data was collected by Lake SWCD staff in the Marsh Creek and Blackbrook subwatersheds in the summer of 2007. 21 sites were assessed, with the majority in Marsh Creek. There were no sites assessed as Class III. 76.2 % were assessed as Modified (Figures 18 and 19). See Figure 20 and the following text for an explanation of the Ohio Stream Classification system.

Figure 18: Stream Class Percentages

Class	%
Class I	14.3
Class I Modified	43
Class II	9.5
Class II Modified	33.2
	100

Figure 19: Stream Class

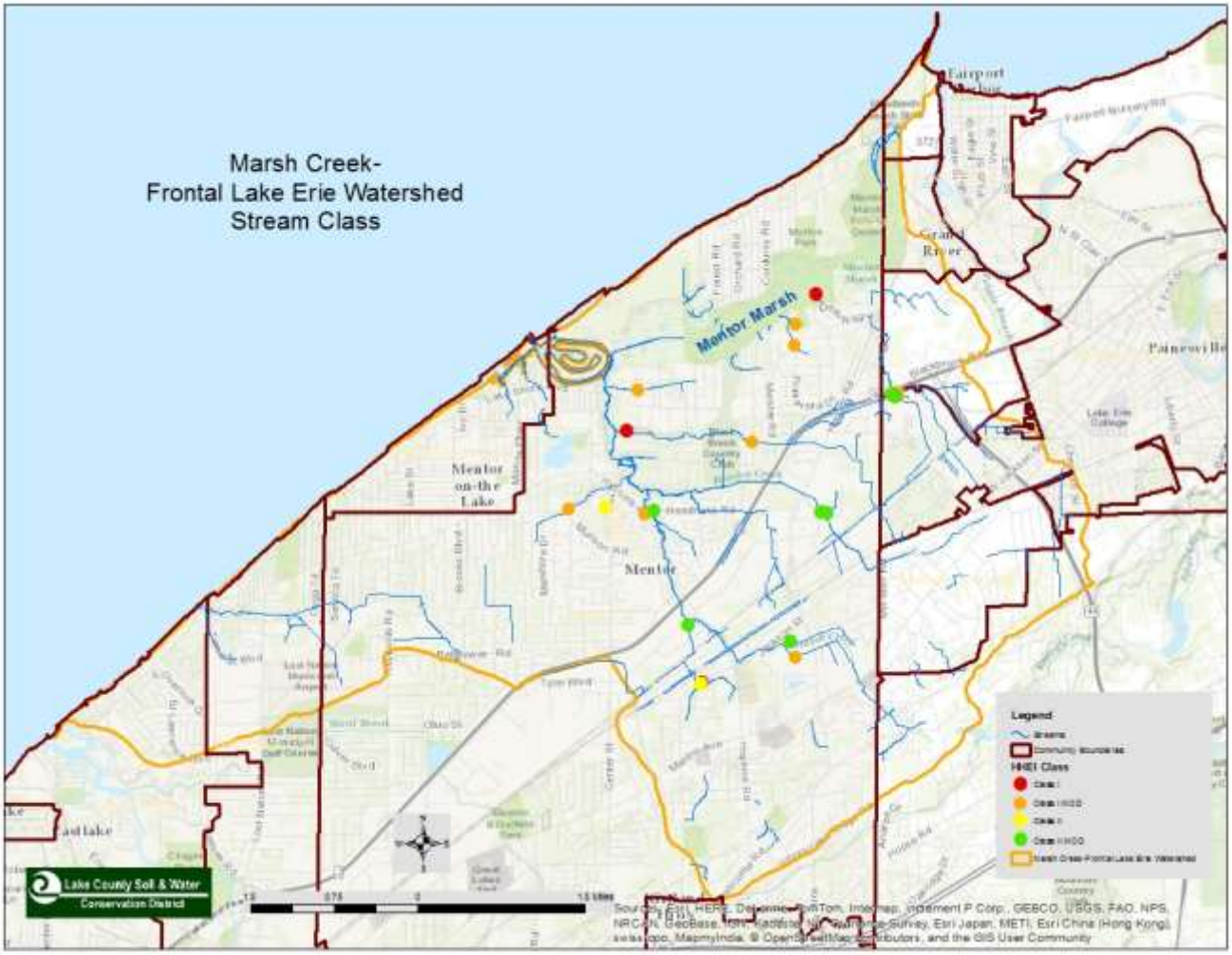
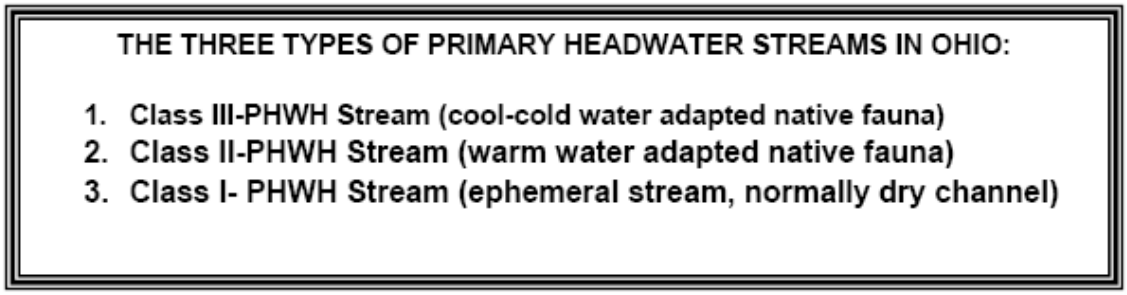


Figure 20: Three Types of Primary Headwater Streams in Ohio (OEPA. 2009.)



Class III-PHWH (Primary Headwater Habitat) streams have a diverse population of native fauna adapted to cool-cold perennial flowing water, with larval stages continuously present in the stream. They exhibit the highest quality of headwater stream habitat, with HHEI scores > 70.

Class II-PHWH streams have a moderately diverse population of warm-water adapted native fauna on a seasonal or annual basis. They are usually intermittent streams, but may have perennial flow in some instances. Class II streams will score between 30 and 70 on the HHEI.

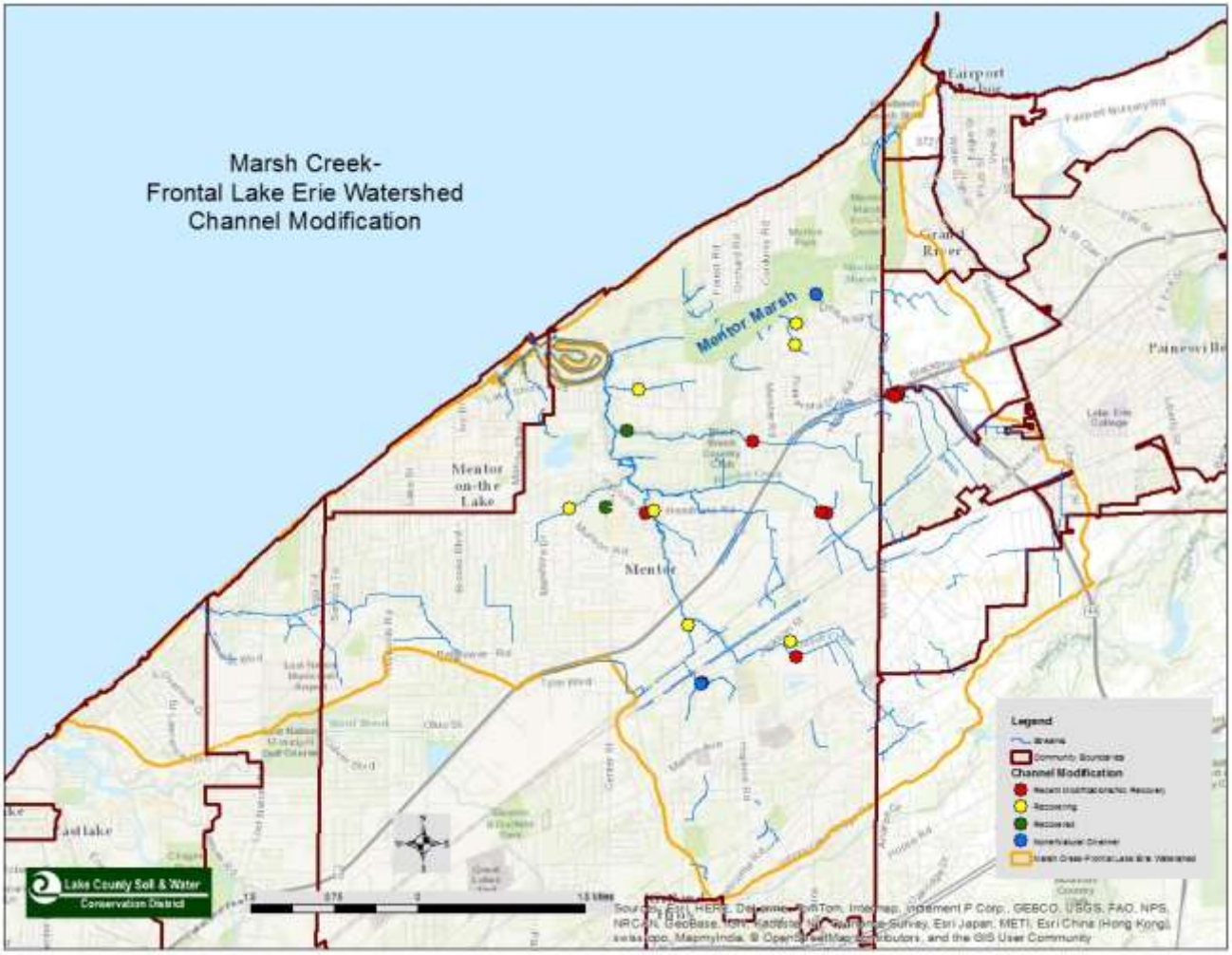
Class I-PHWH streams are ephemeral, with water present for short periods of time, from snow melt or rainwater runoff. Since they are normally dry, there is little or no aquatic life present. They score <30 on the HHEI and do not provide good habitat for salamanders or macroinvertebrates.

The primary physical habitat distinction between Class I and Class II- PHWH streams is that Class II-PHWH streams are watered- either with the presence of flowing water or isolated pools during the summer months, and Class I-PHWH steams are dry. The primary biological habitat distinction is that Class I-PHWH streams have either no species of aquatic life present or the biological community has poor diversity. (OEPA. 2009.)

A natural "stream channel is characterized by the presence of riffles and pools, heterogeneous substrate deposition, the presence of point bars or other evidence of floodplain sediment deposition, appropriate stream channel sinuosity for the setting of the stream in the landscape, varied water depths and current velocity (when flowing), no obvious evidence of current or past bank shaping or armoring activities is present. Natural wooded or wetland riparian vegetation dominates the stream margin." (OEPA. 2009.)

When channels have been historically altered by man, they are categorized as "Modified". This can include a status of "Recovered", where the stream shows evidence of channel alteration, but has fully recovered many of the natural stream channel characteristics listed above; "Recovering", where there is evidence of alteration and the stream is in the process of adjusting, channel sinuosity is lacking and riparian vegetation is in early stages of re-growth; and "Recent or No Recovery", where alteration is evident and few if any natural characteristics are present. Highly modified streams are characterized by uniform depths, over-wide channels, homogeneous substrates, embeddedness of substrates and low sinuosity. (OEPA. 2009.)

Figure 21: Channel Modification



When the HHEI assessment was done in 2007, 43% of the channels were identified as recent with no recovery, 33.2 % as recovering, and 23.8% as recovered or natural channel. Figures 23, 24 and 25 illustrate the different stream classifications within the watershed.

Figure 22: Channel Modification Percentages

Channel Modification	%
Recent/No Recovery	43
Recovering	33.2
Recovered	9.5
None/Natural Channel	14.3
	100

Figure 23: Class I Modified Stream, Recent, No Recovery in Marsh Creek Subwatershed

Figure 24: Class II Modified Stream, Recovering in Marsh Creek Subwatershed

Figure 25: Class I Stream, Natural Channel in Marsh Creek Subwatershed

2.3 Summary of HUC-12 Pollution Causes and Associated Sources

The Ohio EPA 2010 Waterbody Report determined causes of impairment for Aquatic Life Use to be flow alterations and organic enrichment/low dissolved oxygen (Figure 26).

Figure 26: Causes of Impairment for Reporting Year 2010

Cause of Impairment	Cause of Impairment Group	Designated Use	State TMDL Development Status
Flow Alteration(s)	Flow Alteration(s)	Aquatic Life Use	TMDL needed
Organic Enrichment/Low Dissolved Oxygen	Organic Enrichment/Oxygen Depletion	Aquatic Life Use	TMDL needed

The Ohio EPA 2008 Waterbody Report for Lake Erie Tributaries (East of Cuyahoga River to West of Grand River, excluding Chagrin River) determined causes of impairment for Warmwater Habitat to be dissolved oxygen, organic enrichment (sewage), biological indicators and other flow regime alterations (Figure 27).

Figure 27: Causes of Impairment for Reporting Year 2008

Cause of Impairment	Cause of Impairment Group	Designated Use	State TMDL Development Status
Dissolved Oxygen	Organic Enrichment/Oxygen Depletion	Warmwater Habitat	TMDL needed
Organic Enrichment (Sewage) Biological Indicators	Organic Enrichment/Oxygen Depletion	Warmwater Habitat	TMDL needed
Other Flow Regime Alterations	Flow Alteration(s)	Warmwater Habitat	TMDL needed

The Ohio EPA projects a TMDL in 2017.

The Ohio EPA 2010 Integrated Report "Lake Erie Assessment Unit Summary" for the Lake Erie Central Basin Shoreline lists the following Causes of Impairment and Sources of Impairment.

Causes of Impairment:

- Nutrients
- Siltation
- Direct habitat alterations
- Exotic species

Sources of Impairment:

- Municipal point sources
- Combined sewer overflows
- Non-irrigated crop production
- Urban runoff/storm sewers
- Streambank modification/destabilization
- Habitat modifications other than hydromodification
- other

The Ohio EPA 2014 Integrated Report does not list any data for this watershed. All Use Assessments are listed as unknown.

The most recent report, the 2016 Integrated Report lists a Recreational Use Assessment as Impaired, with Causes of Impairment as bacteria. The Aquatic Life Use Assessment did not have "current or historical data" collected from the assessment unit.

2.4 Additional Information Determining Critical Areas and Developing Implementation Strategies

2.5.1 Early efforts to preserve the Mentor Marsh

Appreciation of the Mentor Marsh began with the settlers. The Burroughs Nature Club was one of the earliest groups to begin expressing the need for the preservation of land around the marsh. In 1951, the State of Ohio acquired 125 acres of beach, marsh and woodland for Headlands Beach State Park. Broader efforts to preserve the entire marsh began in 1960 in response to a proposed plan to dredge the marsh and create docking, playground and picnic facilities. The Burroughs Nature Club spearheaded the formation of the Mentor Marsh Committee to work on preservation of the marsh.

In 1965, the Morton Salt Company donated surface rights to 320 acres of marsh to the State of Ohio, and the Diamond Alkali Company donated surface rights to 90 acres to The Nature Conservancy. A successful fundraising campaign by the Mentor Marsh Committee and the Ohio Chapter of The Nature Conservancy enabled the Conservancy to acquire an additional 80 acres of prime swamp forest. Custody of the newly created sanctuary was transferred to the Cleveland Museum of Natural History. The Mentor Marsh Committee was responsible for the day-to-day management and development of the marsh as a "living museum".

In 1966, Mentor Marsh became one of the first areas in the country to be designated as a National Natural Landmark by the U. S. Department of the Interior, because it possessed "exceptional value in illustrating the natural history of the United States." On May 19, 1970, the Ohio General Assembly passed the Natural Areas Act, authorizing the Ohio Department of Natural Resources to establish a statewide system of nature preserves to serve as living sanctuaries for scientific, educational and aesthetic purposes. Mentor Marsh was one of the first four natural areas to be incorporated into the new state nature preserve system. On May 10, 1973, 619 acres of the marsh were dedicated as an interpretive state nature preserve by the Cleveland Museum of Natural History, the first dedicated under the Natural Areas Act.

The Marsh Area Regional Coalition (MARC) founded in 1999 as a concentrated effort to manage the natural resources on a watershed scale. The primary mission of the MARC was to:

- Develop and promote a management plan
- Protect and enhance the environmental, social, and economic assets of the Mentor Marsh area

The MARC is committed to ensuring the legacy of a diverse ecosystem and fostering economic and social well-being in the marsh area and surrounding communities through innovative planning and stewardship.

2.5.2 Special Area Management Plan (SAMP)

The MARC completed a Special Area Management Plan (SAMP) in June 2004, with the assistance of the Ohio Coastal Management Plan and the National Oceanic and Atmospheric Administration. The SAMP outlined the natural resource and development issues, plans for implementation, funding and timelines, responsibilities, performance measures and plans to update the SAMP. The SAMP became the primary guidance for activities of the MARC.

Five critical main issues were identified and prioritized in the SAMP:

1. Water Quality, with salt contamination a High Priority
2. Land Use and Economic Development, with uncoordinated land use planning a High Priority
3. Wetlands and Biodiversity- biodiversity loss, hydromodification, natural disturbances and public understanding and attitudes were all High Priority
4. Recreation and Public Access, with lack of a strategic recreation plan a High Priority
5. Shoreline Management and Nearshore Issues

2.5.3 Mentor Marsh Watershed Action Plan

In 2006, the MARC developed the Mentor Marsh Watershed Action Plan (WAP) with the assistance of the Lake County Soil & Water Conservation District (SWCD), to meet the new state and federal standards for eligibility for grant funding of watershed projects. The plan built on the foundation of the SAMP, and new issues were identified through open meetings with the community, a landowner survey, consultant work and special task forces.

The WAP followed updated guidelines developed by the Ohio Department of Natural Resources and the Ohio Environmental Protection Agency for watershed action plan endorsement. The Mentor Marsh WAP was conditionally endorsed. To receive full endorsement, a TMDL (Total Maximum Daily Load- which represents both a pollutant cap and a restoration or management plan) was required for endorsement and the EPA had no plans to undertake a TMDL study.

2.5.3 Marsh Creek-Frontal Lake Erie Watershed Action Plan

Lake SWCD initiated the update of the Mentor Marsh WAP in December 2013. The WAP endorsement process evolved in the interval following 2006 to allow endorsement without having a TMDL. The update of the plan covered the 12-digit Marsh Creek-Frontal Lake Erie Watershed, HUC 041100030501, so the plan expanded on the Marsh Creek and Blackbrook Creek watershed to add new areas: Two Town Creek and the Lake Erie Direct between Grand River and Mentor Marsh watersheds. Work on the plan was discontinued in 2014 when the Ohio EPA received a directive from the US EPA to revise its watershed planning process.

The Problem Statements, Goals and Objectives were as follows:

1. Mentor Marsh is impaired due to salt pollution from salt wells, salt mine tailings, improperly designed and maintained salt fills, and abandoned brine fields.
    a. Reduce the Sodium levels below 57 mg/L and Chloride levels below 51 mg/L
        i. Stop the influx of salt into the Marsh
2. The biodiversity of the unique wetland and coastal ecosystems is threatened by development.
    a. Restore the native wetland communities
        i. Mitigate wetlands
        ii. Restore the estuary on the eastern end of the Mentor Marsh
        iii. Reduce the phragmites
    b. Restore the swamp forest in the Marsh
        i. Reduce the deer damage
        ii. Plant trees
    c. Protect the Marsh from the effects of development
        i. Create buffers

ii. Develop coordinated land use planning
iii. Educate landowners
iv. Reduce the effects of hydromodification
v. Address coastal ecosystem issues
vi. Protect the Lake Erie bluff edge
vii. Protect the remaining swamp forest/marsh areas

3. The natural resources of the watershed provide economic development but are threatened by development.
    a. Maintain recreational opportunities
        i. Incorporate a strategic recreation plan in the Western Lake County Comprehensive Coastal Plan
        ii. Promote tourism

2.5.4 US Army Corps of Engineers

The US Army Corps of Engineers began to develop interest in restoring the Mentor Marsh in 2003, under Section 206 of the Water Resources Development Act of 1996, P.L. 104-303. The goal was to develop a project under the Habitat Focus Area, and restore the habitat of the Marsh, which had been jeopardized by salt leaching into the Marsh from old salt mine tailings. The most recent action for the project was a public meeting in January 2015.

2.5.5 US Army Corps of Engineers Stream Assessment

The US Army Corps of Engineers did a field assessment of streams in the Marsh Creek- Frontal Lake Erie Watershed in 2015, by using its Stream Channel Sediment Supply Assessment protocol. The Lake County Soil & Water Conservation District Watershed Coordinator assisted the Corps staff in the data collection.

The field data collection was supplemented by a START (Sediment Transport Analysis and Regional Training) Assessment to demonstrate the use of the web-based tools for determining potential areas of erosion and potential areas of sediment supply and transport within the Watershed. START utilized the HIT (High Impact Targeting) tool, the L-THIA LID (Long-Term Hydrologic Impact Assessment Low Impact Development) tool, and the WEPP (Web-based Water Erosion Prediction Project) model to assist in prioritizing areas of erosion potential and determine where Best Management Practices (BMPs) would be most effective.

Figure 28 shows areas of higher erosion along many of the tributaries and main stem of Marsh Creek, concentrated in the lower portions of the tributaries near their confluence with the Marsh Creek mainstem. There are a few other areas in the headwaters of Wayside Gardens, Heisley Creek and Marsh Creek as well. Total Suspended Solids (TSS), a measure of soil sediment in the water column was measured using the Ohio Sediment Stick. The water quality rating was found to be Impaired in two locations on Heisley Creek and Wayside Gardens (Figure 29). This information has helped to identify project areas.

Figure 28: Marsh Creek Sediment Supply

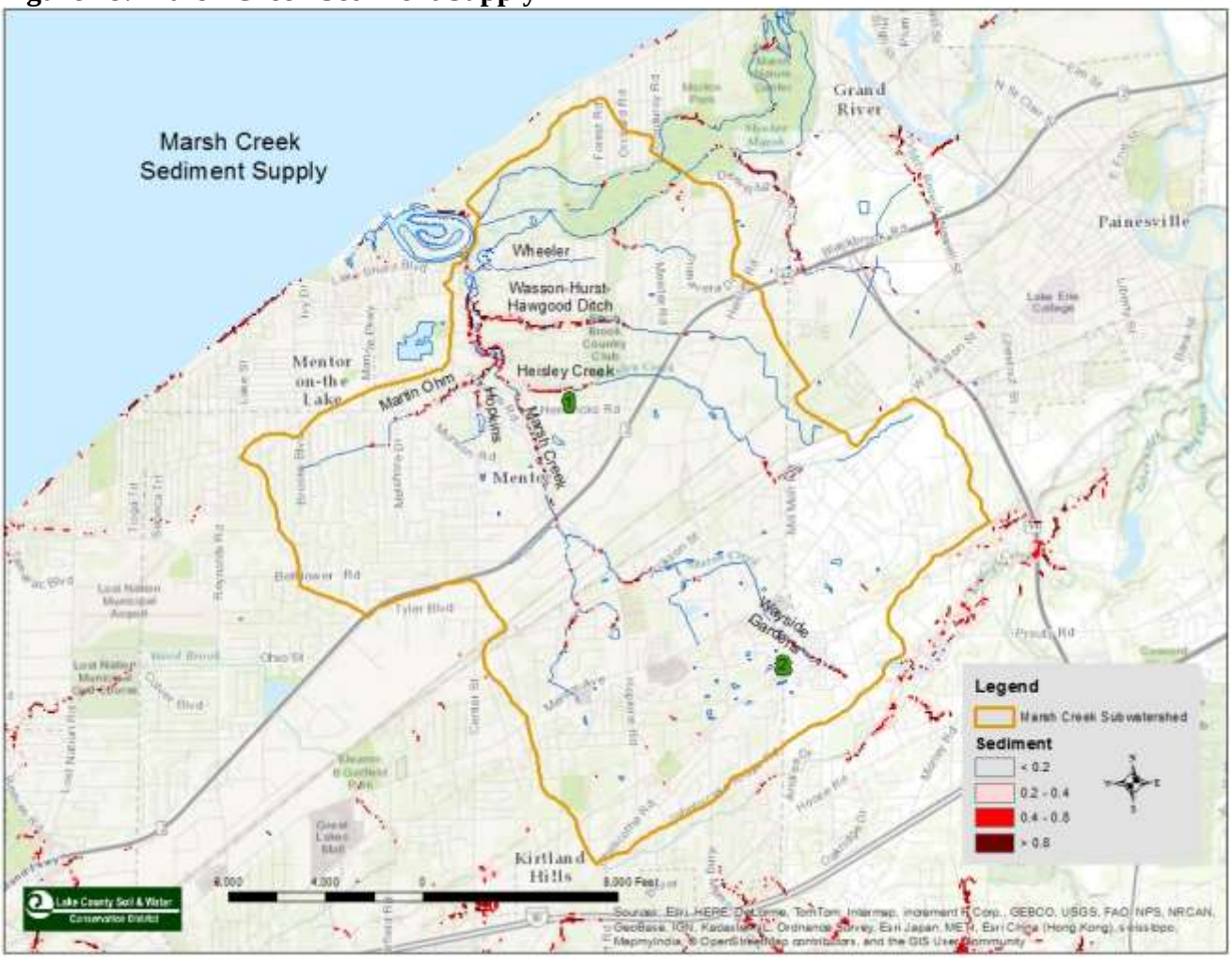


Figure 29: Marsh Creek Estimated TSS (mg/L) on August 26 and 27, 2015

Site	TSS (mg/l) Range	Water Quality Rating
1	45.3	Impaired
2	29.7	Impaired

Readings between 29-133 mg/l indicate impaired water quality

2.5.6 Concord Township Comprehensive Plan

Consultant D. B. Hartt wrote the Concord Township comprehensive plan in 2004. One of the goals is to preserve the Semi-Rural Character of Concord Township. The plan recommends the following:

1. Enhance Township zoning to discourage development in natural areas
2. Secure additional open space for public use through conservation easements
3. Encourage private stewardship of the natural environment on privately owned land
4. Promote residential conservation development zoning for future development
5. Adopt riparian and wetland setbacks

2.5.7 Eastlake Comprehensive Plan

In 2009, the staff of the Lake County Planning Commission wrote a comprehensive plan for Eastlake, through a grant from the Chagrin River Watershed Partners' Chagrin River Balanced Growth Initiative (BGI). In the plan, the Lakeshore is designated as a Primary Conservation Area.

2.5.8 City of Mentor Comprehensive Plan

The City of Mentor was also a part of the 2009 Chagrin River BGI, and its comprehensive plan was written by the Lake County Planning Commission staff.

The Plan goals include:

- Connection of parks to one another
- Development of regulations to protect sensitive land
- Acquisition of land and easements

2.5.9 Painesville Township Comprehensive Plan

The Lake County Planning Commission staff wrote the Painesville Township comprehensive plan in 2007. One of the plan goals is to discourage activities and land uses that could harm waterways and watersheds. The plan contains the following Objectives to help fulfill that goal:

1. Work with county, state and federal agencies to purchase or acquire easements on high priority sites and areas of outstanding natural significance, for restoration and/or preservation.
2. Support appropriate uses along rivers and streams that limit their impact and protect the environmental qualities of these natural systems, such as parks and open space, carefully planned residential development, institutional uses, and civic uses located outside floodplains.
3. Promote conservation along rivers and streams through parks, open space, floodplain preservation, forested buffers, and conservation easements.
4. Encourage green construction practices, such as permeable pavement and green roofs to reduce stormwater runoff.
5. Work with state and federal officials to obtain grants and assistance to clean or seal toxic sites.

2.5.10 City of Willoughby Comprehensive Plan

The City of Willoughby contracted with D.B. Hartt in 2009 to write its comprehensive plan.
The plan designates the Lakeshore, the stream corridor of Ward Creek and 12 acres along Lost Nation Road by Tamarac as a Primary Conservation Area.

2.5.11

Riparian Setbacks
Three communities in the watershed have riparian setbacks:

- Painesville Township: 75 feet on Red Creek and most of the tributaries, 25 on any tributary draining one square mile or less.

Chapter 3: Critical Area Conditions & Restoration Strategies

3.1 Overview of Critical Areas

The Critical Area for the Marsh Creek-Frontal Lake Erie Watershed is the Marsh Creek Subwatershed. As described below, Marsh Creek is impaired by flow alteration, organic enrichment and oxygen depletion by impacts from development, inadequately managed stormwater runoff, and stream channelization.

The three main subwatersheds all have imperviousness higher than 20%, which is more than two times the tipping point for channel stability and macroinvertebrate diversity. The Marsh Creek Subwatershed has been identified as the Critical Area by the stakeholders as the highest priority because Marsh Creek is the largest of the stream systems in the watershed with the most data to assess its condition. In this subwatershed, 76.2% of the stream channels have been modified; 43% are classified as "recent/no recovery". The 2015 sampling data of the Ohio EPA found the lower section of Marsh Creek at Hendricks Road to be in Non-Attainment.

Lake SWCD has the most data for the Marsh Creek Subwatershed, including the HHEI assessments (Figure 38) and the erosion and sediment data gathered with the US Army Corps of Engineers in Marsh Creek in 2015 (Figure 28 and 29), which show high areas of sediment supply and areas where the water quality is impaired from total suspended sediments.

3.2 Critical Area 1: Conditions, Goals & Objectives for the Marsh Creek Subwatershed

3.2.1 Detailed Characterization

Marsh Creek drains approximately 10,506 acres or 42.5 square miles. It is located in the central portion of the Marsh Creek-Frontal Lake Erie Watershed (Figure 30). The land use is highly urban, with 53% in residential land uses and 22% in commercial and industrial land uses (Figure 32). The industrial land uses are clustered in the center of the watershed between SR 2 and the railroad tracks. Most of the commercial enterprises are along SR 20, with some in the industrial corridor. The Mentor Marsh, the ancient watercourse of the Grand River, is bisected by the watershed, and approximately 362 acres of the Marsh are in the Marsh Creek Watershed (Figure 31).

25.7% of the watershed has impervious area. The urban nature of the watershed is accompanied by the features of high imperviousness: stream channel erosion, flooding, and habitat degradation, loss of wetlands, loss of riparian corridor and channelization.

The watershed straddles 4 communities (Figure 34). The City of Mentor comprises the majority of the watershed, with small portions of Painesville Township, Concord Township and Painesville City in the watershed.

31% of the soils have good drainage characteristics, 30% are non-hydric with hydric inclusions and 36% of the soils are hydric, with poor drainage characteristics (Figure 35).

Figure 30: Marsh Creek Subwatershed Location

Figure 31: Marsh Creek Subwatershed

Figure 32: Marsh Creek Subwatershed Land Use

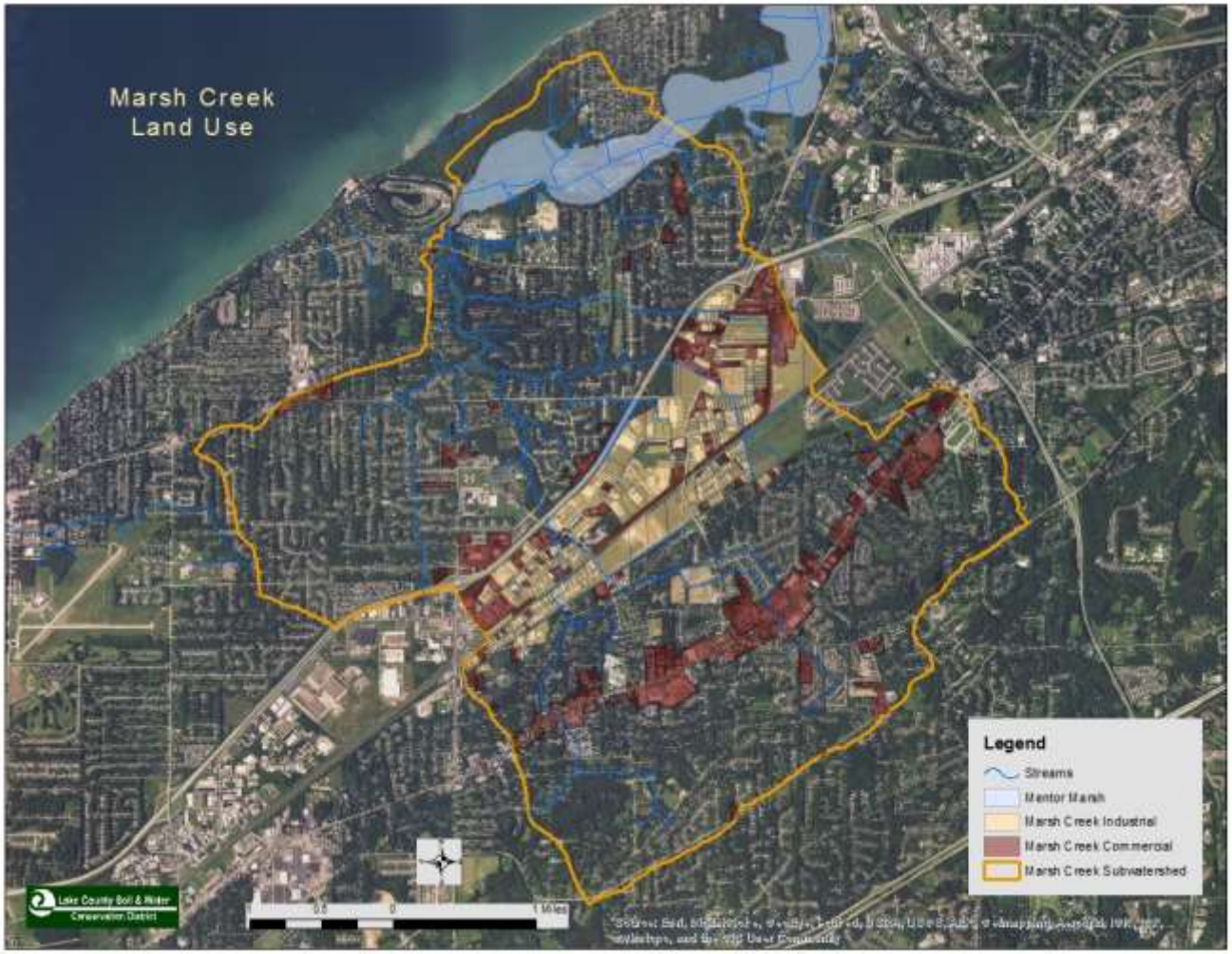


Figure 33: Marsh Creek Subwatershed Land Use

Land Use	Acres	% of Total
Agriculture	153	1.6
Industrial	904	9.4
Commercial	1041.6	11
Residential	5544	58
Public	1484	15
Utilities	85.5	1
Unclassified	385.6	4
	9597	**100**

Figure 34: Marsh Creek Subwatershed Communities

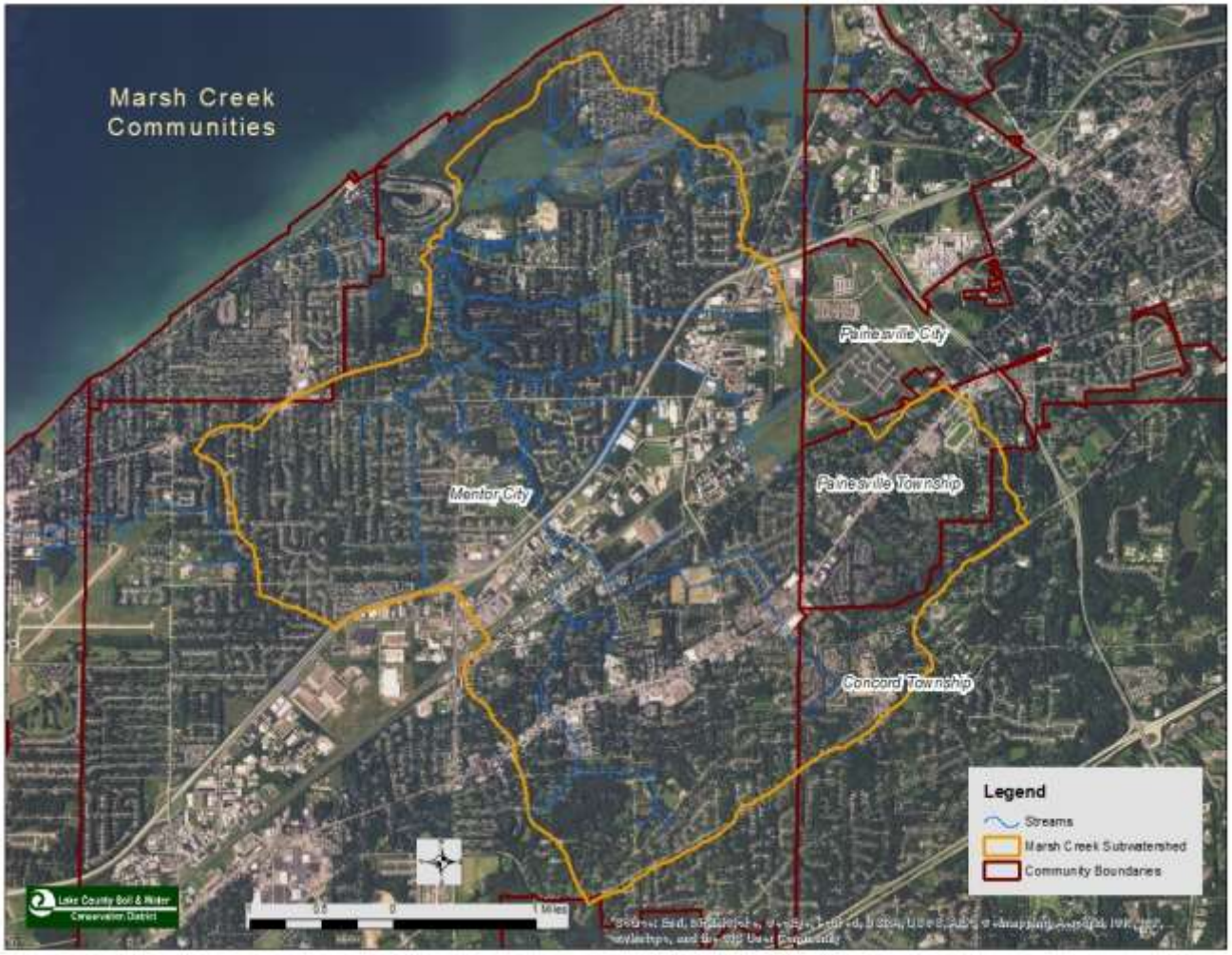


Figure 35: Marsh Creek Subwatershed Soil Drainage Characteristics

Figure 36: Marsh Creek Subwatershed Soil Drainage Data

Soil Drainage Characteristics	Acres	% of Total
Somewhat Excessively Drained	2.3	2.5
Exceptionally Well Drained	434	4.5
Well Drained	2375	22.5
Moderately Well Drained	65	.5
Primary Hydric	3400	32
Non-Hydric w/ Hyd. Inclusions	3188	31
Somewhat Poorly Drained	446	4.5
Urban	255	2.4
Water	5.5	.1
	10605	**100**

3.2.2 Detailed Biological Conditions

The Ohio EPA Aquatic Life Use Designation for the watershed is Warmwater Habitat (WWH). The causes and sources of impairment are listed in the Ohio EPA Water Quality Summary 2014 Integrated Report for the HUC-12 watershed and substantiated for this subwatershed by the knowledge of the stakeholder groups.

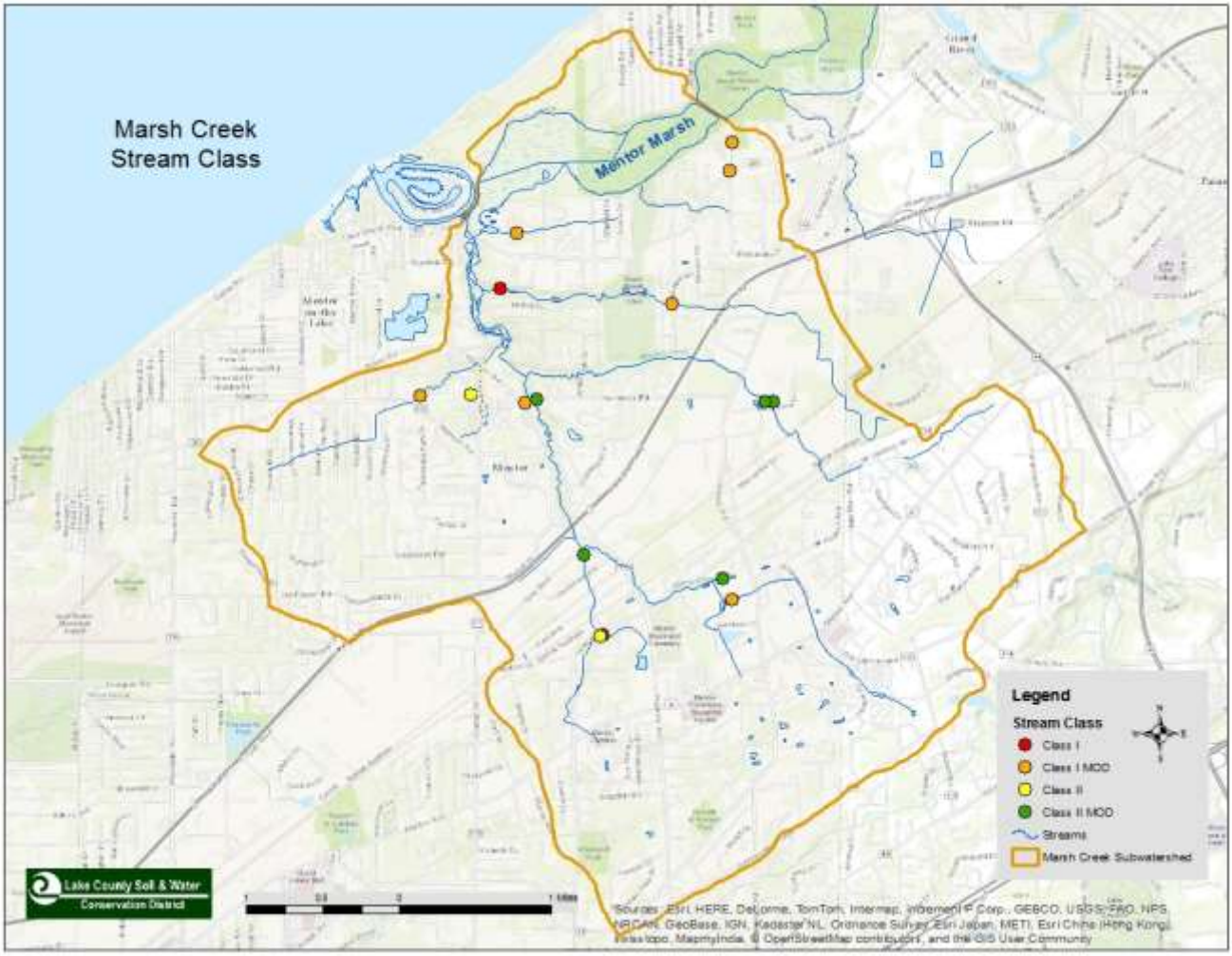
There is no TMDL for the Marsh Creek Subwatershed. The EPA sampled at two locations in 2015, at Lakeshore Boulevard and Hendricks Road. The draft results show Low/Fair and Poor ICI, and a Non-Attainment for Aquatic Life Use designation for the Hendricks Road site (Figure 37).

Figure 37: Marsh Creek WWH Aquatic Life Use (Draft)

Mile	Location	IBI	ICI	QHEI	Attainment Status	Causes
.2	Lakeshore		Poor			
1.5	Hendricks	26	Low/Fair	61.5	**NON**	Sediment/Siltation Urban runoff/storm sewers

Lake SWCD collected HHEI data in the Marsh Creek Subwatershed in 2007 (Figure 38). 75% of the sampled streams had been modified, 31% of those were recent with no recovery and 44% were recovering. All streams were Class I or Class II (see Figure 20 and description).

Figure 38: Marsh Creek Subwatershed Stream Class



3.2.3 Detailed Causes and Associated Sources

The causes and sources of impairment in Critical Area 1, Marsh Creek Subwatershed are gathered from the Ohio EPA 2008 Waterbody Report for Lake Erie Tributaries, the Ohio EPA 2010 Integrated Report "Lake Erie Assessment Unit Summary" for the Lake Erie Central Basin Shoreline, the Ohio EPA Water Quality Summary 2014 Integrated Report for the HUC-12 watershed, the draft data from the Ohio EPA 2015 sampling season, and stakeholder knowledge. The Aquatic Life Use attainment is listed as unknown in the Ohio EPA Water Quality Summary- 2016 Integrated Report, and it is shown as Non-attainment in the Ohio EPA 2015 sampling season draft report at Hendricks Road.

Cause	Source
Habitat alterations	Streambank modification/destabilization Habitat modifications other than hydromodification
Siltation/Sediment	Urban runoff/storm sewers Non-irrigated crop production
Organic enrichment/oxygen depletion	Source data not reported
Nutrients	Municipal point sources Combined sewer overflows Urban runoff/storm sewers
Loss of biodiversity in Mentor Marsh	Salt contamination

3.2.4 Outline Goals and Objectives for the Critical Area

Hydromodification is a large source the nonpoint pollution in the watershed causing habitat alterations and siltation. Biological community performance measures will be used to determine attainment levels. Using biology reveals trends over time and assesses habitat conditions including sediment transport and water quality. If the biology is there, it is a good indicator of a healthy watershed and not just a healthy stream segment. Because of the location of the watershed on the Lake Plain (see Topography, page 12), a lack of larger boulder-sized substrate will limit the ability to achieve HHEI scores higher than 50.

Figure 39: Ohio EPA HHEI Scoring Scheme

Channel Condition	Score	Classification
Natural	< 30	Class I
Modified	<= 30	Class I Modified
Natural	>= 50	Class II
Modified	>= 50	Class II Modified
Natural	>= 70	Class II

Goals	Objectives
1.1 Raise QHEI scores to 70 in Wayside Gardens west of Heisley • Not Achieved: Site currently has a score of 27	1.1.1 Restore and protect natural flow conditions. Restore 2000 LF of stream channel 1.1.2 Reconnect 2000 LF of stream to floodplain 1.1.3 Plant 2000 LF of riparian buffer
1.2 Raise QHEI scores to 70 in Marsh Creek mainstem • Not Achieved: Site currently has a score of 35	1.2.1 Restore and protect natural flow conditions. Restore 2500 LF of stream channel north of SR 2 1.2.2 Remove dam on Marsh Creek below Hendricks Road 1.2.3 Treat impervious areas on Mentor City School property on Hopkins and City Of Mentor Civic Center property with 1 acre of LID practices 1.2.4 Restore wetland on City of Mentor property off of Chillicothe Road
1.3 Raise HHEI scores to 50 or higher in Wasson-Hurst-Hawgood Ditch • Not Achieved: Site currently has a score of 48	1.3.1 Restore and protect natural flow conditions. Restore 1400 LF of stream channel 1.3.2 Plant 1400 LF of riparian buffer
1.4 Raise QHEI scores to 70 in Heisley Creek • Not Achieved: Site currently has a score of 42	1.4.1 Restore and protect natural flow conditions. Restore 1700 LF of stream channel west of SR 2 1.4.2 Plant 1700 LF of riparian buffer
1.5 Increase biodiversity in Mentor Marsh	1.5.1 Reduce salinity by remediating salt fill on 19 acres 1.5.2 Plant trees on 15 acres 1.5.3 Control invasives on 302 acres

As the objectives are implemented, water quality monitoring will be conducted (both project related and regularly scheduled monitoring) to determine progress toward meeting the identified water quality goals. These objectives will be reevaluated and modified or added to if determined to be necessary. Reevaluation will utilize the Ohio EPA Nonpoint Source Management Plan Update (Ohio EPA, 2013) which lists all the eligible NPS management strategies to address:

- Urban sediment and nutrient reduction
- Altered stream and habitat restoration
- Nonpoint source reduction
- High quality waters protection

Chapter 4: Projects and Implementation Strategy

4.1 Projects and Implementation Strategy Overview Table

The projects and evaluation needs that are believed to be necessary to remove the impairments to the Marsh Creek-Frontal Lake Erie HUC-12 are listed below. They were determined by evaluating the identified causes and associated sources of nonpoint source pollution. Because the attainment status is based upon biological conditions, it will be necessary to periodically re-evaluate whether or the implemented projects are sufficient to achieve restoration. The response of biological systems may take some time following project implementation. If issues other than nonpoint source pollution are causing impairments, they will need to be addressed under different initiatives, authorities or programs.

There is one Project and Implementation Strategy Overview Table, as there is currently only one Critical Area in the watershed. The Critical Area Goals aim to address flow alteration and loss of functionality from hydromodification of historical agricultural land drainage and runoff from developed areas through restoration of natural flow conditions and habitat.

The projects described in the Overview Table have been prioritized using the following three step prioritization method:

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

Priority 2: Projects where there is land-owner willingness to engage in projects that are designed to address the cause(s) and source(s) of impairment or where there is an expectation that such potential projects will improve water quality in the McKinley Creek-Frontal Lake Erie Watershed.

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 as stakeholders to participate and implement projects like those mentioned in Priority 1 and 2.

Project Summary Sheets (PSS) are in subsection 4.2. 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 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).

For *Marsh Creek-Frontal Lake Erie* (041100030204) —Critical Area #1								
Applicable Critical Area	**Goal**	**Objective**	**Project #**	**Project Title** *(EPA Criteria g)*	**Lead Organization** *(criteria d)*	**Time Frame** *(EPA Criteria f)*	**Estimated Cost** *(EPA Criteria d)*	**Potential/Actual Funding Source** *(EPA Criteria d)*
Recommend that your critical areas be numbered or coded for reference.That number/code listed here comes from Chapter 3 section 3.1	*It is recommended that your goals and objectives be numbered or coded for easy reference. The number/code listed here comes from Chapter 3 section 3.x.4.*		*The information listed here comes from the Project Summary Sheets Chapter 4 Table 4.2.*	*The information listed here comes from the Project Summary Sheets Chapter 4 Table 4.2.*	*The information listed here comes from the Project Summary Sheets Chapter 4 Table 4.2.*	*The information listed here comes from the Project Summary Sheets Chapter 4 Table 4.2.*	*The information listed here comes from the Project Summary Sheets Chapter 4 Table 4.2.*	*The information listed here comes from the Project Summary Sheets Chapter 4 Table 4.2.*
Urban Sediment and Nutrient Reduction Strategies								
Altered Stream and Habitat Restoration Strategies								
1	1.1	1.1.1	1	Springbrook stream restoration	City of Mentor	1-3 years	$550,000	319, City of Mentor
1	1.2	1.2.1		Marsh Creek stream restoration at COM Civic Center	City of Mentor	3-5 years		319, City of Mentor
1	1.2	1.2.2		Marsh Creek dam removal	City of Mentor	3-5- years		319, City of Mentor
1	1.2	1.2.3		LID at Mentor Civic Center	City of Mentor	3-5 years		319, City of Mentor
1	1.2	1.2.3		LID at Mentor School	City of Mentor	3-5 years		319, City of Mentor
1	1.2	1.2.4		Wetland restoration	City of Mentor	3-5 years		319, GLRI, City of Mentor
1	1.3	1.3.1, 1.3.2		WHH Ditch stream restoration	City of Mentor	5-7 years		319, City of Mentor

1	1.4	1.4.1, 1.4.2		Mentor Civic Center stream restoration	City of Mentor	3-5 years		319, City of Mentor
1	1.5	1.5.1		Salt fill remediation	Lake SWCD	5-7 years		GLRI, private landowner
1	1.5	1.5.2		Marsh tree planting	Lake SWCD	3-5 years		SOGL, GLRI
1	1.5	1.5.3		Marsh invasives control	Cleveland Museum of Natural History	3-5 years		SOGL, GLRI
Agricultural Nonpoint Source Reduction Strategies								
High Quality Waters Protection Strategies								
Other NPS Causes and Associated Sources of Impairment								

Section 4.2 Project Summary Sheet(s)

Nine Element Criteria	Information needed	Explanation
n/a	**Title**	Springbrook Garden Park Stream Restoration
criteria d	**Project Lead Organization & Partners**	City of Mentor and Lake SWCD
criteria c	**HUC-12 and Critical Area**	041100030204 Marsh Creek – Frontal Lake Erie Watershed Critical Area #1
criteria c	**Location of Project**	6776 Heisley Road Mentor, Ohio 44060
n/a	**Which strategy is being addressed by this project?**	Altered stream and habitat alteration
criteria f	**Time Frame**	Short-Term (Priority) (1-3 yr) Spring 2017 to Spring 2019
criteria	**Short Description**	A restoration project to improve functionality and stability by creating a channel of morphologically appropriate dimensions and improved riparian corridor. This will be accomplished with a variety of natural channel restoration techniques including raise grade and sinuous channel creation within the existing valley.
criteria g	**Project Narrative**	This reach is currently incised with 6-8 ft bank heights and eroding banks. The instream habitat is also severely limited during high velocity flood flows which are confined within the entrenched channel. Poor morphological development and low stability are limiting factors for improvement in the system. Restoration at the site will greatly improve the functionality and stability in this tributary to Lake Erie by creating more frequent floodplain access and improved functional capacity of the riparian corridor. Stream restoration concepts developed for this site begin upstream at Heisley Rd for approximately 1900 LF. Native floodplain species such as Platanus occidentalis (American sycamore), Acer saccharinum (Silver Maple), Populus deltoids (Eastern cottonwood), Cornus amomum (Silky dogwood), Cornus racemosa (Grey dogwood) and Cornus sericea (Red-osier dogwood) will be planted as container stock or live stakes as appropriate. This material will provide species diversity, streambank protection, shade and nutrient filtering functions. A native floodplain seed mix is also specified for the floodplain areas. Invasive species will be treated through the corridor using a combination of aquatic safe herbicide and manual removal.
criteria d	**Estimated Total cost**	$550,000.00
criteria d	**Possible Funding Source**	319 Grant Funding and Local Match (Cash and In-Kind)

criteria a	**Identified Causes and Sources**	*Provide a list of the identified Cause(s) and associated Source(s) that your project will address. The causes/source should be those listed for the critical area you are working in.* ***Flow Alteration*** ***Organic Enrichment / Low Dissolved Oxygen***
criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?**	QHEI score raised from 27 to 70 or higher
	Part 2: How much of the needed improvement for the whole Critical Area is *estimated* to be accomplished by this project?	This project will create more frequent floodplain access and improved functional capacity of the riparian corridor to 2000 feet of Wayside Gardens tributary. It completely addresses Objective 1 in Critical Area 1. It is anticipated that the QHEI score will reach 50 in the short term and 80 to 90 in the long term through the implementation of this project.
	Part 3: Load Reduced?	Nitrogen: 304lbs/yr Phosphorus: 260lbs/yr Sediment: 500tons/yr
criteria i	**How will the effectiveness of this project in addressing the NPS impairment be measured?**	The success of the project will be evaluated by comparison of preconstruction habitat and postconstruction habitat. A QHEI was conducted on the existing channel conditions by SWCD staff. The net score for the project area was 27/100. It is anticipated that the project will improve habitat conditions and score 80-90/100.
criteria e	**Information and Education**	The following Outreach Deliverables are proposed: Project Fact Sheet 1 Public Meetings 2 Press Releases 1 Create/Maintain Websites 2 Develop Displays 2 Conduct Tours 1 Conduct Stream Clean-Ups 1 Conduct Workshops 1 Mail Flyer 1

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Appendix A. Acronyms

BMP	Best Management Practice
CWH	Cold Water Habitat
EQIP	Environmental Quality Incentives Program
ERIN	Earth Resources Information Network
EWH	Exceptional Warmwater Habitat
GIS	Geographic Information System
LED	Lake Erie Direct
FEMA	Federal Emergency Management Agency
HHEI	Headwater Habitat Evaluation Index
HIT	High Impact Targeting
HUC	Hydrologic Unit Code
IBI	Index of Biotic Integrity
ICI	Invertebrate Community Index
LF	Linear Feet
L-THIA	Long-Term Hydrologic Impact Assessment
LID	Low Impact Development
MIwb	Modified Index of Well Being
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NPS-IS	Nonpoint Source Implementation Strategy
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
ODA	Ohio Department of Agriculture
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
PHWH	Primary Headwater Habitat
QHEI	Qualitative Habitat Evaluation Index
SMD	Stormwater Management Department
START	Sediment Transport Analysis and Regional Training
SWCD	Soil & Water Conservation District
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
WEPP	Web-Based Water Erosion Prediction Project
WWH	Warmwater Habitat