McKinley Creek-Frontal Lake Erie
HUC-12: 041100030204
Nine-Element
Nonpoint Source Implementation Strategic Plan (NPS-IS Plan)

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Version 1.0

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Acknowledgements

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Chapter 1: Introduction

1.1 Report Background

The vision of the McKinley Creek-Frontal Lake Erie Nonpoint Source Implementation Strategies (NPS-IS) plan is for the communities to work together to address the issues of the watershed so that the streams function, are clean, free flowing and do not flood.

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.

The goals that were identified in stakeholder meetings included the following:

- Encourage the long-term health of the stream systems in the watershed
- Utilize land use and zoning practices for better stormwater management
- Re-establish free-flowing streams
- Reduce flooding
- Minimize the pollutants that get into Lake Erie
- Improve water quality with Best Management Practices
- Protect working lands with easements
- Promote low impact development practices
- Educate the public
- Reduce shoreline erosion

1.2 Watershed Profile & History

The McKinley Creek-Frontal Lake Erie Watershed is located in northeastern Lake County in Northeast Ohio, directly on the Lake Erie shoreline (Figure 1). It is bounded to the north by Lake Erie, to the west and south by the Grand River Watershed and to the east by the Arcola Creek Watershed. It drains approximately 29.7 square miles into the Great Lakes Basin. The McKinley Creek-Frontal Lake Erie Watershed 12 digit Hydrologic Unit Code (HUC) is 041100030204.

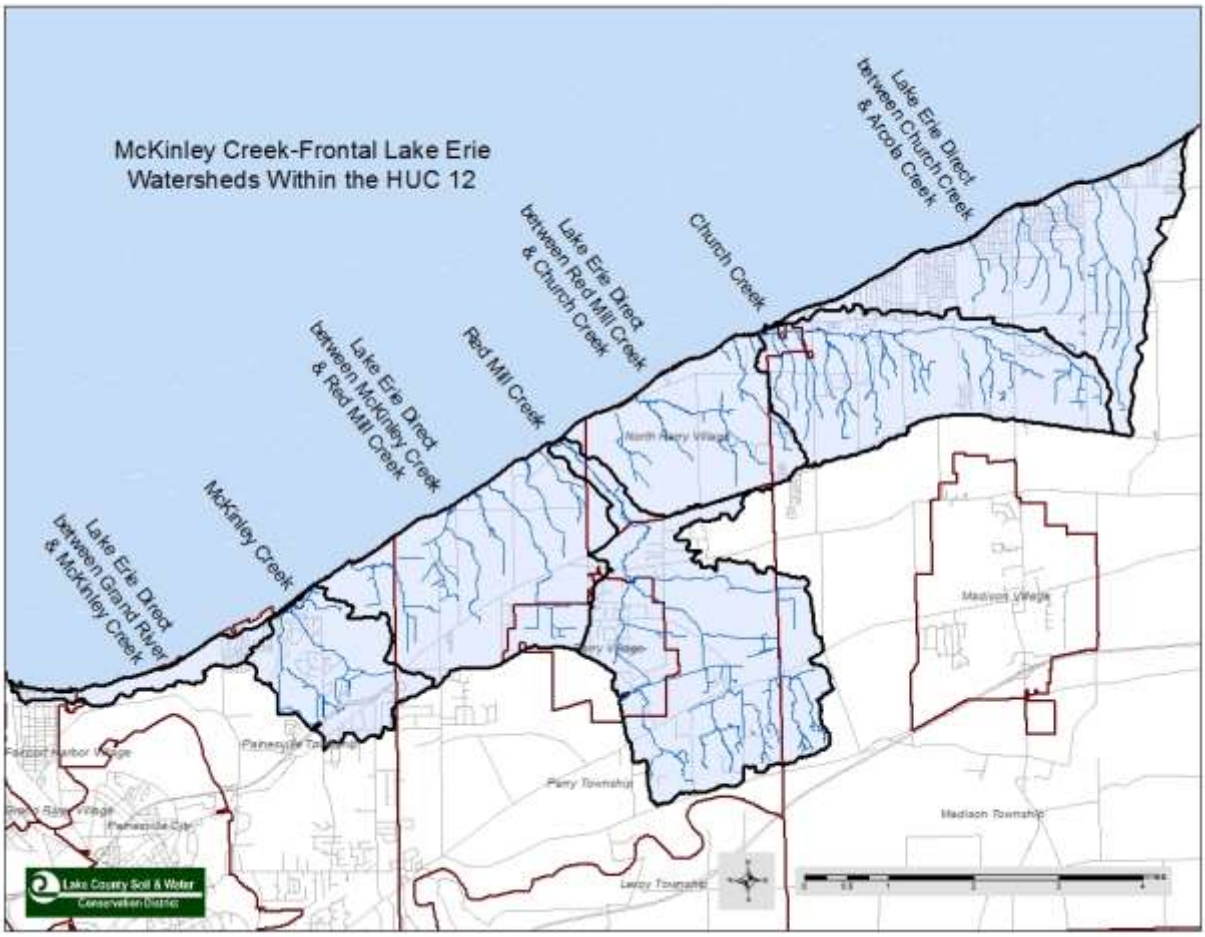
The center of the watershed is approximately 40 miles from the City of Cleveland central business district, 30 miles from the Interstate 271 business corridor and 10 miles from the City of Mentor.

The HUC-12 watershed encompasses seven subwatersheds, listed from west to east (Figure 2): Lake Erie Direct between McKinley and Grand River, McKinley Creek, Lake Erie Direct between Red Mill and McKinley, Red Mill Creek, Lake Erie Direct between Church and Red Mill, Church Creek and Lake Erie Direct between Arcola and Church Creek. All subwatersheds drain directly into Lake Erie.

The watershed contains portions of Fairport Harbor (59 ac.), Painesville Township (2,156 ac.), Perry Township (5,857 ac.), Perry Village North Perry Village and Madison Township (7,358 ac.). Perry Village (1,492 ac.), and North Perry Village (2,458 ac.), are completely within the watershed. Madison Township has the largest amount of land in the watershed, with 36.7% of the total, Perry Township has 29.2%, and Painesville Township comprises 10.8% of the watershed. Together, they make up 76.7% of the watershed with 15,371.47 acres.

Figure 1. Location of Watershed

Figure 2. Watersheds within the HUC-12



Fairport Harbor, Painesville Township, Perry Village and Madison Township 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. Perry Township and North Perry Village take care of their NPDES requirements on their own.

Prior to WWII, the region was primarily agricultural, in nursery production. With the evolution of the street car, automobile and federal home financing programs, large-scale population increases began in 1930. Between 1930 and 1970, the population increased 470% to 197,000. Much of the growth can be described as "sprawl" from the Cleveland Metropolitan Area to the west. This west to east migration trend continues and eastern Lake County rural communities are growing to semi-rural and suburban landscapes.

The current landscape can be described as "Agricultural lands interspersed with single-family residential development and small scale commercial uses". (Eastern Lake County Coastal Tributaries (ELCCT) Balanced Growth Plan, p. 26.) In a community that has a substantial agricultural base,

sprawl can negatively affect the amount of productive land needed to sustain and maintain a viable agricultural industry. Agricultural preservation programs and innovative zoning strategies will be an important part of retaining the balances of land use in the watershed.

1.3 Public Participation and Involvement

This 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. 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, Ohio State University Extension/Sea Grant, Painesville Township, North Perry Village, Perry Township, Perry Village, Lake Metroparks, Lake County Port Authority, Lake County Utilities Department
4. Non-Governmental organizations: Chagrin River Watershed Partners

The stakeholder group met three times to discuss watershed issues and develop the plan. The first stakeholder meeting was held in North Perry Village on July 31, 2014 with follow-up meetings in September and November of that year. Three work groups were formed to discuss and identify solutions for **stormwater management**, **resources** (biology, wetlands and Lake Erie issues) and **land use** (urban, agriculture, septics and recreation). The goals and action items of each group were discussed with the stakeholder group as a whole, and then integrated into the plan.

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.

Water Resources	
100 year floodplain	510.1 ac
Wetlands (2007)	885.2 ac
Ponds & lakes	99.3 ac
Streams & rivers	65.3 ac
Approx. number of water wells	228
Highly sensitive to groundwater contamination	18,986.7 ac
Ohio EPA permitted CSOs	

Land Use and Environment	
Conservation & recreation land	952.4 ac
Ohio EPA NPDES industrial & municipal discharge permits	12
Ohio EPA Approved bio-solid app. Fields	957.7 ac
Dams	1
Ecological region:	Erie Lake Plain, Erie Gorges

Land Use (acres)	**1994**	**2001**	**2009**
Agriculture	6,402	7,340	3,421
Water	820	1,712	265
Urban	1,069	2,827	10,195
Forest	10,056	6,883	4,945
Barren	15	17	37
Shrub/scrub	509	204	9

Ohio EPA Aquatic Life Use Designation	
Coldwater Habitat (CWH)	0
Exceptional Warmwater Habitat (EWH)	0
Warmwater Habitat (WWH)	2.4

Ohio EPA Source Water intakes & Protection Areas	
Fairport Harbor Village Public Water Supply	119 ac
Lake County East Water Subdistrict	1,760 ac
Painesville City Public Water Supply	153 ac

Source: ERIN Watershed Report

Topography

The elevation ranges from 840 feet above sea level in the southern watershed boundary to 572 feet along the Lake Erie shoreline, a change of 268 feet.

The watershed is located in the Lake Plain physiographic region, which is characterized by glacial sediment overlaying Devonian shale, ranging from fine sand, silt and clay. The southern extent of the watershed is part of the Ashtabula Till End Moraine. The southern boundary of the watershed is on the Portage Escarpment, which marks the boundary between the Lake Plain region and the Allegheny Plateau (Figure 3).

The Lake Plain is relatively flat and is poorly drained in most places. It is crossed by several sand ridges that mark the locations of shores of earlier higher levels of late-glacial Lake Erie. These ridges are well drained and rise 10 to 30 feet above the Lake Plain. They were used by earlier inhabitants as the main travel routes, and are known today as North Ridge, Middle Ridge and South Ridge Roads.

Figure 3. Topography

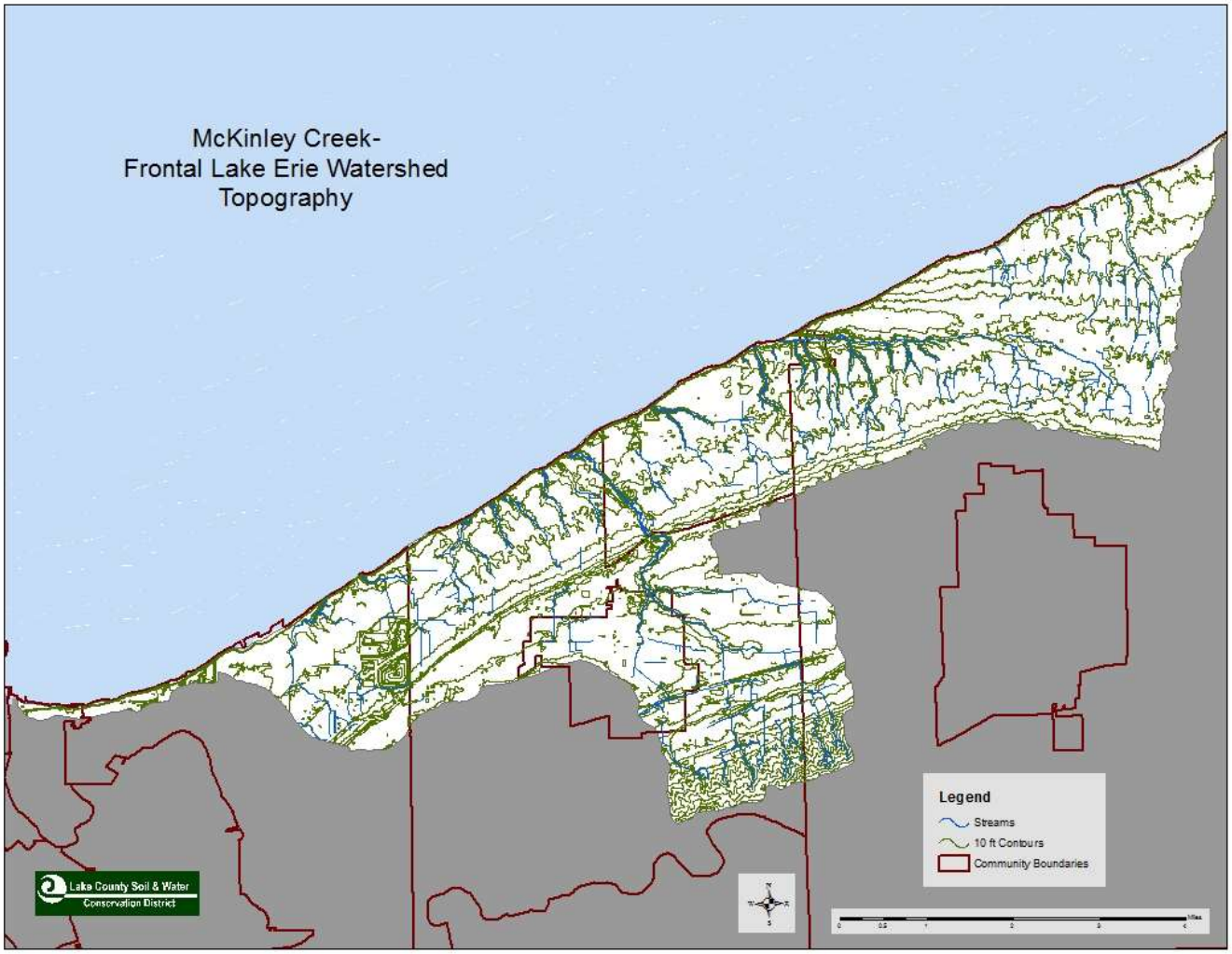
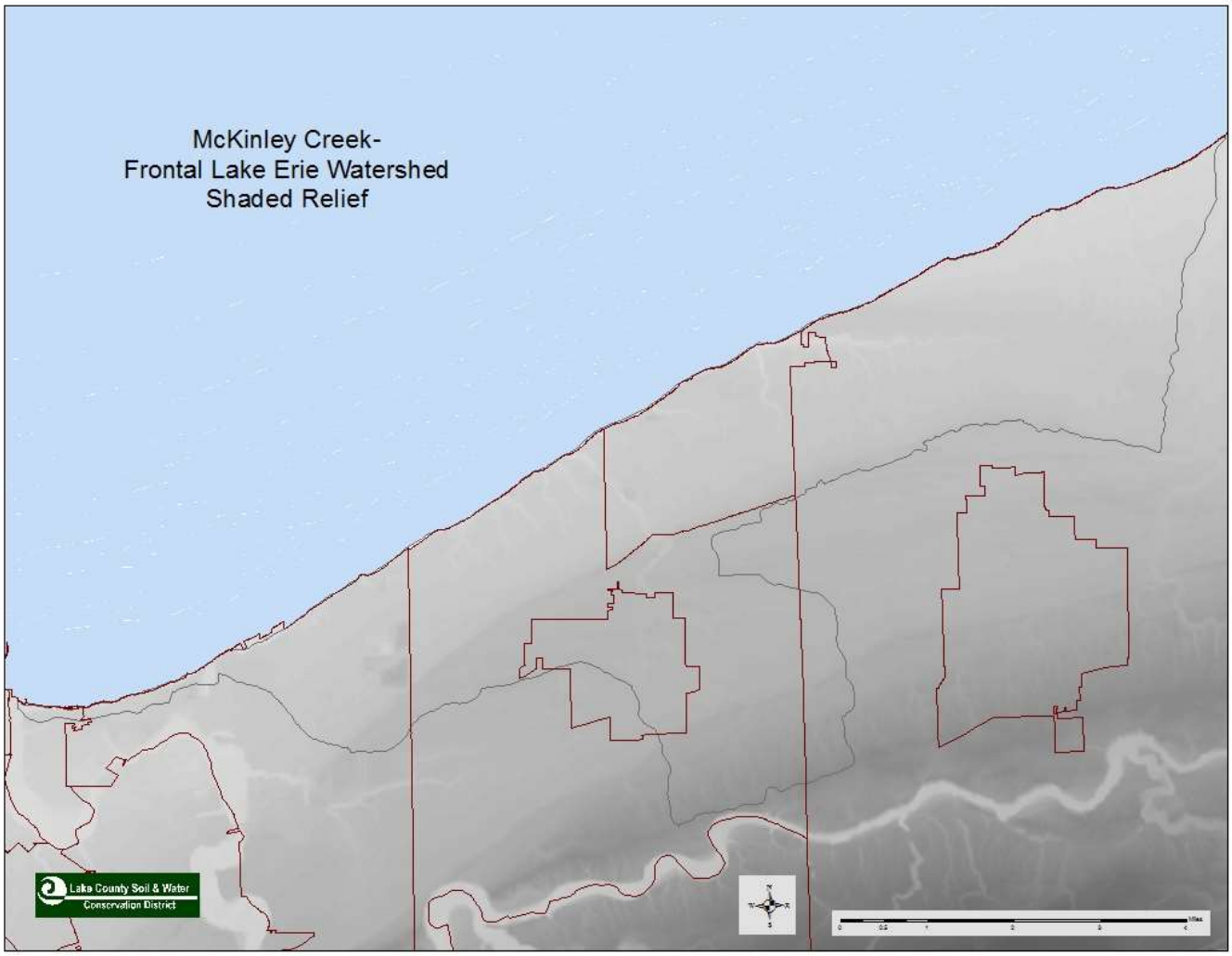


Figure 4. Topography- Shaded Relief View



Geology & Glacial History

The McKinley Creek-Frontal Lake Erie Watershed is in the glaciated plateau of Ohio and underlain by the Lake Plain (Figure 5). 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.

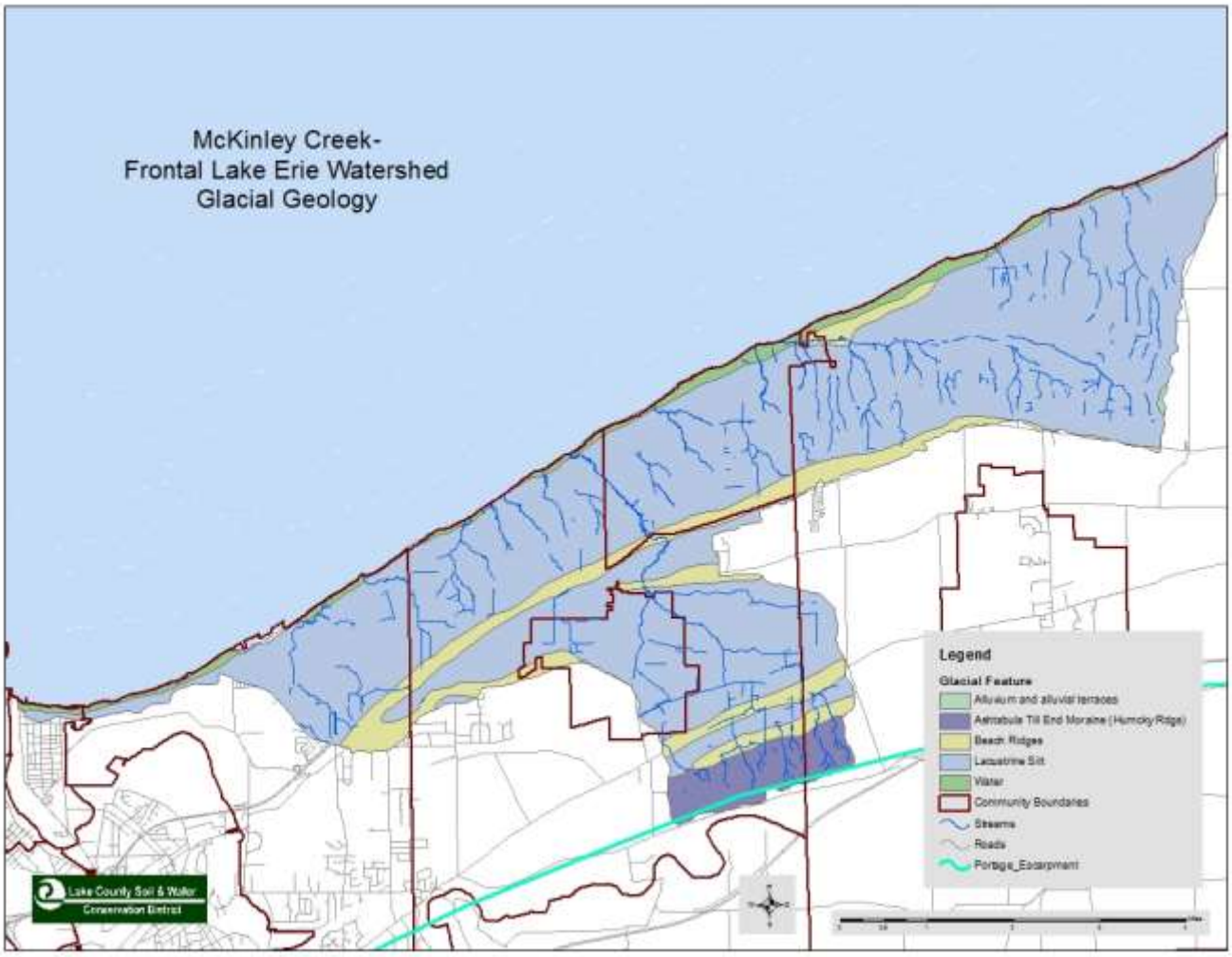
Three sandy and gravelly ridges, from earlier higher lake levels parallel the present Lake Erie shoreline, are identifiable by the three major roads running in an east-west direction- North Ridge (ancient Lake Warren), Middle Ridge and South Ridge/Johnny Cake Ridge (ancient Lake Whittlesey) Roads. The South ridge road- Johnny Cake Ridge Road ridge, which is just outside of the watershed, 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 Lake Plain is characterized by ephemeral and low quality Warmwater streams. The potential for stream habitats to reach their highest quality is limited by the geology as well as the present and historical land uses in the watershed. High quality habitat requires large substrates, such as bedrock, boulders and cobbles which are not typically found in the Lake Plain. Intensive agricultural use and development have limited the ability of streams to develop pools, stable substrate and access to floodplains, which aquatic organisms need to survive.

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 5. Glacial Geology



Soils

The soils in the watershed (Figure 6) 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. Refer to the Soil Survey of Lake County, Ohio for more information about the soils and their properties.

More than 79% of the soils have severe limitations for development. However, several varieties of loamy fine sands and silt loams have special characteristics that make them ideal for field stock nursery production. The area extending from the beach ridges north to the Lake is one of a few places in the state where a three foot deep water table is present, which is suitable for irrigation ponds. "In 1997, the North Perry Village Council passed a resolution requesting the Lake County Soil and Water Conservation District to help preserve these unique assets. Five soils were designated by the United States Department of Agriculture (USDA) as "unique and of local importance". In obtaining the "unique" designation, the USDA recognized for the first time anywhere in the United States the extreme importance soils play in the local economy. North Perry was the country's first community to achieve this ranking." (BGI)

Soils designated as “unique and of local importance”:

- Colonie loamy fine sand with 2% to 6% slope
- Elnora loamy fine sand with 1% to 5% slope
- Kingsville fine sand
- Minoa fine sandy loam
- Stafford loamy fine sand

Five more soils were recently added to the list of “unique soils and of local importance”:

- Conotton silt loam
- Granby sandy loam
- Otisville gravelly loamy fine sand
- Pierpont silt loam
- Platea silt loam

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 6,402 acres in 1994 to 3,421 acres in 2009. Preserving farmland is a land use priority for North Perry Village.

Hydric soils (in shades of blue, Figure 7) form under prolonged saturated, flooded or ponded conditions and have developed anaerobic (limited oxygen) qualities. They are used to delineate wetlands and are most suitable for non-developed land uses. Many hydric soils have been developed however, and not surprisingly continue to experience wet and flooded conditions.

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 7), whereas wetlands and on-site storage BMPs should be utilized in hydric soils.

Lake Erie Shoreline

Lakeshore erosion is the predominant geologic hazard in Lake County. The coastline has severe erosion in many areas, with steep, high bluffs characterizing much of the topography. The beaches are narrow and bluff slumping is common as there is little sand on the lake bottom to absorb wave energy. Deep narrow valleys are found where streams have carved their way through the bluffs to the lake. The Ohio EPA estimates 132.4 total shoreline miles.

Figure 6. Soils

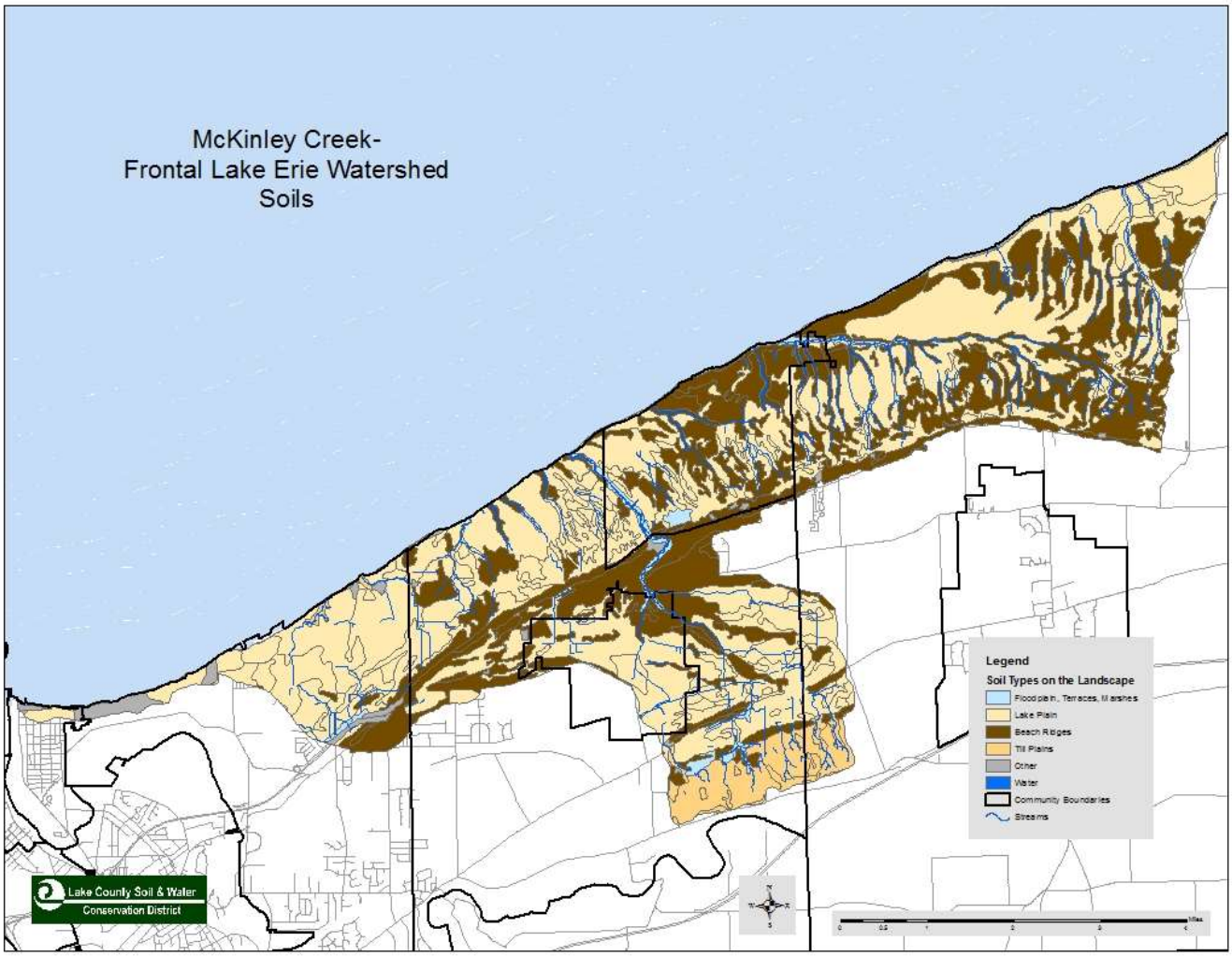
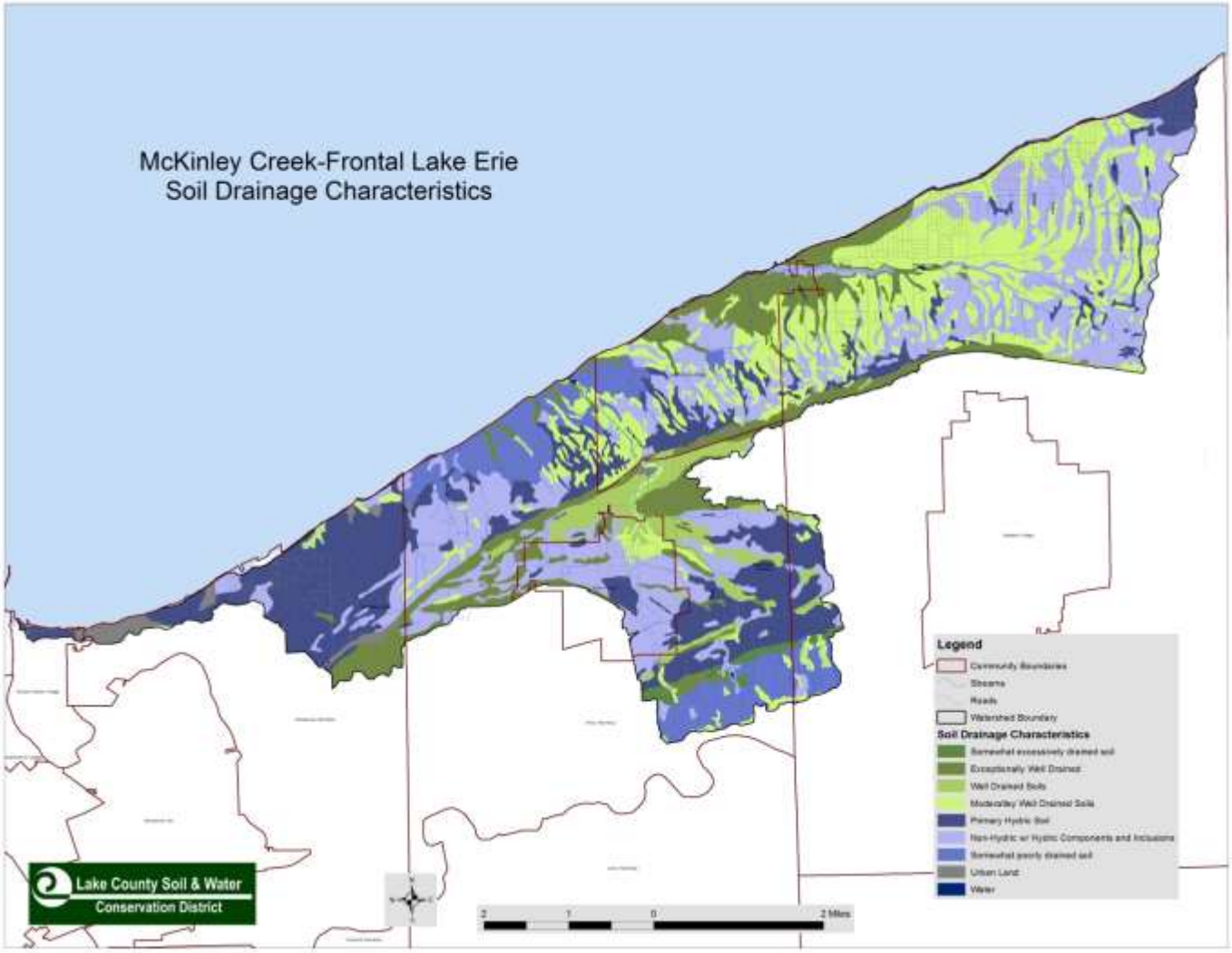


Figure 7. Soil Drainage Characteristics



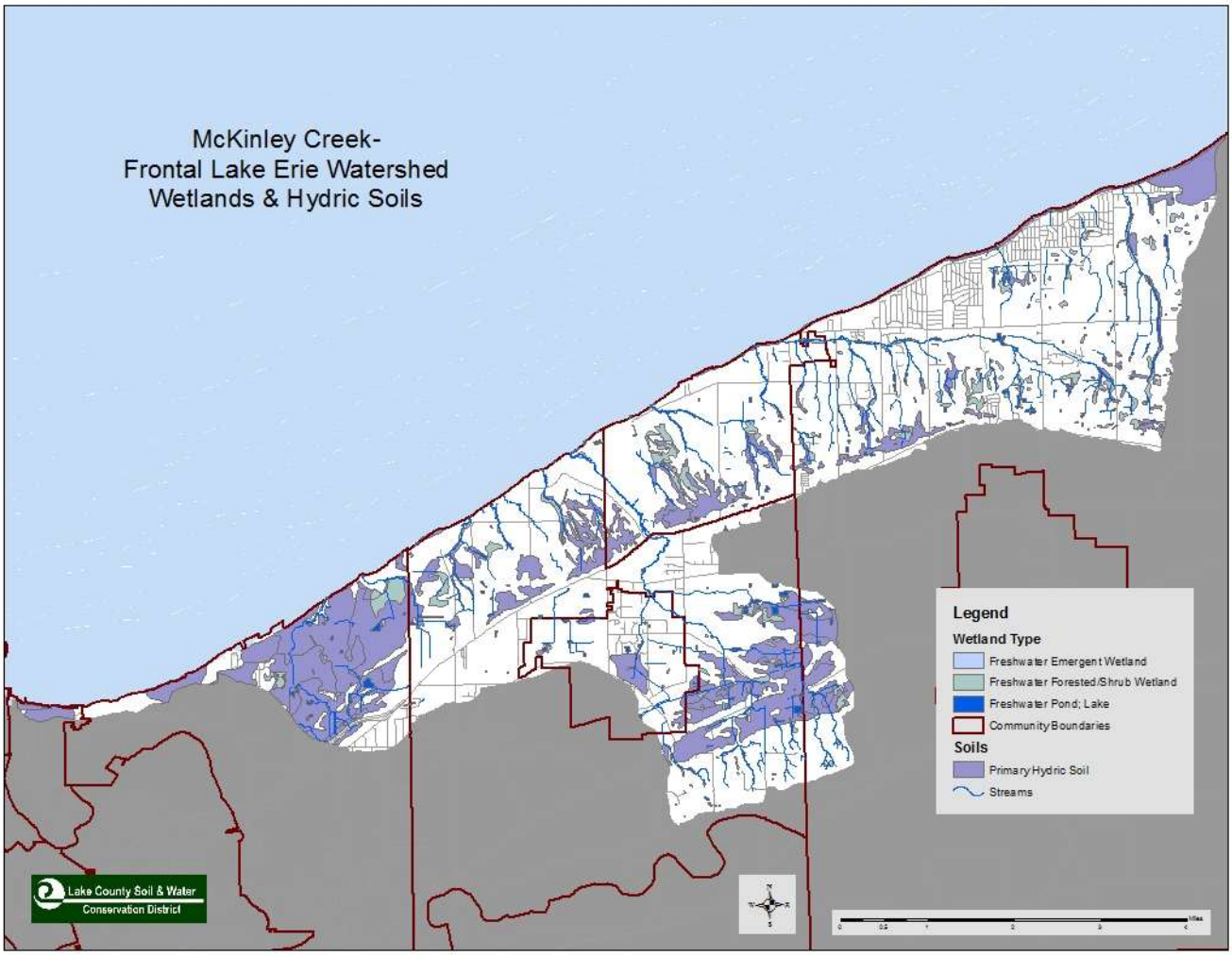
Wetlands

Most of the land between Lake Erie and the old beach ridges is level and poorly drained (Figure 8). "Much of northern Lake County was swampy and covered by large tracts of swamp forest until draining of the area by settlers began 200 years ago." (Szubski, 2002.) Very little of the swamp forest remains and most of the County's extensive wetland areas have been drained. The overall percentage of land in the watershed covered by water and wetlands is 6.1 %. (ERIN Watershed Report.)

The wetlands are shown using the U.S Fish and Wildlife Service National Wetlands Inventory (NWI) database. The NWI was created in 1974 to provide resource managers with information about the location, types and extent of wetlands in the country. The map is supplemented with hydric soils data to provide further detail on the extent of wetlands in the watershed.

It is a priority for the plan developers to preserve wooded wetlands where they still remain in larger blocks, particularly in the mid- and northern sections of Red Mill Creek.

Figure 8. Wetlands and Hydric Soils



2.1.2 Land Use and Protection

The ELCCT Balanced Growth Plan provided the following land use statistics:

57.6% is undeveloped (from a long-term capacity standpoint):

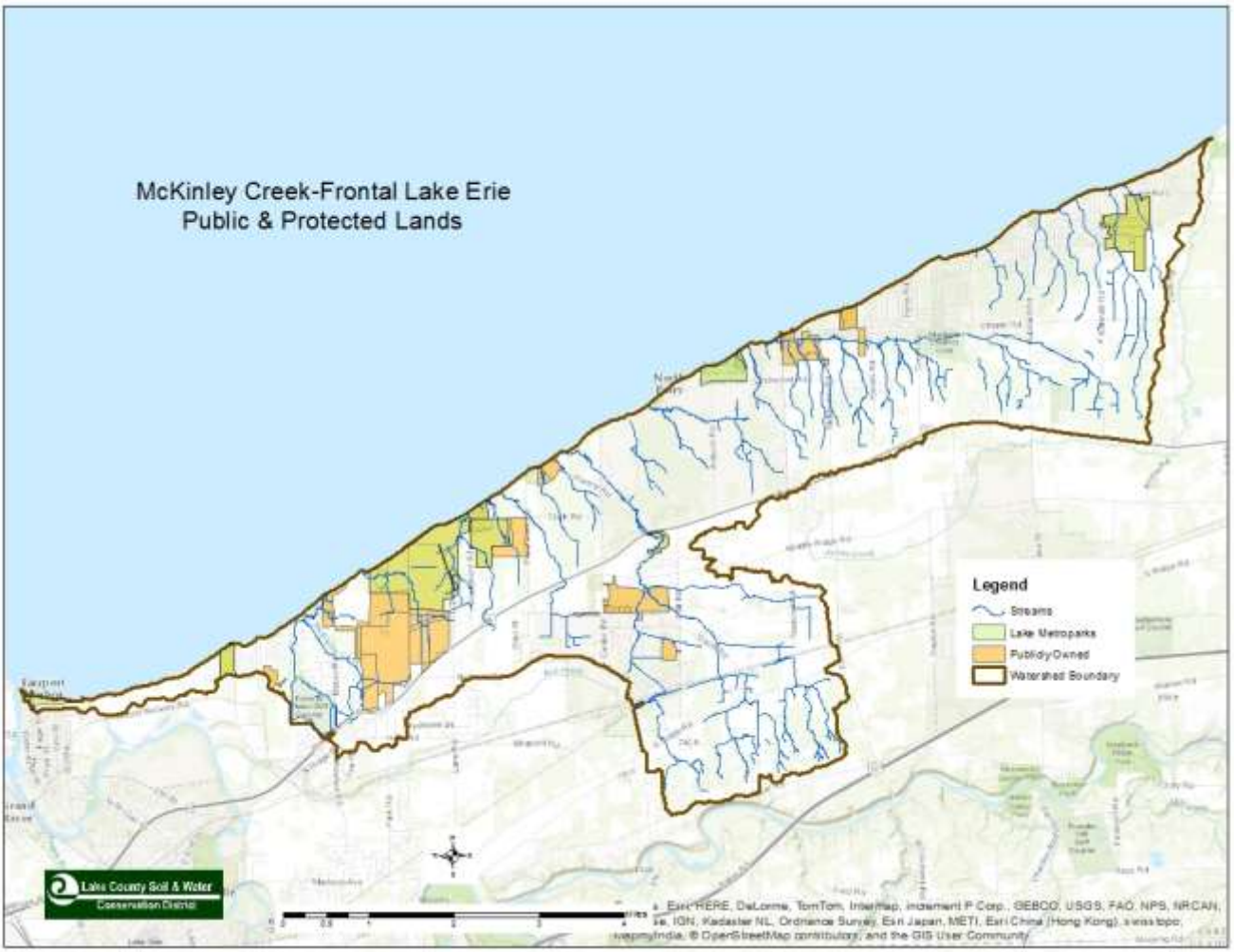
- 64.4% vacant
- 35.6% active agriculture

42.4% is developed

- 51.3% residential
- 16.8% transportation or utility use, including the Lake County Land Fill
- 3.4% commercial or office
- 5.0% parks or school athletic fields
- 4.8% golf courses or driving ranges
- 4.7% light industrial or transportation uses
- 7.4% governmental offices, town halls, community centers, cemeteries or vacant land owned by units of local government
- 5.4% semi-public
- 1.2% marine uses

5% of the land is protected by Lake Metroparks, with parks located along the lakeshore and one golf course. 6.1% of the land is publicly owned, which includes boards of education property, township-owned properties and the Lake County landfill (Figure 9). Lake Metroparks and Lake County landfill properties provide good restoration and preservation opportunities in the McKinley Creek subwatershed, as they are publicly owned, they drain directly into Lake Erie and such projects would further the resource goals of these entities.

Figure 9. Public and Protected Lands



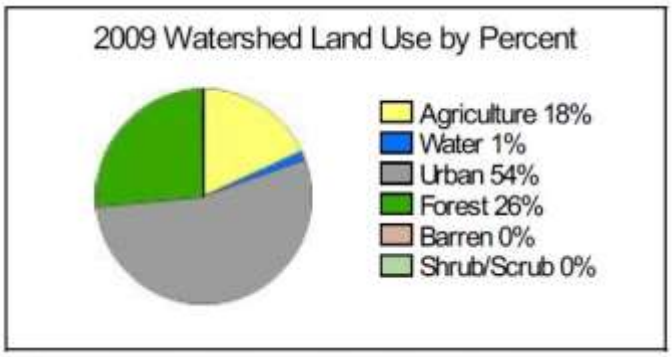
The ERIN Watershed Report delineated more than half of the land use as urban in 2009, with forest the next highest percentage at 26% and agriculture at 18% (Figure 10).

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%. According to the Center for Watershed Protection's Watershed Vulnerability Analysis report (Center for Watershed Protection, 2002), "…certain zones of stream quality exist, most notably at about 10% impervious cover, where the most sensitive stream elements are lost from the system. A second threshold appears to exist at around 25 to 30% impervious cover, where most indicators of stream quality consistently shift to a poor condition (e.g., diminished aquatid diversity, water quality and habitat scores)." U.S. Geological Survey StreamStats data show the imperviousness in selected subwatersheds as follows:

- Red Mill Creek- 8.03%
- Church Creek- 9.45%
- Foster & Vernick- 14.2%
- McKinley- 19.5%

Some are at the balance point for degradation, McKinley has tipped over the balance point. Opportunities for retrofits with green infrastructure should be utilized wherever possible.

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



The ELCCT Balanced Growth Plan assessed current zoning in the watershed and determined that if the watershed developed according to the zoning pattern, approximately 64% of the watershed would be residential, 20% would be industrial and the remaining 16% would be a mix of recreational, commercial and industrial uses. According to the comprehensive/master plans adopted by the communities, residential land uses would account for over 63% of the land area in the watershed if future build-out followed the local plans. Industrial uses would account for about 10% of the land area.

Lake SWCD has assisted landowners with protecting their farmland with agricultural easements since 2004, through applications to the state and federal easement purchase programs. Within this HUC12, 170 acres of farmland have been preserved in North Perry Village for six landowners, as of July 2016. It is a priority of the Lake SWCD to assist the Village with protection of its agricultural land from urban development with agricultural easements in this watershed. Land under agricultural easements must follow a conservation plan written by the Natural Resource Conservation Service, which consists of practices tailored to the natural resource needs of the property and can include riparian and edge of field buffers. Where there are water quality-related resource concerns, the NRCS assists with funding and resolution through the NRCS Environmental Quality Incentives Program (EQIP).

More than 80% of the watershed has public water service. Three smaller areas in western Madison Township, central Perry Township and northeast Painesville Township are serviced by private wells (18.5%). The far eastern edge of the watershed has no water service, and is largely in agricultural land use. Sanitary sewer service is available in 48% of the watershed, which is served by the Madison Treatment Plant on Cashen Road, just outside the watershed. Where there is no water or sanitary infrastructure, intense development is restricted by that lack, and pressure on agricultural lands and open spaces is eased.

2.2 Summary of HUC-12 Biological Trends

The Ohio EPA Aquatic Life Use Designation for the watershed is Warmwater Habitat (WWH).

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 McKinley 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 11, 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 11. Section 303(d) List

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

The Aquatic Life Use Assessment by the EPA based on sampling in 2002 reported the following:

- Sites Monitored: 12
- Sited Full Attainment: 3 (25%)
- Sites Partial Attainment: 4 (33.3%)
- Sites Non-Attainment: 5 (41.7%)

More recently, two sites (total) in two subwatersheds were sampled by the EPA in 2015, Red Mill Creek and Church Creek. Red Mill was in Partial Attainment and Church Creek was in Non-Attainment.

Figure 12. Draft Overall Biological Indices Scores for Sampled Sites (Ohio EPA 2015)

River Mile - Location	Station	DA (mi_{sq})	IBI	MIwb[b]	ICI	QHEI	Attainment Status
Red Mill Creek (07-024-000) *Recommend WWH*							
1.7 H - US 20	303280	6.3	36	-	LF*	71	PARTIAL
Church Creek (07-022-000) *Recommend WWH*							
0.65 H - McMackin Road	303279	4	22*	-	P*	47	NON

H= Headwater site; LF= Low Fair; P= Poor; * = significant departure from applicable biocriteria;

Headwater Habitat Evaluation Index

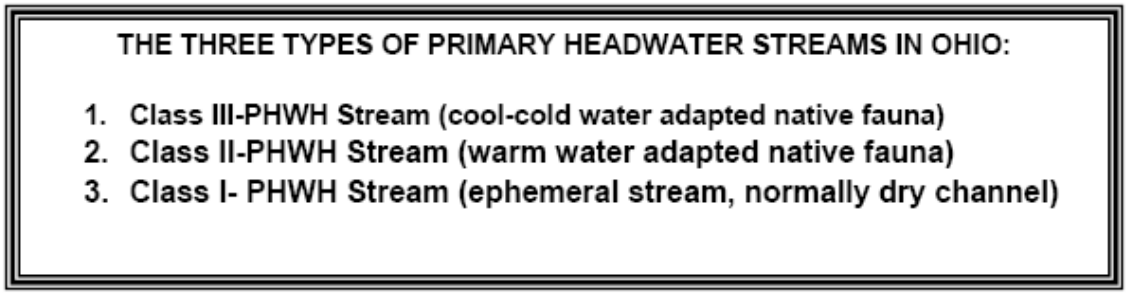
Lake SWCD worked with the EPA to develop and collect Headwater Habitat Evaluation Index (HHEI) data for Lake County watersheds to establish a baseline database of existing conditions. HHEI data was collected by Lake SWCD staff in the McKinley Creek-Frontal Lake Erie Watershed between 2006 and 2008. Conditions were not very conducive to aquatic life because of the urban nature of this watershed and only 15 % of the total stream length in the watershed was assessed. 28 sites were assessed, with the majority occurring on Church Creek and its tributaries. Two sites were assessed as Class III; twenty-six were Class II Modified or below. Fifty percent were Class II Modified (Figures 13 and 14). See Figure 15 and the following text for an explanation of the Ohio Stream Classification system.

Figure 13. Stream Class Percentages

Class	%
Class I	14
Class I Modified	11
Class II	18
Class II Modified	50
Class III	7
	100

Figure 14. Stream Class

Figure 15. 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.)

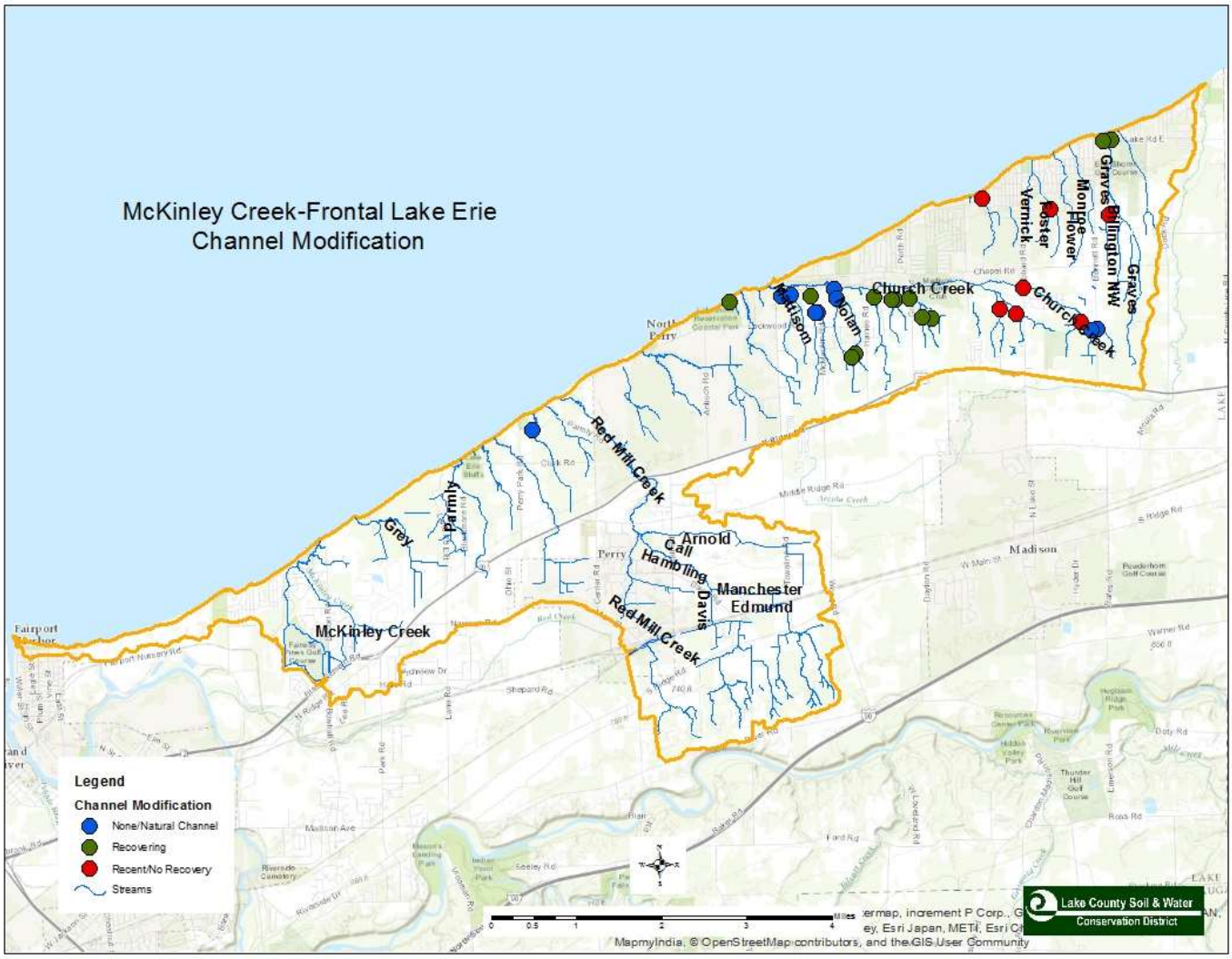
A natural "stream channel is characterized by the presence of riffles and pools, heterogeneous substrate deposition, the presence of point bars or other evidence of floodplain sediment deposition, appropriate stream channel sinuosity for the setting of the stream in the landscape, varied water depths 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 16. Channel Modification Percentages

Channel Modification	%
None/Natural Channel	32
Recovering	43
Recent/No Recovery	25
	100

Figure 17. Channel Modification



When the HHEI assessment was done in 2007, 25% of the channels were identified as recent with no recovery, and 75% as recovering or natural channel. Figures 18, 19 and 20 illustrate the different stream classifications within the watershed.

Figure 18. Class I Modified Stream, Recent with No Recovery in Red Mill Subwatershed

Figure 19. Class II Modified Stream in Church Creek Subwatershed

Figure 20. Class III Stream in Church Creek Subwatershed

2.3 Summary of HUC-12 Pollution Causes and Associated Sources

As listed in the 2014 Integrated Water Quality Monitoring and Assessment Report, Ohio EPA has determined that the biological impairments in the watershed are primarily from nutrients, siltation, direct habitat alterations and exotic species. The sources of impairment are:

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

Many of the waterways in this watershed have been historically modified and treated as ditches, to remove poorly draining water from developed land uses, where residents have experienced flooding and standing water, and from nursery land uses (Figures 21 and 22).

Figure 21. Stream Modified in Nursery Land Use

Figure 22. Stream Modified in Urban Land Use

Lake SWCD contracted with the US Army Corps of Engineers in 2015 to do a watershed assessment for sediment transport, using the Sediment Transport Analysis and Regional Training (START) Initiative. The assessment included field reconnaissance, using the Stream Channel Sediment Supply Assessment protocol and computer modeling using the web-based High Impact Targeting (HIT) tool. (Figure 23)

Figure 23. HIT Results

Items	Total (tons/yr) *(from entire watershed)*	Rate (tons/ac/yr) *(Average over entire watershed)*
Erosion Rates[1]	3,412	0.180
Sediment Loading (delivery)[2]	715	0.038

[1]estimated annual soil erosion

[2]estimated percentage of eroded soil from a given area that reaches the nearby stream network

2.4 Additional Information Determining Critical Areas and Developing Implementation Strategies

Flooding has been a long-standing problem in the watershed. Numerous studies have been undertaken to determine how to alleviate the flooding and improve water quality.

2.5.1 U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers "Special Flood Hazard Evaluation Report, Red Creek and Red Mill Creek, Village of Perry, Lake County, Ohio, November 1995" study recommended establishing Areas of Special Flood Hazard as identified by the Federal Emergency Management Agency (FEMA) to more effectively manage growth and development and reduce future flood damages through planning and regulation of the floodplain.

2.5.2 Lake SWCD

In May 1997, Lake County Soil & Water Conservation District prepared a draft proposal for Perry Village to address Perry area flooding and Red Mill Creek Drainage. The suggested goals included alleviating flooding problems using projects to improve creek water storage capacity, water quality, and wildlife habitat.

2.5.3 Hydrosphere Engineering

The "Hydrology Study for the Red Mill Creek Upper Watershed, Philip H. De Groot, Ph.D., P.E., Hydrosphere Engineering, August 1998" proposed several hydrologic options.

- Build a detention basin, or wet pond in the headlands of the watershed
- Set specific thresholds for impervious surfaces and stormwater runoff in new subdivisions, and recommend the use of conservation-style subdivision design.
- Develop a conservation overlay zone to specify vegetated buffers along the creek and ditches to promote erosion control, water quality improvements and wildlife habitat.

2.5.4 Lake Metroparks

Lake Metroparks monitored water quality in Red Mill Creek at Red Mill Valley from 1993 to 1996, using both biological and chemical sampling methods. It found values for biota ranging from Very Good to Fairly Poor, with values usually in the Good range, but determined Red Mill Creek to be one of the poorest quality streams in the park system.

2.5.5 Balanced Growth Plan

The Eastern Lake County Coastal Tributaries (ELCCT) Balanced Growth Plan (December 2011) was produced by a Watershed Planning Partnership that included the Lake County Planning Commission, Lake SWCD, Lake County Stormwater Management Department, Lake County GIS Department and the Chagrin River Watershed Partners, as well as the watershed communities. The plan listed the following concepts to attain a living equilibrium between a strong, diversified economy and a healthy Lake Erie ecosystem:

- Maximize investment in existing core urban areas, transportation, and infrastructure networks to enhance the economic vitality of existing communities
- Minimize the conversion of green space and the loss of critical habitat areas, farmland, forest and open spaces
- Limit any net increase in the loading of pollutants or transfer of pollution leading from one medium to another
- To the extent feasible, protect and restore the natural hydrology of the watershed and flow characteristics of its streams, tributaries and wetlands
- Restore the physical habitat and chemical water quality of the watershed to protect and restore diverse and thriving plant communities and preserve rare and endangered species

The plan designated areas for:

- Priority Conservation- 3,931 acres (Figure 24)
- Priority Development- 1,374 acres (Figure 25)
- Priority Agricultural- 6,445 acres (Figure 26)

Figure 24. Priority Conservation Areas, ELCCT Balanced Growth Plan

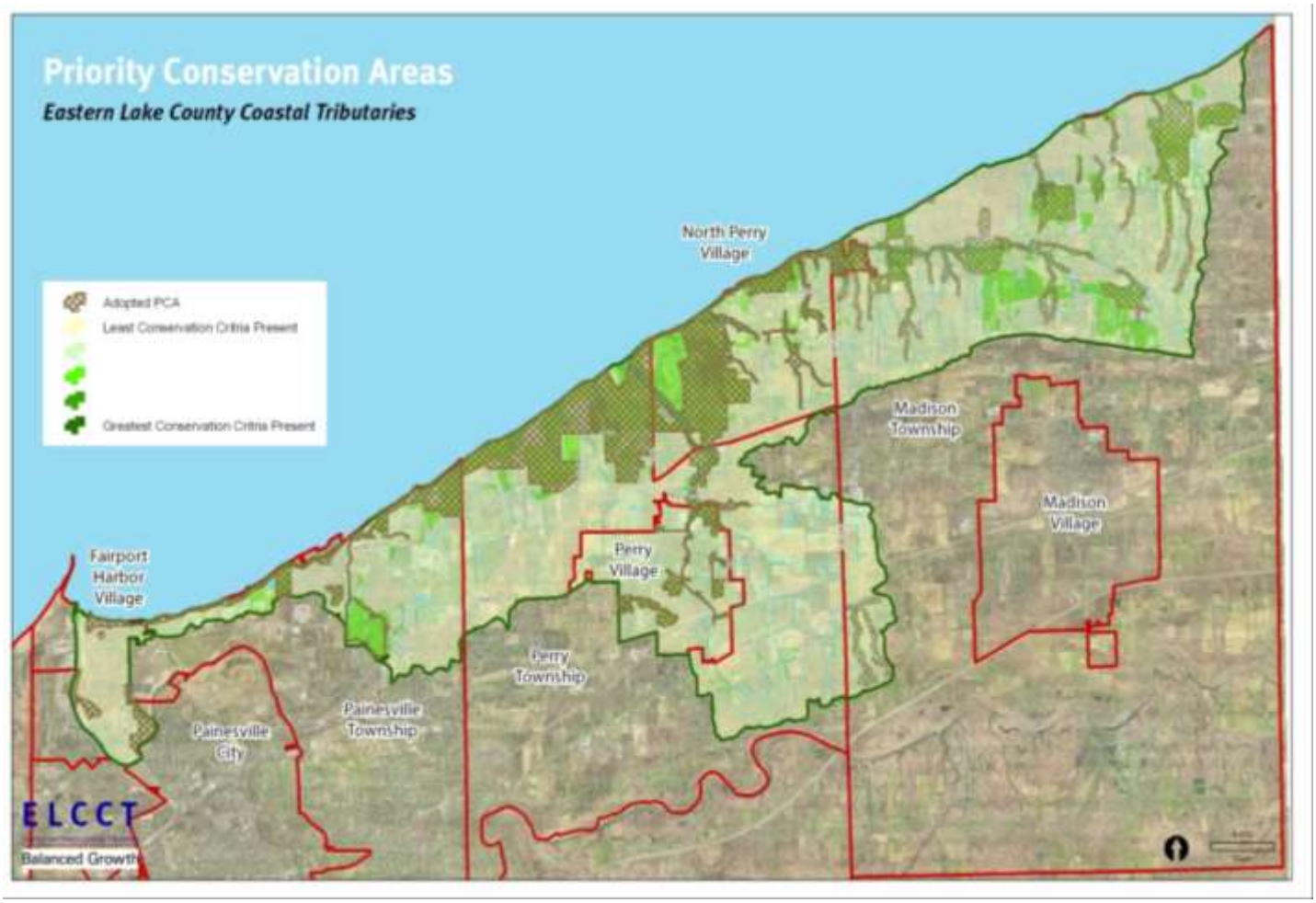
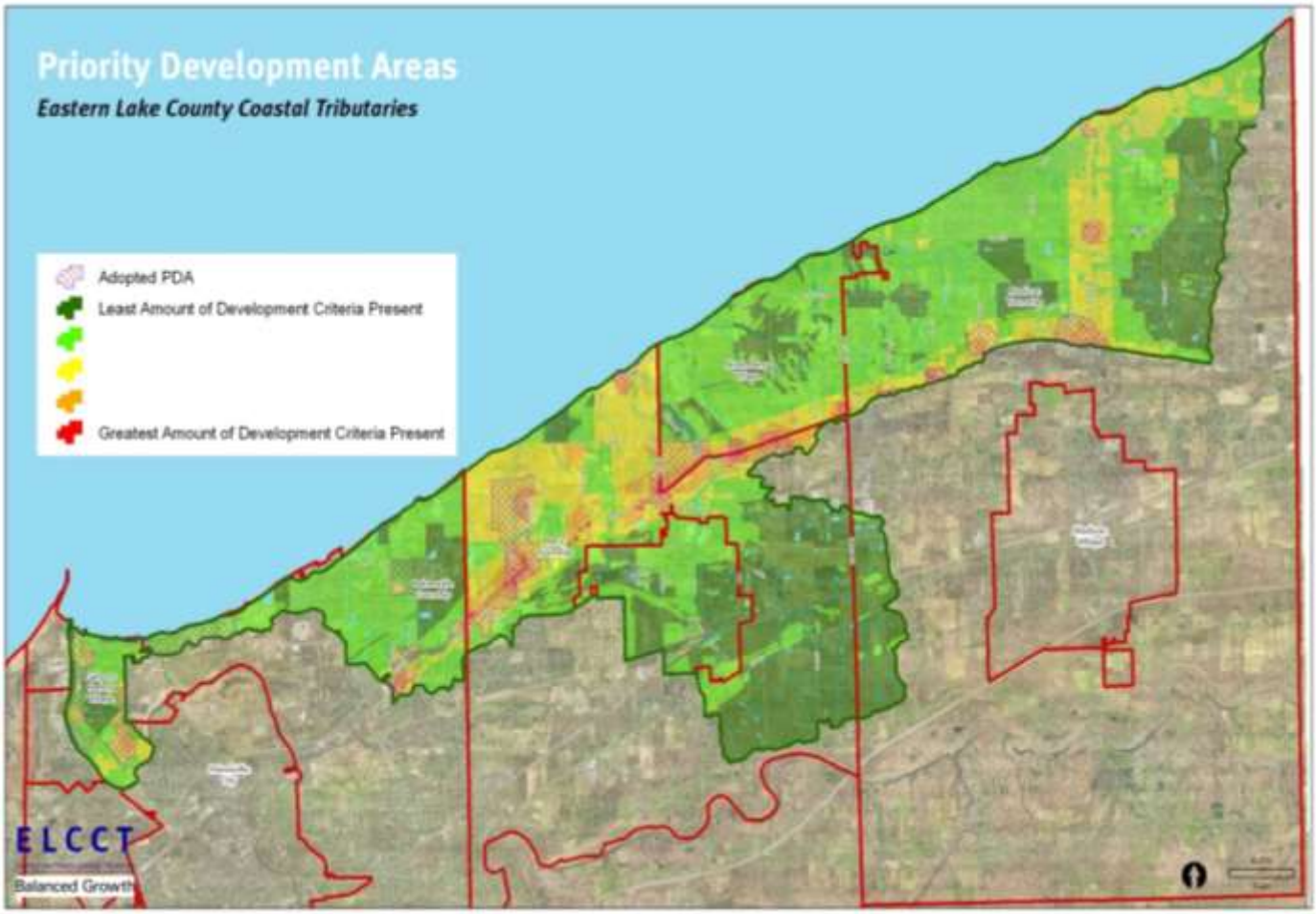


Figure 25. Priority Development Areas, ELCCT Balanced Growth Plan



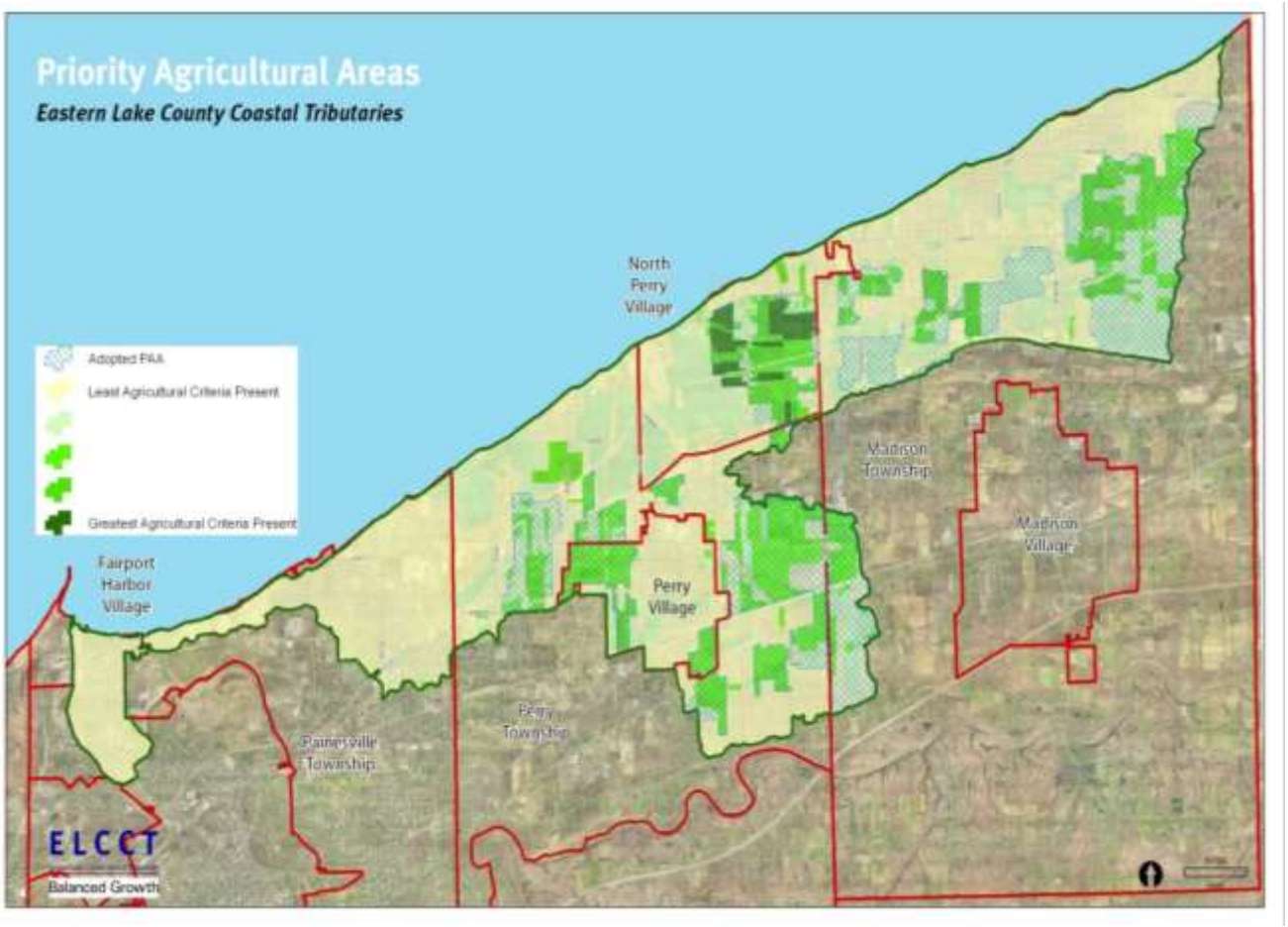
2.5.6 US Army Corps of Engineers Stream Assessment

The US Army Corps of Engineers did a field assessment of streams in the McKinley 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. Areas of higher sediment contributions shown for Red Mill Creek in Figure 26 illustrate the applicability of these tools and have informed the decisions in choosing critical areas.

Figure 26. Red Mill Creek Sediment Supply

Figure 27. Priority Agricultural Areas, ELCCT Balanced Growth Plan



2.5.7 Painesville Township Plan

Painesville Township worked with the Lake County Planning Commission on a comprehensive plan in 2007 and 2016. 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.
6. Riparian setbacks shall be required on all land adjacent to designated watercourses.

2.5.8 Perry Village Plan

The Perry Village Comprehensive Plan adopted in 2005, includes goals to manage future development of land in order to protect and improve the quality of air, surface water resources (creeks, lakes, wetlands, floodplains) and other natural resources from pollution, sedimentation and unnecessary alteration of their natural forms and functions and maintain the rural character of the Village. The plan states that the floodplains of the two main watersheds of the Village are building constraints for future growth and development, and that the Village and Perry Township will need to collaborate to properly manage stormwater as new development continues. The Village will need to adopt a drainage policy to "eliminate negative impacts on environmentally sensitive areas and to protect existing horticultural activities".

2.5.9 North Perry Village Plan

The North Perry Village 2009 Comprehensive Plan includes goals to:

- Preserve agricultural lands and retain the semi-rural character.
- Preserve open spaces and natural areas.

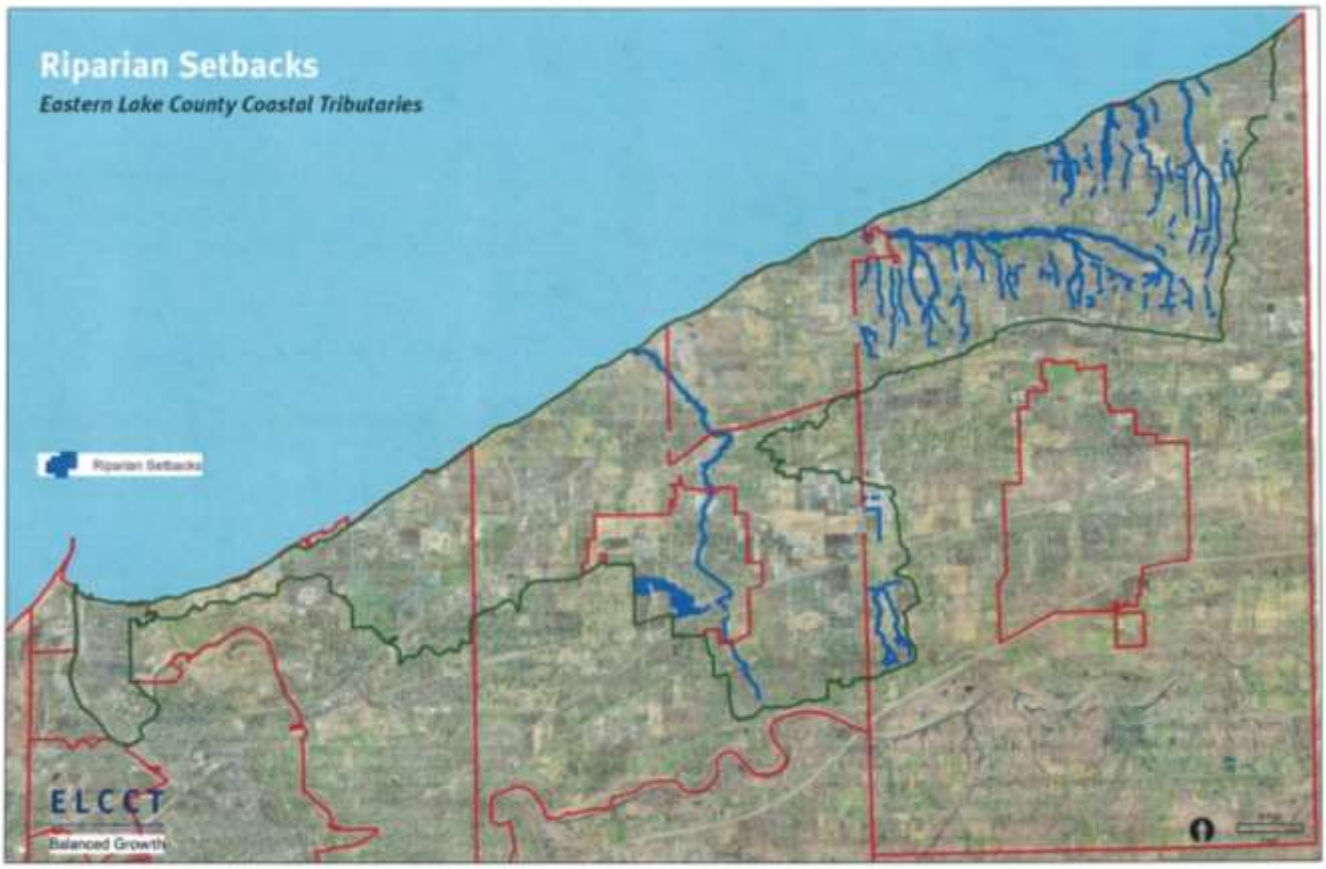
The Village has established a priority agricultural area, where to date, six landowners have established agricultural easements on 169.5 acres through the federal Farm and Ranch Land Protection Program.

2.5.10 CT Consultants

CT Consultants prepared a Stormwater Management Report for North Perry Village in April 2012 to investigate the drainage conditions within North Perry Village and the watersheds contributing to the Village. The Report recommended an Annual Drainage Improvement Program to address the key areas that were identified. The alternatives included storm sewer, detention basin and drainage channel improvements within the Village. This report has contributed to the decision to make the Lake Erie Direct between Red Mill and Church Creek subwatershed a critical area.

Madison Township, Perry Village and North Perry Village have incorporated riparian setbacks into their zoning; Perry Township has setback zoning along two of the major riparian corridors (Figure 28).

Figure 28. Riparian Setbacks, ELCCT Balanced Growth Plan



Chapter 3: Critical Area Conditions & Restoration Strategies

3.1 Overview of Critical Areas

The Critical Areas for the McKinley Creek-Frontal Lake Erie watershed are Red Mill Creek, Lake Erie Direct between Church and Red Mill Creek and Lake Erie Direct between McKinley and Red Mill Creek subwatersheds. These subwatersheds are impacted by development, inadequately managed stormwater runoff, agricultural land uses and stream channelization. The rationale for this determination follows.

Critical Area 1: Red Mill Creek

Red Mill Creek has experienced flow alterations and direct habitat alterations from development and agricultural land uses. Many of the headwater streams have been channelized and ditched, and riparian trees and vegetation removed.

Red Mill Creek has 8.03% imperviousness overall, coming close to the point at which stream systems and water quality decline. Portions of the watershed are more developed than others and have greater imperviousness; stormwater runoff issues have "surfaced" in those areas. There is seasonal imperviousness as well, when nurseries cover the hoop houses with plastic to protect their plants

during the winter season. Many of the nursery fields lack a riparian buffer, and it is a priority for Lake SWCD to increase the usage of buffers in the agricultural land uses.

The watershed extends the farthest south in the HUC-12, and the southern portions are on the higher Ashtabula Till Moraine (Figures 3, 4 and 5). The transition to the lower Lake Plain creates some opportunities for erosive flow; some of the areas of greater erosion occur in this area (Figure 36).

Critical Area 2: Lake Erie Direct (LED) between Church and Red Mill Creek
LED between Church and Red Mill Creek subwatershed has been identified as a critical area above some of the other subwatersheds with similar issues because North Perry Village has the interest and ability to provide funding to help resolve its long-standing drainage, flooding and water quality issues. Several project areas have been identified with landowners willing to participate in the projects.

The streams have lost their functionality, stability and access to floodplain. Channels are incised and banks are eroding, delivering sediment loadings directly to Lake Erie. Instream habitat is severely limited because of poor morphological development and low stability. This is a small watershed and once the critical areas have been addressed, projects will be developed in other subwatersheds within the HUC-12.

Critical Area 3: Lake Erie Direct (LED) between McKinley and Red Mill Creek
LED between McKinley and Red Mill Creek subwatershed has six tributaries that drain directly into Lake Erie, more than any other subwatershed. Areas of high sedimentation have been identified by the US Army Corps of Engineers Stream Assessment study. 33% of this watershed is publicly owned by Lake Metro Parks and Lake County Utilities, maximizing the opportunity for projects to manage stormwater runoff and restore the effects of stream channelization in the watershed.

Figure 29. Critical Areas

Red Mill Creek	Critical Area 1
Lake Erie Direct between Church & Red Mill	Critical Area 2
Lake Erie Direct between McKinley & Red Mill	Critical Area 3

3.2 Critical Area 1: Conditions, Goals & Objectives for Red Mill Creek

3.2.1 Detailed Characterization

The Red Mill Creek watershed drains 7.24 square miles in eastern Perry Township and Perry Village, and narrows to drain into Lake Erie. The watershed narrows from a width of 2.2 miles in the headwaters area to a neck of approximately 1,900 feet at State Route 20, which contributes to flooding in that area.

The land use is largely agriculture and residential. The agricultural industry in the watershed is predominantly nursery. During the winter months, many nursery beds with hoop houses are covered with plastic to protect the plants, which causes a seasonal increase in imperviousness. The stream channels have been channelized and maintained as ditches to drain agricultural land and reduce

flooding in residential areas. Large portions of the stream corridor in nursery operations lack a riparian buffer.

The watershed is in portions of Madison Township, Perry Township, Perry Village and North Perry Village (Figure 30). Perry Township is not in the Lake County Stormwater Management Department, which is a factor when considering funding sources for watershed improvement practices that require a match.

The land use is 44% agriculture, 40 % residential and contains a portion of the First Energy Nuclear Power Plant property (Figures 31 and 32). The agricultural land uses are primarily nursery. It is a priority of North Perry Village and Lake SWCD to preserve working agricultural lands in the Village, and about half of the Village is identified as a priority agricultural area in the Balanced Growth Plan (Figure 27). The Perry Board of Education campus covers about 160 acres, and as the largest area of rooftops and parking lots in the watershed, provides a good opportunity for adding infiltration practices, in addition to the ones that were installed during construction of the newer buildings and infrastructure.

63% of the soils have hydric drainage characteristics; 16% are exceptionally well drained (Figures 33 and 34). Wetlands are prevalent in the central section of this subwatershed (Figure 35). They have been mapped using several different sources of wetland delineations; the darker the color in Figure 40, the greater the likelihood of wetlands being at that location. 43% of the land area is classified as wetlands with this database. Many of them have been drained through "ditches" and tile drainage for agricultural purposes, many have been cleaned to reduce flooding in residential areas and many are intact in the wooded areas.

The 2015 U.S. Army Corps of Engineers field steam assessment generated data of erosion and sediment potential in the watershed. Figure 36 shows areas of higher erosion along many of the tributaries and main stem of Red Mill Creek. 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 six locations (Figure 37 & 38). Several of these areas have been identified as project areas.

Several of the tributaries are named (Figure 39).

Figure 30. Red Mill Creek Location

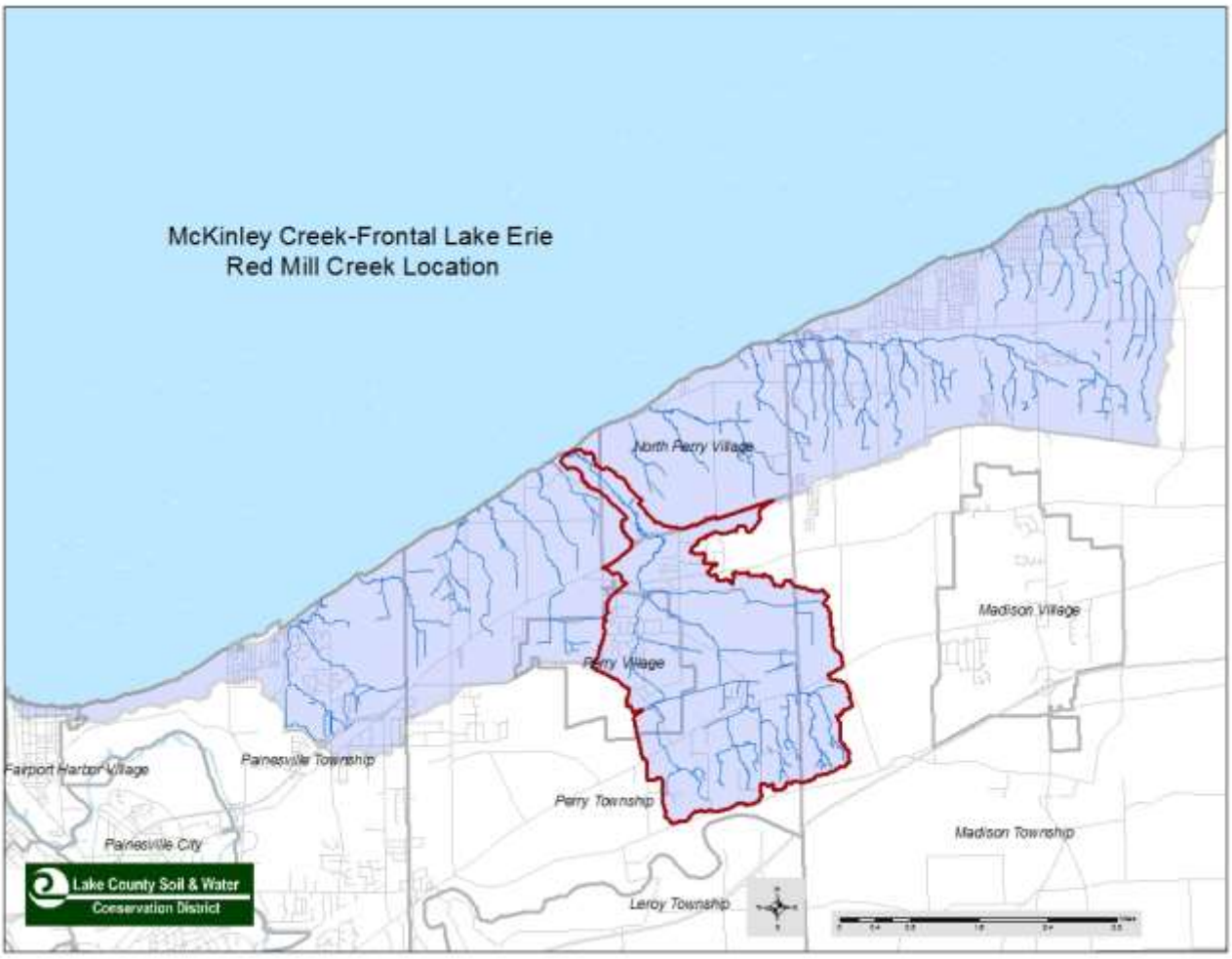


Figure 31. Red Mill Creek Land Use

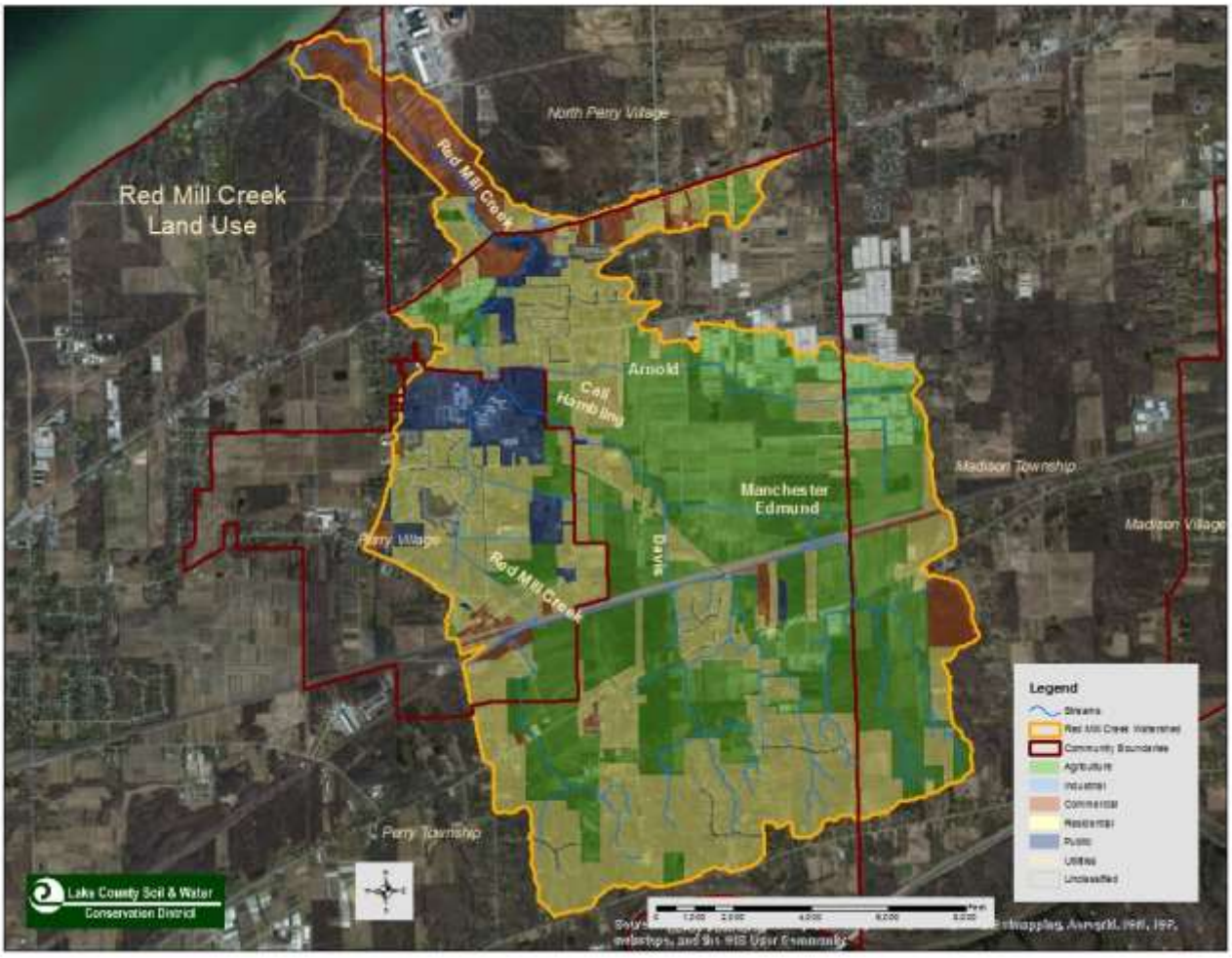


Figure 32. Red Mill Creek Land Use Data

Land Use	Acres	% of Total
Agriculture	2024.9	44.2
Industrial	11.4	.2
Commercial	195.8	4.3
Residential	1822.4	39.8
Public	260.1	5.7
Utilities	240.7	5.2
Unclassified	25.3	.6
	4,580.6	**100**

Figure 33. Red Mill Creek Soil Drainage Characteristics

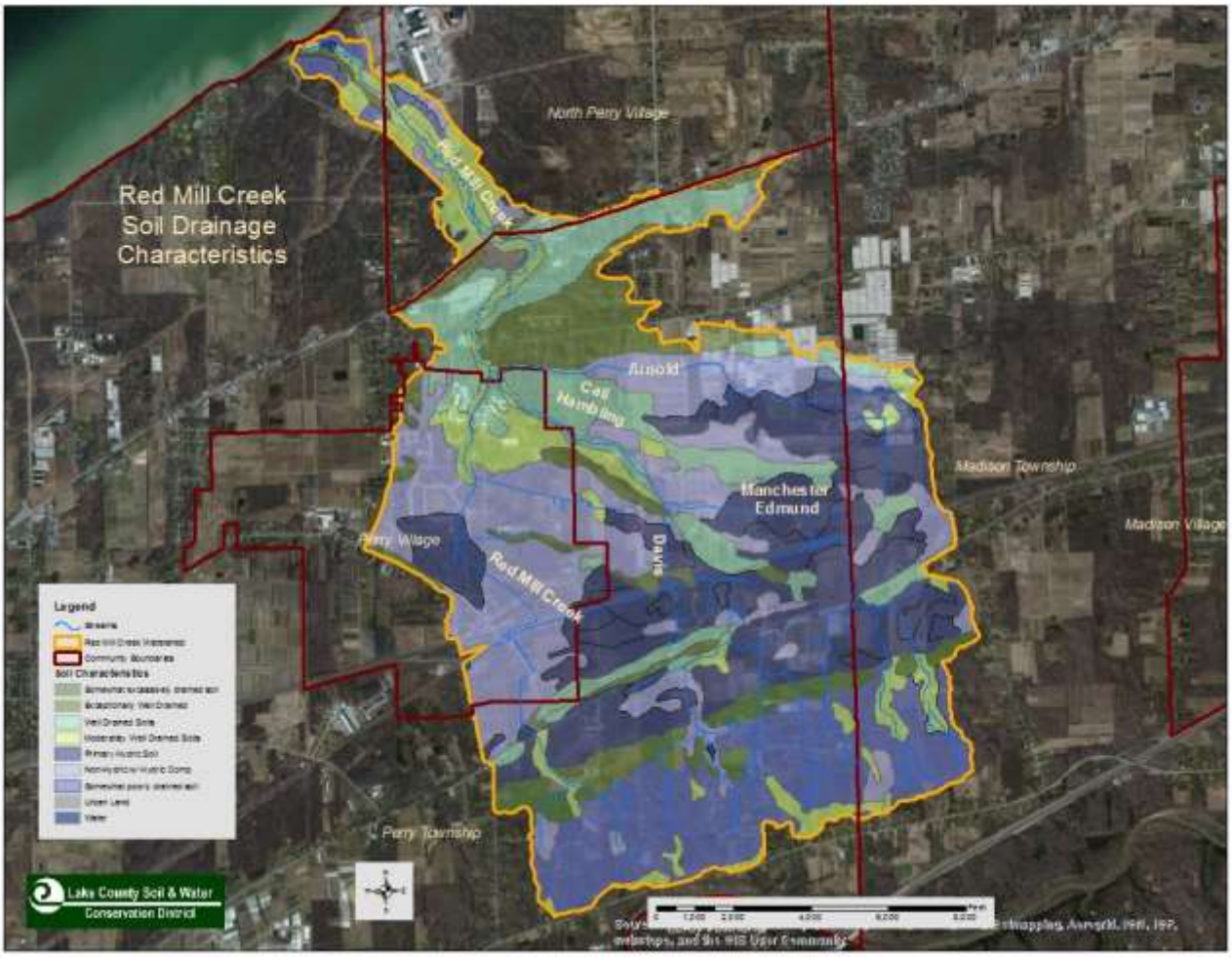


Figure 34. Red Mill Creek Soil Drainage Data

Soil Drainage Characteristics	Acres	% of Total
Somewhat Excessively Drained	133.6	2.9
Exceptionally Well Drained	423.2	9.1
Well Drained	625.8	13.5
Moderately Well Drained	491.6	10.6
Primary Hydric	1193.0	25.7
Non-Hydric w/ Hyd. Inclusions	1077.3	23.2
Somewhat Poorly Drained	665.1	14.4
Urban	21.5	.5
Water	4.0	.1
	4,635.1	**100**

Figure 35. Red Mill Creek Wetlands

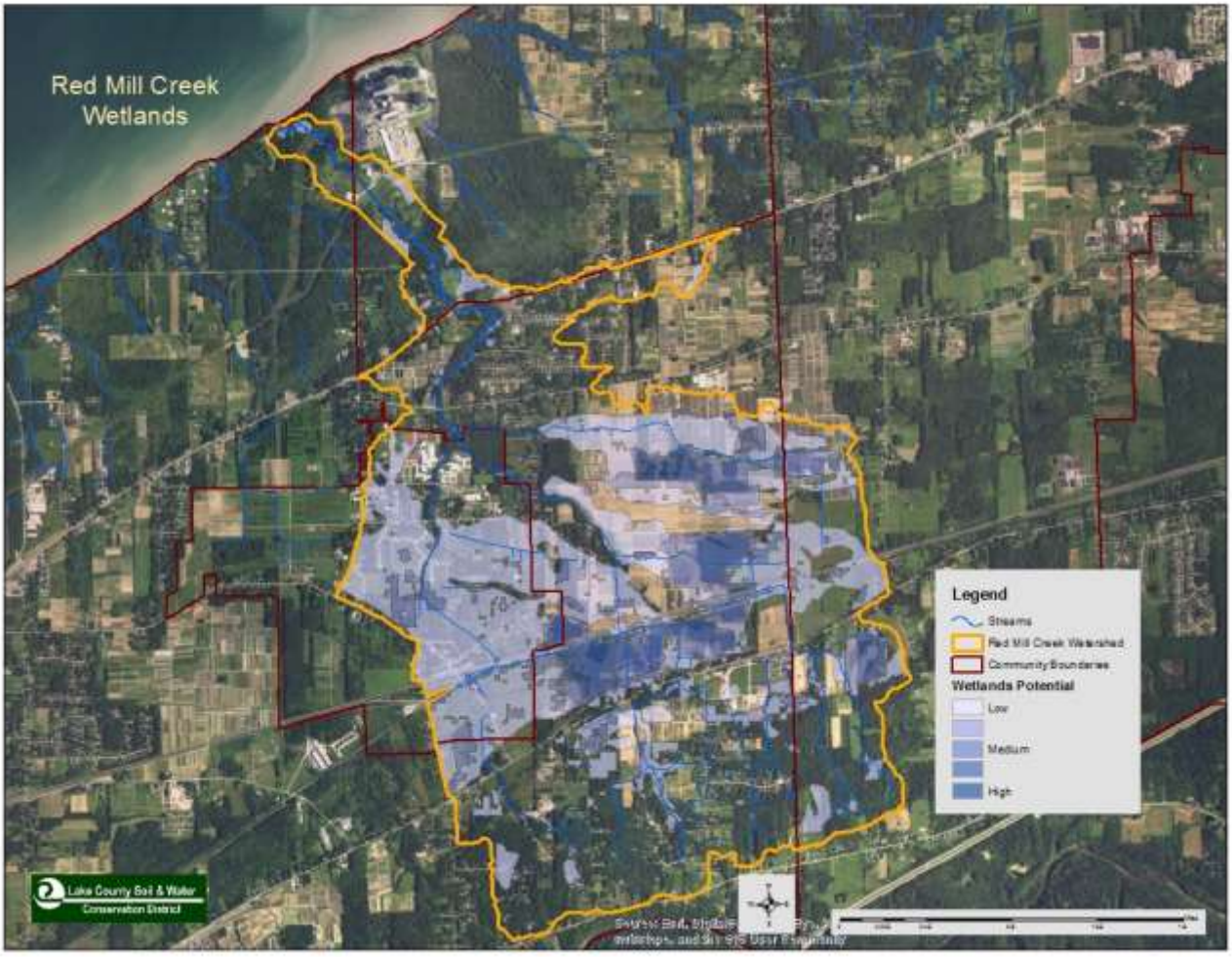


Figure 36. Red Mill Creek Sediment Supply

Figure 37. Red Mill Creek Estimated TSS (mg/L) on June 30 & July 1, 2015

Site	TSS (mg/l) Range	Water Quality Rating
1	66.1	Impaired
2	54	Impaired
3	54	Impaired
4	66.1	Impaired
5	66.1	Impaired
6	33.7	Impaired

Readings 29-133 mg/l indicate impaired water quality

Figure 38. Red Mill Creek TSS Impairments

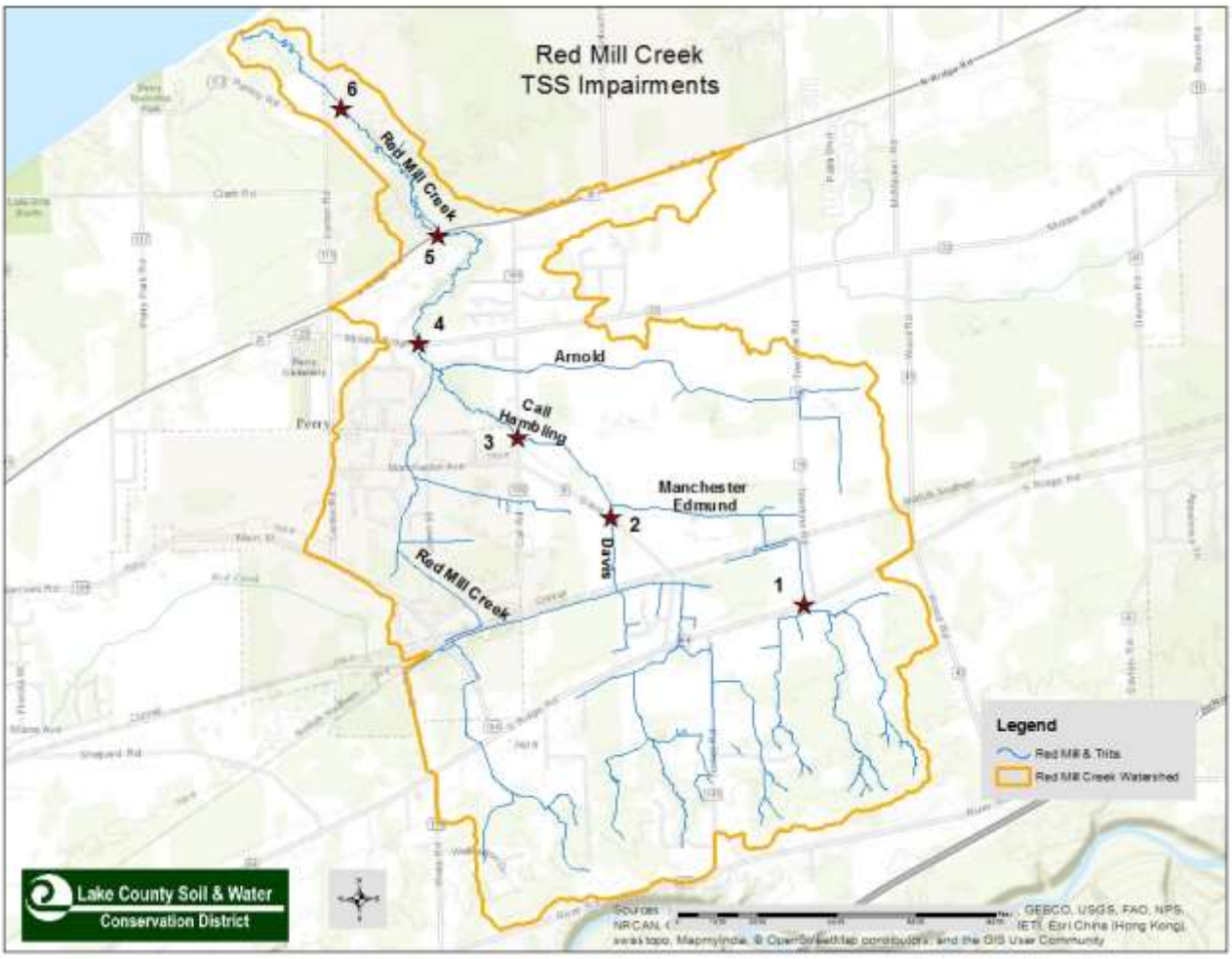
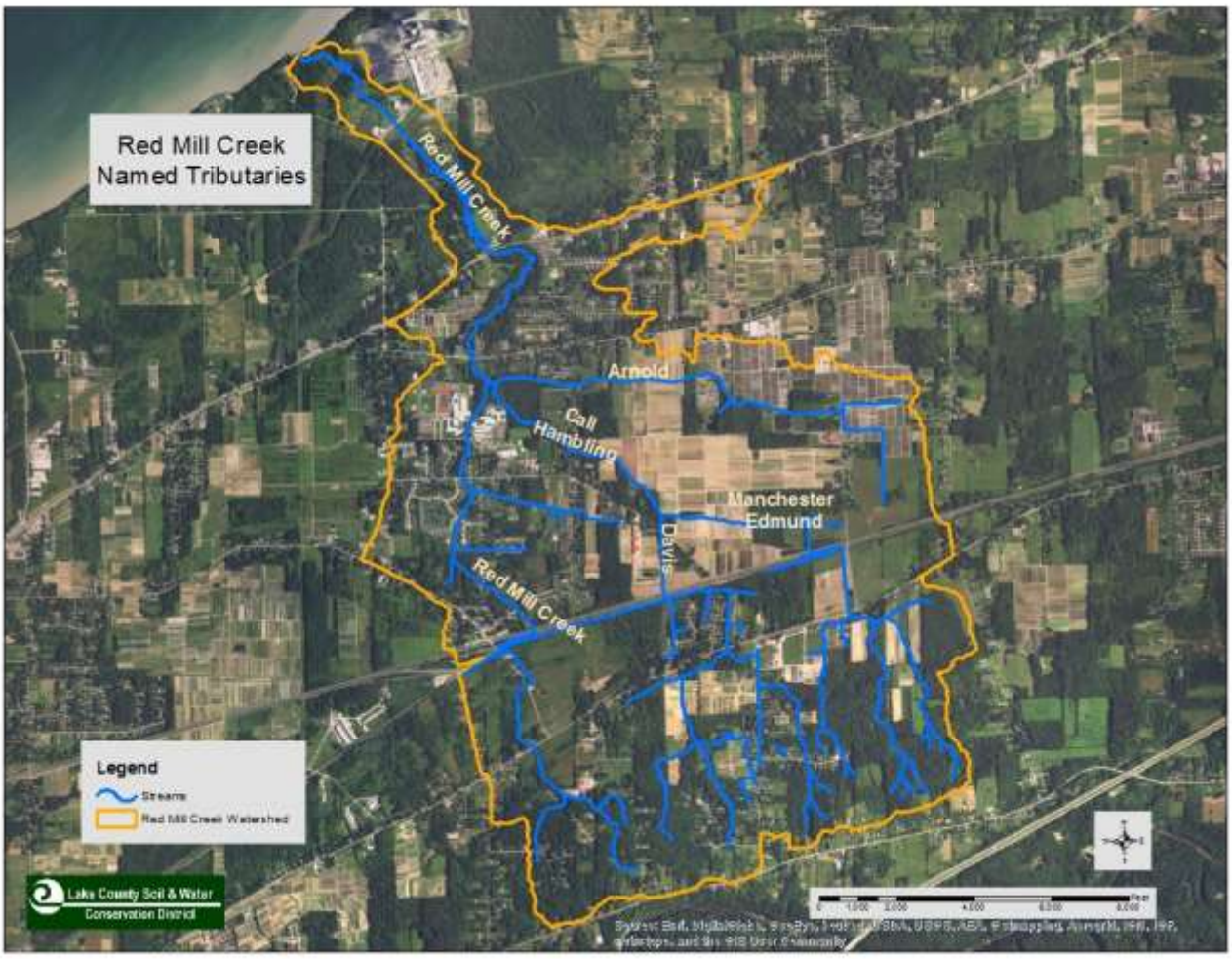


Figure 39. Red Mill Creek Named Tributaries



3.2.2 Detailed Biological Conditions

The Aquatic Life Use for the HUC-12 is designated WWH by the Ohio EPA. The Aquatic Life Use attainment for the HUC-12 is "Impaired needing TMDL". One site in Red Mill Creek was assessed by the Ohio EPA in 2015, where SR 20 crosses the northern section of the watershed. The QHEI score was 71, but it was determined to be in Partial Attainment.

Lake SWCD has collected HHEI data in the McKinley Creek-Frontal Lake Erie HUC-12, but no evaluations were done in the Red Mill Creek watershed. Numerous sites were evaluated in the adjacent Arcola Creek Watershed, in headwaters areas similar to the headwaters of Red Mill Creek (Figure 41). 69% of the sites were Class I or Class I Modified. 62% of the HHEI scores were less than 30, which scores Poor (Figure 40).

Figure 40. Arcola Creek HHEI Data

Stream Class	Percentage
Class I	54
Class I Modified	15
Class II	27
Class II Modified	1
	100

Figure 41. Red Mill Creek HHEI Locations

3.2.3 Detailed Causes and Associated Sources

The causes and sources of impairment in Critical Area 1, Red Mill Creek are listed in the Ohio EPA Water Quality Summary 2014 Integrated Report for the HUC-12 watershed.

Cause	Source
Hydromodification/Habitat Modification	Channelization from development Channelization from agricultural land uses
Flow alteration	Flow regulation/modification from development
Cause unknown	Source unknown

3.2.4 Outline Goals and Objectives for Critical Area 1

Hydromodification is a large source the nonpoint pollution in the watershed, so the stakeholders chose to use biological community performance measures to determine attainment levels. Using biology lets us look at trends over time and assess 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.

The identification of areas with Total Suspended Solids (TSS) impairments (Figure 38) by the US Army Corps of Engineers study guided the identification of project locations. With the mix of development and agricultural land uses in this watershed, a mix of type of projects is needed, including reducing stormwater runoff from large areas of imperviousness and restoring stream functionality in agricultural land uses. The high percentage of modified stream channels for agricultural drainage in the region makes a good case for the need to reverse the historical hydromodification practices.

Goals	Objectives
1.1 Raise average QHEI scores to 70 or higher in Red Mill Creek mainstem • Not Achieved: Site currently has a score of 51.5	1.1.1 Treat impervious areas with 1.5 acres of LID practices on Perry School property 1.1.2 Repair eroding banks on 900 LF at Red Mill Park 1.1.3 Restore 3000 LF of stream channel south of the railroad tracks
1.2 Raise HHEI scores to 50 in Call Hambling tributary • Not Achieved: Site currently has a score of 24	1.2.1 Plant riparian buffers on 3000 LF of nursery fields 1.2.2 Restore 3000 LF of stream channel
1.3 Raise HHEI scores to an average of 50 or higher in Manchester Edmund tributary • Not Achieved: Site currently has a score of 22.5	1.3.1 Restore 7000 LF of stream channel, including the areas south of South Ridge Road and west of Townline Road

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

3.3 Critical Area 2: Conditions, Goals & Objectives for the Lake Erie Direct Subwatershed between Red Mill and Church Creek

3.3.1 Detailed Characterization

Lake Erie Direct (LED) between Red Mill and Church Creek drains 3.48 square miles with several tributaries that drain directly into Lake Erie. The watershed is predominantly in North Perry Village, and most of North Perry Village is in this watershed (Figure 42).

The western portion of the watershed contains the First Energy Nuclear Power Plant, a large part of which is forested. The remainder of the land use is balanced between residential and agricultural (Figure 43). The streams in the residential and agricultural areas have been modified and buried in some instances to drain the land. North Perry Village has designated an agricultural preservation area, and currently has 170 acres protected with agricultural easements. The agricultural land uses are nursery and vegetable production.

Nearly half of the soils are exceptionally or moderately well drained and the other half has hydric drainage characteristics (Figure 44).

North Perry Village contracted with CT Consultants to conduct a hydrologic analysis of the drainage conditions because of recurring flooding problems in the Village. This study determined that the storm culverts may be undersized and/or in need of replacement. Channels have been incised and flooding may be alleviated by restoring floodplain access. Floodplain restoration would greatly improve the functionality and stability of streams and improved functional capacity of the riparian corridor.

Wetlands are prevalent in this subwatershed (Figure 45). They have been mapped using several different sources of wetland delineations; the darker the color in Figure 43, the greater the likelihood of wetlands being at that location. Many of them have been drained through “ditches” and tile drainage for agricultural purposes, and many are intact in the wooded areas.

Figure 42. Lake Erie Direct between Red Mill & Church Creek Location

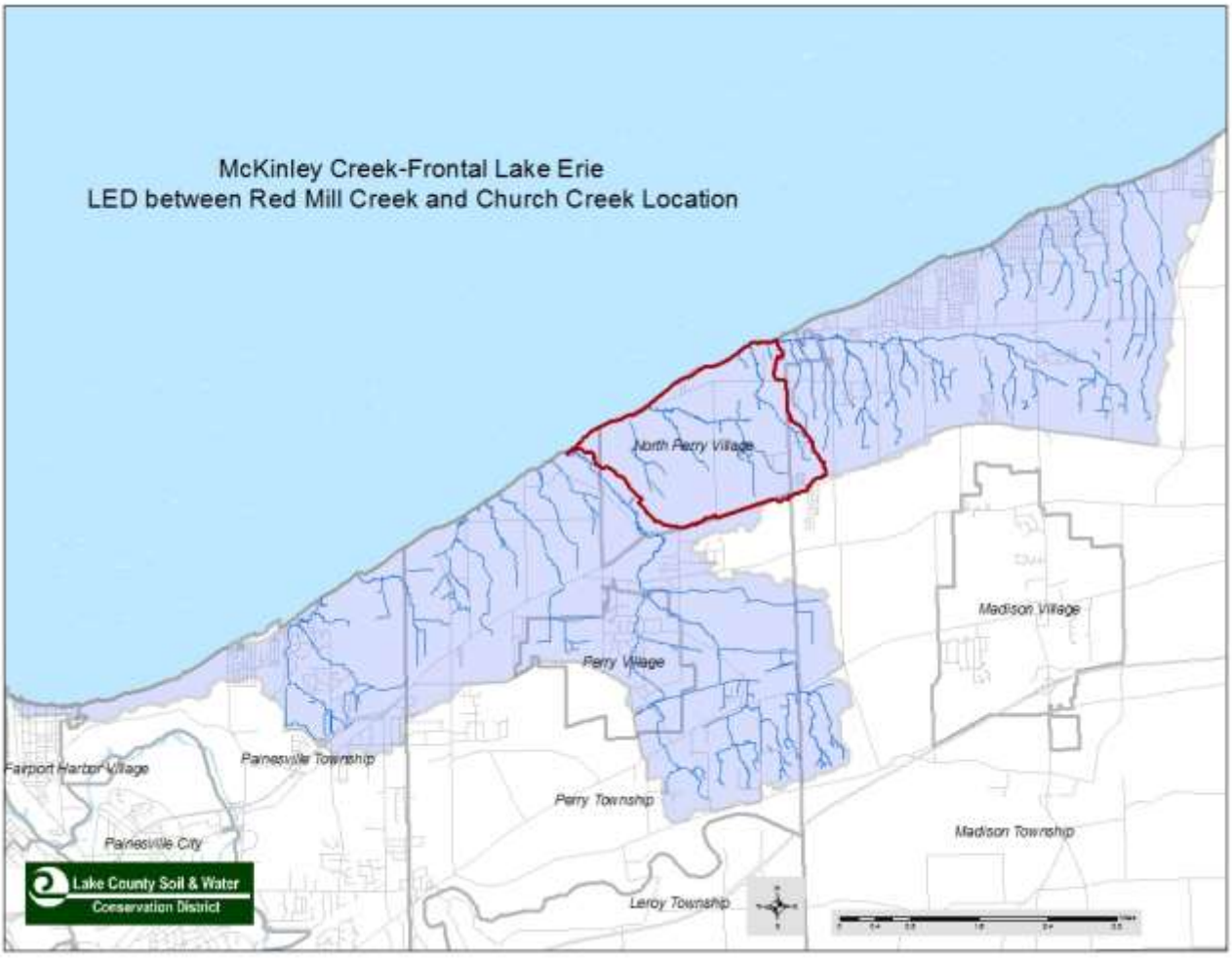


Figure 43. Lake Erie Direct between Red Mill & Church Creek Land Use

Note the shadow of the steam from the nuclear power plant cooling tower on Lake Erie.

Figure 44. Lake Erie Direct between Red Mill & Church Creek Soil Drainage Characteristics

Figure 45. Lake Erie Direct between Red Mill & Church Creek Wetlands

3.3.2 Detailed Biological Conditions

The Aquatic Life Use designation for the HUC-12 is WWH. The HUC-12 was monitored in 2015, but no samples were taken in this subwatershed. The Aquatic Life Use assessment in the Ohio EPA Water Quality Summary-2016 Integrated Report is: Impaired; TMDL needed- historical data; retained from 2008 IR (5hx).

The Lake Erie Direct subwatershed between Red Mill Creek and Church Creek has been determined a critical even though it has not been assessed in particular by the EPA. This decision was made based on the conditions observed by the stakeholders. The streams have lost their functionality, stability and access to the floodplain. Channels are incised and banks are eroding; instream habitat is severely limited because of poor morphological development and low stability.

Lake SWCD has collected HHEI data in the McKinley Creek-Frontal Lake Erie HUC-12, but only one site was evaluated in this Lake Erie Direct subwatershed. Poor morphological development and low stability are limiting factors for improvement in the system, but stream restorations can greatly

improve the functionality and stability of the system. The HHEI data was collected in 2008. The site was Class II Modified, with an HHEI score of 31, which is in the Poor category (Figure 46).

The 2015 U.S. Army Corps of Engineers field steam assessment generated data of erosion and sediment potential in the watershed (Figure 48). Areas of higher erosion include the lower end of the eastern tributary and the two branches of the central tributary, west of Antioch Road. This information has helped to identify project areas.

Figure 46. Lake Erie Direct subwatershed Class II Modified, Recovering

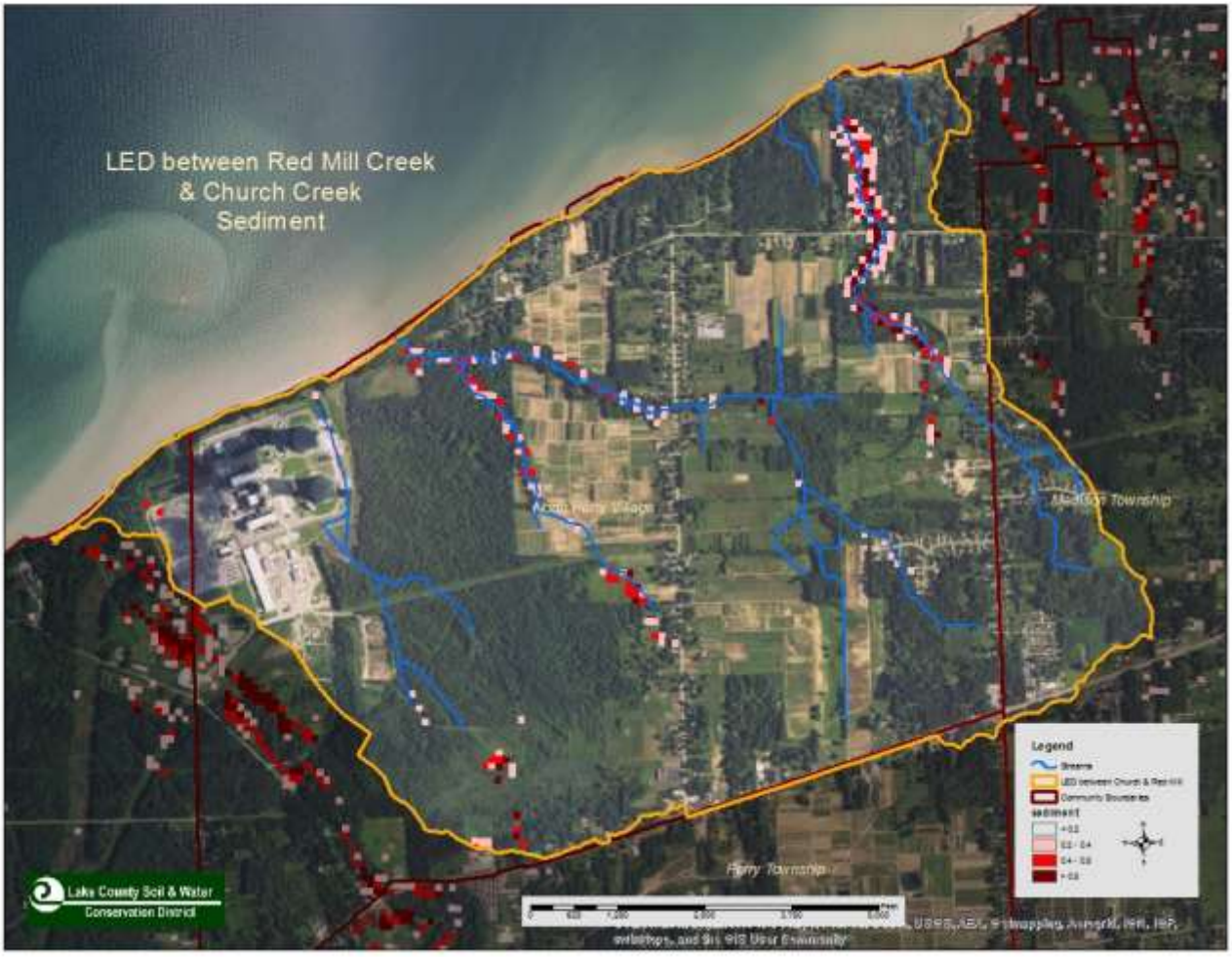
It is doubtful that an Excellent score can be achieved in this watershed because the small drainage areas prevent streams from forming deeper pools, and because of the lack of larger boulder-sized substrate. A Good score is achievable in this watershed (Figure 47).

The Ohio EPA sampled two sites in Red Mill Creek and Church Creek in 2015, both of which are adjacent to this Lake Erie Direct subwatershed; conditions on the Lake Plain in all three watersheds are comparable. The Red Mill Creek site was determined to be in Partial Attainment Status; the Church Creek site was in Non-Attainment Status.

Figure 47. Ohio EPA QHEI Scoring Scheme

Narrative Score	Headwaters Streams	Wading Streams
Excellent	70 and above	75 and above
Good	55-69	60-74
Fair	43-54	45-59
Poor	30-42	30-44
Very Poor	Less than 30	Less than 30

Figure 48. Lake Erie Direct between Red Mill & Church Creek Sediment



3.3.3 Detailed Causes and Associated Sources

The causes and sources of impairment in Critical Area 2, the Lake Erie Direct subwatershed between Red Mill Creek and Church Creek are outlined below. The impairments were summarized from the Ohio EPA Water Quality Summary, 2014 Integrated Report for the entire HUC-12 watershed, and substantiated for this subwatershed by the knowledge of the stakeholder groups.

Cause	Source
Hydromodification/Habitat Modification	Channelization from development Channelization from agricultural land uses
Flow alteration	Flow regulation/modification from development
Cause unknown	Source unknown

3.3.4 Outline Goals and Objectives for Critical Area 2

Hydromodification is a large source the nonpoint pollution in the watershed, so the stakeholders chose to restore stream channels and use biological community performance measures to determine attainment levels. Some agricultural drainage channels are more suited to a two-stage channel and for those, reductions in nutrient and sediment loadings will be included as performance measures.

Areas of high sediment loading identified by the US Army Corps of Engineers (Figure 48) informed the type and location of projects to raise HHEI scores and meet use attainments. The historical modification of stream channels for agricultural drainage in the region makes a good case for the need to reverse the historical hydromodification practices.

The large area of wooded wetlands in the western portion of the watershed, with much of it under the ownership of First Energy Nuclear presents an opportunity to protect the absorbing and filtering function of the wetlands to deliver clean water to Lake Erie in perpetuity.

Goals	**Objectives**
2.1 Raise HHEI scores to 50 in tributary west of Townline Road • Not Achieved: Site currently has a score of 30	2.1.1 Restore 2000 LF feet of stream 2.1.2 Restore floodplain access on 2000 feet of stream 2.1.3 Restore riparian buffer on 2000 feet of stream
2.2 Raise HHEI scores to 50 in western tributary • Not Achieved: Site currently has a score of 36	2.2.1 Acquire easements on 100 acres of wooded wetlands
2.3 Raise HHEI scores to 50 in central tributary • Not Achieved: Site currently has a score of 41	2.3.1 Acquire agricultural easements on 50 acres
2.4 Raise HHEI scores to 50 in central tributary • Not Achieved: Site currently has a score of 41	2.4.1 Convert 2500 LF of stream to two-stage channels

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

3.4 Critical Area 3: Conditions, Goals & Objectives for Lake Erie Direct between McKinley Creek and Red Mill Creek

3.4.1 Detailed Characterization

The LED between McKinley Creek and Red Mill Creek watershed drains 5.6 square miles (Figure 49). Six tributaries drain directly into Lake Erie. The land use is largely agricultural land in nursery production and publicly owned (Figures 53 and 54). 50% of the publicly owned land is owned by Lake Metroparks and 30% is owned by Lake County Department of Utilities, which is the county landfill. The landfill property in this subwatershed has been slated for future landfill space, and there is a good opportunity to address stream and drainage issues before it begins operations. The First Energy Nuclear company owns approximately 410 acres of wooded acreage, some of which is wetland. Most of the nursery operations lack a riparian buffer and many of the stream channels have been channelized and maintained as ditches to drain agricultural land.

The watershed is on the Lake Plain and the elevation drops from 706' at the top of the watershed to 572' at the Lake level, for a 1% average slope. The "ridge" from a former lake level elevation and which forms North Ridge Road is visible on a topographical map running parallel to the lake in the southern of the third of the watershed (Figure 50). The streams tend to cut their way down to the Lake bluff edge and have deeper channels closer to the Lake (Figure 51).

The watershed is in portions of Painesville Township, Perry Township, Perry Village and North Perry Village (Figure 52). Perry Township is not in the Lake County Stormwater Management Department, which is a factor when considering funding sources for watershed improvement practices that require a match.

72% of the soils have hydric drainage characteristics; 14% are exceptionally well drained (Figures 55 and 56). Wetlands are prevalent in the western section of this subwatershed, with some scattered in the eastern-central section (Figure 57). They have been mapped using several different sources of wetland delineations; the darker the color in Figure 57, the greater the likelihood of wetlands being at that location. The highest potential for wetlands is in wooded areas, where they have not been drained. It is a priority to protect these remaining wetlands with conservation easements where possible.

Figure 49. LED between McKinley Creek & Red Mill Creek Location

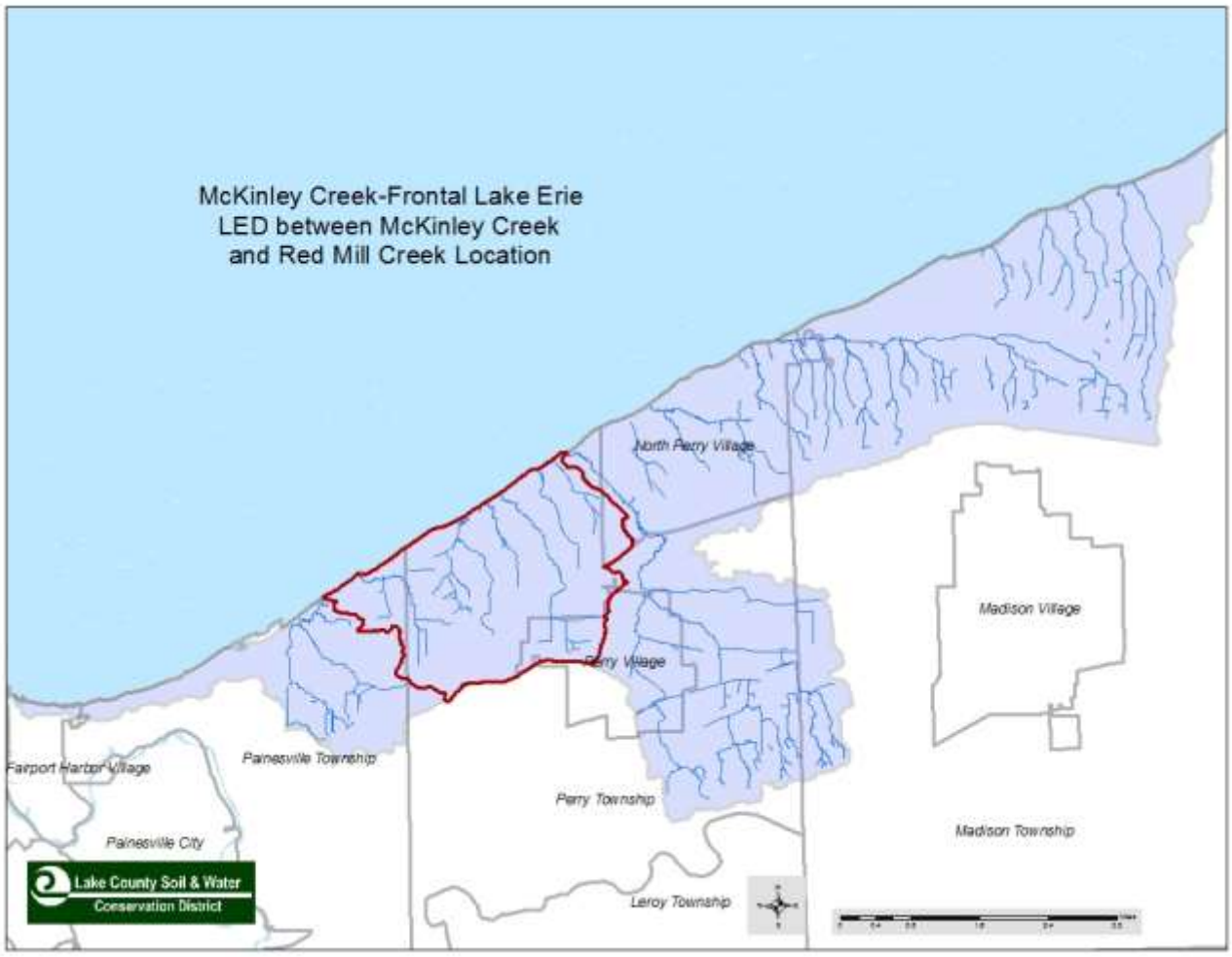


Figure 50. LED between McKinley & Red Mill Creek Topography

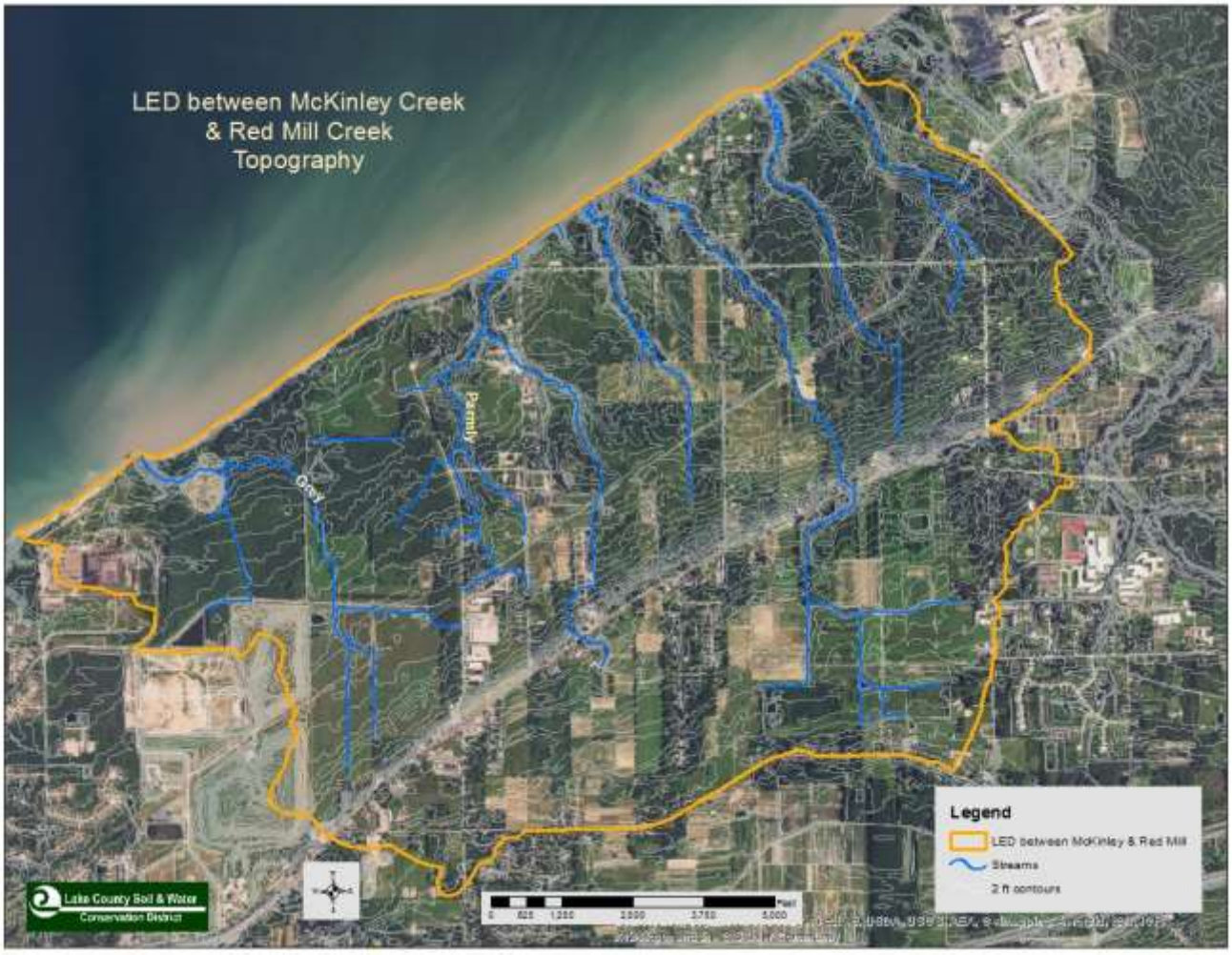


Figure 51. Lake Erie Bluff

Figure 52. LED between McKinley & Red Mill Creek Communities

Figure 53. LED between McKinley & Red Mill Creek Land Use

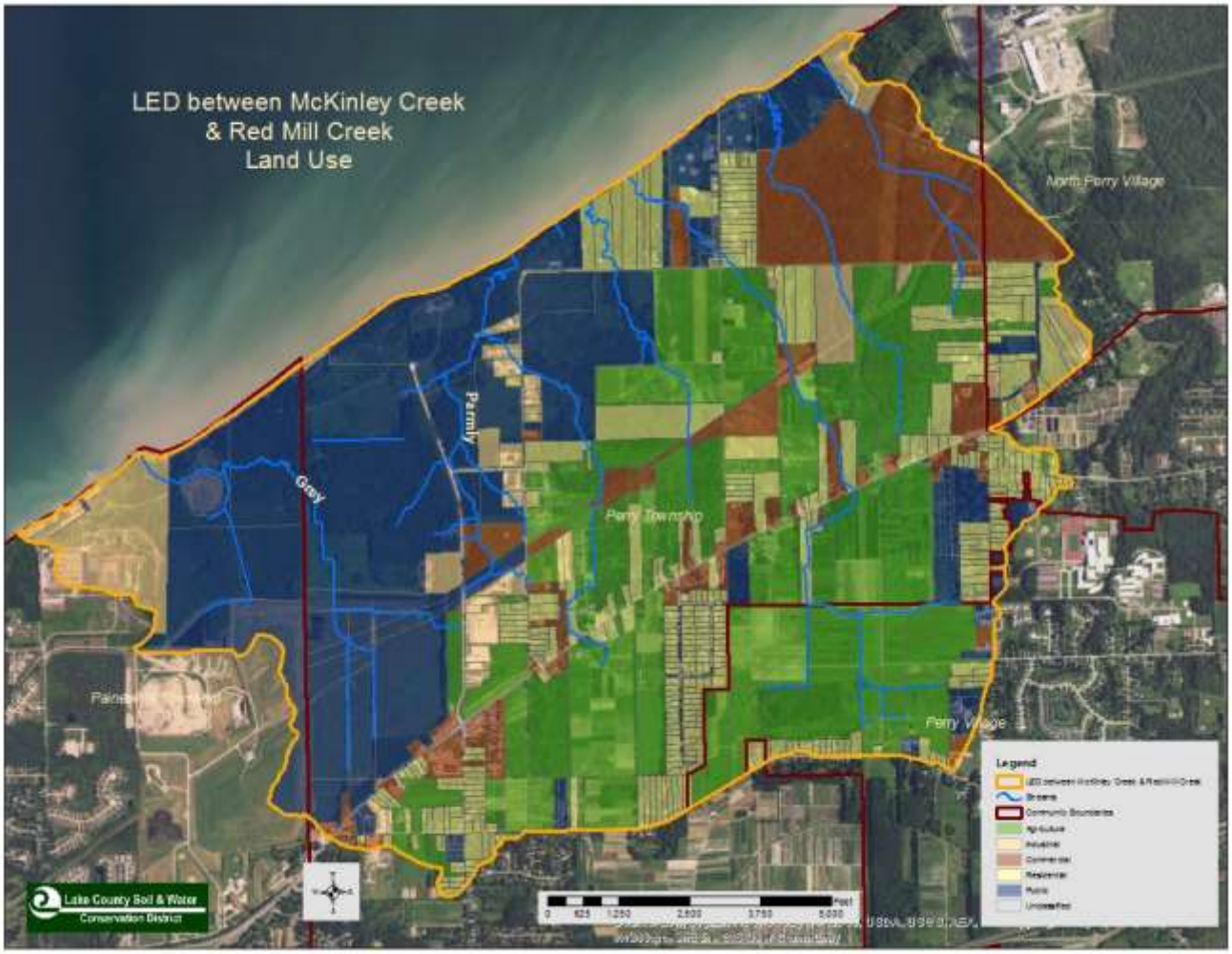


Figure 54. LED between McKinley & Red Mill Creek Land Use Data

Land Use	Acres	% of Total
Agriculture	1100.7	31
Industrial	232	6.5
Commercial	457	13.5
Residential	576	16
Public	1165	33
	3533.5	**100**

Figure 55. LED between McKinley & Red Mill Creek Soil Drainage Characteristics

Figure 56. LED between McKinley & Red Mill Creek Soil Drainage Data

Soil Drainage Characteristics	Acres	% of Total
Exceptionally Well Drained	508.3	14.2
Well Drained	159	4.5
Moderately Well Drained	304	8.5
Primary Hydric	700.1	19.6
Non-Hydric w/ Hyd. Inclusions	1240	35
Somewhat Poorly Drained	622.5	17.5
Urban	30.4	.7
	3565.7	**100**

Figure 57. LED between McKinley & Red Mill Creek Wetlands

3.4.2 Detailed Biological Conditions

The Aquatic Life Use designation for the HUC-12 is WWH. The HUC-12 was monitored in 2015, but no samples were taken in this subwatershed. The Aquatic Life Use assessment in the Ohio EPA Water Quality Summary-2016 Integrated Report is: Impaired; TMDL needed- historical data; retained from 2008 IR (5hx).

Detailed biological data is not available, but the habitat for biological life is lacking. The streams have lost their functionality, stability and access to the floodplain. Channels are incised and banks are eroding; instream habitat is severely limited because of poor morphological development and low stability (Figure 59).

The 2015 U.S. Army Corps of Engineers field steam assessment generated data of erosion and sediment potential in the watershed (Figure 58). Areas of high sediment exist along the headwaters of five tributaries, and at the lower reaches of four. Several of these areas have been identified as project areas.

Figure 58. LED between McKinley & Red Mill Creek Sediment

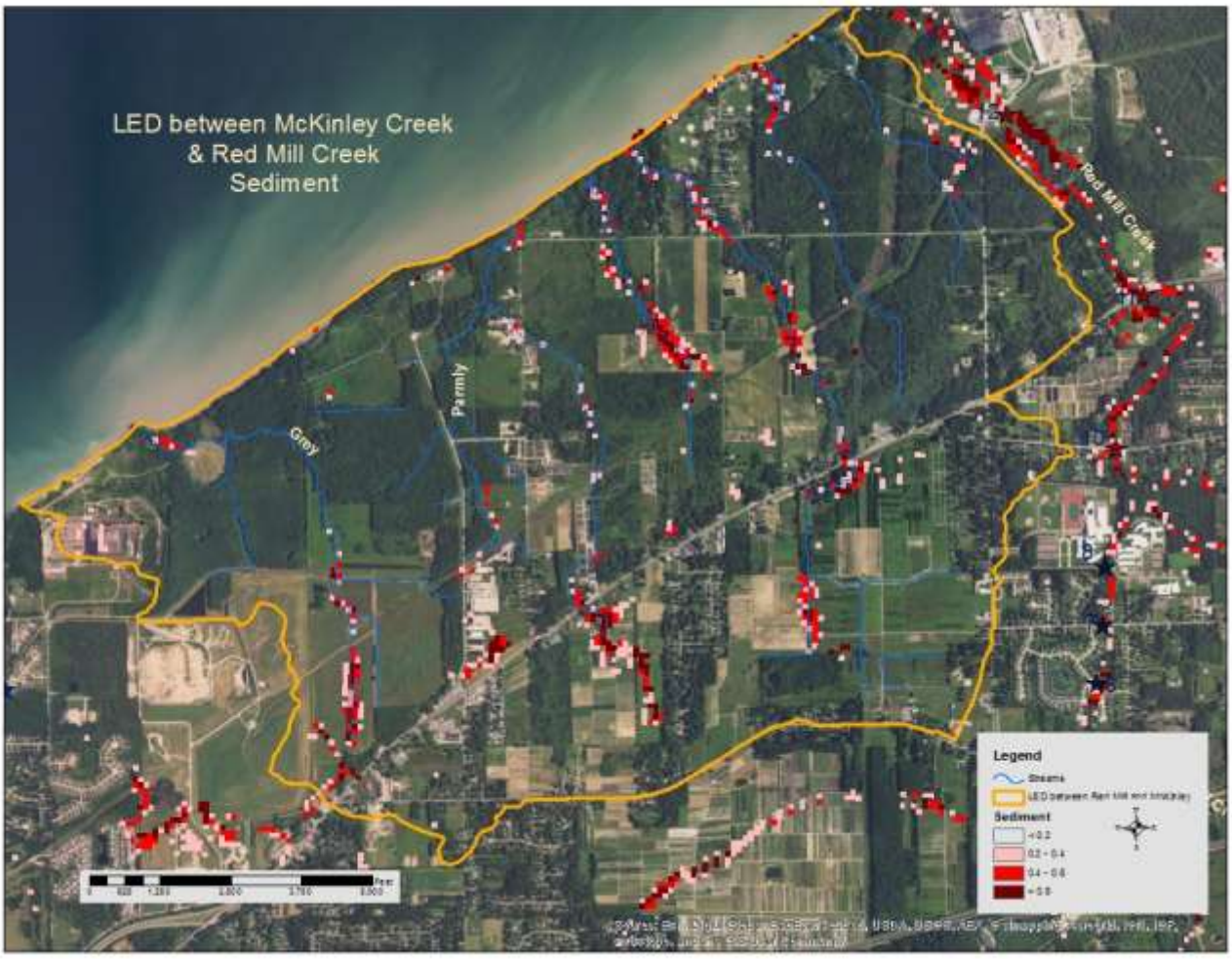


Figure 59. Natural Channel

3.4.3 Detailed Causes and Associated Sources

The Ohio EPA Aquatic Life Use Designation for the watershed is Warmwater Habitat (WWH). The causes and sources of impairment in the LED between McKinley Creek & Red Mill Creek 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.

Cause	Source
Hydromodification/Habitat Modification	Channelization from development Channelization from agricultural land uses
Flow alteration	Flow regulation/modification from development
Cause unknown	Source unknown

3.4.4 Outline Goals and Objectives for Critical Area 3

Hydromodification is a large source the nonpoint pollution in the watershed, so the stakeholders chose to restore stream channels and use biological community performance measures to determine attainment levels. Some agricultural drainage channels are more suited to a two-stage channel and for those, reductions in nutrient and sediment loadings will be used as performance measures.

Again, the identification of areas of high sediment by the US Army Corps of Engineers (Figure 58) informed the type and location of projects to raise HHEI scores and meet use attainments. The

historical modification of stream channels for agricultural drainage in the region makes a good case for the need to reverse the historical hydromodification practices from agricultural land uses. The larger areas under public ownership- Lake Metroparks and Lake County Utilities provide excellent opportunities for restoration projects. First Energy Nuclear owns a large portion of wooded wetlands in this watershed as well as in Critical Area 2, providing the same opportunity to protect the absorbing and filtering function of the wetlands to deliver clean water to Lake Erie in perpetuity.

Goals	**Objectives**
3.1 Raise HHEI scores to 50 on Lake County Utilities property • Not Achieved: Site currently has a score of 27	3.1.1 Restore 3000 LF of stream on Lake County Utilities property 3.1.2 Plant riparian buffers on 3000 LF on Lake County Utilities property 3.1.3 Restore 7 acres of wetlands on Lake County Utilities property
3.2 Raise HHEI scores to 50 on Lake Metro Parks property • Not Achieved: Site currently has a score of 27	3.2.1 Restore 5000 LF of stream on Lake Metroparks property 3.2.2 Protect and restore forested wetlands. Acquire conservation easements on 50 acres of wooded wetlands
3.3 Raise HHEI scores to 50 on Perry Township property on Perry Park Road • Not Achieved: Site currently has a score of 10	3.3.1 Convert 1000 LF of stream to two-stage channels 3.3.2 Plant riparian buffer on 500 feet of restored channel
3.4 Raise HHEI scores to 50 on Lake County Nursery property south of North Ridge Road • Not Achieved: Site currently has a score of 21	3.4.1 Convert 1300 LF of stream to two-stage channels 3.4.2 Plant riparian buffer on 1300 feet on agricultural fields 3.4.3 Remove invasives on 1300 feet of stream channel
3.5 Raise QHEI scores to 70 on First Energy Properties property • Not Achieved: Site currently has a score of 52	3.5.1 Protect and restore forested wetlands. Acquire conservation easements on 50 acres of wooded wetlands

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

The projects and evaluation needs that are believed to be necessary to remove the impairments to the McKinley 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 are three Project and Implementation Strategy Overview Tables, one for each Critical Area. Critical Area 1, 2 and 3 Goals aim to address flow alteration and loss of functionality from hydromodification of agricultural land drainage and runoff from developed areas through restoration of natural flow conditions and habitat.

The projects described in the Overview Tables 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).

Section 4.1 Project and Implementation Strategy Overview Table(s)

For *McKinley Creek- Frontal Lake Erie (HUC-12)* (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)*
Urban Sediment and Nutrient Reduction Strategies								
Altered Stream and Habitat Restoration Strategies								
1	1.1	1.1.1		LID at Perry Schools	Lake SWCD	3-5 years		319
1	1.1	1.1.2		Red Mill Park bank restoration	Lake SWCD	3-5 years		319, Lake Metro Parks
1	1.1	1.1.3		Stream restoration South of the Railroad tracks	Lake SWCD	3-5 years		319
1	1.2	1.2.1, 1.2.2		Stream Restoration in Call Hambling tributary	Lake SWCD	3-5 years		319
1	1.3	1.3.1		Stream Restoration in Manchester Edmund tributary	Lake SWCD	3-5 years		319
Agricultural Nonpoint Source Reduction Strategies								
High Quality Waters Protection Strategies								
Other NPS Causes and Associated Sources of Impairment								

For *McKinley Creek- Frontal Lake Erie (HUC-12)* (041100030204) —Critical Area #2								
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)*
Urban Sediment and Nutrient Reduction Strategies								
Altered Stream and Habitat Restoration Strategies								
2	2.1	2.1.1, 2.1.2, 2.1.3	1	NPV Floodplain Restoration Phase I	Lake SWCD	1-3 years	$213,192	319, North Perry Village
2	2.2	2.2.1		Wooded wetland easements in western tributary	Lake SWCD	3-5-years		GLRI, 319, Clean Ohio
2	2.3	2.3.1		Agricultural easements in NPV	Lake SWCD	3-5 years		ALE
2	2.4	2.4.1		Central tributary two-stage channel	Lake SWCD	3-5 years		319, EQIP
Agricultural Nonpoint Source Reduction Strategies								
High Quality Waters Protection Strategies								
Other NPS Causes and Associated Sources of Impairment								

For *McKinley Creek- Frontal Lake Erie (HUC-12)* (04110003024) —Critical Area #3								
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)*
				.				
Urban Sediment and Nutrient Reduction Strategies								
Altered Stream and Habitat Restoration Strategies								
3	3.1	3.1.1, 3.1.2, 3.1.3		Lake County Utilities natural resources restoration	Lake SWCD	7+ years		319, Lake County Dept of Utilities
3	3.2	3.2.1, 3.2.2		Lake Metro Parks stream restorations	Lake SWCD	3-5 years		319, Lake Metro Parks
3	3.5	3.5.1		First Energy property stream restoration	Lake SWCD	3-5 years		319
3	3.3	3.3.1, 3.3.2		Perry Township JEDD two-stage channel	Lake SWCD	3-5 years		319, EQIP
3	3.4	3.4.1, 3.4.2, 3.4.3		Lake County Nursery two-stage channel	Lake SWCD	3-5 years		319, EQIP
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**	NPV Floodplain Restoration Phase I
criteria d	**Project Lead Organization & Partners**	North Perry Village and Lake SWCD
criteria c	**HUC-12 and Critical Area**	HUC: 04110030204 McKinley Creek – Frontal Lake Erie Critical Area 2
criteria c	**Location of Project**	2438 Townline Road North Perry, Ohio
n/a	**Which strategy is being addressed by this project?**	Altered Stream and Habitat Restoration
criteria f	**Time Frame**	Short-Term (Priority) (1-3 yr) Spring 2017 to Spring 2018
criteria	**Short Description**	A restoration project to improve functionality and stability by creating more frequent floodplain access and improved functional capacity. This will be accomplished with a floodplain creation approach to connect the stream to a floodplain of adequate width and elevation.
criteria g	**Project Narrative**	This reach is currently incised with 6-8ft 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. This will largely be accomplished with a floodplain creation (excavation) approach to connect the stream to a floodplain of adequate width and elevation. The proposed floodplain dimensions will be more consistent with the floodplains detected on the upper terrace during initial survey work conducted by the Village and SWCD. To support this approach, morphological data on the existing conditions at the project site and at a selected reference reach are currently being collected. Besides the channel being incised, the site has several positive aspects such as the adjacent forested riparian terrace and easy access to the site via the existing sanitary sewer corridor along the eastern terrace. Phase 1 restoration work will begin downstream at the Kroggel property line and extend upstream ~900.0-ft. to the upstream property line. Floodplain excavation will then create over 112,000 CF of floodplain storage while utilizing the existing meander geometry. Areas of erosion that were observed along the right descending bank will be stabilized

		during the vegetative restoration phase of the project. The increase in accessible floodplain will lower the flood stage in this reach and reduce the shear stress for given flows. Less velocity and shear stress in the stream will have numerous beneficial results. Bank erosion will be lowered; which will reduce sediment loadings in the stream and accompanying pollutants. In addition plantings of woody vegetation (trees and shrubs) will be installed in approximately 1.2-acres consisting of the existing right bank and the created floodplain. 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**	Total Project Cost: $213,192.37 See Table Below from 319 Application
criteria d	**Possible Funding Source**	319 Grant Funding and Local Match (Cash and In-Kind)
criteria a	**Identified Causes and Sources**	Causes: Hydromodification/Habitat Modification Sources: Channelization from agricultural land uses
criteria b & h	**Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?**	HHEI scored raised from 30 to 50
	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 the tributary west of Townline Road. It completely addressed Objective 1 in Critical Area 2. It is anticipated that the HHEI score will reach 39.5 in the short term and 66.5 in the long term through the implementation of this project.
	Part 3: Load Reduced?	Nitrogen: 40 lbs/yr Phosphorus: 20 lbs/yr Sediment: 23 tons/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 with both quantitative and qualitative methods. A HHEI was conducted on the existing channel conditions by SWCD staff. The net score for the project area was 29.5/100. The proposed restoration technique of floodplain creation does not actively change conditions within the channel itself and therefore will not immediately improve many of the scoreable metrics on the QHEI. However, the benefits of improved habitat metrics that would be

		measureable on a HHEI will occur from channel evolution "healing" itself from the high shear stress conditions that will be removed. Therefore an estimation of both "interim" and "future" conditions are offered. The interim scores would be estimates of HHEI metric scores within one season after construction of the project. The future scores are then estimates of HHEI metric scores which would be expected within 5-10 years after construction of the project. The interim HHEI score is estimated to be 39.5/100 and the future HHEI score is estimated to be 66.5/100.
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 Village Flyer 1

Federal

Budget Justification

*Provide a summary of your **TOTAL FEDERAL GRANT FUNDS** project budget (by category) and include a **BRIEF** justification and **ITEMIZED** breakdown for the amount proposed in each category. **ANY** budget category with an amount entered **MUST** be accompanied by a justification/description. Applicants requesting PERSONNEL and/or FRINGE BENEFIT funding MUST also complete a PERSONNEL ROSTER.*

Category	Federal $$ Requested	BUDGET Justification & Description
Personnel: Include a Personnel Roster if Personnel funds are requested. (Check activity description for any limits on personnel)		
Fringe Benefits Include a Personnel Roster if Fringe Benefit funds are requested		
Travel		
Equipment		
Supplies		
Subcontract: Include a Subcontract Worksheet.	**$120,000.00**	Project/Grant/Construction Management and earthwork activities required for completion of the floodplain excavation and restoration activities.
Other		
Cost Share		
Indirect Only available if you have a negotiated federal indirect rate with US EPA. (May not exceed 25% of personnel and fringe costs).		
TOTAL	**$120,000.00**	

Match
Budget Justification

*Provide a summary of your **total CASH MATCH and In-Kind Services** budget (by category) and include a **BRIEF** justification and **ITEMIZED** breakdown for the amount proposed in each category. **ANY** budget category with an amount entered **MUST** be accompanied by a justification/description. PLEASE NOTE: Applicants providing PERSONNEL and/or FRINGE BENEFIT match funding MUST also complete a PERSONNEL ROSTER. Applicants showing match under the Subcontracts Category must also complete a SUBCONTRACT WORKSHEET.*

Category	Local Match Budget	BUDGET Justification & Description
Personnel: Applicants must include a Personnel Roster if Personnel Matching Funds are included.	**$20,126.10**	Staff commitment for project deliverables (earthwork, signage, clerical, oversight) $11,070.00 from North Perry and $9056.10 from SWCD
Fringe Benefits Applicants may only claim sponsoring organization personnel fringe benefits as Match.	**$9,129.27**	$4270.00 NPV estimate and $4859.27 SWCD
Travel If out-of-state travel is requested you must include an itemized listing of each proposed trip and estimated costs by trip.		
Equipment Specific items costing more than $5,000 per unit are not eligible.	**$500.00**	Laser level, tripod and grade rod
Supplies	**$3,000.00**	Paper/printing costs, lath and paint, herbicide, seed/mulch, trees and live stakes
Subcontract: includes technical services provided by project partners such as engineering, etc. Include a subcontract worksheet.	**$43,500.00**	Earthwork Contractor for excavation, spoiling, mass grading and contouring of floodplain.
Other:	**$17,000.00**	Heavy equipment rental (Track Hoe, Dozer, Dump Trucks)
Cost Share		
Indirect: Only available if you have a negotiated federal indirect rate with US EPA at the time of application. (Unrecovered Indirect costs >25% may be used as local match)		
TOTAL	**$93,192.37**	

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Appendix A. Acronyms

BGI	Balanced Growth Initiative
BMP	Best Management Practice
CWH	Cold Water Habitat
ELCCT	Eastern Lake County Coastal Tributaries
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
JEDD	Joint Economic Development District
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