East Fork Little Miami River
Watershed Action Plan

East Fork Lake Tributaries Watershed Management Plan

September 2006

East Fork Little Miami River entering William H. Harsha Lake

East Fork Watershed Collaborative
P.O. Box 549, 1000 Locust Street
Owensville, OH 45160-0549

Table of Contents

Table of Contents (continued)

List of Figures

List of Tables

East Fork Watershed Collaborative

East Fork Lake Tributaries Watershed Management Plan

Chapter One

Introduction

CHAPTER 1: INTRODUCTION

Historically, environmental regulatory agencies have addressed water quality concerns by focusing on the discharges from "point sources," the direct discharges from industrial facilities and municipal wastewater treatment plants. While controlling these discharges has significantly improved water quality in many streams, many others - including many streams within the East Fork Little Miami River watershed - remain impaired. Other possible sources of impairment include stormwater runoff, failing septic systems, and runoff from agricultural fields. To successfully manage pollutant loadings so that streams are "fishable, swimmable and drinkable" (the goals of the Clean Water Act), a watershed must be addressed as a whole, and all potential sources of pollution taken into account.

In 2000, the Soil and Water Conservation Districts in Brown, Clermont, Clinton and Highland Counties partnered with Clermont County to participate in the Ohio Department of Natural Resources Watershed Planning Program. A grant was received to fund a Watershed Coordinator for the East Fork Little Miami River Watershed, and the East Fork Watershed Collaborative was born.

The East Fork Watershed Collaborative (EFWC or "the Collaborative") has accepted the responsibility for developing a watershed action plan (WAP) for the entire East Fork Little Miami River watershed. Due to the size of the East Fork watershed (500 mi^2 or almost 320,000 acres), and the variability in land use and stream conditions in various parts of the East Fork watershed, the EFWC made a decision to divide the overall watershed into smaller, more manageable subwatersheds for the purpose of planning. The subwatersheds selected as planning units are the Lower East Fork watershed, the Middle East Fork watershed, the Stonelick Creek watershed, the East Fork Lake Tributaries, and the East Fork Headwaters (see Figure 1-1).

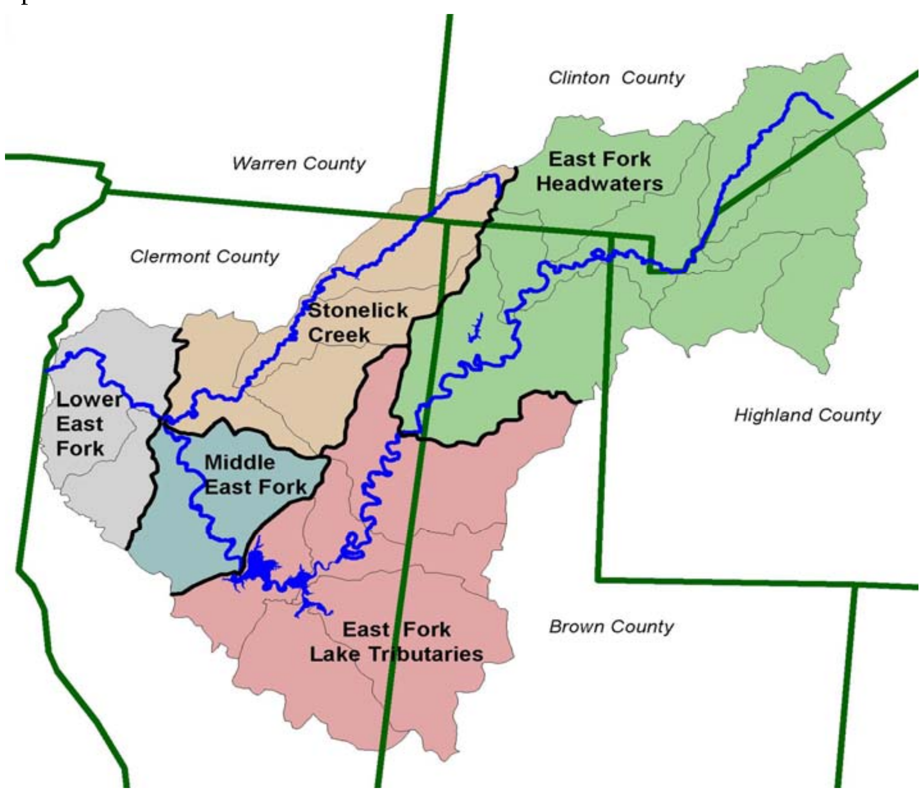


Figure 1-1. East Fork watershed planning units.

Subwatershed plans will focus on concerns unique to each subwatershed, providing a detailed description of subwatershed characteristics and stream conditions, causes and sources of water quality impairment, and specific recommendations on how those impairments might be addressed.

A watershed plan for the Lower East Fork was submitted to and endorsed by Ohio EPA and Ohio Division of Natural Resources (ODNR) in 2003. A watershed plan for the East Fork Headwaters was submitted and endorsed by Ohio EPA and Ohio DNR in June 2006. The Lake Tributaries watershed plan - contained herein - is the third East Fork subwatershed plan. The EFWC is currently developing watershed plans for the Stonelick Creek and Middle East Fork subwatersheds, with completion expected by September 2006. Our final Watershed Action Plan for the East Fork Little Miami River will integrate the five subwatershed plans into a coherent whole, highlighting the connections and differences among the subwatersheds.

East Fork Lake Tributaries Watershed Action Plan

This document represents the action plan for the East Fork Lake Tributaries, which consists of the entire East Fork drainage area downstream of Fivemile Creek and upstream of the Harsha Lake dam (see Figure 1-1, p1). This plan contains the following sections:

- a watershed inventory, focusing on geology, soils, biological features, water resources, land use, point sources and non-point sources of pollution, and alterations to natural habitat;
- a summary of water resource quality in the East Fork Little Miami RIver and its tributaries;
- a summary of community water management goals and interests;
- a discussion of watershed impairments, including an identification and quantification of potential pollutant sources, and recommended watershed restoration and protection goals.

The development of the Lake Tributaries Watershed Action Plan (Lake Tribs WAP) was truly a team effort, with input from dozens of partners and participants. Some of those contributions are described here.

Watershed Inventory

The inventory requirements to receive Ohio EPA endorsement are outlined in the Appendix 8 update (Ohio EPA, 2003) to "*A Guide to Developing Local Watershed Action Plans in Ohio*" (Ohio EPA, 1997). A wide variety of data sources must be tapped to complete the inventory. This WAP inventory includes information contributed by:

- Clermont County GIS Departments;
- Farm Service Agencies of Brown and Clermont Counties;
- Soil and Water Conservation Districts of Brown and Clermont Counties;
- Health Departments of Brown and Clermont Counties;
- Ohio Department of Natural Resources, US Geological Survey, U.S. EPA, and Ohio EPA;
- Clermont Office of Environmental Quality, Ohio-Kentucky-Indiana (OKI) Regional Council of Governments, and the Little Miami River Partnership.

(Apologies to those not mentioned.)

Water Resource Quality

Use attainment and water quality information was compiled from Ohio EPA and Clermont OEQ data.

Community Water Resource Management Interests

The success of any plan requires buy-in from those with the ability to implement the recommendations of the plan. For the Lake Tribs WAP, every effort was made to involve local community members (landowners, business owners, elected officials, county agency staff, …) in defining the local water management goals, and developing

East Fork Watershed Collaborative

The East Fork Watershed Collaborative was formed in 2001 to provide local agencies, groups and individuals the opportunity to collaboratively plan and implement water quality improvement projects. The Collaborative's mission is "to enhance the biological, chemical and physical integrity of the East Fork Little Miami River and its tributaries."

The Collaborative is an informal organization (i.e., no application has been made for legal non-profit status), structured to minimize hierarchy/bureaucracy while maintaining effectiveness and accountability. The EFWC Steering Committee consists of representatives from four counties and five subwatersheds within the East Fork Little Miami River watershed. Four of the Steering Committee members are directly appointed by the Board of Commissioners for Brown, Clermont, and Highland counties. Four additional members represent the Soil and Water Conservation Districts of Brown, Clermont, Clinton and Highland counties. The final five Steering Committee members represent the five subwatershed planning areas (Lower East Fork, Middle East Fork, Stonelick Creek, East Fork Lake Tributaries, and East Fork Headwaters) by contributing knowledge about agriculture, industry, and other community resources and activities in the region. The Steering Committee is responsible for defining the scope and direction of the Watershed Program, providing direction to the Watershed Coordinator, and acting as liaison between the Collaborative and the local community.

Through a grant received from the Ohio Department of Natural Resources, the Clermont County Soil and Water Conservation District hired a Watershed Coordinator for the East Fork Little Miami River in December 2000. The Watershed Coordinator's position is supplemented with funding from the Clermont County Commissioners and the Soil and Water Conservation Districts from Brown, Clinton and Highland Counties. Jason Brown currently serves as the East Fork Watershed Coordinator. Anyone wishing to receive more information about this plan or the East Fork watershed in general can contact the East Fork Watershed Coordinator at (513) 732-7075.

EFWC Goals:

Provide direction and assistance to the East Fork Watershed Coordinator.

Provide guidance to the stakeholder groups involved in the development and implementation of the adopted watershed action plan.

Administer the terms and conditions of the ODNR – Watershed Coordinator Grant

Assist in the prioritization of recommendations in the watershed action plan.

Help identify funding opportunities that will assist in accomplishing the established objectives of the action plan.

Periodically reassess the stated objectives of the action plan and provide an evaluation of on-going efforts.

Periodically reassess changing conditions and needs in the watershed and oversee necessary revisions to the plan.

Serve as an informational resource for interested constituents relating the needs, conditions, and opportunities within the East Fork Watershed.

Provide technical assistance to the groups, organizations, and individuals in the watershed that are involved in activities effecting water quality and land use activities in the watershed.

Provide a forum for discussions across political boundaries about opportunities to improve water quality and the use of the resources throughout the East Fork Watershed.

EFWC Measures of Success:

Improvement in water quality in the East Fork Watershed

Increased public awareness of water quality in the East Fork Watershed

Degree of Implementation of recommendations from the Watershed Action Plan

Viability of the East Fork Collaborative and stakeholder groups

Increased usage of BMPs in the East Fork Watershed

Extent of protection and restoration provided to the riparian corridor in the East Fork Watershed

Decreased duplication in administrative efforts to protect water quality in the East Fork Watershed appropriate strategies for meeting both water quality and water quantity management objectives.

Public meetings were used to review water quality information and sources of impairment, and to identify local water management challenges and interests. From there, the Collaborative organized ad-hoc committees (also called Work Groups) that worked to develop broad goals, specific and measurable objectives, indicators of success, and implementation strategies in the areas of Land Use, Stormwater Management, and Wastewater Management.

The participatory process is more fully detailed in Chapter 4 and Appendix A. A detailed list of stakeholders that made up the Work Groups is given in Appendix A.

Watershed Restoration and Protection Goals

Chapter 5 of this document is where the rubber hits the road. This chapter describes water quality impairments by stream segment, details watershed management and restoration goals, and outlines recommended strategies (the who, what, where, when, how and how to pay) to meet the goals. The goals and strategies were developed and prioritized by the work groups.

The action plan, as well as a wide range of educational materials, are available at the East Fork watershed page (www.eastforkwatershed.org).

Local Endorsement

Once the Watershed Action Plan has been fully endorsed by Ohio EPA and Ohio DNR, the Collaborative will present the action plan to: the Board of Commissioners of Brown and Clermont Counties; the Village Councils of Bethel, Hamersville, and Williamsburg; and the Clark, Jackson, Pike, Sterling, Tate and Williamsburg Township trustees during open public sessions. After each presentation, the appropriate Board or Council will either formally endorse the plan or make recommendations for any needed revisions. EFWC partners will review the watershed plan annually, and update the plan as needed.

Implementation and Evaluation

The implementation of any watershed plan requires the cooperation of landowners, local governments, local businesses and other stakeholders. The East Fork Watershed Collaborative continues to seek partners in implementing practices and programs that will improve water quality in the East Fork and its tributaries. Many such activities are described in this document; however, the Collaborative will revisit this document with our project partners on an annual basis to measure progress toward our goals, to review whether our goals and priorities are still appropriate, to solicit additional resources, and to direct available resources where they are most needed.

For a summary of previous watershed efforts and ongoing implementation projects sponsored by the East Fork Watershed Collaborative see Appendix B.

Information and Education

The information and education component will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the non-point source management measures that will be implemented.

Education and Outreach Component

The East Fork Collaborative and its partners have a strong education component in place for the East Fork Lake Tributaries. The primary objective is to raise awareness about water quality and watershed management in the East Fork Watershed. Education and outreach will be conducted as a joint effort between: East Fork watershed coordinator, Soil and Water Conservation Districts (Brown and Clermont), OSU Extension, Farm Bureau, County Health Departments, local sewer departments, Clermont County Office of Environmental Quality, and other EFWC partners.. Education programs will be enacted with school and youth programs, adult educational presentations, media, and individual consultations. Current and complimentary education and outreach programs in the entire East Fork Watershed are summarized in Appendix B. Education and Outreach management actions, resources, time frame, and performance indicators can be found in Chapter 5, page 9.

Information Component

All records and documents pertaining to the entire East Fork Watershed will be kept by Clermont Soil and Water Conservation District and Clermont Office of Environmental Quality. Final documents of the East Fork Lake Tributaries WAP will be available on CD at all sponsoring SWCD's (Brown and Clermont) and will be downloadable from the OEQ website at www.oeq.net and from Clermont SWCD web site at www.clermontswcd.org Final copies will also be sent to local library branches in the Lake Tributaries region (Brown and Clermont counties).

To receive a copy of the East Fork Lake Tributaries Watershed Action Plan contact Jason Brown, East Fork Watershed Coordinator, at (513) 732-7075 or contact the SWCD's in Brown and Clermont counties.

East Fork Lake Tributaries Watershed Management Plan

Chapter Two

Watershed Inventory

CHAPTER 2: WATERSHED INVENTORY

A number of factors - both natural and manmade - influence the quantity and quality of water in our streams and lakes. These factors include: the underlying geology and soils that formed over thousands of years; the local climate and, in particular, precipitation; the type and location of surface water bodies including wetlands, lakes, reservoirs, streams and rivers; land use; and point and non-point sources of pollution. The purpose of a watershed inventory is to catalog these factors in a way that helps us understand the natural and human impacts on the condition of our water resources.

Location

The East Fork Lake Tributaries watershed covers approximately 147 square miles (94,500 acres), about 40% (57 mi^2) in Brown County and 60% (90 mi^2) in Clermont County (see Figure 2-1). Over 90% of the East Fork Lake Tributaries watershed falls within six townships (Clark, Pike and Sterling Townships in Brown County; and Jackson, Tate and Williamsburg Townships in Clermont County). Smaller portions of the watershed fall within Green, Perry and Scott Townships (Brown County); and Batavia, Monroe, Ohio and Pierce Townships (Clermont County). The Villages of Bethel, Hamersville and Williamsburg all fall within the Lake Tributaries watershed. Other unincorporated population centers in the watershed include Afton, Bantam, Concord, Crosstown, Eastwood, Fivemile, Locust Ridge, New Harmony, and Upper Fivemile.

Geology

Geology influences watershed management in several ways. As an example, different bedrock materials and overlying soils have different levels of susceptibility to erosion by water (erodibility). Also, the composition of the bedrock material and soils are primary natural factors governing the shape and slope of the stream bed and, ultimately, the depth and velocity of water running through the channel. In addition, porous bedrock material such as sand, gravel or limestone can act as a conduit and/or reservoir for ground water, whereas solid bedrock, clays and shales serve as barriers to subsurface water flow.

The underlying geology of the East Fork Lake Tributaries region is primarily interbedded shale and limestone of Ordovician age (450 million

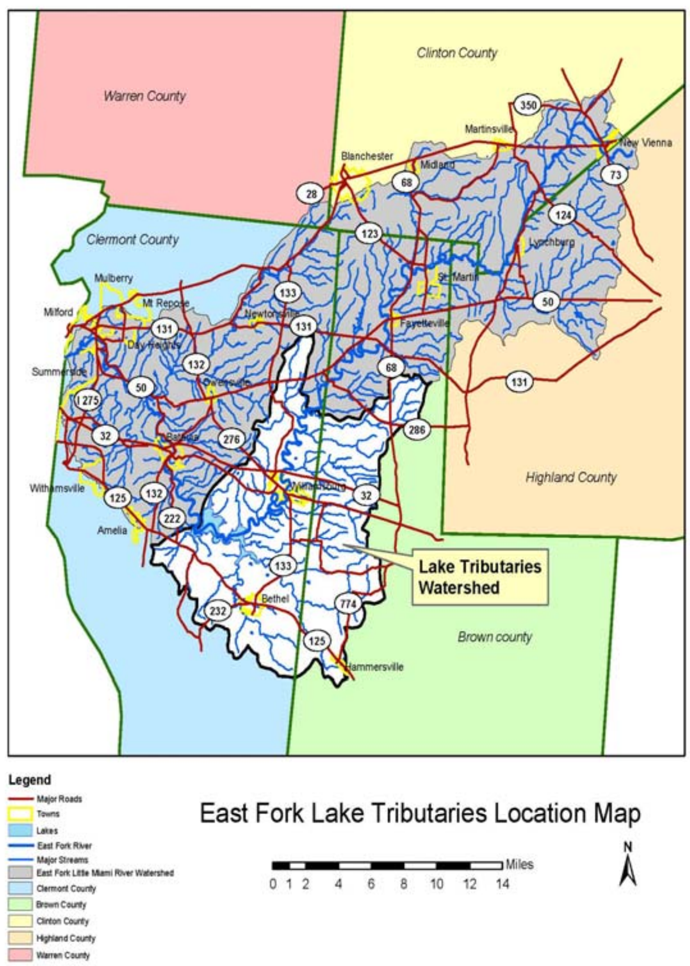


Figure 2-1. Location of the East Fork Lake Tributaries watershed.

years ago). This bedrock is overlain by glacial cover (Figure 2-3) and a relatively shallow layer of loess from a few to as much as 40 inches depth.

The glacial cover is a clayey till of Illinoian Age. This clay layer is situated above the bedrock but below the soil, often creating an impermeable layer preventing infiltration into the bedrock below. The glacial cover of the Illinoian till plains is generally 10 to 30 feet thick, covered with a loess cap of 18-40 inches depth. The levelness and poor permeability of the Illinoian till plain soils create an ideal environment for crayfish, and this area is sometimes called the "Crawdad Flats."

Slope also affects runoff and erosion rates. Level areas tend to store water in depressions — whether puddle, wetland or ditch — slowing the rate of runoff and encouraging infiltration or evaporation. Steeper topography yields more runoff, faster surface water flow and increased erosion, increasing the potential for surface runoff to carry eroded soil to water bodies. Similarly, steeper stream channels have higher stream velocity that, in turn, can increase streambank erosion. A map of slope for the East Fork Lake Tributaries watershed is shown in Figure 2-2.

The highest point in the East Fork Lake Tributaries watershed - at the top of the Fivemile Creek basin southeast of Fayetteville in Perry Township - has an elevation of approximately 990 ft above sea level. The East Fork Little Miami River enters the Lake Tributaries watershed (at river mile

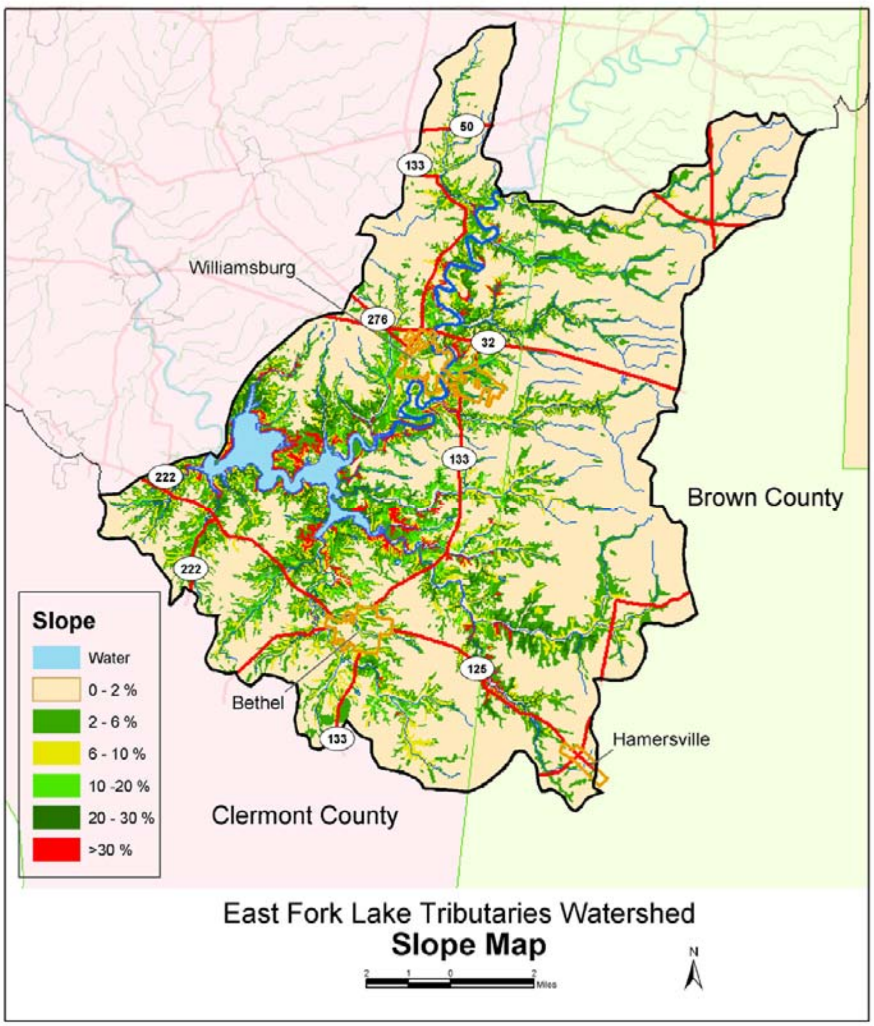


Figure 2-2. Slope in the East Fork Lake Tributaries watershed.

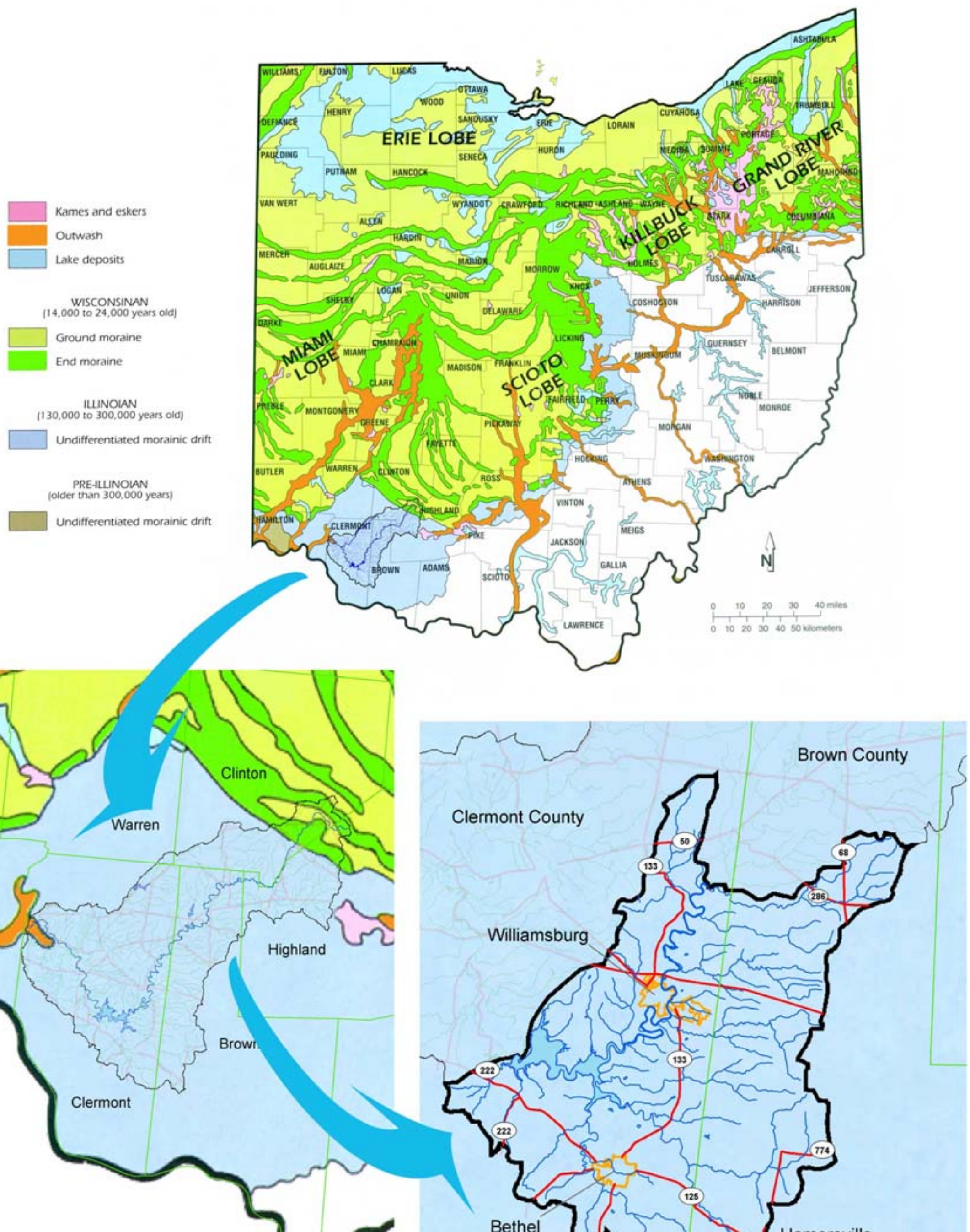


Figure 2-3. Glacial geology of Ohio and the East Fork Lake Tributaries watershed.

44) near Blue Sky Park Rd. at an elevation of 845 ft above sea level. The lowest point in the East Fork Lake Tributaries is the water surface of Harsha Lake maintained at approximately 730 ft above sea level. The mainstem of the East Fork drops 115 feet from its the confluence with Fivemile Creek to Harsha Lake 14 miles downstream, for an average slope (or drop) of 8.2 ft per mile upstream of the reservoir.

Along the East Fork, the valley width ranges from a minimum of 200 ft to a maximum width over 1200 ft. The “typical” valley width is between 400 ft and 800 ft through this stretch of the East Fork.

Soils

Soil plays an extremely important role in watershed management. For example, in many watersheds soils act as natural water filters. Certain soil types are prone to flooding or erosion, affecting runoff rates and sedimentation. An understanding of soil types, with their benefits and limitations, leads to more effective land use management. The following paragraphs provide a summary of soil characteristics in the East Fork Lake Tributaries watershed.

The United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) in conjunction with ODNR Division of Soil and Water Conservation identified 27 different soil series in the East Fork Lake Tributaries watershed. Figure 2-4 illustrates the distribution of soil associations (i.e., groups of soil series found in conjunction) within the

SOIL SERIES DESCRIPTIONS

(for soils constituting more than 1% of Lake Tributaries watershed)

Avonburg (21.5%) - nearly level to gently sloping, somewhat poorly drained soils formed in a 18 to 40 inch silt mantle and underlying Illinoian age glacial till. These soils are in upland areas of the Illinoian till plain.

Blanchester (4.3%) - nearly level to slightly depressional, poorly drained soils formed in a 18 to 40 inch silt mantle and underlying Illinoian age glacial till. These soils are in upland areas of the Illinoian till plain.

Cincinnati (5.1%) - well drained, gently sloping to steep soils with a frangipan that formed in a 18 to 40 inch silt mantle and underlying Illinoian age glacial till. These soils are in the Illinoian till plain.

Clermont (34.1%) - nearly level, poorly drained soils formed in a silt mantle and underlying weathered Illinoian age glacial till. These soils are mostly in broad upland areas of the Illinoian till plain.

Edenton (3.2%) - sloping to very steep, well-drained soils that formed in clay loam weathered from Illinoian age glacial till over shale and limestone bedrock.

Genesee (1.8%) - nearly level, well-drained soils that formed in loamy alluvium. These soils are in areas adjacent to stream channels of nearly every stream in the watershed. They are subject to periodic flooding. The largest areas are along the East Fork of the Little Miami River and its major tributaries.

Hickory (2.3%) - moderately steep to very steep, well-drained soils that formed in a thin mantle of silt and the underlying clay loam or loam weathered from Illinoian age glacial till.

Rossmoyne (17.6%) - nearly level to sloping, well-drained soils with a frangipani that formed in a 18 to 40 inch silt mantle and underlying Illinoian age glacial till. These soils are on upland ridge tops throughout the watershed.

Williamsburg (1.2%) - gently sloping to moderately steep, well-drained soils that formed in a silt mantle or salty loamy alluvium as much as 24 inches thick and in the underlying outwash material of stratified loam, clay loam, sandy loam, and gravel. These soils are on the relatively high terraces as much as one-half mile wide along the East Fork Little Miami River and its major tributaries.

Sources: STATSGO, SSURGO, Brown County Soil Survey (1992), Clermont County Soil Survey (2002)

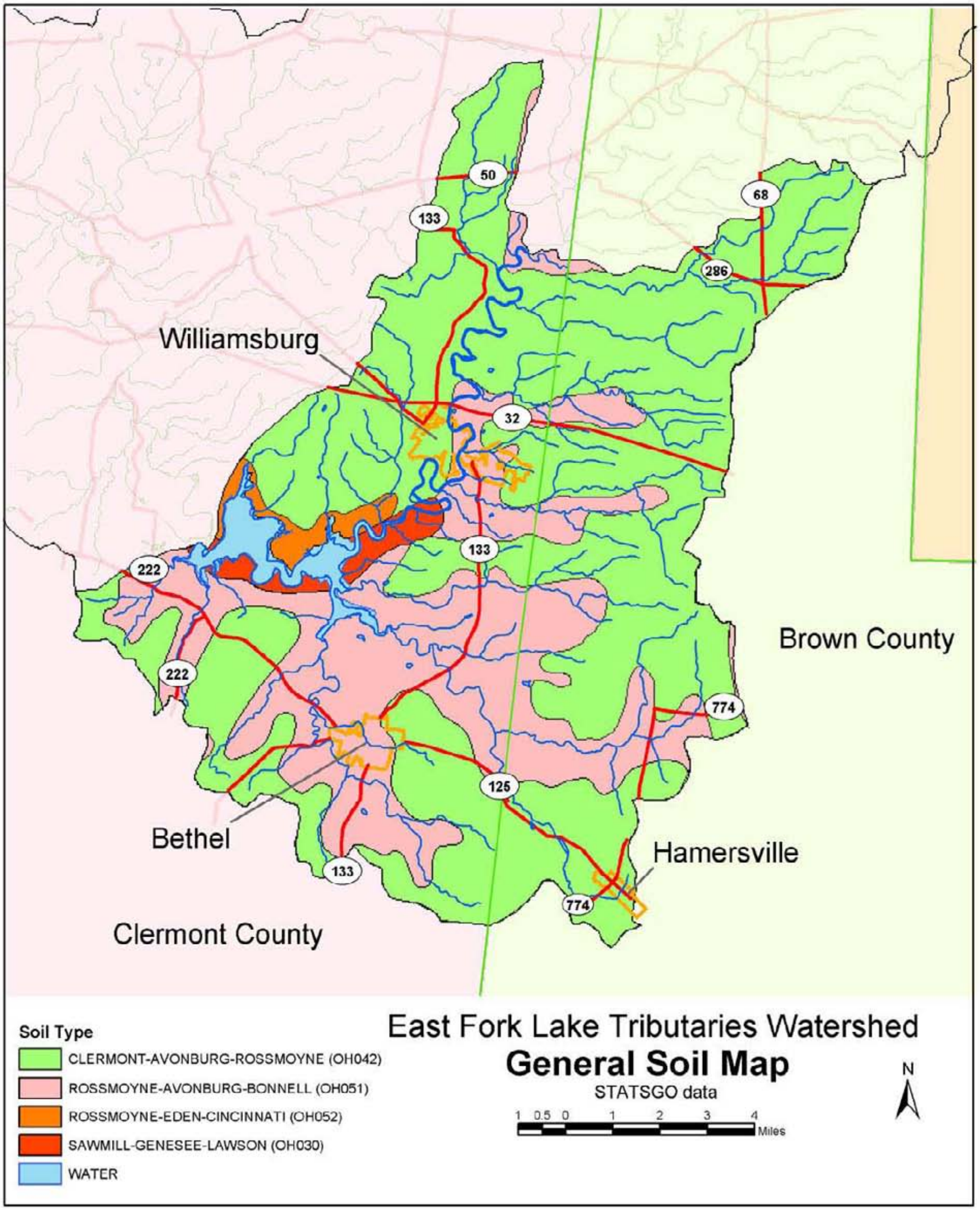


Figure 2-4. Soil map of the East Fork Lake Tributaries watershed.

East Fork Lake Tributaries watershed.

Table 2-1 describes the most common soil series in the East Fork Lake Tributaries watershed, and provides information on the permeability, drainage and runoff characteristics of each.

The management of Illinoian-age glacial soils is inherently challenging for agriculture due to low permeability, low organic matter, and low to moderate moisture holding capacity. The seasonal wetness of the poorly drained Clermont and somewhat poorly drained Avonburg soils presents an important management problem because these soils do not respond well to subsurface drainage. These problems can be partially addressed through surface drainage if a suitable outlet can be found. The steeper Rossmoyne soils are moderately to highly erodible and require best management practices such as conservation tillage, contour farming, crop rotations, cover crops, and grassed waterways to maintain long-term productivity.

Because of seasonal ponding common to the Avonburg, Blanchester and Clermont soils (locally called the A-B-C soils), approximately 60% of the watershed is not suitable for traditional leach-field home sewage treatment systems (HSTS). It should be noted that the same drainage limitations that make them unsuitable or limited for septic systems almost guarantee a wet footprint for any house built on these soils.

To learn more about soils in this watershed, check out the Soil Surveys for each of the individual counties, available for viewing at your local library or Soil and Water Conservation District. Soil Surveys are now available in digital format; contact your local SWCD to acquire a digital CD of soil surveys.

Soil Series	Topography	Permeability	Drainage	Seasonal High Water Table	Runoff	Erosion Risk
Avonburg silt loam	Nearly level to gently sloping	Very slow	Somewhat poorly drained	1 - 3 ft	Slow to medium	Low to moderate
Blanchester silt loam	Nearly level to slightly depressional	Slow to very slow	Poorly drained	0 - 0.5 ft or ponded	Very slow or ponded	Low
Cincinnati silt loam	Gently sloping to steep	Slow to moderately slow	Well drained	2.5 - 4.0 ft	Rapid	Severe
Clermont silt loam	Nearly level	Very slow	Poorly drained	0 - 1 ft or ponded	Slow	Low
Edenton loam	Sloping to very steep	Moderately slow	Well drained	NA	Rapid to very rapid	Severe
Genessee silt loam	Nearly level	Moderate	Well drained	> 6 ft	Slow	Low
Hickory loam/clay loam	Moderately steep to very steep	Moderate	Well drained	NA	Rapid	Severe
Rossmoyne silt loam	Nearly level to moderately steep	Moderately slow to slow	Moderately well-drained	1.5 - 3 ft	Slow to rapid	Low to high
Williamsburg silt loam	Gently sloping to moderately steep	Moderate	Well drained	> 6 ft	Slow to medium	Low to moderate

Table 2-1. Characteristics of soil series of the East Fork Lake Tributaries watershed.

Biological Features

Figure 2–5. Rayed bean; endangered fresh-water mussel found in the East Fork river. (Photo courtesy of S. Staton NWRI)

The native vegetation of the East Fork Lake Tributaries watershed was deciduous hardwood forest, though species composition varied based on soil moisture. The more level areas of the watershed were characterized by seasonal wetness. The dominant species in these areas were pin oak, soft maples, ash, elm, and swamp oak with beech and sweetgum also present. In the better drained areas, white and red oak, beech, sugar maple and hickory were dominant, with elm, ash, black walnut, honey locust, and blackgum also present. Sycamore, boxelder, hackberry, willow and cottonwood were common in bottom-land forests.

The Ohio Department of Natural Resources, Division of Natural Areas and Preserves maintains a list of rare, threatened and endangered species in the State of Ohio, including endangered species of fish and macroinvertebrates. Species found in the East Fork Lake Tributaries considered to be endangered, threatened or of special concern are summarized in Table 2-2 and Figure 2-6. Animal communities of special significance, such as mollusk beds, are also included in Figure 2-6.

It is important to note that these are confirmed occurrences of these species, and other rare plant and animal species are likely present in the water-

Common Name	Scientific Name	Federal Status	State Status	Location
Rare Plant List				
Blue False Indigo	Baptisia australis		Endangered	East Fork State Park
Potatos-dandelion	Krigia dandelion		Endangered	East Fork State Park
Netted Chain Fern	Lorinseria areolata		Threatened	East Fork State Park
Bulbosa woodrush	Luzula bulbosa		Threatened	East Fork State Park
Spring Coral Root	Corallorhiza wisteriana		Threatened	East Fork State Park
Floating Pondweed	Potamogeton natans		Potentially Threatened	East Fork State Park
Few-Flowered tick-trefoil	Desmodium pauciflorum		Potentially Threatened	East Fork State Park
Prairie wake-robin	Trifolium stoloniferum		Potentially Threatened	East Fork State Park
Rare Animal List				
Little Spectaclecase	Villosa lienosa		Endangered	East Fork Little Miami River
Rayed Bean	Villosa fabalis	Proposed for Listing	Endangered	East Fork Little Miami River
Northern Harrier	Circus cyaneus		Endangered	East Fork State Park
Southern Woodthrush	Luzula bulbosa		Threatened	East Fork State Park
Rough Green Snake	Opheodrys aestivus		Species of Concern	East Fork State Park
Salamander Mussel	Simpsonaias ambigua	Proposed for Listing	Species of Concern	East Fork Little Miami River
Slenderhead Darter	Percina phoxocephala		Species of Concern	East Fork Little Miami River

Table 2-2. Rare, threatened and endangered species in the East Fork Lake Tributaries.

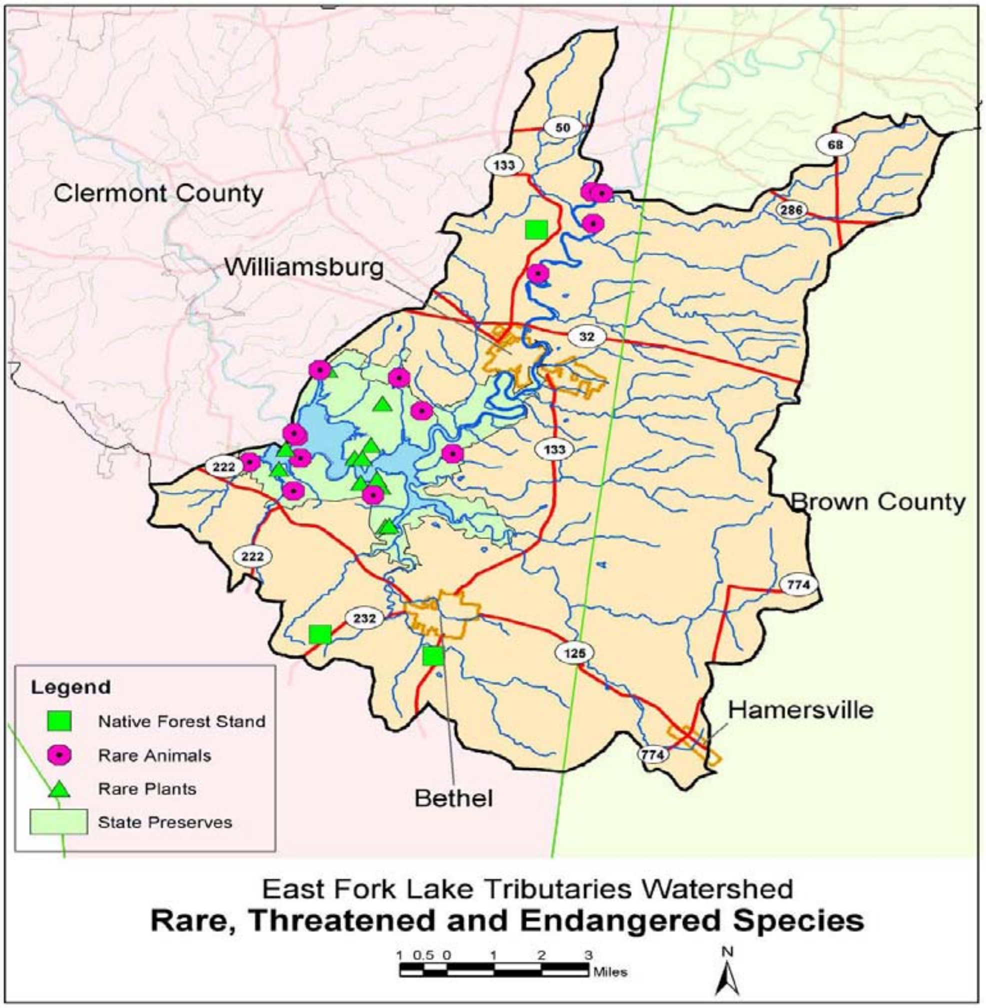


Figure 2-6. Rare, threatened and endangered species of the East Fork Lake Tributaries.

shed, but haven't been identified. Occurrences of rare plant and animal species may be reported to the Ohio Department of Natural Resources, Division of Natural Areas and Preserves (614-265-6453; http://www.ohiodnr.com/dnap/about.htm).

Invasive Nonnative Species

Numerous invasive plant species are common throughout the entire East Fork watershed. These include bush honeysuckle (*Lonicera* species), Japanese honeysuckle (*Lonicera japonica*), multiflora rose (*Rosa multiflora*), and garlic mustard (*Alliaria petiolata*) (Figure 2-7). Each of these plants have negative impacts on other vegetation and/or animals within the watershed.

Bush and Japanese honeysuckle out-compete and displace native plants, alter natural habitats by decreasing light availability, and depleting soil moisture and nutrients for native species. Exotic bush honeysuckle competes with native plants for pollinators, resulting in reduced seed set for native species. Unlike native shrubs, the fruits of exotic bush honeysuckles are carbohydrate-rich and do not provide migrating birds with the high-fat content needed for long flights.

Multiflora rose forms dense thickets, excluding most native shrubs and herbs from establishing and may be detrimental to nesting of native birds. This species was once encouraged by Soil and Water Conservation Districts for living fences and

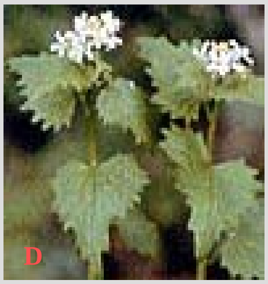


Figure 2-7. Common invasive species located within East Fork watershed: A) Bush Honeysuckle species B) Japanese Honeysuckle C) Multi-flora rose D) Garlic Mustard.

Photos courtesy of ODNR Division of Natural Areas and Preserves. For more information regarding invasive species in your area contact your local Soil and Water Conservation District.

wildlife habitat, however it is no longer encouraged.

Garlic mustard invades areas disturbed by human activities and appears to be aided by white-tailed deer that prefer to eat native wildflowers and leave garlic mustard untouched. Garlic mustard displaces many native spring wildflowers such as spring beauty, wild ginger, bloodroot, Dutchman's breeches, toothworts and trilliums that occur in the same habitat. It is also credited with the decline of the West Virginia white butterfly because chemicals in garlic mustard appear to be toxic to the butterfly's eggs.

Invasive nonnative plant species are not the only threat to the East Fork watershed. Zebra mussels *(Dreissena polymorpha*) are rapidly spreading throughout the Midwest. Zebra mussels and a related species, the Quagga mussel, are small, fingernail-sized mussels native to the Caspian Sea region of Asia. They are tolerant of a wide range of environmental conditions and have now spread to parts of all the Great Lakes, the Mississippi River, and the Ohio River. Zebra mussels clog water-intake systems of power plants and water treatment facilities, as well as irrigation systems, and the cooling systems of boat engines. They have severely reduced, and may eliminate native mussel species. No zebra mussels or Quagga mussels have been found in the East Fork watershed. It is important, however, to continue to monitor the watershed for the presence of these aquatic invasives.

Climate and Precipitation

The entire East Fork watershed has a temperate climate characterized by well-defined winter and summer seasons. Historically, the coldest month is January, which has an average daily temperature of 26 degrees F, and average daily maximum and minimum temperatures of 35 and 18 degrees F, respectively (data taken from climate station at Hillsboro in central Highland County). The warmest month is July, with an average daily temperature of 74 degrees F, and maximum and minimum temperatures of 83 and 64 degrees F, respectively.

The average annual total precipitation ranges from 41-43 inches. Of this, about 17 inches (~40 percent) falls during the growing season between May and August. The months with the least amount of precipitation are January, February and October, all with average monthly totals of less than 3.0 inches. The wettest months, on average, are March, May, July, and August, each with average monthly precipitation amounts greater than 4.0 inches. Before June, rainfall events are typically more widespread, caused by frontal systems moving through the area. In the hotter months of July, August and the beginning of September, rainfall is more spotty in coverage, as convective, "pop-up" thunderstorms in the afternoon are common.

Surface Water

For purposes of this Watershed Management Plan, the East Fork Lake Tributaries watershed is defined as the land area that drains to the East Fork Little Miami River downstream of the confluence with Fivemile Creek but upstream from the Harsha Lake dam (see Figure 2-1, pg. 2-1). It consists of five 14-digit Hydrologic Unit Codes (HUCs), as defined by the U.S. Geological Survey:

- East Fork Little Miami above Fivemile Creek to S.R. 276 Williamsburg (HUC 05090202-110-020)
- East Fork Little Miami below S.R. 276 at Williamsburg to above Cloverlick Creek (HUC 05090202-110-030)
- Cloverlick Creek (HUC 05090202-120-010)
- Poplar Creek (HUC 05090202-120-020)
- East Fork Little Miami below Cloverlick Creek to below Lucy Run [split at Harsha Dam] (HUC 05090202-120-030)

There are no stream gauges currently maintained by the U.S. Geological Survey in the East Fork Lake Tributaries. There are two stream gauges maintained by Clermont County Office of Environmental Quality (OEQ). These gauges are located at the Kain Run intersection with St. Rte. 276 and at the St. Rte. 133 bridge over the East Fork mainstem.

Within this watershed, the mainstem of the East Fork (Ohio Waterbody ID OH53-36, OH53-20; River Code 11-100) extends 25 miles beginning at RM 45.2 just above its confluence with Fivemile Creek (RM 44) to Harsha Lake Dam (RM 20.5) in Clermont County. Ohio EPA has designated this section of the East Fork mainstem as Exceptional Warmwater Habitat. The East Fork mainstem is also designated for Primary Contact Recreation, and is designated a Public Water Supply because Harsha Lake is a primary water supply for Clermont County.

The major tributaries to the East Fork Little Miami River in the Lake Tributaries Watershed are Fivemile Creek (OH53-42; 11-138), Cloverlick Run (OH53-; 25-), and Poplar Creek (OH53-; 27-). The Fivemile Creek watershed is 10.7 square miles and primarily located within Sterling Township, Brown County. The Cloverlick Creek watershed is 42.1 square miles and primarily located within Tate Township, Clermont County, and Clark Township, Brown County. The Poplar Creek watershed is 24.9 square miles and located primarily within Tate Township, Clermont County. All three streams hold a Warmwater Habitat aquatic life use designation. Each of these tributaries is designated for Primary Contact Recreation. Cloverlick is also designated as a Public Water Supply at RM 3.23. See Table 2-3 for a list of the significant tributaries in the Lake Tributaries watershed region.

William H. Harsha Lake

Harsha Lake (also called East Fork Lake) serves as a water supply for much of Clermont County and is located in the Lake Tributaries region. The 2,160 acre lake also provides flood reduction and offers many opportunities to enjoy wildlife or recreate in the great outdoors. According to the U.S. Army Corps of Engineers William H. Harsha Lake has prevented over $77.0 million in flood damages since impoundment, and in fiscal year 2005 alone the lake generated approximately $32.8 million in visitor expenditures.

William H. Harsha Lake exists as a cooperative management effort between the U.S. Army Corps of Engineers and the Ohio Department of Natural Resources - Divisions of Parks and Recreation, Watercraft, and Wildlife. A variety of other partnerships play important roles in the management of the 10,000 plus acres of public lands at William H. Harsha Lake.

The Bob McEwen Water Treatment Plant withdraws surface water from Harsha Lake for public drinking, serving 30% of residents in Clermont County. Because it is a source of public drinking water, a Source Water Assessment was completed by Ohio EPA in 2003 (See Appendix C). The assessment has been reviewed by the East Fork Watershed Collaborative and its results have been incorporated into this Watershed Action Plan. Problem statements and recommended actions are

Stream Name	Length (miles)	Drainage Area (sq. mile)	Use Designation
Fivemile Creek	3.5	10.7	WWH, AWS, IWS, PCR
East Fork Fivemile Creek	3.5	2.6	WWH, AWS, IWS, PCR
Fourmile Creek	3.6	6.1	WWH, AWS, IWS, PCR
Pleasant Run	3.4	6.8	WWH, AWS, IWS, PCR
Crane Run	4.1	9.1	WWH, AWS, IWS, PCR
Kain Run	1.7	6	WWH, AWS, IWS, PCR
Todd Run	3.6	9.7	WWH, AWS, IWS, PCR
Indian Camp Run	2.1	1.7	WWH, AWS, IWS, PCR
Cloverlick Creek	10.6	42.1	WWH, AWS, IWS, PCR, PWS at RM 3.23
Barnes Run	4.4	8.4	WWH, AWS, IWS, PCR
Polecat Run	4.4	3.6	WWH, AWS, IWS, PCR
Trible Run	1.3	1.2	WWH, AWS, IWS, PCR
Light Run	1.7	4.9	WWH, AWS, IWS, PCR
Snow Run	1.4	0.7	WWH, AWS, IWS, PCR
Poplar Creek	8.1	24.9	WWH, AWS, IWS, PCR
Sugartree Creek	1.7	4.3	WWH, AWS, IWS, PCR
Town Run	1.6	2.8	WWH, AWS, IWS, PCR
Guest Run	0.4	1.7	WWH, AWS, IWS, PCR
Ulrey Run	0.6	4	WWH, AWS, IWS, PCR
Cabin Run	2	2.5	WWH, AWS, IWS, PCR
Slabcamp Run	2	2.1	WWH, AWS, IWS, PCR
Back Run	2	3.4	WWH, AWS, IWS, PCR

EWH (Exceptional Warm Water Habitat)
WWH (Warm Water Habitat)
PCR (Primary Contact Recreation)
AWS (Agricultural Water Supply)
IWS (Industrial Water Supply)
PWS (Public Water Supply)

Table 2-3. Significant tributaries in the East Fork Lake Tributaries watershed.

presented in Chapter 5 (Watershed Management Recommendations) and address Source Water Protection.

Since streams within the Lake Tributaries region flow into Harsha Lake this region has been deemed by the Ohio EPA as a Source Water Protection Area for surface water. Upon completion of the Lake Tributaries Watershed Action Plan it will be sent to Ohio EPA and Ohio Division of Natural Resources for endorsement as a Watershed Action Plan and will also be sent to Ohio EPA for endorsement as a Source Water Protection Plan for the Bob McEwen Water Treatment Plant Source Water Protection Area. See Appendix D for detailed maps about defined source water protection areas for surface and ground water in Ohio.

Source Water Assessment and Protection Program (SWAP)

The Source Water Assessment and Protection (SWAP) Program aims to protect Ohio's streams, rivers, lakes, reservoirs, and ground waters used for public drinking water from future contamination. The 1996 amendments to the Safe Drinking Water Act require every state to develop and submit a SWAP Program to the U.S. EPA and to complete a drinking water source assessment of every public water system. Specifically, the amendments require three steps to be taken for each public water system:

1. Delineate the area to be protected, based on the area that supplies water to the well or surface water intake;
2. Inventory potential significant contaminant sources within the protection area; and
3. Determine the susceptibility of each public water supply to contamination, based on information developed in the first two steps.

For more information concerning the Ohio EPA's SWAP program visit: http://www.epa.state.oh.us/ddagw/pdu/swap.html

Drinking Water Source Assessment for the Clermont County Bob McEwen Water Treatment Plant

Public Water System # 1401211
Prepared by:
Ohio Environmental Protection Agency
Division of Surface Water
Division of Drinking and Ground Waters
Southwest District Office

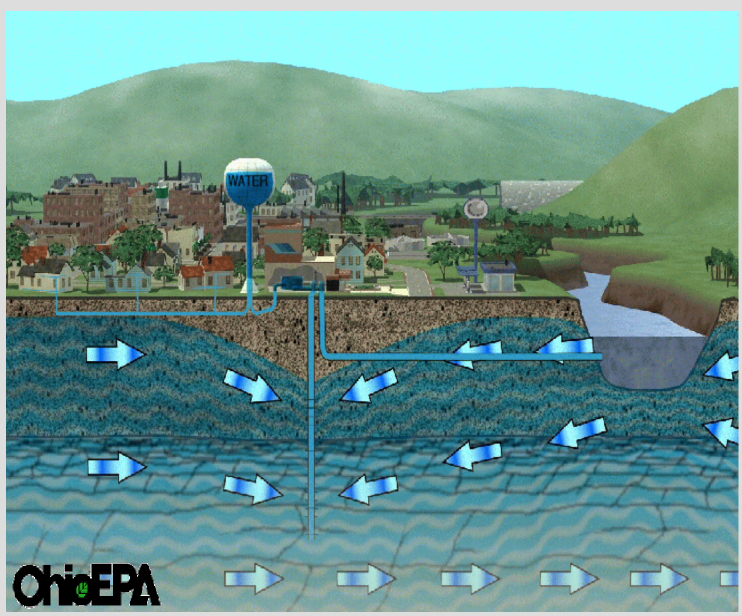


Figure 2-8. Bob McEwen Drinking Water Assessment title page developed by Ohio EPA.

Drinking Water Source Assessment for the Clermont County Bob McEwen Water Treatment Plant

The Bob McEwen Water Treatment Plant is owned by the Clermont County Board of Commissioners. Daily operational responsibilities of the Bob McEwen Water Treatment Plant are managed by Clermont County Water and Sewer Department. The water treatment facility distributes over 1 billion gallons of water annually.

The drinking water source protection area for the surface water sources are shown in Appendix C Figure 1. Also included in Appendix C are the results of an inventory of all potential contaminant sources within the protection areas. Threats to surface water sources include runoff from row crop agriculture, effluent from municipal sewage treatment facilities, inadequate household sewage treatment systems (HSTS), stormwater runoff from housing and commercial development in the watershed. Potential spills at numerous road and rail bridges crossing the East Fork Little Miami River and its tributaries are also an ever present threat.

The ultimate goal of source water assessment is implementation of protective strategies that will better protect the drinking water source. Chapter 5 (Watershed Management Recommendations) provides recommended actions to address drinking source water protection. Strategies include protection of Harsha Lake by controlling HSTS discharges and runoff from urban and agricultural areas, effective land use planning, and coordinating with local emergency response agencies.

Ohio EPA's Drinking Water Source Assessment for the Clermont County Bob McEwen Water Treatment Plant has provided the community with information regarding activities within the Drinking Water Source Protection Area that directly affect the water supply source area. It is within this area that a release of contaminants, from a spill or improper usage, may travel through the watershed and reach the surface intake. By examining where the source waters are most sensitive to contaminants, and where potential contaminants are located, the assessment identifies the potential risks that should be addressed first. An ecologically healthy lake, stream, and watershed will provide a stable, high quality resource for drinking water.

Drinking Water Source Protection Area for Surface Water

The Drinking Water Source Protection Area for an inland stream is defined as the drainage area upstream of the point where the water is withdrawn from a surface source such as a stream, lake or reservoir. The protection area is subdivided into corridor and emergency management zones. An illustration of the protection area and corridor management zones for the Bob McEwen pubic water system in shown in Appendix C Figure 1. The emergency management zone is shown in Appendix C Figure 2.

Corridor Management Zone (CMZ)

The Corridor Management Zone (CMZ) is an area along streams and tributaries within the source water assessment area that warrants delineation, inventory, and management. The Corridor Management Zone (Appendix C Figure 2) is the area within 1000 feet of each bank of the East Fork Little Miami River and within 500 feet of the tributaries. The CMZ extends to the bridge on US 32, 12 miles upstream from the intake. Sixty-one percent of the CMZ is contained within East Fork Lake State Park. The cities of Bethel and Williamsburg are within the CMZ (Appendix C Figure 4).

Emergency Management Zone (EMZ)

The Emergency Management Zone (EMZ) is defined as an area in the immediate vicinity of the surface water intake in which the public water system operator has little or no time to respond to a spill. The EMZ is a 500 foot radius around the intake that is highly succeptable to spills with no time to respond to a spill event. The Emergency Management Zones for the Bob McEwen public water system is shown in Appendix C Figure 2.

Source Assessment Water Quality Data

Available chemical and biological water quality data collected by Ohio EPA and United State Geological Survey from the streams in the protection area, and sampling results from finished water reported to Ohio EPA by the Bob McEwen Water Treatment Plant were evaluated to characterize water quality. These data were used to compile problem statements in Chapter 5 for the Drinking Water Source Protection Area. See Chapter 5 for water quality data and recommended actions.

The Bob McEwen Water Treatment Plant Source Water Assessment is available in Appendix C and can be obtained by contacting Ohio EPA Division of Surface Water.

Wetlands

There are many wetlands in the Lake Tributaries region. A map based on National Wetlands Inventory data is shown in Figure 2-10. The Ohio EPA recognizes many of these as medium to high quality wetlands, due to their capacity for controlling storm water runoff, filtering pollutants, and providing diverse wildlife habitat.

According to the U.S. Army Corps of Engineers, a landowner may have a wetland and require a permit for impacting the area (dredging, filling, building, etc.) if there is: 1) standing water early in the year for a week or more; 2) black, stained leaves on the ground; 3) trees with swollen trunks at ground level (plants adaptation for surviving in standing water); and 4) areas containing water loving plants (rushes, sedges, cattails, arrowhead, bald cypress, willows, pin oak, swamp white oak, silver and red maple, river birch, green ash, etc.). Anyone unsure about needing a wetland or stream permit in the East Fork region can contact the Army Corps Cincinnati office at 513-825-2752 and Ohio EPA at 614-644-2152.

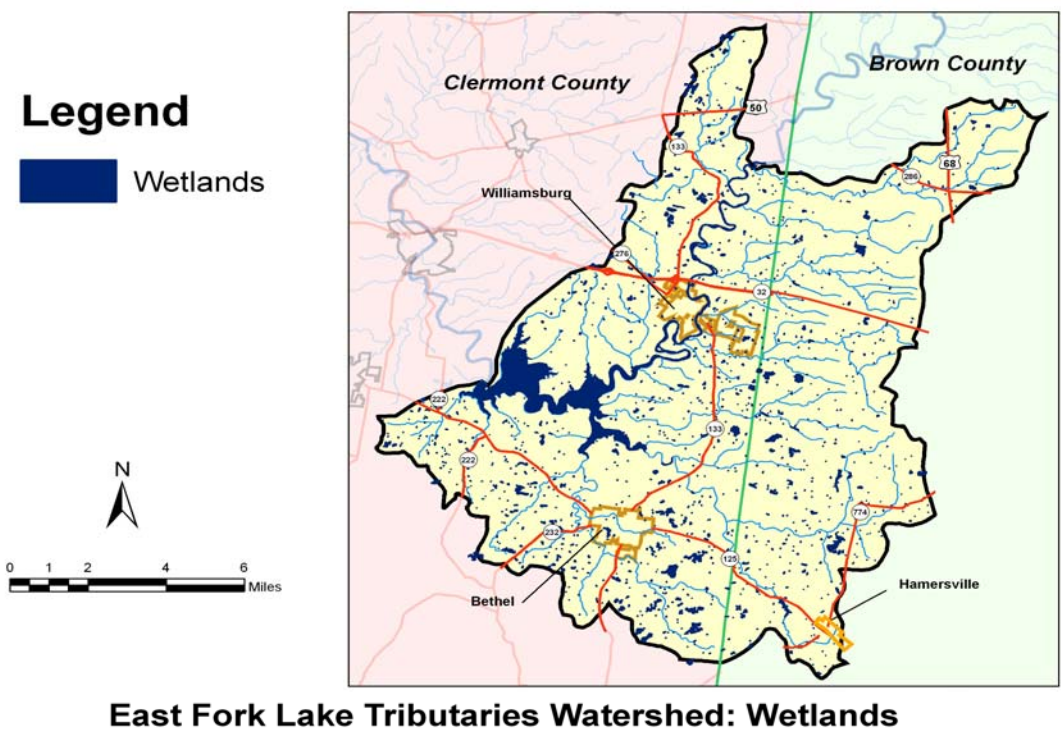


Figure 2-9. Location of wetlands in East Fork Lake Tributaries watershed.

Ground Water

The majority of aquifers in the East Fork Lake Tributaries are poor sources of ground water. The bedrock consists of interbedded plastic shales and thin limestone layers that seldom yields more than a few gallons per minute. The glacial cover ranges from 20 to 50 feet thick and is mainly clay. The valley fill aquifer along the East Fork contains sand and gravel deposits of limited thickness and extent. Yields in this aquifer can range up to 20 gallons per minute.

Ground water areas sensitive to pollution in the East Fork Lake Tributaries are primarily located within riparian reaches and aquifer systems. There are no high risk areas located in the East Fork Lake Tributaries. See Appendix D for ODNR Ground Water Pollution Potential Maps for Clermont County. Maps for Brown County are not available.

East Fork Lake Tributaries Demographics

The population characteristics of the East Fork Lake Tributaries watershed were obtained using US census data from the years 1990 and 2000. This is the second most rural and least densely populated watershed within the larger East Fork basin. Data from the 2000 census indicates that approximately 26,280 residents live within the watershed. Bethel and Williamsburg are the most populated villages in the Lake Tributaries. In 2000 Bethel's population numbered 2,637 while Williamsburg's population numbered 2,358. The average population density in the East Fork Lake Tributaries is about 110 people per square mile (Figure 2-11). For comparison, the Lower East Fork Watershed (see Figure 1-1, p1-1), located in the eastern suburbs of Cincinnati (Eastgate, Union Township, Miami Township, Milford), has a population density of 1590 people/sq mi.

Comparisons of the 1990 and 2000 census indicate a 13 percent increase in population in the East Fork Lake Tributaries, from 23,189 to 26,280. The area of the Lake Tributaries watershed with the fastest growing population, at over 24% growth between 1990 and 2000, was western Brown County. Population growth in the Lake Tributaries Clermont County region only grew around 5%. The village of Hamersville, in Brown County, experienced a population decrease during this time of 13% from 586 to 515.

Reference: U.S. Census Bureau Website (www.census.gov)

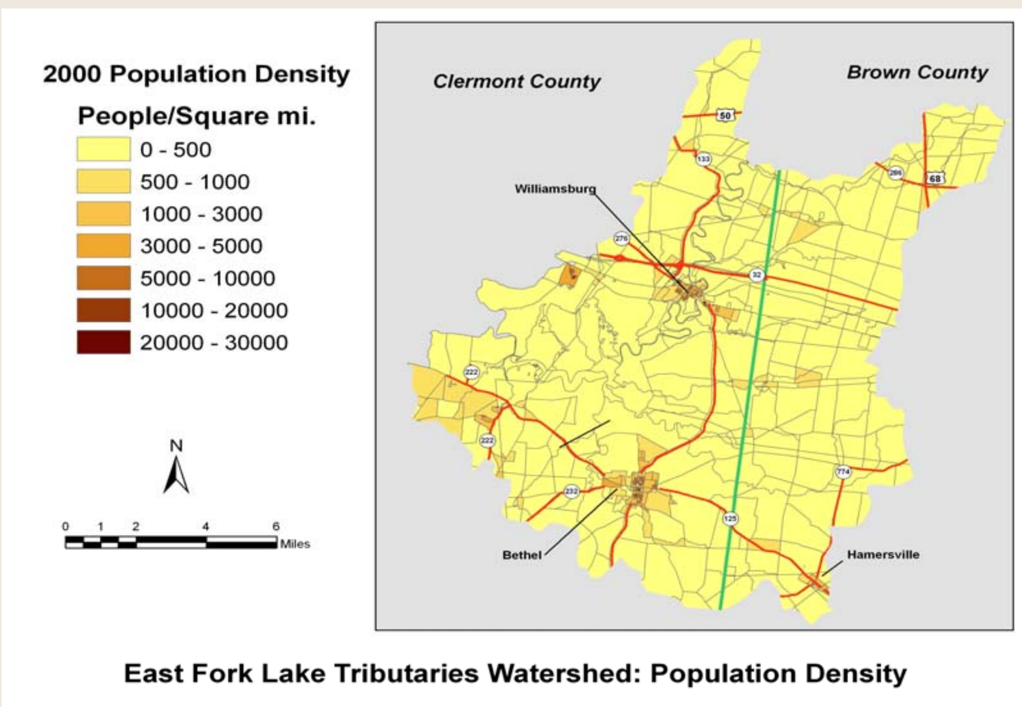


Figure 2-10. Population density within East Fork Lake Tributaries watershed for the year 2000.

Land Use

Land use is a dominant factor in determining the overall condition of a watershed. The following sections present a summary of land use in the East Fork Lake Tributaries watershed based on 1997 land use data (see sidebar for explanation). The East Fork Lake Tributaries has a significant population with two developing villages within the watershed boundary; Williamsburg and Bethel. With State Route 125 to the south and State Route 32 (Appalachian Highway) to the north, commercial and rural residential development are rapidly changing land use within the watershed. Agriculture is still the dominant land use within the watershed. However, much of the Lake Tributaries region is forested due to the presence of East Fork State Park.

Based on 1997 land use data, it is easy to see the extent of agricultural land use in the East Fork Lake Tributaries. Agriculture accounts for 42.5% of land use, light urban/ residential accounts for 32.3%, while forest accounts for 25.2% (Figure 2-12). A map illustrating land use within the East Fork Lake Tributaries watershed is shown in Figure 2-13.

It is important to note that these figures are based on 1997 land use data. The area of land used for agriculture has undoubtedly declined since that time because of rural residential development. The water management consequences of this type of unplanned rural development, sometimes referred to as "rural sprawl," are not fully understood.

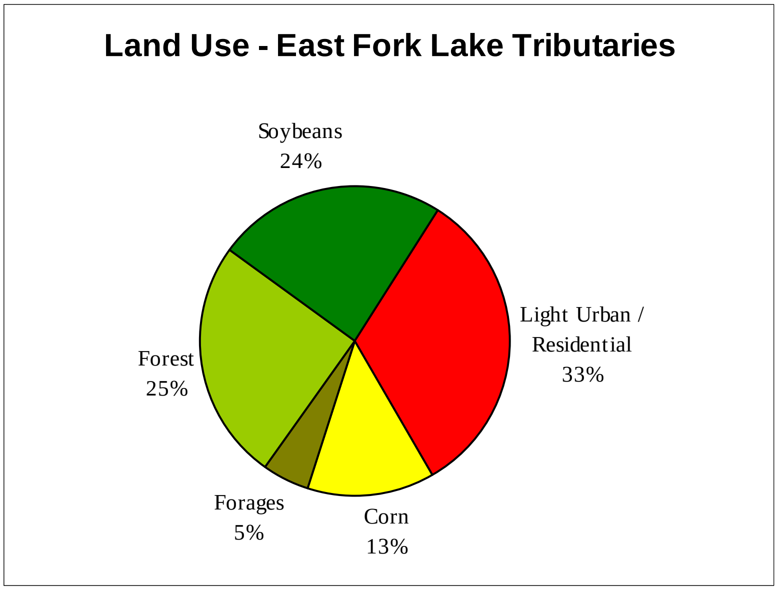


Figure 2-11. Distribution of land uses within the East Fork Lake Tributaries watershed.

Agriculture

Based on 1997 land use data, approximately 40,313 acres out of the total watershed area of 94,720 acres (42.5%) are used for agriculture. Of this, corn and soybean production account for the majority of land use with corn production on 12,336 acres (13%) and soybean production on 22,628 acres (24%) in 1997. Wheat (701 acres; 0.7%), tobacco (49 acres; 0.1%) and pasture/ forages (4,599 acres; 4.8%) comprise the remaining agricultural land use.

Land Use Data Source

Accurate land use data is necessary to understand the location and distribution of non-point source pollutants and to assess the impacts of impervious surface in the East Fork Watershed. Therefore, we wanted to have data that was recent, detailed, and accurate, and was available for the entire watershed. We used the 1997 Land Use and Chemical Application Analysis conducted by OSU Extension and Clermont Soil and Water Conservation District. A limitation of this data, although this analysis provided high quality information regarding agricultural and forest lands, is that it provided no information regarding the composition of nonagricultural lands, a very important part of the landscape when determining the sources of non-point source pollution.

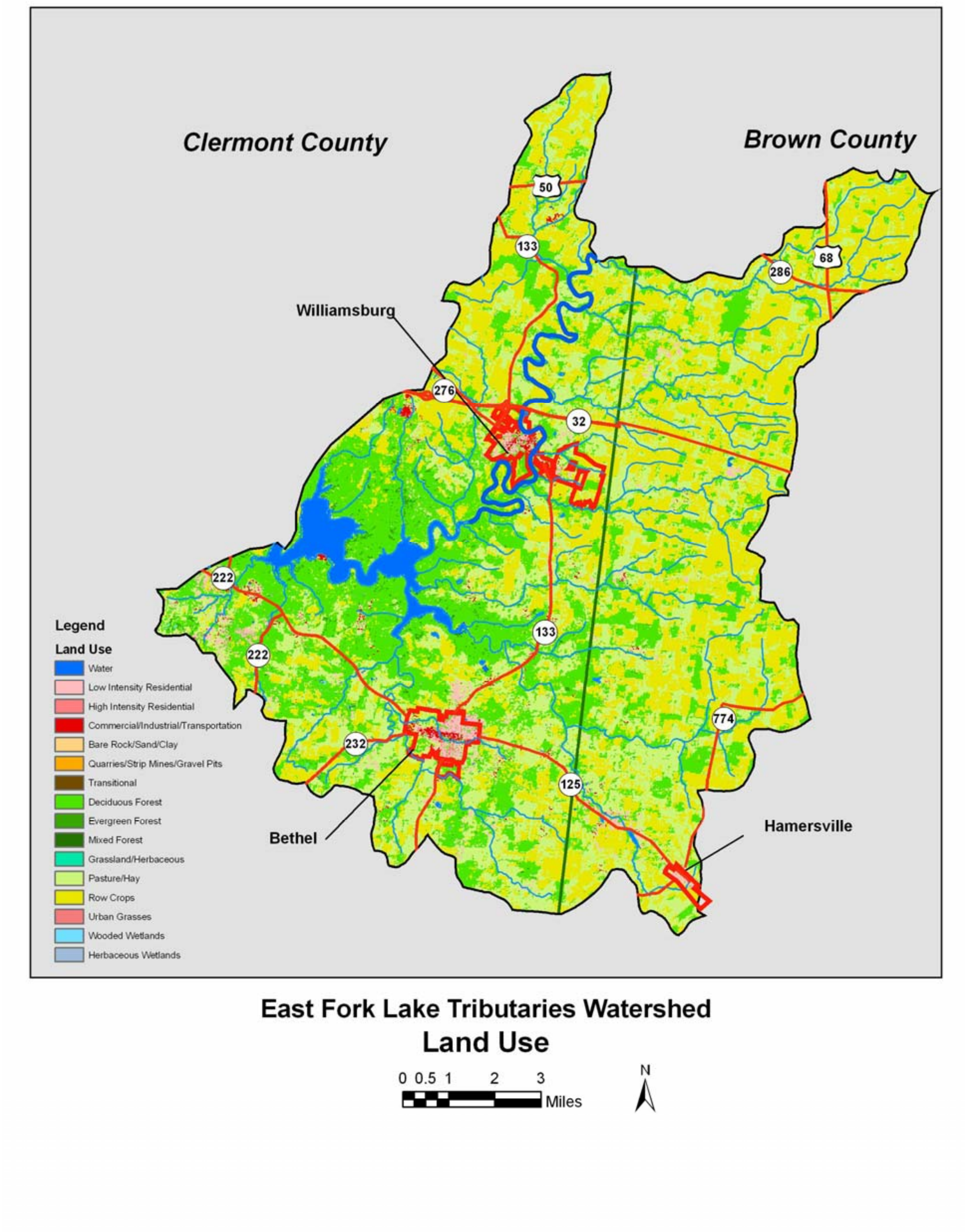


Figure 2-12. Land use in the East Fork Lake Tributaries watershed (1997).

Forest

According to the 1997 land use data, forested areas comprise approximately 23,830 acres (25.2 %) of the East Fork Lake Tributaries watershed. Nearly 40% of the forested land is located within and adjacent to East Fork State Park. Because of the widespread use of tillable soil for agriculture, forested areas outside of East Fork State Park are extremely patchy and largely confined to wet areas, steep slopes, or stream borders.

Forested areas typically support a healthy watershed. Root systems help to prevent soil erosion, aiding water infiltration into the soil while preventing excess sediments from entering water bodies. Forested areas along streambanks help to increase the stability of the stream channel by preventing erosion. Riparian forestation also provides shade to streams, which helps maintain desirable water temperatures and dissolved oxygen levels.

Light Urban Development - Residential and Commercial

With the presence of three villages and two major roads the East Fork Lake Tributaries region has a significant percentage of light urban development, totaling 30,577 acres (32.3%). This category of land use includes residential, institutional (schools, churches, etc.) and commercial property.

Within the East Fork Lake Tributaries, the majority of residential development historically has been concentrated within and around the communities of Williamsburg, Bethel, and Hamersville but increasingly the building of homes or siting of manufactured homes on large rural lots has become a popular alternative for homebuyers.

This watershed also has several commercial areas within the villages of Williamsburg and Bethel and along major roads (e.g., St. Rte. 125, St. Rte. 32). Commercial lands are notable because of their high percentage of impervious area.

Other Land Use Categories

There are no barren lands, special designations or districts located in the Lake Tributaries. The major water body in the Lake Tributaries is Harsha Lake, a 2,160-acre public lake. Numerous small privately owned lakes and ponds exist in this region (see pg. 2-14, Fig. 2-10) . The Lake Tributaries contains approximately 89 linear miles of major streams and rivers [estimated from river basin maps, Ohio Department of Natural Resources (ODNR) Division of Water]. In addition, county-maintained ditches and numerous miles of privately-maintained ditches are used for land drainage.

Potential Sources of Pollution — Non-point Source Inventory

Several factors determine the impact from non-point sources of pollution including type and characteristics of contaminants, the concentration of contaminants, soil type, percent impervious surface, amount of rain, and the presence of buffers or other best management practices (BMPs). The primary sources of non-point source pollution in the East Fork Lake Tributaries watershed are discussed in the following pages.

Point Sources vs. Non-point Sources of Pollution

For ease of communication, potential pollution sources are classified as either "point sources" or "non-point sources." As the name implies, point sources are very concentrated sources of pollution, typically "end-of-pipe" discharges such as wastewater treatment plant effluent. Non-point source pollution is used to describe the many sources of pollution—such as runoff from agricultural fields, suburban lawns or parking lots—associated with storm water runoff. Even though some areas—for example household sewer treatment systems, chemical handling areas on farms, and feedlots—have a higher concentration of potential pollutants, they are still treated as non-point sources because the contaminants are typically carried to surface water in storm water runoff.

Agriculture—Row Crop Production

Based on the land use information presented in the last section, agriculture is a dominant economic driver and way of life within the East Fork Lake Tributaries. Often considered to be more environmentally friendly than residential or commercial development, agriculture can also have significant impacts on water quality. Excess fertilizers applied by farmers may enrich surface waters with nitrogen and phosphorus through runoff and erosion. Certain tillage practices promote erosion of topsoil. Increased sediments can ultimately change the flow and shape of a stream, and negatively impact stream habitat. Also, phosphorus attaches itself to sediment particles and enters the water body through sedimentation. Additionally, residues from pesticides applied to crops to control weeds, insects and fungi can enter streams through runoff and soil erosion. See Appendix E for a chemical use analysis and tillage practices in the East Fork watershed.

Agriculture—Livestock Production

Table 2-4 lists estimates of the type and number of livestock in the East Fork Lake Tributaries watershed, broken out by the major drainage areas (USGS HUC-14s). These are best estimates based on current information from large producers plus USDA livestock program information from 1999 and 2002. Anybody familiar with agriculture in the area is aware of how quickly livestock demographics change based on family economics, markets, government programs, weather, and other factors. The trend is toward a few much larger livestock production facilities and away from the middle-sized operations of the recent past. There still are quite a number of farmers that only have a few to a few dozen head, kept to take advantage of pasture or existing facilities. Many farmers who produced some livestock in the 1980s or 1990s have completely given up livestock production in favor of row-crop production.

From dozens of commercial dairies in the 1960s and early 1970s, that industry now has only one or two hold-outs in the watershed. A number of farmers, however, are still raising beef cattle to add value to their grain crops or to take advantage of pasture ground. The issues related to cattle waste vary depending on whether the cattle are concentrated on a feed lot or are pastured. Though beef cattle are raised throughout the East Fork Lake Tributaries watershed, Table 2-4 shows the majority are concentrated in Cloverlick watershed.

Livestock on pasture have the potential to contribute excess pollutant loadings to rivers, streams and lakes in the absence of appropriate manage-

Stream/Sub-basin	*Livestock – Type and Number*				
	*Hogs**	*Cattle*	*Sheep & Goats*	*Horses*	*Total*
East Fork River—above Fivemile Creek to S.R. 276 Williamsburg		176	8	65	249
East Fork River—below S. R. 276 at Wsbrg. to above Cloverlick Creek		62		32	94
Cloverlick Creek		330	56	65	451
Poplar Creek		87	8	38	133
East Fork River—below Cloverlick to below Lucy Run (Split at dam)		32		28	60
TOTALS		687	72	228	987

Table 2-4. Estimated numbers of livestock in the East Fork Lake Tributaries watershed.
[Sources: USDA-FSA 1999 Small Hog Operation Payment Program (SHOP-II), USDA-FSA 2002 Livestock Compensation Program (LCP), livestock producers]
* There are no significant Hog Farm or Hog stock numbers in the East Fork Lake Tributaries

Livestock Type	Size	Total Manure Production	Total Solids	BOD5	N	P_2O_5	K_2O
	lb	lb/day	lb/day	lb/day	lb/day	lb/day	lb/day
Dairy Cow	1200	98	12.5	2.0	0.49	0.20	0.39
Beef Cattle	1000	60	6.9	1.6	0.34	0.25	0.29
Finish Hog	200	13	1.2	0.4	0.09	0.07	0.07
Sow w/litter	375	33	3.0	1.0	0.23	0.17	0.18
Sheep	100	4	1.0	0.1	0.05	0.02	0.04
Horse	1000	45	9.4	-	0.27	0.10	0.20

Table 2-5. Manure production and characteristics for common livestock animals.

ment practices. The most important practice is to fence livestock out of streams, leaving a buffer area that settles out sediment and treats animal waste contained in the runoff.

Larger livestock facilities like feedlots and hog barns offer a broader set of challenges. At the production facility, animal wastes are highly concentrated. Great care must be taken to contain animal wastes until they can be applied properly to crop ground or composted. There are no large livestock facilities located in the Lake Tributaries region.

Typical pollutants of concern from livestock production include suspended sediments and excess nutrients, resulting in the organic enrichment of surface waters. The decomposition of animal matter and excreta (as measured by BOD_5) depletes oxygen supplies in water bodies, which in extreme cases can be depleted to a point that aquatic life can no longer be sustained. Furthermore, the flushing of animal excreta into lakes and streams can potentially introduce pathogens (bacteria and viruses) into the water supply, and create a contact hazard for recreational users. Potential pollutants generated by different types of livestock are presented in Table 2-5.

Horse Farms

No source was available on the number of horses in the watershed. However, they number in the hundreds, as the number of 5-10 acre hobby farms has sky-rocketed, joining the few horse-based businesses (riding stables, breeders, etc.). Though most horse farms probably have little impact on water quality, the number of complaints and the sight of poorly maintained horse pastures and manure management reflects the limited knowledge that some new horse owners have about managing horses and their waste. It should be noted that fifty-five miles of trails, including a 32-mile lakeside perimeter trail, draw dozens of experienced riders to East Fork State Park each year. Ohio Horsemen Council (OHC) members totaled 13,565 saddle miles in the park during 1999. In addition to the trails, East Fork sports a day-use equestrian activity field that is a favorite with the Clermont County chapter of the OHC. Trail riding at East Fork is heaviest in the fall when the demanding trails are dry. Rental horses are available through local liveries.

Quarries or Barren Lands

There are no quarries or barren lands located in the Lake Tributaries. Quarries are worth noting because of the potential for non-point source pollution generated by excavating, moving and processing large quantities of sand and gravel if appropriate best management practices are not employed.

Household Sewage Treatment Systems

There are approximately 4000 household sewage treatment systems (HSTS) - more commonly called septic systems or on-site wastewater treatment systems - in the East Fork Lake Tributaries watershed. A percentage of those systems are not providing adequate wastewater treatment due to a variety of reasons that include poor design, poor construction, or installation of a system inappropriate for the soil type (e.g., leach field treatment system on Clermont soil). Because of seasonal ponding common to the Avonburg, Blanchester and Clermont soils (locally called the A-B-C soils), approximately 60% of the watershed is not suitable for traditional leach-field home sewage treatment systems (HSTS). When a HSTS is not providing adequate treatment of wastewater, untreated sewage will collect on the ground surface or be carried directly to a ditch or stream.

Failing HSTS systems are a serious public health concern because of the potential that people will come into direct contact with untreated sewage in yards, ditches or streams. Stormwater runoff will carry the untreated sewage with its high concentration of nutrients into streams causing organic enrichment, excessive algal growth, and loss of dissolved oxygen. The flushing of untreated sewage into lakes and streams can potentially introduce pathogens (bacteria and viruses) into the water supply, and create a contact hazard for recreational users.

Many failing systems are simply older systems that were installed when knowledge of HSTS was limited and before HSTS were adequately regulated. State and county laws and standards regulating the design and siting of on-site systems have been periodically updated to reflect the increased understanding of how these systems work (or don't work) in a given environment.

Urban Stormwater Runoff

Growth can be important to the vitality of neighborhoods and towns. It can have beneficial impacts for communities in terms of economics and community structure. However, growth and development that occur without environmental planning can create numerous challenges with stormwater management such as localized flooding and degraded stream quality. Urbanization increases the amount of impervious surfaces in the watershed, increases the runoff and pollutant loads, and potentially results in the impairment of streams. Based on 1997 land use data it has been estimated that the entire East Fork watershed has 3% impervious surface coverage. Local knowledge of land use cover suggest that the Lake Tributaries region probably has even less impervious cover. A detailed impervious surface cover analysis is currently underway in Clermont County using GIS software. See sidebar for watershed classifications based on percent of impervious cover.

In order for a balance to exist between growth and the environment, water quality concerns should be taken into consideration during the planning stages of development. In response to such concerns the Clermont Stormwater Management Department collaborates with other local agencies and organizations to enhance the quality of life in Clermont County by reducing problems associated with drainage, flooding, and infrastructure, and by improving water quality through construction and maintenance of the stormwater system, and through the promotion and implementation of effective storm water management practices. The Clermont Storm Water Management Department oversees several programs including the Phase II Strom Water Management Program.

Impervious Area and Non-point Source Pollution

Higher amounts of impervious area are associated with commercial, industrial and even residential land uses. Impervious area is any surface which does not allow the infiltration of rainwater. Typical examples include roofs, road surfaces, parking lots, driveways and sidewalks. Studies have shown that as little as ten percent impervious cover in a watershed can be linked to stream degradation, with degradation becoming more severe as the impervious area increases. Watersheds are often classified based on their percent of impervious surfaces. Those with the least amount of impervious area tend to have the highest quality streams; and those with the most amount of impervious area typically have degraded conditions. The Center for Watershed Protection has classified watersheds with impervious cover of less than 10% as sensitive; 10-25% as degraded or impacted; greater than 25% as non-supporting of aquatic life.

Phase II Storm Water Management Program: By March 2003, the Ohio Environmental Protection Agency (EPA) required communities within rapidly urbanizing areas to develop stormwater management plans and to apply for coverage under the agency's Phase II storm water general permit. The goal of the Phase II program is to minimize the water quality problems that result from storm water runoff. These regulations affected 15 communities in Clermont County, including the County itself. The Storm Water Management Department coordinates the implementation of the Clermont Storm Water Management Plan for 14 of the 15 Phase II communities (the City of Loveland has an individual permit).

Illicit Solid Waste Disposal

Population growth and populations in general can also contribute to illicit solid waste disposal (e.g., litter and dumping). Many roadways are lined with litter and spatially dotted with illicit dumping sites. Unfortunately, many of these dumping sites are located adjacent to streams and within stream valleys. Because of the size and nature of illicit solid waste disposal it is difficult to calculate the enormity and location of illicit solid waste dispersal within a watershed. However, this does not mean such a problem can be ignored.

Figure 2-13. Illicit solid waste found along the East Fork.

The East Fork Watershed Collaborative with direct assistance from local soil and water conservation districts and solid waste district are working closely to address this issue. Numerous educational programs have been established to spread awareness concerning litter prevention and the threat of illicit dumping in or near streams. Other programs have been established to engage the pubic in illicit solid waste removal.

Potential Sources of Pollution — Point Source Inventory

Any time that contaminated or "waste" water is discharged from the end of a pipe, the pollution is termed "point source pollution." That water has typically received treatment to meet certain water quality standards that were designed to minimize its impact on the stream. Point sources have historically been one of the biggest culprits in stream pollution and degradation of water quality. In response to the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) was created to regulate the quality of water from factories and wastewater treatment facilities. Now those facilities have to conduct regular monitoring of pipe effluent and meet strict environmental standards. Though significant progress has been made these discharge points may still have an impact on water quality because of water temperature, nutrients, metals, and other contaminants. This is especially true during summer low stream flow when the waste water discharges may make up a large percentage of stream flow.

Within the East Fork Lake Tributaries watershed, there are seven point-source dischargers permitted by Ohio EPA (see Figure 2-15). The permitted dischargers are:

- CECOS International Inc.
- East Fork Lake Water Treatment Plant
- Forest Creek Mobile Home Park (MHP)
- Holly Towne MHP Sewage Treatment Plant
- US DOA William H. Harsha Lake
- Village of Bethel Waterworks
- Williamsburg WWTP

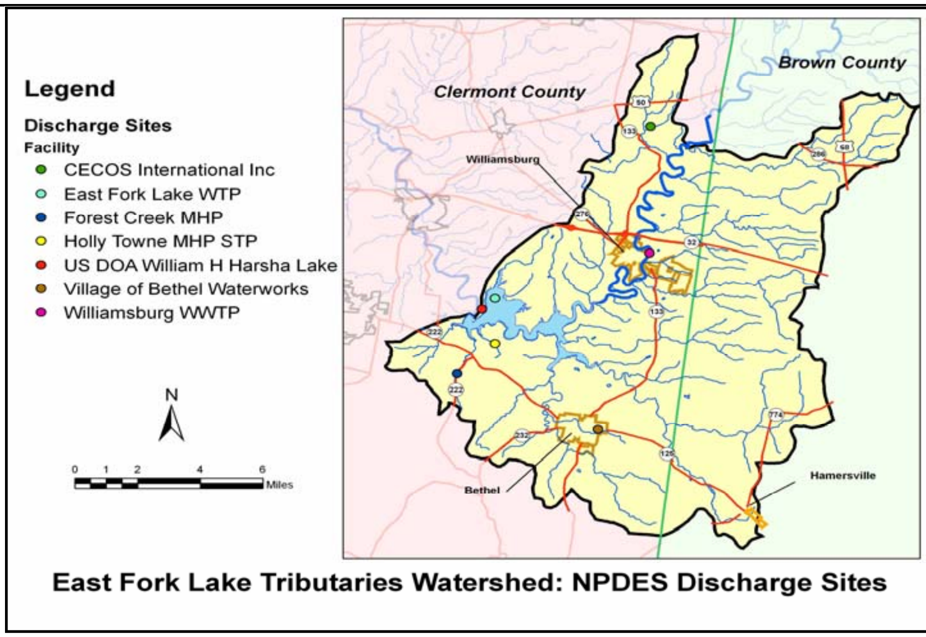


Figure 2-14. Location of NPDES permitted discharge sites in the East Fork Lake Tributaries watershed.

CECOS Hazardous Waste Landfill Facility

The CECOS Hazardous Waste Landfill facility is located along Pleasant Run within the Lake Tributaries watershed. This landfill operated from early 1970s through fall 1989, when it was closed by the Ohio EPA. The CECOS hazardous waste landfill facility consists of 12 land disposal units. No immediate water quality problems have been associated with this facility, however due to the content of the hazardous materials located at this facility it will need to be continually monitored. The materials located at the CECOS facility present an inherent threat to the Lake Tributaries watershed for years to come.

Physical Stream Characteristics

A detailed analysis of physical stream characteristics has been conducted for the entire Clermont County section of the East Fork watershed. The analysis was prepared by Tetra Tech Inc. in 2001 for the Clermont County Office of Environmental Quality. Six streams in the Lake Tributaries were assessed; Crane Run, Cabin Run, Kain Run, tributary to Cloverlick, Guest Run, and a tributary to Harsha Lake. A summary of analysis results can be found in Appendix G.

Ohio EPA does not collect direct measures of stream morphology (see Figure 2-16), though some qualitative indicators are recorded as part of the Qualitative Habitat Evaluation Index (QHEI) outlined in Chapter 3.

Several general observations can be made about physical stream characteristics in the watershed:

- The watershed is largely agricultural. A number of the smaller tributaries have been modified (i.e., straightened and/or deepened) to facilitate agricultural drainage. This channelization or ditching is less pronounced in the East Fork Lake Tributaries than in other agricultural areas in Ohio because the soils do not respond well to subsurface drainage, thus reducing the need for tile outlets.

- A majority of streams have sufficient instream cover due to significant wooded riparian zones.

- Stream flow along the mainstem is interrupted by the Williamsburg low head dam and Harsha Lake. The low head dam is located north of Williamsburg and was created to provide an annual surplus of water for the

Stream Morphology and Floodplain Access

More and more, scientists, engineers, environmental professionals and landowners are realizing the importance of stream channel form - also called stream morphology - to the maintenance of water quality. Channel form - channel size and shape, access or lack of access to a floodplain, presence of alternating pools and riffles - dictates how the stream handles both water and sediment. This is especially important during larger storm events when both flow and sediment loads are at their highest.

Streams that have the ability to overflow their banks during high flows dissipate much of the erosive energy of those high flows, and deposit some of the entrained sediment onto the floodplain. Conversely, highly entrenched streams (i.e., those that cannot access their floodplain during most high flows) contain and concentrate the erosive energy of high flows within the stream channel.

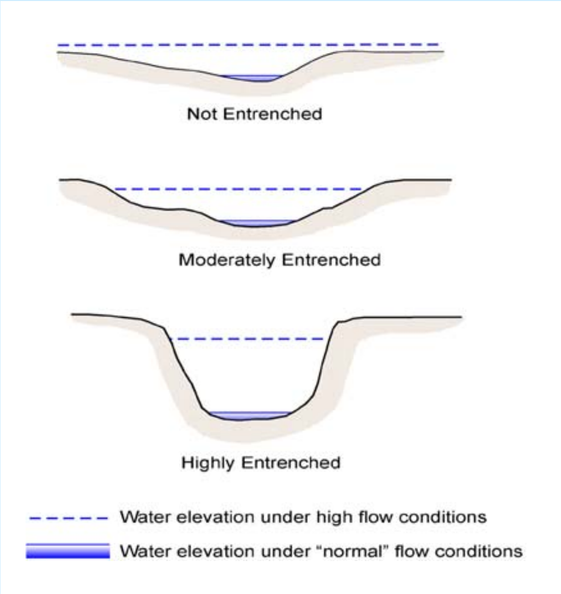


Figure 2-15. Entrenchment describes a stream's ability to access its floodplain under high flow conditions.

Figure 2-16. Backwater section of the East Fork mainstem as it enters Harsha Lake. (Photo courtesy of Mike Miller)

Williamsburg Reservoir. The reservoir is no longer in use, however the dam still impounds the East Fork mainstem. Over a mile of the mainstem is pooled due to Harsha Lake. This decreases physical habitat and creates homogeneous habitat.

- Areas in which cattle have access to streams tend to exhibit excessive streambank erosion.

It should be noted that conducting an inventory and detailed assessment of physical stream characteristics was identified as a priority during watershed planning for the East Fork Lake Tributaries (see Chapters 4 & 5).

Community Resources

Clermont County has lead and participated in numerous regional and local utility, land use and transportation planning initiatives that include direct environmental influences to all or part of the East Fork Lake Tributaries Watershed. These initiatives include: 208 Water Quality Management Plan developed by Ohio-Kentucky-Indiana Council of Governments *(available through OKI Council of Governments)*; Eastern Corridor - Green Infrastructure Plan; Ohio 32 Corridor Vision Plan *(available through OKI Council of Governments)*; Clermont County Wastewater Master Plan *(available through Clermont County Serer and Water District)*; and Clermont County Thoroughfare Plan *(available through Clermont County Engineers Office).*

Each of these initiatives, developed with stakeholder input, over a long period of time, addresses the need and a vision for protecting water quality in the East Fork Lake Tributaries Watershed and beyond. Each initiative has considerable merit on an individual basis, but the consistent theme and broad stakeholder participation provides addition weight to the direction and value of a local vision. Notably, the Eastern Corridor - Green Infrastructure Plan included an advanced mitigation strategy that addressed the need to provide mitigation in advance of transportation projects for both primary and secondary impacts. The plans advance the concept of creating sustainable economic growth, balanced with sustainable environmental qualities, to insure a high quality of life for the community.

Cultural Resources

There is an abundance of cultural resources within the entire East Fork watershed that increase the quality of life for residents in the region. Most of these resources highlight naturally and historically significant areas in the watershed. The East Fork Lake Tributaries is home to a variety of these resources. Historic villages, local shops, museums, and William H. Harsha Lake are some examples of cultural resources found in the Lake Tributaries. East Fork State Park is the largest and most recognized cultural resource in the East Fork watershed.

Recreation

The quality of recreational opportunities within the East Fork watershed, and elsewhere, are inextricably linked to water quality and overall environmental quality. Often, forms of outdoor recreation are not compatible with the sustainability of the natural resources they utilize. It is the responsibility of planners, municipal leaders, and recreational organizations to ensure that activities in the East Fork watershed do not negatively impact the rich diversity of natural resources that draw tourism dollars into the region. Reversely, recreational opportunities offer residents a chance to enjoy the wonderful natural resources located within the watershed. Parks, preserves, and other recreational areas provide protection of open space within the watershed that help to ensure the future quality of the natural resources in the region.

There are many types of recreational opportunities for outdoor enthusiasts and a good supply of outdoor recreational amenities located in the East Fork watershed. Hunting, fishing, canoeing, boating, hiking, bird watching, and biking are a few of the recreational opportunities found within the watershed. The majority of these opportunities exist at East Fork State Park.

East Fork State Park

One of Ohio's largest state parks, East Fork offers a great diversity of recreational opportunities and natural history only 25 miles from Cincinnati. The park's terrain includes both rugged hills and open meadows, setting the stage for a wonderful get-away.

Camping

East Fork has one of the largest camping areas in the state with 399 sites, all of which have electrical hookups. Seven full-service sites also have sewer and water hookups. The campground offers showers, flush toilets, drinking water, a camper's beach, and boat ramp. Pets are permitted in designated areas. The campground features a mini-golf course, bike rental, basketball and horseshoe courts, and playgrounds.

Spacious Cedar Cabins with all the amenities of a fully-equipped RV are available for daily or weekly rental. Four camper cabins may also be rented spring through fall. A 17-site horsemen's camp is available as well.

Trails

For the hiker and backpacker, the Backpack Trail traverses approximately 10 miles of scenic park areas, offering a 20-mile round trip. In addition, the 32-mile Steven Newman Worldwalker Perimeter Trail circles the park and is available for hikers, backpackers, and horsemen. Four primitive campsites are located along these trails. Permits for their use are available through the park office. For those less adventuresome, shorter trails are easily accessible. A 5-mile mountain bike trail begins just west of the park entrance on S.R. 125.

Williamsburg-Batavia Hike Bike Trail

The proposed Williamsburg –Batavia Hike and Bike Trail (see Figure 2-18) is a 13.3-mile long shared use path that offers a wide variety of recreational uses between Batavia and Williamsburg. It will provide scenic connections in each village while traveling through East Fork State Park. Cyclists, hikers, runners, walkers and roller-bladers can experience forested areas, wildlife, and stream crossings along a smooth path to their destination.

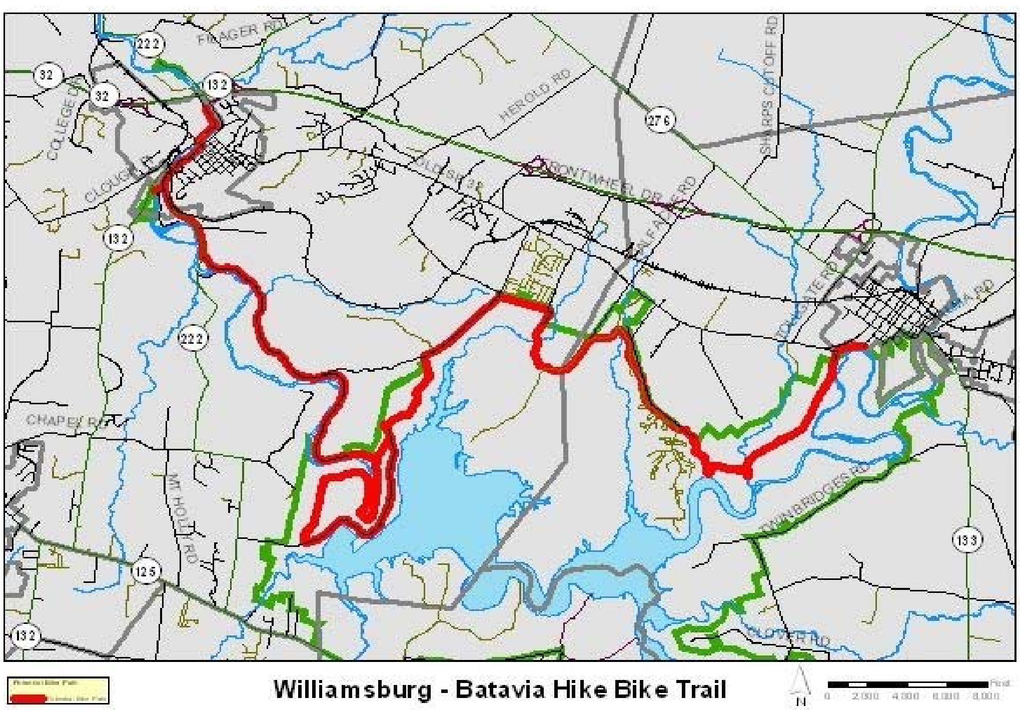


Figure 2-17; Map of the proposed Williamsburg-Batavia Hike Bike Trail.
[note: red line represent proposed trail and green represent East Fork State Park boundary]

Boating
Those who enjoy water sports will find East Fork Lake very accommodating. There are 2,160 acres of water and unlimited horsepower boating with access available at six launch ramps. Harsha Lake has a 2000 meter buoyed rowing course used to host four REGATTAS each year.

Hunting and Fishing
The lake offers quality fishing with excellent catches of largemouth and smallmouth bass, bluegill, and crappie. For the sport fisherman, East Fork is stocked with the Hybrid Striper. Hunting is permitted in designated areas only. Valid Ohio hunting and fishing licenses are required. Game includes deer, fowl, squirrel, and rabbit.

Picnicking
Picnic areas with tables, grills and drinking water are located around the park. Two picnic shelters are available. The Turkey Ridge shelter is reservable.

Swimming
A 1,200-foot swimming beach features change booths with showers and restrooms.

East Fork State Park is leased from the U.S. Army Corps of Engineers. The U.S. Army Corps of Engineers Louisville District at William H. Harsha Lake provides plenty of information to make your visit more enjoyable. Information used for this section can be found at http://www.dnr.state.oh.us/parks/parks/eastfork.htm.

History

The Little Miami River basin in which East Fork State Park is situated has been home to many generations of man, dating back to nearly 3,000 years ago. Moundbuilders, the Adena and Hopewell Indians, occupied this area. The mound near Elklick Road is thought to have been built by the Adena. The Erie Indians also lived here much later, though by 1655 this nation was completely destroyed by the powerful Iroquois. The area was virtually uninhabited through the remainder of the 17th century.

As the new state of Ohio began to be settled in the early 19th century, the East Fork region attracted settlers from the east. Grist mills, sawmills, blacksmith shops, tanneries and stagecoach depots were among the early commercial activities.

The East Fork region played an important role in the Underground Railroad due to its geography near the Ohio River across from the slave owning states of Kentucky and Virginia. A number of villages in Clermont County gave refuge to slaves, including New Richmond, Moscow, Williamsburg and Bethel. Clermont County was one of the first

Figure 2-18. Williamsburg Historical Marker.
(photo courtesy of the Clermont County Historical Society: http://www.clermonthistoric.org)

places that slaves could rest and be safe.

In 1869, two gold mines operated in the vicinity. One mine was located near Elklick and consisted of a flume for washing gravel containing flakes of gold. The mine near Twin Bridges tunneled underground to reach gold deposits encased in bedrock.

Not far from the present park office, the "Old Bethel Church" on Elklick Road dates from 1867. It occupies the site of a log church built about 1807 by Reverend John Collins. Some of the hand-hewn timbers secured with wooden pegs and hand-forged nails used to construct the 1818 church are still present in the existing church.

More recently, the area has taken on a new appearance due to the creation of East Fork Reservoir in 1978. As part of the U.S. Army Corps of Engineers flood control program, East Fork Lake and the surrounding region comprise one of southwestern Ohio's largest recreational areas.

For detailed maps of recreational, historical and other cultural resources in the East Fork Lake Tributaries region visit the Ohio Valley Regional Development Commission web page at www.ovrdc.org. For further information about East Fork State Park visit http://www.dnr.state.oh.us/parks/parks/eastfork.htm.

East Fork Lake Tributaries Watershed Management Plan

Chapter Three

Water Resource Quality

CHAPTER 3: WATER RESOURCE QUALITY

Use Attainment Status

The 2004 Integrated Water Quality Monitoring and Assessment Report prepared by Ohio EPA provides the agency's most recent assessment of streams in the East Fork Lake Tributaries subwatershed (defined in the report as the area draining to the East Fork downstream of Howard's Run to the dam at East Fork Lake). The subwatershed encompasses approximately 25 miles of the East Fork Little Miami River (EFLM) upstream and inclusive of East Fork Lake, three tributaries to the EFLM (Fivemile Creek, Pleasant Run, and Todd Run) that drain directly into the EFLM upstream of the lake, and seven streams (Barnes Run, Cabin Run, Cloverlick Creek, Kain Run, Poplar Creek, Slabcamp Run, and Ulrey Run) that drain directly into the lake. This chapter summarizes the status of these streams in terms of meeting their use designations (e.g., aquatic life use support, contact recreation use support) based on water quality and biological data collected by the state and Clermont County. Data does not exist for several streams in the Lake Tributaries subwatershed; those streams are omitted from this chapter.

The mainstem of the EFLM within the subwatershed has received an "Exceptional Warmwater Habitat" (EWH) aquatic life use designation, meaning this waterbody has the potential to support exceptional biological communities. All of the streams that serve as tributaries to the EFLM or drain directly into East Fork Lake have been designated by Ohio EPA as Warmwater Habitat (WWH) streams. Cloverlick Creek and the entire length of the East Fork are also designated for Public Water Supply, and all streams have been designated for Primary Contact Recreation.

Ohio EPA's assessment of the East Fork Lake Tributaries subwatershed is based on data last collected in 1998. A more specific assessment of individual streams within the subwatershed is provided in the agency's 2000 *Ohio Water Resources Inventory* 305(b) report. Based on these data, approximately 13 percent (3.2 river miles) of the EFLM was found to be in "Full, but Threatened" attainment of the river's use designation (EWH), while 47 percent (11.6 miles) was listed in "Partial" attainment (see Figure 3.1). The remaining 40 percent of the East Fork Little Miami River

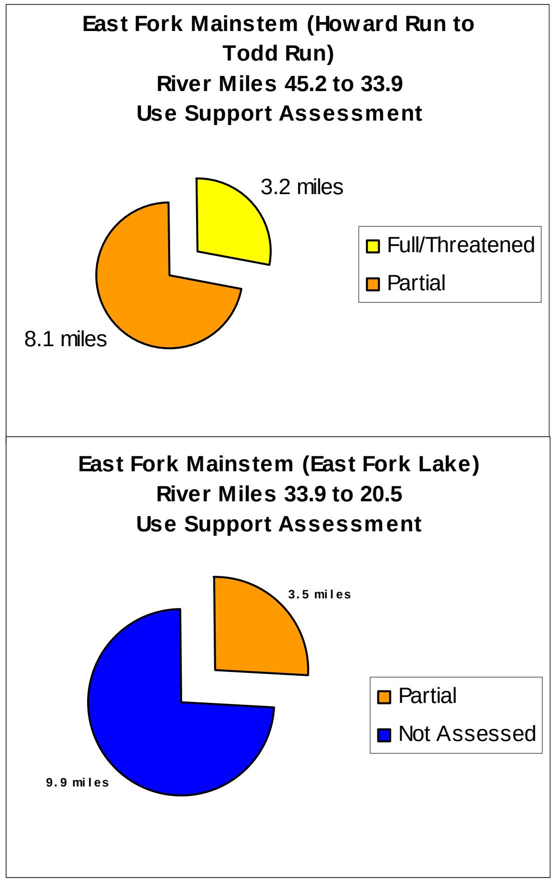


Figure 3.1 Use Attainment Support Assessment for EFLM River Mainstem Segments (EWH).

in this subwatershed (9.9 river miles) actually consists of East Fork Lake itself and was, therefore, not sampled by Ohio EPA.

Of the tributary stream segments monitored by Ohio EPA in 1998, approximately 15 percent (4.0 miles) fully supported their aquatic life designated use, while 24 percent (6.3 miles) were rated "Full, but Threatened". Approximately 21 percent of the streams (5.4 miles) were in "Partial" support,

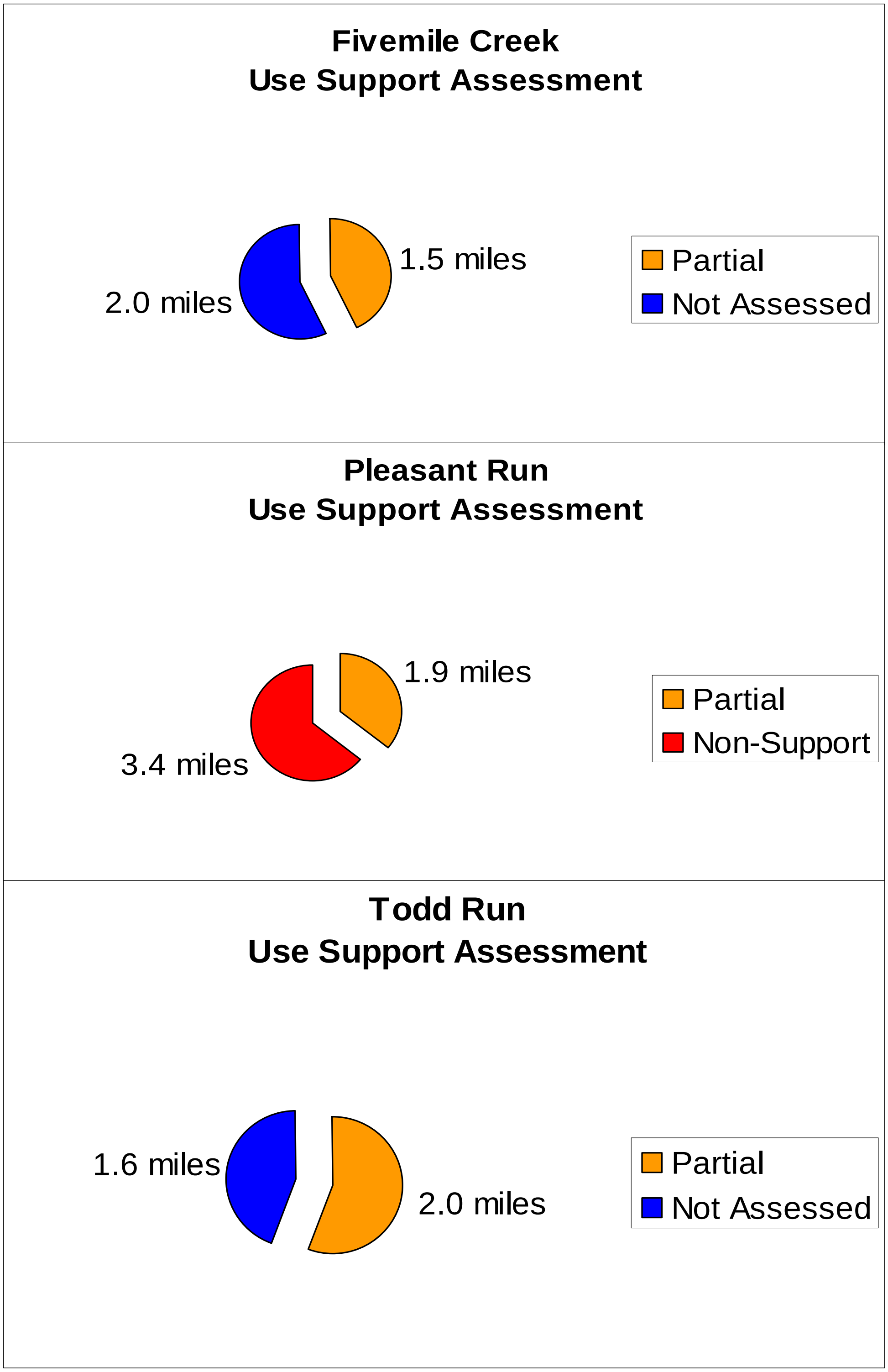


Figure 3.2 Use Attainment Support Assessment for Tributaries to EFLM River (WWH).

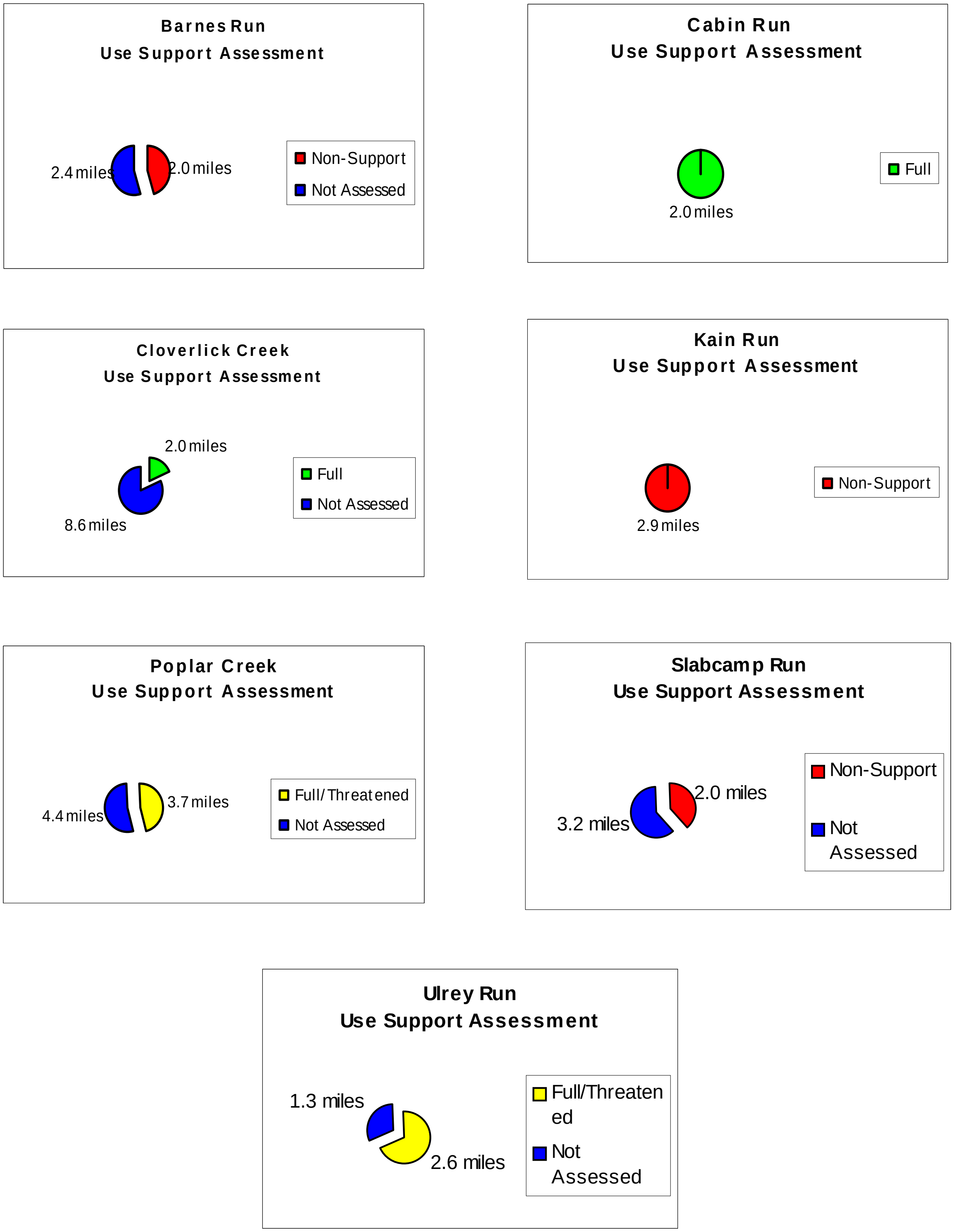


Figure 3.3. Use Attainment Support Assessment for East Fork Lake Tributaries (WWH).

while over 39 percent (10.3 miles) did not support their aquatic life use.

High concentrations of nutrients and siltation were listed as primary causes of impairment in the segment of the EFLM extending from Howard Creek to Todd Run. Non-irrigated crop production was listed as the most significant pollutant source. Between Todd Run and the dam at East Fork Lake, flow alteration was listed as the primary cause of impairment, the result of development in that part of the subwatershed.

Three tributaries to the EFLM were also assessed by Ohio EPA – Fivemile Creek, Pleasant Run, and Todd Run. All three streams are designated as Warmwater Habitats (WWH). In Fivemile Creek, the primary cause of impairment was organic enrichment/low dissolved oxygen (DO). The source of this impairment is unknown. In Pleasant Run, impairment was primarily due to organic enrichment/DO, while flow alteration and unionized ammonia were listed as moderate causes. The primary source of this impairment was identified as onsite wastewater systems (septic tanks), while non-irrigated crop production was identified as a contributing factor. The cause(s) of impairment in Todd Run are unknown.

As stated above, seven of the streams in the Lake Tributaries sub-watershed drain directly into East Fork Lake – Barnes Run, Cabin Run, Cloverlick Creek, Kain Run, Poplar Creek, Slabcamp Run, and Ulrey Run. All are designated as Warmwater Habitat (WWH). In Barnes Run, the primary cause of impairment is listed as organic enrichment/DO, while siltation is listed as a moderate cause. Onsite wastewater systems (septic tanks) is listed as the primary source of this impairment, with non-irrigated crop production listed as a secondary source.

Cabin Run was in full attainment of its designated use. While no causes or sources of impairment were noted in this stream, the 2000 OEPA report did note that some bacterial spikes suggest sewage inputs, probably from residential onsite sewage systems. Cloverlick Creek received a rating of "Full, but Threatened" for its Aquatic Life Use Attainment, with the threat identified as siltation resulting from nonirrigated crop production.

In Kain Run, the cause of impairment was listed as nutrients from non-irrigated crop production. Poplar Creek is another stream that received a "Full, but Threatened" use designation. The primary threats were identified as organic enrichment/DO and pathogens from sanitary sewer overflows. Slabcamp Run showed impairment in the form of organic enrichment/DO, a problem exacerbated by intermittent flow conditions. The primary source of this impairment was identified as onsite wastewater systems (septic tanks). Ulrey Run was designated as achieving "Full, but Threatened" use attainment status. Potential threats to the stream include organic enrichment/DO and pathogens from onsite wastewater systems (septic tanks). Table 3.1 highlights the primary causes of impairment for the East Fork Little Miami River, as well as other streams assessed by Ohio EPA in the Lake Tributaries subwatershed.

According to Ohio EPA's 2004 Integrated Water Quality Monitoring and Assessment Report, the status of Primary Contact Recreation use support in this watershed is not impaired. However, there is a fish consumption advisory in effect for the entire length of the East Fork Little Miami River. The advisory recommends that fish consumption be limited to one meal per month for the following species: channel catfish, flathead catfish, rock bass, smallmouth bass and spotted bass. In general, the Ohio Department of Health advises that all persons limit consumption of sport fish caught in all Ohio waterbodies to one meal per week, unless there is a more restrictive advisory in place.

Summary of Stream Conditions

Most data available in the East Fork Lake Tributaries sub-watershed has been collected and compiled by Ohio EPA. Clermont County has also conducted a number of studies in the watershed, including biological surveys at three main stem sites beginning in 1996. The following paragraphs summarize the findings from these studies in the East Fork Little Miami River main stem downstream of Howard's Run to the dam at East Fork Lake.

Causes of Stream Impairment - Ohio EPA 2000 305(b) Report						
Impairment:	*Organic Enrich-ment/DO*	*Nutri-ents*	*Silta-tion*	*Flow Altera-tion*	*Unknown*	*No Impair-ment*
Mainstem						
East Fork Mainstem (Howard Run to Todd Run)		X	X			
East Fork Mainstem (East Fork Lake)				X		
River Tribs						
Fivemile Creek	X					
Pleasant Run	X					
Todd Run					X	
Lake Tribs						
Barnes Run	X					
Cabin Run						X
Cloverlick Creek						
Kain Run		X				
Poplar Creek						X
Slabcamp Run	X					
Ulrey Run						X

Table 3.1: Causes of Impairment in East Fork Lake Tributaries sub-watershed streams, OhioEPA 000 305(b) Report.

Stream Biology - East Fork Main Stem

The Ohio Environmental Protection Agency (OEPA) conducted intensive biological surveys in the East Fork watershed in 1982 and more recently, in 1998. A list of the Ohio EPA sampling stations, types of biological surveys conducted, and years conducted, is presented in Table 3-2.

Sample Site Identification

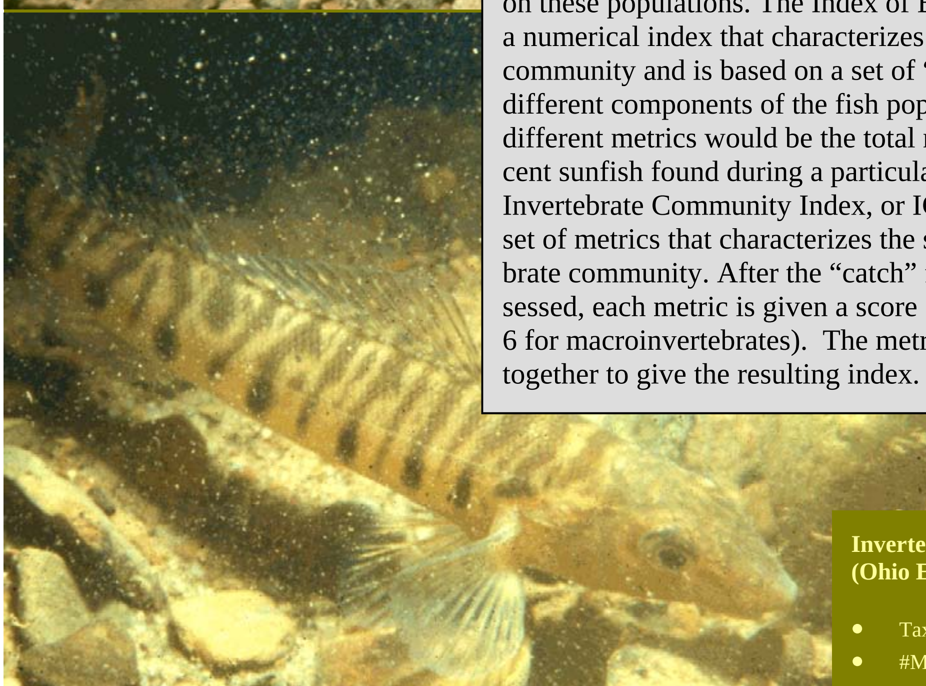
River Miles are an easy and accurate way to identify sampling locations. River miles are measured in terms of distance (in tenths of a mile) from the stream "mouth." In Barnes Run, river mile 0.0 (RM 0.0) would be the point where the stream enters the East Fork Little Miami River. River miles increase as you move upstream. Many of Clermont County's sampling sites are named using river miles. For example, EFRM 44.1 indicates samples collected at East Fork River Mile 44.1.

During 1996, Clermont County conducted macroinvertebrate surveys at two sites on the East Fork main stem, including river mile 42.8, downstream of Pleasant Run, and river mile 44.1, upstream of the Blue Sky Parkway Bridge. In 1997 the county conducted macroinvertebrate and fish surveys at both of these locations, as well as at river mile 36.2, downstream from the Williamsburg dam. In 1997, 1999, 2000, and 2001, the county conducted macroinvertebrate and fish surveys at the RM 42.8 and RM 44.1 locations. In 1998, only the RM 42.8 site was sampled for macroinvertebrates and fish.

<u>*Fish Survey Results*</u>
With only one exception, Ohio EPA conducted all its fish surveys in the East Fork Lake Tributaries sub-watershed in 1982 and 1998 (EFRM 42.3 was surveyed in 1984). The results show that there is no difference between IBI scores for the 1982 and 1998 surveys (Figure 3.4). The average IBI score for 17 surveys conducted on the East Fork Little Miami River in 1982 is 41.2 $\pm$ 10.6, while the average IBI score for the 12 East Fork surveys conducted in 1998 is 41.2 $\pm$ 4.4. Two of the six sites surveyed in 1982 (EFRM 35.6 and EFRM 41.2) had average IBI scores that met the EWH criteria. In contrast, none of the seven main stem sites sur-

Sampling Station	Location	Type of Survey	Year(s) of Survey
RM 30.4/30.8	Upstream East Fork Lake	Fish / Macroinvert	1982, 1998
RM 34.7/35.1	Main Street Williamsburg	Fish / Macroinvert	1982. 1998
RM 35.6	Downstream McKeever Road Bridge	Fish	1982
RM 35.8	Upstream McKeever Road Bridge	Macroinvertebrates	1998
RM 41.0/41.2	Jackson Pike Bridge	Fish / Macroinvert.	1982, 1984, 1998
RM 42.3	Downstream Pleasant Run	Fish.	1984
RM 44.1/44.4	Upstream Blue Sky Pkwy Bridge	Fish / Macroinvert	1982, 1998
RM 48.6/48.8	McCafferty Road Covered Bridge	Fish	1982, 1998
RM 50.5	Adj. US 50, d/s Glady Run	Macroinvertebrates	1998
RM 54.2-54.8	SR 131, d/s Fayetteville WWTP	Fish / Macroinvert.	1982, 1983, 1998
RM 56.2	US 50 bridge @ Fayetteville	Fish / Macroinvert	1982
RM 62.1	Morgan Road	Fish / Macroinvert	1998
RM 64.6	Eubanks Road, above 251	Fish	1982
RM 70.1	Wise Road bridge	Macroinvertebrates	1982
RM 70.1	Wise Road bridge	Fish	1998
RM 70.9	Dye Nursery, u/s Dodson Creek	Fish / Macroinvert.	1982, 1998
RM 72.8	Turner Road @ Lynchburg	Fish	1982
RM 75.3/75.4	Canada Road bridge	Fish / Macroinvert.	1982, 1998
RM 80.5	SR28 east of Hildebrant St	Fish / Macroinvert.	1982
RM 82.4	Thornburg Rd, d/s N.Vienna WWTP	Fish / Macroinvert	1998
RM 84.5	Rice Street @ New Vienna	Fish / Macroinvert	1982
RM 84.9/85.3	SR 73 bridge @ New Vienna	Fish / Macroinvert	1982, 1998

Table 3-2. Ohio EPA biological sampling locations in the East Fork Lake Tribs subwatershed.



Biotic Indices

Ohio EPA has established biotic indices for both fish and macroinvertebrates as a means to directly assess any impacts on these populations. The Index of Biotic Integrity, or IBI, is a numerical index that characterizes the condition of the fish community and is based on a set of “metrics” that measure different components of the fish population. Examples of different metrics would be the total number of species or percent sunfish found during a particular survey. Likewise, the Invertebrate Community Index, or ICI, is based on a separate set of metrics that characterizes the stream’s macroinvertebrate community. After the “catch” for each survey is assessed, each metric is given a score (1, 3 or 5 for fish; 2, 4 or 6 for macroinvertebrates). The metric scores are then added together to give the resulting index.

OHIO EPA MODIFIED IBI METRICS	HEADWATER SITE TYPE (<20 SQ. MI.)	WADEABLE SITE TYPE (20-300 MI.^{2})	BOATABLE SITE TYPE (200-6000 MI.^{2})
1. Total Native Species	X	X	X
2. #Darter Species		X	
#Darters + Sculpins	X*		
%Round-bodied Suckers			X*
3. #Sunfish Species		X	X
#Headwater Species	X*		
%Pioneering Species	X*		
4. #Sucker Species		X	X
#Minnow Species	X*		
5. #Intolerant Species		X	X
#Sensitive Species	X*		
6. %Tolerant Species	X	X	X
7. %Omnivores	X	X	X
8. %Insectivores	X	X	X
9. %Top Carnivores		X	X
10. %Simple Lithophils	X*	X*	X*
11. %DELT Anomalies	X	X	X
12. Number of Individuals	X	X	X

* - Substitute for original IBI metric described by Karr (1981) and Fausch et al. (1984)

Invertebrate Community Index (Ohio EPA 1987; DeShon 1995)

- Taxa Richness
- #Mayfly taxa
- #Caddisfly taxa
- #Dipteran taxa
- %Mayflies
- %Caddisflies
- %Tanytarsini Midges
- %Other Diptera/Non-Insects
- %Tolerant taxa
- Qualitative EPT taxa
- 6,4,2,0 metric scoring categories.
- 0 to 60 scoring range.
- Calibrated on regional basis.
- Scoring adjustments needed for very low numbers of specific taxa

Biological Criteria

Ohio EPA has established separate biocriteria for five ecoregions in the State of Ohio. The EFLM Lake Tributaries sub-watershed lies within the Interior Plateau ecoregion. Ohio EPA has designated the mainstem of the East Fork Little Miami River within sub-watershed as having “exceptional warmwater habitat” (EWH). The EWH use designation means that this stretch of the East Fork is expected to have a more diverse and healthy biological community than a typical Ohio stream. As a result, the biological criteria established by Ohio EPA for is section of East Fork are more stringent. To meet the EWH criteria in the Interior Plateau ecoregion, the Index of Biotic Integrity (IBI) scores used to rate the fish communities must be equal to or greater than 50 (or 48 for those sites fished using Ohio EPA’s boat electrofishing protocol).

The health of the macroinvertebrate community is measured using Ohio EPA’s Invertebrate Community Index, or ICI. For the EWH segment of the East Fork, ICI scores of 46 or greater must be attained to meet EPA’s criterion, while ICI scores of 36 or greater will meet the WWH criterion. Scores within four index points of either IBI or ICI criteria are said to be in “non-significant departure” of the criteria, meaning that these streams would still be in compliance with Ohio’s biological criteria. For example, EWH streams with IBI scores as low as 46 and ICI scores as low as 42 would still meet state standards.

Ohio Biological Criteria Adopted May 1990

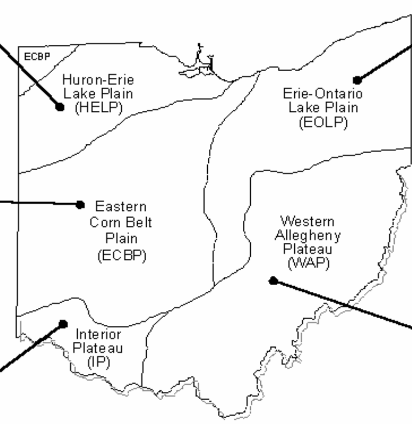
(OAC 3745-1-07; Table 7-14)

Huron Erie Lake Plain (HELP)

Use	Size	IBI	MIwb	ICI
WWH	H	28	NA	34
	W	32	7.3	34
	B	34	8.6	34
MWH-C	H	20	NA	22
	W	22	5.6	22
	B	20	5.7	22
MWH-I	B	30	5.7	NA

Erie Ontario Lake Plain (EOLP)

Use	Size	IBI	MIwb	ICI
WWH	H	40	NA	34
	W	38	7.9	34
	B	40	8.7	34
MWH-C	H	24	NA	22
	W	24	6.2	22
	B	24	5.8	22
MWH-I	B	30	6.6	NA



Eastern Corn Belt Plains (ECBP)

Use	Size	IBI	MIwb	ICI
WWH	H	40	NA	36
	W	40	8.3	36
	B	42	8.5	36
MWH-C	H	24	NA	22
	W	24	6.2	22
	B	24	5.8	22
MWH-I	B	30	6.6	NA

Western Allegheny Plateau (WAP)

Use	Size	IBI	MIwb	ICI
WWH	H	44	NA	34
	W	44	8.4	34
	B	40	8.6	34
MWH-C	H	24	NA	22
	W	24	6.2	22
	B	24	5.8	22
MWH-A	H	24	NA	30
	W	24	5.5	30
	B	24	5.5	30
MWH-I	B	30	6.6	NA

Interior Plateau (IP)

Use	Size	IBI	MIwb	ICI
WWH	H	40	NA	30
	W	40	8.1	30
	B	38	8.7	30
MWH-C	H	24	NA	22
	W	24	6.2	22
	B	24	5.8	22
MWH-I	B	30	6.6	NA

Statewide Exceptional Criteria

Use	.Size	IBI	MIwb	ICI
EWH	H	50	NA	46
	W	50	9.4	46
	B	48	9.6	46

veyed in 1998 supported the EWH use designation (IBI Score ≥ 48), although EFRM 35.1 and EFRM 41.0 had values not significantly different from the criteria value (IBI Score ≥ 44). The site surveyed in 1984 (EFRM 42.3) was sampled three times and had IBI scores of 56, 54, and 54, for an average of 54.7, thus meeting the EWH use designation.

While the 1982 survey data show a wider range of IBI scores than the 1998 data, both surveys follow a similar spatial trend, with IBI scores improving as one moves downriver from EFRM 48.8 to approximately EFRM 35, below which the scores begin to decline. Possible reason(s) for this trend are unknown.

In surveys conducted at three sites by Clermont County from 1997 through 2001, IBI scores have been higher (Figure 3.5). Two sites exceeded the criteria value of 48 (EFRM 36.2 scored a 49 in 1997 and EFRM 44.1 scored a 50 in both 1997 and 2000). Six additional sampling events resulted in IBI scores not significantly different from the criteria value (IBI Score ≥ 44), while only one sampling event (EFRM 42.8, sampled in 1999) resulted in a value (IBI = 40) significantly below the criteria value of 48.

<u>DELT Anomalies</u>

One of the metrics used in calculating the IBI is a rating based on the percentage of <u>D</u>eformities, <u>E</u>roded fins, <u>L</u>esions and <u>T</u>umors – also known as DELT anomalies – found on fish. Metric scores

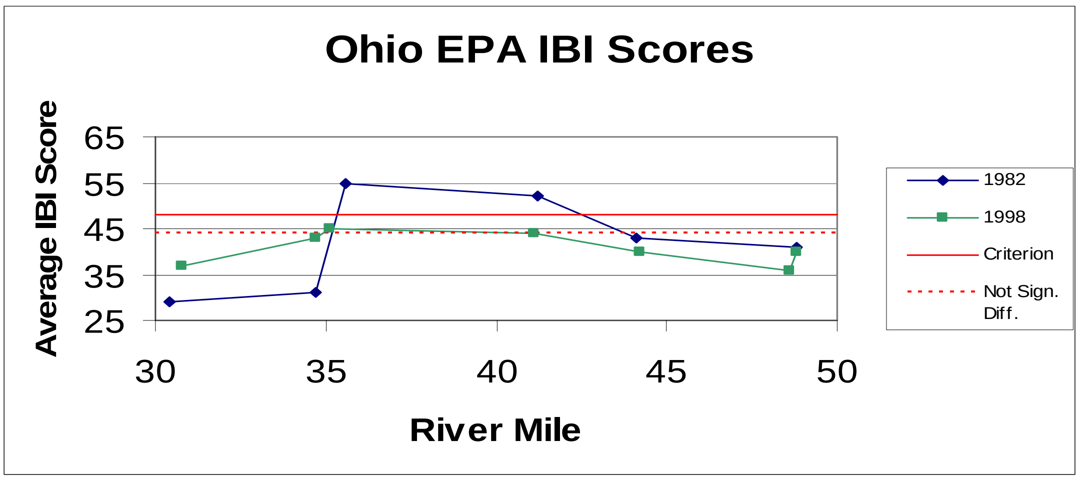


Fig. 3.4. Ohio EPA Index of Biotic Integrity (IBI) Scores, EFLM Lake Tributaries Sub-watershed (1982 and-1998).

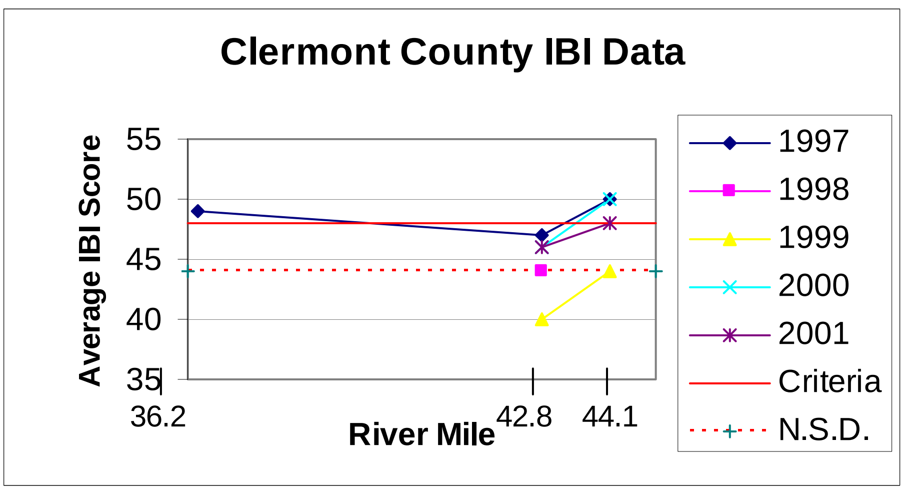


Fig. 3.5, Clermont County Index of Biotic Integrity (IBI) Scores, EFLM Lake Tributaries Sub-watershed (1997-2001).

of 1, 3 or 5 are given based on the percent DELT anomalies seen in a sample collection, with a score of 1 indicating more anomalies, and a score of 5 indicating few to none. There does not appear to be a statistically significant temporal trend in the Ohio EPA's DELT scores from 1982 to 1998 (Fig. 3.6). For surveys conducted in 1982, the average DELT score over 18 surveys was 3.6 ± 1.5. For the three surveys conducted at EFRM 42.3 in 1984, the average DELT score was 3.7 ± 1.2. For the 12 surveys conducted in 1998, the average DELT score was 3.8 ± 1.0. Figure 3.6 provides a plot of average DELT scores by River Mile for each year. There does not appear to be any consistent spatial trend in either year for which multiple sites were sampled.

Fish Consumption Advisory

There is a fish consumption advisory in effect for the entire length of the East Fork Little Miami River. The advisory recommends that fish consumption be limited to one meal per month for the following species: channel catfish, flathead catfish, rock bass, smallmouth bass and spotted bass. In general, the Ohio Department of Health advises that all persons limit consumption of sport fish caught in all Ohio waterbodies to one meal per week, unless there is a more restrictive advisory in place.

Macroinvertebrate Survey Results

The Ohio EPA surveyed macroinvertebrates at three main stem sites (RM 34.9, RM 41.0, and RM 44.1) in the Lake Tributaries sub-watershed in 1982, one site (RM 41.0) in 1984 , and five sites (RM 30.6, RM 34.9, RM 35.8, RM 41.1 and RM 44.1) in 1998. In 1982, two of the three sites surveyed (RM 34.9 and RM 44.1) received low ICI scores of 32, while the RM 41.0 site received a score of 44, not significantly different from the EWH criteria value of 46. The RM 41.0 site sampled in 1984 received a score of 48, exceeding the EWH criteria. All of the sites sampled in 1998 received scores that were either above or not significantly different than the EWH criteria value of 46 (Figure 3.7). This implies that overall water quality improved between 1982 and 1998. However, more recent ICI data from Clermont County for this section of the East Fork Little Miami River collected from 1996 through 2001

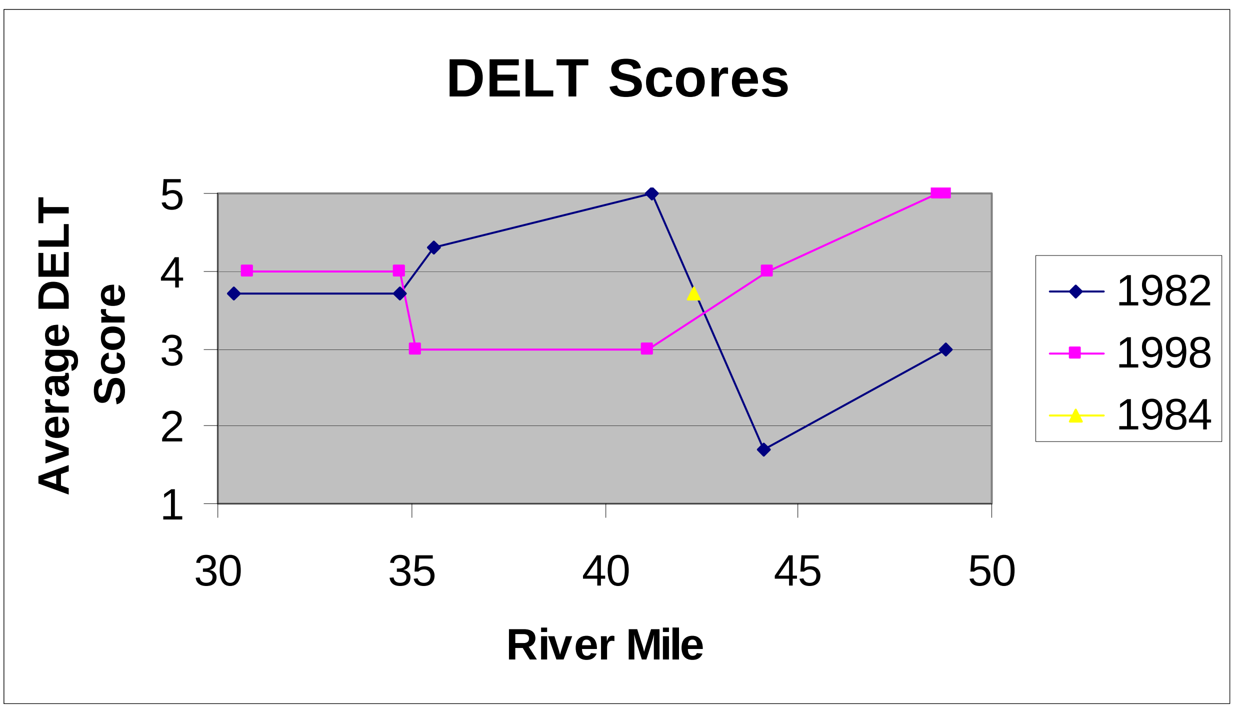


Fig. 3.6. Ohio EPA DELT Scores, EFLM Lake Tributaries Sub-watershed.

(Figure 3.8) would tend to contradict this observation, as all but one of the sites had ICI scores significantly less than the OEPA EWH criteria value of 46. It should be noted that, in 1996, samples were collected on the October-November timeframe, while the OEPA criteria are based on summer sampling. Also, low scores for 1997 may be attributable to extremely low flow conditions prior to and during the sampling period.

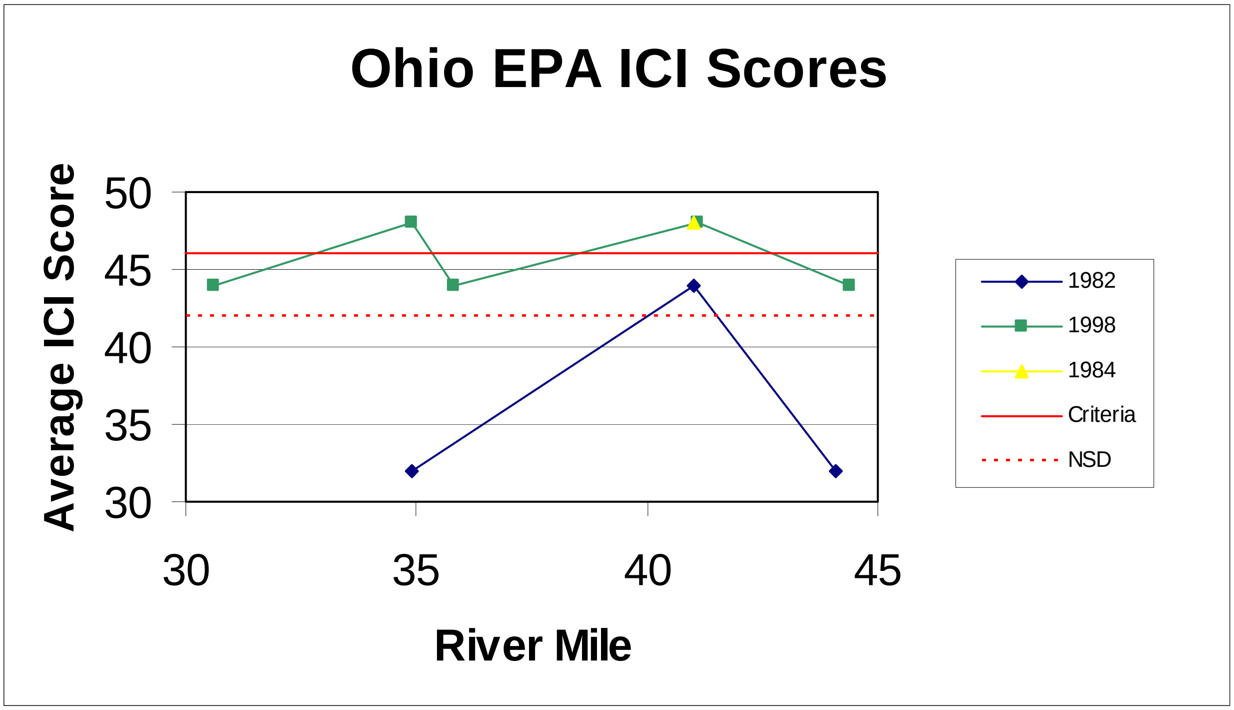


Fig. 3.7. Ohio EPA Invertebrate Community Index (ICI) Scores, EFLM Lake Tributaries Sub-watershed.

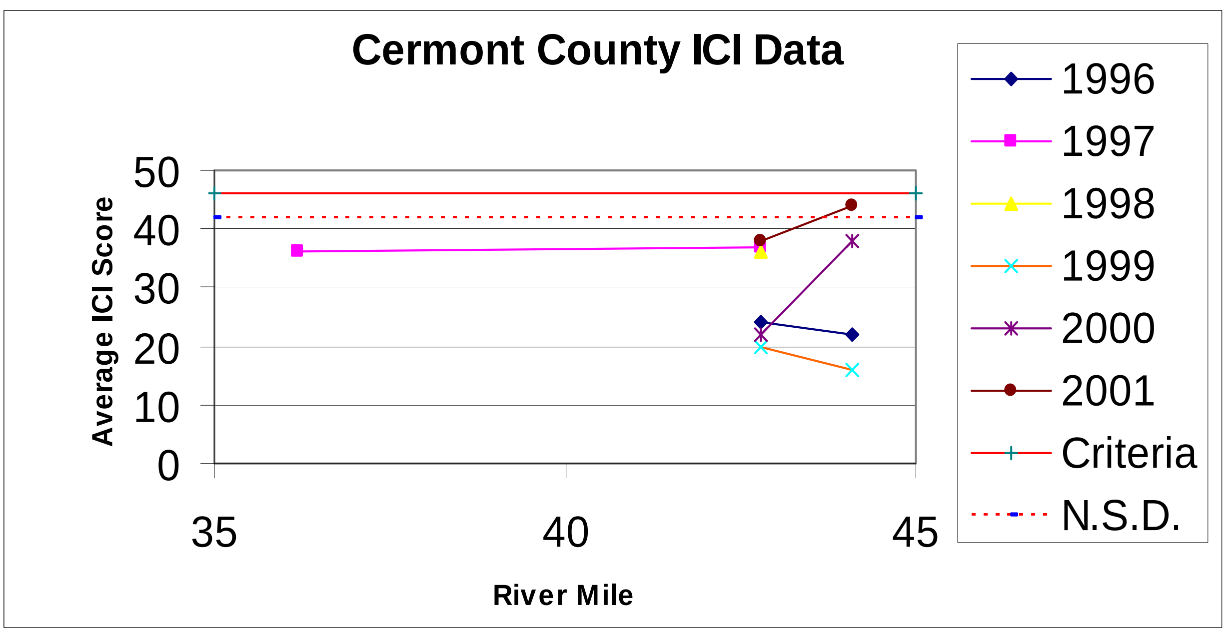


Fig. 3.8. Clermont County Invertebrate Community Index (ICI) Scores, EFLM Lake Tributaries Sub-watershed.

Stream Biology - East Fork Little Miami River Lake Tributaries

Biological Communities

Ohio EPA has also investigated the biological communities on nine tributary streams in the East Fork Little Miami River Lake Tributaries sub-watershed. Three of these streams (Fivemile Creek, Pleasant Run and Todd Run) drain directly into the East Fork Little Miami river upstream of the lake, while the other six streams (Barnes Run, Cloverlick Creek, Kain Run, Poplar Creek, Slabcamp Run, and Ulrey Run) all drain directly into the lake itself. The Ohio EPA sampled Fivemile Creek at RM 0.4 in 1982. In 1997, the OEPA sampled Barnes Run at RM 1.9, Kain Run at RM 0.3, Pleasant Run at RM 1.3, Poplar Creek at RM 3.8, and Ulrey Run at RM 1.9. In 1998, the OEPA sampled Cabin Run at RM 1.3, Fivemile Creek at RM 0.5, Pleasant Run at RM 0.5, RM 1.3, RM 2.5 and RM 4.0, Slabcamp Run at RM 2.6, and Todd Run at RM 1.0 (Table 3.3). Clermont County has also conducted biological surveys on a number of tributaries in the East Fork Lake Tributaries sub-watershed, beginning in 1996 and continuing through 2003 (Table 3.4).

Ohio EPA has designated all tributaries to the EFLM River in the Lake Tributaries sub-watershed as warmwater habitat (WWH) streams. The fish (IBI) criterion for WWH headwater/wadable streams is 40. Streams in the Lake Tributaries sub-watershed must attain an ICI of 30 to meet the WWH use designation. Any score within 4 points of the criteria value is not significantly different from the criteria value. Therefore, in order to meet use attainment criteria, IBI scores must be greater than or equal to 36, and ICI scores must be greater than or equal to 26.

As seen from an examination of the ICI columns in Tables 3.3 and 3.4, only one sampling event, per-

TRIBUTARY	RM	YEAR	ICI	IBI	QHEI	DELT
Barnes Run	1.9	1997	x	24	65.0	5
Cabin Run	1.3	1998	x	47	70.0	5
Fivemile Creek	0.4	1982	x	36	70.0	5
Fivemile Creek	0.5	1998	x	32	56.5	5
Kain Run	0.3	1997	x	30	70.0	3
Pleasant Run	0.5	1998	x	35	62.5	4
Pleasant Run	1.3	1997	x	38	65.0	3
Pleasant Run	1.3	1998	x	40	62.0	5
Pleasant Run	2.5	1998	x	35	62.0	5
Pleasant Run	4.0	1998	x	12	37.0	1
Poplar Creek	3.8	1997	x	38	63.5	3
Slabcamp Run	2.6	1998	x	23	52.0	3
Todd Run	1.0	1998	x	31	61.5	4
Ulrey Run	1.9	1997	x	40	60.5	5

At or above OEPA Criteria Value

x = stream sampled but unable to calculate ICI

Not significantly different from OEPA Criteria Value

Below OEPA Criteria Value

Table 3.3. Ohio EPA Biology Data for EFML Lake Tributaries Sub-watershed Tributaries.

formed by Clermont County at Pleasant Run RM 0.2 in 1996, resulted in an ICI score. For all other sampling events, no ICI score could be calculated. This is most often due to the fact that, for most of these small tributary streams, summer flows are too low to allow the prolonged deployment of the artificial substrates used for ICI sampling. As a result, the streams are usually sampled using kick net sampling, the results of which can only be used to make qualitative assessments of macroinvertebrate community health.

Barnes Run

Barnes Run was sampled in 1997 by Ohio EPA at River Mile 1.9. This site received a failing IBI score of 24. However, the DELT score of 5 was good, indicating that the species of fish that were present did not appear to be unduly stressed. In its 2000 report, OEPA states that "Though agricultural land use paired with a narrow riparian corridor led to siltation via bank erosion and runoff, the biological communities performed in the poor range, suggesting an impact beyond siltation". The report goes on to reference Clermont County data suggesting that serious bacterial problems associated with land use and failing residential on-site sewage systems might be causing the observed impairment.

Cabin Run

This stream was sampled at River Mile 1.3 by Ohio EPA in 1998, receiving a very high IBI score of 47. In its 2000 report, OEPA described Cabin Run as a small, good quality stream, with most of its drainage area lying within the East Fork State Park. A high DELT score of 5 was also reported for this stream. Reference was made to occasional "spikes" in bacteria counts, possibly due to failing on-site sewage systems.

Fivemile Creek

Ohio EPA surveyed Fivemile Creek at River Mile 0.4 in 1982 and at River Mile 0.5 in 1998. The 1982 survey resulted in an IBI score of 36, just at the low range of "not significantly different than" the criteria value of 40. In 1998, the stream received a failing score of 32, although the survey was complicated that year by low-flow conditions. Qualitative macroinvertebrate sampling showed good quality, but the fish community showed impairment. Both surveys (1982 and 1998) resulted in high DELT scores of 5. Bacterial exceedences suggested inputs of sewage from failing on-site systems or, possibly, animal waste from poorly managed agricultural concerns in this rural watershed.

Kain Run

Ohio EPA conducted biological surveys at River Mile 0.3 of Kain Run in 1997. The survey resulted in an IBI score of 30, well below the criteria value of 40 for Warmwater Habitat. The DELT score was 3, indicating some level of stress in the fish collected. OEPA proposed that this poor performance might be due to low flow conditions, citing that few fish were collected given the high quality of the physical habitat of the stream. They did observe significant growths of in-stream algae, indicative of organic enrichment or excessive nutrient loading from agricultural land use.

Kain Run was also surveyed by Clermont County in 2000 (RM 0.3) and 2001 (RM 0.3, RM 1.8 and RM 3.0). The county was interested in establishing baseline values for water quality parameters in a watershed dominated by agricultural land use but predicted to develop significantly into a suburban area in the near future. All of the county's fish surveys resulted in failing IBI scores, ranging from 30 to 35, with the highest scores reported at the most downstream site (RM0.3).

Pleasant Run

Pleasant Run represents the most extensively surveyed stream in the Lake Tributaries subwatershed, due the presence of a hazardous waste disposal facility in the stream's drainage area, and the potential for significant environmental and human health impacts that would arise in the event that materials were to leak from this facility. In fact, 1.4 miles of the stream (RM 1.5-RM 2.9) actually runs through the facility. In 1997, Ohio EPA surveyed Pleasant Run at River Mile 1.3 and reported an IBI score of 38, not significantly different from the criteria value of 40. In 1998, OEPA sampled the stream at RM 0.5 (IBI = 35), RM 1.3 (IBI = 40), RM 2.5 (IBI = 35), and RM 4.0 (IBI = 12). The poor scores upstream of the hazardous waste landfill were attributed to a combination of intermittent stream flows, high bacteria and ammonia levels, and low Dissolved Oxygen (DO) levels. The DELT score at RM 4.0 was 1, indicating that a high percentage of the fish collected exhibited some form of anomaly. Conditions gradually improved in the lower reaches of the stream, with IBI scores ranging from 35 to 40 and DELT scores of 3 to 5. There were no observable impacts from the landfill.

Clermont County has also monitored conditions in Pleasant Run extensively, beginning in 1996 and most recently in 2003 (See Table 3.4). All of the county's sampling has been done at RM 0.2, just upstream of the confluence of Pleasant Run with the East Fork Little Miami River. As seen from Table 3.4, IBI scores have ranged from a low of 30 in 2000 to a high of 44 in 1997, with no apparent temporal trend.

Poplar Creek

Poplar Creek was surveyed by Ohio EPA in 1997 at River Mile 3.8, receiving a marginally good IBI score of 38 with a DELT score of 3. Qualitative macroinvertebrate data also indicated a marginally good biological community. There is little data to indicate potential sources of impairment.

Slabcamp Run

In 1998, the Ohio EPA surveyed Slabcamp Run at River Mile 2.6. The stream has intermittent flow conditions and this fact, combined with elevated nutrient levels and bacterial counts, resulted in a very low IBI score of 23. The DELT score for this survey was 3. It is believed that the nutrients and bacteria are the result of failing on-site sewage treatment systems.

Todd Run

Todd Run is a small rural watershed in eastern Clermont County. It was surveyed at River Mile 1.0 by Ohio EPA in 1998, and received a poor IBI score of 31, and a DELT score of 4. According to OEPA's 2000 annual report, the cause and source of impairment is unknown.

Ulrey Run

In 1997, the Ohio EPA surveyed Ulrey Run at River Mile 1.9. The stream received a good IBI score of 40 and a DELT score of 5, but designated use attainment was deemed to be "Full, But Threatened" due to marginal qualitative macroinvertebrate scores. In its 2000 annual report, OEPA makes reference to Clermont County data indicating significant bacterial exceedences, most likely due to failing on-site residential sewage systems.

RIVER	RIVER MILE	YEAR	ICI	IBI	QHEI
Kain Run	0.3	2000	x	35.0	60.0
Kain Run	0.3	2001	x	34.0	65.5
Kain Run	1.8	2001		30.0	
Kain Run	3.0	2001		30.0	64.0
Pleasant Run	0.2	1996	21		
Pleasant Run	0.2	1997	x	44.0	
Pleasant Run	0.2	1998	x	32.0	
Pleasant Run	0.2	1999	x	36.0	
Pleasant Run	0.2	2000	x	30.0	67.5
Pleasant Run	0.2	2001	x	40.0	67.5
Pleasant Run	0.2	2003	x	40.0	65.0

At or above OEPA Criteria Value (green)

x = stream sampled but unable to calculate ICI

Not significantly different from OEPA Criteria Value (yellow)

Below OEPA Criteria Value (red)

Table 3.4. Clermont County Biology Data for EFML Lake Tributaries Sub-watershed Tributaries.

Habitat Evaluations

Ohio EPA field crews typically assess the quality of stream habitat when they conduct fish or macroinvertebrate surveys using the state's Qualitative Habitat Evaluation Index (see Sidebar). Since 1982, EPA crews completed 22 habitat surveys in the East Fork Lake Tributaries sub-watershed, including eight on the East Fork main stem between river miles 30.4 and 44.2 (Table 3.5), and 14 tributary surveys. Clermont County also performed habitat assessments as part of its surveys on Kain Run and Pleasant Run, beginning in 2000.

River	River Mile	Year Surveyed	QHEI Score
East Fork Little Miami	30.8	1998	93.5
East Fork Little Miami	35.1	1998	88.5
East Fork Little Miami	35.6	1982	78.0
East Fork Little Miami	41.1	1998	94.5
East Fork Little Miami	41.2	1982	74.5
East Fork Little Miami	42.3	1984	85.5
East Fork Little Miami	44.1	1982	73.5
East Fork Little Miami	42.2	1998	89.0

Table 3.5: Ohio EPA QHEI Scores, East Fork Little Miami River, River Miles 30.4 to 44.2.

In general, QHEI scores were very good in the main stem East Fork, with scores ranging between 73.5 and 94.5. Scores from the most recent survey in 1998 were higher (88.5 – 94.5) than scores from earlier surveys in 1982 and 1984 (73.5 – 78.0). It is unclear if these differences are due to actual improvements in physical habitat or changes in scoring methodology.

In addition to the East Fork main stem surveys, Ohio EPA also evaluated the habitat in nine tributary streams. Barnes Run, Cabin Run, Kain Run, Poplar Creek, Slabcamp Run, Todd Run and Ulrey Run all had one location surveyed once during the 1997-1998 period, while Pleasant Run was surveyed at four different locations during this time. Fivemile Creek was surveyed at River Mile 0.4 in 1982 and at River Mile 0.5 in 1998. Results of these surveys are included in Table 3.3. In general, these

Qualitative Habitat Evaluation Index

The Qualitative Habitat Evaluation Index, or QHEI, is a physical habitat index designed to provide a quantified evaluation of stream characteristics that are important to fish and macroinvertebrates. The QHEI is composed of six separate measures, or metrics, each of which are scored individually and then summed to provide the total QHEI score. The metrics include: substrate type and quality; presence of different types of instream cover and the overall amount of cover available; channel morphology; the quality of the riparian buffer zone and extent of bank erosion; the quality of the pool, glide and/or riffle-run habitats; and stream gradient (the elevation drop through the sampling area). The maximum QHEI score possible is 100. Streams with a QHEI of 80 or greater typically have a very good chance to meet Exceptional Warmwater Habitat (EWH) criteria. If QHEI scores are less than 60, it is generally difficult for streams to achieve the Warmwater Habitat (WWH) criteria.

Reference:
Rankin, E.T. 1989. The Qualitative Habitat Evaluation Index (QHEI): Rationale, Methods and Application. Ohio EPA, Columbus, OH.

Website:
http://www.epa.state.oh.us/dsw/bioassess/ohstrat.html

tributary streams had lower QHEI scores than the main stem East Fork. This may, in part, explain why the Ohio EPA considers the main stem an Exceptional Warmwater Habitat, capable of supporting a very broad and diverse biological community, while the tributary streams have all been designated as Warmwater Habitat, with lower expectations regarding their biological communities.

As Table 3.3 indicates, the lowest QHEI scores were 37.0 at River Mile 4.0 of Pleasant Run and 52.0 at River Mile 2.6 of Slabcamp Run. Both of these sites exhibited intermittent flow conditions. Likewise, the QHEI score for RM 0.5 of Fivemile Creek was only 56.5 in 1998, a year in which the survey was complicated by low flow conditions. As expected, IBI scores and QHEI scores tended to follow each other relatively closely, i.e. the better the habitat, the better the fish community (Figure 3.9). Exceptions include RM 0.3 of Kain Run surveyed by OEPA in 1997, when the survey resulted in a low IBI score of 30, despite a good QHEI score of 70, RM 1.9 of Barnes Run, also surveyed by OEPA in 1997, when survey results indicated an IBI of 24 when the QHEI score was 65.0, and RM 0.2 of Pleasant Run, sampled by Clermont County in 2000, when the survey indicated an IBI score of 30 and a QHEI of 67.5. Discrepancies of this nature indicate situations in which the observed impairment in biological community structure was likely due to factors other than physical habitat alteration.

Water Chemistry – Ohio EPA Assessment

The results of water chemistry sampling conducted by Ohio EPA are summarized by stream segment in the 2000 *Water Quality Resource Inventory*. Within the Lake Tributaries subwatershed, the East Fork Little Miami River was divided into two assessment segments. The upstream segment goes from River Mile 45.18 to River Mile 33.9 (Howard Run to Todd Run). Within this segment, the report references Clermont County data indicating occasional spikes in nutrient levels, presumably from agricultural sources in the upper watershed. High levels of aluminum, barium and chromium are also re-

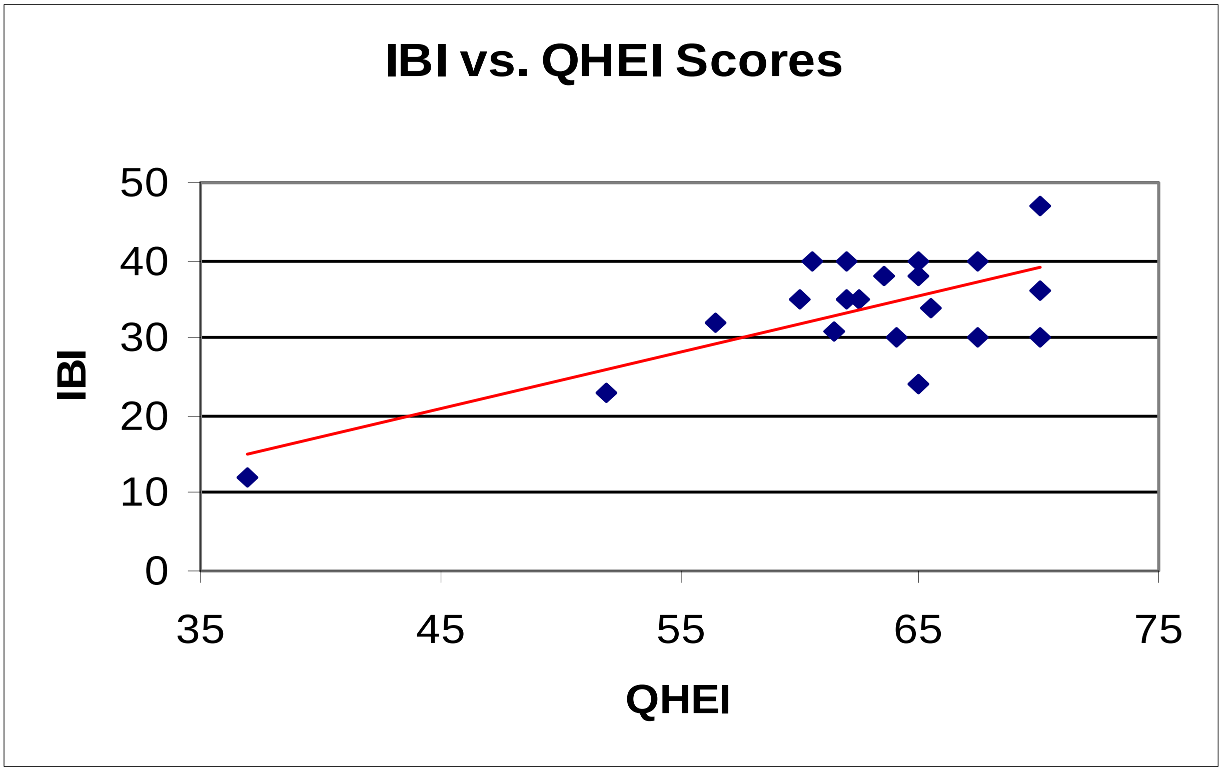


Fig. 3.9. IBI vs. QHEI Scores (OEPA and Clermont County Data).

ported, and are presumed to be due to natural background conditions. There were also sediment "hits" of five Polycyclic Aromatic Hydrocarbons (PAHs) at one site upstream from Pleasant Run, originating from an unknown source.

The downstrean segment stretches from River Mile 33.9 to River Mile 20.5, and consists primarily of East Fork Lake itself. The report does not provide any information with regard to water chemistry in this section of the watershed.

Water Chemistry – Clermont County Assessments

Clermont County has been collecting water chemistry data from various sections of the East Fork Little Miami watershed since 1996. Two types of data collection activities have occurred in the Lake Tributaries sub-watershed, wet weather sampling and ambient sampling. Wet weather sampling involves collecting water samples as streams rise, peak, and subside after a major rainfall event within the watershed. They are intended to detect contaminants that are flushed into the streams in high concentrations via non-point source runoff during these events but which would otherwise enter at levels below detection limits, if at all, under other conditions. This sampling was performed at RM 34.8 of the East Fork mainstem in 1999, 2000, 2001 and 2002. It was also performed at RM 1.8 of Kain Run in 1999, 2000, 2001, 2002, and 2004.

In addition to these wet weather surveys, Clermont County has also conducted ambient sampling at various locations throughout the Lake Tributaries sub-watershed since 1996 (see Table 3.6). This involved collecting grab samples at these locations periodically over the April-October sampling season in an effort to characterize stream chemistry under a broad range of environmental conditions. Two sites on the mainstem East Fork (RM 34.8 and RM 44.1) have more than two years of sampling data, while the same is true for four tributaries (Cabin Run, Kain Run, Pleasant Run, and Ulrey Run). Therefore, this report will focus on these locations.

Parameters of interest to the county fall into five general categories: Nutrients, Suspended Solids, Bacteria, Organic Enrichment/Dissolved Oxygen, and Metals.

Nutrients
Ohio EPA has established water quality criteria for some nutrients, while criteria for others have not yet been developed. Criteria have been estab-

EAST FORK MAINSTEM	1996	1997	1998	1999	2000	2001	2002
RM 30.7		X					
RM 34.8			X	X	X	X	
RM 35.8	X						
RM 36.2		X	X				
RM 41.0	X						
RM 44.1		X	X	X	X	X	X
RM 46.7							X
RM 48.7							
TRIBUTARIES	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Barnes Run	X	X					
Cabin Run	X	X	X	X	X	X	X
Cloverlick Creek		X					X
Kain Run	X	X	X	X	X	X	
Pleasant Run	X	X	X	X	X	X	X
Poplar Creek	X	X					X
Ulrey Run	X	X	X	X	X	X	X

Table 3.6. Clermont County Ambient Sampling Locations.

Nutrients

The two nutrients of primary interest to water quality managers are nitrogen (N) and phosphorus (P). While these elements are essential nutrients for many aquatic plants, high concentrations can lead to excessive plant growth. This is usually followed by massive die-offs which result in large amounts of detrital matter, the bacterial degradation of which can ultimately deplete the water of its oxygen, leading to anoxic conditions incapable of supporting aquatic life. Nutrients can enter streams from agricultural sources (fertilizer application to row-crops and pasture/feed-lot run-off), from failing or improperly maintained home sewage treatment systems, or from improperly treated sewage from municipal wastewater treatment plants.

Nitrogen exists in several forms in the aquatic environment. These include nitrate, nitrite, ammonia, and organic nitrogen. Organic nitrogen includes such natural materials as proteins and peptides, nucleic acids and urea, and numerous synthetic organic materials. Phosphorus occurs in streams almost solely as phosphates. These are classified as orthophosphates, condensed phosphates, and organically bound phosphates. Orthophosphates are a primary component of many agricultural fertilizers.

In an effort to identify potential sources of nutrient contamination, water quality managers will often sample streams not only for total nitrogen and total phosphorus, but also for the various forms in which these elements exist in the aquatic environment

lished for ammonia based on its toxicity to aquatic life. Ammonia-nitrogen (NH_3-N) has a more toxic form at high pH and a less toxic form at low pH, un-ionized ammonia (NH_3) and ionized ammonia (NH_4^+), respectively. In addition, ammonia toxicity increases as temperature rises. Therefore, criteria values also vary by temperature and pH. For Exceptional Warmwater Habitats, these values range from a high of 13 mg/L in low pH/low temperature conditions to a low of 0.7 mg/L for high temperature/high pH conditions. For Warmwater Habitat, criteria values range from a high of 13.0 mg/L to a low of 1.1 mg/L.

Criteria for nitrites/nitrates and total phosphorus have not been established; however, criteria development for these parameters is in progress. One possible source for numeric nutrient targets is a technical bulletin published by Ohio EPA entitled "Association Between Nutrients, Habitat and the Aquatic Biota in Ohio Rivers and Streams (Ohio EPA, 1999). The nutrient criteria proposed in this document for different drainage areas and use designations are listed in Table 3.7. For the mainstem of the East Fork Little Miami River in the Lake Tributaries sub-watershed, the EWH Small River criteria would be applicable, while all of the tributaries in the sub-watershed would be classified as WWH Wadable streams.

Stream Type	Drainage Area	Proposed NO3-NO2	Proposed TP
EWH Wadable	20 mi^2 < DA < 200 mi^2	0.5 mg/L	0.05 mg/L
EWH Small River	200 mi^2 < DA < 1000 mi^2	1.0 mg/L	0.10 mg/L
WWH Wadable	20 mi^2 < DA < 200 mi^2	1.0 mg/L	0.10 mg/L
WWH Small River	200 mi^2 < DA < 1000 mi^2	1.5 mg/L	0.17 mg/L

Table 3.7: Ohio EPA suggested nutrient criteria (taken from *Association Between Nutrients, Habitat and the Aquatic Biota in Ohio Rivers and Streams*, Ohio EPA, 1999).

Total Kjeldahl Nitrogen (TKN) is a measure of the concentration of organic nitrogen and ammonia in a stream. To date, the Ohio EPA has not established criteria values for TKN. Likewise, there are currently no criteria values for orthophosphates.

Suspended Solids
Suspended solids are defined as that material in a water sample that can be retained by a filter. Waters with high amounts of suspended solids tend to be more turbid and, therefore, aesthetically unsatisfactory for purposes such as bathing. They also tend to be less palatable as a source of drinking water. Currently, the Ohio EPA does not have in-stream criteria values for suspended solids.

Bacteria
Fecal Coliform and *E. coli* provide information regarding the extent to which streams are being contaminated by human or animal waste. They are primarily used to determine if streams are meeting their primary contact recreation use, i.e. are the waters safe for people to use for swimming and other recreational activities. Ohio EPA has established Fecal Coliform criteria for all streams designated for primary contact recreation use, including all those monitored by Clermont County. The current Fecal Coliform criteria are:

- Geometric mean based on not less than five samples in a 30-day period shall not exceed 1000 colony forming units (cfu) per 100 mL
- Fecal Coliform content shall not exceed 2000 cfu/100 mL in more than 10 percent of the samples collected in a 30-day period.

Ohio EPA has also established *E. coli* criteria for all streams designated for primary contact recreation use. The current *E. coli* criteria are:

- Geometric mean based on not less than five samples in a 30-day period shall not exceed 126 colony forming units (cfu) per 100 mL
- *E. coli* content shall not exceed 298 cfu/100 mL in more than 10 percent of the samples collected in a 30-day period.

While the data collected by Clermont County cannot be directly compared to the criteria due to the frequency of sampling, the criteria can still be used as a guideline to assess stream conditions.

Organic Enrichment/Dissolved Oxygen
Clermont County determines organic enrichment in its streams by measuring carbonaceous biological oxygen demand ($CBOD_5$). $CBOD_5$ represents a measure of the amount of dissolved oxygen consumed in five days by biological processes breaking down organic matter. This represents the potential of organic contaminants to strip life-supporting oxygen from the stream through these processes. The Ohio EPA currently does not have criteria values for $CBOD_5$. A more direct measure of this type of impact is the determination of actual dissolved oxygen concentrations in the stream. Dissolved oxygen criteria for both EWH and WWH streams have been established by Ohio EPA. Criteria include:

- Minimum in-stream concentration of 4.0 mg/L for WWH streams; 5.0 for EWH streams
- Minimum 24-hour average concentration of 5.0 mg/L for WWH streams; 6.0 for EWH streams.

Metals
Many metals are toxic to aquatic life, some at relatively low concentrations. Ohio EPA criteria state that concentrations must not exceed 9.3 ug/L for copper, 6.4 ug/L for lead, and 120 ug/L for zinc (assuming a hardness concentration of 100 mg/L).

Results – Wet Weather Sampling

Results of wet weather sampling events at RM34.8 on the mainstem East Fork Little Miami River are presented in Table 3.8. Results of wet weather sampling performed on Kain Run are presented in Table 3.9.

Nutrients
While the ammonia levels observed in the wet weather sampling events at RM34.8 on the mainstem and on Kain Run do not exceed existing OEPA criteria values, it is obvious from an

EFLM RM 34.8 Wet Weather Sampling - Annual Average Values (EWH Small River)				
Ammonia (mg/L)	1999	2000	2001	2002
Rising	0.11	0.10	0.23	0.10
Level	0.10	0.10	0.10	0.10
Falling	0.10	0.10	0.19	0.10
Total Kjeldahl Nitrogen (mg/L)	1999	2000	2001	2002
Rising	1.15	1.46	1.33	2.08
Level	0.78	1.63	0.95	1.38
Falling	0.73	1.47	1.05	1.43
Nitrite/Nitrate (mg/L)	1999	2000	2001	2002
Rising	1.28	0.70	1.98	0.24
Level	0.78	0.70	0.41	0.27
Falling	0.83	0.63	0.88	0.89
Ortho-Phosphate (mg/L)	1999	2000	2001	2002
Rising	0.19	0.16	0.20	0.09
Level	0.14	0.19	0.19	0.08
Falling	0.14	0.20	0.25	0.09
Total Phosphorus (mg/L)	1999	2000	2001	2002
Rising	0.32	0.43	0.37	0.71
Level	0.23	0.55	0.39	0.50
Falling	0.23	0.46	0.39	0.41
Suspended Solids (mg/L)	1999	2000	2001	2002
Rising	43.43	85.30	45.54	255.65
Level	14.60	116.55	22.45	182.75
Falling	9.83	90.58	47.07	137.75
E. coli (c.f.u./100 mL)	1999	2000	2001	2002*
Rising	597	416	813	6300
Level	553	4352	1422	2100
Falling	86	3112	445	1200
CBOD5 (mg/L)	1999	2000	2001	2002*
Rising	2.93	2.78	2.64	7.60
Level	2.37	3.83	2.00	3.50
Falling	1.88	3.50	2.32	3.70

* Single Sampling Event

E. coli values are geometric means.

Green = Meets Exisiting or Proposed Criteria for this Parameter
Red = Does Not Meet Existing or Proposed Criteria for this Parameter
Black = No Existing or Proposed Criteria for this Parameter

Table 3.8 - EFRM34.8 Wet Weather Sampling Data.

Kain Run RM 1.8 Wet Weather Sampling - Annual Average Values (WWH Wadable Stream)					
Ammonia (mg/L)	**1999**	**2000**	**2001**	**2002**	**2004**
Rising	0.13	0.15	0.14	0.10	0.16
Level	0.37	0.16	0.07	0.10	0.15
Falling	0.37	0.10	0.10	0.10	0.15
Total Kjeldahl Nitrogen (mg/L)	**1999**	**2000**	**2001**	**2002**	**2004**
Rising	1.31	2.43	2.04	1.32	3.73
Level	1.72	3.35	1.74	1.57	2.73
Falling	1.18	2.71	1.43	1.51	2.02
Nitrite/Nitrate (mg/L)	**1999**	**2000**	**2001**	**2002**	**2004**
Rising	0.21	0.47	0.76	0.87	0.45
Level	0.29	1.10	0.65	1.54	0.40
Falling	0.44	0.77	0.54	1.10	0.41
Ortho-Phosphate (mg/L)	**1999**	**2000**	**2001**	**2002**	**2004**
Rising	0.15	0.16	0.14	0.29	N/A
Level	0.22	0.41	0.23	0.20	N/A
Falling	0.20	0.25	0.23	0.36	N/A
Total Phosphorus (mg/L)	**1999**	**2000**	**2001**	**2002**	**2004**
Rising	0.36	1.09	0.75	0.49	2.19
Level	0.46	2.04	0.73	0.48	1.46
Falling	0.34	1.19	0.62	0.60	1.10
Suspended Solids (mg/L)	**1999**	**2000**	**2001**	**2002**	**2004**
Rising	78	422	300	31	2596
Level	74	709	251	87	1099
Falling	63	401	106	45	287
E. coli (c.f.u./100 mL)	**1999**	**2000**	**2001**	**2002**	**2004**
Rising	934	10664	10308	381	
Level	1889	2838	17550	7746	
Falling	1563	2583	9791	2899	
CBOD5 (mg/L)	**1999**	**2000**	**2001**	**2002**	**2004**
Rising	6.47	4.84	6.23	9.37	6.65
Level	5.63	6.50	5.30	5.45	6.80
Falling	5.85	5.97	4.82	13.27	5.90

E. coli values are geometric means.
Green = Meets Exisiting or Proposed Criteria for this Parameter
Red = Does Not Meet Existing or Proposed Criteria for this Parameter
Black = No Existing or Proposed Criteria for this Parameter

Table 3.9 - Kain Run Wet Weather Sampling Data.

evaluation of the data presented in Tables 3.8 and 3.9 that, in some years, average values for Nitrites/Nitrates in both streams occasionally exceeded proposed the OEPA criteria value of 1.0 mg/L. For the RM34.8 sampling location, this occurred in the "Rising" sample in 1999 and 2001. In Kain Run, the average Nitrites/Nitrates concentration exceeded the proposed criteria value in the "Level" sample in 2000, and in the "Level" and "Falling" samples in 2002. There does not appear to be any temporal trend in these data. For Total Phosphorus, average concentrations for every year and every sample (Rising, Level and Falling) exceeded the proposed OEPA criteria value of 0.1 mg/L. This is consistent with comments in the OEPA Water Quality Resource Inventories regarding heavy nutrient loading from agricultural runoff in this area of the watershed.

Suspended Solids

While it is difficult to evaluate suspended solids data without specific numeric criteria, Tables 3.8 and 3.9 both show an increase in suspended solids concentrations in the last year for which data is available (2002 for RM34.8 and 2004 for Kain Run). The increase is significant in the Kain Run data, with average suspended solids concentrations as high as 2596 mg/L for the "Rising" sample. This may indicate increased disturbances in the watershed associated with construction/ development.

Bacteria

The OEPA criterion for *E. coli* is a geometric mean value of 126 colony forming units (cfu) per 100 mL in a minimum of five samples collected over a 30-day period. Results presented in Tables 3.8 and 3.9 are geometric mean values for all samples collected during the April-October sampling period in any given year. Therefore, for strict compliance monitoring, Clermont County's data could not be compared directly to the OPEA criterion. However, for the purposes of this report, this is a valid comparison, especially given the high number of samples exceeding the criterion (26 of 27) and the extremely high values associated with some of the samples (up to 17,550 cfu/100 mL). This clearly indicates a problem in the subwatershed, although the exact source(s) of this contamination are unknown.

Organic Enrichment/Dissolved Oxygen

Clermont County measures $CBOD_5$ in its wet weather samples, but does not routinely measure dissolved oxygen levels in these sampling events, as high flow conditions generally oxygenate the streams to the extent that high D.O. levels would be expected, but not representative of normal stream conditions. As with Suspended Solids, there is no OEPA criteria value for $CBOD_5$. Annual average values for the wet weather samples at RM34.9 ranged from 1.88 to 7.6 mg/L, with all but one value below 4.0 mg/L. In Kain Run, values were slightly higher, ranging from 4.82 to 13.27 mg/L. Annual average values for ambient samples collected throughout the Lake Tributaries subwatershed were consistently in the 2-3 mg/L range (see below), implying some elevation in organic enrichment associated with stormwater runoff events.

Metals

Wet weather samples were not analyzed for metals.

Results – Ambient Sampling

Ambient sampling results for two locations on the mainstem of the East Fork Little Miami River are presented in Table 3.10, while Tables 3.11 through 3.14 present the results of ambient sampling on four EFLM tributaries (Cabin Run, Kain Run, Pleasant Run, and Ulrey Run).

EFLM RM34.8 Ambient Sampling - Annual Average Values (EWH Small River)

PARAMETER	1998	1999	2000	2001
Ammonia (mg/L)	0.13	0.10	0.11	0.10
Nitrate/Nitrite (mg/L)	1.03	1.12	0.90	1.40
Total Kjeldahl Nitrogen (mg/L)	1.25	1.64	1.28	0.99
Ortho-phosphorus (dissolved) (mg/L)	0.14	0.22	0.13	0.11
Total Phosphorus (mg/L)	0.35	0.31	0.30	0.23
Suspended Solids (mg/L)	70.49	19.04	49.78	32.49
E. coli. (c.f.u./100 mL)	685.89	226.17	423.42	405.42
Fecal Coliform (c.f.u./100 mL)				
CBOD5 (mg/L)	2.65	2.44	2.91	2.48
Dissolved Oxygen (mg/L)	7.69	6.34	8.99	8.07
Copper (ug/L)	5.03	3.93	8.99	6.24
Lead (ug/L)	3.08	2.92	3.92	2.17
Zinc (ug/L)	25.33	10.16	177.88	20.00

EFLM RM44.1 Ambient Sampling - Annual Average Values (EWH Small River)

PARAMETER	1997	1998	1999	2000	2001	2002
Ammonia (mg/L)	0.12	0.11	0.08	0.11	0.10	0.12
Nitrate/Nitrite (mg/L)		0.99	0.29	1.00	1.34	1.22
Total Kjeldahl Nitrogen (mg/L)	1.15	1.14	1.10	1.31	1.13	1.22
Ortho-phosphorus (dissolved) (mg/L)	0.06	0.10	0.07	0.12	0.09	0.10
Total Phosphorus (mg/L)	0.25	0.24	0.18	0.29	0.22	0.23
Suspended Solids (mg/L)	73.57	80.5	24.1	52.58	44.94	40.79
E. coli. (c.f.u./100 mL)		611.38	166.17	506.43	368.78	190.78
Fecal Coliform (c.f.u./100 mL)	106.54					
CBOD5 (mg/L)	2.15	2.29	2.20	2.68	2.99	2.59
Dissolved Oxygen (mg/L)	7.62	7.66	6.45	7.65	8.18	
Copper (ug/L)	4.95	5.69	1.89	11.17	5.70	
Lead (ug/L)	5.98	4.26	1.50	3.04	3.72	
Zinc (ug/L)	19.05	16.46	7.60	171.29	20.00	

E. coli and Fecal Coliform values are geometric means.
Green = Meets Exisiting or Proposed Criteria for this Parameter
Red = Does Not Meet Existing or Proposed Criteria for this Parameter
Black = No Existing or Proposed Criteria for this Parameter

Table 3.10 - Ambient Sampling Data for Mainstem East Fork Little Miami River.

Cabin Run Ambient Sampling - Annual Average Values (WWH Wadable Stream)

PARAMETER	1996	1997	1998	1999	2000	2001	2002
Ammonia (mg/L)	0.10	0.10	0.10	0.08	0.10	0.10	0.10
Nitrate/Nitrite (mg/L)			0.16	0.16	0.14	0.37	0.27
Total Kjeldahl Nitrogen (mg/L)	0.87	0.66	0.54	0.56	0.48	0.65	0.57
Ortho-phosphorus (dissolved) (mg/L)	0.03	0.02	0.03	0.04	0.03	0.04	0.02
Total Phosphorus (mg/L)	0.07	0.12	0.06	0.04	0.05	0.06	0.07
Suspended Solids (mg/L)	146.92	49.63	16.91	3.60	9.02	8.30	1.68
E. coli. (c.f.u./100 mL)			139.78	339.51	247.96	211.04	124.19
Fecal Coliform (c.f.u./100 mL)	155.46	89.98					
CBOD5 (mg/L)	2.11	2.10	1.77	2.01	2.02	2.00	2.00
Dissolved Oxygen (mg/L)	10.87	8.65	8.92	8.72	7.90	8.70	
Copper (ug/L)	5.27		2.64	1.89			
Lead (ug/L)	2.58		1.87	1.67			
Zinc (ug/L)			10.93	12.50			

E. coli and Fecal Coliform values are geometric means.
Green = Meets Exisiting or Proposed Criteria for this Parameter
Red = Does Not Meet Existing or Proposed Criteria for this Parameter
Black = No Existing or Proposed Criteria for this Parameter

Table 3.11 - Cabin Run Ambient Sampling Data.

Kain Run Ambient Sampling - Annual Average Values (WWH Wadable Stream)

PARAMETER	1996	1997	1998	1999	2000	2001
Ammonia (mg/L)	0.12	0.14	0.11	0.20	0.15	0.19
Nitrate/Nitrite (mg/L)			0.38	0.87	0.70	0.41
Total Kjeldahl Nitrogen (mg/L)	1.20	1.20	1.70	1.38	1.01	0.92
Ortho-phosphorus (dissolved) (mg/L)	0.06	0.03	0.05	0.18	0.15	0.12
Total Phosphorus (mg/L)	0.14	0.14	0.14	0.28	0.27	0.19
Suspended Solids (mg/L)	120.99	11.97	18.14	13.18	9.44	12.17
E. coli. (c.f.u./100 mL)			116.00	339.82	626.47	457.02
Fecal Coliform (c.f.u./100 mL)	196.16	81.89				
CBOD5 (mg/L)	2.55	2.69	2.14	2.87	2.19	2.91
Dissolved Oxygen (mg/L)	8.50	7.03	6.93	5.61	5.64	6.53
Copper (ug/L)	6.45			2.34		
Lead (ug/L)	6.25					
Zinc (ug/L)						

E. coli and Fecal Coliform values are geometric means.
Green = Meets Exisiting or Proposed Criteria for this Parameter
Red = Does Not Meet Existing or Proposed Criteria for this Parameter
Black = No Existing or Proposed Criteria for this Parameter

Table 3.12 - Kain Run Ambient Sampling Data.

Pleasant Run Ambient Sampling - Annual Average Values (WWH Wadable Stream)

PARAMETER	1996	1997	1998	1999	2000	2001	2002
Ammonia (mg/L)	0.10	0.16	0.11	0.10	0.10	0.11	0.17
Nitrate/Nitrite (mg/L)			0.36	0.14	0.49	1.05	0.52
Total Kjeldahl Nitrogen (mg/L)	1.07	1.32	0.98	0.86	0.95	0.84	1.21
Ortho-phosphorus (dissolved) (mg/L)	0.16	0.31	0.13	0.14	0.16	0.15	0.25
Total Phosphorus (mg/L)	0.20	0.36	0.21	0.19	0.22	0.20	0.37
Suspended Solids (mg/L)	132.06	18.71	24.29	12.33	25.23	9.88	25.50
E. coli. (c.f.u./100 mL)			283.33	86.46	229.01	289.59	226.47
Fecal Coliform (c.f.u./100 mL)	253.64	505.83					
CBOD5 (mg/L)	2.34	3.13	2.22	2.00	2.08	2.13	2.98
Dissolved Oxygen (mg/L)	8.16	7.44	8.44	6.84	8.53	9.07	
Copper (ug/L)	6.92	5.27	4.27	2.68	4.48	5.46	
Lead (ug/L)	5.11	4.21	2.40	1.61	2.82	2.38	
Zinc (ug/L)		10.65	13.79	8.40	454.27	21.82	

E. coli and Fecal Coliform values are geometric means. Of the 20 samples analyzed for Zinc in 2000, one had a value of 2680 ug/L, and four others had values greater than 100ug/L.

Green = Meets Exisiting or Proposed Criteria for this Parameter
Red = Does Not Meet Existing or Proposed Criteria for this Parameter
Black = No Existing or Proposed Criteria for this Parameter

Table 3.13 - Pleasant Run Ambient Sampling Data.

Ulrey Run Ambient Sampling - Annual Average Values (WWH Wadable Stream)

PARAMETER	1996	1997	1998	1999	2000	2001	2002
Ammonia (mg/L)	0.10	0.10	0.10	0.06	0.11	0.10	0.10
Nitrate/Nitrite (mg/L)			1.40	2.51	1.87	1.81	1.92
Total Kjeldahl Nitrogen (mg/L)	0.83	0.82	0.63	0.85	0.73	0.71	0.77
Ortho-phosphorus (dissolved) (mg/L)	0.15	0.11	0.10	0.20	0.21	0.25	0.20
Total Phosphorus (mg/L)	0.18	0.15	0.16	0.30	0.24	0.30	0.22
Suspended Solids (mg/L)	23.48	8.71	11.60	25.69	7.73	18.72	3.63
E. coli. (c.f.u./100 mL)			205.48	193.52	251.82	240.63	97.93
Fecal Coliform (c.f.u./100 mL)	210.95	137.90					
CBOD5 (mg/L)	2.06	2.25	2.12	2.28	2.28	2.68	2.00
Dissolved Oxygen (mg/L)	9.45	8.65	8.76	8.25	9.06	9.19	
Copper (ug/L)	3.10						
Lead (ug/L)	1.73						
Zinc (ug/L)							

E. coli and Fecal Coliform values are geometric means.
Green = Meets Exisiting or Proposed Criteria for this Parameter
Red = Does Not Meet Existing or Proposed Criteria for this Parameter
Black = No Existing or Proposed Criteria for this Parameter

Table 3.14 - Ulrey Run Ambient Sampling Data.

Nutrients

Annual average ammonia concentrations were below OEPA criteria values for all sites and all years. Values at Kain Run were slightly higher than those at the other sampling locations. On the East Fork mainstem, six of the nine annual average values for nitrites/nitrates exceeded the proposed OEPA criteria value of 1.0 mg/L. With the exception of Ulrey Run, the tributaries all had annual average nitrite/nitrate levels at or below the proposed criteria value, while Ulrey Run exceeded the proposed Total Phosphorous criteria value for every year studied. For both the mainstem and the tributaries, all sites exceeded OEPA's proposed criteria value of 0.1 mg/L for every year sampled.

Suspended Solids

There does not appear to be any spatial or temporal trends in the suspended solids data from the ambient monitoring program. Overall, the mainstem tended to have higher annual average values than the tributaries. While Cabin Run and Kain Run had annual average values greater than 100 mg/L in 1996, data for all subsequent years was significantly lower. As no existing or proposed criteria values exist for this parameter, it is difficult to interpret the impact of these results.

Bacteria

Clermont County analyzed water samples for fecal coliform in 1996 and 1997. Beginning in 1998, the county started analyzing samples for *E. coli*. None of the annual fecal coliform values exceed the OEPA 30-day geometric mean criteria value of 1000 c.f.u./100 mL. However, all of the mainstem annual values, and most of the tributary values (15 of 19) exceed the OEPA 30-day geometric mean criteria value of 126 cfu/100 mL, suggesting a serious problem with fecal contamination throughout the Lake Tributaries subwatershed.

Organic Enrichment/Dissolved Oxygen

Annual average values for $CBOD_5$ in the ambient water quality monitoring program were very close to the detection limit of 2.0 mg/L for every sampling location and year. Average annual dissolved oxygen levels consistently exceeded OEPA criteria values of 5.0 mg/L for WWH streams and 6.0 mg/L for EWH streams.

Metals

Ambient water samples were analyzed for numerous metals each year, including three (copper, lead, and zinc) for which the OEPA has criteria values (9.3ug/L, 6.4 ug/L and 120 ug/L respectively). Copper and Lead concentrations were consistently below EPA critera values for all sites and all years, with the exception of EFMR44.1, which had an annual average value of 11.17 ug/L in 2000. Zinc concentrations also showed a spike in 2000, exceeding the OEPA criterion at EFRM34.8, EFRM 44.1, and Pleasant Run. It should be noted that the remaining tributaries were not sampled for metals after 1999. Therefore, all sites in the Lake Tributaries subwatershed that were sampled for zinc in 2000 had annual average values that exceed the OEPA criteria value. This was tentatively traced to a problem with the laboratory performing the metals analyses. When the 2000 zinc data are removed, there is no evidence in the county database that metals contamination is an issue of concern in the subwatershed.

East Fork Lake Tributaries Watershed Management Plan

Chapter Four

Community Water Management Goals and Interests

CHAPTER 4: COMMUNITY WATER MANAGEMENT GOALS AND INTERESTS

For any plan to be implemented, the recommendations must be in the interest of the individuals and organizations (including businesses and local governments) that make up the community.

This chapter summarizes the water management interests, issues and concerns that were identified by a broad group of stakeholders who live and work in the East Fork Lake Tributaries watershed. In response to those interests, a series of water management goals were developed, and a broad suite of strategies were identified to achieve those water management goals. The strategies introduced in this chapter also serve as the basis for the recommended actions to achieve water quality goals outlined in Chapter 5 - Watershed Management Recommendations. This chapter begins with a description of the process used to identify water management interests, issues and concerns, and then to develop the goals and strategies to address those areas of need.

East Fork Lake Tributaries Stakeholder Involvement Process

The process for identifying community water management goals and interests consisted of four steps:

Invitation to Participate in the Planning Process

The watershed coordinator made every effort to meet with each county board of commissioners, township board and village council to describe the watershed planning effort and to invite their participation in the planning process. We requested representation from each board. We also extended the same invitation to county agencies (SWCDs, county engineers, health departments, planning departments,...), businesses, developers, interest groups (Farm Bureau, Clinton Streamkeepers, etc.), and individual landowners in the watershed.

Issue Identification

On November 18, 2003, the Collaborative held the initial East Fork Lake Tributaries planning meeting at the Williamsburg Fire Department. Three major tasks were accomplished by participants at the meeting: (1) an exhaustive list of water management interests, issues and concerns was generated, (2) the issues were organized into groupings of related issues, and (3) a list was developed of appropriate and interested stakeholders who could better define, and develop strategies for addressing, the issues. The 30 community members who participated represented county, township, and village governments, as well as a other diverse interests (the attendance list is included in Appendix A).

Goal Setting

Work groups of interested stakeholders took the issues and concerns identified during the kickoff meeting described above and turned them into a broad set of water management goals.

Strategy Development

The same work groups then developed a set of strategies designed to achieve the water management goals as well as strategies to track progress toward those goals. Each work group classified, by consensus, every strategy they developed as high, medium, or low priority. The factors that went into their priority determination included: 1) the importance of the action for achieving the stated goal; 2) the return on investment (i.e., are we accomplishing a lot with the resources used); 3) the "doability" (person or entity available and willing to take leadership, funding or personnel available to accomplish the task, community and/or political support {or opposition}, etc.); and 4) opportunistic within a strategic approach based on water quality goals and cost effectiveness. Once the Lake Tributaries plan is completed we will use our best judgment to invite stakeholders back to meet and create a two year work plan to implement projects based on listed criteria. Stakeholders will be continually updated on implementation projects. They will be notified by letter and at the end of each year a East Fork News newsletter will be compiled and sent to them detailing accomplished goals and future projects. As implementation projects arise stakeholders unique to those projects will be contacted and invited to participate in the planning process.

Stakeholder Involvement Update

The watershed planning process has led to an improvement in communications and cooperation among county offices and among the affected counties, municipalities and townships. For example, the Clermont Office of Environmental Quality (OEQ) and Clermont SWCD was approached by the Village of Williamsburg in March of 2006 concerning a proposed extensive stream restoration project along a 600 meter reach of the East Fork mainstem. The village, Clermont SWCD, OEQ, and East Fork watershed coordinator are now working together to assess the site, research restoration opportunities, and raise funding for the project.

Another example is increased cooperation between Clermont Water and Sewer District, OEQ, Clermont Stormwater Department, and East Fork watershed coordinator concerning the development of Source Water Protection strategies and implementation of those strategies for the Bob McEwen Water Treatment Plant.

As a follow up to the 2003 stakeholders meetings the East Fork watershed coordinator contacted several stakeholders to have them review the Lake Tributaries WAP; with an emphases on Chapter 5 (Watershed Recommendations). The comments and suggestions were welcomed by the East Fork watershed coordinator and addressed in the Lake Tribs WAP. The WAP was reviewed by John McMannus, Program Manager Clermont Stormwater Management Department; Paul Braasch, Solid Waste Director for the Adams-Clermont Joint Solid Waste Management District; Dennis McMullen, Project Manager Clermont Office of Environmental Quality; and Mark Day, Water Supply and Protection Coordinator Clermont Water and Sewer District.

The East Fork Watershed Collaborative has played a key role in the stakeholder process. One of the primary responsibilities of the Collaborative is to provide leadership is building stakeholder collaboration and involvement. Due to the watershed planning process the Collaborative and East Fork watershed effort is recognized by local governments, agencies, businesses, and citizens that are connected to the East Fork watershed. The East Fork Watershed Collaborative and East Fork watershed coordinator will continue to provide leadership for promoting local leadership and collaboration among key entities within the East Fork watershed.

The Issues

Table 4-1 summarizes the water management interests, issues and concerns identified during the November 18, 2003 East Fork Lake Tributaries kick-off planning meeting (a complete list of issues is included in Appendix A). Upon consideration of this list of issues, they were segregated into three groups or themes:

- land use issues
- stormwater management issues
- wastewater management issues

Work groups were organized to address each of these groups of issues.

Protection of Habitat and Natural System Services
Protect riparian corridors/natural vegetation
Preserve wetlands
Protect wildlife habitat

Land Use
Land use planning and zoning that includes riparian corridor and floodplain protection/ accounts for water quality
Farmland and open space preservation
Smart growth – coordinate watershed planning and economic development

Stormwater/Runoff
Better stormwater management
Reduce non-point source pollution (e.g., erosion) from all sources
Manage runoff/sediment from construction sites
Manage impervious surface levels
Atrazine and nutrient loading from agriculture
Household & agricultural BMPs

Drainage
Improve and maintain drainage in township and county ditches

Wastewater/Sewers/Septics
Failing septic system effect on water quality
Raw sewage in road ditches and streams
Reduce bacterial loading
Financial assistance to repair failing septic systems
Better control over rural and semi-public system design, operation and maintenance

Monitoring & Assessment
Practical measurement of stream quality
More stream/water quality data
Identification of pollutants
Water quality monitoring by students

Drinking Water
Protect public and private water supplies

Water Quality (General)
All streams meet use designation/OEPA standards
Hazardous spill notification

Education
Raise awareness about watersheds—newsletters, AWARE program, ...
K-12 educational programming
Develop sound scientific understanding of water quality issues

Recreation
Stream water safe for human contact
Harsha Lake concerns – bacteria, sediment, nutrients, algae
Sustain water quality to provide a viable recreation resource (i.e., swimming & fishing)
Recreational use – boating, canoeing, hiking, fishing, swimming, wading

Miscellaneous/Other
Remove "orphan" dams
Political leadership
CECOS

Table 4-1. Watershed management interests, issues and concerns identified by East Fork Lake Tributaries stakeholders.

Water Management Goals

Table 4-2 presents the water management goals developed by each of the work groups. The goals are discussed in more detail in the following sections, but a couple of items are worth noting here:

• Each group placed emphasis on establishing a water quality monitoring program to effectively define the water quality problem(s), to isolate any sources of impairment, and to track changes in water quality in response to management. Monitoring is seen as a good investment to ensure that implementation dollars are well spent.

• There was an overlap of interests between the Land Use and the Stormwater Groups. For planning purposes the Land Use Group focused on more global issues such as finding the right balance between economic development and stream protection whereas the Stormwater Group focused more on the specifics of site-level stormwater management. Upon review of the goals and strategies that follow, you will see that it is difficult—and possibly foolish—to separate the issues in this manner.

Implementation Strategies

The following sections and Tables 4-3, 4-4, and 4-5 present the water management goals and implementation strategies recommended by each of the work groups.

Land Use Goals
Goal 1. Meet Use Attainment in All Streams Goal 2. Protect Drinking Water Supplies Goal 3. Minimize Damage to Property/Infrastructure from Flooding Goal 4. Minimize Threats to Safety from Flooding/Flash Flooding Goal 5. Maintain Adequate Drainage Goal 6. Promote Exceptional Quality of Life Goal 7. Natural Resources and Water Resources Central to Economic Development
Stormwater Management Goals
Goal 1. Improve In-stream Water Quality and Habitat Goal 2. Minimize Negative Health Impacts Goal 3. Protect Drinking Water Quality Goal 4. Good Drainage Goal 5. Minimize Flood Damage Goal 6. Shared Knowledge of Status of Rivers and Tributaries Goal 7. Identify and Protect Floodplains, Wetlands, Riparian Corridors and other Functional Open Space Goal 8. Continuity of Regulations Across Watershed Goal 9. Recharge Groundwater Goal 10. Improve/Maintain Recreational Value of Stream Goal 11. Maintain Economic Growth and Tourism
Wastewater Management Goals
Goal 1. Determine Water Quality of All Streams Goal 2. Determine Whether Water Quality is Improving or Degrading Goal 3. Achieve/Maintain Water Quality in All Streams Acceptable for Human Activities and Use Goal 4. Understand Wastewater System Impacts on Water Quality Goal 5. 100% of Home Sewage Treatment Systems Function Properly Goal 6. Public/Semi-public Wastewater Collection and Treatment Systems Meet All Regulatory Requirements Goal 7. Ensure Sewage Treatment Costs Are Not a Burden to Community Goal 8. Aware and Responsible Citizens

Table 4-2. Watershed management goals identified by East Fork Lake Tributaries Work Groups.

Land Use

The Land Use Work Group believed the central goals were meeting use attainment in all East Fork Lake Tributaries streams and protecting drinking water supplies. The Group also focused on strategies to manage stormwater quantity to maintain adequate drainage and minimize damage from flooding. Recommendations included:

- using planning, zoning and smart development to protect water resources
- managing stormwater where it falls
- protecting natural system services provided by the soil, wetlands, headwaters streams, and floodplains.

This Group also felt that the protection of water resources was closely tied to economic development and quality of life; that is, as this area changes over time, a continued commitment to protecting natural areas and promoting passive recreation will result in development that minimizes flooding and maintains excellent water quality.

Goals	Strategies	Priority
Goal 1 Meet Use Attainment in All Streams **Goal 2 Protect Drinking Water Supplies**	Benchmarking—determine current status of water quality	High
	Define problems and identify contaminants	High
	Conform to regulations	High
	Maintain natural system services	Medium
	Implement water quality Best Management Practices (BMPs)	High
	Improve Home Sewage Treatment System (HSTS) discharges	High
	Land use planning that considers water quantity and water quality	High
	Zoning	
	Development strategies that protect water resources	High
	Education—raise citizen awareness	High
Goal 3 Minimize Damage to Property/ Infrastructure from Flooding **Goal 4 Minimize Threats to Safety from Flooding/Flash Flooding**	Manage stormwater at its source	High
	Protect/maintain/enhance natural system services	
	Minimize impervious area/maximize pervious area	
	Grade drainage ditches	
	Protect floodplains; accurately map floodplains on all streams	
	Protect headwaters streams	High
	Zoning	High
	Development strategies that protect water resources	Low
Goal 5 Maintain Adequate Drainage	Study feasibility of townships or county assuming management responsibility for ditches	High
	Use stormwater utility or stormwater district to maintain drainage/ditches	
	Use petition process to maintain stormwater system/ditches	
	Prevent and remove log jams	
	Homeowner BMPs/education	High
Goal 6 Promote Exceptional Quality of Life	Leadership and vision	High
	Promote rural character	High
	Community renewal	High
	Life-long learning	High
	Recreational opportunities	High
Goal 7 Natural Resources and Water Resources Central to Economic Development	Events	Medium
	Bike paths	
	Recreational activities	
	Promotion	Medium
	Fish studies	Medium

Each work group classified, by consensus, every strategy they developed as high, medium, or low priority. The factors that went into their priority determination included: 1) the importance of the action for achieving the stated goal; 2) the return on investment (i.e., are we accomplishing a lot with the resources used); 3) the doability (person or entity available and willing to take leadership, funding or personnel available to accomplish the task, community and/or political support {or opposition}, etc.); and 4) opportunistic within a strategic approach based on water quality goals and cost effectiveness.

Table 4-3. Recommendations of the Land Use Work Group.

Stormwater Management

The Stormwater Management Work Group focused on management of both water quality and water quantity, recognizing the interrelationship between them. The Group was looking for strategies that promote human health and safety, protect drinking water quality, and help streams meet their use designations (Goals 1-4).

In addition to Source Water Protection strategies for Harsha Lake, the group focused on the management of water quantity and quality through:

1. The protection of natural system services provided by floodplains, wetlands, riparian corridors, and the soil
2. Implementation of agricultural and urban BMPs.

Goals	Strategies	Priority
Goal 1 **Improve In-stream Water Quality and Habitat** **Goal 2** **Minimize Negative Health Impacts** **Goal 3** **Protect Drinking Water Quality**	Establish monitoring sites and criteria for monitoring	High
	Develop Source Water Protection Plan	
	Protect riparian areas	
	Agricultural best management practices (BMPs)	High
	Urban best management practices (BMPs)	High
Goal 4 **Good Drainage** **Goal 5** **Minimize Flood Damage**	Create stormwater utility	High
	Maintain existing (required) stormwater facilities	
	Eliminate homeowner association oversight of stormwater facilities	
	Inventory basin drainage features and stormwater infrastructure	
	Develop county-wide stormwater plan	
	Protect riparian areas	
	Delineate and protect floodplains beyond FEMA maps	High
	Review current floodplain regulations/incorporate higher standards	High
Goal 6 **Shared Knowledge of Status of Rivers and Tributaries**	No specific strategies identified	High
		High
Goal 7 **Identify and Protect Floodplains, Wetlands, Riparian Corridors and other Functional Open Space**	Inventory riparian areas	High
	Protect riparian areas	High
	Update existing wetlands inventory	
	Require wetlands delineation for any land use change	
	Protect wetlands	Medium
	Delineate floodplains beyond FEMA maps	High
	Review current floodplain regulations/incorporate higher standards	High
	Identify threats early in development process	Low
Goal 8 **Continuity of Regulations across Watershed**	Promote uniform adoption of floodplain regulations	High
	Include riparian areas in definition of open space for PUDs county-wide	High
Goal 9 **Recharge Groundwater**	Identify and protect open space, wetlands, floodplains, riparian corridors	Medium
	Minimize impervious area/maximize pervious area	High
	Develop Source Water Protection Plans	High
Goal 10 **Improve Recreational Value of Stream** **Goal 11** **Maintain Economic Growth and Tourism**	Inventory and protect riparian corridors	High
		High
		High
		High

Each work group classified, by consensus, every strategy they developed as high, medium, or low priority. The factors that went into their priority determination included: 1) the importance of the action for achieving the stated goal; 2) the return on investment (i.e., are we accomplishing a lot with the resources used); 3) the doability (person or entity available and willing to take leadership, funding or personnel available to accomplish the task, community and/or political support {or opposition}, etc.); and 4) opportunistic within a strategic approach based on water quality goals and cost effectiveness.

Table 4-4. Recommendations of the Stormwater Management Work Group.

Wastewater Management

The Wastewater Management Work Group believed meeting water quality use designations (Goal 1) and protecting human health (Goal 3) were the overarching goals, with the other goals and strategies designed to achieve those primary goals.

Goals 2 and 4, and the listed strategies, are aimed at achieving a better understanding of wastewater treatment systems and their impact on water quality.

The Wastewater Group felt that there were several opportunities to improve wastewater management that would help to protect public health, as well as provide water quality benefits.

Most homes in this largely rural watershed are served by home sewage treatment systems (HSTS), more commonly called septic systems. Combine that reality with the fact that the predominant soils in the watershed (Clermont and Avonburg) present limitations for installation of traditional leach field systems, and it suggests that a comprehensive approach is needed to ensure properly functioning HSTS. That comprehensive approach is outlined in the Wastewater Master Plan for Clermont County and the recently completed Home Sewage Treatment Plans in Brown County and includes installation of appropriate systems based on soil type, development and implementation of an HSTS inspection program, and repair or replacement of failing systems.

The Group felt that effective, affordable wastewater treatment requires both a reasonable set of environmental regulations, standards and expectations from the State, and an awareness by the public of the costs and responsibilities of managing waste.

Each work group classified, by consensus, every strategy they developed as high, medium, or low priority. The factors that went into their priority determination included: 1) the importance of the action for achieving the stated goal; 2) the return on investment (i.e., are we accomplishing a lot with the resources used); 3) the doability (person or entity available and willing to take leadership, funding or personnel available to accomplish the task, community and/or political support {or opposition}, etc.); and 4) opportunistic within a strategic approach based on water quality goals and cost effectiveness.

Goals	Strategies	Priority
Goal 1 Meet Clean Water Act Use Designations	Develop monitoring program to track stream conditions and water quality	High
Goal 2 Determine Whether Water Quality is Improving or Degrading	Develop monitoring program to track stream conditions and water quality	High
Goal 3 Achieve/Maintain Water Quality Acceptable for Human Activities and Use	Track wastewater-related water quality problems	High
	Enforce existing rules and regulations	Low
	Sanitize drilled wells	High
	Grade drainage ditches	Medium
Goal 4 Understand Wastewater System Impacts on Water Quality	Map all HSTS systems in GIS	High
	Monitor and Document all discharges (WWTP, Semi-public, HSTS)	High
	Track wastewater flows of all systems vs. rain events	High
	Identify and quantify failing or improper systems	High
Goal 5 100% of Home Sewage Treatment Systems Function Properly	Develop county wide home sewage treatment system (HSTS) plan for Brown County; periodically update Clermont County Wastewater Management Plan	High
	Maintain effective Health Department HSTS inspection programs in Brown and Clermont Counties	High
	Identify failing or improper systems	High
	Repair or replace failing systems	High
	Fit appropriate on-site system to site	High
	Develop HSTS utility	Low
	Develop operation and maintenance program	Low
	Develop an effective homeowner education program	High
	Proper application or disposal of septage	High
	Registration/testing of septage haulers	High
	Improve homeowner awareness about sewage treatment costs & responsibilities	High
	Update State of Ohio HSTS legislation	Low
Goal 6 Public/Semi-Public Wastewater Collection and Treatment Systems Meet All Regulatory Requirements	Enforce existing regulations	High
	Quantify performance of sewer treatment system (CSTS)	High
	Eliminate sanitary sewer overflows (SSOs)	High
	Reduce infiltration and inflow (I & I)	Low
	Address smells at lift stations	Low
	Use citizens groups as watchdog	High
	Look at alternative approaches to wastewater management	High
	Improve homeowner awareness about sewage treatment costs & responsibilities	High
Goal 7 Sewage Treatment Costs Not a Burden to Community	Self-funding public wastewater systems and full-cost accounting	High
	Fair, equitable, affordable sewage treatment	High
Goal 8 Aware and Responsible Citizens	Educate citizens about responsibility/accountability for sewage treatment	High
	Use local media	High
	Educational programs for schools	High

Table 4-5. Recommendations of the Wastewater Management Work Group.

Monitoring and Assessment

A Monitoring and Assessment (M&A) Work Group did not meet during the November Lake Tributaries stakeholder meeting. The M&A goals addressed in this section reflect needs identified by other work groups during other East Fork stakeholder meetings (i.e., Lower East Fork, Headwater). To ensure consistency throughout the entire East Fork watershed it has been recognized by the collaborative to follow the same M&A goals and strategies set forth by other work groups. These will also be used to identify strategies necessary to assure data quality and to organize, manage and communicate information.

Stream assessment using Ohio EPA protocols is necessary to determine whether East Fork Lake Tributary streams are meeting their use attainment. Until resources are found to accomplish that goal, there are other objectives that may be accomplished by developing a strong monitoring and assessment program. For example, citizen monitoring has been used effectively in other watersheds to identify areas with poor water quality, or to identify sources of impairment. Citizen monitoring programs are a relatively cost-efficient way to build a water quality database, and can be an important way to raise awareness about the watershed.

The last Ohio EPA assessment of East Fork Lake Tributaries streams found several impaired stream segments but, in several cases, failed to identify specific causes or sources. Further investigation at those sites may provide the evidence necessary to identify specific sources of impairment. Targeted monitoring can also be used to evaluate the effectiveness of practices used in the watershed.

In addition to the more mainstream measures of water quality such as water chemistry and stream biology, previous M&A Groups recommended assessment of stream morphology and riparian buffers throughout the East Fork Lake Tributaries.

Previous M&A Groups felt that the recommendations presented here are only the beginning of the work that needed to be done in the entire East Fork watershed. Toward that end, the Group recommended formation of a permanent East Fork Watershed Monitoring and Assessment Group to provide leadership and ongoing oversight to monitoring programs for the entire East Fork Watershed.

Each work group classified, by consensus, every strategy they developed as high, medium, or low priority. The factors that went into their priority determination included: 1) the importance of the action for achieving the stated goal; 2) the return on investment (i.e., are we accomplishing a lot with the resources used); 3) the doability (person or entity available and willing to take leadership, funding or personnel available to accomplish the task, community and/or political support {or opposition}, etc.); and 4) opportunistic within a strategic approach based on water quality goals and cost effectiveness.

Goals	Strategies	Priority
Goal 1 Determine Use Attainment of All Streams	Conduct use attainment assessment using Ohio EPA methods	High
	Develop citizen monitoring program	High
	Use land use information to narrow focus	High
	Establish long-term monitoring stations	Low
	Get flow data (to be able to calculate loadings)	Medium
	Identify bacteria sources	Low
	Collect rainfall data	High
Goal 2 Conduct Physical/Morphological Assessment of All Streams	Collect known information about streams by stream segment	High
	Conduct physical assessment of streams using Rosgen method	High
	Assess riparian buffers	High
Goal 3 Identify Specific Causes and Sources of Impairment	Follow monitoring (Goals 1 & 2) above)	High
	Use inventory to identify potential point sources, land uses, ...	High
	Sample to isolate causes/sources	High
	Follow up on complaints	High
Goal 4 Organize, Manage and Communicate Data Efficiently and Professionally	Form permanent Monitoring and Assessment group for review and oversight	High
	Develop clear monitoring and assessment goals and link monitoring goals to decision makers	High
	Link data to GIS—GPS/geo-locate all data, monitoring sites, pollution sources,	High
	Provide GPS units and digital cameras to schools and volunteer monitors	High
	Develop good supporting data (land use, livestock, septic systems, …)	High
	Conduct windshield surveys to fill data gaps	Medium
	Make data understandable	High
	Require report and recommendations from all data collection projects	High
Goal 5 Establish and Follow Data Quality Protocols	Form permanent Monitoring and Assessment group for review and oversight	High
	Use standard, generally-accepted methods	High
	Conduct data checks by unbiased sources	High
Goal 6 Evaluate Effectiveness of Practices	Measure soil quality	High
	Review existing research reports	High
	Inventory practices in use in East Fork watershed	High
	Isolate practices and measure water quality	High
	Use models to assess practices	High
Goal 7 Raise Awareness about Water Quality and Watershed Management	Use local media	High
	Produce and release reports on findings	High
	Disseminate information through field days and public meetings	High
	Piggy-back on AWARE program and events	High
	Develop school monitoring program	High
	Develop volunteer monitoring program	High

Table 4-6. Recommendations of the Monitoring and Assessment Work Group.

East Fork Lake Tributaries Watershed Management Plan

<u>Chapter Five</u>

Watershed Management Recommendations

CHAPTER 5: WATERSHED MANAGEMENT RECOMMENDATIONS

The East Fork Lake Tributaries watershed inventory - Chapter 2 - provided the context within which watershed management activities take place. Chapter 2 also described potential point and non-point sources of water quality impairment. In Chapter 3, a detailed summary of existing water quality conditions in the East Fork Lake Tributaries watershed was presented. Chapter 4 summarized the goals and interests of East Fork Lake Tributaries watershed stakeholders.

This chapter integrates the information from the earlier chapters and presents a set of recommendations designed to help East Fork Lake Tributaries streams meet their use attainment. The chapter also includes other recommendations designed to achieve a broader set of water management goals including recommendations to address the Bob McEwen Source Water Protection Area (e.g., emergency management zone and corridor management zone).

Management strategies for the East Fork Lake Tributaries watershed were developed through a number of stakeholder meetings. Those strategies and the process by which they were developed are summarized in Chapter 4, and further detailed in Appendix A. Within this chapter, the strategies are applied to a given stream segment or subwatershed based on the primary causes or sources of impairment. Where sources of impairment have not been identified, or for those streams for which no water quality data exists, additional monitoring and assessment activities are recommended.

Table 5-1 summarizes the Ohio EPA identified causes and sources of stream impairment in the East Fork Lake Tributaries watershed by stream segment. Probable sources are listed for each cause of impairment. For example, high in-stream nutrient concentrations and siltation are listed as causes of impairment for the East Fork mainstem. Contributing sources identified by Ohio EPA during their assessment include agricultural runoff, riparian grazing, and flow alteration.

Problem statements and recommended implementation strategies for the East Fork Lake Tributaries, both the East Fork mainstem and its tributaries, are included in the following pages. Each problem statement provides a summary of use attainment status, and a description of the causes and sources of non-attainment estimated from Ohio EPA biological data and field observations. Estimated pollutant loadings from the different sources are also included.[1] For those stream segments where causes or sources of impairment were listed as unknown, the loading estimates were calculated using available information (i.e., land use, number of household sewage treatment systems (HSTS), and livestock numbers). Estimated load reductions are given as percentages and are based on Ohio EPA target values for allowable loads. Allowable loads are based on the LSPC modeled flows and the applicable water quality targets. Target values of 0.08 and 0.10 mg/L for total phosphorous (TP) [varies based on drainage area], 1.0 mg/L for nitrate, and 25 mg/L for total suspended solids (TSS) were used for determining allowable loads. Those values are all based on Ohio EPA guidance. .

Following each problem statement is a list of goals for addressing the sources of impairment, and a list of recommended management strategies and projects designed to maintain full support of the streams' designated uses. Each task includes potential sources of funding, a time frame for implementation, and measurable performance goals.

As shown in the tables that follow, some of the management strategies are relatively inexpensive and easier to accomplish, while others are more expensive and complex. However, funds for some of the more costly tasks, such as riparian zone protection and stream restoration projects, are not available at this time. The Collaborative and its partners will continue to search for potential funding sources for these projects, and investigate alternative management strategies if funds are not available. Updates to this action plan will be made as new funding sources and management strategies are identified.

1. The loadings were estimated using the Loading Simulation Program in C++ (LSPC) (see box on following page). These modeling estimates were provided by Tetra Tech a consultant working with Clermont County to develop Total Maximum Daily Loads (TMDLs) for the East Fork Little Miami River basin. The development of TMDLs will result in more accurate estimates of pollutant loads throughout the watershed.

Target Area	Causes of Impairment	Sources of Impairment
East Fork Mainstem (UST Lake) Above Harsha Lake	Flow Alteration	Flow Regulation (due to Harsha Dam)
East Fork Mainstem (Howard Run to Todd Run)	Siltation Nutrients	Crop production
Barnes Run	Organic enrichment/ DO Siltation	HSTS (Home Sewage Treatment Systems) Crop production
Cabin Run	Full Attainment (WWH)	
Cloverlick Creek	Siltation Nutrients	Crop production
Fivemile Creek	Organic enrichment/ DO	Unknown
Kain Run	Nutrients	Crop production Low Flow
Pleasant Run	Organic enrichment/ DO Flow alteration Unionized Ammonia	HSTS Crop Production Natural
Poplar Creek	Organic enrichment/ DO Pathogens	SSO's, HSTS
Slabcamp Run	Organic enrichment/ DO Flow alteration	HSTS Industrial impervious surface runoff
Todd Run	Partial Attainment Causes unknown	Unknown
Ulrey Run	Organic enrichment/ DO Pathogens	HSTS Semi-public WWTP
East Fork Fivemile Crane Run Indian Camp Run Polecat Run Trible Run Light Run Snow Run Sugartree Creek Town Run Guest Run Back Run	Designated Warm Water Habitat (WWH) Not Assessed	

Table 5-1. Target area summary for the East Fork Lake Tributaries watershed.
[Source: Ohio Water Resource Inventory. Ohio EPA, 2000]

Load Estimation - The LSPC Model

LSPC is the Loading Simulation Program in C++, a watershed modeling system that includes streamlined Hydrologic Simulation Program Fortran (HSPF) algorithms for simulating hydrology, sediment, and general water quality on land as well as simplified stream transport models. LSPC has been widely used for assisting with TMDL calculation and source allocations. LSPC was designed to handle very large-scale watershed modeling applications. The model has been successfully used to model watershed systems composed of over 1,000 subwatersheds.

Reference: http://www.epa.gov/athens/wwqtsc/index.html

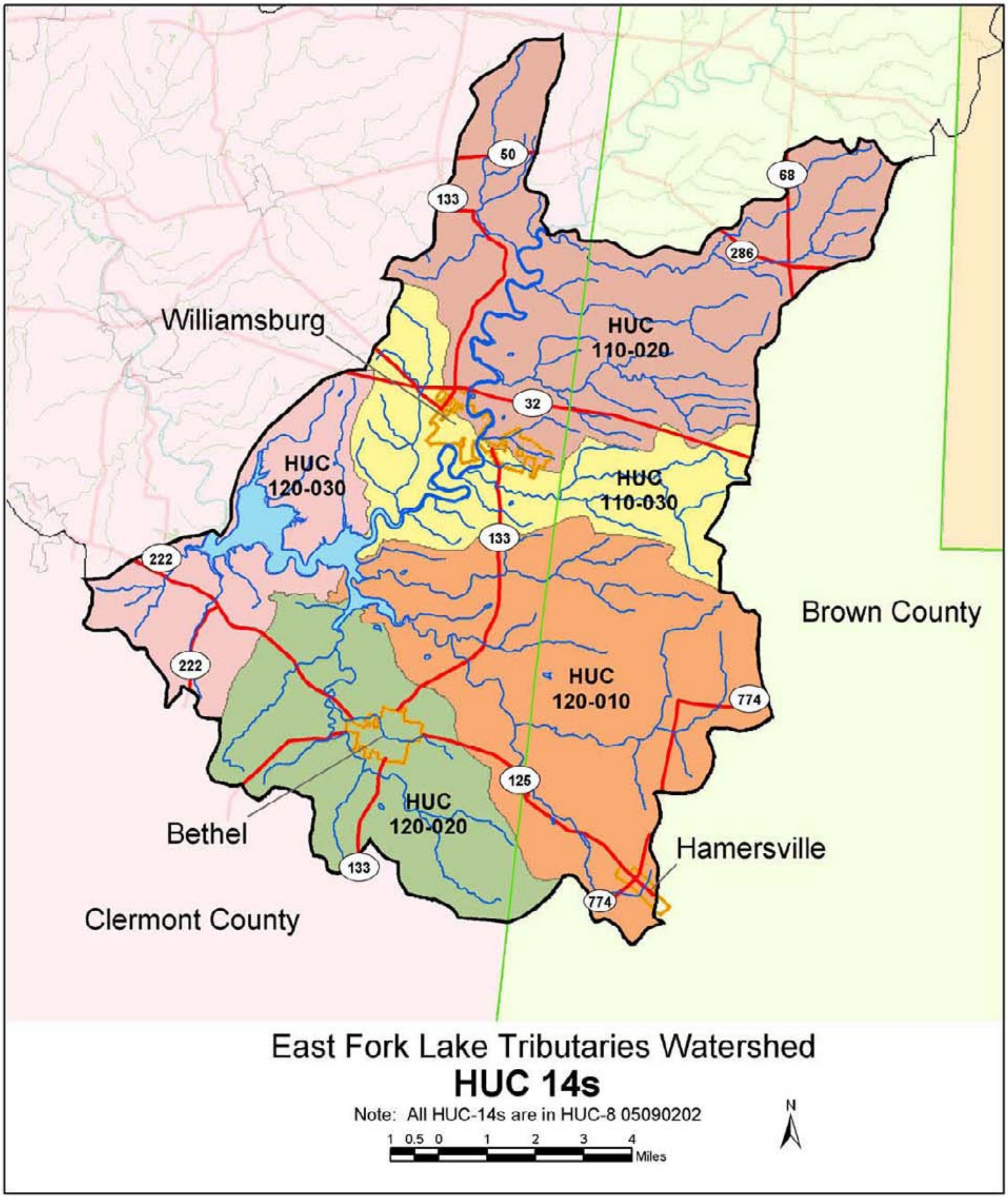


Figure 5-1. 14-digit Hydrologic Unit Codes (HUC-14s) of the East Fork Lake Tributaries.

[Note: HUC-14s, or 14-digit Hydrologic Unit Codes, are a set of numerical identifiers used by government agencies to communicate about individual streams and watersheds. HUC 120-030 was split at Harsha dam, the remaining portion of this HUC (below Harsha Dam is included in the Middle Fork sub-watershed planning area (see Ch.1, p.1, Fig 1-1).]

East Fork Lake Tributaries Watershed
Drainage Area: 148 mi^2
Use Designation: EWH/WWH

Background

The East Fork Lake Tributaries watershed covers 148 mi^2 in Brown and Clermont Counties. Ohio EPA's assessment of the East Fork Lake Tributaries watershed can be found in the agency's 2000 *Ohio Water Resources Inventory* 305(b) report. Based on these data, approximately 13 percent (3.2 river miles) of the EFLM was found to be in "Full, but Threatened" attainment of the river's use designation (EWH), while 47 percent (11.6 miles) was listed in "Partial" attainment. The remaining 40 percent of the East Fork Little Miami River in this subwatershed (9.9 river miles) actually consists of East Fork Lake itself and was, therefore, not sampled by Ohio EPA. Of the tributary stream segments monitored by Ohio EPA in 1998, approximately 15 percent (4.0 miles) fully supported their aquatic life designated use, while 24 percent (6.3 miles) were rated "Full, but Threatened". Approximately 21 percent of the streams (5.4 miles) were in "Partial" support, while over 39 percent (10.3 miles) did not support their aquatic life use. Many Lake Tributaries streams have not been assessed. It should be noted that the Lake Tributaries watershed is the primary source for public drinking water that is withdrawn from Harsha Lake and treated by the Bob McEwen Water Treatment Plant.

Problem Statement

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that causes of water quality impairment within the East Fork Lake Tributaries watershed include high nutrient levels, organic enrichment/low dissolved oxygen, siltation, flow alteration and habitat degradation. Many miles of streams have not been assessed in the Lake Tributaries. Extending water quality assessment into the major tributaries in the East Fork Lake Tributaries watershed is a top priority.

Within the Lake Tributaries watershed, the primary source of nutrients is from row crop agricultural production. Other sources include failing septic systems and livestock agriculture. Because of the effect of Harsha Lake (i.e., settling and algal uptake) it is difficult to model total loadings in the Lake Tributaries watershed. A lake model will need to be developed in order to truly capture existing loads and to determine allowable loadings into Harsha Lake. Using the LSPC model, the total nitrogen and phosphorus loads for the Lake Tributaries watershed at Harsha Dam are estimated to be 4,777 and 1,470 tons per year, respectively. Based on existing and allowable load results from modeled streams in the Lake Tributaries watershed, an estimated 50% reduction in nitrogen and phosphorous is needed to meet Ohio EPA allowable loads. Only two streams (Cabin Run and Slabcamp Run) are meeting their allowable load limits and do not need reductions in nitrogen and phosphorous.

The LSPC model predicts that the total sediment load for the Lake Tributaries watershed at Harsha Dam is 367,617 tons per year. The primary sources of sediment are row crop agriculture, pasture and urban/ residential stormwater runoff from developed areas. Based on loadings results entering Harsha Lake a 50% reduction in Total Suspended Solids (TSS) is needed to reach allowable load limits.

The table that follows presents a set of general recommendations for managing water quality and water quantity throughout the entire East Fork Lake Tributaries watershed. This extensive set of strategies and recommendations developed through the stakeholder process provides evidence of the complex nature of watershed management, and of the cumulative impact of varying human activities.

2. Unless otherwise noted, all assessments referenced in this chapter were conducted by Ohio EPA scientists.

Objective	Action	Resources	Time Frame	Performance Indicators
Monitoring and Assessment				
Determine use attainment status of all non-assessed streams and rivers	Conduct Aquatic Life Use assessment of listed streams using Ohio EPA protocols and Ohio EPA Level 3 certified data collectors	Ohio EPA staff, Ohio EPA 319 grant, USEPA grant or similar grant	2008-2012	Use attainment status determined and reported in technical support document
Evaluate habitat quality of all non-assessed streams and rivers	Conduct Qualitative Habitat Evaluation Index (QHEI) assessment of each stream	Ohio EPA staff as part of water quality analysis described above; or watershed coordinator or other qualified evaluator using existing resources	2007-2009	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of all streams and rivers	Conduct physical and morphological assessment of each stream using Rosgen Level III assessment or equivalent	Watershed coordinator and/or other qualified evaluator using existing resources; or Ohio EPA 319 grant or other similar grant	2007-2009	Physical and morphological assessment completed and reported in technical support document
Inventory 100 percent of riparian corridor along all streams and rivers	Using aerial photos and field verification, map width, land use, and vegetation of all riparian corridors	Watershed coordinator or other partners using existing resources; or Intern project or university class project	2007-2009	GIS riparian corridor database completed and mapped
	Accurately map floodplains for all streams	FEMA or USACE grant for major streams; watershed coordinator or other qualified evaluator for minor tributaries; seek grant $$	2006-2010	Maps of functional floodplain, floodway, 100-year floodplain
Identify specific causes and sources of impairment	Develop citizen monitoring program - involve schools, Farm Bureau, volunteers, …; potentially form local environmental group for testing, education, ...	Watershed coordinator, partners, volunteers using existing programs (e.g., schools, AWARE, Saturday Snapshot, …) and grants	2006-2008	Effective, coordinated citizen monitoring program
	Develop complete and accurate land use inventory; use inventory to identify potential point and non-point sources; map HSTS - note failing or improper systems	Watershed coordinator and partners using existing resources, Health Districts	2006-2008	Maps of priority target areas
	Establish long-term monitoring stations in East Fork Lake Tributaries; collect water quality and rainfall data	EFLMR Monitoring and Assessment Team, volunteer monitors; seek grants to fund program	2006-2008	Appropriate number of permanent stations established
	Get flow data to be able to calculate loadings	Watershed coordinator and partners using existing resources; or grants, interns, USEPA, ...	2006-2010	Flow data (rating curves) for all significant tributaries
	Measure water quality using Ohio EPA primary contact recreation criteria	Watershed coordinator, partners, volunteers using existing programs resources and grants	2006-2010	Recreational use attainment status determined

Objective	Action	Resources	Time Frame	Performance Indicators
Monitoring and Assessment (continued)				
Evaluate effectiveness of Best Management Practices	Inventory practices in use in East Fork Lake Tributaries watershed	Watershed coordinator, SWCDs and partners	2006-2008	Completed inventory of BMPs
	Conduct windshield survey during storm events	Watershed coordinator and partners	2006-2010	BMP effectiveness database
	Conduct end-of-field or end-of-pipe water quality sampling	EFLMR Monitoring and Assessment Team, volunteer monitors; using existing resources or grants, interns, ...	2006-2010	Completed local BMP effectiveness database
	Collect research information on BMP effectiveness	Watershed coordinator and partners	2006-2008	BMP effectiveness database
Organize, manage and communicate data efficiently and professionally	Form permanent East Fork watershed monitoring and assessment group for review and oversight	Watershed coordinator and partners using existing resources or grants	2007	M&A group established
	Develop clear monitoring and assessment goals for EFLMR watershed	EFLMR Monitoring and Assessment Team	2007	Goals developed and documented
	Create data clearinghouse for storing and analyzing data	EFLMR Monitoring and Assessment Team, Clermont OEQ, and/or TMDL consultant; using existing resources or grants, interns, ...	2006-2008	Completed user-friendly water quality database
	Develop good supporting data (land use, livestock, BMPs, septic systems, …); conduct windshield surveys to fill data gaps	Watershed coordinator and partners using existing resources or grants	2006-2008	Updated land use maps, BMP database, HSTS maps & database, ...
	Link data to GIS - GPS/geolocate all data, monitoring sites, pollution sources; provide GPS units and digital cameras to schools and volunteer monitors	Watershed coordinator, partners, volunteers using existing resources and grants	ongoing	All data georeference; digital photo catalog
	Effectively communicate water quality information - make data understandable, require report and recommendations from all data collection projects	EFLMR Monitoring and Assessment Team	ongoing	Catalog of water quality reports for both technical and lay audiences
Establish and follow data quality protocols	Form permanent East Fork watershed monitoring and assessment (M&A) group for review and oversight	Watershed coordinator and partners using existing resources or grants	2007	M&A group established
	Use standard, generally-accepted methods; conduct data checks by unbiased sources	EFLMR Monitoring and Assessment Team	ongoing	Completed monitoring QA plan

Objective	Action	Resources	Time Frame	Performance Indicators
Manage Water Quality and Water Quantity				
Manage flood peaks and minimize drainage problems	Maintain or enhance riparian corridors and stream buffers; encourage natural flood control	Landowners with assistance from watershed coordinator and all partners; educational programs, zoning, NRCS programs, land trusts, Clean Ohio, WRRSP, …	ongoing	Width of corridors; miles or percentage of riparian corridors permanently protected
	Manage stormwater at its source—manage the amount of impervious surface, use open ditches, employ stormwater detention BMPs, improve soil quality and infiltration, minimize land use or development in high risk or sensitive areas, ...	Educational programs, zoning, water management and sediment control regulations, water quality volume, ag BMPs; landowners, developers and farmers with assistance from watershed coordinator and all partners	ongoing	Number of complaints from downstream neighbors; land changes result in minimal change to original storm hydrograph
	Develop low-impact log jam management program	Landowners, watershed coordinator, SWCDs, county engineers, and patners	2007-2009	Tools and tracking system to identify and remove log jams without degrading habitat
	Use stormwater management programs (e.g., ditch maintenance programs) and management easements to maintain drainage infrastructure	County commissioners, county engineers, SWCDs, Stormwater Department	ongoing	Less local flooding; fewer complaints
	Educational programs - get drainage information to homebuyers, realtors, and developers	Watershed coordinator, SWCDs, stormwater department, realtors associations, homebuilders associations, ...	ongoing	Fewer complaints against developers, realtors, neighbors
Improve quality of stormwater runoff	Manage stormwater at its source - manage the amount of impervious surface, use open ditches, employ stormwater detention BMPs, improve soil quality and infiltration, minimize land use or development in high risk or sensitive areas, ...	Educational programs, zoning, water management and sediment control regulations, water quality volume, ag BMPs; landowners, developers and farmers with assistance from watershed coordinator and all partners; NRCS programs	ongoing	Water quality leaving sites through surface drainage or stormwater treatment basins
	Maximize treatment of stormwater with BMPs - detention basins, treatment ponds and wetlands, buffer strips, grassed waterways, ...	Educational programs, zoning, water management and sediment control regulations, water quality volume, ag BMPs; landowners, developers and farmers with assistance from watershed coordinator and partners; NRCS programs & grant funding for BMPs	ongoing	Water quality leaving sites through surface drainage or stormwater treatment basins
	Increase number of farms using nutrient management plans and conservation plan - tie to government program eligibility	NRCS, FSA, OSU Extension, agricultural consultants; education and promotion programs; incentive programs; grant funding	ongoing	Percent of farms or number of acres using CNMPs and conservation plans

Objective	Action	Resources	Time Frame	Perform-ance Indicators
Manage Water Quality and Water Quantity (Continued)				
Maintain stream-bank erosion at "natural" levels	See actions under managing flood peaks above	See above	ongoing	QHEI and Pfankuch scores
Provide recommen-dations for main-taining or re-establishing ripar-ian corridor	Based on riparian inventory, habi-tat evaluation and morphological assessment, identify best strate-gies for maintaining or establish-ing functional stream corridor	Watershed coordinator and EFWC partners	2006-2010	List of recom-mendations for each segment of listed streams
Maintain properly functioning septic systems	Repair or replace failing HSTS	Homeowners using existing resources, low-interest loans or cost-share funds	2006-2010	100% properly functioning systems
	Develop county wide home sew-age treatment system (HSTS) plans for Brown County	County health departments with assistance from Ohio EPA and Ohio Dept of Health	Completed	Completed HSTS plan
	Develop an effective Health De-partment HSTS inspection pro-gram for Brown County	County health departments	2006-2010	County HSTS inspection pro-gram in place in each county
	Develop an effective homeowner education program	County health departments, OSU Extension, watershed coordinator and partners	2006-2008	Educational materials for homeowners, developers, realtors
Minimize water quality impairments from wastewater treatment, hauling and sludge man-agement	Ensure effective, up-to-date pub-lic and semi-public wastewater treatment facilities	Ohio EPA, local elected offi-cials, citizens groups; low-interest loans, cost-share for WWTP updates	ongoing	No NPDES violations
	Effective regulation, registration and testing of septage haulers; proper application or disposal of septage	County health districts and Ohio EPA	ongoing	No reports of illicit discharges or improper handling
Reduce solid waste in streams	Enforce litter/dumping laws	Local police, ODNR, citizen watchdogs using existing resources	ongoing	"Clean" streams
	Raise awareness though educa-tion and outreach; develop volun-teer clean-up events including Adopt-a-Waterway program	Watershed coordinator, Solid Waste District, citizen groups, volunteers, and part-ners	ongoing	"Clean" streams; tons garbage collected
Maintain rural char-acter and livelihood	Encourage land use planning, smart growth, farmland preserva-tion and county-wide zoning	County planning depart-ments, zoning boards, local elected officials, land trusts	2006-2010	Land use plans and zoning regulations that consider water quality and water quantity

Objective	Action	Resources	Time Frame	Performance Indicators
Education and Outreach				
Raise awareness about water quality and watershed management	Develop outreach program to communicate information about water quality standards, benefits of drinking water protection, historic and current water quality status, water quality improvement programs, volunteer opportunities, ...	Watershed coordinator, SWCDs, OSU Extension, Farm Bureau, and partners, Ohio EPA Office of Pollution Prevention	2006-2010	Increasing environmental literacy as measured by surveys
	Educate citizens about costs, accountability and responsibility for sewage treatment	County health districts and local sewer districts, watershed coordinator	ongoing	Fewer complaints about costs
	Develop and distribute information on HSTS operation and maintenance	County health districts, watershed coordinator	2006 ongoing	Completed materials and distribution infrastructure
	Develop and distribute information on homesite drainage	SWCDs, watershed coordinator, realtors association, homebuilders association	2006 ongoing	Completed materials and distribution infrastructure
	Produce and release reports on programs, activities and findings	Watershed coordinator, EFLMR Monitoring and Assessment Team, Clermont OEQ	ongoing	Quarterly newsletter, water quality reports
	Use local media—multiple outlets, multiple messages	Watershed coordinator and all EFWC partners	ongoing	Media network and press releases SOP
	Disseminate information through field days and public meetings; piggy-back on AWARE signage program and events	Watershed coordinator, SWCDs, OSU Extension, Farm Bureau, and all EFWC partners	ongoing	Minimum of 3 field days or workshops per year
	Develop school monitoring program	Watershed coordinator, SWCDs, OSU Extension, Farm Bureau, and all EFWC partners	2006-2008	Participation from at least one school in each county
	Develop volunteer monitoring program	Watershed coordinator, SWCDs, OSU Extension, Farm Bureau, and all EFWC partners	2006-2008 ongoing	Effective, coordinated citizen monitoring program

Bob McEwen Water Treatment Plant (BMWTP)
Drinking Water Source Protection Area
Corridor Management Zone & Emergency Management Zone

Background

The Safe Drinking Water Act Amendments of 1996 established the national Source Water Assessment and Protection Program, targeting drinking water sources for all public water systems in the United States. As a part of the Ohio program the Ohio EPA compiled a Drinking Water Source Assessment for the Clermont County Bob McEwen Water Treatment Plant. The Ohio program is intended to identify drinking water protection areas and provide information on how to reduce the risk of contamination of the waters within those areas. The goal of the program is to ensure the long term availability of abundant and safe drinking water for the present and future citizens of Ohio. The Bob McEwen Drinking Water Source Assessment can be found in Appendix C.

The Bob McEwen Water Treatment Plant (BMWTP) is located near Batavia and serves 29,948 persons with 11,664 service connections. Surface water is withdrawn from Harsha Lake. Harsha Lake was constructed in 1973 by placing a 205 foot dam across the East Fork Little Miami River at RM 20.5. Maximum storage capacity of Harsha Lake is 96 billion gallons. Harsha Lake is a part of the East Fork State Park. Plant production for the BMWTP is rated for maximum capacity of 10 MGD. There are three 300 HP pumps at the intake structure on Harsha Lake. Each pump is rated at 3500 gpm. An illustration of the drinking water source protection area including the corridor management zone for the Bob McEwen public water system is shown in Appendix C Figure 1.

The Corridor Management Zone (CMZ) is the area within 1000 feet of each bank of the East Fork Little Miami River and within 500 feet of the tributaries. The CMZ extends to the bridge on U.S. 32, 12 miles upstream from the intake. Sixty-one percent of the Corridor Management Zone (CMZ) is contained within the East Fork State Park. The cities of Bethel and Williamsburg are within the CMZ.

The Emergency Management Zone (EMZ) is defined as an area in the immediate vicinity of the surface water intake in which the public water system operator has little or no time to respond to a spill. The EMZ is a 500 foot radius around the intake that is highly succeptable to spills with no time to respond to a spill event.

Problem Statements

According to the 2003 Ohio EPA Drinking Water Source Assessment the presence of Manganese, Atrazine, and high Total Organic Carbon (TOC) cause the most problems in the treatment of surface water at the BMWTP. Manganese is found throughout the watershed and is probably most often a result of solution of manganese from soils and sediments aided by bacteria or complexing with organic material. Manganese is a common exceedence of Ohio EPA water quality criteria upstream of Harsha Lake. Manganese is not a health threat, however excessive levels stain plumbing fixtures and clothing and is generally unacceptable to the customers.

Nutrient loading from the Williamsburg WWTP (RM 35.25), 12 miles upstream, failed HSTS systems, and farm field run off in the watershed have caused high nutrient concentrations of phosphorous, nitrate/nitrite, and ammonia which facilitate algal blooms in Harsha Lake during the warmer months. Algae blooms can impart an earthy or musty flavor to treated water, in addition to contributing to the total organic carbon in raw water. Raw water containing high total organic carbon will produce excessive Total

Trihalomethanes and Halo Acetic Acids (Disinfectant/Disinfection Byproducts) (DDBP) when chlorinated. Failing HSTS systems and feed lots can contribute to influxes of pathogens such as cryptosporidium, giardia, and E.coli.

Atrazine along with other agricultural chemicals are found in surface water throughout the watershed. In 1998, Ohio EPA conducted a water quality survey documenting Atrazine in East Fork Little Miami River going into Harsha Lake at low levels (<2 µg/l) throughout the summer, but high levels of Atrazine (>50 µg/l) and other agricultural chemicals are present in the spring during high water events. Atrazine concentrations in surface water is a function of application time and rainfall events. Harsha Lake holds 96 billion gallons of water that can take a long time to build up and slowly release contaminants. Atrazine has been recorded as high as 15 µg/l in the raw water from Harsha Lake entering the water treatment plant. This problem usually peaks by May and slowly dissipates throughout the year. Granulated activated carbon filter caps are used to take out agricultural chemicals as well as controlling taste and odor problems and disinfection byproducts.

It should also be noted that a detailed Watershed Action Plan has been submitted and endorsed by the Ohio EPA and ODNR for the Headwaters of the East Fork Little Miami River. Recommended watershed actions are presented in this chapter concerning the Lake Tributaries sub-watershed and include the East Fork mainstem and tributaries that flow into the Source Water Protection Area including the Corridor Management Zone and Emergency Zone. The East Fork Headwaters Action Plan and Lake Tributaries Action Plan provide recommended actions for protecting surface water entering Harsha Lake that is used for public drinking water. The endorsed watershed action plans will be used as Source Water Protection Plans and the Lake Tributaries Watershed Action Plan will be submitted to the Ohio EPA for endorsement as a Source Water Protection Plan for the Bob McEwen Water Treatment Plant Source Water Protection Area.

HUC-14: 05090202-110-020 and 030

East Fork Little Miami River Mainstem (Howard Run to Todd Run)
OEPA Stream Code: 11-100
Drainage Area: 247.35 mi^2
Use Designation: EWH

Background

According to Ohio EPA, the East Fork Little Miami River [HUC 14: 05090202-100-020 and 030; Ohio EPA Stream Code: 11-100], from river mile 45.18 to the confluence with Todd Run at river mile 33.90, is not fully meeting its water quality use designation. Of this 11.28 mile river segment, 8.08 miles partially support the aquatic life use designation while the remaining 3.2 miles are fully attaining but threatened. This assessment unit is dominated by row crop agriculture with some livestock production. The Village of Williamsburg is in the assessment unit. This segment is also located downstream from the closed CECOS landfill.

Problem Statement

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that high nutrient levels and siltation were resulting in impaired use attainment. The primary source of nutrients was non-irrigated row crop agricultural production. There were no indications of influences from the CECOS landfill or the Williamsburg WWTP.

Using the LSPC model, the total nitrogen and phosphorus loads for the assessment unit are 3,497 and 817 tons per year. Allowable loadings have not been determined for the East Fork mainstem. Upon completion of the TMDL allowable loadings will be incorporated into this document. Based on modeled loadings of tributaries entering the East Fork mainstem above Todd Run it is estimated that a 50% reduction in nitrogen and phosphorous will be needed to meet estimated allowable loadings.

The LSPC model predicted Total Suspended Solids (TSS) loadings at 219,676 tons per year. Again, allowable loadings have not been determined. However, based on modeled loadings of tributaries entering the East Fork mainstem above Todd Run it is estimated that a 50% reduction in TSS will be needed to meet estimated allowable loadings.

Goals

1. Reduce mean nutrient loadings from row crop agriculture by 20 percent.
2. Maintain or reduce nutrients loading from livestock agriculture.
3. Reduce nutrient loadings from HSTS systems by 50 percent.
4. Reduce sediment loading from row crop agriculture by 50 percent.
5. Reduce sediment from streambank erosion by 50 percent.
6. Evaluate morphological status and stream stability of the East Fork Little Miami River.
7. Inventory 100 percent of riparian corridor along the East Fork Little Miami River; provide recommendations for maintaining or re-establishing riparian corridor.
8. Permanently protect 25% of the riparian corridor between RM 45.18 and RM 33.90 through land purchase or conservation easement.
9. Meet EWH/WWH use support in the mainstem of the East Fork.

Objective	Action	Resources	Time Frame	Performance Indicators
Reduce mean nutrient loadings from row crop agriculture by 20 percent	Increase number of farms using nutrient management plans; implement BMPs—riparian buffers, grassed waterways, conservation tillage	NRCS, FSA, agricultural consultants; education and promotion programs; incentive programs; grant funding	2006-2010	Percent of farms or number of acres using CNMPs
Maintain or reduce mean nutrient loadings from livestock agriculture	Increase number of farms using nutrient management plans; fence livestock out of streams	NRCS, FSA, agricultural consultants; education and promotion programs; incentive programs; grant funding	2006-2010	Percent of farms or number of acres using CNMPs; no livestock in streams
Reduce mean nutrient loadings from HSTS systems by 50 percent	Develop an effective homeowner education program	County health districts, watershed coordinator and partners	2006-2010	Educational materials for homeowners, realtors, developers
	Repair or replace failing HSTS	Homeowners using existing resources, low-interest loans or cost-share funds	2006-2010	100% properly functioning systems
	Develop an effective Health Department HSTS inspection program for Brown, Clinton, and Highland Counties	County health departments	2006-2010	County HSTS inspection program in place in each county
Reduce mean sediment loadings from row crop agriculture by 50 percent	Increase number of farms using conservation plans; implement BMPs—riparian buffers, grassed waterways, conservation tillage	NRCS, FSA, agricultural consultants; education and promotion programs; incentive programs; grant funding	2006-2010	Percent of farms or acres using conservation plans; QHEI and Pfankuch scores; sediment in water samples
Reduce mean sediment loadings from streambank erosion by 50 percent	Maintain or enhance riparian corridors and stream buffers; remove levees; encourage natural flood control; low-impact log-jam removal	Landowners with assistance from watershed coordinator and all partners; educational programs, NRCS programs, land trusts, Clean Ohio, WRRSP, …	2006-2010	QHEI and Pfankuch scores; sediment in water samples
Evaluate morphological status and stream stability of the East Fork Little Miami River	Conduct physical and morphological assessment of each stream using Rosgen Level III assessment or equivalent	Watershed coordinator and/or other qualified evaluator using existing resources; or Ohio EPA 319 grant or other similar grant	2007-2009	Morphological assessment completed and reported in technical support document
Inventory 100 percent of riparian corridor along the East Fork Little Miami River	Using aerial photos and field verification, map width, land use, and vegetation of all riparian corridors	Watershed coordinator or other EFWC partners using existing resources; or Intern project or university class project	2007-2009	GIS riparian corridor database completed and mapped
Provide recommendations for maintaining or re-establishing riparian corridor	Based on riparian inventory, habitat evaluation and morphological assessment, identify best strategies for maintaining or establishing functional stream corridor	Watershed coordinator and EFWC partners	2007-2009	List of recommendations for each segment of listed streams
Permanently protect 25% of the riparian corridor between RM 45.18 and RM 33.90 through land purchase or conservation easement	Use all available programs to permanently protect riparian corridors through setbacks, conservation easements and land purchase	Landowners with assistance from watershed coordinator and all partners; educational programs, NRCS programs, land trusts, Clean Ohio, WRRSP, …	2006-2010	Width of corridors; miles or percentage of riparian corridors permanently protected

HUC-14: 05090202-110-020

Fivemile Creek
OEPA Stream Code: 11-138
Drainage Area: 10.7 mi^2
Use Designation: WWH

Background

Fivemile Creek [HUC 14: 05090202-110-020; OEPA Stream Code: 11-138], a tributary to the East Fork Little Miami River, is only partially meeting its warmwater habitat (WWH) aquatic life use designation due to organic enrichment. At the 1998 assessment, 1.5 miles were assessed and was partially attaining aquatic life designation, the remaining 2 miles have not been assessed. This assessment unit is dominated by row crop agriculture with some livestock production.

Problem Statement

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that organic enrichment and other unknown causes were resulting in impaired use attainment. The 1998 assessment was somewhat complicated by low flow conditions. Bacterial exceedences suggest inputs of sewage, probably from residential onsite systems. Agricultural sources may also be influencing water quality in this rural watershed. Ammonia and phosphorous concentrations were slightly above median background values for the Interior Plateau ecoregion.

The LSPC model estimated that the total suspended sediment (TSS) load for the assessment unit is 15,110 tons per year. A 40% reduction in TSS is recommended to meet allowable loads.

The LSPC model estimated existing Nitrogen loads at 281 tons per year and phosphorous at 51 tons per year. Nitrogen and phosphorous loads should be reduced by 50% to satisfy Ohio EPA allowable loadings.

Goals

1. Reduce sediment loading from row crop agriculture by 25 percent.
2. Reduce sediment from streambank erosion by 25 percent.
3. Evaluate habitat quality of Fivemile Creek.
4. Evaluate morphological status and stream stability of Fivemile Creek.
5. Inventory 100 percent of riparian corridor along Fivemile Creek; provide recommendations for maintaining or re-establishing riparian corridor.
6. Assess remaining 2 miles of Fivemile Creek.
7. Assess potential bacterial inputs of sewage from HSTS systems.
8. Meet WWH use designation in Fivemile Creek.

Objective	Action	Resources	Time Frame	Performance Indicators
Reduce mean sediment loadings from row crop agriculture by 25 percent	Increase number of farms using conservation plans; implement BMPs—riparian buffers, grassed waterways, conservation tillage	NRCS, FSA, agricultural consultants; education and promotion programs; incentive programs; grant funding	2006-2010	Percent of farms or number of acres using conservation plans; QHEI and Pfankuch scores; sediment in water samples
Reduce mean sediment loadings from streambank erosion by 25 percent	Maintain or enhance riparian corridors and stream buffers; remove levees; encourage natural flood control; low-impact log-jam removal	Landowners with assistance from watershed coordinator and all partners; educational programs, NRCS programs, land trusts, Clean Ohio, WRRSP, …	2006-2010	QHEI and Pfankuch scores; sediment in water samples
Evaluate habitat quality of Fivemile Creek	Conduct Qualitative Habitat Evaluation Index (QHEI) assessment of each stream	Ohio EPA staff as part of water quality analysis described above; or other qualified evaluator using existing resources	2007-2009	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Fivemile Creek	Conduct physical and morphological assessment of each stream using Rosgen Level III assessment or equivalent	Watershed coordinator and/or other qualified evaluator using existing resources; or Ohio EPA 319 grant or other similar grant	2007-2009	Physical/ morphological assessment completed and reported in technical support document
Inventory 100 percent of riparian corridor along the Fivemile Creek	Using aerial photos and field verification, map width, land use, and vegetation of all riparian corridors	Watershed coordinator or other EFWC partners using existing resources; or Intern project or university class project	2007-2009	GIS riparian corridor database completed and mapped
Provide recommendations for maintaining or re-establishing riparian corridor	Based on riparian inventory, habitat evaluation and morphological assessment, identify best strategies for maintaining or establishing functional stream corridor	Watershed coordinator and EFWC partners	2007-2009	List of recommendations for each segment of listed streams
Assess and identify potential bacterial inputs of sewage from onsite systems; reduce bacterial inputs (e.g., cryptosporidium, E.coli, giardia)	Identify and quantify failing/improper (HSTS); repair or replace failing systems	Watershed coordinator, EFWC partners, Brown and Clermont County Health Departments; Ohio EPA 319 grant or other similar grant	2007-2009	Identify, repair or replace failing systems. Improve home owner awareness about sewage treatment cost and responsibilities

HUC-14: 05090202-110-020

Pleasant Run
OEPA Stream Code: 11-137
Drainage Area: 6.8 mi^2
Use Designation: WWH

Background

Pleasant Run [HUC-14: 05090202-110-020; OEPA Stream Code: 11-137], a tributary to the East Fork Little Miami River (EFLMR) is not fully meeting is water quality use designation. Of this 5.3 mile stream, 1.9 miles partially support the aquatic life use designation while the remaining 3.4 miles are not attaining the aquatic life use designation. The CECOS landfill is located along Pleasant Run. This assessment unit is dominated by row crop agriculture with some livestock production.

Problem Statement

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that upstream from the CECOS landfill there was significant non-attainment with poor/very poor biological communities. Though intermittent stream flow conditions were present, high bacteria and ammonia levels along with low DO further degraded the communities. Organic enrichment, flow alteration, and unionized ammonia were resulting in impaired use attainment. Failing onsite wastewater systems (HSTS) and non-irrigated crop production were noted as the sources of impairment. No observable impact was observed from the CECOS landfill. CECOS represents a substantial risk to surface water due to large amounts of hazardous waste buried at the site and leachate generated.

The LSPC model predicts existing nitrogen and phosphorous loads at 108 tons per year and 20 tons per year. A 68% reduction in nitrogen is needed to meet allowable loadings and a 60% reduction is needed for phosphorous.

The LSPC model predicts existing total suspended solids (TSS) at 4944 tons per year. A 48% reduction is needed to meet allowable loads for TSS.

Goals

1. Evaluate habitat quality of Pleasant Run.
2. Evaluate morphological status and stream stability of Pleasant Run.
3. Reduce BOD & nutrient loadings from HSTS systems by 50 percent.
4. Reduce sediment loadings from streambank erosion by 25 percent.
5. Inventory 100 percent of riparian corridor along Pleasant Run; provide recommendations for maintaining or re-establishing riparian corridor.
6. Establish ongoing surface water monitoring for CECOS drainage
7. Meet WWH aquatic life use designation in Pleasant Run.

Objective	Action	Resources	Time Frame	Performance Indicators
Evaluate habitat quality of Pleasant Run	Conduct Qualitative Habitat Evaluation Index (QHEI) assessment of each stream	Ohio EPA staff as part of water quality analysis described above; or other qualified evaluator using existing resources	2007-2009	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Pleasant Run	Conduct physical and morphological assessment of each stream using Rosgen Level III assessment or equivalent	Watershed coordinator and/ or other qualified evaluator using existing resources; or Ohio EPA 319 grant or other similar grant	2007-2009	Morphological assessment completed and reported in technical support document
Reduce BOD and nutrient loadings from HSTS by 50 percent	Develop an effective homeowner education program	Clermont County health district, watershed coordinator and partners; 319 grant	2006-2010	Educational materials for homeowners, realtors, developers
	Repair or replace failing HSTS	Homeowners using existing resources, low-interest loans or cost-share funds; 319 grant	2006-2010	100% properly functioning systems
Reduce mean sediment loadings from streambank erosion by 25 percent	Maintain or enhance riparian corridors and stream buffers; remove levees; encourage natural flood control; low-impact logjam removal	Landowners with assistance from watershed coordinator and all partners; educational programs, NRCS programs, land trusts, Clean Ohio, WRRSP, …	2006-2010	QHEI and Pfankuch scores; sediment in water samples
Inventory 100 percent of riparian corridor along the Pleasant Run	Using aerial photos and field verification, map width, land use, and vegetation of all riparian corridors	Watershed coordinator or other EFWC partners using existing resources; or Intern project or university class project	2007-2009	GIS riparian corridor database completed and mapped
Provide recommendations for maintaining or re-establishing riparian corridor	Based on riparian inventory, habitat evaluation and morphological assessment, identify best strategies for maintaining or establishing functional stream corridor	Watershed coordinator and EFWC partners	2007-2009	List of recommendations for each segment of listed streams
Monitor surface water drainage from CECOS	Conduct regular or event related monitoring of CECOS surface water runoff	CECOS, Ohio EPA, Office of Environmental Quality (OEQ)	2007 ongoing	Compliance with Ohio EPA NPDES Permit with supplemental monitoring by Clermont OEQ

HUC-14: 05090202-110-030

Todd Run
OEPA Stream Code: 11-133
Drainage Area: 9.7 mi^2
Use Designation: WWH

Background

Todd Run [HUC-14: 05090202-110-030; OEPA Stream Code: 11-133], a tributary to the East Fork Little Miami River (EFLMR) is not fully meeting its water quality use designation. Of this 3.6 mile stream, 2 miles partially support the aquatic life use designation while the remaining 1.6 miles have not been assessed. This assessment unit is dominated by row crop agriculture with some livestock production.

Problem Statement

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that partial attainment was due to a fair fish community collected in 1998. Macroinvertebrate communities were marginally good in 1997. The cause and source of impairment is unknown, although it did not appear to be habitat related.

The LSPC model estimates existing nitrogen and phosphorous loads at 256 tons per year and 53 tons per year. A 53% reduction in nitrogen is needed to meet allowable loadings and a 49% reduction is needed for phosphorous.

The LSPC model predicts existing total suspended solids (TSS) at 13,189 tons per year. A 40% reduction is needed to meet allowable loads for TSS.

Goals

1. Evaluate habitat quality of Todd Run.
2. Evaluate morphological status and stream stability of Todd Run.
3. Inventory 100 percent of riparian corridor along Todd Run; provide recommendations for maintaining or re-establishing riparian corridor.
4. Meet WWH aquatic life use designation in Todd Run.

Objective	Action	Resources	Time Frame	Performance Indicators
Evaluate habitat quality of Todd Run	Conduct Qualitative Habitat Evaluation Index (QHEI) assessment of each stream	Ohio EPA staff as part of water quality analysis described above; or watershed coordinator or other qualified evaluator using existing resources	2007-2009	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Todd Run	Conduct physical and morphological assessment of each stream using Rosgen Level III assessment or equivalent	Watershed coordinator and/or other qualified evaluator using existing resources; or Ohio EPA 319 grant or other similar grant	2007-2009	Physical/ morphological assessment completed and reported in technical support document
Inventory 100 percent of riparian corridor along Todd Run	Using aerial photos and field verification, map width, land use, and vegetation of all riparian corridors	Watershed coordinator or other EFWC partners using existing resources; or Intern project or university class project	2007-2009	GIS riparian corridor database completed and mapped
Provide recommendations for maintaining or re-establishing riparian corridor	Based on riparian inventory, habitat evaluation and morphological assessment, identify best strategies for maintaining or establishing functional stream corridor	Watershed coordinator and EFWC partners	2007-2009	List of recommendations for each segment of listed streams

HUC-14: 05090202-110-030

Kain Run
OEPA Stream Code: 11-132
Drainage Area: 6 mi^2
Use Designation: WWH

Background

Kain Run [HUC-14: 05090202-110-030; OEPA Stream Code: 11-132], a tributary to the East Fork Little Miami River (EFLMR), is in non-attainment of its warmwater habitat (WWH) aquatic life use designation. This assessment unit is dominated by row crop agriculture with some livestock production, however land use changes due to population growth and development is expected within the next twenty years.

Problem Statement

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that high nutrient levels from non-irrigated crop production were resulting in impaired use attainment. It was also noted that the biological performance may be related to low stream flows. Home Sewage Treatment Systems (HSTS) may also be contributing to nutrient loading.

The LSPC model predicts that the total suspended sediment (TSS) load for the assessment unit is 9,789 tons per year. A 47% reduction in TSS is needed to meet allowable loadings. The LSPC model predicted existing nitrogen and phosphorous loads at 116 tons per year and 41 tons per year. A 54% reduction in nitrogen is needed to meet allowable loadings and a 56% reduction is needed for phosphorous.

Goals

1. Evaluate habitat quality of Kain Run.
2. Evaluate morphological status and stream stability of Kain Run.
3. Reduce BOD & nutrient loadings from HSTS by 50 percent.
4. Reduce sediment loading from row crop agriculture by 50 percent.
5. Reduce sediment loading from streambank erosion by 25 percent.
6. Inventory 100 percent of riparian corridor along Kain Run; provide recommendations for maintaining or re-establishing riparian corridor.
7. Meet WWH aquatic life use designation in Kain Run.

Objective	Action	Resources	Time Frame	Performance Indicators
Evaluate habitat quality of Kain Run	Conduct Qualitative Habitat Evaluation Index (QHEI) assessment of each stream	Ohio EPA staff as part of water quality analysis described above; or watershed coordinator or other qualified evaluator using existing resources	2007-2009	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Kain Run	Conduct physical and morphological assessment of each stream using Rosgen Level III assessment or equivalent	Watershed coordinator and/or other qualified evaluator using existing resources; or Ohio EPA 319 grant or other similar grant	2007-2009	Physical/ morphological assessment completed and reported in technical support document
Reduce BOD and nutrient loadings from HSTS systems by 50 percent	Develop an effective homeowner education program	Clermont County health district, watershed coordinator and partners; 319 grant	2006-2010	Educational materials for homeowners, realtors, developers
	Repair or replace failing HSTS	Homeowners using existing resources, low-interest loans or cost-share funds; 319 grant	2006-2010	100% properly functioning systems
Stabilize and restore segments of Kain Run affected by livestock grazing	Fence livestock out of stream; establish permanent stream buffer	NRCS, FSA: education and promotion programs; incentive programs; grant funding	2006-2010	No livestock in streams
Reduce mean sediment loadings from row crop agriculture by 50 percent	Increase number of farms using conservation plans; implement BMPs—riparian buffers, grassed waterways, conservation tillage	NRCS, FSA, agricultural consultants; education and promotion programs; incentive programs; grant funding	2006-2010	Percent of farms or acres using conservation plans; QHEI and Pfankuch scores; sediment in water samples
Reduce mean sediment loadings from streambank erosion by 25 percent	Maintain or enhance riparian corridors and stream buffers; remove levees; encourage natural flood control; low-impact log-jam removal	Landowners with assistance from watershed coordinator and all partners; educational programs, NRCS programs, land trusts, Clean Ohio, WRRSP, …	2006-2010	QHEI and Pfankuch scores; sediment in water samples
Inventory 100 percent of riparian corridor along the Kain Run	Using aerial photos and field verification, map width, land use, and vegetation of all riparian corridors	Watershed coordinator or other EFWC partners using existing resources; or Intern project or university class project	2007-2009	GIS riparian corridor database completed and mapped
Provide recommendations for maintaining or reestablishing riparian corridor	Based on riparian inventory, habitat evaluation and morphological assessment, identify best strategies for maintaining or establishing functional stream corridor	Watershed coordinator and EFWC partners	2007-2009	List of recommendations for each segment of listed streams

HUC-14: 05090202-120-010

Barnes Run
OEPA Stream Code: 11-122
Drainage Area: 8.4 mi^2
Use Designation: WWH

Background

Barnes Run [HUC-14: 05090202-120-010; OEPA Stream Code: 11-122], a tributary to the East Fork Little Miami River (EFLMR) is in non-attainment concerning of its water quality use designation. Of this 4.4 mile stream, 2 miles is in non-attainment while the remaining 2.4 miles have not been assessed. This assessment unit is dominated by row crop agriculture with some livestock production.

Problem Statement

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that though agricultural land use paired with a narrow riparian corridor led to siltation via bank erosion and runoff, the biological communities performed in the poor range, suggesting an impact beyond siltation. Clermont County data suggests serious bacterial problems associated with land use and failing Home Sewage Treatment Systems (HSTS).

The LSPC model predicts that the total suspended sediment (TSS) load for the assessment unit is 13,489 tons per year. A 57% reduction in TSS is needed to meet allowable loadings. The LSPC model predicted existing nitrogen and phosphorous loads at 158 tons per year and 58 tons per year. A 48% reduction in nitrogen is needed to meet allowable loadings and a 48% reduction is needed for phosphorous.

Goals

1. Evaluate habitat quality of Barnes Run.
2. Evaluate morphological status and stream stability of Barnes Run.
3. Reduce sediment loading from row crop agriculture by 50 percent.
4. Reduce sediment loading from streambank erosion by 25 percent.
5. Identify and assess potential sources of bacterial problems and reduce BOD & nutrient loadings from HSTS.
6. Inventory 100 percent of riparian corridor along Barnes Run; provide recommendations for maintaining or re-establishing riparian corridor.
7. Meet WWH aquatic life use designation in Barnes Run.

Objective	Action	Resources	Time Frame	Performance Indicators
Evaluate habitat quality of Barnes Run	Conduct Qualitative Habitat Evaluation Index (QHEI) assessment of each stream	Ohio EPA staff as part of water quality analysis described above; or watershed coordinator or other qualified evaluator using existing resources	2007-2009	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Barnes Run	Conduct physical and morphological assessment of each stream using Rosgen Level III assessment or equivalent	Watershed coordinator and/or other qualified evaluator using existing resources; or Ohio EPA 319 grant or other similar grant	2007-2009	Physical/ morphological assessment completed and reported in technical support document
Reduce mean sediment loadings from row crop agriculture by 50 percent	Increase number of farms using conservation plans; implement BMPs—riparian buffers, grassed waterways, conservation tillage	NRCS, FSA, agricultural consultants; education and promotion programs; incentive programs; grant funding	2006-2010	Percent of farms or acres using conservation plans; QHEI and Pfankuch scores; sediment in water samples
Reduce mean sediment loadings from streambank erosion by 25 percent	Maintain or enhance riparian corridors and stream buffers; remove levees; encourage natural flood control; low-impact log-jam removal	Landowners with assistance from watershed coordinator and all partners; educational programs, NRCS programs, land trusts, Clean Ohio, WRRSP, …	2006-2010	QHEI and Pfankuch scores; sediment in water samples
Identify and assess potential sources of bacterial problems and reduce BOD & nutrient loadings from HSTS systems.	Identify and quantify failing/improper (HSTS)	Watershed coordinator, EFWC partners, Brown and Clermont County Health districts; Ohio EPA 319 grant or other similar grant	2007-2009	Identify source of bacterial inputs and inventory failing HSTS systems.
	Develop an effective homeowner education program	Clermont & Brown County health districts, watershed coordinator and partners; 319 grant	2006-2010	Educational materials for homeowners, realtors, developers
	Repair or replace failing HSTS	Homeowners using existing resources, low-interest loans or cost-share funds; 319 grant	2006-2010	100% properly functioning systems
Inventory 100 percent of riparian corridor along Barnes Run	Using aerial photos and field verification, map width, land use, and vegetation of all riparian corridors	Watershed coordinator or other EFWC partners using existing resources; or Intern project or university class project	2007-2009	GIS riparian corridor database completed and mapped
Provide recommendations for maintaining or re-establishing riparian corridor	Based on riparian inventory, habitat evaluation and morphological assessment, identify best strategies for maintaining or establishing functional stream corridor	Watershed coordinator and EFWC partners	2007-2009	List of recommendations for each segment of listed streams

HUC-14: 05090202-120-010

Cloverlick Creek
OEPA Stream Code: 11-121
Drainage Area: 42.1 mi^2
Use Designation: WWH

Background

Cloverlick Creek [HUC-14: 05090202-120-010; OEPA Stream Code: 11-121], a tributary to the East Fork Little Miami River (EFLMR) is in partial attainment concerning its Warmwater Habitat (WWH) water quality use designation. Of the 10.6 mile stream, 2 miles is in partial attainment while the remaining 8.6 miles have not been assessed. This assessment unit is dominated by row crop agriculture with some livestock production and horse farms. Cloverlick Creek drains portions of the communities of Hamersville and Bethel; both have Home Sewage Treatment Systems (HSTS). Cloverlick is designated as a Public Water Supply at RM 3.23.

Problem Statement

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that siltation from non-irrigated row crop production was the cause and source of impairment. Until the remaining 8.6 miles of Cloverlick are assessed it will be difficult to know the true status of the stream. Manure management from horse farms and in effective HSTS systems may also add to the impairment.

The LSPC model predicts that the total suspended sediment (TSS) load for the assessment unit is 52,151 tons per year. A 64% reduction in TSS is needed to meet allowable loadings. The LSPC model predicted existing nitrogen and phosphorous loads at 557 tons per year and 216 tons per year. A 52% reduction in nitrogen is needed to meet allowable loadings and a 68% reduction is needed for phosphorous.

Goals

1. Determine use attainment status of remaining 8.6 stream miles of Cloverlick Creek.
2. Evaluate habitat quality of Cloverlick Creek.
3. Evaluate morphological status and stream stability of Cloverlick Creek.
4. Reduce sediment loading from row crop agriculture by 50 percent.
5. Reduce sediment loading from streambank erosion by 25 percent.
6. Identify and assess potential sources of bacterial problems and reduce BOD & nutrient loadings from HSTS.
7. Identify manure management practices at large horse farms in the watershed.
8. Inventory 100 percent of riparian corridor along Cloverlick Creek; provide recommendations for maintaining or re-establishing riparian corridor.
9. Meet WWH aquatic life use designation in Cloverlick Creek.

Objective	Action	Resources	Time Frame	Performance Indicators
Determine use attainment status of remaining 8.6 stream miles of Cloverlick Creek	Conduct Aquatic Life Use assessment of listed streams using Ohio EPA protocols and Ohio EPA Level 3 certified data collectors	Ohio EPA staff, Ohio EPA 319 grant, USEPA grant or similar grant	2008-2012	Use Attainment status determined and reported in technical support document
Evaluate habitat quality of Cloverlick Creek	Conduct Qualitative Habitat Evaluation Index (QHEI) assessment of each stream	Ohio EPA staff as part of water quality analysis described above; or watershed coordinator or other qualified evaluator using existing resources	2007-2009	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Cloverlick Creek	Conduct physical and morphological assessment of each stream using Rosgen Level III assessment or equivalent	Watershed coordinator and/ or other qualified evaluator using existing resources; or Ohio EPA 319 grant or other similar grant	2007-2009	Physical/ morphological assessment completed and reported in technical support document
Reduce mean sediment loadings from row crop agriculture by 50 percent	Increase number of farms using conservation plans; implement BMPs—riparian buffers, grassed waterways, conservation tillage	NRCS, FSA, agricultural consultants; education and promotion programs; incentive programs; grant funding	2006-2010	Percent of farms or acres using conservation plans; QHEI and Pfankuch scores; sediment in water samples
Reduce mean sediment loadings from streambank erosion by 25 percent	Maintain or enhance riparian corridors and stream buffers; remove levees; encourage natural flood control; low-impact log-jam removal	Landowners with assistance from watershed coordinator and all partners; educational programs, NRCS programs, land trusts, Clean Ohio, WRRSP, …	2006-2010	QHEI and Pfankuch scores; sediment in water samples
Identify and assess potential sources of bacterial problems and reduce BOD & nutrient loadings from HSTS.	Identify and quantify failing/ improper (HSTS)	Watershed coordinator, EFWC partners, Brown and Clermont County Health Departments; Ohio EPA 319 grant or other similar grant	2007-2009	Identify source of bacterial inputs and inventory failing HSTS systems.
	Develop an effective homeowner education program	Clermont County health district, watershed coordinator and partners; 319 grant	2006-2010	Educational materials for homeowners, realtors, developers
	Repair or replace failing HSTS	Homeowners using existing resources, low-interest loans or cost-share funds; 319 grant	2006-2010	100% properly functioning systems
Identify large horse farms in the watershed and identify manure management practices of those farms.	Use available data and field checking methods to identify large horse farms and their manure management practices	OSU Extension, Brown & Clermont SWCD's, FSA, NRCS, watershed coordinator	2007-2009	100% inventory of manure management practices at large horse farms in the watershed
Inventory 100 percent of riparian corridor along Cloverlick Creek	Using aerial photos and field verification, map width, land use, and vegetation of all riparian corridors	Watershed coordinator or other EFWC partners using existing resources; or Intern project or university class project	2007-2009	GIS riparian corridor database completed and mapped
Provide recommendations for maintaining or re-establishing riparian corridor	Based on riparian inventory, habitat evaluation and morphological assessment, identify best strategies for maintaining or establishing functional stream corridor	Watershed coordinator and EFWC partners	2007-2009	List of recommendations for each segment of listed streams

HUC-14: 05090202-120-020

Poplar Creek
OEPA Stream Code: 11-123
Drainage Area: 24.9 mi^2
Use Designation: WWH

Background

Poplar Creek a tributary to the East Fork Little Miami River (EFLMR) [HUC 14: 05090202-120-020; 11-123], is meeting its warmwater habitat (WWH) aquatic life use designation. The 3.7 mile segment assessed by Ohio EPA in 1998 is marginally meeting is use designation but is threatened. The remaining 4.4 miles of Poplar Creek have not been assessed. The Village of Bethel is located along Poplar Creek. Cropland is the dominant agricultural land use in this watershed, but residential/other (industrial, commercial) is the dominant land use at 38%; agriculture is second at 36%.

Problem Statement

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that fish and macroinvertebrate communities in this segment were both evaluated and marginally good. Clermont County data notes potential storm sewer overflow problems, though the water quality data revealed little. Organic enrichment from sanitary sewer overflow (SSO) and pathogens (e.g., cryptosporidium, giardia, E.coli) were noted as the causes and source of impairment although SSO have been eliminated large portions of the Bethel area are non-sewered and have HSTS which could be contributing to impairment.

The LSPC model predicts that the total suspended sediment (TSS) load for the assessment unit is 19,358 tons per year. A 37% reduction in TSS is needed to meet allowable loadings. The LSPC model predicted existing nitrogen and phosphorous loads at 250 tons per year and 99 tons per year. A 50% reduction in nitrogen is needed to meet allowable loadings and a 63% reduction is needed for phosphorous.

Goals

1. Evaluate habitat quality of Poplar Creek.
2. Evaluate morphological status and stream stability of Poplar Creek.
3. Reduce sediment loading from row crop agriculture by 50 percent.
4. Reduce sediment loading from streambank erosion by 25 percent.
5. Identify and assess potential sources of bacterial problems and reduce BOD & nutrient loadings from HSTS.
6. Inventory 100 percent of riparian corridor along Poplar Creek; provide recommendations for maintaining or re-establishing riparian corridor.
7. Meet WWH aquatic life use designation in Poplar Creek.

Objective	Action	Resources	Time Frame	Performance Indicators
Evaluate habitat quality of entire Poplar Creek	Conduct Qualitative Habitat Evaluation Index (QHEI) assessment of each stream	Ohio EPA staff as part of water quality analysis described above; or watershed coordinator or other qualified evaluator using existing resources	2007-2009	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Poplar Creek	Conduct physical and morphological assessment of each stream using Rosgen Level III assessment or equivalent	Watershed coordinator and/or other qualified evaluator using existing resources; or Ohio EPA 319 grant or other similar grant	2007-2009	Physical/ morphological assessment completed and reported in technical support document
Reduce mean sediment loadings from row crop agriculture by 50 percent	Increase number of farms using conservation plans; implement BMPs—riparian buffers, grassed waterways, conservation tillage	NRCS, FSA, agricultural consultants; education and promotion programs; incentive programs; grant funding	2006-2010	Percent of farms or acres using conservation plans; QHEI and Pfankuch scores; sediment in water samples
Reduce mean sediment loadings from streambank erosion by 25 percent	Maintain or enhance riparian corridors and stream buffers; remove levees; encourage natural flood control; low-impact log-jam removal	Landowners with assistance from watershed coordinator and all partners; educational programs, NRCS programs, land trusts, Clean Ohio, WRRSP, …	2006-2010	QHEI and Pfankuch scores; sediment in water samples
Identify and assess potential sources of bacterial problems and reduce BOD & nutrient loadings from HSTS systems.	Identify and quantify failing/ improper (HSTS)	Watershed coordinator, EFWC partners, Brown and Clermont County Health Districts; Ohio EPA 319 grant or other similar grant	2007-2009	Identify source of bacterial inputs and inventory failing HSTS systems.
	Develop an effective homeowner education program	Clermont County health department, watershed coordinator and partners; 319 grant	2006-2010	Educational materials for homeowners, realtors, developers
	Repair or replace failing HSTS	Homeowners using existing resources, low-interest loans or cost-share funds; 319 grant	2006-2010	100% properly functioning systems
Inventory 100 percent of riparian corridor along Poplar Creek	Using aerial photos and field verification, map width, land use, and vegetation of all riparian corridors	Watershed coordinator or other EFWC partners using existing resources; or Intern project or university class project	2007-2009	GIS riparian corridor database completed and mapped
Provide recommendations for maintaining or re-establishing riparian corridor	Based on riparian inventory, habitat evaluation and morphological assessment, identify best strategies for maintaining or establishing functional stream corridor	Watershed coordinator and EFWC partners	2007-2009	List of recommendations for each segment of listed streams

HUC-14: 05090202-120-030

Cabin Run
OEPA Stream Code: 11-131
Use Designation: WWH

Background

Cabin Run [HUC-14: 05090202-120-030; OEPA Stream Code: 11-131], a tributary to the East Fork Little Miami River (EFLMR) is in full attainment of its Warmwater Habitat (WWH) water quality use designation. The entire 2 mile stream is meeting its water quality use designation. This is a small, good quality stream, with most of its drainage within the East Fork State Park. The region is dominated by forest land cover (48%) and residential/other land use (43%) with only 10% of the land in agriculture. It should be noted, however, that the headwaters of Cabin Run is located in a commercial and residential developed landscape and begin at a large manufacturing facility.

Problem Statement

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that some bacterial spikes suggest sewage inputs, probably from Home Sewage Treatment Systems (HSTS). Due to the location of commercial and residential development at the headwaters of Cabin Run it will be important for future monitoring and assessment of Cabin Run.

The LSPC model predicts that the total suspended sediment (TSS) load for the assessment unit is 809 tons per year. No reductions are needed in TSS, allowable loadings are being met. The LSPC model predicted existing nitrogen and phosphorous loads at 11 tons per year and 4 tons per year. No reductions are needed in nitrogen and phosphorous, allowable loadings are being met.

Goals

1. Evaluate habitat quality of Cabin Run.
2. Evaluate morphological status and stream stability of Cabin Run.
3. Identify and assess potential sources of bacterial problems and reduce BOD & nutrient loadings from HSTS systems.
4. Inventory 100 percent of riparian corridor along Cabin Run; provide recommendations for maintaining or re-establishing riparian corridor.
5. Continue to meet WWH aquatic life use designation in Cabin Run.

Objective	Action	Resources	Time Frame	Performance Indicators
Evaluate habitat quality of Cabin Run	Conduct Qualitative Habitat Evaluation Index (QHEI) assessment of each stream	Ohio EPA staff as part of water quality analysis described above; or watershed coordinator or other qualified evaluator using existing resources	2007-2009	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Cabin Run	Conduct physical and morphological assessment of each stream using Rosgen Level III assessment or equivalent	Watershed coordinator and/or other qualified evaluator using existing resources; or Ohio EPA 319 grant or other similar grant	2006-2009	Physical/ morphological assessment completed and reported in technical support document
Identify and assess potential sources of bacterial problems and reduce BOD & nutrient loadings from HSTS systems.	Identify and quantify failing/ improper (HSTS)	Watershed coordinator, EFWC partners, Brown and Clermont County Health Districts; Ohio EPA 319 grant or other similar grant	2007-2009	Identify source of bacterial inputs and inventory failing HSTS systems.
	Develop an effective homeowner education program	Clermont County Health District, watershed coordinator and partners; 319 grant	2006-2010	Educational materials for homeowners, realtors, developers
	Repair or replace failing HSTS systems	Homeowners using existing resources, low-interest loans or cost-share funds; 319 grant	2006-2010	100% properly functioning systems
Inventory 100 percent of riparian corridor along Cabin Run	Using aerial photos and field verification, map width, land use, and vegetation of all riparian corridors	Watershed coordinator or other EFWC partners using existing resources; or Intern project or university class project	2007-2009	GIS riparian corridor database completed and mapped
Provide recommendations for maintaining or re-establishing riparian corridor	Based on riparian inventory, habitat evaluation and morphological assessment, identify best strategies for maintaining or establishing functional stream corridor	Watershed coordinator and EFWC partners	2007-2009	List of recommendations for each segment of listed streams

HUC-14: 05090202-120-030

Slabcamp Run
OEPA Stream Code: 11-120
Use Designation: WWH

Background

Slabcamp Run [HUC-14: 05090202-120-030; OEPA Stream Code: 11-120], a tributary to the East Fork Little Miami River (EFLMR) is not meeting its Warmwater Habitat (WWH) water quality use designation. Of the 5.2 mile stream, 2 miles were not meeting attainment; the remaining 3.2 miles have not been assessed. The region is dominated by forest land cover (48%) and residential/other land use (43%) with only 10% of the land in agriculture. The headwaters of Slabcamp Run is located in a commercial and residential developed landscape. The headwaters are greatly influenced by a large industrial manufacturing facility, rail lines, and multi-lane roads. Slabcamp Run enters Harsha Lake directly above the Bob McEwen Water Treatment Plant intake. This area is a part of the Emergency Management Zone located within the Drinking Water Source Protection Area.

Problem Statement

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that this stream had intermittent flow conditions. Elevated nutrients and high bacterial counts were recorded, indicating additional stress and degradation. The probable cause was failing residential onsite sewage systems. The fish and macroinvertebrate communities were both rated poor. Because of the commercial and residential developed located at the headwaters of Slabcamp it will be important to continue monitoring and assessment of Slabcamp Run.

The LSPC model predicts that the total suspended sediment (TSS) load for the assessment unit is 656 tons per year. No reductions in TSS are needed, allowable loadings are being met. The LSPC model predicted existing nitrogen and phosphorous loads at 9 tons per year and 3 tons per year. No reductions are needed in nitrogen and phosphorous, allowable loadings are being met. LSPC model predictions for Slabcamp do not match with suggested impairments observed by OEPA during 1997 field assessments. This is likely due to failing residential onsite sewage systems which are not modeled with LSPC.

Goals

1. Evaluate habitat quality of Slabcamp Run.
2. Evaluate morphological status and stream stability of Slabcamp Run.
3. Identify and assess potential sources of bacterial problems and reduce BOD & nutrient loadings from HSTS systems.
4. Monitor stormwater runoff at Slabcamp Run headwaters.
5. Establish monitoring program for Slabcamp Run.
6. Inventory 100 percent of riparian corridor along Slabcamp Run; provide recommendations for maintaining or re-establishing riparian corridor.
7. Meet WWH aquatic life use designation in Slabcamp Run.

Objective	Action	Resources	Time Frame	Performance Indicators
Evaluate habitat quality of Slabcamp Run	Conduct Qualitative Habitat Evaluation Index (QHEI) assessment of each stream	Ohio EPA staff as part of water quality analysis described above; or watershed coordinator or other qualified evaluator using existing resources	2007-2009	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Slabcamp Run	Conduct physical and morphological assessment of each stream using Rosgen Level III assessment or equivalent	Watershed coordinator and/ or other qualified evaluator using existing resources; or Ohio EPA 319 grant or other similar grant	2007-2009	Physical/ morphological assessment completed and reported in technical support document
Identify and assess potential sources of bacterial problems and reduce BOD & nutrient loadings from HSTS systems.	Identify and quantify failing/ improper (HSTS)	Watershed coordinator, EFWC partners, Clermont County Health Districts; Ohio EPA 319 grant or other similar grant	2007-2009	Identify source of bacterial inputs and inventory failing HSTS systems.
	Develop an effective homeowner education program	Clermont County Health District, watershed coordinator and partners; 319 grant	2006-2010	Educational materials for homeowners, realtors, developers
	Repair or replace failing HSTS systems	Homeowners using existing resources, low-interest loans or cost-share funds; 319 grant	2006-2010	100% properly functioning systems
Monitor Stormwater runoff at Slabcamp Run headwaters	Assess impervious surface coverage in Slabcamp Run watershed	Clermont County Stormwater department, watershed coordinator, Office of Environmental Quality (OEQ)	2007-2009	100% assessment of impervious surface coverage in Slabcamp Run watershed
	Inventory stormwater conveyances (e.g., stormwater drains, ditches) using GIS software and available data	Clermont County Stormwater department, watershed coordinator, OEQ	2007-2009	100% inventory of stormwater conveyances in Slabcamp Run watershed
	Develop an effective stormwater education program concerning stormwater conveyances, retention and detention	Clermont County Stormwater department, watershed coordinator, Clermont SWCD	2007-2009	Creation and distribution of fliers/ information concerning effective stormwater practices
Establish monitoring program for Slabcamp Run	Develop a monitoring plan and protocol for Slabcamp Run	Clermont OEQ, Water & Sewer District, Watershed Coordinator, Ohio EPA	2007-2009	Development of Slabcamp Monitoring Program; collection of monitoring data
Inventory 100 percent of riparian corridor along Slabcamp Run	Using aerial photos and field verification, map width, land use, and vegetation of all riparian corridors	Watershed coordinator or other EFWC partners using existing resources; or Intern project or university class project	2007-2009	GIS riparian corridor database completed and mapped
Provide recommendations for maintaining or re-establishing riparian corridor	Based on riparian inventory, habitat evaluation and morphological assessment, identify best strategies for maintaining or establishing functional stream corridor	Watershed coordinator and EFWC partners	2007-2009	List of recommendations for each segment of listed streams

HUC-14: 05090202-110-030 and 120-030

East Fork Little Miami River Mainstem (from Todd Run to Harsha Dam, including Harsha Lake)
OEPA Stream Code: 11-100
Drainage Area: 148 mi^2
Use Designation: EWH

Background

According to Ohio EPA, the East Fork Little Miami River [HUC 14: 05090202-110-030 & 120-030; Ohio EPA Stream Code: 11-100], from its confluence with Todd Run at river mile 33.9. to Harsha Dam at river mile 20.5, is not fully meeting its water quality use designation. Of this 13.4 mile river segment, 3.5 miles (26%) is partially meeting its aquatic life use designation. The remaining 9.9 miles have not been assessed. Most of this segment consists of Harsha Lake (also called East Fork Lake).

Problem Statement

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that the upper 3.5 miles of the segment are free-flowing, but may become inundated during high flow events. Partial attainment was recorded due to the fish community being only marginally good. Impacts are most likely due to periodic flow modification.

The primary source of nutrients is from row crop agricultural production. Other sources include failing HSTS systems and livestock agriculture. Because of the effect of Harsha Lake (i.e., settling and algal uptake) it is difficult to model total loadings for this section of the East Fork mainstem. A lake model will need to be performed in order to truly capture existing loads and to determine allowable loadings into Harsha Lake.

Using the LSPC model, the total nitrogen and phosphorus loads for this section of the East Fork mainstem are estimated to be 4,777 and 1,470 tons per year, respectively. Based on existing and allowable load results from modeled streams in the Lake Tributaries watershed it is estimating that a 50% reduction in nitrogen and phosphorous is needed to meet Ohio EPA allowable loads.

The LSPC model predicts that the total sediment load for this section of the East Fork mainstem is 367,617 tons per year. The primary sources of sediment are row crop agriculture, pasture and urban/ residential stormwater runoff from developed areas.. Based on loadings results entering Harsha Lake a 50% reduction in Total Suspended Solids (TSS) is needed to reach allowable load limits.

Goals

1. Reduce mean nutrient loadings from row crop agriculture by 20 percent.
2. Reduce nutrients loading from livestock agriculture by 20 percent.
3. Reduce nutrient loading from HSTS systems by 50 percent.
4. Reduce sediment loading from row crop agriculture by 50 percent.
5. Reduce sediment from streambank erosion by 50 percent.
6. Evaluate morphological status and stream stability of the East Fork Little Miami River.
7. Inventory 100 percent of riparian corridor along the East Fork Little Miami River; provide recommendations for maintaining or re-establishing riparian corridor.
8. Permanently protect 25% of the riparian corridor between RM 45.2 and RM 56.5 through land purchase or conservation easement.
9. Meet EWH use support in the mainstem of the East Fork.

Objective	Action	Resources	Time Frame	Performance Indicators
Reduce mean nutrient loadings from row crop agriculture by 20 percent	Increase number of farms using nutrient management plans; implement BMPs—riparian buffers, grassed waterways, conservation tillage	NRCS, FSA, agricultural consultants; education and promotion programs; incentive programs; grant funding	2006-2010	Percent of farms or number of acres using CNMPs
Reduce mean nutrient loadings from livestock agriculture by 20 percent	Increase number of farms using nutrient management plans; fence livestock out of streams	NRCS, FSA, agricultural consultants; education and promotion programs; incentive programs; grant funding	2006-2010	Percent of farms or number of acres using CNMPs; no livestock in streams
Reduce mean nutrient loadings from HSTS systems by 50 percent	Develop an effective homeowner education program	County health departments, watershed coordinator and partners	2006-2010	Educational materials for homeowners, realtors, developers
	Repair or replace failing HSTS systems	Homeowners using existing resources, low-interest loans or cost-share funds	2006-2010	100% properly functioning systems
	Develop an effective Health District HSTS inspection program for Brown, Clinton, and Highland Counties	County health districts	2006-2010	County HSTS inspection program in place in each county
Reduce mean sediment loadings from row crop agriculture by 50 percent	Increase number of farms using conservation plans; implement BMPs—riparian buffers, grassed waterways, conservation tillage	NRCS, FSA, agricultural consultants; education and promotion programs; incentive programs; grant funding	2006-2010	Percent of farms or # of acres using conservation plans; QHEI and Pfankuch scores; sediment in water samples
Reduce mean sediment loadings from streambank erosion by 50 percent	Maintain or enhance riparian corridors and stream buffers; remove levees; encourage natural flood control; low-impact log-jam removal	Landowners with assistance from watershed coordinator and all partners; educational programs, NRCS programs, land trusts, Clean Ohio, WRRSP, …	2006-2010	QHEI and Pfankuch scores; sediment in water samples
Evaluate morphological status and stream stability of the East Fork Little Miami River	Conduct physical and morphological assessment of each stream using Rosgen Level III assessment or equivalent	Watershed coordinator and/or other qualified evaluator using existing resources; or Ohio EPA 319 grant or other similar grant	2007-2009	Morphological assessment completed and reported in technical support document
Inventory 100 percent of riparian corridor along the East Fork Little Miami River	Using aerial photos and field verification, map width, land use, and vegetation of all riparian corridors	Watershed coordinator or other EFWC partners using existing resources; or Intern project or university class project	2007-2009	GIS riparian corridor database completed and mapped
Provide recommendations for maintaining or re-establishing riparian corridor	Based on riparian inventory, habitat evaluation and morphological assessment, identify best strategies for maintaining or establishing functional stream corridor	Watershed coordinator and EFWC partners	2007-2009	List of recommendations for each segment of listed streams
Permanently protect 25% of the riparian corridor between RM 33.9 and RM 20.5 through land purchase or conservation easement	Use all available programs to permanently protect riparian corridors through setbacks, conservation easements and land purchase	Landowners with assistance from watershed coordinator and all partners; educational programs, NRCS programs, land trusts, Clean Ohio, WRRSP, …	2006-2010	Width of corridors; miles or percentage of riparian corridors permanently protected

HUC-14: 05090202-120-030

Ulrey Run
OEPA Stream Code: 11-119
Drainage Area: 4 mi^2
Use Designation: WWH

Background

Ulrey Run [HUC 14: 05090202-120-030; Ohio EPA Stream Code: 11-119], a tributary of the East Fork Little Miami River, is in full but threatened attainment of its Warmwater Habitat water quality use designation. Of the 3.85 mile stream, 2.6 miles is meeting full but threatened attainment; the remaining 1.25 miles have not been assessed. Ulrey Run flows directly into Harsha Lake. This area is primarily forested and residential/commercial.

Problem Statement

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that the macroinvertebrate community was marginally good, while the fish community was rated good. Clermont County data revealed significant bacterial exceedences, most likely caused by failing residential onsite sewage systems.

The LSPC model predicts that the total suspended sediment (TSS) load for the assessment unit is 2,417 tons per year. A 30% reduction in TSS is needed to meet allowable loadings. The LSPC model predicted existing nitrogen and phosphorous loads at 39 tons per year and 12 tons per year. A 56% reduction in nitrogen is needed to meet allowable loadings and a 58% reduction is needed for phosphorous.

Goals

1. Evaluate habitat quality of Ulrey Run.
2. Evaluate morphological status and stream stability of Ulrey Run.
3. Identify and assess potential sources of bacterial problems and reduce BOD & nutrient loadings from HSTS systems by 50%.
4. Inventory 100 percent of riparian corridor along Ulrey Run; provide recommendations for maintaining or re-establishing riparian corridor.
5. Meet WWH aquatic life use designation in Ulrey Run.

Objective	Action	Resources	Time Frame	Performance Indicators
Evaluate habitat quality of Ulrey Run	Conduct Qualitative Habitat Evaluation Index (QHEI) assessment of each stream	Ohio EPA staff as part of water quality analysis described above; or watershed coordinator or other qualified evaluator using existing resources	2007-2009	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Ulrey Run	Conduct physical and morphological assessment of each stream using Rosgen Level III assessment or equivalent	Watershed coordinator and/or other qualified evaluator using existing resources; or Ohio EPA 319 grant or other similar grant	2007-2009	Physical/ morphological assessment completed and reported in technical support document
Identify and assess potential sources of bacterial problems and reduce BOD & nutrient loadings from HSTS systems.	Identify and quantify failing/improper (HSTS)	Watershed coordinator, EFWC partners, Brown and Clermont County Health Departments; Ohio EPA 319 grant or other similar grant	2007-2009	Identify source of bacterial inputs and inventory failing HSTS systems.
	Develop an effective homeowner education program	Clermont County health department, watershed coordinator and partners; 319 grant	2006-2010	Educational materials for homeowners, realtors, developers
	Repair or replace failing HSTS systems	Homeowners using existing resources, low-interest loans or cost-share funds; 319 grant	2006-2010	100% properly functioning systems; reduce BOD & nutrient loadings from on-site septic systems by 50%.
Inventory 100 percent of riparian corridor along Ulrey Run	Using aerial photos and field verification, map width, land use, and vegetation of all riparian corridors	Watershed coordinator or other EFWC partners using existing resources; or Intern project or university class project	2007-2009	GIS riparian corridor database completed and mapped
Provide recommendations for maintaining or re-establishing riparian corridor	Based on riparian inventory, habitat evaluation and morphological assessment, identify best strategies for maintaining or establishing functional stream corridor	Watershed coordinator and EFWC partners	2007-2009	List of recommendations for each segment of listed streams

HUC-14: 05090202-120-020

Sugartree Creek
OEPA Stream Code: 11-124
Drainage Area: 4.3 mi^2
Use Designation: WWH

Town Run
OEPA Stream Code: 11-125
Drainage Area: 2.8 mi^2
Use Designation: WWH

Guest Run
OEPA Stream Code: 11-126
Drainage Area: 1.7 mi^2
Use Designation: WWH

HUC-14: 0509202-120-030

Back Run
OEPA Stream Code: 11-118
Drainage Area: 3.4 mi^2
Use Designation: WWH

Background

Sugartree Creek, Town Run, and Guest Run are tributaries of Poplar Creek and are located in HUC-14: 05090202-120-020. None of these streams have been assessed by either the OEPA or by Clermont County. The Village of Bethel is located in this watershed. Cropland is the dominant agricultural land use in the watershed, but residential/other (industrial, commercial) is the dominant land use at 38%; agriculture is second at 36%.

Back Run drains directly into Harsha Lake and is located in HUC-14: 05090202-120-030. Back Run has not been assessed.

Problem Statement

The water quality of Sugartree Creek, Town Run, Guest Run, and Back Run has not been assessed, so it is unknown if they meet their Warmwater Habitat (WWH) use designation.

The LSPC model predicts that the total suspended sediment (TSS) load for Sugartree Creek, Town Run, and Guest Run each need to be reduced by 36% to meet OEPA allowable loads. Back run is meeting allowable loads for TSS and does not require reductions, according to the LSPC model. The LSPC model predicted that existing nitrogen and phosphorous loads need to be reduced in each stream (Sugartree Creek, Town Run, Guest Run, and Back Run) by 50% to meet OEPA allowable loads.

Without Ohio EPA biological assessment data it is difficult to measure the accuracy of the LSPC model loadings and to determine the most effective implementation actions for these streams.

Goals

1. Determine use attainment status of Sugartree Creek, Town Run, Guest Run, and Back Run.
2. Evaluate habitat quality of Sugartree Creek, Town Run, Guest Run, and Back Run.
3. Evaluate morphological status and stream stability of Sugartree Creek, Town Run, Guest Run, and Back Run.
4. Inventory 100 percent of riparian corridor along Sugartree Creek, Town Run, Guest Run, and Back Run; provide recommendations for maintaining or re-establishing riparian corridor.
5. Meet WWH aquatic life use designation in Sugartree Creek, Town Run, Guest Run, and Back Run.

Objective	Action	Resources	Time Frame	Performance Indicators
Determine use attainment status of Sugartree Creek, Town Run, Guest Run, and Back Run	Conduct Aquatic Life Use assessment of listed streams using Ohio EPA protocols and Ohio EPA Level 3 certified data collectors	Ohio EPA staff, Ohio EPA 319 grant, USEPA grant or similar grant	2008-2012	Use Attainment status determined and reported in technical support document
Evaluate habitat quality of Sugartree Creek, Town Run, Guest Run, and Back Run	Conduct Qualitative Habitat Evaluation Index (QHEI) assessment of each stream	Ohio EPA staff as part of water quality analysis described above; or watershed coordinator or other qualified evaluator using existing resources	2007-2009	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Sugartree Creek, Town Run, Guest Run, and Back Run	Conduct physical and morphological assessment of each stream using Rosgen Level III assessment or equivalent	Watershed coordinator and/or other qualified evaluator using existing resources; or Ohio EPA 319 grant or other similar grant	2007-2009	Physical/ morphological assessment completed and reported in technical support document
Inventory 100 percent of riparian corridor along Sugartree Creek, Town Run, Guest Run, and Back Run	Using aerial photos and field verification, map width, land use, and vegetation of all riparian corridors	Watershed coordinator or other EFWC partners using existing resources; or Intern project or university class project	2007-2009	GIS riparian corridor database completed and mapped
Provide recommendations for maintaining or re-establishing riparian corridor	Based on riparian inventory, habitat evaluation and morphological assessment, identify best strategies for maintaining or establishing functional stream corridor	Watershed coordinator and EFWC partners	2007-2009	List of recommendations for each segment of listed streams

HUC-14: 05090202-110-020

Fourmile Creek
OEPA Stream Code: 11-136
Drainage Area: 6.1 mi^2
Use Designation: WWH

Crane Run
OEPA Stream Code: 11-135
Drainage Area: 9.1 mi^2
Use Designation: WWH

HUC-14: 0509202-120-010

Polecat Run
OEPA Stream Code: 11-130
Drainage Area: 3.6 mi^2
Use Designation: WWH

Trible Run
OEPA Stream Code: 11-127
Drainage Area: 1.2 mi^2
Use Designation: WWH

Light Run
OEPA Stream Code: 11-128
Drainage Area: 4.9 mi^2
Use Designation: WWH

Background

Fourmile Creek and Crane Run are located in HUC-14: 05090202-110-020 and have not been assessed. Both of these streams flow directly into the East Fork Little Miami River. Row crop agricultural is the dominant land use in the region.

Polecat Run, Trible Run, and Light Run are tributaries of Cloverlick Creek [HUC-14: 05090202-120-010] and have not assessed. This assessment unit is dominated by row crop agriculture with some live-stock production.

Problem Statement

The water quality of Fourmile Creek, Crane Run, Polecat Run, Trible Run, and Light Run has not been assessed, so it is unknown if they meet their Warmwater Habitat (WWH) use designation.

The LSPC model predicts that the total suspended sediment (TSS) loadings for Fourmile Creek needs to be reduced by 40%; Crane Run 29%; Polecat Run 73%; Trible Run 32%; and Light Run 37%. to meet OEPA allowable loads. The LSPC model predicted that existing nitrogen and phosphorous loads need to be reduced in Fourmile Creek, Polecat Run, Trible Run, and Light Run by 50% to meet OEPA allow-able loads. According to the LSPC model nitrogen loads need to be reduced in Crane Run by 77% and phosphorous needs to be reduced by 18% to meet OEPA allowable loads. The source of Crane Run's high nitrogen is unknown, however is likely connected to row crop agriculture.

Without Ohio EPA biological assessment data it is difficult to measure the accuracy of the LSPC model loadings and to determine the most effective implementation actions for these streams.

Goals

1. Determine use attainment status of Fourmile Creek, Crane Run, Polecat Run, Trible Run, and Light Run.
2. Evaluate habitat quality of Fourmile Creek, Crane Run, Polecat Run, Trible Run, and Light Run.
3. Evaluate morphological status and stream stability of Fourmile Creek, Crane Run, Polecat Run, Trible Run, and Light Run.
4. Inventory 100 percent of riparian corridor along Fourmile Creek, Crane Run, Polecat Run, Trible Run, and Light Run; provide recommendations for maintaining or re-establishing riparian corridor.
5. Meet WWH aquatic life use designation in Fourmile Creek, Crane Run, Polecat Run, Trible Run, and Light Run.

Objective	Action	Resources	Time Frame	Performance Indicators
Determine use attainment status of Fourmile Creek, Crane Run, Polecat Run, Trible Run, and Light Run	Conduct Aquatic Life Use assessment of listed streams using Ohio EPA protocols and Ohio EPA Level 3 certified data collectors	Ohio EPA staff, Ohio EPA 319 grant, USEPA grant or similar grant	2008-2012	Use Attainment status determined and reported in technical support document
Evaluate habitat quality of Fourmile Creek, Crane Run, Polecat Run, Trible Run, and Light Run	Conduct Qualitative Habitat Evaluation Index (QHEI) assessment of each stream	Ohio EPA staff as part of water quality analysis described above; or watershed coordinator or other qualified evaluator using existing resources	2007-2009	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Fourmile Creek, Crane Run, Polecat Run, Trible Run, and Light Run	Conduct physical and morphological assessment of each stream using Rosgen Level III assessment or equivalent	Watershed coordinator and/or other qualified evaluator using existing resources; or Ohio EPA 319 grant or other similar grant	2007-2009	Physical/ morphological assessment completed and reported in technical support document
Inventory 100 percent of riparian corridor along Fourmile Creek, Crane Run, Polecat Run, Trible Run, and Light Run	Using aerial photos and field verification, map width, land use, and vegetation of all riparian corridors	Watershed coordinator or other EFWC partners using existing resources; or Intern project or university class project	2007-2009	GIS riparian corridor database completed and mapped
Provide recommendations for maintaining or re-establishing riparian corridor	Based on riparian inventory, habitat evaluation and morphological assessment, identify best strategies for maintaining or establishing functional stream corridor	Watershed coordinator and EFWC partners	2007-2009	List of recommendations for each segment of listed streams

East Fork Lake Tributaries Watershed Management Plan

APPENDICES

APPENDIX A: Summary of East Fork Lake Tributaries Planning Activities and Community Input.

APPENDIX B: Summary of Previous and Current Water Quality Efforts in the East Fork Little Miami River Watershed.

APPENDIX C: Drinking Source Water Assessment for the Clermont County Bob McEwen Water Treatment Plant

APPENDIX D: Source Water Protection Maps for Ohio

APPENDIX E: Ground Water Pollution Potential Map for Clermont County

APPENDIX F: East Fork Little Miami River Watershed Chemical Use Analysis and Tillage Practices

APPENDIX G: Analysis of Physical Stream Characteristics in the East Fork Lake Tributaries, Clermont County

APPENDIX A
Summary of East Fork Lake Tributaries Planning Activities and Community Input

East Fork Lake Tributaries Watershed Planning Meetings

11-18-03	East Fork Lake Tributaries Issue Framing Meeting
12-15-03	Wastewater Management Working Group Meeting 1
12-16-03	Land Use & Stormwater Management Working Group Meeting 1
1-12-04	Wastewater Management Working Group Meeting 2
1-20-04	Land Use & Stormwater Management Working Group Meeting 2
2-17-04	Land Use & Stormwater Management Working Group Meeting 3
2-18-04	Wastewater Management Working Group Meeting 3
8-4-04	East Fork Lake Tributaries Goals and Strategies Review Meeting
9-11-06	East Fork Lake Tributaries Watershed Action Plan Review Meeting
9-19-06	East Fork Lake Tributaries Source Water Protection Meeting

East Fork Lake Tributaries Watershed
Issue Framing and Kick-off Meeting

Date/time: November 18, 2003, 5:30-8:30 PM
Location: Williamsburg Township Fire Station

Meeting objectives: (1) to identify water management interests, issues, and concerns within the East Fork Lake Tributaries community; (2) to organize those issues and concerns into a few general areas of interest; (3) to identify who should participate in planning for each area of interest.

East Fork Lake Tributaries Planning Meeting
Invitation List

Representatives of:

Bethel	County Commissioners (Brown, Clermont)
Hamersville	SWCDs (Brown, Clermont)
Williamsburg (Village)	Health Dept (Brown, Clermont)
Brown	Planning Commission/Dept (Brown, Clermont)
Clark Twp	County Engineer (Brown, Clermont)
Pike Twp	OSU Extension (Brown, Clermont)
Sterling Twp	Clermont Co Office of Environmental Quality
Clermont	Clermont Parks & Recreation
Jackson Twp	Clermont Water and Sewer District
Tate Twp	US Army Corps – Harsha Lake
Williamsburg Twp	Rural Developers/Rural Real Estate
East Fork State Park	CECOS/BFI
Ohio DNR	Little Miami, Inc.
Ohio EPA	Farm Bureau
NRCS	Southern Ohio Farmland Preservation Assn

East Fork Watershed Collaborative

- Protecting & Enhancing the East Fork Since 2001 -

November 7, 2003

Dear,

We request your attendance at the planning meeting for the East Fork Lake Tributaries watershed on Tuesday, November 18 from 5:30 – 8:30 PM at the Williamsburg Township Fire Station (see attached map/directions). Dinner will be provided.

The purpose of this meeting is to make sure we understand everyone's goals and interests related to water management, whether those interests relate to the quantity of water (flooding, drainage, stormwater, …) or the quality of the water in our streams, creeks, and lakes. As a leader in the community, your participation is essential to help make sure that everyone's interests are represented.

Please note the date/time of the meeting and RSVP using the enclosed postcard.

If you have any questions, please contact me at (513) 732-7075. Thank you for your interest.

Truly yours,

Jay Dorsey
East Fork Watershed Coordinator

East Fork Lake Tributaries
Issue Identification and Framing Meeting
November 18, 2003
Williamsburg EMS

Meeting Summary

On November 18, 2003 at Williamsburg EMS, a group of community leaders gathered to identify goals, concerns and interests related to water management in the East Fork Lake Tributaries area (see map). The group also organized those issues into categories to facilitate the planning process. This was the first step toward developing a watershed management plan for the East Fork Lake Tributaries area. At the November 18 meeting, it was decided to focus on three areas: land use, stormwater management, and wastewater management. The list of people who participated, and the entire list of issues and interests that was generated, are included below.

<u>Persons in Attendance</u>

Roger Adkins, Brown Co Planning Comm
Ralph Benson, SOFPA/ Clermont Health Dept
Paul Berringer, Clermont SWCD
Chris Clingman, Clermont Co Park District
James Danbury, Williamsburg Twp Trustee
Howard Daugherty, Tate Township Trustee
Chris Dauner, East Fork State Park
Steve Dick, Brown Co Health Dept
Dave Dugan, OSU Extension – Brown Co
Roger Griffith, Pike Township Trustee
Eric Heiser, Williamsburg Village Council
John Herbolt, Brown Co Farm Bureau
Hal Herron, Jackson Township Trustee
Steve Mezger, Sterling Township Trustee
Curt Paddock, Clermont Co Planning Dept
Eric Partee, Little Miami, Inc.
Jim Penrod, Jackson Township Zoning
Matt Powell, CECOS/BFI
Stephanie Simstad, OSU Extension–Clermont Co
Dave Spinney, Clermont County Administrator
Jim Taylor, Williamsburg Township Trustee
Dennis TenWolde, LMRP
Hugh Trimble, Ohio EPA
Sheila Waterfield, Brown SWCD
Robert Wildey, Clermont Co Health District
Tom Yeager, Clermont Water & Sewer District
Dave Zagurny, US Army Corps/Harsha Lake
Paul Braasch, Clermont OEQ

Listing of Goals, Interests, Issues & Concerns

[Note: number in () represents multiple listings of same item]

Biology - All streams meet Aquatic Life Use designations/water quality standards (3); return the mussels.

Drainage - Better drainage and better maintenance for township/county ditches (3); remove log jams from township ditches.

Drinking Water - Protect public and private drinking water supplies (2); improve water quality; Harsha Lake concerns – bacteria, sediment, nutrients, algae.

Education - Sound scientific understanding of water quality issues; public better informed about watershed; use K-12 Programming to increase general knowledge and awareness; water quality monitoring by students; educate public about the potential impacts to the East Fork; use Farm Bureau AWARE Program; publicity/newsletter.

Land Use – Better land use planning; land use planning that accounts for water quality/stream protection (2); lack of interface between watershed planning and subdivision approval process; assure that watershed planning does not inhibit economic growth; establish specific standards in township zoning regulations that support water quality standards; balance development and ag. land preservation so that attainment goals can be achieved and maintained; compensate farmers to protect headwaters (3); farmland preservation; more dedicated green space in watershed (2); smart growth; less development in rural watershed area; don't develop housing on wetlands; stop building in and development in floodplain.

Protection of Habitat and Natural System Services - Improve water quality of tributaries; healthy streams meet water quality standards; pristine streams; preserve wetlands; protect wildlife habitat; maintenance/protection of stream corridors and natural vegetation (4).

Monitoring & Assessment - More data on streams; fund water quality data collection; identification of pollutants (2); practical measurement of stream quality; monitor water runoff from homeowners lawns; water quality monitoring by students; quantify failing septic systems effect on water quality.

Recreation – Stream water safe for human contact; continue to sustain water quality to provide a viable recreation resource– canoeing, hiking, fishing, swimming, wading (3); maintain the East Fork State Park and its water resources for the enjoyment of future generations (2).

Stormwater/Runoff – Mitigate flooding in the East Fork area; better stormwater management (2); manage the impervious surface levels in subwatershed; foster percolation alternatives to stormwater management; more control over subdivision water management; reduce erosion/sediment (3); less streambank erosion; better sediment control/soil conservation on development sites (5); sediment from agriculture;
establish thresholds for nutrient run-off; nutrient loading; limit atrazine runoff; show homeowners & farmers proper application of liquids; household BMPs.

CECOS - CECOS negative image; CECOS secured or leakage problem?; need to be better informed on what's happening at CECOS.

Wastewater/Sewers/Septics - Reduce bacterial loading; control of septic systems draining into watershed (3); sewage in road ditches (3); more control over subdivision septics; strict laws on septic runoff; quantify failing septic systems effect on water quality; small community/cluster sewage treatment systems for development; local control of semi-public sewage systems design, maintenance and operation (Project XL); grant money or $$$ incentives to help fix failing septic systems/improve onsite wastewater (2).

Miscellaneous/Other - Remove "orphan" dams; will we informed of a hazardous spill?; political leadership.

December 8, 2003

Dear ,

We are currently developing a Watershed Management Plan for the East Fork Lake Tributaries area (see map). A watershed plan outlines ways a community can protect or improve its water resources (streams, lakes, drinking water supply) while achieving other community goals such as drainage, flood control, and economic development.

A group of community leaders (e.g., township trustees, village officials, county personnel) was invited to meet November 18 to help us understand the breadth of issues and interests in their respective communities as we develop a watershed plan for the Lake Tributaries area. I've attached a summary of the meeting.

At the November 18 meeting, we organized the issues and interests into, and formed Working Groups for, the following topics:

- **Land Use**
- **Stormwater Management**

Wastewater Management

For each one of these areas, we will hold one meeting per month over the next three months to:
Meeting #1 – Develop a comprehensive set of goals with specific, measurable indicators of success for each goal.
Meeting #2 – Develop strategies for achieving those goals based on our indicators of success.
Meeting #3 – Discuss and develop details (who, what, when, where, how, how much, …) of how each strategy will be implemented.

We have now scheduled the first of those meetings. Please note the date/time of the meeting(s), and join us if you are available and interested.

The **Wastewater Working Group** will meet from **3:00 – 5:00 PM, next Monday, December 15 at the Williamsburg Library**, at 594 Main St.

The **Stormwater Working Group** and **Land Use Working Group** will both meet from **5:30 – 7:30 PM, next Tuesday, December 16 at the Williamsburg Library**, at 594 Main St. **Pizza and Pop will be served.**

If you have any questions, please contact me at (513) 732-7075. Thank you for your interest and your involvement. I hope to see you next week.

Truly yours,

Jay Dorsey
East Fork Watershed Coordinator

Press Release

December 15 & 16 Meetings to Address Concerns in East Fork Watershed

Williamsburg, Ohio. The East Fork Watershed Collaborative is hosting a series of meetings to develop goals and strategies to address community concerns related to water management in the East Fork Lake Tributaries area (see map). This area includes those portions of Clark, Green, Pike and Sterling Townships in Brown County, and Jackson, Monroe, Tate and Williamsburg Townships in Clermont County that drain to the East Fork River and East Fork Lake. This area also includes the villages of Bethel, Hamersville and Williamsburg.

At a meeting November 18, a group of community leaders shared their interests and identified their biggest challenges related to water management. A broad range of issues and interests were identified. Asked to organize the issues into focus areas, the group settled on Wastewater Management, Stormwater Management and Land Use.

A meeting to develop watershed-based goals for **Wastewater Management** will be held at **3:00 PM, Monday, December 15, at the Williamsburg Library** conference room. Specific interests and issues to be discussed could include maintaining septic systems, the cost of on-site systems, extension of sewer lines, or water quality and health problems associated with bacteria and pathogens from poorly-functioning systems.

Stormwater Management will be the focus of a meeting at **3:00 PM, Tuesday, December 16, at the Williamsburg Library**

Land Use including land use change and rural development

For more information on the meetings, contact Jay Dorsey, East Fork Watershed Coordinator, at (513) 732-7075 or jay-dorsey@oh.nacdnet.org.

Land Use Working Group

Name	Affiliation
Eric Partee	Little Miami Inc.
Curt Paddock	Clermont County Planning Department
Paul Berringer	Clermont SWCD
Ralph Benson	Southern Ohio Preservation Association
Steve Masterson	Countrytyme Inc.
Judy Squire	Jackson Township
John Herbolt	Brown County Farm Bureau
Johnathan Kennard	Buckeye United Fly Fishers
Chris Clingman	Clermont County Park District
Mary Werner	Clermont County Planning & Development
Bob Goldsberry	Buckeye United Fly Fishers

Stormwater Management Working Group

Name	Affiliation
Michael Lober	Clermont County Engineers Office
Dave Zagurny	US Army Corps/Harsha Lake
Paul Berringer	Clermont SWCD
Jim Beasley	Brown County Engineers Office
Jim Penrod	Jackson Township Zoning
Eric Heiser	Village of Williamsburg
John McManus	Clermont County Stormwater Department
Ray Sebastian	Clermont County Chief Building Inspector
Richard Bissanty	Brown County
Stephanie Simstad	OSU Extension – Clermont Co
Johnathan Kennard	Buckeye United Fly Fishers

Wastewater Management Working Group

Name	Affiliation
Eric Heiser	Village of Williamsburg
James Danbury	Village of Williamsburg
Tom Yeager	Clermont Water & Sewer District
Sheila Waterfield	Brown SWCD
Robert Wildey	Clermont General Health District
Steve Dick	Brown County Health Department
Paul Berringer	Clermont SWCD
Eric Davenport	Brown County
Paul Braasch	Clermont OEQ

East Fork
WATERSHED COLLABORATIVE

June 30, 2004

Dear,

The East Fork Lake Tributaries Watershed Plan is under construction. Enclosed you will find the following items:

- Draft Table of Contents for the East Fork Lake Tributaries Watershed Plan
- A Summary of Goals and Strategies developed by the three East Fork Lake Tributaries work groups (Land Use, Stormwater, and Wastewater)
- A more detailed description of goals and strategies for any work group in which you may have participated (included only if you attended one or more working group meetings)

I ask that you review the enclosed materials to ensure they reflect the discussions in which you participated and they include your goals, interests and suggestions. You can communicate any suggested changes to me by: making any comments or suggestions directly on a document and returning it to me at the address below; contacting me by phone (513-732-7075) or e-mail (jay-dorsey@oh.nacdnet.org); or by attending the upcoming Watershed Plan review session at 5:30 PM on Wednesday, August 4 at the Williamsburg Library.

After incorporating any needed changes to the goals and strategies, these documents will serve as the basis for Chapter 5 (Community Water Resource Management Interests) and will be used to establish watershed management priorities detailed in Chapter 6 (Watershed Restoration and Protection Goals). The entire implementation matrix for each work group will be included in the Watershed Plan Appendix.

Thank you for your continued interest in the development of a Watershed Plan for the East Fork Lake Tributaries.

Sincerely,

Jay Dorsey
East Fork Watershed Coordinator
P.O. Box 549
Owensville, OH 45160-0549

Working Agenda
East Fork Watershed Collaborative
East Fork Lake Tribs Meeting
August 4, 2004
Williamsburg Library
5:30 - 7:00 PM (dinner provided)

Desired Outcomes: At the end of this meeting, attendees will:

"Sign-off" on goals and strategies for the East Fork Headwaters Watershed developed by working groups

Understand how community goals and strategies will be merged with water quality data to develop problem statements

Understand the watershed plan endorsement process

Identified at least one or two doable short-term projects we will begin working on

Identified high priority projects for which we currently do not have resources (grant opportunities)

Leave the meeting with a clear understanding of ways which they can contribute to (i.e., implement or influence) implementation of the WAP goals/strategies

Meeting Facilitation Team: Jay Dorsey, Paul Berringer, Chris Rogers

Invitees (~60) – expected attendance ~10-15

Logistical Notes:

Library meeting room has been reserved for 5:00 – 8:00 PM [double check 7/28 - Jay]
Facilitation Team has been asked to arrive at 5:00 PM for set-up
Bring water, coffee, cream, sugar, cups, spoons, napkins, coffee maker, coolers, ice, sodas - Jay
Pizzas will be ordered once we have a sense of total attendance [note: order at least one vegetarian pizza]
Have sign-in sheet and blank tags for all attendees
Display map of Lake Tirbs Planning Area

Room Arrangement:
Arrange 15 chairs in semi-circle (w/tables) in front of projection screen.

Meeting Activities:
1 Welcome//Introductions (10 min/Jay)
Welcome/explain bathrooms & dinner
Have each attendee introduce themselves with name, where from, what they do (or who they represent)
Outline of the Evening - describe what we are going to accomplish, and how (pass out East Fork Lake Tribs Watershed Plan Outline)

2 Watershed Plan Endorsement Process (5 min – Jay)
- Steps + Timeline (Who, What, When)

3 East Fork Lake Tribs Goals and Strategies – Powerpoint (10 min/Jay Dorsey)
- Priorities
- Overlap/similarities/differences/characteristics

4 Problem Statements – (15 min/Jay)
What are they? Why are they important?
Data + Loading Calculations + Communities Goals and Strategies = Problem Statements
Examples – Dodson Creek and Solomon Run

5 Implementation/Next Steps – Water Quality Assessment (15 min – Jay)
- Review the case for focusing on water quality assessment
- How?

6 Implementation/Next Steps – Short term action items (30 min – Jay)
- Split into groups to identify priorities (top 3 short-term, doable projects, programs or events + 1 long-term, resource intensive)
- "Your role" exercise – use hand-out to ID ways they can contribute to implementation of short-term action items
- How?

APPENDIX B
Summary of Previous and Current Water Quality Efforts in the East Fork Little Miami River Watershed

History of Previous Water Quality Efforts in the Watershed

Upper East Fork, Little Miami River 319 Nonpoint Source Project

In 1991 the Soil and Water Conservation District's of Brown, Clinton, and Highland Counties received a Nonpoint Source Project Grant (319) for the headwaters region of the East Fork of the Little Miami River. The duration of the project was for 36 months beginning in April 1992 and ending in March 1995. The goal of the project was to accelerate technical assistance and educational activities to improve water quality and warmwater habitat in the project watershed. The project sponsors focused on five specific objectives to reach the project goal;

1. Protect and improve water quality in the East Fork of the Little Miami River.
2. Reduce sedimentation and nutrient loading to the East Fork Reservoir.
3. Increase cooperation between health departments, agricultural agencies and other public and private groups in identifying and solving non-point source problems.
4. Monitor existing stream quality to establish baseline data for future comparison to determine effectiveness of the project.
5. Educate health department's employees on use of soils information in designing on-site wastewater treatment systems.

Clermont County 319 Nonpoint Source Project

In 1998 the Clermont County Board of County Commissioners received a Nonpoint Source Project Grant (319) to perform bank stabilization in a section of Stonelick Creek. Stonelick Creek is a major tributary of the East Fork Little Miami River. The project was coordinated and completed by the Clermont County Engineer's Office. During the months of September and October of 1998 a three hundred foot stream-bank section of Stonelick Creek was stabilized using two different bank stabilization techiniques; (1) rock weers; (2) rootwad stabilization. The section of stream that was stabilized was located above the Stonelick Covered Bridge along Stonelick Williams Corner Road in Clermont County.

Clermont County Watershed Management Program

In 1995, Clermont County completed a Wastewater Master Plan that proposed a strategy to effectively treat wastewater throughout the County. As the County developed the plan, it quickly became evident that this alone would not protect the water quality of Clermont's streams and lakes. A number of other potential pollutant sources needed to be addressed if stream quality was to be protected. A comprehensive water resources management approach was needed. Soon after the development of the Wastewater Master Plan, the County initiated a watershed management process to better characterize water quality conditions, implement control measures to protect and improve water quality, and plan for future growth while preserving Clermont's natural character and environment.

In 1996, the Clermont County Office of Environmental Quality initiated a comprehensive monitoring program to characterize stream conditions throughout the East Fork watershed. Since the inception of the program, OEQ has:

•assessed the physical conditions of stream channels,
•conducted annual biological surveys to evaluate the fish and macro-invertebrate communities and their habitat,
•conducted annual water quality sampling to monitor various pollutants,
•established five auto-sampling stations to continuously monitor conditions and collect samples during and after periods of rain.

In 1998, the Office of Environmental Quality began hosting public stakeholder meetings at various locations in the East Fork watershed. Early meetings focused on the basics of stream quality and watershed protection. Information on why water quality is important, both in terms of economics and quality of life, were presented at these meetings. As participants at these meetings began to build an understanding of water quality and watershed management issues, the issues presented became more specific and complex. Eventually, the regular public stakeholder meetings held by OEQ became the basis for establishing the East Fork Watershed Collaborative.

In 2000, Clermont County partnered with the Clermont Soil and Water Conservation District (SWCD), as well as the SWCDs in Brown, Clinton and Highland Counties, to participate in the Ohio Department of Natural Resources Watershed Planning Program. A grant was received to fund a Watershed Coordinator for the East Fork Little Miami River Watershed. The primary responsibility of the coordinator is to guide the development and implementation of watershed action plans for the entire East Fork watershed.

Current Efforts in the Watershed to Meet Water Quality Standards

East Fork Watershed Collaborative

The East Fork Watershed Collaborative (a.k.a. EFWC or the Collaborative) was formed in 2001 to provide local agencies, groups and individuals the opportunity to collaboratively plan and implement water quality improvement projects. The Collaborative's mission is "to enhance the biological, chemical and physical integrity of the East Fork Little Miami River and its tributaries."

The EFWC Steering Committee consists of representatives from four counties and five subwatersheds within the East Fork Little Miami River watershed. The Steering Committee is responsible for defining the scope and direction of the Watershed Program, and acting as liaison between the Collaborative and the local community.

The Collaborative organizes Work Groups to achieve specific tasks as needed. The formation and facilitation of Work Groups was the primary means for soliciting citizen input for the development of the East Fork Headwaters Watershed Plan and East Fork Lake Tributaries Watershed Plan.

The East Fork Watershed Collaborative has accepted the responsibility for developing a watershed management plan for the entire East Fork Little Miami River watershed. Due to the size of the East Fork watershed (500 mi^2 or almost 320,000 acres), and the variability in land use and stream conditions in various parts of the East Fork watershed, the Collaborative made a decision to divide the overall watershed into smaller (i.e., more manageable) subwatersheds for the purpose of planning. The subwatersheds selected as planning units are the Lower East Fork watershed, the Middle East Fork watershed, the Stonelick Creek watershed, the East Fork Lake Tributaries, and the East Fork Headwaters. Subwatershed plans focus on concerns unique to each subwatershed, providing a detailed description of subwatershed characteristics and stream conditions (including causes and sources of impairments), and specific recommendations on how those impairments might be addressed. The Watershed Management Plan for the Lower East Fork was completed, submitted to Ohio EPA and Ohio Department of Natural Resources (ODNR), and endorsed by the State in 2003. The East Fork Headwaters Watershed Management Plan was submitted in May 2006 to Ohio EPA and ODNR and received endorsement in August 2006. EFWC is currently developing, and expecting to complete and submit to Ohio EPA and ODNR by September 2006, watershed plans for the East Fork Lake Tributaries, Stonelick and Middle East Fork subwatersheds. Our final watershed management plan for the East Fork Little Miami River will integrate the five subwatershed plans into a coherent whole, highlighting the connections and differences among the subwatersheds.

The watershed planning process has led to an improvement in communication and cooperation among county offices and among the affected counties, municipalities and townships. An example of this cooperation can be seen in the partnership formed among Clermont County's Office of Environmental Quality (OEQ), Water and Sewer District and Health Department to draft and submit a Section 319 grant proposal in April 2003 (see below). Another example can be seen with OEQ and the County's Department of Planning and Economic Development, which worked together to plan and host a Low-Impact Development workshop in 2005. Additionally, years of effort by Clermont County to involve stakeholders in the planning process has resulted in a close relationship with the cities, villages and townships within the County.

Lower East Fork Watershed Management Plan

The Watershed Management Plan for the Lower East Fork was completed, submitted to Ohio EPA, and endorsed by the State in 2003[2]. That endorsement was the culmination of three years work by the Collaborative partners to develop a plan that would meet local water management goals as well as bring the Lower East Fork and its tributaries into use attainment. The Collaborative partners put together a comprehensive inventory of geology, soils, land use, demographics, and biological resources within the Lower East Fork region. Using Ohio EPA data and additional data collected by Clermont County between 1996 and 2002, the LEF Plan described current water resource conditions, and water quality trends. Based on Ohio EPA assessment and local experience, causes and sources of impairment were identified for the East Fork mainstem, as well as for the five major tributaries to the Lower East Fork. The Collaborative partners developed "problem statements" for each assessed stream segment that:

- Described the water resource conditions for that segment with identified causes and sources of impairment;
- Provided loading estimates for the pollutants of concern;
- Presented goals for each pollutant of concern, that, if met, should result in attainment of the assigned use designation;
- Detailed a suite of complementary strategies to mitigate point and non-point pollutant sources, and to restore streams and protect riparian areas; each strategy included specifics on responsible entity, how the strategy will be funded, when it will be implemented, and how performance will be measured.

The Collaborative partners are now implementing the Lower East Fork Watershed Plan. It is worth noting the following activities that will contribute to improved water quality in the Lower East Fork.

- The Clermont Sewer District is in the midst of some $30,000,000 of sewer system improvements that will eliminate SSOs, remove the trunk line from Shayler Run, extend sewers to areas with high concentrations of failing septic systems, and improve the quality of discharge from the Lower East Fork WWTP;
- The Valley View Foundation has partnered with the City of Milford to solicit WRRSP and Clean Ohio

Funds to permanently protect over 100 acres of floodplain and riparian corridor along the Lower East Fork;

•Lower East Fork communities have significantly increased resources devoted to the management of stormwater quantity and quality. Phase II requirements will result in measurable improvements in pre- and post-construction stormwater controls, illicit discharges, and pollution prevention/good housekeeping. The City of Milford recently established a stormwater utility to address historic stormwater management issues as well as the requirements of Phase II, and to offer incentives for BMPs that lessen the impact of stormwater runoff. Clermont County is exploring the merits of a stormwater utility and recently hired a stormwater program coordinator to implement Phase II requirements;

•The Phase II communities in Clermont County are also conducting an aggressive campaign to increase watershed literacy throughout the County and East Fork watershed. Projects include installation of watershed signs, distribution of backyard BMP flyers, storm drain labeling, newsletter and newspaper articles, ...;

•The Collaborative partners are seeking funding to implement portions of the Plan for which there are inadequate local resources; the $335,000 Lower East Fork 319 Grant described below is an example;

•In recent public meetings held in the Hall Run watershed, residents voiced strong support for the proposed project and an interest in being more involved. There appears to be an excellent opportunity to create a “Friends of Hall Run” type group to promote good watershed citizenship, and stream and riparian BMPs. This group could serve as a model for other East Fork subwatersheds and other urbanizing watersheds in Southwest Ohio.

Lower East Fork Section 319 Grant (Restoration of Stream Function and Water Quality Improvement in Tributaries of the Lower East Fork Little Miami River)

The East Fork Watershed Collaborative, in partnership with Clermont SWCD, Clermont County Office of Environmental Quality, Clermont County Health District and Clermont County Sewer District, recently received a $335,000 Section 319 Grant (FY2004) to address water quality impairments in the Lower East Fork watershed. The purpose of the Lower East Fork 319 (*Restoration of Stream Function and Water Quality Improvement in Tributaries of the Lower East Fork Little Miami River*) project is to improve water quality in Hall Run and Wolfpen Run, major tributaries to the Lower East Fork Little Miami River, in an effort to fully attain their WWH status. It is also expected that water quality improvement in these major tributaries will lead to significant improvement to water quality status of the Lower East Fork Little Miami River. The project has the following goals:

•to address habitat alteration and hydromodification in Hall Run, use natural channel design and management techniques to restore and enhance hydrologic and ecological function (in-stream/ riparian habitat) of a stream segment in the Hall Run headwaters;

•to address habitat alteration and hydromodification in the larger East Fork watershed, use the stream and riparian restoration in Hall Run to demonstrate natural channel restoration and management techniques, and other riparian BMPs, that can be applied in headwater streams throughout the East Fork watershed;

•to achieve the maximum amount of environmental benefit for the resources expended, coordinate the stream restoration activities with sewer improvement projects being conducted by the Clermont County Water and Sewer District;

•to reduce the number of failing septic systems (with associated nutrient and pathogen loadings) in the Hall Run and Wolfpen Run subwatersheds, employ an aggressive outreach/educational approach to improve awareness and understanding of septic system operation and maintenance, enroll additional homeowners in the Clermont Health District’s Basic System Assessment inspection program, and repair or replace failing septic systems.

East Fork Headwaters Management Plan

The Watershed Management Plan for the East Fork Headwaters was completed, submitted to ODNR/ Ohio EPA, and endorsed by the State in August 2006. That endorsement was the culmination of three years work by the Collaborative partners to develop a plan that would meet local water management goals as well as bring the Headwaters and its tributaries into use attainment. The Collaborative partners put together a comprehensive inventory of geology, soils, land use, demographics, and biological resources within the Headwaters region. Using Ohio EPA data and additional data collected by Clermont County between 1996 and 2002, the Headwaters Plan described current water resource conditions, and water quality trends. Based on Ohio EPA assessment and local experience, causes and sources of impairment were identified for the East Fork mainstem, as well as for the 20 major tributaries to the East Fork Headwaters.

The Collaborative partners developed "problem statements" for each assessed stream segment that:

- Described the water resource conditions for that segment with identified causes and sources of impairment;
- Provided loading estimates for the pollutants of concern;
- Presented goals for each pollutant of concern, that, if met, should result in attainment of the assigned use designation;
- Detailed a suite of complementary strategies to mitigate point and non-point pollutant sources, and to restore streams and protect riparian areas; each strategy included specifics on responsible entity, how the strategy will be funded, when it will be implemented, and how performance will be measured.

Highland County East Fork Watershed Water Quality Improvement Project

In 2005 Highland County Soil and Water Conservation District partnered with the East Fork Watershed Collaborative and the Highland County General Health Department to submit an application for an Ohio EPA 319 Nonpoint Source Project Grant. The application was approved and the project began January 2006. The overall purpose of the project is to improve water quality in the Highland County region of the East Fork Little Miami River watershed in an effort to fully attain designated aquatic life use status (EWH, WWH). This is a part of the East Fork Headwaters subwatershed planning area. More specifically, the project will repair or replace failing septic systems, employ an aggressive outreach/educational approach to improve awareness and understanding of septic system design, operation and maintenance, and generally, reduce the number of failing septic systems (with associated reduction of nutrient, solids and pathogen loadings) in Highland County EFLMR watershed. The three main objectives are given below;

1. Reduce nutrient, solids, and bacterial loading, and organic enrichment from failing Home Sewage Treatment Systems (HSTS) in the EFLMR watershed.
2. Use a broad-based education and outreach effort to improve performance of Home Sewage Treatment Systems (HSTS) in the EFLMR watershed.
3. Conduct water quality monitoring to collect impairment data, measure outcomes, and get volunteer citizen participation.

Clermont County Office of Environmental Quality

Driven by a commitment to protect the County's existing high quality of life and to support and encourage sustainable growth, the Office of Environmental Quality (OEQ) initiated a comprehensive watershed management program in 1996 to protect the EFLMR. Since that time the County has successfully:

•collected data from a comprehensive monitoring network including biological, chemical, and physical data sets
•developed a linked watershed modeling system of the watershed, lake, and river so that future growth issues can be studied and evaluated
•evaluated management options for control of sources to preserve and enhance tributary and riverine water quality
•developed the Ecological Data Application System (EDAS) database to store and process the water chemistry, biology, and physical stream assessment data
•sponsored the formation of a stakeholder group and conducted public outreach and education efforts, including the development of report cards summarizing water quality and trends
•developed a site assessment tool to evaluate the impacts of new development on water resources
•became a U.S. EPA Project XL Community in September 2000, and completed a Quality Management Plan in August 2001 (subsequently approved by both Ohio EPA and U.S. EPA).

East Fork TMDL Development

In September 2003, Clermont County received a $225,000 Section 104(b)(3) grant from the U.S. Environmental Protection Agency to take the lead in developing a watershed-wide TMDL for the East Fork Little Miami River watershed. This TMDL will use a unique and innovative approach that should result in the development of more successful watershed management strategies and improved stream conditions. Under this project, the County, with the help of Tetra Tech, will develop a model that provides a statistical relationship linking physical and chemical stressors to biological response (i.e., fish and macro-invertebrate indices). This will provide a more accurate representation of the sources responsible for biological impairment, and thus enable the County to develop nutrient and sediment TMDLs that will result in marked improvements in stream quality.

While Clermont County and Tetra Tech are taking the lead on the modeling effort, all counties, municipalities and townships within the watershed will be involved in the TMDL development process. The public stakeholder effort is being led by the East Fork Watershed Collaborative and the East Fork Watershed Coordinator. The first public meeting was attended by over 50 people from throughout the watershed, including representatives from Brown, Clermont, Clinton and Highland Counties.

The TMDL is scheduled to be completed by September 2006. Once completed, Clermont County and the East Fork Watershed Collaborative will explore the possibilities of establishing different innovative watershed management strategies, including pollutant trading and watershed permitting, to implement the TMDL. If it is decided that such strategies may achieve “superior environmental performance” compared to conventional management practices, Clermont County will work with both Ohio EPA and U.S. EPA to implement these under Project XLC.

Clermont County Sewer System Improvements

Clermont County is implementing many sewer infrastructure improvements in the Lower East Fork watershed. These improvements are detailed in the “Clermont County 5-Year Wastewater Capital Improvement Plan (2003-2007)”. Several of the major projects within the Lower East Fork watershed are summarized in the attached Problem Statements from the Lower East Fork Watershed Management Plan. Those improvements include:

•$2,000,000 for extension of sewers into currently unsewered areas. This includes areas with concentra-

tions of failing septic systems in the Hall Run and Wolfpen Run subwatersheds;
•$6,000,000 for update of sewer mains and removal of all SSOs from the Hall Run subwatershed to be completed 2006;
•$20,000,000 for replacement of the trunk line in Shayler Creek to be completed in 2007;
•Renovation of the Lower East Fork WWTP to be completed in 2007.

NPDES Phase II Stormwater Program

A total of 15 communities in Clermont County, including the County itself, were designated as urbanized areas and thus required to submit a Phase II stormwater management plan to Ohio EPA by March 10, 2003. Early in 2002, a group of leaders from affected communities formed a Stormwater Task Force to help the County, municipalities and townships meet the Phase II requirements. This group determined that the most cost effective and efficient approach for addressing the requirements was to develop and implement a regional approach that utilized existing programs to the greatest extent practical. As a result, 13 of the 15 communities jointly developed and submitted a stormwater management plan and applied for a Phase II general permit in March 2003. Only the City of Loveland, which is located in portions of three separate counties, and Tate Township, which applied for an exemption (as only 0.09 square miles are within the urbanized area), did not participate. The amount of cooperation among the different communities illustrates the type of commitment necessary to solve water management problems at a watershed scale.

Since the submittal of the plan, several projects are underway to implement the six minimum controls. There is an extensive public education and notification in place. Many of these activities are being implemented by the East Fork Watershed Collaborative, as well as the Clermont County Soil and Water Conservation District (SWCD) and the Office of Environmental Quality (OEQ). One particular program of note is the joint stormwater web site developed by OEQ and graduate students from Miami University's Institute of Environmental Sciences. The web site can be viewed at www.oeq.net/sw/. In addition, the students provided a review of county, municipal and township pollution prevention programs already in place and made recommendations to each community for improvement. This project was completed in May 2004.

While the number of projects contained in the County's stormwater management plan are too numerous to discuss in detail, two deserve special notice. These include a regional stormwater best management practice (BMP) manual being developed by Clermont County, Northern Kentucky Sanitation District, and Louisville MSD, and a Low Impact Development workshop hosted by the Clermont County Stormwater Department and the Center for Watershed Protection in February of 2005.

Regional Stormwater BMP Manual

In 2003, the Clermont County Office of Environmental Quality began a joint effort with the Sanitation District No. 1 of Northern Kentucky and the Louisville & Jefferson County (KY) Metropolitan Sewer District to develop a regional manual of post-construction stormwater management practices. By combining resources, the three agencies are able to develop a product they would not have been able to complete alone. This manual will include information for a variety of BMPs with details on their cost, installation procedures, maintenance requirements, and their effectiveness at reducing the levels of different stormwater pollutants. This manual will serve as a valuable resource for local planning departments and members of the development community as they design post-construction stormwater controls for new development. Currently, the manual is in its final draft form and is being reviewed by representatives of three cooperating agencies. A final manual will be available by the end of 2005.

Low Impact Development Workshop

As mentioned in Ohio EPA's 2004 Integrated Water Quality Monitoring and Assessment report, urban runoff is one of the primary sources of stream impairment in the East Fork watershed. Clermont County is seeking to work cooperatively with local planning departments, zoning commissions and members of the development community to address the problem of stormwater runoff. As part of this effort, the Clermont County received an Ohio Environmental Education Fund grant from Ohio EPA in the amount of $11,850 to conduct a low impact development workshop in the early part of 2005. Through this grant, the County contracted with the Center for Watershed Protection to lead the workshop. The agenda for the workshop was developed by an organizational committee comprised of local planners, developers, engineers, and representatives of the Homebuilders Association.

On the day following the workshop, Clermont OEQ hosted a tour of developments that have successfully used designs to minimize stormwater impact. This workshop and tour provided the development community (including planners, developers, engineers, contractors, and zoning and code enforcement officials) with information that will enable them to meet Phase II permit requirements, minimize problems associated with flooding, and become more involved in the watershed management process.

The workshop and tour was held in February 2005, with attendance just over 100. Educational materials, including a workshop CD, were provided as part of the workshop.

Education and Outreach

The East Fork Watershed Collaborative applied for and received two grants to purchase canoes to use for the East Fork river Sweep, Adopt-a-Waterway and other educational programs. The Collaborative received a $11,160 grant from the Boating Safety Education Program of the Ohio Department of Natural Resources, Division of Watercraft, and a $4,980 grant from the Ohio Environmental Education Fund to purchase 16 canoes, two canoe trailers, life vests, and paddles.

With the purchase of the canoes mentioned above, the East Fork Collaborative is looking to expand our Adopt-a-Waterway program. Groups of any size (companies, non-profits, civic organizations) can adopt a stream segment of 2-3 miles length, similar to the Adopt-a-Highway program. The Collaborative provides canoes, trash bags, gloves and trash pick-up for two events each year. There are about 40 "canoeable" miles of the East Fork that could be adopted, and a number smaller tributaries that would also benefit from an annual clean-up.

On June 14 of 2005, the Clermont County Green Team (Park District, Office of Environmental Quality, Soil and Water Conservation District) teamed with the Harsha Lake U.S. Army Corps of Engineers office and Batavia Township to remove 104 tires from the East Fork River near Elklick Road.

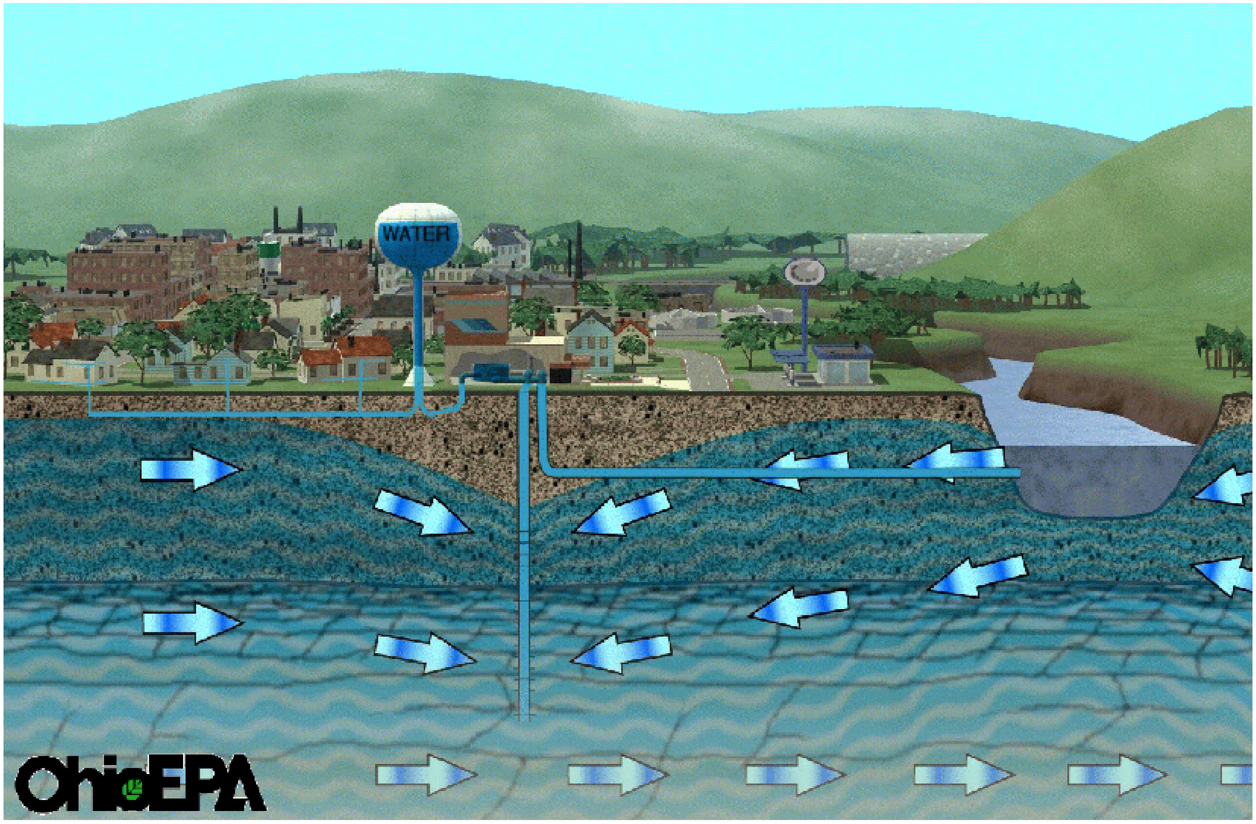
The Collaborative is also hosting education canoe floats on the East Fork during which local elected officials, other community leaders and landowners learn more about how streams function. During two floats in summer of 2005 attendees heard a historical overview of the area, with a special emphasis on the East Fork River, from Rick Crawford a Clermont County historian. They also discussed opportunities for managing stormwater quantity and quality, and canoed two miles of the East Fork Little Miami River. Stream biologists from the Ohio Department of Natural Resources used an electrical shocking technique to sample the type of fish found in this segment of the East Fork. The biologists shared what they found, highlighting fish species indicative of the good water quality in the East Fork.

As part of a region-wide public awareness campaign called Project SIGNS, watershed signs with tributary names have been posted at about 30 stream crossings in the East Fork Watershed, and about 250 stream crossings throughout the Tri-state area. The Collaborative received a $1000 Watershed Awareness to Watershed Action (WAWA) grant from the ODNR to purchase and install watershed signs at stream crossings in the upper portion of the East Fork watershed.

APPENDIX C

**Drinking Water Source Assessment
for the Clermont County Bob McEwen
Water Treatment Plant**

**Public Water System # 1401211
Prepared by:
Ohio Environmental Protection Agency
Division of Surface Water
Division of Drinking and Ground Waters
Southwest District Office**



How to Use this Assessment

Clean and safe drinking water is essential to everyone. Protecting the source of drinking water is a wise and cost effective investment. The purpose of this drinking water source assessment is to provide information your community can use to develop a local Drinking Water Protection Program. The Drinking Water Source Assessment benefits your community by providing the following:

A basis for focusing limited resources within the community to protect the drinking water source(s).

The assessment provides your community with information regarding activities within the Drinking Water Source Protection Area that directly affect your water supply source area. It is within this area that a release of contaminants, from a spill or improper usage, may travel through the watershed and reach the surface water intake. By examining where the source waters are most sensitive to contaminants, and where potential contaminants are located, the assessment identifies the potential risks that should be addressed first.

A basis for informed decision-making regarding land use within the community.

The assessment provides your community with a significant amount of information regarding where your drinking water comes from (the source) and what the risks are to the quality of that source. This information allows your community planning authorities to make informed decisions regarding proposed land uses within the protection area that are compatible with both your drinking water resource and the vision of growth embraced by your community.

A start to a comprehensive plan for the watershed and source water area.

This assessment can be the beginning of a comprehensive plan for the water resource, one that addresses all of the uses the water resource provides. An ecologically healthy lake, stream and watershed will provide a stable, high quality resource for drinking water.

Intake for BMWTP on Harsha Lake

For information about developing a local Drinking Water Source Protection Program, please contact the Ohio EPA Division of Drinking and Ground Waters at (614) 644-2752 or visit the Division's web site at http://www.epa.state.oh.us/ddagw/pdu/swap.html.

1.0 INTRODUCTION

The 1996 Amendments to the Safe Drinking Water Act established a program for states to assess the drinking water source for all public water systems. The Source Water Assessment and Protection (SWAP) Program is designed to help Ohio's public water systems protect their sources of drinking water from becoming contaminated.

The purpose of this assessment is to identify where and how the Clermont County Bob McEwen WTP (BMWTP) source waters are at risk of contamination. The report:

- identifies the drinking water source protection area,
- examines the characteristics of the watershed and the water quality,
- inventories the potential contaminant sources within that area, and discusses the susceptibility of the system to contamination.

Finally, the report suggests actions that the public water supplier and local community may take to reduce the risk of contaminating their source of drinking water and ensure the long term availability of abundant and safe drinking water resources.

Results and recommendations presented in this report are based on the information available at the time of publication. Ohio EPA recognizes that additional information may become available in the future that could be used to more accurately determine the drinking water source protection area. Also, changes in land use may occur after Ohio EPA completes the potential contaminant source inventory. This report should be used as a starting point to develop a plan to protect drinking water resources.

This report was prepared by Greg Buthker, Division of Surface Water, Ohio EPA Southwest District Office.

2.0 PUBLIC WATER SYSTEM DESCRIPTION

The Clermont Water System operates three water treatment plants that pump into a common distribution system serving a total of 98,094 persons. Two of the plants are well systems. Miami Goshen System (MGS) is located near Miamiville and draws groundwater from the Little Miami Valley Aquifer from 5 wells, producing an average of 0.98 million gallons per day (MGD). Pierce Union Batavia system is near New Palestine where 20 wells draw from the Ohio River Valley Aquifer, an average of 8.89 (MGD).

Bob McEwen Water Treatment Plant (BMWTP) is located near Batavia and serves 29,948 persons with 11,664 service connectons. Surface water is withdrawn from Harsha Lake. Harsha Lake was constructed in 1973 by placing a 205 foot dam across the East Fork Little Miami River at RM 20.5. Maximum storage capacity of Harsha Lake is 294,800 acre-ft or 96 billion gallons. Harsha Lake is part of the East Fork State Park .

Plant production for the BMWTP is rated for maximum capacity of 10 (MGD). A total of 1.375 billion gallons of drinking water was taken from Harsha Lake from September 2002 to October 2001. Daily average for this time frame was 3.7612 MGD with the monthly average 114.575 MGD. Demand was highest in July 2002 with 187.9 million gallons pumped for an average of 6.06 MGD. There are three 300 HP pumps used at the intake structure on Harsha lake. Each pump is rated at 3500 gpm.

The presence of Manganese, Atrazine, and high Total Organic Carbon (TOC) cause the most problems in the treatment of surface water at the BMWTP. Manganese is found throughout the watershed and is probably most often a result of solution of manganese from soils and sediments aided by bacteria or complexing with organic material. Manganese is a common exceedence of Ohio EPA water quality criteria upstream of Harsha Lake. On September 8, 2000, the Bob McEwen Surface Water Treatment Plant was shut down due to numerous complaints in the distribution system of brown or discolored water due to high Manganese levels in the finished water. The plant switched from using anthracite filtration to granulated activated carbon. Manganese complexed with organic material or clay particles was solubilized enough to pass through the sand filter and not removed during the treatment process. Although manganese is not a health threat, excessive levels stain plumbing fixtures and clothing and is generally unacceptable to the customers. Chlorine dioxide has recently been approved as an oxidant to remove manganese during the treatment process.

Nutrient loading from the Williamsburg WWTP (RM 35.25), 12 miles upstream, failed septic systems, and farm field run off in the watershed have caused algal blooms in Harsh Lake during the warmer months. Algae blooms can impart an earthy or musty flavor to treated water, in addition to contributing to the total organic carbon in raw water. Raw water containing high total organic carbon will produce excessive Total Trihalomethanes and Halo Acetic Acids (Disinfectant/Disinfection Byproducts)(DDBP) when chlorinated.

Atrazine along with other agricultural chemicals are found in surface water throughout the watershed. In 1998, Ohio EPA conducted a water quality survey documenting Atrazine in East Fork Little Miami River going into Harsha Lake at low levels (<2 µg/l) throughout the summer, but high levels of Atrazine (>50 µg/l) and other agricultural chemicals are present in the spring during high water events. Harsha Lake holds 96 billion gallons of water that can take a long time to build up and slowly release contaminates. Atrazine has been recorded as high as 15 µg/l in the raw water from Harsha Lake entering the water treatment plant. This problem usually peaks by May and slowly dissipates throughout the year. Granulated activated carbon filter caps are used to take out agricultural chemicals as well as controlling taste and odor problems and disinfection byproducts. Granulated activated carbon and chlorine dioxide were not installed when the plant was approved. The treatment components were required to insure compliance with MCLs for Atrazine , DDBPs , and manganese.

3.0 DRINKING WATER SOURCE PROTECTION AREA - SURFACE WATER

The **Drinking Water Source Protection Area** (protection area) for an inland stream is defined as the drainage area upstream of the point where the water is withdrawn from a surface source such as a stream, lake or reservoir. The protection area is subdivided into corridor and emergency management zones. An illustration of the protection area and corridor management zones for the Bob McEwen public water system is shown in Figure 1. The emergency management zones is shown in Figure 2.

The **Corridor Management Zone, (CMZ),** is an area along streams and tributaries within the source water assessment area that warrants delineation, inventory, and management The corridor management zone (Figure 1) is the area within 1000 feet of each bank of the East Fork Little Miami River and within 500 feet of the tributaries. The CMZ extends to the bridge on US

32, 12 miles upstream from the intake. Sixty-one percent of the Corridor Management Zone (CMZ) is contained within East Fork Lake State Park. The cities of Bethel and Williamsburg are within the CMZ. (Figure 4)

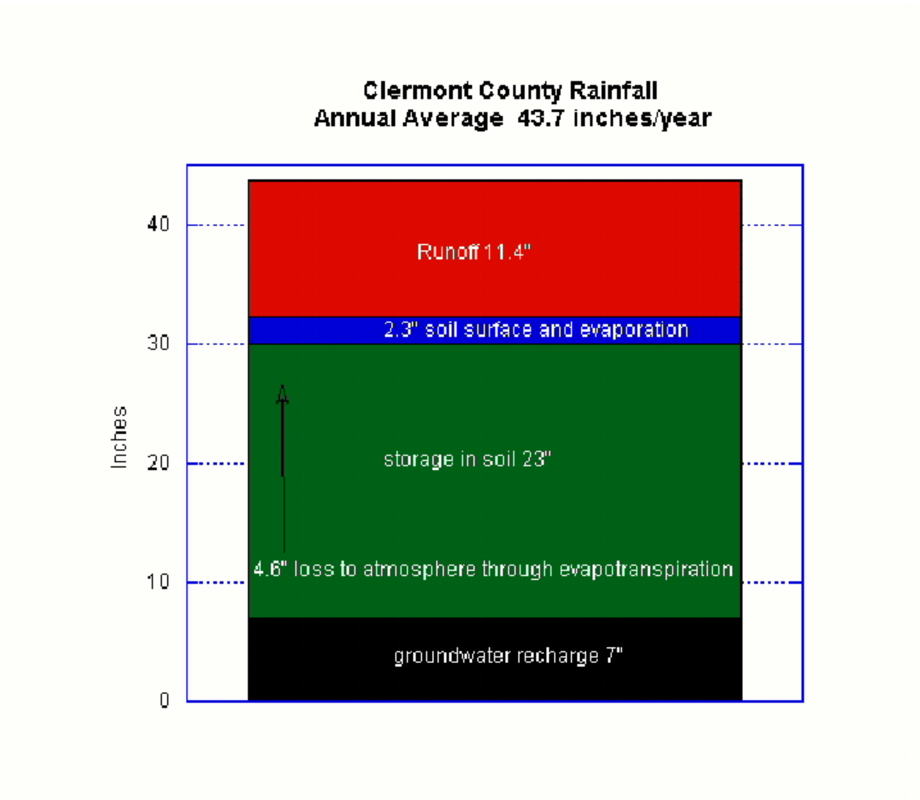
The **Emergency Management Zone, (EMZ),** is defined as an area in the immediate vicinity of the surface water intake in which the public water system operator has little or no time to respond to a spill. The Emergency Management Zone is a 500 foot radius around the intake that is highly succeptable to spills with no time to respond to a spill event. The intake for the Clermont County BMWTP is on Harsha Lake and the concept of an EMZ is not the same as those intakes on river systems. Fuel and oil from power boats are the potential sources of contamination in Harsha lake.

4.0 RESOURCE CHARACTERIZATION

Figure 3 shows the land use for the protection area taken from 1994 data. The predominant land use is 76.8% agriculture (row crops and pasture/hay). Deciduous forest covers 19.3% of the land surface in irregular patches, usually near river banks and hollows. Low intensity residential makes up 1.6 % the SWAP area, but this number does not reflect the recent growth in residental housing.

Hydrologic Setting

Clermont County averages 43.7 inches of rain per year which is above the average for all of Ohio (38 inches per year). Runoff averages 11.4 inches per year across the county but local averages can be much higher in urban areas where impervious surfaces can greatly increase the runoff coefficient from the current average 0.26 to 0.8 or above.



The East Fork Little Miami River has its headwaters in Highland County and travels a total of 58 miles through Clinton and Brown Counties before flowing into Harsha Lake. The watershed upstream from the lake drains approximately 344 square miles and is designated as an an Exceptional Warm Water Habitat aquatic use designation to its confluence with the Little Miami River. That same section of the river is classified as Primary Contact Recreation (PCR), waters that are suitable for full body contact.

Harsha Lake was constructed in 1973 by building a 205 foot dam across the East Fork Little Miami River at RM 20.5. Maximum storage capacity of Harsha Lake is 294,800 acre-ft or 96 billion gallons. The Bob McEwen Water Treatment Plant (BMWTP) is located near Batavia and draws surface water from Harsha Lake near the mouth of Slabcamp Run. Harsha Lake is part of the East Fork State Park system.

The East Fork Little Miami River flows into East Fork State Park at RM 34.92 in Williamsburg. Time of travel studies conducted by OEPA, indicated the tail waters of the impoundment reach upstream to Williamsburg. The impoundment restricts flow to an extent that the East Fork functions as a lake ecosystem starting in Williamsburg.

Two different dye tests were conducted by Ohio EPA to measure the time of travel in the East Fork Little Miami River. One dye test was conducted on April 18, 1985 and was designed to measured the time of travel in the unimpeded part of the river from the mouth of Pleasant Run (RM 42.96) to RM 36.3 (near US 32). The other dye test was conducted on August 18, 1987 and measured time of travel in the impeded part of the East Fork Little Miami River from the Williamsburg WWTP (RM 35.25) to RM 33.9, inside East Fork State Park.

Comparing the two time of travel studies, which were under similar flow conditions:

East Fork Little Miami River	Date	Distance (miles)	Time of Travel	Ave. Velocity Ft/sec mi/hr	Flow (cfs) Batavia
RM (42.96-36.3)	4/18/85	6.65	13 hr. 27 min	0.73 0.49	40
RM (35.25-33.9)	8/18/87	1.34	31 hr. 45 min.	0.06 0.04	35

Soils

Soils in the uplands and headwaters tributaries of the East Fork Little Miami are of the Clermont-Avonburg association. These soils are poorly drained and not suitable for septic tank adsorption. Ponding, seasonal wetness and restricted permeability have caused Clermont County Health Department to require modified mound systems on new construction. The Clermont County Health Department feels that most septic systems constructed in these soils will fail when the water table is high. Clermont County has implemented an inspection system of private residences on septic systems, failing septic systems are required to construct modified mound systems.

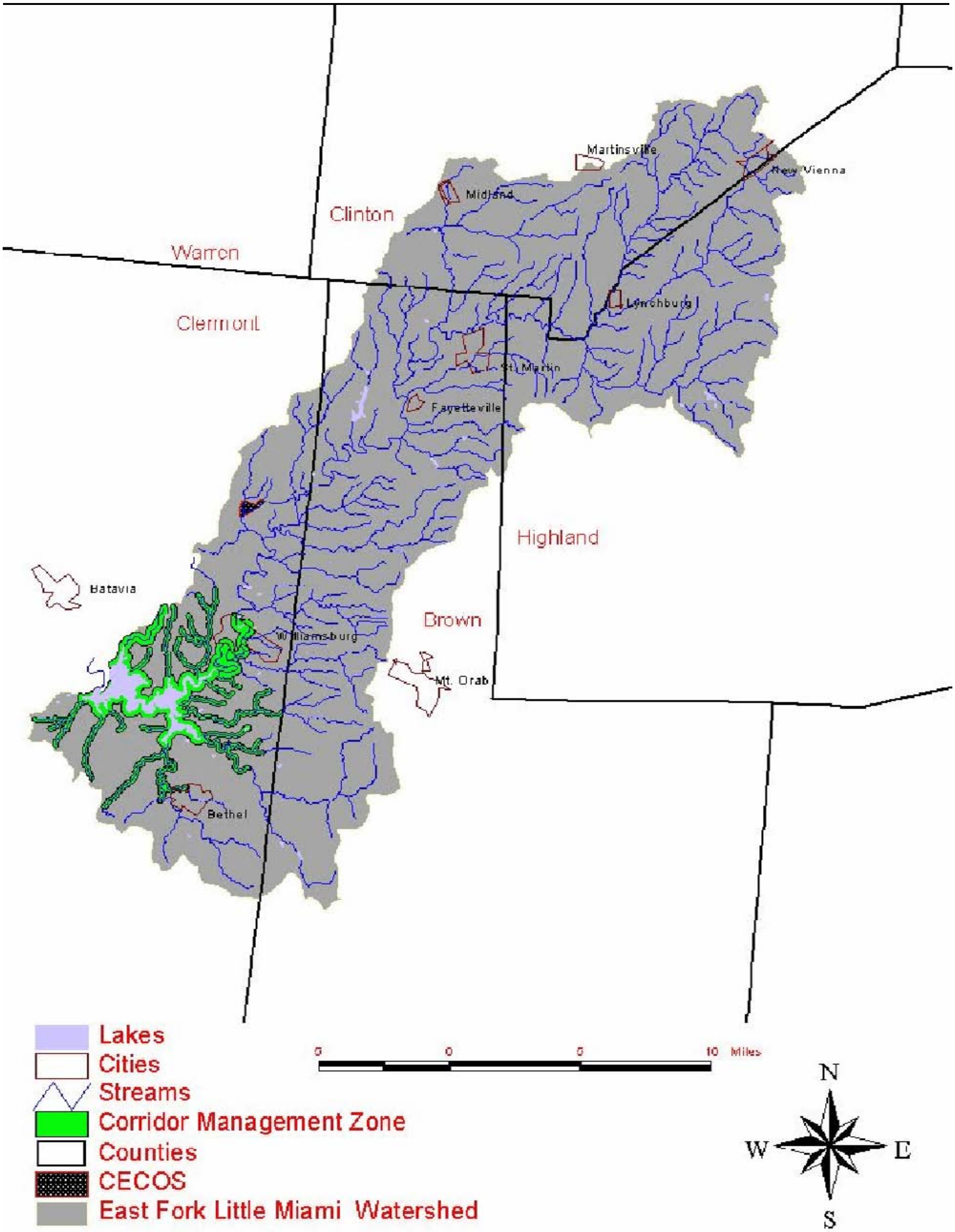


Figure 1: Clermont County BMWTP's Source Water Assessment and Protection.

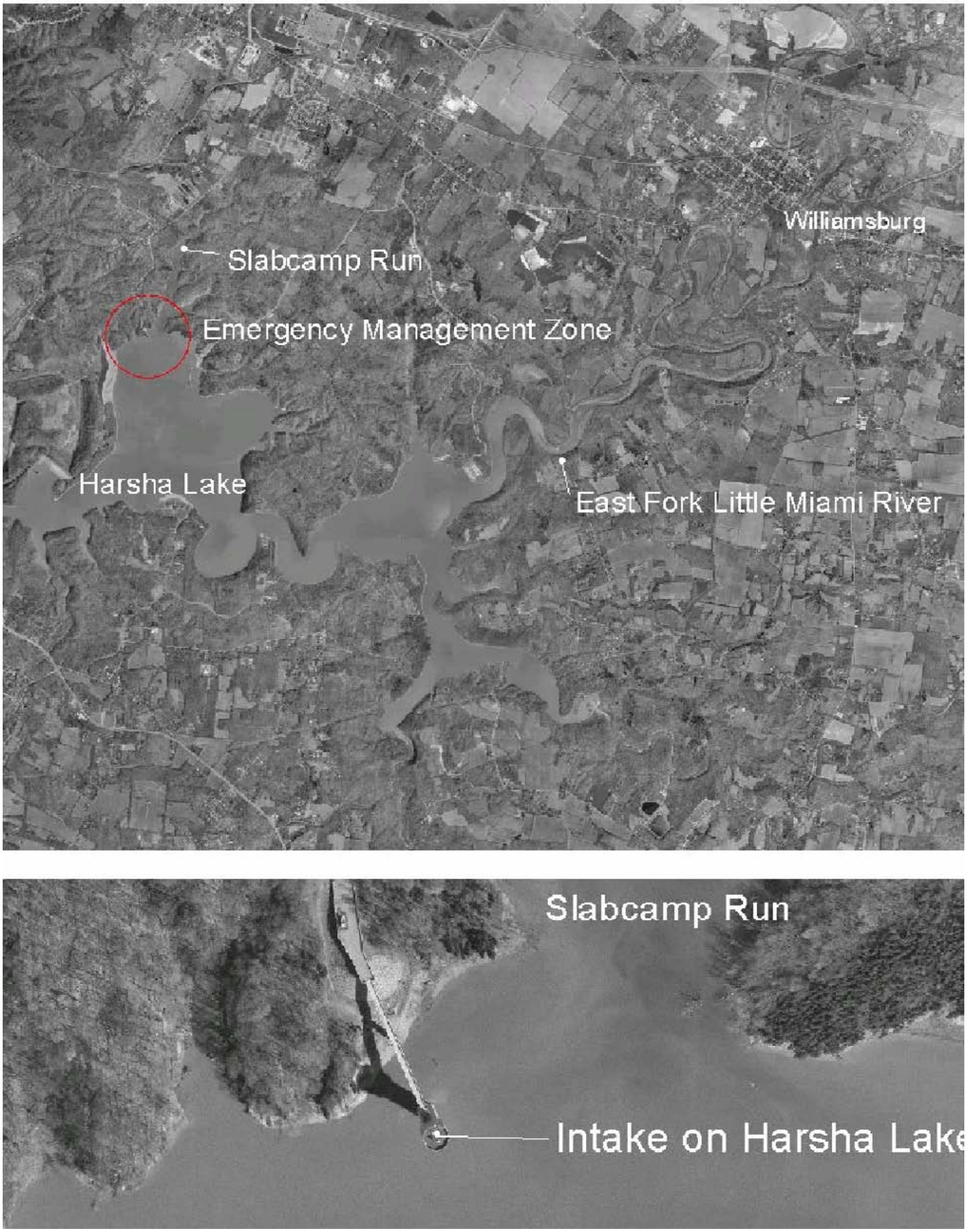


Figure 2: Emergency Management Zone for Intake on Harsha Lake.

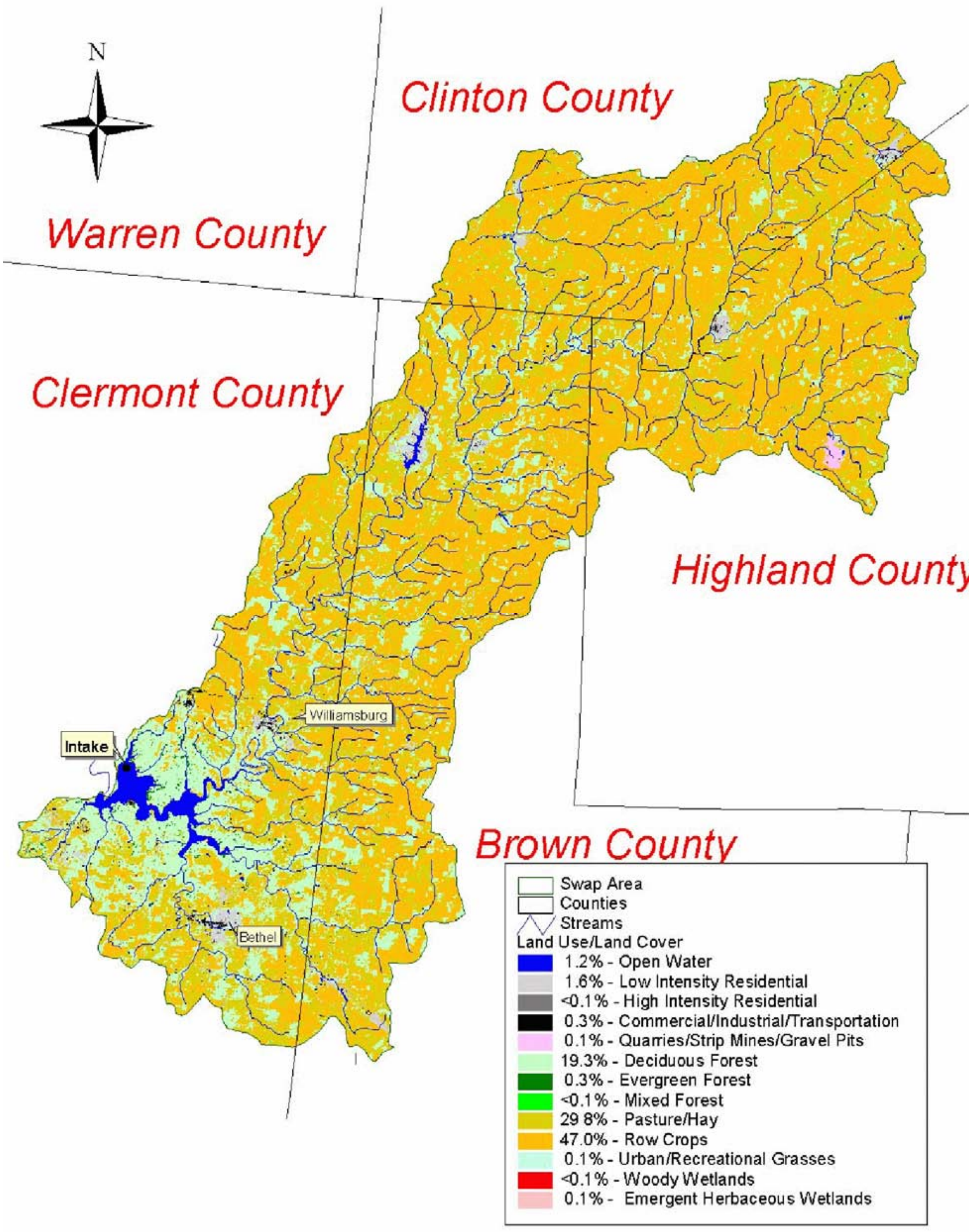


Figure 3: Land Use in the Source Water Protection Area.

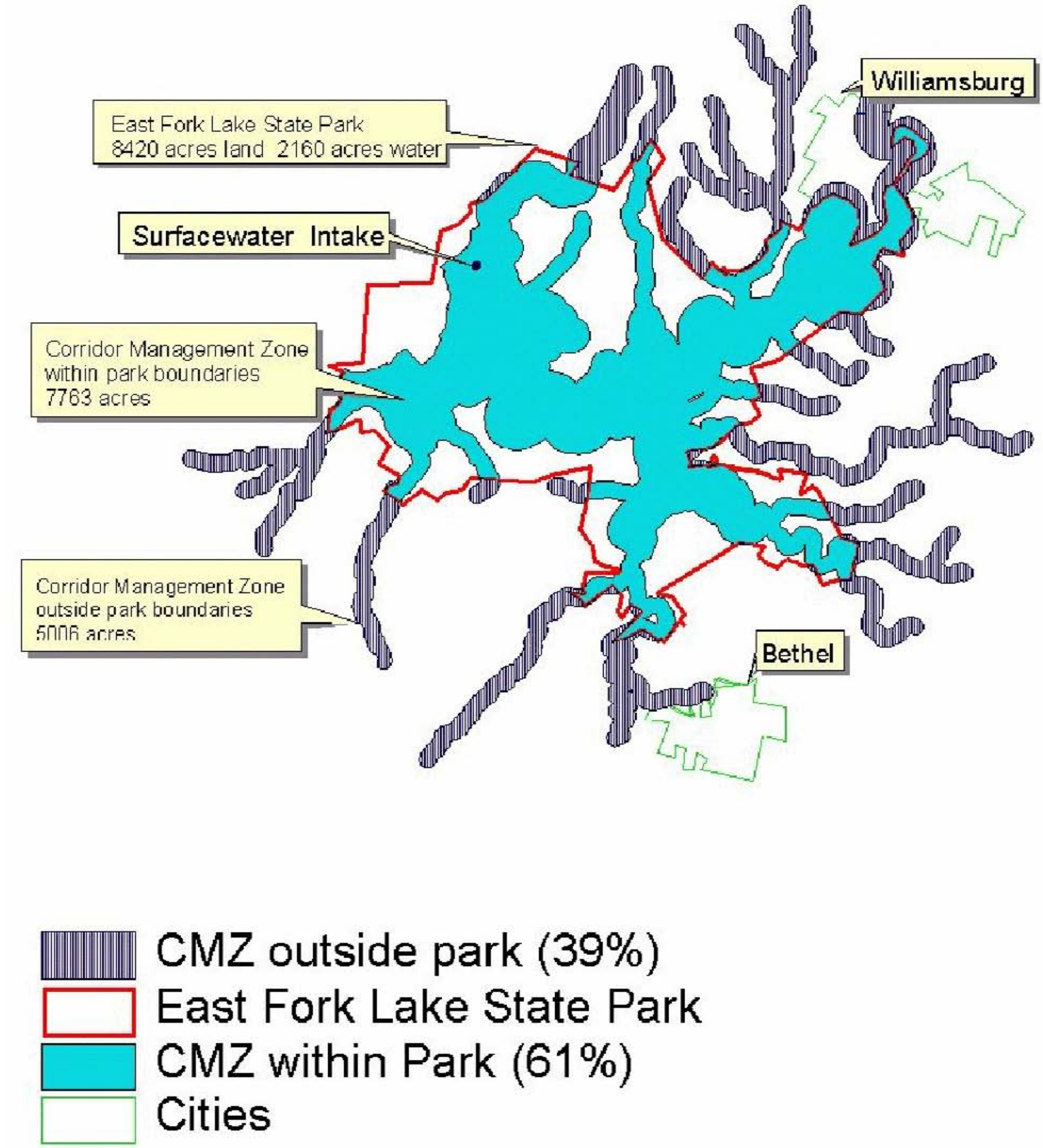


Figure 4: Corridor Management Zone Protected by East Fork Lake State Park.

5.0 WATER QUALITY

Available chemical and biological water quality data collected by Ohio EPA (Table #1) and United States Geological Survey (Table #2) from the streams in the protection area, and sampling results from finished water reported to Ohio EPA by the BMWTP (Table #3) were evaluated to characterize water quality.

Treated Water Quality

A review of the Clermont County Bob McEwen Public Water System compliance monitoring data from 1991-2002 revealed that the system had no health based or maximum contaminant level (MCL) violations. Table 3 lists contaminants where at least one result was above the level of detection, and does not include all contaminants tested for by the public water system.

It should also be recognized that sampling results presented in this report can only provide information on the quality of the water at the time the sample was collected. Water quality may change over time due to a number of reasons. Therefore, it is recommended that the reader also consult the most recent Consumer Confidence Report (CCR) for the Bob McEwen Public Water System. All community public water systems are required to annually prepare and distribute the CCR to their customers. This report is a good source of information of health effects associated with detected contaminants and contains information on the community's drinking water, including the source of the water, contaminants detected, the likely sources of detected contaminants, and the potential health effects of contaminants at levels above the drinking water standards.

East Fork Little Miami River-Raw Water

Clermont County's raw water entering the treatment plant relies upon the surface water reservoir at Harsha Lake. Harsha Lake was created by damming the East Fork Little Miami River at RM 20.5. Storm water run off upstream Harsha Dam drains aproximately 344square miles. During the rain events, chemicals applied to farm fields and residential lawns are transported to the East Fork Little Miami River by means of storm water runoff.

A river sample was collected by Ohio EPA on May 6, 2003 at River Mile 34.92 (SR 74 Williamsburg) after a rainfall event of 2.05 inches. The sampling event took place one day after the rain event and did not collect the highly contaminated first flush of a storm water event, but did get flow from farm field tiles draining in the watershed. High flow events are causing Harsha Lake to act as a nutrient and farm chemical reservoir for the contaminated spring run off. Results of the 1998 survey found the highest levels of agricultural chemicals (Atrazine 4.3 and 4.5 µg/l; Cyanazine 2.4 and 2.2 µg/l ; and Metolachlor 4.0 and 3.4 µg/l); immediately downstream of Harsha Lake (RM 19.65).

In the May 6, 2003 sample results taken by Ohio EPA (Table 1), Atrazine was detected at 53.5 µg/l (17.8 times the MCL), Simazine was detected at 6.00 µg/l (1.5 times the MCL), and Alachlor was detected at 0.28 µg/l (below the MCL). Other non regulated (no established MCL) farm chemicals present in the surface water were Acetochlor, at 11.0 µg/l and Metolachlor, 11.8 µg/l.

Bacteria samples of surface water on May 6,2003 in East Fork Little Miami River detected E. *Coli* at 950 colonies/ 100 ml and *fecal coliform* at 4500 colonies/ 100 ml. Both E. *Coli* and *fecal coliform* are above recreational criterion. Fecal Streptococcus was detected at 25000 colonies/ 100 ml. There is no criterion for Fecal Streptococcus. Failing home septic systems and animal

East Fork Little Miami River RM 34.92 at SR 74 in Williamsburg

feed lots are suspected sources of bacterial contamination in the watershed.

Total Organic Carbon in East Fork Little Miami River was 14 mg/l. TOC value over 6 mg/l are considered high. Trihalomethanes and haloacetic acids tend to exceed the MCL as chlorination byproducts form in waters having a TOC value greater than 6 mg/l. Total Organic Carbon is added to surface water by natural sources such as decaying leaves, vegetation and other organic matter. Algae also add to the TOC levels in drinking water. Activated carbon is added to the water treatment process to remove organic contaminants and to control taste and odor problems associated with high TOC in treated water.

Nutrient loading from Phosphorus (0.603 mg/l), Nitrite/Nitrate-N (2.56 mg/l), and Ammonia-N (0.817 mg/l) facilitate the growth of algae in Harsha Lake.

1999-2000 Study of Harsha Lake by United States Geological Survey (USGS)

The USGS conducted a survey to assess pesticide and pesticide degradation in Harsha Lake and in drinking water supplied by the lake. In all, 42 pesticide compounds (24 herbicide, 4 insecticide, 1 fungicide and 13 degradates) were detected. No compounds in treated water samples exceeded any drinking water standard. The switch to granulated activated carbon from powdered activated carbon in the treatment process greatly reduced taste and odor problems and pesticide concentrations in treated water.

Pesticide concentrations in the upstream and Harsha Lake samples varied in response to seasonal and drought- related changes in rainfall and runoff. During 1999, a drought year, May-June pesticide levels were significantly lower in the surface water compared to 2000, a more normal water year. Reduction in rainfall during the drought resulted in fewer runoff events.

Parameter	E.F. Little Miami RM 34.92	MCL	Parameter	E.F. Little Miami RM 34.92	MCL
Acetochlor (µg/l)	11.0	none	Aluminum (µg/l)	4310	50[2]
Alachlor (µg/l)	0.28	2.0 µg/l	Barium (µg/l)	72	2000
Atrazine (µg/l)	53.5	3.0 µg/l	Calcium (mg/l)	31	none
bis (2-Ethylhexyl) adipate (µg/l)	2.32	none	Chromium (µg/l)	<30	100
bis (2-Ethylhexyl) phthalate (µg/l)	0.86	6.0 µg/l	Copper (µg/l)	<10	1300
Metolachlor (µg/l)	11.8	none	Iron (µg/l)	5360	3000[2]
Simazine (µg/l)	6.00	4.0 µg/l	Magnesium (mg/l)	9	none
			Manganeese (µg/l)	186	50[2]
Ammonia-N (µg/l)	0.817	none	Nickel (µg/l)	<40	none
Nitrite-Nitrate-N (µg/l)	2.56	10 mg/l	Potassium (mg/l)	9	none
Phosphorus, Total (mg/l)	0.603	none	Sodium (mg/l)	5	none
Conductivity	263	none	Strontium (µg/l)	84	none
TOC (mg/l)	14	none	Zinc (µg/l)	26	5000[2]
Total Dissolved Solids	214	none	Hardness, Total (mg/l)	114	none
Total Suspended Solids	157	none			
pH	7.63	none	E.coli (# /100ml)	950	1
CBOD5 (mg/l)	3.0	none	Fecal Coliform (# /100ml)	4500	1
COD (mg/l)	37	none	Fecal Streptococcus (# /100ml)	25000	1
TKN (mg/l)	1.72	none			

Table 1: May 6, 2003 East Fork Little Miami River Wet Weather Sampling Done by Ohio EPA at SR 74 (RM 34.92).

MCL- Maximum Contaminant Level set by federal or state drinking water standards. A sampling result that exceeds the MCL value does not indicate a MCL violation by the Public Water System.
MCL violations for many contaminants are based on an annual average value.

[2]SMCL- Advisory Limit only

Date	Flow (cfs)	Atrazine (µg/l)
12/14/1998	25	1.83
4/23/1999	103	0.0518
5/11/1999	23	2.4
5/23/1999	20	7.33
6/09/1999	11	1.19
6/22/1999	11	1.25
7/8/1999	4.7	2.07
7/21/1999	2.3	1.52
5/11/2000	28	0.155
5/24/2000	97	14.6
6/07/2000	27	18.8
6/21/2003	163	4.73
7/06/2000	851	0.912
7/18/2000	28	0.585
8/02/2000	17	0.461
8/15/2000	16	0.538
8/28/2000	13	0.323

Table 2: USGS atrazine results from the East Fork Little Miami River RM 34.92

Ohio EPA's May 6, 2003 rain event sample documented Atrazine (53.5 µg/l) at higher concentrations than any USGS survey results in the May-July time frame (18.8 µg/l). The reasons for the difference in concentrations are:

1) USGS filters their surface water samples with a 0.7-µm glass fiber filter. Pesticides tend to adsorb to sediment fines in the water column. USGS analyzes for dissolved parameters.
2) Ohio EPA's sample was designed to catch a worse case condition, first major rainfall (>0.75 inch) after the spring application of atrazine to row crops.
3) USGS samples are not biased toward wet weather events.

Contaminant (units)	Levels Found	Primary MCL	Exceeds MCL [1]	Typical Source
Inorganic Contaminants				
Barium (mg/l)	0.030-0.076	2	No	Discharge of drilling wastes; Discharge from metal refineries; Erosion of natural deposits
Chromium (µg/l)	1.1-1.9	100	No	Discharge from steel and pulp mills; Erosion of natural deposits
Fluoride (mg/l)	0.8-1.12	4	No	Erosion of natural deposits; Water additive which promotes strong teeth; Discharge from fertilizer and aluminum factories
Lead (µg/l)	7.38	AL=15	No	Corrosion of household plumbing systems; Erosion of natural deposits
Nitrate (mg/l)	0.121-4.2	10	No	Runoff from fertilizer use; Leaching from septic tanks, sewage; Erosion of natural deposits
Nitrite (mg/l)	0.23	1	No	Runoff from fertilizer use; Leaching from septic tanks, sewage; Erosion of natural deposits
Selenium (µg/l)	1.5	50	No	Discharge from petroleum and metal refineries; Erosion of natural deposits; Discharge from mines
Sulfate (mg/l)	46.2-65.6	none	NA[2]	Erosion of natural deposits; decomposition product of organic matter; discharge from mining and industrial waters; detergents in sewage; component of precipitation in metropolitan areas
Radioactive Contaminants				
Beta/photon emitters (pCi/L)	4.96-8.9	AL=50	No	Decay of natural and man-made deposits
Synthetic Organic Contaminants including Pesticides and Herbicides				
Alachlor [3] (µg/l)	0.12-0.88	2	No	Herbicide runoff
Atrazine [3] (µg/l)	0.104-8.73	3	No	Herbicide runoff
Metolachlor [3] (µg/l)	0.06-6.33	none	NA	Pesticide runoff
Metribuzin [3] (µg/l)	0.06	none	NA	Pesticide runoff
Simazine [3] (µg/l)	0.07-1.01	4	No	Herbicide runoff
Cyanazine [3] (µg/l)	0.13-3.4	none	NA	Pesticide runoff
Acetochlor [3] (µg/l)	0.24-0.69	none	NA	Herbicide runoff
Volatile Organic Contaminants				
Dichloroacetic Acid (µg/l)	1.1-122	none	NA[4]	By-product of drinking water chlorination
Trichloroacetic Acid (µg/l)	1.55-75.6	none	NA[4]	By-product of drinking water chlorination
Monobromoacetic Acid (µg/l)	1.3-3.3	none	NA[4]	By-product of drinking water chlorination
Monochloroacetic Acid (µg/l)	1.3-58.0	none	NA[4]	By-product of drinking water chlorination

Table 3. Water Quality Monitoring Summary of Treated Water Clermont County Bob McEwen Public Water System.

Ohio EPA Public Water System Compliance Monitoring Database (1991- 2003)
Ohio EPA Pesticide Special Study (May 1995 - March 1999)

MCL = Maximum Contaminant Level (AL = Action Level)

[1]MCL set by federal or state drinking water standards. A sampling result that exceeds the MCL value does not necessarily indicate a violation by the public water system. MCL violations for many contaminants are based on a running annual average.

Secondary Maximum Contaminant Level (SMCL) for this parameter. SMCLs are non-health-related limits.

[3] Data includes Ohio EPA Pesticide Special Study results (1995-1999). For the study, samples were analyzed using an immunoassay (IA) method and by USEPA Method 507, a gas chromatograph (GC) method. The immunoassay results are only estimations of the actual concentration values. The IA test kits tend to overestimate concentrations, due to cross reactivity of chemically similar pesticides (e.g. atrazine and simazine).

[4] Total Trihalomethanes (TTHMs): (MCL = 80 µg/l) calculated as the sum of the concentrations of Bromodichloromethane, Dibromochloromethane, Bromoform, and Chloroform. Five Haloacetic Acids (HAA5): (MCL = 60 µg/l) calculated as the sum of the concentrations of Monochloroacetic acid, Dichloroacetic acid, Trichloroacetic acid, Monobromoacetic acid, and Dibromoacetic acid.

USGS found that thermal stratification of Harsha Lake was another seasonal factor that affected pesticide concentrations in samples collected at the reservoir intake. Warmer springtime rains having higher pesticide concentrations were not mixing with the deeper, cooler water of the reservoir. Mixing did not occur until autumn or winter. To avoid high pesticide concentrations and problems with taste and odor, the Bob McEwen Water Treatment Plant switched from a shallow water intake to a deeper (20 feet) intake in May 1999. The shallow intake is used starting in December when the lake turns over or mixes.

Biological and Chemical Monitoring in East Fork Little Miami River and Pleasant Run

In 1998, Ohio EPA conducted a biological and water quality study of the East Fork Little Miami River watershed. Eight of the study sites upstream of the Harsha Lake were included in the study. Four sites were on the mainstem and four on Pleasant Run. Samples were taken during the summer of 1998 reflect low flow conditions and do not document the high levels of nutrients and farm chemicals found during high flow events.

Sites evaluated:
East Fork Little Miami River

site	River Mile	Location
#08	RM 44.15	Blue Sky Parkway
#09	RM 41.07	Jackson Pike ,Dst.Pleasant Run (CECOS)
#10	RM 35.87	McKeever Rd. (Inside CMZ)
#11	RM 34.80	SR 133 Dst. Williamsburg WWTP (Inside CMZ)

Pleasant Run (*enters EFLMR @ RM 42.96***)**

#31	RM 4.00	Bucktown Road
#32	RM 2.70	Dst. U.S. 50/Aber Road (Hartman House)
#33	RM 1.35	Blue Sky Parkway (Dst. CECOS)
#34	RM 0.42	Glancy Corner-Marathon Road

Drainage Area Upstream of the CMZ (US 32) (RM 36.35) to County Line (RM 47)

Pleasant Run
The impact of the CECOS facility on Pleasant Run and the East Fork Little Miami north of Harsh Lake was evaluated in 1998*.* Pleasant Run did not document any significant impacts from the CECOS facility, but Pleasant Run is an impacted watershed. Pleasant Run (Interior Plateau Warm Water Habitat) is not meeting its use designation upstream of the CECOS facility (RM 4.00 and 2.5) and only meeting a partial use designation downstream of the CECOS facility (RM 1.3 and 0.5). Dissolved oxygen (DO) and bacteriological water quality exceedences characterize the entire stream. Legacy and new age farm chemicals are also present in the two sites (RM 4.00 and 1.35) sampled on Pleasant Run for organic

compounds in the water column. Iron and Manganese were the only metals found to exceed water quality criteria in the watershed, these could be a function of the regional geology.

The Bucktown Road site at RM 4.00 has exceedences of the Ohio EPA water quality criteria in eight categories **.** (Table 3) (D.O < 5.0 mg./l (3 occurrences), E.coli (4 occurrences), Fecal coliform (2 occurrences)**,** Iron (4 occurrences), Manganeese (2 occurrences), Dieldrin, Endosulfan and Endrin (legacy compounds) (each 1 occurrence).

Atrazine was detected at (2.5 and 1.4 µg/l), below the MCL of 3 µg/l. Metolachlor was detected at (25 and 32 µg/l). There is no established MCL for this compound but these levels are high for low flow conditions. Metribuzin was detected at 0.54 and 0.57 µg/l and there is no established MCL for this compound.

Lack of wooded riparian, sedimentation, failed septic systems, algae blooms, agricultural runoff and channel modification were impacting the water quality of Pleasant Run RM 4.00. Pleasant Run exhibited problems noted in other tributaries of the East Fork Little Miami. Both the fish (IBI=12) and macroinvertibrate (ICI= poor) communities are limited to pollution tolerant species. (The minimum WWH IBI for Pleasant Run should be 40) The Qualitative Habitat Community Index (QHEI =37) indicated lack of good habitat in and around the stream. A QHEI of 60 is generally indicative of habitat sufficient enough to support a warn water faunas, whereas scores less than 45 generally can not support a biological assemblage consistent with the WWH biological criteria. Of the thirty five tributaries evaluated in the 1998 survey of the East Fork Little Miami River, 46% (16) were in non attainment of their use designation, 26% (9) were meeting partial use attainment, and only 29% (10) were in full attainment.

Pleasant Run improved slightly at RM 2.5 (Aber Rd. and US 50), but is still not meeting its use designation. The habitat of the stream was improved by more wooded riparian(QHEI=62) and the fish community (IBI=35) improved, but was still below the WWH criteria of 40. The ICI was poor and dominated by pollution tolerant macroinvertibrate species. Chemical water quality exceedences were in four categories :Ammonia (1 occurrence), D.O.(2 occurrences)
E.coli (2 occurrences) and Manganese (4 occurrences). On August 12,1998, ammonia was documented at 1.12 mg/l at US 50/Aber Rd. None of the other samples from the four sites on Pleasant Run documented ammonia over 0.2 mg/l.

Pleasant Run, RM 1.35 downstream. Of CECOS was in partial use attainment. The habitat of the stream was improved by more wooded riparian(QHEI=66) and the fish community (IBI=40) improved to meet WWH criteria. The ICI improved to fair but was still dominated by pollution tolerant macroinvertibrate species. Chemical water quality exceedences of Ohio EPA water quality criteria were in eight categories: (D.O < 5.0 mg./l (2 occurrences).,E.coli (4 occurrences)
Fecal coliform (2 occurrences),Iron-T (2 occurrences), Manganeese (1 occurrence),
Aldrin, Dieldrin and Heptachlor (legacy compounds)(each 1 occurrence).

Aldrin and heptachlor were not found upstream of the site, but attribution to the CECOS facility is not clear. Aldrin and heptachlor are also associated with agricultural runoff, which dominated the land use in the area.

Atrazine was detected at 0.67 and 0.20 µg/l, below the drinking water MCL of 3 µg/l. Metolachlor was detected at 3.8 and 0.46 µg/l, but there is no established MCL .Metribuzin was detected at 0.54 and 0.57 µg/l, and there is no established MCL for this compound. Both new age chemicals were found at higher levels upstream.

The only sediment sample taken in Pleasant Run was at RM 1.35. Volatile, Semi volitile , Pesticide and PCB compounds were all below the detection limit. Acetone (0.1 mg/kg) was found in the sample but it is believed to a remnant of the cleaning process of the sampling or laboratory equipment. Eighteen sediment metals were analyzed in this sample. Aluminum (161000 mg/kg) was the only sediment metal found in the extremely elevated category above the Ohio Sediment Reference value. No other sediment metals were found to be of concern. . The geology of the area may contribute to high Aluminum levels in sediment.

Pleasant Run at RM 0.5 is in partial use attainment. The habitat of the stream was improved by more wooded riparian(QHEI=62.5). The fish community (IBI=35) was not meeting WWH criteria. The ICI improved to marginally good. Chemical water quality exceedences of Ohio EPA water quality criteria were in three categories: D.O < 5.0 mg./l (2 occurrences).,
E.coli (3 occurrences), Fecal coliform (2 occurrences)***,***

East Fork Little Miami River (Exceptional Warmwater Habitat)(Upstream of the CMZ)

East Fork Little Miami River was in non attainment for the aquatic life Exceptional Warmwater Habitat use designation at RM 48.7. The QHEI of the East Fork Little Miami River is 76 as it enters Clermont County. QHEI scores over 75 are generally needed to support exceptional warm water faunas. Impacts to the fish population noted by pollution intolerant species and the decline in the robustness of the fish population was documented in 1998.

East Fork Little Miami River, RM 44.1, upstream of Pleasant Run improved to partial attainment for an Exceptional Warmwater Habitat stream. The QHEI improved to a very good score of 89, as the robustness of the fish population increased to Exceptional WWH levels (MIwb=9.5), unfortunately the diversity of pollution intolerant species had not improved (IBI-40). The ICI score improved to 44.

Chemical water quality exceedences were in four categories :Dieldrin (2 occurrences),
Heptachlor (1 occurrence), D.O < 5.0 mg./l (1 occurrence) and Iron-T (1 occurrence)

Atrazine was detected at 1.1 and 0.47 µg/l, below the drinking water MCL of 3 µg/l, Cyanazine was detected at 0.29 µg/l, below the drinking water MCL of 1 µg/l, and Metolachlor was detected at 0.84 µg/l. There is no established MCL .

Sediment sample were taken at RM 44.2. Five different Polycyclic Aromatic Hydrocarbons (PAH) were detected in sediments: (Benzo(a)Pyrene (0.59 mg/kg), Chrysene (0.81 mg/kg), Flouranthene (1.7 mg/kg), Phenanthrene (1.4 mg/kg), and Pyrene (1.3 mg/kg). Phenanthrene was over the MacDonald Extreme Effect Concentration (EEC), adverse effects usually or always occur in freshwater ecosystems. The other four PAHs were between the MacDonald Threashold Effects Concentration (TEC) and the EEC, adverse effects frequently occur in freshwater ecosystems. Volatile, Pesticide and PCB compounds were all below the detection limit. Eighteen sediment metals were analyzed in this sample. Aluminum (146,000 mg/kg) was the only sediment metal found in the extremely elevated category. No other sediment metals were found to be of concern. Aluminum could be a product of the local geology or a remnant of the sandblasting of the bridge prior to painting.

East Fork Little Miami River RM 41.1 downstream of Plesant Run was still in partial attainment for the Exceptional Warmwater Habitat use designation. The habitat was excellent (QHEI=94.5) fully capable of supporting EWH fauna. The fish population had improved since 1993 to (IBI=44) but is still not above the threshold needed to attain EWH criteria. The robustness of the fish community dropped slightly (MIwb=9.2), but was at the lower limit of the EWH classification. Macroinvertibrate communities support the EWH classification (ICI=48). Chemical water quality exceedences were in five categories :E.coli (1 occurrence),
Aldrin (1 occurrence), Dieldrin (2 occurrences), Endosulfan II (1 occurrence), and
Iron-T (1 occurrence).

Atrazine was detected at 1.2 and 0.50 µg/l, below the drinking water MCL of 3 µg/l. Cyanazine was detected at 0.29 µg/l, below the drinking water MCL of 1 µg/l. Metolachlor was detected at 0.85 µg/l. There is no established MCL .

Sediment sample were taken at RM 44.2. No VOC, Semi Volatile, Pesticide or PCB compounds were detected in sediment samples. take. No sediment metal samples were taken.

Drainage Area in the CMZ

***East Fork Little Miami River* ,RM 35.9,** at McKeever Road did not have a full biological assessment. Only the macroinvertibrate communities were evaluated. The ICI was 44, just at the threshold needed to be considered in the EWH range. Water column and sediment samples were taken. Chemical water quality exceedences were in four categories :
E.coli (2 occurrences),Dieldrin (2 occurrences), Endosulfan II (2 occurrence), and
Manganeese-T (2 occurrences).

Atrazine was detected at 1.2 and 0.54 µg/l, below the drinking water MCL of 3 µg/l, Cyanazine was detected at 0.28 µg/l, below the drinking water MCL of 1 µg/l. Metolachlor was detected at 1.0 µg/l. There is no established MCL .

Sediment sample were taken at RM 35.9. No VOC, Semi Volatile, Pesticide or PCB compounds were detected in sediment samples taken. Eighteen sediment metals were analyzed in this sample. Chromium (52.7 mg/kg) was found to be above the Ohio Sediment Reference Value. No other sediment metals were found to be of concern.

***East Fork Little Miami River* RM 34.8** downstream of SR 133 and the Williamsburg WWTP was in partial attainment for an Exceptional Warmwater Habitat criteria. The habitat is very good (QHEI=87.0), fully capable of supporting EWH fauna. The fish population was similar to the upstream sites (IBI=43), still not above the threshold needed to be considered in the EWH range. The robustness of the fish community dropped slightly (Miwb=8.9), but is at the lower limit of the EWH criteria. Macroinvertibrate communities support the EWH classification (ICI=48).

Chemical water quality exceedences were in four categories :E.coli (3 occurrences),
Fecal coliform (1 occurrence), Dieldrin (2 occurrences), and Manganeese-T (1 occurrence).

Atrazine was detected at 1.4 and 0.64 µg/l, below the drinking water MCL of 3 µg/l. Cyanazine was detected at 0.34 µg/l, below the drinking water MCL of 1 µg/l. Metolachlor was detected at 1.1 µg/l. There is no established MCL .

Sediment sample were taken at RM 34.7. No VOC, Semi Volatile, Pesticide or PCB compounds were detected in sediment samples. Eighteen sediment metals were analyzed in this sample. No sediment

Table 4: Exceedences of Ohio EPA water quality criteria (OAC 3745-1) (and other chemicals not codified for which toxicity data is available) for upstream water intake, chemical/physical water parameters measured in grab samples taken from the East Fork Little Miami River study area during 1998 (units are µg/l for metals and organics, #colonies/100ml for fecal coliform and E.coli, µmhos/com for conductivity, SU for pH, and mg/l for all the paremeters.

Waterbody	RM	Use Designations	Parameter	Result
Pleasant Run	4.00	(Warm Water Habitat, Primary Contact Recreation, Agricutlural Water Supply	D.O	1.30^3, 4.20^3, 2.40^3
			E. Coli	(2700^5,160^4, 24000^5, 2800^5)
			Fecal coliform	(5600^5 ,7300^5)
			Iron	(3380^1 , 1060^1 1280^1,7400^1)
			Manganese-T	(396^1,164^1)

Pleasant Run	RM	Use Designation	Parameter	Result
			Dieldrin	0.0099[1,2]
			Endosulfan	0.044[1]
			Endrin	0.0052[1]
	2.70		Ammonia	1.12[1]
			D.O.	(3.60[3], 4.00[3])
			E. coli	230[4]
			Manganese-T	(496[1],134[1] 194[1] ,167[1])
	1.35		D.O.	(3.80[3],1.80[3])
			E. coli	(800[5],450[5], 21000[5], 440[5])
			Fecal coliform	(3200 [5], 31000 [5])
			Iron	(1160[1] , 1180[1])
			Manganese-T	191[1]
			Aldrin	0.01[2]
			Dieldrin	0.012[1,2]
			Heptachlor	0.0042[1,2]
	0.42		D.O.	(4.60[3],2.40[3])
			E. coli	(2900[5],210[5], 1600[5])
			Fecal coliform	(3200 [5],5900 [5])

East Fork Little Miami River	RM	Use Designation	Parameter	Result
	44.15	(Exceptional Warm Water Habitat, Primary Contact Recreation, Agricultural Water Supply)	D.O.	5.60[3],
	Blue Sky Parkway		Iron-T	1200[1]
			Dieldrin	0.0063[1,2] 0.0061[1,2]
			Heptachlor	0.0041[1,2]
	41.07 Jackson Pike, Dst. Pleasant Run		E. coli	140[4]
			Iron-T	1690[1]
			Aldrin	0.0062[2]
			Dieldrin	(0.0033[2] 0.0061[1,2])
			Endosulfan II	0.0043[1]
	35.87 McKeever Rd.		E. coli	(340[5], 390[5])
	Inside CMZ		Manganese-T	(109[1],129[1])
			Dieldrin	(0.0033[2] 0.0063[1,2])
			Endosulfan II	(0.0047[1] 0.0042[1])
	34.80 SR 133 DST. Williamsburg WWTP		E. coli	(780[5], 190[4], 190[4])
			Fecal coliform	2200 [5]
			Manganese-T	101[1],
			Dieldrin	(0.0029[2] 0.0077[1,2])

[1] Exceedence of numerical criteria for prevention of chronic toxicity (CAC).
[2] Exceedence of numerical criteria for the protection of human health (non-drinking).
[3] Value is below the EWH minimum 24-hour average dissolved oxygen (D.O.) criterion (6.0 mg/l) or value is below the WWH minimum (24-hour) average D.O. criterion (5.0 mg/l).
[4]Value is above the average Primary Contact Recreation (PCR) criteria. (fecal coliform 1000/100ml; E. coli 126/100ml).
[5]Value is above maximum PCR criteria. (fecal coliform 2000/100ml; E. coli 298/100ml).
[6]Value is above maximum criteria applicable to all waters (fecal coliform 5000/100ml; E. coli 576/100ml).

6.0 Potential Contamination Sources

East Fork Lake State Park contains 61% of the Corridor Management Zone on East Fork Little Miami River (Figure 4). Restricted land use within the park will serve to protect this valuable resource well into the future. Thirty nine percent of unprotected perimeter of the Corridor Management Zone is vulnerable in many areas.

1) The surface water entering the CMZ at RM 36.56 (US 32 bridge) is not meeting the Exceptional Warm Water Habitat use designation. The East Fork Little Miami is only as healthy as the tributaries it drains. Removal of wooded riparian, sedimentation, failed septic systems , algae blooms, agricultural runoff and channel modification in the headwaters are part of the stressors that impact aquatic life and lowering water quality.

2) The Williamsburg WWTP is an ongoing source of nutrients to Harsha Lake.
Monthly operating reports submitted by Williamsburg from 1/1/2000 to 11/30/2003, documented 41 numeric permit violations. Electrical failures and plant upsets are a constant problem at the facility.

Table 5: Williamsburg WWTP Numeric NPDES Permit Violations (1/1/2000 to 11/1/2003)

Parameter	# of Violations	% of Violations
Dissolved Oxygen <6 mg/l	5	12%
$CBOD_5$	13	32%
Total Suspended Solids	14	34%
pH	1	2%
Fecal Coliform	2	5%
Oil and Grease	5	12%
Ammonia	1	2%

Table 6: Williamsburg WWTP Nutrient Loadings from 1/1/2000 to 11/30/2003 into Harsha Lake based upon an average flow of 280,000 gallons/day

Parameter	Ave. Concentration	Daily Loading	Yearly Loading
Nitrate/Nitrite	6.72 mg/l	15.65 lbs/day	5711 lbs/yr
Ammonia	0.49 mg/l	1.14 lbs/day	416 lbs/yr
Phosphorous	0.47 mg/l	1.09 lbs/day	399 lbs/yr

3) The Forrest Creek (AKA Berry Mobile Gardens MHP) (#14 on PCSI map) is a poorly run package plant discharging an average of 20,000 gallons of effluent per day into Ulery Run. Ulery Run flows into the southern part of Harsha Lake. During high water events, the sandfilters are overwhelmed and the bypassed effluent flows into Ulrey Run. Monthly operating reports submitted by Forrest Creek MHP from 1/1/2000 to 11/30/2003 documented 55 numeric permit violations.

Table 7: Forrest Creek WWTP Numeric NPDES Permit Violations (1/1/2000 to 11/30/2003)

Parameter	# of Violations	% of Violations
Chlorine Residual	24	47%
Dissolved Oxygen <6mg/l	16	29%
Ammonia	9	16%
Total Suspended Solids	5	9%
pH	10	15%
Fecal Coliform	1	2%

4) The Bethel Lift station has bypassed for 20 years on the trunk sewer connecting the village of Bethel to the Batavia WWTP. It is located near S.R 125 and Burke Road and flows into Poplar Creek. Nutrients and untreated sewage enter the lake via Poplar Creek. Clermont

County has plans to install new pumps in the surge structure to prevent overflows.

5) Slabcamp Run is the most direct route for contamination to reach the surface water intake. A potential spill on US 32 reaching Slabcamp Run would be the most direct route to the intake at the mouth of Slabcamp Run. A railroad crossing is located 3 miles upstream on Slabcamp Run. A spill from the rail road crossing could take about 5 hours @ 1 ft/sec to reach the intake. There are 2 lift stations (Cain Run and Greenbrier Road lift stations) along old 32 that have had historic overflow problems during wet weather conditions. Both lift stations flow to Slabcamp Run. Clermont County has made electrical improvements to the pumps to prevent bypasses. Both lift stations can bypass during power outages.

6) The transportation network is a potential source of contamination through vehicular accidents that could release hazardous materials. There are 20 different major highway and 5 rail crossings within the perimeter of the Corridor Management Zone.

A Hazmat Commodity Flow Study of US 32 in Clermont County was conducted for the Clermont County Local Emergency Planning Commission on September 8-11, 1999 . Results indicated that 122 different types of placarded containers representing 1066 truckloads were counted. In all, 6.2% of the 17,132 trucks traveling on US 32 required placarding. Some of the more toxic materials were:

194 tankers of Gasoline or Motor Spirits	20 tankers of Sodium Hydroxide solution
59 tankers of Ethyl Nitrate and diesel fuel	20 truckloads of radioactive material
33 truckloads of solid hazardous waste	13 tankers of Methyl Methacrylate monomer
24 truckloads of paint (flammable)	13 tankers of resin solution
11 tankers of corrosive inorganic acids	9 truckloads of liquid hazardous waste
2 tankers of Potassium Cyanide	

1 tanker each of (Uranium Hexafluoride, PCBs, Hydrazine, Isocyanate Solution)

US 32 crosses the East Fork Little Miami River at RM 36.56 at the edge of the Corridor Management Zone in Williamsburg. There is a potential that a tanker truck accident and spill could enter the water supply via US 32. Due to the lake like nature of East Fork Little Miami in Williamsburg (Time of travel 0.04 mi/hr @ 40cfs), a spill would take days for the contamination to reach the intake at approximately Rm 21.5.

US 32 crosses Kain Run At RM 2.94 and Cabin Run at RM 3.11.Any potential spill at this location would take about 5 hours @ 1ft/sec to reach the East Fork Little Miami River in the East Fork Park. Once the spill reached the tailwaters of the lake, (RM 29.0 for Kain Run) and RM 27.0 for Cabin Run, flows drop to approximately 0.04 mi/hr. and it could take days for the contamination to reach the intake.

The rail road crosses Kain Run at RM 2.32 and Cabin Run at RM 2.54 which would take a potential spill approximately 4 hours@ 1 ft/sec to reach the lake like part of East Fork Little Miami River. Once the spill reached the tail waters of Harsha Lake. Flows drop to approximately 0.04 mi/hr. and in this location it could take days for the contamination to reach the intake.

7) A review of available regulated facility data bases and a field survey of the corridor management zone indicate that 20 potential contaminant sources are present in the drinking water source protection area. Figure 5 and Table 8 show the potential sources in the Corridor Management Zone. Growth of industrial facilities along US 32 is predicted in the future.

It is important to note that this inventory represents *potential* contaminant sources, and includes any source that has the *potential* to release a contaminant to surface or ground waters in the protection area. It is beyond the scope of this study to determine whether any specific potential source is actually releasing a contaminant, or to what extent any potential source(s) may be contributing to the overall pollutant load.

Changing land uses in the protection area may result in new potential sources of contaminants. New housing and commercial development have occurred in the protection area since the land use analysis shown in Figure 3 was conducted in 1994. Such changes are reflected in nonpoint source pollution pattern changes. Land cleared for construction can result in greatly accelerated rates of erosion and sedimentation of streams. After development there is usually more impervious surface which increases the rate and volume of runoff. Materials deposited on the surface of the land are incorporated into the runoff and enter streams during rainfall events. Some local programs and the NPDES general permit for construction sites attempt to control sediment laden runoff from these sites during construction. Enforcement of these regulations has not kept pace with the development, however, and a significant amount of sediment enters streams in the watershed as a result. Perviously developed areas contribute different types of pollutants to the watershed runoff (oil & grease and lawn chemicals).

7.0 SUSCEPTIBILITY ANALYSIS

For the purposes of source water assessments, all surface waters are considered to be susceptible to contamination. By their nature surface waters are open and accessible and can be readily contaminated by chemicals and pathogens, with relatively short travel times from source to the intake. Based on the information compiled for this assessment, the Bob McEwen drinking water source protection area is susceptible to contamination from agricultural, residential and commercial sources, and from accidental releases and spills.

It is important to note that this assessment is based on available data, and therefore may not reflect current conditions in all cases. Water quality, land uses and other activities that are potential sources of contamination may change with time. While the source water for the of Bob McEwen Public Water System is considered susceptible to contamination, historically, the Bob McEwen Public Water System has effectively treated this source water to meet drinking water quality standards.

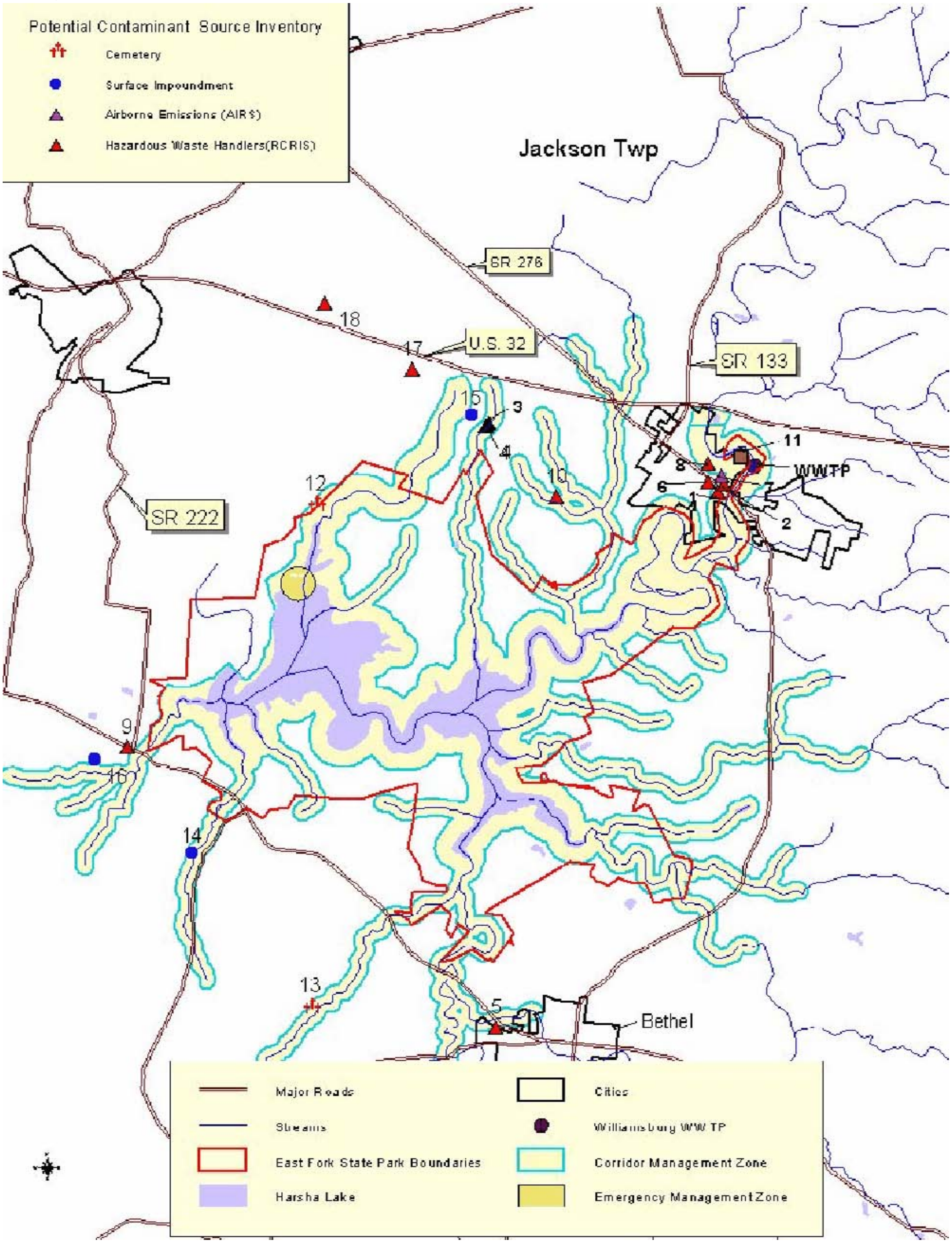


Figure 5: Potential Source Contaminant Inventory in Corridor Management Zone (CMZ).

Table 8: Potential Contaminant Source Inventory for the Bob McEwen Drinking Water Source Protection Area (Map ID corresponds to Figure 5)				
Map ID	**Unique ID**	**Facility Name and Address**	**Source Description**	**Data Source**
1	OH0000891309	Ashland Branded Marketing 209 West Main St. Williamsburg, Ohio 45176	RCRIS	US EPA Envirofacts
2	OHD004255063	Cincinnati Box Partition 234 North Front St. Williamsburg, Ohio 45176	RCRIS, TRIS, AIRS/ AFS	US EPA Envirofacts
3	OHD 052150703	Cincinnati Fiberglass 4174 Half Acre Rd. Batavia, Ohio 45103	RCRIS, TRIS, AIRS/ AFS	US EPA Envirofacts
4	OHD054443379	Cincinnati Milacron Batavia 4165 Half Acre Rd. Batavia, Ohio 45103	RCRIS, TRIS, AIRS/ AFS	US EPA Envirofacts
5	OHD099864605	Hensley Rigging 2461 State Route 125 Bethel, Ohio 45106	RCRIS	US EPA Envirofacts
6	OHD981779317	Williamsburg Kwik Coin Wash 119 North Third St. Williamsburg, Ohio 45176	AIRS/AFS	US EPA Envirofacts
7	OHD986987428	Meyers Duckworth 244 North Second St. Williamsburg, Ohio 45176	RCRIS	US EPA Envirofacts
8	OHD987008315	Dualite 1 Dualite Lane Williamsburg, Ohio 45176	RCRIS	US EPA Envirofacts
9	OHD987025269	Vandemark 2129 State Route 125 Amelia, Ohio 45102	RCRIS	US EPA Envirofacts
10	OHD987054244	Hughes Auto 3099 Old State Route 32 Batavia, Ohio 45103	RCRIS	US EPA Envirofacts
11	LAN 1013	Williamsburg Dump Williamsburg, Ohio 45176	Inactive/Closed Landfill	OEPA Landfill GIS Layer

Table 8: Potential Contaminant Source Inventory for the Bob McEwen Drinking Water Source Protection Area (Map ID corresponds to Figure 5)

Map ID	Unique ID	Facility Name and Address	Source Description	Data Source
12	CEM 1663	Greenbrier Cemetery	Cemetery	USGS Geonames
13	CEM 4393	Sugartree Cemetery	Cemetery	USGS Geonames
14	OH0040568	Forest Creek Mobile Home Park 300 Berry Road Batavia, Ohio 45103	WWTP Surface Impoundment	OEPA DSW
15	SIM 0204	Cincinnati Malacron Plastics 4165 Half Acre Rd. Batavia, Ohio 45103	Surface Impoundment	OEPA DSW
16	SIM 0208	Holly Towne Inc. 7168 Beechmont Ave. Cincinnati, Ohio	Surface Impoundment	OEPA GIS Layer
17	OHD093041565	Z.F. Batavia 1981 Front Wheel Dr. Batavia, Ohio 45103	RCRIS	OEPA DSW
18	OHD085513026	Southern Ohio Fabricators 2565 Batavia-Williamsburg Rd. Batavia, Ohio 45103	RCRIS	OEPA DSW
19	OHD987028057	B.P. Oil 609 Wet Main St. Williamsburg, Ohio 45176	Gas Station	OEPA DSW
20	OHR000042663	Hosea Industrial Packaging 4160 Half Acre Rd. Batavia, Ohio 45103	RCRIS	US EPA Envirofacts

8.0 PROTECTIVE STRATEGIES

Clermont County's Office of Environmental Quality will be conducting a Total Maximum Daily Load (TMDL) study of East Fork Little Miami watershed for USEPA starting in the next few years. Surface water concerns identified in this SWAP report will be investigated in further detail and plans will be implemented to improve and protect water quality upstream from Harsha Lake.

Clermont County's Office of Environmental Quality is currently working with stakeholders on watershed action plans for the East Fork Little Miami River. The Bob McEwen Water Treatment Plant is one of those stakeholders involved in the project. When finished, the watershed action plan should incorporate the TMDL into its overall plan to improve the watershed by:

- Controlling septic discharges by working with the Health Departments in identification and repair of failed septic systems within the watershed. This will involve cooperation with Brown, Highland and Clermont Counties.
- Controlling agricultural and urban runoff, with particular attention to sources of herbicides and fecal bacteria within the watershed.
- Exploring the application of best management practices for reducing the transport of sediment and contaminants from agricultural, residential and commercial sources;
- Preservation and restoration of wooded riparian areas in the watershed

Protection of Harsha Lake should including the connecting of the Williamsburg WWTP to the Clermont County collection system. A trunk sewer has been constructed by Clermont County in the vicinity of Williamsburg capable of handling the flow from Williamsburg.

The Long Term 2 Surface Water Treatment Rule enacted by USEPA may require surface water systems with average test results for E. Coli > 25 colonies /100ml in their source water to test for Cryptosporidium. The detection of Cryptosporidium in source water may require additional treatment to be installed for removal or inactivation. Implementation of a State approved watershed protection plan that will reduce the source vulnerability activities may result in treatment credit.

The Ohio EPA Division of Drinking and Groundwater recommended that Clermont County complete a Comprehensive Performance Evaluation (CPE) after turbidity violations that occurred at the Bob McEwen Plant in January and February of 2003. A recommendation of the CPE was the institution of a watershed protection program to minimize impact of total organic carbon and pesticides on the raw water intake. The Ohio EPA is aware that Clermont County has initiated Watershed Protection activities. We highly encourage the County to develop a comprehensive plan. An aggressive watershed protection program *may* help reduce treatment costs and compliance with existing and future regulatory requirements. Failure to do so may result in additional treatment cost requirements both capital and operational.

Other source water protection efforts may include:

Education and Outreach: Informing people who live, work, or own property within the protection area about the benefits of drinking water protection is very important. Although some communities develop their own educational outreach resources, assistance is available at no cost from various agencies. For example, staff from Ohio EPA's Office of Pollution Prevention can visit businesses (free of charge) and provide recommendations to modify processes, materials and practices to generate less pollution in a cost-effective and technically feasible manner. An effort should be made to educate homeowners and businesses of the potential threat their activities can pose to the water supply. Education could also focus on increasing public awareness of illegal dumping and drinking water protection, particularly in recreational boating areas.

Transportation Routes: There is a potential for spills along roads within the protection area. Clermont County may want to consider contacting the local fire department and local emergency planning agency about the location of the drinking water source protection area, so that strategies can be developed to prevent spilled materials from impacting Harsha Lake.

Emergency Response Planning: Clermont County should prepare a plan that includes early warning of spills and coordination of response and remediation activities for spills that may enter Harsha Lake. This plan should include emergency response actions, such as the placement of absorbent booms to control oil spills, or the ability to mechanically add oxygen to oxidize chemicals with a high oxygen demand. Different response plans could be developed for different types of contamination. The emergency response plan may also contain strategies for dealing with unexpected levels of runoff containing chemicals such as fertilizers and pesticides from adjacent land uses. Though it may be less catastrophic than a major spill, this kind of contamination is more prevalent and is harder to detect and contain.

Zoning Ordinances: A water protection zoning ordinance is a regulatory control that typically places some restrictions or standards on activities conducted within a specified zone (such as the corridor management zone and/or the emergency management zone). Such ordinances enable the municipality to require people who live or work in this area to avoid contaminating the source of the municipality’s drinking water. Ordinances can help ensure best management practices are being employed at local businesses and can help reduce the volume of contaminants stored within the protection area. Clermont County may want to consider working with the counties, townships, and municipalities in the protection area to develop zoning overlays that require specific standards for chemical storage, handling of waste materials, and other source control strategies. Several communities in Ohio have enacted very successful drinking water source protection ordinances. Copies can be obtained by contacting Craig Smith at (614) 644-2752.

Regulatory Compliance: Where possible, Clermont County, can monitor the compliance of potential contaminant sources with existing regulations through inspections and/or contact with regulatory agencies. If routine inspections are a regulatory requirement, they provide an excellent opportunity to educate an important segment of the community about the importance of drinking water source protection. Inspections also provide an opportunity to encourage improved materials handling procedures, hazardous materials training, waste and disposal assessments, facility spill/contingency planning, and pollution prevention initiatives.

Ohio EPA encourages the Clermont County to incorporate the types of protective strategies listed above into a drinking water source protection plan, and to develop a local program to protect the source waters. A local program is capable of responding to changing conditions within the watershed and can bring together the local governments and stakeholders needed for an effective protection effort. Source water protection efforts could benefit the community by allowing theBob McEwen water treatment plant to more fully use its surface water resource.

Two guidance documents are available from Ohio EPA to assist with development of a Drinking Water Source Protection and Management Plan. *A Guide to Developing Local Watershed Action Plans in Ohio*" is available on the internet at and *"Developing Local Drinking Water Source Protection Plans in Ohio"* at . For more information on drinking water source protection, please contact the Drinking Water Protection staff at (614) 644-2752.

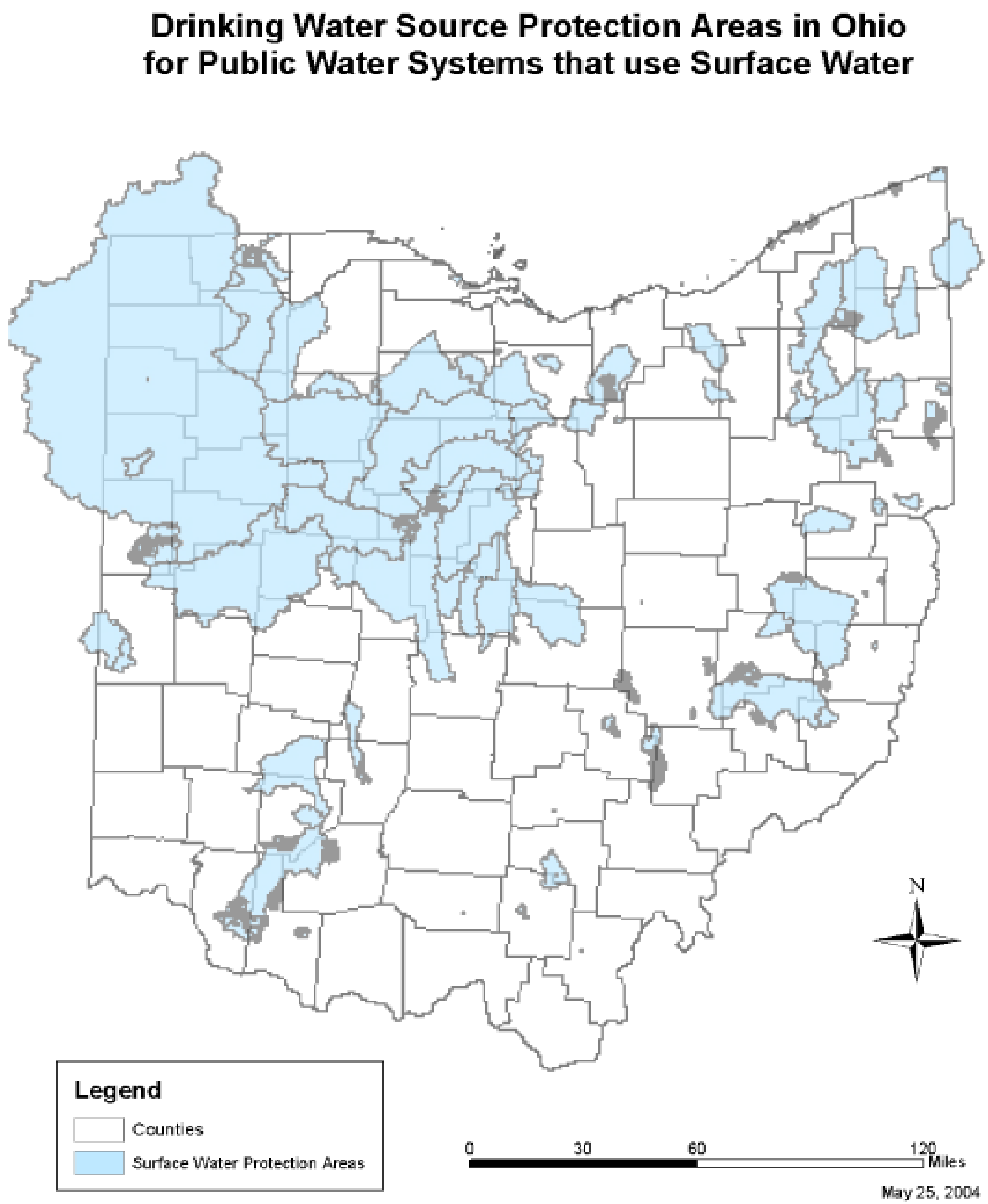
References

Gazetteer of Ohio Streams, Second Edition, Ohio Department of Natural Resources, Division of Water. 2001.

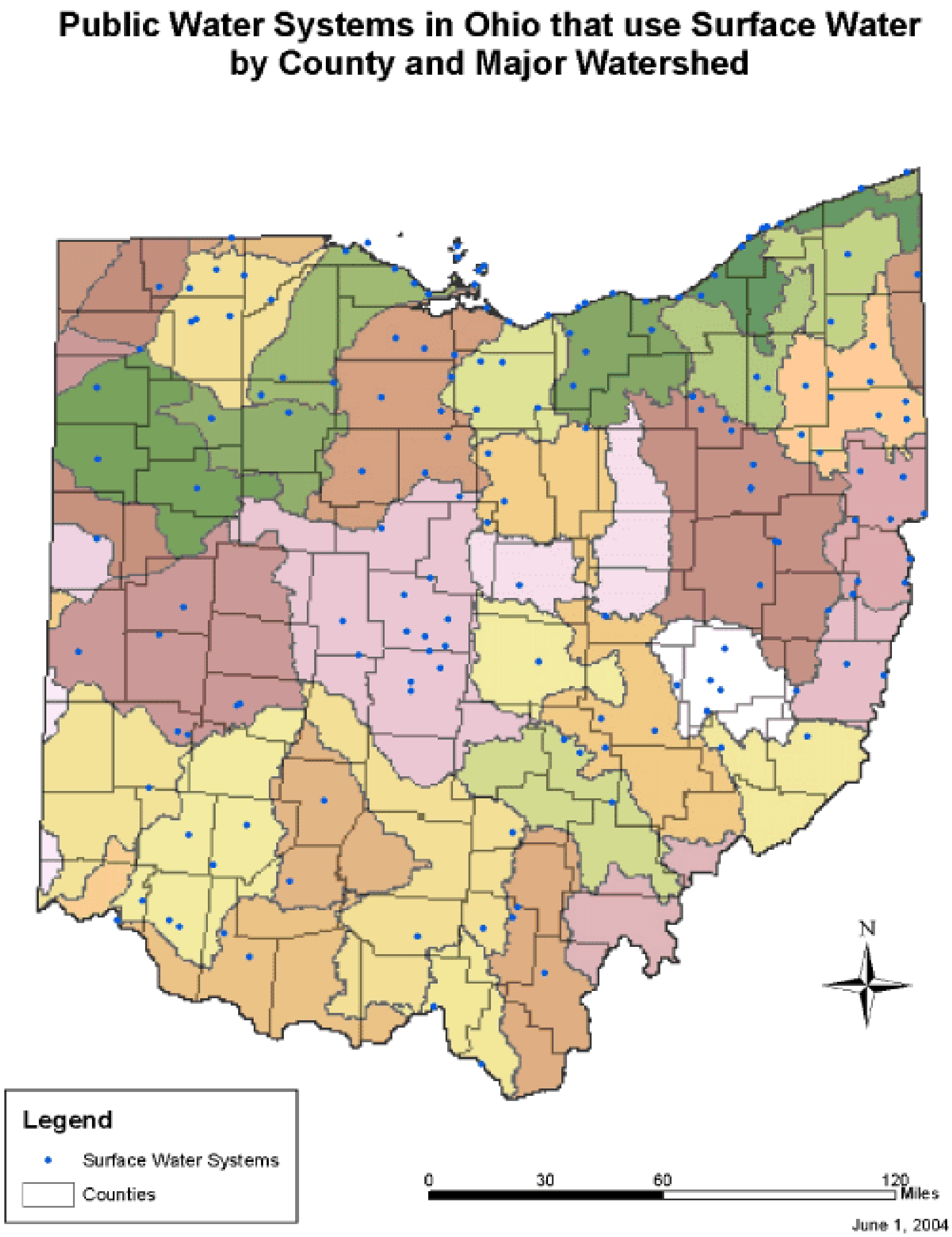
Ohio EPA, 1997. Biological and Water Quality Study of the East Fork Little Miami River, Division of Surface Water Monitoring and Assessment Section, Ohio Environmental Protection Agency. Unpublished OEPA Technical Report

U.S.Geological Survey,2003, Pesticides and Pesticide Degradates in the East Fork Little Miami River and William H. Harsha Lake, Southwestern Ohio,1999-2000: U.S. Geological Survey Water-Resource Investigation Report 03-4216

APPENDIX D
Source Water Protection Maps for Ohio

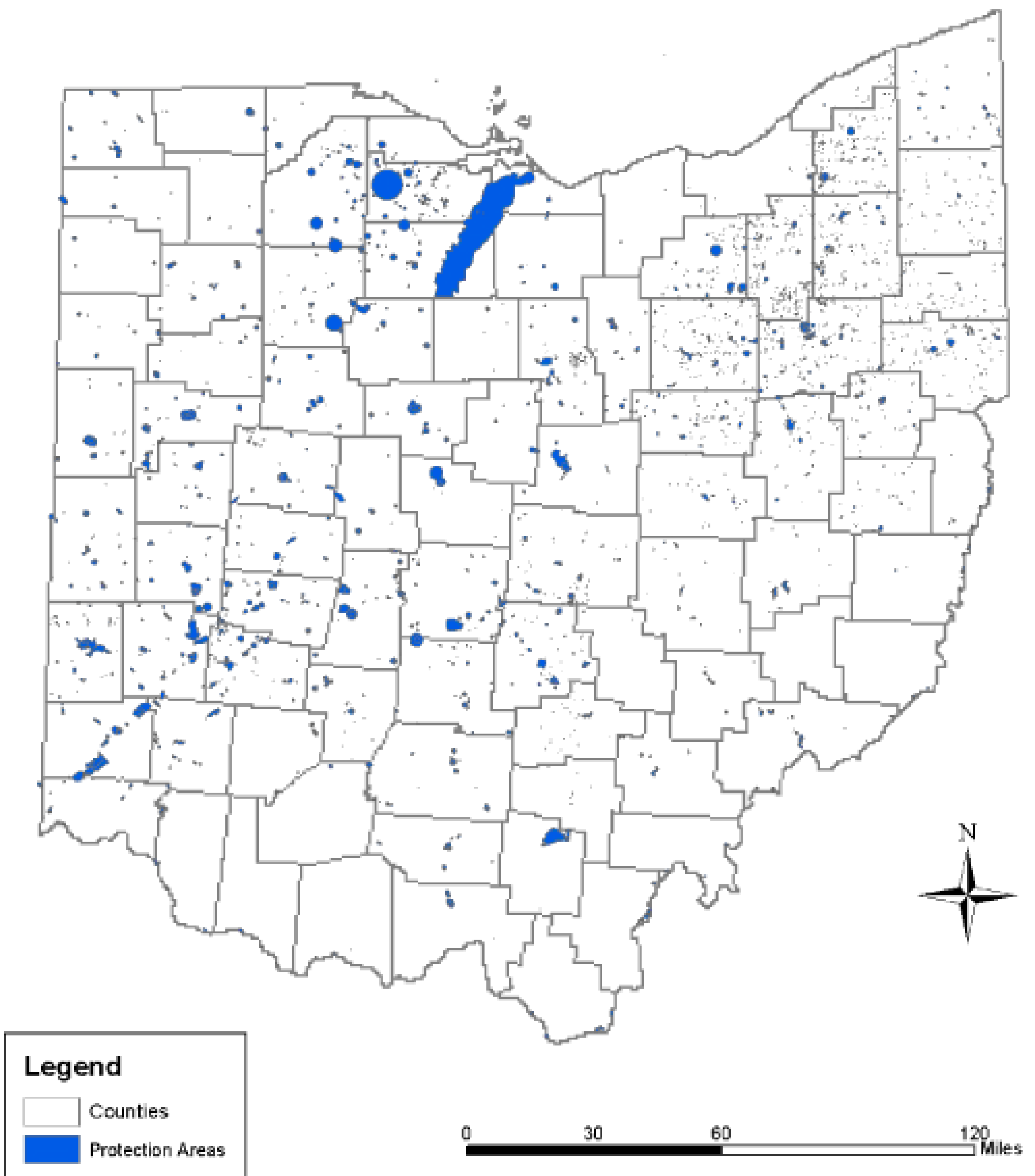


Source: www.epa.state.oh.us/ddagw/pdu/swap_maps.html



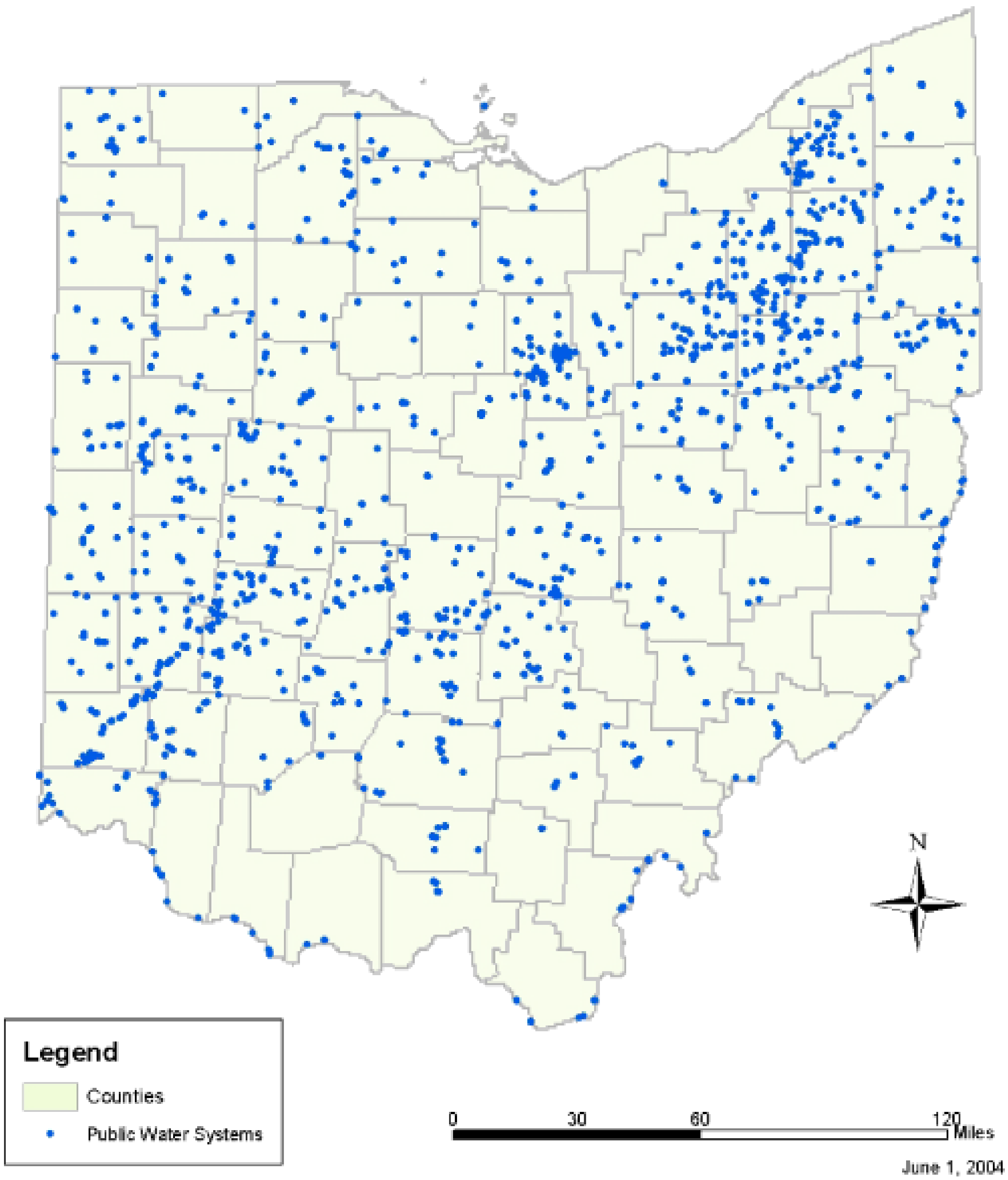
Source: www.epa.state.oh.us/ddagw/pdu/swap_maps.html

Drinking Water Source Protection Areas in Ohio for Public Water Systems that use Ground Water



Source: www.epa.state.oh.us/ddagw/pdu/swap_maps.html

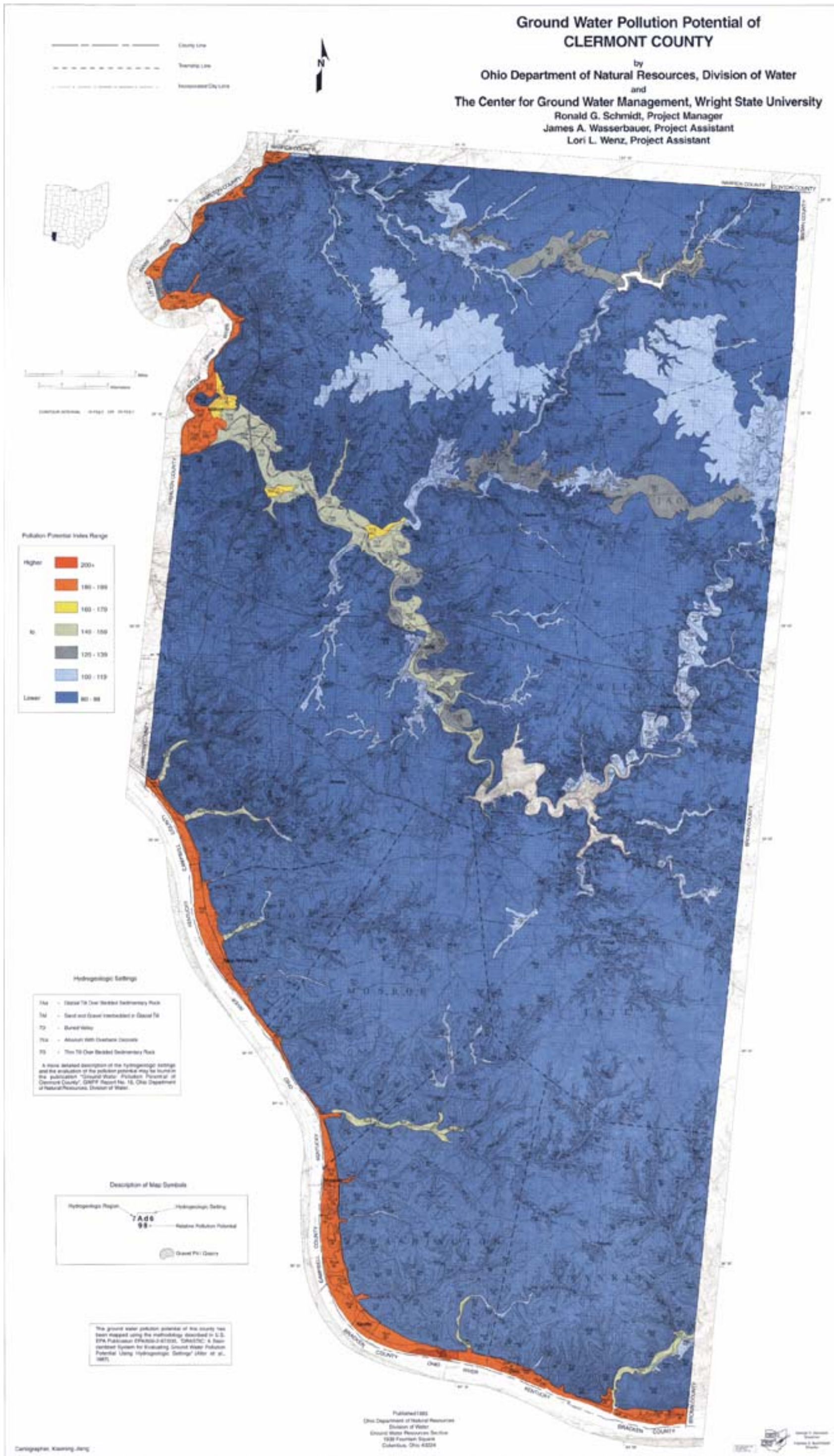
Community Public Water Systems in Ohio that use Ground Water



Source: www.epa.state.oh.us/ddagw/pdu/swap_maps.html

APPENDIX E
Ground Water Pollution Potential Map for Clermont County

Source: http://www.dnr.state.oh.us/water/gwppmaps/



APPENDIX F
Chemical Use Analysis and Tillage Practices of the Entire East Fork Little Miami River Watershed

This Appendix presents the chemical use analysis data of agriculture, horticulture, and highway/infrastructure chemical use throughout the entire East Fork Little Miami River watershed obtained during the 1997 Land Use and Chemical Analysis study conducted by Clermont SWCD and OSU Extension completed in May 1999.

Agricultural Chemical Use Analysis

Preserving and improving the quality of the water resources of the EFLMR watershed are two key goals. With the increasing demands upon Lake Harsha to be a reliable source of clean, safe drinking water, it is imperative that a proactive approach be taken to ensure that this valuable resource be maintained. With 50 percent of the watershed being in some form of agricultural utilization, efforts are certainly needed to address concerns that are associated with this industry.

Corn acreage within the watershed was 47,685 in 1997. Based on the information collected, 90 percent to 95 percent of this acreage received some form of atrazine herbicide. Most farmers are using the chemicals at the rate of two pounds of active ingredient per acre. This would indicate that between 43,000 and 45,500 acres will have atrazine applied for weed control. This would translate to atrazine applications between 86,000 and 91,000 pounds. Harness was another herbicide that was used on the remaining 2,300 to 4,500 acres. Harness and atrazine are restricted pesticides and have a ground water advisory statement.

Table I provides an inventory of chemicals associated with corn production and the estimated total amount of each herbicide applied in the watershed during 1997.

Table I Estimated Chemical Use in Watershed - Corn Production

Chemical Name	% Use Watershed	Total Acres	Total Amount
Etrazine 4L (Bladex & Atrazine)	46%	1,897	2,371 qts.
Bicep II (Dual II & Atrazine)	36%	1,477	2,954 qts.
Harness	12%	519	519 qts.
Lariat (Lasso & Atrazine)	4%	159	636 qts.
2,4-D	2%	71	35 qts.
Total	100%	4,123	N/A

Herbicides

Atrazine is the corn herbicide that has received considerable attention regarding water quality. Restrictions regarding the use of this chemical have increased in recent years. Farmers are more aware of the concerns surrounding the use of this herbicide. Restrictions are in place that limits application within 200 feet of a lake or reservoir. A 66 foot buffer strip has been established for application near a stream. If the land is highly erodible, the 66 foot buffer zone must be planted in a cover crop. For mixing and loading, a 50 foot set back is required to protect wells and streams.

With the financial pressure and small profit margins (or no profit) that has existed for the past three years, the use of atrazine is likely to continue. Atrazine currently provides the best weed control for the dollar spent. As the Roundup Ready corn becomes more available and affordable, this technology should become more acceptable. Farmers are aware of the concerns surrounding atrazine and do not want more restrictions or the complete loss of this valuable herbicide. Chemicals are expensive and farmers can not afford to waste money.

Other herbicides applied within the watershed are Dual II, Bladex, 2,4-D, Lasso, Harness and Roundup. These chemicals are typical applied with atrazine or in a pre-mix combination.

Nearly double that of the corn acreage, soybeans were the major crop grown in the watershed during 1997. The 88,823 acres represents 56 percent of the total production agricultural land. The herbicide of choice is Roundup. With the advantages that exist with Roundup from an economic stand point, weed control results and reduced labor costs, the use of this technology will continue to increase. In 1999, there could be a 65 percent to 75 percent use of Roundup Ready soybean across the watershed. In those areas where the utilization of this technology has lagged behind, the trend is that more farmers are adopting this method. The areas of the watershed that produce the majority of the soybean are presently utilizing this technology on 75 percent of the acreage. With the advantages associated with the use of Roundup from both the farmers' viewpoint and a water quality standpoint, this certainly presents an encouraging picture for the future.

Due to the combination of herbicides such as Tricept, Squadron, Turbo and Canopy the total amount of each specific chemical is more difficult to determine. For example, Sencor was applied to 19 acres not 111 because of the pre-mix Turbo. Sceptor was applied to a total of 1,819 acres not 481 acres due to the application of Squadron and Tricept. The survey did not indicate a large number of acres with Roundup even though there is an extensive amount of Roundup Ready soybean being grown in the watershed.

Table II lists the estimated chemical use in the watershed for the production of soybeans.

Table II Estimated Chemical Use in Watershed for Soybean Production

Chemical Name	Total Acres	Total Amount
Canopy (Classic & Lexone)	1,346	210 qts.
Turbo (Sencor & Dual II)	1,048	1,376 qts.
Dual II	334	443 qts.
Sencor	111	42 qts.
Squadron (Sceptor & Prowl)	329	494 qts.
Tricept (Sceptor & Treflan)	1,009	1,160 qts.
Sceptor	481	32 qts.
Assure II	542	13 qts.
Roundup	247	247 qts.
Lasso	104	234 qts.
Pursuit	203	25 qts.

Fertilizers

Fertilizers are also a concern when considering water quality. Based on the Ohio Agricultural Statistics and Ohio Department of Agriculture Annual Report an expected yield of 140 bushels is reasonable for the watershed. The Tri-State Fertilizer Recommendations for corn for this desired yield would be 160 pounds of nitrogen per acre. Data collected would indicate that farmers (83 percent) are using 200 plus pounds per acre. Based on the corn acreage of 47,780, nitrogen application is between 7,644,800 and 10,511,600 pounds of actual nitrogen in the watershed. Corn is very dependent upon nitrogen for high yields. It would appear that farmers are applying too much nitrogen. Applying 220 pounds of nitrogen per acre should produce 180 plus bushels per acre. This would appear to be a waste of money for the farmers and may be exposing the water resources to nearly 3,000,000 pounds of nitrogen that is not required. An educational effort is necessary to inform farmers regarding this matter.

Phosphorus is the second major nutrient of concern. The recommendations for phosphorus are harder to state in an across the board application due to varying levels of soil fertility, pH and the cation exchange capacity of the soil. To produce one bushel of corn, phosphorus is required at the 0.37 pounds per acre (P_2O_5) rate. This is strictly a maintenance level of production. To produce 140 bushels of corn per acre a farmer would need to apply 52 pounds of actual phosphorus per acre. If average fertility levels (30 to 60 pounds/acre) exist in the field then this application rate would be adequate. Application rates can exceed 100 pounds per acre if soil fertility levels are low. If soil fertility is below average (20 pounds available/acre), to produce a 140 bushel yield would require an additional 75 pounds of actual phosphorus.

Based on the data collected from the farmers' survey and the vendors' responses, farmers would appear to be applying excessive phosphorus. This data would indicate that 70 percent of farmers are applying phosphorus at the rate of 90 pounds or more per acre. Application of 100 pounds or more are being applied by 63 percent of the farmers surveyed. If application rates were reduced by 40 pounds/acre across the watershed there would be a reduction of 1,911,200 pounds of actual phosphorus applied.

The third nutrient of concern is potassium. Corn harvested as grain removes 0.27 pounds of K_2O/acre. However, to make a potassium application recommendation that would be applicable to all farms is more difficult than phosphorus. The reason being the numerous combinations of soil fertility level, cation exchange capacity, and desired yield. An average soil test would have a soil fertility level of 200 to 260 pounds/acre, a CEC of 10 and desired yield of 140 bushels /acre. An application of 60 pounds/acre of actual potassium would be required. Data collected would indicate that farmers are applying too much potassium. Vendors stated that farmers are applying between 100 to 140 pounds/acre. The surveys indicated that farmers are applying potassium at the rate of 120 to 149 pounds/acre (27 percent) and 150+ pounds/acre (68 percent). It would appear that double the recommended amount of potassium is being applied. A reduction of 60 pounds/acre would result in 2,866,800 pounds of potassium not being applied.

As stated previously, some farmers could be applying higher rates of phosphorus and potassium to their corn crop to provide nutrients for the next year's soybean crop. Not all farmers utilize this farming practice. A corn/soybean rotation is not practiced by all farmers. Excessive nitrogen is being applied and it is very likely that phosphorus and potassium are being applied at rates that are higher than recommended.

Farmers in the watershed are producing 88,729 acres of soybean. Approximately 75 percent of this acreage receives zero nitrogen. The remaining acres have less then 30 pounds/acre of nitrogen applied. The impact on water quality is not a concern.

Phosphorus is removed at the rate of 0.80 pounds/bushel produced. A typical field would need 30 to 40 of P_2O_5 pounds/acre to produce a yield range of 40 to 50 bushel/acre. The vendors indicated that farmers are purchasing between 50 to 90 pounds of phosphorus per acre. Farmers indicated that they are utilizing 60 to 100 pounds/acre (64 percent), 30 to 59 pounds/acre (20 percent) and 0 to 29 pounds/acre (16 percent). Based on this information, farmers are applying phosphorus at rates that are excessive. If 70 percent of farmers would reduce their application rate by 40 pounds/acre there would be a reduction of 2,484,412 pounds across the watershed.

Soybeans remove potassium at the rate of 1.40 pounds/bushel harvested. A yield of 40 to 50 bushels/acre would consume 56 to 70 pounds/acre. Tri-State Fertilizer Recommendation for a field with average fertility characteristics of 200 to 260 available K and a CEC of 10, producing a 40 to 50 bushels/acre yield would be 75 to 90 pounds/acre. The vendors indicated that farmers are applying potassium at the rate of 75 to 110 pounds/acre. The survey indicated that 29 percent of the farmers are applying K at the recommended rate. Application rates of 150 to 180 pounds/acre were being utilized by 47 percent of the farmers surveyed. An additional 8 percent were applying K at the rate of 120 to 149 pounds/acre. This would suggest that 55 percent of the farmers are applying excessive K. If application rates would be reduced by 50 pounds/acre in the highest application range, a 2,085,131 pound reduction would result. Additional reduction would occur if the additional 8 percent would bring their application rates more in line with recommendation levels.

Wheat production is limited in the watershed. Few chemicals are utilized in the production of the wheat crop. Fertilizer usage falls in the recommended range. The impact upon water quality would be very limited.

Tobacco acreage is extremely small in the watershed. The use of fertilizers can be heavy, especially nitrogen. Chemical usage for insect and disease control is more prevalent than for other crops. Due to the small acreage the overall impact to water resources is limited.

Forage production is not utilizing fertilizers and chemicals to any great extent. The impact on the watershed is very limited.

Horticultural Chemical Use Analysis

This section addresses the status of chemical application by homeowners and horticultural businesses in comparison to the official recommendations of Ohio State University Extension. This section is divided by the types of horticultural operations including home lawn care, grounds maintenance, golf course, nursery/greenhouse, fruits, and vegetables.

Home Lawn Care

Home lawn care involves many horticultural practices such as proper grass selection, seeding, mowing, water, core aeration in addition to lawn fertilization, weed control, and pest management. Typically a recommended fertilization program is a four step program. Fertilizers should be applied once in May, once in July, once in September, and once more in November. However, if someone only fertilizes their lawn once, late fall fertilization should be the best option. If two lawn fertilizations are made, fertilization once in late fall, and once in spring would work well. Fertilizer ratios of 3-1-2 to 5-1-2 are preferred. The recommended rate is about 0.5 to 1.5 pounds actual nitrogen per 1,000 sq. ft. One recommended fertilizer for home lawn is the one with N-P-K ration of 24-4-12 at 2 to 4 pounds per 1,000 sq. ft.

The fertility programs used by national lawn care companies are typically 4 to 5 steps, similar to what Ohio State University Extension recommends for a high maintenance program. The fertility programs by local lawn care companies varied greatly based on the knowledge of business owners. There is a great deal of fertilizer application misuse by both homeowners and some lawn care companies. One good example is the application of fertilizers 10-10-10 or 19-19-19 for grasses instead of recommended N-P-K ratios of 3-1-2 to 5-1-2. This practice resulted in the over application of phosphorus and potassium, and under appliation of nitrogen. Some of the commercial blends like Scotts' or TrueGreen ChemLawn lawn fertilizers have too much nitrogen, and too little phosphorus and potassium.

Weed control programs in home lawns are pretty standard. Many homeowners applied pre-emergent herbicides for the control of crabgrasses in late winter to early spring as recommended by manufactures. For broadleaf weeds, many homeowners or commercial companies applied 2,4-D, Dicamba, and MCPP as recommended. However, these products were put down too early resulting in the application of additional herbicides later in the season. Best timing for dandelion control is when it reaches puffball stage. That developmental stage is typically May.

For insect control such as white grubs, misuse of insecticides is much more widespread. Many garden centers start selling grub control chemicals in spring. That leads to the application of many insecticides at the wrong time. The correct timing for most grub control materials is in late July and early August. One chemical that should be applied earlier is GrubEx. The proper timing for GrubEx is mid May.

Grounds Maintenance

Many grounds maintenance companies are involved in mulching, fertilization, weed control, and pesticide. There is a very large variation among these companies in terms of the levels of expertise. There are many hundreds of ornamental plant species with 10 to 15 common insect and disease problems. Misdiagnosis does occur and leads to misapplications of pesticides. The companies we received survey responses from did not seem to fall in that category since they make use of Extension offices, attend pesticide applicator training, and tend to follow recommendations by Ohio State University Extension.

Golf Courses

Golf course superintendents go through intensive training each year since golfers and greens committees demand perfection. Several pesticides and fertilizers are applied on the golf courses. Most of golf courses follow the recommendations by Ohio State University Extension very closely. Based on the survey received from one golf course superintendent in Brown County, it appears that very little misuse exists.

Nursery/Greenhouses

There are several small nurseries and greenhouses located in the watershed. Many bulletins have been developed for specific crops in the floriculture industry by Ohio Florists' Association in close cooperation with Extension specialists at Ohio State University. Most nursery and greenhouse growers tend to spray less than what are recommended in OSU Extension bulletins. For example, there are bulletins on geraniums, garden mums, bedding plants, and hanging baskets. With nurseries, growers can grow an assortment of trees, shrubs, perennials, ground covers, and ornamental grasses. No two growers have identical crop makeup in either nurseries or greenhouses, especially with smaller operations. Many growers will purchase plants from other growers (to resale), in addition to the plants they grow themselves. Generally chemical application by our greenhouse and nursery growers is very low, mainly due to higher tolerance to insects, diseases, and weeds compared to that of flower growers in Western parts of Cincinnati or nursery growers in Lake County, the nursery capital of the mid-west.

Fruits

The recommended spray programs are listed in the OSU Extension bulletins "Commercial Tree Fruit Spray Guide" and "Commercial Small Fruit and Grape Spray Guide." A typical spray program for apple trees is listed in Table III.

Table III Spray Program for Apple Trees

Developmental Stages	Insecticides	Fungicides
Dormant to silver tip	None	Bordeaux mix plus oil and Ridomil 2E if needed
Green Tip	Apollo SC at 4-8 fl. oz for mite control	Benlate 50 WP at 8-12 oz./acre or fungicides
Half-inch green	Thiodan 3 EC at 2.67 - 4 qt./acre or other insecticides	None
Tight cluster	Savey 50 WP at 4-8 fl./acre or other miticides	Mancozeb 80 WP at 3 lbs./acre or other fungicides
Pink	Carzol 92% SP at 2 lbs. Per acre or other insecticides.	Bayleton 50 DF at 2-8 oz plus Captan at 6 lbs. per acre or other fungicides
Bloom	None to save honeybees!	Fungicides plus Streptomycin 17 W at 2 lbs. per acre
Petal Fall	Guthion 50 WP at 2-3 lbs. Per acre and Lannate 90 SP at 1 lb. per acre	Nova 40 WP at 5-8 oz. per acre
First and second cover	Ziram 76 DF at 6-8 lbs. per acre or other insecticides	Mancozeb 80 WP at 3 lbs. per acre or other fungicides
Third cover	Sevin EXL at 3-4 qt. per acre or other insecticides	Captan 50 WP at 6 lbs. per acre or other fungicides
Summer cover sprays	Imidan 70 WP at 2.13 - 5.3 lbs. per acre or other insecticides	Captan 50 WP at 6 lbs. per acre or other fungicides

Spray programs are developed from many years of field research. In the watershed, fruit growers with significant acreage follow the spray programs very closely. The common fruits grown in the watershed are apples, pears, peaches, blackberries, blueberries, and raspberries. Growers with few fruit trees and bushes sprayed very little since they do not depend on the fruit production as a significant source of their income.

In general, successful fruit growers make use of both soil testing and tissue testing for their fertilizer recommendations. The desirable soil test maintenance levels are listed in Table IV.

Table IV Desirable Soil Test Maintenance Levels

Nitrogen	Phosphorus	Potassium
40 to 150 lbs. of N per acre	30 - 90 lbs. of available P per acre	200 - 400 lbs. of exchange-able K per acre

A fruit grower in Clermont County did not apply fertilizers in his orchard in 1997 while another grower in Highland County (outside the watershed) applied 250 pounds. of nitrogen, 125 pounds of phosphorus, and 125 pounds of potassium. One grower experienced severe under fertilization while the other experienced over application of nitrogen and phosphorus.

Vegetables

Common vegetables grown in the watershed are tomatoes, peppers, pumpkins, green beans, and sweet corns. Chemicals labeled for each crop are different. The fertility program for tomatoes is listed in Table V.

Table V Fertility Program for Tomatoes

Nitrogen	Phosphorus (P_2O_5)	Potassium (K_2O)
Broadcast 60-80 lb N/A prior to planting. Sidedress with an additional 30-60 lb N/A with calcium nitrate.	100-175 lbs.	200-350 lbs.

Vegetables are definitely not pest free. There are many pesticides that need to be applied on vegetable crops if high quality crops are expected. Vegetable growers seem to have applied much fewer chemicals than the OSU Vegetable Production Guide called for. This is likely due to a combination of economics and good pesticide management practices. Most vegetable growers sell their crops at local farmers' markets where consumers are willing to accept some imperfections on the produce.

Generally the pesticides applied by horticultural businesses in the watershed were minimal. Fertilizers represent the largest percentage of chemical input in both commercial horticulture and residential areas. In the future, we might see more small farms specializing in horticultural crops especially flowers, vegetables, trees and shrubs, and sod. We might see more housing developments, and possibly more golf courses. Education of small scale farmers, developers, and homeowners will be critical to maintain and improve the water quality in the watershed.

Highway and Infrastructural Chemical Use Analysis

Based upon the estimated 310 miles of major highway within the EFLMR total watershed, application of 2,973 tons of salt and 822 gallons of 2.5 percent active ingredient Roundup Pro are estimated to have been applied.

Conservation Tillage

Sediment is another source of water pollution. Conservation tillage is the number one defense against sediment. Reducing soil loss also decreases the potential pollution problems associated with fertilizers and pesticides. Conservation tillage is designed to leave residue on the soil surface. The residue protects the soil surface from erosion by absorbing the energy of raindrops, thus reducing soil particle detachment. Residue reduces surface crusting and sealing which improve water infiltration. A third benefit of residue is the slowing of the velocity of the runoff water. This can allow particles in the runoff to be redeposited.

Conservation tillage leaves residue that is important in reducing runoff. Due to the protection that residue can provide, it was important to determine the type of tillage practices that farmers were using. Farmers were asked to state the type of tillage system that they had selected for each field that they were farming. The three tillage practices that farmers were ask to choose from were conventional, minimum, and no-till. The data collected are shown in Table VI.

Table VI Tillage Practice by Crop in Acres and Percent

Tillage Practice	Corn	Soybean	Wheat
No-till	878 (21.2%)	704 (15.2%)	120 (60%)
Minimum	338 (8.2%)	1,969 (42.6%)	82 (40%)
Conventional	2,925 (70.6%)	1,946 (42.1%)	0
Total	4,141	4,619	200

Corn producing farmers are still using conventional tillage (71 percent) in the majority of their operations. The heavy, wet soils that make up a large portion of the watershed create difficulties for farmers when using either a no-till or minimum tillage practice. Compaction is another concern when working wet soils in early spring. Soybean producing farmers have adopted conservation tillage practices more extensively. Roundup Ready soybean have aided in the transition to either no-till or minimum tillage practices. The later planting dates can allow the soil to dry out more. The wheat crop for which information was available indicates extensive use of conservation tillage practices.

APPENDIX G

Analysis of Physical Stream Characteristics in the East Fork Lake Tributaries, Clermont County

Prepared for:

Clermont County
Office of Environmental Quality
2275 Bauer Road
Batavia, Ohio 45103

Prepared by:

Tetra Tech, Inc.
Cleveland, Ohio
Laurel, Maryland
Fairfax, Virginia

November 9, 2001

Over the past six years, Clermont County has developed and maintained a comprehensive watershed monitoring program for the East Fork of the Little Miami River (EFLMR). Integrating both ambient and wet weather water quality data with biological monitoring, this program has provided a comprehensive system for determining the baseline water quality and ecological health of the EFLMR. One additional component of watershed health previously not evaluated is the physical, or geomorphic, condition of the streams draining to the EFLMR. Information on stream physical conditions can be very useful for obtaining a better understanding of overall watershed health, identifying areas of altered or degraded physical habitat, and developing the data necessary to understand how land use change might affect the physical characteristics of county streams.

This Appendix details a preliminary evaluation of stream channel conditions within six Lake Tributaries streams located in Clermont County using the Rosgen Level I and II stream classification system. In this section, a description of each assessment reach is provided, organized by stream type. Also included is a description of upstream land use and riparian area characteristics at the sample reach. A picture is also sometimes included, although technical difficulties resulted in some sites not being photographed. Finally, any available water quality or biological data are presented.

Rosgen Stream Classification

The Rosgen stream classification system is a methodology used to describe streams and stream behavior based on basic hydrologic and morphological parameters (Rosgen, 1996). It uses a hierarchy of four assessment levels ranging from a broad geomorphic characterization (Level I) to detailed reach-specific hydraulic and sediment relationships (Level IV).

A Level I assessment classifies streams based on broad geomorphic stream characteristics. This characterization provides a framework for initial delineation of stream types and assists in setting priorities for more detailed assessments. A Level II (morphological) characterization provides a more detailed description based on field determined stream reach information. Level II information can be used as a basis for management interpretations. The third (Level III or "state") characterization level utilizes additional field observations and parameters to provide a description of stream conditions in terms of current and potential natural stability, and provides an assessment of the extent of departure from the natural potential. The fourth (Level IV or validation) assessment level is used to verify the assessment of stream condition, potential, and stability obtained in the Level III assessment. The Rosgen stream classification system has been found to provide a consistent methodology for comparing physical stream characteristics and stream behavior. In this study, only Level I and Level II evaluations were performed.

Rosgen stream classifications are performed to:

- •Obtain physical stream data using a consistent methodology
- •Classify and compare streams based on observed data
- •Identify impacted stream channels
- •Correlate physical stream characteristics to water quality and biological data
- •Quantify stream stability and erosion rates
- •Describe stream behavior

The data obtained from the different assessment levels can be used to:

- •Predict stream response to major storm events
- •Predict stream erosion rates and sediment loads
- •Predict stream response to road and bridge construction
- •Predict stream response to urbanization practices (e.g., housing developments, construction sites)
- •Provide guidance in performing stream restorations

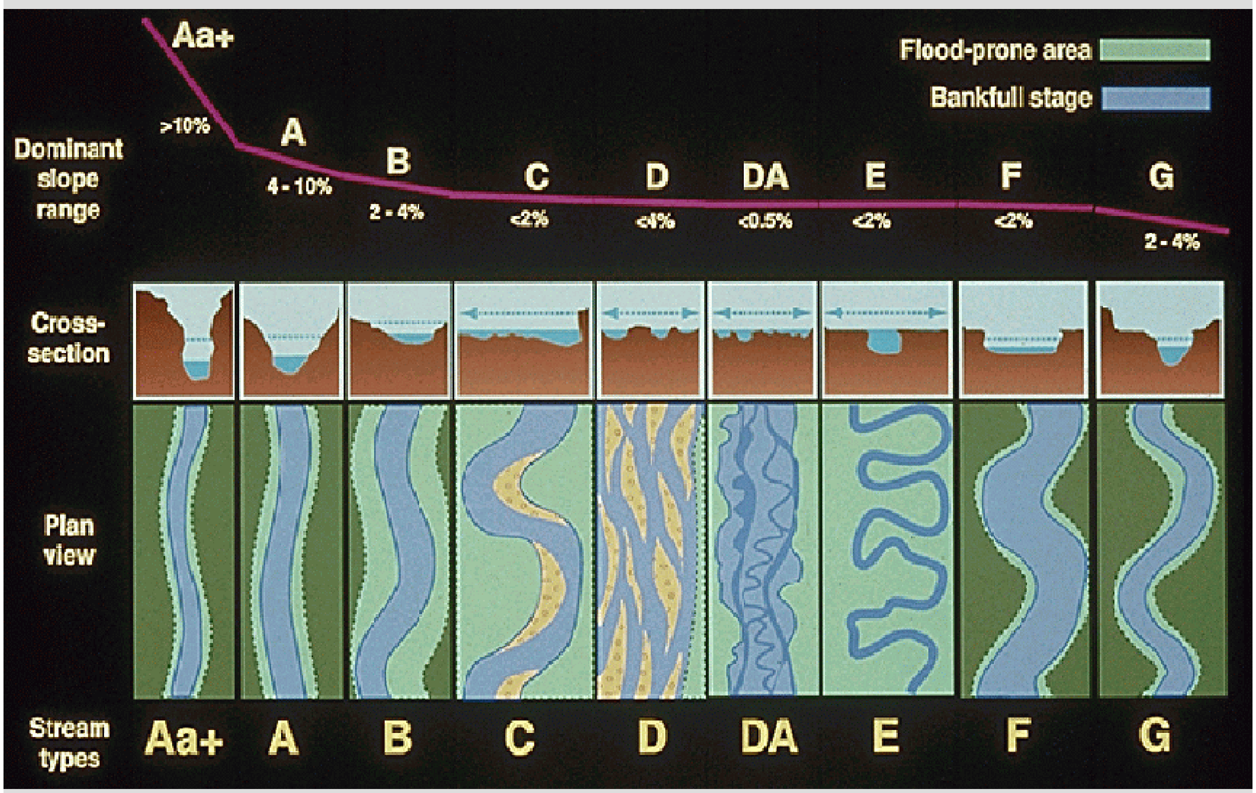


Figure G-13 ; Rosgen Level 1 Stream Types (Rosgen, 1996).

Guest Run

The Guest Run watershed is located at the southern border of the EFLMR watershed near Bethel Village (Figure G-2). It is a tributary to Poplar Creek, which flows into Harsha Lake. The Rosgen Level II sampling site was located on a large residential lot near the confluence with Poplar Creek (Figure G-1). The watershed size at the site was 1.59 square miles and there were 7.7 miles of streams upstream of the site. Most of the land in this area is used for agriculture (68 percent) and forest land (29 percent). Some large residential lots (greater than 5 acres) have been developed within the past several years, however most of the land is actively farmed. All but seven acres of the watershed are zoned for agricultural use.

The landscape in the Guest Run watershed consists of rolling hills with flat valley bottoms. At the sampling site, the right bank had a 15-foot forested riparian area while the left bank had been mowed to the edge of the bank. This practice was observed at several places along Guest Run.

Basin Geomorphic Condition

All of the streams in the Guest Run watershed were classified as B streams. B streams are moderately entrenched with a step-pool system and low sinuosity. The Rosgen Level II analysis determined that the stream at the sampling site was a B6c stream. This classification indicates that the dominant channel material was silt and clay, and the water surface slope was less than two percent. The low water surface slope indicates that this is an atypical B stream. It most likely has been entrenching due to changes in flow within the watershed. No chemistry or biology data were collected along Guest Run.

Figure G-1: Guest Run Sampling Site.

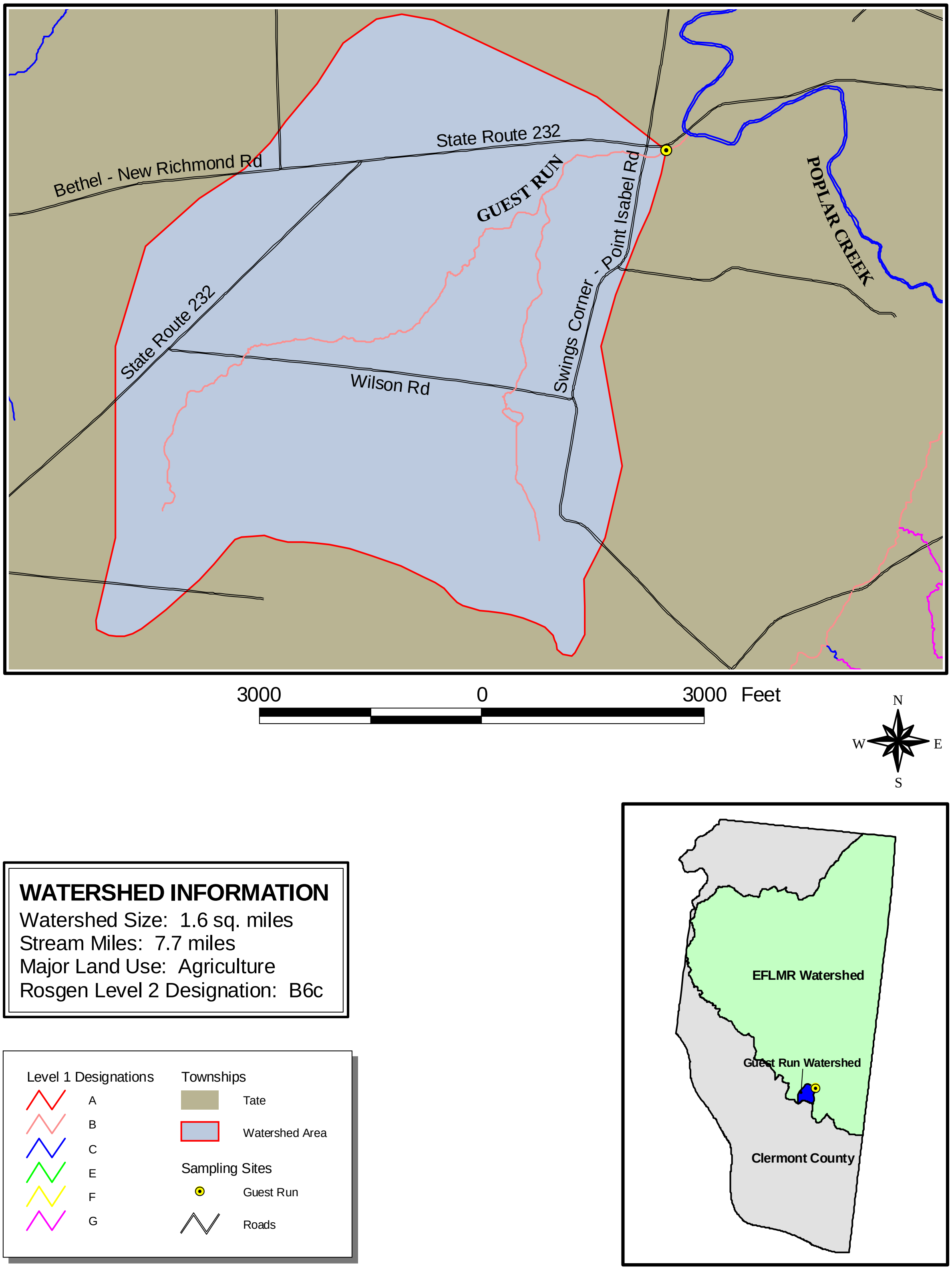


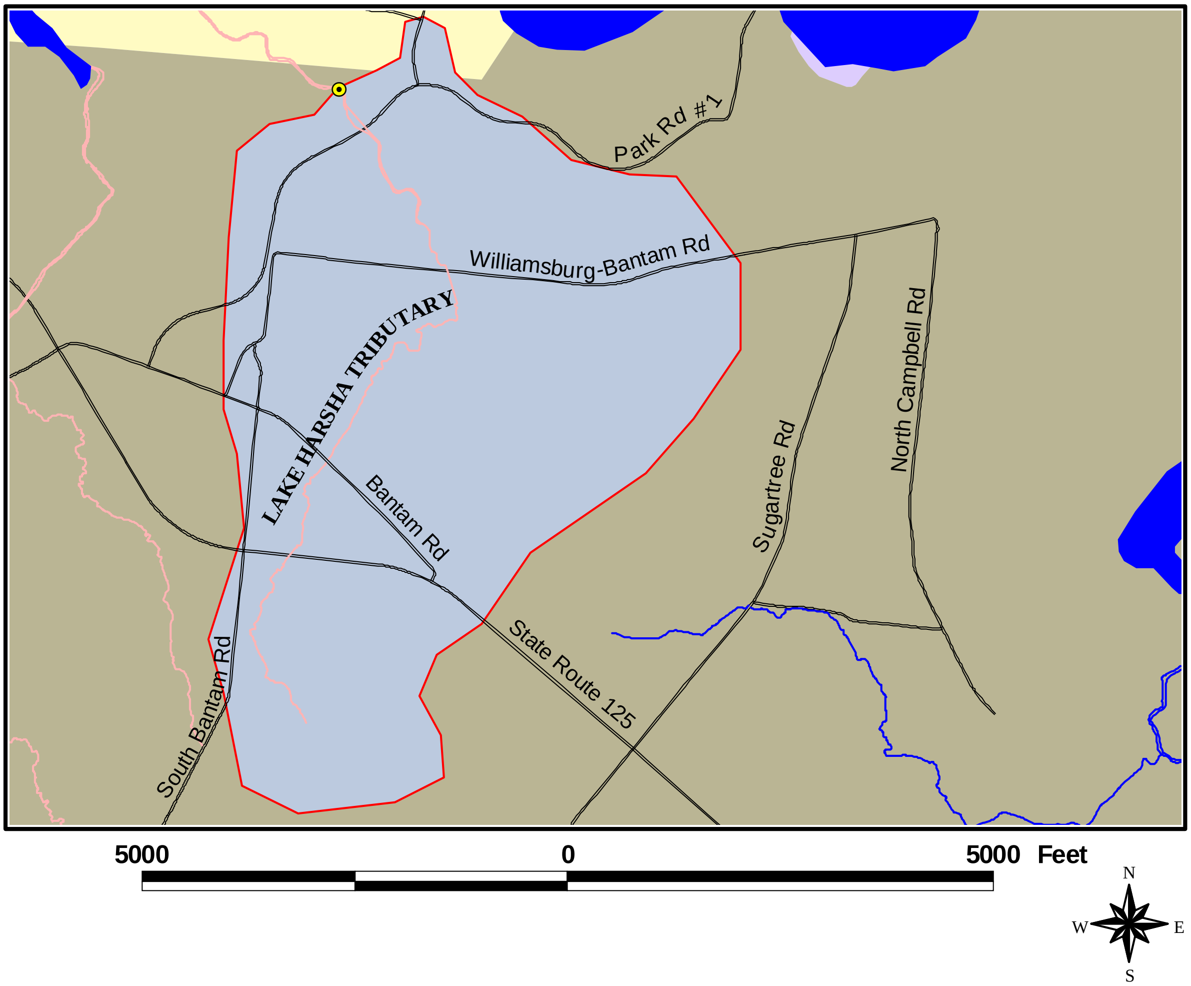
Figure G-2: Guest Run Watershed.

Harsha Lake Tributary

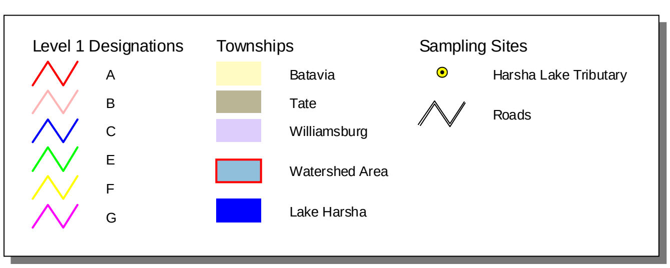
This unnamed tributary to Lake Harsha primarily flows through the East Fork State Park in Tate Township. The Rosgen Level II assessment was performed approximately 1000 feet downstream of Park Road Number 1 in East Fork State Park (Figure A-3). The watershed size at the Rosgen sampling site is 1.26 square miles with 8.0 miles of upstream streams. Land around the sampling site was forested and undisturbed. There were large riparian areas as well. Land use in this watershed is primarily forested (54 percent) which is largely due to the presence of the state park. Landscape conditions in this area of Clermont County consist of rolling hills that are dissected by stream channels.

Basin Geomorphic Condition

Streams in this watershed were classified as B streams. The B stream is a moderately entrenched step pool system with low sinuosity. B streams are generally stable and have low stable banks and channels. At the sampling site, a B4c stream was observed. This stream had moderate entrenchment, low sinuosity and a predominately gravel bottom. A “c” suffix was added to the Level II classification because the water surface slope was lower than most typical B streams. The low channel slope can be attributed to the shale bedrock found in the stream channel which most likely controls the channel slope. No chemistry or biology data were collected at this site.



WATERSHED INFORMATION
Watershed Size: 1.3 sq. miles
Stream Miles: 8.0 miles
Major Land Use: Forest
Rosgen Level 2 Designation: B4c



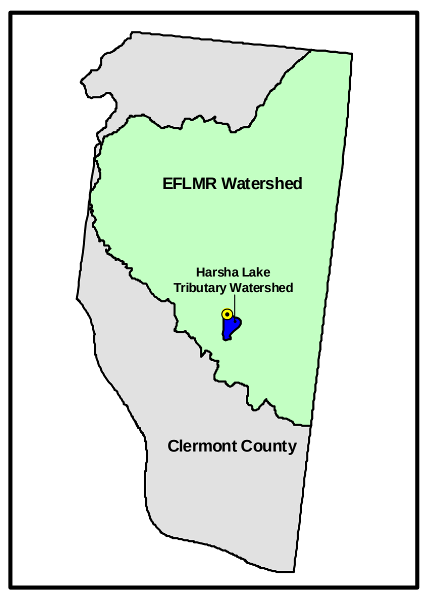


Figure G-3: Unnamed Tributary to Harsha Lake.

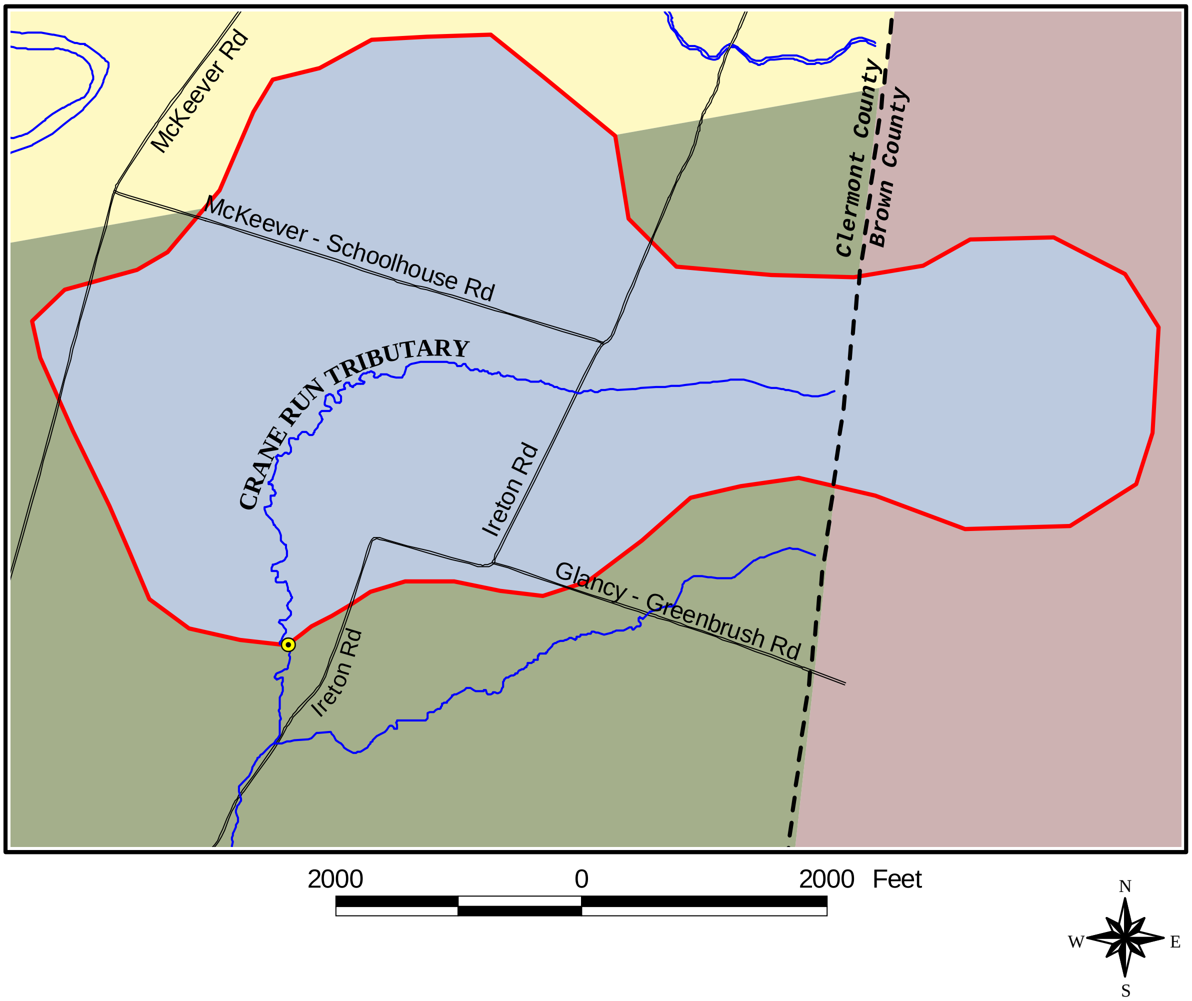
Crane Run Tributary

This small tributary to Crane Run lies in the eastern part of Clermont County near the Brown County border (Figure G-5). The watershed size at the Rosgen Level II sampling site was 0.93 square miles and there were 5.2 miles of streams upstream of the site. The stream flowed through a small, forested valley with agriculture on the upland areas. Most of the watershed consisted of agriculture (73 percent) and forest land (26 percent), and the entire watershed was zoned for agricultural land use. The valley terrain and forest cover provided a large riparian area that separated the stream from nearby agricultural land uses.

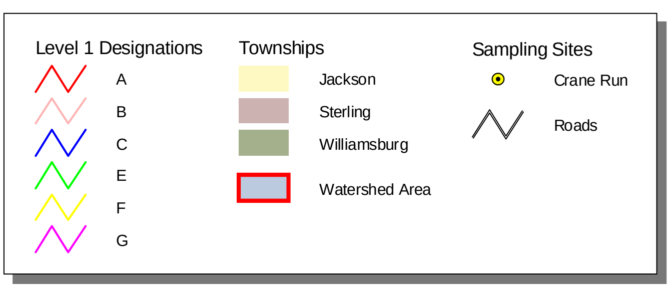
Basin Geomorphic Condition

Most of the streams in this area were classified as C streams. The C stream is slightly entrenched, very sinuous, and has a riffle-pool morphology. Point bars and scour pools are characteristic in C streams. These streams are very sensitive to disturbance, especially in the riparian areas. At the sampling site, a C5 stream was observed. This stream had high sinuosity and a well developed floodplain. A predominantly sandy bottom was observed. No other biology or chemistry data were collected at this site.

Figure G-4: Crane Run Tributary Sampling Site.



WATERSHED INFORMATION
Watershed Size: 0.9 sq. miles
Stream Miles: 5.2 miles
Major Land Use: Agriculture
Rosgen Level 2 Designation: C5



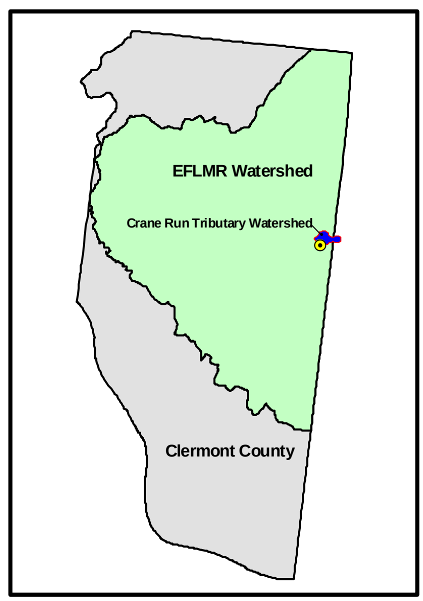


Figure G-5: Crane run Tributary Watershed.

Kain Run

Kain Run flows through a largely agricultural area west of Williamsburg Village. This site was sampled because of the ambient water quality sampling site located on Kain Run near State Route 276. The Rosgen Level II site was located approximately 400 feet downstream of the Kain Run autosampler (Figure G-7)). The landscape near this site consisted of rolling hills with large residential lots and agricular land uses. Riparian areas around the sample site were small, and several agricultural fields were located near the stream banks.

The watershed at the sampling site was 2.77 square miles and there were 7.9 miles of streams upstream of the site. The watershed is 82 percent agricultural land and is mostly zoned for agricultural uses. Part of State Route 32 corridor is located in the Kain Run watershed.

Basin Geomorphic Condition

Streams in the Kain Run watershed were classified as C and E streams. The C stream is slightly entrenched, very sinuous, and has a riffle-pool morphology. Point bars and scour pools are characteristic in C streams. They are very sensitive to disturbance, especially in the riparian areas. E streams are also slightly entrenched and very stable. E streams have low width to depth ratios, while C-streams have high ratios. At the sample site, a C4 stream was observed. The sinuosity at this site was very low, which is atypical of most C streams. The D50 analysis indicated a predominately gravel bottom.

Ecological and Water Quality Conditions

Water quality data (suspended solids, turbidity, and total volatile suspended solids) were relatively low and stable at the Kain Run ambient water quality sampling site. The automatic sampler at Kain Run detected significant increases in all three parameters during wet weather events in 2000. The five-year trend analysis showed that suspended solids concentrations were improving over the past five years (Tetra Tech, 2001a, 2001b).

Fish, invertebrates, and habitat were sampled at a site downstream of the water quality sampling site. Christian and Guttman (2000) and Grimm and Guttman (2000) showed that all three parameters were rated “good” at the Kain Run sampling site in 2000.

Figure G-6: Kain Run Sampling Site.

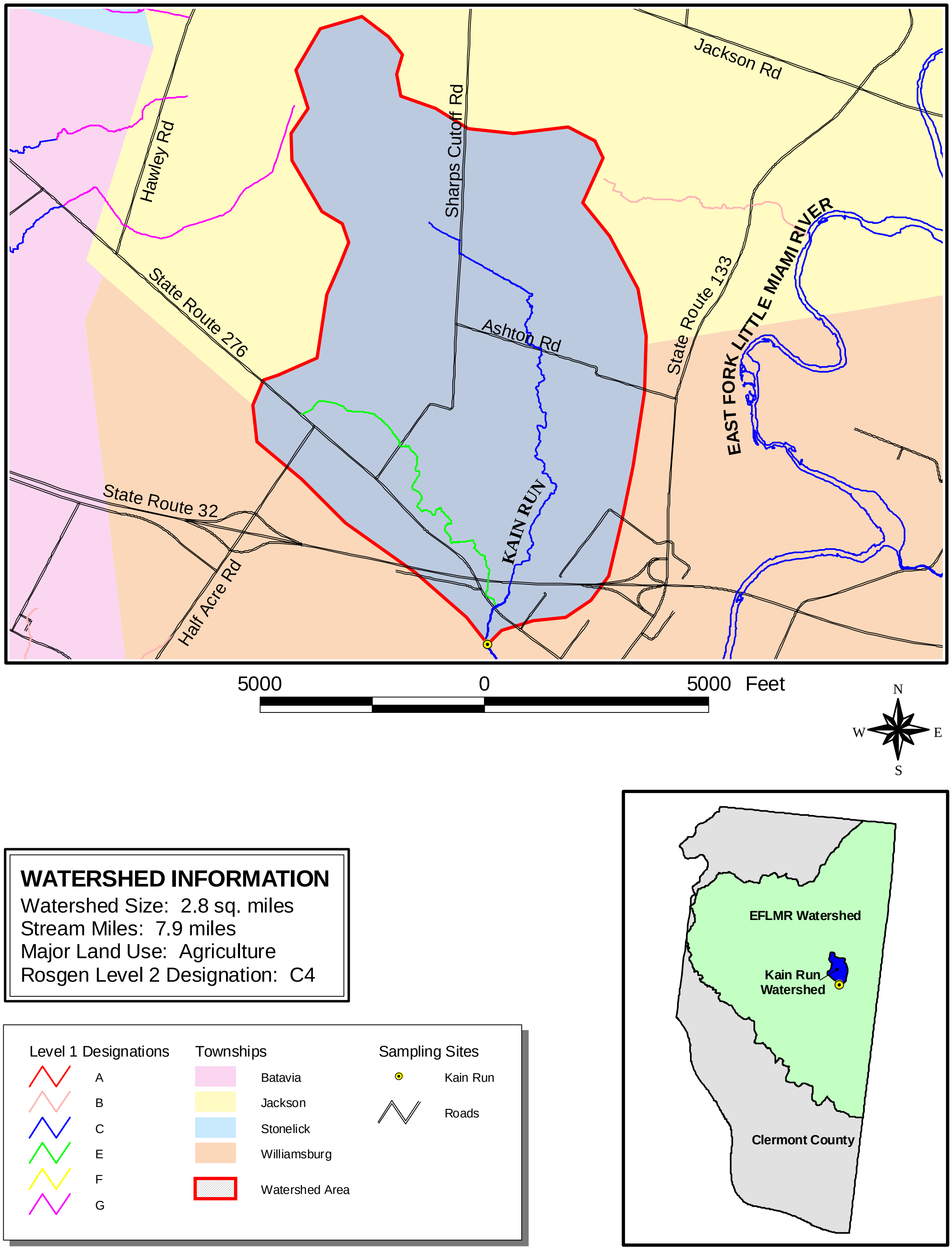


Figure G-7: Kain Run Watershed.

Kain Run (Headwaters)

This site was located in the headwater region of Kain Run upstream of the Kain Run sampling site near State Route 276 (Figure G-8). It was a small stream flowing through agricultural fields and some forested wetland areas. The watershed size at this site was 0.24 square miles. Clermont County classified 0.40 miles of streams upstream of the sampling site, however, there may be more watershed area and stream miles draining to the Rosgen sampling site due to unclassified drainage ditches and tiles from the agricultural fields. The MRLC land use data indicated that 78 percent of the watershed was used as agricultural land and there was evidence that corn was planted in the fields next to the stream in 2000.

Basin Geomorphic Condition

The Rosgen Level I stream assessment determined that this site was an E stream. E streams are slightly entrenched and have very low width to depth ratios. The width to depth ratio at this site was lower than at any other site which indicates that the channel was narrow and deep. Sinuosity is typically high in E streams, however, at this site the sinuosity was very low. This is most likely due to influence from agricultural runoff and drainage. A typical E-stream ripple-pool morphology was found in this portion of Kain Run. At the sampling site, silt and clay were the dominant channel material and the water surface slope was 0.30 making this an E6 stream. No chemistry or biology data were collected at this site, but data were collected downstream near the other Kain Run sampling site.

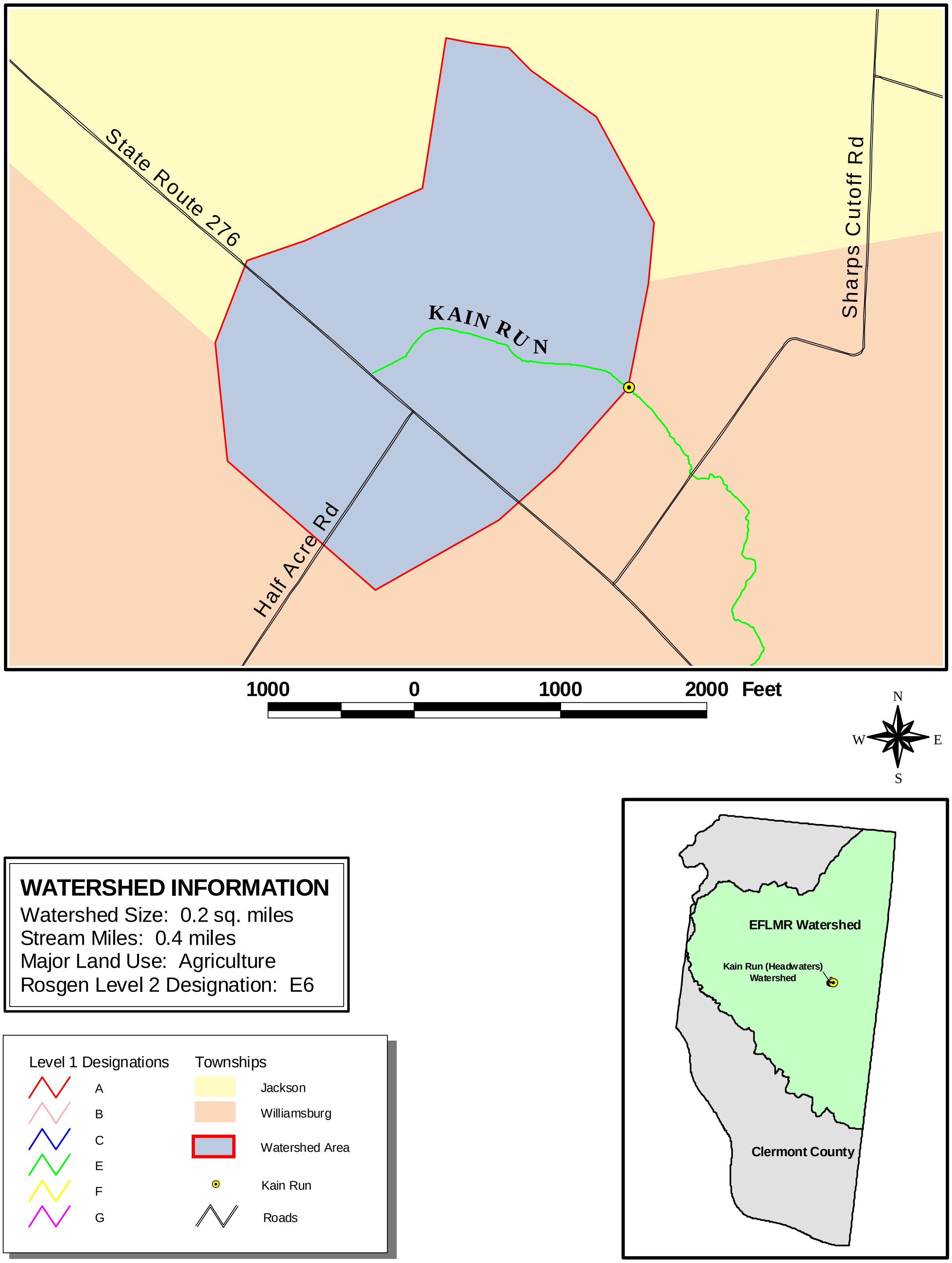


Figure G-8: Kain Run (headwaters) Sampling Site.

Cabin Run

The headwaters of Cabin Run originate near State Route 32 and flow through the East Fork State Park to the confluence with Lake Harsha (Figure G-10). This watershed lies in a steep valley consisting of mostly forested land. The Rosgen Level II sampling site was chosen to be near the current ambient water quality monitoring site in the State Park, and the site is approximately 2500 feet upstream of the lake. The watershed at this site drains 1.37 square miles and there are 10.6 miles of streams upstream of the site. Most of the land in the watershed is forested (67 percent). Because of the State Park, this site and most of the watershed was relatively undisturbed.

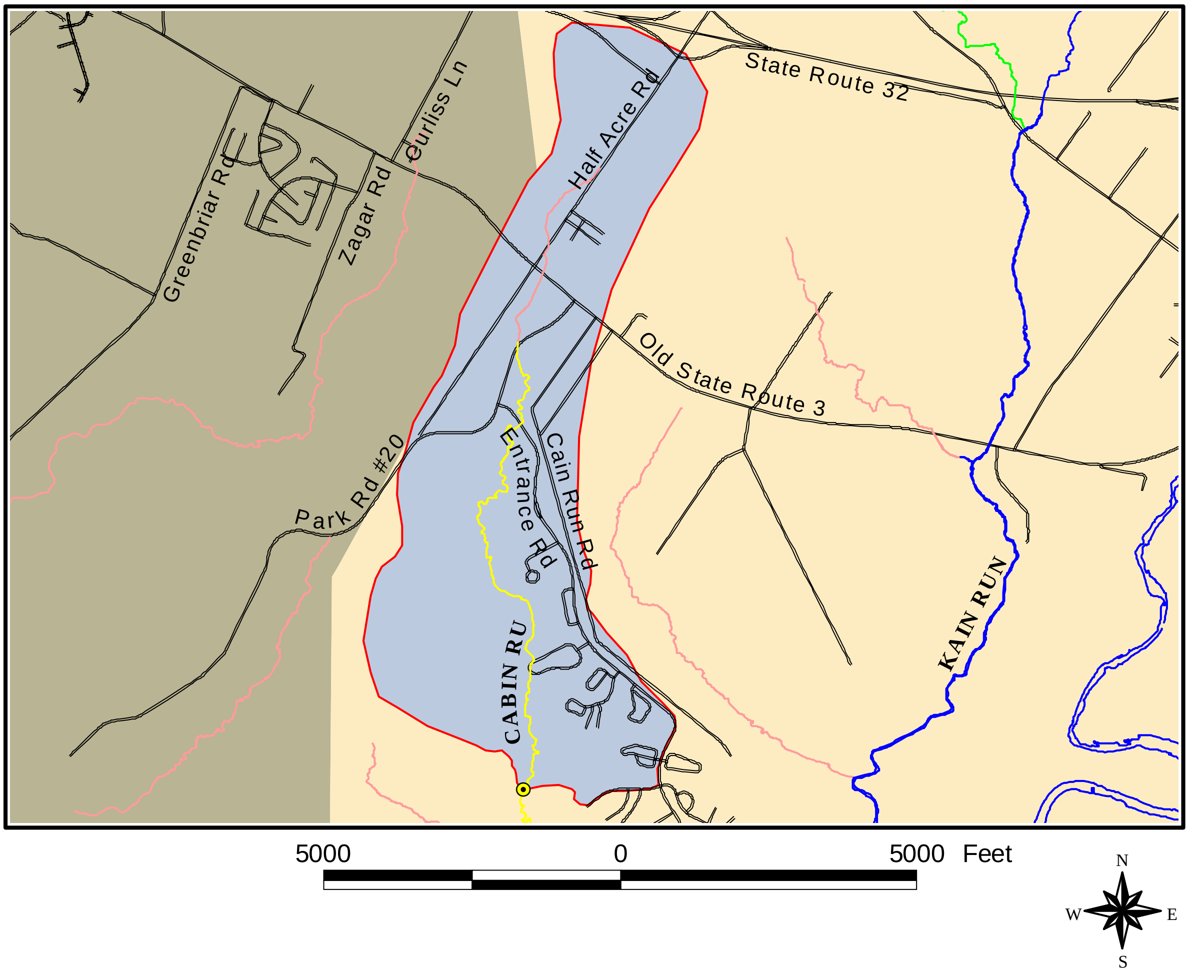
Basin Geomorphic Condition

Because of the level of entrenchment, most of Cabin Run was classified as an F stream. Areas in the headwater region were classified as B streams. F streams are typically highly entrenched and have a riffle-pool system. These streams can have high erosion rates. The B stream is a moderately entrenched step pool system with low sinuosity. B streams are generally very stable and have stable banks and channels. The B streams in the Cabin Run watershed were classified in the upland areas where the streams were beginning to enter the steep valley and had higher water surface slopes. At the Cabin Run sampling site, an F4 stream was observed. This site had high entrenchment, high width to depth ratios, and a water surface slope of less than 2 percent. The dominant channel material was gravel. Erosional features were present in the form of steep cutbanks as seen in Figure A-9.

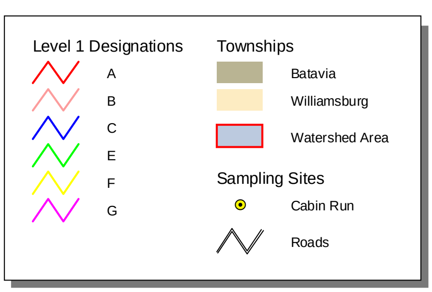
Water Quality Conditions

Ambient water quality data are collected from Cabin Run each year at a site located near the Rosgen sampling site. Suspended solids, total volatile suspended solids, and turbidity data all indicated good water quality in 2000 (Tetra Tech, 2001a). The five-year trend analysis showed that suspended solids concentrations were improving between 1996 and 2000 (Tetra Tech, 2001b).

Figure G-9: Erosional Feature at Cabin Run Sampling Site.



WATERSHED INFORMATION
Watershed Size: 1.4 sq. miles
Stream Miles: 10.6 miles
Major Land Use: Forest
Rosgen Level 2 Designation: F4



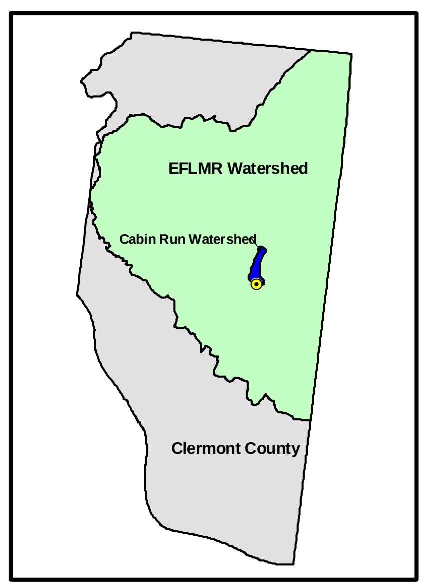


Figure G-10: Cabin Run Watershed.

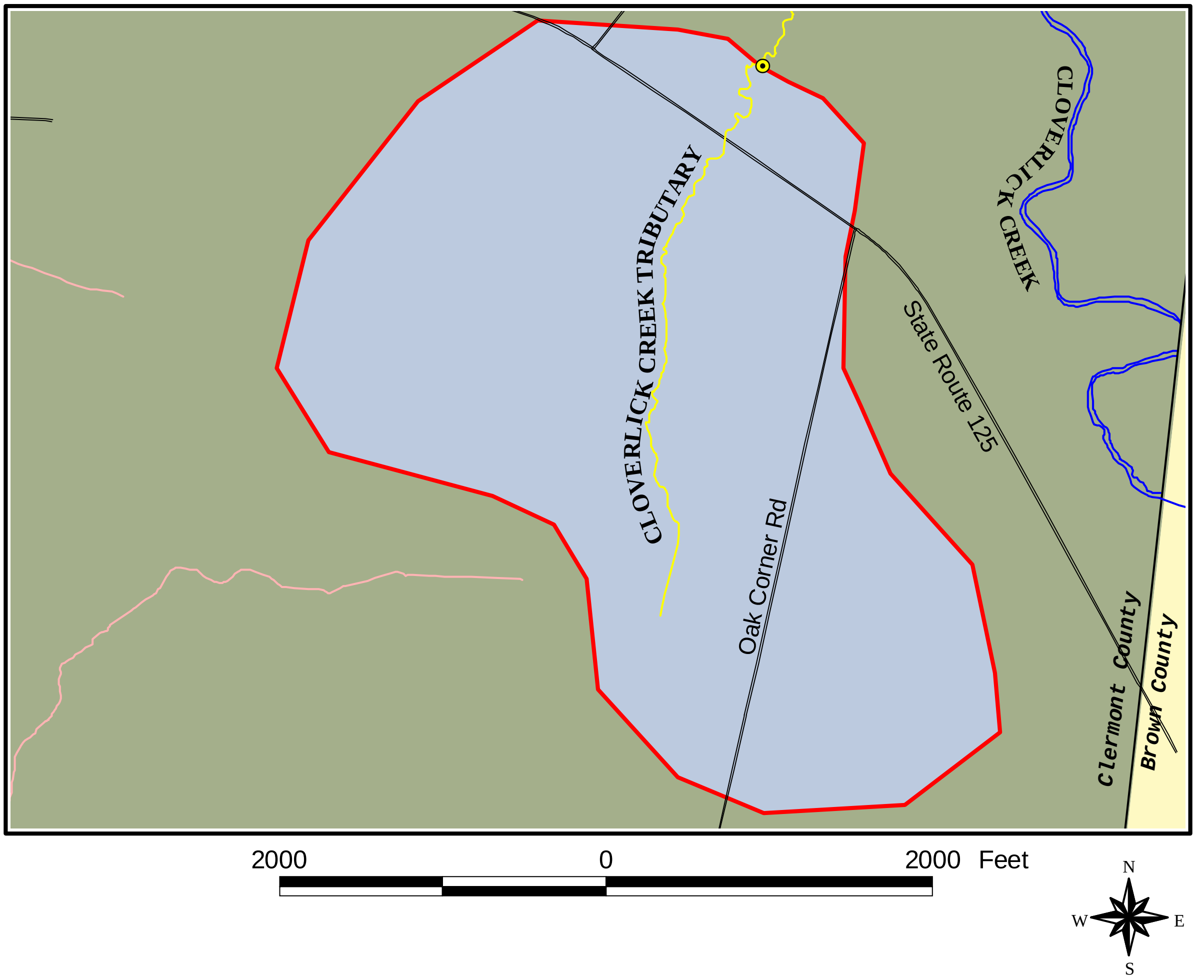
Cloverlick Creek Tributary

Cloverlick Creek flows through the southeast portion of the EFLMR watershed in a predominately rural area. The tributary evaluated in this study was located east of the town of Bethel (Figure G-12). It joined Cloverlick Creek near the Clermont-Brown County border just north of State Route 125. The Rosgen Level II sampling site was located downstream of State Route 125. The 0.47 square mile watershed contained mostly agricultural land (74 percent) and forest land (24 percent). However, several new homes were built on large lots (greater than 5 acres) near the sampling site and lawns were planted down to the stream banks. Most of the watershed is zoned for agricultural land use.

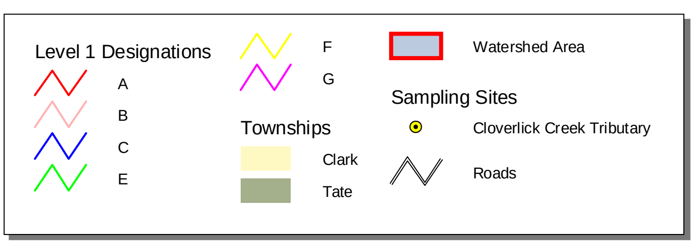
Basin Geomorphic Condition

Although Cloverlick Creek was classified as a C stream, this tributary was classified as an F stream. The stream was classified this way because of the high entrenchment and width to depth ratios found at the sampling site (Figure G-11). F streams are highly entrenched and have a riffle-pool system that is similar to C streams. These streams can have high erosion rates. The stream at the sampling site was classified as an F5 stream because of the predominately sandy bottom. The reason for the high entrenchment ratio at this site is unknown. It is possible that the entrenchment has been affected by new construction or agricultural practices in the area. Other watersheds draining urban areas (Hall Run, Shayler Run) were classified as F streams, however these watersheds had significant amounts of urban land. Chemistry and biology data were not collected in this watershed.

Figure G-11: Cloverlick Tributary Sampling Site.



WATERSHED INFORMATION
Watershed Size: 0.5 sq. miles
Stream Miles: 1.8 miles
Major Land Use: Agriculture
Rosgen Level 2 Designation: F5



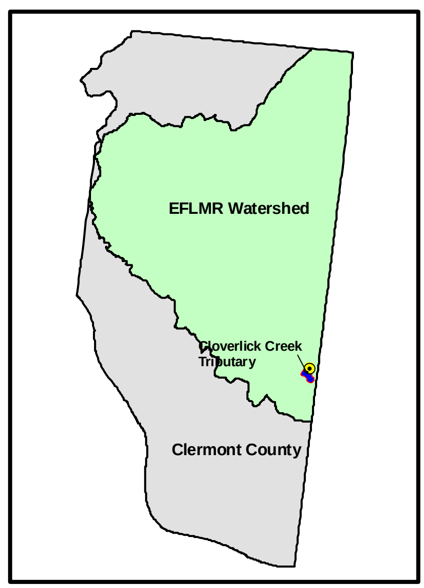


Figure G-12: Cloverlick Tributary Watershed.

REFERENCES

Christian, A. D. and S. I. Guttman. 2000. *Final Report: Invertebrate Community Index Assessment of The East Fork Little Miami River, Clermont County, Ohio. Summer Sampling 2000.* Department of Zoology. Miami University. Oxford, Ohio.

Grimm, E. and Guttman, S.I. 2000. *Index of Biological Integrity (IBI) Assessment. East Fork Little Miami River, Clermont County, Ohio. Summer Sampling 2000.* Miami University. Oxford, Ohio.

Tetra Tech. 2001a. *2000 Water Quality Report – Supplement to the East Fork Little Miami River Water Quality Assessment Report for Clermont County, Ohio.* March 2001. Tetra Tech, Inc. Cleveland, Ohio.

Tetra Tech. 2001b. Clermont County Ambient Water Quality Monitoring Program - East Fork of the Little Miami River: Five-Year Status and Trends. July, 2001. Tetra Tech, Inc. Cleveland, Ohio.

Rosgen, D. 1996. *Applied River Morphology*. Printed Media Companies, Minneapolis.