East Fork Little Miami River
Watershed Action Plan

East Fork Headwaters Watershed Management Plan

May 2006

Picture of the West Fork, East Fork Headwaters Watershed

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

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).

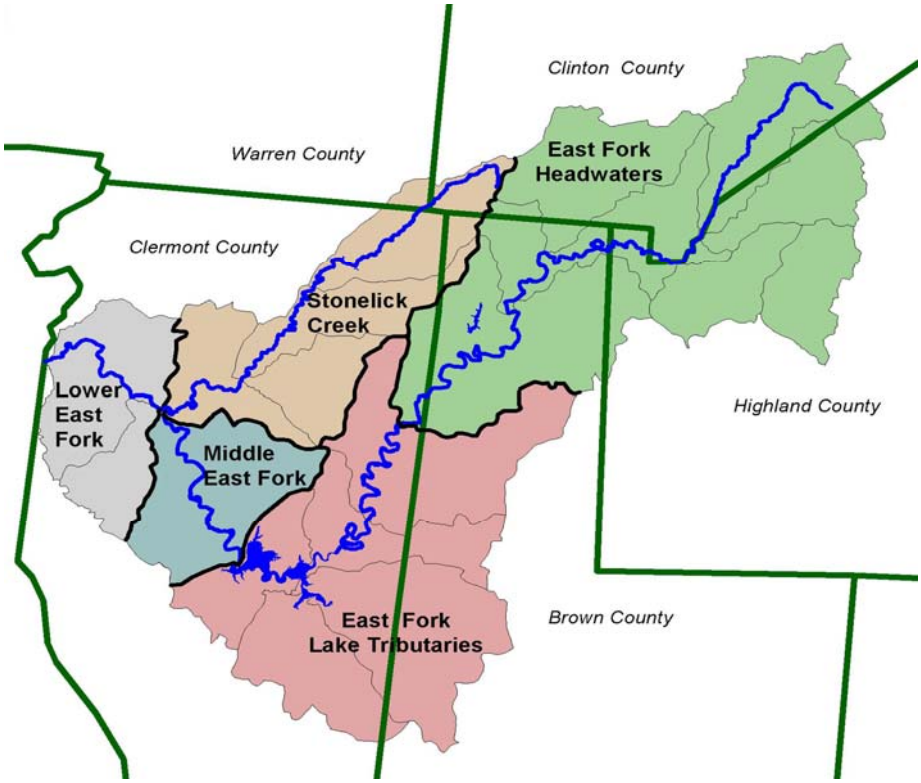


Figure 1-1. East Fork watershed planning units.

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. The EFWC is currently developing, and expecting to complete by December 2006, watershed plans for the Lake Tributaries, Stonelick Creek and Middle East Fork subwatersheds. 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 Headwaters Watershed Action Plan

This document represents the action plan for the East Fork Headwaters, which consists of the entire East Fork drainage area upstream of Fivemile Creek (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 Headwaters 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 Headwaters Watershed Action Plan (Headwaters 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, Clinton and Highland County GIS Departments;
- Farm Service Agencies of Brown, Clermont, Clinton and Highland Counties;
- Soil and Water Conservation Districts of Brown, Clermont, Clinton and Highland Counties;
- Health Departments of Brown, Clermont, Clinton and Highland 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 Headwaters 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 appropriate strategies for meeting both water quality and water quantity management objectives.

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

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 Water Quality Monitoring, Land Use and Stormwater Management, Wastewater Management, and Agricultural Runoff.

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, Clermont, Clinton and Highland Counties; the Village Councils of Fayetteville, Lynchburg, Midland, and New Vienna; and the Clark, Green, Jefferson, Dodson, Union and Perry 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 Headwaters 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 Headwaters. 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, Clermont, Clinton, & Highland), 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, p9.

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 Headwaters WAP will be available on CD at all sponsoring SWCD's (Brown, Clermont, Clinton, & Highland) 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 headwaters region (Brown, Clermont, Clinton, and Highland counties).

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

CHAPTER 2: WATERSHED INVENTORY

A number of factors - both natural and manmade - influence the quantity and quality of water in our streams. These factors include: the underlying geology and the 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 Headwaters watershed is 195 square miles (125,000 acres), about evenly distributed among Brown (56.2 mi^2 or 28.9 %), Clinton (65.9 mi^2 or 33.8 %), and Highland (66.2 mi^2 or 34.0 %) Counties (see Figure 2-1). A small portion of the Headwaters falls within Clermont County (6.6 mi^2 or 3.4 %). Approximately 90% of the East Fork Headwaters Watershed falls within six townships (Perry Township in Brown County; Clark, Green and Jefferson Townships in Clinton County; and Dodson and Union Townships in Highland County). Smaller portions of the watershed fall within Sterling Township (Brown County); Jackson Township (Clermont County); Marion and Washington Townships (Clinton County); and Hamer, Liberty, New Market, Penn and Salem Townships (Highland County). The Villages of Fayetteville, Lynchburg, Midland, New Vienna and St. Martin all fall within the Headwaters Watershed. Other unincorporated population centers in the watershed include Allensburg, Chasetown, Dodsonville, Fairview, Farmers Station, Lake Lorelei, Marathon, Russell, Vera Cruz, Webertown, Westboro, and Willettsville.

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

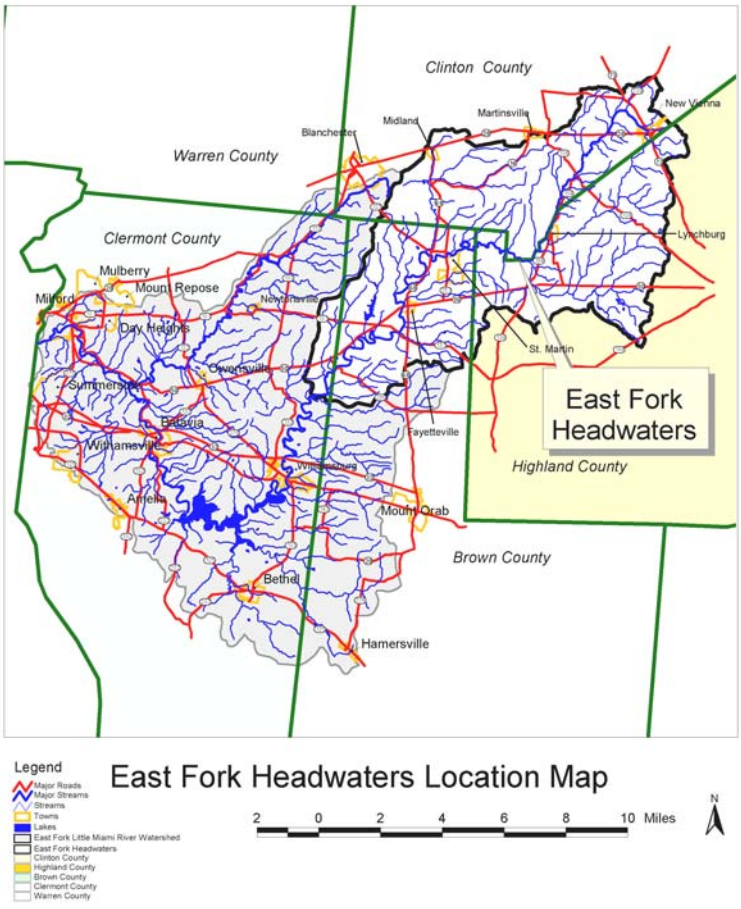


Figure 2-1. Location of the East Fork Headwaters watershed.

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 Headwaters is primarily interbedded shale and limestone of Ordovician age (450 million 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 oldest glacial deposits are of Illinoian Age. The younger glacial deposits are associated with the Wisconsin glaciation.

In the northeastern-most part of the East Fork Headwaters, the glacial cover is Wisconsin Age glacial till. In this area, the glacial till is between 10 and 25 feet thick over bedrock on till plains, and can be as much as 65 feet deep to bedrock on end moraines. The till in this area is covered with a thin loess cap from 0 to 18 inches deep.

In the rest of the Headwaters, 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 plains 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 Headwaters watershed is shown in Figure 2-2.

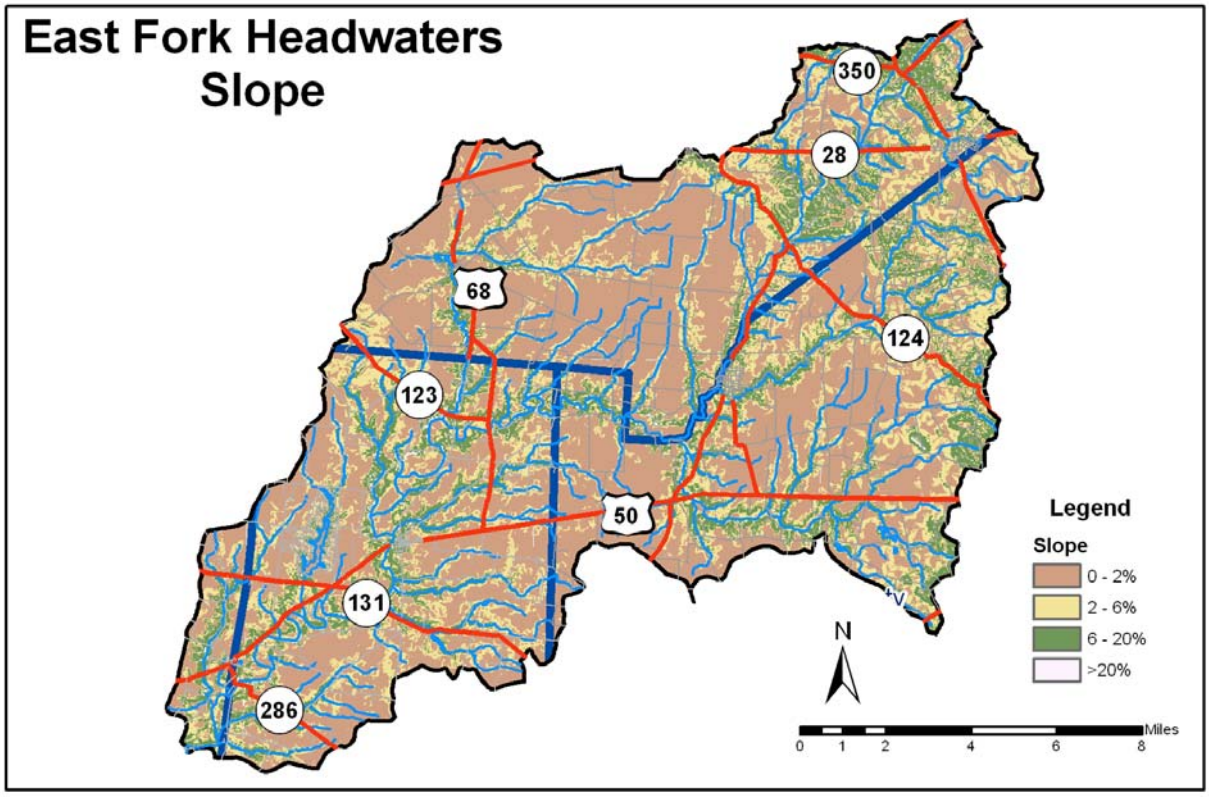


Figure 2-2. Slope in the East Fork Headwaters watershed.

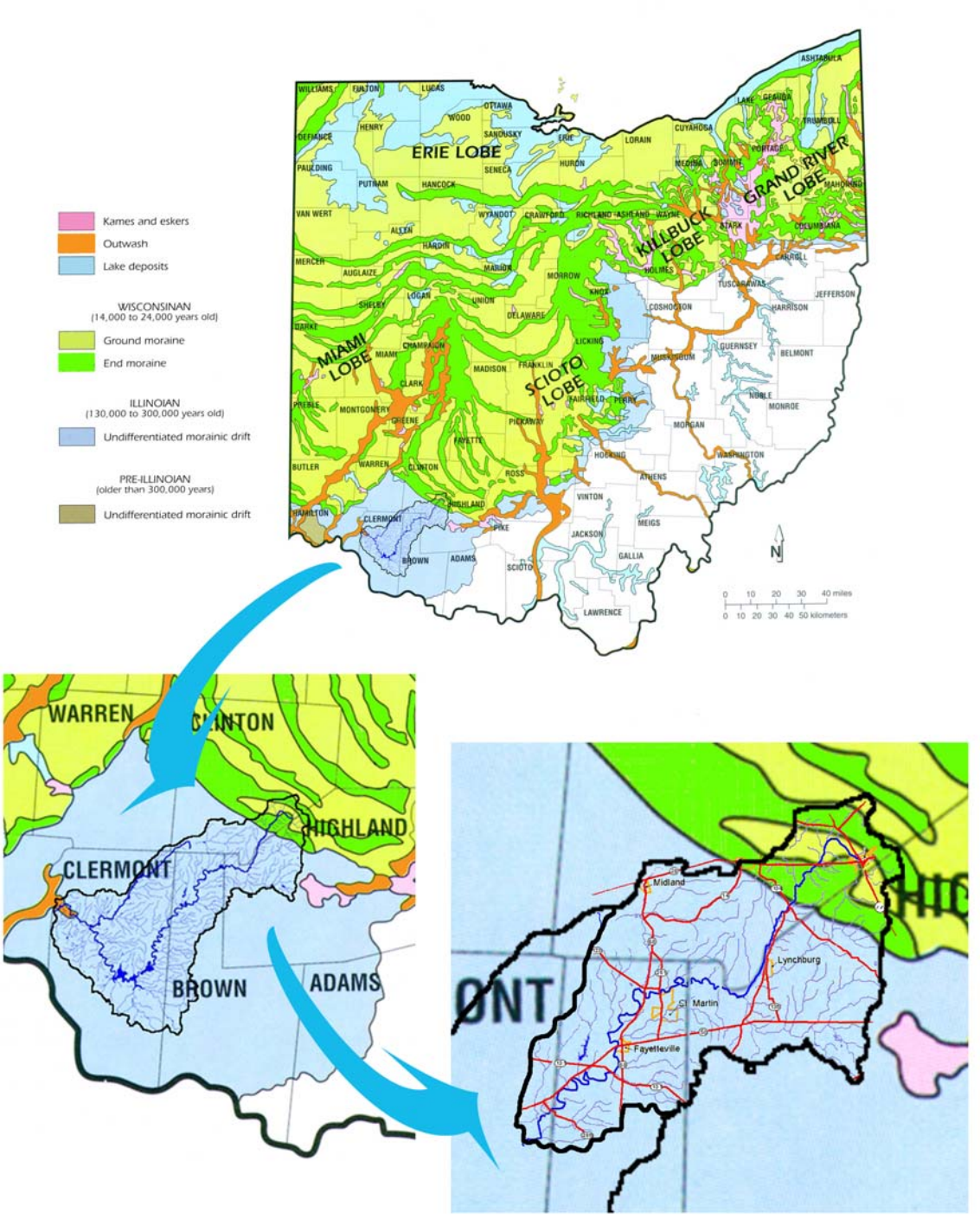


Figure 2-3. Glacial geology of Ohio and the East Fork Headwaters watershed.

The highest point in the entire East Fork Watershed lies in the East Fork Headwaters, just east of New Vienna, at an elevation of 1190 ft above sea level. The beginning of the East Fork Little Miami River (river mile 85) is also near New Vienna, at an elevation of 1140 ft above sea level. The lowest point in the East Fork Headwaters, where the East Fork River (river mile 44) has its confluence with Fivemile Creek, is 845 ft above sea level. The mainstem of the East Fork drops 295 feet from its beginning to the confluence with Fivemile Creek 41 miles downstream, for an average slope (or drop) of 7.2 ft per mile.

Along the East Fork, the valley width increases in a downstream direction. By the time the East Fork reaches the southern end of the Headwaters area, the valley width averages about 800 ft with a maximum width of 1800 ft.

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 Headwaters watershed.

The United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) in conjunction with ODNR Division of Soil and Water Conservation identified 35 different soil series in the East Fork Headwaters watershed, 18 within the area of the Wisconsin glaciation and 17 within the area of the Illinoian glaciation. Figure 2-4 illustrates the distribution of soil associations (i.e., groups of soil series found in conjunction) within the East Fork Headwaters watershed. [Note: A finer level of detail, including maps of individual soil series, can be seen in the Soil Surveys of the individual counties. Contact your county Soil and Water Conservation District to obtain a copy.]

Tables 2-1 and 2-2 describe the most common soil series in the East Fork Headwaters watershed, and provide information on the permeability, drainage and runoff characteristics of each.

WISCONSIN TILL SOILS

Fincastle-Brookston-Miamian association (bright yellow in Figure 2-4) consists of "deep, nearly level to gently sloping, very poorly drained and somewhat poorly drained soils that formed in thin loess and the underlying glacial till."

Miami-Miamian-Xenia association (orange in Figure 2-4) consists of "deep, gently sloping to steep, well drained and moderately well drained soils that formed in thin loess and the underlying glacial till."

In the area of soils that developed in Wisconsin Age glacial till, Miami (21%), Miamian (18%), Xenia (16%) and Fincastle (16%) are the most common soil types.

ILLINOIAN TILL SOILS

Rossmoyne-Boston-Bratton association (brown in Figure 2-4) consists of "deep and moderately deep, nearly level to moderately steep, well drained and moderately well drained soils that formed in loess and the underlying glacial till."

Clermont-Avonburg-Rossmoyne association(green in Figure 2-4) consists of "deep, nearly level to gently sloping, somewhat poorly drained and poorly drained soils that formed in loess and the underlying glacial till."

Rossmoyne-Avonburg-Bonnell association (pink in Figure 2-4) consists of "deep, nearly level to steep, moderately well drained and well drained soils that formed in loess and the underlying glacial till" and "deep, nearly level to sloping, well drained, somewhat poorly drained, and moderately well drained soils that formed in alluvium or loess and the underlying water-deposited material."

In the area of soils that developed in Illinoian Age glacial till, Clermont (41%), Avonburg (27%), and Rossmoyne (16%) are the most common soil types.

Sources: STATSGO, Highland County Soil Survey (1977)

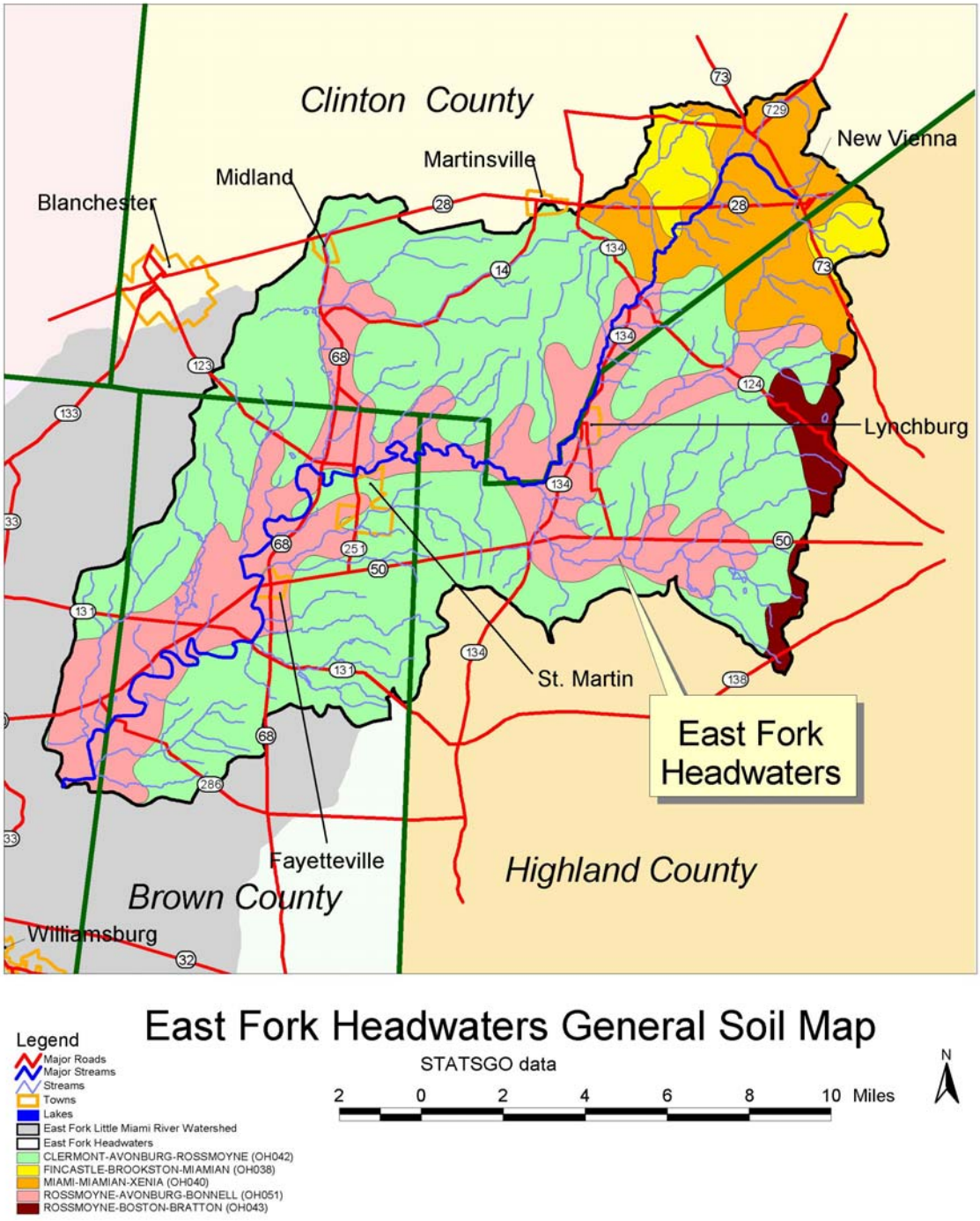


Figure 2-4. Soil map of the East Fork Headwaters watershed.

The Wisconsin-age glacial till soils are generally highly productive for agriculture, especially if soil limitations are addressed. The steeper Miami, Miamian and Xenia soils are 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. The very poorly drained Brookston and Cyclone soils, and somewhat poorly drained Fincastle soils, respond well to subsurface drainage.

Within the Illinoian-age glacial till area, the soils are inherently less productive 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, approximately 40% of the watershed (Clermont soils, and the less-prevalent Blanchester and Brookston soils) is not suitable for traditional leach-field home sewage treatment systems (HSTS). Other soils with seasonal high water tables (another approximately 25% of the watershed), such as Avonburg soils, present limitations for HSTS that are treated differently within the different counties. 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 Series	Topograhpy	Permeability	Drainage	Seasonal High Water Table	Runoff	Erosion Risk
Fincastle silt loam	Nearly level to gently sloping	Moderately slow	Somewhat poorly drained	0.5 – 1.5 ft	Slow	Low to moderate
Miami silt loam	Gently sloping to sloping	Moderately slow	Well-drained	> 3 ft	Medium to rapid	Moderate to high
Miamian silt loam	Gently sloping to steep	Moderately slow	Well drained	> 3 ft	Medium to rapid	Moderate to high
Xenia silt loam	Nearly level to sloping	Moderately slow	Moderately well drained	1 – 3 ft	Slow to medium	Moderate to high

Table 2-1. Characteristics of soil series developed in Wisconsin glacial till.

Soil Series	Topograhpy	Permeability	Drainage	Seasonal High Water Table	Runoff	Erosion Risk
Avonburg silt loam	Nearly level to gently sloping	Very slow	Somewhat poorly drained	0.5 – 1.5 ft	Slow to medium	Low to moderate
Clermont silt loam	Nearly level	Very slow	Poorly drained	0.5 – 1 ft	Slow	Low
Rossmoyne silt loam	Nearly level to moderately steep	Moderately slow to slow	Moderately well-drained	1 - 3 ft	Slow to rapid	Low to high

Table 2-2. Characteristics of soil series developed in Illinoian glacial till.

Biological Features

Figure 2–5. The river redhorse, a rare fish species found in the East Fork Headwaters. (Photo - Bob Miltner, OEPA)

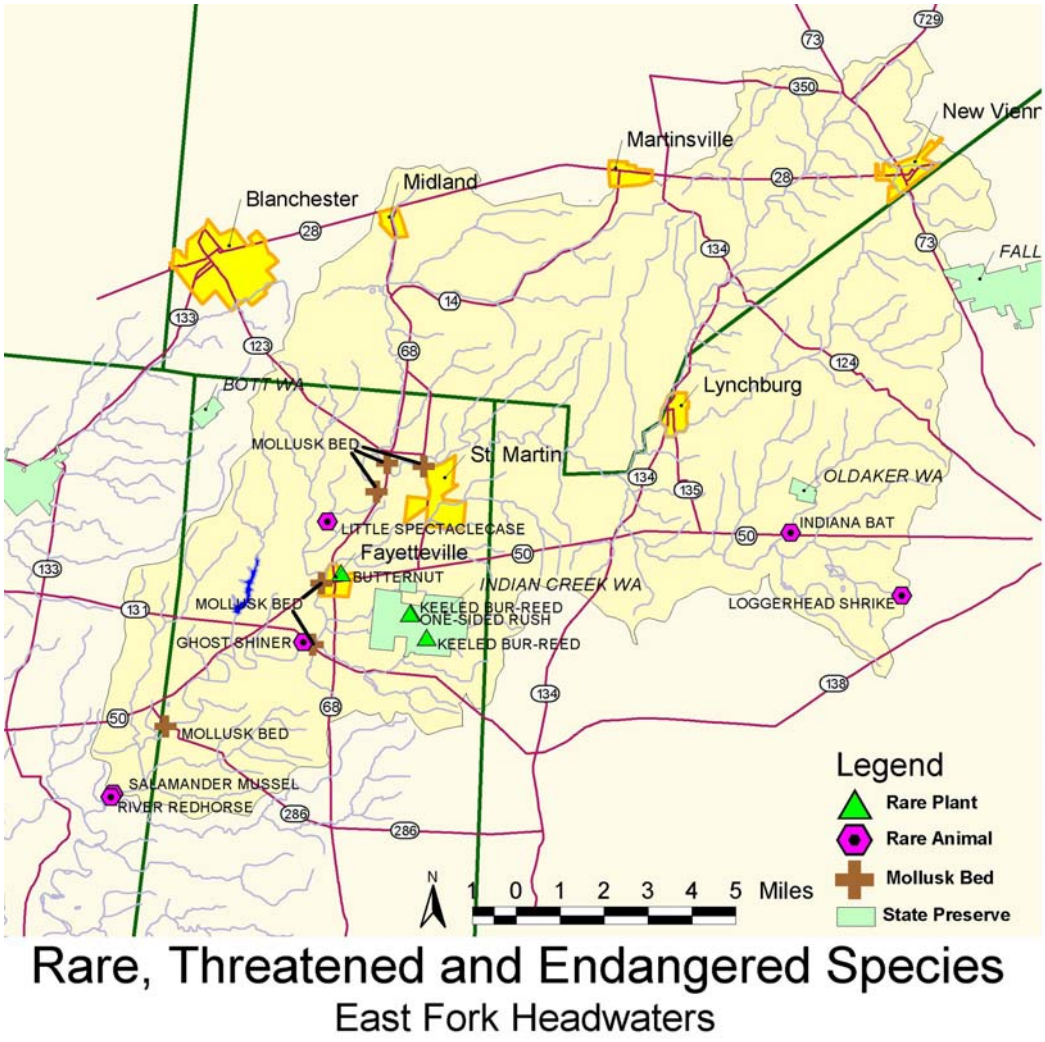
The native vegetation of the East Fork Headwaters watershed was deciduous hardwood forest, though species composition varied based on soil moisture. In the better drained areas, white and red oak, beech, sugar maple and hickory were dominant, with elm, ash, black walnut, honey locust, and blackgum also present. Much of the watershed lies within the wetter, level areas of the Illinoian till plains where the dominant species were pin oak, soft maples, ash, elm, and swamp oak with beech and sweetgum 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 Headwaters considered to be endangered, threatened or of special concern are summarized in Table 2-3 and Figure 2-6. Animal communities of special significance, such as mollusk beds, are also included.

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 watershed, 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).

Common Name	Scientific Name	Year Recorded	Federal Status	State Status	Location
Rare Plant List					
Butternut	Juglans cinerea	1992		Potentially threatened	Indian Creek Wildlife Area
Four-angled Spikerush	Eleocharis quadrangulatat	1968		Potentially threatened	Indian Creek Wildlife Area
Keeled Bur-reed	Sparganium Androcladum	1989, 1990		Potentially threatened	Indian Creek Wildlife Area
One-sided Rush	Juncus secundus	1968		Threatened	Indian Creek Wildlife Area
Rare Animal List					
Indiana Bat	Myotis sodalis	1968	Endangered	Endangered	
Loggerhead Shrike	Lanius ludovicianus	1984		Endangered	
Ghost Shiner	Notropis buchanani	1983			East Fork Little Miami River
Little Spectaclecase	Villosa lienosa	1990		Endangered	East Fork Little Miami River
River Redhorse	Moxostoma carinatum	1982		Species of Concern	East Fork Little Miami River
Salamander Mussel	Simpsonaias ambigua	1973		Species of Concern	East Fork Little Miami River
Slenderhead Darter	Percina phoxocephala	1983		Species of Concern	East Fork Little Miami River
Other Natural Features of Interest					
Mollusk Bed		1990			East Fork Little Miami River
Turkey Vulture Roost		1974			

Table 2-3. Rare, threatened and endangered species in the East Fork Headwaters.



Rare, Threatened and Endangered Species
East Fork Headwaters

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

Invasive Nonnative Species

Numerous invasive plant species are common throughout the East Fork Watershed. These include bush honeysuckle (*Lonicera* species), Japanese honeysuckle (*Lonicera japonica*), multi-flora rose (*Rosa multiflora*), and garlic mustard (*Alliaria petiolata*). 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 and alter natural habitats by decreasing light availability and depleting soil moisture and nutrients for native species. Exotic bush honeysuckle compete 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. These species was once encouraged by Soil and Water Conservation Districts for living fences and wildlife habitat, however it is no longer encouraged.

Garlic mustard invades areas disturbed by human

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.

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 Headwaters watershed is defined as the land area that drains to the East Fork Little Miami River upstream of the confluence with Fivemile Creek (see Figure 1-1, p1-1). It consists of seven 14-digit Hydrologic Unit Codes (HUCs), as defined by the U.S. Geological Survey:

- East Fork Little Miami headwaters to above Turtle Creek (HUC 05090202-100-010)
- Turtle Creek (HUC 05090202-100-020)
- Dodson Creek headwaters to below South Fork (HUC 05090202-100-030)
- Dodson Creek below South Fork to East Fork Little Miami (HUC 05090202-100-040)
- East Fork Little Miami below Turtle Creek to above Solomon Run (HUC 05090202-100-050)
- West Fork of the East Fork Little Miami River (HUC 05090202-100-060)
- East Fork Little Miami River above Solomon Run to above Fivemile Creek (HUC 05090202-110-010).

There are no stream gauges maintained by the U.S. Geological Survey in the East Fork Headwaters, therefore no stream flow data exists for the headwaters region. All 1st order streams in the headwaters are either intermittent or interstitial. Larger streams are perennial.

Within this watershed, the mainstem of the East Fork (Ohio Waterbody ID OH53-45, OH53-52, OH53-60; River Code 11-100) extends 41 miles from its inception near New Vienna (RM 85) to its confluence with Fivemile Creek (RM 44) near Blue Sky Park Road in Clermont County. Ohio EPA has classified the East Fork mainstem downstream from river mile 75.1 as Exceptional Warmwater Habitat. The stretch of the East Fork mainstem upstream of mile 75.1 is designated Warmwater Habitat. The East Fork mainstem is also designated for Primary Contact Recreation, and as a Public Water Supply, by the State.

The major tributaries to the East Fork Little Miami River in the Headwaters Watershed are Turtle Creek (OH53-61; 11-154), Dodson Creek (OH53-57; 11-151), and West Fork (OH53-56; 11-150) (See Table 2-4 for significant tributaries in the East Fork Headwaters Watershed).

Stream Name	Length (miles)	Drainage Area (sq. mile)	Use Designation
Turtle Creek	8.5	18.2	WWH, PCR, AWS, IWS
Dodson Creek	11.5	32.5	EWH, PCR, AWS, IWS
West Fork	9	28.45	WWH, PCR, PWS, AWS, IWS
Sixmile Creek	2.9	1.87	WWH, PCR, AWS, IWS
Howard Run	2	5.93	WWH, PCR, AWS, IWS
Grassy Fork	3.4	7.25	WWH, PCR, AWS, IWS
Glady Run	3.1	5.68	WWH, PCR, AWS, IWS
Saltlick Creek	1.5	6.4	WWH, PCR, AWS, IWS
Indian Creek	1	3.7	WWH, PCR, AWS, IWS
Little Indian Creek	3	1.66	WWH, PCR, AWS, IWS
Solomon Run	4.6	9.99	WWH, PCR, PWS, AWS, IWS
Murray Run	4	3.16	WWH, PCR, AWS, IWS
Sycamore Creek	2.6	6.86	WWH, PCR, AWS, IWS
Anthony Run	1.6	1.87	WWH, PCR, AWS, IWS

Table 2-4. Significant tributaries in the East Fork Headwaters Watershed. 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).

The only significant lakes or reservoirs in the East Fork Headwaters watershed are Lake Lorelei and the Westboro Reservoir. Lake Lorelei is a 190-acre man-made reservoir at the center of a 1700 lot residential development west of Fayetteville. Lake Lorelei was created by impounding Glady Run (Figure 2-8). The Westboro Reservoir (also called Houston Upground Reservoir), adjacent to Nicely Rd just west of

Figure 2-8. Lake Lorelei was created by impounding Glady Run.

the community of Westboro, impounds the West Fork. As mentioned above, the Westboro reservoir serves as a backup water supply for the Village of Blanchester. There are a large number of smaller man-made lakes/ponds throughout the watershed.

It should be noted that the East Fork Headwaters watershed provides a significant percentage of the water that flows into Lake Harsha (also called East Fork Lake) which serves as a water supply for much of Clermont County. As such, source water protection practices should be employed (see sidebar).

Source Water Assessment and Protection Program

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.

The East Fork Headwaters region is within a defined source water protection area for surface water but not for ground water. There are no Public Drinking systems in the Headwaters region that use surface water, however there are four Public Drinking systems that use ground water. See Appendix C for detailed maps about defined source water protection areas for surface and ground water in Ohio.

Most of the identified wetlands within the East Fork Headwaters watershed are small and isolated. The exceptions are the concentrations of man-made wetlands at the Indian Creek Wildlife Area southeast of Fayetteville and the Oldaker Wildlife Area just west of the community of Russell in Highland County. A map based on National Wetlands Inventory data is shown in Figure 2-9.

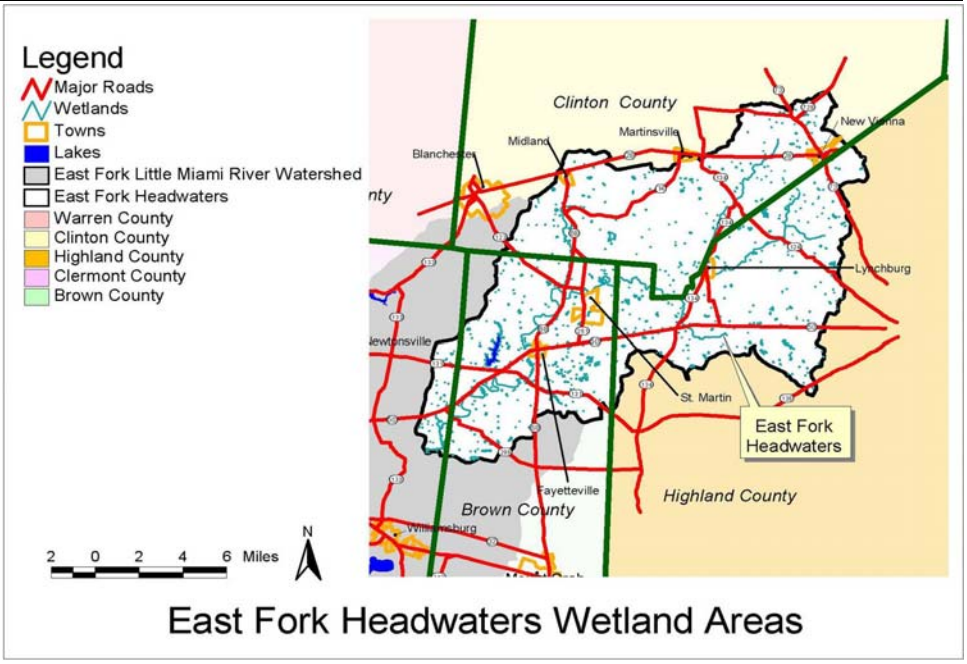


Figure 2-9. Location of wetlands in East Fork Headwaters watershed.

Figure 2-10. Wetland at Indian Creek Wildlife Preserve, Brown County.

Ground Water

The majority of aquifers in the East Fork Headwaters are poor sources of ground water. The bedrock consists of interbedded plastic shales and thin limestone layers and 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.

The Villages of Lynchburg and New Vienna use ground water wells, located in alluvial sediments in stream valleys, for their public water supplies. For the remainder of the East Fork Headwaters watershed, drinking water is pumped into the watershed by various rural water utilities or comes from individual wells or cisterns.

Ground water areas sensitive to pollution in the East Fork Headwaters watershed are primarily located within riparian reaches and aquifer systems. There are no high risk areas located in the East Fork Headwaters. It is important to monitor areas for ground water pollution sensitivity. See Appendix F for ODNR Ground Water Pollution Potential Maps for Clermont, Clinton, and Warren counties. Maps for Highland and Brown Counties are not available.

East Fork Headwaters Demographics

The population characteristics of the East Fork Headwaters watershed were obtained using GIS census data from the years 1990 and 2000. This is the most rural and least densely populated watershed within the larger East Fork basin. Data from the 2000 census indicates that approximately 14,570 residents live within the watershed. Over one-fourth of the residents of the Headwaters watershed live in New Vienna (2000 population of 1294), Lynchburg (pop. 1350), or Lake Lorelei (est. population of 1300). The average population density in the East Fork Headwaters is about 75 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.

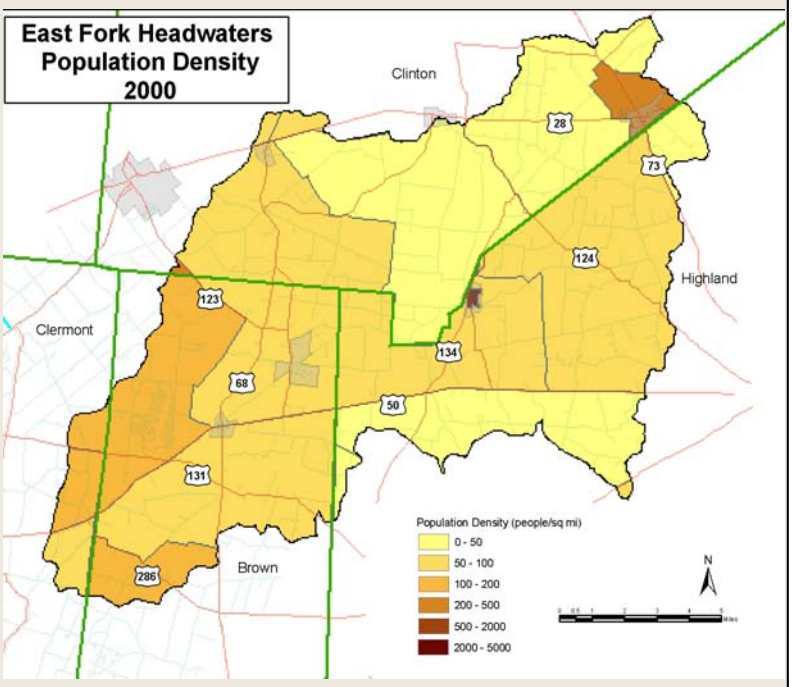


Figure 2-11. Population density within East Fork Headwaters watershed for the year 2000.

Comparisons of the 1990 and 2000 census indicate a 23 percent increase in population in the East Fork Headwaters, from 11,800 to 14,570. The area of the Headwaters watershed with the fastest growing population, at over 50% growth between 1990 and 2000, was western Brown County (see Figure 2-12). This growth area is the western half of Perry Township (including Lake Lorelei) and northern Sterling Township. Large areas of Dodson and Union Townships in Highland County, and the New Vienna area, grew at over 25% between 1990 and 2000. This increase in population is expected to continue.

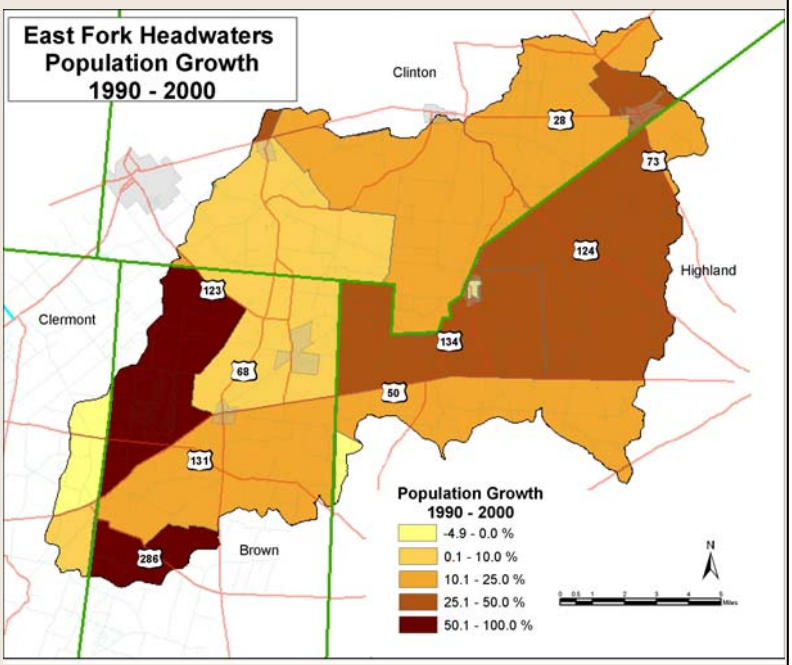


Figure 2-12. Population growth within East Fork Headwaters watershed from 1990 to 2000.

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

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 Headwaters watershed based on 1997 land use data (see sidebar for explanation). The East Fork Headwaters is the least populated of all the East Fork watersheds, with agriculture still the dominant land use. However, a drive through the watershed shows that commercial development within communities and along major roads, as well as subdivision and rural residential development are rapidly changing land use within the watershed.

Based on 1997 land use data, it is easy to see the extent of agricultural land use in the East Fork Headwaters. Agriculture accounts for 70.6% of land use, light urban/ residential accounts for 17.7 %, while forest accounts for 11.7% (Figure 2-13. A map illustrating land use within the East Fork Headwaters watershed is shown in Figure 2-14.

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 widespread rural residential development. The water management consequences of this type of unplanned rural development, sometimes referred to as "rural sprawl," are not fully understood.

Agriculture

Based on 1997 land use data, approximately 88,000 acres out of the total watershed area of 125,000 acres (70.6%) are used for agriculture. Of this, corn and soybean production account for the majority of land use with corn production on 25,700 acres (20.6%) and soybean production on 50,800 acres (40.8%) in 1997. Wheat (1370 acres; 1.1%), tobacco (<10 acres; 0%) and pasture/forages (10,100 acres; 8.1%) comprise the remaining agricultural land use.

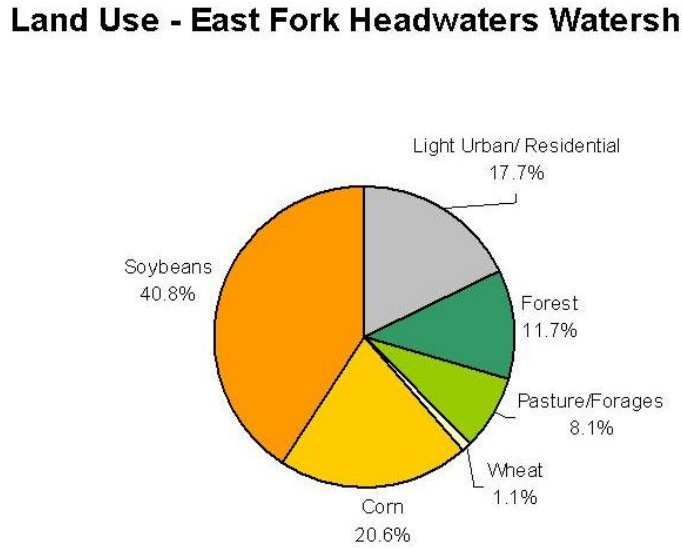


Figure 2-13. Distribution of land uses within the East Fork Headwaters watershed.

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.

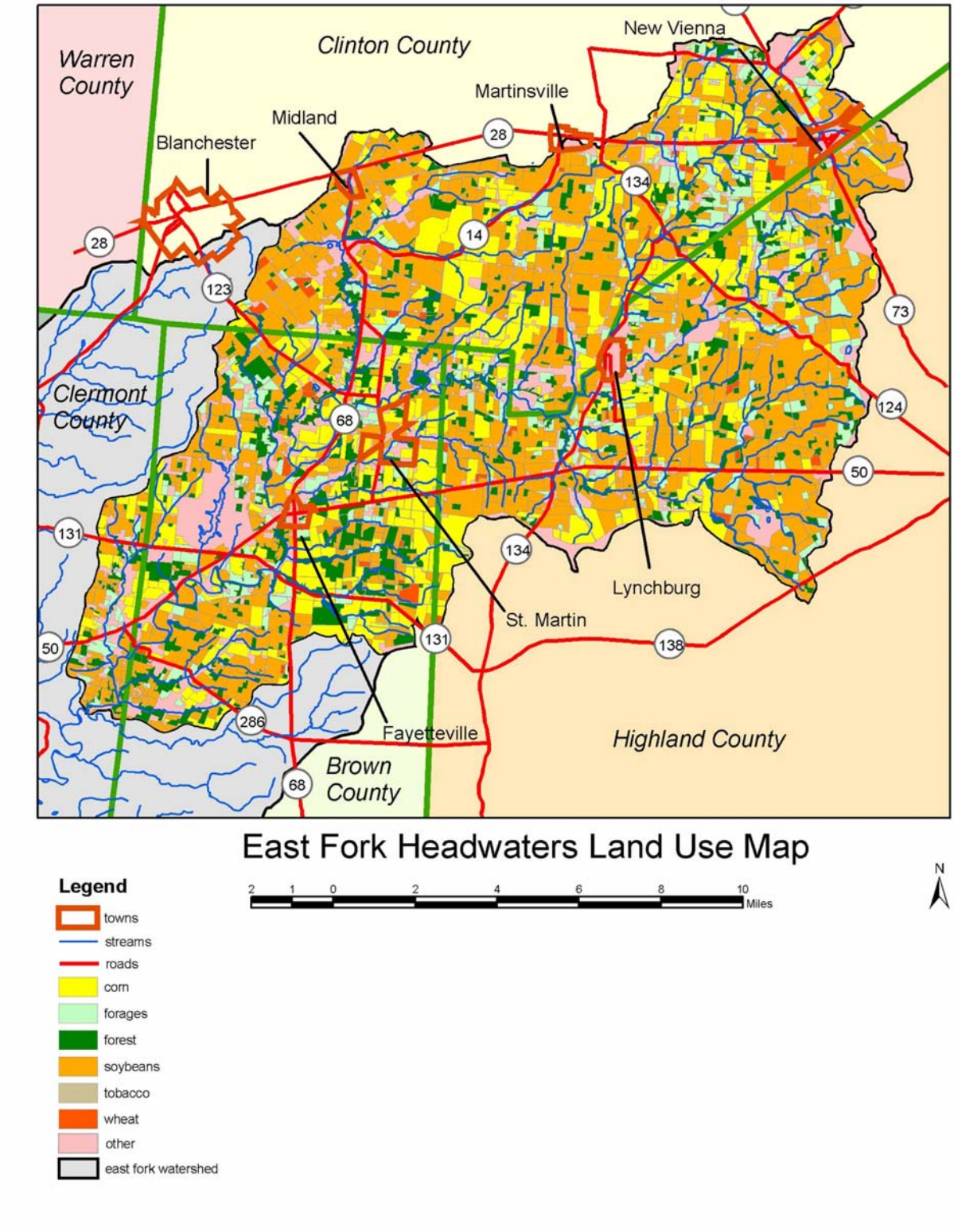


Figure 2-14. Land use in the East Fork Headwaters watershed (1997).

Forest

According to the 1997 land use data, forested areas comprise approximately 14,600 acres (11.7 %) of the East Fork Headwaters watershed. Because of the widespread use of tillable soil for agriculture, forested areas 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

As the least populated subwatershed within the East Fork watershed, the East Fork Headwaters region has the lowest percentage of light urban development, totaling just 22,000 acres (17.7%). This category of land use includes residential, institutional (schools, churches, etc.) and commercial property.

Within the East Fork Headwaters, the majority of residential development historically has been concentrated within and around the communities of Fayetteville, Lynchburg, New Vienna, and Lake Lorelei, 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 (Fayetteville, Lynchburg, New Vienna, Midland, St. Martin) and along major roads (e.g., U.S. 50 and U.S. 68). Though currently a very small percetage of land use in the Headwaters, commercial lands are notable because of their high percentage of impervious area.

See Appendix D for other Land use Categories in the East Fork Headwaters Region.

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 Headwaters watershed are discussed below.

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 Headwaters. Often considered to be more environmentally friendly than residential or commercial development, agriculture can also have significant impacts on water quality. Excess fertilizers ap-

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 stormwater runoff. Even though some areas—for example septic 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 stormwater runoff.

plied 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 Headwaters 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.

Figure 2-15. This facility in the Lower Dodson Creek watershed in Highland County houses 2200 finish hogs.

Each of the Lower Dodson Creek, Turtle Creek and the West Fork basins has one large confinement hog facility with a maximum of 2400 sows or finish hogs. Those facilities make up the bulk of the hog production in those watersheds, and almost 70% of hog production in the East Fork Headwaters. The rest of the hogs are raised in smaller facilities or feedlots with a few to a few hundred hogs per operation. A concentration of these smaller operations is in the upper reaches of the East Fork

Stream/Sub-basin	*Livestock – Type and Number*				
	Hogs	*Cattle*	*Sheep & Goats*	*Mixed/ Unknown Type*	*Total*
East Fork River - Headwaters to Dodson Creek	2559	390	538	93	3580
East Fork River – Dodson Creek to Solomon Run	41	137	115		293
East Fork River – Solomon Run to Howard Run		1050	70		1120
Upper Dodson Creek		63			63
Lower Dodson Creek	2200	144			2344
Turtle Creek	2450	189	160	54	2853
West Fork of East Fork	3200	368	39		3607
TOTALS	**10,450**	**2,341**	**922**	**147**	**13,860**

Table 2-5. Estimated numbers of livestock in the East Fork Headwater watershed.
[Sources: USDA-FSA 1999 Small Hog Operation Payment Program (SHOP-II), USDA-FSA 2002 Livestock Compensation Program (LCP), livestock producers]

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 2-6. Manure production and characteristics for common livestock animals.

Headwaters.

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 Headwaters watershed, Table 2-5 shows nearly half are concentrated in the lower reaches (between Solomon Run and Fivemile Creek).

The concentration of sheep and goats is in the upper reaches of the East Fork Headwaters, taking advantage of the loamy soils and rolling terrain. Many fields in this area have highly fertile soils, but are too steep for continuous row crop production.

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

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 2-6.

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 reflects the limited knowledge that some new horse owners have about managing horses and their waste.

Quarries

Quarries represent a very small percentage of the area within the East Fork Headwaters watershed, but 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. The three large quarries located within the East Fork Headwaters are: Ohio Asphaltic Limestone, Mad River Rd; Martin Marietta, Sharpsville Rd; and Highland Stone, Roush Road. All are located within Highland County (see Figure 2-16).

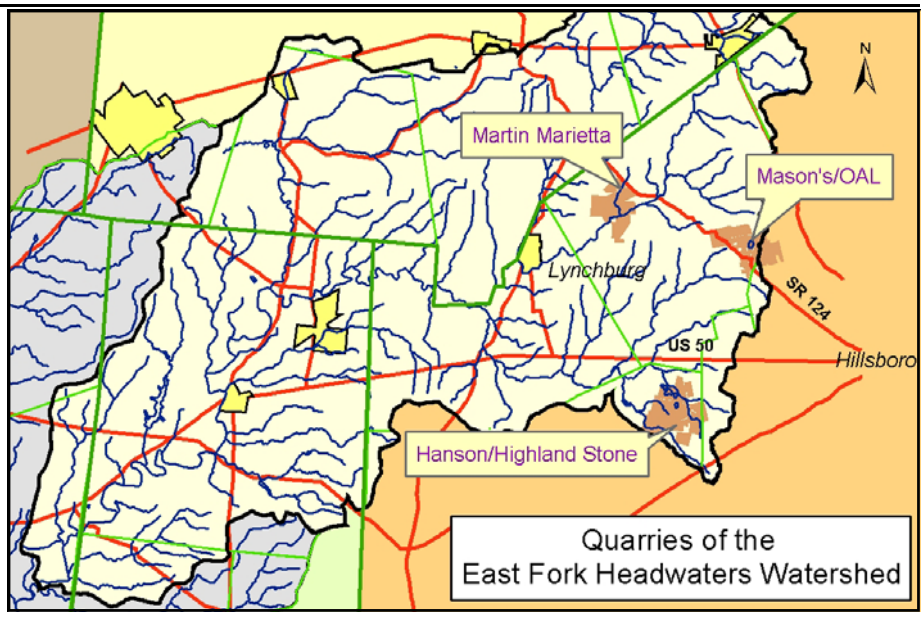


Figure 2-16. Location of surface mining operations in the East Fork Headwaters watershed.

Septic Systems

There are approximately 4000 home sewage treatment systems (HSTS) - more commonly called septic systems or on-site wastewater treatment systems - in the East Fork Headwaters 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). 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 septic 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.

The Highland County Home Sewage Treatment System Implementation Plan (Highland County General Health District, 2005) estimates that "10% of the HSTS in Highland County are malfunctioning or failing in some way." The same document notes that "within the East Fork and the White Oak Creek watersheds exist some of Highland County's poorest soils, resulting in a high number of existing HSTS failures." Some local estimates put the percentage of failing systems in the East Fork Headwaters at closer to 25%.

Many of the failing systems are simply older systems that were installed when our 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 our increased understanding of how these systems work (or don't work) in a given environment.

More specific information on septic systems may be found in the Home Sewage Treatment System Improvement Plans for Brown, Clermont and Highland Counties (Clinton County currently does not have a HSTS plan).

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 3.42% impervious surface coverage. Local knowledge of land use cover suggest that the headwaters region probably has even less impervious cover. A detailed impervious surface cover analysis will be performed 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.

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.

It should be noted that there are no Phase II stormwater communities located in the East Fork Headwaters watershed.

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.

The East Fork Collaborative with direct assistance from local soil and water conservation districts and solid waste districts 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. These discharge "hot spots" 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 Headwaters watershed, there are six point-source dischargers permitted by Ohio

EPA (see Figure 2-17). The permitted dischargers are:

- New Vienna wastewater treatment plant
- New Vienna water works
- Snow Hill County Club wastewater package plant
- Lynchburg wastewater treatment plant
- St. Martin wastewater treatment plant
- Fayetteville-Perry wastewater treatment plant

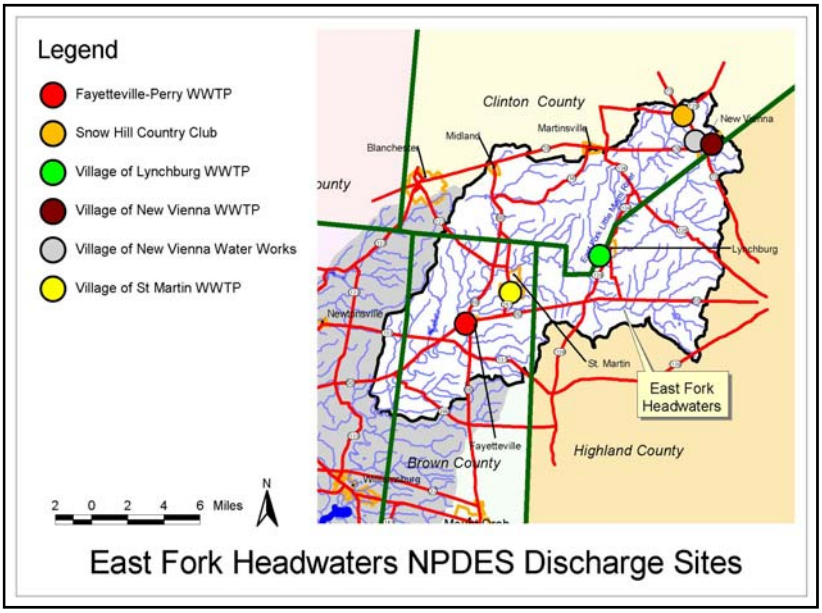


Figure 2-17. Location of NPDES permitted discharge sites in the East Fork Headwaters watershed.

Physical Stream Characteristics

The East Fork Watershed Collaborative currently has no data on physical stream characteristics in the East Fork Headwaters watershed. Ohio EPA does not collect direct measures of stream morphology (see Figure 2-19), though some qualitative indicators are recorded as part of the Qualitative Habitat Evaluation Index (QHEI) outlined in Chapter 3. However, 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 Headwaters than in other agricultural areas in Ohio because the soils do not respond well to subsurface drainage, thus reducing the need for tile outlets.

- Channelization is not limited to small headwaters streams. The most notable example of this phenomenon is the extensive channelization of the West Fork upstream and downstream from Frazier Rd (see Figure 2-18). A segment of the East Fork mainstem recently was channelized near Lynchburg.

- In several locations, levees have been constructed directly adjacent to the stream channel to prevent the natural flooding that occurs during large rain events. Most notable is the extensive leveeing along the East Fork mainstem in a number of stream reaches upstream and downstream of Fayetteville.

- 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 Headwaters (see Chapters 4 & 5).

Figure 2-18. Channelized segment of West Fork.

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.

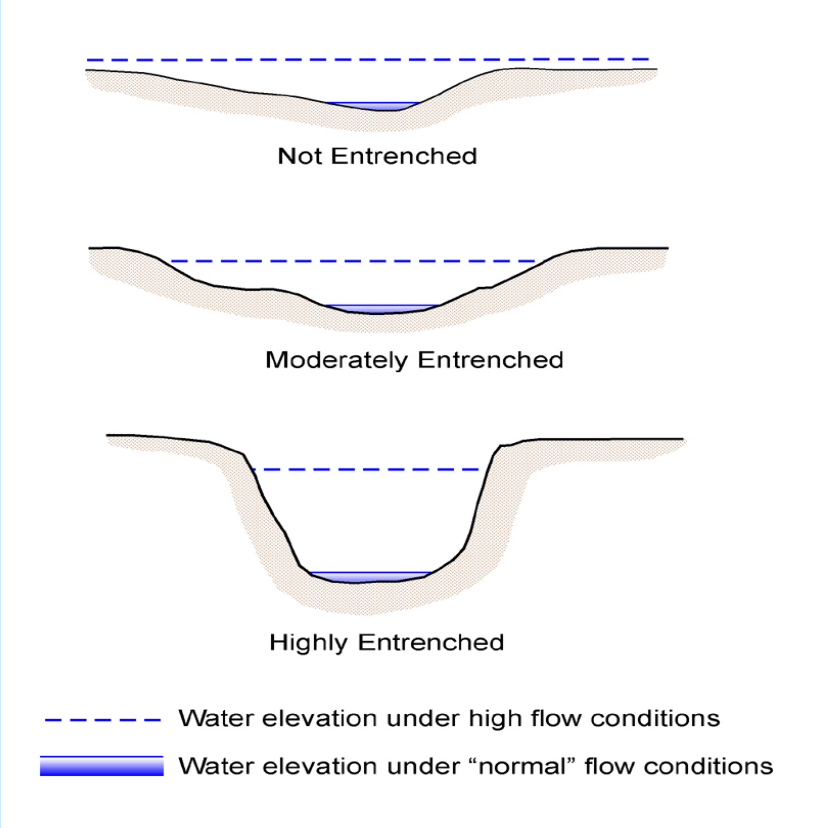


Figure 2-19. Entrenchment describes a stream's ability to access its floodplain under high flow conditions.

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 natural and historical significant areas in the watershed.

Recreation

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 in the Clermont, Brown, and Highland county regions of the watershed.

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.

History

The East Fork watershed region has a rich historical past. A number of Native American tribes called this area home, including the Shawnee, Miami, Delaware, Mingo, Ottawa, Cherokee, and Wyandot. The last Native American village in the area was located in Clermont County two miles south of Marathon in Jackson Township, along the mouth of Grassy Run on the East Fork of the Little Miami River. The Wyandot lived there until 1811. That location was the site of the largest frontier battle in Clermont County, the Battle of Grassy Run, where pioneer Simon Kenton clashed with Shawnee warrior, Tecumseh, on April 10, 1792.

The East Fork watershed 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 places that slaves could rest and be safe.

For detailed maps of recreational, historical and other cultural resources in the East Fork watershed region visit the Ohio Valley Regional Development Commission web page at www.ovrdc.org.

Figure 2-20. The dairy house at Harmony Hill is the oldest structure in Clermont County, built in 1796.

CHAPTER 3:
WATER RESOURCE QUALITY

The primary source of water quality data for the East Fork watershed is the Ohio EPA database developed over the last 30 years by the Ohio EPA Ecological Assessment Unit. The Ohio EPA data are supplemented here by monitoring data collected by the Clermont County Office of Environmental 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 Headwaters (defined in the report as the area draining to the East Fork upstream of Fivemile Creek). This report summarizes the status of Ohio 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.

Two streams in the East Fork Headwaters have received an "Exceptional Warmwater Habitat" (EWH) aquatic life use designation, meaning these streams have the potential to support exceptional biological communities. The two EWH streams in this watershed are the East Fork Little Miami River, from river mile 75 (near Canada Road in Clinton County) to the downstream boundary of the subwatershed, and the entire length of Dodson Creek. All other streams that have been designated by Ohio EPA are Warmwater Habitat (WWH) streams. The entire length of the East Fork is also designated for Public Water Supply, as are two tributaries - Solomon Run and the West Fork of the East Fork. All streams have been designated for Primary Contact Recreation.

Ohio EPA's assessment of streams in the East Fork Headwaters are based on data last collected in 1998. Of the streams monitored by Ohio EPA, 33 percent fully supported their aquatic life designated use, while 54 percent of the streams were in partial support. A total of 13 percent did not support their aquatic life use. Ohio EPA's 2000 *Ohio Water Resources Inventory* 305(b) presents a more specific assessment of individual streams. In the 2000 report (also based on 1998 data), Ohio EPA assessed the East Fork River from the headwaters to Howard Run, as well three major tributaries to this section of the river (Dodson Creek, Turtle Creek and the West Fork of the East Fork Little Miami River; see Figure 3-1).

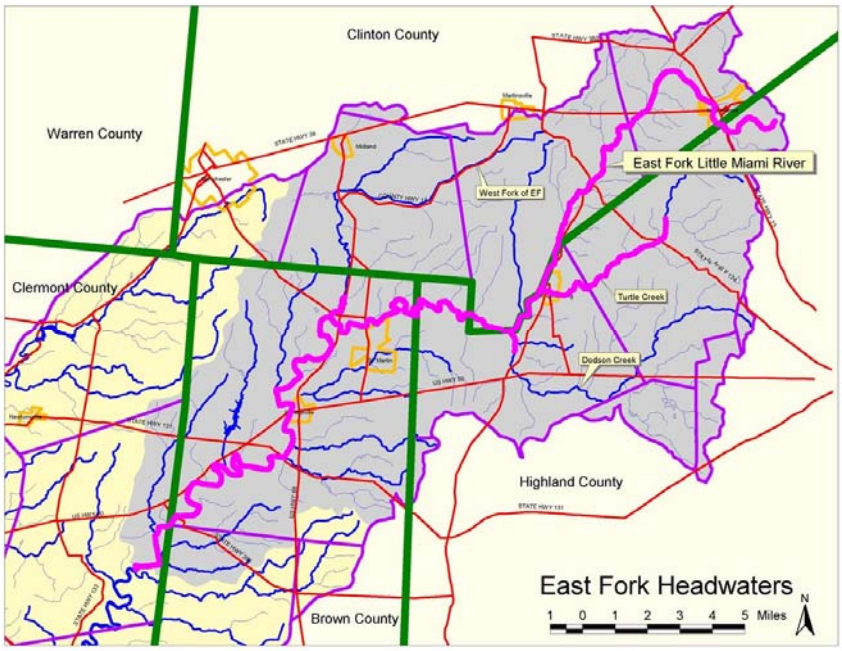


Figure 3-1. East Fork Headwaters streams; the East Fork mainstem, and portions of Dodson Creek, Turtle Creek and West Fork have been assessed by Ohio EPA (assessed segments highlighted in purple).

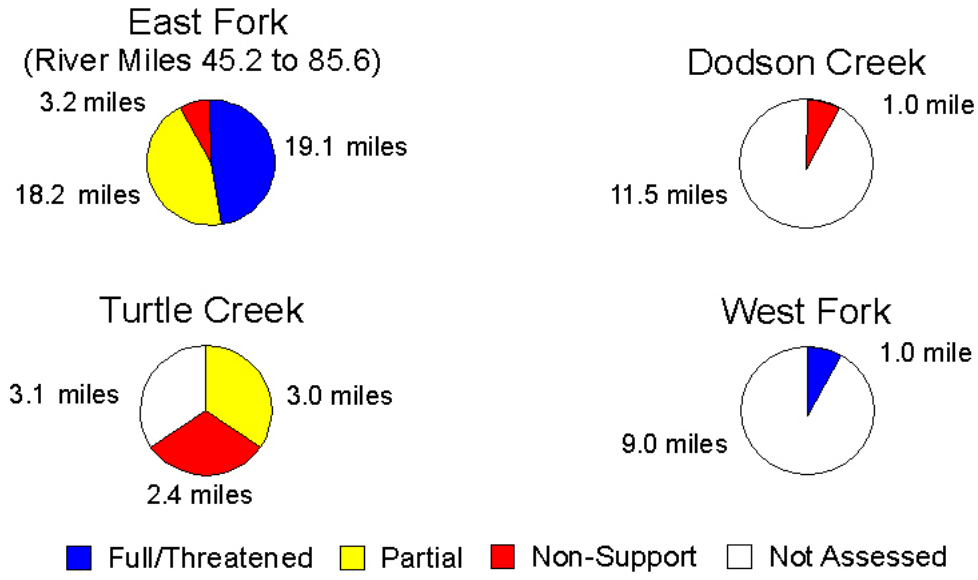


Figure 3-2. Use attainment status for East Fork Headwater streams.

Based on data collected by Ohio EPA through 1998, approximately 47 percent (19.05 stream miles) of the East Fork was found to be in full, but threatened, attainment of the river's use designations (either WWH or EWH), while 45 percent (18.2 miles) was listed in "partial" attainment, and 8 percent (3.15 miles) was non-supporting (see Figure 3-2).

High concentrations of nutrients and siltation were listed as primary causes of impairment in the segment of the East Fork extending from the headwaters to Dodson Creek. Non-irrigated crop production was listed as the most significant pollutant source, while surface mining, range grazing and natural causes were listed as moderate sources. Between Dodson Creek and Solomon Run, both the cause and source of stream impairment is characterized as "unknown." From Solomon Run to Howard Run, siltation is again listed as the primary cause of non-attainment, with nutrients mentioned as a secondary cause. Non-irrigated crop production was identified as the primary source in this segment of the East Fork. Table 3-1 below highlights the primary causes of impairment for the East Fork Little Miami River, as well as other streams assessed by Ohio EPA in the Headwaters watershed.

Stream Segment	***Impairment:***			
	Nutrients	***Siltation***	***Unknown***	***No Impairment***
East Fork River - Headwaters to Dodson Creek	X	X		
East Fork River – Dodson Creek to Solomon Run			X	
East Fork River – Solomon Run to Howard Run		X		
Dodson Creek			X	
Turtle Creek		X	X	
West Fork of East Fork				X

Table 3-1. Causes of impairment in East Fork Headwaters streams (Ohio EPA 2000 305(b) Report).

Three tributaries in the East Fork Headwaters were also assessed by Ohio EPA — Dodson Creek, Turtle Creek and the West Fork of the East Fork. Ohio EPA has designated Dodson Creek, the largest tributary in the East Fork Headwaters, as an Exceptional Warmwater Habitat Stream. Of the 11 ½-mile stream segment, Ohio EPA has only assessed one mile, and this has been categorized as non-supporting. The reasons for non-attainment are unknown.

Ohio EPA also assessed 5.4 miles of Turtle Creek, a WWH stream which enters the East Fork upstream of Dodson Creek at the Village of Lynchburg. Three miles were said to be partially supporting the WWH aquatic life use, and 2.4 miles were non-supporting. A total of 3.1 miles were not assessed. Siltation is listed as a high cause of impairment, as is ""cause unknown." Excessive siltation and turbidity were noted near the mouth of Turtle Creek; however, the substrates at a second site upstream of a gravel operation were clean and the water was clear. Ohio EPA lists both surface mining and "source unknown" as high sources of impairment.

The West Fork of the East Fork runs for nine miles from the Martinsville area in Clinton County to the East Fork Little Miami River in Brown County, just west of St. Martin. Ohio EPA monitored one regional reference site near the mouth of the West Fork in 1998. Results from both the fish and macroinvertebrate surveys reflected healthy biological communities, and fully supported the stream's WWH use designation.

Ohio EPA's 2004 Integrated Water Quality Monitoring and Assessment Report does state that the status of Primary Contact Recreation use support in this watershed is impaired; however, this is based on limited sampling conducted at three ambient sites and by one NPDES discharger.

Figure 3-3. West Fork near Ohio EPA reference site.

Summary of Stream Conditions

Most data available in the East Fork Headwaters watershed has been collected and compiled by Ohio EPA. Clermont County has conducted a limited number of studies in the watershed, including biological surveys at two mainstem sites in 2000, and intensive water quality sampling during periods of dry and wet weather in 2002. The following paragraphs summarize the findings from these studies in the East Fork Headwaters tributary streams and the mainstem from the headwaters in New Vienna to Howard's Run.

It should also be noted that staff at the U.S. Environmental Protection Agency research facility in Cincinnati are conducting intensive sampling in the East Fork Headwaters watershed; however, data collected as the result of their efforts have not yet been released to the public.

Stream Biology - East Fork Mainstem

The Ohio Environmental Protection Agency (OEPA) conducted intensive biological surveys in the East Fork Headwaters 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

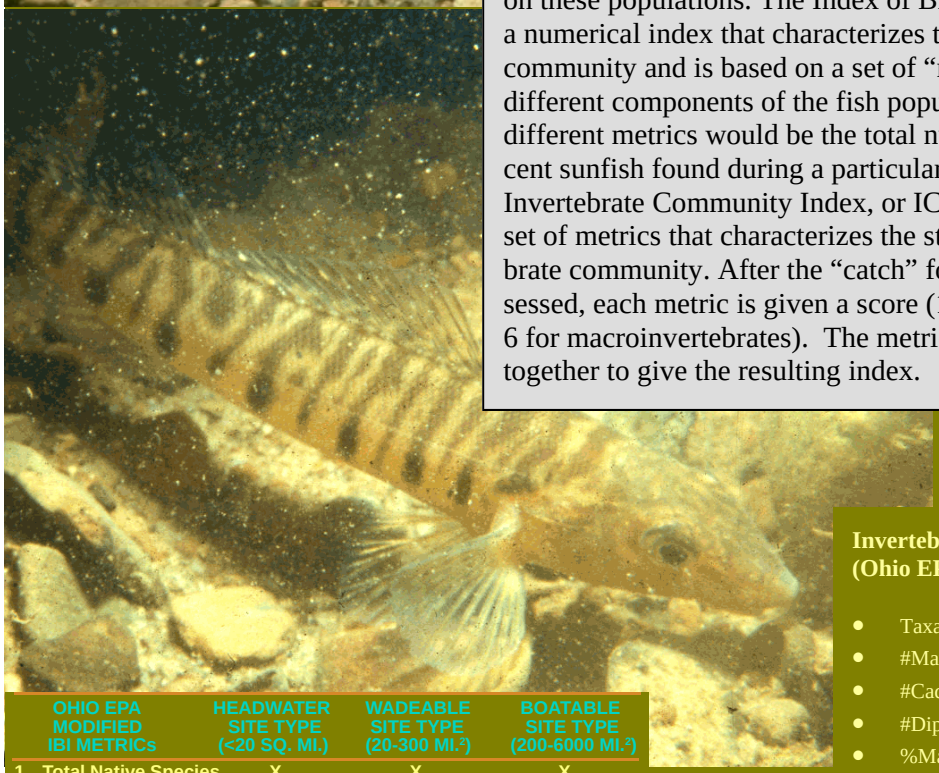
River Miles are an easy and accurate way to identify sampling locations. River miles are measured in terms of distance (in tenths of a mile) from the stream "mouth." In Dodson Creek, river mile 0.0 (RM 0.0) would be the point where the creek enters the East Fork Little Miami River. River miles increase as you move upstream. Many of Clermont County's sampling sites are named using river miles. For example, EFRM75.3 indicates samples collected at East Fork River Mile 75.3.

Sampling Station	Location	Type of Survey	Year(s) of Survey
RM 48.6/48.8	McCafferty Rd 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 Headwaters 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 East Fork Headwaters watershed lies within two of these ecoregions — the Eastern Corn Belt Plain and the Interior Plateau. Most of the East Fork Headwaters watershed is in the Interior Plateau ecoregion, including the East Fork Little Miami River downstream of river mile 66.7 and Dodson Creek. The East Fork upstream of river mile 66.7 and Turtle Creek are in the Eastern Corn Belt Plain ecoregion.

Ohio EPA has designated the upper 10 miles of the East Fork Little Miami River (river miles 75 to 85) as a "Warmwater Habitat" stream, while the remainder of the East Fork from river mile 75 to Lake Harsha in Clermont County has been categorized 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 the EWH section of East Fork are more stringent. To meet the EWH criteria in both the Eastern Corn Belt and Interior Plateau ecoregions, 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 IBI criterion for the upper ten miles of the East Fork with the WWH designation is 40.

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)

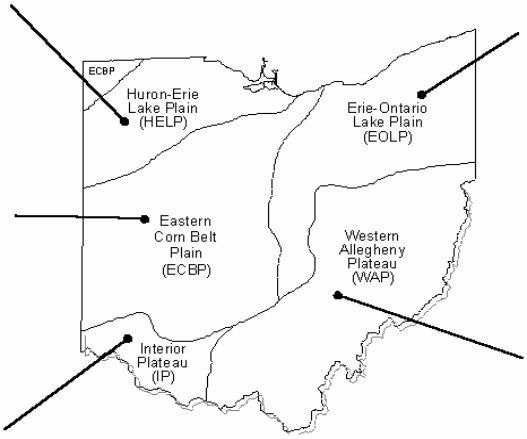
Use	Size	IBI	MIwb	ICI
WWH	H	28	NA	34
	W	32	7.3	34
	B	34	8.6	34
MWH-C	H	20	NA	22
	W	22	5.6	22
	B	20	5.7	22
MWH-I	B	30	5.7	NA

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

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



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

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

Statewide Exceptional Criteria

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

During 2000, Clermont County conducted fish and macroinvertebrate surveys at two sites on the East Fork mainstem, including river mile 48.8 at the McCafferty Road covered bridge in Brown County, and at river mile 56.2 in Fayetteville. These represent the only biological surveys conducted by Clermont County in the East Fork Headwaters watershed.

Fish Survey Results

With only one exception, Ohio EPA conducted all its fish surveys in the East Fork Headwaters in 1982 and 1998 (EFRM 54.2 was surveyed in 1983). The results show that there is a significant difference between IBI scores for the 1982-83 and 1998 surveys (Figure 3-4). The average IBI score for 31 surveys conducted on the East Fork Little Miami River in 1982-83 is 37.2, while the average IBI score for the 14 East Fork surveys conducted in 1998 is 44.7. No stream survey sites in 1982 met the EWH criteria. The highest average IBI score for any one site was 43.3. In contrast, average scores for three of the seven mainstem sites surveyed in 1998 supported the EWH use designation. Two sites were surveyed in both 1982 and 1998 — EFRM 75.3 at Canada Road and EFRM 48.8 at McCafferty Road bridge. Results show that EFRM 75.3 met the EWH criteria in 1998 (average IBI of 50), but not in 1982 (average IBI of 42.7). The EFRM 48.8 site did not meet the EWH use designation in either year, and IBI scores were slightly lower in 1998 (38) than in 1982 (41.3). It is difficult to say if the generally higher scores in 1998 are the result of improving water quality, or simply the result of changes in sampling methods utilized by Ohio EPA.

Focusing only on the most recent 1998 surveys (which were conducted using wading rather than boat sampling methods), 57.1 percent of the surveys resulted in average index scores that met the appropriate criteria (Figure 3-4). All sites in the upper 10 miles of the East Fork met the WWH criterion, with two sites achieving

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.

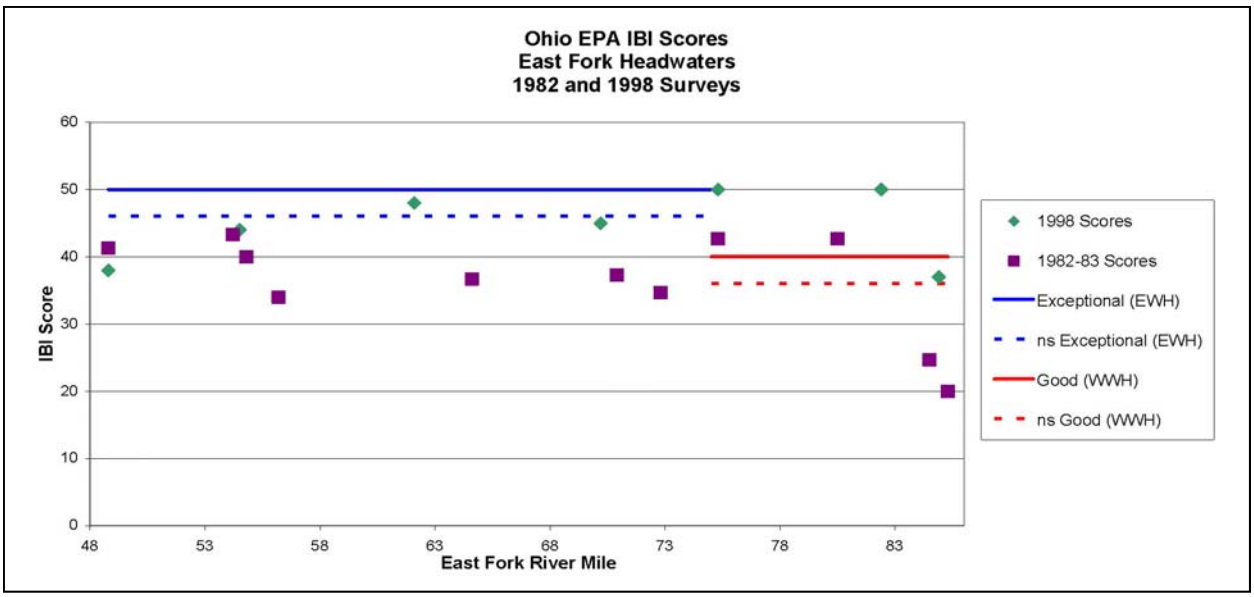


Figure 3-4. Ohio EPA Index of Biotic Integrity (IBI) scores for East Fork Little Miami River (RM 48-85).

scores that would also meet the EWH criterion. Only one of the four sites surveyed between river miles 75 and 48 met the EWH criterion, although all survey scores fell within the non-significant departure range for warm water habitat criterion (IBI scores of 36 or greater). The site which scored the poorest in 1998 was EFRM 48.8 at the McCafferty Road covered bridge in Brown County, with an average IBI score of 38.

In more recent surveys conducted at two sites by Clermont County, IBI scores have been higher. In 2000, the County conducted fish surveys at EFRM 48.8 (McCafferty Road) and EFRM 56.2 (US 50 bridge west of Fayetteville). The average IBI score at EFRM 48.8 was 45, an improvement over the IBI score of 38 measured by Ohio EPA two years earlier, but still below the EWH criterion. The EFRM 56.2 scored exceptional with an IBI score of 52. This site had not been measured by Ohio EPA since 1982, scoring only 34 at that time.

DELT Anomalies

One of the metrics used in calculating the IBI is a rating based on the percentage of Deformities, Eroded fins, Lesions and Tumors – also known as DELT anomalies – found on fish. Metric scores 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. For surveys conducted in 1982 or 1983, the average DELT score over 31 surveys was 3.5. Anomalies appeared more frequently in fish collected downstream of EFRM 72.8. A marked improvement was noted in 1998, where the average score increased to 4.5. A total of 11 of the 14 survey sites received a perfect score of 5, and no sites received the lowest possible score of 1. However, a high percentage of DELT anomalies were found in fish collected at EFRM 48.8 by Clermont County in 2000.

Macroinvertebrate Survey Results

The macroinvertebrate community in the upper East Fork between river miles 50.5 and 75.4 appears to be in excellent condition, according to Ohio EPA survey results. Of the five separate surveys conducted by Ohio EPA in 1998, four had ICI scores in "non-significant departure" of the EWH criteria of 46. The fifth site received a qualitative score of "excellent." Two sites in the East Fork Headwaters (river miles 82.4 and 85.0) received a "fair" rating. Both of these sites have drainage areas less than six square miles.

The 1998 macroinvertebrate results also seem to show that water quality has improved since previous surveys conducted in 1982, where ICI scores ranged between 34 and 36, and no site received a qualitative rating higher than "good" The apparent improvement in the well-being of the macroinvertebrate community is illustrated by three separate surveys conducted at EFRM 54.4 in 1982, 1983 and 1998 The results from the first survey in 1982 yielded an ICI score of 34, which meets WWH, but not EWH criteria. The 1983 score improved to 42, which is in non-significant departure of the EWH criterion. The 1998 survey showed even greater improvement with an exceptional ICI score of 52.

As with fish, Clermont County conducted two macroinvertebrate surveys at East Fork river miles 48.8 and 56.2 in 2000. The EFRM48.8 site at McCafferty Road received an ICI score of 44, which meets the EWH criterion. The EFRM56.2 site at U.S. Route 50 in Fayetteville scored lower, with an ICI of 38. This same site was surveyed by Ohio EPA in 1982, receiving an ICI score of 36. Ohio EPA has not conducted macroinvertebrate sampling at EFRM 48.8.

Stream Biology - East Fork Headwater Tributaries

Biological Communities

Ohio EPA has also investigated the biological communities on four tributary streams to the upper East Fork, though not as extensively as the East Fork itself. These streams include:

- Dodson Creek at Crampton Road,
- three sites on Solomon Run,
- two sites on Turtle Creek, and
- West Fork of the East Fork at State Route 123.

Figure 3-5 illustrates these sampling locations.

Clermont County has not conducted any biological surveys on tributaries in the East Fork Headwaters sub-watershed.

With the exception of Dodson Creek, Ohio EPA has designated all tributaries to the upper East Fork as warmwater habitat (WWH) streams. The fish (IBI) criterion for WWH headwater streams is 40. There are different macroinvertebrate (ICI) criteria for the two different ecoregions represented in the sub-watershed. Streams in the Interior Plateau ecoregion (i.e., those entering the East Fork downstream of river mile 66.7 and those in the Dodson Creek watershed) must attain an ICI of 30 to meet the WWH use designation, while all other streams in the Eastern Corn Belt Plain ecoregion must have ICI scores of 36 or better to meet the WWH standard. Dodson Creek is the only exceptional warmwater habitat tributary in the East Fork Headwaters. To meet the EWH criteria, Dodson Creek must attain IBI and ICI scores of 50 and 46, respectively.

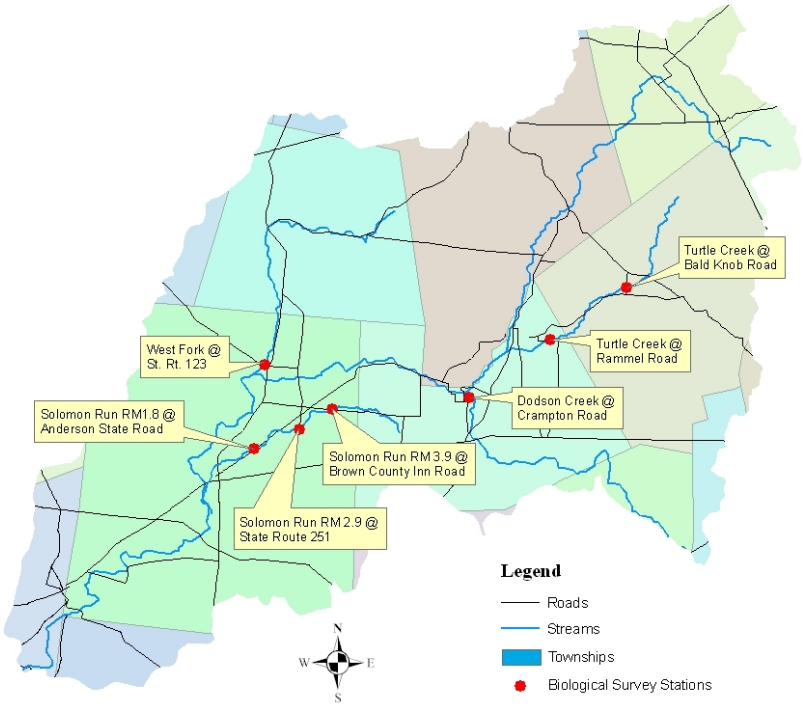


Figure 3-5. Ohio EPA biological survey sites on East Fork Headwater tributaries.

Dodson Creek

Biological surveys conducted by Ohio EPA show that there is some degree of impairment on Dodson Creek near its mouth. Reasons for non-attainment are unknown. Early surveys conducted in 1982 resulted in an average IBI score of 44.7 — a good score, but short of meeting the EWH criterion of 50. Two additional fish surveys were conducted in 1998, and there was a large discrepancy between the July fish sample (IBI of 30) and the August sample (IBI of 44). The macroinvertebrate community rated good in 1998. Ohio EPA does note that habitat quality, as measured by the Qualitative Habitat Evaluation Index (QHEI), dropped considerably between 1982 and 1998 as the result of heavy erosion in the watershed, increased embeddedness and reduced riffle habitat.

Solomon Run

All surveys on Solomon Run were conducted in 1982. Both fish and macroinvertebrate surveys were conducted at three locations — stream miles 1.8, 2.9 and 3.9. In general, the fish community became healthier in a downstream direction (i.e., as drainage area increases). The IBI scores met the current IBI criterion at the most downstream site, which has a drainage area of six square miles. The WWH criterion was not met at the two upstream sites, and was extremely low at stream mile 3.9. Similarly, the macroinvertebrate community seemed slightly healthier at the downstream site, receiving a qualitative score of "good," compared to the "moderately good" scores at the other two locations. No habitat data are available for Solomon Run.

Turtle Creek

Ohio EPA surveyed two sites on Turtle Creek in 1998, including stream mile 1.7 at Rammel Road just east of Lynchburg, and stream mile 4.4 at Bald Knob Road in Union Township, Highland County. The Rammel Road location had an average IBI score of 35, which is fair, but does not meet the WWH standard. The upstream site at Bald Knob Road scored slightly lower, with an IBI score of 32. Qualitative samples of macroinvertebrates were collected at stream mile 1.7, and received a rating of very good. Both sites exhibit moderately good habitat with some siltation problems.

West Fork of East Fork

Ohio EPA conducted biological surveys at one site on the West Fork of East Fork near its mouth at the State Route 123 bridge in Brown County. Fish surveys were conducted in both 1982 and 1998, while macroinvertebrates were investigated only in 1998. The results of the 1982 and 1998 fish surveys were almost identical, with average IBI scores of 38.7 and 38, respectively, and high individual survey scores of 42. This stream site met the WWH use designation both years, although just barely, with the average IBI scores within the range of non-significant departure from the criterion. A qualitative survey of macroinvertebrates at this same location in 1998 yielded "very good" results. Habitat scores were good in both 1982 and 1998, with QHEI scores of 78.5 and 71, respectively. The 1998 habitat survey did show increasing levels of siltation and embeddedness.

Stream Habitat – Ohio EPA Assessment

When Ohio EPA field crews conduct fish or macroinvertebrate surveys, they typically assess the quality of stream habitat using the state's Qualitative Habitat Evaluation Index (see Sidebar). Since 1982, EPA crews completed 19 habitat surveys in the East Fork Headwaters, including 13 on the East Fork mainstem (between river miles 48 and 85), and six tributary surveys.

In general, QHEI scores were very good in the upper East Fork, with scores ranging between 65 and 84. The low score of 65 was seen at the most upstream site – river mile 84.9 in New Vienna. The drainage area at this point is 2.2 square miles. The only other sites receiving scores of less than 70 were EFRM75.3 at Canada Road, which showed heavy siltation and extensive embeddedness, along with a poor riparian buffer zone; and EFRM48.7 at the McCafferty Road covered bridge, which scored 68.5 during a 1993 survey. This same site scored better in 1998 (QHEI = 76) despite increased levels of silt and sediment. A 2000 habitat survey conducted by Clermont County at the covered bridge site resulted in a QHEI score of 70.

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

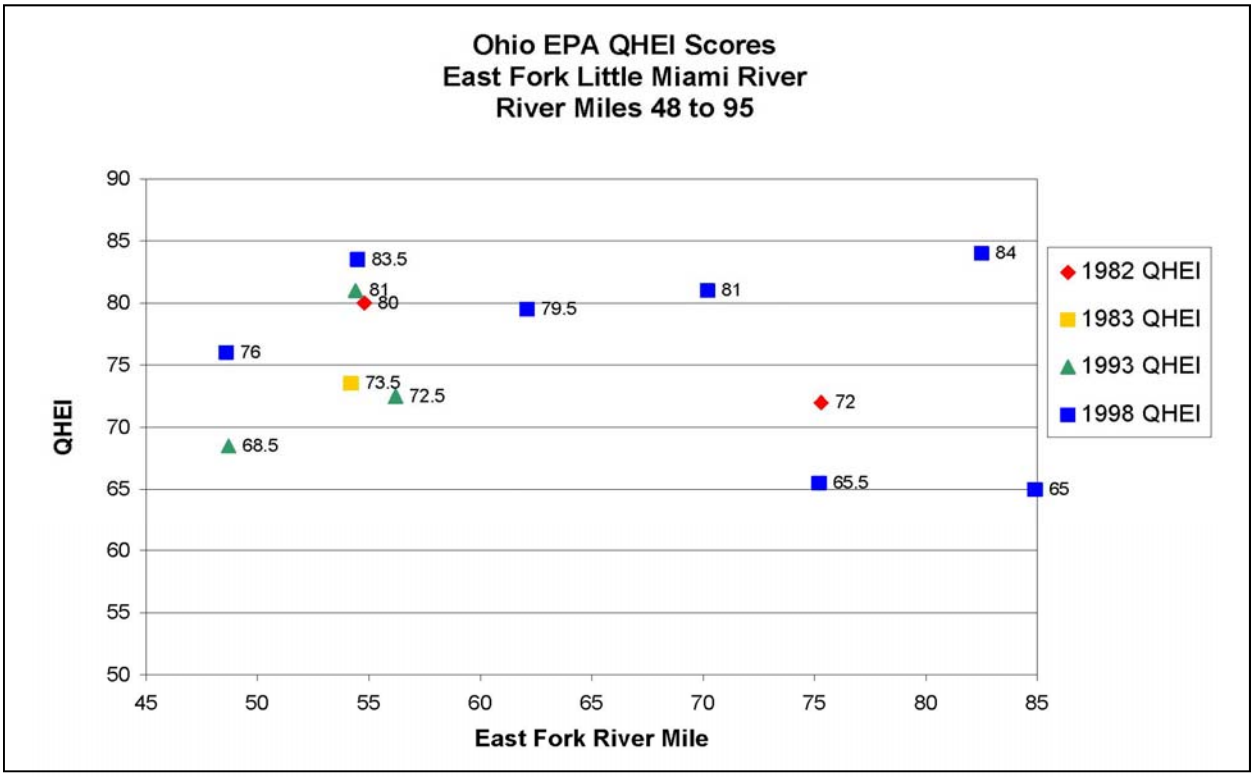


Figure 3-6. Ohio EPA QHEI scores, East Fork Little Miami River, river miles 48 to 85.

Sites along the East Fork that exhibited the best habitat during the most recent survey conducted in 1998 include EFRM82.4 at Thornburg Road (QHEI = 84), EFRM54.5 near SR 131 in Brown County (QHEI = 83.5), and EFRM 70.2 at Wise Road (QHEI = 81). Figure 3-6 illustrates the QHEI results from the 13 Ohio EPA surveys on the East Fork from its headwaters to river mile 48.

In addition to the East Fork mainstem surveys, Ohio EPA evaluated stream habitat in three tributaries - Dodson Creek, Turtle Creek and the West Fork. Two surveys were conducted at Dodson Creek river mile 0.2, the first in 1982 and the most recent in 1998. Scores were fair to poor, and the habitat is nowhere near the quality needed for the stream to achieve its EWH use designation. In 1982, the habitat assessment resulted in a QHEI score of 64.5. Metric scores were mostly average across the board, with fair substrate quality, normal amounts of silt and average riffle and pool quality. In 1998, the QHEI score dropped significantly to 47. While the substrate quality was still average, a heavy amount of silt was noted by Ohio EPA. Also, less instream cover was available, the quality of the riparian buffer zone had decreased, the quality of pools were poor, and riffles were practically nonexistent.

In 1998, Ohio EPA crews conducted surveys at two locations along Turtle Creek, river miles 1.7 (Rammel Road) and 4.4 (Bald Knob Road). The QHEI scores at both sites were fair. The Rammel Road site received a score of 65.5, with heavy amounts of silt, extensive embeddedness and poor riffle development. The upstream site at Bald Knob Road had a QHEI score of 61.5, showing many of the same problems as the downstream location.

Like Dodson Creek, two separate surveys were conducted on the West Fork at river mile 0.2, in 1982 and again in 1998. In both instances QHEI scores were good; however, the QHEI score of 71 in 1998 had declined slightly from a score of 78.5 in 1982. The primary reasons for the lower score were increased embeddedness and a lower quality riparian buffer zone.

Water Chemistry – Ohio EPA Assessment

The results of water chemistry sampling conducted by Ohio EPA are summarized by stream segments in the 2000 *Water Quality Resource Inventory*. The East Fork Little Miami River was divided into three assessment segments, including a 14.7 mile stretch from the headwaters to Dodson Creek; a 14.4 mile stretch from Dodson Creek to Solomon Run, and an 11.3 mile segment from Solomon Run to Howard Run. In the most upstream segment, study results indicate high nutrient concentrations and heavy siltation, most likely the result of runoff from surrounding agricultural fields. Organic enrichment and low dissolved oxygen concentrations are not listed as a concern. The report does note highly elevated concentrations of aluminum and barium in the sediments; however, this may be due to natural conditions.

The lower segment of the East Fork from Solomon Run to Howard Run was similar, having high nutrient concentrations and heavy siltation. Elevated concentrations of aluminum and barium were also found in the sediments. For the middle segment of the East Fork (Dodson Creek to Solomon Run), the *Water Quality Resource Inventory* report provides little information about stream chemistry. Neither nutrients, solids, nor organic enrichment and low dissolved oxygen are listed as concerns. The cause of impairment for the 6.2 segment of river in partial support is listed only as "unknown." However, it is likely that nutrients and siltation are at least a contributing factor, as high levels of each were identified both upstream and downstream of this stream segment.

Water Chemistry – Clermont OEQ Assessments

In an effort to begin to characterize pollutant levels and sources in the East Fork watershed upstream of Lake Harsha, the Clermont County Office of Environmental Quality (OEQ) conducted intensive, event-based water chemistry sampling in the East Fork Headwaters watershed during the summer of 2002. Two surveys were conducted during dry weather conditions and three surveys were conducted during and immediately after significant periods of rainfall. Dry weather conditions were defined as periods of time where there had been an antecedent dry period of at least three days. Wet weather events were characterized as widespread rains that affected the entire Headwaters area, following a minimum of three consecutive days of dry weather.

As part of the dry weather surveys, field crews collected single sets of stream samples at 11 locations, shown in Figure 3-7, including:

Brown County
East Fork River Mile 48.7 at McCafferty Road
East Fork River Mile 54.4 at SR 131
East Fork River Mile 56.2 at US 50 in Fayetteville
Glady Run at SR 131 downstream of Lake Lorelei
West Fork of East Fork, at SR 123

Clinton County
East Fork River Mile 70.1 at Wise Road
East Fork River Mile 75.3 at Canada Road
East Fork River Mile 82.4 at Thornburg Road

Highland County
East Fork River Mile 85.0 @ SR 73, New Vienna
Dodson Creek at SR 134
Turtle Creek at Rammel Road

Wet weather surveys were conducted at only five sites, including Dodson Creek, the West Fork of East Fork, and East Fork river miles 54.4, 70.1 and 75.3. However, rather than single sample sets, field crews collected five sets of samples at approximately two hour intervals after the storm. For both dry and wet surveys, samples were collected and analyzed for ammonia, nitrate–nitrite (NO_3-NO_2), total Kjeldahl nitrogen (TKN), total phosphorus (TP), orthophosphate, total suspended solids (TSS), 5-day carbonaceous biological oxygen demand ($CBOD_5$), dissolved oxygen (DO), *E. coli*, stream temperature, pH and conductivity. Duplicate samples were collected in approximately 10 percent of the samples, and equipment blanks were also collected by each field crew.

In addition to the event-based sampling in 2002, Clermont OEQ has conducted a minimal amount of ambient water chemistry sampling in the East

Fork Headwaters. In 1996, samples were collected approximately once every two weeks, from January through November, at East Fork river mile 46.7, which is located at Burdsall Road at the Clermont/Brown County border. Samples were analyzed for a wide range of pollutants, including nutrients, solids, CBOD5, dissolved oxygen, fecal coliform, and eight different metals. The following paragraphs summarize the results of all ambient and event-based sampling conducted in the East Fork Headwaters watershed.

Figure 3-7. Dry weather and wet weather sampling locations in the East Fork Headwaters watershed, 2002 (sampling by Clermont County Office of Environmental Quality).

Clermont OEQ Dry Weather Survey Results

Nutrients

Clermont OEQ collected and analyzed samples for several nutrients during dry weather conditions in East Fork headwater streams, including ammonia, NO_3-NO_2, TKN, total phosphorus and orthophosphate. Ohio EPA has established water quality criteria for some nutrients, while criteria for others have not yet been developed. Acute and chronic criteria have been established for ammonia based on its toxicity to aquatic life. Criteria for 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 3-3 below.

Exceptional warmwater habitat (EWH) streams in the East Fork Headwaters include Dodson Creek and the East Fork downstream of river mile 75. All other streams designated by Ohio EPA are warmwater habitat streams.

Stream Type	Drainage Area	Proposed NO3-NO2	Proposed TP
EWH Headwaters	< 20 mi^2	0.5 mg/L	0.05 mg/L
EWH Wadable	20 mi^2 < DA < 200 mi^2	0.5 mg/L	0.05 mg/L
WWH Headwaters	< 20 mi^2	1.0 mg/L	0.08 mg/L
WWH Wadable	20 mi^2 < DA < 200 mi^2	1.0 mg/L	0.10 mg/L

Table 3-3. Ohio EPA suggested nutrient criteria (taken from *Association Between Nutrients, Habitat and the Aquatic Biota in Ohio Rivers and Streams*, Ohio EPA, 1999).

It must be noted that there is some dispute regarding direct causal relationships between nutrient concentrations and biotic measurements (such as the IBI and ICI). In the absence of established and accepted criteria, these target concentrations can be used as benchmarks to review the existing data.

Ammonia was not detected in measurable amounts during either of the dry weather surveys except at Glady Run. All other samples collected had concentrations at or below the detection limit of 0.1 mg/L. Results from Glady Run samples showed ammonia concentrations of 0.45 mg/L and 0.14 mg/L during the June and August surveys, respectively. While higher than the other streams sampled, the ammonia levels for Glady Run were still less than both the average and maximum criteria established by Ohio EPA.

Nitrate-nitrite (NO_3-NO_2) levels on the East Fork River increased significantly between river miles 56.2 and 70.1 (see Figure 3-8). At sites downstream of river mile 56.2, NO_3-NO_2 concentrations remained less than 1.0 mg/L. Even at these sites, concentrations for all but one sample were greater than the 0.5 mg/L target level identified by Ohio EPA (Table 3-3). Above EFRM 56.2, there is a large rise in NO_3-NO_2, and levels tended to increase further in an upstream direction. In both the East Fork and its tributaries, NO_3-NO_2 concentrations were slightly higher during the August dry weather survey than during the June survey, with levels in Glady Run and Turtle Creek climbing above 1.0 mg/L. For both surveys, concentrations in Dodson Creek and the West Fork were less than their respective Ohio EPA targets.

Unlike NO_3-NO_2, TKN concentrations were relatively level over the length of the East Fork, particularly during the June survey, where values ranged from 0.66 to 1.29 mg/L. During August, concentrations were also similar at each location, with the exception of the sample collected at EFRM85.0, where the level was less than the laboratory detection level. For either survey, there were no discernible longitudinal trends.

For the most part, total phosphorus levels during dry weather were quite low, and there were no

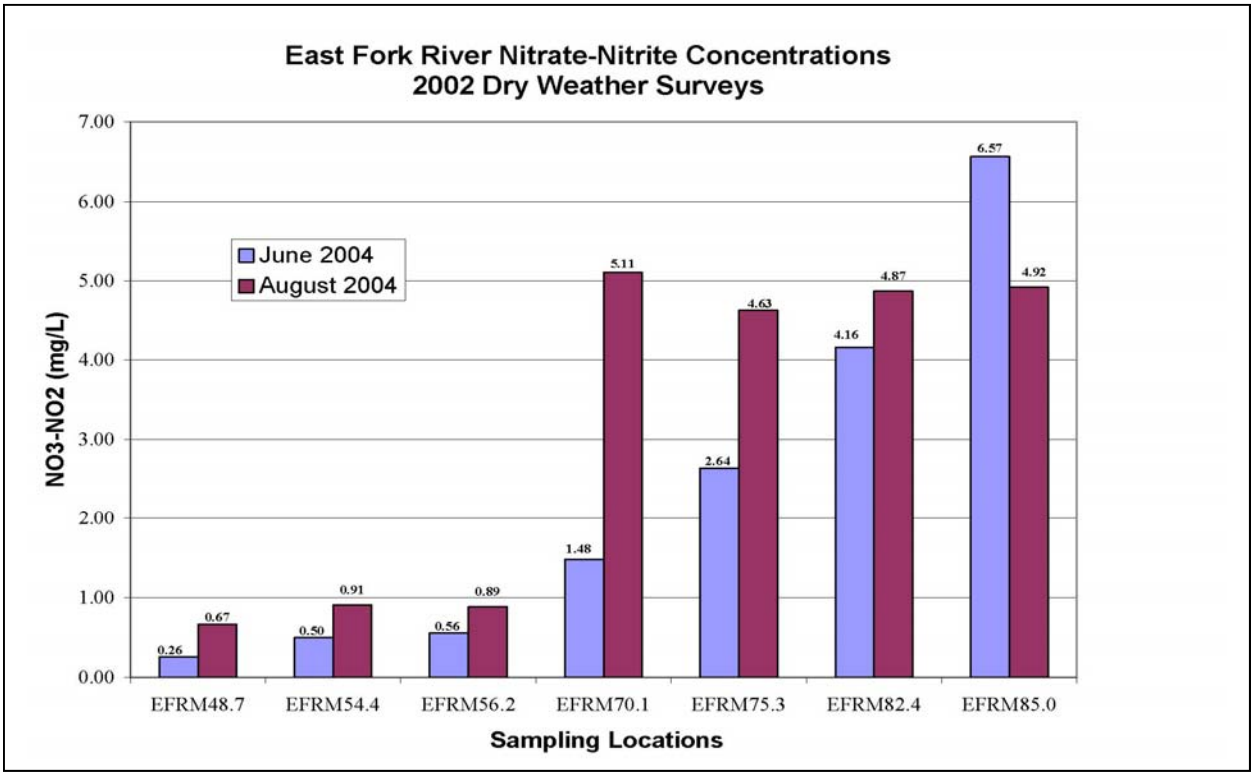


Figure 3-8. East Fork River nitrate-nitrite concentrations, 2002 dry weather surveys.

significant increases in either an upstream or downstream direction. The highest concentrations were measured at EFRM83.4 in June 2002 (0.41 mg/L) and at EFRM85.0 in August 2002 (0.89 mg/L). All other samples collected were less than 0.25 mg/L (see Figure 3-9). Even during dry weather, however, all samples collected had concentrations greater than the exceptionally low Ohio EPA target of 0.05 mg/L. Tributary levels were also low during dry weather, with a high of only 0.18 mg/L on the West Fork of the East Fork in August 2002.

Suspended Solids

The two dry weather surveys yielded similar results in terms of total suspended solids (TSS) measurements. In both instances, TSS concentrations tended to be lower between East Fork river miles 70.1 and 82.4, with higher concentrations in the downstream segments, as well as at the State Route 73 bridge in New Vienna (EFRM85.0). This is illustrated in Figure 3-10. This was more pronounced in the August survey, where TSS concentrations reached a high of 50.8 mg/L at the most downstream sampling location. In all instances, suspended solids concentrations in the tributaries were relatively low. The highest measured value was 17.2 mg/L on Turtle Creek (June 2002).

Bacteria (E. coli)

During both dry and wet surveys, *E. coli* samples were collected at all sites. Ohio EPA has established *E. coli* criteria for all streams designated for "primary contact recreation use," including all those monitored in 2002 by Clermont County. 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
- Geometric mean 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.

Based on data collected during the June and August 2002 dry weather surveys, *E. coli* concentra-

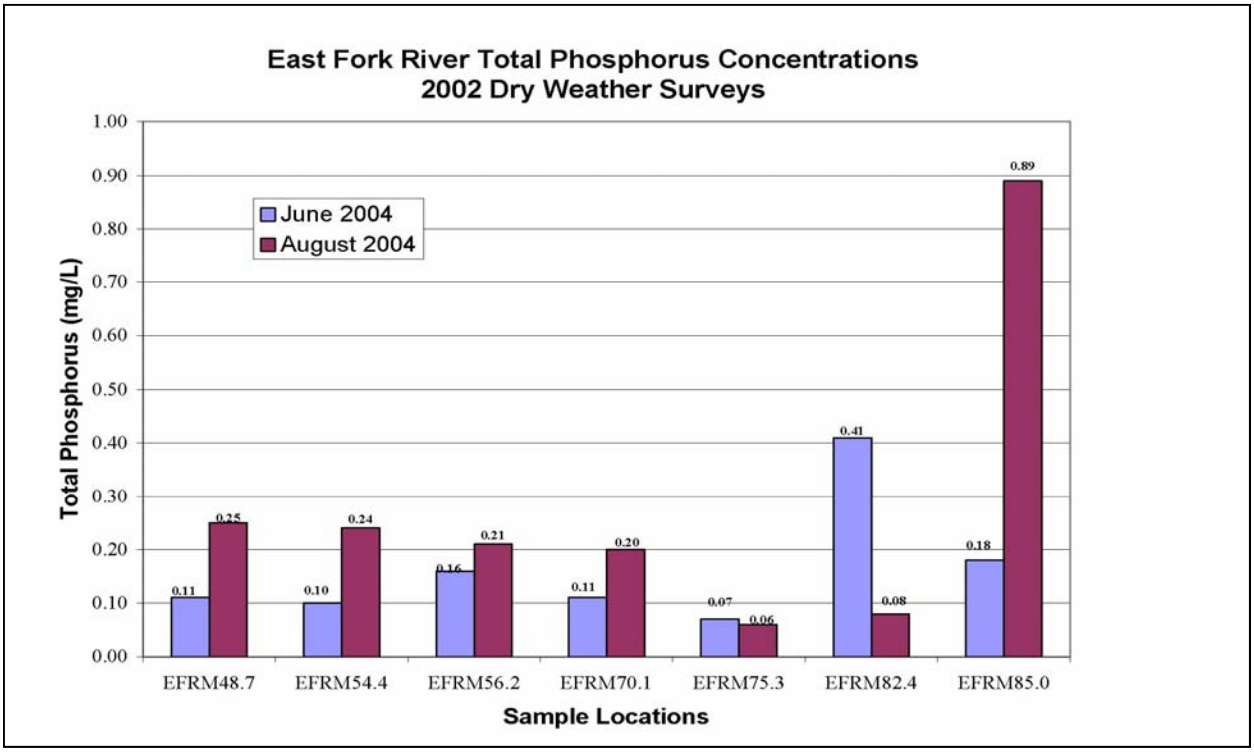


Figure 3-9. East Fork River total phosphorus concentrations, 2002 dry weather surveys.

tions appear to increase in an upstream direction. Levels at both EFRM48.7 and EFRM54.4 were less than 298 cfu/100 mL during both surveys, and generally greater than this at upstream monitoring locations (Figure 3-11). In particular, there are problems at EFRM85.0 in New Vienna, which had *E. coli* counts of 3,400 and 1,000 cfu/100 mL in June and August, respectively. Both measurements are very high for dry weather conditions.

In the tributaries, *E. coli* concentrations were slightly elevated for dry weather conditions, with higher concentrations measured in June compared to August. Only West Fork had *E. coli* counts less than 298 cfu/100 mL during both surveys. Concentrations in Glady Run (540 cfu/100 mL) and Turtle Creek (730 cfu/100 mL) were high in June, but below 298 cfu/100 mL in August.

Organic Enrichment / Dissolved Oxygen

During both dry and wet weather surveys, Clermont County field crews monitored dissolved oxygen (DO) concentrations and stream temperature at all stream sites. Additionally, samples were collected and analyzed for 5-day carbonaceous biochemical oxygen demand ($CBOD_5$) concentration. Dissolved oxygen criteria for both EWH and WWH streams have been established by Ohio EPA. Criteria include:

- Minimum instream 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.

All DO, $CBOD_5$ and stream temperature data are shown below in Table 3-4. The DO data presented in this report represent readings taken at a single point in time, and therefore should be compared against Ohio EPA's criteria for minimum instream concentrations. Overall, there do not seem to be any concerns with low DO levels in either the East Fork or the tributaries. The results show that all samples meet the absolute minimum criteria established by Ohio EPA. During June, all concentrations were 7.2 mg/L or greater. During the August survey, DO concentrations were generally lower than in June, despite lower instream temperatures and $CBOD_5$ readings below the detection level. In the East Fork, two sites had DO

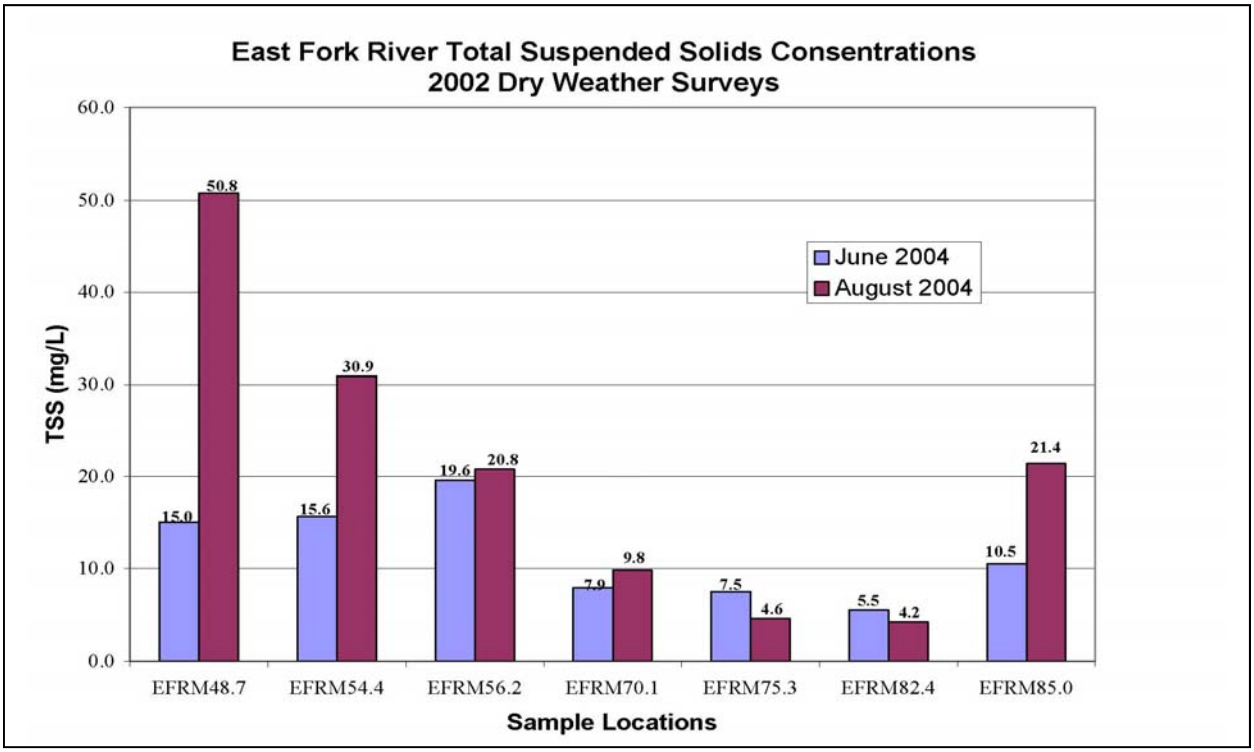


Figure 3-10. East Fork River total suspended solids concentrations, 2002 dry weather surveys.

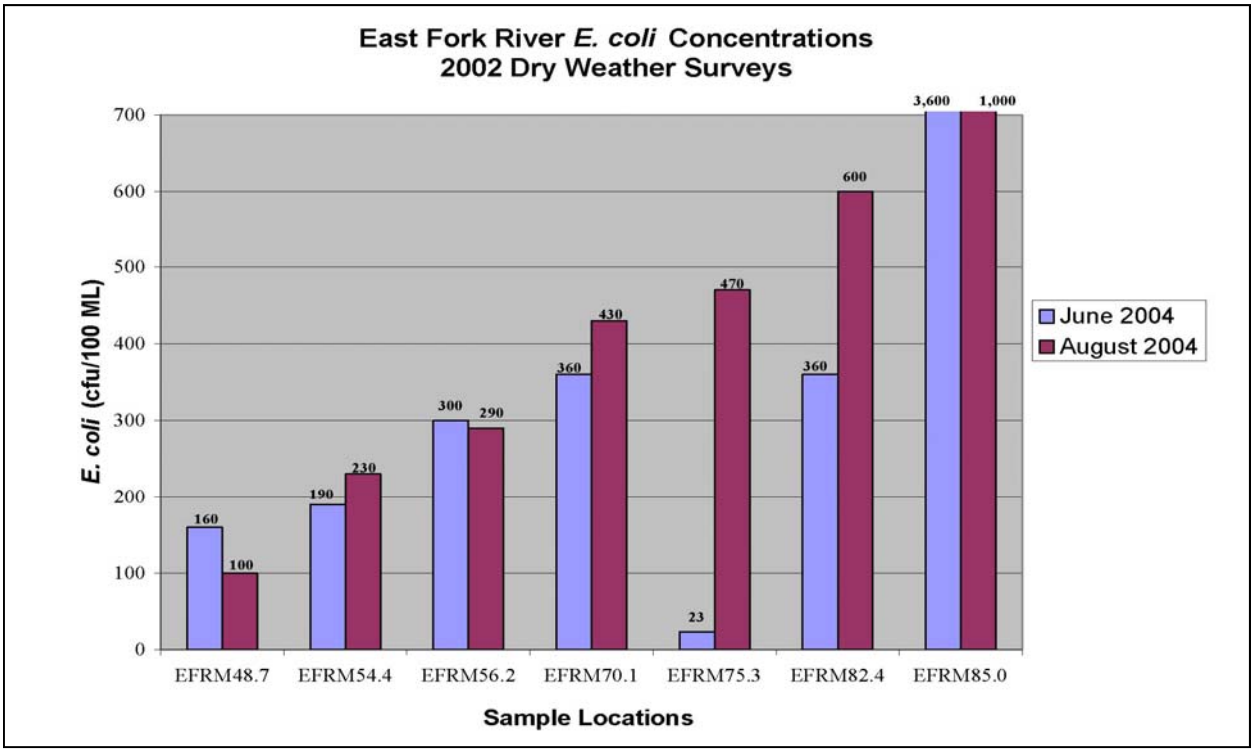


Figure 3-11. East Fork River *E. coli* concentrations, 2002 dry weather surveys.

	June 20, 2002 Dry Survey			August 7, 2002 Dry Survey		
Stream	**DO (mg/l)**	**Temp (ºC)**	**$CBOD_5$ (mg/l)**	**DO (mg/l)**	**Temp (ºC)**	**$CBOD_5$ (mg/l)**
East Fork Little Miami River						
EFRM48.6	7.5	22.8	5.4	5.9	21.2	< 2.0
EFRM54.4	8.6	22.4	3.3	6.3	22.2	< 2.0
EFRM56.2	9.1	22.8	7.8	6.3	20.7	< 2.0
EFRM70.1	8.1	20.1	2.1	6.8	20.6	< 2.0
EFRM75.3	8.8	21.1	< 2.0	7.6	20.0	< 2.0
EFRM82.4	7.6	20.3	2.2	8.1	18.5	< 2.0
EFRM85.0	8.9	20.6	< 2.0	5.2	17.5	< 2.0
Tributaries						
Dodson Cr	7.2	21.4	< 2.0	5.3	20.0	< 2.0
Glady Run	7.3	17.7	< 2.0	5.7	18.3	< 2.0
Turtle Cr	9.0	21.3	2.9	7.4	19.9	< 2.0
West Fork	9.3	21.9	< 2.0	7.2	19.4	< 2.0

Table 3-4. Stream temperatures and instream concentrations of dissolved oxygen and $CBOD_5$ in East Fork Headwater streams.

levels less than 6.0 mg/L — EFRM48.6 and EFRM85.0. Of these two sites, only EFRM48.6 has the exceptional warmwater habitat use designation. Two tributaries also had DO concentrations less than 6.0 mg/L, including Dodson Creek (an EWH stream) and Glady Run.

Clermont OEQ Wet Weather Survey Results

The Clermont County Office of Environmental Quality conducted three wet weather surveys in the East Fork Headwaters watershed during the summer of 2002. Limited sampling was conducted during the first event on July 29. Based on the forecast and radar images, field crews completed their sampling preparations and traveled to the sampling locations. However, the storm dissipated as it neared the upper East Fork watershed. A brief, intense rain fell over a very small area, and the remainder of the watershed received only trace amounts of precipitation. The total rainfall measured at the Wilmington Airport in Clinton County was 0.07 inches. As a result, crews only collected a single set of samples at each of the five stream sites, rather than five sets over an eight hour period. Results showed that concentrations for all parameters were very similar to those measured during the dry weather events, with the exception of *E. coli*, which increased in response to only minimal rainfall amounts. Concentrations of *E. coli* at the three East Fork locations (river miles 54.4, 70.1 and 75.3) were between 1,400 and 1500 cfu/100 mL, while Dodson Creek and West Fork had counts of 1,000 and 540 cfu/100 mL, respectively.

The East Fork Headwaters received significantly greater amounts of precipitation for the next two storm events on August 18 and September 20. During the afternoon of August 18, most of the watershed received between 1.0 and 1.5 inches of rain, with localized areas receiving as much as 3.0 inches or more, over the period of a few hours. A second storm during the late afternoon and early evening of September 20 dropped between one and two inches; however, this primarily occurred over Brown and Clinton County, while areas in Highland County, including the Dodson Creek and Turtle Creek watersheds, received less rain — approximately 0.6 inches on average. The results of the wet weather surveys conducted after these two storms are presented below.

Nutrients

Increases in ammonia concentrations were seen in only two instances during both wet weather surveys. On August 18, a peak ammonia concentration of 0.44 mg/L was observed at EFRM75.3 during the first hour of sampling. Also, ammonia concentrations were detectable in all samples collected from EFRM70.1, with a peak concentration of 0.24 mg/L occurring at Hour 4. These levels were still less than the Ohio EPA criterion for the average ammonia concentration at the observed stream temperature and pH levels.

The NO_3-NO_2 sampling results were somewhat surprising. Only twice during both surveys was there an evident increase in NO_3-NO_2 concentrations over time, from the first samples collected at Hour 0 to the last set of samples collected at Hour 8. Concentrations over time at all East Fork sampling locations for both surveys are illustrated in Figures 3-12 and 3-13. During the August 18 storm event, NO_3-NO_2 levels at EFRM 54.4 rose from 0.31 mg/L at Hour 0 to 1.1 mg/L for the last sample collected eight hours later. Concentrations appeared to still be increasing when the last sample was collected. At EFRM75.3, the peak concentration was seen in the second sample, with levels declining afterward. It is likely that crews were not able to begin sampling early enough to catch the early impacts of the storm at this location. On September 20, concentrations at EFRM 75.3 rose steadily from 0.37 mg/L at Hour 0 to 1.38 mg/L at Hour 6, before dropping slightly at Hour 8. The site at EFRM70.1 began to show signs of rising NO_3-NO_2 concentrations at Hour 6, while concentrations remained flat over the entire sampling period at EFRM54.4, which likely had not responded to the rainfall yet.

The most surprising results were the levels of in-stream NO_3-NO_2 concentrations following both storms. Peak levels at all three East Fork sites ranged between 2.32 and 2.53 mg/L, and averages over both storms for all sites ranged between 0.56 and 1.45 mg/L. Much higher concentrations were seen during the dry weather surveys. Wet

weather average NO_3-NO_2 concentrations were lower at each site than their corresponding dry weather averages. At EFRM75.3, the highest measured concentration during wet weather sampling (2.53 mg/L) was less than the lowest concentration seen at this site (2.64 mg/L) during dry weather.

Similar results were seen in the tributaries. Dodson Creek had a peak NO_3-NO_2 concentration of 1.1 mg/L during the August 18 survey, which, while greater than levels seen during dry weather, was not exceptionally high. Levels of NO_3-NO_2 in Dodson Creek during the September 20 survey remained flat and very low (between 0.09 and 0.17 mg/L), which was not unexpected as this watershed received much less precipitation than other areas. On the West Fork, wet weather concentrations during the August survey (average 0.45 mg/L) were not much different than those seen during dry weather (average 0.41 mg/L). Higher levels were seen with the September storm event, with NO_3-NO_2 concentrations peaking at 1.9 mg/L.

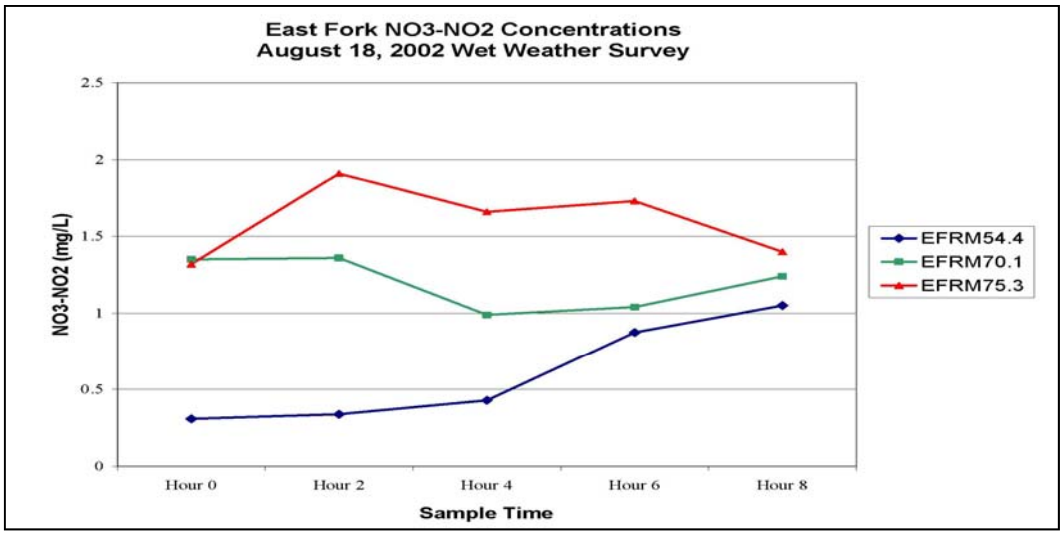


Figure 3-12. East Fork NO_3-NO_2 concentrations, August 18, 2002 wet weather survey.

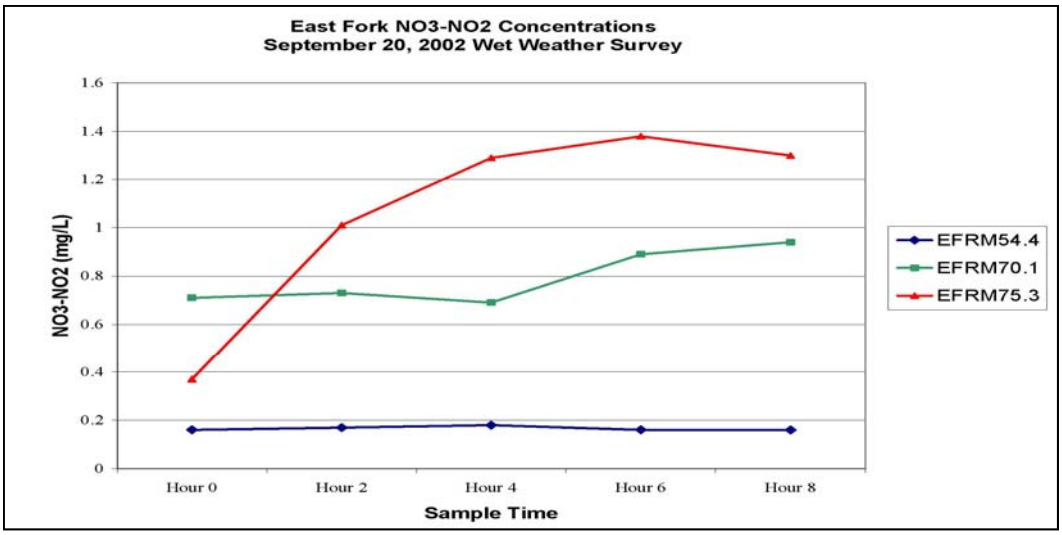


Figure 3-13. East Fork NO_3-NO_2 concentrations, September 20, 2002 wet weather survey.

Increases in total phosphorus (TP) concentrations in response to wet weather were more significant than those seen for NO_3-NO_2, particularly during the August 18 survey. Concentrations were already elevated at the two upstream East Fork sites by the time the crews collected their first samples (Figure 3-12). At EFRM75.3, TP levels climbed as high as 1.9 mg/L, well beyond the 0.1 mg/L target for wadable WWH streams, and the 0.2 mg/L average concentration seen during the dry weather survey. Downstream of Lynchburg at EFRM 70.1, TP concentrations peaked at 1.3 mg/L. At EFRM54.4 in Brown County, TP concentrations remained at background levels until Hour 6, when they began to rise. The last sample collected at Hour 8 had a concentration of nearly 1.0 mg/L. Of the two tributaries, Dodson Creek experienced the sharpest increase in TP concentrations during this survey, reaching a peak concentration of 1.4 mg/L. The greatest concentration seen in West Fork was 0.55 mg/L.

Increases in in-stream phosphorus levels were not as pronounced in the September 20 survey. Figure 3-13 shows that only EFRM75.3 experienced any significant increase in TP concentrations.

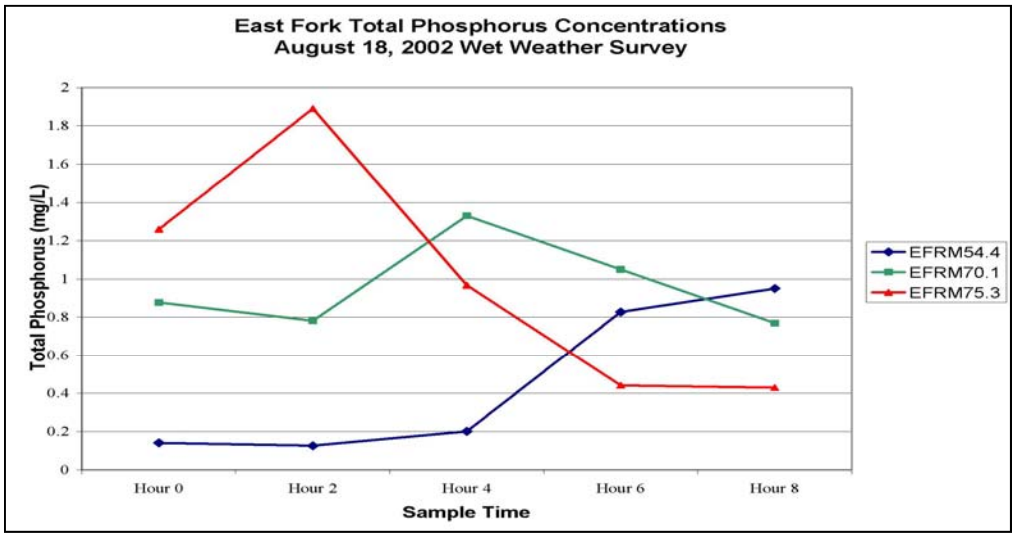


Figure 3-14. East Fork total phosphorus concentrations, August 18, 2002 wet weather survey.

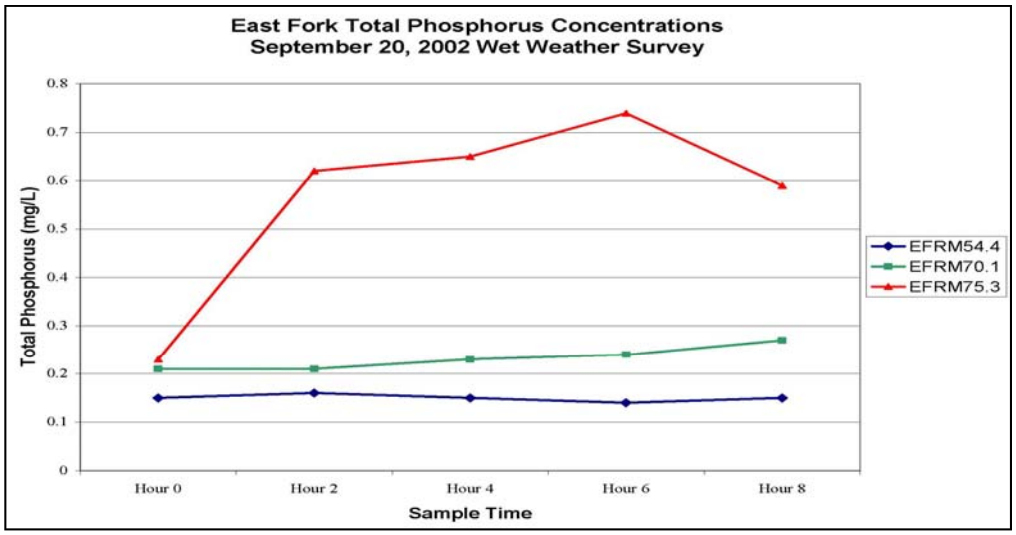


Figure 3-15. East Fork total phosphorus concentrations, September 20, 2002 wet weather survey.

Levels of TP at this site were still at or near background concentrations, but quickly rose over a period of six hours to a peak of 0.74 mg/L before beginning to decline. At EFRM 70.1 and EFRM54.4, TP concentrations remained near background throughout the survey, with only EFRM70.1 showing a slight increase over time. Neither tributary had a large increase in TP levels. Dodson Creek levels never climbed above 0.2 mg/L, and West Fork levels stayed below 0.3 mg/L.

Suspended Solids

As expected, total suspended solids (TSS) concentrations increased dramatically at most sample sites during the wet weather surveys. Figures 3-16 and 3-17 below illustrate the results at all East Fork sites for the August and September surveys, respectively. Similar to nutrient concentrations, TSS levels increased more rapidly and reached greater peaks at the upstream sampling locations. This is particularly evident during the August 18 event (Figure 3-16). At the most upstream site (EFRM75.3), TSS concentrations were highest in the first sample collected at Hour 0, indicating that field crews were not able to initiate

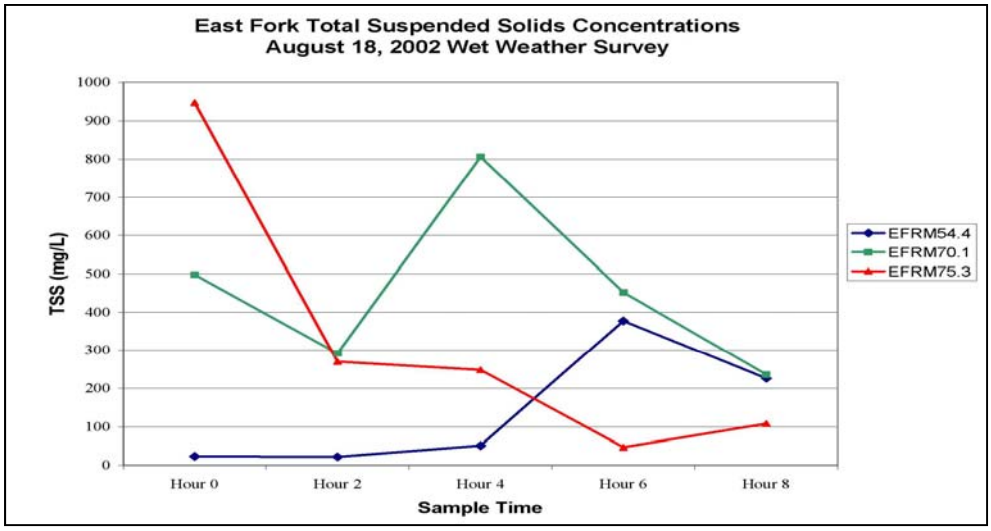


Figure 3-16. East Fork total suspended solids concentrations, August 18, 2002 wet weather survey.

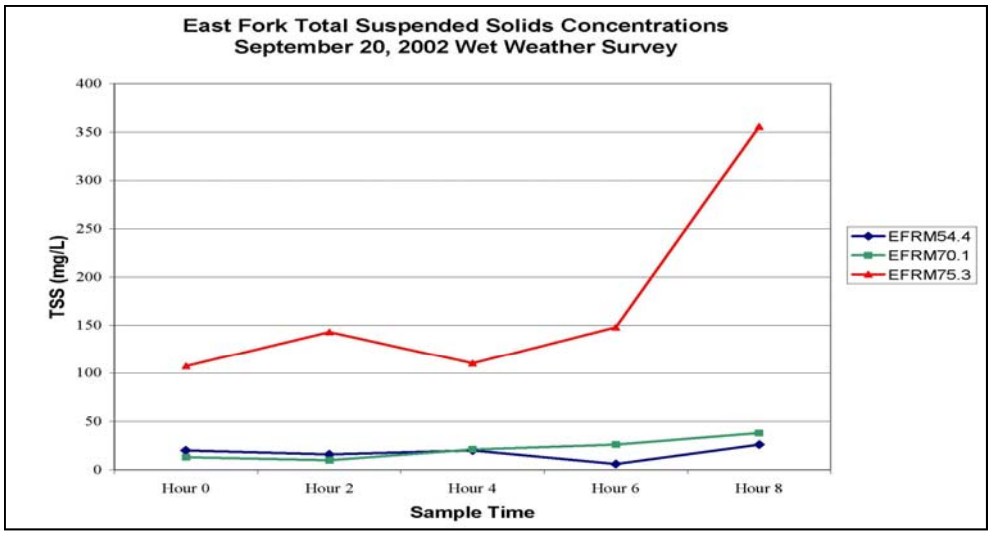


Figure 3-17. East Fork total suspended solids concentrations, September 20, 2002 wet weather survey.

sampling before the river began to respond at this location. The TSS concentration of 948 mg/L was more than 126 times greater than the highest TSS concentration seen at this site during dry weather. Conversely, TSS concentrations at EFRM54.4 — the most downstream sampling location — were at background levels until they began to rise after Hour 4, reaching a peak of 377 mg/L at Hour 6.

As with nutrients, only EFRM75.3 experienced an increase in TSS during the September 20 survey (Figure 3-17). Here, TSS concentrations were moderately elevated (between 100 and 150 mg/L) for the first six hours of the survey, and then rose rapidly between Hours 6 and 8. Suspended solids levels at the other two sites remained at dry weather levels throughout the survey, likely indicating that impacts from stormwater runoff had not yet moved that far downstream.

The tributaries responded in a similar fashion. Concentrations of TSS were higher during the August 18 survey. The peak level of 672 mg/L in Dodson Creek was 67 times greater than the peak dry weather concentration. The greatest TSS concentration seen in the West Fork (157 mg/L) was lower than that seen in Dodson Creek, but still more than 16 times greater than what was seen in the West Fork during dry weather. As with nutrients, TSS levels in both tributaries remained near dry weather concentrations during the September 2002 survey.

Bacteria (E. coli)

Without exception, all streams surveyed in the East Fork Headwaters during wet weather conditions failed to achieve primary contact recreation criteria. The minimum and maximum counts and geometric means for each station are presented in Table 3-5. Every sample collected had *E. coli* counts greater than 298 cfu. Except for the West Fork during the October survey, all stations had geometric means greater than 1,000 cfu/100 mL. Individual counts were often greater than 10,000 cfu/100 mL. The site at EFRM70.1 experienced particularly high counts during the August survey. This was likely due to problems experienced by the Lynchburg wastewater treatment plant a short distance upstream. Field crews noted the WWTP was bypassing during the event. Concentrations at this site were much lower, though still elevated, during the October survey.

Organic Enrichment / Dissolved Oxygen

Average dissolved oxygen concentrations during wet weather were slightly lower than those seen in dry weather; however, all sites met their respective aquatic life criteria for minimum and average DO concentrations (Table 3-6). The site that experienced the lowest DO levels during wet weather was Dodson Creek, which also had the

	August 18, 2002 Survey			**September 20, 2002 Survey**			**Dry Weather**
Site	*Minimum*	*Maximum*	*Geo. Mean*	*Minimum*	*Maximum*	*Geo. Mean*	*Geo. Mean*
EFRM54.4	840	16000	4336	400	620	473	209
EFRM70.1	46000	105000	72363	2500	11000	4332	393
EFRM75.3	8000	17000	9913	2700	35000	15671	104
Dodson Cr	7100	20000	9382	350	3500	1923	263
West Fork	3600	9600	7107	580	2400	1232	88

E. coli counts are presented as colony forming units (cfu) per 100 mL

Table 3-5. Comparison of wet and dry weather *E. coli* data in East Fork Headwater streams.

	August 18, 2002 Survey			September 20, 2002 Survey			Dry Weather
Site	*Minimum*	*Maximum*	*Average*	*Minimum*	*Maximum*	*Average*	*Average*
EFRM54.4	6.5	7.6	7.1	6.2	7.0	6.5	7.4
EFRM70.1	6.4	6.8	6.6	6.4	7.1	6.7	7.4
EFRM75.3	6.3	6.8	6.5	6.2	7.0	6.6	8.2
Dodson Cr	5.7	6.4	6.2	5.8	6.5	6.0	6.3
West Fork	6.8	8.3	7.6	4.2	7.1	5.2	8.2

Dissolved oxygen concentrations are in mg/L

Table 3-6. Comparison of wet and dry weather dissolved oxygen data in East Fork Headwater streams.

lowest average dry weather concentration. The average DO concentration of 6.0 mg/L just did meet the average DO criterion for exceptional warmwater habitat streams.

The West Fork of the East Fork responded quite differently during the two wet weather surveys. This site had the highest minimum, maximum and average DO concentration in August, while in September, the West Fork had the lowest DO average, with single measurements as low as 4.2 mg/L. Figure 3-18 illustrates the drop in DO levels in the West Fork during the October survey.

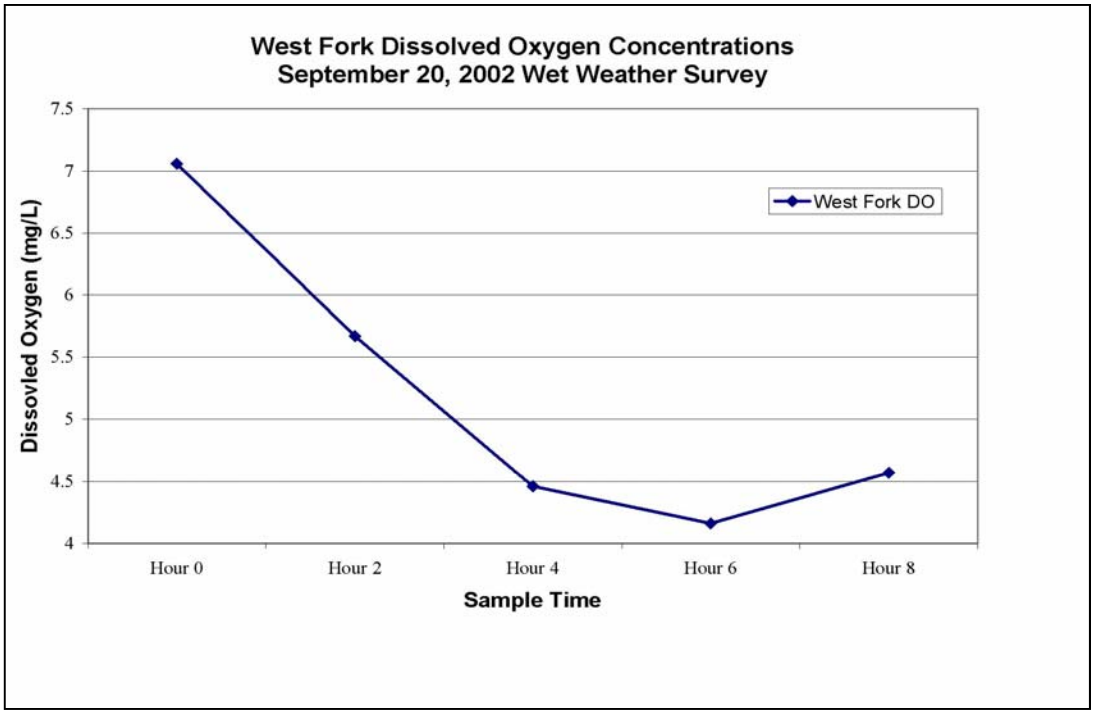


Figure 3-18. West Fork dissolved oxygen concentrations, September 20, 2002 Wet Weather Survey.

Clermont OEQ Ambient Sampling Results - East Fork Mainstem

In 1996, the Clermont County Office of Environmental Quality conducted ambient water chemistry sampling at EFRM46.7, located at the Clermont/Brown county border. Sampling was conducted approximately once every two weeks between January and November. Parameters monitored include nutrients, solids, CBOD5, dissolved oxygen, fecal coliform, and eight different metals.

Nutrients
Ammonia concentrations at this site were relatively low in 1996. Of the 30 samples collected, the highest measured concentration was 0.28 mg/L, well within Ohio EPA standards. Nitrate-nitrite levels were somewhat high, averaging 1.1 mg/L, more than twice the Ohio EPA target value listed in Table 3-3. The minimum NO3-NO2 concentration was 0.1 mg/L, while the maximum reached 3.5 mg/L. Total phosphorus averages were lower, at 0.29 mg/L, although individual measurements were as high as 2.19 mg/L.

Suspended Solids
A total of 30 samples were collected from EFRM46.7 and analyzed for total suspended solids. Results show a wide range of concentrations, from a low of 1.9 mg/L to a high of 562 mg/L. The average concentration was 65.2 mg/L. The standard deviation of 124 mg/L illustrates how widely varied the results were. Although the TSS data has not been compared to local precipitation data, the elevated concentrations likely occur during wet weather conditions.

Bacteria (Fecal Coliform)
In 1996, bacteria samples collected by Clermont County were analyzed for fecal coliform rather than *E. coli*. As with solids, fecal coliform concentrations varied greatly. The low concentration at EFRM46.7 was 12 cfu/100 mL. The highest count of 2,900 cfu/100 mL is relatively low, as compared to bacteria counts seen in the East Fork during the 2002 wet weather surveys.

Organic Enrichment / Dissolved Oxygen
In all but one sample, DO concentrations met Ohio EPA's Exceptional Warmwater Habitat minimum criterion of 5.0 mg/L. A dissolved oxygen concentration of 4.9 mg/L was recorded on February 5, 1996. There is the possibility that this was a result of an instrument error, as typical stream temperatures in February make this reading seem unlikely. Concentrations only fell below 6.0 mg/L three times, and averaged 8.6 mg/L over 30 samples.

Metals
Eight different metals were screened at EFRM46.7 by Clermont County in 1996, including total recoverable arsenic, cadmium, hexavalent chromium, copper, lead, nickel, selenium and silver, along with total hardness concentrations. Of these, only copper and lead samples exceeded average, or chronic, aquatic life criteria at any time. No samples ever exceeded acute criteria. Of the sixteen samples collected, three exceeded the chronic copper criterion and two were greater than the chronic criterion for lead (at the corresponding hardness measurements). Measurements for those samples that exceeded criteria are presented in Table 3-7. Note that Ohio EPA crite-

Date	Parameter	Measured Hardness (mg/L)	Instream Concentration (ug/L)	Chronic Criterion (ug/L)
1/19/96	Copper	98	9.3	8.8
1/19/96	Lead	98	11.0	6.3
1/26/96	Copper	147	13.7	12.4
4/1/96	Copper	112	13.0	9.9
4/1/96	Lead	112	15.6	7.4

Table 3-7. Stream Samples exceeding Ohio EPA metals criteria at EFRM46.7.

ria for these parameters are dependent upon hardness values.

Clermont OEQ Ambient Sampling Results - Grassy Fork

In 2002, Clermont County collected the first pieces of water quality information from Grassy Fork, a primarily agricultural watershed whose tributary enters the East Fork just downstream of the Brown/Clermont border. A total of five sample sets were collected from May through early November. Monthly sampling was planned; however, a very dry summer resulted in Grassy Fork going dry during the months of August and September, which precluded any sampling. Any samples collected were analyzed for ammonia, nutrients, CBOD5, suspended solids, dissolved oxygen, pH and E. coli.

Nutrients

Ammonia concentrations were all below detection level, with the exception of the May 29 sample, which was collected following periods of rainfall on May 28-29. This sample had an NH3 concentration of 1.29 mg/L. Nitrate-nitrite concentrations ranged from 0.07 mg/L to 1.68 mg/L. Concentrations were greater than 1.0 mg/L in samples collected on May 29, June 12 and November 4. Samples collected on July 18 and October 4 had NO3-NO2 concentrations less than 0.2 mg/L. Both total phosphorus and orthophosphate levels were generally low, with peaks of 0.34 mg/L and 0.15 mg/L respectively seen during wet weather conditions on May 29.

Other Parameters

Similar to nutrient levels, concentrations of other pollutants were generally low and experienced their peak during wet weather conditions on May 29. Suspended solids concentrations were less than 14 mg/L, with the exception of the May 29 sample, where solids climbed to 45.5 mg/L. E. coli levels were similar, with counts less than 120 cfu/100 mL in all samples except that collected on May 29, where the count reached 7,600 cfu/100 mL.

Concentrations of CBOD5 were less than detectable levels in all samples with the exception of the May 29 sample (4.2 mg/L) and the July 18 sample (5.5 mg/L). Low levels of dissolved oxygen did not appear to be a problem, except for August and September, when water in the creek was reduced to stagnant pools as the result of prolonged dry weather. The lowest measured DO concentration was 6.91 mg/L on July 18. Levels of pH were not a concern either, with values ranging between 6.9 and 8.1.

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 Headwaters (see Appendix A for a full list of those involved). 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 - chapter name. 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 Headwaters 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 20, 2003, the Collaborative held the initial East Fork Headwaters planning meeting at the Fayetteville 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 29 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 and Prioritization

The same work groups then developed a set of strategies to achieve the water management goals as well as strategies to track progress toward these 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

Figure 4-1. East Fork Headwaters Issue Meeting at Fayetteville, November 20, 2003.

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 Headwaters 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.

The Issues

Table 4-1 summarizes the water management interests, issues and concerns identified during the November 20, 2003 East Fork Headwaters 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 four groups or themes:

- land use, development and non-agricultural stormwater runoff issues
- agricultural management and agricultural runoff issues
- wastewater management issues
- monitoring and assessment issues

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

East Fork Watershed Collaborative

The East Fork Watershed Collaborative was created with two primary goals in mind. The goal to help maintain the water quality in the East Fork Little Miami River watershed is captured in our mission statement, "to protect and enhance the chemical, physical and biological integrity within the East Fork Little Miami River and its tributaries." But the Collaborative also supports the community in achieving their broader water management goals.

The following were identified by East Fork Watershed Collaborative partners as the primary roles and responsibilities of the Collaborative:

- Serves as a forum to discuss water resource management across jurisdictional boundaries
- Develops watershed plans
- Monitors water quality
- Implements community water quality improvement projects
- Identifies and secures funding for water quality projects
- Educates those who live, work and recreate in the East Fork watershed

For more information about the collaborative see Chapter 1 (p. 3) and Appendix B.

Monitoring & Assessment
Better studies to identify specific problems
More stream/water quality data
Put data to use

Protection of Habitat and Natural System Services
Stream corridor protection
Natural channel migration
Streambank erosion
Channelization
Habitat degradation

Land Use
Urbanization/sprawl
Land use planning and zoning
Farmland and open space preservation
Population growth and cost of services

Stormwater/Runoff
Non-point source pollution
Urban runoff
Runoff from development

Drainage
Lack of good drainage
Improve drainage/less flooding
Storm drains in village of Fayetteville

Agriculture
Managing agricultural runoff quality
Sediment runoff from ag areas
Farm chemicals – pesticides, herbicides, fertilizers
Nutrient/sediment management practices
Phosphorus loading from misapplication
Construction of grassed waterways
Money for filter strips
Animal waste runoff
Livestock in or near streams
Confined Animal Feeding Operations (CAFOs)

Quarries
Quarry sediment runoff
Active participation from quarries

Wastewater/Sewers/Septics
Raw sewage in stream
Midland/Martinsville sewage treatment
Failing septic systems
Grant money available for repair of failing septic systems
Control bacteria
Changing EPA requirements
No additional requirements without funding to meet requirements
Wastewater treatment plants/sludge applications

Water Quality (General)
Water quality – ag or urban
Meet Ohio EPA standards
Increase number of streams attaining all uses
Don't create new problems
Be responsible for our actions and interactions

Education
Raise awareness about watersheds
K-12 educational programming
Adult education

Miscellaneous/Other
Unauthorized dump sites
Remove "orphan" dams
Spills & accidents
Wood treatment plant
Unused well closure program
Pay for services provided
Financing projects
Algae levels
Aesthetics
Recreation

Table 4-1. Watershed management interests, issues and concerns identified by East Fork Headwaters 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:

- Though there was a separate monitoring and assessment group formed based on the interests and issues at the initial stakeholder meeting, each of the other work groups acknowledged a need to really understand the status of East Fork Headwaters streams. Each group placed an emphasis on conducting baseline water quality monitoring, and the use of monitoring to isolate any sources of impairment. Monitoring was seen as a good investment up front so that implementation dollars were well spent.

- Both the Land Use/Stormwater group and the Agriculture group discussed the challenge of finding the right balance between drainage and retention. Farmers, homeowners and businesses all want to get rid of stormwater as quickly as possible to protect property or for their convenience. Improving drainage in one location almost always means higher flows downstream. In a watershed that was predominantly wetland forest before settlers arrived, this may be the single biggest challenge in the watershed for the foreseeable future.

Implementation Strategies

The following sections and Tables 4-3, 4-4, 4-5 and 4-6 present the water management goals and implementation strategies recommended by each of the work groups.

Land Use and Stormwater Management Goals
Goal 1. Meet Use Attainment in All Streams
Goal 2. Develop Complete and Accurate Land Use Inventory
Goal 3. Improve Stormwater Runoff Quality
Goal 4. Maintain Adequate Drainage
Goal 5. Reduce Flood Peaks and Flood Damage
Goal 6. Reduce Solid Waste in Streams
Agricultural Water Management Goals
Goal 1. Determine Baseline Water Quality of All Streams
Goal 2. Improve Water Quality to Meet Use Attainment in All Streams
Goal 3. Promote and Implement Best Management Practices (BMPs)
Goal 4. Evaluate Effectiveness of Current Best Management Practices (BMPs)
Goal 5. Increase Number of Farms Using Nutrient Management Plans
Goal 6. Increase Number of Farms Using Conservation Plans
Goal 7. Minimize Flooding/Drainage Problems
Goal 8. Maintain Rural Character and Livelihood
Wastewater Management Goals
Goal 1. Determine Water Quality of All Streams
Goal 2. Determine Sources of Impairment
Goal 3. Improve Water Quality in West Fork
Goal 4. Achieve/Maintain Water Quality in All Streams Acceptable for Human Activities
Goal 5. Maintain Properly Functioning Septic Systems
Goal 6. Minimize Water Quality Impairments from Wastewater Treatment, Hauling, and Sludge Management
Goal 7. Ensure Sewage Treatment Costs Are Not a Burden to Individuals or Community
Goal 8. Ensure Public is Aware of Costs and Responsibilities of Wastewater Treatment
Monitoring and Assessment Goals
Goal 1. Determine Use Attainment of All Streams
Goal 2. Conduct Physical/Morphological Assessment of All Streams
Goal 3. Identify Specific Causes and Sources of Impairment
Goal 4. Organize, Manage and Communicate Data Efficiently and Professionally
Goal 5. Establish and Follow Data Quality Protocols
Goal 6. Evaluate Effectiveness of Practices
Goal 7. Raise Awareness about Water Quality and Watershed Management

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

Land Use and Stormwater Management

The Land Use and Stormwater Management (LUSM) Work Group identified the primary goal as meeting use attainment in all East Fork Headwaters streams. The Group also focused on strategies to manage stormwater quantity to maintain adequate drainage and minimize damage from flooding.

Of all the Work Groups, the LUSM Group's recommendations were the simplest and most straight-forward. The recommendations can be summarized as:

- protect high risk or sensitive areas through planning and smart development
- manage stormwater where it falls
- use appropriate stormwater management and sediment controls to treat any runoff
- protect natural system services provided by the soil, wetlands, headwaters streams, and floodplains.

Goals	Strategies	Priority
Goal 1 Meet Use Attainment in All Streams	Control erosion	High
	Treat stormwater runoff	High
	Maintain riparian corridors and stream buffers	High
	Develop sediment control plans for quarries	Medium
	Control land use/development in high risk or sensitive areas	High
	Minimize or reduce the amount of impervious surface	High
	Improve planning to consider water quantity and water quality	High
Goal 2 Develop Complete and Accurate Land Use Inventory	Accurately map current land uses, zoned land uses, riparian corridors, ...	High
	Accurately map floodplains for all streams	High
Goal 3 Improve Quality of Stormwater Runoff	Manage stormwater at its source	High
	Employ sediment retention Best Management Practices (BMPs)	High
	Maximize treatment of stormwater with BMPs	High
	Use subsurface drainage to control and treat surface runoff	Low
Goal 4 Maintain Adequate Drainage	Prevent/remove log jams	High
	Maintain bank stability in ditches and streams	High
Goal 5 Reduce Flood Peaks and Flood Damage	Manage stormwater at its source	High
	Manage the amount of impervious surface	High
	Use retention/detention to reduce peaks	High
	Minimize the use of storm sewers—maintain open ditches	High
	Encourage natural flood control with associated functions and services	High
Goal 6 Reduce Solid Waste in Stream	Enforce litter/dumping laws	Medium
	Raise awareness through education and outreach	Medium
	Develop volunteer clean-up events including Adopt-a-Waterway	Medium

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

Agricultural Water Management

The Agricultural Water Management Work Group felt that the bottom line should be meeting use attainment in all East Fork Headwaters streams. That primary goal suggests two major thrusts for implementation:

1. since most of the stream miles in the East Fork Headwaters watershed lack water quality data, a top priority is to conduct the monitoring and assessment necessary to establish baseline water quality conditions throughout the watershed;
2. implement a comprehensive outreach program to promote and install best management practices, especially in those areas where agriculture has been identified as a primary cause of water quality impairment.

The Group placed high priority on having all major tributaries assessed by Ohio EPA or by others using Ohio EPA protocols. Given that Ohio EPA's Ecological Assessment Unit is not scheduled to return to the East Fork watershed until 2012, and the prohibitive expense of hiring qualified consultants to conduct the assessment, the Group recommended development of a local, citizen-based monitoring program that can begin to evaluate water quality and stream conditions.

As for implementation of management practices that protect or improve water quality, the Group emphasized promoting and enhancing existing NRCS programs (CRP, WRP, EQIP, GRP, ...), and expanding educational programs. We are open to the exploration of other existing or new programs that are accessible and effective. Comprehensive nutrient management plans, conservation plans, buffer strips and grassed waterways were best practices identified specifically by the Group.

The Group was also interested in getting a better handle - through monitoring or research reports - on which practices provided the greatest water quality benefits. This would help us target specific practices in specific areas, gaining the most benefit for the resources spent.

This Group also identified a number of concerns related to rural development and especially the rapid rural development found in certain areas within the Headwaters watershed. Because so much of row-crop management depends on timely access to crop fields, effective drainage is essential. The Group suggested working closely with realtors, rural developers, building departments, and new homeowners to minimize drainage problems associated with land conversion.

[Note: One goal identified by the Agricultural Water Management group - managing wildlife populations, especially deer, geese, and turkey - was eliminated because it was not directly related to water management.]

Goals	Strategies	Priority
Goal 1 Determine Baseline Water Quality of All Streams	Assess/monitor water quality using Ohio EPA methods	High
	Enhance citizen monitoring program using existing equipment	High
	Create data clearinghouse for storing and analyzing data	High
Goal 2 Improve Water Quality to Meet Use Attainment in All Streams	Track land use changes	High
	Implement government programs (CRP, WRP, EQIP, fencing, …)	High
	Get grant funding for practices	High
	Enhance education and outreach programs to farmers	High
Goal 3 Promote and Implement Best Management Practices (BMPs)	Implement government programs (CRP, WRP, EQIP, fencing, …)	High
	Enhance education and outreach programs to farmers	High
Goal 4 Evaluate Effectiveness of Current Best Management Practices (BMPs)	Use water quality sampling to test practices	High
	Conduct a windshield survey during storm events	High
	Collect research information on effectiveness of practices	Medium
Goal 5 Increase Number of Farms Using Nutrient Management Plans	Education and promotion	High
	Offer incentives to develop plans	High
	Legislate nutrient management plan requirement	Low
Goal 6 Increase Number of Farms Using Conservation Plans	Tie to government program eligibility	High
	Utilize Conservation Security Program	High
	Add NRCS/SWCD staff	Low
	Education and promotion	High
Goal 7 Minimize Flooding and Drainage Problems	Ditch maintenance programs	Medium
	Stormwater/urban drainage programs	High
	Easements on drainageways and improvements	High
	Install subsurface drainage	Low
	Restrict new homes/enforce zoning and regulations	High
	Get information on drainage to homebuyers	High
	Get drainage information to realtors and developers	High
	Keep water where it falls	High
	Improve soil quality	High
	Basic land management and land use planning	High
Goal 8 Maintain Rural Character and Livelihood	Encourage Smart Growth	High
	Promote farmland preservation	High
	Land use planning	High
	County-wide zoning	High

Table 4-4. Recommendations of the Agricultural Water Management Work Group.

Wastewater Management

The Wastewater Management Work Group decided the first priority was to assess water quality throughout the East Fork Headwaters watershed to determine where (and even if) there were water quality impairments. For those areas not meeting use attainment, the next step is to determine whether wastewater is a primary source of water quality impairment. The thought was "if it's not broken, there is no need to fix it."

Regardless of whether East Fork Headwaters streams are meeting use attainment, 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 recently completed Home Sewage Treatment Plans in Brown and Highland Counties 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.

A number of concerns were raised about handling, hauling and application of septage and sludge. Strategies for addressing those concerns included effective enforcement of existing regulations, and increased oversight of haulers by local health departments.

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.

Goals	Strategies	Priority
Goal 1 Determine Water Quality of All Streams	Develop monitoring program	High
	Form permanent Monitoring and Assessment Group for oversight	High
	Assure unbiased water quality testing by using standard protocols and thorough documentation	High
Goal 2 Determine Sources Of Impairment	Follow sampling under Goal 1	High
	Map septic systems—note failing or improper systems	High
	Use water quality model to determine loadings/sources	Low
Goal 3 Improve Water Quality in West Fork	Build Midland-Martinsville WWTP	High
	Address other failing septic systems in West Fork basin	Medium
Goal 4 Achieve/Maintain Water Quality Acceptable for Human Activities in All Streams	Form local environmental group for testing, education, ...	Medium
	Measure water quality using Ohio EPA primary contact recreation criteria	High
	Raise public awareness	Medium
Goal 5 Maintain Properly Functioning Septic Systems	Repair or replace failing systems	High
	Develop county wide home sewage treatment system (HSTS) plan for Brown, Clinton and Highland Counties	High
	Develop an effective Health Department HSTS inspection program for Brown, Clinton and Highland Counties	High
	Develop an effective homeowner education program	High
	Operation and maintenance program	High
	Update State of Ohio HSTS legislation	Low
Goal 6 Minimize Water Quality Impairments from Wastewater Treatment, Hauling and Sludge Management	Ensure effective, up-to-date public and semi-public wastewater treatment plants	High
	Cost-share wastewater treatment plant updates	High
	Require operation and maintenance contracts	High
	Ohio EPA enforcement of existing wastewater treatment regulations	Low
	Update State of Ohio legislation regarding sludge management	Low
	Effective regulation of septage haulers by Ohio EPA and local health districts	High
	Registration and testing of septage haulers	High
	Proper application or disposal of septage	High
	Provide incentives for WWTPs to accept septage	Medium
	Test septage at WWTPs	Low
	Educate community/public officials about impacts of industrial waste	Low
	Conduct environmental impact study on effects of industrial waste	Low
	Use environmental group(s) as watchdogs	Low
Goal 7 Ensure Sewage Treatment Costs Are Not a Burden to Individuals or Community	Full-cost accounting	High
	Self-funding public wastewater systems	High
	Cost share/grant money/low interest loans for septic system upgrades	High
Goal 8 Ensure Public is Aware of Costs and Responsibilities of Wastewater Treatment	Educate citizens about responsibility/accountability for sewage treatment	High
	Use local media—multiple outlets, multiple messages	High

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

Monitoring and Assessment

The recommendations of the Monitoring and Assessment (M&A) Work Group reflect needs identified by the other work groups but also 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 Headwaters 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 Headwaters 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, the M&A Group recommended assessment of stream morphology and riparian buffers throughout the East Fork Headwaters.

The M&A Group felt that the recommendations presented here are only the beginning of the work that needed to be done in this area. 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.

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.

CHAPTER 5: WATERSHED MANAGEMENT RECOMMENDATIONS

The East Fork Headwaters 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 Headwaters watershed was presented. Chapter 4 summarized the goals and interests of East Fork Headwaters watershed stakeholders.

This chapter integrates the information from the earlier chapters and presents a set of recommendations designed to help East Fork Headwaters streams meet their use attainment. The chapter also includes other recommendations designed to achieve a broader set of water management goals.

Management strategies for the East Fork Headwaters 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 the appendix. 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 Headwaters 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 surface mining.

Problem statements and recommended implementation strategies for the East Fork Headwaters, 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 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 still were calculated using available information including land use, number of households on septic systems, and livestock numbers.

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. This can be expected in any watershed. Some of the more costly items are capital improvement projects such as the Midland-Martinsville WWTP; in several cases funding has been set aside for these projects. However, funds for some of the other 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 Spreadsheet Tool for the Estimation of Pollutant Load (STEPL) model (see box on following page). It is important to note that these are estimates only. Clermont County is currently working with a consultant to develop Total Maximum Daily Loads 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 (Upstream of Turtle Creek)	Nutrients Siltation Flow Alteration	Agricultural Runoff Pasture/Riparian Grazing Surface Mining
East Fork Mainstem (Turtle Creek to Solomon Run)	Unknown	Unknown
East Fork Mainstem (Solomon Run to Fivemile Creek)	Siltation Nutrients	Agricultural Runoff
Turtle Creek	Siltation Unknown	Surface Mining Unknown
Dodson Creek	Unknown	Unknown
West Fork (RM 0-1.0)	Fully Meeting WWH	
Solomon Run	Organic Enrichment/DO Ammonia Flow Alteration	Wastewater Treatment Plants Other
Anthony Run Glady Run Grassy Fork Howard Run Indian Run Little Indian Run Murray Run Saltlick Creek Sixmile Creek Sycamore Creek West Fork (RM>1.0)	Designated WWH Not Assessed	
Crane Creek Glady Creek Hales Branch Patton Ditch	Not Designated Not Assessed	

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

Load Estimation - The STEPL Model

The Spreadsheet Tool for the Estimation of Pollutant Load (STEPL) model is an Excel spreadsheet that estimates the load of common pollutants in surface runoff at a watershed scale. The model "employs simple algorithms to calculate nutrient and sediment loads from different land uses and the load reductions that would result from the implementation of various best management practices (BMPs)." The model calculates surface runoff, sediment loads, and loads of nitrogen, phosphorus and BOD. The model works in watersheds with agricultural and urban/residential land uses. The STEPL model has received approval for use in Section 319 Water Quality projects from U.S. EPA Region 5.

Reference: User's Guide—Spreadsheet Tool for the Estimation of Pollutant Load (STEPL), Version 3.0. Revised 2004. Tetra Tech, Inc. for U.S. EPA.

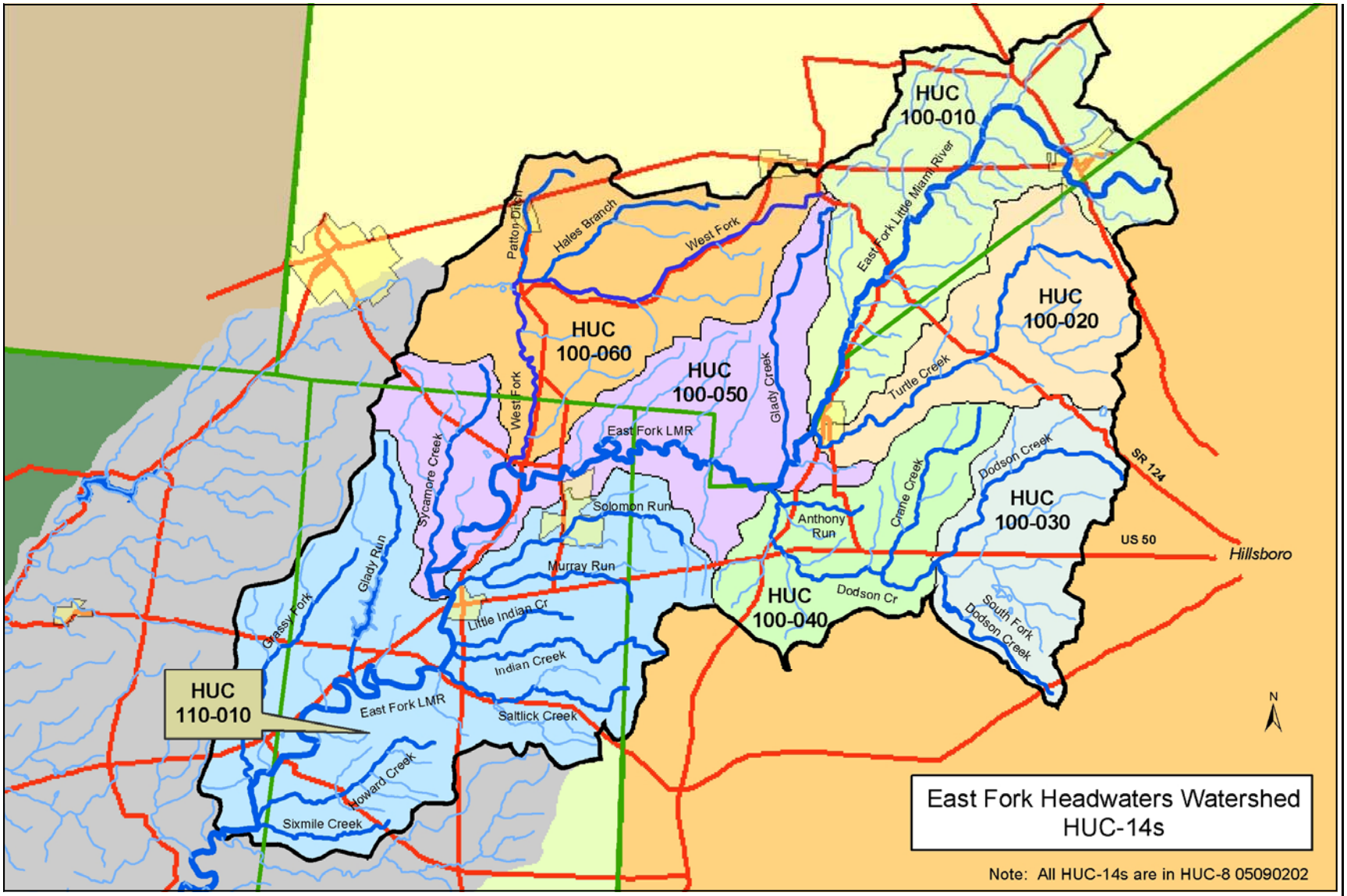


Figure 5-1. 14-digit Hydrologic Unit Codes (HUC-14s) of the East Fork Headwaters.

[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.]

East Fork Headwaters Watershed
Drainage Area: 194.7 mi^2
Use Designation: EWH/WWH

Background

The headwaters of the East Fork Little Miami River watershed cover 194.7 mi^2 in Brown, Clermont, Clinton and Highland Counties. Of 47.8 miles of stream assessed[2] within the East Fork Headwaters, 20.1 miles (42%) are in full attainment of their exceptional warmwater habitat (EWH) or warmwater habitat (WWH) aquatic life use designation. Full-attainment status is considered threatened in 19.1 miles of the 20.1 miles. The other 27.7 miles are either in partial attainment (21.2 miles or 44%) or in non-attainment (6.5 miles or 14%) of their aquatic life use designation. There are approximately 1150 miles of stream (i.e., USGS blue line streams) in the East Fork Headwaters.

Problem Statement

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that causes of water quality impairment within the East Fork Headwaters watershed include high nutrient levels, siltation, flow alteration, and habitat degradation. With only 47.8 of a possible 1150 stream miles assessed, extending water quality assessment into the major tributaries in the East Fork Headwaters watershed is a top priority.

Within the Headwaters watershed, the primary source of nutrients was row crop agricultural production. Other sources include failing septic systems, small wastewater treatment plants for the villages of New Vienna, Lynchburg, and St. Martin, and livestock agriculture. Using the STEPL model developed for USEPA Region 5, the total nitrogen and phosphorus loads for the Headwaters watershed are estimated to be 640 and 145 tons per year, respectively. The STEPL model predicts that approximately 79 percent (507 ton/year) of the nitrogen loading and 87 percent (126 ton/year) of the phosphorus loading comes from agriculture. The STEPL model predicts another 91 ton/year of nitrogen, and 15 ton/year phosphorus are contributed by the estimated 1000 failing or poorly performing home sewage treatment systems throughout the assessment unit. The failing septic systems also contribute approximately 360 ton/year BOD loading to the assessment unit (the STEPL model does not estimate bacterial loadings).

The STEPL model predicts that the total sediment load for the Headwaters Watershed is 44,200 tons per year. The primary sources of sediment are row crop agriculture (36,000 ton/year or 81%), pasture (1600 ton/year or 3.5%) and urban/residential stormwater runoff from developed areas (6500 ton/year or 15%). The STEPL model does not take into account streambank erosion which may be on the same order of magnitude as the contribution from overland sources.

The table that follows presents a set of general recommendations for managing water quality and water quantity throughout the entire East Fork Headwaters 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	2006-2008	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	2006-2008	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	2006-2008	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 septic systems - note failing or improper systems	Watershed coordinator and partners using existing resources	2006-2008	Maps of priority target areas
	Establish long-term monitoring stations in East Fork Headwaters; 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 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	2006	M&A group established
	Develop clear monitoring and assessment goals for EFLMR watershed	EFLMR Monitoring and Assessment Team	2006	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, ...	2005-2007	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, septic system 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 group for review and oversight	Watershed coordinator and partners using existing resources or grants	2006	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	2006-2008	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	ongoing	Less local flooding; fewer complaints
	Educational programs - get drainage information to homebuyers, realtors, and developers	Watershed coordinator, SWCDs, 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
	Develop and implement sediment control plans at all quarries	Quarries with assistance from ODNR, watershed coordinator and partners	2006-2008	Water quality leaving sites through surface drainage or stormwater basins
	Increase number of farms using nutrient management plans and conservation plan - tie to government program eligibility	NRCS, FSA, 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 septic systems	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, Clinton, and Highland Counties	County health departments with assistance from Ohio EPA and Ohio Dept of Health	2005-2007	Completed HSTS for each county
	Develop an effective Health De-partment HSTS inspection pro-gram for Brown, Clinton, and Highland Counties	County health departments	2006-2010	County HSTS inspection pro-gram in place in each county
	Develop an effective homeowner education program	County health departments, 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 departments 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, citi-zen groups, volunteers, and partners	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, historic and current water quality status, water quality improvement programs, volunteer opportunities, ...	Watershed coordinator, SWCDs, OSU Extension, Farm Bureau, and partners	2006-2010	Increasing environmental literacy as measured by surveys
	Educate citizens about costs, accountability and responsibility for sewage treatment	County health departments and local sewer districts, watershed coordinator	ongoing	Fewer complaints about costs
	Develop and distribute information on septic system operation and maintenance	County health departments, 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 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	Effective, coordinated citizen monitoring program

HUC-14: 05090202-100-010

East Fork Little Miami River Mainstem (upstream of confluence with Turtle Creek)
OEPA Stream Code: 11-100
Drainage Area: 30.0 mi^2
Use Designation: WWH (ust RM 75.1); EWH (dst RM 75.1)

Background

According to Ohio EPA, the East Fork Little Miami River [HUC 14: 05090202-100-010; Ohio EPA Stream Code: 11-100], from its inception at river mile 85.6 to the confluence with Turtle Creek at river mile 70.9, is not fully meeting its water quality use designation. Of this 14.7 mile river segment, 6.7 miles partially support the aquatic life use designation while the remaining 8.0 miles are fully attaining but threatened. This assessment unit is dominated by row crop agriculture with some livestock production. The Village of New Vienna and part of the Village of Lynchburg are in the assessment unit.

Problem Statement

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that high nutrient levels, siltation and flow alteration were resulting in impaired use attainment.

The primary source of nutrients was row crop agricultural production. Other sources include failing septic systems, small wastewater treatment plants for the villages of New Vienna and Lynchburg, and livestock agriculture. Using the STEPL model developed for USEPA Region 5, the total nitrogen and phosphorus loads for the assessment unit are 91 and 21 tons per year, respectively. The STEPL model predicts that approximately 76 percent (71 ton/year) of the nitrogen loading and 86 percent (18 ton/year) of the phosphorus loading comes from agriculture. The STEPL model predicts another 13 ton/year of nitrogen, and 2.2 ton/year phosphorus are contributed by the estimated 140 failing or poorly performing home sewage treatment systems throughout the assessment unit. The failing septic systems also contribute approximately 55 ton/year BOD loading to the assessment unit.

The STEPL model predicts that the total sediment load for the assessment unit is 9670 tons per year. The primary sources of sediment are row crop agriculture (8160 ton/year or 84%), pasture (480 ton/year or 5%) and urban/residential stormwater runoff from developed areas (1000 ton/year or 10%). The STEPL model does not take into account streambank erosion which may be on the same order of magnitude as the contribution from overland sources. It should be noted that best available data, accepted technology in STEPL, and best professional judgment were used to estimate loading percentages. TMDL is under development and is expected to improve accuracy of loading estimates.

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 on-site septic 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 70.9 and RM 85.6 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 septic 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 septic systems	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	2006-2008	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	2006-2008	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	2006-2008	List of recommendations for each segment of listed streams
Permanently protect 25% of the riparian corridor between RM 70.9 and RM 85.6 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: 05090202-100-020

Turtle Creek
OEPA Stream Code: 11-154
Drainage Area: 18.2 mi^2
Use Designation: WWH

Background

Turtle Creek [HUC 14: 05090202-100-020; OEPA Stream Code: 11-154], a tributary to the East Fork Little Miami River, is only partially meeting its warmwater habitat (WWH) aquatic life use designation due to siltation and other unknown impairments. At the 1998 assessment, 3.0 miles of Turtle Creek were partially attaining and 2.4 miles not attaining the designated use; 3.1 miles have not been assessed. This assessment unit is dominated by row crop agriculture with some livestock production. Part of the Village of Lynchburg is in the assessment unit. Two active quarries drain to Turtle Creek.

Problem Statement

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that siltation and other unknown causes were resulting in impaired use attainment.

The STEPL model predicts that the total sediment load for the assessment unit is 6390 tons per year. STEPL attributes 5480 ton/year of sediment load to row crop agriculture, 310 ton/year to pasture and 580 ton/year to urban/residential stormwater runoff. The STEPL model does not model runoff from surface mining or take into account streambank erosion. The two quarries likely contribute a significant amount of sediment runoff. In their 1998 assessment, Ohio EPA specifically noted heavy siltation downstream of the surface mining operation on Sharpsville Rd. Streambank erosion also contributes to siltation.

It should be noted that best available data, accepted technology in STEPL, and best professional judgment were used to estimate loading percentages. TMDL is under development and is expected to improve accuracy of loading estimates.

Goals

1. Reduce sediment loading from row crop agriculture by 25 percent.
2. Reduce sediment loading from surface mining by 50 percent.
3. Reduce sediment from streambank erosion by 25 percent.
4. Evaluate morphological status and stream stability of Turtle Creek.
5. Inventory 100 percent of riparian corridor along Turtle Creek; provide recommendations for maintaining or re-establishing riparian corridor.
6. Meet WWH use designation in Turtle 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 surface mining by 50 percent	Develop and implement sediment control plans at all quarries	Quarries with assistance from ODNR, watershed coordinator and partners	2006-2008	Water quality leaving sites through surface drainage or stormwater basins
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 morphological status and stream stability of Turtle 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	2006-2008	Physical/ morphological assessment completed and reported in technical support document
Inventory 100 percent of riparian corridor along the Turtle 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	2006-2008	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	2006-2008	List of recommendations for each segment of listed streams

HUC-14: 05090202-100-030

Dodson Creek (headwaters to above South Fork)
OEPA Stream Code: 11-151
Drainage Area: 16.0 mi^2
Use Designation: EWH

Background

Dodson Creek [HUC-14: 05090202-100-030; OEPA Stream Code: 11-151], a tributary to the East Fork Little Miami River (EFLMR), has not been assessed in this segment.

Problem Statement

The water quality of this segment of Dodson Creek has not been assessed, so it is unknown if it meets its use designation. There are several potential contributors to water quality impairment including two surface mining operations, unfenced livestock pasture in riparian areas, as well as nutrient and sediment runoff from row crop agriculture, the dominant land use in the assessment unit. It is also worth noting that the Highland County Home Sewage Treatment System plan identifies the communities of Russell and Willetsville as likely concentrations of non-performing septic systems. Habitat degradation (as measured by low QHEI scores) was noted as a source of impairment of lower Dodson Creek during a 1998 survey. Windshield surveys suggest that habitat degradation is likely impairing this segment of Dodson Creek as well. Local officials have reported flooding of poorly sited houses located adjacent to Dodson Creek in the Anderson Road area.

Goals

1. Determine use attainment status of Dodson Creek.
2. Evaluate habitat quality of Dodson Creek.
3. Evaluate morphological status and stream stability of Dodson Creek.
4. Reduce BOD & nutrient loadings from on-site septic systems by 50 percent.
5. Stabilize and restore segments of Dodson Creek affected by livestock grazing.
6. Reduce sediment loadings from surface mining by 25 percent.
7. Reduce sediment loadings from streambank erosion by 25 percent.
8. Inventory 100 percent of riparian corridor along Dodson Creek; provide recommendations for maintaining or re-establishing riparian corridor.
9. Address local flooding issue at Anderson Rd.
10. Meet EWH aquatic life use designation in upper Dodson Creek.

Objective	Action	Resources	Time Frame	Performance Indicators
Determine use attainment status of Dodson 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 Dodson 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	2006-2008	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Dodson 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	2006-2008	Morphological assessment completed and reported in technical support document
Reduce BOD and nutrient loadings from septic systems by 50 percent	Develop an effective homeowner education program	Highland County health department, watershed coordinator and partners; Highland County 319 grant	2006-2010	Educational materials for homeowners, realtors, developers
	Repair or replace failing septic systems	Homeowners using existing resources, low-interest loans or cost-share funds; Highland County 319 grant	2006-2010	100% properly functioning systems
	Develop an effective Health Department HSTS inspection program for Highland County	Highland County health department	2006-2010	County HSTS inspection program in place in each county
Stabilize and restore segments of Dodson Creek 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 surface mining by 25 percent	Develop and implement sediment control plans at all quarries	Quarries with assistance from ODNR, watershed coordinator and partners	2006-2008	Water quality leaving sites through surface drainage or stormwater basins
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 Dodson 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	2006-2008	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	2006-2008	List of recommendations for each segment of listed streams
Address local flooding problem at Anderson Rd	Work with local officials, homeowners, developer to resolve problem	Developer, homeowners or other resources	2006-2008	Problem resolved

HUC-14: 05090202-100-030 (continued)

South Fork Dodson Creek
OEPA Stream Code: 11-153
Drainage Area: 9.98 mi^2
Use Designation: WWH

Crane Creek
OEPA Stream Code: none assigned
Use Designation: WWH

Background

South Fork [OEPA Stream Code: 11-153] and Crane Creek, tributaries of Dodson Creek, have not been assessed. The South Fork of Dodson Creek flows next to a section of a large surface mining operation. Row Crop agriculture is the dominant land use practice in this region.

Problem Statement

The water quality of South Fork and Crane Creek has not been assessed, so it is unknown if they meet their warmwater habitat (WWH) use designation. Unconnected riparian corridors is a potential problem in the South Fork. Discontinuous riparian buffers could result in increased non-point source pollution. The lack of riparian buffers connected with row crop agriculture could result in increased nutrient loadings into the South Fork. Water quality needs to be assessed above and below the South Fork dam.

Goals

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

Objective	Action	Resources	Time Frame	Performance Indicators
Determine use attainment status of South Fork Dodson Creek and Crane 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 South Fork Dodson Creek and Crane 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	2006-2008	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of South Fork Dodson Creek and Crane 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	2006-2008	Physical/ morphological assessment completed and reported in technical support document
Inventory 100 percent of riparian corridor along South Fork Dodson Creek and Crane 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	2006-2008	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	2006-2008	List of recommendations for each segment of listed streams

HUC-14: 05090202-100-040

Dodson Creek (below South Fork to East Fork LMR)
OEPA Stream Code: 11-151
Drainage Area: 32.5 mi^2
Use Designation: EWH

Background

Dodson Creek [HUC-14: 05090202-100-040; OEPA Stream Code: 11-151], a tributary to the East Fork Little Miami River (EFLMR), is not meeting its exceptional warmwater habitat (EWH) aquatic life use designation due to unknown causes. Only 1.0 mile of Dodson Creek was assessed, and the segment was in non-attainment.

Problem Statement

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that unknown causes were resulting in impaired use attainment. Ohio EPA field notes from their 1998 survey report a 20 point decline in QHEI score from 1982 to 1998, largely due to sand deposition in the stream. Sources of the sand could

include streambank erosion, stormwater runoff from surface mining operations or runoff from farms. The field notes cite a number of large (3-4") rainfall events leading up to the 1998 sampling as contributing to the erosion and deposition of the sand.

The STEPL model predicts that the total sediment load for the assessment unit is 3380 tons per year. STEPL attributes 2830 ton/year of sediment load to row crop agriculture, 90 ton/year to pasture and 450 ton/year to urban/residential stormwater runoff. The STEPL model does not model runoff from surface mining or take into account streambank erosion. The two quarries possible contribute a significant amount of sediment runoff. Streambank erosion also contributes to deposition of silts and sands.

It should be noted that best available data, accepted technology in STEPL, and best professional judgment were used to estimate loading percentages. TMDL is under development and is expected to improve accuracy of loading estimates.

Goals

1. Determine use attainment status of Dodson Creek.
2. Evaluate habitat quality of Dodson Creek.
3. Evaluate morphological status and stream stability of Dodson Creek.
4. Reduce BOD & nutrient loadings from on-site septic systems by 50 percent.
5. Stabilize and restore segments of Dodson Creek affected by livestock grazing.
6. Reduce sediment loading from row crop agriculture by 25 percent.
7. Reduce sediment loading from streambank erosion by 25 percent.
8. Reduce sediment loading from surface mining by 25 percent.
9. Raise QHEI score from current value in the 40s to a value in the 60s
10. Inventory 100 percent of riparian corridor along Dodson Creek; provide recommendations for maintaining or re-establishing riparian corridor.
11. Meet EWH aquatic life use designation in Dodson Creek.

Objective	Action	Resources	Time Frame	Performance Indicators
Determine use attainment status of Dodson 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 Dodson 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	2006-2008	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Dodson 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	2006-2008	Physical/morphological assessment completed and reported in technical support document
Reduce BOD and nutrient loadings from septic systems by 50 percent	Develop an effective homeowner education program	Highland County health department, watershed coordinator and partners; Highland County 319 grant	2006-2010	Educational materials for homeowners, realtors, developers
	Repair or replace failing septic systems	Homeowners using existing resources, low-interest loans or cost-share funds; Highland County 319 grant	2006-2010	100% properly functioning systems
	Develop an effective Health Department HSTS inspection program for Highland County	Highland County health department	2006-2010	County HSTS inspection program in place in each county
Stabilize and restore segments of Dodson Creek 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 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 acres using conservation plans; QHEI and Pfankuch scores; sediment in water samples
Reduce mean sediment loadings from surface mining by 25 percent	Develop and implement sediment control plans at all quarries	Quarries with assistance from ODNR, watershed coordinator and partners	2006-2008	Water quality leaving sites through surface drainage or stormwater basins
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
Raise QHEI score from current value in the 40s to a value in the 60s	Restore stream habitat in affected segments	Landowners with assistance from watershed coordinator, SWCDs, NRCS; grant funds	2006-2010	QHEI in 60s
Inventory 100 percent of riparian corridor along the Dodson 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	2006-2008	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	2006-2008	List of recommendations for each segment of listed streams

HUC-14: 05090202-100-040 (continued)

Anthony Run
OEPA Stream Code: 11-152
Drainage Area: 1.87 mi^2
Use Designation: WWH

Background

Anthony Run [OEPA Stream Code: 11-152], a tributary of Dodson Creek, has not been assessed. The headwaters of Anthony Run have been channelized and begin in an extensive agricultural field (see photo below). The middle and lower sections of Anthony Run have a narrow wooded riparian buffer and flow behind several residential properties.

Problem Statement

The water quality of Anthony Run has not been assessed, so it is unknown if it meets its use designation. The headwaters of Anthony Run drains an extensive agricultural field and has no riparian buffer. This could contribute to increased nutrient loadings into Anthony Run.

Goals

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

Right Channel

Left Channel

Anthony Run Headwaters

Objective	Action	Resources	Time Frame	Performance Indicators
Determine use attainment status of Anthony 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 Anthony 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	2006-2008	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Anthony 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	2006-2008	Physical/ morphological assessment completed and reported in technical support document
Inventory 100 percent of riparian corridor along Anthony 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	2006-2008	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	2006-2008	List of recommendations for each segment of listed streams

HUC-14: 05090202-100-050

East Fork Little Miami River Mainstem (below Turtle Creek to above Solomon Run)
OEPA Stream Code: 11-100
Drainage Area: 140.8 mi^2
Drainage Area (HUC-14 only): 31.0 mi^2
Use Designation: EWH

Background

According to Ohio EPA, the East Fork Little Miami River [HUC 14: 05090202-100-050; Ohio EPA Stream Code: 11-100], from its confluence with Turtle Creek at river mile 70.9 to its confluence with Solomon Run at river mile 56.5, is not fully meeting its water quality use designation. Of this 14.4 mile river segment, 6.2 miles partially support the aquatic life use designation while the remaining 8.2 miles are fully attaining but threatened. 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 the causes of impaired use attainment were unknown. It is likely that impacts associated with largely agricultural areas are the main contributors to water quality impairment. This would include sediment and nutrient runoff from row crops and pasture, in-stream habitat degradation and failing septic systems.

Using the STEPL model, the total nitrogen and phosphorus loads for the assessment unit are 108 and 25 tons per year, respectively. The STEPL model predicts that approximately 83 percent (89 ton/year) of the nitrogen loading and 88 percent (22 ton/year) of the phosphorus loading come from agriculture. The STEPL model predicts 12 ton/year of nitrogen, and 2.0 ton/year phosphorus are contributed by the estimated 150 failing or poorly performing home sewage treatment systems throughout the assessment unit. The failing septic systems also contribute approximately 49 ton/year BOD loading to the assessment unit.

The STEPL model predicts that the total sediment load for the assessment unit is 6640 tons per year. The primary sources of sediment are row crop agriculture (5590 ton/year or 84%), pasture (190 ton/year or 3%) and urban/residential stormwater runoff from developed areas (840 ton/year or 13%). The STEPL model does not take into account streambank erosion which may be on the same order of magnitude as the contribution from overland sources. It should be noted that best available data, accepted technology in STEPL, and best professional judgment were used to estimate loading percentages. TMDL is under development and is expected to improve accuracy of loading estimates.

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 loading from on-site septic 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 56.5 and RM 70.9 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
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 septic 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 septic systems	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 number 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	2006-2008	Physical/ 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	2006-2008	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	2006-2008	List of recommendations for each segment of listed streams
Permanently protect 25% of the riparian corridor between RM 56.5 and RM 70.9 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: 05090202-100-050 (continued)

Glady Creek
OEPA Stream Code: none assigned
Use Designation: WWH

Sycamore Creek
OEPA Stream Code: 11-149
Drainage Area: 6.86 mi^2
Use Designation: WWH

Background

Glady Creek and Sycamore Creek [OEPA Stream Code: 11-149], tributaries of the East Fork Little Miami River, have not been assessed. Both streams are located in primarily agricultural regions with row crop agriculture being the dominant practice.

Problem Statement

The water quality of Glady Creek and Sycamore Creek has not been assessed, so it is unknown if they meet their warmwater habitat (WWH) use designation. Livestock grazing along riparian corridors is occurring in some areas of Glady Creek and Sycamore Creek and could cause bank erosion (see photo below). The lack of livestock exclusion fencing in these areas could also contribute to high nutrient loadings as livestock enters the stream. Unconnected riparian corridors is another potential problem in these streams. Discontinuous wooded riparian buffers could result in increased non-point source pollution. An effective riparian buffer can control erosion and nutrient enrichment, reducing instream loading. Riparian buffers can also aid in stabilizing local climate variation along streams.

Goals

1. Determine use attainment status of Glady Creek and Sycamore Creek.
2. Evaluate habitat quality of Glady Creek and Sycamore Creek.
3. Evaluate morphological status and stream stability of Glady Creek and Sycamore Creek.
4. Maintain or reduce nutrients loading from livestock agriculture.
5. Inventory 100 percent of riparian corridor along Glady Creek and Sycamore Creek; provide recommendations for maintaining or re-establishing riparian corridor.
6. Meet WWH aquatic life use designation in Glady Creek and Sycamore Creek.

Section of Glady Creek with unfenced livestock pasture.

Objective	Action	Resources	Time Frame	Performance Indicators
Determine use attainment status of Glady Creek and Sycamore 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 Glady Creek and Sycamore 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	2006-2008	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Glady Creek and Sycamore 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	2006-2008	Physical/ morphological assessment completed and reported in technical support document
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
Inventory 100 percent of riparian corridor along Glady Creek and Sycamore 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	2006-2008	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	2006-2008	List of recommendations for each segment of listed streams

HUC-14: 05090202-100-060

West Fork
OEPA Stream Code: 11-150
Drainage Area: 28.45 mi^2
Use Designation: WWH

Background

The West Fork, a tributary to the East Fork Little Miami River (EFLMR) [HUC 14: 05090202-100-060; 11-150], is meeting its warmwater habitat (WWH) aquatic life use designation in the one (1) mile segment assessed by Ohio EPA in 1998. However, the remaining 11.5 miles of the West Fork have not been assessed.

Visual inspection of the stream below its confluence with A.E. Patton County Ditch suggests that organic enrichment and high nutrients from failing septic systems are causing impairment of the West Fork upstream of the Westboro Reservoir. Also, the West Fork is notable for having the longest channelized segment of any major tributary of the East Fork, adjacent to Jonesboro Road near Frazier Road.

Problem Statement

The West Fork appears to have good habitat near its confluence with the East Fork Little Miami River, including the segment assessed by Ohio EPA in 1998. That 1-mile segment had healthy fish and macroinvertebrate communities, and met the warmwater habitat (WWH) aquatic life use standards. However, the remaining 11.5 miles of the West Fork have not been assessed, so it is unknown if the rest of the West Fork meets its aquatic life use designation.

As mentioned above, the stream is impaired by organic enrichment and high nutrients from failing septic systems upstream of the Westboro Reservoir. Impairment from failing septic systems typically indicates a public health concern under the primary contact recreation designation of the water quality standards. Testing by the Clinton County Health Department found high nitrates and Fecal Coliform in water samples collected from A.E. Patton County Ditch downstream of the Village of Midland. A.E. Patton County Ditch is a sizable tributary, emptying into the West Fork near the community of Westboro.

Additionally, channelized streams rarely meet warmwater habitat aquatic life use due to poor habitat. It is likely that the channelized segment of the West Fork mentioned above would require some form of habitat and corridor restoration to achieve its designated use.

Goals

1. Connect all homes in Midland and Westboro with septic systems to new Midland-Martinsville wastewater treatment plant.
2. Determine use attainment status of West Fork.
3. Evaluate habitat quality of West Fork.
4. Evaluate morphological status and stream stability of West Fork.
5. Inventory 100 percent of riparian corridor along West Fork; provide recommendations for maintaining or re-establishing riparian corridor.
6. Restore segments of the West Fork that have been channelized.
7. Meet WWH aquatic life use designation in West Fork.

Objective	Action	Resources	Time Frame	Performance Indicators
Eliminate 100 percent of failing septic systems in Midland and Westboro	Connect all homes with septic systems in Midland and Westboro to new Midland-Martinsville wastewater treatment plant	Clinton County Sewer District and government cost-share	2005-2007	Wastewater plant and infrastructure completed; all homes connected centralized sewer
Determine use attainment status of entire West Fork	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 entire West Fork	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	2006-2008	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of West Fork	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	2006-2008	Physical/ morphological assessment completed and reported in technical support document
Inventory 100 percent of riparian corridor along West Fork	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	2006-2008	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	2006-2008	List of recommendations for each segment of listed streams
Restore segments of West Fork that have been channelized	Restore stream habitat and riparian corridor in affected segments	Landowners with assistance from watershed coordinator, SWCDs, NRCS; grant funds	2006-2010	Restored corridor; QHEI in 60s

HUC-14: 05090202-100-060 (continued)

Hales Branch
OEPA Stream Code: none assigned
Use Designation: WWH

Background

Hales Branch, a tributary of the West Fork, has not been assessed. Hales Branch is located in a predominantly agricultural landscape.

Problem Statement

The water quality of Hales Branch has not been assessed, so it is unknown if it meets its use designation. Livestock grazing along riparian corridors is occurring in some areas of Hales Branch and could cause bank erosion. The lack of livestock exclusion fencing in these areas could also be contributing to high nutrient loadings as livestock enters the stream (see photo below). Unconnected riparian corridors is another potential problem in this stream. Discontinuous wooded riparian buffers could result in increased non-point source pollution. An effective riparian buffer can control erosion and nutrient enrichment, reducing instream loading. Riparian buffers can also aid in stabilizing local climate variation along streams.

Goals

1. Determine use attainment status of Hales Branch.
2. Evaluate habitat quality of Hales Branch.
3. Evaluate morphological status and stream stability of Hales Branch.
4. Maintain or reduce nutrients loading from livestock agriculture.
5. Inventory 100 percent of riparian corridor along Hales Branch; provide recommendations for maintaining or re-establishing riparian corridor.
6. Meet WWH aquatic life use designation in Hales Branch.

Cows drinking from Hales Branch

Objective	Action	Resources	Time Frame	Performance Indicators
Determine use attainment status of Hales Branch	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 Hales Branch	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	2006-2008	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Hales Branch	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	2006-2008	Physical/ morphological assessment completed and reported in technical support document
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
Inventory 100 percent of riparian corridor along Hales Branch	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	2006-2008	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	2006-2008	List of recommendations for each segment of listed streams

HUC-14: 05090202-100-060 (continued)

A.E. Patton County Ditch
OEPA Stream Code: none assigned
Use Designation: none assigned

Background

A.E. Patton County Ditch, a tributary of the West Fork, has not been assessed for aquatic life use attainment by Ohio EPA.

Problem Statement

The biological water quality of A.E. Patton County Ditch has not been assessed, so it is unknown if it meets its aquatic life use designation. However, testing by the Clinton County Health Department found high nitrates and Fecal Coliform in water samples downstream of the Village of Midland (McVey, L. and M. Johannes. 1998. Wastewater Disposal Performance: The Villages of Martinsville and Midland. Clinton County Health Department). The study found that 36 percent of on-site wastewater treatment systems in the two villages were not functioning properly. The report stated that "the Village of Midland has a pollution problem related to the discharge of insufficiently treated sewage". Due to the small lot sizes throughout the Village of Midland, replacement on-site systems are not a viable option. The Clinton County Health Department came to the conclusion that "the villages of Martinsville and Midland have a sewage treatment problem that can only be solved by some sort of collection and central treatment facility."

Goals

1. Eliminate 100 percent of failing septic systems in Village of Midland and community of Westboro.
2. Determine use attainment status of A.E. Patton County Ditch.
3. Evaluate habitat quality of A.E. Patton County Ditch.
4. Evaluate morphological status and stream stability of A.E. Patton County Ditch.
5. Inventory 100 percent of riparian corridor along A.E. Patton County Ditch; provide recommendations for maintaining or re-establishing riparian corridor.
6. Meet WWH aquatic life use designation in A.E. Patton County Ditch.

Objective	Action	Resources	Time Frame	Performance Indicators
Eliminate 100 percent of failing septic systems in Midland and Westboro	Connect all homes with septic systems in Midland and Westboro to new Midland-Martinsville wastewater treatment plant	Clinton County Sewer District and government cost-share	2005-2007	Wastewater plant and infrastructure completed; all homes connected centralized sewer
Determine use attainment status of A.E. Patten County Ditch	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 A.E. Patten County Ditch	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	2006-2008	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of A.E. Patten County Ditch	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	2006-2008	Physical/ morphological assessment completed and reported in technical support document
Inventory 100 percent of riparian corridor along A.E. Patten County Ditch	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	2006-2008	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	2006-2008	List of recommendations for each segment of listed streams

HUC-14: 05090202-110-010

East Fork Little Miami River Mainstem (above Solomon Run to above Fivemile Creek)
OEPA Stream Code: 11-100
Drainage Area: 194.7 mi^2
Drainage Area (HUC-14 only): 53.9 mi^2
Use Designation: EWH

Background

According to Ohio EPA, the East Fork Little Miami River [HUC 14: 05090202-100-050; Ohio EPA Stream Code: 11-100], from its confluence with Solomon Run at river mile 56.5. to its confluence with Fivemile Creek at river mile 45.2, is not fully meeting its water quality use designation. Of this 11.3 mile river segment, 2.8 miles (25%) is fully meeting its aquatic life use designatation; the use attainment in this segment is considered threatened. Of the remaining 8.5 miles, 5.3 miles (47%) partially support the aquatic life use designation and 3.1 miles (28%) are considered not-supporting. This assessment unit is dominated by row crop agriculture, though there is some livestock production. The Village of Fayetteville and the Lake Lorelei community fall within this assessment unit.

Problem Statement

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that the causes of impaired use attainment were siltation and nutrients. Because the area is largely agricultural, the main source of water quality impairment is identified as row crop agriculture. In addition to sediment and nutrient runoff from row crops and pasture, there will be some contribution of nutrients from failing septic systems.

According to the STEPL model, the total nitrogen and phosphorus loads for the assessment unit are 171 and 37 tons per year, respectively. The STEPL model predicts that approximately 75 percent (127 ton/year) of the nitrogen loading and 84 percent (31 ton/year) of the phosphorus loading comes from agriculture. The STEPL model predicts another 32 ton/year of nitrogen, and 5 ton/year phosphorus are contributed by urban/residential sources including the estimated 250 failing or poorly performing home sewage treatment systems throughout the assessment unit. The failing septic systems also contribute approximately 127 ton/year BOD loading to the assessment unit. An additional 10.5 ton/year of nitrogen, and 0.9 ton/year phosphorus are contributed by pastures and feedlots.

The STEPL model predicts that the total sediment load for the assessment unit is 9690 tons per year. The primary sources of sediment are row crop agriculture (6950 ton/year or 72%), pasture (280 ton/year or 3%) and urban/residential stormwater runoff from developed areas (2410 ton/year or 25%). The STEPL model does not take into account streambank erosion which may be on the same order of magnitude as the contribution from overland sources.

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 on-site septic 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 septic 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 septic systems	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 # 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	2006-2008	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	2006-2008	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	2006-2008	List of recommendations for each segment of listed streams
Permanently protect 25% of the riparian corridor between RM 45.2 and RM 56.5 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: 05090202-110-010 (continued)

Solomon Run
OEPA Stream Code: 11-147
Drainage Area: 9.99 mi^2
Use Designation: WWH

Murray Run
OEPA Stream Code: 11-148
Drainage Area: 3.16 mi^2
Use Designation: WWH

Background

Solomon Run [OEPA Stream Code: 11-147], a tributary of the East Fork Little Miami River, has not been assessed since 1982. At that time, 1.8 miles of the 4.6 mile warmwater habitat (WWH) stream were in full attainment, 2.1 miles were in non-attainment, and 0.7 miles had not been assessed.

Murray Run [OEPA Stream Code: 11-148], a tributary of the Solomon Run, has not been assessed.

Problem Statement

The water quality of Solomon Run has not been assessed since 1982, so it is unknown if it currently meets its use designation. In 1982, 2.1 miles of Solomon Run (54% of the assessed segment) were not attaining the WWH aquatic life use designation. Ohio EPA identified organic enrichment (with associated low dissolved oxygen) and un-ionized ammonia as the primary causes of impairment. Ohio EPA identified the St. Martin wastewater treatment plant as the likely source of the organic enrichment and ammonia. Flow alteration and intermittent flow are likely contributing to impairment in the upper reaches of Solomon Run. Because of the predominance of row crop agriculture within the watershed, Ohio EPA listed agriculture as a possible contributor to impairment.

The water quality of Murray Run has not been assessed, so it is unknown if it meets its use designation.

Goals

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

Objective	Action	Resources	Time Frame	Performance Indicators
Determine use attainment status of Solomon Run and Murray 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 Solomon Run and Murray 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	2006-2008	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Solomon Run and Murray 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	2006-2008	Physical/ morphological assessment completed and reported in technical support document
Inventory 100 percent of riparian corridor along Solomon Run and Murray 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	2006-2008	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	2006-2008	List of recommendations for each segment of listed streams

HUC-14: 05090202-110-010 (continued)

Little Indian Creek
OEPA Stream Code: 11-146
Drainage Area: 1.77 mi^2
Use Designation: WWH

Indian Creek
OEPA Stream Code: 11-145
Drainage Area: 3.7 mi^2
Use Designation: WWH

Saltlick Creek
OEPA Stream Code: 11-144
Drainage Area: 6.4 mi^2
Use Designation: WWH

Glady Run
OEPA Stream Code: 11-143
Drainage Area: 5.68 mi^2
Use Designation: WWH

Grassy Fork
OEPA Stream Code: 11-142
Drainage Area: 7.25 mi^2
Use Designation: WWH

Howard Run
OEPA Stream Code: 11-141
Drainage Area: 5.93 mi^2
Use Designation: WWH

Sixmile Creek
OEPA Stream Code: 11-140
Drainage Area: 1.87 mi^2
Use Designation: WWH

Background

Little Indian Creek [OEPA Stream Code: 11-146], Indian Creek [OEPA Stream Code: 11-145], Saltlick Creek [OEPA Stream Code: 11-144], Glady Run [OEPA Stream Code: 11-143], Grassy Fork [OEPA Stream Code: 11-142], Howard Run [OEPA Stream Code: 11-141], and Sixmile Creek [OEPA Stream Code: 11-140], tributaries of the East Fork Little Miami River, have not been assessed.

Glady Run is impounded to form Lake Lorelei.

Problem Statement

The water quality of Little Indian Creek, Indian Creek, Saltlick Creek, Glady Run, Grassy Fork, Howard Run and Sixmile Creek has not been assessed, so it is unknown if they meet their warmwater habitat (WWH) use designation.

Goals

1. Determine use attainment status of Little Indian Creek, Indian Creek, Saltlick Creek, Glady Run, Grassy Fork, Howard Run and Sixmile Creek.
2. Evaluate habitat quality of Little Indian Creek, Indian Creek, Saltlick Creek, Glady Run, Grassy Fork, Howard Run and Sixmile Creek.
3. Evaluate morphological status and stream stability of Little Indian Creek, Indian Creek, Saltlick Creek, Glady Run, Grassy Fork, Howard Run and Sixmile Creek.
4. Inventory 100 percent of riparian corridor along Little Indian Creek, Indian Creek, Saltlick Creek, Glady Run, Grassy Fork, Howard Run and Sixmile Creek; provide recommendations for maintaining or re-establishing riparian corridor.
5. Meet WWH aquatic life use designation in Little Indian Creek, Indian Creek, Saltlick Creek, Glady Run, Grassy Fork, Howard Run and Sixmile Creek.

Objective	Action	Resources	Time Frame	Performance Indicators
Determine use attainment status of Little Indian Creek, Indian Creek, Saltlick Creek, Glady Run, Grassy Fork, Howard Run, and Sixmile 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 Little Indian Creek, Indian Creek, Saltlick Creek, Glady Run, Grassy Fork, Howard Run, and Sixmile 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	2006-2008	QHEIs completed and reported in technical support document
Evaluate morphological status and stream stability of Little Indian Creek, Indian Creek, Saltlick Creek, Glady Run, Grassy Fork, Howard Run, and Sixmile 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	2006-2008	Physical/ morphological assessment completed and reported in technical support document
Inventory 100 percent of riparian corridor along Little Indian Creek, Indian Creek, Saltlick Creek, Glady Run, Grassy Fork, Howard Run, and Sixmile 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	2006-2008	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	2006-2008	List of recommendations for each segment of listed streams

East Fork Headwaters Watershed Management Plan

APPENDICES

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

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

APPENDIX C: Source Water Protection Maps for Ohio

APPENDIX D: Other Land Use Categories in the East Fork Headwaters Watershed.

APPENDIX E: East Fork Chemical Use Analysis and Tillage Practices

APPENDIX F: Ground Water Pollution Potential Maps for Clermont, Clinton, and Warren Counties.

APPENDIX A
Summary of East Fork Headwaters Planning Activities and Community Input

East Fork Headwaters Watershed Planning Meetings

11-20-03	East Fork Headwaters Issue Framing Meeting
1-13-04	Wastewater Management Working Group Meeting 1
1-13-04	Land Use & Stormwater Management Working Group Meeting 1
1-14-04	Monitoring & Assessment Working Group Meeting 1
1-14-04	Agricultural Water Management Working Group Meeting 1
2-10-04	Monitoring & Assessment Working Group Meeting 2
2-11-04	Agricultural Water Management Working Group Meeting 2
2-12-04	Land Use & Stormwater Management Working Group Meeting 2
2-12-04	Wastewater Management Working Group Meeting 2
3-2-04	Monitoring & Assessment Working Group Meeting 3
3-9-04	Land Use & Stormwater Management Working Group Meeting 3
3-9-04	Wastewater Management Working Group Meeting 3
3-10-04	Agricultural Water Management Working Group Meeting 3
7-8-04	East Fork Headwaters Goals and Strategies Review Meeting

East Fork Headwaters Watershed
Issue Framing and Kick-off Meeting

Date/time: November 20, 2003, 5:30-8:30 PM
Location: Fayetteville-Perry EMS-Fire Department, Fayetteville

Meeting objectives: (1) to identify water management interests, issues, and concerns within the East Fork Headwaters 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 Headwaters Planning Meeting
Invitation List

Representatives of:

Fayetteville	Commissioners (Brown, Clinton, Highland)
Lynchburg	SWCDs (Brown, Clinton, Highland)
Midland	Health Dept (Brown, Clinton, Highland)
New Vienna	Planning Commission or Depts (Brown, Clinton, Highland)
St. Martin	
Brown	County Engineer (Brown, Clinton, Highland)
Perry Township	OSU Extension (Brown, Clinton, Highland)
Clinton	Ohio Dept of Natural Resources
Clark Township	Ohio EPA
Green Township	Quarries
Jefferson Township	Farm Bureau
Highland	Rural Developers/Rural Real Estate
Dodson Township	Clinton Streamkeepers
Union Township	Chatfield College
Lake Lorelei POA	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 Headwaters watershed on Thursday, November 20 from 5:30 – 8:30 PM at the Fayetteville-Perry Fire Station in Fayetteville (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

Working Agenda
East Fork Watershed Collaborative
East Fork Headwaters Issue Framing Meeting
November 20, 2003; 5:30 - 8:30 PM (dinner provided)
Fayetteville Fire Department

Desired Outcomes: At the end of this meeting, we will have:

- identified all issues of interest in the East Fork Headwaters Watershed
- organized ("framed") them into logical issue groupings
- self-selected into the issue group of our choice
- identified who else needs to work with each issue group.

This meeting lays the groundwork for the East Fork Headwaters "Kick-off" and the planning work to come.

Meeting Facilitator: Joe Bonnell, Ohio State University Extension
Facilitation Team: Joe Bonnell, Anne Baird, Paul Berringer, Jay Dorsey

Invitees (~40):
Reps of Fayetteville, Lynchburg, Midland, New Vienna
Twp Trustees from Clark, Green, Jefferson, Dodson, Union, Perry Townships
County Commissioners
County Engineer Reps, OEQ Rep, Planning Commission Reps, County SWCD Reps, County Health Dept Reps
Ohio EPA Rep, ODNR Rep
Farm Bureau, Clinton Streamkeepers, LMRP

Meeting Activities:

1 Welcome//Introductions (10 min/Jay)

- Welcome/explain bathrooms
- Have each attendee introduce themselves with name, where from, what they do (or who they represent)

2 East Fork Headwaters Inventory/Summary of Stream Conditions/ Project Overview - Powerpoint presentation (20 min/Jay Dorsey)

3 "Framing the Issues" – Outline of the Evening (5 min/Joe)

- Have expected outcomes outlined on newsprint
- Have day's process outlined on newsprint
- Introduce facilitators

4 Issue Generation Exercise (40 min/Small Groups – Joe et al.)

- Joe, Anne, Paul, Jay each facilitate a small group of 6-8 participants
- Groups are pre-sorted by color dot on name tag
- Each person writes down on BIG sticky notes as many (at least 3) ideas important to them (answer any of three questions on easel)
- Paired sharing – help clarify, see how issues are related, spark other related ideas
- Use round robin technique to identify any/all issues of interest to the participants – each participant names one issue of interest and posts sticky note on easel pad (clarify wording if needed for all to understand) – go around circle with people posting related issues – when all issues related to that topic are posted, go on to next issue/topic – continue process until no one has any additional items to add – post all issues on easel pad/group organizes like issues as it goes

5 Reporting/Issue Framing (20 min/Joe)

- Rep from first group posts issues on wall (butcher paper) reading each one and placing in groups of related issues
- Rep from second group posts issues on wall (butcher paper) reading each one and placing with appropriate issues from first group; 3rd and 4th groups do same – audience provides guidance; eliminate duplicate ideas (agreed to by group)

6 Generate Issue Headings (10 min/Joe)

- Joe asks participants to develop heading/description for each group of issues – massage until entire group is comfortable with organization of issues and headings

7 Break (10 min)

- Bathroom break; coffee, juice, baked goods; conversations

8 Self-Select Issue Group of Choice (5 min/Joe)

- Cut up butcher paper by sets of issues and post each to its own easel.
- Ask each participant to choose one issue group to focus on and go to that easel

9 Meet as Issue Groups and ID stakeholders (20 min/Joe et al.)

- Each group works through a brainstorming session with a facilitator to identify/list any/all stakeholders who might have an interest in the topic/issues – looking for types/groups of stakeholders as well as individuals who might be appropriate – can add additional issues/interests if desired/missed in earlier work

East Fork Headwaters
Issue Identification and Framing Meeting
November 20, 2003
Fayetteville Fire Department/EMS

Meeting Summary

On November 20, 2003 at the Fayetteville Fire Department, a group of community leaders gathered to identify goals, concerns and interests related to water management in the East Fork Headwaters 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 Headwaters area. At the November 20 meeting, it was decided to focus on four main areas: (1) agriculture and agricultural runoff; (2) changing land use (including stormwater management), (3) wastewater management (including septics); and (4) monitoring and assessment of water quality. The list of people who participated, and the entire list of issues and interests that was generated, are included below.

Persons in Attendance

Dick Babb, Clinton Streamkeepers
Jim Beasley, Brown County Engineer
Howard Bickel, Farmers Union
Bob Coblentz, NRCS – Clinton County
Abbe Copple, NRCS – Highland County
Laura Curliss, Landowner on East Fork
Tom Denier, Fayetteville-Perry Sewer District
Steve Dick, Brown Co Health Dept
John Henize, Union Township Trustee
Dan Hoyle, Lake Lorelei Prop Owners Assn
Paul Kleemeyer, Fayetteville Village Council
Wayne Lewis, Farmer/East Fork Exec Board
John McManus, Clermont OEQ
Ryan Mobley, Clinton Co Farm Bureau
Neil Rhonemus, Clinton Co Farm Bureau
Chris Rogers, Brown SWCD
Harry Snyder, Highland Co Econ Development
Don Spurling, Clinton Streamkeepers
Rick Stanforth, Clinton County Commissioner
Dennis TenWolde, LMRP
Harold Thornburg, Green Township Trustee
Hugh Trimble, Ohio EPA
Mary Ann Webb, Highland Co Health Dept
Chuck Williams, Highland SWCD
James Woodruff, Green Township Trustee
Frank Mezger, Brown Co Farm Bureau

Listing of Goals, Interests, Issues & Concerns

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

Agriculture - managing ag runoff quality – chemicals/pesticides/fertilizers (5); phosphorus loading from misapplication or over application; chemical containment; improved nutrient/ sediment management practices (3); construction of grassed waterways; improve cropping systems; $$$ for filter strips; animal waste runoff (2); livestock in or near streams (2); ag CAFOs (i.e., large confinement livestock operations) – not a problem yet but may be in future (2)

Drainage - poor drainage; improve drainage/less flooding; good ag drainage; improve storm drains in villages

Education - better public education on watersheds (3); K-12 educational programming (2); adult education

Monitoring & Assessment - more stream/water quality data (2); put data to use; better study of stream waters to identify specific problems; monitor smaller areas; more data sources – with only 5% of streams assessed, hard to ID & target problems

Land Use – urbanization/sprawl; planned development (2); control residential and commercial development; areas closest to town should develop first; consider infrastructure – utilize to control development; population growth and cost of services; land use planning that considers stream quality; farmland and open space preservation; promote/adopt county zoning

Protection of Habitat and Natural Characteristics - better stream corridor protection (2); natural channel migration; channelization & streambank erosion; protect stream banks; habitat degradation; habitat preservation; promote fish & wildlife habitat; maintain algae levels naturally; aesthetics; recreation

Quarries - active participation from quarries; quarry sediment runoff; stream clouding & oxygen reduction from quarries

Stormwater/Runoff - non-point source pollution; urban runoff; runoff & sediment control during and after construction (4); erosion/sediment (5); sediment contamination of streams

Wastewater/Sewers/Septics - raw sewage in stream; control bacteria; failing septic systems (4); improve septic systems (2); grant money for repair of failing septic system; proceed with S. Clinton County villages sewage treatment plans/goals (2); complete sewage systems as necessary; wastewater treatment plants/sludge applications (2); changing EPA requirements – criteria met then changed again; no additional requirements without funding to meet requirements; sewage related to development; also see concerns with livestock waste under Agriculture

Water Quality (General) - meet Ohio EPA standards; increase number of streams attaining all uses; don't create new problems; be responsible for our actions and interactions

Miscellaneous/Other - unauthorized dump sites; spills & accidents; wood treatment plant; remove "orphan" dams; unused well closure program; pay for services provided; financing for projects

December 22, 2003

Dear ,

We are currently developing a Watershed Management Plan for the East Fork Headwaters 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 was invited to meet November 20 to help us understand the breadth of issues and interests in their respective communities as we develop a watershed plan for the Headwaters area. I've attached a summary of the meeting.

At the November 20th meeting, we organized the issues and interests into, and formed Working Groups for, the following topics:

- **Agriculture and Agricultural Runoff**
- **Land Use Change (including Stormwater Management)**
- **Wastewater Management (including Septics)**
- **Monitoring & Assessment**

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 – Develop details 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.

The **Wastewater Working Group** will meet from **2:00 – 4:00 PM, Tuesday, January 13 at the Fayetteville Library**, at 406 East St.

The **Land Use Change/Stormwater Working Group** will meet from **5:30 – 7:30 PM, Tuesday, January 13 at the Fayetteville Library**, at 406 East St. (Because this is a dinner-hour meeting, **Pizza and Pop will be served.**)

The **Monitoring and Assessment Working Group** will meet from **1:00 – 3:00 PM, Wednesday, January 14 at the Fayetteville Library**, at 406 East St.

The **Agriculture/Agricultural Runoff Working Group** will meet from **3:00 – 5:00 PM, Wednesday, January 14 at the Fayetteville Library**, at 406 East St.

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

Sincerely,

Jay Dorsey
East Fork Watershed Coordinator

Press Release

January 13 & 14 Meetings to Address Concerns in East Fork Watershed

Fayetteville, 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 Headwaters area. Everyone is invited to attend.

The East Fork Headwaters area includes those portions of Perry Township in Brown County, Dodson and Union Townships in Highland County, and Clark, Green and Jefferson Townships in Clinton County that drain to the East Fork River. This area also includes the villages of Fayetteville, Lynchburg, Midland, and New Vienna.

At a meeting November 20, 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. The group organized the issues into the following focus areas: Agriculture and Agricultural Runoff, Land Use Change/Stormwater Management, Wastewater Management, and Water Quality Monitoring and Assessment. The next step is to develop goals and strategies for each of these focus areas.

A meeting to develop watershed-based goals for **Wastewater Management** will be held at **2:00 PM, Tuesday, January 13, at the Fayetteville 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 concerns associated with bacteria and pathogens from poorly-functioning systems.

Land Use Change (including Drainage and Stormwater Management) will be the focus of a meeting at **5:30 PM, Tuesday, January 13, at the Fayetteville Library** conference room. The purpose of the meeting is to develop watershed-based goals that will help balance the diverse needs within the community including stormwater runoff, erosion, drainage, flooding, water quality, and stream protection.

Water Quality Monitoring and Assessment will be the focus of a meeting at **1:00 PM, Wednesday, January 14, at the Fayetteville Library** conference room. The purpose of the meeting is to develop a strategy to improve our understanding of water quality issues within the East Fork Headwaters.

A meeting to develop watershed-based goals for **Agriculture and Agricultural Runoff** will be held at **3:00 PM, Wednesday, January 14, at the Fayetteville Library** conference room. Specific interests and issues to be discussed could include managing agricultural runoff quality, improved sediment management practices and livestock waste.

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

Agricultural Water Management Working Group

Name	Affiliation
Ralph Barber	Perry Township Trustee
Roger Butts	Agricultural Consultant
Jay Dorsey	Watershed Coordinator
Dave Dugan	OSU Extension—Brown County
John Etienne	Highland SWCD
Jim Faust	Highland County Farm Bureau
Joe Fraysier	Union Township Trustee
Rob Hamilton	Ohio DNR Division of Soil & Water Conservation
John Henize	Union Township Trustee
Dan Hoyle	Lake Lorelei Property Owners Association
Paul Kelly	Clinton SWCD Supervisor
Wayne Lewis	Farmer and East Fork Watershed Collaborative Board
Dave Parry	NRCS—Highland County
John Pulse	Farmer/Landowner
Chris Rogers	Brown SWCD
Lane Schafer	Clinton SWCD
Chuck Williams	Highland SWCD

Land Use and Stormwater Management Working Group

Name	Affiliation
Jim Beasley	Brown County Engineer
Laura Curliss	Riparian Landowner
Jay Dorsey	Watershed Coordinator
John Pulse	Farmer/Landowner
Harry Snyder	Highland County Economic Development
Dennis TenWolde	Little Miami River Partnership

Wastewater Management Working Group

Name	Affiliation
David Brinkman	Perry Township Trustee
Eric Davenport	Brown County Health Department
John Denier	Fayetteville-Perry Sewer District
Stephen Dick	Brown County Health Department
Jay Dorsey	Watershed Coordinator
Louis Johnson	Perry Township Trustee
Matt Johannes	Clinton County Health Department
Harry Snyder	Highland County Economic Development
Don Spurling	Clinton Streamkeepers
Bill Sulfsted	Village of Lynchburg
Mary Ann Webb	Highland County Health Department

Monitoring and Assessment Working Group

Name	Affiliation
Roger Butts	Agricultural Consultant
Abbe Copple	NRCS - Highland County
Jay Dorsey	Watershed Coordinator
Barb Graves	Highland SWCD
Rob Hamilton	Ohio DNR Division of Soil & Water Conservation
Rick Ludwick	Village of Lynchburg
John McManus	Clermont County Office of Environmental Quality
Neil Rhonemus	Clinton County Farm Bureau
Bill Sulfsted	Village of Lynchburg

June 21, 2004

Dear ,

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

1. Draft Table of Contents for the Watershed Plan
2. A Summary of Goals and Strategies developed by the four work groups (Agriculture, Land Use/Stormwater, Wastewater, Monitoring and Assessment)
3. 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 (jaydorsey@oh.nacdnet.org); or by attending the upcoming Watershed Plan review session at 5:30 PM on Thursday, July 8 at the Fayetteville 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 Headwaters.

Sincerely,

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

APPENDIX B
Summary of Previous and Current Water Quality Efforts in the East Fork 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 in 2003. The East Fork Headwaters Plan was completed and submitted in May 2006, it has been reviewed and endorsed by Ohio EPA and ODNR. The 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, Middle Fork and Stonelick 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.

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 concentrations 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.

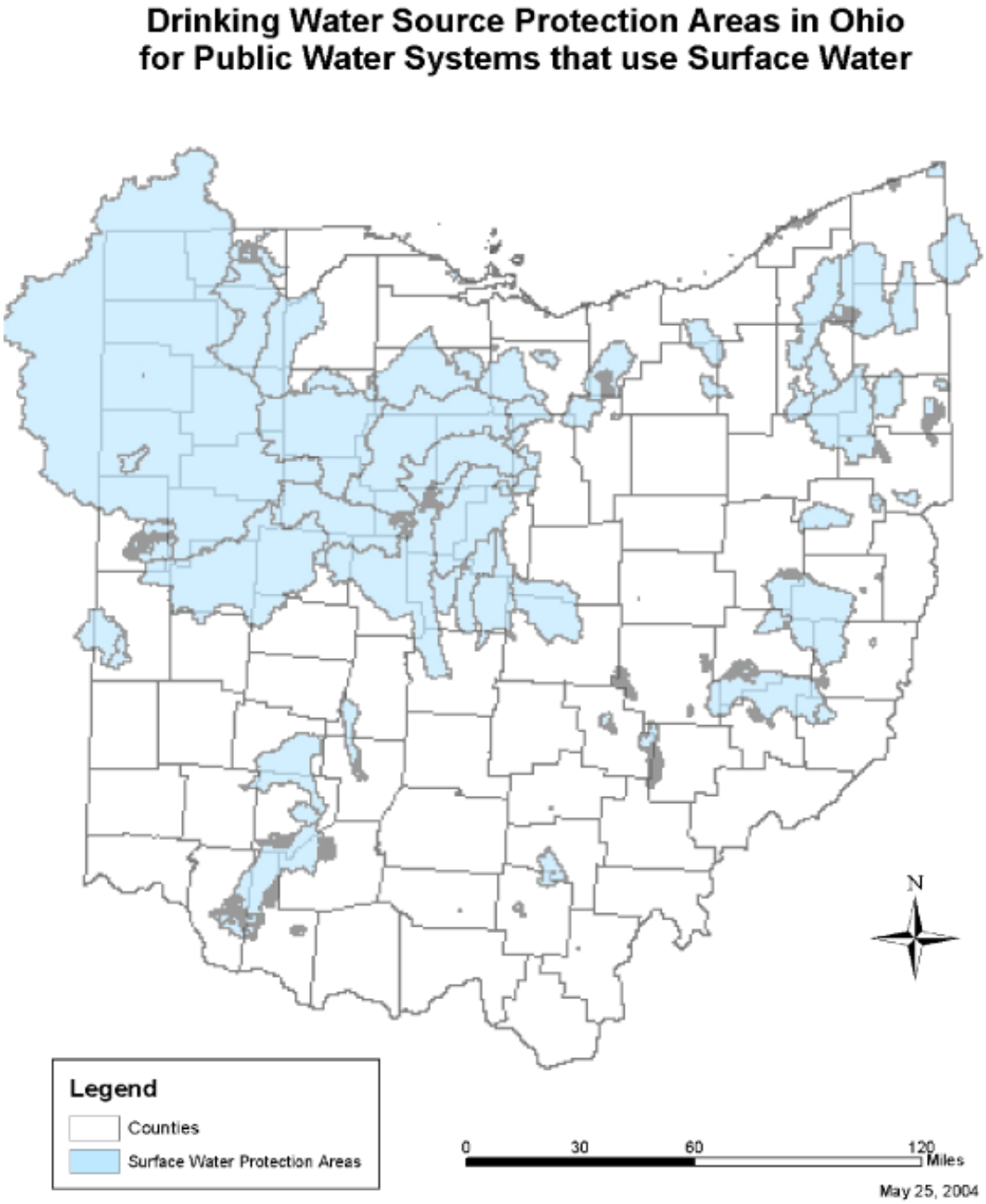
On June 14 of 2005, the Clermont County Green Team (Park District, Office of Environmental Quality, Soil and Water Conservation District) teamed with the Harsha Lake U.S. Army Corps of Engineers office and Batavia Township to remove 104 tires from the East Fork River near Elklick Road.

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.

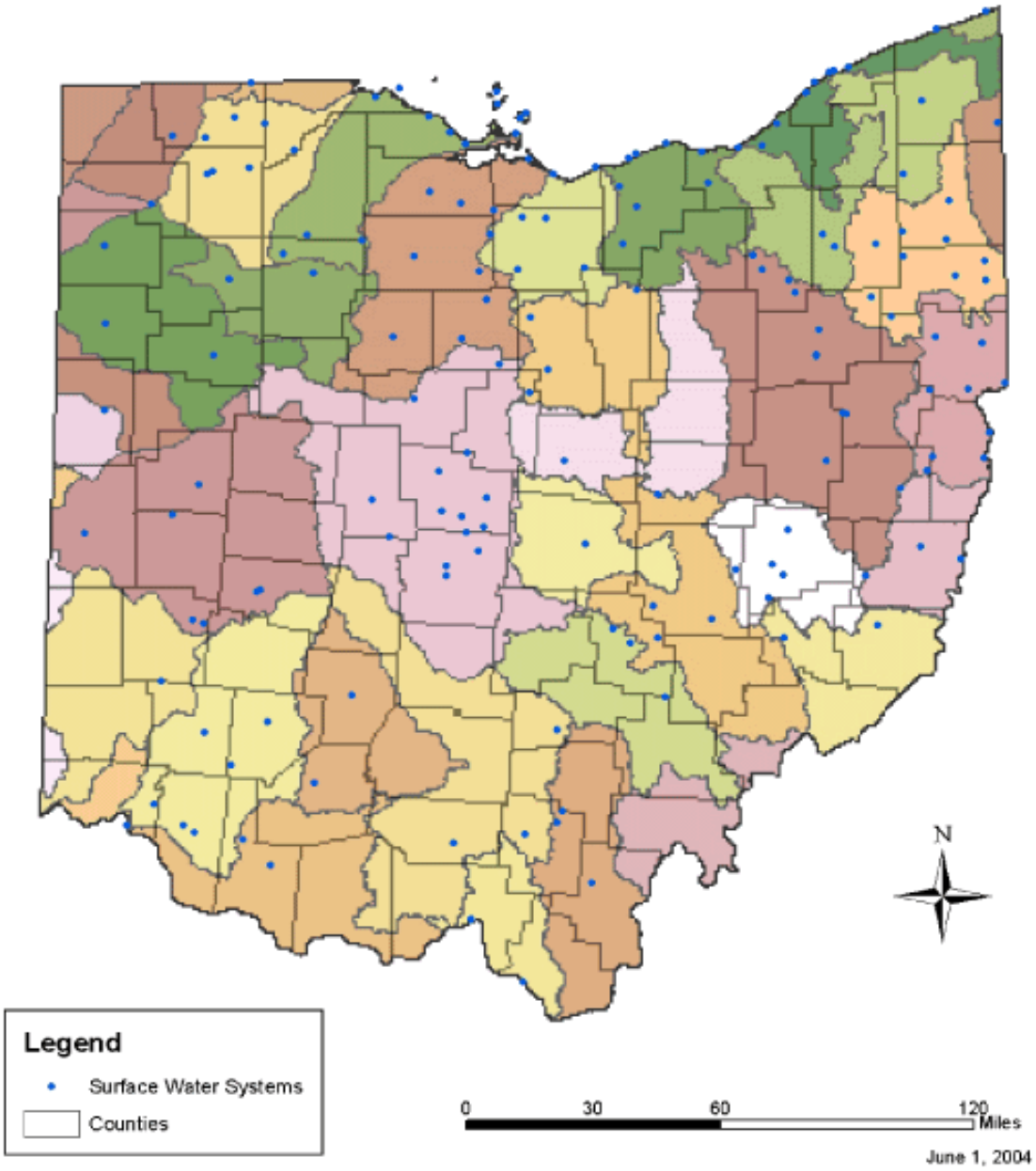
As part of a region-wide public awareness campaign called Project SIGNS, watershed signs with tributary names have been posted at about 30 stream crossings in the East Fork Watershed, and about 250 stream crossings throughout the Tri-state area. The Collaborative received a $1000 Watershed Awareness 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
Source Water Protection Maps for Ohio



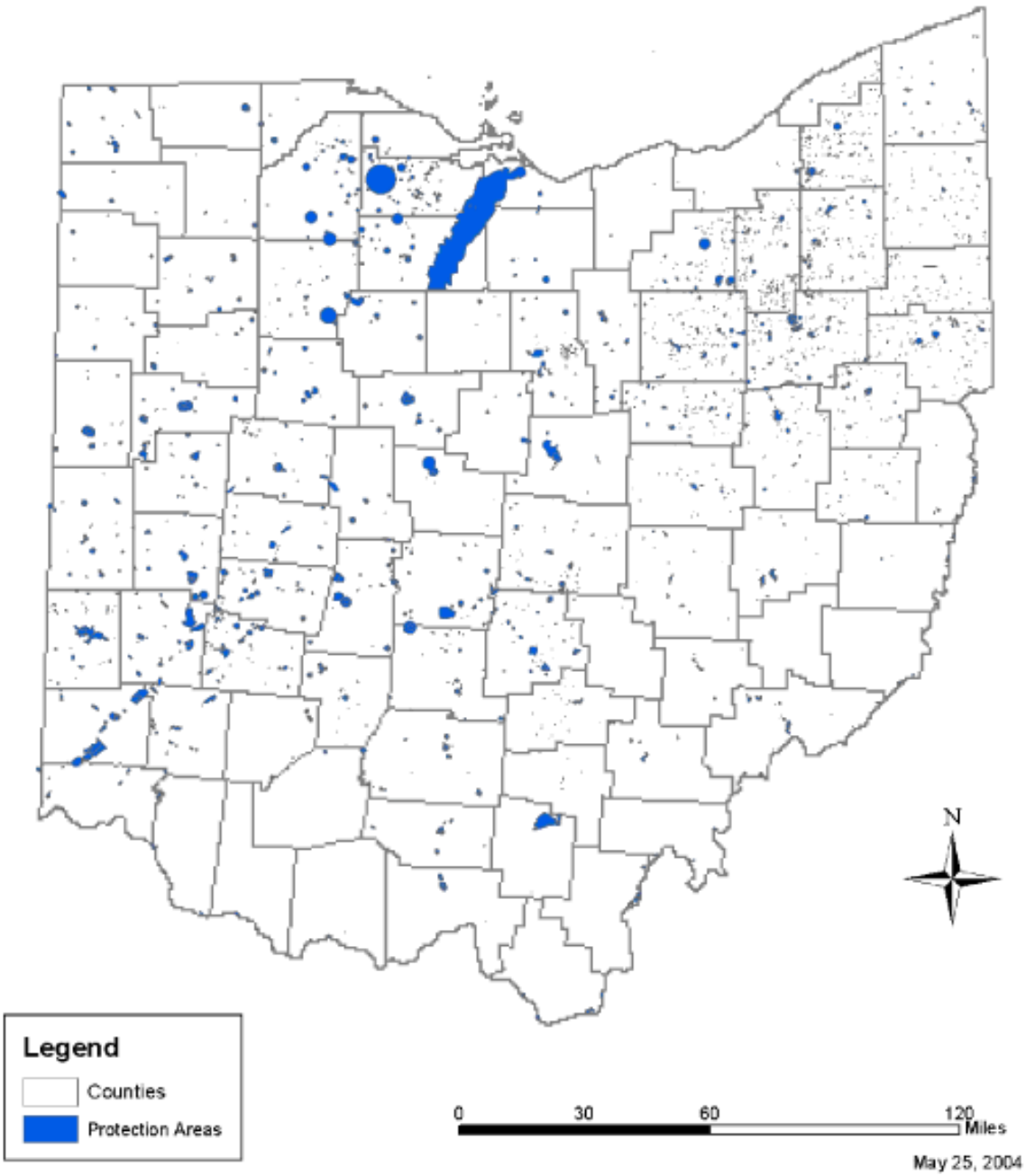
Source: www.epa.state.oh.us/ddagw/pdu/swap_maps.html

Public Water Systems in Ohio that use Surface Water by County and Major Watershed



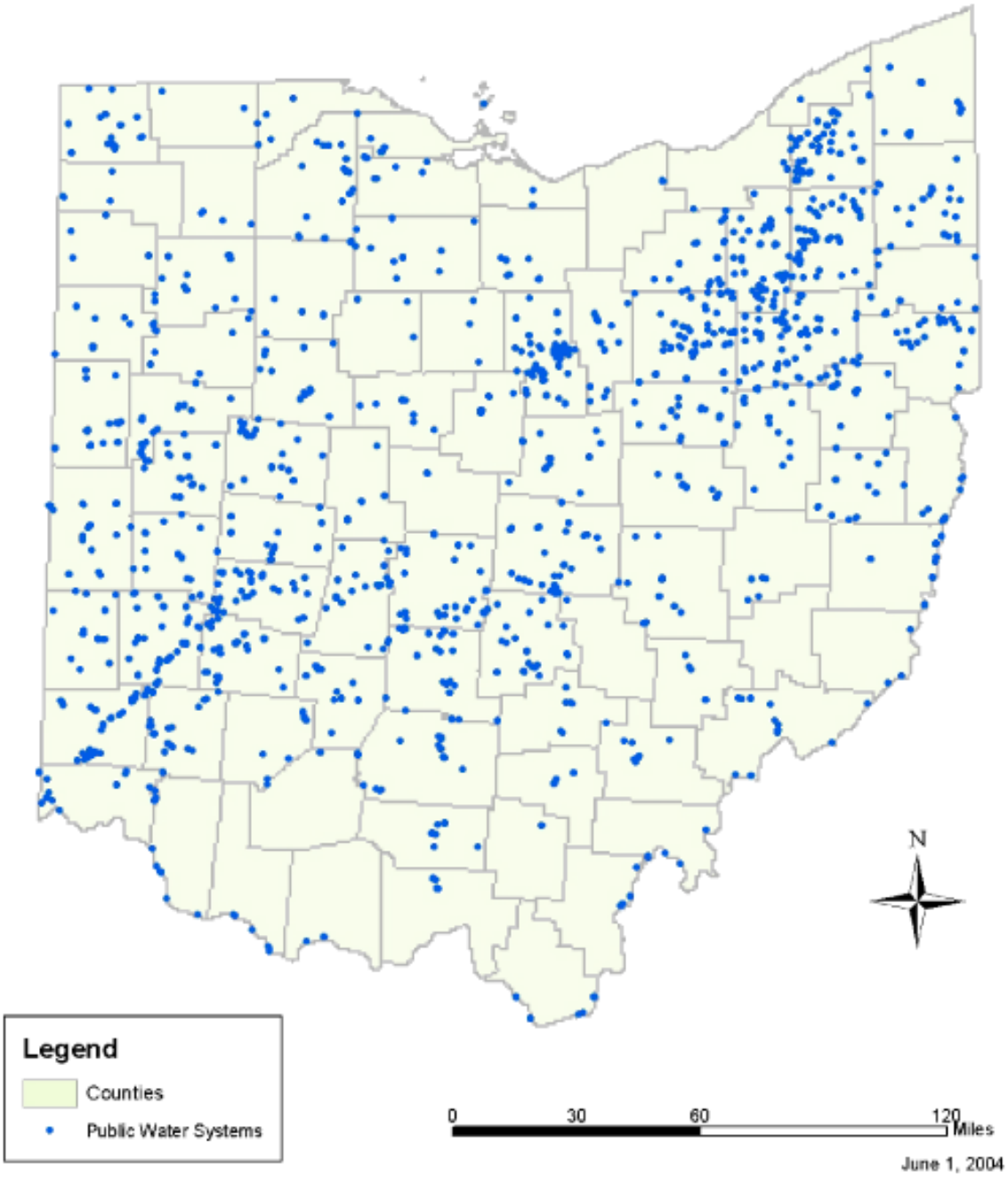
Source: www.epa.state.oh.us/ddagw/pdu/swap_maps.html

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 D
Other Land Use Categories in the East Fork Headwaters Watershed

It should first be noted that there are no special districts or designations located in the East Fork Headwaters Watershed.

Water Bodies

Lakes and Ponds

The only significant lakes or reservoirs in the East Fork Headwaters watershed are Lake Lorelei and the Westboro Reservoir. Lake Lorelei is a 190-acre man-made reservoir at the center of a 1700 lot residential development west of Fayetteville. Lake Lorelei was created by impounding Glady Run. The Westboro Reservoir (also called Houston Upground Reservoir), adjacent to Nicely Road just west of the community of Westboro, impounds the West Fork. The Westboro reservoir serves as a backup water supply for the Village of Blanchester. There are a large number of smaller man-made lakes/ponds throughout the watershed.

Wetlands

Most of the identified wetlands within the East Fork Headwaters watershed are small and isolated. The exceptions are the concentrations of man-made wetlands at the Indian Creek Wildlife Area southeast of Fayetteville and the Oldaker Wildlife Area just west of the community of Russell in Highland County. A map based on National Wetlands Inventory data is shown in Chapter 2 on page 12 in Figure 2-9 (see below) There are no apparent or significant tracts of non-forested wetlands in the East Fork Headwaters.

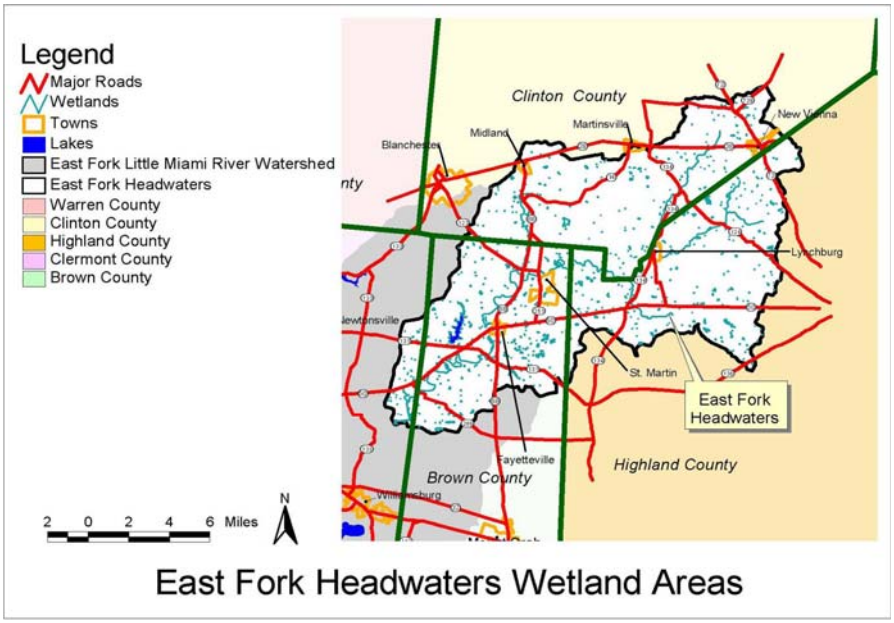


Figure 2-9. Location of wetlands in East Fork Headwaters watershed.

Barren Lands

Quarries

Quarries represent a very small percentage of the area within the East Fork Headwaters watershed, but 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. The three large quarries located within the East Fork Headwaters are: Ohio Asphaltic Limestone, Mad River Rd; Martin Marietta, Sharpsville Rd; and Highland Stone, Roush Road. All are located within Highland County (see Figure 2-16).

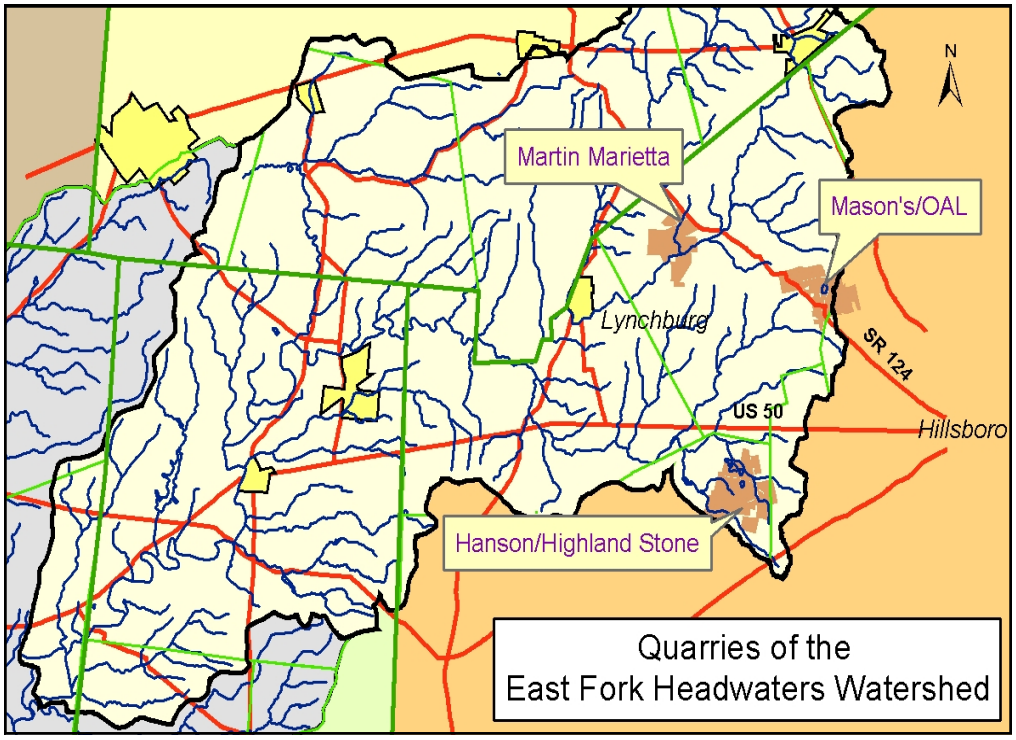
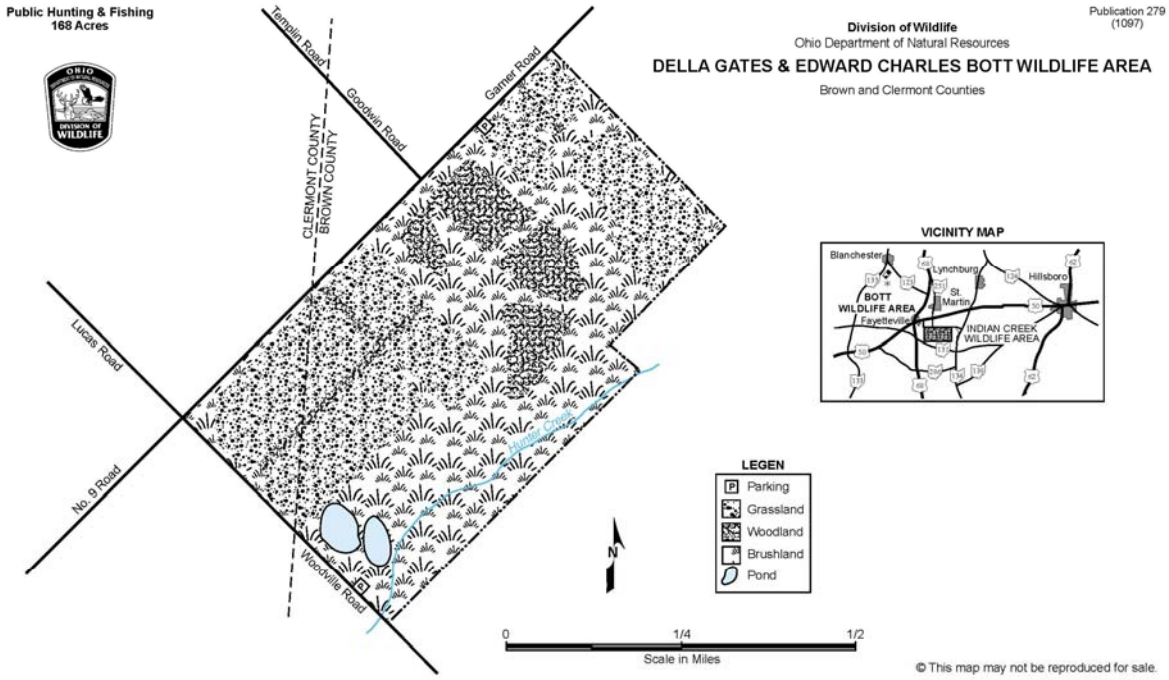


Figure 2-16. Location of surface mining operations in the East Fork Headwaters watershed.

Protected Lands in the East Fork Headwaters Region

State Wildlife Areas



WILDLIFE AREA
Public Hunting - Fishing

DELLA GATES & EDWARD CHARLES BOTT WILDLIFE AREA

Brown and Clermont Counties

DISTANCE FROM MAJOR POPULATION CENTERS

2 miles from Blanchester
15 miles from Wilmington
25 miles from Hillsboro
30 miles from Cincinnati
41 miles from Dayton

LOCATION AND DESCRIPTION

This 168-acre wildlife area is approximately 2 miles due south of Blanchester and is accessible from the Fayetteville-Blanchester Road on the east and Woodville Road on the west. The majority of the area is in Brown County with approximately 18 acres in Clermont County.

The terrain is very flat to gently rolling. Approximately 50 percent is in grassland, 25 percent is mature woods, and 25 percent is brushland.

HISTORY AND PURPOSE

The area was a donation from Edward G. and Robert C. Bott as a memorial to their parents, Della Gates and Edward Charles Bott. The Division of Wildlife took possession of the property on May 7, 1985.

The area is managed for quail and rabbit. There are two ponds on the area for public fishing and waterfowl hunting.

FISH AND WILDLIFE

Bobwhite quail, cottontail rabbit, gray and fox squirrels, and deer are the most abundant game species. Raccoon, muskrat, skunk, opossum, and waterfowl are the other major furbearer and game species. Woodcock frequent the area during migration.

PUBLIC USE FACILITIES

Two parking lots are located on the area; one on Garner Road and the other is located on Woodville Road and provides access to the ponds.

ADDITIONAL INFORMATION

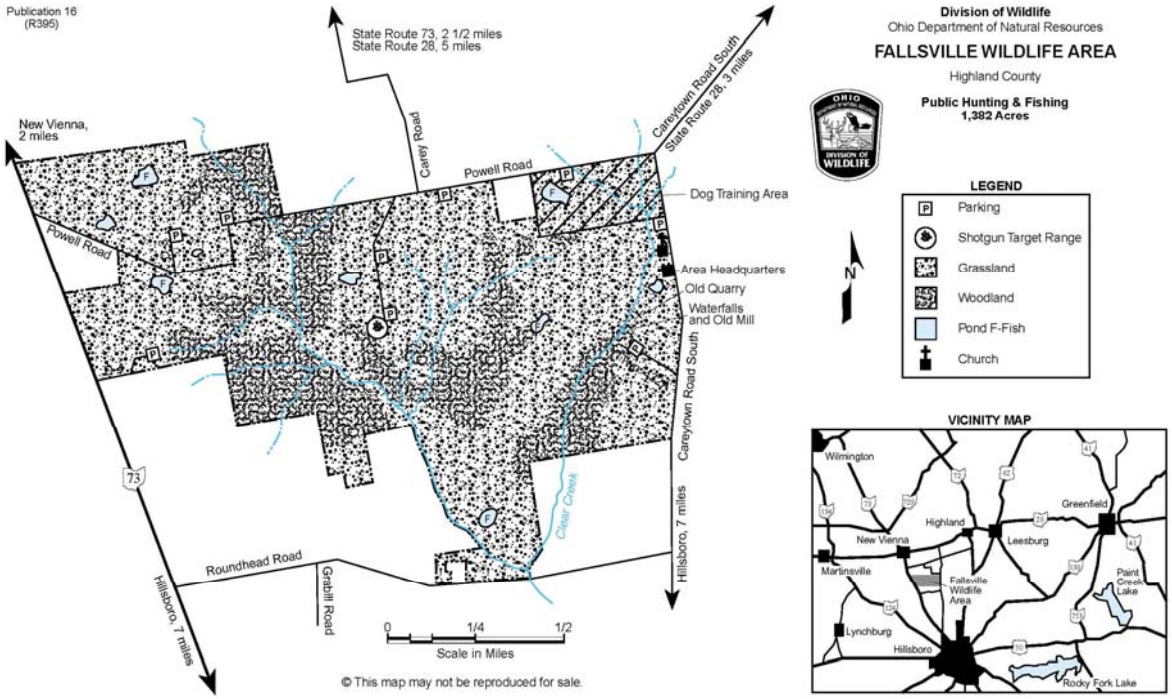
Further information may be obtained from the Wildlife District Five Office, 1076 Old Springfield Pike, Xenia, Ohio 45385; Phone (937) 372-9261. Or contact Indian Creek Wildlife Area, 4258 Snowhill Road, Fayetteville, Ohio 45118; Phone (513) 875-2111.

TURN IN A POACHER

Ohio's TIP, "Turn In a Poacher," program is helping to curtail poaching throughout the state. TIP is designed to involve the public in reporting wildlife violations. Citizens who observe wildlife violations should call the TIP toll-free hotline, 1-800-POACHER.

Equal Opportunity Employer - M/F/H

Source: http://www.dnr.state.oh.us/wildlife/Images/wildarea/pub279.gif



WILDLIFE AREA
Public Hunting - Fishing

FALLSVILLE WILDLIFE AREA

Highland County

DISTANCE FROM MAJOR POPULATION CENTERS

63 miles from Portsmouth
44 miles from Cincinnati
46 miles from Dayton
51 miles from Springfield
62 miles from Columbus

LOCATION AND DESCRIPTION

Fallsville Wildlife Area is in southwest Ohio, seven miles north of Hillsboro on State Route 73. The 1,382-acre wildlife area is almost 50 percent meadow and grain crops. About 20 percent of the area is a mixture of shrubs, small trees, grasses, and forbs and almost 30 percent is woodland. Six shallow ponds are located on the area.

HISTORY AND PURPOSE

The initial purchase of land for this area began in 1957. Because the area is in the productive agricultural section of Highland County, it has been managed primarily for species of wildlife associated with farm land. Wildlife management to improve habitat has included development of crop rotations and field sizes to provide food and cover for upland wildlife. Wildlife habitat has been enhanced by planting trees and shrubs to establish field dividers, improving existing fencerows through selective cutting, and protecting and improving woodlands.

FISH AND WILDLIFE

Good populations of bass and bluegill are present in ponds on the area.

Cottontail rabbit, ring-necked pheasant, bobwhite quail, fox and gray squirrels, woodchuck, and white-tailed deer are the major game species. Waterfowl are most common during migration. Common furbearers are raccoon, opossum, muskrat, mink, weasel, skunk, and red and gray foxes.

A great variety of both nesting and migrant birds use the area. The spring migration of waterfowl and songbirds and the fall migration of hawks are of special interest. A variety of songbirds are on the area all year. Observing these birds provides recreation and enjoyment for many visitors.

HUNTING, TRAPPING, AND FISHING

Fallsville is popular for rabbit and pheasant hunting. Fox squirrels can be found in mature timber and woodlots, and along the fencerows. Gray squirrels are more abundant in the large tracts of bigger timber. Jump-shooting for ducks on the ponds is often productive. Night hunting is popular for raccoon and fox, and trapping for muskrat and mink is productive along the streams and pond banks.

Largemouth bass and bluegill are the principal fish species stocked in ponds on this area and good catches of both are reported. The old quarry also provides good fishing.

UNUSUAL FEATURES

A scenic waterfall and former old mill site are located on Clear Creek, which flows through the area.

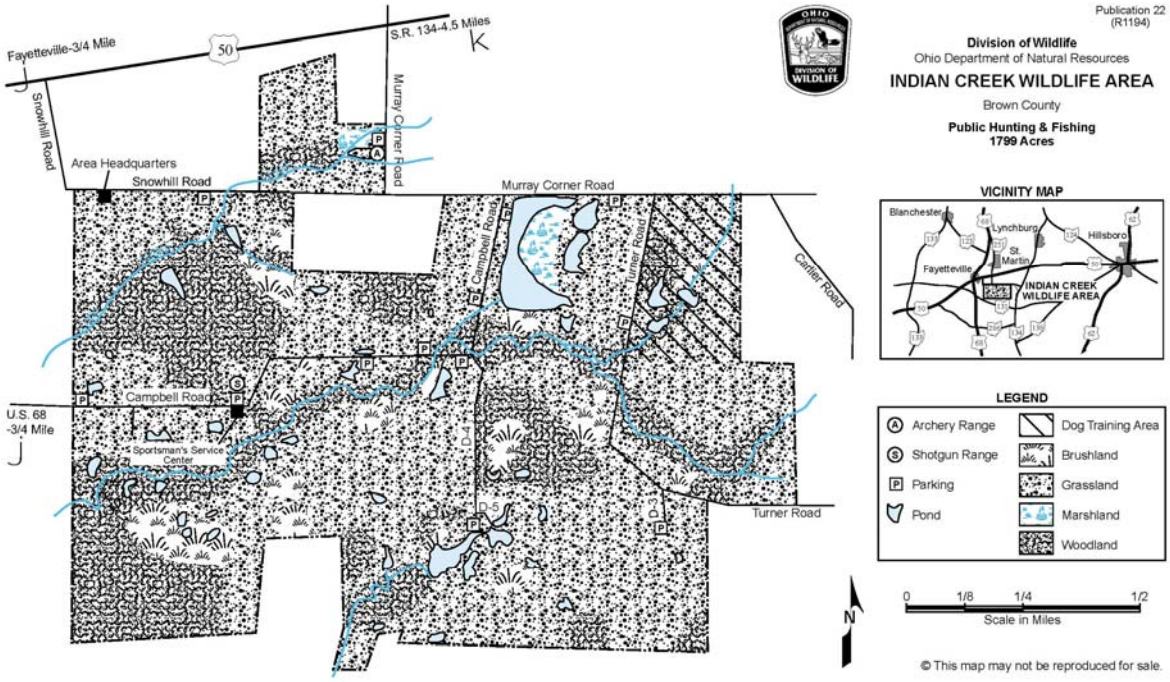
PUBLIC USE FACILITIES

Parking lots are situated throughout the area. A designated shotgun-only target area and a dog training area are maintained for year-round use.

ADDITIONAL INFORMATION

Further information may be obtained from the Area Manager, Fallsville Wildlife Area, 10221 Careytown Road, New Vienna, Ohio 45159; telephone (937) 987-2508 or from the Wildlife District Five Office, 1076 Old Springfield Pike, Xenia, Ohio 45385; telephone (937) 372-9261.

Source: http://www.dnr.state.oh.us/wildlife/Images/wildarea/pub016.gif



WILDLIFE AREA
Public Hunting - Fishing

INDIAN CREEK WILDLIFE AREA

Brown County

DISTANCE FROM MAJOR POPULATION CENTERS

15 miles from Hillsboro
20 miles from Cincinnati
50 miles from Dayton

LOCATION AND DESCRIPTION

This 1,799-acre wildlife area is one mile east of Fayetteville in northern Brown County. County and township roads provide good access to the area from U.S. Routes 50 and 68.

The terrain is very flat, except for the narrow valleys of Indian Creek and Little Indian Creek, which flow westerly through the area. Approximately 60 percent of the area is open land, consisting of crop fields intermixed with fields of broomsedge and scattered sassafras, soft maple, pin oak, and gum. The remainder is divided equally between woods and brush. Pin oak, hickory, soft maple, and beech are the principal tree species. Cottonwood and sycamore are common along the streams.

HISTORY AND PURPOSE

Area acquisition began in 1952. Nearly 50 ponds, potholes, and shallow marshes—ranging up to 5 acres in size and totaling 65 surface acres—have been constructed to enhance conditions for waterfowl and furbearers, and to provide additional fishing opportunity. Bird dog field trials are a secondary use of the area and have become increasingly popular.

FISH AND WILDLIFE

Bobwhite quail, deer, cottontail rabbit, and gray and fox squirrels are the most abundant game species. The wildlife area lies in Ohio's best quail range. Raccoon, muskrat, skunk, opossum, and waterfowl are the other major furbearer and game species. Woodcock frequent the area during migration.

All of the larger ponds and some of the small marshes have been stocked with fish. Largemouth bass, bluegill, and catfish are the most important pond fish species.

HUNTING AND FISHING

The best hunting for upland game is in the open fields,brushy coverts, and along the old fencerows. The larger woods in the southwest and northwest portions of the area are usually the most rewarding for the squirrel hunter. Both decoy hunting and jump shooting are productive for ducks on the numerous small marshes, potholes, and ponds. Woodcock hunting is best in the wetter brushy coverts. Hunting is good for woodchuck and raccoon, both of which are well distributed throughout the area. Deer hunting is good and improving each year.

The best fishing is usually in the shallower areas of the ponds in early morning and late evening. During the day, fishing is more productive in the deeper water areas.

PUBLIC USE FACILITIES

Parking lots are well distributed over the area. Other facilities include a horse barn, a 95-acre dog training area, a shotgun range, and an archery course (handicap accessible). A 56-acre marsh and an 8-acre marsh were restored for waterfowl and related species habitat and nesting.

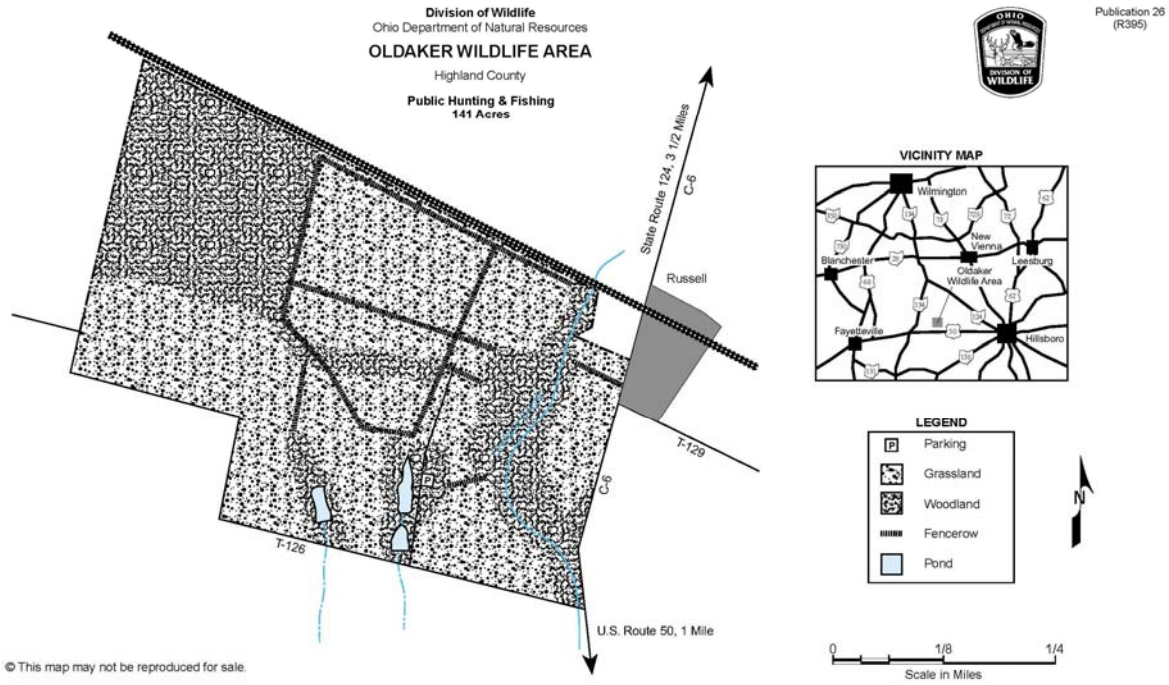
ADDITIONAL INFORMATION

Further information may be obtained from Wildlife District Five Office, 1076 Old Springfield Pike, Xenia, Ohio 45385; Telephone (937)372-9261.

TURN IN A POACHER

Ohio's TIP, "Turn In a Poacher," program is helping to curtail poaching throughout the state. TIP is designed to involve the public in reporting wildlife violations. Citizens who observe wildlife violations should call the TIP toll-free hotline, 1-800-POACHER.

Source: http://www.dnr.state.oh.us/wildlife/Images/wildarea/pub022.gif



WILDLIFE AREA
Public Hunting - Fishing

OLDAKER WILDLIFE AREA

Highland County

DISTANCE FROM MAJOR POPULATION CENTERS

63 miles from Portsmouth
7 miles from Hillsboro
45 miles from Cincinnati
51 miles from Dayton
70 miles from Columbus

LOCATION AND DESCRIPTION

This 141-acre wildlife area lies in the gently rolling farming region of Highland County, seven miles west of Hillsboro. It is easily reached from U.S. Route 50, six miles west of Hillsboro, by traveling one mile northeast on County Road 6-C. The area lies on the northwest side of the road just south of the village of Russell.

Most of the area is in meadow and grain crops intermixed with brushy fencerows and extensive brushy coverts along Dodson Creek. An exceptionally fine 25-acre mature woods of beech, maple, swamp white and pin oak, and other hardwoods may be found in the northwest corner of the area.

HISTORY AND PURPOSE

This area was purchased in 1944. Located in an agriculturally productive section of Highland County, the area is managed primarily for rabbits and quail.

Open fields are maintained in a desirable mixture of meadow and grain crops for farm game species. Several thousand shrubs and conifers have been planted. The woods have been protected and improved. Several ponds have been constructed.

FISH AND WILDLIFE

Cottontail rabbit, bobwhite quail, fox and gray squirrels, woodchuck, raccoons, muskrats, skunk, and opossum are the principal upland game and fur species in this region of Ohio. All of them are found on the area. A variety of waterfowl use the ponds, especially during spring migration.

Largemouth bass, bluegills, and catfish are the principal species of fish.

The best rabbit and quail hunting is in the openfields and brushy coverts. Both fox and gray squirrels are found in the 25-acre woods. Fox squirrels can be taken in the scattered woods along Dodson Creek. Raccoon and woodchuck hunting is usually good. The best fishing is usually in the more shallow areas of the ponds during the early morning and late evening, and in the deeper areas during the day.

PUBLIC USE FACILITIES

One parking lot is located on the south side of the area.

ADDITIONAL INFORMATION

Further information may be obtained from the Wildlife District Five Office, 1076 Old Springfield Pike, Xenia, Ohio 45385; telephone (937) 372-9261.

TURN IN A POACHER

Ohio's TIP, "Turn In a Poacher," program is helping to curtail poaching throughout the state. TIP is designed to involve the public in reporting wildlife violations. Citizens who observe wildlife violations should call the TIP toll-free hotline, 1-800-POACHER.

Source: http://www.dnr.state.oh.us/wildlife/Images/wildarea/pub026.gif

APPENDIX E
East Fork Chemical Use Analysis and Tillage Practices

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 exchangeable 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.

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.

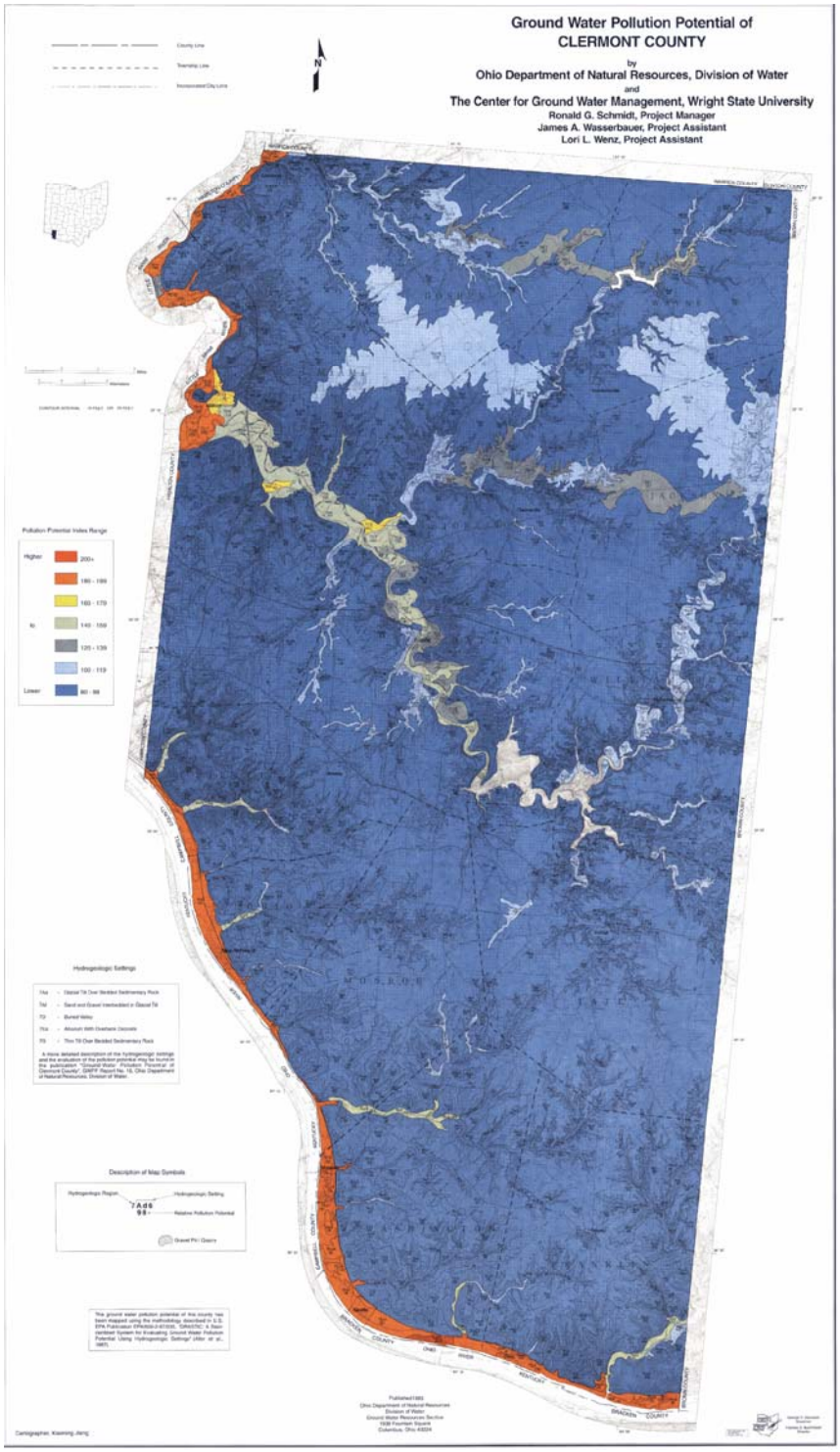
Table VI Tillage Practice by Crop in Acres and Percent

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

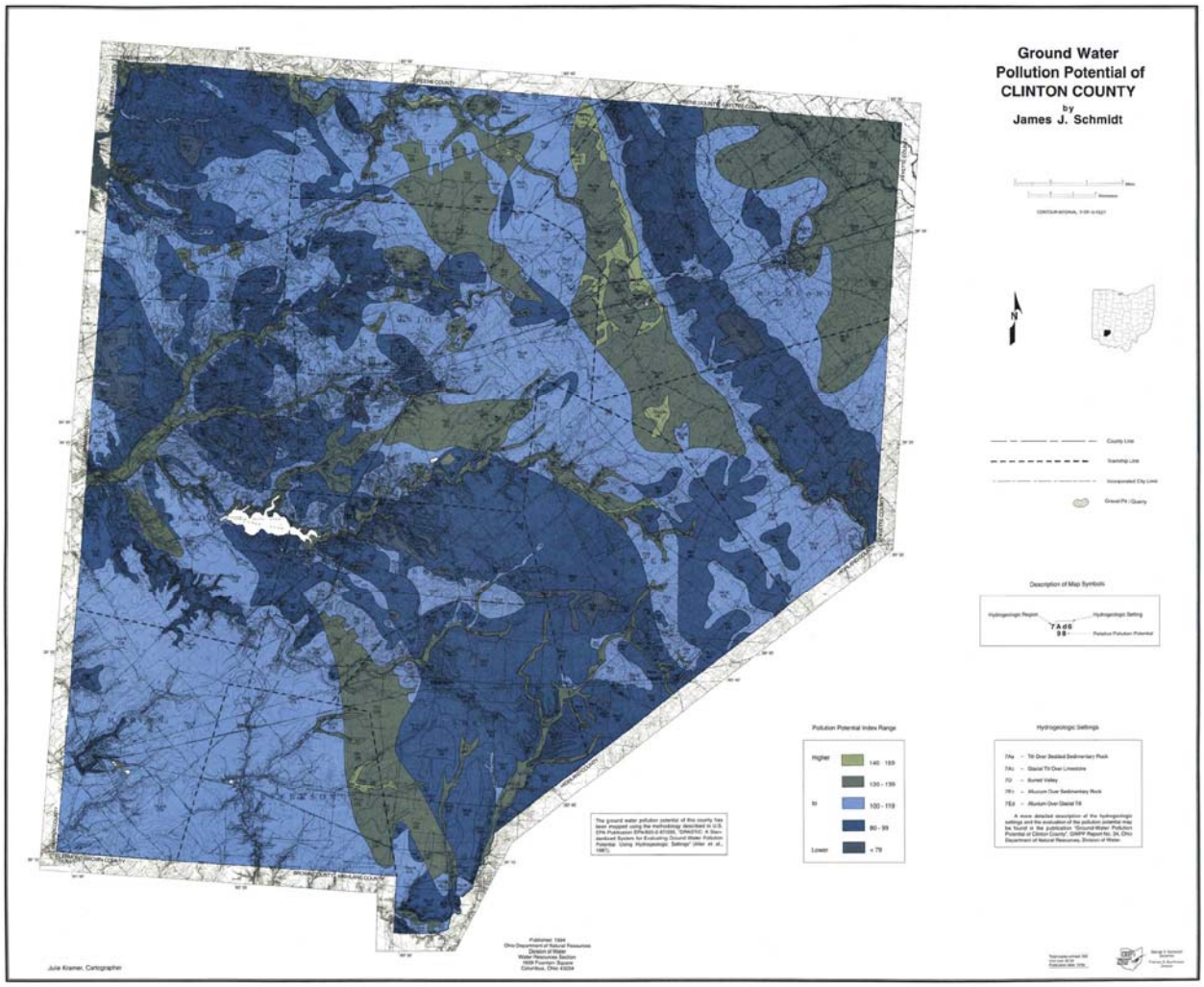
Corn producing farmers are still using conventional tillage (71 percent) in the majority of their operations. The heavy, wet soils that make up a large portion of the watershed create difficulties for farmers when using either a no-till or minimum tillage practice. Compaction is another concern when 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 F
Ground Water Pollution Potential Maps

Source: http://www.dnr.state.oh.us/water/gwppmaps/



Source: http://www.dnr.state.oh.us/water/gwppmaps/



Source: http://www.dnr.state.oh.us/water/gwppmaps/