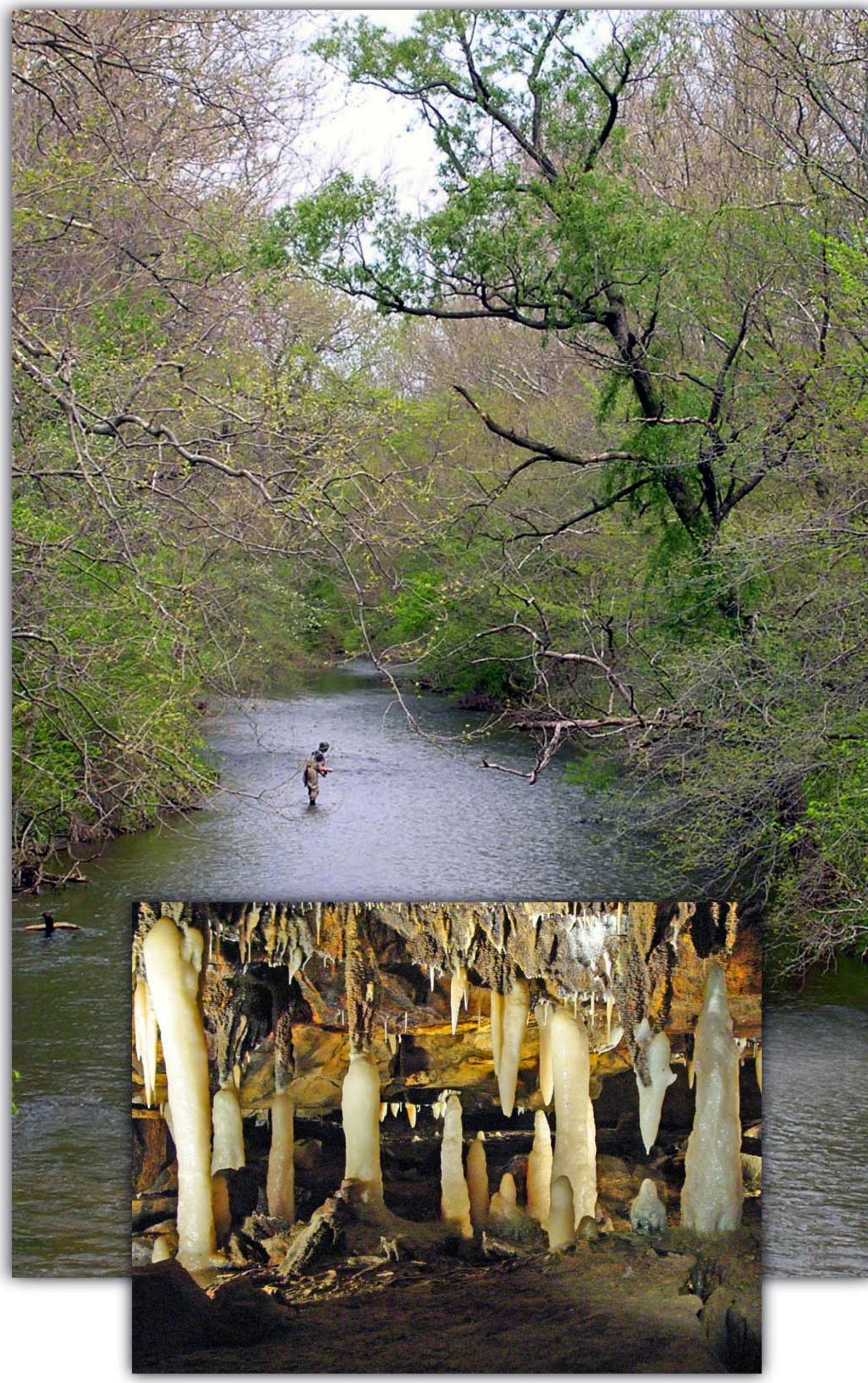


Mad River Watershed Strategic Plan

prepared by Anne Coburn-Griffis,
ODNR/DNAP Ohio Scenic Rivers Program,
for the Mad River Watershed Strategic Plan Joint Board of Supervisors

EXECUTIVE SUMMARY

This watershed action plan consists of six major sections: Introduction, Social Resources Inventory, Natural Resource Inventory, Water Quality Resource, and Implementation. The Introduction section describes project background, mission, previous planning studies, and watershed steering committee membership. Justification and need for conservation and protection activities are described, particularly the economic benefits associated with "ecosystem services," aquaculture, tourism, and outdoor recreation opportunities.

The Social Resources Inventory consists of a history of human development in Logan, Champaign and Clark Counties as well as the prevailing economic status, demographics, and resource extraction. This includes water resource applications.

The Natural Resource Inventory consists of a compilation of known data concerning land use, land cover, geology, soils, minerals, surface and groundwater, terrestrial habitats, streams, lakes, floodplains, wetlands, faunal and floral diversity and rare species.

The Water Quality Resource section is an expansion of the previou section as it includes aquatic habitat and water quality, water chemistry, stormwater, Ohio Environmental Protection Agency use designations and impacts caused by riparian vegetation removal, range grazing, land development and stream channelization activities. In an effort to analyze trends, historical, and socio-economic data is also included in this section.

The Implementation section is perhaps the most important. The strategies highlighted, if employed, would restore or maintain ecosystem functions, quality of life and recreational opportunities.

If one studies the chemical, physical and biological integrity of the Mad River watershed, a prescription of restoration and preservation managerial responses appears appropriate.

Strategy topics include measures to the effects of roadway maintenance and new infrastructure, logjam removal, and streambank stabilization through land acquisition or obtaining conservation easements from willing landowners. Floodplain protection and wetland restoration are also noted strategy topics. Managing stormwater, improving landowner and local governmental decision making, spill response planning, maximizing existing and increasing outdoor recreation opportunities and increasing environmental education and awareness complete the section.

If you have any questions or comments regarding this watershed action plan, please contact:

Mike Terry, Mad River Joint Board Chairman
Mad River Watershed Strategic Plan
Champaign Soil and Water Conservation District
1512 S. US Highway 68, Suite E100
Urbana, Ohio 43078
937-484-1507

On the cover:
River photograph courtesy of The Ohio Scenic Rivers Program

Ohio Caverns stalactites and stalagmites, provided by and used with permission from Ohio Caverns

TABLE OF CONTENTS

EXECUTIVE SUMMARY 1
TABLE OF CONTENTS 2
INTRODUCTION 5
Purpose of this Management Plan 5
General Description of the Mad River 6
Table 1: Watershed Fact Sheet 9
Figure 1: Mad River Watershed 10
Mission of the Mad River Watershed Strategic Plan 11
Watershed Joint Board and Advisory Committee 11
Previous Watershed Studies 12
Table 2: Mad River Aquatic Life Use Attainment Status (June-October, 2003) 14
Outdoor Recreation 16

SOCIAL RESOURCES INVENTORY
History of Human Development of the Area 21
Overview 21
Engineering of the Mad River 22
Figure 3: Blueprint of 1931 Channelization 23
Figure 4: Blueprint of 1922 Streambank Stabilization 24
Champaign and Logan Counties (Upper Mad River Watershed) 25
Clark County (Lower Mad River Watershed) 27
Administrative Boundaries 29
Districts 29
Demographics 30
Economics 33
Agriculture and Economy 34
Figure 5: Agricultural Statistics by County 35
Resource Extraction 36

NATURAL RESOURCES INVENTORY
Physiography, Relief, and Drainage 38
Climate and Precipitation 39
Agronomy and Soils 40
Current Stream Biological Diversity and Water Quality 45
Surface Water and Sediment Quality 45
Nutrient Concentrations 46
Mammals of the Mad River Watershed 46
Birds of the Mad River Watershed 47

Fish Species of the Mad River Watershed 51
Table 3: Fish and Aquatic Habitat Sampling Results 53
Aquatic Macroinvertebrates of the Mad River Watershed 54
Table 4: Macroinvertebrate Sampling Results 58
Amphibians and Reptiles of the Mad River Watershed 66
Woody Plants of the Mad River Watershed 67
Plants of Cedar Bog 69

CURRENT LAND AND WATER RESOURCES
Topographyand Current Land Use 73
Figure 6: Upper Mad River Land Use 74
Figure 7: Lower Mad River Land Use 75
Groundwater Resources 76
Figures 8-11: Groundwater Resources 79
Water Suppliers 81
Hydromodification of the Mad River 87
Table 5: Summary of Champaign County Lowhead Dams 87
Figure 12: Chapaign County Lowhead Dams 88
Subwatershed Inventory 91
Mac-o-chee Creek 92
Mad River Headwaters 97
Kings Creek 101
Glady Creek-Mad River 103
Muddy Creek 106
Dugan Run 109
Nettle Creek 113
Anderson Creek 117
Storms Creek 120
Chapman Creek 125
Bogles Run-Mad River 131
East Fork Buck Creek 135
Buck Creek Headwaters 141
Sinking Creek 145
Beaver Creek 150
Clarence J. Brown Lake-Buck Creek 156
City of Springfield-Buck Creek 160
Moore Run 164
Pondy Creek-Mad River 169
Mill Creek 173
Donnels Creek 178
Rock Run-Mad River 185
Jackson Creek-Mad River 190

WATER RESOURCE QUALITY
Fish Habitat 195

Water Quality.......... 195
Water Quality Criteria 196
Habitat Access.......... 196
Habitat Elements 197
Habitat Recommendations.......... 197
Landfills.......... 198
Point Sources.......... 199
Table 6: Industrial and Municipal NPDES Permits.......... 202
Habitat Improvement.......... 207
Stream Habitats: The Parts Equal the Whole by Greg Nageotte.......... 207
Figure 13: Good Stream Habitat.......... 209

IMPLEMENTATION
Best Management Practices.......... 211
Table 7: Upper Mad River Nitrogen Reduction Program.......... 212
Table 8: Kings Creek Watershed Welll-Test Data.......... 213
Environmental Education and General Public Awareness of Mad River Resource.......... 216
Potential Projects 219
Monitoring 220

EVALUATION 221

UPDATE……........... 221

REVISION.......... 222

REFERENCES
Acronyms.......... 223
Glossary of Watershed Terms.......... 223

LITERATURE CITED 226

DISTRIBUTION.......... 228

INTRODUCTION

Ohio's last two glacial events, the Illinoian and Wisconsonian, filled many drainage valleys with outwash and deposits of sand and gravel. Following glaciation, the stream that formed to flow southwest through Logan, Champaign, and Clark counties meandered slowly with springs and seeps discharging from the outwash deposits. Periodic flooding deposited alluvial sediments rich with organic material. The actual stream bed was difficult to distinguish in an environment of bogs and swamps. As the land was difficult to travel, and flooded frequently, Native American tribes referred to the waterway as the Mad River.

For years following the last glacial event, the Mad River flowed in its natural state through the valley of sand and gravel deposits, winding back and forth like a snake. The local Shawnee as well as other Native American tribes depended on the river for food, travel, and drinking water. Even European settlers respected the Mad for its powerful flood events.

After the flood of 1913, the Mad River was dredged, leveed and channelized to control flooding and protect farms established in the rich soil. These acts permanently altered the natural processes of the watershed, the aquatic environment and the dynamic of the stream flow. The dredging increased the velocity and probably the amount of ground water discharge, especially in Logan and Champaign counties. Until the river was dredged, the native species that made of the fish population were bass, several kinds of forage fish, sunfish, and minnows. Today, the 80 percent of annual streamflow is baseflow, supplied by groundwater, resulting in clear, high quality, highly oxygenated conditions of a consistent temperature (54-56 degrees Fahrenheit) more conducive for trout.

Yet in 1934, less than ten years after final channelization, records indicate that the river drastically needed improvement if it was to prosper as a fishery. Furthermore, groundwater and surface water are more completely connected in the Mad River watershed than any other river system in Ohio.

Proper land use is extremely important, as contamination at the surface will affect both ground water and surface water in this highly sensitive system.

The Purpose of This Management Plan

The purpose of this plan is to identify and reduce aquatic habitat degradation and to identify and protect high quality habitat areas of the Mad River and its tributaries. The plan will help guide members of the Mad River watershed community, from everyday residents to elected officials to local, regional, and government agencies, regarding decisions and actions affecting the watershed. The decision and actions include policy and procedure development and projects undertaken that will facilitate the accomplishment of strategies found in the plan while considering economic outcomes. The plan represents an analysis of environmental, recreational, socioeconomical, and historical factors related to activities in the watershed and outlines strategies to restore, enhance and protect resources to maintain quality of life.

General Description of the Mad River

Prior to glaciation, the main drainage in Ohio was the Teays River, a major stream which had its headwaters in the Appalachians in the present valley of the New River. The Teays flowed northwestward across Ohio from east of Portsmouth to Celina and westward into Indiana. This river lasted from about 200 million years ago until its demise when the first of the Ice Age glaciers blocked and buried it, diverting its flow into a newly created ice-marginal river, the Ohio River. The only evidence of this earlier famous, long-lived river in the Till Plains is its abandoned valley, now deeply buried by glacial deposits.The Mad River watershed is part of the Till Plains physiographic region, stretching from south of the Lake Plain and West of the Appalachian Escarpment to the Ohio River. The Till Plains are a result of the deposition and smoothing action of the glaciers.

The Till Plains receives its name from the glacial debris, or till, which covers pre-glacial hills and valleys, except where it thins along the Southern glacial boundary. Most of the hills in the Till Plains are mounds of boulders, sand, silt, and clay left by the retreating Wisconsinan glacier. Sometimes the ice front remained stationary for 100 to 200 years – just long enough for a few million tons of rock and soil to pile up in a series of broad moraines up to 100 feet high and six miles wide. Eight of these moraines loop across the Till Plains. In Logan County they drape around the Bellefontaine Outlier, a hilly belt of bedrock that rises to 1,549 feet, the highest point in the state.

The succession of glaciers also changed drainage patterns. Advancing ice fronts often dammed streams, backing them up forming lakes. Eventually, this water overflowed and the streams cut new courses. In this way the Ohio River was created after the Kansan glacier dammed the Teays River, former master stream east of the Mississippi River. Made up of a patchwork of the courses of former streams, the Ohio River gradually evolved along the margin of the continental glacier. The Teays, which had formerly drained much of the eastern and southeastern United States, ceased to exist. North of Chillicothe its channel lies buried under up to 400 feet of glacial till. Only in Southern Ohio, where the glaciers never reached, is the Teays Valley clearly visible.

A warmer climate stopped the southern advance of the Wisconsonian glacier about 19,000 years ago; so this ice did not completely cover the older till plains. Today the ice advance is marked by two terminal moraines: Hartwell on the west and Cuba on the east. South of this belt, Illinoian till (40,000 years old) underlies the Till Plains section. The Illinoian till is much flatter and is less well-drained. It also has been weathered for a much longer time and the weathering has leached many plant nutrients downward, forming a hardpan about nine feet below the surface. This hardpan is almost watertight, and it slows drainage from the surface so much that the upper soil levels are frequently wet, especially in woodland depressions. The local term for this is “crawfish land”, a name derived from the large numbers of crayfish which burrow in the slow-draining soil. The clay soil of the area holds together exceptionally well, and the crayfish mound the soil up to several hundred inches high around their burrow entrances. Some fields have hundreds of these “chimneys” before farmers plow in the spring.

About 14,000 years ago, as the last period of glaciation retreated from Ohio, the western Ohio region would have been a more barren place. Retreating glaciers left accumulations of peat (organic material), forming two types of freshwater peatlands called bogs and fens. The feature that distinguishes fens from bogs is the fact that fens receive water from the surrounding watershed in inflowing streams and groundwater, while bogs receive water primarily from precipitation.

The cold, flowing water also cools fen temperatures below ground level in the summer time. This cooling shortens the growing season and affects seed germination of fen vegetation. Grasses and sedges are common plants in fens and fens often look like meadows. Sedges and grasses make up the bulk of the peat formed in alkaline bogs.

Fens are also characterized by extensive accumulations of marl, a grayish-white, lime-rich mud which develops when calcium carbonate precipitates out of ground water. Certain places within the fen may quake just like the floating mat in a kettle lake bog. This quaking mass of peat is usually not floating over deep water; instead, it is supported on shallow, high volume springs.

Fens typically occur on sites adjacent to, on, or at the base of somewhat porous gravel ridges or hilly terminal moraines where springs supply clear, cold ground water. The majority of fens, or alkaline bogs, occur in western Ohio, particularly in Champaign, Logan, and Clark counties. Perhaps the best known of these alkaline bogs is Cedar Bog, located in the Mad River Valley of Champaign County 4 miles south of Urbana.

Instead of highly acid water, springs and brooks in a fen are at the other extreme – highly alkaline. Their pH often ranges from 8.0-9.5 because the glacial deposits through which the water percolates contain large amounts of limestone-rich gravel. As ground water moves through these highly permeable deposits, it dissolves the limey materials and becomes charged with calcium and magnesium bicarbonates. The impact of this highly alkaline water on plants is similar to that of acid. Once again, water absorption seems to become a problem for many fen plants. Ground water is typically oxygen deficient. In microscopic organisms that normally decompose

dead plants, we find an accumulation of peat. Consequently, fens also tend to be about as deficient in nitrogen as sphagnum peat bogs.

As the glacier retreated, the climate changed dramatically over the next several thousand years, and conditions became less hospitable for northern bogs and fens, and they began to succeed into other types of plant communities. An estimated 98% of Ohio's original bogs and fens have been lost to development of one sort or another since the time of European settlement.

Beneath the almost continuous cover of glacial deposits lies sedimentary bedrock, which, in the Till Plains, is mostly carbonate, with a little shale. Much of this carbonate is the magnesium-bearing form called dolomite. All these rocks are of early Paleozoic age (Ordovician through Devonian), approximately 350 to 500 million years old, and many contain fossils of ancient marine invertebrates, such as corals, brachiopods, clams, snails, cephalopods, crinoids, and trilobites.

The Cincinnatian (Ordovician) rocks contain so many fossils of such diverse species, many weathering out loose, that they have become very famous and, since the early 1800s, have drawn people from all over the world to come and collect them. In places in the younger Devonian rocks, obscure fossilized fragments of primitive fish can be found, but higher forms of life are unknown in these rocks since such forms had not yet developed. These rocks, with their fossils, indicate the presence of a broad, shallow sea that flooded Ohio for about 300 million years. Lime precipitated from the water accumulated on the bottom and recrystalized forming the carbonate bedrock.

The youngest rocks of the Till Plains, which lie on top of the limestones and dolomites, are shales. These form a narrow north-south belt through central Ohio, extending eastward into the plateau and eroding away to the west. They, too, tell a story, for they represent the consolidated remains of the first extensive muds to have been washed out into the ancient Paleozoic ocean in Ohio from rising land to the east. This eastern land was beginning to rise as a result of the first of the forces that would, 150 million years later, create the Appalachian Mountains. As the land rose, it was being eroded by streams that washed this sediment westward into the Ohio seas.

When the Appalachian Mountains were formed, all the different limestone and shale layers, or rock formations, of Ohio were bowed up into a low arch, the Cincinnati Arch, the sides of which slope very gently at angles of less than one degree. Extensive erosion of these arched rock layers took place throughout Ohio, but the erosion cut deepest where the Arch stood highest, in western Ohio. Thus it is Ohio's oldest rocks (limestone and dolomites) that form the bedrock in the Till Plains, with the younger shale laying on the older rocks on the eastern side of the arch. A slight bulge in the crest of the Arch at Cincinnati caused erosion to go deepest there, thus exposing the famous fossiliferous Cincinnatian rocks.

The bedrock of the Till Plains may be observed mainly in quarries, road cuts, and stream banks. However, such places are quite limited in most of the Till Plains, because the glacial cover there is almost continuous and locally quite thick. An exception to this is the famous "Bellefontaine Outlier" in Logan County, where a remnant of the eastern shale rises up and protrudes as rocky hills. Immediately beneath the shale is the Columbus Limestone which, due to its purity, here contains caves – the Ohio Caverns and Zane Caverns. This is the same rock formation that occurs in the Marble Cliff quarries of Columbus and the huge quarry on Marblehead Peninsula, and in which the famous Kellys Island glacial grooves were cut.

Erosion of all these rocks takes a long time. The erosion began as sediment deposition ended and the seas drained away, about 200 million years ago, and continued until the first advance of the Ice Age (Pleistocene) glaciers about two million years ago. Thus, though the glacial materials lie directly on the Paleozoic bedrock in the Till Plains, they are very much younger than the rock; the surface on which they lie is simply the final surface left by all that erosion.

All the younger sedimentary rocks of Ohio, even those of the eastern plateaus, were once present in western Ohio before they were eroded. All of this erosion was done by streams. The glacier could not have moved this rock and soil because it came too late and the ice was much too thin.

Mad River Watershed Fact Sheet

Inventory of the Watershed

USGS Hydrologic Unit # 05080001 150/160/170/180

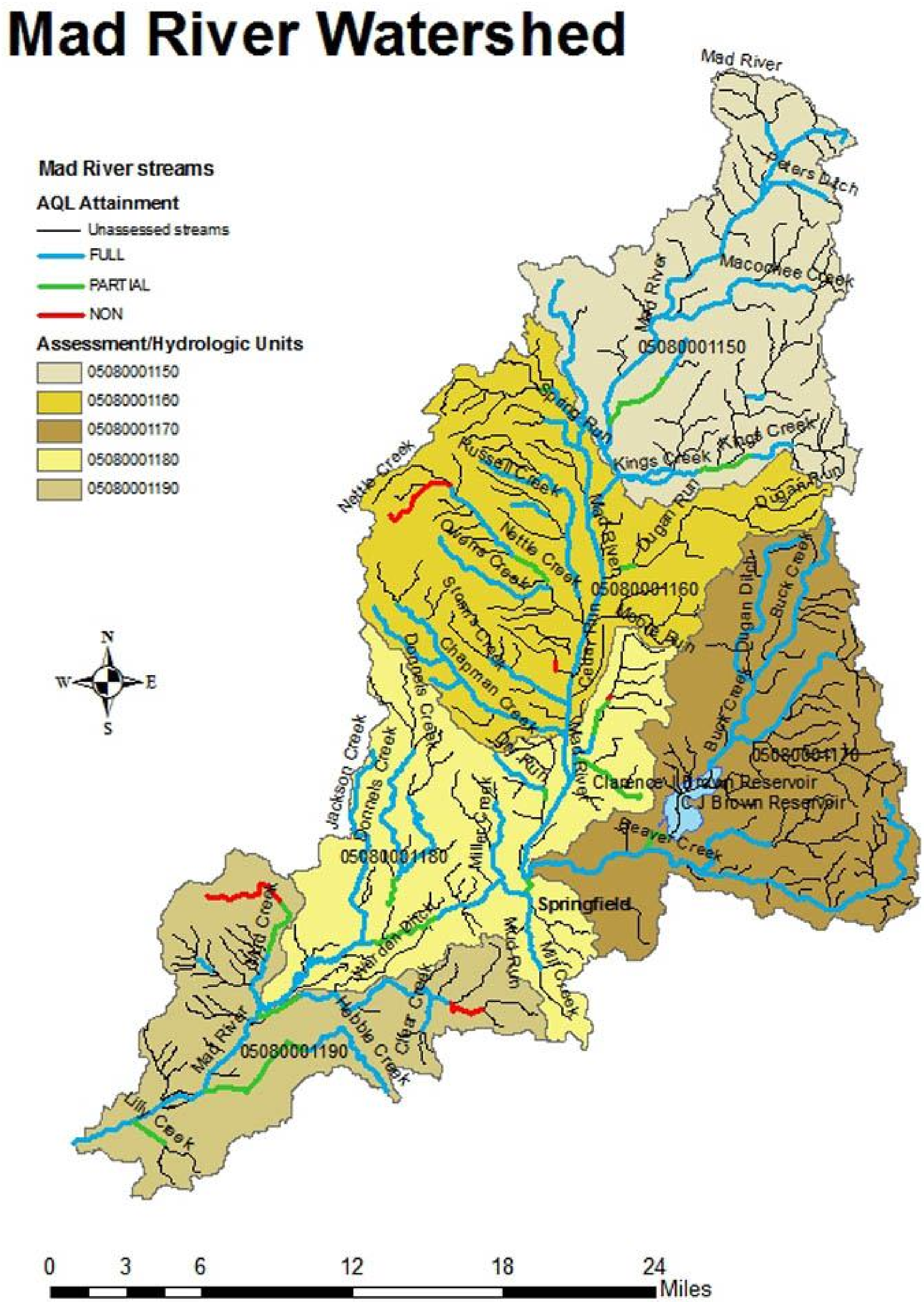
Counties:
Logan County 43,584.04 acres
Champaign County 45,604.96 acres
Clark County 107,285.23 acres

Ecoregion: Eastern Corn Belt Plains - Mad River Interlobate Area

Watershed Size:
Total acres 401,647.5 acres
Drainage 308.4 sq. miles

Elevations:
Headwaters 1500 feet
Upper Limits 935 feet
Total fall 565 feet
Average fall 2.35 ft/mi

HUC 12 Name	HUC 12	Drainage Acres
Mac-o-chee Creek	050800011501	12281.8801
Mad River Headwaters	050800011502	23441.4062
Kings Creek	050800011503	28039.5133
Glady Creek-Mad River	050800011504	22464.983
Muddy Creek	050800011601	14615.4073
Dugan Run	050800011602	15014.119
Nettle Creek	050800011603	18286.2751
Anderson Creek	050800011604	11355.2277
Storms Creek	050800011605	5826.1252
Chapman Creek	050800011606	15626.51
Bogles Run-Mad River	050800011607	17535.8239
East Fork Buck Creek	050800011701	18464.5829
Buck Creek Headwaters	050800011702	19547.3727
Sinking Creek	050800011703	8864.1165
Beaver Creek	050800011704	16444.0032
Clarence J. Brown Lake-Buck Creek	050800011705	15103.5736
City of Springfield-Buck Creek	050800011706	11593.5465
Moore Run	050800011801	11741.2959
Pondy Creek-Mad River	050800011802	10767.5723
Mill Creek	050800011803	9884.0283
Donnels Creek	050800011804	16944.5859
Rock Run-Mad River	050800011805	13385.8826
Jackson Creek-Mad River	050800011806	19296.9832


Mad River Watershed
Mad River streams
AQL Attainment
Unassessed streams
FULL
PARTIAL
NON
Assessment/Hydrologic Units
05080001150
05080001160
05080001170
05080001180
05080001190
N
W
E
S
Mad River
Peters Ditch
Macochee Creek
05080001150
Spring Run
Kings Creek
Kings Creek
Dugan Run
Dugan Run
Nettle Creek
Russell Creek
Nettle Creek
Mad River
05080001160
Storms Creek
Chapman Creek
Donnels Creek
Jackson Creek
Dugan Ditch
Buck Creek
Buck Creek
05080001170
C J Brown Reservoir
Clarence J Brown Reservoir
Beaver Creek
Mad River
Cedar Run
Moore Run
Chapman Creek
Donnels Creek
Miller Creek
05080001180
Springfield
Mud Run
Mill Creek
Warden Ditch
Mad River
05080001190
Clear Creek
Hebble Creek
Lilly Creek
0
3
6
12
18
24
Miles

The Mission of the Mad River Watershed Strategic Plan

The mission of the Mad River Watershed Strategic Plan is to protect and enhance the watershed of the Mad River and its tributaries of Logan and Champaign counties by establishing a coordinated effort of federal, state, and local government agencies, landowners, local community leaders, special interest groups and the general public and by utilizing sound practice and comprehensive education to establish effective programs.

Since most of the watershed is privately owned, the protection, restoration and enhancement of the Mad River is fundamentally connected to those who own land in the watershed. The management of resources of elemental importance to the Mad River Watershed Advisory Committee include: Farmland and agricultural resources, greenspace resources, historic and archeological resources, recreational resources, ground and surface water resources, and biodiversity.

Members of the Joint Board of Supervisors represented a diverse group of government officials and advocacy members. All identified community stakeholders agreed to serve on the Advisory Board and were active in the planning process.

Mad River Watershed Strategic Plan Joint Board of Supervisors

- Eric Johnson, Logan Soil and Water Conservation District, Joint Board Member
- Richard Mason, Champaign Soil and Water Conservation District, Joint Board Secretary
- Joe Ramsey, Logan Soil and Water Conservation District, Joint Board Member
- John Ritter, Clark Soil and Water Conservation District, Joint Board Member
- Michael Terry, Champaign Soil and Water Conservation District, Joint Board Chairman

Mad River Watershed Strategic Plan Advisory Board

- Tom Allen, Madmen
- Matt Berner, Clark County Landowner
- Tom Chiarvolotti, Zanesfield Rod and Gun Club
- Max Coates, Champaign County Commissioner
- Wes Dodds, LUC Regional Planning Commission
- Ed Everman, Ohio Department of Natural Resources
- Robert Gable, Ohio Department of Natural Resources
- Russ Gibson, Ohio Environmental Protection Agency
- Chad Hall, City of Urbana
- Kyle Hanigosky, LUC Regional Planning Committee
- Steve Hess, Champaign County Commissioners
- Tom Martin, Wittenberg University
- George McConkey, Clark County SWCD
- Nick McGuire, Champaign County Landowner
- Ron Nieman, Natural Resources Conservation Service
- Karen Richards, Champaign County SWCD
- Deb Roberts, Logan County SWCD
- Fereidou Shokouhi, Champaign County Engineer
- Chris Simpson, Clark County SWCD
- Bob Stoll, Natural Resources Conservation Service
- Hugh Trimble, Ohio Environmental Protection Agency
- Robert Vargo, Ohio Department of Natural Resources
- Alex Ward, Champaign County Landowner
- Harold Watters, Ohio State University Extension
- Tim Weaver, City of Springfield
- Jeff Webb, Champaign County Health District

The Mad River Watershed Strategic Plan and the development process thereof was presented for public commentary and input at eight advertised meetings. Dates of these public meetings were: 11/6/08, 12/10/08, 1/14/09, 2/24/09, 3/26/09, 5/27/09, 6/24/09, 7/21/09. All were held at the Champaign County SWCD conference center.

Previous Studies of the Mad River Watershed

USGS work in Upper Mad River Basin Basic Data Collection

The USGS operates stream gages throughout the state of Ohio. Data from these gages can be seen on: http://waterdata.usgs.gov/oh/nwis/sw

Ground-water data can be found on: http://waterdata.usgs.gov/oh/nwis/gw

All of associated data is published annually in the Ohio Water Science Center Annual Data Report on: http://oh.water.usgs.gov/AR/ar.html

Interpretive Studies

Results of interpretive studies are published by the USGS and by other agencies. A review of the Ohio Water Science Center bibliography reveals several relevant publications:

- Cross, W. P., and Feulner, A. J., 1963, "Anomalous streamflow-ground-water regimen in the Mad River Basin, near Springfield, Ohio: U. S. Geological Survey Professional Paper" 475-D, p. 198-201.
- Dumouchelle, D. H., 2001, "Ground-water levels and flow directions in glacial sediments and carbonate bedrock near Tremont City, Ohio, October – November 2000", U. S. Geological Survey Water-Resources Investigations Report 01-4224; Map Report *pdf (748 kb)
- Feulner, A .J., 1960, "The ground-water resources of Champaign County, Ohio: Unnumbered U. S. Geological Survey" Open-File Report.
- Feulner, A .J., and Hubble, J H., 1960, "Occurrence of strontium in the surface and ground waters of Champaign County, Ohio: Economic Geology", v. 55, no. 1, p. 176-186.
- Feulner, A J., 1961, "Cyclic-fluctuation methods for determining permeability as applied to valley train in the Mad River Valley in Champaign County, Ohio": Ohio: Journal of Science, v. 61, no. 2, p. 99-106.
- Koltun, G. F., 1995, "Determination of base-flow characteristics at selected sites on the Mad River", Ohio: U. S. Geological Survey Water-Resources Investigations: Report 95-4037, 12 p. Abstract
- Kunze, A. E., Sroka, B. N., 2004, "Effects of Highway Deicing Chemicals on Shallow Unconsolidated Aquifers in Ohio--Final Report: U.S. Geological Survey; Scientific Investigations Report 2004-5150", 188 p Online report
- Mayo, R.I., 1977, "Hydrologic analysis, Mad River at State Highway 41, Springfield, Ohio": U. S. Geological Survey Open-File Report 77-399, 25 p. Abstract
- Sheets, R. A. and Yost, W. P., 1994, "Hydrogeology of the Mad River Buried Valley Aquifer System in Southwestern Ohio", Ohio Journal of Science, vol. 94-5, pp. 138-146. Abstract

National Water-Quality Assessment (NAWQA) Study of the Great and Little Miami River Basin

Surface-water samples have been collected from Mad River at Saint Paris Pike from 1998 through 2004 as part of the Great and Little Miami River Basin National Water-Quality Assessment (NAWQA) Program. Surface-water samples were analyzed for nutrients, major ions, pesticides, e. coli bacteria, suspended organic carbon, dissolved organic carbon, sediment, dissolved oxygen, pH, specific conductance, and water temperature.

Twenty-three wells within the Mad River Basin were sampled in 1999 and 2000. The ground-water samples were analyzed for nutrients, major and trace elements, and pesticides. Bed sediment and fish tissue were collected from Mad River near Hwy 41 near Springfield in 1998. Samples were analyzed for trace elements and organic compounds. Results can be found in the following NAWQA publications:

- Debrewer, Linda M., Gary L. Rowe, David C. Reutter, Rhett C. Moore, Julie A. Hambrook, and Nancy T. Baker, 1999, "Environmental Setting and Effects on Water Quality in the Great and Little Miami River Basins, Ohio and Indiana", WRIR-99-4201, 98 p.

- Harrington, Stephanie, 1999, "Occurrence and Distribution of Fish Species in the Great and Little Miami River Basins, Ohio and Indiana, Pre-1900 to 1998", WRIR 99-4198, 15 p.
- Janosy, Stephanie D., 2002, "Trace Elements and Synthetic Organic Compounds in Streambed Sediment and Fish Tissue in the Great and Little Miami River Basins, Ohio and Indiana", 1990-98, WRIR 02-4305, 29 p.
- Reutter, David C., 2002, "Nitrogen and Phosphorus in Streams of the Great Miami River Basin, Ohio, 1998-00", WRIR 02-4297, 67 p.
- Rowe, Gary L. Jr., David C. Reutter, Donna L. Runkle, Julie A. Hambrook, Stephanie D. Janosy, and Lee H. Hwang, 2004, "Water Quality in the Great and Little Miami River Basins Ohio and Indiana, 1999-2001", U.S. Geological Survey Circular 1229, 50 p.

The USGS is currently working with the Ohio EPA to develop a water-quality model (HSPF) to determine concentrations and loads of nitrate and fecal coliform within streams of the Mad River Basin. This model will be used by the Ohio EPA to develop total maximum daily loads (TMDLs) for the Mad River Basin. More information is available by contacting Dave Reutter (email dreutter@usgs.gov, phone: (614) 430-7732). Dave is also the contact for NAWQA publications above.

Ohio Environmental Protection Agency (OEPA) Biological and Water Quality Study

The OEPA published the "Biological and Water Quality Study of the Mad River and Selected Tributaries 2003: Logan, Champaign, Clark, Miami, Greene and Montgomery Counties", June 22, 2005, OEPA Technical Report EAS/2005-5-5. This Technical Support Document (TSD) is in an inredisciplinary monitoring effort coordinated on a watershed scale.

Miami Conservancy District

The Miami Conservancy District is a river management agency operating in Southwest Ohio to control flooding of the Great Miami River and its

tributaries, including the Mad River. Relevant publications include:

- "Miami Conservancy District, 2004, Assessment of groundwater quality in the Mad River watershed in southwestern Ohio: Accessed November 6, 2006", at http://www.miamiconservancy.org/resources/Library/visitors/search.asp

- "Miami Conservancy District, 2007, On-line daily precipitation for the Mad River watershed collected at the wastewater treatment plant in Urbana, Ohio": http://www.miamiconservancy.org/Water_Data/OBPrecip/StationData.asp

Local School Water Monitoring Program

A water monitoring program was set up with five local schools districts in Logan and Champaign County. The school water monitoring teams monitor for 10 different physical, chemical, and biological parameters. Students and teachers participate in the macro-invertebrate monitoring program. Activities include collecting, identifying and documenting the invertebrate life forms that inhabit the river Students have collected many invertebrates including crayfish, water penny beetles, mayfly nymphs, aquatic worms and caddisfly larvae, hellgrammites, and many others.

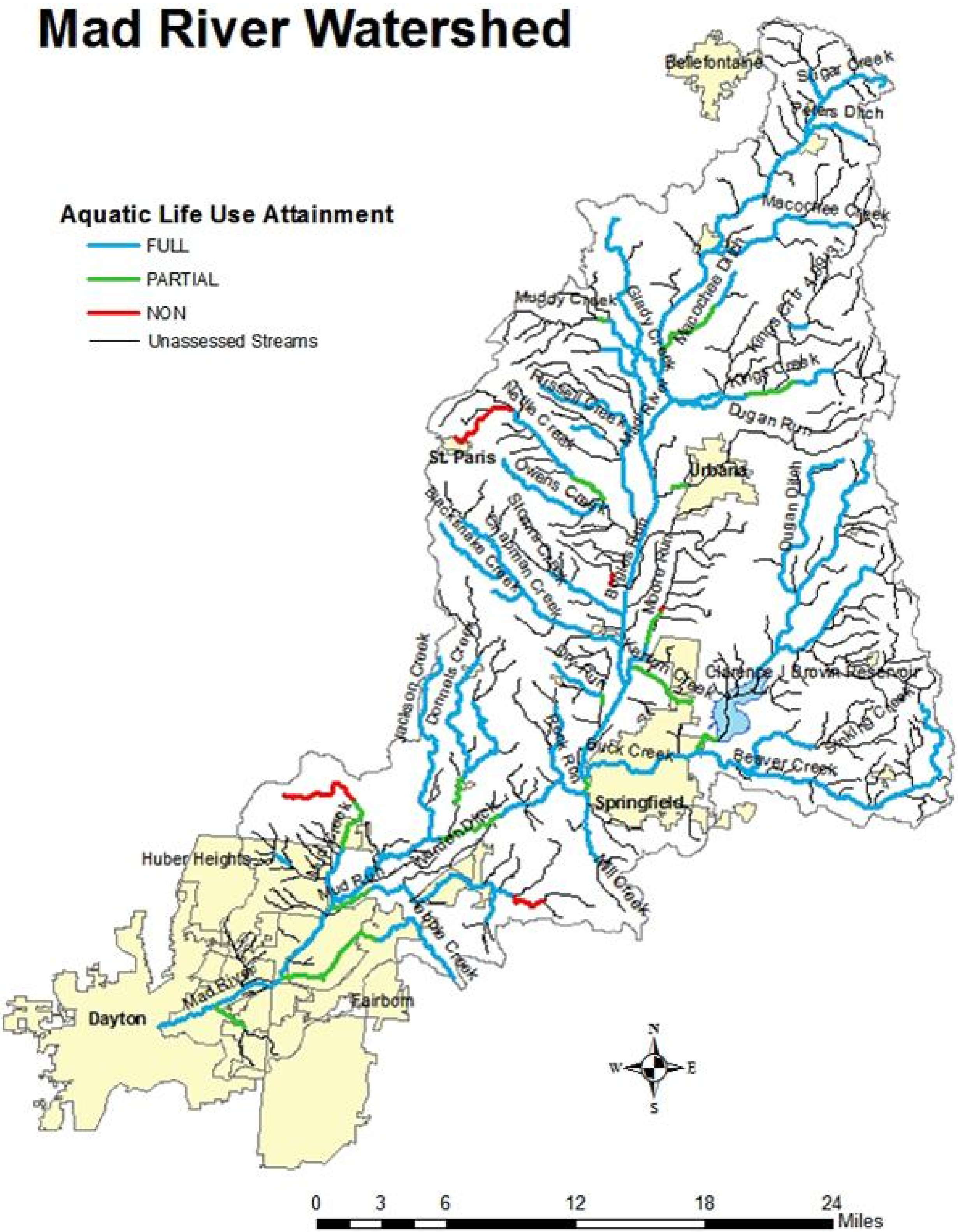

Mad River Watershed
Aquatic Life Use Attainment
FULL
PARTIAL
NON
Unassessed Streams
Bellefontaine
Sugar Creek
Peters Ditch
Macochee Creek
Muddy Creek
Glady Creek
Macochee Ditch
Kings Creek
Dugan Run
Russell Creek
Nettle Creek
St. Paris
Urbana
Owens Creek
Dugan Ditch
Storms Creek
Chapman Creek
Blacksnake Creek
Moore Run
Jackson Creek
Donnels Creek
Dry Run
Clarence J Brown Reservoir
Buck Creek
Beaver Creek
Springfield
Huber Heights
Mad River
Mill Creek
Fairborn
Dayton
N
E
S
W
0
3
6
12
18
24
Miles

Table 1: Mad River Aquatic Life Use Attainment Status (June-October, 2003)

River Mile	Attainment Status	IBI	Miwb	ICI/Narrative	QHEI	Drainage Area	Narrative Evaluation
61.3	Full	54	N/A	G	85	7.4	CWH
57.2	Full	40	N/A	50	62	20.4	CWH
53.2	Full	41	N/A	46	67.5	34	CWH
52.0	Full	41	N/A	44	72	36	CWH
51.1	Full	40	N/A	48	79	56	CWH
51.0	Full	41	N/A	48	72	56	CWH
49.1	Full	39[ns]	N/A	52	63	63	CWH
43.9	Full	42	N/A	54	68.5	91	CWH
41.6	Full	48	N/A	56	73	160	CWH
39.9	Full	41	N/A	50	79.5	162	CWH
38.4	Full	41	N/A	46	69	188	CWH
32.7	Full	36[ns]	N/A	46	76	264	CWH
29.6	Full	44	N/A	54	73.5	310	CWH
27.0	Full	46	N/A	G	79	323	CWH
25.5	Partial	35*	8.7	42	84.5	464	WWH
24.1	Full	38[ns]	9.0	G	75	490	WWH
17.5	Partial	34*	8.4[ns]	G	77.5	527	WWH
13.1	Full	41[ns]	9.2	G	83.5	554	WWH
11.5	Full	38[ns]	9	46	83	554	WWH
9.0	Full	40[ns]	9.2	G	81.5	617	WWH
6.0	Full	43	8.7	40	77.5	622	WWH
4.0	Full	52	10.1	42	76.5	642	WWH
1.6	Full	52	9.7	G	74	654	WWH
0.3	Full	50	9.5	G	61	657	WWH

Outdoor Recreation

Parks and Preserves

Logan County:

Ohio Caverns
2210 East State Route 245
West Liberty, Ohio 43357

Champaign County:

Cedar Bog Nature Preserve
980 Woodburn Road
Urbana, OH 43078

Davey Woods State Nature Preserve
Lonesome Road
St. Paris, OH 43072

Goshen Memorial Park
Parkview Road
Mechanicsburg, Ohio (Located just off of 29)

Kiser Lake State Park and Nature Preserve
Box 55
Rosewood, Ohio 43070

Meadow Lake Campground and Swim Resort
4739 Woodville Pike
Urbana 43078

Siegenthaler-Kaestner Esker State Nature
Couchman Road
(Northwest of Urbana, between Urbana and Rosewood)

Clark County:

Buck Creek State Park
1901 Buck Creek Lane
Springfield 45502

Davey Woods State Nature Preserve

C.J. Brown Dam and Reservoir
2630 Croft Road
Springfield , OH 45503

George Rogers Clark Park
936 S Tecumseh Rd
Springfield, OH 45506

Golf Courses

Logan County:

Briarwood Sporting Club
2001 TR 55
Bellefontaine, OH 43311

Champaign County:

Urbana Country Club
Architect: P.B. Dye
4761 E. US Hwy 36
Urbana, OH 43078

Indian Springs Golf Course
Architect: Jack Kidwell
11111 State Route 161
Mechanicsburg, OH 43044

Lakeland Golf Course
Architect: Barry Serafin
1772 Kiser Lake Road
St. Paris, OH 43072

Woodland Golf Course
Architect: Jack Kidwell
4900 Swisher Road
Cable, OH 43009

Clark County:

Forest Hills Pr 3
925 Upper Valley Pike
Springfield, OH 45504

National Golf Links
276 Clubhouse Dr
South Charleston, OH 45368

Northwood Hills Country Club
1536 Villa Rd
Springfield, OH 45503

Reid Park Golf Course
1325 S Bird Rd
Springfield, OH 45505

Rocky Lakes
3950 Springfield Xenia Rd
Springfield, OH 45506

Snyder Park Golf Course
1901 Snyder Park Road
Springfield, OH 45504

Springfield Country Club
2315 Signal Hill Rd
Springfield, OH 45504

Windy Knoll Golf Course
5500 Roscommon Dr
Springfield, OH 45503

Cycling Trails

Champaign and Clark Counties:

Simon Kenton Trail
www.simonkentonpathfinders.org
Trail Length: 14 miles through Urbana and to the Little Miami Scenic Trail
Activities:Biking, walking, running, in-line skating, Wheelchair Accessible
Trail Surface(s):Asphalt

Mad River Watershed Waypoints

The following list describes the watercraft recreational points located within the Mad River Watershed. The list was complied by Thomas P. Martin, Ph.D., FACSM Professor, Health, Fitness and Sport Department, Wittenberg University. During July of 2001, Dr. Martin, an Ohio Division of Watercraft Volunteer and professor at Wittenberg University in Springfield Ohio, collected information, canoed, and drove to bridges and access points along the Mad River in southwest Ohio. Tom and Mr. Tom Stafford took three days to canoe the 50.7 miles from West Liberty to the confluence with the Great Miami River in Dayton Ohio. Waypoints were revisited and their descriptions updated as of August 2006. For purposes of this watershed action plan, description of points 14.9 to 10.6 were eliminated as they do not affect the geographical outreach under consideration.

The purpose of this project was to correct and update the information on the Mad River contained in the Ohio Division of Watercraft pamphlet "Boating on Ohio's Streams: 2 Southwest Section," which was last published in 10/95. The project was expanded to include additional information on river miles, Global Positioning System (GPS) data, access points, and canoe liveries.

The river miles used in this report are those established by the Miami Conservancy District, 38 E. Monument Ave., Dayton Ohio 45402, (937) 223-1271. They were obtained from the following two maps: Dayton – Springfield #30588 and Springfield – Zanesfield #30589, dated 8-24-84. The river miles begin at the point where the Mad River enters the Great Miami River and proceed upstream. River miles for access points and dams are presented in red. River miles for other waypoints (e.g. bridges with no access, creeks entering river, etc.) are presented in blue.

The Global Positioning System (GPS) data in this report was collected with a Garmin GPS 12 Personal Navigator. This unit used WGS 84 map datum. Bridge measurements were taken in the middle of the upstream side of each bridge. Launch site measurements were taken at the launch site at river's edge. Ninety five percent of the site measurements were checked on a second or third day to insure accuracy.

51.2 West Liberty Park Access, entrance 0.5 mile east of US 68 on SR 245 (Baird St), enter park, go to west side of baseball fields, access river left where Onion Creek enters Mad River
GPS – N 40º 15.260 W 83º 44.861
Parking Lot
Picnicking
Restrooms
Water

51.1 SR 245 (Baird St) bridge in West Liberty, roadside access river left
GPS – N 40º 15.134 W 83º 44.963
Roadside Parking

50.7 US 68 bridge in West Liberty, roadside access, river right
GPS – N 40º 14.950 W 83º 45.309
Parking Lot

50.0 Pimtown Road bridge, roadside access
GPS – N 40º 14.610 W 83º 45.865
Parking Lot (small)

49.4 Old farm road bridge
GPS – N 40º 14.186 W 83º 45.601

48.9 Farm road bridge
GPS – N 40º 13.776 W 83º 45.762

48.8 ConRail railroad bridge
GPS – N 40º 13.736 W 83º 45.829

48.2 Sullivan Road/Mennonite Church Road (Upper Valley Pike), roadside access
GPS – N 40º 13.359 W 83º 46.391
Roadside Parking

47.9 Upper Valley Pike, roadside access
GPS – N 40º 13.185 W 83º 46.670
Roadside Parking

45.8 Lippincott Road Access, access river right
GPS – N 40º 11.683 W 83º 47.803
Roadside Parking
Ramp

45.2 Macochee Ditch enters river left
GPS – N 40º 11.206 W 83º 47.662

44.2 DAM (2 ft) - farm road through river, approach with caution, portage on either side
Also, old farm road bridge across river immediately downstream
GPS – N 40º 10.380 W 83º 47.743

Glady Creek enters river right just below dam

43.8 Old farm road bridge
GPS – N 40º 10.121 W 83º 47.726

43.4 Old farm road bridge
GPS - N 40º 09.760 W 83º 47.425

43.0 Kings Creek enters river left
GPS - N 40º 09.419 W 83º 47.216

42.8 SR 29/SR 296 bridge northwest of Urbana, roadside access
GPS – N 40º 09.310 W 83º 47.304
Roadside Parking

40.9 Birch Bark Canoe Livery Ltd. just N of Millerstown Road on River Road northwest of Urbana, access river right with permission.
Muddy Creek enters river right at canoe livery
GPS – N 40° 07.908   W 83° 48.587
Ramp
Canoe Rentals
Restrooms
Camping, primitive (fee)
Picnicking

40.7 Millerstown Road bridge and River Road northwest of Urbana, access river right
GPS – N 40° 07.810   W 83° 48.577
Roadside Parking

39.1 US 36 bridge Access, west of Urbana, river right
GPS - N 40° 06.441   W 83° 47.951
Parking Lot
Ramp

39.0 DAM (2-3 ft) – just downstream from US 36 bridge, portage river right, ramp to put in is 10 yards downstream of dam
GPS – N 40° 06.408   W 83° 47.956
Parking Lot
Ramp

38.6 Abandoned railroad (Penn Central) bridge
GPS – N 40° 06.062   W 83° 47.904

38.6 Dugan Run enters river left just below RR bridge
GPS – N 40° 06.039   W 83° 47.903

37.5 Old Troy Pike bridge, roadside access
GPS – N 40° 05.156   W 83° 48.074
Roadside Parking

36.4 Combined Nettle and Anderson Creeks enter river right
GPS – N 40° 04.214   W 83° 48.606

36.2 SR 55 bridge Access, southwest of Urbana, river right
GPS – N 40° 04.110   W 83° 48.624
Parking Lot
Ramp

35.1 Dallas Road bridge, roadside access
GPS – N 40° 03.172   W 83° 48.900
Roadside Parking

34.3 Stony Creek enters river right
GPS – N 40° 02.459   W 83° 49.213

34.2 Bogles Run enters river left

33.4 Cedar Run enters river left just upstream from County Line Road
GPS – N 40° 01.738   W 83° 49.271

33.4 County Line Road bridge (Champaign and Clark counties) north of Tremont City, roadside access river left
GPS – N 40° 01.694   W 83° 49.271
Roadside Parking

33.1 Storms Creek enters river right
GPS – N 40° 01.462   W 83° 49.393

31.9 Tremont City Road bridge east of Tremont City, roadside access river left
GPS – N 40° 00.443   W 83° 49.393
Roadside Parking

31.8 Chapman Creek enters river right
GPS – N 40° 00.356   W 83° 49.418

30.0 Moore Run enters river left
GPS – N 39° 58.741   W 83° 49.213

29.7 Eagle City Road bridge Access, east of Eagle City, river left
GPS – N 39° 58.588   W 83° 49.337
Parking Lot
Ramp

28.8 St. Paris Pike bridge south of Eagle City, steep access river left
GPS – N 39° 57.854   W 83° 49.894
Roadside Parking

27.9 Pondy Creek enters river right
GPS – N 39º 57.221 W 83º 50.404

27.4 Railroad bridge (ConRail)
GPS – N 39º 56.823 W 83º 50.739

27.1 SR 41 (First Street) bridge west of Springfield
GPS – N 39º 56.659 W 83º 50.949

27.0 Launch site below SR 41 bridge, river left. Take US 68 S entrance ramp off of SR 41 and immediately turn right onto Universal Dr. and then turn left onto W First St. and continue to parking area near river.
Forever Sports Mad River Canoe Rental is located ¼ mile E of river.
GPS – N 39º 56.620 W 83º 50.949
Parking Lot
Ramp
Canoe Rentals
Restrooms
Picnicking (with permission)
Water

26.3 Forest Lake Road bridge (emergency access)
GPS – N39º 56.038 W 83º 51.092

25.8 US 68 bridges and ConRail railroad bridge
GPS – N 39º 55.775 W 83º 51.281

25.6 US 40 bridges (3)
GPS – N 39º 55.547 W 83º 51.240

25.5 Buck Creek enters river left (Ohio Edison plant)
GPS – N 39º 55.465 W 83º 51.105

25.4 ConRail railroad bridge
GPS – N 39º 55.383 W 83º 51.063

24.7 Mill Creek enters river left
GPS - N 39º 54.925 W 83º 51.106

24.6 US 68 bridges
GPS – N 39º 54.917 W 83º 51.190

23.9 ConRail railroad bridge
GPS – N 39º 55.038 W 83º 51.993

23.5 Lower Valley Pike bridge (emergency access), Rock Run enters river right
GPS – N 39º 55.341 W 83º 52.163

23.1 Old Mill Road bridge
GPS - N 39º 55.138 W 83º 52.569

22.7 Lower Valley Pike bridge access river right
GPS – N 39º 54.927 W 83º 52.837
Roadside Parking

21.6 Erie-Lackawanna railroad bridge
GPS – N 39º 54.451 W 83º 53.761

20.8 Abandoned railroad bridge
GPS - N 39º 54.327 W 83º 54.585

20.1 Aaron's Canoe & Kayak Center (formerly Morgan's) on Old Lower Valley Pike east of Springfield, access river right with permission
GPS – N 39º 54.011 W 83º 55.198
Ramp
Canoe Rentals
Restrooms
Camping - fee
Picnicking - with permission
Water

19.0 Enon Road bridge, access river left
GPS – N 39º 53.506 W 83º 56.125
Roadside Parking

18.8 SR 4 (Business I 70) bridges
GPS - N 39º 53.515 W 83º 56.310

18.7 Minich Ditch enters river right
GPS - N 39º 53.560 W 83º 56.486

17.8 Donnels Creek enters river right
GPS - N 39º 53.228 W 83º 57.398

16.9 Snider Road bridge, emergency access only
GPS - N 39º 53.139 W 83º 57.992

16.5 Jackson Creek enters river right

SOCIAL RESOURCES INVENTORY

History of the Human Development in Logan, Champaign and Clark Counties

Overview

The Mad River flows from its source north of Zanesfield in Logan County through Logan, Champaign and Clark counties to its junction with the Great Miami River near Dayton. For thousands of years following the last glacial event, the Mad River flowed in its natural state through the outwash valley of sand and gravel deposits, winding back and forth like a snake. This sinuosity, in fact, may prove the source of the river's name; local folklore holds that the name "Mad" was given to the river due to its erratic path through the valley. This same significant meander has also proven a boon to the area's human inhabitants, creating large tracts of arable land, fertile hunting grounds and a ready source of potable water.

Archaeologists studying the river valley have discovered artifacts dating back as far as 8,000 BCE. These artifacts, including stone tools and weapons, are attributed to the Archaic Indians. The Adena, Hopewell and Fort Ancient Indians, who successively resided in the river valley from 800 BCE to 1300 CE, also left bountiful evidence of their presence. Since that time, the Mad River Valley has provided habitat to a host of settlers. Prior to European settlement, the most recent inhabitants of the watershed were the Miami and Shawnee Indians. Other tribes, such as Wyandot, Delaware, Ottawa, and Mingo, also inhabited the area. The Mad River Valley, with its herb gardens and mineral springs, was a favorite hunting ground and medicinal retreat.

In the early years of settlement by the pioneers, marshes and bogs were scattered throughout the watershed, which included savannah areas that were wet in the early part of the year, but were subject to summer droughts. These areas were natural filters that ensured high water quality. Early French and English hunters and trappers and other European explorers

and soldiers told stories of the great natural wealth and beauty of the area. The endless fresh clear water of the Mad River, fed by numerous springs, the rich fertile lands in the valleys of the Mad River, and the abundant forests of the smooth, hilly countryside attracted a continuous stream of settlers to the area.

Early European settlements were primitive, but after the Treaty of Greenville was signed in 1795, settlement of the area increased. The first major settlement was established at Cribb's Station, at the forks of the Mad River, in the spring of 1796. Several British and French Trading Posts were also located along the river.

Presently, the Mad River Watershed supports a richly diverse community of agriculture, industry and communities of various sizes. While the Mad River is deservedly recognized as the primary reason for this diversity, railroads also played their part.

The Mad River and Lake Erie Railroad was the first chartered railroad in the State of Ohio west of the Allegheny Mountains. On September 17, 1835 ground was broken at Sandusky for the line by General William Henry Harrison and Joseph Vance, Governor of Ohio. Finally by June 1849, 134 1/2 miles of track was completed with the road reaching the southern terminus in Springfield, Ohio. The cost of this project was $1,754,263. This project tied northern and southern Ohio together in an unprecedented fashion and opened the door to significant growth. That growth would signal a significant change in the course of the river.

The Engineering of the Mad River

A striking present-day feature of the Mad River is the lack of sinuosity in Champaign and Clark counties upstream of the Buck Creek confluence in Springfield. This is due to the channelization of the river that occurred around 1915 to reduce flooding and provide for agricultural drainage.

Native American tribes, such as the Shawnee, who depended on the river for food, travel, and drinking water, and even the early frontier settlers that brought a new way of life, including their practices of cleaning large tracts of land for agriculture, left the river virtually unchanged. Even up to as late as the late 19th Century, inhabitants respected the Mad River with its frequent flood events that left the land near the river swampy and bog-like, and unfit for many land uses, including agricultural practices. While some individuals did take minor action to control flooding of agricultural land, the river was, in great part, left alone. A catastrophe that struck the region in the early 20th Century put an end to this principally hands-off philosophy.

In April of 1913, three days of heavy rain pushed the Mad River out of its banks to flood the entire area. The resultant destruction incited local governments to demand action that would ensure that such a calamitous event would never reoccur. As a consequence, people in the area constructed levees and channelized the river and many of its tributaries (see Figure 5.) to control the flooding. These acts permanently altered the natural processes of the watershed, the aquatic environment, and the dynamics of stream flow. Further, dredging of the stream, while significantly contributing to a greater depth and width of the river, provided material to raise the level of the river's banks, creating a levee of sorts, which was stabilized with willow shoots, according to a 1922 blueprint (see Figure 6.). The modification of the Mad River created a straight, artificial ditch without pools or riffles. Dredging changed the dynamics of stream flow by

increasing the velocity and probably the amount of ground water discharge, especially in the Logan and Champaign County area. Today, the base flow rate produces highly oxygenated conditions. This groundwater influence makes the Mad River unique in this part of Ohio as a coldwater stream, the largest in the State of Ohio, which only rarely exceeds 70 degrees Fahrenheit during the summer.

Until the river was altered, bass, sunfish and several kinds of forage fish and minnows were the native species that made up the fish population in the aquatic environment. Today, remnants of those native populations, including some rare and endangered species like the Stickleback fish, Tongue-tied Chub, and Brook Lamprey inhabit the Mad River and its tributaries. However, due to its high oxygen content and cold temperatures, the Mad River provides ideal habitat for trout. The River received its first stocking of brook trout in the late-1800s and was stocked with rainbows beginning in 1884. The Division of Wildlife started its own program in 1931 and continued adding rainbows until 1984, when it turned to stocking only brown trout. The Division annually stocks 10,000 to 15,000 browns in the six- to eight-inch range. Trout have been stocked in the Mad River and its tributaries since the late 1800's, mainly on a put-and-take basis. Though conditions for trout are right, including an abundant food source, the Mad River's lack of aquatic habitat has limited it from becoming the fishery it could be.

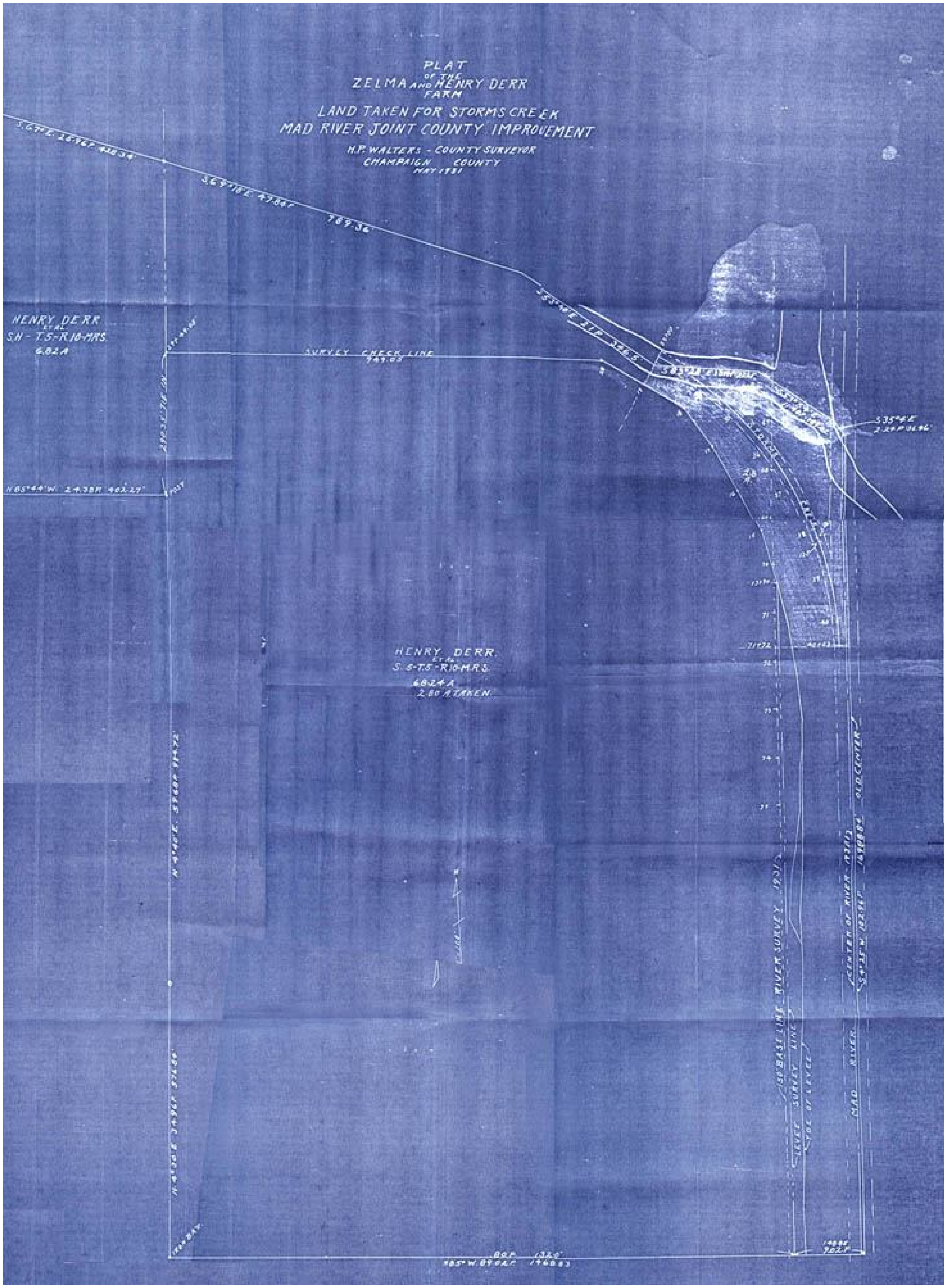


Figure 5. Blueprint of Storms Creek channelization project, May 1931. *(Source: Champaign County Enigineer)*

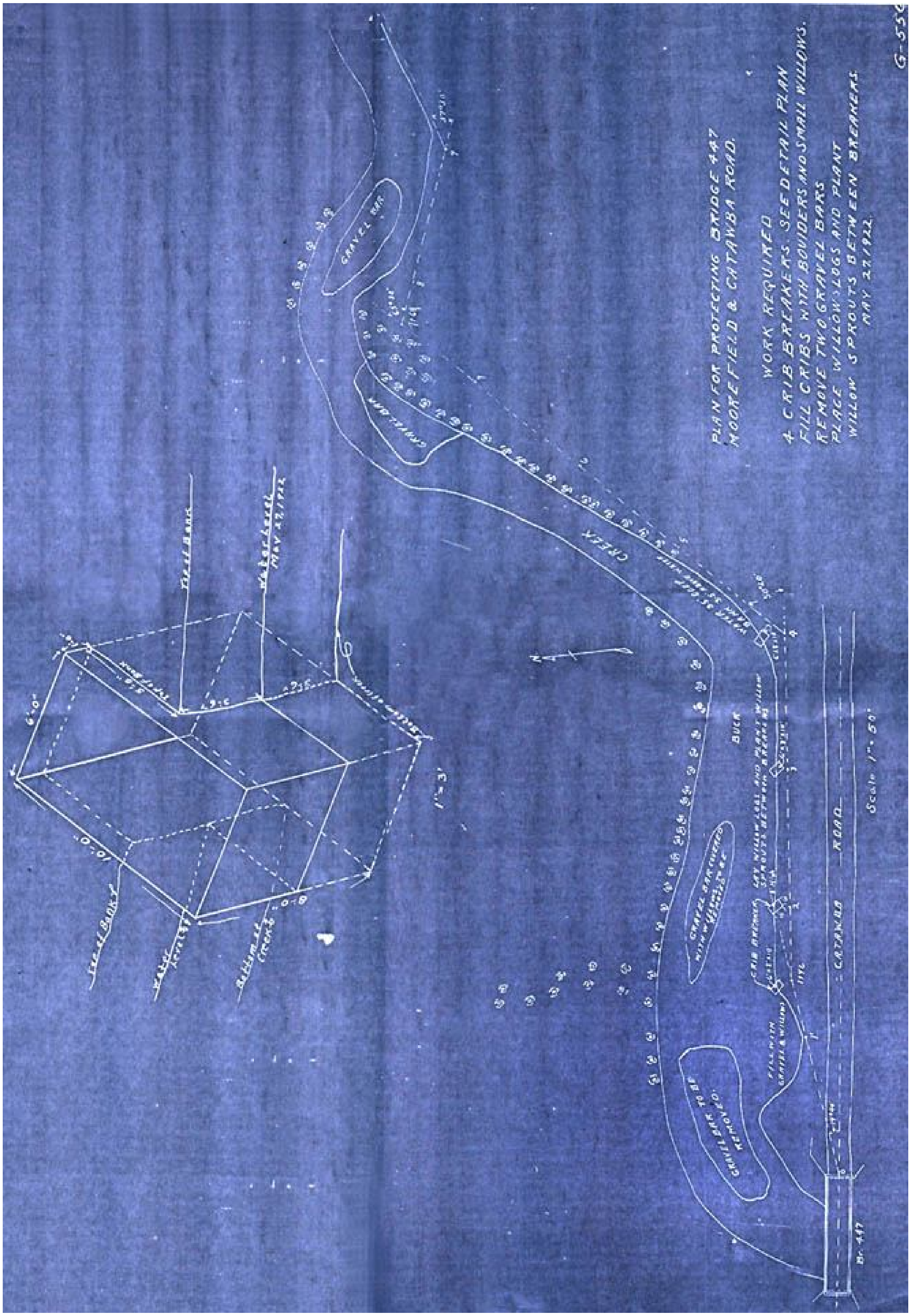


Figure 6. Blueprint of bank stabilization project at Moorefield and Catawba Roads in which willow logs and sprouts were placed between breakers, May 1922. *(Source: Champaign County Enigineer)*

Champaign and Logan Counties (Upper Mad River Watershed)

Champaign County became the 18th of 88 Ohio counties on March 1, 1805. It was carved from Greene and Franklin counties by Legislative action. It stretched north to Lake Erie from the Greene County Line with it seat being in Springfield. It was March 1, 1817 when Champaign County took on its present boundaries when both Logan and Clark counties were formed. An attempted population count in 1800 showed 100 pioneer settlers. Champaign County derives its name from the character of its surface, a French word meaning level or flat.

As with the other counties through which the Mad River runs, human habitation of the area dates back to Paleolithic times. The first inhabitants of the area are believed to have emigrated from Asia. Subsequent peoples included those cultures that comprised the Mound Builders. These peoples inhabited the area from 8,000 BCE until approximately 1,300 CE when more recent Native American tribes, such as the Shawnee, populated the area. Mounds in Champaign County have been found on Pretty Prairie close to Mechanicsburg and eight miles southeast of Urbana between the north and east fork of Buck Creek.

Generally considered Shawnee country, the Miami, Ottawa, Mingo, Delaware and Seneca Indians often passed through this area as well. Between 1600 and 1750 this area was the hunting grounds for parties from these Northern and Southern tribes. The Northern Tribes were victorious in taking possession of the land south to the Ohio River, however no permanent Indian settlements were established. It was at this time that Daniel Boone and Simon Butler Kenton came into this region exploring and setting up settlements. Simon Kenton is now buried in Urbana's Oakdale Cemetery.

The county was organized and recognized by the State of Ohio in 1805. The county’s first schoolhouse, located on what was then known as College Hill, was established in 1804. At the same time that the county was organized, its county seat, Urbana, was also established. The town’s founder, William Ward, named Urbana after the word urbanity.

Urbana grew slowly. In 1840, the town had just 1,070 residents. Twenty retail stores, four churches, two newspapers, two machine shops, an iron foundry, and a woolen mill existed in the community. With the completion of three railroads, which connected Urbana to the rest of the state more easily, the city’s population soared to 6,252 people in 1880. Five newspapers, eleven churches, four banks, and numerous manufacturing establishments existed in the town in 1886. The town contained three broom manufacturers, while other businesses produced stoves, carriages, leather, machinery, iron castings, and numerous other items. Urbana was also home to Urbana University, established in 1850 by the Swedenborgians. During the nineteenth century, frontiersman Simon Kenton and Ohio Governor Joseph Vance both resided in Urbana. They are also both buried in a local cemetery in the town. John Quincy Adams Ward, a famous sculptor, was born in Urbana, as was Brand Whitlock, a novelist, Progressive, and eventual mayor of Toledo, Ohio.

Urbana University was founded in 1850. The groundwork for the founding of the University was laid in part by John Chapman, better known as “Johnny Appleseed.” The University was the second institution in Ohio to admit women and the first nontraditional degree completion program of its kind in Ohio.

Champaign County sent 3,235 men to fight for the Union in the Civil War. 578 men lost their lives and it is to these men that the statue that stands today in Urbana's town square is dedicated. The statue, referred to as, The Man on the Monument, is a bronze cavalryman, facing the north with head bowed for his fallen comrades.

The state officially formed the boundaries of Logan County in 1817 and named it after General Benjamin Logan. Many of the towns founded by the early European settlers were on or near the sites of the old Indian villages because of their ideal location to water and good farm land. Some of these towns included Bellefontaine on the site of Blue Jacket's Town, West Liberty near where Moluntha's Town stood, Zanesfield at Zane's Town, and Lewistown at the same place as the village of the Shawnee chief Captain Lewis. European settlers first settled the southern, southeastern and central regions of Logan County.

Logan County has shown one of the longest records of human habitation in the state. Artifacts dating from the Archaic Indians (8000 B.C.-1000 B.C.) have been found in the county. Artifacts have also been found of the prehistoric Indians who followed the Archaic. These people included the Adena (800 B.C.-300 A.D.), the Hopewell (100 B.C.-600 A.D.) and the Fort Ancient (800 A.D.-1300 A.D.). These artifacts, such as spear points, arrow points, scrapers, knives and other tools show that people have lived, or at least hunted, in Logan County for 3000 years. They may have been here even earlier. Paleo-Indians (13,000 B.C.-1000 B.C.) may have also hunted on these lands. A tooth from a mastodon, an important animal to the Paleo Indians, was found near West Liberty.

The first known European settlements appeared in Logan County during the 1760s and 1770s. There were an estimated 12 to 15 Indian towns located within the county. Most of these villages belonged to the Shawnee Nation. The Shawnees were forced by the encroachment of whites to move from their villages in southern Ohio to newer sites in Clark and Greene counties, and later into Miami, Champaign, Auglaize and Logan counties. The Shawnees built several villages along the Mad River called the Mac-A-Cheek towns.

The Shawnee Indians were supplied by British forces at Ft. Detroit and encouraged to conduct raids against the squatter frontier settlements in Kentucky by the British agent Col. Alexander McKee from the British Blockhouse and Trading Post in McKeestown, located six miles north of present day West Liberty on U.S. 68. In retaliation for these raids, General George Rogers Clark commissioned Col. Benjamin Logan of the Kentucky Militia, to attack the Mac-o-Chee Valley villages of the Shawnee along the Mad River in the autumn of 1786 (Lord Dunmore's War). Colonel Logan led a force of U.S. soldiers and mounted Kentucky militia against the Mac-A-Cheek towns. Logan's forces burned the towns and food supplies. Despite their losses, the Shawnees eventually rebuilt many of their burnt towns on the Mad River and stayed there for another 20 to 25 years. After the burning of the villages, a settlement was begun known as Enoch's Mill, centering around the establishment of a gristmill on the Mad River. Pioneers from miles around brought their grain to the mill to be ground. Soon afterwards, a store arose just north of the mill. This store grew to house a hotel and the town post office. In 1817, West Liberty was founded as a Village and later incorporated in 1834.

During the War of 1812, General Hull, following Indian trails, left his camp in Urbana, (eight miles to the south of present day West Liberty), and cut his way through the forest, laying a corridor road, (known as "Hull's Trace"), northward over which his army could march on the way to the ill fated attempt to hold Ft. Detroit from the British. The army crossed the Mad River about twenty feet west of the present bridge on U.S. 68 on the southern edge of town. Part of this road became the Main Street of West Liberty.

Later, a defeat at Fallen Timbers led to the Treaty of Greenville. This treaty gave the U.S. two-thirds of what is now the State of Ohio. The treaty line ran through western and northern Logan County. The lands south of this line belonged to the Americans and the land north remained in Indian hands. However, most of the Indians in Logan County continued to live south of this line for another 10 to 15 years because very few whites moved into the area.

Isaac Zane and James McPherson first came to the area as captives of the Wyandot and Shawnees, respectively. Tarhe-the Crane, the principal chief of the Wyandot, adopted the nine-year-old Zane after Wyandot warriors captured the boy on a raid. Tarhe gave Zane his village on the Mad River and the Wyandot chief moved to Solomon's Town in the north central part of the county. The Mad River village then became known as Zane's Town. Isaac Zane became an important liaison between the Indians of Logan County and the Americans.

The villages of West Liberty, Zanesfield and Bellefontaine were officially laid out in the first two decades of the 19th Century. The rest of the county followed soon after, except in the northwest corner.

This area remained part of the Lewiston Reservation until 1832. Very few Americans moved there after the Indians left because the land was too swampy to farm or build homes. Settlement in this area did not begin in earnest until after the reservoir was built and much of the swampy land was covered with the lake. The population rose greatly after the state established Indian Lake State Park in 1898 and better roads and railroads reached the region from other places in the county starting in the early 20th century.

Logan County continued to grow throughout the 19th century. Most of the people in the county farmed the land. Those who did not farm worked in the region's flour mills, lumber mills, carriage shops, schools, banks and taverns. In the years leading up to and during the Civil War, Logan County played a crucial role in the emancipation of slaves with residents of the area providing over 100 stops along the Underground Railroad. By 1904, one in four people employed in Logan County worked for the railroad. A similar ratio worked for the boarding houses, restaurants, stores and other related businesses that served the railroad and its crews.

The more than 42,000 citizens of Logan County and the thousands of tourists who visit every year enjoy one of the most diverse counties in Ohio. Its water-carved caverns, beautiful hills and valleys, fertile farmland, man-made lake, various industries and rich history make Logan County a valuable asset to Ohio.

The topography and geology of Logan County is unique and spectacular. Campbell Hill, located two miles east of Bellefontaine, is the highest point in Ohio at 1,549 feet above sea level. Ohio Hi-Point Career Center, a joint-vocational school, is currently at this site. The 664th Aircraft Control and Warning Squadron was stationed on Campbell Hill in the 1950s and 1960s. The 664th A.C.&W. monitored the skies with a radar system set up on the peak of Ohio.

Logan County also contains some of Ohio's most magnificent caverns. Ohio Caverns, located three miles east of West Liberty, are the state's largest and most colorful caverns. Over time, underground rivers and dripping water formed many stalagmites and stalactites. Zane Caverns, near Zanesfield, offers other natural wonders. Rare cave pearl formations are found in these caverns. Zane Caverns are now owned by the Shawnee Remnant Band. The site includes the Shawnee & Woodland Native American Museum.

Two of Ohio's major rivers begin in Logan County. A small stream flows into the waters of Indian Lake from the east and exits the lake in the south. This small stream becomes the Great Miami River. The hills of central Logan County provide the waters for the Mad River. The Mad River flows into the Great Miami River in Dayton, Ohio. Both of these rivers and their valleys have been important to Ohio's inhabitants for housing, transportation, food and water.

Clark County
(Lower Mad River Watershed)

The history and people of Clark County is rich and diverse, populated with individuals who were some of the most important and significant personalities of their time and cultures that were the most enigmatic.

From approximately 2 million years before present to 14,000 years before present, glaciers episodically covered western Ohio and what is now Clark County until after 14,000 BCE. As the glaciers receded, they left behind huge lakes, and mounds and ridges of gravel. It is believed that the area's first settlers, the Glacial Kame people, were immigrants from Asia who came to hunt big game, such as mastodon and mammoth. The Glacial Kame culture used the gravel ridges as burial mounds.

As Ohio warmed, the Mound Builders arrived. These peoples derived their name from their practice of burying their dead in mounds that they designed of earth. At one time, there were twelve such mounds around what is now Enon. The Mound Builders were comprised of several different cultures, including the Adena and the Hopewell, who absorbed the Adena culture in approximately 200 BCE. The Adena's mounds were large and extravagant in design. In contrast, the Hopewell's arranged smaller mounds in unique configurations. Unfortunately, because they were so small, most have been plowed under or desecrated and no longer exist.

It is most likely that Tecumseh, arguably the greatest of the Shawnee Indian chiefs, was born at Old Piqua along the Mad River in 1768. By 1811, Tecumseh and his brother, who came to be known as The Prophet, had established themselves as a significant threat to European settlers expanding west. Although driven from Ohio by the westward expansion of whites, Tecumseh and his brother established Prophet's Town in what was once Tippecanoe. Tecumseh was adopted by Chief Blackfish of the Chillicothe tribe after his father was killed. Tecumseh became chief of the Shawnee tribe in 1795 and lived in the area until 1798 when he moved to Indiana to establish Prophet's Town. He later moved to Canada to join British forces. He died at the age of 45, killed at the Battle of Thames near Detroit on October 5, 1813.

In 1782 General George Rogers Clark, for whom the county was named attacked a Shawnee army of 1,000 near Piqua. The Shawnee, in alliance with the British during the Revolutionary War, had made a practice of attacking European settlements and harassing individual settlers. Clark defeated the Shawnee at the battle of Piqua and the Shawnee stopped all activities against the Americans for the remainder of the Revolutionary War.

By 1790, European settlers were arriving in droves, with such notables as John Paul who settled on Honey Creek near present-day New Carlisle, and David Lowry and Jonathon Donnel, who settled the Mad River Valley in 1795. In 1799 Simon Kenton led twelve families to the confluence of the Mad River and Buck Creek. By the early 1800s, Kenton had established himself as an early industrialist, having established a grist mill, a saw mill and a carding mill.

In 1801, James Demint settled the lands and laid the seed for what would later become the City of Springfield. Springfield was officially laid out in 1803, the same year that the U.S. Congress accorded the Ohio Territories statehood. The City of Springfield was officially laid out in 1803, the same year that Ohio became a state. Clark County was created from parts of Champaign, Greene, and Madison Counties by an act of the Ohio Legislature on March 1, 1818. The county was named in honor of General George Rogers Clark of the Revolutionary War. Progress and settlement in the area became more rapid after the creation of Clark County.

The first census of Clark County, taken in 1820, showed a population of 610. Growth and progress stopped for a while with the failure of the Second Bank of the United States and the Panic of 1819. Springfield, the county seat, was incorporated in 1827.

In 1830, John Chapman, an itinerant agriculturalist and missionary, better known as Johnny Appleseed, visited relatives in the region. Chapman's success as a purveyor of apple trees and seeds ultimately led to a legendary status until the man who actually lived is readily confused with the inhabitants of tall tales, such as Paul Bunyan or Pecos Bill.

As was true of many counties in Ohio in the mid-1800s, Clark County suffered a cholera epidemic that left a good percentage of the population dead. In the 1850s, Anne Aston Warder organized the Underground Railroad and in 1864, the state's first labor union, Iron Molders #72, was organized in Clark County.

Presently, most of the land in Clark County is used for farming practices. This comes about in great part due to the engineering of the Mad River, which resulted in some of the state's most fertile farmland. The main enterprises are cash-grain farming, livestock production, and dairying.According to the Clark and Champaign County Farm Service Agencies, an average of 285 acres of rural land is converted for urban use each year in the Lower Mad River Watershed. The loss of prime farmland to other uses places agricultural pressures on marginal lands, which generally are more erodible, drought-stricken, less productive, and cannot be easily cultivated. Throughout most of the farmland in the county, a drainage system has been installed in areas consisting of inundated soils to improve crop production. Urban or built-up land makes up 12% of the county and is expanding at a moderate rate.

Administrative Boundaries

Counties:
Logan, Champaign, Clark

Cities:
Springfield (Clark Co.)
Urbana (Champaign Co.)

Logan County Villages:
Zanesfield
Valley Hi
West Liberty

Champaign County Villages:
Mechanicsburg
Mutual
St. Paris

Clark County Villages:
Catawba (Clark Co.)
Donnelsville (Clark Co.)
Enon (Clark Co.)
Lawrenceville (Clark Co.)
North Hampton (Clark Co.)
South Vienna (Clark Co.)
Tremont City (Clark Co.)

Townships:
Logan County
Jefferson
Liberty
Monroe
Perry
Union
Zane

Champaign County
Concord
Urbana
Harrison
Mad River
Jackson
Johnson
Salem
Wayne
Union

Clark County
Bethel
German
Harmony
Mad River
Moorefield
Pike
Pleasant
Springfield

Districts:
Logan County Soil & Water Conservation District
Champaign County Soil and Water Conservation District
Clark County Soil and Water Conservation District
Miami Conservancy District
National Trails Parks and Recreation District
Clark County Park District
Clark County Combined Health District
Clark County Waste Management District

School Districts:
Benjamin Logan
West Liberty Salem
Graham Local
Bellefontaine City Schools
Urbana City Schools
Mechanicsburg Schools
Clark-Shawnee Local Schools
Greenon Local Schools
Northeastern Local Schools
Northwestern Local Schools
Springfield City Schools

Demographics

According to the U.S. Census Bureau, 2007 estimate, the population of Logan County is 46,279 with a change of 0.6% from April 1, 2000 to July 1, 2007.

The population of Champaign County is 39,522, with a change of 1.6% from April 1, 2000 to July 1, 2007.

The population of Clark County is 140,477, with a change of -2.9% from April 1, 2000 to July 1, 2007.

Several villages are located within the watershed boundary, Valley Hi at a population of 240, Zanesfield at a population of 420, West Liberty with a population of 1813 and St. Paris at a population of 1998. The two cities located within the watershed, Urbana and Springfield, have populations of 11,621 and 62,844 respectively.

Zanesfield

Zanesfield is located at 40°20'18" North, 83°40'41" West (40.338242, -83.677990). According to the United States Census Bureau, the village has a total area of 0.3 km² (0.1 mi²). 0.3 km² (0.1 mi²) of it is land and none of the area is covered with water.

Demographics: As of the census of 2000, there were 220 people, 96 households, and 57 families residing in the village. The population density was 707.9/km² (1,867.6/mi²). There were 105 housing units at an average density of 337.8/km² (891.4/mi²). The racial makeup of the village was 99.09% White, 0.45% Native American, and 0.45% from two or more races.

There were 96 households out of which 29.2% had children under the age of 18 living with them, 49.0% were married couples living together, 6.3% had a female householder with no husband present, and 39.6% were non-families. 35.4% of all households were made up of individuals and 13.5% had someone living alone who was 65 years of age or older. The average household size was 2.29 and the average family size was 3.07.

In the village the population was spread out with 25.5% under the age of 18, 8.2% from 18 to 24, 30.0% from 25 to 44, 23.2% from 45 to 64, and 13.2% who were 65 years of age or older. The median age was 35 years. For every 100 females there were 93.0 males.

For every 100 females age 18 and over, there were 102.5 males. The median income for a household in the village was $41,667, and the median income for a family was $57,500. Males had a median income of $36,786 versus $23,500 for females. The per capita income for the village was $19,869. 0.9% of the population and 0.0% of families were below the poverty line. 0.0% of those under the age of 18 and 4.3% of those 65 and older were living below the poverty line.

West Liberty

West Liberty is a village located within Logan County. As of the 2000 census, the village had a total population of 1,813. West Liberty is located at 40°15'15" North, 83°45'27" West (40.254169, -83.757452). According to the United States Census Bureau, the village has a total area of 2.9 km² (1.1 mi²). 2.9 km² (1.1 mi²) of it is land and none of the area is covered with water. The Mad River is the major source of running water in the area.

Demographics: As of the censusGR2 of 2000, there were 1,813 people, 660 households, and 432 families residing in the village. The population density was 630.6/km² (1,637.7/mi²). There were 698 housing units at an average density of 242.8/km² (630.5/mi²). The racial makeup of the village was 98.46% White, 0.17% African American, 0.28% Native American, 0.28% Asian, 0.11% Pacific Islander, 0.00% from other races, and 0.72% from two or more races. 0.17% of the population were Hispanic or Latino of any race.

There were 660 households out of which 31.8% had children under the age of 18 living with them, 54.2% were married couples living together, 8.8% had a female householder with no husband present, and 34.4% were non-families. 31.4% of all households were made up of individuals and 13.2% had someone living alone who was 65 years of age or older. The average household size was 2.36 and the average family size was 2.98.

In the village the population was spread out with 23.2% under the age of 18, 6.4% from 18 to 24, 23.5% from 25 to 44, 19.3% from 45 to 64, and 27.6% who were 65 years of age or older. The median age was 43 years. For every 100 females there were 76.2 males. For every 100 females age 18 and over, there were 70.2 males.

The median income for a household in the village was $38,819, and the median income for a family was $51,193. Males had a median income of $35,000 versus $26,518 for females. The per capita income for the village was $19,083. 5.3% of the population and 4.9% of families were below the poverty line. 6.7% of those under the age of 18 and 5.0% of those 65 and older were living below the poverty line.

Water: The Village potable water supply is obtained from the Mad River Aquifer. This aquifer located in the glacial outwash deposits of the Mad River Valley is listed as the highest yielding single aquifer in Logan County (Ground Water Pollution Potential Report # 36, ODNR Div. of Water, July, 1995). The Village has three wells located in the West Liberty Community Park. These wells currently supply about 200,000 gallon per day with peak usage of 300,000 gallon per day.

Attractions: West Liberty is most notable for its location near the Ohio Caverns and the Piatt Castles. The area is rich in Shawnee history, and shares a part in the life stories of Benjamin Logan (who the county is named after), Blue Jacket and Simon Kenton. Besides the Historical attractions, West Liberty is also most visited for its Annual Fire Sale day of garage sales and the Labor Day Festival. The Labor Day Festival is marked by a weekend festival on the grounds of the Lion's park to the east of the town. Exhibits include hundreds of tractors, antique farm equipment, booths and activities for all ages. The Fire Sale takes place on the third Saturday of May in remembrance of a fire that destroyed much of the downtown area businesses. All over town households set up personal garage sales which are frequented by many town and area residents

Valley Hi

Valley Hi is located at 40°18'45" North, 83°40'46" West (40.312531, -83.679559) According to the United States Census Bureau, the village has a total area of 1.7 km² (0.7 mi²). 1.7 km² (0.7 mi²) of it is land and none of the area is covered with water.

Demographics: As of the census of 2000, there were 244 people, 97 households, and 65 families residing in the village. The population density was 142.7/km² (370.4/mi²). There were 113 housing units at an average density of 66.1/km² (171.5/mi²). The racial makeup of the village was 97.95% White, 0.00% African American, 0.41% Native American, 0.00% Asian, 0.41% Pacific Islander, 0.00% from other races, and 1.23% from two or more races. 0.82% of the population were Hispanic or Latino of any race.

There were 97 households out of which 39.2% had children under the age of 18 living with them, 50.5% were married couples living together, 10.3% had a female householder with no husband present, and 32.0% were non-families. 23.7% of all households were made up of individuals and 2.1% had someone living alone who was 65 years of age or older. The average household size was 2.52 and the average family size was 2.98.

In the village the population was spread out with 28.3% under the age of 18, 11.9% from 18 to 24, 37.3% from 25 to 44, 16.4% from 45 to 64, and 6.1% who were 65 years of age or older. The median age was 30 years. For every 100 females there were 106.8 males. For every 100 females age 18 and over, there were 118.8 males.

The median income for a household in the village was $43,125, and the median income for a family was $46,364. Males had a median income of $32,350 versus $26,250 for females. The per capita income for the village was $17,077. 4.7% of the population and 3.7% of families were below the poverty line. 4.1% of those under the age of 18 and 0.0% of those 65 and older were living below the poverty line.

St. Paris

St. Paris is a village located in Champaign County, Ohio. As of the 2000 census, the village had a total population of 1,998. St. Paris is located at 40°7'41" North, 83°57'36" West (40.128173, -83.959863). According to the United States Census Bureau, the village has a total area of 2.3 km² (0.9 mi²). 2.3 km² (0.9 mi²) of it is land and none of the area is covered with water.

Demographics: As of the census of 2000, there were 1,998 people, 781 households, and 556 families residing in the village. The population density was 886.7/km² (2,302.5/mi²). There were 809 housing units at an average density of 359.0/km² (932.3/mi²). The racial makeup of the village was 98.55% White, 0.10% African American, 0.60% Native American, 0.00% Asian, 0.00% Pacific Islander, 0.15% from other races, and 0.60% from two or more races. 0.65% of the population were Hispanic or Latino of any race.

There were 781 households out of which 38.0% had children under the age of 18 living with them, 55.8% were married couples living together, 11.4% had a female householder with no husband present, and 28.8% were non-families. 25.9% of all households were made up of individuals and 11.4% had someone living alone who was 65 years of age or older. The average household size was 2.56 and the average family size was 3.07.

In the village the population was spread out with 29.1% under the age of 18, 9.6% from 18 to 24, 29.6% from 25 to 44, 20.2% from 45 to 64, and 11.6% who were 65 years of age or older. The median age was 33 years. For every 100 females there were 87.1 males. For every 100 females age 18 and over, there were 82.8 males.

The median income for a household in the village was $39,917, and the median income for a family was $47,014. Males had a median income of $35,417 versus $22,326 for females. The per capita income for the village was $16,811. 8.8% of the population and 8.8% of families were below the poverty line. 10.8% of those under the age of 18 and 9.1% of those 65 and older were living below the poverty line.
Reference: Brown, Kathleen Kite (1975). "History of St. Paris (The Pony Wagon Town) St. Paris, Ohio": Kathleen Kite Brown

Urbana

Urbana is a city located in Champaign County, 47 miles (76 km) west of Columbus. Urbana was laid out in 1805, and for a time in 1812 was the headquarters of the Northwestern army. Urbana was named after a town in Virginia. It is the burial-place of the Indian fighter Simon Kenton. In 1900, 6,808 people lived in Urbana; in 1910, 7,739; and in 1940, 8,335. As of the 2000 census, the city had a total population of 11,613. It is the county seat of Champaign CountyGR6 and the home of Urbana University.

Urbana is located at 40°6'39" North, 83°45'5" West (40.110937, -83.751463). According to the United States Census Bureau, the city has a total area of 17.7 km² (6.8 mi²). 17.7 km² (6.8 mi²) of it is land and none of the area is covered with water.

Demographics: As of the census of 2000, there were 11,613 people, 4,859 households, and 2,998 families residing in the city. The population density was 657.4/km² (1,702.3/mi²). There were 5,210 housing units at an average density of 295.0/km² (763.7/mi²). The racial makeup of the city was 91.03% White, 5.95% African American, 0.34% Native American, 0.30% Asian, 0.03% Pacific Islander, 0.48% from other races, and 1.88% from two or more races. 1.08% of the population were Hispanic or Latino of any race. There were 4,859 households out of which 29.0% had children under the age of 18 living with them, 46.2% were married couples living together, 11.8% had a female householder with no husband present, and 38.3% were non-families. 33.4% of all households were made up of individuals and 13.1% had someone living alone who was 65 years of age or older. The average household size was 2.29 and the average family size was 2.92.

In the city the population was spread out with 23.7% under the age of 18, 9.8% from 18 to 24, 27.9% from 25 to 44, 22.4% from 45 to 64, and 16.2% who were 65 years of age or older. The median age was 37 years. For every 100 females there were 87.2 males. For every 100 females age 18 and over, there were 83.6 males.

The median income for a household in the city was $33,702, and the median income for a family was

$42,857. Males had a median income of $33,092 versus $26,817 for females. The per capita income for the city was $17,831. 10.9% of the population and 7.2% of families were below the poverty line. 16.3% of those under the age of 18 and 7.6% of those 65 and older were living below the poverty line.

Water: The City of Urbana obtains its potable water from the Mad River Buried Valley Aquifer. The Upper Mad River Watershed is listed as a TMDL, (Total Maximum Daily Loading) watershed and is Ohio's only natural cold water habitat. The Mad River watershed's geology allows for significant variation in the surface water base flow throughout the watershed.

The aquifer system has received federal designation as the sole source aquifer for the region and is known as The Mad River Buried Valley Aquifer. The cities current well fields are installed in thick glacial outwash sand and gravel deposits associated with the Mad River buried aquifer system. To meet current demands of approximately 3 MGD (million gallons per day), Peak Flows have been around 2.9 MGD and average 2.1 MGD, the City of Urbana, relies on two existing well fields: one in the Mad River valley along Old Troy Pike and one just south of Grimes Airport.

Springfield

Springfield is the county seat of Clark County. The city is home to Wittenberg University, one of the nation's top liberal art and science colleges.

As of the 2000 census, the city had a total population of 65,358, but in 2007, the population was down to 62,417. According to the US Census 2007 estimate, the Springfield, Ohio Metropolitan Statistical Area has a population of 140,477 residents. As of the census[3] of 2000, there were 26,254 households, and 16,224 families residing in the city. The population density was 2,908.6 people per square mile (1,123.0/km²). There were 29,309 housing units at an average density of 1,304.2/sq mi (503.6/km²). The racial makeup of the city was 78.04% White, 18.22% African American, 0.34% Native American, 0.70% Asian, 0.02% Pacific Islander, 0.54% from two or more races. Hispanic or Latino of any race were 1.18% of the population.

There are 26,254 households out of which 29.9% have children under the age of 18 living with them, 40.5% are married couples living together, 16.6% have a female householder with no husband present, and 38.2% are non-families. 32.2% of all households are made up of individuals and 13.5% have someone living alone who is 65 years of age or older. The average household size is 2.38 and the average family size is 2.99.

In the population is spread out with 25.6% under the age of 18, 11.5% from 18 to 24, 27.0% from 25 to 44, 20.7% from 45 to 64, and 15.2% who are 65 years of age or older. The median age is 34 years. For every 100 females there are 89.3 males. For every 100 females age 18 and over, there are 84.1 males.

The median income for a household in the city is $32,193, and the median income for a family is $39,890. Males have a median income of $32,027 versus $23,155 for females. The per capita income for the city is $16,660. 16.9% of the population and 13.5% of families are below the poverty line. Out of the total population, 23.9% of those under the age of 18 and 9.6% of those 65 and older are living below the poverty line.

Economics

Logan County

The 2002 annual average labor force estimates for Logan County were: total labor-23,416, employment-20,934, unemployment- 2482, and unemployment rate at 10.6%.

In 2002 the total employment for all industries in Logan County was 11,325 with Industrial Groups claiming the largest portion with 54.1%.
(US Census Bureau)

Champaign County

The 2004 annual average civilian labor force estimates for Champaign County were: total labor force- 20,167, employment-18,936, unemployment-1,320, and unemployment rate is 6.1.

In 2004 the total employment for all industries in Champaign County was 8,410, with the manufacturing industry claiming the largest portion with 41.7 percent. *(Ohio County Profiles)*

Clark County

The 2004 annual average civilian labor force estimates for Clark County were: total labor force-20,167, employment-18,936, unemployment-1,320, and unemployment rate is 6.1.

Agriculture and Economy

Agriculture is the predominant land use with row crop and pasture/hay accounting for 47.2% and 33.5%, respectively, of the total watershed area (University of Cincinnati, 2001). The present condition of the Mad River is the result of extensive channelization and levee construction as early as 1915 that facilitated row crop agriculture (Trautman 1981).

The agricultural tables on the following pages are from the 2006 Ohio Department of Agriculture Annual Report and Statistics. This information is presented on a county basis.

Logan

2006 Crops	Acres Harvested	Yield	Production	Rank
Corn for Grain, Bu	61,200	165.5	10,130,700	19
Soybeans, Bu	91,200	51.0	4,651,000	20
Wheat, Bu	10,100	60.7	613,400	32
Oats, Bu	-	-	-	-
All Hay, Ton	11,000	3.81	41,900	36
Tobacco, lb.	-	-	-	-
Proc. Tomatoes, Ton	-	-	-	-

Livestock	Number	Rank
All Cattle & Calves (1/01/07)	12,700	37
Milk Cows (1/01/07)	3,300	26
All Hogs & Pigs (12/01/06)	18,700	26
Stock Sheep (1/01/07)	2,000	16

Number of Farms = 1,030
Average Farm Size = 213 Acres
Total Land in Farms = 219,000 Acres
Commercial Grain Storage Capacity = 2,190,000 Bushels

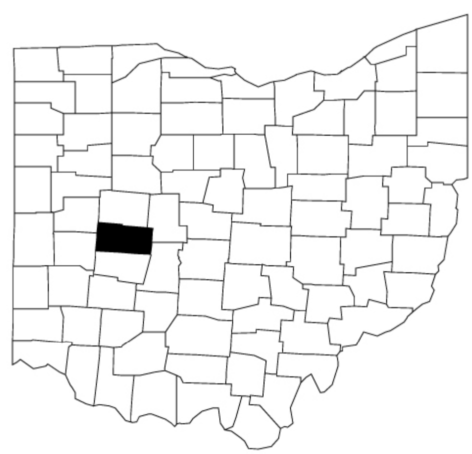
2005 Cash Receipts from Marketing of Farm Commodities

Corn	16,982,000	Dairy & Milk	10,033,000
Soybeans	24,769,000	Cattle & Calves	3,993,000
Wheat	2,318,000	Hogs & Pigs	4,597,000
Oats & Hay	1,544,000	Poultry & Other Livestock	863,000
Other Crops	2,579,000	Total	67,678,000
Average per farm	65,707		

2002 Census of Agriculture
Selected Machinery & Equipment on Place

	Number
Tractors	2,423
Combines	390
Forage Harvesters	4
Balers	353

Champaign



2006 Crops	Acres Harvested	Yield	Production	Rank
Corn for Grain, Bu	71,300	166.3	11,860,100	10
Soybeans, Bu	94,500	50.4	4,759,500	17
Wheat, Bu	6,400	71.4	457,200	39
Oats, Bu	-	-	-	-
All Hay, Ton	9,800	2.95	28,900	49
Tobacco, lb.	-	-	-	-
Proc. Tomatoes, Ton	-	-	-	-

Livestock	Number	Rank
All Cattle & Calves (1/01/07)	11,600	43
Milk Cows (1/01/07)	2,000	38
All Hogs & Pigs (12/01/06)	25,500	18
Stock Sheep (1/01/07)	-	-

Number of Farms = 920
Average Farm Size = 224 Acres
Total Land in Farms = 206,000 Acres
Commercial Grain Storage Capacity = 6,432,000 Bushels

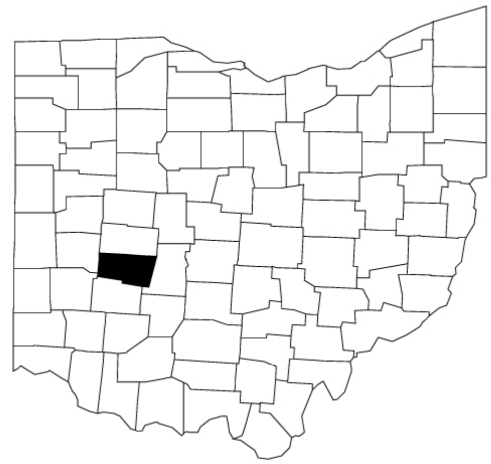
2005 Cash Receipts from Marketing of Farm Commodities

Corn	16,691,000	Dairy & Milk	4,076,000
Soybeans	19,956,000	Cattle & Calves	3,556,000
Wheat	1,206,000	Hogs & Pigs	5,610,000
Oats & Hay	1,057,000	Poultry & Other Livestock	615,000
Other Crops	5,079,000	Total	57,846,000
Average per farm	62,876		

2002 Census of Agriculture
Selected Machinery & Equipment on Place

	Number
Tractors	2,227
Combines	341
Forage Harvesters	5
Balers	414

Clark



2006 Crops	Acres Harvested	Yield	Production	Rank
Corn for Grain, Bu	56,900	174.7	9,941,600	20
Soybeans, Bu	72,900	53.1	3,870,100	29
Wheat, Bu	4,100	75.6	310,100	47
Oats, Bu	-	-	-	-
All Hay, Ton	6,500	3.54	23,000	58
Tobacco, lb.	-	-	-	-
Proc. Tomatoes, Ton	-	-	-	-

Livestock	Number	Rank
All Cattle & Calves (1/01/07)	18,000	25
Milk Cows (1/01/07)	2,400	35
All Hogs & Pigs (12/01/06)	12,200	35
Stock Sheep (1/01/07)	-	-

Number of Farms = 750
Average Farm Size = 220 Acres
Total Land in Farms = 165,000 Acres
Commercial Grain Storage Capacity = 4,104,000 Bushels

2005 Cash Receipts from Marketing of Farm Commodities

Corn	15,330,000	Dairy & Milk	4,013,000
Soybeans	17,451,000	Cattle & Calves	5,480,000
Wheat	861,000	Hogs & Pigs	2,987,000
Oats & Hay	1,049,000	Poultry & Other Livestock	585,000
Other Crops	34,744,000	Total	82,499,000
Average per farm	109,999		

2002 Census of Agriculture
Selected Machinery & Equipment on Place

	Number
Tractors	1,464
Combines	203
Forage Harvesters	7
Balers	184

Resource Extraction

Some water users in Ohio must register their withdrawals with the ODNR Division of Water. Through the Water Withdrawal Facility Registration Program, owners of facilities that could withdraw 100,000 gpd (70 gpm) or more must register those facilities. Information collected through this program includes withdrawal capacity, ground- or surface-water sources, location and type of water use, and location of discharge points. The program is for registration only, and not for allocation or permission. Registered withdrawers file annual reports of their water use. This information helps planners at ODNR determine the availability of water for projected needs and better manage and protect Ohio's water resources. Documenting water use also provides official records for individual uses.

Logan County

Ground water is the major water source for rural households in Logan County. Approximately 49 percent of all households obtain their water from private wells. Based on an estimated usage of 75 gallons per person per day, 1.5 million gallons per day (gpd) from private wells is used. Additional private water uses include industry (440,000 gpd) and livestock use (910,000 gpd), mostly from ground-water supplies. The remaining 51 percent of households use public-water supplies with ground water as the source, as identified in Table 1.

Logan County also has 10 non-transient non-community public water supplies. Non-transient non-community systems are small public supplies, such as some schools and industries, that serve more than 25 of the same people for six months of the year. In Logan County, 5,822 people are served by non-transient non-community systems, and the total usage is 402,000 gallons per day.

Source: Ohio State University Extension Factsheet AEX-480.46; Chuck Gamble, Kristina M. Boone, Larry C. Brown. ohioline.osu.edu/aex-fact/0480_46.html

Champaign County

Champaign County's highest yielding aquifer is an unconsolidated sand and gravel outwash deposit located adjacent to the Mad River. Sand and gravel aquifers are commonly the highest yielding aquifers in Ohio, and the same is true for Champaign County. This aquifer runs north to south through the center of the county, and is capable of yielding 500 to 1,000 gallons per minute (gpm) in wells properly constructed at 60 to 95-foot depths.

The carbonate bedrock aquifer, composed of limestone, is the primary ground-water source for the county but the second highest yielding aquifer. Yields of as much as 300 gpm may be obtained from depths greater than 225 feet. Farm and domestic supplies of 5 to 15 gpm are developed from thick glacial drift at depths up to 335 feet. An overview of the ground-water resources in the county is given in *Champaign County Ground-Water Resources*, AEX-490.11.

The yield of a well will vary considerably depending on the age and depth of the well, well construction, the diameter of the casing, pump capacity and age, and more importantly, properties of the geologic formation. Specific information on ground-water availability and wells can be obtained by contacting the ODNR Division of Water.

The county's largest public water system is the City Of Urbana, that uses two wells for its supply. All of the public water systems in Champaign County are supplied by ground water.

Ground water is the only water source for rural households in Champaign County. Approximately 50 percent of all households obtain their water from private wells. Based on an estimated usage of 75 gallons per person per day, 1,358,925 gallons per day (gpd) from private wells are used. Additional private water uses include industry (1,763,800 gpd) and livestock use (900,000 gpd), mostly from ground-water supplies. The remaining 50 percent of households use public-water supplies.

Source: Ohio State University Extension Factsheet AEX-480.11; Tammy L. Dobbels, John T. Sommers, Karen T. Ricker, Larry C. Brown. ohioline.osu.edu/aex-fact/0480_11.html

Clark County

The largest ground-water source in Clark County is the Mad River buried valley aquifer. This aquifer contains outwash sediments deposited by water rushing away from the melting glacial ice. Well-sorted sand and gravel deposits help make buried valley aquifers the most productive aquifers of the basin and some of the most productive in the world. Municipal water supplies are withdrawn from this aquifer for the cities of Springfield, New Carlisle, the village of Enon and the Clark County Water and Sewer District, which serves Northridge, Medway, Park Layne and parts of Enon. In the Mad River aquifer system, yields of 500 to 1000 gallons per minute (gpm) may be developed from properly constructed wells. Potential yields decrease to as low as 3 to 10 gpm in other sections of the county. An overview of the county's ground-water resources is given in *Clark County Ground-Water Resources*, AEX-490.12.

The county has 84 public-water systems. These systems serve communities ranging from small trailer courts to the city of Springfield. Ground water is the only source used by public water systems in the county. Further, nearly 23 percent of all households have a private well.

Source: Ohio State University Extension Factsheet AEX-480-12; Michael E. Haubner, Kristina M. Boone, Larry C. Brown. ohioline.osu.edu/aex-fact/0480_12.html

NATURAL RESOURCES INVENTORY

The Mad River Watershed is physically, culturally and geologically diverse. This mixture of properties and practices gives the region what ideally is an attraction for agriculturalists, outdoor enthusiasts and urbanites wishing to leave more populated areas of Ohio.

Because of this rich diversity, the Mad River Watershed offers an abundance of natural resources. However, historic channelization of the natural waterways and subsequent streamside habitat removal has eroded soils and impacted the quality of aquatic habitat that provides the streams with a balanced ecological environment. Conservation of the se documented natural resources will improve water quality throughout the region.

Physiography, Relief, and Drainage

Logan County is a part of the Indiana and Ohio Till Plan section of the Central Lowlands physiographic province. The relief varies because of the movements of the Wisconsin glacier. Parts of eight glacial end moraines and associated ground moraines occur in the county in a complex pattern. Areas along the western edge of the county and in the northwest, northeast, and southwest corners dominantly are parts of a nearly level and gently sloping ground moraine where most major differences in topography are along streams and on the Beehive moraine, which bisects the northwest corner. Blount, Pewamo, and Wetzel soils are dominant on the ground moraine in the western and northeastern areas, and Brookston and Crosby soils are dominant in the southwestern area.

Inward from these four areas, the landscape is nearly level to very steep because it is dissected by the Farmersville, Cable, Powell, and Broadway moraines. The moraines tend to arc around a “bedrock high” near Bellefontaine. Eldean and Miamian soils are

Winter Cover Crops established along Buck Creek (Champaign County)

dominant on the Farmersville moraine and Celina, Crosby, and Miamian soils on the Cable moraine.

The glacial till on the Powell moraine is somewhat finer textured than that on the Farmersville and Cable moraines. Blount and Glynwood soils are dominant on the Powell moraine. The nearly level to sloping Napanee, Paulding, and St. Clark soils are between the Powell and Broadway moraines.

The Upper Mad River Basin drains an area extending from the east-central part of the county to the south-central edge. This area is the beginning of a large glacial outwash plain that extends southward into Champaign County. This outwash plain has many high and low terraces occurring in association with flood plains. Here, Algiers, Eldean, Fox, Genesee, Homer, Lippincott, and Wallkill soils dominate.

The land surfaces of Clark County can be described in five general divisions: (1) nearly level flood plains and low alluvial terraces of the stream valleys; (2) slightly higher, nearly level to gently slopping benches or outwash deposits of the glacial valleys; (3) rolling to steep valley walls, produced either by stream dissection or constructive morainal deposits; (4) predominantly undulating divides of the general upland level (mainly on the till plains); and (5) recessional or end moraines and kames that protrude above the general upland level.

In general, the slope pattern is complex in the uplands and uniform and simple along the larger drainageways. Relief ranges from nearly level to steep, but the land surface is predominantly undulating. Nearly level areas occur principally on stream flood plains, outwash plains, valley trains, and stream terraces and in the uplands in depressions and on flats, particularly on the till plains. Hilly to steep or very steep areas occur most extensively along the valley walls of the major drainageways and on the moraines. These hilly to steep or very steep areas are in Pleasant and Moorefield Townships, in the northern and eastern parts of Springfield Township, and in the southeastern part of Mad River Township. Along the west wall of the Mad River Valley, between the Champaign County line and U.S. Highway 40 and for some distance westward, the topography is rough and steep and has apparently formed in part by erosion that has taken place since the last glaciation. Otherwise, the topography of the county is essentially the same as when the Late Wisonsinan ice sheet retreated.

The upland is about 1,000 to 1,100 feet above sea level. It slopes gently to the southwest. The highest elevation in the county, approximately 1,250 feet, is about 2 miles northeast of Catawba near the Champaign County line. The lowest elevation, 820 feet, is in the southwest corner where the Mad River crosses the county line.

The major trunk streams include the Beaver Creek-Buck Creek-Mad River system in the northeast, central, and western parts of the county. This drainage is for the most part natural, except for some channelization in some parts of the Mad River and for the C.J. Brown Reservoir on Buck Creek northeast of the City of Springfield.

Climate and Precipitation

Logan, Champaign and Clark counties are cold in winter and warm in summer. Winter precipitation, frequently snow, results in a good accumulation of soil moisture by spring and minimizes drought during summer on most soils. Normal annual precipitation is adequate for all crops that are suited to the temperature and length of growing season in the area.

Logan and Champaign Counties experience an average winter temperature of 29 degrees F, and the average daily minimum temperature is 21 degrees. In summer, the average temperature is 71 degrees, and the average daily maximum temperature is 82 degrees. During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

During the winter, the average temperature in Clark County is 27.8 degrees Fahrenheit (F) and the average daily minimum temperature is 19.0 degrees F. The lowest temperature on record, which occurred in Springfield on January 19, 1974, is –26.0 degrees F. During the summer, the average temperature is 71.0 degrees F and the average daily maximum temperature is 81.0 degrees F. The highest temperature, which occurred on August 21, 1983, is 100 degrees F.

Of the total annual precipitation in the Mad River Watershed, of approximately 21 inches, or 60% usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in spring through September is less than 16 inches. Thunderstorms occur on about 40 days each year, and most occur in summer.

Average seasonal snowfall is 22 inches. The greatest snow depth at any one time during the period of record was 11 inches. On the average, 13 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in mid-afternoon is about 60%. Humidity is higher at night, and the average at dawn is about 80%. The percentage of possible sunshine is 65 in summer and 40 in winter. The prevailing wind is from the south-southwest. Average wind speed is highly, 10 miles per hour in winter.

Tornadoes and severe thunderstorms occur occasionally. These storms are usually local and of short duration and cause damage in a variable pattern.

Agronomy and Soils

Eldean-Algiers: Nearly level to sloping, well drained and somewhat poorly drained soils formed in moderately coarse textured to moderately fine texture sediments on flood plains and outwash terraces.

This consists of nearly level to sloping soils on broad flats on outwash terraces and flood plains that have gentle rises and knolls. Differences in elevation range from about 0 to 20 feet. Slopes generally are short in the gently sloping and sloping areas.

Eldean soils are well drained, medium textured, and nearly level to sloping. They are on broad flats, knolls, and slight rises on outwash terraces. Permeability is moderate or moderately slow in the subsoil and rapid or very rapid in the substratum. Available water capacity is low or moderate. Organic-matter content is moderate. Algiers soils are somewhat poorly drained, medium textured, and nearly level. They occur as narrow strips along streams. Permeability is moderate. The seasonal high water table is near the surface. Available water capacity is high. Organic-matter content is moderate.

Eldean-Lippincott-Montgomery: Lippincott soils are very poorly drained, moderately fine textured, and nearly level. They occur as broad, low lying areas on outwash plains. Permeability is moderate in the subsoil and rapid in the substratum. The seasonal high water table is near the surface. Organic matter content is high. Available water capacity is low or moderate.

Ag – Algiers silt loam: This deep, nearly level, somewhat poorly drained soil occurs as narrow strips along streams. It is frequently flooded for very brief period in winter and spring. Slope is 0 to 2%. Most areas are long and narrow and range from 30 to 70 acres in size.

Typically, this soil has two layers of recent alluvium over a buried soil. The surface layer is dark brown, firm silt loam about 10 inches thick. The next layer is dark brown, firm silty clay loam about 8 inches thick. The buried soil has a block, firm silty clay loam surface layer about 12 inches thick and a dark gray, mottled, firm silty clay loam subsoil about 12 inches thick. The substratum to a depth of about 60 inches is dark gray, firm silty clay loam.

Included with this soil are small areas of Shoals and Sloan soils on flood plains and Brookston and Pewamo soils on till plains. Also included are areas where the surface layer and subsoil are mildly alkaline or moderately alkaline.

The seasonal high water table is near the surface in winter and in spring and other extended wet period. Permeability is moderate. Runoff is very low. The root zone is deep and has a high available water capacity. It is slightly acid or neutral in the upper part and neutral to moderately alkaline in the lower part. Organic-matter content is moderate. The surface layer can be easily tilled throughout a fairly wide range in moisture content.

Most of the acreage is used for pasture. A few areas are cultivated. This soil has good potential for cultivated crops and woodland and poor potential for building site development and sanitary facilities.

The major limitations of this soil for farming are seasonal wetness and flooding, which delay planting and limit the choice of crops. Undrained areas can be used for hay and pasture, but maintaining tilth and desirable forage stands is difficult unless the soil is drained and grazing is controlled. Drained areas are suited to cultivated crops. Open ditches and subsurface drains are commonly used to lower the water table. Cover crops, incorporation of crop residue into the soil, crop rotations, and tillage at proper moisture levels improve tilth and increase the organic-matter content.

Undrained areas of this soil are suited to woodland and vegetation grown as habitat for wildlife. Species that are tolerant of some wetness should be selected for reforestation. Plant competition can be reduced by spraying, mowing, and disking. The use of harvesting equipment is restricted during wet periods.

The seasonal high water table and the flooding severely limit this soil as a site for buildings and sanitary facilities. The soil has potential for such recreation areas as hiking trails that are used during the drier part of the year. Diking to control flooding is difficult. Local roads can be improved by hauling in fill and suitable base material from other areas.

Capability subclass IIw; woodland suitability subclass 2w.

EmA - Eldean silt loam, 0 to 2% slopes: This deep, nearly level, well drained soil is on broad flats on outwash plains and valley trains. Most areas are irregularly shaped and range from 5o to 100 acres in size.

Typically, the surface layer is dark brown, friable silt loan about 7 inches thick. The subsoil is about 27 inches thick. The upper part is dark brown and brown firm clay, clay loam, and gravelly sandy clay; the lower part is brown, firm gravelly clay loam and loose gravelly coarse sandy loam. The substratum to a depth of about 60 inches is brown, calcareous, loose gravelly sand.

Included with this soil are small areas of Ockley soils on terraces and Miamian soils near breaks to the uplands. Permeability is moderate or moderately slow in the subsoil and rapid or very rapid in the substratum. Runoff is slow. The root zone is mainly moderately deep to sand and gravel and has a low or moderate available water capacity. Organic-matter content is moderate. The surface layer can be easily tilled throughout a fairly wide range in moisture content. The upper part of the subsoil is medium acid to neutral, and the lower part is neutral or mildly alkaline.

Most of the acreage is farmed. This soil has good potential for cultivated crops, hay, pasture, trees, and building site development.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is the main limitation on cropland. Crops can be seeded early because the soil warms and dries early in spring. Row crops can be grown year after year if a high level of management is applied. The soil is well suited to irrigation. Returning crop residue to the soil or regularly adding other organic material and minimizing tillage reduce crusting and increase the rate of water intake.

Compaction and poor tilth can result if pasture is over-grazed or grazed when the soil is soft and sticky because it is wet. Pasture rotation and deferment of grazing during wet period keep the pasture and the soil in good condition.

Even though only a small acreage is wooded, this soil is well suited to woodland. Plant competition can be reduced by spraying, mowing, or disking.

Although low strength and the shrink-wall potential are moderate limitations, this soil is well suited to building site development. The low strength can be overcome by extending the building foundation to the substratum. Local roads can be improved by replacing the subsoil with suitable base materials. If sanitary facilities are installed on this soil, the effluent can pollute underground water supplies. Laws are adversely affected by droughtiness during dry period. This soil is a good source of sand and gravel.

FIA – Fox loam, 0 to 2% slopes: This deep, nearly level, well drained soil is on slight rises on outwash plains. Most areas are round or long and narrow and are 15 to 60 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is about 28 inches thick. The upper part is dark yellowish brown or dark brown, firm sandy clay loam, and gravelly clay loam; the lower part is yellowish brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is brown, calcareous, loose gravelly sand.

Permeability is moderate in the subsoil and very rapid in the substratum. Runoff is slow. The root zone is mainly moderately deep and has a low or moderate available water capacity. Organic-matter content is moderate. The surface layer can be easily tilled throughout a fairly wide range in moisture content. The upper part of the subsoil is slightly acid or neutral, and the lower part is neutral or mildly alkaline.

Most of the acreage is farmed. This soil has good potential for cultivated crops, hay, pasture, trees, building site development and recreation uses.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The major management concern is conserving moisture, but maintaining a high level of fertility and a sufficient amount of crop residue is a related concern. Because of the limited amount of water available to plants, the soil is better suited to early maturing crops than to crops that mature late in summer. It is suited to irrigation. Minimizing tillage, returning crop residue to the soil, and including sod crops in the cropping sequence reduce crusting and increase the rate of water intake.

This soil is well suited to grazing early in spring. Overgrazing or grazing during wet periods when the soil is soft and sticky cause's compaction and poor tilth. Pasture rotation and deferment of grazing during wet periods keep the pasture and the soil in good condition.

This soil is suited to woodland, but only a small acreage supports trees. Plant competition can be reduced by spraying, mowing, and disking.

Even though the shrink-swell potential and the low strength are moderate limitations, this soil is suited to building site development. These limitations can be partly overcome by extending foundations to the underlying sand and gravel and by backfilling with suitable material. Local roads can be improved by providing suitable base materials. The possible contamination of ground water limits the use of this soil as a site for some sanitary facilities. Laws are adversely affected by droughtiness during extended dry period. The soil is well suited to recreation uses. It is a good source of sand and gravel.

Capability subclass IIs; woodland suitability subclass 2o.

Gn - Genesee silt loam: This deep, nearly level, well drained soil is in the highest position on flood plains. It is commonly flooded for brief periods in fall, winter, and spring. Most areas are long and narrow and range from 20 to 100 acres or more in size. Slope is 0 to 2%.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The substratum to a depth of about 60 inches is brown and dark yellowish brown, friable silt loam.

Included with this soil are narrow strips of Eel soils at a slightly lower elevation on the flood plains.

Permeability is moderate. Runoff is slow. The root zone is deep and has a high available water capacity. Organic-matter content is moderate. The surface layer can be easily tilled throughout a fairly wide range in moisture content. Reaction is mildly alkaline or moderately alkaline throughout the soil.

This soil is used for cropland, pasture, and woodland. It has good potential for cropland, pasture, and woodland and poor potential for building site development and sanitary facilities.

Flooding is the main hazard if this soil is cropped. Although the choice of crops is limited, the soil is well suited to corn and soybeans. Such a crop as winter wheat is severely damaged by floodwaters in winter and early in spring. In most years, row crops can be planed and harvested during period when flooding does not occur. Cover crops and crop residue maintain the organic-matter content, reduce crusting, and protect the surface during floods.

This soil is suited to grasses and legumes for pasture. Overgrazing or grazing during wet periods, when the soil is soft and sticky, cause compaction and poor tilth. Pasture rotation and deferment of grazing during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees and other vegetation grown as habitat for wildlife. Tree seedlings grow well if competing vegetation is controlled or removed by spraying, mowing, or disking.

Flooding seriously limits this soil as a site for most buildings and sanitary facilities. The soil has potential for recreation uses, such as picnic areas, hiking trails, and golf fairways. Diking to control flooding is difficult. Filling elevates roads above normal flood levels.

Capability subclass IIw; woodland suitability subclass 1o.

HoA – Homer silt loam, 0 to 2% slopes: This deep, nearly level, somewhat poorly drained soil occurs as irregularly shaped areas on low rises and long and narrow strips on terraces and outwash plains. Most areas are 5 to 20 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 11 inches thick. The subsoil is about 28 inches thick. The upper part is brown and yellowish brown, mottled, friable silt loam and firm silty clay loam and clay loam; the lower part is gray, dark gray, and pale brown, firm clay, gravelly clay loam, and gravelly loam. The lower part is mottled to a depth of about 33 inches. The substratum to a depth of about 60 inches and is brown and light brownish gray, loose gravelly sand.

The seasonal high water table is between depths of 1 foot and 3 feet in winter, early in spring, and in other extended wet periods. Permeability is moderate in the subsoil and very rapid in the substratum. Runoff is slow. The root zone is mainly moderately deep to sand and gravel and has a moderate available water capacity. Organic-matter content is moderate. The surface layer can be easily tilled throughout a fairly wide range in moisture content. The upper part of the subsoil is slightly acid or neutral, and the lower part is mildly alkaline.

Most of the acreage is farmed. This soil has good potential for cultivated crops, hay, pasture, and trees. The potential for building site development and sanitary facilities is poor.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Seasonal wetness is the main limitation. Unless drained, the soil warms slowly in spring and dries late in spring. Most cropped areas have been drained. A subsurface drainage system is the most common drainage method. Returning crop residue to the soil or adding other organic material maintains good tilth and reduces surface crusting. The soil should be tille4d and corps harvested at optimum moisture level sand with the kind of equipment that minimizes compaction.

Overgrazing or grazing during wet periods, when the soil is soft and sticky, causes compaction and poor tilth. Pasture rotation and restricted grazing during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees and other vegetation grown as habitat for wildlife. Species that can tolerate some wetness should be selected for new plantings. Seedlings grow well if competing vegetation is controlled by spraying, mowing, or disking.

Seasonal wetness and seepage severely limit the use of this soil as a site for buildings and most sanitary facilities. The wetness also limits recreation uses. The seepage can result in pollution of underground water supplies. Sanitary facilities should be connected to control sewers if possible. Drainage ditches and subsurface drains can lower the water table in areas where good outlets are available. Landscaping is needed on building sites to keep surface water away from foundations. Foundation drains and protective exterior wall coatings help to keep basements dry. Excavation is limited during winter and spring because the water table is high and banks can slough.

Capability subclass IIw; woodland suitability subclass 3o.

Lp – Lippincott silty clay loam: This deep, nearly level, very poorly drained soil is in low lying areas on outwash plains, terraces, and valley trains. In the lower parts of depressions, it can be ponded by runoff from adjacent higher lying soils. Slope is 0 to 2%. Most areas are long and narrow and range from 10 to 200 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 12 inches thick. The subsoil is about 15 inches thick. The upper part is dark gray and gray, mottled, firm clay; the lower part is gray, very friable, very gravelly loam. The substratum to a depth of about 60 inches is light brownish gray, loose very gravelly sand.

Included with this soil are small areas of Homer soils on slight rises. The seasonal high water table is at the surface in fall and winter and in spring and other extended wet periods. Permeability is moderate in the subsoil and rapid in the substratum.

Runoff is very slow or ponded. The root zone is deep and has a low or moderate available water capacity. Tilth is fair to good. Organic-matter content is high. The upper part of the subsoil is slightly acid or neutral, and the lower part is mildly alkaline.

Most of the acreage is farmed. This soil has good potential for cultivated crops, hay, pasture, and trees. The potential for building site development, sanitary facilities, and recreation uses is poor.
If artificially drained, this soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Row crops can be grown year after year if optimum management is applied. Most cropped areas have been drained. Seasonal wetness is the main limitation on cropland. Subsurface drains and open ditches provide drainage. Timely tillage is important because the soil puddles and clods if it is worked during wet periods, when it is soft and sticky. Returning crop residue to the soil and planting cover crops reduce crusting, improve tilth, and increase the rate of water infiltration.

If this soil is used for pasture, controlled grazing is needed, even in drained areas. If the pasture is grazed during wet periods, when the soil is soft and sticky, the surface layer compacts easily. The compaction results in poor tilth. Pasture rotation and restricted grazing during wet periods keep the pasture and the soil in good condition.
This soil is suited to trees that are tolerant o wetness. A few areas support native hardwoods. Tree seedlings can survive and grow well only if competing vegetation is controlled. Competing vegetation can be controlled or removed by spraying, mowing, or disking. Wetness severely limits the use of planting and harvesting equipment in winter and spring.

Seasonal wetness, ponding, and seepage severely limit the use of this soil as a site for buildings and most sanitary facilities. The wetness also limits recreation uses. Ditches are somewhat effective in controlling the water if outlets are available. Excavations are limited in winter and spring because the water table is high and banks can slough. As a result of seepage, the effluent from sanitary facilities can pollute underground water supplies. Sanitary facilities should be connected to commercial sewers if possible.

Providing artificial drainage and suitable base material improves local roads.

Capability subclass IIw; woodland suitability subclass 2w.

Wa-Wallkill silt loam: This deep, nearly level, very poorly drained soil is in depressions on terraces and uplands. It is subject to frequent flooding. Most areas are circular and range from 5 to 30 acres in size. Slope is 0 to 2%.

Typically, the surface layer is dark, grayish brown, friable silt loam about 8 inches thick.

The subsoil is gray, friable silt loam about 8 inches thick. The substratum is gray, mottled friable silt loam about 4 inches thick. Below this to a depth of about 60 inches is black, friable muck. Included with this soil are small areas of Carlisle and Muskego soils. These soils are near the center of the mapped areas.

Water is near the surface and ponds for long periods. Runoff is very slow. Permeability is moderate in the mineral soil and moderately rapid or rapid in the organic deposit. The root zone is deep and has a very high available water capacity. Organic-matter content is moderate. Tilth is good. The subsoil is commonly mildly alkaline.

Most of the acreage is woodland or cropland. This soil has good potential for cultivated crops, hay, and pasture. The potential for sanitary facilities, building site development, and recreation uses is poor.

If artificially drained, this soil is well suited to corn and soybeans and to grasses for hay and pasture.

Seasonal wetness is the main limitation on cropland. Subsurface drains and open ditches commonly provide drainage. Draining some areas is difficult because adequate outlets are not available. Subsidence or shrinkage occurs in some areas as a result of oxidation of the organic material after the soil is drained. Returning crop residue to the soil or regularly adding other organic material improves fertility and reduces crusting.

Overgrazing pasture or grazing during wet periods when the soil is soft and sticky, causes surface compaction and poor tilth. Pasture rotation and deferment of grazing during wet periods keep the pasture and the soil in good condition.

This soil is suited to the trees that are tolerant of wetness. Competing vegetation around tree seedlings can be controlled by spraying, mowing, and disking. Planting and harvesting are limited by seasonal wetness.

Frequent flooding, wetness, seepage, and low strength seriously limit the use of this soil as a site for most sanitary facilities and buildings. Undrained areas provide good habitat for wetland wildlife.

Capability subclass IIw; woodland

Current Stream Biological Diversity and Water Quality

Surface Water and Sediment Quality

According to the Biological and Water Quality Study of the Mad River Basin, 2003 (Ohio EPA TSD), water chemistry was generally good throughout the entire Mad River watershed. Water chemistry results from the TSD made apparent the interaction between the study area's groundwater and surface water. Cool water temperature in the Upper Mad River watershed and high nitrate levels were both associated with groundwater recharge of surface waters.

Organic compound detection was attributed to agricultural land use. Water samples taken after spring application of herbicides contained higher herbicide levels than in late summer. Although water chemistry were not severely impacted, the TSD promotes the need for management practices to minimize the release of nutrients and organic compounds from agricultural areas and in urban runoff.

Urban sources were cited in the TSD as the principal cause of sediment contamination throughout the Mad River Watershed. Sources indicated were combined sewage outflows (CFOs), stormwater. One specific location cited was Moore Run downstream from International Truck and Engine Corporation (RM 2.46). Ammonia, phosphorus, metals and PAHs were present in concentrations likely to impact biological communities.

Unusually high sediment ammonia values were recorded in urban and rural locations in the wtareshed. Elevated values were associated with wetlands in the upper watershed and human activities, two examples of which are hypolimnetic water realease from Brown Reservoir. Another example is Dugan Run (RM 0.95) which has been altered from a warm water habitat to a storm water conveyance.

The City of Urbana contributes significant amounts of urban stormwater runoff into the river system. Sediments, nutrients, bacteria and heavy metals are the primary concern.

In summary, accelerated sedimentation, from a number of sources, into the mainstem and tributary stream channels is causing biological habitats within the channel to degrade as substrates become clogged, disabling life to survive in the crevice, and pool/riffle structures are lost.

Nutrient Concentrations

Given the diverse topography of the Mad River Watershed, there are numerous pasture-based livestock operations located within the watershed.

Many of the pasture fields within the watershed have a stream flowing through or adjacent to them.

Some of the streams located within pasture fields are achieving exceptional warm water habitat quality because of proper pasture management. However, some streams are experiencing excessive bank erosion, especially in the Macochee Ditch, irregular width to depth ratios, and entrenchment due to livestock impacts.

In pasture situations soil erosion and runoff rates are the highest during the winter feeding period and after drought conditions. Winter feeding areas if not moved frequently or armored with gravel or concrete tend to be barren, compacted areas that are primarily located on sloping land. Under these conditions when a rainfall event takes place, most all of the water runs off from winter-feeding sites with very little being absorbed into the soil profile.

Cow wanders through a Mad River tributary.

Mammals of the Mad River Watershed

Didelphidae
Didelphis virginiana (Virginia Opossum)

Scoricidae (Shrews)
Sorex cinereus (Masked Shrew)
Blarina brevicauda (Short-tailed Shrew)
Cryptotis parva (Least Shrew)

Talpidae (Moles)
Scalopus aquaticus (Eastern Mole)
(Star-nosed Mole)

Verspertilionidae (Bats)
Myotis lucifugus (Little Brown Bat)
Myotis keenii (Keen's Bat)
Myotis sodalist (Indiana Bat)
Lasionycteris noctivagans (Silver-haired Bat)
Pipistrellus subflavus (Eastern Pipistrelle)
Eptesicus fuscus (Big Brown Bat)
Lasiurus borealis (Red Bat)
Lasiurus cinereus (Hoary Bat)
Nycticeius humeralis (Evening Bat)

Order Lagomorpha (Rabbits and Hares)
Sylvilagus floridanus (Eastern Cottontail)

Sciuridae (Rodents Misc)
Tamias striatus (Eastern Chipmunk)
Marmota monax (Groundhog)
Spermophilus tridecemlineatus
(Thirteen-lined Ground Squirrel)
Sciurus carolinensis (Gray Squirrel)
Sciurus niger (Fox Squirrel)
Tamiasciurus hudsonicus (Red Squirrel)
Glaucomys volans (Southern Flying Squirrel)

Castoridae (Beaver)
Castor canadensis (Beaver)

Cricetidae (Rats, Mice, Voles, Lemmings)
Reithrodontomys humulis (Eastern Harvest Mouse)
Peromyscus maniculatus (Deer Mouse)
Peromyscus leucopus (White-footed Mouse)
Microtus pennsylvanicus (Field Mouse)
Microtus ochrogaster (Prairie Vole)
Microtus pinetorum (Woodland Vole)
Ondatra zibethicus (Muskrat)

Synaptomys cooperi (Southern Bog Lemming)

Muridae (Old World Rats and Mice)
Rattus norvegicus (Common Rat)
Mus musculus (House Mouse)

Zapodidae (Jumping Mice)
Zapus husonius (Meadow Jumping Mouse)

Canidade (Dogs, Foxes, Wolves)
Canis latrans (Coyote)
Vulpes vulpes (Red Fox)
Urocyon cinereoargenteus (Gray Fox)

Procyonidae (Raccoons and allies)
Procyon lotor (Raccoon)

Mustelidae (Weasels, Skunk, Mink, Otter, Badger)
Mustela nivalis (Least Weasel)
Mustela frenata (Long-tailed Weasel)
(Short-tailed Weasel)
Mustela vison (Mink)
Taxidea taxus (Badger)
Mephitis mephitis (Striped skunk)
(River Otter)

Cervidae (Deer)
Odocoileus virginianus (White Tailed Deer)

Birds of the Mad River Watershed
Includes Year Round, Migrating, Summer Breeding, and Wintering Species

Waterfowl
Aix sponsa (Wood Duck)
Anas acuta (Northern Pintail)
Anas americana (American Wigeon)
Anas clypeta (Northern Shoveler)
Anas crecca (Green-Winged Teal)
Anas discors (Blue-winged Teal)
Anas platyrhynchos (Mallard)
Anas rubripes (American Black Duck)
Anas strepera (Gadwall)
Anser albifrons (Greater White-Fronted Goose)
Aythya affinis (Lesser Scaup)
Aythya Americana (Redhead)
Aythya collaris (Ring-Necked Duck)
Aythya marila (Greater Scaup)
Aythya valisineria (Canvasback)
Branta canadensis (Canada Goose)
Bucephala albeola (Bufflehead)
Bucephala clangula (Common Goldeneye)
Chen caerulescens caerulescens (Lesser Snow Goose)
Clangula hyemalis (Long-Tailed Duck)
Cygnus columbianus (Tundra Swan)
Cygnus olor (Mute Swan)
Lophodytes cucullatus (Hooded Merganser)
Melanitta fusca (White-Winged Scoter)
Melanitta nigra (Black Scoter)
Melanitta perspicillata (Surf Scoter)
Mergus merganser (Common Merganser)
Mergus serrator (Red-breasted Merganser)
Oxyura jamaicensis (Ruddy Duck)

Grouse and Allies
Colinus virginianus (Northern Bobwhite)
Meleagris gallopavo (Wild Turkey)
Perdix perdix perdix (Gray Partridge)
Phasianus colchius (Ring-Necked Pheasant)

Loons
Gavia immer (Common Loon)
Gavia stellata (Red-Throated Loon)

Grebes
Podiceps auritus (Horned Grebe)
Podiceps grisegena (Red-Necked Grebe)
Podiceps nigricollis (Eared Grebe)
Podilymbus podiceps (Pied-Billed Grebe)

Pelicans
Pelecanus erythorhynchos (American White Pelican)

Cormorants
Phalacrocorax auritus (Double-Crested Cormorant)

Herons
Ardea alba (Great Egret)
Ardea herodias (Great Blue Heron)
Botaurus lentiginosus (American Bittern)
Bubulcus ibis (Cattle Egret)

Butorides virescens (Green Heron)
Egretta caerulea (Little Blue Heron)
Egretta thula (Snowy Egret)
Ixobrychus exilis (Least Bittern)
Nyctanassa violacea (Yellow-Crowned Night Heron)
Nyctiocorax nyctiocorax (Black-Crowned Night Heron)

Vultures
Cathartes aura (Turkey Vulture)
Coragyps atratus (Black Vulture)

Hawks and Eagles
Accipiter cooperii (Cooper's Hawk)
Accipiter gentilis (Northern Goshawk)
Accipiter gentilis atricapillus (Goshawk)
Accipiter striatus (Sharp-shinned Hawk)
Aquila chrysaetos (Golden Hawk)
Buteo jamaicensis (Red-Tailed Hawk)
Buteo lagopus (Rough-Legged Hawk)
Buteo lineatus (Red-Shouldered Hawk)
Buteo platypterus (Broad-Winged Hawk)
Cirus cyaneus (Northern Harrier)
Cirus cyaneus hudsonius (Marsh Hawk)
Falco columbarius (Merlin)
Falco peregrinus (Peregrine Falcon)
Falco sparverius (American Kestrel)
Haliaeetus leucocephalus (Bald Eagle)
Pandion haliaetus (Osprey)

Rails and Coots
Coturnicops noveboracensis (Yellow Rail)
Fulica americana (American Coot)
Gallinula chloropus (Common Moorhen)
Grus canadensis (Sandhill Crane)
Porzana carolina (Sora)
Rallus elegans (King Rail)
Rallus limicola (Virginia Rail)

Plovers
Charadrius melodus (Piping Plover)
Charadrius semipalmatus (Semipalmated Plover)
Charadrius vociferus (Killdeer)
Pluvialis dominica (American Golden Plover)
Pluvialis squatarola (Black-Bellied Plover)

Avocet
Recurvirostra americana (American Avocet)

Sandpipers and Allies
Actitis macularia (Spotted Sandpiper)
Arenaria interpres (Ruddy Turnstone)
Bartramia longicauda (Upland Sandpiper)
Calidris alba (Sanderling)
Calidris alpine (Dunlin)
Calidris bairdii (Baird's Sandpiper)
Calidris fusciollis (White-Rumped Sandpiper)
Calidris himantopus (Stilt Sandpiper)
Calidris mauri (Western Sandpiper)
Calidris melanotes (Pectoral Sandpiper)
Calidris minutilla (Least Sandpiper)
Calidris pusilla (Semipalmated Sandpiper)
Catoptrophorus semipamatus (Willet)
Gallinago delicata (Wilson's Snipe)
Gallinago gallinago (Common Snipe)
Limnodromus griseus (Short-Billed Dowitcher)
Limosa fedoa (Marbled Godwit)
Limosa haemastia (Hudsonian Godwit)
Phalaropus lobatus (Red-Necked Phalarope)
Phalaropus tricolor (Wilson's Phalarope)
Scolopax minor (American Woodcock)
Totanus flavipes (Lesser Yellowlegs)
Totanus melanoleucus (Greater Yellowlegs)
Tringa solitaria (Solitary Sandpiper)
Tryngites subruficollis (Buff Breasted Sandpiper)

Gulls and Allies
Chlidonias niger (Black Tern)
Larus argentatus (Herring Gull)
Larus atricilla (Laughing Gull)
Larus delawarensis (Ring-Billed Gull)
Larus philadelphia (Bonaparte's Gull)
Larus pipixcan (Franklin's Gull)
Sterna forsteri (Foster's Tern)
Sternula antillarum (Least Tern)
Sternula caspia (Caspian Tern)
Sternula hirundo (Common Tern)

Doves and Cuckoos
Coccyzus americanus (Yellow-Billed Cuckoo)
Coccyzus erthropthalmus (Black-Billed Cuckoo)

Columba livia (Rock Pigeon)
Zenaida macroura (Mourning Dove)

Owls
Aegolius acadicus (Northern Saw-Whet Owl)
Asio flammeus (Short-Eared Owl)
Asio otus (Long-Eared Owl)
Bubo scandiacus (Snowy Owl)
Bubo virginianus (Great Horned Owl)
Megascops asio (Eastern Screech Owl)
Strix varia (Barred Owl)
Tyto alba (Barn Owl)

Nightjars
Chaetura pelagica (Chimney Swift)
Chordeiles minor (Common Nighthawk)

Hummingbirds
Archilochus colubris (Ruby-Throated Hummingbird)

Kingfishers
Ceryle alcyon (Belted Kingfisher)

Woodpeckers
Colaptes auratus (Northern Flicker)
Dryocopus pileatus (Pileated Woodpecker)
Melanerpes carolinus (Red-Bellied Woodpecker)
Melanerpes erythrocephalus (Red-Headed Woodpecker)
Picoides pubescens (Downy Woodpecker)
Picoides villosus (Hairy Woodpecker)
Sphyrapicus varius (Yellow-Bellied Sapsucker)

Flycatchers
Contopus cooperi (Olive-Sided Flycatcher)
Contopus virens (Eastern Wood Pewee)
Empidonax alnorum (Alder Flycatcher)
Empidonax flaiventris (Yellow-Bellied Flycatcher)
Empidonax minimus (Least Flycatcher)
Empidonax traillii (Willow Flycatcher)
Empidonax virescens (Acadian Flycatcher)
Myiarchus crinitus (Great Crested Flycatcher)
Sayornis phoebe (Eastern Phoebe)
Tyrannus tyrannus (Eastern Kingbird)
Tyrannus verticalis (Western Kingbird)

Shrikes
Lanius ludovicianus (Loggerhead Shrike)

Vireos
Vireo bellii (Bell's Vireo)
Vireo flavifrons (Yellow-Throated Vireo)
Vireo gilvus (Warbling Vireo)
Vireo griseus (White-Eyed Vireo)
Vireo olivaceus (Red-Eyed Vireo)
Vireo philadelphicus (Philadelphia Vireo)
Vireo solitarius (Blue-Headed Vireo)

Jays and Crowns
Corvus brachyrhynchos (American Crow)
Cyanocitta cristata (Blue Jay)

Larks
Eremophila alpestris (Horned Lark)

Swallows
Hirundo rustica (Barn Swallow)
Petrochelidon pyrrhonota (Cliff Swallow)
Progne subis (Purple Martin)
Riparia riparia (Bank Swallow)
Stelgidopteryx serripennis
(Northern Rough-Winged Swallow)
Tachycineta bicolor (Tree Swallow)

Chickadees and Titmice
Baeolophus bicolor (Tufted Titmouse)
Poecile atricapillus (Black-Capped Chickadee)
Poecile carolinensis (Carolina Chickadee)

Nuthatches
Sitta canadensis (Red-Breasted Nuthatch)
Sitta carolinensis (White-Breasted Nuthatch)

Creepers
Certhia americana (Brown Creeper)

Wrens
Cistothorus palustris (Marsh Wren)
Cistothorus platensis (Sedge Wren)
Thryomanes bewickii (Bewick's Wren)
Thryothorus ludovicianus (Carolina Wren)
Troglodytes aedon (House Wren)

Troglodytes troglodytes (Winter Wren)

Kinglets
Regulus calendula (Ruby-Crowned Kinglet)
Regulus satrapa (Golden-Crowned Kinglet)

Gnatcatchers
Polioptila caerulea (Blue-Gray Gnatcatcher)

Bluebirds and Thrushes
Catharus fuscescens (Veery)
Catharus guttatus (Hermit Thrush)
Catharus minimus (Gray-Cheeked Thrush)
Catharus ustulatus (Swainson's Thrush)
Hylocicha mustelina (Wood Thrush)
Sialia sialis (Eastern Bluebird)
Turdus migratorius (American Robin)

Mimic Thrushes
Dumetella carolinensis (Gray Catbird)
Mimus polyglottos (Northern Mockingbird)
Toxostoma rufum (Brown Thrasher)
Sturnus vulgaris (European Starling)

Pipits
Anthus rubescens (American Pipit)

Waxwings
Bombycilla cedrorum (Cedar Waxwing)

Wood-Warbler
Vermivora pinus (Blue-Winged Warbler)
Vermivora chrysoptera (Golden-Winged Warbler)
Vermivora peregrine (Tennessee Warbler)
Vermivora celata (Orange-Crowned Warbler)
Vermivora ruficapilla (Nashville Warbler)
Parula americana (Northern Parula)
Dendroica petechia (Yellow Warbler)
Dendroica pensylvanica (Chestnut-Sided Warbler)
Dendroica magnolia (Magnolia Warbler)
Dendroica tigrina (Cape May Warbler)
Dendroica caerulescens (Black-Throated Blue Warbler)
Dendroica coronata (Yellow-Rumped Warbler)
Dendroica virens (Black-Throated Green Warbler)
Dendroica fusca (Blackburnian Warbler)
Dendroica dominica (Yellow-Throated Warbler)
Dendroica pinus (Pine Warbler)
Dendroica discolor (Prairie Warbler)
Dendroica palmarum (Palm Warbler)
Dendroica castanea (Bay-Breasted Warbler)
Dendroica striata (Blackpoll Warbler)
Dendroica cerulean (Cerulean Warbler)
Mniotilta varia (Black-and-White Warbler)
Setophaga ruticilla (American Redstart)
Protonotaria citrea (Prothonotary Warbler)
Helmitheros vermivorus (Worm-Eating Warbler)
Seiurus aurocapilla (Ovenbird)
Seiurus noveboracensis (Northern Waterthrush)
Seiurus motacilla (Louisiana Waterthrush)
Oporonis formosus (Kentucky Warbler)
Oporonis agilis (Connecticut Warbler)
Oporornis philadelphia (Mourning Warbler)
Geothlypis trichas (Common Yellowthroat)
Wilsonia citrine (Hooded Warbler)
Wilsonia pusilla (Wilson's Warbler)
Wilsonia canadensis (Canada Warbler)
Icteria virens (Yellow-Breasted Chat)

Tanager
*Piranga ludoviciana (*Western Tanager)
Piranga rubra (Summer Tanager)
Piranga olivacea (Scarlet Tanager)

Sparrows and Allies
Pipilo erythrophthalmus (Eastern Towhee)
*Spizella arborea (*American Tree Sparrow)
Spizella passerina (Chipping Sparrow)
Spizella pallida (Clay-Colored Sparrow)
Spizella pusilla (Field Sparrow)
Pooectes gramineus (Vesper Sparrow)
Passerculus sandwichensis (Savannah Sparrow)
Ammodrmus savannarum (Grasshopper Sparrow)
Ammodramus henslowii (Henslow's Sparrow)
Passerella iliaca (Fox Sparrow)
Melospiza melodia (Song Sparrow)
Melospiza lincolnii (Lincoln's Sparrow)
Melospiza Georgiana (Swamp Sparrow)
Zonotrichia albicollis (White-Throated Sparrow)
Zonotrichia leucophrys (White-Crowned Sparrow)
Junco hyemalis (Dark-Eyed Junco)
Calcarius lapponicus (Lapland Longspur)
Plectrophenax nivalis (Snow Bunting)

Grosbeaks and Buntings
Cardinalis cardinalis (Northern Cardinal)
Pheucticus ludovicians (Rose-Breasted Grosbeak)
Passerina cyanea (Indigo Bunting)
Spiza americana (Dickcissel)

Blackbirds and Allies
Dolichonyx oryzivorus (Bobolink)
Agelaius phoeniceus (Red-Winged Blackbird)
Sturnella magna (Eastern Meadowlark)
Sturnella neglecta (Western Meadowlark)
Euphagus carolinus (Rusty Blackbird)
Euphagus cyanocephalus (Brewer's Blackbird)
Quiscalus quiscula (Common Grackle)
Molothrus ater (Brown-Headed Cowbrid)
Icterus spurius (Orchard Oriole)
Icterus galbula (Baltimore Oriole)

Finches
Carpodacus purpureus (Purple Finch)
Carpodacus mexicanus (House Finch)
Loxia curvirostra (Red Crossbill)
Loxia leucoptera (White-Winged Crossbill)
Carduelis flammea (Common Redpoll)
Carduelis pinus (Pine Siskin)
Carduelis tristis (American Goldfinch)
Coccothraustes vespertinus (Evening Grosbeak)

Old World Sparrows
Passer domesticus (House Sparrow)

Fish Species of the Mad River Watershed

Petromyzontidae (lamprey)
Lampetra appendix (American brook lamprey)

Clupeidae (alewife, shad)
Dorosoma cepedianum (gizzard shad)

Cyprinidae (minnows, shiners, etc.)
Campostoma anomalum (central stoneroller)
Carassius auratus (goldfish)
Clinostomus elongatus (redside dace)
Ctenopharyngodon idella (grass carp)
Cyprinella spiloptera (spotfin shiner)
Cyprinus carpio (common carp)
Ericymba buccata (silverjaw minnow)
Exoglossum laurae hubbsi (western tonguetied minnow)
Fundulus notatus (blackstrip topminnow)
Hybopsis amblops (bigeye chub)
Luxilus chyrsocephalus (striped shiner)
Lythrurus fasciolaris (rosefin shiner)
Nocomis micropogon (river chub)
Notemigonus crysoleucas (golden shiner)
Notropis buccatus (silverjaw minnow)
Notropis heterolepis (blacknose shiner)
Notropis photogenis (silver shiner)
Notropis rubellus (roseyface shiner)
Notropis stramineus (sand shiner)
Notropis umbratilis (redfin shiner)
Notropis volucellus (mimic shiner)
Phoxinus erythrogaster (southern redbelly dace)
Pimephales notatus (bluntnose minnow)
Pimephales promelas (fathead minnow)
Rhinichthys obtusus (western blacknose dace)
Semotilus atromaclatus (creek chub)

Castomstomidae (suckers)
Carpiodes cyprinus (quillback)
Castostomus commersonii (common white sucker)
Erimyzon oblongus (creek chubsucker)
Hypentelium nigricans (northern hog sucker)
Moxostoma anisurum (silver redhorse sucker)
Moxostoma carinatum (river redhorse sucker)
Moxostoma duquesnei (black redhorse sucker)
Moxostoma erythrurum (golden redhorse sucker)
Moxostoma macrolepidotum (shorthead redhorse sucker)

Ictaluridae (bullhead, catfishes, madtoms)
Ameiurus melas (black bullhead)
Ameiurus natalis (yellow bullhead)
Ictalurus nebulosus (brown bullhead)
Ictalurus punctatus (channel catfish)
Noturus flavus (stonecat)
Noturus gyrinus (tadpole madtom)

Esocidae (pike, pickerel)
Esox americanus (grass pickerel)

Umbridae (mudminnows)
Umbra limi (central mudminnow)

Salmonidae (trout)
Onocorhynchus mykiss (rainbow trout)
Salmo trutta (brown trout)
Salvelinus fontinalis (brook trout)*

Atherinidae (silversides)
Labidesthes sicculus (brook silverside)

Gasterosteidae (sticklebacks)
Culaea inconstans (brook stickleback)

Cottidae (sculpins)
Cottus bairdi (mottled sculpin)

Centrarchidae (sunfishes, bass)
Ambloplites rupestris (rock bass)
Lepomis cyanellus (green sunfish)
Lepomis gibbosus (pumpkinseed sunfish)
Lepomis humilis (orangespotted sunfish)
Lepomis macrochirus (bluegill sunfish)
Lepomis magalotis megalotis (central longear sunfish)
Lepomis microlophus (red ear sunfish)
Micropterus dolomieui (smallmouth bass)
Micropterus salmoides (largemouth bass)
Pomoxis annularis (white crappie)
Pomoxis nigromaculatus (black crappie)

Percidae (darters, walleye)
Etheostome blenniodies (greenside darter)
Etheostoma caeruleum (rainbow darter)
Etheostoma flabellare (fantail darter)
Ethostoma exile (Iowa darter)
Etheostoma nigrum (johnny darter)
Etheostoma spectabile (orangethroat darter)
Etheostoma zonale (banded darter)
Perca flavescens (yellow perch)
Percina caprodes (log perch)
Percina maculate (blackside darter)
Stizostedion vitreum (walleye)
Stizostedion vitreum x canadense (saugeye)

Sciaenidae (drum)
Aplodinotus grunniens (freshwater drum)

Table 2: Mad River Fish and Aquatic Habitat Sampling Results by Ohio EPA

River Mile	Mean # of Fish Species	Cumulative No. of Fish Species	Mean Relative No. of Fish/0.3 km	Mean Relative Weight of Fish/0.3 km	QHEI*	Mean Wiwb	IBI**
61.3	20	646	969	14.58	85	N/A	54
57.2	17	1082	812	15.04	62	N/A	40
53.2	18	1875	1223	14.7	67.5	N/A	41
52.0	15	667	535	9.63	72	N/A	41
51.1	17	1076	807	21.45	79	N/A	40
51.0	19	1063	797	20.58	72	N/A	41
49.1	13	878	527	6.75	63	N/A	39[ns]
43.9	10	318	308	5.06	68.5	N/A	42
41.6	17	168	252	4.02	73	N/A	48
39.9	20	506	506	77.62	79.5	N/A	41
38.4	23	523	523	117.23	69	N/A	41
32.7	18	282	564	135.46	76	N/A	36[ns]
29.6	22	490	490	87.46	73.5	N/A	44
27.0	27	640	640	79.16	79	N/A	46
25.5	28	460	460	82.42	84.5	8.7	35*
24.1	27	747	747	183.24	75	9.0	38[ns]
17.5	26	576	576	90.52	77.5	8.4[ns]	34*
13.1	21	544	544	79.52	83.5	9.2	41[ns]
11.5	22	623	623	56.21	83	9	38[ns]
9.0	26	595	595	86.22	81.5	9.2	40[ns]
6.0	22	620	620	67.24	77.5	8.7	43
4.0	27	382	382	146.05	76.5	10.1	52
1.6	33	683	569	199.63	74	9.7	52
0.3	24	494	494	154.64	61	9.5	50

Aquatic Macroinvertebrates of the Mad River Watershed

Diptera (Flies)

Antericidae (snipe flies)

Atherix lantha

Certopogonidae (biting midges)

Chironomidae (non-biting midges)

Ablabesmyia mallochi
Ablabesmyia simpsoni
Brillia flavifrons group
Cardiocladius obscurus
Chelifera sp
Chironomus (C.) decorus group
Chironomus (C.) riparius group
Cladotanytarsus vanderwulpi group Type 1
Clinotanypus pinguis
Conchapelopia sp.
Corynoneura "celeripes"
Corynoneura lobata
Corynoneura n.sp 1
Cricotopus (C.) bicinctus
Cricotopus (C.) lucidae
Cricotopus (C.) sp.
Cricotopus (C.) tremulus group
Cricotopus (C.) trifascia
Cryptotendipes pseudtotener
Cyptochironomus sp
Diamesa sp
Dicrotendipes fumidus
Dicrotendipes neomodestus
Doncricotopus bicaudatus
Eukiefferiella brehmi group
Eukiefferiella claripennis group
Eukiefferiella devonica group
Glyptotendipes (G.) sp
Hayesomyia senata/Thienemannimyia norena
Helopelopia sp.
Heterotrissocladius marcidus
Heterotrissocladius sp
Meropelopia sp
Microcylloepus pusillus
Micropsectra sp
Microtendipes "caelum"
Microtendipes pedellus group
Nanocladius (N.) minimus
Nanocladius (N.) sp
Nanocladius (N.) spiniplenus
Natarsia baltimoreus
Natarsia species A
Nilotanypus fimbriatus
Odontomesa ferringtoni
Orthocladius (O.) sp
Pagastia orthogonia
Paracladopelma nais
Parakiefferiella n.sp 2
Paralauterborniella nigrohalteralis
Paramerina fragilis
Parametriocnemus sp
Paratanytarsus n. sp. 1
Paratanytarsus sp
Paratendipes albimanus/Paratendipes duplicatus
Paratrichocladius sp
Pentaneura incomspicua
Phaenopsectra flavipes
Phaenopsectra obediens group
Polypedilum (P.) fallax group
Polypedilum (P.) illinoense
Polypedilum (P.) laetum group
Polypedilum (Tipodura) scalaenum group
Polypedilum (Tripodura) halterale group
Polypedilum (Uresipedilum) aviceps
Polypedilum (Uresipedilum) flavum
Potthastia longimana
Procladius (Holotanypus) sp
Prodiamesa olivacea
Psectrotanypus dyari
Rheocricotopus (Psilocricotopus) robacki
Rheopelopia paramaculipennis
Rheotanytarsus pellucidus
Rheotanytarsus sp.

Saetheria species 1
Stempellinella n.sp nr. flavidula
Stenochironomus sp.
Stictochironomus sp
Subletta coffmani
Tanytarsus curticornis group
Tanytarsus glabrescens group sp 1
Tanytarsus glabrescens group sp 7
Tanytarsus sepp
Tanytarsus sp
Thienemanniella similis
Thienemanniella taurocapita
Thienemanniella xena
Tribelos jucundum
Tvetenia bavarica group
Tvetenia discoloripes group
Zaverlimyia sp

Culicidae (mosquitos)
Aedes sp
Anopheles sp
Dixidae
Dixella sp

Dolichopodidae (metallic flies)

Empididae (dance flies)
Clinocera (Hydrodromia) sp
Hemerodromia sp

Ephydridae (shore flies)
Ephyda fluviatilis

Muscidae (muscoid flies)
Limnophora aequifrons
Limnophora discreta

Sciomyzidae (marsh flies)

Simulidae (black flies)
Simulium sp

Stratiomyidae (solider flies)
Myxosargus sp
Odontomyia)
Stratiomys sp

Tabanidae (Horseflies)
Chrysops sp
Tabanus sp

Tipulidae (Craneflies)
Antocha sp
Hexatoma sp
Limonia sp
Pilaria sp
Tipula sp
Tipula abdominalis

Trichoptera (caddisflies)

Glossosomatidae
Glossosoma sp
Protoptila sp

Helicopsychidae
Helicopysche borealis

Hydropsychidae
Ceratophsyche slossonae
Ceratophysche morosa group
Ceratophysche sparna
Cheumatopsyche sp
Hydropsyche depravata group

Hydroptilidae
Hydroptila sp

Lepidostomatidae
Lepidostoma sp

Leptoceridae
Mystacides sp
Nectopsyche diarina
Oecetis inconspicua complex sp A
Oecetis nocturna
Triaenodes marginatus

Limnephilidae
Ptilostomis sp
Pycnopsyche sp

Philopotamidae
Chimarra aterrima
Dolophilodes distinctus
Polycentropus sp

Polycentropodidae
Neureclipsis sp
Nyctiophylax sp.

Psychomyiidae
Lype diversa
Psychomyia flavida

Uenoidae
Neophylax sp

Odonata (dragonflies and damselflies)

Aeshnidae
Aeshna sp (darner)
Anax junius (common green darner)
Boyeria vinosa (fawn darner)

Calopterygidae
Argia sp (damselfly)
Argia bipunctulata (seepage dancer damselfly)
Calopteryx sp (banded damselfly)

Hetaerina sp (damselfly)
Coenagrionidae (damselfly)
Corduliidae
Somatochlora sp (emerald dragonfly)
Gomphidae
Gomphus sp (clubtail dragonfly)
Gomphus externus (clubtail dragonfly)
Libellulidae
Epitheca (prince baskettail dragonfly)
Nannothemis bella (elfin skimmer dragonfly)
Plathemis lydia (common whitetail dragonfly)

Ephemeroptera (mayflies)
Baetidae
Acentrella turbida
Acerpenna macdunnoughi
Baetis flavistriga
Baetis intercalaris
Baetis tricaudatus
Callibaetis sp
Centroptilum sp
Diphetor hageni
Plauditus dubius / Plauditus virilis
Plauditus punctiventris
Procloeon sp
Pseudocloeon frondale
Caenidae
Caenis sp
Ephemerellidae
Ephemerella needhami
Ephemerella sp
Eurylophella sp
Serratella deficiens
Timpanoga (Dannella) simplex
Ephemeridae
Ephemera sp
Heptageniidae
Leucrocuta sp
Leucrocuta recurvata
Nixe sp
Stenacron sp
Stenonema exiguum
Stenonema femoratum
Stenonema pulchellum
Stenonema terminatum
Stenonema vicarium

Isonychiidae
Isonychia sp
Leptophlebiidae
Leptophlebia sp
Paraleptophlebia sp
Tricorythidae
Tricorythodes sp

Amphipoda (shrimp-like crustaceans)
Crangonyctidae
Synurella dentate

Decapoda (crayfish, shrimp, scuds)
Cambaridae
Cambarus (Cambarus) sp A (scud)
Cambarus (Tubericambarus) sp A (scud)
Orconectes (Procericambraus) rusticus (rusty crayfish)

Isopoda (sowbugs)
Aselidae
Caecidotea sp
Lirceus sp
Hyalellidae
Hyalella azteca

Annelidia (earthworms, leeches)
Oligochaeta (earthworms)
Hiruinda (leeches)
Placobdella montifera
Placobdella ornate
Placobdella papillifera
Placobdella parasitica
Erpobdella punctata punctata
Glossiphonia complanata
Helobdella stagnalis
Helobdella triserialis
Mooreobdella microstoma
Mooreobdella sp.

Nematomorpha (horsehair worms)

Nemertea (ribbon / proboscis worms)

Platyhelminthes (flatworms)
Turbellaria
Coleoptera (beetles)
Dryopidae (long-toed water beetles)
Helichus sp

Dystiscidae (predaceous diving beetles)
Agabus sp
Copelatus glyphicus
Hydroporus sp
Laccophilus sp
Elmidae (riffle beetles)
Ancyronyx variegate
Dubiraphia quadrinotata
Dubiraphia vittala group
Macronychus glabratus
Optioservus fastiditus
Optioservus sp.
Optioservus trivittatus
Stenelmis sp
Gyrinidae (whirligig beetle)
Gyrinus sp
Hapliplidae (crawling water beetles)
Haliplus sp
Peltodytes sp
Hydrophilidae (water scavenger beetles)
Berosus sp
Cymbiodyta sp
Enochrus sp
Helochares maculicollis
Laccobius sp
Paracymus sp
Tropisternus sp
Scirtidae (marsh beetles)
Cyphon sp
Psephenidae (water pennies)
Ectopria sp
Psephenus herricki

Veneroida (clams, freshwater mussels)
Corbiculidae
Corbicula fluminea (aquatic clam)
Sphaeriidae
Pisidium sp (fingernail clam)
Sphaerium sp (fingernail clam)

Gastropoda (snails)
Ancylidae
Ferrissia sp (limpets)
Planorbidae
Gyraulus (Torquis) parvus (orb snail)
Helisoma anceps anceps (orb snail)
Pleuroceridae
Elimia sp (river snail)
Physidae
Physella sp (pouch snail)
Veneroida
Planorbella (Pierosoma) pilsbryi (planorbidae- rams horn)
Bryozoa (moss animals)
Fredericella sp
Plumatella sp

Hydrozoa (freshwater radial animals, jellyfish)
Cordylophora lacustris
Craspedacusta sowerbyi
Hydra sp
Porifera (sponges)
Heteromeyenia latitenta (freshwater sponge)

Hydracarina (water mites)

Plecoptera (stoneflies)
Leuctridae
Leuctra sp
Perlidae
Perlesta placida complex
Perlodidae
Isoperla similes
Isoperla sp

Hemiptera (true bugs)
Belastomatidae (giant water bugs)
Belastoma sp
Corixidae (water boatmen)
Palmacorixa sp
Sigara sp
Trichocorixa sp
Naucoridae (creeping water bug)
Pelocoris sp
Nepidae (water scorpions)
Ranatra sp
Notonectidae (backswimmers)
Notonecta sp
Pleidae (pigmy backswimmers)
Neoplea sp
Megaloptera (dobsonflies, hellgrammites, alderflies, fishflies)
Corydalidae
Nigronia serricornis (fishfly)
Sialidae
Sialis sp (alderfly

Table 3: Mad River Inverebrate Sampling Results by Ohio EPA

River Mile	No. of Organisms	Quantative Taxa	Qualitative Taxa	Total Taxa	Qualitative EPT*	ICI**
61.3	872	46	44	70	13	G
57.2	5698	44	63	73	21	50
53.2	3610	55	53	79	19	46
52.0	3024	50	68	84	20	44
51.1	2506	49	48	73	15	48
51.0	5418	43	52	67	24	48
49.1	1525	54	44	73	52	52
43.9	3710	39	47	65	21	54
41.6	4939	40	49	65	21	56
39.9	4499	55	54	81	19	50
38.4	2699	46	55	69	20	46
32.7	6004	35	47	62	19	46
29.6	3140	42	50	70	20	54
27.0	0	0	55	55	20	G
25.5	7986	51	52	77	15	42
24.1	2887	52	45	71	16	G
17.5	0	0	43	43	16	G
13.1	0	0	31	31	8	G
11.5	2605	55	38	71	13	46
9.0	0	0	43	43	15	G
6.0	6696	40	33	58	11	40
4.0	8154	41	40	58	11	42
1.6	0	0	37	37	12	G
0.3	0	0	42	42	16	G

Amphibians and Reptiles of the Mad River Watershed

Proteidae (Mudpuppies)
Necturus maculosus maculosus (Mudpuppy)

Salamandridae (Newts)
Notophthalmus viridescens (Eastern Newt)

Ambystomatidae (Mole Salamanders)
Ambystoma jeffersonianum (Jefferson Salamander)
Ambystoma laterale (Blue Spotted Salamander)
Ambystoma maculatum (Spotted Salamander)
Ambystoma texanum (Small Mouthed Salamander)
Ambystoma tigrinum tigrinum (Eastern Tiger Salamander)

Plethodontidae (Lungless Salamanders)
Gyrinophilus prophyriticus (Northern Spring Salamander)
Hemidactylium scutatum (Four-Toed Salamander)
Plethodon cinereus (Red-Backed Salamander)
Plethodon richmondi (Riverine Salamander)
Pseudotriton ruber ruber (Northern Red Salamander)

Bufonidae (True Toads)
Bufo americanus americanus (Eastern American Toad)
Bufo fowleri (Fowler's Toad)

Hylidae (Treefrogs and relatives)
Acris crepitans blanchardi (Blanchard's Cricket Frog)
Hyla chrysoscelis (Cope's Gray Treefrog)
Hyla versicolor (Eastern Gray Treefrog)
Pseudacris crucifer crucifer (Northern Spring Peeper)
Pseudacris triseriata (Striped Chorus Frog)

Ranidae (Typical Frogs)
Rana catesbeiana (Bullfrog)
Rana clamitans melanota (Green Frog)
Rana palustris (Pickerel Frog)
Rana pipiens (Northern Leopard Frog)
Rana sylvatica (Wood Frog)

Chelydridae (Snapping Turtles)
Chelydra serpentina serpentina (Common Snapping Turtle)

Kinosternidae (Musk and Mud Turtles)
Stenotherus odoratus (Common Musk Turtle)

Emydidae (Pond and Box Turtles)
Chrysemys picta (Midland Painted Turtle)
Clemmys guttata (Spotted Turtle)
Graptemys geographica (Common Map Turtle)
Terrapene carolina carolina (Eastern Box Turtle)
Trachemys scripta elegans (Red-Eared Slider)

Trionychidae (Softshell Turtles)
Apalone spinifera spinifera (Eastern Spiny Softshell Turtle)

Scincidae (Skinks)
Eumeces fasciatus (Five-lined Skink)

Colubridae (Typical Snakes)
Clonophis kirtlandii (Kirtland's Snake)
Coluber constrictor (Racer)
Diadophis punctatus edwardsii (Northern Ring-Necked Snake)
Elaphe obsoleta obsolete (Black Rat Snake)
Heterodon platirhinos (Eastern Hog-Nosed Snake)
Lampropeltis triangulum triangulum (Eastern Milk Snake)
Nerodia erythrogaster neglecta (Copper-Bellied Water Snake)
Nerodia sipedon (Northern Water Snake)
Regina septemvittala (Queen Snake)
Storeria dekayi (Northern Brown Snake)
Thamniphis butleri (Butler's Garter Snake)
Thamniphis radix radix (Eastern Plains Garter Snake)
Thamniphis sirtalis (Eastern Garter Snake)

Viperidae (Pit Vipers and Vipers)
Sistrurus catenatus catenatus (Eastern Massasuga)

Woody Plants of the Mad River Watershed

Acer negundo (Box Elder)
Acer nigrum (Black Maple)
Acer rubrum (Red Maple)
Acer saccharinum (Silver Maple)
Acer saccharum (Sugar Maple)
Acer spicatum (Mountain Maple)
Aesculus glabra (Ohio Buckeye)
Alnus rugosa (Speckled Alder)
Amelanchier spicata (Serviceberry)
Asimina triloba (Pawpaw)
Betula pumila (Yellow Birch)
Campsis radicans (Trumpet Creeper)
Carpinus caroliniana (Ironwood)
Carya cordiformis (Bitternut Hickory)
Carya laciniosa (Big Shellbark Hickory)
Carya ovata (Shagbark Hickory)
Carya tomentosa (Mockernut Hickory)
Ceanothus americanus (New Jersey Tea)
Celastrus scandens (Bittersweet)
Celtis occidentalis (Hackberry)
Cephalanthus occidentalis (Buttonbush)
Cercis canadensis (Redbud)
Cornus alternifolia (Pagoda Dogwood)
Cornus amomum (Dogwood Var.)
Cornus drummondi (Roughleaf Dogwood)
Cornus florida (Flowering Dogwood)
Cornus oblique (Silky Dogwood)
Cornus racemosa (Gray Dogwood)
Cornus stolonifera (Red Osier)
Corylus americana (Hazel)
Crataegus calpodendron (Cockspur Thorn var.)
Crataegus crus-galli (Cockspur Thorn)
Crataegus gattingeri (Cockspur Thorn var.)
Crataegus macrosperma (Cockspur Thorn var.)
Crataegus margaretta (Cockspur Thorn var.)
Crataegus mollis (Cockspur Thorn var.)
Crataegus pruinosa (Cockspur Thorn var.)
Crataegus punctata (Cockspur Thorn var.)
Crataegus vallicola (Cockspur Thorn var.)
Diospyros virginiana (Persimmon)
Dirca palustris (Leatherwood)
Euonymus atropurpureus (Burning Bush)
Euonymus obovatus (Running Strawberry Bush)
Fagus grandifolia (Beech)
Fraxinus americana (White Ash)
Fraxinus nigra (Black Ash)
Fraxinus pennsylvanica (Red Ash)
Fraxinus quadrangulata (Blue Ash)
Gaylussacia baccata (Huckleberry)
Gleditsia triacanthos (Honey Locust)
Gymnoclaudus dioica (Kentucky Coffee Tree)
Hamamelis virginiana (Witch-Hazel)
Hydrangea arborescens (Wild Hydrangea)
Hypericum spathulatum (Shrubby St. John's Wort)
Ilex verticillata (Winterberry)
Juglans cinerea (Butternut)
Juglans nigra (Black Walnut)
Juniperus virginiana (Red Cedar)
Lindera benzoin (Spice-Bush)
Liriodendron tulipifera (Tuliptree)
Lonicera dioica (Wild Honeysuckle)
Lonicera prolifera (Grape Honeysuckle)
Menispermum canadense (Moonseed)
Mitchella repens (Partridge Berry)
Morus rubra (Mulberry)
Nyssa sylvatica (Black Gum)
Ostrya virginiana (Hop-Hornbeam)
Parthenocissus quinquefolia (Virginia Creeper)
Physocarpus opulifolius (Ninebark)
Platanus occidentalis (Sycamore)
Pontentilla fruiticosa (Shrubby Cinquefoil)
Populus deltoids (Cottonwood)
Populus grandidentata (Bigtooth Aspen)
Populus heterophyilla (Swamp Cottonwood)
Populus tremuloides (Quaking Aspen)
Prunus americana (Wild Plum)
Prunus serotina (Wild Black Cherry)
Prunus virginiana (Choke Cherry)

Ptelea trifoliata (Hop Tree)
Pyrus coronaria (Wild Crab Apple)
Pyrus floribunda (Purple Chokeberry)
Pyrus melanocarpa (Black Chokeberry)
Quercus alba (White Oak)
Quercus bicolor (Swamp White Oak)
Quercus borealis (Red Oak)
Quercus imbricaria (Shingle Oak)
Quercus macrocarpa (Bur Oak)
Quercus muehlenbergii (Yellow Oak)
Quercus palustris (Pin Oak)
Quercus shumardii (Shumard Red Oak)
Quercus velutina (Black Oak)
Rhamnus alnifolia (Alder Buckhorn)
Rhamnus lancealata (Lance Leaf Buckhorn)
Rhus aromatica (Fragrant Sumac)
Rhus glabra (Smooth Sumac)
Rhus radicans (Poison Ivy)
Rhus typhina (Staghorn Sumac)
Rhus vernix (Poison Sumac)
Ribes americanum (Wild Black Currant)
Ribes cynosbati (Wild Gooseberry)
Ribes hirtellum (Smooth Gooseberry)
Robinia pseudo-acacia (Black Locust)
Rosa carolina (Wild Rose)
Rosa pallustris (Swamp Rose)
Rosa setigera (Climbing Rose)
Rubus allegheniensis (Blackberry)
Rubus hispidus (Bristly Dewberry)
Rubus idaeus (Red Raspberry)
Rubus occidentalis (Black Raspberry)
Rubus odoratus (Flowering Raspberry)
Rubus pubescens (Dwarf Red Raspberry)
Salix amygdaloides (Peach-leaf Willow)
Salix discolor (Pussy Willow)
Salix humilis (Upland Willow)
Salix lucida (Shining Willow)
Salix nigra (Black Willow)
Salix pedicellaris (Bog Willow)
Salix rigida (Heart-Leaf Willow)
Salix sericea (Silky Willow)
Salix subsericea (Willow hybrid)
Salix tristis (Dwarf Upland Willow)
Sambucus canadensis (Common Elder)
Sassafras albidum (Sassafras)
Smilax hispida (Bristly Greenbriar)
Smilax rotundifolia (Sawbriar)
Spiraea alba (Meadow Spiraea)
Staphylea trifolia (Bladdernut)
Taxus canadensis (Yew)
Thuja occidentalis (Northern White Cedar)
Tilia americana (Basswood)
Ulmus americana (White Elm)
Ulmus rubra (Red Elm)
Ulmus thomasi (Cork Elm)
Vaccinium macrocarpon (Cranberry)
Viburnum acerifolium (Maple Leaf Viburnum)
Viburnum lentago (Nannyberry)
Viburnum prunifolium (Black Haw)

Plants of Cedar Bog

Achillea millefolium (Yarrow)
Acorus calamus (Sweetflag)
Actaea pachypoda (Baneberry)
Actinomeris alternifolia (Wingstem)
Adiantum pedantum (Maidenhair Fern)
Agrimonia gryposepala (Agrimony)
Agrimonia parviflora (Small Flowered Agrimony)
Alisma subcordatum (Water Plantain)
Alliaria petiolata (Garlic Mustard)
Allium cernuum (Nodding Onion)
Allium tricoccum (Ramps)
Andropogon gerardii (Big Bluestem Grass)
Andropogon scoparius (Little Bluestem Grass)
Anemone quinquefolia (Wood Anemone)
Anemone virginiana (Thimbleweed)
Anemonella thalictroides (Rue Anemone)
Angelica atropurpurea (Angelica)
Apios americana (Ground Nut)
Aplectrum hyemale (Orchid Puttyroot)
Apocynum cannabinum (Indian Hemp)
Apocynum cannaginum (Indian Grass)
Aquilegia canadensis (Columbine)
Arabis hirsuta (Hairy Rockcress)
Aralia racemosa (Spikenard)
Arisaema atrorubens (Jack in the Pulpit)
Arisaema dracontium (Green Dragon)
Asarum canadense (Wild Ginger)
Asclepias incarnata (Swamp Milkweed)
Asclepias syriaca (Common Milkweed)
Asclepias tuberosa (Butterfly Weed)
Aster lateriflorus (Calico Aster)
Aster novae-angilae (New England Aster)
Aster punecius (Purple Stemmed Aster)
Aster umbellatum (Aster Parasol)
Barbarea vulgaris (Yellow Rocket)
Berberis vulgaris (Barberry)
Bidens connata (Swamp Beggar Ticks)
Bidens coronata (Midwestern Tickseed Sunflower)
Bidens frondosa (Beggar Ticks)
Blephilia hirsuta (Hairy Woodmint)
Butrychlum virginianum (Rattlesnake Fern)
Cacalia suavolens (Sweet Scented Indian Plantain)
Cacalia tuberous (Tuberous Indian Plantain)
Calopogon pulchellus (Grass Pink Orchid)
Caltha palustris (Marsh Marigold)
Campahula americana (Tall Bellflower)
Cardamine bulbosa (Spring Cress)
Cardamine douglassii (Purple Bittercress)
Caulophtllum thalictroides (Blue Cohosh)
Cephalanthus occidentalis (Button Bush)
Chelone glabra (Turtlehead)
Chichorium intybus (Chickory)
Circaea quadrisulata (Enchanter's Nightshade)
Circium discolor (Field Thistle)
Circium mutucum (Swamp Thistle)
Circuta maculatum (Water Hemlock)
Cirsium vulgare (Thistle Bull)
Claytonia virginica (Spring Beauty)
Clematis virginiana (Virgins Bower)
Conium maculatum (Poison Hemlock)
Convolvulus sepium (Bindweed Hedge)
Coreopsis tripteris (Tall Coreopsis)
Cornus alternifolius (Pagoda Dogwood)
Cornus amomum (Silky Dogwood)
Cornus stolonifera (Red Osier Dogwood)
Cryptotaenia canadensis (Honewort)
Cuscula gronovii (Dodder)
Cypripedium parviflorum (Small Yellow Lady's Slipper Orchid)
Cypripedium reginae (Showy Lady's Slipper Orchid)
Daucus carota (Queen Anne's Lace)
Desmodium canadense (Canadian Showy Tick Trefoil)
Desmodium paniculatum (Panicled Tick Trefoil)
Dodecatheon media (Shooting Star)
Drocera rotundifoli (Sundew)
Echinacea purpurea (Purple Coneflower)
Echinocyst obata (Cucumber Wild)
Epilobium spp (Willow Herb)

Ereiophorum diricaninatum (Green Cotton Sedge)
Erigeron annuus (Fleabane Daisy)
Erigeron philadelphicus (Philadelphia Fleabane)
Eriophorum veridcarinatum (Green Cotton Sedge)
Euonymus atropurpureus (Wahoo)
Euonymus obovatus (Running Strawberry Bush)
Eupatorium maculatum (Joe Pye Weed)
Eupatorium perfoliatum (Boneset)
Euphorbia corollata (Flowering Spurge)
Filapendula rubra (Queen of the Prairie)
Fragaria virginiana (Wild Strawberry)
Galium aparine (Beadstraw Cleavers)
Galium boreale (Northern Bedstraw)
Gentiana andrewsii (Closed Gentian)
Gentiana procera (Fringed Gentian)
Geranium maculatum (Wild Geranium)
Gerardia purpurea (Purple Gerardia)
Gerardia tenuifolia (Slender Gerardia)
Geum canadense (White Avens)
Helenium autumnale (Sneezeweed)
Helianthus giganteous (Tall Sunflower)
Helicanthuis maximilliani (Maximillian Sunflower)
Heliopsis heilanthoides (Oxeye)
Hepatica americana (Hepatica)
Hesperis matronalis (Dames Rocket)
Heuchera americana (Alum Root)
Humulus lupulus (Common Hop)
Hydrangea arborescens (Wild Hydrangea)
Hydrastis canadensis (Goldenseal)
Hydrophyllum appendiculatum (Appendaged Waterleaf)
Hypoxis hirsuta (Yellow Star Grass)
Hystrix patula (Bottlebrush Grass)
Ilex vericillata (Winterberry)
Impatiens capensis (Spotted Touch-me-not)
Iris pseudocorus (Yellow Iris)
Iris virginica var. shrevil (Blue Flag Iris)
Krigia biflora (Two Flowered Cynthia)
Lactuca canadensis (Wild Lettuce)
Lamium purpureum (Red Dead Nettle)
Latuca biennis (Tall Blue Lettuce)
Lepidium virginicum (Wild Peppergrass)
Liatris spicata (Blazing Star)
Lilium michiganense (Michigan Lily)
Lindera benzoin (Spicebush)
Liparis loesselii (Twayblade Bog Orchid)
Lobelia kalmii (Kalms Lobelia)
Lobelia siphlitica (Great Lobelia)
Lonicera prolifera (Grape Honeysuckle)
Lysimachia ciliate (Fringed Loosestrife)
Lysimachia quadriflora (Prairie Fringed Loosestrife)
Lythrum alatum (Wing Angled Loosestrife)
Lythyrus palustris (Marsh Pea)
Maianthemum canadense (Horse Nettle)
Melilotus alba (White Sweet Clover)
Melilotus officinalis (Yellow Sweet Clover)
Menispermum canadense (Moonseed)
Mentha arvenis (Field Mint)
Mentha piperita (Peppermint)
Minulus ringens (Monkey Flower)
Mitchella repens (Partridgeberry)
Mitella diphylla (Miterwort)
Monarda fistulosa (Wild Bergamot)
Monarda media (Purple Bergamot)
Nasturtium officinale (Watercress)
Oenothera biennis (Evening Primrose)
Onoclea sensibilis (Sensitive Fern)
Orchis spectabilis (Showy Orchis)
Osmorhiza claytoni (Bland Sweet Cicley)
Osmorhiza longistylis (Aniseroot Sweet Cicley)
Osmunda cinnamomea (Cinnamon Fern)
Parnassia glauca (Bog Stars)
Pastinaca sativa (Wild Parsnip)
Pedicularis canadensis (Swamp Lousewort)
Penstemon digitalis (Beardtounge Foxglove)
Phlox divaricata (Wild Blue Phlox)
Phlox maculatum (Spotted Phlox)
Phryma leptostanchya (Lopseed)
Physalis heterophylla (Clammy Ground Cherry)
Physocarpus opulifolius (Ninebark)
Physostegia virginiana (Obedient Plant)

Phytolacca americana (Pokeweed)
Plantathera clavelata (Green Woodland Orchid)
Plantathera lacera (Ragged Fringed Orchid)
Plantathera psyodes (Small Purple Fringed Orchid)
Podophyllum peltatum (Mayapple)
Polemonium reptans (Greek Valerian)
Polygonatum biflora (Hairy Solomon's Seal)
Polygonatum canaliculatum (Great Solomon's Seal)
Polygonum hydropiperoides (Mild Waterpepper)
Polygonum persicaria (Lady's Thumb)
Polygonum scandens (Climbing False Buckwheat)
Polymnia canadevsis (Small Flowered Leafcup)
Potentilla fruticosa (Shrubby Cinquefoil)
Potentilla recta (Rough Fruited Cinquefoil)
Prenanthes alba (Tall White Lettuce)
Prenanthes racemosa (Smooth White Lettuce)
Prunella vulgaris (Heal All)
Prunus serotina (Wild Black Cherry)
Ptela trifoliata (Wafer Ash)
Pycnanthemum virginianum (Virginia Mountain Mint)
Ranunculus abortivus (Kidneyleaf Buttercup)
Ranunculus pensylvanicus (Bristley Crowfoot)
Ranunculus recurvatus (Hooked Buttercup)
Ranunculus sceleratus (Cursed Crowfoot)
Ranunculus septentrionalis (Swamp Buttercup)
Ratibida pinnata (Gray-headed Coneflower)
Rhus radicans (Poison Ivy)
Ribes cynosbati (Prickly Gooseberry)
Ribes hirtellum (Smooth Gooseberry)
Rosa arkansana (Prairie Rose)
Rosa Multiflora (Multiflora Rose)
Rosa palustris (Rose Swamp)
Rubus allegneniensis (Blackberry)
Rubus pubescens (Dwarf Raspberry)
Rudbeckia hirta (Black Eyed Susan)
Rudbeckia lacinata (Green-headed Coneflower)
Ruellia strepens (Smooth Ruellia)
Saggitaria latifolia (Arrowhead)
Sambucus canadensis (Black Elderberry)
Sanguinaria canadense (Bloodroot)
Sanguisorba canadensis (Canada Burnet)
Sanicle sp (Black Snakeroot)
Scirpus sp (Soft Stemmed Bulrush)
Senecio aureus (Golden Ragwort)
Sicyos angulatus (Cucumber Burr)
Silphium perfoliatum (Cup Plant)
Silphium terebinthinacum (Prairie Dock)
Silphium trifoliatum (Whorled Rosinweed)
Sium suave (Water Parsnip)
Smilacina racemosa (False Solomon's Seal)
Smilacina stellata (Starry False Solomon's Seal)
Smilax rotundifolia (Common Greenbrier)
Solanum dulcamaara (Nightshade Bittersweet)
Solidago altissima (Tall Goldenrod)
Solidago caesia (Wreath Goldenrod)
Solidago flexicaulis (Zigzag Goldenrod)
Solidago graminifolia (Narrow Leaved Goldenrod)
Solidago ohiensis (Ohio Goldenrod)
Solidago reddellii (Riddells Goldenrod)
Solidago sp (Bog Goldenrod)
Sparganium chlorocarpum (Bur Reed)
Stellaria media (Common Chickweed)
Symplocarpu foetidus (Skunk Cabbage)
Sysrinchium angustifolium (Blue-Eyed Grass)
Taraxacum officinale (Dandelion)
Teuchrium canadense (American Germander)
Tevara virginiana (Virginia Knotweed)
Thalictrum dasycarpum (Purple Meadow Rue)
Thalictrum dasycarpum (Purple-stemmed Meadow Rue)
Thalictrum diocium (Early Meadow Rue)
Thelypteris palustris (Marsh Fern)
Tofieldia glutinosa (False Asphodel)
Toxicodendron vernix (Poison Sumac)
Tradescantia ohiensis (Ohio Spiderwort)
Tradescantia virginiana (Virginia Spiderwort)
Trapagon pratensis (Goatsbeard)
Trientalis borealis (Starflower)
Trifolium pratense (Red Clover)
Trifolium repens (White Clover)
Triglochin maritimum (Seaside Arrowgrass)

Trillium flexipes (DroopingTrillium)
Trillium grandiflorum (Large Flowered Trillium Large)
Trillium grandiflorum (Large Flowered Trillium)
Trillium sessile (Toadshade Trillium)
Typha latfolia (Common Cattail)
Urtica dioica (Stinging Nettle)
Urtica procera (Tall Nettle)
Utricularia cornuta (Horned Bladderwort)
Utricularia intermedia (Flat Leaved Bladderwort)
Utricularia vulgaris (Common Bladderwort)
Uvularia grandiflora (Large Flowered Bellwort)
Vaccinium arboreum (Black Huckleberry)
Valeriana ciliata (Prairie Valerian)
Valerianella intermedia (Corn Salad)
Verbascum blattaria (Moth Mullein)
Verbascum thapsus (Common Mullein)
Verbena hastata (Blue Vervain)
Verona altissima (Tall Ironweed)
Veronica anagallis-aquatica (Water Speedwell)
Viburnum lentago (Nannyberry)
Viola cucullata (Marsh Violet)
Viola labradorica (Dog Violet)
Viola pubescens (Downy Yellow Violet)
Viola rostrata (Long Spurred Violet)
Viola sororia (Common Blue Violet)
Viola sp (Violets)
Vitis ripara (Wild Grape)
Zigendus nuttallii (Wand Lily)
Zizia aurea (Golden Alexanders)

CURRENT LAND AND WATER RESOURCES

Topography and Current Land Use

The topography of the area is nearly level to gently sloping, although some subwatersheds experience rolling topography. Nearly 79% of the land falls into the category of prime farmland. Most of the prime farmland is located on the till plains and valleys of the Mad River and along the secondary streams. Some soils rated as prime farmland soils do have limitations or hazards, such as a seasonably high water table and frequent flooding.

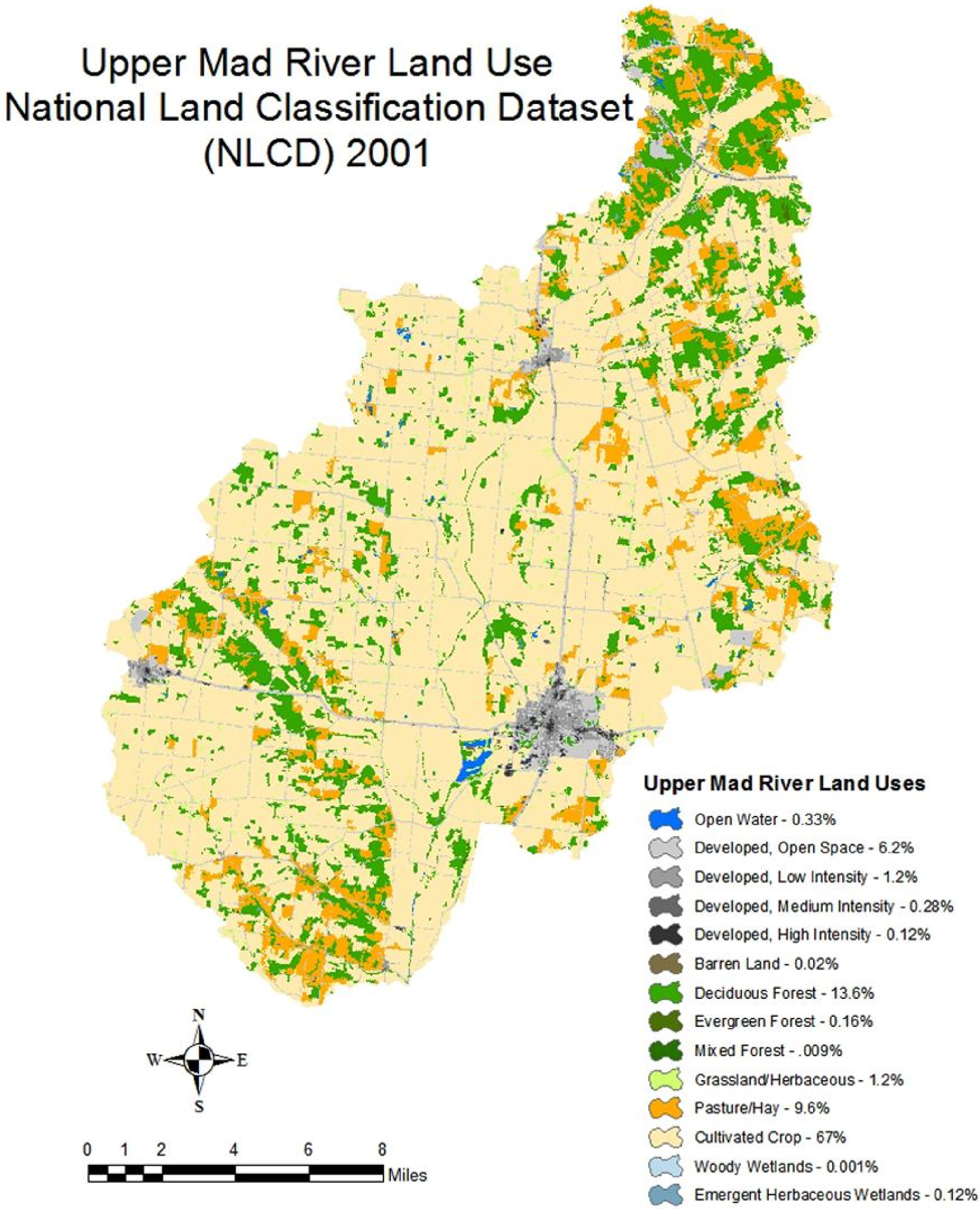
Extensive floodplains are found along the Mad River and many of the related tributaries, such as Buck Creek. Floodplains are particularly extensive along the Mad River southwest of Springfield along I-70 and south to the Clark County line. In order to qualify as prime farmland, these areas have overcome the above limitations by implementing measures such as drainage and/or flood control. In recent years, a considerable amount of prime farmland has been lost to industrial and urban uses. According to the Clark and Champaign County Farm Service Agencies, an average of 285 acres of rural land is converted for urban use each year in the Mad River Watershed. The loss of prime farmland to other uses places agricultural pressures on marginal lands, which generally are more erodible, drought-stricken, less productive, and cannot be easily cultivated.

The watershed has 85% of the Highly Erodible Land (HEL) acres for Clark County. A total of 29,550 acres of HEL ground can be found in the Lower Mad River Watershed. The average slope for HEL ground in the Lower Mad River Watershed is 8%. Agricultural production for corn, soybeans, and beef cattle ranks in the upper twenties among Ohio's eighty-eight counties. However, small grain and hay production rank falls to the middle forties among Ohio's counties, showing a need for a cover crop program and extended crop rotations. NRI data from NRCS indicates that average soil loss is approximately 3 tons per acre per year.

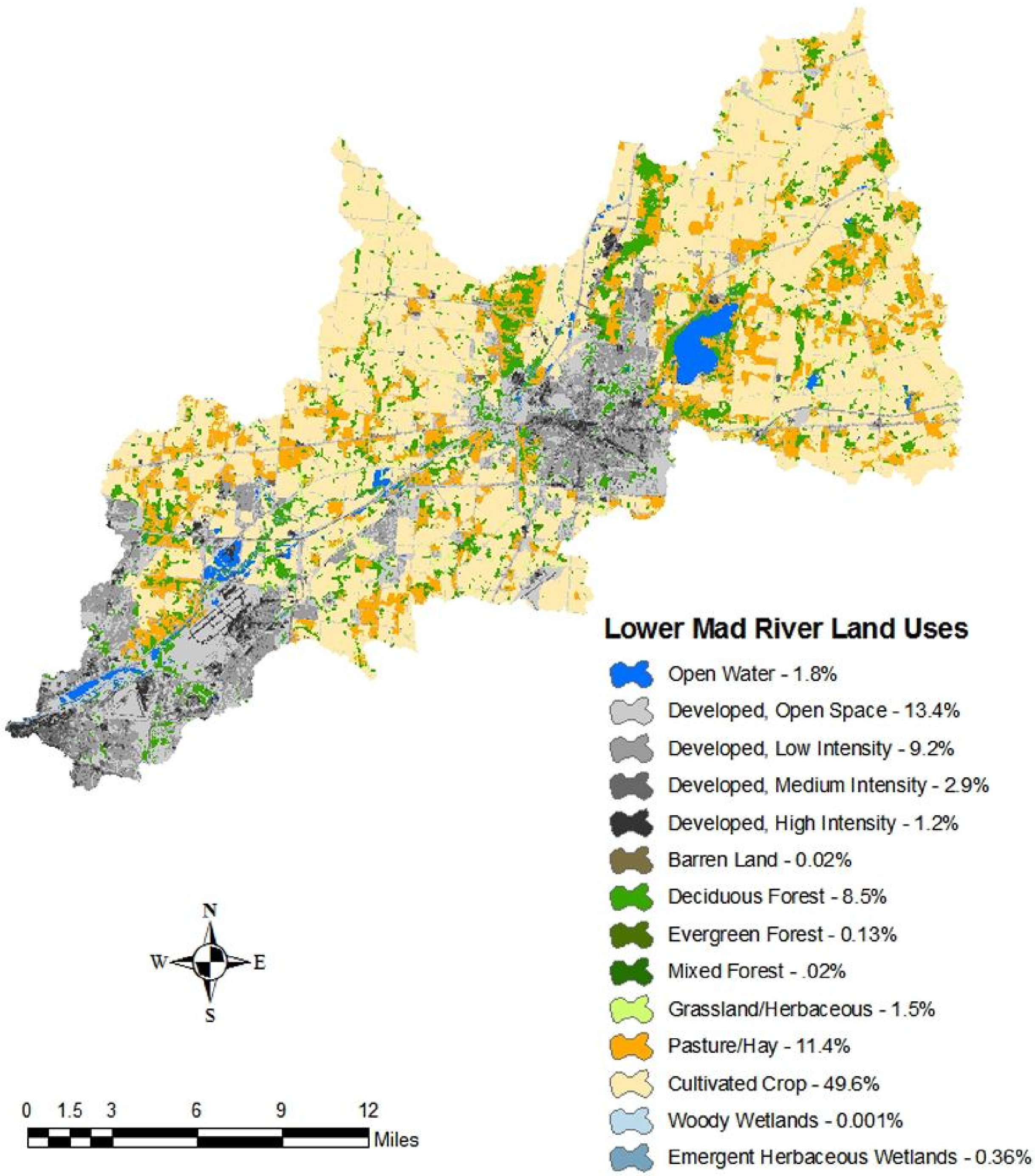
Tillage transects conducted by NRCS personnel in 2002 show that 85% of the tillage method used is minimum tillage.

Most of the land in the watershed is used for farming practices. The main enterprises are cash-grain farming, livestock production, and dairying. Throughout most of the farmland, a drainage system has been installed in areas consisting of inundated soils to improve crop production. Most soils are well suited for field crops, pastures, and trees. Wetness is a major limitation affecting the use of many of the soils. The hazard of erosion is generally severe on sloping to steep soils on terminal moraines and along stream valleys.

The watershed has a total of 401,647.5 acres of open space, recreation, and open space links. The Upper Mad River Watershed contains 184,481 of this acreage, while 217,166.5 acres are in the Lower portion of the watershed. The open spaces are highly visible areas in the watershed that provide recreational opportunities such as hiking, boating, fishing, swimming, and camping for western and central Ohio residents.


Upper Mad River Land Use
National Land Classification Dataset
(NLCD) 2001
Upper Mad River Land Uses
Open Water - 0.33%
Developed, Open Space - 6.2%
Developed, Low Intensity - 1.2%
Developed, Medium Intensity - 0.28%
Developed, High Intensity - 0.12%
Barren Land - 0.02%
Deciduous Forest - 13.6%
Evergreen Forest - 0.16%
Mixed Forest - .009%
Grassland/Herbaceous - 1.2%
Pasture/Hay - 9.6%
Cultivated Crop - 67%
Woody Wetlands - 0.001%
Emergent Herbaceous Wetlands - 0.12%
N
W
E
S
0 1 2 4 6 8
Miles

Lower Mad River Land Use National Land Classification Dataset (NLCD) 2001



Groundwater Resources

The Mad River watershed's geology allows for significant variations in surface water base flow throughout the watershed.

Ground water and surface water are more completely connected in the Mad River watershed than any other river system in Ohio. In "Determination of base-flow characteristics at selected sites on the Mad River, Ohio: U. S. Geological Survey Water-Resources Investigations Report", G. F. Kolton (1995), states that the median percentage of annual total streamflow attributed to baseflow from groundwater ranges from 61.8 to 76.1 percent, the highest of any river in Ohio. Kingscreek Subwatershedhas the highest base-flow per square mile of drainage within the Mad River System.

The groundwater pollution potential is relatively high in part because of the interaction between surface water and groundwater. In his 2007 report "The Relationship between Land Use, Ground Water Flow and Non-Point Source Contamination in the Upper Mad River Watershed", Wayne Jones of Ohio Department of Natural Resources (ODNR), Division of Water (DOW), states, "Nitrate in ground water is a nonpoint source contaminant…The majority of the land use in Champaign County is agricultural. The largest agricultural activity within Champaign County is the production of grain crops, especially corn. The process of growing corn relies heavily on the application of synthetic fertilizers such as anhydrous ammonia. Excess fertilizers can leach into the ground water system producing nitrate contamination of the aquifer…Including nitrogen that was fixed from the atmosphere and nonfarm uses in 1997, Champaign County accounted for over 3,000,000 pounds of nitrogen fertilizer."

Nitrate contamination is concentrated in the Kingscreek sub-watershed. Probability plots show a 50 percent probability for a Nitrate value of 4.7 mg/L in any well drilled in Kingscreek compared with 0.02 mg/L in the South Subwatershedof the study area.

Source: Ohio Caverns

The largest ground water source in Clark County is the Mad River buried valley aquifer. This aquifer contains outwash sediments deposited by water rushing from the melting glacial ice. Well-sorted sand and gravel deposits help make buried valley aquifers the most productive aquifers of the basin and some of the most productive in the world. Municipal water supplies are withdrawn from this aquifer for the cities of Springfield and New Carlisle, the village of Enon, and the Clark County Water and Sewer District, which serves Northridge, Medway, and Park Layne.

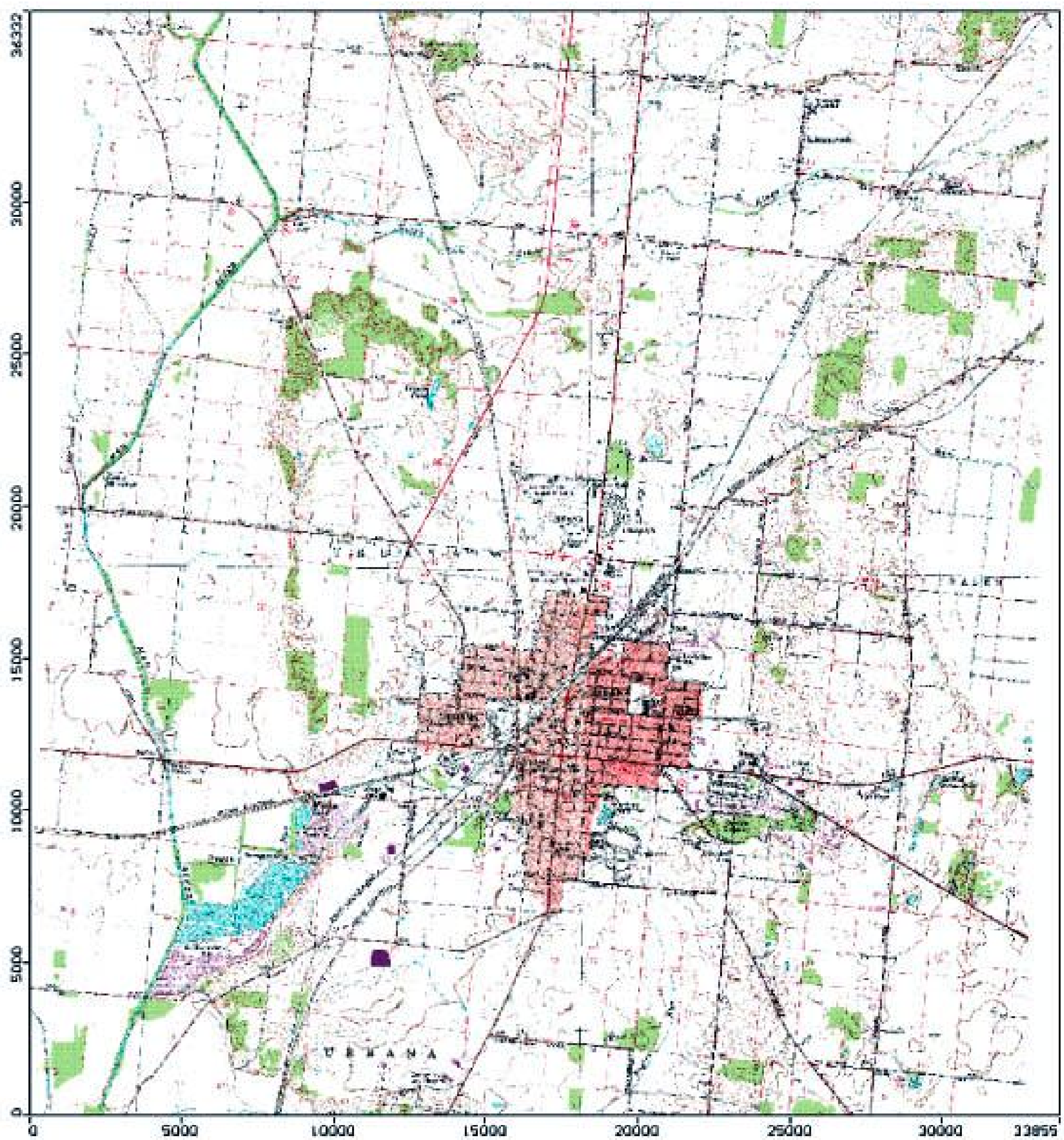
The majority of ground water in Clark County comes from unconsolidated aquifers of sand and gravel. As water moves through the fractured limestone underlying the county, it dissolves and transports minerals contained in the bedrock. The water tends to have high concentrations of calcium carbonate and iron. Many households and municipalities, such as the City of Springfield, treat the water before use or distribution.

Due to the geology of the southwestern portion of the Lower Mad River Watershed, surface and ground water are closely connected. According to information distributed by Bob Moore and Rich Bendula of the Ohio EPA, the Lower Mad River Watershed contains areas where bedrock aquifers are located near the surface and are vulnerable to surface water contamination. The Ohio EPA and the Clark

County Combined Health District have conducted water quality studies to determine inorganic and bacteriological quality of the upland bedrock aquifers. In these areas of the watershed, residents experience water quality problems following heavy rain events. Drinking wells become turbid and some become contaminated with bacteria and nitrates.

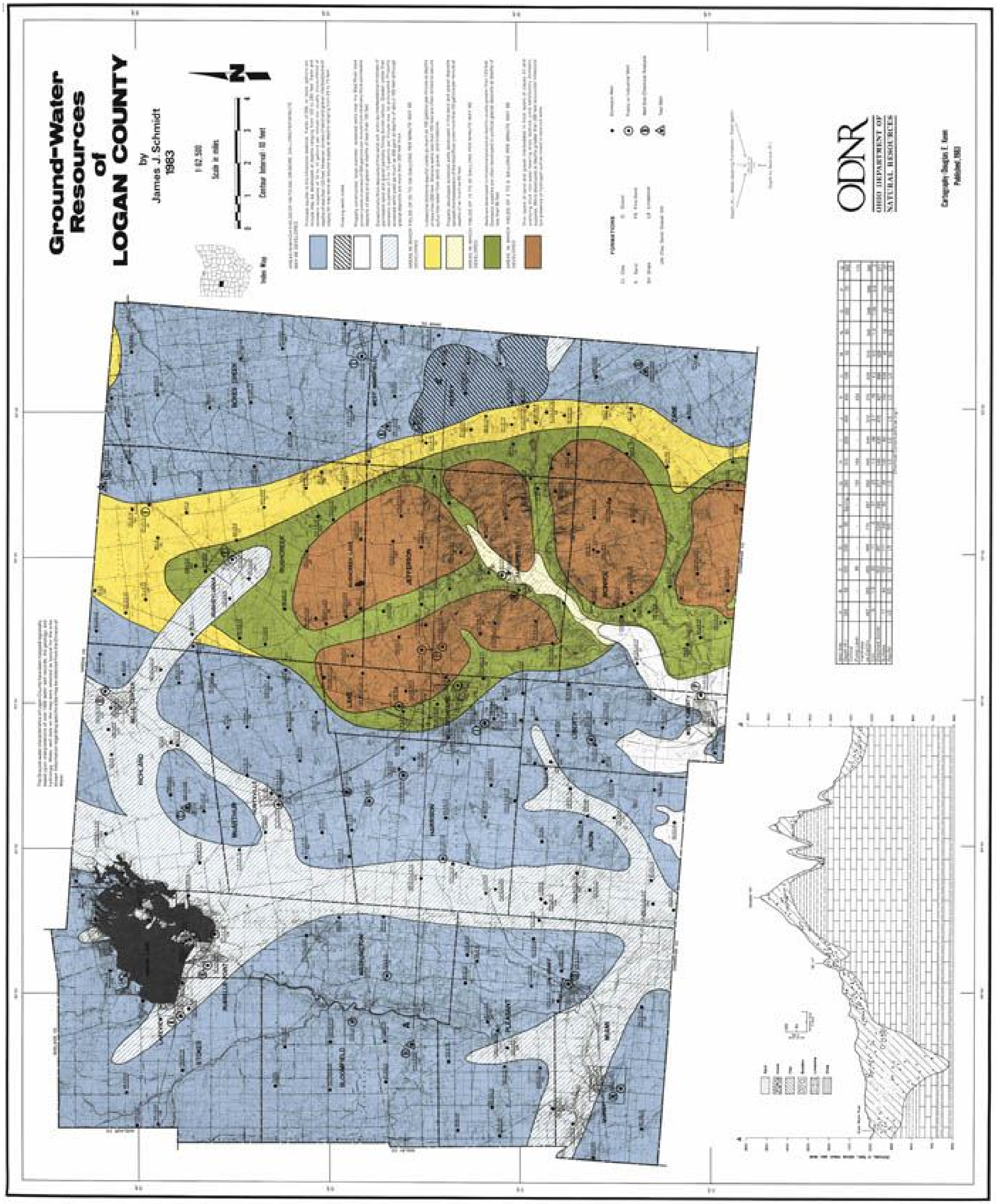
The water that is deflected off impervious surfaces would under natural (pre-urbanized) conditions (especially in the City of Urbana portion of the watershed), percolate into the ground and become stored as groundwater. This water would then seep from the ground into the river or stream allowing a stable flow of water in the channel. Without this recharge, flow in the stream is reduced during low precipitation months.

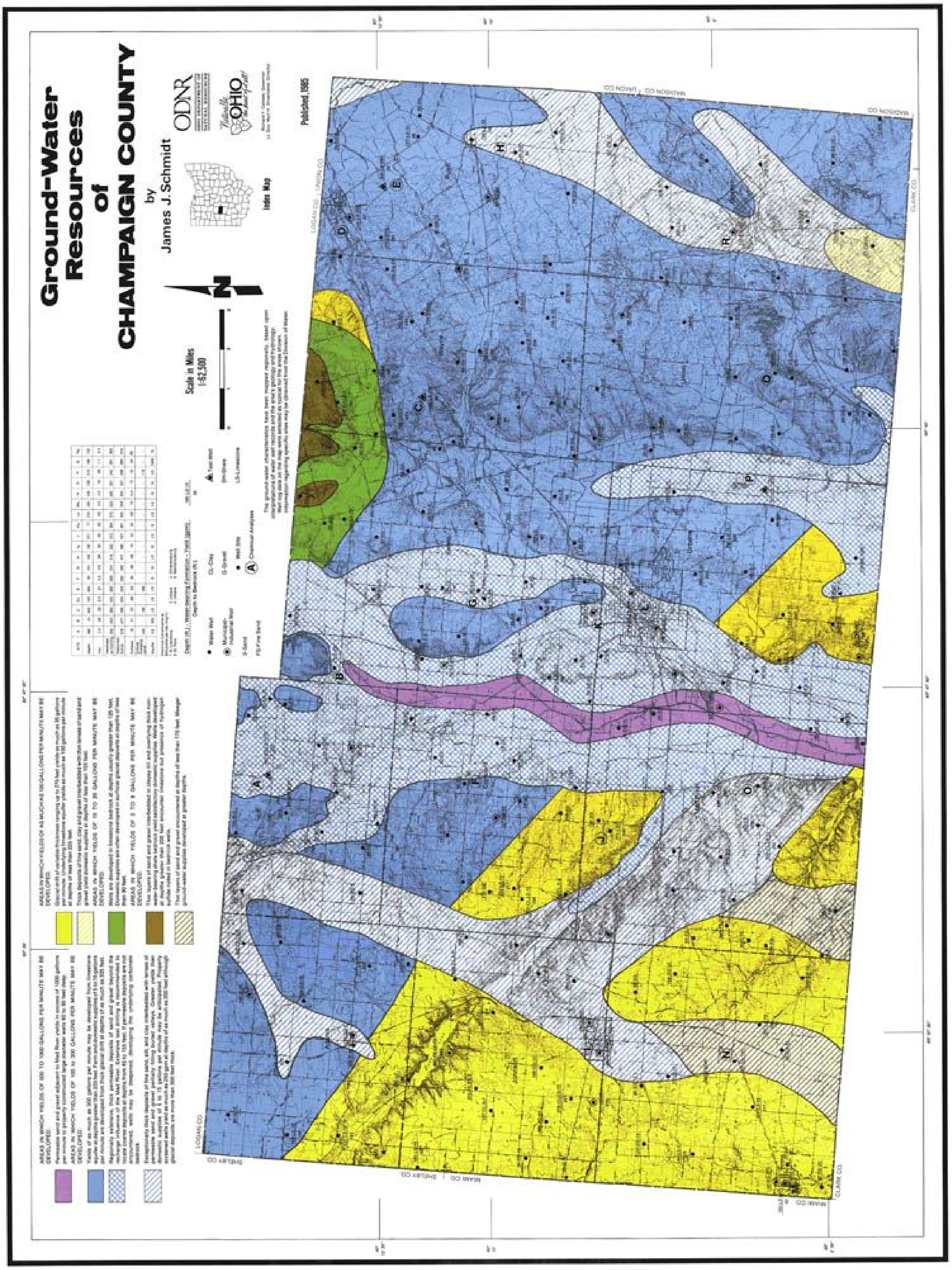
A reduction of impervious surfaces can provide for better groundwater infiltration to enhance stream recharge.

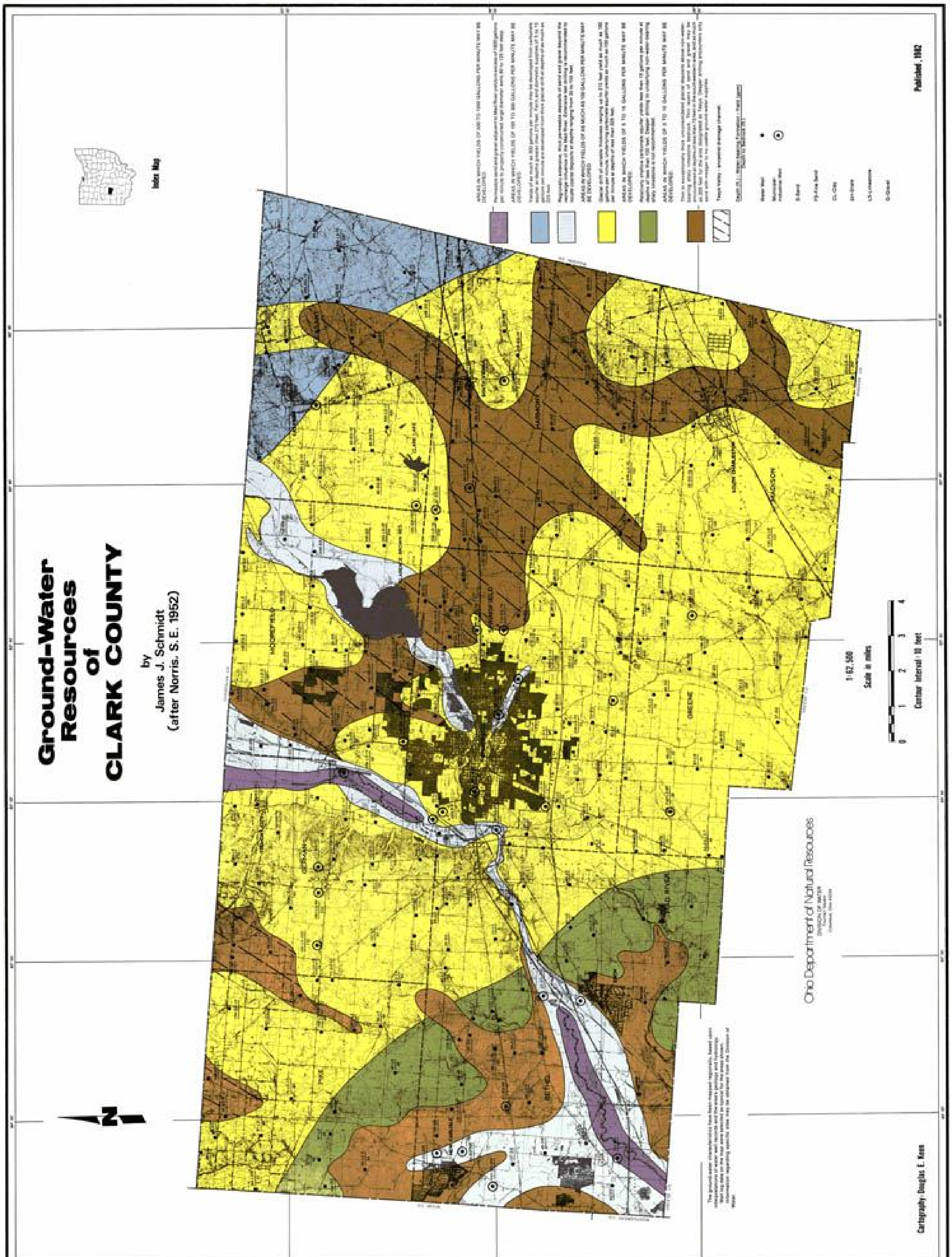


A ground water flow model was used to simulate ground water flow and the interaction with surface drainage. The ground water flow model chosen for this study was MODFLOW (McDonald and Harbaugh, 1984). Modflow is a three-dimensional finite difference flow model. Contained in the Visual Modflow package is the module MODPATH. MODPATH is a post-processing package that calculates particle paths and generates graphs. MODPATH is for backward particle tracking to illustrate the pathway from a contaminated well to the recharge area and contaminant source. It can also calculate the travel time for contaminant transport. The main purpose for constructing a ground water flow model was to use MODPATH particle tracking software to determine the source of recharge to nitrate contaminated wells.

-Source: "The Relationship between Land Use, Ground Water Flow and Non-Point Source Contamination in the Upper Mad River Watershed", Wayne Jones of Ohio Department of Natural Resources (ODNR), Division of Water (DOW)


Ground-Water Resources of LOGAN COUNTY
by
James J. Schmidt
1983
ODNR
OHIO DEPARTMENT OF NATURAL RESOURCES


Ground-Water Resources of CHAMPAIGN COUNTY
by
James J. Schmidt
ODNR
Index Map
Scale in Miles
1:62,500


Ground-Water
Resources
of
CLARK COUNTY
by
James J. Schmidt
(after Norris, S. E. 1952)
Ohio Department of Natural Resources
Index Map
Published, 1962
Cartography: Douglas E. Keen

Water Suppliers

City of Urbana

To meet current demands of approximately 3 MGD (million gallons per day), Peak Flows have been around 2.9 MGD and average 2.1 MGD, the City of Urbana, Ohio relies on two existing wellfields: one in the Mad River valley along Old Troy Pike and one just south of Grimes Airport. A potentially advancing plume of volatile organic contaminants released from upgradient industrial sites has threatened the Old Troy Pike wellfield. In addition, the wellfield near Grimes Airport is in an area where nitrates approach or exceed the permissible drinking water standard of 10 mg/l (as Nitrogen). As a result, the Ohio Environmental Protection Agency (OEPA) had mandated closure of 2 wells at this wellfield, and only one production well remains in operation at this time.

Historically, the water from the existing wells has not required any other treatment other then disinfection. In the late 1980s OEPA began seeing detects of TCE, (Trichloroethene) and Benzene in the Wells at Old Troy Pike. Considering that only trace amounts of these substances were being detected and were well below the MCL's (Maximum Concentration Limits), OEPA began delineating the plume to determine the origins of the pollution and no public alerts were issued or warranted. Four industrial sites were eventually named as potential locations of the plume origins.

The present site owners are in negotiations with OEPA regarding Site Remediation.

These industries had used these volatile compounds as cleaning and degreasing agents in the past and historical disposal of the spent solvents was land dumping thus leading to the advancing plume.

Over the course of the next 10 years, OEPA and Urbana realized the plume was advancing toward the Old Troy Pike Wellfield and concentrations of PCE, (Tetrachlroethene) and TCE, (Trichloroethene) were slowly increasing at the Wellfield Entry Point.

Susceptibility Analysis: A susceptibility analysis evaluates the likelihood that a public water system's source water could become contaminated. The analysis is based on the sensitivity of the aquifer to contamination, the available water quality data for the water system, and the number and types of potential contaminant sources located within the protection area.

Susceptibility Rating. The aquifer that supplies drinking water to the City of Urbana's Old Troy Pike and Grimes Airport wellfields (Mad River Aquifer) has a high susceptibility to contamination based on the aquifer's sensitivity to contamination, the numbers and types of potential contaminant sources within the protection area, and evidence of ground water quality impacts from human activities.

Aquifer Sensitivity. The City of Urbana's Grimes Airport Wellfield draws water from an unconfined sand and gravel aquifer with a depth to water of less than 30 feet below the ground surface. The aquifer is covered by 10 to 15 feet of clay, providing little protection from contaminant movement from the ground surface to the aquifer. The topography is relatively flat and the soils are a silty to sandy loam, allowing for much of the precipitation to infiltrate into the aquifer instead of running off the ground surface. The Grimes Airport well is cased to a depth of between 50 and 59 feet below the land surface. The City of Urbana's Old Troy Pike Wellfield draws water from an unconfined sand and gravel aquifer with a depth to water of less than 30 feet below the ground surface. The aquifer is continuous to the surface, with no protection from contaminant movement. The topography is relatively flat and the soils are very sandy, allowing for much of the precipitation to infiltrate into the aquifer instead of running off the ground surface. The Old Troy Pike wells are cased to a depth of 30 feet below the land surface.

Water Quality. At this time, there is evidence indicating the quality of water provided by the City of Urbana has been impacted. Compliance monitoring data and ambient ground water monitoring data (raw and treated water) collected since 1991 has contained nitrate above the concentration of concern of 2 mg/L on over 100 occasions, with concentrations ranging from 2.16 to 12.9 mg/L. This indicates an impact from human activities. The federal and state drinking water standard for nitrate is 10 mg/L, and water quality at the City of Urbana exceeded this standard on some occasions. Compliance monitoring data and ambient ground water monitoring data (raw and treated water) collected since 1991 also contained concentrations of Tetrachlroethene (PCE) and trichloroethene (TCE) above the detection limit (0.5 :g/L) in both raw and treated water. Concentrations of PCE ranged from 0.8 to 1.5 :g/L on 22 occasions, and TCE ranged from 0.5 to 0.9 :g/L on 24 occasions. These values are well below the federal and state drinking water standard of 5:g/L for both constituents.

Potential Contaminant Sources. There are five potential contaminant sources within the City of Urbana's Grimes Airport wellfield's one year time of travel area and nine within the five year time of travel area. The types of potential contaminant sources present include an airport, agricultural areas, a feed lot, burned-down plastics plant, an armory, a junk yard, a former underground storage tank, rivers, roadways and railways.

There are four potential contaminant sources within the City of Urbana's Old Troy Pike well field's one year time of travel area and nine within the five year time of travel area.

The types of potential contaminant sources present include rivers, agricultural areas, gravel mining operations, former dumps, industrial facilities, roadways and railways. Because of the concerns to the City drinking water supply, the Ohio EPA required the City to locate a new water supply, sufficiently remote from these areas of ground water quality concerns. Through a series of test borings and geologic evaluations, various sites in and around the City have been considered for wellfield development. Although these initial sites offered various individual potential, none provided sole source capacity and quality suitable for replacing the City's current supply.

In 1998 the City commissioned Bennett and Williams to begin to investigate water source options. An area to the East of the City was intensely investigated as the City owned land there and was in the area of planned growth. Additionally, ten other sites were prioritized and investigated including a City owned farm and the Fair Grounds. However, none of these sites could provide the quantity and quality of water Urbana was seeking.

With Ohio EPA's concurrence, further investigation focused on the Mad River Valley north of the City and further away from the sources of contamination and plume delineation. By geologic mapping, a potentially favorable area was identified north of Millerstown Road, between Rt. 29 and the Mad River. In October 2002, four tests borings were installed in this area: three extending from the north to south ends of the area, along the Mad River, and the fourth just north of Millerstown Road, one half mile east of the Mad River. Each of these test borings encountered a usable aquifer, although the northern two borings, on the Stadler Farm property, suggested the greatest potential. Accordingly, a site for aquifer testing was selected on the Stadler Farm property.

For this testing, a pattern of eleven observation wells and one pumping well was installed, followed by test pumping at 1900 gpm (gallons per minute) for three days.

Aquifer Test: The pattern of observation wells included 7 deep wells and 4 shallow wells, separated by an intermediate clay layer in the middle of the aquifer. Two observation wells, one deep and one shallow were installed on the west bank of the Mad River; all of the remaining observation wells in the test pattern were installed within the floodplain east of the river.

The drilling of each well was supervised by an experienced hydrogeologist, who directed the drilling procedures, inspected the formation samples as they were recovered, and prepared a log of materials encountered.

Five well points also were driven through the bed of the Mad River to monitor ground water levels directly beneath the river channel. The well points were 1.5 inches in diameter, with perforated screen sections of two and three feet in length. Each well point was connected to a 1.5 inch diameter steel riser casing extended several feet above the level of the Mad River. Top of the screen section for each well point was driven approximately two feet below the bed of the river channel, to minimize the potential for direct interconnection with the river.

In addition, a river gage and river stilling well were installed in the river, to allow monitoring of river level fluctuations. A transducer installed in the stilling well was used to continuously monitor the river level electronically, whereas the river gage was used by field personnel for direct observation at regular intervals during the test period.

Geology: Prior to the Pleistocene glaciations, the region around Urbana was a hilly terrain with deep valleys, much like currently observed in southeastern Ohio. Through a series of multiple glacial advances, a thick sequence of deposits buried this terrain, leaving more than 300 feet of sediments in the deepest portions of the buried valleys, such as the one underlying the Stadler Farm test site.

Ideally, this thick sequence of deposits would be entirely permeable sand and gravel. Instead, the multiple glacial events left alternating layers of sand and clay, some thicker and more extensive than others. The Old Troy Pike wellfield, also within these Mad River valley glacial deposits, produces water from the shallow sand and gravel unit, at depths of about 65 feet. Because of accessibility to sources of recharge, this shallow unit at Old Troy Pike has provided a supply of reliable capacity and exceptional quality, without any need for treatment other than chlorination.

At the Stadler property, a shallow aquifer comparable to that at Old Troy Pike was identified. The initial two borings, at the north and south ends of this property, encountered predominantly sand and gravel to the depths of 78 and 70 feet, respectively.

At each location, an intervening clay layer was encountered near the middle of the aquifer: an 8.5-foot zone from 29 to 37.5 feet below ground surface on the north side of the property, and a one-foot zone at 32 feet below ground surface on the south side. The south side boring also had three thin clay zones in the bottom 11 feet of the aquifer, limiting its useful depth to about 59 feet below ground surface.

The intermediate clay zone conceptually separates the shallow aquifer into upper and lower units. The upper unit, although slightly thinner, has the coarsest, cleanest, and most permeable gravel sediments. The lower unit is sufficiently coarse but is somewhat dirtier and denser than the upper unit. Collectively the two units furnish a transmissive aquifer suitable for development of large capacity ground water supplies comparable to that at Old Troy Pike.

At the test site, midway between the two exploratory test borings, the aquifer displays many of the same characteristics and even improves slightly in some respects. In the central portion of the test pattern, the aquifer is about 72 feet deep and has stratigraphically equivalent upper and lower units of sand and gravel.

Results: Although the pumping level had not stabilized by the end of the test, it was declining slowly, at a rate of about 0.01 feet every four hours. Given a total drawdown recharge scenario of about 19 feet at 2.9 MGD and a cone of influence of 1300 feet, the required capacity of 3.0 MGD can be attained. The Water quality reflected samples typical for the region. The quality is dominated by calcium bicarbonate and would be characterized as moderately hard, with a slight potential for encrustation. Manganese is the only parameter that exceeded a secondary drinking water standard, although iron in the initial test well sample was only slightly less than its limit. Sufficient recharge from the river, that may potentially improve these parameters, is not anticipated.

Treatment for at least these two parameters was anticipated. None of the volatile organics were detected, and all other parameters are within recommended drinking water standards.

Negotiations began on land acquisition of the Stadler Property for the purposes of sitting a Wellfield with a capacity of 3.0 MGD.

Opposition: The City had obtained funding for the wellfield through federal grants and loans all of which had certain prescribed time lines including a requirement that the City be under contract for the drilling of said new wells by the end of 2003.

The City held several public meetings with the concerned area residents and farmers in an attempt to relieve their anxieties regarding excessive rules or regulations regarding land use in the county or surrounding townships. Additionally an Agricultural Sub-Committee was formed to advise the city on Best Management Practices and attempt to give a more positive public relations image of the dealings between the City and the agriculture community.

Current Conditions: Grimes airfield Well Site – Well 5 has been decommissioned and is no longer in use due to excessive nitrate contamination.

Urbana worked with Mr. Wayne Jones of ODNR (Ohio Department of Natural Resources) who obtained a grant from The Ohio Development Authority to research the source of the nitrate contamination by utilizing Global Positioning System's technology in symphony with MODFLOW and MODPATH to give a detailed description of flow conditions and predict where areas of nitrate contamination was likely and where changes in land use patterns may result in aquifer contamination. Nests of Monitoring wells were installed and sampled. Isotopes of Oxygen and Nitrogen were used to help potentially identify the sources of contamination. However, the results of this study proved to be inconclusive.

Old Troy Pike Wellfield: Urbana has arranged a understanding with Grimes/Honeywell and signed a contract to have a GAC, (Granular Activated Carbon) facility built to treat the water for VOC's. This facility went online on December 24, 2004. Additionally Honeywell has agreed to pay for all maintenance costs of the facility for 20 years.

North Sr 29 Wellfield: The City purchased approximately 30 acres of the Stadler property adjacent to the Mad River and has obtained a conservation easement for the approximately 10 acres which includes the Mad River and its banks. This allows for the 300 foot isolation radius required for up to 4 production wells, as well as about 3 acres near SR 29 for a treatment facility if required.

North SR 29 Wellfield (photo by Jennifer Ganson)

Phase 1 of the project which included 3 production wells and the raw water line has been completed. The City employed ARCADIS for the design of Phase 2 of the project. This Phase of the project included a two mile finished water line to the Gwynne Street Tower, An Iron and Manganese Removal Treatment Facility and a 200,000 gallon clear well. The new facility went on line January 28, 2009 and is capable of treating 2 MGD.

Protective strategies: Educational Outreach: The City is broadcasting over the public access channel a variety of educational videos regarding water quality and source water protection. An Education Team has been formed consisting of the Urbana Water Superintendent, Water Quality Program Assistant at OSUE, Logan County SWCD Education Coordinator and several local teachers.

Coordination with Existing Activities: The City of Urbana and stakeholders within the protection area are developing a local program to protect the source waters. A local program is capable of responding to changing conditions within the watershed and can bring together the local governments and stakeholders needed for an effective protection effort. To this end, the Urbana Wellhead Protection

Committee has been created and meets discuss issues relating to wellhead protection and other environmental issues and concerns.

Water Pollution Control Plant -The City of Urbana

The City of Urbana Water Pollution Control Plant is located southwest of the city limits on Muzzy Road. The original plant was constructed in 1915 and one of the buildings still exists. In 1954, a new plant was constructed on the same plant site providing complete treatment and designed for an average flow of 1.5 MGD. The plant was introduced as a Trickling Filter system with Primary and Secondary Settling Tanks with anaerobic digestion. In 1973, construction was started on updating and expanding the existing plant facilities. The expansion consisted of aeration tanks, aerobic digesters, and 2 settling tanks for secondary clarification. This upgrade raised the plant average flow to 3 MGD treatable. In late 1991 through 1992 the facility received its last upgrade. At that time the N-viro process was introduced and allowed the Urbana WPCF to produce Class A exceptional quality sludge (EQS). Along with the Nviro process, a chlorine contact tank, and a post aeration tank were designed. At the end of 2005 the plant treated 803 MG of domestic and industrial wastewater and produced about 2030 ton of Class A (EQS) sludge.

With small capital expenditures in the past 15 years, the Urbana WPCF has started a new design and upgrade study in early 2006. With small capital expenditures in the past 15 years, the Urbana WPCF designed and installed a new state of the art microwave sludge drying system. The unit was installed in late 2008 and completed in 2009. The Burch Bio-Wave unit produces a Class A material with a 90% reduction in volume of sludge. This end product can be land applied to farm ground at agronomic rates or other valuable reuses that the City is looking at. Along with the microwave project in 2008, the Urbana WPCF completed a septage receiving facility that accepts multiple county household sewage. This facility is a 24 hour a day 7 day a week facility that currently has 9 registered septage haulers from 3 counties. With many new

City of Urbana septage receiving facility

regulations facing municipal facilities, Urbana WPCF is currently under study for a plant upgrade to handle an average of 4.5 MGD with nutrient removal and additional liquid sludge storage.

Clark County

The largest ground water source in Clark County is the Mad River buried valley aquifer. This aquifer contains outwash sediments deposited by water rushing from the melting glacial ice. Well-sorted sand and gravel deposits help make buried valley aquifers the most productive aquifers of the basin and some of the most productive in the world. Municipal water supplies are withdrawn from this aquifer for the cities of Springfield and New Carlisle, the village of Enon, and the Clark County Water and Sewer District, which serves Northridge, Medway, and Park Layne. The majority of ground water in Clark County comes from unconsolidated aquifers of sand and gravel. As water moves through the fractured limestone underlying the county, it dissolves and transports minerals contained in the bedrock. The water tends to have high concentrations of calcium carbonate and iron. Many households and municipalities, such as the City of Springfield, treat the water before use or distribution.

Due to the geology of the southwestern portion of the Lower Mad River Watershed, surface and ground water are closely connected. According to information distributed by Bob Moore and Rich Bendula of the Ohio EPA, the Lower Mad River Watershed contains areas where bedrock aquifers are located near the surface and are vulnerable to surface water contamination. The Ohio EPA and the Clark County Combined Health District have conducted water quality studies to determine inorganic and bacteriological quality of the upland bedrock aquifers. In these areas of the watershed, residents experience water quality problems following heavy rain events. Drinking wells become turbid and some become contaminated with bacteria and nitrates.

Flow & Depth (USGS station)
USGS 03267000 Mad River near Urbana, OH

LOCATION.-Lat 40°06'27", long 83°47'57", on west line of sec. 35, T.5 E.,R. 11 N., Champaign County, Hydrologic Unit 05080001, on left bank at downstream side of bridge on U.S. Highway 36, 1.8 mi upstream from Dugan Run, 1.8 mi downstream from Muddy Creek, 2.5 mi west of Urbana, and at mile 39.7.

DRAINAGE AREA.-162 mi^2.

PERIOD OF RECORD.-September 1925 to September 1931, August 1939 to current year.

REVISED RECORDS.-WSP 1305: 1930(M), WSP 1505: 1956. WSP 1625: 1929. WSP 1908: Drainage area.

GAGE.-Water-stage recorder. Datum of gage is 985.22 ft above sea level. Prior to May 18, 1930, nonrecording gage at same site and datum. May 18, 1930, to Sept. 30, 1931, nonrecording gage at site 600 ft downstream at datum 0.36 ft lower. Aug. 1 to Sept. 25, 1939, nonrecording gage at present site and datum.

REMARKS.-Sediment data collected at this site.

COOPERATION.-Base data furnished by Miami Conservancy District.

Hydromodification of the Mad River

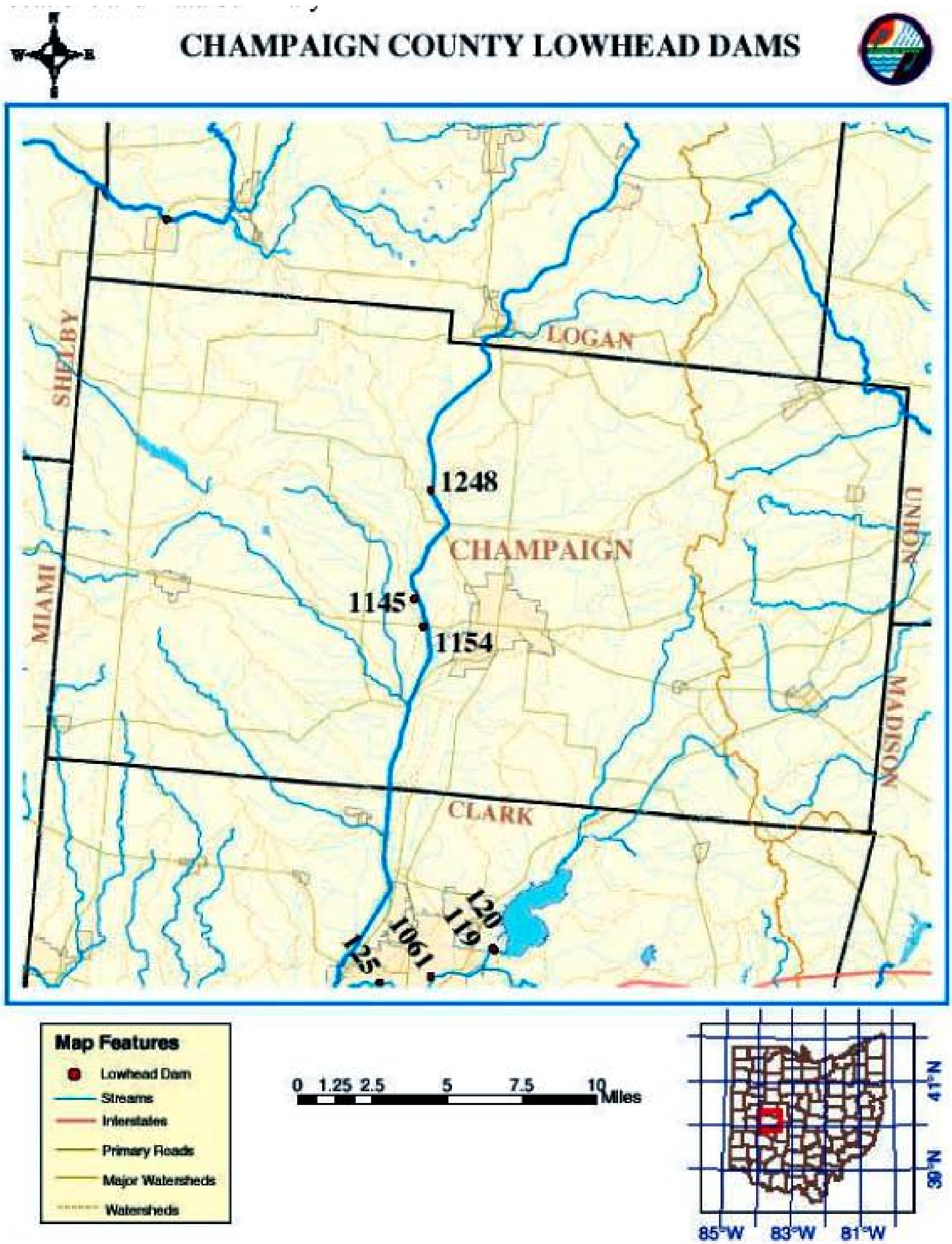
Lowhead Dams

An example of hydromodification that greatly affects the health of the Mad River is the series of three low head dams that cross it. These structures have converted reaches of the Mad River form a stream system consisting of riffles, pools and runs to a stream system with fewer and more uniform habitat attributes. The reduction is available in-stream habitat has consequently reduced the number of organisms that inhabit impounded stream reaches. These structures also prevent fish and other organisms from migrating up and down river.

The lowhead dams increase the temperature of the water and decrease the amount of dissolved oxygen. Lowhead dams also eliminate the transport of bedload materials allowing only file silts to move through the impounded segment. This not only has an effect on the impounded area, but also has an effect directly downstream of the dam. Ohio EPA documented this effect downstream of the St. Rt. 36 Dam.

Summary of Champaign County Lowhead Dams

Summary Data: Champaign County Lowhead Dams									
ID	County	Waterway	Description	Long.	Lat.	Township	ODOT District	HYUN	Watershed
1145	CHAMPAIGN	MAD RIVER	DAM--(farm road through river), approach with caution, portage on either side	-83.81	40.12	MAD RIVER	7	05080001	UPPER GREAT MIAMI
1154	CHAMPAIGN	MAD RIVER	DAM--2-3 feet just downstream from bridge, portage river right	-83.8	40.11	URBANA	7	05080001	UPPER GREAT MIAMI
1248	CHAMPAIGN	MAD RIVER	2 ft-high dam/farm road through river, approach with caution, portage on either side.	-83.8	40.17	CONCORD	7	05080001	UPPER GREAT MIAMI


CHAMPAIGN COUNTY LOWHEAD DAMS
LOGAN
SHELBY
MIAMI
CHAMPAIGN
UNION
MADISON
CLARK
1248
1145
1154
120
119
1061
125
Map Features
Lowhead Dam
Streams
Interstates
Primary Roads
Major Watersheds
Watersheds
0 1.25 2.5 5 7.5 10 Miles
41°N
39°N
85°W 83°W 81°W

Levees

Levees, or earthen embankments adjacent to a water body, border most of the Mad River

Levees were constructed in the late 1800's and early 1900's to prevent floodwaters from inundating and damaging adjacent floodplain lands in order to make the lands more productive for developing agriculture. Despite this benefit, levees also increase water volumes and velocities within the stream channel. Streams consequently must readjust by increasing the channel capacity. This process causes down cutting and widening of the channel, severe instability, excessive erosion, and degraded in-stream habitat. Levees also decrease or eliminate over-bank flooding into adjacent floodplain areas. Over-bank flooding allows for energy to dissipate away from the stream channel and the subsequent deposition of sediments and other non-point source pollutants onto riparian areas, providing very cost effective treatment of stormwater. Overbank flooding also provides nourishment to the riparian ecosystem and allows for groundwater recharge.

Levees have been historically maintained to ensure that they will hold back floodwaters. In many cases, riparian areas within levees are neatly manicured lawns devoid of trees and other woody vegetation, eliminating all the benefits of streamside forests. Levees may also be armored with riprap to ensure that channel migration will not deplete the integrity of the levee, preventing the stream from migrating laterally.

Bridges

As existing bridges reach the end of their service life, the Mad River watershed community has an opportunity to replace them with structures that serve to improve the environment and provide a high level of civic value to the citizens of our community. There are currently 1,181 county and state road bridges over the Mad River and tributaries. Logan County has 300 bridges on county roads and 143 on state roads. Champaign County has 214 bridges on county roads and 104 on state roads. Clark County has 239 bridges on county roads and 187 on state roads.

Culverts

Culverts typically range in size from 12 inches to 72 inches in diameter. Culverts that have a span or opening size greater than 10 feet in diameter are considered bridges and are treated as such. Culverts that are part of a storm water management system are designed to function as an integral part of that system and should be addressed as part of that system. Because of its width and volume of flow, there are no culverts on the main stem of the Mad River. However, many if not all tributaries of the Mad River have had culverts placed on them.

Culverts may negatively impact the local ecology of the stream in which they have been installed. These structures tend to be smaller than the geometry of the stream channel and can cause constricted flows. This constriction causes sediment to be deposited at the inlet end and stream bank erosion at the outlet. Culverts may also prevent fish and other aquatic organisms from migrating upstream due to their length, steepness, or lack of water during low flow conditions.

Degradation of Stream Channels

The increase in stormwater runoff is often too much for the natural drainage system to handle. As a result, stream banks and channels erode, causing them to widen and deepen and become unstable. This also causes habitats within the channel to degrade (substrates become clogged, disabling life to survive in the crevices, loss of pool/riffle structures). This is particularly evident in Dugan Run; its function has been changed from a natural warm water stream to one of storm water conveyance.

Diminishing Groundwater Recharge

The water that is deflected off impervious surfaces would under natural (pre-urbanized) conditions (especially in the City of Urbana portion of the watershed), percolate into the ground and become stored as groundwater. This water would then seep from the ground into the river or stream allowing a stable flow of water in the channel. Without this recharge, flow in the stream is reduced during low precipitation months.

Sewage Overflows

In urban areas, storm water, groundwater and stream water infiltration and inflow (I & I) can cause sanitary sewer and combined sewer overflows. In Urbana, this I & I is taken in by the Waste Water Treatment Plant and at times, overwhelms the capacity of the facility. There are no known overflow relief points in Urbana's system, but I & I is evident due to the increased amount of influent to the plant during rain events. The City of Springfield is predominantly CSO as 40% of the city's collection system is a combined system with 58 overflow points. Tim Weaver of the City of Springfield reports an average of 75 overflows per year over the last 10 years which is down from a high recording of 91.

Stormwater

The City of Urbana Stormwater has begun to focus on developing a model Phase II application. They will be looking at management practices (BMPs) that treat for quality and quantity of stormwater and then make recommendations for undeveloped and developed (i.e., impacted) areas.

Urban and suburban development changes the landscape from vegetations such as trees, grasses, and agricultural crops that absorb rainfall, to hard impervious surfaces such as roads, parking lots, rooftops and driveways. This causes rainfall to be deflected off the surface and become stormwater runoff. This runoff is directed into storm sewers which discharge into the river or tributary stream.

Stormwater Runoff Recommendations

A small portion of the Mad River Watershed is primarily urban in nature which has and will continue to significantly impact the habitat, flow regime, and water quality of the Mad River via Dugan Run. The City of Urbana contributes significant amounts of urban storm water runoff into the river system. Sediments, nutrients, bacteria and heavy metals are the primary concerns.

As more of these areas become developed and incorporated into the urban landscape, measures must be taken to reduce the impacts associated with urbanization. Storm water treatment in the undeveloped areas of the Mad River should entail the following levels of protection. Existing, critical features should be preserved. Critical features include woodlots, wetlands, floodplains, steep slopes, ravines and all tributaries (perennial, intermittent, and ephemeral). It is recommended that these features be places in conservation easements or permanently protected using other mechanisms. These features contribute to maintaining a functional watershed ecosystem and flow regime as well as provide much under-valued storm water treatment by absorbing storm water before it reaches the receiving stream.

Significant losses of storm water benefits occur as open channels are replaced with conduit or as channels with some natural attributes are shortened, bank heights increased, or floodplain access reduced. These channel morphology modifications result in drainage systems having reduced functions in areas like groundwater recharge, assimilation of pollutants and attenuation of storm flows. This reduction in the ability to manage predevelopment loads of flow and sediments (and other materials) occurs at the same time that pollution loads, volume and energy are increasing with new land uses. Installing storm water facilities rarely mitigates these impacts. For that reason, they are best addressed by protection or rehabilitation measures in and along stream systems.

Practical Methods

Capture and treat storm water for post-construction pollutants. Capture and treat to the maximum extent practicable the first flush of storm water runoff volume. Different methods exist for accomplishing this, including those discussed in the American Society of Civil Engineers (ASCE, 1998) – Water Environment Federation Manuals of Engineering Practice #87 to simply provide extended detention. If nutrients are an issue, wet ponds, wetland treatment systems or additional measures may be required.

Provide extended detention of frequent storms. Provide extended detention of frequent storms in order to control the post-construction increase in bedload transport ability. "Effective discharge" storm events become more frequent following development and are rarely controlled by common storm water detention strategies. The result is increased tractive force in channels. Indications are that capturing and providing extended detention for the runoff from the first 0.75 inches of rainfall will meet the objective of maintaining stream stability. This can likely be combined with the volume captured by first flush best management practices.

Provide detention for overbank flood protection and extreme flood protection. The intent is to minimize the impact of flood damage from infrequent (large) storm events and mimic the predevelopment flood conditions in receiving streams.

Encourage return of active floodplain along entrenched or incised channels. In channels that are degraded or incised, this would mean removing earth or fill along the channel to provide greater floodplain access or providing grade control to down cutting channels. In newly designed channels, it would mean incorporating a multi-stage design in order to improve water quality, channel substrates and lower maintenance.

Home Sewage Treatment and Disposal Systems Defined

Home Sewage Treatment and Disposal Systems are designed to treat and dispose of all of the wastewater from individual homes. They can be divided into three main types.

On-lot septic and leach systems. On-lot septic and leach systems, also known as traditional deep trench soil absorption systems, are built to discharge the effluent to the surrounding soil, where it is naturally filtered by biological processes. Septic and leach fields use on-lot soil absorption as treatment and final disposal, therefore reducing the chance of any potential health risk migrating off site. Since on-lot systems are set up to be self-contained, there should be no discharge of effluent off the lot. The effluent from an on-lot system should not reach ground water or surface water if it is properly sited and meets current sewage disposal regulations as mandated by the Clark, Champaign and Logan County Health Districts.

Current Conditions for Home Sewage Treatment Disposal System

Champaign County. In the year 2005, there were approximately 150 aeration systems operation permits, and 30 semi-public operation permits in Champaign County outside of the city of Urbana. There are an estimated 5000 or more soil based disposal systems. There are approximately 10 mound systems in operations in the Champaign County. A complete inventory of all HSTD Systems has never been completed.

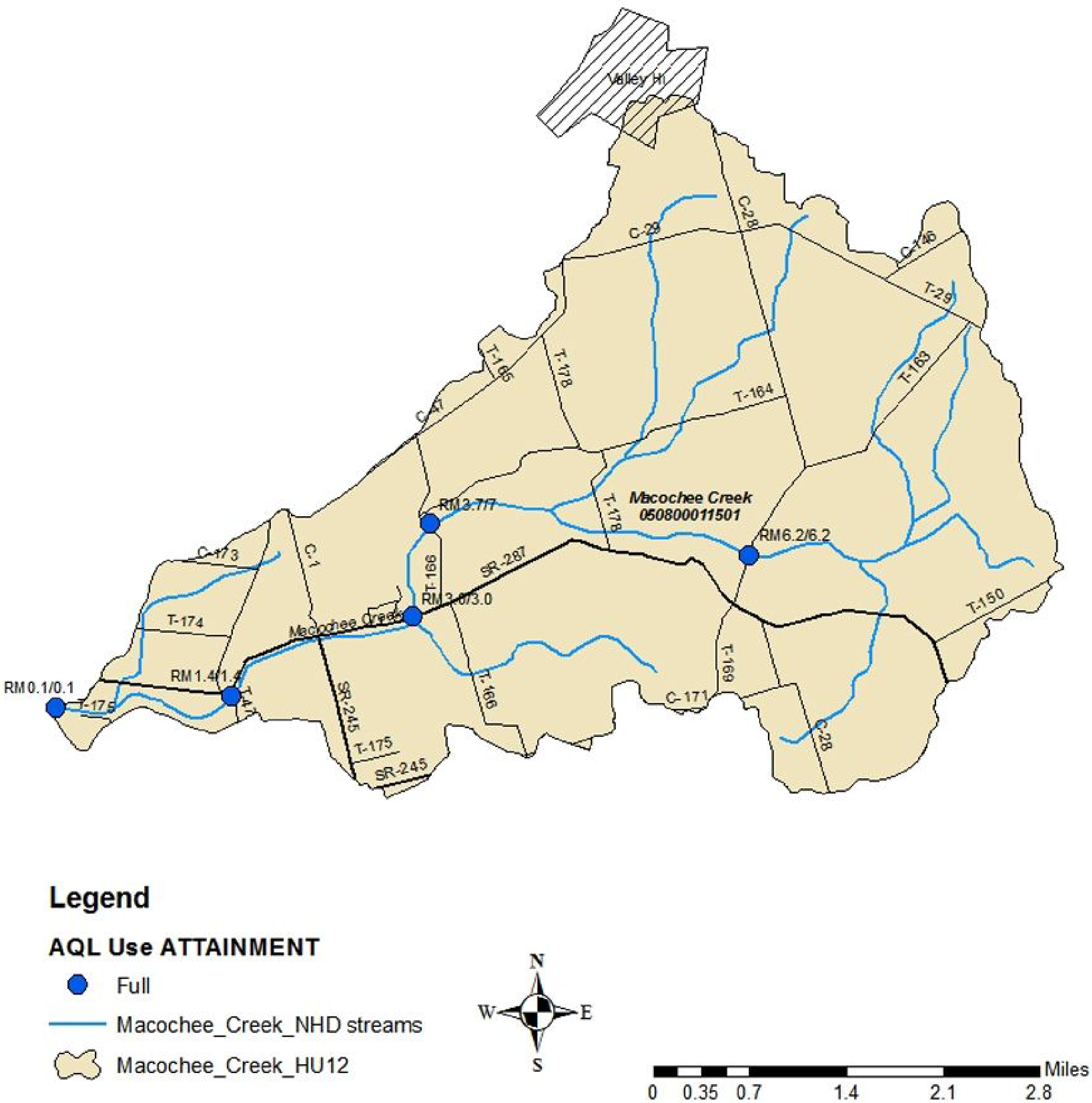
Effective January 1, 2009, the Champaign Health District adopted rules prohibiting the land application of septage. This rule was adopted due to concerns regarding the potential for surface and ground waterpollution. In an effort to provide septage haulers with a viable alternative for disposal, the City of Urbana constructed a septage receiving facility. This facility permits haulers to dispose of septage 24 hours a day and 7 days a week.

Logan County. In the year 2005, there were approximately 100 aeration systems operation permits, most were permitted in the 1970's. There are an estimated 5000 or more soil based disposal systems. Approximately 1000 of these are "discharging" by design into a field tile networks or to surface water. The other 4000 would be discharging into a leach bed of sorts. The Health District does over 100 real estate inspections annually and respond to approximately 50 complaints a year. They also provide inspection to about 130 new installations each year, and in the past have inspected over 200 a year. The current inspections are low due to economics. A complete inventory of all HSTD Systems has never been completed.

Subwatershed Inventory

The following is a brief narrative of the Subwatershed Inventory that has been completed for all 12 sub-watersheds. These inventories are specific summaries of the physical attributes of the stream segments and surrounding land use areas. These inventories are also referred to as habitat modification inventories.

Macochee Creek Watershed
HUC 050800011501



Macochee Creek

Macochee Creek Restoration Project (Source: ODNR)

12 Digit HUC 050800011501	
Acres:	**12,276**
Stream Classification:	**CWH**
Segment Length:	**6.2 miles**
Drainage Area:	**18.95 square miles**
Year Sampled By EPA:	**2003**
Attainment:	**Full**

Background: The Macochee Creek Watershed encompasses 12,276 acres. This sub watershed drains 7 of the Mad River tributaries into Macochee Creek. This stream segments meets full attainment of Aquatic Life Use for Cold Water Habitat (CWH) This subwatershed is south of the Village of Valley Hi and East of West Liberty. These areas include some forested riparian buffer areas, largely channelized areas and an abundance of macro invertebrates and fish communities. This sub watershed contains approximately 15 Ohio Department of Transportation and Logan County Highway Department maintained bridges and numerous culverts.

Past and Present Conservation Efforts: A 1,500 foot section of the Macochee Creek and its floodplain at Logan County's Piatt Castles was restored in 2008. During the Macochee Creek restoration project, environmental contractors studied the soil, water, and topography of the area to determine the best spot for the new creek to flow. They then dug a new channel for the water to run through and redirected the creek into it. The new route is meandering to mimic what would have been the creek's original condition. The contractors also planted trees, grasses, and forbs in the floodplain area around the creek to reduce stream bank erosion and to act as natural filters to improve water quality.

Macochee Creek Restoration Project in 2009

Funding for the project was primarily from the ODNR Division of Wildlife's Wildlife Diversity and Endangered Species Fund. Additional funding was provided by the U.S. Department of Agriculture's Wildlife Habitat Incentives Program.

Problem Statement: Sections of the Macochee Creek Watershed are threatened as increasing agricultural drainage projects continue, altering habitat and destroying riparian zones.

Goals:

- Reduce sedimentation and nutrient run off from agricultural fields
- Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems
- Educate watershed residents on proper on site septic system maintenance

Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers. Promote grid soil sampling and precision application of fertilizers, pesticides and herbicides	**USDA**- Farm Bill (CRP)	Work in conjunction with Logan SWCD/NRCS to promote streamside buffers through USDA programs on agricultural lands. Submit newspaper and newsletter articles advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.
Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.	**USDA-**Farm Bill (EQIP) **ODNR**-Pollution Abatement Funds **Ohio Livestock Coalition** targeted mailing list	Work with Logan SWCD/NRCS to identify livestock producers who have livestock operations. Establish one demonstration site along Macochee Creek utilizing livestock exclusion fencing and pasture management. Submit newspaper and newsletter articles to promote proper spreading and storage of animal waste from feedlots.	On going Feb. 2011 – Feb. 2014 Feb. 2011 – Feb. 2014	Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Lineal feet and number of cattle excluded from stream. Newsletters produced and number of articles appearing in local newspapers. Document number of animal waste complaints received.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Logan Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2011- Jan 2011	Approved Countywide HSTS plan by OEPA and Logan Co. Health Board Number of on site septic systems upgraded/replaced.
Educate watershed residents on proper on site septic system maintenance	**Logan Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping and system management.	April 2011 April 2011	Number of workshop attendants. Number of handouts distributed.

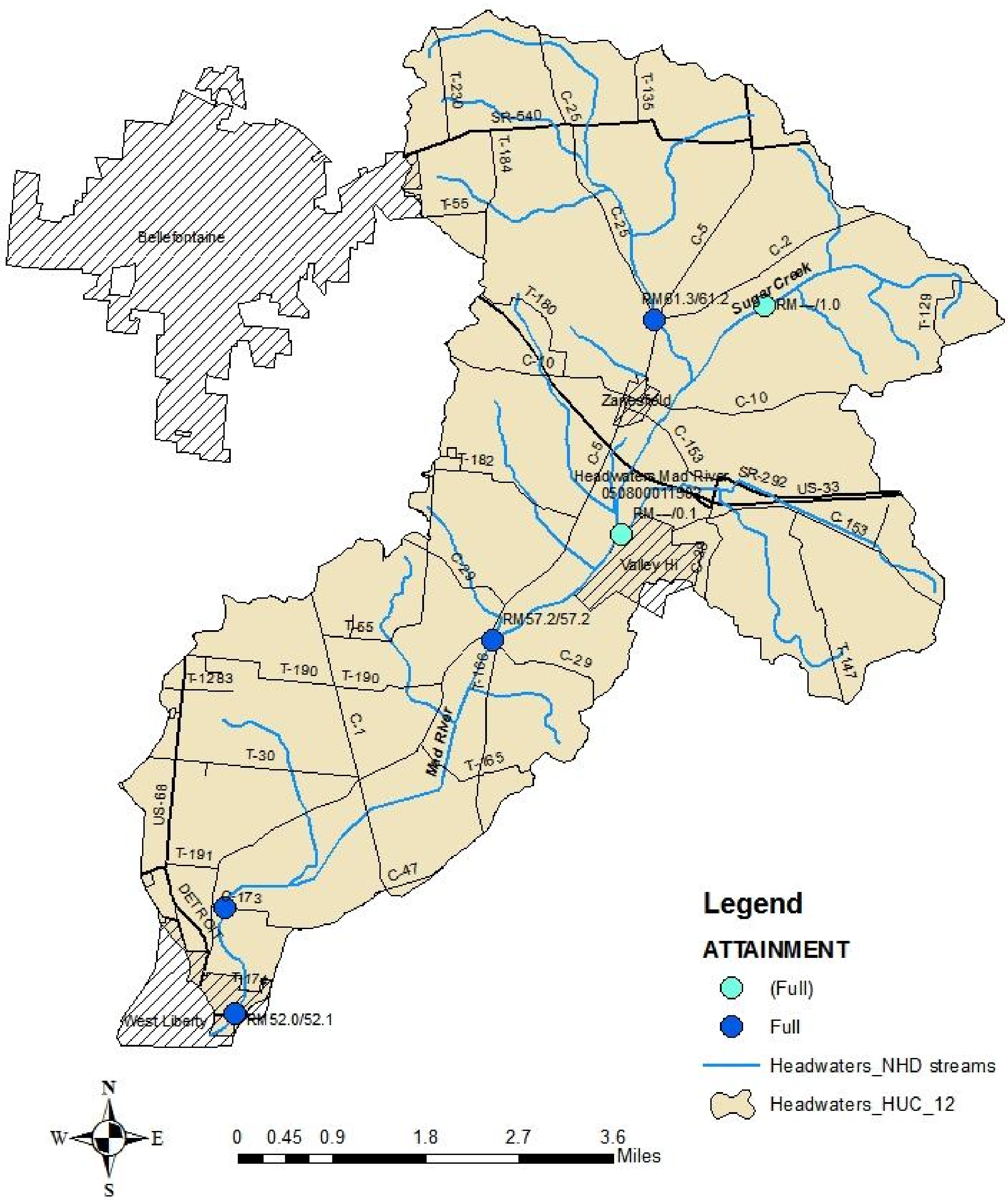
Refer to the following spreadsheet of action items for prioritized deliverables as determined by the Mad River Watershed Strategic Plan Joint Board of Supervisors and Advisory Board. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Logan County Health Department, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.

Macochee Creek HUC 050800011501
Logan County

Objectives	Deliverables	Quantity of Deliverable	Cost	Deliverable Units	Total Cost
Streambank & Riparian Restoration	Restore Streambank Using Bio-Engineering	2640	$ 3.02	Linear Feet	$ 7,972.80
	Restore Streambank By Recontouring or Regrading	1	$ 10,309.00	Acre	$ 10,309.00
	Plant Prairie Grasses in Riparian Areas (w/herbicide/fertilzer	3	$ 411.93	Acre	$ 1,235.79
	Remove/treat Invasive Species (Heavy)	3	$ 309.46	Acre	$ 928.38
	Plant Trees or Shrubs in Riparian Areas	7	$ 609.44	Acre	$ 4,266.08
	Install In-Stream Habitat Structures	10	$ 1,000.00	Structure	$ 10,000.00
Restoration	Reconstruct & Restore Wetlands (Tiled cropland)	8	$ 107.92	Acre	$ 863.36
Conservation Easements	Acquire Riparian Conservation Easements	250	$ 2,000.00	Acre	$ 500,000.00
	Acquire Wetland Conservation Easements	100	$ 2,000.00	Acre	$ 200,000.00
Home Sewage Treatment Systems	Inspect HSTS	100	$ 90.00	Inspections	$ 9,000.00
	Repair or Replace Traditional HSTS	30	$ 6,000.00	HSTS	$ 180,000.00
	Repair or Replace Alternative HSTS	5	$ 9,000.00	HSTS	$ 45,000.00
Agricultural Best Management Practices	Plant Cover/Manure Crops (10% AC)	488	$ 42.41	Acre	$ 14,655.00
	Install Nitrogen Reduction Practices (IPM) (20% AC)	977	$ 15.00	Acre	$ 14,655.00
	Install Controll Drainage System (5% AC)	245	$ 1,044.00	Each	$ 255,780.00
	Develop Nutrient Management Plans (Per 200 AC Farm) (30% AC)	7	$ 2,766.00	Each	$ 19,362.00
	Develop Whole Farm Management Plans (75% AC)	3666	$ 11.84	Acre	$ 43,405.44
	Implement Conservation Tillage Practices (30% of AC)	1466	$ 15.02	Acre	$ 22,019.32
	Implement Prescribed & Conservation Grazing Practices (3 Day Rotation) (10% of Pasture AC)	150	$ 25.07	Acre	$ 3,760.50
	Install Alternative Water Supplies(Springs)	5	$ 1,634.30	Each	$ 8,171.50
	Install Erosion & Sediment Control Structures (Rip Rap Chute) (1 per 100 AC)	39112	$ 4.13	SQ FT	$ 161,532.56
	Install Grassed Waterways (1 per 100 AC)	36	$ 5,446.00	Acre	$ 196,056.00
	Install Vegetated Buffer Strips (Forb/Legume w/herbicide) (1/3 of cropped streams)	5.9	$ 155.74	Acre	$ 918.87
	Install Livestock Crossings (7 each)	5040	$ 3.26	SQ FT	$ 16,430.40
	Install Heavy Use Feeding Pads (7 each)	35000	$ 1.47	SQ FT	$ 51,450.00
	Install Livestock Exclusion Fencing (1% of pasture w/200 FT per AC)	29330	$ 0.51	Linear Feet	$ 14,958.30
	Install Chemical Mixing Pads (2)	10000	$ 3.80	SQ FT	$ 38,000.00
	Construct Animal Waste Storage Structures (Concrete/Wood Walls w/ roof) (3 each)	45000	$ 2.07	CU FT	$ 93,150.00
	Implement Manure Management Practices	2400	$ 15.00	Acre	$ 36,000.00
	Conduct Soil Testing	2400	$ 24.81	Acre	$ 59,544.00
	Implement Grass/Legume Rotations (Cool Season)	1496	$ 187.50	Acre	$ 280,500.00
	Implement Manure Transfer Practices (2-4.9 Miles)	50	$ 13.26	Acre	$ 663.00
	Install Roof Water Management Practices (10 each)	600	$ 4.19	FT	$ 2,514.00
	Execute Landowner Cost-Share Contracts	12	$ 250.00	Each	$ 3,000.00
				TOTAL	$ 2,306,101.30

Mad River Headwaters
HUC 050800011502



Mad River Headwaters

12 Digit HUC 050800011502

Acres:	**23,508.24**
Stream Classification:	**CWH**
Segment Length:	**47 miles**
Drainage Area:	**36.73 square miles**
Year Sampled By EPA:	**2003**
Attainment:	**Full**

Background: The Headwaters of the Mad River encompass 23,508.24 acres. This sub watershed drains all four of the Mad River headwaters. This entire stream segment meets full attainment of Aquatic Life Use for Cold Water Habitat (CWH).

These areas include some forested riparian buffer areas, largely channelized areas and an abundance of macro invertebrates and fish communities. The size of the stream increases slightly as the headwater streams flow into one. Sections of the Headwaters are threatened by increasing agricultural drainage projects continue. This subwatershed approximately 4 Ohio Department of Transportation and Logan County Highway Department maintained bridges and approximately 17 culverts.

Problem Statement: The present condition of the Mad River is the result of extensive channelization and levee construction as early as 1915 that facilitated row crop agriculture. These activities ranged from simple bank shaping to large scale channelization and levee projects. Habitat alteration has had a profound influence upon the macrohabitats and aquatic communities within the Upper Mad River.
Source: Biological and Water Quality Study of the Mad River Basin, 2003 by the State of Ohio EPA

Goals:

- Reduce sedimentation and nutrient run off from agricultural fields
- Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems
- Educate watershed residents on proper on site septic system maintenance

Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **OEPA 319**	Work in conjunction with Logan SWCD/NRCS to promote farm streamside buffers through USDA Submit newspaper and newsletter article advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.

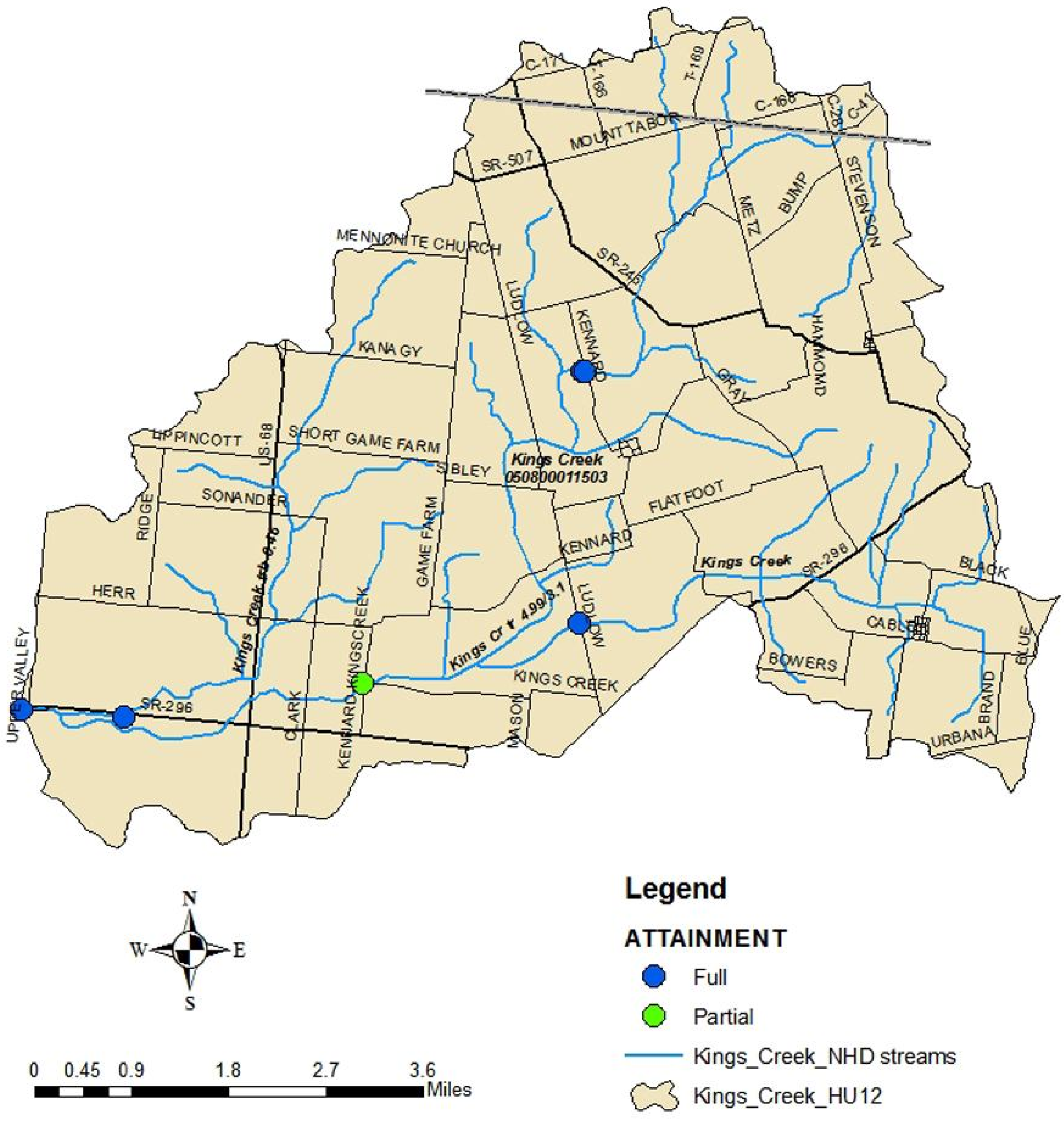
Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.	**USDA-**Farm Bill (EQIP) **ODNR**-Pollution Abatement Funds **Ohio Livestock Coalition-**targeted	Work with Logan SWCD/NRCS to identify livestock producers who have livestock operations. Establish one demonstration site along Mad River utilizing livestock exclusion fencing and pasture management. Submit newspaper and newsletter articles to promote proper spreading and storage of animal waste from feedlots.	On going Feb. 2011 – Feb. 2014 Feb. 2011 – Feb. 2014	Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Lineal feet and number of cattle excluded from stream. Newsletters produced and number of articles appearing in local newspapers. Document number of animal waste complaints received.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Logan Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2011- Jan 2014	Approved Countywide HSTS plan by OEPA and Logan Co. Health Board Number of on site septic systems upgraded/replaced.
Educate watershed residents on proper on site septic system maintenance	**Logan Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping/ system management.	April 2011 April 2011	Number of workshop attendants. Number of handouts distributed.

Refer to the following spreadsheet of action items for prioritized deliverables as determined by the Mad River Watershed Strategic Plan Joint Board of Supervisors and Advisory Board. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Logan County Health Department, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.

	Headwaters Mad River HUC 050800011502 Logan County				
Objectives	**Deliverables**	**Quantity of Deliverable**	**Cost**	**Deliverable Units**	**Total Cost**
Streambank & Riparian Restoration	Restore Streambank Using Bio-Engineering	5280	$ 3.02	Linear Feet	$ 15,945.60
	Restore Streambank By Recontouring or Regrading	2.5	$ 10,309.00	Acre	$ 25,772.50
	Plant Prairie Grasses in Riparian Areas (w/herbicide/fertilzer	7	$ 411.93	Acre	$ 2,883.51
	Remove/treat Invasive Species (Heavy)	7	$ 309.46	Acre	$ 2,166.22
	Plant Trees or Shrubs in Riparian Areas	14	$ 609.44	Acre	$ 8,532.16
	Install In-Stream Habitat Structures	20	$ 1,000.00	Structure	$ 20,000.00
Restoration	Reconstruct & Restore Wetlands (Tiled cropland)	17	$ 107.92	Acre	$ 1,834.64
Conservation Easements	Acquire Riparian Conservation Easements	1000	$ 2,000.00	Acre	$ 2,000,000.00
	Acquire Wetland Conservation Easements	200	$ 2,000.00	Acre	$ 400,000.00
Home Sewage Treatment Systems	Inspect HSTS	200	$ 90.00	Inspections	$ 18,000.00
	Repair or Replace Traditional HSTS	70	$ 6,000.00	HSTS	$ 420,000.00
	Repair or Replace Alternative HSTS	5	$ 9,000.00	HSTS	$ 45,000.00
Agricultural Best Management Practices	Plant Cover/Manure Crops (10% AC)	1039	.	Acre	$ 1,039.00
	Install Nitrogen Reduction Practices (IPM) (20% AC)	2079	$ 15.00	Acre	$ 31,185.00
	Install Controll Drainage System (5% AC)	670	$ 1,044.00	Each	$ 699,480.00
	Develop Nutrient Management Plans (Per 200 AC Farm) (30% AC)	16	$ 2,766.00	Each	$ 44,256.00
	Develop Whole Farm Management Plans (75% AC)	7795	$ 11.84	Acre	$ 92,292.80
	Implement Conservation Tillage Practices (30% of AC)	3118	$ 15.02	Acre	$ 46,832.36
	Implement Prescribed & Conservation Grazing Practices (3 Day Rotation) (10% of Pasture AC)	312	$ 25.07	Acre	$ 7,821.84
	Install Alternative Water Supplies(Springs)	10	$ 1,634.30	Each	$ 16,343.00
	Install Erosion & Sediment Control Structures (Rip Rap Chute) (1 per 100 AC)	82400	$ 4.13	SQ FT	$ 340,312.00
	Install Grassed Waterways (1 per 100 AC)	75	$ 5,446.00	Acre	$ 408,450.00
	Install Vegetated Buffer Strips (Forb/Legume w/herbicide) (1/3 of cropped streams)	14	$ 155.74	Acre	$ 2,180.36
	Install Livestock Crossings (12 each)	8640	$ 3.26	SQ FT	$ 28,166.40
	Install Heavy Use Feeding Pads (12 each)	60000	$ 1.47	SQ FT	$ 88,200.00
	Install Livestock Exclusion Fencing (1% of pasture w/200 FT per AC)	62360	$ 0.51	Linear Feet	$ 31,803.60
	Install Chemical Mixing Pads (10)	50000	$ 3.80	SQ FT	$ 190,000.00
	Construct Animal Waste Storage Structures (Concrete/Wood Walls w/ roof) (10 each)	150000	$ 2.07	CU FT	$ 310,500.00
	Implement Manure Management Practices	3200	$ 15.00	Acre	$ 48,000.00
	Conduct Soil Testing	3200	$ 24.81	Acre	$ 79,392.00
	Implement Grass/Legume Rotations (Cool Season)	3118	$ 187.50	Acre	$ 584,625.00
	Implement Manure Transfer Practices (2-4.9 Miles)	200	$ 13.26	Acre	$ 2,652.00
	Install Roof Water Management Practices (10 each)	2000	$ 4.19	FT	$ 8,380.00
	Execute Landowner Cost-Share Contracts	26	$ 250.00	Each	$ 6,500.00
Education & Outreach	Develop Brochures/Fact Sheets (1 mtg/yr/5yrs)	5	$ 100.00	Brochures/Fact Sheets	$ 500.00
	Conduct Public Meeting (1 mtg/yr/5yrs)	5	$ 500.00	Public Meetings	$ 2,500.00
	Create/Maintain Websites (hours per 5 yrs)	136	$ 20.00	Website	$ 2,720.00
	Install Signs	1 (per yr)	$ 5,000.00	Signs	$ 5,000.00
	Develop Displays	1	$ 1,000.00	Displays	$ 1,000.00
	Conduct Tours (1 per yr)	5	$ 1,000.00	Tours	$ 5,000.00
	Conduct Stream Clean-Ups (1 per yr)	5	$ 1,000.00	Clean-Ups	$ 5,000.00
	Conduct Field Days (1 per yr)	5	$ 1,000.00	Days	$ 5,000.00
	Stencil Storm Drains (1 time)	1 (time)	$ 1,000.00	For all Drains	$ 1,000.00
	Develop Manual(s)	1 (time)	$ 3,000.00	For all Manuals	$ 3,000.00
	Deliver On-Site Technical Assistance (est 100 operation of 200 AC w/4 visits each	400	$ 50.00	Site Visits	$ 20,000.00
	Develop Newsletters	0		Newsletters	$ -
Monitoring	Conduct Chemical Sampling	1	$ 2,000.00	Kit	$ 2,000.00
	Conduct Macroinvertebrate (ICI) Sampling (10Xyear) for 5 yrs	50	$ 40.00	Sites	$ 2,000.00
	Conduct Fish (IBI) Sampling (10Xyear) for 5 yrs	50	$ 40.00	Sites	$ 2,000.00
	Conduct Habitat (QHEI or HHEI) Sampling (10Xyear) for 5 yrs	50	$ 40.00	Sites	$ 2,000.00
	Conduct Nitrate Sampling (WATER) (10Xyear) for 5 yrs	50	$ 40.00	Sites	$ 2,000.00
	Prepare and Submit Final Monitoring Report and Data (10Xyear) for 5 yrs	40	$ 20.00	Report	$ 800.00
				TOTAL	$ 5,414,660.57

Kings Creek
HUC 050800011503



Kings Creek

12 Digit HUC 050800011503
Acres: 24,024
Stream Classification: CWH
Segment Length: 6.2
Drainage Area: 43.6 square miles
Year Sampled By EPA: 2003
Attainment : Full (RM0.1/6.1)
Partial (3.9)

Background: The Kings Creek Watershed encompasses 24,024 acres and is the largest Subwatershed in the Upper Mad River Watershed, and includes all of Kings Creek. Full attainment of Aquatic Life Use for Cold Water Habitat (CWH) at River Mile 6.2. This sub watershed includes the part of the Village of West Liberty. These areas include some forested riparian buffer areas, largely channelized areas and an abundance of macro invertebrates and fish communities. This sub watershed has approximately 12 Ohio Department of Transportation and Champaign County Highway Department maintained bridges and numerous culverts.

Past and Present Conservation Efforts: Over 2 miles of habitat improvement work has been completed in this sub watershed by the various trout clubs.

Problem Statement: Only partial attainment at River Mile 0.7 was determined due to significant departure from eco-region biocriterion; poor to very poor results were underlined in the *Biological and Water Quality Study of the Mad River Basin, 2003 by the State of Ohio EPA*. Sections of the streams are threatened as increasing agricultural drainage projects continue, habitat alterations and riparian zones are being destroyed.

Goals:

- Reduce sedimentation and nutrient run off from agricultural fields
- Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems
- Educate watershed residents on proper on site septic system maintenance

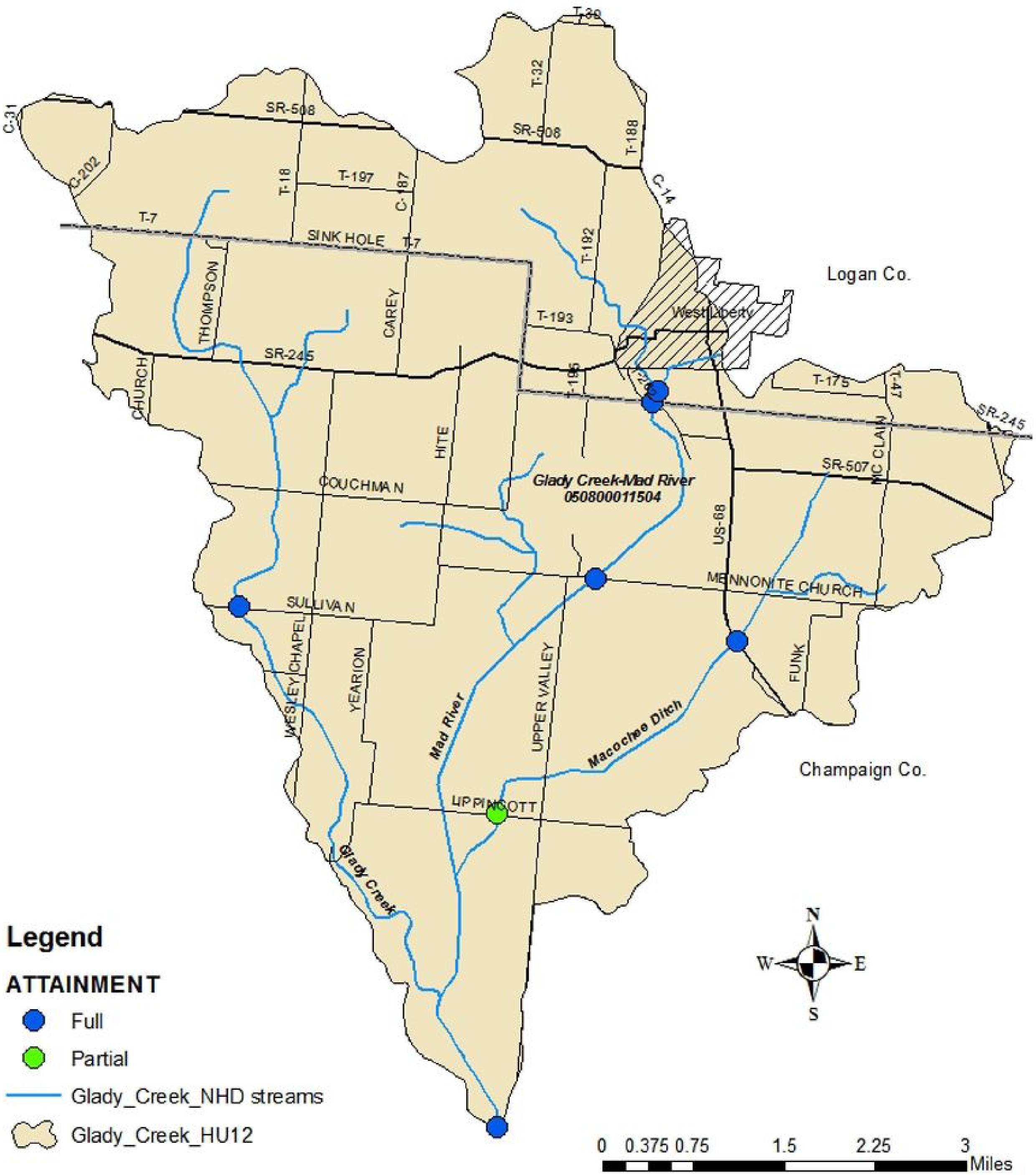
Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **OEPA 319**	Work in conjunction with Champaign SWCD/NRCS to promote farm streamside buffers through USDA Submit newspaper and newsletter article advertising the benefits of riparian buffers.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets.

		Target operators and landowners who farm HEL land.		Newsletters produced and number of articles appearing in local newspapers.
Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.	**USDA-**Farm Bill (EQIP) **ODNR**-Pollution Abatement Funds **Ohio Livestock Coalition-**targeted	Work with Champaign SWCD/NRCS to identify livestock producers who have livestock operations. Establish one demonstration site along Kings Creek utilizing livestock exclusion fencing and pasture management. Submit newspaper and newsletter articles to promote proper spreading and storage of animal waste from feedlots.	On going Feb. 2011 – Feb. 2014 Feb. 2011 – Feb. 2014	Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Lineal feet and number of cattle excluded from stream. Newsletters produced and number of articles appearing in local newspapers. Document number of animal waste complaints received.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Champaign Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2011 – Jan. 2013	Approved Countywide HSTS plan by OEPA and Champaign Co. Health Board Number of on site septic systems upgraded/replaced.
Educate watershed residents on proper on site septic system maintenance	**Champaign Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping/ system management.	April 2011 April 2011	Number of workshop attendants. Number of handouts distributed.

Refer to the spreadsheet of action items for prioritized deliverables on page 123. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Champaign County Health Department, Army Corps of Engineers, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.

Glady Creek - Mad River
HUC 050800011504



Glady Creek

12 Digit HUC 050800011504
Acres: 8,105
Stream Classification: CWH
Segment Length: 4.2 miles
Drainage Area: 12.7 square miles
Year Sampled By EPA: 2003
Attainment: Full

Background: The Glady Creek Watershed encompasses 8,105 acres. This subwatershed drains 1 unnamed tributary of Glady Creek before entering the the Mad River. This stream segment meets full attainment of Aquatic Life Use for Cold Water Habitat (CWH). This sub watershed includes all of Glady Creek. These areas include some forested riparian buffer areas, largely channelized areas and an abundance of macro invertebrates and fish communities. This subwatershed has approximately 9 Ohio Department of Transportation and Champaign County Highway Department maintained bridges and numerous culverts.

Problem Statement: Sections of the streams are threatened as increasing agricultural drainage projects continue, habitat alterations and riparian zones are being destroyed.

Goals:

- Reduce sedimentation and nutrient run off from agricultural fields
- Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems
- Educate watershed residents on proper on site septic system maintenance

Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **OEPA 319**	Work in conjunction with Champaign SWCD/NRCS to promote farm streamside buffers through USDA Submit newspaper and newsletter article advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.
Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.	**USDA-**Farm Bill (EQIP) **ODNR**-Pollution Abatement Funds	Work with Champaign SWCD/NRCS to identify livestock producers who have livestock operations.	On going	Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets.

	Ohio Livestock Coalition-targeted	Establish one demonstration site along Kings Creek utilizing livestock exclusion fencing and pasture management. Submit newspaper and newsletter articles to promote proper spreading and storage of animal waste from feedlots.	Feb. 2011 – Feb. 2014 Feb. 2011 – Feb. 2014	Lineal feet and number of cattle excluded from stream. Newsletters produced and number of articles appearing in local newspapers. Document number of animal waste complaints received.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Champaign Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2011 – Jan. 2013	Approved Countywide HSTS plan by OEPA and Champaign Co. Health Board Number of on site septic systems upgraded/replaced.
Educate watershed residents on proper on site septic system maintenance	**Champaign Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping/ system management.	April 2011 April 2011	Number of workshop attendants. Number of handouts distributed.

Refer to the spreadsheet of action items for prioritized deliverables on page 123. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Champaign County Health Department, Army Corps of Engineers, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.


Muddy Creek
HUC 050800011601
RUSSELL
CHURCH
NINE MILE
CALLAND
SR-29
SNAPP
CHURCH
Muddy Creek
050800011601
CEMETERY
HECK HILL
IDLE
BAKER
SR-560
Spring Run
WESLEY CHAPEL
CEMETERY
WOODVILLE
WOODVILLE
WOODVILLE CONCORD
KIZER
RIVER
HANNA
RIVER
Muddy Creek
Legend
ATTAINMENT
Full
Partial
Muddy_Creek_NHD streams
Muddy_Creek_HU12
N
W
E
S
0 0.3 0.6 1.2 1.8 2.4
Miles

Muddy Creek

12 Digit HUC 05080011601	
Acres:	**14,605**
Stream Classification:	**CWH**
Segment Length:	**6.3 miles**
Drainage Area:	**22.9 square miles**
Year Sampled By EPA:	**2003**
Attainment:	**Full (0.4/0.5)**
	Partial (6.3)

Background: The Muddy Creek Subwatershed encompasses 14,605 acres. This subwatershed includes all of Muddy creek and all of Spring Creek. Full attainment of Aquatic Life Use for Cold Water Habitat (CWH) at River Mile 0.4/0.5. This sub watershed has approximately 28 Ohio Department of Transportation and Champaign County Highway Department maintained bridges and numerous culverts.

Problem Statement: Only partial attainment at River Mile 6.3/6.3 was determined due to Habitat Alteration for Agricultural Practices in the *Biological and Water Quality Study of the Mad River Basin, 2003 by the State of Ohio EPA*. These areas include some forested riparian buffer areas, largely channelized areas and an abundance of macro invertebrates and fish communities. Sections of the streams are threatened as increasing agricultural drainage projects continue, habitat alterations and riparian zones are being destroyed.

Goals:

- Reduce sedimentation and nutrient run off from agricultural fields
- Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems
- Educate watershed residents on proper on site septic system maintenance

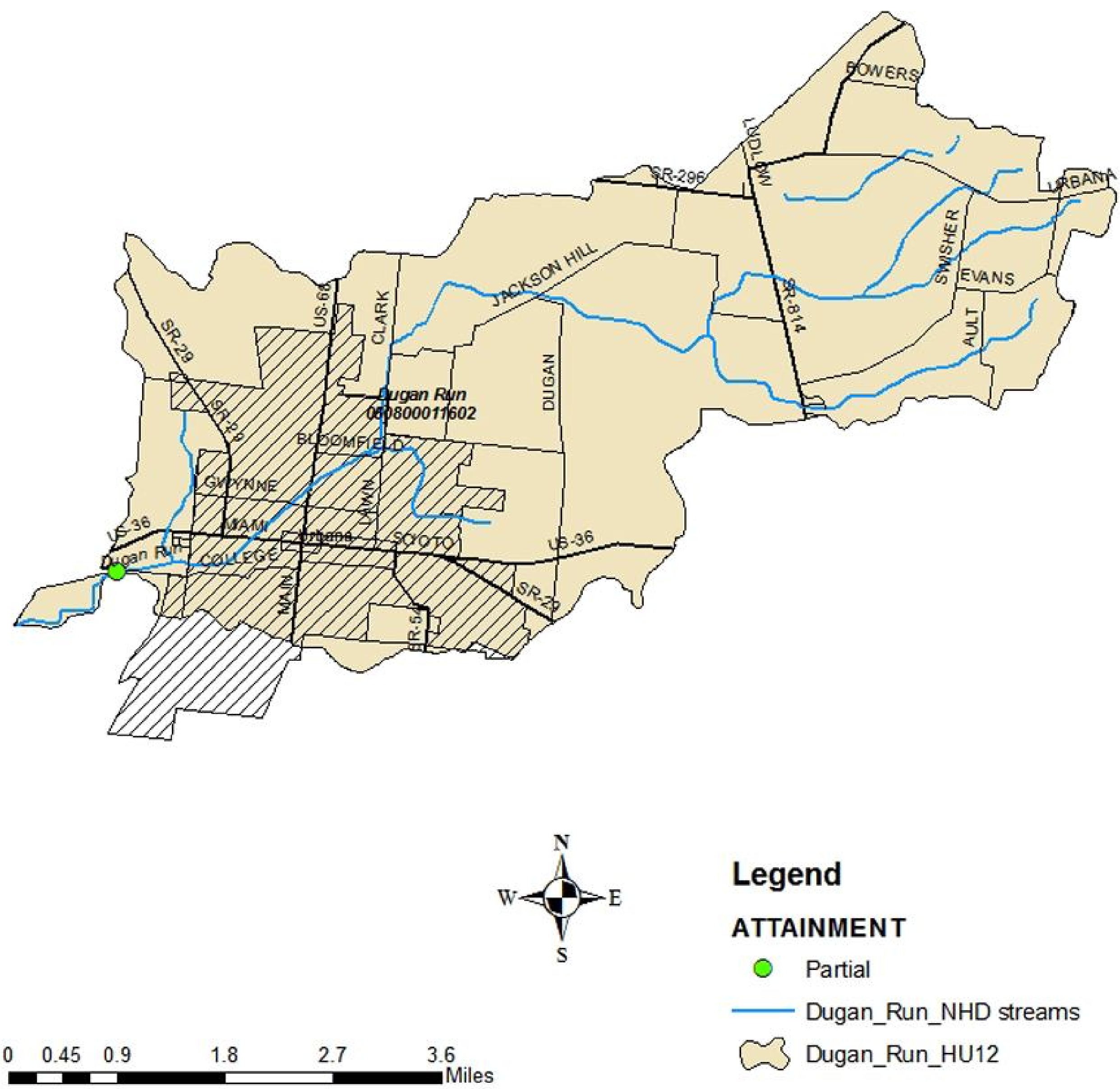
Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **OEPA 319**	Work in conjunction with Champaign SWCD/NRCS to promote farm streamside buffers through USDA Submit newspaper and newsletter article advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.

Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.	**USDA-**Farm Bill (EQIP) **ODNR**-Pollution Abatement Funds **Ohio Livestock Coalition-**targeted	Work with Champaign SWCD/NRCS to identify livestock producers who have livestock operations. Establish one demonstration site along Kings Creek utilizing livestock exclusion fencing and pasture management. Submit newspaper and newsletter articles to promote proper spreading and storage of animal waste from feedlots.	On going Feb. 2011 – Feb. 2014 Feb. 2011 – Feb. 2014	Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Lineal feet and number of cattle excluded from stream. Newsletters produced and number of articles appearing in local newspapers. Document number of animal waste complaints received.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Champaign Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2011 – Jan. 2013	Approved Countywide HSTS plan by OEPA and Champaign Co. Health Board Number of on site septic systems upgraded/replaced.
Educate watershed residents on proper on site septic system maintenance	**Champaign Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping/ system management.	April 2011 April 2011	Number of workshop attendants. Number of handouts distributed.

Refer to the spreadsheet of action items for prioritized deliverables on page 123. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Champaign County Health Department, Army Corps of Engineers, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.

Dugan Run
HUC 050800011602



Dugan Run

12 Digit HUC 05080011602

Acres:	**15,006**
Stream Classification:	**WWH**
Segment Length:	**1.2 miles**
Drainage Area:	**23.4 square miles**
Year Sampled By EPA:	**2003**
Attainment:	**Partial**

Background: The Dugan Run Subwatershed encompasses 15,006 acres. This sub watershed includes all of Dugan Run and includes part of the City of Urbana. Dugan Run (RM 0.95) drains the City of Urbana which has considerable industrial land use and runoff. In addition to stormwater runoff, it appears that dumping of industrial and solid waste has occurred near RM 0.95. The sampling location is next to Muzzy Road and provides easy access to Dugan Rd.

Results from Dugan Run published in the *Biological and Water Quality Study of the Mad River Basin, 2003 by the State of Ohio EPA* revealed the sediments mercury, zinc, copper and lead concentrations are above the Ohio Sediment Reference guidelines. Lead was above the MacDonald Probable Effect Concentration range, indicating that adverse effects to benthic organisms usually or always occur. Copper, mercury, and zinc were between the Mac Donald Threshold Effect Concentration (TEC) and the Probable Effect Concentration (PEC), meaning adverse effects to benthic organisms frequently occur. Sediment arsenic was between the MacDonald TEC and PEC, but below the Ohio SRV of 18 mg/kg and not considered to adversely affect benthic organisms. Dugan Run was also contaminated with organic chemicals. Eleven different Polycyclic Aromatic Hydrocarbons (PAH) compounds were detected at a total level (37.26 mg/k total PAH) exceeding the MacDonald Probable Effect Concentration range, indicating that adverse effects to benthic organisms usually or always occur. Six of the eleven PAH compounds were individually over the MacDonald PEC. Total chlordane (0.0207 mg/kg) exceeded the MacDonald PEC. Total Polychlorinated Biphenyls (0.2997 mg/kg) were detected between the MacDonald TEC and PEC.

Past and Present Conservation Efforts: The City of Urbana is working on Phase II planning and will be conducting some testing for contaminents throughout Dugan Run in the City.

In August 2006, OEPA collected five water samples at sites along Dugan Run and at the overflow from the manure lagoon at Ohio Valley Farms (M.M. Harris, personal communication, September 12, 2006). This was done in response to a citizen complaint that Dugan Run was discolored. The samples were analyzed for several parameters including ammonia. In three of these samples, ammonia far exceeded 13.0 mg/L, the level at which ammonia is toxic to aquatic wildlife. Ammonia concentration at the overflow was 712 mg/L. At one location along Dugan Run, the ammonia concentration was an average of 46.0 mg/L. OEPA is taking action to stop the overflow from the manure lagoon from reaching Dugan Run (M.M. Harris, personal communication).

Problem Statement: Only partial attainment of Aquatic Life Use for Warm Water Habitat (WWH) at River Mile 1.2/1.2. was determined due to Habitat Alteration, nutrients, enrichment/DO, metals and organics, channelization, urban run off and contaminated sediments are listed as sources of containation in the *Biological and Water Quality Study of the Mad River Basin, 2003 by the State of Ohio EPA*. Dugan Run drains most of the City of Urbana, which has considerable industrial run off, urban storm water run off and signs of industrial and solid waste dumping is evident near RM 0.95.

Goals:
- Reduce sedimentation and nutrient run off from agricultural fields
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems
- Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots
- Educate watershed residents on proper on site septic system maintenance
- Reduce NPS pollutants associated with stormwater
- Reduce sedimentation from riparian land areas
- Address contamination from the manure lagoon at Ohio Valley Farms using measures that include:
  1. Sample the effluent at the Ohio Valley Farms operation on Dugan Road.
  2. Run sample of horse manure waste pile.
  3. Run a composite on septic outflow samples.
  5. Run an isotope sample for Dugans Run.
  6. Obtain samples of the local fertilizers and run analysis on these samples
  7. Obtain samples outside of the influence, but inside the valley for analysis

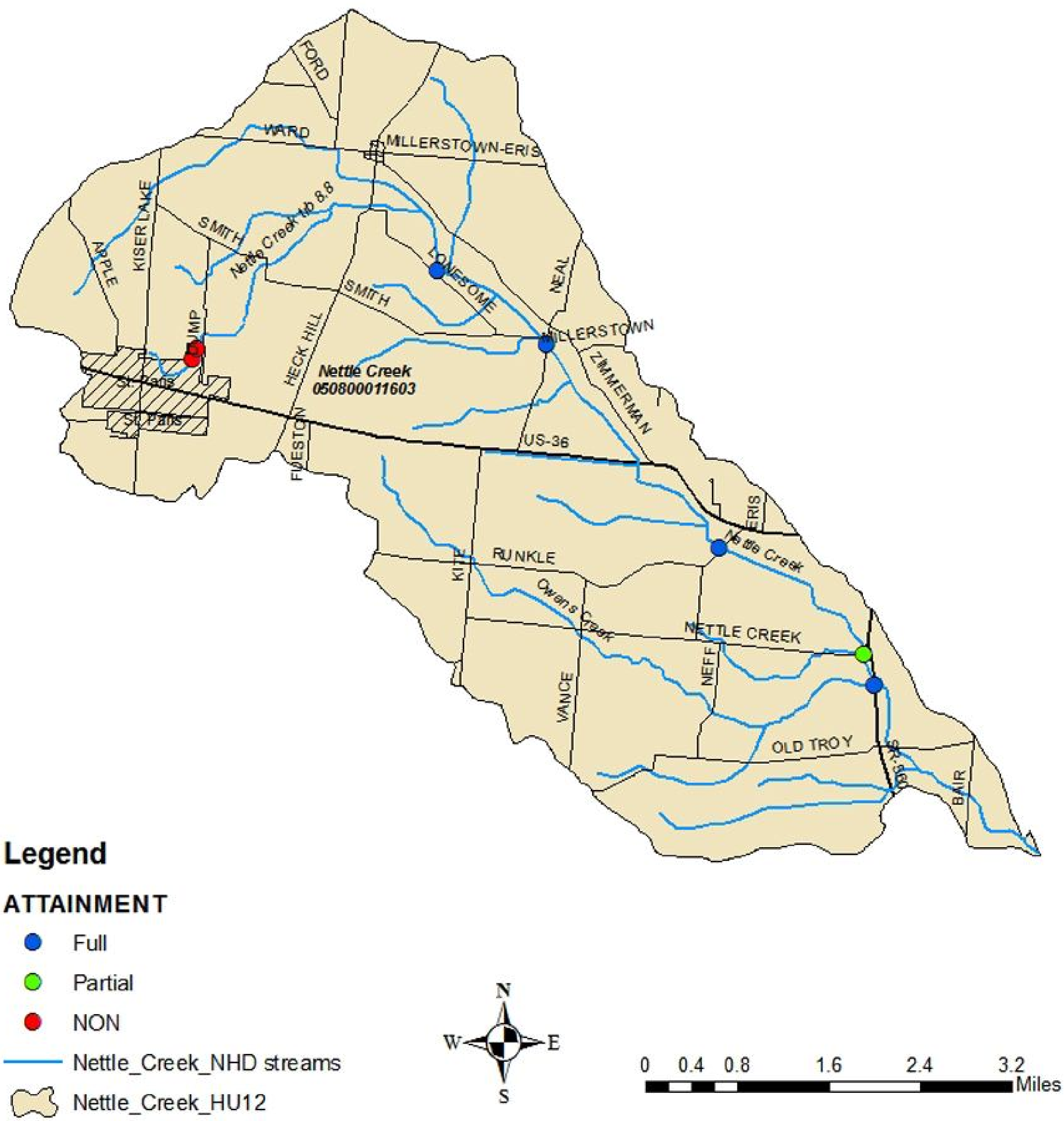
Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **OEPA 319**	Work in conjunction with Champaign SWCD/NRCS to promote streamside buffers through USDA programs on agricultural lands. Submit newspaper and newsletter article advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Champaign Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2011 – Jan. 2013	Approved Countywide HSTS plan by OEPA and Champaign Co. Health Board Number of on site septic systems upgraded/replaced.

Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.	**USDA**-Farm Bill (EQIP) **ODNR**- Pollution Abatement Funds **Ohio Livestock Coalition**-targeted mailing list	Work with Champaign SWCD/NRCS to identify livestock producers who have livestock operations. Establish one demonstration site along Dugan Run utilizing livestock exclusion fencing and pasture management. Submit newspaper and newspaper articles to promote proper spreading and storage of animal waste from feedlots.	On going Feb. 2011 – Feb. 2013 Feb. 2011 – Feb. 2013	Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Lineal feet and number of cattle excluded from stream. Newsletters produced and number of articles appearing in local newspapers. Document number of animal waste complaints received.
Educate watershed residents on proper on site septic system maintenance	**Champaign Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping/ system management.	April 2011 April 2011	Number of workshop attendants. Number of handouts distributed.
Reduce NPS pollutants associated with stormwater by implementing BMPs and education of watershed residents on stormwater management.	**OEPA**-DEFA Program	Storm drain labeling in areas with curb and gutter stormwater systems. Create and submit articles to local newspapers on stormwater and stream health.	Jan. 2011 – Jan. 2013 May 2011	Number of stormwater system upgrades Number of storm drains labeled. Number of articles appearing in newsletter.
Reduce sedimentation from riparian land areas by promoting protection of riparian corridors and proper streambank restoration methods improving in stream habitat.	**OEPA**-401 mitigation list	Work with Champaign SWCD/NRCS to identify riparian landowners with eroded streambank issues. Establish one demonstration site along Dugan Run utilizing Bioengineering erosion control and natural channel design methods and natural stream channel design	On going Feb. 2011 – Feb. 2013	Create mailing list Targeting streamside landowners to receive educational materials. Document soil saved/not delivered from eroding streambanks using R.U.S.L.E. Lineal feet of streambank protected or restored.

Refer to the spreadsheet of action items for prioritized deliverables on page 123. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Champaign County Health Department, Army Corps of Engineers, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.

Nettle Creek
HUC 050800011603



Nettle Creek

12 Digit HUC 05080011603
Acres: 18,273
Stream Classification: CWH
Segment Length: 8.2 miles
Drainage Area: 46.2 square miles
Year Sampled By EPA: 2003
Attainment: Partial (RM2.5/2.8)
Full (4.4/8.2)

Background: The Nettle Creek Subwatershed encompasses 18,273 acres. This sub watershed includes all of Nettle Creek and all of the Village of St. Paris. Full attainment of Aquatic Life Use for Cold Water Habitat (CWH) at River Mile 0.1/2.5 and 2.8/8.2 exists. This sub watershed has approximately 32 Ohio Department of Transportation and Champaign County Highway Department maintained bridges and numerous culverts.

According to the *Biological and Water Quality Study of the Mad River Basin, 2003 by the State of Ohio EPA*, the St. Paris tributary (RM 2.64), a tributary to Nettle Creek, is downstream from the outfall for the St. Paris WWTP. Concentrations of lead and zinc were over the Ohio Sediment reference Guidelines (SRVs) and between the MacDonald TEC and PEC. Results from the St. Paris tributary sediments detected ten different PAH compounds (17.04 mg/kg total). Five of the ten PAH compounds were individually over the MacDonald PEC. The lab contaminant acetone was also detected at 0.11 mg/kg.

Problem Statement: Only partial attainment at River Mile 2.5/2.8 was determined due to siltation (sand). The source listed is undetermined but possibly natural, in the *Biological and Water Quality Study of the Mad River Basin, 2003 by the State of Ohio EPA*. These areas include some forested riparian buffer areas, largely channelized areas and an abundance of macro invertebrates and fish communities. Sections of the streams are threatened as increasing agricultural drainage projects continue, habitat alterations and riparian zones are being destroyed. The St. Paris tributary (RM 2.64) to Nettle creek, is downstream from the outfall for St. Paris WWTP. Concentrations of Lead and Zinc were over the Ohio Sediment Reference Guidelines (SRV's) and between the MacDonald TEC and PEC.

Goals:

- Reduce sedimentation and nutrient run off from agricultural fields
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems
- Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots
- Educate watershed residents on proper on site septic system maintenance
- Reduce NPS pollutants associated with stormwater
- Reduce sedimentation from riparian land areas

Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **OEPA 319**	Work in conjunction with Champaign SWCD/NRCS to promote streamside buffers through USDA programs on agricultural lands. Submit newspaper and newsletter article advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Champaign Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2011 – Jan. 2013	Approved Countywide HSTS plan by OEPA and Champaign Co. Health Board Number of on site septic systems upgraded/replaced.
Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.	**USDA**-Farm Bill (EQIP) **ODNR**- Pollution Abatement Funds **Ohio Livestock Coalition**-targeted mailing list	Work with Champaign SWCD/NRCS to identify livestock producers who have livestock operations. Establish one demonstration site along Nettle Creek utilizing livestock exclusion fencing and pasture management. Submit newspaper and newspaper articles to promote proper spreading and storage of animal waste from feedlots.	On going Feb. 2011 – Feb. 2013 Feb. 2011 – Feb. 2013	Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Lineal feet and number of cattle excluded from stream. Newsletters produced and number of articles appearing in local newspapers. Document number of animal waste complaints received.
Educate watershed residents on proper on site septic system maintenance	**Champaign Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping/ system management.	April 2011 April 2011	Number of workshop attendants. Number of handouts distributed.
Reduce NPS pollutants associated with stormwater by implementing BMPs and education of watershed residents on stormwater management.	**OEPA**-DEFA Program	Storm drain labeling in areas with curb and gutter stormwater systems. Create and submit articles to local newspapers on stormwater and stream health.	Jan. 2011 – Jan. 2013 May 2011	Number of stormwater system upgrades Number of storm drains labeled. Number of articles appearing in newsletter.

Reduce sedimentation from riparian land areas by promoting protection of riparian corridors and proper streambank restoration methods improving in stream habitat.	**OEPA**-401 mitigation list	Work with Champaign SWCD / NRCS to identify riparian landowners with eroded streambank issues. Establish one demonstration site along Nettle Creek utilizing Bioengineering erosion control and natural channel design methods and natural stream channel design	On going Feb. 2011 – Feb. 2013	Create mailing list Targeting streamside landowners to receive educational materials. Document soil saved / not delivered from eroding streambanks using R.U.S.L.E. Lineal feet of streambank protected or restored.

Refer to the spreadsheet of action items for prioritized deliverables on page 123. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Champaign County Health Department, Army Corps of Engineers, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.


Anderson Creek
HUC 050800011604
BAKER
WOODVILLE
IDLE
WISEMAN
LANTZ
Hog Creek
MILLERSTOWN-ERIS
NEAL
Russell Creek
ERIS
CHURCH
SR-560
BARGER
Harban Creek
Anderson Creek
050800011604
BARGER
MILLERSTOWN
STICKLEY
RIVER
RIVER
US-36
BAIR
OLD TROY
Anderson Creek
Legend
ATTAINMENT
(Full)
Full
Anderson_Creek_NHD streams
Anderson_Creek_HU12
N
W
E
S
0 0.25 0.5 1 1.5 2
Miles

Anderson Creek

12 Digit HUC 05080011604

Acres:	**11,348**
Stream Classification:	**CWH**
Segment Length:	**5.9 miles**
Drainage Area:	**17.7 square miles**
Year Sampled By EPA:	**2003**
Attainment:	**Full**

Background: The Anderson Creek Subwatershed encompasses 11,348 acres. This subwatershed includes all of Anderson Creek. Full attainment of Aquatic Life Use for Cold Water Habitat (CWH) at River Mile 1.0/5.9. was determined in the *Biological and Water Quality Study of the Mad River Basin, 2003 by the State of Ohio EPA*. These areas include some forested riparian buffer areas and are largely agricultural. This sub watershed has approximately 22 Ohio Department of Transportation and Champaign County Highway Department maintained bridges and numerous culverts.

Problem Statement: Sections of the streams are threatened as increasing agricultural drainage projects continue, habitat alterations and riparian zones are being destroyed.

Goals:

- Reduce sedimentation and nutrient run off from agricultural fields
- Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems
- Educate watershed residents on proper on site septic system maintenance

Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **OEPA 319**	Work in conjunction with Champaign SWCD/NRCS to promote farm streamside buffers through USDA Submit newspaper and newsletter article advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.
Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.	**USDA-**Farm Bill (EQIP) **ODNR**-Pollution Abatement Funds	Work with Champaign SWCD/NRCS to identify livestock producers who have livestock operations.	On going	Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets.

	Ohio Livestock Coalition-targeted	Establish one demonstration site along Anderson Creek utilizing livestock exclusion fencing and pasture management. Submit newspaper and newsletter articles to promote proper spreading and storage of animal waste from feedlots.	Feb. 2011 – Feb. 2014 Feb. 2011 – Feb. 2014	Lineal feet and number of cattle excluded from stream. Newsletters produced and number of articles appearing in local newspapers. Document number of animal waste complaints received.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Champaign Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2011 – Jan. 2013	Approved Countywide HSTS plan by OEPA and Champaign Co. Health Board Number of on site septic systems upgraded/replaced.
Educate watershed residents on proper on site septic system maintenance	**Champaign Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping/ system management.	April 2011 April 2011	Number of workshop attendants. Number of handouts distributed.

Refer to the spreadsheet of action items for prioritized deliverables on page 123. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Champaign County Health Department, Army Corps of Engineers, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.


Storms Creek
HUC 050800011605
KITE
OLD TROY
OLD TROY
KITE
RHODES
SR-55
Storms Creek
050800011605
COFFIN STATION
TERRE HAUTE
STONY CREEK
STORMS CREEK
WILLOW DALE
Storms Creek
Champaign Co.
Clark Co.
Legend
ATTAINMENT
Full
Storms_Creek_NHD streams
Storms_Creek_HU12
N
W
E
S
0 0.25 0.5 1 1.5 2
Miles

Storms Creek

12 Digit HUC 05080011605
Acres: 5,822
Stream Classification: CWH
Segment Length: 2.7 miles
Drainage Area: 9.26 square miles
Year Sampled By EPA: 2003
Attainment: Full

Background: The Storms Creek Subwatershedencompasses 5,822 acres. This sub watershed includes all of Storms Creek and is south west of Urbana. Full attainment of Aquatic Life Use for Cold Water Habitat (CWH) at River Mile 0.7/2.7 was determined in the *Biological and Water Quality Study of the Mad River Basin, 2003 by the State of Ohio EPA*. These areas include some forested riparian buffer areas and are largely agricultural. This sub watershed has approximately nine Ohio Department of Transportation and Champaign County Highway Department maintained bridges and numerous culverts.

Problem Statement: Sections of the streams are threatened as increasing agricultural drainage projects continue, habitat alterations and riparian zones are being destroyed.

Goals:

- Reduce sedimentation and nutrient run off from agricultural fields
- Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems
- Educate watershed residents on proper on site septic system maintenance

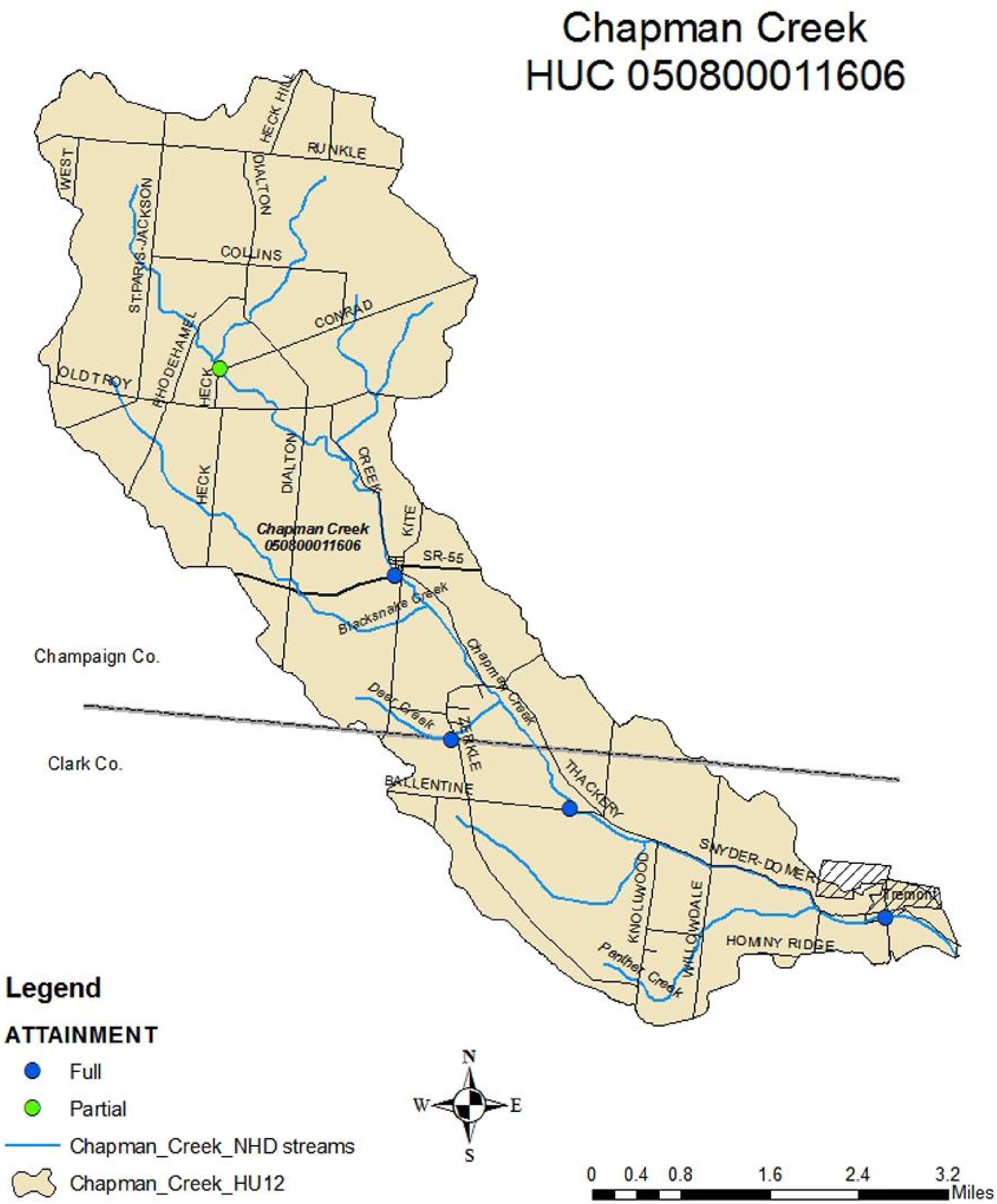
Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **OEPA 319**	Work in conjunction with Champaign and Clark SWCD/NRCS to promote farm streamside buffers through USDA Submit newspaper and newsletter article advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.
Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.	**USDA-**Farm Bill (EQIP) **ODNR**-Pollution Abatement Funds	Work with Champaign and Clark SWCD/NRCS to identify livestock producers who have livestock operations.	On going	Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets.

	Ohio Livestock Coalition-targeted	Establish one demonstration site along Storms Creek utilizing livestock exclusion fencing and pasture management. Submit newspaper and newsletter articles to promote proper spreading and storage of animal waste from feedlots.	Feb. 2011 – Feb. 2014 Feb. 2011 – Feb. 2014	Lineal feet and number of cattle excluded from stream. Newsletters produced and number of articles appearing in local newspapers. Document number of animal waste complaints received.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Champaign and Clark Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2011 – Jan. 2013	Approved Countywide HSTS plan by OEPA and Champaign Co. Health Board Number of on site septic systems upgraded/replaced.
Educate watershed residents on proper on site septic system maintenance	**Champaign and Clark Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping/ system management.	April 2011 April 2011	Number of workshop attendants. Number of handouts distributed.

Refer to the spreadsheet of action items for prioritized deliverables on page 123. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Champaign County Health Department, Army Corps of Engineers, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.

Waterbody HUC	Waterbody A	Cause #1	Cause #2	Action Item	Target	Unit	Total Costs	Funding Source
	Mad River (main stem)	Hydromodification		Remove Dam	1	dams	$75,000	ODOT & 319
50800011504	Mac-o-chee Ditch	Habitat Alteration	Agr. Channelization	Construct 2-stage channel	5,920	linear feet	$236,800	ODNR & 319
50800011504	Mac-o-chee Ditch	Habitat Alteration	Agr. Channelization	Plant trees or shrubs in riparian areas	6	acres	$3,657	OEPA 319
50800011502	Mad River Headwaters						$0	
50800011503	Kings Creek	Habitat Alteration	Agr. Channelization	Plant trees or shrubs in Riparian Areas	6	acres	$3,657	OEPA 319
50800011504	Gladys Creek-Mad River	Habitat Alteration	Agr. Channelization	Restore flood plain	10,560	linear feet	$1,858,560	ODNR, Army Corp. & 319
50800011504	Gladys Creek-Mad River	Habitat Alteration	Agr. Channelization	Plant trees or shrubs in riparian areas	12	acres	$7,313	OEPA 319
50800011601	Muddy Creek	Agr Channelization	Habitat Alteration	Construct 2-stage channel	4,000	linear feet	$160,000	ODNR & 319
50800011601	Muddy Creek	Agr Channelization	Habitat Alteration	Plant trees or shrubs in riparian areas	8	acres	$4,876	OEPA 319
50800011602	Dugan Run	Habitat Alteration	Urban Runoff	Restore flood plain	5,280	linear feet	$929,280	ODNR, Army Corp. & 319
50800011602	Dugan Run	Habitat Alteration	Urban Runoff	Plant trees or shrubs in riparian areas	2	acres	$1,219	OEPA 319
50800011602	Dugan Run	Habitat Alteration	Urban Runoff	Conduct Nitrate Sampling	1	sites	$20/sample	OEPA
50800011602	Dugan Run	Habitat Alteration	Agr. Channelization	Develop Nutrient Management Plans	7	acres	$3000/plan	OEPA 319
50800011603	Nettle Creek	Agr. Channelization	Nutrients	Restore flood plain	2,000	linear feet	$352,000	
50800011603	Nettle Creek	Agr. Channelization	Nutrients	Plant trees or shrubs in riparian areas	10	acres	$6,094.44	OEPA 319
50800011604	Anderson Creek						0	
50800011605	Storms Creek						$0	
5080001160	Stony Creek	Habitat Alteration		Inspect HSTS	1	inspections	$0	Champaign County Health District
5080001160	Stony Creek	Habitat Alteration		Conduct Chemical Sampling	1	site	$20/sample	OEPA
50800011606	Chapman Creek	Habitat Alteration	Nutrients	Plant trees or shrubs in riparian areas	2	acres	$1,219	OEPA 319
50800011606	Chapman Creek	Habitat Alteration	Nutrients	Inspects HSTS	1	inspections	$0	Champaign County Health District
50800011606	Chapman Creek	Habitat Alteration	Nutrients	Conduct Chemical Sampling	1	site	$20/sample	OEPA
50800011607	Bogles Run-Mad River						$0	
50800011701	East Fork Buck Creek						$0	
50800011702	Buck Creek Headwaters	Habitat Alteration		Construct 2-stage channel	5,920	linear feet	$236,800	ODNR & 319
50800011702	Buck Creek Headwaters	Habitat Alteration		Plant trees or shrubs in riparian areas	6	acres	$3,657	OEPA 319
50800011703	Sinking Creek						$0	
50800011704	Beaver Creek						$0	
50800011705	Clarence J. Brown Lake-Buck Creek	Habitat Alteration	Upstream Impoundment	Remove Levees	3/4 mile	levees	$2,376,000	Army Corp & 319
50800011705	Clarence J. Brown Lake-Buck Creek	Habitat Alteration	Upstream Impoundment	Restore natural flood plain function	10	acres	$1,393,920	Army Corp & 319
50800011705	Clarence J. Brown Lake-Buck Creek	Habitat Alteration	Upstream Impoundment	Install Habitat Structures	10	structures	$35,000	OEPA 319
50800011705	Clarence J. Brown Lake-Buck Creek	Habitat Alteration	Upstream Impoundment	Plant trees or shrubs in riparian areas	1	acres	$609	OEPA 319
50800011706	City of Springfield-Buck Creek						$0	
50800011801	Moore Run	Habitat Alteration	Agr. Channelization	Restore flood plain	2,000	linear feet	$352,000	OEPA 319
50800011801	Moore Run	Habitat Alteration	Agr. Channelization	Plant trees or shrubs in riparian areas	1	acres	$609	OEPA 319
50800011801	Moore Run	Habitat Alteration	Agr. Channelization	Conduct fish (IBI) sampling	1	site	$0	ODNR Div. of Wildlife
5080001160	Kenton Creek	Flow Alteration	Agr. Channelization	Restore flood plain	10,560	linear feet	$1,858,560	ODNR, Army Corp. & 319
50800011802	Pondy Creek-Mad River	Apparently goes dry		Restore natural flood plain function	2	acres	$484,840	ODNR, Army Corp. & 319
50800011803	Mill Creek						$0	
5080001003	Mad River downstream Donnels Creek	Flow Alteration	Agr. Channelization	Plant trees or shrubs in riparian areas	4	acres	$2,438	OEPA 319
5080001003	Mad River downstream Donnels Creek	Flow Alteration	Agr. Channelization	Remove Levees	1	levees	$3,168,000	Army Corp & 319
5080001003	Mad River downstream Donnels Creek	Flow Alteration	Agr. Channelization	Breach or modify levees	1	levees	$3,168,000	Army Corp & 319
50800011804	Donnels Creek	Lowered water table		Restore natural flow	12,880	linear feet	$2,266,880	ODNR & 319
50800011804	Donnels Creek	Lowered water table		Remove Levees	1	levees	$3,168,000	Army Corp & 319
50800011805	Rock Run-Mad River						$0	
50800011806	Jackson Creek-Mad River						$0	
Total est Implement costs							$22,137,848	


Chapman Creek
HUC 050800011606
HECK HILL
RUNKLE
WEST
DIALTON
ST.PARIS-JACKSON
COLLINS
CONRAD
RHODEHAMEL
OLDTROY
HECK
CREEK
DIALTON
KITE
Chapman Creek
050800011606
SR-55
Blacksnake Creek
Chapman Creek
Champaign Co.
Deer Creek
ZERKLE
Clark Co.
BALLENTINE
THACKERY
SNYDER-DOMER
KNOLLWOOD
WILLOWDALE
Tremont
HOMINY RIDGE
Panther Creek
Legend
ATTAINMENT
Full
Partial
Chapman_Creek_NHD streams
Chapman_Creek_HU12
N
W
E
S
0 0.4 0.8 1.6 2.4 3.2
Miles

Chapman Creek

12 Digit HUC 05080011606	
Acres:	**15,615**
Stream Classification:	**CWH**
Segment Length:	**10.1 miles**
Drainage Area:	**24.4 square miles**
Year Sampled By EPA:	**2003**
Attainment:	**Full (RM 0.8/6.9)**
	Partial (RM 10.1)

Background: Varying topography can be seen throughout this rural sub-watershed. Rolling land is a common characteristic, but gentle sloping to large flat flood plain areas do exist. This sub-watershed consists mainly of agricultural land but many acres of forested land can be seen. Tremont City located near the confluence of Chapman Creek and the Mad River and is the only incorporated area of the watershed.

Agricultural land uses dominate this watershed, but some residential housing does exist. Row crop, small grains and hay production are common, along with a few truck crop operations. Due to the rugged terrain in the headwater areas, row cropped fields may be designated as highly erodible land (H.E.L) by the USDA-NRCS. Additionally, there are a few cattle operations located in the high ground. Many of these operations take place in fields that are permanent pasture due to the potential for erosion. A majority of row cropping in this sub watershed occurs in the flat low-ground next to Chapman Creek. These tracts of ground have highly productive soils with low erosion potential. These areas have ideal conditions for grain production.

Residential housing can be seen along roadsides of this landscape. Areas of Willowdale Road and Knollwood Road have the most existing and potential for future housing. The Village of Tremont City has the highest concentrated population in the watershed. The Tremont City Landfill is also located in the Chapman Creek Watershed. This 200 plus acre facility is located 300 feet North of Chapman Creek along Snyder-Domer Road. The landfill has been closed for several years and signs of contamination have been found in groundwater and soils in the area.

Due to the rural character of the Chapman Creek watershed, residents utilize domestic on site septic and water wells. Homes located in Tremont City are older and spaced very close together. According to the Clark County Health Department, residents of Tremont City have a difficult time to replace existing on site septic systems and wells. Typically, homeowners have to apply for variances for distance setbacks between wells and existing septic systems. Tremont City will need to have public sewer and water infrastructure in the future.

The major threat to water resources is the Tremont City Landfill site that lies next to Chapman Creek west of Tremont City. The 80-acre site is divided into the former Waste Transfer Facility (14 acres), the closed Sanitary Landfill (58 acres), and the Barrel fill, also known as the Industrial Waste Disposal (IWD) Chemical Waste Landfill (8.5 acres). The former Waste Transfer Facility, permitted in 1977 as a hazardous waste treatment facility, subsequently underwent clean closure Pursuant to Ohio EPA's hazardous waste rule requirements in 1985 when operations ceased. The Sanitary Landfill, permitted as a solid waste disposal facility in 1969, closed under Ohio EPA's solid waste rules in 1995, and is currently engaged in post-closure monitoring and undertaking corrective actions pursuant to those rules.

The U.S. EPA and Ohio EPA's Division of Emergency and Remedial Response (DERR) launched an investigation of the closed Tremont City Landfill site in 1999 and concluded that contamination exists which has migrated from the disposal areas and affected groundwater, soils, and sediments. The agencies are currently focusing their attention on the Barrel fill area, operated from 1976 to 1979 by IWD, a subsidiary of Danis, as a drum and barrel disposal area. Historical records indicate that 47,000 drums of industrial wastes were placed in a series of cells or trenches excavated to a depth of 15 to 25 feet within the glacial till and covered with soil.

Potentially hazardous waste streams include paint sludges, glues, resins, asbestos, and ink sludges. In October 2003, U.S. EPA and the parties responsible for contamination related to the Barrel fill signed a legal order to conduct a Remedial Investigation/Feasibility Study (RI/FS). The first phase of the Remedial Investigation (RI), including the installation and sampling of groundwater wells, collection of soil and soil gas samples, and excavating five test pits has been completed. Based on the data collected, a second phase has begun which includes the installation of additional groundwater monitoring wells and an aquifer test. Analysis of stream water samples collected at RM 0.77 in Chapman Creek during the 2003 survey, however, did not reveal any elevated concentrations downstream from the Tremont City Landfill.

The channel of Chapman Creek remains in a natural state with good stream functions. The creek bed is primarily composed of gravel and sand, with small amounts of boulders, slabs, and cobbles. Natural channel conditions are evident, with a moderate to narrow wooded riparian corridor. The in-stream channel appears to be of high quality with a mixture of pool, riffle, and run habitats. The Clark SWCD/NRCS investigates several complaints a year in regard to streambank erosion. Due to the sandy/gravelly soils characteristics of riparian areas, along with high stream gradient and flow, unstable banks exist along much of the stream.

Past and Present Conservation Efforts: Several landowners have taken advantage of Farm Bill Programs to establish best management practices on farmland. In the headwater areas, many acres of grassed waterways and subsurface drainage systems have been installed to control erosion. Additionally, no-till farming practices along with grass filter strips have been implemented on many acres of farmland. The Environmental Quality Incentives Program (EQIP) has been popular with landowners having cattle operations. Several feet of cattle exclusion fencing and alternative watering systems have been installed to improve water quality

During implementation of the 1999 319 water quality grant, four septic tanks were pumped and educational materials disseminated to promote proper on site septic system management. This sub-watershed was targeted for this program due to septic system issues of Tremont City.

Problem Statement: Ohio EPA reports indicate that crop production and livestock operations are sources of water quality degradation. Leachate from the Tremont City Landfill is listed as well. Additionally, lack of stormwater management in Tremont City has the potential to convey pollution to Chapman Creek.

With the headwater reaches having a more rolling topography and being in an agricultural area, row cropped fields may be designated as highly erodible land (HEL) by the USDA-NRCS. Many landowners have installed grass waterways that have become silted in and becoming unusable to control gully erosion. Cattle production is another agricultural activity seen in headwater areas, but in low numbers. Many of these operations are done in permanent pastures rather than a feedlot setting.

Row cropped areas in the lower portions of the watershed take place in large flat tracts of flood plain ground. These types of soils are known for their high fertility and yields for grain production. Due to the nature of flood plain soils, ground and surface water have the ability to become interconnected. With advances in global positioning system (GPS) technologies, grid soil sampling combined with precision application of fertilizers and pesticides can reduce agricultural effects on our water resources.

Throughout the entire Chapman Creek watershed, aging and failing on-site septic are an issue. Tremont City is notorious for having septic system problems and lack of useable space for replacement. These conditions could pose a threat to the residents of Tremont City and future considerations should be made for water and sewer systems. Tremont City also has issues with a lack of stormwater management. The stormwater system in Tremont City was designed and built prior to the implementation of stormwater regulations.

Stormwater rolling of this land has the potential to carry pollutants and has higher velocity and erosive flows impacting stream morphology and function. The major threat of water quality in this sub watershed comes from concerns with the Tremont City Landfill. As previously noted, several investigations have been made by Ohio and United States Environmental Protection Agency. Several local organizations, such as CF water, have been making strides to promote cleaning up the landfill and protect the groundwater aquifer that the community utilizes.

Goals:

- Reduce sedimentation and nutrient run off from agricultural fields
- Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems
- Educate watershed residents on proper on site septic system maintenance
- Reduce NPS pollutants associated with stormwater

Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers. Promote grid soil sampling and precision application of fertilizers, pesticides and herbicides	**USDA**- Farm Bill (CRP) **Miami Conservancy District**-water quality credit trading program	Work in conjunction with Clark SWCD/NRCS to promote streamside buffers through USDA and MCD programs on agricultural lands. Submit newspaper and newsletter articles advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.
Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.	**USDA-**Farm Bill (EQIP) **Miami Conservancy District**-water quality credit trading program	Work w/ Clark SWCD/NRCS to identify livestock producers who have livestock operations. Establish one demonstration site along Beaver Creek utilizing livestock exclusion fencing and pasture management.	On going Feb. 2010 – Feb. 2013	Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Lineal feet and number of cattle excluded from stream.

	ODNR-Pollution Abatement Funds **Ohio Livestock Coalition** targeted mailing list	Submit newspaper and newsletter articles to promote proper spreading and storage of animal waste from feedlots.	Feb. 2010 – Feb. 2013	Newsletters produced and number of articles appearing in local newspapers. Document number of animal waste complaints received.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Clark Co. Health Department-**Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2010- Jan 2012	Approved Countywide HSTS plan by OEPA and Clark Co. Health Board Number of on site septic systems upgraded/replaced.
Educate watershed residents on proper on site septic system maintenance	**Clark Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping and system management.	April 2010 April 2010	Number of workshop attendants. Number of handouts distributed.
Reduce NPS pollutants associated with stormwater by implementing BMP's and education of watershed residents on stormwater management.	**OEPA**-DEFA Program **Miami Conservancy District**-water quality credit trading program **Clark County and Springfield Twp.-** Work with entities involved in Phase II areas.	Retrofit a bioretention or stormwater wetland area to the existing stormwater system of Tremont City. Storm drain labeling in areas with curb and gutter stormwater systems. Create and submit articles to Springfield News-Sun on stormwater and stream health.	Jan. 2010-Jan. 2013 May 2010	Number of stormwater system upgrades Number of storm drains labeled. Number of articles appearing in newsletter. Water quality activities reported to Ohio EPA for Phase II as required.

This table denotes the action items declared in the approved watershed action plan, *Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach* (Clark County Soil and Water Conservation District, 2007).

Refer to the following spreadsheet of action items for prioritized deliverables as determined by the Mad River Watershed Strategic Plan Joint Board of Supervisors and Advisory Board. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

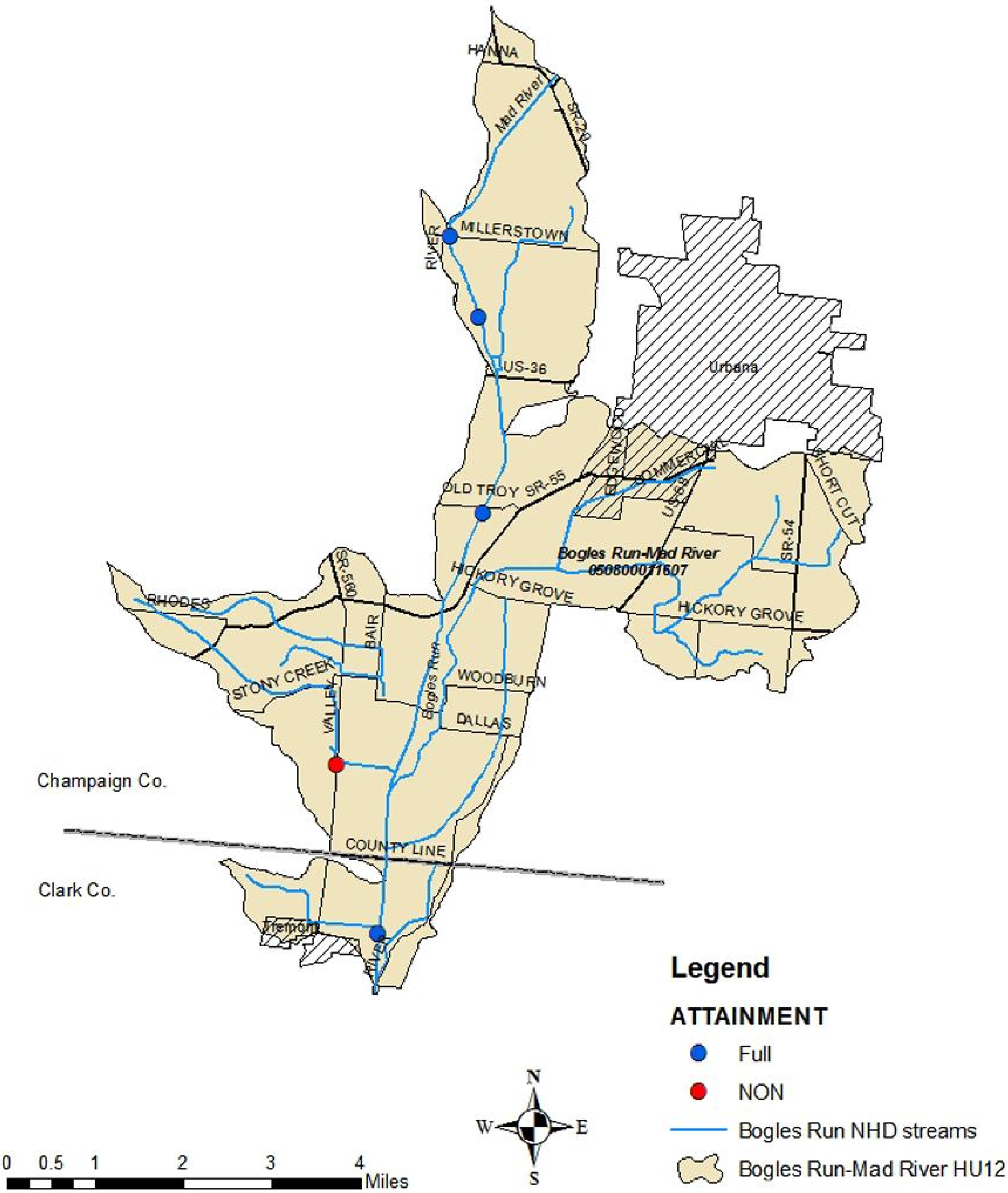
Funding sources include EPA 319, USDA Farm Bill programs, Logan County Health Department, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.

Chapman Creek HUC 05080001180

Objectives	Deliverables	Quantity of Deliverable	Cost	Deliverable Units	Total Cost
Streambank & Riparian Restoration	Restore Streambank Using Bio-Engineering and/or By Recontouring or Regrading	1200	$ 10,000.00	Linear Feet	$ 12,000,000.00
	Plant Grasses or Prairie Grasses in Riparian Areas	125	$ 411.93	Acre	$ 51,491.25
	Plant Trees or Shrubs in Riparian Areas	15	$ 609.44	Acre	$ 9,141.60
Stream Restoration	Restore Floodplain	0		Linear Feet	
	Restore Stream Channel	1200		Linear Feet	
	Install In-Stream Habitat Structures	0		Structure	$ -
	Construct 2-Stage Channel	0		Linear Feet	
	Install Grade Structures	10		Structure	
	Restore Natural Flow	0		Linear Feet	$ -
Wetland Restoration	Reconstruct and Restore Wetlands	10		Acre	
Dam Modification or Removal	Remove Dams	0		Dams	
	Modify Dams	0		Dams	
	Restore Natural Flow	0		Acre	
	Restore Natural Floodplain Function	0		Acre	
Conservation Easements	Acquire Riparian Conservation Easements	0	$ 2,000.00	Acre	$ -
	Acquire Wetland Conservation Easements	0	$ 2,000.00	Acre	$ -
Home Sewage Treatment Systems	Inspect HSTS	75	$ 90.00	Inspections	$ 6,750.00
	Repair or Replace Traditional HSTS	25	$ 6,000.00	HSTS	$ 150,000.00
	Repair or Replace Alternative HSTS	0	$ 9,000.00	HSTS	$ -
Agricultural Best Management Practices	Plant Cover/Manure Crops	1500		Acre	
	Develop Nutrient Management Plans	5	$ 2,766.00	Each	$ 13,830.00
	Implement Conservation Tillage Practices	1200	$ 15.02	Acre	$ 18,024.00
	Install Alternative Water Supplies	0	$ 1,634.30	Each	$ -
	Install Erosion & Sediment Control Structures	5	$ 4.13	SQ FT	$ 20.65
	Install Grassed Waterways	75	$ 5,446.00	Acre	$ 408,450.00
	Install Livestock Crossings	0	$ 3.26	SQ FT	$ -
	Install Heavy Use Feeding Pads	0	$ 1.47	SQ FT	$ -
	Install Livestock Exclusion Fencing	0	$ 0.51	Linear Feet	$ -
	Construct Animal Waste Storage Structures	0	$ 2.07	CU FT	$ -
	Conduct Soil Testing	1500	$ 24.81	Acre	$ 37,215.00
	Execute Installer Contracts	10		Each	$ 10.00
Education and Outreach	Develop Brochures/Fact Sheets	5		Brochures/Sheets	$ 5.00
	Develop Press Releases	1		Releases	$ 1.00
	Install Signs	3		Signs	$ 3.00
	Conduct Tours	5		Tours	$ 5.00
	Conduct Stream Clean-Ups	5		Clean-Ups	$ 5.00
	Stencil Storm Drains	50		Drains	$ 50.00
	Deliver On-Site Technical Assistance	10		Site Visits	$ 10.00
Monitoring	Conduct Chemical Sampling	5		Sites	$ 5.00
	Conduct Macroinvertebrate (ICI) Sampling	5		Sites	$ 5.00
	Conduct Fish (IBI) Sampling	5		Sites	$ 5.00
	Conduct Habitat (QHEI) Sampling	5		Sites	$ 5.00
	Conduct Nitrate Sampling (Water)	50		Samples	$ 50.00
	Conduct Nitrate Sampling (Soil)	50		Samples	$ 50.00
	Prepare and Submit Final Report and Data	1		Report	$ 1.00

	Mad River bel Chapman Creek ab Buck Creek HUC 05080001801				
Objectives	**Deliverables**	**Quantity of Deliverable**	**Cost**	**Deliverable Units**	**Total Cost**
Streambank & Riparian Restoration	Restore Streambank Using Bio-Engineering and/or By Recontouring or Regrading	0	$ 10,000.00	Linear Feet	$ -
	Plant Grasses or Prairie Grasses in Riparian Areas	0	$ 411.93	Acre	$ -
	Plant Trees or Shrubs in Riparian Areas	10	$ 609.44	Acre	$ 6,094.40
Stream Restoration	Restore Floodplain	0		Linear Feet	
	Restore Stream Channel	0		Linear Feet	
	Install In-Stream Habitat Structures	0		Structure	$ -
	Construct 2-Stage Channel	5200		Linear Feet	
	Install Grade Structures	0		Structure	
	Restore Natural Flow	0		Linear Feet	$ -
Wetland Restoration	Reconstruct and Restore Wetlands	15		Acre	
Dam Modification or Removal	Remove Dams	0		Dams	
	Modify Dams	0		Dams	
	Restore Natural Flow	0		Acre	
	Restore Natural Floodplain Function	0		Acre	
Conservation Easements	Acquire Riparian Conservation Easements	50	$ 2,000.00	Acre	$ 100,000.00
	Acquire Wetland Conservation Easements	0	$ 2,000.00	Acre	$ -
Home Sewage Treatment Systems	Inspect HSTS	150	$ 90.00	Inspections	$ 13,500.00
	Repair or Replace Traditional HSTS	50	$ 6,000.00	HSTS	$ 300,000.00
	Repair or Replace Alternative HSTS	0	$ 9,000.00	HSTS	$ -
Agricultural Best Management Practices	Plant Cover/Manure Crops	0		Acre	
	Develop Nutrient Management Plans	5	$ 2,766.00	Each	$ 13,830.00
	Implement Conservation Tillage Practices	1200	$ 15.02	Acre	$ 18,024.00
	Install Alternative Water Supplies	0	$ 1,634.30	Each	$ -
	Install Erosion & Sediment Control Structures	0	$ 4.13	SQ FT	$ -
	Install Grassed Waterways	0	$ 5,446.00	Acre	$ -
	Install Livestock Crossings	0	$ 3.26	SQ FT	$ -
	Install Heavy Use Feeding Pads	0	$ 1.47	SQ FT	$ -
	Install Livestock Exclusion Fencing	0	$ 0.51	Linear Feet	$ -
	Construct Animal Waste Storage Structures	0	$ 2.07	CU FT	$ -
	Conduct Soil Testing	2500	$ 24.81	Acre	$ 62,025.00
	Execute Installer Contracts	15		Each	$ 15.00
Education and Outreach	Develop Brochures/Fact Sheets	5		Brochures/Sheets	$ 5.00
	Develop Press Releases	1		Releases	$ 1.00
	Install Signs	10		Signs	$ 10.00
	Conduct Tours	5		Tours	$ 5.00
	Conduct Stream Clean-Ups	5		Clean-Ups	$ 5.00
	Stencil Storm Drains	1200		Drains	$ 1,200.00
	Deliver On-Site Technical Assistance	15		Site Visits	$ 15.00
Monitoring	Conduct Chemical Sampling	5		Sites	$ 5.00
	Conduct Macroinvertebrate (ICI) Sampling	5		Sites	$ 5.00
	Conduct Fish (IBI) Sampling	5		Sites	$ 5.00
	Conduct Habitat (QHEI) Sampling	5		Sites	$ 5.00
	Conduct Nitrate Sampling (Water)	50		Samples	$ 50.00
	Conduct Nitrate Sampling (Soil)	50		Samples	$ 50.00
	Prepare and Submit Final Report and Data	1		Report	$ 1.00

Bogles Run
HUC 050800011607



Bogles Run

12 Digit HUC 05080011607
Acres: 4,544
Stream Classification: CWH
Segment Length: 7 miles
Drainage Area: 7.1 square miles
Year Sampled By EPA: 2003
Attainment: Full; Non Stony Creek R.M. 0.7

Background: Bogles Run encompasses 7.1 square miles. The whereabouts of the water source that sustains Cedar Bog has been the subject of several investigations in the past two decades. Some of these studies indicated that a recharge area lies to the east and northeast of the Bog. Using environmental isotopes of oxygen and hydrogen, a recent study (* ***Isotopic tracing of the source water for Cedar Bog in west-central Ohio, USA. Songlin Cheng,*** *Department of Geological Sciences, Wright State University, Dayton, OH 45435, USA. Received 25 November 1995; accepted 23 January 1996)* positively identifies a major recharge area located northeast of the Bog that is enclosed by two small tributaries of the Mad River. These two tributaries are Cedar Run and Bogles Run. Bogles Run enters the Mad River at R.M. 34.2.

Problem Statement: The stream water in Bogles Run is only about 30 cm deep. There is concern that encroaching development threatens the sustainability of Cedar Bog and its fragile ecosystem. Sections of the streams are threatened as increasing agricultural drainage projects continue, habitat alterations and riparian zones are being destroyed. Stony Creek, which lies in the southwest portion of this subwatershed, was heavily impacted prior to 2005 by an improperly operated wastewater treatment from Lakewood Swim Club. The 2003 Mad River Basin TSD recommends that Stony Creek be revisited.

Goals:

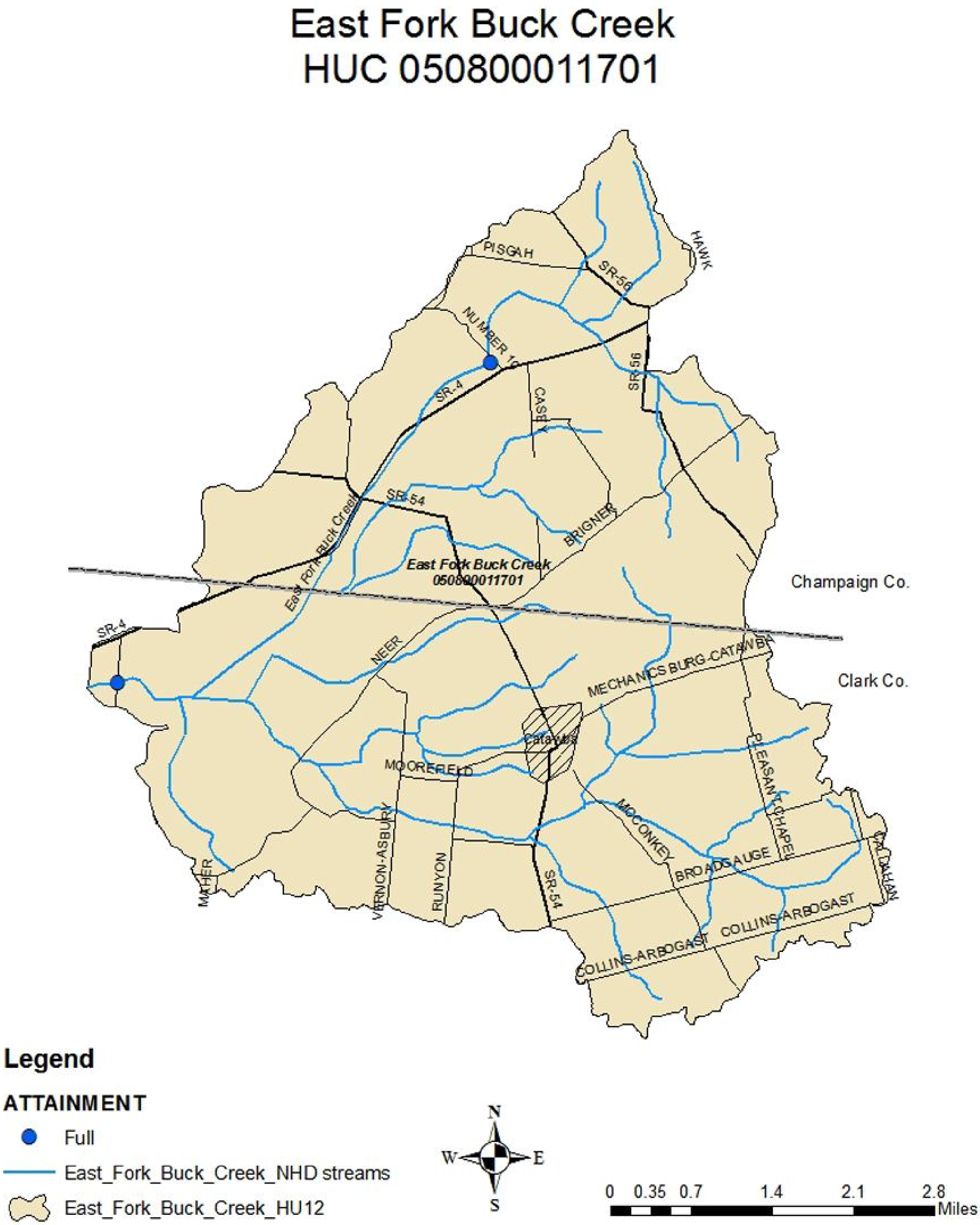
- Reduce sedimentation and nutrient run off from agricultural fields
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems
- Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots
- Educate watershed residents on proper on site septic system maintenance
- Reduce NPS pollutants associated with stormwater
- Reduce sedimentation from riparian land areas

Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **OEPA 319**	Work in conjunction with Champaign and Clark SWCD/NRCS to promote streamside buffers through USDA programs on agricultural lands. Submit newspaper and newsletter article advertising the benefits of riparian buffers.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets.

		Target operators and landowners who farm HEL land.		Newsletters produced and number of articles appearing in local newspapers.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Champaign and Clark Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2010 – Jan. 2013	Approved Countywide HSTS plan by OEPA and Champaign Co. Health Board Number of on site septic systems upgraded/replaced.
Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.	**USDA**-Farm Bill (EQIP) **ODNR**- Pollution Abatement Funds **Ohio Livestock Coalition**-targeted mailing list	Work with Champaign and Clark SWCD/NRCS to identify livestock producers who have livestock operations. Establish one demonstration site along Bogles Run utilizing livestock exclusion fencing and pasture management. Submit newspaper and newspaper articles to promote proper spreading and storage of animal waste from feedlots.	On going Feb. 2010 – Feb. 2012 Feb. 2010 – Feb. 2012	Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Lineal feet and number of cattle excluded from stream. Newsletters produced and number of articles appearing in local newspapers. Document number of animal waste complaints received.
Educate watershed residents on proper on site septic system maintenance	**Champaign and Clark Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping/ system management.	April 2010 April 2010	Number of workshop attendants. Number of handouts distributed.
Reduce NPS pollutants associated with stormwater by implementing BMPs and education of watershed residents on stormwater management.	**OEPA**-DEFA Program	Storm drain labeling in areas with curb and gutter stormwater systems. Create and submit articles to local newspapers on stormwater and stream health.	Jan. 2010 – Jan. 2012 May 2010	Number of stormwater system upgrades Number of storm drains labeled. Number of articles appearing in newsletter.
Reduce sedimentation from riparian land areas by promoting protection of riparian corridors and proper streambank restoration methods improving in stream habitat.	**OEPA**-401 mitigation list	Work with Champaign and Clark SWCD/NRCS to identify riparian landowners with eroded streambank issues. Establish one demonstration site along Nettle Creek utilizing Bioengineering erosion control and natural channel design methods and natural stream channel design	On going Feb. 2010 – Feb. 2012	Create mailing list Targeting streamside landowners to receive educational materials. Document soil saved/not delivered from eroding streambanks using R.U.S.L.E. Lineal feet of streambank protected or restored.

Refer to the spreadsheet of action items for prioritized deliverables on page 123. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Champaign County Health Department, Clark County Health Department, Army Corps of Engineers, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.


East Fork Buck Creek
HUC 050800011701
PISGAH
HAWK
SR-56
NUMBER 10
SR-4
CASEY
SR-56
SR-54
East Fork Buck Creek
BRIGNER
East Fork Buck Creek
050800011701
Champaign Co.
SR-4
NEER
MECHANICSBURG-CATAWBA
Clark Co.
Catawba
MOOREFIELD
PLEASANT CHAPEL
MCCONKEY
BROADGAUGE
CALLAHAN
VERNON-ASBURY
RUNYON
MATHER
SR-54
COLLINS-ARBOGAST
COLLINS-ARBOGAST
Legend
ATTAINMENT
Full
East_Fork_Buck_Creek_NHD streams
East_Fork_Buck_Creek_HU12
N
W
E
S
0 0.35 0.7 1.4 2.1 2.8
Miles

East Fork Buck Creek

12 Digit HU050800011701
Acres: 18,464.5829
Stream Classification: CWH
Segment Length: 6.4 miles
Drainage Area: 28.8 square miles
Year Sampled by OEPA: 1984
Attainment: .5 miles Full; 5.9 miles N/A

Background: This area can be characterized by its rural nature, rolling topography and rugged terrain. This sub-watershed consists mainly of agricultural land with dense patches of wooded area and minimal non-forested wetlands. Consequently, several tributaries have been affected by channelization to control flood flow or by unrestricted livestock grazing in riparian areas.

Agriculture is the dominant land use where cattle and hay production are the typical farming practices. Agricultural fields being row cropped are typically classified as highly erodible land (H.E.L) by the USDA-NRC. A gravel mining operation can be found. This is a predominately rural area, but is currently experiencing rapid residential development.

Water is being used by truck crop operations for irrigation purposes. Flood control structures were built with the creation of the Buck Creek Conservancy District in the late 1960's in efforts to improve farmland and protect against flooding. A flood control structure is present at the intersection of State Route 4 and State Route 54. The Village of Catawba has its own municipal water system that serves 360 residents. Ground water is the primary water source for the village and water usage is approximately 23,000 gallons per day. The WWTP has a capacity of 64,000 gallons per day if demanded.

Diverse areas exist in the stream corridor depending on adjacent land use. Tributaries and East Fork Buck Creek have been leveed and wooded riparian zones denuded in some agriculture areas to control storm flow and prevent land damaged from flooding caused by log-jams. Other streamside areas maybe fully wooded with an existing natural channel and functional flood plain. An example of these inconsistencies can be seen at County Line Road to Buck Creek Lane.

Past and Present Conservation Efforts: Two hundred and twelve acres of cover crops and 8 acres of filter strips were established through a 1999 section 319 grant. Additionally, 11 septic tanks were pumped and educational materials disseminated to help improve water quality. A variety of CRP projects have been implemented, such as the establishment of native grasses on Brigner Road. No-till farming practices are also benefiting water quality.

Problem Statement: Crop production, increasing number of livestock, and pasture/feedlots posses the ability to raise nutrient and bacterial levels in East Fork Buck Creek. Large numbers of cattle having access to tributaries along with crop production in highly erodible land (H.E.L.) areas are compromising water quality. Field observations made by Clark SWCD and NRCS personnel identify excessive sedimentation/siltation, pathogens, pesticides, and organic enrichment as causes of impairments. Specifically noted were several areas where stream channel and flood plain modifications have been made.

The Village of Catawba is on a sanitary sewer system and the WWTP outlets into East Fork Buck Creek. Homes with older on site septic systems that are in need of upgrading are also jeopardizing water quality.

Source: "Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach", Clark County Soil and Water Conservation District, 2007.

Goals:

- Reduce sedimentation and nutrient run off from agricultural fields
- Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems
- Educate watershed residents on proper on site septic system maintenance

Objective	Resources	Action	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **Miami Conservancy District**-water quality credit trading program	Work in conjunction with Champaign and Clark SWCD/NRCS to promote farm streamside buffers through USDA and MCD programs. Submit newspaper and newsletter article advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.
Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.	**USDA-**Farm Bill (EQIP) **Miami Conservancy District**-water quality credit trading program **ODNR**-Pollution Abatement Funds **Ohio Livestock Coalition-**targeted	Work w/ Champaign and Clark SWCD/NRCS to identify livestock producers who have livestock operations. Establish one demonstration site along Buck Creek utilizing livestock exclusion fencing and pasture management. Submit newspaper and newsletter articles to promote proper spreading and storage of animal waste from feedlots.	On going Feb. 2010 – Feb. 2012 Feb. 2010 – Feb. 2012	Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Lineal feet and number of cattle excluded from stream. Newsletters produced and number of articles appearing in local newspapers. Document number of animal waste complaints received.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Champaign and Clark Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2010 – Jan. 2013	Approved Countywide HSTS plan by OEPA and Champaign/Clark Co. Health Board Number of on site septic systems upgraded/replaced.

Educate watershed residents on proper on site septic system maintenance	**Champaign and Clark Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping/ system management.	April 2010 April 2010	Number of workshop attendants. Number of handouts distributed.

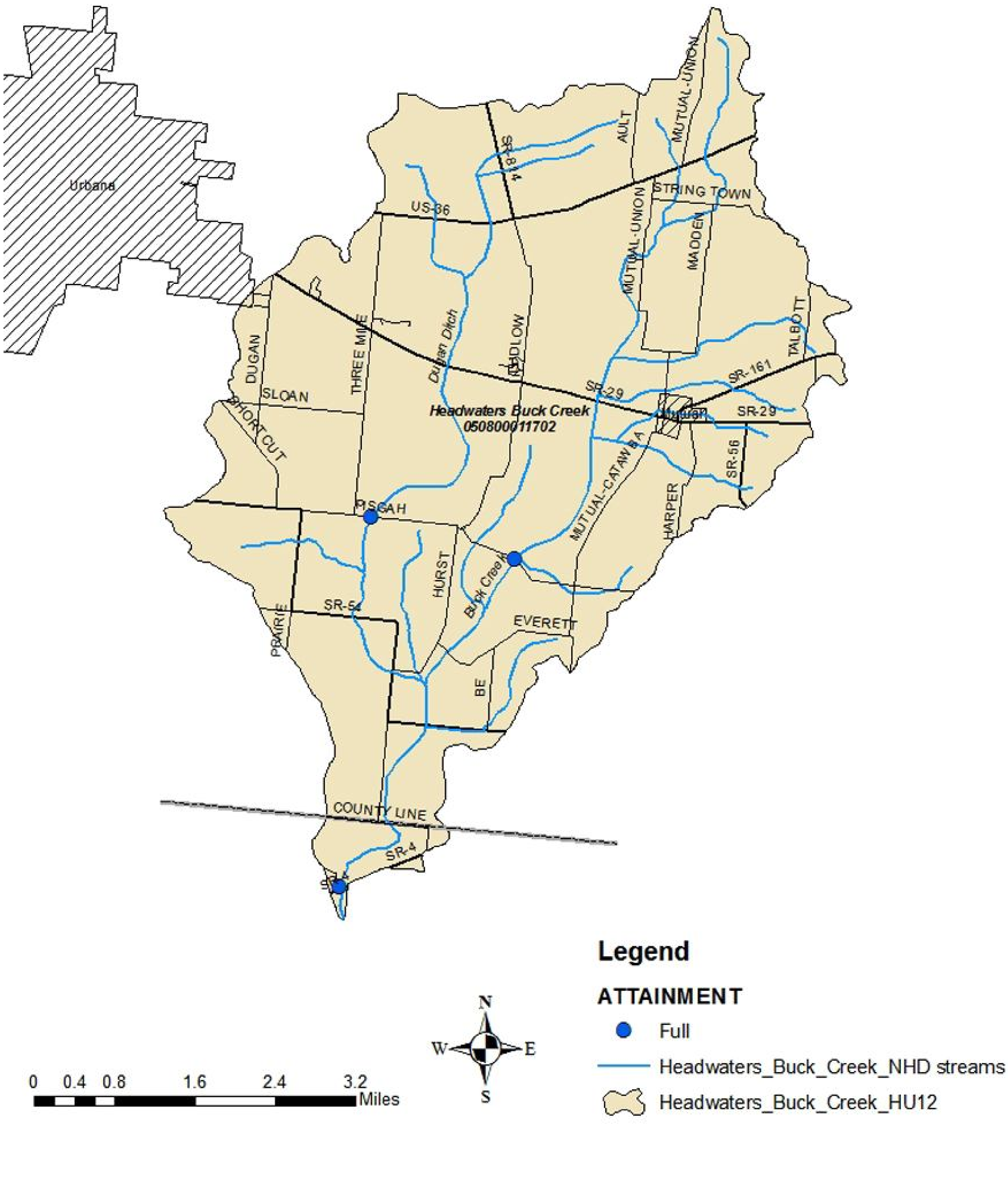
This table denotes the action items declared in the approved watershed action plan, *Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach* (Clark County Soil and Water Conservation District, 2007).

Refer to the following spreadsheet of action items for prioritized deliverables as determined by the Mad River Watershed Strategic Plan Joint Board of Supervisors and Advisory Board. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Champaign County Health Department, Clark County Health Department, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.

	East Fork Buck Creek HUC 050800011702				
Objectives	Deliverables	Quantity of Deliverable	Cost	Deliverable Units	Total Cost
Streambank & Riparian Restoration	Restore Streambank Using Bio-Engineering and/or By Recontouring or Regrading	300	$ 10,000.00	Linear Feet	$ 3,000,000.00
	Plant Grasses or Prairie Grasses in Riparian Areas	125	$ 411.93	Acre	$ 51,491.25
	Plant Trees or Shrubs in Riparian Areas	20	$ 609.44	Acre	$ 12,188.80
Stream Restoration	Restore Floodplain	1500		Linear Feet	
	Restore Stream Channel	0		Linear Feet	
	Install In-Stream Habitat Structures	0		Structure	$ -
	Construct 2-Stage Channel	5200		Linear Feet	
	Install Grade Structures	0		Structure	
	Restore Natural Flow	0		Linear Feet	$ -
Wetland Restoration	Reconstruct and Restore Wetlands	40		Acre	
Dam Modification or Removal	Remove Levees	300		Levees	
	Modify Dams	0		Dams	
	Restore Natural Flow	0		Acre	
	Restore Natural Floodplain Function	10		Acre	
Conservation Easements	Acquire Riparian Conservation Easements	0	$ 2,000.00	Acre	$ -
	Acquire Wetland Conservation Easements	0	$ 2,000.00	Acre	$ -
Home Sewage Treatment Systems	Inspect HSTS	75	$ 90.00	Inspections	$ 6,750.00
	Repair or Replace Traditional HSTS	25	$ 6,000.00	HSTS	$ 150,000.00
	Repair or Replace Alternative HSTS	0	$ 9,000.00	HSTS	$ -
Agricultural Best Management Practices	Plant Cover/Manure Crops	2500		Acre	
	Develop Nutrient Management Plans	10	$ 2,766.00	Each	$ 27,660.00
	Implement Conservation Tillage Practices	2500	$ 15.02	Acre	$ 37,550.00
	Install Alternative Water Supplies	5	$ 1,634.30	Each	$ 8,171.50
	Install Erosion & Sediment Control Structures	10	$ 4.13	SQ FT	$ 41.30
	Install Grassed Waterways	100	$ 5,446.00	Acre	$ 544,600.00
	Install Livestock Crossings		$ 3.26	SQ FT	$ 3.26
	Install Heavy Use Feeding Pads	12	$ 1.47	SQ FT	$ 17.64
	Install Livestock Exclusion Fencing	7500	$ 0.51	Linear Feet	$ 3,825.00
	Construct Animal Waste Storage Structures	10	$ 2.07	CU FT	$ 20.70
	Conduct Soil Testing	5000	$ 24.81	Acre	$ 124,050.00
	Execute Installer Contracts	40		Each	$ 40.00
Education and Outreach	Develop Brochures/Fact Sheets	5		Brochures/Sheets	$ 5.00
	Develop Press Releases	1		Releases	$ 1.00
	Install Signs	10		Signs	$ 10.00
	Conduct Tours	5		Tours	$ 5.00
	Conduct Stream Clean-Ups	5		Clean-Ups	$ 5.00
	Stencil Storm Drains	300		Drains	$ 300.00
	Deliver On-Site Technical Assistance	40		Site Visits	$ 40.00
Monitoring	Conduct Chemical Sampling	10		Sites	$ 10.00
	Conduct Macroinvertebrate (ICI) Sampling	10		Sites	$ 10.00
	Conduct Fish (IBI) Sampling	10		Sites	$ 10.00
	Conduct Habitat (QHEI) Sampling	10		Sites	$ 10.00
	Conduct Nitrate Sampling (Water)	100		Samples	$ 100.00
	Conduct Nitrate Sampling (Soil)	100		Samples	$ 100.00
	Prepare and Submit Final Report and Data	1		Report	$ 1.00

Headwaters Buck Creek
HUC 050800011702



Buck Creek Headwaters

12 Digit HUC 050800011702	
Acres:	**19547.3727**
Stream Classification:	**CWH**
Segment Length:	**12 miles**
Drainage Area:	**30.49 square miles**
Year Sampled by OEPA:	**1984 and 2003**
Attainment:	**.5 miles Full, 11 miles N/A**

Background: This area can be characterized by its rural nature, rolling topography and rugged terrain. This sub-watershed consists mainly of agricultural land with dense patches of wooded area and minimal non-forested wetlands. Consequently, several tributaries have been affected by leveeing/ditching to control flood flow or by unrestricted livestock grazing in riparian areas. Sandy, gravely soils are characteristic of this sub-watershed.

Agriculture is the dominant land use in this sub-watershed. Presently, this area is very rural, but is experiencing urban development pressures. Due to the rolling topography, row cropped fields are typically designated as Highly Erodible Land (H.E.L) by USDA-NRCS. Agricultural areas not being row cropped are utilized for livestock and hay production. Several gravel-mining operations are located in this sub-watershed.

Due to the rural character of this watershed, residential homes do not have access to municipal water and waste water system. This includes the Village of Mutual. Residences will have to rely on domestic on conventional septic systems and wells for years to come.

Diverse areas exist in the stream corridor depending on adjacent land use. Tributaries and East Fork Buck Creek have been levied and wooded riparian zones denuded in some agriculture areas to control storm flow and prevent land damaged from flooding caused by log-jams. Other streamside areas maybe fully wooded with an existing natural channel and functional flood plain.

Past and Present Conservation Efforts: Fourteen acres of grass filter strip and 110 acres of cover crops have been established in this sub-watershed. Seven septic tanks have been pumped to help improve the water quality of Buck Creek. All of these practices have been implemented through the 319 Grant. No-till farming practices are also benefiting water quality.

Problem Statement: OEPA Water quality reports indicate that agricultural land use has the most potential to affect water quality. Crop production, increasing number of livestock, and pasture/feedlots posses the ability to raise nutrient and bacterial levels in Buck Creek. Large numbers of cattle having access to tributaries along with crop production in highly erodible land (H.E.L.) areas are compromising water quality. Field observations made by Clark SWCD and NRCS personnel identify excessive sedimentation/siltation, pathogens, pesticides, and organic enrichment as causes of impairment.

The Village of Mutual contains dense housing, all with on-site septic systems and private water wells. This may pose a threat to public health and water quality due to the age and close proximity of these water/waste-water systems. The subdivision of Highland Hills, east of the Village of Mutual, is encountering issues with failing septic systems.

Source: "Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach", Clark County Soil and Water Conservation District, 2007.

Goals:

- Reduce sedimentation and nutrient run off from agricultural fields.
- Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems.
- Educate watershed residents on proper on site septic system maintenance.

Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers.	**USDA**- Farm Bill (CRP) **Miami Conservancy District**-water quality credit trading program	Work in conjunction with Champaign SWCD/NRCS to promote farm streamside buffers through USDA and MCD programs. Submit newspaper and newsletter article advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.
Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.	**USDA-**Farm Bill (EQIP) **Miami Conservancy District**-water quality credit trading program **ODNR**-Pollution Abatement Funds **Ohio Livestock Coalition-**targeted	Work w/ Champaign SWCD/NRCS to identify livestock producers who have livestock operations. Establish one demonstration site along Buck Creek utilizing livestock exclusion fencing and pasture management. Submit newspaper and newsletter articles to promote proper spreading and storage of animal waste from feedlots.	On going Feb. 2010 – Feb. 2013 Feb. 2010 – Feb. 2013	Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Lineal feet and number of cattle excluded from stream. Newsletters produced and number of articles appearing in local newspapers. Document number of animal waste complaints received.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Champaign Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2010 – Jan. 2012	Approved Countywide HSTS plan by OEPA and Champaign/Clark Co. Health Board Number of on site septic systems upgraded/replaced.

Educate watershed residents on proper on site septic system maintenance	**Champaign/Clark Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping/ system management.	April 2010 April 2010	Number of workshop attendants. Number of handouts distributed.

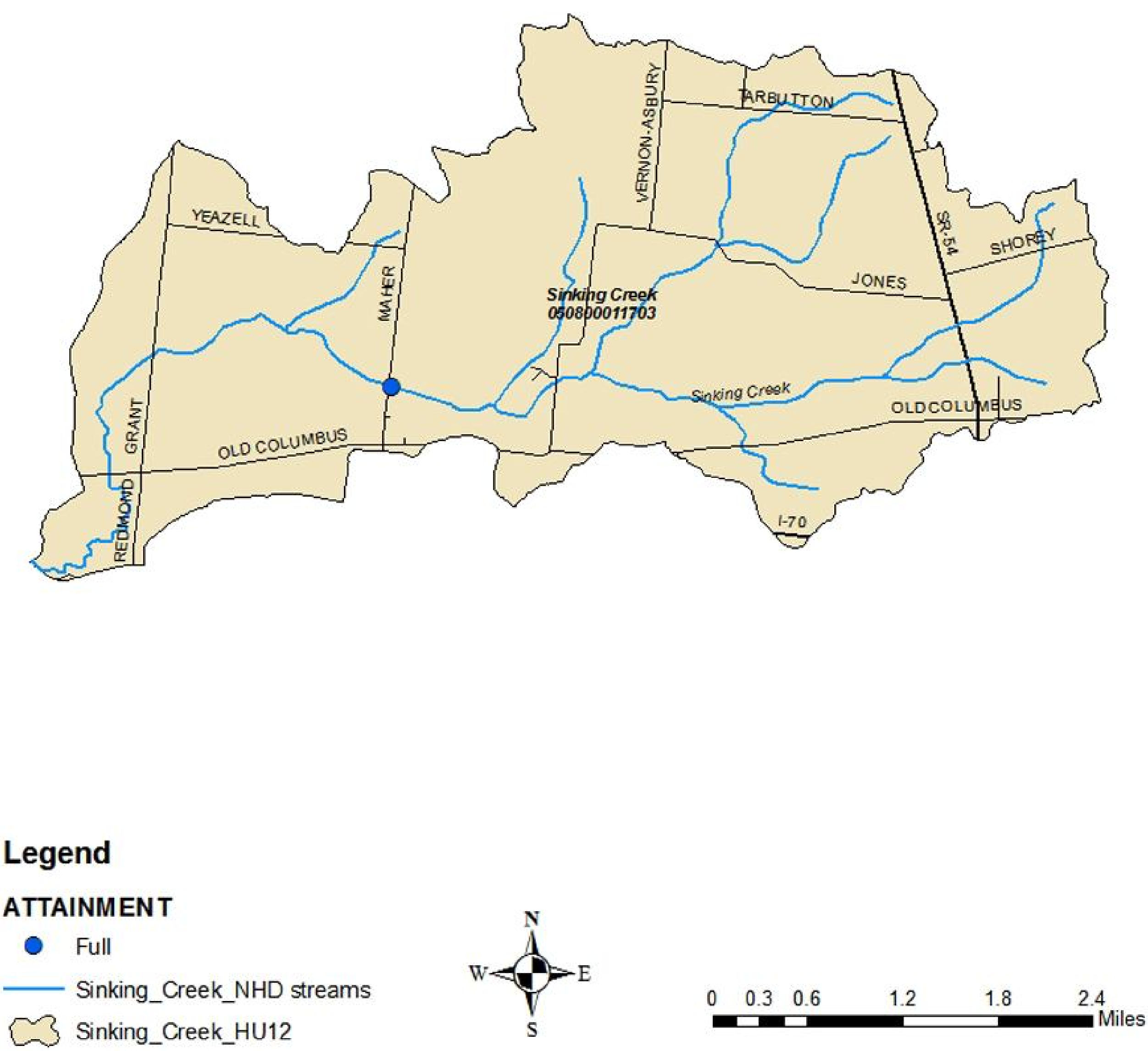
This table denotes the action items declared in the approved watershed action plan, *Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach* (Clark County Soil and Water Conservation District, 2007).

Refer to the following spreadsheet of action items for prioritized deliverables as determined by the Mad River Watershed Strategic Plan Joint Board of Supervisors and Advisory Board. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Champaign County Health Department, Clark County Health Department, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.

	Buck Creek bel East Fork Buck Creek and above Beaver Creek HUC 050800011703				
Objectives	**Deliverables**	**Quantity of Deliverable**	**Cost**	**Deliverable Units**	**Total Cost**
Streambank & Riparian Restoration	Restore Streambank Using Bio-Engineering and/or By Recontouring or Regrading	300	$ 10,000.00	Linear Feet	$ 3,000,000.00
	Plant Grasses or Prairie Grasses in Riparian Areas	125	$ 411.93	Acre	$ 51,491.25
	Plant Trees or Shrubs in Riparian Areas	20	$ 609.44	Acre	$ 12,188.80
Stream Restoration	Restore Floodplain	1500		Linear Feet	
	Restore Stream Channel	0		Linear Feet	
	Install In-Stream Habitat Structures	0		Structure	$ -
	Construct 2-Stage Channel	5200		Linear Feet	
	Install Grade Structures	0		Structure	
	Restore Natural Flow	0		Linear Feet	$ -
Wetland Restoration	Reconstruct and Restore Wetlands	40		Acre	
Dam Modification or Removal	Remove Levees	300		Levees	
	Modify Dams	0		Dams	
	Restore Natural Flow	0		Acre	
	Restore Natural Floodplain Function	10		Acre	
Conservation Easements	Acquire Riparian Conservation Easements	0	$ 2,000.00	Acre	$ -
	Acquire Wetland Conservation Easements	0	$ 2,000.00	Acre	$ -
Home Sewage Treatment Systems	Inspect HSTS	150	$ 90.00	Inspections	$ 13,500.00
	Repair or Replace Traditional HSTS	50	$ 6,000.00	HSTS	$ 300,000.00
	Repair or Replace Alternative HSTS	0	$ 9,000.00	HSTS	$ -
Agricultural Best Management Practices	Plant Cover/Manure Crops	2500		Acre	
	Develop Nutrient Management Plans	10	$ 2,766.00	Each	$ 27,660.00
	Implement Conservation Tillage Practices	2500	$ 15.02	Acre	$ 37,550.00
	Install Alternative Water Supplies	5	$ 1,634.30	Each	$ 8,171.50
	Install Erosion & Sediment Control Structures	10	$ 4.13	SQ FT	$ 41.30
	Install Grassed Waterways	100	$ 5,446.00	Acre	$ 544,600.00
	Install Livestock Crossings		$ 3.26	SQ FT	$ 3.26
	Install Heavy Use Feeding Pads	12	$ 1.47	SQ FT	$ 17.64
	Install Livestock Exclusion Fencing	7500	$ 0.51	Linear Feet	$ 3,825.00
	Construct Animal Waste Storage Structures	10	$ 2.07	CU FT	$ 20.70
	Conduct Soil Testing	5000	$ 24.81	Acre	$ 124,050.00
	Execute Installer Contracts	40		Each	$ 40.00
Education and Outreach	Develop Brochures/Fact Sheets	5		Brochures/Sheets	$ 5.00
	Develop Press Releases	1		Releases	$ 1.00
	Install Signs	10		Signs	$ 10.00
	Conduct Tours	5		Tours	$ 5.00
	Conduct Stream Clean-Ups	5		Clean-Ups	$ 5.00
	Stencil Storm Drains	1000		Drains	$ 1,000.00
	Deliver On-Site Technical Assistance	40		Site Visits	$ 40.00
Monitoring	Conduct Chemical Sampling	10		Sites	$ 10.00
	Conduct Macroinvertebrate (ICI) Sampling	10		Sites	$ 10.00
	Conduct Fish (IBI) Sampling	10		Sites	$ 10.00
	Conduct Habitat (QHEI) Sampling	10		Sites	$ 10.00
	Conduct Nitrate Sampling (Water)	100		Samples	$ 100.00
	Conduct Nitrate Sampling (Soil)	100		Samples	$ 100.00
	Prepare and Submit Final Report and Data	1		Report	$ 1.00

Sinking Creek
HUC 050800011703



Sinking Creek

12 Digit HUC 050800011703	
Acres:	**8,863.9**
Stream Classification:	**WWH**
Segment Length:	**6.4 miles**
Drainage Area:	**13.9 square miles**
Year Sampled by OEPA:	**2003**
Attainment:	**N / A**

Background: This sub-watershed consists mainly of agricultural lands with dense patches of forest, but development does exist. The landscape topography is very rolling to gently sloping. Soils characterics are dominated by deep-heavy clay with a seasonal high water table to loamy-clay.

Agricultural land use dominants this sub-watershed. Row crop, small grains and hay production are most common, but a few animal operations do exist. Due to the rugged terrain, some row cropped areas may be designated as highly erodible land (H.E.L) by the USDA-NRCS. Typically hay production occurs in these steep areas.

Sinking Creek has experienced urbanization and linear roadside development on Jones Road, Shorey Road, and Old Columbus Road. Due to its rural character, residents of this watershed utilize conventional wells and on-site septic systems. Brookside Mobile Home Park, located on Mahar Road, and Northeastern High School have their own wells and wastewater treatment systems. Sinking Creek receives wastewater discharges that are under the control of Ohio EPA.

Clark Lake Wildlife Area is located in this sub-watershed and was created in the mid-1950s. Clark Lake was established to provide recreational and fishing activities for local residents and to provide wildlife habitat.

The riparian corridor of Sinking Creek is marginal and averages less than 25 feet wide in some areas. Certain portions of the creek have a stream channel that changes from natural and sinuous with an active flood plain to channelized. Some reaches that were cleared and straightened in the past are beginning to recover.

Past and Present Conservation Efforts: In the mid-1970's, the Sinking Creek watershed received special funding from the State of Ohio to reduce erosion and sedimentation entering Clark Lake. Cost share monies were provided to implement best management practices like, cover crops, grass waterways and incentives for no-till farming practices.

During the 1999 section 319 grant, one hundred and six acres of cover crops were established in HEL designated fields over the winter months to reduce erosion and improve soil conditions. Additionally, 9 septic tanks were pumped and educational materials disseminated to inform residents of the importance of proper septic system maintenance.

An experimental septic system was established on Jones Road in 2001. This project was a joint effort between the Clark County Combined Health District and Clark County Waste Management District. This innovative system utilizes shredded tires as a leaching medium. Grassed waterways, sub-surface drainage and no-till farming practices have been implemented on many acres of farmland. Several landowners have taken advantage of Farm Bill

Programs to establish filter strips, cattle-exclusion fencing and agricultural containment facilities to protect water quality.

Problem Statement: Ohio EPA reports list crop production as the major source of water quality degradation in the Sinking Creek watershed. Due to the rolling ground some row crop production does occur in ground designated as H.E.L. Aging on-site septic systems do have the potential to impair water quality. For example, Rebecca Drive is lined with older homes on small lots and unsuitable soils. Areas like this are in need of septic system upgrading. Point source discharges, like Brookside Village and Northeastern High School, do outfall into Sinking Creek, but are under Ohio EPA jurisdiction. However, these discharges do have a negative impact on water quality. Field observations made by Clark SWCD and NRCS personnel identify excessive sedimentation/siltation, pathogen/bacterial contamination, high nutrient loadings and organic enrichment as causes of impairment.

Source: "Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach", Clark County Soil and Water Conservation District, 2007.

Goals:

- Reduce sedimentation and nutrient run off from agricultural fields.
- Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems.
- Educate watershed residents on proper on site septic system maintenance.

Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **Miami Conservancy District**-water quality credit trading program	Work in conjunction with Clark SWCD/NRCS to promote farm streamside buffers through USDA and MCD programs on agricultural lands. Submit newspaper and newsletter article advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Champaign and Clark Co. Health Departments-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2010 – Jan. 2012	Approved Countywide HSTS plan by OEPA and Champaign/Clark Co. Health Board Number of on site septic systems upgraded/replaced.
Reduce sedimentation from riparian land areas by promoting protection of riparian corridors and proper streambank restoration methods improving in	**Miami Conservancy District**-water quality credit trading program	Work w/ Clark SWCD/NRCS to identify riparian landowners with eroded streambank issues.	On going	Creat mailing list targeting streamside landowners to receive educational materials.

stream habitat.	**OEPA**- 401 mitigation list	Establish one demonstration site along Sinking Creek utilizing bioengineering erosion control methods and natural stream channel design.	Feb. 2010 – Feb. 2013	Document soil saved/not delivered from eroding streambanks using R.U.S.L.E. Lineal feet of streambank protected or restored.
Educate watershed residents on proper on site septic system maintenance	**Champaign and Clark Co. Health Departments**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping/ system management.	April 2010 April 2010	Number of workshop attendants. Number of handouts distributed.

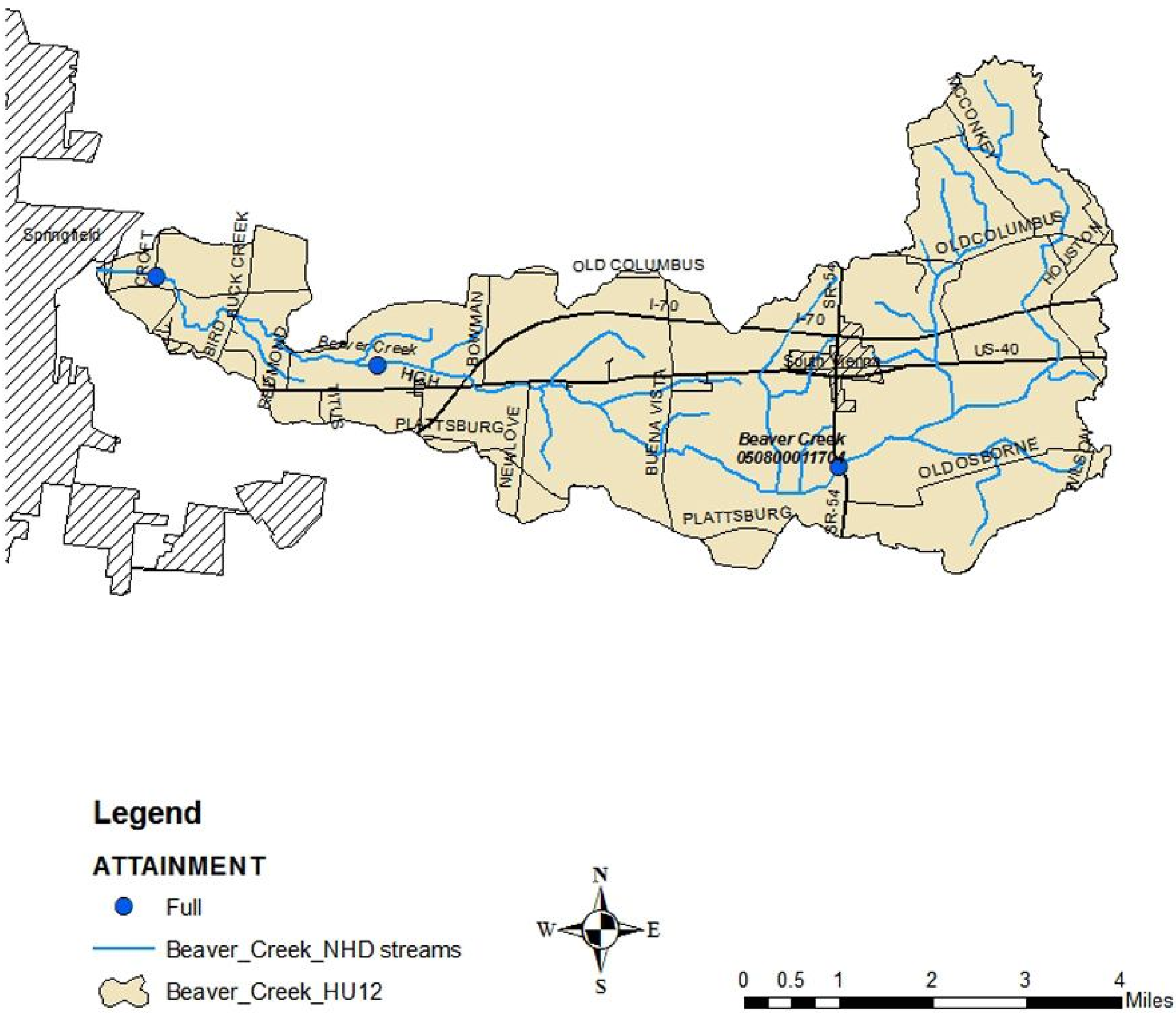
This table denotes the action items declared in the approved watershed action plan, *Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach* (Clark County Soil and Water Conservation District, 2007).

Refer to the following spreadsheet of action items for prioritized deliverables as determined by the Mad River Watershed Strategic Plan Joint Board of Supervisors and Advisory Board. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Champaign County Health Department, Clark County Health Department, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.

	Sinking Creek HUC 050800011705				
Objectives	**Deliverables**	**Quantity of Deliverable**	**Cost**	**Deliverable Units**	**Total Cost**
Streambank & Riparian Restoration	Restore Streambank Using Bio-Engineering and/or By Recontouring or Regrading	160	$ 10,000.00	Linear Feet	$ 1,600,000.00
	Plant Grasses or Prairie Grasses in Riparian Areas	65	$ 411.93	Acre	$ 26,775.45
	Plant Trees or Shrubs in Riparian Areas	10	$ 609.44	Acre	$ 6,094.40
Stream Restoration	Restore Floodplain	0		Linear Feet	
	Restore Stream Channel	0		Linear Feet	
	Install In-Stream Habitat Structures	0		Structure	$ -
	Construct 2-Stage Channel	2800		Linear Feet	
	Install Grade Structures	0		Structure	
	Restore Natural Flow	0		Linear Feet	$ -
Wetland Restoration	Reconstruct and Restore Wetlands	10		Acre	
Dam Modification or Removal	Remove Dams	0		Dams	
	Modify Dams	0		Dams	
	Restore Natural Flow	0		Acre	
	Restore Natural Floodplain Function	0		Acre	
Conservation Easements	Acquire Riparian Conservation Easements	0	$ 2,000.00	Acre	$ -
	Acquire Wetland Conservation Easements	0	$ 2,000.00	Acre	$ -
Home Sewage Treatment Systems	Inspect HSTS	150	$ 90.00	Inspections	$ 13,500.00
	Repair or Replace Traditional HSTS	50	$ 6,000.00	HSTS	$ 300,000.00
	Repair or Replace Alternative HSTS	0	$ 9,000.00	HSTS	$ -
Agricultural Best Management Practices	Plant Cover/Manure Crops	800		Acre	
	Develop Nutrient Management Plans	3	$ 2,766.00	Each	$ 8,298.00
	Implement Conservation Tillage Practices	600	$ 15.02	Acre	$ 9,012.00
	Install Alternative Water Supplies	2	$ 1,634.30	Each	$ 3,268.60
	Install Erosion & Sediment Control Structures	3	$ 4.13	SQ FT	$ 12.39
	Install Grassed Waterways	50	$ 5,446.00	Acre	$ 272,300.00
	Install Livestock Crossings	0	$ 3.26	SQ FT	$ -
	Install Heavy Use Feeding Pads	5	$ 1.47	SQ FT	$ 7.35
	Install Livestock Exclusion Fencing	2650	$ 0.51	Linear Feet	$ 1,351.50
	Construct Animal Waste Storage Structures	3	$ 2.07	CU FT	$ 6.21
	Conduct Soil Testing	1300	$ 24.81	Acre	$ 32,253.00
	Execute Installer Contracts	10		Each	$ 10.00
Education and Outreach	Develop Brochures/Fact Sheets	5		Brochures/Sheets	$ 5.00
	Develop Press Releases	1		Releases	$ 1.00
	Install Signs	3		Signs	$ 3.00
	Conduct Tours	5		Tours	$ 5.00
	Conduct Stream Clean-Ups	5		Clean-Ups	$ 5.00
	Stencil Storm Drains	50		Drains	$ 50.00
	Deliver On-Site Technical Assistance	10		Site Visits	$ 10.00
Monitoring	Conduct Chemical Sampling	5		Sites	$ 5.00
	Conduct Macroinvertebrate (ICI) Sampling	5		Sites	$ 5.00
	Conduct Fish (IBI) Sampling	5		Sites	$ 5.00
	Conduct Habitat (QHEI) Sampling	5		Sites	$ 5.00
	Conduct Nitrate Sampling (Water)	50		Samples	$ 50.00
	Conduct Nitrate Sampling (Soil)	50		Samples	$ 50.00
	Prepare and Submit Final Report and Data	1		Report	$ 1.00

Beaver Creek
HUC 050800011704



Beaver Creek

12 Digit HUC 050800011704	
Acres:	**16,443.5**
Stream Classification:	**CWH / *WWH****
Segment Length:	**14.5 miles**
Drainage Area:	**39.7 square miles**
Year Sampled by OEPA:	**1984 and 2003**
Attainment:	**14.5 miles Full**

Sources: Mad River Stream Segment Data (Ohio 305b Report); Biological and Water Quality Study of the Mad River Basin, 2003 by the State of Ohio EPA.
**Recommendation to change aquatic use life use following 2003 sampling data.*

Background: Varying topography can be seen throughout this sub-watershed. Rolling land is a common characteristic, but gentle sloping to large flat flood plain areas do exist. This sub-watershed consists mainly of agricultural land with patches of forested land in the headwater reaches. Lower reaches are highly urbanized and populated with residential development as Beaver Creek flows into areas of Springfield Township and the City of Springfield.

Beaver Creek has a healthy, natural riparian corridor in a majority of stretches. These areas demonstrate characteristics of proper stream morphology and have actives flood plains, but other areas do exist in a modified state. In areas utilized for row cropping, a wooded corridor and sinuous channel can been seen. Areas that have cattle grazing typically have access to the creek. Here, stream channels and vegetation have been cleared, resulting in unstable / eroding banks.

Beaver Creek is considered to be the most diverse sub-watershed of the Lower Mad River Watershed due to a variety of land uses. Agricultural land use dominants this sub-watershed in the headwater areas. Row crop, small grains and hay production are common, and several animal operations do exist. Due to the rugged terrain, some row cropped areas may be designated as highly erodible land (H.E.L) by the USDA-NRCS. Typically, hay production occurs in these steep areas. Beaver Creek has the highest concentration of cattle production than any other sub-watershed. Two tree farms and the National Links Golf Course are also located here.

Urbanization is a dominating factor affecting water quality in the lower portions of Beaver Creek, but roadside and lineal development can be seen in the headwater regions. Many landowners have applied for agriculture easements to combat this issue. The Village of South Vienna and the community of Sylvan Shores are the most populated areas in the upper portion of the watershed. Several subdivisions, mobile home and recreational parks are common throughout the entire watershed.

Sylvan Lake is located in this sub-watershed and water quality is being affected by on-site septic systems leaching into the lake. Additionally, the community of Harmony has condensed residential homes with aging conventional septic systems. Poorly drained soils are compounding this issue along with the fact that the area lays near / in the Beaver Creek flood plain. Harmony and Sylvan Shore have no public water system and rely on private wells as a source of drinking water.

South Vienna has a population of 665 residents. The Village has their own sanitary sewer and public water system. Water usage is approximately 65,000 gallons per day and the wastewater treatment plant (WWTP) has the capacity to produce 100,000 gallons per day if demanded. The discharge from the WWTP outlets into Beaver Creek and is under the jurisdiction of Ohio EPA.

Several smaller wastewater treatment plants exist in the watershed. Beaver Valley Resort & Campground, Tomorrow's Stars R.V. Park, Harmony Estates Mobile Home Park (MHP), and Bridgewood MHP. Although EPA monitors effluent from these point sources of pollution, they are still contributing to water quality degradation.

Past and Present Conservation Efforts: The watershed of Beaver Creek has seen a wide variety of conservation practices implemented. During the 1999 section 319 grant, six acres of grass filter strips, 2 acres of riparian filter strips, and 255 acres of cover crops were established. In addition, 19 septic tanks were pumped and a bioengineering erosion control project has been implemented.

Many landowners have enrolled streamside acres into the Conservation Reserve Program (CRP) by establishing grass filter strips. Grass Waterways have also been installed through CRP to control gully erosion. Another popular program in this sub-watershed is the Environmental Quality Incentives Program (EQIP). Utilizing these funds, several cattle operators have installed livestock exclusion fence to keep cattle from accessing the stream as a water source. Trees were then planted to re-establish a wooded riparian corridor putting more space between the creek and livestock. Spring developments were also created in conjunction with the fencing to provide a watering source. An additional aspect of the Beaver Creek watershed is the large number of landowners that have applied to place their farm and woodland into easement programs. The Tecumseh Land Trust has preserved 96 acres of farmland along Beaver Creek near U.S. Route 40.

Problem Statement: Several feedlots and pastureland that allow cattle to have unrestricted access to Beaver Creek are sources of water quality impairments. The lower portions of the watershed are being affected by urban land uses. Several subdivisions exist that have a stormwater system and were built prior to the implementation of stormwater regulations. This has led to higher velocity and erosive flows impacting stream morphology and function.

Throughout the entire Beaver Creek watershed, aging and failing on-site septic are an issue. Areas like Sylvan Shores and the community of Harmony are notorious for having septic system problems. Additional stresses on water quality can be seen with the many point source discharges entering Beaver Creek.

Field observations made by Clark SWCD and NRCS personnel identify excessive sedimentation/siltation, high nutrient loads, pathogens, pesticides, toxic substances, organic enrichment and habitat modifications as causes of impairment.

Goals:

- Reduce sedimentation and nutrient run off from agricultural fields.
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems.
- Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.
- Educate watershed residents on proper on site septic system maintenance.
- Reduce NPS pollutants associated with stormwater.

Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **Miami Conservancy District**-water quality credit trading program	Work in conjunction with Clark SWCD/NRCS to promote farm streamside buffers through USDA and MCD programs on agricultural lands. Submit newspaper and newsletter article advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Clark Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2010 – Jan. 2012	Approved Countywide HSTS plan by OEPA and Champaign/Clark Co. Health Board Number of on site septic systems upgraded/replaced.
Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.	**USDA**-Farm Bill (EQIP) **Miami Conservancy District**-water quality credit trading program **ODNR**- Pollution Abatement Funds **Ohio Livestock Coalition**-targeted mailing list	Work with Clark SWCD/NRCS to identify livestock producers who have livestock operations. Establish one demonstration site along Beaver Creek utilizing livestock exclusion fencing and pasture management. Submit newspaper and newspaper articles to promote proper spreading and storage of animal waste from feedlots.	On going Feb. 2010 – Feb. 2013 Feb. 2010 – Feb. 2013	Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Lineal feet and number of cattle excluded from stream. Newsletters produced and number of articles appearing in local newspapers. Document number of animal waste complaints received.
Educate watershed residents on proper on site septic system maintenance	**Clark Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping/ system management.	April 2010 April 2010	Number of workshop attendants. Number of handouts distributed.

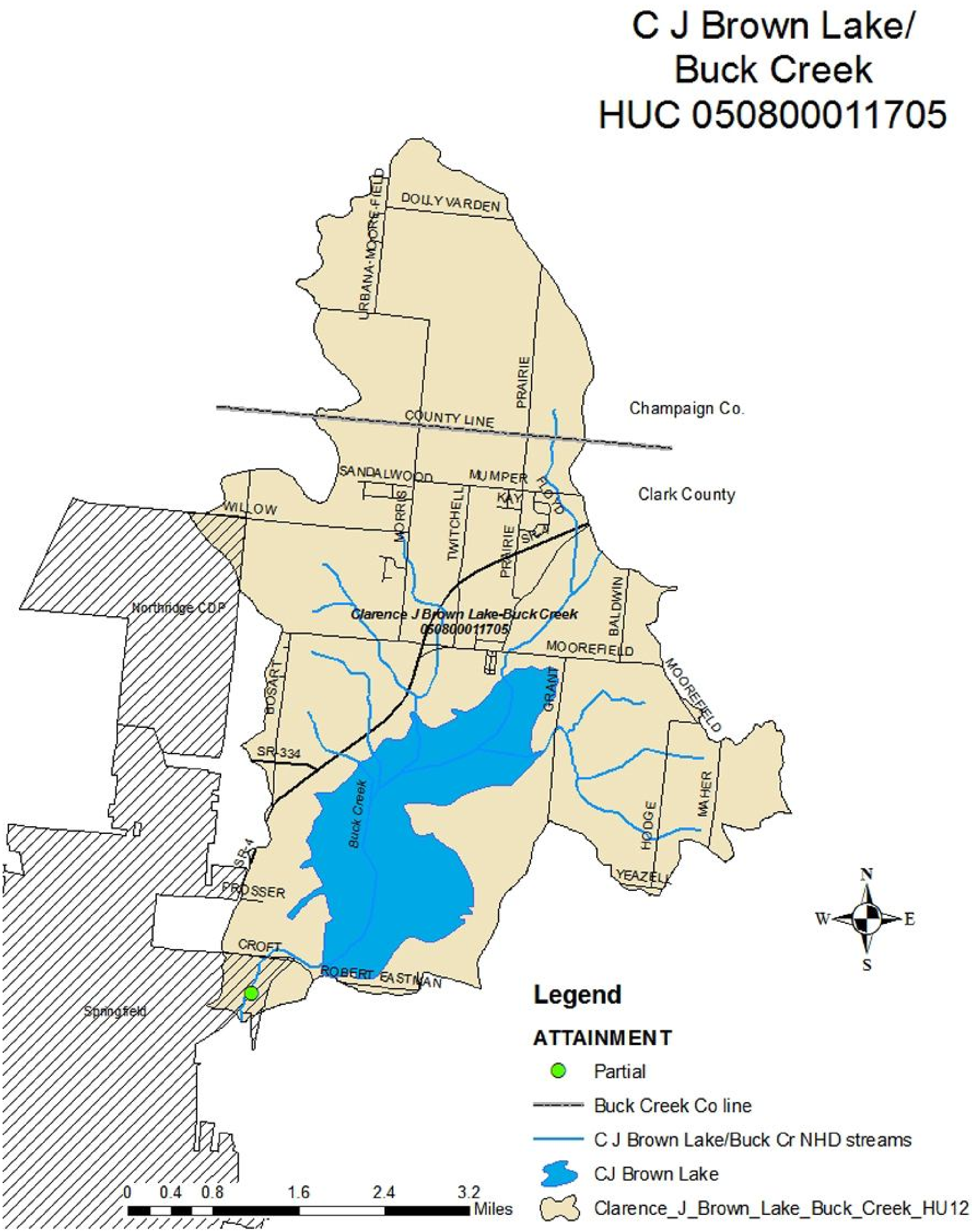
Reduce NPS pollutants associated with stormwater by implementing BMPs and education of watershed residents on stormwater management.	**OEPA**-DEFA Program **Miami Conservancy District**-water quality credit trading program **Clark Co. and Springfield Twp.-** Work with entities involved in Phase II areas.	Retrofit a bioretention or stormwater wetland area to the existing stormwater system of Holiday Hills. Storm drain labeling in areas with curb and gutter stormwater systems. Create and submit articles to Springfield News-Sun on stormwater and stream health.	Jan. 2010 – Jan. 2013 May 2010	Number of stormwater system upgrades Number of storm drains labeled. Number of articles appearing in newsletter. Water quality activities reported to Ohio EPA for Phase II as required.

This table denotes the action items declared in the approved watershed action plan, *Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach* (Clark County Soil and Water Conservation District, 2007).

Refer to the following spreadsheet of action items for prioritized deliverables as determined by the Mad River Watershed Strategic Plan Joint Board of Supervisors and Advisory Board. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Clark County Health Department, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.

Objectives	Deliverables	Quantity of Deliverable	Cost	Deliverable Units	Total Cost
	Beaver Creek HUC 050800011704				
Streambank & Riparian Restoration	Restore Streambank Using Bio-Engineering and/or By Recontouring or Regrading	300	$ 10,000.00	Linear Feet	$ 3,000,000.00
	Plant Grasses or Prairie Grasses in Riparian Areas	125	$ 411.93	Acre	$ 51,491.25
	Plant Trees or Shrubs in Riparian Areas	20	$ 609.44	Acre	$ 12,188.80
Stream Restoration	Restore Floodplain	0		Linear Feet	
	Restore Stream Channel	0		Linear Feet	
	Install In-Stream Habitat Structures	0		Structure	$ -
	Construct 2-Stage Channel	5200		Linear Feet	
	Install Grade Structures	0		Structure	
	Restore Natural Flow	0		Linear Feet	$ -
Wetland Restoration	Reconstruct and Restore Wetlands	25		Acre	
Dam Modification or Removal	Remove Dams	0		Dams	
	Modify Dams	1		Dams	
	Restore Natural Flow	500		Acre	
	Restore Natural Floodplain Function	5		Acre	
Conservation Easements	Acquire Riparian Conservation Easements	0	$ 2,000.00	Acre	$ -
	Acquire Wetland Conservation Easements	0	$ 2,000.00	Acre	$ -
Home Sewage Treatment Systems	Inspect HSTS	150	$ 90.00	Inspections	$ 13,500.00
	Repair or Replace Traditional HSTS	50	$ 6,000.00	HSTS	$ 300,000.00
	Repair or Replace Alternative HSTS	0	$ 9,000.00	HSTS	$ -
Agricultural Best Management Practices	Plant Cover/Manure Crops	1500		Acre	
	Develop Nutrient Management Plans	5	$ 2,766.00	Each	$ 13,830.00
	Implement Conservation Tillage Practices	1200	$ 15.02	Acre	$ 18,024.00
	Install Alternative Water Supplies	3	$ 1,634.30	Each	$ 4,902.90
	Install Erosion & Sediment Control Structures	5	$ 4.13	SQ FT	$ 20.65
	Install Grassed Waterways	100	$ 5,446.00	Acre	$ 544,600.00
	Install Livestock Crossings		$ 3.26	SQ FT	$ 3.26
	Install Heavy Use Feeding Pads	10	$ 1.47	SQ FT	$ 14.70
	Install Livestock Exclusion Fencing	5000	$ 0.51	Linear Feet	$ 2,550.00
	Construct Animal Waste Storage Structures	5	$ 2.07	CU FT	$ 10.35
	Conduct Soil Testing	2500	$ 24.81	Acre	$ 62,025.00
	Execute Installer Contracts	25		Each	$ 25.00
Education and Outreach	Develop Brochures/Fact Sheets	5		Brochures/Sheets	$ 5.00
	Develop Press Releases	1		Releases	$ 1.00
	Install Signs	5		Signs	$ 5.00
	Conduct Tours	5		Tours	$ 5.00
	Conduct Stream Clean-Ups	5		Clean-Ups	$ 5.00
	Stencil Storm Drains	1200		Drains	$ 1,200.00
	Deliver On-Site Technical Assistance	25		Site Visits	$ 25.00
Monitoring	Conduct Chemical Sampling	5		Sites	$ 5.00
	Conduct Macroinvertebrate (ICI) Sampling	5		Sites	$ 5.00
	Conduct Fish (IBI) Sampling	5		Sites	$ 5.00
	Conduct Habitat (QHEI) Sampling	5		Sites	$ 5.00
	Conduct Nitrate Sampling (Water)	50		Samples	$ 50.00
	Conduct Nitrate Sampling (Soil)	50		Samples	$ 50.00
	Prepare and Submit Final Report and Data	1		Report	$ 1.00


C J Brown Lake/
Buck Creek
HUC 050800011705
DOLLY VARDEN
URBANA-MOORE-FIELD
PRAIRIE
COUNTY LINE
Champaign Co.
Clark County
SANDALWOOD
MUMPER
KAY
FLOYD
WILLOW
MORRIS
TWITCHELL
PRAIRIE
Northridge CDP
Clarence J Brown Lake-Buck Creek
050800011705
BALDWIN
MOOREFIELD
MOOREFIELD
BOSART
GRANT
SR-334
Buck Creek
MAHER
HODGE
SR-4
PROSSER
YEAZELL
CROFT
ROBERT EASTMAN
Springfield
N
W
E
S
Legend
ATTAINMENT
Partial
Buck Creek Co line
C J Brown Lake/Buck Cr NHD streams
CJ Brown Lake
Clarence_J_Brown_Lake_Buck_Creek_HU12
0 0.4 0.8 1.6 2.4 3.2
Miles

Clarence J. Brown Lake-Buck Creek

12 digit HUC 050800011705	
Acres:	**15103.5736**
Stream Classification:	**WWH**
Segment Length:	**7.2 miles**
Drainage Area:	**16.68 square miles**
Year Sampled by OEPA:	**2003**
Attainment:	**RM 6.4 Partial**

Background: Varying topography can be seen throughout this sub-watershed. Rolling land is the dominating characteristic, but gentle sloping to large flat flood plain areas do exist. This sub-watershed consists of agricultural land with dense patches of forested land in the headwater reaches. Many tributaries in agricultural areas have been modified to protect farmland and improve crop production. Below C.J. Brown Reservoir, Buck Creek has been channelized and lined with rock to carry high velocity flow exiting the dam spillway.

Downstream from the reservoir, Buck Creek partially attained the WWH aquatic life use. The site at RM 6.4 was only a short distance downstream from the lake outlet (RM 7.2). Conditions at this site were typical of those encountrered below similarly constructed reservoirs in Ohio. The stream was channelized and water relased from the lake likely carried with it an abundance of fine organic material. This resulted in limited populations of non-filter-feeding macroinvertebrate taxa as opposed to diversity observed both upstream from the reservoir (RM 13.1) and further downstream at RM 0.6. The macroinvertebvrate community was only in fair condition at RM 6.4 but improved at RM 0.6 even though the lower site was also extensively channelized.

Ohio EPA reports indicate that crop production and low head dams are known sources causing water quality degradation.

Source: Biological and Water Quality Study of the Mad River Basin, 2003 by the State of Ohio EPA.

Problem Statement: Field observations made by Clark SWCD and NRCS personnel confirm that excessive sedimentation/siltation, organic enrichment/DO and flow regulation/modification flow as impairments having a negative impact on water quality.

Source: "Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach", Clark County Soil and Water Conservation District, 2007.

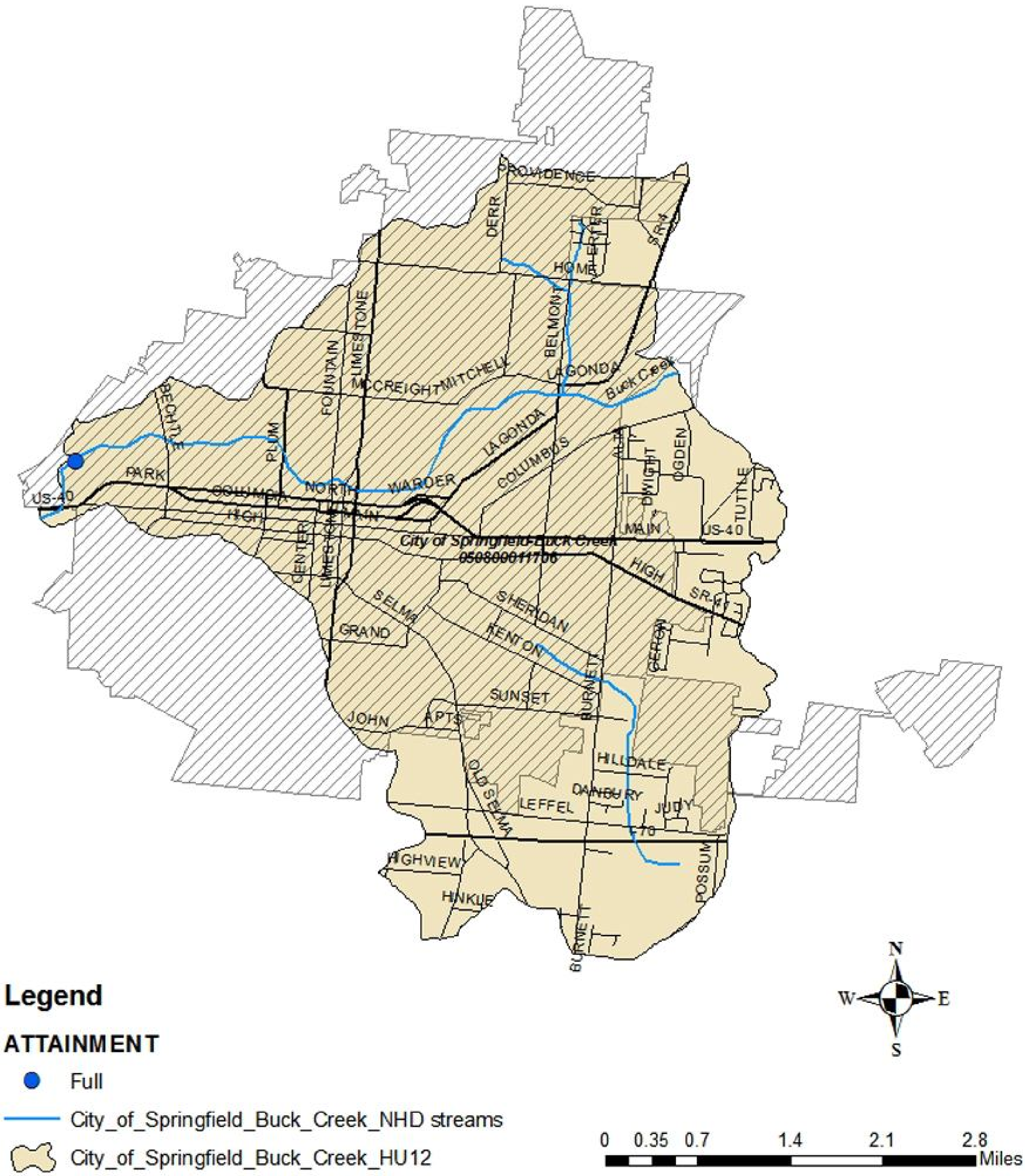
Goals:
- Reduce sedimentation and nutrient run off from agricultural fields.
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems.
- Educate watershed residents on proper on site septic system maintenance.
- Reduce NPS pollutants associated with stormwater
- Low head dam removal, stream channel modifications and flow regime improvements

Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **Miami Conservancy District**-water quality credit trading program	Work in conjunction with Clark SWCD/NRCS to promote farm streamside buffers through USDA and MCD programs on agricultural lands. Submit newspaper and newsletter article advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Clark Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2010 – Jan. 2012	Approved Countywide HSTS plan by OEPA and Champaign/Clark Co. Health Board Number of on site septic systems upgraded/replaced.
Educate watershed residents on proper on site septic system maintenance	**Clark Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping/ system management.	April 2010 April 2010	Number of workshop attendants. Number of handouts distributed.
Reduce NPS pollutants associated with stormwater by implementing BMPs and education of watershed residents on stormwater management.	**OEPA**-DEFA Program **Miami Conservancy District**-water quality credit trading program **Clark Co. and Springfield Twp.-** Work with entities involved in Phase II areas.	Retrofit a bioretention or stormwater wetland area to the existing stormwater system of Holiday Hills. Storm drain labeling in areas with curb and gutter stormwater systems. Create and submit articles to Springfield News-Sun on stormwater and stream health.	Jan. 2010 – Jan. 2013 May 2010	Number of stormwater system upgrades Number of storm drains labeled. Number of articles appearing in newsletter. Water quality activities reported to Ohio EPA for Phase II as required.
Low head dam removal, stream channel modifications and flow regime improvements	**Miami Conservancy District**-water quality credit trading program **Springfield Conservancy District** - maintain Buck Creek Corridor/ streamside parks downstream of C.J. Brown	Create stakeholder group to explore the feasibility of low head dam removal. Establish a demonstration project along the Buck Creek Corridor. Remove/alter low head dam(s) and channel modification utilizing natural stream channel design along Buck Creek	June 2010- June 2012 July 2011	Establishment of stakeholder group, list of participants, minute of meetings. Number of low head dams removed.

Refer to the spreadsheet of action items for prioritized deliverables on page 123. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Clark and Champaign County Health Departments, Army Corps of Engineers, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.

Buck Creek-City of Springfield
HUC 050800011706



City of Springfield-Buck Creek

12 digit HUC 050800011706	
Acres:	**11593.5465**
Stream Classification:	**WWH**
Segment Length:	**15.5 miles**
Drainage Area:	**141 square miles**
Year Sampled by OEPA:	**1994 and 2003**
Attainment:	**4.8 miles Full, 1.2 miles Partial**

Background: A vast majority of this sub-watershed of Buck Creek lies in the political boundaries of the City of Springfield. This area has a very urbanized landscape with patches of woodland and open space.

The City of Springfield has a population of 65,358 and depends on ground water as their primary water source. Water usage is approximately 16,000,000 gallons per day and the wastewater treatment plant (WTTP) has a capacity of 36,000,000 gallons per day. Water quality of Buck Creek is drastically degraded due to the CSO issue in this portion of the watershed.

A few areas outside of the City of Springfield use conventional on site septic and water well systems. These areas, located in the southeast corner of Springfield Township, will be forced to hook up to public sewer and water when the current systems poses a threat to public health.

According to Ohio EPA reports, sources of water quality degradation are from urban stormwater runoff, low head dam construction and combined sewer overflow(s). Due to the landscape being urbanized, many man made alterations can be seen to control storm and flood water. Run off from impervious covers like parking lots, roads and rooftops, carry higher pollutant loads with increased flow velocity. The stormwater infrastructure of Springfield was built prior to any water quality regulations and stormwater runoff has no means of being treated prior to entering Buck Creek. Compounding this issue is that storm water and sewer water systems are combined resulting in highly polluted run off entering Buck Creek during rain events. Ohio EPA has regulatory jurisdiction on the CSO issue and steps have been made to improve the situation, but this issue is having negative impacts on water quality.

Past and Present Conservation Efforts: Many of the low head dams in the channel of Buck Creek were used to impound water for industrial processes and flood control in years past. Consequently, the City of Springfield based many of their stormwater outfalls and other utility locations on these impounded water levels. Removal of some dams is not practical due to this issue. The Springfield Conservancy District has conducted studies to see if other dams can be altered and or lowered to improve stream flow to draw recreation. This will also improve flow regime enhancing water quality.

Problem Statement: The channelization of Buck Creek was done for flood control to protect the City of Springfield. This has led to a degradation of in-stream habitat and lack of a healthy wooded riparian corridor. Several green space and recreational areas are located in the flood plain, but are managed for easier stream channel maintenance. Due to constructed levees and flood control structures, there is not much opportunity for riparian corridor enhancements. Additional stresses on water quality can be seen with point source discharges entering Buck

Creek from industrial companies in Springfield. Although Ohio EPA has regulatory jurisdiction over point source effluent, negative impacts are seen affecting water quality.
Source: "Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach", Clark County Soil and Water Conservation District, 2007.

Goals:

- Reduce NPS pollutants associated with stormwater.
- Low head dam removal, stream channel modifications and flow regime improvements

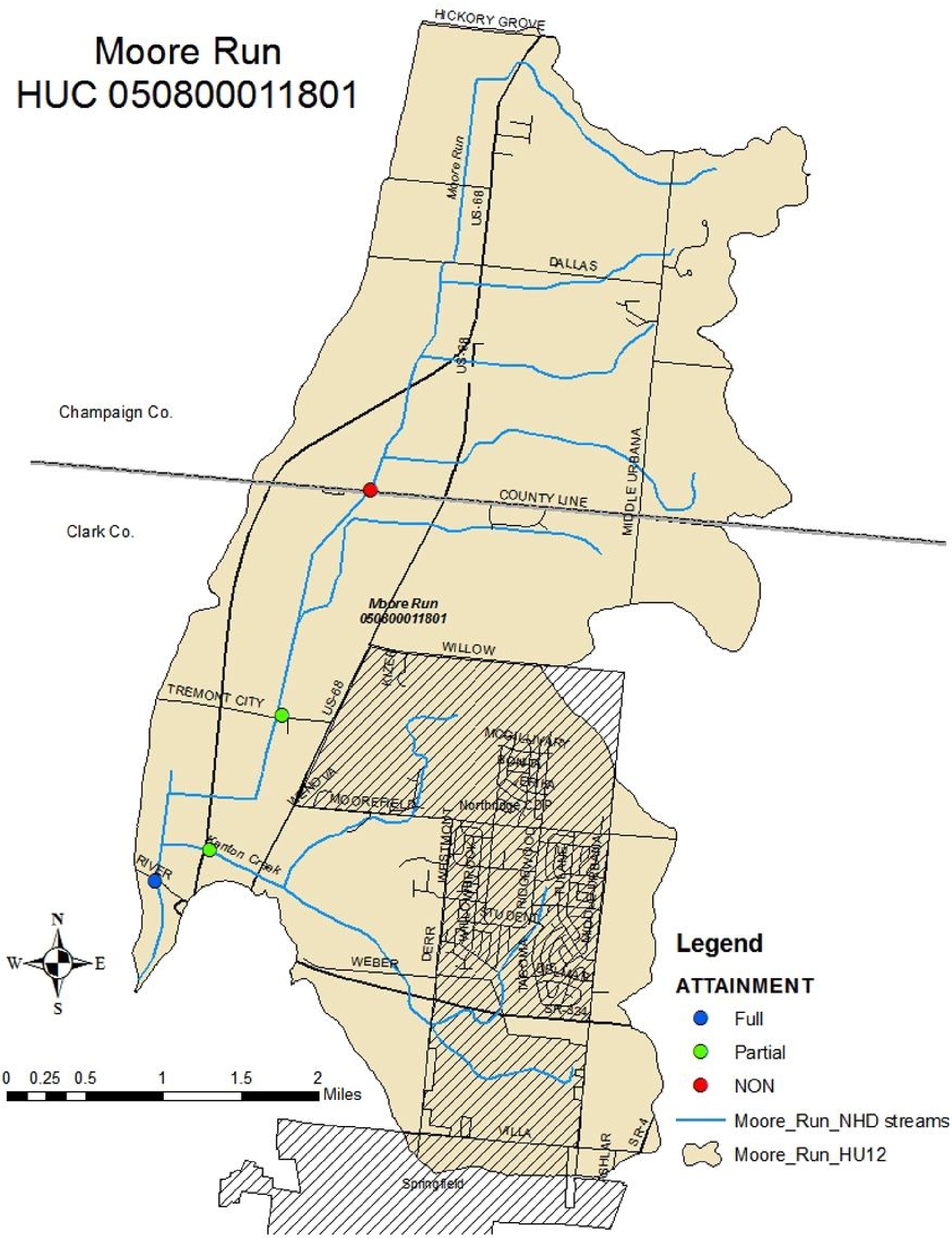
Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce NPS pollutants associated with stormwater by implementing BMP's and education of watershed residents on stormwater management.	**OEPA**-DEFA Program **Miami Conservancy District**-water quality credit trading program **City of Springfield-** Work with entities involved in Phase II areas.	Retrofit a bioretention or stormwater wetland area to an existing stormwater system. Storm drain labeling in areas with curb and gutter stormwater systems. Create and submit articles to Springfield News-Sun on stormwater and stream health.	Jan. 2010- Jan. 2013 May 2010	Number of stormwater system upgrades Number of storm drains labeled. Number of articles appearing in newsletter. Water quality activities reported to Ohio EPA for Phase II as required.
Low head dam removal, stream channel modifications and flow regime improvements	**Miami Conservancy District**-water quality credit trading program **Springfield Conservancy District** - maintain Buck Creek Corridor and streamside parks downstream of C.J. Brown	Create stakeholder group to explore the feasibility of low head dam removal. Establish a demonstration project along the Buck Creek Corridor. Remove/alter low head dam(s) and channel modification utilizing natural stream channel design along Buck Creek	June 2010- June 2012 July 2010	Establishment of stakeholder group, list of participants, minute of meetings. Number of low head dams removed.

This table denotes the action items declared in the approved watershed action plan, *Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach* (Clark County Soil and Water Conservation District, 2007).

Refer to the following spreadsheet of action items for prioritized deliverables as determined by the Mad River Watershed Strategic Plan Joint Board of Supervisors and Advisory Board. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Champaign County Health Department, Clark County Health Department, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.

	Buck Creek below Beaver Creek above Mad River HUC 050800011706				
Objectives	**Deliverables**	**Quantity of Deliverable**	**Cost**	**Deliverable Units**	**Total Cost**
Streambank & Riparian Restoration	Restore Streambank Using Bio-Engineering and/or By Recontouring or Regrading	0	$ 10,000.00	Linear Feet	$ -
	Plant Grasses or Prairie Grasses in Riparian Areas	0	$ 411.93	Acre	$ -
	Plant Trees or Shrubs in Riparian Areas	0	$ 609.44	Acre	$ -
Stream Restoration	Restore Floodplain	0		Linear Feet	
	Restore Stream Channel	0		Linear Feet	
	Install In-Stream Habitat Structures	0		Structure	$ -
	Construct 2-Stage Channel	0		Linear Feet	
	Install Grade Structures	0		Structure	
	Restore Natural Flow	0		Linear Feet	$ -
Wetland Restoration	Reconstruct and Restore Wetlands	25		Acre	
Dam Modification or Removal	Remove Dams	1		Dams	
	Modify Dams	2		Dams	
	Restore Natural Flow	0		Acre	
	Restore Natural Floodplain Function	10		Acre	
Conservation Easements	Acquire Riparian Conservation Easements	0	$ 2,000.00	Acre	$ -
	Acquire Wetland Conservation Easements	0	$ 2,000.00	Acre	$ -
Home Sewage Treatment Systems	Inspect HSTS	0	$ 90.00	Inspections	$ -
	Repair or Replace Traditional HSTS	0	$ 6,000.00	HSTS	$ -
	Repair or Replace Alternative HSTS	0	$ 9,000.00	HSTS	$ -
Agricultural Best Management Practices	Plant Cover/Manure Crops	0		Acre	
	Develop Nutrient Management Plans	0	$ 2,766.00	Each	$ -
	Implement Conservation Tillage Practices	0	$ 15.02	Acre	$ -
	Install Alternative Water Supplies	0	$ 1,634.30	Each	$ -
	Install Erosion & Sediment Control Structures	0	$ 4.13	SQ FT	$ -
	Install Grassed Waterways	0	$ 5,446.00	Acre	$ -
	Install Livestock Crossings	0	$ 3.26	SQ FT	$ -
	Install Heavy Use Feeding Pads	0	$ 1.47	SQ FT	$ -
	Install Livestock Exclusion Fencing	0	$ 0.51	Linear Feet	$ -
	Construct Animal Waste Storage Structures	0	$ 2.07	CU FT	$ -
	Conduct Soil Testing	0	$ 24.81	Acre	$ -
	Execute Installer Contracts	0		Each	$ -
Education and Outreach	Develop Brochures/Fact Sheets	5		Brochures/Sheets	$ 5.00
	Develop Press Releases	1		Releases	$ 1.00
	Install Signs	5		Signs	$ 5.00
	Conduct Tours	5		Tours	$ 5.00
	Conduct Stream Clean-Ups	5		Clean-Ups	$ 5.00
	Stencil Storm Drains	5000		Drains	$ 5,000.00
	Deliver On-Site Technical Assistance	0		Site Visits	$ -
Monitoring	Conduct Chemical Sampling	5		Sites	$ 5.00
	Conduct Macroinvertebrate (ICI) Sampling	5		Sites	$ 5.00
	Conduct Fish (IBI) Sampling	5		Sites	$ 5.00
	Conduct Habitat (QHEI) Sampling	5		Sites	$ 5.00
	Conduct Nitrate Sampling (Water)	50		Samples	$ 50.00
	Conduct Nitrate Sampling (Soil)	50		Samples	$ 50.00
	Prepare and Submit Final Report and Data	1		Report	$ 1.00


Moore Run
HUC 050800011801
HICKORY GROVE
Moore Run
US-68
DALLAS
Champaign Co.
Clark Co.
COUNTY LINE
MIDDLE URBANA
Moore Run
050800011801
WILLOW
TREMONT CITY
US-68
MOOREFIELD
Northridge CDP
Kenton Creek
RIVER
WESTMONT
RIDGEWOOD
DERR
WEBER
SR-334
VILLA
SR-4
SHLAR
Springfield
N
S
E
W
0 0.25 0.5 1 1.5 2
Miles
Legend
ATTAINMENT
Full
Partial
NON
Moore_Run_NHD streams
Moore_Run_HU12

Moore Run

12 Digit HUC 050800011801

Acres:	**11,741**
Stream Classification:	**WWH**
Segment Length:	**8.1 miles**
Drainage Area:	**18.3 square miles**
Year Sampled by OEPA:	**1994 and 2003**
Attainment:	**8.1 miles Non**

Background: The topography of the Moore Run watershed consists of a steep landscape in the headwater areas in both Clark and Champaign Counties. The areas in Champaign County are located in an agricultural area, where Clark County areas are highly urbanized. The lower reaches of Moore Run are characterized by having very large tracks of land with a flat flood plain area. The channel of Moore Run has been drastically modified from a natural state.

Ohio EPA reports indicate that Moore Run is being affected by diverse land use activities. Sources of impairments range from point sources to crop production to improper stormwater run off management. Independent of land use, channelization of Moore Run can be seen as the main issue affecting water quality.

Cattle production tends to take place in the more rolling landscapes, but a few operations do have animals that can access the Moore Run tributaries. A vast majority of row cropping is done in the flat, flood plain areas of the watershed. The potential of accelerated erosion from these areas is minimal.

Lack of stormwater management from the developed and industrial areas is having a definite affect on water quality. According to the *Biological and Water Quality Study of the Mad River Basin, 2003 by the State of Ohio EPA*., "EPA personnel noted a petroleum odor and oily sheen on the water surface". The report indicates that EPA would review permit adequacy and compliance to limit water quality impacts. The community of Northridge has several conventional stormwater systems that flow directly into the tributary, Kenton Creek. Due to the age and design of this infrastructure, stormwater has no means of being treated or improved prior to being discharged.

Not only does stormwater run off have potential to carry pollutants off the landscape, but also has accelerated flow. Due to the native riparian areas being cleared when stream modifications were made, only marginal vegetated areas exist next to streams. Severely eroded and unstable bank exist from this more erosive flow of stormwater.

The most chemical-sediment contaminated site in the *Biological and Water Quality Study of the Mad River Basin, 2003 by the State of Ohio EPA* survey area was on Moore Run (RM 2.46 downstream from the International Truck and Engine Corporation (Navistar). Barium, cadmium, lead, manganese, and zinc were above the Ohio SRV sediment guidelines. Moore Run at RM 4.1 was the only site in that survey's assessment unit with both impacted fish and Macroinvertebrate communities that resulted in nonattainment of the WWH use.

Problem Statement: Field observations made by Clark SWCD and NRCS personnel identify high nutrient loadings, pathogens, pesticides, toxic substances, organic enrichment, and flow alterations as causes of impairments. Additionally, discharges from wastewater treatments plants are also impacting water quality and are under regulatory jurisdiction of Ohio EPA.

Source: "Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach", Clark County Soil and Water Conservation District, 2007.

Goals:

- Reduce sedimentation and nutrient run off from agricultural fields
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems
- Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.
- Educate watershed residents on proper on site septic system maintenance
- Reduce NPS pollutants associated with stormwater
- Reduce sedimentation from riparian land areas

Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **Miami Conservancy District**-water quality credit trading program	Work in conjunction with Clark and Champaign SWCD/NRCS to promote streamside buffers through USDA and MCD programs on agricultural lands. Submit newspaper and newsletter article advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Clark and Champaign Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2010 – Jan. 2013	Approved Countywide HSTS plan by OEPA and Clark Co. Health Board Number of on site septic systems upgraded/replaced.
Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.	**USDA**-Farm Bill (EQIP) **Miami Conservancy District**-water quality credit trading program **ODNR**- Pollution Abatement Funds **Ohio Livestock Coalition**-targeted mailing list	Work w/ Clark and Champaign SWCD/NRCS to identify livestock producers who have livestock operations. Establish one demonstration site along Moore Run utilizing livestock exclusion fencing and pasture management. Submit newspaper and newspaper articles to promote proper spreading and storage of animal waste from feedlots.	On going Feb. 2010 – Feb. 1013 Feb. 2010 – Feb. 2013	Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Lineal feet and number of cattle excluded from stream. Newsletters produced and number of articles appearing in local newspapers. Document number of animal waste complaints received.

Educate watershed residents on proper on site septic system maintenance	**Clark Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping/ system management.	April 2010 April 2010	Number of workshop attendants. Number of handouts distributed.
Reduce NPS pollutants associated with stormwater by implementing BMPs and education of watershed residents on stormwater management.	**OEPA**-DEFA Program **Miami Conservancy District**-water quality credit trading program **Clark Co. and Springfield Twp.-** Work with entities involved in Phase II areas.	Retrofit a bioretention or stormwater wetland area to the existing stormwater system of Holiday Hills. Storm drain labeling in areas with curb and gutter stormwater systems. Create and submit articles to Springfield News-Sun on stormwater and stream health.	Jan. 2010 – Jan. 2013 May 2010	Number of stormwater system upgrades Number of storm drains labeled. Number of articles appearing in newsletter. Water quality activities reported to Ohio EPA for Phase II as required.
Reduce sedimentation from riparian land areas by promoting protection of riparian corridors and proper streambank restoration methods improving in stream habitat.	**Miami Conservancy District**-water quality credit trading program **OEPA**-401 mitigation list	Work w/ Clark and Champaign SWCD/NRCS to identify riparian landowners with eroded streambank issues. Establish one demonstration site along Moore Run utilizing Bioengineering erosion control and natural channel design methods and natural stream channel design	On going Feb. 2010 – Feb. 2013	Create mailing list Targeting streamside landowners to receive educational materials. Document soil saved/not delivered from eroding streambanks using R.U.S.L.E. Lineal feet of streambank protected or restored.

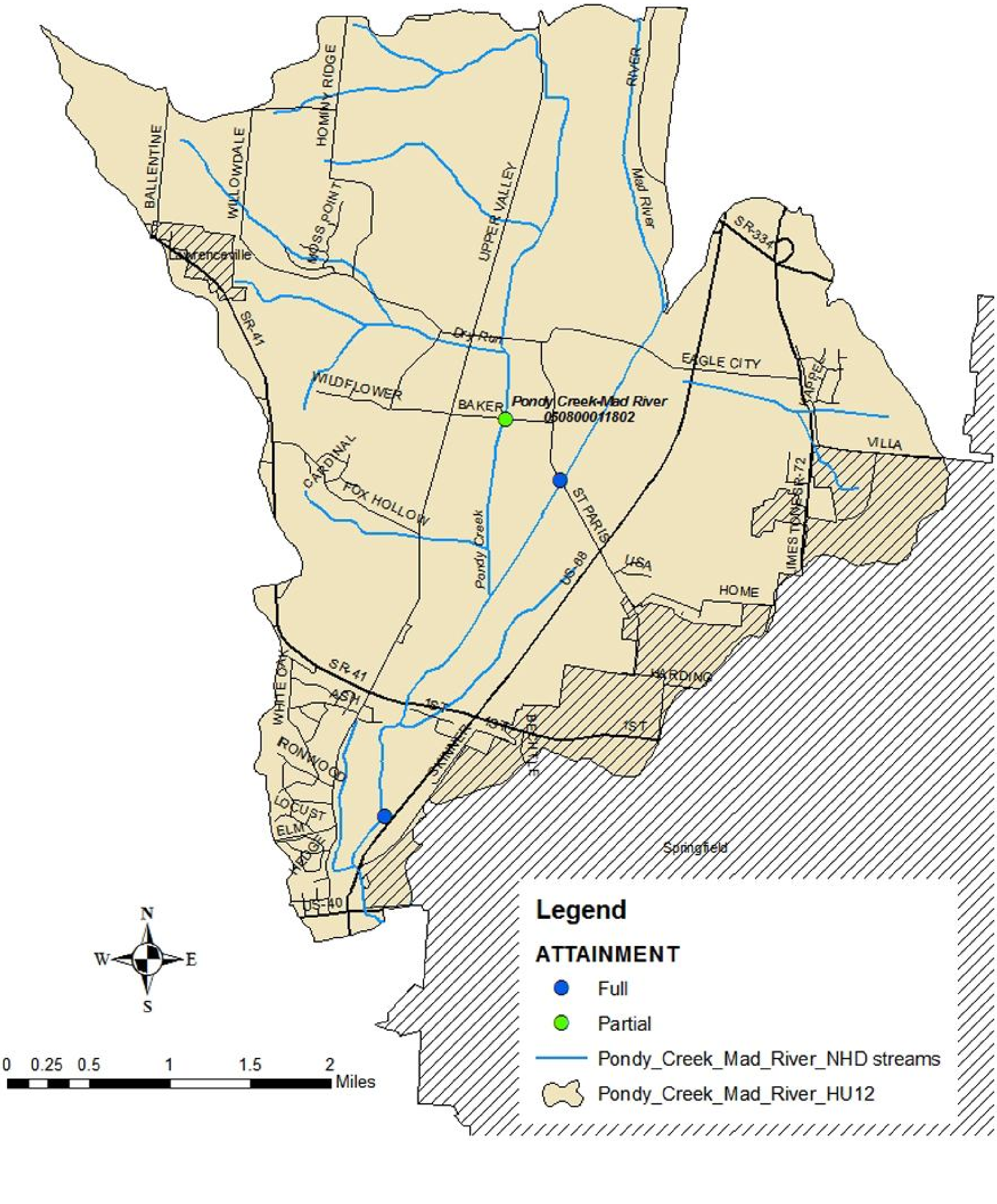
This table denotes the action items declared in the approved watershed action plan, *Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach* (Clark County Soil and Water Conservation District, 2007).

Refer to the following spreadsheet of action items for prioritized deliverables as determined by the Mad River Watershed Strategic Plan Joint Board of Supervisors and Advisory Board. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Champaign County Health Department, Clark County Health Department, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.

Objectives	Deliverables	Quantity of Deliverable	Cost	Deliverable Units	Total Cost
	Moore Run HUC 050800011802				
Streambank & Riparian Restoration	Restore Streambank Using Bio-Engineering and/or By Recontouring or Regrading	150	$ 10,000.00	Linear Feet	$ 1,500,000.00
	Plant Grasses or Prairie Grasses in Riparian Areas	0	$ 411.93	Acre	$ -
	Plant Trees or Shrubs in Riparian Areas	10	$ 609.44	Acre	$ 6,094.40
Stream Restoration	Restore Floodplain	5200		Linear Feet	
	Restore Stream Channel	5200		Linear Feet	
	Install In-Stream Habitat Structures	0		Structure	$ -
	Construct 2-Stage Channel	0		Linear Feet	
	Install Grade Structures	0		Structure	
	Restore Natural Flow	0		Linear Feet	$ -
Wetland Restoration	Reconstruct and Restore Wetlands	0		Acre	
Dam Modification or Removal	Remove Dams	0		Dams	
	Modify Dams	0		Dams	
	Restore Natural Flow	0		Acre	
	Restore Natural Floodplain Function	0		Acre	
Conservation Easements	Acquire Riparian Conservation Easements	20	$ 2,000.00	Acre	$ 40,000.00
	Acquire Wetland Conservation Easements	0	$ 2,000.00	Acre	$ -
Home Sewage Treatment Systems	Inspect HSTS	75	$ 90.00	Inspections	$ 6,750.00
	Repair or Replace Traditional HSTS	25	$ 6,000.00	HSTS	$ 150,000.00
	Repair or Replace Alternative HSTS	0	$ 9,000.00	HSTS	$ -
Agricultural Best Management Practices	Plant Cover/Manure Crops	0		Acre	
	Develop Nutrient Management Plans	0	$ 2,766.00	Each	$ -
	Implement Conservation Tillage Practices	0	$ 15.02	Acre	$ -
	Install Alternative Water Supplies	1	$ 1,634.30	Each	$ 1,634.30
	Install Erosion & Sediment Control Structures	1	$ 4.13	SQ FT	$ 4.13
	Install Grassed Waterways	0	$ 5,446.00	Acre	$ -
	Install Livestock Crossings	1	$ 3.26	SQ FT	$ 3.26
	Install Heavy Use Feeding Pads	0	$ 1.47	SQ FT	$ -
	Install Livestock Exclusion Fencing	2000	$ 0.51	Linear Feet	$ 1,020.00
	Construct Animal Waste Storage Structures	0	$ 2.07	CU FT	$ -
	Conduct Soil Testing	0	$ 24.81	Acre	$ -
	Execute Installer Contracts	5		Each	$ 5.00
Education and Outreach	Develop Brochures/Fact Sheets	5		Brochures/Sheets	$ 5.00
	Develop Press Releases	1		Releases	$ 1.00
	Install Signs	10		Signs	$ 10.00
	Conduct Tours	5		Tours	$ 5.00
	Conduct Stream Clean-Ups	5		Clean-Ups	$ 5.00
	Stencil Storm Drains	2500		Drains	$ 2,500.00
	Deliver On-Site Technical Assistance	5		Site Visits	$ 5.00
Monitoring	Conduct Chemical Sampling	5		Sites	$ 5.00
	Conduct Macroinvertebrate (ICI) Sampling	5		Sites	$ 5.00
	Conduct Fish (IBI) Sampling	5		Sites	$ 5.00
	Conduct Habitat (QHEI) Sampling	5		Sites	$ 5.00
	Conduct Nitrate Sampling (Water)	50		Samples	$ 50.00
	Conduct Nitrate Sampling (Soil)	50		Samples	$ 50.00
	Prepare and Submit Final Report and Data	1		Report	$ 1.00

Pondy Creek - Mad River
HUC 050800011802



Pondy Creek

12 Digit HUC 05080011802	
Acres:	**4,352**
Stream Classification:	**CWH / *WWH****
Segment Length:	**3.6**
Drainage Acres:	**6.8 square miles**
Year Sampled By EPA:	**2003**
Attainment:	**RM 1.1 Partial**

**Recommendation to change aquatic use life use following 2003 sampling data.*

Background: Pondy Creek enters from the west into Mad River at RM 27.9. It has its source a mile or so north of Lawrenceville. For a short distance from its source it flows to the northeast, coming within less than a mile of Chapman's Creek, south of Tremont City. The creek then flows south parallel to the river. It has a turbulent little branch entering it about two miles from its mouth called Dry Run. Both of these streams are what may be called dry-water streams.

Pondy Creek is a stream for which a WWH aquatic life use is appropriate rather than the current CWH use. According to *Biological and Water Quality Study of the Mad River Basin, 2003 by the State of Ohio EPA*., Pondy Creek did not support the requisite minimum of four coldwater macroinvertebrate taxa. In addition, several mobile home facilities border the creek in this subwatershed.

Past and Present Conservation Efforts: The PLM Properties, Inc. facility is located in a rural/suburban area three miles northwest of Springfield, Ohio. It is now occupied by Lewisburg Container Corporation, a company which makes cardboard boxes and does not use hazardous chemicals.

Most of the property now owned by PLM Properties, Inc. (about 50 acres) was owned and operated by the former SPECO company. At this location, SPECO manufactured gears and other metal products for the aircraft industry. The original site covered 71 acres and was surrounded on three sides by farmland. The Mad River is located approximately 1000 feet southeast of the plant. Pondy Creek crosses the site about 500 feet to the west of the plant.

In a 2008 Fact Sheet, the U.S. EPA, in conjunction with the OEPA, proposed that PLM Properties, Inc. implement the remedies to address the contaminated soils and groundwater at the facility site. These actions include:

- Maintenance of the existing Institutional Control which limits the use of land to industrial/commercial, and prohibits the use of groundwater on the site,
- Monitored Natural Attenuation (MNA) of the groundwater contamination, with a contingent remedy to be implemented if MNA is not successful, and
- Financial Assurance to demonstrate that funds will be available for implementation of the selected remedy.

Problem Statement: In *Biological and Water Quality Study of the Mad River Basin, 2003 by the State of Ohio EPA*, Pondy Creek is noted as a naturally dry stream. Field observations made by ODNR personnel suggest channelization and excessive bank modification restrict the natural floodplain to cause further impairment.

Goals:

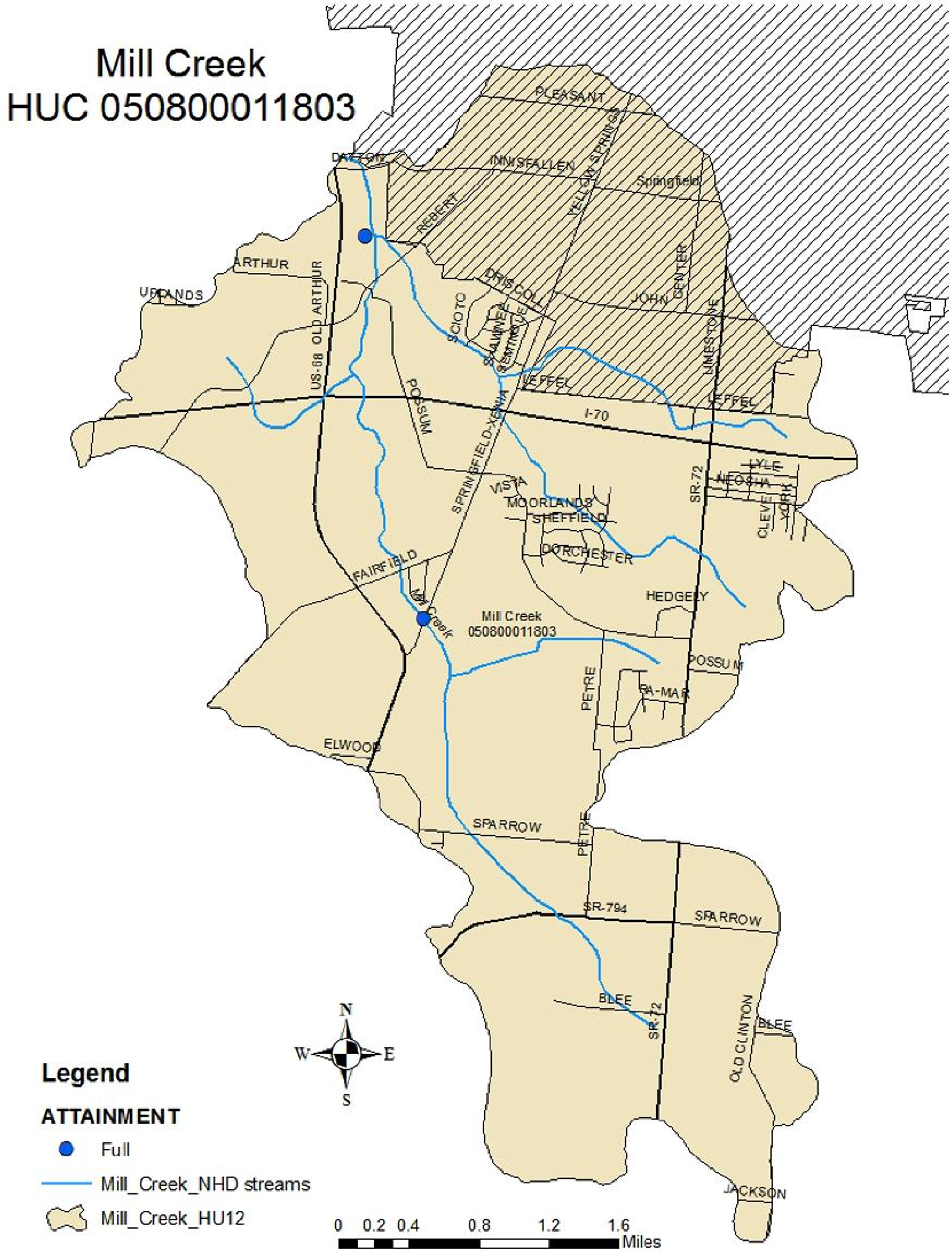
- Reduce sedimentation and nutrient run off from agricultural fields
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems
- Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.
- Educate watershed residents on proper on site septic system maintenance
- Reduce NPS pollutants associated with stormwater
- Reduce sedimentation from riparian land areas

Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **Miami Conservancy District**-water quality credit trading program	Work in conjunction with Clark SWCD/NRCS to promote streamside buffers through USDA and MCD programs on agricultural lands. Submit newspaper and newsletter article advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Clark Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2010 – Jan. 2013	Approved Countywide HSTS plan by OEPA and Clark Co. Health Board Number of on site septic systems upgraded/replaced.
Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.	**USDA**-Farm Bill (EQIP) **Miami Conservancy District**-water quality credit trading program **ODNR**- Pollution Abatement Funds **Ohio Livestock Coalition**-targeted mailing list	Work with Clark SWCD/NRCS to identify livestock producers who have livestock operations. Establish one demonstration site along Pondy Creek utilizing livestock exclusion fencing and pasture management. Submit newspaper and newspaper articles to promote proper spreading and storage of animal waste from feedlots.	On going Feb. 2010 – Feb. 1013 Feb. 2010 – Feb. 2013	Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Lineal feet and number of cattle excluded from stream. Newsletters produced and number of articles appearing in local newspapers. Document number of animal waste complaints received.
Educate watershed residents on proper on site septic system maintenance	**Clark Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping/ system management.	April 2010 April 2010	Number of workshop attendants. Number of handouts distributed.

Reduce NPS pollutants associated with stormwater by implementing BMPs and education of watershed residents on stormwater management.	**OEPA**-DEFA Program **Miami Conservancy District**-water quality credit trading program **Clark Co. and Springfield Twp.-** Work with entities involved in Phase II areas.	Retrofit a bioretention or stormwater wetland area to the existing stormwater system of Holiday Hills. Storm drain labeling in areas with curb and gutter stormwater systems. Create and submit articles to Springfield News-Sun on stormwater and stream health.	Jan. 2010 – Jan. 2013 May 2010	Number of stormwater system upgrades Number of storm drains labeled. Number of articles appearing in newsletter. Water quality activities reported to Ohio EPA for Phase II as required.
Reduce sedimentation from riparian land areas by promoting protection of riparian corridors and proper streambank restoration methods improving in stream habitat.	**Miami Conservancy District**-water quality credit trading program **OEPA**-401 mitigation list	Work with Clark SWCD/NRCS to identify riparian landowners with eroded streambank issues. Establish one demonstration site along Moore Run utilizing Bioengineering erosion control and natural channel design methods and natural stream channel design	On going Feb. 2010 – Feb. 2013	Create mailing list Targeting streamside landowners to receive educational materials. Document soil saved/not delivered from eroding streambanks using R.U.S.L.E. Lineal feet of streambank protected or restored.

Refer to the spreadsheet of action items for prioritized deliverables on page 123. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Clark and Champaign County Health Departments, Army Corps of Engineers, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.


Mill Creek
HUC 050800011803
PLEASANT
INNISFALLEN
YELLOW SPRINGS
Springfield
DRISCOLL
JOHN
CENTER
LIMESTONE
ARTHUR
OLD ARTHUR
US-68
SCIOTO
SHAWNEE
SEMINOLE
LEFFEL
I-70
POSSUM
SPRINGFIELD-XENIA
SR-72
LYLE
NEOSHA
CLEVE
YORK
VISTA
MOORLANDS
SHEFFIELD
DORCHESTER
FAIRFIELD
HEDGELY
Mill Creek
050800011803
POSSUM
PETRE
ELWOOD
SPARROW
SR-794
BLEE
OLD CLINTON
JACKSON
N
W
E
S
Legend
ATTAINMENT
Full
Mill_Creek_NHD streams
Mill_Creek_HU12
0 0.2 0.4 0.8 1.2 1.6
Miles

Mill Creek

12 Digit HUC 050800011803	
Acres:	**9,883.7**
Stream Classification:	**WWH**
Segment Length:	**3.6 miles**
Drainage Area:	**15.5 square miles**
Year Sampled by OEPA:	**2003**
Attainment:	**N / A**

Background: The topography of the Mill Creek watershed is gently slopping, with soils ranging from deepheavy clay to shallow bedrock. The southern headwater areas are located in an agricultural setting. Mill Creek flows from South to North and becomes more urbanized as it approaches the City of Springfield and Mad River. Approximately one quarter of the watershed lie in the political jurisdiction of the City of Springfield where the rest is located in portions of Springfield and Green Townships.

The Mill Creek has a wide diversity of land uses all having different impacts on water quality. Agricultural land use dominants this sub-watershed in the southern most areas. Row crop, small grains and hay production are common along with a few livestock operations. A majority of these row cropped areas are typically designated as non-erodible by the USDA-NRCS, but some highly erodible land (H.E.L) do exist.

Land use transforms from agriculture to a mix of urbanization, commercial and industrial all with in a short distance. The Springfield Beckley Airport and Ohio Air National Guard (178th Fighter Wing) have several permits issued by Ohio EPA to discharge stormwater run off and wastewater effluent into tributaries of the Mill Creek. This area is known to have several acres of impervious cover with no means of treatment prior to entering tributaries. This has led to stormwater quality issues.

Interstate 70 cuts through the Mill Creek watershed and has two exits to state highways. Due to the ideal location and easy access, this has led to several industrial and commercial companies to locate here. A majority of these businesses are located along State Route 72 or State Route 68, but quite a few new companies are moving to land that has become available on Leffels Lane.

Urbanization is a dominating factor affecting water quality in the Northern reaches of the watershed. Roadside housing and lineal development can be seen throughout the entire watershed, but becomes more concentrated in areas located in Springfield Township. Subdivisions like Sunnyland, RaMar Estates and Possum Woods were located in areas with poorly drained soils. This has led to several issues with on-site septic management systems. These subdivisions also have curb and gutter with no means of stormwater treatment due to the era when they were built. The area of Limecrest, also located in Springfield Township, also has a high concentration of housing and is provided with sanitary sewer utilities.

The Southern portion of the City of Springfield that lies in the watershed boundaries has the highest population of residents and percentage of impervious cover. This is an older part of the City and has very little green and open space. All stormwater leaving this area is directly piped into tributaries of Mill Creek.

Watershed areas located in the City of Springfield are serviced with public water and sewer utilities. During the mid-1980s, the Limecrest area was hooked onto the City of Springfield's wastewater sewer system because of the high amount of failed septic systems and active outhouses/ privies. An agreement was reached between leaders of the City of Springfield and Springfield Township.

Homes located in Springfield and Green Townships utilize conventional on site septic and well systems. As previously noted, many of these areas are located in poorly drained soils. According to the Clark County Health Department, the Possum Woods subdivision and parts of Sunnyland known to have many septic systems issues. Many homes do not have enough acreage to install a new wastewater treatment system.

The Southern Interceptor Project was established with agreements between City, County and Township officials. This project consisted of a nine-mile sanitary sewer line that was installed in many of the outlying areas of this watershed. The idea of the pipeline project was to help reduce stress on current sanitary sewer infrastructure, facilitate development and provide sanitary sewer to areas in need. Many residents will be forced to hook up to this system if their current septic system poses a threat to public health.

A majority of the Mill Creek channel exists in a natural state. The stream has a sinuous pattern with a wooded corridor in both urban and agricultural areas. Conversely, headwater areas around the Springfield-Beckley Airport have been channelized and altered to convey stormwater produced by the many acres of impervious cover. A few tributaries that were modified as ditches, like Blee Ditch, can be seen as recovering.

Past and Present Conservation Efforts: Grassed waterways, sub-surface drainage and no-till farming practices have been implemented on many acres of farmland in the Mill Creek Watershed. Several landowners have taken advantage of Farm Bill Programs to establish filter strips and agricultural containment facilities to protect water quality.

Source: "Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach", Clark County Soil and Water Conservation District, 2007.

Problem Statement: Field observations made by Clark SWCD and NRCS personnel identify impairments like sedimentation/siltation, pathogens, pesticides, toxic substances, and organic enrichment. Due to the diverse land uses, impairments originate from different sources and have different impacts on water quality. In the headwater regions of the south, agriculture is the dominant land use. Typical row crop and grain production takes place in fields that are gently slopping, but some highly erodible land does exist. Cattle grazing and hay production occurs in these rolling areas.

Goals:

- Reduce sedimentation and nutrient run off from agricultural fields
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems
- Educate watershed residents on proper on site septic system maintenance
- Reduce NPS pollutants associated with stormwater

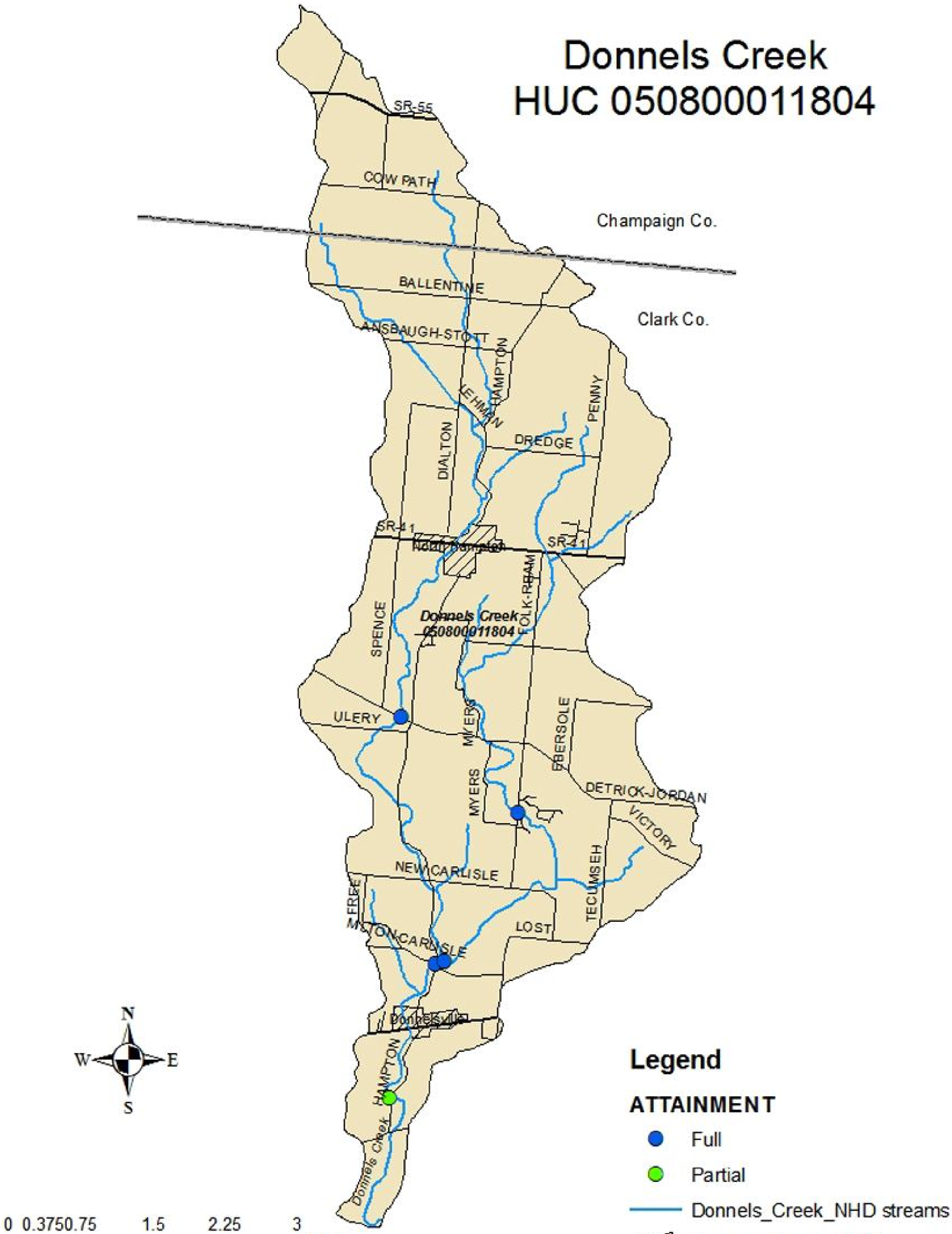
Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **Miami Conservancy District**-water quality credit trading program	Work in conjunction with Clark SWCD/NRCS to promote streamside buffers through USDA and MCD programs on agricultural lands. Submit newspaper and newsletter article advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Clark Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2010 – Jan. 2013	Approved Countywide HSTS plan by OEPA and Clark Co. Health Board Number of on site septic systems upgraded/replaced.
Educate watershed residents on proper on site septic system maintenance	**Clark Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping/ system management.	April 2010 April 2010	Number of workshop attendants. Number of handouts distributed.
Reduce NPS pollutants associated with stormwater by implementing BMPs and education of watershed residents on stormwater management.	**OEPA**-DEFA Program **Miami Conservancy District**-water quality credit trading program **Clark Co. and Springfield Twp.-** Work with entities involved in Phase II areas.	Retrofit a bioretention or stormwater wetland area to the existing stormwater system of Holiday Hills. Storm drain labeling in areas with curb and gutter stormwater systems. Create and submit articles to Springfield News-Sun on stormwater and stream health.	Jan. 2010 – Jan. 2013 May 2010	Number of stormwater system upgrades Number of storm drains labeled. Number of articles appearing in newsletter. Water quality activities reported to Ohio EPA for Phase II as required.

This table denotes the action items declared in the approved watershed action plan, *Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach* (Clark County Soil and Water Conservation District, 2007).

Refer to the following spreadsheet of action items for prioritized deliverables as determined by the Mad River Watershed Strategic Plan Joint Board of Supervisors and Advisory Board. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Champaign County Health Department, Clark County Health Department, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.

	Mill Creek HUC 050800011804				
Objectives	**Deliverables**	**Quantity of Deliverable**	**Cost**	**Deliverable Units**	**Total Cost**
Streambank & Riparian Restoration	Restore Streambank Using Bio-Engineering and/or By Recontouring or Regrading	180	$ 10,000.00	Linear Feet	$ 1,800,000.00
	Plant Grasses or Prairie Grasses in Riparian Areas	75	$ 411.93	Acre	$ 30,894.75
	Plant Trees or Shrubs in Riparian Areas	12	$ 609.44	Acre	$ 7,313.28
Stream Restoration	Restore Floodplain	0		Linear Feet	
	Restore Stream Channel	0		Linear Feet	
	Install In-Stream Habitat Structures	0		Structure	$ -
	Construct 2-Stage Channel	3120		Linear Feet	
	Install Grade Structures	0		Structure	
	Restore Natural Flow	0		Linear Feet	$ -
Wetland Restoration	Reconstruct and Restore Wetlands	0		Acre	
Dam Modification or Removal	Remove Dams	0		Dams	
	Modify Dams	0		Dams	
	Restore Natural Flow	0		Acre	
	Restore Natural Floodplain Function	0		Acre	
Conservation Easements	Acquire Riparian Conservation Easements	0	$ 2,000.00	Acre	$ -
	Acquire Wetland Conservation Easements	0	$ 2,000.00	Acre	$ -
Home Sewage Treatment Systems	Inspect HSTS	150	$ 90.00	Inspections	$ 13,500.00
	Repair or Replace Traditional HSTS	50	$ 6,000.00	HSTS	$ 300,000.00
	Repair or Replace Alternative HSTS	0	$ 9,000.00	HSTS	$ -
Agricultural Best Management Practices	Plant Cover/Manure Crops	900		Acre	
	Develop Nutrient Management Plans	3	$ 2,766.00	Each	$ 8,298.00
	Implement Conservation Tillage Practices	720	$ 15.02	Acre	$ 10,814.40
	Install Alternative Water Supplies	2	$ 1,634.30	Each	$ 3,268.60
	Install Erosion & Sediment Control Structures	3	$ 4.13	SQ FT	$ 12.39
	Install Grassed Waterways	60	$ 5,446.00	Acre	$ 326,760.00
	Install Livestock Crossings	0	$ 3.26	SQ FT	$ -
	Install Heavy Use Feeding Pads	6	$ 1.47	SQ FT	$ 8.82
	Install Livestock Exclusion Fencing	3000	$ 0.51	Linear Feet	$ 1,530.00
	Construct Animal Waste Storage Structures	3	$ 2.07	CU FT	$ 6.21
	Conduct Soil Testing	1500	$ 24.81	Acre	$ 37,215.00
	Execute Installer Contracts	15		Each	$ 15.00
Education and Outreach	Develop Brochures/Fact Sheets	5		Brochures/Sheets	$ 5.00
	Develop Press Releases	1		Releases	$ 1.00
	Install Signs	3		Signs	$ 3.00
	Conduct Tours	3		Tours	$ 3.00
	Conduct Stream Clean-Ups	3		Clean-Ups	$ 3.00
	Stencil Storm Drains	100		Drains	$ 100.00
	Deliver On-Site Technical Assistance	15		Site Visits	$ 15.00
Monitoring	Conduct Chemical Sampling	3		Sites	$ 3.00
	Conduct Macroinvertebrate (ICI) Sampling	3		Sites	$ 3.00
	Conduct Fish (IBI) Sampling	3		Sites	$ 3.00
	Conduct Habitat (QHEI) Sampling	3		Sites	$ 3.00
	Conduct Nitrate Sampling (Water)	30		Samples	$ 30.00
	Conduct Nitrate Sampling (Soil)	30		Samples	$ 30.00
	Prepare and Submit Final Report and Data	1		Report	$ 1.00


Donnels Creek
HUC 050800011804
Champaign Co.
Clark Co.
SR-55
COW PATH
BALLENTINE
ANSBAUGH-STOTT
HAMPTON
LEHMAN
PENNY
DIALTON
DREDGE
SR-41
North Hampton
SR-41
FOLK-REAM
SPENCE
Donnels Creek
050800011804
ULERY
MYERS
MYERS
EBERSOLE
DETRICK-JORDAN
VICTORY
NEW CARLISLE
TECUMSEH
FREE
MILTON-CARLISLE
LOST
Donnelsville
HAMPTON
Donnels Creek
0 0.3750.75 1.5 2.25 3
Miles
N
W
E
S
Legend
ATTAINMENT
Full
Partial
Donnels_Creek_NHD streams
Donnels_Creek_HU12

Donnels Creek

12 Digit HUC 050800011804
Acres: 11,138.7
Stream Classification: Exceptional WWH
Segment Length: 11.6 miles
Drainage Area: 26.4 square miles
Year Sampled by OEPA: 1994 and 2003
Attainment: 6 miles Full, 5.6 miles Non

Background: The landscape of this watershed can best be described as a narrow valley agricultural setting, with the Donnels Creek meandering through the center. Patches of dense woodland can also be seen. Headwater/highland reaches of the watershed have a gently rolling topography that go through a steep transitional landform heading toward the creek. Flat and broad flood plain areas can be seen near the confluence with the Mad River. Soils characteristics range from deep-heavy clay to shallow bedrock to sandy/gravelly. As Donnels Creek flows toward the South, higher rates of roadside residential housing can be seen. The Villages of North Hampton and Donnelsville are located in this sub watershed.

Agricultural land use dominants this sub-watershed. Row crops, small grains and hay production are common along with a few livestock operations. A majority of the row cropped headwater areas are typically designated as non-erodible by the USDA-NRCS in this location. Due to the sloping terrain of the central portion, row cropped areas may be designated as highly erodible land (H.E.L) by the USDA-NRCS. Residential housing can be seen along roadside through out the watershed, but some sub divisions do exist. Heistand Estates, located just East of Donnelsville, is approximately six years old. Donnels Creek farm, west of North Hampton, began construction in 2005. Both of these areas were required to implement stormwater best management practices to protect water quality.

Due to its rural character, residents of this watershed utilize domestic wells and on-site septic systems. The Village of North Hampton has it own drinking water well and waste water treatment systems. The well is located in North Hampton and provides water to 500 residents that use approximately 50,000 gallons per day. The sanitary sewer system is an extension from the City of New Carlisle. Due to the age and close proximity of homes in this location, these public utilities were crucial to the Village. Recently, talks have been conducted to extend this sewer line to Northwestern High School and Chateau Estates mobile home park. Effluent from this system would outfall in the Honey Creek Watershed.

The Village of Donnelsville has recently installed a sanitary sewer line to provide to their residents. Many of the aging homes were in close proximity and had on site septic management issues. Combined with the shallow bedrock soils of the area, this was a public health hazard. The Village and Clark County Utilities worked to extend a sewer from the Southwest Waste Water Treatment Plan. In addition to bringing this area on-line, Tecumseh High School would also be added. The Community of Dialton should also be considered to be placed on a sanitary sewer system due lack of space to upgrade septic systems. Stormwater issues also exist in these two urbanized areas. Acres of impervious cover create more amounts of stormwater runoff. When these Villages were established, no legislation existed to mandate stormwater run off controls. This has led to water quality degradation.

Headwater areas typically have soils that are poorly drained and sub-surface drainage improvements have been made. The headwater tributary, Thackery Ditch, was constructed to provide an adequate outlet for subsurface drainage systems. This stream can be seen as maintained in some locations and recovering in others. This has led to in stream habitat degradation. A majority of the Donnels Creek channel exists in a natural state having good stream morphology and function. The stream has a sinuous pattern with a wooded corridor and an active flood plain.

Past and Present Conservation Efforts: Several landowners have taken advantage of Farm Bill Programs to establish best management practices on farmland. In this sub-watershed, several acres of grassed waterways and subsurface drainage systems have been installed to control erosion. Additionally, no-till farming practices along with grass filter strips have been implemented on many acres of farmland.

During implementation of the 1999 319 water quality grant, fourteen acres of grass filter strip were established. Additionally, two septic tanks were pumped and educational materials disseminated to promote proper on site septic system management. This sub-watershed was targeted for this program due to septic system issues of Donnelsville.

Source: "Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach", Clark County Soil and Water Conservation District, 2007.

Problem Statement: Prior to the 2003 Mad River Basin TSD study, Ohio EPA did not have much biological water quality data on Donnels Creek. The Ohio EPA's 305b report lists crop production as known sources of impairments. Field observations made by Clark SWCD and NRCS personnel identify impairments like sedimentation/siltation, pathogens, pesticides, and organic enrichment.

A majority of this landscape is utilized for agricultural production. Typical row crop and grain production takes place in fields that are gently slopping, but erosion issues are present. Headwater areas are known to have soils with seasonal high water tables. Many acres of this land have been drained systematically with sub surface tile. These soil types are highly productive when properly drained.

Due to the rolling topography in the central areas, erosion issue can be an issue with row crop production. These lands may be designated as highly erodible land (H.E.L) by the USDA-NRCS. Cattle production numbers are low in this area and occur on ground that is permanent pasture. Confined cattle production does occur in low numbers here. Many old feedlots can be seen vacated.

Near the confluence of the Mad River, large tracts of flood plain land can be seen. This farmland is known to have highly productive soils that are ideal for agriculture, but flooding does occur. Residents of this sub-watershed utilize on site septic and wells. Being in a rural location will force these homes to use this type of system for many years. Watershed residents of Donnelsville and North Hampton utilize a sanitary sewer system that will improve water quality.

In the near future, Northwestern High School and Chateau Estates mobile home park will be on line with a sewer line extended from the Village of North Hampton. Considerations should be made to add the Community of Dialton to a sanitary system.

Impervious surfaces of Donnelsville and North Hampton are sources of non-point pollutants. Due to a traditional stormwater management practices pollutants such as pathogens, pesticides, toxic substances, organic enrichment, and thermal stress exist as water quality concerns. No stormwater controls exist that would improve stormwater run off quality.

Goals:

- Reduce sedimentation and nutrient run off from agricultural fields
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems
- Educate watershed residents on proper on site septic system maintenance
- Reduce NPS pollutants associated with stormwater

Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **Miami Conservancy District**-water quality credit trading program	Work in conjunction with Clark SWCD/NRCS to promote streamside buffers through USDA and MCD programs on agricultural lands. Submit newspaper and newsletter articles advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On-going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered usingRUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Clark Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2010-Jan 2012	Approved Countywide HSTS plan by OEPA and Clark Co. Health Board Number of on site septic systems upgraded/replaced.
Educate watershed residents on proper on site septic system maintenance	**Clark Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping and system management.	April 2010 April 2010	Number of workshop attendants. Number of handouts distributed.
Reduce NPS pollutants associated with stormwater by implementing BMP's and education of watershed residents on stormwater management.	**OEPA**-DEFA Program **Miami Conservancy District**-water quality credit trading program	Retrofit a bioretention or stormwater wetland area to the existing stormwater system in Donnelsville or North Hampton. Storm drain labeling in Donnelsville or North Hampton. Create and submit articles for New Carlisle paper and Township newsletter on stormwater and stream health.	Jan. 2010-Jan. 2013 May 2010	Number of stormwater system upgrades Number of storm drains labeled. Number of articles appearing in newsletter.

This table denotes the action items declared in the approved watershed action plan, *Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach* (Clark County Soil and Water Conservation District, 2007).

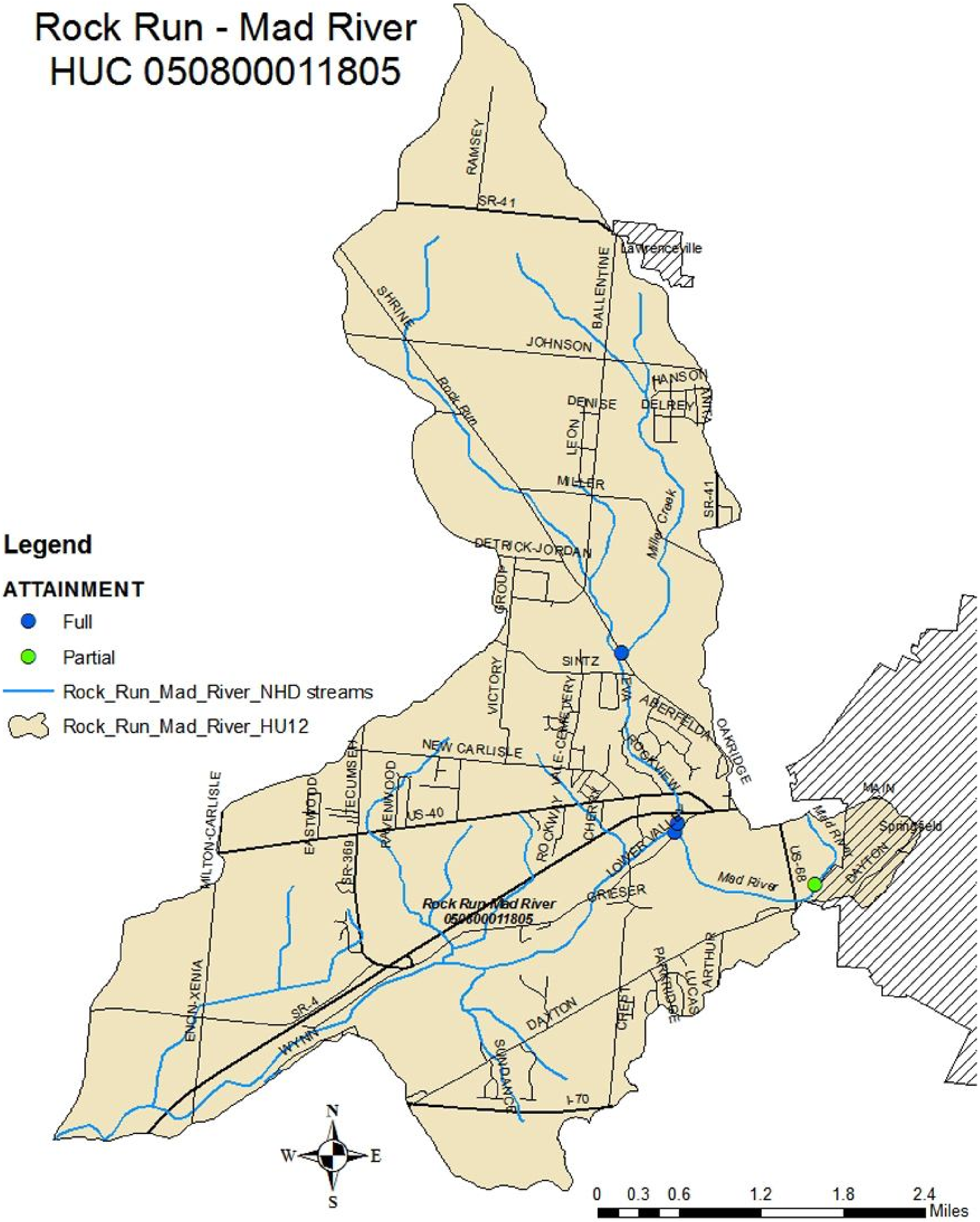
Refer to the following spreadsheet of action items for prioritized deliverables as determined by the Mad River Watershed Strategic Plan Joint Board of Supervisors and Advisory Board. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Champaign County Health Department, Clark County Health Department, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.

Donnels Creek HUC 050800011806

Objectives	Deliverables	Quantity of Deliverable	Cost	Deliverable Units	Total Cost
Streambank & Riparian Restoration	Restore Streambank Using Bio-Engineering and/or By Recontouring or Regrading	150	$ 10,000.00	Linear Feet	$ 1,500,000.00
	Plant Grasses or Prairie Grasses in Riparian Areas	60	$ 411.93	Acre	$ 24,715.80
	Plant Trees or Shrubs in Riparian Areas	10	$ 609.44	Acre	$ 6,094.40
Stream Restoration	Restore Floodplain	0		Linear Feet	
	Restore Stream Channel	0		Linear Feet	
	Install In-Stream Habitat Structures	0		Structure	$ -
	Construct 2-Stage Channel	2800		Linear Feet	
	Install Grade Structures	0		Structure	
	Restore Natural Flow	0		Linear Feet	$ -
Wetland Restoration	Reconstruct and Restore Wetlands	10		Acre	
Dam Modification or Removal	Remove Dams	0		Dams	
	Modify Dams	0		Dams	
	Restore Natural Flow	0		Acre	
	Restore Natural Floodplain Function	0		Acre	
Conservation Easements	Acquire Riparian Conservation Easements	0	$ 2,000.00	Acre	$ -
	Acquire Wetland Conservation Easements	0	$ 2,000.00	Acre	$ -
Home Sewage Treatment Systems	Inspect HSTS	100	$ 90.00	Inspections	$ 9,000.00
	Repair or Replace Traditional HSTS	30	$ 6,000.00	HSTS	$ 180,000.00
	Repair or Replace Alternative HSTS	0	$ 9,000.00	HSTS	$ -
Agricultural Best Management Practices	Plant Cover/Manure Crops	800		Acre	
	Develop Nutrient Management Plans	3	$ 2,766.00	Each	$ 8,298.00
	Implement Conservation Tillage Practices	600	$ 15.02	Acre	$ 9,012.00
	Install Alternative Water Supplies	2	$ 1,634.30	Each	$ 3,268.60
	Install Erosion & Sediment Control Structures	3	$ 4.13	SQ FT	$ 12.39
	Install Grassed Waterways	60	$ 5,446.00	Acre	$ 326,760.00
	Install Livestock Crossings	0	$ 3.26	SQ FT	$ -
	Install Heavy Use Feeding Pads	6	$ 1.47	SQ FT	$ 8.82
	Install Livestock Exclusion Fencing	2750	$ 0.51	Linear Feet	$ 1,402.50
	Construct Animal Waste Storage Structures	3	$ 2.07	CU FT	$ 6.21
	Conduct Soil Testing	1500	$ 24.81	Acre	$ 37,215.00
	Execute Installer Contracts	15		Each	$ 15.00
Education and Outreach	Develop Brochures/Fact Sheets	5		Brochures/Sheets	$ 5.00
	Develop Press Releases	1		Releases	$ 1.00
	Install Signs	5		Signs	$ 5.00
	Conduct Tours	5		Tours	$ 5.00
	Conduct Stream Clean-Ups	5		Clean-Ups	$ 5.00
	Stencil Storm Drains	660		Drains	$ 660.00
	Deliver On-Site Technical Assistance	15		Site Visits	$ 15.00
Monitoring	Conduct Chemical Sampling	5		Sites	$ 5.00
	Conduct Macroinvertebrate (ICI) Sampling	5		Sites	$ 5.00
	Conduct Fish (IBI) Sampling	5		Sites	$ 5.00
	Conduct Habitat (QHEI) Sampling	5		Sites	$ 5.00
	Conduct Nitrate Sampling (Water)	50		Samples	$ 50.00
	Conduct Nitrate Sampling (Soil)	50		Samples	$ 50.00
	Prepare and Submit Final Report and Data	1		Report	$ 1.00

	East Fork Donnels Creek HUC 050800011807				
Objectives	**Deliverables**	**Quantity of Deliverable**	**Cost**	**Deliverable Units**	**Total Cost**
Streambank & Riparian Restoration	Restore Streambank Using Bio-Engineering and/or By Recontouring or Regrading	700	$ 10,000.00	Linear Feet	$ 7,000,000.00
	Plant Grasses or Prairie Grasses in Riparian Areas	125	$ 411.93	Acre	$ 51,491.25
	Plant Trees or Shrubs in Riparian Areas	15	$ 609.44	Acre	$ 9,141.60
Stream Restoration	Restore Floodplain	0		Linear Feet	
	Restore Stream Channel	0		Linear Feet	
	Install In-Stream Habitat Structures	0		Structure	$ -
	Construct 2-Stage Channel	3000		Linear Feet	
	Install Grade Structures	0		Structure	
	Restore Natural Flow	0		Linear Feet	$ -
Wetland Restoration	Reconstruct and Restore Wetlands	10		Acre	
Dam Modification or Removal	Remove Dams	0		Dams	
	Modify Dams	0		Dams	
	Restore Natural Flow	0		Acre	
	Restore Natural Floodplain Function	0		Acre	
Conservation Easements	Acquire Riparian Conservation Easements	0	$ 2,000.00	Acre	$ -
	Acquire Wetland Conservation Easements	0	$ 2,000.00	Acre	$ -
Home Sewage Treatment Systems	Inspect HSTS	75	$ 90.00	Inspections	$ 6,750.00
	Repair or Replace Traditional HSTS	25	$ 6,000.00	HSTS	$ 150,000.00
	Repair or Replace Alternative HSTS	0	$ 9,000.00	HSTS	$ -
Agricultural Best Management Practices	Plant Cover/Manure Crops	700		Acre	
	Develop Nutrient Management Plans	5	$ 2,766.00	Each	$ 13,830.00
	Implement Conservation Tillage Practices	500	$ 15.02	Acre	$ 7,510.00
	Install Alternative Water Supplies	2	$ 1,634.30	Each	$ 3,268.60
	Install Erosion & Sediment Control Structures	5	$ 4.13	SQ FT	$ 20.65
	Install Grassed Waterways	70	$ 5,446.00	Acre	$ 381,220.00
	Install Livestock Crossings	0	$ 3.26	SQ FT	$ -
	Install Heavy Use Feeding Pads	5	$ 1.47	SQ FT	$ 7.35
	Install Livestock Exclusion Fencing	2000	$ 0.51	Linear Feet	$ 1,020.00
	Construct Animal Waste Storage Structures	5	$ 2.07	CU FT	$ 10.35
	Conduct Soil Testing	1200	$ 24.81	Acre	$ 29,772.00
	Execute Installer Contracts	15		Each	$ 15.00
Education and Outreach	Develop Brochures/Fact Sheets	5		Brochures/Sheets	$ 5.00
	Develop Press Releases	1		Releases	$ 1.00
	Install Signs	5		Signs	$ 5.00
	Conduct Tours	5		Tours	$ 5.00
	Conduct Stream Clean-Ups	5		Clean-Ups	$ 5.00
	Stencil Storm Drains	50		Drains	$ 50.00
	Deliver On-Site Technical Assistance	15		Site Visits	$ 15.00
Monitoring	Conduct Chemical Sampling	5		Sites	$ 5.00
	Conduct Macroinvertebrate (ICI) Sampling	5		Sites	$ 5.00
	Conduct Fish (IBI) Sampling	5		Sites	$ 5.00
	Conduct Habitat (QHEI) Sampling	5		Sites	$ 5.00
	Conduct Nitrate Sampling (Water)	50		Samples	$ 50.00
	Conduct Nitrate Sampling (Soil)	50		Samples	$ 50.00
	Prepare and Submit Final Report and Data	1		Report	$ 1.00


Rock Run - Mad River
HUC 050800011805
Legend
ATTAINMENT
Full
Partial
Rock_Run_Mad_River_NHD streams
Rock_Run_Mad_River_HU12
Rock Run Mad River
050800011805
Lawrenceville
Springfield
Rock Run
Miller Creek
Mad River
RAMSEY
SR-41
SHRINE
BALLENTINE
JOHNSON
HANSON
DENISE
DELREY
LEON
MILLER
DETRICK-JORDAN
GROUP
SINTZ
VICTORY
ABERFELDA
OAKRIDGE
NEW CARLISLE
ROCKVIEW
MILTON-CARLISLE
EASTWOOD
TECUMSEH
RAVENWOOD
US-40
ROCKWAY
LOWER VALLEY
GRIESER
SR-369
US-68
MAIN
DAYTON
ENON-XENIA
SR-4
WYNN
ARTHUR
LUCAS
I-70
N
W
E
S
0 0.3 0.6 1.2 1.8 2.4
Miles

Rock Run

12 Digit HUC 050800011805	
Acres:	**5,780.9**
Stream Classification:	**WWH**
Segment Length:	**3.7 miles**
Drainage Area:	**9.1 square miles**
Year Sampled by OEPA:	**2003**
Attainment:	**Full**

Background: The topography of the Rock Run watershed is gently slopping, with soils ranging from deep, heavy clay to shallow bedrock. The Northern headwater areas are located in an agricultural setting. As Rock Run flows toward the Mad River, higher rates of residential housing can be seen. Approximately 3 quarters of the watershed lies in German Township and the rest in Springfield Township.

Rock Run has a diversity of land uses all having different impacts on water quality. Agricultural land use dominants this sub-watershed in the northern areas. Row crop, small grains and hay production are common along with a few livestock operations. A majority of the row cropped areas are typically designated as non-erodible by the USDA-NRCS.

Headwater areas typically have soils that are poorly drained and sub-surface drainage improvements have been made. Many of these areas are under urban pressures for housing due to location. This watershed has some livestock production with some animals having access to streams, as seen on Shrine Rd.

Many of the roads in this watershed are lined with residential homes, but some subdivisions and apartment complexes due exist. In the upland part of the watershed, roadside development is typical. The upland area also has several mobile home parks that utilize on site septic and well water systems. Southern areas have sub-divisions like Cedar Hills, Alberfelda, Deber Estates and parts of Forest Hills in addition to the developed roadsides.

Many residents of this sub-watershed utilize on-site septic and well water systems. Due to location, a majority of these areas are too far from public utilities. Rockway School, Alberfelda Heights and Cherry Lane do have public water that is supplied through an agreement between the City of Springfield and Springfield Township.

Soil types in populated areas are typically poorly drained. In the northern areas, soils have seasonal high water tables, where southern areas have restrictive bedrock layers. This situation has led to many conventional septic systems to fail early. Adding to this concern is that many homes were built on small lots making on-site septic replacement difficult. Compounding this issue is that many conventional septic systems were replaced with aeration septic systems that discharge effluent to local drainage ways rather than utilizing soil as a treatment media. This has led to a high concentration of treated aeration discharge entering drainage ways. Many of these tributaries can go dry leaving the effluent to lay stagnant.

In addition to numerous residential on site septic systems, small waster water treatment plants are in use. Rockway School, Greenlawn Village Condominiums, Westwind Properties and the Rolling Terrace mobile home park all discharge treated wastewater into tributaries of Rock Run. Although these facilities are permitted through Ohio EPA, they are having negative impacts on water quality.

A majority of the Rock Run channel exists in a natural state having good stream morphology and function. The stream has a sinuous pattern with a wooded corridor in urban and some agricultural areas. A few tributaries that were modified as a ditches, like portions of Miller Creek, can be seen as recovering. Areas where cattle are raised next to streams have no wooded vegetation with minimal ground cover.

Past and Present Conservation Efforts: Several landowners have taken advantage of Farm Bill Programs to establish best management practices on farmland. In this sub-watershed, several acres of grassed waterways and subsurface drainage systems have been installed to control erosion. Many of these projects were established along Shrine Rd. Additionally, no-till farming practices along with grass filter strips have been implemented on many acres of farmland.

During implementation of the 1999 319 water quality grant, eight septic tanks were pumped and educational materials disseminated to promote proper on site septic system management. This area was targeted for this program due to the issues of failing on site septic systems and high concentration of aeration systems.

Problem Statement: Field observations made by Clark SWCD and NRCS personnel identify impairments like sedimentation/siltation, pathogens, pesticides, and organic enrichment.

Due to the diverse land uses, impairments originate from different sources and have different impacts on water quality. In the headwater regions of the North, agriculture is the dominant land use. Typical row crop and grain production takes place in fields that are gently slopping, but erosion issues are present. Cattle operations, specifically along portions of Shrine Road, have access to the Rock Run channel. A wooded riparian zone and ground cover is non-existent.

In developed portions of this sub-watershed, aging on-site septic systems can be seen degrading water quality. Several sub-divisions have been located in areas with poorly drained soils. This has led to an overabundance of septic systems failures. Future consideration should be taken to tie these areas on sanitary sewers. Some areas of the watershed will not be able to hook into a sewer system do to their outlying locations and on-site systems will have to be used. Point sources of pollution can also be seen as threatening water quality. With several mobile home parks and apartment complexes being located in this area, discharge of treated effluent from these areas is under regulatory jurisdiction of Ohio EPA.

Source: "Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach", Clark County Soil and Water Conservation District, 2007.

Goals:

- Reduce sedimentation and nutrient run off from agricultural fields
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems
- Educate watershed residents on proper on site septic system maintenance
- Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.

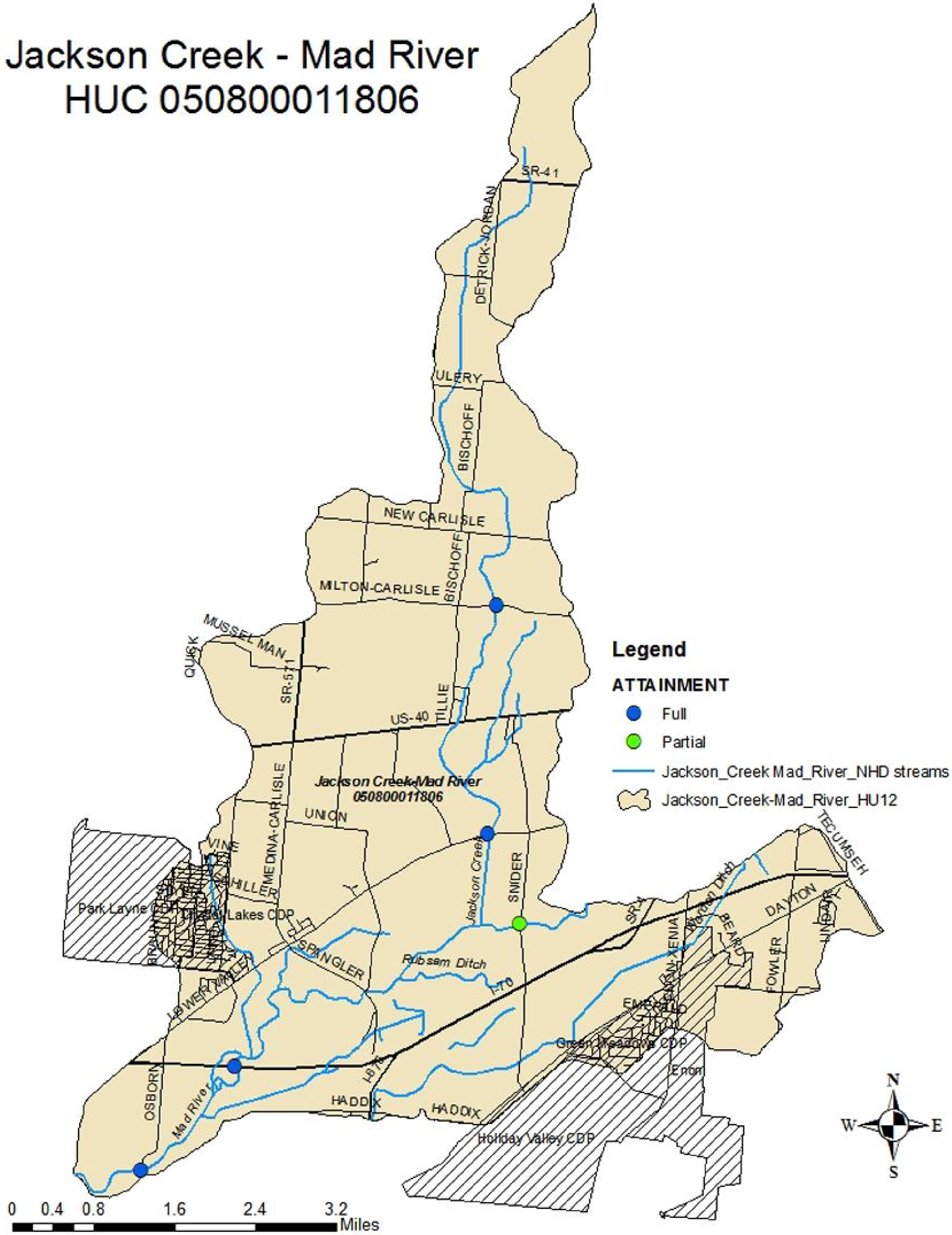
Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **Miami Conservancy District**-water quality credit trading program	Work in conjunction with Clark SWCD/NRCS to promote streamside buffers through USDA and MCD programs on agricultural lands. Submit newspaper and newsletter articles advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On-going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered usingRUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Clark Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2010-Jan 2012	Approved Countywide HSTS plan by OEPA and Clark Co. Health Board Number of on site septic systems upgraded/replaced.
Educate watershed residents on proper on site septic system maintenance	**Clark Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping and system management.	April 2010 April 2010	Number of workshop attendants. Number of handouts distributed.
Reduce sedimentation, organic enrichment, and bacterial/pathogen levels from unrestricted livestock and feedlots.	**USDA**-Farm Bill (EQIP) **Miami Conservancy District**-water quality credit trading program **ODNR**-Pollution Abatement Funds **Ohio Livestock Coalition**-targeted mailing list	Work w/ Clark SWCD/NRCS to identify livestock producers who have livestock operations. Establish one demonstration site along Rock Run utilizing livestock exclusion fencing and pasture management. Submit newspaper and newspaper articles to promote proper spreading and storage of animal waste from feedlots.	On going Feb. 2010 – Feb. 2013 Feb. 2010 – Feb. 2013	Document soil saved/not delivered using RUSLE or nutrient loading spreadsheets. Lineal feet and number of cattle excluded from stream. Newsletters produced and number of articles appearing in local newspapers. Document number of animal waste complaints received.

This table denotes the action items declared in the approved watershed action plan, *Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach* (Clark County Soil and Water Conservation District, 2007).

Refer to the following spreadsheet of action items for prioritized deliverables as determined by the Mad River Watershed Strategic Plan Joint Board of Supervisors and Advisory Board. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Clark County Health Department, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.

	Rock Run HUC 050800011805				
Objectives	**Deliverables**	**Quantity of Deliverable**	**Cost**	**Deliverable Units**	**Total Cost**
Streambank & Riparian Restoration	Restore Streambank Using Bio-Engineering and/or By Recontouring or Regrading	150	$ 10,000.00	Linear Feet	$ 1,500,000.00
	Plant Grasses or Prairie Grasses in Riparian Areas	60	$ 411.93	Acre	$ 24,715.80
	Plant Trees or Shrubs in Riparian Areas	10	$ 609.44	Acre	$ 6,094.40
Stream Restoration	Restore Floodplain	0		Linear Feet	
	Restore Stream Channel	0		Linear Feet	
	Install In-Stream Habitat Structures	0		Structure	$ -
	Construct 2-Stage Channel	2000		Linear Feet	
	Install Grade Structures	0		Structure	
	Restore Natural Flow	0		Linear Feet	$ -
Wetland Restoration	Reconstruct and Restore Wetlands	0		Acre	
Dam Modification or Removal	Remove Dams	0		Dams	
	Modify Dams	0		Dams	
	Restore Natural Flow	0		Acre	
	Restore Natural Floodplain Function	0		Acre	
Conservation Easements	Acquire Riparian Conservation Easements	0	$ 2,000.00	Acre	$ -
	Acquire Wetland Conservation Easements	0	$ 2,000.00	Acre	$ -
Home Sewage Treatment Systems	Inspect HSTS	300	$ 90.00	Inspections	$ 27,000.00
	Repair or Replace Traditional HSTS	50	$ 6,000.00	HSTS	$ 300,000.00
	Repair or Replace Alternative HSTS	100	$ 9,000.00	HSTS	$ 900,000.00
Agricultural Best Management Practices	Plant Cover/Manure Crops	800		Acre	
	Develop Nutrient Management Plans	5	$ 2,766.00	Each	$ 13,830.00
	Implement Conservation Tillage Practices	600	$ 15.02	Acre	$ 9,012.00
	Install Alternative Water Supplies	2	$ 1,634.30	Each	$ 3,268.60
	Install Erosion & Sediment Control Structures	3	$ 4.13	SQ FT	$ 12.39
	Install Grassed Waterways	60	$ 5,446.00	Acre	$ 326,760.00
	Install Livestock Crossings	0	$ 3.26	SQ FT	$ -
	Install Heavy Use Feeding Pads	6	$ 1.47	SQ FT	$ 8.82
	Install Livestock Exclusion Fencing	1000	$ 0.51	Linear Feet	$ 510.00
	Construct Animal Waste Storage Structures	3	$ 2.07	CU FT	$ 6.21
	Conduct Soil Testing	1500	$ 24.81	Acre	$ 37,215.00
	Execute Installer Contracts	15		Each	$ 15.00
Education and Outreach	Develop Brochures/Fact Sheets	5		Brochures/Sheets	$ 5.00
	Develop Press Releases	1		Releases	$ 1.00
	Install Signs	10		Signs	$ 10.00
	Conduct Tours	5		Tours	$ 5.00
	Conduct Stream Clean-Ups	5		Clean-Ups	$ 5.00
	Stencil Storm Drains	500		Drains	$ 500.00
	Deliver On-Site Technical Assistance	15		Site Visits	$ 15.00
Monitoring	Conduct Chemical Sampling	5		Sites	$ 5.00
	Conduct Macroinvertebrate (ICI) Sampling	5		Sites	$ 5.00
	Conduct Fish (IBI) Sampling	5		Sites	$ 5.00
	Conduct Habitat (QHEI) Sampling	5		Sites	$ 5.00
	Conduct Nitrate Sampling (Water)	50		Samples	$ 50.00
	Conduct Nitrate Sampling (Soil)	50		Samples	$ 50.00
	Prepare and Submit Final Report and Data	1		Report	$ 1.00


Jackson Creek - Mad River
HUC 050800011806
Legend
ATTAINMENT
Full
Partial
Jackson_Creek Mad_River_NHD streams
Jackson_Creek-Mad_River_HU12
Jackson Creek-Mad River
050800011806
SR-41
DETRICK-JORDAN
ULERY
BISCHOFF
NEW CARLISLE
MILTON-CARLISLE
MUSSELMAN
QUICK
SR-571
US-40
TILLIE
UNION
MEDINA-CARLISLE
VINE
SNIDER
Jackson Creek
Rubsam Ditch
SPANGLER
Park Layne CDP
Lakes CDP
I-70
SR-4
DAYTON
TECUMSEH
FOWLER
BEARD
Green Meadows CDP
Enon
HADDIX
Holiday Valley CDP
OSBORN
Mad River
N
W
E
S
0 0.4 0.8 1.6 2.4 3.2
Miles

Jackson Creek

12 Digit HUC 050800011806	
Acres:	**6,805.5**
Stream Classification:	**Exceptional WWH / *WWH****
Segment Length:	**4.8 miles**
Drainage Area:	**9.56 square miles**
Year Sampled by OEPA:	**2003**
Attainment:	**Full**

**Recommendation to change aquatic use life use following 2003 sampling data.*

Backgound: The landscape of this watershed can best be described as a narrow valley in an agricultural setting, with the Jackson Creek through the center. Patches of dense woodland can also be seen. Headwater/highland reaches of the watershed have a gently rolling topography that go through a steep transitional landform heading toward the creek. Flat and broad flood plain areas can be seen near the confluence with the Mad River. Soils characteristics range from deep-heavy clay to shallow bedrock to sandy/gravelly.

Agricultural land use dominants this sub-watershed. Row crops, small grains and hay production are common along with a few livestock operations. A majority of the row cropped headwater areas are typically designated as non-erodible by the USDA-NRCS. Due to the slopping terrain of the central portion, row cropped areas may be designated as highly erodible land (H.E.L) by the USDA-NRCS. Residential housing can be seen along roadsides through out the watershed. Recent development has occurred on areas of Myers and Bishoff Roads. A large cluster of homes can be seen built in the Jackson Creek flood plain along Tille Lane.

Due to its rural character, residents of this watershed utilize domestic wells and on-site septic systems. Tecumseh High School has recently been connected to a sewer from the Southwest Waste Water Treatment Plant. This line was extended to provide sewer utilities to the Village of Donnelsville as well.

Headwater areas typically have soils that are poorly drained and sub-surface drainage improvements have been made. Headwater reaches of Jackson Creek were channelized to provide an adequate outlet for subsurface drainage systems. This stream can be seen as maintained in some locations and recovering in others. This has led to in stream habitat degradation.

In the central portion of the watershed, the Jackson Creek channel exists in a natural state having good stream morphology and function. The stream has a sinuous pattern with a wooded corridor and an active flood plain. Several houses exist in this stretch along Tille lane. These homes are located in the flood plain and a levee was created along Jackson Creek to control flooding. Compounding this issue is that the development sits at the bottom of a hill and has soils with seasonal high water tables. The Clark SWCD and Clark County Engineers have worked with residents and Bethel Township to propose drainage improvements, but no involved parties will pay toward the project costs. South of Lower Valley Pike, the topography changes from rolling and steep to flat and broad. Jackson Creek becomes a straightened channelized ditch as it flows through the flood plain to the Mad River. The stream channel has no wooded vegetation, but grass ground cover is present.

Past and Present Conservation Efforts: Several landowners have taken advantage of Farm Bill Programs to establish best management practices on farmland. In this sub-watershed, several acres of grassed waterways and subsurface drainage systems have been installed to control erosion. Additionally, no-till farming practices along with grass filter strips have been implemented on many acres of farmland. Several acres of warm season grass filter strips were established on Bishoff Road. During implementation of the 1999 319 water quality grant three septic tank were pumped and educational materials disseminated to promote proper on site septic system management.

Problem Statement: Field observations made by Clark SWCD and NRCS personnel identify impairments like sedimentation/siltation, pathogens, pesticides, and organic enrichment. A majority of this landscape is utilized for agricultural production. Typical row crop and grain production takes place in fields that can be gently slopping, but erosion issues are present. Headwater areas are known to have soils with seasonal high water tables. Many acres of this land have been drained systematically with sub surface tile. These soil types are highly productive when properly drained.

Due to the rolling topography in the central areas, erosion issue can be an issue with row crop production. These lands may be designated as highly erodible land (H.E.L) by the USDA-NRCS.
Near the confluence of the Mad River, large tracts of flood plain land can be seen. This farmland is known to have highly productive soils that are ideal for agriculture, but flooding does occur.
Residents of this sub-watershed utilize on site septic and wells. Being in a rural location will force these homes to use this type of system for many years. The Village of Donnelsville and Tecumseh High School are the only two areas of this watershed that are connected to a sanitary sewer system.

Goals:

- Reduce sedimentation and nutrient run off from agricultural fields
- Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems
- Educate watershed residents on proper on site septic system maintenance
- Reduce NPS pollutants associated with stormwater

Objectives	Resources	Actions	Time frame	Performance Indicators
Reduce sedimentation and nutrient run off from agricultural fields through promoting conservation tillage, crop rotation and establishment of filterstrips and riparian buffers	**USDA**- Farm Bill (CRP) **Miami Conservancy District**-water quality credit trading program	Work in conjunction with Clark SWCD/NRCS to promote streamside buffers through USDA and MCD programs on agricultural lands. Submit newspaper and newsletter articles advertising the benefits of riparian buffers. Target operators and landowners who farm HEL land.	On-going	Acres of agricultural lands enrolled in conservation programs. Document soil saved/not delivered usingRUSLE or nutrient loading spreadsheets. Newsletters produced and number of articles appearing in local newspapers.
Reduce organic enrichment and pathogen/bacterial sources of pollution from on site septic systems	**OEPA**-DEFA Program **Clark Co. Health Department-** Funds to inventory and write plan.	Work with local Health Dept. to complete HSTS inventory identifying failing systems and establishing guidelines for septic system corrections/upgrades.	Jan. 2010-Jan 2012	Approved Countywide HSTS plan by OEPA and Clark Co. Health Board Number of on site septic systems upgraded/replaced.

Educate watershed residents on proper on site septic system maintenance	**Clark Co. Health Department**	Host workshop for watershed residents on proper on site septic system maintenance. Create handouts promoting septic pumping and system management.	April 2010 April 2010	Number of workshop attendants. Number of handouts distributed.
Reduce NPS pollutants associated with stormwater by implementing BMP's and education of watershed residents on stormwater management.	**OEPA**-DEFA Program **Miami Conservancy District**-water quality credit trading program	Retrofit a bioretention or stormwater wetland area to the existing stormwater system in Donnelsville or North Hampton. Storm drain labeling in Donnelsville or North Hampton. Create and submit articles for New Carlisle paper and Township newsletter on stormwater and stream health.	Jan. 2010- Jan. 2013 May 2010	Number of stormwater system upgrades Number of storm drains labeled. Number of articles appearing in newsletter.

This table denotes the action items declared in the approved watershed action plan, *Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach* (Clark County Soil and Water Conservation District, 2007).

Refer to the following spreadsheet of action items for prioritized deliverables as determined by the Mad River Watershed Strategic Plan Joint Board of Supervisors and Advisory Board. These action items will be undertaken and implemented according to a 10-year plan from June 2010 to June 2020, with the exception of ongoing best management practices.

Funding sources include EPA 319, USDA Farm Bill programs, Clark County Health Department, ODNR Division of Wildlife and ODNR-Pollution Abatement Funds.

	Jackson Creek HUC 050800011808				
Objectives	**Deliverables**	**Quantity of Deliverable**	**Cost**	**Deliverable Units**	**Total Cost**
Streambank & Riparian Restoration	Restore Streambank Using Bio-Engineering and/or By Recontouring or Regrading	100	$ 10,000.00	Linear Feet	$ 1,000,000.00
	Plant Grasses or Prairie Grasses in Riparian Areas	50	$ 411.93	Acre	$ 20,596.50
	Plant Trees or Shrubs in Riparian Areas	8	$ 609.44	Acre	$ 4,875.52
Stream Restoration	Restore Floodplain	0		Linear Feet	
	Restore Stream Channel	0		Linear Feet	
	Install In-Stream Habitat Structures	0		Structure	$ -
	Construct 2-Stage Channel	2000		Linear Feet	
	Install Grade Structures	0		Structure	
	Restore Natural Flow	0		Linear Feet	$ -
Wetland Restoration	Reconstruct and Restore Wetlands	10		Acre	
Dam Modification or Removal	Remove Dams	0		Dams	
	Modify Dams	0		Dams	
	Restore Natural Flow	0		Acre	
	Restore Natural Floodplain Function	0		Acre	
Conservation Easements	Acquire Riparian Conservation Easements	0	$ 2,000.00	Acre	$ -
	Acquire Wetland Conservation Easements	0	$ 2,000.00	Acre	$ -
Home Sewage Treatment Systems	Inspect HSTS	75	$ 90.00	Inspections	$ 6,750.00
	Repair or Replace Traditional HSTS	25	$ 6,000.00	HSTS	$ 150,000.00
	Repair or Replace Alternative HSTS	0	$ 9,000.00	HSTS	$ -
Agricultural Best Management Practices	Plant Cover/Manure Crops	600		Acre	
	Develop Nutrient Management Plans	2	$ 2,766.00	Each	$ 5,532.00
	Implement Conservation Tillage Practices	400	$ 15.02	Acre	$ 6,008.00
	Install Alternative Water Supplies	1	$ 1,634.30	Each	$ 1,634.30
	Install Erosion & Sediment Control Structures	2	$ 4.13	SQ FT	$ 8.26
	Install Grassed Waterways	40	$ 5,446.00	Acre	$ 217,840.00
	Install Livestock Crossings	0	$ 3.26	SQ FT	$ -
	Install Heavy Use Feeding Pads	4	$ 1.47	SQ FT	$ 5.88
	Install Livestock Exclusion Fencing	1800	$ 0.51	Linear Feet	$ 918.00
	Construct Animal Waste Storage Structures	2	$ 2.07	CU FT	$ 4.14
	Conduct Soil Testing	1000	$ 24.81	Acre	$ 24,810.00
	Execute Installer Contracts	10		Each	$ 10.00
Education and Outreach	Develop Brochures/Fact Sheets	5		Brochures/Sheets	$ 5.00
	Develop Press Releases	1		Releases	$ 1.00
	Install Signs	5		Signs	$ 5.00
	Conduct Tours	5		Tours	$ 5.00
	Conduct Stream Clean-Ups	5		Clean-Ups	$ 5.00
	Stencil Storm Drains	0		Drains	$ -
	Deliver On-Site Technical Assistance	10		Site Visits	$ 10.00
Monitoring	Conduct Chemical Sampling	5		Sites	$ 5.00
	Conduct Macroinvertebrate (ICI) Sampling	5		Sites	$ 5.00
	Conduct Fish (IBI) Sampling	5		Sites	$ 5.00
	Conduct Habitat (QHEI) Sampling	5		Sites	$ 5.00
	Conduct Nitrate Sampling (Water)	50		Samples	$ 50.00
	Conduct Nitrate Sampling (Soil)	50		Samples	$ 50.00
	Prepare and Submit Final Report and Data	1		Report	$ 1.00

WATER RESOURCE QUALITY

Fish Habitat

Limiting Factors: Fish habitat has declined over space and time in the Mad River watershed. Sustained trout productivity requires a network of complex and interconnected habitats, which are created, altered and maintained by natural physical processes in freshwater. These diverse habitats are crucial for trout spawning, rearing, maintenance of food webs, and predator avoidance.

High-quality fish habitats have common components which can be described and/or measured, i.e.: water quality, water quantity, habitat access, and a number of habitat elements. Habitat components are affected by both natural and man-caused events. When a habitat component falls below a certain benchmark level, it may become a limiting factor on fish production. For the trout fishery to increase, these limiting factors must be identified and addressed where they occur.

Water Quality

The condition and availability of water in the Mad River basin is impacted by both natural and human causes. Inversely, water quality and quantity affect both the natural and human environments as the cycle goes full circle.

On June 14, 2009, the Madmen Chapter of Trout Unlimited (TU) conducted a stream cleanup with effort concentrated mainly around bridges. Volunteers were mainly made up of TU and Central Ohio Flyfishers (COFF) members with one local citizen from the Kaiser Lake area. The group collected 15 bags of trash, covering an area from West Liberty downstream to St. Rt. 55, with the bulk of it coming from the St Rt 29/296, St Rt 36 and St Rt 55 bridge areas.

TU member Tom Allen expressed concern for the river areas canvassed during the cleanup. "Of more immediate concern is the observed condition of the stream. Stream flow is very low for this time of year and the algae bloom is tremendous. In over 40 years of involvement with Mad River I have never witnessed algae in the river as thick as it is now."

Water quality studies conducted by the Clark County Combined Health District have indicated that residential drinking wells become infiltrated with surface water causing bacterial contamination and elevated nitrate levels. The City of Springfield's well field is listed as a Source Water Protection Area and is another area where ground and surface water interact due to large amounts of sand and gravel deposits. As Ohio EPA studies have indicated that several volatile organic compounds have been detected in the City of Urbana's well field, City of Springfield officials have been prompted to increase and expand groundwater-monitoring programs.

In other areas of the watershed, and specifically in the City of Springfield's Wellhead Protection/Source Water Protection Area, ground and surface water have close interactions due to large amounts of sand and gravel deposits. Recharge to the well field is largely induced by infiltration from the Mad River and Moore Run. Other studies conducted by Ohio EPA have indicated that several volatile organic compounds have been detected in the City of Urbana's well field. The City of Springfield's Water Treatment Plant has great concern with this plume of pollution reaching the city's drinking water supply.

Abundant, clean, water is necessary for drinking, irrigation, and recreation (some water-contact recreation includes fishing, swimming, boating, scenic values, camping, and recreational mining). Good water quality is also necessary to sustain instream fisheries.

Water quality standards, as defined by the Clean Water Act, have two elements. the beneficial use being protected the specific "water quality criteria" or benchmark, which represents the quality of water that supports a particular use.

Beneficial Uses: Fish passages, trout spawning and rearing, and resident fish and aquatic life are often the most sensitive of the beneficial uses. For example, juvenile fingerlings are extremely sensitive to elevated temperature regime during their life cycles.

Water Quality Criteria

Low Dissolved Oxygen Levels: Dissolved oxygen (DO) is important for maintaining a healthy and balanced distribution of aquatic life, and was one of the earliest measures chosen for protecting water quality. Trout species are some of the most sensitive beneficial use affected by DO concentration. In particular, the juvenile stage of trout is sensitive to even a light reduction in oxygen during emergence from gravel spawning beds.

Organic material held in fine sediments results in an elevated sediment oxygen demand. Oxygen carried in the water is absorbed by this organic material and leaves water low in dissolved oxygen. As water temperatures increase, water holds even less oxygen. Point sources of organic materials include sewage treatment plants, other permitted National Pollution Discharge Elimination System Sites (NPDES), and Confined Animal Feeding Operations (CAFO). Examples on non-point sources of organic material include inchannel livestock watering and improperly maintain septic tanks and drainfields.

Oil and Toxins: Toxic substance concentrations (or combinations) may be harmful, or may chemically change to harmful forms in the environment. They may also accumulate in sediments or bio-accumulate in aquatic life or wildlife to levels that adversely affect public health, safety, or welfare; aquatic life; wildlife; or other beneficial uses.

Sediment/Turbidity: High sediment loads fill pool habitat, cover spawning gravels, and entrain organic material reducing inter-gravel dissolved oxygen. Sediment deposition can result in temporary barriers to upstream adult migration, losses in deep water habitat, and elevated temperatures. Extreme turbidity events can result in gill abrasion and subsequent chronic effects on fish.

Temperature: Aquatic life is the beneficial use most sensitive to water temperature. Trout fishes, and some amphibians appear to be the most temperature-sensitive species. It is assumed that if summertime temperatures are maintained within recommended limits, cooler temperatures will be maintained for spawning, egg incubation and development during late fall, winter and spring as well.

Stream temperature is measured as the 7-day moving average of the daily maximum temperatures. If there is insufficient data to establish a 7-day average of maximum temperatures, the numeric criteria is applied as an instantaneous maximum.

Habitat Access

Human Caused Limitations: Several man-made fish migration barriers exist in the Mad River. Culverts and dams are the best examples, they can prevent fish access due to steepness, velocity, or inaccessibility. The result is a loss of viable instream habitat. This is especially true of the dammed area south of SR 36.

Culverts: Some road culverts act as fish passage barriers and result in a direct loss of access to viable instream habitat. Some road culverts act as partial barriers.

Dams and Diversions: Three small dams and diversions exist in the watershed. The WAP will work with the Various Trout and Fly Fishing Clubs to use stream habitat surveys to identify these and take appropriate action.

Natural Limitations: Log jams and falls are naturally occurring features of high gradient stream reaches, and develop and dissipate often as a result of flood events. The ice storm from January 2005 caused severe damage in the upper reaches of the Mad River in Logan County. Numerous log jams have been reported in this area.

Habitat Elements

Substrate: Gravel can be available in a stream, but have relatively low amounts located appropriately for spawning. Streams deficient in wood or boulder structure often experience gravel transport to non-spawning areas.

Large Wood Debris: Removal of large woody debris and boulders entrained in the riparian and river system began in the late 1800's and early 1900's. Where these actions took place, the removal of structure has resulted in significant losses of instream habitat during elevate flow events, loss of sediment and gravel deposition areas, and the loss of channel diversity and deep water pool habitat.

Historical Impacts on habitat components: The cumulative impacts of natural events and human activities have changed the fish habitat resulting in the decline of many fish populations in the Mad River watershed. Natural events can have short- and long-term effects on freshwater habitats. Examples of natural events include: short-term droughts and floods; as well as long-term trends of cooling, warming, low rainfall, high rainfall, etc. Human activities such as fishing, artificial propagation, alteration of habitats have also impacted the fishery.

Contemporary habitats in the Mad River are often characterized by a combination of the following conditions which have altered flows and flushing action; affecting wildlife and aquatic habitat: stream channels generally lack complexity insufficient large wood is present in stream channels water temperatures are higher in some areas because riparian vegetation has been reduced and channel depth has decreased due to sedimentation (increased W:D ratio) summer flows are lower in some areas because less water is retained in upriver areas.

Stream Bank Conditions: Early historical accounts identified the Mad River as a meandering river. Although streambank erosion is often observed in meandering systems, currently stream channels are severely eroding in portions of the Mad River. Long-term land uses have changed the composition and amount of riparian vegetation, resulting in the degradation of stream corridors and channel banks. This is apparent in the stream channel South of SR 55. Modification of waterways, including channelization and dredging, increased peak flows and sedimentation.

Floodplain Connectivity: Two factors were prominent in the loss of functioning wetlands: human disturbances that have impacted the meandering of tributary streams of the Mad River (channelization) flood control measures implemented in recent decades.

The main stem of the Mad River remains connected to historic floodplains and floods yearly, although the connectivity is somewhat affected by diking as a result of roads, power lines, and, less frequently, agricultural activities. However, many tributary floodplains have been disconnected and are no longer functioning in flood events (e.g., 10, 25, 50, 100 year storm events). This loss of connectivity to floodplains and wetland areas has resulted in accelerated sedimentation into tributary stream channels, decreasing the natural application of sediments to wetland areas through flood events. As a result, the agricultural community continues to invest in the removal and disposal of accumulated sediments. This is apparent in the Mad River, West of SR 68 and South of West Liberty.

Many systems have been channelized in order to remove meanders and maximize agricultural production. Drainage ditches are other alterations that were employed for flood control.

Habitat Recommendations

No sustained fishery is possible without healthy habitat. Forests, rangeland, rivers, and fish have the internal capacity to recover from major disturbances. The principal role for people in the recovery of habitat is not to interfere in the natural recovery process, but to control their own behavior in a way that lets natural recovery take place. In other words, there is a strong need for the practice of stewardship that encourages the natural healing process.

Stream Characteristics: For projects to be successful, we must work within the constraints of the physical properties of the streams and adjacent landscapes. Within the Mad River watershed, stream reaches can be described by geomorphic characterization of channel forms and processes. This characterization is a useful way to group streams since those which have similar forms and processes are likely to respond to management and restoration in a similar manner.

Activities by limiting factors: Actions to conserve, restore, and sustain trout must be worked out by communities and landowners, with local knowledge of problems and ownership in solutions. The various fishing clubs are an important local partner in the grassroots effort for accomplishing the work done on private land and coordinating, where appropriate, with federally, state and local funded projects occurring on public lands in upper watershed areas.

The Mad River Watershed Strategic Plan (WSP) has the following objectives in project implementation:

1. **To promote stewardship through public involvement.** Many of the proposed restoration components will encourage ongoing landowner maintenance. Restoration projects implemented on private lands allow landowners to become aware of environmental concerns and possible restoration prescriptions. In addition, volunteers will be utilized for re-treatment of plantings as necessary. All educational opportunities will be maximized.

2. **To act quickly to accomplish restoration tasks and demonstrate success within the community.** Demonstrate to the community that this is an action orientated organization. The WSP will work with private land managers to develop site specific management proposals to implement restoration activities in sub-watersheds. The fishing clubs will strive for on-the-ground restoration based on sound planning.

Landfills

General History of Urbana Landfill

The closed Urbana Landfill is on the northeast side of the city, south of Children's Home Road, in Champaign County, Ohio. The landfill consists of 47.5 acres, approximately two-thirds of which has been used for solid waste disposal. Operations began in 1953, receiving solid municipal, commercial and non-hazardous wastes. Municipal wastes included household refuse, street sweepings, leaves and miscellaneous debris.

Commercial wastes included wood, paper and cardboard. Industrial wastes were restricted to solid non-hazardous materials. Little information is available on the quantity of waste received prior to 1980, however, approximately 1,800 to 2,000 cubic yards per month of solid wastes were disposed at the landfill over the last eight years of operation.

The landfill stopped receiving solid wastes on December 31, 1987 and the City of Urbana began closing the landfill in 1988. The landfill was a trench-and-fill operation, with wastes placed and compacted in trenches 15 to 25 feet deep by 20 feet wide. The compacted wastes were covered with excavated soils on a daily basis. The landfill surface is moderately flat and slopes to the west. The landfill has been graded and a well-established vegetative cover is present over the site. Generally, drainage from the landfill is to the west.

The Geoprobe sampling results were submitted to the Ohio Environmental Protection Agency (OEPA) in the August 29, 2000 Third Quarter Assessment Activity Report and the March 30, 2001 First Quarter Assessment Activity Report.

To indicate the extent and concentration of waste-derived constituents in ground water at the closed landfill, isoconcentration maps of specific waste-derived constituents were produced from ground-water quality data collected during the April 2004 sampling event. Isocentration contour maps for the inorganic analytes ammonia, arsenic, barium, chloride, nickel, potassium, and sodium and for the volatile organic compounds 1,1,1 dichloromethane, 1,1-dichloromethane, chloromethane, cis-1,2-dichloroethylene and vinyl chloride were produced from ground-water quality data collected in April 2004 as part of the assessment activities at the landfill. These compounds and analytes were selected because at some wells their concentrations were greater than the tolerance limits that were calculated as part of the statistical analysis of the data. To provide an overall indication of the amount of volatile organic compound (VOC) contamination in the ground water at the landfill, a map was produced that tabulates the VOC concentrations detected at each well where VOC's were detected.

A ground-water monitoring program has been designed to assess the effectiveness of the corrective measures at the Urbana Landfill and to evaluation the water quality trends for VOC's and selected inorganic constituents. This program varies from the current groundwater quality assessment program relative to the proposed monitoring wells in the network and the recommended compound/analyte list.

Point Sources

The Mad River Watershed Strategic Plan encourages all jurisdictions and facilities with National Pollution Discharge Elimination Systems (NPDES) Permits with Ohio EPA to comply with the permit in accordance with the Clean Water Act. Open discussions with facilities and periodic review of compliance status by the Ohio EPA is encouraged.

Upper Mad River Watershed Point Sources

Chemical Sediment Quality:

Sediment quality was evaluated at eight sites in WAU 05080001-160. Two of the sites were on the Mad River and six were on the tributaries. Mainstem sediment results were below any Ohio Sediment Reference Value Guidelines used to evaluate sediment metals. Sediment arsenic at Mad River RM 39.89 was between the MacDonald TEC and PEC, but below the Ohio SRV of 18 mg/kg. Sediments between the MacDonald TEC and PEC indicate that adverse benthic effects should frequently occur, but Ohio's sediment is naturally higher in arsenic and not considered to adversely affect benthic organisms at concentrations below the Ohio SRV. The only organic chemical detected in one of the two mainstem sites was the laboratory contaminant acetone.

Two tributary samples reflected contamination from urban influences and wastewater discharges. Results from three of the tributary sites were below any sediment guidelines used to evaluate metals and organic samples. All six tributary sites had sediment particle size below the goal of 30% fine grain material (FGM).

Dugan Run (RM 0.95) drains the City of Urbana which has considerable industrial land use and runoff. In addition to stormwater runoff, it appears that dumping of industrial and solid waste has occurred near RM 0.95. The sampling location is next to Muzzy Road and provides easy access to Dugan Rd.

Results form Dugan Run revealed the sediments mercury, zinc, copper and lead concentrations are above the Ohio Sediment Reference guidelines. Lead was above the MacDonald Probable Effect Concentration range, indicating that adverse effects to benthic organisms usually or always occur. Copper, mercury, and zinc were between the Mac Donald Threshold Effect Concentration (TEC) and the Probable Effect Concentration (PEC), meaning adverse effects to benthic organisms frequently occur.

Sediment arsenic was between the MacDonald TEC and PEC, but below the Ohio SRV of 18 mg/kg and not considered to adversely affect benthic organisms.

Dugan Run was also contaminated with organic chemicals. Eleven different Polycyclic Aromatic Hydrocarbons (PAH) compounds were detected at a total level (37.26 mg/k total PAH) exceeding the MacDonald Probable Effect Concentration range, indicating that adverse effects to benthic organisms usually or always occur. Six of the eleven PAH compounds were individually over the MacDonald PEC. Total chlordane (0.0207 mg/kg) exceeded the

MacDonald PEC. Total Polychlorinated Biphenyls (0.2997 mg/kg) were detected between the MacDonald TEC and PEC.

The St. Paris tributary (RM 2.64), a tributary to Nettle Creek, is downstream from the outfall for the St. Paris WWTP. Concentrations of lead and zinc were over the Ohio Sediment reference Guidelines (SRVs) and between the MacDonald TEC and PEC. Results from the St. Paris tributary sediments detected ten different PAH compounds (17.04 mg/kg total). Five of the ten PAH compounds were individually over the MacDonald PEC. The lab contaminant acetone was also detected at 0.11 mg/kg. Spring Run (RM 0.62) at Woodville Pike was the only site in the watershed to have sediment ammonia levels (160 mg/kg) over the Ontario sediment disposal guideline (100 mg/kg). This site is far away form any development and in the middle of flat farmland. Runoff from farm practices into Spring Run may be one potential source of ammonia.
-2003 Mad River Basin TSD

Mad River/Nettle Creek Watershed Assessment Unit (WA 05080001 160):

The Mad River/Nettle Creek watershed assessment unit encompasses 98,167 acres (153.4 mi2) in Champaign and Clark counties. It includes the Mad River mainstem downstream from the confluence of Kings Creek (RM 43.82) to the confluence of Chapman Creek at RM 32.58. Tributaries of the Mad River in the assessment unit include Muddy Creek (drainage area 22.9 mi2), confluence RM 39.43), Nettle Creek (drainage area 46.2 mi mi2, confluence RM 37.18). Stony Creek (drainage area 1.7 mi2, confluence RM 35.05), Storms Creek (drainage area 9.26 mi2, confluence RM 33.90), and Chapman Creek (drainage area 24.4 mi2, confluence RM 32.58). Additionally, Anderson Creek enters Nettle Creek at RM 0.20 and drains 17.7 mi2.

Row crop agriculture and pasture/hay account for 67.5% and 19%, respectively, of the total land use in this watershed assessment unit (Figure 17) (University of Cincinnati, 2001). Nine percent is covered by deciduous forest.

The City of Urbana and the communities of St. Paris and Tremont City (unsewered) are the largest communities in this watershed with respective 2000 census populations of 11613, 1998, and 349, respectively. Effluent from the largest discharger in the assessment unit, the City of Urbana WWTP, enters the Mad River mainstem at RM 39.15. Four facilities discharge in the Dugan Run watershed. International Fiber Corporation discharges noncontact cooling water at RM 1.54. Orbis Corporation discharges noncontact cooling water and stormwater to Dugan Run at RM 1.84 and has two additional stormwater outfalls. Johnson Welded Products discharges noncontact cooling water at RM 0.21 to a tributary entering Dugan Run at RM 1.75 while the Fox River Paper Company discharges noncontact cooling water and stormwater at approximately RM 0.16 to an unnamed tributary entering Dugan Run near RM 2.26. Graham High School discharges at RM 1.2 to an unnamed tributary entering Nettle Creek at RM 6.67. The Village of St. Paris WWTP discharges at RM 2.65 to the St. Paris tributary. Stony Creek receives the discharge from the Lakewood Swim Club at RM 0.85. Valley View MHP currently discharges wastewater to dry wells in the Bogles Run watershed and is under a schedule of compliance requiring wastewater improvements. Urbana Local Elementary School discharges to an intermittent tributary of Bogles Run via a field tile. Graham South Elementary School discharges at RM 10.40 on Chapman Creek.

Lower Mad River Watershed Point Sources

Sinking Creek:

Point source discharges, like Brookside Village and Northeastern High School, do outfall into Sinking Creek, but are under Ohio EPA jurisdiction. However, these discharges do have a negative impact on water quality.

Beaver Creek:

Several smaller wastewater treatment plants exist in the watershed. Beaver Valley Resort & Campground, Tomorrow's Stars R.V. Park, Harmony Estates Mobile Home Park (MHP), and Bridgewood MHP. Although EPA monitors effluent from these point sources of pollution, they are still contributing to water quality degradation.

Moore Run:

The Moore Run watershed also has several industries, such as International Harvester Truck and Engine and the KTK Industrial park, that are present along Old State Route 68/Urbana Pike.

These areas are known to have many acres of impervious cover with a lack of stormwater retention/detention degrading water quality. Additionally, several point sources discharge into Moore Run from wastewater treatment plants and cooling water from industrial processes.

Buck Creek below Beaver Creek to Mad River:

Municipal and industrial land uses dominant this sub-watershed. In the past, Buck Creek was the heart of Springfield's industry. Companies like International Harvester and Crowell-Collier publishing were located here to utilize Buck Creek as a source of water and discharge for industrial processes. Many of these industrial sites have set empty or been demolished, with impervious ground surface still in existence.

In this area, the City of Springfield's sewer and stormwater system are combined. The result of this infrastructure leads to stormwater that is polluted with raw sewage and urban run-off entering Buck Creek. Springfield has 57 active combined sewer outfalls (CSO's) that can enter Buck Creek following a 0.25-inch rainfall event. Springfield has conducted studies to identify these CSO points and come up with a long-range plan to rectify the situation.

Mad River below Buck Creek to above Donnels Creek:

This sub-watershed is also has several mobile home parks that utilize both private well water and waste water treatment systems. Stressors on water quality can be seen from the many point source discharges of these facilities that outlet into small tributaries that drain to the Mad River. Ohio EPA has regulatory authority of these systems. The Clearview mobile home park was ordered to up grade their waster water treatment system by the Ohio Attorney Generals Office in June 2000.

Compounding water quality degradation from point sources is the City of Springfield's combinedsewer overflow issue. The City's wastewater treatment system outfall is located in this subwatershed and is known as the largest combined sewer over flow point. The wastewater treatment plant was built in 1935 and any upgrades have been made to rectify this situation. Currently, Springfield's wastewater infrastructure is 70% separate sanitary and 30% combined sewer. The City of Springfield working with several local stakeholders are developing a longrange plan to combat the problems of combined sewer overflow.

Rock Run:

Point sources of pollution can also be seen as threatening water quality. With several mobilehome parks and apartment complexes being located in this area, discharge of treated effluent from these areas is under regulatory jurisdiction of Ohio EPA.

Mad River below Donnels Creek to above Mud Run:

Point sources of pollution can also be seen as threatening water quality. The Clark County Southwest Waste Water Treatment Plant collects and treats waste from Park Layne, Crystal Lakes and Enon. Due to the close proximity of homes and soil types that have high percolation rates, a sanitary sewer system was essential for the area. Many other problematic areas will eventually be brought on to this system via sewer line extension projects. Many of the mobile home parks operating an on site treatment system will be required to utilize this new infrastructure. Lack of stormwater management from the developed areas is having an affect on water quality. The Village of Enon and community of Park Layne are urbanized areas with large amounts of impervious cover. These conventional stormwater systems flow directly into Mud Creek in Park Layne and Smith Ditch in Enon. Due to the age and design of this infrastructure, stormwater has no means of being treated or improved prior to being discharged. Not only does stormwater run off have potential to carry pollutants off the landscape, but also has accelerated flow leading to higher rates of erosion and downstream flooding.

The following is a listing of active Industrial and Municipal NPDES Permits issued by OEPA within the Mad River Watershed.

Facility Name	Type	NPDES Number	Permit Document	Factsheet
A&R Reck Sunset Terrace MHP	Minor	1PV00118		</TD< tr>
Christiansburg Water Works	Minor	1IY00310		</TD< tr>
Graham High School	Minor	1PT00088		</TD< tr>
Harvest Square MHP	Minor	1PV00082		</TD< tr>
International Fiber Corp	Minor	1IH00020	PDF (154 KB)	</TD< tr>
Johnson Welded Products Inc	Minor	1IS00000	PDF (156 KB)	</TD< tr>
Mechanicsburg WWTP	Minor	1PB00037		</TD< tr>
North Lewisburg WWTP	Minor	1PB00039	PDF (56 KB)	</TD< tr>
Orbis Corp Div of Menashu Corp	Minor	1IN00093	PDF (154 KB)	</TD< tr>
Rolling Hills MHP STP	Minor	1PV00047		</TD< tr>

Saint Paris WWTP	Minor	1PB00029	PDF (93 KB)	</TD< tr>
Spring Meadows Care Center	Minor	1PX00047		</TD< tr>
Triad Local Sch WWTP	Minor	1PT00099		</TD< tr>
Urbana Local Elem Sch	Minor	1PT00100		</TD< tr>
Urbana WPCF	Major	1PD00011	PDF (50 KB)	PDF (264 KB)
Urbana WTP	Minor	1IY00300	PDF (68 KB)	</TD< tr>
Valley View MHP	Minor	1PY00002		</TD< tr>
West Liberty Salem School	Minor	1PT00066		</TD< tr>
West Liberty STP	Minor	1PC00012	PDF (96 KB)	
Beaver Valley Resorts	Minor	1PX00042	PDF (76 KB)	</TD< tr>
BP Springfield Bulk Plant	Minor	1IN00256	PDF (25 KB)	</TD< tr>

Bridgewood MHP	Minor	1PV00112		</TD< tr>
Brookside Village MHP	Minor	1PV00097		</TD< tr>
Buckeye Resources Inc	Minor	1IN00283	PDF (69 KB)	</TD< tr>
C & S Tree Recycling Service	Minor	1PX00056	PDF (68 KB)	</TD< tr>
Cascade Corp	Minor	1IS00020	PDF (161 KB)	</TD< tr>
Catawba SD	Minor	1PA00020		</TD< tr>
Chateau Estates MHP	Minor	1PV00056		</TD< tr>
Edgewood MHP	Minor	1PV00100		</TD< tr>
Enon Heights MHP	Minor	1PV00106		</TD< tr>
Enon Sand and Gravel LLC	Minor	1IJ00062	PDF (16 KB)	</TD< tr>
Enon WTP	Minor	1IX00032		</TD< tr>

Fairborn Sand & Gravel	Minor	1IJ00026	PDF (18 KB)	</TD< tr>
Fuel Mart No 764	Minor	1PZ00092		</TD< tr>
Greenon HS	Minor	1PT00014		</TD< tr>
Harmony Estates MHP	Minor	1PV00007		</TD< tr>
Hustead Elem Sch	Minor	1PT00069		</TD< tr>
KTK Industrial Park WWTP	Minor	1PZ00003		</TD< tr>
Moyno Inc	Minor	1IS00019		</TD< tr>
Navistar Inc - SAP	Major	1IN00022	PDF (79 KB)	PDF (1772 KB)
Northeastern HS	Minor	1PT00033	PDF (72 KB)	</TD< tr>
OS Kelly Co Compressed Metallurgical Products	Minor	1IS00023		</TD< tr>
Pleasant Valley Est MHP	Minor	1PV00105		</TD< tr>

Possum Primary and Middle School	Minor	1PT00121	PDF (28 KB)	</TD< tr>
Reid Primary Middle School	Minor	1PT00120	PDF (28 KB)	</TD< tr>
Rockway Primary Middle School	Minor	1PT00118		</TD< tr>
Rolling Terrace MHP	Minor	1PV00058		</TD< tr>
South Vienna STP	Minor	1PA00021		</TD< tr>
Southwest WWTP	Major	1PK00013	PDF (54 KB)	PDF (175 KB)
Springfield Beckley Municipal Airport	Minor	1PS00009		</TD< tr>
Springfield Waste Water Treatment	Major	1PE00007	PDF (278 KB)	PDF (356 KB)
Tech II Inc	Minor	1IQ00017	PDF (73 KB)	</TD< tr>
Tecumseh Court MHP	Minor	1PV00126		</TD< tr>
Tomorrows Stars Resort Inc	Minor	1PX00043	PDF (79 KB)	</TD< tr>

Habitat Improvement

In stream and riparian habitat improvement are critical components of any surface and ground water resource protection program. Typical examples of the effects of habitat alteration include loss of stream side (riparian) vegetation, sedimentation, smothering of bottom dwelling creatures and increased surface water temperature.

Riparian habitat, to a large extent, can be reduce the amount of contaminants is important to the health of the water body, its residents (aquatic species) and human recreational users. Numerous BMP's exist that are designed to improve in stream riparian habitat. Programs of this nature are needed throughout the Mad River Watershed.

Stream Habitats:
The Parts Equal the Whole

by Greg Nageotte, NPS Coordinator,
ODNR Division of Soil and Water Conservation

Overview of Stream Habitat:

A healthy stream is a busy place. Wildlife finds shelter and food near and in its waters. Vegetation grows along its banks, shading the stream and filtering pollutants before they enter the stream. Within the stream itself are fish, insects and other tiny creatures with specific needs: dissolved oxygen to breathe; rocks, overhanging tree limbs, logs, and roots for shelter; vegetation and other tiny animals to eat; and special places to breed and hatch their young. For any of these activities, they might also need water of specific velocity, depth, and temperature. Many land-use activities can alter these characteristics, causing problems with the entire habitat.

Riparian Zone - Land between the water's edge and the upper edge of the flood plain; transition zone between water and land: Trees, bushes, shrubs and tall grasses that help buffer the stream from polluted runoff, and create habitat for fish and wildlife characterize the healthy riparian zone. These plants also provide stream shading (or overhead canopy) and serve several important functions in the stream habitat. The canopy helps keep water temperatures cool by shading it from the sun, while offering protection and refuge for animals.

The shape and condition of the stream channel can give many clues to the types of land uses in the adjacent watershed. For example, sometimes too much water flooding the stream in a short time will alter the channel, and the channel can become disconnected from its floodplain. This may indicate a nearby urban area with many impervious surfaces, so the rain or melting snow cannot naturally soak into the ground. Large volumes of runoff then flood the nearest stream with too much water. This often results in distortion of the stream channel until the channel is cut off from its floodplain, which would normally dissipate the water's erosive force and trap sediment. A channel disconnected from an active floodplain represents a stream severely out of balance with its watershed.

The flow of water naturally sculpts the stream's shape. A mixture of flows and depths creates a variety of habitats to support fish and invertebrate life.

- Pools are deep with slow water.
- Riffles are shallow with fast, turbulent water running over rocks.
- Runs are deep with fast-moving water with little or turbulence.

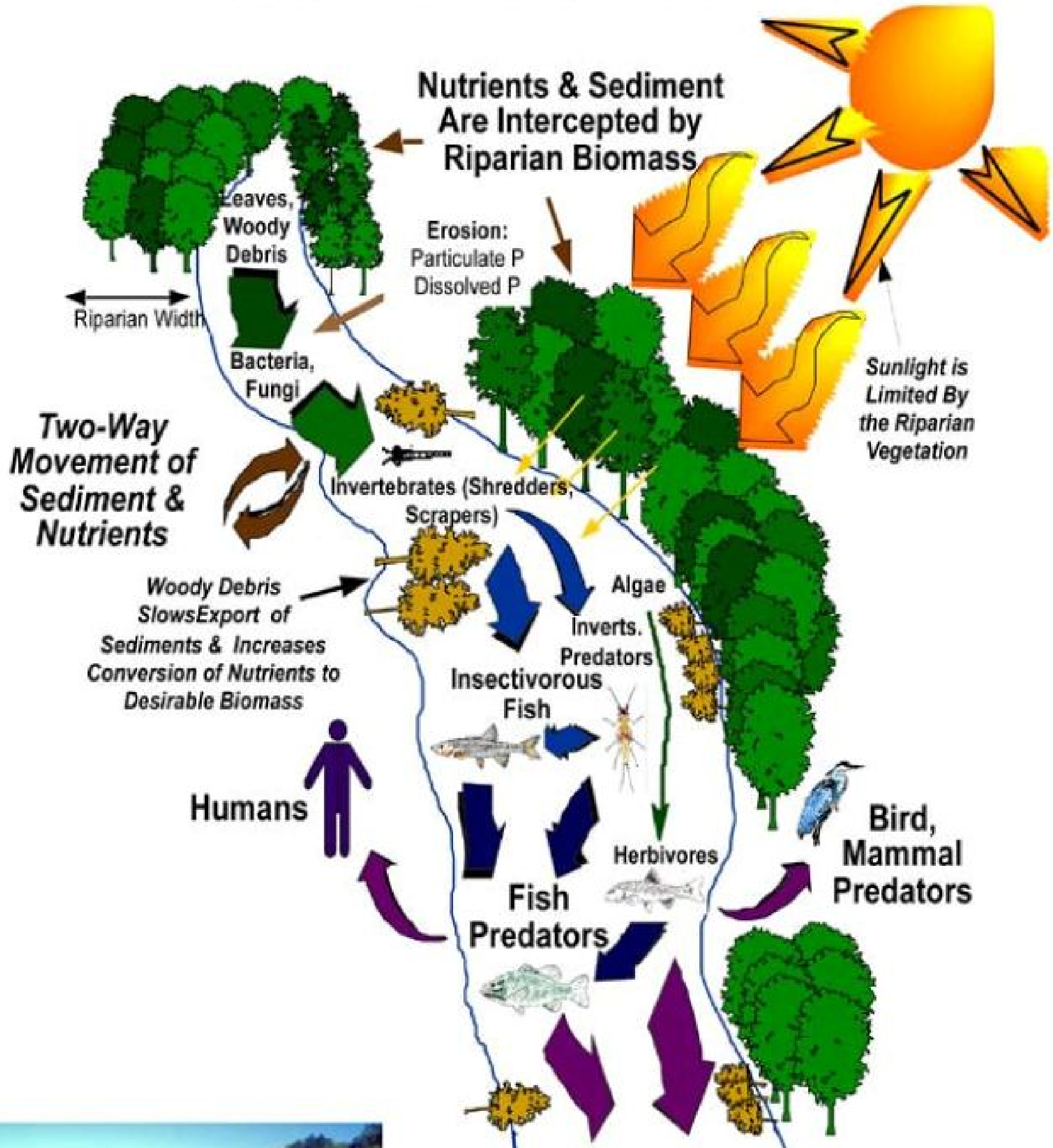
Stream velocity influences the health, variety, and abundance of aquatic animals. If water flows too quickly, some organisms might be unable to maintain their hold on rocks and vegetation and be flushed downstream; if water flows too slowly, oxygen diffusion is insufficient for species needing high levels of dissolved oxygen. Dams, channelization or straightening out the stream's natural bends (sinuosity), certain kinds of terrain, runoff, and other factors can affect stream velocity.

Stream banks:

Poor stream bank conditions can include the loss of natural plant cover. Erosion can occur when streamside vegetation is trampled or missing or has been replaced by poorly designed landscaping or pavement. More severe cases of stream bank erosion include washed away banks or banks that have collapsed. Excessive mud or silt entering the stream from erosion can distort the stream channel, interfere with beneficial plan growth, dissolved oxygen levels and the ability of fish to sight prey. Siltation can clog fish gills and smother fish eggs in spawning areas. Often it is the result of eroding stream banks, poor construction site practices, urban area runoff, silviculture (forestry practices) or ditches that drain the surrounding landscape.

Stream Bottoms - Substrate:
Stream bottoms (substrate) are classified according to the comprising material. Rocky bottom streams are defined as those made up of gravel, cobbles and boulders in any combination. They usually have definite riffle areas. Soft bottom streams have naturally muddy, silty or sandy bottoms that lack riffles. Usually, these are slow-moving, log gradient streams.

Good Stream Habitat



Major Downstream Exports:

I. Desirable Biomass (*e.g.,* fish, plants, birds, mammals, sensitive species)

II. Low Sediment Delivery

III. Water Quality Suitable for ALL Uses

Embeddedness is the extent to which rocks, are buried by silt, sand, or mud on the stream bottom. Generally the more embedded rocks, the less rock surface or space between rocks available for aquatic macroinvertebrate habitat for fish spawning. Excessive silty runoff from erosion can increase a stream's embeddedness.

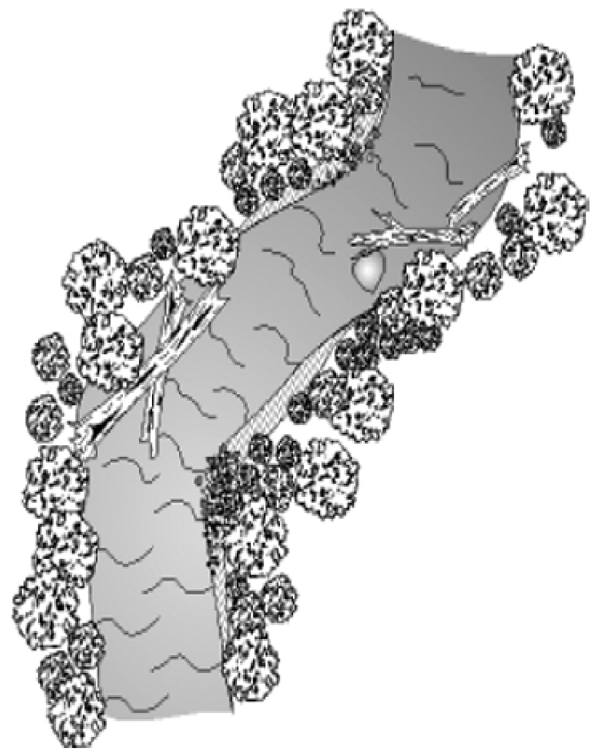
Large Woody Debris (LWD)- branches, stumps, logs and logjams:

Almost all LWD in streams is derived from trees located in the riparian corridor. Streams affected by urbanization, agriculture, development, or clear cuts often lack a sufficient quantity of the LWD necessary to maintain an ecologically healthy and stable ecosystem.

Streams with adequate LWD tend to have greater habitat diversity, a natural meandering shape and greater resistance against high water events. Therefore, LWD is an essential component of a healthy stream's ecology and is beneficial.

LWD is an important component of high quality streams that helps increase the diversity of biological communities and physical habitats. Certain species of fish depend on the wood in the streams to survive.

All these habitat components work together to form a complete stream ecosystem, and when any one of them is disturbed, the communities of life within the stream will change to reflect the problem. Drastic changes in a watershed or to the stream itself are most detrimental, and recovery can take decades if at all. Streams with healthy habitats are more resilient to disturbances, are self-maintaining, and provide a broader range of valuable functions and services for people and wildlife.



Sources:

- University of Wisconsin Extension, "Water Action Volunteers-Volunteer Monitoring Factsheet Series."
- ODNR Division of Water, Guide 21, *Large Woody Debris in Streams*
- Oxbow River & Stream Restoration, Inc. Web

IMPLEMENTATION

Best Management Practices

The effects of human use of the land on surface and ground water quality can be considerable. Agriculture, including livestock and row crop production, can contribute excessive amounts of contaminates such as nutrients (including Nitrate and phosphorus), pesticides, sediments, and pathogens (such as fecal coli form bacteria, viruses and protozoan) to surface and ground water resources. Other human activities contribute to water resource quality degradation including improperly treated waste water from wastewater treatment plants, injection of wastewater into underground injection wells, poorly installed or maintained sanitary sewage disposal systems and storm water run-off from construction sites and impervious surfaces (such as rooftops, paved streets and parking lots). Best Management practices (BMP's) programs are needed to help watershed residents and landowners reduce their impacts on surface and ground water resource quality.

Champaign and Logan Counties (Upper Mad River Watershed)

BMP -Nitrogen Reduction

The ongoing project that could show great water quality improvement is the Nitrate Reduction Project. The program included a best management practice net returns performance warranty in the Kings Creek watershed, a tributary of the Mad River. The program enticed operators to adopt OSU Extension's tri-state N recommendations, which suggest applying less N than most operators typically apply. The intension was that this project would convince operators that in most cases N application at the recommended rate would not significantly reduce corn yields, but actually save money on fertilizer purchase, and can help reduce nitrate pollution in the groundwater. The N reduction program protected the operator who was skeptical of applying less N by guaranteeing the net returns of the crop. Program participants applied N to their enrolled crop acres following OSU's recommended rates, but also plant a check strip utilizing their normal N application rates. OSU then compared yields of the two areas at the end of the growing season. OSU Extension through a guarantee with AgFlex Inc. compensated cooperators for loss of income if the tri-state N recommended rate yields a lower net return than the higher N rate.

After four growing seasons, the program results generally show that the Tri-State Recommendations are correct and if followed do reduce nitrogen rates and maintain economic returns. However in all growing seasons, the farmer N rate grain yields actually exceeded that of the Tri-State N recommended rate yields. But when the economics are attached and the cost of the additional nitrogen applied is subtracted from the additional yield then in only 2004 was there an advantage for the grower to apply the higher than recommended rates. Across the four years, just seven of the 18 sites benefited from additional nitrogen, with four of those situations occurring in 2004 - a year of record high yields. With rising nitrogen prices (see survey below) growers would benefit by reducing their nitrogen rates to the recommended rates to an even greater extent than presented here. For the guarantee program we calculated the advantage (loss) based on values of 20 cents per pound for N for the years 2002, 2003 and 2004 and 25 cents per pound for 2005 – these are all generally below the price paid by most growers.

The following table reflects a four-year summary of results from the Nitrate Reduction Project.

Upper Mad River Nitrogen Reduction Program

year	cooperators	acres	N rate lb/A: Grower N rate	N rate lb/A: Tri-State N rate*	Yield bu/A: Grower N rate	Yield bu/A: Tri-State N rate	corn price	N price/lb	Tri-State Rate N advantage $/A
2002	4	150	194.3	159.3	93.0	92.0	$2.25	0.20	$4.89
2003	3	226	198.5	156.4	176.5	173.1	$2.25	0.20	$0.67
2004	5	256	224.9	159.3	197.2	186.4	$2.50	0.20	$(13.96)
2005	6	300	169.2	145.0	103.5	101.7	$2.20	0.25	$2.04
Four Year Summary			**197**	**155**	**142.6**	**138.3**	**$2.30**	**0.2125**	**$(0.95)**

* The Tri-State nitrogen (N) recommendations are the Best Management Practices (BMP) rate.
from Survey of area Nitrogen Prices
N Price increase over time

$/lb N	2002	2003	2004	2005
NH_3	0.155	0.179	0.247	0.292
28%	0.229	0.254	0.311	0.373

Besides the obvious benefits of implemented objectives, many reminders of the watershed protection project will continue to positively affect the opinions of the local citizens. The project will undoubtedly continue with storm drain stenciling, educational workshops and public outreach. All objectives were very well received and will in some way improve water quality and will help in the process in achieving better water quality for the future.

BMP – Waste Utilization – Manure Press System – Solid/Liquid Separation

Reduce excessive nutrients, pathogens and other negative by-products of animal waste that are detrimental to the water quality of Mad River and its tributaries. The Oakview Genetics, Inc. hog facility will serve as a demonstration site and encourage proper containment and disposal of animal waste and improve aquatic habitat and life.

BMP – Nutrient Management

Reduce excessive nutrients and pathogens that may be running off across crop fields or infiltrating the ground water resource. Manure testing will be completed to determine the amount of N, P, &K in the manure. In conjunction with the manure testing, soil sampling and plant tissue tests will be conducted on acres that manure is applied. The results of these tests will provide fertilizer recommendations to the operator. Manure and fertilizer applications will not exceed the crop uptake for phosphorous.

BMP – Well Testing

Numerous household water supplies in Kings Creek subwatershed have been biologically and chemically tested. Tests identified water quality concerns that pertain to household uses. There is a need to continue testing wells because many of the homes have on site well and sewage systems within close proximity of one another, as well as the higher nitrate concerns within the Kings Creek area. The following data has been collected since 2002 on wells in the Kings Creek Subwatershed HUC 05080001-150/160. The well that tested positive for total coliform were given directions on how to chlorinate a well and then were retested after.

Kingcreek Watershed Well-Test Data					
Address	**Total Coliform**	**E Coli**	**Nitrate (mg/l)**	**Result**	**Date**
2002					
1587 E. Kingscreek Rd.	**positive**	No	0.22	unsafe	11/21/2002
1522 W. St. Rt. 296	**positive**	No	8.05	unsafe	11/21/2002
1638 E. St. Rt. 296	negative	No	<0.1	safe	11/21/2002
6764 N. Ludlow Rd.	**positive**	No	9.00	unsafe	12/5/2002
2834 Kennard Kingscreek Rd.	negative	No	4.45	safe	12/12/2002
2003					
2624 N. U.S. Hwy. 68 (business)	negative	No	0.88	safe	4/3/2003
2624 N. U.S. Hwy. 68 (house)	negative	No	9.40	safe	4/3/2003
2624 N. U.S. Hwy. 68 (mid barn)	negative	No	9.75	safe	4/3/2003
2624 N. U.S. Hwy. 68 (W. end barn)	negative	No	<0.1	safe	4/3/2003
2624 N. U.S. Hwy. 68 (E. end barn)	**positive**	No	<0.1	unsafe	4/3/2003
2004					
967 E Herr Rd	**positive**	no	13.00	unsafe	4/2/2004
1243 E Kingscreek Rd	negative	no	11.80	safe	3/26/2004
1587 E Kingscreek Rd	negative	no	0.18	safe	4/2/2004
1843 W St Rt 29	negative	no	<0.10	safe	4/2/2004
5266 Flatfoot Rd	negative	no	<0.10	safe	4/2/2004
5740 W Kangy Rd	negative	no	11.70	safe	4/2/2004
1165 Kennard Kingscreek Road	negative	no	7.90	safe	4/8/2004
1669 SR 296	negative	no	<0.10	safe	4/8/2004
1805 SR 29	negative	no	<0.10	safe	4/8/2004
1814 SR 29	negative	no	<0.10	safe	4/8/2004
4018 Ludlow Rd	negative	no	<0.10	safe	4/8/2004
4769 Flatfoot Road	negative	no	<0.10	safe	4/8/2004
5011 Game Farm Rd	negative	no	<0.10	safe	4/8/2004
778 W. Herr Rd.	negative	no	<0.10	safe	4/8/2004
2250 Kingscreek Road	negative	no	*13.80*	safe	4/15/2004
2299 SR 29	negative	no	4.50	safe	4/15/2004
2600 Kennard/ Kingscreek Rd.	negative	no	<0.1	safe	4/15/2004
3950 US HWY 68	negative	no	<0.10	safe	4/15/2004
5133 Flatfoot Rd.	negative	no	0.45	safe	4/15/2004
6715 Kanagy Rd	negative	no	9.90	safe	4/15/2004
1667 SR 29	negative	no	4.90	safe	4/22/2004
1675 SR 29	negative	no	7.30	safe	4/22/2004
1815 Sibley Rd.	negative	no	<0.10	safe	4/22/2004
2712 Kennard Kingscreek Rd.	negative	no	7.00	safe	4/22/2004
6074 Game Farm Road	negative	no	<0.10	safe	4/22/2004
6170 Game Farm Rd	negative	no	11.00	safe	4/22/2004
724 SR 296	negative	no	10.50	safe	4/22/2004
2077 SR 29	negative	no	4.75	safe	4/29/2004
2005					
1544 Mennonite Church Road	negative	no	10.60	safe	3/7/2005
1358 Mennonite Church Road	negative	no	4.90	safe	3/4/2005
1843 W. SR 29 Urbana	negative	no	<0.1	safe	3/18/2005
1638 E. SR 296 Urbana	negative	no	0.58	safe	3/18/2005
4861 W. SR 29 Urbana	negative	no	<0.1	safe	3/18/2005
7419 UpperValley Pike, West Liberty	negative	no	3.80	safe	3/25/2005
1458 Kennard Kingcreek Road, Urbana	negative	no	5.00	safe	3/25/2005
4562 Clark Road, Urbana	negative	no	7.00	safe	5/27/2005
2624 N. SR 68, Urbana	negative	no	9.60	safe	5/27/2005
5841 Cedar Creek Road, Urbana	negative	no	3.20	safe	4/29/2005
6911 SR 36 West, St. Paris	negative	no	2.30	safe	4/29/2005
5045 N. SR 68, Urbana	negative	no	<0.1	safe	4/8/2005

135 W. Herr Road			<0.1	safe	7/7/2005
2512 SR 287, West Liberty	negative	no	4.40	safe	5/16/2005
706 CR 5, Zanesfield	positive	no		safe	5/4/2005
6253 SR 55, Urbana			<0.10	safe	7/15/2005

BMP – Stream bank & Shoreline Protection

Reduce sedimentation, nutrients, organic material, pesticides in surface run-off reaching ground water. Improve aquatic habitat and life. Participants must agree to install steam bank stabilization or habitat improvement structure/practiced. The Mad River Steering Committee in cooperation with technical assistance provided by Ohio State University Extension (OSUE), Natural Resource Conservation Service (NRCS) and Soil and Water Conservation District (SWCD) have outlined the selection criteria. Stream bank stabilization/habitat improvements have been implemented based on consistency with natural channel design and habitat principles as defined by ODNR and Ohio EPA. Participant agreed to a Resource Management System.

BMP-Conservation Reserve Program

The Conservation Reserve Program (CRP) is a voluntary program for agricultural landowners. Through CRP, you can receive annual rental payments and cost-share assistance to establish long-term, resource conserving covers on eligible farmland.

The Commodity Credit Corporation (CCC) makes annual rental payments based on the agriculture rental value of the land, and it provides cost-share assistance for up to 50 percent of the participant's costs in establishing approved conservation practices.

Participants enroll in CRP contracts for 10 to 15 years. The program is administered by the CCC through the Farm Service Agency (FSA), and program support is provided by Natural Resources Conservation Service, Cooperative State Research and Education Extension Service, state forestry agencies, and local Soil and Water Conservation Districts.

BMP-Filter Strips

Areas of grass, legumes, and other vegetation that filter runoff and waste water by trapping sediment, pesticides, organic matter, and other pollutants. Filter strips are planted on cropland at the lower edge of a field, or adjacent to bodies of water.

Filter strips are designed and managed to promote uniform depth of flow though the strip. The width and type of vegetation established in the filter area are determined by site conditions including soil type, land slope, and type of runoff entering the filter. Technical standards are set by the Natural Resources Conservation Service. Shelter belts, windbreaks, and snow fences must be planted so as to reach full effectiveness within 20 years. Where natural precipitation is too low for the species planted, the participant must use moisture conservation or supplemental watering.

BMP -Grass Waterways

Channels, either natural or constructed, that are planted with suitable vegetation to protect soil from erosion. Grass waterways can help heal gullies and washouts, and greatly reduce loss of topsoil and the sedimentation of streams, ponds, and lakes. Usually broad and shallow, waterways must have the capacity to carry the runoff of a 24- hour storm of the intensity that happens once every 10 years. In areas with prolonged water flows, high water tables, or seepage problems, a rock-lined center channel may be required.

BMP -Cropped Wetlands Restoration

A vital part of the New CRP is its increased emphasis on the enrollment and restoration of cropped wetlands. Cropped wetlands provide important habitat for migratory birds and other wildlife, especially many threatened and endangered species. Wetland acreage also filters out pollution and sedimentation and improves water quality, and it serves as an important flood control mechanism by attenuating and slowing down the flow of water. Healthy wetlands are vital to the recharging of underground aquifers. The New CRP seeks to restore and expand America's wetland acreages for the health and enjoyment of current and future generations.

Clark County
(Lower Mad River Watershed)

Best management practices implemented through the Lower Mad River Watershed Protection Project received an overwhelming response from watershed residents. Numerous landowners enrolled in the septic pumping program, the cover crop program, and the grass/tree filter strip program. These programs have not only educated landowners about the importance of conservation practices, but have also contributed significantly to the improvement of water quality in the Lower Mad River Watershed. In addition, Canoe Floats held annually by the Lower Mad River Watershed Protection Project also received a tremendous amount of support from local government officials and personnel.

In the summer of 2002, Clark SWCD received the Buffer Ohio Award for its outstanding achievements in establishing filter strips and buffers. The Lower Mad River Watershed Protection Project was instrumental in receiving this award by promoting streamside programs to targeted landowners.

Clark SWCD personnel have been actively involved in creating the NPDES Phase II Storm Water Management Plan for Clark County. The purpose of this plan is to stimulate a reduction in stormwater amounts.

Chemistry students from Clark State Community College conducted extensive studies on two sub-watersheds located in the Lower Mad River Watershed. These students contributed water quality information pertaining to Buck Creek above East Fork Buck Creek and Mad River below Nettle Creek to above Chapman Creek.

NRCS provides financial incentives and cost-share programs for Clark County residents including CRP (grassed waterways, filter strips, riparian buffers, and shallow water wetlands) EQIP, WRP, and FIP.

Clark SWCD provides technical support for NRCS cost-share programs and also provided environmental education programs and workshops to local schools and educators.

Environmental Education and General Public Awareness of Mad River Resource

Objective #1
Provide Administrative Leadership to support the implementation of the water quality solutions in the upper mad River Protection Project data source inventory and to identify other watershed land management/mapping characteristics through the utilization of a trimble GPS explorer III.

a) 1 FTE Salary Watershed Coordinator
- Jeremy Stanford
- Melinda Morrison
- Jennifer Ganson - May 16, 2004-Present

b) 1 FTE Travel
- All travel reported in quarterly fiscal reports.

c) Purchase Trimble GPS Explorer III for mapping of the Upper Mad River Watershed.
- The GPS unit described is no longer being made.
- The purchase of a Garmin GPSMAP 76CS with carrying case and US Topo CD-ROM was made. The Garmin GPSMAP 76CS is a better unit with many more capabilities utilizing advanced technology.

d) Office Space, equipment, computer and supplies
- All reported on quarterly fiscal reports

Objective #2
Provide cost share program to design and install a manure press system.

a) Manure Press System Installation (75% cost share)
- April 2004 the manure press unit was installed on the Merryl Runyun Farm, Oakview Genetics at a total cost of $54,816.47.

b) Manure Nutrient Testing (1 liquid and 1 solid per quarter for 3 years)
- 2 samples were taken.

c) Soil and Tissue Testing
- Testing was not completed, as the manure press by-product was never applied to the ground.

d) 2 Field Days hosted at demonstration site.
- 1st field day September 24, 2004, Field day hosted, 3 people attended. The focus on the field day was *Manure separation units, installation and utilization*.
- 2nd field day September 23, 2005, Field day hosted, 10 people attended. The focus on the field day was *Swine Manure separation, Swine Air Quality Updates and Animal Composting.*

Objective #3
Conduct 3 Construction Seminars to encourage contractors to adopt BMP's to educate attendees on BMP's according to specifications in the TR 55 NRCS Manual and NEMO recommendations**.**
- 1 construction seminar was held December 17 2003, focus on *Applying Agricultural Water Management Techniques to the Urban/rural Interface*. 33 people attended.
- The 2nd Construction seminar was held December 15, 2005, with a focus on *Best Management practices on Urban Development Sites*. 18 people attended

Objective #4
Provide educational efforts in the Kings Creek sub watershed on septic and water systems. 2 seminars per year, 2 fact sheets and well test for nitrates, bacteria and pathogens.

a) 215 Well Tests for Nitrates and Bacteria in the Kingscreek Watershed.
- A total of 56 well tests were done.

b) 6 septic/water workshops over 3 years.
- 1st septic management workshop, February 27, 2003 – 11 attended
- 2nd septic management workshop, October 30, 2003 – 7 attended
- 3rd Household Sewage seminar, January 23, 2004 – 24 attended
- 4th Septic/Water Management seminar, August 12, 2004 – 0 attended
- 5th Household Sewage Seminar, January 28, 2005 – 22 attended
- 6th On-site Septic Management Workshop, September 7, 2005 – 42 attended

Objective #5

Habitat Improvement Project (Summary)
01/01/03 - 12/31/05

As identified in Ohio EPA Stream Survey Reports, the number one limiting factor to the health and diversity of life in Mad River is the lack of in-stream habitat. This is a direct result of the construction of levees and channel modification, to control flooding, as occurred at the end of the 19th century and into the early part of the 20th century. It has changed the overall dynamics of the stream and disrupted the ecological balance. It creates an adverse environment for all aquatic life from invertebrates at the lower end of the food chain, to fish at the higher end. During high water events, the energy and velocity of flow is compounded because it is not dispersed by overflowing onto the floodplain or by flowing through the curves and bends of a natural stream channel. Ultimately these stream channel modifications impact water quality because it removes and alters the natural treatment elements.

Over the past 3 years, over 2 miles of in-stream/riparian habitat improvements have been completed. The success of this project was a result of hundreds of hours of volunteer time from members of the Madmen Chapter of Trout Unlimited (TU), Central Ohio Flyfishers (COFF-Columbus), Miami Valley Flyfishers (MVFF-Dayton), Buckeye United Flyfishers (BUFF-Cincinnati) and Northern Kentucky Flyfishers (NKFF). Volunteers were also involved in other watershed projects and activities, not covered by the 319 grant funds, including construction and improvements of parking areas, stream access, riparian cleanup and maintenance, tree and wildflower plantings, education and outreach, placement of watershed signs and logjam removal. The Madmen Chapter of TU has been involved with logjam removals for over 30 years. It has resulted in improved relations with landowners, by removing flow restriction and addressing erosion in a less destructive manner, while creating in-stream habitat. For more information see the web site www.tumadmen.org and the DVD "Mad River – on the Fly").

Four project areas along stretches of Mad River have been completed with instream/riparian habitat improvements. Three of these were identified in the site selection plan. The stream segments originally selected from the plan included Watson's (Mad River Farm Market), Pimtown Road and St. Rt. 29/296. Because of the opportunity to build public relations for watershed protection, the West Liberty Park project was added in 2005 through a cooperative agreement with the Village of West Liberty and the Lions Club. Also, it was determined to postpone work at St. Rt. 36 with the potential of removing the spill way located downstream of the bridge. All sites had unique conditions and needs, but in general all projects involved strategically placed logs, boulders and cobble, to create stream meander, riffle/pools, in-stream habitat and to stabilize the stream banks. All structures are placed at base flow, so they will not restrict flow to the point of flooding or have any impact on drainage.

Watson's (Mad River Farm Market) – This stretch of approximately 3,800 feet and extends from just above the railroad trestle downstream to the Sullivan Road bridge on the property owned by Mr. Roger Watson. The landowner has established 50- to 60-foot buffers on each side of the stream and planted hundreds of trees to improve the forestation of the riparian area. In-stream habitat improvements included cabling 72 logs and placing over 90 tons of cobble and boulders in thirteen sections of the stream segment where there was identified increase in depth. These structures have survived two record high-water events. Observed improvements include more meander within the channel created by staggered log placement, more riffle/pool structure that includes three new constructed riffles, increase in average depth from 26 inches to 30 inches at base flow with some pools deepening to 48 inches, improved numbers and diversity of aquatic insects and increased population and aerial extent of fishes from minnows to trout. Continued sampling of the invertebrates and fishes, as well as general water quality testing, will be conducted to measure sustainability of improvements. One benefit of log placement has been an extension of the bank material to the heel of the logs and lessening the destruction of erosion or undercutting tree roots during high river flows. Only time will tell if these conditions are sustained.

Pimtown Road – The State of Ohio owns approximately 3,400 feet of Mad River including 20 to 40 feet on each side, from Pimtown Road and extending downstream to the Watson property line. Meander, riffle/pool structure and in-stream habitat exists in the middle section of this stretch but the last 300 feet was void of instream habitat and the upper section had severe bank slumping and erosion resulting from bank material makeup of mainly hydric soils and less cobble and gravel. In the upper stretch, eighteen logs were cabled parallel to the toe of the banks and three more were cabled out from the bank extending in an upstream angle. At the end of the stretch, nine logs were cabled in a staggered pattern extending out from the bank at an upstream angle, as was used in the Watson project. For the most part, the bank slump and erosion is under control with resulting cleaner gravels making up the base of the stream. More natural meander with increased depth in the middle of the channel has been observed at the end of the stretch. Trout populations have been observed within the improved in-stream habitat. Future water quality and aquatic life sampling will be conducted to measure any improvements.

West Liberty Park – This project was a cooperative effort between the Mad River Watershed Strategic Plan Joint Board and Advisory Committee, the Village of West Liberty and the West Liberty Lions Club, in the approximately 2,000 foot stretch of Mad River from the Pikeraltown Road bridge downstream to the St. Rt. 247 bridge that runs through the West Liberty Park. In the upper 800 feet or so of the upper stretch eighteen logs were cabled in a staggered pattern, extending out from the bank at an angle, directed upstream. Over 40 tons of cobble and small boulders were placed at the heel of the logs, filling in the space between the logs and bank and boulders were placed in the middle of the channel. The placement of the logs, cobble and boulders is intended to deepen the middle of the channel, create meander of flow, control bank erosion and create in-stream habitat. Oxbow Stream Restoration Inc. was hired to construct a lunker structure extending downstream on the east bank, below the mouth of Onion Run. This structure stabilized bank erosion and created instream habitat. The project took place in September of 2005, so the success of the project, in terms of water quality and aquatic life, has yet to be observed or measured. The bank erosion seems to have lessened and trout populations have been noted in the created instream habitat areas.

St. Rt. 29/296 – The project took place on property owned by the State of Ohio from the mouth of Kings Creek downstream approximately 2,600 feet. The stream segment below the St Rt. 29/296 bridge was straight and wide, with a shallow flat channel and void of instream habitat. Eighteen logs were cabled in a staggered pattern, extending from the banks upstream at an angle. This is intended to deepen the middle of the channel, lessen the bank erosion, create meander and create in-stream habitat. Though the project work took place in October 2005 and there are no observed or measured improvements, the expectations are for similar improvements as with the Watson project. For more information on the in-stream/riparian habitat improvements See "Mad River Watershed Newsletters" for Winter and Summer 2004 and Fall and Winter 2005.

Purchase of a Hauling/Storage Trailer
• Trailer purchased December 2004

Objective #6
Conduct water quality monitoring at 10 sites designated on the mouth of several large tributaries in the Mad River watershed, monitoring to be done for 30 months over the grant period.
a) Water quality monitoring on 10 sites approximately 300 samples.
• 348 water quality samples have been tested, a total of 12 samples were taken each month on the 10 designated sites. 29 monthly tests were been conducted. A summary of results and individual site results can be found in OSUE.

Objective #7
Develop extensive educational tools and settings to stimulate public interest and water quality concerns within the watershed.
a) Watershed newsletter- 12 issues over grant period
• 13 newsletters were published.

b) Canoe trips for public education 3 per grant period.

• 1st canoe float October 5, 2002 -20 people attended
• 2nd canoe float September 24, 2003 – 2 people attended (cancelled)
• 3rd canoe float August 22, 2004 – 68 attended
• 4th canoe float August 21, 2005 – 74 attended

c) 5000 Brochure highlighting 2001 319 grant activities to be published.
• 2000 brochures printed and distributed throughout watershed.

d) 4 water quality field days for elementary students, total of 12 over grant period.
• 6 field days hosted in 2002
• 12 field days hosted in 2003
• 26 field days hosted in 2004
• 10 field days hosted in Spring/summer of 2005
• 22 field days hosted fall of 2005
• A total of 76 water quality field days were conducted

e) 3 Teachers Workshops over grant period to be hosted.
• Project wet Workshop hosted October 18, 2002
• Healthy Water, Healthy People workshop hosted October 17, 2003
• Down and Dirty with Soils workshop hosted August 17, 2005

f) 1250 storm drains stenciled in Urbana, coordinating with local youth groups.
• 3000 storm drains labeled in the city of Urbana from 2002-present by various youth groups.
• May 2004 program extended to other villages in Watershed
• Approximately 500 storm drains labeled in St. Paris by Boy Scout Pack 90
• Approximately 500 storm drains labeled in West Liberty by Pork Chops 4-H group.

g) Purchase quarterly full page newspaper ads in 2 local newspapers.
• 3 articles published in 2002
• 5 articles published in 2003
• 4 articles published in 2004
• 3 articles published in 2005
• A total of 15 full page ads were published.

h) Watershed boundary signs.
• Signs designed and ordered in winter 2005, to be posted and utilized at educational sites through out the watershed.

Objective #8

Nitrate reduction Program to farmers utilizing BMP yield insurance policy, Plant tissue testing and educational field day.

a) Nitrate Reduction Program 1250 acres were targeted.
• 2002 – 4 cooperators- 150 acres total
• 2003 – 3 cooperators – 226 acres total
• 2004 – 5 cooperators – 256 acres total
• 2005 – 6 cooperators – 300 acres total
• 932 total acres participated in the reduction program.

b) Plant tissue testing -80 tests
• 2 tissue tests were conducted in 2004.

c) Host 2 field days to provide education and dissemination of information on nitrate reduction
• 2nd Field day hosted August 1, 2005 – 38 attended

Potential Projects

Identify and Treat Sources of Sediments--Treatment of chronic sediment sources will include:

- Road treatments: decommissioning, maintenance, culvert maintenance and retrofit.
- Treatment and/or removal of fish passage barriers.
- Culvert assessment and modification where needed.
- Plant and Protect Stream Corridors. Restore native vegetation to stream corridors in low gradient valleys.

Restoration activities will include:

- Plant and diversify riparian zone with shade-producing mix of site appropriate native trees and shrubs.
- Fence riparian zones. Design on a site specific basis, e.g., electric, woven wire, barbed wire, etc.
- Provide stream-crossing structures and keyhole or off channel watering sites for livestock.

- Provide stock driveways where stream protection goals warrant.
- Provide alternative resource areas for stock, e.g., position watering, salt sources, fly control equipment, and shade away from stream corridors.
- Promote the application of good animal husbandry and management, e.g., good pasture management.
- Promote alternative structure for fish. Treatments might include log weirs, boulder deflectors, scour structures, and cover structures.
- Maintain and/or improve floodplain rearing areas for fish.
- Reduce fecal coli-form loading from point sources and non-point source agriculture.
- Install and manage an improved flow and precipitation monitoring network.
- Better document the impacts flow has upon water quality and project impacts on flow.
- Apply soft erosion control approaches to stable but eroding stream-banks utilizing soil bioengineering. Re-sloping for riparian plantings and in-stream structure techniques should be applied as energy dissipation is accomplished.
- Identify those sites where circumstances prohibit the application of soft erosion control approaches.
- Treatment and/or removal of fish passage barriers.
- Funding and availability of resources will limit the number, types, and locations of projects the WSP will be able to implement. Excellent interagency and inter-program coordination currently exists and will be invaluable to accomplishing proposed restoration efforts.

Monitoring

Overview: The WSP will be coordinating activities among individuals, organizations and agencies and will help these groups vie for grant monies (public and private) to address resource management issues. Any program that spends large sums of public money must be accountable to the public and to interest groups affected by the program.

- A monitoring program should:
- Identify what conditions need to be monitored;
- Summarize existing monitoring efforts;
- Identify overlaps and/or gaps;
- Have a strategy to address gaps, including coordination of priorities, funding, and staff from existing agency programs; and,
- Recommend ways to fund the monitoring strategy.

Monitoring is more than the systematic and periodic collection of data; it is the basis for effective adaptive management. Properly supported and implemented, the monitoring program will provide an unbiased data set for determining baseline condition, cause and effect relationships, and trends in conditions over time. Data will also be used to assess current water quality standards and management practices, determine the effectiveness of restoration activities, and suggest new actions.

In developing a monitoring program, a basic understanding must be reached on the kinds of monitoring. There are at least four different and distinct kinds of monitoring relevant to a watershed monitoring program:

Ambient Monitoring: This type of monitoring provides information on current and past conditions and trends over a broad area (sometimes called baseline or trend monitoring). This level of monitoring looks at indicators of watershed health as measured over space and time in a defined sub-basin or watershed. It involves collecting samples (to be analyzed for many parameters) from a specific location on a defined schedule usually for a period of many years.

Because of the need for an ongoing commitment of resources, this kind of monitoring is generally done by permanently funded agencies or large industrial forestland owners at a limited number of sites. For example, MCD maintains a monitoring network for water quality. This network provides for only a few sampling locations in a given subwatershed. It provides general information on the quality of water but it usually cannot provide detailed information on subtle changes caused by an individual program or project.

EVALUATION

Evaluation is a necessary step in a watershed planning process. The Mad River Watershed Joint Board and Advisory Committee will continue tracking the Mad Watershed Plan implementation progress by documenting all activities undertaken in the plan. Close communication, through quarterly or biannual meetings between the Mad River Watershed Joint Board and Advisory Committee will ensure that activities are documented appropriately. Other watershed stakeholders are encouraged to participate whenever possible.

The Mad River Watershed Joint Board and Advisory Committee will continue to share the annual results of plan activities with the citizens of the Mad River watershed. Likewise, the continued participation of watershed partners on various regional planning committees will serve as an informal means of sharing results. Water quality improvements associated with some of the strategies will take time to monitor, and progress may not be fully shown in a one to three year time frame. Surrogates of water quality progress and other activities undertaken by watershed partners (but not captured in the plan) will also be documented.

Water quality goals are generally planned on a three-year time frame in the action plan; a more in-depth evaluation will take place as water quality data are made available by further studies by the Ohio EPA (through their rotating basin approach or TMDL program). The Mad River Watershed Joint Board and Advisory Committee will seek general revenue funding for a full-time, permanent position in the watershed. Various state and federal grants and assistance from local partners will be sought to fund the watershed plan long-term.

UPDATE

The Mad River Watershed Strategic Plan is a “living document” which will be updated and revised as new information emerges and implementation practices are put into place. As stakeholders reflect on the past accomplishments and forge ahead into the future to plan the watersheds new direction. The water quality of the Mad River is improving with each individual’s effort. This action plan has been written to aid the development of water quality and community support. Short and long term benefits will come from the implementation of the action plan. The plan is designed to be flexible and continuously updated. The plan is written on a ten year time frame with updates inserted as needed. The ten year time frame runs from 2009 through 2019, this will allow for short and long term goals to be administered. The plan will be reevaluated on a yearly basis and additions to the plan can be submitted to the Mad River Joint Board Chairman at the Champaign Soil and Water Conservation District.

To continue the improvement of water quality in the Mad River Watershed, numerous practices have been identified and will be carried out in the future. Once the Mad River Watershed Strategic Plan ends, implementation of future conservation projects will be carried out by Logan SWCD, Clark SWCD, Champaign SWCD, and NRCS if funding is available from USDA.

For sub-watersheds facing rural pressures including agriculture and livestock production, cattle-exclusion fencing through EQIP and CRP, feedlot improvements, cover crops, and filter strips will be applied. For sub-watersheds that are facing urban pressures, septic tank pumping, along with storm drain marking and education will be applied. Major emphasis will be placed on floodplain restoration, improved riparian corridor and septic system maintenance education due to the fact that at least 60 systems can be classified as failing in Clark County. Urban settings that are experiencing a decline in pervious surfaces will also need to maintain these surfaces by keeping them free of chemicals, such as motor oil, and debris.

Several agencies located in Clark and Champaign Counties have the capability to implement these practices. Champaign SWCD will aid practices needed for the sub-watersheds falling in Champaign County while Logan SWCD and Clark SWCD will aid practices needed for sub-watersheds falling in Logan and Clark Counties. Champaign SWCD will continue to provide educational programs and teacher workshops to train educators on the effects of NPS pollution and its relationship to water quality. NRCS, the Clark County Health Department, and the Champaign County Engineer's Office will also supply technical assistance to remedy watershed impairments.

REVISION

Formal revisions to the plan will be made when necessary. Additional interim plan amendments will be made if important opportunities exist and new data becomes available. The amendments will be developed by Mad River Watershed Joint Board and Advisory Committee and forwarded to the Ohio EPA.

Lessons learned, such as techniques and activities found to be especially effective (or ineffective) will be shared as well. Owing to the technical expertise and managerial experience possessed by the Mad River Watershed Joint Board and Advisory Committee, substantive and methodological knowledge of the county, state and nonprofit processes and programs appears more than adequate.

CONCLUSION

With the completion of this document, citizens of the Mad River watershed have the rare opportunity to prevent its degradation in the 21st Century. It is the residents, living in harmony with and caring for their local water resources, who are the only people who can truly implement actions to avoid degradation and inappropriate development, leading to decreased biodiversity, lowered water quality and loss of open space.

This plan is not a blueprint for success, but merely a guidebook, providing direction from which important ideas, plans and further strategies will develop. The ultimate goal, embraced by all the fiends of the river and its watershed, should not be to slow its degradation, but to incrementally and indefinitely improve upon the remarkable resource that is the Mad River.

REFERENCES

Acronyms

BOD Biological Oxygen Demand
BMP Best Management Practices
CRP Conservation Reserve Program
CWH Cold Water Habitat
FSA Farm Service Agency
GAC Granulated Activated Carbon
GIS Geographic information System
GPS Global Positioning System
HUC # Hydrologic Unit Code Number
HSTS Household Sewage Treatment Systems
I&I Infiltration and Inflow
IBI Index of Biotic Integrity
ICI Invertebrate Community Index
MCL Maximum Contaminate Level
Miwb Modified Index of Well Being
N/A Not Available
NPDES National Pollutant Discharge Elimination System
NPS Non Point Source Pollution
NRCS Natural Resource Conservation Service
OAC Ohio Administrative Code
ODNR Ohio Department of Natural Resources
OEPA Ohio Environmental Protection Agency
OSUE Ohio State University Extension
QAPP Quality Assurance Project Plan
QHEI Qualitative Habitat Evaluation Index
RC&D Ohio Resource Conservation and Development
RM River Mile
SWCD Soil and Water Conservation District
SWEET Source Water Environmental Education Team
TDR Transferable Development Rights
TMDL Total Maximum Daily Load
TSD Technical Support Document
USGS United States Geological Society
VOC Volatile Organic Contaminate
WWH Warm Water Habitat
WWTP Wastewater Treatment Plant
305(b) Ohio Environmental Protection Agency Water Quality Report

Glossary of Watershed Terms

Aquatic corridor: an area of land and water which is important to the integrity and quality of a stream, river, lake, wetland, or other body of water. An aquatic corridor usually consists of the actual body of water ("corridor" usually connotes a river or stream), the adjacent buffer, and a fringe of adjacent upland areas.

BMPs (Best Management Practices): Methods that have been determined to be the most effective, practical means of preventing or reducing pollution from non-point sources, such as pollutants carried by urban runoff.

Buffer: an area adjacent to a lake or estuarine shoreline, wetland edge, or streambank, where a) critically important ecological processes and water pollution control functions take place, and b) development may be restricted or prohibited for these reasons.

Cluster or Open Space Development: the use of designs which incorporate open space into a development site; these areas can be used for either passive or active recreational activity or preserved as naturally vegetated land.

Combined Sewer Overflow: Discharge of a mixture of storm water and domestic waste, occurring when the flow capacity of a sewer system is exceeded during rainstorms.

Conservation easements: a practice used to apply and enforce restrictions to preserve natural resources. Typically, a landowner will grant very specific rights concerning a parcel of land to a qualified recipient (e.g. public agency or non profit land conservancy organization). The easement gives the recipient the right to enforce the restrictions. The recipient does not assume ownership but does assume long-term responsibility for enforcement and stewardship of the easement. For example, a wildlife management agency may obtain easements in forested floodplains from private landowners that help them manage wildlife and fish.

Floodplain: a generally flat, low-lying area adjacent to a stream or river that is subjected to inundation during high flows. The relative elevation of different floodplains determines their frequency of flooding, ranging from rare, severe storm events to flows experienced several times a year. For example, a "100-year floodplain"would include the area of inundation that has a frequency of occurring, on average, once every 100 years.

Illicit connections: illegal and/or improper waste discharges into storm drainage systems and receiving waters.

Impacted stream or subwatershed: a very general, watershed imperviousness-based classification category for a subwatershed with 11 to 25% impervious cover. Urbanization is generally expected to lead to some impacts on stream quality, but the type and magnitude of these effects can vary significantly among different watersheds at similar levels of imperviousness.

Impervious cover: any surface in the urban landscape that cannot effectively absorb or infiltrate rainfall; for example, sidewalks, rooftops, roads, and parking lots.

Imperviousness: the percentage of impervious cover by area within a development site or watershed, often calculated by identifying impervious surfaces from aerial photographs or maps.

National Pollutant Discharge Elimination System (NPDES): established by Section 402 of the Clean Water Act, this federally mandated permit system is used for regulating point sources, which include discharges from industrial and municipal facilities and also stormwater discharges from discrete conveyances such as pipes or channels.

Non-stormwater flows: runoff which occur from sources other than rainwater; for example, personal car washing, lawn watering overspray, street cleaning, or pressure-washing of restaurant waste disposal facilities.

Non-supporting stream or subwatershed: a very general, watershed imperviousness-based classification category for a stream or subwatershed with more than 25% total impervious cover. Urbanization is generally expected to lead to some impacts on stream quality, but the type and magnitude of these effects can vary significantly among different watersheds at similar levels of imperviousness. These non-supporting streams are usually not candidates for restoration of relatively healthy aquatic ecosystems, but often can benefit from some physical rehabilitation designed to reduce additional degradation – for example, excessive erosion and siltation – that affects downstream areas.

Open Space: a portion of a site which is permanently set aside for public or private use and will not be developed. The space may be used for passive or active recreation, or may be reserved to protect or buffer natural areas.

Package Treatment Plant: a small, onsite waste treatment facility designed to handle the specific needs of a specialized, small, or remotely located waste generator; for example, a treatment plant that services a trailer park.

Rooftop runoff: rainwater which falls on rooftops, does not infiltrate into soil, and runs off the land.

Sensitive stream or subwatershed: a very general, watershed imperviousness-based classification category for a stream or a subwatershed with less than

10% impervious cover, that is potentially still capable of supporting stable channels and good to excellent biodiversity. Urbanization is generally expected to lead to some impacts on stream quality, but the type and magnitude of these effects can vary significantly among different watersheds at similar levels of imperviousness.

Stormwater "hotspots": land uses or activities that generate highly contaminated runoff. Examples include fueling stations and airport de-icing facilities.

Stormwater best management practice: a structural or non structural technique designed to temporarily store or treat stormwater runoff in order to mitigate flooding, reduce pollution, and provide other amenities.

Stormwater runoff: rainwater which does not infiltrate into the soil and runs off the land.

Subwatershed: a smaller geographic section of a larger watershed unit with a drainage area between 2 to 15 square miles and whose boundaries include all the land area draining to a point where two second order streams combine to form a third order stream.

Transferable Development Rights (TDRs): a form of incentive for developers in which the developer purchases the rights to an undeveloped piece of property in exchange for the right to increase the number of dwelling units on another site. Often used to concentrate development density in certain land areas.

Watershed: An area of land that drains water, sediment and dissolved materials to a common receiving body or outlet. The term is not restricted to surface water runoff and includes interactions with subsurface water. Watersheds vary from the largest river basins to just acres or less in size. In urban watershed management, a watershed is seen as all the land which contributes runoff to a particular water body.

Zoning: A set of local government regulations and requirements that govern the use, placement, spacing and size of buildings and lots (as well as other types of land uses) within specific areas designated as zones primarily dedicated to certain land use types or patterns.

Literature Cited

Biological and Water Quality Study of the Mad River Basin, 2003 by the State of Ohio EPA

Brown, Kathleen Kite (1975). History of St. Paris (The Pony Wagon Town). St. Paris, Ohio: Kathleen Kite Brown

Clark County Soil and Water Conservation District, 2007, Lower Mad River Watershed Protection Project Watershed Action Plan: A Community-Based Watershed Management Approach.

Cross, W. P., and Feulner, A. J., 1963, Anomalous streamflow-ground-water regimen in the Mad River Basin, near Springfield, Ohio: U. S. Geological Survey Professional Paper 475-D, p. 198-201.

Dumouchelle, D. H., 2001, Ground-water levels and flow directions in glacial sediments and carbonate bedrock near Tremont City, Ohio, October - November 2000, U. S. Geological Survey Water-Resources Investigations Report 01-4224 Map Report *pdf (748 kb)

Feulner, A .J., 1960, The ground-water resources of Champaign County, Ohio: Unnumbered U. S. Geological Survey Open-File Report.

Feulner, A .J., and Hubble, J H., 1960, Occurrence of strontium in the surface and ground waters of Champaign County, Ohio: Economic Geology, v. 55, no. 1, p. 176-186.

Feulner, A J., 1961, Cyclic-fluctuation methods for determining permeability as applied to valley train in the Mad River Valley in Champaign County, Ohio: Ohio Journal of Science, v. 61, no. 2, p. 99-106.

Jones, Wayne. Ground Water Pollution Potential of Champaign County, Ohio Report No. 39. Ohio Department of Natural Resources, Division of Water, Water Resources Section. April, 1995.

Jones, Wayne. Sainey, Eric B., Schiefer, Mike. Identification of the Hydrologic System and Non-point Source Impacts in the Mad River Watershed. Ohio Department of Natural Resources, Division of Water, Water Resources Section. July 1996.

Koltun, G.F. Determination of Base-Flow Characteristics at Selected Stream flow gaging Stations on the Mad River, Ohio. U.S. Geological Survey. Water Resources Investigations Report 95-4037. 1995.

Koltun, G. F., 1995, Determination of base-flow characteristics at selected sites on the Mad River, Ohio: U. S. Geological Survey Water-Resources Investigations Report 95-4037, 12 p. Abstract

Kunze, A. E., Sroka, B. N., 2004, Effects of Highway Deicing Chemicals on Shallow Unconsolidated Aquifers in Ohio--Final Report: U.S. Geological Survey Scientific Investigations Report 2004-5150, 188 p Online report

LaSota, Donald E. Bidlack, Todd W. Evans, James W. Laboratory Manual for the Microbiological Analyses of Public Drinking Water. pp. 10-12. Ohio Environmental Protection Agency. 2001.

Mayo, R.I., 1977, Hydrologic analysis, Mad River at State Highway 41, Springfield, Ohio: U. S. Geological Survey Open-File Report 77-399, 25 p. Abstract

Munch, Robert W. In The Search For Water" URBANA, OHIO, A Case History of Wellfield Exploration as a Result of Historical Pollution and Contamination. City of Urbana, Water Division, 2003

Ohio Environmental Protection Agency. Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices. pp. 3-16 – 3-18. 1991.

Sheets, R. A. and Yost, W. P., 1994, Hydrogeology of the Mad River Buried Valley Aquifer System in Southwestern Ohio, Ohio Journal of Science, vol. 94-5, pp. 138-146. Abstract

Sprowles, Katherine M. Ground Water Pollution Potential of Logan County, Ohio. Report No. 36. Ohio Department of Natural Resources, Division of Water, Water Resources Section. July, 1995.

Mad River Watershed Strategic Plan Distribution List

- Ohio State University Extension – Champaign County
- Ohio State University Extension – Clark County
- Ohio State University Extension – Logan County
- Mad River Watershed Strategic Plan Joint Board of Supervisors
- Mad River Watershed Strategic Plan Advisory Board
- Miami Conservancy District
- Logan Soil and Water Conservation District
- Champaign Soil and Water Conservation District
- Clark Soil and Water Conservation District
- City of Springfield
- City of Urbana
- Village of Zanesfield
- Village of Valley Hi
- Village of St. Paris
- Village of West Liberty
- City of New Carlisle
- Village of Catawba
- Village of Donnelsville
- Village of Lawrenceville
- Village of North Hampton
- Village of South Vienna
- Village of Tremont City
- Village of Mutual
- Top of Ohio Resource Conservation and Development
- Ohio Environmental Protection Agency
- Ohio Department of Natural Resources
- Natural Resource Conservation Service
- Miami Conservancy District
- ODNR – Division of Wildlife
- ODNR – Division of Forestry
- ODNR – Division of Soil and Water Conservation
- ODNR – Divison of Natural Areas and Preserves
- Champaign County Commissioners
- Clark County Commissioners
- Logan County Commissioners
- Ohio Farm Bureau

- Champaign County Farm Bureau
- Logan County Farm Bureau
- Champaign County Health Department
- Clark County Health Department
- Clark County Parks and Recreation
- Logan County Health Department
- Logan County Engineer’s Office
- Champaign County Engineer’s Office
- Clark County Engineer’s Office
- Ohio Township Trustees Association
- Champaign County Auditor’s Office
- Clark County Auditor’s Office
- Logan County Auditor’s Office
- Clark County Building Regulations
- Clark County Development Office
- Clark County Planning Commission
- Clark County Public Library
- Clark County Recorder’s Office
- Clark County Transportation Coordinating Committee
- Clark County Treasurer’s Office
- Clark County Waste Management District
- State Representatives
- State Highway Garage
- State Watercraft
- Farm Credit Services
- Farm Service Agency
- NRCS State Office
- Clark County Historical Society
- Champaign County Historical Society
- Township Zoning Inspectors
- Clark County School Agriculture Vocational Departments

All records and documents pertaining to this plan will be kept in the:

Champaign Soil and Water Conservation District
1512 S. US Highway 68, Suite E100
Urbana, Ohio 43078
937-484-1507