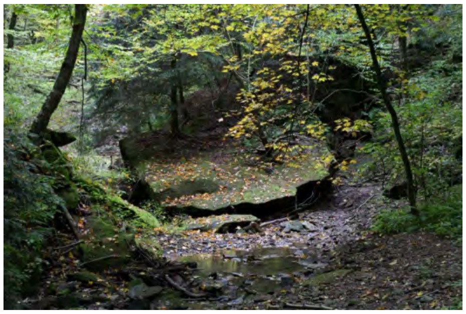
Captina Creek
Watershed Action Plan

2014

A Collaboration of the Belmont Soil and Water Conservation District and Captina Creek Watershed Stakeholders



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Cover photos courtesy of Dover Woods Photography
Powhatan Point, Ohio

May 30, 2014

Kim Brewster
Belmont Soil & Water Conservation District
101 N. Market Street, Suite D
St. Clairesville, OH 43950

Dear Ms. Brewster:

Congratulations! We are pleased to provide this letter as notice of full endorsement for the Captina Creek Watershed Action Plan (HUC 10: 0503010609) by the Ohio EPA-Division of Surface Water and ODNR-Division of Soil and Water Resources.

We want to thank you and the watershed stakeholders for all the work that went into producing this endorsed comprehensive watershed action plan. This work, along with continued collaboration among local communities, businesses and support agencies are important to maintain and improve the health of Captina Creek and downstream waters.

We recognize watershed planning is an ongoing process requiring periodic review and updates in light of achievements and lessons learned. Therefore, when new data is made available and you proceed with implementation please update this plan to reflect these changes. Timely plan updates are required to maintain state endorsement, and we look forward to working with you through subsequent phases of watershed implementation.

Sincerely,

Karl R. Gebhardt, Chief
Ohio EPA, Division of Surface Water

Michael Bailey, Chief
ODNR, Division of Soil & Water Resources

cc: Russ Gibson, Rick Wilson, John Navarro, Bob Mulligan, Chad Amos

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List of Acronyms

AMD	Acid mine drainage
AML	Abandoned Mine Lands Reclamation Program
BMP	Best management practice
CWH	Coldwater habitat
CWA	Clean Water Act
EMA	Emergency Management Agency
EQIP	Environmental Quality Incentives Program
EWH	Exceptional warmwater habitat
GIS	Geographical Information Systems
HHEI	Headwater Habitat Evaluation Index
HSTS	Household Sewage Treatment Systems
HUC	Hydrologic unit code
IBI	Index of Biotic Integrity
ICI	Invertebrate Community Index
MiWB	Modified Index of Well Being
NPDES	National Pollution Discharge Elimination System
NPS	Non-Point Source Pollution
NRCS	Natural Resources Conservation Service
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
ODNR	Ohio Department of Natural Resources
	- DMRM Division of Mineral Resources Management
	- DOF Division of Forestry
	- DOW Division of Wildlife
	- DSWR Division of Soil and Water Resources
ODOT	Ohio Department of Transportation
OSM	Office of Surface Mining
OSU Ext.	Ohio State University Extension
PCR	Primary Contact Recreation
PWS	Public Water Supply
QHEI	Qualitative Habitat Evaluation Index
RC&D	Resource Conservation and Development
RM	River mile
RUSLE	Revised Universal Soil Loss Equation
SCR	Secondary Contact Recreation
SMCRA	Surface Mining Control and Reclamation Act
SWCD	Soil and Water Conservation District
TDS	Total dissolved solids
TMDL	Total Maximum Daily Load
TSS	Total suspended solids
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Society
WAP	Watershed Action Plan
WQS	Water quality standards
WWH	Warmwater habitat
WWTP	Wastewater treatment plant

Acknowledgements

The completion of this watershed action plan would not have been possible without generous support from the following:

Residents, landowners and stakeholders of the Captina Creek watershed

Ohio Department of Natural Resources – Division of Wildlife for financial support of the Captina Creek Watershed Coordinator position

The support of the Belmont Soil and Water Conservation District Board of Supervisors, both past and present. The current Board of Supervisors:

Don Giffin
Jason Mayberry
Ed Mowrer
David Totterdale
Tim Wojchowski

The Belmont County Commissioners

Belmont-Guernsey-Monroe-Noble County Farm Bureaus

Ohio Department of Natural Resources

- Division of Soil and Water Resources
- Division of Wildlife
- Division of Mineral Resources Management

Ohio Environmental Protection Agency

United States Department of Agriculture – Natural Resources Conservation Service

Ohio State University Extension

Monroe Soil and Water Conservation District

The Captina Conservancy

Olney Friends School

Raven Rocks, Inc.

Cover photos courtesy of Dover Woods Photography

Writing contributions, technical guidance, reviews and edits provided by:
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Jeff Bettinger, United States Department of Agriculture – Natural Resources Conservation Service
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John Navarro, Ohio Department of Natural Resources – Division of Wildlife
Don Pickenpaugh, Belmont County GIS
Ron Preston, Captina Conservancy
Katie Pugh, formerly Murray Energy Corporation
Stephen Schumacher, formerly Ohio State University Extension
Bryan Smith, formerly Belmont Soil and Water Conservation District
Constance White, Ohio Department of Natural Resources – Division of Soil and Water Resources

Executive Summary

Biological studies of Captina Creek and its tributaries have revealed exceptional fish and macroinvertebrate populations at the majority of sampling locations within the watershed, comparable to some of the best quality streams in Ohio. The Ohio Environmental Protection Agency has listed the mainstem of Captina Creek as an Outstanding State Water from river mile 25.42 to 0.8, and several tributaries are listed as Superior High Quality Water. The United States Environmental Protection Agency has also designated the creek an Aquatic Resource of National Importance based on its biodiversity and water quality values. The mainstem of Captina Creek scored the highest average Index of Biotic Integrity (measure of stream health based on fish assemblages) in the state with a diversity of fifty-six fish species sampled, seventeen of which are pollution intolerant. Additionally, average Invertebrate Community Index (macroinvertebrate assemblage) scores place Captina Creek among the ten highest scoring watersheds in the state. Adding to its unique diversity, Captina Creek is home to one of the state's most important Eastern Hellbender populations, and one of only two watersheds where successful reproduction in the past decade has been documented. The watershed also supports a healthy small mouth bass fishery and an abundance of other wildlife in its forested habitat.

Water quality data indicate the presence of physical and chemical factors that could threaten this high quality resource if not properly managed. While these threats are not direct causes of non-attainment of water use designations, proper management and protection strategies are required to preserve the exceptional biological assemblages that have been maintained. Therefore, watershed management efforts for the Captina Creek watershed are developed with a focus to preserve this high quality resource by protecting the watershed from future degradation and restoring water resources that have been impacted.

From a watershed management perspective, the Captina Creek watershed is unique because it meets state-designated water quality standards and the habitat has been rated exceptional both on the mainstem and the majority of its tributaries. While most watershed action plans are drafted to repair and restore damaged habitat, the purpose of the Captina Creek action plan is to preserve and protect the relatively undisturbed landscape that gives the creek its exceptional water quality and biological diversity. This management plan will provide a guiding framework for watershed stakeholders and key individuals at the community, state and federal levels that can be implemented to protect the biological, chemical and physical integrity of streams in the Captina Creek watershed.

Section I: Watershed Overview

Chapter 1: Introduction

A watershed is an area of land receiving precipitation which eventually drains into a specific location (stream, lake, river, or ocean) through surface or subsurface flow. Water flows over and under land that is characterized by its geological, pedological (soil), and biological features. Land is also characterized by many land uses, such as agriculture, forestry, mineral extraction, or urban development. Since a watershed is defined by topography and geology, rather than more traditional, human-made boundaries such as city limits or county lines, the watershed approach provides a more holistic and comprehensive perspective of how land and water resources are being managed.

As stated in the Ohio Environmental Protection Agency's *A Guide to Developing Local Watershed Action Plans in Ohio*, "the watershed approach refers to a comprehensive effort to address multiple causes of water quality and habitat degradation in a watershed. It is a process that emphasizes prioritizing problem areas and developing comprehensive, integrated solutions by involving stakeholders from both inside and outside government." Stakeholder involvement and public support are essential for identifying water quality problems or threats and using that information to direct and implement watershed protection efforts.

Interdisciplinary groups working at the local watershed level can protect and maintain the quality of water resources through the development of a watershed action plan, which outlines the necessary steps to achieving water quality attainment goals. Public involvement and support from local watershed stakeholders helps to ensure the successful achievement of goals and the sustainability of the watershed protection effort.

From a watershed management perspective, the Captina Creek watershed is unique because it meets state-designated water quality standards and the habitat has been rated exceptional both on the mainstem and the majority of its tributaries. While most watershed action plans are drafted to repair and restore damaged habitat, the purpose of the Captina Creek action plan is to preserve and protect the relatively undisturbed landscape that gives the creek its exceptional water quality and biological diversity. Many streams within the watershed contain rare and diverse species of fish, macroinvertebrates and amphibians and show little signs of chemical, physical or biological stress. Sparsely populated areas surrounding the watershed's tributaries allow for the growth of extensive riparian corridors around nearly unaltered streambeds. The Ohio Environmental Protection Agency (OEPA) has listed the mainstem of Captina Creek as an Outstanding State Water from river mile (RM) 25.42 to RM 0.8 and several tributaries are listed as Superior High Quality Water. The United States Environmental Protection Agency (USEPA) has also designated the creek an Aquatic Resource of National Importance based on its biodiversity and water quality values (OEPA 2010).

Nearly the entire length of Captina Creek is classified by the OEPA as exceptional warmwater habitat (EWH). This status indicates that it is capable of supporting an exceptional or unusual assemblage of warmwater aquatic organisms that is comparable in diversity, composition and organization to the seventy-fifth percentile of reference sites for Ohio (USEPA 2010). Several of the headwater tributaries feeding into the creek have attained coldwater habitat (CWH) status based on the presence of coldwater fish and macroinvertebrates. The mainstem of Captina Creek scored the highest Index of Biotic Integrity (IBI) average in the state (55.1 out of a possible 60 points) with a diversity of fifty-six fish species sampled, 17.5 percent of which are pollution intolerant. Additionally, average Invertebrate Community Index (ICI) scores place Captina Creek among the ten highest scoring watersheds in the state (OEPA 2010). Adding to its unique diversity, Captina Creek is home to one of the state's most important Eastern Hellbender (*Cryptobranchus alleganiensis alleganiensis*) populations, and one of only two watersheds where successful reproduction in the past decade has been documented. The watershed also supports a healthy small mouth bass fishery and sightings of the state-threatened bobcat (*Felis rufus*) have also increased in the forested habitat of the watershed over the past decade.

Qualitative Habitat Evaluation Index (QHEI) scores are used by the OEPA to measure stream physical habitat in terms of substrate type, embeddedness within streams and stream geomorphology characteristics. The average QHEI score recorded by OEPA for the entire Captina Creek watershed was 72.2, which is consistent with very good overall habitat quality (OEPA 2010). Headwater Habitat Evaluation Index (HHEI) assessments have been conducted for numerous streams in the watershed by OEPA including Casey Run, Reeves Hollow, Berry's Run and Mikes Run. HHEI metrics evaluate the quality of primary headwater stream habitat (< 1 square mile of drainage area) based on the presence of macroinvertebrates, fish and salamanders, and an assessment of substrate content, stream depth and channel width. A score of 70 classifies a headwater stream as Class III - Primary Headwater Habitat (PHWH) indicating a stream of the highest quality able to support cold water biota year-round. All four of these headwater streams scored above 70 with Casey Run registering an 84 at RM 0.75 (USEPA 2010).

Although Captina Creek has received high scores for biological and habitat assessments, water quality data indicates the presence of physical and chemical factors that may threaten this high quality resource if not properly managed. Sedimentation affects headwater and tributary streams during times of heavy rainfall due to naturally geological erosive processes. Human activities without the use of best management practices such as logging, construction, gravel excavation and recreational all-terrain vehicle (ATV) traffic are prevalent in portions of the watershed and contribute to the sediment load of specific tributaries. Agricultural concerns include unrestricted livestock access in portions of the creek, compacting stream banks and increasing loadings of nutrients and total suspended solids (TSS). Inadequate or outdated home sewage treatment systems in some areas may increase the amounts of sewage discharging directly into streams. This untreated wastewater can increase ammonia in the streams and result in algae blooms during low flow periods. Pathogens from these outdated systems, such as fecal coliform, can also be a public health concern due to possible exposure during swimming, wading and boating.

Mining for coal and other mineral resources has been a culturally and economically significant part of the region's history, including the Captina Creek watershed. Two active coal mines, Ohio Valley Coal Company (OVCC) and American Energy Corporation (AEC), both owned by Murray Energy Corporation, are located in the middle section of the watershed near the mainstem of Captina Creek. Recent releases of coal slurry and blackwater have occurred, elevating downstream concentrations of organic and metal contaminants in Captina Creek and damaging habitat and aquatic life at the time of release. Coal slurry is a waste material generated by washing impurities from coal once it is retrieved from the ground. Elevated specific conductivity has also occurred downstream of mine wastewater discharges, affecting 2.8 miles of Piney Creek and approximately 22 river miles to the confluence of the Ohio River (OEPA 2010).

A positive partnership has been built between Captina Creek watershed stakeholders and Murray Energy Corporation, and company representatives have demonstrated a commitment to be involved in the watershed planning process and future mitigation projects. Much effort to improve pollution control has been completed by the company in recent years in response to these wastewater release incidents and the watershed protection effort. In addition to their efforts, the Ohio Division of Wildlife has adopted a Pollution Contingency Plan for Areas Occupied by Eastern Hellbenders (Lipps et al. 2012) to address such issues in the future.

Historical surface and underground mining for coal, which occurred before the passage of mining reclamation laws, has left behind unreclaimed gob piles and abandoned mine lands which can produce acid mine drainage (AMD). Fortunately, water quality monitoring indicates that in most cases AMD does not impair water chemistry, and dilutes to undetectable levels further downstream due to the stream's limestone bedrock substrate that naturally buffers the effects of acidity and other contaminants. Additional watershed management concerns arise from possible future changes in land use, and include the degradation of riparian corridors and excessive withdrawal of water from the creek.

The purpose of this management plan is to provide a guiding framework for watershed stakeholders and key individuals at the community, state and federal levels that can be implemented to protect the biological, chemical and physical integrity of streams in the Captina Creek watershed. This protection effort must rise from local, grassroots involvement, and activities will include community outreach and the implementation of voluntary best management practices for the watershed's natural resources. Support from a variety of public and private stakeholders and collaboration among local, state and federal agencies will be necessary in order to achieve the goals set in this action plan and to ensure the preservation of the Captina Creek watershed.

Chapter 2: Defining the Watershed

Watershed Boundaries

The Captina Creek watershed drains approximately 180 square miles of land in Belmont and Monroe counties in eastern Ohio. Of that area, 167.8 square miles (93.2%) are located in Belmont County and 12.2 square miles (6.8%) are in Monroe County (Figure 1). The watershed is part of the OEPA designated Central Ohio River Tributaries which extends from south of McMahon Creek to north of Fish Creek in West Virginia.

Figure 1. The Captina Creek watershed is located in the southern half of Belmont County and the very northernmost portion of Monroe County.

There are six incorporated villages within the Captina Creek watershed: Barnesville, Beallsville (northern portion), Bethesda, Jerusalem (northern portion), Powhatan Point and Wilson (northern portion) (Figure 2). There are also fifteen unincorporated communities in the watershed region, some of which are difficult to identify within the landscape (e.g. Captina and Clover Ridge) because of limited or absent structural features. The unincorporated communities are: Alledonia, Armstrongs Mills, Bingham, Boston, Captina, Centerville, Clover Ridge, Cool Hill, Crabapple, Hunter, Jacobsburg, New Castle, Somerton, Speidel and Steinersville.

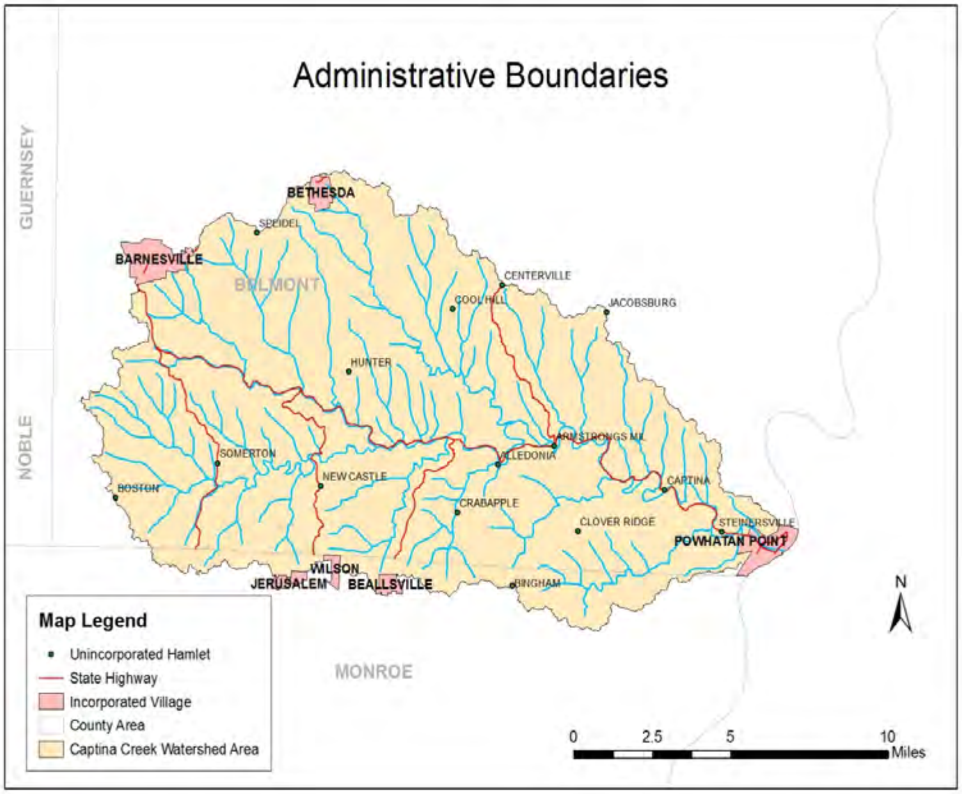


Figure 2. Incorporated and unincorporated cities and communities within the Captina Creek watershed.

Special Districts within the Watershed

Parks: Within the Captina Creek watershed there are several parks for public recreational activities. Village parks include Somerton Park in Somerton and Epworth Park in Bethesda. Centerville and Powhatan Point also have recreational ball fields and community areas which are not designated city parks. Powhatan Point has a community marina for launching watercraft into the Ohio River as well. Three golf courses are located within the watershed: Clair-Mar Golf Course in Steinersville, Horseshoe Bend Golf Course in Armstrongs Mills and a golf course at Switzerland Lake in Wilson. No national or state parks reside in the watershed, however there are private fisheries located near the unincorporated hamlet of Captina (Lake Shawn) and at Switzerland Lake.

The Ohio Riverfront Development Committee (ORDC) and Rails to Trails have expressed interest in extending recreational biking and horseback trails from Powhatan Point westward along the mainstem of Captina Creek. If constructed near the creek a walking/biking trail could be beneficial in preserving riparian corridors and green space, and providing residents an alternative to ATV recreation.

Regional Planning Agencies: Government agencies in the watershed are the Belmont and Monroe Soil and Water Conservation Districts, the United State Department of Agriculture - Natural Resources Conservation Service, the Ohio Department of Transportation (Highway Garages), Ohio State University Extension Service of Belmont County and the Belmont and Monroe County Farm Bureaus.

Conservation: There are two current land conservation areas within the watershed, Dysart Woods and Raven Rocks, and several conservation and mitigation sites held by Murray Energy. Dysart Woods is an old growth forest preserve of approximately 55 acres owned and operated by Ohio University. It is located in the west-central portion of Smith Township in the Bend Fork subwatershed and is used primarily for academic research, although its nature trails are open to the public year-round.

Raven Rocks Inc. is a private organization that owns land for conservation practices. The group has acquired approximately 1200 acres of land in southeastern Wayne Township within the Piney Creek subwatershed to protect from mining. The Captina Conservancy has recently developed its first large-scale project to place a portion of the Raven Rocks property into an easement, made possible through the Clean Ohio Fund. The Captina Conservancy will need to continue to play a large role in the conservation and preservation of any land abutting Captina Creek.

Murray Energy Corporation, which owns Ohio Valley Coal Company's Powhatan No. 6 and American Energy Corporation's Century mines, holds several conservation easements on private property in Wayne and Washington townships. Easements in Wayne Township are located on different parcels between six streams in Section 3 including Long Run and Piney Creek. The combined easements along these tributaries total 11,110 linear feet at a width of 50 feet. Also in the same township section, a 2.7 acre easement exists next to Township Road 87 where a patch of wetlands has been reclaimed as a mitigation project. Other conservation easements held by Murray Energy are located near the mouth of Bend Fork in Sections 23, 24 and 30 of Washington Township along Township Road 101 and on Millers Run in Section 30 of Washington Township. The easements at the mouth of Bend Fork cover 831.7 linear feet of stream with a width of 250 feet while those in Millers Run cover 844 linear feet of stream at a width of 100 feet (Wood-Pugh, personal communication, 2011). Finally, ODNR holds a single easement in the Bend Fork subwatershed.

Schools: Public school districts in the watershed region include a portion of Switzerland of Ohio Local School District (including Beallsville Schools), portions of Shadyside Local School District, portions of Union Local Schools, Bellaire Schools and Barnesville Exempted Village School District (Figure 3). Additionally Olney Friends School is a private secondary school located in Barnesville.

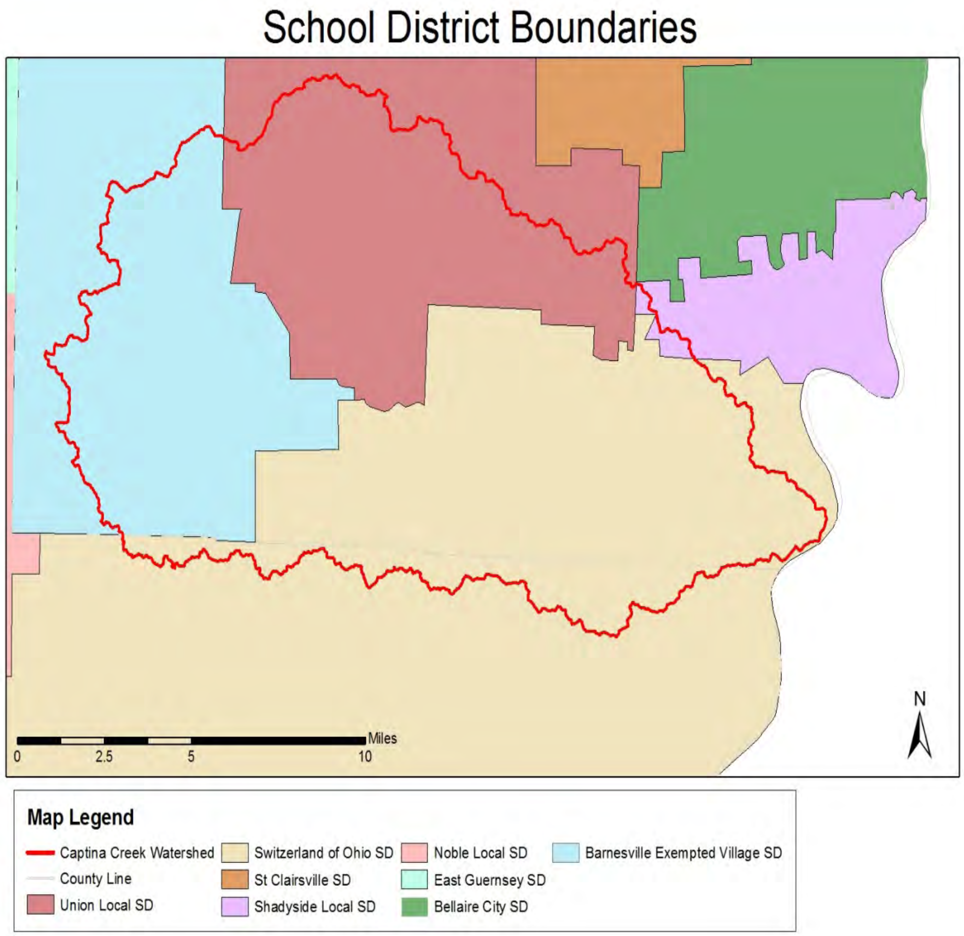


Figure 3. Public school district boundaries within the Captina Creek watershed.

Special Designations

The mainstem of Captina Creek (from RM 25.2 to State Route 7 at RM 0.8) and South Fork Captina Creek have been designated Outstanding State Waters (OSW) by OEPA based on exceptional ecological values and the presence of the Eastern Hellbender salamander. Two additional tributaries, North Fork Captina Creek (from RM 6.64 to the mouth) and Pea Vine Creek, have been declared Superior High Quality Waters by OEPA as well (OEPA 2010). The creek has also garnered recognition as an Aquatic Resource of National Importance (ARNI) by USEPA. It is not designated as national or state Wild and Scenic River but may be considered in the future. Captina Creek is a reference stream for other watersheds striving to achieve the high water quality attainment. Stream referencing is considered ecologically sound science in restoration and conservation planning in other watersheds.

Phase Two Storm Water Communities

The National Pollution Discharge Elimination System (NPDES), established by the Clean Water Act, provides governing rules for stormwater runoff. NPDES regulations are divided in two phases. Phase 1 is developed for the most severe stormwater pollution and Phase 2 is developed for less severe stormwater pollution, usually from smaller municipalities that were exempt from earlier regulations. There are no Phase 1 or Phase 2 storm water communities present within the Captina Creek watershed.

Chapter 3: Watershed Demographics

Population and Age

The estimated population residing in the Captina Creek watershed is approximately 11,138 persons with nearly one third of the population living in unincorporated areas. Population estimates are based on 2010 GIS address data provided by Belmont and Monroe Counties' 911 Services and was calculated by adding the total number of houses and trailers within the watershed boundary then multiplying that number by the county averages of 2.37 persons per household in Belmont and 2.5 persons per household in Monroe respectively (U.S. Census Bureau 2009). A map of the watershed population distribution by township is given in Figure 4. Each dot in Figure 4 represents either a structural building or trailer within the watershed. As expected, the majority of dots are situated in or near the incorporated villages. Using calculations described for estimating population numbers in the watershed, the population of individuals living within the watershed was 828 in Monroe County and 10,310 in Belmont County.

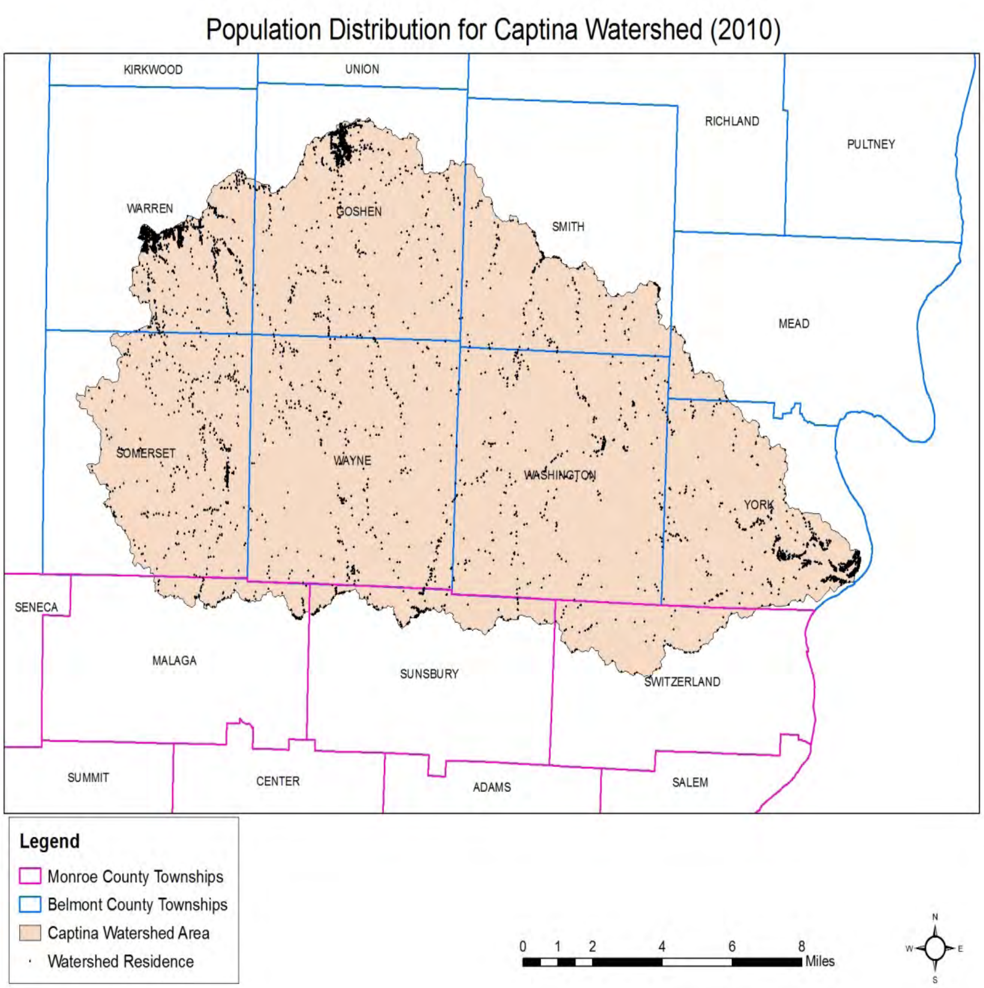


Figure 4. Belmont County townships are outlined in blue and Monroe County townships are outlined in red. More highly populated areas are represented by more highly concentrated dots on the map.

Based on 2010 census estimates, the population of Belmont County was 70,400 persons and the population of Monroe County was 14,642 persons. The population of Belmont County has slightly increased in the last ten years (increase of 0.25% from 70,226 persons) while the population of Monroe County has declined (decrease of 3.5% from 15,180) since 2000 (U.S. Census Bureau 2007-2011). Figures 5a and 5b represent a breakdown of the age groups by percentage in each county.

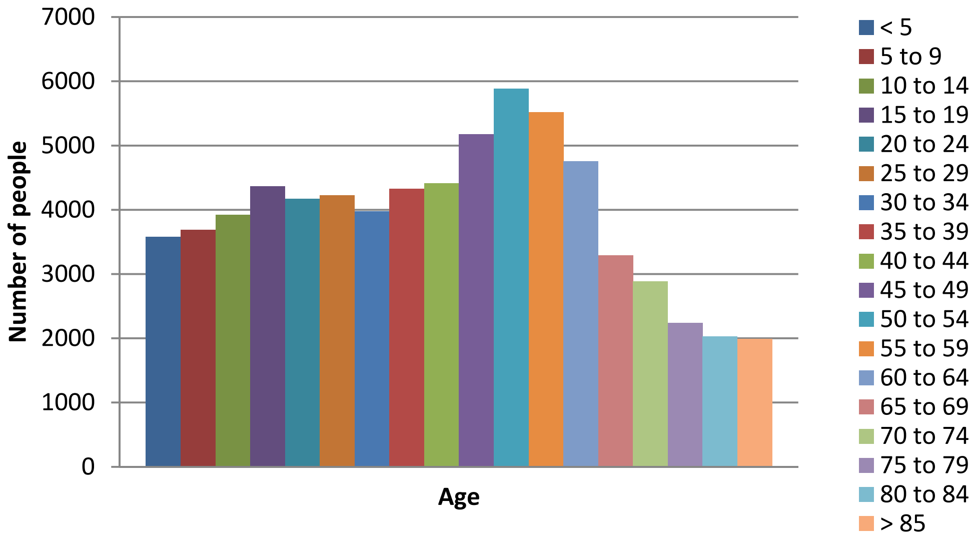


Figure 5a. Distribution of people in Belmont County by age, based on 2010 estimates (U.S. Census Bureau 2007-2011).

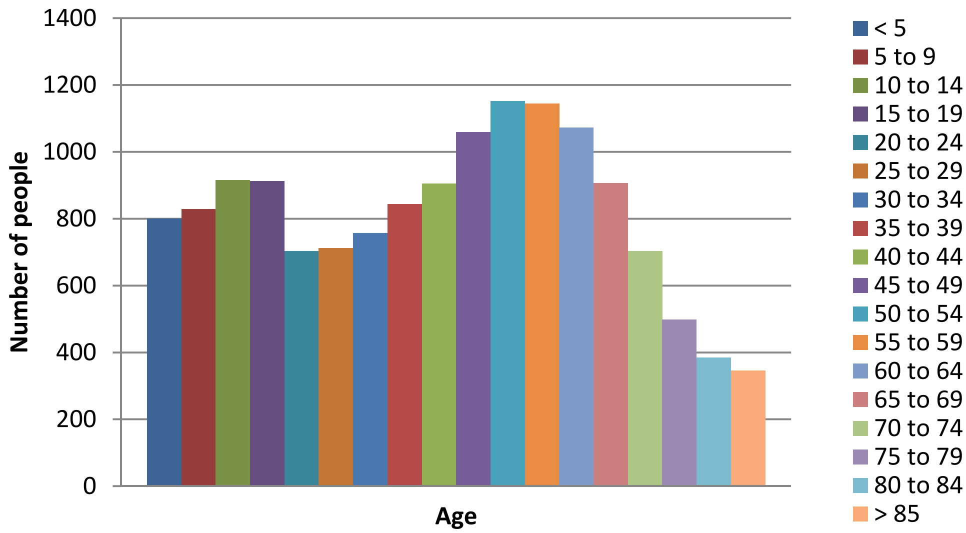


Figure 5b. Distribution of people in Monroe County by age, based on 2010 estimates (U.S. Census Bureau 2007-2011).

Education Levels

Educational attainment is similar for Belmont and Monroe counties, based on five-year estimates from 2007 to 2011. Rates of attainment for a high school diploma or higher were 87.0% for Belmont County and 85.9% for Monroe (85.9%) County, which is consistent with state (87.8%) and national (85.4%) averages for the same time period. Of those individuals who attend post-secondary institutions, 13.5% of individuals in Belmont County and 9.0% of individuals in Monroe County go on to earn bachelor degrees (U.S. Census Bureau 2007-2011). Figures 6a and 6b depict the educational attainment for individuals of both counties in the watershed.

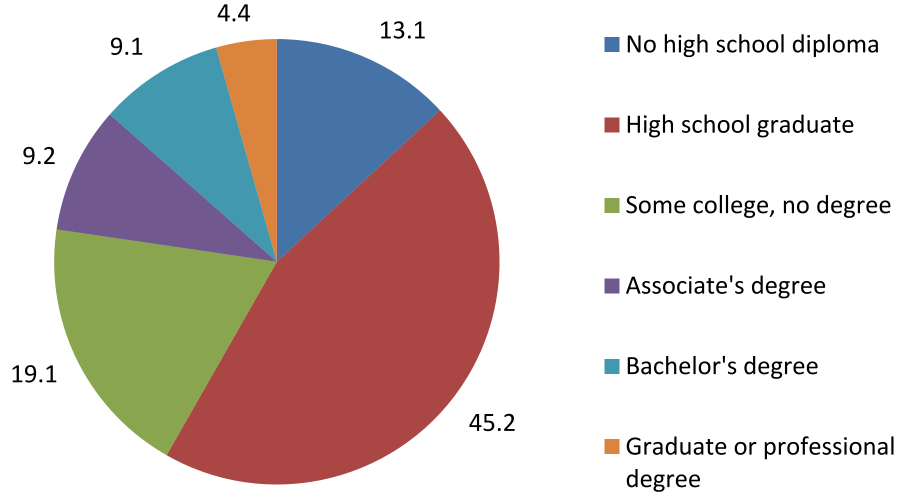


Figure 6a. Educational attainment (percentage) for individuals 25 years of age or older in Belmont County (U.S. Census Bureau 2007-2011).

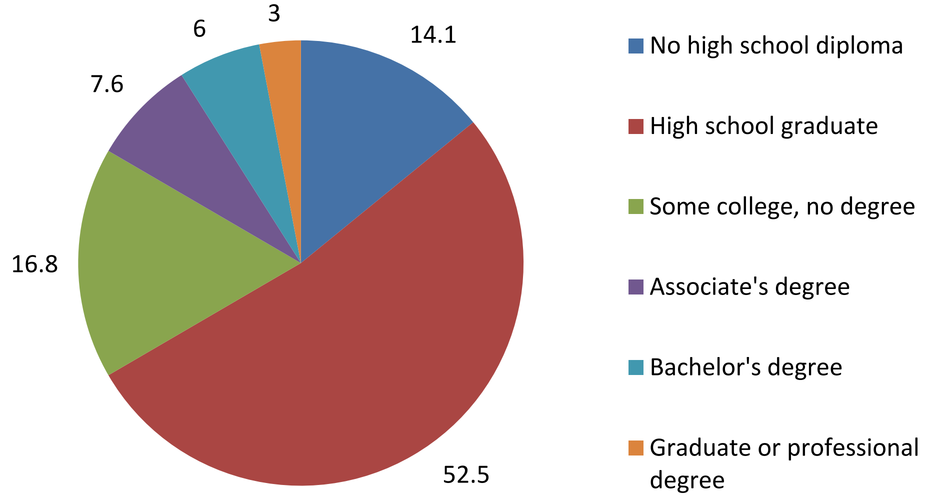


Figure 6b. Educational attainment (percentage) for individuals 25 years of age or older in Monroe County (U.S. Census Bureau 2007-2011).

Income Levels

Median annual income per household (in 2011 inflation-adjusted dollars) was $39,712 for Belmont County and $38,811 for Monroe County, compared to a state median of $48,071 and a national median of $52,762. The percentage of people whose income in the past twelve months was below the poverty level was 14.2% for Belmont County and 18.1% for Monroe County for the same period. Figures 7a and 7b depict yearly income statistics for residents of each county (U.S. Census Bureau 2007-2011). In 2011, the rate of unemployment for individuals 16 years of age or older was 8.6% for Belmont County and 11.2% for Monroe County (Ohio DJFS 2011).

In Belmont County, occupations represented by employed individuals 16 years of age or older were categorized as the following: management, business, science, and arts occupations (25.7%); sales and office occupations (25.5%); service occupations (21.0%); production, transportation, and material moving occupations (14.0%); and natural resources, construction, and maintenance occupations (13.8%). Industries most represented were educational services, healthcare and social assistance (26.3%) and retail trade (13.9%). Other industries represented were: manufacturing (8.6%); construction (5.9%); and agriculture, forestry, fishing and hunting and mining (5.9%).

In Monroe County, occupations represented by employed individuals 16 years of age or older were categorized as the following: sales and office occupations (22.4%); management, business, science, and arts occupations (22.1%); production, transportation, and material moving occupations (21.0%); natural resources, construction, and maintenance occupations (20.0%); and service occupations (14.5%). Industries most represented were educational services, healthcare and social assistance (19.3%), manufacturing (12.9%) and construction (12.1%). Other industries represented were: retail trade (11.9%); agriculture, forestry, fishing and hunting and mining (8.0%); and transportation, housing and utilities (6.8%) (U.S. Census Bureau 2007-2011).

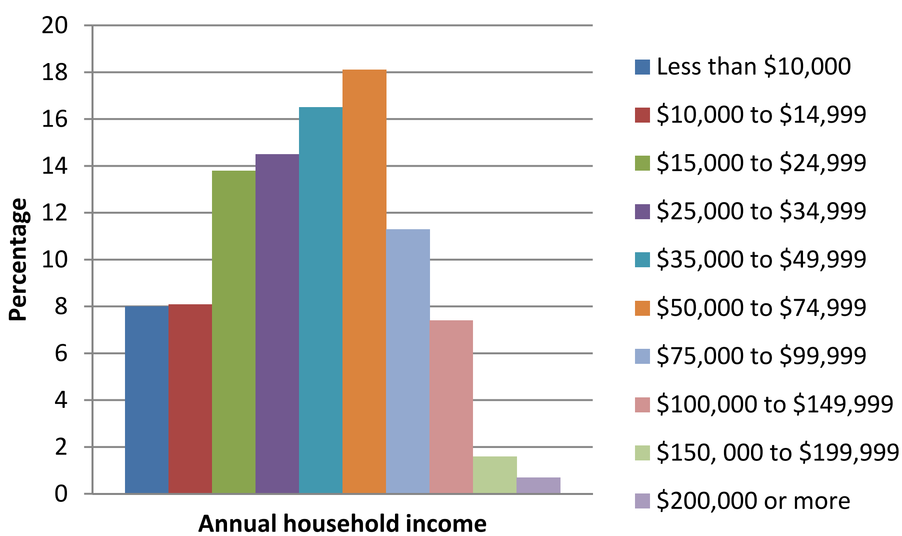


Figure 7a. Percentage of households in Belmont County within annual income brackets (in 2011 inflation-adjusted dollars) (U.S. Census Bureau 2007-2011).

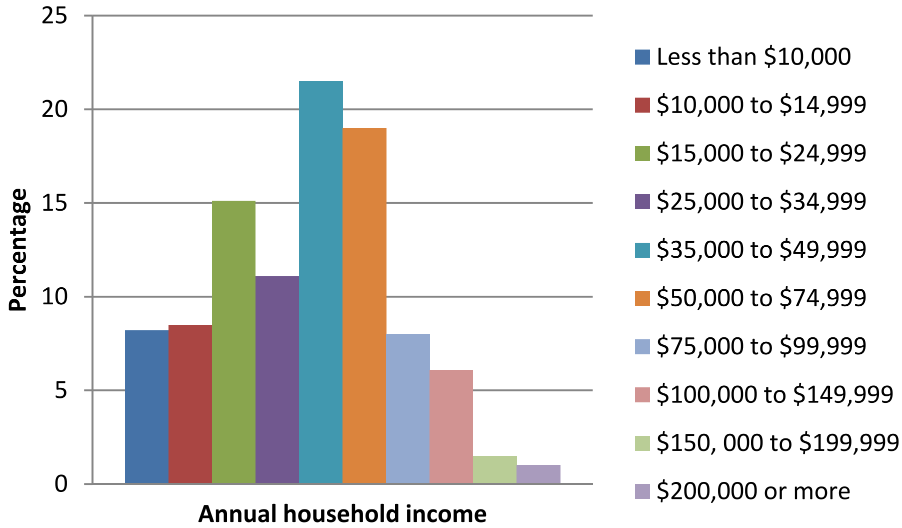


Figure 7b. Percentage of households in Monroe County within annual income brackets (in 2011 inflation-adjusted dollars) (U.S. Census Bureau 2007-2011).

Economic Growth

From 2000 to 2011, the size of the labor force in Belmont County has increased from 31,000 to 33,700 and the unemployment rate has increased from 6.0% to 8.6%. For the same period, the size of the labor force in Monroe County has decreased from 6,300 to 5,600 and the unemployment rate has increased from 7.0% to 11.2% (Ohio DJFS 2011).

According to U.S. Census Bureau projections, populations within Belmont and Monroe counties are expected to continue to decrease over the next ten years primarily due to a sluggish local economy and youth emigration for job opportunities. However, increases in activity for the oil and gas industry could increase employment and change economic and population projections for much of eastern Ohio, including Belmont and Monroe counties. Figures 8a and 8b represent historical and projected population changes over the next few decades for Belmont and Monroe counties (U.S. Census Bureau, 2000).

The Belmont County Community Improvement Corporation (CIC) has indicated that urban growth and development in the Captina Creek watershed is not forecast to be significant in the foreseeable future. A CIC representative has stated that Murray Energy has been the only corporation in the watershed that has worked with CIC in the past. CIC has also indicated that several private entities seek to establish future recreational ventures along the mainstem of the creek. The newest community improvement project developed for Belmont County is a commercial park located behind the Ohio Valley Plaza in St. Clairsville, well north of the Captina Creek watershed area (Douglass, personal communication, 2010). Additionally, the Switzerland of Ohio School District has constructed a new elementary school near Captina Creek west of Powhatan Point.

Economic forecasts are similar in Monroe County with a prediction for slow commercial development. The Black Walnut Center in Woodsfield and the State Route 7 corridor along the Ohio River are likely locations for potential future growth. The Switzerland of Ohio School District has constructed a new school facility in Monroe County. This facility serves as the new Beallsville Schools campus and is located along State Route 556 on the extreme southern edge of the watershed area.

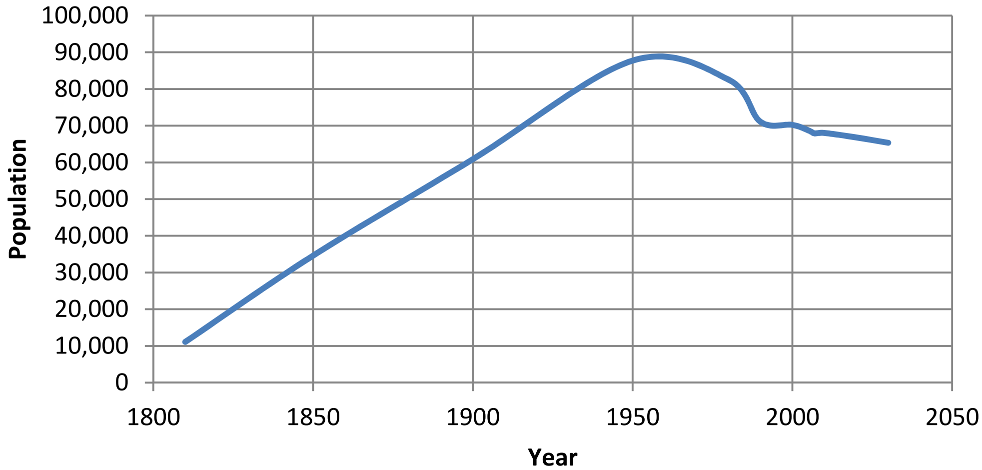


Figure 8a. Historical and projected population changes for Belmont County, 1800 – 2050 (U.S. Census Bureau, 2000).

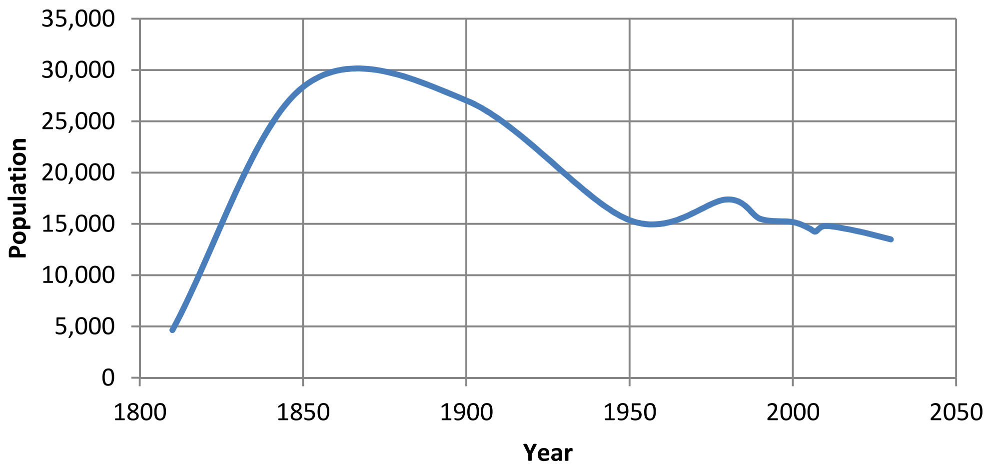


Figure 8b. Historical and projected population changes for Monroe County, 1800 – 2050 (U.S. Census Bureau, 2000).

Other Demographic Factors

Absentee land ownership is becoming more common within the watershed area. Although no census data exists regarding absentee ownership trends in the watershed, hunters and individuals seeking recreational retreats from surrounding urban areas (Columbus, Cleveland Pittsburgh) are constructing small cabins and mobile homes as temporary housing at an increased rate. These facilities have the potential to impact the creek and its tributaries as detailed in later sections of this watershed action plan.

Chapter 4: Watershed Geographic Locators

Geographically, Captina Creek is located in rural southeastern Ohio and is part of the foothills of the Appalachian Mountains. It is a direct tributary to the Ohio River and drains the southern third of Belmont County and the extreme northern edge of Monroe County, for a total drainage area of 180 square miles. The watershed area is bound by the Ohio River to the east, the McMahon Creek Watershed to the north, the Leatherwood and Salt Fork drainages to the west and the Sunfish Creek watershed to the south.

The Ohio sub-basin code is 7 (of the 93 Ohio sub-basins) and the 305(b) identification number is 06E. The Captina Creek watershed is part of the Central Ohio Tributaries and is located in section 05 of the United States Geological Survey corresponding to the Ohio River Basin drainage region. The creek is located in the Upper Ohio Sub-region (0503) with a total area of 13,200 square miles, Upper Ohio-Beaver accounting unit (050301) which is 6,570 square miles and an Upper-Ohio Wheeling cataloging unit (05030106) which is 1,490 square miles (Figure 9). Spatially, the watershed area lies between longitude coordinates 81°13'12.14" W and 80°47'43.58" W and between latitude coordinates 40°01'36.00" N and 39°49'36.50" N.

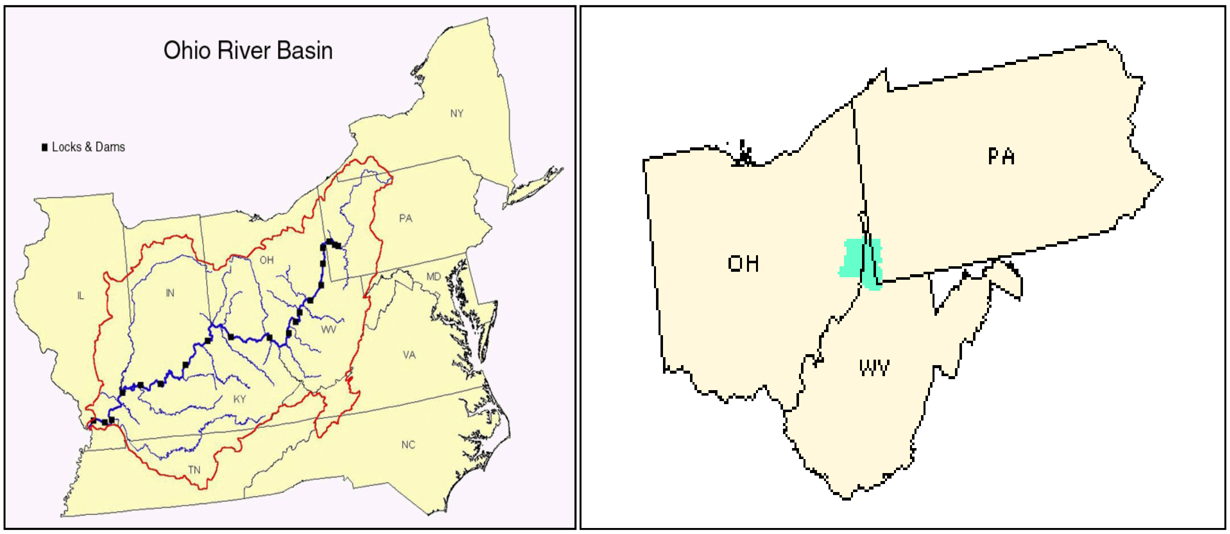


Figure 9. Maps of the Ohio River Basin *(left)* and the Upper Ohio Wheeling Watershed *(right)*. *Map sources:* The Ohio River Basin Consortium and Ohio EPA.

The Captina Creek watershed area consists of six subwatershed tributary regions that drain directly into the mainstem of Captina Creek. These subwatersheds are named North Fork Captina Creek, South Fork Captina Creek, Bend Fork, Piney Creek, Pea Vine Creek and Cat Run from west to east respectively.

Hydrologic unit codes (HUCs) were developed by the United States Geological Survey (USGS) in the 1970s as a means to standardize the watershed classification system in the U.S. Hydrologic units are watershed boundaries organized hierarchically by surface area. They range from regions of 2 to 16-digit codes with smaller codes representing a larger surface drainage and codes with higher digits representing very specific watershed drainages within a region (USGS 2010). ODNR currently recognizes 12-digit HUC coding for classifying watershed areas (Figure 10 and Table 1). The entire Captina Creek watershed also has an 8-digit HUC designated as 05030106 (NRCS, 2010).

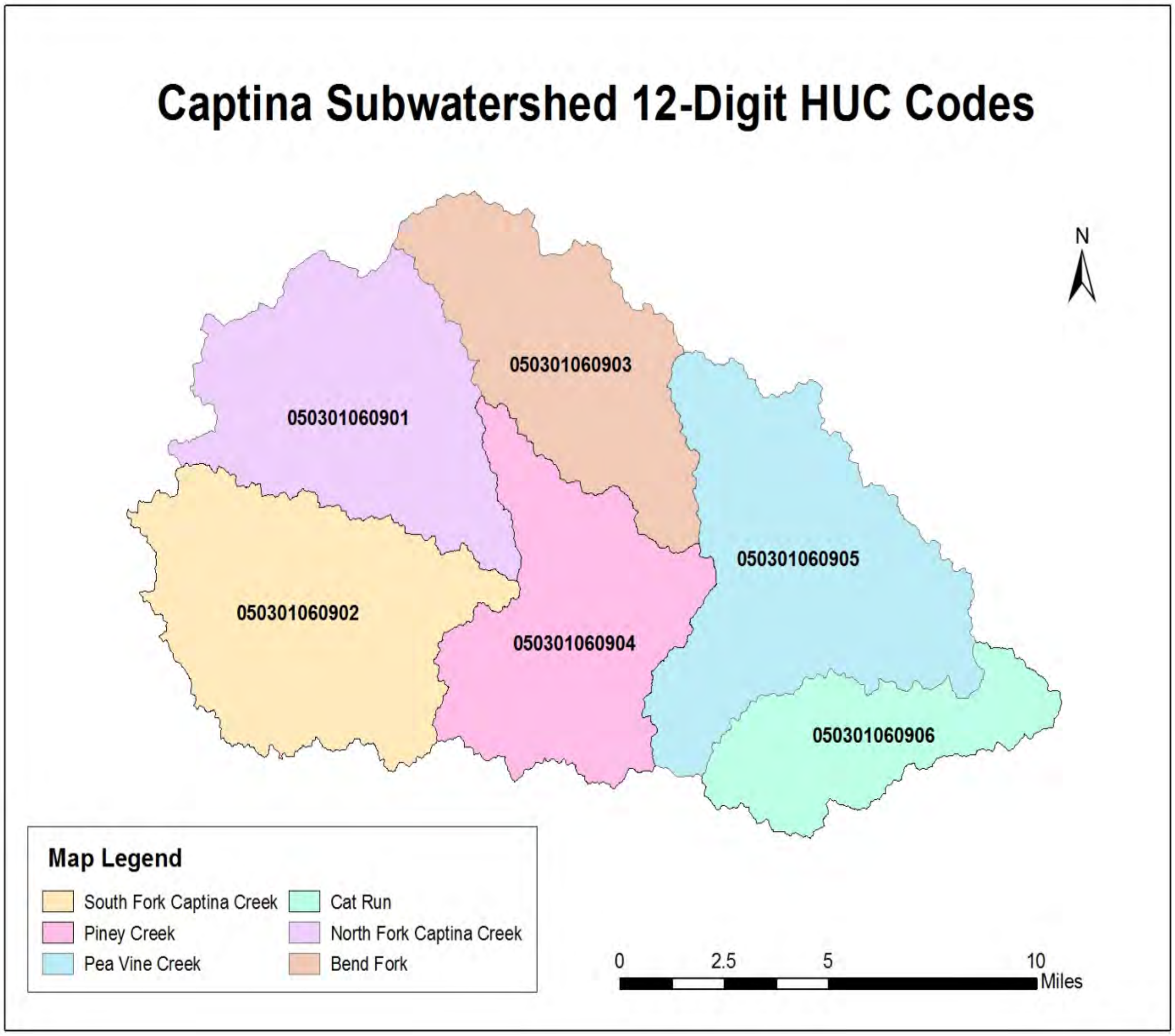


Figure 10. Map of the 12-digit hydrologic unit code (HUC) subwatersheds within the Captina Creek watershed and their corresponding HUC codes.

Table 1. Subwatershed areas by acreage (derived from Ohio Geological Survey data). Total stream miles were calculated using all tributary drainages in each subwatershed area including those that are semi-permanent.

Subwatershed	Twelve-Digit HUC	Surface Area (acres)	Total Stream Miles
Pea Vine Creek	050301060905	24,332	220.5
South Fork	050301060902	23,036	191.3
North Fork	050301060901	20,942	172.3
Piney Creek	050301060904	18,608	163.4
Bend Fork	050301060903	17,290	140.1
Cat Run	050301060906	10,980	64.3

Chapter 5: History of the Watershed and Restoration Efforts

Captina Creek is located in one of the most heavily mined areas of the state and is included in the Appalachian Coal Basin, one of the largest coal fields in the United States. Ohio Valley Coal Company's (OVCC) No. 6 mine facility located in west central Washington Township and American Energy Corporation's (AEC) Century Mine located immediately upstream in east central Wayne Township together make Belmont County the largest coal-producing county in the state, accounting for 43.9% of Ohio's total annual production volume in 2011. Monroe County ranked fourth in 2011 with 9.2% of the state’s coal production (ODNR 2012a; Pugh, personal communication, 2010). Both coal companies are owned by Murray Energy Corporation. With production forecast estimates from these mines ranging anywhere from another 30 to 60 years, it is likely that coal mining will continue to be a driving force in the area's economy and a key factor for watershed management.

Historically, coal mining in the watershed region has been mostly subsurface longwall or room-and-pillar extraction with some surface strip mining occurring primarily in Goshen Township. Figure 11 shows the extent of abandoned underground mine coverage in Belmont and Monroe counties. Figures 12a and 12b show areas in the watershed that have been previously surface strip mined or contain NRCS Soil Survey Geographic Database (SSURGO) spoil soils. Spoil soils consist of overburden or waste coal refuse left behind by strip mining processes and are generally poor quality soils.

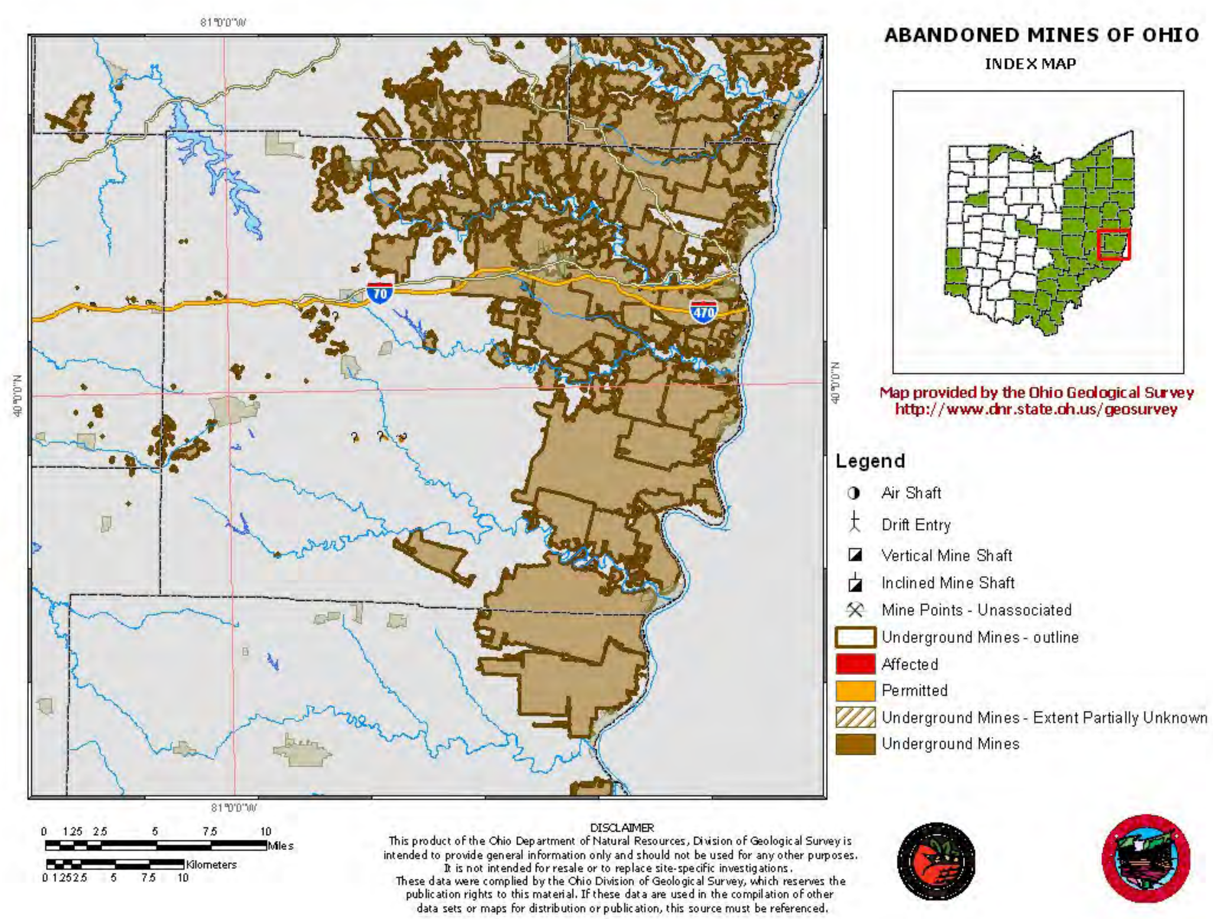


Figure 11. Map depicting underground mines located in Belmont and Monroe counties. *Map source:* ODNR – Ohio Geological Survey Abandoned Underground Mine Locator (2013).

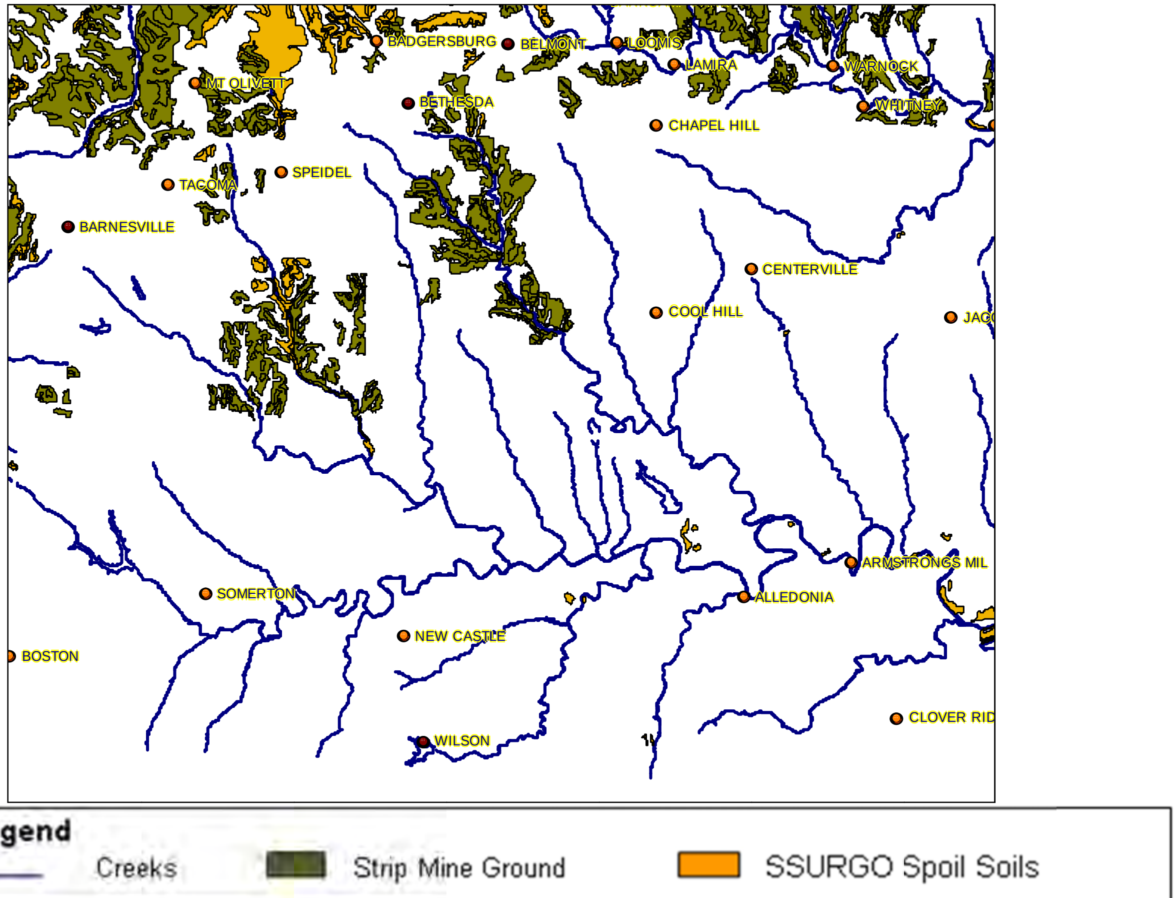


Figure 12a. Location of strip mined lands in the western portion of the Captina Creek watershed area. *Map source:* Belmont County GIS.

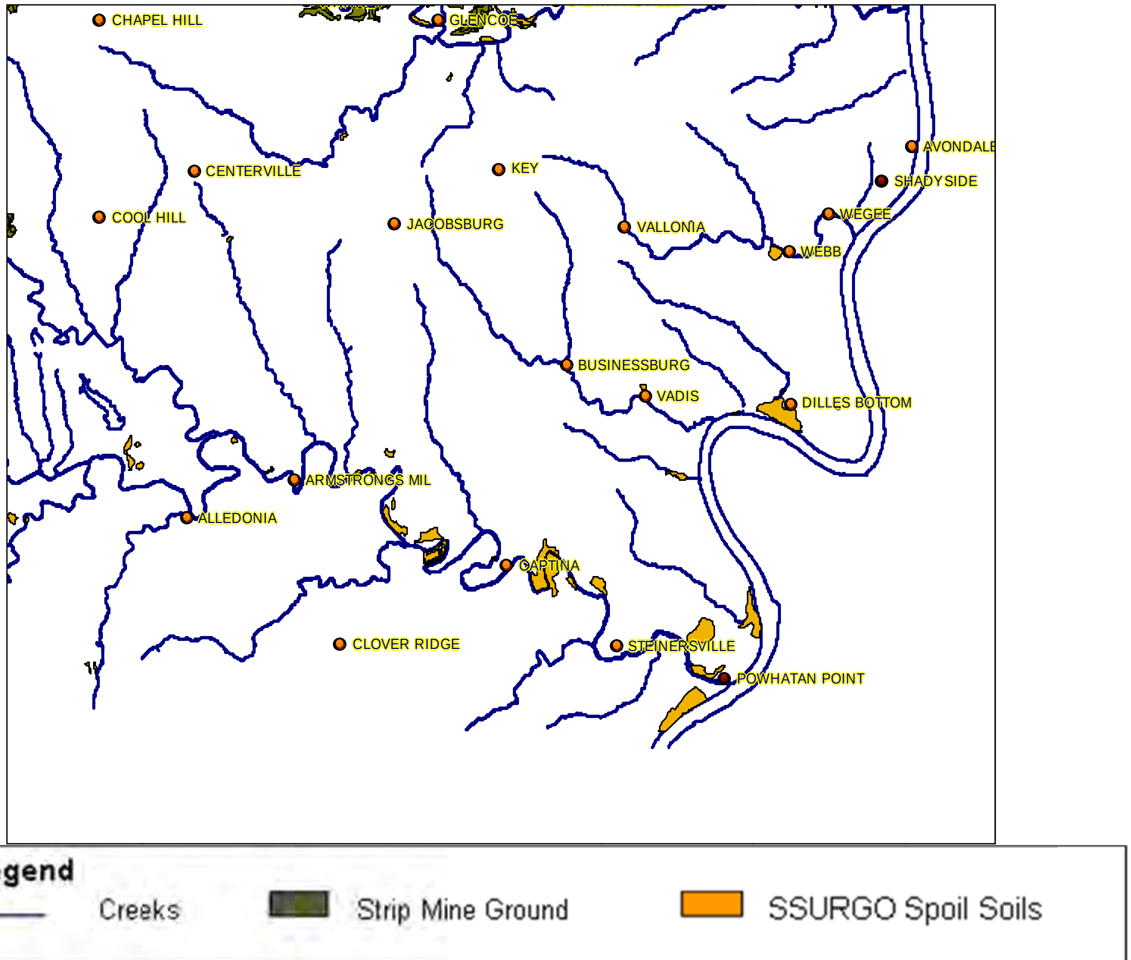


Figure 12b. Location of strip mined lands in the eastern portion of the Captina Creek watershed area. *Map source:* Belmont County GIS.

Captina Creek has had one historic restoration and cleanup effort of note. The campaign was led by the watershed organization *Citizens for a Clean Captina* that formed in the late 1970s, a time when water quality was so bad that large sections of the mainstem of Captina Creek were declared dead because of mining activities along its banks. The group was organized by watershed resident Dennis Bigler and had the goal of restoring water quality standards within the watershed at a time when there was little influence by the EPA on coal mining discharge and acid mine drainage (AMD). Contributing to water quality problems were waste coal gob piles deposited directly on creek banks and leaching AMD into Captina Creek, unregulated slurry seepage into the creek, and AMD from unreclaimed strip mine grounds and contaminated water discharging from underground mines. The *Citizens for a Clean Captina* group had seventy stakeholders of which forty attended regular meetings.

During this time the group organized unreclaimed strip mine funds to launch studies of acid mine drainage abatement and treatment (AMDAT) for Captina Creek. No formal watershed planning documents were developed at that time. *Citizens for a Clean Captina* disbanded in 1982 after successful cleanup efforts of the Oglebay-Norton gob pile at the former Cravat site near the confluence of Pea Vine and Captina Creeks. In a personal interview conducted in September of 2010, Dennis Bigler stated that he could not believe how fast the creek's habitat rebounded once the gob pile was removed. “In a matter of a few years the habitat went from seemingly dead to thriving,” commented Bigler.

Cravat Coal Company received recognition for its reclamation of 55 acres of strip mined grounds in the 1980s, located in section 33 of York Township across State Route 148 from Lake Shawn. The restoration project eliminated an existing high wall in the reclamation area, constructed two settling ponds lined with limestone slag to neutralize AMD and buried an existing gob pile at the site. Further improvements were made to this site from 1990 to 2000 with the assistance of Abandoned Mine Lands (AML) Appalachian Clean Streams (ACS) initiative. Included in these improvements were the installment of two additional settling ponds at the site and an alkaline slag bed to treat water escaping the toe of the buried gob pile. Cravat has also been credited for the reclamation of surface mined grounds in the late 1970s just west of Armstrongs Mills in Washington Township sections 10 and 16, and a reclamation of the Linn Tipple facility by installing settling ponds for AMD prior to 1986.

Two abandoned subsurface coal mines have also been reclaimed by ODNR - Division of Mineral Resources Management (DMRM) along the banks of Captina Creek. One area is located west of Powhatan Point along Cove Road and the other is just east of York Township Road 810 near the intersection with State Route 148. Both sites employ the use of alkaline dosing silos to treat acidic water pumped from underground mine shafts before entering the creek. The Cove Road silo is at the former Bellaire Corporation Powhatan No. 2 mine which was abandoned in 1954 and the York Township Road 810 silo is at the former Bellaire Corporation Powhatan No. 5 mine abandoned in the early 1980s.

In 2006, crews working for Murray Energy Corporation were able to remove a portion of the abandoned Oklahoma Coal Company Linn Tipple gob pile located in Section 4 of Washington Township. The reclaimed area is specifically located between State Route 148 and the railroad tracks. A sizable gob pile still remains on the hillside above the railroad tracks at this location and has been documented releasing AMD into a culvert along State Route 148. Mike Mozena, of DMRM's Abandoned Mine Land Program, states that the remnants of the Linn Tipple gob pile along Captina Creek in eastern Washington Township remain a priority project for his department. Two other partially reclaimed piles are located along Captina Creek downstream of Linn Tipple, and their locations are given in Table 2.

Table 2. Existing gob pile locations in the Captina Creek watershed.

Township and section	Subwatershed	Description	Coordinates	12-digit HUC
Washington - Sec. 4	Pea Vine Creek	Oklahoma Coal Company Linn Tipple Facility	80^{o} 54' 18.4" W 39^{o} 54' 5.1" N	050301060905
York - Sec. 21	Pea Vine Creek	Bellaire Corporation Powhatan No. 5 Mine site	80^{o} 51' 15.7" W 39^{o} 53' 17.5" N	050301060905
York - Sec. 33	Pea Vine Creek	Reclaimed Cravat gob pile	80^{o} 53' 35.8" W 39^{o} 53' 39.8" N	050301060905

Additionally, in spring 2007 biologists from Murray Energy Corporation reclaimed a wetland parcel near the Century Mine in Section 3 of Wayne Township along Township Road 87. The location was recently inspected and approved by the Army Corps of Engineers. Officials at Murray Energy Corporation have been open to ideas for mitigation projects, such as wetland restoration, that will improve water quality in the Captina Creek watershed.

In 2002, the Natural Resources Conservation Service (NRCS) targeted the Captina Creek watershed for the Environmental Quality Incentive Program (EQIP). This cost-sharing program protects soil and water resources by promoting the use of agricultural best management practices (BMPs). Since 1996, the program has provided Belmont County more than $3.2 million for conservation practices designed to protect water quality through the use of riparian buffer corridors, animal waste and nutrient management facilities, best silviculture practices and outreach activities (Bettinger, personal communication, 2013).

In 2010, specifications were made to the EQIP application guidelines by Belmont SWCD and the NRCS Local Work Group, giving extra points to farmers who live in the Cat Run and South Fork subwatersheds. These areas were targeted based on the 2008-2009 OEPA assessment of stream habitat and water quality, indicating higher than normal nutrient loadings due to lack of agricultural best management practices.

Section II: Watershed Action Plan Development

Chapter 1: Watershed Stakeholders and Partners

The following is a list of stakeholders and partners with representatives regularly attending Captina Creek watershed stakeholders meetings:

- Residents, landowners and local supporters of the Captina Creek watershed
- Belmont and Monroe County Commissioners
- Belmont County Tourism Council
- Belmont and Monroe County Health Departments
- Belmont and Monroe County Emergency Management Agencies
- Belmont County Department of Development/ Community Improvement Corporation
- Belmont County Engineer's and Geographic Information System (GIS) Departments
- Belmont Soil and Water Conservation District
- Monroe Soil and Water Conservation District
- Jefferson-Belmont Regional Solid Waste Authority (JB Green Team)
- Belmont-Guernsey-Monroe-Noble County Farm Bureaus
- Local Township Trustees
- Village of Powhatan Point
- Village of Barnesville
- Village of Bethesda
- Village of Beallsville
- Village of Wilson
- Ohio Department of Natural Resources
    - Division of Soil and Water Resources
    - Division of Wildlife
    - Division of Forestry
    - Division of Mineral Resources Management
- Ohio Environmental Protection Agency
- United States Fish and Wildlife Service, Ohio Private Lands Division
- United States Department of Agriculture – Natural Resources Conservation Service
- Ohio State University Extension – Belmont and Monroe Counties
- Ohio University – Eastern Campus
- Belmont College
- The Captina Conservancy
- Raven Rocks, Inc.
- Olney Friends School
- Murray Energy Corporation
    - Ohio Valley Coal Company
    - American Energy Corporation
- Columbus Zoo and Aquarium
- The Wilds
- Oglebay Good Zoo
- Barnesville Rotary Club
- St. Clairsville Area Chamber of Commerce
- Ohio Valley Riverfront Development Committee

The following is a list of individuals who have contributed to recent meetings and are thought to be valuable assets to the watershed stakeholders group:

Watershed Residents and Landowners:

Dennis Bigler - Director of Public Services, City of St. Clairsville
Role: Resident of the watershed and co-founder of the former *Citizens for a Clean Captina* watershed group.
Contact: dops@stclairsville.com

Randy and Nancy Boan - Owners, Horseshoe Bend Golf Course
Role: Conservation-minded active members in the watershed stakeholders group.
Contact: randyboan@gmail.com

Marie Bundy – watershed resident
Role: Has expert knowledge of watershed wildlife and birds and willing to assist in watershed events.
Contact: mmbundy@comcast.net

Rosemary Campbell - watershed resident, amateur birder
Role: Very conservation-minded and willing to help restore habitat in the watershed. Has agreed to allow USFWS to fund vernal pool restorations on her property.
Contact: rosiecampbell@ymail.com

Daniel Caron - watershed resident, professional photographer
Role: Good contact for nature photography photos and general information about the watershed.
Contact: daniel@naturenomad.com

Tom and Cathy Carpenter – watershed residents
Role: Tom is a local photographer and Cathy is a local artist. Involved in watershed outreach events, especially near Powhatan Point.
Contact: twcarpente@aol.com

Ted Cope - Co-owner, Raven Rocks, Inc., Captina Conservancy member
Role: Active participant in watershed stakeholder meetings and eager to contribute to watershed restoration projects.
Contact: don@ravenrocks.org

Jim and Georgiana Green – watershed residents
Role: Jim is a retired EPA biologist and very knowledgeable of fish and macroinvertebrates. Both are involved in watershed outreach events, especially near Powhatan Point.
Contact: bugman1946@gmail.com

Don Guindon – watershed resident
Role: Former Belmont SWCD Supervisor and involved in Technical Committee meetings.
Contact: don@olneyfriends.org

Leonard Guindon - Science Teacher, Olney Friends School
Role: Active member of the watershed group. Good source for volunteers to sample or monitor Captina Creek.
Contact: leonard@olneyfriends.org

Dorothy "Dottie" Milton - Owner, OYO Market in Powhatan Point
Role: Local business owner actively involved in the watershed group as well as the Ohio Riverfront Development Committee.
Contact: dorothy@choicesfordesign.com

Harold Pickens – watershed landowner
Role: Active member of the watershed group who owns property in the watershed and is willing to help advance the group forward.
Contact: pickensharold@yahoo.com

Ron Preston - Retired EPA biologist
Role: Great contact for biological information in the watershed and also for Barnesville area businesses. Very involved with the watershed group. Has been a mentor to the watershed coordinator position.
Contact: rpreston23@comcast.net

Christine Schneider - watershed resident
Role: Property owner along Captina Creek with interest in contributing to the watershed stakeholders group.
Contact: bubbles1@1st.net

Beverly Kirk Shull – Treasurer, Captina Conservancy
Role: Watershed resident and active member of the Captina Conservancy.
Contact: bevshull@gmail.com

Rich Sidwell - Retired Head of School, Olney Friends School and Co-owner of Raven Rocks, Inc.
Role: Active conservationist in the watershed along with other members of Raven Rocks, Inc.
Contact: rich@olneyfriends.org

Mike Tarter – member, Captina Conservancy
Role: Watershed landowner and active member of the Captina Conservancy.
Contact: smudrick958@aol.com

Debbie Waterman - watershed resident
Role: Has a definite interest in the well-being of the watershed and has offered to volunteer at watershed events.
Contact: twater51@juno.com

Jerry Witmer – Vice-president, Captina Conservancy
Role: Watershed landowner and active member of the Captina Conservancy.
Contact: jerrywitmer@sbcglobal.net

Agency and Institutional Partners:

Brad Allar – Former Belmont SWCD Supervisor
Role: Able to assist with landowner and stakeholder outreach and implementation of the watershed action plan.
Contact: bradallar@yahoo.com

Brian Baker – Belmont County Wildlife Officer
Role: Good resource for information and assistance with wildlife in the watershed.

Dan Beetem - Director of Animal Management, The Wilds
Role: Actively involved in eastern hellbender research projects in the Captina Creek watershed. Has also contributed to public promotional events in the watershed.
Contact: dbeetem@thewilds.org

Jeff Bettinger - District Conservationist, NRCS
Role: Great resource for information about agricultural best management practices for landowners in the watershed.
Contact: jeff.bettinger@oh.usda.gov

Kimberly Brewster – Captina Creek Watershed Coordinator, Belmont SWCD
Role: Development and implementation of the watershed action plan.
Contact: kb.belmontswcd@att.net

Liza Butler – Wildlife/Forestry Specialist, Belmont SWCD
Role: Can provide technical expertise relating to wildlife and forestry in the watershed.
Contact: butlerswcd@att.net

Kelly Capuzzi – Ohio EPA Biologist with Division of Surface Water
Role: Involved with data collection and water quality assessment in the watershed. Excellent resource for technical information about the watershed.
Contact: kelly.capuzzi@epa.state.oh.us

Sue Douglass - Executive Director, Belmont County CIC/DOD
Role: Important contact for information regarding zoning regulations and development in the watershed.
Contact: suedouglass.belmontcounty@comcast.net

Bruce Edinger - Retired biologist
Role: Active member of watershed group who has previous experience with drafting watershed action plans.
Contact: bruce_edinger@yahoo.com

Mike Freeman - Environmental Director, Belmont County Health Department
Role: Good contact for information on rural septic system installations and failing systems in the watershed.
Contact: Michael.Freeman@odh.ohio.gov

Jim Graham – Ohio Department of Transportation
Role: Has attended Technical Committee meetings. Excellent resource for information about transportation and road infrastructure in the watershed.
Contact: jim.graham@dot.state.oh.us

Don Giffin – Belmont SWCD Supervisor
Role: Able to assist with landowner and stakeholder contacts and implementation of the watershed action plan.
Contact: dongif@sbcglobal.net

Jerry Iles - Watershed Coordinator Advisor, OSU Extension
Role: Great resource for ideas on how to run effective watershed group meetings and for insight on developing the watershed action plan.
Contact: iles.9@osu.edu

Tammy Jones - Program Administrator, Monroe Soil and Water Conservation District
Role: Contact for watershed information in Monroe County.
Contact: tj.mswcd@yahoo.com

Chad Kinney – ODNR-DMRM Environmental Specialist
Role: Very knowledgeable of macroinvertebrate life in Captina Creek as well as AMD drainage locations. Active member of the watershed stakeholders group.
Contact: chad.kinney@dnr.state.oh.us

Greg Lipps - Private Biologist, ODNR Division of Wildlife
Role: Leading researcher of eastern hellbender populations in the watershed. Can provide technical information and has many connections at different levels statewide.
Contact: GregLipps@gmail.com

Vickie Markey-Tekely - Curator of Education, Wheeling Park Commission and Oglebay Good Zoo and Resort
Role: Contact for Oglebay Good Zoo. Supporter of and contributor to watershed events.
Contact: VMarkey@oglebay-resport.com

Katie Marks – Operations Manager, Belmont SWCD
Role: Administers watershed coordinator position and assists with development of the watershed action plan and watershed activities.
Contact: belmontswcd@att.net

Jason Mayberry – Belmont SWCD Supervisor
Role: Able to assist with landowner and stakeholder contacts and implementation of the watershed action plan.
Contact: jason@kuesterimplement.com

Kraig McPeek - Biologist, USFWS Ohio Private Lands Division
Role: Potential source of funding for watershed restoration and preservation projects.
Contact: Kraig_McPeek@fws.gov

Ed Mowrer – Belmont SWCD Supervisor
Role: Able to assist with landowner and stakeholder outreach and implementation of the watershed action plan.
Contact: edmowrer@gmail.com

Mike Mozena – ODNR-DMRM, Abandoned Mine Land Program
Role: Great resource for information regarding abandoned mines and AMD drainage outfalls in the watershed.
Contact: mike.mozena@dnr.state.oh.us

Jon Nagel – Murray Energy Corporation
Role: Involved in Technical Committee and great resource for information about MEC and reviews of the watershed action plan.
Contact: jnagel@coalsource.com

Greg Nageotte - ODNR Division of Soil and Water Resources, Ohio Watershed Program Coordinator
Role: Oversees and advises the watershed coordinator position and drafting of the watershed action plan.
Contact: greg.nageotte@dnr.state.oh.us

John Navarro - ODNR Division of Wildlife
Role: Provides funding for the Captina Creek watershed coordinator position through the Division of Wildlife. Active participant in watershed meetings and supporter of the position.
Contact: john.navarro@dnr.state.oh.us

Mary Ellen Newport - President, biologist, former assistant head, Olney Friends School and current teacher at the Interlochen Academy of Michigan
Role: Member of the Captina Conservancy Board of Trustees and key organizer in launching the Conservancy.

Rick Oberdick – Former Belmont SWCD Supervisor
Role: Able to assist with landowner and stakeholder outreach and implementation of the watershed action plan.
Contact: rick.oberdick@gmail.com

Don Pickenpaugh - GIS Director, Belmont County
Role: Is a wealth of information regarding mapping and spatial land analysis in the watershed. Has contributed significantly to the coordinator position in terms of equipment, maps and spatial data.
Contact: donp@belmontcountygis.com

Katie Pugh – Former Biological Coordinator, Murray Energy Corporation
Role: Primary watershed contact with Murray Energy Corporation but has recently relocated. Active member of the watershed group.
Contact: kwood@coalsource.com

Steve Schumacher - OSU Extension Educator, Belmont County
Role: Has served as the local contact to OSU Extension for the watershed coordinator.
Contact: schumacher.1@cfaes.osu.edu

Tammy Shepherd and Dorene Unterzuber - Belmont County JB Green Team
Role: Important contacts for organizing recycling and litter cleanup projects in the watershed.
Contact: tshepherd@jbgreenteam.org , dunterzuber@jbgreenteam.org

Brent Sodergren – U.S. Fish and Wildlife Service
Role: Important contact for developing watershed projects and representative of partnership with USFWS.
Contact: brent_sodergren@fws.gov

David Totterdale – Belmont SWCD Supervisor
Role: Able to assist with landowner and stakeholder contacts and implementation of the watershed action plan.

Doug Warmolts - Assistant Director of Living Conditions, Columbus Zoo and Aquarium
Role: Actively involved in the watershed through eastern hellbender research projects. Has contributed significantly to promoting the watershed and with organization of the Jack Hanna event.
Contact: Doug.Warmolts@ColumbusZoo.org

Mark Waters - Associate Professor of Biology, Ohio University Eastern
Role: Has conducted research with queen snakes and is currently working with eastern hellbenders in Captina Creek. Possible resource for monitoring or sampling water quality.
Contact: watersr1@ohiou.edu

Mike Willis - Owner, Broken Timber Outdoor Education Center
Role: Local business owner actively involved in the watershed group as well as the Ohio Riverfront Development Committee.
Contact: M_Willis55@yahoo.com

Constance White - Ohio River Watershed Specialist, ODNR Division of Soil and Water Resources (now retired)
Role: Oversees implementation of the Captina Creek Watershed Coordinator Grant at the regional level. Excellent resource for advice on coordinating public meetings and developing watershed plan content.
Contact: constance.white@dnr.state.oh.us

Tim Wojchowski – Belmont SWCD Supervisor
Role: Able to assist with landowner and stakeholder contacts and implementation of the watershed action plan.
Contact: wojchowski@aol.com

Chapter 2: Partner Roles and Responsibilities

Although there is no formally organized watershed organization, the following mission statements direct the efforts of entities directly involved in protection of the Captina Creek Watershed:

<u>Captina Creek Watershed Coordinator:</u> To restore and maintain the chemical, physical and biological integrity of water resources within the Captina Creek watershed.

<u>Belmont Soil and Water Conservation District:</u> To educate and assist present and future land users in the wise use of our soil and water resources.

<u>Captina Conservancy:</u> To promote and engage in the conservation and restoration of the Captina Creek watershed, through education, voluntary conservation agreements and acquisitions.

Belmont Soil and Water Conservation District and the Watershed Coordinator Position

The Belmont Soil and Water Conservation District (SWCD), organized in 1945, is a legal subdivision of state government that provides natural resource management assistance to county landowners and other units of local government. The district is funded by the Belmont County Commissioners and county funds are supplemented by funding from the Ohio Department of Natural Resources. A five-member board of county residents governs the district. Board members serve staggered three-year terms. The mission of the

Belmont SWCD is to educate and assist present and future land users in the wise use of Belmont County's soil and water resources.

In December 2007, The Division of Wildlife (DOW) approached Belmont SWCD about establishing a watershed coordinator position to write a watershed action plan for Captina Creek. DOW was very interested in Captina Creek due to the presence of a reproducing population of federally-endangered Eastern Hellbender salamanders, in addition to the creek's status as having the highest Index of Biotic Integrity (IBI) scores in Ohio.

Belmont SWCD submitted a proposal to establish the Captina Creek Watershed Coordinator position in 2008. The Coordinator is responsible, in part, for assisting with the organization and revitalization of a public watershed group with the goal of protecting local water resources within the Captina Creek watershed. The Coordinator is to assist with development of strategic and funding plans for a sustainable position and project implementation.

The Coordinator is responsible for completing the Captina Creek watershed action plan using input from the watershed group, technical committee, stakeholders, federal, state and local agencies, nonprofit organizations and interested individuals. There is a watershed education component to the position with the goal of promoting best management practices for maintaining and protecting the water quality of the watershed. Educational programs for the general public, landowners and local leaders are an important component of this work. The Coordinator is to assist with development of strategies and goals to bring all the necessary stakeholders together to implement the action plan.

The Coordinator is supervised on a day-to-day basis by the Belmont SWCD Operations Manager, who is responsible for performing management functions and administrative coordination of the District. The Operations Manager reviews the coordinator's progress quarterly. The Belmont SWCD Board reviews the coordinator annually and reviews quarterly reports by the Operations Manager. An Area Assistance Team provides assistance and direction in plan development and is involved in the annual review by the state. A technical advisory committee meets quarterly, or as needed, to provide expertise for project planning and implementation.

The Captina Creek Watershed Coordinator can be reached at the Belmont Soil & Water Conservation District, 101 N. Market St., Suite A, St. Clairsville, Ohio 43950, or by telephone at 740-526-0027.

The Captina Conservancy

The Captina Conservancy, established in 2010, is a 501(c)(3), charitable, non-profit land trust located in Barnesville, Ohio. The purpose of the Conservancy is to promote and engage in the conservation, sustainability, and restoration of the Captina Creek watershed though education, voluntary conservation agreement and acquisitions. The Conservancy is managed by a Board of Trustees who meets quarterly to discuss the Conservancy's role and participation in activities that will promote its purpose. The organization has adopted the Land Trust Standards and Practices recommended by the Land Trust Alliance (Appendix A).

The Captina Conservancy prepared an application for funds to the Clean Ohio Funds in 2012 for the purpose of establishing a significant (1,015 acres) permanent conservation easement in the watershed. Upon approval and distribution of the funds, the easement will become a reality for Belmont County communities. This first project will lead the way for future land conservation in the watershed, as more awareness of this success is gained by potential landowners interested in developing an easement on their properties.

The Captina Conservancy Board of Trustees is comprised of the following individuals:

- Jerry Whitmer, *President, a landowner in the watershed, a teacher at University of Akron and a farmer*
- Ron Preston, *Vice-President, Conservancy Project Manager, retired aquatic biologist, Captina Creek recreational user, watershed resident*
- Beverly Kirk Shull, *Treasurer, Captina Watershed resident, retired business manager, healthcare professional*
- Ted Cope, *Olney Friends School graduate, watershed resident, farmer*
- Mike Tartar*, resident of Bellaire, Captina Creek recreational user*
- Dr. Harold Pickens, *Optometrist, watershed landowner and recreational user*
- Rich Sidwell*, member, trustee, one of the founding members of Raven Rocks, Inc., retired Head of School at Olney Friends School*
- Denny Strickland*, member, Regional Land Manager for the Murray Energy Corporation, Slippery Rock University graduate*

The Captina Conservancy can be contacted by phone at 740-359-4013, by mail at P.O. Box 318, Barnesville, Ohio 43713, or by email at contact@captina.org. Additional information can also be found on the Captina Conservancy website at http://www.captina.org.

Captina Creek Watershed Stakeholders Group

There is currently no existing, formal organization of Captina Creek watershed stakeholders. Strong, long-term local participation is essential for successful protection of the watershed. A partnership of diverse stakeholders will ensure broad public support for watershed protection efforts. The desire to protect this water resource is shared by a variety of stakeholders, including watershed residents and landowners, local governments, businesses, and industries, educational institutions, nonprofit organizations, and natural resource agencies. Many of these stakeholders have already demonstrated interest and involvement in the watershed protection effort. The future formation of a formal watershed group may provide further opportunities for collaboration and productive relationships among these stakeholders to achieve their shared goal of watershed protection.

If established, the formal structure of a watershed stakeholders group should include a mission statement, operational procedures, bylaws and organizational structure (e.g. board of directors, group membership) will be developed through stakeholder input. Decision-making and watershed protection efforts will be overseen by various advisory committees (e.g. Technical Committee, Executive Committee, and Educational Committee) through a consensus-based approach. Advisory committees can be interdisciplinary groups comprised of both professionals with expert knowledge and interested citizens.

- A technical advisory committee can design, supervise, and evaluate protection or restoration projects implemented by the watershed group. Additionally, this committee can supervise monitoring efforts within the watershed. The formation of a citizen science group may be a good way to involve the community in watershed group activities and combine education efforts with monitoring needs.
- An executive advisory committee will handle policy issues, conduct dispute resolution, facilitate group decision-making, manage public relations and conduct fundraising.
- An educational advisory committee will organize outreach events such as community events, watershed tours, landowner workshops and youth programs.

Chapter 3: Watershed Action Plan Development

General Plan Contents

The purpose of the watershed action plan is to give a complete and thorough evaluation of the current status of the Captina Creek watershed and to make plans for future conservation and protection efforts within the watershed. The action plan is designed as an assessment of the current status of Captina Creek and its tributaries as well as a predictor of future trends in the watershed, in terms of impacts to its hydrologic, biological, ecological and geological components. The action plan includes cultural and demographic information regarding the residents of the watershed as well as background information about natural history and land usage. This plan does not establish a total maximum daily load (TMDL), which is an assessment of pollutants contained within the watershed's aquatic bodies and ways to limit their release from point and nonpoint sources. The Captina Creek watershed at this time is not in need of a TMDL; the Ohio EPA has assessed the mainstem and various tributaries of Captina Creek, which have all met 100% aquatic life use attainment (with the exception of South Fork RM 3.0 and Cat Run RM 3.3, both due to natural conditions).

Development of the watershed action plan also includes the establishment of relationships among various stakeholders that are essential for the accomplishment of watershed protection goals. These relationships must be developed and maintained for future collaboration among local, state and federal entities and successful implementation of conservation projects within the watershed.

A summary of information included in the plan is listed below:

- Watershed overview
- Historical history and natural resource information
- Demographic and socioeconomic information
- Geographical and administrative boundaries
- Development and evaluation of the watershed action plan
- Watershed inventories
    - Biological, physical and chemical water quality
    - Geology, soils, water resources and land usage
- Summary of water quality threats and impairments
- Action plans (goals, objectives, actions) for the 12-digit HUC subwatershed
- Glossary and references

Endorsement and Adoption of the Watershed Action Plan

Following the completion of the watershed action plan and approval of the plan by ODNR - Division of Soil and Water Resources and the Ohio EPA, the watershed coordinator will then distribute and present the plan to the general public, various organizations and government entities for local adoption and endorsement, including the following:

- Belmont and Monroe County Commissioners
- Trustees of York, Mead, Smith, Goshen, Washington, Wayne, Somerset and Warren townships in Belmont County and Miltonsburg, Sunsbury, and Switzerland townships in Monroe County
- Mayors and City Councils of Barnesville, Beallsville, Bethesda, Powhatan Point
- Belmont and Monroe County Emergency Management Agencies

- Belmont and Monroe County Soil and Water Conservation Districts
- Belmont and Monroe County Ohio State University Extension Staff
- Belmont and Monroe County Community Improvement Councils
- Belmont and Monroe County Health Departments
- Local Kiwanis Clubs, Rotary Clubs, 4-H Councils, and local Farm Bureaus

The purpose of these meetings will be to distribute and present the plan (using PowerPoint presentations when necessary) and provide time for questions and feedback. Media outlets will be used to announce the completion and endorsement of the plan, including local newspapers (*The Times Leader*, *The Intelligencer*), the Belmont Soil and Water Conservation District newsletter, the Ohio Watersheds Listserv, and the Ohio Federation of Soil and Water Conservation Districts listserv. Copies of the watershed action plan will also be available at the following locations:

- Belmont and Monroe County Public Libraries
- Belmont and Monroe Soil and Water Conservation Districts
- Websites for Belmont and Monroe Soil and Water Conservation Districts and the Ohio Watershed Network

Evaluation, Update and Revision of the Watershed Action Plan

The progress of the implementation of the WAP will be tracked by the watershed coordinator and the watershed stakeholders group, through documentation of objectives accomplished and goals met. These accomplishments will be recorded in the implementation tables for each subwatershed in this WAP, documented through annual work plans, and progress will be discussed at quarterly Technical Advisory Committee meetings. Completed projects will also be recorded in the ODNR – Division of Soil and Water Resources software program, Soil and Water Information Management System (SWIMS), and progress will be assessed by the Division's Watershed Program Manager through semi-annual progress reports. In addition, water quality monitoring data will be recorded on the NPS Project Entry Database (www.watersheddata.com) in order to track water quality changes associated with implemented projects. Long-term water quality monitoring will be conducted on a monthly or bi-monthly basis by the watershed coordinator and a team of volunteers. QHEI and macroinvertebrate monitoring will be conducted annually or bi-annually by the monitoring team and/or the OEPA, as needed. The accomplishment of watershed goals and objectives will also be announced to the public through the various media outlets mentioned above.

The unexpected scenario in which the WAP's goals and objectives are not achieved within the proposed timeline (possible reasons including poor weather conditions, lack of funding, etc.) should be addressed by the Technical Advisory Committee (TAC). The TAC will determine what actions are not being completed, potential reasons for unsatisfactory progress, and how improvements can be made. Evaluation of the watershed action plan may also indicate the need for updates and/or revisions. An evaluation of the successful completion of WAP goals should be conducted three years after endorsement and should be submitted to the TAC. Revisions or amendments to the plan may be required in response to the availability of new data, the emergence of new opportunities or new water quality problems, or the determination of insufficient time allowed for achievement of a goal. All revisions must be reviewed by the TAC and watershed stakeholders, and submitted for approval to the Division of Soil and Water Resources and the Ohio EPA. Copies of the watershed action plan will then be replaced with the updated version at all locations where they are available, and the changes will be announced to the public.

History of Public Participation in the Development of the Watershed Action Plan

The development of the Captina Creek watershed action plan is rooted in the concerns and interests of local residents who were encouraged to participate in the planning process. Initially, newspaper press releases were posted to inform the public about the watershed coordinator position and the overall purpose of the watershed action plan. The press releases expressed that public involvement is essential for completion of the plan and encouraged interested residents to contact the watershed coordinator.

The first Captina Creek watershed stakeholders meeting was held July 30th, 2009 at the Horseshoe Bend Golf Course. The purpose of this meeting was to inform the public about the watershed action plan and discuss local factors influencing the watershed. Concerns from citizens were used to shape the contents of the action plan. Since the start of the planning process, several public events have taken place during which the watershed coordinator has encouraged the public to become involved with the watershed group. These events include visits from Jack Hanna of the Columbus Zoo and Aquarium during the Captina Creek Watershed Rallies. This event, which was first held on May 24th, 2010 at the Belmont County Fairgrounds, serves to promote awareness of the significance of the watershed to the public. As a follow-up to his 2010 visit to the Carnes Center, Jack Hanna returned to the Health and Physical Education Center at the Ohio University Eastern Campus on May 4th, 2011 to show support for the Captina Creek watershed. A formal dinner was also held in Shannon Hall following Hanna's presentation for landowners interested in hearing more about the Captina Conservancy. Contact information was obtained through a door prize raffle which yielded approximately 50 new contacts for the watershed stakeholders group. A very similar landowners meeting was held at the Rally on May 14th, 2012.

Since the initial meeting in 2009, additional stakeholders meetings have been held on October 26th, 2010, March 21st, 2011, and October 28th, 2011. The purpose of the first meeting was to reiterate the goals of the watershed coordinator position and the action plan. Local concerns about the watershed were also recorded and addressed in a question and answer session following the meeting. The March 2011 meeting served to address content from the impairments section of the watershed action plan. It was also suggested by the group at this meeting to remove Pipe and Wegee Creek subwatersheds from the action plan due to their geographic location outside of the Captina Creek watershed. An additional meeting was held on October 18th, 2011 at the OOYO store in Powhatan Point, in order to construct a local focus group at the most eastern point of the watershed. The goal of these public meetings is to promote conversations and relationships that will increase collaboration among stakeholders and provide a local movement for implementation of the watershed protection effort. Future public meetings will incorporate the development of a watershed stakeholders group and the implementation of the endorsed watershed action plan.

Endorsement of Plan by Watershed Partners

Section III: Watershed Inventory

Chapter 1: Geologic Description of the Watershed

Topographical Features

Topography can be defined as the shape of a land area in terms of change in elevation over a given distance. Elevations in the Captina Creek watershed range from heights exceeding 1,400 feet above sea level on the ridge tops of the southeastern subwatershed areas to below 640 feet above sea level at the mouth of Captina Creek in Powhatan Point. The three highest elevations in the Captina Creek watershed are listed in Table 3.

Table 3. Highest elevations (expressed in feet above sea level) in the Captina Creek watershed, identified by subwatershed, 12-digit HUC and geographic coordinates. *Source:* United States Geological Survey.

Location	Elevation (feet above sea level)	Subwatershed	12-digit HUC	Geographic coordinates (long./lat.)
Unnamed knob at the top of German Ridge	1381	Cat Run	050301060906	80° 51' 50.0"W/ 39° 50' 58.9"N
One Half Mile South of New Castle	1369	Piney Creek	050301060904	81° 4' 30.3"W/ 39° 53' 11.3"N
Two miles north of Hunter	1364	Bend Fork	050301060903	81° 3' 23.6"W/ 39° 58' 26.9"N

Stream drainages and erosive processes characteristic of a temperate climate zone have created a hilly landscape of moderately deep valleys with steep-sided slopes conducive to flash flooding during heavy rainfall. Figure 13 indicates the location of each subwatershed relative to the entire watershed region. Topographic profiles of each subwatershed in the Captina Creek watershed are shown in Figures 14 through 19.

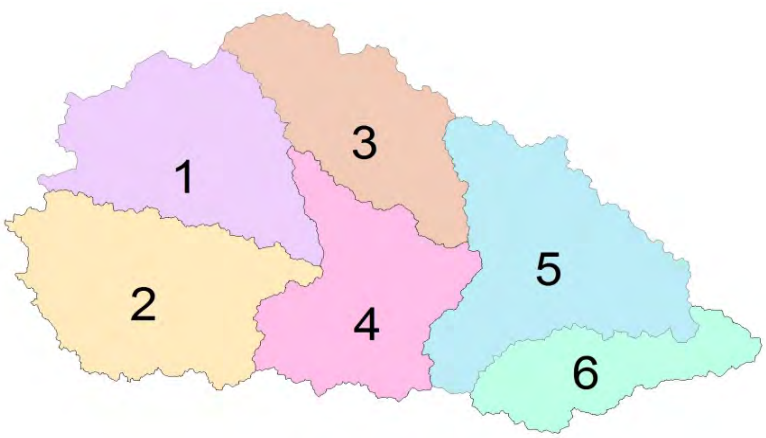


Figure 13. Map depicting the location of each subwatershed within the Captina Creek watershed. Numbers are used to label each subwatershed for identification in Figures 14 – 19.

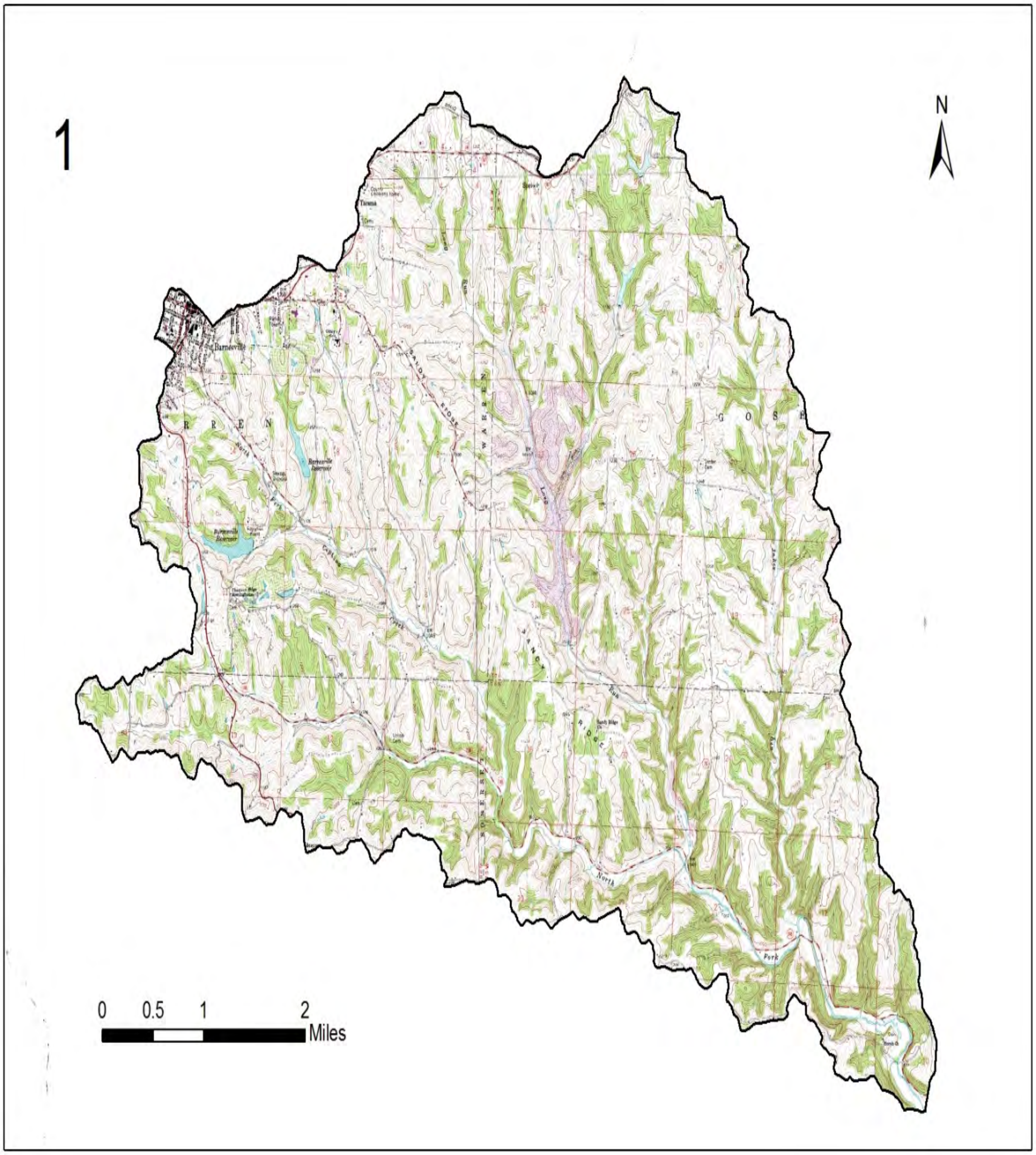


Figure 14. Topographic map (7.5 minute quadrangle) of the North Fork subwatershed. Contour interval is 20 feet. *Source:* United States Geological Survey.

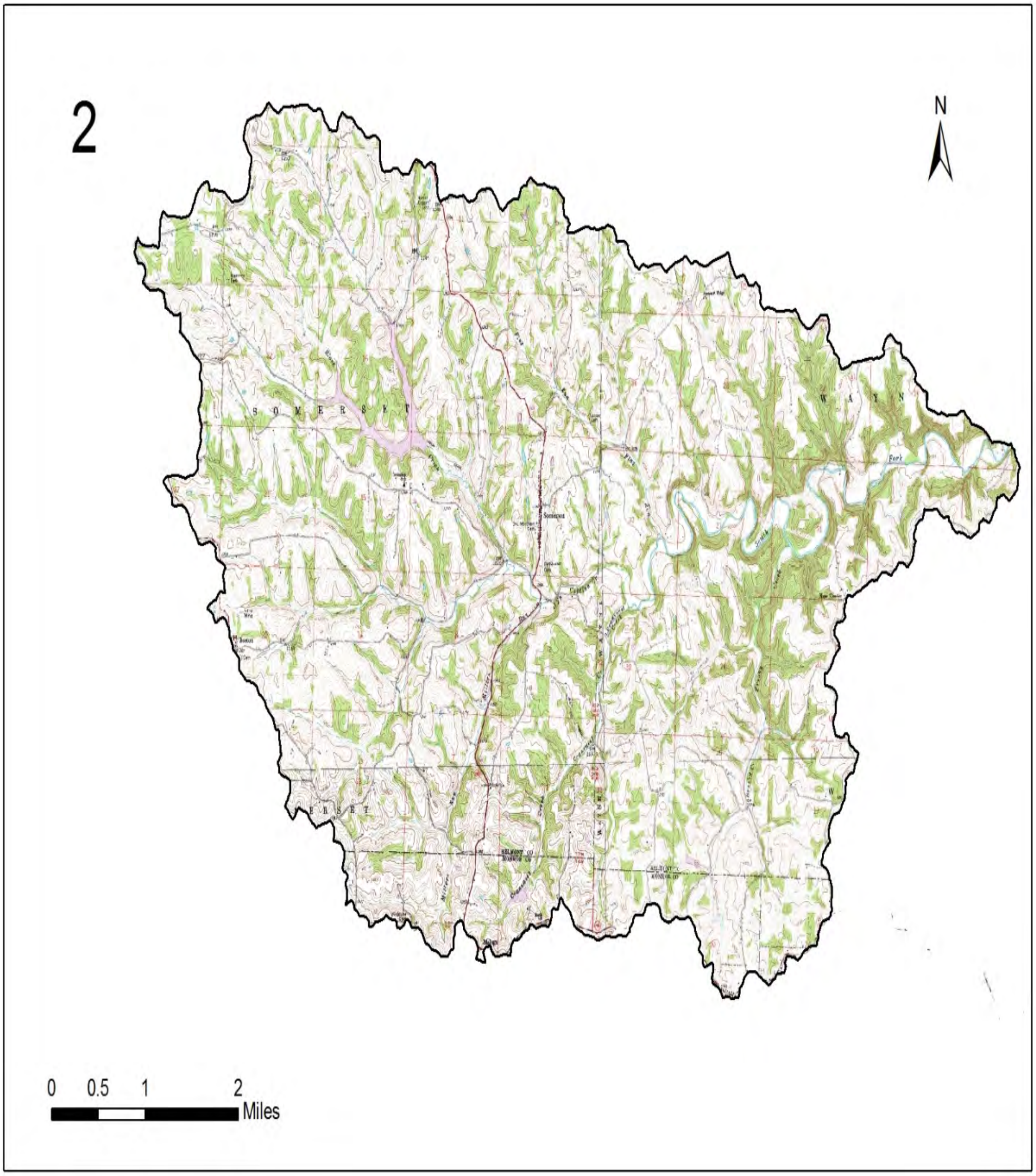


Figure 15. Topographic map (7.5 minute quadrangle) of the South Fork subwatershed. Contour interval is 20 feet. *Source:* United States Geological Survey.

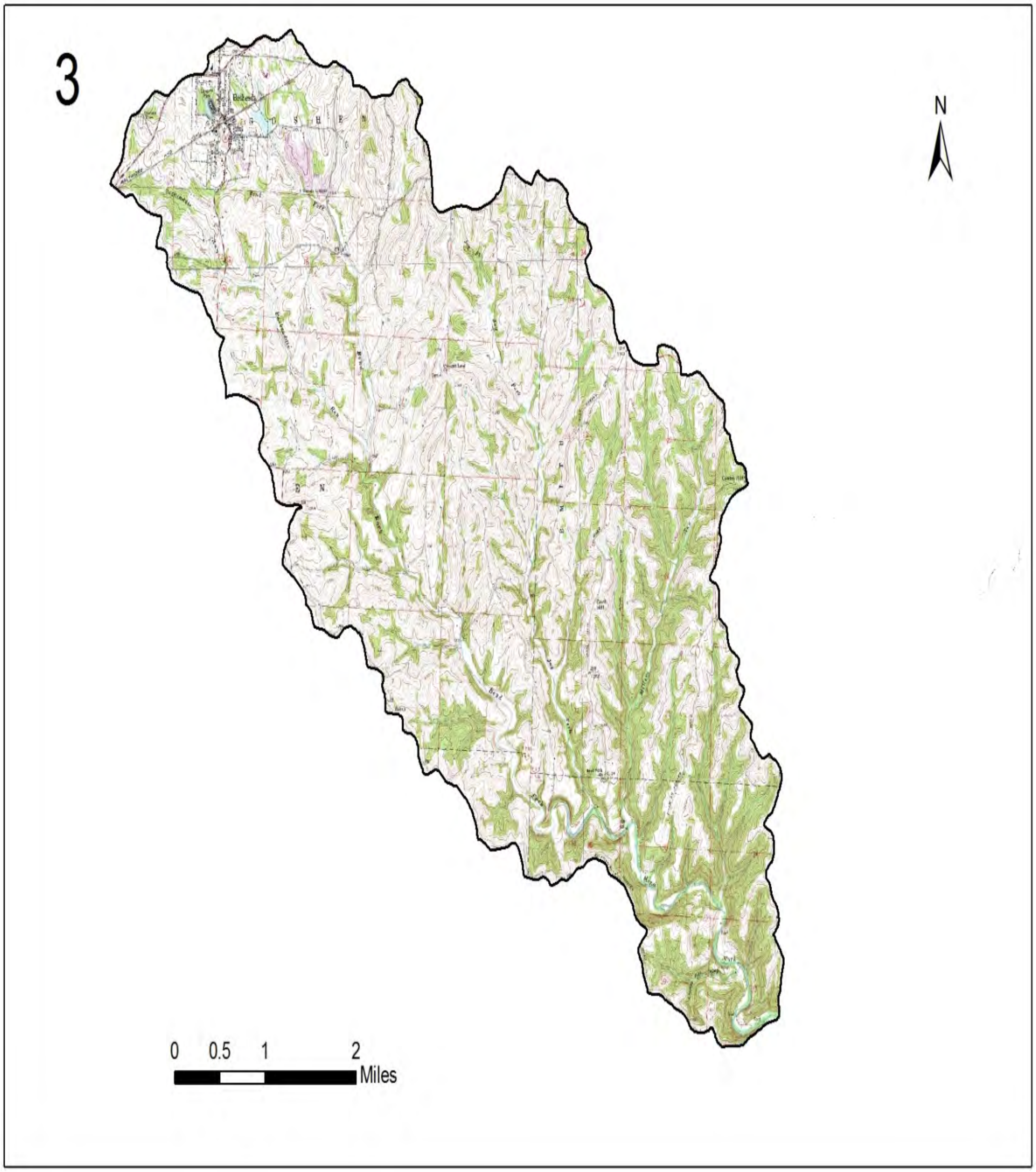


Figure 16. Topographic map (7.5 minute quadrangle) of the Bend Fork subwatershed. Contour interval is 20 feet. *Source:* United States Geological Survey.

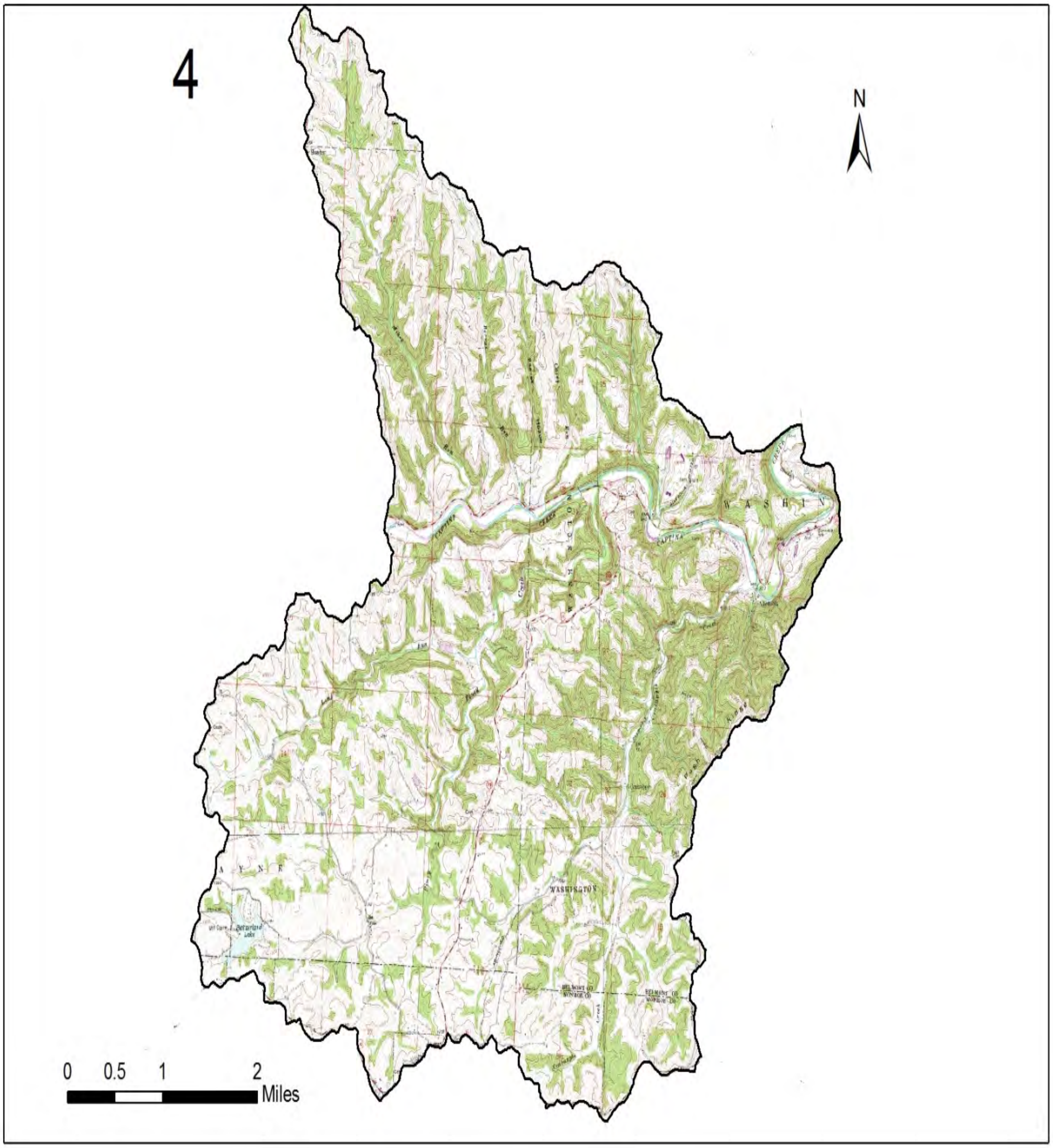


Figure 17. Topographic map (7.5 minute quadrangle) of the Piney Creek subwatershed. Contour interval is 20 feet. *Source:* United States Geological Survey.

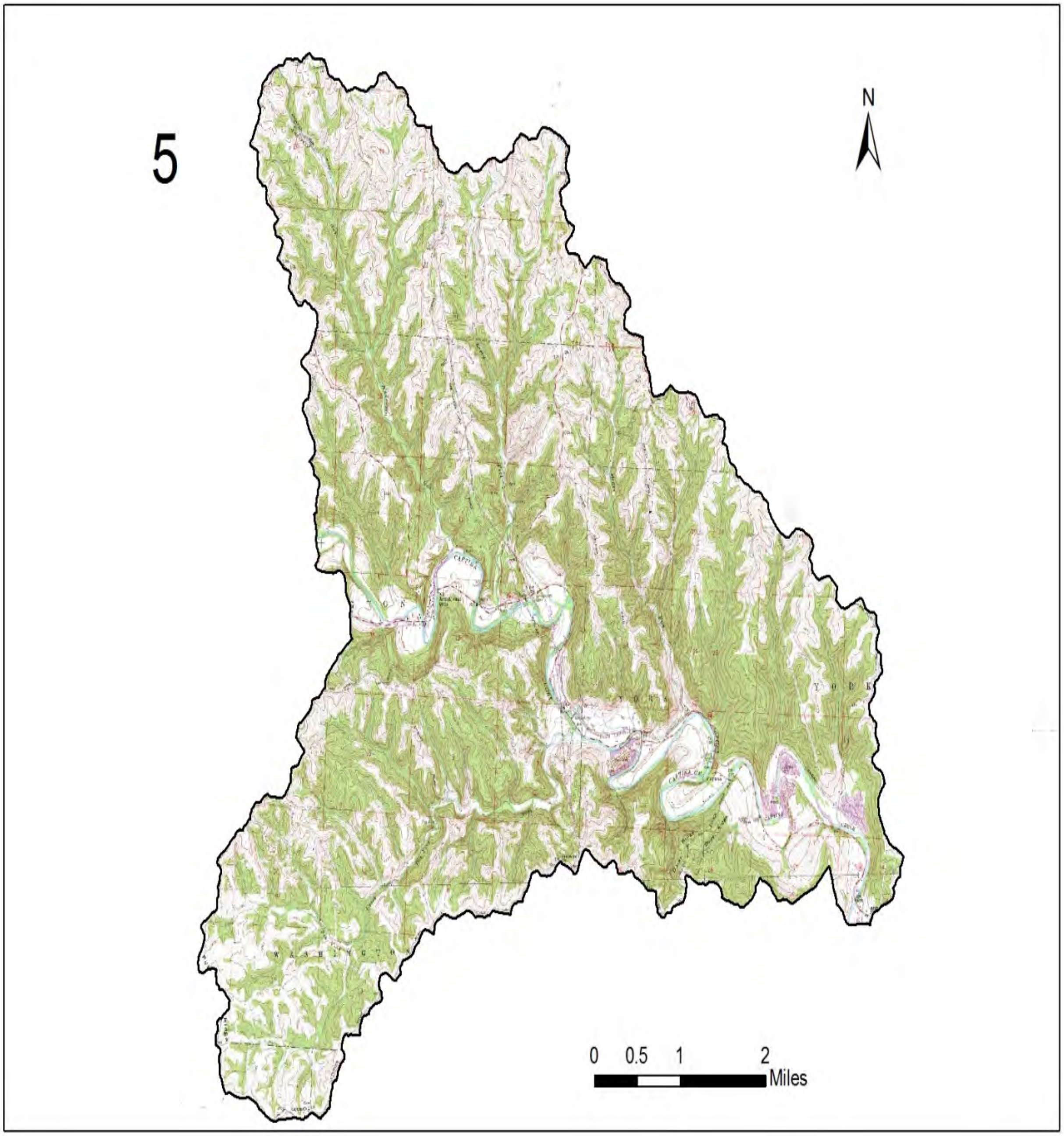


Figure 18. Topographic map (7.5 minute quadrangle) of the Pea Vine Creek subwatershed. Contour interval is 20 feet. *Source:* United States Geological Survey.

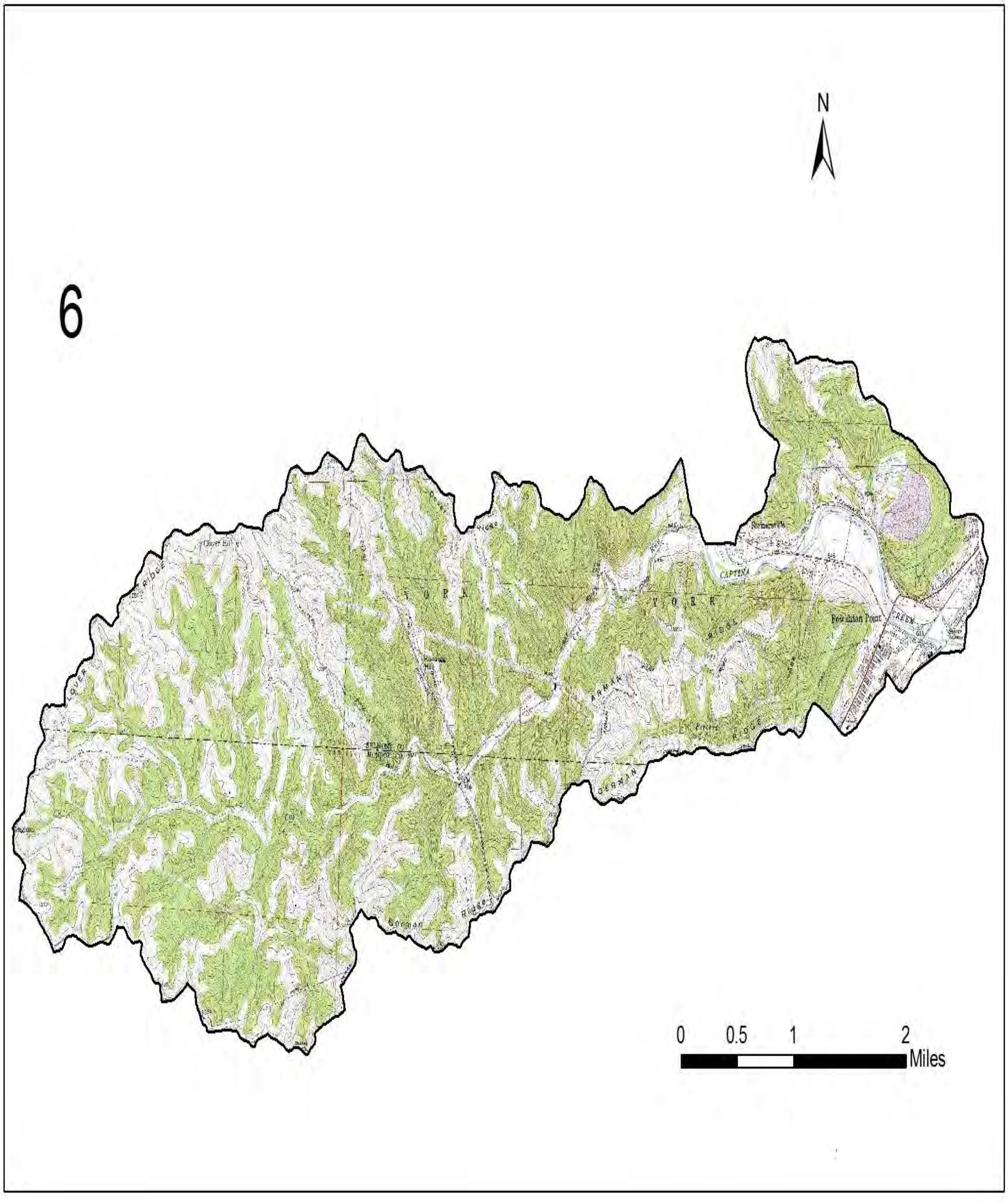


Figure 19. Topographic map (7.5 minute quadrangle) of the Cat Run subwatershed. Contour interval is 20 feet. *Source:* United States Geological Survey.

The Captina Creek watershed encompasses the southern third of the eastern and western borders of Belmont County and can be topographically divided into four generalized provinces of terrain within the county (Figure 20). The extreme eastern portion of the watershed area borders the Ohio River and is composed of long, narrow ridge tops and valleys bounded by steep (25% - 50%+) to very steep (50%+) slopes with very steep being more predominant. The highest elevation in the watershed is located in this topographic province. The terrain to the immediate west of the eastern-most portion, about one fourth of the span of the watershed region itself, contains hills that aren't quite as steep or tall. In this area ridge tops are slightly wider with moderate steepness (15% - 25).

The topography of the western fourth of the watershed region is similar to this section, but has been altered by extensive strip mining. The fourth of the watershed region to the immediate east of the extreme western fourth contains moderate (8% - 15%) to moderately steep (15% - 25%) terrain with rounded hilltops. The ridge tops in this region are wider, and there are fewer steep and very steep hillsides (USDA 1981).

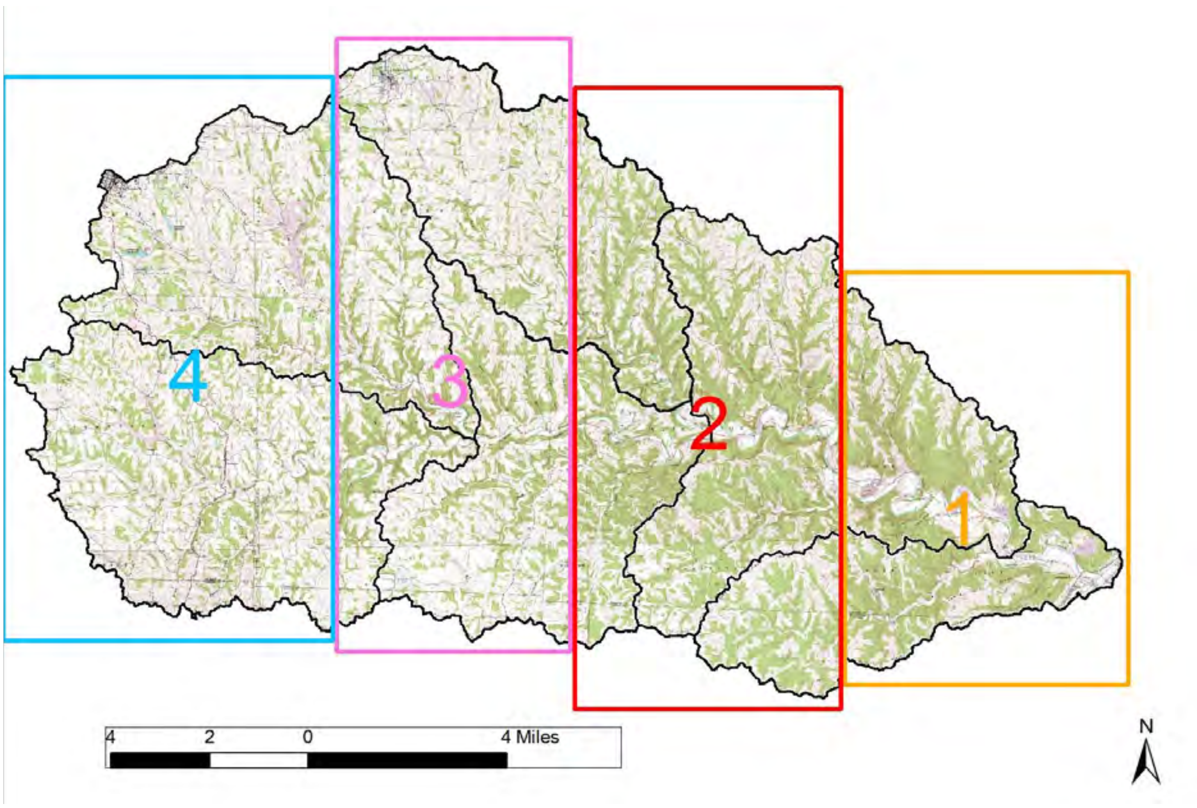


Figure 20. Topographic map depicting the four generalized provinces of terrain within the watershed. Terrain in Province 1 is composed of soil slopes that commonly exceed 50% and crest on narrow ridgetops. Province 2 has terrain similar to 1 but with broader ridgetops and gentler slopes between 25 and 50%. Province 3 contains the least sloping, broadest-topped terrain while the terrain in Province 4 is more similar to that of 2.

Geological Features

The Captina Creek watershed is located on the unglaciated Western Allegheny Plateau ecoregion in the extreme east-central area of the state. Specifically, the watershed basin is situated on the Little Switzerland Plateau east of the Flushing divide, a geologic remnant of the ancient Teays drainage basin.

The Flushing Divide stretches north and south through the western end of Belmont County and represents a division between Muskingum River drainages and direct drainages to the Ohio River. This area of the state is dominated geologically by sedimentary rocks that are horizontally bedded and dip generally to the southeast away from the Flushing Divide at an average of 18 feet per mile (USDA 1981). Figure 21 shows the physiographic regions of eastern Ohio relative to the Captina Creek drainage.

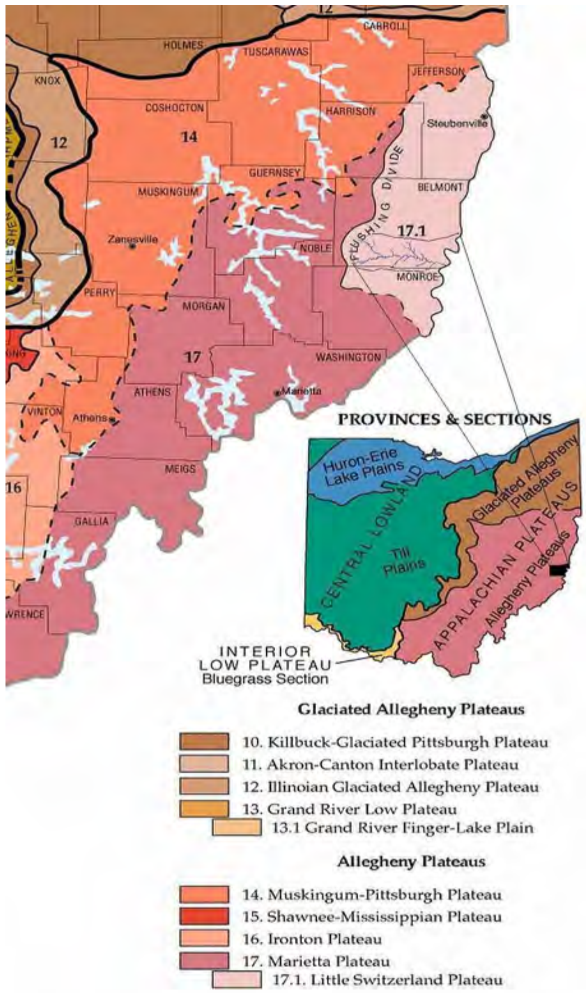


Figure 21. Eastern Ohio's physiographic ecoregions (adapted from ODNR map). The solid black line indicates the glacial boundary in southeastern Ohio. The dashed line indicates a boundary between the Marietta and Muskingum-Pittsburgh Plateaus. *Source:* Ohio Department of Natural Resources.

Shale, mudstone and siltstone alternate with sandstone layers on the ridgetops of the entire watershed region while the deeper valleys primarily contain layers of inorganic limestone and bituminous coal. Rocky overhangs, outcrops and caverns form on the steeper hillsides where less resistant shale layers are eroded away faster than overlying sandstone (Figure 22). In some cases these rock features can create microclimate habitats that support unique plant communities (Forsyth 1965).

Figure 22. A rocky outcrop formed from uneven erosion of shale and siltstone layers on a forested hillside.

The most significant geological feature of the Captina Creek watershed region may be the Pennsylvanian Period limestone bedrock found within the deeper valleys (Figure 23). Limestone is naturally alkaline and raises pH levels of soils and water. Metals entering the creek from acid mine drainage would typically lower water pH levels and degrade aquatic life. Limestone rock layers lining the creek beds buffer the pH (many parts of the stream have natural pH values > 8), allowing aquatic life to thrive despite numerous coal slurry spills and drainage from mining operations. Rock formations of this geologic time period also contain the majority of the coal extracted from the watershed for energy production (ODNR 2011b).

Figure 23. Thick beds of limestone exposed near the mouth of Anderson Run in the Pea Vine Creek subwatershed.

Marcellus Shale Formations

Lying deeper under the watershed than the Pennsylvanian Period limestone and the coal seam is an older formation of organic sedimentary rock known as the Marcellus shale. The origin of the Marcellus shale was during the Devonian geologic period, 350-415 million years ago. During this time much of the eastern United States was partially or entirely underwater, filled with thriving communities of algae, plants and other organisms. As these organisms died they fell to the bottom and were covered by silt, which would eventually become the Marcellus shale formation and provide the carbon needed to produce hydrocarbons such as methane. As a result, the forming gases exerted pressure and caused fractures in the shale running in a northeast to southwest direction. Today, the natural gas in the shale exists either as free flowing gas within the natural fractures or locked up in the porous spaces between the shale particles. Rocks in this formation are referred to as black shales due to high organic content and are considered a rich source of natural gas (ShaleTEC 2012).

Some scientific estimates predict Marcellus reserves could supply all the United States at its current consumption level for more than a decade. New advances in drilling technologies, accompanied by an increased market demand, have made “exploration” of the Marcellus shale highly attractive to the oil and gas industry (WVRC 2010). Figure 24 maps the extent of the Marcellus formation in the Appalachian region in terms of relative thickness. Figure 25 shows the depth below the surface at which the formation lies. Geologists believe the thickness of the shale layer is related to its ability to produce gas in different areas of the region.

Extracting natural gas from the Marcellus shale involves drilling down to the depth of the formation and using new horizontal drilling technology that exposes more of the shale. Once the formation is reached, a mixture of water, sand, and chemicals is injected into the well under high pressure in order to fracture the pores of the shale rock and stimulate the flow of gas. This extraction process is known as hydraulic fracturing. Additionally, other less-explored natural gas reserves exist in shale layers underneath the Marcellus formation. The Utica formation can be found at depths exceeding 10,000 feet below sea level and could possibly be more productive than the Marcellus formation in some locations. Exploration of this layer is still in the early stages but results have indicated that it extends into eastern Ohio. Natural gas reserves contained in rocks from the Utica formation are extracted using the same hydraulic fracturing process that is used in extracting reserves from the Marcellus formation. Figure 26 illustrates the depth and range of the Utica shale formation in the northeastern United States. A discussion of potential environmental impacts and best management practices associated with hydraulic fracturing in the Captina Creek watershed are discussed in Section IV of this action plan.

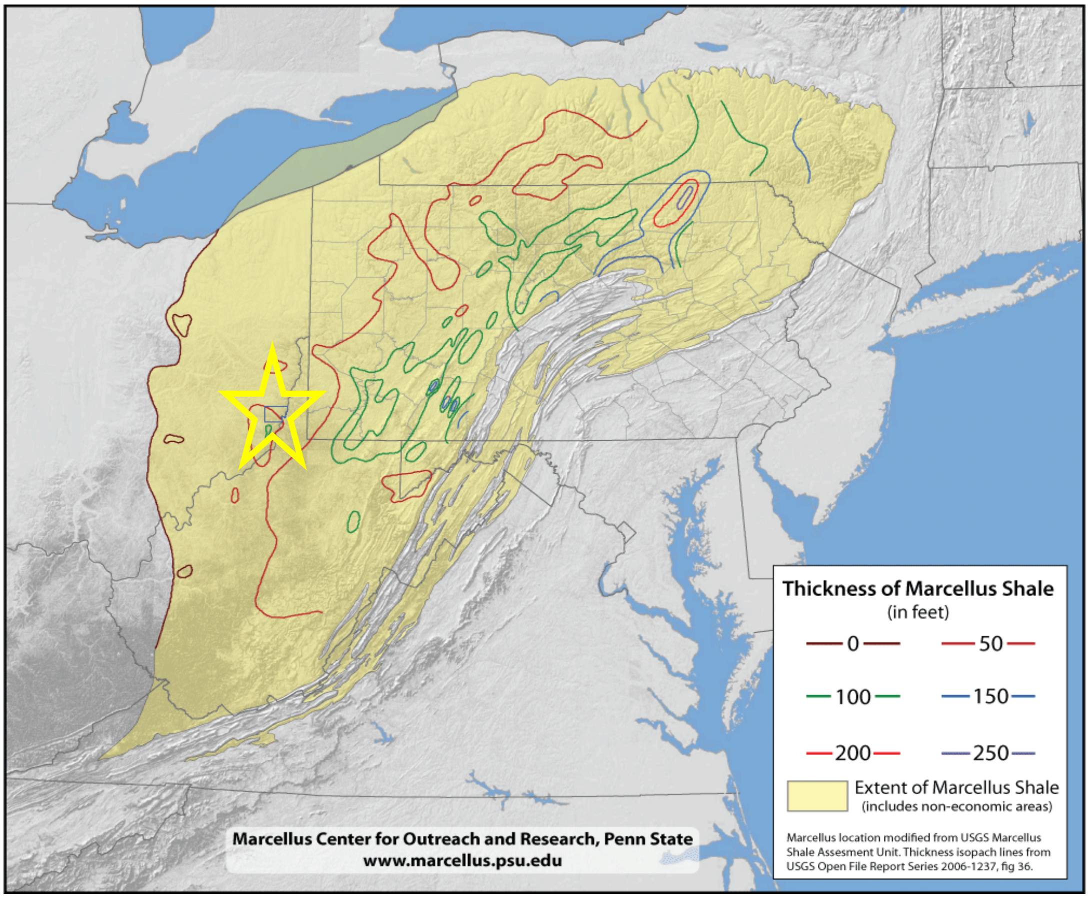


Figure 24. The Captina Creek watershed region (outlined in blue within the star) lies over the Marcellus shale formation estimated to be up to 200 feet in thickness in the southern parts of the region. *Source:* United States Geological Survey and Penn State University Marcellus Center for Outreach (2010).

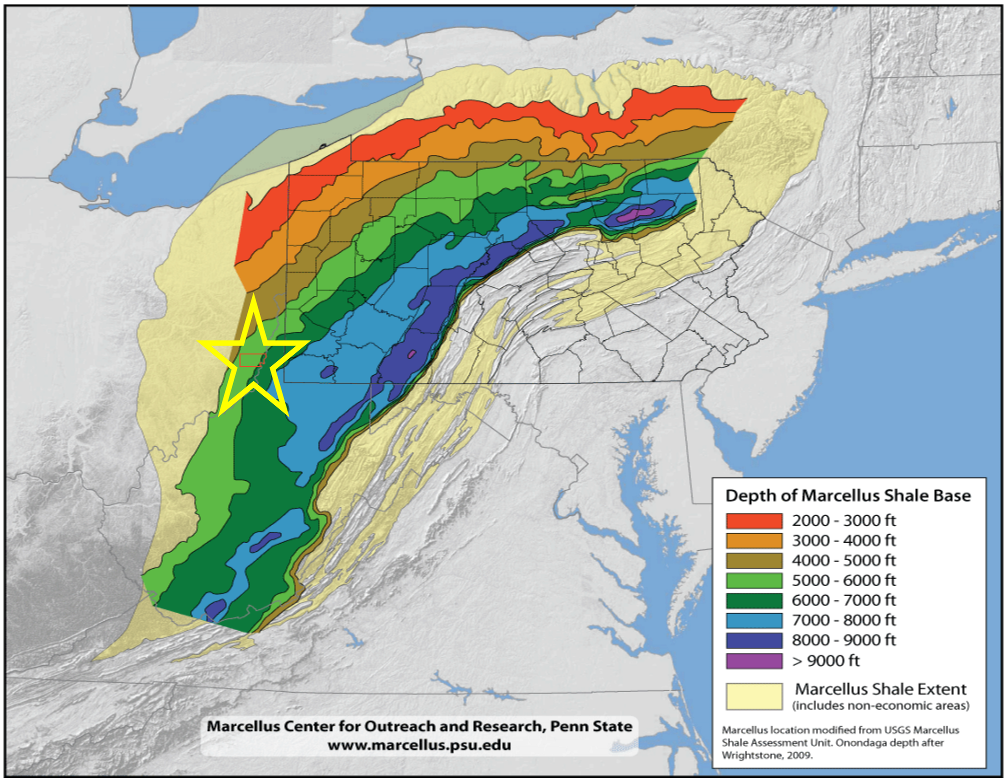


Figure 25. Depth of the Marcellus shale formation. The Captina Creek watershed region is outlined in red within the star. *Source:* Penn State University Marcellus Center for Outreach 2010.

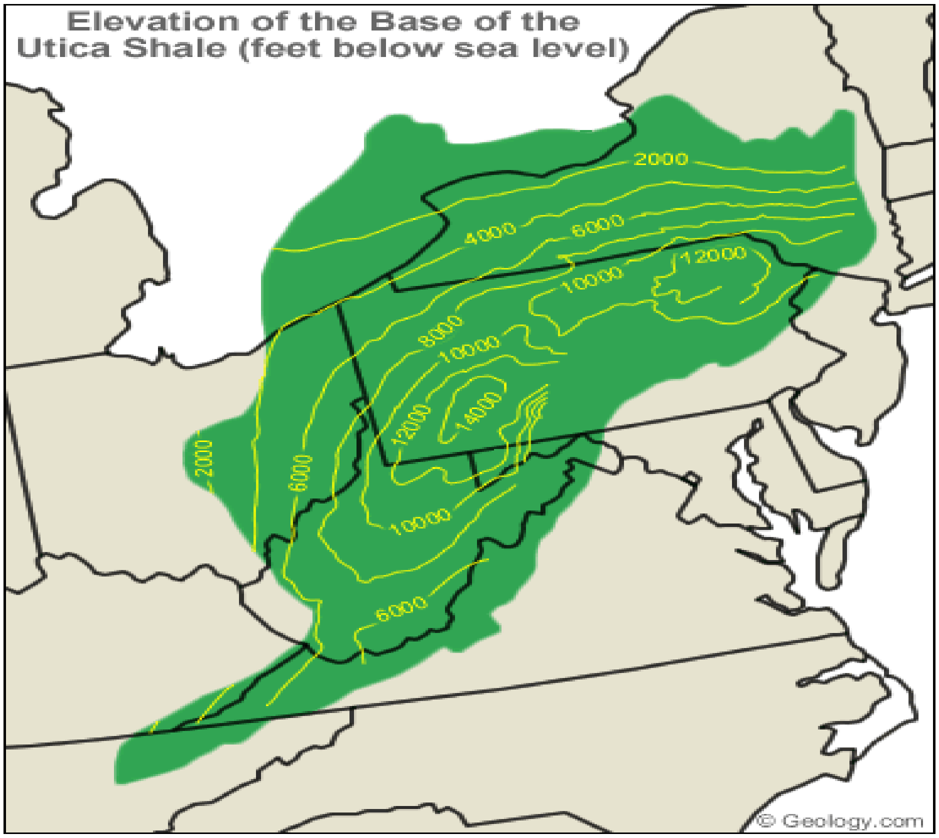


Figure 26. Map depicting the depth and range of the Utica shale formation in the northeastern United States. The green area represents areas of the Utica shale formation that are thought to be economically productive. Elevations are in feet below sea level. *Source:* Map compiled by Geology.com with data provided by the Energy Information Administration , the United States Geological Survey and the Pennsylvania Geological Survey.

Geologic History

The rocks found in eastern Ohio were formed during the Pennsylvanian Period, some 290 million years ago (Figure 27). During this time, Eastern Ohio was located roughly 10 degrees south of the equator and had an extremely tropical setting. These conditions gave way to a plethora of life, mostly plants. Massive coal swamps formed in Eastern Ohio and adjacent areas. These swamps were similar to modern swamps, with constantly wet conditions, a high amount of plant life and a high amount of dead organic material. Eastern Ohio had plants that are now extinct but fossils of these plants can be found today. Some of the more common plants included Calamites (a giant horsetail), Lepidodendron, Cordaites and Sigillaria. During the Pennsylvanian Period, the environment was called a coal swamp due to the fact that those areas, over time, gave way to the massive deposits of coal we see today. Along with the flora, Eastern Ohio was also home to a large number of insects and tetrapods (four-limbed vertebrates). We can attribute a large part of the Eastern Ohio's identity and economy to ancient coal swamps (ODNR 2011b).

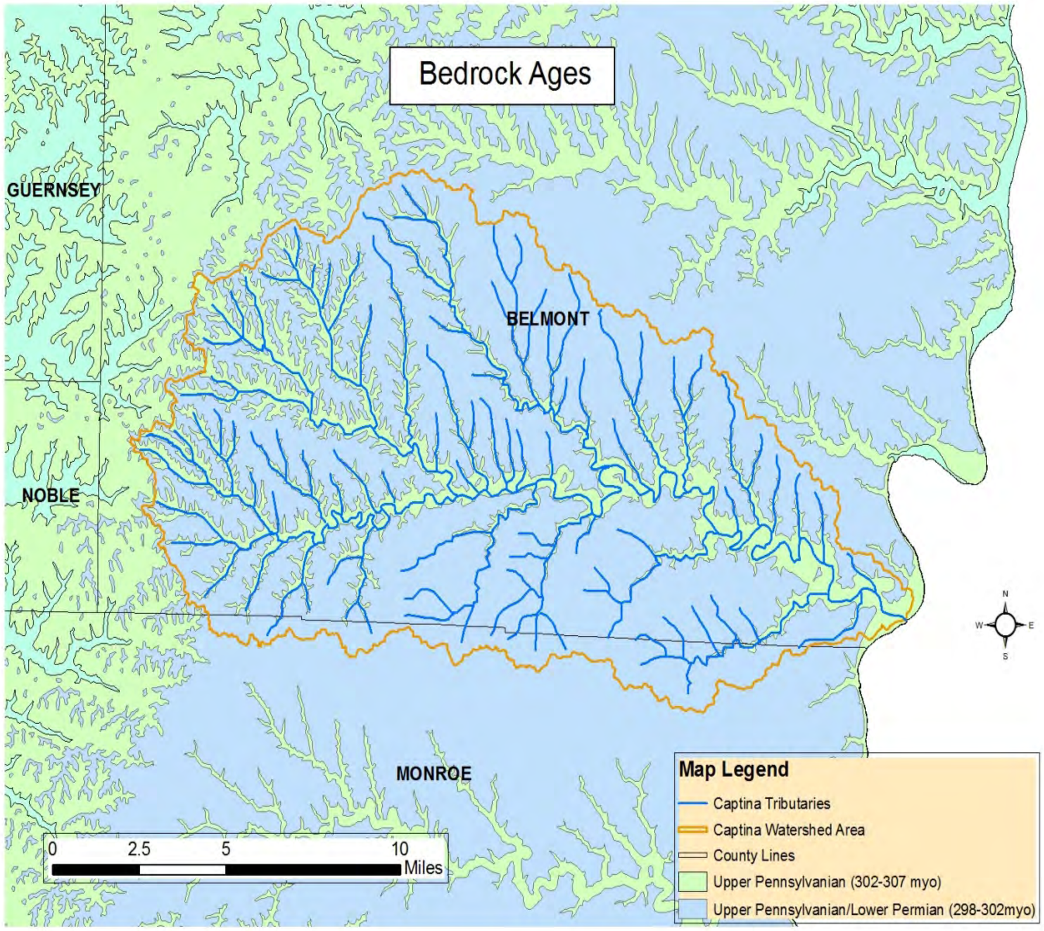


Figure 27. Bedrock ages in extreme eastern Ohio (*myo* = million years old). The ridge tops are composed of younger rocks (Permian Period) than the valleys (Pennsylvanian Period).

The exposed rock strata consist of two geologic formations and one geologic group. These are the upper 350 feet of the Conemaugh Formation, the Monongahela Formation, and the lower 470 feet of the Dunkard Group (Figure 28). The Conemaugh and Monongahela Formations are part of the older Pennsylvanian system lying within the deeper valleys of the watershed. The Dunkard Group is part of the younger Permian System located on the ridgetops. The Conemaugh Formation crops out only in the western part of the county and in the valleys of the northeastern part. It is the least exposed of the formations. The Dunkard Group is the most extensively exposed bedrock. It occurs mostly in the eastern half of the county. The Monongahela Formation within the Pennsylvanian system is less extensive than the Dunkard Group but more extensive than the Conemaugh Formation. It is exposed mostly in the western part of the county, but also in the main valleys that drain to the Ohio River. The Pittsburgh No. 8 coalbed, the Sewickley No. 9, the Uniontown No. 10, and the Waynesburg No. 11 are in the Monongahela Formation of the Pennsylvanian system. The Washington No. 12 is the only coalbed located in the Dunkard Group of the younger Permian system (USDA 1981).

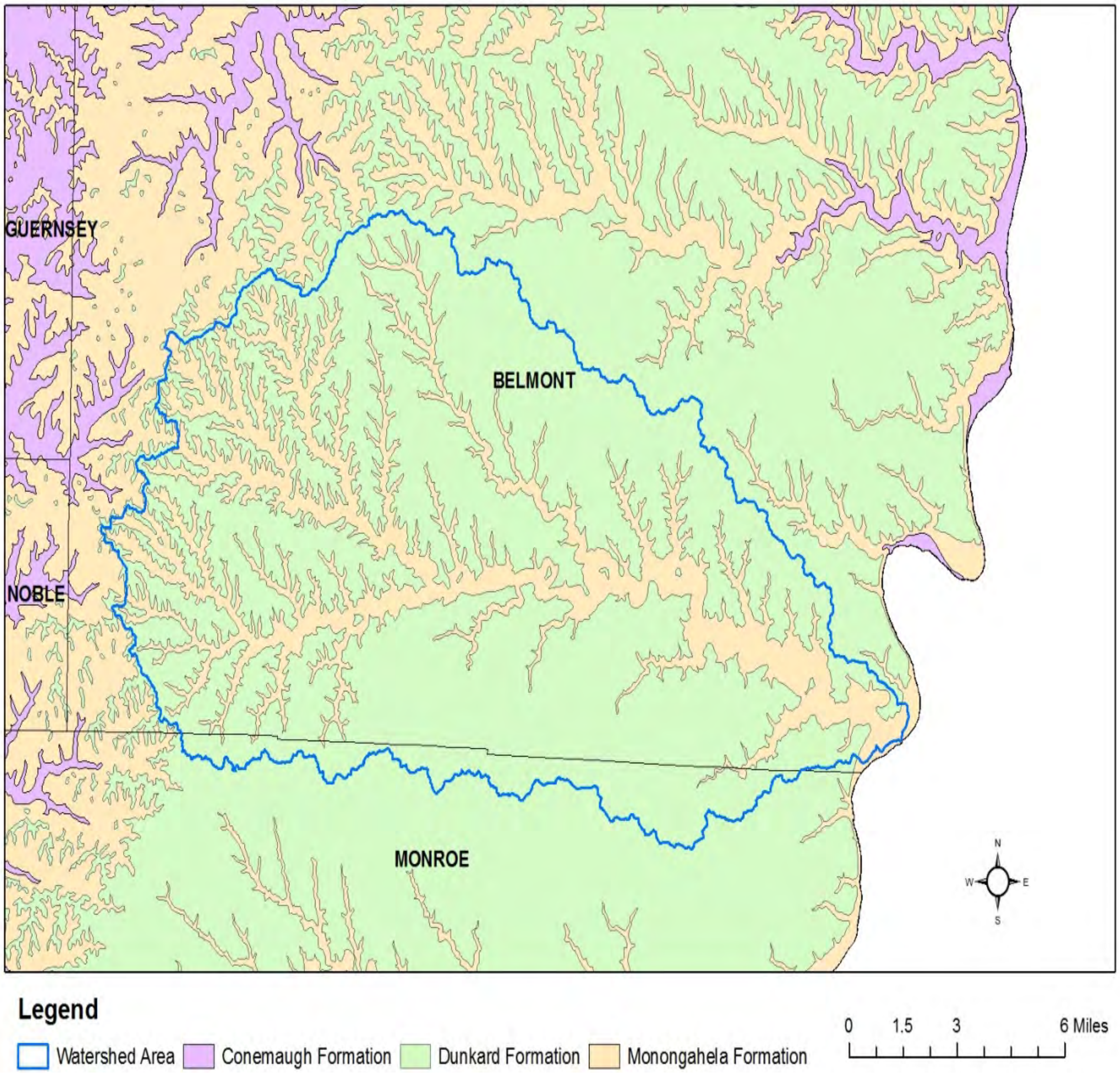


Figure 28. Map depicting bedrock formations within the Captina Creek watershed. Most coal mined from under the watershed originates from the Monongahela formation of the Pennsylvanian bedrock system. Rocks from the Monongahela formation are estimated to be between 302 and 307 million years old. *Sources:* United States Geological Survey and Ohio Department of Natural Resources.

Soils

Twenty-seven different soil associations can be found within the Captina Creek watershed region, as illustrated in Figure 29. Soil and bedrock composition of an area may affect water chemistry and stream physical habitat. Soils also influence habitat characteristics in terms of slope, permeability and runoff potential. The Captina Creek watershed is located in the Gilpin-Upshur-Lowell-Guernsey soil region of Ohio. Each of the twenty-seven associations is described below. Soil association data is referenced from the United States Department of Agriculture's Soil Survey of Belmont County (1981) and Soil Survey of Monroe County (1974).

***Allegheny Variant* (Ae)** soils are formed in alluvium on high terraces in Belmont County along strongly sloping drainages of 8 to 15%. They have a characteristically sandy texture, are dark grayish brown to yellow, deep, moderately well-drained and moderately permeable. Due to its high water capacity this soil can support hay, pastureland, trees and some cultivated crops (corn, legumes). Buildings on this soil are recommended without basement and roads are recommended with suitable foundation.

***Brooke* (Bw)** soils are moderately deep and well drained with a dark colored surface layer and a clayey subsoil. They are formed from weathering of limestone inter-bedded with thin layers of siltstone, sandstone or shale and can be found on steep to very steep hillsides and moderately steep ridgetops and knolls. Brooke soils are slow in permeability and erode severely if not protected. Because they are associated with landslides, building development is not suitable. It is generally suited for long-term pasture, meadow or woodland.

***Brookside* (Bs, Bu)** soils, like Nolin Variant, occur in two varieties in Belmont County: Brookside silty clay loam (Bs) and Brookside-Urban land complex (Bu). Brookside silty clay loams are deep, moderately well-drained soils occurring on steep to moderately steep hillsides. It is brown in color with moderately slow permeability and rapid runoff. Most areas are used for pasture and hay with medium suitability for cultivated crops and high suitability for small grain, hay, pasture and woodland. Slow permeability and potential for slippage give this soil a low suitability for building and development. Brookside-Urban land complex soils occur on moderately well drained alluvial fans 3 to 40% in slope with urban development such as streets and sidewalks. Moderately slow permeability, potential for hillside slippage and seasonal wetness are factors that limit development of building and sanitary facilities within this soil. Potential is high for lawns, trees and shrubs.

***Chagrin* (Cg)** soils are deep silt loams on nearly level well drained floodplains subject to occasional flooding. The surface layer is dark grayish brown becoming a yellowish brown with depth. Permeability is moderate, runoff is slow and available water capacity is high. When not flooded, the potential is high for cultivated crops with corn and hay being the main crops farmed. Chagrin soils are also suitable for pasture, however potential is low for building site development and sanitary facilities due to the threat of flooding.

***Culleoka* (Cu)** soils are moderately deep, gently to strongly sloping and well drained mainly occurring on narrow ridgetops and crests of knolls. The surface layer is brown progressing to a yellowish colored subsoil occurring over sandstone bedrock. Permeability is moderately rapid and the water capacity is low. The soil is suited to pasture as well as corn, small grain, grasses and legumes, but can be droughty. Hazard of erosion is moderate if cultivated. The soil is suitable for building and roads but unsuitable for sanitary facilities due to depth to bedrock and possible contamination of groundwater.

***Dekalb* (Dk, Dm)** soils are moderately deep, gently to moderately steep and well drained occurring on hillsides, knolls and narrow ridgetops. They are classified as loams and are brown on the surface with a yellowish substratum appearance. Permeability is rapid to moderately rapid, runoff is moderate if cultivated and the available water capacity is low sometimes leading to droughty conditions. Potential is medium for cultivated crops, hay, pasture, trees due to excessive dryness in the summer. Dekalb soils are suitable for building but have shallow bedrock in some areas. Depth to bedrock, slope, and possible contamination of groundwater are severe limitations to sanitary facilities.

***Disturbed Ground* (Ds, Dp, Uc, Ud)** For the purposes of this report, these four associations have been grouped together under a single name. Disturbed ground consists of nonsoil fill (Dp) like bricks, rocks, gravel and stone along with mine gob piles (Ds), surface coal mines and quaries (Uc) and highway cuts (Ud). These are soil associations that are not suitable for agricultural or developmental purposes.

***Gilpin* (Gd, Gp)** soils are dark grayish brown, moderately deep, well-drained and loamy occurring on ridgetops, benches and steep to very steep hillsides. They are formed from sediment originating in siltstone, sandstone and shale and have deep rooting zones and low moisture capacity. They are moderately permeable and are used mostly for pasture and woodlands and are subject to slippage.

***Gilpin-Upshur* (Gk, Gl, Gn)** soil complexes occur primarily in the Monroe County portion of the Captina Creek watershed region and are a mixture of 50% Gilpin soils and 40% Upshur soils which tends to be reddish in color. Soils of this association are suited for field crops but are prone to erosion if cultivated. Surface runoff is rapid and depth to bedrock is shallow. Gilpin-Upshur soils are located on rounded knobs and broad to narrow ridgetops with moderately steep hillsides. They are subject to slippage and not recommended for non-farm uses.

***Gilpin-Westmoreland* (Go, Gp)** soil complexes are located on ridgetops and hillside benches primarily in Monroe County and are a mixture of 50-60% Gilpin soils and 20-30% Westmoreland soils. These soils are suited for agricultural crops and pasture but are better suited for permanent vegetation as opposed to row crops. Excessive erosion is a hazard with these soils along with slope and limited depth to bedrock for non-farm uses.

***Guernsey* (Gr, Gs, Gu, Gw)** soil series consist of deep, moderately drained soils on hillsides, benches and ridgetops and originate from weathering of limestone, sandstone, siltstone and shale. They are usually found in series with Upshur soils and Westmoreland soils and are characterized by a dark yellow color. Guernsey soils are moderately permeable and exhibit rapid runoff and are highly erodible if not protected. They are used primarily for hay and pasture and have a deep rooting zone.

***Hartshorn* (He)** soil associations are deep, level soils located on floodplains in narrow valleys near stream headwaters. Hartshorn soils are well drained with rapid permeability and slow runoff. They serve well as pasture, hayfields and cropland but are poor building sites. These soils are noted for rapidly drying out in the summer but are suited for trees and other plants with deeper roots.

***Huntington* (Hu)** soils are dark in color, flat and well drained. They are formed from sediment deposition occurring on the flood plains of the Ohio River and are relatively easy to cultivate. These soils are moderately permeable, deep and have a high moisture capacity. Corn and hay are the primary crops cultivated in this soil series.

***Keene* (Ke, Kl)** soils are dark brown, deep, moderately well drained soils occurring on ridgetops, hillsides and bench areas in the north central part of Monroe County. Lower layers of this association contain clay which slows permeability during wet periods of late winter and early spring. Because of this, they are noted for drying and warming slower than surrounding associations making them somewhat unsuitable for crop growth in wetter years. Common agricultural uses for Keene soils are hay and pasture.

***Lowell* (Le)** soil associations are deep, well-drained silt loams located on gently sloping to very steeply sloping hillsides. Permeability is moderately slow and runoff is rapid. Soils of this association are best suited for cultivation of crops, hay, and pasture except for LeF, which is more suited for wildlife habitat due to steepness of hillside.

***Lowell-Westmoreland* (Lo, Lp, Lw)** soil associations are located on strongly sloping narrow ridgetops, on moderately steep and steep hillsides and narrow valleys near stream headwaters. The hillsides may have irregular slopes with narrow stream valleys and floodplains may be narrow with uneven foot slopes. Lowell-Westmoreland soils are used for cultivated crops, hay, pasture, woodland, openland, and woodland wildlife habitat. Erosion and hillside slippage are the main hazards for the soils in this association and would be the limiting factor for building development.

***Newark* (Ne, Nm, Nn)** soils are deep, dark grayish-brown, poorly drained and loamy. They are commonly found on flat floodplains next to large streams where sediment deposition occurs from flooding on a regular basis. Top layers of this association may be under water for several weeks at a time throughout the year making it difficult to farm unless artificially drained. Agriculturally, Newark soils are used as meadow and row crops in summers of drier years. Frequent flood potential also limits construction and development over these soils.

***Nolin Variant* (No, Nu)** soils are divided into two units within the Captina watershed region. Nolin Variant silt loams (No) are dark brown, deep, well drained soils found on the flood plains of larger streams. Permeability is moderate, runoff is slow and water capacity is high. Developmentally speaking, potential is low for building and sanitary facilities. Agriculturally, potential is high for cultivated crops, pasture and trees and medium for hay and small grain. Nolin Variant urban land complex (Nu) soils are deep, level, well drained soils on flood plains that have been urbanized with streets, parking lots and buildings. Permeability is moderate, runoff is slow and available water capacity is high. This soil is suited for recreational use such as golf courses, trails and picnic areas and is well suited for growth of trees and shrubs.

***Sciotoville* (Sc)** soils are dark-brown, deep, moderately well drained silt loams that form from alluvial deposits on lower benches near large streams and rivers, particularly in Monroe County. These soils are subject to occasional flooding in late winter and early spring and are known for seasonal wetness. Sciotoville soils are suitable for cropping and pastureland but have limited development potential due to the potential for flooding.

***Sees* (Ss)** soils are deep, moderately well drained, dark grayish brown silt loams that form from a mixture of materials that weathered from stratified layers of limestone, siltstone, sandstone and shale called colluvium. They are common in eastern and northwestern Monroe County on base slopes and lower bench areas. Sees soils have a medium to high available moisture capacity and moderate to low permeability due to runoff collected from higher areas. They are subject to slippage and cracking and therefore have low potential for building and development. Agriculturally they are used for pasture and meadow but are considered too steep for tilling.

***Upshur* (Up, Ur)** soils are well drained, deep and medium textured with a reddish brown clay subsoil component. They occur on ridgetops, steep to very steep slopes and upper benches throughout Monroe County and are commonly mixed with Gilpin and Guernsey soils. Agriculturally, Upshur soils are suited for pasture, hayland and some crops but are not suitable for cultivation due to potential for excessive erosion, rapid runoff and steepness of terrain. Upshur soils are noted for their softness when moistened. Slow permeability and potential for slippage are limitations for building and development on this soil.

***Wellston* (Wh)** soils are deep, gently to strongly sloping soils found on ridgetops, benches and saddles between knolls in Belmont County. They are a yellowish brown silt and clay loam of moderate permeability, medium runoff and high water capacity. Agriculturally, potential is high for cultivated crops, hay, pasture and trees. Developmentally, potential is medium to high for buildings and sanitary facilities providing some of the best sites in the uplands of the county.

***Westmore* (Wk)** soil associations are deep, well-drained silt loams located on gently sloping to steeply sloping hillsides. Permeability is slow to moderately slow and runoff is slow to very rapid. This soil is best suited for growing legumes, grains, hay and some crops, except for WkC which is better suited for pasture trees and woodland life.

Westmoreland **(Wm, Wo)** soils are deep, well drained and loamy that form in materials weathered from siltstone, shale and sandstone. These soils are dark brown and found on ridgetops, upper benches and gently sloping to very steep hillsides in both Belmont and Monroe Counties. Westmoreland soils have a deep rooting zone but only a medium moisture capacity due to coarse fragments in subsoil layers. Because of this characteristic the soil will dry out and warm up quickly, making it easy to work. these soils are suited for woodlands, pasture and somewhat for cultivated crops. Additionally, this soil is suitable for building and development as long as the slope is not too great.

Zanesville **(Zn)** soils are deep, moderately well drained, gently sloping to moderately steep with a brown, firm texture. They are found on broad rounded ridgetops, benches between steeper slopes and between upland divides. Zanesville soils originate from loess combined with material weathered from siltstone and shale. They have a medium soil capacity, are moderately permeable and have a medium runoff rate. This soil is used for cultivated crops, hayland, pasture and trees and can be cultivated perennially is erosion is managed. Development is medium suited for buildings and sanitary facilities.

Zanesville-Woodsfield **(Zo)** soils are silt loams located on broad to gently rounded ridgetops near divides to bench areas on hillsides in Monroe County. The soil is a mixture of 55% Zanesville soils and 30% Woodsfield soils and has a yellowish surface layer. This soil exhibits rapid runoff and is subject to damage from erosion if cultivated and not managed properly. Agriculturally, this soil is best suited for hay and pasture and moderately suited for row and cultivated crops. Developmentally, these soils are limited for building due to their low permeabilities and slopes.

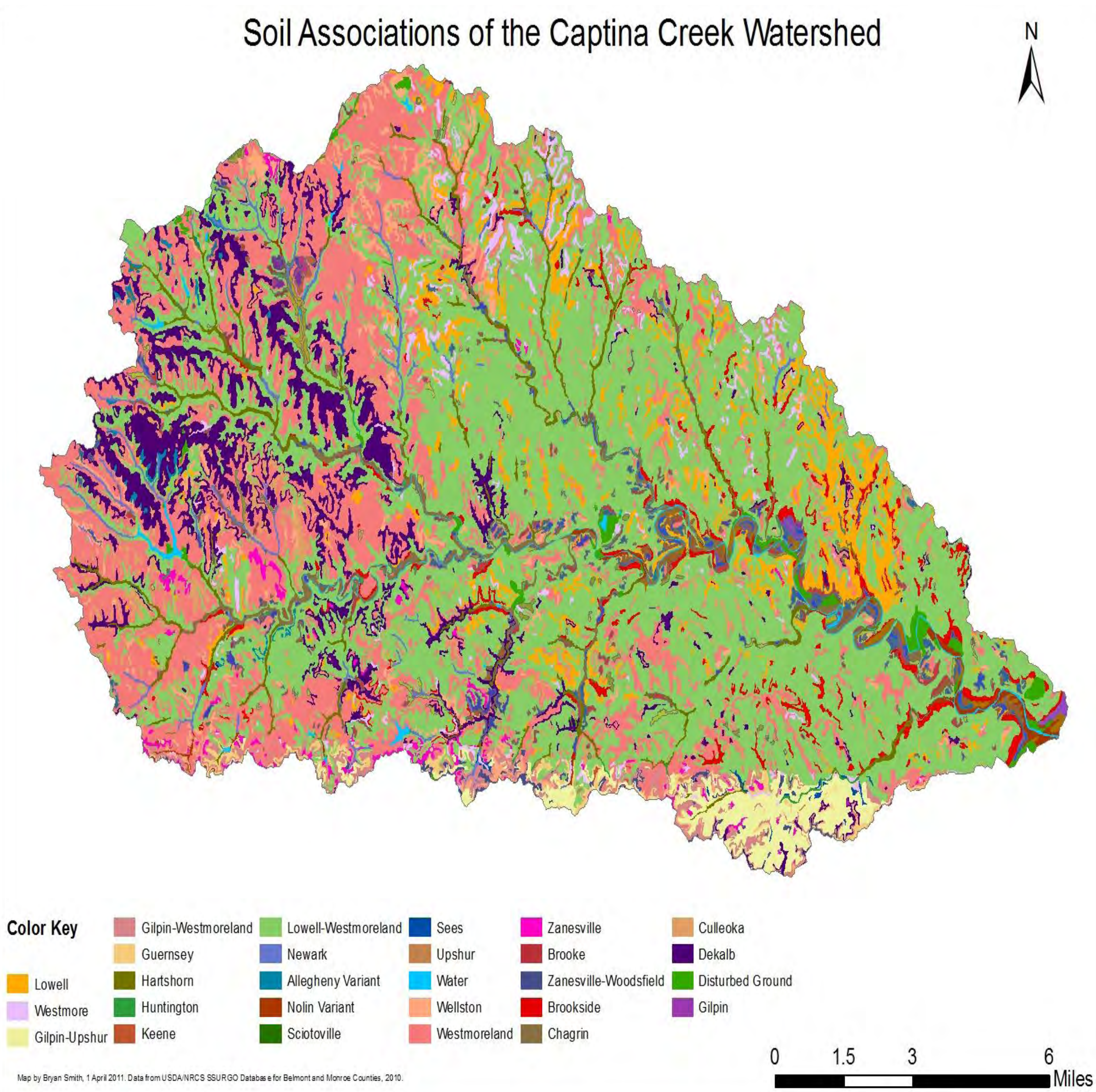


Figure 29. The Captina Creek watershed is comprised of 27 major soil associations. The dominant soil type throughout the watershed is a combination of Westmoreland including Lowell and Gilpin, which is dominant in the headwaters. *Map source:* Created by Bryan Smith, April 2011. Data from USDA/NRCS SSURGO database for Belmont and Monroe Counties, 2010.

Glacial History

As stated previously, the Captina Creek watershed is located in the unglaciated region of the state. Lack of glaciation has left the landscape hilly and moderate to steep slopes unlike the flatter terrain found further west and north in the state. Even though glaciers did not cover this region, glacial meltwater did influence the rivers of the area and is believed to have shaped the formation of the Ohio River and its tributaries (Forsyth 1965). Figure 30 shows the extent of glacial advancement in the most recent ice age ending approximately 10,000 years ago.

Before the existence of the Ohio River drainage system we know of today, an older pre-glacial river system known as the Teays dominated the Ohio landscape. It is not known exactly when the Teays' tributaries gave way to the current Ohio River system tributaries, but geologists believe the Teays River flowed for 20 to 30 million years before its icy demise. The headwaters of the Teays began in the highlands of Virginia and North Carolina and ran northwards through southern and central Ohio into Indiana and Illinois. During this time, tributaries in roughly the southwestern two-thirds of the state drained into the Teays River, while tributaries in the northeastern third, including what is now Captina Creek, drained northward into the Steubenville River of the larger Erigan River system. The remnant of the geologic feature that divided the Teays and Erigan drainage systems is marked today by the Flushing Divide in eastern Ohio. Successive glacial advancements over the last 500,000 years caused the Teays to repeatedly dam with ice in southern Ohio eventually altering its northward course and re-routing runoff westward into the Ohio River system of today (Forsyth 1965).

Figure 30. Map depicting glacial advancement in Ohio. *Source:* Ohio Department of Natural Resources.

Chapter 2: Biological Features of the Watershed

Rare, Threatened and Endangered Species

Species of special interest, species of concern, threatened species and endangered species of state designation status are found within the Captina Creek watershed. The Ohio Department of Natural Resources has developed definitions for species status designations, detailed in Table 4.

Table 4. Definitions for species status designations in Ohio (ODNR 2012b).

Species Status	Definition
Endangered	A native species or subspecies threatened with extirpation from the state. The danger may result from one or more causes, such as habitat loss, pollution, predation, interspecific competition, or disease.
Threatened	A species or subspecies whose survival in Ohio is not in immediate jeopardy, but to which a threat exists. Continued or increased stress will result in its becoming endangered.
Species of Concern	A species or subspecies which might become threatened in Ohio under continued or increased stress. Also, a species or subspecies for which there is some concern, but for which information is insufficient to permit an adequate status evaluation. This category may contain species designated as a furbearer or game species, but whose statewide population is dependent on the quality and/or quantity of habitat and is not adversely impacted by regulated harvest.
Special Interest	A species that occurs periodically and is capable of breeding in Ohio. It is at the edge of a larger, contiguous range with viable population(s) within the core of its range. These species have no federal endangered or threatened status, are at low breeding densities in the state, and have not been recently released to enhance Ohio's wildlife diversity. With the exception of efforts to conserve occupied areas, minimal management efforts will be directed for these species because it is unlikely to result in significant increases in their populations within the state.
Potentially Threatened	Designation only used with plants. Indicates a species residing in small populations within specific habitats (shale barrens, limestone prairies, etc.) of a region which might become threatened due to increased stress, loss of habitat or modification of habitat.
Extirpated	A species or subspecies that occurred in Ohio at the time of European settlement and that has since disappeared from the state.
Extinct	A species or subspecies that occurred in Ohio at the time of European settlement and that has since disappeared from its entire range.

State listed endangered species that have been confirmed in the Captina watershed region of Belmont and Monroe counties since 2010 include the eastern hellbender, black bear and bobcat (downgraded to a threatened species in 2012). Species listed in Tables 5a - 5d have been documented in the watershed region in the last 50 years by scientists from ODNR or by sightings from reliable sources. Unless otherwise indicated, listed birds do not include migrants, only individuals that nest in the watershed region. A list of extirpated and extinct species from the Captina Creekwatershed region can be found in Table 6.

Table 5a. Endangered, threatened and specially listed vertebrates of the Captina Creek watershed region. *Sources:* The Ohio Department of Natural Resources (2012b); personal records of Mary Sidwell and Greg Lipps.

Mammals			
Endangered	**Threatened**	**Species of Concern**	**Species of Interest**
^Indiana Bat	*Bobcat	*Little Brown Bat	
*Black Bear		*Big Brown Bat	
Birds			
Endangered	**Threatened**	**Species of Concern**	**Species of Interest**
*Yellow Bellied Sapsucker	*Dark-eyed Junco (winter resident only)	*Sharp-shinned Hawk	*Red-breasted Nuthatch
		*Cerulean Warbler	*Pine Siskin (winter resident only)
		*Bobolink	*Purple Finch
Reptiles and Amphibians			
Endangered	**Threatened**	**Species of Concern**	**Species of Interest**
*Eastern Hellbender		*Eastern Box Turtle	
		*Queen Snake	
Fish			
Endangered	**Threatened**	**Species of Concern**	**Species of Interest**

^Listed as federally endangered. Is thought to occur in eastern Ohio but has not yet been vouchered from the watershed region.
*State listed species

Table 5b. Migratory birds listed as rare or in decline by U.S. Fish and Wildlife Service that have been observed recently in the Captina Creek watershed. *Source:* U.S. Fish and Wildlife Midwest Birds of Concern, 2011.

Common Name
Bald Eagle
Black-Billed Cuckoo
Northern Flicker
Wood Thrush
Brown Thrasher
Blue-Winged Warbler
Field Sparrow
Orchard Oriole

Table 5c. Endangered, threatened and specially listed invertebrates of the Captina Creek watershed region. *Source:* Ohio Department of Natural Resources.

Mussels			
Endangered	**Threatened**	**Species of Concern**	**Species of Interest**
		*Wavy-Rayed Lampmussel	
Arthropods			
Endangered	**Threatened**	**Species of Concern**	**Special Interest**
		*Tiger Spiketail	

*State listed species

Table 5d. Endangered, threatened and specially listed plant species of the Captina Creek watershed region. Common names provided in parenthesis. *Source:* Ohio Department of Natural Resources.

Plants		
Endangered	**Threatened**	**Potentially Threatened**
Botrychium Simplex (Grape Fern)	*Spiraea virginiana* (Virginia meadowsweet)	*Delphinium exaltatum* (Tall Larkspur)
#Trifolium stoloniferum (Running Buffalo Clover)	*#Elymus trachycaulus* (Bearded Wheat Grass)	*Cystopteris tennesseensis* (Tennessee Bladder Fern)
Oxalis montana (Mountain Wood Sorrel)	*#Trifolium reflexum* (Buffalo Clover)	
Lathyrus venosus (Veiny Pea)	*Symphyotrichum oblongifolium* (Shale Barren Aster)	
Ramalina intermedia (Rock Ramalina)		

#denotes historical record only found prior to 1980

Table 6. Extirpated and extinct species from the Captina Creek watershed region. *Source:* Ohio Department of Natural Resources.

Extirpated	Extinct
Wapiti (Elk)	Carolina Parakeet
Mountain Lion	Passenger Pigeon
Timber (Gray) Wolf	

Invasive and Non-Native Species and their Potential Impacts

Invasive species are organisms (plant, animal or microbe) that are introduced into a foreign habitat and successfully adapt to that habitat in the absence of competition or predation. Table 7 provides a summary of some of the more prevalent and aggressive invasive species observed in the Captina Creek watershed. Under the right conditions, invasive organisms can quickly and aggressively dominate or disrupt native ecosystem communities. Invasive plant species are sometimes introduced unintentionally as residential or agricultural ground cover or ornamental foliage that eventually escapes into the surrounding countryside. Invasive plant and animal species can also hitchhike to new habitats on transportation vessels or escape from captivity.

Clarification should be given to the difference between invasive species and non-native species. Both are foreign in the habitat they occupy but invasive species are aggressive in bringing significant changes to an ecosystem in short periods of time, while non-native species are slow to occupy and integrate into a new habitat. Examples of non-native species in the Captina Creek watershed are the European honeybee, coyote and osage orange. Though none of these species were documented historically in eastern Ohio at the time of European settlement, each has adapted to a specific niche without causing significant or immediate change to the ecosystem. Non-native species are therefore not listed in this watershed action plan.

Table 7. Invasive species documented in the Captina Creek watershed region.

Species	Potential Impacts
Trees, Shrubs and Vines	
Autumn Olive	Shrub that crowds out native species
Bush Honeysuckle	Shrub that crowds out native species
Buckthorn	Shrub that crowds out native species
Multiflora Rose	Shrub that crowds out native species
Japanese Honeysuckle	Vine that aggressively covers native herbaceous species
Tree of Heaven (*Ailanthus*)	Fast growing, crowding out native deciduous tree species
Oriental Bittersweet	Vine that aggressively climbs, girdles and covers native deciduous trees
Barberry (*Berberis*)	Competes with native shrubbery

Herbaceous Plants and Grasses	
Garlic Mustard	Crowds out native species
Japanese Knotweed	Crowds out native species
Common Reed Grass (*Phragmites sp.*)	Crowds out native species
Purple Loosestrife	Crowds out native species
Reed Canary Grass (*Phalaris sp.*)	Crowds out native species
Common Ragweed	Crowds out native species
Great Burdock	Crowds out native species
Lambsquarters	Crowds out native species
Chicory	Crowds out native species
Bullthistle	Crowds out native species
Jimson Weed	Crowds out native species
Common Teasel	Crowds out native species
Numerous other species that aggressively occupy abandoned farm fields and waste areas	All crowd native species and compete for resources
Invertebrates	
Gypsy Moth	Large-scale deciduous defoliation
Emerald Ash Borer	Mass mortality of white and green ash trees
Asian Longhorned Beetle	Mass mortality of a variety of hardwood species including elm, maple, buckeye and ash
Acorn Weevil	Interferes with oak reproductive processes
Asian Clam	Competes with native mussels for resources
Vertebrates	
Asiatic Carp	Displaces native fish
Feral Pig	Damages and consumes native vegetation
Fungal Blights	
Dutch Elm Disease	Mass mortality of Elm tree species
American Chestnut Blight	Mass mortality of American Chestnut trees

Captina Creek Fish Species

The Ohio Environmental Protection Agency (OEPA) has conducted aquatic life surveys in the Captina Creek mainstem and tributaries from 1983 to the present. The results of these surveys indicate that the Captina Creek watershed supports a high diversity of fish species. The fish community of Captina Creek received an Index of Biotic Integrity (IBI) 25-year average score of 53.4, the highest score for the entire state. The average IBI score in Captina Creek during the 2008-2009 sampling season was 55.1, which is comparable to some of the highest IBI-ranked streams in Ohio. Fourteen of the tributaries sampled met Exceptional Warmwater Habitat (EWH) biocriteria, and coldwater fish biocriteria was met at two tributary sites (Joy Fork and Casey Run). Only two tributary sites did not fully attain fish biocriteria, due to shallow limestone bedrock (South Fork RM 3.0) and a natural waterfall barrier (Cat Run RM 3.3). IBI biocriteria for headwater/wading sites is 44 for warmwater habitat (WWH) and 50 for EWH.

A total of 56 fish species were collected in Captina Creek mainstem and tributaries during 2008-2009 OEPA surveys. Out of these species, 17.5% are considered sensitive (or intolerant) of water pollution. Further, ten of these species are considered "highly sensitive" and are only found in very high quality streams (OEPA 2010). Tables 8a and 8b list fish species and hybrid fish species found in the Captina Creek watershed.

Table 8a. Fish species present in Captina Creek mainstem and tributaries during 2008-2009 sampling (OEPA 2010).

Captina Creek Fish Species				
Gizzard Shad	Quillback	Silver Redhorse	Black Redhorse	Golden Redhorse
Northern Hog Sucker	White Sucker	Common Carp	Goldfish	Hornyhead Chub
River Chub	Creek Chub	Suckermouth Minnow	Emerald Shiner	Silver Shiner
Rosyface Shiner	Striped Shiner	Steelcolor Shiner	Spotfin Shiner	Sand Shiner
Mimic Shiner	Silver Jaw Minnow	Bluntnose Minnow	Central Stoneroller	Channel Catfish
Yellow Bullhead	Black Bullhead	Stonecat Madtom	Brindled Madtom	Brook Silverside
White Bass	White Crappie	Black Crappie	Rock Bass	Smallmouth Bass
Spotted Bass	Largemouth Bass	Warmouth Sunfish	Green Sunfish	Bluegill Sunfish
Longear Sunfish	Pumpkinseed Sunfish	Sauger	Yellow Perch	Logperch Darter
Johnny Darter	Greenside Darter	Banded Darter	Variegate Darter	Rainbow Darter
Fanttail Darter	Freshwater Drum	Saugeye		

Table 8b. Hybrid fish species present in Captina Creek mainstem and tributaries during 2008-2009 sampling season (OEPA 2010).

Additional Hybrid Species
Striped Shiner x River Chub
Striped Shiner x Rosyface Shiner
Green Sunfish x Bluegill
Longear Sunfish x Bluegill
Green Sunfish x Longear Sunfish
Orangespot Sunfish x Pumpkinseed Sunfish

Crayfish in the Captina Creek Watershed

According to ODNR, twenty species of crayfish (Order *Decapoda*) are known to exist in Ohio. None of these species are state-listed as endangered, but two are listed as threatened: Cavespring crayfish (*Cambarus tenebrosus*) and Sloan's crayfish (*Orconectes sloanii*). Three others are listed as species of concern in Ohio: *O. obscurus*, *O. propinquus*, and *O. virilis*. In a 1986 study of Ohio crayfish, an abundant population of the species *O. obscurus* was found in Captina Creek. However, in nearby Sunfish Creek, *O. obscurus* was found in headwater streams but populations were impacted in the mainstem due to an invasion of the non-native O. *rusticus* (Rusty-sided Crayfish) (Jezerinac 1986). A survey of crayfish in the Flushing Escarpment streams was also completed by Roger Thoma and funded by the Ohio Division of Wildlife. The results of this survey, which included Captina Creek, indicated that the Rusty-sided Crayfish is not present in the Creek, although this species has been found in adjacent watersheds (Lipps, personal communication, 2012).

Chapter 3: Water Resources

Climate and Precipitation

Eastern Ohio has a continental temperate climate with four distinct seasons and wide daily ranges in temperature throughout the year. Winters are cold with temperatures sometimes falling below 0°F, and moderately snowy with abundant cloud cover due to seasonal wind patterns that pass over Lake Erie. Summers are fairly warm and humid with occasionally hot days above 90°F. Rainfall is generally well distributed throughout the year with fall being the driest season. Normal annual precipitation is adequate for all of the normally grown crops. Summer temperatures and growing season dates in valleys differ slightly from those at higher elevations. The latest freeze in spring and earliest freeze in fall generally occur in valleys on nights with clear skies and light winds (Table 9) (USDA 1981).

Table 9. Frost data for Barnesville, Ohio (NOAA Station ID OH330430, elevation 1240 feet above sea level). Autumn percentages indicate the likelihood of the first frost occurring before that date. Spring percentages are the likelihood of the last frost occurring before that date. *Source:* National Oceanic and Atmospheric Administration Weather Data.

First Frost			**Last Frost**		
10%	50%	90%	10%	50%	90%
September 28th	October 12th	October 26th	April 16th	May 4th	May 21st

For Belmont County, the average temperature in winter is 28°F, and the average daily minimum temperature is 18°F. In summer the average temperature is 68°F, and the average maximum daily temperature is 81°F. On average, 43.2 inches of precipitation fall on Belmont County annually, of which 23 inches fall in April through September which is the growing season for most crops. In one out of five years, the rainfall in April through September is less than 19 inches. Thunderstorms occur on an average of 40 days each year, and are most frequent and intense in summer.

Average seasonal snowfall is 34.2 inches for the county, with an average of 22 days having at least one inch of snow on the ground. The number of such days varies widely from year to year. The average relative humidity in mid-afternoon is 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent (USDA 1981). Selected monthly climatic data for Barnesville, Ohio is provided in Table 10.

Table 10. Selected monthly climatological data for Barnesville, Ohio (Station ID OH330430. Data includes years 1948-2008). *Source:* NOAA Weather Data retrieved November 2010.

Average Temperature

	YEAR	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
°F	48.6	24.5	27	37.9	47.5	57.7	66.2	70.3	68.7	62.3	50.4	40.8	30.4

Highest Recorded Temperature

	YEAR	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
°F	103	75	70	84	90	93	96	100	103	101	89	86	83

Lowest Recorded Temperature

	YEAR	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
°F	-25	-25	-21	-19	3	21	30	40	36	25	14	-13	-17

Average Precipitation

	YEAR	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
inches	43.2	2.5	2.7	3.7	4.0	4.5	4.4	4.8	3.7	3.3	2.9	3.5	3.2

Average Snowfall

	YEAR	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
inches	34.2	11.5	8.7	4.8	1.6	---	---	---	---	---	0.1	1.6	6.3

Heavy rains, which occur any time of the year, and severe thunderstorms in summer sometimes cause flash flooding particularly in the narrow valleys of the eastern end of the watershed area. Subwatershed areas bordering the Ohio River are also subject to river flooding especially in winter and early spring when melting snow combines with heavy rain events (USDA 1981). Flood trends within the area are discussed in more detail in later sections of the watershed action plan.

Surface Water – Wetlands

Ohio's wetlands have been drastically reduced in many areas due to development and drainage for agricultural uses. Estimates show a 90% reduction of wetlands statewide since 1780 (ODNR n.d.). Habitat in southeastern Ohio is originally mixed mesophytic and mixed oak forest covering steep, hilly terrain and is not ideal for extensive wetland coverage. Compared to more favorable areas of the state (west, central, north) for wetland habitat coverage, the Captina Creek watershed lags significantly in total acreage. Currently, the watershed region is approximately 0.02% wetlands.

Wetlands are very important as natural filtering agents which aid in removal of contaminants and excess nutrients from the water column. Soil association distributions influence the occurrence of wetlands in a landscape. Favorable associations for wetlands are those with low permeabilities, low runoff rates, nearly zero slope and high water capacities. These associations are termed hydric soils and support unique communities of plants due to their water content. Hydric soils identified in the Captina Creek watershed are Brookside, Chagrin, Newark, Newark Variant and Nolin Variant (Table 11) (USDA 1981). Of these five soil associations, Newark has been identified as the most favorable for supporting wetland plant communities and year-round shallow water areas (USDA 1981). Figure 31 illustrates coverage of Newark soils in the watershed region which are most suitable for wetland habitat, and Figure 32 indicates wetland locations within the watershed.

Table 11. Properties of hydric soil associations found in the Captina Creek watershed region (USDA 1981).

Soil Association	Wetland plant Favorability	Shallow Water Areas Favorability	Permeability (Inch/hr.)	Available Water Capacity (Inch/inch)
Brookside (Bs, Bu)	Very Poor	Very Poor	0.2 - 2.0	0.05 - 0.23
Chagrin (Cg)	Poor	Very Poor	0.6 - 2.0	0.08 - 0.24
Newark (Ne, Nm)	Fair/Good	Fair/Good	0.6 - 2.0	0.15 - 0.23
Newark Variant (Nn)	Fair	Fair	0.6 - 6.0	0.01 - 0.24
Nolin Variant (No, Nu)	Poor	Very Poor	0.6 - 2.0	0.16 - 0.24

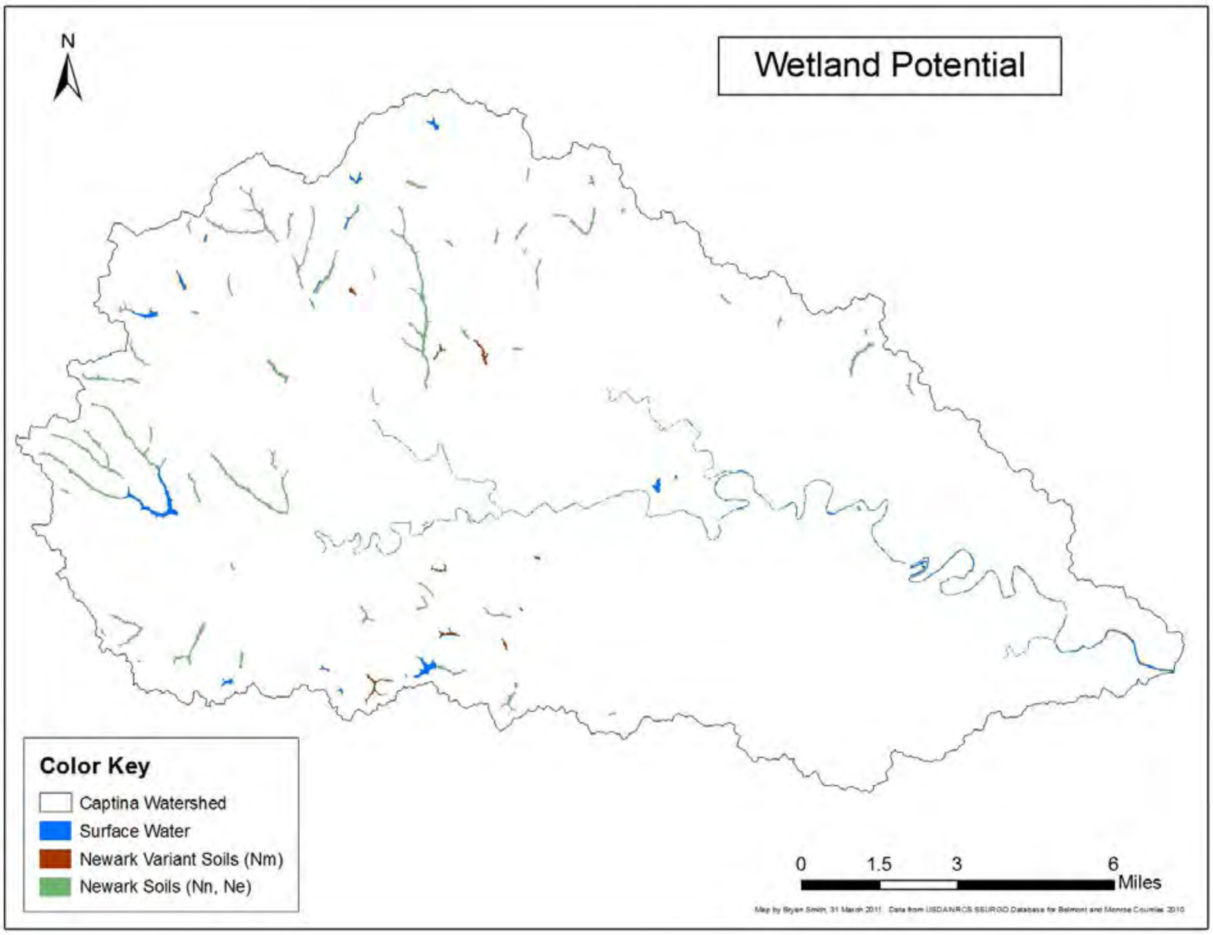


Figure 31. Favorable soils for supporting wetlands in the watershed region. *Map source:* Made by Bryan Smith, 2011 with data from USDA/NRCS SSURGO Database for Belmont and Monroe counties.

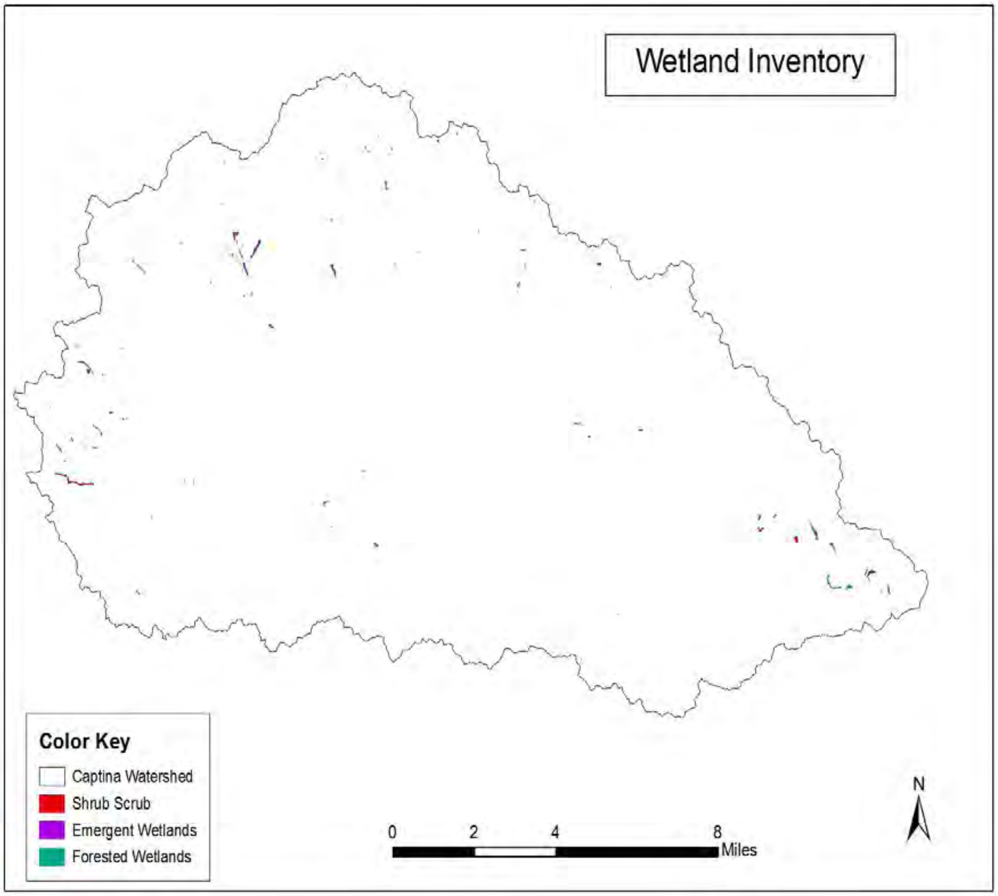
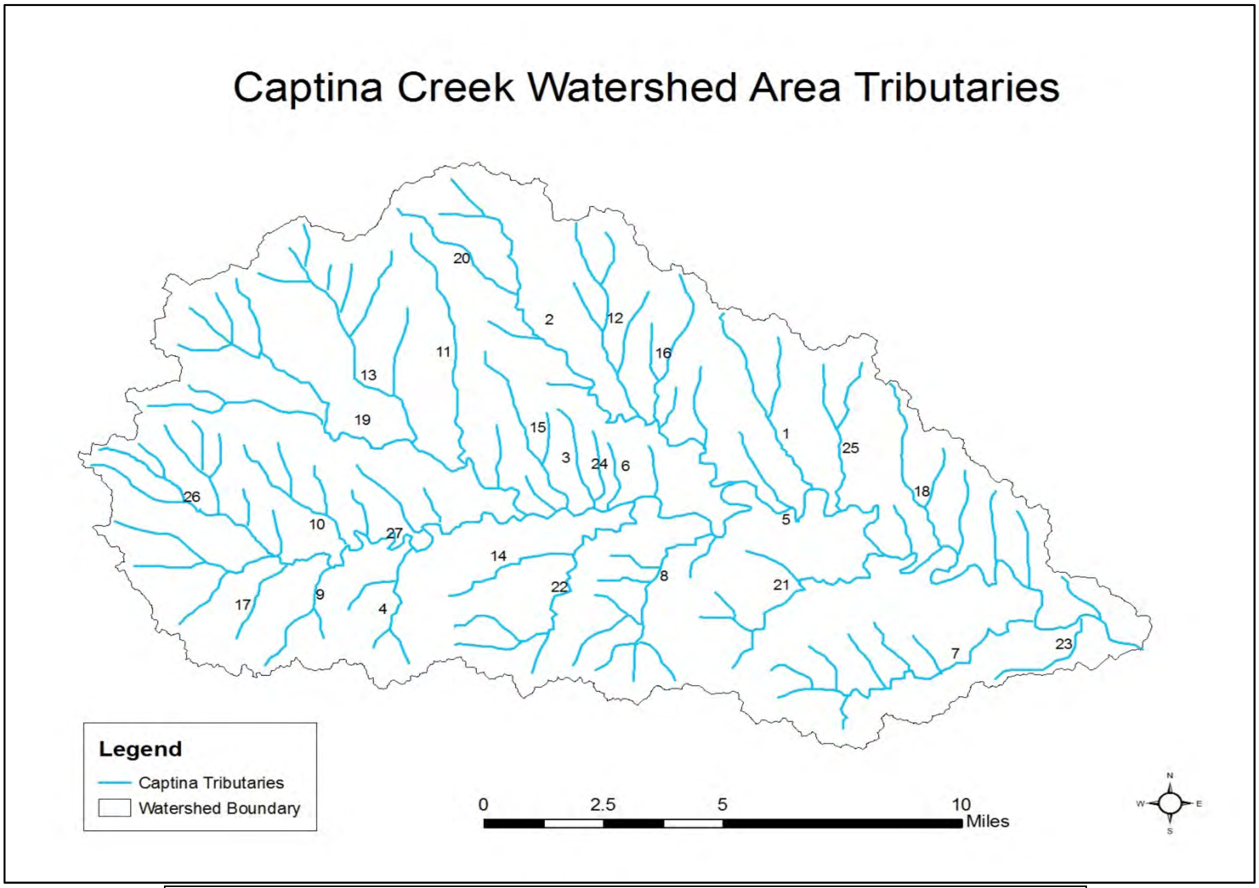


Figure 32. Wetland locations within the Captina Creek watershed. *Source:* National Wetland Inventory for Ohio.

Surface Water – Watershed Streams and Tributaries

Figure 33 illustrates the location of the major tributaries within the Captina Creek watershed area with numbers indicating the locations of named tributaries. Descriptions of Captina Creek watershed tributaries are provided in Table 12 and stream data for named tributaries is provided in Table 13.



1	Anderson Run	12	Joy Fork	23	Porters Run
2	Bend Fork	13	Long Run (N.F. trib)	24	Reeves Hollow
3	Berrys Run	14	Long Run (Piney Trib)	25	Rocky Fork
4	Brushy Creek	15	Mikes Run	26	Slope Creek
5	Captina Creek	16	Millers Run (B.F. trib)	27	South Fork Captina
6	Casey Run	17	Millers Run (S.F. trib)		
7	Cat Run	18	Moore Run		
8	Crabapple Creek	19	North Fork Captina		
9	Cranenest Creek	20	Packsaddle Run		
10	Flag Run	21	Pea Vine Creek		
11	Jakes Run	22	Piney Creek		

Figure 33. Captina Creek mainstem and tributaries within the Captina Creek watershed. Numbers indicate the locations of named tributaries, which are listed.

Table 12. Descriptions of Captina Creek watershed tributaries.

Tributary name	Description
Anderson Run (OH 7 23)	Anderson Run is 5.4 miles long and flows southwards along abandoned Anderson Run Rd (Smith/Washington TWP Rd.118) to Captina Creek at Armstrongs Mills in the central region of the watershed area. It drains 5.88 square miles and drops 105 ft/mile. Anderson run is a location of heavy ATV traffic. Its attainment status is unknown.
Bend Fork (OH 7 24)	Bend Fork is 13.4 miles long and flows southwards along Goshen TWP Rd 195 and Washington TWP Road 101 from south of Bethesda in the northern region of the watershed area to the mainstem of Captina Creek west of Armstrongs Mills. It drains 27.1 square miles and drops an average of 34.6 ft/mile. Bend Fork has 13.4 miles of stream in full attainment and is designated exceptional warmwater habitat (EWH).
Berrys Run (OH 7 33)	Berrys Run is 2.3 miles long and flows along Wayne TWP Rd 89 west of Casey Run in the central region of the watershed area. It drains 1.42 square miles and drops 181 ft/mile. Berrys Run has 2.3 miles of unknown stream attainment.
Brushy Creek (OH 7 40)	Brushy Creek is 3.2 miles long and flows along Brushy Creek Rd (Wayne TWP Rd 63) from north of the hamlet of Jerusalem in Monroe County northward to merge with South Fork Captina Creek in the southwestern region of the watershed. It drains 5.32 square miles and drops 67.2 ft/mile. Brushy Creek has unknown attainment status.
Captina Creek (OH 7 28)	Captina Creek is 26.1 miles long and flows from west of Alledonia east-southeastward along SR 148 to the Ohio River at Powhatan Point. It drains 180 square miles of land and drops an average of 15.7 ft/mile. Captina Creek is in full attainment over its entire length and has garnered EWH life use designation and Outstanding State Water (OSW) status.
Casey Run (OH 7 32)	Casey Run is 1.7 miles long and flows southward from CR 86 into Captina Creek just west of the Ohio Valley Coal Company No. 6 facility in the central region of the watershed. It drains 0.62 miles and drops 207 ft/mile. Casey Run has 1.7 miles of stream designated Coldwater Habitat (CWH) and has been recommended for inclusion as a class III primary headwater stream. It is also in full attainment status.
Cat Run (OH 7 19)	Located in the southeastern region of the Captina Creek watershed area, Cat Run is 7.2 miles long and flows northeasterly from the hamlet of Bingham on Clover Ridge to merge with Captina Creek just west of Steinersville. It drains 12.9 square miles and drops an average of 80 ft/mile. Cat Run has 7.2 miles of stream in partial water quality attainment due to high flow alterations, excessive nutrient loading and natural fish barriers. Large portions surrounding the mouth of the stream are in the 100 and 500 year flood zones.
Crabapple Creek (OH 7 29)	Crabapple Creek is 5.5 miles long and flows northeasterly along Crabapple Rd (Washington TWP Rd. 103) from Beallsville to Captina Creek at Alledonia in the central region of the watershed. It drains 8.32 square miles and drops 77.8 ft/mile. Crabapple Creek has 5.5 miles of stream in full attainment and is designated dual CWH and EWH status.

Cranenest Creek (OH 7 42)	Cranenest Creek is 3.1 miles long and flows along Carpenter Rd (Somerset TWP Rd. 38) from Malaga in Monroe County northward to merge with the South Fork in the southwestern region of the watershed area. It drains 3.68 square miles and has an average gradient of 61 ft/mile. Cranenest Creek has 3.1 miles of stream with unknown attainment status.
Flag Run (OH 7 41)	Located in the western region of the watershed area, Flag Run is 3.9 miles long and flows southeasterly from east of Howell Airport in Somerset TWP to the South Fork east of Somerton. It drains 3.5 square miles and drops 81.5 ft/mile. Flag Run has 3.9 miles of stream with unknown attainment status.
Jakes Run (OH 7 37)	Jakes Run is 6.6 miles long and flows southwards from Bethesda to merge with the North Fork in the western region of the watershed. It drains 5.18 square miles and drops 62.1 ft/mile. Jakes Run has 6.6 miles of stream in full attainment status and is also designated dual CWH and EWH aquatic usage.
Joy Fork (OH 7 26)	Joy Fork is 5.3 miles long and flows southward along Hatcher Road (Goshen/Smith TWP Rd.197) southeast of Bethesda to merge with Bend Fork in the northern region of the watershed. It drains 6.04 square miles and drops an average of 87 ft/mile. Joy Fork has 5.3 miles of stream in full attainment and is designated CWH. Two of Joy Fork's headwater tributaries originate in Dysart Woods preserve in Smith TWP.
Long Run (North Fork subwatershed) (OH 7 38)	Long Run is 6.4 miles long and flows from east of Barnesville southwards to the North Fork at the intersection of State Routes 26 and 148 in the western region of the watershed area. It drains 10.6 square miles and drops 50.8 ft/mile. It has 6.4 miles of stream in full attainment status.
Long Run (Piney Creek subwatershed) (OH 7 31)	Long Run is 3.6 miles long and flows northeasterly from south of New Castle to Piney Creek near AEC's Century mine. It drains 2.44 square miles and drops an average of 98.6 ft/mile. Long Run has 3.6 miles of stream in unknown attainment status and is designated EWH.
Mikes Run (OH 7 35)	Mikes Run is 4.6 miles long and flows from east of Hunter south-southeasterly between Wayne TWP Rds. 89 and 70 in the central region of the watershed area. It drains 3.38 square miles, drops an average of 102.2 ft/mile and is in unknown attainment status.
Millers Run (Bend Fork subwatershed) (OH 7 25)	Millers Run is 4.1 miles long and flows west of Centerville south-southwesterly along Smith TWP Rd 234 to merge with Bend Fork in the north central region of the watershed area. It drains 3.46 square miles and descends 97.3 ft/mile. Millers Run has 4.1 miles of stream in unknown attainment status.
Millers Run (South Fork subwatershed) (OH 7 43)	Millers Run is 3.7 miles long and flows from northwest of Malaga in Monroe County northeasterly entering the South Fork in the extreme southwestern corner of the watershed area. It drains 2.64 square miles and drops an average of 74.7 ft/mile. Millers Run has unknown attainment status.
Moore Run (OH 7 20)	Moore Run is 4.4 miles long and flows southbound along the central interior of the watershed area from the split of County Roads 56 and 5 to the end of Moore’s Run Road where it merges with Captina Creek. It drains 3.88 square miles of land and has a gradient of 123.4 ft/mile. Moore Run has 4.4 miles of stream in unknown attainment status.

North Fork Captina Creek (OH 7 36)	North Fork Captina Creek is 10.5 miles long and flows from Barnesville Reservoirs #1 and #2 southeastward to join the South Fork Captina Creek and form the mainstem of Captina Creek. It drains 32.7 square miles and falls 35.5 ft/mile. The North Fork has 10.5 miles of stream in full attainment status and has been designated EWH below the confluence with Long Run at RM 4.0.
Packsaddle Run (OH 7 27)	Packsaddle Run is 3.5 miles long and flows south of Bethesda into Bend Fork in the northern region of the watershed. It drains 2.28 square miles and drops 55.6 ft/mile. Packsaddle Run has 3.5 miles of stream in unknown attainment.
Pea Vine Creek (OH 7 21)	Pea Vine Creek is 6.9 miles long and flows along Washington TWP Rd. 106 northeast to Captina Creek in the southeastern region of the watershed. It drains 9.96 square miles and drops 65.9 ft/mile. Pea Vine Creek has 6.9 miles of stream in full attainment and is designated dual CWH and EWH status. Similar to Bend Fork and Anderson Run, it has also been a historical location for ATV traffic.
Piney Creek (OH 7 30)	Piney Creek is 7.2 miles long and flows from Switzerland Lake northeasterly passing the Century coal mine in the southern region of the watershed area before merging with Captina Creek just west of the split of SRs 145 and 148. It drains 9.92 square miles and drops an average of 55.7 ft/mile. Piney Creek has 7.2 miles of stream with full attainment status and is designated CWH.
Porters Run (named tributary to Captina Creek)	Porters Run is a small tributary of the Cat Run subwatershed that flows northeasterly along German Ridge in York TWP, entering Captina Creek at the Clair Mar golf course in Steinersville. It is 2.9 miles in length, drops an average of 215.2 ft/mile and drains an area of 1.37 square miles. Its attainment status is unknown.
Reeves Hollow (OH 7 34)	Reeves Hollow is 1.7 miles long and flows between Berrys Run and Casey Run to Captina Creek in the central region of the watershed area. It drains 0.52 square miles and drops 227 ft/mile. Reeves Hollow has 1.7 miles of stream with unknown attainment status.
Rocky Fork (OH 7 22)	Rocky Fork is 3.9 miles long and flows southward along Rocky Fork Road (Smith/Washington TWP Rd 120) from Jacobsburg entering Captina Creek east of Armstrongs Mills in central region of the watershed. It drains 4.42 square miles and drops 113 ft/mile. Rocky Fork has 3.9 miles of stream in unknown attainment.
Slope Creek (OH 7 44)	Slope Creek is 4.4 miles long and flows out of Barnesville Reservoir #3 southeasterly to the South Fork in the western region of the watershed area. It drains 7.04 square miles and falls 45.5 ft/mile. Slope Creek has 4.4 miles with unknown attainment status.
South Fork Captina Creek (OH 7 39)	South Fork Captina Creek is 14 miles long and comprises the southwest region of the watershed area. It drains 36.18 square miles and drops an average of 25.8 ft/mile. South Fork Captina Creek has 14 miles of stream in partial/full attainment due to organic enrichment and extensive bedrock in the stream channel. It is also designated EWH.

Table 13. Stream data for named tributaries in the Captina Creek watershed. *Source:* United States Geological Survey *StreamStats for Ohio*, 2011.
cfs = cubic feet per second
PK2 Description - *Denotes two year recurrence interval average flow with a prediction error of 37% (Equivalent years of record = 2.1).
7Q10 Description - Seven day, ten year low flow volume based on an annual series of the smallest values of mean discharge computed over any seven consecutive days during the annual period.

Name	Length (miles)	Drainage Area (sq. miles)	Average PK2 Flow Rate (cfs)	7-day, 10-Year Low Flow (cfs)	Attainment Status	Sinuosity
Anderson Run	5.4	5.88	506	1.06	Unknown	1.1
Bend Fork	13.4	27.1	1340	5.15	Full	1.5
Berrys Run	2.3	1.42	183	0.27	Unknown	1.3
Brushy Creek	3.2	5.32	414	0.95	Unknown	1.3
Captina Creek	26.1	180	4930	39.5	Full	1.9
Casey Run	1.7	0.62	95.1	0.10	Full	1.3
Cat Run	7.2	12.9	875	2.5	Partial/Full	1.3
Crabapple Creek	5.5	8.32	600	1.48	Full	1.2
Cranenest Creek	3.1	3.68	309	0.65	Unknown	1.1
Flag Run	3.9	3.5	313	0.60	Unknown	1.1
Jakes Run	6.6	5.18	398	0.93	Full	1.2
Joy Fork	5.3	6.04	470	1.08	Full	1.3
Long Run (N.F.)	6.4	10.6	637	1.98	Full	1.2
Long Run (P.C.)	3.6	2.4	237	0.42	Full	1.2
Mikes Run	4.6	3.38	301	0.57	Unknown	1.2
Millers Run (B.F.)	4.1	3.46	311	0.57	Unknown	1.1
Millers Run (S.F.)	3.5	2.64	259	0.47	Unknown	1.7
Moore Run	4.4	3.88	379	0.71	Unknown	1.2
North Fork	10.5	32.7	1480	6.39	Full	1.2
Packsaddle Run	3.5	2.28	219	0.44	Unknown	1.3
Pea Vine Creek	6.9	9.96	701	1.82	Full	1.6
Piney Creek	7.2	9.92	597	1.83	Full	1.6
Porters Run	2.9	1.37	177	0.25	Unknown	1.4
Reeves Hollow	1.7	0.52	85.8	0.09	Unknown	1.3
Rocky Fork	3.9	4.42	402	0.76	Unknown	1.2
Slope Creek	4.4	13.6	752	2.53	Unknown	1.1
South Fork	14.0	36.18	1520	7.02	Partial/Full	1.6

B.C. = Belmont County **N.F.** = North Fork Subwatershed Area **S.F.** = South Fork Subwatershed Area
M.C. = Monroe County **B.F.** = Bend Fork Subwatershed Area

Surface Water – Floodplain Areas

According to ODNR data, the most significant flood hazard areas within the watershed are along Captina Creek between Armstrongs Mills and Powhatan Point. Flood hazard areas, illustrated in Figures 34 - 36, are subject to flooding because of flat terrain near stream elevation. Floodplains along Captina Creek are most extensive in downstream areas where the valley floor widens significantly and lessens in coverage further upstream where hillsides run directly into creek banks. Only the larger tributaries of North Fork, South Fork and Bend Fork exhibit significant stretches of floodplain outside of the mainstem of Captina Creek.

As mentioned in the climatology section of the watershed action plan, two types of flooding events threaten those who live in floodplains along the larger tributaries in the watershed: flash flooding and river flooding. Both of these flooding events result in loss of property and even life, but by different means in each case. Flash floods occur when heavy rainfall quickly saturates soils on steep tributary hillsides causing excess runoff to quickly overwhelm and exit stream banks. In short time a small tributary can become a raging river of mud, rocks, water and debris that can approach speeds of 30 - 40 mph given the topography of the stream channels of the central and eastern areas of the watershed.

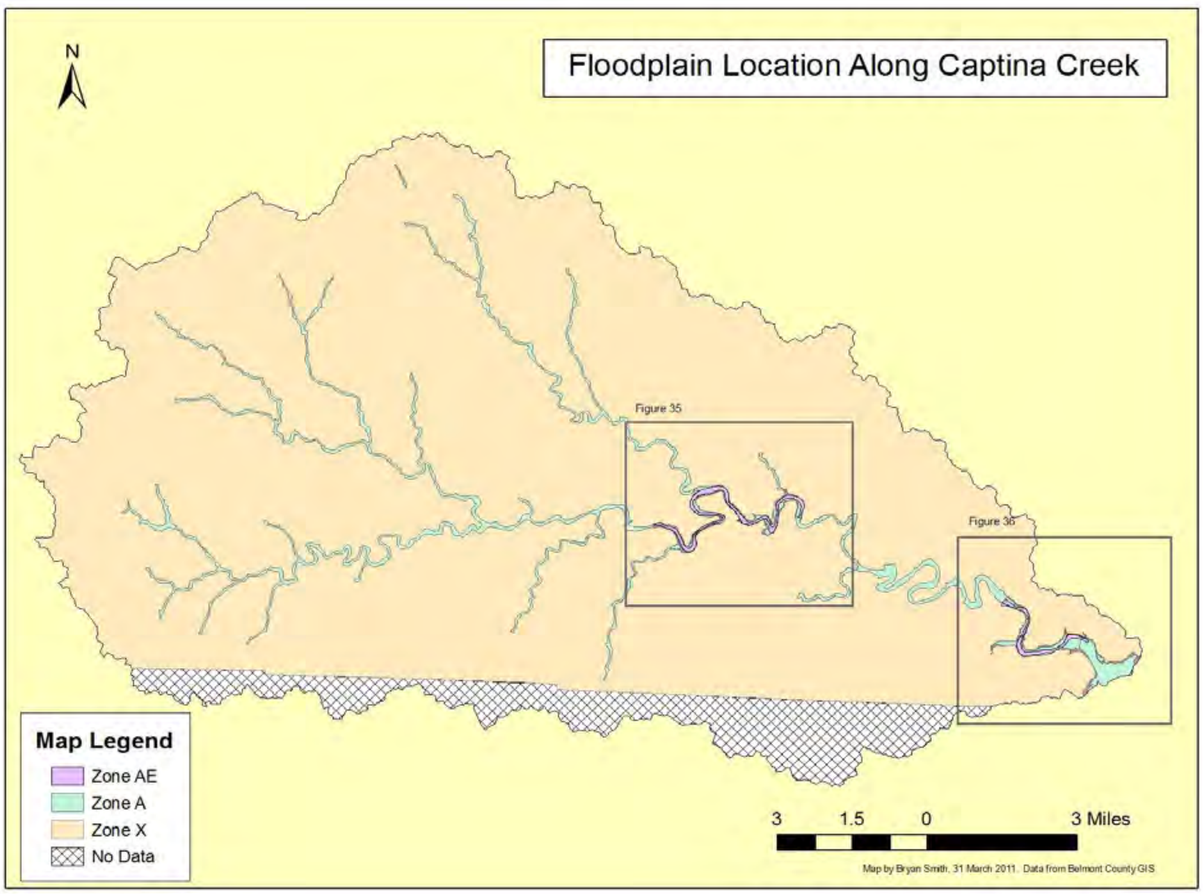


Figure 34. Floodplain zones of the Captina Creek watershed region. Refer to Table 14 for description of floodplain zones. *Map source:* Bryan Smith, 2011. Data from Belmont County GIS 2010.

Flash floods are most likely to occur in the watershed during late spring or early summer when thunderstorms drop excessive rains on soils that have already been saturated by persistent spring rains. Adding to the potency of flash floods, drainage ways can get blocked with landowners' debris and personal items, exacerbating the event. Blockages within the stream channel can temporarily dam water, rupture, and repeat the process in progressively larger scales downstream, producing hazardous waves of water. Due to the threat of flash flooding in the watershed, some local officials have lobbied for streambed dredging to alleviate flood potential.

As of 2011 there are 464 structures that exist in designated Zone A floodplain along the length of Captina Creek and its major tributaries, of which 160 are located in the Powhatan Point area alone. Armstrongs Mills is the only other area in the watershed with concentrated residential structures in floodplain zones with approximately 50 structures in floodplain zones. Historical flash flooding events in the Captina Creek watershed are detailed in Table 15.

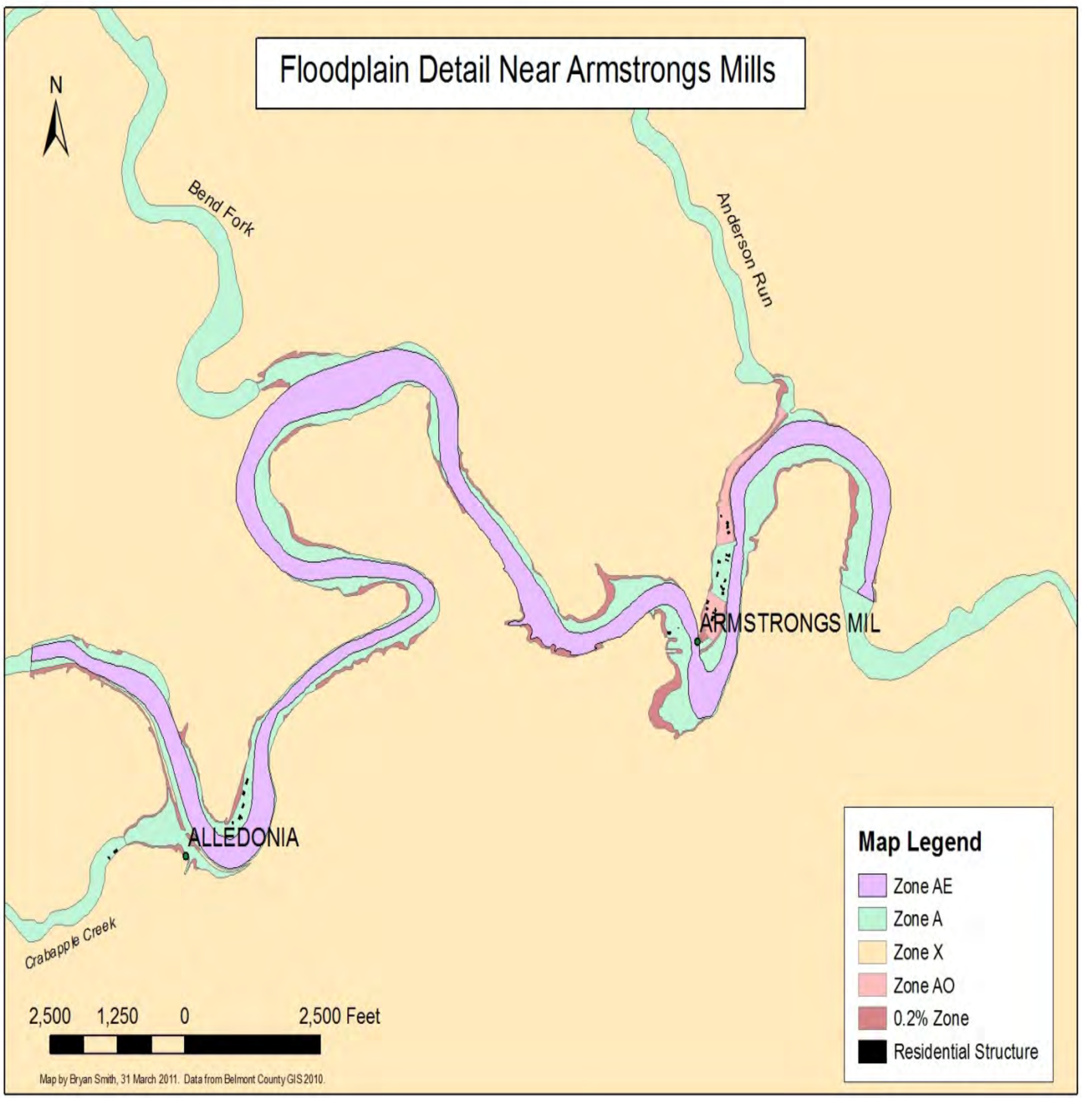


Figure 35. Highly flood prone regions of Captina Creek mainstem near Armstrongs Mills, Ohio. *Map source:* Bryan Smith, 2011. Data from Belmont County GIS 2010.

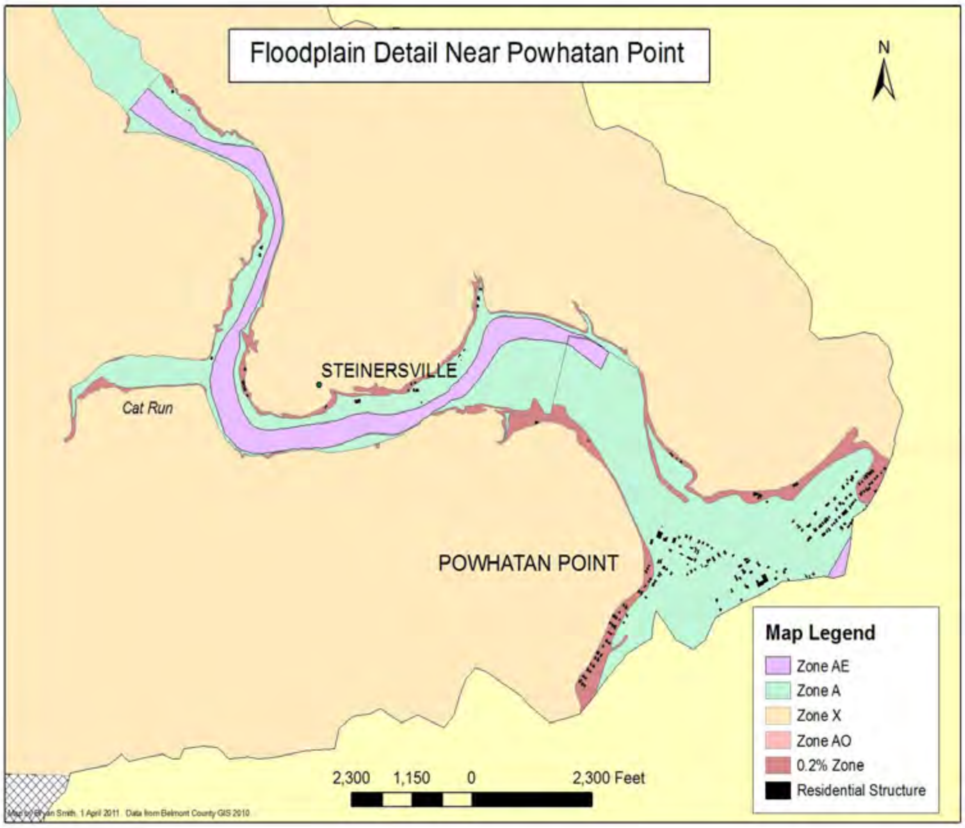


Figure 36. Highly flood prone regions of Captina Creek mainstem near Powhatan Point, Ohio. *Map source:* Bryan Smith, 2011. Data from Belmont County GIS 2010.

Table 14. Floodplain zone descriptions. *Source:* Belmont County GIS, 2011.

Floodplain Zone	Description
Zone A	Zone A is the flood insurance rate zone that corresponds to the 1-percent annual chance floodplains that are determined in the Flood Insurance Study by approximate methods of analysis. Because detailed hydraulic analyses are not performed for such areas, **no Base Flood Elevations or depths are shown within this zone.**
Zone AE	Zone AE is the flood insurance rate zone that corresponds to the 1-percent annual chance floodplains that are determined in the Flood Insurance Study by detailed methods of analysis. In most instances, **Base Flood Elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.**
Zone AO	Zone AO is the flood insurance rate zone that corresponds to the areas of 1-percent shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average flood depths derived from the detailed hydraulic analyses are shown within this zone. In addition, alluvial fan flood hazards are shown as Zone AO on the Flood Insurance Rate Map.
Zone X	Zone X is the flood insurance rate zone that correspond to areas outside the 0.2 to 1-percent annual chance floodplain, areas of 1-percent annual chance sheet flow flooding where average depths are less than 1 foot, areas of 1-percent annual chance stream flooding where the contributing drainage area is less than 1 square mile, or areas protected from the 1-percent annual chance flood by levees. No Base Flood Elevations or depths are shown within this zone.
0.2% Zone	Zone 0.2% is the flood insurance rate zone that corresponds to the 0.2-percent annual chance floodplains that are determined in the Flood Insurance Study by approximate methods of analysis (formerly known as 500 year flood stage).

Table 15. Historical flash flooding events in the Captina Creek watershed. *Source:* Data from National Oceanic and Atmospheric Administration and United States Geological Survey.

Date	Watersheds Affected	Summary
September 17th, 2004	Captina Creek	In two separate precipitation events, remnants of hurricanes Frances and Ivan deposited an estimated 8 inches of rain in less than one week on already moderately saturated soils in the watershed. The second event resulted in record flow volumes for Captina Creek (~27,000 cfs peak at Armstrongs Mills river gauge) and caused widespread damage from Alledonia to Powhatan Point. Homes were swept away, portions of Lake Shawn were collapsed and numerous mud slides blocked State Route 148 which was peeled away by raging floodwaters near the Town Hill bridge.

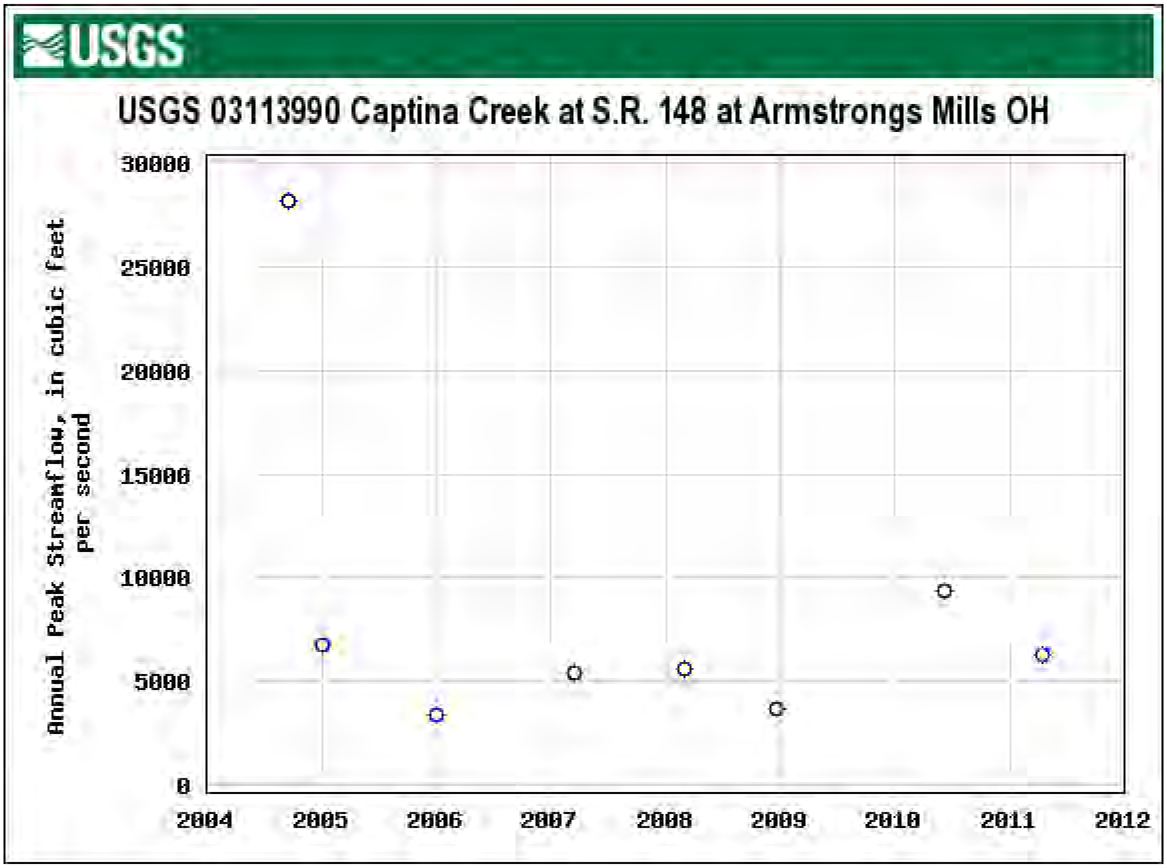


Figure 37. Captina Creek peak flows (in cubic feet per second) from 2004 – 2012 at Armstrongs Mills, Ohio gauge (03113990). *Source:* United States Geological Survey - National Water Information System, 2013.

Flooding can also result when extended periods of sub-freezing temperatures are followed by heavy rains in winter. These conditions sometimes lead to the formation of ice jams that impede water flow within Captina Creek, causing water levels to rise upstream of the jam. Ice jams are composed of blocks of ice (ranging from cinder block size to large sheets measuring several feet across) that accumulate on debris in the creekbed or around sharp bends in the creek. The threat also exists for flash flooding downstream of the jam if it were to suddenly break loose after impounding water for several hours.

Table 16. Historic Ohio River crests at Powhatan Point, Ohio. Normal gauge height is 17 feet and flood stage is 37 feet (*Source:* NOAA Advanced Hydrologic Prediction Data, 2010). Though the 1936 flood crest is accurate, NOAA – National Weather Service flood record data for Powhatan Point is incomplete. Therefore crests for Wheeling, WV (located 15 miles upstream) were used in place for 2 - 5.

	Date	**Crest** (feet above river bottom)
1	March 19th, 1936	53.3
2	December 21st, 1942	51.5
3	March 28th, 1913	51.2
4	March 15th, 1907	50.1
5	January 26th, 1937	48.7

Surface Water – Sinuosity and Entrenchment

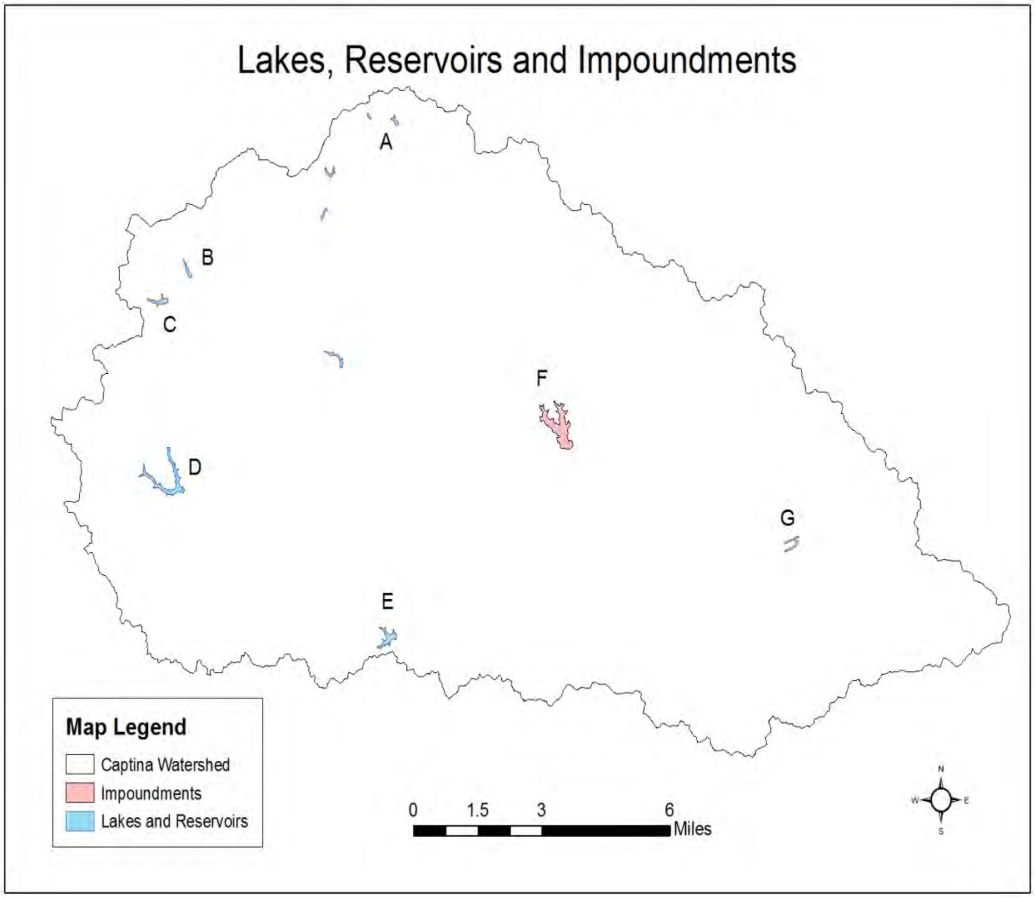
Sinuosity is a measure of the channel length divided by the down-valley length. Sinuosity is calculated by dividing the shortest linear distance covered by the stream by the total length of the stream to provide a numerical reference. A value of one represents a completely straight stream while a value higher than one represents a stream with more sinuosity. Captina Creek has a sinuosity of 1.9 indicating it meanders significantly along its length.

The average sinuosity for all tributaries in the Captina Creek watershed is 1.3. Captina Creek's sinuosity of 1.9 indicates that it travels through a wider, flatter valley than streams with lower sinuosity values. Captina Creek's tributaries flow straighter with an average sinuosity of 1.3 due to the fact that they run through steeper, narrower valleys.

Entrenchment refers to the down-cutting of the stream (or the measure of the steepness of streambanks) due to stream power and excessive erosion in poor riparian zones. Entrenched areas usually have steep to vertical banks of 1 - 5 feet in height. Streams in the Captina Creek watershed are generally not entrenched and have adequate access to their floodplains. They are shallow and have little stream bank in most cases, especially in the deeper, wider valleys. Areas of greatest entrenchment along Captina Creek are those having steep banks on both sides of the stream, which are rare. Usually if a bank is steep on one side of the creek, a wide gradually sloping floodplain exists on the opposite side. A large majority of Captina Creek's length is dominated by areas with gradual sloping sides.

Surface Water – Lakes and Reservoirs

Within the watershed boundary, there are seven named lakes and reservoirs with greater than five acres in surface area, as illustrated in Figure 38. Four other unnamed water bodies are over five acres, and numerous ponds with less than 5 acres of surface area exist as well. Impoundments are bodies of water artificially created for non-recreational use. An artificial impoundment retains coal slurry at the Ohio Valley Coal Company Powhatan No. 6 mine near Alledonia. By surface area it is the largest body of water in the Captina Creek watershed. This slurry pond is a total of 186 acres in surface area and is designed to handle an average daily design flow of 1.5 million gallons per day (MGD) of coal slurry.



A	Bethesda Reservoir	C	Barnesville Reservoir #2	E	Switzerland Lake	G	Lake Shawn
B	Barnesville Reservoir #1	D	Barnesville Reservoir #3	F	OVCC Impoundment		

Figure 38. Lakes, reservoirs and impoundments within the Captina Creek watershed. Letters A – G represent the location of the named water bodies. *Source:* Data from United States Geological Survey.

The Village of Barnesville waste water treatment plant reports all water quality monitoring results as required for National Pollutant Discharge Elimination System (NPDES) permits. Table 17 summarizes physical data from the major reservoirs of the Captina Creek watershed.

Table 17. Summary of physical data for water bodies greater than five acres within the Captina Creek watershed.

Name	Use	Area (Surface Acres)	Sub-Watershed	Detention Time
Ohio Valley Coal Company	Industrial	186	Piney Creek	N/A
Barnesville Reservoir #3	Reservoir	98	South Fork	N/A
Switzerland Lake	Reservoir	44	Piney Creek	N/A
Barnesville Reservoir #1	Reservoir	35	North Fork	N/A
Lake Shawn	Private/Fishing	16	Pea Vine Creek	N/A
Bethesda Reservoir	Reservoir	13	Bend Fork	N/A
Barnesville Reservoir #2	Reservoir	11	North Fork	N/A

Groundwater - Aquifers (Location, Recharge Rates, Uses)

The Captina Creek watershed contains bedrock aquifers of the Pennsylvanian aquifer and the Permian Dunkard Group aquifer. Approximately 17% of drinking water supplies in the watershed area are obtained from private wells. Seventy five percent of watershed households rely on groundwater for drinking. Barnesville and Bethesda have public water supplied from surface water reservoirs while Powhatan Point uses groundwater for public water supply (Schumacher et al. 1993a).

Groundwater is present in all regions of the watershed. Although there are no major aquifers located within the watershed, small aquifers are present, especially close to the Ohio River. Most upland areas in the watershed have wells capable of producing 0 – 2 gallons per minute. Wells located near downstream areas of Captina Creek produced the highest yields of groundwater (ODNR 1991).

According to ODNR’s groundwater resources map for Belmont County, the aquifers rarely yield more than 3 gallons per minute. Limited water supplies are located in thin beds of sandstone, shale, and limestone. The average depth of wells is over 95 feet. Aquifers around Captina Creek near Armstrongs Mills yield 3 – 10 gallons of water per minute due to layers of sand and gravel up to 60 feet thick. Areas near the Ohio River such as Powhatan Point yield nearly 300 gallons per minute (Figure 39) (ODNR 1991).

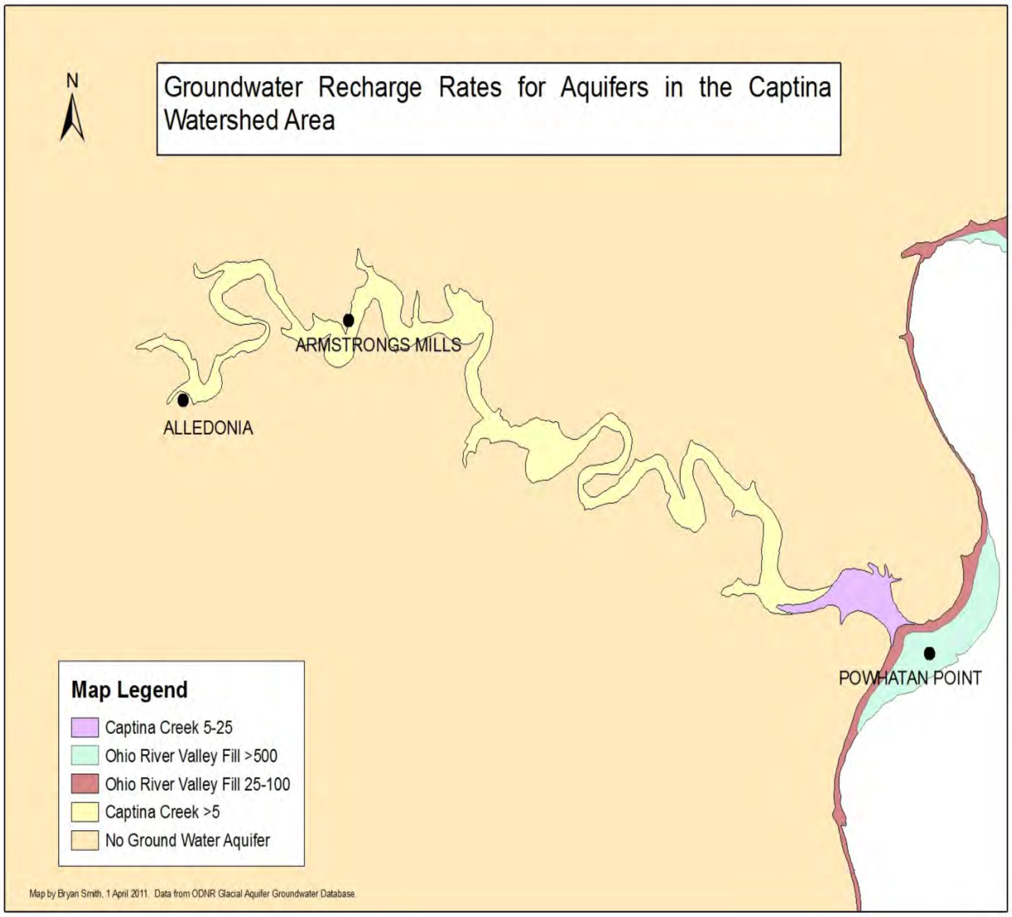


Figure 39. Groundwater recharge rates for aquifers in the Captina Creek watershed. Named aquifers are illustrated with potential recharge rates expressed in gallons per minute. No named aquifers exist upstream of OVCC's Powhatan No. 6 coal mine located just northwest of Alledonia on the mainstem of Captina Creek. *Map source:* Bryan Smith, 2011. Data from ODNR Glacial Aquifer Groundwater Database.

Groundwater – Flow Regime

Groundwater flow and direction data is unavailable for the watershed on a small scale basis. Groundwater flows down higher elevation gradients to lower elevations and eventually flows into a centralized water body (Frigon n.d.). Groundwater in the western region (higher elevation) of the watershed area will eventually flow to the eastern region (lower elevation) of the watershed area and subsequently into the Ohio River. The gradient drop from west to east in the watershed (11.7 ft./mile, USGS Streamstats Online Database 2011) will cause the groundwater to flow in that direction due to gravity. Flow regime may be in many directions within specific portions of the watershed due to localized gradients and geological variables, but the general flow direction is from west to east toward the Ohio River.

Source Water Assessment Plan Information

The Source Water Assessment Plan (SWAP) program in Ohio assists communities in protecting their public drinking water resources from pollution contamination and planning for spill prevention. SWAPs have been developed for the following Public Water Supplies (PWS) in Belmont County, serving a total of 35,759 people: Belmont County Sanitary District 3 PWS, Holloway PWS, Martins Ferry PWS and Shadyside PWS (OEPA 2013). The Belmont County Sanitary District 3 PWS includes two lines that extend into the Captina Creek watershed: one line extending southeast along Mount Victory Road to Cove Road near Powhatan Point and another line extending to the unincorporated communities of Alledonia and Armstrongs Mills.

DRASTIC Maps and the Sensitivity of Groundwater to Local Sources of Contamination

Groundwater flowing through aquifers is susceptible to contamination. DRASTIC maps, as shown in Figure 40, use variables such as soil composition and topographical profiles to estimate the degree of sensitivity that areas have for potential groundwater pollution. DRASTIC is an acronym for Depth to water, net Recharge Aquifer media, Soil media, Topography, Impact of vadose zone media, and hydraulic Conductivity to the aquifer (USEPA 1987). Areas with DRASTIC scores approaching 200 have higher potential for groundwater contamination than areas with lower scores and are shown in red on the map. Areas with low scores, shown in blue, have the lowest potential for groundwater contamination due to factors such as depth to water or the presence of impermeable soils above the aquifer. Some areas are not rated because they are open water or have been strip- or subsurface-mined or contain significant amounts of Soil Survey Geographic database (SSURGO) spoil soils. DRASTIC data do not currently exist for locations in Monroe County.

According to DRASTIC data for the Captina Creek watershed, areas most susceptible to groundwater contamination are those nearest to deep aquifers located along the lower mainstem of Captina Creek and along the Ohio River near Powhatan Point. Areas along the mainstem of Captina Creek west of Armstrongs Mills and along the North and South Fork tributaries also have scores indicative of higher susceptibility to groundwater pollution, though not as high as those found further downstream.

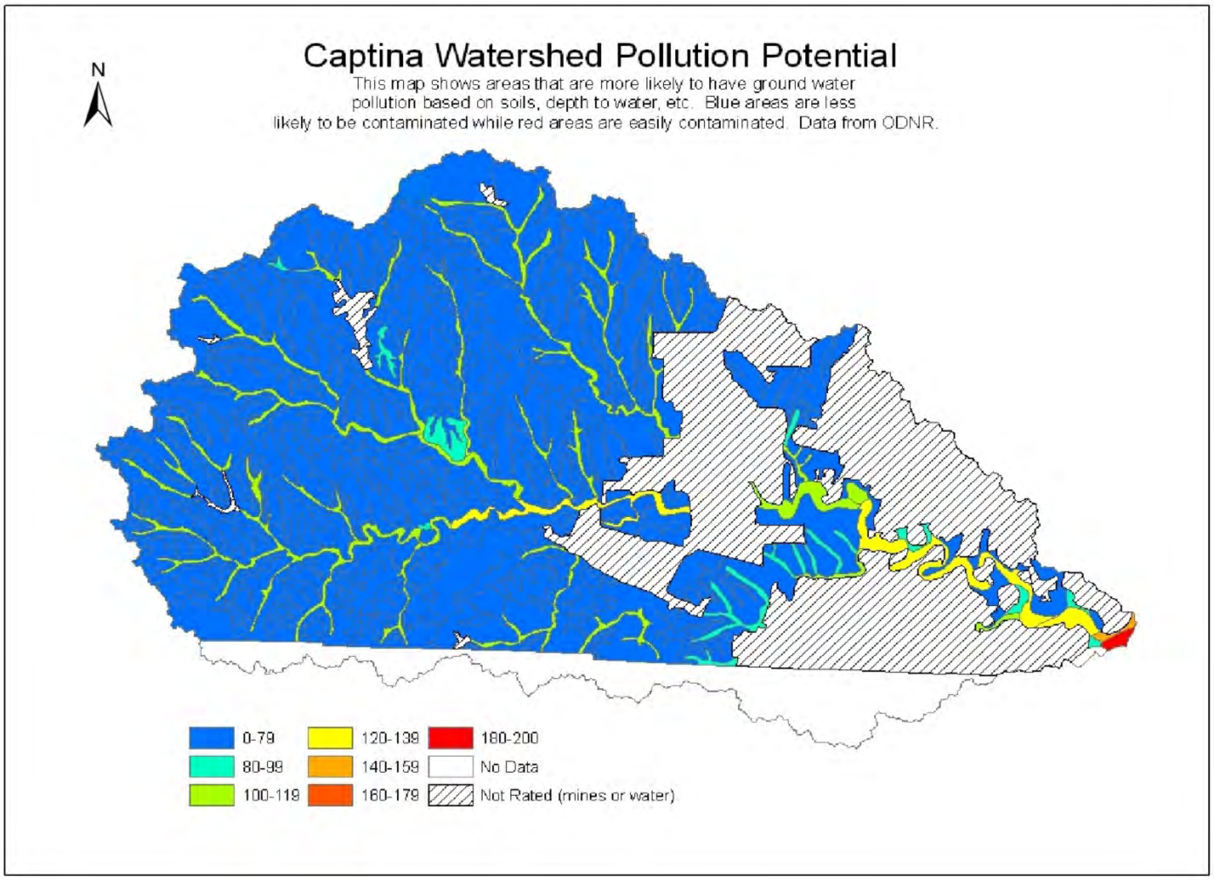


Figure 40. Groundwater pollution potential within the Captina Creek watershed. Areas most susceptible to groundwater pollution also tend to be those with greatest groundwater recharge rates. Scores between 151 and 200 indicate high potential for groundwater contamination from sources of pollution while scores under 75 indicate low potential for contamination based on DRASTIC criteria. DRASTIC data for Monroe County is currently unavailable.

Chapter 4: Land Use in the Captina Creek Watershed

Land Use

There are a variety of land uses in the Captina Creek watershed. The majority of the landscape is forested but some agriculture exists primarily as hayfields and limited cropland (Figure 41). Urbanization and development are not significant and are concentrated around the villages of Barnesville, Bethesda and Powhatan Point.

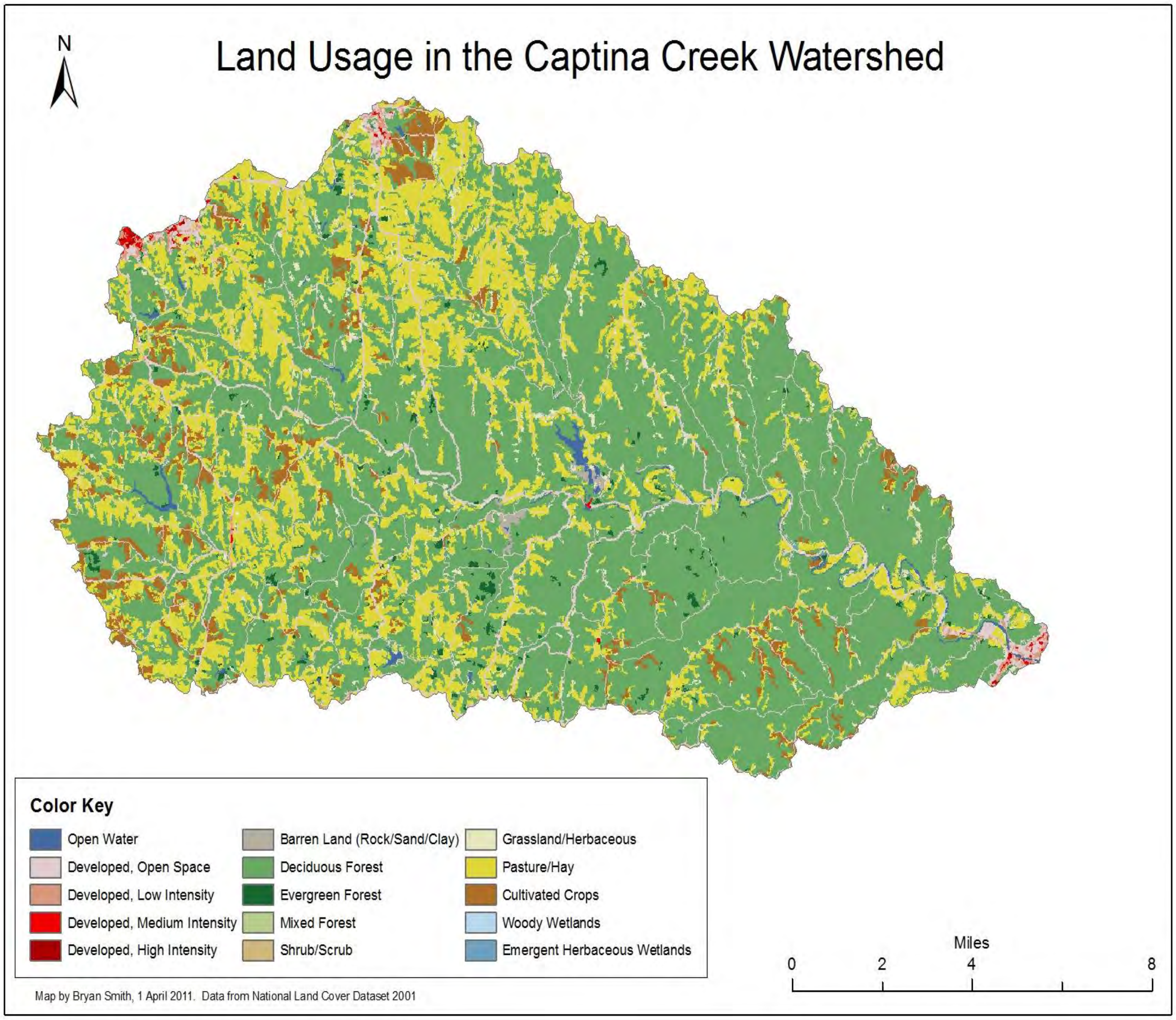


Figure 41. Map depicting land use in the Captina Creek watershed. *Map source:* Bryan Smith, 2011. Data from the National Land Cover Dataset, 2001.

Land Cover

The dominant land cover in the watershed is temperate forest (64.6%), most of which is deciduous (63.8%) with isolated patches of native hemlock and domestic stands of white pine (0.8%). Other land cover is pasture (23%), development (6%), cultivated crops (4%), grassland (2%), water (0.6%), and the remaining land is wetlands, scrub/shrubs, or barren land (Table 18).

Table 18. Land cover (percentage) in the Captina Creek watershed. Based on National Land Cover Database Map (2001) and United State Geological Survey *Streamstats for Ohio* Online Database, 2011.

Subwatershed	Bend Fork	Pea Vine	Cat Run	Piney Creek	South Fork	North Fork
Open Water	0.2	0.7	0.6	1.5	0.5	0.4
Developed Space (All)	6.6	4.8	7.3	7.4	5.9	8.5
Deciduous Forest	51.2	84.7	73.2	65.4	51.6	52.3
Coniferous Forest	0.4	0.7	0.4	1.3	0.8	0.8
Shrub/Scrub	0.1	0.0	0.0	0.1	0.0	0.0
Grassland	2.3	3.1	1.6	2.3	1.6	2.6
Pasture/Hay	34.9	0.1	11.2	20.2	30.9	30.6
Cultivated Crops	4.2	2.2	4.5	0.9	8.6	4.8
Wetlands (All)	0.0	0.2	0.0	1.3	0.0	0.0
Barren Land	0.0	0.0	0.0	1.3	0.0	0.0

Urban Land Use and Impervious Surfaces

Impervious surfaces are surfaces such as roads, parking lots, and rooftops through which precipitation cannot penetrate to reach underlying soil. Impervious surfaces have negative effects on water quality by increasing rates of runoff and the amount of pollution entering into surface waters. In the Captina Creek watershed, there are 9,295 buildings and houses which total about 290 acres of rooftop (0.2% of the watershed). Within the watershed boundary, there are approximately 425 buildings within 150 feet of a stream, 310 buildings within 100 feet, and 148 within 25 feet. Figure 42 illustrates the extent of all impervious surfaces in the Captina watershed. Total impervious cover in the watershed is detailed in Table 19.

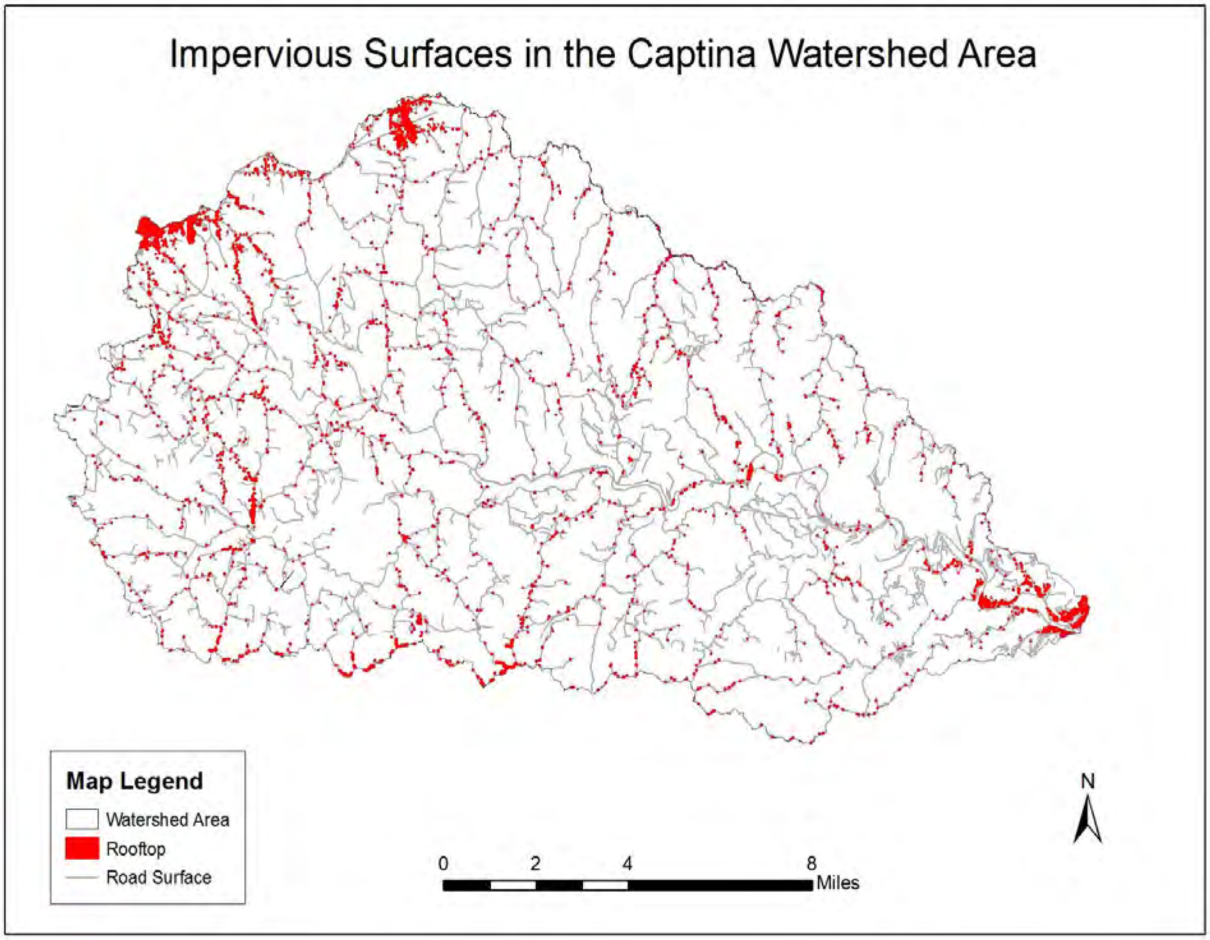


Figure 42. Impervious surfaces within the Captina Creek watershed.

Table 19. Total impervious cover in the watershed is 2,530 acres or 2.2 % of the watershed based on current land uses. *Source:* Purdue University Department of Agricultural Engineering Online Spatial Analyst Calculator, 2011.

Watershed Area (acres)	114,956.7		
Land Use	Soil Group	Area (acres)	Impervious Area (acres)
Water	B	562.9	0
Water	C	440.4	0
Commercial	B	47.6	34.3
Commercial	C	134.8	97.3
Agriculture	B	800	15.2
Agriculture	C	1,575.1	29.9
HD-Residential	B	8.6	3.1
HD-Residential	C	28.4	10.3
LD-Residential	B	558.9	86
LD-Residential	C	467.8	72
Grass/Pasture	B	13,929.8	264.6
Grass/Pasture	C	30,573.6	580.8
Forest	B	12,641.9	240.1
Forest	C	53,020	1,007.3
Industrial	B	40.5	21.6
Industrial	C	126.2	67.3
Total Area		114,956.7	2,529.8

Locations of Home Sewage Treatment Systems

Home sewage treatment systems are prevalent throughout the rural areas of the Captina Creek watershed. Home sewage treatment systems are not spatially mapped, but are utilized by 40% of residences in the watershed area. Residences within municipal incorporated village limits are networked to localized wastewater treatment plants and therefore do not require private septic tanks. Ohio Revised Code (ORC) 3701-29-02 (C) states that all dwellings must have a disposal system that must be properly maintained and operated by the owner, and must receive all the sewage from the dwelling.

The locations of rural residences throughout the watershed area are illustrated in Figure 43. By law, those residences outside of incorporated limits must have a properly functioning septic disposal system. Currently there are estimated to be 2,390 active systems in the watershed region, assuming that every residence is properly equipped. This number is based on records from the Belmont County Health Department. Septic systems locations and numbers by subwatershed area are addressed in more detail in Section IV of this watershed action plan.

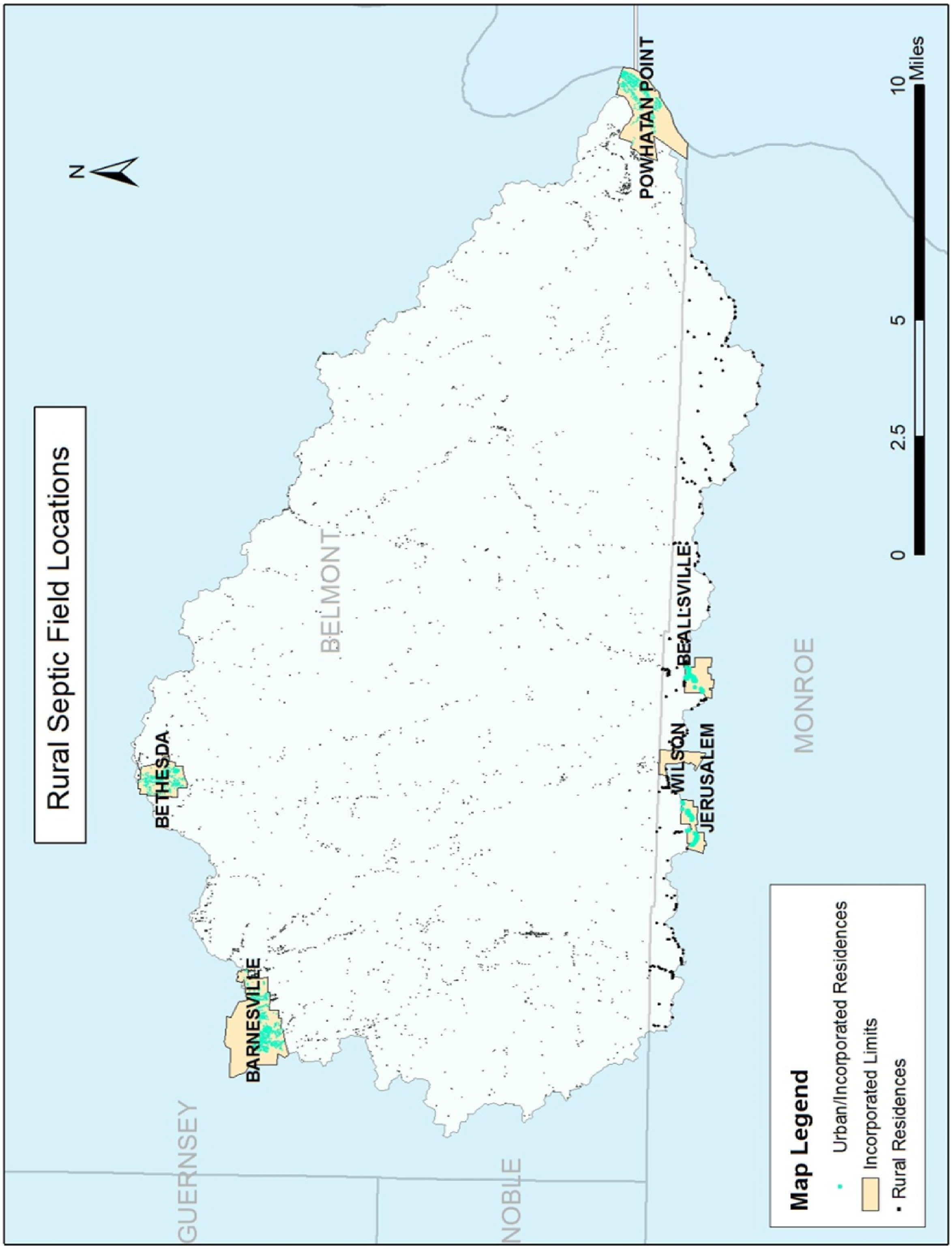


Figure 43. Locations of rural residences within the Captina Creek watershed required to have a proper septic disposal system.

Forest Coverage

The Captina Creek watershed lies in a region generally known as the Central Broadleaf forest which includes Kentucky, West Virginia and most of Ohio and Pennsylvania (Yahner 2000). It is 63% forested with mostly deciduous forest present and sparsely patched evergreen forest. Specifically, forests in the watershed can be divided into two zones with distinct tree species in each: upland and bottomland forest zones (Figure 44). Upland forests vary in tree diversity based on characteristics like soil drainage and exposure to sunlight. South facing slopes and ridge-tops are warmer and drier year-round and are generally composed of oak/hickory or maple/beech/tulip poplar tree communities mixed with black cherry and white ash.

North facing upland slopes are more shaded, resulting in cooler temperatures and increased soil moisture throughout the year. Consequently, the tree communities in these areas are generally composed of elm/black walnut/hickory with basswood, honey locust and some red oak. The second type of forested zone in the watershed is the bottomland forest, which tends to be cool and damp year-round and is subject to occasional flooding. Tree communities in the bottomland zones, such as those that line the banks of Captina Creek, include yellow buckeye, sycamore, black walnut and green ash with isolated stands of river birch and eastern hemlock (Yahner 2000; Perine and Profant 1993).

Figure 44. A mature upland oak/hickory deciduous forest on a south-facing slope *(left)* and a unique mature bottomland forest composed of river birch and eastern hemlock *(right)*.

Deciduous forests of the eastern U.S. have three distinct layers. Beginning on the forest floor is the herbaceous layer which contains the smallest plants, usually ferns, mosses and wildflowers. The herbaceous layer is most active in early spring before the overlying layers leaf out. Moving upwards from the forest floor is the understory, which is primarily composed of shrubs and small trees that grow from 5 – 20 feet in height. Common understory trees and shrubs in the Captina watershed are eastern hophornbeam, paw paw, witch hazel, spicebush and dogwood. Further upwards from the understory is the canopy, which contains the tallest trees with the broadest crowns such as oaks, maples and hickories (Perine and Profant, 1993).

Forest patches in the western region of the watershed, west of Piney Creek and Mike's Run, are fragmented and exhibit less cover near the streams. Most of the watershed's isolated eastern hemlock stands are contained around the tributaries of this region. The central region and eastern region of the watershed contain the largest forested sections as shown in Figure 45. Tributaries in the central and eastern regions also contain excellent tracts of riparian corridor which is believed to contribute to the creek's outstanding water quality. Generally speaking, both the flood plains of Captina Creek and the ridge tops are partly deforested while most of the neighboring slopes are forested. Figure 46 illustrates historic forest community coverage in the state of Ohio.

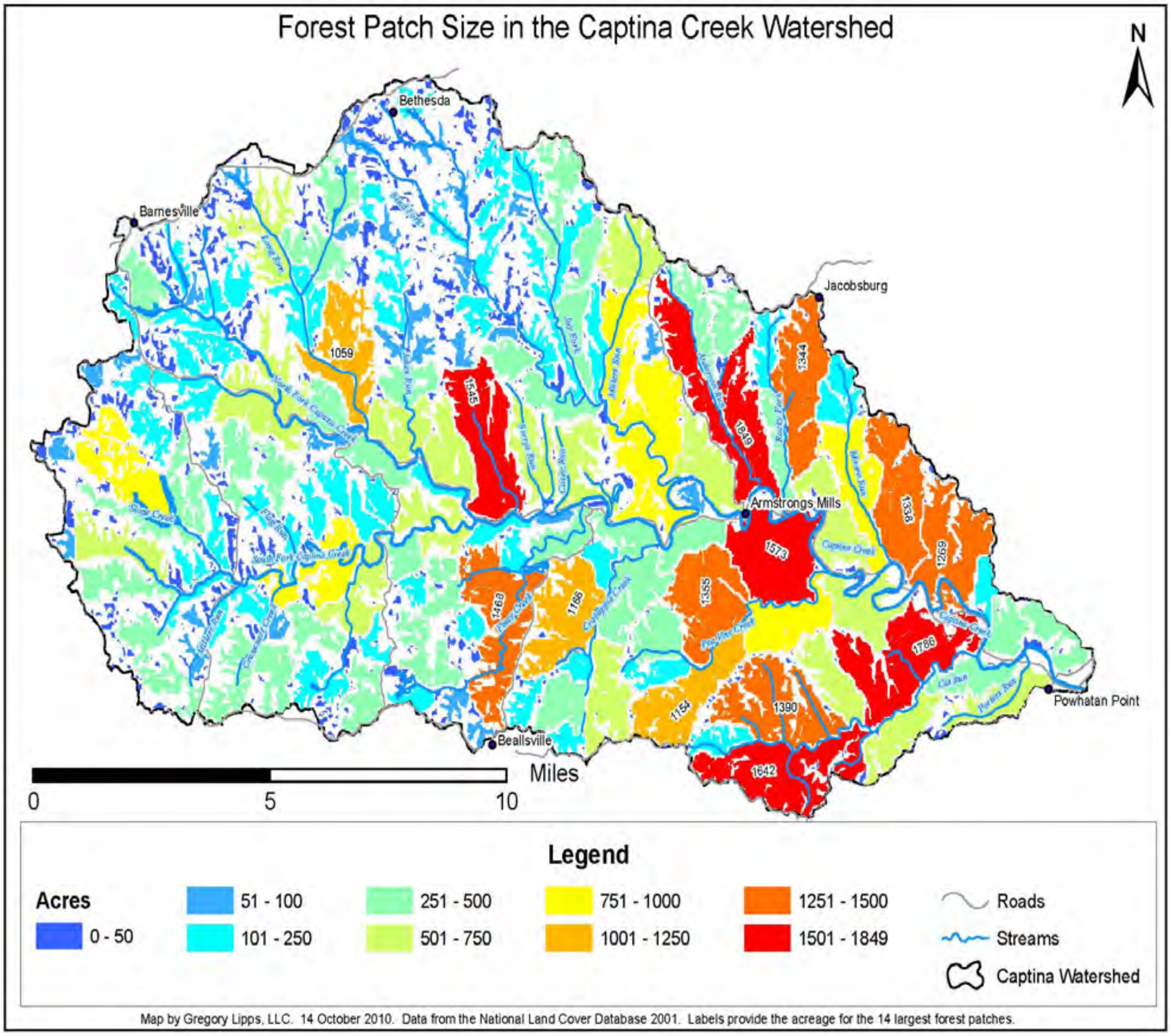


Figure 45. Forest patch size in the Captina Creek watershed. Labels provide the acreage for the 14 largest forest patches. *Map source:* Gregory Lipps, LLC., 2010. Data from the National Land Cover Database, 2001.

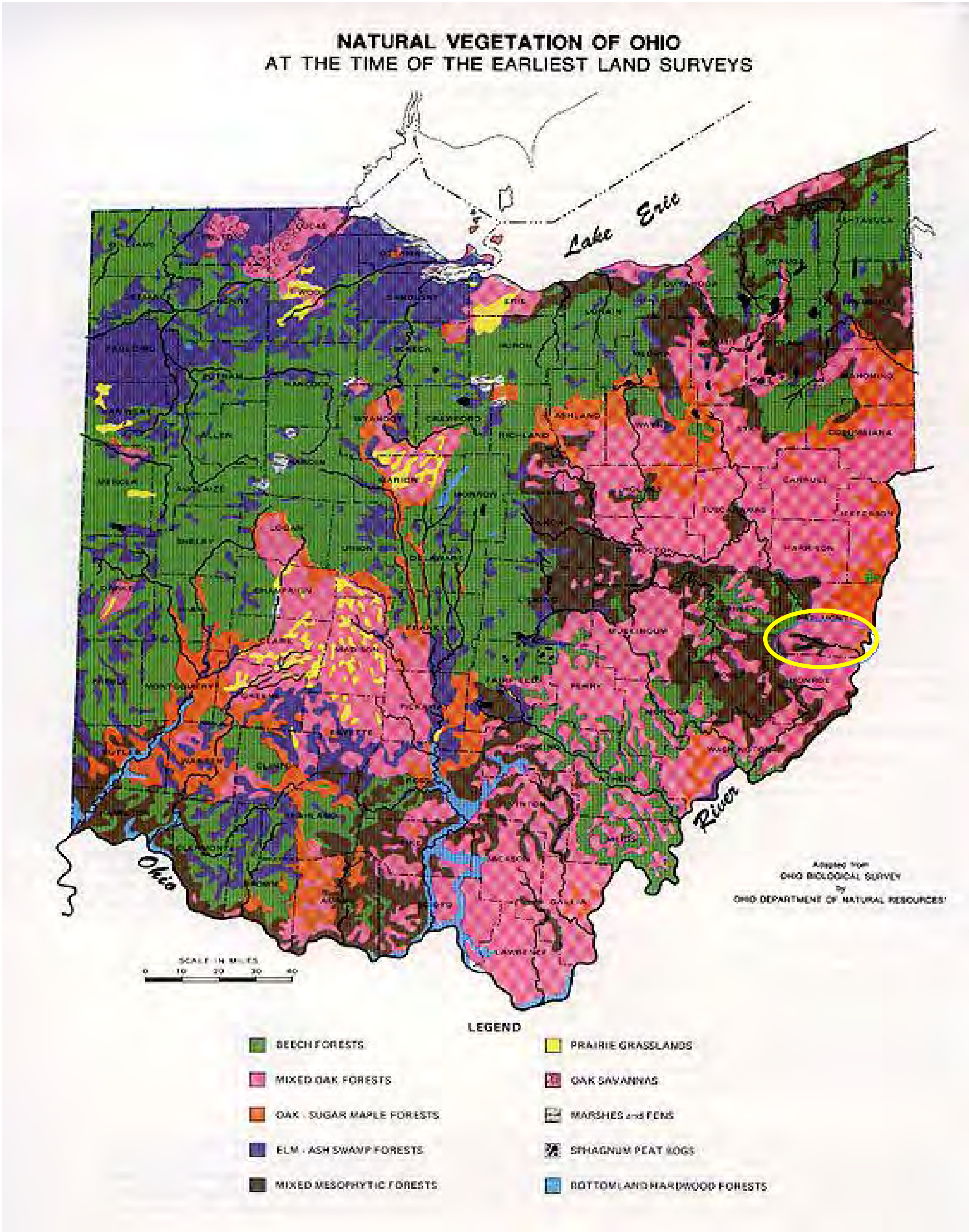


Figure 46. Historic forest community coverage in the state of Ohio. The Captina Creek watershed region is circled in yellow. *Map source:* Ohio Department of Natural Resources, 2010.

Agriculture

According to the Ohio Department of Agriculture, there were an estimated 660 farms in Belmont County in 2010, with an average size of 191 acres and a total of 126,000 acres of total land in farms. In Monroe County, there was an average of 630 farms in 2010, with an average size of 156 acres and a total of 98,000 acres of total land in farms (ODA 2010). Major crop production in the watershed centers around hay and corn, in addition to forested land use and silviculture practices. Other crops consist of oats and vegetables. Compared to other land uses, very little row crop agriculture takes place in the region with most of the agriculture being used to feed livestock in the form of hay production. Corn and hay are typically rotated every few years. Farmers have a greater need to produce hay than they do corn. Conservation tilling is emphasized in the area through Belmont and Monroe SWCD's no-till drill rental program and NRCS's conservation programs. Cultures in the area still practice traditional tilling methods, but no-till practices are becoming more frequently used.

Livestock production in the Captina Creek watershed is limited (Tables 20a and 20b). Grazing patterns within the watershed region are mainly continuous with some rotational grazing patterns. Animal feeding operations of large scales, also referred to as industrial farming, are not common in the Captina Creek watershed area. Industrial farming operations use animal confined, cost-effective methods to increase profits. Farming and ranching are somewhat common in Belmont and Monroe Counties, and within the subwatershed area, but small family-run operations are the typical practice.

Table 20a. Livestock production estimates for Belmont and Monroe counties for years 2009 – 2011. *Source:* Ohio Department of Agriculture, 2010.

County	**Animal**	**County rank by production**	**Year**	**Number of animals**	**Milk sold (million lbs)**
Belmont	Hogs & pigs	n/a	2009	n/a	
	Sheep	47	2011	1000	
	Cattle & calves	17	2011	19,800	
	Milk cows	59	2011	900	19,400
Monroe	Hogs & pigs	71	2009	400	
	Sheep	36	2011	1,200	
	Cattle & calves	36	2011	12,000	
	Milk cows	46	2011	1,400	25,800

Table 20b. Approximate number of livestock and operators per Captina Creek subwatershed. Approximations are based on Ohio Department of Agriculture (2010) livestock production estimates for Belmont and Monroe counties and land area for each subwatershed. Approximate number of operators per subwatershed is based on average herd size for the area (hogs/pigs – 5; sheep – 30; cattle – 15; dairy cows – 50).

	Hogs/pigs		Sheep		Cattle		Milk cows	
Subwatershed	Animals	Operators	Animals	Operators	Animals	Operators	Animals	Operators
North Fork	0	0	60.4	2.0	1,196	79.7	54.4	1.1
South Fork	0	0	66.5	2.2	1,317	87.8	59.9	1.2
Bend Fork	0	0	49.9	1.7	988.0	65.9	44.9	0.9
Piney Creek	0	0	53.8	1.8	1,065	71.0	48.4	1.0
Pea Vine Creek	0	0	70.2	2.3	1,390	92.7	63.2	1.3
Cat Run	7.6	1.5	39.1	1.3	550.0	36.7	41.3	0.8
TOTALS	**7.6**	**1.5**	**339.9**	**11.3**	**6,506**	**433.8**	**312.1**	**6.3**

Chemicals are used on rotational crops, but cropland is limited in the watershed region. With much of the agriculture being hay, little chemicals are used for the remaining crops. Irrigation systems are not used in the watershed for large scale agricultural purposes and are limited to hoses and home sprinklers of private residences. There have been decreased farmland and farming practices locally, reflected by decreased total crop production for both hay and corn in Belmont County (108,600 tons of hay and 171,500 bushels of corn in 2000 versus 72,000 tons of hay and 75,500 bushels of corn produced in 2005). Tables 20c and 20d demonstrate agricultural yields for hay and alfalfa in Belmont and Monroe counties in 2009 and 2010. Statistics for wheat and both corn and soybeans planted and harvested for grain was unavailable for Belmont and Monroe counties for 2009 and 2010 due to data not being published for areas with less than 500 acres of production (ODA 2010).

Table 20c. Hay production (acres, yield and production) in Belmont and Monroe counties for years 2009 - 2010. *Source:* Ohio Department of Agriculture, 2010.

County	County rank by production	Year	Harvested (acres)	Yield (tons/acre)	Production (tons)
Belmont	4	2009	23,800	2.00	47,300
Belmont		2010	26,500	2.00	52,800
Monroe	9	2009	16,000	2.30	36,400
Monroe		2010	18,000	2.05	37,300

Table 20d. Alfalfa production (acres, yield and production) in Belmont and Monroe counties for years 2009 - 2010. *Source:* Ohio Department of Agriculture, 2010.

County	County rank by production	Year	Harvested (acres)	Yield (tons/acre)	Production (bushels)
Belmont	10	2009	8,160	2.85	171,500
Belmont		2010	10,100	2.75	130,100
Monroe	26	2009	n/a	n/a	n/a
Monroe		2010	6,800	2.60	17,800

Forestry remains an important factor in the local economies for both Belmont and Monroe counties, due to their abundance of forested lands (most being privately owned). Forest industries generate $14.4 million in Belmont County and $10.8 million in Monroe County, in addition to tax revenue benefits for the counties. Belmont County forests contain 950 million board feet of sawtimber, while logs and roundwood in Monroe County provide the highest industrial production value out of the top agricultural products in the county (including milk products, crop farming products, cattle, and poultry/egg products) at 1.1 billion board feet of sawtimber (McConnell and Schumacher 2012; McConnell and Landefeld 2012).

Water Use

Human alterations of the water flow are present within the watershed. Dams have been constructed for reservoirs near Barnesville, Bethesda, and Wilson. Other dams have been constructed on a smaller scale for private ponds. The Ohio Valley Coal Company also has a dam built to hold waste coal slurry for its operations. Channel modifications are present near roads, private dwellings and water treatment facilities.

Industry and municipalities in the watershed withdraw ground and surface water for different uses. Figure 47 shows ground and surface water withdrawals for Belmont County. Murray Energy Corporation along Captina Creek is the largest consumer of surface water in the watershed. The R.E. Burger plant, no longer in operation, was once the largest consumer of surface water in the watershed (Figure 47). Future Marcellus and Utica drilling for oil and gas near Captina Creek may draw significant amounts of surface water, as each well can typically use 10 million gallons of water in the hydraulic fracturing process (Leehr, personal communication, 2013). Water withdrawal is further discussed in Section IV of this watershed action plan.

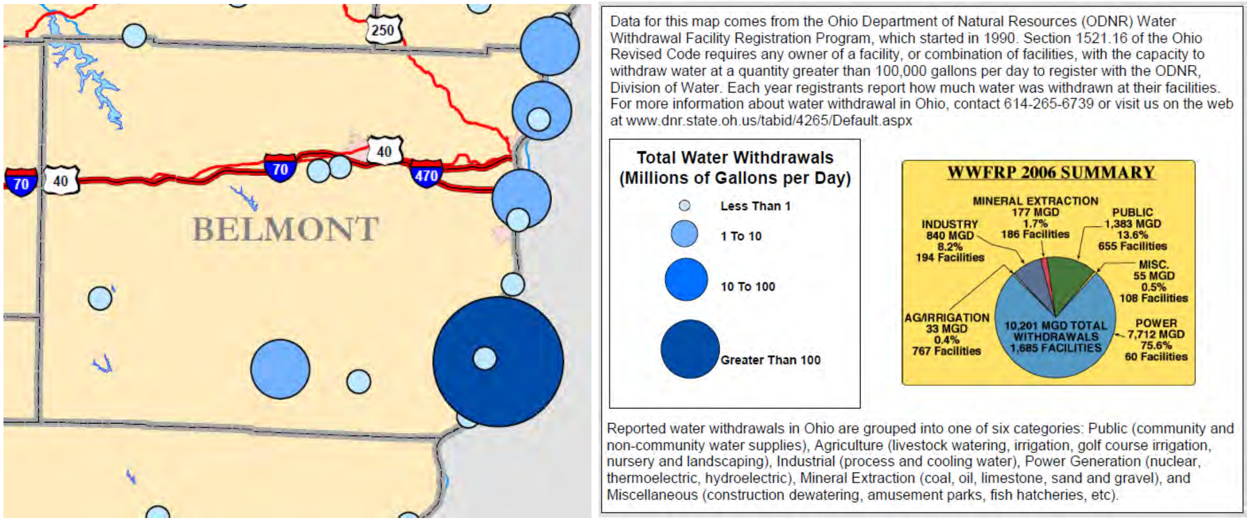


Figure 47. Surface water withdrawals in Belmont County in 2006. The large blue circle is the location of the R.E. Burger plant, which at one time was the largest consumer of surface water in Belmont County, but is no longer in operation.

Special Habitats in the Watershed – Non-Forested Wetlands

Few nonforested wetlands exist within the watershed (refer to Figures 32 and 41 for coverage). They are found in the floodplains of Captina Creek near Armstrongs Mills and to a lesser extent in the floodplains near the intersection of SR 7 and SR 148 west of Powhatan Point.

Emerging herbaceous wetlands grow in areas with intermittent high water tables similar to those found in primary floodplain along Captina Creek. Smaller tributaries of Captina Creek do not have high water tables and are not suitable for herbaceous wetlands. In general, wetlands have declined over 90% across Ohio since settlement and probably have declined similarly with human development along Captina Creek where homes, roads and pastures are present in floodplain areas.

Special Habitats in the Watershed – Xeric Limestone Prairies

Xeric limestone prairies (XLPs) are open, nonforested areas in which herbaceous plant communities occur on shallow, rocky soils derived from calcareous limestone substrates. The grasslands are characterized by the dominance of C4 perennial grasses (particularly little bluestem *Schizachyrium scoparium*) and are distributed throughout the eastern United States from Missouri and Pennsylvania south to Arkansas and Georgia. Limestone of the Pennsylvanian Conemaugh Formation is the only substrate upon which this vegetation type is developed in the unglaciated Allegheny Plateau of Belmont County. Soils of XLPs are typically shallow (≤1.0 m) and rocky, and often they appear as rock outcrop complexes with one or more associated soil series (Lowell soils in the Captina Creek watershed). The majority of XLPs occur on moderate to steep slopes, where soil erosion generally exceeds soil formation resulting in bedrock being exposed at the surface (Lawless et al. 2006).

Not only are XLPs the rarest habitat type in the Captina Creek watershed, they are also one of the rarest in the state of Ohio with only a few other documented locations from Adams County over 100 miles southwest of the area (Table 21). Generally, XLPs can be identified by the growth of eastern red cedars among unique grasses and herbaceous plants which tolerate poor, alkaline soil conditions. The growth of cedars lends to the habitat's nickname as "cedar glades" or "cedar barrens." Oaks and white pines intersperse with the cedars and tower over understory shrubbery that is composed of redbud, dogwood and blackhaw viburnum (Lawless et al. 2006). There are two documented locations of XLPs in the watershed, each being less than 10 acres in coverage: Hunter Prairie and Armstrongs Mills Prairie (Figure 48).

Figure 48. Hunter Prairie in Wayne Township *(left)* and rocky outcrops at Hunter Prairie consisting of limestone cobble with very shallow soils *(right)*. *Photo credit:* Bryan Smith.

Table 21. Documented unique plants found in the XLPs of the Captina Creek watershed.

Woody Plants	**Herbaceous Plants and Grasses**
Blackhaw Viburnum	Greenbrier
Shingle Oak	Little Bluestem
Chinquapin Oak	

Special Habitats in the Watershed – Barren Lands

Barren lands are those that are dry and have been stripped of all topsoil and vegetation. They are contributors to sedimentation and erosion and are associated with coal refuse gob piles, land immediately surrounding coal storage piles at the OVCC No. 6 and AEC Century mines, and land surrounding the coal slurry settling pond at OVCC. Collectively, barren lands total approximately 300 acres of surface area throughout the watershed. Murray Energy Corporation has placed sediment catches at the base of the tributaries leading off of the coal storage piles at the No. 6 and Century mines to prevent sedimentation and leaching of heavy metals into Captina Creek.

Special Habitats in the Watershed – Protected Lands

Some lands within the watershed are protected from development for recreation or conservation, though the total acreage is not significant within the watershed area. The watershed does not contain any state or federal forests. Epworth Park in Bethesda is a city park that is at the headwaters of Bend Fork while Dysart Woods is a 55-acre tract of old growth forest preserve owned and managed by Ohio University and located at the headwaters of Joy Fork. Raven Rocks is a property owned by a private group of landowners wishing to preserve the area, with over 1,200 acres of holdings in the headwaters of Piney Creek. The owners of Raven Rocks Inc. practice sustainable living, agriculture and forestry, and originally purchased the land to preserve it from mining.

The Captina Conservancy, a nonprofit land trust organization that is detailed in *Section II*, is gaining momentum as it has developed its first large-scale easement (1,015 acres) in the Piney Creek subwatershed, made possible through the Clean Ohio Fund. This first project will lead the way for future land conservation in the watershed, as more awareness of this success is gained by potential landowners interested in developing an easement on their properties. Additionally, Murray Energy Corporation holds several easements along Captina Creek and Bend Fork, as detailed in *Section I, Chapter 2*.

Land Use Status and Trends (Historical, Current, Projected)

Upon European settlement, land cover in the region was nearly all deciduous virgin forest growth; however, reckless logging practices beginning in the mid1800s lasting through the early 1900s left the watershed highly deforested and fragmented, much like the rest of Ohio and the eastern United States at the time. Timber harvesting continues today but at a much smaller, more sustainable scale than a century ago. Current forest tracts in the watershed are some of the most extensive forested tracts located in eastern Ohio and consist of secondary growth timber stands. The 55-acre woodland tract at Dysart Woods is the only remaining old growth forest left in the region from pre-European settlement. Since the 1930s the amount of forested land in the watershed has been increasing in correlation with forest coverage throughout southeastern Ohio (Yahner 2000). Forested land coverage may continue to increase slowly with continued decreases in agricultural land usage and no major plans for development or urbanization in the watershed region. The R.E. Burger biomass facility located in Dilles Bottom, Ohio was expected to impact forest coverage in the Captina Creek watershed but has since closed its operations as of January 2011 due to difficult economic conditions and lack of cost effectiveness for burning biomass compared with coal.

An additional concern related to forested land coverage is the increase in the number of invasive species within the Captina Creek watershed region. Nonnative vines, shrubs, trees, herbaceous plants, insects and fungal blights can increase stress or kill native hardwoods, threatening the health of the deciduous forest ecosystem. Historically, the American chestnut blight completely eliminated all chestnut trees from the forests of the watershed region in only a couple of decades. More recently, fungal Dutch Elm disease has greatly reduced populations of Elm (*Ulmus)* species in the watershed's forests. Invasive species are not just limited to terrestrial forested habitat but are also increasing in the tributaries of the watershed region. The Asiatic clam and Asian carp are well established in the larger tributaries of the Captina Creek watershed and impact local aquatic communities by competing with native inhabitants.

Two additional invasive species predicted to have large-scale impacts on the forests of Captina Creek are the emerald ash borer (*Agrilus planipennis*), which has now been documented in all of Ohio's counties, and the Asian long-horned beetle (*Anoplophora glabripennis*), currently spreading its coverage in the Midwest and mid-Atlantic regions (Figure 49). Emerald ash borers are specific pests to Ash (*Fraxinus sp.*) trees while Asian long-horned beetles choose a greater diversity of host trees, having been found in maple (*Acer*), buckeye (*Aesculus*), elm (*Ulmus*), sycamore (*Plantanus*) and ash (*Fraxinus*) species (USDA 2012). If established over large areas, these invasive pests have the ability to disrupt forest ecosystems and fragment riparian corridors. Significant loss of forest coverage on steep terrain could result in large-scale erosion and sediment deposition in tributaries of the watershed region.

Traditionally, agriculture has been present in the region since it was used to sustain the first European settlements along the Ohio River in the early 1800s. Agricultural coverage peaked in eastern Ohio during the 1930s when small ranches and farms (<500 acres) were common in the area. Since that time, the acreage of agricultural lands has steadily decreased. More recently, the number of farms has decreased 10% from 2005 – 2010 along with total crop production (USDA 2010). In the same time period, farmland has decreased 9% in the watershed region while average farm size has increased 1% (USDA 2010). This coincides with the U.S. trend of farms becoming fewer, larger and more industrialized. Decreased farmland coverage also correlates with an increase in forest coverage in the watershed as pastureland reverts back to its native wooded state. Abandoned or transitioning farmlands are ideal sites for invasive plants to establish and dominate native vegetation unless properly managed.

Figure 49. The Emerald Ash Borer *(left)* and the Asian Long-Horned Beetle *(right)*. *Photo sources:* Ohio Department of Natural Resources and United States Department of Agriculture, respectively.

While Belmont and Monroe counties were never historically swampy areas due to inadequate native soil associations and steep terrain, smaller woody wetlands and extensive vernal pools were probably more abundant in pre-settlement times than today. This statement is supported by the fact that most development in the watershed has been historically associated with larger expanses of flat terrain found only on broad ridgetops and on valley floodplains containing suitable aquifers and wetland habitat. Although development is not substantial along Captina Creek and its tributaries, wetlands could have been drained or eliminated in the past to make way for coal mines, gravel pits, buildings and transportation corridors. Recently, more attention has been devoted to the preservation of wetlands statewide as their value to watersheds is finally being realized. Wetlands serve as natural filters for watershed drainages by removing dissolved solids, metals and organics from the water column while serving to slow the flow of water downstream. Decreased wetland coverage inhibits the removal of these materials, resulting in contamination of surface water supplies.

Surface water levels may be affected by increases in industrial activities near the mainstem of Captina Creek. As stated previously, the OVCC No. 6 facility and the Century mine are the main consumers of surface water along Captina Creek, but their consumptions could be rivaled in the near future by natural gas drilling in the Marcellus and Utica shale formations. A typical Marcellus drilling site may require 10 million gallons of surface water to operate and creates an initial 3-5 acre footprint on the landscape. The impact of the Marcellus Shale development in the Captina Creek watershed is unknown at this time, but based on recently increased drilling activity in neighboring counties to the east (Marshall, Ohio, and Wetzel counties in West Virginia), it is likely to be significant.

Barren land surrounding mining operations could expand or move locations over time. These lands are not the result of strip mining operations, but rather the result of coal storage and coal refuse gob piles. Removing and reclaiming existing gob piles along Captina Creek will reduce barren land coverage and allow the affected land to revert to its natural state.

Besides Dysart Woods, and the easements held by Captina Conservancy (Raven Rocks) and Murray Energy Corporation, no protected lands exist or have existed in the Captina Creek watershed. Protected lands may increase in the future as private and public interests seek to preserve sections of the creek for recreational purposes or for protection of endangered species and sensitive habitat.

Chapter 5: Cultural Resources and History of the Watershed

Cultural Resources

The lands surrounding Captina Creek were initially settled around 1790 with the establishment of Fort Dille about six miles north of Powhatan Point along the Ohio River. Historically, Captina Creek lies within the Old Seven Ranges geographic survey area of the original Northwest Territories (Figure 50). The Old Seven Ranges also include the watersheds of Opossum, Sunfish, McMahon, Wheeling, Short, Cross and Yellow Creeks in extreme eastern Ohio on the eastern slope of the Flushing Divide. A plaque near the marina in Powhatan Point commemorates the location of a campsite occupied twice by George Washington in the fall of 1770 while surveying the Ohio Country. The Captina watershed is historically noted for brief conflicts between frontiersmen and Native Americans of the Shawnee nation. One conflict particularly noted in local history is the *Battle of Captina*, involving a rescue mission for three scouts who had been captured by Shawnee natives near the mouth of the creek (Howe 1888).

Figure 50. The Old Seven Ranges Ohio historical survey region. The Captina Creek watershed area is outlined in black. *Source:* Ohio Historical Society.

Within the watershed region there are significant historical locations that have been designated state sites by the National Register of Historic Places. In Barnesville there are prehistoric rock drawings known as "track rocks" which date to the Adena occupation of the watershed around 500 BC. A similar site named the Tower near Barnesville is also listed as historically significant. Just bordering the watershed boundaries is the Barnesville Historic District and the Barnesville B&O Railroad depot. Additionally, Olney Friends School is a private secondary institute located in Barnesville that specializes in Quaker education.

The Ohio Historical Society has markers within the Captina watershed region as well. One is located in Powhatan Point commemorating the 1944 Powhatan No. 1 coal mine disaster in which 66 men were killed in an explosion. Another Historical Society marker exists at the headwaters of Cat Run recognizing the Frederick Kindelberger stone house and barn. Two additional Ohio Historical Markers are located in Barnesville signifying the Watt Mining Car and Wheel Company, which manufactured small coal cars to be used in underground mining, and the birthplace of Ohio's first native-born governor Wilson Shannon.

The Current Watershed Protection Effort

Today there may not be another watershed in the state that is garnering more attention from all levels of government than Captina Creek. Interests in the health and well-being of the creek span levels from local residents to federal government. Locally, the Captina Creek watershed stakeholders group is focused on preserving water quality standards within the watershed and the health of the creek in general. The stakeholders group and the Technical Committee are contributing information to the development of the watershed action plan and informing the watershed coordinator of changes that occur along tributaries of the area. A local private secondary school (Olney Friends School) has shown interest in volunteering to sample and observe streams and wetlands along Captina Creek. Olney students have also created a 13' x 7' portable aerial map with marked features in the watershed. The map serves as a valuable tool for increasing awareness and education about the resources of the Captina Creek watershed.

Another local partner, the Captina Conservancy, has been working to preserve land holdings through the use of conservation easements. As mentioned earlier, the Conservancy has received a Clean Ohio Fund grant to place 975 acres of land from Raven Rocks, Inc. into a conservation easement. The Captina Conservancy has received support from the Belmont County Commissioners, Wayne Township Trustees and Belmont Soil and Water Conservation District during the Clean Ohio Fund application process. Several members of the watershed stakeholders group are also active in the Conservancy's efforts.

Murray Energy Corporation, owner of the Ohio Valley Coal Company and American Energy Corporation's Century Mine, has shown interest in improving water quality with mitigation projects, wetland restoration and increased stream monitoring and sampling around outfall discharges at their mine facilities. In spring of 2007, biologists from Murray Energy Corporation reclaimed a wetland parcel near the Century Mine in Section 3 of Wayne Township along Township Road 87. The parcel is approximately 3 acres in size.

At the state level, OEPA scientists routinely monitor water quality along the length of Captina Creek and its tributaries, and are in the midst of conducting HHEI assessments of Captina Creek's headwaters streams. A herpetologist funded by the Ohio Department of Wildlife has also been working with the local community on outreach programs to increase awareness of the state endangered eastern hellbender and has assisted in the formation of the Captina Conservancy. His work has been important in understanding the distribution and biology of the endangered eastern hellbender and has spotlighted the watershed to wildlife agencies and state organizations.

At the federal level, the USEPA and the Army Corps of Engineers are reviewing a permit application by Murray Energy Corporation to construct a new coal slurry settling impoundment in Casey Run (Figure 51). The application was filed in 2009 and is still pending. Alternative sites for the impoundment in the vicinity of OVCC's No. 6 mine are in consideration. Lastly at the federal level, the U.S. Fish and Wildlife Service has funded an effort to restore vernal pool habitat on private property in Goshen Township and is willing to install or restore similar habitat in other areas of the watershed.

The history of previous watershed restoration efforts is discussed earlier in Section I, Chapter 5 of this watershed action plan.

Figure 51. The location of Casey Run within the Bend Fork subwatershed.

Section IV: Habitat Modification Summary

Early Settlement Conditions

Early settlement conditions of the region were somewhat different than what is seen today. At that time, almost all of the land in eastern Ohio consisted of old growth forest, unlike the highly fragmented secondary growth forests of today. Historical accounts indicate extensive oak/hickory/tulip poplar forests were abundant along the ridgetops of the Captina Creek and many invasive herbaceous plants in the local pastures and hayfields were not established. Native Americans of the Shawnee nation did clear trees and use fire for agricultural purposes, but did not make a noticeable impact on the land (Yahner 2000). According to ODNR, early settlers within the watershed witnessed an abundance of wildlife including elk, mountain lion, bobcat, gray wolves and black bear, and settlers competed with Native Americans for resources. Wildlife and land resources were readily consumed by European colonizers in efforts to establish settlements and domestic agriculture along the river.

The first settlers that sailed down the Ohio River to colonize the new frontier west of the River were generally of Dutch, Swiss and German descent. They were mesmerized by the steep-sided, wooded hills and ridges that embanked the river. Swiss immigrants especially took notice and thus nicknamed the area "Little Switzerland". Zane Trace was one of the first settlers to explore the area along with frontiersman Lewis Wetzel. The first settlement near the Captina Creek watershed was Fort Dille north of Powhatan Point along the Ohio River. The current location of the village of Powhatan Point was a popular campsite for frontiersmen exploring territories west of the Ohio River including George Washington, however, the village itself was not settled until 1849.

Physical Attributes of Streams by Subwatershed

The following sections detail stream physical characteristics and habitat modifications for each subwatershed of the Captina Creek watershed. The sections define subwatersheds by their 12-digit HUC code and include analysis of attainment status, riparian cover, entrenchment, livestock impact, floodplain access and inventory of bridges and culverts.

North Fork Captina Creek Subwatershed – 12-digit HUC: 050103060901

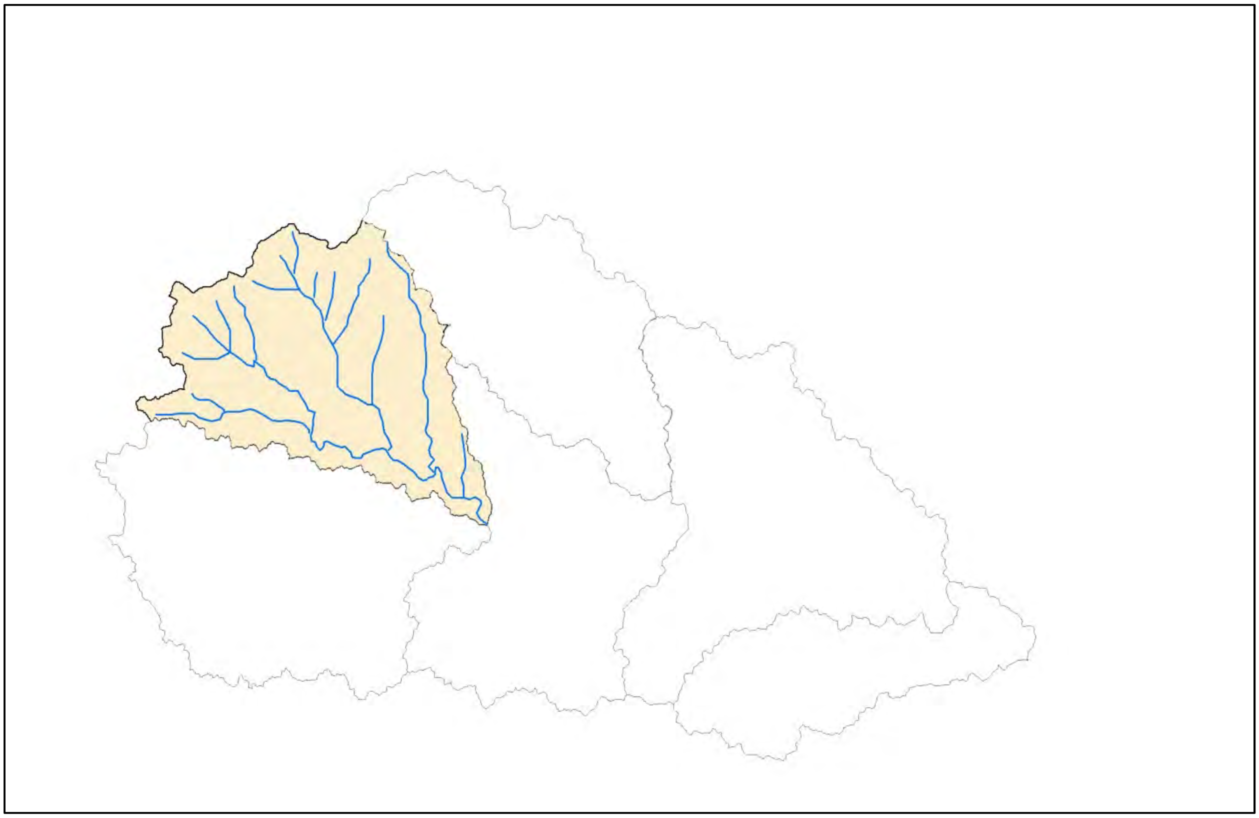


Figure 52. North Fork subwatershed of Captina Creek.

Table 22. Stream physical characteristics for named tributaries in the North Fork subwatershed. *Source:* USGS *StreamStats for Ohio* Online Database, 2011.

Major Tributaries	Length (miles)	Drainage Area (miles^2)	PK2(ft^3/sec)	7Q10 (ft^3/sec)	Attainment Status	Sinuosity
			Flow/Min/Max			
North Fork	10.5	32.7	1480*/773^/2830^	6.39	Full	1.2
Jakes Run	6.6	5.2	398*/200^/790^	0.93	Full	1.2
Long Run	6.4	10.6	637*/324^/1250^	1.98	Full	1.2

PK2 Description - *Denotes two year recurrence interval peak flow with a prediction error of 37% (Equivalent years of record = 2.1) ^Two-year recurrence interval peak flow at 90% prediction interval.
7Q10 Description - Seven day, ten year low flow volume based on an annual series of the smallest values of mean discharge computed over any seven consecutive days during the annual period.

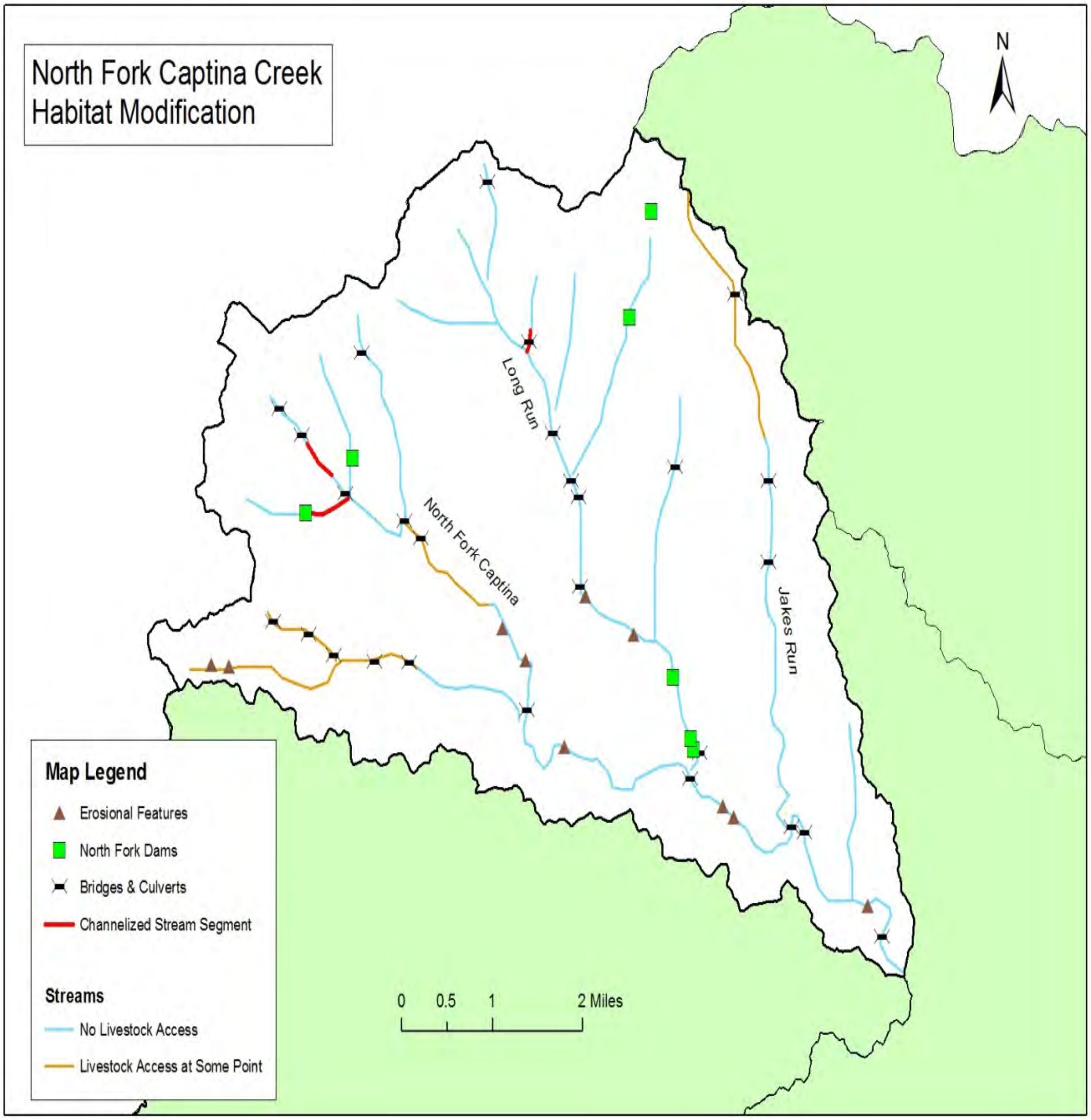


Figure 53. Notable impacts and modifications to tributaries of the North Fork subwatershed.

Floodplain Access/Riparian Levees

<u>Channel and Floodplain Condition</u> - Streams in the North Fork subwatershed have access to the floodplain. Some headwater streams wind through steep banks where no floodplain exists. Near the mouth of the North Fork, the floodplain becomes more defined as the valley widens, allowing streams easier access to the floodplain. The limiting factor for floodplain access in this subwatershed area is not riparian levees but steep upland terrain bounding the streambanks. Also of note is that the North Fork

subwatershed area has less sloping terrain than other subwatershed areas further east in the watershed region. Channelization is most prevalent along Long Run where strip mining has occurred.

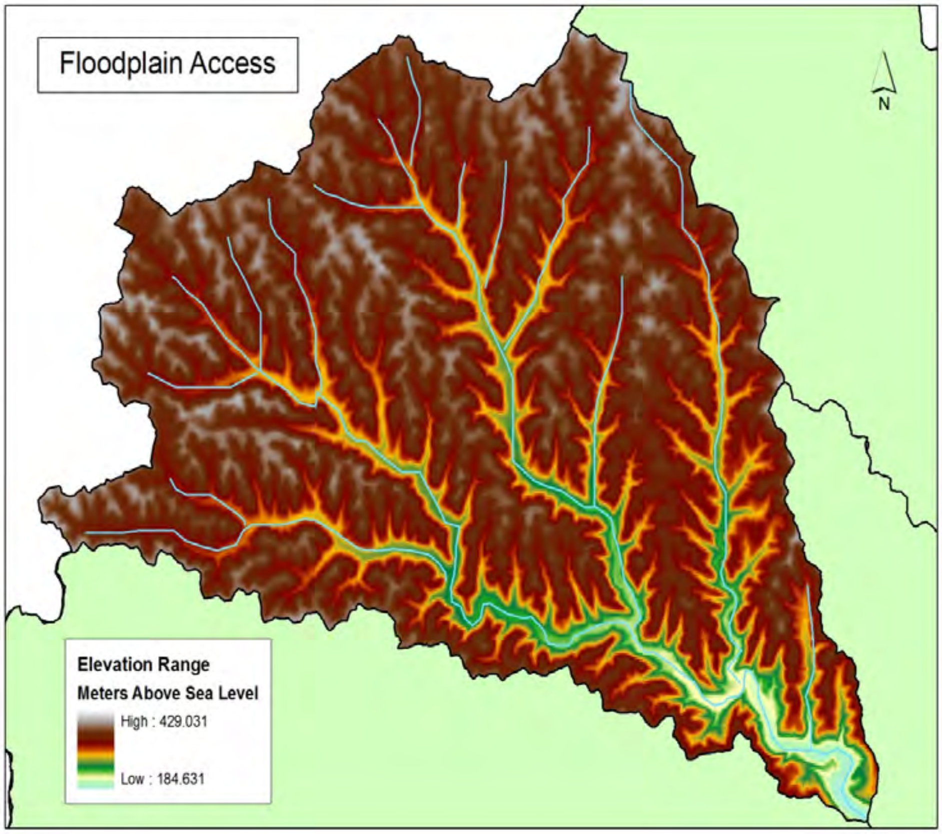


Figure 54. National Elevation Dataset (NED) relief of the North Fork subwatershed area showing its major tributaries and their floodplain access.

Riparian Assessment

Of the 32 miles of named tributaries in the North Fork subwatershed, 23.2 (72.5%) have good riparian buffers. The North Fork subwatershed has forested riparian cover along much of Jakes Run, Long Run, and North Fork Captina Creek. Jakes Run is very secluded with heavily forested steep slopes. Long Run has forested corridors through abandoned strip mines and fields. North Fork Captina has forested corridors, but also runs along a more populated area with houses and fields near the stream, resulting in less riparian corridor. No permanent conservation easements are applied to this subwatershed's riparian corridors.

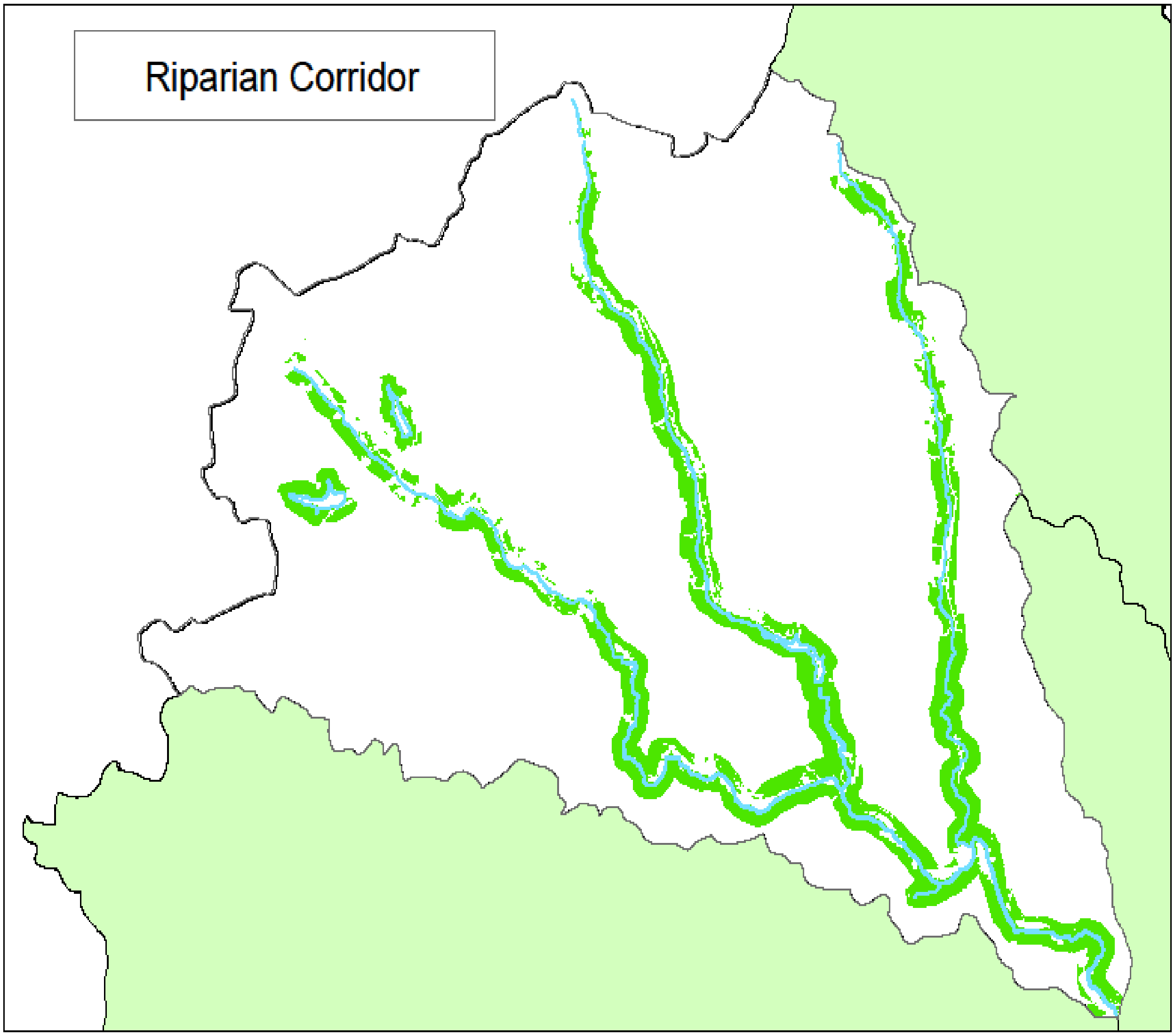


Figure 55. Riparian corridors represented in shaded green. Absent green shade represents missing or inadequate riparian buffers.

Natural and Modified Channel

There are 30.84 (98.2%) miles of natural channel and 0.58 (1.8%) miles of modified channel in the North Fork subwatershed. Modified channel sections are located in a tributary of Long Run (0.23 miles) and near the headwaters of the North Fork (0.35 miles) near the Barnesville wastewater treatment plant.

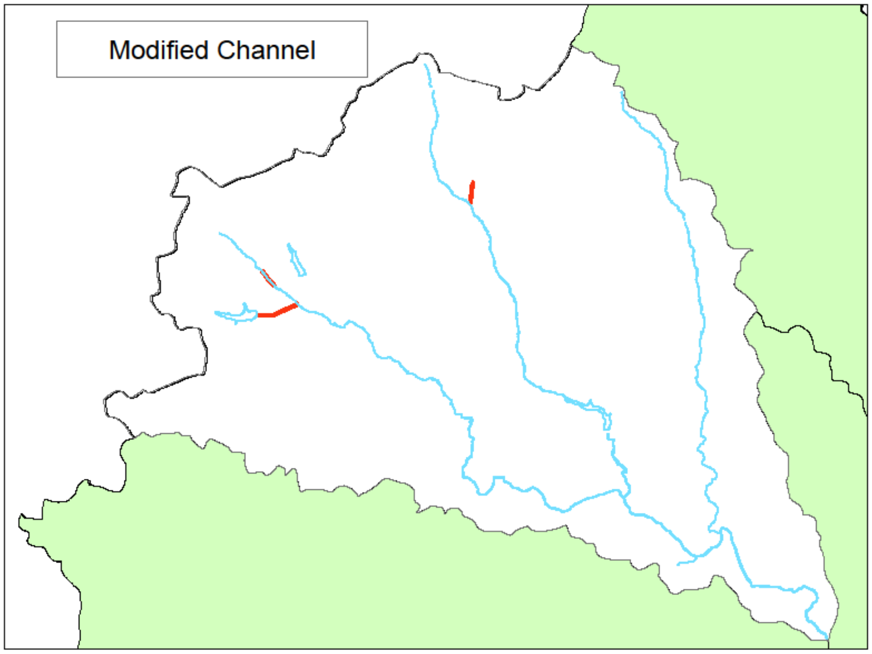


Figure 56a. Modified straightened creek channels in the North Fork subwatershed.

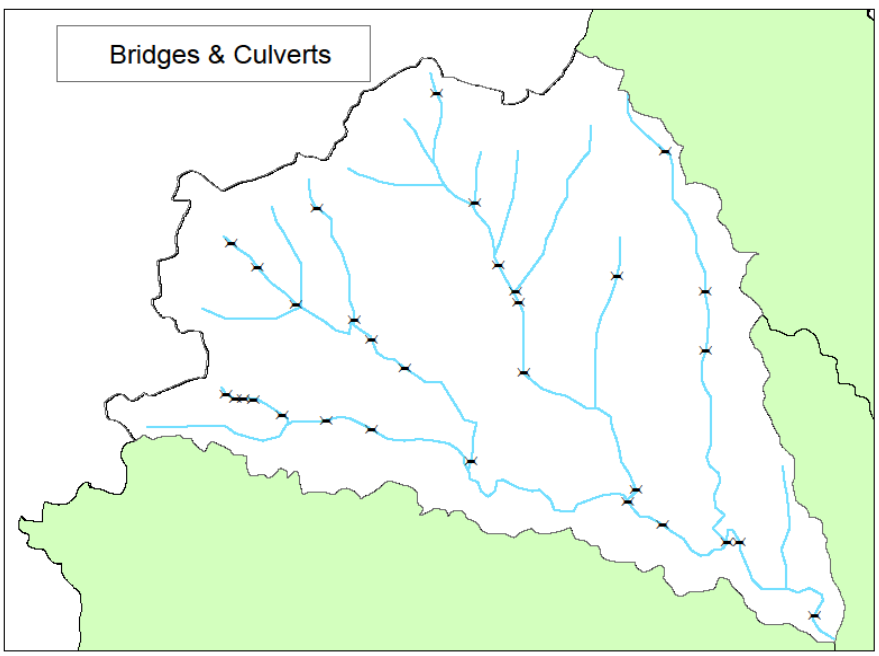


Figure 56b. Bridges and culverts diverting creek channel under bridges and roads in the North Fork subwatershed.

Dams

Seven dams have been observed along tributaries of the North Fork subwatershed and are mapped in Figure 56. Two of the dams are located at the headwaters of the North Fork and serve as municipal reservoirs for the village of Barnesville. Two other dams are situated on a headwater tributary to Long

Run southeast of the hamlet of Speidel. The other three dams lie on Long Run just upstream from the confluence with the North Fork. Many smaller dams retaining surface areas of 2 acres of water or less have been constructed on private properties mostly for agricultural purposes. Analysis of 2007 aerial imaging from Belmont County GIS reveals that there are 44 such dams in the North Fork subwatershed, most of which are located on headwater streams or on reclaimed strip mine lands. There is no known indication of water quality impairment due to these smaller dams within the subwatershed.

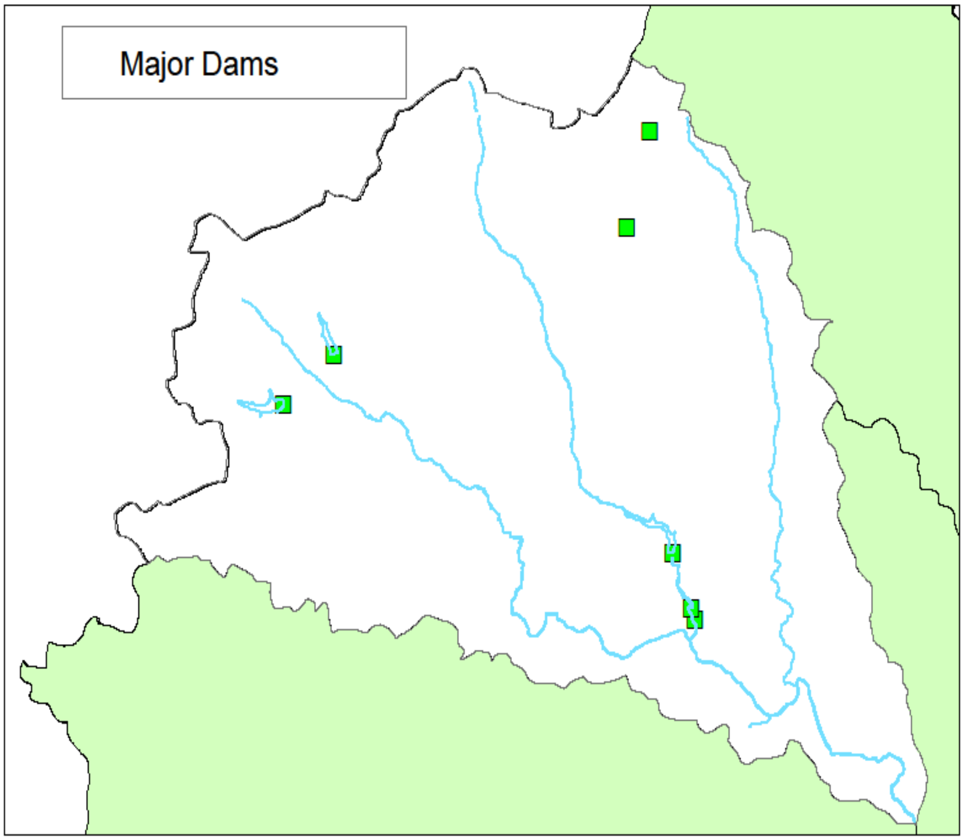


Figure 57. Major dams within the North Fork subwatershed.

Streams with Livestock Access

Small segments of the headwaters of Jakes Run and North Fork Captina Creek in the North Fork subwatershed have been observed with unrestricted livestock access. Unrestricted access is defined as the ability of livestock to enter streambeds at will and is usually associated with lack of proper fencing around stream banks. Excessive livestock activity in stream beds can cause increased sedimentation in the water column, compaction of the river banks and nutrient loading from livestock fecal matter, leading to unwanted algal blooms. Data from Figure 57 was obtained using roadside observation, however many livestock grazing areas are not visible from roads and other areas of stream access could exist. The amount of livestock present varies by stream and location.

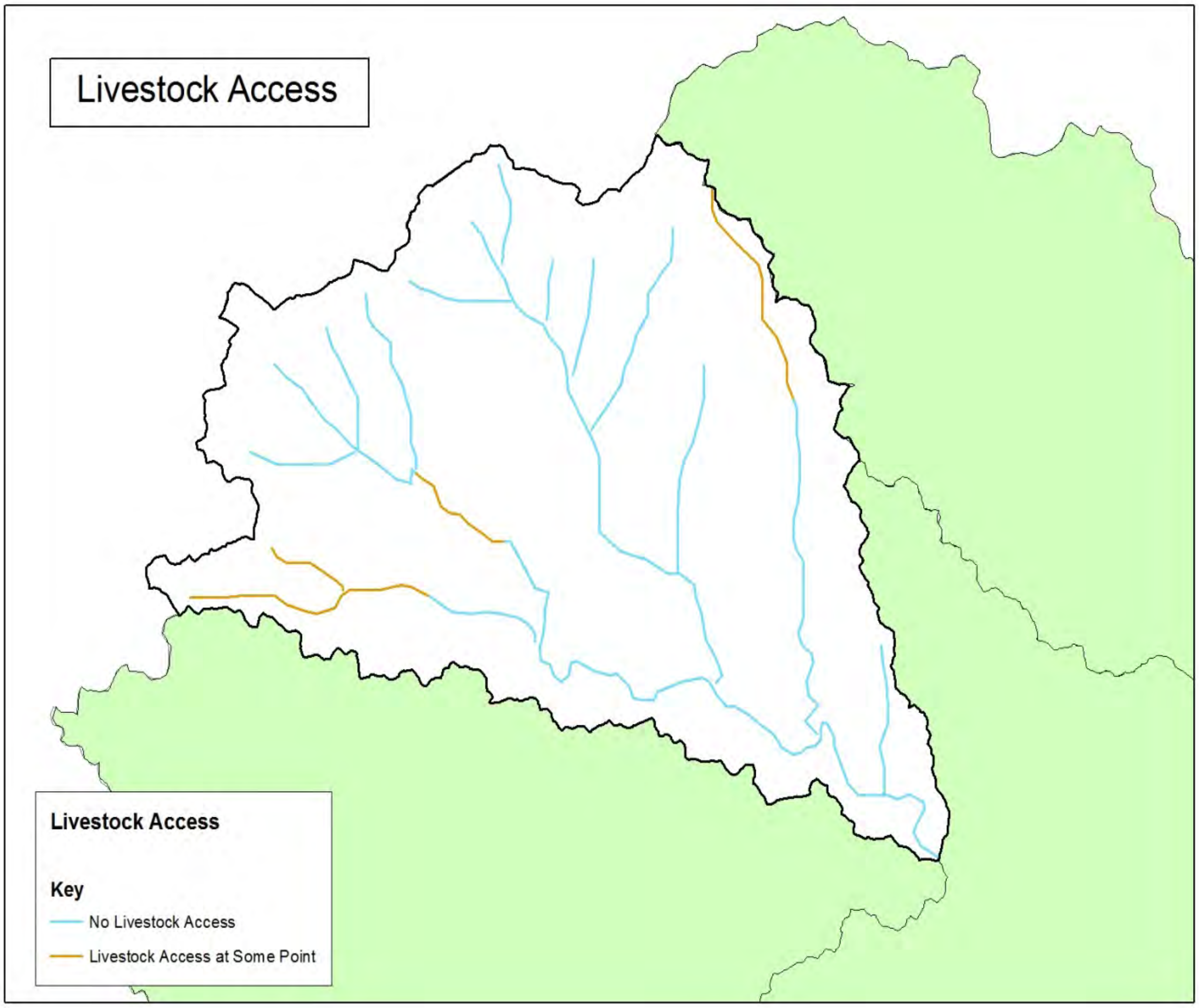


Figure 58. Livestock access in the North Fork subwatershed. *Note:* Color-coding does not indicate length of tributary affected by unrestricted livestock access. Coding only designates streams that have access at some point along their length. In most cases throughout the watershed region, livestock access to streams is minimal, only affecting small portions of tributaries but adversely affecting many feet downstream from degraded streambanks.

Eroding Banks

Eroding banks can cause impairments to water quality by increasing sediment in the water column. Observations from roadside drive-bys in June of 2009 revealed that most stream banks in the subwatershed area were highly vegetated. Using aerial photographs from Belmont County GIS, eight areas were identified for severely eroding banks. These areas are mapped in Figure 59.

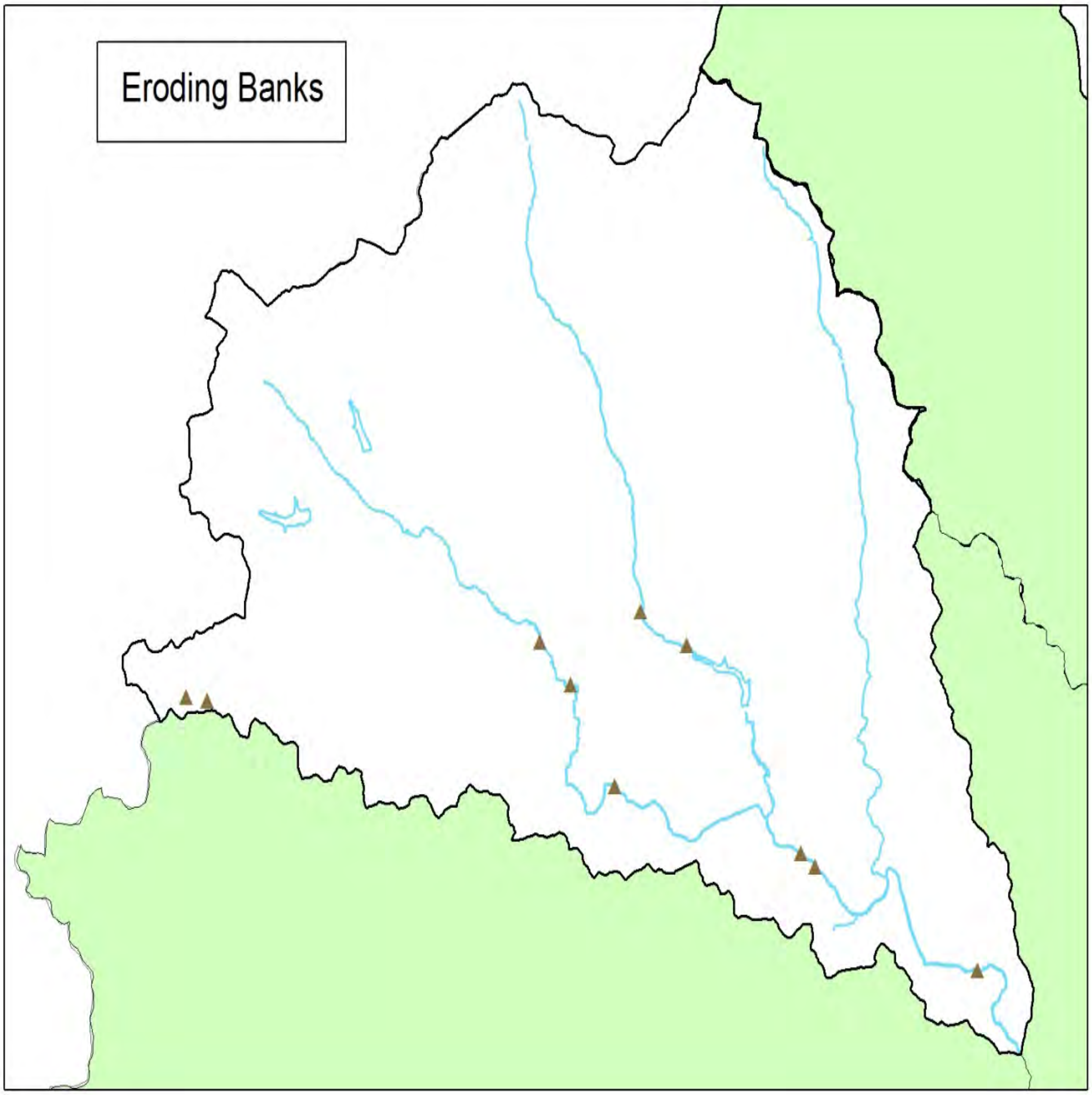


Figure 59. Locations with eroding banks in the North Fork subwatershed. Triangles indicate severely eroding stream banks visible from aerial photography.

Highly Erodible Lands

The North Fork subwatershed contains 19,579.7 acres (93.6 percent) of highly erodible lands based on soil type and slope (ODNR n.d.). The estimated annual potential soil loss from these lands is summarized in Appendix C. The Captina Creek Watershed Soil Erosion Model uses a landscape-scale approach to predict soil loss in the Captina Creek watershed (Lipps 2013). It is noted that the model only takes into account sources of sediment from outside the stream channel; however, it is possible that the greatest source of sediment may be from the stream channel itself (Rabeni and Smale 1995). Section VI, Chapter

1 provides a more detailed description of soil erosion and stream sedimentation in the Captina Creek watershed.

Entrenchment

Streams in the North Fork subwatershed are not entrenched. Most streams observed under normal conditions have small flows where the water is nearly even across the streambed to the adjacent shore. Sinuosity in streambeds exhibit normal entrenchment along their outer sides. Hills surrounding streams in the North Fork are moderately steep to gently sloping. The entrenchment is normal for headwater streams in the Appalachia region, only becoming less when surrounding land use is degrading from improperly fenced cattle causing aggradation from degraded hillsides and streambanks.

Status and Trends in the North Fork Subwatershed

Historically, this subwatershed area has been most impacted by surface mining especially along Sandy Ridge and the upstream portions of Long Run. Though the area has been reclaimed, settlement ponds still exist along Long Run. Previously strip mined lands could also be the cause of increased sedimentation observed in the downstream portions of Long Run.

There are no expected roads, highways, or significant residential development in the North Fork subwatershed in the foreseeable future. Most of the population resides near Barnesville and Bethesda with population densities generally highest along the North Fork and along state routes 147 and 148. Some recent construction of private homes has been observed along Sandy Ridge Road east of Barnesville, however it is not substantial. Headwater streams to the North Fork could be impacted by development near Barnesville if it were to occur, but low flows of these streams would generally not pose a significant threat to the overall water quality of the mainstem of Captina Creek.

Of greater concern is that recently there has been an increase in the number of mobile homes and seasonal cabins constructed by absentee land owners in this subwatershed, especially on the eastern end of the subwatershed area on the banks of the North Fork. Without proper wastewater treatment systems, these structures pose a threat to water quality in the North Fork as well as further downstream. Improvements made to the Barnesville wastewater treatment plant will also improve water quality in this subwatershed area by decreasing the amount of ammonia and nitrate entering the North Fork.

Table 23. Development in the North Fork subwatershed area from 2005 – 2010.

New Homes	3
New Mobile Homes/Cabins	6
Feeding Operations	0
Petition Ditches	0
Levies	0

South Fork Captina Creek Subwatershed – 12-digit HUC: 050103060902

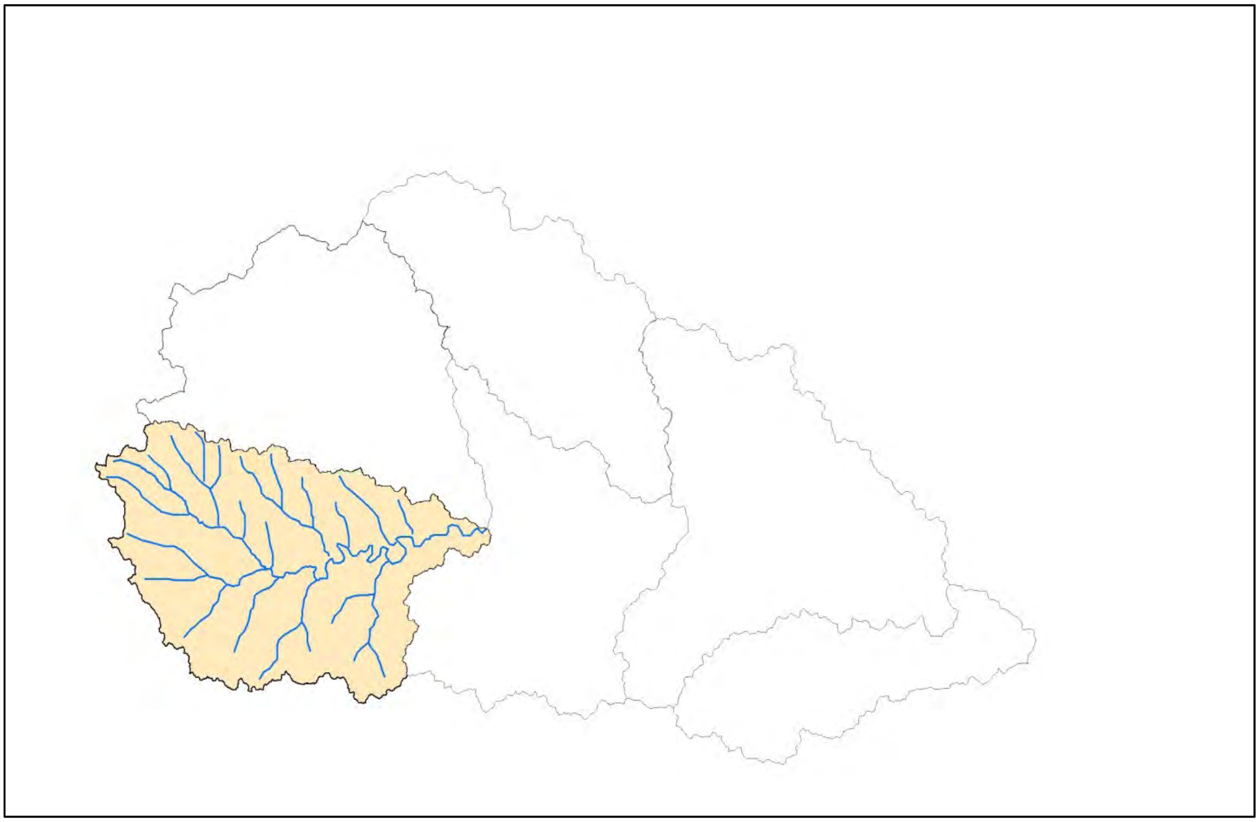


Figure 60. The South Fork subwatershed.

Table 24. Stream physical characteristics for named tributaries in the South Fork subwatershed. *Source:* USGS *StreamStats for Ohio* online database, 2011.

Major Tributaries	Length (miles)	Drainage Area (miles^2)	PK2(ft^3/sec)	7Q10 (ft^3/sec)	Attainment Status	Sinuosity
			Flow/Min/Max			
South Fork	14.0	36.18	1520*/799^/2880^	7.02	Partial/Full	1.6
Flag Run	3.9	3.48	313*/157^/627^	0.60	Unknown	1.1
Slope Creek	4.4	13.6	752*/384^/1570^	2.53	Unknown	1.1
Millers Run	3.5	2.64	259*/129^/521^	0.47	Unknown	1.7
Cranenest Creek	3.1	3.68	309*/155^/619^	0.65	Unknown	1.1
Brushy Creek	3.2	5.32	414*/208^/825^	0.95	Unknown	1.3

PK2 Description - *Denotes two year recurrence interval peak flow with a prediction error of 37% (Equivalent years of record = 2.1) ^Two-year recurrence interval peak flow at 90% prediction interval.

7Q10 Description - Seven day, ten year low flow volume based on an annual series of the smallest values of mean discharge computed over any 7-consecutive days during the annual period.

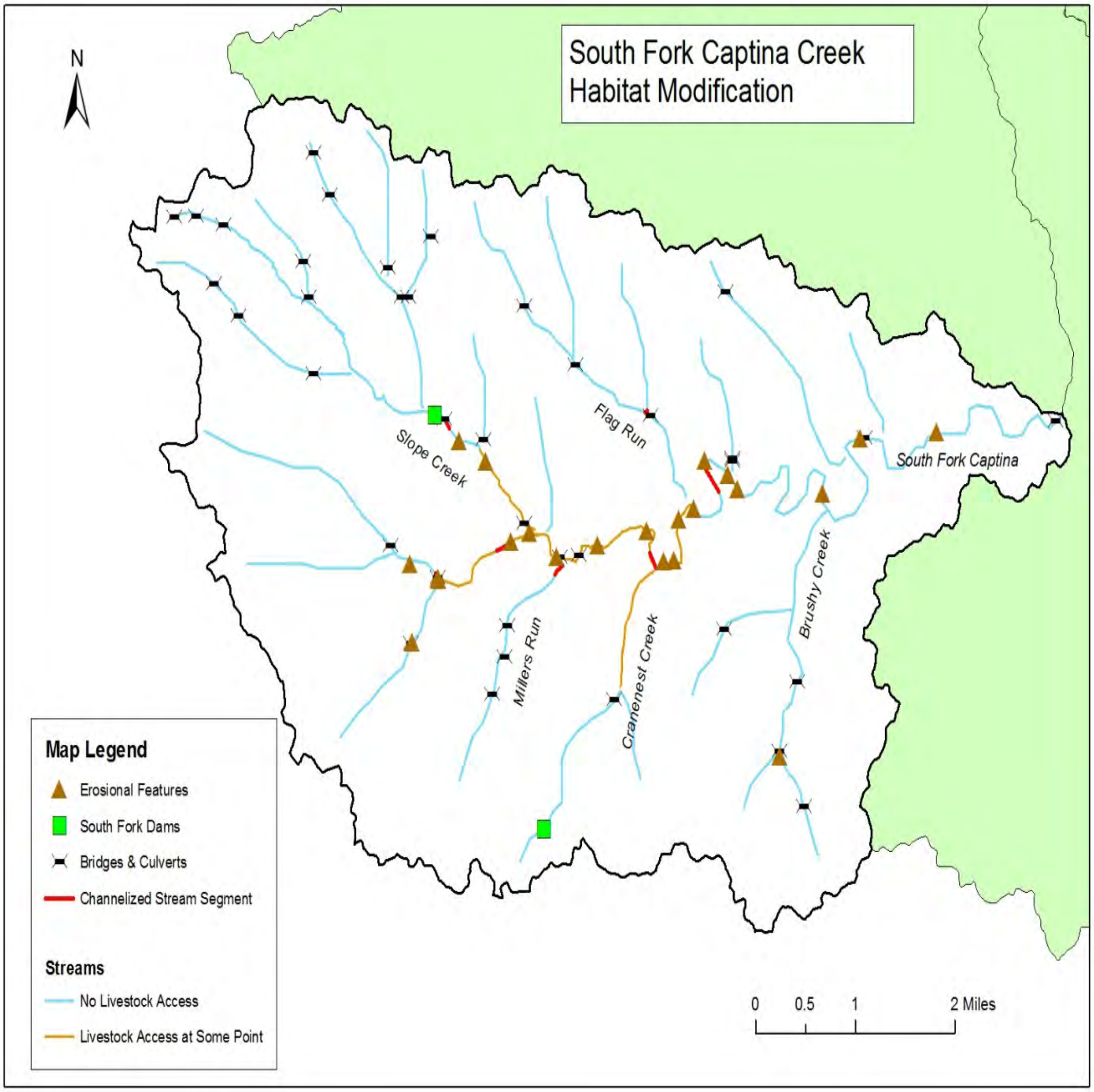


Figure 61. Notable impacts and modifications to tributaries of the South Fork subwatershed.

Floodplain Access/Riparian Levees

Channel and Floodplain Condition – Streams in the South Fork Captina subwatershed have access to the floodplain. Near the east end of the subwatershed area the floodplain becomes more defined as the valley widens, giving streams easier access. The limiting factor for floodplain access is not riparian levees, but gently sloping hillside terrain. The South Fork subwatershed has the least sloping terrain of any subwatershed area in the Captina watershed region.

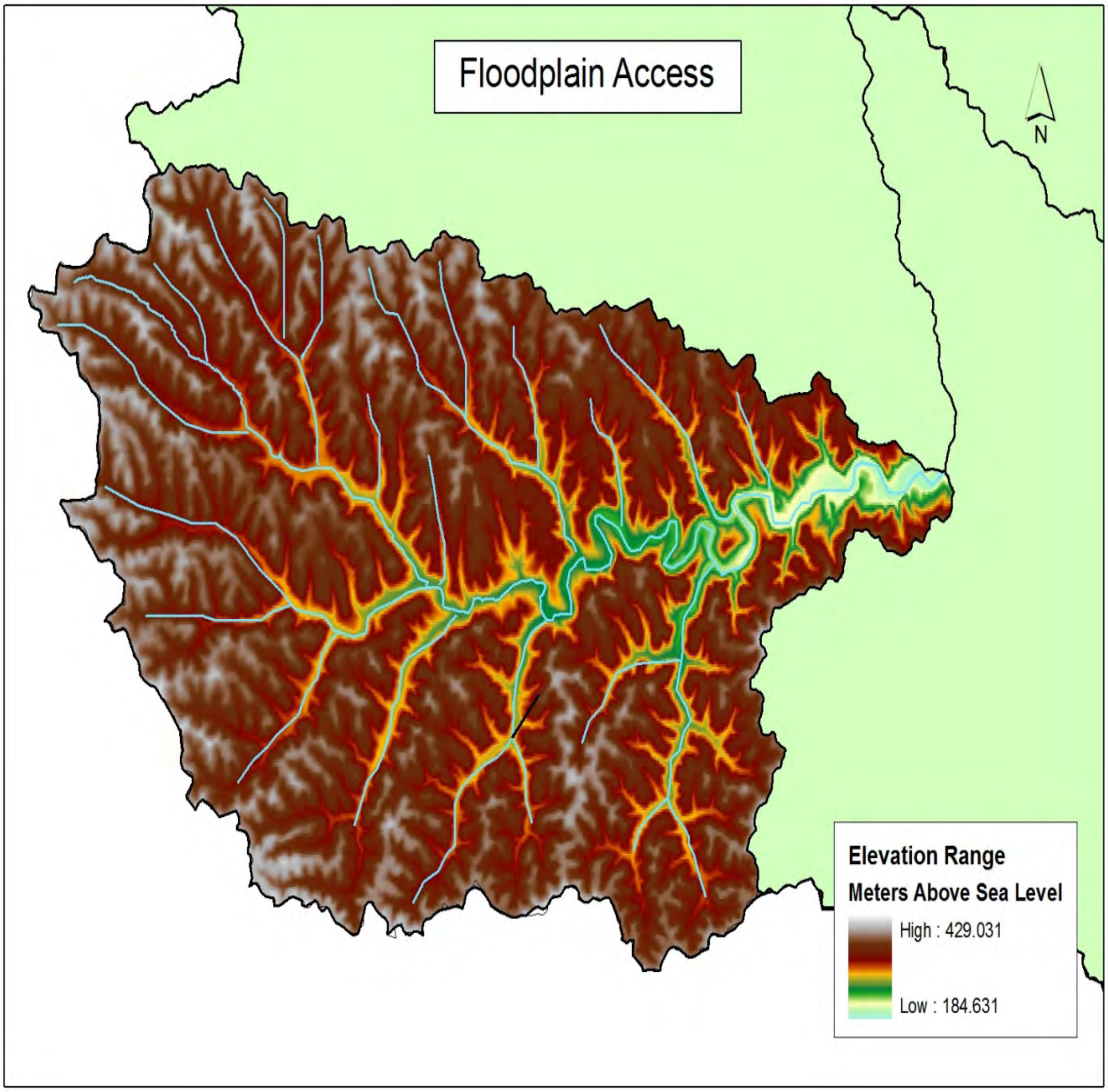


Figure 62. National Elevation Dataset (NED) relief of the South Fork subwatershed showing its major tributaries and their floodplain access. Elevations are in meters above sea level.

Riparian Assessment

Forested Riparian Corridor Assessment – Of the 48 miles of major named tributaries in the South Fork Captina Creek subwatershed, 38 (79.2%) contain intact riparian buffer zones. Northern areas around Slope Creek and Flag Run have good riparian corridors despite the fact that more residents live in these areas. Central areas along the South Fork have many agricultural fields next to the stream with fragmented riparian buffer zones. Millers, Cranenest and Brushy Creeks are located toward the south end of the subwatershed area where the population is sparse and forested cover dense. Southern portions of the subwatershed area are very rural and have excellent riparian cover outside of the few farms that border creeks in the area. None of the streams in the area are in permanent protection.

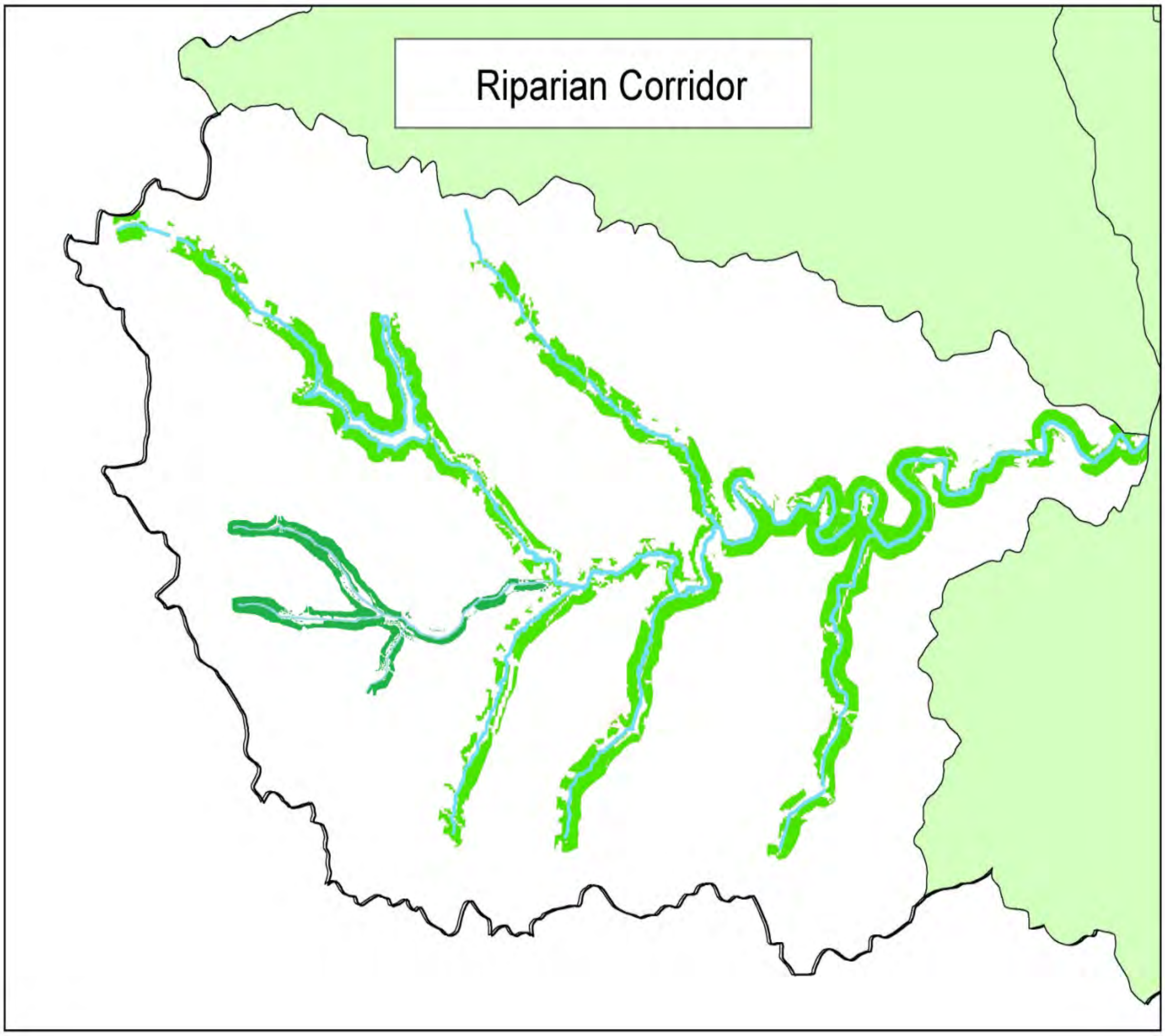


Figure 63. Riparian corridors in the South Fork subwatershed. Riparian corridors are represented in shaded green. Absent green shade represents missing or inadequate riparian buffers.

Natural and Modified Channel

There are 47.3 miles (99%) of natural channel with 0.7 miles of channel being artificially modified. The modified sections are mostly located on the South Fork and are mapped in Figure 64a. Bridges and culverts are mapped in Figure 64b.

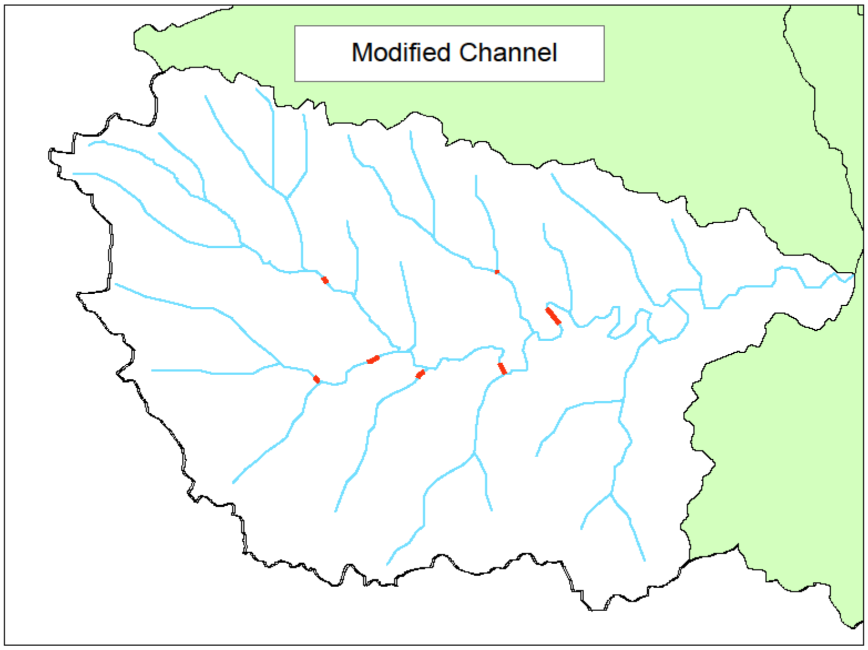


Figure 64a. Modified channels in the South Fork subwatershed.

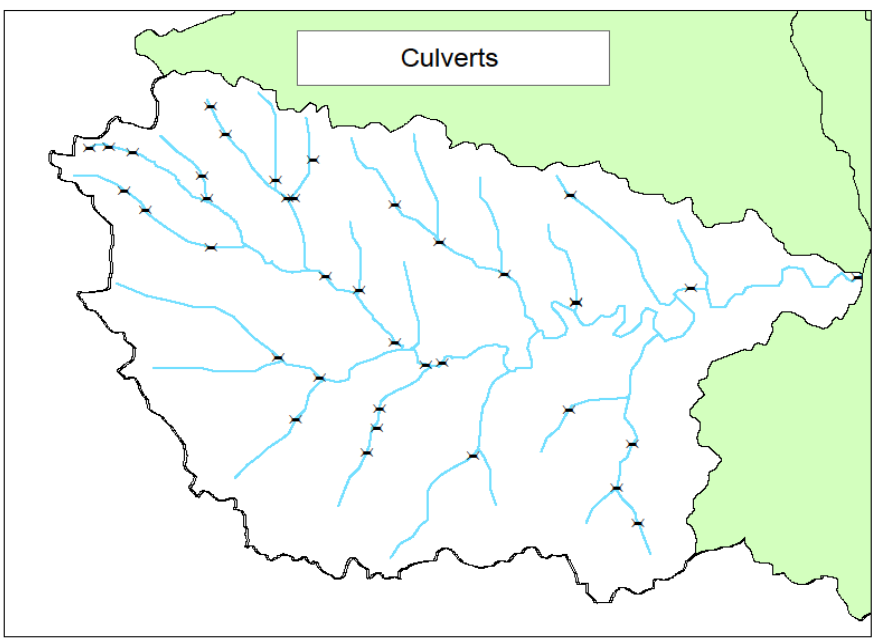


Figure 64b. Bridges and culverts diverting creek channel under bridges and roads in the South Fork subwatershed.

Dams

Two major dams are observed in the South Fork subwatershed area and are mapped in Figure 65. The larger of the two dams is located on Slope Creek and retains the waters of Barnesville Reservoir #3. The other dam is a large private pond located at the headwaters of Cranenest Creek north of the village of Malaga in Monroe County. Many smaller dams retaining surface areas of 2 acres of water or less have been constructed on private properties mostly for agricultural purposes. Analysis of 2007 aerial imaging from Belmont County GIS reveals that there are 43 such dams in the South Fork subwatershed, most of which are located on headwater streams or in farm fields. There is no known indication of water quality impairment due to these smaller dams within the subwatershed.

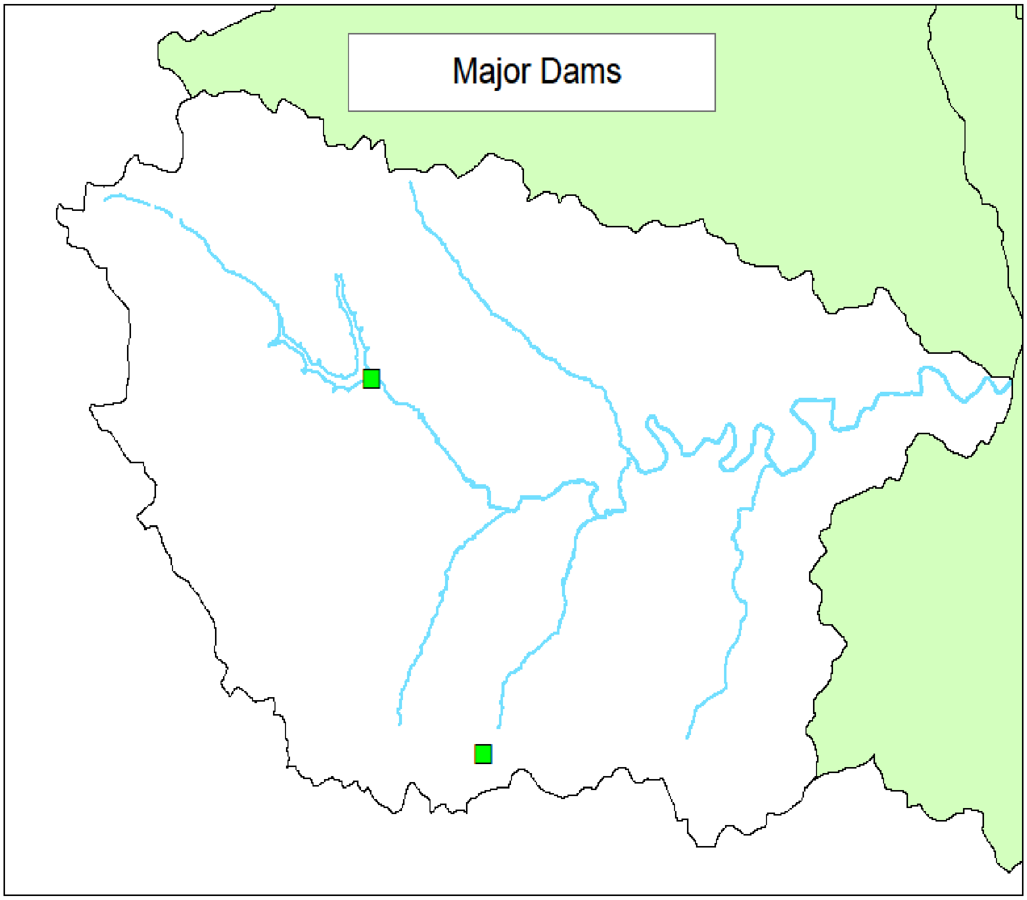


Figure 65. Major dams within the South Fork subwatershed.

Streams with Livestock Access

Small segments of the central drainage of South Fork Captina Creek have been observed with livestock access into streams. Excessive livestock activity in stream beds has been shown to increase sediment in the water column as well as the nutrient load of the creek, leading to unwanted algal blooms. Data from Figure 66 was obtained using roadside observation, however many livestock grazing areas are not visible from roads and other areas of stream access could exist. The amount of livestock present varies by stream and location.

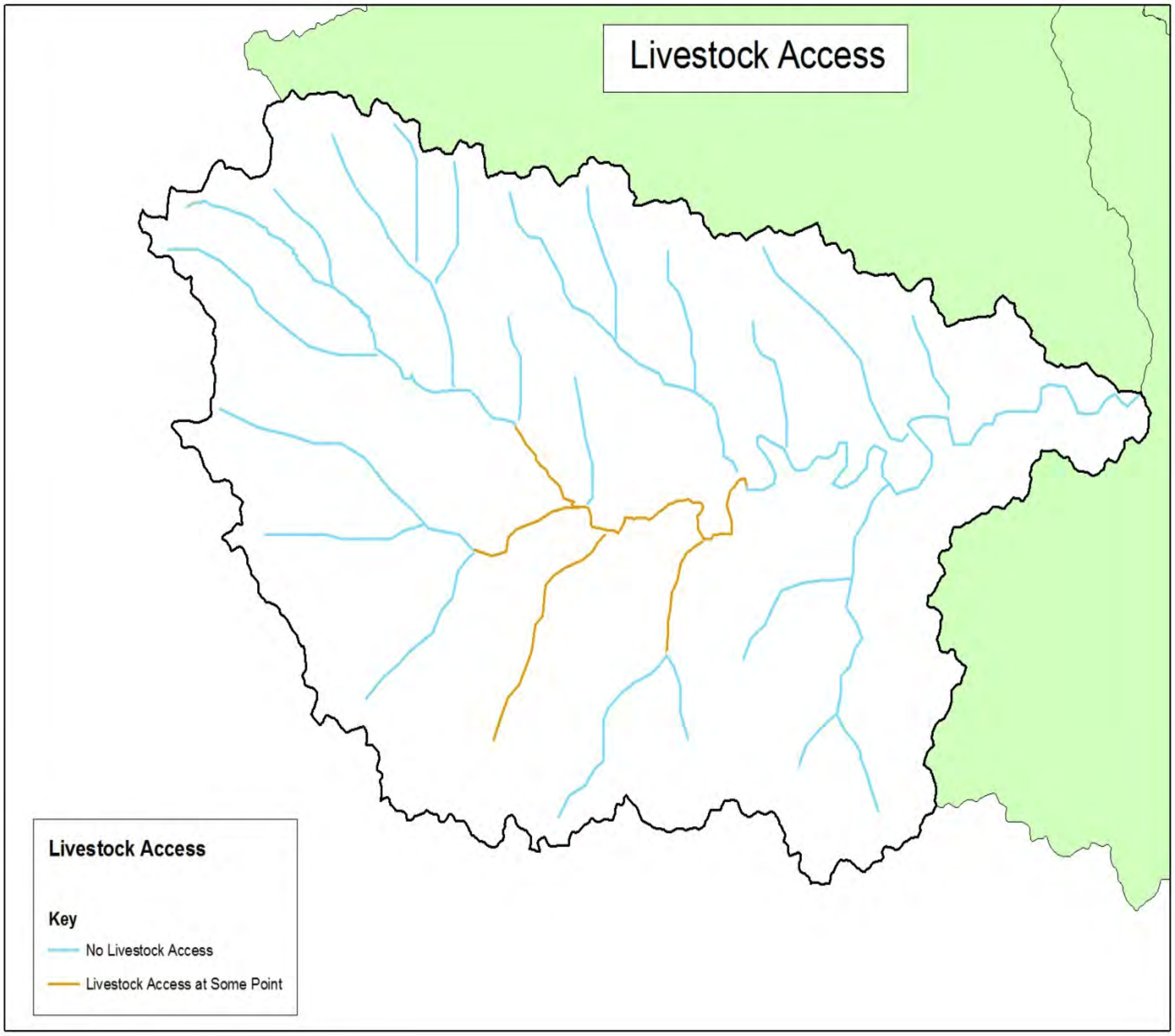


Figure 66. Livestock access within the South Fork subwatershed. *Note:* Color-coding does not indicate length of tributary affected by unrestricted livestock access. Coding only designates streams that have access at some point along their length. In most cases throughout the watershed region, livestock access to streams is minimal only affecting small portions (<100') of these tributaries.

Eroding Banks

Eroding banks can cause impairments to water quality by increasing sediment in the water column. During a visual evaluation in June 2009, most banks that were observed were highly vegetated, although there were notable areas where erosion was taking place due to the proximity of agricultural fields next to streams with no riparian buffer zones. Using aerial imagery from 2007, twenty locations in the subwatershed were noted for severely eroding banks. These locations are mapped in Figure 67. Some of the observed erosion is due to livestock crossings between fields, however logging operations in Slope Creek and at the headwaters of the South Fork near Boston along with the installation of the REX pipeline in 2009 have disrupted hillsides, adding to the sediment load of local streams (although some areas have revegetated).

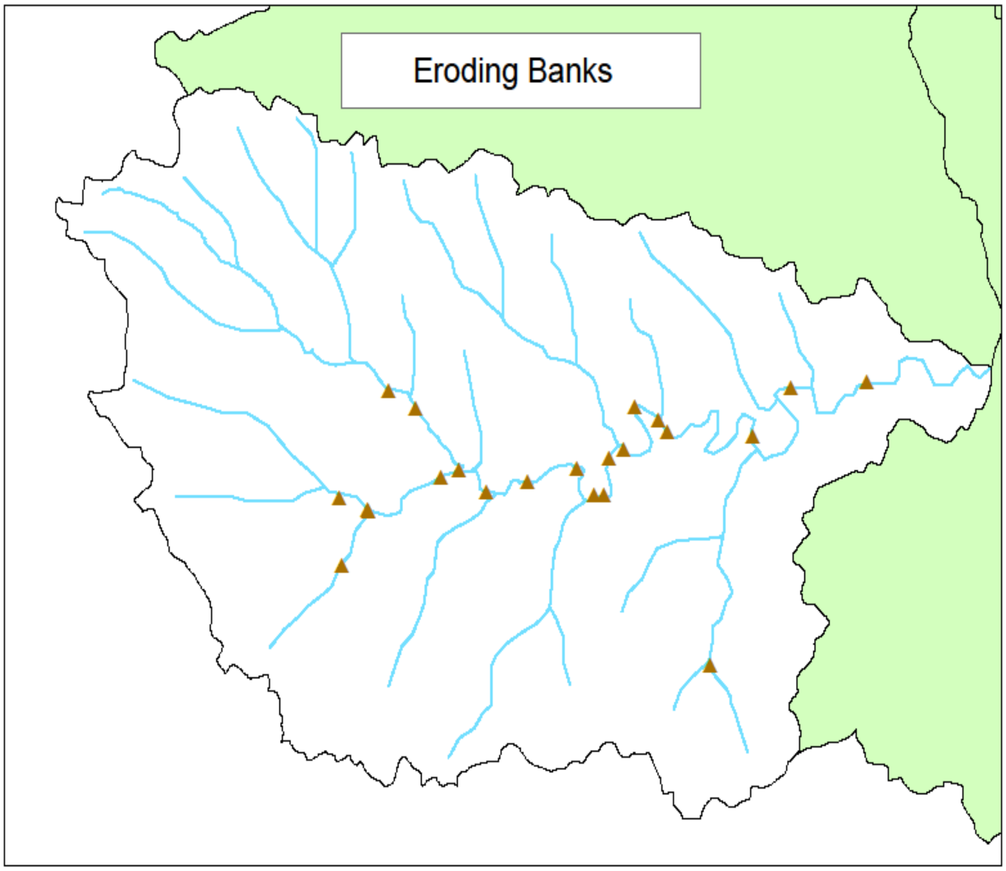


Figure 67. Eroding banks within the South Fork subwatershed. Triangles indicate severely eroding stream banks visible from aerial photography.

Highly Erodible Lands

The South Fork subwatershed contains 21,594.8 acres (93.8 percent) of highly erodible lands based on soil type and slope (ODNR n.d.). The estimated annual potential soil loss from these lands is summarized in Appendix C. The Captina Creek Watershed Soil Erosion Model uses a landscape-scale approach to predict soil loss in the Captina Creek watershed (Lipps 2013). It is noted that the model only takes into account sources of sediment from outside the stream channel; however, it is possible that the greatest source of sediment may be from the stream channel itself (Rabeni and Smale 1995). Section VI, Chapter 1 provides a more detailed description of soil erosion and stream sedimentation in the Captina Creek watershed.

Entrenchment

Streams in the South Fork subwatershed are not entrenched. Most streams observed under normal conditions have small flows where the water is nearly even across the streambed to the adjacent shore. Bends in the streams have normal slope along their outer sides. Hills surrounding the streams in the South Fork are moderately steep to gently sloping with flat floodplains surrounding the larger streams, especially toward the downstream area of the South Fork.

Status and Trends

There are no expected roads, highways, or development to be constructed in the foreseeable future in the South Fork subwatershed area (Table 25). The most recent development to occur was the installation of the Rocky Mountain Express (REX) natural gas pipeline in autumn of 2009 that transected the subwatershed area from northwest to southeast, passing north of Boston and Somerton on its way to Clarington along the Ohio River (Figure 68). Though the pipeline follows utility right-of-ways over most of its course, a significant amount of timber was cleared and streams were disrupted as equipment bored underneath them to accommodate the 36-inch vessel. Another natural gas pipeline right-of-way is under consideration for this area but is currently expected to pass to the south near the village of Malaga in Monroe County. Additional changes include the clearing of a forested hillside along the lower portion of South Fork in 2011 to accommodate upgrades to Murray Energy mine shafts and power lines.

Figure 68. Installation of the REX pipeline in the South Fork subwatershed near New Castle.

The South Fork subwatershed is one of the most agriculturally active areas in the Captina Creek watershed. Though agricultural production is spread out, certain stretches of stream in this subwatershed area are impacted by livestock access to the creek banks and bottoms, and lack of riparian cover. Unrestricted livestock access to stream beds increases nutrient loading and sedimentation, resulting in excess growths of algae as illustrated in Figure 69. Grazing livestock also restrict riparian growth on stream banks which leads to sedimentation and increased water temperatures. The majority of the population in the South Fork subwatershed lives near the hamlets of Somerton and New Castle and along corridors of state routes 800 and 26 and along the South Fork tributary mainstem.

Figure 69. Excessive algae growth in a pool.

The South Fork subwatershed area has the most tributaries listed in unknown attainment status of any of the subwatersheds in the Captina Creek watershed. Tributaries to the South Fork have undetermined water quality attainment status, however, it is believed that these tributaries would grade at least WWH or CWH attainment status given the surrounding forested habitat. OEPA sampling, utilizing the HHEI index on one unnamed tributary to the South Fork in October of 2010, indicated exceptional headwater habitat (84/100 possible points) rich in macroinvertebrate and salamander richness and diversity.

Table 25. Development in the South Fork subwatershed area from 2005 – 2010.

New Homes	Unknown
Feeding Operations	0
Petition Ditches	0
Levies	0

Bend Fork Subwatershed – 12-digit HUC: 050103060903

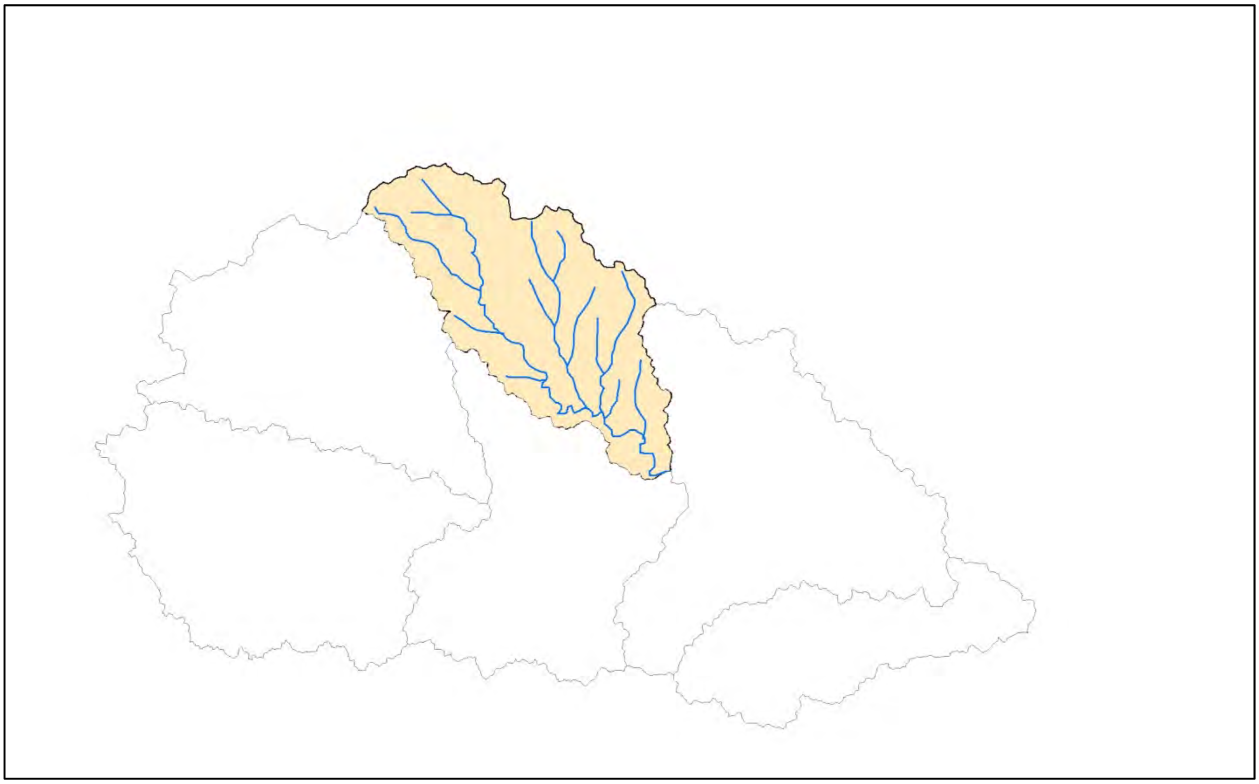


Figure 70. The Bend Fork subwatershed.

Table 26. Stream physical characteristics for named tributaries in the Bend Fork subwatershed. *Source:* USGS *StreamStats for Ohio* Online Database, 2011.

Major Tributaries	**Length (miles)**	**Drainage Area ($miles^2$)**	**PK2(ft^3/sec)**	**7Q10 (ft^3/sec)**	**Attainment Status**	**Sinuosity**
			Flow/Min/Max			
Bend Fork	13.4	27.1	1340*/699^/2570^	5.15	Full	1.5
Joy Fork	5.3	6.04	470*/238^/930^	1.08	Full	1.3
Millers Run	4.1	3.46	311*/154^/628^	0.57	Unknown	1.1
Packsaddle Run	3.5	2.28	219*/109^/439^	0.44	Unknown	1.3

PK2 Description - *Denotes two year recurrence interval peak flow with a prediction error of 37% (Equivalent years of record = 2.1) ^Two-year recurrence interval peak flow at 90% prediction interval.
7Q10 Description - Seven day, ten year low flow volume based on an annual series of the smallest values of mean discharge computed over any 7-consecutive days during the annual period.

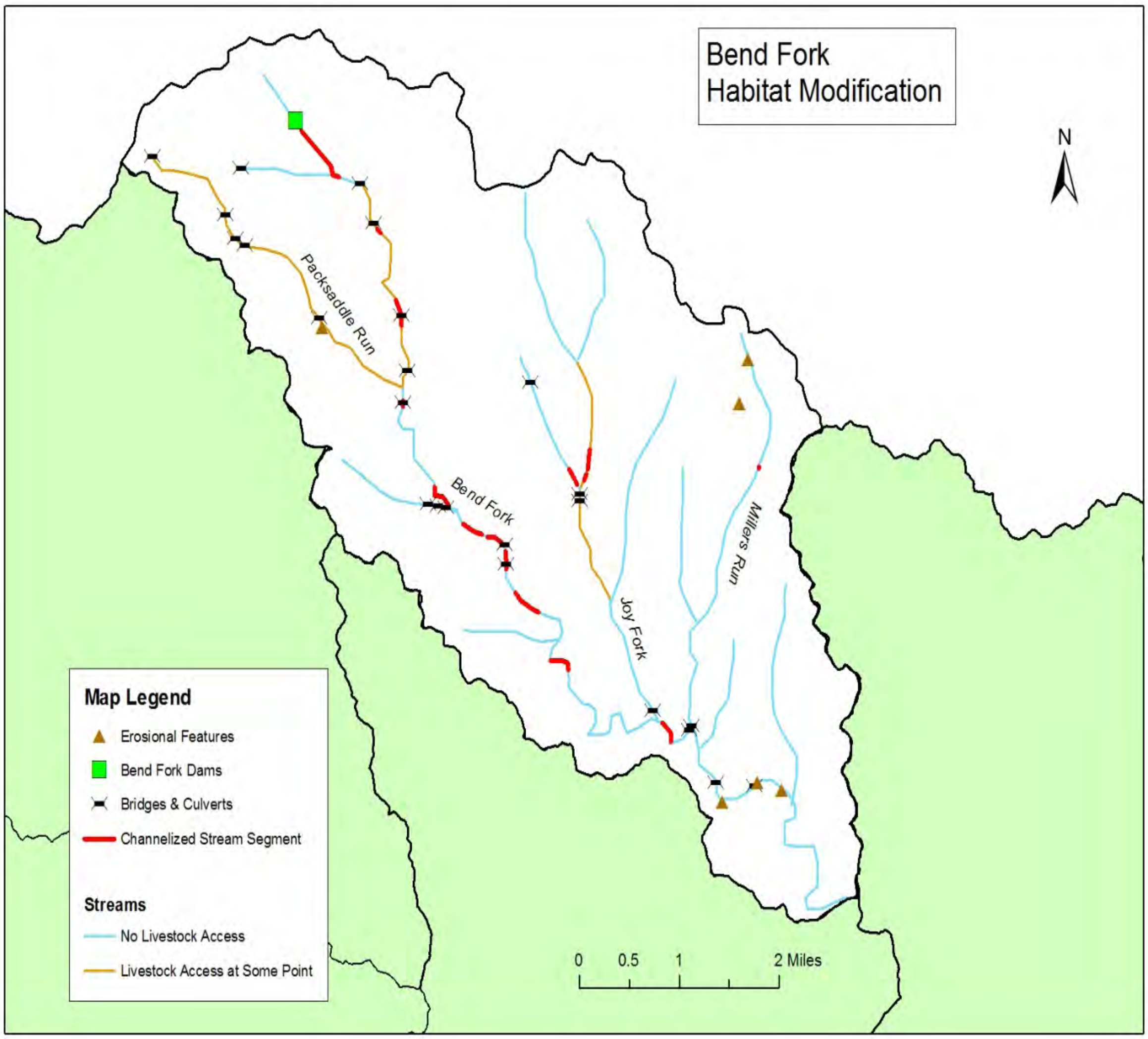


Figure 71. Notable impacts and modifications to tributaries of Bend Fork subwatershed.

Floodplain Access/Riparian Levees

<u>Channel and Floodplain Condition</u> – Streams in the Bend Fork subwatershed have access to the floodplain. Many small streams wind through steep banks where no floodplain exists, especially in eastern sections of the subwatershed area. Along downstream sections of Bend Fork, the floodplain becomes broader and more defined allowing streams easier access. The limiting factor for floodplain access is not the presence of riparian levees, but steep to moderately steep terrain. Bend Fork subwatershed has steep terrain in northern areas with moderately steep terrain near the confluence with Captina Creek in the south.

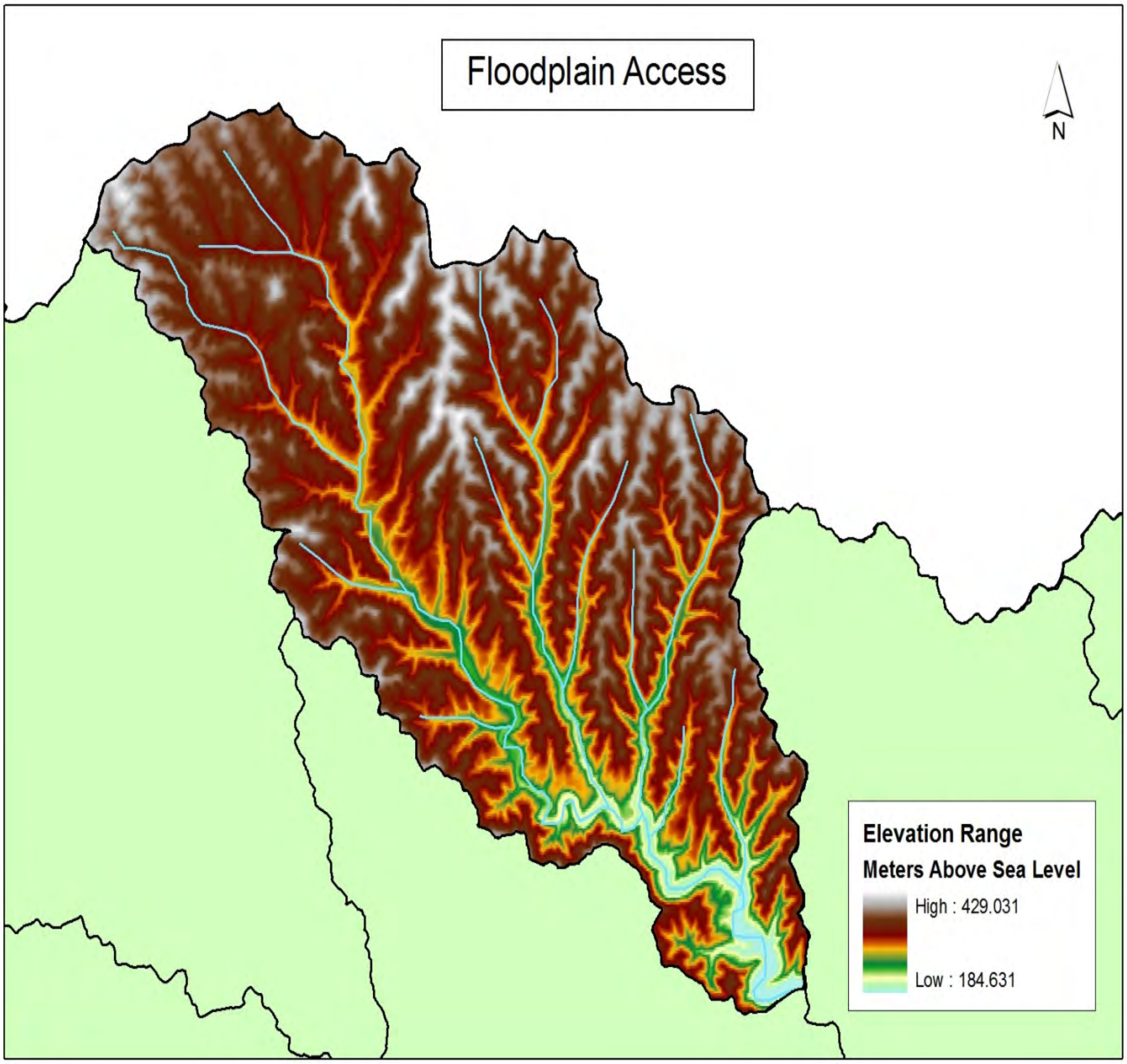


Figure 72. National Elevation Dataset (NED) relief of Bend Fork subwatershed showing its major tributaries.

Riparian Assessment

Forested Riparian Corridor Assessment – Of the 34.5 miles of named tributaries in Bend Fork subwatershed, 32.5 miles (94%) have intact riparian buffers zones (Figure 73). The northern areas along upstream portions of Bend Fork, Packsaddle Run, Joy Fork, and Millers Run have good growths of riparian corridor. More residents live in the northern area, but occupancy is confined to ridgetops at higher elevations away from streams. The central and lower sections of the subwatershed have fewer residents and have good riparian buffers. Dysart Woods is located in the headwaters of Joy Fork and is protected from disturbance by Ohio University. Murray Energy Corporation holds conservation easements for portions of Millers Run and Bend Fork near the confluence with Captina Creek.

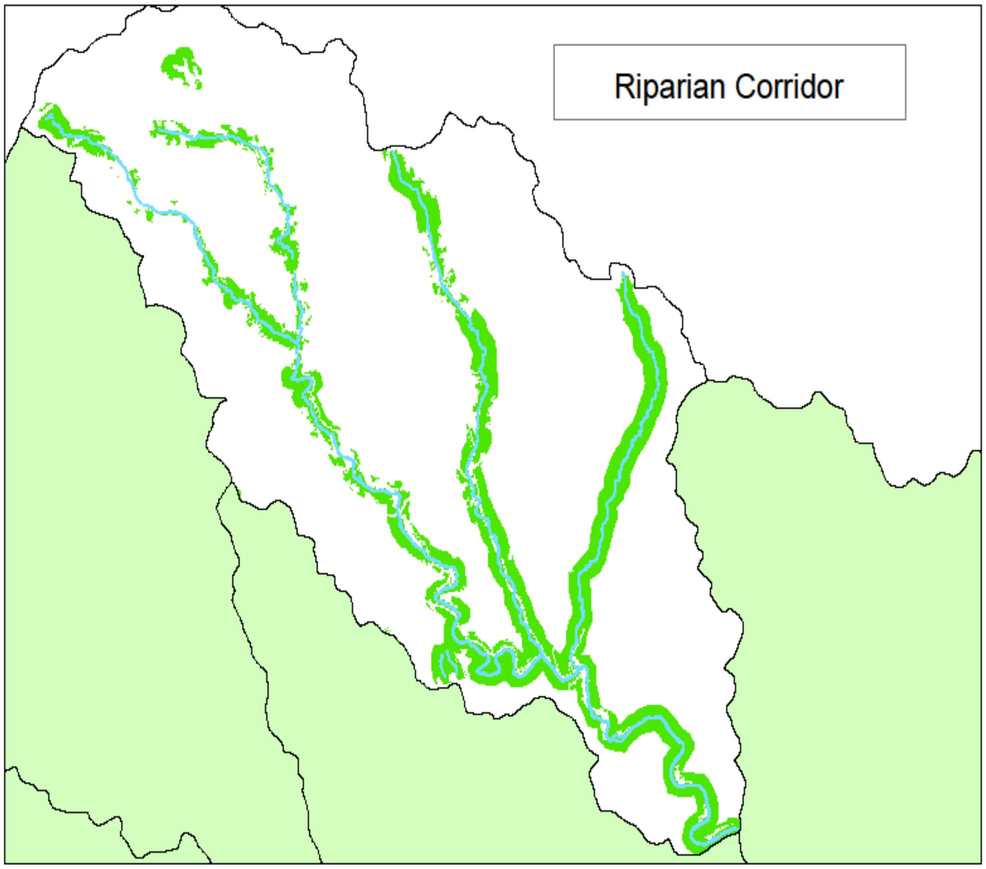


Figure 73. Riparian corridors within the Bend Fork subwatershed. Riparian corridors represented in shaded green. Absent green shade represents missing or inadequate riparian buffers.

Natural and Modified Channel

Of the named tributaries in Bend Fork subwatershed there are 32.5 miles (94%) of natural channel with 1.96 miles of channel being artificially modified. The modified sections are located on primarily along Bend Fork with some locations along Joy Fork. Most of the modified channel is short segments that have been straightened near homes or agricultural fields. Channelized segments have been observed near property lines and around roads and driveways. Effects of channelization along Bend Fork are unknown; however, channelized segments often have difficulty reestablishing riparian cover. Modified sections of Bend Fork and Joy Fork are mapped in Figures 74a and 74b.

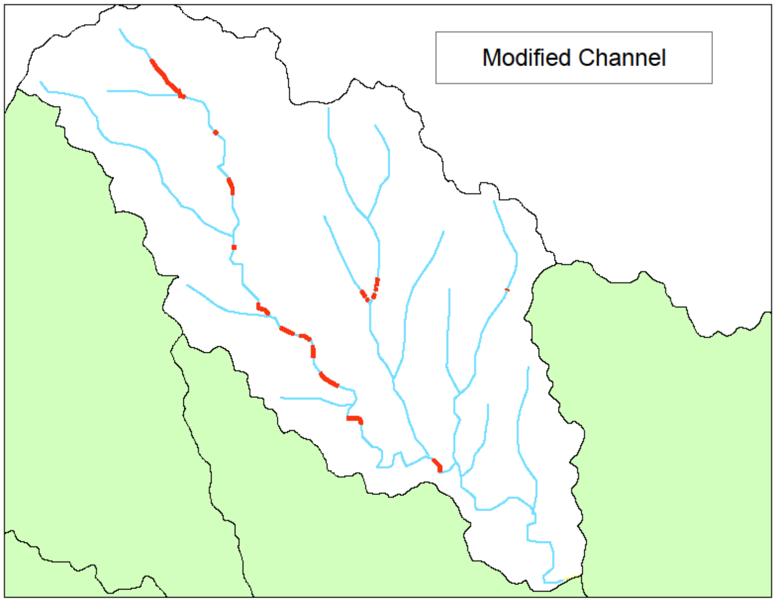


Figure 74a. Modified channels within the Bend Fork subwatershed.

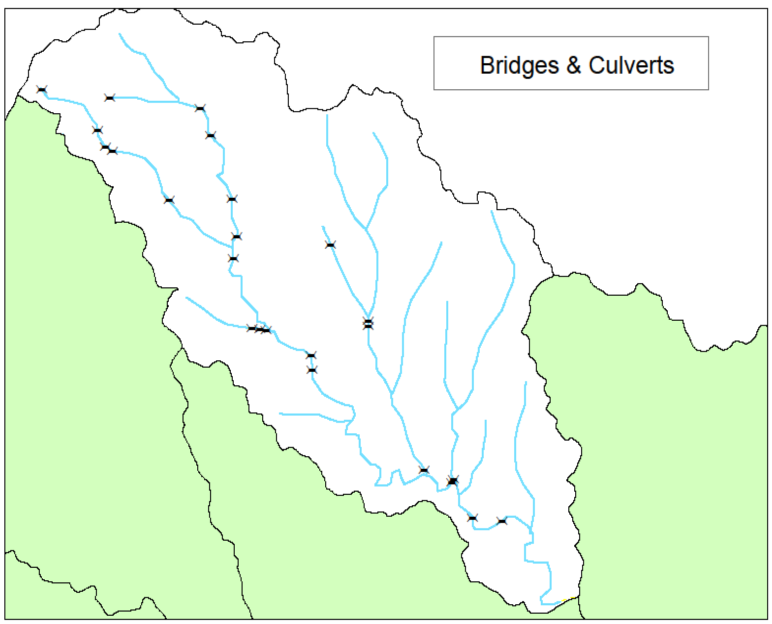


Figure 74b. Bridges and culverts diverting creek channels under bridges and roads within the Bend Fork subwatershed.

Dams

One large dam has been observed in the Bend Fork subwatershed (Figure 75), located at the Bethesda reservoir near the headwaters of Bend Fork. The dam does not have a major effect on the flow regime of Bend Fork. Using aerial photography from 2007, 44 smaller dams impounding two acres of water or less were located within in the subwatershed area. The dams are on private property and typically head small farm ponds in agricultural fields. None of the dams are located on named streams. There is no known indication of water quality impairment due to these smaller dams within the subwatershed.

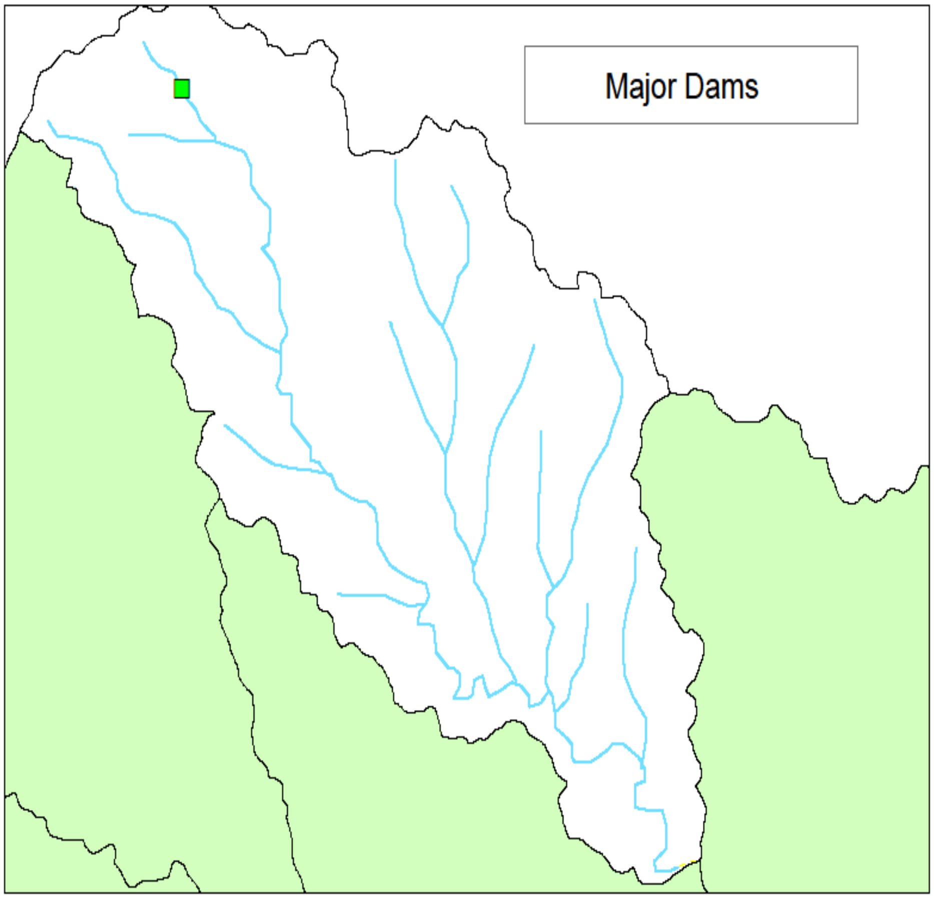


Figure 75. Major dams within the Bend Fork subwatershed.

Streams with Livestock Access

Small segments of the headwaters of Bend Fork, Packsaddle Run and Joy Fork have been observed with unrestricted livestock access. Unrestricted access is defined as the ability of livestock to enter streambeds at will and is usually associated with lack of proper fencing around stream banks. Excessive livestock activity in stream beds has been shown to increase sediment in the water column as well as the nutrient load of the creek, leading to unwanted algal blooms. Data for Figure 76 was obtained using roadside observation; however, many livestock grazing areas are not visible from roads and other areas of stream access could exist. The amount of livestock present varies by stream and location.

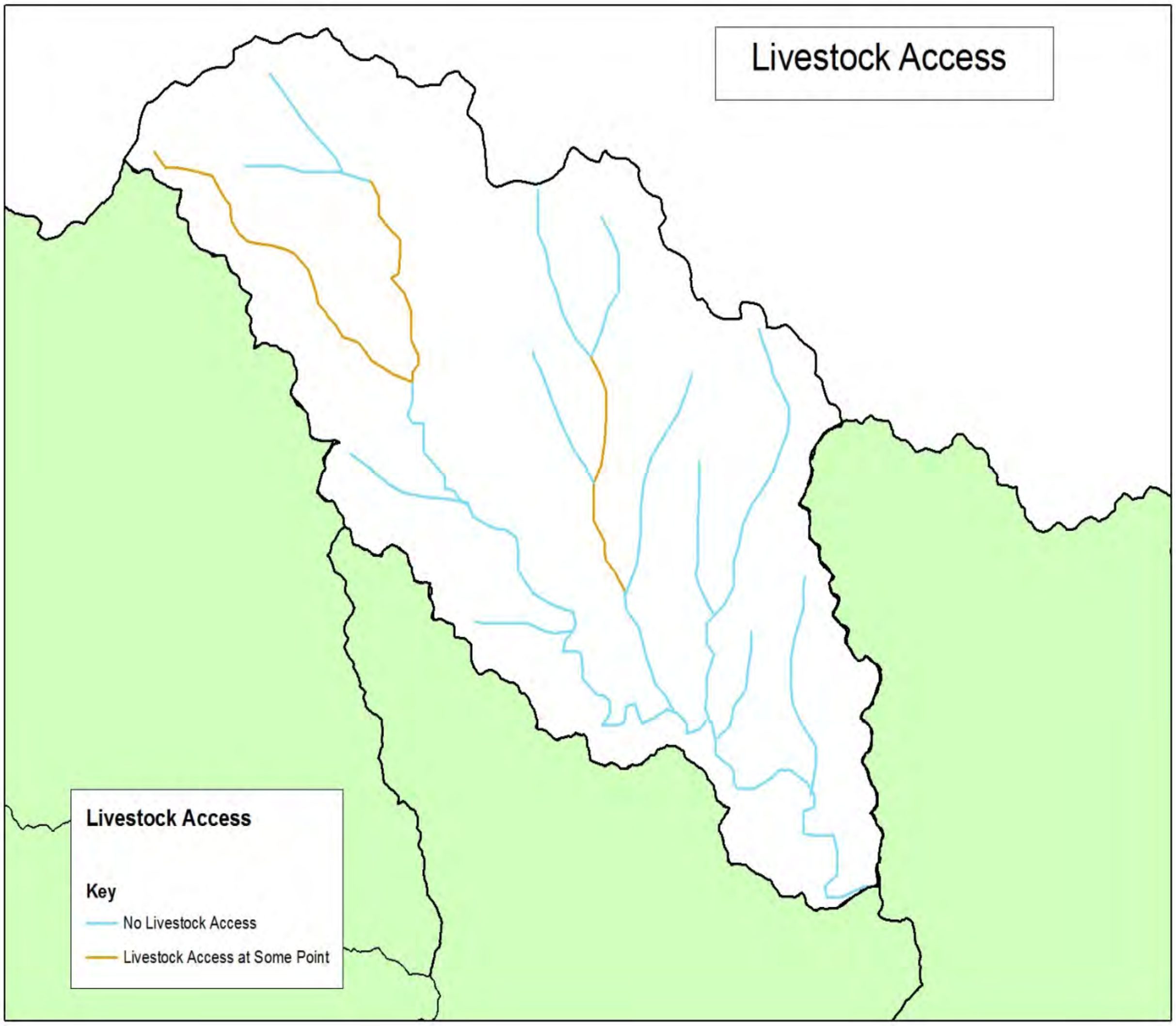


Figure 76. Livestock access within the Bend Fork subwatershed. *Note:* Color-coding does not indicate length of tributary affected by unrestricted livestock access. Coding only designates streams that have access at some point along their length. In most cases throughout the watershed region, livestock access to streams is minimal, only affecting small portions (<100') of these tributaries.

Eroding Banks

Eroding banks can cause impairments to water quality by increasing sediment in the water column. During a visual evaluation in June 2009, most banks were that were observed were highly vegetated. There are six areas that stand out for having severely eroding banks. These areas were identified using aerial photography and roadside observations. A primary cause of eroding banks within the subwatershed is roads cutting through stream beds. Near the confluence of Bend Fork and Captina Creek, many dirt driveways and roads pass through the stream and all-terrain vehicle (ATV) trails are observed next to Bend Fork. Other erosion issues exist on steep banks and hillsides. These areas are mapped in Figure 77. Despite the presence of erosional features, Bend Fork subwatershed has excellent water clarity with low sedimentation during periods of no precipitation.

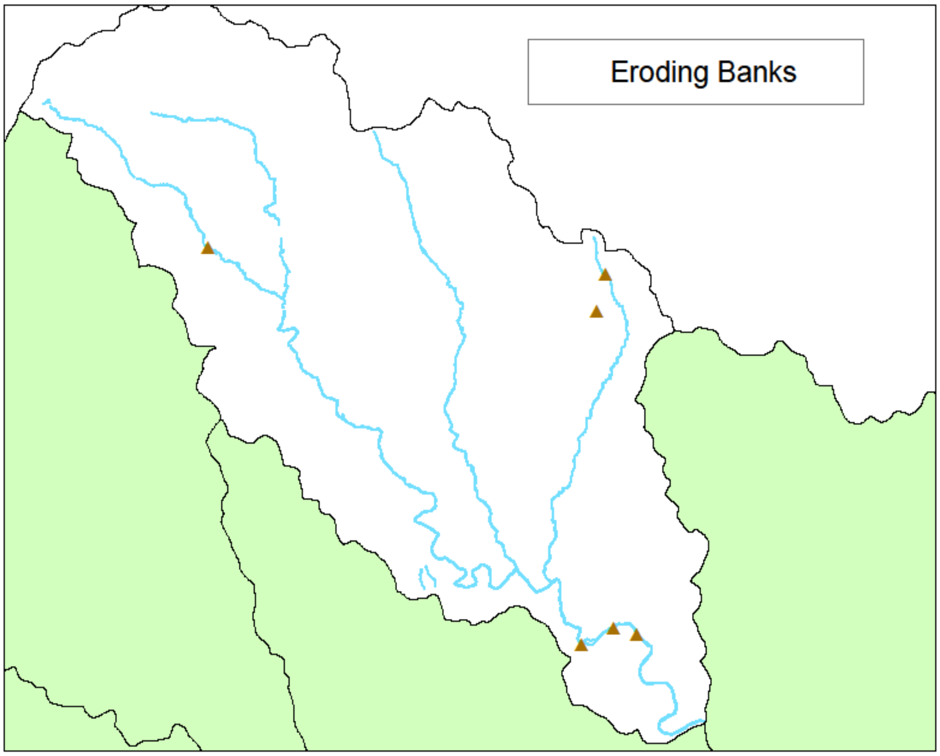


Figure 77. Locations of eroding banks within the Bend Fork subwatershed. Triangles indicate severely eroding stream banks visible from aerial photography.

Highly Erodible Lands

The Bend Fork subwatershed contains 16,270.1 acres (94.2 percent) of highly erodible lands based on soil type and slope (ODNR n.d.). The estimated annual potential soil loss from these lands is summarized in Appendix C. The Captina Creek Watershed Soil Erosion Model uses a landscape-scale approach to predict soil loss in the Captina Creek watershed (Lipps 2013). It is noted that the model only takes into account sources of sediment from outside the stream channel; however, it is possible that the greatest source of sediment may be from the stream channel itself (Rabeni and Smale 1995). Section VI, Chapter 1 provides a more detailed description of soil erosion and stream sedimentation in the Captina Creek watershed.

Entrenchment

Streams in the Bend Fork subwatershed are not entrenched. Most streams under normal conditions have small flows where the cubic feet per second (cfs) water velocity is uniform across the streambed to the adjacent shore. Bends in the streams have normal entrenchment along their outer sides. Hills surrounding streams in Bend Fork are steep to moderately steep, but relatively flat floodplains surround the larger streams, especially toward the southern end of the subwatershed near the confluence with Captina Creek.

Status and Trends in the Bend Fork Subwatershed

There are currently no expected roads, highways, or developments scheduled for the Bend Fork subwatershed. The U.S. Fish and Wildlife Service has developed plans to remove a submarine bridge located on Joy Fork that is serving as a fish barrier in the stream (Figure 78). According to the OEPA, removing the barrier will improve aquatic habitat designation for fish from warmwater habitat (WWH) to exceptional warmwater habitat (EWH) for Joy Fork. Funding for this project is secured and construction should begin in late summer or early fall 2013.

Most of the population lives in the northern region of the subwatershed near Bethesda and Centerville. Any construction there would pose little threat to streams downstream due to the amount of buffer between these villages and the mainstem of Bend Fork. Construction in the lower region of the subwatershed would cause noticeable impacts on Captina Creek's water quality in terms of increased sedimentation rates, but few houses exist in that region with no foreseeable changes in the future.

Figure 78. A fish barrier formerly located on Joy Fork, within the Bend Fork subwatershed (OEPA 2010).

Traditionally, certain tributaries of this subwatershed have been favored locations for large-scale ATV recreation, particularly those along the mainstem of Bend Fork from below Miller's Run to above the confluence with Joy Fork. Locally this area is known as "Seven Creeks" and contains numerous ATV trails that cross through stream beds and amplify erosion on stream banks. ATV traffic is most prevalent in forested areas that have been timbered due to the access created by logging trails. ATVs have damaging effects on stream and vernal pool ecosystems by causing mass mortality of aquatic organisms, dramatically increasing sedimentation rates, and causing localized pollution from leaking oil and other petroleum products into the water table. Local law enforcement has had limited success in curtailing the activity on private property in the past.

Table 27. Development in the Bend Fork subwatershed in from 2005 – 2010.

New Homes	Unknown
Feeding Operations	0
Petition Ditches	0
Levies	0

Piney Creek Subwatershed – 12-digit HUC: 050103060904

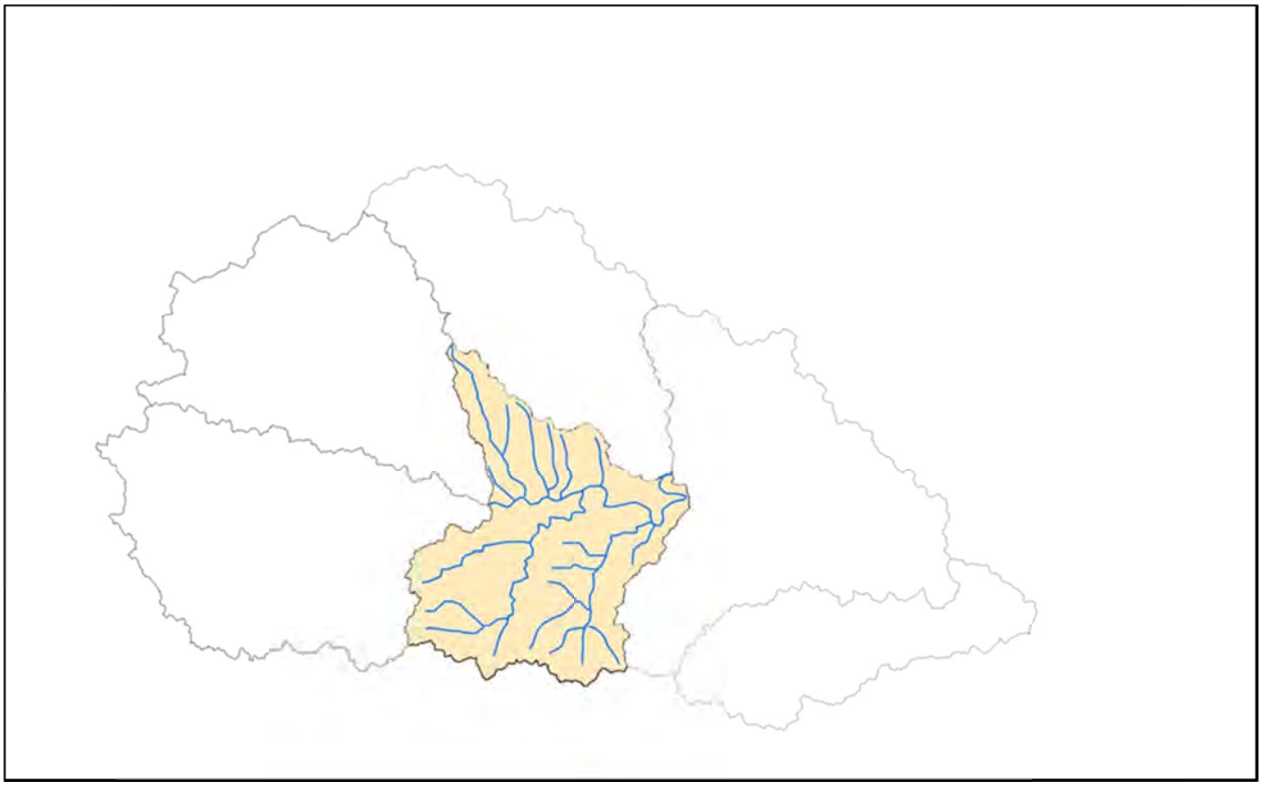


Figure 79. The Piney Creek subwatershed.

Table 28. Stream physical characteristics for named tributaries in Piney Creek subwatershed. *Source:* USGS *StreamStats for Ohio* Database Ohio, 2011.

Major Tributaries	Length (miles)	Watershed Area ($miles^2$)	PK2(ft^3/sec) Flow/Min/Max	7Q10 (ft^3/sec)	Attainment Status	Sinuosity
Berrys Run	2.3	1.42	183*/88.8^/376^	0.27	Unknown	1.3
Casey Run	1.7	0.62	95.1*/45.2^/200^	0.10	Full	1.3
Crabapple Creek	5.5	8.32	600*/304^/1180^	1.48	Full	1.2
Long Run	3.55	2.44	237*/117^/480^	0.42	Full	1.3
Mikes Run	4.6	3.38	301*/150^/605^	0.57	Unknown	1.2
Piney Creek	7.2	9.92	597*/304^/1170^	1.83	Full	1.6
Reeves Hollow	1.7	0.52	85.8*/40.6^/181^	0.09	Unknown	1.3

PK2 Description - *Denotes two year recurrence interval peak flow with a prediction error of 37% (Equivalent years of record = 2.1) ^Two-year recurrence interval peak flow at 90% prediction interval.
7Q10 Description - Seven day, ten year low flow volume based on an annual series of the smallest values of mean discharge computed over any 7-consecutive days during the annual period.

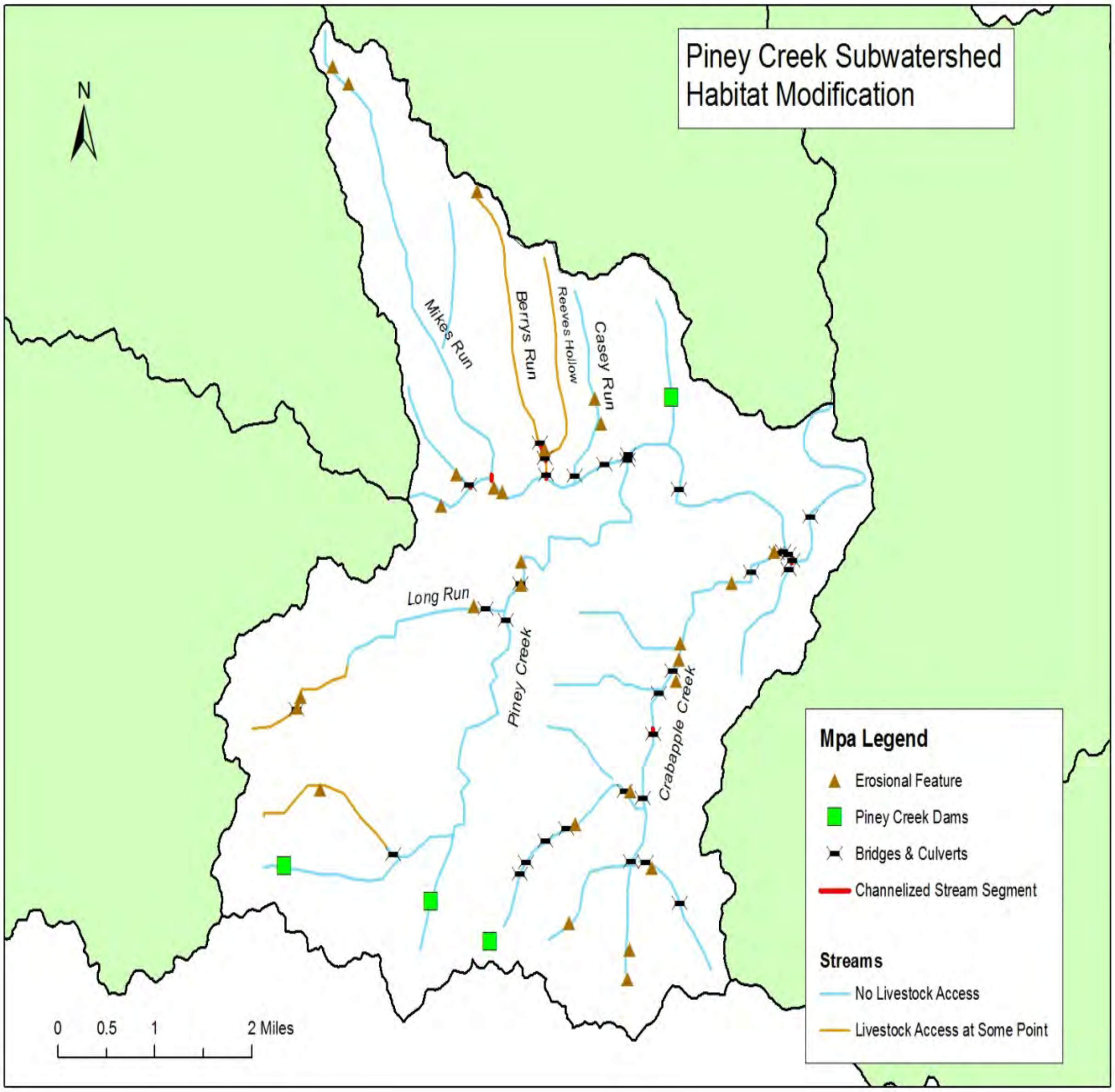


Figure 80. Notable impacts and modifications to tributaries of the Piney Creek subwatershed.

Floodplain Access/Riparian Levees

Channel and Floodplain Condition – Streams in the Piney Creek subwatershed have access to the floodplain, however, many streams wind through moderately steep to steep banks where no floodplain exists (Figure 81). Downstream portions of larger streams in the subwatershed area exhibit wider valley floors giving streams easier access to their floodplains. The limiting factor for floodplain access is not the presence of riparian levees, but steep to moderately steep terrain.

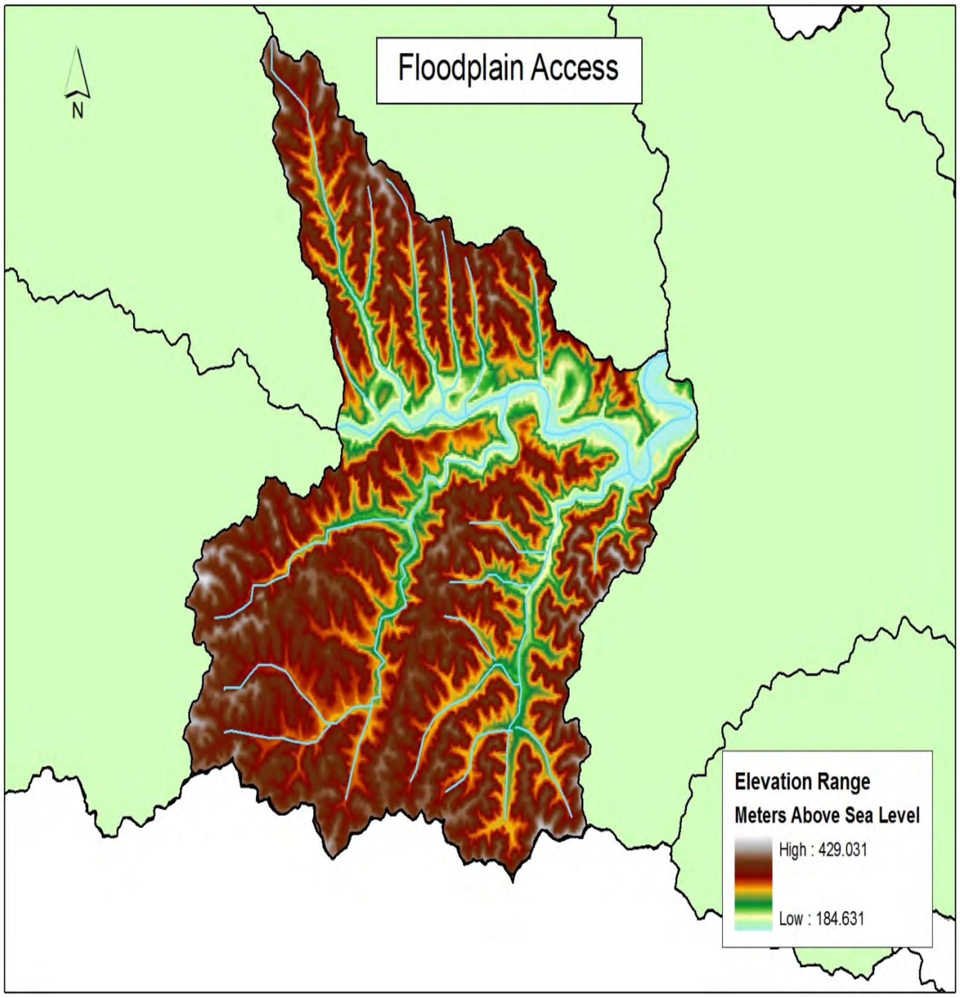


Figure 81. Floodplain access in the Piney Creek subwatershed. National Elevation Dataset (NED) relief of the subwatershed shows its major tributaries.

Riparian Assessment

<u>Forested Riparian Corridor Assessment</u> – Most of the streams in Piney Creek subwatershed are surrounded by good growths of riparian corridor. Of the major named tributaries there are 41.3 miles (90.6%) of natural riparian corridor around the streams leaving 4.3 total miles of stream with no riparian buffer. While a good portion of the land surrounding streams is used for hay fields and agriculture, farmers have done a great job maintaining forested riparian zones around streams as mapped in Figure 82. Mikes Run is heavily forested along with Crabapple Creek and upstream portions of Piney Creek and Long Run. Non-buffered riparian areas are scattered throughout the subwatershed area and concentrate locally around agricultural fields and residential areas. Conservation easements are held on downstream portions of Piney Creek by Murray Energy Corporation and a portion of land is owned by Raven Rocks, Inc. at the headwaters of Piney Creek and Long Run. The Raven Rocks, Inc. property is currently being developed into a conservation easement to be held by the Captina Conservancy, made possible through a grant from the Clean Ohio Fund.

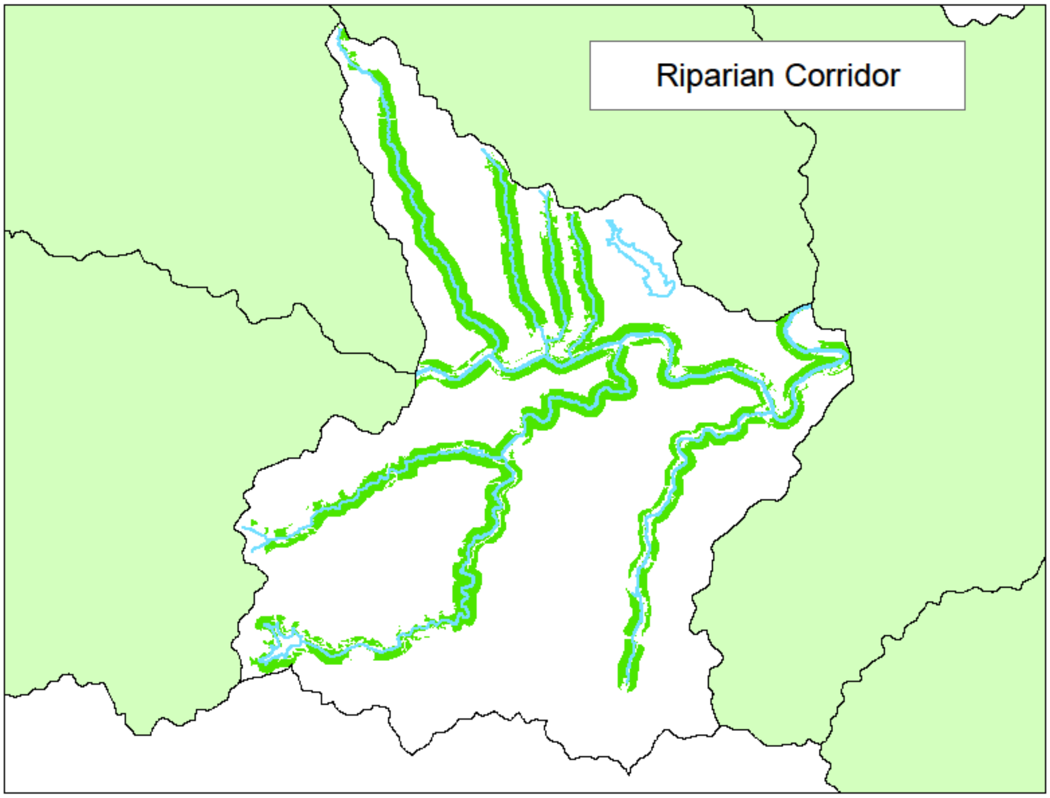


Figure 82. Riparian corridor within the Piney Creek subwatershed. Riparian corridors represented in shaded green. Absent green shade represents missing or inadequate riparian buffers.

Natural and Modified Channel

Within the Piney Creek subwatershed, less than 0.25 total miles of stream have been channelized or artificially modified. There are six known locations that have been modified from their natural state in order to control stream flow around homes and roads, as shown in Figure 83a. Locations of bridges and culverts are mapped in Figure 83b.

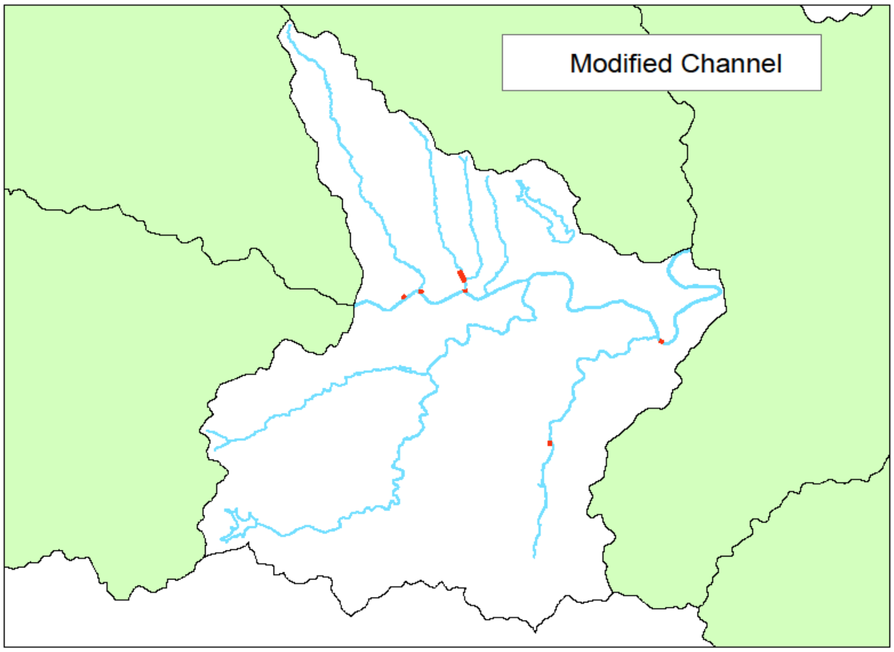


Figure 83a. Locations of modified channels within the Piney Creek subwatershed.

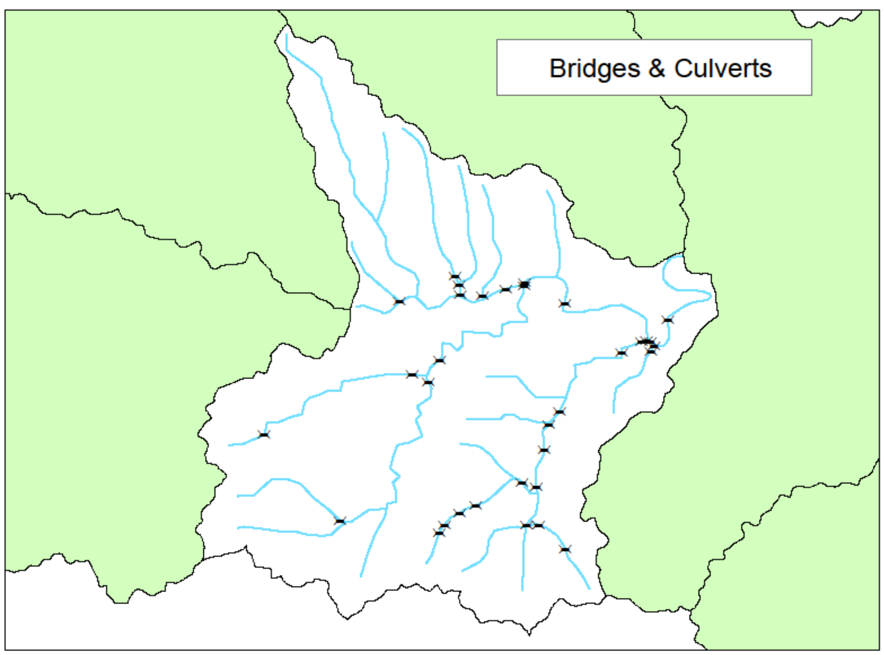


Figure 83b. Bridges and culverts located within the Piney Creek subwatershed.

Dams

Four large dams have been observed in the Piney Creek subwatershed and are mapped in Figure 84. Wilson Lake dam is on the headwaters of Piney Creek and does not have any known impacts on water quality of the creek. Two other dams are located on private property on headwater tributaries of Piney

Creek and Crabapple Creek. The fourth, and largest dam, is located at Ohio Valley Coal Company (OVCC) Powhatan No. 6 coal slurry impoundment near Captina Creek in western Washington Township. The impoundment dam was constructed on Perkins Run, a small tributary to Captina Creek. Within the Piney Creek subwatershed there are also 21 smaller dams located on private property which typically retain small farm ponds or are settling ponds used by AEC at the Century Mine. None of the smaller dams are located directly on named streams, and there is no known indication of water quality impairment due to these smaller dams within the subwatershed.

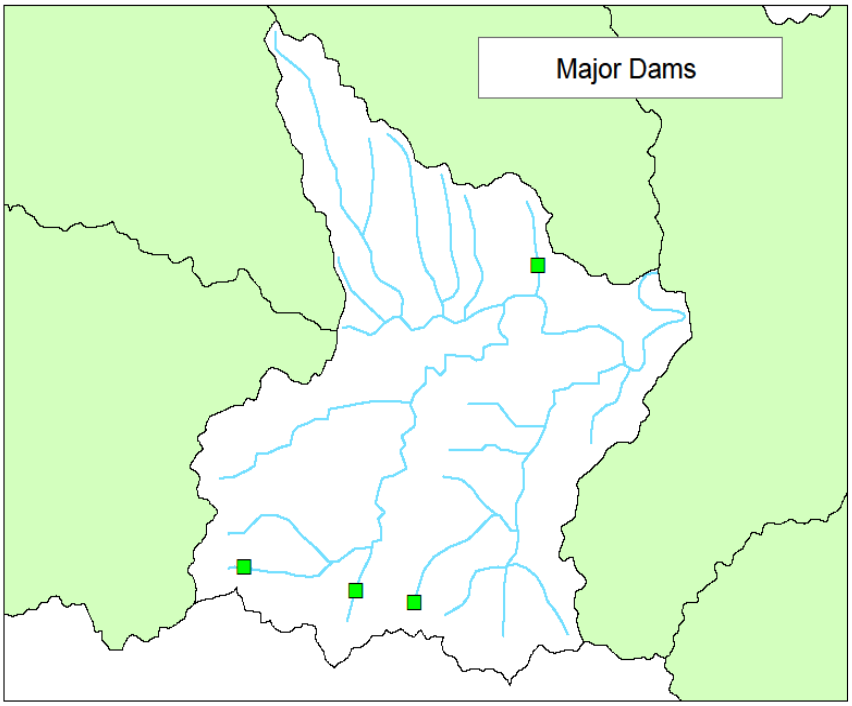


Figure 84. Major dams within the Piney Creek subwatershed.

Streams with Livestock Access

There are no known areas in the subwatershed where livestock have access to streams, although the mouth of Berrys Run is surrounded by fields containing livestock, as are some headwater streams of Long Run (Figure 85). Many livestock grazing areas are not visible from nearby roads, including the majority of Mikes Run, Berrys Run, and Piney Creek, and it is possible for livestock to have access into these streams. The majority of farms in this subwatershed are built on hilltops away from stream beds. No unrestricted livestock access has been observed within Crabapple Creek, Casey Run, or the mainstem of Captina Creek.

Figure 85. Streams with livestock access within the Piney Creek subwatershed.

Eroding Banks

Eroding banks can cause impairments to water quality by increasing sedimentation. During a visual evaluation in June of 2009 most banks that were observed were highly vegetated. However, there were areas where erosion was taking place due to lack of riparian buffer next to streams. Using aerial photography there are 27 areas that were identified for having severely eroding banks. These areas are mapped in Figure 86.

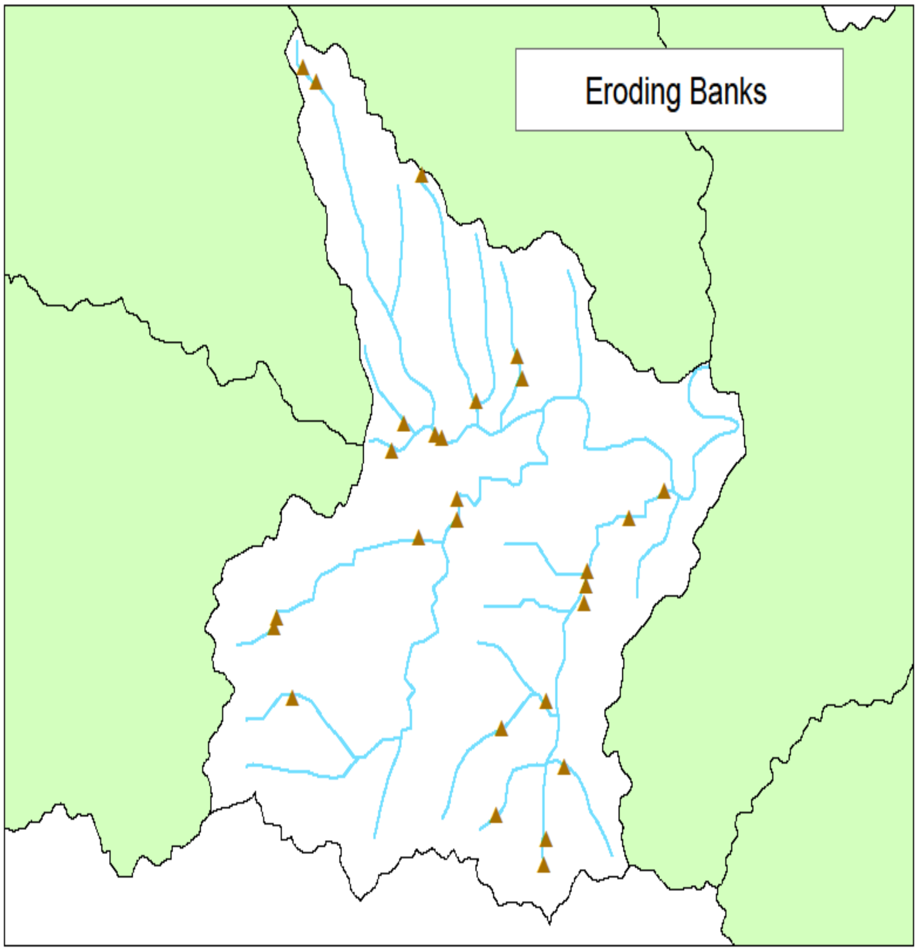


Figure 86. Locations with eroding banks in the Piney Creek subwatershed.

Highly Erodible Lands

The Piney Creek subwatershed contains 17,409.1 acres (93.6 percent) of highly erodible lands based on soil type and slope (ODNR n.d.). The estimated annual potential soil loss from these lands is summarized in Appendix C. The Captina Creek Watershed Soil Erosion Model uses a landscape-scale approach to predict soil loss in the Captina Creek watershed (Lipps 2013). It is noted that the model only takes into account sources of sediment from outside the stream channel; however, it is possible that the greatest source of sediment may be from the stream channel itself (Rabeni and Smale 1995). Section VI, Chapter 1 provides a more detailed description of soil erosion and stream sedimentation in the Captina Creek watershed.

Entrenchment

Low to moderate entrenchment exists within small sections of the mainstem of Captina Creek in this subwatershed. Entrenchment varies from wide and shallow water flowing through flood-prone areas, to sections of deep and narrow water flowing through exposed steep banks which can extend upwards over three feet above normal water levels. Most smaller tributaries under normal conditions have small flows during which the water is nearly even across the streambed to the adjacent shore. Bends in these streams have normal entrenchment along their outer sides. Hills surrounding the streams in this subwatershed area are steep to moderately steep, but relatively flat floodplains surround larger streams, especially along and near Captina Creek.

Status and Trends in the Piney Creek Subwatershed

There are no expected roads, highways, homes or businesses to be developed in this subwatershed in the foreseeable future; however, industrial development could be more significant here than any other area in the Captina Creek watershed. Two large subsurface coal mines owned by Murray Energy Corporation (Century Mine and OVCC Powhatan No. 6 Mine) reside in this subwatershed, along with a coal slurry impoundment pond. According to ODOT, a bridge on State Route 148 just east of the Century Mine train loading facility will need to be replaced in the near future. No other major work is planned along this route in the near future except for routine maintenance.

In the winter of 2010-2011, a parcel of land on the west side of the mouth of Casey Run and a parcel on the adjacent west slope of Captina Creek was cleared of timber to make way for a utility right-of-way to service AEC's Century Mine. The right-of-way is located just east of the conveyor at Century Mine. Clearing a section of forested hillside may result in increased sedimentation along a 1000-foot length of Captina Creek.

In 2008, the OVCC applied for a Section 401/404 permit to develop Casey Run into a 130 surface acre coal slurry impoundment facility that would hold over 35 million cubic yards of fine and coarse coal refuse material. The proposed #3 impoundment would be located approximately one mile west of the current Perkins Run #2 impoundment and would impact 29,928 linear feet of 72 headwater streams. Impacts of the construction and maintenance of the new impoundment could pose risks to water quality in Captina Creek and would disturb significant portions of Casey Run, which has been recommended for Class III primary headwater habitat (PHWH) by OEPA, and is capable of supporting a high diversity of cold water aquatic species (OEPA 2010). Officials from Murray Energy Corporation have commented that although the proposed impoundment would impact Casey Run, the most severe impacts would be limited to mid-sections of the stream valley with lesser impacts in the headwaters and downstream closer to the confluence with Captina Creek. Additionally, the possibility has been discussed for a drainage system placed under the slurry impoundment that would serve as a way to transport clean water from the headwater tributaries downstream without contamination (Pugh, personal communication, 2011).

In 2013, American Energy Corporation submitted a proposal to install a coal course refuse disposal area which would permanently impact several tributaries to Long Run, which drains into Piney Creek. The proposal is currently pending action by the OEPA.

As mentioned previously, in autumn of 2009 the Rocky Mountain Express (REX) natural gas pipeline was installed in the southern portion of the Piney Creek subwatershed as it exited the South Fork subwatershed on its way to the Ohio River at Clarington. The pipeline passes just north of both the hamlet of New Castle and the Raven Rocks, Inc. properties, and at the time of installation it posed threats to the water quality of localized headwater streams to Piney Creek and Long Run. These threats included increased sedimentation due to earth excavation and the number of acres of timber removed.

Table 29. Development in Piney Creek subwatershed from 2005 – 2010.

New Homes	Unknown
Feeding Operations	0
Petition Ditches	0
Levies	0

Pea Vine Creek Subwatershed – 12-digit HUC: 050103060905

Figure 87. The Pea Vine Creek subwatershed.

Table 30. Stream physical characteristics for named tributaries of Pea Vine Creek subwatershed. *Source:* USGS *StreamStats for Ohio* Online Database Ohio, 2011.

Major Tributaries	Length (miles)	Watershed Area (mi^2)	PK2(ft^3/sec) Flow/Min/Max	7Q10 (ft^3/sec)	Attainment Status	Sinuosity
Anderson Run	5.4	5.88	506*/253^/1010^	1.06	Unknown	1.1
Moore Run	4.4	3.88	379*/187^/769^	0.71	Unknown	1.2
Pea Vine Creek	6.9	9.96	701*/355^/1380^	1.82	Full	1.6
Rocky Fork	3.9	4.42	402*/199^/810^	0.76	Unknown	1.2

PK2 Description - *Denotes two year recurrence interval peak flow with a prediction error of 37% (Equivalent years of record = 2.1) ^Two-year recurrence interval peak flow at 90% prediction interval.

7Q10 Description - Seven day, ten year low flow volume based on an annual series of the smallest values of mean discharge computed over any 7-consecutive days during the annual period.

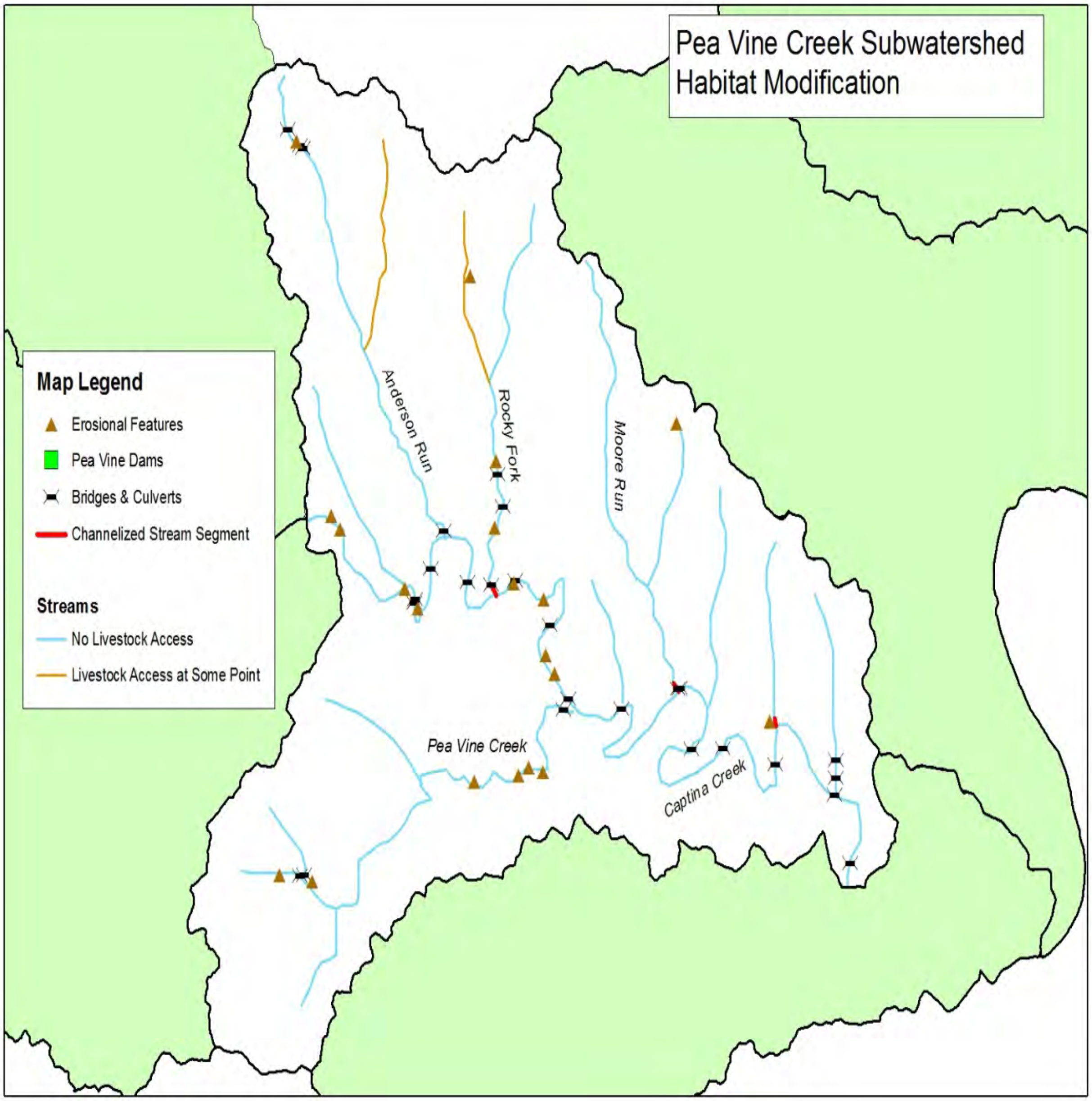


Figure 88. Notable impacts and modifications to tributaries of the Pea Vine Creek subwatershed.

Floodplain Access/Riparian Levees

<u>Channel and Floodplain Conditions</u> – Streams in the Pea Vine Creek subwatershed have access to their floodplains. Many streams wind through moderately steep to very steep slopes where no floodplain exists. Steep terrain supports the existence of waterfalls on tributaries of the north side of Captina Creek in this subwatershed area. Along the mainstem of Captina Creek the floodplain becomes wider and more defined, allowing streams easier access. The limiting factor for floodplain access is not riparian levees, but steep to very steep terrain along the side tributaries. Floodplain surrounding Captina Creek is widest on the east end of the subwatershed, allowing the creek to meander into wide bends.

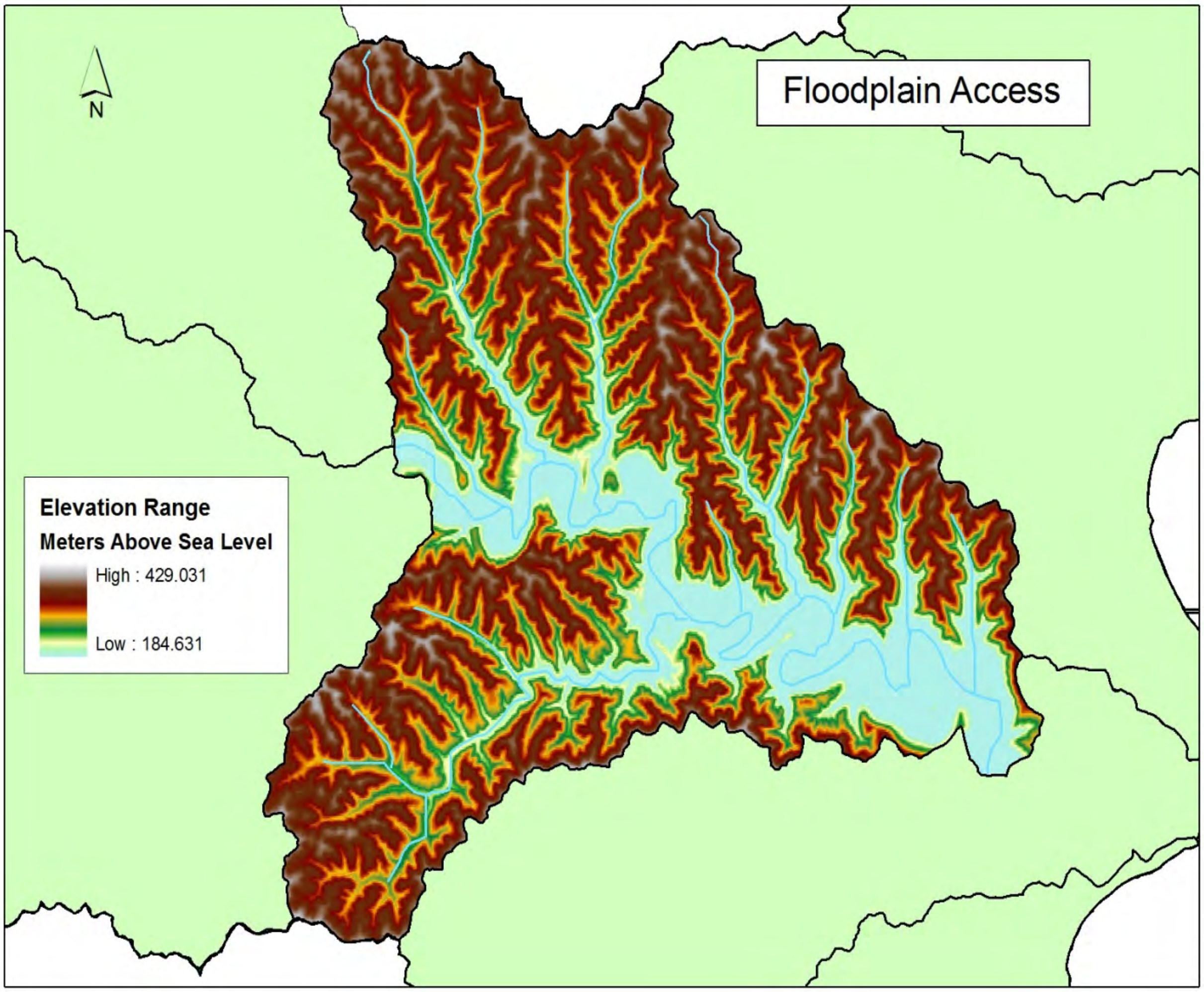


Figure 89. Floodplain access in the Pea Vine Creek subwatershed. National Elevation Dataset (NED) relief of Pea Vine Creek subwatershed showing its major tributaries.

Riparian Assessment

Forested Riparian Corridor Assessment – Most of the streams in the Pea Vine subwatershed are extensively forested and surrounded by good growths of riparian corridor (Figure 90). Some of the largest tracks of forest in the watershed region are located in this subwatershed, with an expanse along Pea Vine Creek exceeding 2,000 acres. Of the named tributaries in the subwatershed area there are 43.0 miles (88.7%) of natural riparian corridor, leaving 5.5 miles of stream with no riparian buffer zones. The mainstem of Captina Creek is more developed in this subwatershed than others, primarily due to the hamlets of Armstrongs Mills and Steinersville. Because of this development, the mainstem of Captina Creek has less riparian coverage compared to side tributaries in this subwatershed area. No land in this subwatershed is known to be in permanent protection.

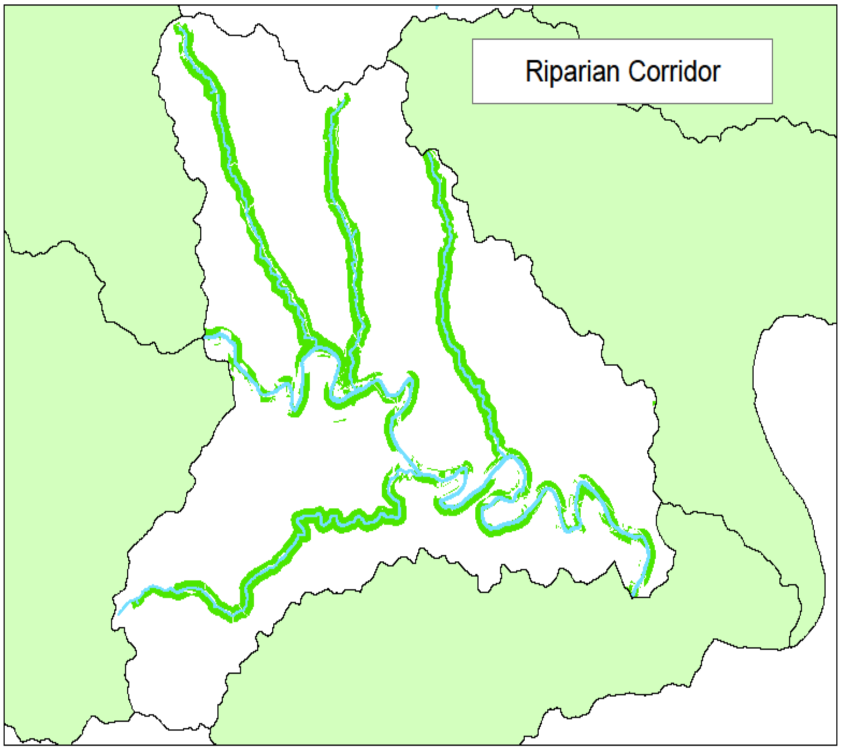


Figure 90. Riparian corridors within the Pea Vine Creek subwatershed.

Natural and Modified Channels

Within the Pea Vine Creek subwatershed, three small sections of stream have been channelized. The channelized sections are located on Captina Creek, Moore Run, and Rocky Fork and are mapped in Figure 91a. Channelized segments on Moore Run and Rocky Fork are less than 0.1 miles in length and are designed as underpasses to allow both tributaries entrance into Captina Creek from under State Route 148. Locations of documented bridges and culverts are mapped in Figure 91b.

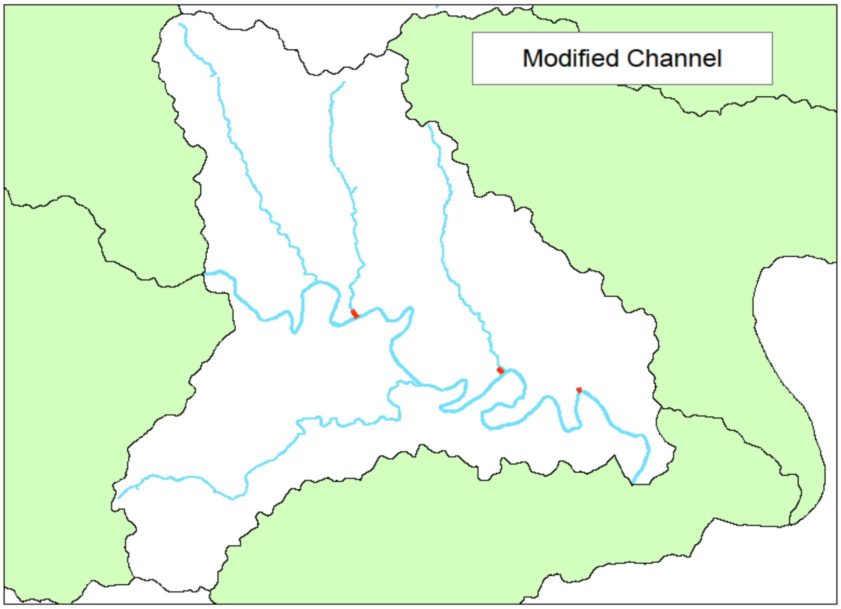


Figure 91a. Modified channels within the Pea Vine Creek subwatershed.

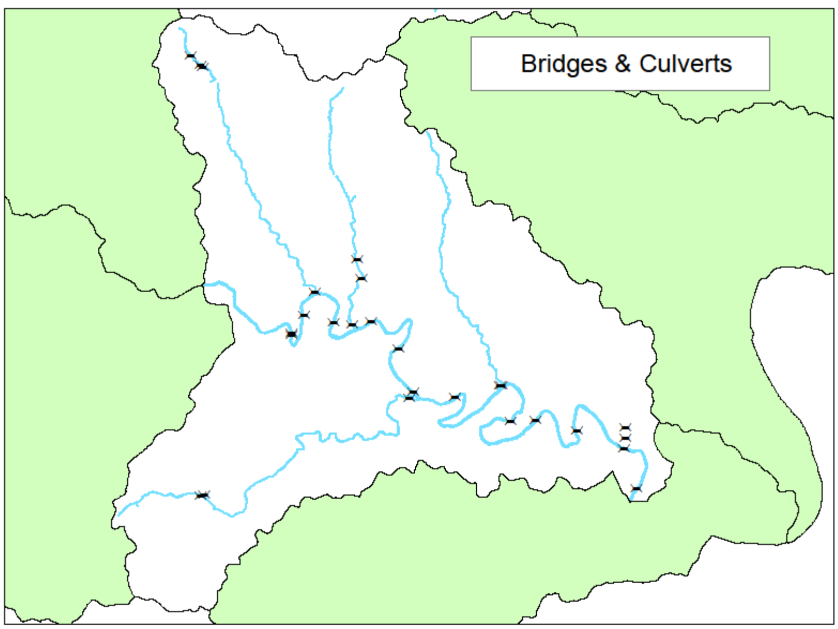


Figure 91b. Bridges and culverts located within the Pea Vine Creek subwatershed.

Dams

There are no large dams within the Pea Vine Creek subwatershed, but there are 25 smaller dams heading private ponds of two acres or less and settling ponds for AMD around Linn Tipple, the Cravat reclamation site, and former Powhatan No. 5 coal mine (Figure 92). Most small dams are on landowner’s property near agricultural fields and are not built along major streams. A series of private fishing ponds, created from strip pits for recreation and named Lake Shawn, exist in west-central York Township just east of

Linn Tipple. A bridge crossing the mainstem of Captina Creek in a remote area of Section 21 in York Township is partially obstructing the flow of water. The bridge (Figure 92) is part of an abandoned access road connecting State Route 148 to a limestone gravel pit and located on the north side of the railroad tracks in Section 21. There is no known indication of water quality impairment due to the bridge nor the smaller dams within the subwatershed.

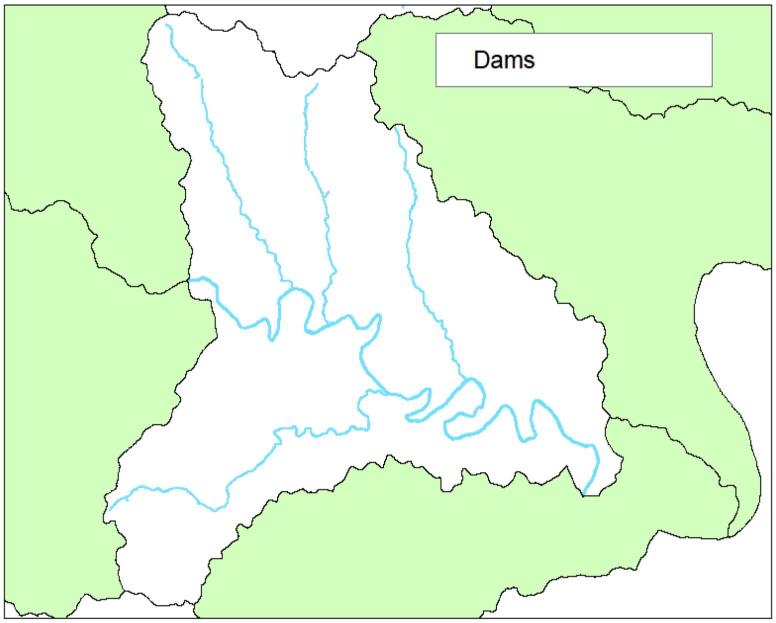


Figure 92. Major dams located within the Pea Vine Creek subwatershed. No major dams exist in this subwatershed.

Figure 93. A 20-foot culvert passes under this access bridge across Captina Creek in York Township.

Streams with Livestock Access

There is one known area where livestock potentially have access to a stream, located near the headwaters of a tributary to Rocky Fork (Figure 94). Many livestock grazing areas are not visible from nearby roads, and it is possible for livestock to have access into streams in other locations that are not known. The amount of livestock at this location is not known.

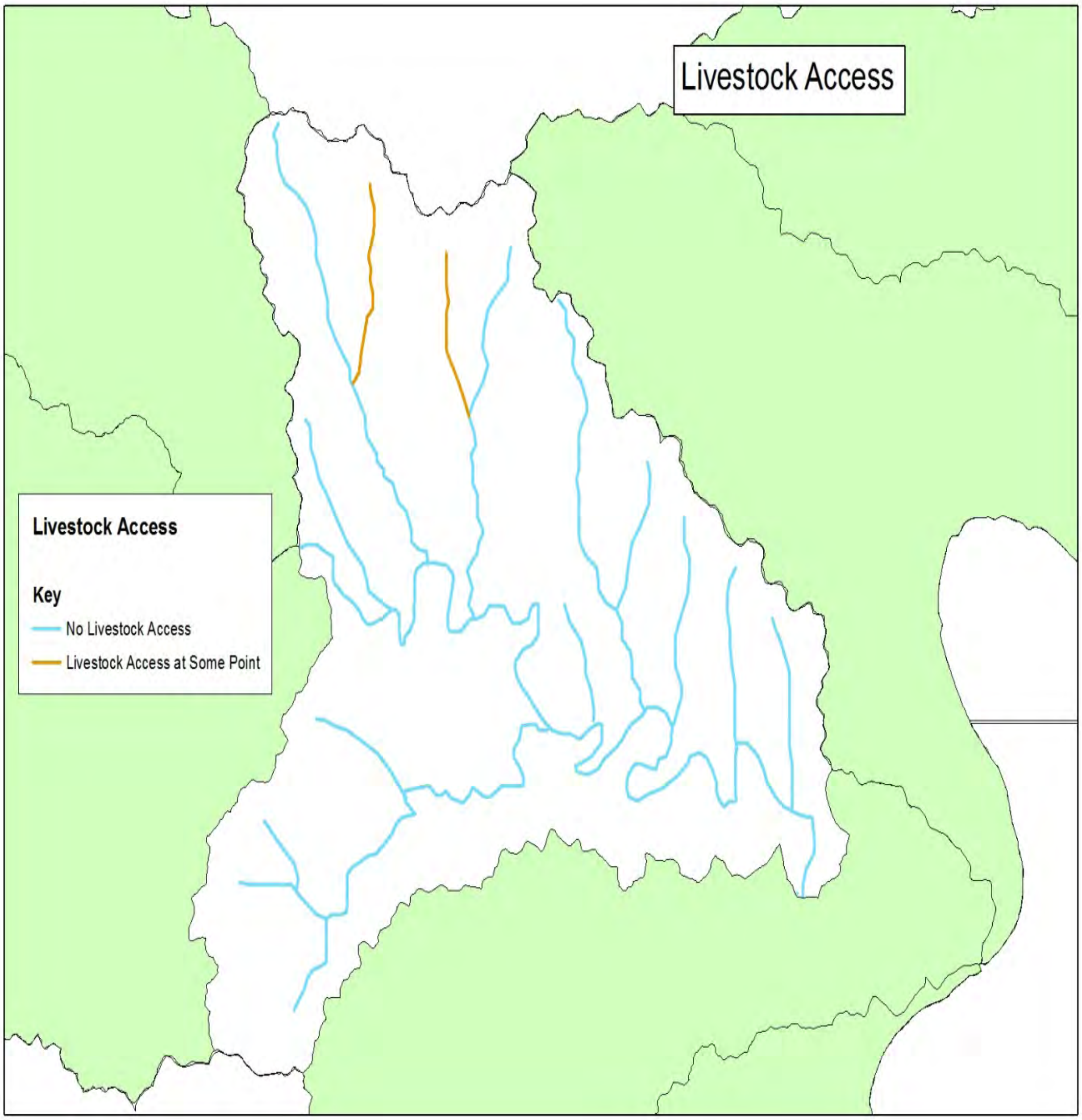


Figure 94. Livestock access within the Pea Vine Creek subwatershed.

Eroding Banks

Eroding banks can cause impairments to water quality by increasing turbidity in water columns. During a visual evaluation in June 2009, most banks observed in the Pea Vine subwatershed were highly vegetated. However, there are some locations where erosion was taking place due to fields located next to streams with no riparian buffer. There are 18 areas with severely eroding banks, mapped in Figure 95.

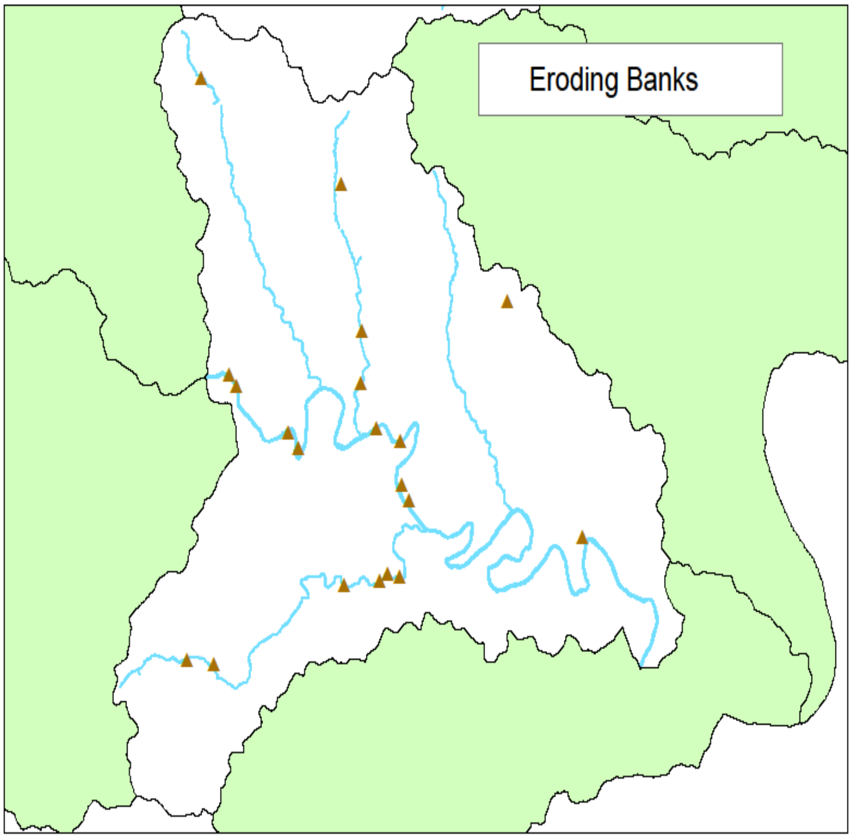


Figure 95. Locations of eroding banks within the Pea Vine Creek subwatershed.

Highly Erodible Lands

The Pea Vine Creek subwatershed contains 22,660.8 acres (93.2 percent) of highly erodible lands based on soil type and slope (ODNR n.d.). The estimated annual potential soil loss from these lands is summarized in Appendix C. The Captina Creek Watershed Soil Erosion Model uses a landscape-scale approach to predict soil loss in the Captina Creek watershed (Lipps 2013). It is noted that the model only takes into account sources of sediment from outside the stream channel; however, it is possible that the greatest source of sediment may be from the stream channel itself (Rabeni and Smale 1995). Section VI, Chapter 1 provides a more detailed description of soil erosion and stream sedimentation in the Captina Creek watershed.

Entrenchment

Headwater streams in the Pea Vine Creek subwatershed are not naturally entrenched. Some entrenchment occurs in streams affected by ATV traffic, as discussed in the section titled *Status and Trends*. Most streams under normal conditions have small flows where the water is nearly even across the streambed to the adjacent shore. Bends in streams exhibit normal entrenchment along their outer sides. Hills surrounding streams in this subwatershed are moderately steep to steep but relatively flat floodplains surround the downstream sections of larger streams and the mainstem of Captina Creek. Low to moderate entrenchment exists within small sections of Captina Creek and varies from wide and shallow through flood-prone areas to deep and narrow sections with exposed banks over three feet above normal water levels.

Status and Trends in the Pea Vine Creek Subwatershed

In 2013, ODOT straightened portions of State Route 148 in this portion of the Captina Creek watershed. According to ODOT, a bridge on SR 148 over Captina Creek near the Horseshoe Bend Golf Course will need to be replaced in the near future. No other major work is planned along this route in the near future except for routine maintenance. As mentioned previously, in autumn of 2009 the Rocky Mountain Express (REX) natural gas pipeline was installed in the southern portion of the subwatershed as it exited the Piney Creek subwatershed on its way to the Ohio River at Clarington. The pipeline passes south of the hamlets of Crabapple and Clover Ridge, and at the time it posed threats to the water quality of headwater streams of Pea Vine Creek. These threats included increased sedimentation due to earth excavation and the number of acres of timber removed. In addition, the installation of an interstate pipeline (Ohio Pipeline Energy Network –OPEN Expansion Project) has been proposed to run north and south through the Pea Vine Creek subwatershed, also crossing Captina Creek. If approved, construction is planned for 2015.

Table 31. Development in the Pea Vine Creek subwatershed from 2005 – 2010.

New Homes	2
Feeding Operations	0
Petition Ditches	0
Levies	0

Gas wells tapping reservoirs in the Marcellus Shale formation have been recently established in the Pea Vine Creek subwatershed. Drilling for natural gas reserves in the Marcellus and Utica shale formations is expected to increase throughout the Captina Creek watershed region in the near future.

Areas of minimal human impact are scattered along the mainstem of Captina Creek from Armstrongs Mills to Steinersville. A golf course is managed with conservation practices in mind while private residences and some agriculture boarder the creek, but most of the land use is deciduous forest. Like those located in the Bend Fork subwatershed, tributaries of the Pea Vine Creek subwatershed are also common locations for extensive ATV recreation, especially Anderson Run and Pea Vine Creek where numerous trails pass through the streams multiple times. Figure 96 illustrates damage caused to streambanks by ATV traffic in Anderson Run. Major traffic in these streams sometimes corresponds to holidays in the spring and summer when dozens of vehicles travel through creeks in a given day. The presence of logging access trails may amplify ATV activity by allowing easier access to remote, forested creeks. In some cases these trails also may complicate law enforcement of ATV traffic because they pass through property parcels in which owners are in disagreement about allowing ATV access.

Figure 96. An all-terrain vehicle (ATV) trail along Anderson Run *(left)* and excessive sedimentation caused by ATV traffic passing through a small tributary to Anderson Run *(right)*.

A local resident has expressed interest in constructing a canoe livery in this subwatershed along with another livery further downstream in the Cat Run subwatershed in order to increase outdoor recreation opportunities; however, no specific locations have been determined for the liveries. Given the large variation in stream volume throughout the year it is unclear whether such a venture will be successful. More studies need to be carried out to determine the impact of potentially increased canoe traffic on the streambed and its inhabitants.

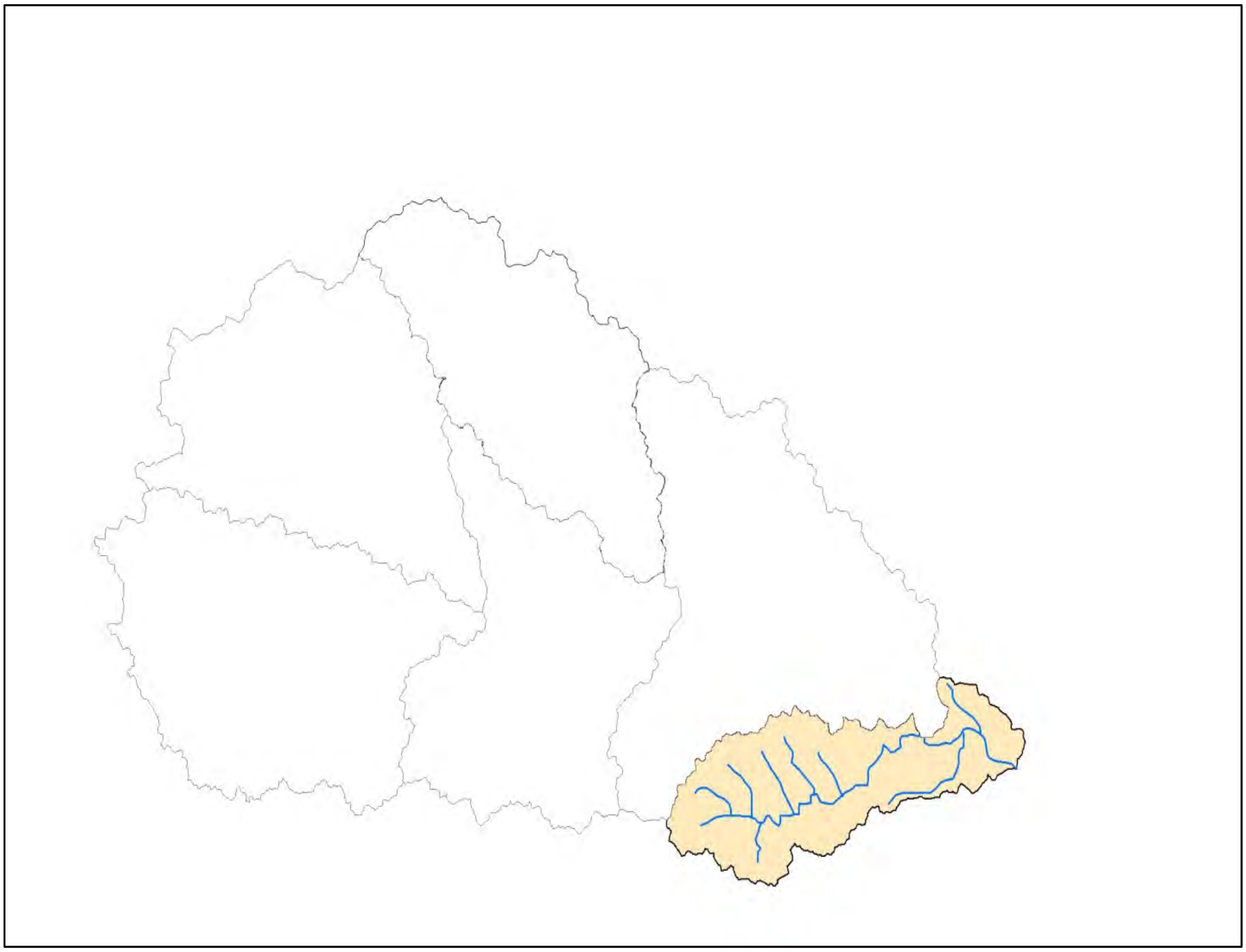


Figure 97. The Cat Run subwatershed.

Table 32. Stream physical characteristics for named tributaries of Cat Run subwatershed. *Source:* USGS *StreamStats for Ohio* Online Database Ohio, 2011.

Major Tributaries	Length (miles)	Watershed Area	PK2(ft^3/sec) Flow/Min/Max	7Q10 (ft^3/sec)	Attainment Status	Sinuosity
Cat Run	7.2	12.9	875*/446^/1720^	2.50	Partial/Full	1.3
Porters Run	2.9	1.37	177*/84.6^/372^	0.25	Unknown	1.4

PK2 Description - *Denotes two year recurrence interval peak flow with a prediction error of 37% (Equivalent years of record = 2.1) ^Two-year recurrence interval peak flow at 90% prediction interval.
7Q10 Description - Seven day, ten year low flow volume based on an annual series of the smallest values of mean discharge computed over any 7-consecutive days during the annual period.

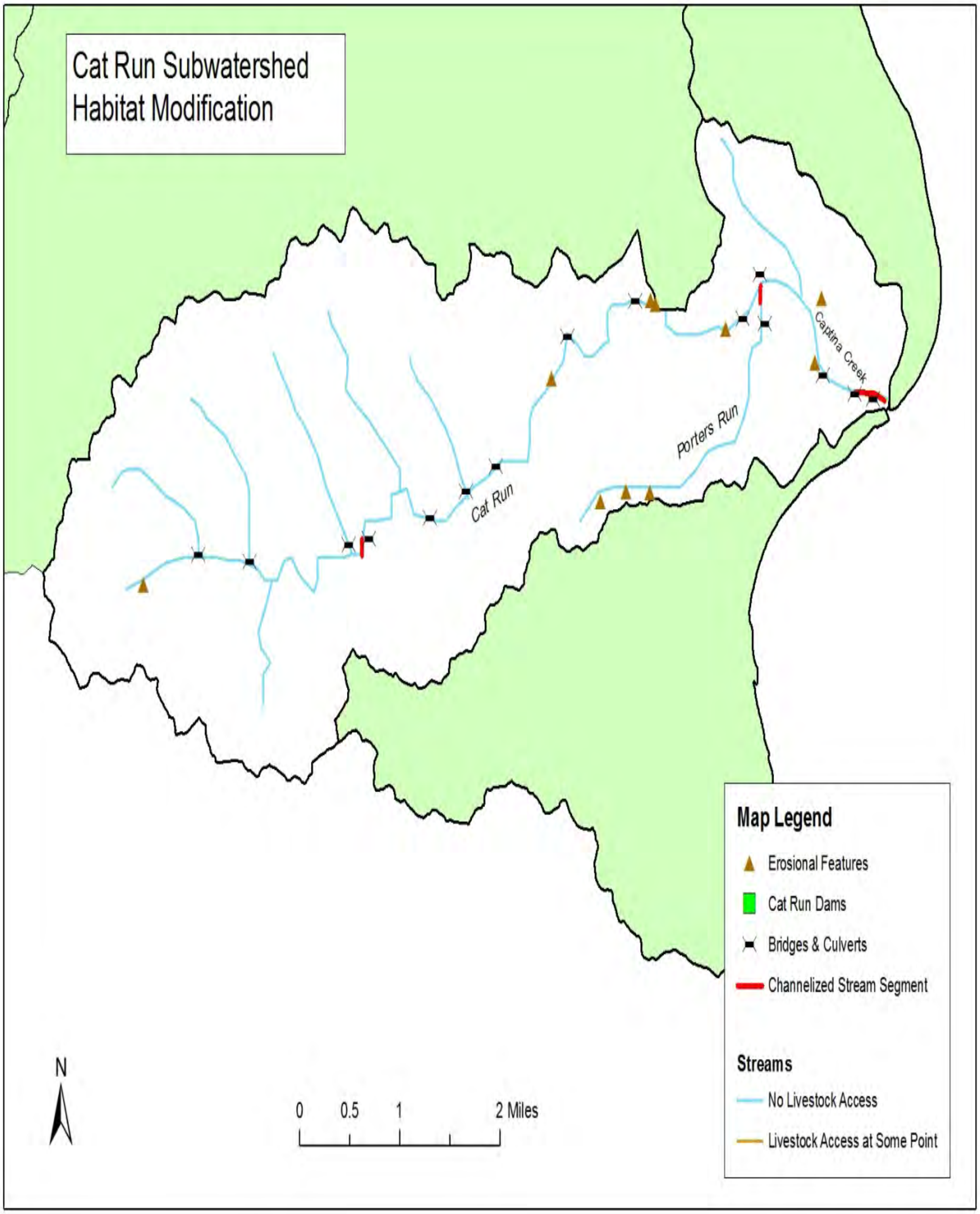


Figure 98. Notable impacts and modifications to tributaries in the Cat Run subwatershed.

Floodplain Access/Riparian Levees

Channel and Floodplain Conditions – Streams in the Cat Run subwatershed have the best access to their floodplains of any of the subwatershed areas in the Captina Creek watershed region due to their close proximity to the Ohio River (Figure 99). The eastern end of the subwatershed area has valleys that are broad and wide; however, valleys of the western end are moderately steep to very steep with narrow ridgetops. Some of the highest elevation terrain is contained in this subwatershed area, with several knobs approaching 1,400 feet above sea level. Captina Creek in this region has a broad, well defined floodplain and is under the influence of the Ohio River year-round in terms of water flow and depth. Due to these characteristics, areas in the Cat Run subwatershed are prone to river flooding more than locations in other subwatersheds. The limiting factor for floodplain access is not riparian levees, but steep to very steep terrain in the upstream sections of Cat Run and Porters Run.

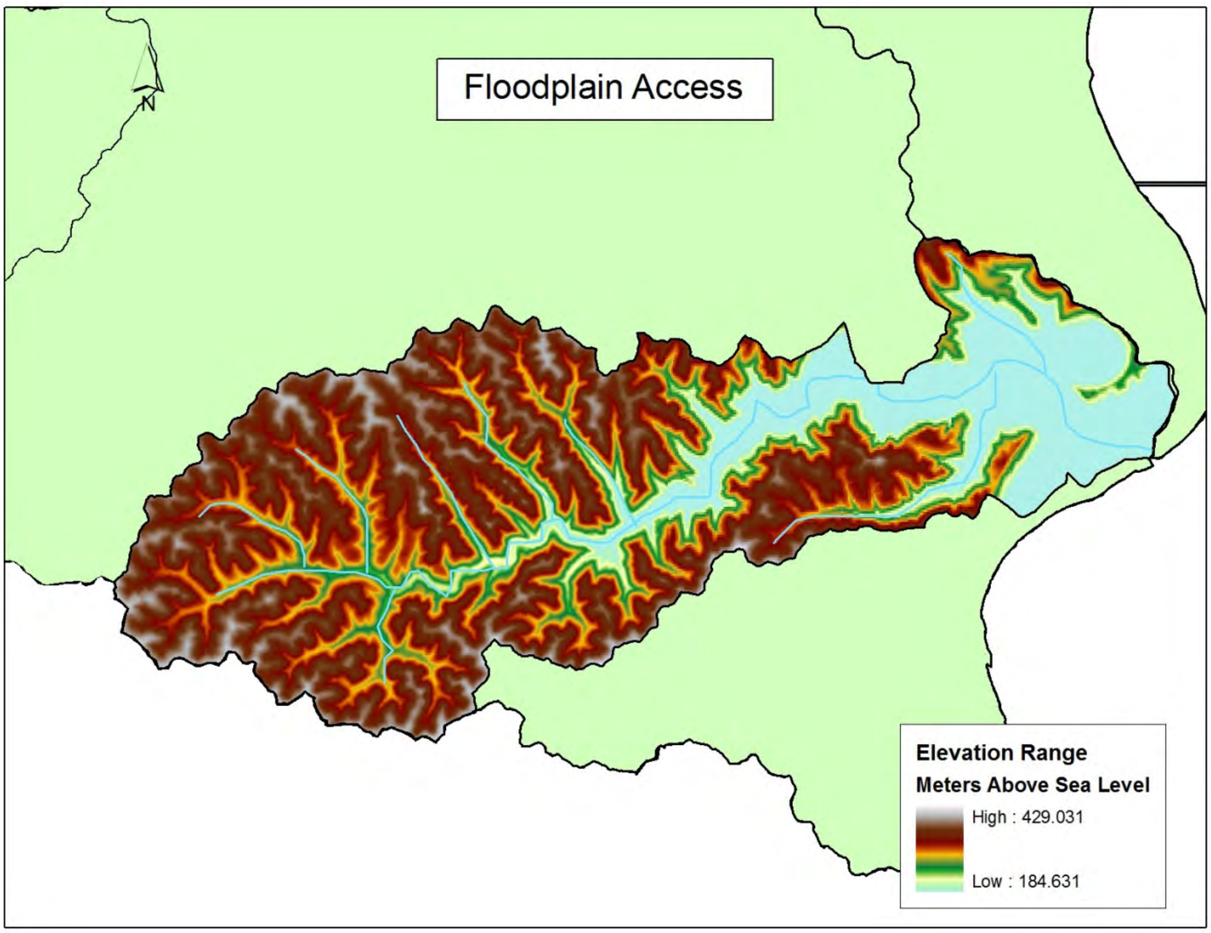


Figure 99. Floodplain access in the Cat Run subwatershed. National Elevation Dataset (NED) relief of Cat Run subwatershed area shows its major tributaries.

Riparian Assessment

Forested Riparian Corridor Assessment – Most of the streams in the Cat Run subwatershed are heavily forested and surrounded by good growths of riparian corridor (Figure 100). Of the major named tributaries there are 17.7 miles (85.5%) of natural riparian corridor leaving a combined 3 total miles of streams with no riparian buffer. All tributaries to Cat Run are heavily forested. Captina Creek passes through the village of Powhatan Point and encounters more urban development here than any other location along its length. Captina Creek does not have the same appearance in this sub-watershed as in others in terms of flow and depth due to its influence by the Ohio River. None of the land in this subwatershed is known to be in permanent protection.

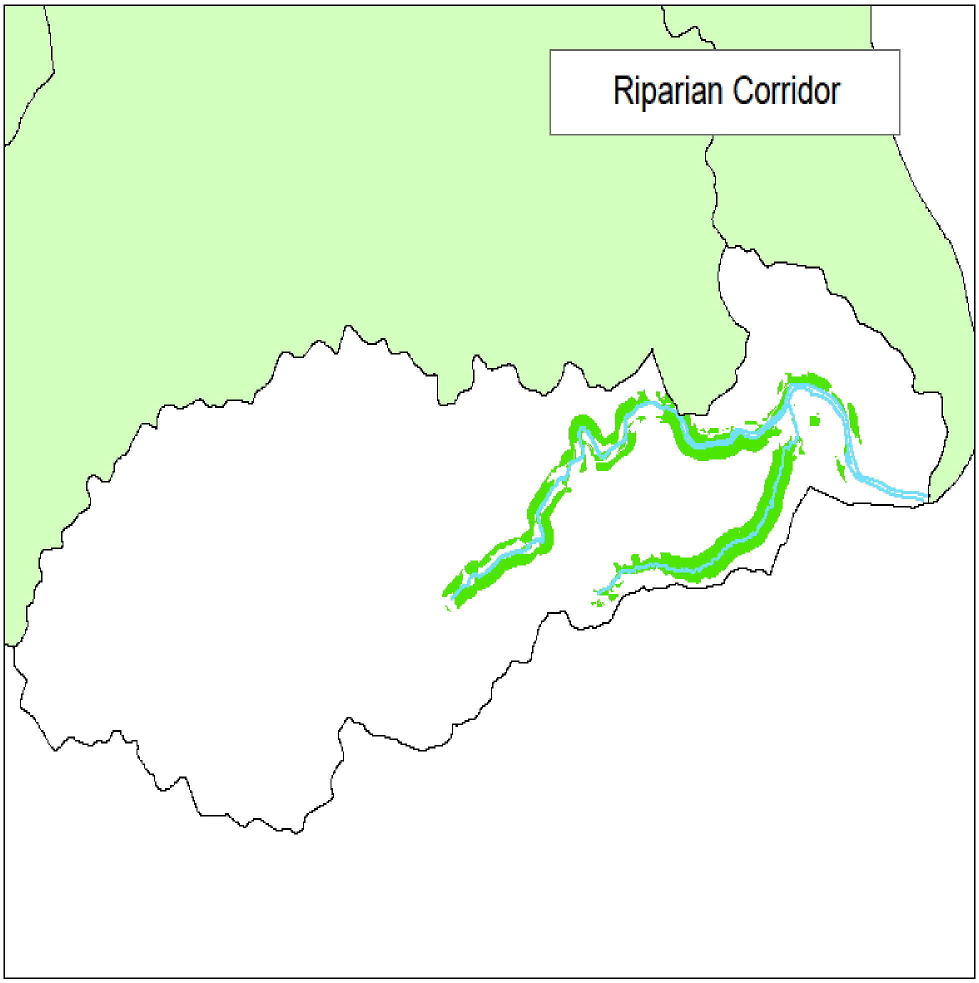


Figure 100. Riparian corridors in the Cat Run subwatershed.

Natural and Modified Channel

Two sections of stream channel are artificially modified in the Cat Run subwatershed, as illustrated in Figure 101a. Porters Run is culverted under a road near Captina Creek, and an upstream section of Cat Run is modified near a bridge and a piece of property along Switzerland Township Road 199 in Monroe County (Figure 101b). The mouth of Captina Creek is channelized near the locations of two bridges in Powhatan Point.

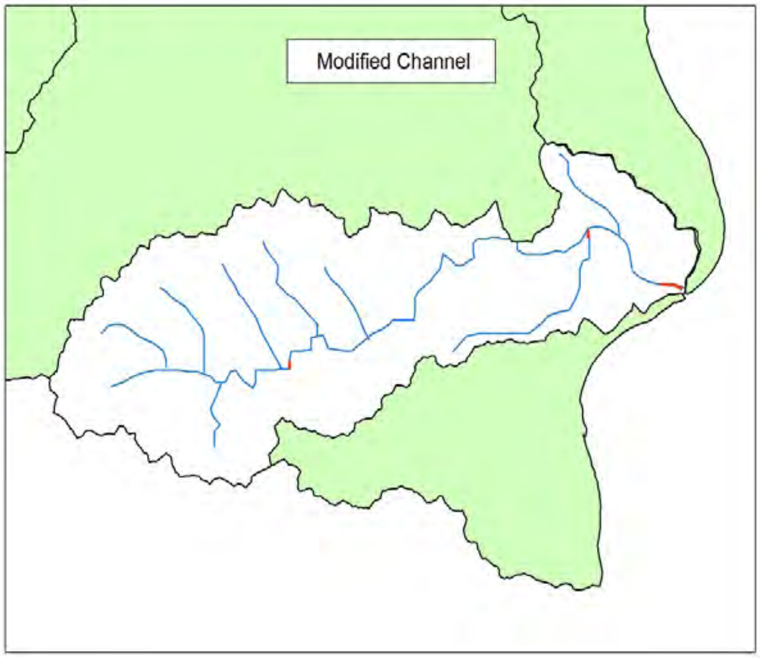


Figure 101a. Modified channels within the Cat Run subwatershed.

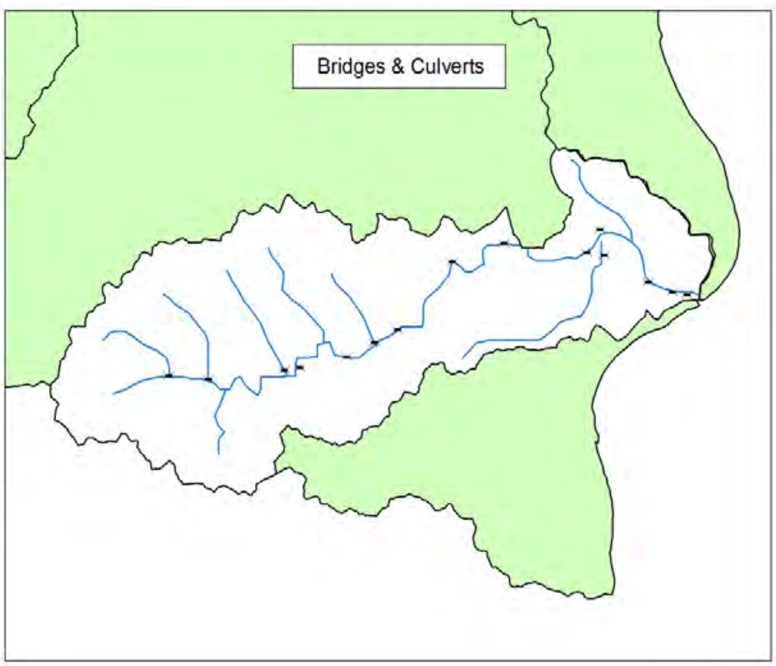


Figure 101b. Bridges and culverts within the Cat Run subwatershed.

Dams

There are no large dams within the Cat Run subwatershed area; however, there are 24 smaller dams identified using aerial photography. Smaller dams consist of private ponds in agricultural fields and AMD settling ponds along Cove Road west of Powhatan Point (Figure 102). None of the dams are located on streams, and there is no known indication of water quality impairment within the subwatershed due to these smaller dams.

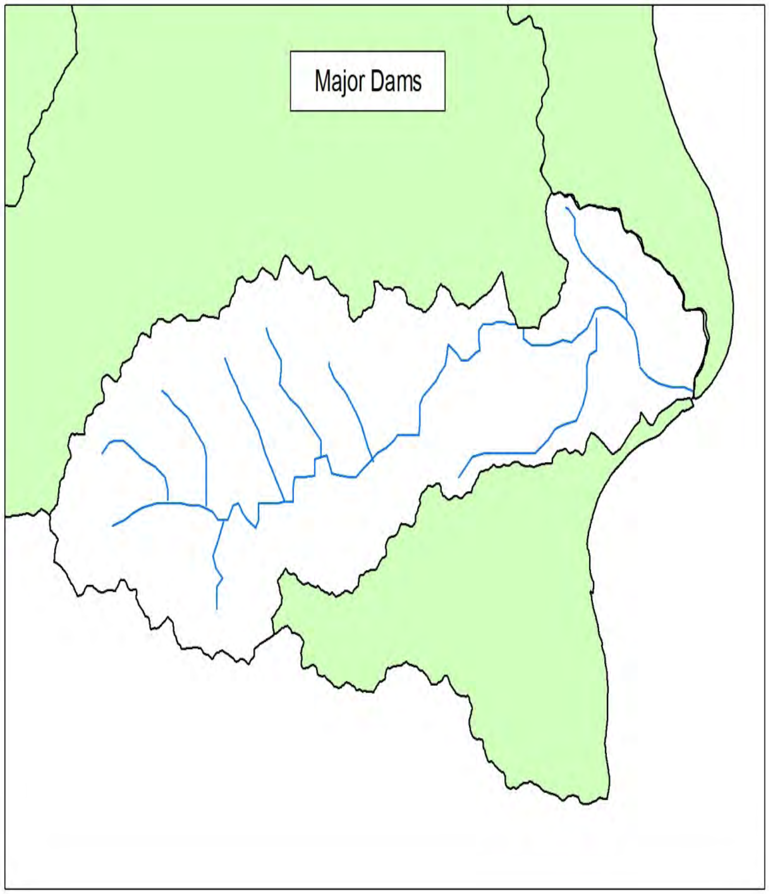


Figure 102. Major dams located within the Cat Run subwatershed. No major dams are located within this subwatershed.

Streams with Livestock Access

Though livestock are prevalent along Cat Run, no locations exist where they have unrestricted access to the stream (Figure 103). All fields along the stream have fencing on or near the creek bank.

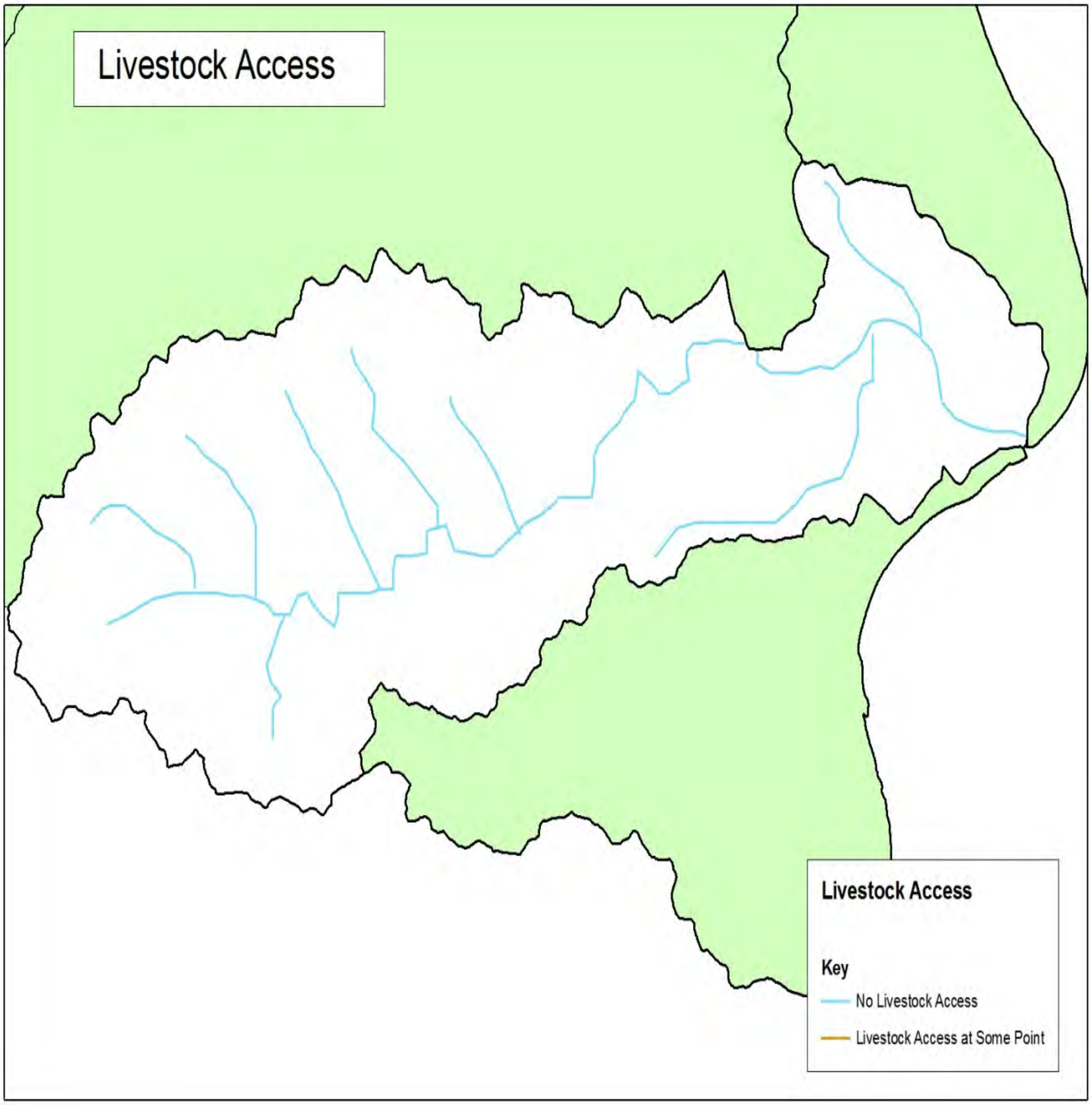


Figure 103. Livestock access within the Cat Run subwatershed.

Eroding Banks

Eroding banks can cause impairments to water quality by increasing turbidity in the water column. During a visual evaluation in June 2009, most observed banks were highly vegetated, although there were several banks where erosion was taking place due to agricultural fields being located next to streams with no riparian buffer. Nine areas in the subwatershed stand out for severely eroding banks on the most recent aerial photographs. These sites are mapped in Figure 104.

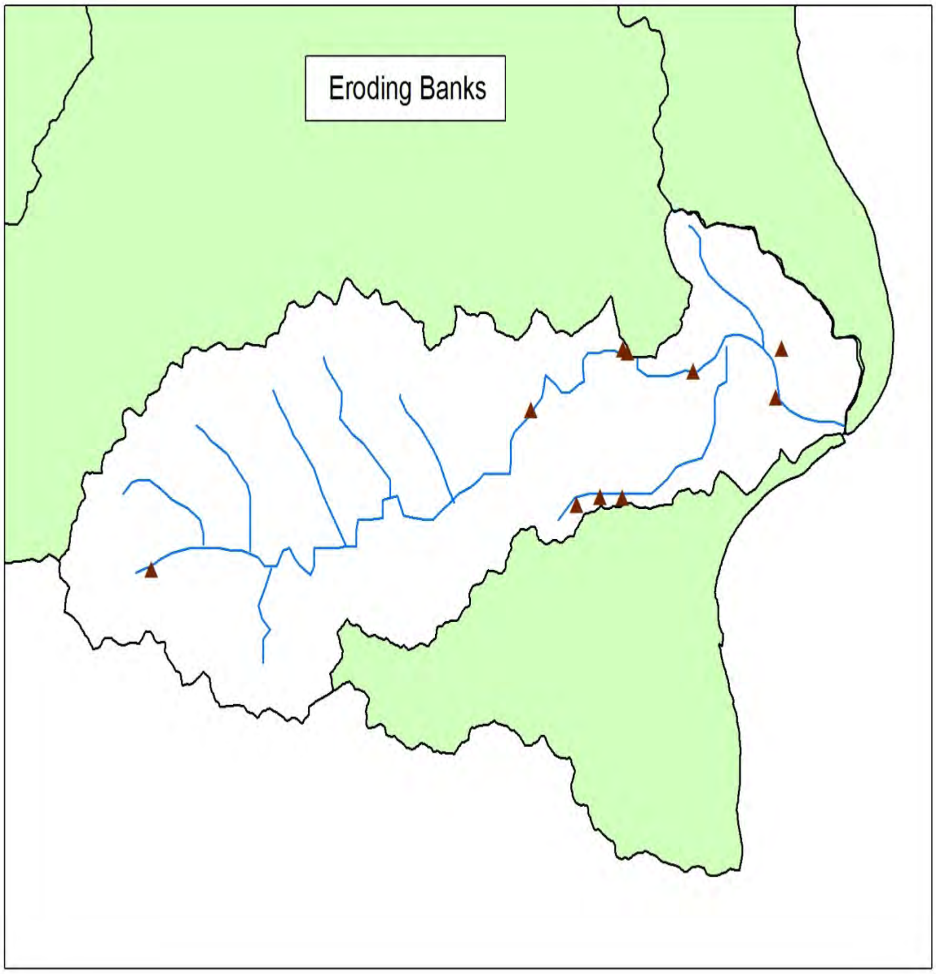


Figure 104. Eroding banks within the Cat Run subwatershed.

Highly Erodible Lands

The Cat Run subwatershed contains 10,474.8 acres (93.9 percent) of highly erodible lands based on soil type and slope (ODNR n.d.). The estimated annual potential soil loss from these lands is summarized in Appendix C. The Captina Creek Watershed Soil Erosion Model uses a landscape-scale approach to predict soil loss in the Captina Creek watershed (Lipps 2013). It is noted that the model only takes into account sources of sediment from outside the stream channel; however, it is possible that the greatest source of sediment may be from the stream channel itself (Rabeni and Smale 1995). Section VI, Chapter 1 provides a more detailed description of soil erosion and stream sedimentation in the Captina Creek watershed.

Entrenchment

Cat Run and Porter's Run are not entrenched; flows within these tributaries are small with water levels being even across the streambed to the adjacent shore. The mainstem of Captina Creek is slightly entrenched as it approaches Powhatan Point. The floodplain narrows somewhat as Captina Creek approaches the river.

Status and Trends in the Cat Run Subwatershed

Cat Run subwatershed has many houses near the streams, and much more people living in the entire subwatershed area compared to other sparsely populated subwatersheds. Powhatan Point is located on the confluence of Captina Creek and the Ohio River. The population is the most concentrated north of the creek and scattered near the banks of Captina Creek. There is also a golf course constructed on the western edge of Powhatan Point. Few livestock and agriculture practices exist in this area and seemed to be concentrated along Cat Run near the Belmont/Monroe county line.

There are no expected roads or highways to be constructed in Cat Run subwatershed in the foreseeable future. The installation of an interstate pipeline (Ohio Pipeline Energy Network –OPEN Expansion Project) has been proposed to run north and south through the Cat Run subwatershed. If approved, construction is planned for 2015. Potential water quality threats include increased sedimentation due to earth excavation and the number of acres of timber removed.

Recently, the Switzerland of Ohio School District constructed a new elementary school near Captina Creek west of Powhatan Point. Additionally, the Ohio Riverfront Development Committee (ORDC) has secured a grant to fund the construction of a fishing pier which will be located on the Ohio River just below the mouth of Captina Creek. The installation of a canoe livery has also been discussed upstream of the marina to increase recreational opportunities in the area.

The Cat Run subwatershed is the most active in terms of aquatic recreation due to its proximity to the Ohio River. Under normal conditions, small watercraft can travel upstream nearly four miles from the mouth of Captina Creek, provided they can clear the State Route 7 overpass. The Powhatan Marina is located near the mouth of the creek and is a launching area for watercraft.

According to OEPA's 2009 assessment, small waterfalls along Cat Run are keeping the stream from full aquatic habitat attainment status by acting as a fish barrier. One citizen in Powhatan Point has complained of eroding banks along the mainstem of Captina Creek, supposedly caused by boat traffic near the village marina. Complaints have also been made about people dumping grass and brush into the creek near the marina.

Table 33. Development in the Cat Run subwatershed from 2005 – 2010.

New Homes	Unknown
Feeding Operations	0
Petition Ditches	0
Levies	0

Section V: Water Quality Inventory

During the summers of 2008, 2009 and 2010, OEPA biologists conducted water quality evaluations of selected tributaries in the Captina Creek watershed to determine aquatic life use designation status and aquatic life attainment status. Aquatic life use designations are assigned to individual water bodies according to their ability to support and reach the goals of an aquatic life use, based on chemical, physical and biological criteria. The status of a particular water body can be in full, partial or non-attainment of its designated life use based on the criteria set for each life use. Beneficial life use designations are also assigned to water bodies for recreational and water supply uses (USEPA 2013). A summary of Ohio's beneficial life use designations is provided in Table 34. The watershed region lies within the Central Ohio River Tributaries area. Results of the OEPA study are summarized in Table 35 and Figure 105. Use attainment statuses for Captina Creek and selected tributaries are summarized in Table 36. Table 37 summarizes the number of threatened stream miles in the Captina Creek watershed region and Table 38 summarizes the causes for partial or nonattainment status for specific streams or stream segments. Figure 106 and Table 39 illustrate the full, partial and unknown attainment statuses of Captina Creek and selected tributaries within the watershed. Recreational use attainment statuses are illustrated in Figure 107.

Table 34. Ohio's beneficial life use designations to protect aquatic life, recreation and water supplies and their key attributes (USEPA 2004).

To protect:	**Beneficial Use Designation**	**Key Attributes**
Aquatic Life	Coldwater habitat (CWH)	native cold water or cool water species; put-and-take trout stocking
	Seasonal salmonid habitat (SSH)	supports lake run steelhead trout fisheries
	Exceptional warmwater habitat (EWH)	unique and diverse assemblage of fish and invertebrates
	Warmwater habitat (WWH)	typical assemblages of fish and invertebrates, similar to least impacted reference conditions
	Limited warmwater habitat (LWH)	temporary designations based on 1978 Water Quality Standards and not subjected to use attainability analysis; this designation is being phased out
	Modified warmwater habitat (MWH)	tolerant assemblages of fish and macroinvertebrates, but otherwise similar to WWH; irretrievable condition precludes complete recovery to reference condition
	Limited resource waters (LRW)	fish and macroinvertebrates severely limited by physical habitat or other irretrievable condition
Recreation	Bathing waters (BW)	bathing beach with lifeguards/bath house; greatest potential exposure to bacteria

To protect:	**Beneficial Use Designation**	**Key Attributes**
	Primary contact recreation (PCR)	water depth allows full body immersion; high proximity to residential areas; intermediate potential exposure to bacteria
	Secondary contact recreation (SCR)	water depth precludes full body immersion; low proximity to residential areas; lowest potential exposure to bacteria
Water supply	Public water supply	all waters within 500 yards of all public water supply surface water intakes, all publicly owned lakes and reservoirs, all privately owned lakes and reservoirs used as a drinking water source, all emergency water supplies
	Agricultural water supply	water used, or potentially used, for livestock watering and/or irrigation
	Industrial water supply	water used for industrial purpose

Table 35. Aquatic life use designations (based on OEPA 1978, 1985, 2008 and 2009 water quality data for selected tributaries within the watershed) (OEPA 2010).

Symbology

- (+) Existing use from previous testing
- (▲) New recommended use based on 2009 sampling
- (*) 1978 and 1985 water quality standards
- (o) confirmed without biological assessment

Water Body Segment	**Use Designations**												
		Aquatic Life Habitat						**Water Supply**			**Recreation**		
	SRW	WWH	EWH	MWS	SSH	CWH	LRW	PWS	AWS	IWS	BW	PCR	SCR
Captina Creek (RM 25.2 - RM 0.8)			+						+	+		+	
Captina Creek (RM 0.8 - mouth)		+							+	+		+	
Cat Run		+							+	+		▲	
Moore Run		*							*	*		*	
Pea Vine Creek			▲			▲			+	+		+	
Rocky Fork		*							*	*		*	
Anderson Run		*							*	*		*	
Bend Fork (HW to Joy Fork)		+							+	+		+	
Bend Fork (Joy Fork			+						+	+		+	

Water Body Segment	Use Designations												
		Aquatic Life Habitat						Water Supply			Recreation		
	S R W	W W H	E W H	M W S	S S H	C W H	L R W	P W S	A W S	I W S	B W	P C R	S C R
to mouth)													
Millers Run		*							*	*		*	
Joy Fork						▲			+	+		+	
Packsaddle Run		*							*	*		*	
Crabapple Creek			▲			▲			*	*		*	
Piney Creek						▲			*	*		*	
Long Run			▲						+	+		+	
Casey Run						▲			*	*		*	
Berrys Run		*							*	*		*	
Reeves Hollow		*							*	*		*	
Mikes Run		*							*	*		*	
South Fork Captina Creek			+						+	+		+	
Brushy Creek		*							*	*		*	
Flag Run		*							*	*		*	
Cranenest Creek		*							*	*		*	
Millers Run		*							*	*		*	
Slope Creek		*						o	*	*		*	
North Fork Captina Creek (HW to Long Run)		+							+	+		+	
North Fork Captina Creek (Long Run to mouth)			+						+	+		+	
Jakes Run			▲			▲							
Long Run		+							+	+		*	
Little Captina Creek		*							*	*		*	
Pipe Creek		▲							+	+		+	
Big Run (Belmont Co.)		▲							+	+		+	
Wegee Creek		▲							+	+		+	
Big Run (Monroe Co.)		N/A											
Blair Run		N/A											

SRW = state resource water; WWH = warmwater habitat; EWH = exceptional warmwater habitat; MWH = modified warmwater habitat; SSH = seasonal salmonid habitat; CWH = coldwater habitat; LRW = limited resource water; PWS = public water supply; AWS = agricultural water supply; IWS = industrial water supply; BW = bathing water; PCR = primary contact recreation; SCR = secondary contact recreation; HW= head waters.

Findings from Ohio EPA Sampling of Tributaries in the Captina Creek Watershed Region

The following list was compiled from the OEPA's test results for water quality in selected tributaries in the Captina Creek watershed region between 2009 and 2010:

- North Fork Captina Creek (from confluence with Long Run to mouth), Bend Fork (from confluence with Joy Fork to the mouth) and the mainstem of Captina Creek (from the confluence of the North and South Forks to RM 0.8 at the SR 7 bridge) should all retain EWH status
- North Fork Captina Creek (from confluence with Long Run to headwaters), Cat Run and Long Run (North Fork trib.) should retain existing WWH status
- Bend Fork (from headwaters to confluence with Joy Fork) and South Fork Captina Creek are recommended for EWH status
- Joy Fork, Piney Creek and Casey Run are recommended for CWH designation with upstream portions of Casey Run recommended for class III PHWH (primary headwater habitat) designation based on macroinvertebrate taxa and coldwater fish species sampled
- Pea Vine Creek, Crabapple Creek and Jakes Run are recommended for dual EWH/CWH aquatic use designation due to the presence of coldwater taxa and exceptional biological communities
- North Fork Captina Creek and the mainstem of Captina Creek should retain class A PCR (primary contact recreation) use while all other streams should retain class B PCR use along with AWS and IWS use
- Cat Run is recommended to be upgraded from SCR (secondary contact recreation) to PCR due to the observation of several deep pools and the presence of multiple access points
- The mainstem of Captina Creek should retain OSW (outstanding state water) antidegradation classification status based on the presence of the state endangered Eastern Hellbender salamander including juvenile individuals
- North Fork Captina Creek (from confluence with Long Run to mouth) and South Fork Captina Creek should retain SHQW (superior high quality water) antidegradation classification status based on the presence of juvenile Eastern Hellbenders found in each stream
- SHQW antidegradation classification should be expanded along the entire length of Bend Fork due to the presence of high IBI and ICI scores and declining fish populations
- Pipe Creek, currently listed as LRW (limited resource water) is recommended for WWH aquatic use designation based on exceptional ICI and habitat scores
- It was noted that although Big Run (Belmont County) and Wegee Creek are currently designated LRW and LWH (limited water habitat), biologists noted that biological communities in these streams would greatly improve with the removal of gob piles on their banks. Macroinvertebrate populations above the gob piles on each stream were good to excellent but fish populations were poor.

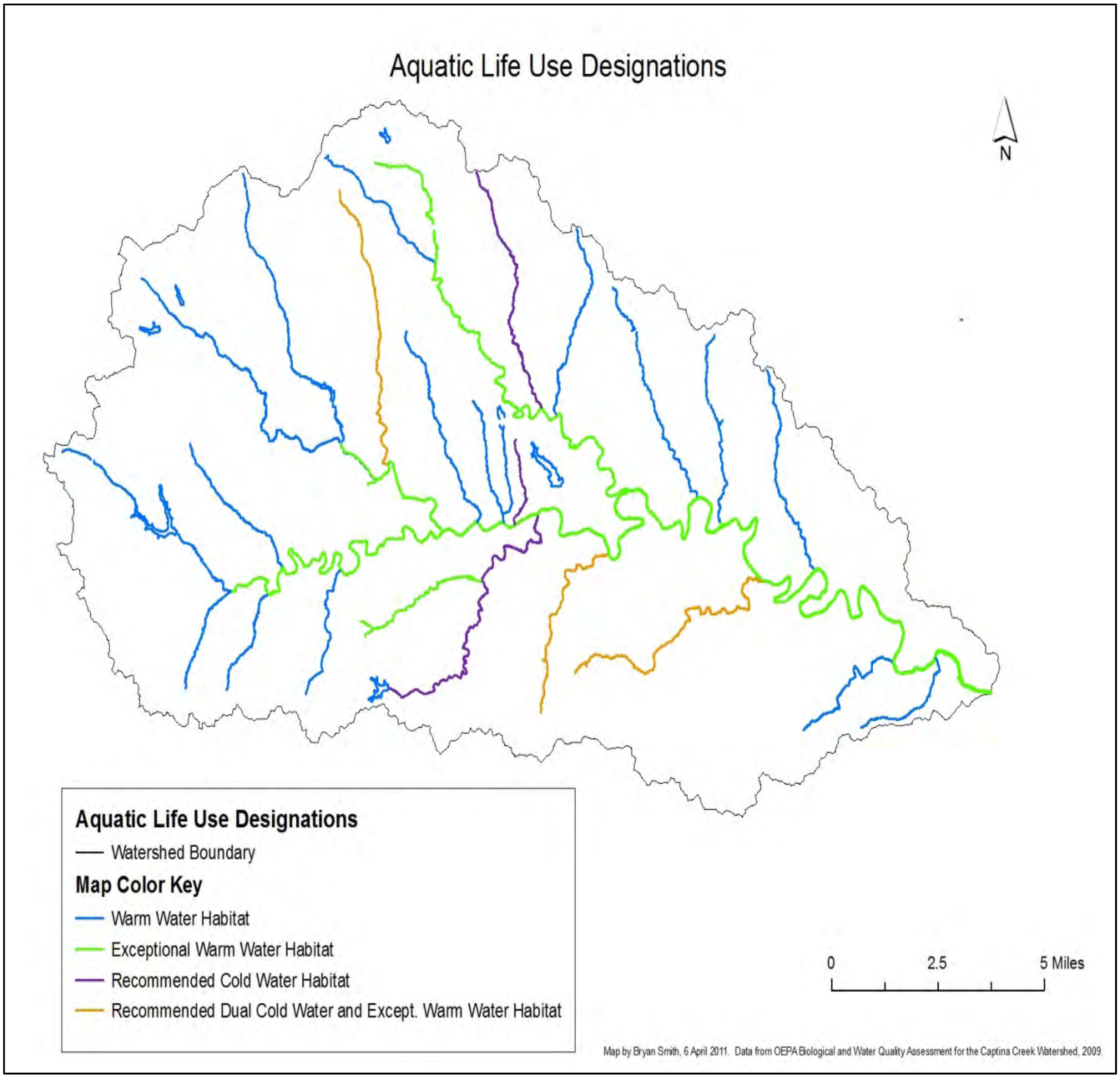


Figure 105. Aquatic life use designations for Captina Creek and selected tributaries, based on 2009 and 2010 assessments (OEPA 2010). *Map source:* Bryan Smith, 2011.

Table 36. Use attainment status for selected tributaries in the Captina Creek watershed. Attainments are color coded based on Figure 104.

Aquatic Life Use Attainment Status		
Partial/Full	**Full**	**Unknown**
Cat Run (RM 3.3)	Captina Creek	Long Run (Trib to P.C.)
South Fork (RM 3.0)	Crabapple Creek	Millers Run (Trib to B.F.)
	Bend Fork	Millers Run (Trib to S.F.)
	Joy Fork	Anderson Run
	Cat Run (RM 0.3)	Brushy Creek
	North Fork	Reeves Hollow
	Long Run (Trib to N.F.)	Mikes Run
	Casey Run	Moore Run
	Piney Creek	Packsaddle Run
	Jakes Run	Rocky Fork
	Slope Creek	Flag Run
	South Fork (RM 9.5 and RM 0.1)	Cranenest Creek
		Berry's Run

Table 37. Number of threatened stream miles in the Captina Creek watershed region.

Aquatic Life Use Attainment Status	Cumulative Miles
Full	100.2
Threatened	0.0
Full/Partial	11.0
Non	0.0
Unknown	50.9

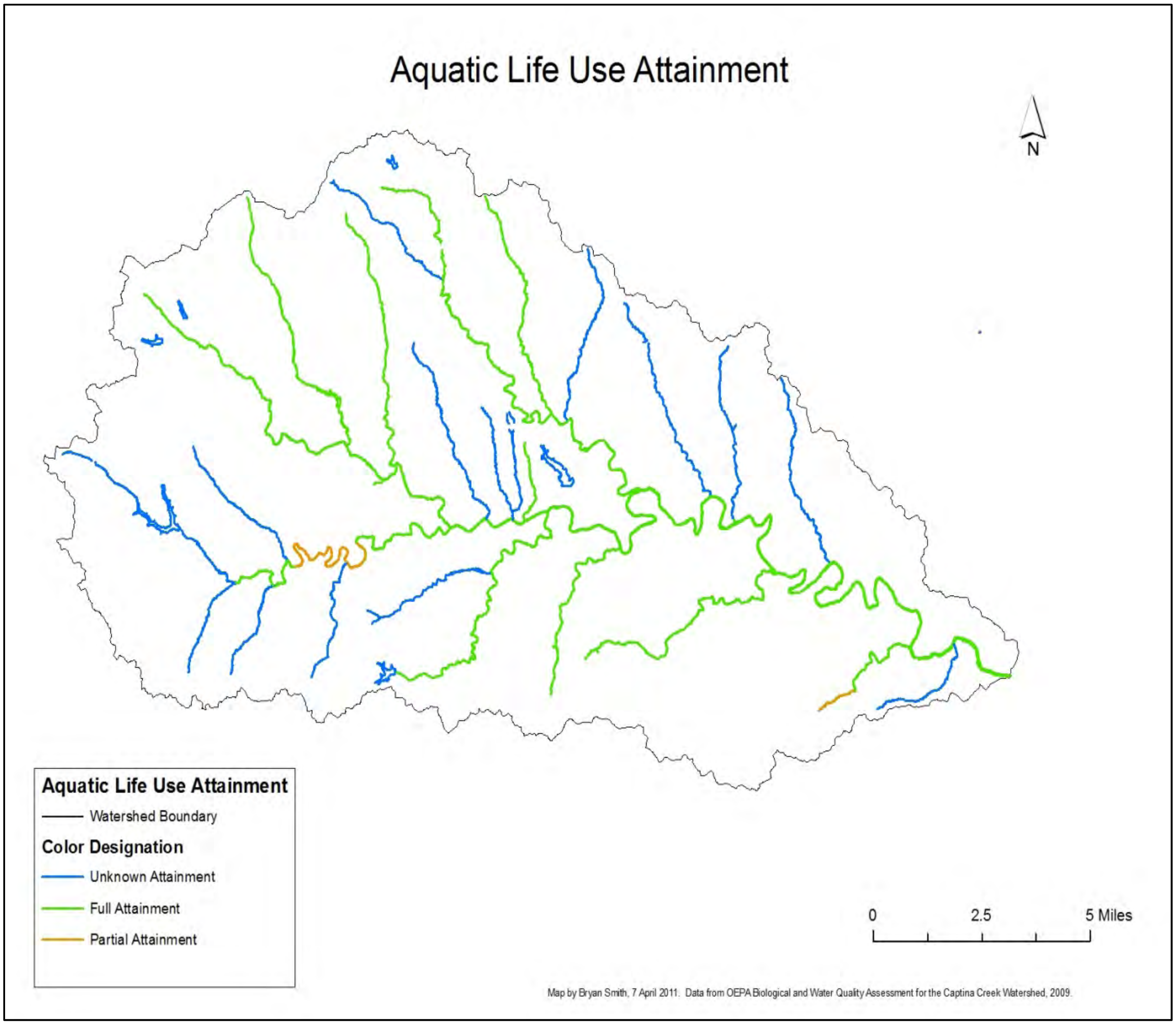


Figure 106. Aquatic life use attainment statuses for Captina Creek and selected tributaries, based on 2009 and 2010 assessments (OEPA 2010). *Map source:* Bryan Smith, 2011.

Table 38. Streams in the Captina Creek watershed with unknown aquatic life use attainment status.

Stream Name	Subwatershed Area	12-Digit HUC	Length (miles)
Anderson Run	*Pea Vine*	050301060905	5.4
Berrys Run	*Piney Creek*	050301060904	2.3
Brushy Creek	*South Fork*	050301060902	3.2
Cranenest Creek	*South Fork*	050301060902	3.1
Flag Run	*South Fork*	050301060902	3.9
Mikes Run	*Piney Creek*	050301060904	4.6
Millers Run	*Bend Fork*	050301060903	4.1
Millers Run	*South Fork*	050301060902	3.5
Moore Run	*Pea Vine Creek*	050301060905	4.4
Packsaddle Run	*Bend Fork*	050301060903	3.5
Porters Run	*Cat Run*	050301060906	2.9
Reeves Hollow	*Piney Creek*	050301060904	1.7
Rocky Fork	*Pea Vine Creek*	050301060905	3.9
Slope Creek	*South Fork*	050301060902	4.4
		Total Stream Miles in Unknown Attainment Status	**50.9**

Table 39. Summary of causes for partial or nonattainment status for specific streams or stream segments within the Captina Creek watershed (OEPA 2010). Attainment statuses are color coded based on Figure 105.

Name	Total Length (miles)	Affected Length (miles)	Attainment Status	Cause
Cat Run	7.8	4.5	Partial/Full	Natural fish barrier (waterfall) at RM 3.3, Low IBI scores upstream of waterfall that need further analysis to determine exact cause.
South Fork	14.0	6.5	Partial/Full	Organic Enrichment/DO, Shallow bedrock
North Fork* (above Long Run-RM 4.0)	10.5	6.5	Full	High ammonia, nitrate/ nitrite and phosphorus values, Unknown source of sedimentation

*Although the North Fork has achieved full attainment status over its entire length, portions above the confluence with Long Run are rated WWH while portions downstream of this point are rated EWH. OEPA biologists believe reducing nutrient loading in the headwaters of the North Fork will upgrade the habitat use designation to EWH.

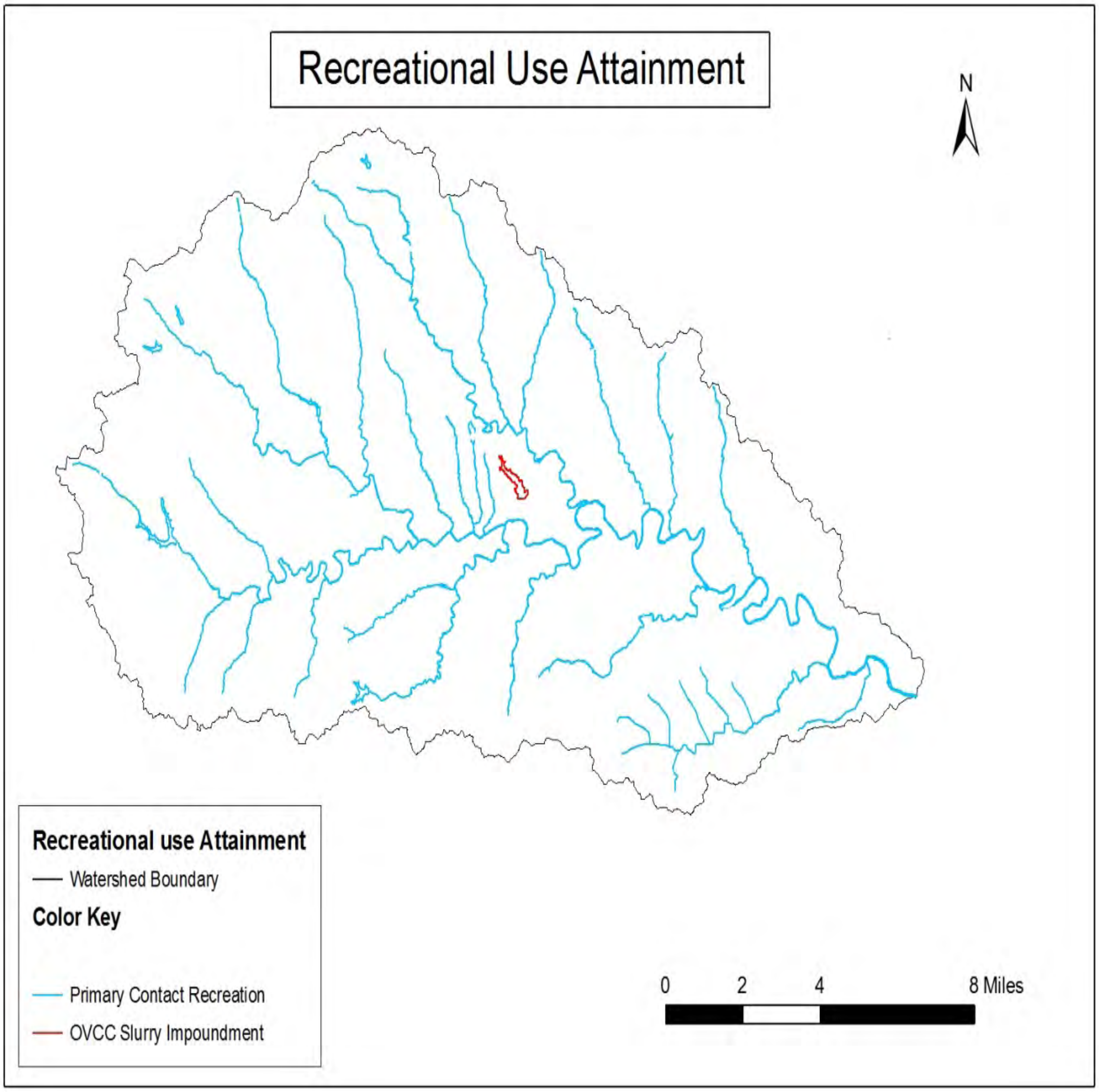


Figure 107. Recreational use attainment statuses for Captina Creek and selected tributaries. Following the 2009 watershed assessment, the OEPA recommended that Cat Run be changed from Secondary Contact Recreation (SCR) to Primary Contact Recreation (PCR) based on the number of access points and deep pools present. Cat Run was the only tributary in the watershed area to be designated SCR prior to the assessment (OEPA 2010).

Attainment in the Lakes of the Captina Creek Watershed
Contributed by Dan Imhoff, Ohio EPA Biologist

The OEPA has sampled three public lakes in the Captina Creek watershed: Barnesville Reservoirs No. 1, 2 and 3. Reservoirs No. 1 and 2 are in Warren Township and Reservoir No. 3 is in Somerset Township. All reservoirs were built as water supplies for the Village of Barnesville. In all three reservoirs, fishing is allowed but swimming is not. Boating is allowed only on Reservoir No. 3 on which two boat ramps are available for public use. The reservoirs support normal warmwater sport fish populations including largemouth bass, crappie, channel and bullhead catfish, carp, bluegill and sunfish.

To assess the condition of Captina Creek watershed's lakes, the OEPA collected samples over a two-year period, specifically five times during the summer seasons of 2009 and 2010. Preliminary data analysis indicates that the lakes are somewhat nutrient enriched. As is typical of most Ohio lakes, the lakes stratify during the summer with an oxygen rich upper layer to a depth of about twelve feet and an anoxic lower layer. Physical characteristics of these lakes is summarized in Table 40.

Table 40. Physical characteristics of the Barnesville Reservoirs. *Data source:* Ohio Environmental Protection Agency, 2010.

	Reservoir		
	#1	**#2**	**#3**
Dam Location (Lat/Long):	39° 58' 21.6"N 81° 9' 21.6"W	39° 57' 52.3"N 81° 9' 58.3"W	39° 54' 30.6" N 81° 9' 35.5" W
Watershed Drainage Area (acres):	507	322	3,622
Maximum Depth (feet):	32	28	55
Lake Area (acres):	12.2	20.6	82.1
Storage Volume (acre/feet):	241	179	2,050
Date Constructed:	1904	1936	1965
Onstream Impoundment of:	Unnamed trib. to North Fork Captina Creek	Unnamed trib. to North Fork Captina Creek	Slope Creek

Attainment of Wetland in the Captina Creek Watershed

It is estimated that 90% of the wetlands in the United States have been destroyed since European settlement. Wetlands are very beneficial to streams because they slow water velocity, allowing suspended pollutants to settle out in layers of sediment or bioaccumulate in plant tissue (ODNR n.d.). A study conducted by U.S. Fish and Wildlife in 2004 estimates that 5.5% of the U.S. is covered in wetland habitat, with 93.5% of the U.S. being upland and 1% being deepwater. The study found that during 1998 – 2004 the major losses of wetlands nationwide were due to development (urban and rural) and silviculture (USFWS 2005). Attainment status of wetlands in the Captina Creek watershed is unknown. Wetland locations have been mapped (Figure 108) based on the presence of hydric soils, but wetlands have not been sampled by OEPA in the Captina Creek watershed.

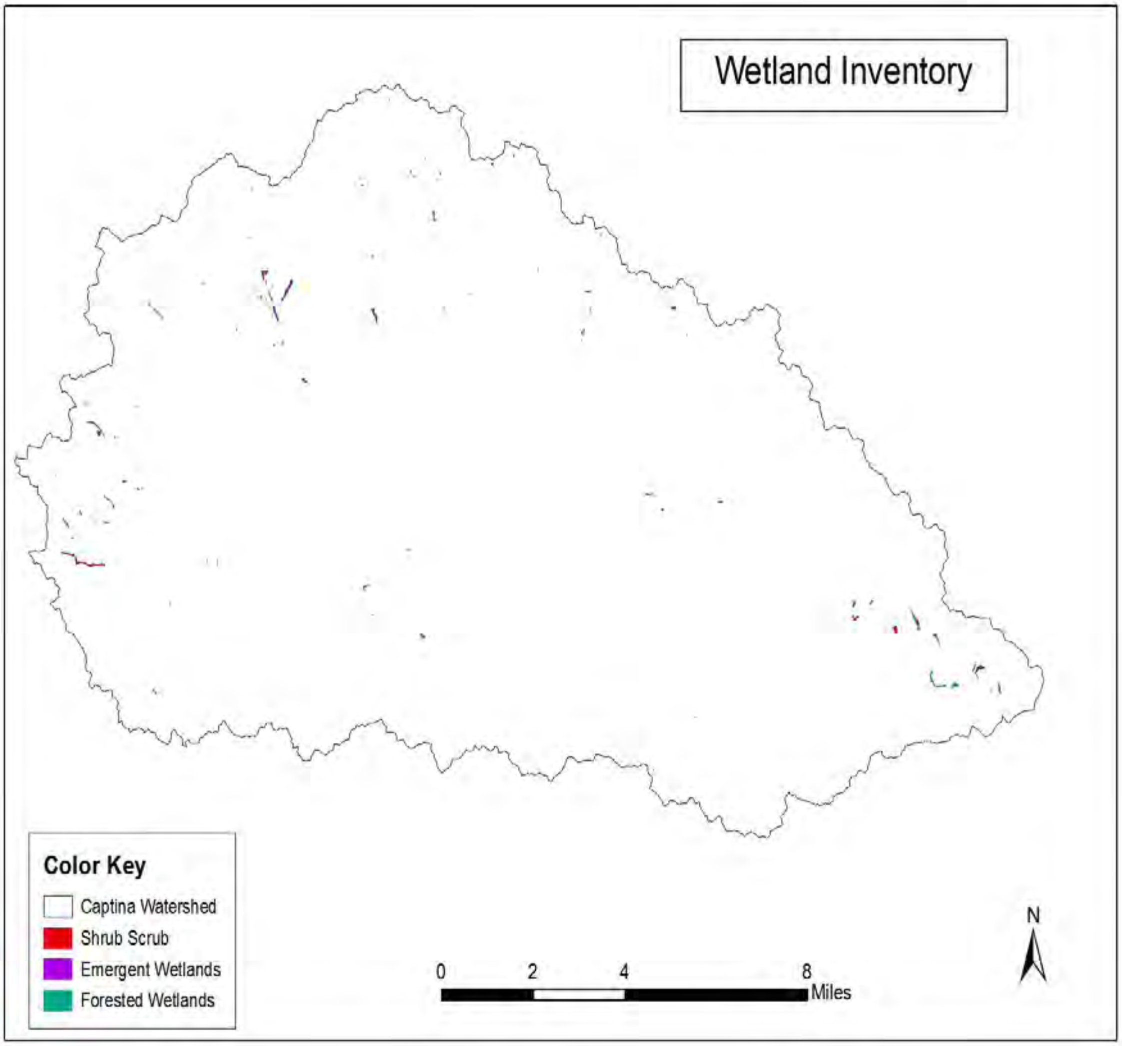


Figure 108. Inventory of wetlands in the Captina Creek watershed. *Source:* National Wetland Inventory, Ohio.

National Pollutant Discharge Elimination System (NPDES) Permits

Industrial facilities discharging point source wastewater into a watershed must have a National Pollutant Discharge Elimination System (NPDES) permit approved by the Ohio EPA and must adhere to the discharge requirements for that permit. There are seven facilities having NPDES permits on file with the OEPA in the Captina Creek watershed (Table 41).

Table 41.Permitted NPDES facilities within the Captina Creek watershed. *Data source:* Ohio Environmental Protection Agency NPDES Online Database Query.

Facility Name	NPDES ID	Receiving Waters
American Energy Corp - Century Mine	OH0059552	Piney Creek
Barnesville WWTP	OH0024015	North Fork
Bellaire Corp. Powhatan #5 Mine	OH0011576	Captina Creek
Bethesda WWTP	OH0021121	Bend Fork
Ohio Valley Coal Company Powhatan #6 Mine	OH0012661	Captina Creek
Oklahoma Coal Company Linn Tipple Facility	OH0059633	Captina Creek
Powhatan Point WWTP	OH0027219	Captina Creek

Groundwater Quality

Groundwater in the Captina Creek watershed originates from a mixture of sand and gravel aquifers located along the Ohio River and under the lower half of the mainstem Captina Creek. Aquifers located directly below Captina Creek are considered moderately sensitive due to potential ease of contamination determined by DRASTIC analysis (Figure 40). Depth to water across the watershed ranges from 60 - 178 feet, with most wells at depths of 90 - 100 feet. Water yields for these wells range from 1 - 5 gallons per minute and usually decreases in production with distance from the Ohio River basin. While groundwater drinking wells are common and safe in both Belmont County and the Captina Creek watershed region, isolated complaints of discolored well water have been reported from residents along Captina Creek.

In 1993, Belmont County participated in a statewide study to determine the quality of groundwater collecting in municipal drinking wells. The study sampled six municipal wells for chemical analysis (Table 42). Overall only two wells exceeded primary or secondary standards for total dissolved solids (TDS) and iron, however neither of these wells are located in the Captina Creek watershed (Schumacher et al. 1993b).

Table 42. Analysis of groundwater from municipal drinking wells in Belmont County (adapted from Schumacher et al. 1993b).

Belmont County Groundwater Analysis							
Well No.	**1**	**2**	**3**	**4**	**5**	**6**	
Location	Sec. 20 Richland TWP	Shadyside	Powhatan Point	Martins Ferry	Morristown	Bethesda/ Belmont	
Well Depth (ft.)	93	71	66	68	58	70	
Capacity (gpm)	2	600	300	700	_ _ _	4	
Depth to Bedrock (ft)	10	NE*	NE*	NE*	61.5	_ _ _	
Chemical Constituents of Groundwater							
							Effect if Primary Standard Exceeded
Total Dissolved Solids (ppm)	366	388	106	623/500	330	238	Adverse Taste/ Plumbing Deterioration
Hardness ($CaCO_3$)	- - -	- - -	- - -	370	242	164	Film deposits on appliances/stains clothing
Iron (ppm)	0.46/0.30	0.03	0.03	0.18	0.13	0.20	Metallic Taste/Stains Laundry & Plumbing
Manganese	0.03	0	0.03	- - -	- - -	- - -	Metallic Taste/Stains Laundry & Plumbing
Chloride	2	24	18	31	4	0.16	Salty Taste/Corrosion of Plumbing
Sulfate	36	122	106	- - -	- - -	- - -	Laxative/Deposits on Plumbing & Appliances
Fluoride	0.40	0.14	0.13	- - -	- - -	- - -	Mottling of Teeth

*NE - Wells in these locations did not encounter bedrock when constructed.
Values in red indicate levels above OEPA primary standard.
Values in blue are comparative OEPA primary standards.
Values in orange indicate a sample location in the Captina Creek watershed.

More recently, the OEPA conducted a statewide study of groundwater quality focusing on potential impacts from industrial and surface features. Although several of these facilities exist in Belmont County, none are located within the Captina Creek watershed. The closest facility impacting groundwater quality to the Captina Creek region is a landfill in northeastern Monroe County, specifically in the Sunfish Creek watershed. OEPA groundwater maps show that there are no facilities with impacts to groundwater (OEPA 2008). Although the OVCC No. 6 mine and Century mine withdraw a sizeable volume of surface water for coal production, their operations do not directly impact groundwater supplies in the region.

Underground Storage Tanks - Dozens of underground storage tanks (USTs) containing petroleum products are scattered throughout Belmont County and the Captina Creek watershed, many of which are inactive. Businesses and facilities containing USTs must register with the Ohio Department of Commerce and are routinely monitored for leakage. A list of USTs in the Captina watershed region is given in Table

43. Not surprisingly, most tanks in the region are located around the higher population densities of Powhatan Point, Barnesville and Shadyside.

Table 43. Bureau of Underground Storage Tank Regulations (BUSTR) active and inactive facilities in the Captina Creek watershed. *Source:* Ohio Department of Commerce, Division of State Fire Marshal, 2011.

Facility ID	Name	Subwatershed Area	12-Digit HUC
07000027	Rolling Hills Landmark, Bethesda	Bend Fork	050301060903
*07000052	Brubaker's Ashland, Steinersville	Pea Vine Creek	050301060905
*07000081	Hissom's Gas & Go, Barnesville	North Fork	050301060901
*07000086	Bethesda Loading Zone	Bend Fork	050301060903
07000089	Tacoma Garage, Barnesville	North Fork	050301060901
*07000100	Tom's Carryout, Powhatan Point	Cat Run	050301060906
*07000115	ODOT Outpost, Barnesville	North Fork	050301060901
*07000136	Barnesville Starfire	North Fork	050301060901
07000164	Ohio Bell and Telephone, Barnesville	North Fork	050301060901
07000168	Certified Oil Co. #344, Powhatan	Cat Run	050301060906
07000170	Barnesville Exempted Village Schools	North Fork	050301060901
07000175	Van Dyne's Market, Jacobsburg	Pea Vine Creek	050301060905
07000203	First Nat'l Bank of Powhatan	Cat Run	050301060906
07000204	D&M General Store, Somerton	South Fork	050301060902
07000214	Village Market, Somerton	South Fork	050301060902
*07000384	Stonebraker's Garage, LTD, Jacobsburg	Pea Vine Creek	050301060905
07000586	Boston's Store, Armstrongs Mills	Pea Vine Creek	050301060905
*07001144	Belmont Carson Petroleum, Barnesville	North Fork	050301060901
07002219	Powhatan Fuel Center	Cat Run	050301060906
*07005263	The Ohio Valley Coal Company, Alledonia	Piney Creek	050301060904
07005796	Washington Township Garage, Alledonia	Piney Creek	050301060904
07008007	D&K Excavating, Powhatan Point	Cat Run	050301060906
07009142	Loveday Automotive, Barnesville	North Fork	050301060901
07009540	Tri-State Petroleum Corp., Powhatan Point	Cat Run	050301060906

Facility ID	Name	Subwatershed Area	12-Digit HUC
07009632	Kevin's Marathon, Bethesda	Bend Fork	050301060903
07009633	Captina Carry Out	Piney Creek	050301060904
*07009889	Convenient Food Mart, Powhatan	Cat Run	050301060906
07009901	Wynncrest Chevrolet, Barnesville	North Fork	050301060901
07009903	Former Ashland Gas Station, Barnesville	North Fork	050301060901
07009941	Kenney Residence, Somerton	South Fork	050301060902
07009964	Former Shell Station, Somerton	South Fork	050301060902

*Denotes an UST facility currently in use.

Water Quality Status and Trends

Of the 162 miles of streambed in the Captina Creek watershed, no section is categorized as threatened while 100.2 miles (61.8%) have been designated full attainment status. No stream miles sampled by OEPA have graded non-attainment status, while 50.9 miles (31.4%) remain in unknown attainment status. A small percentage of river miles (11.0; 6.8%) have been designated full/partial attainment status due to naturally occurring features in Cat Run and the lack of fully intact riparian corridors in the South Fork. As more sampling is performed by OEPA in the watershed region, total stream mileage designated in full attainment status should increase. The streams with undesignated attainment status will probably fall under the WWH aquatic attainment status. Visual observation of tributaries currently designated as unknown attainment status indicates that most are in good condition in terms of habitat quality, water quality and species diversity, and would likely be designated as at least WWH by the OEPA.

Several streams currently grade full attainment status but could degrade with time if not carefully managed, Casey Run being one example. It is currently achieving full attainment status and is recommended for CWH status by OEPA, but faces an uncertain future pending the approval by the U.S. Army Corps of Engineers for a permit to install a coal wastewater impoundment that will impact the middle portion of the streambed. A utility right-of-way has also been cleared near the mouth of Casey Run, which has removed some of the riparian cover along the mainstem of Captina Creek.

Piney Creek is currently recommended for CWH and EWH status; however, these excellent conditions could be threatened by elevated conductivity in Captina Creek downstream of mine outfalls during low flow conditions. Though discharge values are currently within acceptable parameters, OEPA sampling in 2008 and 2009 revealed conductivity values of 2442 umhos/cm and total dissolved solids (TDS) values of 2050 mg/l in Piney Creek at RM 0.02 downstream of the Century mine facility. Closer to the mine conductivity values of 6520 umhos/cm, 8400 umhos/cm, 9760 umhos/cm and 6830 umhos/cm were recorded at mine outfalls 008, 013, 015 and 016 respectively. OEPA biologists commented that these values could be impacting the success of macroinvertebrate populations in this portion of Piney Creek, citing a lack of mayfly larvae in waters below the outfalls (OEPA 2010). Elevated TDS and metals can also have effects on aquatic life further downstream during low flow conditions, when surface water dilution is minimal. Careful monitoring and collaboration between watershed stakeholders and the mining companies will be essential to minimizing potential impacts to aquatic life due to these sources.

The South Fork currently holds partial/full attainment status due to shallow bedrock impairing fish habitat, though it retains a Superior High Quality Water antidegradation classification due in part to the presence of larval Hellbenders. Increases in livestock access and development from seasonal cabins near the stream could result in increased nutrient loading and fecal coliform counts. Similarly, the recent addition of seasonal trailers and cabins next to the North Fork threatens its full attainment status due to faulty or lacking septic fields.

Pea Vine Creek is recommended dual CWH and EWH status and is currently in full attainment status. It is a pristine stream with minimal human impact and contains the largest contiguous expanse of forest found anywhere in the Captina Creek watershed. Potential threats to water quality in Pea Vine Creek include increased ATV traffic, logging practices without the use of best management practices and an increase in seasonal hunting cabins with inadequate septic systems. Other tributaries in this subwatershed area, such as Anderson Run, face similar threats from excessive ATV traffic and associated erosion and streambank damage.

Bend Fork is designated EWH and Joy Fork, its tributary, is designated CWH. Activity along Bend Fork such as gravel extraction and ATV traffic could potentially impair water quality with increased sedimentation and bank erosion. Future removal of a submarine bridge at TWP Rd. 101would improve Index of Biological Integrity (IBI) scores in Joy Fork by allowing fish to migrate further upstream.

Cat Run is designated partial/full attainment status due to low IBI scores above RM 3.3 and warmwater habitat classification over its entire length. Unlike the South Fork, Cat Run has a natural waterfall that acts as a fish barrier, limiting its IBI score and thus keeping the stream from attaining EWH classification over its entire length. The waterfall does act as a fish barrier; however, this is a natural feature and may help maintain biodiversity.

Elevated nutrient levels that have historically impacted portions of the North Fork downstream of the Barnesville wastewater treatment plant should be improved following upgrades to the facility in 2011. The only section of North Fork that does not meet the EWH attainment is at RM 0.4. This section of the North Fork has a limestone bedrock substrate that impairs the stream’s quality of macroinvertebrate habitat. However, this limestone bedrock is a natural geological feature that is present throughout the watershed, and it one of the factors contributing to its excellent overall health and resilience to human impact.

Section VI: Watershed Action Plans for the 12-digit HUC Subwatersheds

Introduction

Biological studies of Captina Creek and its tributaries have revealed exceptional fish and macroinvertebrate populations at the majority of sampling locations within the watershed, comparable to some of the best quality streams in Ohio. Much of the Captina Creek mainstem and tributaries has been recommended for full attainment of Exceptional Warmwater Habitat, Warmwater Habitat, or Coldwater Habitat life use designations by the Ohio EPA. Additionally, the Ohio Water Quality Standards list Captina Creek as an Outstanding State Water, and several tributaries are listed as Superior High Quality Water.

Water quality data indicate the presence of physical and chemical factors that may threaten this high quality resource if not properly managed. While these threats are not direct causes of non-attainment in the watershed, proper management and protection strategies are required to preserve the exceptional biological assemblages that have been maintained. Therefore, watershed management efforts for the Captina Creek watershed are developed with a focus to preserve this high quality resource by protecting the watershed from future degradation and restoring water resources that have been impacted.

Both point and non-point sources of pollution could threaten the excellent water quality of the Captina Creek watershed if not properly managed. Point sources of pollution can be attributed to a specific location, such as a pipe discharging a pollutant into a body of water. Industrial facilities discharging point source wastewater into a watershed must have a National Pollutant Discharge Elimination System (NPDES) permit approved by the Ohio EPA and must adhere to the discharge requirements for that permit.

Non-point sources of pollution are generated over a larger area and may come from multiple sources, such as soil erosion from disturbed lands or runoff with elevated amounts of nutrients or bacteria. Due to their widespread and sometimes complex nature, non-point sources of pollution can be difficult to identify and control. The voluntary use of best management practices (BMPs) is often the best way to manage non-point sources of pollution.

Problem statements are developed to identify each cause of impairment with its source(s), and the relative contribution of pollution from each source, and link them to the quality of each water resource (OEPA 1997). The following problem statements, arranged by 12-digit hydrologic unit code (HUC) subwatershed and listed in order of priority, address water quality concerns that will guide and assist in the prioritization of watershed management efforts. A summary of the causes and sources of water quality concerns within the watershed is presented in Table 44.

Following each problem statement are goals that address each source of water quality impairment and objectives that address technical solutions for each goal. Objectives include specific actions or activities to be accomplished in order to reach objectives and goals. This section will also identify key stakeholders to be involved in each watershed management action, along with a timeline for the completion of actions and the achievement of goals.

Chapter I: Summary of Water Quality Issues

This section provides an overview of the water quality issues that are present in the 12-digit HUC subwatersheds. The problem statements following this section will detail the causes and sources of water quality impairments for each subwatershed, and will also include goals, objectives, and actions to address each problem statement.

Table 44. Summary of causes and sources of water quality concerns within the Captina Creek watershed, including subwatersheds affected. Sources are further divided into point and non-point sources.

Cause	*Source(s)*	*Affected 12-digit HUC subwatershed(s)*
Sedimentation, stream embeddedness	Point sources: Wastewater treatment facilities Non-point sources: Soil erosion from construction and land use activities without BMPs; livestock access in and near streams; excessive all-terrain vehicle (ATV) access in and near streams; public and residential vehicle stream crossings; inadequate riparian zones along streambanks	North Fork, South Fork, Bend Fork, Piney Creek, Pea Vine Creek, Cat Run
Excessive nutrients	Point sources: Wastewater treatment facilities Non-point sources: Livestock access in and near streams; inadequate or outdated septic fields; fertilizer runoff from croplands	North Fork, South Fork
Pathogens (Fecal coliform)	Non-point sources: Livestock access in and near streams; inadequate or outdated septic fields	A potential threat for all six subwatersheds
Excessive water withdrawal	Non-point sources: Multiple water withdrawals for public or industrial uses	A potential threat for all six subwatersheds
Elevated organic and metal contaminants	Point sources: Releases of mining wastewater; elevated concentrations of contaminants downstream of permitted NPDES discharges during low flow conditions	Piney Creek
Acidity and heavy metals	Non-point sources: Acid mine drainage from abandoned surface or underground mines	Pea Vine Creek, Cat Run
Trash/debris in and near streams	Non-point sources: Littering in public areas and roadsides; illegal dumping of trash	North Fork, South Fork, Bend Fork, Piney Creek, Pea Vine Creek, Cat Run
Barriers to fish migration	Point sources: Human-made bridge; natural waterfall	Bend Fork, Cat Run, Piney Creek, Pea Vine Creek
Loss of property and life due to flooding	Non-point sources: Development in floodplain zones; rapid runoff over impervious surfaces	Pea Vine Creek, Cat Run

Issue 1: Sedimentation and stream embeddedness

Embeddedness is the degree that interstitial spaces between large particles in the stream substrate (e.g. boulders, gravel) are filled by fine sediment (Burns and Edwards 1985). Buildup of sediment on the stream substrate can bury important habitat for aquatic organisms such as fish, macroinvertebrates and amphibians. This is a concern especially for reproducing-age fish and amphibians in the watershed, including the presence of rare darters and the state endangered eastern hellbender salamander. High turbidity (cloudiness caused by suspended particles) may result downstream of nonpoint sources of sediment following large precipitation events (Figure 109). Nonpoint sources of sediment can include inadequate riparian zones along streambanks (Figure 110) and soil erosion from land uses without BMPs. Public and residential vehicle stream crossings (Figure 111) and excessive all-terrain vehicle (ATV) access in and near streams (Figure 112) are other potential sources of sediment. Livestock access in and near streams can also cause soil erosion as animals enter and exist streambanks (Figure 115). According to a 2011 survey of fifteen Captina Creek watershed stakeholders, when asked about the severity of specific problems in the watershed, ATV traffic ranked an average score of 2.2 (1=major problem, 3=problem exists, 5=no problem).

Point sources of sediment may be easier to detect in a water body when total suspended solids are elevated during low flow conditions, rather than following large precipitation events. Point sources of sediment can include facilities discharging effluent high in total suspended solids.

Sedimentation is the most widespread water quality concern in the Captina Creek watershed, occurring in at least four out of six subwatersheds. A summary of habitat conditions at selected tributaries within the Captina Creek watershed (the mouths of four subwatersheds) is provided in Table 45. This information indicates that overall habitat conditions are excellent and generally within metric targets for the streams' aquatic life uses. Any deviation from metric targets is mainly for the substrate category, which includes an evaluation of stream-bottom characteristics and embeddedness. Despite most targets being met for Captina Creek and its tributaries, many potential sources of sediment must be managed in order to preserve these excellent habitat conditions.

Table 45. Substrate, channel, and riparian metric scores for Qualitative Habitat Evaluation Index (QHEI) assessment at selected stream locations within the Captina Creek watershed. Scores are compared to metric targets for aquatic life uses *(EWH = exceptional warmwater habitat, WWH = warmwater habitat)*, including deviation, if any, from the applicable target and identification of the main category causing impairment (OEPA 2009).

Stream	River mile	QHEI categories			Total sediment score	Deviation from target	Main impairment category
		Substrate	Channel	Riparian			
North Fork (EWH)	0.4 (mouth)	11.5	14	9.5	35	0%	Substrate
South Fork (EWH)	0.1 (mouth)	12.5	14	7	33.5	4.3%	Substrate
Bend Fork (EWH)	0.1 (mouth)	15.5	17	9.5	42	0%	N/A
Cat Run (WWH)	0.4 (mouth)	16.5	15	8.5	40	0%	N/A
Target (EWH)		**≥15**	**≥15**	**≥5**	**≥35**		
Target (WWH)		**≥13**	**≥14**	**≥5**	**≥32**		

The proportion of highly erodible lands within a watershed can be a factor influencing the amount of soil loss to streams, depending on the land use in these areas. Highly erodible lands have a naturally high potential for soil erosion due to soil erodibility, slope and other factors. These lands are often targeted for agricultural conservation BMPs. Due to the soil types and steep terrain over much of the watershed, a high proportion of each subwatershed is considered highly erodible. Table 46 provides the acreage of land with highly erodible land (HEL) soils and the proportion of HEL within each subwatershed. Appendix C provides a landscape-scale model of predicted soil erosion in the Captina Creek Watershed based on the Sediment Assessment Tool for Effective Erosion Control (SATEEC).

Table 46. Summary of the acreage of highly erodible lands and percentage of HEL within each subwatershed (ODNR n.d.)

Subwatershed	Highly erodible land (acres)	Percentage of highly erodible land (%)
North Fork	19,579.7	93.6
South Fork	21,594.8	93.8
Bend Fork	16,270.1	94.2
Piney Creek	17,409.1	93.6
Pea Vine Creek	22,660.8	93.2
Cat Run	10,474.8	93.9

Land use can also have a large influence on the amount of suspended solids that enter a stream. Potential soil loss can be a concern for certain land uses without BMPs. The proportion of land use types vary among each Captina Creek subwatershed, although forestland remains the most widely-occurring land use for all subwatersheds (Table 47). Pastureland is more common in the Bend Fork (35.8%), South Fork (33.0%) and North Fork (32.9%) subwatersheds. Cropland is most common in the South Fork subwatershed (8.7%). Specific soil erosion concerns vary by land use type, although the majority of concerns are associated with pasture and crop lands without the use of BMPs.

Table 47. Area (acres) by land use type in each 12-digit HUC subwatershed and totals for 10-digit HUC Captina Creek watershed, and associated soil erosion concerns by land use type. Data for land use by subwatershed area is from the Ohio EPA's Watershed Assessment Unit Summary (OEPA n.d.). Soil erosion concerns for Ohio developed by the Natural Resource Conservation Service (NRCS 2012).

Land use	Developed	Crop	Grass/Pasture	Forested (90% ungrazed)	Other	**TOTAL**
North Fork subwatershed area (acres)	1,842 (8.8%)	1,025 (4.9%)	6,885 (32.9%)	11,196 (53.5%)	0	**20,928 (100.0%)**
South Fork subwatershed area (acres)	1,382 (6.0%)	2,004 (8.7%)	7,603 (33.0%)	12,050 (52.3%)	0	**23,040 (100.0%)**
Bend Fork subwatershed area (acres)	1,210 (7.0%)	726 (4.2%)	6,186 (35.8%)	9,124 (52.8%)	17.3 (0.1%)	**17,280 (100.0%)**
Piney Creek subwatershed area (acres)	1,248 (6.7%)	186 (1.0%)	4,284 (23.0%)	12,664 (68.0%)	242 (1.3%)	**18,624 (100.0%)**
Pea Vine Creek	1,240 (5.1%)	535 (2.2%)	3,113 (12.8%)	19,407 (79.8%)	24.3 (0.1%)	**24,320 (100.0%)**

subwatershed area (acres)						
Cat Run subwatershed area (acres)	963 (8.6%)	638 (5.7%)	1,411 (12.6%)	8,187 (73.1%)	0	**11,200 (100.0%)**
TOTAL	**7,885 (6.8%)**	**5,114 (4.4%)**	**29,482 (25.5%)**	**72,628 (62.9%)**	**283.6 (0.2%)**	**115,392 (100.0%)**

Land use (total percent in Captina Creek watershed)	Potential soil erosion concerns without the use of BMPs
Developed (6.8%)	Minimal soil erosion concerns; sediment runoff from construction sites without the use of BMPs
Crop (4.4%)	Few concerns; poor residue management; minimal use of cover crops; excessive tillage; insufficient crop rotation
Grass/Pasture (25.5%)	Concentrated mud and nutrients around winter livestock feeding areas; overgrazing
Forested (90% ungrazed) (62.9%)	Minimal soil erosion concerns; logging without the use of BMPs
Other (0.2%)	Barren/steep slopes

Figure 109. Differences in suspended solids can be seen at the confluence of the North Fork and Long Run, especially following precipitation events. *Photo source*: Belmont Soil & Water Conservation District, 2009.

Figure 110. This portion of the South Fork lacks riparian cover where agricultural land uses extend to streambanks. These conditions are a source of increased water temperature and decreased dissolved oxygen concentrations, especially during warmer months.

Figure 111. Public and residential stream crossings for vehicles, including these township roads located in the Bend Fork subwatershed (*left*, Goshen Township) and the Piney Creek subwatershed (*right*, Washington Township), can contribute to sedimentation downstream. *Photo sources:* Belmont Soil & Water Conservation District, 2012 and 2013.

Figure 112. *(Left and right)* Anderson Run, in the Pea Vine Creek subwatershed. ATV traffic on abandoned township roads along this tributary has accelerated rates of erosion on exposed streambanks, resulting in increased sedimentation downstream. *Photo source:* Belmont Soil & Water Conservation District.

Issue 2: Excessive nutrients

Elevated levels of nutrients such as nitrogen and phosphorus have been a cause of water quality impairment in many Ohio watersheds. Elevated nutrient levels can lead to excessive algae and aquatic plant growth downstream of a source, especially during low flow conditions. Algae blooms eventually die and decompose, and the bacteria involved in this process consume oxygen. Excessive algae growth and decomposition can result in hypoxia, or a lack of oxygen in the water. Fish, macroinvertebrates and other aquatic life depend on an adequate oxygen supply and are unable to survive, grow and reproduce under severe hypoxic conditions (Camargo and Alonso 2006). Certain types of algae blooms, such as blue green algae, can pose a health hazard to animals and humans alike (NRCS 2012).

Nutrient levels at sites sampled in the Captina Creek watershed in 2008 and 2009 were generally below reference conditions for the Western Allegheny Plateau ecoregion, and indicative of healthy nutrient conditions overall. Elevated nutrient levels above reference conditions were found in the North Fork and Piney Creek subwatersheds; however, potential sources exist in all subwatersheds, and these sources should be managed in order to preserve the excellent habitat conditions found throughout the Captina Creek watershed (OEPA 2010).

Waste Water Treatment Plants

The point source of elevated nutrients in the North Fork subwatershed during 2008 and 2009 sampling was the Barnesville Waste Water Treatment Plant (OEPA 2010). Upgrades to the Barnesville WWTP were completed in 2011 and included two new decanter aeration tanks, a new sampling lab and a sludge press (Figure 113). Processed sludge will now be shipped to landfills instead of being spread on fields in the surrounding area. These upgrades have resulted in lower solids and ammonia nitrate/nitrite loadings into the North Fork, and should prevent future NPDES violations (Dave McMillen, personal communication, 2012).

Figure 113. The Barnesville waste water treatment plant (*left*) after completion of 2011 upgrades. Treated discharge enters the North Fork of Captina Creek (*right*). *Map source:* “Barnesville Waste Water Treatment Plant.” 39°58’12.54” N and 81°09’45.75” W. **Google Earth.** October 27, 2011. October 22, 2012. *Photo source*: Belmont Soil & Water Conservation District, 2012.

Built in 1990, the Bethesda wastewater treatment plant is located in the headwaters of Bend Fork and services approximately 1,500 persons in the village. Effluent discharge and E. coli parameters downstream of the wastewater treatment plant are within acceptable EPA parameters. The stream is designated Class B PCR recreational use; however, village officials have stated that upgrading the plant with an ultraviolet sterilizer in place of chlorine and sulfate dosing pumps used in the final stages of treatment will improve efficiency and reduce potential discharge downstream.

Home Sewage Treatment Systems

Inadequate or outdated home sewage treatment systems can be a nonpoint source of elevated nutrients in rural areas, especially those without access to county water sources or at seasonal, recreational residences. Rural residences located outside of village public sanitary sewer networks use private septic tanks with leach field drainages.

Septic tanks filter home sewage using a two-step process. The first step involves collecting raw sewage in a large concrete tank, buried below the freeze line down slope of a residential dwelling. Specialized bacteria in the tank biochemically degrade the sewage into a liquid effluent which then drains into a leach field. The second step of the process involves mechanical filtration of the effluent in a leach field, which consists of a long perforated pipe surrounded by polymer filler or gravel. The length of the pipe can be anywhere from 400’ to 1000’, and multiple pipes can service one tank. The length and number of leach field pipes is determined by the estimated maximum load placed on the system. For example, based on Belmont County Sanitary Sewer District requirements, a three bedroom home will need two 450' leach pipes connected to a 1,500 gallon collection tank. Depending on tank size and the number of residents, a three-bedroom home can be expected to discharge 360 gallons of effluent per day to the environment (ODH 2008).

According to Belmont County Health Department records, there were 143 new home sewage treatment systems installed in the county in 2009 and 79 systems installed in 2010. Of the systems installed in 2010, 19 were within the Captina Creek watershed region, bringing the total number of systems registered with the Health Department to 1,316. The average septic tank in Belmont County was installed in 1988 which makes the average septic tank over 20 years old.

Septic tanks can degrade stream quality if not properly maintained. Each faulty system has the potential to release excessive amounts of phosphorus and nitrogen into the water table as well as fecal coliform pathogens. The Ohio Department of Health's 2008 report estimates a 26 percent failure rate for home sewage treatment systems in southeastern Ohio (ODH 2008). The data compiled for the septic systems in the watershed are from the Belmont County Health Department. The county records were extracted by addresses within the watershed boundaries. Septic tank age is based on original installation date. Data for systems installed before 1970 are incomplete for Belmont County as well as areas in Monroe County (Table 48).

An area of concern may be the installation of seasonal trailers and cabins along the North Fork to service absentee land owners and hunters. Few of these facilities have adequate sewage disposal and sometimes let raw sewage enter directly into the streambed. Figure 114 illustrates the locations of all rural septic fields in the watershed.

Table 48. Recorded home sewage treatment system installations, age of systems, and estimated failure rate (inadequate treatment of wastes) of systems in the Captina Creek watershed as of 2010. Age of system may be a poor indicator of system function due to possible upgrades. *Source:* Belmont and Monroe County Health Departments.

Subwatershed	Systems	> 20 Years	10-20 Years	<10 Years	Failure Rate (26%)
North Fork	409	49%	21%	30%	106
South Fork	217	48%	22%	30%	56
Bend Fork	272	46%	26%	28%	71
Piney Creek	178	46%	24%	30%	46
Pea Vine Creek	138	53%	21%	26%	36
Cat Run	102	58%	22%	20%	27
TOTAL	**1,316**				**342**

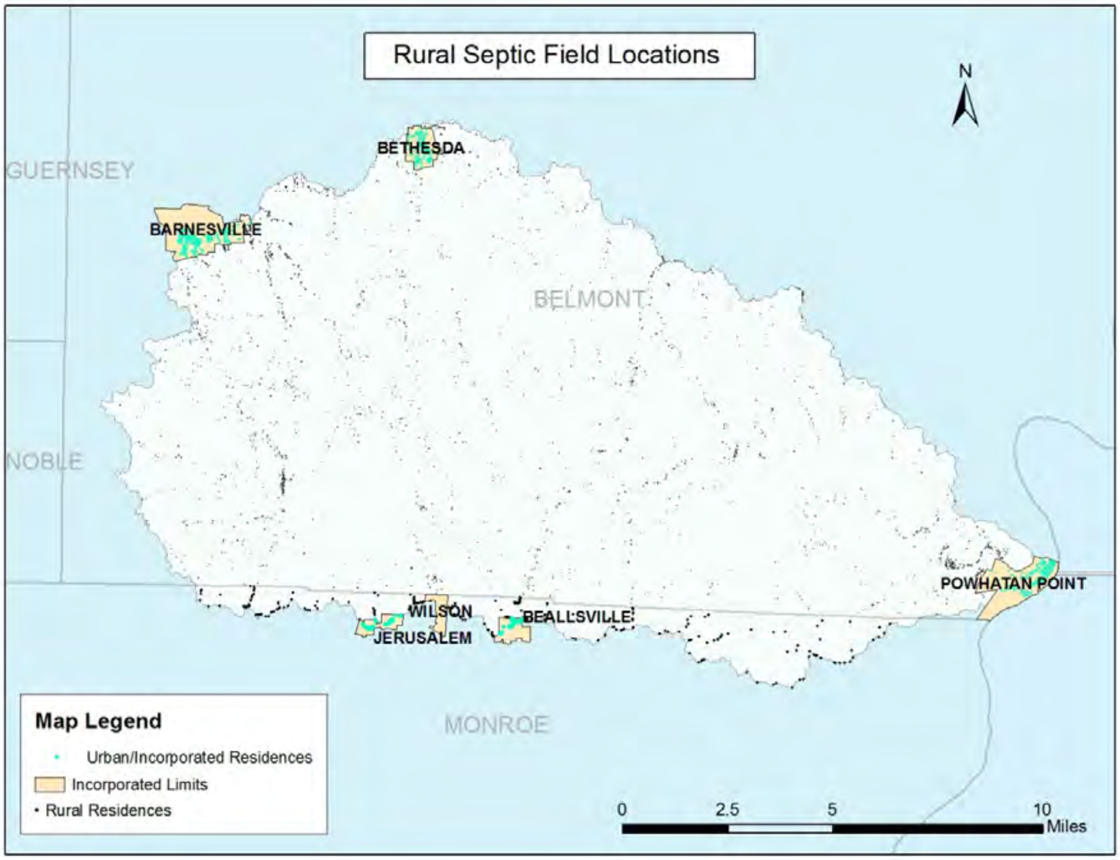


Figure 114. The locations of all rural septic fields in the Captina Creek watershed.

Unrestricted Livestock Access to Streams

Another potential nonpoint source of elevated nutrients is livestock wastes in streams or other water resources due to ineffective livestock restriction or lack of alternative watering systems (Figure 115). This can result in increased nutrients and excessive algae growth downstream, especially during low flow conditions (Camargo and Alonso 2006). Finally, fertilizer runoff is another nonpoint source of nutrients that can occur when fertilizer is applied without the use of BMPs.

Figure 115. Ineffective restriction around a stream allows livestock to enter this stream in Belmont County. These conditions can be a source of increased nutrients and excessive algae growth downstream. *Photo source*: Belmont Soil & Water Conservation District, 2009.

Issue 3: Pathogens (Fecal coliform)

Pathogens are bacteria, viruses, protozoa or worms that exist naturally in the environment. Elevated levels of water-borne pathogens, including intestinal organisms such as fecal coliform bacteria, can be sources of sickness and disease for animals and humans after direct contact (Rosen 2000). Nonpoint sources of pathogens include wastes from humans or animals (wildlife, companion pets, or agricultural animals). Inadequate waste water treatment facilities can be point sources of elevated pathogens.

Similar to aquatic life use designations, the Ohio EPA establishes recreational use designations for water bodies based on proximity to residential areas, water depth allowing full body immersion, and potential exposure to bacteria. There are three recreational use designations: bathing waters (suitable for swimming with the use of safety precautions), primary contact recreation (suitable for full body contact), and secondary contact recreation (suitable for partial body contact). Class A and Class B further distinguish the primary contact designation as supportive of either frequent or occasional contact, respectively (Lawriter 2010). The Ohio EPA has designated Captina Creek and its tributaries in full attainment of Primary Contact Recreation use, Class A (Captina Creek mainstem and lower four miles of North Fork) or Class B (all other streams assessed by the Ohio EPA), in response to bacterial concentrations observed at seven locations within the watershed (OEPA 2010).

In summer and fall 2013, the Ohio EPA conducted bacterial nuisance water quality monitoring at twelve sites within the Captina Creek watershed. *E. coli* monitoring was performed upstream and downstream of sites potentially affected by non-point sources of bacteria, such as livestock access to streams and inadequate HSTS. Mean *E. coli* (cfu/100ml) was elevated above water quality criterion at three sites: North Fork RM 5.3, South Fork RM 11.4, and Berry's Run RM 0.1 (Table 49). Livestock access to streams was present at both the South Fork and Berry's Run sites, and several campers were located upstream of the North Fork site.

Table 49. *E. coli* concentrations by stream and river mile for bacterial nuisance sampling conducted on August 22, August 29, October 17, and October 23, 2013. Mean *E. coli* concentration over the sampling period, along with discharge (cfs) information for each sampling day is also provided. Mean concentrations above the geometric mean water quality criterion for each location's recreation use attainment (126 cfu/100ml for PCR Class A and 161 cfu/100ml for PCR Class B) are highlighted. *Source:* Ohio EPA; USGS.

		E. coli concentrations for each sampling date (cfu/100ml)				
Stream	River mile	8/22/13 *(15 cfs)*	8/29/13 *(31 cfs)*	10/17/13 *(28 cfs)*	10/23/13 *(23 cfs)*	Mean *E. coli* (cfu/100ml)
Captina Creek	24.8	190	70	140	40	110.0
Captina Creek	16.3 (new gage)	50	70	10	30	40.00
Captina Creek	15.6 (old gage)	20	60	60	30	42.50
Captina Creek	2.1	30	270	100	<10	102.5
North Fork	5.2	310	750	290	180	382.5
North Fork	2.4	50	210	130	90	120.0
North Fork	0.4	70	160	130	80	110.0
South Fork	11.4	210	330	-	120	220.0
South Fork	1.9	160	120	-	60	113.3
South Fork	0.1	70	210	180	50	127.5
Berry's Run	0.1	550	1,500	6,500	1,300	2,463
Cat Run	0.3	70	240	100	40	112.5

To maintain these exceptional recreational uses, potential sources of pathogens should be identified and managed. Potential sources of pathogens in the Captina Creek subwatersheds may include inadequate or outdated home sewage treatment systems (Table 48 and Figure 116) and livestock access in and near streams.

Figure 116. *(Left and right)* Trailers and cabins along the banks of the North Fork lacking septic tanks or adequate septic fields.

Issue 4: Water withdrawal

The Ohio Department of Natural Resources – Division of Soil and Water Resources (ODNR-DSWR) oversees the state's Water Withdrawal Facilities Registration Program. This program was established in 1988 to gather and provide information about water demand to water users. Facilities in Ohio are required to register if the capacity to withdraw water is greater than 100,000 gallons per day, even if the actual volume of water withdrawn is lower. The program was not designed to regulate water withdrawal in Ohio, but to aid in better management of water source quantity for the benefit of all water users (ODNR 2012).

According to ODNR-DSWR, 96.4 percent of fresh water withdrawal in Belmont County was from surface water sources, and 3.6 percent of fresh water withdrawal was from ground water resources in 2005. Power (electric) production accounted for 96.3 percent (252.2 million gallons per day) of fresh water withdrawal in Belmont County in 2005, public use accounted for 3.2 percent (8.48 million gallons per day), and mineral extraction accounted for 0.5 percent (1.28 million gallons per day) (ODNR, n.d.). In 2011, there were three active surface water withdrawal facilities with seven individual intakes in the Captina Creek watershed registered with ODNR-DSWR. These three water withdrawal facilities had a total surface water withdrawal of 538 million gallons in 2011(ODNR 2011a).

Stakeholders have expressed concern that water withdrawal may increase in the Captina Creek watershed with future increases in industrial activity, especially related to the horizontal hydraulic fracturing process of drilling for oil and natural gas. Each new hydraulic fracturing well can require 6 – 10 million gallons of water, which is sometimes withdrawn from adjacent creeks in order to reduce the trucking distance to farther water sources (ODNR 2012; Leehr, *pers. comm.*, 2013). Belmont County is one of the leading counties in Ohio for new permits approved to drill horizontal wells, with a total of 45 permits granted by ODNR as of July 2013 (ODNR 2013). Excessive water withdrawal, or the cumulative effects of multiple sources of withdrawal, could result in inadequate water resources and habitat downstream, especially during low flow conditions. The number of undocumented water withdrawals in the watershed is unknown, but objectives for this concern will include an effort by the Watershed Coordinator and Technical Group to gather information from watershed stakeholders and provide information to residents about the Water Withdrawal Facilities Registration Program.

Issue 5: Elevated organic and metal contaminants

A positive partnership has been built between Captina Creek watershed stakeholders and Murray Energy Corporation (parent company of American Energy Corporation (AEC) and Ohio Valley Coal Company (OVCC), both with active coal mines in the watershed), whose representatives have demonstrated a commitment to be involved in the watershed planning process and future mitigation projects.

Both companies' National Pollutant Discharge Elimination System (NPDES) discharges are located in the Piney Creek subwatershed, including a coal slurry impoundment owned by OVCC (Figure 117). These discharges are regularly monitored by the Ohio EPA for compliance within pollution limits set by their respective NPDES permits. Despite multiple slurry releases and water quality standard exceedances downstream of mines during low flow conditions, the biological integrity of Captina Creek has been maintained by a limestone bedrock substrate that naturally buffers the effects of some contaminants. The impacts of past releases have also been minimized by quick and effective responses by responsible parties, and mining discharges are not currently violating NPDES limits (Figures 120 - 122). However, future illicit discharges of mining wastewater into Captina Creek should be prevented in order to maintain its exceptional biological integrity.

Figure 117. The OVCC Powhatan No. 6 mine and slurry impoundment facility near Alledonia, Ohio. The impoundment discharges into an artificially constructed outfall drainage to Captina Creek west of the Powhatan #6 mine. Although NPDES permit violations have occurred in the past, the Powhatan #6 mine remains below acceptable parameters for discharging metals and currently has no defined limits on discharging total dissolved solids (Wood-Pugh, personal communication, 2011). *Photo source:* “OVCC Slurry Impoundment.” 39°55’08.23” N and 80°59’32.11”W. **Google Earth.** October 27, 2011. October 22, 2012.

Figure 118. Located in Wayne Township, the AEC Century Mine has multiple NPDES discharges that are regularly monitored by the Ohio EPA for compliance within pollution limits, including mine water, sanitary wastewater, and industrial stormwater (OEPA 2010). Water quality parameters for Century mine discharges remain within NPDES requirements and the permit currently has no defined limits on discharging total dissolved solids (Wood-Pugh, personal communication, 2011). *Photo source:* “American Energy Corporation - Century Mine.” 39°53’43.88” N and 81°01’21.17” W. **Google Earth.** October 27, 2011. October 22, 2012.

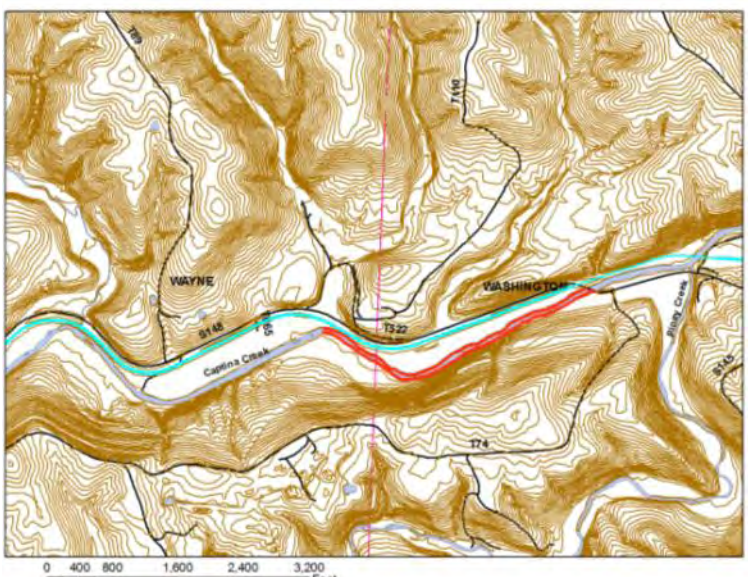


Figure 119. Stream length affected by 2010 coal wastewater release. Two accidental slurry releases from the pipeline between the Century and Powhatan No. 6 coal mines have been documented over the last decade occurring on October 1, 2010 and February 28, 2005, respectively. The most recent spill resulted when a transport pipe north of the Century mine burst, releasing slurry into Captina Creek and severely impacting aquatic life for over a mile downstream. *Map source*: Belmont Soil & Water Conservation District.

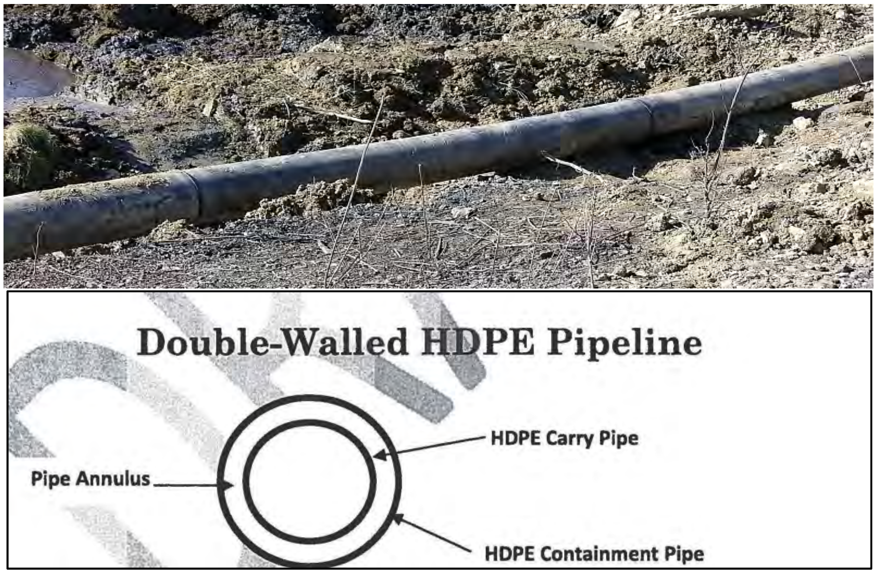


Figure 120. A section of high density polymer pipeline used to transfer slurry from Century mine's prep plant to the slurry impoundment at Powhatan No. 6 mine *(top)* has burst in two separate locations since 2005, releasing slurry into Captina Creek. OVCC has since completed the installation of a larger, double-walled pipeline *(bottom)* that will capture slurry from future breaks and direct the slurry into containment facilities, where it can be safely disposed without entering the creek. Alarm systems further ensure the prevention of a future slurry release (Pugh, personal communication, 2012). *Photo source:* Belmont Soil & Water Conservation District. *Image source:* Murray Energy Corporation.


Figure 121. Slurry deposition along Captina Creek (*left*) and approximately one mile downstream of spill site (*right*) after the October 2010 release. *Photo sources*: Belmont Soil & Water Conservation District, 2010.

Figure 122. Slurry spill cleanup by Murray Energy Corporation (*from left to right*): an earthen levee dug around the October 2010 spill site; hay bale barriers in the stream; slurry removal with vacuum trucks; the downstream end of spill contamination zone after one week. *Photo sources*: Belmont Soil & Water Conservation District, 2010.

Issue 6: Acidity and heavy metals

Mining for coal and other mineral resources has been a culturally and economically significant part of the region's history, including the Captina Creek watershed. Current mining reclamation laws require the restoration of mined lands. However, some of this surface and underground mining, which occurred before the passage of mining reclamation laws, has left behind unreclaimed gob piles and abandoned mine lands which can produce acid mine drainage (AMD). AMD is a result of previously-buried pyritic minerals being exposed to oxygen in the forms of air and water after mining. This reaction produces acidity, which can dissolve sub-surface metals such as iron and aluminum, and often results in orange or white colored streams. This drainage can be detrimental to aquatic life such as fish and macroinvertebrates when contaminant levels are outside of their tolerance limits (Evans 1987).

AMD has been observed entering Captina Creek, but water quality monitoring indicates that in most cases it does not impair water chemistry, and dilutes to undetectable levels further downstream. In addition, the biological integrity of Captina Creek has been maintained by a limestone bedrock substrate that naturally buffers the effects of acidity and other contaminants (OEPA 2010). Figures 123 – 128 feature various abandoned mine lands in the Captina Creek watershed, some of which have been partially or fully reclaimed.

Figure 123. Settling ponds surrounding the reclaimed Cravat Coal gob pile, located in the Pea Vine Creek subwatershed. AMD from the pile is passively treated with limestone slag before entering the creek. Officials from Ohio Department of Natural Resources – Division of Mineral Resources Management (ODNR-DMRM) have stated that creating passive treatment wetland habitat around the edge of the gob pile would further decrease the threat of AMD entering the stream from this location. *Map source:* "Cravat Coal Reclamation." 39°53'36.67" N and 80°53'28.36" W. **Google Earth.** October 7, 2011. October 22, 2012.

Figure 124. Located in Section 4 of Washington Township (Pea Vine Creek subwatershed), a portion of the gob pile at the Linn Tipple facility between State Route 148 and the railroad tracks was recently reclaimed by Murray Energy. A large area remains on the hillside east of the railroad tracks and leaches AMD into a roadside ditch along State Route 148, but effects on water quality downstream are minimal. *Map source:* "Linn Tipple Gob Pile." 39°54'04.93" N and 80°54'18.76" W. **Google Earth.** October 7, 2011. December 27, 2012.

Figure 125. In the Pea Vine Creek subwatershed, AMD from reclaimed strip mine lands on the east and west sides of Dover Ridge Road (York Township Road 729) has been observed entering Captina Creek, but water quality monitoring indicates that it does not impair water chemistry, and dilutes to undetectable levels further downstream (OEPA 2010). *Map source:* “Dover Ridge AMD.” 39°53’08.38” N and 80°52’40.28” W. **Google Earth.** October 7, 2011. December 27, 2012.

Figure 126. Remnants of two small gob piles exist in Section 21 of York Township (Pea Vine Creek subwatershed), originally occupied by Bellaire Corporation Powhatan No. 5 coal mine. This site was also the former location of a limestone gravel pit. AMD draining from the site does not impair water chemistry, and dilutes to undetectable levels further downstream (OEPA 2010).

Figure 127. Located in the Pea Vine Creek subwatershed, Bellaire Corporation's Powhatan No. 5 coal mine in central York Township has been reclaimed and an NPDES permit requires monitoring for stormwater runoff and AMD seepage. A dosing silo and settling pond treat acidic water pumped out of abandoned mine shafts with alkaline material before it can enter Captina Creek. Additional reclamation is planned by North American Coal, the current owner of the site. *Map source:* “Town Run Reclamation Site.” 39°52’51.32” N and 80°50’31.08” W. **Google Earth.** October 7, 2011. December 27, 2012.

Figure 128. A dosing silo and settling ponds, located near the intersection of Cove and Lysein Roads just west of Powhatan Point (Cat Run subwatershed), treat acidic water pumped out of abandoned mine shafts with alkaline material before it can enter Captina Creek. This site is the former location of Bellaire Corporation's Powhatan No. 2 coal mine. Additional remediation is planned by North American Coal, the current owner of the site. *Photo source*: Google Earth.

Issue 7: Trash in and near streambanks

Illegal dumping of trash in undesignated areas, especially in and around streambanks, remains a problem in the watershed area and deteriorates wildlife habitat and the aesthetic value of the region (Figure 129). Trash and debris in and around streambanks can be carried downstream during heavy rain events, often making it difficult to determine the source. Other threats include debris jams that can worsen the effects of flooding, runoff of dump site chemicals into surface waters, and health risks posed to humans or livestock exposed to sharp objects. According to a 2011 survey of fifteen Captina Creek watershed stakeholders, when asked about the severity of specific problems in the watershed, trash/debris ranked an average score of 3.3 (1=major problem, 3=problem exists, 5=no problem).

Figure 129. Trash and debris on streambanks, such as this Belmont County stream, can degrade the quality of riparian habitat. *Photo source*: Belmont Soil & Water Conservation District, 2009.

Issue 8: Barriers to fish migration

Natural or human-made physical barriers to fish migration exist in at least two locations in the Captina Creek Watershed. These barriers, located in the Bend Fork and Cat Run subwatersheds (Figures 130 and 131), inhibit the movement of fish species to upstream reaches, may cause excessive expenditures of energy, and can impede sexual reproduction for fish. This can result in impaired biological diversity and degraded aquatic life use attainment in upstream reaches. Examples of natural barriers include waterfalls and log jams, and examples of artificial barriers include culverts, dams and submarine bridges. Improvements can be made by removing the barrier, raising pool levels, or installing a fish passage around the barrier. These solutions may be costly and careful analysis is required to compare costs with biological benefits, including an examination of alternative solutions (Powers and Orsborn 1985).

Biological sampling has not been collected upstream and downstream of additional barriers in the watershed, including a bridge across Captina Creek in the Pea Vine Creek subwatershed and a submarine bridge across Crabapple Creek in the Piney Creek subwatershed (Figures 132 and

133). These barriers may result in impaired biological diversity and degraded aquatic life use attainment in upstream reaches, but biological monitoring is required to determine their impact.

Figure 130. Located in Washington Township, this low-water bridge crossing Joy Fork is a barrier to fish migration upstream (OEPA 2010). *Source:* Belmont Soil & Water Conservation District.

Figure 131. Natural waterfall barrier to fish migration in Cat Run. *Photo source*: Ohio Environmental Protection Agency, 2010.


Figure 132. An abandoned bridge across Captina Creek (RM 5.5) in Section 21 of York Township partially obstructs flow and may be a barrier to fish movement upstream. The bridge serves as access to abandoned gravel pits from State Route 148. *Photo source*: Google Earth.


Figure 133. Submarine bridge through Crabapple Creek (RM 3.3). *Photo source:* Belmont Soil & Water Conservation District, 2013.

Issue 9: Flooding

Flooding is a naturally occurring event in the Captina Creek watershed. As indicated in *Section I: Watershed Inventory*, the most significant flood hazard areas within the watershed are along Captina Creek between Armstrongs Mills and Powhatan Point. These areas are subject to flooding because of flat terrain near stream elevation. Flash flooding and river flooding are a threat for those who live in floodplains along the larger tributaries of the watershed, and can result in loss of property and life. Ice jams in the winter months can also cause flooding conditions upstream or flash flooding downstream following the breakage of an ice jam impoundment. Finally, increased runoff due to development and stream alteration can increase the threat of flooding in the watershed.

As of 2011, there are 464 structures that are at risk in a floodplain zone in the entire watershed. Due to the steep terrain in portions of the Captina Creek watershed, floodplains are often a favorable alternative for residential development. However, flood damage in the floodplain zone is a threat to the safety of residents and their property. Although Belmont County and incorporated areas within the watershed have adopted local floodplain ordinances, other unincorporated communities and rural residential areas within the watershed may be at risk. According to a 2011 survey of fifteen Captina Creek watershed stakeholders, when asked about the severity of specific problems in the watershed, flooding ranked an average score of 2.5 (1=major problem, 3=problem exists, 5=no problem).

Although the risk of flooding and property damage due to flooding is a major concern of stakeholders within the Captina Creek watershed, this WAP will only address water quality concerns related to flooding in the watershed. Floods can be a water quality concern when increased runoff is the source of soil erosion and stream sedimentation or when stormwater runoff results in an increased contribution of pollutants to streams. However, these issues will be addressed in the problem statements directly related to those resource concerns.

In order to reduce the risk of flood damage and improve the safety of residents in floodplain zones, the Belmont County Emergency Management Agency is collaborating with various county agencies to develop a Hazard Mitigation Plan. Several action items in this WAP that improve water quality, such as riparian conservation easements and riparian enhancement, will also enhance the watershed’s natural ability to hold and slowly release floodwaters.

Chapter II: Problem Statements and Action Plans for each Subwatershed

Problem statements are developed to identify each cause of impairment with its source(s), and the relative contribution of pollution from each source. The following problem statements, arranged by 12-digit HUC subwatershed and listed in order of priority, address water quality concerns that will guide and assist in the prioritization of watershed protection efforts.

Following each problem statement are goals that address each source of water quality impairment and objectives that address technical solutions for each goal. Objectives also include specific actions or activities to be accomplished in order to reach objectives and goals. Tables 50 and 51 provide a summary of priority projects for the entire 10-digit HUC watershed, including a timeline, estimated cost, funding strategy, list of key stakeholders to be involved, and measurable indicators for each project to be completed. Tables following each 12-digit HUC subwatershed action plan provide implementation details for each subwatershed (Tables 52 – 57).

Goals and Objectives to Address Concerns Beyond Impairments

Two of the six Captina Creek subwatersheds contain water quality impairments as identified in the Ohio EPA’s *Biological and Water Quality Study of the Captina Creek Watershed* (OEPA 2010). Both the South Fork of Captina Creek and Cat Run were in partial attainment of their designated aquatic life use due to natural conditions (predominant bedrock habitat and a natural waterfall, respectively). Due to the excellent quality of many of the streams in the Captina Creek watershed, the preservation of areas providing a service in protecting the watershed (e.g. conservation easements and acquisitions) has been identified as an important approach in this plan. In addition to preservation, goals and objectives for stream restoration beyond the two impairments are identified when there is a threat of potential water quality impairment, or if improvement beyond water quality requirements is desired. The justification for each of the goals and objectives beyond the two impairments found in the water quality study is detailed in the action plans for each subwatershed.

Table 50. Summary of priority projects for the 10-digit HUC Captina Creek watershed, **listed in order of priority**.

Project Name	*Cause(s)*	*Sub-watershed(s)*	*Timeline*	*Estimated cost (U.S dollars)*	*Potential funding sources/Funding strategy*	*Responsible parties*	*Measurable indicators*	*Progress towards completion*
Riparian zone protection/ conservation easements	Sediment; nutrients	All	2013 - 2016	Varies	Clean Ohio Fund	Technical Committee; Captina Conservancy	Number of acres held in easements	1,015 acres protected
Streambank restoration	Sediment	All	2013 - 2016	Varies	NRCS NWQI Program; OEPA Surface Water Improvement Fund Grants; OEPA 319 Grant Program	Technical Committee; ODNR-DSWR; NRCS	30,355 ft of streambank restored	
Livestock exclusion fencing and alternate watering sources	Sediment, nutrients, pathogens	North Fork, South Fork, Bend Fork, Piney Creek	2013 - 2016	9,270 ft * high tensile wire (12 ga, 4000' coil) est. 94.89/roll; wooden line post (7', 4-5") 6.78/each. 2,500 gallon cistern $1,965; tank (400 Gal. w/ 1.5" Brass couplings, w/ piping) $506.25	NRCS's EQIP; funding programs through ODNR-DOW and ODNR-DOF; OEPA 319 Grant Program; OEPA Surface Water Improvement Fund Grants	Belmont SWCD; NRCS; OSU Ext.	9,270 ft of fencing installed	
Management of specific conductivity sources during low flow and prevention of blackwater releases	Inorganic dissolved solids	Piney Creek, Pea Vine Creek, Cat Run	2013 - 2016	N/A	OEPA Ohio Environmental Education Fund Grant Program for volunteer WQ monitoring program	Technical Committee; local industries; OEPA	24.8 RM of Captina Creek and Piney Creek with decreased loadings of inorganic dissolved solids	

Project Name	*Cause(s)*	*Sub-watershed(s)*	*Timeline*	*Estimated cost (U.S dollars)*	*Potential funding sources/Funding strategy*	*Responsible parties*	*Measurable indicators*	*Progress towards completion*
Install/repair failing or outdated HSTS	Pathogens, nutrients	All	2013 - 2016	Avg repair cost in Ohio = $9,800.00 * 84 systems = $823,200.00	Clean Water State Revolving Fund (CWSRF)	Belmont SWCD; Belmont County Health Department	84 installed or repaired HSTS in watershed	
Restoration of public and private vehicle stream crossings	Sediment	All	2013 - 2016	Varies; bank stabilization and gradient work $3./cu.yd; bank and bridge stabilization $28.94/ton; permanent log and lank bridge $20 per 40' locust log	ODNR's Recreational Trails Program; OEPA 319 Grant Program; mitigation funding opportunities	Belmont SWCD; ODNR-DOW; USFWS; ODOT	30,660 ft with decreased TSS and TDS	
Water quantity protection	Excessive water withdrawal	All	2013 - 2016	N/A	N/A	Technical Committee; local industries; ODNR-DSWR; ODNR-DOW; ODNR-Div. Oil & Gas; OEPA	Healthy flow levels established and maintained	
Conservation tillage and nutrient stewardship program	Sediment, nutrients	North Fork, South Fork, Bend Fork, Piney Creek	2013 - 2016	Cost of equipment repairs	Future incentive program through Belmont SWCD; equipment rental fees	Belmont SWCD; NRCS; OSU Ext.; OFSWCD	280.3 acres under conservation tillage practices; 3,942 acres under nutrient management plans	210.5 acres under conservatio n tillage practices

Project Name	*Cause(s)*	*Sub-watershed(s)*	*Timeline*	*Estimated cost (U.S dollars)*	*Potential funding sources/Funding strategy*	*Responsible parties*	*Measurable indicators*	*Progress towards completion*
Construction runoff controls	Sediment	All	2013 - 2016	N/A	N/A	Belmont SWCD; ODNR-DSWR; ODNR-Div. Oil & Gas; ODOT; ECOBIA; local businesses and industries	Controls installed at all new sites	
Timber harvest BMP program	Sediment	Pea Vine Creek, Cat Run	2013 - 2016	Varies	American Forest Foundation's American Tree Farm System; USDA Forest Service's Ohio Forest Legacy Program; NRCS's EQIP	Belmont SWCD; ODNR-DOF	350 ft buffer strip and BMPs installed at new sites	
Trash removal and prevention	Trash/debris in and near streambanks	All	2013 - 2016	Varies	OEPA Litter Collection and Prevention grant; JB Green Team grants; Bridgestone Tire Removal Program; ODOT Adopt-A-Highway Program	Belmont SWCD; JB Green Team; ODOT; ORSANCO	3 litter cleanups conducted per year in watershed	One cleanup along Long Run (North Fork subwatershed)
Removal of fish barriers	Barriers to fish migration	Bend Fork, Piney Creek, Pea Vine Creek, Cat Run	2013 - 2016	Varies	OEPA Surface Water Improvement Fund Grants; mitigation funding opportunities	Belmont SWCD; U.S.FWS; Belmont County Engineer's Office; township trustees	At least two barriers removed in watershed	Joy Fork culvert project completed March 2014

Project Name	*Cause(s)*	*Sub-watershed(s)*	*Timeline*	*Estimated cost (U.S dollars)*	*Potential funding sources/Funding strategy*	*Responsible parties*	*Measurable indicators*	*Progress towards completion*
AMD remediation	Acidity and heavy metals	Pea Vine Creek, Cat Run	2014 - 2016	Unknown; Estimated $1,080/acre (material, equipment, labor)	ODNR-DMRM Abandoned Mine Lands (AML) Reclamation Program; in-kind services from local industries	ODNR-DMRM; local industries; Technical Committee	Remediation of AMD draining 55 acres of unreclaimed or partially reclaimed surface-mined lands	

Three overall goals serve the mission to protect and conserve the excellent quality of the Captina Creek watershed. These goals apply to the entire 10-digit HUC watershed:

Overall Goal 1: Strengthen Watershed Stakeholders Partnership

Strong, long-term local participation is essential for successful protection of the Captina Creek watershed. A partnership of diverse stakeholders will ensure broad public support for watershed protection efforts. The desire to protect this water resource is shared by a variety of stakeholders, including watershed residents and landowners, local governments, businesses, and industries, educational institutions, nonprofit organizations, and natural resource agencies. Productive relationships among these stakeholders will provide opportunities for collaboration to achieve shared goals of watershed protection.

Objective 1: Engage existing and potential stakeholders

Action 1: Maintain watershed stakeholders list and contact information
Action 2: Continue to contact potential stakeholders to gauge interest in and commitment to the watershed protection effort
Action 3: Conduct public stakeholders meetings as needed for input on various projects. Meeting locations can be rotated to various sites within the watershed
Action 4: Continue involvement of stakeholder representatives at Technical Committee meetings and with the implementation of the watershed action plan

Overall Goal 2: Land Conservation

Due to the excellent quality of the Captina Creek watershed, much of the protection efforts will focus on preservation of these excellent conditions and protection of land from future changes in land use. Fee-simple acquisitions and conservation easements are effective tools to achieve these goals. Conservation easements protect land and water resources by preventing certain types of development or land use in ecologically-important areas. These agreements are voluntary, long-term and legally binding.

The land conservation effort has already achieved success in the watershed. The Captina Conservancy, a nonprofit land trust organization that is detailed in *Section II*, is gaining momentum as it has developed its first large-scale easement in the Piney Creek subwatershed, made possible through the Clean Ohio Fund. This first project will lead the way for future land conservation in the watershed, as more awareness of this success is gained by potential landowners interested in developing an easement on their properties.

Initial projects will be especially beneficial for the lower reaches of the South Fork. Land in this subwatershed is heavily forested, located upstream of pollutant discharges, and much of the land is divided into very large parcels owned by a few landowners. Protection of the South Fork is also a priority due to the presence of several rare and sensitive aquatic species. Mitigation projects and projects available for in-lieu fee program funding (pending establishment of the proposed In-Lieu Fee Program in the State of Ohio) will provide additional opportunities for watershed protection and collaboration with local industries.

Objective 1: Watershed coordinator and Technical Committee should work closely with, and support, the Captina Conservancy in its efforts to develop land conservation projects in the watershed

Action 1: Help to promote the mission of the Captina Conservancy through education and outreach (e.g. landowner workshops, distribution of informational brochures)
Action 2: Conduct awareness campaign to educate landowners about local land conservation successes and opportunities
Action 3: Work with the Captina Conservancy to identify landowners potentially interested in conservation easements on their property. A part-time Captina Conservancy employee will assist with this task in Summer 2013.
Action 4: Assist the Captina Conservancy with the development of conservation easements and fee-simple acquisitions (e.g. technical assistance, landowner relations, etc.)

Overall Goal 3: Education and Outreach

Watershed residents, many of whose families have resided in the watershed for generations, have demonstrated a deep affection for Captina Creek. Many residents are interested in seeing their Creek and their rural lifestyle protected for future generations. This personal connection to the land is the basis for strong, local support of the watershed protection effort. Education and outreach, especially for youth, can help foster a land and water stewardship ethic for the region.

Much work towards this goal has already been initiated. Watershed programs, including community events such the Captina Rally featuring Jack Hanna, youth and school programs through the Belmont Soil and Water Conservation District, and adult outreach through the Captina Conservancy have already been implemented. Future landowner workshops can provide education about BMPs and available funding programs. Engagement of agricultural stakeholders can be promoted through outreach events and partnerships with agricultural organizations such as the Belmont County Farm Bureau and the local chapter of the Ohio Cattlemen's Association. Watershed events can also promote recreation and local tourism through activities such as canoe floats, trail hikes and fishing programs, in addition to partnerships with recreational organizations such as The Ohio Smallmouth Alliance, Project Healing Waters Flyfishing and the OYO Canoe and Kayak Paddle Club.

Objective 1: Increase watershed and conservation awareness among area youth
Action 1: Conduct at least 10 presentations/programs per year at schools and universities within the watershed or within Belmont and Monroe counties
Action 2: Conduct at least 4 youth events per year (e.g. field days, workshops)
Action 3: Conduct at least 1 summer program per year for area youth (e.g. daycamps, field days)
Objective 2: Increase watershed landowners' knowledge of BMPs and available funding programs
Action 1: Conduct multiple landowner workshops to provide information for various watershed and land use topics
Action 2: Distribute informational brochures about BMPs and funding programs at community events
Action 3: Coordinate with agencies, such as the Natural Resources Conservation Service, to increase awareness of programs available to landowners

Objective 3: Increase general awareness and appreciation for the watershed among the general public

Action 1: Conduct at least 1 large-scale community watershed event per year
Action 2: Develop and conduct one watershed tour for the public per year (e.g driving tour, interpretive canoe float or hike, legislator's tour)
Action 3: Increase availability of watershed information and updates through sources such as websites, social media, a weblog, newspaper articles, newsletters, television and radio interviews, etc.
Action 4: Achieve the Ohio Department of Natural Resources - Division of Natural Areas and Preserves Ohio Scenic River Designation for Captina Creek within five years. This designation will increase property values and provide educational and technical assistance to landowners from the Program.
Action 5: Install signage along state routes 7, 148 and 800, marking watershed boundaries and crossings over Captina Creek. Potential funding sources include the Ohio EPA's Ohio Environmental Education Fund (OEEF) grants program
Action 6: Develop volunteer monitoring team to assist with chemical and biological monitoring needs in the watershed and to involve and educate the public about watershed health. Potential funding sources include the OEEF grants program
Action 7: Coordinate with local recreational organizations (e.g. OYO Canoe & Kayak Paddle Club and Rails to Trails) to develop and support recreational opportunities within the watershed

Table 51. Implementation details for actions relating to overall 10-digit HUC watershed goals (Strengthen Watershed Stakeholders Partnership, Land Conservation, Education & Outreach).

Project Name	*Aquatic Life Use*	*Attainment Status*	*Causes*	*Project Type*	*Sources*	*Action Item*	*Unit*	*Target*	*Estimated Cost*	*Potential Funding Sources*	*Responsible Parties*	*Status*	*Project Priority*
Strengthen Watershed Stakeholders Partnership						Update stakeholders list and contact to gauge interest	List	1	0	n/a	Belmont SWCD	Completed; update as necessary	1-5 years
Strengthen Watershed Stakeholders Partnership						Conduct stakeholders meeting	Meeting	1/yr	0	n/a	Belmont SWCD	4 public meetings held	1-5 years
Land conservation						Conservation easement awareness campaign	Workshop; brochures	1/yr; 500/yr	0; ~ $600.00	n/a	Captina Conservancy; Belmont SWCD	150 brochures distributed	1-5 years
Land conservation						Identify landowners for potential easements	Roster	1	0	n/a	Captina Conservancy	Completed Summer 2013	1-5 years
Land conservation						Development of targeted conservation easements and acquisitions	Acres of land protected		Unknown	Clean Ohio Fund	Captina Conservancy	1,015 acres protected	10+ years
Education and outreach						School and university presentations	Presentations / Programs	10/yr	Minimal for supplies	Educational grants; fundraising	Belmont SWCD	Ongoing	Ongoing
Education and outreach						Watershed youth events and summer programs	Programs	5/yr	Minimal for supplies	OEPA Ohio Environmental Education Fund Grant Program; local grant programs	Belmont SWCD; Captina Conservancy	Ongoing	Ongoing
Education and outreach						Community watershed events	Event	1/yr	5,000.00	OEPA Ohio Environmental Education Fund Grant Program; Belmont County Tourism Council GAP Funding; donated goods and services	Belmont SWCD; Captina Conservancy	4 completed	1-5 years
Education and outreach						Public watershed tour	Tour	1/yr	Minimal for press, handouts	n/a	Belmont SWCD	1 completed	1-5 years

Project Name	*Aquatic Life Use*	*Attainment Status*	*Causes*	*Project Type*	*Sources*	*Action Item*	*Unit*	*Target*	*Estimated Cost*	*Potential Funding Sources*	*Responsible Parties*	*Status*	*Project Priority*
Education and outreach						Watershed information outreach	Websites, blogs, articles, newsletters, interviews, etc.	12 website updates; 6 articles; 4 newsletters	Minimal	n/a	Belmont SWCD; Captina Conservancy	Ongoing	1-5 years
Education and outreach						Ohio Scenic River Designation	Ohio Scenic River Designation	1	n/a	ODNR - Division of Natural Areas and Preserves	Belmont SWCD; local municip-alities	Not completed	5-10 years
Education and outreach						Watershed signage along state routes	Signage program	1	Varies	Ohio Environmental Education Fund (OEEF) grants program	Belmont SWCD	Not completed	1-5 years
Education and outreach						Develop volunteer water quality monitoring team	Sites monitored	100/yr	$850-$10,000/yr	Ohio Environmental Education Fund (OEEF) grants program	Belmont SWCD; Captina Conservancy; local schools and universities	Not completed	1-5 years

North Fork Subwatershed Action Plan (12-digit HUC: 050301060901)

North Fork Problem Statement 1: Sedimentation and stream embeddedness

In the North Fork subwatershed, especially downstream of the Barnesville Waste Water Treatment Plant (WWTP) and in downstream portions of Long Run, reducing sedimentation is the highest priority for improving water quality (Figure 109). Practices may also be implemented where water quality is not impaired but sources of silt should be removed to preserve high water quality. In the North Fork subwatershed, increased sedimentation is due to the following non-point sources:

1) 4,020 tons/yr of sediment by water erosion from agricultural fields without the use of BMPs
2) approximately 5 miles of stream with livestock stream access along its length (based on roadside observations)

the following *potential* non-point source (pending future use of BMPs):

3) potential, unknown loading of sediment by water erosion from new industrial and commercial construction site development without the use of BMPs

and the following point source:

4) Recent upgrades to the Barnesville WWTP have helped maintain pollutant levels within NPDES permit limits since their completion in 2011. Prior to these upgrades, Ohio EPA monitoring for NPDES permit compliance indicated effluent violations for maximum TSS in two quarters (579 kg/day in February 2010 and 637 kg/day in May 2010) out of twelve from July 2009 to June 2012 (U.S. EPA 2012). However, the completed upgrades should minimize any future violations and reduce the load of total suspended solids leaving Barnesville WWTP, which discharges directly into the North Fork at river mile 10.50. No violations of TSS limits have occurred since March 2011.

Goal 1: Reduce soil erosion from agricultural fields by 4,020 tons of sediment per year and prevent new sources of soil erosion in the next five years through the use of voluntary BMPs

Objective 1: Install 12,100 ft of riparian buffers and bank stabilization along riparian corridors in agricultural fields at the following locations:

Location	Length (ft)	Sediment load reduction (tons/yr)*
Unnamed trib to North Fork, RM 2.3-3.3	5,500 ft	140.2
North Fork RM 5.4 – 5.7	1,850 ft	47.2
North Fork RM 7.6 – 8.0	2,500 ft	212.6
Long Run RM 1.5 – 2.0	2,250 ft	47.8
TOTAL	**12,100 ft**	**447.8**

*Estimates based on RUSLE Region 5 Model calculations

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of riparian zone protection on agricultural lands

Action 2: Seek funding to provide incentive program for riparian zone protection on agricultural lands

Objective 2: Increase acres of cropland in the entire watershed under the use of conservation tillage practices from 210.5 to 280.3 acres in three years (estimated sediment load reduction using RUSLE Region 5 model, based on corn grain/soybean rotation and no-till 20% cover = 3,572 tons/yr)

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of conservation tillage, crop rotation and cover crops. Provide landowners with contacts for local NRCS staff.

Action 2: Provide information to landowners about equipment and supplies available for BMPs (no-till corn planter, no-till grain drill, geo-textile fabric, etc.) with brochures, flyers and announcements

Action 3: Seek funding to provide incentive program for conservation tillage practices on agricultural lands. Similar programs include Washington County SWCD's point-based no-till/cover crop incentive program for highly erodible lands.

Objective 3: Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed

Action 1: Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA's OEEF grants program

Action 2: Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed

Action 3: Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)

Action 4: Enter data into the NPS Project Entry Database (www.watersheddata.com) and document results through annual watershed implementation reports

Goal 2: Reduce soil erosion due to livestock stream access by 9.6 tons/yr of sediment (estimated using RUSLE Region 5 Model)

Objective 1: Install 750 ft of livestock exclusion fencing and alternative watering sources for livestock at unnamed tributary to North Fork RM 1.9 – 2.1 (Somerset Township, Section 12)

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of BMPs for livestock operations

Action 2: Seek programs providing funding and technical assistance for livestock exclusion projects and provide landowners with information about these programs through brochures and at annual workshop. Current funding programs include NRCS's EQIP and funding through the ODNR - Division of Wildlife and Division of Forestry

Action 3: Assist landowners in the development and implementation of grazing management plans and pasture rotation practices

Objective 2: Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed

Action 1: Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA's OEEF grants program

Action 2: Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed

Action 3: Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)
Action 4: Enter data into the NPS Project Entry Database (www.watersheddata.com) and document results through annual watershed implementation reports

Goal 3: Reduce off-site sediment yield from construction site development by an estimated 395 tons/ac/yr (NRCS 2000) through the installation and maintenance of sediment and erosion control BMPs

Objective 1: Install temporary and/or permanent runoff controls for all new construction developments in the watershed

Action 1: Identify entities involved in construction projects within the watershed (e.g. Ohio Department of Transportation; oil and gas drilling and pipeline construction companies) and invite their representatives to watershed stakeholder meetings
Action 2: Conduct one workshop per year, providing information and handouts to landowners about sediment and erosion control BMPs that can be voluntarily included in legal easement agreements for construction activities on their land
Action 3: As needed, provide technical guidance about sediment and erosion control BMPs, and also site-specific characteristics such as soil type, drainage area, topography and other pertinent information, to municipalities, developers, planners, engineers, and other entities involved with construction activities
Action 4: Collaborate with the East Central Ohio Building Industry Association in the implementation of the WAP and outreach opportunities
Action 5: Collaborate with ODNR-DSWR to implement Agricultural Impact Mitigation Agreements for pipeline construction projects through agricultural lands within the watershed (Appendix B)

Objective 2: Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed

Action 1: Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA's OEEF grants program
Action 2: Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed
Action 3: Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)
Action 4: Enter data into the NPS Project Entry Database (www.watersheddata.com) and document results through annual watershed implementation reports

Goal 4: Maintain discharge loadings of TSS within current NPDES effluent limits (148 kg/day monthly avg. and 221 kg/day weekly max. in the winter; 98 kg/day monthly avg. and 148 kg/day weekly max. in the summer) and prevent future violations of permit limits at the Barnesville WWTP

Objective 1: Conduct chemical and biological water quality monitoring in North Fork upstream and downstream of Barnesville WWTP discharge to assess the effectiveness of WWTP upgrades

Action 1: Develop volunteer monitoring program to conduct long-term monitoring for TSS in North Fork downstream of WWTP. Enter data into the NPS Project Entry Database and perform comparison and analysis of data collected with data reported by WWTP

Action 2: Involve Barnesville WWTP representative in watershed stakeholder meetings and WAP implementation

Action 3: Coordinate with WWTP representative to conduct public presentation highlighting water quality improvements resulting from facility upgrades

Objective 2: Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed

Action 1: Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA's OEEF grants program

Action 2: Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed

Action 3: Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)

Action 4: Enter data into the NPS Project Entry Database (www.watersheddata.com) and document results through annual watershed implementation reports

North Fork Problem Statement 2: Nutrients

During 2008-2009 sampling, mean ammonia-N and Nitrate+Nitrite-N concentrations were above reference conditions for the Western Allegheny Plateau ecoregion on North Fork at RMs 10.12 and 6.65. Phosphorus-T was elevated at RM 3.94 (OEPA 2010). In the North Fork subwatershed, elevated nutrient concentrations are from the following point source:

1) At least 6.5 RM impacted by exceedances of reference conditions for nutrients (ammonia, nitrogen and phosphorus) for the North Fork of Captina Creek downstream of the Barnesville WWTP during 2008 and 2009 water quality monitoring by the Ohio EPA. Upgrades to the facility completed in 2011 have reduced the pollutant loads for effluent leaving Barnesville WWTP, which discharges directly into the North Fork at RM 10.50 (OEPA 2010).

And the following non-point sources:

2) Estimated 106 failing (inadequate or outdated) home sewage treatment systems (HSTS) (Table 48) and an estimated 12 seasonal hunting cabins and trailers with no septic systems
3) Fertilizer draining 1,025 acres of croplands into streams in the subwatershed
4) Approximately 5 miles of stream with livestock stream access along its length, based on roadside observations

Goal 1: Maintain discharge loadings within current NPDES effluent limits for ammonia-N (7.4 kg/day monthly avg. and 15 kg/day weekly max. in the summer) and maintain total nitrite+nitrate and phosphorus-T concentrations at or below reference conditions for the Western Allegheny Plateau ecoregion (0.606 and 0.09 mg/l for headwater streams, respectively). Prevent future violations of permit limits for the Barnesville WWTP

Objective 1: Conduct chemical and biological water quality monitoring in North Fork upstream and downstream of Barnesville WWTP discharge to assess the effectiveness of WWTP upgrades

Action 1: Develop volunteer monitoring program to conduct long-term monitoring for ammonia, nitrogen and phosphorus in North Fork downstream of WWTP. Enter data into the NPS Project Entry Database and perform comparison and analysis of data collected with data reported by WWTP

Action 2: Involve Barnesville WWTP representative in watershed stakeholder meetings and WAP implementation

Action 3: Coordinate with WWTP representative to conduct public presentation highlighting water quality improvements resulting from facility upgrades

Goal 2: Reduce discharge from inadequate or outdated HSTS by 9,360 gallons/day in order to reduce nutrient loadings and reduce nutrient concentrations at or below 90^{th} percentile reference values (headwater/wading values in mg/l: 0.06/0.06 for ammonia-N, 0.606/1.054 for nitrate+nitrite-N, 0.09/0.11 for phosphorus-T)

Objective 1: Install upgrades or replacements for 26 (25%) inadequate or outdated HSTS in the subwatershed in three years

Action 1: Conduct one workshop per year to provide landowners with information about the benefits of HSTS upgrades and preventative maintenance

Action 2: Provide information to landowners, through brochures and at workshop, about cost-share programs to fund home sewage treatment system upgrades or replacements. Potential funding programs include the Clean Water State Revolving Fund's (CWSRF) 75/25 cost-share program for low-income homeowners in Ohio.

Action 3: Implement the U.S. EPA's SepticSmart initiative to promote proper septic care and maintenance among watershed residents

Action 4: Develop volunteer monitoring program to conduct long-term monitoring for ammonia, nitrogen and phosphorus at selected sites within the North Fork subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Goal 3: Reduce nutrient loading draining from fertilized croplands into streams in the entire watershed by at least 2,613 lb/yr for phosphorus and 5,232 lb/yr for nitrogen

Objective 1: Increase acres in the entire watershed under the use of conservation tillage practices by 10% each year, increasing the total amount of cropland under these practices from 210.5 to 280.3 acres in three years (estimated load reductions using RUSLE Region 5 model, based on corn grain/soybean rotation and no-till 20% cover = 2,613 lb/yr for phosphorus and 5,232 lb/year for nitrogen)

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of conservation tillage, crop rotation and cover crops. Provide landowners with contacts for local NRCS staff

Action 2: Provide information to landowners about equipment and supplies available for BMPs (no-till corn planter, no-till grain drill, geo-textile fabric, etc.) with brochures, flyers and announcements

Action 3: Seek funding to provide incentive program for conservation tillage practices on agricultural lands. Similar programs include Washington SWCD's point-based no-till/cover crop incentive program for highly erodible lands

Objective 2: Establish 1,025 acres in the subwatershed under nutrient management plans approved by BSWCD, including the implementation of nutrient stewardship principles

Action 1: Conduct one landowner workshop a year, providing information to landowners about the benefits of nutrient stewardship, including the implementation of the 4R nutrient stewardship program (right source, right rate, right time and right place of nutrient application) (TFI 2013)
Action 2: Provide information to agricultural landowners about the 4R nutrient stewardship program through brochures and flyers distributed at watershed events
Action 3: Assist landowners in the development and implementation of nutrient stewardship plans

Goal 4: Reduce nutrient loadings to the North Fork due to livestock stream access by 9.6 lb/yr of phosphorus and 19.2 lb/yr of nitrogen (estimated using RUSLE Region 5 Model)

Objective 1: Install 750 ft of livestock exclusion fencing and alternative watering sources for livestock at unnamed tributary to North Fork RM 1.9 – 2.1 (Somerset Township, Section 12)

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of BMPs for livestock operations
Action 2: Seek programs providing funding and technical assistance for livestock exclusion projects and provide landowners with information about these programs through brochures and at annual workshop. Current funding programs include NRCS's EQIP and funding through the ODNR - Division of Wildlife and Division of Forestry
Action 3: Assist landowners in the development and implementation of grazing management plans and pasture rotation practices
Action 4: Develop volunteer monitoring program to conduct long-term monitoring for ammonia, nitrogen and phosphorus at selected sites within the North Fork subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

North Fork Problem Statement 3: Pathogens (Fecal coliform)

The Ohio EPA has designated the North Fork mainstem (RM 0.4) in full attainment of Primary Contact Recreation (PCR) Class A recreation use. Bacterial sampling in 2008-2009 indicated a geometric mean of 99 colony forming units (cfu) per 100 ml of water, which meets the criterion of ≤126 cfu/100ml for PCR Class A (OEPA 2010). However, bacterial nuisance water quality monitoring data collected by the Ohio EPA in Summer and Fall 2013 indicated a mean *E. coli* concentration elevated above water quality criterion at North Fork RM 5.2 (382.5 cfu/100ml). Due to the importance of maintaining the watershed's excellent water quality, the following *potential* sources of pathogens have been identified:

1) Estimated 106 failing (inadequate or outdated) HSTS (Table 48) and an estimated 12 seasonal hunting cabins and trailers with no septic systems
2) Approximately 5 miles of stream with livestock stream access along its length, based on roadside observations

Goal 1: Reduce discharge from inadequate or outdated HSTS by 9,360 gallons/day in order to maintain bacteria concentrations downstream of inadequate or outdated HSTS at or below 126 cfu/100ml

***Objective 1**:* Install upgrades or replacements for 26 (25%) inadequate or outdated HSTS in the subwatershed in three years, targeting areas with concentrated HSTS issues at North Fork RM 2.9 and 4.9

Action 1: Conduct one workshop per year to provide landowners with information about the benefits of HSTS upgrades and preventative maintenance

Action 2: Provide information to landowners, through brochures and at workshop, about cost-share programs to fund home sewage treatment system upgrades or replacements. Potential funding programs include the Clean Water State Revolving Fund's (CWSRF) 75/25 cost-share program for low-income homeowners in Ohio.

Action 3: Implement the U.S. EPA's SepticSmart initiative to promote proper septic care and maintenance among watershed residents

Action 4: Develop volunteer monitoring program to conduct long-term monitoring for bacteria at selected sites within the North Fork subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Goal 2: Maintain bacteria concentrations downstream of livestock stream access sites at or below 126 cfu/100ml

Objective 1: Install 750 ft of livestock exclusion fencing and alternative watering sources for livestock at unnamed tributary to North Fork RM 1.9 – 2.1 (Somerset Township, Section 12)

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of BMPs for livestock operations.

Action 2: Seek programs providing funding and technical assistance for livestock exclusion projects and provide landowners with information about these programs through brochures and at annual workshop. Current funding programs include NRCS's EQIP and funding through the ODNR - Division of Wildlife and Division of Forestry

Action 3: Assist landowners in the development and implementation of grazing management plans and pasture rotation practices

Action 4: Develop volunteer monitoring program to conduct long-term monitoring for bacteria at selected sites within the North Fork subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

North Fork Problem Statement 4: Trash in and near streambanks

Trash and debris in and near streambanks does not impair water quality in the North Fork subwatershed; however, the removal of excessive trash and debris will help maintain the high stream and habitat quality and the aesthetic value of streams in the subwatershed. In the North Fork subwatershed, trash in and near streambanks is due to the following sources:

1) At least five documented illegal dumping sites within the subwatershed. The worst site impacts 2.0 stream miles along Long Run (RM 2.0 to 4.0) and Goshen Township Road 184 (Figure 133).

Figure 134. Illegal dumping along Long Run Rd (Goshen TR 184). *Source:* Belmont Soil & Water Conservation District, 2013.

Goal 1: Clean up one dumping site and assist in the prevention of new illegal dumping sites within the subwatershed in the next five years

Objective 1: Conduct at least one trash cleanup per year in the Captina Creek watershed

Action 1: Identify a cleanup site within the Captina Creek watershed for the Ohio River Valley Water Sanitation Commission's annual Ohio River Sweep

Action 2: Work with volunteer groups to establish a two-mile section along a State Route, United States Route or Interstate in the Captina Creek watershed as part of the Ohio Department of Transportation's Adopt-A-Highway Program. Involvement in this program would require four trash cleanups along the route per year.

Action 3: Work with JB Green Team (local solid waste management district for Jefferson and Belmont counties), county health departments, and township trustees to identify illegal dumpsites and develop a map that can be updated to maintain a record of cleanups

Action 4: Coordinate with law enforcement including JB Green Team's Litter Deputy and the Belmont County Sheriff to report open dumping complaints in the watershed

Action 5: Conduct tire cleanup through Bridgestone's Tire Removal and Recycling Program

Action 6: Pursue additional grant opportunities to fund litter cleanups, such as Ohio EPA's Litter Collection and Prevention Grant

Objective 2: Remove trash along 2.0 stream miles of Long Run (TR 184)

Action 1: Conduct community litter cleanup at site. Develop funding and resources for cleanup through JB Green Team, Belmont County Health Department, and Goshen Township Trustees. Possible funding sources also include Bridgestone's Tire Removal and Recycling Program

Action 2: Seek funding to install signs to promote litter awareness and prevent future dumping at the site

Objective 3: Provide education and outreach to increase communities' overall knowledge of the environmental and health effects of trash in and near streambanks, and foster an appreciation for cleaner streams

Action 1: Coordinate with JB Green Team to provide educational programs about litter prevention and recycling at community and youth events

Action 2: Distribute brochures and flyers to watershed residents with information about proper trash disposal and recycling drop-off locations

Action 3: Incorporate litter-free principles at watershed events

North Fork Problem Statement 5: Water withdrawal

In the North Fork subwatershed, there are at least two water withdrawal facilities with a capacity to withdraw greater than 100,000 gallons per day of water from three intakes (as registered with ODNR-DSWR's Water Withdrawal Facilities Registration Program), and the number of undocumented water withdrawals in the watershed is unknown. Excessive withdrawals could potentially damage habitat quality for aquatic wildlife due to lower water volumes, lack of connectivity among habitats, increased water temperatures, decreased oxygen levels, reduced flushing of fine sediments and reduced access to spawning habitats. Ecosystem impacts will vary by season, habitat and species.

Goal 1: Prevent excessive water withdrawal, or the cumulative effects of multiple sources of withdrawal, resulting in inadequate water resources and habitat for Captina Creek and its tributaries, especially during low flow conditions

Objective 1: Encourage greater availability of water withdrawal information in the subwatershed, especially as industrial activity (e.g. oil and gas drilling) increases

Action 1: Watershed Coordinator and Technical Committee will gather information from watershed stakeholders and direct concerns over excessive withdrawal to the appropriate agencies

Action 2: Provide information about the Water Withdrawal Facilities Registration Program to watershed stakeholders through informational handouts

Action 3: Conduct landowner workshop with agency and industry representatives to answer questions and address concerns about water withdrawals in the watershed

Objective 2: Develop long-term solutions to increase the sustainability of water withdrawal in the watershed and protect water and habitat resources

Action 1: Direct industry operators to the appropriate agencies (e.g. U.S. Army Corps of Engineers; ODNR) for information about Ohio regulations and BMPs

Action 2: Conduct a meeting with ODNR-DSWR and Division of Oil and Gas, and local oil and gas drilling companies to raise awareness about the watershed planning process

Action 3: Work with Technical Group and industry representatives to develop a long-term plan designating specific withdrawal locations in the watershed to reduce soil and water impacts from withdrawal locations

Action 4: Work with ODNR-DSWR and Ohio EPA to develop withdrawal permits based on real-time, location-specific flow rates

Table 52. Implementation details for projects identified in the North Fork subwatershed action plan (12-digit HUC: 050103060901).

Project Name	*Aquatic Life Use*	*Attainment Status*	*Causes*	*Project Type*	*Sources*	*Objective*	*Unit*	*Target*	*Estimated Cost (U.S. Dollars)*	*Responsible Parties/ Funding Sources*	*Status*	*Project Priority*
Streambank restoration – unnamed trib to N. Fork	Unknown	n/a	Sediment	Restoration	Unstable bank	Install riparian buffer and bank stabilization	Linear feet	5,500	$460,240[a]	Belmont SWCD; USFWS; OEPA NPS Program; mitigation opportun-ities	Not completed	5-10 years
Streambank restoration - North Fork RM 5.4 – 5.7	EWH	Full	Sediment	Restoration	Unstable bank	Install riparian buffer and bank stabilization	Linear feet	1,850	$154,808[a]	Belmont SWCD; USFWS; OEPA NPS Program; mitigation opportun-ities	Not completed	5-10 years
Streambank restoration - North Fork RM 7.6 – 8.0	WWH	Full	Sediment	Restoration	Unstable bank	Install riparian buffer and bank stabilization	Linear feet	2,500	$209,200[a]	Belmont SWCD; USFWS; OEPA NPS Program; mitigation opportun-ities	Not completed	5-10 years
Streambank restoration - Long Run RM 1.5 – 2.0	WWH	Full	Sediment	Restoration	Unstable bank	Install riparian buffer and bank stabilization	Linear feet	2,250	$188,280[a]	Belmont SWCD; USFWS; OEPA NPS Program; mitigation opportun-ities	Not completed	5-10 years
Conservation tillage practices – North Fork subwatershed	n/a	n/a	Sediment, nutrients	Protection	Agricultural fields	Increase total amount of cropland under conservation tillage practices	Acres in entire watershed	280.3	Unknown	Belmont SWCD; ODNR-DSWR; NRCS	210.5 acres	1-3 years

Project Name	*Aquatic Life Use*	*Attainment Status*	*Causes*	*Project Type*	*Sources*	*Objective*	*Unit*	*Target*	*Estimated Cost (U.S. Dollars)*	*Responsible Parties/ Funding Sources*	*Status*	*Project Priority*
Livestock exclusion - North Fork RM 1.9 – 2.1	EWH	Full	Sediment, nutrients, pathogens	Restoration	Livestock access	Install livestock exclusion fencing and alternative watering sources	Linear feet	750	$3,000	Belmont SWCD; ODNR-DSWR; NRCS	Not completed	5-10 years
Construction runoff controls – North Fork subwatershed	n/a	n/a	Sediment	Protection	Soil disturbance without BMPs	Install temporary and/or permanent runoff controls	Tons/ac/yr per site	395	Unknown	Belmont SWCD; OEPA	Not completed	5-10 years
Sediment control – North Fork subwatershed	n/a	n/a	Sediment	Protection	Varies	Monitoring for TSS with turbidity tubes and measuring streambed sediment through pebble counts	Monitoring events per year	4	$56.50 for turbidity tube; $69.30 for gravelometer	Belmont SWCD; Captina Conservancy; OEPA	1 completed in 2013	1-3 years
Sediment control – North Fork subwatershed	n/a	n/a	Sediment	Protection	Varies	Assessments of stream physical habitat (e.g. QHEI, HHEI)	Monitoring events per year	1	0	Belmont SWCD; OEPA	1 completed in 2008 - 2009	1-3 years
Sediment control – North Fork subwatershed	n/a	n/a	Sediment	Protection	WWTP	Chemical and biological water quality monitoring in North Fork upstream and downstream of Barnesville WWTP discharge to assess the effectiveness of WWTP upgrades	Monitoring events per year	4	Cost of equipment	Belmont SWCD; OEPA	Not completed	1-3 years
Nutrient control – North Fork subwatershed	n/a	n/a	Nutrients	Protection	WWTP	Chemical and biological water quality monitoring in North Fork upstream and downstream of Barnesville WWTP discharge to assess the effectiveness of WWTP upgrades	Monitoring events per year	4	Cost of equipment	Belmont SWCD; OEPA	Not completed	1-3 years
HSTS installation and repair – North Fork RM 2.9 and 4.9	EWH	Full	Nutrients, pathogens	Restoration	Inadequate or outdated HSTS	Install upgrades or replacements for inadequate or outdated HSTS in the subwatershed	Systems	26	$254,800	Belmont Co. Health Dept.; OEPA; Belmont SWCD	Not completed	5-10 years

Project Name	*Aquatic Life Use*	*Attainment Status*	*Causes*	*Project Type*	*Sources*	*Objective*	*Unit*	*Target*	*Estimated Cost (U.S. Dollars)*	*Responsible Parties/ Funding Sources*	*Status*	*Project Priority*
Nutrient management on agricultural lands – North Fork subwatershed	n/a	n/a	Nutrients	Protection	Fertilizer runoff from agriculture fields	Establish cropland under nutrient management plans and nutrient stewardship principles	Acres	1,025	0	Belmont SWCD; ODNR-DSWR; NRCS	Not completed	5-10 years
Litter cleanup – Long Run RM 0.0 – 2.0	WWH	Full	Trash and debris	Restoration	Illegal dumping of trash	Conduct litter cleanup along Long Run	Stream miles	2	Cost of equipment	Belmont SWCD; JB Green Team	Partial cleanup completed in 2013	1-3 years

[a] Cost estimate based on *Stream Restoration in the Upper Midwest, U.S.A.* (Alexander and Allen 2006).

South Fork Subwatershed Action Plan (12-digit HUC: 050301060902)

South Fork Problem Statement 1: Sedimentation and stream embeddedness

In the South Fork subwatershed, especially in the mid-section of South Fork, reducing sedimentation is the highest priority for improving water quality. Practices may also be implemented where water quality is not impaired but sources of silt should be removed to preserve high water quality. In the South Fork subwatershed, increased sedimentation is due to the following non-point sources:

1) 5,401.8 tons/year of sediment by water erosion from agricultural fields without the use of BMPs
2) approximately 6 miles of stream with livestock stream access along its length (based on roadside observations)

the following *potential* non-point source (pending future use of BMPs):

3) potential, unknown loading of sediment by water erosion from new industrial and commercial construction site development without the use of BMPs

Goal 1: Reduce soil erosion from agricultural fields by 5,401.8 tons of sediment per year and prevent new sources of soil erosion in the next five years through the use of voluntary BMPs

Objective 1: Install 16,755 ft of riparian buffers and 1 acre of filter strips along riparian corridors in agricultural fields at the following locations:

Location	Length (ft)	Sediment load reduction (tons/yr)*
South Fork RM 1.2 – 1.6	1,330 ft	172.6
South Fork RM 2.2 – 2.7	3,200 ft (1 acre)	41.0
South Fork RM 5.3 – 5.4	600 ft	12.8
South Fork RM 6.3 – 7.1	4,250 ft	722.6
South Fork RM 7.4 – 8.3	5,000 ft	680.0
South Fork RM 9.2 – 9.7	2,375 ft	200.8
TOTAL	**16,755 ft**	**1,829.8**

*Estimates based on RUSLE Region 5 Model calculations

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of riparian zone protection on agricultural lands

Action 2: Seek funding to provide incentive program for riparian zone protection on agricultural lands

Objective 2: Increase acres of cropland in the entire watershed under the use of conservation tillage practices from 210.5 to 280.3 acres in three years (estimated sediment load reduction using RUSLE Region 5 model, based on corn grain/soybean rotation and no-till 20% cover = 3,572 tons/yr)

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of conservation tillage, crop rotation and cover crops. Provide landowners with contacts for local NRCS staff.

Action 2: Provide information to landowners about equipment and supplies available for BMPs (no-till corn planter, no-till grain drill, geo-textile fabric, etc.) with brochures, flyers and announcements

Action 3: Seek funding to provide incentive program for conservation tillage practices on agricultural lands. Similar programs include Washington SWCD's point-based no-till/cover crop incentive program for highly erodible lands.

Objective 3: Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed

Action 1: Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA's OEEF grants program

Action 2: Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed

Action 3: Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)

Action 4: Enter data into the NPS Project Entry Database (www.watersheddata.com) and document results through annual watershed implementation reports

Goal 2: Reduce soil erosion due to livestock stream access by 14.6 tons/yr of sediment (estimated using RUSLE Region 5 Model)

Objective 1: Install 1,150 ft of livestock exclusion fencing and alternative watering sources for livestock at South Fork RM 11.3 – 11.5 and RM 0.0 – 0.1 of unnamed tributary to South Fork along TR 728 (Somerset Township, Section 8)

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of BMPs for livestock operations

Action 2: Seek programs providing funding and technical assistance for livestock exclusion projects and provide landowners with information about these programs through brochures and at annual workshop. Current funding programs include NRCS's EQIP and funding through the ODNR - Division of Wildlife and Division of Forestry

Action 3: Assist landowners in the development and implementation of grazing management plans and pasture rotation practices

Objective 2: Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed

Action 1: Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA's OEEF grants program

Action 2: Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed

Action 3: Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)

Action 4: Enter data into the NPS Project Entry Database (www.watersheddata.com) and document results through annual watershed implementation reports

Goal 3: Reduce off-site sediment yield from construction site development by an estimated 395 tons/ac/yr (NRCS 2000) through the installation and maintenance of sediment and erosion control BMPs

Objective 1: Install temporary and/or permanent runoff controls for all new construction developments in the watershed

Action 1: Identify entities involved in construction projects within the watershed (e.g. Ohio Department of Transportation; oil and gas drilling and pipeline construction companies) and invite their representatives to watershed stakeholder meetings

Action 2: Conduct one workshop per year, providing information and handouts to landowners about sediment and erosion control BMPs that can be voluntarily included in legal easement agreements for construction activities on their land

Action 3: As needed, provide technical guidance about sediment and erosion control BMPs, and also site-specific characteristics such as soil type, drainage area, topography and other pertinent information, to municipalities, developers, planners, engineers, and other entities involved with construction activities

Action 4: Collaborate with the East Central Ohio Building Industry Association in the implementation of the WAP and outreach opportunities

Action 5: Collaborate with ODNR-DSWR to implement Agricultural Impact Mitigation Agreements for pipeline construction projects through agricultural lands within the watershed (Appendix B)

Objective 2: Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed

Action 1: Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA's OEEF grants program

Action 2: Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed

Action 3: Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)

Action 4: Enter data into the NPS Project Entry Database (www.watersheddata.com) and document results through annual watershed implementation reports

South Fork Problem Statement 2: Nutrients

Data indicate that nutrient levels are low and not a major source of impairment for the mainstem of Captina Creek and most of its tributaries. During 2008-2009 sampling, mean nutrient concentrations were below reference values (headwater/wading values in mg/l: 0.06/0.06 for ammonia-N, 0.606/1.054 for nitrate+nitrite-N, 0.09/0.11 for phosphorus-T) for the Western Allegheny Plateau ecoregion at all sampling locations within the South Fork subwatershed (OEPA 2010). However, elevated nutrient levels could be a future cause of impairment in the South Fork subwatershed and the following *potential* sources should be addressed in the effort to maintain excellent water quality:

1) Estimated 56 failing (inadequate or outdated) HSTS (Table 48)
2) Fertilizer draining 2,005 acres of croplands into streams in the subwatershed
3) Approximately 6 miles of stream with livestock stream access along its length, based on roadside observations

Goal 1: Reduce discharge from inadequate or outdated HSTS by 5,040 gallons/day in order to reduce nutrient loadings and maintain nutrient concentrations at or below 90th percentile reference values (headwater/wading values in mg/l: 0.06/0.06 for ammonia-N, 0.606/1.054 for nitrate+nitrite-N, 0.09/0.11 for phosphorus-T)

> ***Objective 1:*** Install upgrades or replacements for 14 (25%) inadequate or outdated HSTS in the subwatershed in three years
>
> > ***Action 1:*** Conduct one workshop per year to provide landowners with information about the benefits of HSTS upgrades and preventative maintenance
> >
> > ***Action 2:*** Provide information to landowners, through brochures and at workshop, about cost-share programs to fund home sewage treatment system upgrades or replacements. Potential funding programs include the Clean Water State Revolving Fund's (CWSRF) 75/25 cost-share program for low-income homeowners in Ohio.
> >
> > ***Action 3:*** Implement the U.S. EPA's SepticSmart initiative to promote proper septic care and maintenance among watershed residents
> >
> > ***Action 4:*** Develop volunteer monitoring program to conduct long-term monitoring for ammonia, nitrogen and phosphorus at selected sites within the South Fork subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Goal 2: Reduce nutrient loading draining from fertilized croplands into streams in the entire watershed by at least 2,613 lb/yr for phosphorus and 5,232 lb/yr for nitrogen, based on estimated load reductions using the RUSLE Region 5 Model

> ***Objective 1:*** Increase acres in the entire watershed under the use of conservation tillage practices by 10% each year, increasing the total amount of cropland under these practices from 210.5 to 280.3 acres in three years (estimated load reductions using RUSLE Region 5 model, based on corn grain/soybean rotation and no-till 20% cover = 2,613 lb/yr for phosphorus and 5,232 lb/year for nitrogen)
>
> > ***Action 1:*** Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of conservation tillage, crop rotation and cover crops. Provide landowners with contacts for local NRCS staff.
> >
> > ***Action 2:*** Provide information to landowners about equipment and supplies available for BMPs (no-till corn planter, no-till grain drill, geo-textile fabric, etc.) with brochures, flyers and announcements
> >
> > ***Action 3:*** Seek funding to provide incentive program for conservation tillage practices on agricultural lands. Similar programs include Washington SWCD's point-based no-till/cover crop incentive program for highly erodible lands.
>
> ***Objective 2:*** Establish 2,005 acres in the subwatershed under nutrient management plans approved by BSWCD, including the implementation of nutrient stewardship principles
>
> > ***Action 1:*** Conduct one landowner workshop a year, providing information to landowners about the benefits of nutrient stewardship, including the implementation of the 4R nutrient stewardship program (right source, right rate, right time and right place of nutrient application) (TFI 2013)
> >
> > ***Action 2:*** Provide information to agricultural landowners about the 4R nutrient stewardship program through brochures and flyers distributed at watershed events
> >
> > ***Action 3:*** Assist landowners in the development of nutrient stewardship plans

Goal 3: Reduce nutrient loadings to the South Fork due to livestock stream access by 14.6 lb/yr of phosphorus and 29.4 lb/yr of nitrogen (estimated using RUSLE Region 5 Model)

Objective 1: Install 1,150 ft of livestock exclusion fencing and alternative watering sources for livestock at South Fork RM 11.3 – 11.5 and RM 0.0 – 0.1 of unnamed tributary to South Fork along TR 728 (Somerset Township, Section 8)

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of BMPs for livestock operations

Action 2: Seek programs providing funding and technical assistance for livestock exclusion projects and provide landowners with information about these programs through brochures and at annual workshop. Current funding programs include NRCS's EQIP and funding through the ODNR - Division of Wildlife and Division of Forestry

Action 3: Assist landowners in the development and implementation of grazing management plans and pasture rotation practices

Action 4: Develop volunteer monitoring program to conduct long-term monitoring for ammonia, nitrogen and phosphorus at selected sites within the South Fork subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

South Fork Problem Statement 3: Pathogens (Fecal coliform)

The Ohio EPA has designated the South Fork mainstem (RM 0.1) in full attainment of PCR Class B recreation use. Bacterial sampling in 2008-2009 indicated a geometric mean of 44 cfu per 100 ml of water, which meets the criterion of ≤161 cfu/100ml for PCR Class B (OEPA 2010). However, bacterial nuisance water quality monitoring data collected by the Ohio EPA in Summer and Fall 2013 indicated a mean *E. coli* concentration elevated above water quality criterion at South Fork RM 11.4 (220 cfu/100ml). Due to the importance of maintaining the watershed's excellent water quality, the following *potential* sources of pathogens have been identified:

1) Estimated 56 failing (inadequate or outdated) HSTS (Table 48)
2) Approximately 6 miles of stream with livestock stream access along its length, based on roadside observations

Goal 1: Reduce discharge from inadequate or outdated HSTS by 5,040 gallons/day in order to maintain bacteria concentrations downstream of inadequate or outdated HSTS at or below 161 cfu/100ml

Objective 1: Install upgrades or replacements for 14 (25%) inadequate or outdated HSTS in the subwatershed in three years

Action 1: Conduct one workshop per year to provide landowners with information about the benefits of HSTS upgrades and preventative maintenance

Action 2: Provide information to landowners, through brochures and at workshop, about cost-share programs to fund home sewage treatment system upgrades or replacements. Potential funding programs include the Clean Water State Revolving Fund's (CWSRF) 75/25 cost-share program for low-income homeowners in Ohio.

Action 3: Implement the U.S. EPA's SepticSmart initiative to promote proper septic care and maintenance among watershed residents

Action 4: Develop volunteer monitoring program to conduct long-term monitoring for bacteria at selected sites within the South Fork subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Goal 2: Maintain bacteria concentrations downstream of livestock stream access sites at or below 161 cfu/100ml

Objective 1: Install 1,150 ft of livestock exclusion fencing and alternative watering sources for livestock at South Fork RM 11.3 – 11.5 and RM 0.0 – 0.1 of unnamed tributary to South Fork along TR 728 (Somerset Township, Section 8)

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of BMPs for livestock operations.

Action 2: Seek programs providing funding and technical assistance for livestock exclusion projects and provide landowners with information about these programs through brochures and at annual workshop. Current funding programs include NRCS's EQIP and funding through the ODNR - Division of Wildlife and Division of Forestry

Action 3: Assist landowners in the development and implementation of grazing management plans and pasture rotation practices

Action 4: Develop volunteer monitoring program to conduct long-term monitoring for bacteria at selected sites within the South Fork subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

South Fork Problem Statement 4: Trash in and near streambanks

Trash and debris in and near streambanks does not impair water quality in the South Fork subwatershed; however, the removal of excessive trash and debris will help maintain the high stream and habitat quality and the aesthetic value of streams in the subwatershed. In the South Fork subwatershed, trash in and near streambanks is due to the following sources:

1) At least three documented illegal dumping sites within the subwatershed

Goal 1: Clean up one dumping site and assist in the prevention of new illegal dumping sites within the subwatershed in the next five years

Objective 1: Conduct at least one trash cleanup per year in the Captina Creek watershed

Action 1: Identify a cleanup site within the Captina Creek watershed for the Ohio River Valley Water Sanitation Commission's annual Ohio River Sweep

Action 2: Work with volunteer groups to establish a two-mile section along a State Route, United States Route or Interstate in the Captina Creek watershed as part of the Ohio Department of Transportation's Adopt-A-Highway Program. Involvement in this program would require four trash cleanups along the route per year.

Action 3: Work with JB Green Team (local solid waste management district for Jefferson and Belmont counties), county health departments, and township trustees to identify illegal dumpsites and develop a map that can be updated to maintain a record of cleanups

Action 4: Coordinate with law enforcement including JB Green Team's Litter Deputy and the Belmont County Sheriff to report open dumping complaints in the watershed

Action 5: Conduct tire cleanup through Bridgestone's Tire Removal and Recycling Program

Action 6: Pursue additional grant opportunities to fund litter cleanups, such as Ohio EPA's Litter Collection and Prevention Grant

Objective 2: Remove trash along 1.1 stream miles (RM 10.6 – 11.4 along the South Fork and RM 0.0 – 0.3 along an unnamed tributary upstream), along Somerset TR 728

Action 1: Work with landowner to conduct community litter cleanup at site. Develop funding and resources for cleanup through JB Green Team, county health department, and Somerset Township Trustees
Action 2: Seek funding to install signs to promote litter awareness and prevent future dumping at the site

Objective 3: Provide education and outreach to increase communities' overall knowledge of the environmental and health effects of trash in and near streambanks, and foster an appreciation for cleaner streams

Action 1: Coordinate with JB Green Team to provide educational programs about litter prevention and recycling at community and youth events
Action 2: Distribute brochures and flyers to watershed residents with information about proper trash disposal and recycling drop-off locations
Action 3: Incorporate litter-free principles at watershed events

South Fork Problem Statement 5: Water withdrawal

In the South Fork subwatershed, there are at least two water withdrawal facilities with a capacity to withdraw greater than 100,000 gallons per day of water registered with ODNR-DSWR's Water Withdrawal Facilities Registration Program, and the number of undocumented water withdrawals in the watershed is unknown. Excessive withdrawals could potentially damage habitat quality for aquatic wildlife due to lower water volumes, lack of connectivity among habitats, increased water temperatures, decreased oxygen levels, reduced flushing of fine sediments and reduced access to spawning habitats. Ecosystem impacts will vary by season, habitat and species.

Goal 1: Prevent excessive water withdrawal, or the cumulative effects of multiple sources of withdrawal, resulting in inadequate water resources and habitat for Captina Creek and its tributaries, especially during low flow conditions

Objective 1: Encourage greater availability of water withdrawal information in the subwatershed, especially as industrial activity (e.g. oil and gas drilling) increases

Action 1: Watershed Coordinator and Technical Committee will gather information from watershed stakeholders and direct concerns over excessive withdrawal to the appropriate agencies
Action 2: Provide information about the Water Withdrawal Facilities Registration Program to watershed stakeholders through informational handouts
Action 3: Conduct landowner workshop with agency and industry representatives to answer questions and address concerns about water withdrawals in the watershed

Objective 2: Develop long-term solutions to increase the sustainability of water withdrawal in the watershed and protect water and habitat resources

Action 1: Direct industry operators to the appropriate agencies (e.g. U.S. Army Corps of Engineers; Ohio EPA) for information about Ohio regulations and BMPs
Action 2: Conduct a meeting with ODNR-DSWR and Division of Oil and Gas, and local oil and gas drilling companies to raise awareness about the watershed planning process
Action 3: Work with Technical Group and industry representatives to develop a long-term plan designating specific withdrawal locations in the watershed to reduce soil and water impacts from withdrawal locations

Action 4: Work with ODNR-DSWR and Ohio EPA to develop withdrawal permits based on current, location-specific flow rates

Table 53. Implementation details for projects identified in the South Fork subwatershed action plan (12-digit HUC: 050103060902).

Project Name	*Aquatic Life Use*	*Attainment Status*	*Causes*	*Project Type*	*Sources*	*Objective*	*Unit*	*Target*	*Estimated Cost (U.S. Dollars)*	*Responsible Parties / Funding Sources*	*Status*	*Project Priority*
Streambank restoration - South Fork RM 1.2 – 1.6	EWH-R*	Full	Sediment	Restoration	Unstable bank	Install riparian buffer and bank stabilization	Linear feet	1,330	$111,294[a]	Belmont SWCD; USFWS; OEPA NPS Program; mitigation opportun-ities	Not completed	5-10 years
Streambank restoration - South Fork RM 2.2 – 2.7	EWH-R	Full	Sediment	Restoration	Unstable bank	Install riparian buffer and filter strip	Acre / linear feet	1 / 3,200	$267,776[a]	Belmont SWCD; USFWS; OEPA NPS Program; mitigation opportun-ities	Not completed	5-10 years
Streambank restoration - South Fork RM 5.3 – 5.4	EWH-R	Partial	Sediment	Restoration	Unstable bank	Install riparian buffer and bank stabilization	Linear feet	600	$50,208[a]	Belmont SWCD; USFWS; OEPA NPS Program; mitigation opportun-ities	Not completed	5-10 years
Streambank restoration - South Fork RM 6.3 – 7.1	EWH-R	Partial	Sediment	Restoration	Unstable bank	Install riparian buffer and bank stabilization	Linear feet	4,250	$355,640	Belmont SWCD; USFWS; OEPA NPS Program; mitigation opportun-ities	Not completed	5-10 years
Streambank restoration - South Fork RM 7.4 – 8.3	EWH-R	Partial	Sediment	Restoration	Unstable bank	Install riparian buffer and bank stabilization	Linear feet	5,000	$418,400	Belmont SWCD; USFWS; OEPA NPS Program; mitigation opportun-ities	Not completed	5-10 years

Project Name	*Aquatic Life Use*	*Attainment Status*	*Causes*	*Project Type*	*Sources*	*Objective*	*Unit*	*Target*	*Estimated Cost (U.S. Dollars)*	*Responsible Parties / Funding Sources*	*Status*	*Project Priority*
Streambank restoration - South Fork RM 9.2 – 9.7	EWH-R	Full	Sediment	Restoration	Unstable bank	Install riparian buffer and bank stabilization	Linear feet	2,375	$198,740	Belmont SWCD; USFWS; OEPA NPS Program; mitigation opportun-ities	Not completed	5-10 years
Conservation tillage practices – South Fork subwatershed	n/a	n/a	Sediment, nutrients	Protection	Agricultural fields	Increase total amount of cropland under conservation tillage practices	Acres in entire watershed	280.3	Unknown	Belmont SWCD; ODNR-DSWR; NRCS	210.5	1-3 years
Livestock exclusion - South Fork RM 11.3 – 11.5 and RM 0.0 – 0.1 of unnamed tributary to South Fork	EWH-R	Full	Sediment, nutrients, pathogens	Restoration	Livestock access	Install livestock exclusion fencing and alternative watering sources	Linear feet	1,150	$4,600	Belmont SWCD; ODNR-DSWR; NRCS	Not completed	5-10 years
Construction runoff controls – South Fork subwatershed	n/a	n/a	Sediment	Protection	Soil disturbance without BMPs	Install temporary and/or permanent runoff controls	Tons/ac/yr per site	395	Unknown	Belmont SWCD; OEPA	Not completed	5-10 years
Sediment control – South Fork subwatershed	n/a	n/a	Sediment	Protection	Varies	Monitoring for TSS with turbidity tubes and measuring streambed sediment through pebble counts	Monitoring events per year	4	$56.50 for turbidity tube; $69.30 for gravelometer	Belmont SWCD; Captina Conservancy; OEPA	1 completed in 2013	1-3 years
Sediment control – South Fork subwatershed	n/a	n/a	Sediment	Protection	Varies	Assessments of stream physical habitat (e.g. QHEI, HHEI)	Monitoring events per year	1	0	Belmont SWCD; OEPA	1 completed in 2008 - 2009	1-3 years
HSTS installation and repair – South Fork subwatershed	n/a	n/a	Nutrients, Pathogens	Restoration	Inadequate or outdated HSTS	Install upgrades or replacements for inadequate or outdated HSTS in the subwatershed	Systems	14	$137,200	Belmont Co. Health Dept.; OEPA	Not completed	5-10 years
Nutrient management on agricultural lands – South Fork subwatershed	n/a	n/a	Nutrients	Protection	Fertilizer runoff from agriculture fields	Establish cropland under nutrient management plans and nutrient stewardship principles	Acres	2,005	0	Belmont SWCD; NRCS	Not completed	5-10 years

Project Name	*Aquatic Life Use*	*Attainment Status*	*Causes*	*Project Type*	*Sources*	*Objective*	*Unit*	*Target*	*Estimated Cost (U.S. Dollars)*	*Responsible Parties / Funding Sources*	*Status*	*Project Priority*
Litter cleanup – South Fork RM 10.6 – 11.4 and RM 0.0 – 0.3 of unnamed tributary	EWH-R	Full	Trash and debris	Restoration	Illegal dumping of trash	Conduct litter cleanup along South Fork and unnamed tributary	Stream miles	1.1	0	Belmont SWCD; JB Green Team	Not completed	1-3 years

[a] Cost estimate based on *Stream Restoration in the Upper Midwest, U.S.A.* (Alexander and Allen 2006).

* R denotes a recommendation that differs from the current use designation (OEPA 2010).

Bend Fork Subwatershed Action Plan (12-digit HUC: 050301060903)

Bend Fork Problem Statement 1: Sedimentation and stream embeddedness

In the Bend Fork subwatershed, reducing sedimentation is the highest priority for improving water quality. Practices may also be implemented where water quality is not impaired but sources of silt should be removed to preserve high water quality. In the Bend Fork subwatershed, increased sedimentation is due to the following non-point sources:

1) approximately 9 miles of stream with livestock stream access along its length, based on roadside observations
2) 5.2 stream miles affected by public stream crossings and excessive ATV-induced erosion and an unknown number of residential stream crossings for vehicle transportation, contributing at least 129.2 tons/yr of sediment to Bend Fork (Figure 111)

the following *potential* non-point source (pending future use of BMPs):

3) potential, unknown loading of sediment by water erosion from new industrial and commercial construction site development without the use of BMPs

Goal 1: Reduce soil erosion due to livestock stream access by 212.6 tons/yr of sediment (estimated using RUSLE Region 5 Model)

- ***Objective 1:*** Install 2,500 ft of livestock exclusion fencing and alternative watering sources for livestock at Bend Fork RM 9.7 – 10.2 (Goshen Township, Section 9)
  - ***Action 1:*** Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of BMPs for livestock operations
  - ***Action 2:*** Seek programs providing funding and technical assistance for livestock exclusion projects and provide landowners with information about these programs through brochures and at annual workshop. Current funding programs include NRCS's EQIP and funding through the ODNR - Division of Wildlife and Division of Forestry
  - ***Action 3:*** Assist landowners in the development and implementation of grazing management plans and pasture rotation practices
- ***Objective 2:*** Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed
  - ***Action 1:*** Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA's OEEF grants program
  - ***Action 2:*** Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed
  - ***Action 3:*** Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)
  - ***Action 4:*** Enter data into the NPS Project Entry Database and document results through annual watershed implementation reports

Goal 2: Reduce soil erosion caused by public and residential stream crossings for vehicle transportation and excessive ATV-induced soil erosion by 129.2 tons/yr of sediment

Objective 1: Establish a stream crossing alternative (e.g. bridge, high vent-area ratio culvert, ford, rock-ramp fishway) for open stream crossing on Township Rd 194 (Goshen Township, Section 2), affecting approximately 1.6 RM of Joy Fork

Action 1: Identify potential funding sources for alternate stream crossing

Action 2: Coordinate with Goshen Township trustees and Belmont County engineer to develop project plans and hire contractor to complete construction of crossing structure

Action 3: Conduct pre- and post-construction habitat evaluations and monitoring for TSS to determine improvements in stream quality. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Objective 2: Establish stream crossing alternatives (e.g. bridge, high vent-area ratio culvert, ford, rock-ramp fishway) for multiple stream crossings and ATV trails along Township Rd 101, affecting 3.0 RM of Bend Fork in Washington Township, Sections 23, 24 and 30

Action 1: Identify potential funding sources for alternate stream crossing

Action 2: Coordinate with Washington Township trustees and Belmont County engineer to develop project plans and hire contractor to complete construction of crossing structure

Action 3: Conduct pre- and post-construction habitat evaluations and monitoring for TSS to determine improvements in stream quality. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Objective 3: Install voluntary stream crossing structures and reestablishment of native vegetation for ATV trails through riparian corridors along 2,761 ft of Millers Run in Smith Township, Section 27

Action 1*:* Conduct a landowner workshop to provide information about the effects of ATV-induced soil erosion in the watershed and the benefits of BMPs. Invite law enforcement representative to provide presentation to landowners with question and answer session

Action 2: Seek programs funding the installation of stream crossing structures or the creation of new ATV trails with the use of BMPs. Current funding programs include ODNR’s Recreational Trails Program.

Action 3: Monitor the occurrence of ATV-trespassing on privately-owned lands with landowner surveys, especially at locations near streambanks

Action 4: Involve landowners to fence off trespassing entry points to properties by distributing information through mailings and at public workshop

Objective 4: Establish stream crossing alternatives for residential stream crossings in the subwatershed

Action 1: Continue to identify and map residential stream crossings

Action 2: Increase landowners’ knowledge of impacts to water quality through landowner meetings

Action 3: Work with landowners to develop stream crossing projects, identify potential sources of funding, and direct them to expert help for planning and design (e.g. NRCS; private consultants)

Objective 5: Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed

Action 1: Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA’s OEEF grants program

Action 2: Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed

Action 3: Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)
Action 4: Enter data into the NPS Project Entry Database (www.watersheddata.com) and document results through annual watershed implementation reports

Goal 3: Reduce off-site sediment yield from construction site development by an estimated 395 tons/ac/yr (NRCS 2000) through the installation and maintenance of sediment and erosion control BMPs

Objective 1: Install temporary and/or permanent runoff controls for all new construction developments in the watershed

Action 1: Identify entities involved in construction projects within the watershed (e.g. Ohio Department of Transportation; oil and gas drilling and pipeline construction companies) and invite their representatives to watershed stakeholder meetings
Action 2: Conduct one workshop per year, providing information and handouts to landowners about sediment and erosion control BMPs that can be voluntarily included in legal easement agreements for construction activities on their land
Action 3: As needed, provide technical guidance about sediment and erosion control BMPs, and also site-specific characteristics such as soil type, drainage area, topography and other pertinent information, to municipalities, developers, planners, engineers, and other entities involved with construction activities
Action 4: Collaborate with the East Central Ohio Building Industry Association in the implementation of the WAP and outreach opportunities
Action 5: Collaborate with ODNR-DSWR to implement Agricultural Impact Mitigation Agreements for pipeline construction projects through agricultural lands within the watershed (Appendix B)

Objective 2: Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed

Action 1: Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA's OEEF grants program
Action 2: Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed
Action 3: Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)
Action 4: Enter data into the NPS Project Entry Database (www.watersheddata.com) and document results through annual watershed implementation reports

Bend Fork Problem Statement 2: Barriers to fish migration

Sampling at Joy Fork RM 0.3 indicates an IBI fish diversity score of 44, barely meeting WWH biocriteria for fish (minimum score of 44 required to meet WWH and 50 to meet EWH). Joy Fork meets EWH for macroinvertebrates (OEPA 2010). In the Bend Fork subwatershed, 5.3 miles of Joy Fork have impaired fish communities upstream of a barrier that prevents fish migration, due to the following source:

1) One submarine bridge (culvert) located in Washington Township, on Township Road 101, which crosses near the mouth of Joy Fork (Figure 130). Removal of the culvert will increase IBI (fish diversity) scores upstream in Joy Fork, which has recently been recommended for an upgrade from WWH to EWH/CWH designation (OEPA 2010).

Goal 1: Improve IBI scores to ≥50 (for headwater streams) upstream of Joy Fork submarine bridge to meet EWH criteria for fish

Objective 1: Remove existing structure at the site and replace with a box culvert to improve fish migration to upstream reaches of Joy Fork

Action 1: Project plans completed by USFWS in 2011

Action 2: Funding secured from URS Corp. client and partnership agreement with USFWS and Zemba Bros. (contractor) finalized in 2013

Action 3: Coordinate with Belmont County Engineer's office, Washington Township Trustees and Zemba Bros. to oversee construction in Fall 2013/Winter 2014. PROJECT COMPLETED MARCH 2014.

Action 4: Conduct post-construction biological monitoring for fish to determine improvement in IBI scores upstream. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Bend Fork Problem Statement 3: Nutrients

Data indicate that nutrient levels are low and not a major source of impairment for the mainstem of Captina Creek and most of its tributaries. During 2008-2009 sampling, mean nutrient concentrations were below reference values (headwater/wading values in mg/l: 0.06/0.06 for ammonia-N, 0.606/1.054 for nitrate+nitrite-N, 0.09/0.11 for phosphorus-T) for the Western Allegheny Plateau ecoregion at all sampling locations within the Bend Fork subwatershed (OEPA 2010). However, elevated nutrient levels could be a future cause of impairment in the Bend Fork subwatershed and the following *potential* sources should be addressed in the effort to maintain excellent water quality:

1) Estimated 71 failing (inadequate or outdated) HSTS (Table 48)
2) Fertilizer draining 726 acres of croplands into streams in the subwatershed
3) Approximately 9 miles of stream with livestock stream access along its length, based on roadside observations

Goal 1: Reduce discharge from inadequate or outdated HSTS by 6,120 gallons/day in order to reduce nutrient loadings and maintain nutrient concentrations at or below 90th percentile reference values (headwater/wading values in mg/l: 0.06/0.06 for ammonia-N, 0.606/1.054 for nitrate+nitrite-N, 0.09/0.11 for phosphorus-T)

Objective 1: Install upgrades or replacements for 17 (25%) inadequate or outdated HSTS in the subwatershed in three years

Action 1: Conduct one workshop per year to provide landowners with information about the benefits of HSTS upgrades and preventative maintenance

Action 2: Provide information to landowners, through brochures and at workshop, about cost-share programs to fund home sewage treatment system upgrades or replacements. Potential funding programs include the Clean Water State Revolving Fund's (CWSRF) 75/25 cost-share program for low-income homeowners in Ohio.

Action 3: Implement the U.S. EPA's SepticSmart initiative to promote proper septic care and maintenance among watershed residents

Action 4: Develop volunteer monitoring program to conduct long-term monitoring for ammonia, nitrogen and phosphorus at selected sites within the Bend Fork subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Goal 2: Reduce nutrient loading draining from fertilized croplands into streams in the entire watershed by at least 2,613 lb/yr for phosphorus and 5,232 lb/yr for nitrogen, based on estimated load reductions using the RUSLE Region 5 Model

Objective 1: Increase acres in the entire watershed under the use of conservation tillage practices by 10% each year, increasing the total amount of cropland under these practices from 210.5 to 280.3 acres in three years (estimated load reductions using RUSLE Region 5 model, based on corn grain/soybean rotation and no-till 20% cover = 2,613 lb/yr for phosphorus and 5,232 lb/year for nitrogen)

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of conservation tillage, crop rotation and cover crops. Provide landowners with contacts for local NRCS staff.

Action 2: Provide information to landowners about equipment and supplies available for BMPs (no-till corn planter, no-till grain drill, geo-textile fabric, etc.) with brochures, flyers and announcements

Action 3: Seek funding to provide incentive program for conservation tillage practices on agricultural lands. Similar programs include Washington SWCD's point-based no-till/cover crop incentive program for highly erodible lands.

Objective 2: Establish 726 acres in the subwatershed under nutrient management plans approved by BSWCD, including the implementation of nutrient stewardship principles

Action 1: Conduct one landowner workshop a year, providing information to landowners about the benefits of nutrient stewardship, including the implementation of the 4R nutrient stewardship program (right source, right rate, right time and right place of nutrient application) (TFI 2013)

Action 2: Provide information to agricultural landowners about the 4R nutrient stewardship program through brochures and flyers distributed at watershed events

Action 3: Assist landowners in the development of nutrient stewardship plans

Goal 3: Reduce nutrient loadings to Bend Fork due to livestock stream access by 212.6 lb/yr of phosphorus and 212.5 lb/yr of nitrogen (estimated using RUSLE Region 5 Model)

Objective 1: Install 2,500 ft of livestock exclusion fencing and alternative watering sources for livestock at Bend Fork RM 9.7 – 10.2 (Goshen Township, Section 9)

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of BMPs for livestock operations

Action 2: Seek programs providing funding and technical assistance for livestock exclusion projects and provide landowners with information about these programs through brochures and at annual workshop. Current funding programs include NRCS's EQIP and funding through the ODNR - Division of Wildlife and Division of Forestry

Action 3: Assist landowners in the development and implementation of grazing management plans and pasture rotation practices

Action 4: Develop volunteer monitoring program to conduct long-term monitoring for ammonia, nitrogen and phosphorus at selected sites within the Bend Fork subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Bend Fork Problem Statement 4: Water withdrawal

In the Bend Fork subwatershed, there are no water withdrawal facilities with a capacity to withdraw greater than 100,000 gallons per day of water registered with ODNR-DSWR's Water Withdrawal Facilities Registration Program, and the number of undocumented water withdrawals in the watershed is unknown. Excessive withdrawals could potentially damage habitat quality for aquatic wildlife due to lower water volumes, lack of connectivity among habitats, increased water temperatures, decreased oxygen levels, reduced flushing of fine sediments and reduced access to spawning habitats. Ecosystem impacts will vary by season, habitat and species.

Goal 1: Prevent excessive water withdrawal, or the cumulative effects of multiple sources of withdrawal, resulting in inadequate water resources and habitat for Captina Creek and its tributaries, especially during low flow conditions

- ***Objective 1:*** Encourage greater availability of water withdrawal information in the subwatershed, especially as industrial activity (e.g. oil and gas drilling) increases
  - ***Action 1:*** Watershed Coordinator and Technical Committee will gather information from watershed stakeholders and direct concerns over excessive withdrawal to the appropriate agencies
  - ***Action 2:*** Provide information about the Water Withdrawal Facilities Registration Program to watershed stakeholders through informational handouts
  - ***Action 3:*** Conduct landowner workshop with agency and industry representatives to answer questions and address concerns about water withdrawals in the watershed
- ***Objective 2:*** Develop long-term solutions to increase the sustainability of water withdrawal in the watershed and protect water and habitat resources
  - ***Action 1:*** Direct industry operators to the appropriate agencies (e.g. U.S. Army Corps of Engineers; Ohio EPA) for information about Ohio regulations and BMPs
  - ***Action 2:*** Conduct a meeting with ODNR-DSWR and Division of Oil and Gas, and local oil and gas drilling companies to raise awareness about the watershed planning process
  - ***Action 3:*** Work with Technical Group and industry representatives to develop a long-term plan designating specific withdrawal locations in the watershed to reduce soil and water impacts from withdrawal locations
  - ***Action 4:*** Work with ODNR-DSWR and Ohio EPA to develop withdrawal permits based on current, location-specific flow rates

Bend Fork Problem Statement 5: Illegal dumping of trash

Trash and debris in and near streambanks does not impair water quality in the Bend Fork subwatershed; however, the removal of excessive trash and debris will help maintain the high stream and habitat quality and the aesthetic value of streams in the subwatershed. In the Bend Fork subwatershed, trash in and near streambanks is due to the following sources:

1) At least two documented illegal dumping sites within the subwatershed

Goal 1: Clean up one dumping site and assist in the prevention of new illegal dumping sites within the subwatershed in the next five years

Objective 1: Conduct at least one trash cleanup per year in the Captina Creek watershed

Action 1: Identify a cleanup site within the Captina Creek watershed for the Ohio River Valley Water Sanitation Commission's annual Ohio River Sweep

Action 2: Work with volunteer groups to establish a two-mile section along a State Route, United States Route or Interstate in the Captina Creek watershed as part of the Ohio Department of Transportation's Adopt-A-Highway Program. Involvement in this program would require four trash cleanups along the route per year.

Action 3: Work with JB Green Team (local solid waste management district for Jefferson and Belmont counties), county health departments, and township trustees to identify illegal dumpsites and develop a map that can be updated to maintain a record of cleanups

Action 4: Coordinate with law enforcement including JB Green Team's Litter Deputy and the Belmont County Sheriff to report open dumping complaints in the watershed

Action 5: Conduct tire cleanup through Bridgestone's Tire Removal and Recycling Program

Action 6: Pursue additional grant opportunities to fund litter cleanups, such as Ohio EPA's Litter Collection and Prevention Grant

Objective 2: Remove trash along 0.4 stream miles (RM 3.8 – 4.2) of Bend Fork (TR 101)

Action 1: Work with landowner to conduct community litter cleanup at site. Develop funding and resources for cleanup through JB Green Team, county health department, and Washington Township Trustees

Action 2: Seek funding to install signs to promote litter awareness and prevent future dumping at the site

Objective 3: Provide education and outreach to increase communities' overall knowledge of the environmental and health effects of trash in and near streambanks, and foster an appreciation for cleaner streams

Action 1: Coordinate with JB Green Team to provide educational programs about litter prevention and recycling at community and youth events

Action 2: Distribute brochures and flyers to watershed residents with information about proper trash disposal and recycling drop-off locations

Action 3: Incorporate litter-free principles at watershed events

Table 54. Implementation details for projects identified in the Bend Fork subwatershed action plan (12-digit HUC: 050103060903).

Project Name	*Aquatic Life Use*	*Attainment Status*	*Causes*	*Project Type*	*Sources*	*Objective*	*Unit*	*Target*	*Estimated Cost (U.S. Dollars)*	*Responsible Parties /Funding Sources*	*Status*	*Project Priority*
Livestock exclusion - Bend Fork RM 9.7 – 10.2	EWH-R*	Full	Sediment, nutrients, pathogens	Restoration	Livestock access	Install livestock exclusion fencing and alternative watering sources	Linear feet	2,500	$10,000	Belmont SWCD; USFWS; ODNR-DSWR	Not completed	5-10 years
Stream crossing restoration – Joy Fork at RM 1.6	CWH-R*	Full	Sediment	Restoration	Vehicle stream crossing	Establish stream crossing alternative (e.g. bridge, high vent-area ratio culvert, ford, rock-ramp fishway) for open stream crossing on Township Rd 194	Stream crossing alternatives	1	Unknown	Belmont SWCD; USFWS; ODNR-DOW	Not completed	5-10 years
Stream crossing restoration – Bend Fork RM 0.0 to 3.0	EWH	Full	Sediment	Restoration	Vehicle stream crossings	Establish stream crossing alternatives (e.g. bridge, high vent-area ratio culvert, ford, rock-ramp fishway) for multiple stream crossings and ATV trails along Township Rd 101	Stream crossing alternatives	Un-known	Unknown	Belmont SWCD; USFWS; ODNR-DOW	Not completed	5-10 years
Stream crossing restoration – Millers Run	Unknown	Unknown	Sediment	Restoration	Vehicle stream crossings	Install voluntary stream crossing structures and reestablishment of native vegetation for ATV trails through riparian corridors along Millers Run	Linear feet	2,761	Unknown	Belmont SWCD; USFWS; ODNR-DOW	Not completed	5-10 years
Sediment control – Bend Fork subwatershed	n/a	n/a	Sediment	Protection	Varies	Monitoring for TSS with turbidity tubes and measuring streambed sediment through pebble counts	Monitoring events per year	4	$56.50 for turbidity tube; $69.30 for gravelometer	Belmont SWCD; OEPA; Captina Conservancy	1 completed in 2013	1-3 years
Sediment control – Bend Fork subwatershed	n/a	n/a	Sediment	Protection	Varies	Assessments of stream physical habitat (e.g. QHEI, HHEI)	Monitoring events per year	1	0	Belmont SWCD; OEPA	1 completed in 2008 - 2009	1-3 years
Construction runoff controls – Bend Fork subwatershed	n/a	n/a	Sediment	Protection	Soil disturbance without BMPs	Install temporary and/or permanent runoff controls	Tons/ac/yr per site	395	Unknown	Belmont SWCD; OEPA	Not completed	5-10 years

Project Name	*Aquatic Life Use*	*Attainment Status*	*Causes*	*Project Type*	*Sources*	*Objective*	*Unit*	*Target*	*Estimated Cost (U.S. Dollars)*	*Responsible Parties /Funding Sources*	*Status*	*Project Priority*
Fish barrier removal – Joy Fork RM 0.1	CWH-R*	Full	Barriers to fish migration	Restoration	One submarine bridge	Remove existing structure at the site and replace with a box culvert to improve fish migration to upstream reaches of Joy Fork	Culvert	1	$105,059.64	Belmont SWCD; USFWS; Washington Township	Completed March 2014	1-3 years
HSTS installation and repair – Bend Fork subwatershed	n/a	n/a	Nutrients, pathogens	Restoration	Inadequate or outdated HSTS	Install upgrades or replacements for inadequate or outdated HSTS in the subwatershed	Systems	17	$166,600	Belmont Co. Health Dept.; OEPA	Not completed	5-10 years
Conservation tillage practices – Bend Fork subwatershed	n/a	n/a	Nutrients	Protection	Agricultural fields	Increase total amount of cropland under conservation tillage practices	Acres in entire watershed	280.3	Unknown	Belmont SWCD; ODNR-DSWR; NRCS	210.5	1-3 years
Nutrient management on agricultural lands – Bend Fork subwatershed	n/a	n/a	Nutrients	Protection	Fertilizer runoff from agriculture fields	Establish cropland under nutrient management plans and nutrient stewardship principles	Acres	726	0	Belmont SWCD; ODNR-DSWR; NRCS	Not completed	5-10 years
Litter cleanup – Bend Fork RM 3.8 – 4.2	EWH	Full	Trash and debris	Restoration	Illegal dumping of trash	Conduct litter cleanup along Bend Fork	Stream miles	0.4	0	Belmont SWCD; JB Green Team	Not completed	1-3 years

* R denotes a recommendation that differs from the current use designation (OEPA 2010).

Piney Creek Subwatershed Action Plan (12-digit HUC: 050301060904)

Piney Creek Problem Statement 1: Sedimentation and stream embeddedness

In the Piney Creek subwatershed, reducing sedimentation is the highest priority for improving water quality. Practices may also be implemented where water quality is not impaired but sources of silt should be removed to preserve high water quality. In the Piney Creek subwatershed, increased sedimentation is due to the following non-point sources:

1) 3,584 tons/year of sediment by water erosion from agricultural fields without the use of BMPs
2) approximately 8.5 miles of stream with livestock stream access along its length (based on roadside observations)

the following *potential* non-point source (pending future use of BMPs):

3) potential, unknown loading of sediment by water erosion from new industrial and commercial construction site development without the use of BMPs

Goal 1: Reduce soil erosion from agricultural fields by 3,584 tons of sediment per year and prevent new sources of soil erosion in the next five years through the use of voluntary BMPs

Objective 1: Install 950 ft of riparian buffers and streambank protection along Long Run (Piney Creek) at RM 0.2 – 0.4 (Wayne Township, Section 3). Estimated sediment load reduction is 12.1 tons/yr, based on calculations using RUSLE Region 5 Model

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of riparian zone protection on agricultural lands

Action 2: Seek funding to provide incentive program for riparian zone protection on agricultural lands

Objective 2: Increase acres of cropland in the entire watershed under the use of conservation tillage practices from 210.5 to 280.3 acres in three years (estimated sediment load reduction using RUSLE Region 5 model, based on corn grain/soybean rotation and no-till 20% cover = 3,572 tons/yr)

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of conservation tillage, crop rotation and cover crops. Provide landowners with contacts for local NRCS staff.

Action 2: Provide information to landowners about equipment and supplies available for BMPs (no-till corn planter, no-till grain drill, geo-textile fabric, etc.) with brochures, flyers and announcements

Action 3: Seek funding to provide incentive program for conservation tillage practices on agricultural lands. Similar programs include Washington SWCD's point-based no-till/cover crop incentive program for highly erodible lands.

Objective 3: Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed

Action 1: Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA's OEEF grants program

Action 2: Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed

Action 3: Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)
Action 4: Enter data into the NPS Project Entry Database (www.watersheddata.com) and document results through annual watershed implementation reports

Goal 2: Reduce soil erosion due to livestock stream access by 430.6 tons/yr of sediment
Objective 1: Install 2,370 ft of livestock exclusion fencing with alternative watering sources for livestock at Captina Creek RM 25.0 – 25.4, along with an 85-ft riparian setback (Wayne Township, Section 10). Estimated sediment load reduction using RUSLE Region 5 model = 403 tons/yr
Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of BMPs for livestock operations
Action 2: Seek programs providing funding and technical assistance for livestock exclusion projects and provide landowners with information about these programs through brochures and at annual workshop. Current funding programs include NRCS's EQIP and funding through the ODNR - Division of Wildlife and Division of Forestry
Action 3: Assist landowners in the development and implementation of grazing management plans and pasture rotation practices
Objective 2: Install 1,000 ft of livestock exclusion fencing along with alternative watering sources for livestock at Berry's Run RM 0.1 – 0.3 (Wayne Township, Section 4). Estimated sediment load reduction using RUSLE Region 5 model = 21.2 tons/yr
Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of BMPs for livestock operations
Action 2: Seek programs providing funding and technical assistance for livestock exclusion projects and provide landowners with information about these programs through brochures and at annual workshop. Current funding programs include NRCS's EQIP and funding through the ODNR - Division of Wildlife and Division of Forestry
Action 3: Assist landowners in the development and implementation of grazing management plans and pasture rotation practices
Objective 3: Install 1,500 ft of livestock exclusion fencing along with alternative watering sources for livestock along 0.4 RM of unnamed tributary that enters Captina Creek at RM 22.2 (Washington Township, Section 28). Estimated sediment load reduction using RUSLE Region 5 model = 6.4 tons/yr
Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of BMPs for livestock operations
Action 2: Seek programs providing funding and technical assistance for livestock exclusion projects and provide landowners with information about these programs through brochures and at annual workshop. Current funding programs include NRCS's EQIP and funding through the ODNR - Division of Wildlife and Division of Forestry
Action 3: Assist landowners in the development and implementation of grazing management plans and pasture rotation practices
Objective 4: Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed
Action 1: Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA's OEEF grants program

Action 2: Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed
Action 3: Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)
Action 4: Enter data into the NPS Project Entry Database (www.watersheddata.com) and document results through annual watershed implementation reports

Goal 3: Reduce off-site sediment yield from construction site development by an estimated 395 tons/ac/yr (NRCS 2000) through the installation and maintenance of sediment and erosion control BMPs

Objective 1: Install temporary and/or permanent runoff controls for all new construction developments in the watershed

Action 1: Identify entities involved in construction projects within the watershed (e.g. Ohio Department of Transportation; oil and gas drilling and pipeline construction companies) and invite their representatives to watershed stakeholder meetings
Action 2: Conduct one workshop per year, providing information and handouts to landowners about sediment and erosion control BMPs that can be voluntarily included in legal easement agreements for construction activities on their land
Action 3: As needed, provide technical guidance about sediment and erosion control BMPs, and also site-specific characteristics such as soil type, drainage area, topography and other pertinent information, to municipalities, developers, planners, engineers, and other entities involved with construction activities
Action 4: Collaborate with the East Central Ohio Building Industry Association in the implementation of the WAP and outreach opportunities
Action 5: Collaborate with ODNR-DSWR to implement Agricultural Impact Mitigation Agreements for pipeline construction projects through agricultural lands within the watershed (Appendix B)

Objective 2: Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed

Action 1: Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA's OEEF grants program
Action 2: Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed
Action 3: Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)
Action 4: Enter data into the NPS Project Entry Database (www.watersheddata.com) and document results through annual watershed implementation reports

Piney Creek Problem Statement 2: Elevated organic and metal contaminants

In the Piney Creek subwatershed, 7.4 stream miles are affected by elevated concentrations of organic and metal contaminants, due to the following sources:

1) Mine waste releases including one blackwater (unsettled wastewater) release from the OVCC slurry impoundment and two releases from AEC's slurry pipeline in 2005 and 2010, impacting 0.75 miles of stream at the time of release (Figures 119 - 122) (Pugh, personal communication, 2012)
2) During low flow conditions (when there is insufficient dilution), elevated specific conductivity exceeding Western Allegheny Plateau ecoregion reference conditions downstream of mine discharges, affecting 2.8 miles of Piney Creek and approximately 22 river miles to the confluence of the Ohio River (OEPA 2010)
3) Current NPDES permits do not set defined limits for total dissolved solids and permitted discharges remain below accepted limits for specified pollutants. However, total dissolved solids were elevated above Ohio Water Quality Standards criteria (1500 mg/l) downstream of mining discharges in Piney Creek and Captina Creek downstream of the OVCC impoundment during 2008 -2009 sampling (OEPA 2010).

Goal 1: Maintain concentrations of TDS below 1500 mg/l, maintain specific conductivity at or below the 90th percentile reference values (1019/791 umhos/cm for headwater/wading streams) and maintain concentrations of organic and metal contaminants below Ohio Water Quality Standards criteria, in Piney Creek and Captina Creek downstream of active mining operations

Objective 1: Prevent the occurrence of future blackwater and slurry releases from active mining operations and minimize the impact of any future releases to the biological health of Captina Creek

Action 1: Maintain positive partnerships with mining company representatives and continue their involvement in watershed protection efforts

Action 2: Coordinate with mining company representatives to implement their Spill Prevention Plan with BMPs and additional precautions that can be implemented to prevent future releases

Action 3: Coordinate with mining company representatives to develop a mutual Emergency Response Plan that can be utilized by the company and watershed stakeholders in case of a future release

Action 4: Watershed stakeholders and Technical Group assist ODNR – DOW with pollution contingency plan procedures for sensitive aquatic species in case of a future release (e.g. *Pollution Contingency Plan for Areas Occupied by Eastern Hellbenders*, Lipps et al. 2012)

Objective 2*:* Provide better treatment of mine waste discharges and minimize or avoid discharges during low flow conditions

Action 1: Coordinate with mining company representatives to develop BMPs for discharging into Captina Creek and its tributaries during low flow conditions (including the management of TDS, for which there are no limits defined in current NPDES permits)

Action 2: Coordinate with mining company representatives to develop enhanced or additional treatment of mine waste discharges

Action 3: Coordinate with mining company representatives to develop mitigation projects and projects available for in-lieu fee program funding (pending establishment of the proposed In-Lieu Fee Program in the State of Ohio)

Action 4: Conduct biological monitoring upstream of Piney Creek - RM 2.8 to determine if it is meeting EWH conditions. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Action 5: Develop volunteer monitoring program to conduct long-term monitoring for TDS, specific conductivity, and organic and metal contaminants at selected sites within the Piney Creek subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Piney Creek Problem Statement 3: Water withdrawal

In the Piney Creek subwatershed, there is one water withdrawal facility with a capacity to withdraw greater than 100,000 gallons per day of water from two intakes (as registered with ODNR-DSWR's Water Withdrawal Facilities Registration Program), and the number of undocumented water withdrawals in the watershed is unknown. Excessive withdrawals could potentially damage habitat quality for aquatic wildlife due to lower water volumes, lack of connectivity among habitats, increased water temperatures, decreased oxygen levels, reduced flushing of fine sediments and reduced access to spawning habitats. Ecosystem impacts will vary by season, habitat and species.

Goal 1: Prevent excessive water withdrawal, or the cumulative effects of multiple sources of withdrawal, resulting in inadequate water resources and habitat for Captina Creek and its tributaries, especially during low flow conditions

Objective 1: Encourage greater availability of water withdrawal information in the subwatershed, especially as industrial activity (e.g. oil and gas drilling) increases

Action 1: Watershed Coordinator and Technical Committee will gather information from watershed stakeholders and direct concerns over excessive withdrawal to the appropriate agencies

Action 2: Provide information about the Water Withdrawal Facilities Registration Program to watershed stakeholders through informational handouts

Action 3: Conduct landowner workshop with agency and industry representatives to answer questions and address concerns about water withdrawals in the watershed

Objective 2: Develop long-term solutions to increase the sustainability of water withdrawal in the watershed and protect water and habitat resources

Action 1: Direct industry operators to the appropriate agencies (e.g. U.S. Army Corps of Engineers; Ohio EPA) for information about Ohio regulations and BMPs

Action 2: Conduct a meeting with ODNR-DSWR and Division of Oil and Gas, and local oil and gas drilling companies to raise awareness about the watershed planning process

Action 3: Work with Technical Group and industry representatives to develop a long-term plan designating specific withdrawal locations in the watershed to reduce soil and water impacts from withdrawal locations

Action 4: Work with ODNR-DSWR and Ohio EPA to develop withdrawal permits based on current, location-specific flow rates

Piney Creek Problem Statement 4: Nutrients

During 2008-2009 sampling, mean ammonia-N, Nitrate+Nitrite-N, and Phosphorus-T concentrations were above reference conditions for the Western Allegheny Plateau ecoregion in the Piney Creek subwatershed at Casey Run (RM 0.1, Phosphorus-T only) and at Piney Creek-Long Run (RM 0.2, Ammonia-N and Phosphorus-T only). Ammonia-N was also elevated at Perkins Run (RM 0.3 and 0.04), but this stream has been replaced by a constructed outfall for the OVCC's impoundment facility (OEPA 2010). In the Piney Creek subwatershed, elevated nutrient concentrations are from the following sources:

1) Estimated 46 failing (inadequate or outdated) HSTS (Table 48)

2) Fertilizer draining 186 acres croplands into streams in the subwatershed
3) Approximately 8.5 miles of stream with livestock stream access along its length, based on roadside observations

Goal 1: Reduce discharge from inadequate or outdated HSTS by 3,960 gallons/day in order to reduce nutrient loadings and reduce nutrient concentrations at or below 90th percentile reference values (headwater/wading values in mg/l: 0.06/0.06 for ammonia-N, 0.606/1.054 for nitrate+nitrite-N, 0.09/0.11 for phosphorus-T)

Objective 1: Install upgrades or replacements for 11 (25%) inadequate or outdated HSTS in the subwatershed in three years

Action 1: Conduct one workshop per year to provide landowners with information about the benefits of HSTS upgrades and preventative maintenance

Action 2: Provide information to landowners, through brochures and at workshop, about cost-share programs to fund home sewage treatment system upgrades or replacements. Potential funding programs include the Clean Water State Revolving Fund's (CWSRF) 75/25 cost-share program for low-income homeowners in Ohio.

Action 3: Implement the U.S. EPA's SepticSmart initiative to promote proper septic care and maintenance among watershed residents

Action 4: Develop volunteer monitoring program to conduct long-term monitoring for ammonia, nitrogen and phosphorus at selected sites within the Piney Creek subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Goal 2: Reduce nutrient loading draining from fertilized croplands into streams in the entire watershed by at least 2,613 lb/yr for phosphorus and 5,232 lb/yr for nitrogen, based on estimated load reductions using the RUSLE Region 5 Model

Objective 1: Increase acres in the entire watershed under the use of conservation tillage practices by 10% each year, increasing the total amount of cropland under these practices from 210.5 to 280.3 acres in three years (estimated load reductions using RUSLE Region 5 model, based on corn grain/soybean rotation and no-till 20% cover = 2,613 lb/yr for phosphorus and 5,232 lb/year for nitrogen)

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of conservation tillage, crop rotation and cover crops. Provide landowners with contacts for local NRCS staff.

Action 2: Provide information to landowners about equipment and supplies available for BMPs (no-till corn planter, no-till grain drill, geo-textile fabric, etc.) with brochures, flyers and announcements

Action 3: Seek funding to provide incentive program for conservation tillage practices on agricultural lands. Similar programs include Washington SWCD's point-based no-till/cover crop incentive program for highly erodible lands.

Objective 2: Establish 186 acres in the subwatershed under nutrient management plans approved by BSWCD, including the implementation of nutrient stewardship principles

Action 1: Conduct one landowner workshop a year, providing information to landowners about the benefits of nutrient stewardship, including the implementation of the 4R nutrient stewardship program (right source, right rate, right time and right place of nutrient application) (TFI 2013)

Action 2: Provide information to agricultural landowners about the 4R nutrient stewardship program through brochures and flyers distributed at watershed events

Action 3: Assist landowners in the development of nutrient stewardship plans

Goal 3: Reduce nutrient loadings due to livestock stream access by 430.6 lb/yr of phosphorus and 861.2 lb/yr of nitrogen (estimated using RUSLE Region 5 Model)

Objective 1: Install 2,370 ft of livestock exclusion fencing with alternative watering sources for livestock at Captina Creek RM 25.0 – 25.4, along with an 85-ft riparian setback (Wayne Township, Section 10). Estimated nutrient load reductions using RUSLE Region 5 model = 403 lb/yr for phosphorus and 805.8 lb/yr for nitrogen

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of BMPs for livestock operations

Action 2: Seek programs providing funding and technical assistance for livestock exclusion projects and provide landowners with information about these programs through brochures and at annual workshop. Current funding programs include NRCS's EQIP and funding through the ODNR - Division of Wildlife and Division of Forestry

Action 3: Assist landowners in the development and implementation of grazing management plans and pasture rotation practices

Action 4: Develop volunteer monitoring program to conduct long-term monitoring for ammonia, nitrogen and phosphorus at selected sites within the Piney Creek subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Objective 2: Install 1,000 ft of livestock exclusion fencing along with alternative watering sources for livestock at Berry's Run RM 0.1 – 0.3 (Wayne Township, Section 4). Estimated nutrient load reductions using RUSLE Region 5 model = 21.2 lb/yr for phosphorus and 42.6 lb/yr for nitrogen

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of BMPs for livestock operations

Action 2: Seek programs providing funding and technical assistance for livestock exclusion projects and provide landowners with information about these programs through brochures and at annual workshop. Current funding programs include NRCS's EQIP and funding through the ODNR - Division of Wildlife and Division of Forestry

Action 3: Assist landowners in the development and implementation of grazing management plans and pasture rotation practices

Action 4: Develop volunteer monitoring program to conduct long-term monitoring for ammonia, nitrogen and phosphorus at selected sites within the Piney Creek subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Objective 3: Install 1,500 ft of livestock exclusion fencing along with alternative watering sources for livestock along 0.4 RM of unnamed tributary that enters Captina Creek at RM 22.2 (Washington Township, Section 28). Estimated nutrient load reductions using RUSLE Region 5 model = 6.4 lb/yr for phosphorus and 12.5 lb/yr for nitrogen

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of BMPs for livestock operations

Action 2: Seek programs providing funding and technical assistance for livestock exclusion projects and provide landowners with information about these programs through brochures and at annual workshop. Current funding programs include NRCS's EQIP and funding through the ODNR - Division of Wildlife and Division of Forestry

Action 3: Assist landowners in the development and implementation of grazing management plans and pasture rotation practices
Action 4: Develop volunteer monitoring program to conduct long-term monitoring for ammonia, nitrogen and phosphorus at selected sites within the Piney Creek subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Piney Creek Problem Statement 5: Pathogens (Fecal coliform)

The Ohio EPA has designated Captina Creek mainstem (RM 16.0, directly downstream of the Piney Creek subwatershed drainage) in full attainment of PCR Class A recreation use. Bacterial sampling in 2008-2009 indicated a geometric mean of 79 cfu per 100 ml of water, which meets the criterion of ≤126 cfu/100ml for PCR Class A (OEPA 2010). However, bacterial nuisance water quality monitoring data collected by the Ohio EPA in Summer and Fall 2013 indicated a mean *E. coli* concentration elevated above water quality criterion at Berry's Run RM 0.1 (2,463 cfu/100ml). Due to the importance of maintaining the watershed's excellent water quality, the following *potential* sources of pathogens have been identified:

1) Estimated 46 failing (inadequate or outdated) HSTS (Table 48)
2) Approximately 8.5 miles of stream with livestock stream access along its length, based on roadside observations

Goal 1: Reduce discharge from inadequate or outdated HSTS by 3,960 gallons/day in order to maintain bacteria concentrations downstream of inadequate or outdated HSTS at or below 126 cfu/100ml

Objective 1: Install upgrades or replacements for 11 (25%) inadequate or outdated HSTS in the subwatershed in three years

Action 1: Conduct one workshop per year to provide landowners with information about the benefits of HSTS upgrades and preventative maintenance
Action 2: Provide information to landowners, through brochures and at workshop, about cost-share programs to fund home sewage treatment system upgrades or replacements. Potential funding programs include the Clean Water State Revolving Fund's (CWSRF) 75/25 cost-share program for low-income homeowners in Ohio.
Action 3: Implement the U.S. EPA's SepticSmart initiative to promote proper septic care and maintenance among watershed residents
Action 4: Develop volunteer monitoring program to conduct long-term monitoring for bacteria at selected sites within the Piney Creek subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Goal 2: Maintain bacteria concentrations downstream of livestock stream access sites at or below 126 cfu/100ml

Objective 1: Install 2,370 ft of livestock exclusion fencing with alternative watering sources for livestock at Captina Creek RM 25.0 – 25.4, along with an 85-ft riparian setback (Wayne Township, Section 10)

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of BMPs for livestock operations
Action 2: Seek programs providing funding and technical assistance for livestock exclusion projects and provide landowners with information about these

programs through brochures and at annual workshop. Current funding programs include NRCS's EQIP and funding through the ODNR - Division of Wildlife and Division of Forestry

Action 3: Assist landowners in the development and implementation of grazing management plans and pasture rotation practices

Action 4: Develop volunteer monitoring program to conduct long-term monitoring for bacteria at selected sites within the Piney Creek subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Objective 2: Install 1,000 ft of livestock exclusion fencing along with alternative watering sources for livestock at Berry's Run RM 0.1 – 0.3 (Wayne Township, Section 4)

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of BMPs for livestock operations

Action 2: Seek programs providing funding and technical assistance for livestock exclusion projects and provide landowners with information about these programs through brochures and at annual workshop. Current funding programs include NRCS's EQIP and funding through the ODNR - Division of Wildlife and Division of Forestry

Action 3: Assist landowners in the development and implementation of grazing management plans and pasture rotation practices

Action 4: Develop volunteer monitoring program to conduct long-term monitoring for bacteria at selected sites within the Piney Creek subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Objective 3: Install 1,500 ft of livestock exclusion fencing along with alternative watering sources for livestock along 0.4 RM of unnamed tributary that enters Captina Creek at RM 22.2 (Washington Township, Section 28)

Action 1: Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of BMPs for livestock operations

Action 2: Seek programs providing funding and technical assistance for livestock exclusion projects and provide landowners with information about these programs through brochures and at annual workshop. Current funding programs include NRCS's EQIP and funding through the ODNR - Division of Wildlife and Division of Forestry

Action 3: Assist landowners in the development and implementation of grazing management plans and pasture rotation practices

Action 4: Develop volunteer monitoring program to conduct long-term monitoring for bacteria at selected sites within the Piney Creek subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Piney Creek Problem Statement 6: Trash in and near streambanks

Trash and debris in and near streambanks does not impair water quality in the Piney Creek subwatershed; however, the removal of excessive trash and debris will help maintain the high stream and habitat quality and the aesthetic value of streams in the subwatershed. In the Piney Creek subwatershed, trash in and near streambanks is due to the following sources:

1) At least six documented illegal dumping sites within the subwatershed

Goal 1: Clean up one dumping site and assist in the prevention of new illegal dumping sites within the subwatershed in the next five years

Objective 1: Conduct at least one trash cleanup per year in the Captina Creek watershed

Action 1: Identify a cleanup site within the Captina Creek watershed for the Ohio River Valley Water Sanitation Commission's annual Ohio River Sweep
Action 2: Work with volunteer groups to establish a two-mile section along a State Route, United States Route or Interstate in the Captina Creek watershed as part of the Ohio Department of Transportation's Adopt-A-Highway Program. Involvement in this program would require four trash cleanups along the route per year.
Action 3: Work with JB Green Team (local solid waste management district for Jefferson and Belmont counties), county health departments, and township trustees to identify illegal dumpsites and develop a map that can be updated to maintain a record of cleanups
Action 4: Coordinate with law enforcement including JB Green Team's Litter Deputy and the Belmont County Sheriff to report open dumping complaints in the watershed
Action 5: Conduct tire cleanup through Bridgestone's Tire Removal and Recycling Program
Action 6: Pursue additional grant opportunities to fund litter cleanups, such as Ohio EPA's Litter Collection and Prevention Grant

Objective 2: Provide education and outreach to increase communities' overall knowledge of the environmental and health effects of trash in and near streambanks, and foster an appreciation for cleaner streams

Action 1: Coordinate with JB Green Team to provide educational programs about litter prevention and recycling at community and youth events
Action 2: Distribute brochures and flyers to watershed residents with information about proper trash disposal and recycling drop-off locations
Action 3: Incorporate litter-free principles at watershed events

Piney Creek Problem Statement 7: Barrier to fish migration

In the Piney Creek subwatershed, unknown miles of stream with impaired fish assemblages upstream of a barrier that may inhibit fish migration on Crabapple Creek (recommended EWH/CWH at RM 0.5), due to the following source:

1) One submarine bridge on Washington Township Rd 84 crosses Crabapple Creek at RM 3.3 and may impede the stream's flow, contribute to debris buildup and flood conditions, and be a barrier to fish migration to upstream portions of the stream (Figure 133)

Goal 1: Maintain excellent IBI scores (≥50 for headwater streams) upstream of submarine bridge

Objective 1: Acquire additional data about fish communities to determine if fish migration is impaired upstream of submarine bridge

Action 1: Conduct long-term biological monitoring immediately upstream and downstream of bridge
Action 2: If fish migration is impaired, identify potential strategies and funding to improve fish migration, such as a fishway or modification of the current structure (e.g. high vent-area ratio culvert)
Action 3: Conduct pre- and post-restoration monitoring to determine improvement in IBI scores upstream. Enter data into the NPS Project Entry Database (www.watersheddata.com)

Table 55. Implementation details for projects identified in the Piney Creek subwatershed action plan (12-digit HUC: 050103060904).

Project Name	*Aquatic Life Use*	*Attainment Status*	*Causes*	*Project Type*	*Sources*	*Objective*	*Unit*	*Target*	*Estimated Cost (U.S. Dollars)*	*Responsible Parties/ Funding Sources*	*Status*	*Project Priority*
Streambank restoration - Long Run (Piney Creek) RM 0.2 – 0.4	EWH-R*	Full	Sediment	Restoration	Unstable bank	Install riparian buffer and bank stabilization	Linear feet	950	$79,496 [a]	Belmont SWCD; USFWS; OEPA NPS Program; mitigation opportun-ities	Not completed	5-10 years
Conservation tillage practices – Piney Creek subwatershed	n/a	n/a	Sediment, nutrients	Protection	Agricultural fields	Increase total amount of cropland under conservation tillage practices	Acres in entire watershed	280.3	Unknown	Belmont SWCD; ODNR-DSWR; NRCS	210.5	1-3 years
Livestock exclusion - Captina Creek RM 25.0 – 25.4	EWH	Full	Sediment, nutrients, pathogens	Restoration	Livestock access	Install livestock exclusion fencing and alternative watering sources	Linear feet	2,370	$9,480	Belmont SWCD; ODNR-DSWR; NRCS	Not completed	5-10 years
Livestock exclusion - Berry's Run RM 0.1 – 0.3	WWH	Full	Sediment, nutrients, pathogens	Restoration	Livestock access	Install livestock exclusion fencing and alternative watering sources	Linear feet	1,000	$4,000	Belmont SWCD; ODNR-DSWR; NRCS	Not completed	5-10 years
Livestock exclusion - 0.4 RM of unnamed tributary that enters Captina Creek at RM 22.2	Unknown	n/a	Sediment, nutrients, pathogens	Restoration	Livestock access	Install livestock exclusion fencing and alternative watering sources	Linear feet	1,500	$6,000	Belmont SWCD; ODNR-DSWR; NRCS	Not completed	5-10 years
Sediment control – Piney Creek subwatershed	n/a	n/a	Sediment	Protection	Varies	Monitoring for TSS with turbidity tubes and measuring streambed sediment through pebble counts	Monitoring events per year	4	$56.50 for turbidity tube; $69.30 for gravelometer	Belmont SWCD; OEPA; Captina Conservancy	1 completed in 2013	1-3 years
Sediment control – Piney Creek subwatershed	n/a	n/a	Sediment	Protection	Varies	Assessments of stream physical habitat (e.g. QHEI, HHEI)	Monitoring events per year	1	0	Belmont SWCD; OEPA	1 completed in 2008 - 2009	1-3 years

Project Name	*Aquatic Life Use*	*Attainment Status*	*Causes*	*Project Type*	*Sources*	*Objective*	*Unit*	*Target*	*Estimated Cost (U.S. Dollars)*	*Responsible Parties/ Funding Sources*	*Status*	*Project Priority*
Construction runoff controls – Piney Creek subwatershed	n/a	n/a	Sediment	Protection	Soil disturbance without BMPs	Install temporary and/or permanent runoff controls	Tons/ac/yr per site	395	Unknown	Belmont SWCD; OEPA	Not completed	5-10 years
Management of specific conductivity sources during low flow and prevention of blackwater releases – Piney Creek subwatershed	n/a	n/a	Inorganic dissolved solids	Protection	Mine wastewater discharges	Prevent the occurrence of future blackwater and slurry releases	TDS goal value; SpC goal value for headwater/ wading streams	≤1500 mg/l; ≤1019/ 791 umhos/ cm	Unknown	Captina Technical Advisory Committee; Murray Energy Corporation	Unknown	1-3 years
Management of specific conductivity sources during low flow and prevention of blackwater releases – Piney Creek subwatershed	n/a	n/a	Inorganic dissolved solids	Restoration	Mine wastewater discharges	Provide better treatment of mine waste discharges and minimize or avoid discharges during low flow conditions	TDS goal value; SpC goal value for headwater/ wading streams	≤1500 mg/l; ≤1019/ 791 umhos/ cm	Unknown	Captina Technical Advisory Committee; Murray Energy Corporation	Unknown	5-10 years
HSTS installation and repair – Piney Creek subwatershed	n/a	n/a	Nutrients, pathogens	Restoration	Inadequate or outdated HSTS	Install upgrades or replacements for inadequate or outdated HSTS in the subwatershed	Systems	11	$107,800	Belmont Co. Health Dept.; OEPA	Not completed	5-10 years
Nutrient management on agricultural lands – Piney Creek subwatershed	n/a	n/a	Nutrients	Protection	Fertilizer runoff from agriculture fields	Establish cropland under nutrient management plans and nutrient stewardship principles	Acres	186	0	Belmont SWCD; ODNR-DSWR; NRCS	Not completed	5-10 years
Fish barrier removal – Crabapple Creek RM 3.3	EWH/CWH-R*	Full	Barriers to fish migration	Restoration	One submarine bridge	Remove existing structure at the site and replace with a box culvert to improve fish migration to upstream reaches of Crabapple Creek	Culvert	1	Unknown	Belmont SWCD; USFWS; mitigation opportun-ities	Not completed	5-10 years

[a] Cost estimate based on *Stream Restoration in the Upper Midwest, U.S.A.* (Alexander and Allen 2006).
* R denotes a recommendation that differs from the current use designation (OEPA 2010).

Pea Vine Creek Subwatershed Action Plan (12-digit HUC: 050301060905)

Pea Vine Creek Problem Statement 1: Sedimentation and stream embeddedness

In the Pea Vine Creek subwatershed, reducing sedimentation is the highest priority for improving water quality. Practices may also be implemented where water quality is not impaired but sources of silt should be removed to preserve high water quality. In the Pea Vine Creek subwatershed, increased sedimentation is due to the following non-point sources:

1) Unknown number of stream miles affected by ATV-induced erosion on abandoned township roads along Pea Vine Creek mainstem, and Moore and Anderson Runs (Figure 112)
2) 96.6 tons/year of sediment by water erosion from timber harvests in the subwatershed without the use of BMPs

the following *potential* non-point source (pending future use of BMPs):

3) potential, unknown loading of sediment by water erosion from new industrial and commercial construction site development without the use of BMPs

Goal 1: Reduce soil loss due to excessive ATV-induced erosion by 82.8 tons/yr of sediment

- ***Objective 1:*** Install voluntary stream crossing structures and reestablishment of native vegetation for ATV trails through riparian corridors along 2,148 ft of Pea Vine Creek mainstem and 1,100 ft of Anderson Run
  - ***Action 1:*** Conduct a landowner workshop to provide information about the effects of ATV-induced soil erosion in the watershed and the benefits of BMPs. Invite law enforcement representative to provide presentation to landowners with question and answer session
  - ***Action 2:*** Seek programs funding the installation of stream crossing structures or the creation of new ATV trails with the use of BMPs. Current funding programs include ODNR's Recreational Trails Program.
  - ***Action 3:*** Monitor the occurrence of ATV-trespassing on privately-owned lands with landowner surveys
  - ***Action 4:*** Involve landowners to fence off entry points to these properties by distributing information through mailings and at public workshop
- ***Objective 2:*** Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed
  - ***Action 1:*** Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA's OEEF grants program
  - ***Action 2:*** Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed
  - ***Action 3:*** Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)
  - ***Action 4:*** Enter data into the NPS Project Entry Database and document results through annual watershed implementation reports

Goal 2: Reduce soil erosion from timber harvests by 96.6 tons of sediment per year

Objective 1: Install temporary stream crossing structure at logging site affecting 0.8 RM of Rocky Fork (Washington Township, Section 5). Estimated sediment load reduction based on RUSLE Region 5 Model = 0.6 tons/yr

Action 1: Arrange meeting and site visit with landowner to more precisely assess soil loss due to stream crossing and discuss the ecological benefits of BMP implementation

Action 2: Assist landowner in the development of Belmont SWCD forest management plan for their timber harvest

Action 3: Assist with the installation of stream crossing structure by providing information about timber bridge rentals and technical expertise

Objective 2: Install 350 linear feet of 85-ft. buffer strip and silt fencing downslope of log landing at logging site affecting 0.8 RM of Rocky Fork (Washington Township, Section 5). Estimated sediment load reduction based on RUSLE Region 5 Model = 96 tons/yr

Action 1: Arrange meeting and site visit with landowner to more precisely assess soil loss due to log landing and discuss the ecological benefits of BMP implementation

Action 2: Assist landowner in the development of Belmont SWCD forest management plan for their timber harvest

Action 3: Assist with the installation of buffer strip and silt fencing by providing technical expertise

Objective 3: Install forestry BMPs for future timber harvests within the subwatershed (e.g. properly planned haul roads and skid trails, sediment barriers, drainage culverts, and stream crossings)

Action 1: Conduct one workshop per year to provide information to landowners about the advantages of BMPs for timber harvests on their land

Action 2: Provide information to landowners about Belmont SWCD equipment and supplies available for forestry BMP implementation (geotextile fabric, biltmore sticks, tree planter, dibble bars, tree protectors and stakes, Harrison SWCD's timber bridge) with brochures and flyers

Action 3: Assist landowners in the development of Belmont SWCD forest management plans for their timber harvests and provide contact information for ODNR Division of Forestry Service Forester for Area 11

Action 4: Provide information to landowners about other forest management programs, such as the American Forest Foundation's American Tree Farm System and the USDA Forest Service's Ohio Forest Legacy Program

Action 5: Provide information to landowners about potential funding sources for the installation of conservation practices on forested lands, such as NRCS's EQIP and WHIP Programs

Action 6: Distribute informational handouts about the benefits of forestry BMPs at outreach events and programs

Objective 4: Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed

Action 1: Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA's OEEF grants program

Action 2: Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed

Action 3: Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)
Action 4: Enter data into the NPS Project Entry Database (www.watersheddata.com) and document results through annual watershed implementation reports

Goal 3: Reduce off-site sediment yield from construction site development by an estimated 395 tons/ac/yr (NRCS 2000) through the installation and maintenance of sediment and erosion control BMPs

Objective 1: Install temporary and/or permanent runoff controls for all new construction developments in the watershed

Action 1: Identify entities involved in construction projects within the watershed (e.g. Ohio Department of Transportation; oil and gas drilling and pipeline construction companies) and invite their representatives to watershed stakeholder meetings
Action 2: Conduct one workshop per year, providing information and handouts to landowners about sediment and erosion control BMPs that can be voluntarily included in legal easement agreements for construction activities on their land
Action 3: As needed, provide technical guidance about sediment and erosion control BMPs, and also site-specific characteristics such as soil type, drainage area, topography and other pertinent information, to municipalities, developers, planners, engineers, and other entities involved with construction activities
Action 4: Collaborate with the East Central Ohio Building Industry Association in the implementation of the WAP and outreach opportunities
Action 5: Collaborate with ODNR-DSWR to implement Agricultural Impact Mitigation Agreements for pipeline construction projects through agricultural lands within the watershed (Appendix B)

Objective 2: Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed

Action 1: Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA's OEEF grants program
Action 2: Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed
Action 3: Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)
Action 4: Enter data into the NPS Project Entry Database (www.watersheddata.com) and document results through annual watershed implementation reports

Pea Vine Creek Problem Statement 2: Acid mine drainage from abandoned mine lands

In the Pea Vine Creek subwatershed, water quality monitoring indicates that in most cases acid mine drainage (AMD) does not impair water chemistry, and dilutes to undetectable levels further downstream. Reduction of conductivity along the mainstem of Captina Creek, which may be partially contributed by AMD sources, would mitigate the potential impact to biological life from this threat. Streams in the Pea Vine Creek subwatershed receive waters with elevated concentrations of acidity and heavy metals due to AMD from the following sources:

1) 75 acres of unreclaimed or partially reclaimed surface mines, in addition to underground mines, which drain acidity and heavy metals (Figures 123 - 127)

Goal 1: Reduce average conductivity values in Captina Creek and tributaries at or below the 90th percentile values for the ecoregion's reference sites (wading streams: 791 umhos/cm, headwater streams: 1019 umhos/cm). Ensure that AMD is not impairing water quality or biological conditions downstream of sources

Objective 1: Install additional remediation system to increase the effectiveness of the AMD treatment system at the Cravat Coal site (Figure 123)

Action 1: Watershed stakeholders coordinate with ODNR-DMRM and landowner to develop improvements to current system

Action 2*:* Seek programs funding remediation project. Pursue in-kind services from potential stakeholders

Action 3: Determine the potential effectiveness of future remediation by coordinating with Ohio EPA and ODNR-DMRM to develop more extensive pre- and post-remediation water quality monitoring where needed for project implementation. Enter data into the NPS Project Entry Database (www.watersheddata.com)

Objective 2: Install project to improve remediation at Town Run site (Figure 127)

Action 1: Watershed stakeholders coordinate with North American Coal Company to develop remediation of site

Action 2: Seek programs funding remediation project. Pursue in-kind services from potential stakeholders

Action 3: Determine the potential effectiveness of future remediation by coordinating with Ohio EPA and ODNR-DMRM to develop more extensive pre- and post-remediation water quality monitoring where needed for project implementation

Objective 3: Full reclamation and revegetation of 3.2 acres of surface-mined land at the Linn Tipple gob pile site (Figure 124), which has been partially reclaimed by Murray Energy Corporation.

Action 1: Watershed stakeholders coordinate with ODNR-DMRM and Murray Energy Corporation to develop a joint project to fully reclaim and revegetate the site

Action 2: Develop funding through ODNR-DMRM Abandoned Mine Lands (AML) Reclamation Program and additional in-kind services from potential stakeholders

Action 3: Determine the potential effectiveness of future remediation by coordinating with Ohio EPA and ODNR-DMRM to develop more extensive pre- and post-remediation water quality monitoring where needed for project implementation. Enter data into the NPS Project Entry Database (www.watersheddata.com)

Objective 4: Reclaim or install AMD remediation for drainage of approximately 50 acres of reclaimed surface-mined land at the Dover Ridge gob pile site (Figure 125)

Action 1: Watershed stakeholders coordinate with ODNR-DMRM and landowner to develop a joint project to fully reclaim and revegetate the site

Action 2: Develop funding through ODNR-DMRM Abandoned Mine Lands (AML) Reclamation Program and additional in-kind services from potential stakeholders

Action 3: Determine the potential effectiveness of future remediation by coordinating with Ohio EPA and ODNR-DMRM to develop more extensive preand post-remediation water quality monitoring where needed for project implementation. Enter data into the NPS Project Entry Database (www.watersheddata.com)

Objective 5: Reclaim or install AMD remediation for 1.8 acres of gob piles at Bellaire Corporation Powhatan No. 5 mine site (Figure 126)

Action 1: Watershed stakeholders coordinate with ODNR-DMRM and landowner to develop a joint project to fully reclaim and revegetate the site

Action 2: Develop funding through ODNR-DMRM Abandoned Mine Lands (AML) Reclamation Program and additional in-kind services from potential stakeholders

Action 3*:* Determine the potential effectiveness of future remediation by coordinating with Ohio EPA and ODNR-DMRM to develop more extensive pre- and post-remediation water quality monitoring where needed for project implementation. Enter data into the NPS Project Entry Database (www.watersheddata.com)

Pea Vine Creek Problem Statement 3: Water withdrawal

In the Pea Vine Creek subwatershed, there are at least four water withdrawal facilities with a capacity to withdraw greater than 100,000 gallons per day of water from two intakes and three other withdrawal facilities with the total capacity to withdraw 6.5 million gallons per day (MGD) (as registered with ODNR-DSWR's Water Withdrawal Facilities Registration Program). The number of undocumented water withdrawals in the watershed is unknown. Excessive withdrawals could potentially damage habitat quality for aquatic wildlife due to lower water volumes, lack of connectivity among habitats, increased water temperatures, decreased oxygen levels, reduced flushing of fine sediments and reduced access to spawning habitats. Ecosystem impacts will vary by season, habitat and species.

Goal 1: Prevent excessive water withdrawal, or the cumulative effects of multiple sources of withdrawal, resulting in inadequate water resources and habitat for Captina Creek and its tributaries, especially during low flow conditions

Objective 1: Encourage greater availability of water withdrawal information in the subwatershed, especially as industrial activity (e.g. oil and gas drilling) increases

Action 1: Watershed Coordinator and Technical Committee will gather information from watershed stakeholders and direct concerns over excessive withdrawal to the appropriate agencies

Action 2: Provide information about the Water Withdrawal Facilities Registration Program to watershed stakeholders through informational handouts

Action 3: Conduct landowner workshop with agency and industry representatives to answer questions and address concerns about water withdrawals in the watershed

Objective 2: Develop long-term solutions to increase the sustainability of water withdrawal in the watershed and protect water and habitat resources

Action 1: Direct industry operators to the appropriate agencies (e.g. U.S. Army Corps of Engineers; Ohio EPA) for information about Ohio regulations and BMPs

Action 2: Conduct a meeting with ODNR-DSWR and Division of Oil and Gas, and local oil and gas drilling companies to raise awareness about the watershed planning process

Action 3: Work with Technical Group and industry representatives to develop a long-term plan designating specific withdrawal locations in the watershed to reduce soil and water impacts from withdrawal locations
Action 4: Work with ODNR-DSWR and Ohio EPA to develop withdrawal permits based on current, location-specific flow rates

Pea Vine Creek Problem Statement 4: Nutrients

During 2008-2009 sampling, mean nutrient concentrations were below reference values (headwater/wading values in mg/l: 0.06/0.06 for ammonia-N, 0.606/1.054 for nitrate+nitrite-N, 0.09/0.11 for phosphorus-T) for the Western Allegheny Plateau ecoregion at all sampling locations in the Pea Vine Creek subwatershed (OEPA 2010). However, elevated nutrient levels could be a future cause of impairment in the Pea Vine Creek subwatershed and potential sources should be addressed in the effort to maintain excellent water quality. The following *potential* sources of nutrients exist:

1) Estimated 36 failing (inadequate or outdated) HSTS (Table 48), or lack of systems at seasonal hunting cabins

Goal 1: Reduce discharge from inadequate or outdated HSTS by 3,240 gallons/day in order to reduce nutrient loadings and maintain nutrient concentrations at or below 90th percentile reference values (headwater/wading values in mg/l: 0.06/0.06 for ammonia-N, 0.606/1.054 for nitrate+nitrite-N, 0.09/0.11 for phosphorus-T)

Objective 1: Install upgrades or replacements for 9 (25%) inadequate or outdated HSTS in the subwatershed in three years

Action 1: Conduct one workshop per year to provide landowners with information about the benefits of HSTS upgrades and preventative maintenance
Action 2: Provide information to landowners, through brochures and at workshop, about cost-share programs to fund home sewage treatment system upgrades or replacements. Potential funding programs include the Clean Water State Revolving Fund's (CWSRF) 75/25 cost-share program for low-income homeowners in Ohio.
Action 3: Implement the U.S. EPA's SepticSmart initiative to promote proper septic care and maintenance among watershed residents
Action 4: Develop volunteer monitoring program to conduct long-term monitoring for ammonia, nitrogen and phosphorus at selected sites within the Pea Vine Creek subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Pea Vine Creek Problem Statement 5: Pathogens (Fecal coliform)

The Ohio EPA has designated Captina Creek mainstem (RM 3.3, directly downstream of the Pea Vine Creek subwatershed drainage) in full attainment of PCR Class A recreation use. Bacterial sampling in 2008-2009 indicated a geometric mean of 37 cfu per 100 ml of water, which meets the criterion of ≤126 cfu/100ml for PCR Class A (OEPA 2010). However, due to the importance of maintaining the watershed's excellent water quality, the following *potential* sources of pathogens have been identified:

1) Estimated 36 failing (inadequate or outdated) HSTS (Table 48), or lack of systems at seasonal hunting cabins

Goal 1: Reduce discharge from inadequate or outdated HSTS by 3,240 gallons/day in order to maintain bacteria concentrations downstream of inadequate or outdated HSTS at or below 126 cfu/100ml

Objective 1*:* Install upgrades or replacements for 9 (25%) inadequate or outdated HSTS in the subwatershed in three years, targeting areas with concentrated HSTS issues near Armstrongs Mills (Captina Creek RM 16.0)

Action 1: Conduct one workshop per year to provide landowners with information about the benefits of HSTS upgrades and preventative maintenance

Action 2: Provide information to landowners, through brochures and at workshop, about cost-share programs to fund home sewage treatment system upgrades or replacements. Potential funding programs include the Clean Water State Revolving Fund's (CWSRF) 75/25 cost-share program for low-income homeowners in Ohio.

Action 3: Implement the U.S. EPA's SepticSmart initiative to promote proper septic care and maintenance among watershed residents

Action 4: Develop volunteer monitoring program to conduct long-term monitoring for bacteria at selected sites within the Pea Vine Creek subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Pea Vine Creek Problem Statement 6: Trash in and near streambanks

Trash and debris in and near streambanks does not impair water quality in the Pea Vine Creek subwatershed; however, the removal of excessive trash and debris will help maintain the high stream and habitat quality and the aesthetic value of streams in the subwatershed. In the Pea Vine Creek subwatershed, trash in and near streambanks is due to the following sources:

1) At least four documented illegal dumping sites within the subwatershed

Goal 1: Clean up one dumping site and assist in the prevention of new illegal dumping sites within the subwatershed in the next five years

Objective 1: Conduct at least one trash cleanup per year in the Captina Creek watershed

Action 1: Identify a cleanup site within the Captina Creek watershed for the Ohio River Valley Water Sanitation Commission's annual Ohio River Sweep

Action 2: Work with volunteer groups to establish a two-mile section along a State Route, United States Route or Interstate in the Captina Creek watershed as part of the Ohio Department of Transportation's Adopt-A-Highway Program. Involvement in this program would require four trash cleanups along the route per year.

Action 3: Work with JB Green Team (local solid waste management district for Jefferson and Belmont counties), county health departments, and township trustees to identify illegal dumpsites and develop a map that can be updated to maintain a record of cleanups

Action 4: Coordinate with law enforcement including JB Green Team's Litter Deputy and the Belmont County Sheriff to report open dumping complaints in the watershed

Action 5: Conduct tire cleanup through Bridgestone's Tire Removal and Recycling Program

Action 6: Pursue additional grant opportunities to fund litter cleanups, such as Ohio EPA's Litter Collection and Prevention Grant

Objective 2: Remove large tire at the mouth of Rocky Fork at Captina Creek RM 13.9

Action 1: Work with landowner to develop tire removal project

Action 2: Seek funding program and in-kind services from local stakeholders. Current funding programs include Bridgestone's Tire Removal and Recycling Program

Objective 3: Collect trash along 1.0 stream mile on Town Run (Figure 134)

Action 1: Work with landowners to conduct community trash cleanup along Town Run

Action 2: Seek funding programs for cleanup. Current funding programs include the Ohio River Valley Water Sanitation's Ohio River Clean Sweep and in-kind services from local watershed stakeholders

Objective 4: Provide education and outreach to increase communities' overall knowledge of the environmental and health effects of trash in and near streambanks, and foster an appreciation for cleaner streams

Action 1: Coordinate with JB Green Team to provide educational programs about litter prevention and recycling at community and youth events

Action 2: Distribute brochures and flyers to watershed residents with information about proper trash disposal and recycling drop-off locations

Action 3: Incorporate litter-free principles at watershed events

Figure 135. Trash along Town Run Hill Road (York Township) and upstream portions of Town Run. *Source:* Belmont Soil & Water Conservation District, 2013.

Pea Vine Creek Problem Statement 8: Barrier to fish migration

In the Pea Vine Creek subwatershed, unknown miles of stream with impaired fish assemblages upstream of a barrier that may inhibit fish migration, due to the following source:

2) One abandoned bridge across Captina Creek (RM 5.5) in Section 21 of York Township (Figure 132). The bridge partially obstructs flow and may be a barrier to fish movement upstream. Upstream (river mile 6.7) and downstream (river mile 3.3) sampling in 2008-

2009 indicated exceptional fish communities at both sites (IBI scores of 56) (OEPA 2010).

Goal 1: Maintain excellent IBI scores (≥50 for headwater streams) upstream of abandoned bridge

Objective 1: Acquire additional data about fish communities to determine if fish migration is impaired upstream of bridge

***Action 1**:* Conduct long-term biological monitoring immediately upstream and downstream of bridge

Action 2: If fish migration is impaired, identify potential strategies and funding to improve fish migration, such as a fishway or modification of the current structure

Action 3: Conduct pre- and post-restoration monitoring to determine improvement in IBI scores upstream. Enter data into the NPS Project Entry Database (www.watersheddata.com)

Table 56. Implementation details for projects identified in the Pea Vine Creek subwatershed action plan (12-digit HUC: 050103060905).

Project Name	*Aquatic Life Use*	*Attainment Status*	*Causes*	*Project Type*	*Sources*	*Objective*	*Unit*	*Target*	*Estimated Cost (U.S. Dollars)*	*Responsible Parties/ Funding Sources*	*Status*	*Project Priority*
Stream crossing restoration - Pea Vine Creek and Anderson Run	EWH/ CWH-R* and WWH	Full	Sediment	Restoration	Vehicle stream crossing	Establish stream crossing alternatives (e.g. bridge, high vent-area ratio culvert, ford, rock-ramp fishway) for multiple stream crossings and ATV trails along Pea Vine Creek and Anderson Run	Linear feet	3,248	Unknown	Belmont SWCD; USFWS; DOW	Not completed	5-10 years
Timber harvest stream crossing structure – Rocky Fork	WWH	Full	Sediment	Protection	Timber harvests without BMPs	Install temporary stream crossing structure at logging site	Stream miles affected	0.8	Unknown	Belmont SWCD; private loggers	Not completed	1-3 years
Timber harvest stream crossing structure – Rocky Fork	WWH	Full	Sediment	Protection	Timber harvests without BMPs	Install 85-ft. buffer strip and silt fencing downslope of log landing at logging site	Linear feet	350	Unknown	Belmont SWCD; private loggers	Not completed	1-3 years
Construction runoff controls – Pea Vine Creek subwatershed	n/a	n/a	Sediment	Protection	Soil disturbance without BMPs	Install temporary and/or permanent runoff controls	Tons/ac/ yr per site	395	Unknown	Belmont SWCD; OEPA	Not completed	5-10 years
Sediment control – Pea Vine Creek subwatershed	n/a	n/a	Sediment	Protection	Varies	Monitoring for TSS with turbidity tubes and measuring streambed sediment through pebble counts	Monitoring events per year	4	$56.50 for turbidity tube; $69.30 for gravelometer	Belmont SWCD; Captina Conservancy; OEPA	1 completed in 2013	1-3 years
Sediment control – Pea Vine Creek subwatershed	n/a	n/a	Sediment	Protection	Varies	Assessments of stream physical habitat (e.g. QHEI, HHEI)	Monitoring events per year	1	0	Belmont SWCD; OEPA	1 completed in 2008 - 2009	1-3 years
AMD remediation at Cravat Coal site – Captina Creek	EWH	Full	Acid mine drainage	Restoration	Partially reclaimed surface and underground mines	Install additional remediation system to increase the effectiveness of the AMD treatment system at the Cravat Coal site	Unknown	Un-known	Unknown	Belmont SWCD; ODNR-DMRM	Not completed	8-10 years
AMD remediation at Town Run site – Captina Creek	EWH	Full	Acid mine drainage	Restoration	Partially reclaimed surface and underground mines	Install project to improve remediation at Town Run site	Unknown	Un-known	Unknown	Belmont SWCD; ODNR-DMRM	Not completed	8-10 years

Project Name	*Aquatic Life Use*	*Attainment Status*	*Causes*	*Project Type*	*Sources*	*Objective*	*Unit*	*Target*	*Estimated Cost (U.S. Dollars)*	*Responsible Parties/ Funding Sources*	*Status*	*Project Priority*
AMD remediation at Linn Tipple site – Captina Creek	EWH	Full	Acid mine drainage	Restoration	Partially reclaimed surface mine	Full reclamation and revegetation of surface-mined land at the Linn Tipple gob pile site	Acres	3.2	$3,456	Belmont SWCD; ODNR-DMRM	Not completed	8-10 years
AMD remediation at Dover Ridge site – Captina Creek	EWH	Full	Acid mine drainage	Restoration	Partially reclaimed surface mine	Reclaim or install AMD remediation for drainage of approximately 50 acres of reclaimed surface-mined land at the Dover Ridge gob pile site	Acres	50	$54,000	Belmont SWCD; ODNR-DMRM; AML Program	Not completed	8-10 years
AMD remediation at Bellaire Corporation Powhatan No. 5 site – Captina Creek	EWH	Full	Acid mine drainage	Restoration	Unreclaimed surface mine	Reclaim or install AMD remediation for 1.8 acres of gob piles at Bellaire Corporation Powhatan No. 5 mine site	Acres	1.8	$1,944	Belmont SWCD; ODNR-DMRM	Not completed	8-10 years
HSTS installation and repair – Pea Vine Creek subwatershed	n/a	n/a	Nutrients, pathogens	Restoration	Inadequate or outdated HSTS	Install upgrades or replacements for inadequate or outdated HSTS in the subwatershed	Systems	9	$88,200	Belmont Co. Health Dept.; OEPA	Not completed	5-10 years
Litter cleanup – mouth of Rocky Fork	WWH	Full	Trash and debris	Restoration	Illegal dumping of trash	Remove large tire at the mouth of Rocky Fork	Stream miles	0.1	Cost of equipment	Belmont SWCD; JB Green Team grants program	Not completed	1-3 years
Litter cleanup – Town Run RM 0.0 – 1.0	Unknown	n/a	Trash and debris	Restoration	Illegal dumping of trash	Collect trash along Town Run	Stream miles	1.0	0	Belmont SWCD; JB Green Team; Bridgestone Spent Tire Program	Not completed	1-3 years
Fish barrier removal – Captina Creek RM 5.5	EWH	Full	Barriers to fish migration	Restoration	Abandoned bridge	Modification or removal of current structure, pending biological monitoring results	Bridge	1	Unknown	Belmont SWCD; USFWS; mitigation opportunities	Not completed	5-10 years

[a] Cost estimate based on *Stream Restoration in the Upper Midwest, U.S.A.* (Alexander and Allen 2006).
* R denotes a recommendation that differs from the current use designation (OEPA 2010).

Cat Run Subwatershed Action Plan (12-digit HUC: 050301060906)

Cat Run Problem Statement 1: Sedimentation and stream embeddedness

During periods of no precipitation, Cat Run has excellent water quality in terms of turbidity. Two major streams empty into Captina Creek at different areas in this subwatershed. The mouth of Porters Run and the mouth of Cat Run each contribute concentrations less than 6.2 mg/l of total suspended solids, with visibility over 36 inches. This amounts to less than 15 lbs/day of sediment that flows into Captina Creek from both streams in the Cat Run subwatershed.

In the Cat Run subwatershed, reducing sedimentation is the highest priority for improving water quality. At the mouth of Cat Run, there is a four-month average (July – November 2009) TSS loading of 12.36 tons/year (BSWCD 2009), and turbidity testing in March 2013 indicated a visibility of 108.6 cm at RM 0.3. Practices may also be implemented where water quality is not impaired but sources of silt should be removed to preserve high water quality. In the Cat Run subwatershed, sedimentation could become a threat due to the following non-point sources:

1) 3,712 tons/yr of sediment by water erosion from agricultural fields without the use of BMPs
2) 0.2 RM affected by boat traffic near Powhatan Point, contributing 38.3 tons/yr of sediment

and the following *potential* source:

3) potential, unknown loading of sediment by water erosion from future timber harvests in the subwatershed without the use of BMPs

Goal 1: Reduce soil erosion from agricultural fields by 3,712 tons/yr of sediment and prevent new sources of soil erosion in the next five years through the use of voluntary BMPs

- ***Objective 1:*** Install 550 ft of riparian buffers and streambank protection along riparian corridors at Cat Run RM 0.0 – 0.2 (York Township, Section 14). Estimated sediment load reduction, based on calculations using RUSLE Region 5 model = 140.2 tons/yr
  - ***Action 1:*** Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of riparian zone protection on agricultural lands
  - ***Action 2:*** Seek funding to provide incentive program for riparian zone protection on agricultural lands
- ***Objective 2:*** Increase acres of cropland in the entire watershed under the use of conservation tillage practices from 210.5 to 280.3 acres in three years (estimated sediment load reduction using RUSLE Region 5 model, based on corn grain/soybean rotation and no-till 20% cover = 3,572 tons/yr)
  - ***Action 1:*** Conduct one landowner workshop a year, providing information to landowners about the conservation benefits of conservation tillage, crop rotation and cover crops. Provide landowners with contacts for local NRCS staff.
  - ***Action 2:*** Provide information to landowners about equipment and supplies available for BMPs (no-till corn planter, no-till grain drill, geo-textile fabric, etc.) with brochures, flyers and announcements
  - ***Action 3:*** Seek funding to provide incentive program for conservation tillage practices on agricultural lands. Similar programs include Washington SWCD's point-based no-till/cover crop incentive program for highly erodible lands.

Objective 3: Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed

Action 1: Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA's OEEF grants program

Action 2: Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed

Action 3: Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)

Action 4: Enter data into the NPS Project Entry Database (www.watersheddata.com) and document results through annual watershed implementation reports

Goal 2: Reduce soil erosion resulting from boat traffic near the mouth of Captina Creek by 38.3 tons/yr of sediment (based on RUSLE Region 5 calculations)

Objective 1: Reestablish vegetation along 0.2 RM of highly eroded streambank on the north bank of Captina Creek (RM 0.0 – 0.2)

Action 1: Work with landowners and the Village of Powhatan Point to develop projects and funding to revegetate eroded sites with native plants

Action 2: Encourage the use of BMPs for boat launching near the mouth of Captina Creek through brochures and flyers

Objective 2: Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed

Action 1: Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA's OEEF grants program

Action 2: Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed

Action 3: Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)

Action 4: Enter data into the NPS Project Entry Database (www.watersheddata.com) and document results through annual watershed implementation reports

Goal 3: Minimize soil erosion from future timber harvests in the subwatershed

Objective 1: Install forestry BMPs for future timber harvests within the subwatershed (e.g. properly planned haul roads and skid trails, sediment barriers, drainage culverts, and stream crossings)

Action 1: Conduct one workshop per year to provide information to landowners about the advantages of BMPs for timber harvests on their land

Action 2: Provide information to landowners about Belmont SWCD equipment and supplies available for forestry BMP implementation (geotextile fabric, biltmore sticks, tree planter, dibble bars, tree protectors and stakes, Harrison SWCD's timber bridge) with brochures and flyers

Action 3: Assist landowners in the development of Belmont SWCD forest management plans for their timber harvests and provide contact information for ODNR Division of Forestry Service Forester for Area 11

Action 4: Provide information to landowners about other forest management programs, such as the American Forest Foundation's American Tree Farm System and the USDA Forest Service's Ohio Forest Legacy Program

Action 5: Provide information to landowners about potential funding sources for the installation of conservation practices on forested lands, such as NRCS's EQIP and WHIP Programs

Action 6: Distribute informational handouts about the benefits of forestry BMPs at outreach events and programs

Objective 2: Conduct long-term water quality monitoring to measure stream sediment trends and to ensure improvements in substrate condition in the subwatershed

Action 1: Develop volunteer monitoring team and seek funding to purchase water quality monitoring equipment. Current funding programs include the Ohio EPA's OEEF grants program

Action 2: Implement quarterly monitoring for TSS with turbidity tubes and measure streambed sediment through quarterly pebble counts for tributaries within the subwatershed

Action 3: Coordinate with the Ohio EPA to implement yearly assessments of stream physical habitat (e.g. QHEI, HHEI)

Action 4: Enter data into the NPS Project Entry Database (www.watersheddata.com) and document results through annual watershed implementation reports

Cat Run Problem Statement 2: Acid mine drainage from abandoned mine lands

In the Cat Run subwatershed, water quality monitoring indicates that in most cases AMD does not impair water chemistry, and dilutes to undetectable levels further downstream. However, further water quality monitoring should be completed to ensure that this high water quality is maintained downstream of AMD sources. Streams in the Cat Run subwatershed receive waters with increased concentrations of acidity and heavy metals due to AMD from the following sources:

1) At least two unreclaimed or partially reclaimed underground mines which drain acidity and heavy metals into Captina Creek (Figure 128)

Goal 1: Reduce average conductivity values in Captina Creek (Cat Run subwatershed) at or below the 90th percentile values for the ecoregion's reference sites (wading streams: 791 umhos/cm, headwater streams: 1019 umhos/cm). Ensure that AMD is not impairing water quality or biological conditions downstream of sources

Objective 1: Install additional remediation system to increase the effectiveness of the AMD treatment system at the Cove Road site (Figure 128)

Action 1: Watershed stakeholders coordinate with North American Coal Company to develop improvements to current system (e.g. wetlands or other passive treatment system)

Action 2: Seek programs funding remediation project. Pursue in-kind services from potential stakeholders

Action 3: Determine the potential effectiveness of future remediation by coordinating with Ohio EPA and ODNR-DMRM to develop more extensive pre- and post-remediation water quality monitoring where needed for project implementation. Enter data into the NPS Project Entry Database (www.watersheddata.com)

Objective 2: Install AMD remediation at Bent Axil mine site near Steinersville

Action 1: Coordinate with Ohio EPA and ODNR-DMRM to investigate impact of AMD discharging from site

Action 2: If necessary, watershed stakeholders develop project to reclaim or install AMD remediation at site

Action 3: Seek programs funding remediation project. Pursue in-kind services from potential stakeholders

Cat Run Problem Statement 3: Water withdrawal

In the Cat Run subwatershed, there are at least four water withdrawal facilities with a capacity to withdraw greater than 100,000 gallons per day of water that is registered with ODNR-DSWR's Water Withdrawal Facilities Registration Program, and the number of undocumented water withdrawals in the watershed is unknown. Excessive withdrawals could potentially damage habitat quality for aquatic wildlife due to lower water volumes, lack of connectivity among habitats, increased water temperatures, decreased oxygen levels, reduced flushing of fine sediments and reduced access to spawning habitats. Ecosystem impacts will vary by season, habitat and species.

Goal 1: Prevent excessive water withdrawal, or the cumulative effects of multiple sources of withdrawal, resulting in inadequate water resources and habitat for Captina Creek and its tributaries, especially during low flow conditions

Objective 1: Encourage greater availability of water withdrawal information in the subwatershed, especially as industrial activity (e.g. oil and gas drilling) increases

Action 1*:* Watershed Coordinator and Technical Committee will gather information from watershed stakeholders and direct concerns over excessive withdrawal to the appropriate agencies

Action 2: Provide information about the Water Withdrawal Facilities Registration Program to watershed stakeholders through informational handouts

Action 3: Conduct landowner workshop with agency and industry representatives to answer questions and address concerns about water withdrawals in the watershed

Objective 2: Develop long-term solutions to increase the sustainability of water withdrawal in the watershed and protect water and habitat resources

Action 1: Direct industry operators to the appropriate agencies (e.g. U.S. Army Corps of Engineers; Ohio EPA) for information about Ohio regulations and BMPs

Action 2: Conduct a meeting with ODNR-DSWR and Division of Oil and Gas, and local oil and gas drilling companies to raise awareness about the watershed planning process

Action 3: Work with Technical Group and industry representatives to develop a long-term plan designating specific withdrawal locations in the watershed to reduce soil and water impacts from withdrawal locations

Action 4: Work with ODNR-DSWR and Ohio EPA to develop withdrawal permits based on current, location-specific flow rates

Cat Run Problem Statement 4: Barrier to fish migration

In the Cat Run subwatershed, 4.5 miles of stream with impaired fish assemblages upstream of a barrier that prevents fish migration, due to the following source:

1) One natural waterfall, approximately six feet in height, on Cat Run (RM 3.3, Figure 131). Sampling in 2009 indicated Cat Run to be the only sampled tributary with a fair fish community (at RM 3.3 there was only partial attainment of the warmwater habitat aquatic life use designation and an IBI score of 31). Downstream sampling (RM 0.4) indicated exceptional fish communities at the mouth of Cat Run (IBI score of 58) (OEPA 2010).

Goal 1: Since fish migration is impaired by a natural barrier, the goal for this problem statement is to maintain exceptional fish communities downstream of the barrier (IBI score ≥50) and ensure that no further impairment in fish communities occurs upstream of the waterfall, rather than removal of this natural feature

> ***Objective 1:*** Implement a biological monitoring plan to continue assessment of fish communities in Cat Run and monitor the biological impact of the barrier
>
> > ***Action 1:*** Confirm that the waterfall is the source of fish impairment upstream by conducting additional biological and chemical monitoring and habitat assessment immediately upstream and downstream of the site
> >
> > ***Action 2:*** Develop volunteer monitoring team to conduct long-term biological monitoring in Cat Run to determine any future changes in IBI scores upstream of the waterfall. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Cat Run Problem Statement 5: Nutrients

During 2008-2009 sampling, mean nutrient concentrations were below reference values (headwater/wading values in mg/l: 0.06/0.06 for ammonia-N, 0.606/1.054 for nitrate+nitrite-N, 0.09/0.11 for phosphorus-T) for the Western Allegheny Plateau ecoregion at all sampling locations in the Cat Run subwatershed (OEPA 2010). However, elevated nutrient levels could be a future cause of impairment in the Cat Run subwatershed and potential sources should be addressed in the effort to maintain excellent water quality. The following *potential* sources of nutrients exist:

1) Estimated 27 failing (inadequate or outdated) HSTS (Table 48), especially near Steinersville along State Route 148, and possible lack of systems at seasonal hunting cabins

Goal 1: Reduce discharge from inadequate or outdated HSTS by 2,520 gallons/day in order to reduce nutrient loadings and maintain nutrient concentrations at or below 90th percentile reference values (headwater/wading values in mg/l: 0.06/0.06 for ammonia-N, 0.606/1.054 for nitrate+nitrite-N, 0.09/0.11 for phosphorus-T)

> ***Objective 1:*** Install upgrades or replacements for 7 (25%) inadequate or outdated HSTS in the subwatershed in three years
>
> > ***Action 1:*** Conduct one workshop per year to provide landowners with information about the benefits of HSTS upgrades and preventative maintenance
> >
> > ***Action 2****:* Provide information to landowners, through brochures and at workshop, about cost-share programs to fund home sewage treatment system upgrades or replacements. Potential funding programs include the Clean Water

State Revolving Fund's (CWSRF) 75/25 cost-share program for low-income homeowners in Ohio.
Action 3: Implement the U.S. EPA's SepticSmart initiative to promote proper septic care and maintenance among watershed residents
Action 4: Develop volunteer monitoring program to conduct long-term monitoring for ammonia, nitrogen and phosphorus at selected sites within the Cat Run subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Cat Run Problem Statement 6: Pathogens (Fecal coliform)

The Ohio EPA has designated the Cat Run mainstem (river mile 0.3) in full attainment of PCR Class B recreation use. Bacterial sampling in 2008-2009 indicated a geometric mean of 76 cfu per 100 ml of water, which meets the criterion of ≤161 cfu/100ml for PCR Class B (OEPA 2010). However, due to the importance of maintaining the watershed's excellent water quality, the following *potential* sources of pathogens have been identified:

1) Estimated 27 failing (inadequate or outdated) HSTS (Table 48) and possible lack of systems at seasonal hunting cabins

Goal 1: Reduce discharge from inadequate or outdated HSTS by 2,520 gallons/day in order to maintain bacteria concentrations downstream of inadequate or outdated HSTS at or below 161 cfu/100ml

Objective 1: Install upgrades or replacements for 7 (25%) inadequate or outdated HSTS in the subwatershed in three years, targeting areas with concentrated HSTS issues near Steinersville (Captina Creek RM 3.0) and along the length of Cat Run

Action 1: Conduct one workshop per year to provide landowners with information about the benefits of HSTS upgrades and preventative maintenance
Action 2: Provide information to landowners, through brochures and at workshop, about cost-share programs to fund home sewage treatment system upgrades or replacements. Potential funding programs include the Clean Water State Revolving Fund's (CWSRF) 75/25 cost-share program for low-income homeowners in Ohio.
Action 3: Implement the U.S. EPA's SepticSmart initiative to promote proper septic care and maintenance among watershed residents
Action 4: Develop volunteer monitoring program to conduct long-term monitoring for bacteria at selected sites within the Cat Run subwatershed. Enter data into the NPS Project Entry Database (www.watersheddata.com).

Cat Run Problem Statement 7: Trash in and near streambanks

Trash and debris in and near streambanks does not impair water quality in the Cat Run subwatershed; however, the removal of excessive trash and debris will help maintain the high stream and habitat quality and the aesthetic value of streams in the subwatershed. In the Cat Run subwatershed, trash in and near streambanks is due to the following sources:

1) At least five documented illegal dumping sites within the subwatershed

Goal 1: Clean up one dumping site and assist in the prevention of new illegal dumping sites within the subwatershed in the next five years

Objective 1: Conduct at least one trash cleanup per year in the Captina Creek watershed

Action 1: Identify a cleanup site within the Captina Creek watershed for the Ohio River Valley Water Sanitation Commission's annual Ohio River Sweep

Action 2: Work with volunteer groups to establish a two-mile section along a State Route, United States Route or Interstate in the Captina Creek watershed as part of the Ohio Department of Transportation's Adopt-A-Highway Program. Involvement in this program would require four trash cleanups along the route per year.

Action 3: Work with JB Green Team (local solid waste management district for Jefferson and Belmont counties), county health departments, and township trustees to identify illegal dumpsites and develop a map that can be updated to maintain a record of cleanups

Action 4: Coordinate with law enforcement including JB Green Team's Litter Deputy and the Belmont County Sheriff to report open dumping complaints in the watershed

Action 5: Conduct tire cleanup through Bridgestone's Tire Removal and Recycling Program

Action 6: Pursue additional grant opportunities to fund litter cleanups, such as Ohio EPA's Litter Collection and Prevention Grant

Objective 2: Provide education and outreach to increase communities' overall knowledge of the environmental and health effects of trash in and near streambanks, and foster an appreciation for cleaner streams

Action 1: Coordinate with JB Green Team to provide educational programs about litter prevention and recycling at community and youth events

Action 2: Distribute brochures and flyers to watershed residents with information about proper trash disposal and recycling drop-off locations

Action 3: Incorporate litter-free principles at watershed events

Table 57. Implementation details for projects identified in the Cat Run subwatershed action plan (12-digit HUC: 050103060906).

Project Name	*Aquatic Life Use*	*Attainment Status*	*Causes*	*Project Type*	*Sources*	*Objective*	*Unit*	*Target*	*Estimated Cost (U.S. Dollars)*	*Responsible Parties/ Funding Sources*	*Status*	*Project Priority*
Streambank restoration - Cat Run RM 0.0 – 0.2	WWH	Full	Sediment	Restoration	Unstable bank	Install riparian buffer and bank stabilization	Linear feet	550	$46,024 [a]	Belmont SWCD; USFWS; DOW; OEPA NPS Program; mitigation opportun-ities	Not completed	5-10 years
Conservation tillage practices – Cat Run subwatershed	n/a	n/a	Sediment, nutrients	Protection	Agricultura l fields	Increase total amount of cropland under conservation tillage practices	Acres in entire watershed	280.3	Unknown	Belmont SWCD; ODNR-DSWR; NRCS	210.5 acres	1-3 years
Streambank restoration – Captina Creek 0.0 – 0.2	WWH	Full	Sediment	Restoration	Unstable bank	Reestablish vegetation along highly eroded streambank on the north bank of Captina Creek	Stream miles	0.2	Unknown	Belmont SWCD; USFWS; DOW; OEPA NPS Program; mitigation opportun-ities	Not completed	3-5 years
Sediment control – Cat Run subwatershed	n/a	n/a	Sediment	Protection	Varies	Monitoring for TSS with turbidity tubes and measuring streambed sediment through pebble counts	Monitoring events per year	4	$56.50 for turbidity tube; $69.30 for gravelometer	Belmont SWCD; OEPA; Captina Conservanc y	1 completed in 2013	1-3 years
Sediment control – Cat Run subwatershed	n/a	n/a	Sediment	Protection	Varies	Assessments of stream physical habitat (e.g. QHEI, HHEI)	Monitoring events per year	1	0	Belmont SWCD; OEPA	1 completed in 2008 - 2009	1-3 years
AMD remediation at Cove Road site – Captina Creek	EWH	Full	Acid mine drainage	Restoration	Undergroun d mine	Install additional remediation system to increase the effectiveness of the AMD treatment system at the Cove Road site	Unknown	Un-known	Unknown	Belmont SWCD; ODNR-DMRM	Not completed	8-10 years

Project Name	*Aquatic Life Use*	*Attainment Status*	*Causes*	*Project Type*	*Sources*	*Objective*	*Unit*	*Target*	*Estimated Cost (U.S. Dollars)*	*Responsible Parties/ Funding Sources*	*Status*	*Project Priority*
AMD remediation at Bent Axil mine site – Captina Creek	EWH	Full	Acid mine drainage	Restoration	Underground mine	Install AMD remediation at Bent Axil mine site near Steinersville	Unknown	Un-known	Unknown	Belmont SWCD; ODNR-DMRM; AML Program	Not completed	8-10 years
Fish migration improvement – Cat Run RM 3.3	WWH	Partial	Barriers to fish migration	Protection	Natural waterfall	Implement a biological monitoring plan to continue assessment of fish communities in Cat Run and monitor the biological impact of the barrier	Monitoring events per year	4	Cost of equipment	Belmont SWCD; OEPA	Not completed	1-3 years
HSTS installation and repair – Cat Run subwatershed	n/a	n/a	Nutrients, pathogens	Restoration	Inadequate or outdated HSTS	Install upgrades or replacements for inadequate or outdated HSTS in the subwatershed	Systems	7	$68,600	Belmont Co. Health Dept.; OEPA	Not completed	5-10 years

[a] Cost estimate based on *Stream Restoration in the Upper Midwest, U.S.A.* (Alexander and Allen 2006).

Section VII: Glossary and References

Glossary

Attainment: Meeting a water body's designated use (full, partial or not meeting) for aquatic life, recreation or water supplies

Best management practices: Activities, methods or the use of alternative practices used to prevent or reduce the pollution of runoff into receiving water resources and to assist in the conservation of those resources

Biodiversity: The biological diversity, or variety of living organisms, in a particular habitat

Confluence: The joining or meeting of two bodies of water, or the location where a tributary joins a larger river (e.g. the confluence of Captina Creek and the Ohio River is at Powhatan Point, Ohio)

Embeddedness: The degree to which sediment fills the spaces between pebbles, rocks, gravel or boulders in a streambed. High embeddedness can result from deposition of sediment caused by soil erosion, and can damage habitat for aquatic organisms such as fish and macroinvertebrates.

Hydrologic units: Watershed boundaries organized hierarchically by surface area. Units range from regions of 2 to 16-digit codes with smaller codes representing a larger surface drainage and codes with higher digits representing very specific watershed drainages within a region.

Macroinvertebrate: An invertebrate organism (lacking a backbone) large enough to be seen with the naked eye.

Mainstem: The final, most downstream portion of a river draining a watershed.

National Pollutant Discharge Elimination System: Permit required for industrial facilities to discharge point source wastewater into a watershed. Must be approved by the Ohio EPA and facilities must adhere to the discharge requirements established for the permit.

Non-point source pollution: Pollution generated over a large area and may come from multiple sources, such as soil erosion from disturbed lands or runoff with elevated amounts of nutrients or bacteria. Due to their widespread and sometimes complex nature, non-point sources of pollution can be difficult to identify and control.

Point source pollution: Pollution that can be attributed to a specific location, such as a pipe discharging a pollutant into a body of water.

Runoff: The flow of water over the surface of the land.

Sedimentation: Occurs when suspended solids in the water column settle onto the stream bottom, forming a layer of sediment that can damage habitat for aquatic organisms.

Substrate: Material on the bottom surface of a stream or other aquatic habitat.

Topography: Representation of the surface features of an area of land, including information about elevation, land cover, water resources and other natural or artificial landscape features.

Tributary: A stream or river that flows into a larger river or lake.

Turbidity: A measurement of the suspended solids (usually invisible) held in the water column, or a measure of the degree to which suspended solids prevent the passage of light through the water column.

Watershed: An area of land receiving precipitation which eventually drains into a specific location (stream, lake, river, or ocean) through surface or subsurface flow.

Watershed action plan: A guiding framework for watershed stakeholders and key individuals at the community, state and federal levels that can be implemented to protect and restore the biological, chemical and physical integrity of a watershed.

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Appendices

Appendix A

Land Trust Alliance
Together, conserving the places you love

Land Trust
Standards and Practices

Revised 2004

Acknowledgements

The Land Trust Alliance extends its sincere appreciation to the members of the 2004 Land Trust Standards and Practices Revisions Advisory Team and to the hundreds of land conservationists across the country who participated in the development of the 2004 revisions. The Land Trust Alliance also gratefully acknowledges the individuals involved in establishing *Land Trust Standards and Practices* in 1989 and revising them in 1993 and 2001.

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The Land Trust Alliance wishes to thank the following financial supporters for making the 2004 revisions possible:
- Colorado Conservation Trust
- Doris Duke Charitable Foundation
- The Lennox Foundation
- Gordon and Betty Moore Foundation
- National Fish and Wildlife Foundation
- Resources Legacy Fund Foundation
- Surdna Foundation

Second Printing 2007

Introduction

Land Trust Standards and Practices are the ethical and technical guidelines for the responsible operation of a land trust. The Land Trust Alliance developed *Land Trust Standards and Practices* in 1989 at the urging of land trusts who believe a strong land trust community depends on the credibility and effectiveness of all its members and who understand that employing best practices is the surest way to secure lasting conservation. This is a living document and was revised in 1993, 2001 and 2004 to reflect changes in land trust practices and regulations governing nonprofit organizations. The 2004 revisions were prepared by a team of land trust leaders and reviewed by hundreds of conservationists to capture and share the experience of land trusts from throughout the country.

The nation's more than 1,500 nonprofit land trusts have conserved millions of acres of wildlife habitat, farms, ranches, forests, watersheds, recreation areas and other important lands. The continued success of land trusts depends both on public confidence in, and support of, the conservation efforts of these organizations, and on building conservation programs that stand the test of time. It is every land trust's responsibility to uphold this public trust and to ensure the permanence of its conservation efforts.

Implementing *Land Trust Standards and Practices* helps land trusts uphold the public trust and build strong and effective land conservation programs. The Land Trust Alliance requires that member land trusts adopt *Land Trust Standards and Practices* as the guiding principles for their operations, indicating their commitment to upholding the public trust and the credibility of the land trust community as a whole. (See the sample adoption resolution on the next page.) The Land Trust Alliance encourages all land trusts to implement *Land Trust Standards and Practices* at a pace appropriate for the size of the organization and scope of its conservation activities.

Land Trust Standards and Practices are organized into 12 standards and supporting practices to advance the standards. The practices are guidelines; there are many ways for a land trust to implement the practices, depending on the size and scope of the organization. The Land Trust Alliance provides resources to assist land trusts in the implementation of *Land Trust Standards and Practices*. General information on *Land Trust Standards and Practices* and on Alliance publications and training programs related to the standards and practices can be found at www.lta.org. Land Trust Alliance member land trusts and partners can find additional technical information and sample documents at www.LTAnet.org.

While *Land Trust Standards and Practices* are designed primarily for nonprofit, tax-exempt land trusts, they also provide important guidance for any organization or government agency that holds land or easements for the benefit of the public.

Land trusts are a respected and integral part of the nation's land conservation work. With this recognition comes responsibility to ensure that all land trusts operate effectively and that their conservation efforts are lasting. *Land Trust Standards and Practices* are a critical tool in meeting these challenges.

Sample Board Adoption Resolution

The Land Trust Alliance requires that all land trust members of the Alliance adopt *Land Trust Standards and Practices* as their guiding principles. Some public or private funders also ask for such a statement. Below is a sample resolution.

WHEREAS, the [organization] has reviewed *Land Trust Standards and Practices* published by the Land Trust Alliance in 2004; and,

WHEREAS, the [organization] agrees that *Land Trust Standards and Practices* are the ethical and technical guidelines for the responsible operation of a land trust;

NOW, THEREFORE, BE IT RESOLVED THAT the Board of Directors of the [organization], hereby adopts *Land Trust Standards and Practices* as guidelines for the organization's operations and commits to making continual progress toward implementation of these standards and practices.

________________ date adopted

Standard I: Mission

The land trust has a clear mission that serves a public interest, and all programs support that mission.

Practices

- A. Mission. The board adopts, and periodically reviews, a mission statement that specifies the public interest(s) served by the organization.
- B. Planning and Evaluation. The land trust regularly establishes strategic goals for implementing its mission and routinely evaluates programs, goals and activities to be sure they are consistent with the mission.
- C. Outreach. The land trust communicates its mission, goals and/or programs to members, donors, landowners, the general public, community leaders, conservation organizations and others in its service area as appropriate to carry out its mission.
- D. Ethics. The land trust upholds high standards of ethics in implementing its mission and in its governance and operations.

Standard 2: Compliance with Laws

The land trust fulfills its legal requirements as a nonprofit tax-exempt organization and complies with all laws.

Practices

- A. Compliance with Laws. The land trust complies with all applicable federal, state and local laws.

- B. Nonprofit Incorporation and Bylaws. The land trust has incorporated according to the requirements of state law and maintains its corporate status. It operates under bylaws based on its corporate charter or articles of incorporation. The board periodically reviews the bylaws.

- C. Tax Exemption. The land trust has qualified for federal tax-exempt status and complies with requirements for retaining this status, including prohibitions on private inurement and political campaign activity, and limitations and reporting on lobbying and unrelated business income. If the land trust holds, or intends to hold, conservation easements, it also meets the Internal Revenue Code's (IRC) public support test for public charities. Where applicable, state tax-exemption requirements are met.

- D. Records Policy. The land trust has adopted a written records policy that governs how organization and transaction records are created, collected, retained, stored and disposed. (See 9G.)

- E. Public Policy. The land trust may engage in public policy at the federal, state and/or local level (such as supporting or opposing legislation, advocating for sound land use policy, and/or endorsing public funding of conservation) provided that it complies with federal and state lobbying limitations and reporting requirements. Land trusts may not engage in political campaigns or endorse candidates for public office.

Standard 3: Board Accountability

The land trust board acts ethically in conducting the affairs of the organization and carries out the board's legal and financial responsibilities as required by law.

Practices

- A. Board Responsibility. The board is responsible for establishing the organization's mission, determining strategic direction and setting policies to carry out the mission, and, as required by law, the oversight of the organization's finances and operations.

- B. Board Composition. The board is of sufficient size to conduct its work effectively. The board is composed of members with diverse skills, backgrounds and experiences who are committed to board service. There is a systematic process for recruiting, training and evaluating board members.

- C. Board Governance. The land trust provides board members with clear expectations for their service and informs them about the board's legal and fiduciary responsibilities. The board meets regularly enough to conduct its business and fulfill its duties, with a minimum of three meetings per year. Board members are provided with adequate information to make good decisions. Board members attend a majority of meetings and stay informed about the land trust's mission, goals, programs and achievements.

- D. Preventing Minority Rule. The land trust's governing documents contain policies and procedures (such as provisions for a quorum and adequate meeting notices) that prevent a minority of board members from acting for the organization without proper delegation of authority.

- E. Delegation of Decision-Making Authority. The board may delegate decision-making and management functions to committees, provided that committees have clearly defined roles and report to the board or staff. If the land trust has staff, the board defines the job of, oversees and periodically evaluates the executive director (or chief staff person). (See 3F and 7E.)

- F. Board Approval of Land Transactions. The board reviews and approves every land and easement transaction, and the land trust provides the board with timely and adequate information prior to final approval. However, the board may delegate decision-making authority on transactions if it establishes policies defining the limits to that authority, the criteria for transactions, the procedures for managing conflicts of interest, and the timely notification of the full board of any completed transactions, and if the board periodically evaluates the effectiveness of these policies.

Standard 4: Conflicts of Interest

The land trust has policies and procedures to avoid or manage real or perceived conflicts of interest.

Practices

- A. Dealing with Conflicts of Interest. The land trust has a written conflict of interest policy to ensure that any conflicts of interest or the appearance thereof are avoided or appropriately managed through disclosure, recusal or other means. The conflict of interest policy applies to insiders (see definitions), including board and staff members, substantial contributors, parties related to the above, those who have an ability to influence decisions of the organization and those with access to information not available to the general public. Federal and state conflict disclosure laws are followed.

- B. Board Compensation. Board members do not serve for personal financial interest and are not compensated except for reimbursement of expenses and, in limited circumstances, for professional services that would otherwise be contracted out. Any compensation must be in compliance with charitable trust laws. The board's presiding officer and treasurer are never compensated for professional services.

- C. Transactions with Insiders. When engaging in land and easement transactions with insiders (see definitions), the land trust: follows its conflict of interest policy; documents that the project meets the land trust's mission; follows all transaction policies and procedures; and ensures that there is no private inurement or impermissible private benefit. For purchases and sales of property to insiders, the land trust obtains a qualified independent appraisal prepared in compliance with the Uniform Standards of Professional Appraisal Practice by a state-licensed or state-certified appraiser who has verifiable conservation easement or conservation real estate experience. When selling property to insiders, the land trust widely markets the property in a manner sufficient to ensure that the property is sold at or above fair market value and to avoid the reality or perception that the sale inappropriately benefited an insider.

Standard 5: Fundraising

The land trust conducts fundraising activities in an ethical and responsible manner.

Practices

- A. Legal and Ethical Practices. The land trust complies with all charitable solicitation laws, does not engage in commission-based fundraising, and limits fundraising costs to a reasonable percentage of overall expenses.

- B. Accountability to Donors. The land trust is accountable to its donors and provides written acknowledgement of gifts as required by law, ensures that donor funds are used as specified, keeps accurate records, honors donor privacy concerns and advises donors to seek independent legal and financial advice for substantial gifts.

- C. Accurate Representations. All representations made in promotional, fundraising, and other public information materials are accurate and not misleading with respect to the organization's accomplishments, activities and intended use of funds. All funds are spent for the purpose(s) identified in the solicitation or as directed in writing by the donor.

- D. Marketing Agreements. Prior to entering into an agreement to allow commercial entities to use the land trust's logo, name or properties, the land trust determines that these agreements will not impair the credibility of the land trust. The land trust and commercial entity publicly disclose how the land trust benefits from the sale of the commercial entity's products or services.

Standard 6: Financial and Asset Management

The land trust manages its finances and assets in a responsible and accountable way.

Practices

- A. Annual Budget. The land trust prepares an annual budget that is reviewed and approved by the board, or is consistent with board policy. The budget is based on programs planned for the year. Annual revenue is greater than or equal to expenses, unless reserves are deliberately drawn upon.

- B. Financial Records. The land trust keeps accurate financial records, in a form appropriate to its scale of operations and in accordance with Generally Accepted Accounting Principles (GAAP) or alternative reporting method acceptable to a qualified financial advisor.

- C. Financial Reports and Statements. The board receives and reviews financial reports and statements in a form and with a frequency appropriate for the scale of the land trust's financial activity.

- D. Financial Review or Audit. The land trust has an annual financial review or audit, by a qualified financial advisor, in a manner appropriate for the scale of the organization and consistent with state law.

- E. Internal System for Handling Money. The land trust has established a sound system of internal controls and procedures for handling money, in a form appropriate for the scale of the organization.

- F. Investment and Management of Financial Assets and Dedicated Funds. The land trust has a system for the responsible and prudent investment and management of its financial assets, and has established policies on allowable uses of dedicated funds and investment of funds.

- G. Funds for Stewardship and Enforcement. The land trust has a secure and lasting source of dedicated or operating funds sufficient to cover the costs of stewarding its land and easements over the long term and enforcing its easements, tracks stewardship and enforcement costs, and periodically evaluates the adequacy of its funds. In the event that full funding for these costs is not secure, the board has adopted a policy committing the organization to raising the necessary funds. (See 6F, 11A and 12A.)

- H. Sale or Transfer of Assets (Including Land and Easements). The land trust has established policies or procedures on the transfer or sale of assets, including real property. (See 4C, 9K and 9L.)

- I. Risk Management and Insurance. The land trust assesses and manages its risks and carries liability, property, and other insurance appropriate to its risk exposure and state law. The land trust exercises caution before using its land to secure debt and in these circumstances takes into account any legal or implied donor restrictions on the land, the land trust's mission and protection criteria, and public relations impact.

Standard 7: Volunteers, Staff and Consultants

The land trust has volunteers, staff and/or consultants with appropriate skills and in sufficient numbers to carry out its programs.

Practices

- A. Capacity. The land trust regularly evaluates its programs, activities and long-term responsibilities and has sufficient volunteers, staff and/or consultants to carry out its work, particularly when managing an active program of easements.

- B. Volunteers. If the land trust uses volunteers, it has a program to attract, screen, train, supervise and recognize its volunteers.

- C. Staff. If the land trust uses staff, each staff member has written goals or job descriptions and periodic performance reviews. Job duties or work procedures for key positions are documented to help provide continuity in the event of staff turnover.

- D. Availability of Training and Expertise. Volunteers and staff have appropriate training and experience for their responsibilities and/or opportunities to gain the necessary knowledge and skills.

- E. Board/Staff Lines of Authority. If the land trust has staff, the lines of authority, communication and responsibility between board and staff are clearly understood and documented. If the board hires an executive director (or chief staff person), the board delegates supervisory authority over all other staff to the executive director. (See 3E.)

- F. Personnel Policies. If the land trust has staff, it has written personnel policies that conform to federal and state law and has appropriate accompanying procedures or guidelines.

- G. Compensation and Benefits. If the land trust has staff, it provides fair and equitable compensation and benefits, appropriate to the scale of the organization.

- H. Working with Consultants. Consultant and contractor relationships are clearly defined, are consistent with federal and state law, and, if appropriate, are documented in a written contract. Consultants and contractors are familiar with sections of *Land Trust Standards and Practices* that are relevant to their work.

Standard 8: Evaluating and Selecting Conservation Projects

Part II:
Land
Transactions

The land trust carefully evaluates and selects its conservation projects.

Practices

- A. Identifying Focus Areas. The land trust has identified specific natural resources or geographic areas where it will focus its work.

- B. Project Selection and Criteria. The land trust has a defined process for selecting land and easement projects, including written selection criteria that are consistent with its mission. For each project, the land trust evaluates its capacity to perform any perpetual stewardship responsibilities.

- C. Federal and State Requirements. For land and easement projects that may involve federal or state tax incentives, the land trust determines that the project meets the applicable federal or state requirements, especially the conservation purposes test of IRC §170(h).

- D. Public Benefit of Transactions. The land trust evaluates and clearly documents the public benefit of every land and easement transaction and how the benefits are consistent with the mission of the organization. All projects conform to applicable federal and state charitable trust laws. If the transaction involves public purchase or tax incentive programs, the land trust satisfies any federal, state or local requirements for public benefit.

- E. Site Inspection. The land trust inspects properties before buying or accepting donations of land or easements to be sure they meet the organization's criteria, to identify the important conservation values on the property and to reveal any potential threats to those values.

- F. Documenting Conservation Values. The land trust documents the condition of the important conservation values and public benefit of each property, in a manner appropriate to the individual property and the method of protection.

- G. Project Planning. All land and easement projects are individually planned so that the property's important conservation values are identified and protected, the project furthers the land trust's mission and goals, and the project reflects the capacity of the organization to meet future stewardship obligations.

- H. Evaluating the Best Conservation Tool. The land trust works with the landowner to evaluate and select the best conservation tool for the property and takes care that the chosen method can reasonably protect the property's important conservation values over time. This evaluation may include informing the landowner of appropriate conservation tools and partnership opportunities, even those that may not involve the land trust.

- I. Evaluating Partnerships. The land trust evaluates whether it has the skills and resources to protect the important conservation values on the property effectively, or whether it should refer the project to, or engage in a partnership with, another qualified conservation organization.

- J. Partnership Documentation. If engaging in a partnership on a joint acquisition or long-term stewardship project, agreements are documented in writing to clarify, as appropriate, the goals of the project, roles and responsibilities of each party, legal and financial arrangements, communications to the public and between parties, and public acknowledgement of each partner's role in the project.

- K. Evaluating Risks. The land trust examines the project for risks to the protection of important conservation values (such as surrounding land uses, extraction leases or other encumbrances, water rights, potential credibility issues or other threats) and evaluates whether it can reduce the risks. The land trust modifies the project or turns it down if the risks outweigh the benefits.

- L. Nonconservation Lands. A land trust may receive land that does not meet its project selection criteria (see 8B) with the intent of using the proceeds from the sale of the property to advance its mission. If the land trust intends to sell the land, it provides clear documentation to the donor of its intent before accepting the property. Practices 4C, 9K and 9L are followed.

- M. Public Issues. A land trust engaging in projects beyond direct land protection (such as public policy, regulatory matters or education programs) has criteria or other standard evaluation methods to guide its selection of and engagement in these projects. The criteria or evaluation methods consider mission, capacity and credibility.

Standard 9: Ensuring Sound Transactions

The land trust works diligently to see that every land and easement transaction is legally, ethically and technically sound.

Practices

- A. Legal Review and Technical Expertise. The land trust obtains a legal review of every land and easement transaction, appropriate to its complexity, by an attorney experienced with real estate law. As dictated by the project, the land trust secures appropriate expertise in financial, real estate, tax, scientific, and land and water management matters.

- B. Independent Legal Advice. The land trust refrains from giving specific legal, financial and tax advice and recommends in writing that each party to a land or easement transaction obtain independent legal advice.

- C. Environmental Due Diligence for Hazardous Materials. The land trust takes steps, as appropriate to the project, to identify and document whether there are hazardous or toxic materials on or near the property that could create future liabilities for the land trust.

- D. Determining Property Boundaries. The land trust determines the boundaries of every protected property through legal property descriptions, accurately marked boundary corners or, if appropriate, a survey. If an easement contains restrictions that are specific to certain zones or areas within the property, the locations of these areas are clearly described in the easement and supporting materials and can be identified in the field.

- E. Easement Drafting. Every easement is tailored for the property according to project planning (see 8G) and: identifies the important conservation values protected and public benefit served; allows only permitted uses and/or reserved rights that will not significantly impair the important conservation values; contains only restrictions that the land trust is capable of monitoring; and is enforceable.

- F. Documentation of Purposes and Responsibilities. The land trust documents the intended purposes of each land and easement transaction, the intended uses of the property and the roles, rights and responsibilities of all parties involved in the acquisition and future management of the land or easement.

- G. Recordkeeping. Pursuant to its records policy (see 2D), the land trust keeps originals of all irreplaceable documents essential to the defense of each transaction (such as legal agreements, critical correspondence and appraisals) in one location, and copies in a separate location. Original documents are protected from daily use and are secure from fire, floods and other damage.

- H. Title Investigation and Subordination. The land trust investigates title to each property for which it intends to acquire title or an easement to be sure that it is negotiating with the legal owner(s) and to uncover liens, mortgages, mineral or other leases, water rights and/or other encumbrances or matters of record that may affect the transaction. Mortgages, liens and other encumbrances that could result in extinguishment of the easement or significantly undermine the important conservation values on the property are discharged or properly subordinated to the easement.

- I. Recording. All land and easement transactions are legally recorded at the appropriate records office according to local and state law.

- J. Purchasing Land. If the land trust buys land, easements or other real property, it obtains a qualified independent appraisal to justify the purchase price. However, the land trust may choose to obtain a letter of opinion (see definitions) from a qualified real estate professional in the limited circumstances when a property has a very low economic value or a full appraisal is not feasible before a public auction. In limited circumstances where acquiring above the appraised value is warranted, the land trust documents the justification for the purchase price and that there is no private inurement or impermissible private benefit. If negotiating for a purchase below the appraised value, the land trust ensures that its communications with the landowner are honest and forthright.

- K. Selling Land or Easements. If the land trust sells land or easements, it first documents the important conservation values, plans the project according to practice 8G, and drafts protection agreements as appropriate to the property. The land trust obtains a qualified independent appraisal that reflects the plans for the project and protection agreements and justifies the selling price. (The land trust may choose to obtain a letter of opinion from a qualified real estate professional in the limited circumstance when a property has a very low economic value.) The land trust markets the property and selects buyers in a manner that avoids any appearance of impropriety and preserves the public's confidence in the land trust, and in the case of selling to an insider (see definitions) follows practice 4C. (See 6H for sales of other assets.)

- L. Transfers and Exchanges of Land. If the land trust transfers or exchanges conservation land or easements, the land trust considers whether the new holder can fulfill the long-term stewardship and enforcement responsibilities, ensures that the transaction does not result in a net loss of important conservation values and, for donated properties, ensures that the transfer is in keeping with the donor's intent. If transferring to a party other than another nonprofit organization or public agency, the consideration is based on a qualified independent appraisal (or letter of opinion when the property has a very low economic value) in order to prevent private inurement or impermissible private benefit.

Standard 10: Tax Benefits

The land trust works diligently to see that every charitable gift of land or easements meets federal and state tax law requirements.

Practices

- A. Tax Code Requirements. The land trust notifies (preferably in writing) potential land or easement donors who may claim a federal or state income tax deduction, or state tax credit, that the project must meet the requirements of IRC §170 and the accompanying Treasury Department regulations and/or any other federal or state requirements. The land trust on its own behalf reviews each transaction for consistency with these requirements.

- B. Appraisals. The land trust informs potential land or easement donors (preferably in writing) of the following: IRC appraisal requirements for a qualified appraisal prepared by a qualified appraiser for gifts of property valued at more than $5,000, including information on the timing of the appraisal; that the donor is responsible for any determination of the value of the donation; that the donor should use a qualified appraiser who follows Uniform Standards of Professional Appraisal Practice; that the land trust will request a copy of the completed appraisal; and that the land trust will not knowingly participate in projects where it has significant concerns about the tax deduction.

- C. No Assurances on Deductibility or Tax Benefits. The land trust does not make assurances as to whether a particular land or easement donation will be deductible, what monetary value of the gift the Internal Revenue Service (IRS) and/or state will accept, what the resulting tax benefits of the deduction will be, or whether the donor's appraisal is accurate.

- D. Donee Responsibilities — IRS Forms 8282 and 8283. The land trust understands and complies with its responsibilities to sign the donor's Appraisal Summary Form 8283 and to file Form 8282 regarding resale of donated property when applicable. The land trust signs Form 8283 only if the information in Section B, Part 1, "Information on Donated Property," and Part 3, "Declaration of Appraiser," is complete. If the land trust believes no gift has been made or the property has not been accurately described, it refuses to the sign the form. If the land trust has significant reservations about the value of the gift, particularly as it may impact the credibility of the land trust, it may seek additional substantiation of value or may disclose its reservations to the donor. (See 5B for other gift substantiation requirements.)

Standard 11: Conservation Easement Stewardship

The land trust has a program of responsible stewardship for its easements.

Practices

- A. Funding Easement Stewardship. The land trust determines the long-term stewardship and enforcement expenses of each easement transaction and secures the dedicated or operating funds to cover current and future expenses. If funds are not secured at or before the completion of the transaction, the land trust has a plan to secure these funds and has a policy committing the funds to this purpose. (See 6G.)

- B. Baseline Documentation Report. For every easement, the land trust has a baseline documentation report (that includes a baseline map) prepared prior to closing and signed by the landowner at closing. The report documents the important conservation values protected by the easement and the relevant conditions of the property as necessary to monitor and enforce the easement. In the event that seasonal conditions prevent the completion of a full baseline documentation report by closing, a schedule for finalizing the full report and an acknowledgement of interim data [that for donations and bargain sales meets Treasury Regulations §1.170A-14(g)(5)(i)] are signed by the landowner at closing.

- C. Easement Monitoring. The land trust monitors its easement properties regularly, at least annually, in a manner appropriate to the size and restrictions of each property, and keeps documentation (such as reports, updated photographs and maps) of each monitoring activity.

- D. Landowner Relationships. The land trust maintains regular contact with owners of easement properties. When possible, it provides landowners with information on property management and/or referrals to resource managers. The land trust strives to promptly build a positive working relationship with new owners of easement property and informs them about the easement's existence and restrictions and the land trust's stewardship policies and procedures. The land trust establishes and implements systems to track changes in land ownership.

- E. Enforcement of Easements. The land trust has a written policy and/or procedure detailing how it will respond to a potential violation of an easement, including the role of all parties involved (such as board members, volunteers, staff and partners) in any enforcement action. The land trust takes necessary and consistent steps to see that violations are resolved and has available, or has a strategy to secure, the financial and legal resources for enforcement and defense. (See 6G and 11A.)

- F. Reserved and Permitted Rights and Approvals. The land trust has an established procedure for responding to landowner required notices or requests for approvals in a timely and consistent manner, and has a system to track notices, approvals and the exercise of any significant reserved or permitted rights.

- G. Contingency Plans/Backups. The land trust has a contingency plan for all of its easements in the event the land trust ceases to exist or can no longer steward and administer them. If a backup grantee is listed in the easement, the land trust secures prior consent of the backup grantee to accept the easement. To ensure that a backup or contingency holder will accept an easement, the land trust has complete and accurate files and stewardship and enforcement funds available for transfer. (See 11H.)

- H. Contingency Plans for Backup Holder. If a land trust regularly consents to being named as a backup or contingency holder, it has a policy or procedure for accepting easements from other land trusts and has a plan for how it will obtain the financial resources and organizational capacity for easements it may receive at a future date. (See 11G.)

- I. Amendments. The land trust recognizes that amendments are not routine, but can serve to strengthen an easement or improve its enforceability. The land trust has a written policy or procedure guiding amendment requests that: includes a prohibition against private inurement and impermissible private benefit; requires compliance with the land trust's conflict of interest policy; requires compliance with any funding requirements; addresses the role of the board; and contains a requirement that all amendments result in either a positive or not less than neutral conservation outcome and are consistent with the organization's mission.

- J. Condemnation. The land trust is aware of the potential for condemnation, understands its rights and obligations under condemnation and the IRC, and has appropriate documentation of the important conservation values and of the percentage of the full value of the property represented by the easement. The land trust works diligently to prevent a net loss of conservation values.

- K. Extinguishment. In rare cases, it may be necessary to extinguish, or a court may order the extinguishment of, an easement in whole or in part. In these cases, the land trust notifies any project partners and works diligently to see that the extinguishment will not result in private inurement or impermissible private benefit and to prevent a net loss of important conservation values or impairment of public confidence in the land trust or in easements.

Standard 12: Fee Land Stewardship

The land trust has a program of responsible stewardship for the land it holds in fee for conservation purposes.

Practices

- A. Funding Land Stewardship. The land trust determines the immediate and long-term financial and management implications of each land transaction and secures the dedicated and/or operating funds needed to manage the property, including funds for liability insurance, maintenance, improvements, monitoring, enforcement and other costs. If funds are not secured at or before the completion of the transaction, the land trust has a plan to secure these funds and has a policy committing the funds to this purpose. (See 6G.)

- B. Stewardship Principles. The land trust establishes general principles to guide the stewardship of its fee-owned properties, including determining what uses are and are not appropriate on its properties, the types of improvements it might make and any land management practices it will follow.

- C. Land Management. The land trust inventories the natural and cultural features of each property prior to developing a management plan that identifies its conservation goals for the property and how it plans to achieve them. Permitted activities are compatible with the conservation goals, stewardship principles and public benefit mission of the organization. Permitted activities occur only when the activity poses no significant threat to the important conservation values, reduces threats or restores ecological processes, and/or advances learning and demonstration opportunities.

- D. Monitoring Land Trust Properties. The land trust marks its boundaries and regularly monitors its properties for potential management problems (such as trespass, misuse or overuse, vandalism or safety hazards) and takes action to rectify such problems.

- E. Land Stewardship Administration. The land trust performs administrative duties in a timely and responsible manner. This includes establishing policies and procedures, keeping essential records, filing forms, paying insurance, paying any taxes and/or securing appropriate tax exemptions, budgeting, and maintaining files.

- F. Community Outreach. The land trust keeps neighbors and community leaders informed about its ownership and management of conservation properties.

- G. Contingency Backup. The land trust has a contingency plan for all of its conservation land in the event the land trust ceases to exist or can no longer manage the property. To ensure that a contingency holder will accept the land, the land trust has complete and accurate files and stewardship funds available for transfer.

- H. Nonpermanent Holdings. When a land trust holds fee land with the intention to sell or transfer the land, the land trust is open about its plans with the public and manages and maintains the property in a manner that retains the land trust's public credibility. (See 8L.)

- I. Condemnation. The land trust is aware of the potential for condemnation, understands its rights and obligations under condemnation, and works diligently to prevent a net loss in conservation values.

Definitions of Key Terms

Capacity: the ability to perform all the actions required to acquire and manage conservation land and easements and manage other programs by having adequate human and financial resources and organizational systems in place.

Conflict of Interest: a conflict of interest arises when "insiders" are in a position, or perceived to be in a position, to benefit financially (or create a benefit to a family member or other organization with which they are associated) by virtue of their position within the nonprofit organization.

GAAP: the Federal Accounting Standards Board (FASB) issues Generally Accepted Accounting Principles (GAAP). FASB's Statement of Account Standards 116 and 117 provide standards for Financial Statements for Not-for-Profit Organizations.

Important Conservation Values: these are the key values on a site that are the focus of protection efforts. Important conservation values are determined during property evaluation and project planning.

Insiders: board and staff members, substantial contributors, parties related to the above, those who have an ability to influence decisions of the organization and those with access to information not available to the general public.

> The IRS generally considers "insiders" or disqualified persons under IRC §4598 to be persons who, at anytime during the five-year period ending on the date of the transaction in question, were *in a position to exercise substantial influence over the affairs of the organization*. "Insiders" generally include: *board members, key staff, substantial contributors* [see IRC §507(d)(2)]*, parties related to the above and 35-percent controlled entities*. While these are strict definitions within the tax code, land trusts are advised to take an even more proactive approach to the potential damage that conflicts of interest may cause an organization and also include in the definition of "insiders" *all staff* members and *those with access to information not available to the general public* (such as certain volunteers).
>
> Related parties is defined by the IRS to include spouse, brothers and sisters, spouses of brothers and sisters, ancestors, children, grandchildren, great-grandchildren and spouses of children, grandchildren and great-grandchildren.

IRC: Internal Revenue Code

Land Trust: a nonprofit organization that, as all or part of its mission, actively works to conserve land by undertaking or assisting in land or easement acquisitions, or by engaging in the stewardship of such land or easements.

Letter of Opinion: a written estimation of a property's value, most often prepared by a qualified appraiser and occasionally prepared by a highly experienced real estate professional.

A letter of opinion may be used instead of a qualified independent appraisal when the economic value of the property is so low as to negate concerns about private inurement or private benefit or when a full appraisal is not feasible before a public auction. (A letter of opinion is not sufficient in the case of transactions with insiders.) An appraiser may call this document a Restricted Use Appraisal Report.

Private Inurement: when the net earnings of a tax-exempt organization come to the benefit of any private shareholder or individual.

Federal tax-exempt law requires that "no part of … [a tax-exempt organization's] net earnings [may] inure to the benefit of any private shareholder or individual." Generally this means that the financial assets of the organization may not be transferred to a private individual (without the organization receiving adequate compensation) solely by virtue of the individual's relationship with the organization. The IRS prohibition on inurement is absolute. The IRS also imposes penalties on directors, officers, key employees and other disqualified persons who engage in excess benefit transactions.

Qualified Independent Appraisal: an independent appraisal prepared in compliance with the Uniform Standards of Professional Appraisal Practice by a state-licensed or state-certified appraiser who has verifiable conservation easement or conservation real estate experience.

Widely Marketed: announcing the availability of a property for sale to lists of prospective buyers, through Web pages, mailings, and listings in newsletters and other publications or media. "Widely marketed" does not require public listing with a real estate agent.

Notes

The Land Trust Alliance leads and serves a national network of community-based, nonprofit land conservation organizations working to protect land for present and future generations by accelerating the pace, improving the quality and ensuring the permanence of conserved land across America through advocacy, training, communications, and legal defense programs.

The Land Trust Alliance provides resources to assist land trusts in the implementation of *Land Trust Standards and Practices*. General information on *Land Trust Standards and Practices,* Alliance publications and training programs related to the standards and practices can be found at www.lta.org. Alliance member land trusts and partners can find additional technical information and sample documents at www.LTAnet.org.

Land Trust Alliance
Together, conserving the places you love

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Appendix B

Working Draft Developed By ODNR-DSWR – March 21, 2012

COMPANY NAME PIPELINE PROJECT -

AGRICULTURAL IMPACT MITIGATION AGREEMENT
PERTAINING TO THE CONSTRUCTION OF A
BLANK INCH NATURAL GAS PIPELINE AND RELATED APPURTANCES
in
BLANK COUNTY

The following pipeline Agricultural Impact Mitigation Agreement (AIMA) construction standards and policies are established to help preserve the integrity of any agricultural land that is impacted by construction of a pipeline. They were developed with the cooperation of agricultural agencies, organizations, landowners, tenants, drainage contractors, and pipeline companies.

The below prescribed construction standards and policies are applicable to construction activities occurring partially or wholly on privately owned agricultural land. With the exception of Item No. 3 (Repair of Damaged Drainage Lines), they are not intended to apply to construction activities occurring entirely on public right-of-way, railroad right-of-way, publicly owned land, or privately owned land that is not agricultural land. The COMPANY NAME shall adhere to the construction specifications relating to the repair of outlets for drain tile and/or surface drainage when they are encountered on adjacent lands owned or leased by others.

The standard and construction specifications are for mineral soils only and do not pertain to organic muckland soils.

INTRODUCTION

The standards contained within this document are a minimum set of standards or guidelines, and landowners who have additional agricultural resource concerns will need to identify these as part of contract negotiations with COMPANY NAME.

COMPANY NAME shall provide the Landowner a copy of that portion of the final construction plans that affect his property and any other plans or maps that contain information concerning impacts to agricultural areas and or uses.

Unless an easement specifically provides to the contrary, the actions specified in the pipeline standard and construction specifications attached to this AIMA will be implemented in accordance with the conditions listed below:

A. COMPANY NAME shall provide a copy of this AIMA to the Landowner and the Landowner may forward to their Tenant prior to executing an easement agreement. Additionally, COMPANY NAME will provide a copy of this AIMA to each of the Soil and Water Conservation Districts and Farm Bureau offices through which the pipeline traverses.

B. When applicable all items are subject to change as might be negotiated by Landowners, provided such changes are negotiated in advance of construction and acceptable to COMPANY NAME, and any permitting agency including the Federal Energy Regulatory Commission (FERC) and the Ohio Power Siting Board (OPSB). To satisfy FERC and/or the OPSB requirements, any modification to a specification or action must provide an equal or greater level of environmental protection than the original action and may need the approval of FERC or PUCO before it can be implemented.

C. COMPANY NAME may negotiate with Landowners to carry out the actions that Landowners wish to perform themselves, but shall not compensate the landowner for any measures carried out themselves until final inspection has been approved by COMPANY NAME and it is established that at a minimum any such measure carried out by a landowner has followed guidelines set forth in the AIMA.

D. Unless otherwise agreed to by Landowners all actions pursuant to this AIMA shall extend to associated future construction, maintenance and repairs by COMPANY NAME.

E. After construction, COMPANY NAME will provide the Landowners and the SWCD with drawings showing the location by survey station and geo-referencing of tile lines encountered in the construction of the pipeline. The drawings will include a depth measurement from existing ground and will be provided on a county-by-county basis to the SWCDs.

F. COMPANY NAME shall implement the actions contained in this AIMA to the extent that they do not conflict with the requirements of any applicable federal, state and local rules and regulations and other permits and approvals that are obtained by COMPANY NAME for the project. The provisions and requirements of this AIMA shall be included in all easements associated with agricultural lands.

G. When applicable each action contained in this AIMA shall be implemented to the extent that such action is not determined to be unenforceable by reason of the actions approved by, or other requirements, of the FERC and/or OPSB Certificate issued for the project. COMPANY NAME agrees to include this AIMA as part of its submissions to FERC and/or OPSB and hereby expressly agrees to the inclusion of the terms contained in this AIMA in the Environmental Impact Statement to be issued in conjunction with the anticipated Certificate of Public Convenience and Necessity.

H. Prior to the construction of the pipeline, COMPANY NAME shall provide each Landowner and Tenant with a telephone number and address which can be used to contact COMPANY NAME, both during and following the completion of construction, regarding the work that was performed on their property or any other construction-related matter. COMPANY NAME shall respond promptly to Landowner and Tenant telephone calls and correspondence.

I. Certain provisions of this AIMA require COMPANY NAME to consult or agree with the Landowner and Tenant(s) of a property. COMPANY NAME shall engage in a good faith effort to secure the agreement of both Landowner and Tenant in such cases. In the event of a disagreement between Landowner and Tenant, COMPANY NAME's obligation under this AIMA shall be satisfied by securing the Landowner's agreement. Legal documents executed between the Landowner and Tenant will be part of the easement acquisition.

J. If any provision of this AIMA is held to be unenforceable, no other provision shall be affected by that holding, and the remainder of the AIMA shall be interpreted as if it did not contain the unenforceable provision.

K. All mitigative actions employed by COMPANY NAME, unless otherwise specified in these construction standards and policies or in an easement negotiated with a landowner, will be implemented within 45 days of completion of the pipeline facilities on any affected property, weather and landowner permitting. Temporary repairs will be made by COMPANY NAME during the construction process as needed to minimize the risk of additional property damage that may result from an extended construction time period. If weather delays the completion of any mitigative action beyond the 45 day period, COMPANY NAME will provide the affected landowner(s) with a written estimate of the time needed for completion of the mitigative action.

L. A local forester shall be hired by COMPANY NAME to appraise the merchantable value of any timber to be cut for construction of the pipeline. The Landowner shall be compensated 100 percent of the value.

M. COMPANY NAME will coordinate/collaborate with ODNR-DSWR and the local SWCD to develop plans for restoring all conservation practices, including drain tile that will be impacted by pipeline construction.

N. SWCDs and ODNR-DSWR will work with landowners to identify conservation practices, including drain tile, which will be impacted by the project prior to pipeline construction. When a landowner, the SWCD, and/or ODNR-DSWR informs COMPANY NAME of a conservation practice that will be impacted by pipeline construction, COMPANY NAME will coordinate with ODNR-DSWR and the local SWCD to develop plans for restoring the conservation practices to their pre-construction conditions.

O. COMPANY NAME will provide training necessary to allow ODNR-DSWR and SWCD personnel access to the right-of-way during construction. ODNR-DSWR will provide training to COMPANY NAME personnel or consultants.

COMPANY NAME, in consultation with ODNR-DSWR, shall retain qualified Agricultural Inspectors on each work phase of the project. This shall include the initial construction plan development, the construction, the initial restoration, and the post-construction monitoring and follow-up restoration. The Agricultural Inspector shall act to assure that the provisions set forth in this document or in any separate AIMA, will be adhered to in good faith by COMPANY NAME and by the pipeline installation and site restoration contractor(s).

The Agricultural Inspector shall assist with the collection and analyzing of site-specific agricultural information gathered for the construction AIMA development by COMPANY NAME.

This information shall be obtained through field review as well as direct contact with affected landowners and farm operators, local county Soil and Water Conservation District, Agricultural Extension Agents, ODNR-DSWR, and others. The Agricultural Inspector shall maintain contact with the appropriate on-site Project Inspectors throughout the construction phase. The Agricultural Inspector shall maintain contact with affected landowners and farm operators in conjunction with COMPANY NAME rights-of-way agents, as well as local county Soil and Water Conservation District and ODNR-DSWR personnel concerning farm resources and management matters pertinent to the agricultural operations and the site-specific implementation of the construction AIMA. The Agricultural Inspector shall keep records to document these matters and shall provide a courtesy copy of this information to the appropriate local county Soil and Water Conservation Districts.

COMPANY NAME will contract with ODNR-DSWR to employ Agricultural Inspectors that are competent in performing and/or familiar with the following:

COMPANY NAME Plans and Procedures
Pipeline Construction Sequences and Process
All aspects of soil and water conservation
Farm operations
Good oral and written communication skills
Mediator between landowners and project sponsor regarding agricultural resource concerns

There will be a minimum of six Agricultural Inspectors in Ohio during the construction and site restoration phases of the project.

The Agricultural Inspector will have stop work authority to avoid noncompliance situations during construction. Unless immediately required due to safety or blatant, existing noncompliance reasons, the Agricultural Inspector will coordinate with the spread's Chief Inspector prior to implementing this authority. It is expected that by following this procedure an alternative construction procedure can be identified prior to implementing a stop work order.

COMPANY NAME shall encourage its pipeline contractor(s) to use, where and if available, local drain tile contractors to redesign, reconstruct, and/or repair any drain tile lines that are affected by the pipeline installation. Often the local contractors may have installed the Landowner's drain tile system and can have valuable knowledge as to the location, depth of cover, appurtenances, and any other factors affecting the tile operation. The drain tile contractor(s) shall follow the attached construction specifications.

Definitions

<u>Agricultural Land</u>

Land, which is presently under cultivation; land that has been previously cultivated and not subsequently developed for non-agricultural use; and cleared land that is capable of being cultivated. It includes land used for cropland, hay land, improved pastureland, truck gardens, orchards, vineyards, farmsteads, commercial agricultural related facilities, feedlots, livestock confinement systems, land on which farm buildings within 100 feet of the pipeline are located, and land in government set-aside programs or the Conservation Reserve Program. It also includes land that is managed as a forest.

Best Management Practice (BMP)

Any structural, vegetative or managerial practice used to treat, prevent or reduce soil erosion. Such practices may include temporary seeding of exposed soils, construction of retention basins for storm water control and scheduling the implementation of all BMP's to maximize their effectiveness.

Company

COMPANY NAME utility company, and any contractor or sub-contractor in the employ of COMPANY NAME for the purpose of completing the pipeline or any mitigative actions contained herein its successors, and assigns, on its own behalf and as operator of COMPANY NAME.

Cropland

Land used for growing row crops, small grains, or hay; includes land that was formerly used as cropland, but is currently in a government set-aside program and pastureland that was formerly utilized as cropland or is comprised of prime farmland.

Drain Tile

Any artificial subsurface drainage system including: clay and concrete tile, vitrified sewer tile, corrugated plastic tubing, and stone drains.

Landowner

Person(s) holding legal title to property on the pipeline route from whom COMPANY NAME is seeking, or has obtained, a temporary or permanent easement, or any person(s) legally authorized by a landowner to make decisions regarding the mitigation or restoration of agricultural impacts to such landowner's property.

Non-Agricultural Land

Any land that is not "Agricultural Land" as defined above.

Pipeline

The pipeline and its related appurtenances described in COMPANY NAME's application.

Prime farmland

Agricultural land comprised of soils that are defined by the USDA Natural Resources Conservation Service as being "prime" soils (generally considered the most productive soils with the least input of nutrients and management).

<u>Right-of-way</u>

Includes the permanent and temporary easements that COMPANY NAME acquires for the purpose of constructing and operating the pipeline.

<u>Subsoil</u>

Subsoil is defined as the soil material that starts at the bottom of the topsoil to a depth of three feet. Exceptions to this are soils where fractured bedrock or hard bedrock is encountered before three feet.

<u>Surface Drains</u>

Any surface drainage system such as shallow surface field drains, grassed waterways, open ditches, or any other conveyance of surface water.

<u>Tenant</u>

Any person lawfully residing on or in possession of the land such as tenant farmers or farming on shares.

<u>Topsoil</u>

Topsoil is described as all surface and near surface soil horizons (layers) that have a moist Munsell color value of 4 and chroma of 3 or darker and a clay content increase of 10% or less between the individual horizons. On agricultural land at least the top eight inches will be considered topsoil. Horizons with up to a twenty-five percent mixing of the subsoil into the topsoil by agricultural processes will still be considered topsoil.

In areas demonstrating substantial soil erosion, topsoil colors may be lighter than a moist Munsell color value of 4 and chroma 3. In these areas the top 8 inches will be considered topsoil.

Surface horizons with a moist Munsell color value of 4 and chroma of 3 or darker in forested areas that have not been plowed are typically thinner. In these areas the top six inches will be considered topsoil.

In areas where the above conditions do not apply the top eight inches will be considered topsoil on agricultural land and the top six inches will be considered topsoil on forested land that has not been plowed.

Construction Standards and Policies

1. Pipeline depth

A. Except for aboveground piping facilities, such as mainline block valves, tap valves, meter stations, etc., the pipeline will be buried with:

1. a minimum of 5 feet of top cover where it crosses cropland.
2. a minimum of 5 feet of top cover where it crosses pasture land or other agricultural land comprised of soils that are classified by the USDA as being prime soils.
3. a minimum of 5 feet of top cover where it crosses pastureland and other agricultural land not comprised of prime soils.
4. a minimum of 3 feet of top cover where it crosses wooded land or brushy land that is not suitable as cropland.
5. substantially the same top cover as any existing parallel pipeline, but not less than 5 feet, where the route parallels an existing pipeline within a 100 foot perpendicular offset.
6. a minimum of 5 feet of cover shall be maintained over the top of the pipeline where it crosses surface drains, diversions, grassed waterways, open ditches, and streams.

B. Notwithstanding the foregoing, in those areas where rock in its natural formation is encountered, the minimum depth of cover will be 3 feet.

C. On agricultural land subject to erosion, COMPANY NAME will patrol the pipeline right-of-way with reasonable frequency to detect areas of erosion of the top cover. In no instance will COMPANY NAME knowingly allow the depth of top cover to be less than 3 feet.

2. Soil Removal and Replacement

A. The topsoil shall be determined by a properly qualified agricultural inspector, soil scientist or soil technician who will set stakes or flags every 200 feet along the right-of-way identifying the depth of topsoil to be removed. Prior to any staking of the topsoil, ODNR-DSWR and COMPANY NAME will consult on the methods and procedures that will be utilized for identifying topsoil depths. ODNR-DSWR, in cooperation with the county Soil and Water Conservation Districts will perform quality control checks of topsoil depths measured by COMPANY NAME. These checks shall occur a minimum of 1 time per mile of pipeline, but it may be more often in critical areas.

B. COMPANY NAME will conduct topsoil stripping to the actual depth of the topsoil, not to exceed 16 inches, along the construction right-of-way and other areas where construction activities warrant (e.g. staging areas, ATWS). COMPANY NAME will perform the topsoil stripping on all agricultural land including land that is currently forested. Adopting full right-of-way topsoil stripping will avoid issues such as topsoil mixing from deep rutting and topsoil compaction. The topsoil will be stored in a windrow parallel to the pipeline trench in such a manner that it will not become intermixed with subsoil materials. Topsoil may be stored at either edge of the right-of-way, or in some cases spread over the working side of the right-of-way, but not intermixed with subsoil materials. In forested areas where clearing activities are necessary, minimal amounts of topsoil mixing may occur.

C. During the clearing/grading phase, the Agricultural Inspector shall monitor site-specific depths of topsoil stripping. Where right-of-way construction requires cut-and-fill of the soil profile across grades, to the extent practicable, topsoil stockpiling will be located on the up slope edge of the right-of-way. Where topsoil cannot be separately stored on the up slope side, suitable right-of-way space will be provided on the down slope side to ensure the complete segregation of the topsoil from all cut-and-fill material.

D. All subsoil material that is removed from the trench will be placed in a second windrow parallel to the pipeline trench that is separate from the topsoil windrow. If any soil horizon or section of the soil profile has a significant increase in the concentration of rock, that soil shall be separated and placed back at preexisting contours. In no case, shall the concentration of rock be increased in any section of the profile.

E. The soil below the subsoil (substratum) will be placed in a third windrow parallel to the pipeline trench that is separate from the topsoil and subsoil windrows.

F. In backfilling the trench, the stockpiled substratum material will be placed back into the trench before replacing the subsoil and topsoil.

G. Refer to Items Nos. 5.A and 5.B for procedures pertaining to rock removal from the subsoil and topsoil.

H. Refer to Items Nos. 7.A through 7.C for procedures pertaining to the alleviation of compaction of the topsoil.

I. The topsoil must be replaced so that after settling occurs, the topsoil's original depth and contour will be restored. The same shall apply where excavations are made for road, stream, drainage ditch, or other crossings. In no instance will the topsoil materials be used for any other purpose or removed from the right of way.

J. Surface drainage should not be blocked or hindered in any way. If excess spoil is encountered, it will be removed offsite to prevent ridging. Adding additional spoil to the crown over the trench in excess of that required for settlement will not be permitted.

3. Repair of Damaged Drain Tile Lines

All drain tile repair and/or replacement shall be completed prior to topsoil replacement.

If underground drain tile is damaged by the pipeline installation, it shall be repaired in a manner that assures the drain tile is in proper operating condition at the point of repair. If underground drain tile lines in the pipeline construction area are adversely affected by the pipeline construction, COMPANY NAME will take such actions as are necessary to insure the proper functioning of the drain tile lines, including the relocation, reconfiguration, and replacement of the existing drain tile lines. The following standards and policies shall apply to the drain tile line repair:

A. COMPANY NAME shall make a conscientious effort to locate all drain tile lines within the right-of-way prior to the pipeline installation. COMPANY NAME will contact the local county Soil and Water Conservation Districts and affected Landowners and/or Tenants for their knowledge of drain tile line locations prior to the pipeline installation. All identified drain tile lines will be marked with a highly visible lathe to alert construction crews to the need for drain tile line repairs.

B. All drain tile lines shall be repaired with materials of the same or better quality as that which was damaged. The repair plans shall be approved by the Agricultural Inspector. In Ohio, all repairs shall be done according to ODNR detail numbers 5 through 10.

C. During construction drain tile lines that are damaged, cut, or removed shall be distinctly marked by placing a highly visible lathe in the trench spoil bank directly opposite each drain tile line. This marker shall not be removed until the drain tile line has been permanently repaired and such repairs have been approved and accepted by the Landowner and the Agricultural Inspector. The location of the drain tile lines encountered shall be geo-referenced.

D. Where drain tile lines are severed by the pipeline, COMPANY NAME shall consult with the landowner and the SWCD regarding pipeline repair. The following repair methods shall be utilized to repair the severed drain lines.

    1. Steel channel iron, steel angle iron, full-round slotted steel pipe, half-round steel pipe, or schedule 80 pvc pipe with 1/8 inch diameter holes shall be used to support the drain tile lines across the trench.

    2. To prevent settlement of the drain tile repair, the trench, from the bottom of the pipeline to 1 foot above drain tile repair, shall be backfilled with aggregate.

    3. If the drain tile repairs involve clay or concrete tile, the support member shall extend to the first tile joint beyond the minimum 3-foot distance. If the drain tile repairs involve plastic pipe it shall be supported at a 90-degree angle from the bottom of the drain tile. This may involve using angle iron to provide proper support.

    4. There shall be a minimum of 12 inches of clearance between the drain tile line and the pipeline whether the pipeline passes over or under the tile line.

    5. In no instance shall the grade of the drain tile line be decreased.

E. Before completing permanent drain tile repairs, all drain tile lines shall be examined by suitable means on both sides of the trench for their entire length within the right-of-way to check for drain tile that might have been damaged by construction equipment. If any drain tile line is found to be damaged, it shall be repaired so it will operate as well after construction as before construction began.

F. Temporary repairs of drain tile lines shall be made as soon as exposed. This shall include the use of filter material to prevent the movement of soil into the drain tile line or the temporary plugging of the drain tile line until permanent repairs can be made.

G. All permanent drain tile line repairs shall be made within 14 days following completion of the pipeline installation on any affected Landowner's property unless otherwise authorized by the Landowner, weather and soil conditions permitting. Landowners and/or tenants will be contacted prior to final backfill and restoration and offered opportunity to witness final tile line repair.

H. Following completion of the pipeline, COMPANY NAME will be responsible for correcting all tile line repairs that fail due to pipeline construction, provided those repairs were made by COMPANY NAME. The plans for the repairs shall be presented to the local SWCD representatives and approved by the Landowner prior beginning work on the repair. COMPANY NAME will not be responsible for drain tile line repairs that COMPANY NAME pays the landowner to perform.

4. Correction of Future Drainage Problems

COMPANY NAME shall be responsible for installing such additional drainage measures as are necessary to properly drain wet areas on the permanent and temporary easements caused by the construction and/or existence of the pipeline.

5. Rock Removal

The following rock removal procedures only pertain to rocks found in the topsoil, subsoil, and substratum.

A. Before replacing any topsoil, all rocks greater than 3 inches in any dimension will be removed from the surface of all exposed subsoil (i.e. working side and subsoil storage areas); and all material placed above the pipe shall not contain rocks of any greater concentration or size than existed prior to the pipeline construction.

B. All rocks greater than 3 inches in any dimension will be removed from the topsoil surface using a rock rake following final restoration unless undisturbed areas adjacent to the ROW can be shown to contain similar concentration and size.

C. If trenching, blasting, or boring operations are required through rocky terrain, suitable precautions will be taken to minimize the potential for oversized rocks to become interspersed with adjacent soil material.

D. Rocks and soil containing rocks removed from the subsoil areas, topsoil, or from any excavations, will be returned to the pre-existing contours, hauled off the landowner's premises or disposed of on the landowner's premises at a location that is mutually acceptable to the landowner and COMPANY NAME and in accordance with any applicable laws or regulations.

6. Removal of Construction Debris

All construction-related debris and material, which are not an integral part of the pipeline, will be removed from the landowner's property. Such material to be removed would include litter generated by the construction crews which will be removed on a daily basis.

7. Compaction, Rutting, Fertilization, Liming, Seeding, Mulching

A. In all agricultural sections of the right-of-way that were traversed by vehicles and construction equipment, where topsoil is stripped and prior to topsoil replacement, the subsoil shall be fractured by deep ripping to a depth of 16 inches below the surface of the subsoil with the appropriate industrial ripper. Subsurface features (e.g. drain tiles, other utilities) may warrant less depth. The ripper shall have maximum teeth spacing of 16 inches. The ripping shall be performed parallel to the pipeline and at 30 degrees to the pipeline. Following the ripping operation all stone and rock material three (3) inches and larger in size which has been lifted to the surface shall be collected and removed from the site for disposal.

   Upon approval by the Agricultural Inspector of the subsoil decompaction and the stone removal, the topsoil that has been temporarily removed for the period of construction shall then be replaced. The soil profile in the full width of the right-of-way shall be shattered to a depth not to exceed 16 inches with a heavy-duty sub-soiling tool having angled legs. Stone removal shall be completed, as necessary, to eliminate any additional rocks and stones brought to the surface as a result of the final subsoil shattering process.

   The existence of stumps, tile lines or underground utilities may necessitate less depth.

B. The entire right-of-way will then be disked. Three passes will be made across any agricultural land that is ripped.

C. Ripping and disking will be done at a time when the soil is dry enough for normal tillage operations to occur on undisturbed farmland adjacent to the areas to be ripped.

D. COMPANY NAME will restore all compacted or rutted land as near as practicable to its original condition.

E. COMPANY NAME will seed and mulch all disturbed areas according to guidance provided in USDA NRCS Standard Codes: i) 342 – Critical Area Planting, ii) 484 – Mulching, and iii) Appendix A Seeding Tables. In all areas where permanent vegetation is reestablished, COMPANY NAME will consult with the landowner and the SWCD to select an appropriate seed mixture.

F. The cost of applying fertilizer, manure, and/or lime may be included in the damages paid to the landowner, thereby allowing the landowner to apply the appropriate type and amounts of fertilizer, manure, and/or lime as needed depending on the crops contemplated and the construction schedule.

G. In Ohio, subsoil decompaction and topsoil replacement activities may have to be performed as weather permits due to the generally unsuitable weather for continuing agricultural land restoration in late autumn and winter. If there is a dispute between the landowner and COMPANY NAME as to what areas need to be ripped, the depth at which compacted areas should be ripped, or the necessity or rates of lime and fertilizer application, the appropriate county Soil and Water Conservation District's opinion will be considered by COMPANY NAME and the landowner.

8. Land Leveling

A. Following the completion of the pipeline, COMPANY NAME will restore any right-of-way to its original pre-construction elevation and contour should uneven settling occur or surface drainage problems develop as a result of pipeline construction.

B. COMPANY NAME will provide the landowners with a telephone number and address that may be used to alert COMPANY NAME of the need to perform additional land leveling services.

C. If uneven settling occurs or surface drainage problems develop as a result of the pipeline construction, COMPANY NAME will provide land leveling services within 45 days of a landowner's written notice, weather and soil conditions permitting.

D. If there is any dispute between the landowner and COMPANY NAME as to what areas need additional land leveling beyond that which is done at the time of construction, it will be COMPANY NAME’s responsibility to disprove the landowner’s claim that additional land leveling is warranted.

E. Once disturbed areas are stabilized and within 2 years of completion of pipeline construction, trench breakers, water bars, diversions and other similar grade stabilization structures shall be graded to original pre-construction contour elevations.

9. Backfill Profile and Trench Crowning

All rock not utilized as trench backfill material shall be removed from the right-of-way. The remaining backfill material shall consist of suitable subsoil material. Trench crowning shall occur during the trench backfilling operation using subsoil materials over the trench to allow for trench settling. In Ohio, this will be performed in accordance with ODNR detail number 13.

In areas where trench settling occurs after topsoil spreading, imported topsoil shall be used to fill each depression. Topsoil from the adjacent agricultural land shall not be used to fill the depressions. Settlement inspections shall occur at 3 months, 1 year, and 2 years after construction has finished.

In agricultural areas where the materials excavated during trenching are insufficient in quantity to meet backfill requirements, the soil of any agricultural land adjacent to the trench and construction zone shall not be used as either backfill or surface cover material. Under no circumstances shall any topsoil materials be used for pipe padding material or trench backfill. In situations where imported soil materials are employed for backfill on agricultural lands, such material shall be of similar texture and quality to the existing soils on site. Imported soils should be from similar soil types and free from noxious weeds and other pests to the extent possible.

10. Prevention of Soil Erosion and Wet Weather Construction

A. COMPANY NAME will follow the guidelines described and approved in its Upland Construction Plan (COMPANY NAME Plan) and Wetland and Waterbody Construction and Mitigation Procedures (COMPANY NAME Procedures).

B. COMPANY NAME will work with landowners to prevent excessive erosion on right-of- way that has been disturbed by construction. Reasonable methods will be implemented to control erosion. Soil should not remain bare and left without mulch for more than 21 days.

C. If the landowner and COMPANY NAME cannot agree upon a reasonable method to control erosion on the landowner's right-of-way, the recommendations of the appropriate county Soil and Water Conservation District will be considered by COMPANY NAME and the landowner.

D. Temporary sediment and erosion control devices (straw bales, silt fence, etc.) shall be removed by COMPANY NAME once the construction site is stabilized with permanent vegetation. These devices shall be removed within one year after construction is completed.

E. The following conditions will determine whether construction will be allowed to continue due to wet weather conditions. The Agricultural Inspector in coordination with the Chief Environmental Inspector and the Chief Inspector will determine when construction should not proceed in a given area due to wet weather conditions.

   a. Wet weather restrictions will only apply where necessary and may not require cessation of work in areas not affected by wet weather.
   b. Work will not be allowed in areas where rutting is mixing subsoil with topsoil, or potentially could result in mixing subsoil with topsoil, given existing soil conditions. The depth of the allowable rutting is dependent upon the depth of topsoil in a location.
   c. In areas where rutting is, or potentially could result in topsoil/subsoil mixing alternatives such as working equipment on board mats and/or timbers will be acceptable. Low ground weight equipment may also be acceptable to perform tasks otherwise performed by wheeled equipment, such as stringing trucks. Other alternatives to minimize rutting include, use of flat bottom sleds pulled by low ground weight equipment, disking the Right-of-Way to increase evaporation and dewatering the area with portable pumps.

11. Repair of Damaged Soil Conservation Practices

All soil conservation practices (such as spring developments and pipelines, terraces, grassed waterways, critical area seedings, etc.), which are damaged by the pipeline’s construction, will be restored to their pre-construction condition. All restorations shall be supervised by the agricultural inspectors and/or SWCD personnel. Grassed waterways shall be graded to original dimensions and grades with erosion control matting installed. All wetland areas will be restored in accordance with the COMPANY NAME Procedures.

If watering sources, such as spring developments, are affected as a result of the pipeline construction, COMPANY NAME shall provide an alternative supply of water within 24 hours of the watering source being disrupted and shall continue to provide it until the water source is fully functional at pre-construction flow rates.

12. Control of Trench Washouts, Water Piping and Blowouts

Trench breakers shall be installed for the dual purpose of preventing trench washouts during construction and abating water piping and blowouts subsequent to trench backfill. The distances between permanent trench breakers will be as described in COMPANY NAME's Upland Construction Plan and in Ohio meet the requirements as set forth in ODNR detail no.'s 11, 12, & 12A. COMPANY NAME will record each installed trench breaker location, by map-referenced station-number.

Once disturbed areas are stabilized or within 2 years of completion of pipeline construction, trench breakers, water bars, diversions and other similar grade stabilization structures shall be graded to original pre-construction contour elevations, and appropriately seeded or mulched.

13. Damages to Private Property

A. COMPANY NAME will reasonably compensate landowners for any construction-related damages caused by COMPANY NAME that occur on or off of the established pipeline right-of-way.

B. Compensation for damages to private property caused by COMPANY NAME shall extend beyond the initial construction of the pipeline, to include those damages caused by COMPANY NAME during future construction, operation, maintenance, and repairs relating to the pipeline.

14. Clearing of Trees and Brush from the Easement and Reestablishment of Trees Within the Construction Easement

A. If trees are to be removed from the right-of-way, COMPANY NAME will consult with the landowner to determine if there are trees of commercial or other value to the landowner.

B. If there are trees of commercial or other value to the landowner, COMPANY NAME will compensate the landowner at a fair market value for the trees as well as allow the landowner the right to retain ownership of the trees with the disposition of the trees to be negotiated prior to the commencement of land clearing. Dewatering bags shall not be emptied off the right-of-way.

C. COMPANY NAME will identify <u>black cherry</u> trees located on the right-of-way near active livestock use areas during the construction plan development. Black cherry tree vegetation is toxic to livestock when wilted and shall not be stockpiled in areas accessible to livestock. During the clearing phase, such vegetation will be disposed of in a manner that prevents contact with livestock.

D. Unless otherwise restricted by federal, state or local regulations, COMPANY NAME will follow the landowner's desires regarding the removal and disposal of trees, brush, and stumps of no value to the landowner by burning, burial, etc., or complete removal from any affected property.

F. Unless otherwise negotiated with the landowner, COMPANY NAME shall plant trees consistent with preconstruction conditions within the temporary construction easement. The planting, as well as an operation and maintenance plan, shall be approved by the landowner and a qualified local forester hired by COMPANY NAME.

15. Interference with Irrigation Systems

A. If the pipeline and/or temporary work areas intersect an operational (or soon to be operational) spray irrigation system, COMPANY NAME will establish with the landowner an acceptable amount of time the irrigation system may be out of service.

B. If, as a result of pipeline construction activities, an irrigation system interruption results in crop damages, either on the pipeline right-of-way or off the right-of-way, the landowner will be reasonably compensated for all such crop damages.

C. If it is feasible and mutually acceptable to COMPANY NAME and the landowner, temporary measures will be implemented to allow an irrigation system to continue to operate across land on which the pipeline is also being constructed.

16. Ingress and Egress Routes

Prior to the pipeline's installation, COMPANY NAME and the landowner will reach a mutually acceptable AIMA on the route that will be utilized for entering and leaving the pipeline right-of-way should access to the right-of-way not be practical or feasible from adjacent segments of the pipeline right-of-way; from public highway or railroad right-of-way or from other suitable public access.

Where access ramps/pads are required from the highway to the pipeline construction area, the topsoil shall be removed and stock piled for replacement, an underlayment of durable geotextile matting, or equivalent shall be placed over the exposed subsoil surface prior to the placement of temporary rock access fill material. All such material will be removed upon completion of the project. Complete removal of the ramp upon completion of the project and restoration of the impacted site is required prior to topsoil replacement

17. Temporary Roads

A. The location of temporary roads to be used for construction purposes will be negotiated with the landowner.

B. The temporary roads will be designed to not impede surface drainage and will be built to minimize soil erosion on or near the temporary roads.

C. Upon abandonment, temporary roads may be left intact through mutual agreement of the landowner and COMPANY NAME unless otherwise restricted by federal, state, or local regulations.

D. If the temporary roads are to be removed, the rights-of-way upon which the temporary roads are constructed will be returned to their previous use(s) and restored to equivalent condition(s) as existed prior to their construction. All temporary access roads that are removed shall be ripped to a depth of 16 inches. All ripping will be done consistent with Items 7.A. through 7.C.

18. Weed Control

A. On any right-of-way over which COMPANY NAME has jurisdiction as to its surface use, (i.e., valve sites, metering stations, compression stations, etc.), COMPANY NAME will provide for weed control in a manner that prevents the spread of weeds onto adjacent lands used for agricultural purposes. Spraying will be done by a pesticide applicator that is appropriately licensed for doing such work in the state of Ohio.

B. COMPANY NAME will be responsible for reimbursing all reasonable costs incurred by owners of land adjacent to surface facilities when the landowners must control weeds on their land which can be determined to have spread from land accommodating pipeline surface facilities, should COMPANY NAME fail to do so after being given written notice and a 45-day opportunity to respond.

19. Pumping of Water from Open Trenches

A. No back filling shall be done in water filled trench. All freestanding water shall be removed prior to any back filling.

B. In the event it becomes necessary to pump water from open trenches, COMPANY NAME will pump the water in a manner that will avoid damaging adjacent agricultural land, crops, and/or pasture. Such damages include, but are not limited to, the inundation of crops for more than 24 hours, the deposition of excessive sediment in ditches and other water courses, and the deposition of subsoil sediment and gravel in fields and pastures. Sediment dewatering bags shall not be dewatered off the right-of-way.

C. If it is impossible to avoid water-related damages as described in Item 19.B. above, COMPANY NAME will reasonably compensate the landowners for the damages or will correct the damages so as to restore the land, crops, pasture, water courses, etc. to their pre-construction condition.

D. All pumping of water shall comply with existing drainage laws, local ordinances relating to such activities, and provisions of the Clean Water Act.

20. Aboveground Facilities

Locations for aboveground facilities shall be selected in a manner so as to be as unobtrusive as reasonably possible to ongoing agricultural activities occurring on the land adjacent to the facilities. Aboveground facilities on the right-of-way will be located in a manner that attempts to minimize the loss of agricultural land first, and secondly, the impacts to other environmental features. If this is not feasible, such facilities shall be located so as to incur the least hindrance to the adjacent cropping operations (i.e., located in field corners or areas where at least one side is not used for cropping purposes).

21. Advance Notice of Access to Private Property

A. COMPANY NAME will provide the landowner or tenant with a minimum of 24 hours prior notice before accessing his/her property for the purpose of constructing the pipeline.

B. Prior notice shall first consist of a personal contact or a telephone contact, whereby the landowner or tenant is informed of COMPANY NAME's intent to access the land. If the landowner or tenant cannot be reached in person or by telephone, COMPANY NAME will mail or hand deliver to the landowner or tenant's home a dated, written notice of COMPANY NAME's intent. The landowner or tenant need not acknowledge receipt of the written notice before COMPANY NAME can enter the landowner's property.

22. Reporting of Inferior Agricultural Impact Mitigation Work

No later than 45 days prior to the commencement of the pipeline construction across a landowner's property, COMPANY NAME will provide the landowner with a toll-free number the landowner can call to alert COMPANY NAME should the landowners observe inferior agricultural impact mitigation work which is being done or has been carried out on his/her property.

23. Indemnification

COMPANY NAME will indemnify all owners of agricultural land upon which such pipeline is installed. This indemnification for damages shall be made as part of each easement agreement.

24. General Monitoring and Remediation

COMPANY NAME will provide a monitoring and remediation period of no less than three years immediately following the full-length activation of the pipeline or the completion of initial right-of-way restoration, whichever occurs last. COMPANY NAME shall be responsible for the cost of the monitoring and remediation. The three-year period allows for the effects of climatic cycles such as frost action, precipitation and growing seasons to occur, from which various monitoring determinations can be made. COMPANY NAME shall maintain an Agricultural Inspector on at least a part-time basis through this period. The monitoring and remediation phase shall be used to identify any remaining impacts associated with the pipeline construction that are in need of correction and to implement the follow-up restoration.

General right-of-way conditions to be monitored include topsoil thickness, relative content of rock and large stones, trench settling, crop production, drainage and repair of severed fences, etc. The problems or concerns shall be identified through on-site monitoring of all areas along the right-of-way and through contact with respective landowner/operator, ODNR-DSWR, and local county Soil and Water Conservation District.

Topsoil deficiency and trench settling shall be restored with imported topsoil that is consistent with the quality of topsoil on the affected site. Settlement inspections shall occur at 3 months, 1 year, and 2 years after construction has finished. Excessive amounts of rock and oversized stone material shall be determined by a visual inspection of the right-of-way. Results shall be compared to portions of the same field located outside of the right-of-way. Included in the determination of relative rock and large stone content is the right-of-way's condition subsequent to tillage and the relative concentration of such materials within the right-of-way as compared to off the right-of-way. All excess rocks and large stones shall be removed and disposed of by COMPANY NAME.

On site monitoring of agricultural lands shall be conducted at least once during the growing season and shall include a comparison of growth and yield for crops on and off the right-of-way. This monitoring shall occur a minimum of 1 time within every five mile stretch of pipeline. When the subsequent crop productivity within the affected right-of-way is less than that of the adjacent unaffected agricultural land, the Agricultural Inspector, in conjunction with COMPANY NAME as well as other appropriate organizations, shall help to determine the appropriate rehabilitation measures for COMPANY NAME to implement. During the various stages of the project, all affected farm operators shall be periodically apprised of the duration of remediation by their respective Agricultural Inspector. Because conditions that require remediation may not be noticeable at or shortly after the completion of construction, the signing of a release form prior to the end of the remediation period shall not relieve COMPANY NAME’s responsibility to fully redress all project impacts. After completion of the specific remediation period, COMPANY NAME shall continue to respond to the reasonable requests of the landowner/operators to correct project related affects on the agricultural resources.

On lands subject to erosion, the Agricultural Inspector shall patrol the pipeline right-of-way with reasonable frequency to detect erosion of the top cover. Whenever the loss of cover due to erosion creates a safety issue COMPANY NAME shall take corrective action.

Signature: ____________________________________ Date: ___________________

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Signature: ___________________________________ Date: ___________________

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Ohio Department of Natural Resources,
Division of Soil and Water Resources (Printed Name/Title)

Appendix C – Draft Soil Erosion Model for Captina Creek Watershed

Model courtesy of Gregory Lipps, August 2013.

A generalized landscape-scale model of predicted soil erosion in the Captina Creek Watershed based on the Sediment Assessment Tool for Effective Erosion Control (SATEEC) (http://www.envsys.co.kr/~sateec/).

This tool is based on the NRCS Revised Universal Soil Loss Equation (RUSLE):

$$A = R \; K \; LS \; C \; P$$

Where

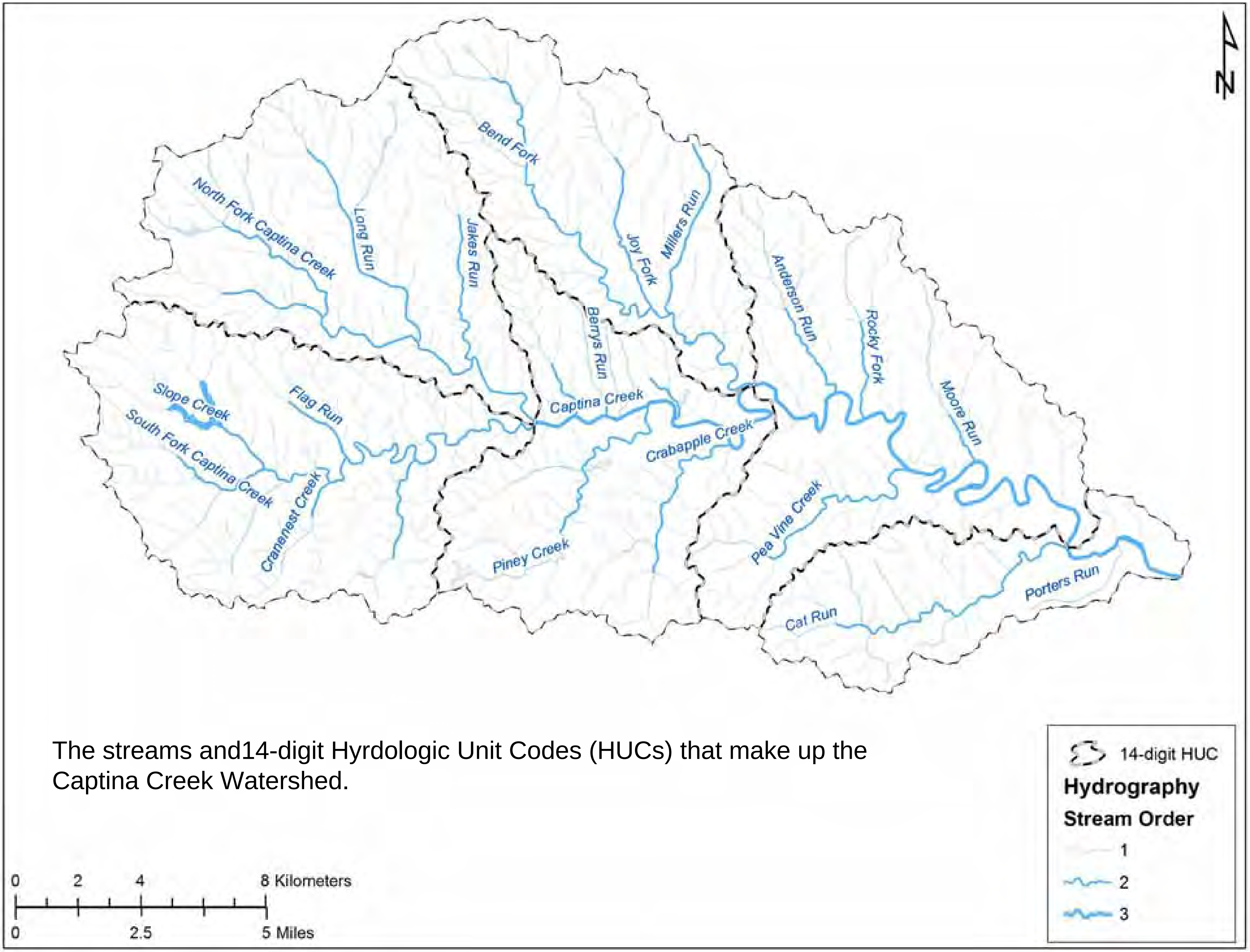
A = average annual soil loss (ton/ac/year),
R = rainfall/runoff erosivity,
K = soil erodibility,
LS = slope length and steepness,
C = cover management,
P = support practice

For the purposes of this exercise, C was generalized based on the crop and land-use/land-cover data available from the USDA's Cropland Data Layer (http://nassgeodata.gmu.edu/CropScape/).
P was kept constant (1). The R value for Belmont County is 120.

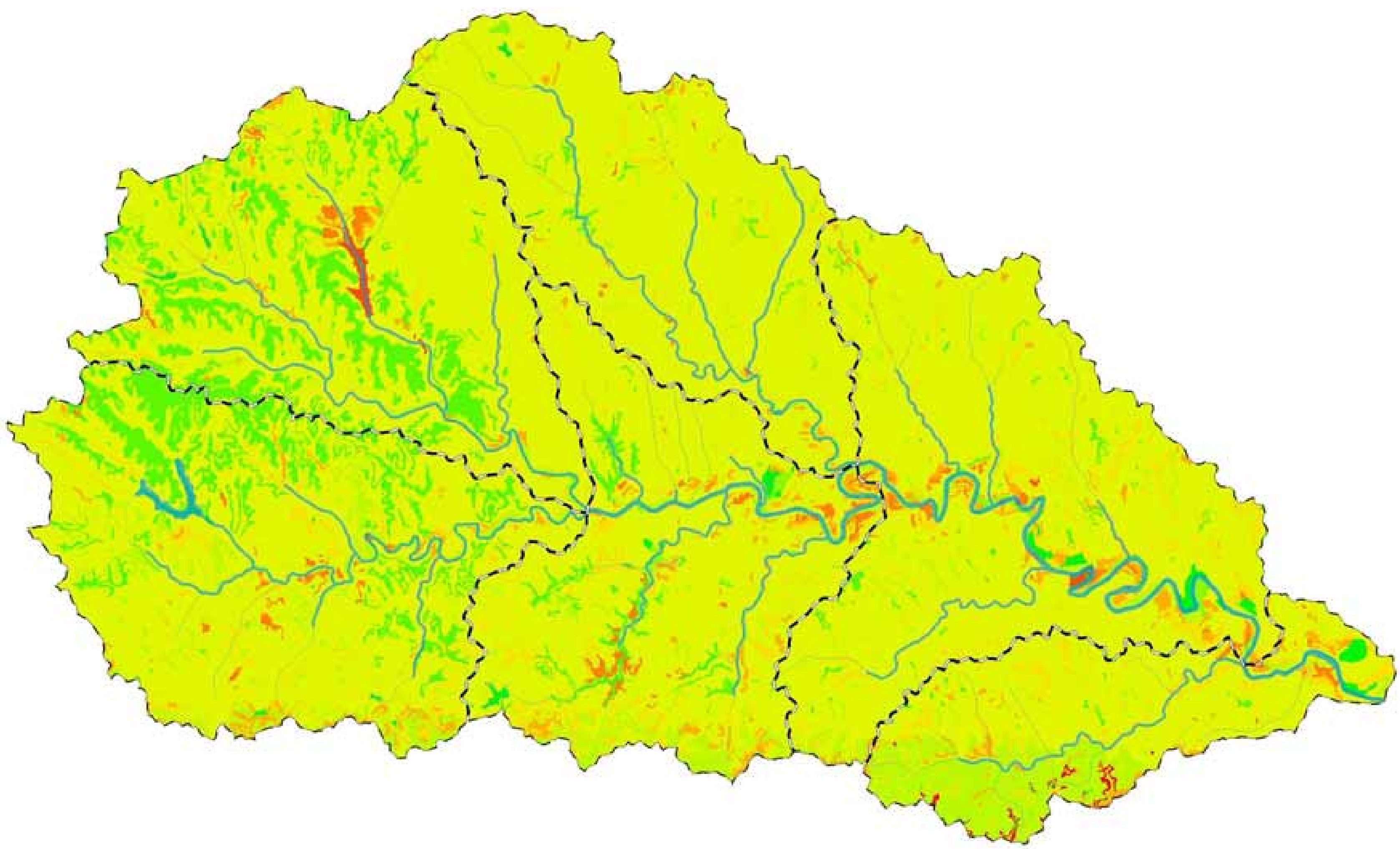
This tool is only for estimating soil loss on agricultural lands, not forests.

This is a landscape-scale model, and does not take into account local practices that influence sedimentation rates.

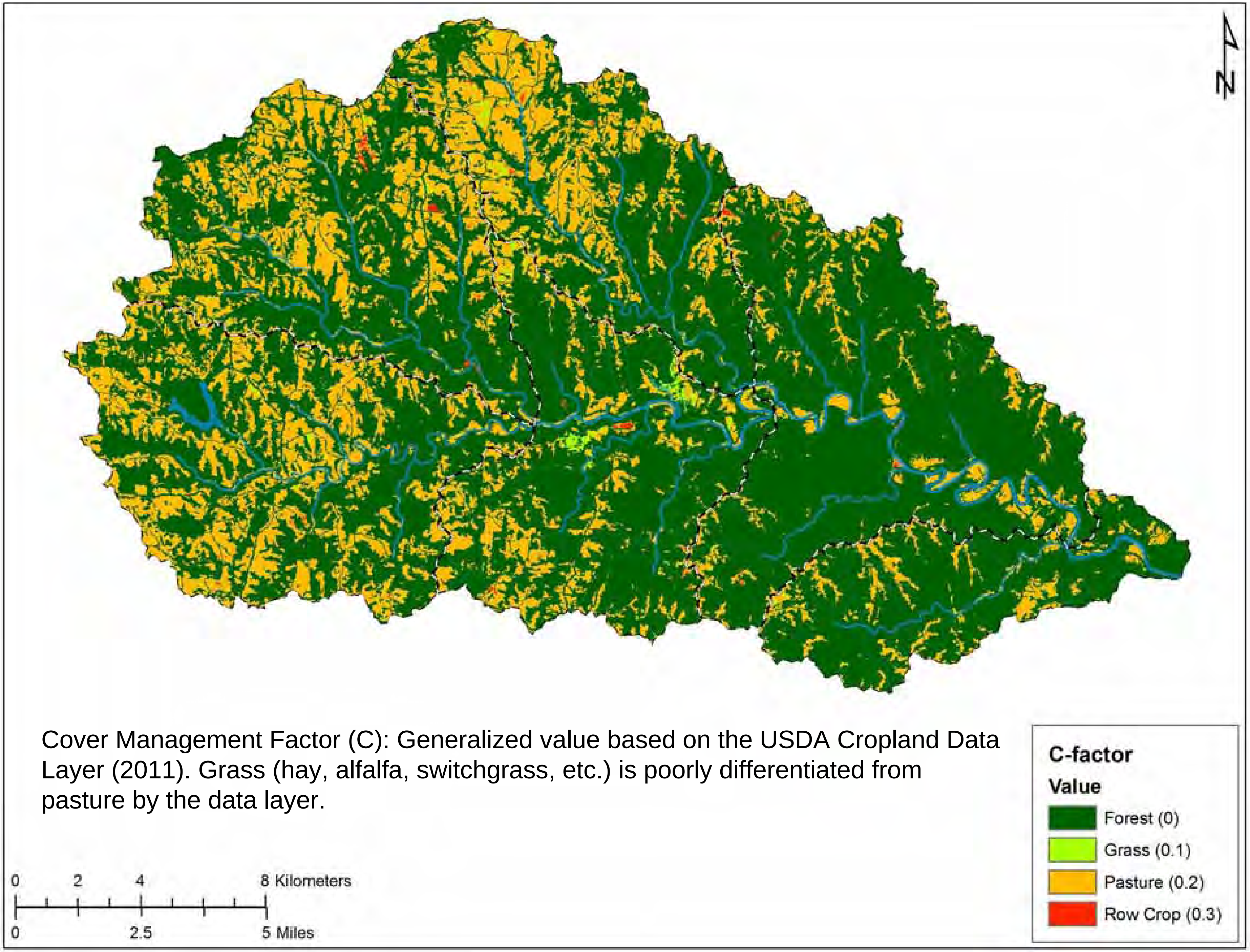
Gregory Lipps. 16 August 2013.



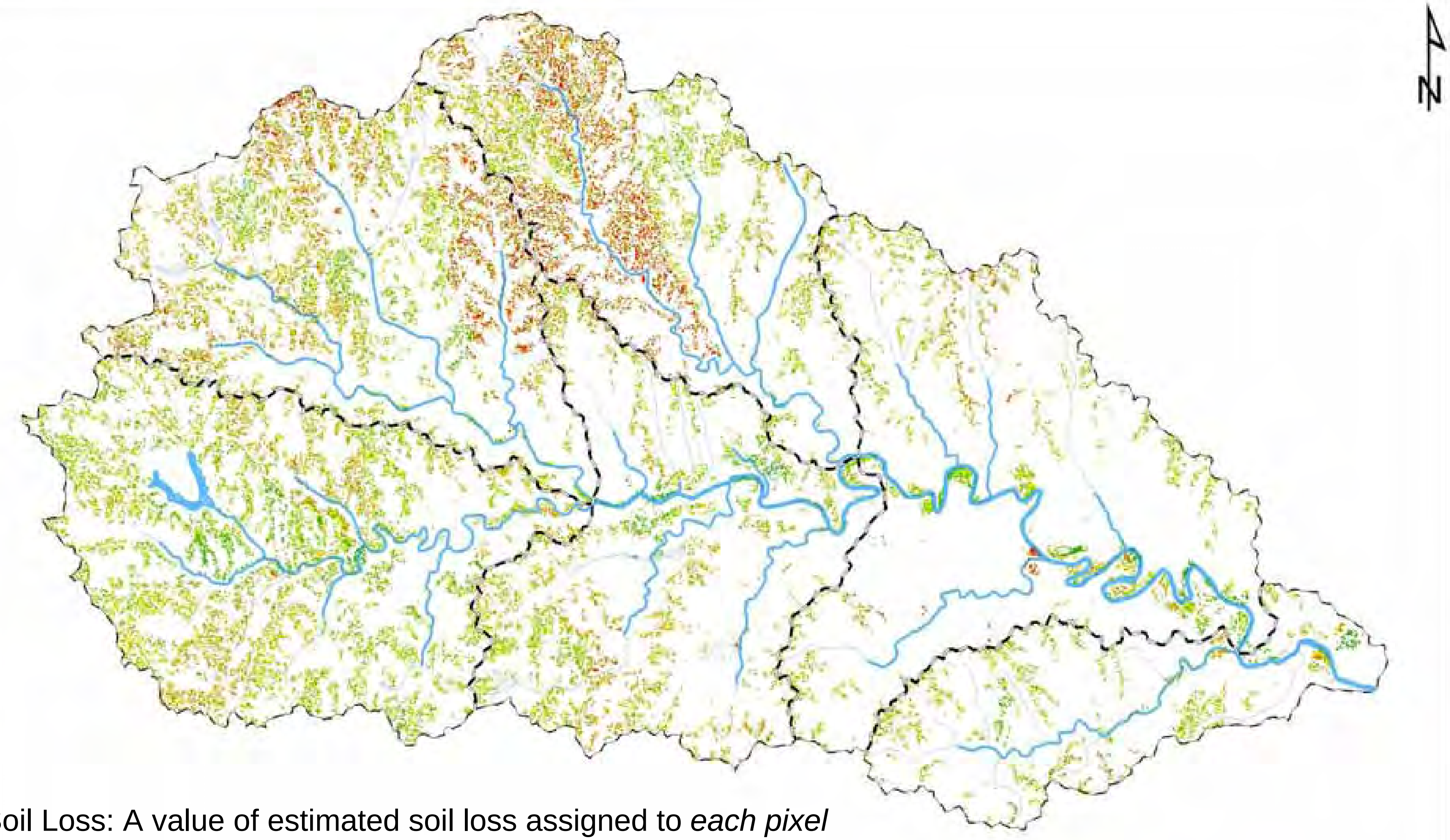
The streams and14-digit Hyrdologic Unit Codes (HUCs) that make up the Captina Creek Watershed.



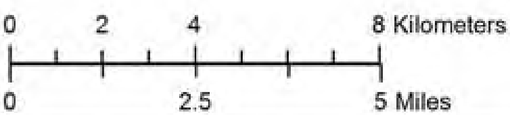
Soil K-factor: soil erodibility factor which represents both susceptibility of soil to erosion and the rate of runoff, as measured under the standard unit plot condition.

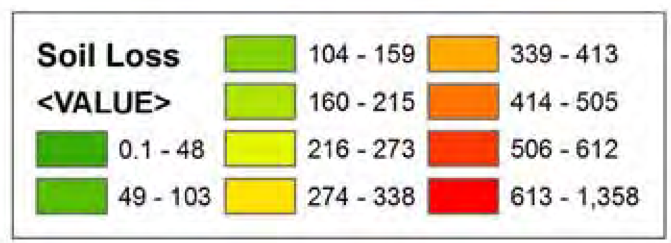


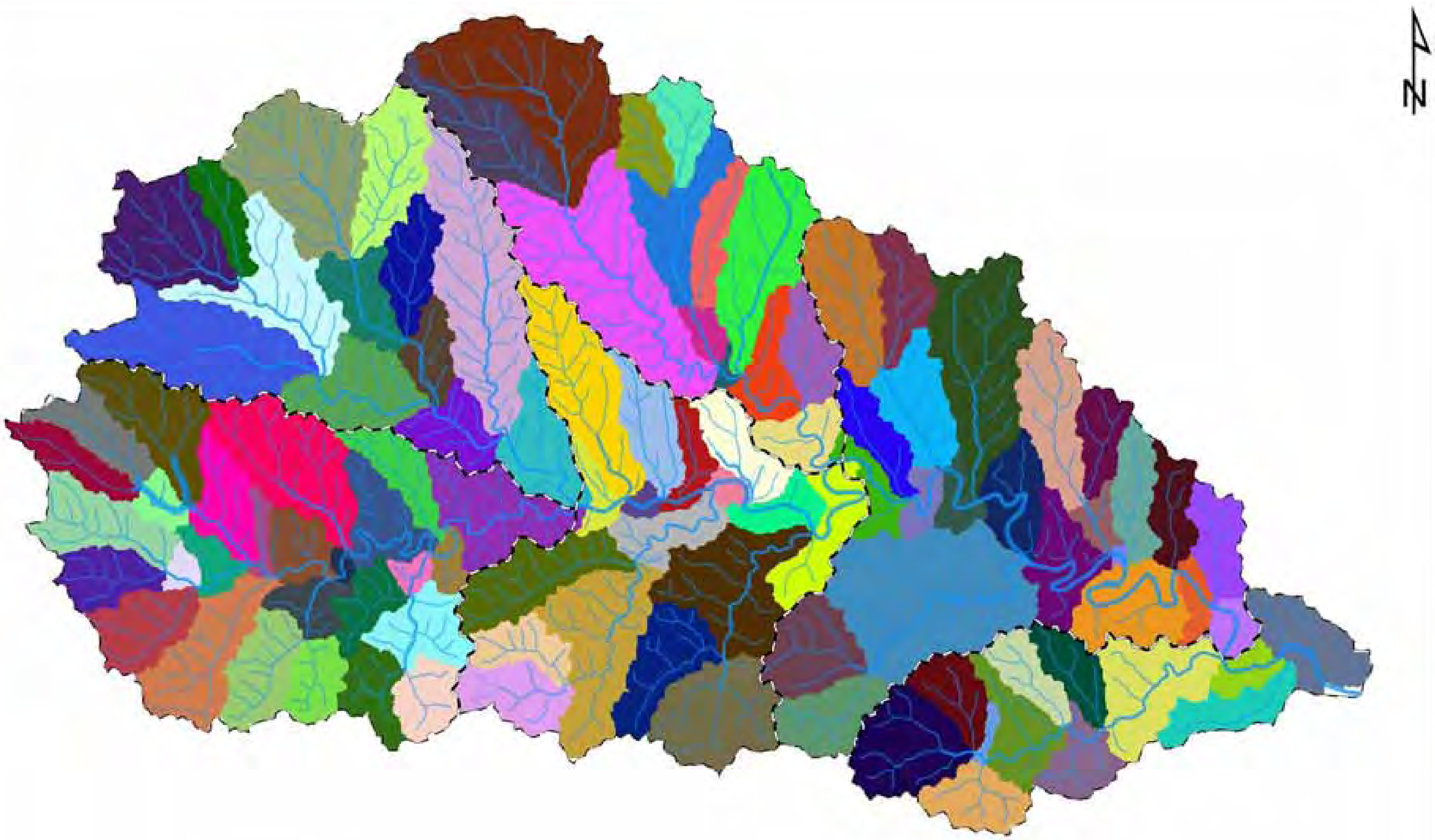
Cover Management Factor (C): Generalized value based on the USDA Cropland Data Layer (2011). Grass (hay, alfalfa, switchgrass, etc.) is poorly differentiated from pasture by the data layer.



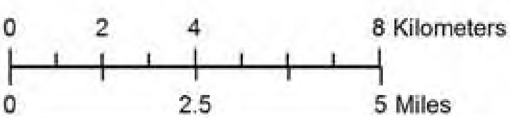
Soil Loss: A value of estimated soil loss assigned to *each pixel* based on the LS (slope) factor, soil k-factor, and c-factor (land-use/land-cover). This output may have some use in identifying areas for restoration, but it does not take into account how well the sediment is transported downstream (see the final model output).



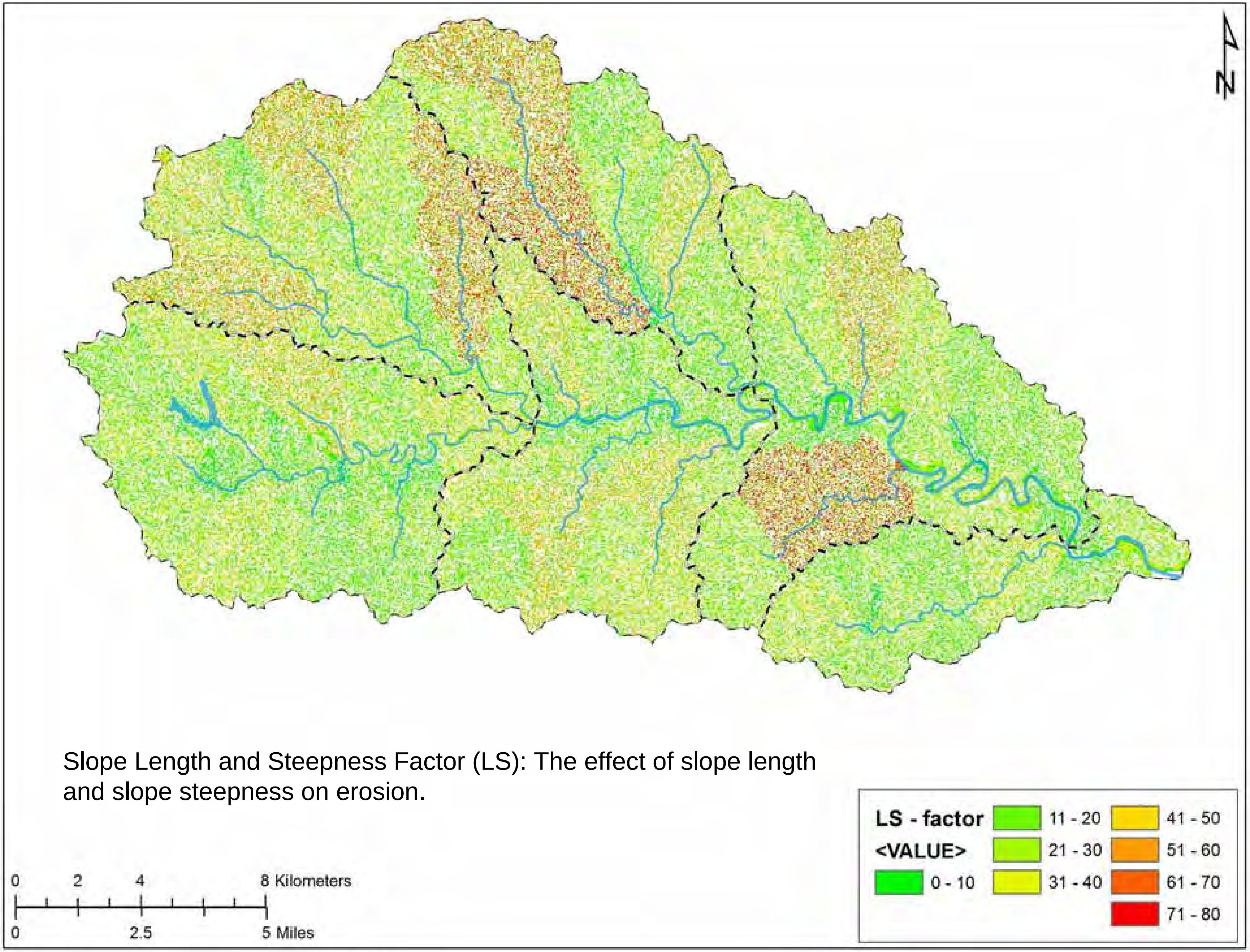




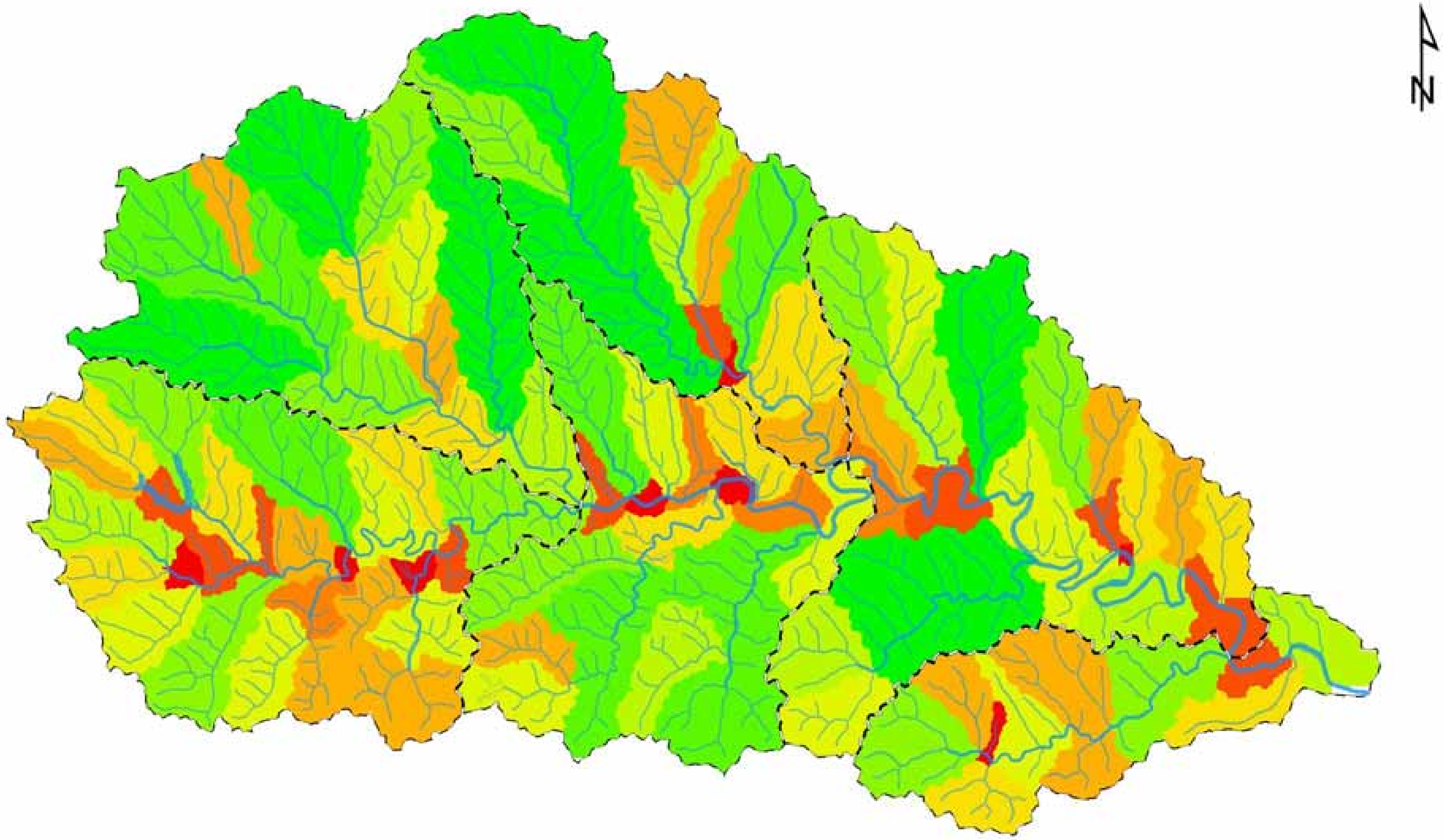
The remainder of the factors take into account the transport of sediment to a specific point, not simply its loss. For the purposes of prioritizing conservation activities, the watershed was divided into 105 units.



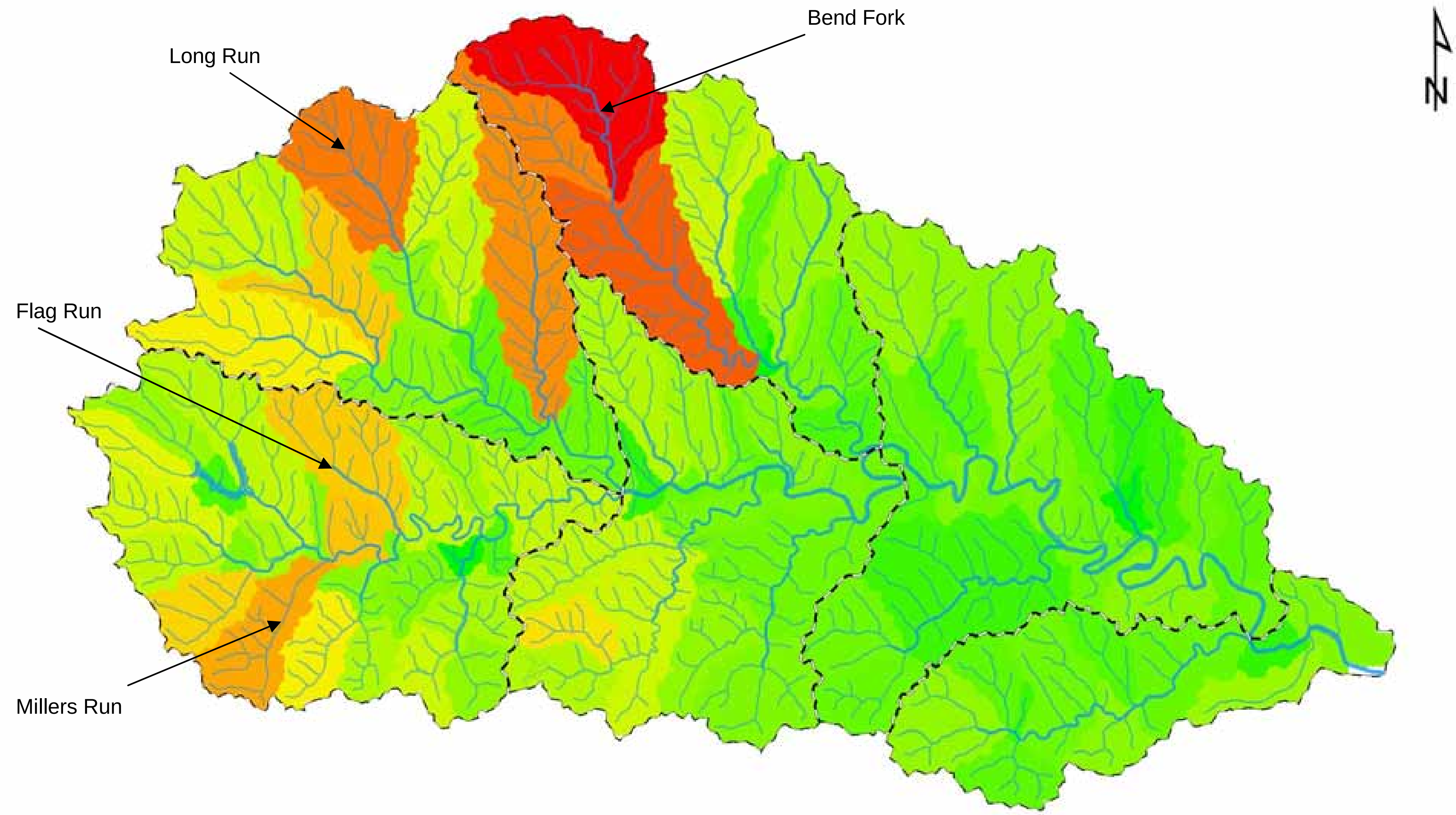
Watershed divided into
105 "mini-watersheds"
for analysis.



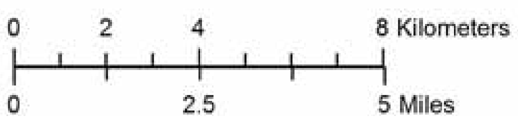
Slope Length and Steepness Factor (LS): The effect of slope length and slope steepness on erosion.

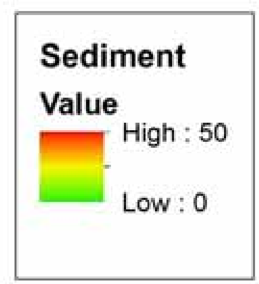


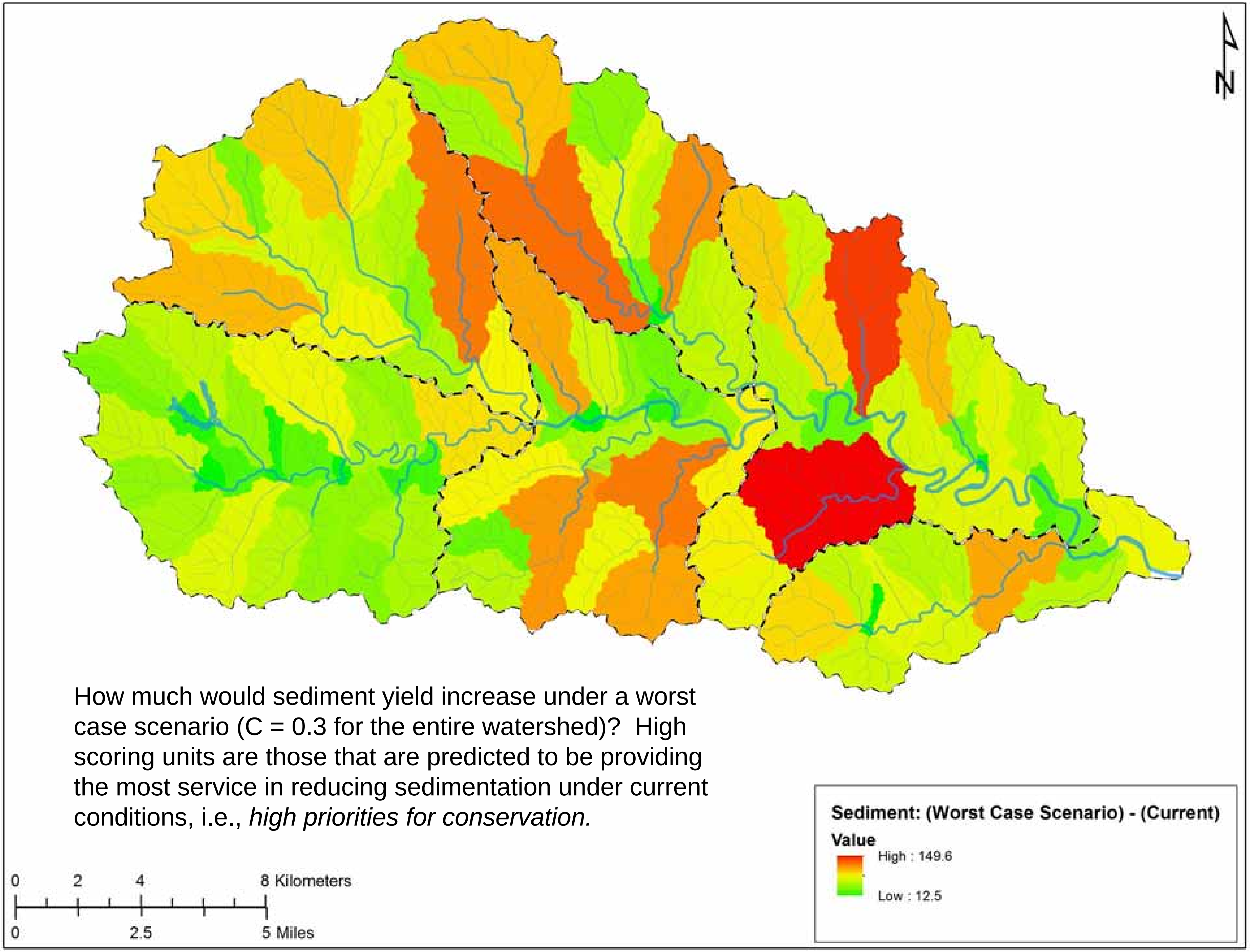
Sediment Delivery Ratio (SDR): the sediment yield from an area divided by the gross erosion of that same area. The SDR represents the efficiency of the watershed in moving soil particles from areas of erosion to the point where sediment yield is measured.



Final model output: The predicted amount of sediment that leaves each of the 105 “mini-watershed” units is calculated from the soil loss for individual pixels and the Sediment Delivery Ratio (SDR). High scoring units are predicted to be the greatest source of sediment, i.e., *high priorities for restoration and BMP implementation.*







How much would sediment yield increase under a worst case scenario (C = 0.3 for the entire watershed)? High scoring units are those that are predicted to be providing the most service in reducing sedimentation under current conditions, i.e., *high priorities for conservation.*

Appendix D

Table 1. List of endangered fish species in Ohio as of September 2013. An asterisk (*) indicates federally (U.S. Fish and Wildlife Service) listed endangered species. *Source:* Ohio Department of Natural Resources, Division of Wildlife (Publication 5356).

Common name	Scientific name
Ohio lamprey	*Ichthyomyzon bdellium*
Northern brook lamprey	*Ichthyomyzon fossor*
Mountain brook lamprey	*Ichthyomyzon greeleyi*
Lake sturgeon	*Acipenser fulvescens*
Shovelnose sturgeon	*Scaphirhynchus platorynchus*
Spotted gar	*Lepisosteus oculatus*
Shortnose gar	*Lepisosteus platostomus*
Cisco (or Lake herring)	*Coregonus artedi*
Goldeye	*Hiodon alosoides*
Shoal chub	*Macrhybopsis hyostoma*
Pugnose minnow	*Opsopoeodus emiliae*
Popeye shiner	*Notropis ariommus*
Longnose sucker	*Catostomus catostomus*
Northern madtom	*Noturus stigmosus*
Scioto madtom *	*Noturus trautmani**
Pirate perch	*Aphredoderus sayanus*
Western banded killifish	*Fundulus diaphanus menona*
Spotted darter	*Etheostoma maculatum*
Iowa darter	*Etheostoma exile*
Gilt darter	*Percina evides*