Executive Summary

McKee Run at Martin Road

EXECUTIVE SUMMARY

A. PROJECT BACKGROUND

In 1997, the Indiana County Office of Planning and Development (ICOPD), in response to a public interest in protecting the upper reaches of the Crooked Creek Watershed, undertook an initiative to plan for the protection and enhancement of this water resource. This effort, known as the Upper Crooked Creek River Conservation Plan, has received overwhelming support from local municipalities within the watershed, private industry, and the general public. The funding for this undertaking was provided through financial resources made available by the Pennsylvania Department of Conservation and Natural Resources (DCNR) Rivers Conservation Program.

The Pennsylvania Rivers Conservation Program is a grant program of the Keystone Recreation, Park, and Conservation Fund and is administered by DCNR. The goal of the program is to develop partnerships between local governments, environmental organizations, stakeholders, and the public to conserve the state's water resources. The program aids groups in accomplishing their local initiatives through planning, implementation, acquisition, and development activities. One aspect of this process is to provide grants to develop a River Conservation Plan that identifies natural, recreational, and cultural resources within the watershed. In addition, the completed plan identifies those issues, concerns, constraints, and opportunities related to the watershed's resources. Once identified, these issues are addressed by a series of recommendations or management options designed to enhance the overall quality of the watershed.

As part of the program, DCNR has established a Pennsylvania Rivers Registry to recognize completed and approved Rivers Conservation Plans. The registry serves to promote public awareness of the completed plan while fostering support for future projects that will enhance the overall quality of the watershed.

In May 1998, Indiana County was awarded a $25,000 grant to prepare a Rivers Conservation Plan for the entire Crooked Creek watershed within Indiana County. In an effort to produce a more cohesive and comprehensive assessment of the watershed, the County Commissioners expanded the study area to include a portion of the Plum Creek watershed in Indiana and Armstrong Counties. This project expansion was funded in part by supplemental grants from the Keystone Plant Owners Group/Keystone Generating Station in the amount of $8,000, and Air Products Incorporated in the amount of $3000. Overall, this plan examines 195 square miles of the 292 square mile Crooked Creek watershed, approximately 28 river miles (r.m.) along Crooked Creek's main stem, sections of 23 named tributaries, and portions of 15 municipalities within two counties.

B. PLANNING PROCESS

The project was initiated with the selection of the Steering and Advisory Committees and the project consultant team. Working closely with the consultant team, the Steering and Advisory Committees held a series of meetings to develop a summary of the primary issues affecting the watershed. After the issues were identified, information concerning physical, natural, and cultural resources was collected and the relationships between issues and resources was analyzed.

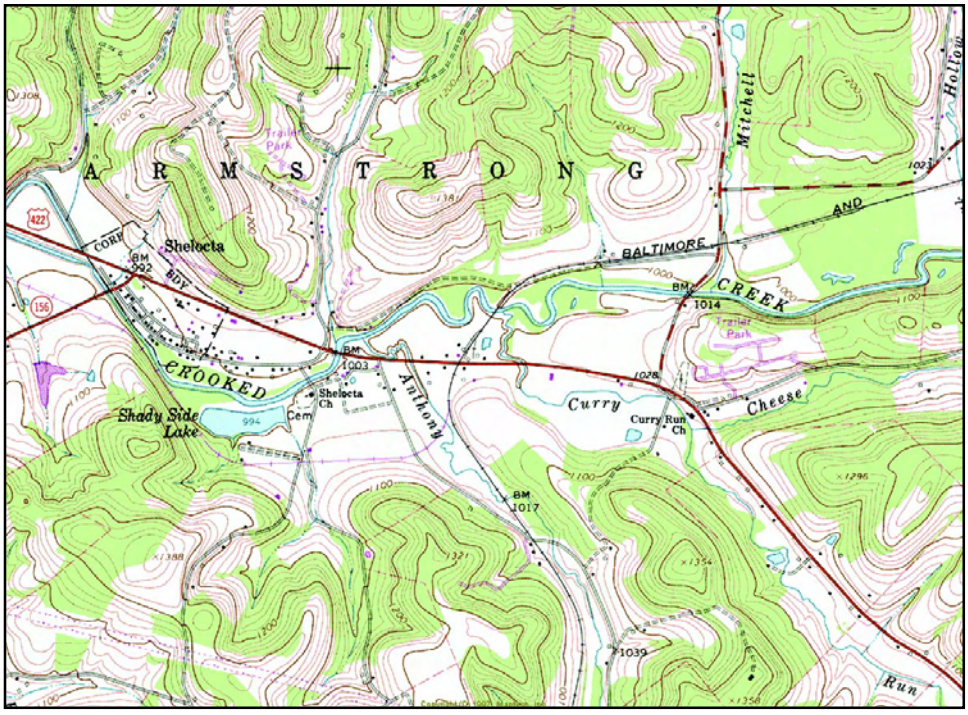
Subsequent to the analysis, issues were prioritized and management options were developed to specifically address them. The compilation of resource data, issues, concerns, constraints, opportunities, and management options were then presented in a Draft Upper Crooked Creek Watershed River Conservation Plan. Two public meetings will be held to present the draft report, followed by a 30 day public comment period. Comments received during this period will be reviewed and addressed in the final plan. Written correspondence from the public comment period will be summarized in Appendix A.

C. PROJECT AREA CHARACTERISTICS

The Crooked Creek watershed is situated within the Pittsburgh Low Plateau Section of the Appalachian Plateau (Pennsylvania Department of Conservation and Natural Resources [DCNR], 1999), and encompasses portions of Indiana and Armstrong Counties. The boundary of the study area consists of the portion of the Crooked Creek watershed from the confluence with Plum Creek in Armsrong County and upstream to the headwaters (Figure 1).

The headwaters of Crooked Creek's mainstem originate near the village of Onberg in Rayne Township, Indiana County, Pennsylvania. From this location, Crooked Creek flows northward approximately 4 miles to the National Register Listed Kintersburg Bridge before turning west-southwest to its confluence with the Allegheny River approximately 1 mile south of Ford City, Pennsylvania.

Crooked Creek's two largest tributaries, the North and South Branches of Plum Creek, are situated in the northern portion of the watershed in South Mahoning Township, Indiana County, Pennsylvania. Plum Creek North Branch originates near Plumville, while Plum Creek South Branch begins near Ambrose. Each follows a southwest course before joining to form the main stem of Plum Creek just north of Gastown, Plum Creek Township, Armstrong County, Pennsylvania.



A portion of the Upper Crooked Creek watershed study area near the town of Shelocta

The contributory drainage of the entire Crooked Creek watershed is approximately 292 square miles in area (186,880 acres) (Pennsylvania Department of Environmental Protection [PADEP], 1989). The study area for the Crooked Creek River Conservation Plan covers the entire watershed in Indiana County and a small section of the Plum Creek watershed in Armstrong County; totaling 195 square miles (125,067 acres). This plan examines approximately 28 river miles (r.m.) along Crooked Creek, contains sections of 23 named tributaries, and encompasses portions of 15 municipalities in two counties.

D. PROJECT AREA RESOURCES – DATA AND CONCLUSIONS

1. Land Resources

Land use is the primary force driving water quality issues throughout Pennsylvania. The predominately rural Crooked Creek watershed is characterized by gently rolling hills, Christmas tree farms, picturesque stream corridors, and agricultural settings. The undercurrent of this serene rural setting, however, involves streams laced with acid mine drainage, degraded buffers, sedimentation, sewage effluent, and gaseous odors as a result of mining, industrial, and residential waste. Three key issues emerged as high priority land use concerns within Crooked Creek watershed: agriculture, mining, and land use planning. Within the fluid landscape of the 21st century, a keen focus on land use within watershed could be one of the most beneficial tasks for its future.

Agricultural resources carpet the watershed with verdant grazing meadows and lush fields of fall crops. Maintaining and enhancing these agricultural resources while focusing on watershed health is one of the major land resources issues. Over 36,000 acres of Agricultural Security Areas remain actively farmed within the watershed, and areas of prime agricultural soil dot the landscape. Plans for the purchase of several prime agricultural lands as conservation easements are presently being developed. In order to maintain agricultural operations without sacrificing water quality, agricultural Best Management Practices are recommended to enhance the economic, water, and aesthetic qualities of the watershed.

Abandoned mines and quarries are also a major land resource issue within the watershed. Several abandoned mine sites, including the Tanoma Bore Hole site and Ernest Drift Mine site, are in varying stages of remediation; however, untreated sites continue to create air and water quality problems. Continued focus on reclaiming abandoned mine sites and remediating tributaries from mine drainage would dramatically change the course of water and air quality of the watershed.

Just a few years ago unrestricted livestock access occurred along this section of Crooked Creek near Onberg. Streambank fencing was later installed along this reach in 2001.

Enforceable ordinances and land use planning should play a central role in the Crooked Creek watershed. Although all of the communities within the watershed have adopted floodplain management ordinances, none have adopted zoning ordinances. The task of simultaneously pursuing conservation and economic development could be better addressed through the development and enforcement of multi-municipal comprehensive plans. The balance

between conservation and well-planned economic development would contribute to maintaining and improving the economy, social quality, and environmental integrity of the region.

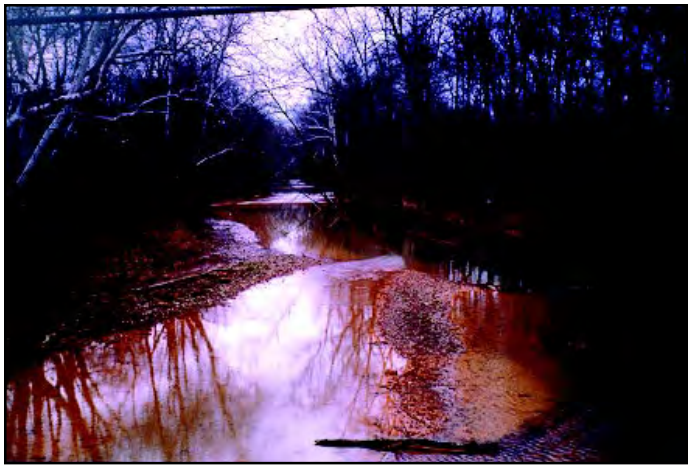
2. Water Resources

Water quality emerged as the highest priority issue within Crooked Creek Watershed. The history of resource extraction, agriculture, and development within the watershed has left a legacy of degraded surface and ground water quality conditions. Sections of the Crooked Creek and Plum Creek remain in fair to good biological health; however, impairment from abandoned mine drainage, municipal waste, and agricultural pollution are salient point and non-point source pollutants.

Unimpacted reach of Crooked Creek near S.R. 119 at Gaibleton.

Throughout this study, abandoned mines arose time after time as significant sources of water quality degradation. Apart from deteriorating the aesthetic quality of stream, drainage from abandoned mines is extremely toxic to aquatic organisms, which are often used as a gauge stream health. Active and passive treatment systems have been implemented at mine drainage producers within the watershed, including the Ernest Coal Mine Site, the Tanoma Bore Hole Site, and Kintersburg Drift Mine. Efforts need to continue in this direction to rejuvenate the quality of the region's streams.

Agriculture ranks as the top industry in the Commonwealth, and Indiana and Armstrong Counties mimic this trend. Recent studies show that three subwatersheds within the Upper Crooked Creek basin are in need of Best Management Practices to improve water quality. Developing Nutrient Management Plans and Conservation Plans through cost-share programs could help abate some of the nutrient pollutions issues associated with agriculture in the region.



Approximately 7 miles downstream of Gaibleton, heavy deposits of "yellow boy" are evident.

Many of the homes within the watershed have on-lot sewage treatment systems built before stricter regulations for system construction were implemented. Even in small quantities, raw sewage can create compounding effects on water quality within the watershed. Costs for improving systems are often daunting, but programs through agencies such as PENNVEST can often help with this.

3. Biological Resources

Biological resources are continuously evolving, with or without human intervention. Within the past 200 years, for example, the old growth forests of the watershed have been removed for intensive resource extraction, with even-aged, immature tree stands now dominating the forested slopes and hillsides.

The present broad leaf forested land, riparian corridors, and floodplains of the Crooked Creek watershed provide habitat for the watershed's wildlife, including six Pennsylvania Threatened or Endangered species. Plant species within the watershed are a complex mix of natives and exotics, which compete for space within the ecosystem. For example, Japanese knotweed and purple loosestrife, both exotic, invasive species, are becoming a dominant component of disturbed riparian areas. The alteration of the native component of riparian areas often foments the growth of resilient, invasive species with weak root systems. This leads to a greater susceptibility of bank erosion and decreased foraging opportunity for native animal species.

Habitat improvements and conservation need to be further addressed within the watershed. Programs such the Pennsylvania Game Commission's Farm Game and Farm Game Coop are excellent examples of promoting conservation and recreation. Both programs have improved several hundred acres of terrestrial habitat within the watershed.

4. Cultural Resources

Numerous historical sites and ubiquitous recreational opportunities characterize the Upper Crooked Creek watershed. Both historic and recreational resources comprise the cultural resource component of this plan.

National Register of Historic Places Listed Kintersberg Covered Bridge.

An extensive rail-trail system, composed of planned and completed trails, stands out as one of the strongest recreational opportunities within the watershed. Completed or soon to be completed trails, such as the C & I Trail, Baker Trail, Ghost Town Trail, and Great Shamokin Path comprise over 210 miles of recreational hiking and biking opportunities. Camping, fishing, and hunting also provide popular outdoor opportunities for adventure-oriented residents and visitors. To accommodate overnight and multiple-day visitors, bed and breakfasts are beginning to surface throughout the watershed and the region.

Transportation and industrialization define the majority of historically significant structures, sites, and venues throughout the watershed. From farming to the salt industry, from coal mining to natural gas extraction, historical sites such as Saltsburg, the beehive coke ovens at Ernest, the Kintersburg Covered Bridge, and Cummings Dam are major historic attractions within the watershed.

As heritage and nature tourism expand in popularity, the region should seize the opportunity and promote its rich resource base. Melding the historical and recreational components of the region into a cohesive promotional package could help increase visitors to the area for extended stays.

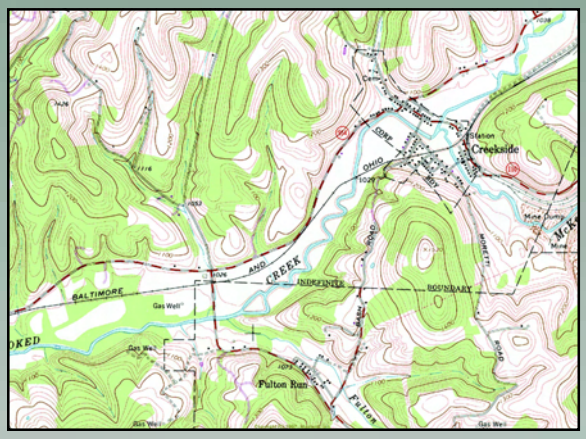
E. MANAGEMENT OPTIONS

Data gathered during the preparation of this report have undergone a thorough analysis to produce management objectives that are tailored for the Crooked Creek Watershed. Through consultation with the Project Manager, Steering Committee, and Advisory Council, Mackin Engineering Company has compiled a chronological series of management options. Each option is identified by resource categories, which include: Cultural and Historical; Economic Development; Education; Natural Resources; Planning; and Recreation.

This report serves as a guide for improving the Crooked Creek watershed and its surrounding region. Partnerships for priority projects and funding are paramount to successful project implementation. All management suggestions included in Chapter 6 are based on the partnership concept. The overriding management recommendation involves developing and instituting an Upper Crooked Creek Watershed Coalition (UCCWC) to oversee the objectives of this plan, manage projects, and maintain a database of watershed resource data. The Crooked Creek Watershed Association would play a key role in the Coalition and would become an integral partner. Without the development of the Coalition, many of the management objectives contained within this plan could not be implemented properly. Implementing this plan's projects will help the Crooked Creek watershed evolve, enhancing community pride and bringing about a cleaner environment and more prosperous region for the future.

Chapter 1

Project Area Characteristics



Crooked Creek Watershed near Creekside

I. PROJECT AREA CHARACTERISTICS

A. LOCATION

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B. SIZE

The contributory drainage of the entire Crooked Creek watershed is approximately 292 square miles in area (186,880 acres) (Pennsylvania Department of Environmental Protection [PADEP], 1989). The study area for the Crooked Creek Watershed Conservation Plan covers the entire watershed in Indiana County and a small section of the Plum Creek watershed in Armstrong County; totaling 195 square miles (125,067 acres). This plan examines approximately 28 river miles (r.m.) along Crooked Creek, contains sections of 23 named tributaries, and encompasses portions of 15 municipalities in two counties(Figures 1 & 2, Table I-1).

Indiana County	Armstrong County
Townships	
Armstrong	Cowanshannock
Cherry Hill	Plum Creek
East Mahoning	
Rayne	
South Mahoning	
Washington	
White	
Boroughs	
Creekside	Atwood
Marion Center	Elderton
Shelocta	Plumville

Table I-1 *Crooked Creek Watershed Municipalities*

C. TOPOGRAPHY

The Crooked Creek basin exhibits a dendritic, or branch-like, drainage pattern, which is characteristic of streams within the Allegheny River watershed. Topography along Crooked Creek's main stem, although highly variable, is dominated by wide bottomland floodplains, extending up to approximately 2000 feet from the stream. As discussed under the Land Resources Section, many of these floodplain regions have been converted to agricultural use. The main stems of Plum Creek North and South Branch also exhibit similar characteristics, with bottomlands extending up to 1000 feet from the stream margin.

Along the main stems of Crooked and Plum Creek, numerous areas of steep, forested slopes are also present. These slopes occur more frequently within the headwaters and generally extend one-quarter to one-half mile outward from the stream margin before leveling to a plateau.

The highest point within the watershed is approximately 1720 feet above sea level and is located in the northeastern section of the watershed, adjacent to Rayne Run and just west of Marion Center, PA. The lowest elevation occurs at Plum Creek's confluence with Crooked Creek and is approximately 980 feet above sea level. This change in channel elevation yields a vertical drop of approximately 740 feet.

D. LAND USE

1. Floodplain Management

There are both federal and state floodplain management regulations affecting development in Pennsylvania. The National Floodplain Insurance Program (NFIP) establishes the federal standards, while the Pennsylvania Floodplain Management Act (Act 166) establishes the state regulations.

For the residents of a municipality to be eligible to participate in the NFIP, it must enact an ordinance that meets the minimum requirements established by the Federal Emergency Management Agency (FEMA). A participating municipality must regulate all construction and development within those areas that have been identified by FEMA as being flood prone. The NFIP defines development as:

> …Any manmade change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation, or drilling operations (Pennsylvania Department of Community and Economic Development [DCED], 1999).

To regulate development within flood-prone areas, the municipality must enact an ordinance requiring a building permit before construction or development takes place. This ensures that the municipality has a chance to review all proposed activities for compliance with applicable floodplain management regulations.

Under this definition, almost any new structures would require a permit. Exceptions to the permit request would include activities that have no direct bearing on increasing flood damage or aggravating flooding conditions.

All of the municipalities within the study area have adopted floodplain management ordinances. Several types of ordinances can be adopted based on the municipality's goals and the other types of regulations (zoning, subdivision and land development, etc.) in the community. The state provides model ordinances based on the municipality's needs, which are updated to meet the newest regulations. Because none of the municipalities within the study area have a zoning ordinance or subdivision and land development ordinance, each municipality should, at the very least, review their current floodplain ordinance and update it accordingly. A model floodplain ordinance, which is dated April 1998 and represents the most current state regulations, has been included in Appendix B. By reviewing and updating these ordinances, municipalities will be completing the first step toward developing a more comprehensive zoning or subdivision and land development plan.

E. MUNICIPALITIES

1. Population Centers

According to 2000 Census figures, the total population for the municipalities located within the Upper Crooked Creek watershed study area accounted for 21.3 percent of total population of Indiana County and Armstrong County combined (US Department of Commerce, 2000). Indiana County municipalities made up the majority of the 34,865 persons residing in the study area (Charts I-1, I-2, and I-3).

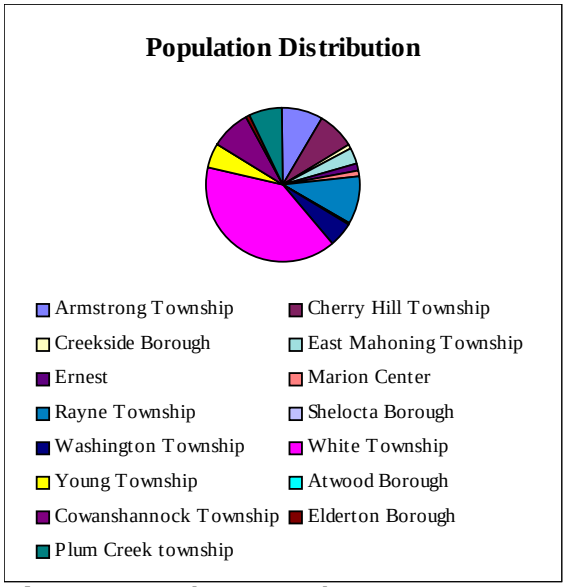


Chart I-1 - *Population Distribution*

Population density within the watershed varied greatly among the boroughs and the townships. In 2000, the population density for Indiana County was 108 people per square mile while Armstrong County's population density was 112 people per square mile. The average population density for municipalities within the watershed (100 people per square mile) was lower than the county averages. The population per square mile of the ten municipalities within Indiana County was 103 people per square mile, while the average of the four municipalities within Armstrong County was only 63 people per square mile.

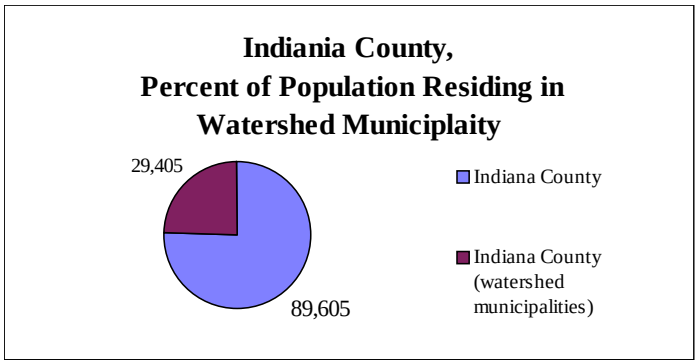


Chart I-2 - *Percent of Population*

Population centers are locales where the population density is greater than 500 people per square mile. Within the watershed, population centers included Creekside, Marion Center, Plumville, and Shelocta in Indiana County; and Atwood and Elderton in Armstrong County (Figure 3). An additional high-density area was located in the portion of White Township near Indiana Borough, which consists of newer housing developments and small commercial areas.

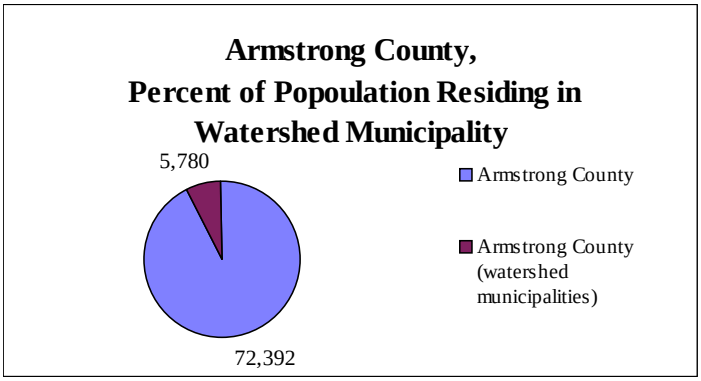


Chart I-3 - *Percent of Population*

An analysis of the population characteristics of the study area was completed to identify which communities and segments of the population could be impacted by policies regarding future development (Table I-2). The age cohort breakdown is important to consider because of the specialized needs and demands exerted upon various municipal and county services by the different age groups. The "wage-earners" group (ages 18-64) is the portion of the population that is usually considered techni-

Population Distribution, 1990-2000								
	Total Population		Percent of Population >18		Percent of Population 18-64		Percent of Population 64+	
	1990	2000	1990	2000	1990	2000	1990	2000
Pennsylvania	***11,881,643***		***23.5***		***61.1***		***15.4***	
Indiana County	***89,994***	***89,605***	***23.3***	***21.1***	***62.9***	***64.0***	***13.8***	***14.9***
Armstrong Township	3,048	3,090	31.0	25.6	60.3	64.0	8.7	10.4
Cherryhill Township	2,764	2,842	27.0	24.2	60.9	64.1	12.3	11.7
Creekside Borough	337	323	21.4	19.5	63.5	61.0	15.1	19.5
East Mahoning Township	1,140	1,196	33.7	29.2	55.1	59.9	11.1	10.9
Ernest	492	501	23.4	26.9	52.1	56.1	24.6	17.0
Marion Center	476	451	28.6	26.8	55.9	58.6	15.5	14.6
Rayne Township	3,339	3,292	29.6	22.1	60.5	64.5	9.9	13.4
Shelocta Borough	108	127	29.6	26.0	53.7	56.7	16.7	17.3
Washington Township	1,861	1,805	30.9	25.5	59.9	65.1	9.2	9.4
White Township	13,788	14,034	22.3	20.0	62.0	60.2	15.7	19.8
Young Township	1,805	1,744	25.4	26.7	57.0	56.2	17.6	17.1
Municipalities within Study Area (Indiana Co.)	29,158	29,405	27.5	24.8	58.3	60.6	14.2	14.6
Armstrong County	***73,478***	***72,392***	***24***	***22.9***	***58.4***	***66.6***	***17.6***	***10.5***
Atwood Borough	121	112	34	25.0	54	62.5	12.0	12.5
Cowanshannock Township	2,813	3,006	26	27.1	57	56.8	17.0	16.1
Elderton Borough	373	358	23	22.3	53	57.0	24.0	20.7
Plumcreek township	2,400	2,304	27	22.0	60	61.9	13.0	16.1
Municipalities within Study Area (Armstrong Co.)	5,707	5,780	27.2	24.0	57.6	60.7	15.2	15.2

Table I-2 - *1990 and 2000 Population Distribution*

cally able to provide for and makes up the labor force of the municipality. This age group utilizes many community facilities and services, but also supports them through income and property taxes. Other age groups, such as those over the age of 65 are of retirement age and usually require additional medical services and specialized housing needs as they become older. The age group, which includes those residents under the age of 18, also requires specialized services. Infants and toddlers of working parents may require specialized childcare services such as day care. As these children get older they will enroll in the public education or private education system. It is important that government leaders are aware of the current population trends. This will enable them to properly plan for the future including additional schools or assisted living facilities.

The communities within the watershed study area had an average age of 35.8 years in 2000, which was slightly higher than the average age of Indiana County (35.5 years) and slightly lower than Armstrong County average (38.6 years).

On a county-wide basis, between 2000 and 1990, Armstrong County decreased its over 65 population by 1.1 percent, while the under 65 population increased by approximately 7.1 percent. Indiana County's over 65 population increased by 1.1 percent while their under 65 population decreased by 1.1 percent.

Historical census data indicated that Armstrong County had lost 0.1 percent of its population between 1950 and 1990. From 1990 to 2000, it was estimated that the county's population decreased by less than 1.5 percent. The figures for Indiana County showed that the population had incresed by 14.3 percent between 1950 and 1990. The largest increase occurred during the 1970s when the county had a total population of 92,281 people. Recent estimates revealed a reverse in this trend, with the county losing less than 0.5 percent of its population between 1990 and 2000. During the forty year period from 1950 to 2000 Pennsylvania saw its population grow by over 12 percent.

2. Zoning

The Upper Crooked Creek Watershed study area includes all, or portions of, fifteen municipalities. Eleven of these are located in Indiana County, while four are located in Armstrong County. During the preparation of this plan, none of the municipalities within the study area had adopted a zoning ordinance.

Indiana County has enacted a Special Recreation and Conservation Zoning Ordinance which has jurisdiction over the portion of any public or private property surrounding the county parks of Blue Spruce Park, Pine Ridge Park, and Hemlock Lake Park; as well as Yellow Creek State Park (Indiana County, 1973, as amended). These parks cover portions of Cherryhill, Rayne, and Washington Townships in the study area.

The Indiana County Special Recreation and Conservation Ordinance establishes two zones, a Buffer Zone and a Conservation Zone. According to the ordinance, the intent of the Buffer Zone is to strictly control the type, density, and quality of development in the areas immediately adjacent to the parks. This zone is designed to protect the parks against immediate encroachment by uses that are, or have a potential to be, detrimental to the park operations or facilities, or which may detract from the recreational atmosphere of the park. The intent of the Conservation Zone is to protect against the development of detrimental land uses within close proximity of the parks, particularly within and immediately beyond the identified drainage basins serving the parks. As the lakes and streams are the focal points of each park, the primary concerns of the regulatory provisions are to ensure adequate protection for the quantity and quality of the park waters, and to prohibit any use that poses a potential to degrade the park waters.

None of the municipalities in the study area have enacted a Subdivision and Land Development Ordinance. However, these municipalities are covered under the Indiana County Subdivision Ordinance or the Armstrong County Subdivision and Land Development Ordinance.

During the development of this plan, State Correctional Institution-Pine Grove was being constructed in White Township. This facility, which opened in January 2001, has a maximum capacity of 500 inmates and provides 250 full-time jobs. After it is constructed, the prison is forecasted to generate 750 spin-off jobs. While the prison facility itself is located outside of the watershed, the sewage line to service the facility bisects the study area. Access to this sewage line will dramatically increase the amount of land available for development. As mentioned above, the only land use controls for any of the municipalities in the watershed are the Indiana County Subdivision Ordinance and the Armstrong County Subdivision and Land Development Ordinance. Not only could this have a negative impact on the watershed, but also on the roads, the landscape, and the way of life in the area.

Another issue that should be addressed because of its potential impacts on the watershed is that of logging. Currently, forestry (logging, lumbering, pulpwood extraction, and other practices of forestry) is a Special Exception use in both the Buffer Zone and the Conservation Zone. This means that logging is permitted only after permission is given by the Zoning Hearing Board, and when the request meets the following requirements:

1. The proposed timbering operation must be clearly demonstrated to be within the best management practices for the land and timber stand.

2. Logging plans must be prepared by a qualified forester.

3. The forestry practices of age management is strongly recommended. Plans may be prepared and reviewed for an age management operation which will be conducted over a number of years.

4. Plans for the timbering operation shall be reviewed and approved by the Indiana County Conservation District, and any other regulatory agency (Indiana County, 1973, as amended).

According to the Indiana County Office of Planning and Development (B. Baronack, personal communication, July 2000), there are two problems associated with the existing regulations. Enforcement of the ordinance is difficult because of the number of operations, and the logging roads are not being properly re-seeded allowing sediment to wash into the streams and negatively impact the watershed.

3. Government Structure

Indiana County, Pennsylvania, is classified as a sixth class county based on its 1990 population according to the Pennsylvania County Code. The governmental structure and services provided varies according to the classification of the county. Indiana utilizes the governmental structure outlined below.

Elected Governing Officials—Board of Commissioners, which are elected every four years. The Board of Commissioners is chaired by the majority party and is elected by the board itself. Indiana County has three commissioners.

Row Offices—Nine row offices must be filled according to sixth class county classification mandates. These include:

- Sheriff
- Coroner
- Recorder of Deeds
- Register of Wills and Clerk of Orphans Courts
- Prothonotary and Clerk of Courts
- Treasurer
- District Attorney
- Jury Commissioners
- County Auditors

Indiana County has a total of 38 municipalities (14 boroughs and 24 second-class townships.) The individual municipalities are responsible for the maintenance of local roads, code enforcement, ordinance administration, issuance of permits and licensing of businesses, and tax collection. In addition, municipalities may provide additional services that could include items such as recreational amenities, public libraries, emergency services, water, sewage and garbage services. One function of local government is to decide when to enact local planning and zoning ordinances. The Indiana County Office of Planning and Development currently administers ordinances for those municipalities who have not adopted land use ordinances.

Indiana County boroughs are of the weak Mayor form of government. This type of government structure utilizes Borough Council as the governing body and the Borough Council President as the Chief Governing Official, instead of the Mayor. Other elected officials include the tax collector, tax assessor, and auditor.

Every township in Indiana County is classified as a second-class township and elects three Township Supervisors as the governing body. The supervisors are elected on a staggered basis for six year terms with one of the supervisors serving as the chairperson. Townships also elect a tax collector and tax assessor, plus three auditors to assist in the management of the township. In addition to traditional road maintenance, the supervisors are responsible for enforcement of local ordinances, building codes, and the collection of taxes. Some townships will also provide water and sewage services and issue building permits.

Within the study area, there are six boroughs and nine townships (Cherryhill and Young Townships were not included in statistical calculations because of their limited contribution to population and land acreage statistics).

In order to ascertain the type of services provided and land use or building ordinances adopted, a municipal survey was developed and mailed to the municipalities located within the study area. A total of thirteen responses were received.

Of those reponding, six have prepared a PA Act 537 plan in accordance with Pennsylvania Department of Environmental Protection (PADEP) regulations. Only two municipalities had adopted comprehensive plans and subdivision and land development ordinances, and none of the respondents indicated that they had a zoning ordinance. Three of the communities had dangerous structures, salvage restriction, and garbage ordinances. Public water was available in six of municipalities, and the availability of public sewage was slightly less for the municipalities who responded to the survey. Only three of the municipalities indicated that they are experiencing growth.

F. TRANSPORTATION FACILITIES

The vitality of a community is often dictated by the mobility and access afforded by the local and regional transportation system. The roads, bridges, parking lots, traffic signals, and public transportation system, which make up the transportation infrastructure, augment the revitalization of commercial areas and improve the quality of life. To determine if the study area has an adequate transportation infrastructure in place to serve its residents, a thorough examination of the existing transportation network must occur.

The Upper Crooked Creek watershed has a well-maintained and well-established transportation network. The project area has several major roadways and is also inter-connected with numerous arterial roadways (Figure 3). In addition, the project area has an industrial rail system with freight rail systems serving nine customers moving goods and mining resources across the region. Air transport is available in both counties.

In the Upper Crooked Creek watershed there are 461 miles of roads that provide residents with the means to travel efficiently from home to work and to access services (Figure 3, Table I-3). According to the Pennsylvania Department of Transportation (Pennsylvania Department of Transportation [PENNDOT], 1995), the number of local roads far outweighs the number of major roads within the study area.

Major Roads	
US Highways	26 miles
Total Miles for Major Roads = 26 miles	
State Routes	133 miles
Township and Other Roads	302 miles
Total Miles for Local Roads = 435 miles	

Table I-3 *Miles of Road by PENNDOT Classification*

1. Roadway Inventory

Based on function, roads within the watershed can be classified into one of the following categories.

Freeway: A multilane divided highway having a minimum of two lanes for exclusive use of traffic in each direction and full control of access and egress. A freeway may be classified as a principal arterial.

Expressway: A divided arterial highway for through traffic with partial control of access and with grade separation at major intersections.

Arterial Streets: Highways that provide inter-county or inter-municipal traffic of substantial volumes. These highways should accommodate speeds up to 55 miles per hour (mph). These traffic routes may be classified as principal or minor arterials.

Collector Streets: Traffic routes that connect minor streets to arterial highways and generally serve inter-county and inter-municipal traffic. They may serve as traffic corridors connecting residential areas with industrial, shopping, and other residential areas and usually accommodate operating speeds at 35 to 45 mph.

Minor Streets: Roads that provide direct access to abutting land and connections to higher classes of roadways. Traffic volumes are usually low and travel short distances. These streets and roads should be designed for operating speeds of 25 mph.

The road network within the study area is comprised of US routes and township roads. Two US routes are located within the watershed, US Route 119 and US Route 422. Other traffic routes located within the watershed are classified as minor arterial and collector roads.

2. Major Through-Ways

US Route 119 travels north and south, bisecting Indiana County. US Route 119 can be considered both an expressway and an arterial street depending upon its function at various locations. Entering the watershed north of Indiana Borough in White Township, US Route 119 begins its path into the watershed as an expressway. As it crosses the Rayne Township border, the roadway is classified as an arterial street. US Route 119 is a major through traffic route to Marion Center, which is one of the largest employment centers in the study area.

US Route 422 travels east and west and enters the watershed after serving as a bypass around Indiana Borough. Similar to US Route 119, US Route 422 also acts as both an expressway and an arterial street. Entering the watershed in Indiana County at the border of Armstrong Township, it is a major through traffic route to Shelocta. US Route 422 continues east into Armstrong County where access is provided to population centers such as Kittanning.

3. Other Traffic Routes

The remaining roads within the watershed provide a network of vehicular traffic corridors to access the sites and communities found in Indiana and Armstrong County.

a) Rail

Complementing the extensive network of roads within the study area is a freight rail system. Freight rail systems have historically moved large amounts of goods and also have served to transport travelers. Freight rail systems can also be used as a tourist related resource as sightseeing trips are becoming increasingly popular.

The major rail lines in Indiana County are the Buffalo & Pittsburgh Railroad, Inc., Norfolk Southern, and the National Railroad Passenger Corporation (Amtrak). Two private rail facilities, Pennsylvania Electric and R.J. Corman Railroad Company, are located in Indiana County. In addition, a new Norfolk Southern line will serve Keystone Power Plant located in Plum Creek Township, Armstrong County.

b) Air

The availability of air travel is essential to the movement of people and goods into and out of the region. Serving as a convenient and faster way to move items from one area to another, air travel is also used for medical emergencies and military transport. Indiana County has one air facility, the Indiana County/ Jimmy Stewart Airport that has a runway length of 4,000 feet and a runway surface of bituminous asphalt. Armstrong County has one air facility, McVille Field, which is located in South Buffalo Township. This facility has a 2,268 foot-long turf runway. Both of these air facilities are located outside of the study area.

G. MAJOR EMPLOYERS

In the last decade, both Armstrong and Indiana County have experienced varying levels of growth in employment; however, both have unemployment rates three to four points higher than the state average.

Data for this section was acquired from second quarter unemployment compensation tax reports filed by employers and published in the following documents: Pennsylvania County Industry Trends 1994-1998, (Penn State Data Center, 1999); the 1999 Indiana County Data Book, (Penn State Data Center, 1999); and the 1990 US Census (U.S. Department of Commerce, 1991).

Workforce and employment figures show that the study area is located in an area that is typical of the western Pennsylvania region when considering economic conditions and employment opportunities. These economic statistics show a region in transition, with a higher than average unemployment rate and generally low industrial growth rates.

1. Armstrong County

According to the 1990 Census (U.S. Department of Commerce, 1991), Armstrong County had a total of 31,171 persons in the civilian labor force and an unemployment rate of 8.2 percent for 1990. In January of 2000, the estimated number of persons in the Armstrong County's civilian labor force had decreased to 30,900 persons. The unemployment rate also fell to 7.9 percent over this ten-year period.

From 1994-98, Armstrong County experienced growth in the number of establishments for the following industries: agriculture, forestry and fishing; construction; transportation; retail trade; finance, insurance, real estate; and services sectors.

Although the county experienced a less than 21.8 percent decrease in mining, this sector remains one of the primary industries in the county. Mining in Armstrong County is classified into three types: coal mining, oil/gas extraction, and mining and quarrying. In 1994 there were 54 establishments that employed 1,282 persons, with the majority in coal mining.

2. Indiana County

According to the U.S. Department of Commerce (1991), Indiana County had 38,602 persons listed in the civilian labor force and an unemployment rate of 8.8 percent. During the ten-year period between 1990 and 2000, unemployment levels for Indiana County remained above the state average. In 1997, while the state unemployment rate was 5.2 percent, Indiana County was experiencing an unemployment rate that was almost three points higher (8.1 percent). In January 2000, the estimated number of persons in the labor force in Indiana County declined as compared to 1990 statistics, listing 35,600 persons available to work.

According to the 1999 Indiana County State Data Book (Penn State Data Center, 1999), the majority of Indiana County workers (75.7 percent) were employed in the private sector; 16.1 percent were employed in local, state, or federal government; and 7.4 percent were listed as self-employed. The primary industry in Indiana County was manufacturing.

According to the Pennsylvania County Industry Trends 1994-1994, (Penn State Data Center, 1999), the industrial base of the county experienced growth in the number of establishments in the following sectors: agriculture, forestry, and fishing; construction; manufacturing; and services. The wholesale trade sector experienced an 11.8 percent decrease in the number of establishments operating within Indiana County. In 1994, Indiana County had 119 wholesale trade establishments and by 1998 this number had fallen to 105 wholesale establishments.

According to the Indiana County Office of Planning and Development (B. Baronak, personal communication, June 1999), the largest employer in the county is Indiana University of Pennsylvania. The Indiana Hospital, Indiana School District, and state and local governments all rank in the top ten employers located within Indiana County. In addition, GPU Energy, Specialty Tires of America, and Westinghouse Specialty Metals are all listed in the top ten major employers for the county.

Marion Center is the primary employment center within the study area with one major employer (>100 employees), the Marion Center Area School District, which has 220 workers.

H. OUTSTANDING OR UNIQUE FEATURES

No outstanding or unique features were identified within the project study area.

Chapter 2

Land Resources

Christmas Tree Farm

II. LAND RESOURCES

A. SOIL CHARACTERISTICS

Factors responsible for soil variations within the study area include the composition of parent material, climate, topographic relief, flora and fauna that live in the soil, human influences, and the length of time that these factors have affected the development of the soil. These particular soil dynamics have created soil associations within the watershed basin that consist of eight major soils and numerous combinations of minor soils (Table II-1). Soil data for this project were compiled from the Indiana and Armstrong County Soil Surveys (Haagen & Martin, 1971; Ruffner & Weaver, 1965).

Soil Association	Characteristics	County
Monongahela-Allegheny-Pope-Philo	Medium textured soils on terraces and floodplains.	Indiana
Gilpin-Wharton-Cavode	Medium textured soils on moderately sloping to moderately steep valley slopes and broad, gently sloping hilltops and benches.	Indiana
Gilpin-Wharton-Upshur	Medium textured and moderately fine textured soils on broad gentle uplands, on gently sloping and moderately sloping benches and hillsides.	Indiana
Dekalb-Clymer-Ernest	Very stony medium textured and moderately coarse textured soils on steep valley slopes, on ridges, and on broad, gently sloping ridgetops.	Indiana
Gilpin-Weikert-Ernest	Medium textured and moderately coarse textured soils on moderately sloping to steep valley slopes and narrow to broad rolling ridgetops.	Indiana, Armstrong
Weikert-Gilpin	Well drained, shallow and moderately deep, steep and very steep soils on uplands.	Armstrong
Rainsboro-Melvin-Steff	Moderately well drained to poorly drained, deep, nearly level to gently sloping soils on terraces and floodplains.	Armstrong
Rayne-Ernest-Hazelton	Well drained and moderately well drained, deep, gently sloping to moderately steep soils in low lying areas on ridgetops and hillsides.	Armstrong

Table II-1 - *Soil Associations in the Upper Crooked Creek Watershed Study Area*

Indiana County

Floodplain and terrace soils along Crooked Creek and Plum Creek, the major tributary to Crooked Creek, are predominately of the Monongahela-Allegheny-Pope-Philo Association. These soils are typical

of floodplains and terraces in the region and are composed of medium-textured soils that are moderately well- to well-drained. Monongahela-Allegheny-Pope-Philo soils are often used for agricultural production. Among many other factors, crop types on these soils can vary in relation to the frequency of flooding in the area.

The remaining portions of Crooked Creek watershed in Indiana County are primarily comprised of the Gilpin-Weikert-Ernest Association. This association is composed of medium-textured and moderately coarse-textured soils on valley slopes and rolling ridgetops. Although these soils are typically present on rolling hills with narrow to broad ridgetops, the association also borders numerous small streams and stream cut valleys. Much of the association is not in productive use, but isolated areas have been used for Christmas tree farming and dairy farming operations. The gently sloping Ernest soils are only slightly limited for residential development. Steep slopes severely limit agricultural use within the remaining portion of the association.

Small sections of the watershed in Indiana County are composed of three different soil associations. These include the Gilpin-Wharton-Cavode, Gilpin-Wharton-Upshur, and Dekalb-Clymer-Ernest Associations. The Gilpin-Wharton-Cavode association is composed of medium-textured soils located on moderately steep valley slopes and broad, gently sloping hilltops and benches. Because of the gently sloping nature of this association, much of it is currently used for agricultural production. The Gilpin-Wharton-Upshur association is composed of medium-textured and moderately fine-textured soils on broad gentle uplands, gently and moderately sloping benches, moderately sloping and moderately steep hills, and narrow rolling hilltops. Most of the soils of this association are used for farming with some areas being fallow or planted with Christmas trees. The Dekalb-Clymer-Ernest Association is composed of very stony, medium-textured and moderately coarse-textured soils on steep sloping valleys, ridges, and ridgetops. Because of the stony nature of the soils and the relief on which they are located, farming and development is limited. Therefore, almost all of this association is covered in woodland area.

Armstrong County

The predominate soil type within the Armstrong County portion of the project area is the Rainsboro-Melvin-Steff Association. These soils are moderately well to poorly drained with deep horizons and are situated primarily on level to gently sloping terraces and floodplains. Although this soil association is occupied by much of the development in Armstrong County, it is otherwise moderately to severely land use limited because of flooding and a seasonally high water table. The Armstrong County portion of the watershed also contains areas of the Gilpin-Weikert-Ernest Association.

Two other soil associations, the Weikert-Gilpin and Rayne-Ernest-Hazelton Associations, make up the remainder of the Armstrong County portion of the study area. The Weikert-Gilpin Association is composed of well-drained, shallow to moderately-deep, steep and very-steep soils on uplands. Because of their prevalence on steep slopes and drought-ridden areas, land use on these soils is severely limited. Therefore, most land areas composed of this association are wooded. The soils of the Rayne-Ernest-Hazelton Association are well-drained and moderately well-drained, deep, gently to moderately-steep sloping soils in low lying areas on ridgetops and hillsides. Water table levels are seasonally high in some of this soil's coverage area. The Rayne-Ernest-Hazelton Association creates moderate limitations for urban development, but most other land use within the Rayne-Ernest-Hazelton Association is productive farmland.

B. GEOLOGY

Both the Indiana and Armstrong County portions of the Crooked Creek watershed are located in the Appalachian Plateau Physiographic Province, Pittsburgh Low Plateau Section, consisting of moderate to low amplitude open folds (Pennsylvania Department of Conservation and Natural Resources [DCNR], 1999a). The bedding of the Pittsburgh Low Plateau Section is smooth and undulating with numerous narrow, shallow valleys along the creek including some high, level terraces. Elevations within this section can range from 660 to 1700 feet. Local upland relief is generally less than 200 feet (DCNR, 2000).

Most of the floodplains along the valleys of Crooked Creek's mainstem are underlain by Pennsylvanian Allegheny Group sequences (Figure 4), a cycle of sandstone, shale, limestone, clay, and coal. Upland areas are composed of the Conemaugh Group, primarily the Glenshaw Formation with isolated areas of the Casselman Formation. Glenshaw sequences consist of cyclic shale, sandstone, red beds, thin limestone and coal along with four marine limestone or shale horizons. The Casselman Formation is similar but lacking marine horizons and pure limestone (Pennsylvania Department of Environmental Resources [DER], 1980).

The Crooked Creek watershed is also located within the Main Bituminous Coal Field of Pennsylvania (DCNR, 1999b). Extensive areas of operating surface mines, old stripping areas, and reclaimed strip mine areas are dispersed throughout the landscape (DCNR, 2000a). Coal that is or has been mined within watershed is primarily high volatile bituminous coal.

In addition to being situated within coalfields, the watershed is also located within the Pennsylvania shallow gas field (DCNR, 1999c) and contains numerous gas wells. In fact, in 1998, Indiana County was the largest producer of natural gas in the state, outputting 22,561,467 thousand cubic feet (Mcf). Armstrong County was not far behind, producing 7,145,578 Mcf of natural gas in the same year (DCNR, 2000b).

C. AGRICULTURAL AREAS

1. Prime Agricultural Soils

The USDA, Natural Resources Conservation Service (NRCS), has designated prime agricultural soils in both Armstrong and Indiana counties. Prime agricultural soils have superior combinations of both physical and chemical characteristics that result in high agricultural production with minimal input of fertilizers, labor, and pesticides. These soils are often composed of deep productive layers, are well drained, and are level to nearly level.

Because of their high quality physical and chemical elements, land areas with prime agricultural soils are also leading sites for development. Keeping this is mind, it is imperative that prime agricultural soils are delineated and acreage is calculated when planning for future development of the region. Otherwise, much of the land well suited for agricultural production could be lost.

The majority of Crooked Creek watershed's agricultural areas are concentrated within valley and lowland sections, occurring less frequently on the hills and ridge tops. The location of agricultural areas are shown in Figure 5.

2. Agricultural Security Areas

Agricultural Security Areas (ASAs) are active and viable farmlands that have been enrolled in a statewide program to restrict specific types of development on designated agricultural properties. An ASA designation is administered by local municipalities and counties, and although designation does not result in tax relief for landowners, ASAs protect farmland areas from indiscriminant condemnation, allow for future farming of the land, and absolve the areas from legislation that would be detrimental to farming operations. Altogether, a minimum of 250 acres is required for ASA designation, and timber is not included on the designated land. However, the properties that lie within the ASA acreage do not have to be contiguous. Renewals for ASA designation must be submitted every seven years.

A list and acreage of all ASAs within the watershed are presented in Table II-2 (Pennsylvania Department of Agriculture, Bureau of Farmland Protection, 2000a).

County	Township	# Of Farmers	Acreage
Armstrong	South Bend*	21	3,292
Armstrong	Plum Creek*	32	4,033
Indiana	White*	15	1,464
Indiana	Rayne*	99	12,390
Indiana	East Mahoning*	65	9,785
Indiana	Cherryhill*	37	5,456
Totals	**6**	**269**	**36,420**
* Township extends beyond study area boundary			

Table II-2 - *Agricultural Security Areas Within the Upper Crooked Creek Watershed Study Area*

3. Farmland Preservation

In addition to ASAs, state and county governments can also purchase conservation easements of prime agricultural lands located within ASAs. The goal of easement purchases is to preserve the productivity of prime agricultural production lands, in perpetuity. Although neither of the counties in the watershed have farmland in the easement program, Indiana County has recently developed an Agricultural Lands Preservation Board, and Armstrong County has begun to develop a county program and has appointed a Board to oversee its development (Pennsylvania Department of Agriculture, Bureau of Farmland Protection, 2000b). These boards function primarily to administer the Agricultural Conservation Easement Program and to assist landowners from "nuisance law" mitigation, such as odor control from farmlands. Indiana County's board is preparing to complete their first easement purchases, while Armstrong County will be able to complete their first easement purchases in a few years, after the board is established.

D. OWNERSHIP

Public land accounts for approximately 780 acres (<1 percent) of the land within the watershed and includes institutional buildings and facilities, boat access sites, open space, county and local parks, and community recreational facilities. These areas are discussed further in the Cultural Resources Section of this report. The remaining acreage is privately owned and is dedicated to industrial uses such as rail corridors, mining operations, light manufacturing; commercial businesses; and privately owned residential dwellings and farms.

E. LANDFILLS

According to PADEP (2000a), there are no active permitted landfills within the watershed. The nearest facility is the Evergreen Landfill (PADEP Permit #100434) located in Center and Brush Valley Townships, Indiana County (PADEP, 2000b). The majority of the waste generated in Indiana and Armstrong County is disposed of at this facility (Commonwealth of Pennsylvania, 1999). One inactive landfill was identified within the Crooked Creek watershed. This facility, once operated by Richard Sanitation, is located just south of Marion Center off of PA Route 403.

F. HAZARD AREAS

1. Waste Sites

An inventory of hazardous and toxic waste sites was conducted for the entire Crooked Creek watershed using the U.S. Environmental Protection Agency's (USEPA) Right-to-Know Network database (USEPA, 2000). This query system identifies waste management facilities listed within the following regulatory databases:

- Resource Conservation and Recovery Information System (RCRIS)
- Comprehensive Environmental Response, Cleanup, and Liability Information System (CERCLIS)
- Toxic Release Inventory (TRI)

Comprehensive results of this database search, as well as descriptions of the federal environmental legislation regulating each of these facilities, can be referenced on the Right-To-Know Network at www.rtk.net (USEPA, 2000).

RCRIS Sites

The Right-To-Know Network database was used to identify any Large Quantity Generators (LQG) located within the watershed. LQGs are operations that produce >2,200 lbs. of hazardous waste in any given month of the year. Results of this search indicated that no LQGs were located within the Crooked Creek watershed. This information was current as of March 2000.

A review of RCRIS was also used to identify the number of Small Quantity Generators (SQG) and Waste Transporters (WT) located within the watershed. A total of 35 SQGs were identified in or adjacent to the Crooked Creek watershed. One SQG within the watershed was noted as having 3 violations and 2 penalties in 1985 (USEPA, 2000). According to the RCRIS report, fees were paid in debt to the violations during the same year. No WTs were identified in the watershed.

No RCRIS listed Storage, Treatment, and Disposal (STD) facilities were located within the watershed.

CERCLIS Sites

The Comprehensive Environmental Response, Cleanup, and Liability Information System (CERCLIS) database provides listings of regulated hazardous waste sites along with the federal environmental legislation

related to these sites. Using a CERCLIS query, no Pennsylvania Superfund Sites (NPL) or active CERCLIS sites were identified within the Indiana or Armstrong County sections of the watershed.

Toxic Release Inventory

The Toxic Release Inventory (TRI) is a public information Right-To-Know report that supplies information concerning chemical releases and discharges associated with manufacturing industries. One industry was identified as releasing arsenic and chromium within the watershed (USEPA, 2000). No violations regarding these discharges were noted, and all facilities are assumed to be in compliance with applicable regulations.

2. Illegal Dumping

Unregulated dumping of refuse at non-permitted sites has been identified as a major issue within the study area. However, because illegal dumping often occurs along hillsides and hidden areas, it may not be readily recognized as an environmental hazard. Apart from decreasing the aesthetic character of the watershed, illegally dumped trash along Crooked Creek and its tributaries can wash into the stream during normal rainfall events creating polluted, and sometimes hazardous, water quality conditions. Flooding makes for an even greater hazard as debris is carried off hillslopes into the stream. However, exposed and unexposed trash need not lie along a streambank in order to decrease water quality. Rainwater can wash over the debris, leaching contaminants from oil cans, aerosol bottles, and other trash, into groundwater supplies.

The Indiana County Chapter of Pennsylvania CleanWays, a Pennsylvania non-profit organization, assists communities with identifying and cleaning illegal dumpsites along with maintaining sites that have been part of past clean-up efforts. PA CleanWays is similar to the Adopt-A-Highway program, but focuses on debris sites along non-state roads and adjacent areas. Currently, PA CleanWays is conducting an inventory of, and mapping illegal dumpsites in the county, which includes the Indiana County protion of the study area (Figure 6). From these inventories, locally driven strategies can be developed to raise public awareness, clean up, and maintain these areas. Sample inventory froms are located in Appendix C.

3. Abandoned Mines/Quarries

Numerous abandoned coal mines, ranging from smaller family-owned facilities to corporate operations encompassing hundreds of acres, occupy the Crooked Creek watershed.

Historic resource extraction associated with underground deep mines and surface mines has left a legacy of coal refuse piles, scarred landscapes, and abandoned mine shafts throughout the watershed. Underground mine pools occupying abandoned deep mines threaten both ground and surface water quality. When the highly pyritic coal and bedrock from the mining operation is exposed to oxygen and moisture, a series of chemical reactions ensue. These reactions typically result in elevated acid and dissolved metal levels in the water draining the mine. The presence of mine drainage is generally identified by a reddish precipitate on the stream substrate. This precipitate is a result of ferric hydroxide, or "yellowboy", which falls out of solution when the pH elevates above 3.5. An easily visible example of this within the Crooked Creek watershed is the open-borehole discharge at Tanoma. In addition to posing a threat to anglers wading the stream, this borehole, a result of previous mining, is a large source of yellow-boy in the watershed. At this time, however, remediation efforts are in place at the borehole.

The locations of abandoned mine problem areas and discharge sites are illustrated in Figures 7 & 8, and some of the proposed reclamation strategies are discussed in further detail under the Water Resources Section of this document. However, a comprehensive identification of all mine locations within the watershed was not within the scope of this project.

Another potential danger to water and air quality identified within the watershed is coal refuse piles. The largest refuse pile identified within the watershed was Air Products Ernest Coal Refuse site dating to the early 1900s. This site has been historically problematic as a result of water from the refuse site being gathered and stored in a temporary holding pond. This water often leaches into the spoil pile and discharges acidic effluent into McKee Run. Two large seeps above and below the refuse pile also discharge AMD and raw sewage, which eminates directly from the deep mine below the pile. However, according to Horrel (2000), Air Products has removed approximately 25 percent of the pile, replacing it with cogen ash to increase the alkalinity of the discharge. The goal of this project is to eventually construct contoured ash wetlands at the site in order to improve the water quality in McKee Run.

4. Active Mines/Quarries

One permitted, non-coal mining operation was identified in the Crooked Creek watershed. This operation is currently active and consists primarily of shale quarries (D. Wissinger & R. Stitt, Ebensburg District Mining Office; A. Buzzard, Greensburg District Mining Office, personal communication, June 2000).

In addition to the non-coal mining operations, 28 active coal mining permits were identified within the watershed (D. Wissinger & R. Stitt, Ebensburg District Mining Office; A. Buzzard, Greensburg District Mining Office, personal communication, June 2000). These permits were issued for deep and strip mining operations, coal preparation, and reprocessing. Twenty-six of these permits were in force, while the remaining two have not been initiated, or were inactive, forfeited, or regraded. Figure 8 illustrates the areas where active mining was occurring during the preparation of this report. A list of the identified coal and non-coal mining permits is located in Table II-3.

5. Sinkholes

Sinkholes in Pennsylvania are generally associated with karst topography. Karst areas are composed of carbonate bedrock, such as limestone, dolomite, or marble, that remains in dissolution for long periods of time. Water that has gradually infiltrated the underlying bedrock will weaken rock joints and eventually cause the ground surface to collapse. This subsidence results in varying sized sinkholes across the landscape. Often, sinkholes can cause subsidence of power lines, buildings, or any structure supported by the ground surface.

Most sinkholes associated with karst topography in Pennsylvania are generally located in the central and eastern portions of the state, as a result of the definitive bedrock. According to Kochanov (1999) and a DCNR database query, no karst formations or associated sinkholes are located within the Crooked Creek watershed. Sinkholes associated with past mining practices have been reported but were not identified as a major concern in the watershed.

G. CRITICAL AREAS

No critical areas were identified within the project study area.

Permit Number	County	Township	Permitee	Status	Operation	Permit Type
32910103	Indiana	Armstrong	Big Mac	Active	Surface Mining	Coal
32803037	Indiana	Armstrong	Kent 53	Active	Surface Mining	Coal
32841312	Indiana	Armstrong	Keystone Coal Company	Active	Deep Mining	Coal
32841313	Indiana	Armstrong	Keystone Coal Company	Active	Deep Mining	Coal
32841323	Indiana	Armstrong	Keystone Coal Company	Active	Deep Mining	Coal
32921301	Indiana	Washington	Keystone Coal Company	Active	Deep Mining	Coal
32841321	Indiana	Washington	Keystone Coal Company	Active	Deep Mining	Coal
32971302	Indiana	Washington	Rosebud	Active	Deep Mining	Coal
3274301	Indiana	Washington	Manor Mines	Active	Surface Mining	Coal
32950109	Indiana	White	Dunamus	Active	Surface Mining	Coal
32950201	Indiana	White	Cambria Recycling	Active	Refuse Recovery	Coal
32841307	Indiana	Rayne	Tinoma Deep Mines	Active	Deep Mining	Coal
32840701	Indiana	Rayne	Tinoma Deep Mines	Active	Refuse Pile	Coal
32970110	Indiana	Rayne	Mears Enterprises Inc	Active	Deep Mining	Coal
32970902	Indiana	Rayne	Mears Enterprises Inc	Active	Refuse Pile	Coal
32910101	Indiana	Rayne	TLH Coal Co.	Active	Surface Mining	Coal
32990107	Indiana	Rayne	Amerikohl Mining	Active	Surface Mining	Coal
03841305	Armstrong	Plum Creek	Keystone Coal Company	Active	Surface Mining	Coal
03831305	Armstrong	Plum Creek	Keystone Coal Company	Active	Surface Mining	Coal
03951601	Armstrong	Plum Creek	Keystone Coal Company	Active	Cleaning Plant	Coal
03181303	Armstrong	Plum Creek	TJS Mining	Active	Deep Mining	Coal
03901304	Armstrong	Plum Creek	TJS Mining	Active	Deep Mining	Coal
03961302	Armstrong	Plum Creek	TJS Mining	Active	Deep Mining	Coal
03840701	Armstrong	Plum Creek	TJS Mining	Active	Refuse Pile	Coal
03870701	Armstrong	Plum Creek	TJS Mining	Active	Refuse Pile	Coal
03851601	Armstrong	Plum Creek	TJS Mining	Active	Cleaning Plant	Coal
03980103	Armstrong	Plum Creek	Parkwood Resources	Active	Deep Mining	Coal
03980103	Armstrong	Plum Creek	Dutch Run Coal	Active	Surface Mining	Coal
03862601	Armstrong	Plum Creek	Glen Flemming Construction	Active	Surface Mining	Non Coal
3200----	Armstrong	Plum Creek	Rosebud	Pending	Deep Mining	Coal

Table II-3 - *PADEP Mining Permits within the Crooked Creek Watershed Study Area*

CHAPTER 3

WATER RESOURCES

Crooked Creek near Fulton Run

III. WATER RESOURCES

A. MAJOR TRIBUTARIES

The project study area covers 195 miles^2 (125,067 acres) including the Crooked Creek watershed from the confluence with Plum Creek in Armsrong County, upstream to the headwaters. The entire study area is located in the Appalachian Plateau Physiographic Province, Pittsburgh Low Plateau Section. Bituminous coal fields abound within the watershed, and the majority of these coal fields have been mined intensively throughout the past one hundred years.

Although twelve major tributaries outlet into the main stem of Crooked Creek (Table III-1, Figure 2), the Plum Creek sub-basin accounts for over 80.2 mi^2 (41percent) of the total drainage area. The two largest tributaries of this sub-basin, North and South Branch Plum Creek, join to form Plum Creek just below the dam at Keystone Lake, before the confluence with Crooked Creek just south of Elderton. Other major tributaries within the study area include McKee Run and Curry Run, which cover 14.2 mi^2 (7.2 percent) and 11.2 mi^2 (5.7 percent) of the study area, respectively.

B. WETLANDS

1. National Wetland Inventory (NWI)

Pennsylvania's landscape is covered by 403,924 acres of wetlands and 412,905 acres of deep-water habitat (Frey, 1996). Wetlands make up roughly 1.4 percent of the Commonwealth's land surface, however these ecological systems are more prominent within the glaciated portions of the northeastern and northwestern PA. Wetlands within the study area were identified through a review of NWI mapping and Indiana County wetland mapping.

Tributary	Drainage Area (mi^2)	River Mile	PADEP Water Use*
Rayne Run	6.23	50.13	CWF
Brush Run	2.47	47.64	CWF
Pine Run	10.1	47.34	CWF
Twomile Run	1.71	41.42	CWF
McKee Run	14.2	40.68	CWF
Fulton Run	4.26	38.85	CWF
Dark Hollow Run	3.44	35.96	CWF
Mitchell Run	3.24	35.06	CWF
Curry Run	11.2	34.35	CWF
Anthony Run	5.19	33.76	CWF
Walker Run	2.52	31.64	CWF
Plum Creek	80.2	30.36	TSF
South Branch**	40.2	5.22	HQ-CWF/CWF
North Branch**	21.1	5.22	CWF
Cessna Run**	7.43	3.4	CWF
Dutch Run**	6.08	1.68	CWF
* PA DEP Chapter 93 Water Quality Standards abbreviations are: CWF – Cold Water Fishery, TSF – Trout Stocked Fishery, HQ – High Quality Waters			
** Major tributaries to Plum Creek within the study area.			

Table III-1 *Major Tributaries within the Upper Crooked Creek Watershed Study Area (*PADEP, 1989*)*

Wetlands can be defined as transitional areas between terrestrial and aquatic environments where the water table often exists at or near the surface, or where the land is inundated by water (Cowardin, Carter, Golet, & LaRoe, 1979). Therefore, wetlands frequently exhibit a combination of physical and biological characteristics indicative of both terrestrial and aquatic systems. Three factors are typically recognized as criteria for wetland classification: the presence of hydric soils; inundated or saturated conditions during part of the growing season; and a predominance hydrophytic (water-loving) vegetation (Environmental Laboratory, 1987). Within this general framework, many different wetland ecosystems and classifications exist.

Crooked Creek and most of the major tributaries to Crooked Creek were designated as either Riverine, Lower Perennial, Open Water, Intermittently Exposed/Permanent (R2OWZ) or Riverine, Upper Perennial, Open Water, Intermittently Exposed/Permanent (R3OWZ) systems. Keystone Lake was classified as a Lacustrine, Limnetic, Open Water, Intermittently Exposed/Permanent, Diked/Impounded (L1OWZh) system. The rest of the watershed varied with the following types of wetland systems:

- Palustrine, Emergent, Temporary (PEMA)
- Palustrine, Emergent, Saturated/Semipermanent/Seasonal (PEMY)
- Palustrine, Forested, Broad-leaved Deciduous, Temporary (PFO1A)
- Palustrine, Forested, Broad-leaved Deciduous, Saturated/Semipermanent/Seasonal (PFO1Y)
- Palustrine, Scrub/Shrub, Broad-leaved Deciduous, Temporary (PSS1A)
- Palustrine, Open Water, Intermittently Exposed/Permanent (POWZ)
- Palustrine, Open Water, Intermittently Exposed/Permanent, Diked/Impounded (POWZh)

Wetlands can perform a variety of functions making them an invaluable environmental asset. Functions can include groundwater discharge/recharge, floodflow alteration, sediment/toxicant retention, nutrient removal/transformation, production export, streambank stabilization, wildlife habitat and aquatic habitat. As a result of the quality functions a wetland can perform, development in wetlands should almost always be restricted or protected to some degree.

C. FLOODPLAINS

Undisturbed floodplains and riparian zones serve a variety of ecological functions including the retention and gradual release of surface and groundwater; vegetative stabilization of stream banks; sediment and toxicant filtering from surrounding uplands; and the production of food sources, cover, and thermal protection for organisms living within the floodplain or riparian area. Floodplains within the project study area are illustrated on Figure 2.

The destruction of riparian habitat ultimately is the most detrimental byproduct of floodplain encroachment from development. In fact, except in extreme cases of contamination by various chemical components, such as those found in abandoned mine drainage, degradation of floodplain and riparian habitat by agricultural and urban land uses within the Crooked Creek watershed has had the greatest influence on aquatic fauna.

Undisturbed floodplain along Crooked Creek's main stem near the confluence of McKee Run. Although the stream bank is eroding in this area, dense herbaceous, scrub shrub, and tree vegetation stabilize the bank.

Additionally, when encroachments from development occur within a floodplain area, other ecological benefits are compromised. For example, the ability of the floodplain to buffer and filter sediments from entering the stream can be greatly abated. Shrinking the size of a floodplain can also often result in increased bank erosion and pollutant runoff into streams, a decreased ability to detain and gradually release floodwaters, and extreme alterations in channel morphology. All of these can have significant impact on the biological health of the stream ecosystems.

Encroachments by residential developments are also responsible for impacts to the floodplain. Typically, flood management and insurance rates are coordinated through the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973 as an effort to reduce the damage and hazards associated with flood events. To accomplish these goals, FEMA conducts routine flood insurance studies that investigate the severity and existence of flood hazards throughout the country. The results of these studies are subsequently used to develop risk data that can be applied during land use planning and floodplain development. Future development and land use plans should be coordinated with the Federal Emergency Management Agency and the National Flood Insurance Program to determine floodplain and special flood hazard areas within the watershed.

The PADEP regulations for floodplain management are outlined in the 25 PA Code § 106. The purpose of these regulations are to:

1. Encourage planning and development in floodplains which are consistent with sound land practices.
2. Protect people and property in floodplains from the dangers and damage of floodwaters and from materials carried by such floodwaters.
3. Prevent and eliminate urban and rural blight that results from the damages of flooding.
4. Support a comprehensive and coordinated program of floodplain management, based upon the National Flood Insurance program, designed to preserve and restore the efficiency and carrying capacity of the streams and floodplains of the Commonwealth.
5. Assist municipalities in qualifying for the National Flood Insurance program.
6. Provide for and encourage local administration and management of floodplains.
7. Minimize the expenditure of public and private funds for flood control projects and for relief, rescue and recovery efforts.

Although all of the municipalities within the watershed have ordinances restricting development within the floodplain, some floodplain encroachments have occurred within the watershed prior to the adoption of these regulations. Most of these encroachments were residential and concentrated in the population centers of Creekside, Ernest, Marion Center, and Shelocta. The Project Area Characteristics section of this document provides additional information concerning floodplain ordinances.

D. LAKES AND PONDS

Significant, publicly owned lakes and ponds within the study area were identified through a review of the *Commonwealth of Pennsylvania 1996 Water Quality Assessment* (Frey, 1996) and are presented in Figure 2. As defined in this assessment, a “significant lake [is] a publicly-owned lake

with a retention time of 14 days or greater". According to Frey (1996), Pennsylvania's definition of a publicly-owned lake is consistent with the EPA definition set forth in 45 CFR Part 35, FR Volume 25, which is "A fresh water lake that offers public access to the lake through publicly-owned contiguous land so that any person has the same opportunity to enjoy non-consumptive privileges and benefits of the lake as any other person". There are 179 significant lakes with public access encompassing 94,530 acres in the state.

The only significant lake identified in the study area is Keystone Lake. The lake is owned by the Keystone Plant Owners Group/Keystone Generating Station, who leases it to the PA Fish and Boat Commission. Keystone Lake consists of 1,000 acres and is a Cold Water Fishery (CWF) (Frey, 1996). According to USGS mapping, there are two other named lakes within the watershed: Shady Side Lake in Armstrong Township, Indiana County, just outside of the Borough of Shelocta, and Green Valley Lake near McIntyre. Although not classified as a significant lake by PADEP or named on USGS mapping, Cummings Dam at Blue Spruce County Park is also publicly owned.

E. WATER QUALITY

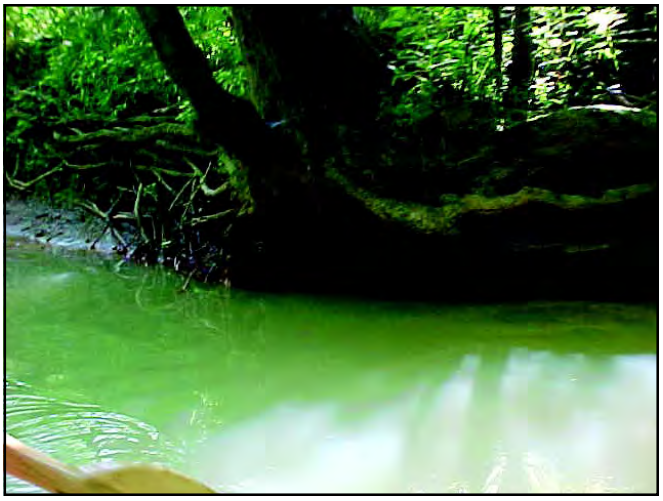
1. General Characteristics

Water pollutants are typically classified according to two major categories: point source and non-point source. Point source, or end of pipe, pollutants area easily identified and can be directly traced to their source. Industrial discharges, municipal discharges, stormwater discharges, combined sewer overflow discharges, and concentrated animal feeding operations are all examples of point source pollution. All point source discharges require a National Pollutant Discharge Elimination System (NPDES) permit, established by Section 402 of the 1972 Clean Water Act. All other water pollutants are referred to as non-point source (NPS) pollution. NPS pollution cannot be easily defined or quantified. Typically, sources of NPS include mine drainage, agriculture, urban runoff, atmospheric deposition, construction activities, on-lot sewage systems, leacheate from landfills, and silviculture. Overall, the major sources of reported impairment on a statewide basis are metals, siltation, nutrients, suspended solids, organic enrichment/low dissolved oxygen and pH from both point and non-point source pollution (Frey, 1998).

The history of resource extraction, agriculture, and development within the Crooked Creek watershed has created various sites of degraded surface and ground water quality conditions. Although some portions of the Crooked Creek watershed remain in fair to good biological health, the three largest sources of reported impairment within the basin are acid mine drainage, municipal waste, and agriculture pollution, a combination of both point and non-point source pollutants.

According to Koryak (1980), acid drainage from both active and abandoned mines has been the most implacable water quality issue within the study area. The Ernest Mine Complex (Figures 7 & 8), the most notorious and significant contributor of mine drainage throughout the basin, started its mining operation in the early 1900s. By the 1930s, the stream was vacated of fish and most other living organisms for a 27-mile reach (Koryak, 1980). Additionally, an aquatic biology study by Kodrick and Moore (1986) from 1983 to 1986 affirmed that, based upon measurements of diversity within macroinvertebrate communities, Crooked Creek could be classified as moderately or severely polluted by iron, siltation and erosion caused by surface mining, agriculture, and development, and acid precipitation, which enhances the impacts of iron and metallic ions. Although some stream

segments have been rebounding over the years, as of 1995 Crooked Creek could not support reproducing trout populations as a result of incessant pollution issues, especially acid mine drainage (Woomer & Lee, 1997).



Dense root networks and undercut banks along Crooked Creek provide valuable cover habitat for fish.

On the other hand, Yasick (2000) conducted a Rapid Bioassessment within the Upper Crooked Creek and Plum Creek watersheds, investigating macroinvertebrate communities at thirteen sites in Crooked Creek and seven sites in Plum Creek (Figure 9, Appendix F). The majority of macroinvertebrate assemblages within Crooked Creek and Plum Creek's watershed (seven and four, respectively) indicated good stream quality (i.e., optimal to suboptimal habitat conditions and high biotic potential). In addition, habitat quality was generally rated as good. However, downstream from Ernest and Creekside in the mainstem Crooked Creek, raw sewage outflow and acid mine drainage clearly created poor water quality conditions.

Trash, debris, and oily sheen on Crooked Creek downstream of Creekside.

Overall, Crooked Creek watershed has been designated as a High Priority Water on the NPS Priority Degraded Watershed List (DWL) under PADEP's Non-point Source Control Program (Frey, 1996). The NPS DWL identifies streams or stream segments that are impacted by non-point sources of pollution. PADEP uses information about the amount of degradation in conjunction with interest from public and local groups in order to assess which watersheds would most likely to benefit from remediation projects.

2. Abandoned Mine Drainage

Abandoned mine drainage involves a complex set of chemical reactions but begins by exposing sulfides to oxygen during the mining process. Sulfides almost always occur within bituminous and anthracite coal seams, in rocks and clays surrounding the seams, and within roof shales. Typically in the mineral form pyrite or marcasite (FeS_2), exposure to oxygen oxidizes the pyrite and liberates sulfate ions (SO_4^{2-}), hydrogen ions (H^+), and ferrous iron (Fe^{2+}). The sulfate and hydrogen ions constitute the components of the familiar compound sulfuric acid (H_2SO_4).

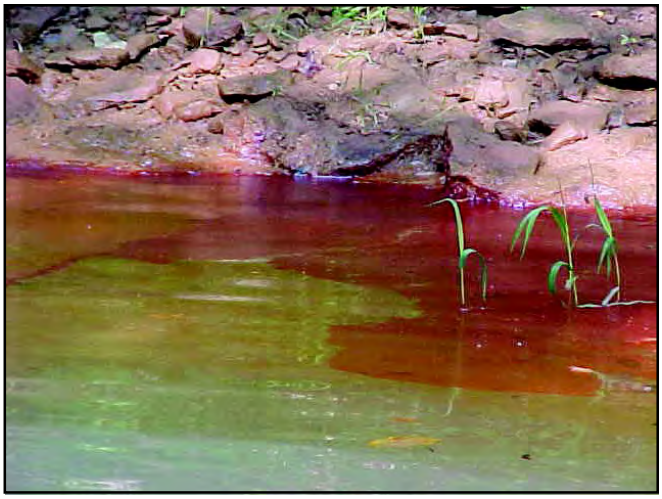
Further oxidation of the ferrous iron is often facilitated by iron bacterium such as *Thiobacillus ferrooxidans, Metalloganium spp., Thiobacillus thiooxidans,* and *Bacillus ferrooxidans* (Manahan,

Iron precipitate or "yellow boy" coates the substrate and streambanks along several reaches of Crooked Creek. This photo was taken near Fulton Run.

1994). The additional oxidation has two consequences. First, the conversion of Fe^{2+} to Fe^{3+} causes the pyrite to further dissolve, thus perpetuating the cycle. Second, the ferric acid ($Fe(H_2O)_6^{3+}$) remains in solution only at a very low pH (<3). When diluted by receiving waters, the pH rises, $Fe(OH)_3$ precipitates and the familiar yellow-orange sediment found in many of Pennsylvania waterways is formed.

The sediments produced by AMD can cause damage by discoloring stream substrates, clogging the gills of aquatic organisms, and increasing the levels of toxic metals. However, the most damaging component of AMD is the production of sulfuric acid, which is acutely toxic to all aquatic organisms (Manahan, 1994).

In western and northcentral Pennsylvania alone, bituminous coal reserves total up to 7.1 billion tons. (Frey, 1996). Because of the abundance of these rich coal resources, intensive mining has riddled the landscape of Pennsylvania for over one hundred years. As a result of resource extraction and subsequent exhaustion of reserves at various sites, abandoned mine drainage has developed and remains the single biggest source of surface water impairment in the Commonwealth. Drainage flowing from abandoned mine sites often decreases the pH of streams and rivers affected by the drainage. Additionally, it can elevate concentrations of heavy metals and suspended solids within impacted waterways. (Frey,1996). Between five to fifteen billion dollars will be required for the complete reclamation of abandoned mine lands in western and northcentral Pennsylvania (Frey, 1996).



The residual effects of abandoned mines are evidenced here by iron precipitate and an oily sheen coating the water.

Significant mine drainage pollution occurs at various points within the study area (Figures 7 & 8). Areas include a coal refuse pile on McKee Run, the Kintersburg Drift Mine, the Tanoma South Borehole, and Air Products Ernest Coal Refuse Site.

a) Remediation and Reclamation Projects

During the intensive coal-mining period of the early 1900s severe runoff from mines polluted Crooked Creek, rendering it unable to support aquatic life. When mining began its gradual decline

in the area throughout the 1940s, water quality slowly began to improve over the next twenty years (ACOE, 2000). Although some areas within the watershed have rebounded after mining was abandoned in 1965, significant areas of AMD continue to impact the basin.

Over the past twenty years, remediation of waters and reclamation of abandoned mine sites have been actively pursued. Although reclamation and remediation technology is constantly evolving, the most recent methods to treat abandoned mine drainage can be lumped into two general categories: active and passive. Active treatment requires more consistent maintenance, often via applications of hydrated lime or crushed limestone in order to reduce acidity and decrease the accumulation of iron and other metals. When limestone is applied to acidic mine water, the following reaction occurs:

$$CaCO_3\,(s) + 2H^+ + SO_4^{2} ==========> Ca^{2+} + SO_4^{2+} + H_20 + CO_2\,(g)$$

The obstacle to completing this reaction is the presence of the iron (III), which precipitates as $Fe(OH)_3$ when the pH of the water is raised. The hydrated iron (III) oxide blankets the carbonate rock creating an impermeable armor that prevents the complete neutralization of the acid, or the hydrogen ions (Manahan, 1994). Active systems are often plagued with this problem, and remedies are tailored to the type of treatment system being utilized.

Active treatment of mine drainage is typically very expensive to construct and operate. Along with this, active treatment is considered a "band-aid" method because drainage cannot be permanently treated with this technology. On the other hand, passive control of abandoned mine drainage entails the construction of a more permanent treatment system that requires less maintenance than active treatment systems. Passive treatment systems vary greatly. Some basic options include open limestone channels, anoxic drains, drainage diversion via wetland systems or other settling structures, and alkaline recharge of groundwater. A simple example of passive treatment is an open limestone channel (OLC). Two construction options are available for OLCs: construction of a drainage ditch lined with limestone where the AMD water is collected or direct placement of limestone fines, or fragments, into the stream. Because $Fe(CO)_3$ and $Fe(OH)_2$ produced by the neutralization coats the limestone and reduces the alkalinity of the mine water, a large amount of limestone is needed to ensure long-term progress of the system (PADEP, 1999).

Application of the appropriate passive treatment system is based upon water chemistry, available treatment options, cost, and experience of the designer. These systems are less expensive than active treatment systems; however, most passive treatment systems are still considered experimental because their long-term effectiveness has not been studied (USOSM, n.d.). A discussion of remediation for three significant mine drainage sites within the watershed follows:

Air Products Ernest Coal Mine Site: One significant mine drainage site within the watershed is the Ernest Mine, an underground coal mining complex about 11 miles long, including a 94-acre surface pile with an estimated weight of 9.4 million tons. The mine site extends through and beneath three townships within the watershed: Rayne, White and Washington (PADEP, 1997). Two large seeps above and below the refuse pile discharge AMD and raw sewage, which eminates directly from the deep mine below the pile. The surface pile associated with the mine is commonly referred

to as the Air Products Ernest Coal Refuse Site. Seeps and stormwater run-off that filter through this site have been a contributor of mine drainage to McKee Run, a major tributary to Crooked Creek and has consistently decreased water quality at its confluence with Crooked Creek and downstream. Several years ago, Air Products initiated the reclamation of this site by removing portions of the refuse pile, burning the ash at the Air Products Cambria Cogeneration Facility, and replacing the refuse materials in the pile with the highly alkaline cogen ash. The goal of the project is to eventually increase the pH of the discharge flowing into Crooked Creek. At present, approximately 25 percent of the refuse pile has been removed (Horrell, 2000). Although the project might take another five to ten years to complete, the final product will be contoured ash wetlands used to treat the drainage by increasing its alkalinity before it enters Crooked Creek.

Additionally, two deep mine discharges from the Ernest Mine Complex flow into McKee Run and continue to degrade water quality in Crooked Creek at the confluence with McKee Run and downstream about ten miles to Plum Creek. The discharges are located along the right and left downstream banks of McKee Run approximately 0.8 miles from the mouth. The right downstream bank area discharge (MS1) has an acidity of 87 mg/l as $CaCO_3$, a pH of 4.65, total iron of 26.7 mg/l, and total aluminum of 6.3 mg/l. This area contributes 326 pounds of iron load per day to Crooked Creek. The second discharge area (MS3), entering McKee Run on the left downstream bank, contributes 1,652 pounds of iron load a day, has a total acidity of 420 mg/l as $CaCO_3$, a pH of 4.45, total iron of 124 mg/l, and total aluminum of 34 mg/l (ACOE, 2000).

At present, the ACOE is focusing on reducing the iron load from the two discharges. Overall, the ACOE is presently leaning towards a constructed wetland treatment method to passively treat both MS1 and MS3. For both systems, the treatment concept will begin by redirecting mine water in wetland ponds for neutralization and the reduction of suspended sediments. The treated water will then be channeled back into McKee Run (ACOE, 2000). During the preparation of this plan, treatment was still in the planning phase; however, these plans should be actively pursued for remediation of this drainage area.

The Tanoma South Borehole. Note the difference in water color upstream (bottom of photo) from the borehole and downstream (top of photo).

Tanoma South Borehole Site: The Tanoma South borehole is yet another mine drainage discharge site within the watershed. The boreholes located at Tanoma drain the Tanoma mine complex. According to Milevec (2000), the Tanoma South Borehole area included two boreholes from abandoned mines injecting acidic and iron rich waters into Crooked Creek. Between 1990 and 1996, water quality information collected by the Bureau of Abandoned Mines and Ebensburg District Mining Offices for the Tanoma South Borehole showed the alkalinity of the discharge ranging from 34 to 180 mg/l, pH from 6.1 to 7.15, and total iron levels from 0.44 to 22.4 mg/l (Spyker, 1997). The average discharge over the six-year period was 2533 gpm with a mean iron discharge of 213 lb/

day flowing directly into Crooked Creek (Spyker, 1997). Although Yasick (2000) found no significant difference in macroinvertebrate composition between upstream and downstream of the original borehole, other sources indicate that downstream of the borehole outlet, water quality has been impaired to a higher degree (Milevec 2000; Spyker 1997). Along with this, seasonal variations in streamflow and remediation efforts might have affected recent studies.

Recent remediation of the boreholes, supported by Pennsylvania Growing Greener Funds, has thus far included construction of a new, strategically placed borehole to replace two of the original boreholes (Milevec, 2000). Water discharging from the new borehole will be retained in a sediment pond and will be subsequently held in an aerobic wetland before discharging directly into Crooked Creek (Spyker, 1997). The final phase of reclamation was completed in 2000, and included sealing the existing two boreholes.

Kintersburg Drift Mine Reclamation Project. This photo illustrates the treatment wetland and settling lagoons.

Kintersburg Drift Mine: The Kintersburg Drift Mine has consistently been another contributor of mine drainage to Crooked Creek. According to Spyker (1997) treatment of the Kintersburg Drift Mine was funded by the Western Pennsylvania Coalition for Abandoned Mine Reclamation via EPA 319 NPS program. To accomplish treatment the sealed opening of the drift mine was redirected to a rock waterway where aeration takes place. Water is then redirected to a bermed wetland for iron oxide removal before the discharge enters a tributary adjacent to the remediation area. No other information regarding the effectiveness of this remediation was available during the preparation of this report.

Mine waters being redirected to the rock aeration waterway.

3. Agriculture

As the top industry in the state, agriculture contributes up to 1,328 miles (30 percent) of NPS pollution within Pennsylvania (Arway, 1996). Unmanaged agricultural practices create frequent disturbances to waterways. First, during high rainfall, snowmelt, or flood events; the fertilizers, manure, pesticides, and silt from agricultural lands can be transported via overland flow into streams and rivers within the watershed. This can create heavy siltation, nutrient accumulation, and suspended solids within stream systems, disrupting both the chemical and biotic health of the watershed. Additionally, increasing the abundance and size of silt entering into the stream channel will result in alterations to the stream's morphological and flow characteristics. Nutrients from agriculture runoff can also leach into soils and potentially contaminate groundwater supplies. The material leached into groundwater can affect drinking water supplies and can eventually feed into stream channels. Finally, unrestricted access of livestock into streams

In order to maximize crop yield, agricultural fields frequently extend up to the stream channel, destroying the riparian zone. This photo was taken along Rayne Run, a tributary to Crooked Creek.

also creates numerous problems. Along with increasing peril to the livestock, i.e., creating an increased capacity for bone fractures, herd contamination, etc., livestock can accelerate streambank erosion, sedimentation, and surface water nutrient enrichment through excrement into the streams.

In 1994, the Armstrong County Conservation District, in cooperation with the Indiana County Conservation District, completed an NPS assessment for the Crooked Creek and Cowanshannock Creek watersheds. The assessment determined the extent and severity of non-point source pollution from agricultural areas within the two watersheds. Utilizing fifty interviews with farmers and evaluating parameters such as the watershed delivery factor, the animal nutrient factor, ground water delivery factor, and the management sub-factor, the conservation districts determined conservation priority rankings for each subwatershed. The report suggests that conservation efforts be addressed within the top ten ranking subwatersheds in need of Best Management Practices (BMPs). Within the Upper Crooked Creek watershed, three subwatersheds were determined as high priority areas for the implementation of Best Management Practices: Plum Creek, Crooked Creek upstream from Creekside, and Plum Creek – South Branch (ACCD and ICCD, 1994). Additionally, Yasick (2000) found agricultural runoff to be a key pollutant within the Plum Creek subbasin.

Within the high priority watersheds listed above, the conservation districts recommend the institution of a cost-share program through which complete nutrient management and conservation plans are developed and implemented. The BMPs recommended in the study include nutrient management practices, erosion control, and animal/pasture management practices. Specifically, a tailored amount of manure storage areas, manure management plans, strip cropping, minimal tillage areas, terraces, cover crops, etc., was recommended for each high priority subbasin. Because regulations instated in the early 1990s for urban nonpoint source runoff do not apply to the primarily rural subwatersheds within the Upper Crooked Creek watershed, the conservation district report affirms the need for developers, engineers, and local officials to monitor improvements recommended in the report.

Just a few years ago unrestricted livestock access occurred along this section of Crooked Creek near Onberg. Streambank fencing was later installed along this reach in 2001.

A multitude of other solutions exist to assist with decreasing the impacts of agricul-

tural lands on water supplies throughout the watershed. Some examples of these solutions include streambank fencing, riparian buffer zones, and rotational grazing. Streambank fencing, or deterring cattle from entering streams, has the potential to decrease pollution in the stream by 565 million fecal coliform bacteria per cow per day for each cow typically allowed to enter the stream (Dawes, 1996). Numerous government agencies (PADEP, PA Game Commission, U.S. Fish and Wildlife Service, etc.) and private organizations (Partners for Wildlife) have streambank fencing programs with up to 100 percent cost-sharing available to farmers within the watershed.

Although much of the Crooked Creek watershed is plagued by water quality concerns, much of the riparian habitat, like these areas near Fulton Run, provides adequate buffering, streambank stabilization, in-stream shading, and detritus development for aquatic animals.

Another innovative method to preventing sediment and nutrient run-off into streams is the "Three Zone Buffer System" (Dawes, 1996). This system is designed to filter agricultural run-off by creating a small forest tract next to the stream, a middle zone with a woodland area, and an outer zone of grasses for trapping of sediments.

A third and final example of preventing nutrients from agricultural lands from entering streams is rotational grazing. On farms using rotational grazing, animals are rotated through a system of grazing fields, allowing some fields to regenerate while animals are grazing on another. Rotational grazing can reduce production costs, create less NPS, reduce the amount of manure the farmer needs to handle, and decreases the amount of farm equipment needed to maintain the agricultural operation (Dawes, 1996).

4. Municipal Point Sources (Sewage)

Raw sewage discharges, a point source pollutant, have been observed at various locations within the Upper Crooked Creek Watershed (Yasick, 2000). In fact, field observations by Mackin have confirmed at least two straight pipes discharging raw sewage into the mainstem of Crooked Creek between Creekside and Fulton Run. Most municipal sewage discharges result from sanitary sewage overflows (SSOs) or combined sewage overflows (CSOs) during periods of excessive discharges, such as storm or snow melt events. According to the USEPA, SSOs are defined as "discharges of untreated water from a separate sanitary collection systems which occur before the

headworks of a sewage treatment plant" (Garber, 1996). CSOs result from similar environmental conditions but are actually a combination of both sewage and stormwater runoff. During these periods of increased surface water flows, both SSOs and CSOs result when discharges exceed the capacity of their respective sewage system or treatment plant. These surplus flows are discharged as raw sewage into adjacent streams before reaching the treatment plant thus creating environmental and health problems.

In the study area, many rural residences possess on-lot sewage treatment and disposal. In 1996, the Pennsylvania Legislature passed strict requirements for on-lot sewage permits including specific methods of soil testing, system design, and construction (Lauch, 1996). However, because most residential systems within the Commonwealth have been built greater than four years ago, these systems often malfunction and are in frequent need of repair. One major issue concerning on-lot sewage systems is the typical homeowner's lack of understanding of the process of on-lot sewage treatment. If on-lot systems do not treat nitrogen loads properly, the loads will be channeled back into the groundwater system and contaminate drinking water supplies (Lauch, 1996).

The overriding problem with malfunctioning sewage systems, raw sewage discharges into surface waters, often results in elevated levels of fecal coliform bacteria. Fecal coliform are indicators of potential pathenogen contamination and therefore represent a potential health risk. Additionally, sewage can increase nutrient levels in the fluvial system. The addition of excess nutrients alters the chemical balance of the system, decreasing levels of oxygen for macroinvertebrates and fish populations, therefore increasing the biological oxygen demand (BOD) within the stream. The USEPA has related fish kills, human health problems, shellfish bed closures, and degradation of waterways to sewage overflows (Garber, 1996).

Solving sewage overflow issues is a daunting task. Along with salvaging on-lot seweage systems, correcting CSOs and SSOs often cost homeowners dearly through elevated taxes, service fees, or replacement of systems. Although the federal government typically orders municipalities to correct sewage problems, the costs and planning usually evolves into a local issue. Several repair options are available, but costs might still be prohibitive. For example, PADEP, in cooperation with PENNVEST and the Pennsylvania Housing Finance Corporation, has developed a low-interest (1 percent) loan program to assist with financial burdens of on-lot system repairs (Lauch, 1996). Repair of CSOs and SSOs are largely in the hands of municipalities, which typically own the sewers within their jurisdiction, and homeowners, who are responsible for the sewer lines from their homes to the public connection point (Garber, 1996).

5. Gas Wells

Oil and gas extraction, which is primarily concentrated in western and north central PA, pose several environmental threats including the extraction of large volumes of brine along with the oil and gas, the spreading of waste pit sludge, an increase in erosion and sedimentation, and improper disposal of wastewater. Several statutes and regulations regulate oil and gas activities. The PADEP Bureau of Oil and Gas Management began regulating the oil and gas industry's impact on the environment in April 1985, after the passage of the Oil and Gas Act of 1984. Regulations were adopted in 1989. The bureau is responsible for processing well permits, registrations and orphan well determinations; issuing permits for wastewater discharges; road spreading of brine dust control, erosion

and sedimentation; and administering the abandoned and orphan well plugging program.

The most significant of these threats is the disposal of unwanted brine. Brine is water that often has a salinity 4 to 5 times greater than ocean water. Brine may also contain contaminants such as heavy metals; crude oil; barium compounds, which are abundant in nature and toxic only in their soluble forms such as $BaCl_2$ (Hammond & Beliles, 1980a); and strontium chloride, another alkaline earth metal with virtually no toxicity in humans (Hammond & Beliles, 1980b). Large amounts of brine are typically spread across the land for dust control and road stabilization. Of the 17 western counties where brine is spread, Clearfield, Crawford, Indiana and Armstrong counties accounted for two-thirds of the total (Dipretoro, n.d.). The Hart Chemical Company, Brine & Frac Water Treatment Facility, located in Creekside, provides a service to dispose of brine properly. They process more than 12,000,000 gallons of oil and gas wastewater per year in accordance with PADEP standards before discharging the treated water to McKee Run.

Another significant threat associated with gas wells is the waste pit sludge. A waste pit is built to contain fluids drawn from the well during drilling. Although these pits are required to be lined by PADEP's Bureau of Oil and Gas, many are not lined resulting in potential groundwater, and eventually surface water contamination. Operators can also legally spread the sludge from the bottom of the well pits on the surrounding land. This sludge contains metals, oils, salinity, additives, and radioactivity.

6. Groundwater

Groundwater contamination results from a variety of sources and can often impact public water supplies. In fact, out of 35 community water systems in Indiana County, 17 come from groundwater sources (Gannet Flemming, 2000). This fact alone conveys the importance of preventing and remediating groundwater pollution.

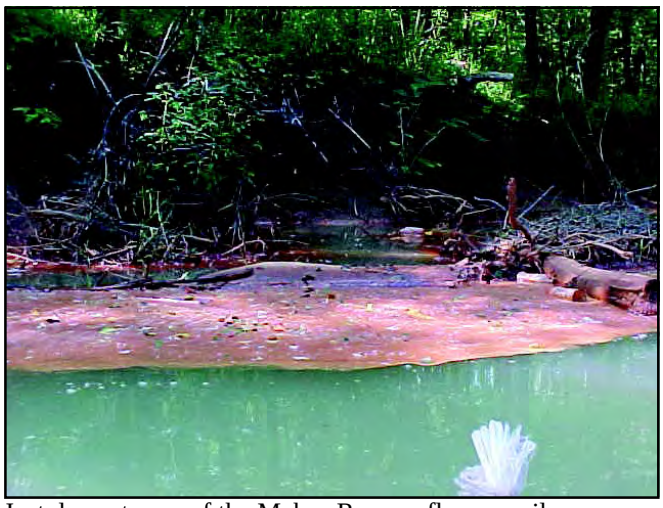
According to Frey (1996) significant sources of groundwater contamination in Pennsylvania include pesticide application, above ground and under ground storage tanks, surface impoundments, landfills, hazardous waste sites, industrial facilities, mining and mine drainage, pipelines, sewer lines, and spills. All of these sources contain hazardous chemical compounds that can leach into the soil and subsequently contaminate groundwater supplies via infiltration and fluctuations in water table depths.

In a recent study, Williams and McElroy (2000) assessed the quality and quantity of water within Indiana County. The study results indicated that the majority of groundwater within Indiana County flows through rock fractures. Additionally, the size and shape of the fractures, which are controlled by lithology, topography, and structure, determine the yield of flows through the fractures (Williams and McElroy, 2000). Because both the Armstrong and Indiana county portions of the watershed have similar geological structure and composition, groundwater flow characteristics can be extrapolated to the Armstrong County portion of the watershed.

Wells within the Glenshaw Formation of the Allegheny Group, the predominate formation within the watershed, yields an adequate amount of water for municipal, commercial, and industrial uses. The Casselman formation, which covers less area within the watershed, supplies a yield great enough for domestic use. However, the quality of water from the Casselman Formation and

Glenshaw Formation is generally hard with iron and manganese concentrations that exceed USEPA Secondary Maximum Contaminant Levels of 0.3 mg/L and 0.05 mg/L, respectively (Williams and McElroy, 2000).

7. Current Water Quality



Just downstream of the Mckee Run confluence, oils, suspended soilds, and suspended iron precipitate accumulate in slow moving pools.

Many of the reclamation efforts within the study area have effectively stabilized or decreased the impacts of AMD in some portions of the basin. Between 1980 and 1995, the Pennsylvania Fish and Boat Commission (PFBC) recorded an increase in pH, alkalinity, and fish species diversity downstream from the confluence of Rayne Run and Crooked Creek as a result of mine drainage treatment at the Tanoma Mines (Woomer and Lee, 1995). Along with this, the USACOE (2000) confirmed that impacts of abandoned mine drainage began to stabilize during the period from 1982 to 1999. Progress such as the 1999 initiation of a watershed ecosystem restoration plan, a cooperative effort between the PADEP, Bureau of Abandoned Mine Reclamation, and the USACOE, also provides encouraging evidence of substantive changes within the Crooked Creek watershed.

Although marked water quality improvements are apparent within the study area, issues such as heavy metal pollution from the AMD and nutrient increases from raw sewage remain. For example, mine drainage along McKee Run continues to degrade Crooked Creek for roughly ten miles from the Ernest Coal Mine to its confluence with Plum Creek (USACOE, 2000). Field observations by Mackin also concluded that raw sewage discharges occur at several locations along Crooked Creek. Additionally, Yasick (2000) also found degraded water quality conditions downstream from Ernest and Creekside, most likely as a result of raw sewage outflow and abandoned mine drainage observed upstream from the site.

A broader portrait of recent water quality conditions within Crooked Creek and Plum Creek is clearly needed. Mackin recommends complete chemical and hydrological assessments at random and strategic locations (i.e, upstream and downstream of point source pollutants) within the watershed. Additionally, seasonal patterns in macroinvertebrate communities need to be evaluated. Partnerships among Crooked Creek Watershed Association, federal and state agencies (USACOE, U.S. Fish and Wildlife Service [USFWS], PADEP, PFBC, PGC, etc.), local civic groups, and businesses would create momentum and cost efficiency in monitoring water quality. This, in turn, would create a mechanism to evaluate recent mine drainage reclamation and remediation activities along with future water quality improvement efforts.

F. WATER SUPPLY

1. Public and Private Supplies

Community water supplies are the primary sources of potable water within municipalities of Pennsylvania. According to the Pennsylvania Safe Drinking Water Act (SDWA), community water systems are mechanisms that provide water for human consumption to at least 15 service connections or 25 persons year round. If the water supply to a community water system is generated from surface waters, ground water under direct influence of surface water, or consecutive system purchases (a system with no source or treatment facilities), municipalities are required to obtain a water allocation permit from the PADEP (Gannett Fleming, 2000). However, if water is withdrawn from wells and springs that are not directly influenced by surface waters, water allocation permits are not required.

All community water systems within Indiana County are identified as either primary or consecutive systems (Figure 10). Primary water systems operate the municipalities principal water source and drive the treatment systems producing potable water. This water is sold either in bulk to consecutive systems or to retail customers. Consecutive systems purchase treated water from primary water systems as a result of having no source or treatment facility (Gannett Flemming, 2000).

The origin of water supplies within the Indiana County portion of the watershed is diverse (Table III-2). Of the 12 community water systems in the Indiana County portion of the watershed, 6

Water System	Population Served	Area Serviced in Study Area	Source	Permitted Allocation or Yield (gpd)
Central Indiana County Water Authority	3,819	White Twp.	Surface	1,300,000
Clymer Borough Municipal Authority	1,613	Cherryhill Twp.	Ground	684,000
Ernest Borough Water Commission	492	Ernest Boro.	Surface	90,000
Green Township Municipal Authority	207	Rayne Twp.	Surface	35,000
ICMSA - Airport Road	297	White Twp.	Interconnect	83,000
ICMSA - Creekside	337	Creekside Boro.	Ground	36,000
ICMSA - Fulton	67	White Twp.	Ground	43,000
ICMSA - Shelocta	1,256	Shelocata Boro., White Twp., Armstrong Twp.	Interconnect	101,000
Longs Mobile Home Park	100	White Twp.	Ground	115,200
Mt. View Heights Haven	26	Cherryhill Twp.	Ground	NA
PA American Water	24,136	White Twp.	Surface	6,000,000
Stoney Flats Mobile Home Park	31	South Mahoning Township	Ground	64,000

Table III-2 *Upper Crooked Creek Watershed Water System Suppliers (*Gannett Fleming, 2000)

are derived from groundwater sources, including wells and seeps; 4 systems are supplied by surface water, including streams and reservoirs; and 2 are generated from interconnected sources of Pennsylvania American Water Company. During the preparation of this report, no information was available concerning water supply sources within the Armstrong County portion of the study area or individual, residential water supplies (Gannett Flemming, 2000).

2. Wellhead Protection Areas

In 1993 the Eastern Armstrong County Municipal Authority (EACMA) initiated a wellhead protection program for 3 wells located approximately 0.65 miles northeast of Elderton Borough along Route 210 in Plumcreek Township Armstrong County. Although this wellhead protection area lies just outside of the study area, EACMA applied to PADEP for a 2000 - 2001 Growing Greener Grant to complete a refined delineation of the area, which would include 2 older wells that are being evaluated for future use.

3. Sewage Service Areas

Indiana County Municipal Sewer Association has implemented a five year plan for furthering the development of sewage services in the Crooked Creek Watershed (Figure 10). Highlights of the plan are summarized as follows. The Shelocta facility, which discharges to Crooked Creek, was constructed in 1999 and has 350 connections with a capacity of approximately 70,000 gallons per day (gpd). This facility services the Borough of Shelocta along US Route 422. Also constructed in 1999, the Plumville facility services Plumville Borough and discharges to Plum Creek. This facility has 250 connections and a capacity of approximately 72,000 gpd. The two phase McKee Run facility services an area which extends from Creekside, east to the PA Route 119/110 intersection and from the community of Pleasant Hill, north along McKee Run approximately 3 miles. Phase I of the McKee Run facility was constructed in 2000 to serve the Pine Grove State Correctional Facility. This facility has a capacity of 150,000 gpd and discharges to Crooked Creek. Phase II of this project is slated for construction during 2002 and will service the lower McKee Run watershed. This facility will add an additional 850 connections with a capacity of 300,000 gpd. Located in East Mahoning Township and scheduled for construction between April 2001 and March 2002, the Marion Center facility will have 300 connections and a capacity of 90,000 gpd. This facility will service the Borough of Marion Center and discharge to Pine Run. The final planned project in the five year plan is the Home/Gaibelton facility which will service the lower Pine Run watershed. Still in the planning stages, this facility will service the residences in the vicinity of Home and Gaibelton. Preliminary projections arre for this facility to be implemented in 2005.

CHAPTER 4

BIOLOGICAL RESOURCES

Eastern Mud Salamander

IV. BIOLOGICAL RESOURCES

Red-Bellied turtle (*Chrysemys rubriventris*)

A. WILDLIFE

1. Terrestrial

In addition to the historical occurrences of Pennsylvania Natural Diversity Index (PNDI) listed species discussed below in Section C, the Crooked Creek watershed supports a diverse wildlife community. Table IV-1, although not a comprehensive inventory, identifies some of the more common inhabitants of the basin.

Common Name	Scientific Name
White-Tailed Deer	*Odocoileus virginianus*
Ruffed Grouse	*Bonasa umbellus*
Beaver	*Castor canadensis*
Woodpeckers	*Picidae*
Woodcock	*Philohela minor*
Porcupine	*Erethizon dorsatum*
Squirrels	*Sciurus spp.*
Wild Turkey	*Meleagris gallopavo*
Eastern Cottontail Rabbit	*Sylvilagus floridanus*
Various Raptors	*Falconiformes*
Various Owls	*Strigiformes*
Ring-Necked Pheasant	*Phasianus colchicus*
Red Fox	*Vulpes fulva*
Coyotes	*Canis latrans*
Raccoon	*Procyon lotor*
Opossum	*Didelphis virginiana*
Black Bear	*Euarctos americanus*

Table IV-1 *Common Resident and Transient Wildlife Occurring in the Crooked Creek Watershed*

A variety of small mammals, songbirds (Appendix E), and waterfowl also occur throughout the basin.

a) Pennsylvania Herpetological Atlas Project

The Pennsylvania Herpetological Atlas Project is a six year study designed to examine the distribution of all reptiles and amphibians within the state. Composed almost entirely of volunteers from environmental organizations, colleges and universities, and state agencies, the program is funded through the Pennsylvania Wild Resource Conservation Fund and private donations.

Among the goals of the atlas are to provide detailed species distribution maps; identify critical reptilian and amphibian habitat; develop comprehensive databases for use by researchers, conservation planners, and government agency personnel; identify and track distributions of threatened and endangered species, and estimate the population status for a variety of species.

Two sample points are located in Blue Spruce County Park near Cummings Dam and one is located near the headwaters of Plum Creek (Figure 11 . Although not threatened or endangered, the species listed in Table IV-2 were observed.

Common Name	Scientific Name
dusky salamander	*Desmognathus fuscus*
American toad	*Bufo americanus*
wood turtle	*Clemmys insculpta*
ringneck snake	*Diadophus punctatus*
long-tailed salamander	*Eurycea longicauda*
rat snake	*Elaphe obsoleta*
milk snake	*Lampropeltis triangulum*
smooth green snake	*Opheodrys vernalis*
red-backed salamander	*Plethodon cinereus*
slimy salamander	*Plethodon glutinosus*
bullfrog	*Rana catesbeiana*
eastern box turtle	*Terrapene carolina*
garter snake	*Thamnophis sirtalis*

Table IV-2 *Species Observed from the Pennsylvania Herpetological Atlas Project*

b) Blue Spruce County Park Inventory

In 1997 the Indiana County Parks Department conducted a natural resource inventory of


Red Fox (*Vulpes fulva*)

Blue Spruce County Park. The purpose of this inventory was to evaluate the diversity of natural resources (primarily plant and avian life) within the park and to serve as a reference tool for future tracking and maintaining an accurate record of the park's flora and fauna.

The results of this study revealed over 68 species of trees and shrubs, 170 species of wildflowers, and 15 different species of *Pteridophyta* or "fern-plants". Also indicated was an extremely diverse avian community with 129 species sighted (Appendices D and E).

2. Aquatic

Discussions of fauna and assessments of fish and macroinvertebrate species are presented in Chapter 3 Water Resources - Section E: Water Quality and Chapter 4 Biological Resources - Section C: Threatened and Endangered Species of this report.

B. VEGETATION

1. Native

Forest land in the Crooked Creek watershed is classified as temperate broadleaf. Ecosystems of this type are exposed to a wide variety of environmental conditions, and extreme fluctuations in daily and seasonal temperatures and precipitation place significant stress on the physiological activities of indigenous plants. Temperate broadleaf forests are further divided into a number of sub-types based upon community composition. Within the Crooked Creek watershed, the northern hardwood forest type is dominant. Highly developed, uneven-aged northern hardwood forests typically consist of four strata. The canopy or uppermost layer is composed of large, mature deciduous trees. Below are a layer of immature trees, a shrub layer, and a ground cover layer.


Mature forest with sparse understory

As a result of historic resource extraction, timbering, and agricultural activities, the majority of old-growth forest land in the Crooked Creek watershed has been destroyed. Today, the watershed's forests are dominated by even-aged, relatively immature stands. Poorly developed strata beneath the canopy often characterize these regions, and community composition is dominated by pioneer species. These highly opportunistic species are adapted to the harsh, nutrient poor habitats that are often associated with man-induced disturbances such as strip mining.

Located within the Appalachian Oak and Mixed Oak Forest Region (Bailey, 1980), dominant tree species in the watershed consist primarily of second growth pole stage and mature deciduous forest. A qualitative investigation indicated that the dominant terrestrial flora is composed of birches (*Betula spp.*), sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), black cherry (*Prunus serotina*), white oak

(*Quercus alba*), red oak (*Quercus rubra*), eastern hemlock (*Tsuga canadensis*), various hickories (*Carya spp.*), American beech (*Fagus grandifolia*), and elms (*Ulmus spp.*). These flora provide important forage, nesting, and cover habitat for a variety of woodland species. A more comprehensive listing of woody tree and scrub shrub vegetation is located in Appendix D.

Stream margins throughout the watershed are composed of several species of riparian vegetation. Dominant emergent vegetation observed included deer-tongue grass (*Dichanthelium clandestinum*), rough sedge (*Carex stipata*), fox sedge (*Carex vulpinoidea*), Canada rush (*Juncus canadensis*), soft rush (*Juncus effuses*), jewelweed (*Impatiens capensis*), woolgrass (*Scirpus atrovirens*), and tussock sedge (*Carex stricta*). The scrub/shrub community is dominated by silky dogwood (*Cornus amomum*), red-osier dogwood (*Cornus stolonifera*), smooth alder (*Alnus serrulata*), and multiflora rose (*Rosa multi-flora*); while the tree community consists primarily of eastern hemlock (*Tsuga canadensis*), American hornbeam or blue beech (*Carpinus caroliniana*), black cherry (*Prunus serotina*), and birch (*Betula spp.*). These riparian and wetland plant species function to alter floodwater flow, retain sedimentation and toxins from upland areas, stabilize and shade the stream margin, and deliver detrital matter to the stream.

The heavily mined areas of the watershed are characterized by dense stands of red pine (*Pinus resinosa*) mixed with pioneer species such as eastern cottonwood (*Populus deltoides*) and bigtooth aspen (*Populus grandidentata*). In addition to the soil forming functions of these pioneering plants, they provide dense cover and roosting habitat for species such as the ruffed grouse.

Herbaceous vegetation throughout the watershed consists of a variety of temperate grasses and wildflowers characteristic of western Pennsylvania (Appendix D).

2. Exotic/Invasive

Exotic and invasive species typically interact with native vegetation and compete for resources through a process called interspecific competition. More specifically, community interactions among exotic/invasive and native species involves interference competition eventually leading to competitive exclusion. As the name implies, this process occurs when an exotic/invasive species interferes with a native species' access to a particular resource through some superior adaptation. Interference might include the consumption of a nutrient limited in availability, the modification of environmental conditions, a lack of natural enemies, or the release of toxins (i.e., allelopathy) (Smith, 1990). In this competitive situation, one species (usually the exotic/invasive) reproduces rapidly enough to prevent the population increase of another, so that it will reduce that population to extinction or exclude it from the area (Smith, 1990).

A prolific invader of Pennsylvania's waterways, roadsides, and abandoned industrial sites is Japanese knotweed (*Polygonum cuspidatum*). Native to eastern Asia and first introduced to North America in the late 19th century, this species has become a serious problem in the Eastern U.S. where it overwhelms and replaces native vegetation (Seiger, 1997). Japanese knotweed first takes hold where human encroachments to riparian corridors and waterways have occurred. Once established, it forms large, monocultures that displace all native vegetation. The presence of this noxious, invasive plant may result in increased erosion problems due to shallow rooting and poor bank stabilization.

Stands of Japanese knotweed have been virtually impossible to eradicate in all areas of the northeast-ern United States (Seiger, 1997). Some success on newly developing communities of knotweed has been demonstrated through manual and chemical controls but biological controls remain speculative, and only

very preliminary work has been done. Manual control consists of digging out the rhizomes (root stems which serve in propagation) or cutting the stalks. Research indicates that at least three cuttings are needed during the growing season to offset rhizome production (Seiger & Merchant, 1990 cited in Seiger, 1997). Biocidal chemicals have also proved effective against Japanese knotweed but were often undesirable due to species non-selectivity and the potential for water contamination. At the time this plan was prepared, only one agent, glyphosphate [N-(phophonomethyl) glycine] (i.e. Rodeo™), had been approved for use near water. Regardless of the remedy, continued management is required and all are labor intensive. However, where populations were small and isolated, those presented represent the best option.

Another widely introduced native of Eurasia that is quickly gaining a foothold in the watershed is poison hemlock (*Conium maculatum*) (T Sitler, PENNDOT Engineering District 10-0, personal communication, February 25, 2000). Not as competitive as Japanese knotweed, this acutely poisonous member of the parsley family is associated with waste places and riparian areas (Gleason & Cronquist, 1991). According to PENNDOT officials, poison hemlock has not reached the point of displacing large areas of native vegetation, but the district has observed an increase in the population distribution of this species.

A complete listing of invasive species included in PENNDOT's Comprehensive Roadside Plan are listed in Table IV-3. These species have been declared noxious because they spread very rapidly, are particularly difficult to control once established, and pose a threat to agriculture (PennDOT Engineering District 10-0, 1999). As a result, their control is mandated by State Law under PA 1982-74.

Common Name	Scientific Name
marijuana	*Cannabis sativa*
musk thistle	*Carduus nutans*
chicory	*Cichorum intybus*
Canada thistle	*Cirsium vulgare*
jimsonweed	*Datura stramonium*
kudzu	*Peuraria lobata*
mile-a-minute	*Polygonum perfoliata*
multiflora rose	*Rosa multiflora*
shattercane	*Sorghum bicolor*
Johnsongrass	*Sorghum halepense*

Table IV-3 *Noxius Weeds Listed in PENNDOT's Comprehensive Roadside Plan*

Perhaps the most rapidly advancing invasive species in Pennsylvania is purple loosestrife (*Lythrum salicaria*). This purple-flowered ornamental was introduced to the eastern United States circa 1800 from Eurasia where it was widely used in herbal remedies (Gleason & Cronquist, 1991). Purple loosestrife prefers wet meadows and moist terrace floodplains, where it can often be found in large stands up to 6 feet tall.

According PennDOT roadside specialists, purple loosestrife has not been identified within Indiana County but several large stands do exist in Armstrong County (T Sitler, PennDOT Engineering District 10-0, personal communication, February 25, 2000).

Similar to Japanese knotweed, purple loosestrife possesses opportunistic reproductive mechanisms. Reproduction in purple loosestrife is both sexual by seeding and vegetative by adventitious roots and rooting of buried and cut stems. Mechanical controls such as hand pulling, tilling, cutting, and mowing tend to enhance these reproductive mechanisms unless care is taken to remove the entire plant, seeds, and root systems.

Chemical controls like glyphosphate [N-(phophonomethyl) glycine] (i.e. Rodeo™) can be used but research suggests that the best solution for controlling purple loosestrife is an integrated pest management strategy. This includes a combination of several methods including mechanical, chemical, and biological controls. Mechanical and chemical efforts should be focused around the edge of the population to prevent further spreading.

In 1992, a biological control consisting of five insect species, mostly leaf-eating beetles and boring weevils that feed on this plant species in Europe, were approved as biological control agents in North America (Vermont Department of Environmental Conservation, 1998). Although there has been intense testing of these species with encouraging results, the use of introduced biological controls is strictly enforced and must be coordinated with the appropriate federal and state environmental agencies.

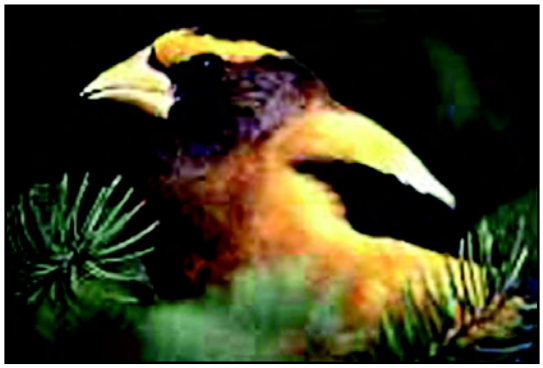
C. THREATENED AND ENDANGERED SPECIES

The Pennsylvania Natural Diversity Inventory (PNDI) is a comprehensive, site-specific database that describes significant natural resources occurring in Pennsylvania. The system includes information on threatened, endangered, and species of special concern; as well as unique ecological communities and habitats. Within this framework, three state agencies share the responsibility of tracking different types of organisms. The Department of Conservation and Natural Resources (DCNR) Bureau of Forestry manages plant species, the Pennsylvania Fish and Boat Commission (PFBC) tracks reptiles, amphibians, fish, and aquatic macroinvertebrates, and the Pennsylvania Game Commission (PGC) oversees mammal and bird species.

According to the PNDI, threatened species are defined as flora and fauna that may become endangered within the foreseeable future throughout their region in Pennsylvania. Endangered species are those organisms in imminent danger of becoming extinct or extirpated throughout their region in Pennsylvania. A database search conducted for the Crooked Creek watershed identified the species listed in Table IV-4 as occurring within or near the study area (Table IV-4).

Common Name	Scientific Name	Status
Puttyroot	*Aplectrum hyemale*	PA Rare
Upland Sandpiper	*Bartramia longicauda*	PA Threatened
Snuffbox	*Epioblasma triquetra*	PA Endangered
Wabash Pigtoe	*Fusconaia flava*	PA Endangered
Round Hickorynut	*Obivaria subrotunda*	PA Endangered
Rayed Bean Mussel	*Villosa fabalis*	PA Endangered
Rainbow Mussel	*Villosa iris*	PA Endangered

Table IV-4 *Threatened and Endangered Species Occurring in Crooked Creek Watershed*



Evening Grosbeak (*Hesperiphona vespertina*)

D. IMPORTANT HABITATS

1. Important Bird Areas

According to the National Audubon Society (1997), Important Bird Area's (IBA) are sites of special significance to breeding or non-breeding birds, which can be distinguished from surrounding areas. Boundaries may be natural, such as wetlands; or human-constructed, such as roads and property boundaries. An IBA should exist as an actual or

potential protected area, or have the potential to be managed in some way for the benefit of birds and other wildlife. There is no minimum or maximum size for IBA's, however, the IBA should be large enough to meet the habitat requirements of particular bird species during the season for which the habitat is utilized (e.g., migratory habitat). At least one of the five criteria below must be met in order to qualify as an IBA:

1. Sites where birds concentrate in significant numbers when breeding, in winter, or during migration

2. Sites for endangered or threatened species

3. Sites for Pennsylvania species of concern

4. Sites containing representative, rare or unique habitats, with characteristic birds

5. Sites for long term avian research or monitoring

At the time of this report, no IBA's existed within the Crooked Creek watershed, however, due to the largely rural nature of the watershed, potential areas for nomination may exist. One in particular is Blue Spruce County Park. According to representatives of the Todd Bird Club, studies of avian populations at the park are ongoing. Although the results so far indicate that the park does not qualify for nomination as an IBA, club representatives are continuing with their data collection.

2. Riparian Buffer Zones

A riparian buffer consists of an area of trees, shrubs, and herbaceous vegetation that is situated within the interface between a terrestrial and aquatic habitat. The ecological functions of a riparian zone are extremely complex but can be defined by three processes. The first process involves reducing the impact of upland sources of pollution from entering an aquatic ecosystem by trapping, filtering, and converting nutrients, sediments, and various deleterious chemicals. This process is achieved through plant uptake, soil absorption, or microbial synthesis. A second process performed by riparian zones is in-stream and fringe area habitat. Benefits to in-stream habitat include thermal buffering through in-stream shading, streambank stabilization, masses of woody vegetation for fish cover and escape habitat, and controlling the velocity of flood waters by energy adsorbing vegetation. The dense vegetation often associated with riparian zones provides fringe area habitat for terrestrial and semi-aquatic species. These habitats include breeding, cover, nesting, rearing, and resting areas. Finally, the biomass accumulated in large trees, shrubs and dense herbaceous vegetation provides

This area of dense streambank vegetation near Gableton is an example of a healthy, functioning riparian buffer. Note the dense root network and in-stream shading function.

essential food sources for aquatic and terrestrial organisms through detrital inputs, mast, and berry crops. In fact, detritus forms the organic base of the food web in most lotic ecosystems (Smith, 1991).

Agricultural encroachment, like at this area along Crooked Creek near Onberg, results in increased sedimentation, runoff pollutants, and bacterial contamination from livestock.

Throughout much of Crooked Creek's basin, negligent logging practices; poor land-use planning leading to excessive urban and residential development; and encroachments from agriculture, livestock grazing, and lawns has lead to the eradication of many riparian areas. According to Frey (1994), agriculture is the second largest cause of water quality degradation throughout the Central Allegheny River watershed. Furthermore, Frey (1994) attributes the source of this degradation to suspended solids and pathogens originating from the Crooked Creek basin.

Suspended solids and pathogens are both constituents associated with livestock encroaching on stream corridors. The impacts of livestock access may appear minimal, but consider the following facts from Dawes (n.d.):

- As few as 50 dairy cows allowed unrestricted access to a stream for 24 hours could contaminate the equivalent of one day's water supply for the city of Baltimore.
- One defecation by a dairy cow produces enough bacteria to make the equivalent of six swimming pools unsafe for swimmers.
- One cow produces approximately 5.4 billion fecal coliform bacteria per day and water with a fecal coliform count of 2 per 100 milliliters is unsafe to drink. This translates into enough bacteria to contaminate over 10 million gallons of water.

Examples of streambank fencing (left) and re-vegetation of riparian corridors (right).

The best solutions for controlling the problem are streambank fencing and the maintenance or establishment of riparian buffers to keep livestock out of the stream. Additional measures include the use of livestock watering facilities that are removed from the stream, the use of rotational grazing, and vegetated filter strips that remove sediments and pollutants before they reach the stream.

3. Farm Game & Forest Game Programs

Two wildlife management programs, the cooperative Farm Game Program and the Forest Game Coop, are available through the PGC. Both are designed to increase recreational opportunities on private lands for hunters while promoting management of the state's wildlife and habitat resources.

In 1999, the cooperative Farm Game program comprised a statewide network of 186 private projects in 59 counties, which opened nearly 2.5 million acres of private property to public hunting. The projects involve over 21,500 private landowners who have agreed to sign an agreement with the PGC to keep their lands open to public hunting. In exchange, the PGC provides landowners with seedlings for creating or augmenting wildlife habitat, informational and directional signs, law enforcement patrols, technical assistance from the Commission's natural resource specialists, wildlife seed mixtures, and border cuttings around agricultural fields to provide edge and transitional habitat.

Hunting is a popular sport throughout the Crooked Creek watershed.

The Forest Game Coop is comprised of forest, coal and gas companies, water authorities, and private individuals. To qualify for this program, a minimum of 1000 acres is required. In return for permitting public access to their properties, cooperators receive the same incentives as participants in the Farm Game program.

The agricultural land use prevalent throughout much of the Crooked Creek watershed makes both programs attractive mechanisms for improving both terrestrial habitat and recreational opportunities. As indicated on Figure 11, several hundred acres of Farm Game and Forest Game Coop lands are concentrated along the rural northern perimeter of the watershed.

4. Natural Heritage Inventory Areass

As part of an initiative to uncover Natural Heritage Areas in Pennsylvania, the Western Pennsylvania Conservancy conducts Natural Heritage Inventories for interested counties. The results of an inventory provides information on areas of unique and significant flora and fauna communities within the state. This data can be used in part for planning for biological diversity enhancements and ecological protection within specific regions or watersheds.

During the preparation of this plan a Natural Heritage Inventory had not been performed for Armstrong County, while Indiana County had declined the preparation of an inventory.

Chapter 5

Cultural Resources

Thomas Covered Bridge

V. CULTURAL RESOURCES

A. RECREATION

1. Types of Facilities

a) Public

1) Rail-Trails

Indiana County is one of nine southwestern Pennsylvania counties participating in the America's Industrial Heritage Project (ICOPD, 1990). The goal of the project is to foster economic development by building tourism through the county's rich industrial heritage. In 1990 the county commissioners submitted the Indiana County Heritage Preservation Plan , which outlines main heritage themes for Indiana County and potential projects.

One part of the heritage plan focuses on Indiana County's rail-trail network (Figure 12). This network provides several functions, most notably the recreational and economic benefit to the surrounding communities. Rail-trails also serve to preserve greenways, link cultural and historical resources, provide access between communities; and in some cases, serve as transportation corridors. At the heart of the region's developing trail network is the completed Ghost Town Trail (Table V-1), which extends between Nanty Glo in Cambria County and Dilltown in Indiana County. Features along the trail include Blacklick Creek, several ghost towns, the Blacklick Valley Natural Area, wildlife, and the potential for lumber, railroad, and iron making interpretation. Just west of Dilltown, another trail along Blacklick Creek has been proposed (Ghost Town Trail Future Extension) and is currently under study. If constructed, this trail would tie-in with the Ghost Town Trail to the east and the PA Route 119 Bikeway to the west. The PA Route 119 Bikeway is part of an improvement project along the existing PA Route 119. The bikeway will travel north to a point approximately 1 mile south of Homer City. The Hoodlebug Trail then continues from the northern terminus of the PA Route 119 Bikeway into Indiana. Features along this proposed section would include Blacklick Creek, the ghost town of Claghorn, Buena Vista Iron Furnace, the Josephine Blast Furnace site, and State Game Lands (SGL) 276.

Name/Segment	Location	Length (mi)	Status
Ghost Town Trail	Dilltown, Indiana County to Nanty Glo, Cambria County	16 finished, 19.5 planned	partially open
C & I Trail	Revloc to White Mill Crossing, Cambria County	23	under construction
Baker Trail	Allegheny National Forest to Freeport, PA	141	open
Great Shamokin Path	Yatesboro, Armstrong County	4	open
Hoodlebug Trail	1 mile south of Homer City to Indiana	6	partially open

Table V-1 - *Completed Trails in the Vicinity of the Upper Crooked Creek Watershed*

Also partially located within the watershed is the completed 141-mile Baker Trail that connects the Allegheny National Forest with Freeport, PA. An approximately 15-mile section of the trail parallels the Armstrong-Indiana county line between Mahoning Creek Lake and Shelocta.

Several additional potential rail-trails were identified in the Crooked Creek watershed and are summarized in Table V-2.

Name/Segment	Location	Length (mi.)	Status
B & O/32059	Armstrong County to Juneau	22.2	abandoned
Indiana Branch/32048A	Jefferson County to Creekside	26.2	active
Indiana Branch/32048C	Creekside to Homer City	15	out of service
Ridge Secondary/32048B	Creekside to Clarksburg	17.08	active from Creekside to Shelocta
Keystone Power Plant/32055	Shelocta to Armstrong County	unknown	active

Table V-2 - *Rail Line Data for the Upper Crooked Creek Watershed*

Located in the southern portion of the watershed, an approximately 15-mile section of the former Baltimore & Ohio Railroad extends from Homer City to Creekside (Table V-2). Owned by the CSX Corporation, six miles of this rail corridor (also known as the Creekside Extension) was included in the Heritage Trails Plan, and IUP has expressed an interest in acquiring a portion of the corridor. Highlights of the potential trail include an approximately 2-mile section adjacent to McKee Run, a 690 foot tunnel, the historic mining town of Ernest, and multiple bridges. If determined feasible, this rail corridor would also serve as a direct link between Blue Spruce County Park, downtown Indiana, Ernest, Creekside, and the developing trail and greenway network throughout southern Indiana County.

Another potential rail-trail is a 22.2-mile segment of the abandoned Buffalo & Susquehanna Railroad situated between Juneau and Sagamore (Table V-2). The majority of this segment is owned by the Kovalchick Salvage Company of Indiana, PA, and was included in the Heritage Trails Plan and the Indiana County Heritage Preservation Plan. The tracks and ties have been removed along this segment, as well as several bridges in the Plumville region. Recreational features of the potential trail include the historic McCormick Mansion, several bridges, Amish settlements, a winery and cheese factory, craft shops, the historic mining town of Sagamore, Bullfrog Campground, stretches along Mahoning and Plum Creeks; and potential links with Keystone Lake, Baker Trail, and Great Shamokin Trail.

Two additional segments of the former Baltimore & Ohio Railroad exist in Creekside. The first is an active 26.2-mile segment which heads north, passing through Chambersville, Marion Center, Hamill, and Rochester Mills before intersecting with the Sagamore to Juneau segment at Juneau (Table V-2). This section is currently owned by Norfolk Southern and features numerous bridges, access to Blue Spruce County Park, and miles of scenic vistas of Crooked and Little Mahoning Creeks. The second, also owned by Norfolk Southern, is an approximately 17-mile segment of the same rail that heads south along Crooked Creek through Shelocta before terminating at Clarksburg (Table V-2). Although active from Creekside to Shelocta, this segment is abandoned from Shelocta to Clarksburg. Highlights of this potential trail include the Thomas Covered Bridge, scenic vistas of Crooked Creek, and access to Shady Side Lake.

An active segment of the former Baltimore & Ohio Railroad intersects with the Creekside to Clarksburg segment at Shelocta (Table V-2). Owned by Keystone Power Plant, Norfolk Southern operates freight over this 4.3-mile potential rail-with-trail. Features include access to Shady Side Lake, seven bridges, and a potential link to the Baker Trail.

2) Parks and Campgrounds

Although not a comprehensive inventory, Table V-3 lists some of the parks and recreational facilities identified within the study area. Additionally, the Charbert Farm Bed & Breakfast located in Shelocta and the Farnsworth House Bed and Breakfast located in Marion Center were identified.

Facility	Municipality	Acreage	Amenities
Armstrong Township Park	Armstrong Township	unknown	unknown
Blue Spruce County Park	Rayne Township	420 land 12 water	Lake, hiking trails, horseback trails, nature programs, cross-country skiing, amphitheater, grills, playgrounds, comfort stations, handicap access, lodge, pavilions, telephone, sledding, softball field, visitor center, volleyball court
Shelocta Community Park	Armstrong Township	29 land 2 water 0.5 stream miles	Ballfields, playground
Wheel-In Campground	Shelocta Borough		Campsites, electric, water, sewage, dump station, fishing, swimming
Creekside Borough Park	Creekside Borough	1.5 land	Picnic pavilion, BBQ pits, playground, ball fields, basketball courts, restrooms
Marion Center High School	East Mahoning Township	25 land	Baseball , softball, and football fields, track, basketball courts, fitness rooms, auditorium, swimming pools, arts/crafts rooms, restrooms
Marion Center Community Park	Marion Center Borough	20 land	Baseball fields, tot-lot, picnic pavilion,
White Woods Nature Center	White Township	245 land	5 miles hiking and nature trails, 3 miles x-country skiing trails
Elderton Elementary School	Elderton Borough	8.5 land	Basketball courts, tot-lot, gymnasium, restrooms, food facilities
Elderton High School	Elderton Borough	22 land	Baseball fields, soccer field, basketball courts, gymnasium, wrestling/boxing rooms, tennis courts, arts/craft rooms, restrooms, food facilities
Elderton/Plum Creek Area Park	Elderton Borough	13.4 land	Baseball fields, soccer fields, tennis courts, basketball courts, racquetball courts, tot-lot, picnic pavilions, restrooms, food facilities
Plumville Parks (2)	Plumville Borough	unknown	unknown

Table V-3 - *Parks and Recreational Areas in the UpperCrooked Creek Watershed*

Ballfields and community parks are commonplace in many of the small towns and boroughs within the watershed.

The western perimeter of Blue Spruce County Park and the breast of Cummings Dam.

Located six miles north of Indiana in the central part of the watershed, the 420-acre Blue Spruce County Park is the only county owned park in the study area. Park access is provided via PA Route 110.

Numerous amenities are available at the park, which features a 12-acre lake associated with Cummings Dam. The lake, which is stocked with trout, offers angling opportunities for local fisherman. The park's 68 species of trees and shrubs, 170 species of wildflowers, and 15 different species of ferns, coupled with 6 miles of hiking trails, horseback trails, nature programs, and cross country skiing make it an attractive opportunity for outdoor enthusiasts. Other facilities include an amphitheater, charcoal grills, playground, comfort stations, handicap access, horseshoe courts, lodge facilities, pavilions, telephone, sledding, softball field, visitor center, and volleyball court. Another highlight of the park is its extensive trail network consisting of seven hiking trails (Map 1).

3) Fishing

In 1998, Pennsylvania supported 363 Class A wild trout stream sections totaling over 1103 miles, 101 Wilderness Trout Streams, and nearly 1600 stream sections with verified trout reproduction (PFBC, 1998a; PFBC, 1998b; PFBC, 1999a). Of these, Indiana and Armstrong Counties accounted for only 13 reproducing trout sections and only one of these, Crooked Creek, was located within the study area. No Class A or Wilderness Trout Streams were located in the study area.

In addition, of the thousands of Approved Trout Waters in Pennsylvania (waters that meet criteria to be stocked by PFBC) only the North Branch Plum Creek occurs within the study area (PFBC, 1999b).

According to PFBC (1997), before a stream can qualify for the Hatchery Trout Subprogram, several biological, chemical, and social factors must be evaluated. These include:

- the status of wild trout populations
- stream size
- recreational use
- potential public access
- land ownership
- proximity to population centers

Although individual streams sections in the study area were not evaluated for their trout stocking potential, observations made during qualitative stream sampling and a canoe trip suggested that the primary factor limiting trout stocking was water quality. A more comprehensive discussion of water quality is located in the Water Resources Section of this document.

Water quality data collection along Crooked Creek's main stem near Creekside.

The following named lakes were identified within the study area: Shady Side Lake, near Shelocta; Cummings Dam, near Ernest; Keystone Lake near Sagamore; and Green Valley Lake, near McIntyre

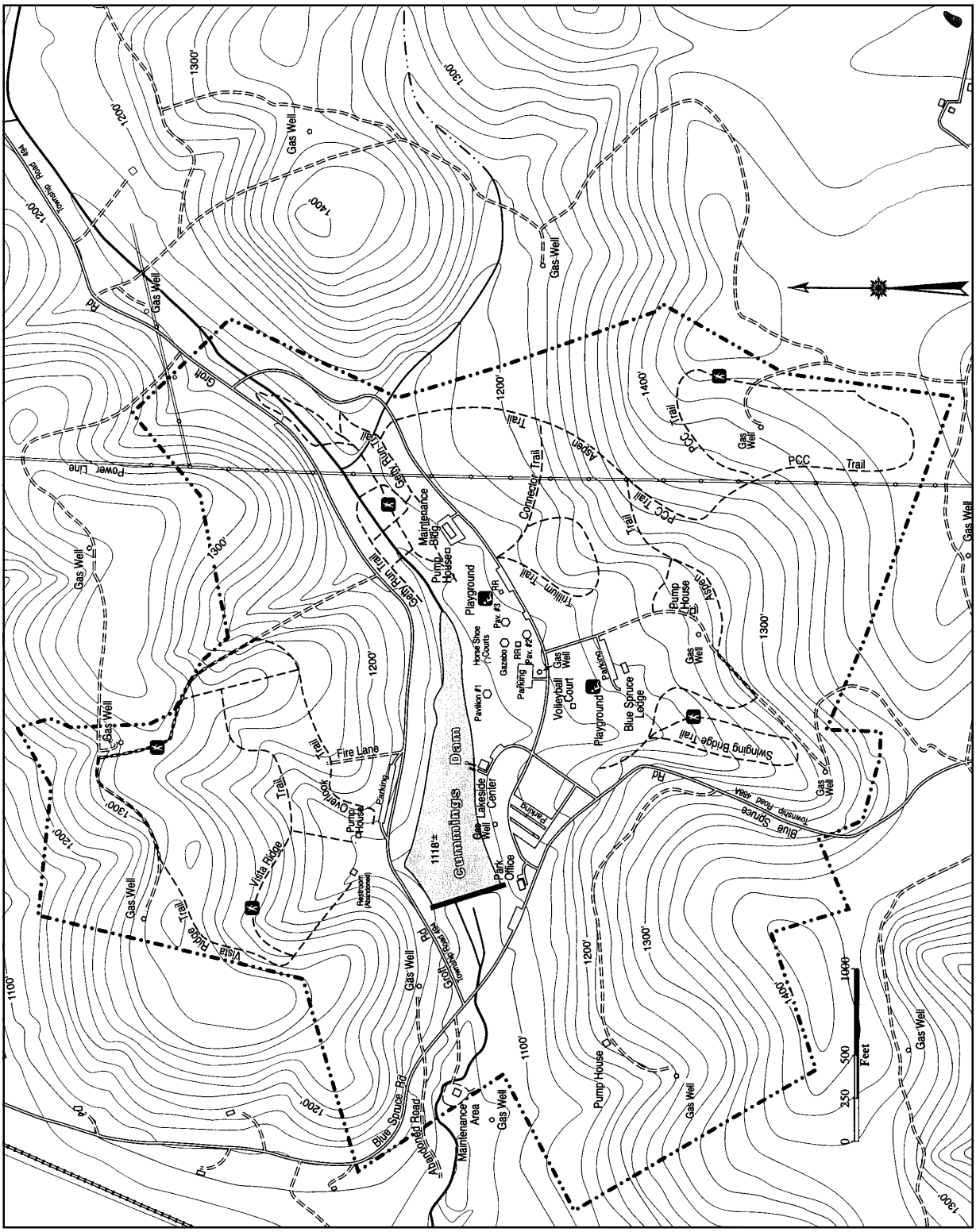
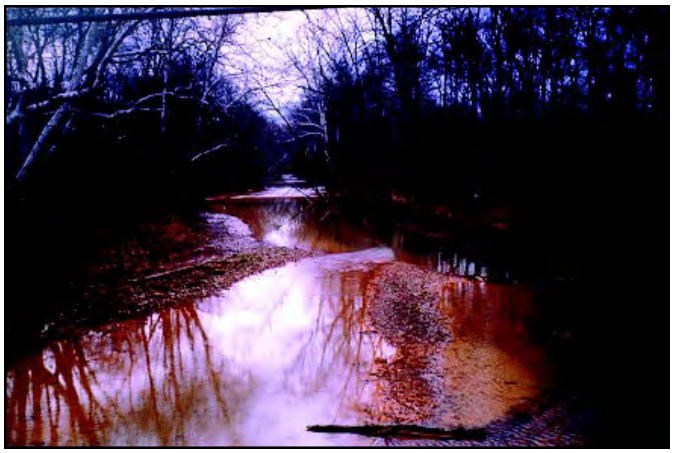


Table V-4 - *Blue Spruce County Park*



Severe AMD, like along this stretch of Crooked Creek near Fulton Run, is one of the primary pollutants prohibiting the propagation of naturally reproducing trout fisheries.

(Figure 2). Although none of these lakes were managed by the PFBC, the Atwood and Numine (Keystone) PFBC boat access areas were identified on Keystone Lake. In addition, Keystone Lake is managed under the PFBC Big Bass Special Regulations Program. Under this program, fishing for largemouth, smallmouth, and spotted bass may is limited to between January 1 to April 16 and June 12 to December 31. Also, the minumum size for harvest is increased to 15 inches and the daily limit is reduced to 4 (PFBC, 1999b).

4) Golf Courses

Bryan Hill Manor Golf Course and the Indiana Country Club are both located along the extreme southeastern perimeter of the watershed.

A Pennsylvania Native Brook Trout (*Salvelinus fontinalis*).

5) Hunting

Although there were no state game lands (SGL) identified within the Crooked Creek watershed, as discussed under the Biological Resources Section, the Pennsylvania Game Commission's (PGC) cooperative Farm Game and Forest Game Coop programs represent statewide networks of private landowners, as well as forest, coal, gas companies, and water authorities who permit the use of their lands for public hunting. Several hundred acres of these coops are concentrated in the headwater region of the watershed (Figure 12).

Statistics on the number of small game and waterfowl hunting trips and harvest rates were not available, however, Tables V-4 and V-5 lists the harvest statistics for whitetail deer and black bear over the past seven years.

6) Potential Future Attractions

As outlined in the Indiana County Heritage Preservation Plan (ICOPD, 1990), several projects throughout the county represent future tourist attractions and opportunities for increased economic development. Most of the projects proposed are conceptual in nature, and detailed feasibility studies would need to be conducted before development could occur. Some of the projects identified by ICOPD (1990) are summarized below.

Coal Town Tours - This project would consist of tours and interpretation of Indiana County's historical coal centers. Clymer was initially suggested because it was the largest coal town

Year	Bear	Antlered Deer	Antleress Deer
1993	26	3489	4241
1994	36	4085	6396
1995	71	4140	5900
1996	38	3593	4227
1997	30	4164	5133
1998	23	4474	5680
1999	51	4517	5919
2000	45	5139	6515

Table V-4 - *Indiana County PGC Harvest Statistics*

Year	Bear	Antlered Deer	Antleress Deer
1993	14	3097	2980
1994	9	3335	5721
1995	31	3415	4996
1996	20	3235	3901
1997	13	3785	4448
1998	18	4168	5289
1999	12	4199	4590
2000	38	4495	7116

Table V-5 - *Armstrong County PGC Harvest Statistics*

in the county and has numerous sites of interest. Other towns included Ernest, Iselin, Lucernemines, Rossiter, Heilwood, Commodore, Whiskey Run, and numerous other mine patch and ghost towns.

Exhibits and/or a replica relating to the early salt industry - According to ICOPD (1990) this industry marked the beginnings of the industrial revolution in Indiana County. Steam engines and coal were both used for the first time in the county because of the salt industry.

Tours of Operating farms and Christmas tree nurseries - Farms would offer demonstrations in milking, hay making, harvesting crops, Christmas tree farming; as well as recreational opportunities such as horseback riding, swimming, and hay rides. Farms may also create exhibits featuring antique farm tools and equipment.

Historic coal mine at Iselin.

Natural gas exhibits contrasting old and new methods - This intepretation might include a replica of a historic drilling derrick and a discussion of old-fashioned methods, followed by a visit to an operating well or an equipment depot where a guided tour would highlight modern drilling methods.

Steam train excursions from Indiana to Punxsutawney - This project would utilize the former Buffalo, Rochester, & Pittsburgh Railroad which is still operational. Built in 1903 - 1904, this rail passes through several coal patch towns, one tunnel, and several bridges.

Amish Horse and Buggy near Smicksburg.

A historical drama on a theme of local and regional history - Plans for this project involve the construction of an outdoor ampitheater or indoor facility to produce historical drama.

Cherry Tree Joe Lumberman and Raftsman Festival - Known as the U.S.'s original Paul Bunyan, Cherry Tree Joe lived in Cherry Tree and worked as a raftsman. A Lumberman and Raftsman Festival could be organized in Cherry Tree including folk arts and crafts, bake sales, games, lumberman competitions, and raft and canoe races.

b) Private

The only private facility identified within the study area was the Shelocta Sportsmen's Club and Lake.

B. ARCHAEOLOGICAL AND HISTORICAL

1. Historical Overview

Indiana County's recorded history began circa 1727 when James LeTort, a French trader, established an Native American trading post near the town of Shelocta (Historical and Geneological Society of Indiana County [HGSIC], 2000). Throughout the early 1700s numerous other traders traveled through the county including famous frontiersmen Conrad Weiser, Peter Shaver, Benjamin Franklin's son William, and John Harris, Sr. who established Harris's Ferry at what is now Harrisburg.

In 1756, at the time of the French and Indian War, Lt. Col. John Armstrong led the 307-man Second Battalion of the Pennsylvania Regiment from Fort Shirley, in what is presently known as Huntingdon County, to overtake the Kittanning Path, a widely used Indian trail that parallels the current US Route 422. In what became known as the Battle of Blanket Hill, Armstrong and his men attacked and overtook the Indians near town of Kittaning. The route, which was renamed the Armstrong Path, is now preserved by the Armstrong Trail Society and used for hiking and nature studies.

The southern portion of Indiana County was purchased by Thomas and Richard Penn, sons of William Penn, from the Iroquois Confederacy or "Six Nations", in 1768 in the first Treaty of Fort Stanwix. The line of purchase, which extends across the center of the county, is known as the purchase line and is commemorated by a monument at Cherry Tree.

In 1784, the Penns signed the second Treaty of Fort Stanwix with the Native Americans for the purchase of the northern section of the county, which became part of Northumberland County. In 1795, Lycoming County was created from part of Northumberland and later became Indiana County.

The areas to the north and south of the Purchase Line were joined in 1803 by the Pennsylvania Legislature, forming Indiana County. Shortly after formation, competition for the county seat developed. In 1805 George Clymer of Philadelphia, a signer of both the Declaration of Independence and the US Constitution, donated approximately 250 acres to be used as the county seat, which later became the town of Indiana.

In 1806, all official business was transferred from Greensburg, and the first session of the Indiana County Court was held at Peter Sutton's Tavern in the town of Indiana. Four years later, the first county courthouse was constructed. During this period the county's population was 1,214 people according to the 1810 census. In 1816, the same year Pittsburgh was incorporated as a city, the town became known as the Borough of Indiana.

Also early in the 1800s, transportation began to develop rapidly. In 1807 Frankstown Road was improved and tolls collected when it became a turnpike. Later in 1825, the success of the Erie Canal in New York state and the Schuylkill Canal connecting Pottsville and Philadelphia, initiated the Canal Age. The Pennsylvania Canal, linking Pittsburgh with Philadelphia by a series of waterways and railroads, began in 1826 with the Conemaugh River comprising a critical link. By 1829, canal boats were common at towns like Blairsville and Saltsburg, and by 1834 the canal was operational along its entire length. However, use of the canal would last only 30 years, being phased out by a more efficient railroad system in the 1860s. The period between the 1830 and 1840 also saw Indiana develop as a local center for abolitionists, with the county serving as one of the mail lines for the Underground Railroad.

The first large scale industry in the county was the manufacture of salt, which was accomplished by evaporating salt water pumped from wells throughout the county. The industry's center, located in the southwestern part of the county, was aptly named Saltsburg.

As early as 1795, the burgeoning coal mining industry began to make its mark throughout the county, soon rivaling farming as the backbone of the local economy. Numerous iron furnaces were constructed in the 1830s, but operations ceased when timber used for making charcoal became scarce. Charcoal fuel was soon replaced by the more efficient coke, and by 1905 coke production became a driving industrial force with the construction of beehive coke ovens at Ernest.

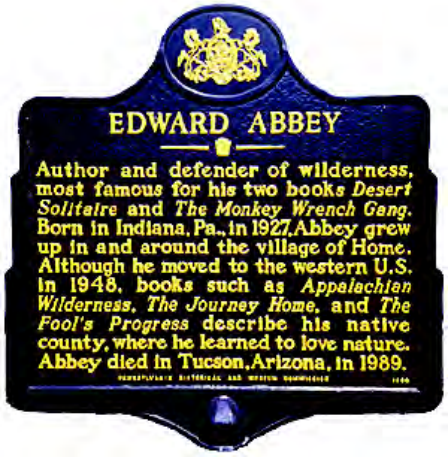
More recently, Indiana has been noted as the birthplace of film star Jimmy Stewart, as well as the Christmas Tree Capitol of the world, marketing over one million trees annually (Indiana County Tourist Bureau, 2000).

Another notable and often overlooked native of Indiana County is the internationally known writer and novelist Edward Abbey. Born in Indiana Hospital in 1927, Abbey spent the first 21 years of his life in the area near Home, PA, before moving to the West in 1948. In the years to follow, his literary work would receive world-wide recognition, with Abbey winning a Fulbright Fellowship to Edinburg University in Scotland in 1951, a Wallace Stegner Creative Writing Fellowship to Stanford in 1957, and a Guggenheim Fellowship in 1974.

The author of over 20 books, Abbey became perhaps best recognized for his stories about the canyons and deserts of the American Southwest where he has been called the "Thoreau of the American West", attracting an almost cult-like following. In fact, his book *Desert Solitaire*, a collection of essays about the red rock country of Arches National Park and Canyon-lands National Park in Utah, is considered by many critics as the best twentieth-century book about the natural world (Cahalan, 2000).

Despite the frequent references to his native region, which are apparent in most of his writings; his work was, and remains today, largely unknown to Western Pennsylvania natives. His anonymity is ironic as Abbey himself considered the Indiana County heritage crucial to his voice as a writer (Cahalan, 2000). His self-proclaimed masterpiece *The Fool's Progress* is autobiographical and deals with his boyhood adventures around Crooked Creek and his eventual return home. According to Cahalan (2000), Abbey's intense desire for hometown recognition is reflected in the story when Abbey's autobiographical protagonist, Henry H. Lightcap, comes upon a historical marker honoring the author.

Although he returned to the Indiana University of Pennsylvania (IUP) and Home, PA several times throughout his career, Abbey never received the recognition he did elsewhere. Sadly, following his death in Tuscon, Arizona in 1989, initial proposals to his home state for a historic marker commemorating his work were met with the reaction, "Who's Edward Abbey" (Cahalan, 2000). Shortly afterwards, friends of Abbey including Robert Redford, Kirk Douglas, and others who knew him well, wrote letters of support for the historical marker. The historical marker was approved and dedicated by PHMC in September 1996 on US Route 119 in Home, PA.



2. Historical Sites

A review of the National Register Listed Individual Properties and Historic Districts in Pennsylvania and Properties Determined Eligible by the Bureau for Historic Preservation (Pennsylvania Historical & Museum Commission [PHMC], 1997) identified four National Register Listed covered bridges in the watershed (Figure 12, Table V-6).

Located along T-890 and spanning Crooked Creek, the Kintersburg Covered Bridge was constructed in 1877 at a cost of $893. Named for Isaac Kinter, a local storekeeper, Kintersburg is the only Howe Truss covered bridge in Indiana County. Located to the east near the village of Davis are the Trusal and Harmon Covered Bridges. Both structures span Plum Creek South Branch. The Trusal Bridge was constructed in 1870 and is known locally as Dice's Bridge, while the larger Harmon Bridge was erected in 1910. The last of Indiana's covered bridges, the Thomas Bridge, spans Crooked Creek near Fulton Run and was built in 1879 for $540 by Amos Thomas. At 93 feet, the Thomas Bridge is more than twice the length of the Harmon Bridge and is the county's only covered bridge in use today.

In addition to listings on the National Register of Historic Places, numerous buildings and structures have been determined to be eligible for listing on the National Register. A review of two Indiana County Historic Sites Surveys (Indiana County Planning Commission [ICPC], 1985a, 1985b, 1989) and the Armstrong County Historic Site Survey (Armstrong County Department of Economic and Communtiy Development [ACDECD], 1982) identified the following resources as eligible for listing on the Register.

Marion Center Borough

Architecture within Marion Center owes its influence to the Borough's roots as an economic trade center. Of the 19 structures surveyed within the borough, eight buildings have been determined eligible for National Register status and are discussed below.

Name	Municipality	PHMC Status
R.H. Harbison House	Young Township	Eligible
Buffalo, Rochester, Pittsburgh, Railway	Various	Eligible
Thomas Bridge	Armstrong Township	Listed
Kintersburg Covered Bridge	Rayne Township	Listed
Harmon's Covered Bridge	Washington Township	Listed
Trusal Covered Bridge	Washington Township	Listed

Table V-6 - *PHMC Historical Sites in the Upper Crooked Creek Watershed*

The Kintersburg and Thomas Covered Bridges are both listed on the National Register of Historic Properties.

Located on Manor Street, the four story, wooden frame Marion Center Milling Company was constructed in 1912. The mill's lack of design features make this a prime example of the Vernacular Utilitarian style. The mill is also representative of Marion Center's oldest industry. A similar Vernacular Utilitarian style structure is the Co-Operative Creamory (1913) located on South Manor Street. Primarily responsible for producing bottled milk and churned butter, this barnlike structure with centered cupola exemplifies Marion Center's ties with its rural environment.

Built for John K. Thompson, one of the borough's most prominent physicians and a later politician, the Vernacular Four Over Four style Thompson residence located on Main Street was a popular style in Pennsylvania from 1820 to 1860 (ICPC, 1985a). Characterized by four rooms on each of its two stories, this particular house is recognized for its architectural contribution and its association with commerce in the community.

The Rochester House was constructed in 1861 for John C. Rochester, a prominent local businessman. In addition to the rarity of this High Style Greek Revival design in northern Indiana County, the Rochester House is recognized for its association with Marion Center's most prominent merchant.

The former Marion Center Schoolhouse on Factory Street was constructed in 1901. This Colonial Revival structure was used for education until 1929 and exemplifies early educational dwellings of the period.

Also located on Factory Street is the Park House, named for its owner Robert Park the son of Marion Center's first settler and founder in 1808, John Park. Modeled in the I-House tradition, which was a popular style of farmhouse from 1840 to1900, the Park House was constructed circa 1840 and is the only resource relating directly to the founding Park family.

Main Street Marion Center.

Another I-House located on Main Street is the Walter H. Klinsing House. Recognized as being the only 19th century brick I-House in Marion Center (ICPC, 1985b), the Eastlake style spindelwork of the front porch adds to the significance to this property.

Marion Center's only National Register Eligible example of the Vernacular Commercial style is the abandoned Blacksmith shop constructed and operated by Norris E. Barr, circa 1911. Although in need of significant restoration, the shop is representative of Marion Center's roots in the railroad and mining industries.


Marion Center Hotel

Ernest

Originally designed by the Jefferson and Clearfield Coal Company as a model mining town, Ernest was once home to over 200 "company houses" built by Hyde, Murphy, & Co (ICPC, 1985b). These dwellings featured little stylistic detail and were designed to house one or two workers and their families. According to ICPC (1985), Ernest's best example of the company-built worker houses is located on SR 110. This unusual duplex style company house is recognized for its direct realtionship with the initial establishment of the community and its association with the major industry of the town.

Rayne Township

Spanning the width of Crooked Creek near Chambersville, Rayne Township, is an excellent example of a Pratt Truss Railroad Bridge constructed in 1903. Although the bridge's estimated date of construction is relatively recent, it provided an integral crossing for the Baltimore and Ohio Railroad during its heaviest use throughout the first half of the 20th century.

From 1898 to 1904, the Buffalo, Rochester, and Pittsburgh Railroad constructed railroad lines that connected Punxsutawney and Indiana. The railroad's purpose, after its final stage of construction in 1904, was to transport extracted minerals from the rich Indiana County coalfields. After several transfers in ownership, the B&O Railroad purchased the lines in 1932. Although the railroad is not heavily used today, it remains in excellent condition. Because of its architectural and historical significance, the railroad bridge may be eligible for listing on the National Register.


Coal Mines at Ernest

Named for an early landowner A.E. Cummings, Cummings Dam was constructed in 1908 by the Buffalo, Rochester, and Pittsburgh Railway. Later enlarged in 1912, the primary reason for constructing the dam was to protect the locomotive equipment from polluted waters. As a result of mining activities in the upper watershed, many of the streams were contaminated with AMD, which translated into a great expense for the railroad when highly corrosive, acidic tributary waters fouled the locomotive boilers. To combat the problem, the railroad quickly began purchasing enormous tracts of surrounding land in an effort to control pollution and protect the waters. The result was the construction of Cummings Dam and the reservoir associated with it.

Although in significant need of restoration, remnants of the 41 acre Lezanic Farm and Homestead can still be found along the Vista Ridge Trail in Blue Spruce County Park. All that remains today is the stone foundation and a well. The site's use as an interpretive site would require extensive trash removal and the clearing of much vegetation.

Intact remnants of the Getty Homestead include a barn foundation and a small outbuilding which can be seen along the Getty Trail in Blue Spruce County Park. Unfortunately, overgrown vegetation and years of neglect prohibit the sites use as an interpretive area.

Plumville Borough

Like other "coal patch" towns of the region, Plumville's architecture was heavily influenced by the construction of Buffalo and Susquehanna Railroad and large scale mining thoughout the area. According to ICPD (1985a), eight structures appear to be eligible for National Register status and are discussed below.

The only remaining structure of the Greek Revival style left in Plumville is located at the intersection of PA Route 85 and Smicksburg Street. Constructed circa 1850 and originally thought to function as the borough's post office, this present day beauty salon was once used as residences and offices for two of Plumville's physicians.

The Woodworth residence, located on Main Street, was constructed circa 1900 - 1910 and has been described as the best example of the Colonial Revival style in the borough. According to ICPD (1985b), this was a time of rapid growth in Plumville, initiated by the large-scale coal mining operations developing in the surrounding regions. The original builder of the house is unknown but it is rumored that the house was purchased by Governor John S. Fisher for his sister.

One of two excellent examples of a Vernacular Commercial style structure in the borough is Lukehart's Hardware Store (ICPD, 1985b). Characterized by a false front extending above the roof line to make the building appear larger from the front, the store was constructed circa 1900 - 1924.

Once a 19th century hotel, Helen's Laundromat on Main Street is a classic structure exhibiting the Four Over Four vernacular style. Constructed circa 1871, the building's history as a large, wood-frame hotel is significant due to the integral part that these structures played in the "market square" atmoshpere along Main Street (ICPD, 1985b).


Main Street Plumville

Another excellent example of the Vernacular Commercial style is the Plumville Dry Cleaners building, also located on Main Street. As with other similar commercial structures, this false front style was widely used during the early part of the century when small communities, like Plumville, were experiencing rapid development as a result of the coal mining and railroad industries (ICPD, 1985b).

Located on the south side of Main Street, the Griffith Residence was constructed circa 1880 and is considered significant for its Vernacular Eastlake style and integrity (ICPD, 1985a).

The Plumville Schoolhouse on Main Street was constructed circa 1905 and its Colonial Revival styling is representative of frame schoolhouses of the period (1985b). Shortly after its construction, the school was moved in 1909 and the second half of the structure was built in 1916.

The last resource in the borough determined to be eligible for National Register status is the Halsey Residence which is a classic Bungalow/Neo-Classical design. Again, as a result of the coal mining and railroad industries, major residential development occurred within most of Indiana's small boroughs and towns (ICPD, 1985b), and this structure typifies the Neo-Classical design commonly used.

Atwood Borough

The only structure within the Armstrong County study area identified as eligible for listing on the National Register of Historic Places was the Duff Estate located on Indiana Street. This residence is a classical Four Over Four folk type dwelling, constructed in 1878 at a cost of $2,225.30 (ACDECD, 1982). According to ACDECD (1982), the integrity of the structure is excellent overall and represents one of the finest examples of folk architechture found in the entire county.

CHAPTER 6

ISSUES, CONCERNS, CONSTRAINTS, & OPPORTUNITIES

Signs of AMD Along Crooked Creek

VI. ISSUES, CONCERNS, CONSTRAINTS, AND OPPORTUNITIES

Much of the Upper Crooked Creek watershed provides a scenic, undeveloped area that has the potential to attract a great number of tourists to its natural, cultural, and recreational resources. Numerous issues, concerns, constraints, and opportunities were identified within the watershed in the subject areas of land use, water quality, biological resources, historical interpretation, and new recreational opportunities.

The availability of a wide variety of underutilized, resources was one of the greatest strengths of the watershed. Capitalizing on this strength by encouraging both residents and non-residents to use these resources in greater numbers should be an important outcome of this plan.

The primary issues, concerns, constraints, and opportunities identified during the development of this plan are outlined below and discussed in further detail in Chapters 1 through 5.

A. LAND RESOURCES

- Because of their high quality physical and chemical elements, land areas with prime agricultural soils are leading sites for development. This represents a major issue within the watershed and it is imperative that prime agricultural soils are delineated and acreage is calculated when planning for future development of the region.

- Agricultural Security Areas (ASAs) are active and viable farmlands that have been enrolled in a statewide program to restrict specific types of development on designated agricultural properties. An ASA designation is administered by local municipalities and counties, and although designation does not result in tax relief for landowners, ASAs protect farmland areas from indiscriminant condemnation, allow for future farming of the land, and absolve the areas from legislation that would be detrimental to farming operations. Over 36,000 acres of ASAs existed within the watershed at the time of this report.

- State and county governments can also purchase conservation easements of prime agricultural lands located within ASAs. The goal of easement purchases is to preserve the productivity of prime agricultural production lands, in perpetuity. Although neither of the counties in the watershed have farmland in the easement program, Indiana County has recently developed an Agricultural Lands Preservation Board, and Armstrong County has begun to develop a county program and has appointed a Board to oversee its development.

- Unregulated dumping of refuse at non-permitted sites has been identified as a major issue within the study area. Apart from decreasing the aesthetic character of the watershed, illegally dumped trash along Crooked Creek and its tributaries can wash into the stream during normal rainfall events creating polluted, and sometimes hazardous, water quality conditions.

- Numerous abandoned coal mines occupy the Crooked Creek watershed. Historic resource extraction associated with underground deep mines and surface mines has left a legacy of coal refuse piles, scarred landscapes, and abandoned mine shafts throughout the watershed. Underground mine pools occupying abandoned deep mines threaten both ground and surface water quality.

- Coal refuse piles represent another threat to water quality throughout the watershed. The largest refuse pile identified within the watershed was Air Products Ernest Coal Refuse site. This site has been historically problematic as a result of polluted waters from the refuse pile, and the deep mine beneath it, entering McKee Run.

B. WATER RESOURCES

- The destruction of riparian habitat ultimately is the most detrimental byproduct of floodplain encroachment from development. Degradation of floodplain and riparian habitat by agricultural and urban land uses within the Crooked Creek watershed has had a significant influence on aquatic fauna. When encroachments from development occur within a floodplain area, other ecological benefits are compromised. For example, the ability of the floodplain to buffer and filter sediments from entering the stream can be greatly abated.

- Encroachments by residential developments are also responsible for impacts to the floodplain. Although all of the municipalities within the watershed have ordinances restricting development within the floodplain, some floodplain encroachments have occurred within the watershed prior to the adoption of these regulations. Most of these encroachments were residential and concentrated in the population centers of Creekside, Ernest, Marion Center, and Shelocta.

- The history of resource extraction, agriculture, and development within the Crooked Creek watershed has created various sites of degraded surface and ground water quality conditions. Although some portions of the Crooked Creek watershed remain in fair to good biological health, the three largest sources of reported impairment within the basin are acid mine drainage, municipal waste, and agriculture pollution, a combination of both point and non-point source pollutants.

- According to Koryak (1980), acid drainage from both active and abandoned mines has been the most implacable water quality issue within the study area.

- The Crooked Creek watershed has been designated as a High Priority Water on the NPS Priority Degraded Watershed List (DWL) under PADEP's Non-point Source Control Program.

- Significant mine drainage pollution occurs at various points within the study area. Areas include a coal refuse pile on McKee Run, the Kintersburg Drift Mine, the Tanoma South Borehole, and Air Products Ernest Coal Refuse Site.

- Unmanaged agricultural practices create frequent disturbances to waterways such as fertilizers, manure, pesticides, and silt from agricultural lands entering streams within the watershed. This situation leads to heavy siltation, nutrient accumulation, and suspended solids within stream systems, disrupting both the chemical and biotic health of the watershed. Nutrients from agriculture runoff also leach into soils and potentially contaminate groundwater supplies. Finally, unrestricted access of livestock into streams also creates numerous problems. Along with increasing peril to the livestock, i.e., creating an increased capacity for bone fractures, herd contamination, etc., livestock can accelerate streambank erosion, sedimentation, and surface water nutrient enrichment through excrement into the streams.

- A1994 non-point source pollution assessment by the Armstrong County Conservation District, in cooperation with the Indiana County Conservation District, for the Crooked Creek and Cowanshannock Creek watersheds identified three subwatersheds as high priority areas for the implementation of Best Management Practices: Plum Creek, Crooked Creek upstream from Creekside, and Plum Creek – South Branch

- Raw sewage discharges have been observed at various locations within the Upper Crooked Creek watershed. A related issue is the presence of on-lot sewage treatment and disposal. Many residential systems within the watershed are older, malfunctioning, and in need of repair. The greatest threat with malfunctioning sewage systems and raw sewage discharges into surface waters is enteric pathogens associated with fecal coliform bacteria.

- A problem associated with oil and gas extraction in the watershed is the disposal of unwanted brine, which may contain contaminants such as heavy metals. Another significant threat associated with gas wells is the waste pit sludge. Although the pits are required to be lined by PADEP's Bureau of Oil and Gas, many are not, resulting in potential groundwater and surface water contamination.

- Of the 35 community water systems in Indiana County, 17 come from groundwater sources. Groundwater contamination may result from a variety of sources and can often impact public water supplies. This fact conveys the importance of preventing and remediating groundwater pollution.

- Although marked water quality improvements are apparent within the study area, issues such as heavy metal pollution from the AMD and nutrient increases from raw sewage remain.

- PFBC and other public boat and fishing access areas were lacking. Although there were a number of small private household points of access, public access by boaters and fishermen was limited within the watershed. This limited public access is primarily due to land ownership, pollution, railroads, highways, and steep slopes.

C. BIOLOGICAL RESOURCES

- The Pennsylvania Herpetological Atlas project is an important project within the Upper Crooked Creek watershed. The goal is to provide detailed species distribution maps; identify critical reptilian and amphibian habitat; develop comprehensive databases for use by researchers, conservation planners, and government agency personnel; identify and track distributions of threatened and endangered species, and estimate the population status for a variety of species.

- Historic resource extraction, unmanaged timbering, and agricultural activities has destroyed the majority of old-growth forest land in the Upper Crooked Creek watershed. Although the watershed's forests are dominated by even-aged, relatively immature stands, some of the heavily mined areas of the watershed are characterized by dense stands of red pine (*Pinus resinosa*) mixed with pioneer species such as eastern cottonwood (*Populus deltoides*) and bigtooth aspen (*Populus grandidentata*), which provide soil forming functions and dense cover and roosting habitat for species such as the ruffed grouse.

- Exotic and invasive species are a significant problem in the Upper Crooked Creek watershed. These non-native species, which typically interact and out-compete native vegetation, have been declared noxious because they spread very rapidly, are particularly difficult to control once established, and pose a threat to agriculture.

- Results from the Pennsylvania Natural Diversity Index indicated that seven rare, threatened, or endangered species may potentially occur in the Upper Crooked Crooked Creek watershed.

- Due to the largely rural nature of the watershed, potential areas for nomination as Important Bird Areas may exist. One in particular is Blue Spruce County Park. According to representatives of the Todd Bird Club, studies of avian populations at the park are ongoing.

- Throughout much of Crooked Creek's basin, negligent logging practices; poor land-use planning leading to excessive urban and residential development; and encroachments from agriculture, livestock grazing, and lawns has lead to the eradication of many riparian areas.

- Hundreds of acres of land within the watershed are enrolled in the Pennsylvania Game Commission's cooperative Farm Game Program and the Forest Game Coop. These programs are attractive mechanisms for improving terrestrial habitat and recreational opportunities.

- Natural Heritage Inventories are lacking for both Armstrong and Indiana Counties. The results of an inventory could provide information on areas of unique and significant flora and fauna communities within the watershed.

D. CULTURAL RESOURCES

- Indiana County is one of nine southwestern Pennsylvania counties participating in the America's Industrial Heritage Project. The goal is to foster economic development by building tourism through the county's rich industrial heritage. Part of the plan focuses on Indiana County's growing rail-trail network. This network provides several functions, most notably the recreational and economic benefit to the surrounding communities. Rail-trails also serve to preserve greenways, link cultural and historical resources, provide access between communities; and in some cases, serve as transportation corridors.

- Several projects outlined in the Indiana County Heritage Preservation Plan such as coal town tours, tours of operating Christmas tree farms, and steam train excursions represent future tourist attractions and opportunities for increased economic development.

- In 1998, Pennsylvania supported 363 Class A wild trout stream sections totaling over 1103 miles, 101 Wilderness Trout Streams, and nearly 1600 stream sections with verified trout reproduction. Of these, Indiana and Armstrong Counties accounted for only 13 reproducing trout sections and only one of these, Crooked Creek, was located within the study area. No Class A or Wilderness Trout Streams were located in the study area.

- Of the thousands of Approved Trout Waters in Pennsylvania (waters that meet criteria to be stocked with trout by PFBC) only the North Branch Plum Creek occurs within the study area.

- As discussed above, the Pennsylvania Game Commission's Farm Game Program and Forest Game Coop proved significant hunting and trapping opportunities for sportsmen within the watershed.

- The Upper Crooked Creek watershed is home to four National Register of Historic Places listed covered bridges and a wide variety of National Register of Historic Places eligible or locally significant homes, businesses, and railroads. The diverse history and culture throughout the watershed can foster increased tourism, interpretation, and recreational opportunities.

CHAPTER 7

MANAGEMENT OPTIONS

VII. MANAGEMENT OPTIONS

The following Management Options are contained within a matrix located at the end of this Chapter. This matrix provides for potential partners, potential funding sources and recommended beginning dates.

GENERAL

1. Institute an Upper Crooked Creek Watershed Coalition to oversee the implementation of this plan and act as a clearinghouse for the management of watershed resource data.

Members of borough councils, township supervisors and county officials can create the Upper Crooked Creek Watershed Coalition (UCCWC) through the adoption of a formal resolution, which would bind the municipalities to work together to work to "insure the best quality development, maximum utilization of resources, and protection of environment" within the watershed. The Coalition would serve as an effective forum to bring together a variety of interest groups who share interest in the health and welfare of the watershed.

Together the members of the Coalition would develop primary objectives, reflective of the community goals, to direct decisions upon. Efforts could include sponsoring watershed-based activities, public education on the resources of the watershed, and actively seeking public support for watershed projects.

2. Coordinate with other River Conservation Plans within the vicinity.

Coordination between river conservation plans can lead to increased support, funding sources, and public awareness. Joining efforts with existing plans for the Clarion River and Kiski-Conemaugh River Basin can lead to more successful, common goals. Any groups that complete River Conservation Plans along the study corridor in the future should also be included.

A. CULTURAL AND HISTORICAL

1. Facilitate regional coordination between historical groups and municipalities through PHMC and CrCWA.

Coordination between local historical societies, river communities, CrCWA, and PHMC is necessary to create a successful strategy for regional development.

In cooperation with PHMC, CrCWA could act as a clearinghouse for information and a regional organizing body. Through its system of consultants and contacts, PHMC could offer technical advice on how to properly rehabilitate or refurbish historic structures, where to go for potential grant money to engage in historic preservation at the community level, how to determine if a structure is historic, and how to nominate it for recognition. As the state commission overseeing historical sites and structures, PHMC should play an active role in facilitating coordination and communication among historical organizations in the Upper Crooked Creek watershed.

2. Coordinate an exchange of historical literature between communities in order to market a regional experience and promote travel to the watershed communities.

Transferring community literature on historical resources is important as a strategy to inspire tourism on a larger scale. Localities for the storage of historical information would include local and regional historical societies and CrCWA offices. Because CrCWA is developing this River Conservation Plan, they are the most appropriate entity to manage this information.

3. Encourage communities to develop a local history book or pamphlet (such as a centennial tribute) to develop one.

This would help document history from a local perspective and would spark interest within the community. It may also uncover items of historical importance that have been previously overlooked. In addition, for those communities that have not initiated any historic archives or documentation, contacting local newspapers is one place to begin assembling information in preparation for a pamphlet or book.

4. Communities should selectively focus conservation efforts by identifying their historical resources, including those listed on the National Register of Historic Places and those which they would like to see listed.

Identifying structures remaining from former industrial sites, commercial, and residential areas is a primary task for communities interested in historical and cultural preservation. However, selectively focusing the community's preservation efforts on significant structures is a better long-term strategy than either ignoring all structures or spreading resources too thinly over many structures. Selective preservation should be done in a coordinated manner with CrCWA, PHMC, and local groups.

5. Implement a regional approach to signs so all historical structures or districts within the project study area communities have similar marking techniques to identify their historical and cultural resources.

Signs are one way to unify the theme of history and culture in the watershed communities. Signs of a similar style or color scheme can be used to mark structures, trails, or historic districts. Signs can also be functional listings of the choices of attractions within each community.

Signs can also be used in a flag or tapestry fashion to add character to a commercial district. The designs for flags and tapestries could be developed through community art projects or contests

6. Attempt to identify sites of exceptional interest for interpretive areas.

Multiple historic and cultural resources depicting the watershed's past were identified during the development of this plan. Although many individual properties have been surveyed by ICOPD, few have been preserved or developed into interpretive areas. A review of these sites should take place in order to prioritize their potential development as interpretive areas for local communities and visitors to the area. Examples identified in the Indiana County Heritage Preservation Plan include Coal Town Tours, salt industry exhibits, and tours of operating Christmas tree farms.

7. Preserve local churches as symbols of cultural and ethnic identity within the watershed.

Churches are a significant part of the landscape in most rural communities because they represent the ethnic and religious variety of previous generations who lived, worked, and worshipped there. Today however, churches throughout southwestern Pennsylvania are in danger of being forgotten as congregational numbers decline and churches close. This trend is not expected to change, which means that more church structures will be put on the resale market as congregations merge. The threat of indiscriminate resale ranges from buyers who remove valuable stained glass from the churches to those that demolish the structures, or allow them to remain unprotected from vandals.

It is important to protect these ethnic and cultural symbols when appropriate. Local municipalities should take the lead in monitoring the resale and reuse of churches and communicate to prospective buyers and developers their concern for churches as ethnic and cultural artifacts. This can help assure that reuse is done with historical and cultural sensitivity. Community development corporations can also play a part in this by including suitable churches in their redevelopment plans.

Resale and reuse can be a positive and lucrative venture, such as the Church Brew Works in Lawrenceville and the Priory Bed and Breakfast on the City of Pittsburgh's North Side. Both of these redevelopment projects were done in the spirit of the original church structure.

8. Design regional history exhibits that can be displayed outside the watershed.

Once the regional historical resources are identified and researched, and the information is managed by the PHMC or CrCWA, the next step would be to design exhibits based on the Upper Crooked Creek watershed's history for traveling displays. Displaying exhibits in neighboring Ohio, West Virginia and eastern Pennsylvania, would spur interest in tourism in southwestern Pennsylvania and the Upper Crooked Creek watershed. Accomplishing this would require approaching organizations such as the Senator John Heinz Regional History Center, which are in a position to develop and circulate such an exhibit.

9. Address regulatory problems that discourage reuse of historical sites.

The main regulatory deterrents are floodplains, local zoning ordinances and building code ordinances. Other issues are Americans with Disabilities Act (ADA), and Occupational Safety Health Administration (OSHA) standards for elevators. Some of the problems of former mill sites and industrial river towns are unrealistic to overcome, notably frequently flooded areas. However, local zoning, ADA, and OSHA can often be resolved through innovative planning and cooperation between agencies.

B. ECONOMIC DEVELOPMENT

1. Complete an inventory of brownfields and prioritize their redevelopment potential under PA Act 2 and Act 4.

Pennsylvania land recycling legislation provides valuable incentives to parties interested in adaptive reuse and/or redevelopment of brownfields. Study corridor municipalities may be eligible for grant funding to assess the environmental condition of brownfields under PA Act 4 (Industrial Sites Environmental Assessment Act) and to redevelop sites under PA Act 2 (Land Recycling and Environmental Remediation Standards Act).

Once an inventory of brownfield sites is completed for the watershed, sites should be prioritized based on their redevelopment potential, including road and utility access, and size. Once this prioritization is complete, the individual municipalities or other interested parties may apply to the state for funding to assess the sites' environmental condition, and in some cases to begin cleanup work.

This inventory should be prepared in conjunction with agencies involved with economic development opportunities such as Southwestern Pennsylvania Regional Planning Commission (SPRPC) or Penn Southwest.

2. Create a Business Directory and map that highlights the commercial districts and other amenities within the project area.

A directory that includes shops, eateries, transportation resources, parks and other points of interest could be developed. The directory and map would be a valuable resource in locating nearby businesses within local commercial districts. The directory could be updated seasonally to highlight municipal or regional events such as parades, festivals and cultural events. Funding could be provided through advertising space within the directory.

3. Promote fishing, hiking, and biking through events.

Promoting the natural beauty and recreation opportunities of the watershed will help to bring new visitors to the river corridor. This will, in turn, help to spur new business development in the service sector and foster an appreciation for the valley's resources and their potential economic effect.

Fishing tournaments have been proven to provide for increased tourism and economic profit. Because of the Big Bass Regulations already in place, Keystone Lake might serve as an ideal location for such an event. PFBC provides for applications to hold these events and the BASS federation has expressed interest in promoting these events throughout Pennsylvania.

The Indiana County Tourist Bureau could enhance the visibility of hiking and biking in the area through marketing and promotional efforts. Tours could be based on themes in the watershed such as covered bridges, forest and farmland, or bed and breakfasts.

4. Promote water quality improvements with an emphasis on economic benefits.

While a direct causal relationship between water quality and economic benefit cannot be accurately quantified, data relating to the economic importance of fishing and boating in Pennsylvania does demonstrate a connection. In 1996, direct trip and equipment revenues from fishing and boating activities totaled over $2 billion statewide (Frey, 1996). Economic benefits are complemented by improved water quality, increased water recreation, improved aesthetics, and more viable fish, bird, and mammal populations. Though costly, continued improvements in water quality directly and indirectly support the betterment of river resources, the recreational experience, and the economy.

C. EDUCATION

1. Develop a newsletter to inform the public of the value of the resources of the Upper Crooked Creek watershed.

Publish a monthly newsletter discussing projects related to water quality monitoring, AMD reclamation projects, recreational activities, cultural activities, and areas of historical interest.

2. Initiate educational programs on floods and floodplain development including "flood emergency response" educational materials and flood awareness seminars for residents.

Flood awareness and prevention seminars should be presented in different formats to local residents, land owners, and municipal officials.

The National Weather Service provides free flood awareness seminars for communities located along rivers and streams in western Pennsylvania. Arranging these seminars will help make people in flood-prone

communities such as Plumville, Shelocta, and Creekside more aware of this problem and alert them of proper procedures in flood emergencies. Other education initiatives and information sessions may be provided by FEMA, NOAA, and ACOE.

3. Promote an essay and/or photo contest throughout school districts within the watershed.

An essay or photo contest would focus on stewardship of the watershed. Contests could be for elementary and high school age students. Themes such as "My view of Crooked Creek" and "How the creek has affected my life" would be considered, focusing attention on watershed conservation and stewardship. Prizes for elementary age students might include family passes to regional attractions such as river tours, history centers or science centers. Awards for high school students might include scholarships for continuing education.

4. Develop educational programs to be used within local school districts

Educational packages that relate to the Crooked Creek Watershed could be developed for nearly all grade levels. Topics could focus on the functions of a watershed, animals and habitat, water chemistry, and the specific problems facing the Crooked Creek Watershed. Special field trips could be planned to help with clean up activities, water sampling, or other related activities. Education programs may also be highlighted by essay contests, artwork, science competitions, or social studies projects.

5. Educate land owners and municipalities on the importance of riparian buffers.

Riparian buffers are vital to the natural process of filtering run-off and pollution and maintaining a healthy waterway. Educational courses, workshops, and literature concerning the importance of buffers should be made available to local land owners and municipalities. Riparian buffers are more likely to be valued and encouraged once their crucial role in the ecosystem is understood.

6. Create a Crooked Creek theme summer camp program.

Summer camps that relate to themes, such as space camps or science camps are growing in numbers. This program would be geared toward elementary school children and developed in conjuntion with the Armstrong Educational Trust's intent to lease the Environmental Learning Center at Crooked Creek. Curriculum would focus on the watershed and its environment. Students could enroll for one day or a week, with each day focusing on different aspects of the watershed. Educational activities would include environmental issues such as abandoned mines, aquatic life and forested riparian buffers; or historic events such as the implementation of the railroads, the salt industry, or coal mining.

7. Develop an Upper Crooked Creek watershed Environmental Center to educate the public about the past and present conditions of the region's rivers.

This facility could be located at any of the communities along Crooked Creek and would focus on interpreting the natural environment of western Pennsylvania's rivers and the changes brought about in that environment by human actions. Topics for display could include abandoned mine drainage and its effects on aquatic systems; the historic impacts of industrial effluent on the rivers; flooding and its effects, including how flooding patterns can change when fill is placed within floodplains; riparian forest buffers and how they function to protect water quality; subaquatic vegetation and its importance to the river ecosystem; fish and other aquatic animals that inhabit the watershed; threatened and endangered species that occur in and along area waterways; and the impact of non-native species on the ecology of the watershed. Many of these

items could be displayed through the use of a large aquarium that would recreate a stream bottom habitat and use native fish and plant species. This would allow visitors to enjoy a glimpse of what occurs below the surface of the waterways on which they will be traveling.

8. Develop a series of citizen's workshops to educate farmers and residents about available resources and funding for Best Management Practices.

A significant portion of the Crooked Creek Watershed is used for agricultural production. Local farmers may not be aware of the benefits of cost-share programs available through various state and federal agencies. Therefore, information on cost-share programs for implementation of Best Management Practices (BMP) must be made available to local farmers. Many of these programs exist through County Conservation Districts, the U.S. Department of Agriculture (CRP Program), PADEP, PFBC, PGC, PADCNR, and the U.S. Fish and Wildlife Service; however, these programs are often underutilized. With the importance of agriculture within the study area comes imperative work to prevent streambank erosion, excess nutrients in the waterways, and sediment from entering the stream channel.

During local conservation district meetings or workshops, an experienced SCD representative would present cost-share options for programs explaining the benefits for agricultural production along with the ecological advantages. Another option would be having a representative from the respective agency sponsoring a specific BMP program discuss the program with meeting/workshop attendees. Through this discussion, a mechanism could be developed regarding outreach to other farmers and community members. The Indiana and Armstrong County Conservation Districts could collaboratively plan such programs for local farmers.

9. Prepare an educational brochure for stakeholders outlining who to contact to report illegal dumping, point source discharge violations, and other critical environmental hazards.

Mackin observed numerous sites of raw sewage discharge, AMD, and gaseous/sulfuric odors along main stem Crooked Creek. Quite often, community members are unsure who to contact when they discover environmental hazards including illegal dumping, straight-pipe discharges into waterways, streambank erosion, water obstructions, etc. A user-friendly brochure directing citizens to the appropriate agencies or organizations would increase the public's knowledge and hopefully assist with documenting sources of water and overall environmental impairment. This brochure could be a collaborative effort among CrCWA, PA CleanWays, PADEP, and local businesses.

D. NATURAL RESOURCES

1. Continue the development and implementation of preliminary restoration plans for two discharges at Ernest, including the construction of passive wetland treatment systems.

Mine drainage from the Ernest Coal Mine Complex has incurred long-term water degradation in McKee Run and the Crooked Creek Watershed. According to a Preliminary Restoration Plan Report (PRP) (September 2000), the ACOE has proposed a conceptual plan, including all phases of development, for a passive wetland treatment system at McKee Run in an effort to reduce iron levels within the basin. Under the authority of Section 206 of the Water Resources Development Act of 1996, Aquatic Ecosystem Restoration, the ACOE can collaborate with a non-federal entity on a 65/35 cost-share basis for restoration projects.

The DEP has expressed interest in sponsoring the McKee Run project. However, the department has requested a copy of PRP with cost estimates before committing resources to the project. Final project costs would entail a total commitment of over $4 million. A partnership agreement between DEP and ACOE for restoration implementation could remedy long-term degraded water quality conditions from the Ernest Mine Complex.

2. Coordinate with PADEP's Bureau of Abandoned Mine Reclamation to identify "Problem Area" abandoned mine sites within the study corridor for reclamation and funding prioritization.

This option is needed to identify the location of priority sites within the study corridor and to accurately establish a reclamation hierarchy based upon the level of hazard at each site.

3. Organize, perform, and maintain clean up of all dumpsites.

Illegal dumpsites along stream banks are often tucked away from regular passersby and therefore left unnoticed. Following an illegal dump survey in Indiana County provided by PA CleanWays, an organized volunteer effort is needed to clean these sites and attempt to maintain their post-clean up appearance. Good examples of community clean up efforts often include a diverse group of stakeholders. Within the Crooked Creek Watershed, the Crooked Creek Watershed Association or a local business could take the lead in organizing a clean up with volunteers from Indiana University of Pennsylvania, municipal governments, other local businesses, and interested individuals. The Western Pennsylvania Conservancy could function as a resource for vegetative enhancement on clean up sites.

4. Coordinate efforts between CrCWA and PADEP Bureau of Abandoned Mine Reclamation to prioritize smaller AMD discharges and develop reclamation strategies.

Crooked Creek Watershed Association has been instrumental in developing partnerships among state and federal agencies to remedy several AMD sites within the Crooked Creek Watershed. Along with this, large, significant sites of mine discharge, such as the Ernest Mine Complex, Tanoma Bore Hole site, and the Kintersburg Drift Mine have been or are currently being addressed. However, smaller, less recognized source areas of mine drainage have yet to be evaluated and/or addressed and remain insidious sources of stream impairment. Field evaluations during chemical monitoring would uncover sites of AMD impairment. This information would be discussed with DEP and District Mining Representatives for appropriate next steps and options for reclamation.

5. Develop a QA/QC plan for, and conduct comprehensive biological and chemical monitoring, of main stem Crooked Creek and Plum Creek.

Both Crooked Creek and Plum Creek lack up to date, comprehensive chemical and biological assessments along their main stem. The most recent report from the University of Pittsburgh, Johnstown, assessed summer (June – August) chemical conditions along Crooked Creek and Plum Creek from 1985 to 1992. It is recommended that the Crooked Creek Watershed Association organize a chemical and biological stream monitoring team trained through the PA Citizens Volunteer Monitoring Program, develop a QA/QC Plan, and conduct regular chemical assessments at various points along the two streams. Funds are available through PADEP and the Canaan Valley Institute for monitoring efforts by volunteer citizens groups.

6. Build Partnerships between CrCWA and local businesses to develop a consensus on community watershed goals and visions, foster volunteer participation, and secure financial assistance.

A healthy component of all community watershed organizations is the open involvement among all stakeholders within the watershed. Many businesses are searching for a mechanism to become involved in their community. A key component is finding a local business or businesses with similar goals for the watershed, such as education. Combining both the interests of CrCWA and local businesses would generate a stronger base of volunteers and financial assistance along with a more cohesive means of building community environmental and economic sustainability.

7. Develop a watershed database to coordinate conservation activities among governmental agencies, private organizations, and the general public.

As local and regional governments and communities become increasingly cognizant of the condition of their surface waters, the centralization of information and resources will become an effective vehicle for coordinating restoration and preservation efforts, pooling technical resources, conducting educational programs, and providing resource contacts and solutions for various problems related to watershed conservation.

CrCWA could function as a resource center and/or clearing-house for the archiving and distribution of water quality data and information. This option could be modeled after groups such as Pennsylvania Environmental Council's Allegheny Watershed Network which deals with issues such as public involvement, watershed economics, government roles, water quality, and aquatic ecosystems.

8. Evaluate public interest in completing Natural Heritage Inventories for Indiana and Armstrong Counties through the Western Pennsylvania Conservancy.

By completing these inventories, the counties within the watershed will have an inventory of the unique and high diversity areas. This will help to define areas open for development without impacting these natural environments. It will also foster knowledge and appreciation of the existing resources. These inventories may also identify interesting areas to be used as educational classrooms.

9. Implement a volunteer trash removal and land stewardship program to clean and preserve the watershed.

Unauthorized dumping and litter was observed throughout the study corridor. Although not a significant source of water pollution, it did severely degrade the visual quality of the watershed. A simple, cost effective solution is to implement a program like the Youghiogheny River Sweep, which is an annual, volunteer event to remove discarded debris. Another solution is to institute a river corridor steward program whereby property owners and interested conservation groups could adopt a river section, with the goal of managing cleanup efforts and conservation. Local municipalities, PA Cleanways, and groups such as the Boy and Girl Scouts of America, or Rotary and Lions Clubs could be approached for their assistance.

10. Investigate habitats within the watershed for potential nomination as Important Bird Areas.

Inventories conducted by officials with Blue Spruce County Park indicated that 129 avian species inhabit the park alone. Within the largely rural, wooded character of the watershed sites of special significance to breeding or non-breeding birds should be investigated for potential nomination. If designated, the IBA could then exist as a protected area and be used for recreational purposes such as wildlife viewing or as an outdoor educational classroom for local schools and universities.

11. Encourage landowners and local businesses to participate in the PGC's Cooperative Farm Game and Forest Game Coop programs.

These programs are designed to increase recreational opportunities on private lands for hunters while promoting management of the state's wildlife and habitat resources. The prevalence of agricultural land throughout much of the Crooked Creek watershed makes both of these programs attractive mechanisms for improving both terrestrial habitat and recreational opportunities. In addition, these programs promote betters relationships and stewardship between landowners and sportsmen.

12. Encourage citizen monitoring and reporting of industrial and residential effluent violations.

As described throughout this plan, water pollution is managed by a complicated network of environmental agencies and regulations. Cumulatively, this framework attempts to provide protection from further degradation and continued improvements in water quality. Nonetheless, it is impossible for regulatory bodies to oversee every individual resident and industry within the study corridor. Citizen monitoring and policing is one of the most efficient, cost effective means of identifying environmental violations. In fact, a substantial amount of environmental legislation (including the Clean Water Act) contains provisions authorizing citizen suits against individual violators, as well as the DEP and EPA "for failure to perform a nondiscretionary duty" (Percival et al., 1996).

If implemented, this option could have a two pronged effect. First, residents within the study corridor would be assisting regulatory bodies in the identification of suspected violations. This heightened public awareness towards effluent violations would serve to deter future illegal discharges. Second, by taking an active role in the regulation of water pollution within their respective communities, citizens would be in a better position to lobby regulatory agencies to take a harder line towards violations.

13. Encourage the preservation of the ecological and visual quality of the river corridor by planting a vegetative barrier along the river's edge where feasible.

Although riparian buffers generally require 100 feet of wooded area to work effectively, they provide aesthetic value as well. Therefore, the areas that already have a riparian buffer should be maintained and protected. New developments along streams should consider the addition of a smaller scale vegetative buffer to give the appearance that the river is still completely forested. Mitigation requirements for developments along waterways should include riparian buffers as a basic course of action. In addition, trails or small openings in these corridors can be made to permit river access without reducing the buffers' function.

14. Identify or create a regional land trust to preserve and protect sensitive ecological habitats or historical properties.

A land trust is a non-profit organization whose primary purpose is the conservation and preservation of open space, park lands or natural areas for public benefit. Although industrial land use occupies significant portions of the study corridor, undeveloped areas do exist. Land trusts, such as the Allegheny River Land Trust, provide a vehicle for acquiring undeveloped land with the goal of maintaining forested viewsheds and conserving riparian zones along the river. A regional land trust would also afford the opportunity to preserve sensitive historic features and reuse them as interpretive areas.

There is a Land Trust Grant Program through DCNR's Keystone Recreation, Park and Conservation Fund that allows for 50% matching funds for the acquisition and management of land trust projects. In order to receive this grant, a land trust organization must be prequalified through DCNR. To prequalify for Keystone Funding, a land trust must fill out a prequalification form; be tax exempt under section 501(c)(3) of the Internal Revenue Code of 1986; be registered with the Bureau of Charitable Organizations, PA Department of State; and be in existence for at least 5 consecutive years.

15. Coordinate with local officials and private industry to educate the public and adopt stormwater management regulations and erosion control methods.

Although not a significant concern during the preparation of this plan, water pollution via overland flows can become a problem as development occurs. Sparsely vegetated, impervious lands adjacent to surface waters prohibit effective filtering of runoff pollutants.

One effective solution is the conservation or reestablishment of riparian buffer zones. The benefits of riparian buffers as filters for surface runoff pollutants and streambank stabilization is widely accepted. In addition, riparian buffers enhance in-stream habitat by providing cooler, shaded river margins and introducing detrital material as a source of organic nutrients.

16. Continue to monitor the Keystone Lake Passive Wetland Treatment System remediation efforts.

During the preparation of this plan, the Crooked Creek Watershed Association was administering a Growing Greener grant to perform water quality monitoring and characterization of the inflow water quality to the existing passive wetland treatment system at the northeastern end of Keystone Lake. Water quality results will then be interpreted and recommendations for design changes to improve treatement efficiency will be developed. Future possibilities under this management option include the funding of any design changes identified.

17. Pursue Keystone Lake under the Adopt a Lake Project

The Crooked Creek Watershed Association is proposing to partner with the PFBC to adopt Keystone Lake for the purposes of improving fish habitat and water quality at Keystone Lake. While improving the ecological integrity of Keystone Lake, this management option would enhance the quality of recreational opportunities available to fisherman and boaters.

18. Complete the Plum Creek Bank Stabilization, Riparian Corridor Restoration, and Fish Habitat Improvement Project.

The Armstrong Coutny Conservation District, in cooperation with the Crooked Creek Watershed Association, has received a Growing Greener Grant to stabilize an approximately 0.5-mile reach of the most severe erosion problems within the 4.5-mile corridor of Plum Creek from its confluence with Millers Run downstream to its confluence with Crooked Creek. Remaining work within the project cooridor is proposed in two phases and will include restoration of the riparian habitat and fish habitat improvements along the entire 4.5 mile reach.

19. Restrict the granting of logging permits to only those loggers that participate in Pennsylvania's Sustainable Forest Initiative (SFI).

The Sustainable Forest Initiative is one of two initiatives begun in Pennsylvania to increase the number of Forestry Management Practices. SFI is a program introduced by the American Forest and Paper Association to persuade sawmills and pulp mills to only purchase logs that are harvested in a sustainable fashion. The program has already resulted in training hundreds of loggers, landowners, and other forest industry personnel to use best management practices for logging. By restricting the granting of permits to loggers that are participating in the SFI program, there is some assurance that best management practices are being followed. This will lead to optimum forest regeneration and renewal; residual stand protection; management of insects, disease and fire; and protection of site and water resource quality.

20. Further the development of a Dirt and Gravel Roads Program throughout the watershed.

Sediment loading into tributary waters throughout the watershed from borough and township dirt and gravel raods has a negative effect on water quality. This option would help to further develop the preliminary Dirt and Gravel Road program through education and providing resources to implement Best Management Practices (BMP). Specific BMP's could include drainage system improvements, upgrading existing stream culverts and erosion control structures, and improving road surfaces through the use of properly sized and more durable road aggregates.

21. Initiate a Wellhead Protection Area study.

This option would consist of conducting a study for the delineation of a Wellhead Protection Area(s) throughout the watersehd. During the preparation of this plan, only one Wellhead Protection Area was delineated by the Eastern Armstrong County Municipal Authority (EACMA) for 3 wells located approximately 0.65 miles northeast of Elderton Borough along Route 210 in Plumcreek Township Armstrong County. In 2000, Indiana County completed a Water Supply Plan (WSP) and a Wellhead Protection Area study is a logical next step to complement the WSP.

E. PLANNING

1. Form the Upper Crooked Creek Watershed Council of Governments (UCCWCOG).

A Council of Governments (COG) is a voluntary association of local governments. The members regularly meet to exchange ideas and develop a common strategy to address regional problems. Any number of objectives can be accomplished through the formation of a COG, including multi-municipal comprehensive planning, code enforcement, equipment sharing, and cooperative purchasing to name a few.

2. Encourage municipalities to enact a timber harvest ordinance.

As of 1992, approximately 135 municipalities in Pennsylvania had timber-harvesting ordinances. A timber-harvesting ordinance can be an extremely effective way of managing timbering in a municipality. However, as with all ordinances, the ordinance is only as good as its enforcement. Model ordinances can be obtained by contacting the Pennsylvania Township's Association or the internet. Timber harvesting ordinances are recommended as long as the Right to Practice Forestry Act is not violated and the municipality has the resources to properly enforce the ordinance.

3. Encourage private landowners to develop forest management plans.

The goal of Pennsylvania's Forest Stewardship Program is to encourage more private forest landowners to have written forest management plans. While a large percentage of private forestland owners do not intend to use their land for timbering, private land it is often the first resource that is tapped during times of financial trouble. While the land is theirs to use, it is important for landowners to understand forest management and incorporate best management practices into their forest management.

4. Adopt most current and applicable Floodplain Management Ordinances.

Violations of floodplain development ordinances are prevalent with the study area. Often, community officials and the public are not aware of the importance of protecting floodplains from encroachments. However, simple outreach efforts, such as introducing a one-half hour program on the importance of floodplain integrity during a municipal council meeting, would increase awareness of the need for floodplain preservation. Following this option, a municipal council member would contact an ACOE, FEMA, or Crooked Creek Watershed Association representative to discuss floodplain functions and values at the meeting.

To control development in the floodplain, as required if a municipality wants to participate in the National Flood Insurance Program, an up-to-date ordinance should be adopted. The provisions could be included in a zoning ordinance; however, because none of the municipalities in the watershed have zoning, a stand alone a Floodplain Management Ordinance should be adopted. The state provides several model ordinances to choose from depending on which situation best suits the municipality. Because none of the municipalities have zoning, the model found in Appendix B is best suited for the municipalities in the watershed.

5. Educate the public on the connection between land use and planning by holding public workshops on the county comprehensive planning process.

Due to the economic status of many corridor communities, planning often does not work as efficiently as it should. In many southwestern Pennsylvania communities, ordinances are frequently changed to accommodate developers and businesses, which conflict with published future land use plans. This pattern has left many of these communities with ordinances which do not consider future regional plans or trends. Future developments within the project area should adhere to a municipality's future land use plans, or to the future land use plan of the appropriate county.

6. Encourage municipalities that do not adopt zoning to develop an Official Map.

For communities that do not wish to implement zoning, an Official Map can be used as a basis to designate land for future public use, but with less enforceable power than a zoning ordinance. Municipalities wishing to adopt an Official Map should follow the guidelines prescribed in Article IV of the Pennsylvania

Municipalities Planning Code. Developing an Official Map as a land use technique can enhance planning by aiding local municipalities in highlighting development opportunities, planning for the overall use of the riverfront, planning for the land acquisitions, and identifying significant cultural and environmental resources for enhancements. Due to the intent of the riverfront overlay district, there would be little liability and enforcement issues normally associated with typical zoning.

7. Develop Multi-Municipal Comprehensive Plans for communities in the watershed.

Comprehensive plans provide an information base that can be used as a tool for guiding future development and land use. Relevant issues such as housing, land use, economic development, community facilities and services, transportation facilities and recreational amenities are typically reviewed to formulate future plans. Multi-municipal comprehensive plans lay the groundwork for regional development strategies. In recent years, the Pennsylvania Department of Community and Economic Development has actively supported regional comprehensive plans, which combine multi-municipal resources.

8. Institute municipal solid waste co-composting.

Composting of municipal solid waste has been identified by the U.S. Environmental Protection Agency as preferential to land filling and waste-to-energy. This project would provide an opportunity to demonstrate that municipal waste composting is both technically and economically feasible for many municipalities.

The goal is to develop a centrally located, in-county, municipal waste co-composting facility to achieve the following benefits:

- to provide waste processing technology that is well-suited to the highly degradable municipal and agricultural organic waste;
- to provide a long term disposal system for the disposal of municipal wastewater treatment plant sludge and septic tank pumpings;
- to provide a strategy for increasing the rate of recycling while minimizing the cost, and at the same time, reducing the county's reliance on landfilling;
- to provide a strategy for collecting hazardous household waste materials;
- to reduce the transportation costs incurred by county residents in hauling waste to out of county disposal sites;
- to provide a long-term waste management strategy that will respond and serve county needs and reduce projected wastes system costs.

9. Develop additional Agricultural Security Areas (ASA) designations.

A way to conserve agricultural land within the watershed is to develop Agricultural Security Areas (ASA). PA Act 43, Agricultural Area Security Law, has authorized these areas. A landowner or a group of landowners whose land comprises at least 250 acres may apply to their local government for the designation of an ASA. The parcels must be viable agricultural land and may be comprised of non-contiguous tracts at least 10 acres in size.

The ASA designation encourages the preservation of agricultural land by giving the landowner protection from local ordinances that restrict farm practices unless a public safety hazard exists. The ASA also protects the area from nuisance ordinances. Additionally, the designation limits condemnation procedures and eminent domain by state and local agencies unless approved by the Agricultural Condemnation Ap-

proval Board. The ASA designation is not a permanent designation but rather land with an ASA designation is reviewed every seven years, which may be desireable for some municipalities and landowners. As of October 1999, there were 824 ASAs in PA totalling over 3.2 million acres.

10. Develop and enroll farms in agricultural assessment tax incentives.

Differential assessment laws direct local governments to assess agricultural land for its agricultural value rather than its full market value, which is generally higher. Differential assessment laws are enacted at the state level and implemented at the local level.

The benefit of this program is that it decreases tax burden on farmers and allows agricultural operations to continue in the face of development, thus helping to ensure the economic viability of agriculture. These taxes align agricultural property taxes with what it actually costs local governments to provide services to the land.

This tax incentive is known as PA Act 319, as amended in 1998 as "Clean and Green", designed to provide incentives to landowners for preserving land in agricultural use, agriculture reserve or forest reserve. This is a voluntary program that provides a financial disincentive to participating landowners who convert land to other than agricultural uses by making the land subject to rollback taxes and penalties. Currently, there are over five million acres enrolled in 48 counties.

11. Encourage farms to register in PA's Farm Link Program

Pennsylvania's Farm Link Program was initiated in 1994 through collaboration with the Rodale Institute, the Center of Local Government Services and Pennsylvania Farmer Magazine. The program was established to help reduce the rapid decline of farms throughout the state. The concept is to link prospective farmers with landowners who are interested in ensuring that their land remains in agricultural production.

The program helps the new farmers with start-up costs through creative agreements designed through the Farm Link Program. Options are made available to farmers wishing to enter or retire from the farming industry. Each link is different, but the end result is to increase the number of new family farmers in Pennsylvania.

In 1995, the Farm Link database, which is regularly reviewed and updated, had over 450 entering and retiring farmers. Workshops are held throughout the state to facilitate meeting of perspective matches.

12. Prepare educational materials on the management of large scale animal operations.

Although state and federal regulations provide a level of oversight that the Commonwealth greatly needs; they clearly do not address some of the concerns local communities have about industrial agriculture. These regulations do not address odor, dust, noise or other nuisances, water use, property value issues, long-term maintenance of operations, and the host of related concerns local communities most often express.

Other major regulatory programs such as air quality regulations and waste management regulations have generally not been applied to; or may have exemptions for agriculture uses. The protection of a community from these and other impacts of industrial agricultural businesses fall upon the local municipality.

The ability of local governments to regulate these operations is not without limitations. Townships who have created local ordinances most commonly encompass the following:

- specifically define the nature of the agricultural operation they wish to manage (so as not to punish family farmers) and clearly define characteristics of such operations;
- adopt a version of the PA CAFO regulations and the Nutrient Management Act at the municipal level to allow for local enforcement of the regulations;
- adopt more powerful enforcement tools including bonds and permit fees, as well as inspections;
- establish set-back requirements such as restrictions and building permit limitations;
- require water use and hydrology reports before facilities are constructed;
- require that operators obtain all relevant state and federal permits before building permits are issued.

13. Encourage municipalities to establish compliance with existing sewage treatment regulations by preparing and updating formal Act 537 sewage facilities plans and prioritizing construction of sewage treatment facilities.

Untreated and undertreated sewage effluent is a growing concern throughout the watershed. Many small communities in these rural areas simply cannot afford the development and implementation of Act 537 sewage facility plans. However, the development of a treatment plan is the first step towards regulatory compliance.

Funding is available through grants and reimbursements from PADEP. In addition, municipalities with official plans, as well as private landowners, may be eligible for funds through programs such as the Pennsylvania Infrastructure Investment Authority (PIIA) established by ACT 16. PIIA provides funding for community construction of new or upgraded water and sewer systems.

14. Develop and implement a Dry Hydrant Program

In any area without water mains and domestic fire hydrants, the dry hydrant concept can provide a simple, cost effective solution to the need for access to water sources without delay. A dry hydrant consists of an arrangement of piping with one end in the water and the other end extending to land and available for connection to a pump. Installation of dry hydrants into numerous nearby and developed water supplies eliminates the inefficiency and complexity of long-distance water shuttle operations. This arrangement also allows access to water sources from a roadway instead of having to work on soft ground immediately adjacent to the pond or stream.

F. RECREATION

1. Develop directional and interpretive signs for display along the existing and proposed trails.

This recommendation would consist of developing multiple types of signs, directing trail users to important locations within local communities, or identifying major regional cultural or natural attractions. For example, upon entering Indiana County from the north, a bicyclist on the Baker Trail would see one information display showing locations within Shelocta that might be of interest and are bike/pedestrian accessible (i.e., parks, historic sites, churches, restaurants, or bike shops). A second information display would show the distance to the other attractions, such as downtown Indiana. This second information display would also show highlights of the facilities within downtown Indiana. A third category of interpretive signs would

display significant cultural or natural resource sites, such as Blue Spruce County Park or Keystone Lake, identifying plant and animal species at each.

By using this approach to informational signing, CrCWA would enhance the trail experience for users and enable them to maximize their enjoyment during a given trip. In addition, this approach would allow trail users to venture off of the main trail and travel into the communities along it, enjoying what these towns have to offer and contributing to their local economy. It will also encourage trail users to plan future trips to the area by making them aware of the resources along the trail and within the watershed.

2. Conduct feasibility studies, inventory, investigate, and acquire abandoned railroad right-of-way for new recreational trails and connections between existing or proposed trails, and investigate the possibility of rail-with-trail connections.

By completing feasibility studies for future trail links, this recommendation would allow for the reuse of abandoned rail lines, an enjoyable sight-seeing tour of the towns and communities surrounding the area, and an increase in the quality of life for people living along; and using, the trail. Bicyclists, hikers, and walkers using the trail network would bring in more tourism and new economic opportunities. Residents within the study corridor would benefit from trail development through increased recreational opportunities and tourism revenues.

3. Develop a comprehensive trail and greenway plan for the entire watershed.

A greenway is a corridor of open space. There are many types of greenways ranging in size, environmental amenities, location and function. Types of greenways include conservation greenways, recreational greenways, riparian buffers, landscaped corridors, greenbelts, and natural areas. Linear greenways can provide conduits for wildlife mobility along corridors and suitable habitat.

A conservation greenway would be a beneficial option for the Crooked Creek Watershed. The primary function of a Conservation Greenway is to protect and enhance ecological values and functions of an open space, such as providing habitat for wildlife. A greenway along a stream corridor provides ecological benefits such as food, shelter, and cover to numerous species.

The county planning departments, along with the local municipal officials, citizens, and private property owners, should determine the greenway boundaries.

4. Develop new or enhance existing fishing access areas in public areas.

This could be accomplished through utilizing existing structures or providing new fishing access. Fishing groups and municipalities could partner to enhance or develop access areas.

5. Repair the infrastructure of Cummings Dam.

Indiana County has been requested by PADEP to develop a plan for repairing the intake/outtake valves on Cummings Dam. The existing valves date from the dam's original construction (1908) and are currently not operable.

To accomplish this, the County retained Gibson-Thomas Engineering to conduct a preliminary cost analysis. The results of this analysis indicated that the repair project would cost in excess of $200,000. In addition to the valve replacement, there is a need to repair concrete spalling on the dam's surface. The

PADEP has not given an order to have the repairs done, but it is expected the County will eventually be issued a deadline to have the work completed.

At the time of this report, Cummings Dam was classified as a high hazard dam by PADEP due to its age. Annual inspections are conducted by the County engineer and the dam is currently considered to be structurally sound. An Emergency Action Plan has also been developed for the dam and is reviewed and updated every 2 years, as required by the PADEP.

An additional need for Cummings Dam is to consider removing silt from the upper portion of the lake. When the County acquired the park in 1966, the dam was drained and the accumulated silt was dredged. Since that time silt has been gradually filling in the upper portion of the lake, resulting in a loss of aquatic habitat and reducing the size of the lake. Erosion from gas well roads, township roads and the stream banks along Getty Run are all contributing factors to the siltation. A photo (taken around 1913) indicates the lake was approximately 15 acres (the current size is 12 acres), and since 1966 it has been estimated that about 1/2 acre of the lake has been lost to siltation.

6. Acquire additional land surrounding Blue Spruce County Park.

Blue Spruce Park is currently 413 acres in size. A strategy to acquire additional land surrounding the park has been recommended by the County Parks staff and Park Board to protect the park from encroachment and development. Acquiring additional property would allow the park to be sustained for future generations of park visitors and allow the park to function more effectively as a viable wildlife and natural habitat area.

It is anticipated that an offer to purchase 230 acres of additional parkland will be made by the County in the near future. This property is currently owned by Consol Energy (formerly R&P Coal Company). This additional property is significant because it contains a major portion of the park watershed and viewshed, and it is located immediately upstream within the park valley.

Additional property along the entrance road to the park (owned by Amerikohl) is also considered important for protecting the park. This property is comprised of five parcels totaling 176 acres. An additional property owned by Kreibal Resources (75 acres) is significant for protecting the park's western boundary.

7. Initiate and implement efforts to enhance the Crooked Creek Watershed area as a destination for recreational and touring cyclists by promoting road improvements, signage and marketing, as well as the annual Indiana Five Points Bicycle Race.

The Crooked Creek Watershed has long been one of the most popular regions within Indiana County for bicycling. The scenic landscape and gentle terrain, as well as the proximity to Indiana Borough have been conducive to attracting cyclists. Bicycling entities may work cooperatively to identify the more popular bicycling routes in the watershed. These designated routes can then be coordinated with PENNDOT's road maintenance schedule and improvement to these routes through projects such as paving, widening of shoulders and line painting. In addition, funding can be sought to develop and implement signs that would highlight these roads as bicycle routes.

The Indiana County Tourist Bureau's involvement would include enhancing the visibility of cycling in this area through marketing and promotional efforts. Tours could be based on themes in the Watershed such as covered bridges, farmland, bed and breakfasts, etc.

VII. MANAGEMENT OPTIONS MATRIX

RESOURCE CATEGORIES	MANAGEMENT OPTIONS AND PRIORITIES	POTENTIAL PARTNERSHIPS and/or RESPONSIBLE PARTIES	POTENTIAL FUNDING SOURCES	ANTICIPATED IMPLEMENTATION
	GENERAL MANAGEMENT			
All categories	**1. Institute an Upper Crooked Creek Watershed Coalition (UCCWC) to oversee the implementation of this plan and act as a clearinghouse for the management of watershed resource data.**	Crooked Creek Watershed Association (CrCWA)	Pennsylvania Department of Conservation and Natural Resources (DCNR) Community Conservation Partnership Program (C2P2), Western Pennsylvania Coalition for Abandoned Mine Reclamation (WPCAMR)	1st two years
All categories	**2. Coordinate efforts with other River Conservation Plans within the vicinity.**	Kiski-Conemaugh River Basin Alliance, Clarion River Basin Commission, Ohio River Basin Commission, Upper Mahoning Creek Watershed Association	No direct cost involved	1st two years
	CULTURAL AND HISTORICAL			
Cultural and Historical	**1. Facilitate regional coordination between historical groups and municipalities through PHMC and CrCWA.**	Pennsylvania Historical and Museum Commission (PHMC), CrCWA, local historical societies, local municipalities	No direct cost involved	1st two years
Cultural and Historical, Recreation, Economic Development	**2. Coordinate an exchange of historical literature among communities in order to market a regional experience and promote travel to the watershed communities.**	CrCWA, local municipalities, county government, local historical societies, PHMC	No direct costs involved	1st two years
Cultural and Historical	**3. Encourage communities to develop a local history book or pamphlet (such as a centennial tribute).**	CrCWA, watershed municipalities, county planning offices, PHMC, local historical societies	Heritage Parks Program (HPP), advertising sales	2nd two years
Cultural and Historical, Recreation	**4. Communities should selectively focus conservation efforts by identifying their historical resources, including those which are listed on the National Register of Historic Places and those which they would like to see listed.**	CrCWA, watershed municipalities, county governments, PHMC, local historical societies	PHMC	2nd two years
Cultural and Historical, Recreation	**5. Implement a regional approach for signs ensuring that historical structures or districts within the project study area communities have similar marking techniques to identify their historical and cultural resources.**	CrCWA, watershed municipalities, county governments, PHMC, local historical societies and museums, Pennsylvania Department of Transportation (PENNDOT)	PHMC, HPP, National Park Service (NPS), Transportation Equity Act (TEA-21), local businesses	2nd two years
Cultural and Historical, Recreation, Economic Development	**6. Attempt to identify local sites of exceptional interest for interpretive areas.**	CrCWA, local historical societies, museums, Indiana University of Pennsylvania (IUP)	Private foundations, volunteers, IUP	2nd two years
Cultural and Historical	**7. Preserve local churches as symbols of cultural and ethnic identity within the watershed.**	CrCWA, PHMC, local historical societies, local municipalities	Private foundations, historical societies, museums	2nd two years
Cultural and Historical, Economic Development	**8. Design regional history exhibits that can be displayed outside the watershed.**	CrCWA, PHMC, local historical societies, Senator John Heinz Regional History Center	Private foundations, historical societies, museums	3rd two years
Cultural and Historical, Planning	**9. Address regulatory problems that discourage reuse of historical sites.**	CrCWA, PHMC, Pennsylvania Department of Environmental Protection (PADEP)	No direct costs involved	2nd two years

RESOURCE CATEGORIES	MANAGEMENT OPTIONS AND PRIORITIES	POTENTIAL PARTNERSHIPS and/or RESPONSIBLE PARTIES	POTENTIAL FUNDING SOURCES	ANTICIPATED IMPLEMENTATION
	ECONOMIC DEVELOPMENT			
Economic Development, Natural Resources	**1. Complete an inventory of brownfields and prioritize their redevelopment potential under PA Act 2 and Act 4.**	CrCWA, Local municipalities, county planning departments, Regional Industrial Site Evaluation System, PADEP	PADEP's Land Recycling Program, Pennsylvania Department of Community and Economic Development (DCED): Communities of Opportunity and Community Revitalization	2nd two years
Economic Development	**2. Create a Business Directory and map that highlights the commercial districts and other amenities within the project study area.**	DCED, Indiana and Armstrong County Offices of Planning and Development, local chamber of commerce	Local businesses through advertisements	2nd two years
Economic Development, Recreation, Natural Resources	**3. Promote fishing, hiking, and biking through events.**	CrCWA, watershed municipalities, county conservation districts, county planning departments, local sportsmen's groups, special interest groups, Pennsylvania BASS Federation Chapter, Pennsylvania Game Commission (PGC), Pennsylvania Fish & Boat Commission (PFBC), Trout Unlimited, outfitters, Indiana County Parks	Volunteer services from special interest groups, public and private donations, corporate sponsorships, Pennsylvania BASS Federation Chapter, Trout Unlimited	1st two years
Economic Development, Natural Resources	**4. Promote water quality improvements with an emphasis on economic benefits.**	CrCWA, PADEP, PFBC, U.S. Army Corps of Engineers (ACOE), DCED, U.S. Environmental Protection Agency (EPA), local watershed organizations	PADEP Environmental Education Grants, DCED, private foundations	1st two years
	EDUCATION			
Education	**1. Develop a newsletter to inform the public of the value of the resources of the Upper Crooked Creek watershed.**	CrCWA, PADEP, EPA, U.S. Coast Guard (USGS), PFBC, PGC, ACOE, DCNR, Western Pennsylvania Conservancy (WPC)	PADEP Environmental Education Grants, county conservation districts, HPP	1st two years
Education	**2. Initiate educational programs on floods and floodplain development including "flood emergency response" educational materials and flood awareness seminars for residents.**	CrCWA, National Wetland Survey (NWS), National Oceanic and Atmospheric Administration (NOAA), Federal Emergency Management Agency (FEMA), ACOE, PADEP, local fire departments, local governments	PADEP Environmental Educational Grants, PADEP Federal Flood Protection Cost Share Projects and Flood Protection Program, NOAA, FEMA, ACOE	1st two years
Education, Cultural Resources	**3. Promote an essay and/or photo contest throughout school districts within the watershed.**	CrCWA, watershed municipalities, local school districts	PADEP Environmental Education Grants, private foundations, local school districts, volunteers	1st two years
Education	**4. Develop educational programs to be used within local school districts.**	CrCWA, DCNR, PADEP, county conservation districts, local sportsmen's groups, DCED	PADEP Environmental Education Grants, DCNR Bureau of State Parks, volunteers	2nd two years
Education, Natural Resources	**5. Educate land owners and municipalities on the importance of riparian buffers.**	PADEP, PFBC, PGC, DCNR, Natural Resource Conservation Service (NRCS), PA Bureau of Forestry (PABOF), regional timber harvesters, county conservation districts, agricultural alliances	PADEP Bureau of Watershed Conservation, DCNR Land Trust Grant, PADEP Environmental Education Grants, PADEP Stream Improvement Program	1st two years
Education	**6. Create a Crooked Creek theme summer camp program.**	Armstrong Educational Trust, ACOE, CrCWA, DCNR, PADEP, county conservation districts, local sportsmen's groups, DCED, Indiana County Parks	Armstrong Educational Trust, PADEP Environmental Education Grants, DCNR Bureau of State Parks, volunteers	1st two years
Education, Cultural and Historical	**7. Coordinate efforts with the Armstrong Educational Trust's proposal to acquire the Environmental Learning Center at Crooked Creek from the ACOE.**	PADEP, PFBC, PGC, ACOE, U.S. Fish & Wildlife Service (USFWS), Trout Unlimited, Pennsylvania BASS Federation Chapter, PHMC, IUP, Indiana County Parks, local school districts	Armstrong Educational Trust, PADEP Environmental Education Grant, private foundations, WPC	3rd two years
Education, Natural Resources	**8. Develop a series of citizens workshops to educate farmers and residents about available resources and funding for Best Management Practices.**	NRCS, PGC, DCNR, CrCWA, PADEP, PFBC, Indiana & Armstrong County Conservation Districts, agriculture alliances	NRCS, DCNR, U.S. Department of Agriculture (USDA) Conservation Reserve Program Funds	1st two years
Education, Natural Resources	**9. Prepare an educational brochure for stakeholders outlining who to contact to report illegal dumping, point source discharge violations, and other critical environmental hazards.**	CrCWA, PADEP, PA Cleanways	Canaan Valley Institute, Heinz Foundation, local businesses, PADEP	1st two years

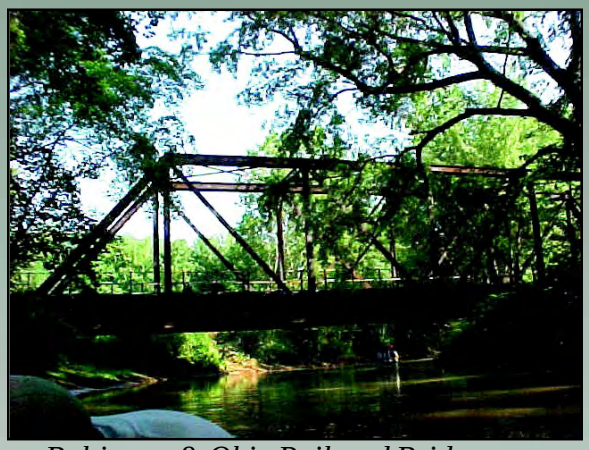
RESOURCE CATEGORIES	MANAGEMENT OPTIONS AND PRIORITIES	POTENTIAL PARTNERSHIPS and/or RESPONSIBLE PARTIES	POTENTIAL FUNDING SOURCES	ANTICIPATED IMPLEMENTATION
	NATURAL RESOURCES			
Natural Resources	**1. Continue the development and implementation of preliminary restoration plans for two discharges at Ernest, including the construction of passive wetland treatment systems.**	ACOE, Air Products, CrCWA, environmental engineering consultants	PADEP Bureau of Abandoned Mine Reclamation	1st two years
Natural Resources	**2.Coordinate with PADEP's Bureau of Abandoned Mine Reclamation to identify "Problem Area" abandoned mine sites within the study corridor for reclamation and funding prioritization.**	PADEP-Bureau of Abandoned Mine Reclamation, CrCWA, US Office of Surface Mining (USOSM), Center for Rural Pennsylvania	PADEP Bureau of Abandoned Mine Reclamation and Bureau of Watershed Conservation, WPCAMR	1st two years
Natural Resources	**3. Organize, perform, and maintain cleanup of dump sites.**	Watershed organizations, local businesses, Indiana University, municipal and county government, PA Cleanways	PADEP, Canaan Valley Institute, local in-kind	1st two years
Natural Resources	**4. Coordinate efforts between CrCWA and PADEP Bureau of Abandoned Mine Reclamation to prioritize smaller AMD discharges and develop reclamation strategies.**	CrCWA, PADEP Bureau of Abandoned Mine Reclamation, NRCS, PFBC, environmental engineering consultants, WPCAMR	NRCS, PADEP Bureau of Abandoned Mine Reclamation, county conservation districts, PADEP Growing Greener Funds, US OSM	1st two years
Natural Resources	**5. Develop a QA/QC plan for, and develop comprehensive biological and chemical monitoring, of the main stem of Crooked and Plum Creeks.**	CrCWA, Indiana County Conservation District, PADEP, PFBC, local volunteers, public schools and universities, EZ Group	PADEP Growing Greener Funds, Canann Valley Institute	1st two years
Natural Resources	**6. Build partnerships between CrCWA and local businesses to develop a consensus on community watershed goals and visions, foster volunteer participation, and secure financial assistance.**	CrCWA, local businesses	Local businesses	2nd two years
Natural Resources	**7. Develop a watershed database to coordinate conservation activities among governmental agencies, private organizations, and the general public.**	CrCWA, local watershed organizations, Trout Unlimited, county conservation districts, EPA, USGS, PADEP, ACOE, PFBC, DCNR, Pennsylvania BASS Federation Chapter	PADEP Bureau of Watershed Restoration and Bureau of Watershed Conservation, PFBC, private foundations, IUP, county conservation districts	1st two years
Natural Resources	**8. Evaluate public interest in completing Natural Heritage Inventories for Indiana and Armstrong Counties through the Western Pennsylvania Conservancy.**	CrCWA, WPC, county conservation districts	WPC, DCNR Keystone Recreation, Park, and Conservation Fund: County Natural Area Inventory Grant, IUP	1st two years
Natural Resources, Education	**9. Implement a volunteer trash removal or land stewardship program to clean and preserve the watershed.**	PA Cleanways, local conservation groups, county conservation districts, local sportsmen's groups, local waste management facilities	Private foundations, county and local government, volunteers	2nd two years
Natural Resources, Recreation, Education	**10. Investigate habitats within the watershed for potential nomination as Important Bird Areas.**	CrCWA, Audubon Society, local bird clubs,DCNR, USFWS, PGC, Todd Bird Club	Audubon Society, DCNR C2P2, USFWS, PGC	1st two years
Natural Resources, Recreation	**11. Encourage landowners and local businesses to participate in the PGC's Cooperative Farm Game and Forest Game Coop programs.**	CrCWA, PGC, agricultural alliances	PGC	1st two years
Natural Resources	**12. Encourage citizen monitoring and reporting of industrial and residential effluent violations.**	PADEP Bureau of Watershed Conservation and Bureau of Water Quality Protection	PADEP's Citizen Volunteer Monitoring Program	1st two years
Natural Resources	**13. Encourage the preservation of the ecological and visual quality of the river corridor by planting a vegetative barrier along the river's edge where feasible.**	PADEP, county conservation districts, WPC, PFBC, ACOE	PADEP's Stream Improvement Program, DCNR Keystone Recreation, Park, and Conservation Fund: Greenway Grant, Ducks Unlimited	2nd two years
Natural Resources, Cultural and Historical	**14. Identify or create a regional land trust to preserve and protect sensitive ecological habitats or historical properties.**	National Land Trust Association, WPC, Allegheny Land Trust, CrCWA, DCNR, Indiana County Parks	DCNR Keystone Recreation, Park, and Conservation Fund: Comprehensive Recreation, Park, Open Space Grant and Greenways Grant	2nd two years
Natural Resources, Education	**15. Coordinate with local officials and private industry to educate the public and adopt stormwater management regulations and erosion control methods.**	County conservation districts, watershed municipalities, local watershed organizations, PADEP	Private foundations, PADEP Storm Water Management Program Grants	2nd two years

RESOURCE CATEGORIES	MANAGEMENT OPTIONS AND PRIORITIES	POTENTIAL PARTNERSHIPS and/or RESPONSIBLE PARTIES	POTENTIAL FUNDING SOURCES	ANTICIPATED IMPLEMENTATION
NATURAL RESOURCES (continued)				
Natural Resources	**16. Continue to monitor the Keystone Lake Passive Wetland Treatment System remediation efforts.**	CrCWA, Armstrong County Conservation District	PADEP	2nd two years
Natural Resources	**17. Pursue Keystone Lake under the Adopt-a-Lake Project**	PFBC, CrCWA, Armstrong County Conservation District	PFBC, PADEP Growing Greener Grant	2nd two years
Natural Resources	**18. Complete the Plum Creek Bank Stabilization, Riparian Corridor Restoration, and Fish Habitat Improvement Project.**	PFBC, CrCWA, Armstrong County Conservation District	PFBC, PADEP Growing Greener Grant	2nd two years
Natural Resources, Economic Development	**19. Restrict the granting of logging permits to only those loggers that participate in Pennsylvania's Sustainable Forest Initiative (SFI).**	CrCWA, county and local government, county conservation districts, PA Bureau of Forestry (PABOF), Northern Hardwood Lumber Association, PA Forestry Association	DCNR C2P2, USDA, NRCS, USFWS	2nd two years
Natural Resources	**20. Further the development of a Dirt and Gravel Roads Program throughout the watershed.**	CrCWA, county and local government, Indiana and Armstrong County Conservation Districts, PADEP, DCNR, PENNDOT	PENNDOT, TEA-21, PADEP Growing Greener Grant	2nd two years
Natural Resources	**21. Initiate a Wellhead Protection Area study**	CrCWA, county conservation districts, county planning departments, PADEP	PADEP Growing Greener Grant	3rd two years
PLANNING				
Planning	**1. Form the Upper Crooked Creek Watershed Council of Governments (UCCWCOG).**	CrCWA, municipal and county government	DCED, municipalities, county government	1st two years
Planning	**2. Encourage municipalities to enact a timber harvest ordinance.**	local governments, county planning departments	local governments, county planning departments, DCED	1st two years
Planning	**3. Encourage private landowners to develop forest management plans.**	NRCS, local governments, county planning departments, Penn State Cooperative Extension, land owners	NRCS, local governments, county planning departments, Penn State Cooperative Extension, land owners	1st two years
Planning	**4. Adopt most current and applicable Floodplain Management Ordinances.**	ACOE, FEMA, NOAA, local government	DCED's Land Use Planning Technical Assistance Program (LUPTAP) grants, FPMS	1st two years
Planning	**5. Educate the public on the connection between land use and planning by holding public workshops in the county comprehensive plan process.**	Local governments, county planning departments	DCED's LUPTAP grants	1st two years
Planning	**6. Have municipalities that do not adopt zoning develop an Official Map.**	Local governments, county planning departments	DCED's LUPTAP grants	1st two years
Planning	**7. Develop Multi-Municipal Comprehensive Plans for communities in the watershed.**	Local government, Indiana County Office of Planning and Development	DCED's LUPTAP grants	4th two years
Planning	**8. Institute municipal solid waste co-composting.**	Municipal and county government	PADEP, municipalities, county government	2nd two years
Planning	**9. Develop additional Agricultural Security Areas.**	Center for Rural PA, PA Farmer Magazine, NRCS, agricultural alliances	Center for Rural PA	3rd two years
Planning	**10. Develop and enroll farms in agricultural assessment tax incentives.**	Municipalities, Indiana County Conservation District, Indiana County Office of Planning and Development, Bureau of Farmland Protection, Indiana County Farmland Easement, county government	Bureau of Farmland Protection, PADEP Growing Greener Funds	2nd two years
Planning	**11. Encourage farms to register in the Farm Link Program.**	Center for Rural PA, PA Farmer Magazine, NRCS, agricultural alliances	Center for Rural PA	2nd two years

RESOURCE CATEGORIES	MANAGEMENT OPTIONS AND PRIORITIES	POTENTIAL PARTNERSHIPS and/or RESPONSIBLE PARTIES	POTENTIAL FUNDING SOURCES	ANTICIPATED IMPLEMENTATION
	PLANNING (continued)			
Planning	**12. Prepare educational materials on the management of large scale animal operations.**	County conservation districts and planning offices	DCED, municipalities, county government	1st two years
Planning, Natural Resources	**13. Encourage municipalities to establish compliance with existing sewage treatment regulations by preparing and updating formal Act 537 sewage facilities plans and prioritizing construction of sewage treatment facilities.**	Watershed municipalities, DEP, Indiana County Office of Planning and Development, Indiana County Municipal Services Agency, C & ITC	PADEP Sewage Management Grants	2nd two years
Planning	**14. Develop and implement a Dry Hydrant Program**	County Conservation Districts	DCED	2nd two years
	RECREATION			
Recreation, Economic Development, Cultural and Historical	**1. Develop directional and interpretive signs for display along the existing and proposed trails.**	CrCWA, PHMC, county planning departments, Indiana County Parks	C2P2, HPP	2nd two years
Recreation, Cultural and Historical	**2. Conduct feasibility studies, inventory, investigate, and acquire abandoned railroad right-of-ways for new recreational trails and connections between existing or proposed trails, and investigate the possibility of rail with trail connections.**	CrCWA, railroad companies, Indiana County Parks, C & ITC	Private foundations, corporate sponsors, C2P2, TEA-21	1st two years
Planning, Recreation	**3. Develop a comprehensive trail and greenway plan for the entire watershed.**	DCED, municipal and county government, Cambria and Indiana County Trail Council (C & I TC), Indiana County Parks	DCED, municipalities, county government, DCNR	2nd two years
Recreation	**4. Develop new or enhance existing fishing access areas in public areas.**	CrCWA, PFBC, Indiana County Parks	PFBC, watershed municipalities, Fish America	1st two years
Recreation	**5. Repair the infrastructure of Cummings Dam.**	ACOE, CrCWA, PFBC, Indiana County Parks	ACOE, PADEP Growing Greener Funds, corporate sponsors	2nd two years
Recreation	**6. Acquire additional land surrounding Blue Spruce County Park.**	CrCWA, PGC, county conservation districts, Indiana County Parks	DCED, PGC, municipalities, county government, county conservation districts, PADEP Growing Greener Funds, corporate sponsors, DCNR C2P2	2nd two years
Recreation	**7. Initiate and implement efforts to enhance the Crooked Creek Watershed area as a destination for recreational and touring cyclists by promoting road improvements, signage and marketing, as well as the annual Indiana Five Points Bicycle Race.**	Indiana County Office of Planning and Development (ICOPD), PENNDOT, Indiana County Tourist Bureau, Indiana Cycling Club, Indiana County Parks, C & ITC	PENNDOT District 10-0 Maintenance Funds, TEA-21	1st two years

CHAPTER 8

REFERENCES



Baltimore & Ohio Railroad Bridge over Crooked Creek near Creekside

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Punxsutawney
Armstrong
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Kittanning
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Allegheny River
Plum Creek
Crooked Creek
Crooked Creek
Indiana
Kiskiminetas River
Indiana
422
Cambria
Ebensburg
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Conemaugh River
Johnstown
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Little Conemaugh River
Greensburg
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Westmoreland
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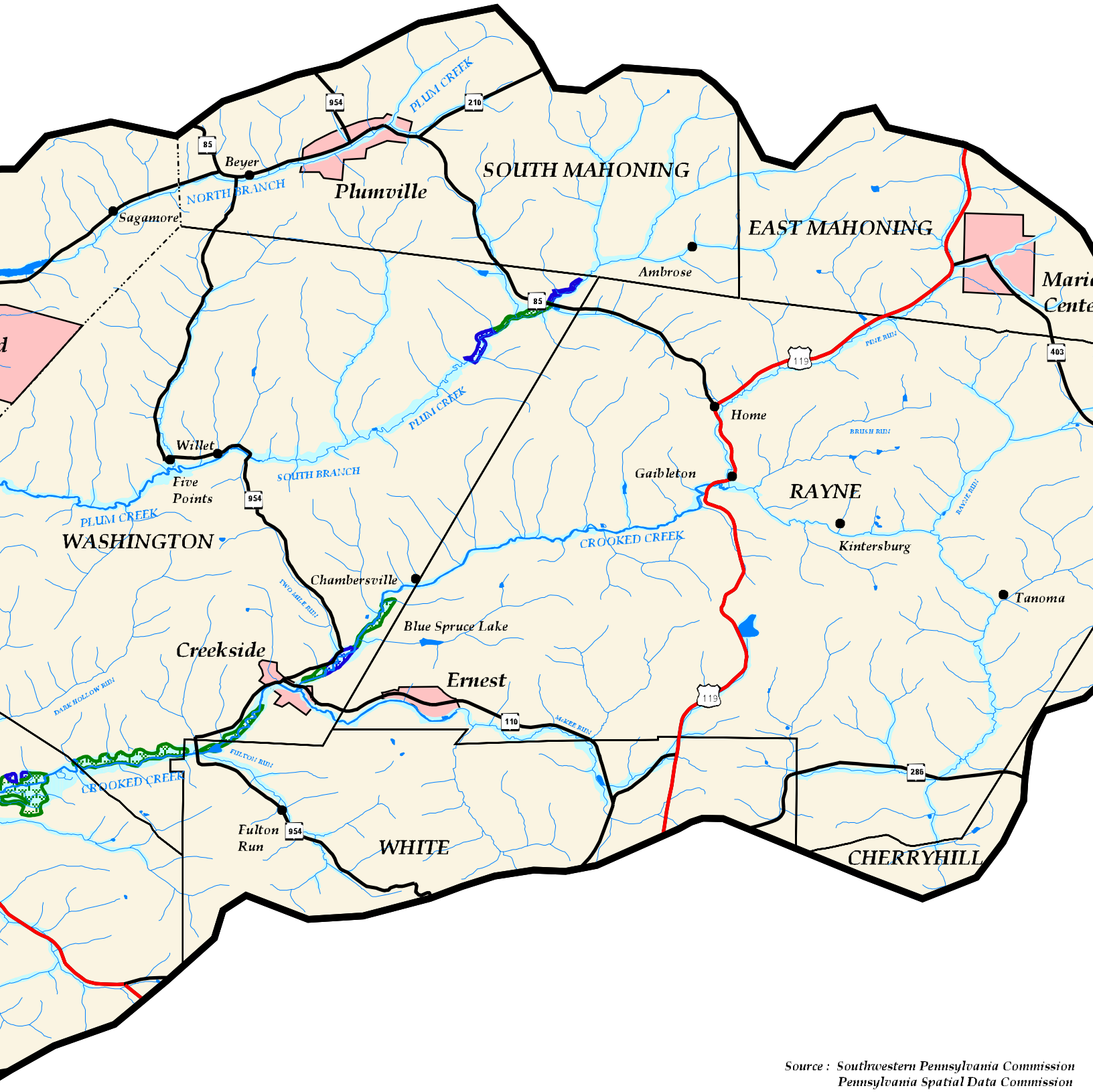
Somerset
Stonycreek River



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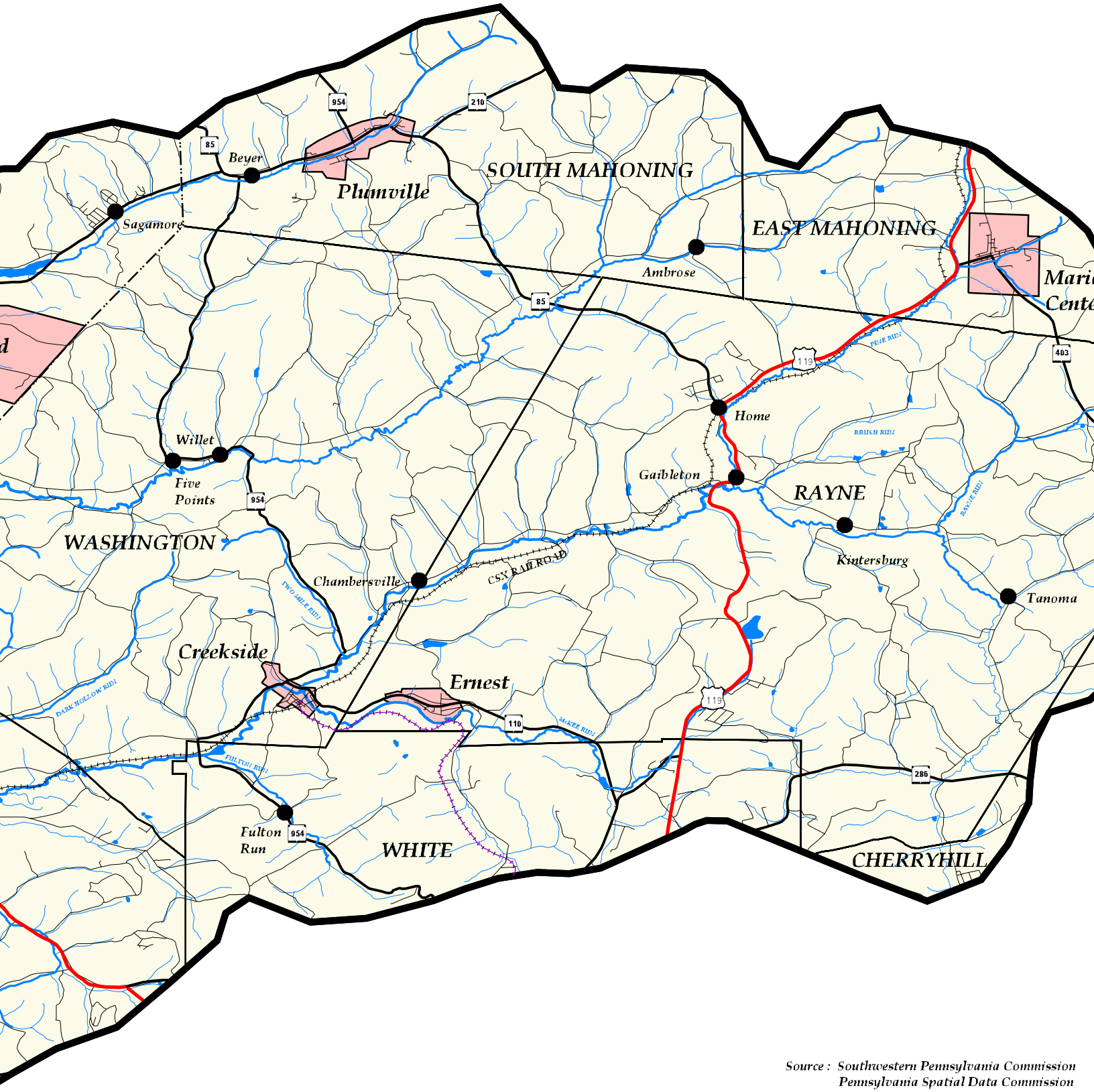

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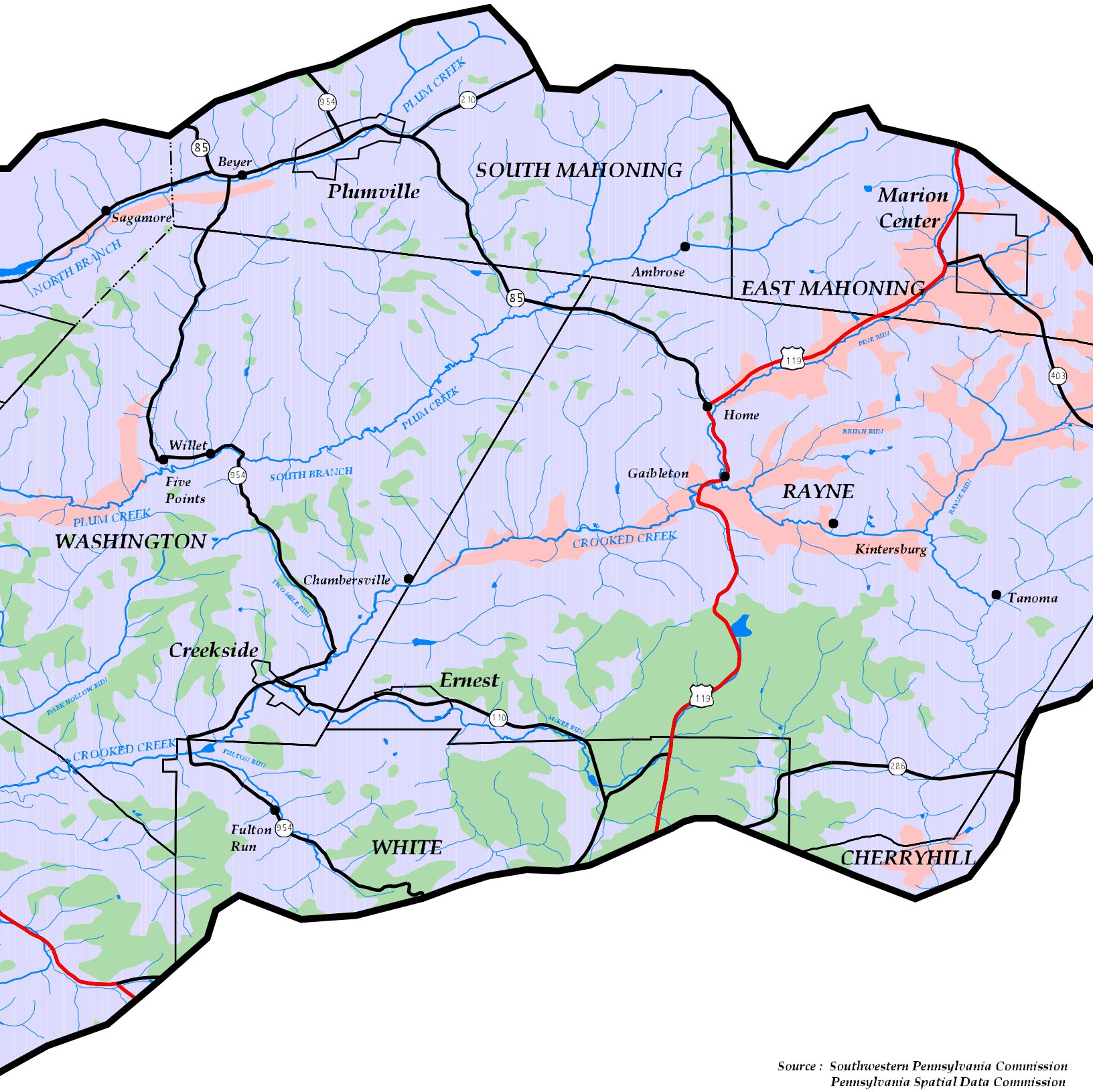

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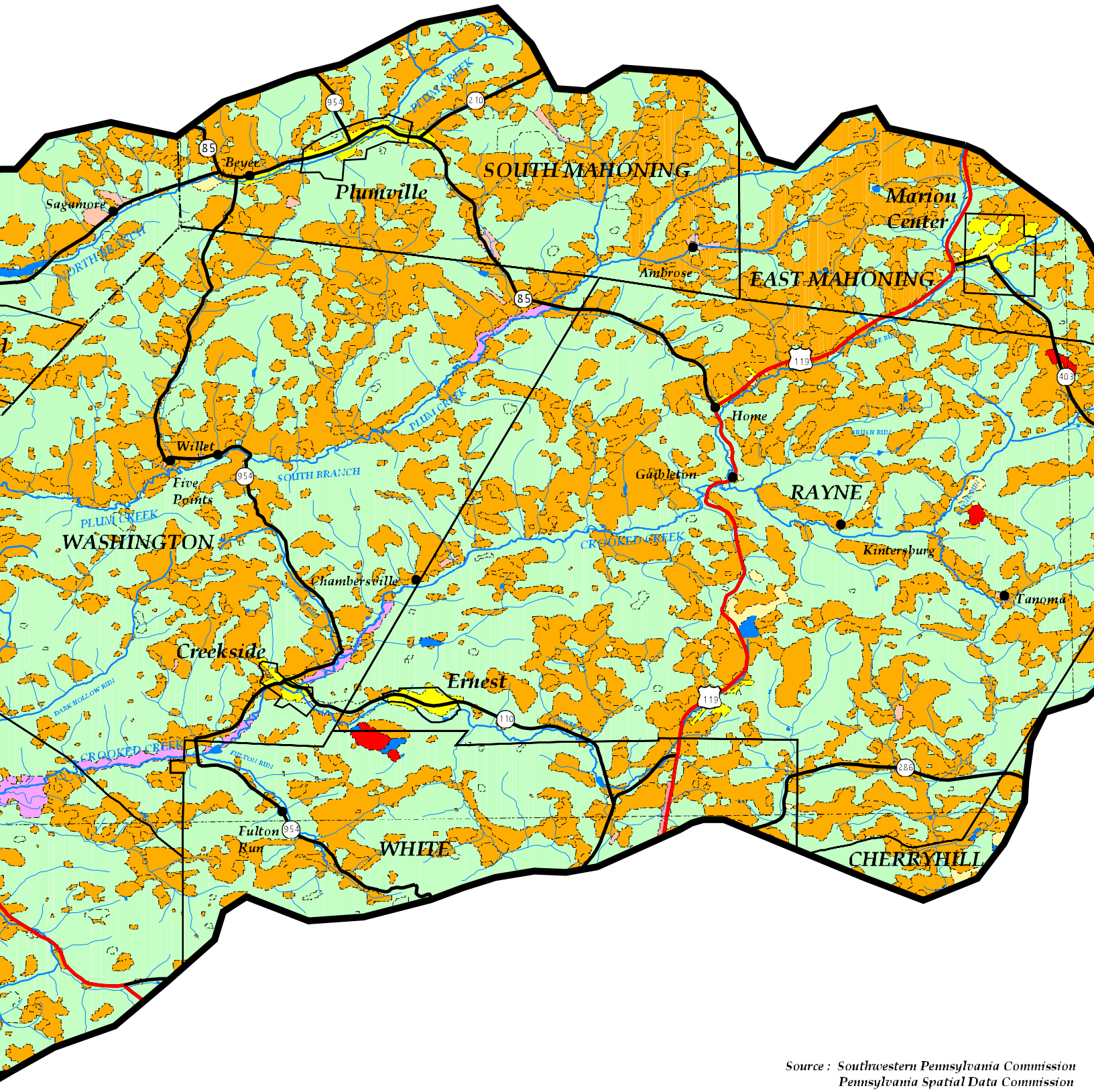

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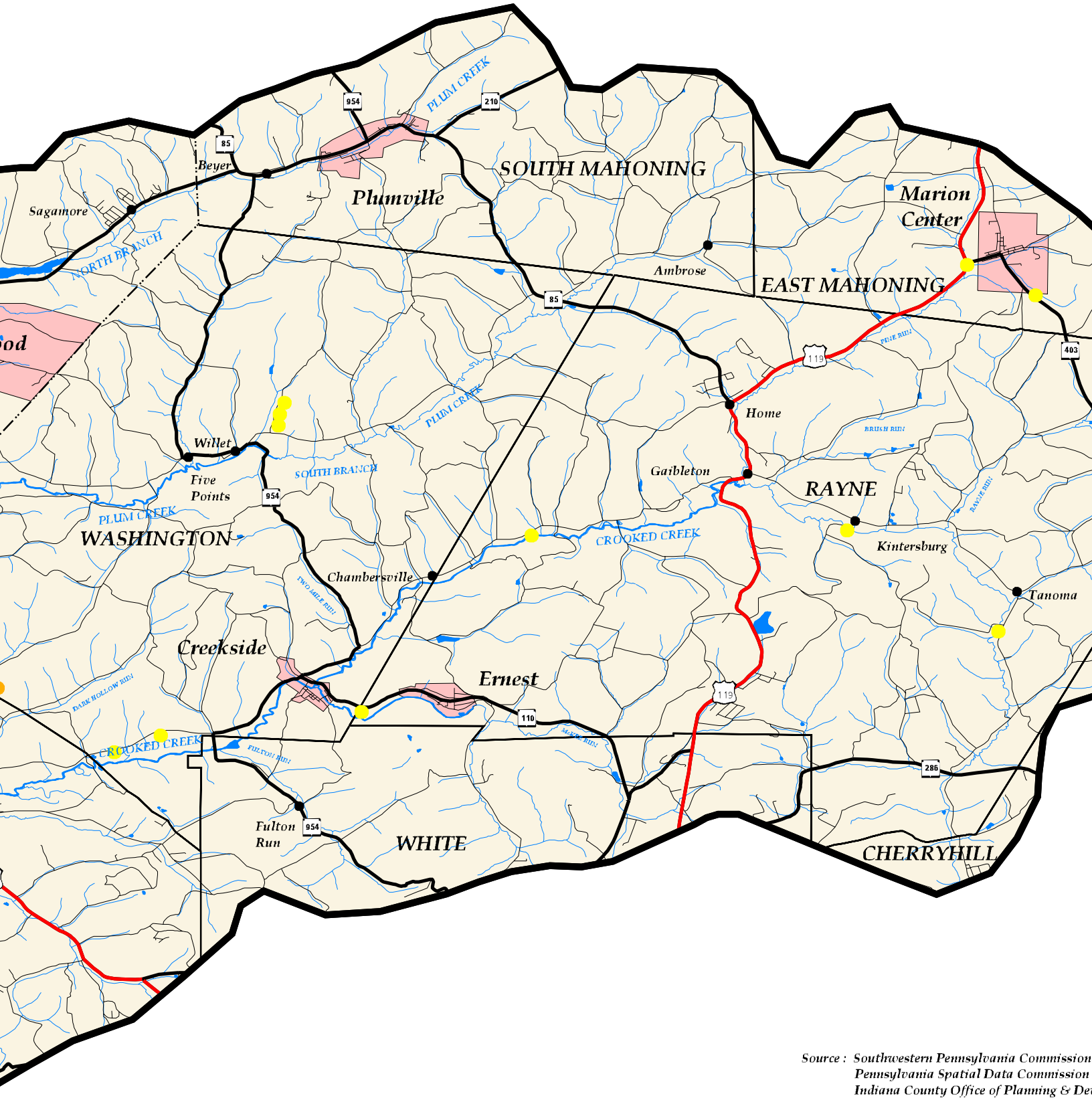

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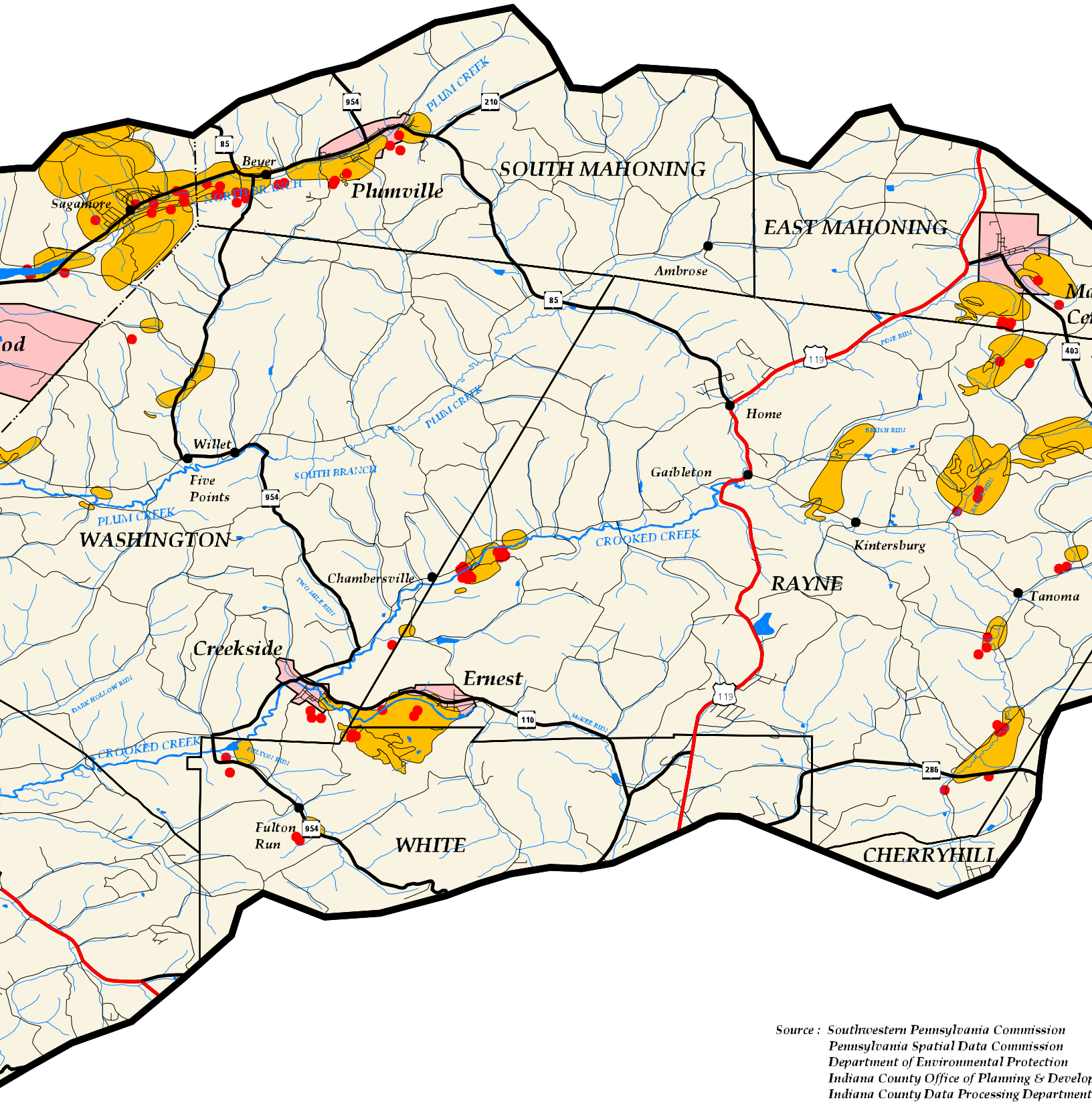

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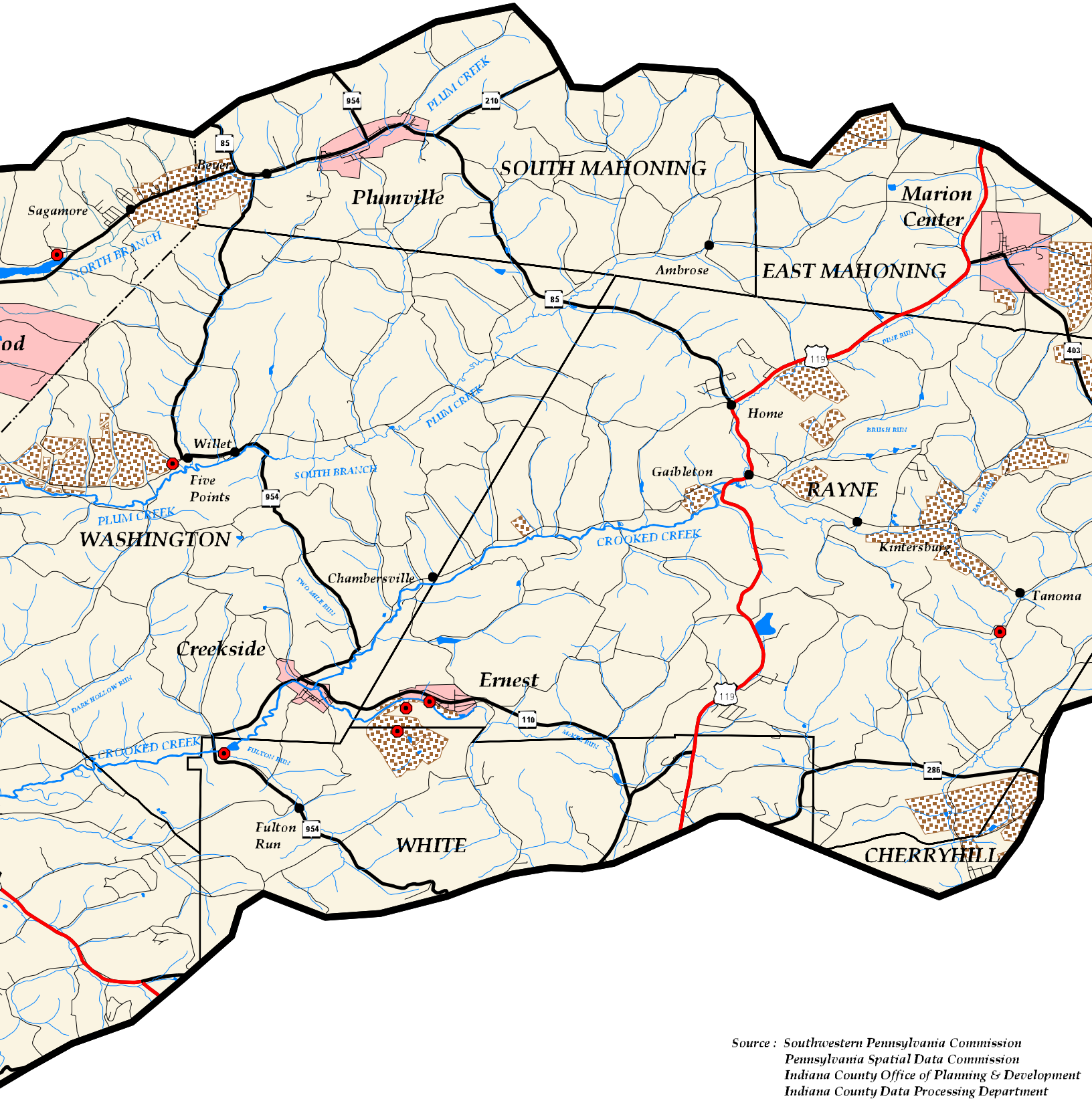

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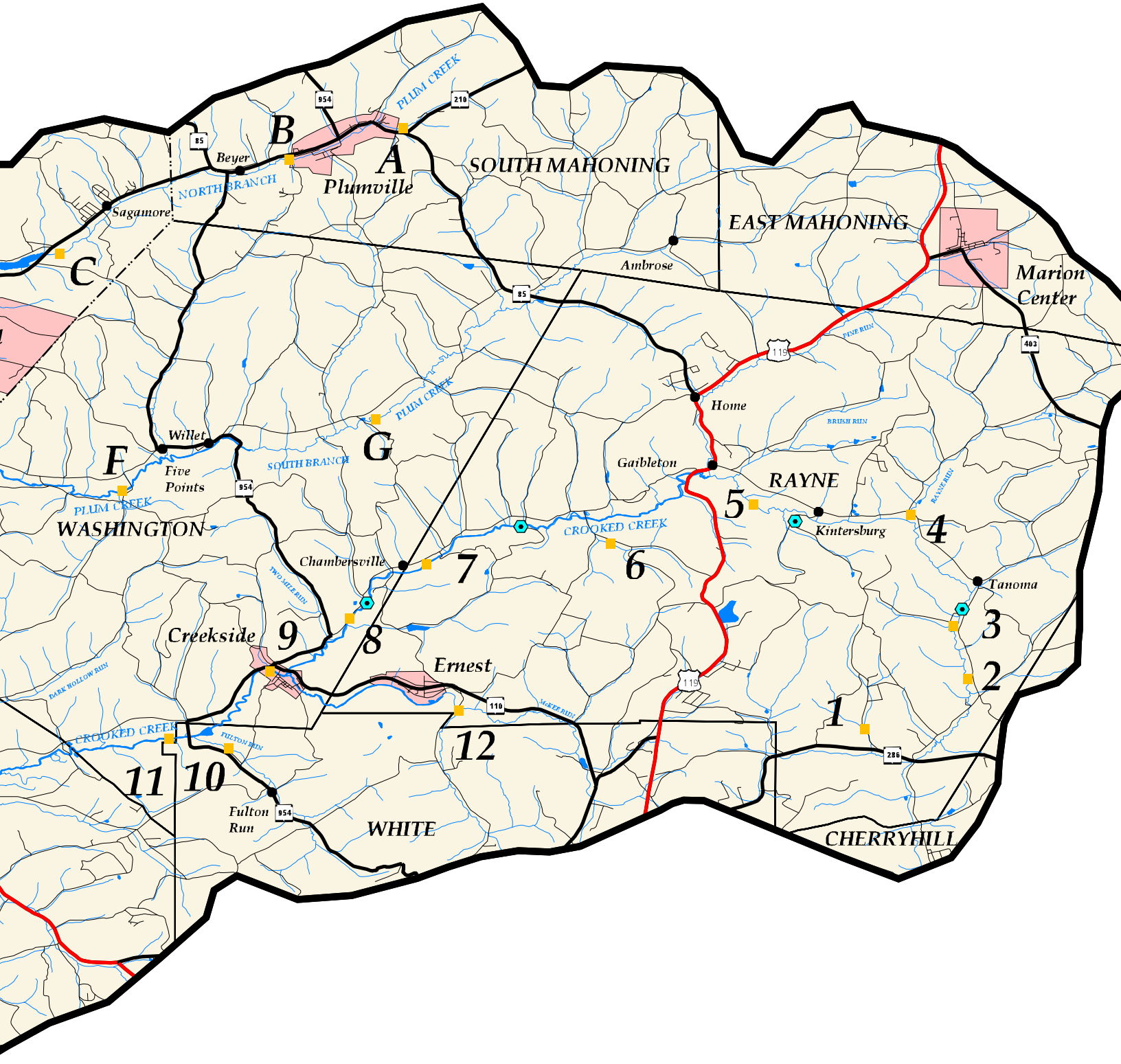

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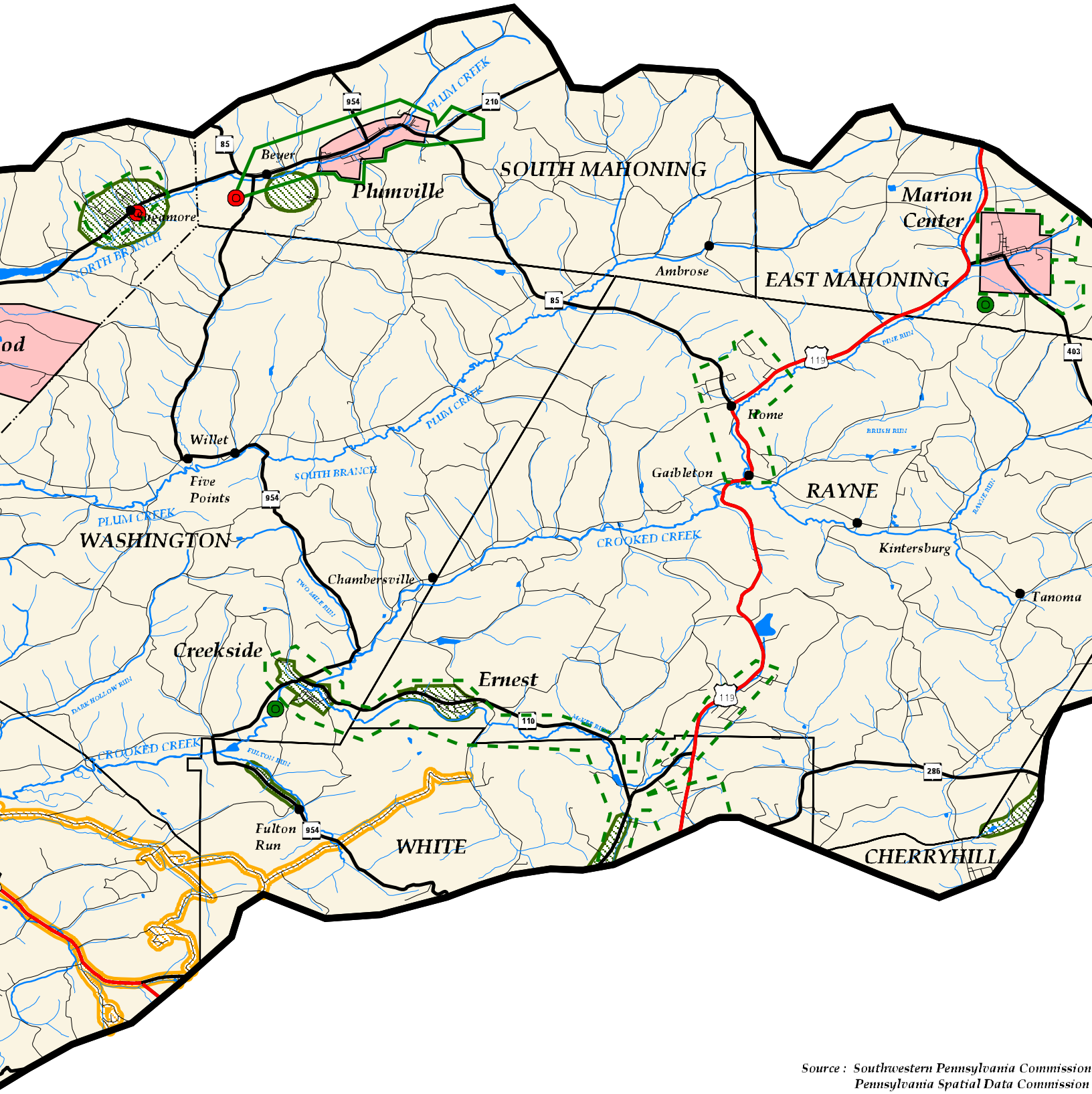

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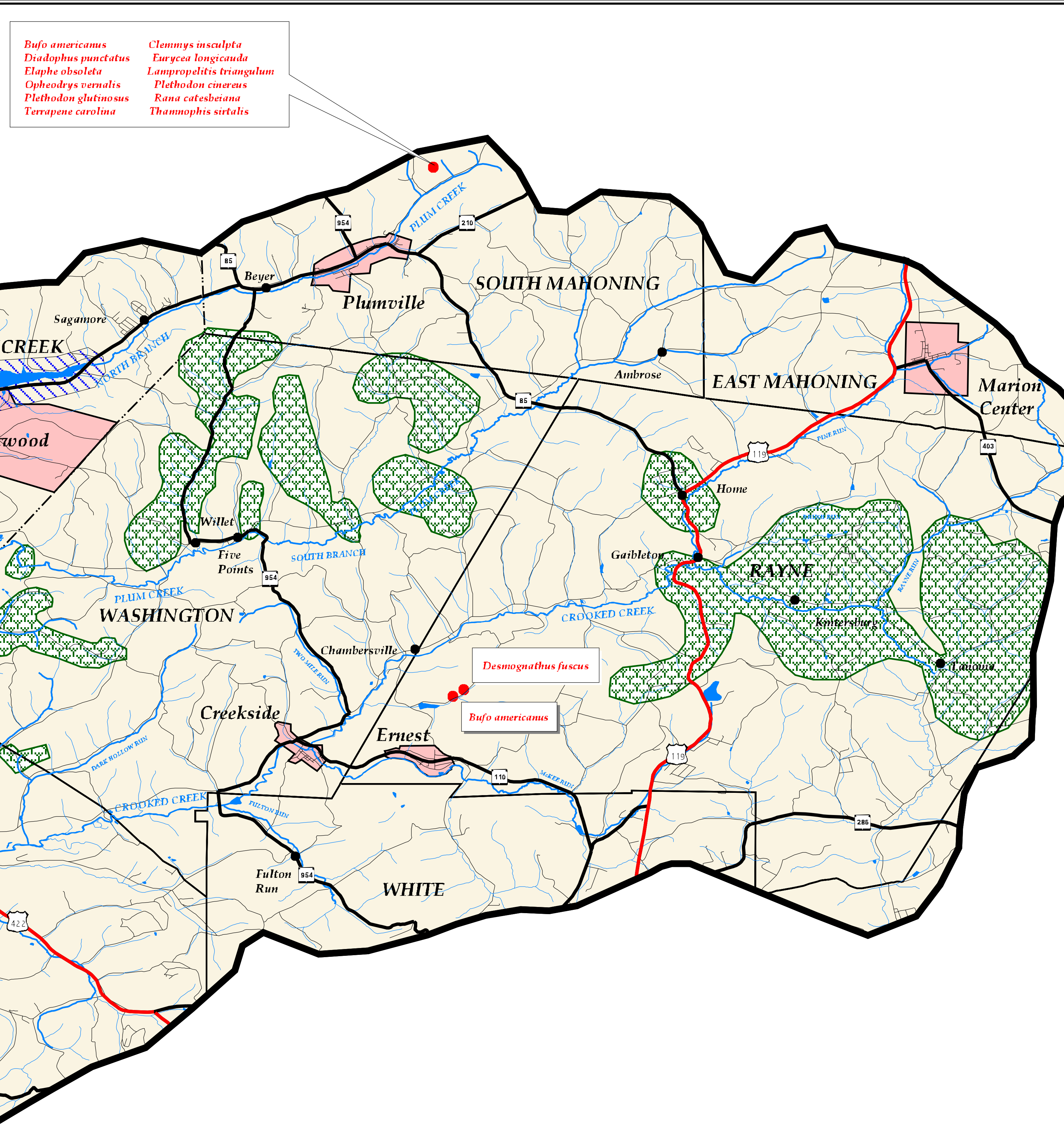
Bufo americanus
Diadophus punctatus
Elaphe obsoleta
Opheodrys vernalis
Plethodon glutinosus
Terrapene carolina
Clemmys insculpta
Eurycea longicauda
Lampropelitis triangulum
Plethodon cinereus
Rana catesbeiana
Thamnophis sirtalis
Desmognathus fuscus
Bufo americanus
SOUTH MAHONING
EAST MAHONING
WASHINGTON
RAYNE
WHITE
CREEK
Plumville
Beyer
Sagamore
Ambrose
Marion Center
Home
Gaibleton
Kintersburg
Tanoma
Willet
Five Points
Chambersville
Creekside
Ernest
Fulton Run
PLUM CREEK
NORTH BRANCH
SOUTH BRANCH
CROOKED CREEK
TWO MILE RUN
DARK HOLLOW RUN
FULTON RUN
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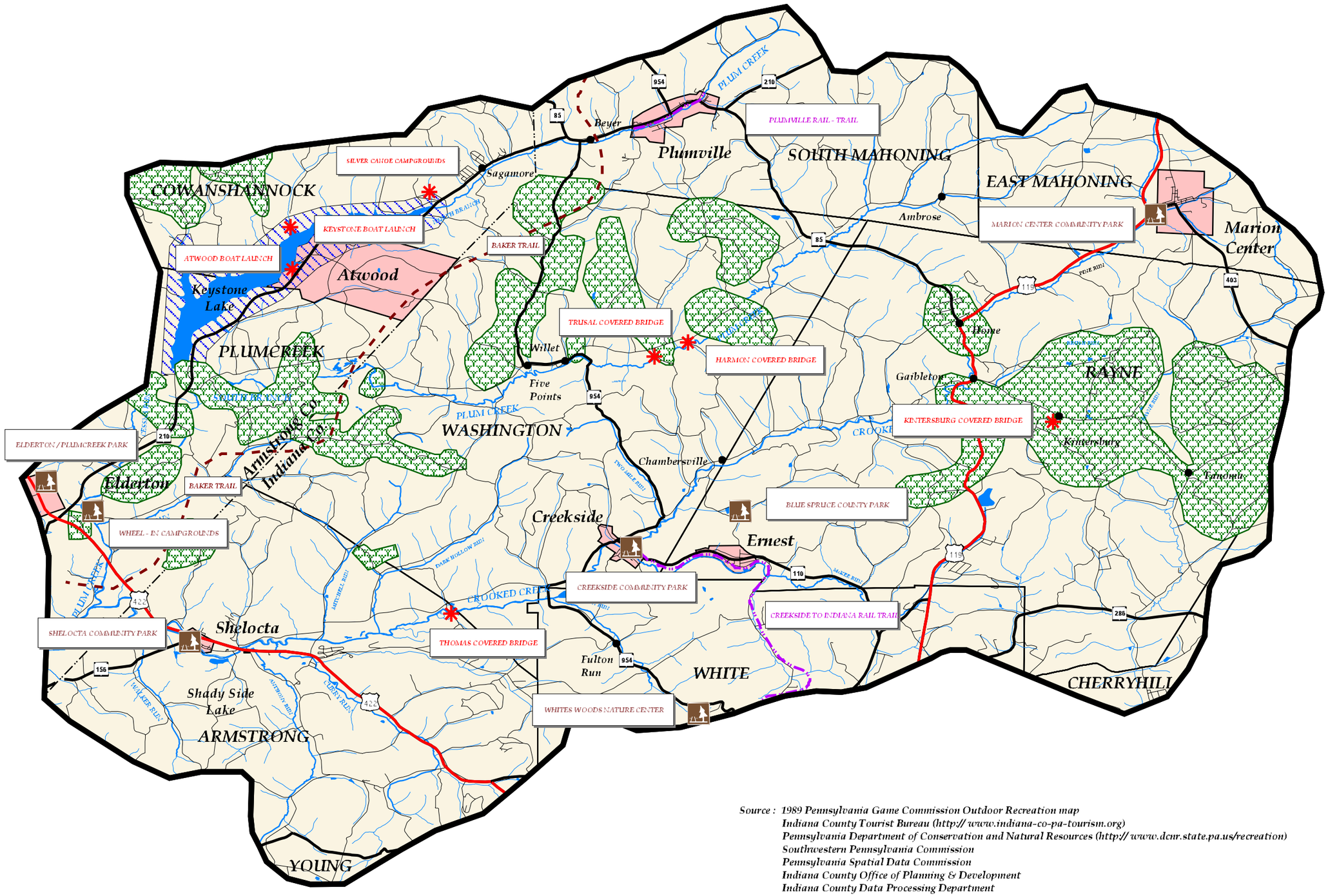
Figure 12

Cultural & Recreational Resources

Upper Crooked Creek Watershed

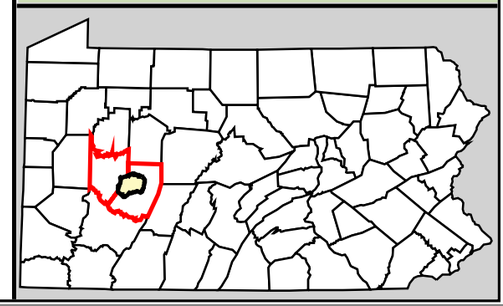


- Boroughs
- Crooked Creek Watershed Study Area
- County Boundaries
- Township Boundaries
- Streams
- Major Roads
- State Roads
- Secondary Roads
- Parks (County, Municipal, and Private Facilities)
- National Register Listed Historical Sites
- Existing Hiking Trails
- Proposed/Planned Rail Trails (Abandoned Railroads)
- Farmland Co-op Areas
- Pa. Fish & Boat Comm. Cooperative Lease

N W E S

1 0 1 2 3 Miles

Indiana County Planning & Development
Indiana, Pennsylvania



Source : 1989 Pennsylvania Game Commission Outdoor Recreation map
Indiana County Tourist Bureau (http:// www.indiana-co-pa-tourism.org)
Pennsylvania Department of Conservation and Natural Resources (http:// www.dcnr.state.pa.us/recreation)
Southwestern Pennsylvania Commission
Pennsylvania Spatial Data Commission
Indiana County Office of Planning & Development
Indiana County Data Processing Department

APPENDIX A

PUBLIC COMMENTS

APPENDIX B

SAMPLE FLOODPLAIN ORDINANCE

APPENDIX C

ILLEGAL DUMPSITE ASSESSMENT FORM

APPENDIX D

VEGETATION SPECIES LIST

Common Name	Scientific Name
Woody Trees and Scrub Shrubs	
red maple	*Acer rubrum*
sugar maple	*Acer saccharum*
silver maple	*Acer saccharinum*
smooth alder	*Alnus serrulata*
Hercules club	*Aralia spinosa*
black birch	*Betula lenta*
American hornbeam	*Carpinus caroliniana*
bitternut hickory	*Carya cordiformis*
shellbark hickory	*Carya laciniosa*
shagbark hickory	*Carya ovata*
mockernut hickory	*Carya tomentosa*
northern hackberry	*Celtis occidentalis*
silky dogwood	*Cornus amomum*
flowering dogwood	*Cornus florida*
panicled dogwood	*Cornus racemosa*
hawthorn	*Crataegus spp.*
white ash	*Fraxinus americana*
black ash	*Fraxinus nigra*
dwarf huckleberry	*Gaylussacia dumosa*
witch-hazel	*Hamamelis virginiana*
butternut	*Juglans cinerea*
black walnut	*Juglans nigra*
spicebush	*Lindera benzoin*
tuliptree	*Liriodendron tulipifera*
cucumbertree	*Magnolia acuminata*
apple	*Malus sylvestris*
black gum	*Nyssa sylvatica*
hornbeam	*Ostrya virginiana*
ninebark	*Physocarpus opulifolius*
blue spruce	*Picea pungens*
eastern white pine	*Pinus strobus*
scotch pine	*Pinus sylvestris*
red pine	*Pinus resinosa*
eastern sycamore	*Platanus occidentalis*
bigtooth aspen	*Populus grandidentata*
crab apple	*Pyrus coronaria*
sour cherry	*Prunus cerasus*
pin cherry	*Prunus pensylvanica*
black cherry	*Prunus serotina*
common chokecherry	*Prunus virginiana*
white oak	*Quercus alba*

Common Name	Scientific Name
northern red oak	*Quercus rubra*
scarlet oak	*Quercus coccinea*
pin oak	*Quercus palustris*
black oak	*Quercus velutina*
rosebay rhododendron	*Rhododendron maximum*
smooth sumac	*Rhus glabra*
black locust	*Robinia psuedoacacia*
multiflora rose	*Rosa multiflora*
common blackberry	*Rubus allegheniensis*
swamp dewberry	*Rubus hispidus*
black raspberry	*Rubus occidentalis*
shining willow	*Salix lucida*
meadow willow	*Salix petiolaris*
silky willow	*Salix sericea*
common elderberry	*Sambucus canadensis*
sassafras	*Sassafras albidum*
American basswood	*Tilia americana*
eastern hemlock	*Tsuga canadensis*
slippery elm	*Ulmus rubra*
early low blueberry	*Vaccinium angustifolium*
deerberry	*Vaccinium stamineum*
maple-leaved viburnum	*Viburnum lentago*
rusty blackhaw	*Viburnum rufidulum*

Herbaceous Vegetation

yarrow	*Achillea millefolium*
agrimonia	*Agrimonia gryposepala*
bugleweed	*Ajuga reptans*
common ragweed	*Ambrosia artimisiifolia*
hog peanut	*Amphicarpa bracteata*
Canada anemone	*Anemone canadensis*
long-fruited anemone	*Anemone cylyndrica*
mountain anemone	*Anemone lancifolium*
wood anemone	*Anemone quinquefolia*
thimbleweed	*Anemone virginiana*
spikenard	*Aralia racemosa*
burdock	*Arctium minus*
jack-in-the-pulpit	*Arisaema triphyllum*
goatsbeard	*Aruncus dioicus*
common milkweed	*Asclepias syriaca*
butterfly weed	*Asclepias tuberosa*

Common Name	Scientific Name
green milkweed	*Asclepias viridiflora*
white-wood aster	*Aster divaricatus*
bushy aster	*Aster dumosus*
crooked-stem aster	*Aster prenathoides*
wintercress	*Barbarea orthoceras*
tickseed sunflower	*Bidens coronata*
false nettle	*Boehmaria cylindrica*
mouse-ear chickweed	*Cerastium vulgatum*
pink turtlehead	*Chelone lyoni*
water hemlock	*Cicuta maculata*
American bugbane	*Cimicifunga americana*
black snakeroot	*Cimicifunga racemosa*
dwarf enchanter's nightshade	*Circaea alpina*
enchanter's nightshade	*Circaea quadrisulcata*
bull thistle	*Cirsium vulgare*
spring beauty	*Claytonia virginica*
bluebead	*Clintonia borealis*
squawroot	*Conopholis americana*
hedge bindweed	*Convovulvus sepium*
lance-leaved coreopsis	*Coreopsis lanceolata*
tall coreopsis	*Coreopsis tripteris*
crown vetch	*Coronilla varia*
Oxeye daisy	*Chrysanthemum leucanthemum*
pink lady's slipper	*Cypripedium acaule*
honewort	*Crytotaenia canadensis*
wild carrot	*Daucus carota*
panicled tick trefoil	*Desmodium paniculatum*
grass pink	*Dianthus armeria*
wild yamroot	*Dioscorea villosa*
teasel	*Dypsacus sylvestris*
purple coneflower	*Echinacea purpurea*
Indian cucumber root	*Echinocystis lobata*
daisy fleabane	*Erigeron annus*
common fleabane	*Erigeron philadelphicus*
joe-pye-weed	*Eupatorium dubium*
trumpetweed	*Eupatorium fistulosum*
boneset	*Eupatorium perfoliatum*
white snakeroot	*Eupatorium rugosum*
wood strawberry	*Fragaria vesca*
cleavers	*Galium aperine*
rough bedstraw	*Galium asprellum*

Common Name	Scientific Name
smooth bedstraw	*Galium boreale*
wild licorice	*Galium circaezans*
sweet-scented bedstraw	*Galium trifolium*
wintergreen	*Gaultheria procumbens*
wild geranium	*Geranium maculatum*
white avens	*Geum canadense*
ground ivy	*Glechoma hederacea*
yellow hawkweed	*Heiracium pratense*
woodland sunflower	*Helianthus divaricatus*
day lily	*Hemerocallis fulva*
dame's rocket	*Hesperis matronalis*
orange hawkweed	*Hieracium aurantiacum*
mouse ear	*Hieracium pirosella*
panicled hawkweed	*Hieracium paniculatum*
field hawkweed	*Hieracium pratense*
goldenseal	*Hydrastis canadensis*
water pennywort	*Hydrocotyle ranunculoides*
common St. Johnswort	*Hypercium perforatum*
jewelweed	*Impatiens capensis*
blue flaf	*Iris versicolor*
tall blue lettuce	*Lactuca biennis*
spiked blazing star	*Liatris spicata*
prickly lettuce	*Lactuca scariola*
wood nettle	*Laportea canadensis*
common motherwort	*leonurus cardiaca*
wild peppergrass	*Lepidium virginicum*
Canada lily	*Lilium canadense*
turk's-cap lily	*Lilium superbum*
birdsfoot trefoil	*Lotus corniculatus*
northern bugleweed	*lycopus uniflorus*
whorled loosestrife	*Lysimachia quadrifolia*
Canada mayflower	*Maianthemum canadense*
musk mallow	*Malva moschata*
Indian cucumber root	*Medeola virginiana*
yellow sweet clover	*Meliotus officinalis*
partridgeberry	*Mitchella repens*
bee balm	*Monarda didyma*
wild bergamot	*Monarda fistulosa*
purple bergamot	*Monarda media*
Indian pipe	*Monotropa uniflora*
sweet cicely	*Osmorhiza claytonia*

Common Name	Scientific Name
yellow wood sorrel	*Oxalis montana*
Virginia creeper	*Parthenocissus quinquefolia*
timothy	*Phleum pratense*
wild sweet william	*Phlox maculata*
clearweed	*Pilea pumila*
English plantain	*Platago lanceolata*
common plantain	*Platago major*
mayapple	*Podophyllum peltatum*
purple milkwort	*Polygala sanguinea*
smooth Solomon's seal	*Polygonatum biflorum*
black bindweed	*Polygonum convovulus*
Japanese knotweed	*Polygonum cuspidatum*
Pennsylvania smartweed	*Polygonum pennsylvanicum*
lady's thumb	*Polygonum persicaria*
common cinquefoil	*Potentilla simplex*
white lettuce	*Prenanthes alba*
tall rattlesnake root	*Prenanthes trifoliata*
self-heal	*Prunella vulgaris*
hooked crowfoot	*Ranunculus recuratus*
deergrass	*Rhexia virginica*
poison ivy	*Rhus radicans*
tall coneflower	*Rudbeckia laciniata*
black-eyed susan	*Rudbeckia serotina*
field sorrel	*Rumex acetocela*
curled-dock	*Rumex crispus*
bitter dock	*Rumex obtusifolius*
short-styled snakeroot	*Sanicula canadensis*
clustered snakeroot	*Sanicula gregaria*
wild basil	*Satureja vulgaris*
downy skullcap	*Scutellaria incana*
mad-dog skullcap	*Scutellaria lateriflora*
balsam ragwort	*Senecio pauperculus*
fire pink	*Silene virginica*
blue-eyed grass	*Sisyrinchium angustifolium*
false Solomon's seal	*Smilacina racemosa*
common greenbriar	*Smilax rotundifolia*
horse nettle	*Solanum carolinense*
goldenrods	*Solidago spp.*
Venus's looking glass	*Specularia perfoliata*
long-leaved stichwort	*Stellaria longifolia*
common chickweed	*Stellaria media*

Common Name	Scientific Name
featherfleece	*Stenanthium graminium*
twisted stalk	*Streptopus amplexifolius*
skunk cabbage	*Symplocarpus foetidus*
common dandelion	*Taraxacum officinale*
tall meadow rue	*Thalictrum polygamum*
jumpseed	*Tovara virginiana*
yellow clover	*Trifolium agrarium*
red clover	*Trifolium pratense*
white clover	*Trifolium repens*
nodding trillium	*Trillium cernuum*
coltsfoot	*Tussilago farfara*
stinging nettle	*Urtica dioica*
bellwort	*Uvulvaria perfoliata*
lamb's lettuce	*Valerianella olitoria*
common speedwell	*Veronica officinalis*
sweet white violet	*Viola blanda*
common blue violet	*Viola papilioniacea*
pale violet	*Viola striata*
fox grape	*Vitis labrusca*
cat grape	*Vitus palmata*
Pteridophytes	
ebony spleenwort	*Asplenium platyneuron*
rattlesnake fern	*Botrychium virginianum*
fragile fern	*Cystopteris fragilis*
hay-scented fern	*Dennstaedtia punctilobula*
spinulose woodfern	*Dryopteris marginalis*
sensitive fern	*Onoclea sensibilis*
cinnamon fern	*Osmunda cinnamomea*
Christmas fern	*Polystichum acrostichoides*
bracken fern	*Pteridium aquilinum*
New York fern	*Thelypteris noveboracenis*
marsh fern	*Thelypteris palustris*
ground pine clubmoss	*Lycopodium flabelliforme*
shining clubmoss	*Lycopodium lucidulum*
tree clubmoss	*Lycopodium obscurum*
ground cedar	*Lycopodium tristachyum*

Source: Blue Spruce County Park Inventory by M. Kuzemchak, 1997.

APPENDIX E

AVIAN SPECIES LIST

Common Name	Scientific Name
Cooper's hawk	*Accipiter cooperti*
sharp-skinned hawk	*Accipiter striatus*
spotted sandpiper	*Acitus macularia*
red-winged blackbird	*Agelaius phoeniceus*
American wideon	*Anas americanus*
mallard duck	*Anas platyrynchos*
American black duck	*Anas rubripes*
ruby-throated hummingbird	*Archilochus colubris*
lesser scaup	*Aythya affinis*
ring-necked duck	*Aythya collaris*
cedar waxwing	*Bombycilla redrorum*
ruffed grouse	*Bonasa umbellus*
Canada goose	*Branta canadensis*
great horned owl	*Bubo virginianus*
bufflehead	*Bucephala albeola*
red-tailed hawk	*Buteoa jamaicensis*
broad-winged hawk	*Buteo platypterus*
green heron	*Butorides striatus*
whipporwill	*Caprimulgus vociferus*
northern cardinal	*Cardinalis cardinalis*
American goldfinch	*Carduelis tristis*
house finch	*Carpodacus mexicanus*
purple finch	*Carpodacus purpureus*
turkey vulture	*Cathartes aura*
veery	*Catharus fuscescens*
hermit thrush	*Catharus guttatus*
Swainson's thrush	*Catharus ustulatus*
brown creeper	*Certhia familiaris*
chimney swift	*Chaetura pelagica*
killdeer	*Charadrius vociferus*
common nighthawk	*Chordeiles minor*
northern harrier	*Circus cyaneus*
oldsquaw	*Clangula hyemalis*
yellow-billed cuckoo	*Coccyzus americanus*
black-billed cuckoo	*Coccyzus erythropthalamus*
~~northern flicker~~	~~*Colaptes auratus*~~

Common Name	Scientific Name
northern bobwhite	*Colinus virginianus*
rock dove	*Columba livia*
eastern wood pewee	*Contopus virens*
American crow	*Corvus brachyrhynchos*
blue jay	*Cyanocitta cristata*
mute swan	*Cygnus olor*
black-throated blue warbler	*Dendroica caerulescens*
day-breasted warbler	*Dendroica castanea*
cerulean warbler	*Dendroica cerulea*
yellow-rumped warbler	*Dendroica coronata*
prairie warbler	*Dendroica discolor*
blackburnian warbler	*Dendroica fusca*
magnolia warbler	*Dendroica magnolia*
chestnut-sided warbler	*Dendroica pensylvanica*
blue-winged warbler	*Dendroica pinus*
blackpoll warbler	*Dendroica striata*
Cape May warbler	*Dendroica tigrina*
black-throated green warbler	*Dendroica virens*
pileated woodpecker	*Dryocopus pileatus*
grey catbird	*Dumetella carolinensis*
alder flycatcher	*Empidonax alnorum*
least flycatcher	*Empidonax minimus*
willow flycatcher	*Empidonax trailii*
acadian flycatcher	*Empidonax virescens*
rusty blackbird	*Euphagus carolinus*
American coot	*Fulica americana*
common yellowthroat	*Geothlypis trichas*
barn swallow	*Hirundo rustica*
wood thrush	*Hylocichla mustelina*
northern oriole	*Icterus galbula*
tree swallow	*Iridoprocne bicolor*
dark-eyed junco	*Junco hyemalis*
ring-billed gull	*Larus delawarensis*
Bonaparte's gull	*Larus philadelphia*
hooded merganser	*Lophodytes cucullatus*

Common Name	Scientific Name
red-bellied woodpecker	*Malanerpes carolinus*
belted kingfisher	*Megaceryle alcyon*
wild turkey	*Meleagris gallopavo*
swamp sparrow	*Melospiza georgiana*
Lincoln's sparrow	*Melospiza lincolnii*
song sparrow	*Melospiza melodia*
red-breasted merganser	*Mergus serrator*
black-and-white warbler	*Mniotilta varia*
brown-headed cowbird	*Molothrus ater*
great crested flycatcher	*Myiarchus crinitus*
Connecticut warbler	*Oporonis agilis*
Kentucky warbler	*Oporonis formosus*
mourning warbler	*Oporonis philadelphia*
northern parula warbler	*Parula americana*
black-capped chickadee	*Parus atricapillus*
tufted titmouse	*Parus bicolor*
indigo bunting	*Passerina cyanea*
cliff swallow	*Petrochelidon pyrrhonota*
double-crested cormorant	*Phalacrocorax auritus*
ring-necked pheasant	*Phasianus colchicus*
rose-breated grosbeak	*Pheucticus ludovicianus*
american woodcock	*Philohela minor*
downy woodpecker	*Picoides villosus*
rufous-sided towhee	*Pipilo erythrophthalmus*
western tanager	*Piranga ludoviciana*
scarlet tanager	*Piranga olivacea*
horned grebe	*Podiceps auritus*
pied-billed grebe	*Podilymbus podiceps*
blue-grey gnatcatcher	*Potioptila caerulea*
common grackle	*Quiscalus quiscula*
ruby-crowned kinglet	*Regulus calendula*
golden-crowned kinglet	*Regulus satrapa*
eastern phoebe	*Sayornis phoebe*
ovenbird	*Seirus aurocapillus*
Louisiana waterthrush	*Seiurus motacilla*

Common Name	Scientific Name
American redstart	*Setophaga ruticilla*
eastern bluebird	*Sialia sialis*
white-breasted nuthatch	*Sitta carolinensis*
yellow-bellied sapsucker	*Sphyrapicus varius*
American tree sparrow	*Spizella arborea*
chipping sparrow	*Spizella passerina*
field sparrow	*Spizella pusilla*
rough-winged swallow	*Stelgidopteryx ruficollis*
European starling	*Sternus vulgarus*
barred owl	*Strix varia*
eastern meadowlark	*Sturnella magna*
Carolina wren	*Thyrothorus ludovicianus*
brown thrasher	*Toxostoma rufum*
solitary sandpiper	*Tringa solitaria*
house wren	*Troglodytes aedon*
winter wren	*Troglodytes troglodytes*
American robin	*Turdus migratoris*
golden-winged warbler	*Vermivora chryotera*
Tennessee warbler	*Vermivora peregrina*
Nashville warbler	*Vermivora ruficapilla*
yellow-throated vireo	*Vireo flavifrons*
warbling vireo	*Vireo gilvus*
red-eyed vireo	*Vireo olivaceus*
Philadelphia vireo	*Vireo philadelphicus*
solitary vireo	*Vireo solitarius*
Canada warbler	*Wilsonia canadensis*
hooded warbler	*Wilsonia citrina*
Wilson's warbler	*Wilsonia pusilla*

Source: Blue Spruce County Park Inventory by M. Kuzemchak, 1997.

APPENDIX F

RAPID BIOASSESSMENT OF UPPER CROOKED CREEK AND PLUM CREEK WATERSHEDS

List of Acronyms

AMD	Abandoned Mine Drainage
ATA	Allegheny Trail Alliance
ACOE	United States Army Corps of Engineers
C & ITC	Cambria and Indiana County Trail Council
COG	Council of Government
CrCWA	Crooked Creek Watershed Association
C2P2	Community Conservation Partnership Program
DCED	Pennsylvania Department of Community and Economic Development
DCNR	Pennsylvania Department of Conservation and Natural Resources
EPA	United States Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FPMS	Flood Plain
HPP	Heritage Parks Program
ICOPD	Indiana County Office of Planning and Development
ICMSA	Indiana County Municipal Services Agency
IUP	Indiana University of Pennsylvania
LUPTAP	Land Use Planning Technical Assistance Program
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NWS	National Wetland Survey
PABOF	Pennsylvania Bureau of Forestry
PADEP	Pennsylvania Department of Environmental Protection
PENNDOT	Pennsylvania Department of Transportation
PFBC	Pennsylvania Fish and Boat Commission
PGC	Pennsylvania Game Commission
PHMC	Pennsylvania Historical and Museum Commission
TEA-21	Transportation Equity Act for the 21st Century
UCCWC	Upper Crooked Creek Watershed Coalition
USGS	United States Geological Survey
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USOSM	United States Office of Surface Mining
WPC	Western Pennsylvania Conservancy
WPCAMR	Western Pennsylvania Coalition for Abandoned Mine Reclamation