Chapter 1
Introduction & Background

Plan Purpose

This plan, for the conservation of the Upper Lackawanna River and its watershed, has been developed in partnership with the Trails Conservation Corporation, Susquehanna County, and municipalities in the upper watershed, with the collaboration of the Lackawanna River Corridor Association. A companion plan for the lower section of the Lackawanna River, from Stillwater Dam to its confluence with the Susquehanna River, has been developed by the Lackawanna River Corridor Association in partnership with Lackawanna County and twenty-six municipalities in the Lackawanna River watershed.

The Upper Lackawanna River watershed area includes:

- The headwaters of the Lackawanna River – the East and West branches along with their lake sources, tributaries, and feeders;
- The Stillwater Dam and Lake area into which the East and West branches flow; and
- The Lackawanna River from Stillwater to the Simpson Viaduct (about 9 miles).

This river conservation plan describes a vision of the Upper Lackawanna River that can be shared by all who are concerned with what a healthy river means for the residents of our watershed and for our friends and neighbors downstream.

For the section of the Upper Lackawanna River to Stillwater Dam, the plan builds on the original *Lackawanna River Citizens Master Plan* of 1990 and the *Plan for the Lackawanna Heritage Valley* of 1991. Following implementation of these plans, this plan examines conditions in the watershed related to the ecological health of land and water resources. The plan also examines issues related to the management of open space resources, historical and contemporary land use practices, recreation, aesthetics, and public and private infrastructure along the river and its tributary streams.

This plan also includes an inventory of conditions recorded on stream walks conducted by volunteers from LRCA, the Rail-Trail Council, BLOSS Associates, RESCUE, and American Environmental Outfitters during the spring and summer of 1999. Based on the inventory findings, input from public meetings, and review by public officials, the plan offers recommendations for actions to be taken to develop site-specific conservation and recreation projects, individual and watershed-wide programs for education, resource management, and decision-making on management and infrastructure issues.

This plan hopes to identify sensitive river areas to be protected or potential threats to river quality. Areas in need of restoration or revegetation because of past mining activities will also be identified. Recommendations for enhancement of recreational

opportunities and local environmental education opportunities will be addressed in the plan, as will concerns for the conservation of the coldwater fishery. An additional goal of the plan is to develop stewardship of local watershed resources through public participation throughout the planning process. Mapping and data will be provided as part of this plan in a digital form.

An important outcome of this plan is the petition for inclusion of the Upper Lackawanna River and its watershed on the Pennsylvania Rivers Conservation Registry. The plan has been developed with assistance from the Pennsylvania Rivers Conservation Program administered by the Pennsylvania Department of Conservation and Natural Resources. With the endorsement of agencies and municipalities, the registry of the Upper Lackawanna River entitles projects and programs of the types recommended in this plan to eligibility for implementation funds from the Commonwealth through the River Conservation Program. This will allow a number of organizations, municipalities, conservation districts, county planning organizations, and community organizations to leverage funding.

TCC & LRCA

The Trails Conservation Corporation (TCC) is the organization leading the effort to address the environmental and natural resource issues affecting the Upper Lackawanna River. For the effort, the TCC has partnered with the Lackawanna River Corridor Association (LRCA), which has been the leading force in conservation and watershed issues across the Lackawanna Valley since its creation in 1987.

Background of the Trails Conservation Corporation. *Trails Conservation Corporation* (TCC) began as a small organization dedicated to preserving abandoned railbeds in Northeast Pennsylvania. The non-profit organization was formed and incorporated in 1993 with its first mission to purchase the thirty-two mile Delaware and Hudson (D&H) abandoned railroad right-of-way. The D&H begins in Simpson, Lackawanna County, and generally runs north along the eastern border of Susquehanna County to Steven's Point. It was the intention of another newly-formed non-profit, the *Rail-Trail Council of Northeastern Pennsylvania* (RTC), to eventually acquire this historic railbed and develop it into a multi-use recreational trail. TCC entered into a three-year purchase agreement with Hudson River Estates, while the Rail-Trail Council concentrated on gathering members, developing a well-rounded board, raising funds, and searching for possible grant fund sources.

The Rail-Trail Council was fortunate to secure Transportation Enhancement funding (ISTEA) for the acquisition of the D&H right-of-way as well as for design and engineering of a recreational trail. TCC transferred the property to the RTC in 1995. The RTC has a Master Plan for the development of the D&H Rail-Trail and is preparing to begin major construction in the spring of 2002; to date, five trailheads have been constructed as well as minor trail surface improvements. TCC has continued its attempts to purchase additional right-of-ways and has purchased an additional seven miles of

D&H from Stevens Point to the New York State border. TCC also has an easement on eight miles of the parallel New York, Ontario and Western (O&W), to also be used as a trail.

With TCC's original mission completed, and with the Rail-Trail Council a viable, ever growing, member supported organization, TCC was ready to change its focus. Issues and concerns about the lands and resources surrounding the trail became a frequent topic of board meetings. A new "industrial highway," Route 6, was under construction and scheduled to open in the fall of 1999. This would open the area surrounding the Upper Lackawanna River to a possible influx of businesses and new residents. The new route would connect with the major routes of 81, 380, and 84, possibly cutting the driving time from Scranton to the Forest City area in half (from 40 to 20 minutes). Development pressures could impact negatively on the watershed. Most of the eleven municipalities along the river and its branches have little if any land use regulations. The board of directors of the Trails Conservation Corporation realized the necessity of expanding its mission statement to better address broader issues in a larger area not limited to by the trail system. The purpose of TCC was amended into its by-laws: *"to protect, preserve, enhance, and acquire, for the benefit of the general public, waters, and lands in the Upper Lackawanna Valley and nearby areas. Waters and lands include but are not limited to streams, rivers, wetlands, riparian corridors, woodlands, scenic areas, open spaces, recreational lands, historic and cultural sites, and abandoned railroad corridors and other rights-of-way."*

The opportunity to develop a river conservation plan through Pennsylvania's Department of Conservation and Natural Resources for the entire upper watershed was an excellent match for the broader mission of TCC. Numerous problems were surfacing along the D&H and O&W trail system and along the Lackawanna River. Most of the concerns were beyond the scope of trail-building efforts and a watershed plan could help to begin to identify and address these issues.

Background of the Lackawanna River Corridor Association. The Lackawanna River Corridor Association was formed in 1987 as a community-based non-profit educational and community development organization. Its goals are to promote the restoration and stewardship of the river and its watershed resources by local residents, businesses, and government agencies.

In 1990, the LRCA completed its *Lackawanna River Citizens Master Plan*, which proposes four major goals and recommendations. The first is Project RiverClean, a comprehensive environmental cleanup of the river, including removal of trash, upgrades to sewer facilities, treatment of acid mine drainage, and restoration of natural habitat. The second goal relates to public awareness, education, and involvement. The third goal proposes a Lackawanna Greenway, or trail system using abandoned railroads and river levees, joining communities together. The fourth goal recommends a Lackawanna River partnership to involve the LRCA with local organizations, private property owners, and governmental agencies to develop programs and coordinate efforts aimed at improving and restoring the Lackawanna River watershed.

The LRCA has many accomplishments to date related to their goals. They have succeeded in developing new riverside parks and are working with the Lackawanna Heritage Valley Authority (LHVA) to develop a forty-mile trail system along the river. They also partner with the LHVA to develop cultural, educational, and resource conservation programs. They conduct RiverWatch, a citizen's water quality monitoring program and another volunteer program to clean up trash sites, plant trees, and build river access areas. A twelve-mile section of river has been designated as a Class A fishery. Since 1989, the LRCA has also worked closely with the Lackawanna Heritage Valley Task Force, which developed the 1991 *Plan for the Lackawanna Heritage Valley*.

The LRCA has been a driving force in partnership efforts for mine reclamation and stream restoration projects. A land trust organization has been developed, the Lackawanna Valley Conservancy, to acquire and manage river corridor and watershed lands. They are currently involved with developing a River Conservation plan with the assistance of the Pennsylvania Department of Conservation and Natural Resources (DCNR). This plan will update and expand upon the *Citizens Master Plan* and include stream inventory information, public involvement, and site-specific conservation and recreation projects.

Trails Conservation Corporation and the LRCA. Both Trails Conservation Corporation and the Rail-Trail Council have partnered with the LRCA on various projects and have a Memorandum of Understanding (MOU) to work together to develop a forty-mile trail system along the Lackawanna River from Stillwater Dam to its confluence with the Susquehanna River at Old Forge. While the RTC is working on a trail from Simpson to the New York State border, efforts are overlapping with a goal of connecting the D&H trail to the Lackawanna Valley, Scranton, and beyond.

TCC has engaged the services of the LRCA as a partner in the development of the plan for the Upper Lackawanna Watershed. The LRCA brings much experience and knowledge to the partnership and enhances the efforts of the overall plan for the entire watershed with consistency and shared goals.

Steering Committee & Stakeholder Involvement

A steering committee formed from various interested citizens who attended the first public meeting. Other individuals were asked to join the committee based on their expertise or involvement with watershed issues. Certain members focused on and presented written information on the lake and ponds in the watershed, the biological resources, fishing opportunities, mine-related impacts, historical information, land conservation issues and recreation. This information was incorporated into the body of the plan. Various stakeholders became evident from the first meeting and remained in contact throughout the process. Kayaking enthusiasts were a large and vocal presence. The municipalities were asked to appoint an advisor and alternate to the "municipal advisory committee". All but Clifford Township and Preston Township appointed individuals as municipal advisors to the plan. A special meeting was held for municipal

officials for the upper and lower watershed. Only one advisor attended from the upper watershed. Surveys were sent out to the municipalities through the advisor, and four (of nine) filled out the survey.

Chapter 2
Description of the
Upper Lackawanna Watershed

Physical Setting of the Upper Lackawanna Watershed

The Upper Lackawanna watershed encompasses 56 square miles, or about 14 percent of the entire Lackawanna River basin, which extends for 350 square miles to the Susquehanna River. The project area of the Upper Lackawanna watershed includes:

- The Upper Lackawanna River corridor from the Simpson Viaduct north to Stillwater Lake and Dam, including feeder streams, such as Brace Brook and Panther Bluff Creek;
- Stillwater Lake and Dam area;
- The East branch of the Lackawanna River with its feeders and lake sources such as Dunn's Pond, Independent Lake, Lake Lorrain, and others;
- The West branch of the Lackawanna with its feeders and lake sources such as Hathaway Lake, Romobe Lake, and others; and
- Fiddle Lake Creek with its feeders and lake sources such as Louis Lake, Lowe Lake, and Fiddle Lake, which joins the West Branch just above Stillwater Lake.

Rail-Trail System and the Watershed. The D&H and the O&W rail-trails run parallel and in close proximity for approximately eight miles. In between the two proposed trails is the Upper Lackawanna River, with the undeveloped Moosic Mountains to the east. Trail users are typically within sight of the Lackawanna River. Small towns border to the west: Richmondale, Vandling, and Forest City. Forest City is the northernmost limit of the anthracite coalfields and mining scars are evident along this stretch.

The river valley from Simpson to Forest City is a study in contrasts. For the most part is seen a pristine rocky river with rhododendron-lined banks and deep, shaded trout pools. Culm piles bound other river areas, with mine refuse sliding into the unshaded river. Five acid mine outfalls are present and discharge varying amounts of rusty brown water into the river. The steep Moosic Mountains to the east present well-established plant communities, from riverbank species to hemlock and rhododendron communities to the scrub oak and heath communities at the mountaintops. In contrast are mine fingers: refuse rock dug out from deep mining activities along with black culm piles and extensive culm flatlands. Panther's Bluff ravine reveals spectacular waterfalls and a solid rock streambed lined with rhododendron. Other water features, in contrast, reflect strange colors of blue and green along with rusty swamps and ponds.

North of Forest City, there is no mining influence on the river and watershed. The trails parallel the river in close proximity until the Stillwater Dam area, where the trails diverge. The D&H trail heads in a northwest direction around the western edge of Stillwater Dam. The O&W heads northeast along the eastern side of Stillwater Dam. The trails continue to diverge: the D&H parallels the West Branch of the Lackawanna River, while the O&W generally follows the East Branch of the Lackawanna River.

The trail system, with its close proximity to the river and its tributaries, presents a greenway system that offers numerous opportunities for recreation, environmental study, and historical and cultural interpretation.

Political Boundaries

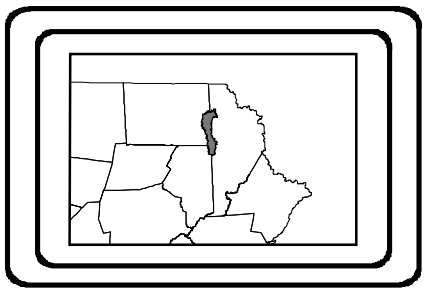
The Upper Lackawanna Watershed is located in northeastern Pennsylvania, in parts of Susquehanna, Wayne and Lackawanna Counties. In the watershed there are eleven (11) municipal political subdivisions. The Upper Lackawanna Watershed touches on all or part of the townships and boroughs listed below.

Susquehanna County (57*)
Townships: Clifford, Herrick (zoning), Ararat
Boroughs: Union Dale, Forest City (zoning)

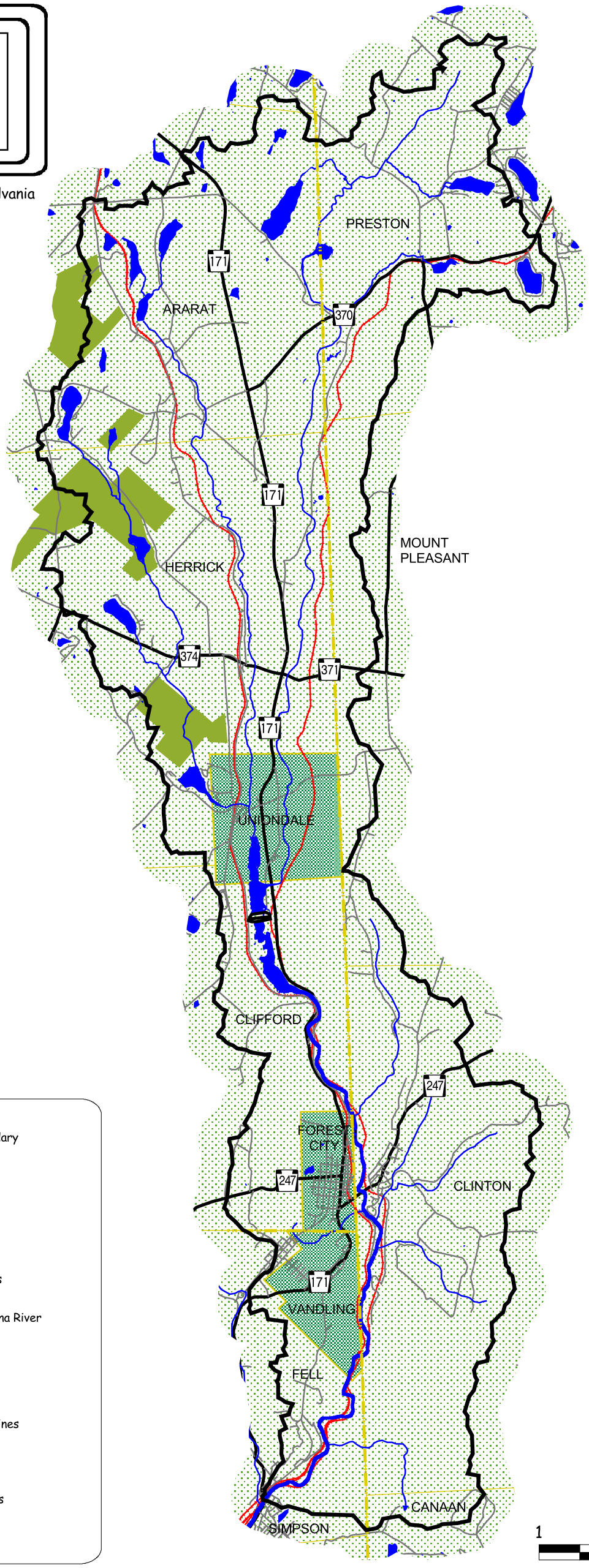
Wayne County (63*)
Townships: Preston, Clinton, Mount Pleasant, Canaan
Boroughs: none

Lackawanna County (35*)
Townships: Fell
Boroughs: Vandling (zoning)

*PennDOT County code



Location in northeast Pennsylvania



- Watershed Boundary
- County Boundary
- Borough
- Township
- State Game Lands
- Upper Lackawannna River
- Major Tributary
- Water Bodies
- Abandoned Rail Lines

Major Roads

- PA Traffic Routes
- Other Roads

Study Area Base Map

Upper Lackawanna Watershed Conservation Management Plan

Information used to produce this map was obtained from PennDot and PASDA.

Trails Conservation Corporation
with BLOSS Associates

BLOSS ASSOCIATES

January, 2002

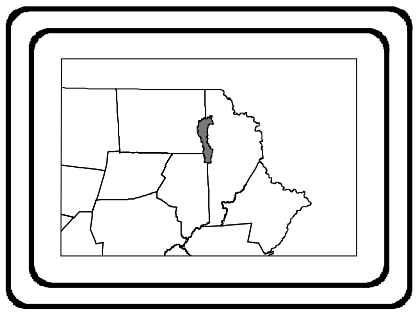
Topography / Geology

Topography. The Upper Lackawanna River Watershed lies within two of the major physiographic provinces of Pennsylvania. Its northern part—upstream of Stillwater Gap through the Moosic Mountains north of Forest City—is in the Glaciated Low Plateaus section of the Appalachian Plateaus Province, a broad area of hilly to low mountainous terrain that extends north and east into New York State and west across the northern tier counties of Pennsylvania. Glaciated U-shaped valleys and gentle relief characterize the northern part of the watershed. The southern part—from the Moosic-Mountains water gap downstream past Forest City and Carbondale—is mostly in the Ridge and Valley Province, which is characterized by long, parallel, sharp-crested mountain ridges separated by long, narrow valleys.

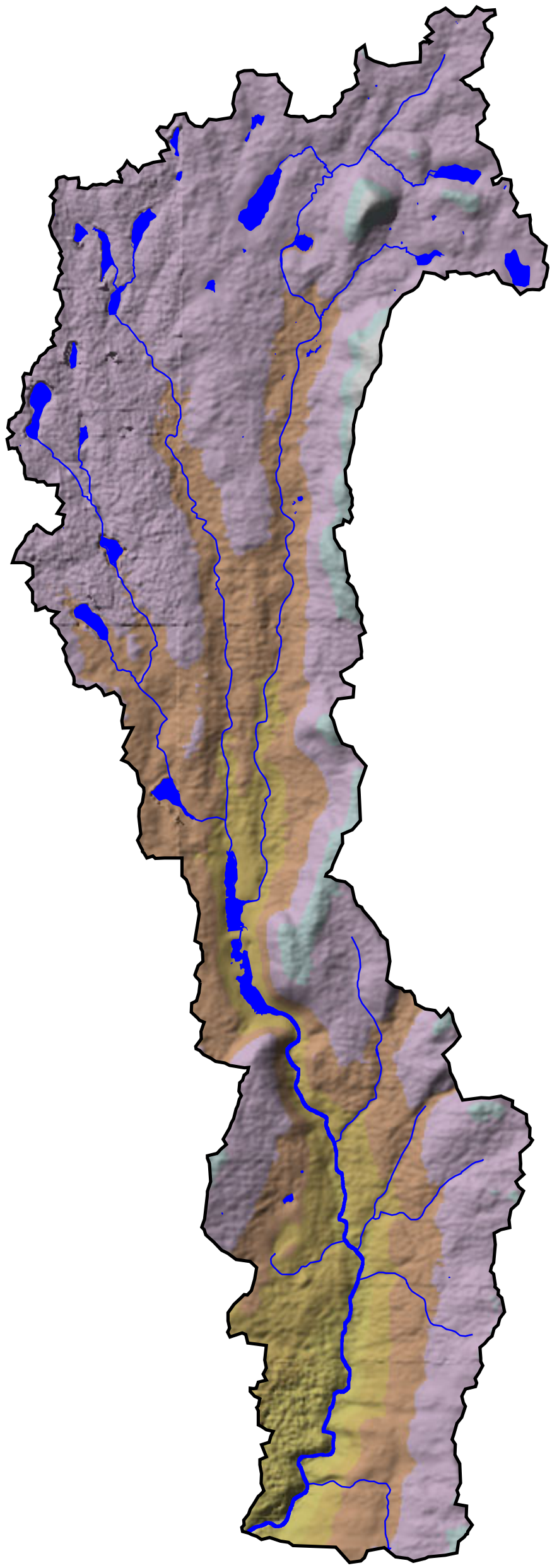
The Upper Lackawanna Watershed is elongated in a northward direction—the river rising in ponds and swamps in the vicinity of Ararat and Orson about 10 miles north of Forest City—and is rather narrow, being mostly on the order of six miles or less in width from east to west.

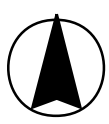
Most hilltops in the plateau country are at elevations of 1,300 to 1,800 feet above sea level, with the valley floors 400 to 1,200 feet lower. The highest points are on the North Knob of Elk Hill (elevation 2,693 feet) on the west boundary of the watershed in Susquehanna County and at Mount Ararat (elevation 2,656 feet) on the east boundary in Wayne County. Numerous natural and man-made lakes occur on the fringes of the watershed on the plateau, many serving as the sources of tributary streams.

The mountains in the Ridge and Valley part of the Upper Watershed reach elevations of 2,200 to 2,300 feet in the Moosic Mountains on the eastern boundary and 1,900 to 2,300 feet in the West Mountain range on the western boundary. The highest point is High Knob (elevation 2,291 feet) in the Moosic Mountains north of Waymart in Wayne County. The Lackawanna River lowland between the mountains drops from an elevation of about 1,600 feet in Stillwater Gap to about 1,000 feet at Carbondale, a distance of about 7 miles.



Location in northeast Pennsylvania





2 0 2 Miles

Legend

Watershed Boundary

Elevation (in feet)

- 400 - 700
- 700 - 900
- 900 - 1200
- 1200 - 1500
- 1500 - 1700
- 1700 - 1900
- 1900 - 2200
- 2200 - 2400
- 2400 - 2700

Watershed Topography

Upper Lackawanna Watershed Conservation Management Plan

Information used to produce this map was obtained from USGS.

Trails Conservation Corporation with BLOSS Associates

BLOSS ASSOCIATES

January, 2002

Bedrock Geology. Bedrock in the Upper Lackawanna River Watershed consists entirely of sedimentary rocks that formed in a continental setting 365 to 300 million years ago. Like the landscape, the bedrock geology of the watershed is divided into two sections.

The plateau country in the northern part is underlain entirely by interbedded red and gray sandstones, siltstones, mudstones, and shales of the Catskill Formation. Sedimentary bedding in these rocks is typically gently inclined or flat lying, but many thick sandstone units exhibit prominent crossbedding (i.e., inclined bedding caused by the river currents that deposited the sand grains). Other sandstone beds in the Catskill are strikingly planar bedded and cut by smooth fractures spaced 3 to 10 feet or more apart. These latter are the source of the flagstone and dimension stone ("Susquehanna bluestone") that is widely quarried throughout Susquehanna and Wayne Counties.

Sandstone for building was quarried extensively near Forest City around the turn of the century. The principal location, known as the Williams & Watts quarry, was high on the ridge about a mile north of Forest City and west of the railroad. A road by which the stone was hauled to the railroad crosses the highway 300 yards north of a coal breaker. A conspicuous and resistant bed of coarse conglomerate crosses the ridge above the breaker. Buildings from stone from this quarry include: Christ Church (1891), Forest City; the front of the First National (First & Farmers) Bank, Forest City; American Hotel (1893), Carbondale, with scrolls and heads; First Methodist M.E. Church (1892), Carbondale; Hotel Jermyn (1895), Scranton. Forest City sandstone can also seen at Broome County Courthouse, Binghamton, New York, and the Sterling Hotel, Wilkes-Barre.

On August 11, 1898 contractor Frank Carlucci secured a big contract from the government to supply cut stone to be used in the erection of the Ellis Island Landing Station in New York Harbor. The stone was taken from the Forest City Quarry. This contract approximated about a quarter of a million dollars.

In the Ridge and Valley Province, the major bedrock units are the Catskill Formation (described above), the Pottsville Formation (massive, white conglomerate and gray, coarse-grained sandstone), and the Llewellyn Formation, or "coal measures" (interbedded gray to black sandstone, conglomerate, siltstone, shale, and anthracite).

The Catskill Formation, being the oldest (about 360 million years old), is at the bottom of the sedimentary pile, while the Llewellyn Formation, being the youngest (308-300 million years old), is at the top. In contrast to the situation on the Allegheny Plateau, sedimentary bedding in most of the Valley and Ridge rocks is distinctly inclined and folded—a result of structural compression during the Appalachian mountain-building episode about 250 million years ago. This compression formed the Lackawanna syncline, or downfold, the site of the Northern Anthracite coalfield.

Of the three folded rock formations in the Ridge and Valley Province, the Pottsville is the most erosionally resistant and typically forms the highest ridges in the Moosic Mountains and West Mountain range. The slightly less resistant Catskill Formation forms the outer

scarps of these mountain ranges, and locally (where thick sandstones are present) caps the highest knobs on the mountains. The Llewellyn Formation underlies the topographically lower slopes of the mountains and the lowlands along the Lackawanna River around Forest City and Carbondale.

Up to eight coal beds were once mined at the north end of the Northern Anthracite field, the number of exploited beds increasing southward from Forest City toward Carbondale. Forest City is at the northern tip of the anthracite coalfields. Just a mile north of Forest City there is no evidence of mining. All of the mined coal was high-rank anthracite, relatively low in sulfur and having heat values of up to about 15,000 BTU/lb. The coal was formed in swamps during the so-called Carboniferous Period when large quantities of vegetation fell into swamps and accumulated as thick masses of woody and leafy debris, or peat, the first stage in the formation of coal. Heat and pressure caused by the weight of a thickening pile of overlying sediments compacted the peat and forced out some of the more easily vaporized compounds. This process concentrated the carbon and eventually turned the peat into lignite, then bituminous coal, and finally anthracite. In this region, where pressures were greatest, anthracite coal is found. A cycle of peat formation and burial was responsible for multiple seams of coal.

Many millions of tons of anthracite were removed along the upper Lackawanna in the 19th century and the first 70 years of the 20th century by both surface and underground methods, but none is currently being mined. From the 1820s to the 1850s, Carbondale was the most important coal town on the Lackawanna River, being the headquarters of the Delaware and Hudson (D&H) Coal Company and the start of the D&H's gravity railroad over the Moosic Mountains to Honesdale and the Delaware and Hudson Canal. The first great anthracite mining accident in American mining history occurred at Carbondale on January 12, 1846, when 14 miners were crushed in the "Carbondale squeeze"—an underground mine collapse caused by inadequate roof support.

About the only conspicuous reminder of the halcyon days of coal mining on the upper Lackawanna today are the large black "culm banks" and waste piles that mark the sites of the old collieries. A good example is the huge pile of mine waste (some of it burned to "red dog") at the site of the Powderly Colliery on the northwest side of new US Route 6 about a mile south of Carbondale.

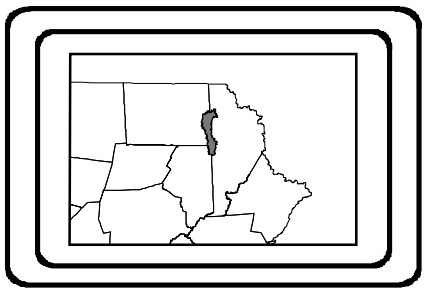
The most scenic of the rock formations on the upper Lackawanna is the Pottsville conglomerate, a hard, white stone composed of a mixture of rounded quartz pebbles and cobbles (sometimes up to 4 inches in diameter) and medium- to coarse-grained quartz sand. "The Conglomerate" forms many picturesque crags on the summits of the Moosic and West Mountain ranges and can often be found as extensive, glacially striated pavements at "balds," or relatively treeless areas, on the mountain slopes. The stone for many large retaining walls, bridge abutments, buildings, and reservoir dams was cut from this hard conglomerate over the past 150 years.

Glacial Geology. The Upper Lackawanna River Watershed was covered by continental glaciers at least three times over the past 2 million years. Only the last of these

glaciations, which occurred between 30,000 and 20,000 years ago, has left any distinct record. In addition to the numerous striated rock pavements mentioned above, other features of the landscape that record the passage of the great ice sheets include: 1) the highly variable deposits of glacial "till" (a heterogeneous mixture of boulders, cobbles, pebbles, sand, and clay) laid down directly by the ice as it melted and which can be found at the ground surface over much of the watershed; 2) the more restricted bodies of sand-and-gravel deposited in ice crevasses and beyond the glacial border by running water melting from the ice sheet; 3) the numerous ponds and swamps, many of which mark the sites of former blocks of ice that melted slower than the surrounding ice and were left engulfed in glacial sediment like plums in a pudding (to melt out later forming "kettle holes"); and 4) bouldery patches downslope of sandstone and conglomerate ledges on the mountain crests that record frost fracturing of rock during the thousands of years of tundra-like climatic conditions following final retreat of the ice sheet about 20,000 years ago.

Summary of bedrock geologic units underlying the upper watershed.

- Llewellyn Formation—Interbedded gray micaeous sandstone and conglomerate, gray to black shale and claystone, and coal. Contains plant fossils. Thickness: 1250+ Ft
- Pottsville Formation—Mostly gray to white, quartzitic conglomerate and sandstone; minor gray to black shale and some coal. Thickness: 100+ ft.
- Catskill Formation—Mostly interbedded gray and red sandstone, siltstone, shale, and mudstone in fining-upward cycles. Contains many lenticular calcitic 'breccia' beds up to 2 ft thick, as well as cross beds, mudcracks, plant fossils, and fish bones. Gray (and locally red) sandstones marketed as flagstone and dimension stone ("Susquehanna bluestone"). Thickness: 1500+ ft



Location in northeast Pennsylvania

Catskill Formation

Pottsville Group

Llewellyn Formation

Duncannon Member

Watershed Boundary

County Boundary

Geology

Catskill Formation

Catskill Formation, Duncannon Member

Llewellyn Formation

Pottsville Group

1 0 1 Miles

Geology

Upper Lackawanna Watershed Conservation Management Plan

Information used to produce this map was obtained from PASDA.

Trails Conservation Corporation with BLOSS Associates

BLOSS ASSOCIATES

January, 2002

Socio-Economic Setting

Socio-Economics and Cultural History. The earliest human evidence in the Lackawanna watershed has been documented by the Frances Dorrance Chapter of the Pennsylvania Society of Archeology. A dig site at the confluence of the Lackawanna and Susquehanna Rivers has produced artifacts from the pre-contact Woodlands period 800 to 1400 A.D. to the Archaic 9000 B.C. There have been other documented discoveries along the ridgelines of the valley at sites known as rock shelters. These sites provided migratory shelter for hunting-gathering groups. Careful investigation is suggested at undeveloped wooded sites along the watershed to determine any potential for archeological value.

Among the legacies of the Native Americans are the many place names in use today, such as Wyoming, Susquehanna, and Lackawanna. In the language of the Lenni Lenape, Susquehanna means broad, shallow river, and Lackawanna means forks or union of waters.

The Delaware (Lenni Lenape) and the Shawnee lived in the region under the eyes of their conquerors to the north – the Iroquois, also known as the six nations of the Mohawk, Oneida, Tuscarora, Seneca, Cayuga, and Onondaga. Other tribes, such as the Lackawanna, Mohicans, and Nanticokes, also lived in the area. Each of these groups enjoyed the abundant fish and game found in the region. Many of them also cultivated corn and squash along the river's shores.

Due to the development of towns and mining sites along the floor of the Lackawanna Valley, the integrity of most of the built-up area for archeological value has been destroyed. Horrace Holister in his seminal 1857 *History of the Lackawanna Valley* relates the discovery and despoilation of Lenape gravesites in the vicinity of the Tripp Homestead in Scranton. He speculates that one of the plundered graves was that of Capouse, the Lenape Chieftain visited by the Moravian Missionary, Count Zinzandorf along Capouse Meadows on the banks of the Lackawanna in 1750. Other evidence of past Native American presence was the discovery of a circa 1675 dugout canoe in Lake Quinn, Wayne County in 1996. This site is east of the Moosic Mountain in the Wallenpaupack watershed.

The historic record also contains the heritage of Native American paths and trails. The Susquehanna Warrior path followed the Susquehanna from the Chesapeake to the Finger Lakes region. The Lackawanna path and the Oquaqa path were a shortcut up the valley to the Lake Otsego headwaters of the Susquehanna at present day Cooperstown, New York. The Minisink Trail leads from the upper Delaware River along the Wallenpaupack and over Moosic Mountain into the Lackawanna and Wyoming valleys. The Minisink was later the route of Connecticut settlers who developed it into a wagon road known as the Connecticut Road. Traces of this road are evident on Moosic Mountain today as jeep trails.

The region was settled by people from Connecticut and the Philadelphia region between the 1760's and 1780's. These groups fought skirmishes with one another and with Lenape and Iroquois groups during the period. The conflicts, known as the Yankee-Pennamite wars, were related to conflicting land claims and sovereignty based on Royal Charters granted by England's King Charles II. These conflicts were resolved by 1787 and Connecticut relinquished its claims. The settlers were given land title under Pennsylvania law and Luzerne County, in the southern part of the Lackawanna River watershed, was founded.

An important battle occurred in the southern part of the valley during the American Revolution. In July 1778 a war party of approximately 800 Loyalist Tories and 1200 Iroquois moved down river from New York and besieged the Wyoming Valley farms and settlements at Wilkes-Barre, Forty Fort, and Pittston. The war party lured the settlers' militia out of Forty Fort and routed them along the flood plain of the Susquehanna. After defeating this group, the party defeated other settlers in forts and blockhouses. There was a great loss of life from savage beatings and torture subsequent to the battle. Several hundred settlers escaped by fleeing through the Pocono Mountains to Stroudsburg and Easton or downriver to Fort Augusta at Sunbury.

The Continental Congress commissioned John Sullivan to conduct a punitive campaign the following year. Sullivan's Army built a roadway through the Poconos from Easton to Wilkes-Barre and transported weapons and supplies to mount an attack up the Susquehanna and into the Finger Lakes region, the heartland of the Six Nations Iroquois Confederacy.

After successive battles, Sullivan's Army defeated the Iroquois as a fighting force and laid waste to their villages and crops. Many Iroquois fled to the safety of British protection past the Niagara frontier. The removal of the Iroquois as a political-military presence on the Pennsylvania-New York frontier was a strategic victory in our nation's war of independence. That victory had its impetus in the Lackawanna-Wyoming watershed.

Following the Revolutionary War, the region developed primarily with an agricultural economy. Economic development was hindered by the difficulties of transportation through the mountains between the valley and coastal settlements. The presence of anthracite coal began to attract the attention of capitalist entrepreneurs after the War of 1812. By the 1820's, anthracite coal had become recognized as both an industrial and domestic fuel, more economical and practical in its uses than wood or charcoal.

The area's rivers became avenues of commerce. Coal was shipped down the Lackawanna and Susquehanna Rivers or taken in ox carts to the Lackawaxen, Lehigh, and Delaware Rivers. The Wurtz brothers led the formation of the Delaware and Hudson Canal Company in the 1820's to access coal in the northern Lackawanna Valley and ship it to markets in New York, New England, and Canada. The D&H Canal ran from the Hudson River at Kingston up the Shawngunk Valley to the Delaware River and up the Delaware and Lackawaxen Rivers to Honesdale. Due to the impracticality of building a canal over

the 2,200 foot-high Moosic Mountain, the D&H developed an ingenious gravity railroad using stationary steam engines, hoisting cables, and inclined planes to transport coal wagons over the Moosic Mountains from Carbondale on the Lackawanna River to Honesdale at the head of the D&H Canal along the Lackawaxen River.

Thus began a 150-year industrial legacy of resource exploitation in the Lackawanna Valley. As the Wurtz brothers' D&H enterprises expanded down the valley in the 1840's, the town of Carbondale grew as an urban industrial center. By 1840, the older towns down-valley of Providence, Hyde Park, and Slocum Hollow, which dated to the Connecticut settlement, began to grow as transportation improvements advanced commercial opportunities.

The Scranton and Platt group of iron makers established an iron works industry at the Slocum Brothers Mill on Roaring Brook a half-mile above its confluence with the Lackawanna in 1838. After several difficult years, they secured a contract to produce Iron "T" rail for the New York and Lake Erie Railroad in 1846. This advanced the industrial urban development of the valley as the iron works at Slocum Hollow grew to become the city of Scranton.

The Scranton brothers and other investors developed the Delaware, Lackawanna and Western Railroad in 1852. The DL&W provided an alternative means of transportation, which further accelerated the valley's development. Later, the Pennsylvania Coal Company developed a gravity rail connection to the D&H Canal at Hawley and the Susquehanna Canal at Pittston.

The Lehigh and Susquehanna Railroad, connected with the Lehigh Coal and Navigation Company, also entered the valley in search of coal mining opportunities. The Erie railroad had several routes into the Lackawanna Valley. These included the Erie and Wyoming Valley Railroad, which resulted from a merger with the Pennsylvania Coal Company Gravity Railroad. This route followed Roaring Brook.

The Delaware and Hudson Railroad opened in 1871, replacing the outdated D&H gravity and canal system. Timely and costly reloadings from gravity car to canal boat, along with the development of the steam engine precipitated this change. The D&H railroad followed the Lackawanna River north from Carbondale to Union Dale and the West Branch of the Lackawanna River to Ararat , leaving the watershed as it crossed Ararat Summit. The D&H was built by the forces of the Erie Railroad through an agreement with the Delaware and Hudson Coal Company who retained trackage rights. This railroad is known by many names: the Jefferson branch of the Erie RR, the 'Jeff', the 'Jeff-Ararat' line, and the D&H.

The New York Ontario and Western Railway was the last railroad to develop a route into the Lackawanna Valley in 1890. The O&W paralleled the Lackawanna River from Scranton to Union Dale. Its gateway to the watershed was near Lake Lorain at the east branch of the Lackawanna headwaters.

The demand for anthracite coal as a primary fuel accelerated as America underwent the industrial revolution in the mid-19th century. Coal mining activities increased at a feverish pace in the watershed. Coal, iron, and rail industries were intertwined along the valley even as they competed for markets. The impacts of the infrastructure and coal mining process caused a tremendous amount of ecological, geological, and hydrological damage to the watershed. This damage expanded with the advent of strip mining and wet process coal preparation in the early- to mid-20th century.

The production of anthracite coal peaked in 1918. The human population of the region, which had grown exponentially with large European migration in the 19th century, peaked in the 1920's.

The human population of the Lackawanna Valley evolved into a diverse spectrum of ethnic, cultural, and religious groups. English, Welsh, Irish, and German were the predominant early migration groups with southern European and eastern European groups arriving in large numbers between the 1880's and 1920's.

The conflicts between industrialists and the working classes in the anthracite region contributed to the evolution of the American Labor Movement. These conflicts helped to institutionalize and legitimize collective bargaining agreements. By the 1920's, through numerous strikes in the previous fifty years, regional coal and rail workers had finally achieved a reasonable standard of living.

The economy was still dominated by anthracite mining with silk and textile industries forming the largest alternative industry. Iron and steel making ended in Scranton in 1902 with the transfer of the Lackawanna steel works to Buffalo, New York, under the ownership of the Bethlehem Steel Company.

The Great Depression of 1929-1940 had a profound effect on the regional economy. The market for anthracite coal began to diminish along with employment in the mining and rail industries. Strip mining had become a more common practice as underground mining became more expensive to conduct.

Social dislocations became endemic as workers left the region for better and safer employment opportunities with manufacturing industries in nearby states.

The out migration increased during and after World War II and remains evident into the 2000 Census as Lackawanna and Luzerne Counties' populations continue to decline.

The fuel dependence of the United States shifted away from coal to oil and natural gas after the Second World War. By 1956, the costs of mining exceeded the price per ton of underground mined anthracite coal. In 1959, the tragic Knox Mine Disaster occurred at Pittston. The Susquehanna River broke into the underground workings and flooded all of the deep mines in the Wyoming Valley. On November 1, 1960, the Hudson, Moffat and Glen Alden operations ceased underground pumping in the Lackawanna Basin, creating the northern anthracite mine pool between Old Forge and Carbondale.

On November 1, 1966, the Continental Mine at the base of West Mountain was closed, ending all underground mining in the Lackawanna Valley. This mine is now open as the Lackawanna Coal Mine Tour at McDade Park, operated by Lackawanna County. Marginal coal strip mining and culm bank reclamation projects have occurred from time to time since the 1960's. Numerous Bureau of Abandoned Mine Reclamation projects have been completed based in part on the Scar-Lift program of 1970.

The legacy of mining has left many environmental scars. Vast acreages of the valley are affected by strip mine overburden piles, pits and unvegetated coal waste banks also known as culm dumps. Over a dozen major acid mine drainage outfalls discharge between 1 and 150 million gallons per day into the Lackawanna River and tributary streams throughout the watershed. Five acid mine drainage outfalls discharge into the Upper Lackawanna River watershed.

The communities in the Lackawanna Valley engendered their own recovery from the anthracite industry beginning in 1942 with the Scranton Plan. Local chambers of commerce, businesses, and local governments have cooperated to create an economic diversity of manufacturing and high-tech industries. This economic growth has expanded at the beginning of the 21st century with a larger role for the information industry and institutions of higher education. The recently developed Great Valley Initiative promotes the area's communications and technological infrastructure and quality of life issues such as small town values, open space, and recreational opportunities as a foundation for smart economic growth.

The Lackawanna River Corridor Association (LRCA) and the Lackawanna Heritage Valley Authority (LHVA) evolved in the 1990's to develop programs based on the cultural and environmental heritage of the watershed. Educational and recreation programs tied to cultural tourism, environmental management technologies, and stewardship of natural and cultural resources are helping to preserve and recreate the region's environment and heritage. The LRCA, LHVA, and the Rail-Trail Council of Northeast Pennsylvania (RTC) are working collaboratively to acquire abandoned rail corridors and develop multi-use recreational trails along the Lackawanna River. Trails Conservation Corporation and the Lackawanna Valley Conservancy are also working to acquire and conserve open space, watershed lands, forests, wetlands, stream corridors, recreational, historic and scenic resources.

Demographics. The population of the entire Lackawanna Watershed (including the Upper and Lower watersheds) in the year 2000 was estimated to be approximately 240,000 (based on 1990 projections for Lackawanna County and estimates for adjacent areas of Wayne, Susquehanna, and Luzerne Counties within the Lackawanna Watershed boundaries). The Lackawanna River Valley is the most densely populated area in the northeast region of Pennsylvania.

In contrast, census data for the Upper Lackawanna watershed shows a more rural, less densely populated area. According to 1990 census data, (based on populations of Forest

City, Union Dale, Ararat, Herrick, Clifford, Preston, Clinton, Mount Pleasant, Fell, and Vandling) the total population of the upper Lackawanna watershed was counted at 12,262 persons, or 4,728 households. See *Table 1, Demographic Profile for the Upper Lackawanna Watershed.*

Table 1
Demographic Profile for the Upper Lackawanna Watershed

MUNICIPALITY	TOTAL POPULATION	TOTAL HOUSEHOLDS
Forest City Borough	1,846	835
Union Dale Borough	303	120
Ararat Township	420	159
Herrick Township	563	214
Clifford Township	2,147	731
Preston Township	1,044	383
Clinton Township	1,582	592
Mount Pleasant Township	1,271	438
Fell Township	2,426	989
Vandling Borough	660	267
WATERSHED TOTALS	12,262	4,728

Source: Census of Population and Housing, 1990, Pennsylvania State Data Center, Penn State Harrisburg

In the Upper Lackawanna watershed, the average per capita income was approximately $10,724, according to 1990 census data. Approximately 4,877 persons age 16 or older were working. On average, 23.7 percent of working persons were employed in the manufacturing industry, while 26.1 percent were employed in the service industry. See *Table 2, Socio-Economic Profile for the Upper Lackawanna Watershed*.

Table 3, Occupational Profile for the Upper Lackawanna Watershed shows the percentage of people working in managerial, sales and support, service, farming, craft and repair, and labor jobs, according to the 1990 census.

Table 2
Socio-Economic Profile for the Upper Lackawanna Watershed

MUNICIPALITY	PER CAPITA INCOME	EMPLOYED PERSONS (AGE 16 AND OVER)	EMPLOYED IN MANUFACTURING INDUSTRY (%)	EMPLOYED IN SERVICE INDUSTRY (%)
Forest City Borough	10,607	648	31.0	27.6
Union Dale Borough	9,249	96	27.1	24.0
Ararat Township	10,600	123	17.9	25.2
Herrick Township	10,402	206	15.0	18.0
Clifford Township	11,124	860	24.8	25.2
Preston Township	10,942	465	15.3	33.1
Clinton Township	10,536	701	26.8	23.8
Mount Pleasant Twp.	10,453	507	13.4	29.6
Fell Township	12,056	991	36.9	25.5
Vandling Borough	11,273	280	28.9	28.9
WATERSHED AVERAGE	10,724	487.7 4,877 (TOTAL)	23.7	26.1

Source: Census of Population and Housing, 1990, The Pennsylvania State Data Center, Penn State Harrisburg

Table 3
Occupational Profile for the Upper Lackawanna Watershed

MUNICIPALITY	Managerial (%)	Sales & Support (%)	Service (%)	Farming (%)	Craft and Repair (%)	Labor (%)
Forest City Borough	17.1	24.2	18.1	2.0	11.4	27.2
Union Dale Borough	25.0	25.0	8.3	0.0	20.8	20.8
Ararat Township	10.6	26.0	11.4	8.9	16.3	26.8
Herrick Township	19.4	27.2	12.6	2.4	18.4	19.9
Clifford Township	17.7	22.8	15.3	4.2	17.9	22.1
Preston Township	17.4	26.7	14.6	9.0	17.2	15.1
Clinton Township	13.7	21.1	12.6	8.0	16.3	28.4
Mount Pleasant Twp.	17.9	18.3	10.8	17.2	17.9	17.8
Fell Township	18.5	23.9	18.4	1.3	14.2	23.7
Vandling Borough	22.1	21.8	13.6	0.0	12.1	30.4

Source: Census of Population and Housing, 1990, The Pennsylvania State Data Center, Penn State Harrisburg

Historical importance of lakes and streams in the Upper Lackawanna Watershed.
In the days of the railroad, 1870 through 1950, the lakes and streams of the Upper Lackawanna River played a much different role than they do today. Today, most lakes are used recreationally by 'lake people' who have second homes on the lake which they use mostly during summer months. Back in the heyday of the railroads, such as the New York Ontario & Western (along the East Branch) and the Jefferson Branch of the Delaware and Hudson (West Branch), lakes played a prominent role in the lives of residents and visitors year-round. Ice cutting and storage was big business along the O&W, as was shoveling snow off the railbed before the advent of more sophisticated snowplows and flangers (after 1910). Railroad sidings led to the icehouses of Bone Pond (originally called Summit Lake), Lake Lorain (Five Mile Lake), and Orson Pond. Local farmers supplemented their seasonal incomes by cutting ice and shoveling snow.

- **Orson Pond** had six icehouses. Four icehouses at the end of the pond were owned by the Scranton Ice Company; two icehouses and a creamery were railroad buildings. Orson Pond yielded the most ice because it was the shallowest of the lakes and the first to freeze.
- **Five Mile Lake** (Lake Lorain) had one icehouse at the end of Old Wye.
- **Summit Lake** (Bone Pond) had two icehouses at the end of the New Wye. Most of the ice from Summit Lake was dispatched to Simpson Ice Company in Carbondale and Consumer's Ice in Scranton, although a fair amount also went to the creameries for icing milk cars.

By the early 1930's, mechanical refrigeration had made the old icehouses obsolete. However, records indicate that ice was shipped out as late as 1940. Today it is easy to forget what a large business the harvesting and shipping of ice was. Not only was ice necessary at the creameries to ice the milk, and keep it cold during shipping, it was also a necessary commodity in every town and city. "Putting up the ice" began as early as December, when the ice was at least 12-14 inches deep. The longest harvests lasted from December to April on the larger lakes, though the height of activity was in January and February. When the call of 'ice is ready' went out, crews of men, women, boys, horses, and equipment converged on the frozen waters. To reduce a large field of ice to manageable blocks required some specialized tools and equipment such as augers, spuds, pole or ice pikers, markets, ice plows, scrapers, circular and grasshopper saws, hand ice saws, and tongs. Workers were designated as field bosses, drivers, tamperers, switchers, packers, spudders, spacers, and engineers and repairmen, who kept the operation going smoothly.

Ice was shipped as late as 1940 with Starlight being the last shipping point. The O&W railroad carried a substantial number of summer visitors to the lakes in the Poyntelle area. The O&W had posters soliciting patrons to visit Lake Lorain and Poyntelle Lake (in the Delaware River drainage, less than one mile away). Steam-powered excursion boats were available. Fishermen also took the train up from Scranton to do some fishing for the day.

If the O&W right-of-way is developed into a recreational trail, efforts should be made to provide historical interpretive signage at these lake sites. The sectional toolhouse along the O&W on Orson Pond should be restored. It is in danger of collapsing and may need to be dismantled, repaired, and rebuilt in part. The toolhouse is believed to be the only sectional toolhouse remaining on the entire O&W. PHMC and the O&W Historical Society should be involved in the restoration.

Transportation

The regional transportation infrastructure underwent significant changes in the 20th Century. The extensive railroad network shrunk as coal shipments diminished. The automobile and trucking culture gradually overtook rail as the public transportation choice. By 1970, the Phoebe Snow, the Lackawanna Railroad's flagship streamline Pullman train between New York and Chicago, was history. Contractors were hard at work pouring concrete and blasting mountainsides to complete the interstate highway system in Northeast Pennsylvania.

The major traffic routes in the Upper Lackawanna watershed include:

- PA Route 171, which parallels the Lackawanna River from Simpson to Herrick Corner, then continues northward between the East and West Branches;
- PA Routes 370, and 374, which cut through the watershed in an east-west direction; and
- PA Route 247, which crosses through Forest City in the southern end of the watershed.

These traffic routes and abandoned rail lines are shown on the *Watershed Base Map*.

The recent completion of a major highway, US Route 6, also known as the Lackawanna Valley Industrial Highway, complements Business Route 6. The new highway provides a fast route from the Forest City and Carbondale areas to the major interchange of Interstates 81, 380, and 84. This highway opens the upper watershed to possible development pressures, and was one of the reasons for the development of this plan. Although the highway ends at the eastern end of Carbondale, there has been a desire by many to continue the highway northward to Forest City and beyond. This recommendation was noted in the public survey section of the Vision 2000 Plan for the Greater Forest City Area.

A transportation survey was conducted in the summer of 1999 by the Northern Tier Regional Planning and Development Committee (NTRPDC). The survey was aimed at residents, businesses/organizations, and professionals/officials. A transportation focus group was also formed. The purpose was to help develop long-range transportation plans for Susquehanna County. The results of the survey and focus group discussions listed the top goal as maintenance and rehabilitation of the present road system. East-west roads need attention with widening, passing lanes, and shoulder improvements. Other roads need attention to users, as those used for the hauling of timber/wood and stone (two of

the major industries in the county). These roads need to be widened and straightened in sections. There was also a need for the development/rehabilitation of railroad sidings in order to move goods in and out of the county. With tourism in mind, the need was voiced for road shoulders for safer biking and the continued development of rail-trails, with a goal of creating an east-west link to existing trail systems. "Taking care of what we have" with attention to business users and potential tourists, was said to be the encompassing goal for the county. A customer advisory board was set up following this study in order to help transportation planners stay in tune with the public.

Land Use / Zoning and Land Use Controls

Most municipalities in Lackawanna County have comprehensive plans, zoning, land use, and subdivision regulations. These include stream corridor building setbacks, floodplain ordinances, and storm water management regulations. In the upper Lackawanna watershed, Forest City Borough and Herrick Township in Susquehanna County have comprehensive zoning plans and regulations. Few of the rural townships have comprehensive plans, relying instead on county plans and ordinances to regulate land use and development.

Herrick Township, Ararat Township, Forest City Borough, and Union Dale Borough require a building setback from water bodies and regulate development in flood plains. Regulation of fill and excavation activities are referred to the conservation district. Only Forest City has a stormwater management ordinance, requiring curbs and gutters with an exception for grassed drainage swales. Only Herrick Township allows the development of conservation subdivisions or cluster housing. Herrick also regulates quarry operations, but no responding municipalities regulate timbering activities. All refer to DEP or the conservation district for regulation of timbering activities.

Forest City is considering updating its Act 537 Municipal Sewage Facilities Plan. Ararat plans to build a sewage treatment plant at Fiddle Lake. Ararat and Herrick both perceive a problem with failing septic systems.

Forest City adopted its zoning ordinance in 1993; its subdivision ordinance is through Susquehanna County. Both Union Dale and Herrick indicated an interest in a cost share grant to review and update land use and subdivision ordinances. There was no interest in developing an environmental inventory of special places. Ararat noted that there are many special places, but would not like to 'advertise' them. However, they did show much concern over Dunn Pond and are willing to investigate partnering with organizations to save this undeveloped lake.

Only Herrick Township indicated a possible interest in the formation of an Environmental Advisory committee. Forest City has a Kennedy Park board and a commercial association. It was noted that there are lake associations for Fiddle Lake, Lewis Lake, and Lowe Lake.

The construction of the Governor Robert Casey (Lackawanna Valley Industrial) Highway between Interstate 81 and U.S. Route 6 in Carbondale between 1995 and 2000 brought federal and state funding to support updates of comprehensive plans and ordinances in twelve Lackawanna Valley municipalities. With the participation of the Lackawanna County Regional Planning Commission (LCRPC), the municipalities are working with planning consultants to develop a unified land use and subdivision program based on a transportation and land use planning process which involves diverse community interests. The new ordinances and plans may help to promote reclamation of mining sites for infill redevelopment, the creation of greenway corridors and buffer zones along waterways, and the conservation of natural areas. The "*Growing Greener*" program and model ordinance, as put forth by the Natural Lands Trust in collaboration with DCNR, provides additional tools to guide development while protecting important natural and cultural resources. A "*Growing Greener*" audit conducted by a qualified professional can help municipalities build and maintain a green infrastructure as part of the development process.

However, development activities and proposals to extend sewer service into previously undeveloped watershed lands and ridgetop natural areas highlight concerns that planning and zoning alone cannot and will not protect essential watershed water quality and natural habitat values. Recent involvement of land trusts and conservancies such as The Nature Conservancy may provide alternative and complimentary land management strategies to assist in maintaining a sustainable watershed habitat.

Outstanding & Unique Features

Outstanding and unique features for the Upper Lackawanna watershed have been identified through the public involvement process. The following describes sites that occur in the watershed:

Sinkhole Swamp. This swampy tract along the former Jefferson Branch Railroad (now the D&H Rail Trail) about a mile south of Ararat marks the site of an interesting engineering failure at the time of the original construction of the line. With no thought about possible adverse foundation conditions, a large earthen or coal ash embankment was quickly thrown across a swamp at the north end of Romobe Lake. The muddy and organic swamp sediments were apparently so impermeable to water movement that the heavy embankment floated on its insubstantial foundation for several months after the initial opening of the railroad in September of 1870, but then suddenly collapsed (in November)—as if into a bottomless pit. The entire embankment was lost. Subsequent test piles into swamp found the hard bottom to be more than 160 feet below ground level. (The swamp apparently marked the former site of a large glacial ice block, the original deep kettle-hole pond having filled in with soft sediment in the thousands of years since the block melted.) The railroad was closed for four months while a new, more substantial embankment was constructed.

Union Dale Gorge. At Uniondale on the D&H Rail Trail, Fiddle Lake Creek has cut a deep, narrow gorge through sandstones and shales of the Catskill Formation. Vertical rock walls on either side of the creek are 50 to 60 feet high. In the 19th—and possibly the early 20th—century, a mill located above the south wall near the railroad tracks took advantage of water power supplied by the sharp fall of the creek at this point. An old millstone can still be seen near the bottom of the gorge.

Stillwater Cliffs (Susquehanna County). These rugged and scenic ledges of white Pottsville conglomerate line the top of the mountain ridge on the east side of Stillwater Gap. The vertical cliffs extend for several hundred feet and are about 100 feet high, the top being at an elevation of about 1800 feet. 'Stoneface' (circa 1941?) a sculpted rock face of George Washington is located on the path to the cliffs, just off the O&W Rail-Trail. This local attraction receives numerous visitors from the Forest City area. It has been placed on a Save Outdoor Sculpture list maintained by the Smithsonian Institute and may be eligible for repairs funding.

Williams and Watts Quarry (Susquehanna County). Located on West Mountain, about a mile northwest of Forest City, this long-abandoned quarry exposes the Pottsville conglomerate (above) and gray-green Catskill sandstone (below). Although the Pottsville (which contains many pebbles 3 inches or more in diameter) is the more impressive rock formation at this site, the chief quarry stone was obtained from the Catskill—mainly because it is somewhat softer and much easier to work. Stone from this quarry was used in the construction of Christ Church (1891) in Forest City and the American Hotel (1893) in Carbondale, among other local buildings. In August 1898, it is reported that Frank Carlucci secured a large contract to supply cut stone from this quarry for use in the Ellis Island Landing Station in New York Harbor.

No.10 Falls (Lackawanna County). At this point about a mile upstream of Simpson, the Lackawanna River flows over and around a series of nearly flat-lying ledges of gray, upper Pottsville sandstone (situated just a little below the lowest coal in the Llewellyn Formation). Particularly noteworthy is the 20-foot-high knob of sandstone that stands in the middle of the stream and forces the shallow channel to split into two around it. Also worthy of notice here are the several 4-to-8-inch-deep potholes that the turbulent river water has eroded into the rocky ledges.

Panther Bluff Creek Gorge. This spectacular ravine on the west flank of the Moosic Mountains just southeast of No. 10 Falls on the Lackawanna River exposes a continuous series of rock pavements and cliffs starting at an elevation of about 1750 feet and extending down to the level of the river at about 1200 feet. Of the numerous waterfalls over ledges of Pottsville sandstone and conglomerate, the highest and most picturesque is the 100-foot high Panther Falls. This cascade is located near the top of the steep part of the mountain slope, its base being at roughly the same elevation as the bend in the "Shepherd's Crook" on the old D&H Gravity Railroad (see below). The creek was the source of water for the steam locomotives on the gravity railroad and also formerly supplied Carbondale with part of its water supply (from a reservoir at the top of Panther

Falls). The former water line tract is now used as a hiking path from the O&W to the middle and upper falls.

The Salko tract. This1,400-acre tract of privately owned land in the Panther Bluff area (Wayne and Lackawanna counties) contains plant species and natural communities of special concern. Short-hair sedge, backward sedge, and Carey's smartweed all occur in a leatherleaf –sedge wetland area. In addition to supporting these three special species, the community also contains "exceptionally high species diversity." The other natural community of special concern is a rhodora barren. This community is a rare variant of the globally rare community type known as mesic scrub oak pitch pine-heath barrens. The long name is a misnomer since pitch pine and scrub oak are absent. A more apt name for the general community is mesic till barrens. Outside of Panther Bluff, this community type is restricted to the southern Pocono Plateau, with perhaps a small occurrence in the Shawangunk Mountains in New York.

Shepherd's Crook. About 2.5 miles northeast of Carbondale, the D&H Gravity Railroad light track grade made a sharp switchback as it descended the west face of the Moosic Mountains toward Carbondale. Although the tracks have long been removed and the abandoned route doesn't even show up on modern topographic maps, the old railroad grade with the poetic name can still easily be following on the ground. A deep rock cut through Pottsville sandstone and conglomerate marks the lower section of the "crook." The sharp bend lies about 1,000 feet south of Panther Bluff Creek (see above). During the 19th and early 20th centuries, sightseers came from miles around to experience the downhill thrill around Shepherd's Crook in open gravity cars, after picnicking at the D&H Coal Company's grounds atop Farview, near Waymart.

Salem Hill Barrens (Carbondale Township, Wayne County*)* - This area supports a Ridgetop Dwarf-tree Forest Natural Community (NC511) characterized by shrub oak (bear oak) only a few feet tall and large expanses of low-bush blueberries, huckleberries, and black chokeberries. This is a large example of this type of community, but has suffered due to littering, an old quarry, a radio transmitter, and off-road vehicle use. There are no known species of special concern here, but this type of community often supports rare moths and butterflies.

Moosic Mountain Barrens - This site is an excellent example of a barrens community. The area includes both Ridgetop Dwarf-Tree Forest and Heath Barrens Natural Communities with unassessed amounts of Northern Appalachian Acidic Rocky Summit Natural Community.

Fallbrook Swamp (Fell Township) - This is a forty-acre wetland including many cover types.

Mud Pond (Fell Township) - This is a natural spring-fed lake surrounded by forest with a section of shore developed as a picnic and beach area. It is maintained as a county park-Merli-Sarnoski Park and attracts fisherman to the well-stocked lake.

Mud Pond (Preston and Ararat Township) It supports five plant species of special concern. Mud Pond, also known as Orson Glade, is an exemplary Glacial Lake community and provides the only known habitat in Pennsylvania for Pennslyvania-Endangered (PE) plant SP511. This plant is under consideration for federal endangered-species status. The Nature Conservancy considers Mud Pond to be one of the most important sites for protection in the state.

Class B Trout Fishery designation for a portion of the Upper Lackawanna River – The Lackawanna River from Stillwater Dam to Carbondale is one of only 100 streams in the Commonwealth of Pennsylvania to receive a Class B trout fishery designation. A river with this classification supports 18 to 36 pounds of fish per surface area of stream.

Otter population – Above Carbondale, the Upper Lackawanna River provides suitable habitat for the river otter. Otters are rare in Pennsylvania and require fish and clean water for survival.

Special Plant Species – The Pennsylvania Natural Diversity Inventory has identified nine plant species of special concern that exist within the Lackawanna River corridor. These are: small floating manna-grass (Glyceria borealis), sweet bayberry (Myrica gale), many-fruited sedge (Carex lasiocarpa), floating heart (Nymphoides cordata), bayonet rush (Juncus militaris), Jacob's ladder (Polemonium vanbruniae), golden club (Orontium aquaticum), water lobelia (Lobelia dortmanna), and purple bladderwort (Utricularia, purpurea).

Anthracite fields – The anthracite fields of the Lackawanna Watershed contain some of the world's most extensive deposits of anthracite coal. In fact, over 80 percent of the world's anthracite coal is found in three great fields of northeastern Pennsylvania.

Vistas of Moosic Mountain – The Moosic Mountains are the largest unbroken tract of land in Wayne County. The Nature Conservancy believes the protection of this ridge should be an important goal of the county and state.

Chapter 3
Water Resources

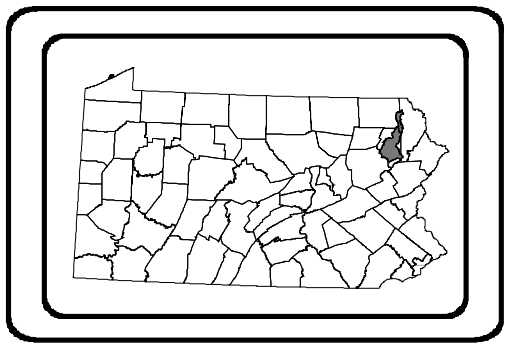
A watershed ultimately connects the communities within it through their common dependence on water resources. Our flowing creeks and streams are perhaps the best barometer of how well we accept stewardship of the land on which we live. Watersheds are important in every community because they embody our sense of place in the landscape, and their waters are important in our daily life. Watersheds are the geographic addresses for our communities.

Hydrological Resources

The River and its Watershed. The Upper Lackawanna River rises in a series of glacial ponds and wetland bogs along the border areas of Wayne and Susquehanna Counties in the glaciated plateau province of the Appalachian Mountains. The entire Lackawanna River flows for nearly sixty (60) miles through a 350 square-mile watershed in four counties in northeastern Pennsylvania to its confluence with the north branch of the Susquehanna River at Coxton, near Pittston, Pennsylvania. The study area of this plan is concerned with the Upper Lackawanna River from its headwater lakes to just above Carbondale.

The source ponds and bogs of the Upper Lackawanna River lay in an arc approximately twelve miles to the northwest, north, and northeast of Forest City, Susquehanna County. The source ponds of the West Branch of the Lackawanna River are: Sink Hole Swamp, Lake Romobe, Ball Lake, Hathaway Lake, Fiddle Lake, Lowe Lake and Lewis Lake. Source ponds of the East Branch of the Lackawanna River are: Bone Pond, Independent Lake, Dunn's Pond, Mud Pond, Lake Lorain, and Orson Pond.

The east and west branches flow together at Stillwater Dam, a flood control dam constructed in 1960 by the U.S. Army Corps of Engineers located one mile south of Union Dale along PA Route 171. After flowing through Stillwater Dam and Old Stillwater Lake, a water supply reservoir, the river flows through Stillwater Cliffs, the Lackawanna Water Gap, and begins its 39-mile course through the Lackawanna Valley to its confluence with the Susquehanna River at Pittston. The river passes out of what is considered the Upper Lackawanna watershed at Simpson.



Location in Pennsylvania

Upper Lackawanna
Watershed

SUSQUEHANNA

WYOMING

WAYNE

LACKAWANNA

Susquehanna
River

LUZERNE

PIKE

2 0 2 4 Miles

Location of the Watershed

Upper Lackawanna Watershed
Conservation Management Plan

Information used to produce this map was obtained from PennDot and PASDA.

Trails Conservation Corporation
with BLOSS Associates

BLOSS ASSOCIATES

January, 2002

Surface Water. Surface water, in the form of rivers, streams, lakes, and ponds, covers about 1 percent of the upper watershed. The watershed boasts numerous ponds of one acre or less and lakes up to 100 acres in size. Many of these were formed by glacial action and many are man-made. The high water table renders the upper watershed extremely conducive to pond building for aesthetic and recreational purposes. The Lackawanna River drains the eastern part of Susquehanna County. The Susquehanna River eventually receives all the drainage from the entire watershed.

Most aquifer recharge takes place within a very short distance from the point of discharge. The largest source of recharge is rainfall. The watershed receives about 42" of rainfall per year. Twelve to fifteen inches of this precipitation seeps back to the saturation zone as recharge. This water continues to move downward and laterally until it returns to the surface as springs and channel seepage that eventually makes up the stream base flow that feeds the Lackawanna River. Within the watershed, 60 to 80 percent of stream flow is groundwater.

Groundwater. Groundwater is the major source of water for residents in the upper watershed except for Forest City, Vandling, and Simpson. Aquifers consisting of unconsolidated materials within a maze of interconnected voids in the rock are the primary source of this water. Water availability depends on the size and degree of inter-connectedness of water-filled openings such as fractures, bedding plate partings, or small voids between grains that make up the rock. Hillsides and hilltops are often underlain by rocks that are more resistant to the forces that cause openings in the rock. These forces include glacial movement, water movement, erosion, and weathering. Relatively shallow groundwater, if unadulterated by surface activities, is generally of a higher quality than deeper water. This is because deeper water moves more slowly and has more contact with subsurface rocks, thereby increasing the mineral content of the water.

Groundwater contamination comes from a variety of sources, including: leaking underground storage tanks, mine drainage, prehistoric brine (saltwater) intrusion, water wells causing flow between aquifers, oil and gas wells, surface water intrusion, agricultural activities (manure, herbicides, pesticides), highway de-icing salts, and atmospheric contaminants (dust, auto emissions, pesticides.)

Sources of groundwater contamination related to waste disposal are industrial wastewater impoundments, landfills and dumps, septic tanks and cesspools, municipal wastewater (leaking sewers, treatment plants, residual soils), land filling and/or spreading of sludge, mine wastes, and animal feed lot wastes.

Water Quality. Few natural areas in the southern portions of the lower watershed within the Northern Anthracite Fields are healthy forest environments. Impacts along the Lackawanna River have been particularly severe where culm and ballast, which were used to build railway corridors, have eroded into the river. Water quality problems are a result of sedimentation, acid mine drainage, and domestic and industrial waste discharge in the southernmost portion of the watershed. As mines were abandoned, underground mine pools formed which feed acid mine drainage into local water sources. The highest

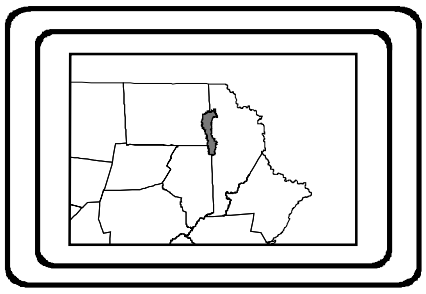
discharge of mine drainage along the river exists in the Forest City area, spilling four cubic feet per second into the river from the Vandling outfall.

Private removal of ballast along the rail corridor and erosion of the rail line have created severe sedimentation into the river. This drainage has decimated local fish populations, stained the riverbeds orange, and ravaged riverine wetlands. Acid mine drainage, erosion, sedimentation, and poor land use practices have all contributed to the continued impairments to river health and overall water quality. These impacts, although not as severe in the upper watershed, are much greater in the lower watershed.

Subwatersheds

The Upper Lackawanna watershed drains an area of about 56 square miles and can be divided into five subwatersheds:

- The East Branch (15.47 sq. miles),
- The West Branch (8.45 sq. miles),
- Fiddle Lake Creek (8.56 sq. miles),
- Stillwater Lake and dam (3.15 sq. miles), and
- The main stem of the Upper Lackawanna from Stillwater to Simpson (20.59 sq. miles).



Location in northeast Pennsylvania

West Branch

East Branch

Fiddle Lake Creek

Stillwater Lake and Dam

Main Stem Lackawanna,
Stillwater to Simpson

171
370
171
374
371
171
247
247
171

1 0 1 Miles

Subwatersheds

Upper Lackawanna Watershed Conservation Management Plan

Information used to produce this map was obtained from Acker Associates.

Trails Conservation Corporation with BLOSS Associates

BLOSS ASSOCIATES

January, 2002

Major Tributaries

The headwaters of the West Branch begin near Burnwood, Susquehanna County, in small lakes and swamps that drain into Hathaway Lake. These bodies of water include Ball Pond, Stearns Swamp, Sinkhole Swamp, and Romobe Lake. Below Hathaway Lake, two unnamed intermittent streams enter the West Branch from the east. Another unnamed intermittent stream enters the West Branch at Burnwood. Fiddle Lake Creek, which flows out of Fiddle Lake and Lewis Lake, enters the West Branch below Uniondale.

The headwaters of the East Branch, near Orson in Wayne County, include a series of lakes connected by streams. Bone Pond is at the northernmost point of the watershed and drains into Independent Lake and Mud Pond before entering the main stem of the East Branch. South of this area, Lake Lorain drains into Orson Pond before entering the river between East Ararat and Orson. To the west, Dunn Pond drains into Mud Pond before entering the main stem of the branch. Several small streams enter the East Branch from Ararat Mountain.

After the East and West Branches converge at Stillwater Lake, the next tributary to enter the river is Meredith Brook, which drains Lake Erie in Forest City. Two unnamed tributaries come down from Moosic Mountain between Panther Bluff Creek and Rogers Brook. Three unnamed runs enter the river between Brace Brook and Stillwater Cliffs. Clarks Creek, which enters the river at Browndale, comes down from Moosic Mountain. Roger's Brook (which passes through Scott Linde's property) joins the Lackawanna River south of Browndale.

The following is a comprehensive list of major and minor surface flows that drain into the Lackawanna River, ascending from the south to the north, beginning at State Route 171 in Fell Township where 171 crosses the Lackawanna River at Simpson, Lackawanna County.

Draining from the west side of the Moosic Mountain Ridge into the Lackawanna River:

- Panther Bluff Creek
- Unnamed tributary locally known as "Salko's Run"
- Unnamed tributary locally known as "Linde's Run"
- Rogers Brook
- Clark's Creek draining from Browndale
- Pevec's Spring
- Brace Brook
- Unnamed tributary "run"
- Unnamed tributary "run"
- Stillwater run
- Meredith Brook – a small tributary south of Browndale

Stillwater Dam – to the north is the confluence of the East and West Branches of the Lackawanna River

Draining into the East Branch of the Lackawanna River:

- Orson Pond / Lake Lorain tributary – comes in along Route 370 on the East Branch
- Mud Pond – the East Branch flows through this large wetland
- Dunn's Pond tributary, which includes:
  - Independent Lake tributary
  - Nettle Run tributary
  - Bone Pond tributary drains into the tributary from Independent lake which drains into a swamp area and
  - From the east of the Bone Pond tributary is an unnamed tributary flowing west into the Bone Pond tributary.

Draining into the West Branch of the Lackawanna River from the Ararat Plateau:

- Fiddle Lake Creek
- Lewis Lake tributary
- Lowe Lake tributary
- Fiddle lake creek, through State Gamelands 236, to its source at Fiddle Lake
- Two small ponds to the east of Fiddle Lake Creek that drain into
  - Two small tributaries which come together and drain into the West branch at Burnwood
- Unnamed tributary at Burnwood coming into the West Branch from the east at Foster Cemetery
- Unnamed tributary to the east of the west branch
- Tributary coming in from the east of the west Branch from Pine Swamp
- Hathaway Lake
- Ball Pond, an open area that exists in Stearn Swamp
- Outlet of Ball Pond and Stearn Swamp flow into Hathaway Lake
- Romobe Lake flows into Hathaway Lake from the west
- Sinkhole Swamp flows into Romobe Lake from the northwest
- Intermittent tributary stream and swamp flow into Sinkhole Swamp.

Table 4
Stream Ascension

Ascension Number	*River Mile*	*Bank*		*Stream Order*	*Name*	*Total Length*	*Miles in Survey*	*Tributaries Name*	*Length*
41	31.7	E		1	Panther Bluff Creek	5	0		
42	33.3	E		1	UNT (Salko's Run)	1	0		
43	34.3	E		1	UNT (Linde's Run)	1	0	1 UNT	
44					Rogers (Clark)				
45	34.8	E		1	Brown Dale Creek	1	0	1 UNT	
46	36.4	E		1	Brace Brook	3	0	2 UNT	
47	36.5		W	1	UNT	1	0		
48	36.6	E		1	UNT	1	0		
49	36.7	E		1	UNT	1	0		
50	38.6	E		1	Stillwater Run	1	0		
	39.5				Stillwater Dam				
51	39.9	E		2	East Branch Lackawanna	12	0	Orson/ Lorain Tributary	3
								Dunn's Tributary	1
								Independent Tributary	1
								Bone Tributary	2
								UNT (Nettle Hill Run)	1
52	40		W	2	West Branch Lackawanna	8	0	Fiddle Lake Creek	6
								UNT	1
								UNT	1
								Bull Lake Run	2

Stream Order

Stream order is a measure of where in a watershed a stream is and how many tributaries it has. First-order streams have no tributaries. Second-order streams have only first-order streams as tributaries. Third-order streams have only first- and second-order streams as tributaries, and so on.

The Upper Lackawanna River is a third-order stream below the confluence of the East and West Branches. The East and West Branches are both second order streams. Fiddle Lake Creek, which enters the West Branch just above Stillwater Lake, is a first-order stream.

Headwater streams are defined as first- and second-order streams. Headwater streams, although the smallest streams, are crucial in watershed management because they dominate the landscape through their sheer number and cumulative length. Although typically short in length, headwater streams actually comprise about 75% of the total stream mileage in the United States. Most of the Upper Lackawanna watershed can be considered headwaters area.

What happens in the local landscape is directly translated to headwater streams. As urbanization increases, streams handle increasing amounts of runoff, which degrades headwater streams and eventually, major tributaries.

Focusing on the headwater stream level in watershed management is important for several reasons:

- Headwater streams are exceptionally vulnerable to watershed changes;
- Headwater streams are often on the same scale as development projects;
- The public intuitively understands streams and strongly supports their protection;
- Headwater streams are good indicators of watershed quality.

Headwater streams have fewer upstream uses to cause problems and can be a reservoir of biodiversity, if protected. In addition, lower-order streams are narrower and therefore are more likely to have overarching trees, lower temperatures, and better food sources for aquatic invertebrates.

Stream Designations

The Commonwealth of Pennsylvania classifies streams according to the uses for which each stream is most suitable. The quality of all streams is expected to be high enough to allow for water supply, recreation, and aquatic life. The Department of Environmental Protection regulates discharges into streams according to the designated use and the water quality that each use demands. For example, cold-water fisheries require higher levels of dissolved oxygen and colder temperatures than warm-water fisheries. Waters designated as “special protection” uses, such as “high quality” or “exceptional value,” must be protected at their current level of use. New or expanded discharges that threaten the existing quality of special protection streams are prohibited unless the economic and social benefits from the discharge significantly outweigh the costs of degrading the stream (25 PA Code Ch. 93).

The Lackawanna River from Stillwater Dam to Carbondale is one of only 100 streams in the Commonwealth of Pennsylvania to receive a Class B trout fishery designation. A river with this classification supports 18 to 36 pounds of fish per surface area of stream.

The East Branch of the Lackawanna River was upgraded to high quality-cold water fishery (HQ-CWF) in 1991 by the Department of Environmental Resources.

State regulations in Chapter 93 define stream classifications and designated uses and describe how designated uses are used to determine what impact can be allowed from various permitted activities.

- Permitted discharges to Exceptional Value streams cannot change existing water quality.
- Permitted discharges to High Quality streams must maintain existing water quality except when social or economic justification for lowering water quality can be demonstrated.
- Permitted discharges to all other streams must protect existing uses (designations).

Table 5 – Stream Classifications and Designated Uses[1]

EV = Exceptional Value Waters. Special Protection. A surface water which is of exceptional ecological significance, such as thermal springs or wetlands which are exceptional value wetlands under Chapter 105,17(1); or a surface water that has excellent water quality, meeting the tests for High Quality Waters, and also meets other requirements such as: is located in a National wildlife refuge or a State game propagation and protection area; or is located in a designated State park natural area or State forest natural area, National natural landmark, Federal or State wild river, Federal wilderness area or National recreational area; or is an outstanding National, State, regional or local resource water; or is a surface water of exceptional recreational significance; or meets a biological test set forth in DEP regulations at Chapter 93.4b(a)(2) or is designated by the Fish Commission as a "Wilderness Trout Stream."

HQ = High Quality Waters. Special Protection. A surface water having quality which exceeds levels necessary to support designated uses as shown by meeting chemical or biological standards set forth in DEP regulations at Chapter 93.4b (a).

CWF = Cold Water Fishery. Maintenance and/or propagation of fish species including the family Salmonidae and additional flora and fauna which are indigenous to a cold water habitat.

TSF = Trout Stocking Fishery. Maintenance of stocked trout from February 15 to July 31 and maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.

MF = Migratory Fishery. Passage, maintenance and propagation of anadromous and catadromous fishes and other fishes which ascend to flowing waters to complete their life cycle.

Class A Wild Trout Water. A surface water classified by the Fish and Boat Commission based on species specific biomass standards, which supports a population of naturally produced trout of sufficient size and abundance to support a long term and rewarding sport fishery.

[1] Chapter 93, Title 25, Pennsylvania Code of Regulations.

Wetlands

The USDA Forest Service estimated that there existed 61 wetland sites over 40 acres in size in Susquehanna County in 1979, amounting to 3,800 acres. Although no data currently exist on the loss of wetlands within the upper watershed, statewide statistics show that between 1956 and 1979 there was a 6 percent loss of wetlands. Forty-six percent of the loss was due to pond and lake construction, 37 percent to development, and 17 percent to agriculture.

Wetlands are the transitional areas between clearly defined aquatic environments and clearly defined terrestrial environments. These areas are inundated by water at or near the surface of the land or are covered by shallow water. Wetlands can be scientifically delineated by the presence of hydric soils, hydrophytic plants, and water.

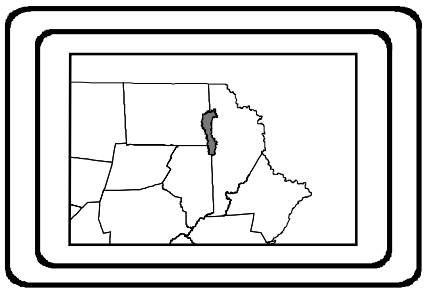
Wetlands have important value in reducing water turbidity and improving water quality. They are also a source of harvestable resources such as timber, fish, wildlife, peat, berries, and wild rice. Wetlands provide recreational activities for fishermen, hikers, hunters, and wildlife watchers. Wetlands also provide extremely important wildlife habitat. They provide water, food, and shelter for a multitude of creatures, ranging from the smallest amoeba to fish, reptiles, amphibians, furbearers, and waterfowl.

- Mud Pond;
- Sinkhole Pond;
- Stearns Swamp; and
- A large unnamed wetland on the West Branch of the Lackawanna River above Herrick Township (Theta property/former PGE watershed)
- A large unnamed wetland on the East Branch at the confluence of the Mud-Dunn Pond Branch and the Lake Lorain-Orson Pond Branch

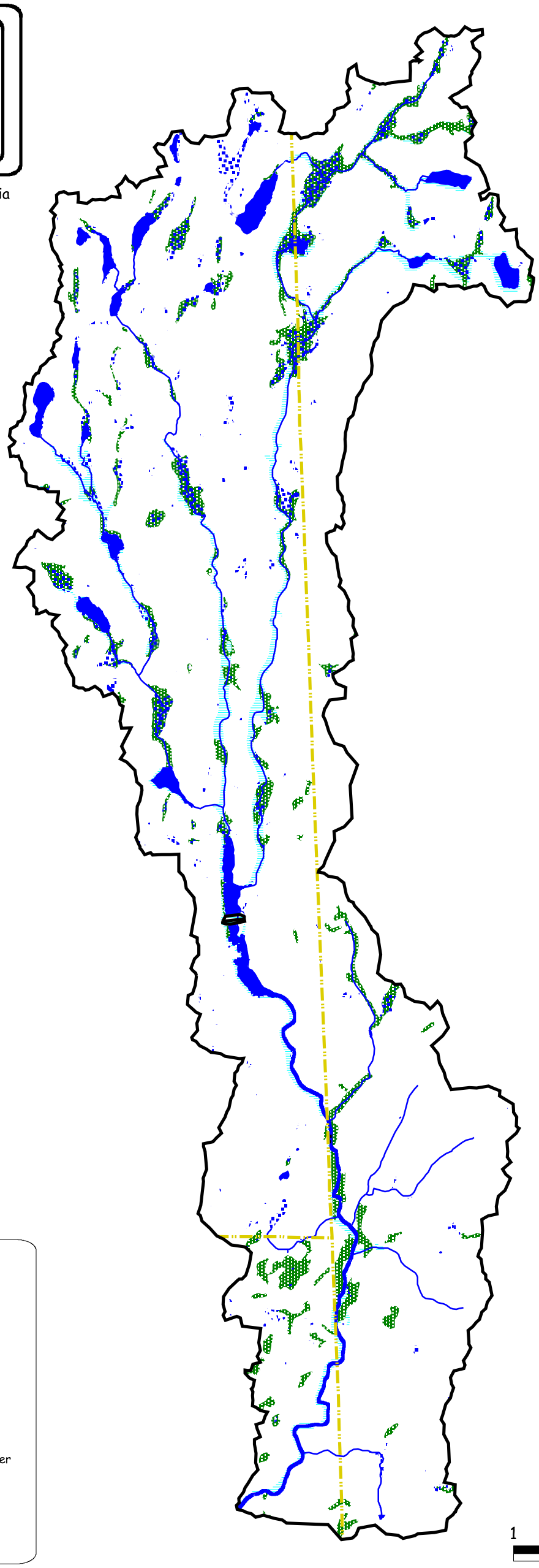
Most of the wetlands that exist in the headwaters region are unnamed. Wetlands make up a small but valuable part of the Upper Lackawanna Watershed.

Wetlands serve many valuable functions. They provide quality wildlife habitat, filter runoff before it enters streams, and provide natural catchment basins for stormwater runoff. The natural filtration processes of wetlands have inspired communities and conservation districts to design and construct wetlands for the purposes of acid mine drainage remediation and sewage treatment.

Various programs, such as the Conservation Reserve Program run by the U.S. Department of Agriculture or Ducks Unlimited's PA Habitat Stewardship Program, offer incentives to farmers and other landowners to protect existing wetlands. Additionally, funds are available to farmers to fence off wet areas, allowing the area to revert to its natural state. Along with incentives, present regulations require anyone filling a wetland to mitigate the action by restoring or constructing replacement wetlands.



Location in northeast Pennsylvania



Watershed Boundary
County Boundary
Wetlands - NWI
Hydric Soils
Floodplain
Upper Lackawannna River
Major Tributary
Water Bodies

1 0 1 Miles

Wetlands and Floodplains

Upper Lackawanna Watershed Conservation Management Plan

Information used to produce this map was obtained from USFWS and PASDA.

Trails Conservation Corporation with BLOSS Associates

BLOSS ASSOCIATES

January, 2002

Floodplains

Early settlers in the Upper Lackawanna Watershed established communities along the rivers, as these were the most opportune locations for transportation, trade, and natural resources. Unfortunately, many of these towns were established in floodplains, leaving some residences and businesses prone to frequent flooding. Flooding in the watershed typically occurs in the early spring as melting snow and rainstorms combine to raise river levels. Herrick Township, Ararat Township, Forest City Borough, and Union Dale Borough require building setbacks from water bodies and regulate development in flood plains.

Storm Water

While stormwater runoff creates occurrences of small stream flooding and streambank erosion during storm events, the most urgent concern of stormwater runoff relates to water quality. The conversion of farmland, forests, wetlands, and meadows to rooftops, roads, parking lots, and lawns creates a layer of impervious cover in the landscape. Water from storm events and melting snow runs rapidly off these surfaces, carrying pollutants to streams and aquifers, instead of slowly percolating into the soil. Research has shown that the amount of impervious cover in a subwatershed can be used to project the current and future quality of streams. In many regions of the country, as little as ten percent watershed impervious cover has been linked to stream degradation, with the degradation becoming more severe as impervious cover increases.

In residential areas, streams are contaminated by residential nutrient runoff from excessive applications of fertilizers, animal waste or malfunctioning septic systems; soil erosion, and streambank erosion. Bacteria, nutrients, sediments and erosion have been identified as water quality problems in the watershed, as a result of agricultural non-point source pollution and sediment from stream bank erosion. Habitat loss and eutrophication are other problems associated with stormwater runoff.

Lakes and Ponds

The Upper Lackawanna Watershed has about a dozen major lakes and wetland complexes that form the nucleus of its headwaters. Wayne County has Lake Lorain, Bone Pond, Independent Pond, and Orson Pond. On the Susquehanna and Wayne County line are Mud Pond and Dunn's Pond, the major headwater ponds of the East Branch of the Lackawanna River. Lewis Lake, Fiddle Lake, Lowe Lake, Ball Pond, Hathaway Lake, Romobe Lake, and other small lakes feed into the west branch of the Lackawanna. Some of these lakes are habited, while some have summers-only cottages, some are surrounded by farmland, and some are completely wooded. Lakes and reservoirs play an important role in the Upper Lackawanna Watershed; some are used for

drinking water and some for recreation. *See Table 3, Lakes and Ponds*, below, for size of major lakes and reservoirs.

Many of the lakes in the headwaters region are now up for sale. Previously, these lakes had been held in a public trust by a water utility, Pennsylvania Gas & Water Company. Pennsylvania Gas & Water Company then sold the headwaters land to PG Energy, who in turn sold the lands to Theta Corp. Much of the headwaters area, including many lakes, is now up for sale. Sale of these lakes could lead to loss of public access, draining of wetlands, and possible degradation of the water source. Seven lakes and ponds in Susquehanna and Lackawanna Counties are up for sale. These include:

- **Lowe Lake (partial)**, Herrick Township, Susquehanna County;
- **Ball Pond**, Ararat Township, Susquehanna County;
- **Mud Pond**, Ararat Township, Susquehanna County;
- **Fiddle Lake** (partial), Ararat Township, Susquehanna County; and
- **Dunn Lake**, Ararat Township, Susquehanna County.

Lakes and ponds in the upper watershed include:

Upper Lackawanna River above Simpson:

- Panther Bluff Pond (east of river)
- Unnamed ponds on Panther Bluff Preserve (east), including Violet Bog
- Unnamed mine ponds (east)
- Brace Brook Reservoir (east)
- Lake Erie (west)
- Kennedy Pond (west)
- PA American Water Co. ponds and dam

Stillwater Lake and Dam

West Branch of the Lackawanna:

- Lewis Lake
- Lowe Lake
- Unnamed ponds and swamps on state game lands
- Fiddle Lake
- Hathaway Lake
- Romobe Lake
- Sinkhole Swamp
- Ball Lake
- Pine Swamp
- Stearns Swamp

East Branch of the Lackawanna:

- Mud Pond
- Unnamed Swamp

- Dunn's Pond
- Independent Lake
- Bone Pond
- Orson Pond
- Lake Lorain

Lakes and Ponds of the Upper Lackawanna River

Panther Bluff Pond. Panther Bluff Pond**,** unnamed ponds, and numerous wetlands and bogs (including Violet Bog) flow off of a high plateau area of the Moosic Mountains to the east of the Lackawanna River. These are contained in a newly conserved area known as Panther's Bluff Preserve. The Wildlands Conservancy assisted the Salko family in purchasing this undeveloped tract for conservation purposes, including 1,400 acres from the river to the top of the Moosic Mountains. Three plant species of special concern have been found on this tract.

These ponds and wetlands flow down the western side of the Moosic Mountain and enter the upper Lackawanna River at three points. Panther Bluff Creek enters the river at mile 31.7 after crossing through a large culvert in need of repair under the O&W Rail-Trail. This streambed has spectacular waterfalls and has been a local attraction for many years. The lower falls are a short walk from the O&W trail. The upper falls are accessed by walking up the solid rock streambed or utilizing a path that follows the old Carbondale Waterline where drinking water was piped from a reservoir at the top of Panther's Falls. The upper falls are adjacent to the old D&H steamline railbed, where trains backed up on a switchback rail. A concrete foundation is visible (early 1900's). A short walk from the upper falls along the steam railbed are remnants of Shephard's Crook and D&H gravity railbeds.

Party and dumping areas have been cleaned up by the Rail-Trail Council and the Salko Family. Vehicle access has been curtailed; however, numerous ATV paths and railroad sidings provide illegal access. Panther Bluff Preserve is posted to discourage use, and access is by permission only. Hiking groups, scouts, and Rail-Trail events have accessed the many hiking trails on this property.

The other two streams draining off the Panther Bluff Preserve enter the river at mile 33.3 and 34.3. Rogers Brook drains off the property to the north of Salko's tract.

A few unnamed ponds exist near the river at mile 34.5. These ponds are locally known as the "Greeny" and as "Blue Pond." Their names indicate the strange colors present, probably due to mine drainage. Others are located at acid mine outfalls and have the characteristic orange rust color.

Kennedy Pond. On the west side of the river within the Borough of Forest City are Kennedy Pond and Lake Erie. Kennedy Pond, located at the popular borough park, drains southerly into Lake Erie. Meredith Brook flows southerly out of Lake Erie,

through Vandling, then reenters Forest City Borough flowing easterly and enters the Lackawanna at mile 35.50, just south of the sewer plant.

Kennedy Park Pond is a small shallow pond with an average depth of 3-4 feet, maximum of 8 feet. The water is typically clear and clean, filtering down from the West Mountain above it. It is located just a few blocks up the hill from the downtown and residential area of Forest City. The pond is within the much-used municipal park and offers swimming with a sandy beach. A lifeguard was hired by the borough, but this practice stopped two years ago for lack of potential guards. Pan fish are common and the pond is the site of an annual fishing derby. A fly-fishing seminar teaching basic casting techniques is also an annual event along the grassy shores. Other park amenities include a Little League baseball diamond, a field house with flush toilets, a concession area, and a storage area. Also, there is a basketball court and a tennis court. A pavilion overlooks the pond and volleyball court; picnic tables are scattered in sun and shade. There are older swings, a slide, and teeter-totters. The borough recently received a DCNR grant to update the play equipment. The gazebo, opposite the beach, provides picture-taking opportunities. The park is well kept by a park maintenance person, paid for through the borough. There is an active Kennedy Park Board that oversees park management and maintenance.

Historically, Kennedy Park Pond was called Ice Pond and provided a source of ice blocks to the borough for about 75 years. An icehouse was located near the present baseball diamond. Ice Pond was one of three sites used for ice-skating in the Forest City area. When the lake was slated to be sold to a developer in the 1940's, local citizens banded together to save the land and sought funding sources to develop a park.

Lake Erie. The outlet from Kennedy Park Pond flows southerly into Lake Erie. This lake is about three times as large as Kennedy, but maintains a shallow depth averaging only 4 feet. Fishing is said to be excellent, with panfish as well as pickerel and bass. No motorboats are allowed, and the lake is very well posted. Lake Erie was built when the Hillside Coal & Iron Company began construction of a dam across the creek in the "Swamp" region near Richmondale, for the purposes of having its own water supply. Lake Hillside, more commonly known as Lake Erie, served until it was drained June 24, 1937 by the Gateway Coal Co. to prevent further mine flooding.

The lake is bounded on the east by a few homes and the Forest City Regional Elementary and High School. The center field of the high school baseball field comes very close to the lake shore and is at many times wet. The level of the lake has been a point of controversy for many years. A tug-of-war has occurred often between those who wanted a lower level (dry outfield) and those who wanted the natural level. The western shore of Lake Erie (about 60 percent) is undeveloped, with secondary growth reaching to the shoreline. There are well-worn paths around the lake used primarily (informally) by the cross-country team. The lake bottom and western side of the lake are privately owned.

In 1991, the Committee for the Preservation and Conservation of Lake Erie was formed, led by local environmentalist and outdoor writer, Bill Feddock. It was this group's goal

to set and restore a 'satisfactory conservation level, with a permanent weir set at the outlet to maintain a proper, agreed upon water level'. By July of 1993, the proper authorities were notified, meetings occurred, permits were filed, and in that September, authorization was given to proceed with the weir and spillway at the outlet. By the summer of 1995, all work at the outlet was completed, including construction of a footbridge across the spillway. The project was well publicized and a notice was sent to the school board, who agreed that the proper steps had been taken and the level set would be adhered to. In July of 1999, someone tampered with the weir in an effort to lower the level of the lake, and posted signs were also destroyed. The 'committee' reported the incident to the school board and promised that the next violation would result in fines and arrests. Repairs have been made, but the controversy continues.

Brace Brook Reservoir. Located on the east side of the river, Brace Brook is a small water reservoir owned and operated by the Pennsylvania American Water Company. It is not in regular use, but is retained as an additional water supply. The reservoir was used as part of Forest City's drinking supply before Stillwater Dam was built in 1960. Now, all of Forest City's (including Browndale, Vandling, and Richmondale) water supply is piped (through a 30'main) from Stillwater to the filtration plant, located along mile 36.25 of the river. Old Stillwater Dam (south of the Army Corps Dam) is the site of the intake for Forest City.

The reservoir is located on 'Browndale Mountain,' a section of Moosic Mountain approximately 7,000' from the Lackawanna River at an elevation of 1,800'. The outlet flows down a spectacular ravine that has informal walking paths on each side. On the north side of Brace Brook Creek can be seen the aboveground water pipeline. There are also several old concrete structures along the creek. The creek passes under the O&W Rail-Trail through a large culvert and enters the river at mile 36.50 just north of the water filtration plant.

Stillwater Dam

Stillwater Dam. Stillwater Dam was built in response to flooding on the Lackawanna River, and is owned, maintained, and operated by the U.S. Army Corps of Engineers (ACOE), Baltimore District. There have been tremendous floods along the river in the last hundred years -- in the 1880's, 1890's, a big flood in 1902, another large flood in 1936, and again in 1942, 1955, 1985, and 1996. The dam was built in response to the floods of 1942 and 1955. Hurricane Diane destroyed houses and businesses in 1955, heavily impacting the area of Roaring Brook, a tributary to the Lackawanna in the lower portion of the watershed.

The Dam was built in 1960, and the way the Dam was designed and authorized reflects two major purposes in its operation and construction: for flood control and for water supply. To deal with flooding problems on the Lackawanna, the Army Corps' recommendation was for a large, dry dam to store the rainfall from a hurricane, or to absorb a 100-year storm event rainfall. The problem was where to build such a dam in the watershed. Areas such as downtown Scranton and Olyphant were ruled out because

the mines so terribly affected the geology that there wasn't anything stable to build on. The Dam couldn't be built in Carbondale or Simpson because the valley was too narrow there and mines were still active. So the Corps settled on Stillwater, near Stillwater Cliffs at a point on the river where they could control the flow from the East and West Branches. The only problem with that location was that there already was a Dam there: Old Stillwater Dam.

Old Stillwater Dam was operated by the PA Gas and Water Company (now PA American Water Co.) and was part of the water supply for Forest City. To solve the problem of both needing to provide drinking water for Forest City and building a flood control dam, Stillwater Dam was designed and built at the tailwaters of Old Stillwater Dam.

The ACOE had to reduce the height of the Old Stillwater Dam down to its original stone foundation, which was about 3 to 4 feet high. The pond behind Old Stillwater is now about 5 feet deep and about 150 to 200 acres in size. To compensate the water company for the loss of water storage, the Corps offered to keep some water for the water company in the new dam that was built just above the old dam. Stillwater Dam would have been built as a completely dry dam, with no water in it except for the water that flows from the two streams, and that would have run out at the bottom of the dam. But because they had to hold some water for water supply, the Corps maintains the pool of water in the flood control dam at a constant 1,672 feet elevation above sea level.

After storm events, the ACOE has to deplete the reservoir. However much water comes into the dam, they control the flow so that they do not cause any major flooding downstream. They have about 40 to 50 feet of capacity in elevation. If the water rises to around 1,700 + feet (elevation above sea level), it goes over the top of the emergency spillway. The ACOE tries to balance the amount of flooding they would cause with their releases downstream in emergency conditions with the desire to maintain this control. After a rainfall event, be it a summer thunderstorm or a hurricane, the ACOE has to reduce the water level back down to 1,672 feet. The water level must be maintained at this level. No water can be released below that level, because it belongs to the water company and it's part of the water supply for Forest City.

Lakes and Ponds of the East Branch

Orson Pond. Orson Pond is a shallow pond with a few dwellings at the outlet (on the west end). At the outlet is a well-built spillway, once used to generate power. The outlet flows into a large stone culvert under the O&W railbed, then under a culvert under Route 370. Just 50 yards from Route 370, it then flows under an old stone foundation barn, turns abruptly through a concreted channel under another road (SR 670). It continues in this channel through part of a well-kept farm, before renaturalizing through the pasture.

The north side of Orson Pond, between the pond and the O&W railbed, is the site of the last remaining sectional toolhouse on the O&W, a wooden structure with gingerbread trim. Overgrown trees and brush seem to be the only support holding it up. It is in danger of collapsing.

Orson Pond had six icehouses in the days of the railroad, two of which were owned by the railroad. The other four were owned by the Scranton Ice Company. A creamery also stood on the shores of Orson Pond, near the toolhouse; its foundations are still visible. Since Orson was a shallow pond, it froze quickly and often, thus yielding the most ice in the region.

Lake Lorain. Lake Lorain, formerly known as Five Mile Pond, is a well-developed lake with a 9-hole golf course nearby. Approximately 35 cottages can be accessed by a road that encircles the lake. Lake Lorain had one icehouse linked to the O&W railroad with a short spur (Old Wye). There is a lake association.

Mud Pond. Mud Pond is a small pond, located to the west of Sugarloaf Mountain (elevation 2,536'), a significant feature in the local topography. Mud Pond is partly in Susquehanna County, and partly in Wayne County, with most of its wetlands falling in Wayne County. Its open water is probably dependent upon significant beaver activity. It is an important wetland area with a large drainage area. Several PNDI species of concern are present. The property was formerly watershed land owned by PA Gas & Water Company, then retained by PG Energy when the gas and water split. PG Energy recently merged with Southern Union, a Texas-based gas company. This property was subsequently sold to Theta Corporation. Theta Corporation purchased this property along with other lands and lakes in Susquehanna, Lackawanna and Luzerne Counties, a total of 40,000 acres of watershed lands. This wetland, along with numerous others, including lakes, forest and ponds, are now for sale to the highest bidder. The Mud Pond property is currently listed with a local realtor as 393 acres of land and water for $2.8 million.

Dunn Pond. Dunn Pond is a large, deep undeveloped lake, former watershed property now owned by Theta Corporation. It is the deepest lake in the upper watershed with an average depth of 19 feet. The lake is listed for sale as 96.3 acres of open water with 211.5 acres of land for $3.6 million. When owned by PA Gas & Water Co., fishing was permitted with a special license issued by PG&W. Now there is no public use permitted.

Located in Ararat Township, Dunn Pond has a recorded history in the development of the township. There is much interest by the township in acquiring and saving Dunn Pond. It is characterized as a 'gem' and was the one of the prime reasons for creating the Ararat Planning Commission. The commission contacted potential partners to help them acquire and conserve the pond. The Game Commission, Fish & Boat Commission, the Nature Conservancy, DCNR, and the Trust for Public Land have all been contacted. Ararat Township has commented on PG Energy's Land Use Management Plan and hoped to enlist PG Energy's assistance in exploring ownership and management options, including the possibility of a bargain sale to the township as a public service. Unfortunately, all watershed lands were sold to Theta Corporation.

An early history of the area, *Then and Now –Reminiscences of Ararat and Vicinity* by J. C. Bushnell, Esq., contains a chapter on James Dunn, a Scotchman who first settled in the area on the lake. Born in 1770 in Scotland, he was a college-educated businessman.

Coming to New York in 1790, he continued as a businessman. Why he moved his family to a pioneering life in Ararat in 1820 is not understood. "That a man with his talent, education and training should plunge into this dense forest and squat upon the shore of this forest gem from mere fancy or admiration of its premature loveliness, is not presumable." First arriving with his two eldest sons, he built a large cabin near one of the springs at the head of the lake. A year later Mrs. Dunn came with nine more children. Mr. Dunn and family first became known for their efforts to improve the road from the lake to the Ararat settlement and to the road that lead to the Newburg Turnpike, five miles south. The family had many stores to barter with: venison, beef, fish, furs, and window sash. So since 1820, the lake became known as Dunn's Pond. Originally inhabited by 'speckled trout, perch, and horned pouted and eels of fabulous growth,' it has long been a favorite of fishermen.

During the 1960's and 1970's, the Scranton Boys Club ran a camp at Dunn's Pond—Camp Kiwanis. While the camp's buildings were not located directly on the lake, lake activities as swimming, canoeing, and hiking took place on and around the lake.

Freddie's Refuse, a closed landfill, is located on state route 2079 near the lake. A local environmental group, RESCUE (Return the Environment of Susquehanna Country Under Ecology), was successful in defeating an attempt to locate a large landfill on the Milos property nearby in 1992. RESCUE was also influential in fighting the possible siting of a low-level radioactive waste facility in the Wayne-Susquehanna County area.

Independent Lake. Independent Lake has two summer camps and about thirty cottages. Independent Lake Camp and Westmount Camp are two of the many camps in upper Wayne County. The combined outlet of Bone Pond and Independent Lake enter a large swamp where they are joined by the drainage of Dunn Pond, which flows into Mud Pond.

Bone Pond. Bone Pond, also known as Summit Lake, has a few cottages and was the former site of two icehouses at the end of the O&W's 'New Wye'. In December 1999, the Delaware Highlands Conservancy signed and recorded a conservation easement protecting 96 acres on Bone Pond. The easement permits the construction of one new home and the restoration of the old 'casino', the only existing building on the property. The plan is to convert the casino into an educational nature center. Boating (no gasoline motors), swimming, and fishing will continue on the lake. Passive recreation is permitted on the land. Land uses that could degrade the scenic and natural qualities of the land are prohibited. These include subdivision, industry or commercial uses including mining and logging, dumping of any toxic materials, and animal breeding.

Lakes and Ponds of the West Branch

Lewis Lake. Lewis Lake is a small, narrow lake with approximately 40 cottages on its shores. There is a cottagers' association. The outlet of Lewis Lake drops precipitously through Union Dale, flows through a large culvert under the D&H rail-trail, and joins the West Branch of the Lackawanna River just above Stillwater Dam. This short stream and ravine (less than one mile) was the site of many water-powered businesses in the late

1800's and early 1900's. Unfortunately, the ravine is littered with old trash. The Rail-Trail Council has conducted numerous clean-ups of the area, but the steepness of the slopes and the long-time accumulation of trash makes for a difficult situation. Along the south side of the Lewis Lake outlet are numerous old mill buildings, which now house The Art Exchange, a community-based art co-op which holds quilting, photography, and pottery classes, as well as children's workshops. A darkroom, studio space, and exhibit halls are all available. In 1897, the Erie Railroad ran a pipe from Lewis Lake to Union Dale to provide water for its locomotives. The lake was also the site of a large icehouse. Records indicate Lewis Lake yielded 2,000 tons of ice in 1896-97.

Lowe Lake. Lowe Lake, also seen in old literature as Low Lake, has more than 70 small cottages concentrated along its eastern shore. The west and north shores are undeveloped, while the south shore has only a few dwellings. There is an active cottagers' association. Theta Corporation now owns part of the area. Twenty-five acres of water and 50 acres of land are now listed for sale; the asking price is $556,000.

A history of Lowe Lake and Herrick Township was recently compiled by lake residents Angel and Bob Marx. It includes Indian beginnings, first settlers and early landowners. It is notable that one of the earliest roads, the Newburg Turnpike, crossed the West Branch of the Lackawanna in Herrick near present Route 374. The Newburg Turnpike was first a stagecoach and mail route connecting Newburg on the Hudson to Cochecton on the Delaware. It later connected to Great Bend on the Susquehanna River and opened up travel in the northeast part of the country. When the D&H/Erie Railroad was built in 1871, the Herrick area grew quickly and became an important business center. The first place of business was a public house serving as the stagecoach stop and offering meals. At this intersection were a large tannery, employing 35 men, company housing, a creamery, post office, a railroad station, taverns, and stores. The Flynn Hotel later became popular, described as a commodious country inn with eighteen rooms. In the 1930's, the Flynn Hotel and its 500-acre farm that adjoined Low Lake became a federal transient farm camp.

The lakes and ponds of the West Branch were all very much affected by extensive timbering operations in the 1800's. The area was known for its sawmills and wood-acid factories (e.g. Burnwood). With the building of the railroad came the growth of dairying along with ice harvesting.

Fiddle Lake. Fiddle Lake is a 63-acre well-developed lake with a summer camp, Camp Chen-A-Wanda. There are approximately 100 cottages around the lake, and the camp is located near the outlet. Theta Corporation has listed 34 acres of water and 11 acres of land for sale, with an asking price of $305,555. A sewer treatment plant is proposed for the Fiddle Lake area. The outlet, Fiddle Lake Creek, runs through State Gamelands #236 where it incorporates many wetlands and ponds. The creek is joined by the Lowe Lake outlet before emptying into Lewis Lake.

Hathaway Pond. Hathaway Pond is located adjacent to the D&H Rail-Trail. One well-kept residence is located near the outlet end. The outlet was recently concreted into a

spillway with large riprap on either side of the outflow. The southern bank was also riprapped and appears to be built up. In the early years of the twentieth century, ice was harvested from Hathaway Pond by the forces of the Erie Railroad and loaded directly onto railcars. Records indicate that ice was still harvested in 1922. Harvested chunks of ice could be up to 16 inches thick, with Hathaway Pond yielding 591 carloads or about 12,427 tons per year.

Romobe Lake. Romobe Lake is a large wetland area with a maze-like mix of open water, islands, and marshy areas. Located just north of Hathaway, the banks are very close to the D&H Rail-Trail. Trail cinder and ballast appear to comprise the west bank of the lake. Old concrete foundations are visible, probably left over from railroad activities. There are a few cottages on the eastern bank, which are accessed by a private road.

Ball Pond. Ball Pond is a small pond surrounded by wetlands, located northwest of Romobe Lake. Stearns Swamp flows into Ball Pond. Theta Corporation owns 80 acres of water and land, listed for $600,000.

Sinkhole Swamp. Sinkhole Swamp, located just above Romobe Lake and to the west of the D&H Rail-Trail, has been recently dammed to retain water. Today, this area is more lake-like than swampy. The name of this swamp comes from a railroad incident in 1871, when a large, newly constructed rail embankment suddenly collapsed as if into a bottomless pit, leaving a large hole. Although there are no sinkholes in the geology of the area, the name remains. In rebuilding the railbed, much fill had to be brought in, and is still evident on the trail. The railroad built a trestle over the swampy region between Sinkhole Swamp and Romobe Lake. There is one home on the west side of the lake.

The flow from Sinkhole, Romobe, Hathaway, and Ball Ponds enters an eastern branch of the West Branch of the Lackawanna. The flow continues through Ararat, Burnwood, and the Herrick Swamp (90 acres of Theta property) to Herrick Center and Union Dale. The flow from the western branch of the West Branch comes from Fiddle, Lowe, and Lewis Lakes. The branches join just before Stillwater Dam in Union Dale.

Table 6
Lakes and Ponds

Lake/Pond	Elevation (feet)	Area (acres)	Volume (million gals)	Average depth (feet)	Drainage area (acres)	Drainage area/ Lake area	Dwellings
Lake Lorain*	2050	48	141	9.0	384	8.0	35+golf
Orson Pond	2000	22	38	5.3	1344	61.0	4
Bone Pond	2045	-	-	-	-	-	26
Independent Lake	2022	30	120	7.1	64	1.7	30+camps
Dunn Pond	1974	95	584	18.9	1088	11.4	0
Mud Pond	<1900	~20	-	-	-	-	0
Ball Pond	<2010	16	-	-	-	-	3
Romobe Lake	<1960	31	40	4.0	192	6.2	5
Hathaway Lake	1945	30	39	4.0	1280	43	1
Fiddle Lake*	2001	63	197	9.6	320	5.1	96+camp
Lowe Lake*	1867	51	197	11.9	448	8.8	70
Lewis Lake*	1710	50	240	14.7	4032	81	40?

*Lake Association

Water Quality

Background. Overall water quality in the Upper Lackawanna Watershed is good and is, in fact, improving. The Lackawanna River has a legacy of abuse. Industrial development, the anthracite industry, and dumping have all contributed to poor water quality within the watershed.

All underground mining in the Lackawanna Valley ended in 1966 with the closing of the Continental Mine. But the legacy of mining has left many environmental scars. Vast acreages of the valley are affected by strip mine overburden piles, pits, and unvegetated coal waste banks known as culm dumps. Over a dozen major acid mine drainage outfalls discharge between 1 and 150 million gallons per day into the river and tributary streams.

Up to eight coal beds were once mined at the north end of the Northern Anthracite field, the number of exploited beds increasing southward from Forest City toward Carbondale. Forest City is at the northern tip of the anthracite coalfields. Just a mile north of Forest City there is no evidence of mining. Water in the headwaters area north of Forest City is relatively pure.

Many millions of tons of anthracite were removed along the upper Lackawanna in the 19th century and the first 70 years of the 20th century by both surface and underground

methods, but none is currently being mined. From the 1820s to the 1850s, Carbondale was the most important coal town on the Lackawanna River, being the headquarters of the Delaware and Hudson (D&H) Coal Company and the start of the D&H's gravity railroad over the Moosic Mountains to Honesdale and the Delaware and Hudson Canal.

Few natural areas in the southern portions of the lower watershed within the Northern Anthracite Fields are healthy forest environments. Impacts along the Lackawanna River have been particularly severe where nutrient-poor and acidic culm and ballast used to build railway corridors have eroded into the river. Water quality problems are a result of sedimentation, acid mine drainage, and domestic and industrial waste discharge in the southernmost portion of the watershed. As mines were abandoned, underground mine pools formed which feed acid mine drainage into local water sources. The highest discharge of mine drainage along the trail exists in the Forest City area, spilling four cubic feet per second into the river from the Vandling drift.

Private removal of ballast along the rail corridor and erosion of the rail line have created severe sedimentation into the river. This drainage has decimated local fish populations, stained the riverbeds orange, and ravaged riverine wetlands. Acid mine drainage, erosion, sedimentation, and poor land use practices have all contributed to the continued impairments to river health and overall water quality. These impacts, although not as severe in the upper watershed, are much greater in the lower watershed.

The ***Lackawanna River Investigation,*** a 1991 study conducted by the Pennsylvania Department of Environmental Resources (DER), compiled data on water quality, flow, effluent mixing, and impact on aquatic biological communities, with special emphasis on toxins and heavy metals. The study's purpose was to resolve the issue of metals limitations on sewage treatment plant discharge into the river.

Samples were collected in July and August of 1991 from 48 river, tributary, and acid mine drainage sampling sites. Samples covered the main stem of the river from below Stillwater Dam to the mouth. Chemical, bacteriological, and flow data were summarized. Concentrations of Fe, Pb, Zn, Al, Mn, Cd, Cr, Ni, and Cu were measured. pH and alkalinity were noted, as well as the presence or absence of aquatic life.

The study found a strong cause and effect relationship between copper concentrations measured in the river downstream of the Clinton Township Sewage Treatment Plant and the observed lack of wild brown trout reproduction throughout the section, but noted that the warming influence of the Stillwater Reservoir and consequent lower dissolved oxygen levels on this section must also be taken into account.

Point Sources

Point sources of pollution are those sites, such as industries or sewage treatment plants, that discharge wastewater directly into a body of water. The entry point of the discharge is at one or more discrete locations in the stream and therefore its effects can be readily measured and regulated. The primary regulatory mechanism of point sources is the

National Pollutant Discharge and Elimination System (NPDES), a permitting system set up by the Clean Water Act and enforced by the EPA and DEP. In the Upper Lackawanna Watershed, a total of three facilities have NPDES permits.

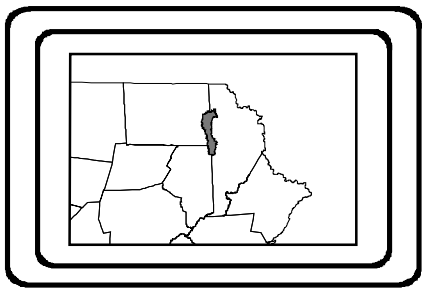
In the Upper Lackawanna Watershed, the most significant point sources of pollution are sewage treatment plant discharges and acid mine drainage. These and NPDES discharge points in the watershed can be seen on the *Map of Point Source Pollutants*. There are two main point sources of pollution from the Forest City area down to Simpson:

The Forest City, Browndale, and Vandling sewer system. These sewer systems are old systems with combined sewer overflows (CSOs). Stormwater from streets, roofs, and parking lots goes into the catch basins and into the same pipes that carry sanitary waste from homes and businesses. These CSOs (owned by Forest City) go to interceptor pipes (owned by the Lackawanna River Basin Sewer Authority, Clinton Township Plant). The interceptor pipes discharge at five locations along the D&H Rail-Trail and then percolate down through Yucca Flats (Scott Linde's property), and finally reach the Lackawanna River through all the coal waste that's there. The sewer plants overflow during stormwater situations. After each rainstorm, higher than desirable coliform counts can be found in the water at the area below the plant. These counts may persist for a few days after a storm event depending on rainfall and other hydrological flow circumstances. The counts are not as high from the Clinton plant as from other larger plants downstream at Archbald, Throop, and Scranton-Dunmore. The higher coliform count is a major consideration for water contact sports like swimming or kayaking. High-water situations, when most kayakers and canoeists like to enjoy the river, are usually when there's more pollution.

Acid mine drainage. The second problem, not directly to a human health issues, is acid mine drainage from several underground sources as well as culm piles. Programs that are working to target AMD sources may be a potential source to also address CSOs. There are five acid mine drainage outfalls in the upper Lackawanna watershed. The Beaver Outfall is located along the western side of the D&H Rail-Trail. The outfall is a series of seeps into a pond and wetland area. The water passes under the rail-trail through a short culvert and meanders along the riverbank, before entering the river at mile 33.2. The Standpipe Outfall is also located along the west side of the D&H. A standing iron pipe of 16-inch diameter spills AMD water into a stone lined ditch, and drains under the rail-trail to the river at mile 33.4. The Grey Slope Outfall is located along the O&W Rail-Trail, to the east side of the river. It is the former location of the Grey slope mine and the outfall is a series of seepages into a pond. A stream leaves the pond to drain into the river at mile 33.5. The Vandling Outfall is located just under the eastern edge of the D&H, where drainage is directly out of a closed mine shaft (No.6 tunnel of the Hudson Coal Company's Clinton Colliery). The water then accumulates in a large beaver impoundment, before it drains to the river at mile 33.7. The Browndale Outfall is located along the O&W in a steep drainage depression. The outfall is a pipe that flows into several small ponds that drain to the river at mile 35.0.

The Lackawanna Watershed 2000 program (EPA funded) began monitoring the AMD outfalls in the entire Lackawanna River watershed in 1998. There are three large outfalls

and eleven lesser outfalls. The five in the upper watershed are considered 5 of the 11 lesser AMD outfalls. The program measures outfall flow and water quality. It was necessary to install crest stall gages on the two highest flow AMDs: the Standpipe and the Vandling. Monitoring was suspended during 2000,but has recently started up again (August 2001). Results are not available as of yet.



Location in northeast Pennsylvania

Versland Associates

PA Gas & Water Co.

LRBSA Clinton Township STP

Forest City Waste Water Treatment Plant

171
370
171
374
371
171
247
247
171

Acid Mine Drainage Site
Waste Water Treatment Plant
NPDES Discharge Point
RCRA Site
Sewershed

Watershed Boundary
County Boundary
Major Tributary
Upper Lackawannna River
Water Bodies
Abandoned Rail Lines

Major Roads
PA Traffic Routes
Other Roads

1 0 1 Miles

Potential Point Source Pollutants

Upper Lackawanna Watershed Conservation Management Plan

Information used to produce this map was obtained from Acker Associates and field/office investigation.

Trails Conservation Corporation with BLOSS Associates

BLOSS ASSOCIATES

January, 2002

Non-Point Sources

In contrast to point source pollution, non-point source pollution comes from diffuse, rather than discrete, sources, such as forestry, agriculture, mining, or residential lots. For example, a logging operation or a farm field may erode, causing sedimentation and perhaps nutrient loading, but the location of this pollution in a stream cannot be clearly pinpointed. Entry points are many and varied, shifting over time and space. Regulation and treatment cannot address the "end of a pipe" in these cases, as they can with point sources. Non-point source pollution is rapidly becoming the most significant and perplexing challenge facing water quality today.

Farmland is a significant non-point source pollutant in the Upper Lackawanna Watershed. Sedimentation can have severe impacts on fish communities, by smothering their food supply and their spawning beds and suffocating them directly due to high turbidity. Sediments often carry agricultural fertilizers as well, which can lead to eutrophication and eventual de-oxygenation of the stream.

Stormwater runoff is perhaps the single most important non-point source pollutant to address. Put simply, stormwater runoff increases as development throughout a watershed increases. While rainwater would normally percolate slowly through soils, cleansing it of any nutrients or chemicals it may carry, on impervious surfaces such as rooftops, driveways, parking lots, and roads, rainwater picks up velocity and may overload the carrying capacity of a stream, causing erosion and sedimentation. An impervious surface is one which prevents the percolation of water into the ground. According to the *Lackawanna River Watershed Act 167 Stormwater Management Plan*, stormwater runoff "increases flood flows and velocities, contributes to erosion and sedimentation, overtaxes the carrying capacity of streams and storm sewers, greatly increases the cost of public facilities to carry and control storm water, undermines floodplain management and flood control efforts in downstream communities, reduces groundwater recharge, and threatens public health and safety."

Because of the highly rural character of the Upper Lackawanna Watershed, many of the watershed's households, including summer cottages in the upper watershed, are not connected to public sewer systems. Septic systems can cause pollution problems if they are not maintained periodically.

Monitoring

In the spring and summer of 1999, a monitoring effort of the main river corridor and the east and west branches was undertaken with volunteers. For a full description of volunteer efforts, methods, and results, see *Chapter 7, **Stream Walk Assessment***.

Water Supply

Public / Private

The Pennsylvania Gas and Water Company (PG&W) owns and operates the water supply and distribution system in the greater Forest City area. Water is drawn from the Lackawanna River in two locations – at a PG&W dam located just below the Stillwater Dam and at a masonry dam located adjacent to the PG&W Forest City filtration plant within the borough of Forest City. The plant was built in the early 1950s and has a capacity of one million gallons per day.

Water drawn from the Lackawanna River is treated for flocculation and sedimentation and is chlorinated by the Forest City treatment plant. After treatment, water is pumped to a 750,000-gallon tank located at a high point in Richmondale. The tank, built in 1990, provides improved water pressure throughout the Forest City area.

Well Head Protection Areas

Because it is out of sight, groundwater is often out of mind. For many of us, we only take notice of well water if it looks, smells, or tastes funny. But groundwater can be contaminated well before any obvious signs appear. Yet it can be difficult to clearly track a groundwater pollutant to its source, especially considering the many layers of soil and rock that water seeps through to reach an aquifer. Cleaning up a contaminated well is very difficult and costly, and it may not return to potable for a relatively long time. Thus it is important to create a "safe zone" around a wellhead by protecting the surrounding land from any potentially harmful activities.

DEP's Wellhead Protection Program is predicated on the principle that it is cheaper to protect drinking water sources than to clean up after contamination occurs.

Chapter 4
Land Resources

The Upper Lackawanna watershed consists primarily of small communities, rural areas, farmland, forests, and abandoned coalfields. The Lackawanna River is the primary tributary of the Susquehanna River, which flows into the Chesapeake Bay. The East and West Branches and the main stem of the Lackawanna River total 62 miles in length and drain an area of 348 square miles. The east and west branches flow through predominately undeveloped, rural areas of small communities with scattered farms, and seasonal and year-round homes.

The immediate banks of the river are generally well vegetated with river birch, sycamore, red maple, white pine, hemlock, willow, alder, and elm. In urban areas, industrial, commercial, or residential development replaces trees within a short distance of the river. The forested hillsides above the river support Northern Red Oak, Hickory, Beech, Birch, Hemlock, and Maple.

Soil Characteristics, Types, and Limitations

Moderate to steep slopes and high groundwater conditions are the upper watershed's greatest limitation to development. The most extensive soils in the area are deep, gently sloping, or sloping and somewhat poorly or moderately well drained. The single most limiting factor to development is the existence of a barely permeable fragipan about fifteen to forty inches below the surface. The fragipan is loamy and brittle and composed of silt and sand. The slow permeability of the fragipan diminishes the soils' capacity to assimilate sewage and solid wastes. Approximately 91.7 percent of all the soils in Susquehanna County have severe limitations for on-site sewage disposal.

The Susquehanna Soil Survey, which includes portions of Wayne and Lackawanna Counties, has generalized the soil types into five broad categories called associations. All are considered to have drainage constraints and are considered to be channery, flaggy, and very stony.

The Volusia-Mardin Association comprises about 20 percent of Susquehanna County and is primarily characteristic of rounded hilltops, sloping sides, and concave lower slopes and swales. Many natural and artificial ponds and lakes are present along with a few continuously flowing steams and many seasonal streams. Elevations range from about 1,300 to 1,800 feet. The soil is poorly drained due to the firm fragipan in the subsoil. Thirty percent of the association is Volusia, and is found mainly in drainage ways on lower concave slopes. Twenty percent is the Mardin Association, found on the lower slopes and deeper to the fragipan. The remaining 50 percent consists of Bath, Morris, Wellsboro, and Lordstown soils suitable for wood lots, open space, ponds, and

recreational uses but unsuitable for farming due to its slow permeability and seasonal high water table.

The Morris-Wellsboro-Volusia Association comprises about 35 percent of Susquehanna County and is found in the same topographic locations as the Volusia-Mardin Association. A firm fragipan restricts water movement and penetration of roots. Wellsboro soils make up 20 percent of the association and are found up-slope from the Morris and Volusia Associations. The fragipan is deeper and the soil dries more quickly than other soils in the association. Forty-eight percent of the soils in this association are of the Bath and Lackawanna types, developed in glacial till on deep and moderately deep well-drained uplands. These soils are more conducive to farming. They are generally found in the southern portion of Susquehanna County where the soil warms and dries faster in the spring. Wood lots and ponds are common.

The Mardin-Volusia Oquaga Association comprises 35 percent of Susquehanna County and is found where deep stream-cut valleys dissect the original high plateau. Long slopes, excessive relief, and rapid runoff are common. Stream water often deposits gravel fans at the base of slopes. This association includes the sloping and very stony area around Elk Mountain, where a high proportion of moderately deep soils are found over hard bedrock. Mardin-Volusia and Oquaga are present in equal amounts. Mardin soils are found upslope from the Volusia soils and are moderately well drained due to a layer of friable soil over firm, slowly permeable fragipan. Volusia soils are somewhat poorly drained. Oquaaga soils are well drained to bedrock 20 to 40 inches below the surface. The remaining 55 percent of this association is primarily made up of Chenanngo and Barbour soil types. Very little farming is supported by these soils due to heavy shade from the high steep slopes. Restricted depth to bedrock and slow permeability limit most other uses. Only the Barbour soils are suitable for woodland, open space, and recreation.

Morris–Wellsboro Association soils are found on gently sloping plateaus with broad swamps, swales, and large lakes. Elevations range from 1,700 to 2,100 feet, but relief is minimal. Streams are few and shallow, and gradients are low. Thirty percent of the association is of the Morris type and 25 percent is of the Wellboro type. Soils of the Morris type can be found on broad gentle hilltops and ridge tops. The Wellsboro soils are found on hilltops, lower slopes, and ridge tops. They are similar to the Morris soils but deeper to the fragipan. Minor soils make up 45 percent of the remaining association and tend to be poorly drained to moderately deep and well drained. Very little farming takes place on these soils due to wet soil, cold temperatures, and a short growing season. Poor drainage, slow permeability, and a high water table limit use.

Soils of the ***Chenango-Barbour-Volusia Association*** are the least limiting soils in Susquehanna County. They are found on floodplains, fans, terraces, and low valley sides below 1,100 feet. About 3 percent of the county's soils are of this association. Much of this land is covered by roads and villages. Chenago soils make up about 30 percent of this association. These soils are deep, permeable, and well drained and are found on terraces and alluvial fans. Ten percent of the association is of the Barbour type, also found on floodplains and alluvial fans. These areas are subject to flooding. Another 10

percent of the association is composed of Volusia soils. These are generally found on lower slopes at the edges of valley bottoms. The remaining 50 percent of the association is composed of Basher and Unadilla soils on low terraces and floodplains. These soils are good for farming but limited for sewage disposal.

Land Ownership (Public, Private)

State and Federal Lands
State Gamelands #236 lies within the watershed to the west of the West Branch of the Lackawanna. It is divided into four parcels with a total acreage of 2,009. Federally owned land in the watershed includes the Stillwater Dam Recreation Area.

County and Municipal Lands
A description of county and municipal recreation areas in the watershed can be found in *Chapter 6, Cultural Resources*.

Other Protected and Quasi-Protected Lands
Numerous private hunting clubs lease or own land in the watershed. Some larger clubs include:

- Tri-County Sportsmen – east of O&W RR, Moosic Mountain adjacent to Panther's Bluff Conservation area;
- Browndale Hunting Club, and
- Richmondale Hunting Club.

In addition, the Rail-Trail Council of Northeast Pennsylvania owns approximately 15 miles of abandoned rail corridor in the watershed, including approximately 13 miles of D&H abandoned rail corridor and a portion of the O&W abandoned rail corridor, from Forest City to the Lackawanna headwaters.

Critical Land Areas

Natural Areas Inventory Sites
A natural areas inventory was conducted in Lackawanna County in 1995, while Wayne County was surveyed in 1991. The Natural Areas Inventory report contains information on the locations of rare, threatened, and endangered species and natural areas deemed to be of the highest quality. Other natural areas and scenic or historic sites have been identified throughout the watershed by biologists, archeologists, property owners, and conservation, civic, and educational organizations. Natural Areas Inventory Sites are shown on the *Map of Critical Land Areas*.

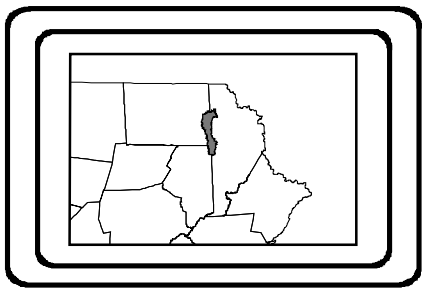
Several areas in the Upper Lackawanna watershed have been identified as critical natural areas. Orson Glade (Mud Pond), at the headwaters of the Lackawanna River, is an exemplary glacial lake community and provides the only known habitat in Pennsylvania for Pennslyvania-Endangered (PE) plant SP511. This plant is under consideration for

federal endangered-species status. The Nature Conservancy considers Orson Glade (Mud Pond) to be one of the most important sites for protection in the state.

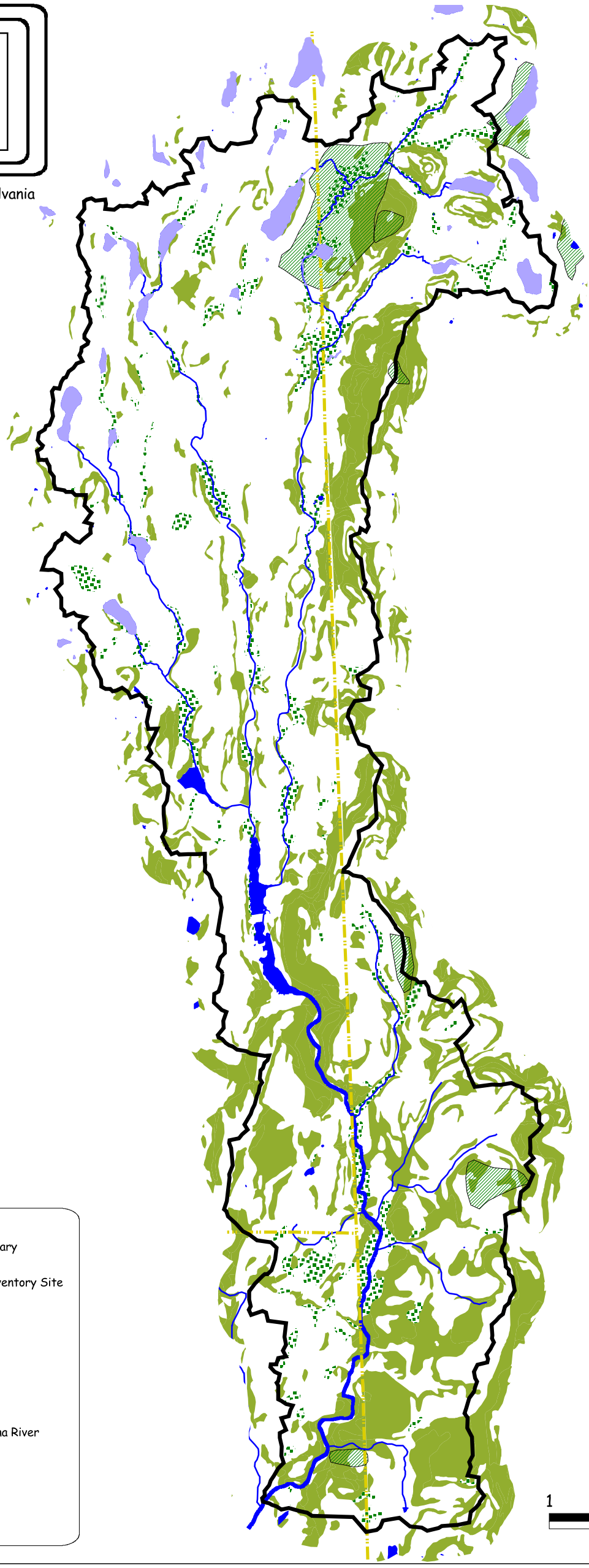
Spruce and Poyntelle Lakes both support populations of aquatic plants that are either Pennsylvania-Rare (PR) or under consideration for PR status. Spruce Lake has a large number of summer cottages on its west shore and a small number on its east shore. Further development and pollution from faulty septic systems are threats to this lake.

Salem Hill Barren, which lies partially in the Upper Lackawanna watershed, is a ridgetop dwarf-tree forest community (NC511) characterized by shrub oak (bear oak) only a few feet tall and large expanses of low-bush blueberries, huckleberries, and black chokeberries. This is a large example of this type of community, but has suffered due to trash, an old quarry, a radio transmitter, and off-road vehicle use. There are no known species of special concern here, but this type of community often supports rare moths and butterflies.

The Moosic Mountains form the largest unbroken tract of land in Wayne County. The Nature Conservancy believes the protection of this ridge should be an important goal of the county and state.



Location in northeast Pennsylvania



- Watershed Boundary
- Natural Areas Inventory Site
- Hydric Soils
- Steep Slope Soils
- Headwaters Lake
- Upper Lackawannna River
- Major Tributary
- Water Bodies

1 0 1 Miles

Critical Land Areas

Upper Lackawanna Watershed Conservation Management Plan

Information used to produce this map was obtained from PASDA.

Trails Conservation Corporation with BLOSS Associates

BLOSS ASSOCIATES

January, 2002

Landfills

There are no municipal landfills in the Upper Lackawanna watershed; however, some private dumping of trash has been observed.

Freddie's Refuse is a closed landfill just to the southeast of Dunn's Pond, owned by Freddy Milos. This landfill is an old, privately owned dump, not currently operating, located right along the banks of the West Branch. A local environmental group, RESCUE (Return the Environment of Susquehanna Country Under Ecology), was successful in defeating an attempt to locate a large landfill on the Milos property nearby in 1992. RESCUE was also influential in fighting the possible siting of a low-level radioactive waste facility in the Wayne-Susquehanna County area.

Hazard Areas

Abandoned Mines and Quarries

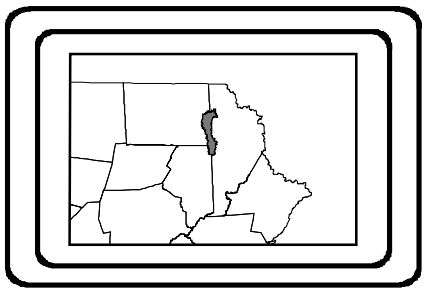
The legacy of mining has left many environmental scars in the Lackawanna River Valley. Vast acreages of the valley are affected by strip mine overburden piles, pits, and unvegetated coal waste banks also known as culm dumps. Over a dozen major acid mine drainage outfalls discharge between 1 and 150 million gallons per day into the river and tributary streams. In 1966, the Continental Mine at the base of West Mountain was closed, ending all underground mining in the Lackawanna Valley. This mine is now open as the Lackawanna Coal Mine Tour at McDade Park, operated by Lackawanna County. Marginal coal strip mining and culm bank reclamation projects have occurred from time to time since the 1960's. Numerous Bureau of Abandoned Mine Reclamation projects have been completed based in part on the Scar-Lift program of 1970.

Acid Mine Drainage Outfalls

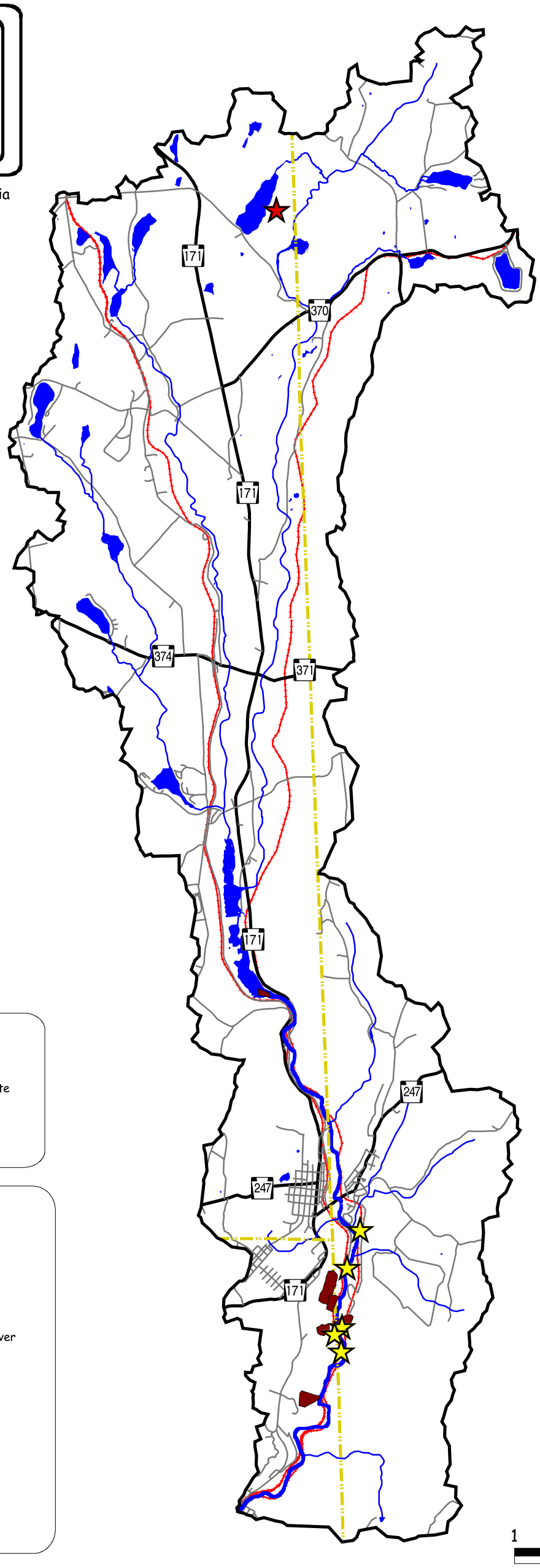
There are five acid mine drainage outfalls in the upper Lackawanna watershed.

- The Beaver Outfall, a series of seeps into a pond and wetland area;
- The Standpipe Outfall, a standing iron pipe of 16-inch diameter spills AMD water into a stone lined ditch;
- The Grey Slope Outfall, the former location of the Grey Slope Mine. The outfall is a series of seepages into a pond. A stream leaves the pond to drain into the river;
- The Vandling Outfall, where drainage is directly out of a closed mine shaft (No.6 tunnel of the Hudson Coal Company's Clinton Colliery). The water then accumulates in a large beaver impoundment, before it drains to the river;
- The Browndale Outfall, a pipe that flows into several small ponds that drain to the river.

Closed landfills, acid mine drainage outfalls, and culm banks are shown on the *Map of Hazard Areas*.



Location in northeast Pennsylvania



Closed Landfill

Acid Mine Drainage Site

Culm Banks

Watershed Boundary

County Boundary

Major Tributary

Upper Lackawannna River

Water Bodies

Abandoned Rail Lines

Major Roads

PA Traffic Routes

Other Roads

1 0 1 Miles

Hazard Areas

Upper Lackawanna Watershed Conservation Management Plan

Information used to produce this map was obtained from Acker Associates and field/office investigation.

Trails Conservation Corporation with BLOSS Associates

BLOSS ASSOCIATES

January, 2002

Chapter 5
Biological Resources

Wildlife

Terrestrial Wildlife Resources. The landscape of the Upper Lackawanna watershed, with its forests and numerous streams, ponds, and bogs, provides valuable habitat for wildlife. Habitat is best in the undeveloped upper reaches of the watershed. About 60 species of mammals are known to inhabit the watershed. The most well known are game animals, including black bear and white tailed deer. Squirrel, raccoon, woodchuck, skunk, and opossum are found in the more developed areas of the watershed. Common furbearers include mink, muskrat, and beaver, all of which are associated with and depend upon clean water.

Above Carbondale, the Lackawanna River provides suitable habitat for the river otter. Otters are rare in Pennsylvania and require plentiful fish and clean water for survival. Since 1980, there have been sightings of both river otter and osprey along the Lackawanna River. The otter is recognized as rare or uncommon and the osprey is considered endangered within the Commonwealth.

Reptiles and amphibians are common throughout the watershed. Forty-five types of amphibians and reptiles have been documented by DER in the Scranton-Peckville area of the lower watershed.

Birds. Over 170 species of bird species use the basin, either residing permanently or passing through in migrations along the Atlantic Flyway. In addition to the Canadian goose, a variety of ducks, from mallards to mergansers, visit the river during seasonal migrations. Many ducks are permanent residents. Great Blue Herons live on the river and the osprey is returning after being reintroduced in the upper Susquehanna basin. Cooper's hawks, redtail hawks, the great horned owl, and the American bald eagle are found on occasion. In an inventory of Lackawanna State Park, 108 bird species were documented. DER records and range data list 349 bird species that could occur in the Scranton area based on range maps.

A list of the breeding birds of the watershed was extracted from the *Atlas of Breeding Birds in Pennsylvania* and discussed with Atlas contributor Mark Blauer. The Atlas, published in 1992, was the outcome of a project conducted across the state from 1983 to 1989. Researchers and volunteers from local bird clubs surveyed the state for 'breeding' birds. The state was divided into 43 regions, mostly counties or groups of counties. Each region was surveyed using USGS quadrant maps, with each quadrant divided into six blocks. Each block was surveyed for breeding bird activity throughout the seasons over a period of seven years. More than 18 criteria were used to determine breeding activity and then categorized into "possible," "probable," or "confirmed." Each species is described

in the atlas with a map indicating the quadrant block(s) where breeding activity occurred and was documented.

From the Atlas and maps for each species, it was determined that there are 125 species of breeding birds in the Upper Lackawanna watershed. This count includes 32 possible, 28 probable, and 65 confirmed species. These species include:

1. Great Blue Heron
2. Green-Backed Heron
3. Black-Crowned Heron** (Lower)
4. Mute Swan
5. Canada Goose
6. Wood Duck
7. American Black Duck
8. Mallard
9. Hooded Merganser**
10. Common Merganser
11. Black Vulture (Lower)**
12. Turkey Vulture
13. Northern Harrier**
14. Sharp-Shinned Hawk
15. Cooper's Hawk
16. Northern Goshawk**
17. Broad-Winged Hawk
18. Red-Tailed Hawk
19. American Kestral
20. Ruffed Grouse
21. Wild Turkey
22. Northern Bobwhite
23. Virginia Rail
24. Sora
25. Killdeer
26. Spotted Sandpiper
27. American Woodcock
28. Rock Dove
29. Mourning Dove
30. Black-Billed Cuckoo
31. Yellow-Billed Cuckoo
32. Barn Owl**
33. Eastern Screech Owl
34. Great Horned Owl
35. Barred Owl
36. Northern Saw-Whet Owl**(Lower)
37. Common Nighthawk
38. Whip-Poor-Will
39. Chimney Swift
40. Ruby-Throated Hummingbird
41. Belted Kingfisher
42. Yellow-Bellied Sapsucker
43. Downey Woodpecker
44. Hairy Woodpecker
45. Northern Flicker
46. Pileated Woodpecker
47. Eastern Wood-Pewee
48. Acadian Flycatcher
49. Alder Flycatcher**
50. Willow Flycatcher
51. Least Flycatcher
52. Eastern Phoebe
53. Great Crested Flycatcher
54. Eastern Kingbird
55. Purple Martin
56. Tree Swallow
57. Northern Rough-Winged Swallow
58. Bank Swallow
59. Cliff Swallow
60. Barn Swallow
61. Blue Jay
62. American Crow
63. Black-Capped Chickadee
64. Tufted Titmouse
65. Red-Breasted Nuthatch**
66. White-Breasted Nuthatch
67. Brown Creeper
68. House Wren
69. Marsh Wren**
70. Eastern Bluebird
71. Veery
72. Hermit Thrush
73. Wood Thrush
74. American Robin
75. Gray Catbird
76. Northern Mockingbird
77. Brown Thrasher
78. Cedar Waxwing

79. European Starling
80. Solitary Vireo
81. Yellow-Throated Vireo
82. Warbling Vireo
83. Red-Eyed Vireo
84. Blue-Winged Warbler
85. Yellow Warbler
86. Chestnut-Sided Warbler
87. Magnolia Warbler
88. Black-Throated Warbler
89. Yellow-Rumped Warbler
90. Black Throated Green Warbler
91. Pine Warbler
92. Prairie Warbler
93. Black-and-White Warbler
94. American Redstart
95. Worm-Eating Warbler
96. Ovenbird
97. Northern Waterthrush
98. Louisiana Waterthrush
99. Mourning Warbler
100. Common Yellowthroat
101. Canada Warbler
102. Scarlet Tanager
103. Northern Cardinal
104. Rose-Breasted Grosbeak
105. Indigo Bunting
106. Rufous-Sided Towhee
107. Chipping Sparrow
108. Field Sparrow
109. Savannah Sparrow
110. Grasshopper Sparrow**
111. Henslow's Sparrow**
112. Song Sparrow
113. Swamp Sparrow
114. White-Throated Sparrow
115. Dark-Eyed Junco
116. Bobolink
117. Red-Winged Blackbird
118. Eastern Meadowlark
119. Common Grackle
120. Brown-Headed Cowbird
121. Northern Oriole
122. Purple Finch
123. House Finch
124. American Goldfinch
125. House Sparrow

**Species significant either as uncommon breeders in PA or outside typical range.

Aquatic Wildlife Resources. Aquatic habitat in the Upper Lackawanna Watershed is quite diverse. Habitat types range from pristine cold-water fisheries of the upper tributaries and main stem of the East and West Branches of the Lackawanna River to the lower part of the watershed, which for many decades was not recognized as a fishing stream due to degradation from mining and railroad activities. However, improvements in water quality in recent years have enabled the fishery to begin reestablishing itself.

Above Stillwater Dam, the West Branch supports trout, including both stocked fish and a small population of naturally producing brown and brook trout, while the East Branch is not stocked at all due to its thriving population of wild brown and brook trout. Numerous gravel-bottomed riffles aerate the water, increasing the oxygen content and providing homes for aquatic insects on which fish feed. Deeper pools, formed by rock outcrops, boulders, and bends in the river, serve as cover and resting areas for fish. The banks are generally lined with trees, which shade the river and maintain cooler water temperatures. Numerous cool tributary streams originating in nearby mountains feed the river and provide spawning areas.

Water temperatures in the upper reaches of the river are cool enough to support a cool water fishery. Important game fish include brown trout, brook trout, rainbow trout,

smallmouth bass, yellow perch, white sucker and brown bullhead. In all, 26 species of fish have been identified in the upper watershed upstream from Simpson through sampling undertaken in 1979-2000 by the Northeast Pennsylvania Urban Forestry Program. These include:

Banded killifish
Tessellated darter
Bluespotted sunfish
Common carp
Smallmouth bass
Rainbow trout
Cutlips minnow
Longnose dace
Rock bass
Bluegill
Yellow perch
Brown bullhead
Golden shiner
White sucker
Brown trout
Common shiner
Margined madtom
Slimy sculpin
Pumpkinseed
Black crappie
Chain pickerel
Largemouth bass
Yellow bullhead
Brook trout
Blacknose dace
Creek chub

Trout fishing is vital to the regional recreational appeal although most trout communities in the watershed are not native or naturally reproducing. A number of pristine headwaters streams are not stocked, however. These are classified as Class A Wild Trout Streams, which represent the best naturally producing fisheries. The Pennsylvania Fish and Boat Commission presently stocks the reach of the Lackawanna River from the old Stillwater Reservoir dam downstream to the Carbondale City line.

In addition to fish, aquatic macroinvertebrates make up an important part of the aquatic ecosystem in the watershed. Macroinvertebrates are tiny animals that lack a backbone. They are considered benthic when they live on the streambed or are attached to plants or floating wood. Indeed, without healthy populations of macroinvertebrates, fish communities would suffer for lack of food and overall aquatic biological communities would be diminished. Many different macroinvertebrate taxa live in the watershed, including larva of mayflies, caddisflies, stonefllies, dobsonflies, damselflies, horseflies, horseflies, black flies, and mosquito, as well as water beetles, crayfish, and worms.

The Lackawanna River was once famous for its native brook trout, but the iron, coal, rail, and textile industries, as well as towns that sprang up along the river, destroyed most of the fish by 1900. In recent years, the river has rebounded significantly. The prevalent trout species today is the brown trout. This European import is more resistant to pollution than the native brook trout. The river, from Stillwater Dam to Carbondale, is one of 100 streams in the Commonwealth of Pennsylvania to receive a Class B trout fishery designation. A river with this classification supports 18 to 36 pounds of fish per surface area of stream. The Lackawanna River also supports warm water fish, such as bullhead, bass, perch, and blue gill. Non-game fish, such as darters, dace, chub, minnow, sucker, and carp also exist.

Vegetation

Forest Resource History. In the mid-1800's, the upper watershed was extensively clear-cut to provide the timber needed for tree props in the mines of the lower anthracite fields, mine carts, and later, for railroad ties used in the construction of the gravity railroad. By the beginning of the 20th century, all of the virgin forest was completely cleared. Since that time, much of the forest has regenerated, and now consists of second- and third-growth stands. However, continued unchecked timbering and poor management practices have contributed to extensive degradation of many privately owned forested land tracts. Today, approximately 40 percent of the watershed is forested. Most of the forest has regenerated with much diversity, although logging activities and poor management practices have had a great impact on species composition.

Forest Type. The watershed is dominated by northern hardwood forest. This deciduous forest community dominates the northern third of Pennsylvania, extending south along the Allegheny Front. The northern hardwood forest is among the most picturesque of the eastern deciduous forests and is known for its marvelous diversity. It has many species in common with the boreal forest to the north and the oak-hickory forest to the south, and is often called the "transition forest." The northern hardwood forest is dominated by three deciduous trees: yellow birch, sugar maple, and American beech. Other indicator species include the eastern hemlock, white pine, northern red oak, gray birch, paper birch, pin cherry, poplar, American mountain ash, mountain maple, and red spruce.

Generally, south-facing slopes are dominated by a mix of northern red oak, white oak, and hickory. Riverine forest tracts are typical of the river type associations of ash, cherry, silver maple, red maple, sycamore, hemlock, white pine, and rhododendron.

The typical forest interior has a well-developed understory of striped maple and viburnum, with many wildflower and fern species. Two conifers, the eastern hemlock and white pine, often grow interspersed between the broad-leafed species. Eastern hemlock is found in cool, moist areas such as ravines and north facing mountainsides. White pine can be found growing on exposed and disturbed sites.

Forest Health Concerns. Within the watershed, there are a number of serious threats to the forest. Most of the American beech in Susquehanna County are infected with Nectria Canker. The canker, first reported in Pennsylvania in 1967, is a cause of mortality in the American beech and appears to hit in 10-year cycles. The DCNR Bureau of Forestry reports that recently some American Beech have shown resistance to the disease. It is hoped that the epidemic will balance naturally in years to come. Another strain of Nectria, which affects yellow and black birch and is causing a high mortality rate in these species, is also present in the upper watershed. Presently, no financially feasible control method is known for either of the Nectria fungi, and it is expected that the Upper Lackawanna Watershed will lose many American beech, yellow birch, and black birch in the next decade.

Woolly Adelgid, a small sucking insect that is causing decline in Canadian Hemlock to the south and east, has not yet been found in the upper watershed. The adelgid has been reported to be moving in a northwesterly direction from New York and New Jersey. This small, wooly white adelgid is found on the backsides of the hemlock needles. Its feeding causes yellowing and needle loss, resulting in death.

The Gypsy Moth has not been a problem for the native oaks since a severe defoliation which occurred in 1990 and 1991. The sycamore within the Upper Watershed have been impacted by the 2000 rainy season and are currently suffering from a severe infestation of Anthractnose. Although highly visible due to severe defoliation, this disease is primarily aesthetic and poses no threat to the native sycamore population.

The greatest threat to the Upper Watershed is the present value of high quality black cherry floor lumber. Pennsylvania black cherry is now selling as high as $7 per board foot. The high grading has led to solicitation of private landowners and increased logging throughout the watershed. Much of this logging is done without proper timber management and much of the cherry-based forest will not regenerate into productive forest if these current practices continue to go unchecked.

Invasive Species. Exotic plants are a serious threat to the watershed. These species grow aggressively, spread, and displace native plants that have more value as forage and habitat for indigenous animal species. In addition, invasive species can disturb or alter natural communities within an ecosystem, often upsetting the natural balances required to keep these systems functioning properly. Endangered, rare, and threatened native species are especially at risk because they occur in small populations, which makes them particularly vulnerable.

Invasive plants are generally undesirable because they are difficult to control. Most invasive plants arrived from other continents and as such are often referred to as “exotic,” “alien,” introduced,” or “non-native.” Invasive plants are noted for their ability to grow and spread aggressively. They can be trees, shrubs, vines, grasses, or flowers. Invasive plants have the ability to reproduce rapidly by roots, seeds, shoots, or by a combination of all three. They also have the ability to adapt to a diverse range of growing conditions and once established, exploit or colonize these areas. Second to habitat loss from development, invasive plants are the next major factor contributing to the decline of native plants.

Recognition of invasive plants, understanding the potential damage they can cause, managed control, and most importantly, avoiding the use of them in plantings, is essential to stopping their spread and protecting native vegetation.

The greatest invasive species threat to the upper watershed is Japanese Knotweed, or Mexican Bamboo, *Polygonum cuspidatum*. This cultivated plant was introduced into North America around 1825 from eastern Asia as a garden plant. The plant is undergoing range expansion and has been found throughout Pennsylvania. Japanese Knotweed is an aggressive spreader that forms dense stands of erect stems, is difficult to control, and has

an incredible capacity for growth. Japanese Knotweed is common along roads, utility right-of-ways, abandoned railroads, and waterways.

Within the upper Lackawanna River Watershed, this invasive species is prevalent. Its ability to adapt to extreme cultural conditions has allowed it to colonize rail corridors, disturbed woodlands, and the river corridor. It quickly forms dense stands that out-compete native vegetation and then provides no habitat or forage for animal populations. It also out-competes native vegetation capable of stabilizing the riverbanks and in the event of a flood, up-roots, allowing erosion and bank cutting to occur. The large, uprooted tuberous rhizomes easily break apart into many pieces, all having the ability to quickly re-generate new plants that continue to recolonize downstream and deeper into the floodplain.

The following species have been documented by DCNR Bureau of Forestry as serious threats in Northeastern Pennsylvania and are present in the upper Lackawanna Watershed:

Amur Honeysuckle	*Lonicera maackii*	Shrub - seeds spread by birds
Autumn Olive	*Elaeagnus umbellata*	Shrub - seeds spread by birds
Bull Thistle	*Cirsium vulgare*	Noxious Weed – seed in open fields
Canada Thistle	*Cirsium arvense*	Noxious Weed – seed in open fields
Garlic Mustard	*Alliaria petiolata*	Noxious Weed – seed in woodland understory
Jap. Honeysuckle	*Lonicera japonica*	Vine – seed spread by birds
Multiflora Rose	*Rosa multiflora*	Shrub – seed spread by birds
Norway Maple	*Acer platanoides*	Tree – straight species spread by seed
Oriental Bittersweet	*Celastrus orbiculatus*	Vine – spread by seed
Purple Loosestrife	*Lythrum salicaria*	Wetland Flower - root or seed in waterways
Reed Grass	*Phragmites australis*	Wetland grass - forms huge colonies
Tatarian honeysuckle	*Lonicera tatarica*	Vine- seed spread by birds
Tree of Heaven	*Alianthus altissima*	Tree – spread by seed

In addition, there are other invasive species known to invade native communities that are deserving of vigilance and have been documented as occurring in the upper Lackawanna Watershed. They include Goutweed (*Aegopodium podagraria*), Reed Canary Grass (*Phalaris arundinaacea*), Japanese Barberry (*Berberis thunbergii*), Common Privet (*Ligustrum vulgare*), and Glossy Buckthorn (*Rhamnus frangula*).

Due to the increased value of lumber in recent years, loggers and private landholders have prospered. Unfortunately, improper management of timber stands and clear cutting has resulted in the invasion of the common Hayscented Fern (*Dennstaedtia punctilobus*) into many privately owned woodlands in Susquehanna County.

Hayscented Fern is a naturally occurring deciduous fern that ranges from Nova Scotia to Minnesota and south to Georgia. It is adaptable to many conditions, indifferent to soil conditions, and able to colonize large areas rapidly. This fern is considered undesirable because it has a naturally occurring herbicide that prevents the germination of seedlings within woodlands. Once colonized, little or no regeneration of woodland understory can

occur. As a result, many woodland tracts within the watershed currently exist in a "successional standstill."

In addition, it should be noted that the Bracken Fern (*Pteridium aquilinum*) and Sensitive Fern (*Onoclea sensibilis*) are considered invasive species in many areas. In the upper watershed, the Bracken Fern has colonized many areas degraded by past mining activities and along the railroad corridor where very poor, acidic soils exist. The Sensitive Fern is often found in degraded wetlands and in riverine floodplains.

Variety of Vegetation. The Upper Lackawanna watershed is home to a wide variety of trees, shrubs, and herbaceous plants. In the early nineteenth century, hemlock, oak, and pine formed the majority of the forest canopy. American chestnut and elm, both canopy species, were also plentiful. The understory was thick with rhododendron and laurel. Most of this was cut for fuel, mining, railroad, and construction uses.

Since the early 20th century, a diverse secondary forest has developed. A vegetative inventory conducted by the Rail-Trail Council listed 19 species of deciduous canopy trees, 3 species of evergreen trees, 9 species of successional trees, 14 species of understory trees, 20 types of shrubs, 3 types of vines, 140 species of herbaceous plants, 10 ferns, 19 grasses, and 15 species of aquatic plants for the upper watershed. For a complete listing of these species, refer to *Appendix C, Vegetative Inventory*.

Today, a riparian forest shades the river and keeps the water cool during the summer. River birch, red maple, willow, elm, alder, and sycamore are found in areas where mining and urban development impacts have lessened. Many of the native understory species are struggling against Asiatic knotweed, a bamboo-like species which is endemic throughout the Appalachian Mountains.

The upland areas of the watershed have a variety of plant communities influenced by altitude, soil depth, and moisture.

Wetland regions are home to the heath family – sheep laurel, mountain laurel, high bush blueberry, cattails, and water lily. Hemlock, black spruce, tamarack, swamp oak, and black gum form the canopy layer in the wetlands and upper tributary stream corridors.

The ridge tops and Pocono plateau are home to a globally unique dry site plant community: the scrub oak / pitch pine dwarf tree forest.

The ridgetops of the Moosic Range also host an Arctic sedge community. These Arctic plants, including reindeer lichens, are vestiges of the last ice age. The Moosic Range is the southernmost habitat of these plants commonly found in the Adirondacks and northern Quebec.

In addition to the rare scrub tree and heath communities along the ridge tops, the watershed hosts plants which are listed as rare by the Pennsylvania Natural Diversity

Inventory (PNDI). Many of these are wetland or aquatic species. See below for the PNDI list.

PNDI Species

The Pennsylvania Natural Diversity Inventory (PNDI) was established in 1982 as a site-specific information system that tracks species of special concern as well as unusual or unique habitats. PNDI is a cooperative effort of the PA Department of Conservation and Natural Resources (DCNR), the Pennsylvania Science Office of The Nature Conservancy, and the Western Pennsylvania Conservancy.

Since its development, the PNDI database has become Pennsylvania's chief storehouse of information on outstanding natural habitat types (natural communities). Its focus is on species rarity and areas of highest natural integrity in order to protect the full range of biological diversity in Pennsylvania.

Species of Special Concern. Three plant species on Pennsylvania's list of special concern have been identified at Panthers Bluff. These include Short Hair Sedge (Carex criniita var. crinita), Backward Sedge (Carex retrorsa), and Carey's Smartweed (Polygonum careyi). All occur in an exceptionally intact and species-rich Leatherleaf-Sedge Wetland.

The Pennsylvania Natural Diversity Inventory has identified nine plant species of special concern that exist within the Lackawanna River watershed. These are: small floating manna-grass (Glyceria borealis), sweet bayberry (Myrica gale), many-fruited sedge (Carex lasiocarpa), floating heart (Nymphoides cordata), bayonet rush (Juncus militaris), Jacob's ladder (Polemonium vanbruniae), golden club (Orontium aquaticum), water lobelia (Lobelia dortmanna), and purple bladderwort (Utricularia, purpurea).

Important Habitats

Two important natural habitats have been documented within the upper watershed at Panther Bluff. One is the Leatherleaf-Sedge Wetland, which has exceptionally high species diversity and from which three species of special concern have been collected. Additional rare plant species could be found in this community as well.

The other important natural habitat is the Rhodora Barren, a rare variant of the globally rare community type known as the Mesic Scrub Oak-Pitch Pine Heath Barrens or simply the Mesic Till Barrens, since pitch pine and scrub oak are absent.

This community type is restricted, as far as is known, to the southern Pocono Plateau, with perhaps a small occurrence in the Shawangunk Mountains in New York and now at Panther Bluff in the Upper Lackawanna watershed. The Mesic Barrens occupy an estimated 25 acres, lying between 1,740 and 1,800 feet in elevation. Approximately four acres are Rhodora Barrens surrounded by about 20 acres of low heath shrubland

including a small highbush blueberry-leatherleaf-sphagnum wetland. These shrublands are surrounded by several hundred acres of red oak-mixed hardwood forest and northern hardwood forest.

Mud Pond has also been identified as important habitat. Several PNDI species of concern are present in this area. Mud Pond has also been identified as potential bird habitat by members of the Audubon Society.

The Florence Shelly Nature Preserve and State Game Lands 236, 70, and 35 also provide important wildlife habitat in the adjacent northern upper watershed.

Important Bird Areas. The following areas in the Upper Lackawanna watershed have been identified as potential bird habitat by members of the Audubon Society:

- Panther Bluff Conservation Area, including ridge tops of the Moosic Mountains;
- Stillwater Dam area, especially old Stillwater Lake and Dam;
- Herrick Township Swamp (West Branch);
- Lake Romobe area (West Branch);
- Wetland at confluence of two East Branch tributaries; and
- Mud Pond area.

Although these areas have been identified as potential bird habitat, bird counts and more long-term investigation are necessary. A more detailed study plan should be developed to identify Important Bird Areas (IBAs) in the watershed.

Chapter 6
Cultural Resources

Recreation

Parks in the watershed can range from small urban squares to extensive tracts of state gamelands and nature preserves. They can also be athletic complexes and settings for the arts. In addition to providing a place for recreation, parks provide corridors for wildlife. They can help to tell the story of our heritage. They can help us live longer and build strong family bonds. They build community pride and increase our property values. They attract business and industry and contribute to a healthy economy.

State Parks, Game Lands, and Forests

- There are about 2,009 acres of state-owned land in the watershed, including State Gamelands #236.

- Federally owned land in the watershed includes the Stillwater Lake and dam area.

Other Recreation Areas

The following parks are in the upper watershed; some are associated with schools, fire departments or private hunting clubs.

- **Kennedy Park** – Kennedy Park is a well-kept 15-acre park including a lake with a sandy beach for swimming, two baseball fields, a volleyball court, basketball and tennis courts. This park also offers an indoor and outdoor pavilion, changing area, play equipment, and picnic areas.

- **Forest City Regional Schools** – The complex has a baseball field, soccer/softball field and a recently improved play area at the elementary center.

- **Babe Ruth Park** – Also recently improved, a playground geared for younger children. This park connects to the D&H Rail-Trail along a wooded path. Summer Youth Service Corps workers (SYSC) have cleared paths, planted shrubs and perennials, and have enhanced the park's appearance and visibility from the rail-trail.

- **Forest City Wading Pool** – Just off the Main Street is a pool manned with a lifeguard geared for small children.

- **Vandling Recreation Complex** – Little League baseball field, volleyball court.

- **Vandling Playground** – Traditional play equipment, soccer field

- **Richmondale Playground** – Traditional play equipment

- **Browndale Recreational Complex** – Teen League / Adult softball field, also doubles as two soccer playing areas; includes fire department picnic grounds

- **Forest City Fire Department Picnic Grounds**

- **Vandling Hose Picnic Grounds**

- **Browndale Sportsmen Club Picnic Grounds**

- **Jefferson Street Park, Simpson, Fell Township –** Located to the west of the D&H Rail-Trail, it has a baseball field, basketball court, tennis court and outdated play equipment. The park is in a state of disrepair and has potential as a linkage to the D&H Rail-Trail by means of a hiking trail.

- **American Legion Picnic Grounds, Simpson –** Located to the east of the O&W Rail-Trail and adjacent to the Fell Township Elementary School, it provides space for fund-raising events for the community, as the annual 'Fellstock' concert.

- **Fell Township Elementary School –** has a small play area with outdated equipment. The school has been scheduled to close by 2002, with students moving to the Carbondale Elementary School, now undergoing an addition. A community group is attempting to form a charter school in the building.

- **Union Dale Park –**along Church St, it is kept by the Borough as open space and has an old baseball backstop. It can provide a public access point to the east branch of the Lackawanna River.

- **Union Dale Fire Department Picnic Grounds**

- **Herrick Center Park –** along Route 374, just below the crossing of the D&H Rail-Trail. The township plans to apply for funding through Pa DCNR to improve the baseball field. They have also recommended to Pa DOT at the '12 year plan' hearings, to add a bike lane or shoulder improvements to Rte 374, to enable safe travel from the Rail-Trail to the field.

- **Merli-Sarnowski County Park** (nearby) **–** lower watershed

Greenways, Trails, and Public Access

The green infrastructure that serves to connect biological resources and human communities must be developed from a regional perspective. Corridor preservation is key to avoiding a fragmented geography that adversely affects the watershed's wildlife and fisheries. It is also important to preserve transportation and recreational opportunities that can promote alternative forms of transportation and provide health benefits close to home.

The D&H and O&W Rail-Trails

Current Status. These parallel rail-trails are in development by the Rail-Trail Council of Northeastern Pennsylvania. The RTC purchased the 32-mile D&H rail bed from Simpson to Stevens Point with federal transportation enhancement funds (80 percent reimbursement) in 1995. A Master Plan has been completed of engineering and design; construction documents are in the final stages of completion and review. Plans are to begin major construction along the southern end of the D&H with trail stabilization, drainage improvements, culvert repair and trail resurfacing as early as spring of 2000. Trails Conservation Corporation recently (September 1999) purchased 6 miles of D&H right-of-way from Stevens Point to the New York State border (below Windsor, NY). Also acquired was a one-mile spur of the Erie railbed which connected the D&H to the Erie Lackawanna at Lanesboro. This spur ends at the existing rail operated by Norfolk-Southern, which runs in an east-west direction and crosses the historic Starrucca Viaduct. The O&W, also beginning in Simpson, is owned by Linde Enterprises to the southern end of Stillwater. The Rail-Trail Council has an easement to use this eight-mile segment as a recreational trail. A short trail connects the O&W and the D&H at this point and provides the opportunity for loop trips of 16 miles, utilizing both rail-trails. North of this point, the O&W continues in a north-easterly direction around the east side of Stillwater Dam and Route 171. The O&W from Stillwater northeast to Poyntelle, approximately 12 miles, is privately owned, but in local use. From Poyntelle to the Delaware River across from Hancock, New York, is owned by the townships of Preston and Buckingham. This segment of about 12 miles is maintained as a township road for about 5 or 6 miles.

Current Usage. The D&H and O&W Rail-Trails receive mostly local usage; however, publicity and a fund-raising campaign are bringing more out-of-area visitors to the trails. A trail guide is available.

Relationship to Watershed. About 18.5 miles of the D&H Rail-Trail is within the Upper Lackawanna River Watershed, generally following the river and its West Branch to its lake sources. Ararat Summit, elevation 2,040, divides the flow into the Lackawanna and the Tunkhannock Creek Watershed. The O&W, generally following the main river and the East Branch, continues about 20 miles within the Upper Watershed to the summit at Poyntelle. North and east of this area, waters flow to the Delaware River. Just 0.5 miles northeast of Lake Lorain is Lake Poyntelle, which drains to the Delaware.

The Delaware & Hudson and the Ontario & Western Rail-Trails generally parallel the river corridor, with the D&H to the west and the O&W to the east. The D&H crosses the Lackawanna River six times between Simpson and the southern end of Stillwater Dam.

Fishing

Lakes. Stillwater Dam allows fishing from the shore. The Pennsylvania Fish & Boat Commission has completed a public access area with parking improvements and a boat ramp. A handicap accessible dock is proposed. Stillwater Lake, or the area of the old dam, is fished occasionally; however, the low water level and marshy shores make shore fishing difficult. Dunn Pond was formerly owned by PGE. It was purchased by Theta Corporation and is no longer accessible to the public. Kennedy Pond allows public fishing, and is used for a children's fishing derby.

Lake Erie, although in private ownership, receives local use. All other lakes in the upper watershed are private.

River. The Lackawanna River remains one of the best public fishing opportunities, as it is stocked with trout by the Fish Commission. It typically receives two stockings from April to May of approximately 9,400 trout (rainbow, brook, and brown). Stocking occurs in the Forest City to Simpson stretch at miles 37-36 and from miles 35-31. The river runs parallel to the D&H Rail-Trail, which crosses the river six times across old railroad bridges. The Rail-Trail Council has worked out an access plan with the Fish Commission, whereby vehicle access will be allowed from the opening day of trout season (beginning mid-April) through the end of May. Removable bollards and gates are in place.

Streams. The West Branch of the Lackawanna River is no longer stocked due to conflicts with adjacent property owners. The East Branch was redesignated in 1991 as a High Quality-Cold Water Fishes (HQ-CWF), thus adding it to the Special Protection Waters of the Commonwealth. This designation recognizes the quality, sensitivity, and value of the natural resources of the East Branch. The East Branch is an excellent wild trout fishery. Access is limited.

The following are recommendations due to the general lack of public access for fishing:

- Develop Stillwater into a public recreational facility not limited to fishing. Potential exists for hiking trails, picnic areas, environmental interpretation. There are no state or county parks in the watershed
- Retain more water;
- Develop a public access parking area for fly-fishing only on the East Branch;
- Develop specific parking areas along the D&H rail-trail for parking and access to the river;
- Acquire Dunn's Pond and Mud Pond
- Consider re-establishing old dam at lower Stillwater Lake; provide a vehicle access point to lower Stillwater (would also provide access to rail-trail).

Hunting

State Gamelands #236 lies within the watershed to the west of the West Branch of the Lackawanna. It is divided into four parcels with a total acreage of 2,009.

Numerous private hunting clubs lease or own land in the watershed. Some larger clubs are:

- Tri-County Sportsmen – east of O&W RR, Moosic Mountain adjacent to Panther's Bluff Conservation area;
- Browndale Hunting Club; and
- Richmondale Hunting Club.

Canoeing and Kayaking

The section of the Upper Lackawanna River between Forest City to Archbald is premium kayaking whitewater. Whitewater kayaking is an increasingly popular sport. Scheduled releases of water for recreational purposes is a possible management option, as is done on the Lehigh River, from the Francis E. Walter Dam.

In the Upper Lackawanna Watershed, canoeing is possible from Forest City when sufficient flows are present. High flows occur in the spring during snowmelt and rains. During summer, occasional wet weather will raise the river to a runable depth for several days. The river from Stillwater to the Route 171 Bridge at Simpson is more appropriate for kayaks.

Archaeological / Historic Resources

Sites / Importance / Ownership / Condition

According to the PA Historical & Museum Commission's National Register, there are no nationally registered historic sites in the Upper Lackawanna watershed study area. The Johnson mansion along Crystal Lake is located near the upper watershed.
The D&H Railroad is on the eligibility list for historic places, due to its importance in the early transportation of coal out of the Lackawanna Valley. The D&H Gravity Railroad and steamline line is also on the eligibility list. Sections of the 'gravity' are located within the Panther Bluff tract on Moosic Mountain. This 1500-acre tract has been preserved with conservation easements. Other gravity sections that continue to Waymart are on private property, but intact. A feasibility study to preserve the gravity beds for public trail use is underway in the Waymart. An important linkage proposed would be the connection from Waymart, over the Moosic Mountains to the Simpson-Carbondale area.

The New York, Ontario and Western Railroad has not been evaluated as yet. Typically if federal funding is used to purchase or develop a rail-trail, a cultural resources search must be completed. The O&W may be eligible.

Heritage Regions

The Upper Lackawanna River watershed lies within two heritage regions:

- **The Lackawanna Heritage Valley –** A state and national heritage area conserving and celebrating the heritage of the coal-mining industry and the related railroading industry. The important story of the anthracite industry's impact on the development of the Valley and the United States is the focus of the Lackawanna Heritage Valley Authority (LHVA). In addition to enhancing heritage tourism, another focus of the LHVA is the development of a regional trail system along the Lackawanna River. This trail is proposed to link with the D&H Rail-Trail and includes the section of the D&H from Simpson to Stillwater Dam.

- **The Endless Mountains Heritage Region** – A state heritage region encompassing Susquehanna, Bradford, Sullivan, and Wyoming counties. This area possesses an unmatched rural landscape shaped by centuries of farming, timbering and quarrying.

Issues, Concerns & Constraints

In order to identify the issues and concerns of watershed residents, several methods of gathering input were employed. The Trails Conservation Corporation (TCC) collected information by holding public meetings, soliciting written responses, using existing studies, and creating a survey for municipal leaders. The Management Options listed in Chapter 8 have been designed around these public issues.

Identifying Issues & Concerns

An exhaustive list of issues and concerns in the Upper Lackawanna watershed was developed through public involvement and examination of prior studies. A review of available data was conducted to help identify some of the key issues in the watershed and potential future impacts of concern, and to help identify potential data and mapping voids. Abstracts of prior studies used to identify issues and concerns are included in this plan as *Appendix E, Prior Studies*.

For ease of reference, these problems, issues, and concerns were divided into four broad subcategories: ***Water Environment, Natural Environment, Human Environment, and Political Environment***.

I. Water Environment

- Pollution of surface water
  - *Fecal coliform*
  - *Temperature*
  - *Dissolved oxygen*
  - *pH (acidity)*
  - *Nitrate (NO3)*
  - *Nitrite (NO2)*
  - *Ammonia*
  - *Phosphorous*
  - *Solids*
  - *Odor*
  - *Conductivity*
  - *Hardness*
- Sewage treatment plant discharges *(Point source pollution)*
- Acid mine drainage *(Point source pollution)*
- Stormwater runoff *(Non-point source pollution)*
  - *Increased flooding*
  - *Sewer overflows*
  - *Agricultural runoff (chemical fertilizers, pesticides, etc.)*

  - *Erosion and sedimentation*
  - *Reduction of groundwater recharge*
- Malfunctioning septic systems *(Non-point source pollution)*
- ***Loss of wetlands due to development***
  - *Artificial pond construction*
  - *Need for wetland mitigation, restoration, or creation*
- Lower stream flow levels
- Pollution of groundwater *(groundwater contamination)*
- Lack of groundwater recharge *(depletion of aquifer)*
- Eroding stream banks *(erosion and sedimentation)*
- Threat of water contamination by hazardous materials shipments

II. Natural Environment

- Fisheries management
  - *Fish stocking*
  - Successful natural fish reproduction in streams
  - *Need to preserve and restore aquatic habitat*
  - *Fewer fish*
  - *Fewer insects*
- Wildlife / game management
  - *Management of public use*
  - *Public access*
  - *Poaching*
- Forest management
  - *Prescribed burning*
  - *Accidental wildfire*
- Loss of biodiversity
  - *Invasive species*
  - *Need for protection of rare, sensitive, threatened or endangered species or communities*
  - *Preservation of animal habitat*
  - *Loss of wetlands*
- Poor riparian zones
  - *Need for restoration / revegetation of riparian zones*
- Warming effects of water impoundment behind dam

III. Human Environment

- Insufficient public access to streams
  - *Vehicle access to river*
  - *Handicapped access*
  - *Private ownership of lakes in headwaters region*
- Need for environmental education and greater public involvement

  - Negative public attitudes
- Growth management planning
  - *Unplanned growth*
  - *Urban sprawl*
  - *Need for sustainable planning*
  - *Highway construction*
- Loss of prime agricultural land
  - *Decreased crop yield*
  - Sedimentation and erosion
- Beautification / aesthetic concerns
  - *Removal of culm piles, refuse, need for landscaping*
- Private ownership of significant portion of public water source *(i.e. lakes in headwaters region up for sale)*
- Preservation of open space
- Need for recreation areas
  - *Passive recreation areas (hiking, camping, fishing, hunting, bird watching)*
  - *Active recreation areas (ball parks, tennis courts, etc.)*
- Preservation of historic and cultural areas and sites
- Solid waste disposal
  - ***Trash, junk, junkyards, littering, refuse dumping, coal wastes***
- Culm and waste piles
  - *Erosion and sedimentation*
  - *Need for revegetation, reclamation*
  - *Displacement of habitat*

IV. Political Environment

- Need for local non-profit organizations to work with federal, state, and local authorities to address watershed problems
- Lack of regional conservation or recreation planning
- Need for strong zoning laws, enforcement
- Need for stronger municipal and state regulations and enforcement
- Need for management of, or supervision over, public use of lands
- Need for clean water as an economic resource for industry, recreation, and drinking

Categorizing Issues

The steering committee and public participants then began grouping these issues into broad issue categories. The result of this process was seven major categories, around which this plan's goals and management recommendations have been developed:

- Water Quality;
- Mine Reclamation;

- Stormwater & Flood Control;
- Watershed Protection & Land Conservation;
- Recreation;
- Economic Development; and
- Watershed Awareness.

Summary of Public Meetings

The first public meeting was held on July 22, 1998 at the Union Dale Methodist Church Hall, Union Dale Rte 171. Lynn Conrad, TCC and Project Director, convened. Twenty-seven members of the public attended. Bernie McGurl began the meeting with a discussion of the river, the watershed area, and the background of the conservation plan. Issues discussed at the meeting included preservation of the river as a recreational resource, dam releases to improve trout habitat and recreation opportunities, and water quality issues such as leaking septic systems, combined sewer overflows, and acid mine drainage.

A summary of issues, concerns, and potential actions discussed at the July 22, 1998 meeting is attached as part of *Appendix A, Public Involvement.*

The second public meeting was held on February 27, 2001, at the National Institute for Environmental Renewal (NIER) in Mayfield, PA. This meeting was a joint public meeting for the Lower and Upper Lackawanna River Conservation Plans, and included a breakout session to focus on Upper Lackawanna goals, issues, concerns, and potential objectives and/or action items. The meeting opened with a presentation on the state of the watershed by Bernard McGurl. Six critical areas of concern, or broad issue categories, were also discussed. Gary Bloss of BLOSS Associates led the discussion with the breakout group along with Lynn Conrad. Participants were asked to write their ideas concerning watershed issues, potential objectives, and action items (including a specific location, if applicable) for the upper watershed on post-it notes. In round robin style, issues were then assigned to the broad categories.

A summary of issues, concerns, and potential objectives and action items discussed at the February 27, 2001 meeting is attached as part of *Appendix A, Public Involvement.*

Stream Walk Assessment

River Assessment Analysis. An assessment of the main river corridor and the east and west branches was undertaken with volunteers in the spring and summer of 1999. A *'River and Shoreline Assessment Data Report Form'* was developed and adapted from previous river assessment forms of the LRCA and 'river watch' forms. It was the intention of the project team to walk every mile of river and stream corridor, documenting existing conditions with both a written assessment form as a well as a photo inventory for every quarter-mile section of the river.

Volunteers and team leaders met for a short training session on the purpose of survey, use of photo-aerial and USGS maps, completion of assessment forms, photography, and use of photo log sheets. Three teams of volunteers – one each for the main stem of the Lackawanna River, the East Branch, and the West Branch – began the inventory on May 1, 1999. Areas not covered that day required teams to regroup and finish assigned miles when possible.

The assessment form addressed three major conditions:

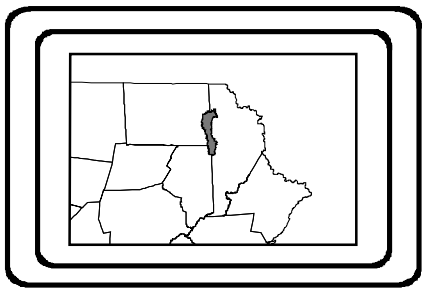
- Attributes of the river (water);
- Condition of the stream banks on both sides; and
- Condition of the vegetation in the river corridor (within 100').

The form included a simple check box system indicating the presence or absence of a condition or attribute. An area was included for explanations if necessary. Also addressed were aesthetic attributes and access potentials. The assessment form was to be filled out for every quarter mile of stream corridor – the survey thus indicates the existing conditions over a quarter mile and not for a specific point. Map sheets were available for the survey teams and were used to orient positions along the stream corridor. Both orthophoto (aerials) and USGS maps were used for orientation and for notes to indicate problem spots such as agricultural drainage, garbage, or erosion of streambanks. The river corridor was marked on the maps in quarter-mile intervals. Map sheets were protected with acetate, which enabled notes to be written on the map (with sharpie markers), sticky red dots were available to mark areas of concern, and other color dots could be used to indicate a site where photos were taken. Three or four representative photos were taken per quarter-mile segment with a written log indicating exposure, stream segment, view, and description.

Survey teams.

1. **Main Branch of the Lackawanna River**, Simpson to Stillwater Dam. River miles 30.70 to 40.50. Volunteers from the Lackawanna River Corridor Association. May 1st and May 12th, 1999.
2. **East Branch of the Lackawanna River,** Stillwater Dam to Lake Lorain. Stream miles 0.00 to 11.07. Mud Pond tributary miles 0.00 to 1.25. Volunteers from the Rail-Trail Council, BLOSS Associates and RESCUE. May 1st, June 9th, and July 14th, 1999.
3. **West Branch of the Lackawanna River.** Stillwater Dam to Lake Romobe. Stream miles 0.00 to 8.50. Volunteers from the Rail-Trail Council and American Environmental Outfitters. May 1st, 1999.

Analysis of Data. The data was entered into an excel spreadsheet for every quarter-mile of river for 45 variables related to river attributes, condition of banks, vegetative cover, aesthetic attributes, and access potentials. A summary matrix of this data for each survey team is attached as *Appendix B, Streamwalk Results.*



Location in northeast Pennsylvania

Stream Reach III

Stream Reach II

Stream Reach I

NOTE: Stream Walk Assessment points denote quarter-mile stream segments.

- Watershed Boundary
- Main Stem Segment Points
- West Branch Segment Points
- East Branch Segment Points
- Major Tributary
- Upper Lackawannna River
- Water Bodies

1 0 1 Miles

Stream Walk Assessment

Upper Lackawanna Watershed Conservation Management Plan

Information used to produce this map was obtained from field/office investigation.

Trails Conservation Corporation with BLOSS Associates

BLOSS ASSOCIATES

January, 2002

Stream Reach I, *Lackawanna River, Simpson to Stillwater Dam.* Thirty-nine survey data sheets (quarter-miles) were generated, with two quarter-mile sections omitted due to lack of access near the Army Corps Dam. These two quarter-mile sections are in a natural state and no problems should exist. This ten-mile length of river has many stark contrasts and is most impacted from mining influences.

In most segments the water was clear and inviting; two sections had red discoloration from acid mine drainage entering the river. Six segments had pipes entering the river (bridge drains, tributary culverts, or sewer treatment plant effluent). Two segments had debris in the river: trash and a culm slide into the river.

The riverbanks were unstable in eight segments (two both banks, six west bank). The erosion was rated as heavy in three sites, with slight instability in seven. All noted areas were described as coal waste or culm, except for two sites checked as bare or compacted probably due to fishing access from campsites along the river. Five east bank segments had garbage or litter, while garbage was seen on the west bank in three segments.

Vegetation along the corridor is predominately forest and brush (hemlock, beech, river birch, rhododendron, willow, and meadowsweet). Coal waste is present within 100 feet of the river in six segments to the east and sixteen segments to the west. Six quarter-mile segments had wetlands adjacent to the river. The wetlands appear to be a collection of various types of runoff dammed up by beaver activity. In two cases, AMD appears to be abated before it reaches the river, and in another, Rte 171 drainage gets a chance to settle before entering the river.

Aesthetically, the river segments were described as natural and quiet, with evidence of wildlife and fish in 32 segments (of 39 segments surveyed). The presence of culm along the river was viewed as an unnatural condition in seven segments. Special areas of waterfalls, rock formations, and pools were seen in twelve segments. Notable along the river are the 'Number 10 Falls', a large rock formation in the middle of the river, many old railroad abutments, a mill run, many rock ledges, and deep pools. Access potential exists in many areas (at least thirteen) due to the proximity of either the D&H or O&W rail-trails. Actual access paths to the river were seen in nineteen segments. Since this length of river is stocked with trout by the Fish Commission in the spring, many well-worn paths exist along the banks of the river. The area also has many camping or party spots that are for the most part clean but compacted.

Stream Reach II, *West Branch of the Lackawanna River, Stillwater Dam to Lake Romobe.* Twenty-nine survey data sheets were analyzed for the West Branch; three quarter-mile segments were inaccessible on heavily posted farm property. The eight-mile West Branch is generally rural with some agricultural impacts.

In all but one segment the water was clear. At mile 7.25, the water was cloudy with sedimentation due to cows in the stream. Four segments (downstream of mile 7.25) had green algae growth on the rocks in the stream, possibly from agricultural runoff. Two

small PVC pipes of unknown origin were seen discharging clear water into the river (each at road crossings). No debris was seen in the stream.

While the stream banks were generally stable, there was erosion noted on both banks in three segments, while two east banks and four west banks showed signs of instability. In all cases it was described as slight erosion, and due to either a stream crossing by livestock or farm vehicle, or access to one side of the stream by livestock. There was no trash along the entire West Branch banks.

The vegetation along the stream was in good condition with a mix of forest, brush, field (natural and pasture), and wetland marsh. In many areas it was difficult to directly access the stream due to thick brush, as alders or the presence of a large wetland along ¾-mile of stream. Over the entire corridor, the vegetation was estimated to be 36 percent forested, 32 percent brush, 13 percent marsh, 10 percent cultivated fields, 6 percent natural fields, and <2 percent bare or compacted ground. Wetlands were present within 100 feet of the stream at seven segments.

Four of the twenty-nine segments were checked as lacking natural attributes. Two were due to the presence of cows along and in the stream. In one area, a large beaver dam backed up the water into a large pool, changing the riverscape. At the outlet of Hathaway Lake, a recent spillway was built of concrete. Large rocks were also placed along the stream banks; the areas disturbed were mulched and seeded. An area noted as special was an extensive hemlock forest encompassing the stream for about one and one-half miles. Also noteworthy was the large marshy area through which the East Branch meandered for about one mile (this was public watershed land and potential important bird habitat, recently sold to an unknown private buyer). An area of concern was a large farm near the headwaters of the West Branch. Livestock grazed along and near the confluence of a minor tributary from the northeast with the main branch from Hathaway Lake. This area was accessed from the township road, so water attributes were not directly observed.

Eight segments were listed as having good or existing accessibility. Paths to and along the West Branch were probably the result of fishing access. Mid-sections of the stream (mile 2.00 to 4.00 and 6.00 to 6.25) were stocked with trout in previous years. Private property posting made it necessary for the Fish Commission to eliminate stocking in this area. The majority of segments (22) were checked as poor access potential, due to thick vegetation and the extensive private posting.

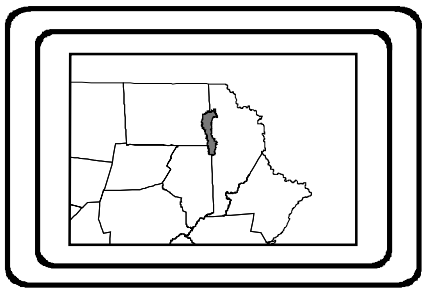
Stream Reach III, *East Branch of the Lackawanna River, Stillwater Dam to Lake Lorain.* Fifty quarter-mile segments of the East Branch, including a tributary from Mud Pond and Dunn Pond, were surveyed. Two half-mile segments were not directly accessible, but survey approximations were made from adjacent properties. One included fenced farm pasture and the other a large swamp. The East Branch Lackawanna River watershed was upgraded to a high-quality-cold water fishery classification (HQ-CWF) in 1991 by the Department of Environmental Resources.

The water in the majority of segments was described as clear and inviting. One segment just south of the large swamp had algae growth on bottom rocks and a large aquatic plant with small white flowers. Just upstream a livestock crossing was noted and downstream the water was dammed with rubble to make a swimming hole. The only other area of concern was at the outlet of Orson Pond, where a blue-green scum had accumulated on the surface. There was very little trash seen in the stream. A large inaccessible swamp with much brush and many dead standing trunks is formed just below Rte 370 by the confluence of the tributary from Lake Lorain and the tributary from Mud and Dunn Pond. It was noted that there is considerable flow from Mud Pond as compared to the trickle from Lake Lorain, when assessed on the same day.

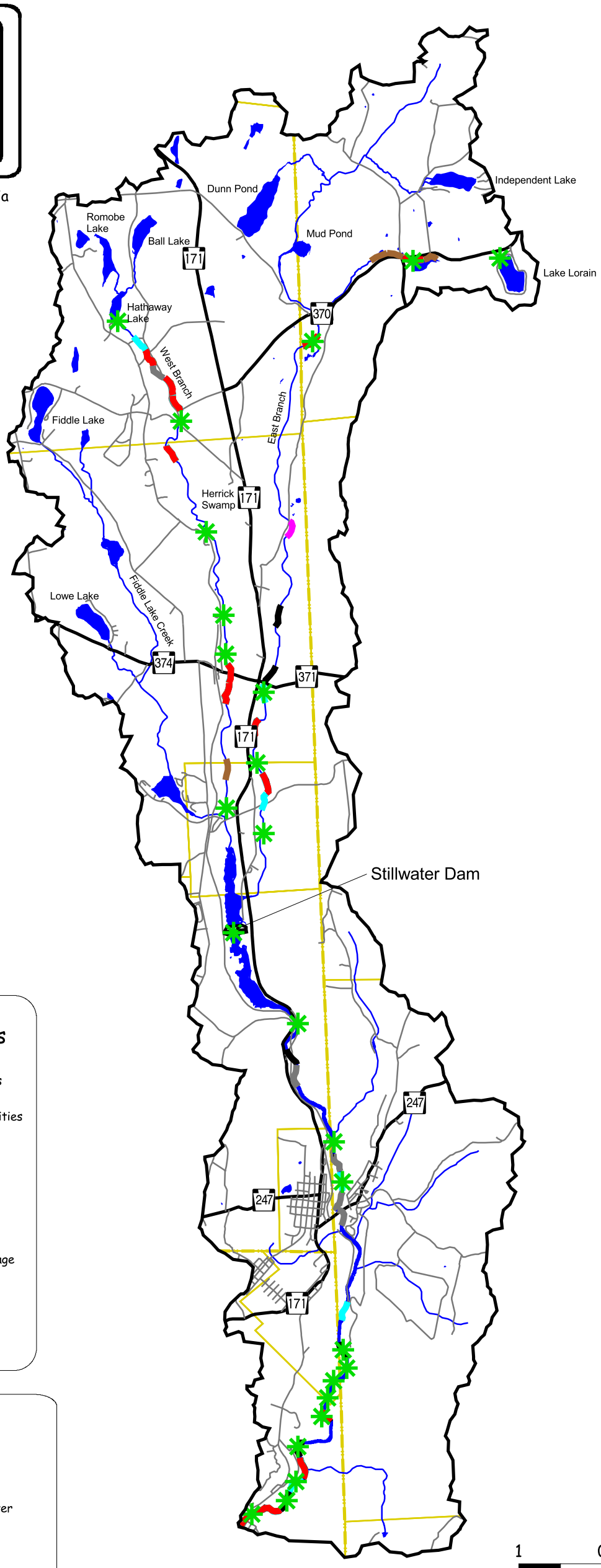
The stream banks of the East Branch were stable in most cases; slight erosion was noted at two areas were bridges crossed. One area had heavy erosion on the west bank near pasture and cultivated fields. The stream was channelized for approximately one-quarter mile just south of Orson Pond. The concrete spillway from Orson Pond channelizes flow towards a large impressive stone block culvert, taking water under the old O&W railbed and State Route 370. Flow then continues in a concreted channel towards and under an old barn, where it then turns sharply and flows under a township road. It continues in the concreted channel then through a rock-lined channel out into the pasture. It appeared that livestock was fenced out from pasturing at the stream, but could possibly use the stream banks as a path to the barn areas. The farm property appeared well taken care of; no barnyard runoff was observed.

Wetlands were adjacent to the streambank in 9 segments on the east and 7 on the west. This included the large woody swamp below the confluence of the tributaries and a marshy area below Lake Lorain. Mud Pond can be considered a large swampy area with some open water areas. Vegetative cover was an even mix of forest and brush (about 33 percent each); wetland vegetation was present at about 13 percent, natural fields 11 percent, cultivated or pasture at 6 percent, and lawn at about 4 percent.

All but five segments were listed as aesthetically pleasing, or in a natural condition. In four cases, the unnatural condition was a bridge; one was the existence of extensive bank erosion. Special attributes were noted in nine segments: pools, hemlock shaded banks, old foundations or walls, and the presence of adjacent swamps and marshes. Dunn Pond is especially pristine with no development along its shores.



Location in northeast Pennsylvania



Streamwalk Results

- Multiple Concerns
- Access Opportunities
- Erosion Areas
- Pollution Areas
- Pipe Locations
- Dumping or Garbage
- Livestock Areas
- Invasive Species

- Watershed Boundary
- Major Tributary
- Upper Lackawannna River
- Water Bodies

1 0 1 Miles

Stream Walk Results

Upper Lackawanna Watershed Conservation Management Plan

Information used to produce this map was obtained from field/office investigation.

Trails Conservation Corporation with BLOSS Associates

BLOSS ASSOCIATES

January, 2002

Municipal Survey

In June of 2000, the Trails Conservation Corporation sent a survey to municipalities in the Upper Lackawanna watershed. The survey addressed topics in the areas of land use policy, recreation, and site-specific projects. Four municipalities out of nine responded: Herrick Township, Ararat Township, Forest City Borough, and Union Dale Borough.

All four municipalities believe there are adequate recreational opportunities with the rail-trail and state game lands; Union Dale suggested the development of Stillwater Dam for recreation. Ararat and Herrick indicated concern over trespassing, or little respect for private property. All had concerns over dumping and listed specific sites, especially in the Forest City area. The rail-trails were also mentioned as inviting dumping. Ararat and Herrick Townships noted failing septic systems as a problem.

There was interest by the responding four municipalities for participation in a cooperative joint maintenance and management program to protect the watershed. However, cost may be a limiting factor.

In visionary comments, all municipalities indicated a need to stay rural and 'unspoiled', and to protect our clean waters. They also indicated concern over a possible influx of people and their effects on the 'sense of place'.

Copies of the returned surveys and municipalities' comments are attached to *Appendix A, Public Involvement.*

Developing Goals

After identifying issues through public meetings, existing studies, streamwalk surveys, and a survey for municipal leaders, and grouping these issues into categories, goal statements were then developed for each issue category:

> ***Water Quality*** – Preserve and enhance the quality of water in the Upper Lackawanna watershed, including water in streams and tributaries and ground water drinking supplies. Utilize the water resources of the watershed safely and efficiently so that sufficient quantities of clean water exist for both in-stream aquatic life and for human and livestock consumption. Maintain septic and public sewer systems in good working order so that wastewater does not degrade surface or groundwater. Reduce or eliminate sources of water pollution such as acid mine drainage and industrial point-source pollution. Retain wetlands to improve water quality, reduce impacts from flooding, and provide habitat for many species. Protect and enhance aquatic habitat and stream corridors.
>
> ***Mine Reclamation*** – Protect and enhance water quality through abatement of acid mine drainage. Restore lands affected by past industrial activities, including culm piles and wastelands.

Stormwater & Flood Control – Manage stormwater to minimize degradation of water resources in the Upper Lackawanna watershed. Direct future development in the watershed to reduce the amount of stormwater runoff. Utilize the abundance of water runoff for community benefit while returning clean water to the watershed's surface and groundwater. Limit development on high-risk land areas such as floodplains, wetlands, and steep slopes.

Watershed Protection and Land Conservation – Direct growth and future development to protect the Upper Lackawanna watershed's water and land resources. Maintain the biological resources of the watershed to provide high quality land and water habitat for diverse species of flora and fauna. Give special consideration to protecting endangered species and important habitat types. Encourage non-profit organizations to work with federal, state, and local authorities to address watershed problems.

Recreation – Ensure that the recreational and cultural resources of the Upper Lackawanna watershed are accessible and affordable to all of the watershed's residents. Preserve important historical sites to serve as important reminders of our industrial and cultural history. Maintain and enhance recreational and cultural resources and facilities to attract economic development and encourage young families to stay in the area.

Economic Development – Create a broadly shared economic vision for the future of the watershed. Encourage cooperation of government entities across political boundaries and cooperation of competing interest groups and non-governmental organizations to provide consistent and effective planning, regulation, and enforcement. Encourage economic development that sustains communities and natural systems through the use of incentives. Develop economic opportunities based on the region's natural beauty and abundant natural resources. Foster local economic development by maintaining and enhancing the watershed's recreational and historic resources to promote tourism and encourage young families to stay in the area.

Watershed Awareness – Achieve greater environmental education for all age groups to address the goals of the watershed conservation plan.

Action items, or potential management options, were developed based on the identified goals. These action items are discussed in full in *Chapter 8, Recommended Actions & Management Options.*

Recommended Actions & Management Options

This chapter includes a vision and broad goals for the Upper Lackawanna River as well as specific recommended actions and management options to achieve those goals. The goals and actions were developed through an extensive public involvement process.

Vision

The following represents how citizens in the watershed will view the landscape in the watershed within the next 20 years. It reflects input from the public derived in preparation of the plan and what could happen if the watershed conservation plan is effectively implemented:

Residents of the Upper Lackawanna River watershed care about clean water. The pure streams and safe drinking water the watershed enjoys are viewed as precious assets and all are aware of how important it is to continually maintain and protect this resource. Planning at all levels of government continues to point to the importance of maintaining and enhancing this resource as a critical goal for supporting the quality of life within the watershed. Both individual actions and municipal policy decisions are made with the knowledge of how these actions affect the health of the watershed and with the understanding that we are all stewards of the watershed's natural and cultural resources. Future generations are assured of a watershed that continues to sustain its human and natural residents.

Water in the watershed is not only clean and plentiful but many of the streams continue to support pristine trout fisheries. The stream corridors also provide an appropriate sense of place as greenway buffers have been maintained and enhanced in a continuous network or green infrastructure that supports other important ecological and cultural functions. In addition to trout habitat, a rich diversity of land and aquatic species are supported. Residents and visitors alike are connected to much of this network by a series of trails that provide access to nature, interpret the rich history, and provide alternative routes of transportation.

Goals and Objectives

The following goals and objectives describe the broad, general goals the plan is striving for in each issue category. The recommended actions listed below were developed with the intention of achieving these goals:

Water Quality – **Preserve and enhance the quality of water in the Upper Lackawanna watershed, including water in streams and tributaries and ground water drinking supplies.**

- ✓ Utilize the water resources of the watershed safely and efficiently so that sufficient quantities of clean water exist for both in-stream aquatic life and for human and livestock consumption.
- ✓ Maintain septic and public sewer systems in good working order so that wastewater does not degrade surface or groundwater.
- ✓ Reduce or eliminate sources of water pollution such as acid mine drainage and industrial point-source pollution.
- ✓ Retain wetlands to improve water quality, reduce impacts from flooding, and provide habitat for many species.
- ✓ Protect and enhance aquatic habitat and stream corridors.

Mine Reclamation – **Protect and enhance water quality through abatement of acid mine drainage.**

- ✓ Restore lands affected by past industrial activities, including culm piles and wastelands.

Stormwater & Flood Control – **Manage stormwater to minimize degradation of water resources in the Upper Lackawanna watershed.**

- ✓ Direct future development in the watershed to reduce the amount of stormwater runoff.
- ✓ Utilize the abundance of water runoff for community benefit while returning clean water to the watershed's surface and groundwater.
- ✓ Limit development on high-risk land areas such as floodplains, wetlands, and steep slopes.

Watershed Protection and Land Conservation – **Direct growth and future development to protect the Upper Lackawanna watershed's water and land resources.**

- ✓ Maintain the biological resources of the watershed to provide high quality land and water habitat for diverse species of flora and fauna.
- ✓ Give special consideration to protecting endangered species and important habitat types.
- ✓ Encourage non-profit organizations to work with federal, state, and local authorities to address watershed problems.

Recreation **– Ensure that the recreational and cultural resources of the Upper Lackawanna watershed are accessible and affordable to all of the watershed's residents.**

- ✓ Preserve important historical sites to serve as important reminders of our industrial and cultural history.
- ✓ Maintain and enhance recreational and cultural resources and facilities to attract economic development and encourage young families to stay in the area.

Economic Development **– Create a broadly shared economic vision for the future of the watershed.**

- ✓ Encourage cooperation of government entities across political boundaries and cooperation of competing interest groups and non-governmental organizations to provide consistent and effective planning, regulation, and enforcement.
- ✓ Encourage economic development that sustains communities and natural systems through the use of incentives.
- ✓ Develop economic opportunities based on the region's natural beauty and abundant natural resources.
- ✓ Foster local economic development by maintaining and enhancing the watershed's recreational and historic resources to promote tourism and encourage young families to stay in the area.

Watershed Awareness **– Achieve greater environmental education for all age groups to address the goals of the watershed conservation plan.**

- ✓ Encourage educational opportunities in conjunction with private conservation organizations.

Watershed Management Units

At the heart of watershed planning and management is the concept of watershed management units. There are many different watershed management units, including river basins, watersheds, subwatersheds, and catchments. A watershed can be defined as the land area that contributes runoff to a particular point along a waterway. The Upper Lackawanna watershed is all the land that drains to the point where the Upper Lackawanna crosses under the Simpson Viaduct. The Upper Lackawanna watershed (measuring 56.22 sq. miles) is part of the larger Lackawanna River watershed. A typical watershed can cover tens to hundreds of square miles, and extend over several political boundaries or jurisdictions. The largest management unit is the basin. The Lackawanna River basin is a sub-basin of the Susquehanna River basin.

Watersheds are broken down into smaller geographic units called subwatersheds. Subwatersheds typically have a drainage area of 2 to 15 square miles, and include the land area draining to the confluence of two second-order streams or to the limits of a third

order stream. This plan has identified five subwatersheds from between 3 to 20 square miles each that form the Upper Lackawanna watershed. These include the East Branch (15.47 sq. miles), the West Branch (8.45 sq. miles), Fiddle Lake Creek (8.56 sq. miles), Stillwater Lake and dam (3.15 sq. miles), and the main stem of the Upper Lackawanna from Stillwater to Simpson (20.59 sq. miles).

Management at the subwatershed level refers to assessment-level studies and specific projects within the smaller subwatershed units, while management at the watershed level refers to broader management issues across an entire watershed. The management units of watershed and subwatershed are most practical for local plans such as this one. Every watershed is composed of many individual subwatersheds, each having its own unique water resource objectives.

The recommendations of this plan focus on the broader issues across the entire watershed. However, the plan recognizes the importance of focusing on the subwatershed unit for several reasons:

- The influence of impervious cover on water quality, hydrology, and biodiversity is most evident at the subwatershed level, where the influences of individual development projects are easily recognizable.
- Because subwatershed management areas are limited to a smaller area, fewer pollutant sources are present to confuse management decisions.
- Subwatersheds are small enough to be within just a few political jurisdictions where it is easier to establish a clear regulatory authority and incorporate the smaller number of stakeholders into the management process.
- A subwatershed plan can generally be completed within a two-year timeframe and still allow ample time for goal development, agency coordination, and stakeholder involvement.

This watershed conservation plan is meant to set up additional planning efforts at a more manageable scale, to keep the focus of the plan clear. Overall the plan represents a long-term process and continuous management commitment.

Subwatershed Categories

One of the most important steps in watershed planning is to establish water resource management goals at an early stage. Within a watershed, individual subwatersheds often have unique management goals. As a management tool of watershed protection outlined by the *Center for Watershed Protection*, each subwatershed can be classified into a subwatershed category according to certain indicators, such as percent impervious cover, aquatic habitat, stream biodiversity, and water quality. Five subwatersheds and their categories have been identified within the Upper Lackawanna Watershed:

- **East Branch Lackawanna River—*Sensitive Stream***
- **West Branch Lackawanna River—*Sensitive Stream***

- **Fiddle Lake Creek—*Sensitive Stream***
- **Stillwater Lake and dam—*Water Supply Reservoir***
- **Lackawanna River below Stillwater Dam—*Impacted Stream***

Subwatershed Categories. The Center for Watershed Protection's *Rapid Watershed Planning Handbook* categorizes a subwatershed as a *sensitive stream* if the subwatershed has less than 10 percent impervious cover, and the stream is rated as high quality according to fish, macroinvertebrates, or habitat indicators, regardless of the stream's classification as a warm, cool, or cold water system. The subwatershed of a *sensitive stream* is generally not served by a public sewer system. The East Branch, the West Branch, and Fiddle Lake Creek can be categorized as *sensitive streams*.

A subwatershed can be categorized as an *impacted stream* if the subwatershed has 10% to 25% impervious cover, and monitoring indicates a decline in physical, biological, or water quality indictors. The subwatershed may be at its "best attainable" condition, given previous disturbances. The Lackawanna River from Stillwater Dam to Simpson can be categorized as an *impacted stream*.

A reservoir managed in order to provide a pure raw drinking water supply or to store drinking water pending advanced treatment can be categorized as a *water supply reservoir*. Stillwater Lake and dam falls into this category.

Finally, in subwatershed areas where surface water has a strong interaction with groundwater because of underlying carbonate rock, cracks, fissures, or abandoned mine networks, and where groundwater is the primary source of potable water, resource management goals can be categorized for *aquifer protection*. Surface water in the Upper Lackawanna Watershed below Stillwater Dam has rapid interaction with groundwater because of the underlying network of abandoned mines.

Management Goals for Sensitive Streams. The overarching management goal for subwatersheds categorized as *sensitive streams* is to maintain the predevelopment stream biodiversity and channel stability. The planning objective is to maintain or enhance predevelopment stream habitat conditions with respect to recharge, hydrology, stream temperature, channel stability, and riparian condition. To reach these goals, watershed analysis must be accomplished, including:

- Mapping of existing and projection of future impervious cover;
- Biological and habitat sampling; and
- Inventory of riparian condition and wetland areas.

Management Goals for Impacted Streams. The overall management goal for an *impacted stream* is to limit the degradation of stream habitat quality and maintain a "good" biological community, or one that is both "fishable and swimmable." Some planning objectives include:

- Reduce the frequency of flooding;
- Maintain channel stability; and
- Provide maximum removal of pollutants, bacteria, and especially AMD.

Mapping of impervious cover and sensitive areas, modeling of stormwater and floodplains, and monitoring of stream systems will be needed.

Management Goals for a Water Supply Reservoir. The overall management goals for a *water supply reservoir* are to protect the quality of the drinking water supply, ensure public safety, and keep water treatment costs reasonable for rate payers. Planning objectives include:

- Control turbidity and coliform inputs to reservoir;
- Prevent algal blooms that case taste or odor problems, and THM formation;
- Prevent or contain spills that would degrade water quality; and
- Keep sedimentation rates low to preserve reservoir capacity.

To accomplish these goals, a survey of stormwater outfalls is needed, as is a monitoring program for the frequency and severity of algal blooms.

Management Goals for Aquifer Protection. The overall management goal for *aquifer protection* is to maintain or enhance the quantity and quality of shallow groundwater. Planning objectives include:

- Maintain recharge rates to aquifer;
- Meet drinking water standards at public and private wells;
- Prevent pollutants or pathogens from entering groundwater; and
- Prevent rapid conveyance of stormwater into groundwater.

To accomplish these goals, managers need to delineate wellhead protection and recharge areas, define surface/groundwater interactions, inventory potential contaminant sources, and compute aquifer drawdown rates.

Management Options. Management options from the Center for Watershed Protection's *Rapid Watershed Planning Handbook* include:

Some management options for *Sensitive Streams* include:

- Limit impervious cover to 10 percent throughout the subwatershed;
- Acquire or apply conservation easements to stream valley lands or other sensitive watershed areas;
- Identify and protect springs, seeps, known spawning areas, and riparian wetlands;
- Identify and prohibit development of steep slopes, wetlands, floodplains, forest conservation areas, and critical habitat areas;
- Prohibit modification of stream channels;
- Prohibit sewer trunk mains in stream valley;
- Apply widest aquatic buffer width (150 to 300');
- Inspect septic systems and make necessary corrections;
- Emphasize stream protections through educational programs;
- Promote stream habitat repair and reforestation of the riparian buffer; and

- Foster the use of "green" lawncare techniques.

Some management options for *Impacted Streams* include:

- Set upper limit on watershed impervious cover to 25 percent;
- Limit on-site impervious cover (i.e. low impact development, narrow streets, reduce parking ratios);
- Identify and regulate development on or adjacent to steep slopes, wetlands, floodplain, forest conservation areas, and critical habitat areas;
- Reduce overflows and inflow of sanitary sewage; and
- Employ cluster development and forest conservation techniques.

Some management options for *Water Supply Reservoirs* include:

- Maintain undeveloped land through land acquisition and conservation easements;
- Direct new development away from intake area;
- Employ wide shoreline buffers (designed for maximum pollutant removal) as well as tributary buffers;
- Prohibit/restrict new NPDES discharges;
- Routinely monitor water quality; and
- Monitor underground storage tanks.

Some management options for *Aquifer Protection* include:

- Direct development away from and limit new impervious cover in significant recharge zones;
- Insulate or prevent groundwater interaction with solid or hazardous waste sites;
- Prevent stormwater infiltration from stormwater hotspots;
- Conduct education programs on groundwater protection, including fertilizer and pesticide use; and
- Conduct underground storage tank (UST) and SARA 312 inventories.

Setting Timeframes

Each recommended action is associated with a timeframe, identifying the suggested initiation period and implementation time necessary for completion of the action.

Timeframes are as follows:

- **Immediate** = One to three years;
- **Mid-Term** = Three to five years; and
- **Long Range** = Five to ten years.

This plan recognizes that there will be limited financial and human resources available to execute the many recommended actions listed below. Some change in the timeframe for

action implementation is expected, as well as the group(s) responsible for carrying out the recommended actions.

Recommended Actions

Recommended actions have been identified through the public involvement process, including public meetings and a careful reading of prior studies. These actions attempt to solve the problems and/or enhance the opportunities associated with each goal. Possible lead agencies or actors have been identified in italics. The goals and their associated action items are summarized below.

Water Quality

Preserve and enhance the quality of water in the Upper Lackawanna watershed, including water in streams and tributaries and ground water drinking supplies.

IMMEDIATE – Actions to be initiated or accomplished within the next one to three years:

- Institute a water quality testing program for the watershed. *Municipalities, Conservation District, Volunteer Senior Corps*
  - Establish baseline data and testing protocols for the upper and lower sections of the river to determine water quality, especially at points indicated from assessment walks that may be receiving agricultural runoff. Make database available to all public agencies.
  - Provide affordable water testing kits to designated stream watchers.
  - Address high phosphorus measurements in Fiddle Lake and Dunn's Pond (DEP testing in 1990-1991).
  - Develop and/or promote a well water monitoring program.
  - Encourage regular monitoring of water quality in the Forest City area, with a new team of the Senior Environmental Corps. *LRCA*
  - Conduct streamwalk assessment of Fiddle Lake Creek.
- Create a watershed coalition or organization to oversee the implementation of projects outlined in this Plan. Hire full-time staff person to oversee and/or help implement the recommendations of this plan.
- Develop sewage management programs to address on-lot septic system problems.
  - Monitor Fiddle Lake sewage treatment plant.
- Promote nutrient management on farmland.
- Assess subwatershed categories according to certain indicators, such as percent impervious cover, aquatic habitat, stream biodiversity, and water quality, to establish unique water resource management goals.
- Accomplish erosion and sedimentation control through the DCNR's Sustainable Forestry program.
- Establish and/or enhance riparian stream buffers along the river and its tributaries.
  - Concentrate efforts on problem areas: farm fields, roads & highways, commercial use areas. Provide trees & shrubs to community service groups.
  - Provide incentives to remove cattle from stream: stream bank fencing and riparian plantings. West Branch assessment walks have indicated specific sites.
  - Encourage natural stream restoration projects using 'Rosgen' or fluvial geomorphology approach.
- Encourage protection of and public access to headwater lakes.
- Implement wetland restoration, including removal of trash and exotic species, reestablishment of native plants and upland buffers, or creation of wetlands.

MID-TERM – Actions to be initiated or accomplished within three to five years:

- Conduct a survey of septic inflows.
- Decrease sewer overflows along the river.
- Prevent sewage contamination by implementing sewage facilities planning.
    - Control sewage discharge into the river by building a sewage treatment plant.
    - Retain or create wetlands areas to enhance the effectiveness of sewage disposal systems.
    - Eliminate CSOs in Forest City/Vandling/Browndale. Encourage Forest City to upgrade its entire sewer system.
    - As an interim solution to CSOs, design and build collection ponds/wetlands for treatment and/or storage of overflows on the Yucca Flats tract.
- Strengthen land use ordinances to require a percent of all land to be kept in a natural state.
- Limit development on wetlands.
    - Encourage pond construction in upland areas rather than in prime wetland areas.
- Implement withdrawal restrictions in times of extreme low flows or drought periods.
- Protect the clean water resources of the upper watershed: lakes, streams, and wetlands. *DCNR's Operation ReLEAF, The Chesapeake Bay Program*

LONG RANGE – Actions to be initiated or accomplished within five to ten years:

- Conduct an integrated, multi-municipal/multi-county study of the watershed to address the river's complex environmental problems. *The River Continuum Project*
- Provide affordable upgrades to address on-lot septic system problems.

Mine Reclamation

Protect and enhance water quality through abatement of acid mine drainage.

MID-TERM – Actions to be initiated or accomplished within three to five years:

- Reduce or eliminate undesirable effects of acid mine drainage in the lower watershed.
- Construct berms or revegetate culm and waste piles along the river to mitigate erosion and sedimentation.
  - Initiate riverbank stabilization projects at areas of culm and mine rock slides with establishment or enhancement of riparian buffer, including Yucca Flats, Northwest Colliery, Grey Slope, and Vandling.
- Abate acid mine drainage through the creation of passive wetland ecosystems. *Earth Conservancy*
  - Enhance the existing wetland at the Vandling acid mine drainage outfall.
- Implement surface water diversions which will minimize rainwater and snowmelt from entering underground pools. Begin by backfilling and sealing all strip pits with existing spoil bank material.
- Reclaim Yucca Flats (Hillside Colliery) for recreation and river access, including removal of culm piles in the area south of Route 247 and culm piles on the east side of the river at outlet of Brace Brook. Encourage partnering efforts by BAMR, EPA, DEP, DCNR and non-profit and private investors.
- Reclaim Northwest Colliery (Fell Coal) lands for possible conservation subdivision development.
- Address mining activities in Fell Township.
- Reclaim Vandling Drifts (Clinton Colliery).
- Reclaim strip mine pit on O&W right-of-way, one mile south of Browndale; re-establish trail.

LONG RANGE – Actions to be initiated or accomplished within five to ten years:

- Restore mine-scarred land by encouraging the use of culm as a fuel source.
- Utilize wastelands to absorb future development needs and/or industrial uses.
- Develop a consensus for future use of reclaimed mine sites.

Stormwater & Flood Control

Manage stormwater to minimize degradation of water resources in the Upper Lackawanna watershed.

MID-TERM – Actions to be initiated or accomplished within three to five years:

- Support an upgrade of Act 167 stormwater management plans for the Upper Lackawanna watershed. *Municipalities*
    - Support upgrades of municipal water quality protection and enhancement ordinances prior to completion of an Act 167 review. *Municipalities*
    - Encourage municipalities to adopt ordinances consistent with the current Act 167 stormwater management plan, including regulation of land development, subdivision, construction of new impervious surfaces, construction of new buildings or additions, diversion of any stream channel, and installation of any storm water system.
- Institute setbacks from the river in zoning ordinances to prevent development in floodplains; work with landowners and trust conservancies in key areas to preserve both watershed and viewshed. *Municipalities*
- Encourage municipalities to require the implementation of best management practices, including: designing filter and infiltration systems into storm water management ponds and swales, reducing impervious surfaces, designing stormwater retention areas, maintaining forested buffers along streams and wetland margins, and using cluster and neo-traditional village type developments.
- Preserve floodplains as open spaces. *Municipalities*

LONG RANGE – Actions to be initiated or accomplished within five to ten years:

- Restore the original floodplain where possible, e.g. by opening up the floodplain to original widths. *Municipalities*

Watershed Protection and Land Conservation

Direct growth and future development to protect the Upper Lackawanna watershed's water and land resources.

IMMEDIATE – Actions to be initiated or accomplished within the next one to three years:

- Conduct *Growing Greener* audits to put conservation into local plans and ordinances for all municipalities in the watershed.
- Acquire or apply conservation easements to stream valley lands or other sensitive watershed areas.
- Explore ways of keeping the Dunn Pond tract (90 acres of water on 211 acres of land) intact and acquire rights to it for environmental preservation and the enjoyment of the public. *Ararat Township Planning Commission, DCNR, DCED, the Trust for Public Land, and the Lackawanna River Basin Conservancy*
- Pursue acquisition of Dunn Pond, Mud Pond, Herrick Swamp (Theta properties) and other associated watershed lands and headwater lakes. *Land trusts, Trust for Public Land, PA Fish and Boat Commission*
- Protect Orson Glade (Mud Pond) as one of the most important sites for protection in the state. *The Nature Conservancy*
- Undertake trash cleanup and prescribed burns to ensure the Salem Hill Barren community's survival. Monitor tree cover to establish the rate of burning that will be effective in sustaining shrublands against forest encroachment.
- Pursue protection of the Moosic Mountains as an important goal of the county and state (the largest unbroken tract of land in Wayne County). *The Nature Conservancy*
- Support the Wildlands Conservancy's management program to buy an easement on the 1,400-acre wildland portion of the Salko tract, including the hemlock ravine, Panther Bluff waterfall, and the mesic barrens, which are located in the center of the tract.
- Pursue acquisition or conservation easements on special places in upper watershed: Stillwater Cliffs, Stone Face, river corridor areas (as No. 10 waterfall, jungle dam).
- Enhance the conservation easement on the Panther Bluff Tract, preserving more Moosic Mountain ridgetop.
- Conserve the D&H Gravity and steamline railbeds in the Moosic Mountain area.
- Implement programs to control/manage invasive & exotic species.
    - Support annual inspections for the reduction and control of wooly adelgid in hemlock glens in the upper watershed.

MID-TERM – Actions to be initiated or accomplished within three to five years:

- Promote a regional view via multi-municipal planning and cooperation between watersheds, e.g. between the Lackawanna River and Delaware River watersheds.
- Strengthen land use ordinances to limit development within a specific distance of bodies of water.
- Strengthen land use ordinances to preserve farmland.
- Conduct an analysis of impervious cover in the watershed.
- Identify and protect springs, seeps, known spawning areas, and riparian wetlands.
- Identify and prohibit development of steep slopes, wetlands, floodplains, forest conservation areas, and critical habitat areas.
- Preserve Ball Pond as open space. *Ararat Township, Land trusts*
- Review the Dunn Pond tract, Ball Pond tract, and parts of the Mud Pond tract as candidates for the wetland mitigation banking program.
- Encourage private landowners to promote natural growth, limit acreage of lawns, and to utilize native species. *Municipalities*
- Promote conservation of important habitat areas through conservation-based ordinances and codes (also known as *Growing Greener* approaches).
- Rebuild wetlands, clean up debris, and implement stormwater plans to build trout populations.
- Develop approaches for more effective deer, geese, and other nuisance wildlife management.
- Use incentive-based approaches to protect, restore, and conserve important fish and wildlife habitat and direct development away from important habitat areas.
- Eliminate fish stocking within natural fish production areas. Designate catch and release (no kill) areas of river.
- Conduct inventory studies to identify Important Bird Areas and other important habitat areas through bird counts, data collection, and research, as per criteria in IBA site nomination form. *Northeast Audubon Society*

LONG RANGE – Actions to be initiated or accomplished within five to ten years:

- Protect sites of statewide importance and sites of local importance to maintain the watershed's biological diversity.

Recreation

Ensure that the recreational and cultural resources of the Upper Lackawanna watershed are accessible and affordable to all of the watershed's residents.

IMMEDIATE – Actions to be initiated or accomplished within the next one to three years:

- Provide public access to the river, especially between the trail and the river in priority locations (between Forest City & Simpson), and provide for vehicle access during trout season.
- Protect the Upper Lackawanna River as a recreational resource.
    - Develop whitewater kayaking potential on the Lackawanna River from Forest City to Archbald.
    - Protect rail-trail and fishing opportunities as recreational resources.
- Explore the possibility of a recreation site at Stillwater dam.
- Provide historical interpretive signage and environmental educational signage and maps at rail-trail trailheads and at significant historic sites along trails and riverways.
- Restore the sectional toolhouse along the O&W on Orson Pond (believed to be the only sectional toolhouse remaining on the entire O&W.) *PHMC, O&W Historical Society*
- Develop the potential for passive recreation in the Dunn Pond tract (hiking, bird watching, hunting, fishing.)
- Enhance trails along the river corridor.
- Encourage non-motorized forms of recreation to reduce motor-driven recreation.

MID-TERM – Actions to be initiated or accomplished within three to five years:

- Construct hiking trails, nodal parks, playgrounds, picnic areas, and fishing access points at road endings along the river.
- Investigate potential area for handicapped fishing access.
- Conduct fisheries inventories in high priority stream areas and review fish stocking programs.
- Protect existing remnants of the Morss sawmill located in Simpson along the river.
- Coordinate rail-trail development with the establishment of a Lackawanna River State Park. Explore another proposed greenway along Number 2 Creek from Kennedy Park to Lake Erie to the D&H rail-trail on the Lackawanna River.
- Promote and develop greenways to link important natural, recreational and wildlife habitat areas in cooperation with willing landowners.

- Develop Lackawanna County's network of abandoned rails as the framework for a valley-wide greenway along the Lackawanna River; provide trail connections between Lackawanna and Wayne Counties.

LONG RANGE – Actions to be initiated or accomplished within five to ten years:

- Create community recreational and educational resources, including parks, rail-trail projects, rehabilitation of riverside parks, and new conservation efforts.

Economic Development

Create a broadly shared economic vision for the future of the watershed.

IMMEDIATE – Actions to be initiated or accomplished within the next one to three years:

- Provide signage and maps at rail-trail trailheads, including maps of nearby downtown areas to encourage local economic activity.
- Develop the river's potential for rafting, canoeing, and kayaking recreational uses.
- Conserve the Dunn Pond tract as a focal point of pride for the township and its history.
- Revitalize Main Street of Forest City to encourage residents and invite visitors to shop at home.
- Foster local economic development through helping area businesses increase sales outside of the Greater Forest City area and bringing in new businesses that sell to customers outside the area.
- Prioritize economic and community development activities/projects on abandoned mine sites in the lower portion of the Upper Lackawanna watershed, e.g. Fell Cole Company site, Yucca Flats, Northwest Tire site.
- Encourage environmentally friendly businesses.
    - Encourage public/private partnerships to provide bicycle rentals and outdoor outfitting.
- Provide increased river access for fishing, specifically at Yucca Flats, along D&H Rail-Trail and on East Branch. Partner with the PA Fish & Boat Commission and encourage increased stocking, with fly-fishing only regulations on the East Branch.
- Acquire missing sections of the D&H Rail-Trail; encourage Lackawanna Heritage Valley to initiate connection:
    - 6,500' D&H Fell Township
    - 2,000' D&H Carbondale Yards, Fell Township
- Acquire the O&W twelve-mile section from Stillwater to Lake Lorain/Poyntelle for development into a recreational trail.
- Conduct a feasibility study to develop a trail connection from the O&W rail-trail to gravity railbeds on the Moosic Mountains with connection to the Waymart tracks-to-trails.
- Perform a reallocation and reauthorization study of Stillwater Dam, matching DCNR river funds with federal funds.
    - Reallocation of water to allow maintenance of a deeper, larger base pool to reduce water temperature of the base release flow to allow for natural

trout reproduction and to allow a reserve flow for recreational releases integrated with fishery management needs.
- Authorization for greater public access and use of Stillwater Dam and lake, including recreational trail linkage across the face of the dam between the D&H and O&W rail-trails.
- Authorization to allow creation of a state or regional park management and facility development.

MID-TERM – Actions to be initiated or accomplished within three to five years:

- Establish a watershed-wide planning commission to develop growth management ordinance strategies.
- Encourage sustainable planning, incorporating some traditional ways towns related to their local landscapes.
- Encourage compact development to conserve green space and consolidate services and broad-based zoning.
- Improve community facilities and services, especially outdoor recreation, that would serve current residents and help to attract young homeowner families to the area.
- Develop a plan (for jobs, recreation, community) to keep the youth in this area.
- Promote eco-tourism and sustainable development, including the development of alternative energy sources where appropriate.
- Plan for changing demographics.
    - Explore the development of community facilities geared towards aging demographics.

Watershed Awareness

Achieve greater environmental education for all age groups to address the goals of the watershed conservation plan.

IMMEDIATE – Actions to be initiated or accomplished within the next one to three years:

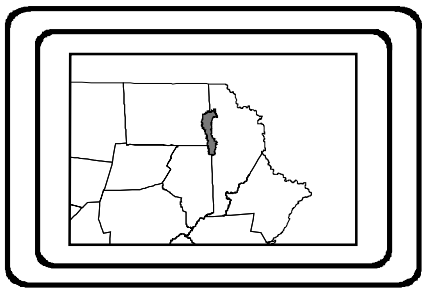
- Promote scouting volunteer opportunities, service projects and education, including rail-trail projects and planting trees. *TCC, local teachers*
- Incorporate an educational component into recreation events.
- Encourage municipal leaders to pursue available grant monies to implement projects outlined in this plan. *TCC*
- Produce an educational video about the conservation plan.
- Develop watershed awareness-raising educational programs, presentations, and handout materials for municipal officials and schools. *TCC, local teachers*
- Encourage local schools to conduct field trips to the river to educate children about watershed issues. *TCC, local teachers*
- Use the D&H Rail-Trail and the Panther Bluff Conservation Area to provide river access and outdoor classroom opportunities for environmental education. *Local teachers*
- Educate municipal leaders about the importance of environmental preservation.
- Develop programs for interpretation, education, and stewardship programs to help preserve the valley's cultural heritage. *TCC, local teachers*
- Develop educational programs about resource conservation, overpopulation, and growth management. *TCC, local teachers*
- Promote conservation education programs in conjunction with the management programs of private property owners. *Local teachers*
    - Promote the use of the Panther Bluff Conservation Area for environmental education by local elementary and high schools. Work with local colleges to develop interpretive signage. Develop learning tools, lesson plans, and a "traveling trunk".
- Develop a guide to the geology of the rail-trails and surrounding areas with state geologists.

Composite Mapping for Recommended Actions

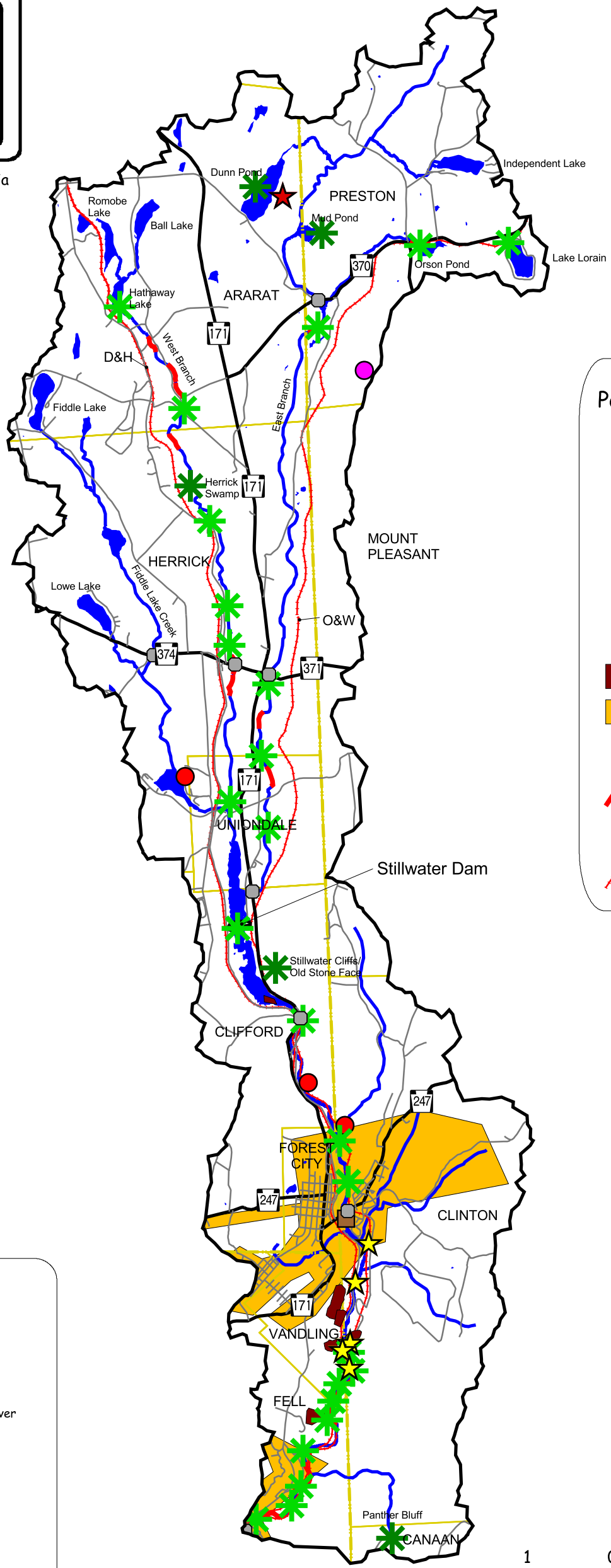
Composite mapping was prepared to help translate the management options to their spatial component. This mapping is meant to be neither definitive nor complete but rather a starting point for identifying "where" in the watershed problems, issues, or concerns are located.

Funding Sources

Funding opportunities for many of the action items listed above can be found through numerous government funding programs as well as through private organizations. A table listing these government programs that offer funding opportunities can be found in *Appendix D, Rivers, Trails and Greenway Funding Options*.



Location in northeast Pennsylvania



Potential Project Locations

- Closed Landfill
- Acid Mine Drainage Site
- Waste Water Treatment Plant
- NPDES Discharge Point
- RCRA Site
- Major Road Crossing
- Culm Banks
- Sewershed
- Conservation Interest
- Impacted River Segment (from Streamwalk Analysis)
- Access Opportunity (from Streamwalk Analysis)
- Abandoned Rail Lines

- Watershed Boundary
- County Boundary
- Major Tributary
- Upper Lackawannna River
- Water Bodies

Major Roads

- PA Traffic Routes
- Other Roads

1 0 1 Miles

Potential Project Locations

Upper Lackawanna Watershed Conservation Management Plan

Information used to produce this map was obtained from Acker Associates and field/office investigation.

Trails Conservation Corporation with BLOSS Associates

BLOSS ASSOCIATES

January, 2002