The Lackawanna River Guide

LRCA
Lackawanna River Corridor Association

The Lackawanna River Guide

A publication of the
Lackawanna River Corridor Association

Second Edition

This Guide is dedicated to
the membership
of
The Lackawanna River Corridor Association
whose support and commitment are helping to create
a revitalized Lackawanna River.

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Introduction

"The Lackawanna… takes its name from the Indian tongue and signifies the meeting of two streams…once abounding in fish of every variety, particularly known for its brook trout…gliding silently by over the gravelly bars dancing in the sunshine…a river of the purest spring water…along its banks, thick with hemlock, oak and pine were deer and moose…among groves of rhododendron and laurel."

from A History of The Lackawanna Valley,
Dr. Horrace Hollister, 1869

The Lackawanna River rises and flows through a three-hundred fifty square mile watershed in four counties of Northeastern Pennsylvania. The twenty-three municipalities in the watershed are home to nearly one quarter of a million people.

This guide is written for the people of the Lackawanna Valley: long time residents, newly arrived neighbors and visitors. The Lackawanna River has a powerful and subtle relationship with us. This guide will help to explore our relationship with the River and examine what the River tells us and the rest of the world about that relationship.

The Lackawanna River Guide will help ask and answer many questions. It will help us evaluate our stewardship of the River and its watershed. It will help make the River a more familiar friend, a resource that each reader can get to know through the seasons of life.

The Lackawanna River Guide is a work in process as human consciousness is itself a work in progress. This edition, written at the end of the 20th Century offers a vision for the future as well as an analysis of today and yesterday. Your experiences and comments can help guide the next generation. The Lackawanna River Corridor Association welcomes your company as we journey along the River. We encourage your involvement with us. We need your participation to help make the Lackawanna Valley a better place to live.

Chapter I

The Valley and The River

The Lackawanna River takes its name from Lech –uh' wanna, a Lenni Lenapi word meaning stream that forks. The Lenapi, an Algonquian speaking tribe, inhabited the Delaware and Upper Susquehanna Valleys at the time of European settlement. The words Lehigh and Lackawaxen may also derive from the same Algonquian word.

The sixty-two mile long Lackawanna River drains a three-hundred fifty square mile watershed in four counties of northeastern Pennsylvania: Susquehanna, Wayne, Lackawanna, and Luzerne.

The River rises in two branches from a number of glacial ponds and wetlands on the Allegheny - Pocono plateau along the Wayne - Susquehanna County line. The east branch flows from Lake Lorain, Bone Pond, Independent Lake, and Dunns Pond to meet the west branch which flows from Fiddle Lake, Lake Lowe, and Lewis Lake. The east

and west branches converge at Stillwater Dam near Pennsylvania Route 171 in Union Dale.

Just below the Dam, the Lackawanna passes scenic Stillwater Cliffs and begins its forty-mile course through the northern anthracite coal field to its confluence with the Susquehanna River at Coxton between Duryea and Pittston in Luzerne County. The Lackawanna is the largest tributary to the North Branch of the Susquehanna River in Northeastern Pennsylvania. Eventually, the waters of the Lackwanna flow into and through the Chesapeake Bay.

The confluence with the Susquehanna River at Pittston

Geography

From its sources at an elevation of 2,000 feet above sea level to its confluence with the Susquehanna at an altitude of 500 feet, the Lackawanna River drops an average of 39 feet per mile. The River and its tributaries form a dendritic drainage pattern. The Lackawanna has 76 tributaries. Some of the larger tributaries are Roaring Brook, Spring Brook, Leggetts Creek, Keyser Creek, Hull Creek, Eddy Creek, Grassy Island Creek, White Oak Run, Aylesworth Creek, Rush Brook, Racket Brook and Fall Brook. The Lackawanna River watershed forms a northern extension of the Appalachian Ridge and Valley Physiographic Province. This province is characterized by long, parallel ridges. The Lackawanna\Wyoming Valley forms a physiographic boundary dividing the Allegheny and Pocono Plateau provinces. The mountain ranges which form the valley are on the west the Lackawanna Range and on the east the Moosic Mountains.

The region experienced several eras of glaciation. The last, the Wisconsin Ice Age, began to recede about twelve thousand years ago. The glacier's retreat left the plateaus covered with thousands of lakes, bogs and ponds. The 47 inches of average annual precipitation help to replenish these wetlands and ponds providing a constant or perennial flow to the Lackawanna and many of the other tributary streams in the upper Susquehanna and Delaware basins.

Geology

The real story of the Lackawanna begins long before the glaciers of the last ice age. The Appalachian Mountains are one of the oldest geological features on the planet. The mountain building occurred between 250 and 500 million years ago during the Paleozoic era. The rocks of this region were alternately parts of the ocean floor in the Devonian period, the great swamps of the Carboniferous period, or the folded and uplifted sedimentary rocks of the Permian age.

The presence of anthracite coal has had the most significant impact on our present day Lackawanna River. Anthracite was formed from the dead vegetation of the Carboniferous age swamps. As time passed, the swamps were covered with ocean sediments which form the shale and sandstone layers we find between the coal veins. The pressure and heat of the overlying sediments and the folding rise of the Appalachian Mountains gradually turned the vegetation into peat then lignite, bituminous and, here in the northeast region where the geologic pressure was greatest, anthracite-the hardest, highest carbon content of all coal.

The anthracite coal beds of Pennsylvania are known as the Llewellyn formation. In the Lackawanna and Wyoming Valleys, the coal bed sits in an older and harder rock formation known as the Pottsville or Pocono Conglomerate. This hard, whitish capstone is a metamorphic rock compound of quartz pebbles and sand. It resembles a very hard concrete. These rocks are visible around Lake Scranton, along Roaring Brook at Nay Aug Falls, and the Moosic and West Mountain ridge tops. Many large retaining walls, bridge abutments, building foundations and reservoir dams were cut from this very hard stone during the last century.

The boundary between the Pottsville and Llewellyn formations runs along the flank of the Valley about half way up the Mountains. This boundary where the coal veins outcrop was chosen as the site of many of our water supply reservoirs.

The Llewellyn Formation was once estimated to contain two billion tons of coal. Some geologists have speculated that ten to twenty billion tons once existed, but were lost over the ages from erosion and glaciers. The coal seams in the Lackawanna Valley are found at various depths, averaging 30 feet to 700 feet below the surface. The beds are in order from the surface:

Number 1 or Big bed
Number 2
Upper 4 foot
4 foot
Diamond
Rock
Rider
14 foot
New County
Clark
Dunmore Numbers, 1, 2, 3, and 4

The Number 1 bed is found on the east side of the Lackawanna River. It ranges in thickness from 10 to 20 feet in places. It pitches out at or near the surface in some locations. At one spot near the Mercy Hospital in Scranton's Hill Section, it was within 3

feet of the surface. One day in the 1890's, miners dug right into some neighborhood backyards in their quest for coal!

The deepest beds, the Dunmore Number 4 are as much as 800 feet below the surface. The Brisben shaft of the Glen Alden Company in North Scranton and the Grassy Island shaft of the Hudson Coal Company, Olyphant reached the Dunmore Number 4. Today much of the anthracite remaining in the Valley is to be found in the Dunmore veins under 600 feet of mine water.

Flora and Fauna
Plants

The Lackawanna Valley is rich in bio-diversity. Situated along a climatalogical boundary between the northern and southern regions of the eastern deciduous forest, the Valley is home to a wide variety of trees, shrubs, and herbaceous plants.

The quotation from Dr. Horrace Hollister at the preface of this book sketches an idyllic picture of what the River and its habitat was like at the beginning of the 19th Century. Hemlock, oak and pine formed the canopy forest in the valley, the understory was thick with rhododendron and laurel. Other canopy species such as the American chestnut and elm were also common and plentiful. Much of the original habitat and forest cover was cut for fuel, railroad, mining, and construction uses. Since the early 20th Century, a fairly diverse secondary forest cover has developed. There are a few locations in the Valley where small remnants of the original forest may remain. One or two acres here and there in some steep and remote glens along the mountains hold hemlocks over a century old.

Today a riparian forest shades the River and keeps its waters cool during the hot summers. River birch, red maple, willow, elm, alder and sycamore are found along many reaches of stream where mining and urban development impacts have lessened. Many of the native understory species struggle against Asiatic knotweed, a bamboo like species which has become endemic throughout the Appalachian Mountains. Knotweed grows by both seed and rhizome. The root system sends up new shoots and chokes other species out. A mass of knotweed along the riverbank may look like thousands of individual plants, but may actually be one organism. The acclamation of knotweed to the Appalachian region is a reminder that northeastern China contains a mirror image of Appalachian geologic, topographic and ecologic features; from anthracite coal, to broad-leafed deciduous forests.

The upland areas of the Lackawanna River watershed have a variety of plant communities influenced by altitude, soil depth and moisture. Wetlands occur along the River and flood plain and along the Moosic and West Mountains and the Pocono plateau. Wetlands are home to the heath family; sheep laurel, mountain laurel, high bush blueberry, as well as cattails, and water lily. Hemlock, black spruce, tamarak, swamp oak, and black gum form the canopy layer in wetlands and upper tributary stream corridors.

The ridge tops and Pocono plateau are the home of a globally unique dry site plant community: the scrub oak/pitch pine dwarf tree forest. Due to shallow rocky soils and rough weather conditions, the oak and pine which grow along the summits are

stunted and only reach five to fifteen feet in height even when fully mature. The ridge tops of the Moosic range also host an Arctic sedge community. Northern grasses, huckleberry, sheep laurel, and other heath plants grow in the sparse soil between outcrops of Pocono Conglomerate. These Arctic plants, including reindeer lichens, are vestiges of the last ice age. The Moosic range is the furthest southern habitat of these plants, commonly found in the Adirondacks or northern Quebec.

In addition to the rare scrub tree and heath community along the ridge tops, the River and watershed host a variety of plants which are listed as rare by the Pennsylvania Natural Diversity Inventory. Many of these are wetland or aquatic species. The list includes:

- 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 vanbruntiae*)
- Golden club (*Orontium aquaticum*)
- Water lobelia (*Lobelia dortmanna*)
- Purple Bladderwort (*Utricularia purpurea*)

Fisheries

The Lackawanna River was once famous for its native brook trout. Early coal prospectors and industrialists such as William and Maurice Wurts and William Henry lived on brook trout as they wandered through the Lackawanna region in search of riches in the 1820's. The iron, coal, rail and textile industries, and the towns which sprung up along the River, virtually destroyed the fishery by 1900. But the Lackawanna has all the ingredients for a vibrant trout fishery. The River has rebounded significantly during the past thirty years. When the mines shut down and the communities built modern sewer treatment systems, the recovery gradually began. The Fish Commission began stocking programs and sporting groups in the upper valley supplemented these efforts. The prevalent species of trout today is the brown trout. This European import is a bit more pollution tolerant than the native brook trout.

The Fish Commission and the Pennsylvania Department of Environmental Resources Bureau of Water Resources conducted water quality and fishery studies on the Lackawanna River in 1991. These studies documented some improvements to water quality and fishery habitat. The Fish Commission has since reclassified the Lackawanna between its headwaters and the Lackawanna Avenue Bridge in Olyphant as a high quality cold water fishery with a section between Jessup and Jermyn listed as Class "A" Trophy Trout waters. (See a further discussion of this fishery, Chapter 3)

The Lackawanna, while predominately a cold-water fishery above Scranton, also supports a variety of warm water fish such as bullhead, bass, perch, and blue gill particularly in the lower portions of the river. A number of non-game fish such as darters, dace, chub, minnow, sucker and carp are also found .

The lower three miles of river are severely affected by drainage from the Old

Forge Bore hole, which dumps over one-hundred million gallons of mine water into the River everyday. Loaded with iron, aluminum, manganese and sulfur, this water is very acidic and extremely low in dissolved oxygen. This reach of the River does not support a fishery or any significant aquatic community.

Wildlife

While the timber wolf, mountain lion, and moose are no longer found in northeastern Pennsylvania forest, the undeveloped areas of the Lackawanna watershed are habitat to over 60 species of mammals and 170 species of birds.

Black bear and white tail deer predominate with fox, beaver, muskrat, mink, and some bobcat. Many urban tolerant species such as squirrel, raccoon, woodchuck, skunk, and opossum are found in the more developed portions of the river corridor. The beaver is also becoming an urban pioneer. A beaver lodge was found along the River in the vicinity of Central Scranton in 1991.

The river otter, a Species of Special Concern in Pennsylvania, is also on the return in both the upper and lower valley.

The Lackawanna is a stop in the Atlantic Flyway for migratory birds. In addition to waterfowl such as Canada goose, a variety of ducks from mallards to mergansers visit the River on seasonal migrations. Many of the ducks are permanent residents. Great blue herons also reside along the Lackawanna. The snowy egret has recently been seen in Scranton. Osprey, a large fish hawk, are making a comeback after being re-introduced in the upper Susquehanna basin by the U.S. Fish and Wildlife Service. Coopers hawks, redtail hawk, and the great horned owl are among the predators found on occasion in the watershed. A pair of juvenile American bald eagles were sighted along the River in 1994, the first report of this magnificent bird on the Lackawanna in decades.

One group of birds which is getting more attention from wildlife biologists are the neo-tropical migratory birds such as the robin, warbler, finch, and verio. These songbirds often use stream corridors and mountain ridges in their migrations. The Lackawanna Valley and the ridge tops may be important corridors for these bird migrations.

History

The documented human history in the Lackawanna Valley goes back 9,000 years. After the retreat of the last glacier, the area was populated by Neolithic ancestors of Native Americans. Evidence of mid-archaic habitation has been uncovered near the confluence of the Lackawanna and Susquehanna Rivers. Archeologists have discovered pottery shards and primitive tools made from flints and animal bones buried in deep river sediments at the confluence.

During colonial times, the Lackawanna Valley was the southern border of the Six Nations Iroquois Confederacy. The Capouse Clan of the Lenni Lenape Tribe (also called the Delaware Indians) had an extensive village along the River and adjacent uplands in the area near Weston Field and Tripps Park. The Moravian missionary from Bethlehem, Count Zinzendorff visited Capouse in 1755. The French and Indian War and the

American Revolution saw the advance of European settlement and geo/politics that gradually subdued the Native Americans. The last effort of the Iroquois to resist occurred in 1778 when a British Tory and Iroquois war party descended on the Wyoming and Lackawanna region destroying the colonial settlements. The following year an American army under General John Sullivan marched from Easton to Wilkes-Barre and up the Susquehanna to the Iroquois heartland in the Finger Lakes region of New York. Sullivan's march destroyed the Iroquois as a political, military and economic power, and opened the way for American settlement in the upper Susquehanna Basin.

This area of Pennsylvania was once claimed by Connecticut and many early settlers were from that state. The Connecticut road into northeast Pennsylvania followed the Minisink Trail from the Delaware River near Port Jervis across the Poconos, up the Wallenpaupack Creek to the summit of Moosic Mountain and down through Dunmore to Capouse Meadows. Settlers widened the native footpaths to accommodate their ox carts. Traces of this road are visible today along the mountain top.

In 1780 the Slocum family established a grist mill along Roaring Brook. The Merrifields, Tripps, and von Storches had farms to the west and north in the villages of Hyde Park and Providence.

In the years between the Revolution War, the War of 1812 and the 1820's , the use of anthracite coal became more common. Prior to the 1820's, charcoal had been the chief fuel for both domestic and industrial purposes. The demand for charcoal led to higher prices and deforestation around the coastal population centers. This increasing demand for fuel encouraged the search for alternatives to charcoal. By the 1820's, the anthracite coal of northeastern Pennsylvania was recognized as a viable alternative.

At that time, this part of Pennsylvania was a wild and remote place. The largest towns were Dundaff near Carbondale and Wilkes-Barre. There were only several hundred citizens in these "population centers". In between, over vast distances of heavily forested mountains, were a scattering of farming hamlets with a grist mill or cross road tavern here and there.

Coal and Iron

The coal fields of the Lackawanna Valley were developed between the 1820's and 1850's by two major entrepreneurial groups. The Delaware and Hudson Company formed by William and Maurice Wurts and the Lackawanna Coal and Iron Company headed by George and Selden Scranton.

The development of the anthracite industry lead to breakthroughs in industrial and transportation technology. The Delaware and Hudson Canal Company built a canal from the Hudson River to Honesdale by 1829 and a gravity railroad from Honesdale over the Moosic Mountain to Carbondale, then known as Ragged Island. While the canal and gravity railroad went into operation in 1829, the company had opened its first mine along the river in 1822. Thus began a century of industrial manipulation and impact on the River.

Down stream and a few years later in 1840, the Scrantons, who operated an iron furnace in Oxford, New Jersey, bought the Old Slocum mill site along Roaring Brook. The discovery of iron ore along Stafford Meadow Brook near present day Montage Mountain, led the Scrantons to build new iron furnaces at Slocum

Hollow. The site had all the ingredients for industry: water power from the brook, coal deposits on the hillsides and iron ore from the mountains. Their venture nearly failed due to the difficulties in using anthracite to smelt iron and the challenges of marketing a product so far from any significant market. But in 1847 their efforts were rewarded. There was an economic trade war between England and the United States. High demand and tariffs on railroad iron dried up the supply of imported iron T rail from England. The Erie Railroad was building a line from New York City to Buffalo. The Erie was running out of rail near Binghamton and would lose its franchise if the line was not completed. By September 1847, the Scrantons were rolling T rail along Roaring Brook and shipping it north by horse and mule teams and ox carts. Farmers from fifty miles around were hired with their teams and wagons. Lackawanna iron T rail helped the Erie make its deadline with four days to spare!

Lackawanna Station

Aside from the D&H Canal and Gravity Railroad, wilderness roads like the Philadelphia and Great Bend Turnpike, which passed up the Wyoming and Lackawanna Valleys and through the notch along Leggetts Creek, were still the main transportation routes in and out of the Valley. With the success of the rail making, the Scrantons and their partners began to build the Cobbs Gap and Delaware Railroad up Roaring Brook and across the Poconos to the Delaware Valley and connections with New Jersey railroads. The Lackawanna and Western Railroad was built through the notch and northward to connect with the Erie at Great Bend. In 1852, these roads were merged to become the Delaware Lackawanna and Western Railroad (DL&W).

Railroads and canals followed the rivers and streams in and out of northeast Pennsylvania. The Lackawanna and its tributaries, Roaring Brook, Spring Brook, Leggetts Creek, and Racket Brook all had railroads along them by the 1880's. The confluence area at Coxton saw the growth of a large rail yard for the Lehigh Valley Railroad as well as a canal boat basin on the North Branch Susquehanna Canal. The DL&W rail yard developed between Roaring Brook and the Lackawanna River and is now the site of Steamtown National Historic Site. The Delaware and Hudson (D&H) rail yard developed at Carbondale where Racket Brook joins the River, the original site of Ragged Island. The Pennsylvania Coal Company Gravity Railroad and later the Erie

Railroad erected large shops along Roaring Brook in Dunmore, now the site of DeNaples Auto Parts.

Water Supply and Sanitation

While railroad and mining companies developed and communities began to grow, the impacts on the once pure Lackawanna River began to have their effects.

In 1866, the year the boroughs of Hyde Park and Providence merged with Scranton to form the city, the River was declared unfit for public water supply. The expansion of underground mining began to pollute both the River and the drinking well aquifers in the valley. The River had become a convenient depository for the new sewers being built under the streets and roads of the growing towns. This practice continued up to the 1960's!

In order to allow the economic development of the valley to continue, sources of clean potable water needed to be developed. The earliest public utilities began in the late 1850's. Gas companies manufactured coal gas and piped it to homes and businesses for lighting and cooking. Water companies were developed at the same time to serve the growing towns. As mentioned earlier, water supply reservoirs, which are still in use today were built along the Moosic and West Mountain ranges just past the geologic boundary of the coal formations. This water supply system and its adjacent watershed, now owned by the Pennsylvania American Water Company, has the capacity to supply the residents of the Lackawanna and Wyoming Valleys with a clean and abundant volume of water.

In recent years, suburban development near some of the reservoir recharge areas has caused water quality problems. Expensive water filtration plants have been built to insure a potable water supply. Concerns for the future vitality of our watershed are important considerations as we enter the 21st Century.

The wisdom of building the water supply system in the last century allowed and encouraged the growth and development of the Lackawanna Valley. The story at the other end of the pipe was somewhat different. By the 1920's, vast stretches of the Lackawanna River were dead. Mine drainage, silt and erosion from strip mines and coal breakers, municipal sewage, garbage and slaughter house waste wreaked havoc on the once pure Lackawanna, all in the name of progress.

By the time of World War I, modern sanitation practices and technology had begun to emerge. Some progressive communities developed municipal sewage treatment authorities and plants.

Primary treatment technology existed to remove wastes and chlorinate waste water before discharging into our streams, lakes and rivers. Public health regulations gave the state authority to require local communities to develop and install sanitary treatment works.

The Pennsylvania General Assembly passed a clean streams law in 1937. This act was one of the first in the country to consolidate water quality regulations and require enforcement of its provisions. It exempted coal companies, however.

Beginning in 1920, numerous civic improvement associations began to advocate the cleanup and restoration of the Lackawanna River. By the time of the Depression in the 1930's, the communities of the Lackawanna Valley did not have the taxing ability to

develop the necessary treatment facilities. Local officials resisted the efforts of citizens' groups and state bureaucrats to do what needed to be done. Many argued that the pollution from the mines neutralized the health threats from the sewage. This "two wrongs make a right" argument continued into the 1960's.

What was true for the Lackawanna Valley towns was common place around the country as well. Federal legislation eventually provided state and local agencies with the funding needed to make the construction of publicly owned sewage treatment facilities affordable. The City of Scranton and Dunmore Borough created the Scranton Sewer Authority in 1966. One hundred years after the River was declared undrinkable Ð a fitting birthday present for the city. The Lackawanna County Commissioners created the Lackawanna River Basin Sewer Authority a few years later to serve towns in the mid and upper valley as well as Moosic. Taylor and Old Forge joined with Avoca, Duryea, and Pittston Township in Luzerne County to form the Lower Lackawanna Sanitary Authority in 1975. Communities in the Abingtons formed a joint authority in 1975 as well.

Townships in the north Pocono area developed separate authorities and have encountered more problems due in part to the topography and development patterns of this growing area. With the Penn Vest program developed by Governor Robert Casey, our local governments now have the funding assistance necessary to keep in compliance with clean water requirements.

The End of Mining

The years around 1960 were significant for the Lackawanna River. On January 29, 1959 the Knox Mine Disaster occurred in Pittston. Miners were stealing pillars of coal from under the bed of the Susquehanna River when a charge set to loosen coal caused the riverbed to collapse into the mine. This disaster permanently flooded the underground mines in the Wyoming and lower Lackawanna Valley. It was the death knell for what was left of the anthracite industry. The last underground mine in the Lackawanna Valley, the Continental Mine, shut down in 1966. (This mine is now the Lackawanna Coal Mine at McDade Park).

With the end of underground mine operations, the thousands of mine tunnels and voids under the valley filled up with ground water and surface water which infiltrates through strip mines and stream beds. All this water has to go somewhere, and that somewhere is the River! From Forest City to Duryea, there are over a dozen tunnels, shafts or bore holes where mine drainage flows unchecked into the River. There are also hundreds of other locations where mine water seeps through hillside springs and into nearby streams.

The body of water under the Lackawanna Valley is known as the Northern Anthracite Mine Pool. If it were a lake on the surface, it would rival one of New York's Finger Lakes in size -- at least in area. As water percolates through the abandoned mine voids, it picks up metallic compounds and minerals from the coal and the rocks between layers of coal. Iron, aluminum, manganese and sulfur compounds are dissolved in the mine water. The mine pool water is largely anaerobic or lacking in dissolved oxygen. Mine water is also highly acidic having a pH between 3 and 6. When this water reaches the surface and enters a river or stream, the metallic sulfide compounds tend to seek out

dissolved oxygen in the surface water. The acidic sulfides bond with the dissolved oxygen and precipitate out of solution. This chemical reaction coats the rocks in and along the riverbanks with a characteristic yellow-orange coloring. Miners called the substance "yellow boy".

Flooding

On August 18, 1955 Hurricane Diane traveled up the east coast and rained itself out over the Lackawanna Valley and the Pocono Mountains. Roaring Brook and the Lackawanna River surged out of their banks during the night. Large portions of Carbondale, the Mid-Valley and Scranton were flooded out. Thousands of residents were left homeless, entire neighborhoods were destroyed, never to be rebuilt.

Flooding is a regular occurrence along rivers and streams. Sometimes there is just too much water. The Lackawanna Valley has experienced major flooding every twenty-five to thirty years, sometimes more frequently. Because flat level land is at a premium in the Valley, many neighborhoods were built on the river flood plain. The floods of 1902, 1936, 1942, 1955 and 1975 caused widespread damage along the River. Local citizens and officials pressed state and federal agencies for a flood protection program. Following the flooding of 1955, the United States Army Corps of Engineers constructed a levee and floodwall system along Roaring Brook at its confluence with the Lackawanna River in South Scranton "Flats" neighborhood.

In 1960, the Corps of Engineers built Stillwater Dam where the east and west branches of the Lackawanna join near Uniondale. Stillwater is basically a dry dam designated to hold back the immense volume of water from a one-hundred year storm event. Its capacity was tested in 1972, 1975 and again after the blizzard of the century in March 1993.

Stillwater and other state flood protection levees have provided a margin of security for many downstream flood plain neighborhoods.

The flooding which occurred after Hurricane Gloria in September of 1985 had much to do with subsequent development in the Mid-Valley and the Abingtons above the Scranton neighborhoods. In addition, several new bridges in Scranton at Albright Avenue and Poplar Street may have contributed to the 1985 flooding. The River flooded in January 1996 after a mid-winter thaw and heavy rainstorm. Citizen groups petitioned state and federal officials for additional flood control projects. Additional levees are proposed in the Plot and Green Ridge neighborhoods in Scranton and in Dickson City. Several groups of homes along the river were demolished using Federal Emergency Management Agency (FEMA) funds.

A knowledge of the natural and human history along the Lackawanna River can lead us to recognize and benefit from the dynamics of the River's relationship with us. An understanding of the River's personality can help our community realize the values we receive from this natural resource. As we come to respect the River, we can see what it offers to us for today and tomorrow.

Chapter II

The Lackawanna River Corridor Association

The Lackawanna River shares much with the great rivers of America. Like the Potomac and the Mississippi, the Lackawanna has retained its Native American name. Like so many of our majestic rivers, its waters have been tapped for power and sustenance for growing communities. The Lackawanna has also been abused; perhaps a bit more than other rivers. Yet, the Lackawanna has always had friends even in its darkest days when it ran black and red with coal and slaughter house waste.

In 1987, the Lackawanna River gained a new friend or more accurately, hundreds of friends. Several hundred citizens joined together and formed the Lackawanna River Corridor Association known by friends of the River as the LRCA.

The citizens task force which formed the LRCA defined a broad mission for the Association to promote the restoration and protection of the Lackawanna River and its watershed resources and to involve the entire community in the process. The LRCA organized as a tax exempt non-profit corporation and developed a series of goals to help the community revitalize the Lackawanna River.

The LRCA learned that the National Park Service which was developing the new Steamtown National Historic Site offered assistance to local river conservation groups. The Park Service co-hosted several public meetings during the summer and fall of 1987. These meetings led to the LRCA's Lackawanna River Citizens Master Plan (CMP). The LRCA received a challenge grant from the Scranton Area Foundation and matched state and Park Service funding to begin the CMP study in 1988.

For two years the LRCA volunteers worked with Chuck Hoffman, a noted river conservation planner and a team of Park Service and local planners. All aspects of the River were studied and problems were identified and assessed. Case studies from other rivers and communities were prepared and opportunities for projects to benefit the Lackawanna River were identified.

In 1990 the LRCA published the Lackawanna River Citizens Master Plan. The plan has four major goals and recommendations. The first is Project River Clean, a comprehensive environmental cleanup of the River including upgrades to sewer facilities, treatment of mine drainage, restoration of natural habitat and removal of trash and debris.

Public involvement, awareness and education is the second recommendation. It addresses our community's need to understand and value the River and stream corridor habitats.

Thirdly, a Lackawanna River Park or Greenway system, is proposed using river levees and abandoned railroad beds to develop a trail and access system joining existing neighborhoods, parks, and commercial areas together.

A Lackawanna River Partnership is the fourth major recommendation of the master plan. The partnership involves the LRCA, local civic organizations and private property owners working together with local, state, and federal agencies to develop clean-up, recreation and educational programs and to coordinate all efforts to improve and restore the Lackawanna River.

The work of the Lackawanna River Partnership is spelled out in the Citizens Master Plan in an Agency Action Agenda. The LRCA and its planning partners

identified all local, state and local agencies with jurisdiction or programs related to the River. These agencies include local departments of public works and sewer authorities, the various bureaus of the Pennsylvania Department of Environmental Protection, the U.S. Environmental Protection Agency, National Park Service, US Army Corps of Engineers and Bureau of Mines. Projects and responsibilities were identified and actions were recommended.

Tree and shrub planting along the River on Nay Aug Ave., Scranton

The plan has received the backing and endorsement of the Lackawanna County Commissioners and many local municipalities through resolutions adopted by councils. The restoration efforts moved ahead during 1992-1993 with the completion of a Lackawanna River Greenway Study by the Corps of Engineers, the National Park Service and the LRCA.

The Corps portion of the study developed project recommendations to deal with acid mine drainage, abandoned mine lands, river habitat restoration and innovative improvements to the sanitary sewer system. The Park Service component built on LRCA recommendations for a greenway trail and recreational access points along abandoned rail lines parallel to the River.

Since 1989 the LRCA has worked closely with the Lackawanna Heritage Valley Task Force which developed the Plan for the Lackawanna Heritage Valley and the recently created Lackawanna Heritage Valley Authority (LHVA).

The LRCA is working with the LHVA to begin building the Greenway trail. In July 1993 the first link in the trail was inaugurated with the Bridge at Heritage Valley Crossing. This one-hundred fifty foot steel arch pedestrian bridge crosses over the Lackawanna River between Blakely and Olyphant. It joins the trails of Robert Mellow Park in Blakely with Philip Condella Park in Olyphant.

The next link is underway from Mellow Park through Winton on the old Ontario & Western rail bed to Laurel Park in Archbald. In September 1994, the LRCA secured additional funds for several more strategic miles of Greenway trail in north Scranton, Archbald, Jermyn, Mayfield, and Carbondale. The Lackawanna River Heritage Trail is envisioned to follow the River for forty miles, linking with rail trails in Luzerne County to the south and Wayne and Susquehanna Counties to the north and east. There are other

trail connections possible through Leggetts Gap to the Abingtons and along Moosic Mountain, Roaring Brook and Spring Brook to the Poconos.

The efforts to increase public access to the River are but one aspect of the LRCA proposals for Lackawanna River restoration. Cleaning up the legacy of the anthracite coal industry, improvements for municipal sewer systems, and encouraging the public to become better stewards of the River and watershed resources are the other major goals of the Citizens Master Plan for the Lackawanna River.

Plans are under way with state and federal agencies to address environmental cleanup issues. The LRCA continues to work with local sewer authorities to identify problems and advocate solutions.

River Watch

River Watch is a program developed by the LRCA to monitor water and environmental quality in the River. Eight teams of volunteers regularly patrol the River looking for pollution sources and taking various samples of river water for analysis. One method of water quality analysis is macro-invertebrate collection. Macro-invertebrates are aquatic organisms such as the larval stages of caddis flies, stone flies, dragonflies and mayflies, water beetles, snails, crayfish, and other small aquatic animals. River Watchers gather these bugs and crustaceans by placing a kick net in a riffle area of the river. Riffles are shallow rapids areas where water flows swiftly over the stony substrate of the stream. Macros live in cocoons among the nooks and crannies of the river bed cobble stones. One person holds the net, another picks up stones and rubs off the algae and macros which cling to the stones' surface. The current carries the samples into the net. After three minutes of collecting at several spots in a riffle area, the River Watchers empty their net on shore into a flat tray and perform the analysis by counting and identifying the various species of creatures found in the net.

These counts and the diversity of species are general indicators of water quality. A healthy and diverse population represents good to excellent water quality. A small sample with only a few different organisms indicates poor water quality and a polluted stream environment.

In addition to macro collections, River Watchers gather water samples for bacteriological testing. The Pennsylvania American Water Company water quality laboratory performs the bacteria counts. Coliform and strep bacteria are present in sewage. High counts of these dangerous bacteria indicate the presence of sewage in the stream. Bacteriological data are an indication of how effective our municipal sanitary systems are. Unfortunately as of 1994, the data shows that there is much work ahead before the Lackawanna is consistently safe for swimming and water contact. The data also shows that there are fluctuations which could be related to combined sewer overflows during rainstorms.

A third component of River Watch is chemical testing. River Watch volunteers receive training for a number of field level chemical and physical tests. Using portable field lab equipment, River Watch looks at phosphate and nitrate counts, iron, dissolved oxygen, pH and temperature.

These criteria provide another picture of water quality which helps the LRCA assess the health of the River and pinpoint what adverse impacts may be present.

Phosphate and nitrate levels can indicate ineffective treatment plant performance, sewer line leaks or overflows and runoff from agricultural fields. The excess of iron can also indicate sewage facility problems, mine drainage or urban non-point runoff. Dissolved oxygen (DO) levels are a crucial indicator for aquatic health. DO represents free oxygen molecules dissolved among the H_2O molecules of water. When fish, macros and other aquatic creatures pass water through their gills they intercept the oxygen that is necessary to sustain life.

When untreated sewage, urban runoff, or acidic mineral- laden mine drainage enters a stream, a chemical reaction occurs which robs the DO from the stream. The oxygen bonds to chemicals or metals in the sewage or mine drainage and is unavailable to support aquatic life. If the discharge is small and the water quality of the stream good, the dilution and downstream flow of the stream current gradually allow a recovery of DO.

In its forty miles from Stillwater to Coxton, the Lackawanna runs a gauntlet of twelve major mine drainage outfalls, one-hundred forty combined sewer overflows, five major sewer plant discharges and thousands of urban non-point pollution sources.

Our roads, parking lots, junkyards and construction sites drain pollutants into the River. By the time the Lackawanna flows into the Susquehanna at Duryea, it is nearly biologically dead and stained bright orange with iron sulfide deposits from the mine drains.

This is the challenge that River Watch, the LRCA, the people of the Lackawanna Valley, our public agencies and private institutions are facing head on. With the watershed approach developed in the Citizens Master Plan we are starting to see some positive results.

River Watchers are identifying everyday problems like sewer line leaks, incidental dumping, erosion and sediment problems. Sewer authorities are responding with better maintenance. DEP is responding with stronger review and incorporation of progressive requirements on our sewer systems. Other federal and state agencies are giving the Lackawanna the serious attention it deserves. More and more local citizens are coming to discover the River as a wonderful and valuable part of the community.

Another way the LRCA involves our community with the River is through the community planning, cleanup and trail projects. The LRCA promotes good municipal planning and zoning. The LRCA and its board of directors have participated in updating community plans and zoning ordinances in several communities. The LRCA sponsors seminars and lectures by well known community planning specialists and designers to focus on the relationship of environmental values, aesthetics, economic development and quality of life.

The practices of good development and community design are evident where the natural resources, open space, woodlands, wetlands and riparian environments of a community are protected and integrated with the built environment of roads, buildings and public infrastructure. Responsible development insures that erosion and sedimentation control measures protect our streams from sediment pollution. Responsible development maintains the natural habitat of a community or building site as much as possible.

The LRCA community planning mission advocates these types of development practices as a way to improve social and economic opportunities for future Lackawanna Valley residents.

LRCA volunteers on Project River Clean, at the Roaring Brook conflunece in Scranton

The LRCA also promotes River Clean and Heritage Trail building projects. These roll up your sleeves, volunteer based efforts have resulted in hundreds of tons of trash and debris being picked off the river banks or pulled out of the River. From beer cans to spare tires to shopping carts and the kitchen sink, you name it and River Clean volunteers have probably hauled it out of the River and heaved it into a dumpster.

Heritage Trail projects involve volunteers and neighbors in developing site improvements after the trash is removed. Some work focuses on building trails and access points, installing signage, retaining walls, drainage work and grading. Other work involves tree planting, stream habitat improvement and stream bank stabilization. All of this volunteer work helps to improve the environment and enhance the neighborhoods where it occurs.

The LRCA initiated the Lackawanna Valley Conservancy program in 1993. Through the Conservancy the LRCA can hold title or conservation easements on river corridor or watershed property. Land conservancy or land trust organizations have been developed as a way to involve private property owners in meeting the communities' natural resource conservation needs. The LRCA conservancy program works closely with other conservancies and trusts in northeastern Pennsylvania.

A conservancy or land trust is a non-profit community organization which holds title or easements on private property for conservation purposes. An easement is a legal document which describes the property or portion of property which the owner and conservancy agree to protect in its natural condition forever. The easement is made part of the property's deed.

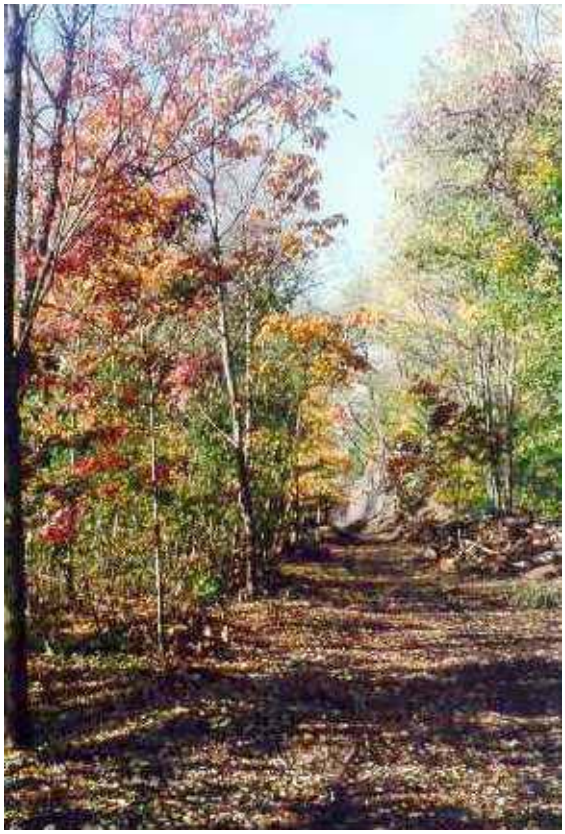
Conservation easements benefit both the private property owner and the public. The owner may request reduction in the assessed value of the property since it can no longer be developed in a commercial sense. Value of the easement can be considered as a tax deductible contribution for income and estate tax benefits.

The public benefits by having the property left in its natural condition. The property remains part of the fabric of natural habitat conservation space forever enhancing the community's quality of life.

The Lackawanna Valley Conservancy can also accept complete title to property. The long term goal of the Conservancy program is to assist local communities and

property owners in preserving the valuable woodlands, wetlands, river and stream corridors of the valley. The preserved areas can serve as amenities to innovative new residential and mixed use subdivisions. The Lackawanna Valley Conservancy program can help the community focus on appropriate economic and conservation development projects into the next century and beyond.

The most important aspect of the Lackawanna River Corridor Association is that it is a community and membership based organization created by citizens of the valley to restore and conserve the River and watershed resources. While the LRCA works with government agencies, the majority of its funding and support comes from individuals, families and businesses in the many towns from Duryea through Scranton to Archbald, Carbondale, and Forest City. The LRCA encourages your membership and support.



The Providence Reach of the Lackawanna River Heritage Trail in Scranton, owned and managed by the Lackawanna Valley Conservancy

Chapter III

Access and Trails

There are numerous points along the Lackawanna River where the river or the abandoned railbeds, trails and footpaths that follow it are easily accessed from a nearby street, parking lot or park. The work to create the Lackawanna River Heritage Trail is presently underway. At this time, however, much of the river corridor is private property.

Many miles of rail-trail along the River have traditionally been used by local residents to access the River for walking, cycling, fishing or canoeing. The property owners are protected from liability under Public Law 1860, which limits liability when private property is open without charge for public recreational access.

Lower Corridor and Confluence Area

The confluence of the Lackawanna and Susquehanna rivers can be viewed from Susquehanna Avenue in West Pittston. Visible above the confluence is Campbell's Ledge, a scenic cliff cut away by the glaciers, which carved the water gap in the West Mountain range. To reach the confluence itself, turn onto Coxton Road off Main Street between Duryea and Pittston junction. After passing under the railroad tracks and crossing the River on the Coxton Road bridge, turn left and follow the dirt road towards the Coxton rail yards and park where the road bears left under the rail yard bridge. Walk along the footpath on the Lackawanna's west bank for a thousand feet to the confluence. Here you will encounter topsoil pits and a heavy stand of riparian forest with large river birch, maple and sycamore trees. Be careful during wet weather or high water flows! You may notice the orange coloration in the waters and shoreline of the Lackawanna River, this is the "yellow boy" or iron oxide staining from the mine discharge upstream. The orange plume follows the east bank of the Susquehanna down through the Nanticoke Gap.

Back at Coxton Road, the Duryea mine outfall is visible entering the Lackawanna on the east bank. Just up Coxton Road, you will see the Lower Lackawanna Sanitary treatment plant. Several hundred feet past the plant, Coxton Road turns left to follow the Susquehanna to Newton Township and Falls. To the north at this spot a reach of abandoned Lehigh Valley Railroad heads up through several hundred acres of flooded topsoil pits to Stevenson Street in Duryea and Connells Patch in Old Forge. There are numerous footpaths through this area known locally as the Duryea Swamps. While the River is not fishable, there are channel cats and other warm water species that have been stocked in the flooded topsoil pits. The Plan for the Lackawanna Heritage Valley envisioned a confluence park or a waterfowl/wildlife management area as a long term use of this region.

Heading upstream, turn west off Main Avenue at Union Street just north of the Old Forge/Duryea Borough line. (That is also the Lackawwanna/Luzerne County border.)

Park in the empty lot at Main and Union Streets next to the Popple Brothers

Colliery sign. Walk over the Union Street bridge and look upstream. This reach of river exhibits numerous outcrops of the Moosic anticline, a folded geological structure which runs perpendicular to the Lackawanna Valley syncline.

The waters of the Lackawanna upstream are a crisp gray blue with froth and foam from the rapids as the River courses over the crest of the anticline. But, you will notice something else from the railing of the Union Street bridge. A concrete box culvert appears along the west bank. Just above the bridge abutment, the infamous Old Forge Bore Hole pours over one-hundred thirty million gallons of mine drainage a day into the Lackawanna.

While there are a dozen smaller tunnels draining mine water into the River from Peckville to Forest City, the Old Forge Bore Hole is the granddaddy of mine drains on the Lackawanna! The River and shoreline turn a bright orange, the coloration noticeable downstream. The Old Forge Bore Hole drains all of the flooded mine tunnels from Olyphant through Scranton and Taylor. The drain was installed by the Bureau of Mines in 1960 after the Glen Alden, Moffat, and Hudson Coal companies turned off their pumps and underground mining ended.

From Old Forge and Moosic to Taylor, the Lackawanna River is bordered by two active railroads. On the west, the Pocono Northeast line runs from Taylor to Pittston on the former DL&W Bloomsburg Branch. On the east, the Delaware and Hudson/Canadian Pacific runs from the Taylor Yards, crosses the River on an old Central Railroad of New Jersey truss bridge and runs through Moosic. Due to the active nature of these rail lines, only the adventurous walker or cyclist should venture through this reach of river corridor.

There are extensive flood control levees in Moosic near the confluence of Springbrook. Footpaths along the Moosic levee can be accessed near the Little League field off Dupont Street, turn west off Main Street. There are two river corridor access areas in Taylor. The first is from the cemetery below East Atherton Street, three blocks east of Main Street. This access to the Taylor-Old Forge river corridor offers several views of the Lower Lackawanna Gorge. High hillsides, active rail lines, and abandoned mine lands present hazards to be considered before venturing into this area - but the views, solitude and wildlife observation opportunities can reward the cautious day hiker.

The upper Taylor access area is located at Depot Street, an eastern turn off Main near the old Moffat breaker. Depot Street crosses the very active D&H/CP Railroad yard at the Taylor station. Watch out for the locomotive! Switching operations may delay your crossing of the tracks. Follow the dirt-surfaced roadway passing to the left of the station building and you will encounter the abandoned Central Railroad of New Jersey and the Lackawanna River. Parking space is available at this location. To the south, the rail bed ends at a junction with the active D&H/CP tracks as they pass under the Taylor - Minooka bridge.

The Scranton Reach

Looking north you will see a metal gate and three small girder bridges spanning Keyser Creek which flows into the River at this spot. The CNJ rail trail follows the River for three miles to Lackawanna Avenue in Scranton. The trail is open and passable by foot or bicycle. The trail passes a recently abandoned strip mine site. A climb to the top of the mine site will open a vista looking upstream into South Scranton. The Scranton

Sewer Authority treatment plant is visible across the River.

For the next mile and a half, the trail passes below the Baker Colliery, a large red ash processing site. The Elliot plant occupies the eastern bank of the River here. This industrial complex sits on the old Scranton Steel Mill site dating back to the 1870's. Some of the slag piles from the steel works are encountered along the CNJ Trail. The Elliot plant itself was built by the Scranton Plan project of the Chamber of Commerce in 1943. Financed through the War Production Board, the plant produced wings for Boeing B-29 superfortesses that helped end the war in the Pacific.

When Elm Street in South Scranton is approached, the access to the trail is partially blocked by cars at Danny's Garage. There are also guard dogs here so be careful! The acquisition of the CNJ property for the Heritage Trail occured in 1998, opening the right-of-way at this location. The Pennsylvania Power and Light Company is installing the new Hoffman - Minooka high voltage line along 1,600 feet of CNJ in the vicinity of Elm Street. The CNJ trail is now open from Elm Street north to 7th Avenue.

From Elm Street the CNJ passes north along a ledge above the River. The ledge is an outcrop of sandstone and shale of the Llewellyn formation. Watch out for poison ivy along this area. The William T. Schmidt Recreation Complex, also known as the Southside ball fields, lies at the upper end of this CNJ Trail segment along Broadway Street. The ball field was once the site of the CNJ roundhouse and engine yard.

Roaring Brook, the largest tributary to the Lackawanna, joins the river to the south of the ball field on the east bank. Roaring Brook and the River itself are encased in concrete and riprapped levees through the South Scranton area. These flood works were built in the 1960's in response to the Hurricane Diane floods in 1955.

You can see the levees and flood walls up close. They are easily accessed to the rear of the Southside Shopping Plaza. Cross the Elm Street bridge to the CNJ to view the graffiti murals painted on the floodwalls recently.

Going north across Broadway Street, the tennis courts and swing sets of the Schmidt Recreation site lay to the riverside of the trail and to the west is the Lower Bellvue neighborhood. Past this area the trail becomes rugged and a cliff rises to the Bellvue neighborhood. Across the River is the old Scranton Gas Works.

Lackawanna Ave. bridge with former CNJ Passenger station at top left

The CNJ trail terminates between Bridge 60 and Lackawanna Avenue in Scranton. Bridge 60 is the large railroad bridge crossing the River at Steamtown. Do not cross this bridge, access is restricted. The city recently removed the old Cliff Street bridge nearby. Much of the river corridor through the central Scranton area has limited access due to steep slopes, retaining walls and active rail lines.

The river corridor is accessible along Love Road on the west bank off Olive Street near the new Mulberry Street Bridge. In 1997-98, the Corps of Engineers will be constructing a levee from the new bridge upstream to North Scranton near Diamond Avenue and Wood Street. The levee will have a trail on it to facilitate an important link in the Lackawanna River Greenway.

The LRCA and LVC have developed a half-mile of the Trail on the O&W Railway from Market Street (next to Rudy's Junkyard) to Depot Street and Dean Street in the Plot. Access this beautiful reach of River Trail from Depot Street or from the LRCA office in the Silkman House, the Providence Branch of the Scranton Public Library, 2006 North Main Avenue.

The Mid-Valley to Carbondale

For many years Dickson City residents have enjoyed some measure of flood protection and a recreational trail along a levee constructed by the state after the 1942 floods. This trail is easily accessible along Boulevard Avenue from the Elm Street Park near where Boulevard Avenue crosses the River from lower Throop or from Palonia Park closer to Dickson City corners. The Marjol superfund site and remnants of the Eddy Creek Colliery present hazards and restrict access on the east bank of the River from Throop to Olyphant.

The next easily accessed section of the River is at the Lackawanna Avenue bridge by the Anchor, at Blakely Corners where the borough boundaries of Olyphant, Dickson City and Blakely meet. Hulls Creek, which rises in Scott Township enters the River here.

Blakely and Olyphant enjoy some of the most accessible reaches of river in the valley. Philip Condella Park in Olyphant has a recently improved trail which passes along the river corridor through a successional riparian forest. At the northern end of Condella Park the trail crosses the River to Robert Mellow Park in Blakely.

The Heritage Valley Crossing bridges the River to join the parks and is the first official link in the Heritage trail. When you cross the bridge notice that each of the three-hundred native oak planks has a memorial plaque. The plaques recognize the many individuals, businesses or families who have helped to fund the bridge.

Robert Mellow Park is easily accessible off Main Street and Pa Route 247 just beyond Valley View Cougars Stadium. North of Mellow Park the River is accessible from upper Peckville to the Winton section of Jessup on the abandoned Ontario and Western Railroad. The Lackawanna Heritage Valley Authority worked with local municipalities and the LRCA to develop the Heritage Trail from Blakely to Archbald along the River. This reach of trail opened in October 1999.

The O&W trail is encountered at the intersection of Hill Street, Jessup and North Main Street, Peckville where "Deckers Bridge" crosses the River. After a brief walk north to the vicinity of a PP&L substation you will notice a beaver dam along the river bank. The orange coloration of mine drainage is evident in the wetland. Walk over the

power line right of way towards the east at the upper end of the wetlannd and you will see the Gravity Slope acid mine drainage outfall, source of the orange water.

The O&W continues on to Winton Street, to the rear of the Riverside Estates subdivision. The Heritage Trail will follow Winton Street across the River to River Street. Follow River Street to the end of pavement and you will find "Dark Valley Road", a dirt path running on high ground between the River and the Lackawanna County Rail Authority's main line. Here the trail follows along Dark Valley passing below the Archbald Co-gen plant before arriving at the dead-end of Laurel Street in Archbald.

O&W Trail near the Jessup/Archbald municipal line

The David Maslyar Park on Laurel Street in Archbald is an excellent river access and trail head location for a variety of recreational activities. The Lackawanna River fourteen-mile Canoe-a-thon run starts at Maslyar Park. There is plenty of white water in the four miles down to Peckville. This reach of river is the heart of Class "A" Trophy Trout waters.

Maslyar Park is also reached by turning east off Main Street, crossing the Monroe Street bridge and turning right on Laurel. The park is one block south.

The Heritage Trail passes through Maslyar Park and back onto the O&W rail bed by an old bridge abutment. The trail is open except for one block near the new borough building.

After passing Gilmartin Street the O&W/Heritage Trail is open all the way to Delaware Street in Jermyn. Watch out for the puddles! This reach of trail passes the LRBSA Archbald plant, the confluence of Aylesworth Creek, and the remains of Powder Mill Dam. River access is spotty through Jermyn and Mayfield. Flood control channelization and a drop structure (a concrete waterfall) are an impediment to canoe or kayak passage at Poplar Street in Mayfield. Both sides of the River are accessible from

just above Poplar Street. A trail runs on the east bank levee from the borough hall to the Valley View Elementary Center. The O&W rail bed runs along the west bank to the Lackawanna Valley Heritage Center near Rte 6.

The O&W rail bed has been sold off and built upon through Childs into Carbondale on the west. The east bank has remnants of coal mine rock dumps. It is steep and inaccessible to Cottage Avenue.

The River is easily accessed at many points through downtown Carbondale. We can pick up the O&W again behind the Ben Mar Restaurant along North Main Street. Racket Brook enters the River here. This was the location of the D&H Gravity Railroad's shops in 1829. John Street follows the D&H along the River to a bridge crossing to the west bank at the D&H yards. The O&W passes parallel to the River here, running for one mile to Belmont Street and Route 171 near the Gentex Plant in Simpson.

Simpson to Stillwater

The River is accessible in Simpson at the upper end of the Carbondale yards where Morse Avenue crosses to the west just off Route 171. This leads to the upper end of the Lackawanna County main line and the beginning of the thirty-one mile D&H rail trail to Forest City, Union Dale, Thompson and Starucca.

The O&W follows the east bank of the Lackawanna from Simpson to Stillwater. It is used to access the River and adjacent private hunting tracts in the vicinity of Panthers Bluff Creek. To access the O&W from Route 171 north, turn right on Reservoir Road immediately before the Simpson viaduct and turn left immediately onto Homestead Street. Drive 300 feet and look for the O&W trailhead access to the left by the sign. The O&W is accessible as part of the Rail Trail Council's thirty-two-mile D&H Trail from Simpson through Forest City Lanesboro on the Upper Susquehanna River.

The hiker or cyclist will encounter Panthers Bluff Creek about two miles north of the trailhead at Simpson. The Creek falls down a steep ravine from Moosic Mountain. Hemlock and rhododendron overhang the creek as it cascades down the mountain. For the adventurous there is a remnant of Shepards Crook turn on the D&H Gravity on the mountain above.

Signage at the trailhead of the O & W rail-trail, Simpson

Just to the west of Panthers Bluff, along the D&H, there is a scenic double waterfall on the River. A large outcrop of sandstone splits the River in two; below the falls is a deep pool. Unfortunately, this spot has become popular with the party crowd. Watch out for litter and broken glass.

The D&H and O&W run parallel to Forest City. There is a lot to explore in this area. The D&H crosses the River back and forth several times and the bridges are dangerous. Access to this remote area is restricted. Be careful.

The rail trails cross PA 247 on either side of the River between Forest City and Browndale. The Rail Trail Council of Northeast Pennsylvania (RTC) now owns the D&H. The D&H and portions of the O&W are open for mixed recreational trail use. Call the RTC office at 570 785-7245 for updated information and a map.

Above Forest City, PA Route 171 follows the River through the "Lackawanna Water Gap" at Stillwater Cliffs. Some of this area is accessible from the O&W trail where it intersects Route 171 one and a half mile north of Forest City. Again, you should respect posted private property. However, some of the rail bed is in common local usage.

The "Lackawanna Water Gap" is the passage the River takes off the Allegheny/ Pocono plateau where it rises. The gap was carved by glaciers during several ice ages. The River follows its course into the great valley beyond. Old Stillwater Lake, part of the water supply of Forest City, lies to the north of Stillwater Cliffs where Route 171 crosses to the east side of the River. This lake was reduced in size when Stillwater Dam was built one mile north in 1960. The Stillwater Lake area is prime waterfowl habitat.

Follow 171 north to reach Stillwater Dam. There are parking areas, picnic tables and pedestrian access at the dam. The east and west branches of the Lackawanna join at Stillwater. The dam carries a shallow pool which floods the confluence. During the snow melt from the Blizzard of the Century in 1993, Stillwater was filled to the brim showing that even the best flood control dam has an upper limit of effectiveness.

The village of Union Dale is located at the tail waters of the dam. The upper watershed spreads over eastern Susquehanna and northern Wayne County. Elk Mountain with its well known ski area raises to the west at 2,684 feet above sea level. It is the highest point in Pennsylvania between the Susquehanna and Delaware Rivers. The headwaters plateau area is one of the more scenic areas of Pennsylvania with numerous glacial lakes, ponds and wetlands, small village crossroads and bucolic farmsteads scattered among wooded hillsides. All season recreational opportunities abound.

A final note on accessing the Lackawanna River corridor: forty miles of river offer a variety of recreational and aesthetic experiences. Many areas are open for common local usage. The LRCA encourages responsible and descrete use of the River and its corridor. Please respect private property and use caution in remote areas. During the next several years as the Heritage Trail and D&H Trail are developed, access to the river corridor will be greatly improved.

Chapter IV

Fishing

The Lackawanna River is a freestone river located in the beautiful rolling hills of Northeastern Pennsylvania. Its average width is approximately fifty to sixty feet. The many public parks along the banks of the River make it a perfect place for the entire family to enjoy a day of fun. The River offers a wide variety of water conditions. There are riffles and deep runs for the more experienced angler and deep quiet pools that are big enough for even a child to learn to fish on. The average size trout in the Lackawanna River is nine to fourteen inches, with many brown trout in the eighteen and twenty inch category.

From their beginnings in Wayne and Susquehanna County, the east and west branches come together at Stillwater Dam where they form the main branch. The main branch is approximately 40 miles long to its confluence with the Susquehanna River in Pittston, Pennsylvania. The east and west branches are small trout streams which receive stockings of trout yearly. Fisherman will do well in the early season using bait such as worms and minnows. Fly fisherman find that nymphs and streamers will produce many trout early, but may find casting a little difficult in this heavily wooded area. As the seasons pass and the water levels get lower, you will find it necessary to use light line on these low waters. But do not overlook these waters because there are always many holdover trout even through winter.

The main branch of the Lackawanna River can be divided into three sections according to classification.

The first section is governed under Pennsylvania statewide regulations and consists of both stocked and unstocked water. This area is approximately fifteen miles long and can be accessed from many public roads. The stocked section runs from Old Stillwater Dam downstream through Fell Township to the lower Carbondale city limits. It receives thousands of brown and brook trout annually. The Pioneer Day committee sponsors an annual stocking and children's fishing derby in Carbondale. The area from Carbondale city limits, downstream to White Oak Creek, Archbald is "Class A Wild Brown Trout Water" and does not receive any hatchery fish. If you want to fish in a secluded area without the noise of the city, this area is for you. The urban area through Carbondale is also a highly productive piece of water. Fishermen will find all of the first section productive in the early season using baits ranging from worms and minnows to nymphs and streamers. When the days grow warmer and the river levels recede after the spring thaw, one will find dry fly fishing with a caddis or mayfly imitation to work very well. In late summer and fall look for trout rising to small midge flies or terrestrials like ants, grasshoppers, crickets and beetles. In the late fall and winter it is time to change your bait again to nymphs and minnow imitations.

The second section is unstocked and is classified by the Pennsylvania Fish and Boat Commission as "Class A Wild Brown Trout Water. It is regulated as Trophy Trout Water and fishing is confined to artificial lures or flies only. It is open to fishing year around with a creel limit of two trout over fourteen inches daily during the regular trout season. This 5.2-mile stretch runs from the White Oak Creek to the Lackawanna Avenue bridge in Olyphant. The wild brown trout in this area are doing remarkably well. The Fish Commission is following up with stringent enforcement of the trophy trout

regulations to prevent over fishing although the best regulations come from the conservation minded angler. The practice of catch and release fishing can serve to improve and preserve this outstanding fishery for many years to come. You can get access to this area at the Archbald Borough Building, Laurel Street ball field, Winton Street bridge, along the old railroad bed near Constitution Avenue bridge "Deckers Bridge", the Robert Mellow Park, Peckville or the Philip Condella Park in the flats section of Olyphant, and also the Lackawanna Avenue bridge at Olyphant /Blakely corners.

You will find that a day on the Lackawanna as early as January will be well worth it, you can catch some big browns on hard body lures such as spinners or plugs. Fly fishermen will find that a well presented streamer or nymph pattern will take many trout. You can start looking for surface activity in the form of caddis flies on warm afternoons in late March and early April. Spin fishermen can use the fly and bubble technique. The best hatches on the Lackawanna River come in mid May through June depending on the weather. One will find hatches of light cahill, to be the best of the mayflies. You will also see some blue winged olives, blue quills, march browns, and a variety of caddis coming off the river. Do not forget terrestrial patterns in the late summer and fall. When the water levels drop you will find most trout feeding in the deeper holes on tiny midge patterns as small as size 26 and 28. As an alternative, try a pattern like a griffiths gnat in sizes 18 or 20. You may want to confine your fishing to early morning and late evening. This is also better for the fish because they can not afford to waste their valuable energy fighting a fisherman on a hot summer afternoon.

Beginning at the Route 81 bridge on the Scranton/Dickson City line, the Lackawanna changes gradually to a warm water fishery. The remaining 19.2 miles are unstocked due to higher water temperature especially in the area below Scranton. However, fishing can be good in the area below the Olyphant Bridge, in Dickson City near the Lackawanna County Public Services Building, and near the bridge on Boulevard Avenue. Further downstream in Scranton you will find some decent trout near the confluence of Leggetts Creek, below the Parker Street Bridge in the Green Ridge area, and by the Broadway Street Bridge below Steamtown National Historic Site. In Dickson City there is a children's Fishing Derby sponsored by the local sportsmen's club. The club stocks several hundred trout annually with many fish remaining after the derby is finished. The angler who is not afraid to venture away from the derby sites may have some peaceful and successful days catching the trout that stray. Many of the same hatches can be found in all of section three as in sections one and two.

In the future, the fishery below Dickson City can only become better with public awareness of the potential the Lackawanna River holds.

For more information on fishing the Lackawanna River see your summary of fishing regulations published by the Pennsylvania Fish and Boat Commission. For more information on hatches see Pennsylvania Trout Streams and Their Hatches by Charles Meck.

Chapter V

Canoeing

The Lackawanna River offers some exciting challenges and opportunities for both novice and experienced river runners. The River is navigable by canoe and kayak for most of its course from Forest City to Pittston when sufficient flows are present. High flows occur during early spring with snow melt and spring rain freshettes. During summer occasional wet weather with thunderstorm events will raise the River to runable depth for several days after a one to two inch storm event.

Wet weather in late fall can also bring runable conditions with the changing colors of autumn.

The US Geological Service (USGS) maintains three stream flow gauging stations on the Lackawanna. They are located at Stillwater Dam, Archbald and Old Forge. These automatic stations are wired into the US Weather Bureau Susquehanna Basin Forecast Center in Harrisburg. You can visit the LRCA website at www.lrca.org for a link to USGS and weather bureau real time stream gauge information.

The Stillwater gauge should read 2.6 feet, the Archbald gauge, 2.9 feet to meet minimum canoeing requirements. Optimum readings of 3.5 feet at Archbald will guarantee a swift and exciting run. Readings above 3.8 feet indicate stronger velocities. Novices should not attempt passage when the River gauge exceeds 3.8 feet at Archbald. Experienced river runners and kayakers should use discretion at levels above 4 feet.

The upper River from Stillwater to Route 171 bridge at Simpson is more appropriate for kayak runs. There are some outstanding ledges near Panthers Bluff in Simpson. At one location the River splits around a large sandstone and conglomerate outcrop with a four-foot cascade on each channel. The upper Lackawanna has class two and three white water.

From Carbondale to Archbald the River picks up in width and depth. A flood control dam and leeve at Mayfield and the remnants of Powder Mill Dam at the Woodlands in Jermyn are serious restrictions to canoe passage. The Jermyn mine tunnel is evident just above Powder Mill Dam.

LRCA Canoe-a-thon, 2000

The Lackawanna River Canoe-a-thon, a fourteen mile timed canoe and kayak race has been run from Laurel Park in Archbald to Schmidt Field in Scranton since 1973. The LRCA has sponsored the run since 1987. Low water during 1992 and 1993 forced cancellation of the event. The Caonoe-a-thon course presents challenges for both the novice and more experienced paddlers. The first five miles from Laurel Park through Winton, Peckville, Jessup and Olyphant have several outstanding class one and two riffles and sluices with a couple of ledges near Mellow Park in Peckville.

The gradient on the River levels out somewhat from Olyphant, Dickson City and North Scranton. There is an interceptor sewer pipeline crossing the river bed between Boulevard Avenue bridge and the LRBSA plant in Throop. The pipeline acts like a small dam but is runable.

The Greenridge - North Scranton area has several long pools which average 18 to 24 inches deep with a slow current during low flows; this reach like one in Dickson City was channelized after flooding in the 40's and 50's.

The River drops through the "Scranton Canyon" from the Mulberry Street bridge, down below central city to South Scranton. The levees and flood walls along South Washington Avenue channel the River where Roaring Brook, its largest tributary, joins from the southeast. The Schmidt Field river access ramp is on the west bank just before the Roaring Brook confluence. The run from Scranton to Moosic will take you through the wooded "lower Lackawanna Canyon" between Taylor and Old Forge. There are some class one riffle runs in this reach, as well as great wildlife habitat. After passing Springbrook Creek confluence on the east bank, the River turns sharply to the west. Lonesome Road is on the east bank, the former Lehigh Electric superfund site is on the west.

From Lonesome Road at the Old Forge/Moosic line to Union Street at the Old Forge/Duryea line, the Moosic anticline rises into the river bed. A series of class four ledges and drops requires considerable skill to navigate, a gear portage is recommended. The experienced canoeist or kayaker will enjoy this run, the most exciting half mile on the lower Lackawanna!

Aside from the Class IV white water, the River takes another 90^{o} turn to the south between Main and Union Streets. The west abutment of the Union Street bridge hosts the concrete culvert where the Old Forge Bore Hole dumps mine water into the River. From here through Duryea to the Susquehanna confluence at Coxton the Lackawanna runs orange.

Below Stevenson Street in Duryea the River splits into several channels. The west channel is the deepest, with class two riffles. From Coxton Road to the confluence the Lackawanna forms a deep estuarial pool spilling into the Susquehanna over a broad alluvial fan.

This brief description of the Lackawanna is intended to provide a minimum of information on the River's navigability. For additional information, seek out someone who has run the River recently. Keystone Canoeing by Edward Gertler is recommended reading for anyone who would paddle the streams of Pennsylvania. Gertler describes the Lackawanna in a straight forward manner and he includes several useful maps as well. (see bibliography)

The Lackawanna River Corridor Association can on occasion provide updated information on river flows. In addition to comments on put in and take out points in Gertler's book, the Lackawanna River Guide suggests these locations for launch and

retrieval along the Lackawanna: Schoolside branch PennStar Bank, Route 6 Carbondale; Chestnut Street bridge Mayfield (to portage the Mayfield flood works put in behind the Martin Media billboard one block downstream of the Poplar Street Bridge where the flood wall transitions to a levee structure); Maslyar Park in Archbald; Mellow Park, Blakely; Lackawanna Avenue bridge, Olyphant/Blakely Corners; Boulevard Avenue bridge, Dickson City/Throop; Albright Avenue bridge, Greenridge/North Scranton; William Schmidt recreation field, South Scranton; Lonesome Road, Old Forge; Susquehanna Avenue, West Pittston.

Lastly, remember to wear an approved personal floatation device at all times on the water. Protective headgear and clothing are recommended for white water areas. Respect the River and private property along the Lackawanna River corridor.
Keep the bow of your canoe pointed downstream and have a great run.

Epilogue

The Lackawanna River Valley is undergoing a metamorphosis as we enter the 21st Century. The community initiatives which have developed for River restoration, the Lackawanna Valley Conservancy, the rail trail programs, and the Lackawanna Heritage programs all offer opportunities to create new processes, technologies and relationships with our valley environment. The opening of the Robert P. Casey Highway offers a challenge to our communities to create new economic opportunities.

How can we reach a balance to conserve the essential natural resources, restore the damaged landscape of the valley and promote beneficial growth to insure useful employment for the future? Understanding the value of the Lackawanna River watershed is crucial to maintaining a long-term quality of life for our children.

Our responsibilities as stewards of the Lackawanna River watershed include guiding our economic activities while we conserve and restore our resources. The need for informed public decision making is paramount. The active participation of citizens and the socially and ecologically responsive involvement of public agencies, private institutions and businesses can insure that a collective democratic wisdom will guide our decision making.

The Lackawanna is more than a stream that sustains us, in many respects it is our connection to the global village. On this blue planet water is a carrier of messages. What messages do we send downstream? Yesterday and tomorrow are present in the decisions we make today. Perhaps we can share a tradition with the people who named our River. Shall we look ahead through the next seven generations? What will the River tell us then?

Appendix

Resource Agencies
Government Agencies

The Lackawanna County Conservation District
1300 Old Plank Road
Mayfield, Pennsylvania 18411
Phone: 1 (800) 573-7701 fax (570) 281-9497

The Lackawanna County Regional Planning Commission
200 Adams Avenue
Scranton, Pennsylvania 18503
Phone: (570) 963-6826

The Lackawanna Heritage Valley Authority
1300 Old Plank Road
Mayfield, Pennsylvania 18433
Phone: (570) 876-6188 fax 876-6199

Lackawanna River Basin Sewer Authority
Post Office Box 9068
Dickson City, Pennsylvania 18519
Phone: (570) 489-7563

Lower Lackawanna Sanitary Authority
Coxton Road
Post Office Box 67
Duryea, Pennsylvania 18641
Phone: (570) 655-1665
Scranton Sewer Authority
Business Office
307 North Washington Avenue
Scranton, Pennsylvania 18503
Phone: (570) 348-5330, Information - (570) 348-5337, Line maintenance

Pennsylvania Fish and Boat Commission
3532 Walnut Street
Harrisburg, Pennsylvania 17105
Phone: (717) 657-4542

Pennsylvania Department of Environmental Protection, Regional Office
2 Public Square
Wilkes-Barre, Pennsylvania 18701
Phone: (570) 826-2511, Information and Emergencies
Website: www.dep.state.pa.us

Non -Governmental Agencies

Alliance for the Chesapeake Bay
225 Pine Street
Harrisburg, Pennsylvania 17101
Phone: (717) 236-8825
www.acb-online.org

American Rivers
801 Pennsylvania Avenue Suite 303
Washington, DC 20003

Chesapeake Bay Foundation
214 State Street
Harrisburg, Pennsylvania 17101
Phone: (717) 234-5550
www.cbf.org

The Lackawanna River Corridor Association
Post Office Box 368
Scranton, Pennsylvania 18501-0368
or 2006 North Main Avenue
Scranton, Pennsylvania 18508
Phone: (570) 207-7608 / 7609, fax: (570) 207-7590, e-mail: lrca@epix.net
www.lrca.org

The Lackawanna Valley Conservancy
Post Office Box 368
Scranton, Pennsylvania 18501-0368
or 2006 North Main Avenue
Scranton, Pennsylvania 18508
Phone: (570) 207-7608 / 7609 , fax 207-7590, e-mail: lrca@epix.net

Pennsylvania Organization for Watershed and Rivers (POWR)
600 North 2nd Street
Harrisburg, Pennsylvania 17101
Phone: (717) 763-9923, e-mail: wpomeroy@aol.com

River Network
520 SW Sixth Avenue, Suite 1130
Portland, Oregon 97204-1535
Phone: (503) 241-9256
www.rivernetwork.org

Visitors Information

The following local visitors Bureaus can provide you with information on hotels, bed and breakfasts, campgrounds, restaurants and additional cultural and recreational facilities in the Lackawanna Valley and nearby areas in Northeastern Pennsylvania.

- Lackawanna County Convention & Visitors Bureau
  1300 Old Plank Road
  Mayfield, PA 18433
  Phone: (570) 963-6363
  Website: www.visitnepa.org
  (for Lackawanna and Luzerne counties)

- Endless Mountains Visitors Center
  RR 6 Box 132A
  Tunkhannock, Pennsylvania 18657-9232
  Phone: (570) 836-5431
  for Bradford, Sullivan, Susquehanna and Wyoming Counties

- Pocono Mountains Vacation Bureau
  1004 Main Street
  Stroudsburg, Pennsylvania 18360
  Phone: (570) 421-5791
  for Monroe, Wayne, Pike and Carbon Counties

River Terms

acid mine drainage (AMD) - water from flooded abandoned mine tunnels which drains into a near by stream. As ground water and surface precipitation flow through the underground tunnels and mine workings in the Lackawanna Valley, the water dissolves minerals which are contained in the coal and rock strata between coal seams. Iron pyrite also known as fool's gold, manganese and aluminum sulfides are the major sources of AMD. When the mineral laden water flows through old drainage tunnels and pours into the River, the metals oxidize and drop out of solution. This action robs the stream of dissolved oxygen and coats the stream bottom and banks with a yellow/orange coloration.

alluvial deposits - an assemblage of sediments marking a location where a stream moves from a steep to a flatter gradient. The stream looses velocity and transporting power. Sediments drop out and form gravel bars or alluvial fans. Many alluvial sediments in the Lackawanna contain shale, culm and anthracite silts.

anadromous fish - a fish which returns from the ocean to a freshwater stream to spawn. Salmon, shad, herring are examples. A shad restoration program may someday open the Susquehanna and Lackawanna to a return of the shad fishery.

anticline - a configuration of folded stratified rocks which dips away from a crest, similar to rafters on a roof. (see syncline.)

benthic - the environment of a river bottom; cobblestones, gravel and sediments form a horizon which provides a habitat for a variety of crustaceans such as crayfish and macro-invertebrates like caddis fly and mayfly.

bog - a wetland formed when a glacial lake fills in with decayed vegetation. The vegetation forms a mat of peat. The centers of some bogs are open water surrounded by sphagnum moss and sedge grasses, evergreen shrubs and trees such as larch and black spruce, red oak and maple. Bogs, glacial lakes and wetlands provide a constant source of water for the Lackawanna and other streams in Northeastern Pennsylvania.

cascade - a waterfall; a stream channel cuts its course through a variety of rock structures, waterfalls are located where a harder rock overlies a softer rock.

channel - the course cut by a stream from its source to its confluence. Meandering and braided channels are common on flood plains with deep sediments.

Class “A” Fishery – in Pennsylvania, a fishery producing forty pounds of trout per acre of stream is rated class “A.” This is usually an indicator of good water quality. The Lackawanna has twelve miles of Class “A” brown trout fishery from Carbondale to Olyphant.

coliform - a type of bacteria common in soil, fecal coliform is present in human waste. Its presence in a stream is an indication of sewage pollution, agricultural or urban non-point runoff.

combined sewer outfall (CSO) - a device or structure which allows an interceptor or trunk line sewer to overflow into a water body. CSO allow the combined sanitary and storm water which floods the line during storm events to discharge into a nearby water body to prevent flooding of the downstream treatment plants or backups into streets and private property. After the storm surge is dissipated, the sanitary flows continue to the treatment plant. New technologies are being developed to treat or eliminate CSO's. There are approximately one-hundred forty CSO's on the Lackawanna.

confluence - a location where two streams join together. The Lackawanna confluence with the Susquehanna is at Pittston.

culm - a mixture of coal, rock and shale, removed from anthracite coal during processing in coal breakers. Various types of culm dumps are conspicuous features of the Lackawanna Valley landscape. Some piles contain extractable coal while others consist of shale and rock. Culm dumps are surface sources of AMD.

dendritic - a pattern of drainage formed in a watershed with uniform flat lying rock. This pattern similar to the branches of a tree is common in the Lackawanna watershed.

flood control - any attempt to mitigate or prevent loss of life or property from flooding. Structural flood control depends on expensive dams, levees, concrete channelization or dredging. Non-structural flood control acknowledges the reality of flooding and encourages development away from flood plains. It also recognizes the value of maintaining vegetation and natural stream corridors to slow down the storm runoff and reduce flood crests.

glacial lake - a lake formed in a depression left by retreating glaciers. The lakes of Susquehanna and Wayne counties, which are the source of the Lackawanna, are glacial in origin.

gorge - an extremely steep sided stream channel formed where the stream has cut hard resistant rocks. The Lackawanna watershed contains several gorges, the most famous being Nay Aug in Scranton. Fallbrook, White Oak Run, Panthers Bluff and Hulls Creek also contain these picturesque geologic features.

gradient - the slope of a stream bed. The gradient of the Lackawanna River is thirty-nine feet per mile.

hundred-year flood - a statistical term predicting that a flood of a certain level has a 1% probability of occurring on any given year.

hydrograph - the measurement of runoff from a storm event. A volume of rain falls over time and runs off over time. The crest of a hydrograph represents the crest of storm run off as it surges downstream.

hydrologic cycle - the path of water through the environment from precipitation to absorption through plants and soils to runoff into streams and evaporation into the atmosphere.

infiltration - the movement of surface water from storm runoff and stream flows through fractures in the ground or stream beds into the mine pool. Some hydrogeological studies have shown that 50% of the AMD entering the Lackawanna River is the result of surface infiltration.

interceptor sewer - a large sewer line usually following a river or stream which intercepts sewage from smaller street sewers. Interceptors were installed to convey sewage to treatment plants and eliminate older discharges into streams.

macro-invertebrate - benthic macro-invertebrates are aquatic invertebrates (animals without backbones) that live at least part of their life cycle in or on the bottom substrate of a body of water. Examples of these organisms are: crayfish, snails, clams, worms, leeches and aquatic insect larvae such as stone flies, mayflies, and Caddis flies. Benthic macro-invertebrates are indicators of overall water quality. Various species exhibit different tolerances for pollution. Macros are an essential link in the food chain between aquatic plants and organic detritus and valuable fish such as trout. The collection and analysis of the number and diversity of organisms from a given site can provide general information about the water quality of the stream in that location.

meander - the tendency of a river or stream to flow in broad sweeping curves. Meanders often occur where rivers flow through the alluvial sediments along broad flood plains. The flow of water removes sediments on the outside bends and deposits material on the inside of the bend. Gravel bars are often found inside bends of the Lackawanna and undercut banks on the deeper faster flowing outside bend. Braided channels result when excessive sediment loads fill the water course in areas of shallow gradient.

mixing zone - a regulatory term describing the area of a water body where a point source of pollution becomes dissolved and mixed in the water column.

non-point source - water pollution which occurs in subtle and minute ways as contaminants become waterborne and enter a stream over a widely dispersed area. Runoff from agricultural chemicals and animal waste are non-point sources of nutrient and bacteriological pollution. Runoff from roads, parking lots, construction, lawn fertilizers are urban non-point sources of chemical, sediment and nutrient pollution.

NPDES (National Pollution Elimination Discharge System) - the process established in federal law which requires states, to regulate water quality and monitor dischargers into water bodies.

nutrient - organic chemical compounds such as phosphates and nitrates, typically found in fertilizer, animal and human waste. Excessive amounts of nutrients stimulate overgrowth of algae causing eutriphication of a water body, degrading the aquatic habitat.

perennial flow - a constant flow of water in a stream or river. Some streams with intermittent flow carry water on a seasonal basis.

point source - an identifiable source of pollution entering a water body. Discharge from industrial plants, sewer plants, combined storm- sewer outfalls (CSO's), and acid mine drainage outfalls (AMD) are point sources of pollution. Point sources are both regulated and non regulated. The Clean Water Act requires all discharges to register, apply for and maintain NPDES permits which regulate what, when and how they discharge treated waste water into a water body. Other point source discharges such as acid mine drainage from some abandoned mines and storm drains from roads and parking lots are not currently regulated.

POTW, Publicly Owned Treatment Works - municipally owned sanitary sewer treatment plants and collection systems also known as STP or sewage treatment plants.

rapids - reaches of a stream where a steeper gradient, increasing velocity, and cobble or rock strata create swiftly flowing white water.

red-ash - the material formed by the burning of culm dumps, similar in some respects to volcanic materials. Red-ash has been used as a base for driveways and trails.

riffle - similar to rapids but consisting predominantly of cobble and gravel.

riparian - an adjective referring to or of a stream bank and/or adjacent flood plain. Example: a riparian zone may indicate an area between high and low flow levels. A riparian forest or habitat may include plants and animals acclimated to river bank environments where a high water table and occasional flooding are normal.

stewardship - the act of caring for a our land, water, air and living natural resources. The responsible management of resources which protects the resources for the future while encouraging the appropriate use and understanding of the resources for today.

swale - a grass lined ditch, a natural or constructed waterway.

syncline - a geological configuration of folded, stratified rocks in which rocks dip downward from opposite directions to come together in a trough. The opposite of anticline.

wetland - an area of land with hydric soils which regularly retain moisture and support the growth of plants acclimated to wet conditions; wetlands may or may not have standing water. Wetlands help retain water from rain and snow runoff, slowly releasing it to provide streams with a constant flow. Wetland retention also aids in reducing peek storm flows, providing downstream communities with natural flood control.

Recommended Reading

Chapter I

History

Folsom, Burton W. Jr. Urban Capitalists. Baltimore, MD: Johns Hopkins University Press, 1981. A comparative historical analysis of the development of Scranton, Wilkes-Barre, Bethlehem, and several other communities in the Anthracite region.

Hollister, Horace, MD. A History of the Lackawanna Valley. New York, NY: Alvord, 1869. A local history of the early settlement of the Valley. Available in the Scranton Public Library reference department.

Geology

Loree, L. F., et al. The Story of Anthracite. Scranton, PA: International Textbook Press, 1932. A corporate history published by the Hudson Coal Company. The Story of Anthracite offers historical, geological, social and economic background on the development of the anthracite industry in the Lackawanna Valley.

Peters, Albert E. Lackawanna River Basin Mine Drainage Abatement Study (Scarlift Program). Scranton, PA: A. E. Peters, A&E Inc, 1978. The Scarlift Program was conducted by PA Department of Environmental Resources in the 1970's. This engineering study contains essential hydrogeologic information helpful in understanding the AMD situation in the Lackawanna Valley.

Van Diver, Bradford B. Roadside Geology of Pennsylvania. Missoula, MT: Mountain Press Publishing, 1990. A useful and informative handbook which interprets the geology of Pennsylvania.

Flooding

While no book has been written on flooding in the Lackawanna Valley, the files of the Scranton Times and the microfilm archives of the Scranton Public Library have extensive newspaper accounts of historical floods. The bibliographies in the Palmer and Stranahan books have numerous citations on flood related books and journal articles. The LRCA has Lackawanna River Basin flood study reports available on a reference basis to students or researchers.

Flora and Fauna

Copeland, Thomas, and Robert Moase. Fisheries Management Report, Lackawanna River. Sweet Valley, PA: PA Fish and Boat Commission, 1992. This study found the Lackawanna supporting a Class "A" brown trout fishery. The report contains the most recent aquatic tissue toxicity data on the Lackawanna.

Fiske, Steve, and Jack Byrne. Key to the Freshwater Macro invertebrate Fauna of New England. Montpelier, VT: River Watch Network, 1988. River Watch Network publishes several useful field handbooks on aquatic resource analysis. The Save Our Streams program of the Izaak Walton League of America is another good source of water quality and aquatic habitat information.

Kricher, John C. A Field Guide to Eastern Forests. Boston, MA: Houghton Mifflin Company, 1988. A publication in the Peterson Field Guide series in association with the National Audubon Society, the National Wildlife Federation, and the Roger Tory Peterson Institute. This book is a must for anyone interested in understanding how our ecosystem works. It covers everything natural in the woods.

Kupsky, Edward P. and Sherrill R. Wills. Lackawanna River Investigation. Wilkes-Barre, PA: PA Department of Environmental Resources, 1991. This report documents a year long study of the Lackawanna by DER. It covers physical, chemical and biological conditions and examines AMD, CSO, and non point urban problems and their effects on water quality in the Lackawanna.

Lackawanna River Corridor Master Plan Resource Assessment. Philadelphia, PA: National Park Service, 1990. One of several supporting documents prepared with federal and state agencies as part of the Lackawanna River Citizens Master Plan. These documents are available from the Lackawanna River Corridor Association.

Chapter II

The LRCA

Arendt, Randall. Designing Open Space Subdivisions. Media, PA: Natural Lands Trust, Inc., 1994. This book by Arendt builds on the theme of conservation based development. With a variety of design approaches, Arendt shows how a property can be developed with a minimum impact on open space habitat and a maximum return on investment. Anyone thinking about developing property should read this book first. Available from Natural Lands Trust, (610) 352 -5587.

Coughlin, R., J. Denworth, et al. Guiding Growth, A Planning and Growth Management Handbook for Pennsylvania Municipalities. 3rd ed. Philadelphia, PA: Pennsylvania Environmental Council, 1993. Every citizen, developer, and municipal official should read this book. Guiding Growth provides a useful summary of the legal basis for community planning and zoning in Pennsylvania. It discusses contemporary and

traditional growth patterns, and offers hundreds of examples of how we can plan better more economically and environmentally responsive communities. Available from the Pennsylvania Environmental Council, 1 (800) 322-9214 or the LRCA.

Deans, Karen, ed. Conservation Options, A Landowners Guide. Washington, DC: The Land Trust Alliance, 1993. This book explains what a conservation easement is and how a private property owner and a local conservancy can work together to conserve land, while meeting the long term financial and estate needs of the property owner. Available from the Land Trust Alliance, (202) 638-4725.

District Engineer. The Lackawanna River Greenway Reconnaissance Report. 3 vols. Baltimore, MD: US Army Corps of Engineers, Baltimore District Planning Division, 1993. This report documents an eighteen month study to identify federal and state interests in environmental restoration, recreation, and comprehensive watershed resources management. Published in three volumes this technical document is available for research purposes from the Lackawanna River Corridor Association.

Ellett, Kathleen, and Alice Mayio. Volunteer Water Monitoring: A Guide for State Managers. Washington, DC: US EPA, Office of Water, 1990. This guide demonstrates how effective citizen volunteer water quality monitoring programs can help local communities identify and solve water quality problems. Legal, scientific and organizational issues are discussed.

Hoffman, Charles R., et al. The Lackawanna River Citizens Master Plan. Scranton, PA: Lackawanna River Corridor Association, 1990. This document describes in detail the results of a two year comprehensive assessment of problems and opportunities relating to the Lackawanna River. The plan's recommendations are the framework for a watershed based resource restoration and management process presently underway with local, state, and federal participants. The LRCA has additional supporting documentation available for research purposes.

Labaree, J. M. How Greenways Work: A Handbook on Ecology. Ipswich, MA: National Park Service and The Atlantic Center for the Environment, 1992. A guide to understanding how the landscape ecology of a greenway helps to restore and maintain stream corridor environments and compliments community values.

Lane, Johnathan, et al. The Plan for the Lackawanna Heritage Valley. Scranton, PA: Lackawanna County Commissioners, 1991. The Plan for the Heritage Valley recommended the creation of the Lackawanna Heritage Valley Authority and the National Institute for Environmental Renewal. This document is essential reading to aid in understanding the broad range of Heritage programs being developed in the Lackawanna Valley. The plans for a Lackawanna River Greenway are integrated to the Heritage plan. This document is available by contacting the Lackawanna Heritage Valley Authority. (570) 876-6188.

Palmer, Tim. Lifelines The Case for River Conservation. Washington , DC: Island Press, 1994. The latest in a series of river related books by Palmer. Lifelines offers some perspective on what we are doing to conserve our nation's river resources.

River, Trail and Conservation Program, National Park Service. Economic Impacts of Protecting Rivers, Trails, and Greenway Corridors: A Resource Book. Washington, DC: US Dept of Interior, 1991. This book demonstrates how conservation of greenways can provide beneficial economic impacts to communities from job creation, improved real estate values and increased public participation in community activities.

Scenic Rivers Program. Stream bank Stabilization Guide and Management Guide for Pennsylvania Landowners. Harrisburg, PA: PA Dept of Environmental Resources, Scenic Rivers Program, 1986. If you have a river or stream along your property this informative book is essential reading to help you better manage your property. Available from the State Bookstore, Post Office Box 1365, Harrisburg, PA 17105 or from the LRCA.

Stranahan, Susan Q. Susquehanna, River of Dreams. Baltimore, MD: Johns Hopkins University Press, 1993. This reflective book looks at our historical and present day relationship with the Susquehanna. It provides a good starting place to begin to learn about the Great Susquehanna watershed and water resources policy in Pennsylvania.

Chapters V and VI

Fishing and Canoeing

Meck, Charles R. Pennsylvania Trout Streams and Their Hatches. Woodstock, VT: Back Country Publications, 1993. This is the bible for fly fishermen in Pennsylvania. This book along with the Lost Higbee Map and a friendly inquisitive personality will help you find the best fly fishing opportunities in Pennsylvania. After the Fish Commission study of 1991, Meck was reintroduced to the Lackawanna by Mike Stevens of Channel 16's Pennsylvania Outdoor Life. Meck has some good things to say about the Lackawanna.

PA Fish and Boat Commission. Summary of Fishery Regulations 1999. This annual summary provides useful information on the locations and regulations governing Pennsylvania fishing waters including the Lackawanna.

Gertler, Edward. Keystone Canoeing, A Guide to the Canoeable Waters of Eastern Pennsylvania. Silver Spring, MD: The Seneca Press, 1988. Recommended reading to anyone who would canoe the Lackawanna or hundreds of other streams in eastern Pennsylvania. Hopefully the Lackawanna River Greenway programs will inspire Mr. Gertler to reappraise his commentary on the aesthetics of certain reaches of the Lackawanna in future editions.

Visit the LRCA website at
www.lrca.org

With links to :

- **This Month on the Lackawanna River** – all the latest volunteer opportunities, meeting announcements and events
- **Membership, Volunteering and Interships** – how to become a member and info on volunteering and interships with the LRCA
- **The Lackawanna River Conservation Plan** – our updated Master Plan for the Lackawanna River Watershed
- **Publications and Photographs** – links to LRCA publications, pictures of our watershed and other River related info
- **Lackawanna Valley Conservancy** – info on our land trust, a sister organization of the LRCA
- **Recreational Opportunities along the River** – info on what recreational opportunties are found on and along the River
- **Water Conditions in the Lackawanna River Watershed** – links to USGS gage station readings on water levels and discharge of the river
- **Links to Friends of the River** – links to agencies, organizations, groups, and businesses which are similar in mission or have provided assistence to the LRCA
- **LRCA Contact Info, Office Location and Staff**
- **Board of Directors** – list of the current Directors of the LRCA
- **Canoe-a-thon** – information on our annual cano-a-thon, duck-a-thon and regatta event in May
- **NEPA Rail to Trails** – link to a sister organization in the upper watershed and info on their trail system

~Be a Friend of the River~

The work of the LRCA is made possible by the support of the citizens of the Lackawanna Valley who join with the LRCA as *Friends of the River*. Your membership makes it all possible; visit our website for more info.