THE PENNSYLVANIA RIVERS CONSERVATION PROGRAM

FRENCH CREEK WATERSHED CONSERVATION PLAN

Prepared By
Western Pennsylvania Conservancy
and
French Creek Project

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grant from the
Pennsylvania Department of Conservation and Natural Resources
Bureau of Recreation and Conservation

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MISSION

Western Pennsylvania Conservancy's mission is to enrich the human relationship with the natural world by saving the places we care about.

HOW WE ACHIEVE OUR MISSION

We accomplish our mission by:

- Conserving the region's places of exceptional ecological, recreational and scenic value;
- Preserving Fallingwater as a symbol of human activity in harmony with nature;
- Engaging others in cooperative partnerships to promote the linkages of ecological protection with social and economic values of communities;
- Connecting people of all ages with the natural world through experience, education and responsible stewardship; and
- Working with communities to enhance livability and reduce pressure on undeveloped areas.

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VISION

"A healthy French Creek will be the heart of a community and economic renaissance where development and land use activities occur in such a fashion as to protect environmental features and enhance our quality of life."

GOALS

- To raise public awareness about the value of the stream through a public education and outreach effort that reaches the general public, riparian property owners, school teachers and students, and local government officials;
- To engage local people who are committed to protecting and enhancing water quality for years to come; and
- To pursue the overriding goal of the Project, which is to preserve habitat, maintain biological diversity, and protect French Creek's endangered species.

ACKNOWLEDGEMENTS

The Pennsylvania Department of Conservation and Natural Resources, Western Pennsylvania Conservancy, and French Creek Project provided the funding for the development of the French Creek Watershed Conservation Plan. The Sansom-Eligator Foundation, Kellogg Foundation, Western PA Watershed Protection Program, and Heinz Endowments graciously contributed matching funds. The Conservation Plan Steering Committee contributed their time and expertise from various technical backgrounds to the conservation planning process. Allegheny College, Edinboro University, and Western Pennsylvania Conservancy provided facilities and amenities for the steering committee meetings. French Creek Project and Western Pennsylvania Conservancy hosted a series of public meetings to gather input on the planning process and to present the Draft Plan. Several municipalities in the French Creek watershed supported this conservation planning process and Western Pennsylvania Conservancy hopes others will realize the Plan's value as a resource conservation tool and support its implementation. Numerous watershed stakeholders voiced opinions regarding threats to French Creek, which were incorporated into this Plan. Staff from the Western Pennsylvania Conservancy's Resource Conservation and Public Affairs departments and French Creek Project, as well as steering committee members reviewed and edited rough drafts of the Conservation Plan. Tara Herman, GIS Intern for Western Pennsylvania Conservancy, developed the GIS for the French Creek Watershed Conservation Plan. Brian Gallagher, Lynne Rackley, and Betty Bernens, Western Pennsylvania Conservancy staff members, worked with H2 Design Consultants on the development of the French Creek Watershed Conservation Plan web page. In addition, Western Pennsylvania Conservancy would like to thank the watershed residents and staff from the various agencies, businesses, industries, and organizations that provided information for the development of the French Creek Watershed Conservation Plan and feedback on the Draft Plan.

- Allegheny College
- Audubon Society
- Conneaut Lake/French Creek Valley Conservancy
- Crawford County Commissioners
- Crawford County Conservation District
- Crawford County Planning Commission
- Creek Connections
- Edinboro University
- Environmental Alliance for Senior Involvement
- Erie County Conservation District
- Erie County Department of Health
- Erie County Planning Department
- French Creek Canoe and Kayak
- French Creek Project
- French Creek Project Advisory Committee
- Lord Corporation
- Mercer County Conservation District
- Mercer County Regional Planning Commission
- Mercyhurst College
- Natural Resources Conservation Service

- Oil Heritage Region
- PA Department of Conservation and Natural Resources
- PA Department of Environmental Protection
- PA Department of Transportation
- PA Fish & Boat Commission
- PA Game Commission
- PA Historical and Museum Commission
- PA Spatial Data Access
- PA State Data Center
- Pennsylvania Farm Bureau
- Pennsylvania Landowners' Association
- Pennsylvania State University
- PPG Industries
- Presque Isle Audubon Society
- The Nature Conservancy
- University of Pittsburgh
- U. S. Army Corps of Engineers
- U. S. Fish & Wildlife Service
- U. S. Geological Survey
- Venango County Conservation District
- Venango County Planning Commission

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INTRODUCTION

French Creek: "An Ecological Treasure"

French Creek, in southwestern New York and northwestern Pennsylvania, is arguably the most ecologically significant waterway in Pennsylvania. It contains more species of fish and freshwater mussels than any other comparably sized stream in the Commonwealth and possibly the northeastern United States. Dr. Jay R. Stauffer, a respected fish biologist from the Pennsylvania State University (PSU), has summarized this watershed by writing that "French Creek is undeniably one of Pennsylvania's foremost aquatic treasures."

Over the past two decades, researchers from Western Pennsylvania Conservancy (WPC), PSU, Ohio State University, Cleveland Museum of Natural History and other organizations have studied the flora and fauna of the French Creek watershed. Comparisons with the early freshwater mussel inventories of Ortmann (1909) and fish inventories of Raney (1938) indicate that the watershed has retained nearly all species of these groups historically represented here. This can be attributed to French Creek's relatively good water quality, abundance of wetlands and other critical habitats, and overall rural character. Researchers warn however, that threats to French Creek's natural resources and healthy stream community do exist. Aquatic experts have voiced their concerns and suggest that it is prudent to propose measures today that will protect the future of this remarkable stream.

Historically, the Ohio River drainage was one of the most biologically diverse river systems in the nation with respect to aquatic species. Many watersheds within this basin supported levels of biodiversity equal to or greater than French Creek. In the last 100 years, human impacts to these watersheds have resulted in the loss of many species, leaving French Creek as the best representative of historical biodiversity in the Pennsylvania portion of the Ohio River basin.

Aquatic species, freshwater mussels, crayfish, and fish, are disappearing at a faster rate nationwide, and perhaps worldwide, than upland plants and animals. In 1998, The Nature Conservancy (TNC) in cooperation with Natural Heritage Programs and the Association for Biodiversity Information published *Rivers of Life – Critical Watersheds for Protecting Freshwater Biodiversity*, which describes the dire conditions facing our aquatic species. *Rivers of Life* reports that "two-thirds of the nation's freshwater mussels are at risk of extinction, and almost 1 in 10 may already have vanished forever; half of all crayfish species are in jeopardy; and about 40 percent of freshwater fish and amphibian species are at risk." The report also lists U. S. watershed "hot spots" with 10 or more at-risk freshwater fish and mussel species and critical watersheds to conserve these species. French Creek, in New York and Pennsylvania, has made both lists.

Western Pennsylvania Conservancy, as the western Pennsylvania partner in the state's Natural Heritage Program, helped initiate the Pennsylvania Natural Diversity Inventory (PNDI) in 1980. With its partner, TNC, working in eastern Pennsylvania, WPC began collecting biodiversity data in western Pennsylvania. Western Pennsylvania Conservancy and TNC participated in statewide scorecard meetings to identify biodiversity areas. This project helped identify French Creek as a

biologically important watershed. Western Pennsylvania Conservancy's PNDI-west work also led to French Creek's inclusion in the *Rivers of Life*.

WPC's History of Conservation in French Creek

Scientific Activity

- **1969** – First natural area land protection effort in the watershed: Wattsburg Fen
- **1974** – Publication of the preliminary list of Natural Areas (Erdman and Wiegman), included several sites in the French Creek watershed.
- **1980** – PNDI began. Started collecting biodiversity data, with a focus on freshwater endangered species.
- **1980s** – WPC participated with TNC in statewide scorecard meetings. Purpose was to look at biodiversity data out of PNDI, to see what sites we were identifying. TNC did this for eastern PA, WPC for western. This project helped identify French Creek as a site to work on. Led to looking for hot spots, which led to map creation by McCardy, Ferringer, and Gray.
- **1983 - Present** – Independent fish and mussel inventories, done in concert with PNDI efforts.
- **1985** – French Creek was recognized and acknowledged as an important watershed. WPC started looking at protection options.
- **1985-6** – Glacial lakes inventory of endangered flora. This study led us to work in Lake Pleasant. Least impacted, highest number of endangered species, and best wetlands.
- **1985-94** – WPC funded some of botanist Jim Bissell's work and worked with him in the French Creek drainage with rare and endangered plants, especially wetlands and some of French Creek proper.
- **1989** – Partially supported George Reese's black tern research in the watershed (Endangered bird).
- **1980s-90s** – WPC acted as the science arm of the French Creek Project (FCP) (reviewed fact sheets, provided info in presentations and events, produced videos about French Creek and the FCP).
- **1990** – Preserve Design and Action Plan for French Creek endangered species submitted to U. S. Fish & Wildlife Service (USFWS).
- **1992** – WPC suggested to Pennsylvania Environmental Council (PEC) that they get involved at French Creek.
- **1992** – WPC identified five places to focus protection on streams (based on info provided by McCardy, Ferringer, and Gray): Utica, Venango, West Branch, Confluence of LeBoeuf/French Creek, and the mouth of Muddy Creek.
- **1992** – Meadville public meeting. Brian Hill facilitated. Lyle Sherwin (Loyalhanna Watershed Association), Jay Stauffer (PSU Fish Biologist), Charles Bier (WPC zoologist) present. Spoke to the public. John Oliver (formerly WPC)/Brian Hill (PEC) put proposal to Heinz Endowments. Formed FCP partnership: PEC, WPC through Allegheny College. Funds were received by WPC and passed through to PEC.

- **1993** – WPC hosted meeting in Pittsburgh to discuss the development of a strategic plan for French Creek.
- **1993** – Mussel inventory. Project implemented with partial money from USFWS to fill in mussel data gaps.
- **1993** – Erie County Natural Heritage Inventory completed.
- **1994** – Initiative to develop and fund GIS data for French Creek. As part of the GIS project, WPC funded a half-time position at Allegheny College. Also developed an MoU with Allegheny College and FCP about the GIS project.
- **1994** – WPC, in conjunction with PEC, submitted proposal to Heinz. This proposal essentially formed the current FCP in 1995.
- **1994** – Cooperative agreement with USFWS to conduct science and outreach projects focused on French Creek (including signage).
- **1995** – Erie National Wildlife Refuge Natural Heritage Inventory completed.
- **1996** – WPC invited to USFWS meeting in Columbus, OH about biodiversity in the Ohio drainage.
- **1990s** – WPC educated PA Fish & Boat Commission (PFBC) staff about freshwater mussels. Took PA Department of Environmental Protection (DEP) staff on educational field trips. WPC speakers presented before Allegheny College classes.
- **1990s** – WPC acknowledged as experts on the French Creek watershed. Advised DEP as well as private and municipal entities on issues such as bank stabilization and impacts of pipeline projects, for example.
- **1990s - Present** – French Creek signage project. Ten permanent interpretive signs produced. Six erected in 2000, two erected in 2001, and two more to be erected early in 2002.
- **2000** – WPC assisted in producing a comprehensive bibliography that covered both French Creek specifically and riverine conservation issues in general. Including a summary of existing research.
- **2000** – Partnered with Edinboro University to sponsor a Glacial Lakes Symposium. Brought in experts on glacial geology and glacial lakes to begin to raise awareness of the uniqueness of these natural lakes and the need to protect them. Officially kicked off WPC's Glacial Lakes Initiative.
- **2000** – Muddy Creek community outreach project initiated with funding from National Wildlife Federation (NWF). "Friends of the Mussels" brochure developed and model streambank stabilization project initiated.
- **2000** – WPC's Northwest Field Station at Lake Pleasant opens.
- **2000** – Two-year study on the health of the Edinboro Lake ecosystem completed and report released.
- **2000-2** – French Creek Watershed Conservation Plan written in conjunction with FCP's outreach about the plan. Draft produced in 2001 for public review and comment. Final plan completed January 2002.
- **2001** – Mercer County Natural Heritage Inventory initiated.
- **2001** – Lake Pleasant Watershed Assessment initiated through a DEP Growing Greener grant.
- **2001** – Mussel surveys completed at various points on Muddy Creek and

French Creek proper for permit applications.

- **2001** – Five-year glacial lakes floral inventory initiated on Lake Pleasant, Edinboro Lake, and Sandy Lake (not in French Creek watershed). Other glacial lakes to be inventoried over five years.
- **2001** – Master site plan for Lake Pleasant Conservation Area initiated.
- **2001** – Received DEP Growing Greener grant to perform a French Creek Watershed Assessment. To be completed by 2003.

Land Protection

Wattsburg Fen: **3 tracts, 374 acres**

- **1969** Acquired Weber tract (32 acres) in Amity Twp.
- **1990** Acquired Weber/Leslie tract (251 acres) in Amity Twp.
- **1992** Acquired Belding tract (91 acres) in Amity Twp.

Lake Pleasant: **10 tracts, 349 acres**

- **1990** Acquired Brumagin tract (35 acres) in Waterford Twp.
- **1994** Acquired Kinsinger tract (1 acre) and Myers tract (193 acres) in Venango Twp.
- **1995** Acquired Johnson tract (2 acres) in Venango Twp.
- **1995** Acquired Myers tract (5 acres) in Venango Twp.
- **1999** Acquired Wurst tract (13 acres) in Green/Venango Twp.
- **1999** Acquired Lyons tract (14 acres) in Venango Twp.
- **2000** Acquired Sutto tract (2 acres) in Venango Twp.
- **2000** Acquired Gorniak tract (31 acres) in Venango/Greene Twp.
- **2000** Acquired Afton tract (53 acres) in Waterford Twp.

French Creek: **12 tracts, 1053.5 acres**

- **1990** Acquired Kratochvil tract (1 acre) in Canal Twp.
- **1994** Acquired Shifflet tract (2 acres) in Venango Borough
- **1994** Acquired Dye tract (103.5 acres) in French Creek Twp.
- **1994** Acquired Hanks tract (1 acre) in Venango Borough
- **1994** Acquired and conveyed Keyser tract (27 acres) in Richmond Twp. to USFWS Erie National Wildlife Refuge
- **1995** Acquired Mountain tract (259 acres) in Venango Twp.
- **1998** Acquired Kuhns tract (53 acres) in Waterford Twp.
- **2000** Acquired and conveyed Swenson tract (100 acres) in Waterford Twp. to PA Game Commission (PGC)
- **2000** Acquired and conveyed Rawa/Bacon tract (170 acres) in Amity Twp. to PGC
- **2000-01** Acquired and conveyed Swenson tract (23 acres) in Waterford Twp. to PGC
- **2001** Acquired Shaw's Landing tract (7 acres) in East Fairfield Twp.
- **2001** Acquired and conveyed Rawa/Bacon tract (307 acres) in Amity Twp. to PGC

Conneaut Marsh: **4 tracts, 842 acres (State Game Lands #213)**

- **1972** Acquired Raydure tract (684 acres) in Sadsbury Twp.

- **1980** Acquired Shafer tract (50 acres) in Union Twp.
- **1980** Acquired Griffith tract (84 acres) in Union Twp.
- **1980** Acquired Abbott tract (24 acres) in Fairfield Twp.

About the French Creek Project

In early May of 1995, Allegheny College joined with PEC and WPC in initiating a cooperative project in northwest Pennsylvania that brings together conservationists, sportsmen, landowners, farmers, the business community, industry, local government officials, and academic institutions in a collaborative effort to protect one French Creek. This partnership was recently expanded to include TNC, which had a similar initiative on the headwaters of French Creek in New York State. The Project has three primary goals:

- To raise public awareness about the value of the stream through a public education and outreach effort that reaches the general public, riparian property owners, school teachers and students, and local government officials;
- To engage local people who are committed to protecting and enhancing water quality for years to come; and
- To pursue the overriding goal of the Project, which is to preserve habitat, maintain biological diversity, and protect French Creek's endangered species.

As the Project began work, it prepared a "vision plan." The plan was developed with the aid of 70 key person interviews, 6 focus groups, and the input of our diverse 30 member advisory committee. The plan laid out steps for future actions, including an aggressive public education effort to help address non-point water pollution and the development of a conservation plan.

For the last six years, the Project has worked to protect the Creek. Some examples of its work to date include:

- in conjunction with three local school districts, an economic development agency and local college, creating the French Creek Outdoor Learning Center which serves 3000 students each year;
- making presentations on the history and ecology of French Creek in every elementary school in the watershed;
- sponsoring annual workshops for local government officials on a host of land use and other issues;
- establishing a volunteer network that includes nearly 500 people;
- working with Crawford County Commissioners to establish the region's first native species research nursery;
- cooperating with farmers in implementing best management practices;
- recreating George Washington's 1753 winter canoe trip on the Creek;
- providing presentations to civic groups, so that over 12,000 people have learned about the Creek;
- printing a quarterly news letter and over a dozen factsheets that are mailed to over 3000 people;
- circulating a 30 minute video program on the Creek that has played on local PBS and cable stations; and

- establishing a new ecotour program for people to learn about the Creek via canoes and kayaks.

Because of its cooperative approach and successes, the Project has won local, regional, state, and national awards. In 2001, it received the inaugural Governor's Award for Watershed Stewardship.

The Nature Conservancy has been active in the conservation of the New York headwaters of the French Creek watershed in a similar community-based project. The Central and Western New York Chapter of TNC has produced a Site Conservation Plan for the New York portion of the watershed and, in 1993, named French Creek one of the "Last Great Places". The Site Conservation Plan describes the New York portions of the French Creek watershed. It identifies important natural systems, stresses to those systems, and sources of those stresses. The Site Conservation Plan ultimately suggests conservation strategies for watershed management and protection.

French Creek Watershed Conservation Plan

In 1999, WPC received a grant from the Pennsylvania Department of Conservation and Natural Resources (DCNR) Keystone Rivers Program to develop a science-based watershed conservation plan. A portion of this grant was used to fund outreach about the Plan through the FCP's efforts. Additionally, the grant was matched by WPC and FCP with private funds. The conservation planning process was initiated in the fall of 1999. The culmination of this two-year process is the production of this final French Creek Watershed Conservation Plan.

In order to better engage the local community in the French Creek planning process, WPC established a new office in Erie County early in 2000. Located on Lake Pleasant, WPC's Northwest Field Station serves as a base for French Creek conservation planning and scientific research, as well as other conservation projects throughout northwest Pennsylvania.

The French Creek Watershed Conservation Plan is intended to compile and present information on watershed resources and potential or known threats to those resources. The Plan provides a fairly comprehensive watershed description with information from the public and other sources on watershed resources and potential threats to those resources. From that information, the Plan's technical steering committee made recommendations on ways to identify and address potential threats to the watershed's resources. These potential threats and recommendations can be viewed in the appropriate section of this document. The "Action Plans" section describes work to be initiated over the next three years to encourage the recommendations and other projects to be implemented. Appendices that provide specific information about French Creek and the Conservation Planning process are contained at the end of the document. The French Creek Watershed Conservation Plan is intended as a tool for various groups including federal, state, and local agencies, municipalities, academics, and conservation organizations to guide research, planning, and conservation projects. The goal of the Plan is to supply the information and framework needed to help people and organizations coordinate restoration, maintenance, and enhancement of the French Creek watershed.

Western Pennsylvania Conservancy and the Plan's technical steering committee suggest watershed conditions will need reevaluated and this document will need revised after a period of three years. The FCP's advisory committee will provide guidance on the implementation of recommendations from the Plan. The partners of the FCP will work with all interested watershed groups to implement recommendations from the Plan. The steering committee members that guided the development of this plan are listed in Appendix A, as well as the advisory council members who assisted the FCP in outreach about the Plan.

Western Pennsylvania Conservancy will convene a science committee of watershed scientists from conservation organizations, academia, industry, agencies, and private consultants. This task was outlined in the FCP's Vision Plan and will be important as recommendations from the Plan are implemented. This committee will be available to provide guidance to the FCP advisory committee and other groups working in the French Creek watershed. It is also intended to improve communications and cooperative projects to ensure that groups are not duplicating research efforts and wasting valuable funding resources.

OUR COMMITMENT TO AGRICULTURE

The development of the French Creek Watershed Conservation Plan has met with skepticism by some members of the agricultural community. There has been a general misunderstanding that the Plan is intended to produce more regulations and infringement on private landowner rights. This is simply not the case, as the Plan is a public document that only makes recommendations for watershed protection. Recommendations in the Plan stress voluntary, incentive-based programs and cooperative efforts between land owners, environmental agencies, municipalities, industry, businesses, and conservation organizations. These are the same ideals that the partners in the French Creek Project have worked under since its inception in 1995.

The following pages include detailed descriptions of the ecological values of French Creek and the natural and human landscape that surround it. What becomes clear upon review of this information is that the French Creek watershed is rural and dominated by agriculture. In fact, because the region has not seen the same level of industrial and commercial development that has occurred elsewhere, the stream has remained surprisingly diverse, one of the Commonwealth's biological gems.

The sponsors of the FCP – Western Pennsylvania Conservancy, Allegheny College, Pennsylvania Environmental Council, and now The Nature Conservancy – recognize that agriculture is a critical part of the local landscape and economy. We view agriculture in a broad fashion that includes silviculture. Farming and logging have occurred in this watershed for over two centuries and, with a little luck and the hard work of the people who live here, will continue into the future.

Agriculture is important to people and the stream. The health of the Creek depends on the participation of the friendly farmers of the French Creek Valley. As a result, we are working aggressively to support farmers and to preserve agriculture in this watershed. Our cooperative approach brings resources to this region, providing mini-grants for upgrading operations and introducing best management practices.

During the last five years, we have invested several hundred thousand dollars on farms that border the Creek and its tributaries. We have worked cooperatively with the county conservation districts and U. S. Department of Agriculture's Natural Resource Conservation Service (NRCS). And, all of the farmers who have participated have done so voluntarily. We have also encouraged those counties that have not adopted an agriculture preservation program to do so. We are committed to agriculture.

PUBLIC PARTICIPATION IN THE PLANNING PROCESS

The development of the French Creek Watershed Conservation Plan has been a publicly driven process. Watershed citizens are stakeholders that have the opportunity to provide input into how their watershed is restored, maintained, and enhanced. Conservation of natural resources occurs most effectively when the public is encouraged to take ownership of the resources and protection is afforded through a fostered sense of place. Residents of the French Creek watershed live, work, and play in this watershed. It is home to many and visited by many more who come to enjoy clean, free-flowing waters, abundant fish and game, and numerous other recreational opportunities. The natural resources offered in the French Creek watershed bring renewed economic opportunities to this region and deserve to be protected. The residents of this watershed are the key to ensuring the conservation ethic is passed from this generation to the next. While some may enjoy short-term benefits that result in the degradation of this watershed, everyone reaps the long-term benefits of protecting it.

The conservation planning process began in the fall of 1999 with a public meeting to announce the conservation plan and gain insight into what citizens perceived to be major issues facing conservation of the French Creek watershed. Public involvement was again incorporated into the planning process in the spring of 2000 with a series of public meetings held throughout the watershed by the French Creek Project and Western Pennsylvania Conservancy. Citizens once again had the opportunity to provide feedback on threats and opportunities in the watershed. This public involvement continued to guide the development of the Plan through citizen involvement in WPC's technical steering committee. The steering committee met periodically to guide the conservation planning process and provide firsthand insight on issues in the French Creek watershed. In the fall of 2001 the public was once again called upon to offer insight and comments on the drafted French Creek Watershed Conservation Plan. These comments were incorporated into this final French Creek Watershed Conservation Plan that will serve as a guiding document and tool for the conservation of the French Creek watershed. Public involvement in the conservation of French Creek will continue to be important as recommendations and action plans are implemented.

Public comments received at the spring 2000 meetings and during the fall 2001 public comment period are located in Appendix B.

Western Pennsylvania Conservancy and the FCP will continue to provide the public convenient access to the French Creek Watershed Conservation Plan via their web pages at http://www.paconserve.org/ or http://frenchcreek.allegheny.edu and through hard copies at WPC's Northwest Field Station located on Lake Pleasant in Erie County and FCP's office at Allegheny College in Meadville. Hard copies of the Plan are also available at public libraries throughout the watershed and at county planning, conservation district, and PA Department of Environmental Protection offices. The Plan and accompanying GIS is also available electronically by contacting WPC.

WATERSHED DESCRIPTION

Location

French Creek and the West Branch of French Creek originate in Chautauqua County, in western New York and flow southwest to their confluence in Erie County, Pennsylvania. The South Branch of French Creek originates near Corry in Erie County and flows west to its confluence with French Creek west of Union City in Erie County. French Creek then flows south through Crawford County, the northeast corner of Mercer County, and finally into Venango County where it flows southeast to its confluence with the Allegheny River at Franklin, Pennsylvania (Figure 1). As part of the Allegheny River watershed, French Creek contributes to the Ohio River, the Mississippi River, and ultimately the Gulf of Mexico. The French Creek watershed drains portions of 72 townships, cities, and boroughs in northwest Pennsylvania (Figure 2). Approximately 93% of the watershed is within Pennsylvania, with the remaining 7% comprised of headwater areas in New York.

Size

The entire French Creek watershed covers an area of approximately 1235 square miles (790,400 acres). The main stem of French Creek flows 117 miles from its New York headwaters to its mouth at Franklin. A relatively large tributary watershed, French Creek constitutes 11 percent of the drainage basin for the Allegheny River, which covers approximately 11,000 square miles.

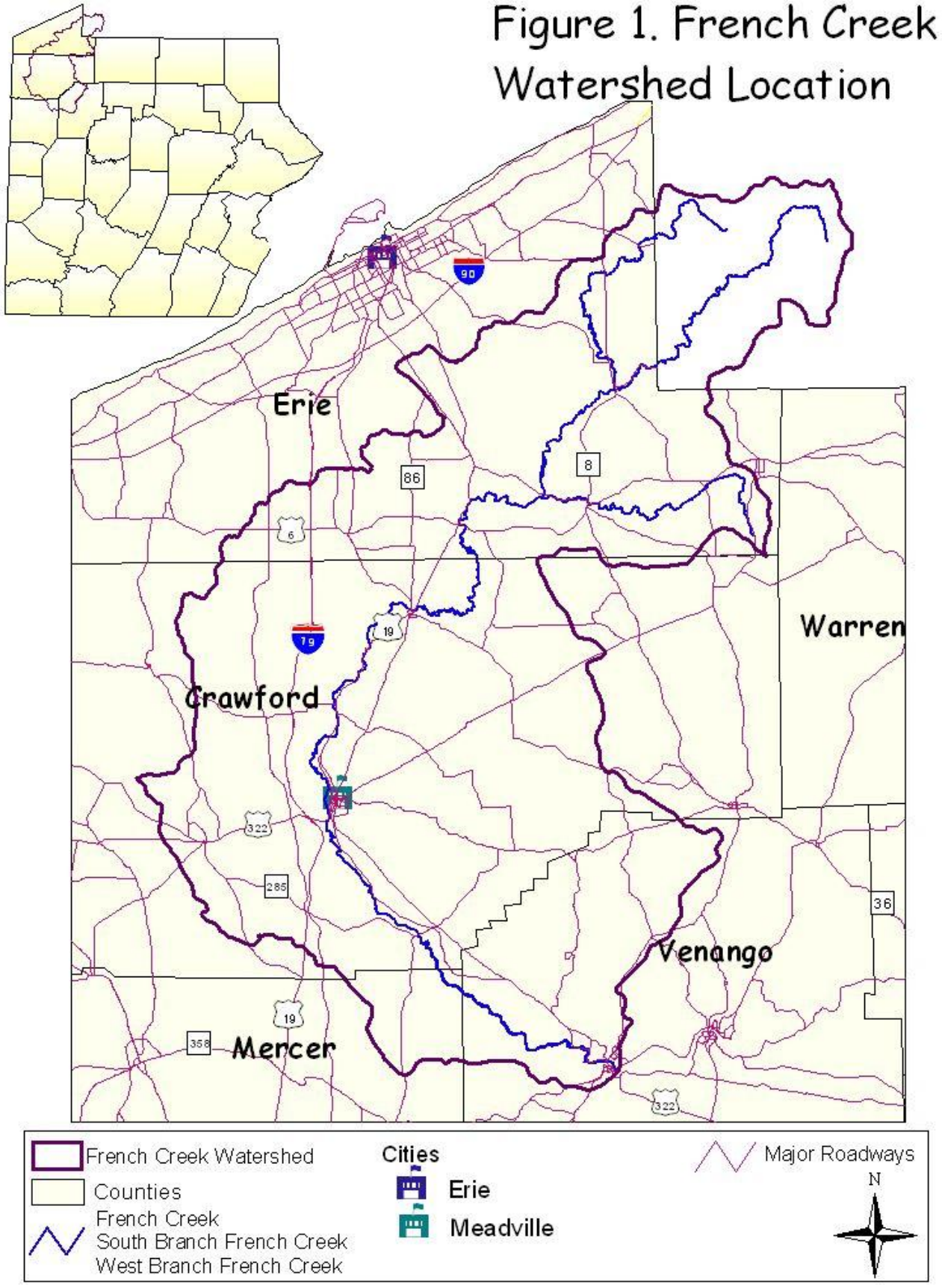
Topography and Glacial History

The French Creek watershed lies almost entirely (over 90 percent of the watershed) within the Northwestern Glaciated Plateau Section of the physiographic Appalachian Plateaus Province. This region is characterized by low, gently rolling hills, broad valleys, and glacial features (Hasse, 1992). Elevation in the watershed ranges from about 1000 feet at the mouth of French Creek and extreme western portions of the watershed to approximately 1900 feet in northeastern sections of the watershed. Vertical relief increases from the northwest to the east, the southwest, and the south.

The small portion of the watershed that lies outside the Northwestern Glaciated Plateau Section is comprised of the extreme south and southeastern sections in Venango and a small portion of eastern Crawford counties. This portion of the watershed lies in the High Plateau Section of the physiographic Appalachian Plateaus Province. This area was unaffected by glacial processes, resulting in steeper side slopes and a plateau top, that was uplifted and bisected by deep valleys and eroded by streams.

The topography of the French Creek watershed is characteristic of glaciated regions. Advancing glaciers gouged out valleys and rounded hills. When they receded, they left huge deposits of clay, silt, sand, and gravel, known as glacial drift, in the valleys and across the landscape. The bedrock of the area was formed during the Devonian,

Figure 1. French Creek Watershed Location



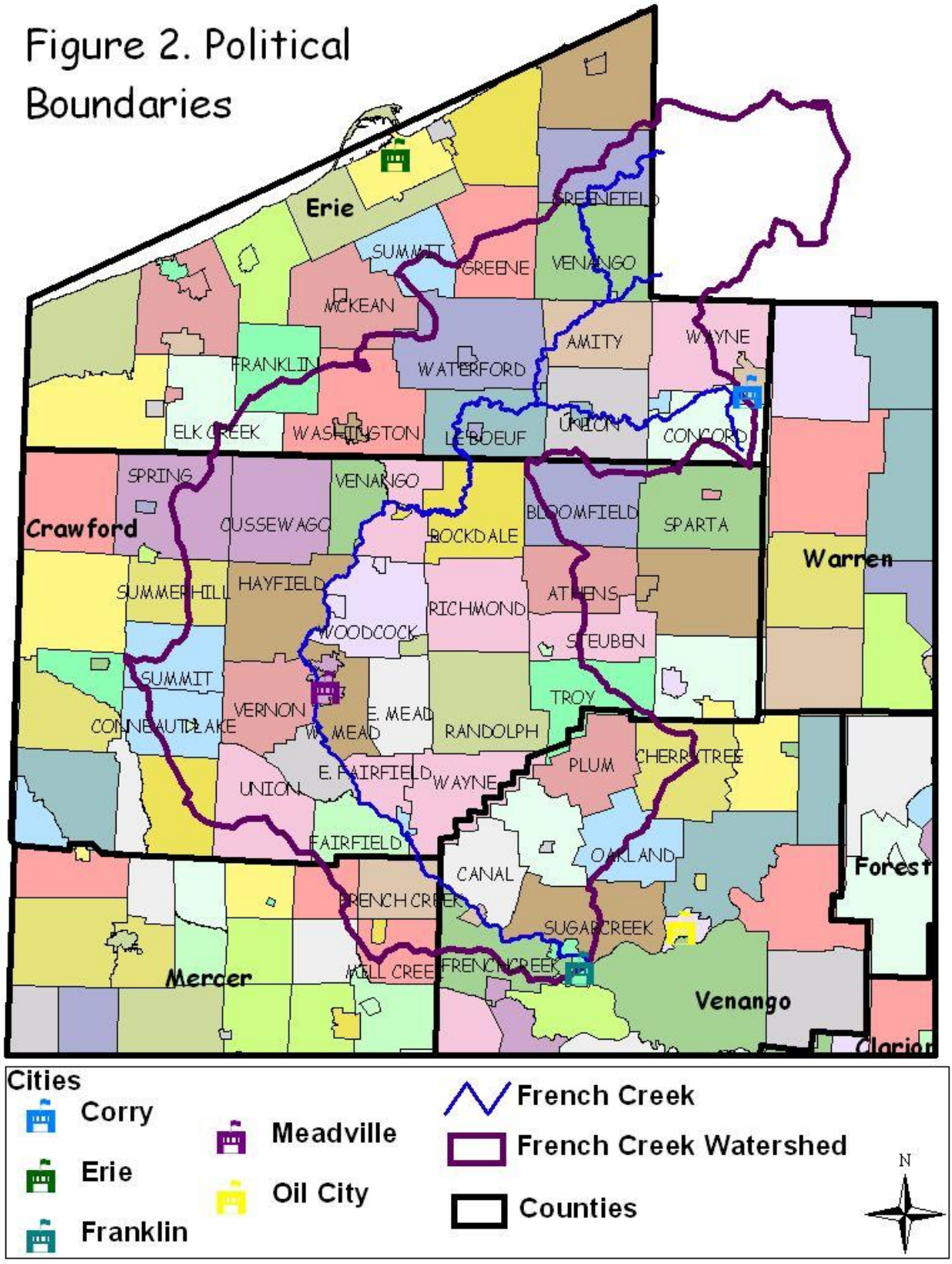


Figure 2. Political Boundaries
Erie
Crawford
Warren
Forest
Venango
Mercer
Clarion
GREENFIELD
SUMMIT
GREENE
VENANGO
MCKEAN
AMITY
WAYNE
FRANKLIN
WATERFORD
ELK CREEK
WASHINGTON
LE BOEUF
UNION
CONCORD
SPRING
VENANGO
BLOOMFIELD
SPARTA
CUSSEWAGO
ROCKDALE
SUMMERHILL
HAYFIELD
ATHENS
RICHMOND
WOODCOCK
STEUBEN
SUMMIT
TROY
VERNON
E. MEAD
CONNEAUTLAKE
W. MEAD
RANDOLPH
PLUM
CHERRYTREE
E. FAIRFIELD
WAYNE
UNION
FAIRFIELD
OILAND
CANAL
FRENCH CREEK
SUGARCREEK
MILL CREEK
FRENCH CREEK
Cities
Corry
Erie
Franklin
Meadville
Oil City
French Creek
French Creek Watershed
Counties
N

Mississippian, and Pennsylvanian Periods of the Paleozoic Era, or about 300-400 million years ago and is characterized by sandstones, siltstones, and shales. These areas were not as affected by the mountain-building processes as were the adjacent areas to the east (Barnes and Sevon, 1996).

The French Creek landscape was shaped by four separate glaciations during the Pleistocene Epoch, which occurred between about 2,000,000 and 20,000 years ago. The oldest glaciation, the older pre-Illinoian, occurred between about 2,000,000 and 770,000 years ago. Not much is known about this period except that it is responsible for the Slippery Rock Till. The younger pre-Illinoian glaciation was the most extensive Pennsylvania glaciation and occurred prior to 770,000 years ago. It is responsible for the highly eroded Mapledale Till. The late Illinoian glaciation occurred between 196,000 and 128,000 years ago. It is responsible for the Titusville Till and contributes greatly to the topography of northwest Pennsylvania. The most recent glacial advance, the late Wisconsinan, is divided into four separate advances, which occurred between 22,000 and 17,000 years ago. These advances are recognized by the glacial till they deposited on the landscape, overlaying that of the late Illinoian glacial period, although not reaching as far south as the late Illinoian. The earliest and most southward advance is known as the Kent Till. Subsequent advances, which traveled increasingly shorter distances into Pennsylvania are the Lavery Till, Hiram Till, and the most recent Ashtabula Till. The Wisconsinan glaciation had early and middle periods prior to the late period, however it is speculative as to whether they reached Pennsylvania. The advances of the late Wisconsinan would have overlaid these earlier Wisconsinan advances, reaching further into Pennsylvania.

The glacial history of northwest Pennsylvania is extremely important to the French Creek watershed. Many of the characteristics of the watershed can be attributed to its glacial history. The late Illinoian glaciation is responsible for most of the landscape characteristics. The southernmost terminal moraine of the Titusville Till stretches from Beaver County in the southwest, through Crawford County, to Warren County in the northeast. The area behind the moraine, which encompasses most of the French Creek watershed, has broad uplands separated by linear valleys and long, linear, rounded ridges. Landscape features run northwest to southeast, which was the flow direction of the glaciers as well as pre-glacial drainage (Sevon and Fleeger, 1999). Additionally, the glacial history is responsible for the many wetland areas and glacial lakes in the French Creek watershed.

Perhaps the most interesting result of the glaciers in northwest Pennsylvania is the reversal of the direction of drainage for river systems. Prior to glaciation, the Allegheny River consisted of three separate stream systems that flowed north into the ancestral St. Lawrence drainage. The massive continental ice sheet and deposited glacial till blocked the northerly flow of these systems causing them to flow southward and eventually join to form the present day Allegheny River system and contribute to the Ohio River drainage. One of the three ancient Allegheny systems, the "middle" Allegheny system, formed the French Creek drainage.

It has been reported that this reversal of flows allowed aquatic species from the northern ancestral St. Lawrence drainage to be mixed with species from the Ohio River drainage. This species "capturing" has been used to explain the high biodiversity found in French Creek, and historically, other parts of the Allegheny and Ohio River drainages. This report disputes that

theory. In fact, the Ohio River drainage historically contained all native species presently found in the French Creek watershed. The large number of Atlantic slope species not found in the French Creek drainage is evidence of this. The reversal of flow direction actually contributed interior species to certain Atlantic slope drainages.

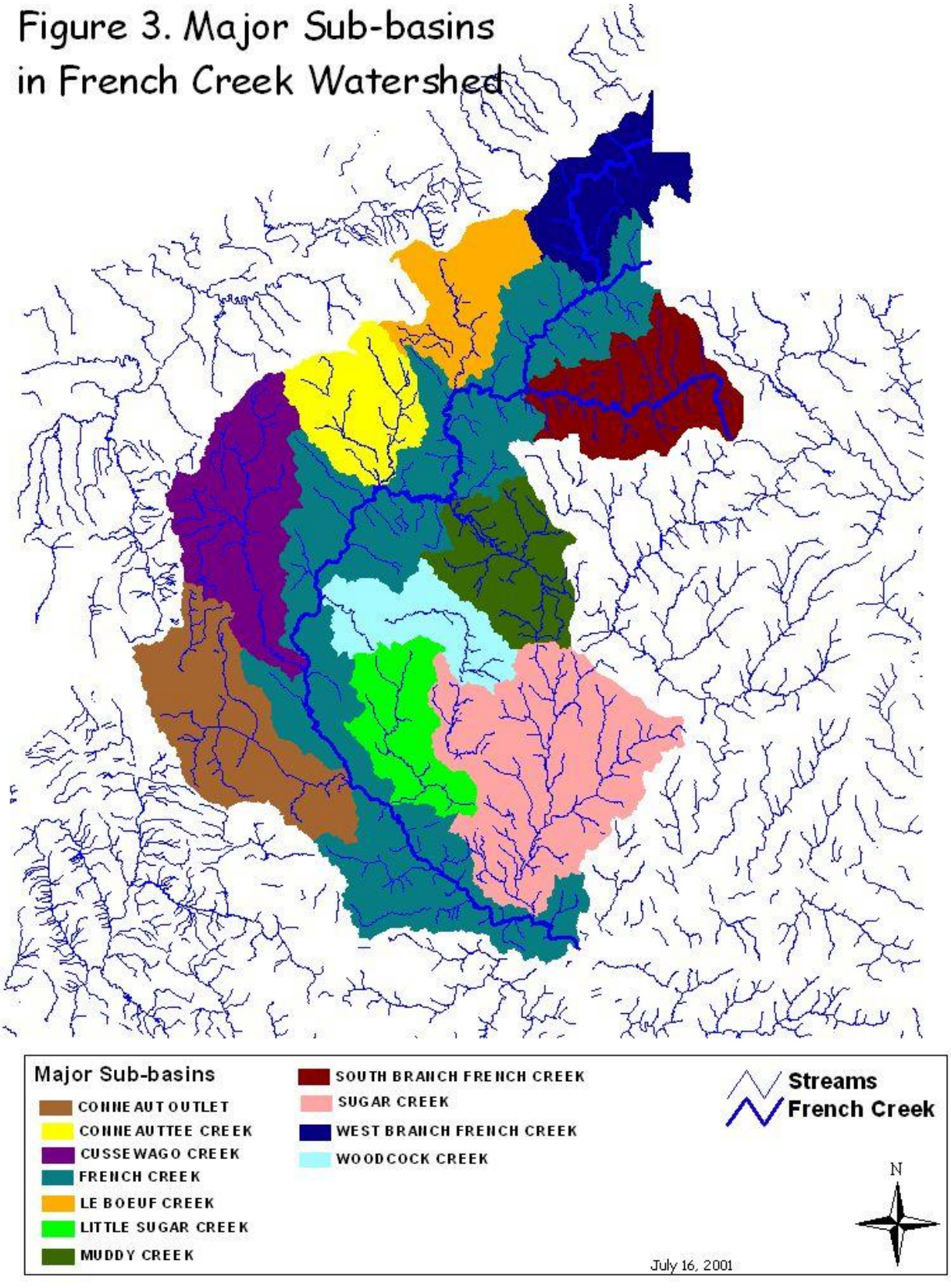
Major Tributaries

There are 10 major tributary sub-basins to French Creek with drainage areas greater than 50 square miles (Figure 3). These tributary sub-basins are listed below in order from the upstream most to the downstream most confluence with the main stem of French Creek.

- West Branch of French Creek (77.7 mi^2) originates in Chautauqua County, New York and joins the main branch of French Creek at Wattsburg, Erie County, Pennsylvania.
- South Branch of French Creek (80.3 mi^2) originates near Corry, Erie County, and joins French Creek west of Union City.
- LeBoeuf Creek (63.3 mi^2) flows through Waterford, drains Lake LeBoeuf, and joins French Creek near the village of Indian Head.
- Muddy Creek (83.6 mi^2) flows through the Seneca Division of the Erie National Wildlife Refuge and joins French Creek near the village of Miller's Station, Crawford County.
- Conneauttee Creek (60.8 mi^2) enters and drains Edinboro Lake, flows through Edinboro, Erie County, and joins French Creek near Cambridge Springs, Crawford County.
- Woodcock Creek (50.5 mi^2), which has been dammed by the United States Army Corps of Engineers (USACE) to form Woodcock Creek Lake, joins French Creek near Saegertown.
- Cussewago Creek (96.9 mi^2) joins French Creek at Meadville.
- Conneaut Outlet (101 mi^2) drains Conneaut Lake and joins French Creek south of Shaws Landing.
- Little Sugar Creek (53 mi^2) joins French Creek at Cochranton.
- Sugar Creek (167 mi^2) joins French Creek at the village of Sugarcreek, Venango County, four miles upstream from the mouth of French Creek at Franklin.

These sub-basins provide a convenient way to conceptualize the French Creek watershed and offer a way to break the entire watershed into smaller, more manageable units. A sub-basin

Figure 3. Major Sub-basins in French Creek Watershed



approach would allow for more accurate land use descriptions to be made resulting in more thorough planning for watershed management.

While some of these sub-basins may be very similar in physical characteristics, others may be very different. Threats to natural resources may differ significantly between sub-basins depending on land use patterns. Research has shown that species distribution varies significantly between sub-basins in the French Creek watershed. It will most likely be necessary to approach natural resource restoration, maintenance, and enhancement differently in each sub-basin.

The 10 major sub-basins listed above account for 834.1 square miles or approximately 68% of the entire French Creek watershed. The remaining 32% of the watershed is comprised of sub-basins smaller than 50 square miles or is draining directly into the main stem of French Creek. These areas must also be considered if a sub-basin approach to watershed conservation is adopted.

Land Use

The French Creek watershed is highly rural with a few urban centers. The landscape is a mix of land use classifications, primarily divided between forested and agricultural (Figure 4). The breakdown of estimated percentages for land use types in 1998 was reported by Kline (n.d.) as follows:

Mixed forest and evergreen forest	53% of the watershed
Hay/pasture	23%
Row crops	17%
Open water and wetlands	5%
Urban and lawns	<2%
Surface mine/quarry	<1%

The northern portion of the French Creek watershed is a changing landscape. The watershed is seeing increasing suburban development from the city of Erie. This trend brings about an increase of impervious material as parking lots and roadways increase thus increasing the amount of polluted run-off that reaches the stream. There is current pressure to subdivide farms for development of home sites as well as other commercial operations. In addition, many small farming operations are merging into larger enterprises (French Creek Project, 1997). Suburban development and large-scale farming operations generally have a greater negative impact to the health of a stream than smaller farms and open areas. In 1997, there were 1,123 farms in Erie County, with an average size of 149 acres, for a total farmed area of 167,634 acres. Comparatively, in 1978 there were 1,529 farms with an average size of 133 acres for a total farmed area of 202,917 acres in Erie County. This represents a loss of small farming operations in favor of larger operations and a net loss of agricultural land.

The middle portion of the French Creek watershed, largely in Crawford County, faces pressures from the urbanized areas surrounding Meadville, the largest city on French Creek. Point discharges from industries and municipal sewage treatment plants in and around Meadville have negatively affected the water quality of sections of French Creek. Increases in impervious

surfaces due to urban development have increased the incident of flash flooding and disturbances to the streambed. The rural portions of the watershed in Crawford County also face suburban sprawl and home site development. Additionally, much of the riparian buffers to streams in the watershed have been fragmented by improper farming practices. In 1997, there were 1,069 farms in Crawford County, with an average size of 194 acres, for a total farmed area of 207,215 acres. In 1978, there were 1,540 farms with an average size of 164 acres for a total farmed area of 252,918 acres. The trends are the same as described in Erie County.

The lower portion of the watershed, largely in southeastern Crawford and northern Venango counties, has limited agriculture and a steeper, more forested terrain. Land use in this part of the watershed reflects the unglaciated nature of the landscape. Failing septic systems associated with streamside cottages and older homes are suspected of impacting these and other sections of French Creek. Venango County, where most of the southern, unglaciated portion of the watershed is found, had 351 farms in 1997, with an average size of 132 acres, for a total farmed area of 46,166 acres. In 1978, there were 506 farms with an average size of 138 acres for a total farmed area of 69,924 acres.

Planning and Development Controls

The highly rural French Creek watershed is largely comprised of private landowners, many who can be quick to oppose land use regulations. Often this opposition is a double-edged sword, which leaves those same landowners unprotected against rampant residential, commercial, or industrial development on neighboring properties. Examples of this were clearly evident during this planning process as residents throughout the watershed opposed power plant proposals, racetrack development, and cell phone tower placement to name a few. Many municipalities in the watershed have little or no zoning and subdivision regulations, and many of the regulations in place are quite dated and provide little protection for environmental or social concerns. Municipalities without these land use controls are generally governed by countywide controls. The complete list of municipal planning and development controls currently in place for municipalities in the French Creek watershed is shown in Table 1.

Figure 4. Land Use

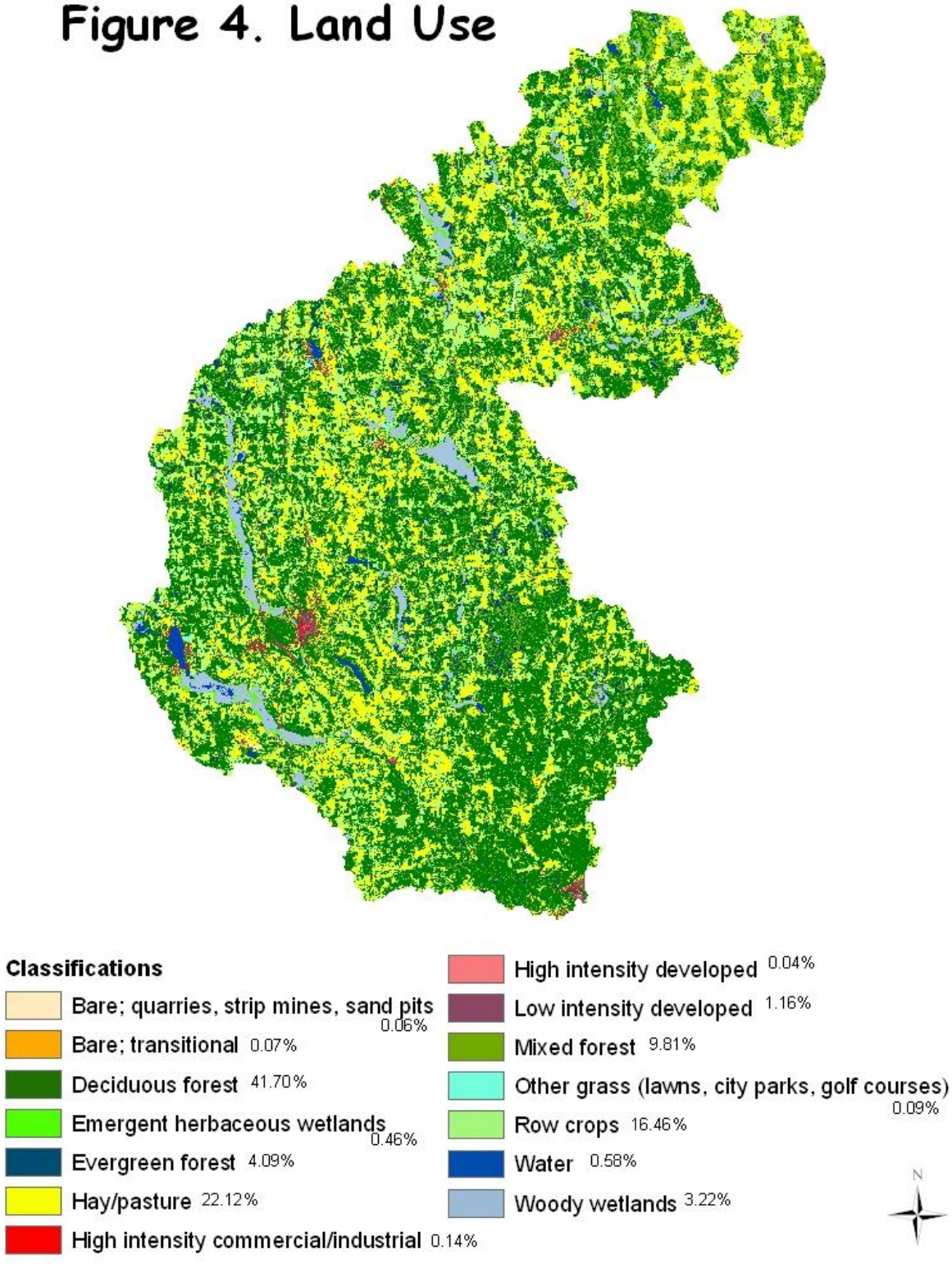


Table 1. List of Municipal Planning and Development Controls for Municipalities in the French Creek Watershed

Erie County					
Municipality	**Comprehensive Plan**	**Zoning Ordinance**	**Subdivision Regulations**	**Stormwater Management**	**Official Map**
Amity Township	Yes	Yes	No	No	No
Concord Township	Yes	Yes	No	No	No
Corry City	Yes	Yes	Yes	No	No
Edinboro Borough	Yes	Yes	Yes	No	No
Elgin Borough	No	Yes	No	No	No
Elk Creek Township	Yes	No	Pending	Yes	No
Franklin Township	Yes	Yes	Yes	Yes	No
Greene Township	Yes	Yes	Yes	Yes	Yes
Greenfield Township	Yes	Yes	Yes	Yes	No
LeBoeuf Township	Yes	Yes	No	No	No
McKean Township	Yes	Yes	Yes	Yes	Pending
Mill Village Borough	Yes	Yes	No	No	No
North East Township	Yes	Yes	Yes	Yes	No
Summit Township	Yes	Yes	Yes	Yes	Yes
Union Township	Yes	Yes	No	No	No
Union City Borough	Yes	Yes	Yes	No	No
Venango Township	Yes	Yes	Yes	Yes	No
Washington Twnshp.	Yes	Yes	Yes	Yes	Yes
Waterford Borough	Yes	Yes	Yes	No	No
Waterford Township	Yes	Yes	Yes	Yes	No
Wattsburg Borough	Yes	Yes	No	No	No
Wayne Township	Yes	Yes	No	No	No
Source: Erie County Department of Planning					

Crawford County					
Municipality	**Comprehensive Plan**	**Zoning Ordinance**	**Subdivision Regulations**	**Stormwater Management**	**Official Map**
Athens Township	No	No	No	No	No
Bloomfield Twnshp.	Yes	Yes	Pending	No	No
Blooming Valley Borough	Yes	Yes	No	No	No
Cambridge Twnshp.	Yes	Yes	Yes	No	No
Cambridge Springs Borough	Yes	Yes	Yes	No	No
Cochranton Borough	Yes	No	No	No	No
Conneaut Lake Borough	Yes	Yes	Yes	Yes	No
Cussewago Twnshp.	Yes	Yes	Yes	No	No
East Fairfield Township	No	Yes	No	No	No
East Fallowfield Township	No	No	No	Yes	No
East Mead Township	Yes	No	Yes	No	No
Fairfield Township	No	No	No	Yes	No
Greenwood Twnshp.	Yes	No	Yes	Yes	No
Hayfield Township	Yes	No	Yes	Yes	No
Meadville City	Yes	Yes	Yes	No	No
Oil Creek Township	Yes	Yes	Yes	No	No
Randolph Township	No	No	No	No	No
Richmond Township	Yes	No	No	No	No
Rockdale Township	No	No	Pending	No	No
Sadsbury Township	Yes	Yes	Yes	Yes	No
Saegertown Borough	Yes	Yes	Yes	No	No
Spring Township	Yes	No	No	No	No
Steuben Township	No	No	No	No	No
Summerhill Twnshp.	Yes	Yes	No	No	No
Summit Township	Yes	Yes	Yes	Yes	No
Townville Borough	No	No	No	No	No
Troy Township	No	No	No	No	No
Union Township	No	No	Yes	Yes	No
Venango Borough	Yes	Yes	No	No	No
Venango Township	No	No	Permit	No	No
Vernon Township	Yes	Yes	Yes	Yes	No
Wayne Township	Yes	No	No	No	No
West Mead Twnshp.	Yes	Yes	Yes	No	No
Woodcock Borough	No	No	No	No	No
Woodcock Twnshp.	Yes	Yes	Yes	No	No
Source: Crawford County Planning Commission					

Mercer County					
Municipality	**Comprehensive Plan**	**Zoning Ordinance**	**Subdivision Regulations**	**Stormwater Management**	**Official Map**
Deer Creek Twnshp.	No	No	No	No	No
French Creek Township	No	No	No	No	No
Mill Creek Twnshp.	No	No	No	No	No
New Lebanon Borough	No	Yes	No	No	No
New Vernon Township	No	Yes	No	No	No
Source: Mercer County Regional Planning Commission					

Venango County					
Municipality	**Comprehensive Plan**	**Zoning Ordinance**	**Subdivision Regulations**	**Stormwater Management**	**Official Map**
Canal Township	No	No	No	No	No
Cherrytree Township	No	No	No	No	No
Cooperstown Borough	No	No	No	No	No
Franklin City	Yes	Yes	Yes	No	No
French Creek Township	No	No	No	No	No
Jackson Township	No	No	No	No	No
Oakland Township	No	No	No	No	No
Plum Township	No	No	No	No	No
Sugarcreek Borough	Yes	Yes	No	No	No
Utica Borough	No	No	No	No	No
Source: Venango County Planning Commission					

Social/Economic Profile

Transportation

Roads

Interstate Highways, U. S. State Highways, and major secondary roads provide easy access to almost all parts of the French Creek watershed (Figure 5). Interstate 79 links the watershed with the Pittsburgh metropolitan area to the south and Erie to the north, and I-90, which runs north of the watershed across Erie County, links the area with Cleveland and Buffalo. Interstate 80 intersects I-79 approximately 20 miles south of the watershed, allowing convenient access for east-west traffic.

The main stem of French Creek is within three miles of a U. S. Highway for its entire length after its confluence with the South Branch. U. S. Highway 6 runs from the city of Corry along the South Branch to the confluence with the main stem of French Creek. It continues, following the main stem, along with U. S. Highway 19, to Meadville and crosses French Creek seven times. From Meadville, U. S. Highway 322 continues along French Creek to its mouth at Franklin, crossing the creek only once in Franklin.

Railroads

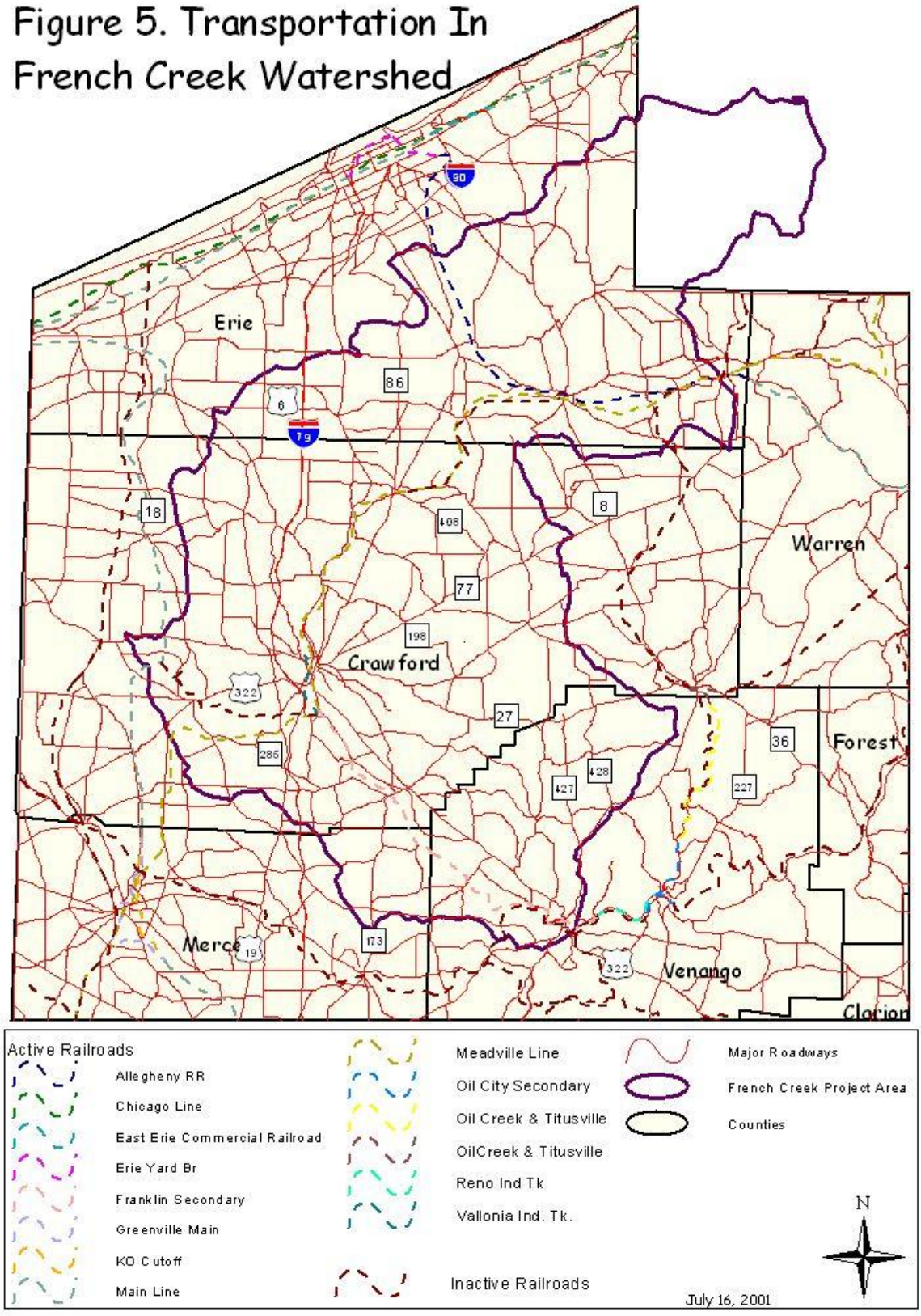
The French Creek corridor, with its wide, flat floodplains, provides an ideal route for railroads (Figure 5). Allegheny and Eastern Railroad operates lines from the city of Erie to the city of Corry, through Union City. From Union City, Oil Creek and Titusville Railroad lines follow French Creek to Meadville. Norfolk Southern Railroad operates lines from Meadville to Franklin and beyond to Oil City, Venango County. Train traffic on this line averages two trains per day at least five days per week. These tracks follow the main stem of French Creek. Also from Meadville, a Norfolk Southern line runs southwest to Shenango, Mercer County and points west. This line has approximately four trains running daily.

The north-south running Bessemer and Lake Erie Railway, which connects western Erie County with Mercer County and points south, runs through an extreme western portion of the French Creek watershed in western Crawford County. An inactive rail bed runs from the city of Corry to Titusville, in Crawford County. A small portion of this rail bed is in the French Creek watershed near Corry. Additional inactive rail beds exist within the French Creek watershed from Union City to Cambridge Springs, from Meadville west to the borough of Conneaut Lake, and a section of the Penn Central Railway near Franklin.

Airports

No major airports exist within the French Creek watershed. Erie International Airport lies to the north in Erie. Other major international airports within an hour drive of the watershed include Pittsburgh, Cleveland, and Buffalo. Several small airports within the French Creek watershed include: Corry-Lawrence Airport in Corry, Erie County Airport in Wattsburg, Port Meadville Airport in Meadville, and Venango Regional Airport in Franklin.

Figure 5. Transportation In French Creek Watershed



Demographics (2000 Census data used where available)

Based on estimations from 2000 census data, the approximate population for the French Creek watershed is 112,959 people in Pennsylvania and approximately 3,000 residents in the New York headwaters (Figure 6). The estimated populations for the portions of each county within the watershed and that county's total 2000 population are as follows: Erie County, 36,557 of 280,843; Crawford County, 59,828 of 90,366; Mercer County, 1,587 of 120,293; and Venango County, 14,987 of 57,565.

Population centers with greater than 1000 people per square mile include: the city of Corry, Edinboro Borough, Union City Borough, Waterford Borough, and Wattsburg Borough in Erie County; Cambridge Springs Borough, Conneaut Lake Borough, the city of Meadville, and Venango Borough in Crawford County; and the city of Franklin in Venango County. These population centers account for nearly one-third of the entire watershed population and all are either located on the main stem or a major branch of French Creek or center around one of the glacial lakes within the watershed. The remainder of the population exists in more sparsely populated centers or scattered throughout the highly rural watershed.

Changes in population for the four counties of the French Creek watershed show Crawford County with the largest percentage of growth at 4.9 percent between 1990 and 2000. Erie County followed with a 1.9 percent increase in population during the same time period. Mercer County saw a 0.6 percent decrease in population and Venango County recorded a 3.1 percent decrease in population during 1990-2000. The largest changes within the watershed were a 28.6 percent increase in population for Cambridge Springs Borough, Crawford County and a 22.2 percent decrease in population for Wattsburg Borough, Erie County. The dramatic increase in the population of Cambridge Springs Borough can be attributed to the construction of a state correctional facility currently housing nearly 700 inmates. All of the other previously mentioned population centers with densities greater than 1000 persons per square mile showed a decrease in population between 1990 and 2000, with the exception of Conneaut Lake Borough, which showed a 1.3 percent increase. This represents an exodus from established towns and cities into rural areas.

All of the municipalities within the French Creek watershed are considered 100 percent rural by the U.S. Department of Commerce with the exception of McKean and Summit Townships, both suburbs of the city of Erie, Sugarcreek Borough, the city of Corry, Edinboro Borough, Union City Borough, the city of Meadville, and the city of Franklin. Only the last five municipalities are considered 100 percent urban.

The French Creek watershed population is approximately 98.2 percent white, 0.7 percent black, and 1.1 percent other minorities. For Pennsylvania as a whole, 85.4 percent of the population is white, 10.0 percent black, and 4.6 percent other minorities.

In 1990, approximately 10.5 percent of the population of the French Creek watershed had at least earned a college Bachelor's degree. In the statewide population, that number was 17.9 percent. Approximately 25 percent of the watershed population had less than a high school education,

which was very close to the statewide average of 25.3 percent. The significantly lower number of individuals in the watershed without at least a Bachelor's degree may have helped account for the approximately $26,315 median household income in the watershed as compared to $29,069 statewide. Unemployment rates for the four counties within the watershed in 1998 were: Erie – 5.2%, Crawford – 5.0%, Mercer – 4.2%, Venango – 5.4% compared to 4.6% statewide.

Approximately 5.5 percent of the watershed population age 16 and older was employed in an agriculturally related field in 1990. This is significantly higher than the statewide average of 1.7 percent. Additionally, Erie and Crawford Counties, where most of the French Creek watershed lies, are ranked 8th and 10th respectively for number of farms in the state.

Outstanding or Unique Features

The unique features of the French Creek watershed are a product of its glacial history. Northwest Pennsylvania is home to seven inland glacial lakes. Five of the seven glacial lakes are found within the French Creek watershed. Conneaut Lake, the largest natural lake in the Commonwealth, is located in western Crawford County. Just east of Conneaut Lake is Conneaut Lake Kame, one of the largest kames in the state. The kame is a glacial deposit of sand and gravel in a depression formed near the terminal end of a glacier. Also associated with Conneaut Lake is Conneaut Marsh within State Game Lands #213, the largest marsh complex in the state. Following Conneaut Outlet for several miles, Conneaut Marsh is the result of an ancient stream channel filled in with glacial material. It is home to nesting bald eagles, *Haliaeetus leucocephalus*, and state endangered black terns, *Chlidonias niger*. Other glacial lakes within the watershed include Sugar Lake, Edinboro Lake, Lake LeBoeuf, and Lake Pleasant. These lakes have associated with them, wetlands, including rare calcareous fens, unique biological communities, and many species of special concern.

Other outstanding glacial features occur throughout the watershed. Moraines, mounds of till representing the furthest advancement of a glacier, occur throughout the watershed for each advance of the Wisconsinan glaciation. A terminal moraine, marking the southern most advance of the glaciations, runs through southeast Crawford County. Drumlins, smooth and rounded low-lying hills of glacial material, are found in Venango Township, Erie County. Additionally, there are numerous wetlands throughout the watershed, including rare wetland communities like bogs and fens. Wattsburg Fen Natural Area is an excellent example of these rare fens found in Erie County. This fen is a registered National Natural Landmark (*previously named Titus and Wattsburg Bogs*). Fens occur when wetland areas are fed by calcareous, highly alkaline groundwater giving rise to unique plant communities adapted to these alkaline conditions. The calcareous, alkaline groundwater is a result of glaciation.

French Creek is itself a unique feature. As a small to medium size, medium gradient river, French Creek is a relatively intact example of a free flowing riverine system; an ecosystem type that is rapidly disappearing. Twenty-seven species of freshwater mussels and over 80 species of fish, including fifteen darter species, are still found in the watershed along with numerous other wildlife and plant species.

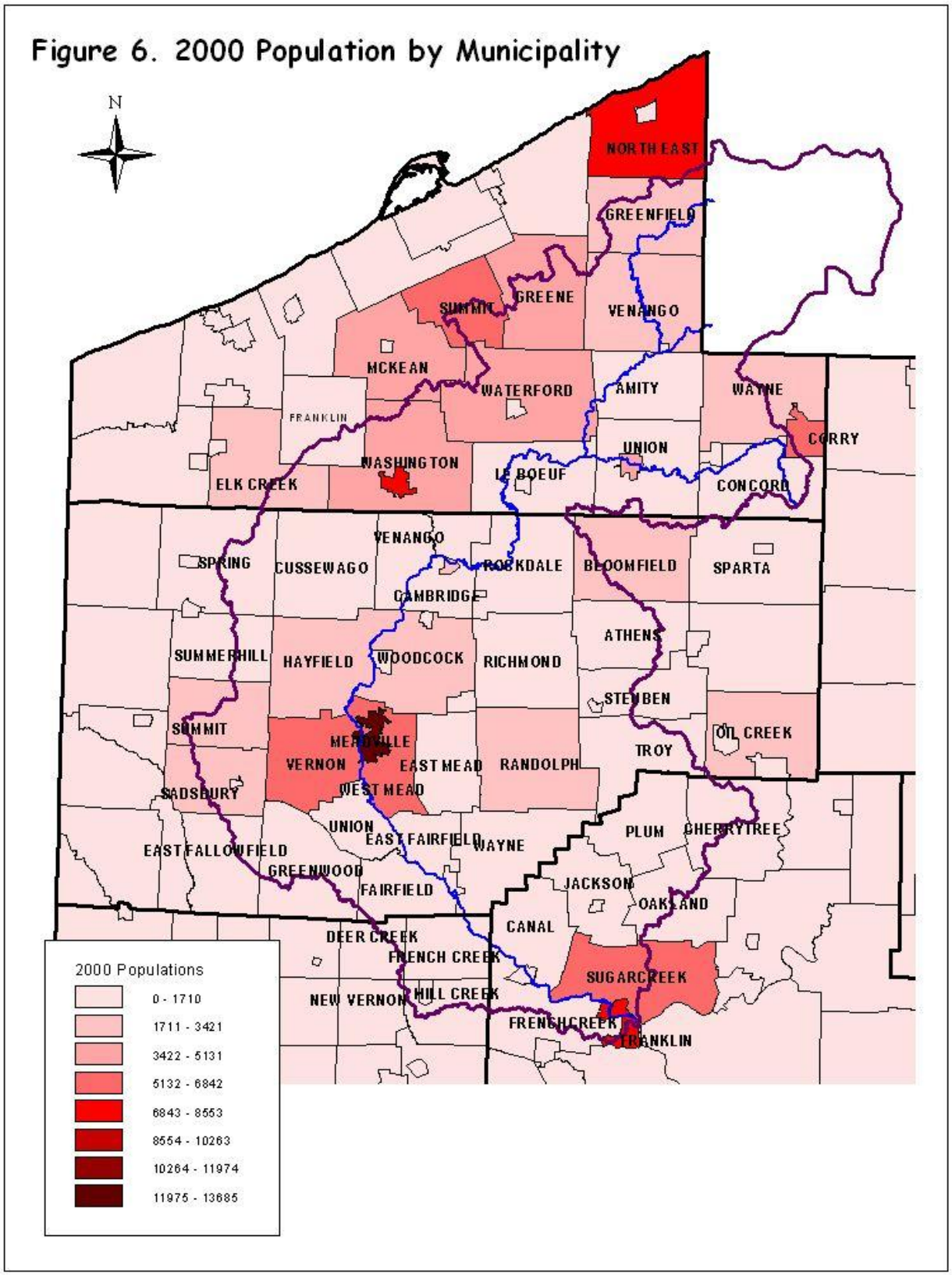


Figure 6. 2000 Population by Municipality
N
NORTH EAST
GREENFIELD
SUMMIT
GREENE
VENANGO
MCKEAN
WATERFORD
AMITY
WAYNE
FRANKLIN
CORRY
UNION
WASHINGTON
LE BOEUF
ELK CREEK
CONCORD
VENANGO
SPRING
CUSSEWAGO
ROCKDALE
BLOOMFIELD
SPARTA
CAMBRIDGE
ATHENS
SUMMERHILL
HAYFIELD
WOODCOCK
RICHMOND
STEUBEN
SUMMIT
OIL CREEK
MEADVILLE
TROY
VERNON
EAST MEAD
RANDOLPH
SADSBURY
WEST MEAD
UNION
EAST FAIRFIELD
PLUM
CHERRYTREE
EAST FALLOWFIELD
WAYNE
GREENWOOD
JACKSON
FAIRFIELD
OAKLAND
CANAL
DEER CREEK
FRENCH CREEK
SUGARCREEK
NEW VERNON
HILL CREEK
FRENCHCREEK
FRANKLIN
2000 Populations
0 - 1710
1711 - 3421
3422 - 5131
5132 - 6842
6843 - 8553
8554 - 10263
10264 - 11974
11975 - 13685

LAND RESOURCES

Geology and Soil Characteristics

The uppermost bedrock of the French Creek watershed is derived from sedimentary materials laid down during the Devonian Period and the younger Mississippian and Pennsylvanian Periods (Figure 7). Shales and siltstones of the Devonian Canadaway and Conneaut Formations underlie the northernmost sections of the watershed. The Cattaraugus shales, sandstones, and redbeds also of Devonian age underlie most of southern Erie County and northern Crawford County. Crawford County portions of the watershed also contain sandstones and shales of the Pocono Formation (Mississippian Period) and southern Crawford County uplands are associated with the Pottsville Group (Pennsylvanian Period). Pottsville shales and sandstones, along with those from the Pocono Group, make up the bedrock of the Mercer and Venango County portions of the watershed as well (Shepps *et al*., 1959).

An important note for the water quality of French Creek is the absence of the coal-containing Allegheny Group (Pennsylvanian Period). This fact has allowed French Creek to escape the fate of coal mining and associated abandoned mine drainage, which has decimated streams to the south and east.

Soils are formed through the interaction of five major factors. These soil-forming factors are: (1) parent material, (2) climate, (3) relief, (4) living organisms, and (5) time. The degree to which the soils are influenced by the individual factors of soil formation varies from place to place (U. S. Department of Agriculture, 1960). Soils of the French Creek watershed have been forming from glacial material (till and outwash) for only approximately 15,000 years since the last glaciation (Figure 8). This relatively young soil has not had time to form distinctive layers and primarily assumes its characteristics from glacial parent material, relatively wet climate, and organic material.

Soils in the glaciated French Creek watershed are generally of two primary categories:

- Gravelly soils of outwash terraces, floodplains, and moraines formed from stream deposits and glacial outwash.
- Soils of upland areas formed from the weathering of glacial till.

The outwash terraces are associated with the lowlands around stream channels. These are comprised of gravelly and sandy soils. Glacial outwash is formed from materials carried away from glaciers by meltwater. These soils may range from saturated to droughty depending on the level of the water table and the percent slope. The steep soils tend to be droughty while the soils in depressions are very poorly drained. These soil types include a small percentage of muck and peat producing areas northwest of Corry where bog and fen wetlands are present. The soils of this general area were historically used for intensive farming. Potatoes were the principal cash crop. Corn, small grains, and alfalfa were grown on the well-drained and moderately drained soils (U. S. Department of Agriculture, 1960). Dairy farming was the most common type of farming on the more poorly drained soils. Although many farms still exist, including some dairy operations, much of the agriculture in the watershed has been lost and portions of this land

have reverted to forest. The better draining sloping and moderately steep soils are used as a source of sand and gravel.

The upland areas in the glaciated portion of the watershed are rounded hills surrounded by the glacial outwash terraces. In general, these soils range from poorly drained in level areas to excessively drained in steep areas and ridge crests where the soil is thin. The soil is underlain by moderately calcareous till, forming a mantle that is slowly permeable to water resulting in a high water table. Most of the soils of this general area were historically used for dairy farming and livestock production. Corn, hay, and small grains were the principal crops but often did not do well due to wet fields. Many of the dairy farming operations no longer exist and much of this land has reverted to forest.

Silty and clayey soils of glacial lakebeds also occur in a few locations in the northern portions of the watershed. These areas indicate the previous existence of a lake, which captured the finest silt and clay particles of glacial outwash and filled in over time.

Portions of the extreme southern reaches of French Creek in Venango County have very steep sided stream valleys associated with them. These areas were not reached by glaciers and exhibit very different topography and consequently, soil types. The floodplains are largely deposited alluvial material, which is usually well drained. The stream valley hillsides are well drained, stony soils underlain by shale, siltstone, and sandstone. The increased relief in this portion of the watershed has not favored agriculture and consequently many ridges are heavily forested.

Within these general soil classifications exist many soil types that vary greatly from one area to another. It is important to consider the soil type in a particular area when considering farming, development, or any project, which could impact the watershed if done incorrectly. It is also important to consider soil types when implementing Best Management Practices (BMP) and riparian restoration projects through streambank stabilization. Some soils are much more erodable than others. Other factors, like grade of slope, are also important in determining appropriate land uses.

Ownership

Publicly owned lands in the French Creek watershed are considered to be those owned by the Pennsylvania Department of Conservation and Natural Resources, Pennsylvania Game Commission (PGC), Pennsylvania Fish & Boat Commission, U. S. Fish & Wildlife Service, and other government agencies including county and local municipalities (Figure 9). Publicly owned lands represent only about four percent of the total land area in the French Creek watershed.

There are no DCNR State Parks in the watershed. There are several state parks within a short drive of French Creek. Presque Isle State Park lies to the north in Erie County, Pymatuning State Park lies to the west in Crawford County, Maurice K. Goddard State Park lies just outside of the watershed in Mercer County, and Oil Creek State Park lies to the southeast in Venango County. There is a small section, 127 acres, of the Cornplanter State Forest, owned by DCNR, in the French Creek watershed in Crawford County near the village of Townville.

Figure 7. Surface Geology in French Creek Watershed

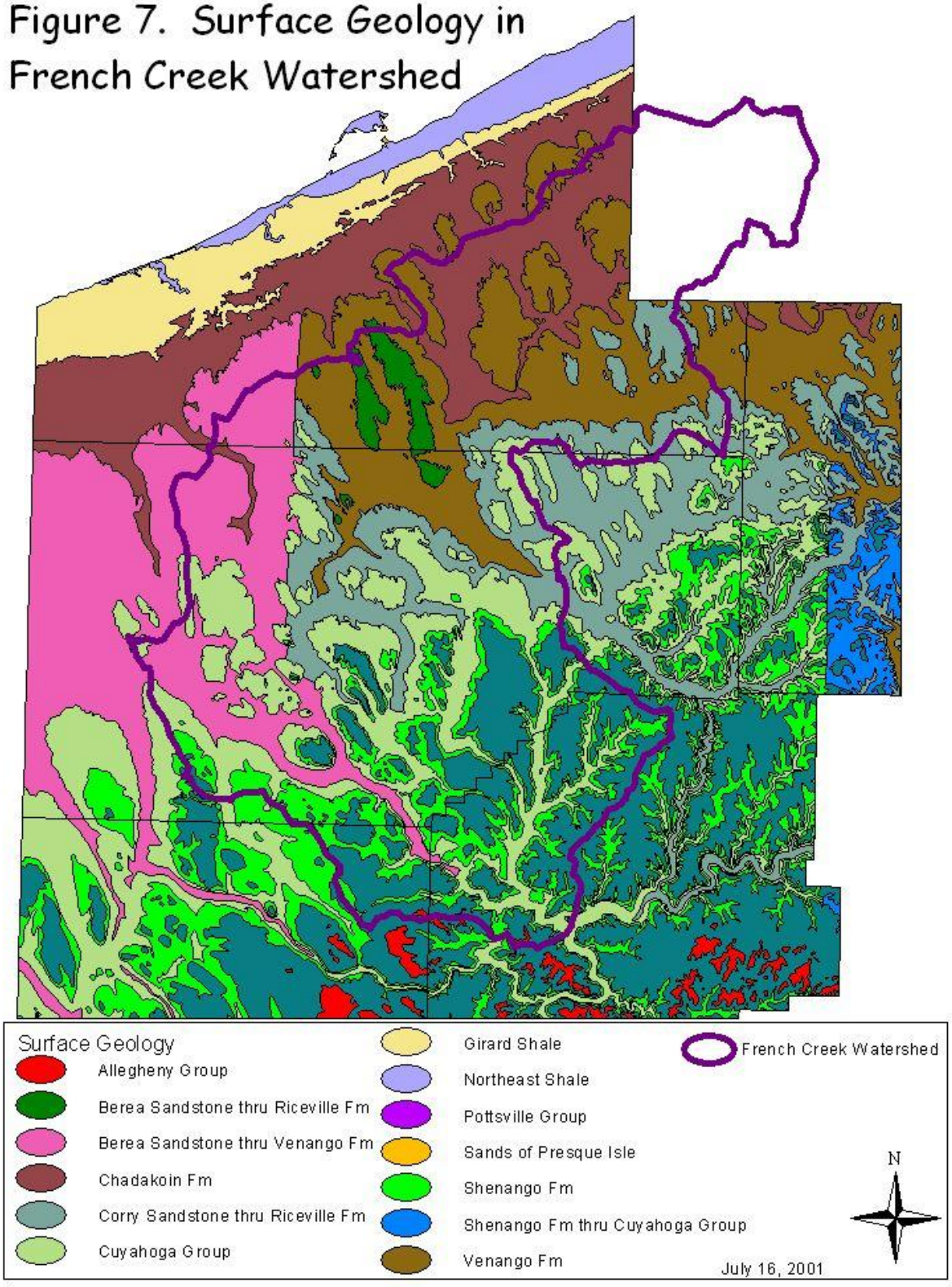
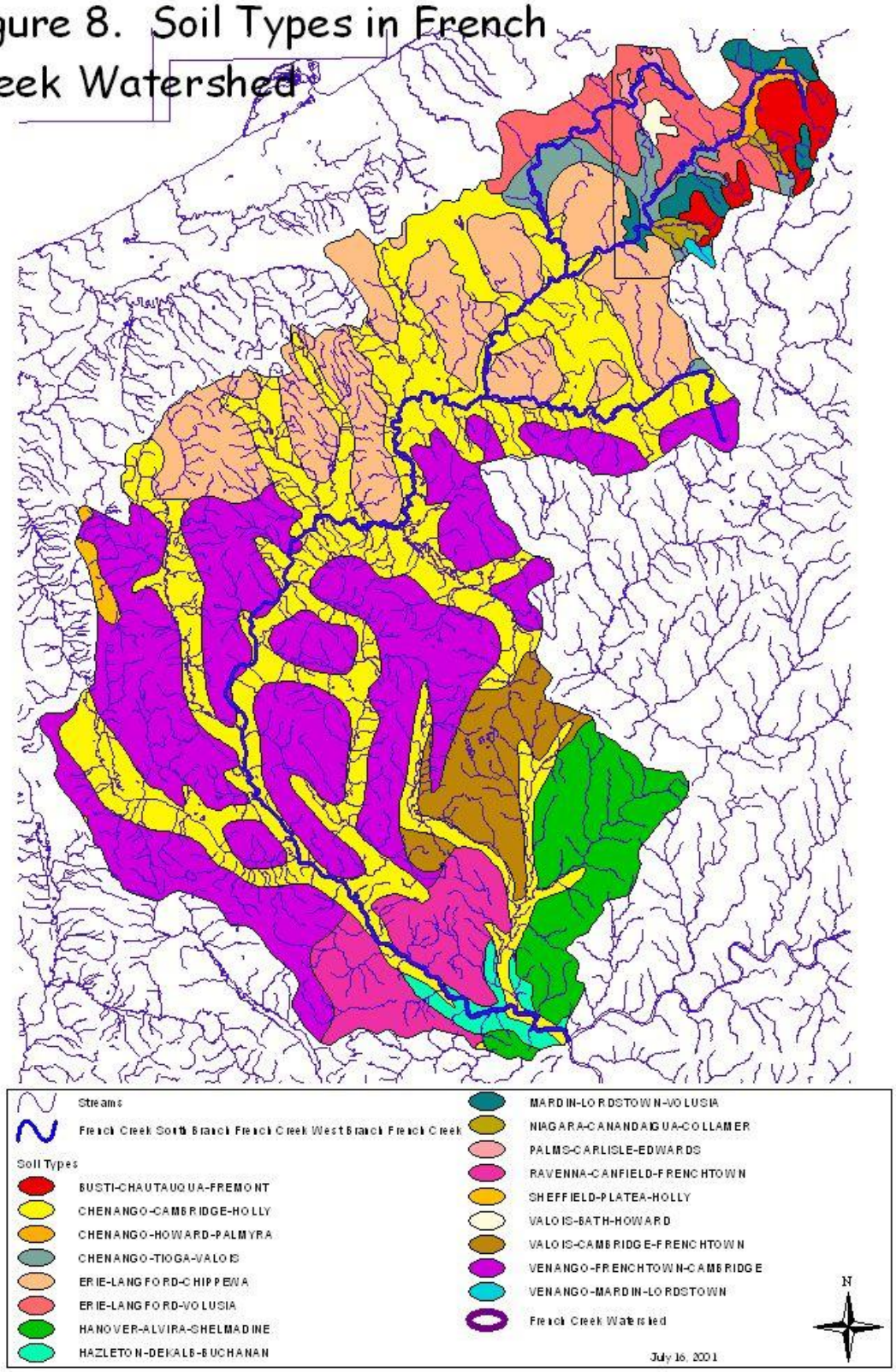


Figure 8. Soil Types in French Creek Watershed



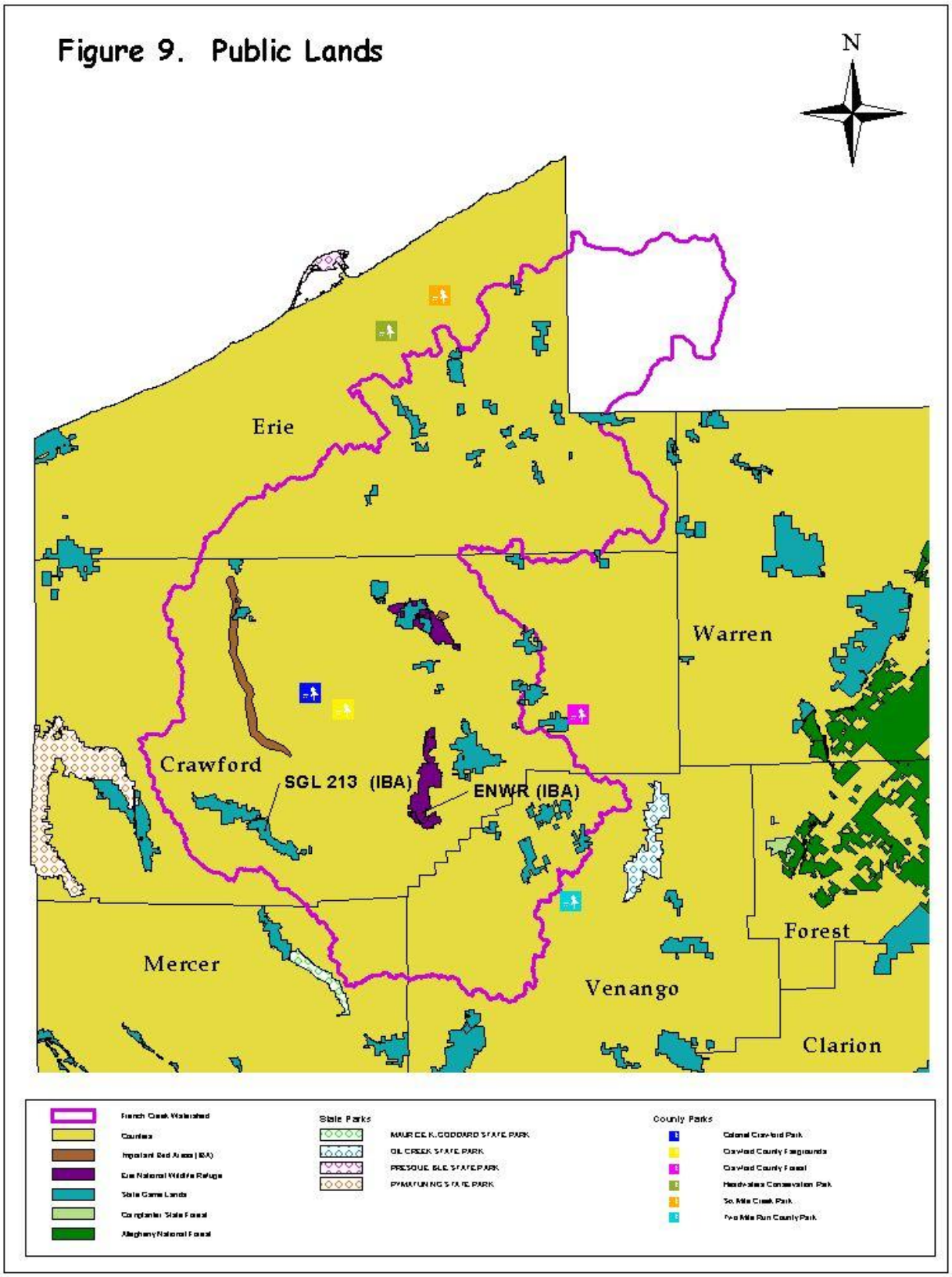


Figure 9. Public Lands
N
Erie
Warren
Crawford
SGL 213 (IBA)
ENWR (IBA)
Mercer
Venango
Forest
Clarion
French Creek Watershed
Counties
Important Bird Areas (IBA)
Erie National Wildlife Refuge
State Game Lands
Conplanter State Forest
Allegheny National Forest
State Parks
MAURICE K. GODDARD STATE PARK
OIL CREEK STATE PARK
PRESQUE ISLE STATE PARK
PYMATUNING STATE PARK
County Parks
Colonial Crawford Park
Crawford County Fairgrounds
Crawford County Forest
Hearts Area Conservation Park
Six Mile Creek Park
Two Mile Run County Park

The PGC owns approximately 21,340 acres in the French Creek watershed. These State Game Lands (SGL) are comprised of relatively small, noncontiguous parcels spread throughout the watershed (Table 2).

Table 2. State Game Lands Within the French Creek Watershed

SGL #	Acreage	Township	County
96	4972.8	Cherrytree, Jackson, Oakland, Plum	Venango
270	2186.64 (in part)	Deer Creek, French Creek	Mercer
102	383.6	Amity, Union	Erie
109	1676.8	Greene, Summit, Waterford	Erie
154	1415.91 (in part)	Wayne	Erie
155	390.7	Venango	Erie
161	234.6	Greene	Erie
162	591.37	Amity	Erie
163	332.71 (in part)	Greenfield	Erie
167	627.4	Amity, Venango	Erie
190	391.09	Amity, Waterford	Erie
191	1223.8	Greenfield, Venango	Erie
192	333.3	Washington, Waterford	Erie
218	1351.22	Greene	Erie
69	4496.01	Randolph, Richmond, Troy	Crawford
85	114.9	Rockdale	Crawford
122	2649.26 (in part)	Athens, Steuben	Crawford
146	526.19	Richmond	Crawford
144	647.53 (in part)	Sparta, Concord	Crawford, Erie
152	499.4	Cussewago	Crawford
199	1131.97	Athens	Crawford
200	154.1	Richmond	Crawford
269	589.5	Cussewago	Crawford
277	971.89	Rockdale, Venango	Crawford
213	5574.08	Greenwood, Union, Vernon	Crawford
Source: PA Game Commission			

The PFBC owns or leases several access areas to French Creek and various lakes within the watershed. In addition, the PFBC operates two fish culture stations near Union City and Corry.

The largest tracts of contiguous, publicly owned land in the watershed belong to the USFWS Erie National Wildlife Refuge. Two separate divisions totaling 8,800 acres are situated in the Crawford County portion of the watershed. The northern 3,600-acre Seneca Division lies in the Muddy Creek sub-basin near Cambridge Springs. The southern 5,200-acre Sugar Lake Division straddles the Sugar Creek and Woodcock Creek sub-basins and is located east of Meadville.

Other agencies like the United States Army Corps of Engineers (USACE) operate public access areas on water bodies such as the Union City Dam Reservoir and Woodcock Creek Lake. All of

these agency-owned properties plus several small municipal parks represent all publicly owned lands in the French Creek watershed.

Western Pennsylvania Conservancy owns 1102.82 acres in the watershed, which are available for public use. In addition, Conneaut Lake/French Creek Valley Conservancy (CLFCVC) owns 72 acres and holds conservation easements on an additional 150 acres in the watershed. In total, about 96 percent of the watershed is in private ownership. This fact places special emphasis on community supported conservation programs for overall protection of the watershed.

Critical Areas

A critical area is one that, due to its nature, has constraints on the types of activities or development that may occur there. Examples of critical areas include erosion prone areas, stream banks, steep slopes, sinkholes, and karstic areas.

Steep slopes are critical areas that often present the potential for severe erosion and landslides. Due to the rolling topography of much of the French Creek watershed, steep slopes are not common. There are some instances of steeply sloped valleys associated with southern portions of French Creek and some of its tributaries that lie outside of the glaciated portion of the watershed (Figure 10). These slopes are normally wooded and pose little threat for erosion. Improper timbering practices or poor land use decisions can alter these steep slopes causing an increase in erosion or likelihood of landslides. This is particularly true of areas where roads or railroad beds are cut into steep slopes, leading to the potential for severe erosion.

French Creek's glacial history has led to ancient, well-defined stream channels being filled with glacial till causing present streams to meander through shallow stream valleys. It is important to note that the meandering of French Creek is a natural occurrence and in itself does not represent a problem. Loss of riparian buffers, alterations to hydrology, and improper land uses have led to large-scale erosion problems along many sections of the banks of French Creek and its tributaries. These human-induced factors have led to many areas of highly eroded stream banks along French Creek and its tributaries. This pattern of erosion and shifting stream channels is evident along the main branch of French Creek in Venango and Amity townships, and Wattsburg Borough in Erie County and elsewhere. These municipalities have worked to stabilize the stream channel using a combination of rock riprap and root wads. Many stream segments through the highly agricultural Erie and Crawford Counties have lost protective riparian buffers and consequently exhibit severe erosion of stream banks. Compounding this problem further downstream may be the increase in bank-full flows caused by the flood prevention dam near Union City on French Creek.

Natural stream movement often causes problems for roads and railways that are built too close to streams. There are many areas in the French Creek watershed where travel corridors were built along stream banks and probably continue to be built too close to streams. The result of natural stream movement is erosion of roads and rail beds necessitating the use of riprap to reinforce these areas. Riprapping is often done when emergency subsidence demands immediate attention. Normally rock or cement is used to stop further streambank erosion. Riprapping tends to transfer

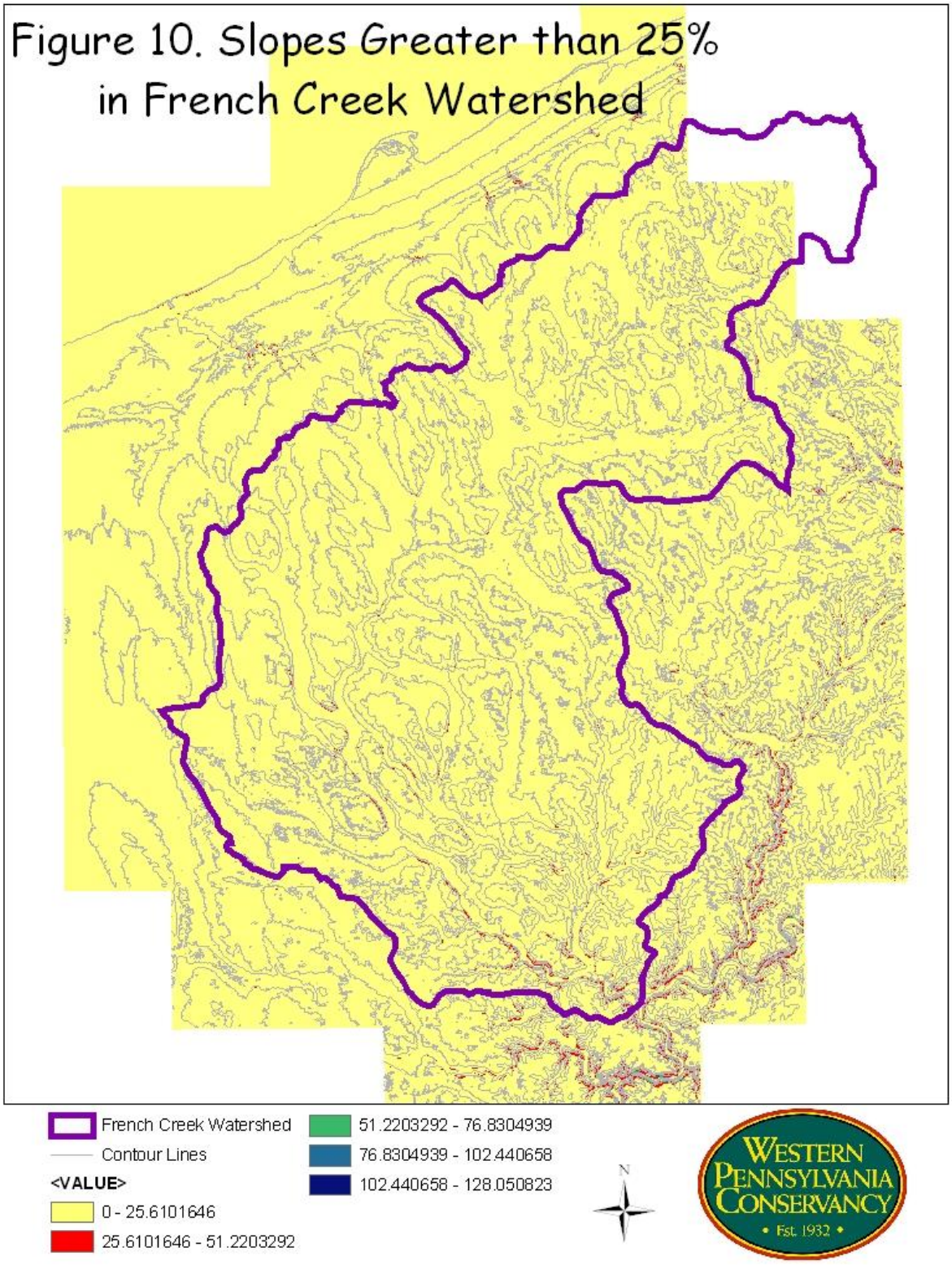


Figure 10. Slopes Greater than 25%
in French Creek Watershed
French Creek Watershed
Contour Lines
<VALUE>
0 - 25.6101646
25.6101646 - 51.2203292
51.2203292 - 76.8304939
76.8304939 - 102.440658
102.440658 - 128.050823
N
WESTERN PENNSYLVANIA CONSERVANCY
Est. 1932

the stream's energy to other locations downstream where increased erosion may occur. Often these projects are undertaken without thought to the impacts to downstream areas.

Landfills

Currently there are two permitted landfills in the French Creek watershed. Kebert Landfill is a demolition landfill south of Meadville in West Mead Township, Crawford County. International Paper operates a permitted landfill near Lowville, in Venango Township, Erie County. This landfill receives wastes from the International Paper plant in the City of Erie, outside of the French Creek watershed. Landfill permits are granted and monitored by the Waste Management Program of the Pennsylvania Department of Environmental Protection. Currently, DEP is conducting an inventory of older individual or abandoned municipal dumpsites.

Potential Hazard Areas

Hazardous Waste Sites

There are no current Superfund sites within the French Creek watershed as identified by the National Priorities List maintained by the U. S. Environmental Protection Agency (EPA). These sites are regulated under Section 111 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Under this legislation, EPA also identifies potential hazardous waste sites, which pose a threat of release of hazardous substances, pollutants, or contaminants. There are several potential hazardous sites in the French Creek watershed (Appendix C).

Mining Operations

Due to a lack of coal deposits, the French Creek watershed has escaped the degradation from abandoned coal mine drainage that has claimed the biological integrity of many Pennsylvania waterways. However, the glacial processes that shaped the northwestern Pennsylvania landscape left the area rich in sand and gravel deposits. These deposits are actively mined to provide material for roadways and other construction projects. Sand and gravel mining occurs throughout the French Creek watershed with much of it concentrated in the northern portions (Figure 11). This may be due to the close proximity to Erie's port, however other areas of the watershed will be more actively mined as these northern deposits are depleted. Open-pit gravel mining has the potential to alter the chemical properties of groundwater by exposing it to acid deposition and/or removing the alkaline bearing material. Surface runoff may also see an increase in sediment loads and pollutants from inadequately maintained mining operations. In addition, alterations in hydrology are a threat to wetland and aquatic organisms that rely on specific natural flow regimes.

Oil and gas drilling also occurs throughout the French Creek watershed (Figure 12). Historically, southern areas of the watershed were actively drilled for oil production. Areas in southeastern Crawford and Venango counties are historically famous for oil production. Presently, gas wells are much more common in the French Creek watershed than oil wells. Many areas throughout the watershed have active wells and a high number of abandoned wells

also exist. Abandoned oil and gas wells have the potential to leach brine into groundwater and surface water. Aside from high salt concentrations, brine also contains heavy metals and other pollutants that can seriously degrade water quality. All mining operations in the French Creek watershed are permitted and monitored by DEP Bureau of Mining in Knox, Pennsylvania (Appendix D).

Natural Erosion and Depositional Patterns

The relatively young stream valleys of the French Creek watershed are a result of glaciation filling in original stream valleys with till and modern streams now re-cutting these areas. Much of French Creek and its tributaries are low to medium gradient streams that tend to meander across wide, shallow stream valleys following the least resistant pathway through the gravelly till, probably often coinciding with the location of original stream valleys. This natural tendency to meander is often compounded by human impacts on the landscape. Loss of riparian zones and alterations in flow regimes due to loss of wetlands, increases in impervious surfaces, removing forests, and damming all have the potential to increase erosive forces in flowing streams. Much of the work currently being done in the watershed to address these problems only attempts to fix the symptoms of erosion problems instead of looking for the causes. It is imperative to gain a better understanding of the natural flow patterns of French Creek in order to more effectively control erosion and sediment deposition.

Figure 11. Mining Sites in French Creek Watershed

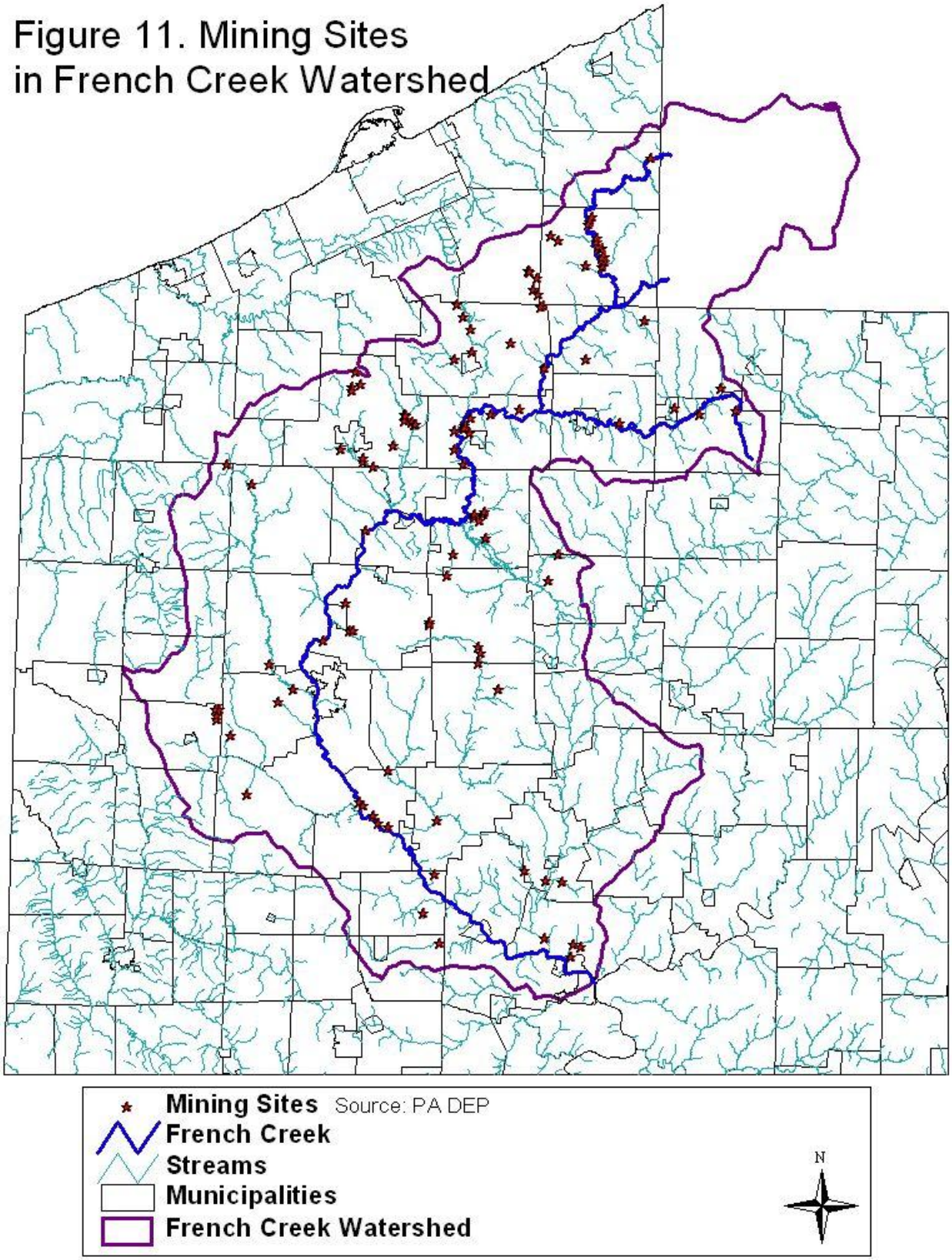
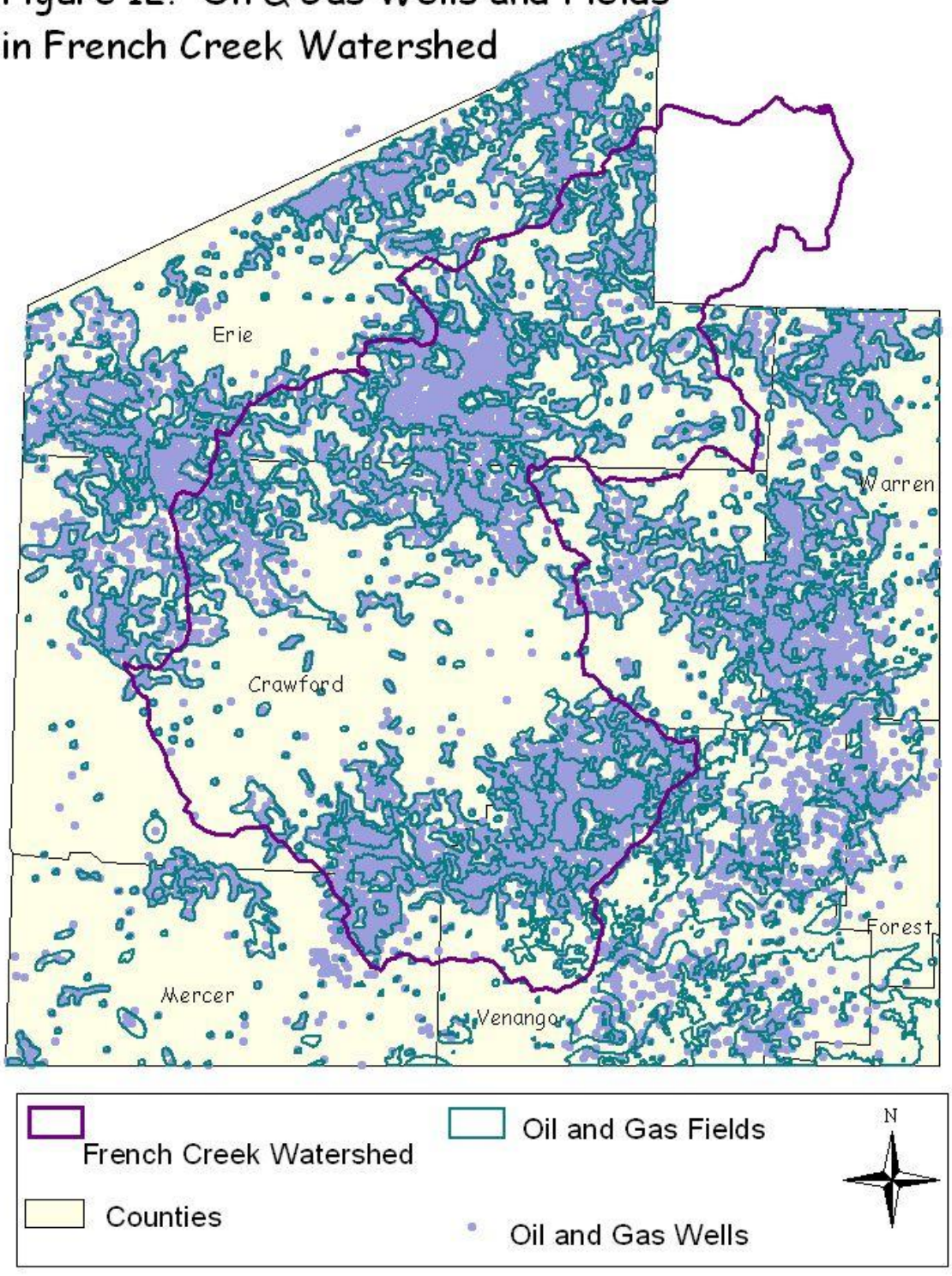


Figure 12. Oil & Gas Wells and Fields in French Creek Watershed



WATER RESOURCES

Major Tributaries

The French Creek watershed has ten major tributaries whose sub-basins cover at least 50 square miles (Figure 3). In addition, those major sub-basins can be broken down further into the Pennsylvania State Water Plan designated small watersheds (Figure 13). The PA portion of the main stem of French Creek is classified as a warm water fishery (WWF) by the PA Department of Environmental Protection's Water Quality Standards (PA Title 25, Chapter 93).

West Branch of French Creek

The West Branch of French Creek originates in Chautauqua County, New York and flows southwest into Erie County, Pennsylvania before turning south. It joins French Creek from the right side (facing downstream), near Wattsburg, at river mile 84.42 and drains 77.7 square miles. It drains portions of Northeast, Greenfield, and Venango townships and Wattsburg Borough in Pennsylvania. The low gradient West Branch and all of its tributaries are classified as WWF.

The West Branch sub-basin contains the most extensive wetlands, including rare fens, of any Pennsylvania headwater area. Although this sub-basin still contains blocks of contiguous forest and undeveloped riparian areas, it is beginning to see development pressure from the city of Erie and North East.

Work by Dr. J. Stauffer, *et al*, Penn State University, and other historic records have documented 26 species of fish from the West Branch sub-basin (Western Pennsylvania Conservancy, 1992). These include the PA threatened mountain brook lamprey (*Ichthyomyzon greeleyi*), and Ohio lamprey (*Ichthyomyzon bdellium*). According to surveys by WPC biologists, this stream also supports 13 freshwater mussel species, including a "viable population of the [former] federal candidate *Epioblasma triqueta* (snuffbox)" (Western Pennsylvania Conservancy, 1994).

South Branch of French Creek

The South Branch of French Creek originates in Concord Township, Erie County and flows generally westward to its confluence with French Creek just west of Union City. It joins the main stem from the left at river mile 73.38 and drains 80.3 square miles. It drains portions of Concord, Wayne, Amity, Union, and LeBoeuf townships, the City of Corry, and Elgin and Union City boroughs in Erie County, as well as small portions of Sparta and Bloomfield townships in Crawford County. The South Branch basin is classified as a Cold Water Fishery (CWF) with the exception of one tributary, Beaver Run, one of two Exceptional Value (EV) streams in the French Creek watershed. Beaver Run contains a naturally reproducing wild brown trout (*Salmo trutta*), population (Lee, 2000) and is classified by the PA Natural Diversity Inventory as a high-gradient clearwater creek.

The South Branch sub-basin contains the largest bottomland forest area in the Pennsylvania headwater area. There are also extensive wetlands associated with the section of the South Branch sub-basin between Corry and Union City. Tributaries in this section have rare fens and

calcareous seep wetlands associated with them. Much of the riparian areas of the South Branch are intact but the basin supports a high degree of agriculture that could potentially threaten these areas.

Thirty-one fish species are recorded from the South Branch sub-basin (Western Pennsylvania Conservancy, 1992). The mountain brook lamprey and the gilt darter (*Percina evides*), are the only fish species of special concern. The South Branch sub-basin contains eight mussel species with the cylindrical papershell (*Anodontoides ferussacianus*) and spike (*Elliptio dilatata*), being the only two species recorded from the headwater areas near Corry (Western Pennsylvania Conservancy, 1994).

LeBoeuf Creek

LeBoeuf Creek forms from two major branches. The East Branch originates in Venango and Greene townships just north of Lake Pleasant in Erie County. The main branch originates in Summit Township, Erie County. The two branches flow southward to their confluence in Waterford Township, Erie County and LeBoeuf Creek continues southward to Lake LeBoeuf in Waterford. From Lake LeBoeuf, LeBoeuf Creek flows south to its confluence with French Creek in LeBoeuf Township. It joins French Creek from the right at river mile 67 and drains 63.3 square miles. LeBoeuf Creek is classified as a Trout Stocked Fishery (TSF). According to the PA Fish & Boat Commission, however, LeBoeuf Creek was last stocked with trout in 1988 due to posting of private property (Lee, 2000). Trout Run, a tributary to LeBoeuf Creek, is classified as an EV stream and a Class A trout stream because of a naturally reproducing wild brown trout population.

The LeBoeuf Creek sub-basin contains extensive wetlands upstream from Lake LeBoeuf and Waterford, which include fen and calcareous marsh areas. Better draining headwater areas as well as parts of the sub-basin downstream are extensively farmed.

Thirty fish species are recorded from the LeBoeuf Creek sub-basin, including the PA endangered Iowa darter (*Etheostoma exile*) and warmouth (*Lepomis gulosus*), and PA threatened Ohio lamprey (Western Pennsylvania Conservancy, 1992). Lower LeBoeuf Creek, below Lake LeBoeuf, contains a diverse mussel community with at least 13 species, including the federally endangered clubshell mussel (*Pleurobema clava*). Upper LeBoeuf Creek has no documented mussel species, however the cylindrical papershell has been recorded from the East Branch of LeBoeuf Creek.

Muddy Creek

Muddy Creek also forms from two major branches. The East Branch originates in Athens Township, Crawford County where it meets the main branch. The main branch originates in Steuben and Richmond townships, Crawford County and drains Townville before entering Athens Township. The main stem of Muddy Creek flows northwest through Athens, Bloomfield, Richmond, and Rockdale townships in Crawford County. In addition, Muddy Creek flows through the northern Seneca division of the Erie National Wildlife Refuge. Muddy Creek joins French Creek from the left at river mile 55.58 and drains 83.6 square miles. The separate

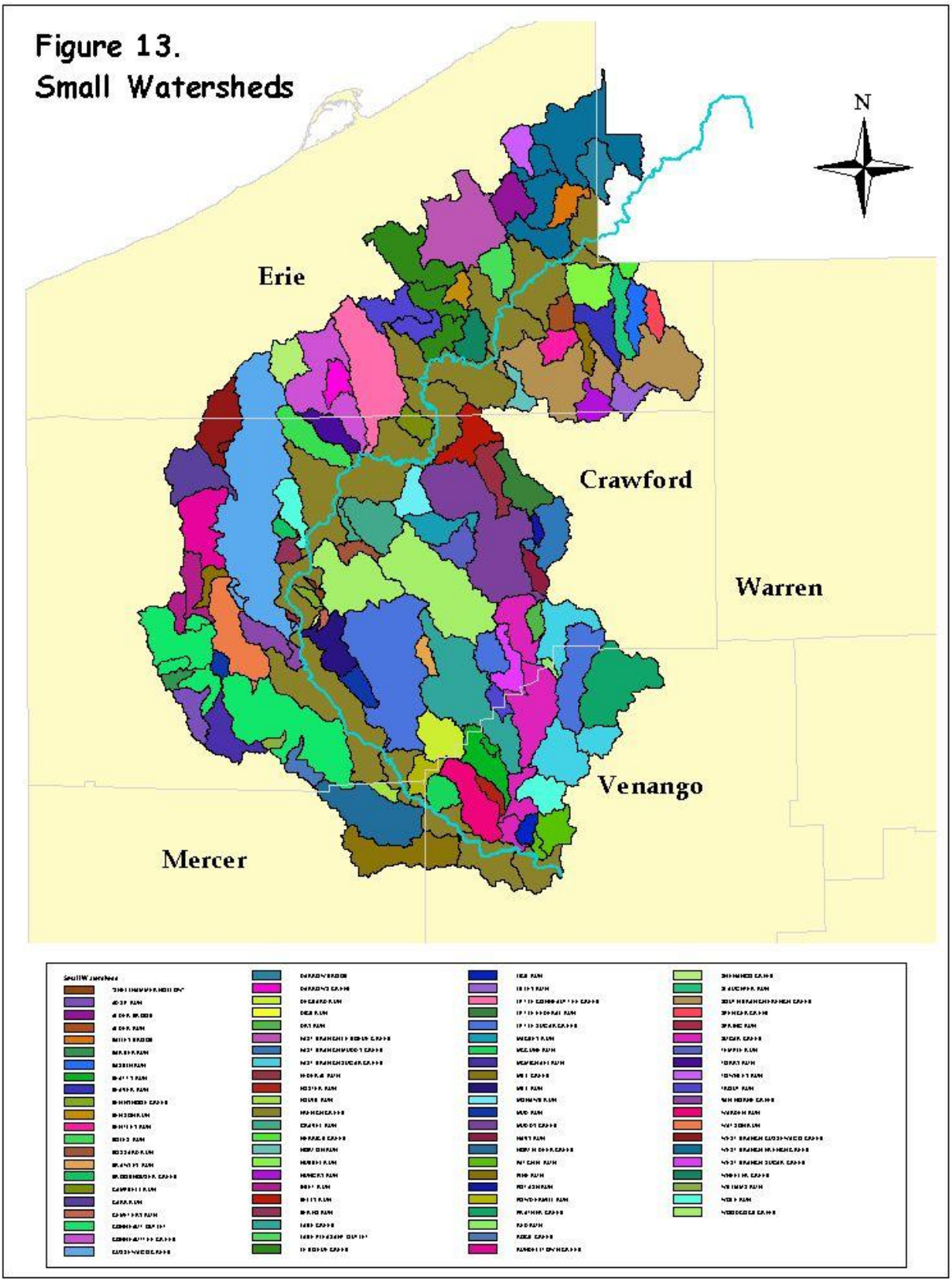


Figure 13.
Small Watersheds
N
Erie
Crawford
Warren
Venango
Mercer

branches of Muddy Creek and its tributaries are classified as High Quality Cold Water Fisheries (HQ-CWF). The main stem of Muddy Creek is a High Quality Trout Stocked Fishery (HQ-TSF).

Much of the headwater areas of the Muddy Creek sub-basin are extensively farmed. In contrast, the Erie National Wildlife Refuge and State Game Lands #83 protect extensive wetlands along the downstream sections of Muddy Creek. Western Pennsylvania Conservancy and the French Creek Project have targeted the Muddy Creek sub-basin for outreach to landowners and implementation of agricultural Best Management Practices.

The Muddy Creek sub-basin holds 25 fish species, including the PA threatened Ohio and mountain brook lampreys (Western Pennsylvania Conservancy, 1992). Muddy Creek also harbors the federally endangered clubshell mussel, along with several other freshwater mussel species. The federally endangered northern rifffleshell (*Epioblasma torulosa rangiana*) has been documented in French Creek near the mouth of Muddy Creek and may exist in Muddy Creek proper.

Conneauttee Creek

Conneauttee Creek and its tributaries originate in Washington and Franklin townships, Erie County and flow into Edinboro Lake. Upon leaving Edinboro Lake, Conneauttee Creek flows generally south-southeast, draining Edinboro and portions of Washington Township before entering Crawford County where it forms the border between Venango and Cambridge townships. Nearly half of the Conneauttee Creek basin is attributed to its major tributary, Little Conneauttee Creek.

Little Conneauttee Creek drains portions of McKean, Waterford, Washington, and LeBoeuf townships in Erie County and Cambridge Township, Crawford County. Little Conneauttee Creek drains 25.9 square miles before its confluence with Conneauttee Creek just above the mouth of Conneauttee Creek.

Conneauttee Creek joins French Creek from the right at river mile 48.02, northwest of Cambridge Springs, Crawford County, and drains a total of 60.8 square miles. Conneauttee Creek is classified as a WWF with the exception of the segment between Edinboro Lake and the Erie-Crawford County border, which is a TSF. Little Conneauttee Creek and its tributaries are classified as a CWF.

The Conneauttee Creek sub-basin is extensively farmed and offers plenty of restoration opportunities for degraded riparian areas. This sub-basin has been targeted by the FCP for agricultural BMP implementation. The Conneauttee Creek sub-basin has some wetlands including a calcareous fen associated with Edinboro Lake.

There were no records of fish surveys done in the Conneauttee sub-basin by Stauffer *et al*. The PFBC have documented 16 species of fish in Conneauttee Creek. The PFBC also report several instances of sediment pollution to Little Conneauttee Creek from oil and gas well drilling (Lee and Obert, 1984). No mussels have been documented in Little Conneauttee Creek; however,

Conneauttee Creek harbors the federally endangered clubshell mussel, as well as the white heelsplitter (*Lasmigona complanata*).

Woodcock Creek

Woodcock Creek drains portions of Randolph, Richmond, Woodcock, East Mead, and West Mead townships and the boroughs of Blooming Valley and Saegertown, all in Crawford County. Flowing generally westward, Woodcock Creek joins French Creek from the left at river mile 37.84, just south of Saegertown, and drains 50.5 square miles. Woodcock Creek was dammed in 1973 by the U. S. Army Corps of Engineers, creating Woodcock Creek Lake. The dam was designed as a triple use dam: recreation, flood control, and low water augmentation. Woodcock Creek, from its headwaters to the reservoir dam, is classified as a HQ-CWF. From the reservoir dam to its mouth, Woodcock Creek is a CWF.

There are 18 fish species recorded from the Woodcock Creek sub-basin, including the PA threatened Ohio and mountain brook lampreys (Western Pennsylvania Conservancy, 1992). Three mussel species have been recorded from the extreme upstream areas of Woodcock Creek within the Erie National Wildlife Refuge. These species include: cylindrical papershell, creek heelsplitter (*Lasmigona compressa*), and paper pondshell (*Utterbackia imbecillis*). No mussel species have been recorded, and it is doubtful that any exist, downstream near Woodcock Creek Lake (Western Pennsylvania Conservancy, 1994).

Cussewago Creek

Cussewago Creek is a south-flowing tributary that forms from two major branches. The West Branch originates in Elk Creek Township, Erie County and drains portions of Spring and Cussewago townships in Crawford County before its confluence with the main branch. The main branch drains portions of Franklin, Elk Creek, and Washington townships in Erie County before its confluence with the West Branch in Cussewago Township, Crawford County. Cussewago Creek and its tributaries also drain portions of Summerhill, Hayfield, and Vernon townships in Crawford County. Cussewago Creek joins French Creek from the right at river mile 31.38, at the city of Meadville, and drains 96.9 square miles. The entire basin is classified as a WWF.

Cussewago Creek has extensive wetlands and bottomland forest areas associated with it. The entire stream corridor has been designated by Audubon as an Important Bird Area (IBA) and provides habitat for nesting bald eagles (*Haliaeetus leucocephalus*). The sub-basin does have extensive farming in some areas with opportunities for riparian restoration.

Thirty-five fish species are recorded from the Cussewago Creek sub-basin, including the PA endangered redfin shiner (*Lythrurus umbratilis*). No mussel records have been found from Cussewago Creek.

Conneaut Outlet

Conneaut Outlet begins at the outflow of Conneaut Lake in Conneaut Lake Borough. It flows southeast draining portions of Sadsbury, East Fallowfield, Hayfield, Vernon, Summit, Greenwood, Union, and Fairfield townships in Crawford County. Conneaut Outlet joins French Creek from the right at river mile 22.22 and drains 101 square miles. Conneaut Lake itself and several tributaries are considered the source basin for Conneaut Outlet and are classified as a High Quality Warm Water Fishery (HQ-WWF). Conneaut Outlet, from the lake to its mouth, is classified as a WWF.

Conneaut Outlet is the remnant of an ancient streambed that was filled with glacial drift. Today, the Outlet meanders through a large, complex system of wetlands as a result of its glacial history. This robust emergent marsh is the largest marsh complex in the state. The marsh has been designated an IBA by Audubon and lies within SGL #213. The marsh is home to many birds including the state endangered American bittern (*Botaurus lentiginosus*), least bittern (*Ixobrychus exilis*), and black tern (*Chlidonias niger*), as well as bald eagles.

No fish records from Stauffer *et al*. or the PFBC were found for Conneaut Outlet. There is a historic record of longnose gar (*Lepisosteus osseus*) from 1938 (Western Pennsylvania Conservancy, 1992). Several mussel species are recorded from Conneaut Outlet, including the snuffbox, long-solid (*Fusconaia subrotunda*), white heelsplitter, eastern pondmussel (*Ligumia nasuta*), lilliput (*Toxolasma parvus*), and the federally endangered clubshell mussel.

Little Sugar Creek

Little Sugar Creek drains southward through portions of West Mead, East Mead, Randolph, East Fairfield, and Wayne townships, Crawford County, before entering French Creek at Cochranton. Converging with French Creek from the left at river mile 18.96, Little Sugar Creek drains 53 square miles. The entire Little Sugar Creek sub-basin is classified as a CWF.

Mud Run, a tributary of Little Sugar Creek, is one of two streams that were dammed by the U.S. Department of Agriculture (USDA) to form Tamarack Lake.

Surveys by the PFBC have recorded 15 fish species from Little Sugar Creek. No records were found from Stauffer *et al*. Included were reports of lampreys but species were not identified. Mussel surveys in Little Sugar Creek have documented six species, with the PA endangered creek heelsplitter being the most rare. Researchers have recommended further surveys near the mouth of Little Sugar Creek where habitat suggests more species may be found (Western Pennsylvania Conservancy, 1994).

Sugar Creek

Sugar Creek, the largest tributary sub-basin in the French Creek watershed, drains portions of Steuben, Troy, Oil Creek, Randolph, and Wayne townships in Crawford County, as well as Cherrytree, Plum, Oakland, Jackson, and Canal townships and Sugarcreek and Cooperstown boroughs in Venango County. Sugar Creek converges with French Creek from the left at river

mile 4.2 and drains 167 square miles. Sugar Creek has East and West Branches, which converge at Cooperstown. The main stem is joined by another major tributary, Lake Creek, just downstream in Cooperstown. Lake Creek drains the southern Sugar Lake Division of the Erie National Wildlife Refuge. It also feeds and drains Sugar Lake. The entire Sugar Creek sub-basin is classified as a CWF.

The Sugar Creek sub-basin has been extensively mined for sand and gravel, limestone, and oil and gas. The watershed is also extensively farmed and has been targeted by the FCP for agricultural BMP implementation.

Twenty-four fish species are recorded from Sugar Creek (Western Pennsylvania Conservancy, 1992). No threatened or endangered species were recorded. Only a single mussel species was recorded from Sugar Creek and researchers speculate whether the suppressed population is attributable to mining or oil and gas activities.

The major sub-basins within the French Creek watershed provide organizations and agencies the opportunity to break the large French Creek watershed into smaller, more manageable units. Each sub-basin has unique resources and threats to those resources. By taking a sub-basin approach, streams receiving conservation and restoration programs can be prioritized depending upon measurable negative contributions by each sub-basin to the overall water quality of French Creek. In addition, high quality sub-basins that contribute positively to the overall water quality of French Creek can be recognized and protected.

Wetlands

Definition and Types

Wetlands exist in a variety of different forms and are thus, sometimes difficult to define. Generally, wetland definitions are comprised of descriptions of three general characteristics: 1) the presence of water for a significant period of time during the year, 2) unique soils that differ from uplands, and 3) vegetation that is adapted to wet conditions (hydrophytes), and an absence of flooding-intolerant vegetation (Mitsch and Gosselink, 1986). Because the study of wetlands is growing in importance and the acceptance of the fundamental need to protect these ecosystems for their benefits to water quality and quantity, humans, and wildlife is increasing, it becomes necessary to adequately define wetland areas. The most widely accepted definition by wetland scientists and managers was adopted by the U. S. Fish & Wildlife Service in 1979 and is described in a report entitled *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin *et al*., 1979):

> *Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water…Wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes, (2) the substrate is predominantly undrained hydric soil, and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.*

In Pennsylvania, wetland encroachment and alteration is regulated by both DEP and the USACE. Regulation of wetland dredging and filling requires a stricter wetland definition and is described in Section 404 of the 1977 Clean Water Act Amendments:

> *The term "wetlands" means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support , and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.*

The Pennsylvania Code, Title 25, Chapter 105, describes wetland classification and regulations pertaining to permitting for encroachment or alteration.

Its glacial history has left the French Creek watershed rich with wetland resources (Figure 14). The New York headwater portions of the watershed contain two major wetland systems, Alder Bottom and Beaver Meadow Swamps. The Alder Bottom Swamp is the largest wetland in the NY portion of the watershed and is characterized by a rare plant community, a rich hemlock-hardwood peat swamp (The Nature Conservancy, 1999).

The Pennsylvania portion of the French Creek watershed contains a wide variety of wetland types. The largest wetland systems are on glacial deposits that filled deep stream valleys, while many smaller wetlands formed in the irregular, hummocky topography of the end and ground moraines (Kline, 1993). Vast marsh and swamp wetlands are associated with many glacial lakes and tributaries. In particular, Lake Pleasant Outlet in Erie County and Conneaut Lake Outlet in Crawford County support extensive marshes. Many streams within the watershed, like LeBoeuf Creek and Muddy Creek, have extensive floodplain and forested wetlands. Of particular importance are the rare glacial bog and alkaline fen wetlands in the watershed. Erie County is home to the Wattsburg Fen Natural Area, a National Natural Landmark. Other small fen and bog wetlands occur in Erie County and elsewhere in the watershed.

Benefits

Wetlands are integral parts of the watershed ecosystem. They function in a variety of ways to benefit humans as well as wildlife. Wetlands improve water quality in lakes and streams by stabilizing and filtering sediments and toxins. Wetland plants also remove or transform excessive nutrients and prevent them from entering waterways.

Wetlands augment and help control water quantity in a watershed. They retain waters during high flow periods to lessen flooding. Loss of wetlands can cause a dramatic increase in flash flooding incidents. Wetlands also provide important recharge areas for groundwater. This is especially important for low flow augmentation for streams and rivers.

Additionally, wetlands are important habitats for many species of plants and animals that depend upon these habitats and no others. Wetlands serve as a link between terrestrial and aquatic environments and dramatically increase plant and animal diversity for both environments.

Lastly, wetlands are important for the recreational and aesthetic values they provide to humans. Boating, fishing, hunting, and birding are just a few of the activities provided by wetlands.

Floodplain

Many of French Creek's floodplains lie in broad, low relief valleys (Figure 15). Historically, the floodplains in the watershed would have been forested with silver maple (*Acer saccharinum*), eastern sycamore (*Platanus occidentalis*), black willow (*Salix nigra*), and several other species dominating. These forested valleys and the streamside buffers that they furnished have been lost in many areas to agriculture, transportation routes and development. In better draining soils of the stream valleys, potatoes, corn, and other grains are grown in the fertile floodplains. Many population centers within the watershed are located in and around floodplains. This pattern of development was further increased by the construction of a flood control dam on French Creek near Union City and a triple use dam (flood control, water supply, and recreation) on Woodcock Creek.

As a relatively young stream, French Creek meanders through gravel filled streambeds with wide floodplains. The coarse, gravelly soils laid down by glacial events tend to be highly erodable. Many areas along French Creek have experienced high levels of erosion due in part to the stream's natural tendency to meander as it cuts its way through the gravelly outwash plains of the former glacial advances. Settlement and development has led to the loss of riparian buffers, the draining and filling of wetlands, and the increase in impervious surfaces in the watershed. These changes have increased the erosive forces of French Creek. This is especially true along French Creek near Wattsburg where severe erosion has occurred. Areas in the NY headwater portions of this stream have seen the loss of significant expanses of wetlands, which historically helped regulate stream flow levels (Peck, 2001). Coupled with the increase in impervious surfaces due to roadway construction, these alterations to the watershed hydrology have significantly changed the stream channel and floodplain characteristics further downstream.

While many sections of French Creek's natural floodplain have been lost to development, transportation routes, agriculture, and erosion, other areas remain intact. Some sections of French Creek and its tributary sub-basins have large sections of intact floodplain forests and wetlands. These areas should be protected as other areas of degraded floodplains and riparian areas are restored.

Lakes and Ponds

The French Creek watershed has a number of natural lakes and ponds, as well as a large number of man-made impoundments and beaver ponds. Five of northwestern Pennsylvania's seven large (> 50 acres) inland glacially formed lakes are located within the watershed (Figure 16). Such lakes are critically imperiled in Pennsylvania due to their unique characteristics, rarity and vulnerability. These water bodies are generally characterized by alkaline water chemistry, associated wetland systems, and habitat for many plant and animal species of concern in the state. In addition, there are several man-made reservoirs, which serve flood-control, water supply, low-flow augmentation, and recreational purposes. These man-made reservoirs typically

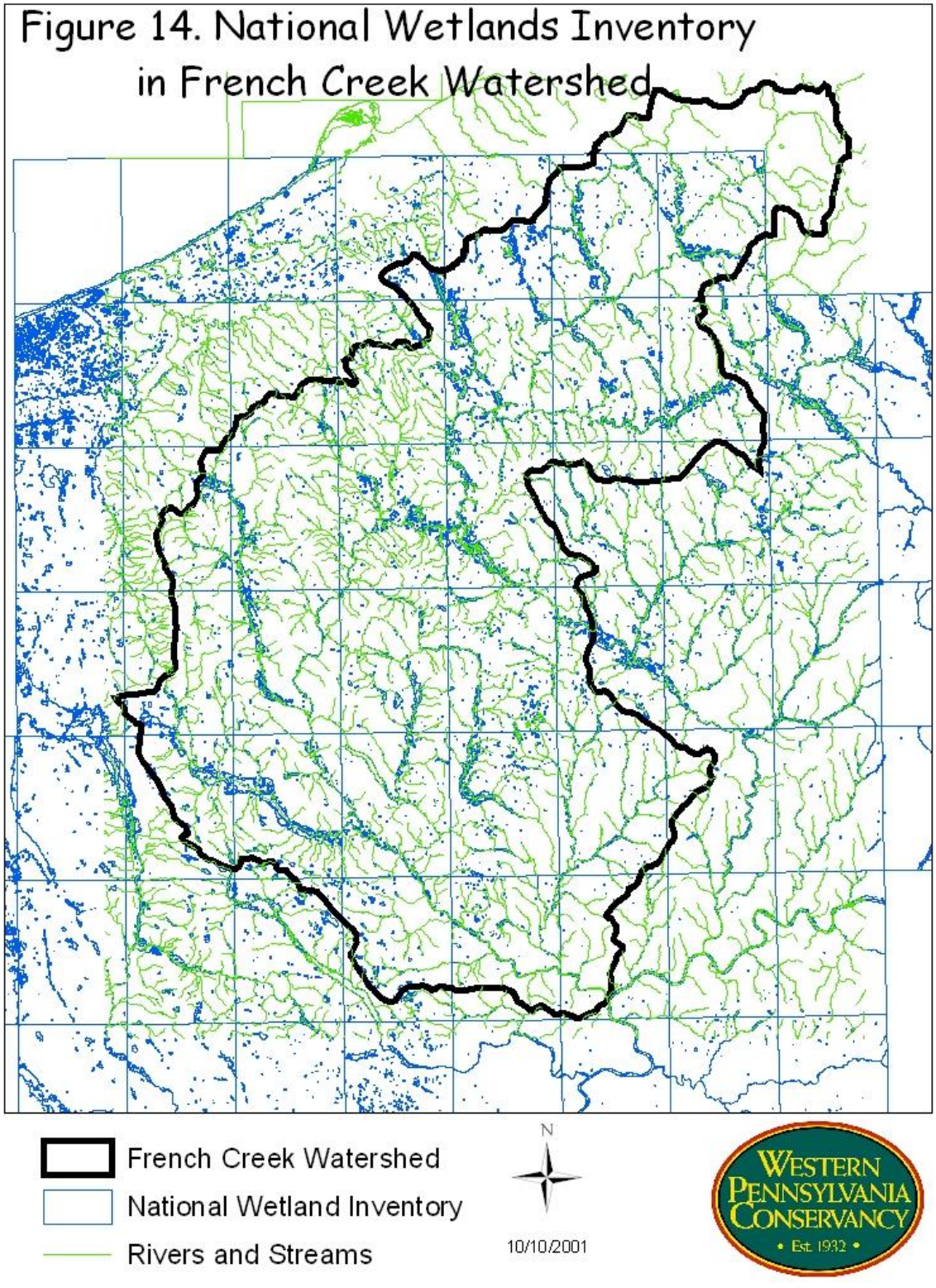


Figure 14. National Wetlands Inventory
in French Creek Watershed
French Creek Watershed
National Wetland Inventory
Rivers and Streams
N
10/10/2001
WESTERN PENNSYLVANIA CONSERVANCY
• Est. 1932 •

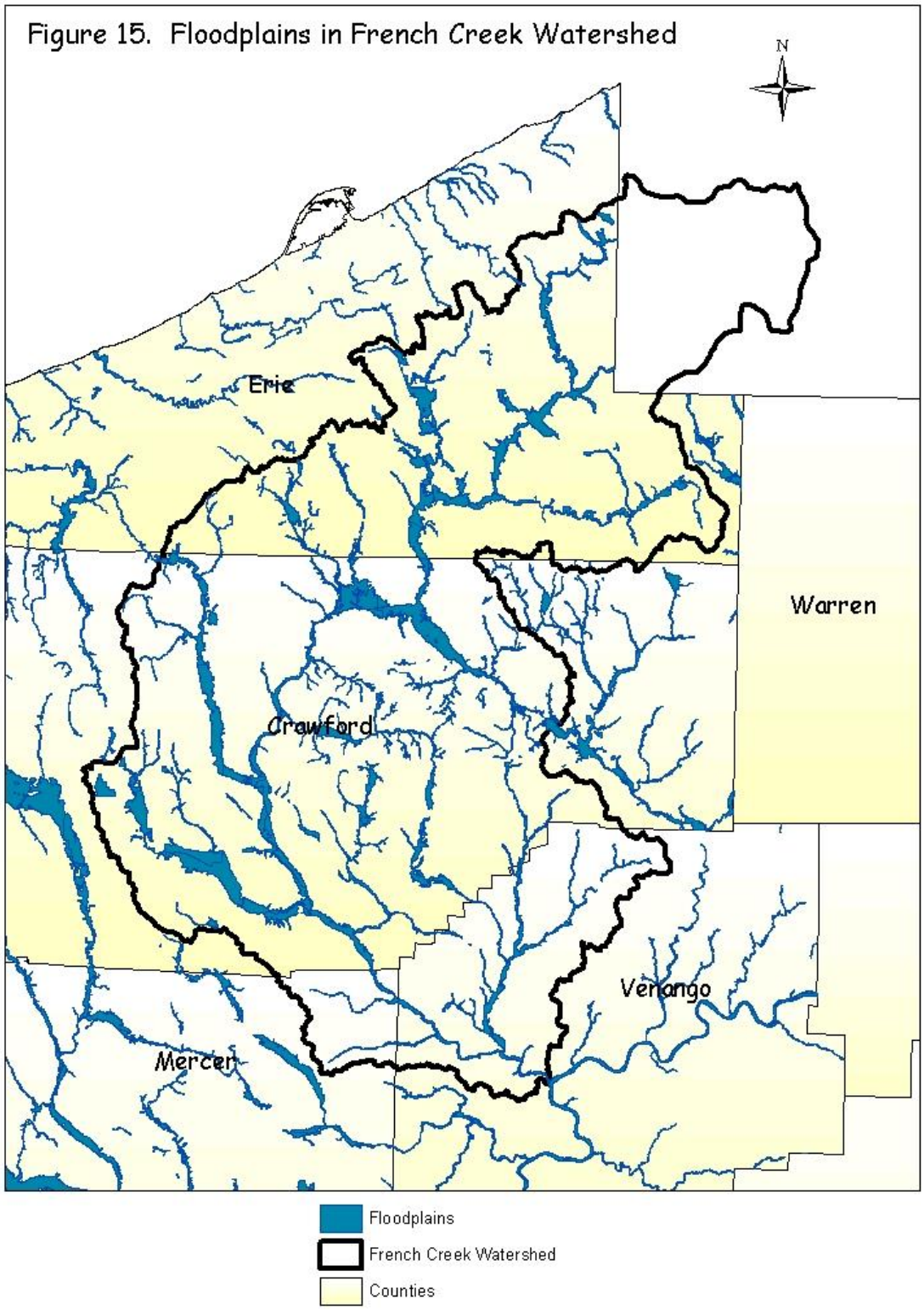


Figure 15. Floodplains in French Creek Watershed
N
Erie
Warren
Crawford
Venango
Mercer
Floodplains
French Creek Watershed
Counties

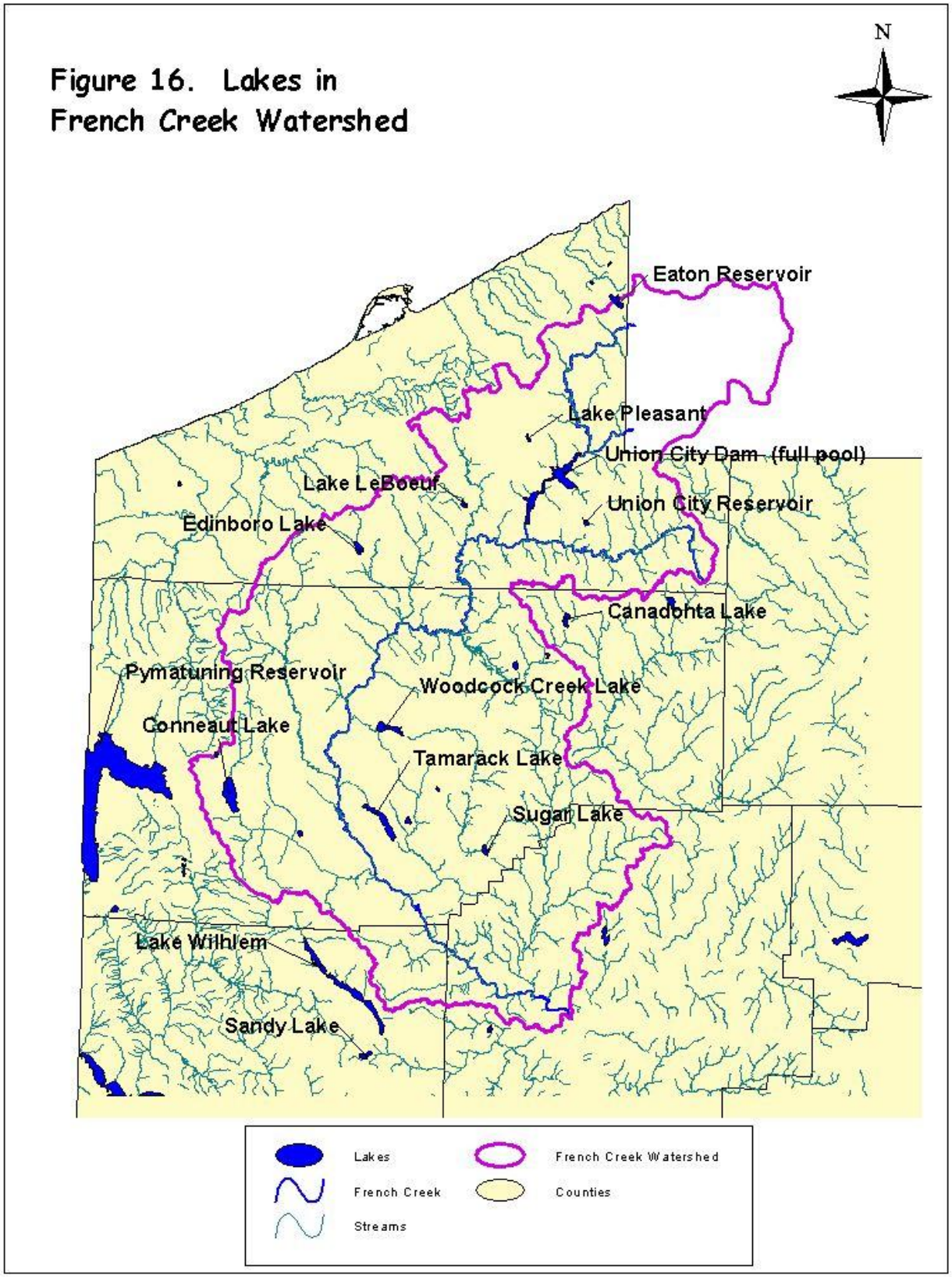


Figure 16. Lakes in French Creek Watershed
N
Eaton Reservoir
Lake Pleasant
Union City Dam (full pool)
Union City Reservoir
Lake LeBoeuf
Edinboro Lake
Canadohta Lake
Pymatuning Reservoir
Woodcock Creek Lake
Conneaut Lake
Tamarack Lake
Sugar Lake
Lake Wilhlem
Sandy Lake
Lakes
French Creek
Streams
French Creek Watershed
Counties

do not have the same characteristics or qualities of natural lakes, such as water quality, species of special concern, or unique natural communities.

Lake Pleasant

Lake Pleasant is an approximately 64-acre oval shaped natural glacial lake (~ 1120' x 2560') located at the head of a glacially carved valley in southwest Venango Township, Erie County, and is drained by Lake Pleasant Outlet, a tributary of French Creek. The lake has a surface elevation of approximately 1300 feet with the surrounding hillsides rising another 250 feet above the lake surface. The lake is 40-45 feet deep with a gravelly bottom covered with silt. Widely accepted as the best example of an intact glacial lake ecosystem in northwest Pennsylvania, this lake has been targeted for protection by WPC. Lake Pleasant has good water quality with neutral to slightly basic pH values and relatively high alkalinity. Minimal surface flow into the lake, and no motors allowed for boats on the lake, have helped protect the good water quality. Most of the water recharge to Lake Pleasant arrives via subsurface flow channels.

The exclusion of boat motors has also helped keep Lake Pleasant free from invasive aquatic plants and animals. Pieces of invasive plants, like Eurasian water-milfoil (*Myriophyllum spicatum*), which is found in nearby impoundments often travel on hulls, trailers, and motors. The exotic zebra mussel (*Dreissena polymorpha*), which invaded the Great Lakes in the 1980's and was recently discovered in nearby Edinboro, Sandy and Canadohta Lakes, is also spread in this manner. There have been introductions of invasive exotic wetland plants like common reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*), and hybrid cattail (*Typha X glauca*) to some wetland areas within the watershed.

The lake is bordered to the north, west, and south with extensive wetlands. The lake and associated wetlands provide habitat for at least 24 plant species of special concern in Pennsylvania and two fish species that are endangered in the state. Of particular importance is a basin graminoid-forb fen community to the south of the lake, which receives mineral-rich ground water and supports seven of the 22 plant species of special concern associated with Lake Pleasant.

Lake Pleasant faces many threats within its roughly 2.7-square mile watershed. Mineral extraction in the form of sand and gravel mining pose threats to ground water levels and chemistry. The lake is fairly nutrient-rich and faces the threat of over-eutrophication by the influx of nutrients, primarily nitrogen and phosphorous, from runoff associated with agriculture and forestry practices. In addition, septic systems associated with homes and cottages around the lake pose a potential threat of nutrient seepage into the lake. State Route 1001, locally known as Lake Pleasant Road, borders the eastern lakeshore and poses the threat of toxins and nutrients entering the lake via surface runoff. Specifically, petroleum products, nutrient-laden silt, heavy metals, and brine are common constituents of runoff from roadways. The vegetative buffer along the eastern lakeshore has been degraded through overuse by automobile traffic and provides no protection against runoff. With the presence of an asphalt plant at the northern edge of the watershed and the associated truck traffic, the potential for a catastrophic spill that could severely impact the lake's ecosystem exists. Despite these and other threats, the Lake Pleasant

community has avoided over-development of the lake's shoreline and loss of buffering wetlands keeping the lake relatively healthy.

Currently, Lake Pleasant is stocked with non-native trout by the PFBC and receives the most attention as a put-and-take fishery. The impact of these trout on native species of forage fish and other native predators is not well understood. The lake also supports a good largemouth bass (*Micropterus salmoides*), fishery. Lake Pleasant is classified as a HQ-CWF. Public access is maintained by the PFBC on WPC owned land through a lease agreement.

Through a grant from DEP's Growing Greener program, WPC is conducting a scientific assessment of the geology, hydrology, and ecology of the Lake Pleasant watershed. This assessment began March 2001 and will continue for two years. The object of this assessment is to gain a better understanding of the processes that occur in the watershed and ultimately affect the water quality and quantity of the lake ecosystem. Through this understanding, a management plan will be developed and conservation projects implemented. Western Pennsylvania Conservancy is also beginning floral inventories on native and invasive aquatic and wetland species associated with Lake Pleasant as part of a multi-year inventory project on all northwest glacial lakes.

Lake LeBoeuf

Lake LeBoeuf is an approximately 70-acre glacially formed lake in Waterford Borough and Waterford Township, Erie County. The lake has a surface elevation of 1166 feet and a maximum depth of 31 feet. The watershed covers 64.2 square miles. The major tributaries to Lake LeBoeuf are Trout Run and LeBoeuf Creek. The outlet stream is LeBoeuf Creek, a tributary of French Creek. An interesting feature of Lake LeBoeuf is an island in the middle of the lake that was formed during the glacial processes that formed the lake itself. The bottom of the lake is described as being composed of rock and silt.

Lake LeBoeuf still has a large area of associated wetlands composed of emergent marsh areas, shrub swamp, and tree savanna swamps. Lake LeBoeuf and its associated wetlands contain four plant species of special concern in Pennsylvania and one fish species. Lake LeBoeuf has fair water quality with relatively high alkalinity. Warm water temperatures and low summer dissolved oxygen levels make this a warm water fishery unable to sustain trout even as a put-and-take fishery. The lake does support good populations of black crappie (*Pomoxis nigromaculatus*), white crappie (*Pomoxis annularis*), walleye (*Stizostedion vitreum*), and northern pike (*Esox lucius*), as well as a fair population of largemouth bass (PA Fish & boat Commission, 2000). Lake LeBoeuf is a brood lake for muskellunge (*Esox masquinongy*), and is also stocked with walleye fingerlings.

The Commonwealth of Pennsylvania owns Lake LeBoeuf and the PFBC operates a public access area. There is a 10 h.p. restriction on boat motors on the lake making fishing the primary recreational use. Although trout have been stocked in tributaries to the lake, Lake LeBoeuf is classified as a WWF.

Nutrient levels are fairly high in Lake LeBoeuf and algal blooms are common. The watershed is characterized by a mixture of forest and agricultural lands. There are several dairy operations within the watershed. Stormwater runoff from Waterford Borough and nutrients from septic systems around the lake are potential sources of nutrients. Interestingly, a 1897 report from the Pennsylvania Commission on Fisheries characterizes the lake as "very clear…absolutely pure…"

Edinboro Lake

Edinboro Lake is another calcareous glacially-formed lake located in Edinboro Borough and Washington Township, Erie County. The lake is approximately 240 acres in size with a surface elevation of 1197 feet and a maximum depth of 34 feet. The lake watershed covers 16.2 square miles and incorporates four main tributaries: Conneauttee Creek, Shenango Creek, Whipple Creek (local name), and Lakeside Run (local name). The outlet stream is Conneauttee Creek, a major tributary to French Creek.

Edinboro Lake continues to have some areas of intact wetlands, including a rare fen; however much of the lake's shoreline has been developed and extensive dredging has occurred in some wetlands to form channels at the lake's northern end. The lake and associated wetlands harbor 23 plant species of special concern in Pennsylvania. Edinboro Lake was originally dammed around 1900 with subsequent enlargements of the dam to its present size, which raises the water level in the lake approximately 11 feet. Historic reports state that Edinboro Lake was as deep as 50 feet (anecdotal); however, large silt deposits have left the lake shallower than previously reported.

In 2000, WPC completed a two-year assessment of the health of Edinboro Lake. It was determined that Edinboro Lake is in the advanced state of eutrophication with water quality rated as poor to fair (Western Pennsylvania Conservancy, 2000). The lake shows strong stratification for temperature and dissolved oxygen levels. Nutrient levels are very high and lead to excessive algal and plant growth. Land uses in the drainage basin that may be contributing nutrients and sediments via surface runoff include agriculture, a golf course, and development. Other nutrient sources include septic systems near the lake and Washington Township's sewage treatment plant discharge. There is also a high population of Canada geese, *Branta canadensis*, associated with the lake that contributes some additional nutrients. Nutrients build up in the sediments on the lake bottom and are released during turnover events also contributing to the eutrophication problem.

Other problems affecting the health of Edinboro Lake stem from excessive erosion and sedimentation within the basin, loss of wetland and shoreline to development, and no limitations on outboard motor size for boats on the lake.

Recently, a new threat to the health of Edinboro Lake was discovered. The zebra mussel has built up a substantial population in Edinboro Lake. The effect of this invasive exotic mussel to the lake ecosystem remains to be seen. Of equal importance is the threat that the zebra mussel poses to French Creek, now with a direct linkage via Conneauttee Creek. Researchers from DEP and Edinboro University are monitoring the zebra mussel. During the 2000-2001 winter and again during the 2001-2002, the lake was drawn down to expose many of the zebra mussels to

freezing temperatures in the hopes of killing many of the adult mussels. Eradication of the zebra mussel may be impossible but it is hoped that periodic drawdowns may help keep the population under control. The effects of the drawdowns on other aquatic and wetland species are not fully understood; however periodic drawdowns have occurred in the past for dam maintenance. Currently, the Edinboro Lake Preservation and Restoration Foundation is forming to address the protection of Edinboro Lake.

Edinboro Lake is a WWF supporting populations of largemouth and smallmouth bass (*Micropterus dolomieu*), bluegill (*Lepomis macrochirus*), and black crappie among others. It is utilized as a brood lake by the PFBC for muskellunge and is also stocked yearly with walleye fingerlings. Aside from fishing, the lake is utilized by a large number of powerboats and jet skis for skiing, tubing, and other recreational activities. A public access area is owned by the borough of Edinboro on the west side of the lake.

Conneaut Lake

Conneaut Lake, the largest natural lake in the Commonwealth, is found in Summit and Sadsbury townships, Crawford County and borders the borough of Conneaut Lake. The lake surface covers 929 acres and lies at an elevation of 1073 feet. Conneaut Lake's maximum depth is approximately 65 feet. The watershed covers 27.9 square miles and includes the drainage of the major tributary Inlet Run. Conneaut Outlet, a major tributary of French Creek that has associated with it a large marsh complex, drains the lake. Most of the lake's surrounding wetlands have been lost, although one large area still remains on the west side of the lake.

The lake and associated wetlands, including those immediately downstream around the outlet, contain 16 plant and 6 animal species of special concern in Pennsylvania. Conneaut Lake has no identifiable dam although some rubble does exist near the outlet that may have been an early dam. The PA Game Commission does own a dam on the outlet near Geneva, which helps control water levels in Conneaut Marsh, downstream of the lake.

Conneaut Lake's watershed has a high degree of agriculture, some forested areas, and intensive development near the lake. These factors, coupled with the loss of wetlands surrounding the lake, have led to increased nutrient levels and greatly increased aquatic vegetation growth. Because Conneaut Lake is a major recreational area with high numbers of power boaters and jet skiers during the summer months, the Conneaut Lake Aquatic Management Association was formed to address the overgrowth of aquatic vegetation. This organization has attempted to control aquatic plants, including the invasive Eurasian water-milfoil through weed harvesting, dredging, and herbicide application. Public access to the lake is possible at the north end via a PFBC access and the south end via a Conneaut Lake Borough access.

Conneaut Lake is classified as a HQ-WWF. The PFBC stocks the lake with walleye fry, muskellunge, white bass fingerlings (*Morone chrysops*), and yellow perch fry (*Perca flavescens*). There is a healthy northern pike population as well as many other warm and cool water species. The state record muskellunge and white bass were caught in Conneaut Lake. Gizzard shad (*Dorosoma cepedianum*), and quillback carpsucker (*Carpiodes cyprinus*), were introduced to the

lake and pose a potential threat to panfish through competition for food (PA Fish & Boat Commission, 1999).

Sugar Lake

Sugar Lake is a glacially formed lake in Wayne Township, Crawford County. The surface area of the lake is 90 acres with a surface elevation of 1288 feet and a maximum depth of 15 feet. The watershed covers 23.3 square miles with the major tributary being Lake Creek, which flows through the Erie National Wildlife Refuge's southern Sugar Lake Division. Lake Creek also drains the lake and joins with Sugar Creek at the borough of Cooperstown in Venango County. The property surrounding the lake is largely in private ownership and large tracts of wetlands still occur. Some riparian areas have been developed as home sites. The wetland areas adjacent to the lake are home to nesting bald eagles the only species of special concern, both state and federal, documented to date at Sugar Lake.

Although privately owned, Sugar Lake has a PFBC public access and is managed under Conservation Regulations, which govern fish harvest. There is a maximum 6 horsepower restriction, or electric motor only, limitation for boats on the lake. There are populations of both warm water and cool water fish species in the lake, with largemouth bass being the primary warm water predator, and the muskellunge the primary cool water predator (PA Fish & Boat Commission, 1996). Sugar Lake is used as a brood lake for muskellunge by the PFBC.

Woodcock Creek Lake

Woodcock Creek Lake was formed by a USACE dam project on Woodcock Creek, completed in 1974. It was one of three flood control reservoirs authorized for the French Creek basin by the Omnibus Rivers and Flood Control Act of 1962. The three-reservoir system consisted of Union City Reservoir, Woodcock Creek Lake, and Muddy Creek Reservoir. The Union City Reservoir was completed in 1971, but the Muddy Creek Reservoir has not been approved for construction. Woodcock Creek Lake serves three main purposes: recreation, the reduction of flood stages in the French Creek and Allegheny River Valleys, and low-flow augmentation and water quality control at Meadville (U. S. Army Corps of Engineers, 1980).

Woodcock Creek Lake lies in Woodcock Township, Crawford County. The full pool of Woodcock Creek Lake covers 775 acres with a surface elevation of 1209 feet. The average summer pool covers 333 acres with a surface elevation of 1181 feet. The lake has a maximum depth of 72 feet at full pool. The drainage basin for the lake covers 45.7 square miles. Much of the drainage basin has historically been in agriculture, resulting in a great deal of sedimentation in the lake. The lake is under USACE ownership with a public recreational area leased and operated by Crawford County.

Woodcock Creek Lake supports fair populations of smallmouth and largemouth bass. The PFBC stocks walleye, muskellunge, and channel catfish (*Ictalurus punctatus*). Panfish populations are low in the lake because the lake experiences annual winter drawdowns, which reduces shoreline habitat needed for breeding and congregates fish making them more susceptible to predation.

The PFBC also stocks Woodcock Creek Lake with trout as a put-and-take fishery. The reservoir is designated as a HQ-CWF.

Union City Dam Reservoir

Considered a dry dam due to its singular purpose of flood control, the Union City Dam was completed in 1971. Dry dams allow normal flows to pass through unhindered, but during periods of heavy rainfall or snow melt, higher flows are retained by the dam. During these periods of heavy flow, the reservoir behind the dam will fill up and the dam releases the water at a controlled rate. Situated on French Creek in Waterford Township, Erie County, the Union City Dam, under normal flow conditions, creates no impoundment. During high flow periods, the surface area of the impoundment can cover 2,290 acres. The surface elevation of the full pool is 1278 feet.

The effects of this dam on the ecological health of French Creek are debated. While the USACE points out that the dam has saved millions of dollars in flood damages (personal communication), the potential damage to the French Creek system is difficult to quantify. One potential problem is the alteration of natural flooding regimes. Flooding serves to inundate the floodplain with nutrients and may recharge groundwater in some areas. The Union City dam has stopped the natural flooding process. Also, holding French Creek at bank-full conditions for longer periods via retention and release from the dam may increase erosive forces to areas downstream.

The USACE has completed a feasibility study on making the Union City Dam into a permanent pool. This legislation has been brought forth several times in the past and has been voted down by the county.

Union City Reservoir

Not to be confused with the USACE Union City Dam Reservoir, the Union City Reservoir is a small (25 acre) manmade impoundment that serves as a water supply for Union City Borough. Located in Union Township, Erie County, the reservoir has a surface elevation of 1394 feet and a maximum depth of approximately 23 feet. Bentley Run, a tributary to the South Branch of French Creek, drains Union City Reservoir. Union City Borough owns the impoundment and public access area. The reservoir provides good fishing for largemouth bass and other panfish and is utilized by the PFBC as a brood lake for muskellunge. There is a no motor restriction for boats on the reservoir.

Tamarack Lake

Tamarack Lake, a man-made impoundment a few miles southeast of Meadville, Crawford County, is unique in that it was formed across a watershed divide by the damming of two neighboring streams. Tamarack Lake was constructed in 1963 by the USDA Soil Conservation Service by damming Mill Run, a tributary of French Creek, and Mud Run, a tributary of Little Sugar Creek. The lake covers 562 acres and has a normal pool elevation of 1216 feet. Because the lake is situated on a saddle between two drainages, it is relatively shallow with a mean depth

of 4.3 feet and a maximum depth of 13 feet. This has led to excessive aquatic vegetation that must be controlled by annual winter drawdowns.

Tamarack Lake is owned by the PFBC and has six public access points. The lake is stocked with walleye and muskellunge fingerling. There is an electric motors only restriction for boats on the lake. Studies indicated that the excessive vegetation in the lake may contribute to slower than normal growth rates for bass and panfish (PA Fish & Boat Commission, 1995).

Eaton Reservoir

Eaton Reservoir is a man-made impoundment on a tributary to the West Branch of French Creek in northeastern Erie County constructed in 1941. It is owned by the borough of North East and serves as a water supply impoundment. The reservoir has a surface area of 244 acres and a surface elevation of 1422 feet. Its maximum depth is 15 feet.

Eaton Reservoir is open for public fishing with a no motor regulation for boats. The reservoir has healthy populations of walleye, smallmouth and largemouth bass, and panfish. The PFBC has historically stocked channel catfish, northern pike, and various species of forage fish. Recently it was determined that the northern pike population was stunted due to several possible factors, including warm temperatures and a large recruitment of small individuals. Attempts were made to transplant all northern pike from Eaton Reservoir to Presque Isle Bay in Lake Erie. The PFBC determined these efforts were futile in attempting to eradicate all northern pike from Eaton Reservoir (PA Fish & Boat Commission, 1998).

The use of water by North East and the resulting drainage of this water into Lake Erie via pipes represents an inter-basin transfer between French Creek and Lake Erie. Water draw during summer months for orchard and vineyard irrigation places significant strain on the water levels in nearby West Branch of French Creek, where water is pumped from to replenish the reservoir. Currently, North East is finishing facilities that will enable them to get their drinking water supplied directly from Lake Erie. Eaton Reservoir will only be used for drinking water in emergencies or during periods of high use.

Findley Lake, N.Y.

Findley Lake was formed in 1810 by a private landowner who dammed the West Branch of French Creek in Chautauqua County, New York. The lake surface elevation is 1420 feet and covers 230 acres. Land use in the drainage basin is a mix of forest and agriculture. The lake is a major tourist attraction and has seen the development of the town of Findley Lake at the north end of the lake as well as numerous homes and cottages along the western and eastern lakeshores.

Watershed Hydrology

The hydrologic cycle, or water cycle, describes the flow of water through the aquatic, terrestrial and atmospheric environments. This cycle includes water storage and transportation. Water can be stored as groundwater, surface water, snow and ice, and atmospheric moisture. Water is

transported through evaporation and transpiration from the Earth's surface to the atmosphere. Condensation and precipitation bring the moisture back to the earth. Runoff brings the water back to storage areas and the cycle continues. This entire process is driven by energy from the sun.

A water budget/hydrologic model is an important piece of information lacking for the French Creek drainage. Through a better understanding of how water cycles through this watershed, better informed decisions can be made regarding changes to groundwater and surface flows. Much of the information for developing a water budget exists in the form of United States Geologic Survey (USGS) gage station data sets and meteorological data. Comprehensive groundwater data does not exist for the watershed. This information must be pulled together with the help of a computerized Geographic Information System (GIS), and analyzed to fully develop a working model for the French Creek water budget. Such a model would allow situations to be tested and predictions to be made regarding land use changes, pollutants, mixing zones, and nutrient loading to name a few.

Surface Flow

There are currently five gauging stations monitored by USGS within the French Creek basin. These stations provide daily stream flow levels at their respective locations. Historically, there were a total of 18 USGS gauging stations in the French Creek watershed (Table 3).

Table 3. List of USGS Gauging Stations in the French Creek Watershed, Current and Historic

Station #	Station Name	County	Dates of Operation
03021350	French Creek, Wattsburg	Erie	1974-present
03021410	W. Br. French Creek, Lowville	Erie	1975-1993
03021500	French Creek, Carters Corners	Erie	1910-1971
03021520	French Creek, Union City	Erie	1972-1991
03021700	Little Conneauttee Creek, McKean	Erie	1960-1978
03022000	French Creek, Venango	Crawford	1938-1946 (partial)
03022500	French Creek, Saegertown	Crawford	1921-1939
03022540	Woodcock Creek, Blooming Valley	Crawford	1974-1995 (partial)
03022554	Woodcock Creek, Woodcock Creek Dam	Crawford	1974-1991
03023000	Cussewago Creek, Meadville	Crawford	1910-1938
03023100	French Creek, Meadville	Crawford	1988-present
03023300	Van Horne Creek, Kerrtown	Crawford	not available
03023500	French Creek, Carlton	Mercer	1908-1925
03024000	French Creek, Utica	Venango	1932-present
03024500	Sugar Creek, Wyattville	Venango	1910-1916
03025000	Sugar Creek, Sugarcreek	Venango	1932-1979
03025200	Patchel Run, Franklin	Venango	1967-1978
03025500	Allegheny River, Franklin	Venango	1914-present
Source: USGS Water Resources Data			

Analysis of stream gauge data sets are important to determine how French Creek's flow regime has changed in response to land use changes, population growth, and dam construction. Comparison of the current data with pre-1970 data shows that the construction of the Union City Dam and the Woodcock Creek Dam have significantly reduced the yearly peak flows in French Creek. A more thorough analysis is needed to determine the effects of these projects on the overall flow regime in French Creek. It is possible that organisms adapted to natural flow regimes would be seriously impacted by alterations to these flows as a result of dam construction. Alterations to flow regimes may also impact the fluvial geomorphology of streams and cause increased erosion in areas of the French Creek watershed.

Groundwater

Groundwater is an extremely important component of the water cycle and its quality, quantity and distribution need to be better understood to effectively protect the water and biological resources of the French Creek watershed. Groundwater serves as a major source of drinking water and contributes nearly all of the flow to streams during warm, summer months. Groundwater is key to the existence and health of rare fens and other wetlands, glacial lakes, and plant and animal communities that rely on the flow of high quality groundwater. Nutrients, such as nitrogen and phosphorous, and other pollutants such as herbicides and pesticides, can infiltrate groundwater sources and threaten the water quality and health of aquatic ecosystems. Pollutants can also impact drinking water sources for people utilizing both private and public wells.

An aquifer is a body of rock material that is permeable to water flow and is underlain by impermeable material. It is capable of storing significant quantities of water fed by groundwater passing through the material. Southern portions of the French Creek watershed are underlain by Pennsylvanian Aquifers, which cover approximately 118 square miles. These are sandstone aquifers in the unglaciated portions of the watershed in Venango County and portions of southeastern Crawford County. Central portions of the watershed are underlain by Mississippian Aquifers covering approximately 326 square miles. These are sandstone and carbonate-rock aquifers in southern glaciated sections of the watershed. Approximately 780 square miles of the northern sections of the watershed have no principle aquifers (U. S. Geological Survey, 1998).

In general, groundwater is more readily available (i.e. well yields are higher) in the unconsolidated glacial material of the outwash plains as opposed to the bedrock aquifers or upland glacial till materials (Richards *et al*., 1987). Groundwater in the French Creek watershed is, on average, hard to very hard. This is due to minerals that the groundwater dissolves while percolating through the glacial material, mainly constituents of calcium and magnesium. Chloride is also a constituent of groundwater and can cause water to be saline, similar to ocean water, if concentrations become too high. Higher salinities are generally found at greater depths where aquifers hold ancient groundwater that does not flush and has time to dissolve chloride from surrounding bedrock. Salinity levels in the French Creek watershed are generally low even in deeper wells; this may be due to the increased rate of flow of groundwater through unconsolidated deposits and the subsequent flushing of even the deeper aquifers.

Groundwater supplies are recharged by precipitation entering the ground through recharge areas. These areas may be wetlands, lakes and streams, or other areas where soils are permeable to

water flow. Identification and protection of recharge areas are important to insure quality and quantity of water for aquatic systems and drinking water supplies. Excess runoff resulting from an increase in impervious surfaces, draining of wetlands, and alterations to hydrology of a watershed decreases groundwater recharge. These factors lead to decreased base flows of streams, decreased water quality, decreases in drinking water quality and quantity, and increased stress on aquatic and wetland organisms.

Water Quality

Natural Water Chemistry

Overall, the water quality in the French Creek watershed is relatively good; however there are sections that are degraded by various pollutants. Water quality has remained good partially due to the glacial history of the watershed. Material deposited across the French Creek landscape by the glaciation process is high in carbonate, which acts as a natural buffer against acidification by atmospheric deposition and industrial discharges. The glacial material in the French Creek watershed is high in calcium carbonate ($CaCO_3$), as well as dolomite, another carbonate-rich material. This leads to the alkaline nature of water in the French Creek watershed.

Alkalinity allows water to withstand certain levels of acidic input without affecting pH levels. Acids are high in hydrogen ions (H+). The more hydrogen ions there are, the higher the acidity. Carbonate (CO_3) binds to the hydrogen ions, neutralizing the acidic conditions. The more CO_3 that is available, the more acidity can be neutralized. The associated calcium in $CaCO_3$ is beneficial to aquatic organisms in a variety of ways; it helps ameliorate the effects of some dissolved compounds on aquatic organisms and it is important for shell and exoskeleton formation as well as many other physiological functions.

Another factor leading to good water quality in French Creek is the highly rural nature of the watershed. With relatively little development and low percentages of impervious material, precipitation and runoff in the watershed is able to seep into the ground and carries fewer pollutants to waterways. There are, however, threats to French Creek's naturally occurring good water quality. In areas where development has occurred at higher levels, especially around lakes, water quality has been degraded. In addition, point discharges from urban areas, including industrial discharges and sewage treatment plants have degraded sections of French Creek and certain lakes within the watershed. While the rural nature of the watershed has protected it from degradation due to urban runoff, the threat of degradation due to improper agricultural and forestry practices is substantial. Improper agriculture and forestry practices can impact water quality by increasing sediment loads, introducing nutrients and pesticides, and eliminating or reducing riparian buffers.

The French Creek watershed has a certain capacity for assimilating pollutants before water quality is degraded. Components of the watershed including wetlands, riparian buffers, alkaline soils, and intact forests all help to boost the capacity of the watershed to buffer water quality against degradation from pollutants. In areas where land use practices excessively disrupt these watershed components, water quality degradation occurs and can spread a significant distance downstream until water inputs dilute the negative impacts sufficiently to restore water quality.

For these reasons, we see good water quality in some sections of the French Creek watershed and degraded water quality in other areas of the watershed.

Lewis (1906) describes the water quality at several points along French Creek. At that time, water clarity and alkalinity were described as very good. However, major towns along French Creek like Corry, Union City, Cambridge Springs, and Meadville were discharging sewage into French Creek. There was also widespread agriculture in the watershed that contributed pollutants to French Creek. Deaths due to typhoid fever, probably caused by drinking water fouled by sewage, were noted in these areas. During the late 1800's and early 1900's, many of these towns that were getting drinking water directly from French Creek began to look at alternative water sources because sewage discharges and farming runoff were polluting French Creek. By 1906, Corry and Union City were getting most of their water supply from reservoirs. Cambridge Springs had been utilizing groundwater, which became fouled by high mineral content and forced the town to revert back to drawing water directly from French Creek. Meadville introduced a groundwater public supply in 1901 because of upstream sewage discharges and farming runoff.

Nutrients and Energy Flow

Vitally important to the protection of a waterway's resources is an understanding of how nutrients and energy cycle through the system. This includes how nutrients and energy sources enter the stream and move through the aquatic food web. In many aquatic environments, primary producers or autotrophs (plants and other photosynthesizing organisms) function as the primary energy source and their contribution is dependent upon the width and flow rate of the stream or river. Smaller or swifter moving waterways rely less on autotrophs (i.e. periphyton, macrophytes, and phytoplankton) for primary energy production than do larger, slower moving rivers (Allan, 1995). Lakes within the watershed, which are lentic (standing water) environments, rely much more heavily on primary production by autotrophs. In these instances, the limiting nutrients for primary production are usually nitrogen and phosphorous.

Generally, lotic (moving water) systems receive the bulk of their energy inputs in the form of non-living organic matter. This may come from dead aquatic macrophytes, terrestrial plant material that falls into the stream, dead aquatic organisms or terrestrial organisms that fall into the waterway, or organic soil matter. Non-living organic matter generally comes in three forms, based on particle size, coarse particulate organic matter (CPOM), fine particulate organic matter (FPOM), and dissolved organic matter (DOM).

The contribution to the stream of dead plant material from aquatic macrophytes, autumn leaf fall, or woody debris as well as dead organisms are referred to as CPOM. These materials are first softened by bacterial breakdown, and then macroinvertebrate shredders and detritivores further breakdown the material and utilize the energy. As small pieces are broken off and flow downstream, it becomes FPOM. Further breakdown, including feces from macro-organisms, causes DOM to enter the aquatic food web. The nutrients flow through the aquatic food web as microorganisms and macroinvertebrates are preyed upon by other macroinvertebrates and fish.

Eutrophication

Eutrophication is the process of nutrient enrichment in aquatic ecosystems. This usually occurs with rising nitrogen and phosphorous levels, two of the most important nutrients in an aquatic system. This process occurs naturally over time and is especially evident in lakes. Oligotrophic lakes are nutrient-poor and are generally characterized as having clear water with low productivity, lower nutrient levels, and high levels of dissolved oxygen. These lakes are generally considered geologically young with little exposure to sediments from the weathering of surrounding rock and soil.

As lakes age, they collect sediments through run off. These sediments carry nutrients that provide for the growth of primary producers like photosynthetic aquatic plants and algae. As nutrient levels rise, lakes become mesotrophic, or midway through the eutrophication process. At some point, nutrients are so plentiful that they no longer become the limiting factor for plant growth in an aquatic system. These aquatic systems are said to be eutrophic and may continue to the point of being hypereutrophic. When this occurs, plant production becomes so high that the water is depleted of oxygen during plant respiration and decaying plant matter further depletes oxygen levels. This leads to the death of aquatic organisms, which can further deplete oxygen levels as the organic tissue decays. The lakes in the French Creek watershed are all fairly productive and in various stages between mesotrophic and eutrophic, possibly even hypereutrophic during the summer months.

Nutrient enrichment is occurring in French Creek and many of its tributaries. This is evident by summer algal blooms and excessive aquatic weed growth. Eutrophication may not be as pronounced in the moving stream environment where oxygen levels are constantly replenished by flowing water, but excessive nutrients can still have a negative effect on aquatic organisms as nutrient levels build up and oxygen levels are sometimes critically depleted during warmer summer months when flows are reduced. This is especially problematic for French Creek's freshwater mussel species, which depend on oxygenated water and cannot move to find more suitable conditions. Excessive aquatic weed growth also reduces aesthetic and recreational opportunities in French Creek.

Point Sources

Portions of French Creek have been historically degraded by sewage discharges from Meadville, West Mead Township, and Cambridge Springs' sewage treatment plants. A portion of French Creek downstream of Meadville was listed as impaired in 1996 on the PA 303(d) list of impaired waterways. The source of impairment was listed as Municipal Point Source, and the cause of impairment was nutrients.

Surveys performed by DEP have documented fouled substrate conditions, profuse plant growth, low dissolved oxygen, and elevated concentrations of suspended and dissolved solids, nutrients, metals, and fecal coliforms below the discharges for these sewage treatment plants (Hasse, 1992, 1994). It was documented that sewage bypasses in 1991 to French Creek from Meadville's sewage treatment plant resulted in 1,837 hours of actual bypassing time and bypasses from West Mead's sewage treatment plant resulted in 14.7 million gallons of untreated sewage entering French Creek.

In total, there are 13 public sewage treatment facilities in the French Creek watershed, which return approximately 3.4 million gallons of treated wastewater to streams in the watershed per day (U. S. Geological Survey, 1990). Recently, the West Mead and Meadville sewage treatment plants were upgraded to prevent future sewage bypasses. The West Mead sewage treatment plant is now linked to a new upgraded Meadville sewage treatment plant. The Cambridge Springs sewage treatment plant, which released over two million gallons of untreated sewage into French Creek in 1993, has not been upgraded. It is unknown how many gallons of untreated sewage are still entering French Creek during overflow periods.

All industrial, commercial, and municipal discharges are permitted by DEP under the National Pollutant Discharge Elimination System (NPDES) (Figure 17). Permitted discharges in the French Creek watershed are listed in Appendix E.

Non-Point Sources

Non-point source (NPS) pollution is the major cause of surface water degradation in the state. Because NPS pollution cannot be traced to a pipe or ditch, it is extremely difficult to control. Non-point source pollution can travel via surface runoff or it can enter the groundwater and flow to streams and lakes via sub-surface channels.

Pennsylvania Department of Environmental Protection's 2000 305(b) Water Quality Assessment Report lists agriculture as the major source of impairment to the Commonwealth's streams and lakes. The associated causes for the impairments are nutrients, organic enrichment/low dissolved oxygen, and siltation.

In 1999 and 2000, the Northwest Regional Office of DEP finished assessing the French Creek watershed (Sub-basins 16A and16D, State Watershed Plan). A total of 255 sites were assessed using aquatic macroinvertebrates as indicators of water quality as well as field measurements of pH, dissolved oxygen, conductivity, and temperature, and a visual assessment of the riparian and in-stream conditions, such as sedimentation of the stream bottom, at each site. Biological impairment or habitat degradation causes the stream segment to be placed on the PA 303(d) report, which lists impaired streams, the source and cause of impairment based on the field biologists' conclusions, and whether Total Maximum Daily Load (TMDL) restrictions will be placed on the stream in an attempt to improve water quality.

The 2000 303(d) Report lists portions of Conneauttee Creek (downstream of Edinboro Lake), Gravel Run and its tributaries, Bentley Run, Boles Run, LeBoeuf Creek, Darrows Creek, Torry Run, an unnamed tributary to Muddy Creek, Little Conneauttee, and ten unnamed tributaries to the South Branch of French Creek as impaired out of all streams sampled in the northern portion of the French Creek watershed (126 sites, 29 impaired) (Figure 18). These streams represent approximately nine percent of the total stream miles surveyed in the northern portion of the watershed (Sub-basin 16A, State Watershed Plan). The source of impairment at 26 of 29 sites was crop related or grazing related agriculture and the cause of impairment was excessive nutrients. At the three remaining impaired sites, road runoff was the source of impairment with siltation as the cause. None of these impairments are scheduled to have TMDLs implemented by 2002.

The remaining southern portions of the French Creek watershed (Sub-basin 16D, State Watershed Plan) were assessed in 2000 (128 sites, 1 impaired). Less than one percent of stream miles assessed in the southern portions of the watershed were considered impaired. Lick Run was the only impaired site.

Lakes within the watershed are also assessed for impairments. Only Conneaut Lake is listed as impaired within the French Creek watershed. It has been listed on the PA 303(d) list since 1998. The sources of impairment in Conneaut Lake are listed as Urban Runoff/Storm Sewers and other sources contributing nutrients and suspended solids to the lake. Conneaut Lake is to have TMDLs in place by 2002. In response to the problems associated with runoff from urban areas, the Conneaut Lake and Conneaut Outlet basin municipalities are the only municipalities within Crawford County to have implemented a comprehensive stormwater management plan.

Other potential sources of NPS pollution include gravel mine drainage, urban runoff/storm sewers, residential runoff, atmospheric deposition, golf courses, development and construction projects, leachate from landfills, and silviculture projects.

Monitoring

An ongoing, watershed-wide, comprehensive monitoring program is lacking in the French Creek drainage. There are several agencies, organizations, and individual researchers that have conducted water quality monitoring at various points throughout the watershed or in certain sub-watersheds. It is not easy to compare results between any of these monitoring programs due to differences in sampling techniques and protocols.

In addition to its stream assessment program, DEP has 10 stations in its Surface Water Quality Monitoring Network (WQN) within the French Creek basin (Table 4). These locations are sampled on a regular basis for macroinvertebrates and water chemistry. Some of these stations have been monitored since 1962.

Table 4. DEP Water Quality Network Monitoring Stations in the French Creek Watershed

Station #	Waterway	Location
827	French Creek	Amity Township, Erie Co.
869	French Creek	Venango Borough, Crawford Co.
849	Woodcock Creek	Woodcock Township, Crawford Co.
850	Conneauttee Creek	South of Edinboro, Erie Co.
851	Muddy Creek	Steuben Township, Crawford Co.
805	Lake Pleasant	**Rotates between Erie Co. lakes**
826	French Creek	Utica Borough, Venango Co.
845	French Creek	Franklin, Venango Co.
846	French Creek	Wilson Chutes Launch, Crawford Co.
847	French Creek	South of Saegertown, Crawford Co.
Source: U.S. EPA STORET Database		

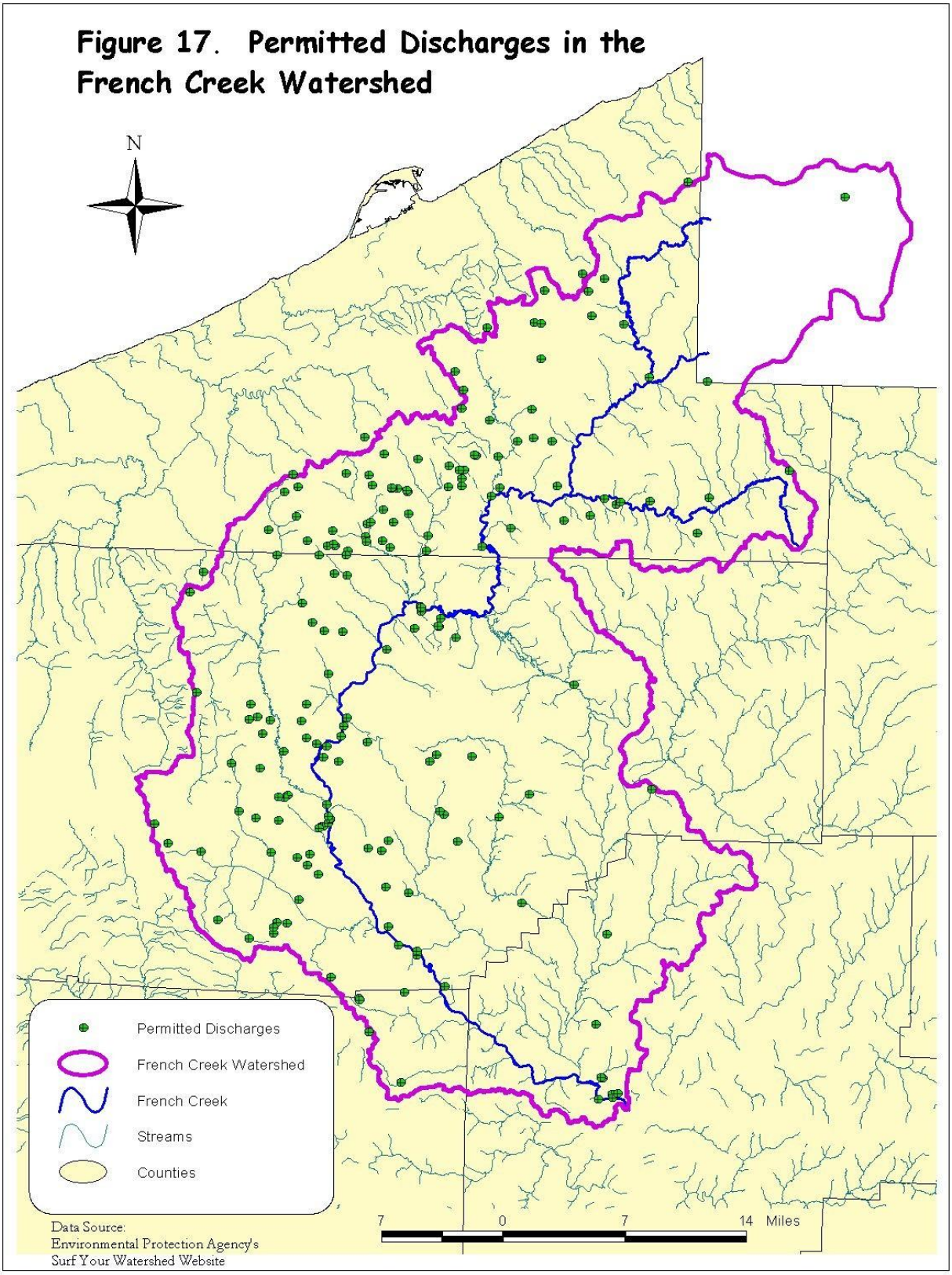
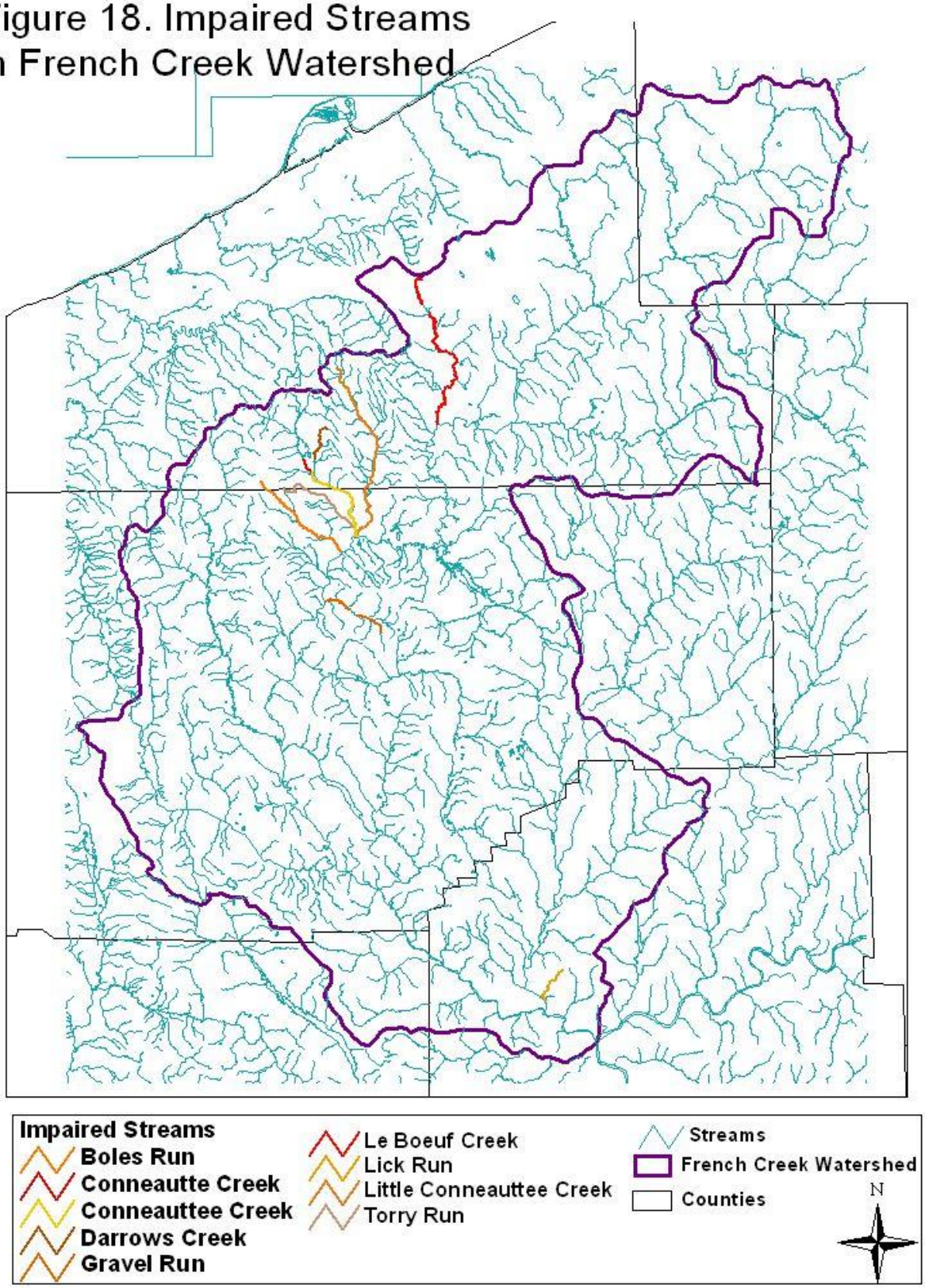


Figure 17. Permitted Discharges in the French Creek Watershed
N
Permitted Discharges
French Creek Watershed
French Creek
Streams
Counties
7 0 7 14 Miles
Data Source:
Environmental Protection Agency's
Surf Your Watershed Website

Figure 18. Impaired Streams in French Creek Watershed



PA Department of Environmental Protection conducts fish tissue sampling in area lakes and streams to monitor bioaccumulation of toxins and heavy metals. Of particular interest are high levels of mercury in fish sampled from Lake Pleasant, Lake LeBoeuf, and to a lesser extent, Edinboro Lake, as noted by the Erie County Health Department. Mercury is a component of various industrial emissions. It is contributed to waterways through dry and wet atmospheric deposition. Once in a lake ecosystem, the mercury settles to the bottom and can accumulate in the substrate. It is also taken up by aquatic organisms and accumulates in the tissue of fish.

PA Department of Environmental Protection also conducts "cause and effect" studies to document pollution occurrences and follow-up monitoring to assess the impacts of these occurrences.

U.S. Geological Survey conducts a variety of water quality and quantity monitoring programs for both surface and groundwater. There have been 17 USGS stations throughout the French Creek watershed and one on the Allegheny River at the mouth of French Creek that monitored daily streamflow levels during certain periods, some beginning as early as 1908 (Table 3). Currently, only four stations record daily flow levels with two other stations operated as partial-record stations.

As part of its National Water Quality Assessment Program (NAWQA), USGS had several stations within its network that also collected various water chemistry parameters. The NAWQA program focused on the Allegheny and Monongahela River basins in New York, Pennsylvania, Maryland, and West Virginia. The French Creek station at Utica was utilized as a NAWQA water quality monitoring station for various periods from 1956 until the NAWQA program in the Allegheny and Monongahela rivers basins was discontinued in 1998. Water quality parameters monitored included pH, temperature, specific conductance, dissolved oxygen, hardness, alkalinity, nitrogen, phosphorous, solids, and many major anions and cations. As part of the NAWQA monitoring program, algae, aquatic macroinvertebrates, and fish were also sampled at the French Creek, Utica station.

Water quality information reported from French Creek at Utica for the water year October 1997 to September 1998 includes:

- mean pH of 7.67 (7.3-8.1)
- mean specific conductance of 236 µS/CM (112-341)
- mean water temperature of 11 deg C (1.0-24.0)
- mean dissolved oxygen of 10.5 mg/L (7.4-14.5)
- mean dissolved calcium concentration of 27 mg/L (11-40)
- mean total alkalinity of 68 mg/L $CaCO_3$ (22-112)
- mean total nitrogen of 0.583 mg/L (0.325-0.968)

- mean total phosphorous of 0.041 mg/L (0.010-0.138)
- mean suspended sediments of 24 mg/L (3-113)

U. S. Geological Survey NAWQA data suggests that French Creek at Utica has a stable circumneutral (approximately 7.0-7.5) pH with good alkaline buffering capabilities against acidification. Increased nutrient levels (nitrogen and phosphorous) as well as increased sediment loads coincided with increased flows January through April.

In addition, the NAWQA program reported 48 fish species collected at Utica between 1997 and 1999, 69 macroinvertebrate families collected in 1996, and 61 macroinvertebrate families in 1997. Aquatic macroinvertebrates are often used as indicators of water quality. A high number of families, including pollution intolerant forms such as those found at Utica, suggest good biodiversity and relatively good water quality.

Groundwater wells throughout Pennsylvania are also monitored by USGS for groundwater levels. Only one well, in Erie County, is within the French Creek watershed. This well, near McKean, has been monitored daily since July 1966. The highest water level recorded was 10.00 feet below land-surface on March 17, 1973 and the lowest level was 24.66 feet below land-surface on September 30, 1998 (U. S. Geological Survey, 1998).

U. S. Army Corps of Engineers has monitored the water quality at several points around Woodcock Creek Lake monthly since the reservoir was formed in 1974. There is also water level monitoring done at both Woodcock Creek Lake and the Union City Reservoir Dam.

Other significant water quality monitoring groups in the French Creek watershed include Creek Connections and the Environmental Alliance for Senior Involvement (EASI) through the French Creek Project. Creek Connections is a project operated from Allegheny College in Meadville that works with French Creek elementary, middle, and high school classes to monitor stream sites near their respective schools. Within the French Creek watershed, there are 46 sites that are regularly monitored by students and the data is obtainable online at http://creekconnections.allegheny.edu/. This program has been working with students on water quality monitoring in French Creek since 1995 and recently expanded to work with schools in the Pittsburgh area. The students routinely perform field analyses for temperature, pH, total dissolved solids, dissolved oxygen, nitrogen, phosphorous, alkalinity, turbidity, sulfates, and iron as well as doing visual assessments of the stream conditions.

The EASI group utilizes senior citizen volunteer water quality monitors. The FCP in Meadville directs the Crawford and Venango County EASI volunteers in doing water quality monitoring in French Creek. This group routinely samples 12 sites along French Creek and performs field analyses for water chemistry as well as visual inspections of stream and riparian conditions. The EASI group maintains an online database of water quality information from their monitoring program at http://www.environmentaleducation.org/.

County Conservation Districts perform some water quality monitoring in sub-basins where their efforts are focused on implementing BMPs for agriculture or other projects to address stream impairments. The PFBC also conducts water quality monitoring throughout the watershed. They utilize water chemistry field analysis, macroinvertebrate sampling, and fish sampling to monitor the health of waterways. This sampling is done periodically on stream segments that are routinely stocked by the PFBC.

There are also numerous researchers associated with local universities who have performed monitoring projects throughout the watershed. These studies are generally short-term and sporadically located throughout the watershed.

Monitoring in the French Creek watershed has not adequately addressed some of the most basic questions regarding water quality and aquatic organisms. In a highly rural, largely agricultural watershed, it is not known where the most significant sources of nutrients are. Data gaps exist with regards to groundwater quality, quantity, and identification of important recharge areas. Biological monitoring has only been done to any degree in easily accessible riffle areas. Macroinvertebrate information as an indication of water quality is lacking for non-riffle and other areas. Aquatic organisms have not been adequately monitored to determine the health of aquatic communities as a whole or populations of certain species, including species of special concern.

Water Supply

Public/Private

Approximately 67 percent of watershed residents receive drinking water from a community or public water supply. Approximately 17 percent of those residents get their water from a public surface water supply and the other 83 percent are utilizing public groundwater supplies. Approximately 4.87 million gallons of water per day are withdrawn from public groundwater supplies for drinking water. Another 1.01 million gallons of water per day are withdrawn from public surface water supplies. The remainder of the watershed population gets their drinking water from private wells. Approximately 3.09 million gallons of groundwater are used daily for drinking water from private wells (U. S. Geological Survey, 1990).

Cambridge Springs Borough is the only municipality in the French Creek watershed that has its public water supplied directly by a surface water intake from French Creek. Other public surface water supplies include 2600 acres of reservoirs in the watershed with the remainder of public water supply sources being wells and springs. Figure 19 shows locations of public water supply intakes in the French Creek watershed.

Well Head Protection Areas

States are required to establish wellhead protection programs by the Safe Drinking Water Act. Pennsylvania's wellhead protection program is administered by DEP and is intended to protect groundwater supplies from contamination. Major sources of groundwater contamination as listed by DEP include: pesticides, leaking storage tanks, surface impoundments, landfills,

hazardous waste sites, industrial facilities, spills, mining and mine drainage, pipelines, and sewer lines.

The wellhead is the location of the well and the area in the immediate vicinity that makes up the well's recharge zone. The wellhead protection program works by establishing buffer areas around public drinking water wells. Typically, the buffer areas are laid out in three zones. Zone one is generally a 100-400 foot radius around the wellhead. Zone two is up to a half mile radius from the wellhead and zone three is any area outside of one half mile that contributes to the well. Protection to the drinking water supply is afforded through assessments and monitoring, plugging of abandoned wells (water, oil or gas) in the vicinity, education of local water users, and assistance by DEP to the local municipality with establishing zoning regulations.

As of 1998, 160 municipalities were in the process of developing or implementing wellhead protection programs throughout Pennsylvania (DEP 2000 305(b) report). There are five public water supplies with wellhead protection plans being worked upon in the French Creek watershed:

- Cochranton Borough Water Department
- Guys Mills Mutual Water Association
- Meadville Area Water Authority
- Mitchell Lake Mobile Home Park
- Washington Township Water Authority

At the present time, none of these five programs have met DEP's criteria for approval. However, DEP continues to work with these groups to improve their wellhead protection programs.

Dams and Impoundments

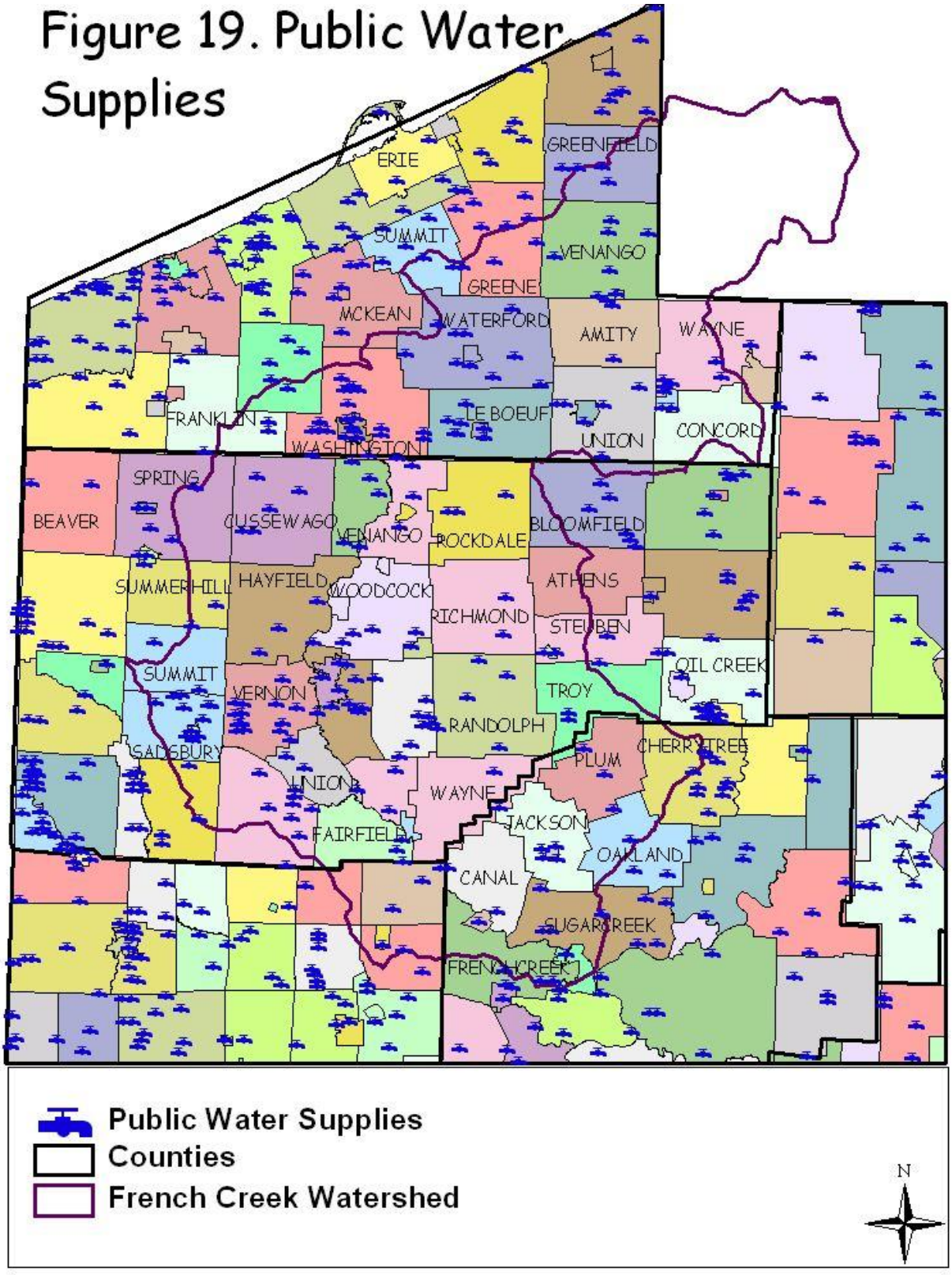
In colonial times, French Creek was reported to have many small dams associated with mills throughout the watershed. Most of these structures have long since vanished but some dams built in the 1800's still remain. The dam that created Findley Lake in the New York headwaters of the West Branch of French Creek was built in 1810. There are also the remains of 1800's dams built at Saegertown and Venango, Crawford County.

The only major dam on the main stem of French Creek is the Union City Dam in Erie County. Built in 1971, this dam is a flood control dam that has reportedly saved millions of dollars in flood damages since its installation (U. S. Army Corps of Engineers, 2000). The only other USACE dam in the French Creek watershed is the Woodcock Creek Dam on Woodcock Creek in Crawford County. Built in 1974, this dam is a multi-use dam (flood control, recreation, and water supply control).

Tamarack Lake was formed by the construction of two dams on neighboring streams. Mill Run and Mud Run, in Crawford County, were dammed by the USDA to form Tamarack Lake.

The PGC has constructed dams in two SGL areas within the French Creek watershed. Conneaut (Geneva) Marsh has a dam built on Conneaut Outlet to provide approximately 1,400 acres of

Figure 19. Public Water Supplies



habitat for waterfowl in SGL #213. Siegel Marsh Dam was built on a tributary of LeBoeuf Creek to form a 150-acre impoundment in SGL #218 for waterfowl habitat.

Edinboro Lake, a naturally formed lake, was originally dammed around 1900 for a mill and later raised to deepen the lake for boating. Howard Eaton Reservoir was formed in 1941, when the borough of North East built a dam on a tributary of the West Branch of French Creek for the creation of a public water supply.

There is a current movement in the United States to reevaluate the need for many of the dams that no longer serve the purpose for which they were originally built. Often the maintenance costs far exceed the cost of removal and generally the aquatic system benefits from the removal. Dam removal needs to be considered on a case-by-case basis. Environmental impacts associated with the dam should be assessed and compared with potential negative impacts of dam removal. Dam removal techniques that limit the potential for catastrophic hydrologic changes should be implemented.

Water Withdrawal

Water withdrawal is an important issue in fully understanding the hydrology of the French Creek watershed. Concerns over water withdrawals have been voiced by the public at meetings for the conservation planning process as well as by the PFBC in personal communications. Water withdrawals typically occur for irrigation and livestock purposes during the warmer, drier summer months. This coincides with the timing of the most stress on aquatic organisms due to water temperatures and low dissolved oxygen levels. Water withdrawals can compound the effects of already low dissolved oxygen levels and elevated water temperatures.

Withdrawals of both groundwater and surface water within the French Creek basin were estimated by USGS in 1990. These figures do not include withdrawal for public drinking water, which was already discussed.

- Commercial withdrawals of both groundwater and surface water amount to approximately 170,000 gallons of water daily.
- Industrial withdrawals amount to approximately 5.1 million gallons of water daily.
- Mining operations in the watershed withdrawal approximately 1.17 million gallons of groundwater and surface water daily.
- Livestock use in the watershed accounts for 1.41 million gallons of water daily.
- Irrigation withdrawals from both groundwater and surface water amount to approximately 550,000 gallons of water daily.

Effects of water withdrawals have been documented by the PFBC in survey reports compiled on Beaver Run in Erie County. Beaver Run supports a wild, naturally reproducing brown trout population and is one of only two EV streams in the French Creek watershed. According to PFBC biologists, water withdrawals by area farmers for irrigation during periods of naturally reduced flows in Beaver Run have led to a decrease in the reproduction of the wild brown trout population (personal communication).

Inter-Basin Transfers

An inter-basin transfer occurs when water is pumped, diverted, or drained out of one watershed and into another. This has potentially negative consequences on water quality and quantity, and it increases the chances of spreading invasive exotic species from one watershed to another. The only inter-basin transfer affecting French Creek occurs when the Borough of North East in Erie County uses Eaton Reservoir (French Creek watershed) for their drinking water supply and the water is transported to the Lake Erie basin via pipes, resulting in a net loss of water for French Creek. Currently, North East is in the process of installing an intake pipe from Lake Erie to their water filtration plant to supply drinking water. This will significantly decrease the need for the borough to utilize Eaton Reservoir for their drinking water supply.

BIOLOGICAL RESOURCES

Wildlife

The French Creek watershed contains a wealth of wildlife resources, both aquatic and terrestrial. There is an abundance of species of special concern, considered rare, threatened, or endangered in the state and in the nation, and also numerous game and non-game species. This amazing biodiversity leads to an enormous array of wildlife viewing and outdoor recreation opportunities. Perhaps more importantly, is the significance and importance this exceptional biodiversity places on conservation initiatives in the French Creek watershed.

Terrestrial

Mammals

There are 63 extant species of mammals in the Commonwealth with another 10 species considered either uncertain or extirpated within Pennsylvania (Merritt, 1987). Fifty species of mammals have ranges that overlap with the French Creek watershed (Appendix F). No rare, threatened, or endangered mammals are listed for the French Creek watershed, although a few have general ranges that include the watershed. There have been unconfirmed reports of river otters (*Lutra canadensis*) seen on French Creek. These individuals, once common in the watershed, may be making their way back to French Creek due to reintroduction efforts in western New York and on the Allegheny River in Pennsylvania.

Many of the mammals once common in the watershed and in other areas of the state have been lost due to the decline of large expanses of forested areas, these include the marten (*Martes americana*), fisher (*Martes pennanti*), and mountain lion (*Felis concolor*). The white-tailed deer (*Odocoileus virginianus*), eastern chipmunk (*Tamias striatus*), woodchuck (*Marmota monax*), striped skunk (*Mephitis mephitis*), porcupine (*Erethizon dorsatum*), eastern cottontail rabbit (*Sylvilagus floridanus*), short-tailed shrew (*Blarina brevicauda*), little brown bat (*Myotis lucifugus*), raccoon (*Procyon lotor*), muskrat (*Ondatra zibethica*), opossum (*Didelphis marsupialis*), and beaver (*Castor canadensis*), are some of the more common mammals found in the French Creek watershed (French Creek Project, web).

Birds

There are at least 379 bird species that nest, winter, or migrate throughout Pennsylvania. Many of these can be found in the French Creek watershed for at least part of the year. French Creek is located near the convergence of major migratory routes for songbirds and waterfowl that are traveling to the Atlantic coast and the Mississippi River and Gulf of Mexico from areas in the northeast U.S. and Canada during the fall and back to northern areas in the spring. Its location along these migratory routes and its diversity of habitats, including a wealth of wetlands, lakes, and streams, affords year-round birding opportunities in the French Creek watershed.

The Audubon Society has designated four Important Bird Areas within the French Creek watershed:

- Cussewago Bottom

- Hemlock Hill Research Area
- U.S. Fish & Wildlife Service Erie National Wildlife Refuge
- Conneaut Marsh

The Audubon Society defines an IBA as:

> *A site of special significance to breeding or non-breeding birds, which, on some basis, can be distinguished from surrounding areas. (Boundaries may be natural, such as watersheds, or man-made, such as roads and property boundaries.) In general, an IBA should exist as an actual or potential protected area, or it should have the potential to be managed in some way for the benefit of birds and other wildlife. There is no minimum or maximum size for an IBA, but whenever possible, an IBA should be large enough to supply all or most of the requirements of the birds during the season for which it is important.*

The Cussewago Bottom IBA is an area of riparian and bottomland habitats running along Cussewago Creek from Meadville to the headwaters of the stream. It is comprised of public State Game Lands #152 and #269 and privately owned land. Habitat includes high-quality wetlands, bottom land and hardwood forest (Crossley, 1999). More than 200 species of birds probably occur on this IBA on a regular basis, including nesting bald eagles.

The Hemlock Hill Research Area IBA is a privately owned site adjacent to the Erie National Wildlife Refuge in Crawford County. It is comprised of habitat ranging from mixed woodlands to open fields in varying successional stages. It has been designated an IBA due to ongoing ornithological research at the site as well as the diverse avifauna raging from Carolinian to Boreal species that are found there (Crossley, 1999).

The Erie National Wildlife Refuge in Crawford County was established in 1959 primarily as waterfowl habitat and has been designated an IBA. This refuge has a variety of habitats ranging from mixed forest to fields with large areas of wetlands. Muddy Creek flows through a portion of the refuge. Over 236 species of birds have been recorded from the site, with at least 112 species breeding there (Crossley, 1999). There are large numbers of migratory waterfowl, songbirds, and shorebirds that inhabit the refuge during various times of the year. Nesting bald eagles are also in the area.

Conneaut (Geneva) Marsh is the final IBA in the French Creek watershed. The largest marsh system in Pennsylvania, Conneaut Marsh is owned entirely by the PA Game Commission. It is one of the most important IBAs in the state for wetland species. The habitat varies from forested wetland to scrub-shrub wetland to open, emergent marsh wetlands. It supports large numbers of waterfowl, shorebirds, and songbirds that prefer wetland habitats. The state endangered black tern, American bittern, and least bittern nest in Conneaut Marsh, as well as bald eagles.

<u>Reptiles and Amphibians</u>

Studies of the amphibians and reptiles in the Erie County portions of the French Creek watershed documented 26 species during 1994-1995, including ten salamanders, eight toads and frogs, two turtles and six snake species (McKinstry *et al*., 1999). The most abundant species were green

frogs (*Rana clamitans*), dusky salamanders (*Desmognathus spp.*), and eastern American toads (*Bufo americanus*). Twenty additional species were historically recorded from the French Creek watershed and were not found during the 1994-1995 sampling.

Game Species

There are many game species in the French Creek watershed. Some of the more important game species include the white-tailed deer, wild turkey (*Meleagris gallopavo*), ruffed grouse (*Bonasa umbellus*), eastern cottontail, numerous waterfowl species, introduced ring-necked pheasant (*Phasianus colchicus*), and squirrels. Popular furbearing species include coyote (*Canis latrans*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), beaver, muskrat, mink (*Mustela vison*), and raccoon.

Aquatic

Fish

French Creek has gained national attention for its diversity of aquatic life. Eighty-eight species of fish have been recorded in the French Creek drainage prior to 1999. This is more species than any other comparably sized stream in Pennsylvania and anywhere north and east of Pennsylvania (Stauffer, 2000). In 2000, another species, the pugnose minnow (*Opsopoeodus emiliae*), was documented by the PA Fish & Boat Commission and verified by Penn State University fish biologists. These species totals probably closely represent the ichthyofauna present in French Creek prior to European settlement. A complete list of the fishes of the French Creek drainage is given in Appendix G.

Biodiversity in French Creek is perhaps best represented by a group of fish known as darters. There are 15 species of darters in the French Creek watershed (Table 5) with as many as 13 collected from a single riffle area by researchers. Eight of the 15 French Creek darter species are listed as threatened or endangered in Pennsylvania.

Table 5. Darter Species of the French Creek Watershed

Common Name	Scientific Name	Known Range	PA Status
eastern sand darter	*Ammocrypta pellucida*	French Creek	endangered
greenside darter	*Etheostoma blennioides*	French, Sugar, Cussewago, LeBoeuf, Woodcock, Muddy, West Branch, South Branch	stable
rainbow darter	*Etheostoma caeruleum*	French, Sugar, LeBoeuf, Woodcock, Muddy, West Branch, South Branch	stable
bluebreast darter	*Etheostoma camurum*	French Creek	threatened
Iowa darter	*Etheostoma exile*	Lake Pleasant, LeBoeuf	endangered
fantail darter	*Etheostoma flabellare*	French, Sugar, Cussewago, LeBoeuf, Woodcock, Muddy, West Branch, South Branch	stable

spotted darter	*Etheostoma maculatum*	French Creek (PA & NY)	threatened
Johnny darter	*Etheostoma nigrum*	French, Sugar, Cussewago, LeBoeuf, Muddy, West Branch, South Branch	stable
Tippecanoe darter	*Etheostoma tippecanoe*	French Creek	threatened
variegate darter	*Etheostoma variatum*	French, Muddy, West Branch, South Branch	stable
banded darter	*Etheostoma zonale*	French, Sugar, Cussewago, LeBoeuf, Woodcock, Muddy, West Branch, South Branch	stable
logperch	*Percina caprodes*	French, Cussewago, LeBoeuf, West branch, South Branch	stable
gilt darter	*Percina evides*	French Creek	threatened
longhead darter	*Percina macrocephala*	French Creek	threatened
blackside darter	*Percina maculata*	French, Sugar, Cussewago, LeBoeuf, Muddy, West Branch, South Branch	stable
Source: WPC files			

These small fish, ranging from about 1.5 inches to 7 inches in length, are related to perch and walleye. Darters get their name from their behavior of darting around the stream bottom in search of prey or to avoid predators. They live primarily in riffles and runs of streams with high water quality; although some can be found in lakes. For the most part they lack swim bladders, which allows them to rest on the bottom.

Darters are an important indicator of water quality because they do not migrate from one season to the next and remain relatively stationary in stream systems (White and Stauffer, 1992). Darters rely on high dissolved oxygen, low temperatures, and low bed siltation rates, making them highly susceptible to environmental threats like those associated with improper agricultural practices (McAlpine, 1999). While acceptable water quality and substrate conditions exist in many sections of French Creek, other areas are threatened by improper agricultural, forestry, and development practices that contribute excessive nutrients and siltation to the stream.

French Creek's fishes also include several gamefish species. Anglers flock to the French Creek watershed's streams, lakes, and reservoirs for walleye, smallmouth and largemouth bass, muskellunge, northern pike, several panfish species, and trout, largely stocked by the PFBC (Table 6).

Table 6. 2000 Trout Stockings by the PFBC in the French Creek Watershed

Waterway	Preseason			In-season		
	Brook	Brown	Rainbow	Brook	Brown	Rainbow
Conneauttee Creek	0	150	150	0	0	600
S. Br. French Creek	0	3300	3300	0	2450	2450

Lake Pleasant	0	840	3360	0	1080	9720
Muddy Creek	560	420	420	440	330	330
Woodcock Creek (1)	750	1000	750	570	760	570
Woodcock Creek (2)	450	600	450	660	880	660
Mill Creek	0	200	200	0	0	0
North Deer Creek (1)	0	150	150	0	0	0
North Deer Creek (2)	0	550	550	0	400	400
Prather Creek	650	650	0	500	500	0
Sugar Creek (1)	0	1440	960	0	1080	720
Sugar Creek (2)	0	2850	2850	0	4000	4000
E. Br. Sugar Creek (1)	0	150	150	0	150	150
E. Br. Sugar Creek (2)	0	1550	1550	0	1150	1150
Little Sugar Creek (1)	0	850	850	0	650	650
Little Sugar Creek (2)	0	2200	2200	0	1650	1650
Source: PFBC files						

Freshwater Mussels

French Creek is probably most noted for its freshwater mussel species. Twenty-nine out of Pennsylvania's approximate 65 species of freshwater mussels have been recorded from the French Creek drainage (Table 7). Twenty-seven of these have been recorded from the main stem of French Creek. Of these totals, 27 species are still known to have surviving populations in the watershed as a whole, with 26 of these still existing in the main stem. This represents a significant percentage of Pennsylvania's mussel resources given that continuing research indicates that 17 of the original 65 species have now been extirpated from the Commonwealth. Therefore, 57% of Pennsylvania's surviving mussel species inhabit the French Creek drainage (Western Pennsylvania Conservancy, 1999). French Creek contains the highest freshwater mussel diversity of any stream in Pennsylvania, as well as anywhere to the north and east in the United States.

Table 7. Freshwater Mussel Species Recorded from the French Creek Watershed

Common Name	Scientific Name	G Rank	S Rank	U.S. Status	PA/PBS Status
mucket	*Actinonaias ligamentina*	G5	S4		
elktoe	*Alasmidonta marginata*	G4	S4		
three-ridge	*Amblema plicata*	G5	S2S3		PT
cylindrical papershell	*Anodontoides ferussacianus*	G5	S2S3		PE
purple wartyback[1]	*Cyclonaias tuberculata*	G5	SX		PX
spike	*Elliptio dilatata*	G5	S4		
northern riffleshell	*Epioblasma torulosa rangiana*	G2T2	S1S2	LE	LE
snuffbox	*Epioblasma triquetra*	G3	S1		PE
long-solid	*Fusconaia subrotunda*	G3	S1		PE
plain pocketbook	*Lampsilis cardium*	G5	S4		

wavy-rayed lampmussel	*Lampsilis fasciola*	G4	S4		
pocketbook	*Lampsilis ovata*	G5	S3S4		
fatmucket	*Lampsilis siliquoidea*	G5	S4		
white heelsplitter	*Lasmigona complanata*	G5	S1		PE
creek heelsplitter	*Lasmigona compressa*	G5	S2S3		PE
fluted-shell	*Lasmigona costata*	G5	S4		
eastern pondmussel[2]	*Ligumia nasuta*	G4G5	S1		
black sandshell	*Ligumia recta*	G5	S3S4		
clubshell	*Pleurobema clava*	G2	S1S2	LE	LE
round pigtoe	*Pleurobema coccineum*	G4	S2		PE
kidneyshell	*Ptychobranchus fasciolaris*	G4	S4		
giant floater	*Pyganodon grandis*	G5	S4		
rabbitsfoot	*Quadrula cylindrica*	G3	S1		PE
salamander mussel	*Simpsonaias ambigua*	G3	S1?		CU
squawfoot	*Strophitus undulatus*	G5	S4S5		
lilliput[3]	*Toxolasma parvus*	G5	S1		PE
paper pondshell	*Utterbackia imbecillis*	G5	S3S4		
rayed bean mussel	*Villosa fabalis*	G1G2	S1S2		PE
rainbow mussel	*Villosa iris*	G5	S1		PE

Notes:
[1] The only species apparently extirpated from the French Creek watershed. Once recorded from French Creek proper in the lower reaches.
[2] This species is believed to have been introduced to the French Creek drainage, probably through the introduction of certain fish carrying larval mussels.
[3] Historically recorded from a tributary to French Creek. Although not recently verified, this species probably still exists.

Key:
G Rank – Global Rank, is a relative scale of global rarity on a scale of G1 (critically imperiled) to G5 (secure, common). PA Natural Diversity Inventory.
S Rank – State Rank, is a relative scale of rarity in PA on a scale of S1 (critically imperiled) to S5 (secure, common). PA Natural Diversity Inventory.
SX – extirpated in PA.
U.S. Status – U.S. Endangered Species Act status (USFWS). **LE** = Listed as Endangered.
PA/PBS Status – Pennsylvania Status (PFBC)/Pennsylvania Biological Survey recommended status. **LE** = Listed as Endangered. **PE** = PBS recommended for Endangered. **PT** = PBS recommended for Threatened. **CU** = PBS Condition Undetermined. **PX** = PBS Extirpated in PA.

Source: WPC and PNDI-west files

The unique and complex lifestyle of freshwater mussels makes them extremely vulnerable to pollution and habitat degradation. These organisms lead a relatively sessile existence as adults. They burrow into the stream bottom with a muscular foot and rarely move more than a few hundred feet during their lifetimes, which can sometimes be 50 or more years. They siphon water into their bodies using incurrent and excurrent siphons. The water then passes through

their gills where oxygen is extracted for breathing and then through their gut where microorganisms and other material are filtered for food.

Pollutants in the water can be taken up in the mussels' body tissue making many species extremely susceptible. Siltation caused by excessive erosion can smother entire mussel beds. In addition, excessive nutrients can deplete the oxygen levels in the water. All of these conditions are potential threats in the French Creek watershed as improper agricultural practices contribute nutrients, sediments, and pesticides to the water, improper timbering increases nutrient runoff and erosion, and riparian areas continue to be lost to timbering, agriculture, and development. Freshwater mussels are also extremely susceptible to chlorine commonly used in treating wastewater and discharged into the stream.

Despite these threats, only one species of freshwater mussel has been lost from the watershed in recent times. However, reductions in freshwater mussel density and diversity have been noted downstream of urban areas like Meadville (Western Pennsylvania Conservancy, 1993) and near the mouth of French Creek at Franklin (Western Pennsylvania Conservancy, 1994). More research is needed to fully understand species distributions, habitat availability, and existing threats.

Macroinvertebrates

Aquatic insects and other macroinvertebrates are commonly used as indicators of water quality. Many studies by PA Department of Environmental Protection, U. S. Army Corps of Engineers, U. S. Geological Survey, university researchers, and other organizations have sampled the aquatic macroinvertebrates in areas of the French Creek watershed. The Nature Conservancy has also monitored aquatic macroinvertebrates in the New York headwaters of French Creek.

The most comprehensive macroinvertebrate sampling to date has been done through the DEP's Unassessed Waters Program. State water pollution biologists perform qualitative sampling of macroinvertebrates and identify specimens to the family level in the field.
A high of 25 families have been found at several of over 250 sampling sites throughout the watershed.

Between 1987 and 1999 the USACE studied adult aquatic insects at the Corps' 16 flood control structures in Ohio, West Virginia, and Pennsylvania. They sampled the inflows, outflows, and tributaries to each of the impoundments using light traps. Included in the study were the Union City Reservoir Dam and Woodcock Creek Lake within the French Creek drainage. Nine insect orders were documented: mayflies (Ephemeroptera), damselflies (Odonata), stoneflies (Plecoptera), true bugs (Hemiptera), dobsonflies (Megaloptera), beetles (Coleoptera), caddisflies (Trichoptera), moths (Lepidoptera), and true flies (Diptera), with caddisflies being the most important in terms of numbers and diversity of species collected and the only order for which lower taxa information was provided in this summary report (Fowles, 2000). The most important note from this study was that the West Branch of French Creek had the highest diversity (49 taxa) of caddisflies out of all streams sampled in Ohio, West Virginia, and Pennsylvania. In addition, a caddisfly belonging to the Genus *Cernotina* was collected from the inflow of Union City Reservoir and represents the first record of this genus in Pennsylvania (Fowles, 2000).

In general, aquatic insects and other macroinvertebrates densities and diversity in the French Creek watershed appear to be very good. Some areas where impairments have been noted due to several possible factors have shown depressed densities or diversity or both. Often, when pollution impacts sensitive macroinvertebrate species, an increase in tolerant species will be noted due to a lack of competition for resources. Benthic (bottom dwelling) macroinvertebrates are often the first to show signs of problems with water quality and should be monitored carefully and comprehensively throughout the watershed. Many fish and other higher aquatic organisms rely on macroinvertebrates for food and the macroinvertebrates themselves play an important role in breaking down organic material to add energy to the aquatic food web.

One of the major obstacles in assessing macroinvertebrate information for French Creek is the lack of genus and species level identification at sampling sites. Often, aquatic macroinvertebrates are identified to the order and family, but due to the time and/or expense required to perform genus or species level identification, this information is typically missing.

Others

French Creek is also home to a unique, fully aquatic salamander, the eastern hellbender (*Cryptobranchus alleganiensis*). As Pennsylvania's largest amphibian, the eastern hellbender can grow to a length of 29 inches, weigh five pounds, and live for nearly 30 years. The eastern hellbender is found in larger streams and rivers where substantial rocks and logs allow it to hide during the daytime and feed at night. It has declined through much of its historical range due to acid mine drainage, industrial pollution, and excessive siltation (French Creek Project, web). It is still found in the Ohio River and Susquehanna River basins, with a viable population existing in French Creek.

A new non-native aquatic organism to the French Creek watershed was discovered in October 2000. The zebra mussel (*Dreissena polymorpha*), a freshwater bivalve, made its first documented appearance in an inland Pennsylvania lake when it was discovered in Edinboro Lake in Erie County. The zebra mussel is a pervasive exotic species that first came to North American waters from Europe in international shipping ballast water. It was introduced to the Great Lakes in the mid-1980's where it quickly increased in numbers to the point of clogging power plant, industrial and public drinking water intakes, fouling boat hauls, and disrupting the aquatic ecosystem of the Great Lakes.

The zebra mussel is transported between waterways in live wells and bilge pumps of boats, in scuba equipment, and in bait bucket water among other ways. Once established in high numbers, they filter large quantities of water and strip lakes of microorganisms, which normally provide food for native organisms. Zebra mussels attach themselves to native mussel shells and other benthic substrates and impact the native mussel's ability to filter, move, and open and close its shell. Severe freshwater mussel kills have occurred in Lake Erie for these reasons. Once established, there is no proven way to rid the waterway of this organism. To date, the zebra mussel has been unsuccessful at establishing itself in the flowing streams of lake outlets. If it is able to establish itself in French Creek through Conneauttee Creek (the outflow of Edinboro Lake), it could prove devastating to the native mussels of the French Creek watershed.

Another introduced mollusk in the French Creek watershed is the Asian clam (*Corbicula fluminea*). This widespread and common species was discovered in Conneaut Outlet in the 1990's after surveys showed no sign of it in the 1980's. The Asian clam occurred above the Conneaut Lake Borough sewage treatment plant and researchers speculate that chlorination by the sewage treatment plant discharge may have kept it from moving downstream (personal communication). However, due to the existence of the federally endangered clubshell mussel in Conneaut Outlet, the USFWS stopped the sewage treatment plant from discharging chlorine. No surveys have been conducted to determine the current range of the Asian clam in Conneaut Outlet. More recently, the Asian clam has been discovered in the West Branch of French Creek (Wellington, 2001).

Vegetation

The French Creek watershed lies almost entirely within the region that historically would have been comprised of Northern Hardwood Forest communities. Dominant species would have included sugar maples (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), American beech (*Fagus grandifolia*), and eastern hemlock (*Tsuga canadensis*) interspersed with white pine (*Pinus strobus*), oaks (*Quercus spp.*), and other maples. This was especially true of upland areas in northern sections of the watershed. Eastern hemlock and white pine dominated the wetter, lowland areas. Oak, particularly white oak (*Quercus alba*), dominated the floodplain of the southern parts of the watershed.

Prior to European settlement, the area was almost entirely forested with some open prairie-like areas in the southern oak-forest sections of the watershed. Periods of intense timbering and clearing the land for agricultural purposes have left the French Creek watershed with a diverse array of plant communities. Within this mosaic of different land uses exists farmland habitat, grassland habitat, old-field habitat, and a variety of wetland habitats in addition to brushy and forested areas.

Currently in a period of agricultural decline, many pieces of land, particularly on the ridge tops, are reverting back to forest. These woodland patches are primarily a mixed oak community. The regeneration of forested areas expands the threats of improper timbering practices impacting the French Creek watershed. Of particular importance are areas of mature floodplain forest in riparian areas throughout the watershed. These areas are currently being targeted by timbering operations and are afforded little protection through wetland or riparian regulations.

Invasive exotic plant species like purple loosestrife, hybrid cattails, and common reed are threats to the native vegetation especially in wetland areas throughout the watershed. These plants thrive in disturbed areas and once established, can quickly out-compete native plants. Native aquatic plant communities are also at risk from the introduction of invasive Eurasian water-milfoil to lakes and streams in the watershed. This plant, found in many French Creek lakes, is a continuing threat to those lakes that contain many rare, threatened, and endangered native aquatic plants. Spread primarily by pieces attached to boat hulls, trailers, and propellers, once introduced, this plant can spread rapidly and out-compete native flora.

Pennsylvania Natural Diversity Inventory

The Pennsylvania Natural Diversity Inventory is a partnership between PA Department of Conservation and Natural Resources, TNC, and Western Pennsylvania Conservancy. The Pennsylvania Natural Diversity Inventory is a program that tracks occurrences of rare, threatened, or endangered species (species of special concern), and unique natural communities and habitats throughout Pennsylvania. These species, natural communities, and unique habitats are referred to as elements. In western Pennsylvania, it is the responsibility of WPC to track PNDI element occurrences. A total of 158 PNDI elements are reported from the French Creek watershed and buffered locations are shown in Figure 20 (Western Pennsylvania Conservancy, 2001). These include nine bird species, 19 fish species, one reptile species, three insect species, 17 unionid species, nine natural communities, three unique habitats, and 97 plant species. A summary of PNDI data identifying features by sub-watershed within the French Creek drainage is contained in Appendix H.

Freshwater Mussel Species of Special Concern

Two of the mussels found in French Creek are presently listed as Endangered under the U.S. Endangered Species Act and the PA Fish Code, the northern riffleshell and the clubshell mussels. Thirteen other mussel species are considered rare, threatened, or endangered in Pennsylvania according to the Pennsylvania Biological Survey (Table 8). One species, the purple wartyback, is considered extirpated from Pennsylvania, but was recorded from French Creek in the early 1900's.

Fish Species of Special Concern

Eight of the 15 species of darters found in the French Creek watershed are considered threatened or endangered in the Commonwealth (Table 5). The state endangered spotted darter is found as far north as the New York headwater portions of the watershed.

There are three special concern species of lamprey in the French Creek watershed. These ancient fish resemble eels and are related to the parasitic sea lampreys that have invaded the Great Lakes, but do not represent the same threat to fishes that the sea lamprey does. The mountain brook lamprey, Ohio lamprey, and American brook lamprey (*Lampetra appendix*), are all threatened in Pennsylvania.

There are three madtom species within the French Creek watershed that are considered threatened or candidate for listing. Related to catfish, madtoms have been documented as far south as the Mercer County portions of French Creek. The mountain madtom (*Noturus eleutherus*), and northern madtom (*Noturus stigmosus*), are threatened in Pennsylvania and the brindled madtom (*Noturus miurus*), is a candidate species.

There are six other fish species of special concern documented from the French Creek watershed. Some of these species were documented in the early 1900's and have not recently been verified. All other fish species of concern have been verified since at least 1985. The longnose gar (*Lepisosteus osseus*) was last documented from Conneaut Lake in 1938. The blackchin shiner

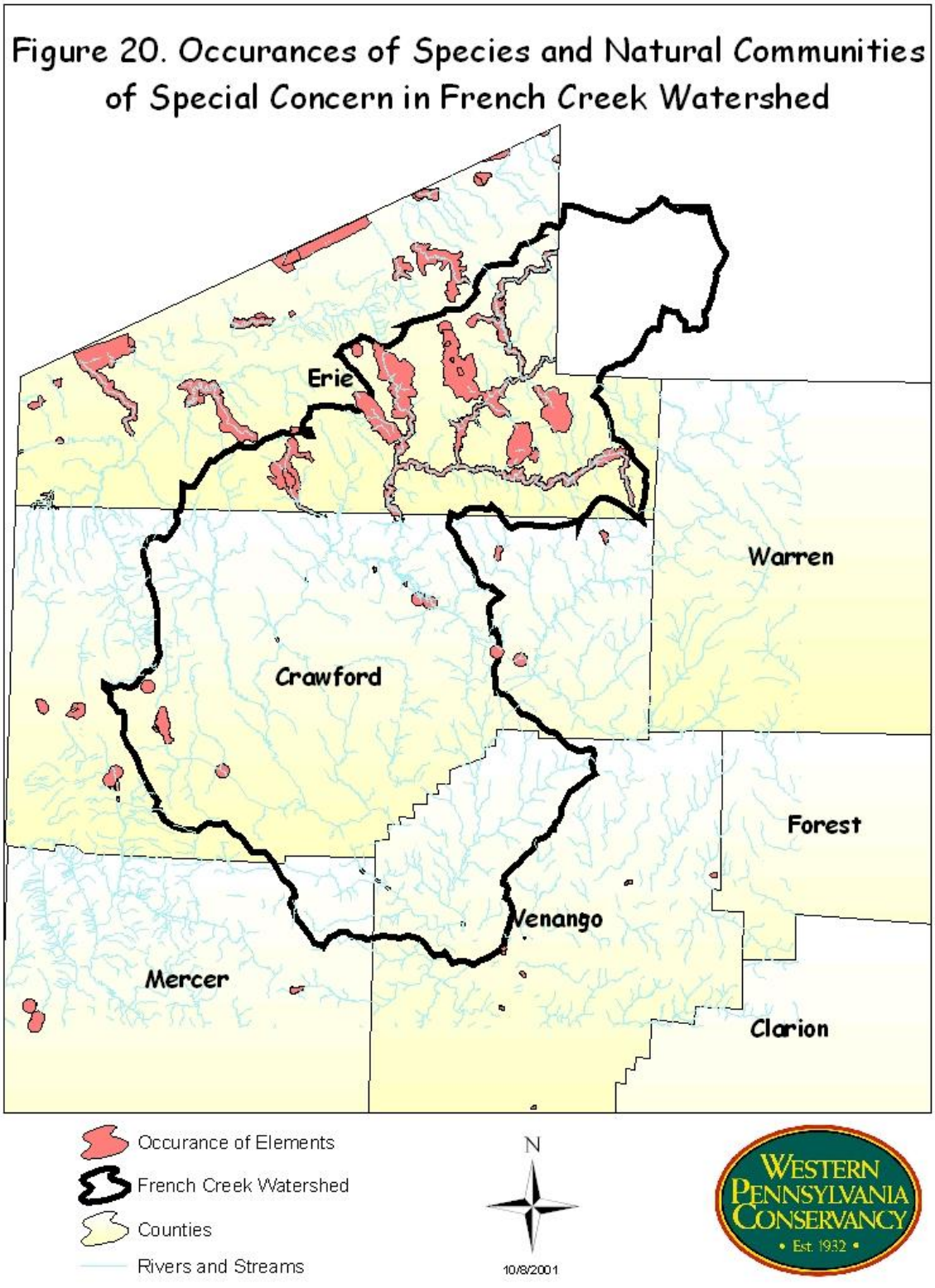


Figure 20. Occurances of Species and Natural Communities of Special Concern in French Creek Watershed
Erie
Warren
Crawford
Forest
Venango
Mercer
Clarion
Occurance of Elements
French Creek Watershed
Counties
Rivers and Streams
N
10/8/2001
WESTERN PENNSYLVANIA CONSERVANCY
• Est. 1932 •

(*Notropis heterodon*) was last documented from Conneaut Lake in 1938 and Lake Pleasant in 1995. The blacknose shiner (*Notropis heterolepis*) is considered to be extirpated from Pennsylvania. It was last recorded from French Creek in 1935 and Conneaut Lake in 1938. The gravel chub (*Erimystax X-punctatus*) was last recorded from Sugar Creek in 1939 but was recorded in the lower reaches of French Creek during the 1980's. The redfin shiner (*Lythrurus umbratilis*) was last recorded in the Erie County headwaters of Cussewago Creek in 1938, but recorded in the Crawford County sections of the stream in the 1980's. The warmouth (*Lepomis gulosus*) was last recorded in Lake Pleasant in 1971 and Trout Run in 1982.

Other Species of Special Concern

There are three insect species of concern found within the French Creek watershed that are tracked by PNDI. The bog copper butterfly (*Lycaena epixanthe*) was last recorded in the Hubbel Run watershed in 1985 and the blue-nosed darner (*Nasiaeschna pentacantha*), a dragonfly, was last recorded from Mercer County sections of the watershed in 1957. The spring blue darner (*Aeshna mutata*) was recorded from the Conneaut Outlet as recently as 1995.

One reptile, blanding's turtle (*Emydoidea blandingii*) is considered extirpated in Pennsylvania but was recorded from Conneaut Lake in 1904. That record might represent the movement of turtles from Lake Erie into the French Creek drainage via man-made canal systems.

Nine bird species of concern are recorded from the French Creek watershed. The American bittern, as a nesting species, was historically recorded from Lake Pleasant and Conneaut Lake in 1890. It was then again recorded from Conneaut Lake in 1982 but no recent sightings of this bird have been confirmed for Lake Pleasant. The expansive marshes associated with these lakes provide breeding habitat for this bird. The least bittern was last recorded from Conneaut Lake in 1982, and was seen at Lake Pleasant in 2000, but nesting behavior could not be verified.

Bald eagles are considered endangered in Pennsylvania, even though they have been downgraded to threatened nationwide, and their numbers are increasing in the French Creek watershed. These birds have been gone from Erie County since 1956 when the last nest was cut down on Presque Isle to make room for a marina. Since 1999, bald eagles have returned and nested on French Creek, north of the Union City Dam. There are a number of bald eagle nests in Crawford County portions of the watershed. Bald eagles currently nest on Sugar Lake and in the Conneaut Marsh along the Conneaut Outlet. In 2000, a new nest was discovered near the Seneca Division of the Erie National Wildlife Refuge in Crawford County.

The Pennsylvania Endangered black tern nests in Conneaut Outlet and was last recorded in 1983. Other birds found in Conneaut Marsh include the sedge wren (*Cistothorus platensis*), Pennsylvania Threatened, and the marsh wren (*Cistothorus palustris*), a candidate for listing. The sedge wren has not been observed since 1928 but the marsh wren was observed as recently as 1982. There is also a historic record for the short-eared owl (*Asio flammeus*), a Pennsylvania Endangered bird, from McMichael Run, Crawford County in 1906.

The French Creek watershed is home to 97 vascular plant species of concern. Many of these are fully aquatic or wetland species associated with calcareous, alkaline water chemistry. Much of

Pennsylvania does not have soils or bedrock with high natural buffering capacity like the French Creek basin does. The overall alkaline water quality in the watershed's lakes, streams, and wetlands has allowed unique, alkaline-loving plant communities to thrive. Many of these species are found at very few locations in the state outside of the French Creek basin.

Common groups of plant species of concern in the French Creek watershed include asters, native water-milfoils, sedges, pondweeds, and wild orchids. The latter group is an especially important group of wetland flowers found in several of the alkaline fen wetlands throughout the watershed. Wild orchids range from extremely conspicuous, such as the showy-lady's slipper (*Cypripedium reginae*), to small, inconspicuous flowers of the leafy white orchids (*Platanthera dilatata*), and leafy northern green orchids (*Platanthera hyperborea*).

Natural Communities and Habitats of Special Concern

In addition to species of concern, PNDI also tracks important natural communities and habitats. These are referred to as landscape element occurrences. A natural community is a group of different species that is adapted to living together under certain conditions or in certain habitats. The habitats found in the French Creek watershed are unique geologic or hydrologic features like:

- calcareous glacial lake
- high-gradient clearwater creek
- medium-gradient clearwater river

and the important natural communities found in the French Creek watershed are:

- eastern hemlock mixed mesic hardwood forest
- basin graminoid-forb fen
- calcareous marsh
- hillside graminoid-forb fen
- northern Appalachian calcareous seep
- glacial bog
- poor fen
- robust emergent marsh
- shrub fen

These landscape element occurrences are found in the French Creek watershed because of the unique soil types and hydrologic regimes, which resulted from the region's glacial history. They are considered rare because the exact conditions that allow them to exist occur nowhere else in Pennsylvania.

Important Habitats

Many important habitats have been discussed. These include IBAs, wetlands, glacial lakes, preserved natural areas (i.e. Erie National Wildlife Refuge, State Game Lands, State Forests, TNC owned lands, WPC owned lands), and French Creek. The French Creek watershed is a vast

system of inter-related habitats. Especially important is the riparian habitat along the streams and lakes in the watershed. Not only does this provide habitat for numerous species, but it also provides protection to the wetland and aquatic habitats that it buffers. There are ranges of habitats from recently mined, highly disturbed areas through early-succession grasslands, mid-succession shrublands, and patches of late succession, mature forests. All of these different habitats that comprise the French Creek watershed account for the diversity of natural resources found within the basin.

CULTURAL RESOURCES

Recreation

Recreational opportunities exist throughout the French Creek watershed. Most of these opportunities highlight the natural resources in the basin. As the human population continues to expand, demands for recreational opportunities will only increase. Opportunities must be developed that satisfy these demands at the same time providing protection for the natural resources that outdoor recreationists potentially threaten.

The quality of recreational opportunities in the French Creek watershed, and elsewhere, are inextricably linked to water quality, wildlife and plant quality, and overall environmental quality. Conservation of natural resources is necessary to ensure quality recreational opportunities exist in the future.

Demand

Often, forms of outdoor recreation are not compatible with the sustainability of the natural resources they utilize. It is the responsibility of planners, municipal leaders, and recreational organizations to ensure that activities in the French Creek watershed do not negatively impact the rich diversity of natural resources that draw tourism dollars into the region. There is an abundance of recreational opportunities within the French Creek watershed that increase the quality of life for residents of the region. As the watershed population continues to grow and population centers in and around the watershed expand, demand for recreational opportunities will increase. If the natural resources that these recreational opportunities are centered around are not protected, recreational opportunities will disappear and quality of life will suffer.

Recently, there has been interest in developing French Creek into an official Water Trails Project under the PA Fish & Boat Commission program. Under this program, minimal amenities would be provided at various locations throughout the French Creek watershed for canoers and kayakers. An educational program would be part of this project. Paddlers would have the opportunity to learn about the resources of the French Creek watershed and some of the threats to these resources through signage. Some examples of this educational signage have already been erected at various access points in the watershed through a cooperative project between Western Pennsylvania Conservancy, French Creek Project, and U. S. Fish & Wildlife Service, and through a grant from PA Department of Environmental Protection's Growing Greener Watershed Protection Program. Some concerns have been raised over the impacts to freshwater mussel beds and other aquatic life if access points are located in sensitive areas or if boating traffic increases significantly on French Creek.

Today, more and more people are turning to alternative forms of transportation for travel, recreation, and fitness. Specifically, walking and biking have grown in popularity throughout the region. This resurgence has led to increased interest in walking and biking trails and greenways. These projects can benefit the individuals using them, the communities in which they are located or link together, and the environment through protection of open space and natural resource buffering. In response to this demand, several groups have begun planning and implementing

trail and greenway development throughout the watershed. These projects range from preserved green space and paved walking trails to proposed rail trails and designated on-road bike routes. Other forms of recreational transportation include all terrain vehicles and snowmobiles. Presently, snowmobiling and ATV riding occurs on select public lands but largely both forms of recreational transportation are limited to private property. In particular, these motorized forms of off-road transportation can negatively impact the natural resources of the region when done irresponsibly. Statewide, efforts are being made to include designated areas where ATV riding and snowmobiling can occur with minimal environmental impact.

Power boating and jet skiing are also popular forms of recreation that occur within the French Creek watershed. Although mainly restricted to lakes, some power boating does occur on the lower reaches of French Creek where public access areas allow motorboats to be launched and the creek is large enough to allow the boats to maneuver. Many of the lakes and reservoirs in the watershed have motor or horsepower restrictions for powerboats; however Conneaut Lake and Edinboro Lake are two of the glacial lakes in the watershed that have no restrictions on horsepower and these see extensive powerboat and jet ski usage. Powerboats used in Lake Erie and then brought to Edinboro Lake are believed to be the cause of the introduction of zebra mussels to Edinboro Lake. This mode of potentially transporting a number of exotic species into the watershed is a constant threat.

There is also demand for many other types of outdoor recreation. Hunting, fishing, ice-fishing, hiking, bird watching, and cross-country skiing are a few of the many activities that are enjoyed throughout the French Creek watershed.

Supply

The French Creek watershed offers the outdoor enthusiast a good supply of outdoor recreational amenities, although many activities are limited by the relative lack of public lands in the watershed. Water based outdoor recreational activities are often restricted by lack of access due to the overwhelming amount of privately owned land. There are however, some public facilities that do offer access to French Creek, area lakes and reservoirs, natural areas, wildlife refuges, and hunting land (Figure 9).

<u>Water-Based Recreation</u>
The main stem of French Creek is navigable by canoe for its entire length from the Union City Dam to its confluence with the Allegheny River at Franklin. Some canoeing is also possible upstream from the Union City Dam when water levels are elevated however access is limited to private property. There are several public access points along the entire stretch of French Creek (Figure 21). These access areas have been mapped and described in the *French Creek Canoe Guide* produced by the FCP and summarized below:

- Beginning at the Union City Dam Recreation Area, owned by the U. S. Army Corps of Engineers, it is a 3.5-5 hour float to a public access area at the intersection of routes 6N and 19 south of Waterford.

- This access area is owned by French Creek Canoe and Kayak, a local retailer, and maintained for public access by the Conneaut Lake/French Creek Valley Conservancy. The next public access area is a 5-7 hour float to the PFBC access at Cambridge Springs. Just downstream, Cambridge Springs Borough also operates a public boat launch and picnic area on French Creek.

- From Cambridge Springs, it is less than an hour float to a Pennsylvania Department of Transportation (PA DOT) owned public access area at the confluence of Conneauttee Creek and French Creek. It is another 3-4 hour float to a PFBC access at Saegertown. A small dam upstream of Saegertown must be portaged along this stretch.

- From the Saegertown access, it is a 2-3 hour float to Bicentennial Park owned by the city of Meadville. Walker's Landing Public Campground is owned by the CLFCVC and is accessed by canoe only just upstream of Meadville. There is also a canoe access point on Cussewago Creek owned by the PFBC that links to French Creek, and Woodcock Creek Lake has an access area owned by the USACE for canoeing on the lake.

- Just downstream of Meadville, the PFBC owns an access area at Wilson Shute (1-2 hours from Meadville) and another downstream at Shaw's Landing (1-2 hours from Wilson Shute) near the confluence of Conneaut Outlet and French Creek. From Shaw's Landing, it is a 4-5 hour float to the Utica Access, owned by WPC.

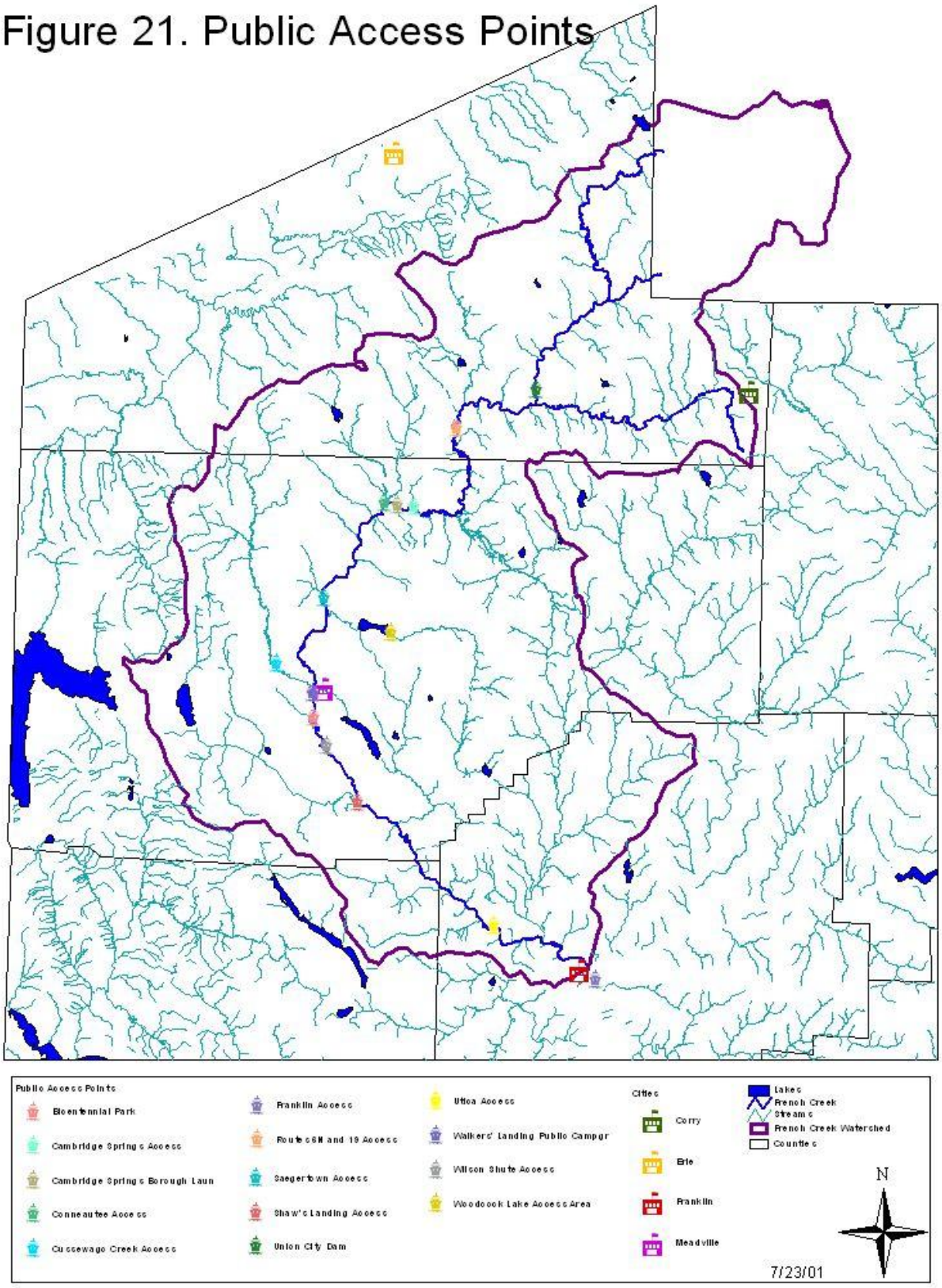
- Another 3 hours on French Creek brings canoers to the mouth at Franklin where the PFBC owns an access area on the Allegheny River, a designated Wild and Scenic River. The city of Franklin also owns Riverfront Park where canoe access is possible.

Paddlers on French Creek are encouraged to obtain a copy of the FCP's Canoe Guide for complete information on canoeing French Creek. French Creek Project has recently begun providing canoe tours to promote French Creek through ecotourism and educate watershed stakeholders on the importance of French Creek's resources.

Canoeing is also permitted on all lakes and reservoirs mentioned in the Water Resources section of this document. Canoers should remember that canoes must be registered with the PFBC if the canoe is to be put in or taken out at a PFBC operated access area. Public access areas are designated on Findley Lake in New York, Eaton Reservoir, Lake Pleasant, Union City Reservoir, LeBoeuf Lake, Edinboro Lake, Conneaut Lake, Woodcock Creek Lake, Tamarack Lake, and Sugar Lake. There is also canoeing permitted on several impoundments located in PA Game Commission's State Game Lands throughout the watershed, for example, Conneaut Marsh in SGL #213 near Geneva, Crawford County.

Conneaut Lake and Edinboro Lake offer unlimited restrictions for powerboating and several other lakes and impoundments in the watershed offer access for limited horsepower or electric

Figure 21. Public Access Points



motors. Lake Pleasant, Eaton Reservoir, and Union City Reservoir allow no motors for boats. In addition to these opportunities for canoeing and boating, the French Creek watershed lies in close proximity to popular boating areas like Presque Isle Bay and Lake Erie, Pymatuning Reservoir in western Crawford County and eastern Ohio, Shenango Reservoir and Lake Wilhelm both in Mercer County.

Land-Based Recreation

Land-based recreational opportunities also abound in the French Creek watershed. There has recently been a surge in interest in establishing trails and greenways throughout the basin. Several PA roadways have recently been designated as PA bicycle routes. These include PA Route 98 as Bicycle Route A and PA Route 6/6N as Bicycle Route U.

In 2000, the Erie County Department of Planning and Metropolitan Planning Organization developed a *Trails and Greenways Plan* for Erie County. This plan describes existing on and off road trails and greenways and proposes the development of new trails and greenways for the county. Greenways are defined in the Erie County plan as "any undeveloped area that is open for recreation, transportation, and quality of life activities. Greenspace resources include: agricultural area, recreational parks, education parks, bikeways, trails, forests, state game lands, riparian area, and community courtyards."

Existing trails and greenways within the French Creek watershed include:

- Edinboro University Highlands Trail (bike trail for Edinboro University faculty, students, and staff only)
- Routes 6 and 6N in Erie and Crawford Counties are designated as an on-road National Recreational Trail.
- The Ernst Bike Trail from Meadville to Conneaut Lake
- Trails on WPC's Lowville Fen Natural Area north of Lowville
- Erie National Wildlife Refuge trails
- Woodcock Creek Lake trails
- State Game Lands trails throughout the watershed

Many organizations are proposing to form new trails and greenways with the hope of providing linkages between trails within the watershed and between regions outside of French Creek. The Erie County Department of Planning is proposing to designate on-road trails for many routes in the watershed (Table 8). The designation of roads as trails is dependent upon modifications to existing roadways, such as widening berms, to increase safety for pedestrians and bicyclists.

Table 8. Proposed On-Road Pedestrian Trails in Erie County Portions of the French Creek Watershed

Name/Location	From	To
Arbuckle Road/Lake Pleasant Road	PA 8	Lake Pleasant
Edinboro Road/Cambridge Springs Road – PA 99	Crawford County/Edinboro	Interchange Road/Millcreek Mall
Jamestown Road – PA 474	Wattsburg	New York
Old Wattsburg Road/PA 8	Waterford	Wattsburg
Route 6N	Mill Village	Springfield/Seaway Trail
Route 19	US 6N	Waterford
Route 89	North East	US 6
Route 97	Waterford	Glenwood Park Avenue
Source: Erie County Dept. of Planning, Trail and Greenways Plan		

Off-road facilities include trails, abandoned rail trails, rails with trails, and greenways with no designated trail. There is a nationwide movement to convert abandoned railway lines into recreational trails known as "railtrails". More recently, some trail organizations have established trails along still-in-use railway beds. These trails are referred to as "rails with trails". Several of these off-road facilities have been proposed for Erie County
(Table 9).

Table 9. Proposed Off-Road Pedestrian Trails in Erie County Portions of the French Creek Watershed

Name/Location	From	To
Allegheny and Eastern Railroad – Rail with Trail	Shannon Road/Penn State – Behrend Campus	City of Corry
Bessemer and Lake Erie (B&LE) Railroad (Conneaut Branch) – Rail with Trail	Cranesville/Albion	Springfield/Ohio
Corry to Clear Lake Trail (abandoned Penn Central RR line)	City of Corry	Crawford County/Clear Lake
Corry to Findley Lake Trail (Chautauqua R/T, Incorporated Corridor)	City of Corry	New York/Findley Lake
French Creek Greenway Trail	To Be Determined	
Northwest Pennsylvania Rail Authority Rail Corridor – Rail with Trail	City of Corry	Crawford County/Meadville
Source: Erie County Dept. of Planning, Trails and Greenways Plan		

Other proposed greenways include plans by the newly formed Cochranton Greenways, Inc. to establish a greenway along French Creek in and around the borough of Cochranton. There is also a multi-municipal Environmental Advisory Council (EAC), made up of municipal leaders and community members from the City of Meadville, Vernon Township, and West Mead

Township, which is proposing to establish a greenway linking these three municipalities in Crawford County.

The Allegheny Valley Trails Association is a non-profit group working on trails in Venango County along French Creek and the Allegheny River. There is a proposed trail that will run from downtown Franklin upstream along French Creek on a former rail line.

Many of the trails can be utilized for cross-country skiing during winter months. There are designated cross-country ski trails at Eaton Reservoir, the Erie National Wildlife Refuge's Sugar Lake Division, and in Cornplanter State Forest's Ingraham Tracts in Crawford County. Cross-country skiing is also permitted on trials and roadways in State Game Lands throughout the watershed.

The many tracts of State Game Lands throughout the watershed, as well as the Cornplanter State Forest's Ingraham Tracts, WPC lands, and the Erie National Wildlife Refuge (with some restrictions) provide areas for public hunting in French Creek. Fishing and birding opportunities are plentiful and have been discussed at length in the Land, Water, and Biological Resources sections.

Venango County, the city of Titusville, and Oil Creek Township in Crawford County are designated as the Oil Heritage Region within the PA Department of Conservation and Natural Resources' Pennsylvania Heritage Parks Program. This designation highlights the region's booming oil history and works with a diverse background of organizations to promote cultural and natural resource conservation, recreation, and heritage education. Although most of the Oil Heritage Region amenities and recreational opportunities lie outside the French Creek watershed, this region is partially within the French Creek watershed and offers area residents many opportunities for educational and recreational pursuits.

A final important consideration for recreational opportunities in the French Creek watershed is the Peek 'n Peak Resort and Conference Center in the New York headwaters of French Creek. Peek 'n Peak includes a downhill ski area, lodge complex, condominiums, and two golf courses. The Nature Conservancy's French Creek Project views the continued growth of this resort as a potential threat to French Creek's water quality (McAlpine, 1999). Ski resorts contribute to water quality and quantity problems through water withdrawal for snowmaking and increases in pollutants running off through snow melt.

Golf courses, like those at Peek 'n Peak and scattered throughout the watershed, represent a significant threat to water quality. PA Department of Environmental Protection has noted increased nutrients and pesticides associated with runoff from golf courses through its stream assessment program. The French Creek watershed, because of its highly rural, gently rolling landscape has many public and private golf courses.

Early History

The French Creek watershed has a rich history beginning several thousand years ago when humans first appeared on the landscape. The Native Americans that settled this region were

descendants of peoples who migrated across a land bridge that connected Alaska with Asia and then spread across North America. The following is an excerpt from the FCP Factsheet entitled *The Iroquois of the French Creek Valley* (Stewart, 1998):

The Iroquois…typically settled inland where their communities revolved around farms, orchards, and hunting. The Iroquoian language family included the Cherokee, Tuscarora, Mohawk, Oneida, Cayuga, Onondaga, and Seneca (all languages still spoken today), along with the Huron, Wyandot, Eriez, Susquehannock, Wenro, and other languages now silent.

Prior to the formation of the Iroquois Confederacy, the relatively small nations of the Eriez and Wenro (no more than 5,000 people at their peak) controlled the French Creek Valley and the Lake Erie shore. The early traditions of the Iroquoian peoples record that the various nations were frequently in conflict as they competed for territory. Then around 1300, a Huron named Deganawida – the Peacemaker – voiced a new vision and proposed a forum in which "thinking will replace violence." Five of the nations agreed – the Mohawks, Oneidas, Onondagas, Cayugas, and Senecas. The Iroquois Confederacy was created.

The sphere of influence of the Confederacy in 1600 extended from the Hudson River across New York State. The Mohawks became the keepers of the eastern gate, the Onondagas were the keepers of the Great Council Fire, and the Senecas were the keepers of the western gate. As Europeans began to settle the continent and compete for trade, the Iroquois became increasingly aggressive against their non-Confederacy neighbors. By the mid-1700's the Eriez people, already decimated by an epidemic, were defeated and its survivors assimilated into the Seneca people of the upper Allegheny region (which included French Creek). Earlier, the Susquehannocks had been similarly defeated and absorbed.

In the 1600's, the Iroquois (and especially the Seneca) were faced with a white incursion from three different fronts: 1) the French had claimed the Ohio River basin from the headwaters of the Allegheny River down the Mississippi, primarily for hunting and trade; 2) the British by this time had established settlements along the Atlantic Coast; and 3) the increasingly assertive "Americans" had claimed the American interior and especially the Ohio River basin for settlement…

By 1753, the French had established a series of forts in western Pennsylvania to stem English penetration of the West. These forts included Fort Presqu' Isle (at present day Erie), Fort LeBoeuf (at Waterford), Fort Venango (at Franklin), and Fort Duquesne (at Pittsburgh). The following is an excerpt from the May 1995 FCP Factsheet (n.a.):

In 1753 a young George Washington was called upon to make an arduous journey to Fort LeBoeuf by way of the Allegheny River and French Creek. Sent on a mission to gather strategic information about the French for the British, Washington traveled for several months from Virginia to northwestern Pennsylvania via these waterways. He arrived at the fort in mid-December 1753, where he remained for five days and found the French strength to be much greater than expected. Washington accepted the French Commander's written response and returned to Virginia experiencing "tedious and fatiguing passage" by canoe down partially frozen French Creek.

Washington's report to Virginia's Governor alerted the English to French plans for the Mississippi Valley. Within a year he was back in western Pennsylvania and fought in the first battle of the French and Indian War. During the war, unsettled and wild French Creek Valley was a battleground for the French, Native Americans, the American colonists, and the British as they fought for control of western Pennsylvania. The forts along the creek were lost by the French, then recaptured, only to be lost again.

…By the time the French and Indian War began in the mid-1700's, these groups were impacting heavily on different fronts of the Iroquois Confederacy…the Seneca allying with the French; the Mohawks and some Oneidas allying with the British; and the Tuscaroras, Onondagas, and Cayugas trying unsuccessfully to remain neutral (FCP, 1998).

The end of the French and Indian War did not bring peace to the French Creek Valley, however. The area remained a battleground through the Revolutionary War and beyond until Anthony Wayne's victory over the Western Tribes at Falling Timbers in 1794.

The French had originally named French Creek "La Riviere aux Boeufs," or "the river of the cattle," for bison that were reported to have been found in this area. It was George Washington on his trip in 1753 that first called this waterway "French Creek".

Expansion of whites into the French Creek watershed is further described by the FCP Factsheet (Stewart, 1998):

With historical accounts of abundant fish, deer, turkey, squirrels, wild pigeons, and bear in the area surrounding French Creek, it is clear why the Allegheny River Seneca had a summer camp in Meadville into the early 1800's. For the most part, the Seneca got along with their new white neighbors like William Wilson at Fort Franklin, Colonel Hackney (a Meadville merchant), and David Mead (who founded Meadville in 1788).

A majority of the Seneca were soon to leave the French Creek Valley, however. In 1800 there were about 2,500 American settlers in Crawford County; by 1810 there were about 6,000, and by 1830 there were 16,000. Most of these new settlers were farmers, who began cutting the trees, cultivating the land, and building dams and mills on the streams. The hunting grounds on which the Seneca lifestyle depended were disappearing from the French Creek Valley.

These historic accounts of French Creek are largely chronicled in, *In French Creek Valley*, by John Earle Reynolds. Written in 1938 and reprinted in 1985, this book can be found in the Crawford County Historical Society.

Early settlers utilized French Creek as a transportation route for goods. Timber, skins, and other products could be shipped all the way to the Gulf of Mexico from the French Creek Valley, via the Allegheny, Ohio, and ultimately the Mississippi Rivers. Until this time, settlers in the region had to traverse the 15 overland miles from Waterford to Lake Erie via the Portage Trail in order to get goods to the Atlantic Ocean. Then in 1837, The French Creek Feeder Canal was completed between Meadville and Conneaut Lake. This allowed goods to be transported from

French Creek at Meadville to Conneaut Lake and then on to Lake Erie via the Erie Extension Canal, thus ending the need to transport goods overland to Lake Erie. The French Creek Valley prospered as timbering and farming molded the landscape, the remnants of which we still see today. Many sites in the watershed became popular tourist attractions. People flocked to resorts in Cambridge Springs to bathe in the mineral-rich springs in the area. In the late 1800's and early 1900's, resorts also attracted tourists to many of the glacial lakes in the watershed, including Conneaut Lake and Lake Pleasant, where social halls, water slides, and boat rides provided family recreation.

Historical Sites

The Pennsylvania Historical & Museum Commission reviews and lists properties in Pennsylvania for inclusion on the National Register of Historic Places. Because of its rich history, the French Creek watershed has 64 sites listed on the National Registry. These sights are listed in Appendix I.

Many historic landmarks from the French Creek watershed have probably been lost. The lack of publicly owned land, including no state parks, and few county or municipal parks in the watershed, make historic preservation difficult.

POTENTIAL THREATS AND RECOMMENDATIONS

There are a multitude of activities in the French Creek watershed that can potentially threaten water quality, aquatic biota, and ultimately, quality of life for watershed residents. Most of the activities that potentially threaten the health of the French Creek watershed are important to the economic viability of the region and the well being of residents. Because of this, it is important to find ways that these activities can exist and thrive while maintaining the ecological integrity of the watershed. Humans are inextricably linked to the environment in which we live. Acknowledging and fostering this link by both utilizing and protecting natural resources with the goal of sustainability is the true essence of conservation.

It is undeniable that human activities such as agriculture, logging, mineral extraction, development, and even some forms of recreation can potentially threaten the health of the French Creek watershed. The goal of this Plan is to provide information on ways to minimize those threats through education, research, and cooperative community based approaches. Most of the potential threats and recommendations have been voiced by watershed stakeholders through the French Creek Project's Visioning Process, through public stakeholder meetings for the conservation planning process, and by the technical steering committee. Potential threats are described as types of pollutants, forms of habitat degradation, or other activities and land uses that may have a negative impact on the health of the watershed. Human activities that have the potential to produce these threats are described. The recommendations that are offered to address these potential threats are grouped according to the type of action required: education, collection of additional information, or cooperative actions. The list of potential threats to the watershed and the priority of those threats will change as recommendations from this Plan are implemented. The goal of these recommendations is the restoration, maintenance, enhancement, and overall protection of the resources of the French Creek watershed.

Pollutants

"A pollutant is a … by-product of human activities which enters or becomes concentrated in the environment, where it may cause injury to humans or desirable species" (Kline, n.d.). Pollutants are generally described as heat, nutrients and organic wastes, toxins/hazardous substances, and invasive exotic species.

Heat

Heat is considered a type of pollution that can impact aquatic organisms if water temperatures are elevated beyond tolerable limits. Elevated water temperatures decrease dissolved oxygen levels and magnify stresses associated with some chemical pollutants. Thermal pollution is common when point discharges are releasing water into a receiving stream at higher than ambient temperatures; however due to the relatively low number of major point discharges throughout the French Creek watershed and existing regulations, elevated temperatures associated with point source discharges probably produce a negligible effect on surface water temperatures. The loss of riparian buffers along streams also contributes to heat pollution as trees and shrubs in an intact riparian buffer shade the water and help lower water temperatures.

Nutrients and Organic Wastes

PA Department of Environmental Protection biologists have noted nutrients as the leading cause of stream impairment in the French Creek watershed. The primary nutrients affecting aquatic ecosystems are nitrogen and phosphorous. Although important for plant growth and primary production in ecosystems, excess nitrogen and phosphorous can promote the eutrophication of streams and lakes (See *Eutrophication* under *Water Resources*). These nutrients cycle naturally through the environment and are initially introduced to aquatic and terrestrial ecosystems through the weathering of soil and rock and from the atmosphere. Anthropogenic impacts to the landscape have dramatically increased the amount of these nutrients entering aquatic systems. The U. S. Geological Survey's National Water Quality Assessment Program reported very high levels of dissolved nitrates in groundwater in the New York headwaters of French Creek and somewhat elevated dissolved ammonia levels at various sites in Crawford and Erie County portions of the watershed. The NAWQA program also reported elevated dissolved nitrogen and ammonia levels in groundwater at a site in the Venango County portion of the watershed in 1998.

Nitrogen and phosphorous cycle through the environment in similar continuous cycles, including via the growth, death and decay of plants and animals. Natural levels of these nutrients are augmented through fertilizer use, combustion, sewage, and organic waste breakdown. The U.S. Environmental Protection Agency estimated in 1987 that the yield for nitrogen in the French Creek watershed was 8.74 lbs. per acre per year. The sources for nitrogen were broken down as follows:

- atmospheric deposition at 3.15 lbs./acre/year
- livestock produced 1.93 lbs./acre/year
- fertilizers produced 1.39 lbs./acre/year
- non-agricultural sources produced 1.81 lbs./acre/year
- point sources produced 0.46 lbs./acre/year

Additionally, the EPA assessed the risk of groundwater contamination by nitrates in the French Creek watershed between 1970 and 1995. Although the findings indicated that aquifer vulnerability was low throughout the watershed, nitrogen inputs were considered high throughout approximately 88% of the watershed.

Much of the atmospheric nitrogen is comprised of naturally occurring elemental (N_2) nitrogen. However, nitrogen reacts with hydrogen to form ammonia and with oxygen to form nitrites (NO_2) and nitrates (NO_3). Plants most readily utilize nitrogen in the form of nitrates. Human land-use practices tend to augment the naturally occurring supply of nitrogen resulting in increased rates of eutrophication of surface waters.

The French Creek watershed is well situated to receive air born pollutants from industrial areas to the west due to continental wind patterns. These pollutants can fall as wet deposition (rain or snow), or dry deposition attached to dust particles. Pennsylvania receives rainfall with an average pH of approximately 4.1 (Novak and Woodwell, eds. n.d.). The average acid

precipitation in the French Creek watershed in 1999 varied between 4.33 and 4.39. Acidic precipitation is the result of chemical reactions in the atmosphere between naturally occurring elements, like oxygen and nitrogen, and the byproducts of the combustion of fossil fuels from industry, agriculture, and vehicles. Along with acidification of surface waters, acid precipitation carries various chemical pollutants, including nitrogen and phosphorous that impact streams, lakes, rivers, and ultimately groundwater. Because fossil fuel combustion is a widespread issue and Pennsylvania receives much of its air born pollutants from other states, it is difficult to implement strategies to combat this threat without federal and state cooperation and goal setting to limit air emissions. It has been noted that there is a lack of air quality monitoring stations within the French Creek watershed.

Agricultural practices throughout the watershed have the potential to contribute high levels of nutrients to surface waters and groundwater. In fact, statewide, agriculture has replaced acid mine drainage as the leading cause of non-point source pollution. Representatives from DEP believe that poor farming practices are a major threat to the French Creek watershed (Holden, 1997). Both crop production and livestock are major sources of nutrients. Fertilizers, applied to fields and stored on farms, are the major sources of nutrients in run-off reaching streams and lakes, and contributing to groundwater. These impacts are exacerbated when riparian buffers are removed and agricultural Best Management Practices are not utilized. Livestock are also direct contributors of nutrients, particularly nitrogen, to surface waters. In some areas of the watershed, particularly the New York headwaters, it is estimated there are twice as many dairy cattle as there are humans. Livestock often have direct access to streams in pasture areas and eliminate wastes directly into water. These impacts are worsened by associated erosion produced when livestock trample stream banks and destroy vegetation.

Nutrients can also be contributed to surface and groundwater supplies by other activities throughout the watershed. Increased run-off and erosion from poor timbering practices and mining operations can mobilize large amounts of nutrients trapped in the soil and transport them to streams and lakes. These effects can be minimized when BMPs are utilized to minimize soil disturbance.

Additionally, as impervious surface area increases through development and urbanization, runoff from parking lots, roadways, rooftops, and other areas carry high levels of nutrients to receiving bodies of water. These problems are compounded when development practices fail to limit or mitigate the effect of impervious surfaces through the use of alternative materials, use of greenspace, and sensitive and sufficient stormwater management design.

Nutrients and organic waste are often contributed by point sources (i.e. a pipe from a sewage treatment plant or industrial discharge, on-lot septic systems). Organic wastes are discharged from food processing plants and other industries. Organic wastes breakdown into nitrogen and phosphorous constituents and further contribute to profuse plant growth and low dissolved oxygen levels. Permitting and monitoring by DEP for point source discharges has helped to curb problems associated with these discharges; however in the case of sewage treatment plants, nutrients are still discharged even in treated effluents. Bypasses of raw sewage due to overloads do occur and result in even higher nutrient levels discharged.

Field surveys by DEP in 1991 noted, "fouled substrate conditions, profuse plant growth and low dissolved oxygen levels" below the city of Meadville (Hasse, 1992). At the time, sewage treatment plants for West Mead Township and Meadville were severely overloaded and discharging untreated sewage into French Creek during periods of overload. Since that time, West Mead Township has combined with Meadville and Meadville has constructed a larger sewage treatment plant that incorporates ultraviolet treatment of wastewater instead of traditional chlorination techniques. Other sewage treatment plants in the watershed continue to operate overcapacity and overloads contribute untreated sewage to streams and lakes in the watershed.

A potential major threat to water quality in French Creek are nutrients released from on-lot septic systems associated with older homes and seasonal cottages along streams and lakes in the watershed. Because of the age of some of these structures, they escape regulation by DEP and can severely impact water quality. Although discussed here as a point source of pollution because they can be traced to a discharge pipe, once discharged, sewage and organic wastes can infiltrate groundwater and spread through sub-surface pathways reaching streams at a myriad of locations.

Impacts from areas of high seasonal cottage densities are evident during summer low flows when excessive weed growth and algae blooms clog waterways and impede canoes downstream of these areas. The porous nature of gravelly soils found in flood plains along French Creek may provide little protection even for properly functioning systems. Gravelly soils often contain less clay and other fine particles that more readily trap nutrients like phosphorous.

Toxins and Hazardous Materials

The following is a discussion on toxic wastes from Kline, n.d., *Background working document for a French Creek conservation plan:*

There are natural sources of some toxic substances such as heavy metals. However, many industrial, agricultural, and household processes produce [these and unnatural] toxic materials. Toxic wastes produced by human activities contain substances that rarely occur in nature, or if so are not [found in] high concentrations. Toxic wastes are not readily biodegradable. Examples are: heavy metals, hydrocarbons of petroleum origin, pesticides, and organic poisons, like PCBs, and inorganic poisons, like chlorine and ammonia.

Toxins have the ability to severely impact water quality and can cause rapid mortality for large numbers of aquatic organisms. In other cases, toxins may not kill aquatic organisms outright, but may build up in their body tissue and affect physiological functions when certain levels are reached. Decreased reproductive success is a possible physiological affect of increased toxin levels in body tissue. Reproductive compromise has received national and international attention through studies of a family of pesticides (halogenated hydrocarbons) of which DDT is the most well known. Raptors such as the bald eagle were particularly affected as pesticide residues accumulated in food chains and the bird's bodies. As a result of bald eagles feeding on fish that had built up high levels of these toxins, egg shell thickness decreased to the point that egg laying and incubation were no longer possible. Build-up of toxins can also be harmful to humans and lead to health recommendations in the form of fish consumption advisories. Certain lakes in the

watershed have been found to contain high levels of mercury in benthic sediments, which also leads to fish consumption advisories.

Every three to five years fish tissue is analyzed via the PA Department of Environmental Protection's (DEP) water quality network. Tissues are sampled for priority pollutants to determine suitability for human consumption. Priority pollutants are cadmium, chromium, copper, lead, mercury, PCBs, and pesticides. DEP has no comprehensive assessment or baseline data of toxics for the watershed. The USGS NAWQA project sampled for the presence of pesticides in the lower reaches of French Creek and found persistent pesticides below EPA action levels (Kline, n.d.).

As mentioned previously, chlorine is commonly used for wastewater treatment by municipal, industrial, and private treatment facilities. Chlorine is extremely toxic to freshwater mussel glochidia (young) and other aquatic organisms. PA Department of Environmental Protection water quality standards for chlorine allow for a mixing zone that extends 15 minutes downstream from the sewage treatment plant where discharged. This limit set does not satisfy the concerns of the U.S. Fish & Wildlife Service regarding the protection of aquatic life (Kline, n.d.). Chlorine has been eliminated at the Meadville Sewage Treatment facility but is still utilized by other sewage treatment plants in the watershed. In addition, toxins like formaldehyde and fungicides are discharged by the PA Fish & Boat Commission hatcheries in Corry and Union City, Erie County (Wellington, 1994).

Brine and petroleum products can be released from abandoned oil and gas wells. These substances can be extremely toxic to receiving waters. Brine often has a higher salt content than seawater and is found in deep aquifers. Deeply drilled oil and gas wells often pass through these aquifers and have the potential to release brine to the surface or shallower groundwater aquifers where drinking water contamination can occur. Brine commonly has many other toxins associated with it such as heavy metals.

Roads and railways are often built along stream and river floodplains where topography is flat. These transportation corridors can negatively impact aquatic habitats by contributing pollutants in runoff. Common pollutants associated with runoff include road salt, heavy metals, and petroleum products. These pollutants can degrade riparian vegetation and severely alter aquatic habitats. Whenever these transportation corridors occur in close proximity to waterways, there exists the potential for catastrophic spills of toxic materials. Any such spills could wipe out large portions of the aquatic ecosystem and render the habitat unsuitable for aquatic organisms for an extended period.

Invasive Exotic Species

Exotic species are introduced, non-native species. They are considered invasive if able to out-compete native species for resources. Considered a form of biological pollution, exotic species have the potential to negatively impact the native flora and fauna of the French Creek watershed. When species are introduced to an ecosystem that did not evolve with them as part of the natural community, they have the tendency to aggressively out compete native species for available

resources and are able to drive the native species out. With no natural predators or sufficient competitors, exotic species can quickly become invasive and reduce the community diversity becoming the overwhelmingly dominant species. In some cases, these species have the potential to drastically alter the ecosystem itself with severe consequences to native species. Many of the lakes and reservoirs in the watershed are infiltrated with Eurasian water-milfoil, an aquatic plant that has the potential to out compete native water milfoils and other aquatic species. Considered nuisance weeds by recreational boaters, aquatic plants, and especially thick growing Eurasian water-milfoil, are targeted with mechanical harvesters and herbicides. Such indiscriminate harvesting can have potentially harmful effects on the ecosystem and other non-target species.

Invasive plants in the French Creek watershed include common reed, purple loosestrife, and hybrid cattails. These species all invade wetlands, especially those that have recently been disturbed either by natural processes (e.g. severe flooding) or human activity. Plant species of special concern, due to their needs for specialized habitats and low-competition environments, are perhaps more susceptible to the threats posed by aggressive exotic species.

Other invasive plant species known to exist in the French Creek watershed include multiflora rose (*Rosa multiflora*), Tartarian honeysuckle (*Lonicera tatarica*), Japanese knotweed (*Polygonum cuspidatum*), and giant hogweed (*Heracleum mantegazzianum*). Experts believe these to be some of the most serious threats to our native ecosystems and many have been designated "Noxious Weeds" by the Pennsylvania Department of Agriculture and are also a major concern to our agricultural community. Other invasive plants in the French Creek watershed that deserve our vigilance are common privet (*Ligustrum vulgare*) and reed canary grass (*Phalaris arundinacea*).

Recently a new exotic species was found in the French Creek watershed. The zebra mussel, a small black and white striped bivalve mollusk, was discovered in Edinboro Lake in 2000. Believed to be in the lake for several years prior to discovery, the zebra mussel population had increased until individuals were discovered attached to boat hulls and large numbers in the shallow lake margins around Edinboro Lake. Since its discovery in Edinboro Lake, the zebra mussel has also been documented in Sandy Lake and Canadohta Lake, two glacial lakes just outside of the French Creek watershed.

The zebra mussel first invaded the Great Lakes in the mid-1980's when it was transported from Europe in the ballast water of oceangoing ships. Once established, the zebra mussel quickly colonizes all available hard substrate on lake bottoms. In a little over 10 years since its presence was confirmed, it has had a dramatic effect on the Lake Erie ecosystem, filtering large quantities of water and depleting the aquatic environment of microscopic algae and zooplankton. Additionally, these organisms have clogged water intake pipes for drinking water and industries, and fouled boat hulls.

Now that the zebra mussel has jumped the watershed divide from Lake Erie into the French Creek watershed, only time will tell the impact to Edinboro Lake and French Creek. Believed to have been introduced to Edinboro Lake through recreational boating, the existence of the zebra mussel in Edinboro Lake poses a serious threat to other lakes in the watershed. In the winter of 2000-2001 and again in 2001-2002, DEP and Edinboro Borough undertook a five-foot draw

down of the lake level to expose a large percentage of the zebra mussels to freezing temperatures in an attempt to kill the majority of the population. Viewed as a possible means of keeping the population under control, the results of the experimental drawdowns are currently being reviewed by researchers from Edinboro University of Pennsylvania. The first drawdown coincided with heavy snow cover, which may have acted to insulate the zebra mussels against freezing temperatures. Temperatures during the second drawdown were unusually mild and again may not have achieved the desired effects on the zebra mussel population.

Prevention through education is probably the best means of avoiding zebra mussel introductions. Once established, it is impossible to completely eradicate the zebra mussel with current levels of understanding about the organism. The threat that the zebra mussel poses to native freshwater mussels in French Creek is a debated topic. Research has shown that zebra mussel veligers (young) cannot survive turbulent waters. This is believed to be the reason the zebra mussel has not been successful at colonizing outlet streams of other lakes where it is found. Adult zebra mussels have been found in Conneauttee Creek, the outlet for Edinboro Lake, but only a short distance below the lake. Research by the USACE at Michael J. Kirwan Reservoir on the West Branch of the Mahoning River in nearby northeast Ohio has shown adult zebra mussels only colonize the outlet stream for a short distance (approximately a half mile) below the reservoir. It is thought that this colonization is a result of adults that get detached from the reservoir and wash downstream before reattaching instead of from veligers (U. S. Army Corps of Engineers, 2000). French Creek does have deep, slow moving pools that may resemble lake situations enough to allow the zebra mussel to colonize. For this reason, efforts are being made to educate the boating public on ways to minimize the risk of transporting zebra mussels to other area lakes.

Many other exotic species threaten the native biota of French Creek. Common carp (*Cyprinus carpio*) have been introduced to French Creek and several other carp species have the potential to be introduced from other PA waterways. Carp are primarily benthic feeders that can severely impact benthic communities, including freshwater mussels. They also aggressively compete with native benthic feeders for food resources.

As previously mentioned, the Asian clam has been documented from the French Creek drainage. Other potential exotics not documented to date are gobies, black carp, and triploid carp (supposed sterile hybrids) among others.

Brown trout and rainbow trout, the two most commonly stocked species in the French Creek watershed, are also exotic species that compete with native game fish. This increased competition may have negative effects on native forage fish and benthic communities.

Table 10 - A.
Educational Recommendations to Address Pollutants in the French Creek Watershed

Recommendation	Recommended Approach	Potential Partners	Priority
Increase Public Education about Non-Agricultural NPS Pollution	More education about non-agricultural non-point sources of pollution needed for the general public. Potential sources include faulty septic systems, improper lawn care, urban runoff, and combined sewage overflows. Education should emphasize things all citizens can do voluntarily to decrease non-point source pollution.	Conservation Organizations, DEP, Conservation Districts, School Districts, Universities	High
Identify and Utilize Educational Outlets	Widespread outlets for public education on issues should be identified and utilized. An example may be the newsletter developed and circulated to watershed homeowners by Rural Electric.	Conservation Organizations, DEP Conservation Districts	Medium
Increase Public Education on Lawn Fertilizer Use	Consumers should be educated on proper fertilizer use for lawn care at point of sale through cooperative programs between retailers and conservation organizations. Incentives and recognition should be given to cooperating retailers.	Conservation Organizations, DEP, Conservation Districts, Retailers	High
Increase Public Education on Toxins	Increase public education about toxins and potential effects on aquatic communities and humans. Education should include alternatives to toxins, proper handling, and disposal. This could be accomplished through workshops and printed material.	Conservation Organizations, DEP, Conservation Districts	High
Promote Recycling	Increase public education about benefits of recycling and proper disposal of potential toxins (batteries, pesticides, etc.). Provide incentives for schools and civic organizations to get involved.	Conservation Organizations, DEP, Municipalities	High
Increase Public Education on Use of Household Chemicals	Increase public education on proper use and disposal of common household chemicals (cleaning agents, degreasers, pesticides, etc.) through media and printed material.	Conservation Organizations, Businesses, DEP	High
Increase Education for Emergency Responders on Stream Issues	County and state emergency responders should be educated on issues dealing with stream protection in addition to public health.	County and State Emergency Response Teams, Conservation Organizations	Low

Increase Public Education on Invasive Species Identification	Education to landowners, sportsmen, and outdoor enthusiasts on invasive species identification is important for monitoring and control. A printed photo guide to invasive species in the French Creek watershed would be valuable.	Conservation Organizations, DEP, DCNR, PFBC, Sea Grant, Conservation Districts	High
Increase Public Education on Invasive Ornamental Species	Education for landowners and retail nurseries about the threats posed by certain species, even those considered sterile hybrids. Include information on alternative native species to be planted.	Conservation Organizations, Retailers	Medium
Increase Public Education on Invasive Species Transport	Prevention through education is necessary. Voluntary monitoring of boats, fishing gear, SCUBA gear, planting, and soil transport is best way to avoid transporting invasive exotic species. Bait shops would be a good location to target education programs on aquatic species.	Conservation Organizations, DEP, DCNR, PFBC, Sea Grant, Retailers, Sportsmen	Medium
Educate Fishermen on Native Baitfish	Prevent spread of non-native forage fish species used as bait by educating fishermen on native species. Provide list of acceptable species for use in French Creek.	Conservation Organizations, PFBC, Retailers	Low
Increase Public Education and Support for Landfill Clean-Ups	Provide incentives and education to landowners for dump clean up. Recognize those efforts, which positively impact water quality.	Conservation Organizations, DEP	Medium

Table 10 - B.
Recommended Research to Address Pollutants in the French Creek Watershed

Recommendation	Recommended Approach	Potential Partners	Priority
Assess Nutrient Levels	Phosphorous and nitrogen levels should be assessed in the watershed through a sub-basin approach. This would allow for the identification of areas of significant contribution. Efforts to implement Best Management Practices and Nutrient Management Plans could be prioritized based on sub-basin contribution.	Conservation Organizations, NRCS, DEP, Conservation Districts, Academics	High
Develop Nutrient Budget	Phosphorous and nitrogen data should be used to develop a nutrient budget that shows where most severe nutrient inputs are coming from to account for total nutrients in French Creek. This can be done initially by sub-basin but should be broken down further to identify farmers in need of cooperative assistance with BMP implementation.	Conservation Organizations, NRCS, DEP, Conservation Districts, Academics	High
Increase Air Quality Monitoring	Air quality monitoring stations should be increased throughout the French Creek watershed to determine impacts to watershed from atmospheric deposition.	Conservation Organizations, DEP, Academics	Medium
Sample and Monitor for Toxins Identified	Toxins impacting French Creek need to be identified along with sources. Comprehensive watershed sampling and monitoring programs should be implemented.	Conservation Organizations, DEP, Academics	High
Monitor Minor Discharges	Minor discharges (<100,000 gal/day) should be identified and monitored. This could be done through conservation organization volunteers and students cooperatively with discharge owners. This would allow a better estimation of cumulative amounts of toxins throughout the watershed. Cooperating owners should be recognized with incentive program.	Conservation Organizations, DEP Academics	Medium
Calculate Total Watershed Toxins Loading	Total loadings of toxins for the watershed from all discharges should be calculated to determine possible cumulative effects on aquatic communities.	Conservation Organizations, DEP, Academics	Medium
Compare Fish Tissue/Sediment	Perform analysis of fish tissue/sediment toxin levels to determine if accumulation is occurring beyond levels detected by discharge	Conservation Organizations, DEP,	Low

Toxin Levels with Discharge Levels	monitoring.	PFBC, Academics	
Research Impacts of Abandoned Oil and Gas Wells	Determine impacts of abandoned oil and gas wells on groundwater and surface water supplies in the immediate vicinity. This will allow prioritization of well capping.	Conservation Organizations, DEP	High
Monitor Fish Hatchery Effluents	Determine impacts to the watershed from releases of toxins (and nutrients) from fish hatcheries in the watershed. Hatchery owners should be recognized for cooperation in minimizing releases.	Conservation Organizations, DEP, PFBC, Academics	Low
Monitor Road Inputs to Adjacent Waterways	Monitoring of road run off at critical times of the year should be done to determine if salt and brine application should be modified.	Conservation Organizations, DEP, PennDOT	Medium
Increase Monitoring and Research of Invasive Species	Identify initial invasions and address immediately. Research ways to control existing populations and ways to prevent potential invasions.	Conservation Organizations, Academics, Sea Grant, PFBC, DCNR	High
Inventory Invasive Species in Watershed	Periodic inventories involving volunteers and watershed residents should be initiated to increase monitoring efforts and evaluate control programs.	Conservation Organizations	High
Research Invasive Species' Impacts	Prioritize threats by species, sites, and impacts to the watershed. This will allow more efficient control programs.	Conservation Organizations, Academics, DEP	Medium

Table 10 - C.
Recommended Cooperative Actions to Address Pollutants in the French Creek Watershed

Recommendation	Recommended Approach	Potential Partners	Priority
Increase BMP Implementation	BMPs should be encouraged for agriculture, logging, urban stormwater management, mining, and development. Projects should be implemented through cooperative, incentive-based programs and partners should be recognized for their efforts. Projects should be monitored where possible to determine effectiveness.	Conservation Organizations, Conservation Districts, NRCS, Planners	High
Increase Awareness and Use of NMPs for Agriculture	Development of Nutrient Management Plans for farmers should be encouraged. This may require education about benefits and resources available.	Conservation Organizations, Conservation Districts, NRCS	High
Provide Assistance to Homeowners to Evaluate Septic Systems	A program should be established to assist homeowners in septic system evaluation. Assistance may come from PennVest, HomeAssist, Conservation Districts, or other similar programs. Incentives and recognition should be offered.	Conservation Organizations, Conservation Districts, DEP	Medium
Promote Septic System Maintenance Agreements	Septic system maintenance agreements between homeowners and municipalities should be considered. Franklin Township's program in Erie County could be modeled.	Municipalities, DEP	Medium
Promote Soil Testing	Soil testing should be encouraged before fertilizer application for both lawns and agriculture. Public may need to be made aware of programs.	Conservation Districts, DEP, Penn State Cooperatives	Medium
Promote Safe Storage of Toxins	Stored toxins/hazardous materials/chemicals should be adequately buffered against spills.	All users of hazardous materials	Low
Remove Hazardous Materials from Floodplain	Hazardous materials should not be stored on the floodplain or areas that do not provide adequate buffering against the material entering a waterway.	All users of hazardous materials	Medium
Cap Abandoned Oil and Gas Wells	Collect information on unknown well locations and well owners, and increase efforts on abandoned well capping for those wells that are	Conservation Organizations, DEP	Medium

	impacting waterways.		
Provide Alternatives to Salt/Brine Application on Roadways	Better enforcement is needed for current application guidelines. Less impactive methods of dust suppression should be used when economically feasible.	Municipalities, DEP, PennDOT	Medium
Address Stream Protection in Emergency Response	Make sure emergency response is adequate for stream protection (need knowledge of train/truck cargo in watershed)	County and State Emergency Response Teams	Medium
Support Landowners in Invasive Species Control	Provide financial and educational support to landowners for removal or control of invasive species. Recognize those landowners who voluntarily work to control invasive species.	Conservation Organizations, Conservation Districts, DEP, DCNR	Medium
Expand Current Invasive Species Control Programs	Expand current identification and control programs (i.e. PA Dept. of Ag, hogweed program). Invasive species should be viewed as a serious threat to future biodiversity.	Conservation Organizations, Conservation Districts, Appropriate Agencies	Medium
Organize Volunteers for Invasive Species Removal	Volunteers from conservation organizations and schools can be a valuable resource regarding invasive species removal when educated and supported.	Conservation Organizations, Conservation Districts, Appropriate Agencies	High
Review Baitfish Regulations	Work with PFBC to review regulations on baitfish sales to determine if protection against invasive species introduction is adequate.	Conservation Organizations, PFBC, Retailers	Low
Locate and Address Abandoned Landfills	Need to address small, old, individual, or abandoned municipal dumps. Monitor sites for impacts to water quality and promote voluntary clean-up efforts.	Conservation Organizations, DEP, Municipalities	Medium

Habitat Degradation

Habitat degradation is another major threat to aquatic organisms. In stream or river systems, habitats ranging from uplands to riparian forest areas to stream bottom substrate must be considered when determining habitat quality. Aquatic organisms rely on healthy riparian buffers for many reasons and the stream health cannot be considered separately from the adjacent land areas. French Creek faces many forms of habitat degradation. All of these stem from human activities and various land use practices throughout the watershed.

Erosion and Sedimentation

French Creek, and all streams, have naturally occurring amounts of suspended sediments that are the result of weathering of rocks and soils in the watershed. These natural levels of suspended sediments rarely are high enough to muddy the water, impede sunlight penetration, or smother benthic aquatic organisms or fish eggs. Human activities on the landscape have a tremendous tendency to increase sediment loads of streams and lakes. Increases in erosion and sedimentation lead to higher than normal levels of suspended sediments in surface water and build up of silt on stream bottoms that can smother aquatic organisms. The human activities that most commonly contribute sediments to surface waters are improper agricultural practices, deforestation, construction of buildings and roadways, urbanization, and mining. Also, it may be possible that dams, like the Union City Dam, which holds French Creek at bank-full flows for longer than normal periods, greatly increases downstream scour and erosion.

Increased amounts of suspended solids and sedimentation can lead to increased turbidity, which blocks sunlight penetration and decreases dissolved oxygen levels. Increased scour and erosive forces occur when sediment levels are increased because sediment particles act like sandpaper abrading the streambed. Sediments can also cover clean sand and gravel stream bottoms needed by many aquatic organisms for feeding, living, and laying eggs. If silt input is severe, freshwater mussel beds can be covered and the mussels smothered.

Agricultural land use has been shown to occur over almost half (40%) of the French Creek watershed. Threats from increased sedimentation occur primarily from row cropping or livestock pasturing along waterways. Improper planting of row crops, and the often-associated loss of riparian buffer, can greatly increase sediment loads in run-off and lead to severe erosion of stream banks. This is evident at many locations throughout the French Creek watershed where crops are planted adjacent to stream banks.

Livestock that have access to streams when pastured also increase erosion of stream banks through consumption and trampling of vegetation. There are several BMPs designed to decrease erosion and many of these provide additional benefits to the farmer. Simply fencing livestock out of streams and providing separate watering areas or reinforced stream crossings can greatly reduce the erosion of stream banks and increase the health of the livestock.

Improper timbering practices also have the potential to greatly increase erosion and sedimentation. The French Creek watershed, along with most of Pennsylvania, has gone through several cycles of large-scale timbering. With approximately half of the watershed reverted to

forest, French Creek is facing threats from improper logging practices in areas where mature woodlots exist. Logging, when done unsustainably, removes a large portion of the vegetation from the landscape resulting in increased runoff, which mobilizes large amounts of soil. In areas where the forests being timbered are along ridge tops, the effects may not be as detrimental to French Creek, but in other areas, steep, highly erodable slopes and mature riparian forests are being targeted by loggers. Logging riparian areas poses a significant threat to the aquatic habitats in the French Creek watershed. These riparian forests play key roles in buffering French Creek against activities on the landscape as well as providing shade and scenic value to the stream. Erosion from logging operations is increased by the use of heavy machinery for log skidding and through the construction of temporary logging roads without the use of BMPs.

Road and building construction is a concern in terms of erosion and sedimentation in the French Creek watershed as rural development occurs, often near streams and lakes. If these projects are near a waterway and could potentially impact that waterway they are required to obtain permits from DEP and to follow erosion and sedimentation plans to ensure sediments are prevented from running off site. Unfortunately, these permits are issued by the County Conservation District, an agency that does not have authority to enforce the regulations or the personnel to adequately monitor all sites. Often the construction projects are sub-contracted out to businesses that are not aware of the regulations and sediment releases occur due to lack of enforcement.

Dirt and gravel roads are common throughout the rural French Creek watershed. These roadways have the potential to contribute large amounts of sediment to nearby waterways. The sediments often carry oils, heavy metals, and salts, which further impact stream ecosystems. Hillside dirt and gravel roads are especially prone to erosion during heavy rainfall and spring snow melt events.

Sand and gravel mining occurs throughout the French Creek watershed. All mining operations are required to obtain permits from DEP. The PA Department of Environmental Protection Bureau of Mining's Knox District Office in Knox, PA is responsible for regulation of mining operations in the French Creek watershed. There are currently 110 permitted sand and gravel mining sites in the French Creek watershed. In addition, there is one sand stone mine located near Cooperstown, Venango County. The Sugar Creek sub-watershed does have the largest concentration of sand and gravel mining sites of any major tributary in the southern portion of the French Creek watershed and is also a popular area for oil and gas drilling. When surveyed for freshwater mussels, Sugar Creek was found to be practically devoid of viable populations (Western Pennsylvania Conservancy, 1994). More comprehensive assessments should be done in Sugar Creek to determine if the causes for the decreased mussel viability are related to impacts from mining or oil and gas wells.

Because mining operations are closely monitored by DEP, and sediments must be contained on-site, the amount of sediments reaching streams in the watershed may be low. Mining is however, a serious potential threat to water quality and aquatic organisms in French Creek and sites should be more thoroughly evaluated to determine actual threats. Barriers to prevent sediments from leaving mining sites do fail and can, in some cases, release catastrophic amounts of sediments to receiving streams.

Alterations of Hydrology

Hydrology is simply the study of the movement of water through various stages on the earth's surface. Water is stored (i.e. groundwater, surface water, ice caps) and transported (i.e. evaporation, transpiration, precipitation) in a continuous cycle. Aquatic habitats evolve certain characteristics based on the hydrology of water. Human impacts to the landscape have altered the hydrology of the French Creek watershed in several ways. Dams, like the Union City Dam, Woodcock Creek Dam, Tamarack Lake dams, and others, have altered natural flow regimes. In addition, water withdrawals from streams, lakes, and groundwater alter the watershed's hydrological patterns.

Numerous watershed stakeholders and citizens have raised concerns over the Union City Dam's negative effects on French Creek. Many of them describe changes they have seen in distribution and abundance of aquatic organisms as well as increases in erosion that have occurred at various sites downstream since construction of the dam. As with many of the threats discussed, it is difficult to determine the impacts that the dam has had to French Creek. Certainly, the natural flooding regime that is responsible for distributing nutrients on the floodplain has been altered. Natural flow regimes no longer rise and fall to the extremes that they did prior to the construction of the dam.

Alterations to natural flow regimes may disrupt nutrient flow in an aquatic ecosystem. Streams and rivers depend on nutrient input from the watershed to provide much of the energy to the flowing aquatic system. These nutrients are passed through aquatic food webs and flow from headwater tributaries to higher order streams, lower in the watershed, to provide energy for all aquatic organisms. Annual flooding not only brings nutrients into a stream but also helps disperse nutrients back to the floodplain where they can be utilized by plants to once again enter the aquatic system as autumn leaf fall or woody debris. The impacts to this cycle, by dams in the watershed, need to be better understood. In addition to alterations in nutrient flow, dams may exacerbate erosion problems downstream by altering natural flow levels. This potentially leads to increased scour in some areas, increased erosion, substrate instability, and increased sediment deposition. These are all problems that lead to habitat degradation for aquatic organisms.

Studies by the USACE have documented good diversity and abundance of aquatic organisms at the dam's outfall. However, what effects does the dam have on aquatic communities further downstream? By holding French Creek at higher flow levels for longer periods of time, scouring and erosion is no doubt increased in areas downstream. This increases sediment loads carried by French Creek and deposited further downstream. These alterations to the natural hydrology of French Creek need to be examined to determine the effects on the watershed's aquatic communities.

Diversion of surface water and extractions of groundwater occur throughout the French Creek watershed. Farmers irrigate fields from nearby streams during the warmest, driest months of the year when aquatic organisms are already stressed by higher water temperatures and low dissolved oxygen levels. These withdrawals are often not regulated, and impacts to aquatic organisms are not adequately researched. Effects of these withdrawals have been documented by the PFBC on streams like Beaver Run in Erie County. This Exceptional Value stream contains a

naturally reproducing brown trout population, which has decreased in numbers in recent years because of decreased precipitation and increased irrigation by area farmers.

The majority of private residences in the watershed depend upon groundwater withdrawals for their water needs. The city of Meadville supplies its residents with drinking water from large wells. Other smaller towns utilize wells and springs or, in the case of Cambridge Springs Borough, obtain water directly from French Creek. Industries are another user of groundwater. Because groundwater recharges streams and lakes, alterations to groundwater levels can impact aquatic, wetland, and riparian habitats. A hydrologic budget that incorporates historic and current flows, groundwater and surface water, and inputs and withdrawals is needed to fully understand the impacts of hydrologic alterations to the French Creek watershed.

Mining has been discussed as a potential source of sedimentation and pollutants, however, it also has the potential to alter watershed hydrology. Removing large amounts of sand and gravel potentially alters flow regimes of groundwater in the mined area. Subtle increases or decreases in groundwater levels can negatively impact stream, lakes, and wetlands and alter the habitats for many organisms. Additionally, opening groundwater recharge areas to the atmosphere decreases filtration due to the remaining material being overburdened.

Only a very small percentage of the French Creek watershed is considered urban. However, research has shown that only a 10% increase in impermeable surfaces in a watershed can have a dramatic effect on aquatic habitats (Center for Watershed Protection). Increases in impermeable surfaces increase runoff and erosion and decrease infiltration to groundwater supplies. The resulting excessive flooding severely impacts streambeds and banks. Stormwater management plans should be considered in municipalities where population centers represent potential growth areas or where sprawl is occurring and impermeable surfaces are on the increase.

Because wetlands act as natural retention areas, loss of wetlands can increase the amount of water running overland and entering streams and lakes. This alteration to natural hydrology leads to increased erosion of streambeds and banks, increased flooding and flashiness, and loss of habitat for aquatic and riparian species.

Channel/Streambank Modification

Modifications to natural stream channels and streambanks are frequent occurrences. Often these modifications occur without adequate thought to the impacts to aquatic organisms or areas downstream of the modification. It is important to note that alterations to the natural stream channel or streambank design are usually not without negative consequence. Modifications at one point on a stream often cause problems such as increased erosion, flooding, or lowered water levels further downstream.

Channel modifications occur for a variety of reasons. Manipulation of stream channels for agricultural uses and flood control are both prominent in the French Creek watershed. Historically, unregulated by government, stream channelization has occurred to facilitate livestock watering and crop irrigation, as well as to reduce flooding by straightening and

deepening stream channels. "Physical alteration of the channel bed has a number of negative impacts on aquatic species including the effects associated with siltation and alteration of nutrient loads, flow, and flushing flows. Physical alteration of the creek channel destroys habitat for some species while creating habitat for others; the newly created habitat may be of poorer quality than the original or may be occupied by species other than the targeted species." (McAlpine, 1993). The community can engage in successful stream restoration projects and BMPs can be implemented to benefit farmer, livestock, and natural communities.

Stream channels are also modified for roadway and bridge replacement projects. These projects can severely disrupt benthic and riparian habitats. Although strictly monitored by DEP, PFBC, and USFWS, these projects can impact native freshwater mussel beds and fish spawning habitat. Relocations of freshwater mussels have been used as a tool to protect these organisms and allow bridge and roadway projects to occur.

A bridge was recently replaced over French Creek at Utica Borough, Venango County. Biologists from USGS translocated mussels from this site and are monitoring the results of translocation on survival rates. Preliminary reports suggest translocated individuals do experience higher mortality than individuals found at the translocated sites and in control sites (Villella, 2001). Because of the aging bridges found throughout the French Creek watershed, several bridges are scheduled to be replaced by PA Department of Transportation and local municipalities in the near future.

Streambanks are often modified by the removal of native vegetation and trees for the purpose of agriculture, livestock grazing, or development. Banks denuded of vegetation are prone to erosion, which increase the sedimentation in the streambed. This alters benthic habitat for aquatic insects, freshwater mussels, and fish spawning areas. Vegetation also helps shade stream channels, keeping water temperatures lower. Elevated water temperatures lower dissolved oxygen levels and magnify the effects of other stresses, such as pollutants. In addition, riparian vegetation is a major source of energy and nutrients for aquatic systems. This energy is added annually through autumn leaf fall and in the form of woody debris.

Many agencies and organizations are working to restore riparian habitat. It has been said that a functioning, intact riparian habitat is the most important tool in combating the effects of non-point source pollution and streambank erosion. Characterization of the riparian habitats throughout the French Creek watershed will be essential in enabling agencies and organizations to more effectively work on restoration in the most critical areas.

In some areas of the watershed, roadways are very close to waterways and result in accelerated erosion of streambanks due to increased run-off and destabilization of the stream banks. This is also true with railways along some portions of French Creek where it has been necessary to shore up rail beds with cement and rock riprap, which further destroys aquatic habitats and potentially displaces erosive forces further downstream.

Recreation

The French Creek watershed has many recreational opportunities that focus on the natural resources of the watershed. The activities are often associated with the lakes and waterways or riparian corridors along the waterways. It is estimated that recreational demands in the watershed will increase as populations increase. Aquatic habitats are at risk by humans trampling and disturbing them as they seek to enjoy the natural resources found there. In addition, many forms of recreation, such as ATV riding and power boating, may be highly incompatible with some areas. This leads to natural resource degradation and loss of aquatic habitat for many species. Any future recreational developments should be very carefully planned to ensure natural resources are protected. This will benefit all by ensuring outdoor enthusiasts will continue to be attracted to the French Creek watershed and by providing a boost to the local economy.

Table 11 - A.
Educational Recommendations to Address Habitat Degradation and in the French Creek Watershed

Recommendation	Recommended Approach	Potential Partners	Priority
Increase Public Education on Sustainable Forestry	Offer educational opportunities for loggers and woodlot owners on sustainable practices. Recognize loggers who utilize Best Management Practices.	Conservation Organizations, Conservation Districts, Penn State Cooperatives, DCNR	High
Establish a Clearinghouse of Information on Loggers	Develop and maintain a clearinghouse of information on loggers in the watershed that can be shared with landowners interested in having timbering done.	Conservation Organizations, Conservation Districts, Penn State Cooperatives, DCNR	Medium
Increase Education on Construction and Urban BMPs	Provide education and incentives for planners and developers for the implementation of construction and urban BMPs. This would include alternative greener methods of development.	Conservation Organizations, Municipalities, Planners	High
Increase Public Education about Benefits of Riparian Protection	Educate landowners about benefits to both the landowner and the environment gained through streambank and riparian protection.	Conservation Organizations, Conservation Districts, DEP, NRCS	High
Increase Public Education about Assistance Available for Riparian Restoration	Educate landowners on resources/agencies available to help with riparian restoration and protection. This includes funding and technical assistance for streambank fencing, erosion control, revegetation, etc.	Conservation Organizations, Conservation Districts, All Appropriate Agencies	High

Increase Public Education about Natural Stream Conditions	Educate landowners that modification of natural stream bed/banks is not desirable. Education should include "big picture" of how a watershed works. Stress the need to address sources of problems and not just the symptoms.	Conservation Organizations, Conservation Districts, DEP, NRCS	Medium
Increase Public Education about the Benefits of Forested Streambanks	Educate landowners and loggers about the negative impacts of cutting trees off streambanks. Stress the need for an intact riparian zone.	Conservation Organizations, Conservation Districts, Penn State Cooperatives, DEP, NRCS	Medium
Increase Public Education about Negative Impacts from Power Boating	Increase education about the links between impacts of power boating and environmental degradation. Link water quality to quality of life in educational programs.	Conservation Organizations, PFBC, DEP	Medium
Increase Public Education about Responsible ATV Use	Increase educational requirements for ATV riders including linking irresponsible riding to environmental degradation.	Conservation Organizations, DCNR	Medium
Increase Public Education about Urban Streams as Community Assets	Focus on urban streams as community assets (park land, etc.) and raise public support through volunteer efforts for clean ups, community activity days, etc. Develop community parks on appropriate streamside locations.	Conservation Organizations, Municipalities, DCNR	Low

Table 11 - B.
Recommended Research to Address Habitat Degradation in the French Creek Watershed

Recommendation	Recommended Approach	Potential Partners	Priority
Conduct Assessments by Sub-Basins on Suspended Sediments	Sources and deposition patterns of suspended sediments need to be determined and contributions should be addressed at the sub-basin level. This information will allow BMP implementation to be prioritized based on highest contributions of sediments.	Conservation Organizations, Conservation Districts, DEP, NRCS, Academics	High
Characterize Streambed Conditions	Baseline information on streambed conditions needs to be collected. Specifically, degree of siltation, embeddedness, degree of streambank erosion, and streambed scour.	Conservation Organizations, Conservation Districts, DEP, Academics	High
Research Macroinvertebrate Communities	Macroinvertebrate communities should be monitored in non-riffle areas and other areas throughout the watershed to compliment DEP data. This information should be compared to physical assessments.	Conservation Organizations, DEP, Academics	High
Research Fluvial Geomorphology	Perform research to increase understanding of the fluvial geomorphology of French Creek especially as related to excessive flooding. A better understanding of flow patterns will aid restoration efforts.	Conservation Organizations, Academics, USGS, Hydrologists	High
Research Dam Impacts	Research impacts of dams on French Creek aquatic communities and consider alternative management options for Union City Dam if warranted.	Conservation Organizations, Academics, DEP, USACOE	Medium
Develop Water Budget/Hydrologic Model	Develop a watershed budget/hydrologic model, which takes stormwater run off into account. Start with theoretical model and build onto by monitoring and collecting information.	Conservation Organizations, Academics, USGS	High
Explore Current Technologies for Stream Evaluation	Research new GIS data being developed for the purpose of stream reach evaluation. Map areas of excessive bank erosion and streambed instability due to flooding.	Conservation Organizations, Conservation Districts, Academics, Appropriate Agencies	High
Early Warning	Monitoring should be designed to provide early warning of stress to	Conservation	High

Monitoring of Water Quantity	aquatic organisms in the watershed during critical low flow periods.	Organizations, Academics, DEP	
Include Community Withdrawals in Hydrologic Model	Tie community withdrawals into overall hydrologic model.	Conservation Organizations, Municipalities, DEP	Medium
Increase Research on Mining Impacts	Hydrogeologic experts should be utilized to determine impacts of mining on waterways. Specific major mining operations or areas should be targeted, especially as related to important biological, or recharge areas in the watershed.	Conservation Organizations, Academics, Hydrologic Consultants, DEP, USGS	High
Research Appropriate Stream Access Locations for Increased Recreational Opportunities	Access areas should be located in appropriate areas based on ecological research. This will minimize impacts to ecologically sensitive areas.	Conservation Organizations, Academics, USFWS, DEP, PFBC	High

Table 11 - C.
Recommended Cooperative Actions to Address Habitat Degradation in the French Creek Watershed

Recommendation	Recommended Approach	Potential Partners	Priority
Promote Stormwater Management Planning	Promote stormwater management planning to address erosion/run off from urban areas. Encourage counties to develop stormwater management plans and municipalities to adopt stormwater development ordinances.	Conservation Organizations, Municipalities, Planners, DEP	High
Promote No-Till Farming and Organic Methods	Promote no-till farming and organic methods in appropriate areas. Most appropriate areas can be determined through research of nutrient and sediment inputs. Incentive programs should be established.	Conservation Organizations, Conservation Districts, NRCS, Penn State Cooperatives	Low
Promote the Use of BMPs in Logging	Promote BMPs for logging operations throughout the watershed including road construction and log skidding. Incentive programs should be established.	Conservation Organizations, Penn State Cooperatives	High
Promote Conservation Easements	Conservation easements should be promoted as a voluntary tool landowners can use to ensure logging, agriculture, development, mining, and recreation occur in a sustainable manner. They are useful tools to conserve open space and protect important habitat.	Conservation Organizations	High
Promote Forest Owner Cooperatives	Promote the development of watershed-wide forest owner cooperatives to provide a support network for small woodlot owners.	Conservation Organizations, Penn State Cooperatives, DCNR	Medium
Encourage Sustainable Forestry Initiatives	Promote programs that lead to increased sustainable forestry initiatives throughout the watershed. Promote selective cutting, BMPs, or other sustainable forestry practices where appropriate.	Conservation Organizations, Penn State Cooperatives, DCNR	High
Provide Guidance and Incentives for Reforestation	Promote reforestation through consideration of appropriate locations, economics, tax forgiveness for forested areas, and modification of the tax code for forest owners.	Conservation Organizations, Legislators, Penn State Cooperatives, DCNR	Medium
Promote BMPs in	Promote the use of BMPs for various construction projects and the	Conservation	Medium

New Construction	use of urban BMPs. Incentive programs should be developed.	Organizations, Municipalities, Builder's Associations	
Promote Dirt & Gravel Road Program	Promote dirt & gravel road program in the watershed to reduce silt-laden run off from dirt and gravel roads. Consider this program as alternative to brine application for dust control.	Conservation Organizations, Conservation Districts, Municipalities, PennDOT	High
Prioritize Dirt & Gravel Road Program	Prioritize municipalities for the dirt & gravel road program according to impacts to the watershed.	Conservation Organizations, Conservation Districts, Municipalities, PennDOT	Medium
Promote the Establishment of Natural Vegetative Buffers Around Mine Areas	Provide incentives and recognition for miners who maintain natural vegetative buffer strips around mining operations.	Conservation Organizations, DEP	Medium
Reclaim Disturbed Areas with Native Species	Provide incentives and seed sources for native species to miners, road construction crews, and developers to use for reseeding.	Conservation Organizations, Nurseries	Medium
Avoid Dam Construction	Refrain from building any new dams in the French Creek watershed.	Any agency or organization	High
Consider Dam Removal	Consider cost/benefits of removal of small dams in the watershed.	Conservation Organizations, Municipalities, Dam Owners	High
Consider Controlled Flooding	Agencies should consider controlled flooding, where appropriate, to mimic natural flooding regimes. This would require research and public education.	Conservation Organizations, USACOE, DEP, NRCS	Low
Better Management of Dam Releases	Agencies should research how releases impact aquatic communities and aquatic habitat. This information should be used to develop management plans for releases that will better accommodate aquatic communities.	Conservation Organizations, USACOE, DEP, NRCS	Low
Address	Locate and assess the impacts from agricultural drainage tiles	Conservation	Low

Agricultural Drainage Tiles Where Appropriate	throughout the watershed. Remove those that are no longer needed and restore wetlands.	Organizations, Conservation Districts, DEP, NRCS	
Promote Urban BMPs	Promote BMPs for urban development and retrofit BMPs in established urban areas. Center for Watershed Protection program can be modeled. BMPs include catchment basins, grass swales for run off infiltration, green islands in large parking lots, etc.	Conservation Organizations, Municipalities, Planners, Developers, DEP	Medium
Promote Urban Reforestation	Promote reforestation in any open urban areas for shade, wildlife, and aesthetics. Volunteers can be used to foster community pride.	Conservation Organizations, Municipalities	Low
Coordinate and Prioritize Water Withdrawals	Conduct meetings of major water users to voluntarily coordinate withdrawals during low flow periods. Establish incentive programs.	Conservation Organizations	Medium
Promote Agricultural Reservoirs for Irrigation	Encourage agricultural operations to make surface reservoirs for withdrawals where feasible. Do not dam streams in reservoir construction. Identify funding to help farmers develop reservoirs. Encourage practices that limit need for irrigation.	Conservation Organizations, Conservation Districts, NRCS, DEP	Medium
Promote Riparian Protection and Restoration	Promote incentive based voluntary programs for streambank fencing and riparian buffer/streambank protection and restoration. Identify funding to assist landowners.	Conservation Organizations, Conservation Districts, NRCS, DEP, Academics	High
Promote Natural Stream Channel Design	Re-establish natural stream channel morphology at bridges (through engineering) and other areas where development or agriculture has altered natural stream channel fluvial geomorphology. Establish incentive programs for landowners and provide assistance.	Conservation Organizations, Conservation Districts, NRCS, PennDOT, DEP	Medium
Encourage Streambank Fencing	Promote voluntary incentive based programs for landowners to fence livestock out of streams. Crossings and watering areas should be designated and reinforced. Provide assistance to landowners and link them to agencies with available funding.	Conservation Organizations, Conservation Districts, All agencies with fencing programs	High
Work at Sub-Basin Level	Citizen groups should be developed in each sub-watershed to take ownership of local projects. An established network would work for the whole of French Creek by focusing on smaller areas. These	Conservation Organizations, Conservation Districts	High

	groups could seek out funding for local landowners.		
Promote Agricultural BMPs and NMPS	Promote agricultural Best Management Practices and Nutrient Management Plans and supply funding and assistance to encourage farmers to implement projects. Projects should include barnyard stabilization and manure management.	Conservation Organizations, Conservation Districts, NRCS	High
Promote Wetland Protection During Logging	Wetland and vernal pool protection should be promoted with loggers. Encourage BMPs and provide incentive and recognition program.	Conservation Organizations, Conservation Districts, Penn State Cooperatives, DEP	High
Promote Better Enforcement of Erosion and Sedimentation Control Plans	Stricter enforcement of E&S Plans is needed.	Conservation Districts, DEP	Medium
Promote Green Space in Development	Development plans should maximize green space. Building lot clustering, establishing development zones, and shared greenspace within developments are examples of ways to maximize green space.	Conservation Organizations, Municipalities, Planners, Developers	High
Urban Stream Revitalization	Restore bank and riparian habitats in urban areas.	Conservation Organizations, Municipalities	Medium
Encourage Municipalities and State Agencies to Focus Infrastructure Dollars	Target growth areas with state funds to allow development while maintaining open space.	Planners, Municipalities	High
Encourage Long Range Planning	Conduct long range planning at the municipal and county level.	Planners, Municipalities	High
Evaluate Land Use and Planning Options	Promote assistance to municipalities for zoning, sub-division, and comprehensive planning issues. Encourage multi-municipal planning.	Conservation Organizations, Municipalities, Planners	High
Address Improper	Support the implementation of DCNR's new program for ATV	Conservation	Medium

ATV Usage	registration. Promote designated trails in less sensitive areas. Increase educational requirements for ATV riders.	Organizations, Recreational Groups, DCNR, PennDOT, PGC	
Encourage Cooperative Approach to Trail Development	Designate and develop appropriate trails and railtrails along stream corridors. Riparian corridors and natural resource protection should be a priority. Private landowners rights should be respected and trail should be developed through voluntary cooperative programs.	Conservation Organizations, Municipalities, Planners, Railways, Trail Groups	High
Promote Catch and Release	Promote catch and release of native species. Waters with introduced species for put-and-take fisheries should be managed as such.	Conservation Organizations, Sportsmen, PFBC, Trout Unlimited	Low
Customize Baitfish Regulations	Regulations for taking baitfish should be customized to protect French Creek's rare, threatened, and endangered fish species especially during breeding periods.	PFBC	Low
Establish Riparian Development Guidelines	Develop guidelines for riparian development for cabins or trails that would maximize protection for riparian areas. Municipalities should be encouraged to adopt conservation programs that protect streams and lakes.	Conservation Organizations, Municipalities	Medium

ACTION PLANS

The French Creek Watershed Conservation Plan Steering Committee has decided that three years is an appropriate timeframe for the execution of the following actions. After three years from the release of the Plan, the Western Pennsylvania Conservancy and its partners in the French Creek Project will reevaluate conditions within the French Creek watershed and revise the Plan with guidance from the Advisory Committee. A longer timeframe for future action plans may then be implemented.

The following action plans are aimed at restoration, maintenance, and enhancement of resources within the French Creek watershed. They are designated for land, water, biological, and cultural resources as well as any miscellaneous action plans. The Plan's Steering Committee has prioritized the action plans in order of importance, with the intention that all actions will be completed or at least initiated within three years following release of the Plan. The advisory committee will provide guidance on the implementation of the recommendations.

Of major importance to the success of the French Creek Watershed Conservation Plan is support for the recommendations from watershed agencies, municipalities, businesses, industry, organizations, and residents. The Plan is intended as a planning tool and is not a regulatory document. Upon completion, the Plan must be nominated to the Pennsylvania Rivers Registry by at least one watershed municipality. Once the nomination has been accepted and the Plan is approved by PA Department of Conservation and Natural Resources, watershed groups and municipalities will be eligible for funding to implement the recommendations of the Plan.

The Plan's Steering Committee has indicated that an important first step in implementing the following actions plans is the formation of sub-watershed citizen volunteer action groups for each of the major sub-basins within the French Creek watershed. These groups should form a network of partnerships to implement recommendations from the Plan within their own sub-basins. The FCP could serve as an umbrella organization, providing assistance to these local groups. With such a network in place, watershed residents could take ownership of French Creek's resources and provide a foundation for proper management to ensure restoration, maintenance, and enhancement of the whole watershed. The partners in the FCP will be available to provide guidance, critique proposals that address recommendations, and potentially assist in technical aspects of projects.

Land Resource Protection

1) Form a network of sub-watershed citizen volunteer action committees to help implement plan recommendations. The partners of the FCP will promote implementation of the Plan recommendations and will foster the formation of sub-basin volunteer groups.
2) Support county and municipal comprehensive land use planning. Existing plans should be updated to identify key areas to target infrastructure dollars. Areas should be designated as priority areas for growth with other areas set aside for conservation of open space. The French Creek Watershed Conservation Plan should be utilized by municipalities as a tool in the planning process. In this manner, municipal planning can incorporate protection for the environment and natural resources. All counties and

municipalities should incorporate farmland preservation programs to add protection to existing farms and ensure this heritage is not lost.

3) Conduct surveys to identify key riparian buffer areas throughout the watershed. Document where riparian buffers have been removed or degraded. Promote the restoration of riparian buffers throughout the watershed with voluntary, incentive-based programs. Focus on key areas as the highest priority.
4) Develop and promote a watershed-wide conservation easement program. These conservation tools can be used to insure land use practices such as agriculture, logging, mining, and recreation occur in a sustainable manner that promotes protection of natural resources.
5) Encourage the implementation of Best Management Practices throughout the watershed for agriculture, logging, urban areas, highways, golf courses, and development. Information about BMPs, funding, and agency resources should be made more readily available to the public to encourage implementation. Educate landowners on BMPs for lawn care. Provide incentive programs, funding, and technical assistance.

Water Resource Protection

1) The physical and biological stream conditions should be assessed throughout the watershed. This would include visual assessments of stream channels as well as riparian areas. A watershed-wide biological assessment to determine water quality should be undertaken, incorporating data from existing monitoring programs through PA Department of Environmental Protection, Environmental Alliance for Senior Involvement volunteer water quality monitors, Creek Connections, and others. In addition, a thorough water quality assessment is needed in order to form a nutrient budget for the watershed. This will provide information that will enable work in sub-watersheds to be prioritized according to impacts to the overall watershed health.
2) A hydrologic model and water budget should be developed for the watershed. This would be a major undertaking requiring assistance from the U. S. Geological Survey, local university experts, and private consultants. This model is necessary to assess impacts to the watershed from water withdrawals for communities, irrigation, and industry. The model would begin as a hypothetical watershed model and be customized for French Creek based on data collected.
3) Begin the development of and implementation of a comprehensive, systematic water quality-monitoring plan for the watershed. Development would include identification of the proper indicators to be monitored, sites, frequency, and protocols. Implementation would include identifying parties to collect samples and training for those individuals.
4) Counties within the watershed should be encouraged to develop stormwater management plans. Additionally, municipalities should be encouraged to develop and adopt stormwater regulations.
5) Research should be conducted to determine what impacts low flows and elevated water temperatures have on aquatic biota in French Creek. This information should include exacerbation from water withdrawals coincident with these conditions.
6) Due to the large size of the French Creek watershed, all recommendations, research, and planning should focus at the sub-basin level where applicable and efforts made to

compile this information into a complete picture of the watershed. The main stem of French Creek can be treated as a sub-basin in itself.

7) Research should be conducted to assess wetland resources in the watershed. This information would allow better monitoring and protection.

Biological Resource Protection

1) All counties in the watershed should be inventoried under the County Natural Heritage Inventory Program. This includes special emphasis on Crawford and Venango counties. Mercer County is currently being inventoried. Erie County's 1993 inventory should be updated. If countywide inventories cannot be completed, emphasis should be placed on competing an inventory for the French Creek watershed. Information from these inventories is used as a tool to expedite planning and development while affording protection to natural resources.
2) Watershed-wide species of concern and natural community assessments should be conducted. These would include information on important instream and wetland habitat that is critical for many species.
3) Groups in the watershed should conduct a watershed-wide inventory for invasive species. This baseline information would allow for monitoring and removal plans to be developed and implemented. Known or potential invasive species in the French Creek watershed include, but are not limited to: zebra mussels, purple loosestrife, goby (*Gobionella shufeldti*), Asian clam, giant hogweed (*Heracleum mantegazzianum*), Eurasian water-milfoil, hybrid cattail, common reed, and Japanese knotweed (*Polygonum cuspidatum*). These inventories should be done in conjunction with the PA Natural Diversity Inventory program.
4) Select endangered, threatened, or rare species in the French Creek watershed should be monitored. These include the federally endangered clubshell and northern riffleshell mussels. Other important species should be identified for monitoring.
5) The aquatic communities in the French Creek watershed should be monitored as an indicator of overall watershed health. Appropriate indicator organisms and protocols should be identified and used in a monitoring program. Appropriate indicator species might include mussels, fish, benthic insects as well as plankton.

Cultural Resource Protection

1) All existing public use lands in the French Creek watershed should be inventoried and mapped. This should include public access points for French Creek.
2) Impacts from all types of watershed recreation should be assessed and a watershed recreational management plan should be developed. The goal should be to increase recreational opportunities while protecting natural resources. Recreational opportunities to consider include: ATV use, Water Trail feasibility, Rail Trail feasibility, identification of appropriate stream access areas, fishing regulations customized to French Creek, and potential greenway corridor identification.
3) Special historic and cultural sites along the waterway and throughout the watershed should be identified, preserved, and integrated into trail, tourism, and recreational plans.

Other Action Plans

1) The many educational programs in and around the watershed should coordinate to expand watershed education. Other educational avenues should be explored to increase outreach to watershed residents. As an example, brochures should be developed that outline the "top 10" activities to be done for watershed protection. These brochures could be tailored to different groups of watershed stakeholders. The Plan recommends many areas for increased public education.
2) The partners of the FCP will meet periodically beginning in Spring 2002 to discuss successes and failures as specific recommendations and action plans are carried out. After three years, conditions in the watershed will be reevaluated and the Plan revised in a similar public process.
3) The partners of the FCP will convene periodic forums throughout the watershed for specific groups of watershed stakeholders to meet and discuss pertinent watershed issues. These forums can be targeted to agriculture, logging, industry, educators, outdoor enthusiasts, and scientists, to name just a few.

The partners of the FCP are available to assist groups in implementing conservation activities and recommendations provided by the plan. The French Creek Project advisory committee is a diverse group of watershed stakeholders capable of providing guidance on this implementation. Western Pennsylvania Conservancy will convene a science committee to assist the advisory committee on ecological issues in the watershed. The recommendations and action plans described above will require the collaborative efforts of watershed agencies, conservation organizations, academia, municipalities, and residents. Western Pennsylvania Conservancy hopes that more and more watershed residents will be compelled to take an active role in the conservation of French Creek.

ABBREVIATIONS AND ACRONYMS

ATV – All-Terrain Vehicle
BMP – Best Management Practice
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS – Comprehensive Environmental Response, Compensation, and Liability Information System
CLFCVC – Conneaut Lake/French Creek Valley Conservancy
CPOM – Coarse Particulate Organic Matter
CWF – Cold Water Fishery
DCNR – Pennsylvania Department of Conservation and Natural Resources
DDT – Dichlorodiphenyltrichloroethane
DEP – Pennsylvania Department of Environmental Protection
DOM – Dissolved Organic Matter
EAC – Environmental Advisory Council
EASI – Environmental Alliance for Senior Involvement
EPA – United States Environmental Protection Agency
EV – Exceptional Value
FCP – French Creek Project
FPOM – Fine Particulate Organic Matter
GIS – Geographic Information System
HQ-CWF – High Quality Cold Water Fishery
HQ-TSF – High Quality Trout Stocked Fishery
HQ-WWF – High Quality Warm Water Fishery
IBA – Important Bird Area
MHP – Mobile Home Park
NAWQA – National Water Quality Assessment Program
NPDES – National Pollution Discharge Elimination System
NPS – Non-Point Source
NRCS – Natural Resource Conservation Service
PEC – Pennsylvania Environmental Council
PA DOT – Pennsylvania Department of Transportation
PFBC – Pennsylvania Fish & Boat Commission
PGC – Pennsylvania Game Commission
PNDI – Pennsylvania Natural Diversity Inventory
SGL – State Game Lands
STORET – Storage and Retrieval Database
STP – Sewage Treatment Plant
TMDL – Total Maximum Daily Load
TNC – The Nature Conservancy
TSF – Trout Stocked Fishery
UNT – Unnamed Tributary
USACE – United States Army Corps of Engineers
USDA – United States Department of Agriculture
USFWS – United States Fish & Wildlife Service
USGS – United States Geological Survey

WPC - Western Pennsylvania Conservancy
WQN – Surface Water Quality Monitoring Network
WWF – Warm Water Fishery

GLOSSARY OF TERMS

303(d) Report	Report required under Section 303(d) of the federal Clean Waters Act from each state listing impaired waters within the state that would not support designated uses even after appropriate and required water pollution control technologies have been applied.
305(b) Report	Report required under Section 305(b) of the federal Clean Waters Act from each state on the state's water quality conditions and water quality management program.
algal bloom	A sudden growth of algae in an aquatic ecosystem. Often induced by nutrient enrichment from pollution.
alkaline	Having a pH greater than 7
alkalinity	The ability of a material to buffer acidity. Usually measured in mg/L $CaCO_3$.
alluvial	Pertains to the environments, processes, and products of streams or rivers. Materials (sediments, detritus, etc.) deposited by flowing water are referred to as alluvial deposits.
anthropogenic	Resulting from human activity.
aquatic	Relating to freshwater.
aquifer	A body of permeable rock that is capable of storing significant quantities of water, that is underlain by impermeable material, and through which groundwater moves.
atmospheric deposition	Matter that falls to the earth either as wet deposition (rain and snow) or dry deposition (dust particles).
autotrophs	An organism that manufactures its own food, using carbon dioxide as its source of carbon and sunlight as an energy source; generally photosynthetic organisms.
avifauna	Bird life
bank-full flow	The maximum amount of discharge that a stream channel can carry without overflowing.

basin (drainage)	*See* **watershed**
bedrock	The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.
benthic	Refers to the bottom sediments and immediately adjacent zone in an aquatic ecosystem.
Best Management Practices	Refer to the most environmentally appropriate techniques for agriculture, forestry, mining, development, urban stormwater management, and other practices that are potential threats to natural resources.
bioaccumulation	The build-up of toxic substances in animal tissue which increases as level in the food chain increases.
biodiversity	The variety of all living things. Can be measured by genetic variability, species richness, or ecosystem complexity.
bog	A plant community adapted to acidic, wet areas. Generally, decomposition rates are slow, resulting in peat formation.
bottomland	Lowland areas generally around waterways.
brine	A saline solution containing high levels of inorganic salts; typically comprises deep groundwater and may be brought to the surface during oil and gas drilling.
calcareous	Describes substances containing calcium carbonate ($CaCO_3$).
carbonate (CO_3)	A substance that bonds to hydrogen ions in carbonic acid, and forms bicarbonate. This reaction reduces acidity and raises alkalinity.
comprehensive plan	A general policy guide for the physical development of a municipality, taking into account many factors including location, character, and timing of future development. A plan provides a blueprint for housing, transportation, community facilities and utilities, and for land use.
conductivity	*See* **specific conductance**
confluence	The meeting of two waterways. The terminal end of the smaller (tributary) waterway at the confluence is referred to as the tributary's mouth.

conservation	The maintenance of environmental quality and resources; resources include physical, biological, or cultural. Ecosystem management within given social and economic constraints; producing goods and services for humans without depleting natural ecosystem diversity, and acknowledging the naturally dynamic character of biological systems.
conservation easement	A legal agreement a property owner makes to restrict the type and amount of development that may take place on his or her property.
contaminant	*See* **pollutant**
contiguous	Adjacent
CPOM	Course particulate organic matter; comprised of dead plant (fallen leaves and woody debris) and animal material (decaying organisms).
darter	Small fish, related to perch and walleye. Most rely on clean, flowing water and silt-free substrate. Some species live in lakes or stream pool habitats.
detritivore	An animal that feeds on dead material (detritus), usually plant material but can include animal material.
dissolved oxygen	Oxygen held in solution in water; utilized by aquatic organisms for respiration. Important indicator of water quality as dissolved oxygen levels often decrease as pollution increases.
dissolved solids	Mineral particles held in solution in water; usually reaches a threshold before particles begin to precipitate out of solution. Important indicator of water quality as high dissolved solids indicate an inflow of sediments or other pollutants.
DOM	Dissolved organic matter; organic matter that has been broken down through mechanical and chemical means and is held in solution in water.
droughty	Extremely dry; refers to well-drained soil.

drumlin	A streamlined, spoon-shaped hill of glacial till formed under a moving ice sheet and elongated in the direction of ice movement.
dry dam	Man-made dam that allows normal stream flows to pass through unhindered, but during periods of heavy rainfall or snow melt, higher flows are retained by the dam and released at a pre-determined rate.
ecology (ecological)	The study of the interrelationships among organisms and between organisms, and between them and all aspects, living and nonliving, of their environment.
ecosystem	A discrete unit that consists of living and nonliving parts, interacting to form a stable system. This term can be applied to different levels (e.g. processes that govern a small pond may be the same in a large lake, the ocean, and the earth).
ecotourism	Tourism that highlights the natural resources of an area with emphasis on conservation; the tourism activities are generally designed to be non-threatening to the resources.
elevation	Height above a base point, generally sea level.
emergent marsh	A more or less permanently wet area of mineral soil that contains plants which jut above the water level. Considered *robust* if plants persist above water levels during the non-growing season.
endangered	A classification given to a species that has a low relative abundance and therefore high probability of extinction.
erosion	The movement of soil and rock material by running water, wind, or other natural forces.
eutrophic (eutrophication)	Describes nutrient-rich waters with high primary productivity. May result in depleted dissolved oxygen levels. Eutrophication is the process by which a water body moves from nutrient-poor to nutrient-rich. This is a natural process that is often sped up by human influences.
exotic species	An introduced, non-native species. May be invasive if able to out-compete native species for resources.

extant	Applied to a group of related organisms (taxon), some members of which are still living.
extirpate	To bring a species to extinction in at least part of its range.
fauna	Animal life
fecal coliforms	Harmful bacteria normally associated with raw sewage.
fen	An area of wet peat that is typically alkaline to only slightly acidic, normally receives mineral-rich groundwater, and gives rise to a unique plant community.
floodplain	The area of a stream or river valley, adjacent to the waterway, that is made up of unconsolidated sediments deposited by the waterway and is periodically flooded.
flora	Plant life
flow regime	The natural processes the govern the movement of a stream or river. Includes water inputs, channel morphology, ground conditions, groundwater, etc.
fluvial geomorphology	The study of how flowing water impacts the land surface.
food web (food chain)	The feeding relationships of organisms within an ecosystem. A food web depicts numerous interconnected pathways for energy flow between an organism and several others. A food chain depicts only a single energy pathway from primary producers (green plants) through a chain of organisms that eat the previous organism and get eaten by the next.
FPOM	Fine particulate organic matter; comprised of organic matter that has been broken down into smaller pieces than CPOM but not yet dissolved.
geology	The study of the development of the earth's crust. Rocks, fossils, etc.
glacial drift	Any rock material deposited by an ice sheet of by meltwaters of that ice sheet.
glacial lake	A natural lake formed from glacial processes. Often referred to as a *kettle lake*, however not all glacial lakes are kettle lakes. Kettle lake refers to a lake that was formed

	when a large block of ice broke off an ice sheet and lay on the ground. The resulting depression after the ice melted filled to form a kettle lake. Lakes may be formed from other glacial processes including gouging of the bedrock, blockage of a stream valley, and filling in behind a moraine.
glacial outwash (plain)	Stratified drift deposited by meltwater streams. The outwash plain refers to the deposit of outwash whose surface is a broad, very gently sloping plan.
glacial till	A nonsorted, nonstratified sediment carried or deposited by a glacier.
glaciation	The covering of a large region by ice; ice age.
glacier	A large mass of ice that rests on a land surface and moves through sliding or growing and melting.
glochidia	Young, larval-stage freshwater mussels.
gradient (streams)	Refers to the amount of elevational drop over a stream's course. High gradient streams are fast flowing, typically characterized by rapid sections. Low gradient streams are slow, characterized by pools.
graminoid-forb	Describes a plant community comprised largely of grasses, sedges, rushes (graminoid) and other non-woody species like ferns (forb).
G Rank	A relative scale that describes a species' conservation status throughout the country or world. G1 signifies a species is critically imperiled and a G5 species is secure.
greenspace	An undeveloped area or open space
greenway	Corridor of open space
groundwater	Water that occurs below the Earth's surface; found in pore spaces in rock material. Source of drinking water for many; also contributes to surface waterways.
Growing Greener	Pennsylvania Legislation recommended by the 21st Century Environment Commission to Governor Tom Ridge in 1998. Invests nearly $650 million between 2000 and 2004 to preserve farmland and protect open space; eliminate the

	maintenance backlog in State Parks; clean up abandoned mines and restore watersheds; and provide new and upgraded water and sewer systems.
habitat	The place where an organism or biological community lives; usually has physical or biological properties that the organism or community can't exist without.
headwater	Refers to upstream reaches of a stream or river.
heavy metals	Refers to a group of metals that can contaminate water and soils and prove toxic to organisms, especially in solution.
hummocky topography	A strongly undulating land surface
hydric	Wet (often used to describe soils)
hydrologic cycle (water cycle)	The flow of water in various states through the atmospheric and terrestrial environments.
hydrologic model (water budget)	A simulation of the hydrologic cycle for a particular waterway that attempts to identify and quantify gains and losses of water.
hydrology	The study of the movement of water (hydrologic cycle) on the Earth; includes surface water and groundwater.
hydrophyte	A plant that is adapted to grow in water or very wet environments.
ichthyofauna	Fish life
impervious surface	Material that water can not penetrate. Refers to concrete surfaces, rooftops, and roadways in urbanized areas. Increased percentages of impervious surfaces increase run-off.
impoundment	Usually refers to a man-made body of water, often through damming a stream or river.
inter-basin transfer	The movement, by human activity, of water from one watershed or drainage to another.
invasive species	A species (often exotic) that is capable of aggressively out competing other species (often native) for resources. Usually results in a monoculture of the invasive species.

kame	A mound composed chiefly of sand and gravel deposited in contact with the ice by meltwaters of glaciers.
karst	Describes an area underlain by limestone and prone to caves, channels, and other voids left from the dissolution of the limestone by water.
lentic	Describes a freshwater habitat of calm or standing water (e.g. lakes, ponds, swamp, and bogs).
limestone	A sedimentary type of rock comprised largely of calcium carbonate and/or dolomite, another carbonate bearing rock. Good buffering capabilities against acidification.
lotic	Describes a freshwater habitat of running water (e.g. springs, streams, and rivers).
macroinvertebrate	Refers to organisms without backbones that are large enough to be seen without magnification and are generally associated with soil or stream substrate.
macrophytes	Rooted plants
marsh	A more or less permanently wet area of mineral soil, as opposed to peat.
mesotrophic	Describes freshwater environments that have nutrient levels mid-way between oligotrophic and eutrophic.
mixing zone	The length of a stream below an input, such as a pipe discharge, where the input mixes with the stream water and becomes diluted.
moraine	An accumulation of till deposited by a glacier.
native	Indigenous; a species that occurs naturally in an area, not introduced by human activity
natural resources	Attributes of an area that occur naturally and provide a benefit to humans. These may be geological, chemical, biological, etc.
nitrogen	An element essential to all plant and animal life. One of the two most important nutrients to the eutrophication of surface waters.

non-point source pollution	Pollution that emanates from various points on the landscape and can not be traced to a single pipe, ditch, or discharge. Typically involves run-off from fields, urban areas, mines, etc.
nutrient loading	The input of excessive nutrients like nitrogen and phosphorous to aquatic systems.
oligotrophic	Describes waters that are poor in nutrients and have low primary productivity.
ordinance	A municipal regulation; ordinances can be used to describe zoning, subdivision, and other land use issues within a municipality.
organic enrichment	Refers to excessive organic materials being introduced to a waterway. Organic compounds typically break down into component nutrients, so this process produces similar results to nutrient enrichment.
ornithology	The study of birds
peat	An organic soil or deposit formed when decomposition of organic material is slowed due to anaerobic conditions usually in a waterlogged environment.
periphyton	Organisms attached to or clinging to the stems and leaves of plants or other objects projecting above the bottom sediments of freshwater ecosystems.
pH	A value on a scale of 0-14 that gives a measure of the acidity or alkalinity of a medium (e.g. water or soil). A pH of 7 is neutral; less than 7 is acidic and more than 7 is basic or alkaline.
phosphorous	An element essential to all plant and animal life. One of the two most important nutrients to the eutrophication of surface waters.
physiographic	A term used to describe the physical relatedness of all areas within a given region.
phytoplankton	The plant plankton and primary producers of aquatic ecosystems, typically diatoms and dinoflagellates.

point source pollution	Pollution that can be traced to a particular pipe, ditch, or discharge.
pollutant	A by-product of human activities which enters or becomes concentrated in the environment, where it may cause injury to humans or desirable species.
primary producers	Photosynthetic and chemosynthetic autotrophs (mainly green plants including algae and phytoplankton) that utilize nutrients and energy from the sun or chemical reactions to produce organic compounds. These organisms form the beginning of all food chains.
put-and-take fishery	Fish are stocked solely for angling purposes usually because water conditions are only habitable for the stocked species part of the year. Describes most of the trout stocked waters in Pennsylvania.
recharge area	The area that acts as a catchment for any particular aquifer.
relief	Describes the relative degree of elevation change in any given area. Flat areas have low relief as opposed to mountainous areas, which tend to have high relief. Not to be confused with elevation that only measures the height above a certain point, typically sea level.
riparian buffer, zone, or area	Refers to the area of land immediately adjacent to a waterway that acts as a buffer against pollutants running off the land. A variety of plants in the riparian buffer act like a sponge, taking up nutrients and other pollutants from surface and shallow sub-surface flows that could degrade the waterway. Buffer, zone, and area are used interchangeably.
rip-rap	A loose foundation layer of irregular rock fragments or other material used to prevent stream banks from eroding. Usually less desirable than utilizing vegetative stabilization techniques but sometimes required for severe erosion problems.
river mile	A term used in the DEP Pennsylvania Stream Gazetteer to identify distances on a stream or river. River miles are measured from the mouth of the stream or river, which is designated river mile 0 for that waterway.

runoff	Water from wet deposition (rain or snow melt) that flows over the surface of the ground to a receiving waterway. May carry high levels of sediment, nutrients, and other pollutants.
sandstone	A type of sedimentary rock, formed of a lithified sand bound together with a mud matrix and a mineral cement. Contains little or no natural buffering capabilities against acidification.
scrub-shrub wetland	A more or less permanently wet area where the water table is low enough to allow woody shrubs to dominate.
sedimentation	The build up of detached soil particles in nearby waterways.
sedimentary	Describes rock formed by the deposition and compression of mineral and rock particles, and often including organic material. This is the rock type that would have been laid down layer after layer on the bottom of ancient seabeds.
sediment deposition	Laying down of detached soil particles on the bottoms of streams, lakes, and rivers.
seep wetland	A dispersed flow of water above ground level that occurs where the water table intercepts the ground surface. Similar to a spring with no obvious flow. Often gives rise to unique plant communities depending on the groundwater chemistry.
shale	Fine-grained, fissile, sedimentary rock composed of clay-sized and silt-sized particles of unspecified mineral composition.
silt	Class of finest-grained mineral soil particles.
siltstone	A lithified silt
silviculture	The management of forests or woodlands for the benefit of the entire ecosystem. More comprehensive than forestry.
siphon (incurrent, excurrent)	Refers to the appendages used by freshwater mussels for drawing water into their bodies (incurrent) for the purpose of food and oxygen extraction and expelling water from their bodies (excurrent).

Smart Growth	A current movement that focuses on redevelopment of established urban areas and other ways to reduce sprawl pressures on undeveloped countrysides.
species	A taxonomic group of individuals that can interbreed within the group but not with members outside the group (i.e. other species).
species of special concern	An organism considered rare, threatened, or endangered at the state or federal level and tracked by the Pennsylvania Natural Diversity Inventory Program.
specific conductance	Refers to the measurable potential of water to conduct an electric current. A higher specific conductance signifies more dissolved and suspended matter in the water. This is an indication of sedimentation or other pollution.
S Rank	A relative scale that describes a species' conservation status throughout the state. S1 signifies a species is critically imperiled and a S5 species is secure.
stormwater management	A program designed to preserve and restore the flood-carrying capacity of Commonwealth streams; to preserve, to the maximum extent practicable, natural stormwater runoff regimes and natural course, current, and cross section of water of the Commonwealth; and to protect and conserve ground waters and ground water recharge areas.
stratification	In aquatic terms, refers to the arrangement of lake water into layers. The upper layer, or epilimnion, is generally warmer, oxygen-rich, and contains the bulk of primary production. The bottom layer, or hypolimnion, is generally colder, oxygen-depleted, and low in primary production. The area in between is known as the mesolimnion. Stratified lakes mix twice yearly, known as turnover, and replenish nutrients and oxygen to the hypolimnion.
sub-basin	*See* **sub-watershed**
subdivision and land development regulation	Subdivision is the creation of new property lines, while land development involves the construction of public or private improvements. The major purposes of subdivision and land development regulations are: to provide adequate sites for development and public use; to maintain reasonable and acceptable design standards; and

	to coordinate public improvements with private development interests.
substrate	The layer of material on the bottom of a stream, river, or lake utilized as habitat by benthic organisms.
sub-watershed	The watershed of a tributary stream; it is a sub-unit of the receiving stream, river, or lake's watershed.
successional stages	Sequential changes in vegetation and the animals associated with it, either in response to an environmental change or induced by the intrinsic properties of the organisms themselves.
Superfund site	A hazardous waste site placed on the Superfund National Priorities List and financed for clean up by the U.S. EPA.
suspended solids	The part of a total load of a stream or river that is carried in suspension. Elevated levels of suspended solids indicates erosion upstream.
swamp	A shallow wet area that is usually covered by standing water all year.
taxon (pl. taxa)	A group of related organisms of an taxonomic rank (e.g. family, genus, or species).
terrestrial	Pertaining to dry land
terminal moraine	A deposit of till at the front end of a glacier signifying the furthest advance of the glacier.
threatened	A classification given to a species that could potentially go endangered.
TMDL	Total maximum daily load; a limit for pollutant load placed on a waterway by DEP. TMDLs are determined for a waterway based on how much pollutant it is determined that the waterway can assimilate. TMDLs will be used to regulate the percentage of total pollutant load that each source in a watershed can contribute.
topography	Describes landscape features of an area.
transpiration	The loss of water vapor from plants to the atmosphere.

tributary	A stream that feeds into another (receiving) stream, river, lake, or ocean.
turbidity	The presence of suspended sediments in water that causes a loss of transparency.
turnover	Mixing of lake waters during the spring warm-up and autumn cool down. Once stratified layers in a lake reach equal temperatures, wind causes the layers to mix. Turnover replenishes oxygen to the lower lake levels.
Unassessed Waters Program	U.S. EPA mandated program requiring states to assess all streams for pollutants. Pennsylvania DEP administers the PA Unassessed Waters Program.
unconsolidated	Loosely occurring, not bound together or formed from solid rock.
upland	Higher elevation areas, usually away from waterways.
veligers	Young larval-stage zebra mussels
watershed	The area from which a surface watercourse or groundwater system derives its water. The area is usually bound by high points and all water within the area runs downhill to a common receiving body of water. This term can be applied to any scale; a tiny stream has its own watershed but that stream and many other streams are part of a larger river system's watershed.
water table	The upper surface of groundwater; or the area below which the soil or rock interstices are saturated.
wellhead protection area	Wellhead is the well location and the recharge area for the well is designated as a protection area. Threats to the groundwater are identified within the protection area and measures are taken to remove the threats.
wetland	Variously defined but generally can be described as all open water habitats and seasonally or permanently waterlogged land areas.
zoning ordinance	A municipal ordinance that divides all land within the municipality into districts, and creates regulations that apply generally to the municipality as a whole as well as specifically to individual districts. To

properly delineate the boundaries of any district created within the zoning ordinance, and to determine the need for any specific district or districts, studies must be conducted in various areas, which allow rational decisions to be made concerning the zoning districts.

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APPENDICES

Appendix A

Western Pennsylvania Conservancy
French Creek Watershed Conservation Plan
Steering Committee

Steering Committee Coordinator and Author
Mr. Todd Sampsell
Western Pennsylvania Conservancy

Mr. Robert Anderson	U. S. Geological Survey
Mr. Charles Bier	Western Pennsylvania Conservancy
Dr. Mike Campbell	Mercyhurst College
Dr. Jonathan Chase	University of Pittsburgh
Ms. Sarah Galloway	Erie County Conservation District
Ms. Marnee Gormley	U. S. Fish & Wildlife Service
Mr. James Grazio	PA Dept. of Environmental Protection
Mr. Brian Hill	French Creek Project
Mr. John Holden	PA Dept. of Environmental Protection
Mr. Michael Koryak	U. S. Army Corps of Engineers
Mr. Jeff Lang	Conneaut Lake/French Creek Valley Conservancy
Dr. Henry Lawrence	Edinboro University
Mr. Budd Luce	French Creek Canoe & Kayak
Mr. Jack Lynch	Crawford County Planning Commission
Mr. Todd Marstellar	Venango County Planning Commission
Mr. Michael McCarthy	U. S. Fish & Wildlife Service
Mr. Daniel Miller	McClure-Miller
Mr. Jim Mondock	Mercer County Conservation District
Mr. Brian Pilarcik	Crawford County Conservation District
Mr. Denny Puko	Mercer County Regional Planning Commission
Mr. David Skellie	Erie County Department of Planning
Ms. Cynthia Smith	PA Dept. of Transportation
Dr. Jay Stauffer	Pennsylvania State University
Mr. Jes Sunder	Venango County Conservation District
Mr. Robert Wellington	Erie County Department of Health
Mr. Allan Woomer	PA Fish & Boat Commission
Mr. Ron Wooster	Lord Corporation
Dr. Brian Zimmerman	Edinboro University

French Creek Project
Advisory Committee

Project Director
Mr. Brian Hill
Pennsylvania Environmental Council

Mr. David Anderson	Moody & Associates
Mr. Steve Beckman	MacDonald, Illig, Jones, & Britton
Ms. Bonnie Beightol	Borough of Sugar Creek
Ms. Marilyn Black	Oil Heritage Region
Ms. Jacquelyn Bonomo	Western Pennsylvania Conservancy
Dr. Robert Concilus	Conneaut Lake/French Creek Valley Conservancy
Ms. Joanne Denworth	10,000 Friends of PA
Mr. Calvin Ernst	Ernst Conservation Seeds
Mr. LeRoy Gross	Erie County Conservation District
Dr. Samuel Harrison	Harrison Hydrosciences
Mr. Lynn Hofius	Benchmark Surveying
Mr. John Holden	PA Dept. of Environmental Protection
Mr. Lynn Hoover	PPG Industries
Mr. Henry Ingram	PA Landowners Association
Mr. Mark Kulich	PA Dept. of Conservation and Natural Resources
Mr. Andrew McElwaine	PA Environmental Council
Mr. James Lang	Dad's Products
Dr. Susan McAlpine	The Nature Conservancy
Mr. Douglas Mehan	PPG Industries
Mr. James Mondock	Mercer County Conservation District
Mr. John Oliver, ex officio	Secretary, PA Dept. of Conservation and Natural Resources
Ms. Lynn Pacior-Malys	Graphic Artist
Dr. Eric Pallant	CEED & Allegheny College
Mr. Jeff Peters	Spruce Row Dairy
Mr. Denny Puko	Mercer County Regional Planning Commission
Mr. Marc Ricard	Venango County Conservation District
Ms. Lynn Sandieson	Crawford County Conservation District
Mr. Steven Tingley	Planning & Economic Development Assoc.
Mr. Mark Troyer	Troyer Farms
Mr. Ronald Wooster	LORD Corporation

Appendix B

Public Comments Received Throughout the French Creek Watershed Conservation Planning Process

Public Comments Received on the Draft French Creek Conservation Plan

Comments Received Via Mail or Electronic Mail

John A. Shaffer, landowner: "I live and own property in the French Creek watershed which includes two small streams so I have an interest in any public policy that will impact my property."

Carlin Marsh, CLFCVC member: "Address rich spring wildflower habitat in mature hardwood forest. Specifically Deer Creek in Venango and Mercer counties, Big Sugar in the Townville area route 27, and Little Sugar near Pine Knoll-Roundknob Gap area. These areas are threatened by deforestation."

"Address invasive exotics including: multiflora rose, privet, tartarian honeysuckle, reed canary grass, and giant hogweed."

Bob Hetrick: "I have read the draft of the French Creek Conservation Plan and doubt that it could be made any better if the authors had two more years to work on it. It is a rather large volume that could be a chore for many individuals to read and/or remember important items and technical explanations."

Ralph R. Caldwell, landowner: "I am a farmer by choice. I don't believe you should be telling me how to farm. The green space you talk about – drive out route 99 Edinboro. It's weed infested buildings falling down, it looks like disgrace to humanity. Road salt gets into waterways also. Too much run off of salt in winter salt in summer is ruining our waterways. Streambed fencing is going to put dairy farmers 6 ft under, then what? I believe you are trying to ruin the country forever."

Crawford County Commissioners: "The Crawford County Commissioners would like to commend the efforts of those involved in the French Creek Conservation Plan. Truly an environmental, cultural, and recreational asset for Crawford County and Northwest Pennsylvania, the French Creek is a testament of the ability for nature's best to coexist, and even thrive in the face of development and progress.

The research and information contained in this plan is an important step in maintaining the integrity of this watershed and the diverse ecology contained within it. We must all understand we are inextricably linked to our environment, and are responsible for it. From the wells that draw water from this watershed, to the streams that irrigate our farms, the people, industries, and governments each play a vital role in the conservation of our natural resources.

The Commissioners fully support efforts to educate the public on how their decisions and actions can impact the watershed, and inform them of better alternatives. The Commissioners support

incentive based programs and policies for industries and landowners to help preserve this watershed and other natural resources of Northwest Pennsylvania. The Commissioners also support local level municipal planning that considers the balance between community development and the environment.

This Board of Crawford County Commissioners must unequivocally express their support for the private property rights of all residents of Crawford County. Policies and programs designed to forcibly take easements or buffer strips along our waterways should not be considered as the result of this Plan. The greatest success for the conservation of this watershed will come as the various elements of this community work together to implement a multitude of approaches.

As this century just begins, we hope the efforts initiated by this Plan continue for generations to come!"

Presque Isle Audubon Society: "On behalf of the Presque Isle Audubon Society let me congratulate you on the masterful conservation plan for the French Creek Watershed. I can't see that you have neglected any facet of the stream or its surrounding ecosystems in your considerations. It is not only scientifically sound, but is presented in a well-organized manner that makes it easy to read and to comprehend.

If we can be of any assistance in the future please know that we stand ready to support your efforts relating to French Creek."

Mike Easton, landowner: "If this plan goes through for French Creek and I own land adjacent to French Creek, will I still be able to build a fire for a wiener roast along the bank? Are there any plans that would infringe on my ability to use my land as I see fit? Are there any plans that in my opinion as a private landowner would actually constitute a "taking" of my property? If the answer is yes, how much do you intend to pay per acre? Thank you in advance for this information."

"I just received a phone call from a friend of mine who claims to have documentation that the French Creek Conservancy has plans to meter well water on private property along French Creek and 26 tributaries. He also claims that it is the Conservancy's intent to monitor use of wetlands in the same areas. He states that it will follow along the same lines as a U. N. Biosphere. He called me as he knows I am politically active in the area. His information, in the past, has always been accurate. But, I wish to check with you as to the accuracy of his information before I act. Thank you in advance for your cooperation."

"I have not had time to meet with the friend that I earlier mentioned due to the holiday. But another friend had some material he picked up at the Crawford County Fair. It was the draft of a plan for French Creek. I found several items to be what I consider intrusive in nature. One recommendation was to work for permits for drilling wells on private land. Another was inspection for septic systems. Another was inspection of drainage tiles. Another was permits for cutting timber on private land. Still another was limiting cattle drinking access to streams on private land. All of these proposals were to be accomplished by using various government agencies and working toward changing laws and regulations to accomplish the objective.

Correct me if I am wrong, but it appears that what we private landowners are faced with is a organization of individuals who do not want to go through the expense of buying their own land and paying taxes on it. They rather tell those of us who have labored to purchase land, how we are to manage it. That is my read on the proposed plan. I am an old fashioned individual who does not like to be told what to do by government or anyone else. I take care of my land and it takes care of me. The only significant damage that ever occurs is because of severe storms. That is something that neither I nor the proposed plan can change. All the governmental and NGO's together cannot change a storm. Also, there was a map on the material that my friend got at the Fair. It seems the French Creek Project has expanded to include Tamarack Lake, Sugar Lake, Woodcock Lake, Union City Dam, Erie Wildlife Refuge and all land in between. This appears to be like one of those bio-spheres you read about popping up in the west with all the attached restrictions. I'm not saying this is the case, but it is starting to look like it. If this is the case, count me out as I want no part of any bio-sphere."

Denny Puko, Mercer County Regional Planning Commission, FCP Advisory Committee, Plan Steering Committee: "WPC should include in the conservation plan an overt statement that the French Creek Project should continue to be the lead facilitator/coordinator of conservation activities including implementation of the conservation plan. The WPC should acknowledge its role as complementary and supportive. Such statements would address the concerns of committee members and not really alter roles already established."

"WPC should describe certain more controversial recommendations as "tools for consideration by the French Creek Project and its partners in implementing the Plan." Have the plan refer to them as options that may be chosen through the Project's grassroots collaborative processes. Committee members may have to give here, especially those members who insist that regulations would never be promoted by the Project. It would be foolhardy to ignore options and choices where warranted and publicly supported. This does not mean the Project must compromise its preference and priority for voluntary, cooperative, stewardship measures."

Pennsylvania Landowners' Association: "The Pennsylvania Landowners' Association ("PLA") submits the following comments on the Draft Conservation Plan (the "Plan") for the French Creek Watershed prepared by the Western Pennsylvania Conservancy ("WPC").

Interest of PLA

PLA is a statewide, non-profit, volunteer organization of individuals whose livelihoods are dependent on the use and development of privately owned land in the Commonwealth. PLA's objective is to advance the interests of private landowners, particularly those individuals who have limited resources in comparison to those of state, local and federal agencies which are frequently arrayed against landowners in matters involving environmental and land-use regulation.

PLA's guiding principles are set forth on the attached Appendix.

PLA is greatly concerned about the proliferation of legislative and regulatory initiatives dealing with water resource management and statewide watershed management and appreciates the opportunity to present this testimony.

PLA recognizes the importance of sound land use of Pennsylvania's land, water and abundant natural resources and good stewardship in land use practices. Indeed, the members of the organization are dependent on land and water resources for their livelihoods. PLA also recognizes the importance of protecting our streams but want to make sure that regulatory measures for such protections account for and enhance economic development and individual liberty with as little government intrusion as possible.

PLA members are understandably concerned when they see so many legislative and regulatory initiatives emerging and even converging at the same time. The DEP is well into the process of implementing watershed management across the state, which we understand to be the comprehensive and holistic approach contemplated by or responsive to, wholly or substantially, the recommendations of the 21st Century Environment Commission (see Report pages 42-45).

At the same time, rural landowners are engaged in assessing and responding to the impacts of the USEPA's new TMDL regulations which DEP is also in the process of implementing as part of the NPDES point source control program. This is important to PLA because flows of surface water runoff, not heretofore considered point source discharges, are coming into the regulatory equation and will be accounted for in ascertaining whether streams are impaired and for the purpose of establishing TMDLs, i.e. effluent limitations based on actual water quality and intended to restore impaired streams.

These concerns mount as landowners, somewhat apprehensively, observe the evolution of Pennsylvania's antidegradation or special waters protection program and related policies, following the alarming takeover of the program by the Federal government several years ago.

Specific Interest in French Creek Watershed

As the Plan points out, about 96% of the land in the French Creek Watershed is privately owned. These landowners formed a natural constituency for the PLA, which although a state-wide organization, was literally founded on the banks of French Creek and PLA has many members who would be directly affected by the implementation of the recommendations of the Plan.

PLA's early activities included educating watershed citizens on the impacts of wetlands and endangered species protection initiatives by government agencies that were proliferating at the time. PLA had regular contacts with organizations such as the WPC and Pennsylvania Environmental Council, locking horns on many issues and conducting joint public information programs on some. In any event PLA's positions on issues were well known in the watershed.

At the time of the initiation of the French Creek Project (the "Project"), John Oliver and Brian Hill and others wee aware of concerns of private landowners over impacts of expanding government regulation on property rights and correctly recognized that the interests and concerns

of French Creek riparian landowners had to be considered and respected if the Project was to succeed.

PLA's opposition to invasive state and federal environmental regulation, particularly relating to wetlands and endangered species protection, was well known in Northwest Pennsylvania at the time. Indeed, at about the same time the DER had appointed a French Creek coordinator whose task it was, PLA understood, to identify any and all regulatory tools that could be used to "protect" French Creek and any government agencies which could be enlisted in the effort to expand environmental regulation as the principal means of protecting French Creek. At this time, as many as seven government agencies: DER, the Fish Commission, the Game Commission, EPA, the U. S. Fish and Wildlife Service, the Soil Conservation Service and the Corps of Engineers might be involved in heavy-handed wetlands enforcement against small landowners and farmers and only a few committed individuals could devote the time and resources necessary to resist what was, from the landowner's perspective, a government lockdown on normal land use activity which had, until then, been entirely acceptable[1]

PLA Footnote: You may be assured that the over-representation of those same agencies on the WPC's Steering Committee for the Plan is disturbing to PLA members whose property and lives have been devastated by such regulation.

Messrs. Oliver and Hill approached the PLA leadership to explain their vision for the Project and encouraged PLA to support it and invited PLA leaders to participate on the Advisory Committee to represent the interests of that critical stakeholder group, private landowners, particularly those who did not have the resources to stand up against the collective resources of the government. PLA was assured that the fundamental purpose of the Project was to protect French Creek through enhanced public awareness of its unique characteristics and value. Through education of individuals and institutions, the Creek could be protected by volunteerism and consensus rather than by expansion of government coercion.

PLA understood, with good reason, based on assurances from the Project leaders that the Project did not and would not advocate additional "command and control" regulation as part of public outreach or the call for action in its efforts to preserve French Creek.

Based on those assurances and understanding of the Project, individuals from the PLA leadership joined the Advisory Committee and perhaps most importantly, PLA endorsed the Project in reliance on the Project's underlying commitment to volunteerism as opposed to coercion and its recognition of the need to protect private property rights and to accommodate the obvious interests of private landowners.

With only a few bumps along the road, until recently, the Project has kept its commitments and stayed on message, as far as PLA is concerned. To the extent that the Project will continue its responsibility for public participation and outreach for the Plan, which clearly contemplates the vigorous use of existing command and control regulatory techniques and strongly advocates new laws and regulations, PLA, would of course, have no choice but to vigorously oppose the Plan and withdraw its endorsement of the French Creek Project.

General Comments on the Plan

As is obvious from the overall tone of the Plan, the interests of private landowners by and large have been ignored. You can read the Plan and come away with the impression either that no one really lives in the watershed or that every human activity creates a problem which the Plan has to address. This tone is more than a little chilling because the Steering Committee is loaded with planners and other bureaucrats and the reader wonders how all this fits into the framework of comprehensive planning that affects real people. Put another way, the Plan is patronizing in tone and seems to be devoid of any concern for the ordinary citizens who live and earn their livelihoods in the watershed. To a degree, that might be a function of the fact that no individual who PLA would recognize as representing the interest of landowners and private property rights, served on the Steering Committee.

It is obvious from reading the Plan that the WPC did what most all other government contractors do in projects like this: the contractor consults existing data bases, does a literature search, regurgitates data already collected and slaps together a bunch of recommendations consistent with the goal of getting "follow-on" contracts or grants to do more work or to advance some private agenda. With all due respect to its authors, there seems to be nothing in the Plan that provides new information or ideas and anyone even remotely interested in the watershed would learn nothing new about the Creek and indeed, might wonder why ten or twelve year-old data is cited at all. There is really nothing new but the call for more laws and red tape.

The language and recommendations for actions are conclusionary and often based on speculation or plain, old gibberish. For example:

"…of greater importance in French Creek with regards to elevated water temperatures might be the increase in incident light reaching the stream as a result of loss of riparian buffer."

"…because fossil fuel combustion is a wide-spread issue and Pennsylvania receives much of its air born pollutants from other states, it is difficult to implement strategies to combat this threat without federal and state cooperation and goal setting to limit air emissions."

What are the authors saying? Where is the documentation?

Specific Comments[2]

PLA Footnote: Page references are to the appropriate page in Section VIII of the Plan, "Potential Threats and Recommendations."

*****_authors note: table and page numbers may have changed due to edits to the Plan_

Table 12 illustrates graphically the call for more red tape, regulation and bureaucracy across the board.

On page 12, the Plan advocates DEP as water withdrawal Czar. What happens to 200 years of common law? Will landowners cede control to Harrisburg?

On page 12, the Plan recommends promotion of forest easements. Apart from PLA's concerns about conservation easements generally, experience in the Forest Legacy Project reveals that the easement concept involved there has attracted the opposition of the entire forest products

industry. Action based on offhand recommendations, without the details, including assurances that landowners are made aware of the economic consequences of granting such easements are certain to draw similar opposition.

On page 12, the Plan advocates a statewide forest practices act. This is contrary to the spirit of the French Creek Project[3] and is specifically opposed by PLA.

PLA Footnote: PLA is not suggesting that the Plan of the WPC planners paid any attention to the spirit of vision of the French Creek Project or were obligated to do so. Indeed, the Plan represents a totally alien, contrary spirit.

On page 12, the Plan suggests the promotion of "conservation" easements to limit unnecessary development. Who decides what is "necessary" – faceless, planning bureaucrats or the people? The WPC should proceed judiciously with conservation easements. It took a lot of cooperation by affected parties just to get legislation passed. Overly aggressive use of this particular tool will lead to problems.

On page 13, the Plan recommends increasing bond amounts. There is no discussion or data in the Plan that suggests a need, let alone documents one. What shelf was this pulled from or did the author intend to abolish sand and gravel operations by having punitively high bond amounts established?

On page 17, Table 16, to address "potential threats of excessive water withdrawal (undocumented in the Plan but converted in the next sentence from potential to excessive) in the…watershed." The Plan proposes and advocates a drastic alteration in Pennsylvania water law and would give the government ironclad control over peoples' most essential resource. Among other things, this is a public policy issue of great importance and clearly a political issue. At best, the recommendation is typical planner's doodling – suggesting big government solution in search of a problem. One wonders how fulsomely this was described during "public outreach" portion of the planning process.

On page 22, Table 19, the Plan recommends permits, bonds and new regulations and restrictions to address "incompatible" logging practices. PLA, along with the forest products industry, opposes old style, command and control, business as usual, regulation of forestry practices. Here the Plan comes down on one side of issues being addressed collegially by various forestry industry stakeholders. It appears to be intended to improperly influence or bias the outcome of that process.

On page 22, the Plan speculates about potential problems arising from mineral extraction. It then recommends obviously standard, shelf-item solutions (i.e., more restrictions) to address undocumented, potential problems.

On page 24, rail-to-trail development is advocated. PLA's concerns about rail-to-trail projects is well known. PLA is opposed to rail-to-trail projects where the rights of reversionary owners and contiguous property owners are not fully protected.

On page 28, and only half a page at that, the Plan purports to address problems associated with "Urbanization." The Plan goes on to recite the "sprawl control" mantra. Protection of the French Creek Watershed is a different enterprise and except to address actual threats identified as sewage and run-off, the WPC should stay out of local or even multi-municipal land use issues. Large land transaction entities like the WPC should be aware that local governments still have some control over land use within their boundaries. As is pointed out on page III-5 of the Plan (somewhat arrogantly and condescendingly), the French Creek Watershed is an area comprised of "largely conservative private landowners, many who can be quick to oppose land use regulations." The authors of the Plan go on to point out that this can be a double edged sword. The WPC would be well advised to bear that in mind itself. There is no constitutionally protected right to have large areas in a municipality gobbled up by seemingly well-heeled conservancies for a conservation area. The locals may want a growth area there instead! Local land use regulation is, indeed, a double edged sword.

Conclusion

PLA has limited its specific comments to those recommendations in the Plan which are directly contrary to PLA's position on the particular issue or where the recommendations are inconsistent with or contrary to assurances given to PLA by particular organizations or interest groups.

PLA does not accept and will vigorously oppose the centrally planned, command and control approach to important land use and environmental issues, the approach taken in the Plan. PLA urges the WPC to go back to the drawing board and try to come up with a watershed conservation plan which is consistent with the philosophy and vision serving as the foundation of the French Creek Project when it was initiated."

Sam Harrison, Harrison Hydrosciences, FCP Advisory Committee: "I read over the packet sent by (PLA) in hopes of being able to skim it, toss it aside, and forget it. I have been a totally inactive member of the French Creek Project Advisory Committee and at this time in my life I am not looking for campaigns, causes, or controversy. I left Allegheny College burned out on fighting for what I believed in and chose to spend the rest of my efforts doing positive things (i.e., doing science to provide facts that might help settle controversies, individually supporting selected groups and activities I believed were good and beneficial, fixing up dilapidated buildings by myself, and avoiding serving on committees). So I am not at all anxious to wade into a controversy or end up on another committee. But (PLA's) packet just wouldn't go away. I found myself thinking back on it and re-reading it several times.

I had skimmed over the Draft Conservation Plan some time ago and none of it stuck with me. I didn't even keep my copy so I could refer to it now. So what is in front of my mind now is not the details of even the tone of the Plan, but rather, what I've read in (PLA's) packet.

Before agreeing to serve on the Advisory Committee, I, too, asked what the goals for the French Creek Project were and what means would be used to try to attain them. My recollection was that the means by which the Project hoped to protect and perhaps improve the watershed were education and awareness. Although I questioned how long a project based on "soft" approach such as this could survive, I thought it could do no harm, might do some good, and in the final

analysis felt confident that whatever Brian Hill did would be done very well and with the best intentions. Viewing the Project from some distance, I think it has achieved a good measure of success in increasing the knowledge about and appreciation of French Creek. And as one who drives along French Creek every day, I think there has been a marked increase in recreational use of the stream over the past decade. That, to me, is the biggest benefit of all for the general public.

If, as the packet provided by (PLA) suggests, the French Creek Project is now considering moving beyond education and awareness and into the realm of land-use control and regulations, I have very serious reservations. I realize every group needs to have new goals and challenges and it could very well be that the Project feels it has done what there is to be done with education and awareness. If so, I suggest for their consideration an alternative challenge. I am not aware of any organized effort to gather basic data on the watershed. And not just basic water quality data for the sake of making measurements, but studies that address or can be used to evaluate hypotheses. I am not aware that we know any more about the "science" of the stream than we did 15 years ago. I know a lot of data has been collected through projects with the public schools. My impression is that that work has been done very well, but its focus was, necessarily, education not establishing and addressing hypotheses.

When I first came to Allegheny in 1970 and we started up the Environmental Science majors, there were a series of in-house publications that were based almost entirely on senior theses. Many of them dealt with the aquatic biology of French Creek or its tributaries. It would be difficult to find these "Allegheny College Environmental Studies" even in Pelletier Library, so I can't cite them as an example of science that has been of much value to our understanding of the watershed, but if an organization such as the French Creek Project had been around then and championed the printing, dissemination, and preservation of these studies, they would be useful to us today.

So what I see lacking, if we choose to do something more to try to "benefit" French Creek, is an organized effort to actually learn more about its basic science. We may think it would be good if we enacted stricter discharge limits for sewage treatment plants, such as Saegertown's, but what actual data do we have to help us make that decision. More than likely, our best effort would be computer modeling, which in turn would be based on very sparce actual data.

Having made my pitch for channeling effort into actually learning more about the science of the stream, I'd now like to back off and take a broader view. I can well remember when I started doing research in the French Creek basin as a green, young, professor in 1970. Looking back, I think I thought everything we people did would have a bad impact on our streams. Three decades later, I've come to believe that natural systems are amazingly resilient, despite the temporal antics of human inhabitants. I look at photos of Pithole and Oil Creek and wonder how the land and streams ever survived or recovered. But they did. As I drive along the French Creek valley up toward Venango I think about 80% of the land being cleared for agricultural use a century ago, with no thought of conservation practices. Yet I question that I could find any evidence today in the stream of whatever those impacts were, no matter how closely I studied the stream channel or its sediment deposits.

Through my work as a consulting hydrogeologist I have worked with many clients whose use or intended use of private property has been impacted by state and federal regulations. I have often found myself brought into controversial situations regarding land use. Those who hire me hope that I will have a professional opinion that will favor their goals. But I figure that my job is to collect and evaluate data and then make my nest effort to provide an understanding of that data to both parties, regardless of which "side" it favors. Perhaps that's a role that the Project could consider."

Marilyn Black, Oil Heritage Region, FCP Advisory Committee: *(Initial submission)* "The title of the document should be changed to Conservation Plan for French Creek Watershed, to emphasize that the plan covers not just the main stem of this waterway but its entire watershed. There appear to be to different titles on the draft that I received.

Please insert a recommendation to identify and preserve special historic and cultural sites along the waterway, with potential partners listed as at least the Planning Commissions, Municipalities, and Nonprofits. I'm not sure the best cluster for this item, perhaps Transportation corridors, or perhaps some new overall category.

Because I have not read the full plan, just the summary, if there is not already a listing of willing partners, that would be a good appendix for the complete plan. In such a listing, please be sure to include the Oil Heritage Region, Inc., an official Pa. Heritage Park, using the address as shown on this letterhead.

Otherwise the balance of the plan is sound and consistent with the Oil Heritage Region's Management Action Plan and Interpretive Plan.

(Second submission) Our earlier comments on the draft conservation plan were based on a reading of just the chart of recommendations as published in the recent newsletter for the French Creek Project. Now that I've read the draft narrative of the Plan, here are additional comments, corrections, and minor edits for the consideration of those preparing the final version of this important document. Comments are arranged in the same sequence as the narrative pages. However, because I lack copies of the appendices, I cannot provide detailed comments on them. **minor editorial comments were addressed but not included here*

Title should reflect is for entire French Creek Watershed.

Page III-9; on this entire page, because 2000 census data is available now, it would be much better to use 2000 information rather than the 1996 estimates.

Page III-10; paragraph 1; unemployment rates should be gleaned for the same time period as the 2000 census, in order to be able to draw more useful parallels, rather than 1997 average annualized figures for unemployment rates. Also, it would be very odd to 'average' Erie County with the other counties, and therefore, I'd suggest list each county's unemployment rate, because the rates are greatly influenced by volume.

Page V-15; paragraph 4; lines 2 and 3; the 'excellent opportunities to catch trophy size largemouth bass and muskellunge' quotation was in 1995, prior to the complete lake drawdown; this statement is no longer descriptive of the angling opportunities at Tamarack Lake; suggest rework or delete the statement.

Page V-27; second paragraph; You may want to point out even more obviously the ironic situation that the same municipality who uses French Creek as the source of their drinking water supply is also the municipality that returns the most untreated effluent into French Creek at peak times!!

Page VI-1; paragraph 3; suggest rework this paragraph; black bears and river otters are both definitely within the French Creek watershed, based on multiple sightings of the animals, their tracks, and their droppings.

Page VI-3; after current section on Birds and before the Reptile section, suggest add a paragraph about the private bird sanctuary of 200+ acres at Buttermilk Hill near Utica; it is being managed by its owners for nesting and migratory birds.

Page VI-5; At Table 7, because trout stockings vary greatly by year, it would be appropriate to indicate the year for which that chart was accurate.

Page VI-13; somewhere, perhaps under Natural Communities of Special Concern, it would be important to mention the declining numbers of crayfish and hellgrammites in the southern portions of French Creek. Multiple anglers and biology teachers have mentioned this trend to me, apparent now for at least two years.

Page VII-5; middle of page; suggest add paragraph about the Allegheny Valley Trails Association, the non-profit managers of trails throughout Venango County, including the planned segment from downtown Franklin upstream along French Creek on a former rail line and then turning west to Polk, Pa.

Page VII-6; at top of page, suggest also add paragraph about easements in Venango County at Takeitezy and Sugar Creek Station.

Page VII-8; at bottom of page, please add paragraph about preserving and interpreting key historic sites in the watershed, especially along the main waterway.

Page IX-1; paragraph 4; entire paragraph questioned; why not use the French Creek Project Advisory Council? Forcing a geographical subdivide would result in smaller thinking instead of system-wide solutions and information sharing.

Page IX-1, #1 under Action Plans; see above; I seriously question the wisdom of organizing a new entity of multiple sub-basin committees with designated liaison to the overall Steering Committee. Plus, why not utilize the French Creek Project Advisory Council, an existing systemwide group of interested citizens from many sectors?

Page IX-3; #6 at top of page; again, unsure about the wisdom of dividing people up into tiny areas and the focus at the sub-basin level.

Page IX-3; #3 under Action Plans for Biological Resource Protection; why include the goby in this list?

Page IX-4; under D, Action Plans for Cultural Resource Protection, please add #3 – Key historic sites in the French Creek watershed should be inventoried and mapped.

Appendices – Because I lack copies of the appendices, I cannot provide detailed comments on those. BUT, I did glance at a set and the historic resources list for Venango County portion of French Creek lacks several important sites and buildings; I could give specific suggestions if a copy were furnished to me for corrections.

Douglas G. Mehan, PPG Industries, Inc., FCP Advisory Committee: "Why does the French Creek Project Advisory Committee appear to have been replaced by a new organization (French Creek Steering Committee)? Section one (Introduction) should have the successes of the French Creek Project noted and emphasized. The French Creek Project has high local visibility and is linked locally to the protection and education of French Creek!

Page I-3 – The Western Pennsylvania Conservancy and the French Creek Steering Committee do not need to reevaluate and revise this plan as this function should be the role of the French Creek Project and the French Creek Project Advisory Committee.

Section II on public participation does not note the participation of industry and other members of the "regulated community". Although the section notes the importance of "watershed citizens", there are many other stakeholder groups that should be included in the process and appear missing. Page VII-1 notes "…it is the responsibility of planners, municipal leaders, and recreational organizers to ensure that activities in the French Creek watershed…" Are these groups represented?

Section II – move "the data" contained in the unlabeled table on pages II'1 through II'15 to an appendix.

Section V, Water Resources, Watershed Hydrology, Groundwater, Page V-18 – The importance of this section is the relationship between the shallow groundwater systems and surface water (French Creek) including the movement of groundwater to French Creek and visa versa. Last paragraph, second sentence needs to be modified to include something to the effect that not only do the soils need to be permeable to allow flow but that you need to have a hydraulic gradient (head) for the movement to occur.

Section V, Water Resources, Water Quality, Natural Water Chemistry, Page V-19/20 – This section includes discussion items that are not part of natural water chemistry. Specifically, the 3rd through the 6th paragraph contain references to items that are more related to anthropogenic or contamination issues and not natural water chemistry. Although the last paragraph is interesting,

much of it should not be part of this section as it is not natural water chemistry (move to history or groundwater?).

Page V-22, 5th complete paragraph, third sentence spelling error…field biologist. Page V-23, remove that last sentence, as it is a commentary and not appropriate for this section of the plan ("None of these impairments are scheduled to have TMDLs implemented by 2002"). If the DEP is not meeting required TMDL schedules, then this deficiency can be addressed as a recommendation elsewhere in the report.

Section V, Water Resources, Water Quality, Monitoring – According to the title, this section should only be about "Water Quality"…page V-25 contains a paragraph with information on the water quantity from a well in Erie County. Although it is an interesting relationship about the change in water level, it is not related to water quality. Page V-26 the final two paragraphs appear to be recommendations for additional information. Should this information be moved to the recommendations section portion of the document? The other sections do not have similar recommendations for additional data yet additional data must be needed.

Page V-27, Figure 17 is not available electronically (Internet on 8/13) or in hard copy.

Page V-27, Safe Drinking Water Act not "Federal Safe Drinking Water Act". The first paragraph implies that the DEP is required to protect all wellheads from contamination. The title spells "Well Head" and the text is "wellhead". Is it one word or two words?

Section V, Water Supply, Water Withdrawal – Here is a significant data gap! We need data to get a better understanding of the total water balance including surface and groundwater interaction and withdrawal!

Page VIII-2 airborne not "air born"

Page VIII-4/5 – Table 11 lists Air Quality Monitoring under "On-lot Septic System"…not likely a good return on your investment. Increased air quality monitoring would be better for use in other areas and other pollutants.

Section "Toxins" – The efforts contained in this section should be directed at the general public as noted in item 10 on Table 12. Existing regulations target industry, however, the other part of the "toxins" issue are those used (and demanded) by the general public and non-regulated entities.

The document notes the importance of public participation in the planning process yet the French Creek watershed "Potential Partners" (Tables 11 through 24) do not include representatives from industry, the public, municipalities and others. The primary "partners" identified in this plan are regulatory-type agencies (PA DEP) and "non-profits". For any successful project to function in northwestern Pennsylvania, it will require partnering with a representative cross section of the community.

Similar to the above comment…The third paragraph in Section IX "Action Plans" it is noted the importance of the success of the French Creek Conservation Plan is support from these select groups ("watershed agencies, municipalities, organizations and residents"). Is this all-inclusive or are there others that should be included?

Page IX-2 Item B1 add French Creek Project to sentence 3 as a potential water quality data acquisition group.

PPG Industries, Inc. has been a contributing member of the French Creek Project and to the French Creek Project Advisory Committee for over 5-years. There appears to be an effort to remove a future role of the French Creek Project Advisory Committee and to replace or eliminate the French Creek Project. The French Creek Project has been successful by including all stakeholders and has the support of residents and "non-profits" such as the Conneaut Lake French Creek Valley Conservancy. This can not be said of the Western Pennsylvania Conservancy who has little or no name recognition in the area and who has no track record of including all local stakeholders as equal project team members."

John J. Bell, Pennsylvania Farm Bureau: "I have looked over the aforementioned draft. My general reaction is that the draft seems to point the finger at agriculture as being a significant culprit in the degradation or potential degradation of the French Creek watershed and connected lakes. However, the recommendations offered in the Draft for agriculture would seem to suggest a pattern of encouraging farmers to voluntarily implement conservation practices on their farms and providing financial incentives for implementation of these practices, rather than attempting to impose regulatory requirements on farm operations.

Comments on Impacts of Agriculture on French Creek Ecosystems.

Numerous negative comments on agricultural practices being performed in the French Creek watershed appear throughout the draft:*

**Author's note: Several examples are cited from throughout the Draft Plan.*

Analysis of Agricultural Impacts on the French Creek Watershed

Although the Draft makes numerous general comments on the adverse impacts that agriculture has and may have on the French Creek watershed, the Draft makes little effort to identify the actual extent in which agricultural practices have impacted the watershed or the quantitative analysis which has been performed to assess the degree of agriculture's impacts. The Draft concedes:

There has been no water budget or hydrologic model developed for the watershed. (V-16)

Comprehensive groundwater data does not exist. (V-19)

An ongoing, watershed-wide, comprehensive monitoring program is lacking. (V-23)

Monitoring in the French Creek watershed has not adequately addressed some of the most basic questions regarding water quality and aquatic organisms. (V-26)

It is not known where the most significant sources of nutrients are, even though the watershed is highly rural and largely agricultural. (V-26)

Data gaps exist with regards to groundwater quality, quantity, and identification of important recharge areas. (V-26)

Diversion of water by agricultural operations is not adequately researched. (VIII-17)

Furthermore, the Draft makes little effort to describe in detail the degree to which the watershed is impacted by agricultural practices. Data that is cited by the Draft as evidencing adverse impacts from agriculture are based on studies and estimates that are more than a decade old:

The Draft's statement of 1.41 million gallons of daily water use for livestock and 0.55 million gallons of daily water use for irrigation is based on U. S. Geological Service estimates in 1990.

The Draft's statement of nitrogen produced by livestock farms (1.93 pounds per acre per year) and crop farms (1.39 pounds per acre per year) is based on estimates performed by EPA in 1987.

Finally, although the Draft cites the Department of Environmental Protection's assessment of streams to demonstrate that agricultural activity is a "major" source of impairment of several French Creek tributaries, the Draft fails to identify DEP's quantitative analysis of the degree in which agricultural activities contributes to impairment of these streams.

Recommendations for Improvement May Not Necessarily Be Onerous for Agriculture.

The Draft's recommendations for agriculture are, for the most part, positive. Some recommendations will not be positively received by the agriculture community:

Encourage better monitoring/permitting of individuals withdrawing water from streams and groundwater. (V-17)

Promote setback regulations for development along waterways and wetlands. (VIII-25)

Encourage counties to develop stormwater management plans and municipalities to adopt stormwater development ordinances. (VIII-16)

Phosphorous and nitrogen levels should be used to develop a budget for the watershed. (VIII-4)

BMPs should be implemented for agriculture. (VIII-4)

Livestock should not have free access to streams. (VIII-21)

But numerous others would implement a voluntary, incentive-driven approach in carrying out conservation practices on farms:

Sub-watershed associations should seek out funding to help local landowners with conservation activities. (VIII-21)

Promote agricultural BMPs and NMPs and supply assistance to encourage farmers to implement projects. (VIII-21)

Promote more incentive programs for streambank fencing and riparian buffer/streambank restoration. (VIII-19)

Soil testing should be encouraged before fertilizer application. Soil testing can be done through County Conservation Districts or Penn State Cooperatives. (VIII-5)

Promote no-till farming and organic methods in appropriate areas. Most appropriate areas can be determined through research of nutrient and sediment inputs. Incentive programs should be established. (VIII-11)

Encourage agricultural operations to make surface reservoirs for withdrawals. Identify funding to help farmers develop reservoirs. (VIII-18)

The community can engage in successful stream restoration projects and BMPs can be implemented to benefit farmer, livestock and natural communities. (VIII-18)

Conclusion

Although local farmers may wish to raise questions regarding the allegations of agriculture's contribution to pollution of French Creek contained in the Draft, I do not think the Draft should be totally dismissed. It would be helpful if the Draft could reflect a more positive attitude toward agriculture and admit, where applicable, that data is unavailable to confirm what the Draft suspects are adverse environmental effects resulting fro agricultural practices in the French Creek watershed. Local farmers should also work toward softening (or flushing out) the recommendations in the Draft to enhance local zoning and land use control and stormwater management in the French Creek watershed. These actions can result in extensive restriction of land use in general and extensive restriction in farming practices in particular. But many of the recommendations contained in the Draft reflect a direction in governmental action that we want to be taken. We want government to develop voluntary, incentive driven programs and to provide adequate funding of these programs to participating farmers in the form of grants."

French Creek Project Advisory Committee: "Overall recommendations of the Group:

Generally the plan provides a very good summary of existing information on the Creek. There was some concern by Mark Troyer about the trout stream that runs through his property and how it was described.

The sections of the report that discuss farming should point out that agriculture is important part of the cultural and economic landscape of this region. Additionally, it is desirable to maintain agriculture and silviculture because these operations generally have less impact on the stream than more intensive development and industrial activities.

In regards to agricultural, the report should recognize the good work that is already occurring by the many groups in the watershed. Significant progress is being made on non-point source pollution through a cooperative program with farmers and this work should continue.

The importance of private land ownership and private property rights should be noted.

The plan would be strengthened if some of the recommendations were combined, reorganized, prioritized, and fleshed out with action steps.

Throughout the recommendations, potential partners are listed with state agencies specifically noted, while non-profits are not. State agencies are also listed as the first partner and this gives the impression that the agencies will be responsible for taking the lead on this efforts. For most of the recommendations this is not the case, so this section should be reorganized.

In Table 11, the third recommendation relates to BMPs. The description should emphasize that BMPs should be implemented on a voluntary basis. It should also say that incentives should be provided to encourage BMPs.

Table 12 deals with "toxins". Given the classifications that exist at the federal and state levels, it might be better to classify these as hazardous materials. In regards to sampling and monitoring recommended in this Table, the request that there be more sampling and monitoring is very general. Unless specific hazardous materials are not currently subject to monitoring and there is evidence that they should be, then this section should be eliminated.

In Table 12, the recommendations relating to the capping of abandoned wells should emphasize those that pose threats through discharges. Also, it is not clear what kinds of wells are being addressed (water, oil, or gas?).

In Table 12, the recommendation on removing toxins from the flood plain should use the phrase hazardous materials. It should recommend that research be done to indicate where there are problems and how this compares to existing regulations. The emphasis here should be education among small businesses, municipalities and landowners. Also, "area that drain directly to a waterway" is broader than intended.

In Table 12, the section addressing the application of brine seems to ignore existing research that has been completed by PA DEP over the last few years. DEP has based its standards on this research. If there is evidence that there is too little information available, this section should recommend additional research.

In Table 13, eliminate the recommendation for "advocate for a forest practices act."

In Table 13, either justify the need for additional bond requirements for gravel mining or eliminate this recommendation.

In Table 13, a recommendation calls for stricter erosion and sediment control plans. Clearly, what is desired is "Better follow through with erosion and sediment control plans." There should be increased monitoring and "follow through with plans."

Table 14 mentions "customized baitfish regulations." Given the way baitfish are collected, this issue is more likely to be addressed through an educational program aimed at anglers who collect "riffle runners."

In Table 16 eliminate those recommendations relating to permitting withdrawals or increased regulations.

In Table 18, reword the first recommendation to state, "Encourage Streambank fencing." Also eliminate the line, "Livestock should not have free access to the streams."

In Table 19, eliminate recommendations relating to permits and bonds.

In Table 20, it is assumed that there are no mandatory setbacks for drilling rigs. Setbacks are required now.

In Table 22, in the first recommendation, note and suggest implementation of PA DCNR's new program on ATVs. Regulations for stream crossings already exist.

In Table 22, the second recommendation should state, "Encourage a cooperative approach to trail development."

In Table 22, when talking about riparian development guidelines, instead of stating, "this may require mandatory setbacks and zoning", state "local governments should be encouraged to adopt conservation programs that protect streams and lakes."

In Table 23, Instead of mandatory setbacks, state "promote riparian protection by local governments." Also, "promote a variety of local tools to protect riparian areas."

In Table 23, change "Designate Growth Areas" to "Encourage municipalities and state agencies to focus infrastructure dollars." The recommendations in this section lend themselves to a white paper on options for local government officials.

The Appendix B is dated."

Erie County Conservation District: "Figure 9, Public Lands Map. This has a county park listed as the Field House Park. That is Headwaters Conservation Park. The symbol for the park is also in the wrong place. The symbol should almost be where Sixmile Creek Park is and Sixmile should be moved over too.

Figure 13, State Water Plan Watersheds. Currently the watersheds are color-coded. Would it be possible to number them also? There are way too many similar colors.

I could not find and mention of the Portage Trail. According to one of our Board Directors, it went from Erie to Port Venango. The trail was on land from Lake Erie to Waterford following Old French Road, then by water from Waterford to Franklin, to the Allegheny River."

Jeff Allio, Pennsylvania Department of Environmental Protection: "I would like to commend you on your extensive research in pulling together the French Creek Watershed Conservation Plan. This yeomen effort will be extremely valuable in aiding local leaders and individuals maintain the high quality of life we have come to expect in this part of the State. Your professionalism in this effort has been under valued.

All good citizens respect private property rights and know how to work together for the common good. Through "Virtue and Learning" the watershed dwellers will be inspired to move beyond their self interest. "What is good for the hive is good for the bee."

We need to clean up the sins of our ancestors, and change our habits to lessen the impact on our neighbors down stream and down wind. Both of these not so simple tasks require spending money. The funds required come only from taxes or tithing. If the players who critique your efforts do not inspire virtue in their own souls and others, they will find that the costs of living in a community being identified as desirable (Future growth) will be doomed to pay the taxes they fear. The longer it takes to learn the lessons (the costs of living unsustainably) the more the load we will all have to bear.

The mantra "Let's not just talk environment – Let's do something about it." was the guiding force in my student intern training at the McKeever Learning Center 20 plus years ago. I believe that the facts that you have identified in your plan spells out what we need to "DO". There is something in it for everyone. There is more than enough work in this plan and until the players quit pointing fingers and start offering to implement some of the suggestions, the sooner all of that virtue they expect, will come home to roost. If not, the costs of living are born by government.

I'm for laying out all the facts, issues and concerns as you have done. I am all too aware of the struggles, costs and confusion incurred when the local government arena is used to solve problems. It is our only alternative to virtue. Local government planning in the form of Environmental Advisory Councils allow for a round table approach on each of the sub-watersheds you have identified. Being a local government entity allows for a comprehensive approach to addressing the identified needs in your research. An EAC can spell out the need for a planning and zoning commission formation. They can identify what other stakeholders in the sub-basin need to step to the plate and address issues with "virtue" in mind. They can ask everyone to participate.

Thank you for all your good work. Your continued review of this plan will be an invaluable tool to the rest of us in the watershed.

Comments Received from Spring 2000 Public Stakeholder Meetings

Date	Meeting Group	Major category	Specific issue
27-Apr	French Creek Stakeholders-Upper Section	Development	Encourage redevelopment of existing areas (neighborhoods, brown fields)
27-Apr	French Creek Stakeholders-Upper Section	Development	Look at total costs of development before decisions are made (economic and ecological costs)
27-Apr	French Creek Stakeholders-Upper Section	Development	Define what the limits to growth are (i.e., water?)
27-Apr	French Creek Stakeholders-Upper Section	Development	Make growth compatible with the environment (i.e., growth is not always progress; progress can be protecting the environment)
27-Apr	French Creek Stakeholders-Upper Section	Development	Define the cost of natural resource loss during development
27-Apr	French Creek Stakeholders-Upper Section	Development	Utilize the emerging science of ecosystem valuation in evaluating cost of development
5-May	French Creek Stakeholders-Southern Section	Development	Assist in development of EACs to help focus development planning on potential eco-impacts
5-May	French Creek Stakeholders-Southern Section	Development	Work with chambers of commerce and tourism promotion agencies
5-May	French Creek Stakeholders-Southern Section	Development	Future partnership with an economic development agency
5-May	French Creek Stakeholders-Southern Section	Development	Promote ordinances that relate to eco-impact of development

5-May	French Creek Stakeholders-Southern Section	Development	Economic development is not necessarily "building" but can be the economic benefits of resource conservation (i.e., eco-tourism)
5-May	French Creek Stakeholders-Southern Section	Development	Foster building reuse instead of green space development (brown fields)
5-May	French Creek Stakeholders-Southern Section	Development	Target the out-of-town developers for education
5-May	French Creek Stakeholders-Southern Section	Development	Growth zones can be linked to county conservation plans
5-May	French Creek Stakeholders-Southern Section	Development	Reach out to "Big Box" retailers to have them do earth-friendly activities to counter development losses
5-May	French Creek Stakeholders-Southern Section	Development	Reevaluate the desire to promote exceptional value status of stream reaches; and the economic impact of that
5-Apr	French Creek Water Trail Initiative	Education	Highlight great biodiversity and ecological importance of stream
5-Apr	French Creek Water Trail Initiative	Education	Create an educational experience
13-Apr	French Creek Stakeholders-Middle Section	Education	Timbering association outreach
13-Apr	French Creek Stakeholders-Middle Section	Education	Landowner self-assessment (Conservation Districts have "home-assist" and "farm-assist" programs)
13-Apr	French Creek Stakeholders-Middle Section	Education	Do more outside of Meadville
13-Apr	French Creek Stakeholders-Middle Section	Education	Push economic benefits of conservation
13-Apr	French Creek Stakeholders-Middle Section	Education	Add interpretive aspect to greenway development
13-Apr	French Creek Stakeholders-Middle Section	Education	Increase outreach to smaller & private schools

13-Apr	French Creek Stakeholders-Middle Section	Education	Provide opportunities for public commitments
13-Apr	French Creek Stakeholders-Middle Section	Education	Increase outreach to other groups (headwater associations; sports clubs; religious groups)
13-Apr	French Creek Stakeholders-Middle Section	Education	Promote county conservation camps
13-Apr	French Creek Stakeholders-Middle Section	Education	Network with people from other watershed groups
13-Apr	French Creek Stakeholders-Middle Section	Education	Target pilot areas for specific problems (i.e., Cussewago Creek for poor agricultural practices)
13-Apr	French Creek Stakeholders-Middle Section	Education	Do a flyover for educational purposes
27-Apr	French Creek Stakeholders-Upper Section	Education	Need for educated and informed municipal officials
27-Apr	French Creek Stakeholders-Upper Section	Education	Promote independent student studies
27-Apr	French Creek Stakeholders-Upper Section	Education	Initiate "adopt-a-stream"
27-Apr	French Creek Stakeholders-Upper Section	Education	Promote students working with and in communities for sustainable change (i.e., rather than "monitoring")
27-Apr	French Creek Stakeholders-Upper Section	Education	Need for municipal government official education
27-Apr	French Creek Stakeholders-Upper Section	Education	Excuse students from class for projects (i.e., experiential education)
27-Apr	French Creek Stakeholders-Upper Section	Education	Promote competition and cooperation among college groups
27-Apr	French Creek Stakeholders-Upper Section	Education	Promote interdisciplinary college approach to watershed protection (i.e., across college program lines)

27-Apr	French Creek Stakeholders-Upper Section	Education	We are not reaching our college students
27-Apr	French Creek Stakeholders-Upper Section	Education	Promote colleges to look at their own sustainability
27-Apr	French Creek Stakeholders-Upper Section	Education	Don't give up on general public education
27-Apr	French Creek Stakeholders-Upper Section	Education	Focus on education and outreach at the sub-watershed level
27-Apr	French Creek Stakeholders-Upper Section	Education	"home-assist" self appraisal approach from Cornell University
27-Apr	French Creek Stakeholders-Upper Section	Education	Encourage farmers to sign up for environmental security areas
27-Apr	French Creek Stakeholders-Upper Section	Education	Encourage permanent farmland preservation
27-Apr	French Creek Stakeholders-Upper Section	Education	Use a web site-media blitz promotion technique
27-Apr	French Creek Stakeholders-Upper Section	Education	Develop and implement training for township supervisors
27-Apr	French Creek Stakeholders-Upper Section	Education	Promote development of municipal residential conservation plans (i.e., smaller lots, more green space)
27-Apr	French Creek Stakeholders-Upper Section	Education	Utilize city and borough meetings as a communication tool
27-Apr	French Creek Stakeholders-Upper Section	Education	Irregular enforcement of erosion and sedimentation plans across municipal boundaries
5-May	French Creek Stakeholders-Southern Section	Education	Riparian landowner education
5-May	French Creek Stakeholders-Southern Section	Education	Set up exhibits at REA annual meetings

5-May	French Creek Stakeholders-Southern Section	Education	Target tree associations (International Society of Arboriculture)
5-May	French Creek Stakeholders-Southern Section	Education	Develop database of all watershed farmers
5-May	French Creek Stakeholders-Southern Section	Education	Focus on whole watershed, not just on riparian landowners
5-May	French Creek Stakeholders-Southern Section	Education	Target planning groups, agencies, etc.
5-May	French Creek Stakeholders-Southern Section	Education	Target zoning boards (i.e., when zoning ordinances are being changed)
5-May	French Creek Stakeholders-Southern Section	Education	Educate people who develop land development ordinances (where zoning is absent)
5-May	French Creek Stakeholders-Southern Section	Education	Target people who develop and update county conservation plans
5-May	French Creek Stakeholders-Southern Section	Education	Develop key stakeholder group interest pages on web site; link to those groups from web site
5-May	French Creek Stakeholders-Southern Section	Education	Target sport fishery groups for education
5-May	French Creek Stakeholders-Southern Section	Education	Target hunters groups (sporting clubs; Ducks Unlimited; Turkey Federation)
5-May	French Creek Stakeholders-Southern Section	Education	Reach out to recreational boaters (educate on exotic spp.; waste disposal by boaters, etc.)
5-May	French Creek Stakeholders-Southern Section	Education	Educate organizers of ATV events (i.e., Poker Run)

5-May	French Creek Stakeholders-Southern Section	Education	Exhibit displays prolifically (municipal buildings; libraries; banks; grocery stores; post offices; Pymatuning Waterfowl Festival; highway welcome centers)
5-May	French Creek Stakeholders-Southern Section	Education	Venango County lacks Environmental Education Center
5-May	French Creek Stakeholders-Southern Section	Education	What schools are being missed in outreach?
5-May	French Creek Stakeholders-Southern Section	Education	Educate groups regarding what grant sources are available
5-May	French Creek Stakeholders-Southern Section	Education	Increase traditional advertising
5-May	French Creek Stakeholders-Southern Section	Education	Do non-traditional advertising (i.e., George Washington float; "French Creek Folk Festival")
5-May	French Creek Stakeholders-Southern Section	Education	"Broadcast" the ecological uniqueness of French Creek
5-Apr	French Creek Water Trail Initiative	Environmental impact of water trails	Keep access areas away from environmentally-sensitive areas
5-Apr	French Creek Water Trail Initiative	Environmental impact of water trails	All work needs to conform to environmental impact analysis
5-Apr	French Creek Water Trail Initiative	Environmental impact of water trails	Walking on mussel beds during low water will be a problem
5-Apr	French Creek Water Trail Initiative	Environmental impact of water trails	Discourage or encourage selective stream use related to sensitivity of areas (both spatially and temporally)
5-May	French Creek Stakeholders-Southern Section	Existing information resources	Science is lacking
5-May	French Creek Stakeholders-Southern Section	Existing information resources	Intensify college research on the streams

5-May	French Creek Stakeholders-Southern Section	Existing information resources	Bring colleges in to study data gaps in lakes
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	GIS information-Erie National Wildlife Refuge
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Lake water quality data-Fish & Boat Commission
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Fish surveys-Fish & Boat Commission
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Develop central information repository
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Data is fragmented, non consistently formatted
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Dirt & gravel road inventory-Conservation Districts
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Water quality assessments-PADEP Water Quality
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Land use and demographics-County Conservation Plans
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	GIS information-PADEP
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Stream environmental assessments-PADOT, esp. at stream crossings
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Individual NPDES discharge data-PADEP and EPA STORET
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	U.S. census data (demographics)
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Cost of sprawl-10,000 friends
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Permitted facilities information-PADEP
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Future growth projections-Municipal chapter 94 reports
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Agricultural data-County Conservation Services
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Soils information-County Conservation Services

13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Flood maps, etc. - U.S. ACE
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Stream level data-USGS
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Lake assessments-USEPA
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Satellite imagery
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Tourism bureaus
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Research & GIS information - Edinboro University
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Research-Allegheny College
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Geneva Marsh information-U. of Pittsburgh Ecology lab
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	County plat maps (riparian landowners)
13-Apr	French Creek Stakeholders-Middle Section	Existing information sources	Pennsylvania bird atlas-Audubon Society
13-Apr	French Creek Stakeholders-Middle Section	Local governments	Water withdrawal for agricultural uses leaves less for municipal use
13-Apr	French Creek Stakeholders-Middle Section	Local governments	Promote Environmental Advisory Councils in municipalities
13-Apr	French Creek Stakeholders-Middle Section	Local governments	Lobbying to promote comprehensive water planning legislation
13-Apr	French Creek Stakeholders-Middle Section	Local governments	Assure quantity of water
13-Apr	French Creek Stakeholders-Middle Section	Local governments	Work to maintain riparian buffers in municipal planning
13-Apr	French Creek Stakeholders-Middle Section	Local governments	Work to manage storm water as sprawl occurs
13-Apr	French Creek Stakeholders-Middle Section	Local governments	Infrastructure often doesn't mirror watershed hydrology

13-Apr	French Creek Stakeholders-Middle Section	Local governments	Sprawl is an issue in Erie County portion of watershed
13-Apr	French Creek Stakeholders-Middle Section	Local governments	Many 537 plans meet only letter of the law
13-Apr	French Creek Stakeholders-Middle Section	Local governments	Help municipalities develop 537 plans
13-Apr	French Creek Stakeholders-Middle Section	Local governments	Municipal funding of projects through Small Flows Institute (WV)
13-Apr	French Creek Stakeholders-Middle Section	Local governments	Exporting of water from watersheds via bottling operations
13-Apr	French Creek Stakeholders-Middle Section	Local governments	DEP funding of municipal environmental management systems
13-Apr	French Creek Stakeholders-Middle Section	Local governments	Impact of brine and road dust controls used by municipalities
13-Apr	French Creek Stakeholders-Middle Section	Local governments	Educate county commissioners re: purpose of conservation easements (they result in reduction of taxes)
5-May	French Creek Stakeholders-Southern Section	Local governments	Talk with Borough or Township associations
5-May	French Creek Stakeholders-Southern Section	Local governments	Reach out one-on-one to municipal officials
5-May	French Creek Stakeholders-Southern Section	Local governments	Have peer-to-peer outreach among municipal officials
5-May	French Creek Stakeholders-Southern Section	Local governments	Target groups like municipal officials for float trips
5-Apr	French Creek Water Trail Initiative	Maps & Guides (water trails)	Waterproof maps vs. paper maps
5-Apr	French Creek Water Trail Initiative	Maps & Guides (water trails)	Brochure kiosk needs
5-Apr	French Creek Water Trail Initiative	Maps & Guides (water trails)	Where can brochures be made available (libraries, shops, trailheads)

5-Apr	French Creek Water Trail Initiative	Maps & Guides (water trails)	Web site posting of information
5-Apr	French Creek Water Trail Initiative	Maps & Guides (water trails)	Need both general and detailed maps for varying needs
5-Apr	French Creek Water Trail Initiative	Riparian Landowners	Information exchange with landowners-letting them know what is upcoming
5-Apr	French Creek Water Trail Initiative	Riparian Landowners	Need landowner education and outreach
13-Apr	French Creek Stakeholders-Middle Section	Riparian Landowners	Farmers are interested in conservation easement purchase program (Crawford Co. hasn't adopted yet, so can't be implemented)
13-Apr	French Creek Stakeholders-Middle Section	Riparian Landowners	Develop capacity with local land trusts & conservancies for smaller parcels not covered by State program
13-Apr	French Creek Stakeholders-Middle Section	Riparian Landowners	Need county tax structure changes to help change land use and pressures
13-Apr	French Creek Stakeholders-Middle Section	Riparian Landowners	Impacts of ORVs
13-Apr	French Creek Stakeholders-Middle Section	Riparian Landowners	Include landowners in outreach
27-Apr	French Creek Stakeholders-Upper Section	Riparian Landowners	Incentives to create stream buffer zones are not high enough
27-Apr	French Creek Stakeholders-Upper Section	Riparian Landowners	Look at ways to link private and government funding to increase incentives to landowners for riparian buffer zones
5-Apr	French Creek Water Trail Initiative	Safety/Liability	Need education on boating safety
5-Apr	French Creek Water Trail Initiative	Safety/Liability	Partner with local groups, non-profits and PA Fish & Boat Commission

5-Apr	French Creek Water Trail Initiative	Safety/Liability	Non-powered boats not traditionally regulated or an educational focus
5-Apr	French Creek Water Trail Initiative	Safety/Liability	Hypothermia is an issue
5-Apr	French Creek Water Trail Initiative	Signage (water trails)	Brochures and signage can be educational
5-Apr	French Creek Water Trail Initiative	Signage (water trails)	Need for pre-paddling videos (safety, ecology, history)
5-Apr	French Creek Water Trail Initiative	Signage (water trails)	Need to overcome inertia to get people from car door to stream
5-Apr	French Creek Water Trail Initiative	Signage (water trails)	Zebra mussel warning signs
5-Apr	French Creek Water Trail Initiative	Signage (water trails)	Need consistency of signs
5-Apr	French Creek Water Trail Initiative	Signage (water trails)	Worry about sign vandalism
5-Apr	French Creek Water Trail Initiative	Signage (water trails)	Road side signs leading people to water trailhead
5-Apr	French Creek Water Trail Initiative	Stream access points (water trails)	Adequate/excess access intervals
5-Apr	French Creek Water Trail Initiative	Stream access points (water trails)	Very little access in upper reaches
5-Apr	French Creek Water Trail Initiative	Stream access points (water trails)	Access to dangerous areas
5-Apr	French Creek Water Trail Initiative	Stream access points (water trails)	Carry in/carry out (as in Susquehanna River water trail)
5-Apr	French Creek Water Trail Initiative	Stream access points (water trails)	Portable toilets at formal access points
5-Apr	French Creek Water Trail Initiative	Stream access points (water trails)	Level of needs depend on level of use
5-Apr	French Creek Water Trail Initiative	Stream access points (water trails)	Trash containers attract more trash
5-Apr	French Creek Water Trail Initiative	Stream access points (water trails)	Over-use may lead to spp. damage in access areas
5-Apr	French Creek Water Trail Initiative	Stream access points (water trails)	Access points provide opportunity for increased & effective education

5-Apr	French Creek Water Trail Initiative	Stream access points (water trails)	Evacuation/emergency access
5-Apr	French Creek Water Trail Initiative	Stream access points (water trails)	Start thinking about stream recreational carrying capacity now
5-Apr	French Creek Water Trail Initiative	Stream access points (water trails)	Need a present use study
5-Apr	French Creek Water Trail Initiative	Stream access points (water trails)	Need a cultural resource assessment
5-Apr	French Creek Water Trail Initiative	Stream access points (water trails)	Permits may be needed for access points (U.S. ACE)
5-Apr	French Creek Water Trail Initiative	Stream access points (water trails)	Access site facilities needed-parking, restrooms, information, trash collection
13-Apr	French Creek Stakeholders-Middle Section	Threats	Fuel storage tanks without secondary containment
27-Apr	French Creek Stakeholders-Upper Section	Threats	Union City Dam (and other dams)
27-Apr	French Creek Stakeholders-Upper Section	Threats	Dams lead to stream bed widening and shallowing
27-Apr	French Creek Stakeholders-Upper Section	Threats	Dams stop upstream migration
27-Apr	French Creek Stakeholders-Upper Section	Threats	Dams secondarily change biological community structure
27-Apr	French Creek Stakeholders-Upper Section	Threats	Constant flow from dams promote erosion downstream
27-Apr	French Creek Stakeholders-Upper Section	Threats	Persistent contaminants (PCBs; mercury) in sediments and biota
27-Apr	French Creek Stakeholders-Upper Section	Threats	Wetlands loss and removal
27-Apr	French Creek Stakeholders-Upper Section	Threats	Recreational boating impact on endangered spp. (especially mussels)
27-Apr	French Creek Stakeholders-Upper Section	Threats	Poor farming practices (esp. cows in stream, nutrient inputs, pesticide-herbicide inputs)

27-Apr	French Creek Stakeholders-Upper Section	Threats	Exotic spp. introduction
27-Apr	French Creek Stakeholders-Upper Section	Threats	Atmospheric deposition (lack of air quality monitoring stations; lack of experts; lack of data)
27-Apr	French Creek Stakeholders-Upper Section	Threats	Urbanization (sprawl; inner city flight; loss of farmland)
27-Apr	French Creek Stakeholders-Upper Section	Threats	Infrastructure expansion into rural areas exacerbates sprawl
27-Apr	French Creek Stakeholders-Upper Section	Threats	No storm water regulations in many areas
27-Apr	French Creek Stakeholders-Upper Section	Threats	Loss of forest land
27-Apr	French Creek Stakeholders-Upper Section	Threats	Poor forestry practices (i.e., clear-cutting)
27-Apr	French Creek Stakeholders-Upper Section	Threats	Poor highway maintenance practices (i.e., brine application; road salt; oils for dust control)
27-Apr	French Creek Stakeholders-Upper Section	Threats	New highway construction
5-May	French Creek Stakeholders-Southern Section	Threats	Pollution
5-May	French Creek Stakeholders-Southern Section	Threats	Erosion
5-May	French Creek Stakeholders-Southern Section	Threats	Urban sprawl
5-May	French Creek Stakeholders-Southern Section	Threats	Invasive species (aquatic and terrestrial)
5-May	French Creek Stakeholders-Southern Section	Threats	Any new dams
5-May	French Creek Stakeholders-Southern Section	Threats	Existing dams
5-May	French Creek Stakeholders-Southern Section	Threats	Dredging
5-May	French Creek Stakeholders-Southern Section	Threats	Four-wheelers (ATVs/ORVs)

5-May	French Creek Stakeholders-Southern Section	Threats	Sedimentation and siltation
5-May	French Creek Stakeholders-Southern Section	Threats	Point source pollution (Meadville STP; septic systems; cooling water discharges; industrial wastewater; hazardous sites; gravel mining)
5-May	French Creek Stakeholders-Southern Section	Threats	Chemical spraying (pesticides and herbicides)
5-May	French Creek Stakeholders-Southern Section	Threats	Lawn care chemicals
5-May	French Creek Stakeholders-Southern Section	Threats	Road runoff
5-May	French Creek Stakeholders-Southern Section	Threats	Road brining
5-May	French Creek Stakeholders-Southern Section	Threats	Road oiling
5-May	French Creek Stakeholders-Southern Section	Threats	Asphalt plant
5-May	French Creek Stakeholders-Southern Section	Threats	Gas and oil wells
5-May	French Creek Stakeholders-Southern Section	Threats	Water withdrawal for agricultural uses
5-May	French Creek Stakeholders-Southern Section	Threats	Mowing or tilling to the stream edge
5-May	French Creek Stakeholders-Southern Section	Threats	Lack of an informed public
5-May	French Creek Stakeholders-Southern Section	Threats	Lack of environmental enforcement
5-May	French Creek Stakeholders-Southern Section	Threats	Trash dumping
5-May	French Creek Stakeholders-Southern Section	Threats	Floods carrying materials into stream from floodplain
5-May	French Creek Stakeholders-Southern Section	Threats	Improper development in the floodplain
5-May	French Creek Stakeholders-Southern Section	Threats	Wetlands loss
5-May	French Creek Stakeholders-Southern Section	Threats	Salt storage runoff

5-May	French Creek Stakeholders-Southern Section	Threats	Lack of proper community land use planning

Appendix C

Potential Hazardous Sites in the French Creek Watershed

Site Name	Municipality	County
LITTLE COOLEY LANDFILL	ATHENS TWP	CRAWFORD
LORD CORP. - CAMBRIDGE SPRINGS	CAMBRIDGE SPRINGS	CRAWFORD
MORCO CORP SITE	COCHRANTON	CRAWFORD
NICKEL PLATE RD	COCHRANTON	CRAWFORD
KEYSTONE ORDINANCE PUMPING STATION WORKS	FAIRFIELD TWP	CRAWFORD
USA KEYSTONE ORDINANCE	GENEVA	CRAWFORD
RUSCO INDUSTRIES	GREENWOOD TWP	CRAWFORD
ERIE NATIONAL WILDLIFE REFUGE	GUYS MILLS	CRAWFORD
WATSON SITE	HAYFIELD TWP	CRAWFORD
LOCKE ROAD GAS WELL ROAD	HAYFIELD TWP	CRAWFORD
RESERVOIR ROAD SITE	HAYFIELD TWP	CRAWFORD
SUPERIOR REFUSE DISPOSAL	HAYFIELD TWP	CRAWFORD
FRENCH CREEK CANAL	HAYFIELD TWP	CRAWFORD
GREENLEAF CORPORATION	HAYFIELD TWP	CRAWFORD
CONRAIL PROGRAM CAR SHOP	MEADVILLE	CRAWFORD
SPAULDINGS, INC	MEADVILLE	CRAWFORD
OLD MEADVILLE LANDFILL	MEADVILLE	CRAWFORD
MEADVILLE MALLEABLE IRON CO	MEADVILLE	CRAWFORD
NEW RICHMOND TANNERY SITE	NEW RICHMOND	CRAWFORD
MERCER SPRING & WIRE	RICHMOND	CRAWFORD
GAME FARM RD LOGGING ROAD	RICHMOND TWP	CRAWFORD
EAGER BEAVER LUMBER CO	RICHMOND TWP	CRAWFORD
SCHILLER SITE	RICHMOND TWP	CRAWFORD
GAME FARM RD LOGGING ROAD	RICHMOND TWP	CRAWFORD
HUGHSON CHEMICAL CO	SAEGERTOWN	CRAWFORD
GATX	SAEGERTOWN	CRAWFORD
SAEGERTOWN INDUSTRIAL AREA	SAEGERTOWN	CRAWFORD
KNUTH KUSTOM COMPLEX	SAEGERTOWN	CRAWFORD
SHALLOWMANDER PROPERTY	SPRING TWP	CRAWFORD
REIXO ROAD SITE	SPRING TWP	CRAWFORD
CONNEAUT LAKE PARK DUMP	SUMMIT TWP	CRAWFORD
SKELTONTOWN RD DRIVEWAY SITE	VENANGO TWP	CRAWFORD
TOBIN SITE	VENANGO TWP	CRAWFORD
ACKERMAN PROPERTY	VERNON TWP	CRAWFORD
AVTEX FIBERS INC	VERNON TWP	CRAWFORD
AVTEX MERCURY SPILL SITE	VERNON TWP	CRAWFORD
MEADVILLE PLATING CO.	WEST MEAD TWP	CRAWFORD
LEETECH SITE	WEST MEAD TWP	CRAWFORD
TALON INC	WEST MEAD TWP	CRAWFORD
LEECH TOOL & DIE RTE 77 SITE	WEST MEAD TWP	CRAWFORD
ABEX PLT - MEADVILLE PLT	WOODCOCK	CRAWFORD

O'POLKA SITE	WOODCOCK TWP	CRAWFORD
AMITY LANDFILL	AMITY TWP	ERIE
WASHINGTON ST LANDFILL	CORRY	ERIE
EDINBORO WELL SITE	EDINBORO	ERIE
MOLDED FIBERGLASS BOAT CO	LEBOUF TWP	ERIE
NICHOLSON'S LANDFILL II	LOWVILLE (VENNANGO TWP)	ERIE
PENN DOT RTE19 LAGOON	SUMMIT TWP	ERIE
AGWAY INC	UNION CITY	ERIE
UNION MACHINE CO INC	UNION CITY	ERIE
UNION CITY LANDFILL	UNION CITY	ERIE
DAVIS DUMP	UNION CITY	ERIE
MFG - PALMER SITE	UNION CITY	ERIE
WASHINGTON TWP DUMP	WASHINGTON TWP	ERIE
PRESQUE ISLE CHEMICAL	WASHINGTON TWP	ERIE
ELGIN ELECTRONICS	WATERFORD	ERIE
WATERFORD MUNICIPAL SITE	WATERFORD	ERIE
HUNT SITE	WATERFORD TWP	ERIE
OLIVER LANDFILL	WATERFORD TWP	ERIE
MONROE LANDFILL	WATERFORD TWP	ERIE
PENN DISPOSAL SITE	WAYNE TWP	ERIE
MORCO DEER CREEK RD SITE	FRENCH CREEK TWP	MERCER
MERCER COUNTY DRUM DUMP SITE	MILLEDGEVILLE	MERCER
CHICAGO PNEWMATIC TOOL CO	FRANKLIN	VENANGO
JOY MANUFACTURING-TRI CITY SPEEDWAY SITE	OAKLAND TWP	VENANGO
AARDVARK TRANSFER & DISP SITE	SUGARCREEK BOROUGH	VENANGO
AMALIE REFINERY	SUGARCREEK BOROUGH	VENANGO
Source: PA DEP		

Appendix D

PA DEP Permitted Mining Sites

DEP Permit #	Site Name	Operator
20970303	2C 5 Mine	Frank Tucci
25870309	Afton 2 Gravel Mine	Afton Trucking Inc.
25930302	Afton 3 Gravel Mine	Afton Trucking Inc.
25900802	Backus Mine	John W. Waldemarson
4876SM12	Bagdad Gravel Mine	Waterford Sand & Gravel
25900303	Batchelor 12 Mine	Hoover Sand & Gravel Co. Inc.
25890301	Bear 1 Mine	Wroblewski Sand & Gravel Inc.
25970308	Bear 3 Mine	Wroblewski Sand & Gravel Inc.
25940301	Beute & Bliley 2 Mine	Beute & Bliley Inc.
25980301	Briggs Showman Mine	Ray Showman Jr. Excavating Inc.
25950301	Brumagin 2 Mine	Hoover Sand & Gravel Co. Inc.
25992805	Burawa Mine	Raymond D. Showman & Sons Inc.
SM-535	Burdick Mine	Vance E. Burdick
3773SM1	Burkhardt Mine	IA Construction Corp.
20870303	Carpenter Mine	Ralph L. Hunter
20842303	Carpenter Mine	Ralph L. Hunter
25960801	Coe Mine	William R. Coe Jr.
3076SM4	Conneaut Lake Sand & Gravel Mine	Conneaut Lake Sand & Gravel Inc.
20950804	Cooley 1 Mine	William Cooley
20800303	Cutshall Mine	W. L. Dunn Construction Co.
20830308	Dale G. Snow Mine	Dale G. Snow
20890801	Daniel E. Berlin Mine	Daniel E. Berlin
25860303	David Klie 1 Mine	David & Elaine Klie
20990805	Dean 1 Mine	Bruce E. Dean
20970305	Deckards Road Mine	Meadville Redi Mix Concrete Inc.
SM459-1	Denny Crns mine	Mrs. Robert L. Smock
43820603	Dietrich Mine	Larry G. Temple
20940803	Donald L. Merritt Mine	Donald L. Merritt
4876SM10	Edinboro Gravel Mine	Edinboro Gravel Co.
3173SM11	Erie Aggregates Mine	Erie Aggregates Inc.
25870301	Fenton Gravel Mine 1	C. B. Fenton
20910303	Ferris 1 Mine	Donald Ferris
25870807	Fiesler Mine	Sally Fiesler
4876SM17	Fountain House Mine	Meadville Redi Mix Concrete Inc.
4878NC7	Foust 2 Mine	Jack R. & Robert L. Foust
3076SM8	Foust Mine	Jack R. & Robert L. Foust
20810302	Foust Road Mine	Conneaut Lake Sand & Gravel Inc.
20800301	Fowler Mine	Conneaut Lake Sand & Gravel Inc.

3772SM8	Franklin Opr Mine	Vincent Excavating & Gravel
43910304	French Creek 1 Mine	Meadville Redi Mix Concrete Inc.
20940304	Fritz Mine	IA Construction Corp.
25870804	Gilbert Kress Mine	Gilbert Kress
25870302	Glover 1 Mine	James H. Glover
20800302	Glover Mine	Leroy R. Glover
20992802	Gravel Run Mine	R. Hunter Inc.
25880305	Hanas 1 Mine	Hanas Gravel Co.
20870802	Herb Landers 1 Mine	David M. Russell
25900304	Hoover 10 Mine	Hoover Sand & Gravel Co. Inc.
25900301	Hoover 9 Mine	Hoover Sand & Gravel Co. Inc.
20940301	Huber Mine	Meadville Redi Mix Concrete Inc.
25842305	Hunt Mine	Carl Hunt Jr.
20890304	Hunter 2 Mine	Ralph L. Hunter
20910306	Hunter 3 Mine	Ralph L. Hunter
25992804	Jack Pfadt 2 Mine	John F. Pfadt
4876SM4	Kantz Mine	W. L. Dunn Construction Co.
61990301*	Karns Mine	Cooperstown Sand & Gravel
25860307	Kent 1 Mine	Waterford Sand & Gravel
25800305	Kingens Gravel Mine	Raymond D. Showman & Sons Inc.
3778SM10	Laing Mine	Franklin Gravel Co.
20850305	Locke Mine	Gary Theuret
20970304	Mac Son 2 Mine	Mac Son Corp.
25820311	Martin Arneman Mine	Martin W. Arneman
20970802	Marzka 1 Mine	Vera I. Marzka
4876SM6	Maybro Lowville Mine	Wroblewski Sand & Gravel Inc.
25880303	McKean 3 Mine	McKean Sand & Gravel Inc.
25860306	McLaughlin 1 Mine	McLaughlin Peat Sales
20930801	McMahon Mine	David L. & Sandra McMahon
3776SM20	McWhirter Mine	IA Construction Corp.
20830306	Meadville Redimix Mine	Meadvile Redi Mix Concrete Inc.
25992807	Munsee Mine	Munsee Sand & Gravel
25870304	Niemeyer 2 Gravel Mine	Rodger E. Niemeyer Sr.
25950303	Niemeyer 3 Gravel Mine	Rodger E. Niemeyer Sr.
25002803	Niemeyer Gravel 4 Mine	Rodger E. Niemeyer Sr.
25992808	Niemeyer Gravel 5 Mine	Rodger E. Niemeyer Sr.
20820305	Northwest Gravel 2 Mine	Northwest Gravel Co.
4878NC3	Orr 1 Mine	Frank Tucci
20900302	Orr 2 Mine	Frank Tucci
25992801	Osborn Mine	Ray Showman Jr. Excavating Inc.
3773SM6	Patchel Run Mine	Cooperstown Sand & Gravel
25002804	Pavkov Mine	Bill Danylko & Son Excavating Inc.
25820302	Pfadt 1 Mine	John F. Pfadt
20992804	Pikula 1 Mine	Joseph G. & M. Shirley Pikula

20830307	Pinney Gravel Mine	Donald R. Wallis
20960303	Powell Mine	W. L. Dunn Construction Co.
4877SM13	Rockdale 1 Mine	Frank Tucci
25002805	Rohrer Blum Mine	Blum Rohrer
25870806	Roy L. Colvin Mine	Roy L. Colvin
20950807	Schlosser Mine	Donald R. Wallis
20890306	Shale 1 Mine	Ralph L. Hunter
25970306	Showman 1 Mine	Raymond D. Showman & Sons Inc.
25992806	Skelton Mine	Raymond D. Showman & Sons Inc.
25960802	Spotts Gravel Mine	Phillip L. Spotts
20960301	Stutzman Mine	R. Hunter Inc.
20880802	Tatalovic 1 Mine	Ralph R. Tatalovic
25980302	Tech Mine	Afton Trucking Inc.
25950802	Thompson Mine	Tom Francis
3773SM4	Tionesta 3 Mine	Cooperstown Sand & Gravel
25950304	Troyer 1 Mine	Troyer Sand & Gravel LTD
4876SM5	Troyer 2 Mine	Mervin Troyer
4878SM1	Union City 3 Mine	Dean Glover Trucking
25910302	Waterford 5 Mine	Waterford Sand & Gravel Co.
3076SM2	West Greene Mine	Afton Trucking Inc.
20890803	William H. Wilson Mine	William H. Wilson
43910308	Wood Dean Mine	Halls Excavating Inc.
25930305	Wroblewski 2 Mine	Wroblewski Sand & Gravel Inc.
61930301	Wyant Mine	Cooperstown Sand & Gravel
4876SM16	Wygant Farm Plt.	Meadville Redi Mix Concrete Inc.
4876SM15	Wygant Farm Wash Plt.	Meadville Redi Mix Concrete Inc.
25940803	Wynn Woods Mine	Wynn Woods
Source: PA DEP		

Appendix E

National Pollution Discharge Elimination System (NPDES) Sites

Site Name	Municipality	County	Receiving Waters
Blooming Valley Church	Blooming Valley Borough	Crawford	UNT Woodcock Creek
BHB Industries	Cambridge Springs Borough	Crawford	French Creek
Cambridge Springs Borough	Cambridge Springs Borough	Crawford	French Creek
Cambridge Township Gen. Mun.	Cambridge Township	Crawford	French Creek
Morco Corp. Mfg.	Cochranton Borough	Crawford	French Creek
PA DOT Rest Area 19	Cussewago Township	Crawford	UNT Cussewago Creek
Shady Acres Mobile Home Park	Cussewago Township	Crawford	Cussewago Creek
Country Acres MHP	East Mead Township	Crawford	UNT Little Sugar Creek
Star Route Estates MHP	East Mead Township	Crawford	UNT Little Sugar Creek
Ebbert's Laundromat	Fairfield Township	Crawford	French Creek
Kebert Enterprises	Greenwood Township	Crawford	Conneaut Outlet
PPG Industrial Works	Greenwood Township	Crawford	Conneaut Outlet
Denny Ridge MHP	Hayfield Township	Crawford	Cussewago Creek
Meadville Area Sewer Authority	Meadville	Crawford	French Creek
Meadville Redevelopment Authority	Meadville	Crawford	French Creek
Norfolk Southern Meadville Yard Diesel Shop	Meadville	Crawford	French Creek
Faith Builders (Penncrest School District)	Randolph Township	Crawford	Woodcock Creek
Maplewood Jr-Sr High School	Randolph Township	Crawford	UNT Woodcock Creek
Conneaut Joint Municipal Authority	Sadsbury Township	Crawford	Conneaut Outlet
Penn Lake Girl Scouts Camp Lend-a-Hand	Sadsbury Township	Crawford	UNT Conneaut Outlet
Runamuck Camping	Sadsbury Township	Crawford	UNT Conneaut Lake
Lord Corp. Chem. Prod. Div.	Saegertown Borough	Crawford	French Creek
Maplewood Elementary School	Townville Borough	Crawford	Muddy Creek
Eagle Crest Manor MHP	Union Township	Crawford	UNT Conneaut Outlet
Lakeview Manor MHP	Union Township	Crawford	Kebort Run
Advanced Casting Products (Meadville Maleable)	Vernon Township	Crawford	French Creek
Crestview MHP (David Reed)	Vernon Township	Crawford	Swamp leading to

			Van Horne
Fredricksburg STP (Vernon Township San. Auth.)	Vernon Township	Crawford	Cussewago Creek
South Watson STP (Vernon Township San. Auth.)	Vernon Township	Crawford	Watson Run
US Bronze	Woodcock Township	Crawford	French Creek
Edinboro Conference Campground	Edinboro Borough	Erie	UNT Boles Run
Edinboro Municipal Authority	Edinboro Borough	Erie	Conneauttee Creek
Greene Township Horseshoe Subdivision	Greene Township	Erie	Fourmile Creek
Greene Township Tate Road STP	Greene Township	Erie	UNT Fourmile Creek
Greene Township Elementary School	Greene Township	Erie	LeBoeuf Creek
Seneca High School	Greene Township	Erie	LeBoeuf Creek
Idyll Whyle Village MHP	McKean Township	Erie	UNT French Creek
Mill Village Elementary School	Mill Village Borough	Erie	Elk Creek
Union City Borough STP	Union City Borough	Erie	South Branch French Creek
Parson's MHP	Venango Township	Erie	UNT French Creek
Edinboro Mobile Home Village	Washington Township	Erie	UNT Conneauttee Creek
General McLane High School	Washington Township	Erie	UNT Conneauttee Creek
Imperial Point South	Washington Township	Erie	Darrows Creek
Lovett's Manufactured Homes	Washington Township	Erie	Darrows Creek
Washington Township Sew. Auth.	Washington Township	Erie	Darrows Creek
Windsor MHP	Washington Township	Erie	Little Conneauttee Creek
Waterford Borough Municipal Authority STP	Waterford Borough	Erie	Trout Run
Beemans MHP	Waterford Township	Erie	UNT Lake LeBoeuf
Rainbow Valley MHP	Waterford Township	Erie	LeBoeuf Creek
Thomas MHP	Waterford Township	Erie	Trout Run
Peaceful Rest Home	French Creek Township	Mercer	Foulk Run
Route 322 MHP	French Creek Township	Mercer	Powdermill Run
Lakeview Estates MHP	New Lebanon Township	Mercer	Mill Creek
Calumet (Reno Pkg. Plant)	Sugarcreek Borough	Venango	Allegheny River
Source: PA DEP (database still under construction)			

Appendix F

Mammals in the French Creek Watershed

Common Name	Scientific Name
Virginia opossum	*Didelphis virginiana*
masked shrew	*Sorex cinereus*
smoky shrew	*Sorex fumeus*
long-tailed shrew	*Sorex dispar* (questionable)
pygmy shrew	*Sorex hoyi*
northern short-tailed shrew	*Blarina brevicauda*
least shrew	*Cryptotis parva*
hairy-tailed mole	*Parascalops breweri*
star-nosed mole	*Condylura cristata*
little brown myotis	*Myotis lucifugus*
Keen's myotis	*Myotis keenii*
silver-haired bat	*Lasionycteris noctivagans*
eastern pipistrelle	*Pipistrellus subflavus*
big brown bat	*Eptesicus fuscus*
red bat	*Lasiurus borealis*
hoary bat	*Lasiurus cinereus*
eastern cottontail	*Sylvilagus floridanus*
snowshoe hare	*Lepus americanus*
eastern chipmunk	*Tamias striatus*
woodchuck	*Marmota monax*
gray squirrel	*Sciurus carolinensis*
fox squirrel	*Sciurus niger*
red squirrel	*Tamiasciurus hudsonicus*
southern flying squirrel	*Glaucomys volans*
northern flying squirrel	*Glaucomys sabrinus*
beaver	*Castor canadensis*
deer mouse	*Peromyscus maniculatus*
white-footed mouse	*Peromyscus leucopus*
southern red-backed vole	*Clethrionomys gapperi*
meadow vole	*Microtus pennsylvanicus*
woodland vole	*Microtus pinetorum*
southern bog lemming	*Synaptomys cooperi*
muskrat	*Ondatra zibethicus*
Norway rat	*Rattus norvegicus* (introduced)
house mouse	*Mus musculus* (introduced)
meadow jumping mouse	*Zapus hudsonius*
woodland jumping mouse	*Napaeozapus insignis*
porcupine	*Erethizon dorsatum*
coyote	*Canis latrans*
red fox	*Vulpes vulpes*

gray fox	*Urocyon cinereoargenteus*
black bear	*Ursus americanus*
raccoon	*Procyon lotor*
ermine	*Mustela erminea*
least weasel	*Mustela nivalis*
long-tailed weasel	*Mustela frenata*
mink	*Mustela vison*
striped skunk	*Mephitis mephitis*
river otter	*Lutra canadensis* (unconfirmed)
bobcat	*Felis rufus*
white-tailed deer	*Odocoileus virginianus*

Appendix G

Fish in the French Creek Watershed

Common Name	Scientific Name
rock bass	*Ambloplites rupestris*
yellow bullhead	*Ameiurus natalis*
brown bullhead	*Ameiurus nebulosus*
bowfin	*Amia calva*
eastern sand darter	*Ammocrypta pellucida*
central stoneroller	*Campostoma anomalum*
quillback	*Carpiodes cyprinus*
white sucker	*Catostomus commersoni*
redside dace	*Clinostomus elongates*
mottled sculpin	*Cottus bairdi*
brook stickleback	*Culea inconstans*
spotfin shiner	*Cyprinella spiloptera*
common carp	*Cyprinus carpio*
streamline chub	*Erimystax dissimilis*
gravel chub	*Erimystax x-punctatus*
grass pickerel	*Esox americanus vermiculatus*
northern pike	*Esox lucius*
muskellunge	*Esox masquinongy*
greenside darter	*Etheostoma blennoides*
rainbow darter	*Etheostoma caeruleum*
bluebreast darter	*Etheostoma camurum*
Iowa darter	*Etheostoma exile*
fantail darter	*Etheostoma flabellare*
spotted darter	*Etheostoma maculatum*
Johnny darter	*Etheostoma nigrum*
Tippecanoe darter	*Etheostoma tippecanoe*
variegate darter	*Etheostoma variatum*
banded darter	*Etheostoma zonale*
tonguetied minnow	*Exoglossum laurae*
banded killifish	*Fundulus diaphanus*
brassy minnow	*Hybognathus hankinsoni*
bigeye chub	*Hybopsis amblops*
northern hogsucker	*Hypentilium nigricans*
Ohio lamprey	*Ichthyomyzon bdellium*
mountain brook lamprey	*Ichthyomyzon greeleyi*
brook silverside	*Labidesthes sicculus*
American brook lamprey	*Lampetra appendix*
longear sunfish	*Lepomis megalotis*
green sunfish	*Lepomis cyanellus*
pumpkinseed	*Lepomis gibbosus*

warmouth	*Lepomis gulosus*
bluegill	*Lepomis macrochirus*
longnose gar	*Lepososteus osseus*
striped shiner	*Luxilus chrysocephalus*
common shiner	*Luxilus cornutus*
redfin shiner	*Lythrurus umbratilis*
pearl dace	*Margariscus margarita*
smallmouth bass	*Micropterus dolomieu*
largemouth bass	*Micropterus salmoides*
silver redhorse	*Moxostoma anisurum*
river redhorse	*Moxostoma carinatum*
black redhorse	*Moxostoma duquesni*
golden redhorse	*Moxostoma erythrurum*
shorthead redhorse	*Moxostoma macrolepidotum*
hornyhead chub	*Nocomis biggutatus*
river chub	*Nocomis micropogon*
golden shiner	*Notemigonus crysoleucas*
emerald shiner	*Notropis atherinoides*
silverjaw minnow	*Notropis buccatus*
blackchin shiner	*Notropis heterodon*
blacknose shiner	*Notropis heterolepis*
sand shiner	*Notropis ludibundus*
silver shiner	*Notropis photogenis*
rosyface shiner	*Notropis rubellus*
mimic shiner	*Notropis volucellus*
mountain madtom	*Noturus eleutherus*
stonecat	*Noturus flavus*
brindled madtom	*Noturus miurus*
northern madtom	*Noturus stigmosus*
rainbow trout	*Onchorhynchus mykiss*
pugnose minnow	*Opsopoeodus emiliae*
yellow perch	*Perca flavescens*
logperch	*Percina caprodes*
gilt darter	*Percina evides*
longhead darter	*Percina macrocephala*
blackside darter	*Percina maculata*
trout-perch	*Percopsis omiscomaycus*
southern redbelly dace	*Phoxinus erythrogaster*
bluntnose minnow	*Pimephales notatus*
fathead minnow	*Pimephales promelas*
white crappie	*Pomoxis annularis*
black crappie	*Pomoxis nigromaculatus*
blacknose dace	*Rhinichthys atratulus*
longnose dace	*Rhinichthys cataractae*
brown trout	*Salmo trutta*
brook trout	*Salvelinus fontinalis*

creek chub	*Semotilus atromaculatus*
walleye	*Stizostedion vitreum*
central mudminnow	*Umbra limi*

Appendix H

Pennsylvania Natural Diversity Inventory (PNDI)
Species of Special Concern in French Creek

SCIENTIFIC NAME	COMMON NAME	US	PA	PBS	SRANK	GRANK	COUNTY	WATERSHED	LAST
****Birds									
ARDEA HERODIAS	GREAT BLUE HERON				S3S4B,	G5	ERIE	WHEELER CREEK	1984
ASIO FLAMMEUS	SHORT-EARED OWL		PE	PE	S1B,S3	G5	CRAWFORD	MCMICHAEL RUN	1906
BARTRAMIA LONGICAUDA	UPLAND SANDPIPER		PT	PT	S1S2B	G5	ERIE	SIXMILE CREEK	1984
BOTAURUS LENTIGINOSUS	AMERICAN BITTERN		PE	PE	S1B	G4	CRAWFORD	CONNEAUT OUTLET	1890
BOTAURUS LENTIGINOSUS	AMERICAN BITTERN		PE	PE	S1B	G4	ERIE	LAKE PLEASANT OUTLET	1890
BOTAURUS LENTIGINOSUS	AMERICAN BITTERN		PE	PE	S1B	G4	CRAWFORD	CONNEAUT OUTLET	1982
CHLIDONIAS NIGER	BLACK TERN		PE	PE	S1B	G4	CRAWFORD	CONNEAUT OUTLET	1983
CHLIDONIAS NIGER	BLACK TERN		PE	PE	S1B	G4	CRAWFORD	CONNEAUT OUTLET	1989
CISTOTHORUS PALUSTRIS	MARSH WREN			CR	S2S3B	G5	CRAWFORD	CONNEAUT OUTLET	1982
CISTOTHORUS PLATENSIS	SEDGE WREN		PT	PT	S1B	G5	CRAWFORD	CONNEAUT OUTLET	1928
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	(PS:L	T PE	PE	S1S2B	G4	CRAWFORD	CUSSEWAGO CREEK	1996
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	(PS:L	T PE	PE	S1S2B	G4	CRAWFORD	LAKE CREEK	1998
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	(PS:L	T PE	PE	S1S2B	G4	CRAWFORD	CONNEAUT OUTLET	1992
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	(PS:L	T PE	PE	S1S2B	G4	CRAWFORD	CONNEAUT OUTLET	1983
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	(PS:L	T PE	PE	S1S2B	G4	CRAWFORD	CONNEAUT OUTLET	1998
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	(PS:L	T PE	PE	S1S2B	G4	ERIE	FRENCH CREEK	1998
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	(PS:L	T PE	PE	S1S2B	G4	CRAWFORD	CUSSEWAGO CREEK	1991
IXOBRYCHUS EXILIS	LEAST BITTERN		PE	PE	S1B	G5	CRAWFORD	CONNEAUT OUTLET	1982
IXOBRYCHUS EXILIS	LEAST BITTERN		PE	PE	S1B	G5	CRAWFORD	CONNEAUT OUTLET	1928
****Fish									
AMMOCRYPTA PELLUCIDA	EASTERN SAND DARTER		PE	PE	S1	G3	CRAWFORD	FRENCH CREEK	1991
AMMOCRYPTA PELLUCIDA	EASTERN SAND DARTER		PE	PE	S1	G3	CRAWFORD	FRENCH CREEK	1948
AMMOCRYPTA PELLUCIDA	EASTERN SAND DARTER		PE	PE	S1	G3	CRAWFORD	FRENCH CREEK	1993
AMMOCRYPTA PELLUCIDA	EASTERN SAND DARTER		PE	PE	S1	G3	ERIE	FRENCH CREEK	1991

ERIMYSTAX X-PUNCTATUS	GRAVEL CHUB	PE	PE	S1	G4	VENANGO	SUGAR CREEK		1939
ERIMYSTAX X-PUNCTATUS	GRAVEL CHUB	PE	PE	S1	G4	VENANGO	FRENCH CREEK	198?	
ERIMYSTAX X-PUNCTATUS	GRAVEL CHUB	PE	PE	S1	G4	VENANGO	FRENCH CREEK		1997
ETHEOSTOMA CAMURUM	BLUEBREAST DARTER	PT	PT	S2	G4	CRAWFORD	FRENCH CREEK		1986
ETHEOSTOMA CAMURUM	BLUEBREAST DARTER	PT	PT	S2	G4	VENANGO	FRENCH CREEK		1991
ETHEOSTOMA CAMURUM	BLUEBREAST DARTER	PT	PT	S2	G4	ERIE	FRENCH CREEK		1986
ETHEOSTOMA CAMURUM	BLUEBREAST DARTER	PT	PT	S2	G4	CRAWFORD	FRENCH CREEK		1992
ETHEOSTOMA CAMURUM	BLUEBREAST DARTER	PT	PT	S2	G4	VENANGO	FRENCH CREEK		1985
ETHEOSTOMA CAMURUM	BLUEBREAST DARTER	PT	PT	S2	G4	CRAWFORD	FRENCH CREEK		1959
ETHEOSTOMA CAMURUM	BLUEBREAST DARTER	PT	PT	S2	G4	ERIE	FRENCH CREEK		1935
ETHEOSTOMA CAMURUM	BLUEBREAST DARTER	PT	PT	S2	G4	MERCER	FRENCH CREEK		1985
ETHEOSTOMA EXILE	IOWA DARTER	PE	PE	S1	G5	ERIE	TROUT RUN		1977
ETHEOSTOMA EXILE	IOWA DARTER	PE	PE	S1	G5	ERIE	LAKE PLEASANT OUTLET		1995
ETHEOSTOMA MACULATUM	SPOTTED DARTER	PT	PT	S2	G2	ERIE	FRENCH CREEK		1985
ETHEOSTOMA MACULATUM	SPOTTED DARTER	PT	PT	S2	G2	CRAWFORD	FRENCH CREEK		1991
ETHEOSTOMA MACULATUM	SPOTTED DARTER	PT	PT	S2	G2	CRAWFORD	FRENCH CREEK		1966
ETHEOSTOMA MACULATUM	SPOTTED DARTER	PT	PT	S2	G2	ERIE	FRENCH CREEK		1987
ETHEOSTOMA MACULATUM	SPOTTED DARTER	PT	PT	S2	G2	VENANGO	FRENCH CREEK		1985
ETHEOSTOMA MACULATUM	SPOTTED DARTER	PT	PT	S2	G2	CRAWFORD	FRENCH CREEK		1985
ETHEOSTOMA MACULATUM	SPOTTED DARTER	PT	PT	S2	G2	MERCER	FRENCH CREEK		1987
ETHEOSTOMA MACULATUM	SPOTTED DARTER	PT	PT	S2	G2	ERIE	FRENCH CREEK		1935
ETHEOSTOMA MACULATUM	SPOTTED DARTER	PT	PT	S2	G2	VENANGO	FRENCH CREEK		1968
ETHEOSTOMA MACULATUM	SPOTTED DARTER	PT	PT	S2	G2	CRAWFORD	FRENCH CREEK		1985
ETHEOSTOMA TIPPECANOE	TIPPECANOE DARTER	PT	PT	S2	G3	CRAWFORD	FRENCH CREEK		1985
ETHEOSTOMA TIPPECANOE	TIPPECANOE DARTER	PT	PT	S2	G3	CRAWFORD	FRENCH CREEK		1987
ETHEOSTOMA TIPPECANOE	TIPPECANOE DARTER	PT	PT	S2	G3	MERCER	FRENCH CREEK		1986
ETHEOSTOMA TIPPECANOE	TIPPECANOE DARTER	PT	PT	S2	G3	VENANGO	FRENCH CREEK		1985
ETHEOSTOMA TIPPECANOE	TIPPECANOE DARTER	PT	PT	S2	G3	CRAWFORD	FRENCH CREEK		1991
ETHEOSTOMA TIPPECANOE	TIPPECANOE DARTER	PT	PT	S2	G3	CRAWFORD	FRENCH CREEK		1991
ETHEOSTOMA TIPPECANOE	TIPPECANOE DARTER	PT	PT	S2	G3	CRAWFORD	FRENCH CREEK		1992
ETHEOSTOMA TIPPECANOE	TIPPECANOE DARTER	PT	PT	S2	G3	VENANGO	FRENCH CREEK		1935
ETHEOSTOMA TIPPECANOE	TIPPECANOE DARTER	PT	PT	S2	G3	CRAWFORD	FRENCH CREEK		1977
ICHTHYOMYZON BDELLIUM	OHIO LAMPREY	PC	C	S2S3	G3G4	ERIE	FRENCH CREEK		1987
ICHTHYOMYZON BDELLIUM	OHIO LAMPREY	PC	C	S2S3	G3G4	ERIE	W. BR. FRENCH CR.		1968

ICHTHYOMYZON BDELLIUM	OHIO LAMPREY	PC	C	S2S3	G3G4	CRAWFORD	MUDDY CREEK		1967
ICHTHYOMYZON BDELLIUM	OHIO LAMPREY	PC	C	S2S3	G3G4	CRAWFORD	FRENCH CREEK		1999
ICHTHYOMYZON BDELLIUM	OHIO LAMPREY	PC	C	S2S3	G3G4	VENANGO	FRENCH CREEK		1968
ICHTHYOMYZON BDELLIUM	OHIO LAMPREY	PC	C	S2S3	G3G4	CRAWFORD	FRENCH CREEK		1987
ICHTHYOMYZON BDELLIUM	OHIO LAMPREY	PC	C	S2S3	G3G4	MERCER	FRENCH CREEK		1987
ICHTHYOMYZON BDELLIUM	OHIO LAMPREY	PC	C	S2S3	G3G4	ERIE	LE BOEUF CREEK	198?	
ICHTHYOMYZON BDELLIUM	OHIO LAMPREY	PC	C	S2S3	G3G4	CRAWFORD	WOODCOCK CREEK		1967
ICHTHYOMYZON BDELLIUM	OHIO LAMPREY	PC	C	S2S3	G3G4	CRAWFORD	FRENCH CREEK		1969
ICHTHYOMYZON GREELEYI	MOUNTAIN BROOK LAMPREY	PT	PT	S2	G3G4	ERIE	FRENCH CREEK		1937
ICHTHYOMYZON GREELEYI	MOUNTAIN BROOK LAMPREY	PT	PT	S2	G3G4	ERIE	S. BR. FRENCH CR.		1975
ICHTHYOMYZON GREELEYI	MOUNTAIN BROOK LAMPREY	PT	PT	S2	G3G4	CRAWFORD	FRENCH CREEK		1948
ICHTHYOMYZON GREELEYI	MOUNTAIN BROOK LAMPREY	PT	PT	S2	G3G4	CRAWFORD	MUDDY CREEK		1975
ICHTHYOMYZON GREELEYI	MOUNTAIN BROOK LAMPREY	PT	PT	S2	G3G4	CRAWFORD	WOODCOCK CREEK		1975
ICHTHYOMYZON GREELEYI	MOUNTAIN BROOK LAMPREY	PT	PT	S2	G3G4	ERIE	W. BR. FRENCH CR.		1975
LEPISOSTEUS OSSEUS	LONGNOSE GAR	PC	CR	S2S3	G5	CRAWFORD	CONNEAUT OUTLET		1938
LEPOMIS GULOSUS	WARMOUTH	PE	PE	S1S2	G5	ERIE	TROUT RUN		1992
LEPOMIS GULOSUS	WARMOUTH	PE	PE	S1S2	G5	ERIE	LAKE PLEASANT OUTLET		1971
LYTHRURUS UMBRATILIS	REDFIN SHINER	PE	PE	S2	G5	ERIE, CRAWFORD	CUSSEWAGO CREEK		1938
LYTHRURUS UMBRATILIS	REDFIN SHINER	PE	PE	S2	G5	CRAWFORD	CUSSEWAGO CREEK		1985
LYTHRURUS UMBRATILIS	REDFIN SHINER	PE	PE	S2	G5	CRAWFORD	CUSSEWAGO CREEK		1938
LYTHRURUS UMBRATILIS	REDFIN SHINER	PE	PE	S2	G5	CRAWFORD	CUSSEWAGO CREEK		1975
LYTHRURUS UMBRATILIS	REDFIN SHINER	PE	PE	S2	G5	CRAWFORD	CUSSEWAGO CREEK	198?	
LYTHRURUS UMBRATILIS	REDFIN SHINER	PE	PE	S2	G5	CRAWFORD	CUSSEWAGO CREEK	198?	
NOTROPIS HETERODON	BLACKCHIN SHINER	PE	PE	S1	G5	ERIE	LAKE PLEASANT OUTLET		1989
NOTROPIS HETERODON	BLACKCHIN SHINER	PE	PE	S1	G5	CRAWFORD	CONNEAUT OUTLET		1938
NOTROPIS HETEROLEPIS	BLACKNOSE SHINER		PX	SX	G5	CRAWFORD	CONNEAUT OUTLET		1938
NOTROPIS HETEROLEPIS	BLACKNOSE SHINER		PX	SX	G5	ERIE	FRENCH CREEK		1935
NOTURUS ELEUTHERUS	MOUNTAIN MADTOM	PE	PE	S1S2	G4	ERIE	FRENCH CREEK		1987
NOTURUS ELEUTHERUS	MOUNTAIN MADTOM	PE	PE	S1S2	G4	CRAWFORD	FRENCH CREEK		1991
NOTURUS ELEUTHERUS	MOUNTAIN MADTOM	PE	PE	S1S2	G4	MERCER	FRENCH CREEK		1987
NOTURUS MIURUS	BRINDLED MADTOM	PT	PT	S2	G5	CRAWFORD			1992
NOTURUS MIURUS	BRINDLED MADTOM	PT	PT	S2	G5	ERIE	FRENCH CREEK		1985
NOTURUS STIGMOSUS	NORTHERN MADTOM	PE	PE	S1	G3	CRAWFORD	FRENCH CREEK		1991
NOTURUS STIGMOSUS	NORTHERN MADTOM	PE	PE	S1	G3	MERCER	FRENCH CREEK		1947

NOTURUS STIGMOSUS	NORTHERN MADTOM	PE	PE	S1	G3	CRAWFORD	FRENCH CREEK		1959
PERCINA COPELANDI	CHANNEL DARTER	PT	PT	S1S2	G4	MCKEAN	POTATO CREEK		1985
PERCINA EVIDES	GILT DARTER	PT	PT	S1S2	G4	CRAWFORD	FRENCH CREEK		1987
PERCINA EVIDES	GILT DARTER	PT	PT	S1S2	G4	VENANGO	FRENCH CREEK	198?	
PERCINA EVIDES	GILT DARTER	PT	PT	S1S2	G4	CRAWFORD	FRENCH CREEK		1991
PERCINA EVIDES	GILT DARTER	PT	PT	S1S2	G4	ERIE	S. BR. FRENCH CR.		1995
PERCINA EVIDES	GILT DARTER	PT	PT	S1S2	G4	CRAWFORD	FRENCH CREEK		1991
PERCINA MACROCEPHALA	LONGHEAD DARTER	PT	PT	S2	G3	CRAWFORD	FRENCH CREEK		1985
PERCINA MACROCEPHALA	LONGHEAD DARTER	PT	PT	S2	G3	VENANGO	FRENCH CREEK		1991
PERCINA MACROCEPHALA	LONGHEAD DARTER	PT	PT	S2	G3	CRAWFORD			1998
PERCINA MACROCEPHALA	LONGHEAD DARTER	PT	PT	S2	G3	CRAWFORD	FRENCH CREEK		1991
PERCINA MACROCEPHALA	LONGHEAD DARTER	PT	PT	S2	G3	CRAWFORD	FRENCH CREEK		1991
PERCINA MACROCEPHALA	LONGHEAD DARTER	PT	PT	S2	G3	ERIE	FRENCH CREEK		1991
****Reptiles									
EMYDOIDEA BLANDINGII	BLANDING'S TURTLE	PC	PX	S1	G4	CRAWFORD	CONNEAUT OUTLET		1904
****Communities									
TSUGA CANADENSIS-MIXED MESIC HARDWOODS	EASTERN HEMLOCK MIXED MESIC HARDWOOD			S?	G?	CRAWFORD	WOODCOCK CREEK	NO D	
BASIN GRAMINOID-FORB FEN	BASIN GRAMINOID-FORB FEN			S1	G?	ERIE	LEBOEUF CREEK		1995
BASIN GRAMINOID-FORB FEN	BASIN GRAMINOID-FORB FEN			S1	G?	ERIE	E. BR. LEBOEUF CR.		1995
BASIN GRAMINOID-FORB FEN	BASIN GRAMINOID-FORB FEN			S1	G?	ERIE	LAKE PLEASANT OUTLET		1986
BASIN GRAMINOID-FORB FEN	BASIN GRAMINOID-FORB FEN			S1	G?	ERIE	CONNEAUTTEE CREEK		1995
CALCAREOUS MARSH	CALCAREOUS MARSH			S1	G?	ERIE	LEBOEUF CREEK		1987
HILLSIDE GRAMINOID-FORB FEN	HILLSIDE GRAMINOID-FORB FEN			S1	G?	ERIE	HUBBLE RUN		1995
HILLSIDE GRAMINOID-FORB FEN	HILLSIDE GRAMINOID-FORB FEN			S1	G?	ERIE	BENTLY RUN		1995
NORTHERN APPALACHIAN CALCAREOUS SEEP CO	NORTHERN APPALACHIAN CALCAREOUS SEEP			S1	G?	ERIE	BEAVER RUN		1986
OLIGOTROPHIC GLACIAL KETTLEHOLE BOG	GLACIAL BOG			S3	G?	ERIE	ALDER RUN		1987
OLIGOTROPHIC GLACIAL KETTLEHOLE BOG	GLACIAL BOG			S3	G?	MERCER		NO D	

OLIGOTROPHIC GLACIAL KETTLEHOLE BOG	GLACIAL BOG		S3	G?	CRAWFORD	INLET RUN	1985
POOR FEN	POOR FEN		S1	G?	CRAWFORD	INLET RUN	1995
ROBUST EMERGENT MARSH	ROBUST EMERGENT MARSH		S2	G?	CRAWFORD	CONNEAUT OUTLET	1982
SHRUB FEN	SHRUB FEN		S1	G2G3	ERIE	W. BR. FRENCH CR.	1995
SHRUB FEN	SHRUB FEN		S1	G2G3	CRAWFORD	MOHAWK RUN	1995
****Habitats							
CALCAREOUS GLACIAL LAKE	CALCAREOUS GLACIAL LAKE		S1	G?	ERIE	LAKE PLEASANT OUTLET	1989
HIGH-GRADIENT CLEARWATER CREEK	HIGH-GRADIENT CLEARWATER CREEK		S3	G?	ERIE	BEAVER RUN 199?	
MEDIUM-GRADIENT CLEARWATER RIVER	MEDIUM-GRADIENT CLEARWATER RIVER		S?	G?	CRAWFORD	FRENCH CREEK	1988
MEDIUM-GRADIENT CLEARWATER RIVER	MEDIUM-GRADIENT CLEARWATER RIVER		S?	G?	V, C, E, M	FRENCH CREEK	1988
****Insects							
AESHNA MUTATA	SPRING BLUE DARNER		S1	G3G4	CRAWFORD	CONNEAUT OUTLET	1995
LYCAENA EPIXANTHE	BOG COPPER		S2	G4G5	ERIE	HUBBEL RUN	1985
NASIAESCHNA PENTACANTHA	BLUE-NOSED DARNER		S2	G5	MERCER	FRENCH CREEK	1957
****Mussels							
AMBLEMA PLICATA	THREE-RIDGE	PT	S2S3	G5	ERIE, CRAWFORD	FRENCH CREEK	1993
AMBLEMA PLICATA	THREE-RIDGE	PT	S2S3	G5	VENANGO	FRENCH CREEK	1993
AMBLEMA PLICATA	THREE-RIDGE	PT	S2S3	G5	CRAWFORD	FRENCH CREEK	1993
AMBLEMA PLICATA	THREE-RIDGE	PT	S2S3	G5	VENANGO	FRENCH CREEK	1993
AMBLEMA PLICATA	THREE-RIDGE	PT	S2S3	G5	VENANGO	FRENCH CREEK	1993
AMBLEMA PLICATA	THREE-RIDGE	PT	S2S3	G5	CRAWFORD	FRENCH CREEK	1993
AMBLEMA PLICATA	THREE-RIDGE	PT	S2S3	G5	CRAWFORD	FRENCH CREEK	1993
AMBLEMA PLICATA	THREE-RIDGE	PT	S2S3	G5	CRAWFORD	FRENCH CREEK	1993
ANODONTOIDES FERUSSACIANUS	CYLINDRICAL PAPERSHELL	PE	S2S3	G5	ERIE	FRENCH CREEK	1993
ANODONTOIDES FERUSSACIANUS	CYLINDRICAL PAPERSHELL	PE	S2S3	G5	ERIE, CRAWFORD	FRENCH CREEK	1993
ANODONTOIDES FERUSSACIANUS	CYLINDRICAL PAPERSHELL	PE	S2S3	G5	ERIE	LE BOEUF CREEK	1993

ANODONTOIDES FERUSSACIANUS	CYLINDRICAL PAPERSHELL			PE	S2S3	G5	CRAWFORD	E. BR. LEBOEUF CR.	1993
ANODONTOIDES FERUSSACIANUS	CYLINDRICAL PAPERSHELL			PE	S2S3	G5	CRAWFORD	FRENCH CREEK	1993
ANODONTOIDES FERUSSACIANUS	CYLINDRICAL PAPERSHELL			PE	S2S3	G5	CRAWFORD	FRENCH CREEK	1993
ANODONTOIDES FERUSSACIANUS	CYLINDRICAL PAPERSHELL			PE	S2S3	G5	ERIE	S. BR. FRENCH CR.	1993
ANODONTOIDES FERUSSACIANUS	CYLINDRICAL PAPERSHELL			PE	S2S3	G5	CRAWFORD	FRENCH CREEK	1993
ANODONTOIDES FERUSSACIANUS	CYLINDRICAL PAPERSHELL			PE	S2S3	G5	CRAWFORD	CARR RUN	1993
ANODONTOIDES FERUSSACIANUS	CYLINDRICAL PAPERSHELL			PE	S2S3	G5	CRAWFORD	FRENCH CREEK	1993
ANODONTOIDES FERUSSACIANUS	CYLINDRICAL PAPERSHELL			PE	S2S3	G5	CRAWFORD	TORRY RUN	1993
ANODONTOIDES FERUSSACIANUS	CYLINDRICAL PAPERSHELL			PE	S2S3	G5	ERIE	S. BR. FRENCH CR.	1993
ANODONTOIDES FERUSSACIANUS	CYLINDRICAL PAPERSHELL			PE	S2S3	G5	ERIE	FRENCH CREEK	1993
ANODONTOIDES FERUSSACIANUS	CYLINDRICAL PAPERSHELL			PE	S2S3	G5	ERIE	W. BR. FRENCH CR.	1993
CYCLONAIAS TUBERCULATA	PURPLE WARTYBACK			PX	SX	G5	VENANGO	FRENCH CREEK	1919
EPIOBLASMA TORULOSA RANGIANA	NORTHERN RIFFLESHELL	LE	PE	PE	S1S2	G2T2	CRAWFORD	FRENCH CREEK	1919
EPIOBLASMA TORULOSA RANGIANA	NORTHERN RIFFLESHELL	LE	PE	PE	S1S2	G2T2	ERIE, CRAWFORD	FRENCH CREEK	1993
EPIOBLASMA TORULOSA RANGIANA	NORTHERN RIFFLESHELL	LE	PE	PE	S1S2	G2T2	CRAWFORD	FRENCH CREEK	1993
EPIOBLASMA TORULOSA RANGIANA	NORTHERN RIFFLESHELL	LE	PE	PE	S1S2	G2T2	VENANGO	FRENCH CREEK	1993
EPIOBLASMA TORULOSA RANGIANA	NORTHERN RIFFLESHELL	LE	PE	PE	S1S2	G2T2	VENANGO	FRENCH CREEK	1993
EPIOBLASMA TORULOSA RANGIANA	NORTHERN RIFFLESHELL	LE	PE	PE	S1S2	G2T2	CRAWFORD	FRENCH CREEK	1908
EPIOBLASMA TORULOSA RANGIANA	NORTHERN RIFFLESHELL	LE	PE	PE	S1S2	G2T2	VENANGO	FRENCH CREEK	1988
EPIOBLASMA TORULOSA RANGIANA	NORTHERN RIFFLESHELL	LE	PE	PE	S1S2	G2T2	VENANGO	FRENCH CREEK	1993

EPIOBLASMA TORULOSA RANGIANA	NORTHERN RIFFLESHELL	LE	PE	PE	S1S2	G2T2	CRAWFORD	FRENCH CREEK	1993
EPIOBLASMA TORULOSA RANGIANA	NORTHERN RIFFLESHELL	LE	PE	PE	S1S2	G2T2	CRAWFORD	FRENCH CREEK	1986
EPIOBLASMA TORULOSA RANGIANA	NORTHERN RIFFLESHELL	LE	PE	PE	S1S2	G2T2	CRAWFORD	FRENCH CREEK	1993
EPIOBLASMA TORULOSA RANGIANA	NORTHERN RIFFLESHELL	LE	PE	PE	S1S2	G2T2	CRAWFORD	FRENCH CREEK	1993
EPIOBLASMA TORULOSA RANGIANA	NORTHERN RIFFLESHELL	LE	PE	PE	S1S2	G2T2	ERIE	FRENCH CREEK	1993
EPIOBLASMA TORULOSA RANGIANA	NORTHERN RIFFLESHELL	LE	PE	PE	S1S2	G2T2	CRAWFORD	FRENCH CREEK	1993
EPIOBLASMA TORULOSA RANGIANA	NORTHERN RIFFLESHELL	LE	PE	PE	S1S2	G2T2	CRAWFORD	FRENCH CREEK	1993
EPIOBLASMA TRIQUETRA	SNUFFBOX			PE	S1	G3	CRAWFORD	FRENCH CREEK	1993
EPIOBLASMA TRIQUETRA	SNUFFBOX			PE	S1	G3	CRAWFORD	FRENCH CREEK	1993
EPIOBLASMA TRIQUETRA	SNUFFBOX			PE	S1	G3	CRAWFORD	FRENCH CREEK	1993
EPIOBLASMA TRIQUETRA	SNUFFBOX			PE	S1	G3	CRAWFORD	FRENCH CREEK	1919
EPIOBLASMA TRIQUETRA	SNUFFBOX			PE	S1	G3	VENANGO	FRENCH CREEK	1988
EPIOBLASMA TRIQUETRA	SNUFFBOX			PE	S1	G3	ERIE	LEBOEUF CREEK	1988
EPIOBLASMA TRIQUETRA	SNUFFBOX			PE	S1	G3	VENANGO	FRENCH CREEK	1993
EPIOBLASMA TRIQUETRA	SNUFFBOX			PE	S1	G3	CRAWFORD	FRENCH CREEK	1993
EPIOBLASMA TRIQUETRA	SNUFFBOX			PE	S1	G3	CRAWFORD	CONNEAUT OUTLET	1919
EPIOBLASMA TRIQUETRA	SNUFFBOX			PE	S1	G3	ERIE	W. BR. FRENCH CR.	1993
EPIOBLASMA TRIQUETRA	SNUFFBOX			PE	S1	G3	ERIE	W. BR. FRENCH CR.	1993
EPIOBLASMA TRIQUETRA	SNUFFBOX			PE	S1	G3	CRAWFORD	FRENCH CREEK	1919
EPIOBLASMA TRIQUETRA	SNUFFBOX			PE	S1	G3	ERIE	FRENCH CREEK	1993
EPIOBLASMA TRIQUETRA	SNUFFBOX			PE	S1	G3	ERIE, CRAWFORD	FRENCH CREEK	1993
EPIOBLASMA TRIQUETRA	SNUFFBOX			PE	S1	G3	CRAWFORD	FRENCH CREEK	1993
EPIOBLASMA TRIQUETRA	SNUFFBOX			PE	S1	G3	CRAWFORD	FRENCH CREEK	1993
FUSCONAIA SUBROTUNDA	LONG-SOLID			PE	S1	G3	CRAWFORD	FRENCH CREEK	1972
FUSCONAIA SUBROTUNDA	LONG-SOLID			PE	S1	G3	ERIE	FRENCH CREEK	1993
FUSCONAIA SUBROTUNDA	LONG-SOLID			PE	S1	G3	CRAWFORD	FRENCH CREEK	1919
FUSCONAIA SUBROTUNDA	LONG-SOLID			PE	S1	G3	CRAWFORD	FRENCH CREEK	1993
FUSCONAIA SUBROTUNDA	LONG-SOLID			PE	S1	G3	VENANGO	FRENCH CREEK	1993
FUSCONAIA SUBROTUNDA	LONG-SOLID			PE	S1	G3	CRAWFORD	CONNEAUT OUTLET	1919

FUSCONAIA SUBROTUNDA	LONG-SOLID			PE	S1	G3	VENANGO	FRENCH CREEK	1993
FUSCONAIA SUBROTUNDA	LONG-SOLID			PE	S1	G3	ERIE, CRAWFORD	FRENCH CREEK	1993
FUSCONAIA SUBROTUNDA	LONG-SOLID			PE	S1	G3	CRAWFORD	FRENCH CREEK	1919
FUSCONAIA SUBROTUNDA	LONG-SOLID			PE	S1	G3	CRAWFORD	FRENCH CREEK	1919
LASMIGONA COMPLANATA	WHITE HEELSPLITTER			PE	S1	G5	CRAWFORD	CONNEAUTEE CREEK	1986
LASMIGONA COMPLANATA	WHITE HEELSPLITTER			PE	S1	G5	ERIE	LEBOEF CREEK	1988
LASMIGONA COMPLANATA	WHITE HEELSPLITTER			PE	S1	G5	CRAWFORD	CONNEAUT OUTLET	1988
LASMIGONA COMPRESSA	CREEK HEELSPLITTER			PE	S2S3	G5	ERIE, CRAWFORD	FRENCH CREEK	1993
LASMIGONA COMPRESSA	CREEK HEELSPLITTER			PE	S2S3	G5	CRAWFORD	FRENCH CREEK	1993
LASMIGONA COMPRESSA	CREEK HEELSPLITTER			PE	S2S3	G5	CRAWFORD	FRENCH CREEK	1993
LASMIGONA COMPRESSA	CREEK HEELSPLITTER			PE	S2S3	G5	CRAWFORD	CARR RUN	1993
LASMIGONA COMPRESSA	CREEK HEELSPLITTER			PE	S2S3	G5	ERIE	S. BR. FRENCH CR.	1993
LASMIGONA COMPRESSA	CREEK HEELSPLITTER			PE	S2S3	G5	CRAWFORD	FRENCH CREEK	1993
LASMIGONA COMPRESSA	CREEK HEELSPLITTER			PE	S2S3	G5	ERIE		1993
LASMIGONA COMPRESSA	CREEK HEELSPLITTER			PE	S2S3	G5	VENANGO	FRENCH CREEK	1993
LASMIGONA COMPRESSA	CREEK HEELSPLITTER			PE	S2S3	G5	CRAWFORD	MUDDY CREEK	1995
LASMIGONA COMPRESSA	CREEK HEELSPLITTER			PE	S2S3	G5	ERIE	FRENCH CREEK	1993
LASMIGONA COMPRESSA	CREEK HEELSPLITTER			PE	S2S3	G5	CRAWFORD	LITTLE SUGAR CREEK	1993
LIGUMIA NASUTA	EASTERN PONDMUSSEL				S1	G4G5	CRAWFORD	CONNEAUT OUTLET	1988
PLEUROBEMA CLAVA	CLUBSHELL	LE	PE	PE	S1S2	G2	CRAWFORD	FRENCH CREEK	1977
PLEUROBEMA CLAVA	CLUBSHELL	LE	PE	PE	S1S2	G2	ERIE, CRAWFORD	FRENCH CREEK	1993
PLEUROBEMA CLAVA	CLUBSHELL	LE	PE	PE	S1S2	G2	CRAWFORD	MUDDY CREEK	1995
PLEUROBEMA CLAVA	CLUBSHELL	LE	PE	PE	S1S2	G2	CRAWFORD	FRENCH CREEK	1993
PLEUROBEMA CLAVA	CLUBSHELL	LE	PE	PE	S1S2	G2	CRAWFORD	FRENCH CREEK	1919
PLEUROBEMA CLAVA	CLUBSHELL	LE	PE	PE	S1S2	G2	CRAWFORD	FRENCH CREEK	1919
PLEUROBEMA CLAVA	CLUBSHELL	LE	PE	PE	S1S2	G2	VENANGO	FRENCH CREEK	1993
PLEUROBEMA CLAVA	CLUBSHELL	LE	PE	PE	S1S2	G2	CRAWFORD	FRENCH CREEK	1993
PLEUROBEMA CLAVA	CLUBSHELL	LE	PE	PE	S1S2	G2	VENANGO	FRENCH CREEK	1993
PLEUROBEMA CLAVA	CLUBSHELL	LE	PE	PE	S1S2	G2	ERIE	FRENCH CREEK	1993
PLEUROBEMA CLAVA	CLUBSHELL	LE	PE	PE	S1S2	G2	CRAWFORD	CONNEAUT OUTLET	1988
PLEUROBEMA CLAVA	CLUBSHELL	LE	PE	PE	S1S2	G2	ERIE	LEBOEUF CREEK	1988
PLEUROBEMA CLAVA	CLUBSHELL	LE	PE	PE	S1S2	G2	CRAWFORD	MUDDY CREEK	196?
PLEUROBEMA CLAVA	CLUBSHELL	LE	PE	PE	S1S2	G2	CRAWFORD	FRENCH CREEK	1993
PLEUROBEMA CLAVA	CLUBSHELL	LE	PE	PE	S1S2	G2	CRAWFORD	FRENCH CREEK	1993

PLEUROBEMA CLAVA	CLUBSHELL	LE	PE	PE	S1S2	G2	CRAWFORD	FRENCH CREEK	1919
PLEUROBEMA CLAVA	CLUBSHELL	LE	PE	PE	S1S2	G2	CRAWFORD	CONNEAUTTEE CREEK	1986
PLEUROBEMA SINTOXIA	ROUND PIGTOE			PE	S2	G4	CRAWFORD	FRENCH CREEK	1993
PLEUROBEMA SINTOXIA	ROUND PIGTOE			PE	S2	G4	VENANGO	FRENCH CREEK	1993
PLEUROBEMA SINTOXIA	ROUND PIGTOE			PE	S2	G4	VENANGO	FRENCH CREEK	1993
PLEUROBEMA SINTOXIA	ROUND PIGTOE			PE	S2	G4	CRAWFORD	FRENCH CREEK	1993
PLEUROBEMA SINTOXIA	ROUND PIGTOE			PE	S2	G4	ERIE, CRAWFORD	FRENCH CREEK	1993
PLEUROBEMA SINTOXIA	ROUND PIGTOE			PE	S2	G4	ERIE	W. BR. FRENCH CR.	1993
PLEUROBEMA SINTOXIA	ROUND PIGTOE			PE	S2	G4	ERIE	FRENCH CREEK	1993
PLEUROBEMA SINTOXIA	ROUND PIGTOE			PE	S2	G4	ERIE	W. BR. FRENCH CR.	1993
PLEUROBEMA SINTOXIA	ROUND PIGTOE			PE	S2	G4	VENANGO	FRENCH CREEK	1993
PLEUROBEMA SINTOXIA	ROUND PIGTOE			PE	S2	G4	CRAWFORD	FRENCH CREEK	1993
PLEUROBEMA SINTOXIA	ROUND PIGTOE			PE	S2	G4	CRAWFORD	FRENCH CREEK	1993
PLEUROBEMA SINTOXIA	ROUND PIGTOE			PE	S2	G4	CRAWFORD	FRENCH CREEK	1993
POTAMILUS ALATUS	PINK HEELSPLITTER			PT	S2	G5	CRAWFORD	FRENCH CREEK	1971
QUADRULA CYLINDRICA	RABBITSFOOT	(PS)		PE	S1	G3	VENANGO	FRENCH CREEK	1993
QUADRULA CYLINDRICA	RABBITSFOOT	(PS)		PE	S1	G3	CRAWFORD		1993
QUADRULA CYLINDRICA	RABBITSFOOT	(PS)		PE	S1	G3	CRAWFORD	FRENCH CREEK	1908
QUADRULA CYLINDRICA	RABBITSFOOT	(PS)		PE	S1	G3	VENANGO	FRENCH CREEK	1993
QUADRULA CYLINDRICA	RABBITSFOOT	(PS)		PE	S1	G3	CRAWFORD	FRENCH CREEK	1993
QUADRULA CYLINDRICA	RABBITSFOOT	(PS)		PE	S1	G3	CRAWFORD	FRENCH CREEK	1993
QUADRULA CYLINDRICA	RABBITSFOOT	(PS)		PE	S1	G3	CRAWFORD	FRENCH CREEK	1993
QUADRULA CYLINDRICA	RABBITSFOOT	(PS)		PE	S1	G3	VENANGO	FRENCH CREEK	1993
QUADRULA CYLINDRICA	RABBITSFOOT	(PS)		PE	S1	G3	CRAWFORD	FRENCH CREEK	1993
QUADRULA CYLINDRICA	RABBITSFOOT	(PS)		PE	S1	G3	CRAWFORD	FRENCH CREEK	1993
QUADRULA CYLINDRICA	RABBITSFOOT	(PS)		PE	S1	G3	ERIE, CRAWFORD	FRENCH CREEK	1993
QUADRULA CYLINDRICA	RABBITSFOOT	(PS)		PE	S1	G3	CRAWFORD	FRENCH CREEK	1908
SIMPSONAIAS AMBIGUA	SALAMANDER MUSSEL			CU	S1?	G3	CRAWFORD	FRENCH CREEK	1985
TOXOLASMA PARVUM	LILLIPUT			PE	S1	G5	CRAWFORD	CONNEAUT OUTLET	1909
VILLOSA FABALIS	RAYED BEAN MUSSEL			PE	S1S2	G1G2	VENANGO	FRENCH CREEK	1993
VILLOSA FABALIS	RAYED BEAN MUSSEL			PE	S1S2	G1G2	CRAWFORD	FRENCH CREEK	1919
VILLOSA FABALIS	RAYED BEAN MUSSEL			PE	S1S2	G1G2	VENANGO	FRENCH CREEK	1993
VILLOSA FABALIS	RAYED BEAN MUSSEL			PE	S1S2	G1G2	CRAWFORD	FRENCH CREEK	1993
VILLOSA FABALIS	RAYED BEAN MUSSEL			PE	S1S2	G1G2	VENANGO	FRENCH CREEK	1993

VILLOSA FABALIS	RAYED BEAN MUSSEL			PE	S1S2	G1G2	VENANGO	FRENCH CREEK	1993
VILLOSA FABALIS	RAYED BEAN MUSSEL			PE	S1S2	G1G2	ERIE	FRENCH CREEK	1993
VILLOSA FABALIS	RAYED BEAN MUSSEL			PE	S1S2	G1G2	CRAWFORD	FRENCH CREEK	1993
VILLOSA FABALIS	RAYED BEAN MUSSEL			PE	S1S2	G1G2	ERIE, CRAWFORD	FRENCH CREEK	1993
VILLOSA FABALIS	RAYED BEAN MUSSEL			PE	S1S2	G1G2	CRAWFORD	FRENCH CREEK	1993
VILLOSA FABALIS	RAYED BEAN MUSSEL			PE	S1S2	G1G2	CRAWFORD	FRENCH CREEK	1993
VILLOSA FABALIS	RAYED BEAN MUSSEL			PE	S1S2	G1G2	CRAWFORD	FRENCH CREEK	1993
VILLOSA FABALIS	RAYED BEAN MUSSEL			PE	S1S2	G1G2	CRAWFORD	FRENCH CREEK	1993
VILLOSA FABALIS	RAYED BEAN MUSSEL			PE	S1S2	G1G2	VENANGO	FRENCH CREEK	1993
VILLOSA IRIS	RAINBOW MUSSEL			PE	S1	G5	VENANGO	FRENCH CREEK	1993
VILLOSA IRIS	RAINBOW MUSSEL			PE	S1	G5	ERIE	FRENCH CREEK	1993
VILLOSA IRIS	RAINBOW MUSSEL			PE	S1	G5	VENANGO	FRENCH CREEK	1972
VILLOSA IRIS	RAINBOW MUSSEL			PE	S1	G5	VENANGO	FRENCH CREEK	1993
VILLOSA IRIS	RAINBOW MUSSEL			PE	S1	G5	CRAWFORD	FRENCH CREEK	1919
VILLOSA IRIS	RAINBOW MUSSEL			PE	S1	G5	ERIE	LEBOEF CREEK	1919
VILLOSA IRIS	RAINBOW MUSSEL			PE	S1	G5	ERIE	W. BR. FRENCH CR.	1993

****Vascular Plants

ALISMA TRIVIALE	BROAD-LEAVED WATER-PLANTAIN		PE	PE	S1	G5	CRAWFORD	ERIE EXTENSION CANAL	1958
ALOPECURUS AEQUALIS	SHORT-AWN FOXTAIL	(PS)	N	TU	S3	G5	ERIE	S. BR. FRENCH CR.	1949
ALOPECURUS AEQUALIS	SHORT-AWN FOXTAIL	(PS)	N	TU	S3	G5	ERIE	LE BOEUF CREEK	1999
ANDROMEDA POLIFOLIA	BOG-ROSEMARY		PR	PR	S3	G5	ERIE	FRENCH CREEK	1953
ARCTOSTAPHYLOS UVA-URSI	BEARBERRY MANZANITA		PX	PX	SX	G5	CRAWFORD	CONNEAUT CREEK	1930
ARETHUSA BULBOSA	SWAMP-PINK		PE	PE	S1	G4	ERIE	HUBBLE RUN	1976
ARETHUSA BULBOSA	SWAMP-PINK		PE	PE	S1	G4	CRAWFORD	INLET RUN	1882
ARETHUSA BULBOSA	SWAMP-PINK		PE	PE	S1	G4	ERIE	HUBBEL RUN	1997
ARETHUSA BULBOSA	SWAMP-PINK		PE	PE	S1	G4	ERIE	LEBOEUF CREEK	1953
ASTER BOREALIS	RUSH ASTER		PE	PE	S1	G5	ERIE	SHENANGO CREEK	1988
ASTER BOREALIS	RUSH ASTER		PE	PE	S1	G5	CRAWFORD	INLET RUN	1993
ASTER BOREALIS	RUSH ASTER		PE	PE	S1	G5	ERIE	LEBOEUF CREEK	1903
ASTER BOREALIS	RUSH ASTER		PE	PE	S1	G5	ERIE	LAKE PLEASANT OUTLET	1987
ASTER PRAEALTUS	VEINY-LINED ASTER		N	TU	S3	G5	CRAWFORD	CUSSEWAGO CREEK	1997
ASTER PUNICEUS VAR FIRMUS	FIRM ASTER		TU	PT	S2	G5T5	CRAWFORD	MUDDY CREEK	1994

ASTER PUNICEUS VAR FIRMUS	FIRM ASTER	TU	PT	S2	G5T5	CRAWFORD	ADSIT RUN	1988
ASTER PUNICEUS VAR FIRMUS	FIRM ASTER	TU	PT	S2	G5T5	CRAWFORD	ERIE EXTENSION CANAL	1993
ASTER PUNICEUS VAR FIRMUS	FIRM ASTER	TU	PT	S2	G5T5	CRAWFORD	CONNEAUT OUTLET	1993
ASTER PUNICEUS VAR FIRMUS	FIRM ASTER	TU	PT	S2	G5T5	CRAWFORD	CONNEAUT OUTLET	1997
ASTER PUNICEUS VAR FIRMUS	FIRM ASTER	TU	PT	S2	G5T5	CRAWFORD	INLET RUN	1993
ASTER PUNICEUS VAR FIRMUS	FIRM ASTER	TU	PT	S2	G5T5	CRAWFORD	CONNEAUT OUTLET	1997
BIDENS DISCOIDEA	SMALL BEGGAR-TICKS	N	PR	S3	G5	CRAWFORD	CONNEAUT OUTLET	1998
BIDENS LAEVIS	BEGGAR-TICKS	N	TU	S3	G5	CRAWFORD	CONNEAUT OUTLET	1868
CARDAMINE PRATENSIS VAR PALUSTRIS	CUCKOOFLOWER	PE	TU	S1	G5T5	CRAWFORD	INLET RUN	1994
CARDAMINE PRATENSIS VAR PALUSTRIS	CUCKOOFLOWER	PE	TU	S1	G5T5	ERIE	CONNEAUT OUTLET	1982
CARDAMINE PRATENSIS VAR PALUSTRIS	CUCKOOFLOWER	PE	TU	S1	G5T5	ERIE	LAKE PLEASANT OUTLET	1992
CARDAMINE PRATENSIS VAR PALUSTRIS	CUCKOOFLOWER	PE	TU	S1	G5T5	CRAWFORD	FRENCH CREEK	1982
CAREX ALATA	BROAD-WINGED SEDGE	PT	PT	S2	G5	CRAWFORD	ERIE EXTENSION CANAL	1997
CAREX ALATA	BROAD-WINGED SEDGE	PT	PT	S2	G5	ERIE	LAKE PLEASANT OUTLET	1987
CAREX ALATA	BROAD-WINGED SEDGE	PT	PT	S2	G5	ERIE	SHENANGO CREEK	1988
CAREX ALATA	BROAD-WINGED SEDGE	PT	PT	S2	G5	CRAWFORD	INLET RUN	1993
CAREX ALATA	BROAD-WINGED SEDGE	PT	PT	S2	G5	CRAWFORD	ERIE EXTENSION CANAL	1993
CAREX ALATA	BROAD-WINGED SEDGE	PT	PT	S2	G5	ERIE	E. BR. LE BOEUF CR.	1991
CAREX ALATA	BROAD-WINGED SEDGE	PT	PT	S2	G5	CRAWFORD	CONNEAUT OUTLET	1998
CAREX ALATA	BROAD-WINGED SEDGE	PT	PT	S2	G5	CRAWFORD	CONNEAUT OUTLET	1988
CAREX AUREA	GOLDEN-FRUITED SEDGE	PE	PE	S1	G5	ERIE	W. BR. FRENCH CR.	1994
CAREX BEBBII	BEBB'S SEDGE	PE	PE	S1	G5	ERIE	LE BOEUF CREEK	1994
CAREX BEBBII	BEBB'S SEDGE	PE	PE	S1	G5	ERIE	E. BR. LE BOEUF CR.	1991
CAREX BEBBII	BEBB'S SEDGE	PE	PE	S1	G5	ERIE	LE BOEUF CREEK	1997
CAREX BEBBII	BEBB'S SEDGE	PE	PE	S1	G5	ERIE	E. BR. LE BOEUF CR.	1991
CAREX CRYPTOLEPIS	NORTHEASTERN SEDGE	PT	PE	S1	G4	CRAWFORD	CONNEAUT OUTLET	1869
CAREX CRYPTOLEPIS	NORTHEASTERN SEDGE	PT	PE	S1	G4	CRAWFORD	INLET RUN	1993
CAREX DIANDRA	LESSER PANICLED SEDGE	PT	PT	S2	G5	ERIE	LAKE PLEASANT OUTLET	1987
CAREX DIANDRA	LESSER PANICLED SEDGE	PT	PT	S2	G5	CRAWFORD	ERIE EXTENSION CANAL	1993
CAREX DIANDRA	LESSER PANICLED SEDGE	PT	PT	S2	G5	CRAWFORD	CONNEAUT OUTLET	1988
CAREX DIANDRA	LESSER PANICLED SEDGE	PT	PT	S2	G5	ERIE	SHENANGO CREEK	1988

CAREX DIANDRA	LESSER PANICLED SEDGE	PT	PT	S2	G5	ERIE	E. BR. LE BOEUF CR.	1992
CAREX DIANDRA	LESSER PANICLED SEDGE	PT	PT	S2	G5	ERIE	LE BOEUF CREEK	1997
CAREX DIANDRA	LESSER PANICLED SEDGE	PT	PT	S2	G5	CRAWFORD	MARSH RUN	1993
CAREX DIANDRA	LESSER PANICLED SEDGE	PT	PT	S2	G5	ERIE	E. BR. LE BOEUF CR.	1991
CAREX DIANDRA	LESSER PANICLED SEDGE	PT	PT	S2	G5	ERIE	HUBBEL RUN	1991
CAREX DISPERMA	SOFT-LEAVED SEDGE	PR	PR	S3	G5	ERIE	SHENANGO CREEK	1989
CAREX DISPERMA	SOFT-LEAVED SEDGE	PR	PR	S3	G5	ERIE	E. BR. LE BOEUF CR.	1991
CAREX DISPERMA	SOFT-LEAVED SEDGE	PR	PR	S3	G5	ERIE	LE BOEUF CREEK	1990
CAREX DISPERMA	SOFT-LEAVED SEDGE	PR	PR	S3	G5	CRAWFORD	FRENCH CREEK	1927
CAREX DISPERMA	SOFT-LEAVED SEDGE	PR	PR	S3	G5	ERIE	ALDER RUN	1987
CAREX DISPERMA	SOFT-LEAVED SEDGE	PR	PR	S3	G5	CRAWFORD	MARSH RUN	1992
CAREX FLAVA	YELLOW SEDGE	PT	PT	S2	G5	CRAWFORD	INLET RUN	1884
CAREX FLAVA	YELLOW SEDGE	PT	PT	S2	G5	ERIE	E. BR. LE BOEUF CR.	1991
CAREX FLAVA	YELLOW SEDGE	PT	PT	S2	G5	ERIE	TROUT RUN	1953
CAREX FLAVA	YELLOW SEDGE	PT	PT	S2	G5	ERIE	HUBBEL RUN	1986
CAREX FLAVA	YELLOW SEDGE	PT	PT	S2	G5	ERIE	BENTLY RUN	1994
CAREX FLAVA	YELLOW SEDGE	PT	PT	S2	G5	ERIE	LE BOEUF CREEK	1994
CAREX FLAVA	YELLOW SEDGE	PT	PT	S2	G5	ERIE	BEAVER RUN	1986
CAREX LASIOCARPA	SLENDER SEDGE	PR	PR	S3	G5	CRAWFORD	INLET RUN	1993
CAREX LIMOSA	MUD SEDGE	TU	PT	S2	G5	ERIE	W. BR. FRENCH CR.	1995
CAREX LUPULIFORMIS	FALSE HOP SEDGE	TU	TU	S1	G4	CRAWFORD	CONNEAUT OUTLET	1868
CAREX PRAIREA	PRAIRIE SEDGE	PT	PT	S2	G5?	ERIE	SHENANGO CREEK	1988
CAREX PRAIREA	PRAIRIE SEDGE	PT	PT	S2	G5?	ERIE	LAKE PLEASANT OUTLET	1987
CAREX PRAIREA	PRAIRIE SEDGE	PT	PT	S2	G5?	CRAWFORD	INLET RUN	1993
CAREX PRAIREA	PRAIRIE SEDGE	PT	PT	S2	G5?	CRAWFORD	FRENCH CREEK	1925
CAREX PSEUDOCYPERUS	CYPERUS-LIKE SEDGE	PE	PE	S1	G5	ERIE	E. BR. LE BOEUF CR.	1991
CAREX PSEUDOCYPERUS	CYPERUS-LIKE SEDGE	PE	PE	S1	G5	ERIE	E. BR. LE BOEUF CR.	1996
CAREX PSEUDOCYPERUS	CYPERUS-LIKE SEDGE	PE	PE	S1	G5	CRAWFORD	KELLY RUN	1952
CAREX PSEUDOCYPERUS	CYPERUS-LIKE SEDGE	PE	PE	S1	G5	ERIE	LAKE PLEASANT OUTLET	1987
CAREX RETRORSA	BACKWARD SEDGE	PE	PE	S1	G5	ERIE	LE BOEUF CREEK	1997
CAREX RETRORSA	BACKWARD SEDGE	PE	PE	S1	G5	ERIE	LE BOEUF CREEK	1994
CAREX RETRORSA	BACKWARD SEDGE	PE	PE	S1	G5	ERIE	E. BR. LE BOEUF CR.	1991
CAREX TYPHINA	CATTAIL SEDGE	PE	PE	S2	G5	CRAWFORD	FRENCH CREEK	1998
CAREX TYPHINA	CATTAIL SEDGE	PE	PE	S2	G5	CRAWFORD	CUSSEWAGO CREEK	1998

CAREX TYPHINA	CATTAIL SEDGE	PE	PE	S2	G5	CRAWFORD	CONNEAUT OUTLET	1998
CHENOPODIUM CAPITATUM	STRAWBERRY GOOSEFOOT	TU	TU	SH	G5	ERIE	S. BR. FRENCH CR.	1869
CLADIUM MARISCOIDES	TWIG RUSH	PE	PE	S2	G5	CRAWFORD	INLET RUN	1993
CLADIUM MARISCOIDES	TWIG RUSH	PE	PE	S2	G5	ERIE	LAKE PLEASANT OUTLET	1929
CUSCUTA CEPHALANTHI	BUTTON-BUSH DODDER	TU	TU	SU	G5	CRAWFORD	CONNEAUT OUTLET	1988
CYPRIPEDIUM CALCEOLUS VAR PARVIFLORUM	SMALL YELLOW LADY'S-SLIPPER	PE	PE	S1	G5	ERIE	LE BOEUF CREEK	1884
CYPRIPEDIUM CALCEOLUS VAR PARVIFLORUM	SMALL YELLOW LADY'S-SLIPPER	PE	PE	S1	G5	ERIE	S. BR. FRENCH CR.	1949
CYPRIPEDIUM CALCEOLUS VAR PARVIFLORUM	SMALL YELLOW LADY'S-SLIPPER	PE	PE	S1	G5	ERIE	S. BR. FRENCH CR.	1962
CYPRIPEDIUM REGINAE	SHOWY LADY'S-SLIPPER	PT	PT	S2	G4	ERIE, CRAWFORD	S. BR. FRENCH CR.	1956
CYPRIPEDIUM REGINAE	SHOWY LADY'S-SLIPPER	PT	PT	S2	G4	ERIE	ALDER BROOK	1960
CYPRIPEDIUM REGINAE	SHOWY LADY'S-SLIPPER	PT	PT	S2	G4	ERIE	ALDER RUN	1950
CYPRIPEDIUM REGINAE	SHOWY LADY'S-SLIPPER	PT	PT	S2	G4	CRAWFORD	NAVY RUN	1962
CYPRIPEDIUM REGINAE	SHOWY LADY'S-SLIPPER	PT	PT	S2	G4	ERIE	HUBBEL RUN	1987
CYPRIPEDIUM REGINAE	SHOWY LADY'S-SLIPPER	PT	PT	S2	G4	ERIE	LE BOEUF CREEK	1992
CYPRIPEDIUM REGINAE	SHOWY LADY'S-SLIPPER	PT	PT	S2	G4	ERIE	S. BR. FRENCH CR.	1992
CYPRIPEDIUM REGINAE	SHOWY LADY'S-SLIPPER	PT	PT	S2	G4	CRAWFORD	INLET RUN	1928
CYPRIPEDIUM REGINAE	SHOWY LADY'S-SLIPPER	PT	PT	S2	G4	ERIE	S. BR. FRENCH CR.	1949
CYPRIPEDIUM REGINAE	SHOWY LADY'S-SLIPPER	PT	PT	S2	G4	ERIE	ALDER RUN	1992
CYPRIPEDIUM REGINAE	SHOWY LADY'S-SLIPPER	PT	PT	S2	G4	ERIE	LE BOEUF CREEK	1985
CYPRIPEDIUM REGINAE	SHOWY LADY'S-SLIPPER	PT	PT	S2	G4	ERIE	LE BOEUF CREEK	1985
CYPRIPEDIUM REGINAE	SHOWY LADY'S-SLIPPER	PT	PT	S2	G4	ERIE	ALDER RUN	1992
CYPRIPEDIUM REGINAE	SHOWY LADY'S-SLIPPER	PT	PT	S2	G4	ERIE	S. BR. FRENCH CR.	1891
DRYOPTERIS CLINTONIANA	CLINTON'S WOOD FERN	N	PT	S2	G5	ERIE	LE BOEUF CREEK	1997
DRYOPTERIS CLINTONIANA	CLINTON'S WOOD FERN	N	PT	S2	G5	CRAWFORD	NAVY RUN	1962
DRYOPTERIS CLINTONIANA	CLINTON'S WOOD FERN	N	PT	S2	G5	CRAWFORD	DEAD CREEK	1997
DRYOPTERIS CLINTONIANA	CLINTON'S WOOD FERN	N	PT	S2	G5	CRAWFORD	FRENCH CREEK	1935
DRYOPTERIS CLINTONIANA	CLINTON'S WOOD FERN	N	PT	S2	G5	ERIE	S. BR. FRENCH CR.	1949
DRYOPTERIS CLINTONIANA	CLINTON'S WOOD FERN	N	PT	S2	G5	ERIE	ALDER RUN	1987
DRYOPTERIS CLINTONIANA	CLINTON'S WOOD FERN	N	PT	S2	G5	CRAWFORD	FRENCH CREEK	1990
DRYOPTERIS CLINTONIANA	CLINTON'S WOOD FERN	N	PT	S2	G5	ERIE	BEAVER RUN	1999
ELEOCHARIS ELLIPTICA	SLENDER SPIKE-RUSH	PE	PE	S2	G5	CRAWFORD	INLET RUN	1994

ELEOCHARIS ELLIPTICA	SLENDER SPIKE-RUSH	PE	PE	S2	G5	ERIE	SHENANGO CREEK	1988
ELEOCHARIS ELLIPTICA	SLENDER SPIKE-RUSH	PE	PE	S2	G5	ERIE	W. BR. FRENCH CR.	1994
ELEOCHARIS ELLIPTICA	SLENDER SPIKE-RUSH	PE	PE	S2	G5	CRAWFORD	MOHAWK RUN	1993
ELEOCHARIS INTERMEDIA	MATTED SPIKE-RUSH	PT	PT	S2	G5	ERIE	LAKE PLEASANT OUTLET	1987
ELEOCHARIS INTERMEDIA	MATTED SPIKE-RUSH	PT	PT	S2	G5	ERIE	CONNEAUTTEE CREEK	1998
EPILOBIUM STRICTUM	DOWNY WILLOW-HERB	PE	PE	S2S3	G5?	CRAWFORD	CONNEAUT OUTLET	1999
EPILOBIUM STRICTUM	DOWNY WILLOW-HERB	PE	PE	S2S3	G5?	CRAWFORD	INLET RUN	1869
EPILOBIUM STRICTUM	DOWNY WILLOW-HERB	PE	PE	S2S3	G5?	ERIE	ALDER RUN	1987
EPILOBIUM STRICTUM	DOWNY WILLOW-HERB	PE	PE	S2S3	G5?	ERIE	FRENCH CREEK	1996
EPILOBIUM STRICTUM	DOWNY WILLOW-HERB	PE	PE	S2S3	G5?	CRAWFORD	MUDDY CREEK	1993
EPILOBIUM STRICTUM	DOWNY WILLOW-HERB	PE	PE	S2S3	G5?	ERIE	S. BR. FRENCH CR.	1962
EPILOBIUM STRICTUM	DOWNY WILLOW-HERB	PE	PE	S2S3	G5?	ERIE	HUBBEL RUN	1987
EPILOBIUM STRICTUM	DOWNY WILLOW-HERB	PE	PE	S2S3	G5?	ERIE	LE BOEUF CREEK	1987
EPILOBIUM STRICTUM	DOWNY WILLOW-HERB	PE	PE	S2S3	G5?	ERIE	PINE RUN	1949
EPILOBIUM STRICTUM	DOWNY WILLOW-HERB	PE	PE	S2S3	G5?	ERIE	W. BR. FRENCH CR.	1994
EPILOBIUM STRICTUM	DOWNY WILLOW-HERB	PE	PE	S2S3	G5?	CRAWFORD	ERIE EXTENSION CANAL	1993
EPILOBIUM STRICTUM	DOWNY WILLOW-HERB	PE	PE	S2S3	G5?	ERIE	LE BOEUF CREEK	1991
EPILOBIUM STRICTUM	DOWNY WILLOW-HERB	PE	PE	S2S3	G5?	ERIE	E. BR. LE BOEUF CR.	1991
EPILOBIUM STRICTUM	DOWNY WILLOW-HERB	PE	PE	S2S3	G5?	ERIE	BENTLEY RUN	1994
EPILOBIUM STRICTUM	DOWNY WILLOW-HERB	PE	PE	S2S3	G5?	ERIE	LAKE PLEASANT OUTLET	1987
EQUISETUM VARIEGATUM	VARIEGATED HORSETAIL	PE	PE	S1	G5	ERIE	BENTLEY RUN	1992
ERIGENIA BULBOSA	HARBINGER-OF-SPRING	PT	PT	S2	G5	ERIE	S. BR. FRENCH CR.	1891
ERIOPHORUM GRACILE	SLENDER COTTON-GRASS	PE	PE	S1	G5	ERIE	SHENANGO CREEK	1989
ERIOPHORUM GRACILE	SLENDER COTTON-GRASS	PE	PE	S1	G5	ERIE	W. BR. FRENCH CR.	1994
ERIOPHORUM GRACILE	SLENDER COTTON-GRASS	PE	PE	S1	G5	ERIE	S. BR. FRENCH CR.	1992
ERIOPHORUM VIRIDICARINATUM	THIN-LEAVED COTTON-GRASS	PT	PT	S2	G5	CRAWFORD	MOHAWK RUN	1994
ERIOPHORUM VIRIDICARINATUM	THIN-LEAVED COTTON-GRASS	PT	PT	S2	G5	ERIE	W. BR. FRENCH CR.	1994
ERIOPHORUM VIRIDICARINATUM	THIN-LEAVED COTTON-GRASS	PT	PT	S2	G5	ERIE	HUBBEL RUN	1950
ERIOPHORUM VIRIDICARINATUM	THIN-LEAVED COTTON-GRASS	PT	PT	S2	G5	ERIE	S. BR. FRENCH CR.	1962
ERIOPHORUM VIRIDICARINATUM	THIN-LEAVED COTTON-GRASS	PT	PT	S2	G5	ERIE	ALDER RUN	1949

ERIOPHORUM VIRIDICARINATUM	THIN-LEAVED COTTON-GRASS	PT	PT	S2	G5	ERIE	BENTLY RUN		1994
ERIOPHORUM VIRIDICARINATUM	THIN-LEAVED COTTON-GRASS	PT	PT	S2	G5	CRAWFORD	INLET RUN		1981
FILIPENDULA RUBRA	QUEEN-OF-THE-PRAIRIE	TU	TU	S1S2	G4G5	VENANGO	BEATTY RUN		1997
FILIPENDULA RUBRA	QUEEN-OF-THE-PRAIRIE	TU	TU	S1S2	G4G5	CRAWFORD	LAKE CREEK		1970
FILIPENDULA RUBRA	QUEEN-OF-THE-PRAIRIE	TU	TU	S1S2	G4G5	CRAWFORD	FRENCH CREEK		1997
FILIPENDULA RUBRA	QUEEN-OF-THE-PRAIRIE	TU	TU	S1S2	G4G5	ERIE	CONNEAUTTEE CREEK		1962
GALIUM LABRADORICUM	LABRADOR MARSH BEDSTRAW	PE	PE	S1	G5	CRAWFORD	INLET RUN		1994
GALIUM LABRADORICUM	LABRADOR MARSH BEDSTRAW	PE	PE	S1	G5	ERIE	LAKE PLEASANT OUTLET		1987
GALIUM TRIFIDUM	MARSH BEDSTRAW	N	PR	S2	G5	CRAWFORD	FRENCH CREEK		1947
GAULTHERIA HISPIDULA	CREEPING SNOWBERRY	PR	PR	S3	G5	ERIE	LE BOEUF CREEK		1961
GAULTHERIA HISPIDULA	CREEPING SNOWBERRY	PR	PR	S3	G5	ERIE	LE BOEUF CREEK		1966
GOODYERA REPENS	LESSER RATTLESNAKE-PLANTAIN	N	TU	S2	G5	CRAWFORD			1868
HELIANTHUS MICROCEPHALUS	SMALL WOOD SUNFLOWER	N	TU	S3	G5	VENANGO	FRENCH CREEK		1956
HELIANTHUS MICROCEPHALUS	SMALL WOOD SUNFLOWER	N	TU	S3	G5	CRAWFORD	CUSSEWAGO CREEK	NO D	
HELIANTHUS MICROCEPHALUS	SMALL WOOD SUNFLOWER	N	TU	S3	G5	VENANGO	ALLEGHENY RIVER		1869
HIEROCHLOE ODORATA	VANILLA SWEET-GRASS	PE	PE	S1	G5	ERIE	FRENCH CREEK		1993
HIEROCHLOE ODORATA	VANILLA SWEET-GRASS	PE	PE	S1	G5	ERIE	LE BOEUF CREEK		1997
JUNCUS BRACHYCEPHALUS	SMALL-HEADED RUSH	PT	PT	S2	G5	ERIE	FRENCH CREEK		1996
JUNCUS BRACHYCEPHALUS	SMALL-HEADED RUSH	PT	PT	S2	G5	ERIE	SHENANGO CREEK		1998
JUNCUS BRACHYCEPHALUS	SMALL-HEADED RUSH	PT	PT	S2	G5	ERIE	LE BOEUF CREEK		1987
LATHYRUS OCHROLEUCUS	WILD-PEA	PT	PT	S1	G4G5	CRAWFORD	CONNEAUT OUTLET		1907
LEMNA TURIONIFERA	A DUCKWEED	TU	TU	SU	G5	CRAWFORD	ERIE EXTENSION CANAL		1951
LINNAEA BOREALIS	TWINFLOWER	PT	PE	S1	G5	ERIE	TROUT RUN		1927
LINNAEA BOREALIS	TWINFLOWER	PT	PE	S1	G5	ERIE	LE BOEUF CREEK		1966
LITHOSPERMUM CAROLINIENSE	HISPID GROMWELL	PE	PE	S1	G4G5	MERCER	SANDY CREEK		1923
LONICERA OBLONGIFOLIA	SWAMP FLY HONEYSUCKLE	PE	PE	S1	G4	CRAWFORD	MOHAWK RUN		1997
LONICERA OBLONGIFOLIA	SWAMP FLY HONEYSUCKLE	PE	PE	S1	G4	CRAWFORD	EIRE EXTENSION CANAL		1993
LONICERA OBLONGIFOLIA	SWAMP FLY HONEYSUCKLE	PE	PE	S1	G4	CRAWFORD	INLET RUN		1993
LONICERA OBLONGIFOLIA	SWAMP FLY HONEYSUCKLE	PE	PE	S1	G4	VENANGO	MILL CREEK		1962
LUPINUS PERENNIS	LUPINE	PR	PR	S3	G5	CRAWFORD	CONNEAUT CREEK		1930

LYCOPODIELLA MARGUERITEAE	A CLUBMOSS	N	PE	SU	G2	ERIE	HUBBEL RUN	1995
LYGODIUM PALMATUM	HARTFORD FERN	PR	PR	S3	G4	CRAWFORD	LAKE CREEK	1991
MALAXIS MONOPHYLLOS VAR BRACHYPODA	WHITE ADDER'S-MOUTH	TU	PE	S1	G4Q	ERIE	BENTLEY RUN	1963
MALAXIS MONOPHYLLOS VAR BRACHYPODA	WHITE ADDER'S-MOUTH	TU	PE	S1	G4Q	ERIE	LE BOEUF CREEK	1966
MALAXIS MONOPHYLLOS VAR BRACHYPODA	WHITE ADDER'S-MOUTH	TU	PE	S1	G4Q	ERIE	W. BR. FRENCH CR.	1928
MALAXIS MONOPHYLLOS VAR BRACHYPODA	WHITE ADDER'S-MOUTH	TU	PE	S1	G4Q	ERIE	FRENCH CREEK	1928
MALAXIS MONOPHYLLOS VAR BRACHYPODA	WHITE ADDER'S-MOUTH	TU	PE	S1	G4Q	CRAWFORD	KELLY RUN	1965
MALAXIS MONOPHYLLOS VAR BRACHYPODA	WHITE ADDER'S-MOUTH	TU	PE	S1	G4Q	ERIE	ALDER RUN	1950
MALAXIS MONOPHYLLOS VAR BRACHYPODA	WHITE ADDER'S-MOUTH	TU	PE	S1	G4Q	ERIE	LAMSON RUN	1962
MEGALODONTA BECKII	BECK'S WATER-MARIGOLD	PE	PE	S1	G4G5	CRAWFORD	CONNEAUT OUTLET	1995
MEGALODONTA BECKII	BECK'S WATER-MARIGOLD	PE	PE	S1	G4G5	CRAWFORD	CONNEAUT OUTLET	1887
MEGALODONTA BECKII	BECK'S WATER-MARIGOLD	PE	PE	S1	G4G5	ERIE	LAKE PLEASANT OUTLET	1995
MYRIOPHYLLUM SIBIRICUM	NORTHERN WATER-MILFOIL	PE	PE	S1	G5	CRAWFORD	CONNEAUT OUTLET	1887
MYRIOPHYLLUM SIBIRICUM	NORTHERN WATER-MILFOIL	PE	PE	S1	G5	ERIE	LAKE PLEASANT OUTLET	1987
MYRIOPHYLLUM SIBIRICUM	NORTHERN WATER-MILFOIL	PE	PE	S1	G5	ERIE	CONNEAUTTEE CREEK	1996
MYRIOPHYLLUM VERTICILLATUM	WHORLED WATER-MILFOIL	PE	PE	S1	G5	ERIE	CONNEAUTTEE CREEK	1988
PEDICULARIS LANCEOLATA	SWAMP LOUSEWORT	N	PE	S1S2	G5	CRAWFORD	CONNEAUT OUTLET	1868
PEDICULARIS LANCEOLATA	SWAMP LOUSEWORT	N	PE	S1S2	G5	CRAWFORD	CUSSEWAGO CREEK	1887
PEDICULARIS LANCEOLATA	SWAMP LOUSEWORT	N	PE	S1S2	G5	CRAWFORD	ERIE EXTENSION CANAL	1998
PLATANTHERA DILATATA	LEAFY WHITE ORCHID	PE	PE	S1	G5	ERIE	LE BOEUF CREEK	1914
PLATANTHERA DILATATA	LEAFY WHITE ORCHID	PE	PE	S1	G5	ERIE	ALDER RUN	1965
PLATANTHERA DILATATA	LEAFY WHITE ORCHID	PE	PE	S1	G5	ERIE	HUBBLE RUN	1976
PLATANTHERA DILATATA	LEAFY WHITE ORCHID	PE	PE	S1	G5	ERIE	S. BR. FRENCH CR.	1962
PLATANTHERA HYPERBOREA	LEAFY NORTHERN GREEN ORCHID	PE	PE	S1	G5	ERIE	BENTLY RUN	1965
PLATANTHERA HYPERBOREA	LEAFY NORTHERN GREEN ORCHID	PE	PE	S1	G5	ERIE	W. BR. FRENCH CR.	1995

PLATANTHERA HYPERBOREA	LEAFY NORTHERN GREEN ORCHID	PE	PE	S1	G5	ERIE	ALDER RUN	1964
PLATANTHERA HYPERBOREA	LEAFY NORTHERN GREEN ORCHID	PE	PE	S1	G5	ERIE	LE BOEUF CREEK	1966
PLATANTHERA HYPERBOREA	LEAFY NORTHERN GREEN ORCHID	PE	PE	S1	G5	ERIE	HUBBEL RUN	1953
PLATANTHERA HYPERBOREA	LEAFY NORTHERN GREEN ORCHID	PE	PE	S1	G5	ERIE, CRAWFORD	S. BR. FRENCH CR.	1965
PLATANTHERA HYPERBOREA	LEAFY NORTHERN GREEN ORCHID	PE	PE	S1	G5	ERIE	BEAVER RUN	1963
PLATANTHERA HYPERBOREA	LEAFY NORTHERN GREEN ORCHID	PE	PE	S1	G5	ERIE	SHENANGO CREEK	1989
PLATANTHERA HYPERBOREA	LEAFY NORTHERN GREEN ORCHID	PE	PE	S1	G5	ERIE	ALDER RUN	1960
PLATANTHERA HYPERBOREA	LEAFY NORTHERN GREEN ORCHID	PE	PE	S1	G5	ERIE	HUBBEL RUN	1992
PLATANTHERA HYPERBOREA	LEAFY NORTHERN GREEN ORCHID	PE	PE	S1	G5	CRAWFORD	KELLY RUN	1965
PLATANTHERA HYPERBOREA	LEAFY NORTHERN GREEN ORCHID	PE	PE	S1	G5	CRAWFORD	MUDDY CREEK	1997
PLATANTHERA HYPERBOREA	LEAFY NORTHERN GREEN ORCHID	PE	PE	S1	G5	ERIE	LE BOEUF CREEK	1997
PLATANTHERA HYPERBOREA	LEAFY NORTHERN GREEN ORCHID	PE	PE	S1	G5	ERIE	ALDER RUN	1986
PLATANTHERA HYPERBOREA	LEAFY NORTHERN GREEN ORCHID	PE	PE	S1	G5	ERIE	LE BOEUF CREEK	1960
PLATANTHERA LEUCOPHAEA	PRAIRIE WHITE-FRINGED ORCHID LT	PX	PX	SX	G2	CRAWFORD	INLET RUN	1881
POA LANGUIDA	DROOPING BLUEGRASS	TU	PT	S2	G3G4Q	CRAWFORD	MOHAWK RUN	1994
POA PALUDIGENA	BOG BLUEGRASS	PT	PR	S3	G3	CRAWFORD	ERIE EXTENSION CANAL	1993
POLYGALA POLYGAMA	RACEMED MILKWORT	TU	PE	S1S2	G5	ERIE	S. BR. FRENCH CR.	1891
POLYGALA POLYGAMA	RACEMED MILKWORT	TU	PE	S1S2	G5	ERIE	S. BR. FRENCH CR.	1962
POLYGONUM AMPHIBIUM VAR STIPULACEUM	A WATER SMARTWEED	TU	TU	S2	G5T5	ERIE	S. BR. FRENCH CR.	1891
POLYGONUM AMPHIBIUM VAR STIPULACEUM	A WATER SMARTWEED	TU	TU	S2	G5T5	CRAWFORD	INLET RUN	1999
POLYGONUM AMPHIBIUM VAR STIPULACEUM	A WATER SMARTWEED	TU	TU	S2	G5T5	CRAWFORD	INLET RUN	1880

POLYGONUM AMPHIBIUM VAR STIPULACEUM	A WATER SMARTWEED	TU	TU	S2	G5T5	CRAWFORD	CONNEAUT OUTLET	1994
POLYGONUM AMPHIBIUM VAR STIPULACEUM	A WATER SMARTWEED	TU	TU	S2	G5T5	CRAWFORD	CONNEAUT OUTLET	1988
POLYGONUM AMPHIBIUM VAR STIPULACEUM	A WATER SMARTWEED	TU	TU	S2	G5T5	ERIE	LAKE PLEASANT	1929
POLYGONUM AMPHIBIUM VAR STIPULACEUM	A WATER SMARTWEED	TU	TU	S2	G5T5	ERIE	E. BR. LE BOEUF CR.	1996
POLYGONUM SETACEUM VAR INTERJECTUM	A SWAMP SMARTWEED	PE	PE	S2	G5T4	ERIE	E. BR. LE BOEUF CR.	1991
POLYGONUM SETACEUM VAR INTERJECTUM	A SWAMP SMARTWEED	PE	PE	S2	G5T4	ERIE	LE BOEUF CREEK	1991
POLYGONUM SETACEUM VAR INTERJECTUM	A SWAMP SMARTWEED	PE	PE	S2	G5T4	ERIE	LAKE PLEASANT OUTLET	1991
POLYGONUM SETACEUM VAR INTERJECTUM	A SWAMP SMARTWEED	PE	PE	S2	G5T4	CRAWFORD	ERIE EXTENSION CANAL	1997
POLYGONUM SETACEUM VAR INTERJECTUM	A SWAMP SMARTWEED	PE	PE	S2	G5T4	CRAWFORD	CONNEAUT OUTLET	1991
POLYGONUM SETACEUM VAR INTERJECTUM	A SWAMP SMARTWEED	PE	PE	S2	G5T4	ERIE	SHENANGO CREEK	1998
POTAMOGETON FRIESII	FRIES' PONDWEED	PE	PE	S1	G4	ERIE	LAKE PLEASANT OUTLET	1987
POTAMOGETON FRIESII	FRIES' PONDWEED	PE	PE	S1	G4	CRAWFORD	CONNEAUT OUTLET	1988
POTAMOGETON GRAMINEUS	GRASSY PONDWEED	PE	PE	SH	G5	ERIE	LAKE PLEASANT OUTLET	1948
POTAMOGETON HILLII	HILL'S PONDWEED	PE	PE	S1	G3	ERIE	BEAVER RUN	1986
POTAMOGETON HILLII	HILL'S PONDWEED	PE	PE	S1	G3	ERIE	HUBBEL RUN	1992
POTAMOGETON HILLII	HILL'S PONDWEED	PE	PE	S1	G3	CRAWFORD	CONNEAUT OUTLET	1868
POTAMOGETON HILLII	HILL'S PONDWEED	PE	PE	S1	G3	ERIE	E. BR. LE BOEUF CR.	1992
POTAMOGETON HILLII	HILL'S PONDWEED	PE	PE	S1	G3	ERIE	E. BR. LE BOEUF CR.	1991
POTAMOGETON ILLINOENSIS	ILLINOIS PONDWEED	TU	PR	S3S4	G5	CRAWFORD	FRENCH CREEK	1959
POTAMOGETON ILLINOENSIS	ILLINOIS PONDWEED	TU	PR	S3S4	G5	CRAWFORD	CONNEAUT OUTLET	1995
POTAMOGETON ILLINOENSIS	ILLINOIS PONDWEED	TU	PR	S3S4	G5	VENANGO	FRENCH CREEK	1997
POTAMOGETON ILLINOENSIS	ILLINOIS PONDWEED	TU	PR	S3S4	G5	CRAWFORD	CONNEAUT OUTLET	1995
POTAMOGETON ILLINOENSIS	ILLINOIS PONDWEED	TU	PR	S3S4	G5	ERIE	LAKE PLEASANT OUTLET	1995
POTAMOGETON ILLINOENSIS	ILLINOIS PONDWEED	TU	PR	S3S4	G5	VENANGO	FRENCH CREEK	1997
POTAMOGETON PRAELONGUS	WHITE-STEMMED PONDWEED	PX	PE	SH	G5	ERIE	SHENANGO CREEK	1958
POTAMOGETON PRAELONGUS	WHITE-STEMMED PONDWEED	PX	PE	SH	G5	CRAWFORD	CONNEAUT OUTLET	1958

POTAMOGETON RICHARDSONII	RED-HEAD PONDWEED	PT	PT	S2S3	G5	VENANGO	FRENCH CREEK	1997
POTAMOGETON RICHARDSONII	RED-HEAD PONDWEED	PT	PT	S2S3	G5	ERIE	LAKE PLEASANT OUTLET	1986
POTAMOGETON RICHARDSONII	RED-HEAD PONDWEED	PT	PT	S2S3	G5	MERCER	FRENCH CREEK	1997
POTAMOGETON RICHARDSONII	RED-HEAD PONDWEED	PT	PT	S2S3	G5	ERIE		1989
POTAMOGETON RICHARDSONII	RED-HEAD PONDWEED	PT	PT	S2S3	G5	CRAWFORD	FRENCH CREEK	1988
POTAMOGETON RICHARDSONII	RED-HEAD PONDWEED	PT	PT	S2S3	G5	CRAWFORD	FRENCH CREEK	1997
POTAMOGETON ROBBINSII	FLAT-LEAVED PONDWEED	PR	PR	S3	G5	CRAWFORD	CONNEAUT OUTLET	1995
POTAMOGETON VASEYI	VASEY'S PONDWEED	PE	PE	S1	G4	ERIE	SHENANGO CREEK	1996
POTAMOGETON VASEYI	VASEY'S PONDWEED	PE	PE	S1	G4	CRAWFORD	CONNEAUTEE CREEK	1886
POTAMOGETON ZOSTERIFORMIS	FLAT-STEM PONDWEED	PR	PR	S2S3	G5	ERIE	LAKE PLEASANT OUTLET	1986
POTAMOGETON ZOSTERIFORMIS	FLAT-STEM PONDWEED	PR	PR	S2S3	G5	CRAWFORD	CONNEAUTEE CREEK	1886
POTAMOGETON ZOSTERIFORMIS	FLAT-STEM PONDWEED	PR	PR	S2S3	G5	CRAWFORD	CONNEAUT OUTLET	1988
POTAMOGETON ZOSTERIFORMIS	FLAT-STEM PONDWEED	PR	PR	S2S3	G5	CRAWFORD	CONNEAUT OUTLET	1995
POTAMOGETON ZOSTERIFORMIS	FLAT-STEM PONDWEED	PR	PR	S2S3	G5	ERIE	E. BR. LE BOEUF CR.	1996
POTAMOGETON ZOSTERIFORMIS	FLAT-STEM PONDWEED	PR	PR	S2S3	G5	ERIE	SHENANGO CREEK	1996
POTAMOGETON ZOSTERIFORMIS	FLAT-STEM PONDWEED	PR	PR	S2S3	G5	ERIE		1989
RANUNCULUS AQUATILIS VAR DIFFUSUS			PR	S?	G5T5	CRAWFORD	CONNEAUT LAKE	1917
RANUNCULUS AQUATILIS VAR DIFFUSUS			PR	S?	G5T5	ERIE	LAKE PLEASANT OUTLET	1987
RANUNCULUS AQUATILIS VAR DIFFUSUS			PR	S?	G5T5	ERIE	LE BOEUF CREEK	1987
RANUNCULUS AQUATILIS VAR DIFFUSUS			PR	S?	G5T5	ERIE	SHENANGO CREEK	1987
RANUNCULUS AQUATILIS VAR DIFFUSUS			PR	S?	G5T5	CRAWFORD	CONNEAUT OUTLET	1988
RANUNCULUS AQUATILIS VAR DIFFUSUS			PR	S?	G5T5	ERIE	BENTLEY RUN	1992
RANUNCULUS AQUATILIS VAR DIFFUSUS			PR	S?	G5T5	ERIE		1989
RANUNCULUS FASCICULARIS	TUFTED BUTTERCUP	PE	PE	S1S2	G5	VENANGO	TWOMILE RUN	1928

RIBES LACUSTRE	SWAMP CURRANT	TU	PE	S1	G5	CRAWFORD	SUGAR CREEK	1966
RIBES TRISTE	RED CURRANT	PT	PT	S2	G5	ERIE	LE BOEUF CREEK	1997
RIBES TRISTE	RED CURRANT	PT	PT	S2	G5	ERIE	ALDER RUN	1987
RIBES TRISTE	RED CURRANT	PT	PT	S2	G5	ERIE	LE BOEUF CREEK	1997
RIBES TRISTE	RED CURRANT	PT	PT	S2	G5	ERIE	S. BR. FRENCH CR.	1891
RIBES TRISTE	RED CURRANT	PT	PT	S2	G5	ERIE	E. BR. LE BOEUF CR.	1991
RIBES TRISTE	RED CURRANT	PT	PT	S2	G5	ERIE	E. BR. LE BOEUF CR.	1991
RIBES TRISTE	RED CURRANT	PT	PT	S2	G5	ERIE	W. BR. FRENCH CR.	1994
RIBES TRISTE	RED CURRANT	PT	PT	S2	G5	ERIE	LAKE PLEASANT OUTLET	1987
SALIX SERISSIMA	AUTUMN WILLOW	PT	PT	S2	G4	ERIE	HUBBEL RUN	1981
SALIX SERISSIMA	AUTUMN WILLOW	PT	PT	S2	G4	CRAWFORD	INLET RUN	1993
SALIX SERISSIMA	AUTUMN WILLOW	PT	PT	S2	G4	ERIE	ALDER RUN	1986
SALIX SERISSIMA	AUTUMN WILLOW	PT	PT	S2	G4	ERIE	SHENANGO CREEK	1988
SALIX SERISSIMA	AUTUMN WILLOW	PT	PT	S2	G4	CRAWFORD	MUDDY CREEK	1992
SALIX SERISSIMA	AUTUMN WILLOW	PT	PT	S2	G4	CRAWFORD	ERIE EXTENSION CANAL	1997
SALIX SERISSIMA	AUTUMN WILLOW	PT	PT	S2	G4	CRAWFORD	ERIE EXTENSION CANAL	1993
SALIX SERISSIMA	AUTUMN WILLOW	PT	PT	S2	G4	ERIE	HUBBEL RUN	1993
SAMOLUS PARVIFLORUS	PINELAND PIMPERNEL	TU	PE	S2	G5	CRAWFORD	FRENCH CREEK	1998
SCHEUCHZERIA PALUSTRIS	POD-GRASS	PE	PE	S1	G5	ERIE	HUBBEL RUN	1982
SCHOENOPLECTUS ACUTUS	HARD-STEMMED BULLRUSH	PE	PE	S2	G5	ERIE	LE BOEUF CREEK	1990
SCHOENOPLECTUS ACUTUS	HARD-STEMMED BULLRUSH	PE	PE	S2	G5	CRAWFORD	CONNEAUT OUTLET	1988
SCHOENOPLECTUS ACUTUS	HARD-STEMMED BULLRUSH	PE	PE	S2	G5	ERIE	LE BOEUF CREEK	1990
SCHOENOPLECTUS ACUTUS	HARD-STEMMED BULLRUSH	PE	PE	S2	G5	CRAWFORD	CONNEAUT OUTLET	1901
SCHOENOPLECTUS FLUVIATILIS	RIVER BULLRUSH	PR	PR	S3	G5	CRAWFORD	MUDDY CREEK	1997
SCHOENOPLECTUS FLUVIATILIS	RIVER BULLRUSH	PR	PR	S3	G5	ERIE	CONNEAUTTEE CREEK	1987
SCHOENOPLECTUS FLUVIATILIS	RIVER BULLRUSH	PR	PR	S3	G5	CRAWFORD	CONNEAUT OUTLET	1988
SMILAX PSEUDOCHINA	LONG-STALKED GREENBRIER	PX	PX	SH	G4G5	CRAWFORD	CONNEAUT OUTLET	1892
SORBUS DECORA	SHOWY MOUNTAIN-ASH	PE	PE	S1	G4G5	ERIE	BEAVER RUN	1999
SORBUS DECORA	SHOWY MOUNTAIN-ASH	PE	PE	S1	G4G5	ERIE	E. BR. LE BOEUF CR.	1991
SORBUS DECORA	SHOWY MOUNTAIN-ASH	PE	PE	S1	G4G5	ERIE	LE BOEUF CREEK	1987
SORBUS DECORA	SHOWY MOUNTAIN-ASH	PE	PE	S1	G4G5	ERIE	LE BOEUF CREEK	1990

SORBUS DECORA	SHOWY MOUNTAIN-ASH	PE	PE	S1	G4G5	ERIE	ALDER BROOK	1998
SORBUS DECORA	SHOWY MOUNTAIN-ASH	PE	PE	S1	G4G5	ERIE	E. BR. LE BOEUF CR.	1996
SORBUS DECORA	SHOWY MOUNTAIN-ASH	PE	PE	S1	G4G5	CRAWFORD	DEAD CREEK	1992
SPIRANTHES LUCIDA	SHINING LADIES'-TRESSES	N	TU	S3	G5	ERIE	HUBBEL RUN	1950
SPIRANTHES LUCIDA	SHINING LADIES'-TRESSES	N	TU	S3	G5	CRAWFORD	LITTLE SUGAR CREEK	1942
SPIRANTHES ROMANZOFFIANA	HOODED LADIES'-TRESSES	PE	PE	S1	G5	ERIE	S. BR. FRENCH CR.	1992
SPIRANTHES ROMANZOFFIANA	HOODED LADIES'-TRESSES	PE	PE	S1	G5	ERIE	HUBBLE RUN	1968
SPIRANTHES ROMANZOFFIANA	HOODED LADIES'-TRESSES	PE	PE	S1	G5	ERIE	ALDER RUN	1949
SPIRANTHES ROMANZOFFIANA	HOODED LADIES'-TRESSES	PE	PE	S1	G5	ERIE	W BRANCH FRENCH CREEK	1993
TRILLIUM FLEXIPES	DECLINED TRILLIUM	TU	TU	S2	G5	ERIE	FRENCH CREEK	1963
TROLLIUS LAXUS	SPREADING GLOBE FLOWER	N	PE	S1	G4	ERIE	CONNEAUTTEE CREEK	1884
UTRICULARIA INTERMEDIA	FLAT-LEAVED BLADDERWORT	PT	PT	S2	G5	CRAWFORD	CUSSEWAGO CREEK	1868
UTRICULARIA MINOR	LESSER BLADDERWORT	PT	PT	S2S3	G5	ERIE	LAKE PLEASANT OUTLET	1987
UTRICULARIA MINOR	LESSER BLADDERWORT	PT	PT	S2S3	G5	CRAWFORD	FRENCH CREEK	1947
UTRICULARIA MINOR	LESSER BLADDERWORT	PT	PT	S2S3	G5	CRAWFORD	DEAD CREEK	1994
UTRICULARIA MINOR	LESSER BLADDERWORT	PT	PT	S2S3	G5	CRAWFORD	DEAD CREEK	1997
UTRICULARIA MINOR	LESSER BLADDERWORT	PT	PT	S2S3	G5	CRAWFORD	DEAD CREEK	1994
UTRICULARIA MINOR	LESSER BLADDERWORT	PT	PT	S2S3	G5	CRAWFORD	INLET RUN	1999
UTRICULARIA MINOR	LESSER BLADDERWORT	PT	PT	S2S3	G5	ERIE	SHENANGO CREEK	1988
UTRICULARIA MINOR	LESSER BLADDERWORT	PT	PT	S2S3	G5	ERIE	LE BOEUF CREEK	1987
UTRICULARIA MINOR	LESSER BLADDERWORT	PT	PT	S2S3	G5	CRAWFORD	CUSSEWAGO CREEK	1868
UTRICULARIA MINOR	LESSER BLADDERWORT	PT	PT	S2S3	G5	CRAWFORD	MOHAWK RUN	1993
UTRICULARIA MINOR	LESSER BLADDERWORT	PT	PT	S2S3	G5	ERIE	W. BR. FRENCH CR.	1994
UTRICULARIA MINOR	LESSER BLADDERWORT	PT	PT	S2S3	G5	ERIE	E. BR. LE BOEUF CR.	1991
UTRICULARIA MINOR	LESSER BLADDERWORT	PT	PT	S2S3	G5	CRAWFORD	MARSH RUN	1993
UTRICULARIA MINOR	LESSER BLADDERWORT	PT	PT	S2S3	G5	CRAWFORD	INLET RUN	1869
VIBURNUM TRILOBUM	HIGHBUSH-CRANBERRY	TU	PR	S3S4	G5T5	ERIE	CONNEAUTTEE CREEK	1998
VIBURNUM TRILOBUM	HIGHBUSH-CRANBERRY	TU	PR	S3S4	G5T5	ERIE	HERRICK CREEK	1947
VIBURNUM TRILOBUM	HIGHBUSH-CRANBERRY	TU	PR	S3S4	G5T5	ERIE	LE BOEUF CREEK	1996
VIBURNUM TRILOBUM	HIGHBUSH-CRANBERRY	TU	PR	S3S4	G5T5	ERIE	ALDER BROOK	1992
VIBURNUM TRILOBUM	HIGHBUSH-CRANBERRY	TU	PR	S3S4	G5T5	ERIE	E. BR. LE BOEUF CR.	1996
VIBURNUM TRILOBUM	HIGHBUSH-CRANBERRY	TU	PR	S3S4	G5T5	ERIE	ALDER BROOK	1992
VIBURNUM TRILOBUM	HIGHBUSH-CRANBERRY	TU	PR	S3S4	G5T5	ERIE	FRENCH CREEK	1992
VIBURNUM TRILOBUM	HIGHBUSH-CRANBERRY	TU	PR	S3S4	G5T5	ERIE	ALDER RUN	1992

VIBURNUM TRILOBUM	HIGHBUSH-CRANBERRY	TU	PR	S3S4	G5T5	ERIE	LE BOEUF CREEK	1960
VIBURNUM TRILOBUM	HIGHBUSH-CRANBERRY	TU	PR	S3S4	G5T5	ERIE	BENTLEY CREEK	1965
VIBURNUM TRILOBUM	HIGHBUSH-CRANBERRY	TU	PR	S3S4	G5T5	ERIE	W. BR. FRENCH CR.	1994
VIBURNUM TRILOBUM	HIGHBUSH-CRANBERRY	TU	PR	S3S4	G5T5	ERIE		1927
VIBURNUM TRILOBUM	HIGHBUSH-CRANBERRY	TU	PR	S3S4	G5T5	ERIE	LE BOEUF CREEK	1992
VIBURNUM TRILOBUM	HIGHBUSH-CRANBERRY	TU	PR	S3S4	G5T5	ERIE	ALDER RUN	1992
VIBURNUM TRILOBUM	HIGHBUSH-CRANBERRY	TU	PR	S3S4	G5T5	ERIE	BENTLEY RUN	1992
VIBURNUM TRILOBUM	HIGHBUSH-CRANBERRY	TU	PR	S3S4	G5T5	ERIE	LE BOEUF CREEK	1990
VIOLA APPALACHIENSIS	APPALACHIAN BLUE VIOLET	PT	TU	S2	G3	ERIE	BENTLY RUN	1968
WOLFFIA BOREALIS	DOTTED WATER-MEAL	TU	TU	S1	G5	CRAWFORD	ERIE EXTENSION CANAL	1951
WOLFFIA BOREALIS	DOTTED WATER-MEAL	TU	TU	S1	G5	CRAWFORD	CONNEAUT OUTLET	1988
WOLFFIELLA GLADIATA	BOG-MAT	PR	PR	S2	G5	ERIE	SHENANGO CREEK	1987
WOLFFIELLA GLADIATA	BOG-MAT	PR	PR	S2	G5	CRAWFORD	CONNEAUT OUTLET	1988

Appendix I

National Historic Register Properties in the French Creek Watershed

Crawford County

Historic Name	Municipality	Listed	Eligible
Alliance College	Cambridge Springs		6/15/92
Beach Avenue Historic District	Cambridge Springs		12/16/91
Bridge in Cambridge Springs Borough	Cambridge Springs	6/22/88	
Cambridge Springs Borough Hall	Cambridge Springs		4/11/94
Cambridge Springs Historic District	Cambridge Springs		12/19/94
Amos Kelly House	Cambridge Springs	7/23/80	
Riverside Hotel	Cambridge Springs	12/13/78	
Cochranton Railroad Station	Cochranton		5/7/81
Meadville Line	Corry to E. Fallowfield Township		5/5/94
Bridge over Unger Run	East Fallowfield	6/22/88	
Mumford Homestead	Fairfield Township		8/8/91
Allegheny College Historic District	Meadville		6/8/87
Atlantic & Great Western Railroad Foundry	Meadville		1/13/96
Baldwin-Reynolds House	Meadville	12/30/74	
Bentley Hall at Allegheny College	Meadville	5/6/77	
Chestnut Street Historic District	Meadville		6/8/87
George B. DeArment House	Meadville		2/13/95
Holland Hall	Meadville		10/16/96
Independent Congregational Church	Meadville	3/8/78	
Market House	Meadville		5/9/83
Mead Avenue Bridge	Meadville		4/17/91
Meadville Downtown Historic District	Meadville	10/2/84	
Dr. J. R. Mosier Office	Meadville	3/28/77	
North End Historic District	Meadville		7/28/91
Park Avenue Historic District	Meadville		7/28/91
Roueche House	Meadville	3/4/82	
Ruter Hall at Allegheny College	Meadville	9/18/78	
Judge Henry Shippen House	Meadville	6/6/84	12/2/81
Terrace Street Historic District	Meadville		6/8/87
U.S. Post Office, Meadville	Meadville		5/12/80
405 Walnut Street	Meadville		3/15/85
438 Walnut Street	Meadville		3/15/85
611-13 Terrace Street	Meadville		11/13/85
John Brown Tannery Site	New Richmond	12/14/78	
Bridge over French Creek	Rockdale Township	6/22/88	

Conneaut Lake Park	Sadsbury Township		9/14/95
Patrick McGill House	Saegertown		6/25/81
Edward Saeger House	Saegertown	8/22/80	
Oliver Saeger Mansion	Saegertown		3/24/87
Calvary Protestant Episcopal Church	Townville		6/25/81
Charles Prescott House	Vernon Township		11/30/92
Bridge over French Creek	West Mead Township	6/22/88	
Woodcock Academy	Woodcock		4/30/81

Erie County

Historic Name	Municipality	Listed	Eligible
Hornby School	Greenfield Township		12/4/87
Bridge in Union City Borough	Union City	6/22/88	
Union City Historic District	Union City	3/9/90	
J. G. Hubbell House	Amity Township		3/4/99
Academy Hall	Edinboro		4/29/93
Tanner Road Bridge over French Creek	Venango Township		10/13/89
Eagle Hotel	Waterford	10/28/77	
Waterford Borough Historic District	Waterford	3/9/90	
Waterford Covered Bridge	Waterford Township	9/17/80	

Mercer County

Historic Name	Municipality	Listed	Eligible
Bridge in French Creek Township	French Creek Township	6/22/88	

Venango County

Historic Name	Municipality	Listed	Eligible
Samuel F. Dale Home	Franklin	12/4/75	
Franklin Historic District	Franklin	1/26/84	
Franklin Rolling Mill and Foundry Company	Franklin		5/5/95
Plumer Block	Franklin	4/20/78	
206 11th Street	Franklin		8/8/86
513 15th Street	Franklin		8/8/86
U. S. Post Office	Franklin		7/3/84
W. H. Cowan Bridge	Jackson Township		3/27/92
Gleason Bridge	Jackson Township		3/27/92
Jack Cowan Bridge	Plum Township		4/10/90
Third Street Bridge	Utica		1/7/98

Source: Pennsylvania Historical & Museum Commission, Bureau for Historic Preservation

Appendix J

Meeting Notes

Western Pennsylvania Conservancy
French Creek Watershed Conservation Plan
Steering Committee
Meeting Notes
March 10, 2000 – 11 A.M.
Edinboro University

Attendees: Todd Sampsell, Jacqui Bonomo, Charles Bier – WPC; Brian Hill – FCP; Henry Lawrence, Brian Zimmerman – Edinboro University; Dave Skellie – Erie Co. Dept. of Planning; John Holden – PA DEP; Robert Wellington – Erie Co. Dept. of Health; Mike Campbell – Mercyhurst College; Budd Luce – French Creek Outfitters; Marnee Gormley – USFWS; Robert Anderson – USGS; Jeff Lang – Dad's Products; Jon Chase – Pitt.; Dan Miller - Attorney; Chrissa Hebert – Crawford Co. Conservation District; Ron Wooster – Lord Corp.

Objectives: The purpose of the meeting was to introduce the committee members and WPC staff and establish a uniform agenda on the conservation planning process. This involved a discussion of the roles of the steering committee and the proposed scope of work.

For next mtg: (committee) – review GIS layers; review scope of work; identify sources of information on French Creek; recommend other committee members

(WPC) – begin implementation of scope of work; schedule individual meetings with committee members; establish list serve; establish web page

Date of next mtg: September 29, 2000

Important dates: Glacial Lakes Symposium – April 1, 2000 (social – March 31)
Pymatuning Open House – April 1-2, 2000
Watertrails meeting – April 5, 2000
Stakeholder's meetings for conservation plan – April 13, 27, and May 5, 2000

Meeting highlights:

Discussed possible additional committee members (US Army Corps of Engineers, Conservation Districts, NRCS, PennDot, Presque Isle Audubon, Erie Aggregates)

Discussed role of steering committee:

- act as a resource
- provide input, steer development

- review drafts
- workgroup substructure
- attend meetings
- data analysis
- augments expertise of WPC staff
- refer additional experts not on committee
- partner to WPC to lend credibility and objectivity to planning process
- assist in homepage and hard document creation for external audiences
- communicate via listserve on contact info, meeting notes, and watershed activities
- review advance material
- review compiled material
- prioritize areas for conservation and restoration
- form implementation groups (phase II)
- help formulate indices to monitor progress in watershed

Discussed important notes for conservation plan

- explore PennDot's GIS capabilities
- explore "dirt and gravel road mapping"
- develop program for townships to take advantage of in final plan (recommendations)
- facilitate better coordination among local groups (recommendations)

Western Pennsylvania Conservancy
French Creek Watershed Conservation Plan
Steering Committee
Meeting Notes
November 17, 2000 – 1 P.M.
Northwest Field Station at Lake Pleasant

Attendees: Todd Sampsell, Charles Bier – WPC; Brian Hill – FCP; Marnee Gormley – USFWS; Sarah Galloway – Erie Co. Conservation District; Brian Pilarcik – Crawford Co. Conservation District; Dave Skellie – Erie Co. Dept. of Planning; Bob Anderson – USGS; Jeff Lang – DAD's Products & Conneaut Lake/French Creek Valley Conservancy
***Attendance was low due to significant snow accumulation.**

Objectives: In addition to welcoming and orienting new committee members, the purpose of this meeting was to provide a progress report to the committee from the Watershed Conservationist and discuss next steps.

For next mtg: (committee) – review draft outline and provide comments by 12/31/00; review drafts of sections as they are completed by Watershed Conservationist and provide comments in time allotted; think about management options and recommendations based on data for next meeting.

(WPC) – finish data collection and library research of available information; begin drafting sections of plan and providing to committee members and WPC staff for comments; establish web page based on committee recommendations.

Date of next mtg: late Spring 2001

Meeting highlights:

Presented updated list of committee members, subject to change if new key individuals are identified as important potential members of committee.

Reviewed March 10, 2000 meeting notes to orient new members.

Discussed progress on Conservation Plan to date:
- presented draft outline for committee review
- discussed intern working on French Creek GIS
- reported on excellent public stakeholder meetings and presentations to other groups

Discussed content of web page as Conservation Plan develops:
- links to data sources on French Creek
- overview of what a Conservation Plan is
- list of committee members (w/o contact info.)

- meeting minutes
- draft outline
- allow public to pose questions anonymously
- promote citizen action committees

Discussed important notes for conservation plan:

- must be user friendly to insure document gets used
- include summary of land use controls such as comprehensive plans, zoning, and development regulations
- make recommendations about smart development, attention to wording when plans are being developed, agricultural security areas, and zoning

Important announcements:

- FCP and WPC are holding a meeting with key individuals to develop outreach and education plan for zebra mussel issue in French Creek watershed

WPC has applied for planning grant to provide guidance on operation of Northwest Field Station and development of Lake Pleasant Conservation Area. This office will be base of operations for WPC work in northwest PA.

Western Pennsylvania Conservancy
French Creek Watershed Conservation Plan
Steering Committee
Meeting Notes
May 22, 2001 – 12 P.M.
Allegheny College, Meadville

Attendees: Todd Sampsell, Charles Bier – WPC; Brian Hill, Alice Sjolander, Zahavo Cheropovich – FCP; Marnee Gormley – USFWS; Sarah Galloway – Erie Co. Conservation District; Brian Pilarcik – Crawford Co. Conservation District; Dave Skellie – Erie Co. Dept. of Planning; Bob Anderson – USGS; Jeff Lang – Conneaut Lake/French Creek Valley Conservancy; John Holden – PA DEP; Cindy Smith – PA DOT; Jim Mondock – Mercer Co. Conservation District; Brian Zimmerman, Hank Lawrence – Edinboro University

Objectives: The purpose of this meeting was to develop specific recommendations to address perceived threats in the watershed. From those specific recommendations, the next step was to define and develop specific management options and action plans for organizations, municipalities, agencies, and others in the watershed to adopt and carry out.

The committee was also asked what else the plan needed to be effective.

Results: An excellent discussion ensued for approximately 3 hours. The committee did not achieve all objectives of the meeting so it was decided that a follow-up meeting was needed to continue these important discussions. A June 6, 2001 meeting was scheduled at Edinboro University.

The following is a summary of the thoughts discussed at the May 22nd meeting. For each threat, specific recommendations are listed.

Nutrients & Organic Wastes

- Address P in the watershed
- Collect nutrient data/nutrient budget
- BMPs with monitoring of results
    - Ag
    - Streambank fencing
    - Riparian Restoration
- Better use of NMPs planning through Conservation Districts/NRCS
    - Increase public awareness of program
- Public awareness of non-ag NPS
    - Septic systems
    - Lawn care
    - CSOs (point source?)

- Establish program to assist homeowners in septic system evaluation
    - PennVest
    - HomeAssist
    - Cons. Dist. Factsheets
- Rural electric newsletter used as educational outlet
- Franklin Township, Erie Co. model of septic system maintenance agreement
- Research to determine nutrient loads by sub-basin, prioritize
    - Identify sources
- Education of fertilizer users on appropriate amounts @ point of sale
- Encourage soil tests
- Increase air quality monitoring stations

Toxins

- Identify sources through sampling
- Look at DEP requirements that say minor discharges (< 100K gal/day) aren't monitored
- Make sure stored toxins are adequately buffered against spills
- Toxins not stored in floodplain
- Increase what toxins are required to be tested for by dischargers
- Determine total loadings for toxins in watershed discharges
- Use toxin info. To increase public awareness
- Promote recycling/proper disposal of toxins (batteries, pesticides, etc.)
- Look @ costs associated with comparing tissue/sediment toxin levels with discharge levels
- Education of public on usage of household hazardous wastes (pesticides)
- Get info. On abandoned well capping
- Determine impacts of abandoned wells
- Determine impacts of salt/brine application on roads (look @ permitting and regulation)
- Determine impacts of releases of toxins and nutrients from hatcheries

Suspended solids

(Ag related)

- Determine sources and deposition contributed by sub-basins
- Collect baseline info. On streambed conditions
- Need macro info. From non-riffle areas
- Research to increase understanding of fluvial geomorphology
- Promote stormwater management planning to address erosion/runoff from urban areas
- Promote no-till farming, organic methods

(Forestry)

- Promote BMP's for timbering
- Promote conservation easements for timbering
- Education for loggers and woodlot owners
- Develop watershed-wide forest owner cooperatives
- State forest practices act

- Clearinghouse of info. on watershed loggers
- Promote forest certification (Sustainable forestry initiative)
- Promote reforestation
    - Proper locations (soil, waterways)
    - Consider economics
    - Tax forgiveness for forested areas
    - Modify tax code for forest landowners
- landowner education on reputable foresters

(Roads & Construction)

- Gain support for stormwater management plans
- Promote urban BMP's in construction
- Promote conservation easements
- Oil grit separators
- Construction BMP's
- Education on proper construction & urban BMP's
- Promote dirt and gravel road program
- Prioritize municipalities based on impacts for dirt & gravel road program
- Increase capacity to monitor E&S from construction projects

(Sand & Gravel mining)

- Promote conservation easements
- Promote natural vegetative buffers
- Identify native species and promote for planting (reclamation)
- Increase bond amounts

- No more dams

- Look at removal of all small dams
- Research impacts of dams on FC communities
    - Consider alternatives for Union City dam

Invasive Species

- Identify initial invasions and address
- Education for landowners on identification
- Support landowners for removal
- Expand current control programs (i.e. Mike Zoeller, hogweed)
- Education for landowners, nurseries
- Organize volunteers for removal
- Annual volunteer inventory of watershed
- Prioritize threats by species, sites, impacts, activities
- Zebra mussel education (Goby & all invasives)
- Increase monitoring for invasives (lakes, streams)
- Work with baitshops on education
- Review PFBC regulations on baitfish sales

- Develop list of acceptable baitfish for watershed (ecotourism)

What else???

- Prioritize projects

- establish timeframes
- establish targeted audience
- agency/organization resource list (including small watershed groups)
- Bib
- Timeframe
- Specific plan for review of plan
- ID key parties for project adoption
- Executive summaries tailored to specific groups (farmers, municipal officials, etc.)

Western Pennsylvania Conservancy
French Creek Watershed Conservation Plan
Steering Committee
Meeting Notes
June 5, 2001 – 11 A.M.
Edinboro University, Edinboro

Attendees: Todd Sampsell, Charles Bier – WPC; Brian Pilarcik – Crawford Co. Conservation District; Dave Skellie – Erie Co. Dept. of Planning; Jeff Lang – Conneaut Lake/French Creek Valley Conservancy; Cindy Smith – PA DOT; Jim Mondock – Mercer Co. Conservation District; Brian Zimmerman, Hank Lawrence – Edinboro University; Jess Sunder – Venango Co. Conservation District

Objectives: The purpose of this meeting was to continue to develop specific recommendations to address perceived threats in the watershed. From those specific recommendations, the next step was to define and develop specific management options and action plans for organizations, municipalities, agencies, and others in the watershed to adopt and carry out.

Results: Todd Sampsell began with a summary of findings from the May 22nd meeting. This led to a short discussion about point source pollution and the need for the plan to present discharge info. and a plan to identify potential dischargers that aren't permitted.

An excellent discussion ensued for approximately 4.5 hours. The committee finished proposing specific recommendations to address threats in the watershed.

The committee decided that the plan should have a 3-year timeframe with the idea of re-evaluating and revising the plan at that time.

The committee listed the top priority action plans/management options for protection of land, water, biological, and cultural resources to be accomplished within the 3 years following the completion of the plan.

The committee decided on other important action plans, which address:
1) expanded educational programs with increased coordination between organizations currently doing education in the watershed
2) plan should present a reference tool for people to easily determine what topics require education, what are the issues about the topics that should be emphasized in educational programs, and who is the target of those educational programs

In closing the discussion, the committee decided to continue meeting, potentially quarterly, and to include members of sub-watersheds groups that are recommended to be formed in the plan. This group will meet to discuss success and failures as the recommendations in the plan are implemented. Lastly, it was

determined that periodic forums should be held throughout the watershed to encourage targeted groups (i.e. municipal officials, scientists, educators, landowners, etc.) to come together for facilitated discussions about issues they face in the watershed.

The following is a summary of the thoughts discussed at the June 5th meeting. For each threat, specific recommendations are listed and for resources, management options/action plans are prioritized for completion in 3 years following completion of the plan.

Alterations of Hydrology

- In the plan, expand on how dams not only increase scour but also prevent natural flooding and natural erosion/deposition patterns
- Agencies should consider controlled flooding
- Agencies should look at how releases are managed
- Develop a watershed budget/hydrologic model which takes into account stormwater
    - Key partners – USGS & team of university researchers
    - Start w/ theoretical model and build onto by monitoring and collecting info.
- Check on new GIS being developed for the purpose of stream reach evaluation
    - May be a tool the conservation districts utilize
- Address the many agricultural drainage tiles in the watershed
- Encourage counties to develop stormwater management plans and municipalities to adopt stormwater development ordinances
- Promote BMPs for urban development (both new development and retrofitted BMPs)
- Retrofit projects in established urban areas
- Promote urban reforestation

Water Withdrawals

- Encourage better monitoring/permitting of individuals withdrawaling
- Monitoring should be designed to provide early warning of impacts to watershed
- Consider revising state regulations with PA DEP as the authority
- Tie community withdrawals into an overall hydrologic model
- Determine adequacy of well info. and permitting for residential wells
- Conduct meeting of withdrawalers to coordinate withdrawals
- Encourage ag operations to make reservoirs for withdrawals, identify funding to help

Channel/Streambank Modifications

- Promote more incentive programs for streambank fencing and riparian buffer/streambank restoration
- Educate landowners to benefits to both environment and landowner for streambank protection
- Educate landowners on resources/agencies available to help
- Re-establish natural channel morphology at bridges (through engineering)
- Educate landowners that modifications of natural streambed/banks is not desirable
- Educate landowners/loggers that cutting trees off streambank is not beneficial to stream
- Education should be geared towards the idea that FC is dynamic and that symptoms are too often addressed w/o addressing the problems (i.e. hydrologic alterations can increase flows, which result in increased erosion – fixing the erosion is not addressing the causes)
- Education has to include the "big" picture of how the watershed works (need hydrologic model)

Agriculture/Livestock

- Increase streambank fencing
- Sub-watershed associations should go after funding to help local landowners
- Promote agricultural BMPs and NMPs
- Promote leaving riparian buffers between crops and streams

Logging

- Wetland (and vernal pool) protection should be a priority
- Stricter enforcement of E&S plans is needed; may require modifications of regulations
- Introduce bonds as is used in mining
- Require logging permits
- Promote lobbying for state regulations requiring sustainable forestry practices

Mineral Extraction

- Identify critical properties that are likely to be mined and promote easements
    - Should be prioritized based on impacts to watershed
- Promote volunteer monitors for mine effluents
- Mandatory setback from wetlands/waterways for drilling rigs

Transportation Corridors

- Make sure emergency response is adequate for stream protection (need knowledge of train/truck cargo)
- County and PA DEP emergency response education for dealing with stream protection (not just public health)

Recreation

- Address ATV usage
    - Promote regulations for stream crossings (fines for non-compliance)
    - Promote designated trails in less sensitive areas
    - Increase education requirements for ATV riders
- Promote rail/trail development along stream
- Access areas must be located in appropriate areas based on ecological research
- Increase education about invasive species transportation
- Promote catch and release
- Creel limits and sizes should be customized to French Creek
- Increase and enforce regulations for taking of baitfish
- Increase education about the impacts of powerboating and environmental degradation
- Develop guidelines for riparian development for cabins or trails

Urbanization

- Promote setback regulations for development
- Development plans should maximize green space
- Restore bank and riparian habitats in urban areas
- Focus on urban streams as community assets (park land)
- Target growth areas with state funds
- Conduct long range planning
- Promote assistance to municipalities for zoning issues

Landfills

- Need to address small, old, individual, or abandoned municipal dumps
- Promote volunteer inventory of sites coupled with water quality monitoring
- Provide incentives and education to landowners for dump clean-up
- Promote recycling and household hazardous waste management

Management Options/Plan of Action

- 3-year review (initially)
- Prioritized
- Municipality must nominate plan to state registry

Land Resources

1) Form network of sub-watershed associations or citizen action committees to implement help implement plan recommendations

2) Promote county and municipal land use comprehensive plans, zoning, and subdivision regulations (existing plans should be updated to incorporate Smart Growth concepts)
    a. Utilize conservation plan in process
    b. Stress environmental protection in process
    c. Stress farmland preservation
3) Identify key riparian buffer areas
    a. Identify where degraded
    b. Increase promotion of riparian restoration
4) Develop conservation easement program
5) Summarize, disseminate, and encourage BMP implementation for:
    a. Agriculture
    b. Logging
    c. Urban areas
    d. Development

Water Resources

1) Assess physical stream conditions
    a. Visual assessment of stream channel and riparian areas
    b. Biological assessment for water quality (watershed wide)
    c. Water quality assessment (nutrient budget)
2) Develop hydrologic model/water budget
    a. Include impacts from low-flow withdrawals
3) Begin development and implementation of comprehensive systematic water quality monitoring plan
4) Encourage watershed stormwater management plan and municipal stormwater regulations
5) Assess impacts to biota during base or lower flows with potential exacerbation from withdrawals
6) Apply sub-watershed approach
7) Assess wetland resources to allow monitoring and protection

Biological Resources

1) Complete CNH Inventories
    a. County-wide or just watershed
    b. Update Erie Co. inventory
2) Complete watershed-wide species of concern and natural communities assessments
    a. Instream habitat
    b. Wetland habitat
3) Inventory and monitor and plan for control or removal of invasive species
    a. Zebra mussel
    b. Purple loosestrife
    c. Gobie
    d. Hogweed

e. Eurasian milfoil
f. Hybrid cattail
g. Phragmites
h. Japanese knotweed

4) Monitor select endangered species
    a. Clubshell
    b. Northern riffleshell
    c. Others to be identified or already known
5) Monitor stream community
    a. Identify appropriate indicator organisms/protocols for monitoring FC community health
    b. Mussels, insects, fish at select locations
    c. Plankton might be appropriate indicator to monitor

Cultural Resources

1) Inventory and map existing public lands and FC access points
2) Assess impacts and develop watershed recreation plan to include:
    a. ATV usage
    b. Watertrail feasibility
    c. Railtrail feasibility
    d. Appropriate access areas
    e. Fishing regulations or recommendations customized to FC
    f. Greenway corridor identification

Other Action Plans

1) Expanded educational program
    a. Develop brochures with "top 10" lists of ways to protect FC targeted to different audiences
    b. Increased coordination and cooperation of existing educational programs (FCP, WPC, Creek Connections, Universities, Glinodo, Cons. Districts, PFBC, DCNR, PGC, Asbury Woods)
2) Summarize public educational needs as identified throughout the plan and present within plan as a tool that would identify topics for education, issues regarding topics that need to be addressed in education, and targeted audiences for education

Future Considerations by Committee:

1) French Creek Steering Committee will include representative of each sub-watershed association and will meet periodically after plan is produced and implemented to discuss successes and failures and to review and update plan.
2) French Creek Steering Committee should consider holding periodic forums throughout watershed to target specific groups to come together and discuss watershed issues.

Public Meetings on Draft French Creek Conservation Plan

August 7, 2001 – WPC Northwest Field Station, Lake Pleasant
August 9, 2001 – Bandstand Park, Franklin, PA
August 16, 2001 – Allegheny College, Meadville, PA

*Attendance was low at first two meetings. French Creek Project Advisory Council invited to third public meeting. Meeting summary follows as captured by French Creek Project staff.

Brian Hill began the meeting with a brief description of current work on French Creek. He also introduced Todd Sampsell from the Western Pennsylvania Conservancy. Todd provided a 35-minute power point presentation on the draft conservation plan, after which there was a discussion on the plan.

Comments on the plan fell into four basic categories: a recognition of the importance of the plan and the amount of the work associated with its development; concern about new regulations; concern about responsibility for final implementation of the plan; and support for local control.

A number of those who commented on the draft plan lauded the work that had gone into the plan and its usefulness as a summary document on French Creek. For example, Denny Puko from the Mercer County Planning Commission emphasized the need to provide basic documentation for the natural, historical, and cultural resources in the watershed and he indicated his support for the effort to develop the plan. Jeff Allio and Mark Gorman from PA DEP also expressed their support for the planning effort and the development of the plan. In fact, among those attending the meeting there appeared to be general support for the plan's development and the need to provide documentation on French Creek.

Keith Klingler from the PA Landowners Association raised a number of objections to the plan. He pointed to recommendations that encouraged new regulations. He said that he felt that this was a violation of the original agreement underlying the French Creek Project. He said that the PLA would oppose the plan without significant changes.

A number of farmers who attended the meeting, including Wayne Stainbrook and George Greig stated their support for the ongoing work of the French Creek Project. They added that they thought that education and voluntary initiatives were the most effective approaches for working with farmers and landowners. They pointed to an initiative by PA DEP to engage farmers to help work with other farmers who are out of compliance with environmental rules. This program started in this region and it has been so successful that it is now used throughout the state. They also stated that local control of the plan's implementation is essential to its success.

Bob Concilus from the Conneaut Lake and French Creek Valley Conservancy and Doug Mehan from PPG Industries both expressed their strong belief that the implementation of the plan should be overseen by the French Creek Project Advisory Committee and not the newly created steering committee. They believe that the Advisory Committee is diverse and has an understanding of the cultural landscape in the watershed. They emphasized the need for local control and

concerns about “a Pittsburgh-based” organization overseeing the plan. Mr. Mehan also had some technical issues with the plan, but he submitted written comments covering those issues.

John Izbinski from the Environmental Alliance for Senior Involvement stated it was important that the groups involved work together to develop a final plan that was acceptable to all parties.

Special Meeting of the French Creek Project Advisory Committee
September 21, 2001
Allegheny College
Meadville, PA

Background: At the request of several members of the French Creek Project Advisory Committee and because of concerns raised by farmers about the draft conservation plan, Brian Hill called a meeting of the Advisory Committee to discuss concerns. He also invited a number of farmers from the French Creek watershed. Todd (Sampsell) invited representatives from the Western PA Conservancy Steering Committee.

Comments: After brief opening remarks by Brian Hill and Todd Sampsell, there was an extensive discussion of the draft plan. Most of the comments related to the substance of the plan, concern about the recommendations that propose new regulations, concern about the composition of the steering committee overseeing the plan, the need for local control, concern about how agriculture is portrayed in the plan, and recognition of ongoing work in the watershed.

Hank Ingram and Mark Troyer, both board members of PA Landowners' Association, raised a number of objections to the plan. Mr. Ingram pointed to the composition of the steering commit and said that there were no farmers or landowners represented on the group. He thought that this was a significant oversight. He also focused on a number of the recommendations in the plan that proposed additional regulations and stated that this is not in accord with original concept behind the French Creek Project (Mr. Ingram also submitted detailed written comments). He said that the French Creek Project and its partners should promote cooperation.

Mr. Troyer agreed with Mr. Ingram's comments and said that he believed that the draft plan portrayed agriculture as the major problem. The plan fails to describe the positive impacts associated with farming and the fact that a significant amount of work is already occurring to improve farm practices. His concern about how farming is depicted was reinforced by a number of other farmers who were present at the meeting including Doug Gilbert, Wayne Stainbrook, George Greig, and Walter Royek. They also raised specific concerns about provisions calling for new logging permits ("will I now have to get a permit to cut trees on my property?") and permits for water withdrawal. Finally, they were concerned that farmers were not included on the steering committee. These farmers as well as Calvin Ernst and Jeff Peters emphasized the importance of the cooperative programs that are currently underway by NRCS, the conservation districts, and the French Creek Project. These are successful and should continue.

Jeff Lang from Dads Products stated that if the plan appeared to be regulatory in nature it was unintended. The language should be modified, because the intention of the steering committee was not to increase regulations. In fact, most of the plan describes cooperative approaches and education. This point was reinforced by Brian Pilarcik.

Robert Concilus from the Conneaut Lake and French Creek Valley Conservancy emphasized the importance of a "community based" approach during plan development and implementation.

Jim Lang also from Dads Products said he understood why WPC chose to include certain expertise on their steering committee, though he thought we could have broadened the FCP Advisory Committee to meet hose needs. Nevertheless, he believed that once the plan was complete that FCP Advisory Committee was more diverse and, therefore, better prepared to oversee implementation.

Bob Concilus advocated that the FCP Advisory Committee oversee the plan implementation and asked for a vote. The Committee voted 14 to 1 in support with 1 abstention.

With the assistance of Mark Kulich from PA DCNR, the group also discussed the purpose of the conservation plan. It was clearly stated that the development of the plan was not a precursor to scenic river designation. Once the plan is in place it will allow municipalities and others in the watershed to access certain PA DCNR funding for a variety of purposes.

The group discussed implementation of the final plan, including broadening the FCP Advisory Committee with extra members to help oversee that effort.

David Skellie from the Erie County Planning Department said he had seen similar debates about plans in the past and after listening to the discussion of the group he believed that most, "maybe 95%," of the plan is acceptable to everyone. We need to deal with the 5% that is of concern.

The FCP Advisory Committee voted to create a special committee to review the plan and make recommendations on behalf of the FCP Advisory Committee to Todd Sampsell. Larry Schweiger and Todd Sampsell said that the comment period would be extended to October 21, 2001. Their goal is to solicit as much public input as possible and to develop a plan that is acceptable to the people who live in the watershed, and will be used.

Western Pennsylvania Conservancy
French Creek Watershed Conservation Plan
Steering Committee
Meeting Notes
November 16, 2001 – 1:00 P.M.
Edinboro University

Attendees: Todd Sampsell, Charles Bier, Ryan Evans – WPC; Brian Pilarcik – Crawford Co. Conservation District; Jim Mondock – Mercer Co. Conservation District; Budd Luce – French Creek Canoe and Kayak; Brian Zimmerman – Edinboro University; Dave Skellie – Erie Co. Dept. of Planning; Brian Hill – French Creek Project; Hank Lawrence – Edinboro University; Cindy Smith – PennDOT; Sarah Sargent – Conneaut Lake/French Creek Valley Conservancy; Michael Koryak – U. S. Army Corps of Engineers; Ron Wooster – Lord Corp.; Marnee Gormley – Landowner

Objectives: The purpose of this meeting was to discuss a reorganization of the potential threats, recommendations, and action plans. Also, to discuss comments received during the public review and comment period and to propose changes based on those comments. Next steps were also presented.

Results: The group discussed the list of potential threats and recommendations that were originally derived by the group. Based on comments received that the section could be more effective if reordered, it was decided that the potential threats would be consolidated and that recommendations would be grouped into the type of action needed: education, research, or cooperative action. It was decided that Todd would take an initial attempt to prioritize the recommendations and the steering committee would provide feedback once the amended plan was posted to the web page.

Changes based on comments received were discussed. The steering committee supported removing recommendations that appeared to call for increased regulations or rewording to show that the recommendation clearly called for voluntary, cooperative actions.

Todd informed the steering committee that the FCP Advisory Committee had voted to oversee implementation of the final plan. Also, members of the steering committee were invited to join the advisory committee on this effort.

The steering committee opposed the notion put forth by some members of the FCP advisory committee that WPC should play no part in this future implementation. The steering committee was reminded by Marnee Gormley of WPC's long history in the French Creek watershed, of their role in the initiation of the French Creek Project, and of their concern for and local presence in the watershed.

Nest Steps: The final plan would be completed and placed on the web page for review by the steering committee and others interested by early January. Notification would be sent to those groups and individuals who submitted comments on the draft plan. The plan would be available for 1-2 weeks online to insure the plan met with public approval before going to print by the end of January. A final public meeting would then be held to present the final plan.

WPC would form a science advisory committee to aid the FCP advisory committee in implementation of the plan. Steering committee members were invited to work with either committee, depending on background and interest.

Appendix K

Conservation Organizations Active in the French Creek Watershed

Organization	Contact
Allegheny Valley Trails Box 264 Franklin, PA 16323 web site: http://eagle.clarion.edu/~grads/avta/	Jim Holden (814) 425-7969 avta@clarion.edu
Bartramian Audubon Society P.O. Box 315 Slippery Rock, PA 16057 web site: www.csonline.net/russs/bas	Suzanne Butcher, President
Center for Economic and Environmental Development (CEED) Steffee Hall of Life Sciences, Allegheny College 520 N. Main Street Meadville, PA 16335 web site: http://ceed.allegheny.edu	Eric Pallant or Kathy Uglow (814) 332-2713 ceed@allegheny.edu
Cochranton Area Greenways 175 N. Franklin Street Cochranton, PA 16314	Dale Shreve (814) 425-7969
Conneaut Lake Aquatic Management, Inc. P.O. Box 314 Conneaut Lake, PA 16316 reimanns@toolcity.net	Tim Anderson (814) 382-2485
Conneaut Lake/French Creek Valley Conservancy P.O. Box 434 297 ½ Chestnut Street Meadville, PA 16335	Sarah Sargent, Director (814) 337-4321 conserve@mdvl.net
Corry Community Development Corporation 221 N. Center Street, Room 209 Corry, PA 16407	Christine Schalles, Executive Director (814) 665-1310 ccdc@erie.net
Crawford Co. Conservation District 14699 N. Main Street Extension Meadville, PA 16335 web site: www.crawfordconserv.com consdist@toolcity.net	Lynn Sandieson, District Manager Brian Pilarcik, Watershed Specialist (814) 724-1793

Crawford Co. Planning Commission County Courthouse 903 Diamond Square Meadville, PA 16335	Jack Lynch, Director (814) 333-7341 ccplan@toolcity.net
Creek Connections Box 10 Allegheny College 520 N. Main Street Meadville, PA 16335 web site: http://creekconnections.allegheny.edu	Jim Palmer or Chris Resek (814) 332-5351 creek@allegheny.edu
Ducks Unlimited, Inc Western PA 217 Pflugh Road Butler, PA 16001	
Edinboro Lake Preservation and Restoration Foundation	John Marchese, Volunteer Lakekeeper (814) 734-1143
Environmental Alliance for Senior Involvement Crawford/Venango counties c/o French Creek Project Erie County c/o Greater Erie Community Action Committee 18 W. 9th Street Erie, PA 16501	Alice Sjolander (814) 332-2946 Ron Howze (814) 459-4581 x457
Erie Co. Conservation District 12723 Route 19 Waterford, PA 16441 eriecons@erie.net	LeRoy Gross, Executive Director Sarah Galloway, Watershed Specialist, (814) 796-6760
Erie Co. Dept. of Health 606 W. 2nd Street Erie, PA 16507	Bob Wellington, Aquatic Biologist (814) 451-6700
Erie Co. Dept. of Planning 140 W. 6th Street, Room 119 Erie, PA 16501	David Skellie, Director (814) 451-6336 dskellie@erie.net
Erie Co. Environmental Coalition 6270 E. Lake Road	Kathy Horan (814) 899-2572

Glinodo Center
Erie, PA 16511

Erie National Wildlife Refuge (USFWS)
11296 Wood Duck Lane
Guy Mills, PA 16327
web site: http://erie.fws.gov

Jeff Haas,
Manager
(814) 789-3585

Ernst Conservation Seeds
9006 Mercer Pike
Meadville, PA 16335
web site: ernstseed.com

Calvin Ernst
(814) 336-2404
(800) 873-3321
calvin@ernstseed.com

French Creek Environmental Advisory Council
PPG Industries, Inc.
Works No. 8
Kebert Industrial Park
Meadville, PA 16335

Doug Mehan
(814) 336-8326
mehan@ppg.com

French Creek Outdoor Learning Center
18308 Broadway
Crawford Co. Industrial Park
Meadville, PA 16335
web site: www.craw.org/wend/fcpl/htm

Judy Acker
(814) 337-7305
fcolc@gremlan.org

French Creek Project
Box 172 Allegheny College
520 N. Main Street
Meadville, PA 16335
web site: http://frenchcreek.allegheny.edu

Brian Hill
(814) 332-2946
1-888-920-8699
frenchcrik@aol.com

French Creek Recreational Trails
773 N. Main Street
Meadville, PA 16335

Tom McNally
(814) 333-1258
1-800-332-2338

Lake Erie-Allegheny Earth Force
6270 East Lake Road
Erie, PA 16511
web site: www.earthforce.org

Pat Lupo, OSB
(814) 899-2572
lea@earthforce.org

Meadville Community Energy Project
Box E Allegheny College
520 N. Main Street
Meadville, PA 16335
web site: http://webpub.allegheny.edu/group/mcep/index.html

Kathy Greely or
Michael Maniates
(814) 332-2986
kgreely@allegheny.edu

Mercer Co. Conservation District 747 Greenville Road Mercer, PA 16137	Jim Mondock, District Manager (724) 662-2242 mercerccd@pathway.net
Mercer Co. Regional Planning Commission 2491 Highland Road Hermitage, PA 16148	Denny Puko, Executive Director (724) 981-2412 dpuko@mcrpc.com
Natural Resources Conservation Service (USDA) 14699 N. Main Street Extension Meadville, PA 16335 web site: www.nrcs.usda.gov	Carl Pelino (814) 336-2127 x111
Northwest Duckhunters Association	(814) 456-6942
Northwest Pennsylvania Woodland Association c/o PSU Cooperative Extension, Warren County 609 Rouse Avenue, Suite 200 Youngsville, PA 16371	(814) 563-9388 WarrenExt@psu.edu
Oil Heritage Region, Inc. National Transit Building 206 Seneca Street 4th Floor P.O. Box 128 Oil City, PA 16301 web site: www.oilregiontourist.com	Marilyn Black (814) 677-3152 x17 1-800-4VENANGO x17 oilheritage@usachoice.net
PA Bureau of Forestry 14699 N. Main Street Extension Meadville, PA 16335	(814) 332-6875
PA Cleanways of Venango County 1007 Elk Street #1 Franklin, PA 16323 web site: www.pacleanways.org/venango.html	Brad Mauersberg (814) 437-6551 bmauers@yahoo.com
PA Dept. of Agriculture 13410 Dunham Road Meadville, PA 16335	(814) 332-6890
PA Dept. of Conservation and Natural Resources Northwest Region 212 Lovell Place	Mark Kulich (814) 871-4190

Erie, PA 16503 web site: www.dcnr.state.pa.us	
PA Dept. of Environmental Protection Northwest Region 230 Chestnut Street Meadville, PA 16335 web site: www.dep.state.pa.us	main office: (814) 332-6945 Art Provost, Watershed Coord.: (814) 332-6840
PA Dept. of Transportation Engineering District 1-0 P.O. Box 398 255 Elm Street Oil City, PA 16301	Thomas Minnich, Environmental Manager (814) 678-7008 minnich@dot.state.pa.us
PA Fish & Boat Commission Northwest Region 11528 State Highway 98 Meadville, PA 16335 web site: www.fish.state.pa.us	education: (814) 336-2426 law enforcement: (814) 337-0444
PA Game Commission Northwest Region 1509 Pittsburgh Road P.O. Box 31 Franklin, PA 16323 web site: www.pgc.state.pa.us	(814) 432-3187 1-877-877-0299
Pennsylvania Environmental Council 64 S. 14th Street Pittsburgh, PA 15203 web site: www.alleghenywatershed.org	Joan Schoff (412) 481-9400 pecpgh@sgi.net
Penn State Crawford Co. Cooperative Extension 13400 Dunham Road, Suite A Meadville, PA 16335	Joel Hunter, Director (814) 333-7460 CrawfordExt@psu.edu
Penn State Erie Co. Cooperative Extension 850 E. Gore Road Erie, PA 16509	Holly Hedstrom, Director (814) 825-0900 ErieExt@psu.edu
Penn State Mercer Co. Cooperative Extension P.O. Box 530 463 North Perry Highway	Janet McDougall, Director (724) 662-3141

Mercer, PA 16137	MercerExt@psu.edu
Penn State Venango Co. Cooperative Extension 867 Mercer Road Franklin, PA 16323	Jeffrey Fowler, Director (814) 437-7607 VenangoExt@psu.edu
Pennsylvania Landowners' Association P.O. Box 391 Waterford, PA 16441 web site: pa.landowners.org	1-800-757-5178 info@pa.landowners.org
Pennsylvania Organization for Watersheds and Rivers (POWR) 25 N. Front Street P.O. Box 765 Harrisburg, PA 17108 web site: www.pawatersheds.org	(717) 234-7910
Presque Isle Audubon Society P.O. Box 1783 Erie, PA 16507 web site: www.presqueisle.org/audubon	Susan Smith (814) 461-9044 ssmith@velocity.net
Purple Martin Conservation Association Edinboro University of Pennsylvania Edinboro, PA 16444 web site: www.purplemartin.org	(814) 734-4420 pmca@edinboro.edu
The Nature Conservancy P.O. Box 310 129 W. Main Street Sherman, NY 14781 web site: www.tnc.org	Andy Peck (716) 761-4212 apeck@tnc.org
Trout Unlimited Northwest PA Chapter 3765 Gable Court Erie, PA 16506 web site: www.fisherie.com/nwpatu	Eric Lyle (814) 838-9512 elyle@adelphia.net
U. S. Army Corps of Engineers Woodcock Creek Lake Rte. 198 Saegertown, PA 16433	Reservoir Manager (814) 763-4477 or (814) 763-4422
Venango Co. Conservation District	Jes Sunder,

R.D. 5 Box 320 Franklin, PA 16323	Watershed Specialist (814) 676-2832
Venango Co. Planning Commission 248 Seneca Street, P.O. Box 128 Oil City, PA 16301	Jim Szymecki (814) 677-3152 x6 vcplanning@csonline.net
Venango Museum/Allegheny River Support Groups 270 Seneca Street Oil City, PA 16323	Barbara Perlstein (814) 676-2007 arsg@venangomuseum.org
Western Pennsylvania Conservancy Northwest Field Station 11881 Valley Road Union City, PA 16438 web site: www.paconserve.org	Todd Sampsell (814) 739-9991 tsampsell@paconserve.org

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