

Coldwater Heritage Partnership

LITTLE LEHIGH CREEK COLDWATER CONSERVATION PLAN



October 2007



Acknowledgements

This project was not possible without the support of the partners listed below.

The Lehigh County Conservation District (LCCD) was critical in the development of the Conservation Plan. The Watershed Specialist **Rebecca Kennedy** and Conservation Program Specialist **Erin Frederick** took on significant roles beyond expectations to ensure success. They were involved in all aspects including developing the protocol for the visual stream assessment, surveying dozens of reaches, and designing a GIS format to better interpret the data collected. LCCD invested enormous amounts of resources and GIS expertise that allowed the partners to develop a Conservation Plan more comprehensive than thought possible.

In addition, dedicated members of the Little Lehigh Trout Unlimited and Saucon Creek Watershed Association volunteered numerous hours walking the main stem of the Little Lehigh Creek to assess the state of the waterway.

Two members of the Saucon Creek Watershed Association deserve special recognition. These volunteers surveyed the greatest number of reaches and their dedication was greatly appreciated.

Terry Boos
Ray Follador

We would like to also thank the hard work of the following volunteers that spent time assessing the creek.

Bob Ditmars
Greg Gliwa
Allan Johnson
Stacy Reed
Jeff Sabo
Burt Schaffer
Mario Spagnoletti
Powen Wang



This plan was made possible through a grant from the Coldwater Heritage Partnership. The Partnership is a collaborative effort between the PA Fish & Boat Commission, PA Department of Conservation and Natural Resources, Western Pennsylvania Watershed Protection Program and Pennsylvania Trout.

TABLE OF CONTENTS

Executive Summary	4
Introduction & Background	5
Watershed Area	5
Land Use & Soils	5
Stream Use & State of the Streams	6
Pennsylvania Fish & Boat Commission Classification	7
United States Geological Survey Gaging Station	8
Summary of Previous Reports	8
Unique & Outstanding Values in the Watershed	11
Water Quality Data Previously Collected	12
2006-2007 Visual Assessment of Main Stem & Photo-documentation	13
A. Protocol	13
B. Stream Visual Assessment Data Collection	14
C. Data	
1. Channel Condition	15
2. Riparian Zone	16
3. Bank Stability	17
4. Nutrient Enrichment	18
5. Barriers to Fish Movement	19
6. Instream Fish Cover	20
7. Insect/Invertebrate Habitat	21
8. Canopy Cover	22
9. Manure Present	23
10. Riffle Embeddedness	23
11. Macroinvertebrates Observed	24
Analysis of Parameters	24
Overall Assessment Score Map	25
Results Summary	26
Watershed Analysis: Areas of Concern	27
Watershed Success	28
Summary of Recommendations	28
Conclusion	31
References & Resources	32
Appendix	34
Little Lehigh Creek Watershed Map	
Table E. Little Lehigh Water Quality Indicators (Main Stem)	
Table F. Little Lehigh Water Quality Indicators (Tributaries)	
Table G. Fish Surveys Conducted on the Little Lehigh Creek Main Stem	
Visual Assessment Data Form	
Letter to Streamside Landowners	
Invitation to Public Meeting	
Press Release Announcing Public Meeting	

Executive Summary

To further protect the Little Lehigh Creek Watershed, stakeholders developed a Coldwater Conservation Plan made possible through a grant from the Coldwater Heritage Partnership. The plan consisted of a qualitative habitat assessment on the main stem of the Little Lehigh Creek, an analysis of the habitat assessment data, and a series of prioritized recommendations to protect and enhance the watershed.

After attending comprehensive training sessions, staff from Wildlands Conservancy and Lehigh County Conservation District, and volunteers from Little Lehigh Trout Unlimited and Saucon Creek Watershed Association surveyed nearly 25 miles of stream. On foot or by kayak, the monitors assessed the creek using a stream assessment protocol created by the United States Department of Agriculture—Natural Resources & Conservation Services. The monitors assessed 750-foot sections of the creek, examining a variety of parameters ranging from fish habitat quality to stream bank stability. After assessing 168 sections, the scores for each reach were averaged and divided into four categories: Excellent, Good, Fair or Poor.

Overall, the majority or 56% of the reaches along the Little Lehigh Creek main stem were in poor condition (nearly 14 miles), according to the assessment. Sections of the creek considered in fair condition comprised 32% (7.6 miles), while the remaining sections or 12% (3.6 miles) were in good condition. No reaches received an overall score in the excellent category.

The best reaches overall are located in the headwaters near Topton and Longswamp Township, Berks County and are rated in good condition, nearing excellent, with scores around 8.8 out of 10. These reaches appear wooded with no roads, houses or farmland in view. Cobbles and boulders create riffles and bank erosion is minimal.

On a scale of one to ten, the poorest reaches received scores of 2.7 or less, with the four most impaired reaches located in Lower Macungie Township. These sections of the creek contained no trees growing alongside the banks, a stream channel entrenched without the ability to connect with the floodplain, unstable eroding banks three-feet high, and the original stream bottom completely buried under sediment.

Visual assessment monitors found that poor stream conditions existed throughout the length of the main stem. Land development, road crossings, and farming activity alongside the stream created less than optimal conditions from Longswamp Township, Berks County; Lower Macungie and Salisbury Townships, Lehigh County to the City of Allentown. Many degraded stretches have inherent constraints like a road built alongside the creek, or an historic dam that prevents a reach from achieving optimal conditions.

Great variability in stream conditions existed. Reaches in good condition could often be found alongside reaches in poor condition due to a bridge crossing or historic land use. Stream monitors also found that varying landowner management practices created a marked effect on the overall condition of the stream. For example, a well-managed wooded section with riffles, overhanging vegetation and plenty of fish might be upstream of a section containing lawn mowed right to the edge, revealing significant bank erosion.

Analysis of this habitat assessment data, in combination with public input, created a number of recommendations to help correct some of the observed problems. One recommendation encourages the development of opportunities for landowners to learn techniques to restore their section of the creek. Another, assessing and strengthening municipal ordinances, may help to protect the reaches currently in good condition. Additionally, problematic areas should be targeted for enhancement and restoration projects. With community commitment, protecting and restoring the Little Lehigh Creek using a variety of approaches will be a powerful strategy to improve the water quality and aquatic habitat for future generations.

Introduction & Background

To better protect the Little Lehigh Creek Watershed through a visual-based assessment, stakeholders developed a Coldwater Conservation Plan made possible through a grant from the Coldwater Heritage Partnership. Various studies of the Little Lehigh Creek watershed have been completed to date, by a number of municipalities and organizations within the watershed. Although the studies highlighted in an upcoming section include information valuable to the protection and enhancement of the Little Lehigh Creek (Summary of Previous Reports Completed), these studies did not include a visual-based habitat assessment and photographic documentation of the stream corridor.

The Little Lehigh Creek Coldwater Conservation Plan (Conservation Plan) provided the opportunity to implement a qualitative, visual-based stream habitat assessment and to develop a series of site-specific recommendations designed to protect and enhance the Little Lehigh Creek and its stream corridor. As part of the process, this project allowed interested residents and watershed stakeholders to learn more information about the Little Lehigh Creek that would help them better preserve this natural resource.

To develop the Conservation Plan, Wildlands Conservancy partnered with the Lehigh County Conservation District and a team of trained volunteers from the Saucon Watershed Association and the Little Lehigh Trout Unlimited to perform the stream assessment. Volunteers and staff took digital photos, jotted down field notes, and filled out forms adapted from the United States Department of Agriculture-Natural Resources and Conservation Service protocols. A series of habitat-related parameters were evaluated and used to develop site-specific recommendations to identify opportunities for restoration or preservation. Targeted outreach to streamside landowners and a public informational meeting created additional community awareness and a foundation of support for future watershed conservation efforts.

Watershed Area

The Little Lehigh Creek flows into the Lehigh River. Once the Little Lehigh Creek enters the Lehigh River, the water travels 16 miles before it empties into the Delaware River. It is approximately 24 miles long and has a 107.5 square mile drainage area, excluding the Jordan Creek watershed (a large tributary that converges with the Little Lehigh near the mouth of the creek). The main stem of the Little Lehigh Creek ranges from five to 125 feet in width. Approximately 18.7 square miles of the drainage basin are located in Berks County and 88.8 square miles of the drainage basin are located in Lehigh County. The Little Lehigh Creek flows from Topton in Longswamp Township, Berks County, through Lower Macungie Township and Salisbury Township, until it converges with the Lehigh River in the City of Allentown, Lehigh County. Tributaries drain Upper Macungie Township, Upper Milford Township, Alburtis and Macungie Boroughs and South Whitehall Township.

The Jordan Creek watershed is 82 square miles and due to its large size it receives its own consideration separately from the Little Lehigh Creek. This watershed has been assessed in 2001 and the Wildlands Conservancy produced a Jordan Creek Watershed Management Plan. (See Appendix for Watershed Map)

Land Use & Soils

The land use in the Little Lehigh Creek watershed varies. Most of the land in the headwaters of the Little Lehigh Creek is rural forested land, vacant, or used for agriculture. Old mining areas have become “ponds” along the main stem in Berks County and are fished by local anglers. As the creek flows towards Emmaus and Allentown, residential housing becomes more plentiful and an urban landscape dominates. A fish hatchery is located on the Little Lehigh Creek in the City of Allentown and the Keck Archaeological Site of Delaware Indians has been found along the main stem. Some industrial and commercial use can also be found in the eastern portion of the watershed.

Historically, residential growth was limited mostly to the Allentown area due to the lack of access to public sewer systems. When more public sewer systems were built in the 1970s, the rest of the watershed increased in population, especially in Upper and Lower Macungie Townships, Lehigh County (Act 167, 1999 Update).

Despite the prosperous growth of the City of Allentown, General Harry C. Trexler around 1900 encouraged the City of Allentown to preserve land in the city. Today, known as the father of Allentown's park system, The Trexler Trust continues to provide funds to maintain the City's expansive park system. A well-loved outdoor gathering area for residents, these urban gems contain more than three miles of the Little Lehigh Creek creating a critical refuge for wildlife. The Little Lehigh Creek Parkway is part of the Delaware-Lehigh State Heritage Park and the Delaware-Lehigh National Heritage Corridor. The National Trail System designated The Lehigh Parkway Heritage Trail that meanders along the creek as Trail No. 689.

There are also protections in place in the headwaters where parcels for homes must be purchased in four-acre parcels. However, much higher density development is permitted in the majority of the watershed. It will be important as more individuals or developers choose to build homes adjacent to the Little Lehigh Creek that conservation groups help homeowners understand the best way to manage their streamside property and retain large forested areas.

Some land issues currently affect the state of the Little Lehigh Creek. Many roads cross the Little Lehigh Creek over historic bridges that can no longer adequately accommodate high water flows. Bridges often create stream and floodplain encroachments that can impede water flow, debris and sediment transport. Another concern in the Little Lehigh watershed is the local geology. Much of the underlying geology is carbonate bedrock that creates challenges regarding the possibility of sinkholes forming or groundwater contamination occurring.

Stream Use & State of the Streams

Federal, state and local laws protect the Little Lehigh Creek. The Environmental Protection Agency implements the Safe Drinking Water Act to ensure communities have reliable potable water. The federal 1972 Clean Water Act was enacted to create fishable and swimmable waters by 1983 and eventually eliminate polluted discharges from entering waterways. This ambitious Act has not met its goals, although most states have made great progress.

The Little Lehigh Creek has been used as an important source of drinking water for generations. The creek water once treated, supplies drinking water to more than 130,000 residents in the City of Allentown. The City of Allentown documents the water quality annually in a report and in 2006 the drinking water met all federal and state standards for safety. Wells and springs in the headwaters provide drinking water to residents living outside of the City of Allentown.

To protect Pennsylvania's streams and in order to meet the obligations of the Clean Water Act, Pennsylvania Department of Environmental Protection's (DEP) enacted the Clean Streams Law. Staff from DEP classify each creek and determine the stream's designated use (aquatic life, fish consumption, potable water supply and recreation). The main stem of the Little Lehigh Creek and its tributaries have all been designated as a "High Quality, Cold-Water Fishery" (aquatic life) by Pennsylvania Department of Environmental Protection's *2006 Pennsylvania Integrated Water Quality Monitoring and Assessment Report* (Integrated List of All Waters—List 5).

Table A. Tributaries of Little Lehigh Creek that have Attained their Designated Use

DEP biologists determined that these reaches below satisfactorily support aquatic life that would exist in a “High Quality—Cold Water Fishery”:

Cedar Creek, Iron Run and Trout Creek

Once a water body is classified, DEP biologists perform surveys to assess the waters to see if the water quality is sufficient to support the designated use (Tables A & B). DEP surveyed the Little Lehigh Creek main stem in 1998 and determined that due to agriculture and construction activities, a 2.39 mile reach did not meet the standard for aquatic life (2006 Integrated List of All Waters – List 5). The action plan to address the impaired reach of the Little Lehigh Creek will be developed by DEP to be completed in 2011. This action plan will determine the Total Maximum Daily Load (TMDL) of pollutants allowable in the creek that will improve the water quality so that the designated use for aquatic life can be met, thereby upholding the Clean Stream Law and Clean Water Act. Little Lehigh Creek tributaries have also been assessed and DEP biologists determined that the designated use has not been attained for many (see below), although a few tributaries support coldwater aquatic life standards. DEP surveyed the Little Lehigh Watershed in 2005-2006 and the results will be published in 2008. DEP Biologist Tim Daley found that some reaches that were previously considered in good condition, may be declared impaired in the upcoming 2008 list.

Table B. Main Stem and Tributaries of Little Lehigh Creek that have NOT Attained their Use

Name of Stream	Reason for Impairment (as determined by DEP biologist after assessment)	Date Listed	DEP Action Plan & TMDL Date
Breinig Run	Crop Related Agriculture - Siltation	2006	2019
Jordan Creek	Urban Runoff/Storm Sewers – Siltation	1998	2011
Leibert Creek	Urban Runoff/Storm Sewers – Siltation	2006	2019
Little Cedar Creek	Suspended Solids	1996	2004
Little Lehigh Creek	Agriculture & Construction - Siltation (2.39 miles)	1998	2011
Schaefer Run	Agriculture & Crop Related Ag	1998 & 2006	2011 & 2019
Spring Creek	Sm. Residential Runoff – Siltation	2006	2019
Swabia Creek	Agriculture – Siltation	1998	2011
Toad Creek	Agric – Organic Enrichment/Low D.O.& Siltation	1998	2011
Toad Creek	Municipal Point Source - Cause Unknown	2002	2015

Fish & Boat Commission Classifications

Further classifications exist, as determined by the Pennsylvania Fish & Boat Commission (PFBC). PFBC stock the Little Lehigh Creek main stem and tributaries Cedar and Swabia Creek. The main stem and a few of the tributaries also support wild trout populations and PFBC classifies portions of the Little Lehigh Creek as “CLASS A Wild Trout Waters” (Table C). This designation refers to “streams that support a population of naturally produced trout of sufficient size and abundance to support a long-term and rewarding sport fishery,” according to PFBC and these areas are not stocked.

PFBC also designated two reaches within the Little Lehigh Creek main stem as “Special Regulation Areas” (Table D) that allow only catch and release fly-fishing. Much of the City of Allentown’s Little Lehigh

remains a popular fishing destination and continues to support naturally reproducing populations of brown trout.

Table C. Sections of Little Lehigh Watershed listed as Class A Wild Trout Waters

Name of Stream	Kind of Fish	Distance of Reach	Location of Reach of Wild Trout Waters
Little Lehigh Creek	Brown Trout	1.8 miles	Smith Lane Bridge (476) downstream to Spring Creek confluence
Cedar Creek	Brown Trout	1.3 miles	Bridge on Cedar Crest Blvd downstream to Lake Muhlenberg
Trout Creek	Brown Trout	1.6 miles	Bridge Dixon Street downstream to mouth of Little Lehigh Creek

Table D. Portions of the Little Lehigh Creek Main Stem for Catch and Release Fly-Fishing Only

Name of Stream	Distance of Reach	Location of Reach of Catch and Release Fly-Fishing Only
Little Lehigh Creek	1.8 miles	from the downstream face of the bridge on T-508 (Wild Cherry Lane) downstream to the upstream face of the bridge on T-510 (Millrace Road)
Little Lehigh Creek	1 mile	from upstream face of Fish Hatchery Road bridge downstream to near the 24th Street bridge

United States Geological Survey Gaging Stations

Two USGS gaging stations operate on the Little Lehigh Creek:

- 1) Data collected since 1945 in Allentown (2.9 miles from the mouth, 0.8 miles upstream of Cedar Creek confluence)
- 2) Data collected since 1986 in Allentown near Tenth Street bridge (0.9 miles upstream of Jordan Creek confluence)

Summary of Previous Reports Completed

The Little Lehigh Creek has been studied for decades. Some of the information found in reports and assessments previously conducted has been summarized below.

1. *Little Lehigh Creek (502C) Management Report Sections 08 and 09* (Billingsley, Marcinko & Frazier. Pennsylvania Fish Commission Division of Fisheries , Fisheries Management Section, 1983).
 - A. In the introduction, historic surveys and observations are mentioned.
 - 1) 1954— Little Lehigh Creek headwaters considered “barren” with wildly fluctuating temperatures. Creek was stocked from Rte 100 to the mouth. Trout and warmwater species were present.

- 2) 1961— Little Lehigh Creek at Rte. 100 considered degraded due to eroding banks. Stocking approved upstream of Wernersville.
 - 3) 1977—Siltation was noted from T-867 bridge downstream to Laudenslager’s Mill Dam, and Pool Wildlife Sanctuary. Reasons given: poor farming practices, sewer line and housing construction. From Pool Wildlife Sanctuary to Bogart’s Bridge, conditions were favorable for reproducing brown trout populations. Conditions not favorable up stream due to high water temperatures and habitat limitations.
2. *Little Lehigh Creek Stream Corridor Conservation Project Stream Status Report* (Wildlands Conservancy, 1994)
- A. Original water chemistry data gathered using test kits in 1993 at 30 sites along the main stem and tributaries concluded:
 - 1) High nitrate levels, high temperature levels and a heavy sediment load were observed on main stem.
 - 2) Tributaries are impaired due to the same problems noted above, but more severely.
 - 3) The tributary Toad Creek exhibited the most severe problems. “Extremely high readings in nitrate, phosphate, pH, sediments and temperature,” were recorded.
3. *Watershed Assessment – Allentown, Pennsylvania* (Prepared by the Cadmus Group, Inc. for City of Allentown, 1998 -- also referred to as the Cadmus Report)
- A. As the Little Lehigh is the source of drinking water, this report assessed existing and potential pollutant sources, and the susceptibility of drinking water to contamination and provided source water protection recommendations.
 - 1) Erosion of soils is a key concern.
 - 2) Adsorbed pollutants to these soils is a concern should pH levels change, releasing heavy metals.
 - 3) Point source pollution does not seem to be of concern.
 - 4) It was undetermined as to whether or not pesticides were a concern.
4. *Development of a Long-Term Monitoring Program for the Little Lehigh Creek Watershed* (Prepared by City of Allentown, 2002)
- A. Monitoring data between March 2001 to September 2002 found sedimentation, nitrates, total coliform and fecal coliform concentrations to be of concern. Water temperatures were above the limit for a cold water fishery. Total coliform exceeded the level for surface water that is used for drinking water. These results confirmed previous monitoring data. Microbial activity increases in waters with high nitrate concentrations and elevated water temperatures.
 - B. Characterization of the most elevated water chemistry parameters by sub-watershed:
 - 1) Nitrate: Highest Level in Spring Creek (10mg/l at Klines Bridge) & Cedar Creek
 - 2) Giardia: Highest Level in Spring Creek
 - 3) Cryptosporidium: Highest Level in Swabia Creek
 - 4) *Enterococcus* bacteria: Highest Level in Little Cedar, Cedar, Little Lehigh & Spring Creeks (Highest Mean observed in Swabia Creek)
 - 5) Fecal coliform (Non-compliance 61% of time): Highest Level in Leibert Creek, Cedar Creek and Spring Creek.
 - 6) Total coliform: Highest Level in Little Cedar and Swabia Creek
 - C. Since monitoring took place during low flow conditions, it was anticipated that small rain events could result in elevated concentrations of pollutants, potentially exceeding acceptable standards for drinking water.

5. *Petition to Redesignate the Little Lehigh Creek As An Outstanding National Resource Water* (Mid-Atlantic Environmental Law Center, 2003)
 - A. Request to redesignate the main stem of Little Lehigh Creek from the Source to Jordan Creek and Jordan Creek to the mouth. Both sections are Protected as High Quality-Cold Water Fishery currently and the petition requests that the main stem of the Little Lehigh Creek become upgraded to an “Outstanding National Resource Water-Cold Water Fishery.”
 - 1) Petitioner’s evidence presented: Flows through Pool Wildlife Sanctuary, Delaware & Lehigh Canal National Heritage Corridor and Heritage State Park, and a nationally registered historical area for Native Americans (Keck Site). Provides drinking water for the City of Allentown and offers outstanding trout sport fishing with naturally reproducing brown trout populations.
 - 2) If the redesignation is granted, then no new or increased discharges and loading increases can occur into the Little Lehigh Creek from both point and nonpoint sources. However, DEP is currently reviewing the changes that go into affect after a waterway has been redesignated. Seek more information from your DEP watershed manager.
 - 3) PA DEP will issue their draft report on their decision in the Fall of 2007. A 30-day public comment period will begin after the report is released. Petitioner, Wildlands Conservancy and municipalities will receive a copy. The public is permitted to read and comment on this report.
6. *Little Lehigh Creek Watershed Sediment Study* (Prepared by Camp, Dresser and McKee for City of Allentown, 2004)
 - A. Contains a characterization of land use, estimates percentages of impervious cover by sub-watershed, runoff and baseflow trends, sediment study with original data
 - B. Main source of sediment not instream erosion, but overland wash load from urban to agricultural lands.
 - C. Recommended that restoration work focus on Schaffers Run due to the highest predicted erosion rate.
 - D. Little Cedar Creek contained the highest TSS loading of any sub-watershed.
 - E. Lower Milford & Hereford Townships were among the highest municipalities for Total Annual TSS loading.
7. *Leibert Creek Watershed Assessment* (Prepared for Borough of Emmaus, 2004)
 - A. Water quality samples collected at three sites, February and May 2002 and found Leibert Creek had good ratings in oxygen concentration, nitrates, phosphates and turbidity reflecting a creek with good water quality.
 - B. Aquatic insect sampling occurred at the same three sites as the water quality survey, and determined according to the number and type of aquatic insects (macroinvertebrates) found that the water quality was in good to very good condition.
8. *Little Lehigh Creek Geomorphic Assessment and Design Report for the Little Lehigh Creek Stabilization Project* (Prepared by LandStudies, Inc. for Wildlands Conservancy, 2004)
 - A. Report summarizes the degree of entrenchment and various bankfull measurements
9. *Borough of Emmaus Wellhead Protection Plan* (Borough of Emmaus with assistance from the Department of Environmental Protection, 2004)
 - A. Contains data about groundwater and inventories and ranks threat potentials.

10. *Lehigh River Watershed Conservation Management Plan* (Wildlands Conservancy, 2004)
 - A. Addendum A provides these “Specific Recommendations” to improve the Little Lehigh Creek watershed including tributaries:
 - 1) Development of an EAC in Longswamp Township, Berks County
 - 2) Develop watershed and restoration plan, & watershed association for Cedar Creek
 - 3) Develop recreational trail through the Macungie Mountain Ridge woodland, Longswamp Township
 - 4) Protect land along Trout Creek and develop trail system, Salisbury Township
 - 5) Develop greenway and land protection plan for Upper Milford Township and the Little Lehigh and Swabia Creek riparian corridors.
 - 6) Support trail network in Little Lehigh Parkway, City of Allentown
 - 7) Protect open space in Lower Macungie and Upper Milford Township adjacent to East Penn School District
 - 8) Encourage Longswamp and Upper Milford Township staff to develop wetland map
 - 9) Longswamp Township regional recreational greenway plan
 - 10) Connect Rodale Reserve, with South Mountain Preserve and Walking Purchase Park, Salisbury Township
 - 11) Promote agricultural BMPs on Little Lehigh Creek in Longswamp Township
 - 12) Remove Furnace Dam on Leibert Creek
 - 13) Create outreach plan to Borough of Macungie, Lehigh County to promote restoration of the Swabia Creek.
 - 14) Establish buffers along Little Lehigh Creek along Spring Creek Road, Lower Macungie Township and Leibert Creek and tributaries in Emmaus and Upper Milford Township

11. *Little Lehigh Creek Watershed Act 167 Stormwater Management Plan Water Quality Update* (Lehigh Valley Planning Commission, Adopted 2004)
 - A. This Act, first written in 1988 and recently updated, helps quantify stormwater runoff and provides recommendations to help reduce volume and rate of stormwater discharges. Water quality standards will be addressed by ensuring that post-construction infiltration equals pre-construction infiltration.

12. *Geomorphic Assessment of Swabia Creek at Brookside Country Club* (Completed by LandStudies, Inc. for Brookside Country Club, 2005)
 - A. Assessment of upstream and downstream conditions. Particle size distribution and creek cross-section surveys conducted on Brookside Country Club property, 2005.

13. *Southwestern Lehigh County Comprehensive Plan: Alburdis, Emmaus, Macungie Boroughs and Lower Milford, Lower Macungie & Upper Milford Townships* (Completed by Southwestern Lehigh County Comprehensive Plan Committee & consultants Urban Research & Development Corporation, in association with Keystone Conservation Engineers, 2005)

Unique and Outstanding Values in the Watershed

The Lehigh County portion of the Little Lehigh Creek watershed contains several outstanding natural areas according to the Pennsylvania Natural Heritage Program inventory (*Lehigh River Watershed Plan, 2003* and *A Natural Areas Inventory of Lehigh and Northampton Counties, 2005 Update*).

- East Texas-Little Lehigh Creek: state-threatened plant species along the park
- Gauff Hill: state-rare plant species along creek
- Crackersport Ponds: state-rare and state-threatened plant species
- The Jungle: receives waters from Spring Creek and Iron Run and is of high county significance,

requires more survey work to determine state significance.

- Macungie/Swabia Creek Watershed: Borough land that contains marsh and shrub swamp communities; and supports a plant and animal species of concern.
- Robert Rodale Reserve: contains seep communities, contains two plant species of special concern and important amphibian habitat.
- Lehigh Mountain: only a very small portion of the mountain drains into the Little Lehigh or Trout Creek near the mouth of the creek.
- Jasper Cliffs, Allentown: found in South Mountain park this geologically notable jasper rock forms cliffs.
- Vera Cruz Jasper Pits: high quality jasper quarried until 1680.

In addition, the Little Lehigh Parkway in the City of Allentown provides 999 acres of parkland adjacent to the Little Lehigh Creek. Park area adjacent to more than 3 miles of the Little Lehigh Creek.

- The section of the park downstream of Fish Hatchery Road is an area designated by the PA Fish & Boat Commission as a “Catch and Release Fly-Fishing Area Only.”
- Two annual fishing contests. One is sponsored by the Lehigh County Fish and Game Protection Association and the other by Trout Creek Fish and Game Association.
- Popular kayaking, fishing, walking, running and horseback riding area.
- Little Lehigh Fly Fishing Shop and Lenni Lenape Indian Museum
- Lil-Le-Hi Trout Nursery: On Fish Hatchery Road near Cedar Crest Boulevard Releases approximately 30,000 mature trout in City streams each year. Visitors Welcome.
- Staffed by volunteers from the Queen City Trout Rearing Committee
- Part of the Delaware & Lehigh National Heritage Corridor

The remaining portion of the watershed in Berks County covers a small area. Berks County completed a County Natural Areas Inventory in 1991, and a draft of the *Greenway, Park and Recreation Plan* suggest these unique features in the Little Lehigh Creek headwaters:

- Animal species of concern in marsh habitat
- Hunsicker’s Grove: 49-acre county park
- Mary Anne Furnace

Water Quality Data Previously Collected

IMPORTANCE OF WATER QUALITY INDICATORS

Reliable indicators can help determine the state of the watershed and gauge the effect of human interactions on the landscape. Indicators, such as the diversity of fish present, water temperature, or the presence of steep eroding banks along a stream, directly reflect the condition of the local watershed.

Water quality indicators can also help us measure our progress and make informed decisions on various issues such as the hydrologic implications of a highway expansion and the effects of mowing lawns to the edge of the stream. With careful monitoring of their physical and biological components, it is possible to draw conclusions regarding the overall condition of the creek, so that solutions can be found to ensure protection of the watershed.

There is a diverse array of water quality data that has already been gathered over the years for the Little Lehigh Creek and a few of its tributaries. Chemical water quality data has also been collected since the mid-1990’s as part of the City of Allentown’s Bureau of Water Resources monitoring program. Volunteers from the Retired Seniors Volunteer Program (RSVP) also monitor chemical water quality twice a month in the City of Allentown. Some chemical water quality data exists from monitoring conducted

at Lehigh Country Club. Chemical water quality data will not be detailed in this Conservation Plan, as much of it is already available and interpreted online in the City of Allentown's Annual Water Quality Report.

In addition to chemical water quality data, aquatic insect or macroinvertebrate surveys have been conducted throughout the watershed. Studying the diversity of macroinvertebrates in a stream provides us with a reliable indicator of stream health. Macroinvertebrates offer more in depth information regarding the condition of the creek as a habitat, not just the water flowing within. Fish surveys and habitat assessments were also conducted in the past to help indicate the state of stream banks, the quality of the vegetation and its filtering capacity along the stream corridor and the diversity of aquatic life.



The water quality and fish survey data previously collected has been summarized in TABLES E, F & G to provide a snapshot of the state of particular stream reaches. (See Appendix for Tables E, F & G.) Indicators of water quality are generally categorized by poor, fair, good to very good/excellent. For habitat assessments the ratings range from poor, marginal, suboptimal to optimal. These ranges have been determined by biologists and the protocols are standard. More information on water quality ratings can be found on the Environmental Protection Agency's website: www.epa.gov (type "indicators" into the search area). *Note: Much of the data has been gathered in the past to determine the condition of the Little Lehigh Creek and its tributaries before and after stream restoration and/or enhancement activities have taken place.*

2006-2007 Visual Assessment of Main Stem & Photo-documentation

PROTOCOL

A significant amount of valuable information has been collected to determine the state of the Little Lehigh Creek. However, interpreting this information became difficult due to substantial variability and little consistency as to which sections have been monitored. Many of the previously assessed reaches have been at degraded sites where restoration or enhancement activities were eventually completed, so the majority of the data collected is from less than optimal reaches. For instance, one reach that is in poor condition may be uncommon in the entire watershed, or it may be symptomatic of watershed-wide challenges. This issue has been addressed by completing a visual assessment for the entire main stem of the Little Lehigh Creek.

To conduct a stream visual assessment, Wildlands Conservancy and Lehigh County Conservation District staff collaborated to create a protocol and develop a training manual. The chosen protocol was adapted from the United States Department of Agriculture's Natural Resources Conservation Service



This reach of the main stem of the Little Lehigh Creek represents ideal conditions that will ensure the highest water quality and greatest biodiversity.

Aquatic Assessment Workgroup. Minor adjustments were made to the original protocol. A copy of the revised visual assessment data sheet used during the visual assessment has been included in the Appendix. Eleven parameters were assessed by monitors: channel condition, riparian zone, bank stability, nutrient enrichment, barriers to fish movement, instream fish cover, presence of pools, aquatic insect/macroinvertebrate habitat, canopy cover, riffle embeddedness and if possible, aquatic insects observed.

Volunteers from Little Lehigh Trout Unlimited and Saucon Creek Watershed Association played a significant role in completing the assessment of nearly 25 miles of stream. Wildlands Conservancy and Lehigh County Conservation District staff partnered and

hosted two training sessions for volunteers in the Fall 2006. On October 11, 2006, seven volunteers attended and on October 29, 2006, five volunteers participated. Each participant was instructed to closely follow the stream visual assessment protocol outlined in the resource manual they were given. Emphasis was placed on creating consistency between different volunteers to ensure the quality of the resulting data.

After demonstrating an understanding of the assessment protocols and their application, participants were assigned a collection of reaches to complete. Each reach measured approximately 750-feet in length. The assigned reaches were delineated with aerial photos and a scoring sheet was assigned for each reach. Participants were asked to walk upstream, take two to three photos and record observations on their scoring sheet. Wildlands Conservancy mailed a notice to landowners along the Little Lehigh Creek to inform them of the visual assessment and seek their permission to access the land adjacent to the stream (copy included in Appendix). The stream was assessed primarily on foot, walking within the stream channel or alongside the stream. Occasionally, stream assessors found the use of kayaks helpful in assessing particular reaches.

STREAM VISUAL ASSESSMENT DATA COLLECTION

Volunteers from Saucon Watershed Association and Little Lehigh Trout Unlimited, and staff from Lehigh County Conservation District and Wildlands Conservancy assessed various reaches of the main stem of the Little Lehigh Creek from November 2006 through July 2007 using the protocols outlined in the previous section. Original data sheets will be stored at the Wildlands Conservancy's office. An example of the data sheet has been included in the Appendix.

CHANNEL CONDITION



During large storm events, bridges (left photo) can create water flow obstructions, exacerbating localized stream bank erosion, and accelerating flooding. The stream bank (right photo) has been stabilized with stones to address decades-long erosion during storms. The stream has become disconnected with its floodplain, so during rain events the velocity builds and the stream banks erode at an accelerated rate. Maintenance of the stone wall will be ongoing.

DATA

1. Channel Condition/Hydrologic Alteration

People often alter stream channels in a number of ways, for many reasons. Bridges, dams, concrete retaining walls, and piping streams were common alterations observed during this assessment. Stream channels under more ideal conditions represent a creek that can effectively handle average storm events to little detriment to the stream itself, stream banks, adjacent land and the aquatic life. Due to natural erosional processes it is common for stream channels to migrate over time. However, past and present needs for roads and bridges and farming practices have unnaturally straightened many stream channels and restricted the stream flow during storm events. This can greatly affect the stream hydrology. As more reaches in a creek are altered for current development, the problems compound.

Reaches of the Little Lehigh Creek that received high assessment scores regarding channel condition would have a stream channel well-connected to its floodplain with vegetated sloping stream banks and no structures in the channel. Poorly scoring reaches contained actively down-cutting (sheer banks with an entrenched stream channel) or widening streams with more than 50% of the stream banks stabilized with stone walls or boulders to address past erosional issues. Or reaches that contain structures like bridges restricting the stream's ability to access the floodplain reduced the potential score for a reach.

The highest scoring reaches for channel condition were found in Longswamp Township, Berks County near the headwaters and Lower Macungie Township. Although most of these reaches in the headwaters were rated in "excellent" condition, approximately 25% of the reaches did not have similarly excellent riparian zones or stable banks. These sites may be candidates for protection or hot spots to watch for future degradation.

The lowest scoring channel condition reaches were located within the Little Lehigh Parkway and Fountain Park in Allentown. These sites also contained minimal riparian zones, where vegetation such as

trees and shrubs comprised less than half the channel width along the stream corridor. Some of the types of channel alteration observed in the lowest scoring reaches included dams, weirs, the piping of the channel, bridges and bridge abutments, cinder blocks, concrete slabs and lumber-lined stream banks that may restrict or prevent the creek from accessing its floodplain.

2. Riparian Zone

To ensure the highest water quality, scientists have documented that the land that surrounds a creek needs to be well-vegetated. Trees, shrubs and a mix of grasses, wildflowers and ferns create a natural biofilter, stabilize the stream banks, and provide a food source for aquatic and terrestrial life. Many municipalities have strict ordinances that require any development to be setback away from the stream bank. These setbacks can range from 25 to 100-feet. Many municipalities also support riparian buffer ordinances that protect the native vegetation so that it cannot be replaced with a closely-cropped lawn. For example, Lower Saucon Township has an ordinance that requires 100-feet of natural vegetation to be left along both sides of a creek.

Reaches of the Little Lehigh Creek main stem that scored high contained extensive riparian zones that include biodiverse woodlands that cover at least two active channel widths on each side of the creek. Poorly scoring sections contained little vegetation lining each side, severely compromising the filtering capacity during storm events. The scores were averaged if a reach supported an excellent riparian zone on one side, but the opposite side contained little vegetation protecting the stream.

A total of 33 out of 168 reaches received an “excellent” score for the riparian zone. Compared to other parameters there was a greater number of sites which received an excellent score. This means that a

RIPARIAN ZONE



The mown grass along the Little Lehigh Creek (left photo) does not provide significant filtering capacity and can reduce water quality. Impervious surfaces such as parking lots and roads collect chemicals and heavy metal residues from cars. During a storm, these pollutants are washed directly into the creek. However, if this land adjacent to the creek was well-vegetated, there could be a reduction in pollution entering the stream. Forested riparian zones provide the greatest protection for water quality. If physical constraints limit the number of trees that can be planted, alternative choices exist. Native wildflower meadows (right photo) enhance the water quality while allowing people to enjoy the view of the creek. This type of riparian corridor is perfect in recreation areas and near busy roads.

significant portions of the land that surrounds the creek is well-vegetated. The best reaches were located within Longswamp Township, Berks County and Lower Macungie Township, Lehigh County. Not limited to the suburban and rural communities, one reach in Allentown along the Little Lehigh Parkway contained a large swath of forest.

A total of 27 out of 168 reaches scored poorly. This low score means there is little to no vegetation along the stream, or the riparian area has been mown to the edge. The majority of the reaches that scored poorly are located in the Little Lehigh Parkway, Allentown where the creek has been made accessible to recreational users, and often mowed close to the edge. This area has many mature trees, but they are not planted densely enough to function as a forest. Additionally, a golf course property in the City of Allentown did not score well, as often woodlands close to playing areas are seen as hindrances to golf play when the course winds along the creek.

It was uncommon for reaches in the headwaters to receive a poor riparian zone score, because much forest in that part of the watershed remains in tact. However, one reach in the headwaters scored poorly due to a couple of factors that negatively affect the creek. The channel had been straightened to accommodate a bridge and the property owner mows closely to the edge. One farm in Lower Macungie Township that was one of the lowest scoring reaches for riparian zone conditions contained little vegetation along the banks, exposing severely eroding banks.

3. Bank Stability

The Department of Environmental Protection determined that siltation is the number one factor impairing the streams in Pennsylvania. Historic land use, the inability of the stream to function properly and excessive erosion on land or in the stream, together create an unstable stream bank and contribute tons of sediment to streams each year. During storm events, the stream water becomes muddy creating det-

BANK STABILITY



Water flowing rapidly downstream can be destructive. Portions of the creek that have been altered by farming practices or construction activities in the past to accommodate bridges, and developments already show signs that the stream has become degraded. The conditions may only worsen with the projected future development of the watershed and the potential that more sections may be ineptly managed by landowners. A creek not functioning properly will contain trees with exposed roots (left photo). Over time these trees will fall into the creek. Normally, the network of roots from a mixture of trees, shrubs, grasses and wildflowers stabilize the banks effectively. Some property owners experience a loss of a foot of land every few years or worse (right photo) because there are too few roots to keep the soil in place during heavy stormwater flows.

perimental conditions for aquatic life. Once the soil settles out among the stones on the bottom of the creek, the habitat becomes degraded and reduces the biodiversity of the aquatic life.

Reaches that received high scores for bank stability have stable, vegetated stream banks. The roots from natural height vegetation protect 33% or more of the naturally eroding portions of the outside bends at normal base flow conditions. In lower scoring reaches, the opposite was true. When banks become unstable, straight sections as well as the outside bends actively erode at an accelerated rate. Trees become vulnerable to falling over as their roots become increasingly exposed. Stream banks become undercut, slump and eventually fall into the stream.

The majority of reaches were rated in good condition. For certain reaches there may have been past manipulation of the stream banks, such as the addition of a stone wall, large boulders or rip-rap. Despite these man-made structures, these sections would be rated highly, because the stability of banks had been addressed.

The reaches of the Little Lehigh Creek that scored poorly for bank stability occurred throughout the watershed. In Lower Macungie Township, the creek scored poorly as it flowed through a farm with severely eroding banks. Cinder blocks and concrete slabs were thrown onto the eroding streambanks in an attempt to alleviate some of the property loss. A low area along the Little Lehigh as it flows adjacent to Spring Creek Road contained three-foot high steep stream banks actively eroding, despite vegetation growing at natural height. Unstable banks were found in areas with quality buffers and it was usually an indicator of poor historic land management practices.

4. Nutrient Enrichment

High levels of nitrogen and phosphorus in streams cause excessive growth of aquatic vegetation. This vegetation consumes a great deal of oxygen during decomposition, reducing the dissolved oxygen available for fish. Many desirable fish species, such as trout, require high levels of dissolved oxygen to

NUTRIENT ENRICHMENT



Excessive nutrients create problems in aquatic ecosystems and in severe conditions they may cause a reduction in dissolved oxygen when large algal masses decompose. This affects the presence and diversity of fish species. These photos document sunny, slow-flowing reaches on the Little Lehigh Creek where algae (left photo) and aquatic vegetation (right photo) are present. Large amounts of algae were also found in a shady wooded reach in Berks County.

survive. Therefore, where the amount of nitrogen and phosphorus in a stream are too high and oxygen levels are low, only very tolerant species of fish can survive. The Little Lehigh Creek in Allentown contains around 4 ppm Nitrate and 0.2 ppm Total Phosphorus. These concentrations are considered higher than optimal levels when compared to the water quality data measured in streams flowing through large tracts of forest in undeveloped areas. Agricultural practices, failing septic systems, and homeowner use of fertilizers contribute to the elevated levels of nitrate and phosphorus in the stream water. However, the continuous cold spring water that enters the Little Lehigh Creek prevents dissolved oxygen levels from fluctuating as rapidly as other warm water streams in Pennsylvania.

Portions of the Little Lehigh Creek main stem that scored high for nutrient enrichment are reaches where the water quality appeared in excellent condition and little algal growth was observed. However, when assessors noticed floating algae, filamentous algae underwater growing on rocks or dense stands of aquatic vegetation, they made notes and scored the poorest reaches with a 1 or 2.

Significant levels of algae were observed throughout the watershed. In two reaches, aquatic vegetation rooted to the stream bottom covered large areas and further study and proper identification may help further explain the significance to water quality. Assessors also observed floating algae in several sections of the creek. One portion of the creek that flows through Longswamp Township was located in a wooded area and well-shaded. Yet, large clumps of algae were noted. This portion of the creek requires further study since the source of excess nutrients is not apparent from the current land use.

Most of the nitrate data available was collected from the Allentown portion of the Little Lehigh Creek. As the water flows from the headwaters, before the urban land use even dominates the Little Lehigh Creek, the nitrate levels are elevated by ecological standards. Between Cedar Crest Boulevard in Lower Macungie Township and the Allentown Water Treatment Plant, it appears the nitrate levels do not increase significantly. The majority of the influx of nitrates enters the creek before it flows through the City of Allentown.

5. Barriers to Fish Movement

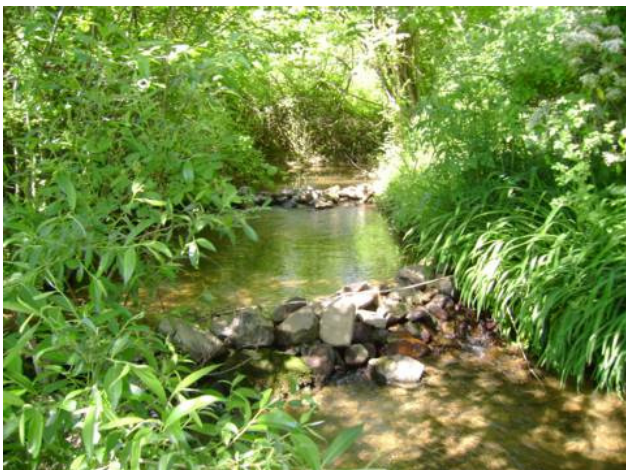
Dams are often a much-loved fixture in the landscape with deep pools behind dams a favored area to fish. However, dams built on creeks affect a stream system negatively. Because they are unnatural barriers, dams only benefit some fish that thrive in deep pools, but negatively affect other fish species, especially migratory fish.

In the past 20 years, there has been a renewed interest to remove dams and restore creeks to more natural channel conditions. Many dams were built during the age of milling in the 1800s and are not needed anymore for their original intended purpose. Some dams were built to address flooding issues as development in the past concentrated along the banks of the Little Lehigh. Dams are not necessarily the best solution and newer more ecologically-sound techniques exist. With the average life span of a dam only 50 years, the future costs to maintain the existing Lehigh Valley dams may not be plausible. Dam removal, on the other hand, can often be done quickly and more cheaply than repairing dams.

Assessors found numerous barriers to fish movement. The score assigned to a particular reach depended on the size of the dam or drop structure. If there were no barriers on the creek, then that section received a score of 10. However, if there was a dam or large rock pile across the creek the reach received a total score from 1 to 5, with 1 being the tallest, most significant barrier.

Out of a total of 167 reaches that received scores regarding barriers, 11 sections contained significant barriers rated 1 to 5. These barriers are located in Longswamp Township, Lower Macungie Township

BARRIERS TO FISH MOVEMENT



Barriers to fish can be as simple as piles of rocks purposefully placed across a stream (left photo) to a large engineered dam (right photo). There are even the remnants of an old water wheel along the Little Lehigh Creek where water is currently piped to bring the water directly to the water wheel no longer in operation.

and the City of Allentown. Some barriers were in tact, while others were compromised and therefore no longer a barrier to fish. The majority of reaches did not contain barriers and were free-flowing.

6. Instream Fish Habitat

Excellent fish habitat contains suitable shelter, food sources, oxygen levels and water temperatures for resident fish. Assessors may find tree trunks that have fallen in the creek, which offer a refuge for fish. Deep pools, as well as riffles with boulders and cobbles in shallow reaches also create an excellent habitat. A riffle, where water runs over a collection of rocks that creates small waves, incorporates oxygen from the air into the water and improves oxygen concentrations in a given reach. Undercut banks and overhanging vegetation are also desirable to find in fish habitat.

Reaches of the creek that received an excellent score for fish habitat represented sections of the creek that contain six or more types of cover. Out of a total of 168 reaches, 25 provided fish with excellent cover. These reaches were located throughout the main stem, including two sections that flow through Fountain Park in Allentown.

Out of a total of 168 reaches assessed, 27 were scored in poor condition. These sections only contained 3 or less types of cover. These reaches were often sections that contained no trees or shrubs along the banks and no boulders or cobbles were present in the stream channel. The portions of the creek that offered less than ideal habitat conditions were found throughout the watershed.

INSTREAM FISH HABITAT



Ideal habitat along the Little Lehigh Creek provides fish with hiding places under logs and overhanging vegetation. Rocks would be plentiful, sheltering the aquatic insects that fish feed on. Habitat that does not benefit fish (left photo) are sections of the creek that contain no trees or overhanging vegetation, leaving fish vulnerable to predators with no shelter. Also in this reach pictured here, past farming practices buried cobbles and boulders under silt. In more urbanized areas, heavily-used recreation areas like the Little Lehigh Parkway (right photo) offers excellent creek access, but to the detriment of fish. Upstream and downstream reaches can then be more ecologically managed with large stands of trees and plantings left in tact. This balances the negative affects of numerous recreational-park users with the ecological needs of the creek.

7. Insect/Invertebrate habitat

Aquatic insects or macroinvertebrates found living within streams, provide an excellent food source for fish. Similar to fish habitat, ideal habitat for aquatic insects encompasses a variety of conditions to support a thriving diverse population. Fine woody debris, submerged logs, clusters of leaves wedged among rocks and fist-sized rocks on the bottom of the stream channel, together create an ideal habitat.

Out of a total of 166 sections, 31 received good to excellent scores for insect habitat. These reaches contained four or more habitat types that would benefit aquatic insects, thereby benefiting fish populations. These reaches could be found throughout the watershed, including portions of the City of Allentown's Little Lehigh Parkway and Fountain Park.

The reaches scored in poor condition were found throughout the watershed and comprised 41 out of the 166 assessed for aquatic insect habitat. These reaches contained only 2 or less types of habitat. Many of these reaches are areas that had few rocks since much of the original stream bottom had been buried under sediment. Often there were also few trees and shrubs present along the creek, reducing the amount of leaves in the stream, an important food source of aquatic insect larvae.

INSECT/INVERTEBRATE HABITAT



Aquatic insects like mayflies and caddisflies are a critical part of the stream, and fish depend on them as a food source. Ideal habitat along the Little Lehigh Creek provides these aquatic insects with submerged logs, plenty of rocks in the stream channel and piles of leaves tucked between rocks or caught on woody debris. In more urbanized areas, like Fountain Park in the City of Allentown (left photo), a section that remains wooded, well-shaded, and not inundated with stormwater can support a diversity of aquatic insects. Habitat that does not benefit aquatic insects (right photo foreground) are sections of creeks that contain no trees or overhanging vegetation. Various sized rocks in the stream channel are absent in this section in Lower Macungie Township, reducing the availability of habitat. The lack of shade and excess nutrients also negatively impact the insect habitat at this site.

8. Canopy Cover

The shade produced from a canopy of mature trees is critical during summer months and reduces the temperature fluctuations of stream water and can improve oxygen concentration levels. There is a direct relationship between water temperature and the concentration of dissolved oxygen. The colder the water temperature, the more soluble oxygen is in water and so the water retains more dissolved oxygen available for aquatic life. Lower oxygen concentrations can become a limiting factor, especially in the summer and negatively affect trout populations. The tree canopy also produces copious amounts of leaves that fall into the creek. These leaves get caught up between rocks and woody debris and become an important part of the aquatic food chain.

Much of the main stem is spring-fed with cool waters, even during the summer. This greatly reduces temperature fluctuations during the summer and is an important reason why the creek supports reproducing brown trout populations in the City of Allentown, despite the negative effects of urbanization.

The canopy cover was rated highly if 75% or the water surface from the center of the channel was shaded. Out of a total of 147 reaches assessed for canopy cover, 16 scored in the excellent category. These reaches contain dense stands of mature trees hanging over the channel. It must be noted that wider sections of the Little Lehigh Creek may have mature woodlands surrounding the creek, however the creek is so wide that it is impossible for the creek to be heavily shaded most of the day. These sections were ranked with lower scores even though trees are present on their banks.

Reaches of the Little Lehigh Creek that received poor scores for canopy cover are areas with 20% or less of the water surface shaded by trees. Out of a total of 147 reaches, 37 received the lowest scores.

CANOPY COVER



The amount of shade that covers the creek channel is an important part of a functioning aquatic ecosystem. Dense shade, especially during the summer months, keeps the water temperature from rising. The colder the water, the higher the oxygen concentration. The tree canopy also represents an important food source for aquatic life in the creek. The stream reach (left photo) that is surrounded by dense woodlands creates the ideal conditions for fish and macroinvertebrates. Portions of streams where the trees have been removed and replaced with grass (right photo) can reduce the biological diversity in that section.

Berks County contains only four reaches that received poor scores, and two of these stretches were recently planted with trees and shrubs as part of a significant Wildlands Conservancy stream restoration project completed in 2001. The remaining reaches in poor condition are located throughout the watershed.

9. Manure Present

Manure from farm animals or horses can be a significant contributor to the degradation of water quality. On the Little Lehigh Creek main stem there were few farm animals within sight of the creek. A more common landscape was agricultural cropland adjacent to the creek.

Assessors observed manure alongside the creek in only a few instances. Out of a total of 168 reaches that were assessed, manure was only present on three reaches. Horse manure was present along the Little Lehigh Parkway trail, and twice it was observed was on a farm in Lower Macungie Township. Overall, it appears farm animal manure is not a chronic problem on the main stem of the Little Lehigh Creek. This survey did not document the presence of pet waste, which may contribute negatively to the water quality.

10. Riffle Embeddedness

Naturally occurring riffles can be found in shallower portions of the stream where rocks break the flow of water. These tiny breaks create small whitewater waves that incorporate oxygen from the air into the water. This grouping of rocks also offers ideal habitat to a diverse array of aquatic insects.

RIFFLE EMBEDDEDNESS



Riffles are a collection of rocks in a shallow stream that create a break in the water. This area represents an important habitat for aquatic insects and provides an influx of oxygen from the air into the water. Despite a residential development adjacent to the Little Lehigh Creek (left photo) a riffle remains intact. In areas that have either overland or instream erosional issues, the stream channel becomes silted in over time and the riffle becomes buried (right photo).

The presence of riffles today depends much on the amount of stormwater. Large quantities of stormwater can easily move fist-sized rocks downstream. Stormwater can also carry large volumes of sediment filling in the stream channel. Additionally, for many years before silt-fencing and modern agricultural practices were employed, large volumes of sediment traveled overland and flowed into the creek, burying the original stream channel.

Out of a total of 121 reaches that received scores for riffle embeddedness, assessors found 16 reaches have riffles completely embedded by sediment or else were simply not present. Some of these reaches were concentrated in the lowest lying areas in the watershed in Lower Macungie Township. In flood-prone areas, it is common for sediment to be carried overland and settle in the low-lying areas. Additionally in these sections, the stream channel widens and the flow decreases.

11. Macroinvertebrates Observed

Macroinvertebrates or aquatic insects serve as excellent indicators of water quality and provide important feedback on the condition of the fish habitat. A quick survey of the macroinvertebrates present was included, however due to time restraints in the field, finding and identifying aquatic insects became difficult. Only 8 reaches were assessed for the presence and diversity of aquatic insects. Additional macroinvertebrate data for the Little Lehigh Creek exists, gathered by the Pennsylvania Department of Environmental Protection. This data has been used to determine if the Little Lehigh Creek meets its designated use as a High-Quality Cold Water Fishery.

Analysis of Parameters

After the assessment took place in the field, the data was entered into Microsoft Excel spreadsheets. This information was then incorporated into an ArcGIS program to create interactive data layers. A map on the following page shows the overall condition of each assessed stream reach on the main stem of the Little Lehigh.



Little Lehigh Creek Visual Assessment

WHITEHALL TOWNSHIP

ALLENTOWN CITY

ENTERING LEHIGH RIVER

SALISBURY TOWNSHIP

UPPER MACUNGIE TOWNSHIP

SALISBURY TOWNSHIP

LEHIGH COUNTY

EMMAUS BOROUGH

LOWER MACUNGIE TOWNSHIP

MACUNGIE BOROUGH

BERKS COUNTY

ALBERTIS BOROUGH

TOPTON BOROUGH

UPPER MILFORD TOWNSHIP

LONGSWAMP TOWNSHIP

HEADWATERS



OVERALL ASSESSMENT SCORE



Results Summary

Visually assessing nearly the entire main stem of the Little Lehigh Creek provides a comprehensive understanding of the variability of the state of the creek. Overall, the majority or 56% of the reaches along the Little Lehigh Creek main stem are rated in poor condition (nearly 14 miles). Sections of the creek considered in fair condition comprise 32% (7.6 miles), while the remaining sections or 12% (3.6 miles) are rated in good condition. No reaches received an overall score in the excellent category. According to the assessment protocols, poor reaches received overall scores that were 0 to 6, fair reaches 6.1 to 7, good reaches 7.5 to 8.9 and excellent reaches needed to obtain an overall score of 9 to 10.

To determine the reaches in the best condition, the scores for all the parameters for each reach was added together and ranked according to their total value. The best reaches overall were rated in good condition, nearing excellent with scores around 8.8 out of 10 (9 and above is excellent). These reaches in good/excellent condition were located in the headwaters south of Tipton Borough and Longswamp Township, Berks County. These reaches are wooded with no roads, houses or farmland in view. Cobbles and boulders create riffles and bank erosion is minimal.

The poorest reaches received scores of 2.7 or less, with the four most impaired reaches located in Lower Macungie Township. These sections of the creek had no trees growing alongside the banks, an entrenched stream channel that was not connected with the floodplain, unstable eroding banks three-feet high or more, and a stream channel buried under sediment.

Poor stream conditions existed throughout the length of the main stem. Land development, road crossings, and farming activity alongside the stream created less than optimal conditions from Longswamp Township, Berks County; through Lower Macungie and Salisbury Townships, Lehigh County to the City of Allentown. Many degraded stretches had inherent constraints, such as bridges or a road located along the creek that will make future restoration projects to improve conditions a challenge.

The visual assessment determined that great variability in stream conditions existed on the main stem of the Little Lehigh Creek. Many reaches in good condition were found alongside reaches in poor condition due to several possible factors, such as a bridge crossing or historic land use. Stream assessors also found that varying landowner management practices created a marked effect on the overall condition of the stream. For example, a well-managed wooded portion of the stream with riffles, overhanging vegetation and plenty of fish might be located upstream of a reach containing lawn mowed right to the edge, revealing significant erosion.

Analysis determined that several parameters individually could serve as useful indicators of reaches in overall poor condition. Extreme bank instability, degraded riparian buffers, little to no canopy cover, barriers to fish movement and poor fish habitat cover could be studied individually, and serve as an excellent predictor for the overall poor condition of the reach. These parameters are also often closely linked ecologically. An unstable bank often has few trees, little shade or canopy cover and therefore would also provide poor fish habitat. Once a reach is severely degraded in one category, it is an indicator that the overall condition of that reach would be determined to be in poor condition.

Conservation professionals from Wildlands Conservancy, and Lehigh and Berks County Conservation Districts aim to use the detailed information from the visual assessment analysis to help prioritize future projects that will be most effective in improving the Little Lehigh Creek. Because private property was accessed for this assessment, specific potential outreach opportunities and possible restoration sites have not been disclosed in detail so that we may reach out to each landowner privately and create a successful partnership that will benefit the landowner, the community and the Little Lehigh Creek.

Watershed Analysis: Areas of Concern

After assessing the main stem of the Little Lehigh Creek, it is clear that there are many watershed-wide areas of concern. Less than ideal conditions could be found as readily in the upper headwater reaches, as in the lower reaches as it flows through the City of Allentown.

One area of concern for the main stem is a lack of woodlands or dense plantings left along the stream corridor. The lack of trees and shrubs or even tall grasses growing alongside the stream greatly reduces the filtering capacity. A mature woodland protects a stream from overland run-off and helps stabilize the stream banks. As more wooded streamside parcels are sold to developers or homeowners, it will be important to protect these forested reaches so that they remain intact. If more property owners remove trees and the area is replanted with lawn grasses, significant degradation to the stream channel will occur quickly. Not surprisingly, it is much more costly and time-consuming to replant a forest and restore a stream channel than to protect one already intact and relatively stable.

It has been beneficial that much of the creek as it flows through the City of Allentown was set aside as parkland. The Little Lehigh Parkway is dotted with non-native weeping willow trees, however many of these trees will die in the next fifty years. Without replacement trees planted soon enough to become the next generation of mature trees, the result will be little shade. This could have a significant negative impact on the aquatic life in the future. Additionally, a large proportion of the Parkway contains lawn mowed closely to the edge. Great progress has been made by the City of Allentown to replant aging trees, reduce the mow zones in less heavily-used areas of the park, and plans are underway to convert more lawn to woodlands or a wildflower meadows.

It appears that many landowners do not fully understand the importance of maintaining a stream in a natural forested state. In addition, many land managers of public lands find resistance from the public to accept areas left in a more natural state, preferring manicured reaches along a creek. Often this challenge can be easily met with creative designs that balance manicured access areas with wildflower meadows or forested tracts. This balance was accomplished in Emmaus Community Park on the Leibert Creek, a project developed by the Lehigh County Conservation District. Water quality and the aquatic habitat could be significantly improved if residents and landowners of this watershed community understood the benefits of a forested stream.

The negative influences of historic land use contribute as well to the challenges faced in the watershed. Bridges built too small for the channel, the presence of dams, or eroded agricultural fields that deposit their soil in the stream channel, all degrade the quality of the stream. Many of these past alterations to the natural landscape may require expensive solutions. Prioritizing and addressing these issues over time will be critical.

Outside of the scope of this Coldwater Conservation Plan, the condition of the numerous miles of tributaries that feed into the Little Lehigh Creek main stem are also a concern. From past studies summarized in a previous section, it is known that particular tributaries significantly contribute negatively to the water quality of the Little Lehigh Creek.

The assessment determined that geese are not a problem along the Little Lehigh Creek main stem. Trash and litter were abundant in the City of Allentown, but dozens of volunteers continue to help remove significant quantities each year benefiting the water quality and aquatic habitat.

Additional concerns may exist in the watershed, however this visual assessment did not examine all the possible issues related to the Little Lehigh Creek. The presence of endangered or threatened species, presence and severity of exotic invasive species along the stream corridor, or the state of stormwater conveyances connected to the main stem have not been studied. The lack of inclusion of these concepts should not signify their lack of importance to watershed stakeholders. There was simply not enough time to examine all significant aspects that affect or reflect the quality of a watershed.

Watershed Successes

Much success has already been achieved in the watershed. Longswamp Township requires four-acre parcels to be purchased in the headwaters to protect the Topton Authority Watershed area, a source of drinking water. Lower Macungie Township has restricted development in the 100-year floodplain to alleviate future increased flooding. The City of Allentown has completed detailed studies to better understand the dynamics of the watershed and its affect on drinking water.

Wildlands Conservancy spearheaded many on-the-ground restoration projects that involved improvements like dam removal, streamside plantings, reconnection of stream channels with the floodplain and fencing farm animals out of the stream channel.

Stream Restoration Projects Complete or Expected in the Watershed

Name	Property	Type of Improvement	Date Completed
Little Lehigh Creek	O'Brien Property	Stream Restoration	1999
Little Lehigh Creek	Pool Wildlife Sanctuary	Dam Removal & Planting	2000
Little Lehigh Creek	Brookvue Farms	Stream Restoration & Fencing	2001
Little Lehigh Creek	Beldon & Hamill Property	Dam Removal & Planting	2002
Little Lehigh Creek	Lehigh Country Club	Stream Restoration	2005
Leibert Creek	Emmaus Community Park	Stream Restoration	2006
Swabia Creek	Brookside Country Club	Stream Restoration	To be Completed

In addition, the City of Allentown and Wildlands Conservancy have trash cleanup programs that have successfully mobilized hundreds of volunteers to clean the creek, offering free gloves, trash bags and brooms to participating volunteer groups.

Summary of Recommendations

After assessing nearly 25 miles of the main stem of the Little Lehigh Creek, many encouraging signs were found. Anglers enjoy first-rate fishing throughout the watershed from forested reaches in the City of Allentown to the headwaters. Well-managed farms use sustainable farming practices and retain forested streamside corridors reducing overland sediment runoff. Families spend time along the creek walking, horseback riding, and biking. Allentown residents are provided with safe drinking water.

Unfortunately, the visual assessment determined that 56% of the reaches along the main stem are considered in poor condition. So, to raise awareness and address concerns in the watershed, a public meeting took place on September 12, 2007 to provide the community with an update on the accomplishments and findings from the visual assessment. The public meeting was publicized in the Allentown newspaper *The Morning Call*, and invitations were sent via email and standard mail to more than 120 Little Lehigh Creek landowners, watershed stakeholders, and governmental agencies. (See Appendix)

A total of 41 attended the public meeting with one-third of the audience represented by landowners, one-third by governmental agencies and one-third by watershed groups. Management priorities to improve the watershed were generated as a result of the visual assessment, and these priority recommendations were highlighted during the public presentation. To encourage public input during the meeting, attendees filled out surveys to help rank these priority recommendations. On the following page, a copy of the survey participants received and filled out during the September 12, 2007 public meeting has been inserted.

7 Priority Recommendations to Improve the Little Lehigh Creek Watershed
2007 Little Lehigh Creek Coldwater Conservation Plan

To help guide the process to protect and restore the Little Lehigh Creek, please score the recommendations below ranking them:

- 1 = MOST IMPORTANT
- 2 = SOMEWHAT IMPORTANT
- 3 = LESS IMPORTANT

- _____ A. Offering landowner outreach activities (such as tours of restored sites or developing workshops to provide landowners with information to help them protect their stream banks and address bank erosion issues with low cost techniques).

- _____ B. Using the visual assessment results to help identify future specific stream restoration projects and areas that require further study, placing emphasis on projects which: protect water quality, improve fish habitat, and reduce the impacts of flooding.
Rate the importance of each objective:
 - _____ water quality protection
 - _____ fish habitat improvement
 - _____ reducing impacts of flooding

- _____ C. Assessing and strengthening municipal ordinances that play a role in the protection on the Little Lehigh Creek.

- _____ D. Re-energizing the Alliance for the Little Lehigh Creek Watershed (a group of state, county, municipal and watershed conservation agencies and organizations meeting regularly to discuss Little Lehigh Creek issues).

- _____ E. Establishing a volunteer group that would focus on implementing riparian buffer planting projects across the watershed, including private land.

- _____ F. Offering professional site visits to assist landowners in making informed decisions about restoring or enhancing the stream on their property.

- _____ G. Facilitate additional studies to better determine specific potential project sites, focusing mostly on: addressing flooding issues, nutrient enrichment, and septic malfunctions.
Rate the importance of each objective:
 - _____ flooding issues
 - _____ nutrient enrichment & source of algal concerns
 - _____ state of septic systems

PLEASE ADD YOUR RECOMMENDATION HERE:

A total of 40 surveys were tabulated and results show, the greatest majority of attendees supported the priority recommendation that focused on using the visual assessment to determine future specific restoration projects (Recommendation B). When asked which restoration objective was most important, the majority chose water quality protection. The opportunity to offer future landowner outreach activities was also seen as an equally critical part of the solution to improve the watershed (Recommendation A). Offering professional site visits to homeowners and the strengthening of municipal ordinances to protect and preserve the watershed rated highly as priorities as well (Recommendations C & F).

The public in attendance did not feel that establishing a volunteer group to help perform restoration projects or re-energizing the Alliance for the Little Lehigh Creek Watershed should become top priorities (Recommendation E). Attendees were also less interested in addressing projects that required further studies, but felt if a new study were undertaken, flooding should be the most critical issue to study in detail (Recommendation G).

A handful of attendees rated all recommendations as “most important.” Not one attendee felt that Recommendation B, or using the visual assessment to implement a restoration project would be considered “less important.” The majority of survey responders did not feel that any of the suggested priority recommendations should be ranked as “less important.”

As part of the public meeting survey, respondents also included their own recommendations to improve the Little Lehigh Creek watershed. Their responses were divided into three topics: landowner outreach, enforcement, and specific issues/actions. The most popular additions to the list of priority recommendations focused on ideas for landowner outreach activities.

Here are a few priority recommendations suggested by attendees:

Landowner Outreach & Awareness -

- Raise awareness and provide assistance/grant monies or low cost methods to improve poor sections.
- Raise awareness and reach out to landowners that own good sections of the creek.
- Raise awareness in the general public, publicize results from the public meeting and add the Conservation Plan to the online content of the partnering organization websites.

Enforcement -

- Enforce the rights of property owners living downstream.
- Enforce certain ecological expectations on property owners to maintain their stream corridor.
- Enforce the long-term maintenance of stormwater retention and protection devices.

Specific Issues/Actions -

- Pick a restoration project in a highly-visible location like the Little Lehigh Parkway.
- Protect floodplains, limit development and increased stormwater run-off.

During the public comment period of the meeting many shared their thoughts and concerns. Below some of those thoughts are summarized.

Little Lehigh Creek landowners were interested in learning more details about how their particular reach rated and what they could do to improve it.

One individual suggested that short-term low cost solutions should go in hand with longer-term more complicated initiatives to improve the watershed.

A member of the Little Lehigh Watershed Coalition was interested in an update on the petition to redesignate the Little Lehigh Creek to be considered an “Outstanding National Resource Water-Cold Water Fishery.”

A local landowner voiced concern over the condition of the Little Lehigh Creek as it passes through a neighbor’s property.

One attendee expressed interest in reconvening and having additional meetings on the future of the Little Lehigh Creek watershed.

A Little Lehigh Trout Unlimited member asked why cows in a stream are permitted.

A watershed resident asked about how development of South Mountain will affect the watershed.

Many more questions arose in the time allotted than could be answered. Time was left after the meeting for individuals to ask more questions one-on-one with a number of staff from Wildlands Conservancy, Lehigh County Conservation District and other municipal or state agencies.

Overall, the public meeting successfully provided participants with important detailed information on the state of the main stem of the Little Lehigh Creek. Attendees expressed optimism and a genuine interest to learn more about the watershed. Many shared that they had learned something new about management techniques that are not beneficial to a creek, such as mowing lawn to the edge. The dedication of the volunteers involved in the Little Lehigh Creek visual assessment coupled with the caliber of the audience that attended the public meeting, creates a dynamic group of individuals committed to future restoration and enhancement of the Little Lehigh Creek.

Conclusion

Combining the rankings of the priority recommendations with the additional public comments, provides watershed stakeholders with a strategy to address the concerns and issues in the watershed. First, future projects should focus on reaches considered in poor condition that had been assessed as part of the Coldwater Conservation Plan. Projects that would best address an increase in water quality should take priority over fish habitat and flooding. Simultaneously, outreach initiatives could include: reaching out to landowners with letters detailing the condition of their portion of the creek, developing workshops to increase the knowledge of landowners on stream management, and raising awareness of the importance of protected forested reaches. Professional site visits conducted by Lehigh County Conservation District and Wildlands Conservancy staff could also help increase the quality of the ecological stewardship of the Little Lehigh Creek. Assessing and strengthening municipal ordinances has been a priority for the Lehigh County Conservation District and Wildlands Conservancy, and the feedback at the public meeting favors the continuation of these efforts.

Possible funding sources to implement some of the priority recommendations include American Rivers and the National Oceanic and Atmospheric Administration Community-based Restoration Program Grants, Cora L. Brooks Foundation, Pennsylvania Department of Environmental Protection's Growing Greener programs, Pennsylvania Department of Conservation and Natural Resources Rivers Conservation Program and Delaware & Lehigh National Heritage Corridor: Lehigh Valley Greenways Implementation Block Grant. Additional resources exist that fund primarily outreach activities like League of Women Voters—Water Resources Education Network. Individuals or watershed groups should contact Wildlands Conservancy and/or Lehigh County Conservation District to find out how to best begin spearheading or helping to address the recommendations outlined in this plan.

By providing targeted outreach activities and identifying site-specific stream and riparian corridor enhancement/protection opportunities, the water quality and aquatic habitat can be improved benefiting future generations. With additional future community commitment promoting and engaging in the proper stewardship of the Little Lehigh Creek, far greater improvements will be achieved than originally thought possible. This Coldwater Conservation Plan with the visual assessment data, together can become a significant guiding document for the Little Lehigh Creek.

REFERENCES

A Natural Areas Inventory of Berks County, Pennsylvania, 1991. (www.naturalheritage.state.pa.us)

A Natural Areas Inventory of Lehigh and Northampton Counties, Pennsylvania, Update 2005. (www.naturalheritage.state.pa.us)

Berks County, *Greenway, Park and Recreation Plan DRAFT*, 2006.

Billingsley, Marcinko & Frazier. *Little Lehigh Creek (502C) Management Report Sections 08 and 09*. Pennsylvania Fish Commission Division of Fisheries, Fisheries Management Section, 1983.

City of Allentown 2006 Annual Water Quality Monitoring Report, available online at http://www.allentownwater.org/water_report_allentown.html.

Lehigh Valley Planning Commission, *Little Lehigh Creek Watershed Act 167 Storm Water Management Plan Update*, 1999 and 2003 Update.

PennEnvironment, *Troubled Waters: An analysis of Clean Water Act Compliance*, July 2003- December 2004.

Pennsylvania Department of Environmental Protection, *2006 PA Integrated Water Quality Monitoring and Assessment Report (Integrated List of All Waters—List 5)*, 2006. Formerly the 303(b) Report.

United States Department of Agriculture—Natural Resources Conservation Service Aquatic Assessment Workgroup, *National Water and Climate Center Technical Note 99-1, Stream Visual Assessment Protocol*, December 1998.

Wildlands Conservancy, *Lehigh River Watershed Conservation Management Plan*, 2004.

RESOURCES

Berks County Conservation District
Watershed Specialist
Berks County Agricultural Center
1238 County Welfare Road Suite 200
Leesport, PA 19533
610-372-4657
(www.co.berks.pa.us)

Department of Environmental Protection
Watershed Manager
4530 Bath Pike
Bethlehem, PA 18017
610-861-2143

Pennsylvania Department of Environmental Protection's website (www.dep.state.pa.us) contains more information on the assessment of Pennsylvania's streams and the state of their water quality, and grants. Pennsylvania Fish & Boat Commission website (www.fish.state.pa/waters_trout.htm) contains more information on trout water classifications and special regulation areas.

Lehigh County Conservation District
Watershed Specialist
4181 Dorney Park Road
Allentown, PA 18104
610-391-9583
(www.lehighconservation.org)

Little Lehigh Watershed Coalition
PO Box 135
Emmaus, PA 18049

Senior Corps RSVP of Lehigh, Northampton and Carbon Counties
Water Quality Monitors
5000 Tilghman Street Suite 204
Allentown, PA 18104
Diane Schrameyer
610-391-8211

United States Geological Service website (waterdata.usgs.gov) contains information about local gaging stations on the streams and rivers.

Wildlands Conservancy, Inc.
Director Rivers Program
3701 Orchid Place Road
Emmaus, PA 18049
610-965-4397

***DIGITAL COPY AVAILABLE from the Wildlands Conservancy's website (www.wildlandspa.org)

APPENDIX

Little Lehigh Creek Watershed Map

Table E. Little Lehigh Water Quality Indicators (Main Stem)

Table F. Little Lehigh Water Quality Indicators (Tributaries)

Table G. Fish Surveys on Little Lehigh Creek Main Stem

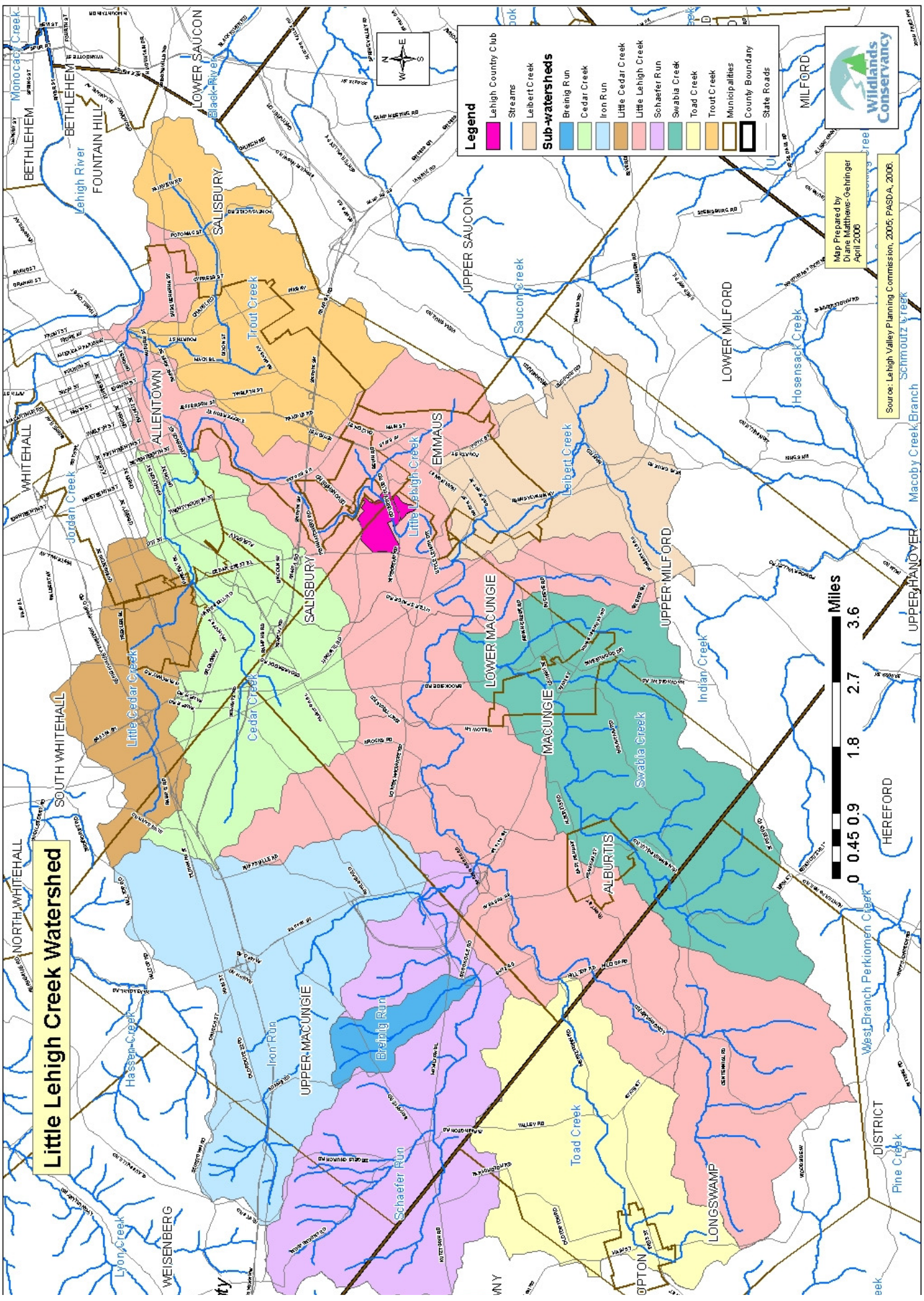
Visual Assessment Data Form

Letter Mailed to Streamside Landowners

Invitation to Public Meeting

Press Release Announcing Public Meeting

Little Lehigh Creek Watershed



Map Prepared by
Diane Matthews-Oehlinger
April 2006

Source: Lehigh Valley Planning Commission, 2005; PASDA, 2006.

Table E. Little Lehigh Water Quality Indicators

MAIN STEM OF THE LITTLE LEHIGH CREEK						
Year	Condition of Stream	Location on LLC Main Stem	Type of Survey	Source	Notes	
2003	FAIR	Lehigh Country Club, Allentown	Macroinvertebrate	Wildlands		
2004	FAIR	Lehigh Country Club, Allentown	Macroinvertebrate	Wildlands		
2006	FAIR to GOOD	Lehigh Country Club, Allentown	Fish	Wildlands		
2006	FAIR to POOR	Lehigh Country Club, Allentown	Macroinvertebrate	Wildlands		
1999	Marginal	O'Brien Property, Emmaus	Habitat	PA Fish&Boat	1	
2000	FAIR	Pool Wildlife Sanctuary, Emmaus	Fish	Wildlands	2	
2001	Suboptimal	Beldon/Hamill Property, Emmaus	Habitat	Wildlands		
2001	FAIR to VERY GOOD	Beldon/Hamill Property, Emmaus	Macroinvertebrate	Wildlands		
2001	FAIR	Beldon/Hamill Property, Emmaus	Fish	Wildlands	3	
	PRE- RESTORATION					
2000	POOR to Suboptimal	Brookvue Farms, Longswmp Twshp, Berks County	Habitat	PA Fish&Boat		
2000	GOOD	Brookvue Farms, Longswmp Twshp, Berks County	Fish	PA Fish&Boat	4	
2001	GOOD to VERY GOOD	Brookvue Farms, Longswmp Twshp, Berks County	Macroinvertebrate	Wildlands		
2002	RESTORATION PROJECT COMPLETED					
2003	Showing Improvement	Brookvue Farms, Longswmp Twshp, Berks County	Fish	PA Fish&Boat	5	
2005	Showing Improvement	Brookvue Farms, Longswmp Twshp, Berks County	Fish	PA Fish&Boat	6	
2005	Suboptimal to Optimal	Brookvue Farms, Longswmp Twshp, Berks County	Habitat	PA Fish&Boat		
2004	Suboptimal	Lower Macungie Park, East Texas	Habitat	PA Fish&Boat		
Notes:						
1	<i>Wild rainbow & brown trout recorded.</i>					
2	<i>Found brook and wild brown trout.</i>					
3	<i>Wild brown trout recorded.</i>					
4	<i>Lower site had 12 fish species, no trout; upper site had 10 wild brown trout, 2 Am. Eels.</i>					
5	<i>58 wild brown trout recorded across both sites.</i>					
6	<i>129 wild brown trout recorded across both sites.</i>					

Table F. Little Lehigh Water Quality Indicators

Name of LLC Tributary:		LEIBERT CREEK			
		This tributary of the Little Lehigh Creek has been well assessed.			
		Contact Emmaus Borough to read a copy of the Leibert Creek Watershed Assessment			
Year	Condition of Stream	Location	Type of Survey	Source	
2002	FAIR TO POOR	26 sites: Leibert Ck & branches - Furnace Dam&Fetterman's Creek	Water Chemistry	Emmaus Borough	1
2004	IMPAIRED	7 sites: 3 sites E-coli exceeded 126 colonies/100ml	Tot Coliform & E-coli	Emmaus Borough	2
2004	POOR	Furnace Dam Tributary	Macroinvertebrate	DEP Biologist	
2004	FAIR	Shimerville Road site and Camp Olympic site	Macroinvertebrate	DEP Biologist	
2004	GOOD	Fetterman's Creek at Quarry Road	Macroinvertebrate	DEP Biologist	
2004	VERY GOOD	Vera Cruz Fire House site	Macroinvertebrate	DEP Biologist	
2002-2004	POOR to GOOD	Headwaters to confluence with Little Lehigh Creek	Visual Assessment	Emmaus Borough	3
2004	no rating given	Emmaus Community Park	Fish	PA Fish&Boat	4
2005	Marginal to Suboptimal	Emmaus Community Park	Habitat Assessment	PA Fish&Boat	
Notes:					
1	Sampling was conducted in July during a drought period. Dissolved oxygen levels were below 5.85 mg/l. This level is not optimal for aquatic life				
	16 sites recorded levels below 5 mg/l that has been shown to put aquatic life under great stress. The water temperature was greater than the range that quantifies a cold water fishery area. Lack of streamside shading and low water levels are cause for these suboptimal conditions.				
2	Cause most likely failing septic systems and possibly horses near the creek.				
3	Lack of riparian buffer, presence of invasive species along streamside, and siltation of the creek channel are the causes of suboptimal conditions				
4	27 brown trout captured; all but one were young-of-the-year				
Name of LLC Tributary:		SWABIA CREEK			
Year	Condition of Stream	Location	Type of Survey	Source	
2005	FAIR to GOOD	Brookside Country Club, Macungie	Macroinvertebrate	Wildlands	1
2005	POOR to FAIR	Brookside Country Club, Macungie	Fish	Wildlands	2
Notes:					
1	Family Biotic Index rated GOOD but Benthic Index of Biotic Integrity rated FAIR				
2	Fish survey found rainbow and brook trout				
Name of LLC Tributary:		CEDAR CREEK			
Year	Condition of Stream	Location	Type of Survey	Source	
2001		Haines Mill Park, South Whitehall Township	Fish	PA Fish&Boat	1
2001	Suboptimal	Haines Mill Park, South Whitehall Township	Habitat Assessment	Wildlands	
2001		Haines Mill Park, South Whitehall Township	Fish	PA Fish&Boat	2
Notes:					
1	13 fish species recorded, including 28 brown trout and 3 brook trout (1 wild).				
2	34 wild brown trout and 1 stocked brook trout recorded.				

Table G. Fish Surveys Conducted on the Little Lehigh Creek Main Stem

		1978	1981	1995	1997	1999	2000	2000	2001	2005	2006
Common Name	Scientific Name	T-867 Bridge to confluence Spring Creek (Fish&Boat: 1 August survey)	Fish Hatchery Rd to 309 bridge (Fish&Boat: 1 September survey)	T-867 Bridge Berks Cty to confluence with Spring Creek (Fish&Boat: 1 August survey)	Wild Cherry Ln to Laudenslager Mill Dam (Fish&Boat: 4 June surveys)	O'Brien Prop. on Lower Macungie Rd (WC:June survey)	Pool Wildlife Sanctuary, Emmaus (WC: June survey)	Brookvue Farms, Mertztown (Fish&Boat: May survey)	Hamill & Beldon Properties October survey	Lehigh Country Club (WC)	Lehigh Country Club (WC)
Brown Trout	<i>Salmo trutta</i>	Present	Present	Present	Present	40	64	10	32	65	48
Rainbow Trout	<i>Oncorhynchus mykiss</i>	FromHatchery	Hatchery	0	Hatchery	2	0	0	0	1	0
Brook Trout	<i>Salvelinus fontinalis</i>	FromHatchery	Hatchery	0	Hatchery	0	3	0	0	0	0
White Sucker	<i>Catostomus commersoni</i>	Present	Present	Present	Present	30	49	51	32	59	5
Creek Chub	<i>Semotilus atromaculatus</i>	Present	0	Present	0	0	0	0	0	0	0
Fallfish	<i>Semotilus corporalis</i>	0	0	Present	0	0	0	0	0	0	0
Creek Chubsucker	<i>Erimyzon oblongus</i>	Present	0	0	0	0	0	0	0	0	0
Brown Bullhead	<i>Ameiurus nebulosus</i>	Present	0	0	0	0	0	0	0	0	0
Margined Madtom	<i>Noturus insignis</i>	Present	0	Present	0	0	0	3	0	0	0
American Eel	<i>Anguilla rostratus</i>	Present	Present	Present	Present	0	2	2	1	6	3
Blacknose Dace	<i>Rhinichthys attratulus</i>	Present	Present	Present	Present	67	65	807	21	39	194
Longnose Dace	<i>Rhinichthys cataractae</i>	Present	Present	Present	Present	8	9	61	0	86	220
Cutlips Minnow	<i>Exoglossum maxillingua</i>	Present	Present	Present	Present	62	5	44	11	46	12
Bluntnose Minnow	<i>Pimephales notatus</i>	0	0	0	0	0	0	94	0	0	0
Common Shiner	<i>Luxilus cornatus</i>	Present	0	Present	Present	1	0	33	0	6	0
Golden Shiner	<i>Notemigonus crysoleucas</i>	0	0	0	0	4	0	0	0	0	0
Satinfish Shiner	<i>Cyprinella anolostana</i>	Present	0	0	Present	0	0	0	0	0	0
Spottail Shiner	<i>Notropis hudsonius</i>	Present	0	0	Present	0	0	4	0	0	0
Spotfin Shiner	<i>Cyprinella spiloptera</i>	0	0	0	0	0	0	6	0	0	0
Goldfish	<i>Carassius auratus</i>	0	0	0	0	0	0	0	0	1	0
Slimy Sculpin	<i>Cottus cognatus</i>	0	Present	0	Present	0	16	0	77	345	428
Tessellated Darter	<i>Etheostoma olmstedii</i>	0	Present	Present	Present	90	3	13	50	20	10
Greenside Darter	<i>Etheostoma blenniodes</i>	0	0	0	0	0	0	2	0	0	0
Johnny Darter	<i>Etheostoma nigrum</i>	Present	0	0	0	0	0	0	0	0	0
Shield Darter	<i>Percina peltata</i>	0	Present	0	Present	0	0	15	0	0	0
Rock Bass	<i>Ambloplites rupestris</i>	0	0	Present	Present	2	1	0	3	5	2
Largemouth Bass	<i>Micropterus salmoides</i>	Present	0	0	Present	0	0	0	0	2	0
Bluegill	<i>Lepomis macrochirus</i>	Present	0	0	Present	0	0	0	0	0	0
Pumpkinseed	<i>Lepomis gibbosus</i>	Present	0	Present	Present	0	4	0	2	0	1
Green Sunfish	<i>Lepomis cyanellus</i>	0	0	0	0	1	1	0	0	0	0
Redbreast Sunfish	<i>Lepomis auritus</i>	Present	0	Present	0	0	0	0	0	0	0
Banded Killifish	<i>Fundulus diaphanus</i>	0	0	Present	Present	0	0	62	0	0	0
Redfin Pickerel	<i>Esox americanus am</i>	Present	0	Present	Present	0	0	0	0	0	0
TOTAL # OF SPECIES SURVEYED		21	11	16	20	11	12	15	9	12	10

Stream Visual Assessment Protocol

Owners name _____ Evaluator's name _____ Date _____

Stream name _____ Waterbody ID number _____

Reach location _____

Ecoregion _____ Drainage area _____ Gradient _____

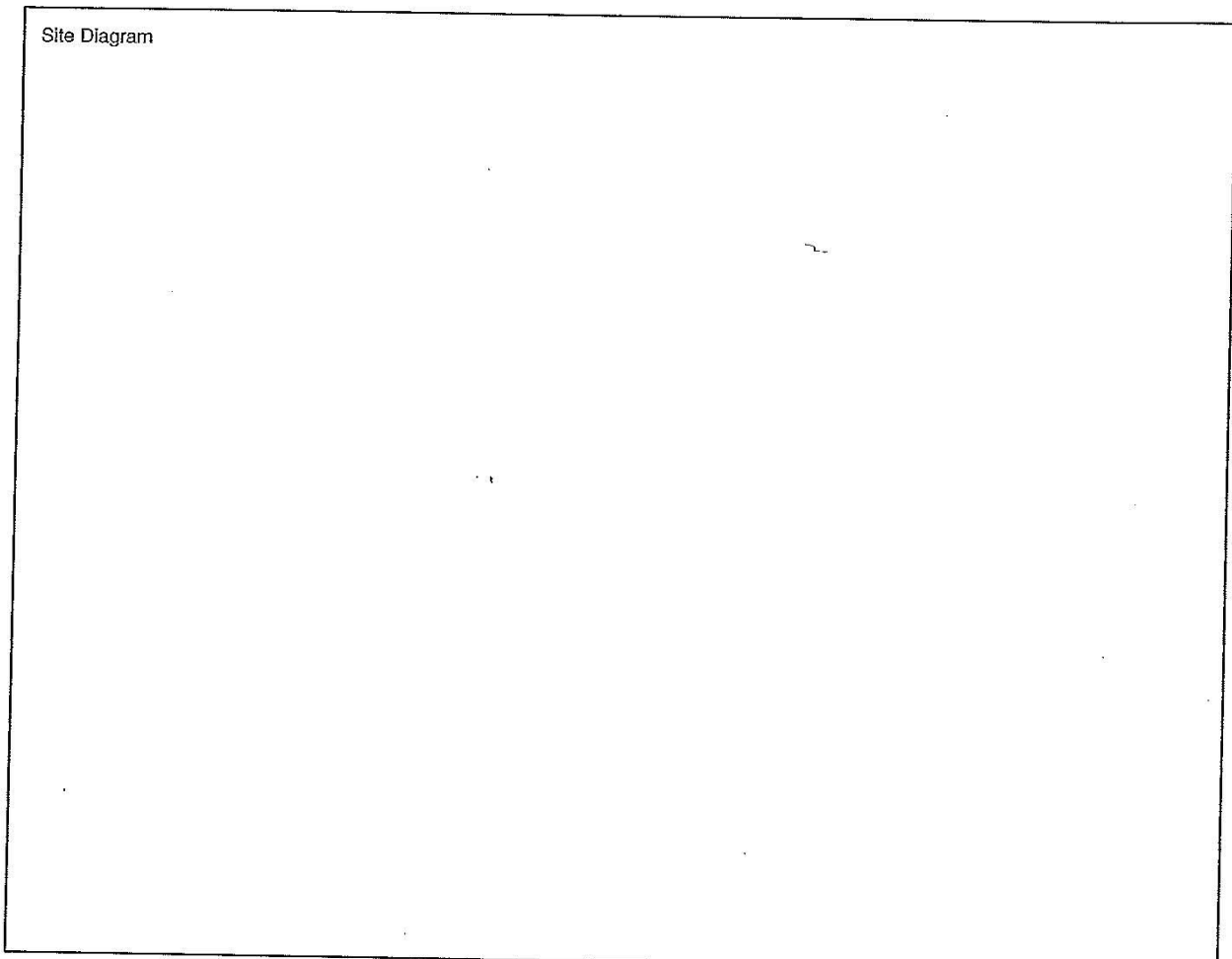
Applicable reference site _____

Land use within drainage (%): row crop _____ hayland _____ grazing/pasture _____ forest _____ residential _____
confined animal feeding operations _____ Cons. Reserve _____ industrial _____ Other: _____

Weather conditions-today _____ Past 2-5 days _____

Active channel width _____ Dominant substrate: boulder _____ gravel _____ sand _____ silt _____ mud _____

Site Diagram



Assessment Scores

Channel condition

Pools

Riparian zone

Invertebrate habitat

Bank stability

<i>Score only if applicable</i>	
Canopy cover	<input type="checkbox"/>
Manure presence	<input type="checkbox"/>
Salinity	<input type="checkbox"/>
Riffle embeddedness	<input type="checkbox"/>
Macroinvertebrates Observed (optional)	<input type="checkbox"/>

Nutrient enrichment

Barriers to fish movement

Instream fish cover

Overall score	<6.0	Poor
(Total divided by number scored)	6.1-7.4	Fair
	7.5-8.9	Good
	>9.0	Excellent

Suspected causes of observed problems _____

Recommendations _____



May 14, 2007

Little Lehigh Creek Landowners:

Wildlands Conservancy has received a small grant from the Coldwater Heritage Partnership (a collaborative effort between PA Fish & Boat, PA Department of Conservation & Natural Resources, Western PA Watershed Protection Program, and Pennsylvania Trout) to assess the condition of the Little Lehigh Creek and develop a Conservation Plan. Through the assessment of the 24-mile creek, we will be able to rank each section and create a plan to effectively protect and enhance this truly unique watershed. **Work is underway and soon Wildlands Conservancy staff will be assessing the Little Lehigh Creek in your area.**

To assess the creek, staff and volunteers walk through the middle of the creek noting erosion issues, bridge concerns, invasive species presence and fish habitat conditions. I have enclosed a copy of the field data sheet that we use. We often park near bridges and enter the creek on municipal land. We will most likely simply walk through the creek on your property, with no need to walk on your land.

Once the data is gathered (30% of the creek has already been completed), staff from the Lehigh County Conservation District will analyze this data and rank each section of the creek from the lowest to highest priority areas for improvement. Wildlands Conservancy will then write a report summarizing these results and present the findings at a public meeting held at our office in September. One hopeful outcome of this report will be the ability of community groups or municipalities to secure future grant money to offset the cost to restore the high priority areas along the main stem. Increasingly, state grants require that a study must be conducted first, to enable them to justify any grant award.

With this effort we hope to reach out and assist landowners whose section of the Little Lehigh Creek needs improvement. Wildlands Conservancy has already worked with a streamside owner in Longswamp Township to restore their section of the creek, securing more than \$15,000 to help pay for stabilizing the stream banks on the property. Grants to restore creeks are difficult to acquire and there is no guarantee funding will be available. However, by prioritizing projects in the watershed, we can increase our chances that a future grant will be funded to restore the Little Lehigh.

We encourage you to attend our public meeting in September when we summarize the results and provide recommendations. Each landowner will receive a mailed invitation with details when we get closer. As part of this meeting, we will also discuss different options that are available to restore the creek and answer any questions from individual landowners. We look forward to meeting you and assisting you however possible.

The Little Lehigh Creek is indeed a special watershed. A tributary of the Lehigh River, it provides drinking water for 150,000 residents in the City of Allentown and is renowned for excellent fishing, supporting a naturally reproducing population of brown trout.

To make this project a success we hope we can count on your support. As we schedule our field work days, we estimate that we will be walking the creek sometime between the end of May to early July. **If you have any questions or concerns, or would like to receive details about the exact day that we will be walking through your section of the Little Lehigh Creek, do not hesitate to contact me at 610-965-4397 x.19 or email me at dbetz@wildlandspa.org.**

I look forward to working with you and the Little Lehigh Creek watershed community to protect and enhance this special place.

Thank you for your time.

Sincerely,

Dani-Ella Betz
Rivers Conservationist

P.S. For more information about the Wildlands Conservancy and the Rivers Program, please visit our website at www.wildlandspa.org and click on “Rivers” and “Projects” to read about past restoration work we have completed on the Little Lehigh Creek.

Here are before (2000) and after pictures (2006) from an eroding stretch of the Little Lehigh Creek. These photos demonstrate how a farmer and Wildlands Conservancy working together were able to reduce property loss by stemming the erosion of stream banks, improve the drinking water quality for the citizens that live downstream, and enhance the habitat for wildlife. This restoration project was made possible by a grant from the PA Department of Environmental Protection.





YOU ARE INVITED:

Public Meeting for Little Lehigh Creek Visual Stream Assessment and Coldwater Conservation Plan

Wednesday, September 12, 2007 at 7:00 PM

Dear Little Lehigh Creek Watershed Partners:

In consideration of your demonstrated interest in preserving, protecting and enhancing the Little Lehigh Creek, Wildlands Conservancy and Little Lehigh Trout Unlimited would like to extend this invitation to attend a Public Meeting for Little Lehigh Creek Visual Stream Assessment and Coldwater Conservation Plan.

Wildlands Conservancy received a grant in 2006 from the Coldwater Heritage Partnership to develop a Coldwater Conservation Plan for the Little Lehigh Creek. In order to develop the Plan, a qualitative, visual-based stream habitat assessment was recently completed by Wildlands Conservancy and Lehigh County Conservation District staff, and by volunteers from Saucon Creek Watershed Association and Little Lehigh Trout Unlimited. During the assessment a series of habitat-related parameters were evaluated and scored. Assessment observations and scores are currently being compiled and incorporated, by the Lehigh County Conservation District, into GIS mapping, which will be included within the plan. Background information and historic biological data is also currently being added. The Plan will be used in combination with other existing watershed studies to identify site specific opportunities to preserve and protect the stream through the implementation of various Best Management Practices.

During the public meeting, the draft Plan will be presented and an opportunity will be given for attendees to ask questions and provide input. Input provided during the meeting will be incorporated into the final Plan.

The presentation is open to the public and will be held at 7:00 p.m. in Wildlands Conservancy's Environmental Enrichment Education Center at Pool Wildlife Sanctuary, 3701 Orchid Place Road in Emmaus. **To attend, please RSVP to Dani-Ella Betz at dbetz@wildlandspa.org or 610-965-4397 x19 by September 10.** Directions are enclosed.

Thank you very much for your continued support of our efforts to preserve, protect and enhance the Little Lehigh Creek. We look forward to seeing you at the meeting.

Sincerely,

Dani-Ella Betz
Rivers Conservationist

Contact: Christopher M. Kocher
Wildlands Conservancy
610/965-4397 ext. 23
ckocher@wildlandspa.org
Susan L. Williams, APR, MA
Susan Williams & Associates
610/366-2155
suewill@ptd.net



LITTLE LEHIGH CREEK COLDWATER CONSERVATION PLAN UNVEILED AT PUBLIC MEETING

(Emmaus, Pa, August 27, 2007)– Miles of the Little Lehigh Creek were visually assessed and photos and observations gathered will be unveiled during a public meeting to be held on September 12th at 7 p.m. at the Wildlands Conservancy Pool Wildlife Sanctuary in Emmaus. Wildlands Conservancy collaborated with the Little Lehigh Creek chapter of Trout Unlimited to visually assess the Little Lehigh Creek and provide recommendations to help preserve and protect the stream for future generations. Significant technical and volunteer assistance was also provided by Lehigh County Conservation District staff and Saucon Creek Watershed Association members.

Wildlands Conservancy and Little Lehigh Trout Unlimited received a grant from the Coldwater Heritage Partnership in 2006 to develop a Coldwater Heritage Conservation Plan (Plan) for the Little Lehigh Creek. To complete the Plan, volunteers and staff from the previously mentioned partnering organizations strapped on waders, and sometimes paddled in kayaks, to visually assess the creek. They collected a series of photographs and recorded scores and observations regarding various stream and stream corridor conditions such as the degree of stream bank erosion occurring, the extent of vegetative buffers growing along the stream and the quality of existing habitat for aquatic organisms.

The Little Lehigh Creek is a tributary of the Lehigh River, and flows for 24 miles from Topton, Berks County through the City of Allentown. The Little Lehigh Creek is a main source of drinking water for the City of Allentown. The stream winds through forests, wetlands, farmlands, residential developments, urban parks and industrial properties. The Little Lehigh Creek also contains a naturally reproducing population of brown trout, and is highly valued for its angling and other recreational opportunities.

“The landowners that we met as we assessed the creek were very interested in this project,” explained Dani-Ella Betz, Rivers Conservationist with Wildlands Conservancy. “They see first-hand how powerful this stream can be and are con-

cerned for the future. They have realized on their own the importance of allowing for the growth of native vegetation along the stream if they want to help reduce stream bank erosion,” she added.

After assessing the creek, staff from the Lehigh County Conservation District compiled field data and incorporated assessment score results and photographs into a GIS mapping program. This information, along with additional background information and historic biological data, is being included within the Plan. The Plan will be used in combination with other existing watershed studies to identify site specific opportunities to preserve and protect the stream.

During the public meeting, the draft Plan will be presented and an opportunity will be provided to attendees to ask questions and provide input. Input provided during the meeting will be incorporated into the final Plan.

The presentation is open to the public and will be held at 7:00 p.m. in Wildlands Conservancy’s Environmental Enrichment Education Center at Pool Wildlife Sanctuary, 3701 Orchid Place Road in Emmaus. To attend, please RSVP to Dani-Ella Betz at dbetz@wildlandspa.org or 610-965-4397 x19 by September 10.

About Wildlands Conservancy

Wildlands Conservancy is dedicated to saving the natural treasures of the Lehigh Valley and the Lehigh River valley for current residents and future generations. Its mission is to preserve, protect, restore and enhance the land, water, ecological and recreational resources of the Lehigh Valley and the Lehigh River valley. Established in 1973, the Conservancy collaborates with partnerships throughout the Commonwealth of Pennsylvania to achieve its goals. As a non-profit, member-supported organization, the Conservancy has protected more than 45,000 acres of critical farmland and wildlands in 18 counties of eastern Pennsylvania. For more information, please visit www.wildlandspa.org.

#