CONSERVATION PLAN FOR THE ALLEGHENY RIVER HEADWATERS REGION

Prepared by the Upper Allegheny Watershed Association

Sponsored by the Coldwater Heritage Partnership

August 2014

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- Potter County Planning Commission
- Potter County GIS Department
- Potter County Conservation District
- Potter County Tax Assessment Office
- God's Country Chapter of Trout Unlimited

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INTRODUCTION

This conservation plan is the culmination of a year-long effort by the Upper Allegheny Watershed Association (UAWA). The UAWA, with a current membership of 75 individuals and organizations, is concerned with the protection and enhancement of the Allegheny River from its source in Potter County, Pennsylvania to the point where it exits McKean County into New York State. The project was conducted with the support of a conservation planning grant from the Coldwater Heritage Partnership, a joint venture of the Pennsylvania Council of Trout Unlimited, the Pennsylvania Fish and Boat Commission, Pennsylvania Department of Conservation and Natural Resources (DCNR), and the Foundation for Pennsylvania Watersheds.

Purpose and Scope

The project undertaken by the UAWA addresses the headwaters portion of the River in Potter County, encompassing the uppermost 79 square miles of the Allegheny River drainage basin. The Allegheny begins at the famous Triple Divide, the only place in the eastern U.S. where three major watersheds meet – the Allegheny River, the Genesee River, and Pine Creek (part of the Susquehanna River/Chesapeake Bay watershed). Despite the low population in this area, development and other pressures have generated concern about the long-term health of the River and its tributaries. Agriculture, logging, residential development (mostly seasonal), and Marcellus Shale natural gas development potentially can have negative impact on these coldwater resources. Development of a conservation plan is a critical first step in protecting the River and its tributaries.

The work conducted was directed toward: 1) characterizing the resource; 2) identifying impacts and threats; and 3) developing a plan of action to reduce or eliminate threats and impacts to the resource. In addition, activities were undertaken to solicit public input to the process.

Characterization of the resource focused on the streams themselves, but also will included riparian areas (nominally 50 feet on either side of the streams), and critical areas of the watersheds. The extent and severity of the following potential impacts and threats to water quality and stream biota were identified and assessed.

- Industrial development, particularly unconventional natural gas drilling and production
- Acid precipitation
- Absence of bank and riparian buffer vegetation
- Obstructions to passage of aquatic organisms
- Accelerated erosion and sedimentation resulting from agricultural practices, logging, dirt and gravel roads, quarries, etc.
- Urban-type development
- Invasive species
- Abandoned oil and gas wells

Study Area

As noted above, the area included in the project encompassed the uppermost 79 square miles of the Allegheny River drainage basin. That area is shown on the overview map on the following page. It includes the River from its source to its confluence with Mill Creek in Coudersport, including Mill Creek and all the tributary streams to those two waters. The streams within the study area are listed below. Tributary streams are listed in downstream order.

- Allegheny River
  - Woodcock Creek
  - Gross Hollow
  - Wambold Hollow
  - Pigeon Creek
  - Toombs Hollow
  - Kohler Hollow
  - Dwight Creek
  - Peet Brook
  - Lent Brook
  - Prosser Hollow
  - Baker Creek
  - Steer Run
  - Reese Hollow
- Mill Creek
  - Nelson Run
  - Bates Hollow
  - Trout Run
    - Dry Run
    - Lyman Creek
    - North Hollow Run
    - South Hollow Run

Upper Allegheny Watershed Association

Headwaters Allegheny River & Mill Creek Watersheds

Headwaters Allegheny River Watershed

Peet Brook BDA #36

Frinks BDA #23

Allegheny River at Coudersport BDA #2

Dutchman Hill BDA #15

Mill Creek Watershed

Biological Diversity Area
- Core Habitat
- Supporting Landscape
- Hydrology
- Watersheds
- State Forest
- Watersheds

N
W E
S

0 1 2 4 Miles
1 in = 1 miles

Sources: Esri, USGS, NOAA

Potter County Pennsylvania

Map Created By:
Rudin Emborsky
Potter County GIS
June 9, 2014

METHODS

Field Observations by Volunteers

Both existing sources and field studies were employed to gather data and information on resources, threats and impacts. The named streams were walked by trained volunteers, typically beginning at the mouth and proceeding upstream until the streambed was dry. To keep them manageable, walking assignments generally were one to two miles in length. A total of 61 miles of stream were walked, and information was recorded on a field data sheet (see Appendix A). Volunteers recorded the presence and coordinates of the following features.

- Riparian vegetation type
- Invasive plant species
- Large woody debris
- Bank erosion
- Obstructions to fish passage
- Streamside development
- Abandoned oil and gas wells

In cases where property access permission was not provided, aerial photography from Google Earth was used to identify riparian vegetation type. Information obtained via field observations was compiled and summed for each stream in Excel spreadsheets.

The features identified via field observation, along with their coordinates, were provided to the Potter County GIS Department. The Department's GIS technician then developed an Arc GIS database, using existing aerial photography as the base and placing the data provided in various layers.

Fish Survey

To assess the viability of designating the very headwaters of the Allegheny River as Class A Wild Trout Waters by the Pa Fish and Boat Commission, electrofishing surveys were conducted at two sites on the River and a single site on Gross Hollow Run. Stream segments 100 meters in length were electro-shocked (single pass) following the Pa Fish and Boat Commission protocol for unassessed waters. Electrofishing surveys were conducted by Dr. Mel Zimmerman and his student assistants from Lycoming College. All species captured were recorded. The length of each trout captured was recorded prior to releasing the fish.

Acid Precipitation

Traditionally, acid precipitation has adversely impacted streams in the eastern U.S., including the poorly buffered, freestone streams of the study area. Reductions in sulfur

dioxide emissions brought about by 1984 amendments to the Clean Air Act have resulted in improvements to streams in many areas. To assess the current severity of acid precipitation, a field study was implemented. Rain gages were installed at four locations, and trained volunteers recorded the amount of precipitation. During freezing weather, the rain gage was brought indoors to allow snow to melt prior to measurement. Volunteers measured its pH using pH test strips (EMD Millipore Corporation). If the amount of precipitation was 0.2 inches or greater, a sample was placed in a 25-ml HDPE plastic bottle and refrigerated. Samples were then brought to a central location and their pH measured using a benchtop pH meter (Thermo Fisher Scientific Orion Star A111). The meter was calibrated to buffered standards of 4.0 and 7.0 immediately prior to analysis of each batch of samples.

Existing Data

Existing data and information regarding the study area streams and their watersheds were acquired from the following sources.

- Potter County Planning Commission
- Potter County Conservation District
- Potter County GIS Department
- Western Pennsylvania Conservancy
- Pennsylvania Fish and Boat Commission
- Pennsylvania Department of Environmental Protection
- Pennsylvania Department of Conservation and Natural Resources
- U.S. Environmental Protection Agency

Documents obtained from these organizations were reviewed and relevant data and information were extracted and compiled. They appear in tables and text elsewhere in this report.

RESOURCE DESCRIPTION

This section of the report provides descriptive information characterizing the streams of the study area, their riparian zones, and their watersheds. Many of the features discussed below are shown on the resource maps in Appendix B.

The study area lies wholly within Potter County, Pennsylvania and includes parts of Allegany, Eulalia, Hebron, Summit, and Sweden Townships and the Borough of Coudersport. Potter County is sparsely populated, with a population of less than 18,000 individuals. Approximately one-sixth of the county's population (approximately 3,000 people) resides in Coudersport. There is very little industry within the study area and within the county in general.

As noted previously, the study area encompasses the drainage areas of the Allegheny River from its source to its confluence with Mill Creek in the Borough of Coudersport, including the Mill Creek drainage area (see Overview Map). General information regarding the watersheds of the 22 named streams of the study area is provided in Table 1. These data were obtained from the Pennsylvania Stream Stats web site of the U.S. Geological Survey. Of particular note is the large percentage of watershed areas occupied by forest. This ranges from 68 percent to 99 percent and typically exceeds 80 percent. Indeed, much of Potter County is forested, and logging is one of its most important economic activities.

As shown it Table 2, all streams in the study area have a designated use of 'Cold Water Fishery' under Pennsylvania's Chapter 93 regulations (Water Quality Standards). This is not surprising, given that the study area location is a largely forested region in northern Pennsylvania. In addition, ten of the 22 streams in the study area are classed as 'High Quality'. They are:

- Woodcock Creek
- Wambold Hollow
- Dwight Creek
- Steer Run
- Mill Creek
- Nelson Run
- Dry Run
- Trout Run
- Bates Hollow
- Lyman Creek

According to Pennsylvania Fish & Boat Commission designations (Table 2) all of the streams in the study area support natural reproduction of trout.

Table 1. Drainage Basin Characteristics.

Stream Name	Drainage Area (sq. mi.)	Total Stream Length (mi.)[1]	Percent Forested	NAD83 Coordinates at Outlet
Allegheny River (above Mill Cr.)	47.38	96.77	85	Lat: 41º 46.398' Long: -78º 1.086'
Woodcock Creek	1.92	2.89	91	Lat: 41º 50.106' Long: -77º 52.806'
Gross Hollow	2.99	4.72	75	Lat: 41º 49.883' Long: -77º 53.142'
Wambold Hollow	1.58	3.00	82	Lat: 41º 49.974' Long: -77º 53.862'
Pigeon Creek	1.11	2.86	85	Lat: 41º 49.884' Long: -77º 54.588'
Toombs Hollow	1.73	4.06	74	Lat: 41º 49.886' Long: -77º 54.594'
Kohler Hollow	0.92	2.61	68	Lat: 41º 49.884' Long: -77º 54.666'
Dwight Creek	3.42	5.36	94	Lat: 41º 50.124' Long: -77º 55.224'
Peet Brook	5.81	12.79	85	Lat: 41º 50.022' Long: -77º 56.550'
Lent Brook	1.62	3.24	96	Lat: 41º 49.308' Long: -77º 58.266'
Prosser Hollow	2.31	4.41	93	Lat: 41º 49.038' Long: -77º 59.100'
Baker Creek	4.41	9.42	88	Lat: 41º 48.606' Long: -78º 0.042'
Steer Run	3.70	6.87	79	Lat: 41º 48.498' Long: -78º 0.894'
Reese Hollow	2.16	4.63	97	Lat: 41º 47.478' Long: -78º 0.942'
Mill Creek	31.33	62.09	87	Lat: 41º 46.380' Long: -78º 01.086'
Nelson Run	4.78	7.96	99	Lat: 41º 43.596' Long: -77º 56.190'

Bates Hollow	0.23	0.60	96	Lat: 41º 44.400’ Long: -77º 56.412’
Trout Run	6.34	10.95	92	Lat: 41º 45.216’ Long: -77º 56.964’
Dry Run	1.89	3.56	89	Lat: 41º 45.414’ Long: -77º 55.248’
Lyman Creek	5.29	10.95	78	Lat: 41º 45.408’ Long: -77º 57.318’
North Hollow Run	5.15	11.62	87	Lat: 41º 46.326’ Long: -77º 59.070’
South Hollow Run	1.93	4.02	88	Lat: 41º 46.308’ Long: -77º 59.202’

Source: US Geological Survey. Pennsylvania Stream Stats. http://water.usgs.gov/osw/streamstats/pennsylvania.html

[1.] Includes all tributary streams, perennial and intermittent.

Table 2. Streams in the study area and their current classifications

Stream Name	Tributary to	PaDEP Designation	PF&BC Class	Wild Trout Limits	Lower Limit Coordinates
Allegheny River		CWF	Natural Reproduction	Headwaters to Reed Run	Lat: 41.751389º Long: -78.107498º
Woodcock Creek	Allegheny River	HQ-CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.834999º Long: -77.880287º
Gross Hollow	Allegheny River	CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.831379º Long: -77.885963º
Wambold Hollow	Allegheny River	HQ-CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.832935º Long: -77.897224º
Pigeon Hollow Run	Allegheny River	CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.831223º Long: -77.909973º
Toombs Hollow	Allegheny River	CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.831665º Long: -77.91008º
Kohler Hollow	Allegheny River	CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.831997º Long: -77.911392º
Dwight Creek	Allegheny River	HQ-CWF	Class A Wild Trout	Headwaters down-stream to mouth	Lat: 41.834999º Long: -77.919998º
Peet Brook	Allegheny River	CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.833889º Long: -77.942223º
Lent Brook	Allegheny River	CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.821411º Long: -77.971336º
Prosser Hollow	Allegheny River	CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.817257º Long: -77.98555º
Baker Creek	Allegheny River	CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.809933º Long: -78.001335º
Steer Run	Allegheny River	HQ-CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.80722º Long: -78.014168º
Reese Hollow	Allegheny River	CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.791313º Long: -78.016029º
Mill Creek	Allegheny River	HQ-CWF	Class A Wild Trout	Country club downstream to mouth	Lat: 41.773056º Long: -78.018608º

Nelson Run	Mill Creek	HQ-CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.732597º Long: -77.937149º
Dry Run	Trout Run	HQ-CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.756943º Long: -77.921112º
Trout Run	Mill Creek	HQ-CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.753334º Long: -77.949448º
Bates Hollow	Mill Creek	HQ-CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.740131º Long: -77.940758º
Lyman Creek	Mill Creek	HQ-CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.756771º Long: -77.955711º
North Hollow Run	Mill Creek	CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.771858º Long: -77.984909º
South Hollow Run	Mill Creek	CWF	Natural Reproduction	Headwaters down-stream to mouth	Lat: 41.991976º Long: -77.987061º

Source: Pennsylvania Fish and Boat Commission. March 2014. http://fishandboat.com/trout_repro.pdf and http://fishandboat.com/classa.pdf

Wetlands and Biologically Diverse Areas

Wetland areas are shown on the resource maps included in Appendix B. These areas typically are found adjacent to the larger streams, particularly the Allegheny River. Wetland types include marsh areas occupied by obligatory and facultative wetland shrubs, grasses, and forbs, and palustrine forested areas dominated by eastern hemlock trees.

The Western Pennsylvania Conservancy defines a biologically diverse area as "An area containing plants or animals of special concern at state or federal levels, exemplary natural communities, or exceptional native diversity." According to the Potter County Natural Heritage Inventory (Western Pennsylvania Conservancy, 2007), there are four biologically diverse areas (BDA) within the study area. They include the following areas, and are shown on the Overview Map located in the Introduction section of this report.

Allegheny River at Coudersport BDA – This section of the Allegheny River provides habitat for the American brook lamprey and another, unspecified aquatic animal of special concern. Both species are considered imperiled in Pennsylvania, but globally secure.

Dutchman Hill BDA – This biologically diverse area is a rich, mesic forested slope dominated by eastern hemlock and sugar maple. It is occupied by the West Virginia white, a butterfly species of special concern in the State, considered imperiled in Pennsylvania and vulnerable globally. This rich, moist forested area is home to a variety of wildflowers that serve as host plants for the West Virginia white butterfly.

Frinks BDA – This hemlock palustrine forest community supports a population of creeping snowberry, a plant species classed as rare in Pennsylvania. The Allegheny River forms the southern border of this forest area.

Peet Brook BDA – This area is occupied by an exemplary hemlock palustrine forest having exceptional diversity of plant species and amphibians. The forest floor has the classic pit and mound microtopography characteristic of hemlock palustrine forests in northern Pennsylvania. Sphagnum mosses abound in this moist environment.

A fifth biologically diverse area – the Allegheny River at Eulalia BDA – is located immediately downstream of the study area and is impacted by activities within the study area. It is similar to and contiguous with the Allegheny River at Coudersport BDA.

Based on field reconnaissance by volunteers, it is felt that there may well be additional biologically diverse areas that were not captured by the Western Pennsylvania Conservancy studies, perhaps due to property access or other constraints. In particular, rich and diverse hemlock palustrine forested areas were observed adjacent to several tributaries to the Allegheny River and along Nelson Run, a tributary to Mill Creek.

Riparian Buffer Areas

Trained volunteers walked the perennial streams within the study area and characterized the riparian vegetation in the following categories.

- Forest
- Old field/scrubland
- Pasture/open
- Cornfield
- Lawn (mowed grassy areas)

Riparian vegetation types on both sides of the stream were recorded and GPS coordinates were taken at their start and end. The results are shown on the resource maps in Appendix B and tabulated in Table 3 on the following page.

As seen in Table 3, the most common riparian vegetation type is forest, comprising 54 percent of the riparian vegetation along the Allegheny River and its tributaries, and nearly 42 percent along Mill Creek and its tributaries. Old field communities were the next most common riparian vegetation type – 26 percent along the Allegheny River and 29 percent in the Mill Creek basin. Other vegetation types occur at lower frequencies.

Of particular note is the relatively high frequency of lawn recorded along several streams, notably Steer Run, Mill Creek and its tributaries North Hollow, Run and South Hollow Run. On Steer Run, a single landowner has mows and maintains as lawn a rather large area. The presence of lawn along Mill Creek and its tributaries is attributable to the golf course on Mill Creek and residential development in the town of Sweden Valley and in North and South Hollows.

Many scientific studies have documented the value of forested riparian zones and forest canopy cover. Streams in forested areas typically are healthy streams. Shrubs such as willows also contribute to stream health. On the other hand, lawn is the least desirable type of riparian vegetation in our opinion. It provides no shade to help maintain water temperatures within the optimal range for trout. Nor does it help to bind soils along stream banks, or contribute large woody debris to stream channels, or help to slow flood waters.

Owners of homes and seasonal residences along streams typically plant lawns and mow close to the stream, often right to the top of the bank. This promotes streambank erosion and other problems. Although we are pleased with the presence of forested and scrubland buffers along streams, the presence of lawns is felt to be a problem within the study area.

Table 3. Riparian Zone Vegetation (left and right banks)

Stream Name	Miles Surveyed[1]	Forest	Old Field/ Scrubland	Pasture/ Open	Hayfield	Cornfield	Lawn
Allegheny River	26.68	56%	25%	7%		2%	8%
Woodcock Creek	2.70	90%	5%	5%			
Gross Hollow	4.44	57%	42%				1%
Wambold Hollow	2.78	100%					
Pigeon Creek	2.16	63%	36%				1%
Toombs Hollow	1.6	76%	24%				
Kohler Hollow	2.26	58%	42%				
Dwight Creek	2.32	36%	64%				
Peet Brook	5.68	45%	10%	30%		15%	
Lent Brook	2.34	38%	62%				
Prosser Hollow	3.86	71%	25%	4%			
Baker Creek	9.38	34%	37%	8%		4%	17%
Steer Run	4.56	14%	9%				77%
Reese Hollow	2.34	95%	5%				
Allegheny Basin Total	73.1	54.23%	26.33%	6.31%	0%	2.41%	9.99%
Mill Creek	15.64	29%	35%	14%			22%
Nelson Run	10.42	92%	1%	2%			5%
Bates Hollow[2]	ND	ND	ND	ND	ND	ND	ND
Trout Run	5.71	50%	26%	13%			11%
Dry Run	2.28	5%	46%	41%			8%
Lyman Creek	4.72	30%	49%	1%			20%
North Hollow Run	6.42	13%	39%	3%			45%
South Hollow Run	1.14		45%				55%
Mill Creek Basin Total	23.16	41.75%	29.01%	9.31%	0%	0%	19.93%

[1]/ Includes both left and right banks.

[2]/ Ephemeral stream; not surveyed

Large Woody Debris

Given the strong positive relationship between large woody debris and habitat for trout, it was decided to record the occurrence of large woody debris in stream channels. Trained volunteers recorded the GPS coordinates of large woody debris as they walked the streams of the study area. The results are tabulated in Table 4 on the following page.

In general, large woody debris was quite common in areas where the riparian area is forested. Conversely, streams whose riparian zones were occupied by agricultural fields or lawn had little or no large woody debris. The streams with the highest frequency of large woody debris are Wambold Hollow (9.35 occurrences per mile) and Nelson Run (7.87 occurrences/mile). Both streams flow through hemlock palustrine forest. They also have the highest percentage of forested riparian zone – 100 and 92 percent, respectively. Other streams with frequent occurrence of large woody debris include Mill Creek, Gross Hollow, and Dwight Creek.

Anecdotally, volunteers reported observing favorable trout habitat (e.g., scour pools, eddies) associated with large woody debris in many of the streams.

Benthic Macroinvertebrates

Benthic macroinvertebrates are animals without a spinal column that live on or in the stream bottom; they are comprised primarily of larval and adult insects, but also include aquatic worms, snails, mussels and other organisms. Benthic macroinvertebrate communities have been studied for many years, and aquatic biologists have found that the composition of a stream's benthic macroinvertebrate community is a good indicator of long-term water quality. Many macroinvertebrate species have annual life cycles, and some take two or even three years to progress from egg to reproducing adult. Thus they have a long-term exposure to the water and any foreign substances it may contain. Biologists have a good understanding of various species to different types and levels of pollution.

The Pennsylvania Department of Environmental Protection (PaDEP) uses benthic macroinvertebrate data to gage stream health and assess if streams are attaining their use designations under Pennsylvania's Chapter 93 Water Quality Standards regulations. In performing stream assessments, PaDEP has conducted benthic macroinvertebrate sampling at approximately 40 locations within the study area. The resulting data were obtained from PaDEP's Bureau of Point and Non-Point Source Management. This is a very large body of data, but fortunately PaDEP's biologists have processed the data and calculated an Index of Biotic Integrity (IBI) for each sample location. The IBI score is calculated using six other measures of the abundance and diversity of benthic macroinvertebrate communities. Its interpretation and use as an assessment metric are conducted within the context of stream type, time of year at which samples were obtained, and the current use designations of the stream in question.

Table4. Large Woody Debris

Stream Name	Miles Surveyed	LWD Locations	Frequency: #/Mile
Allegheny River	13.34	30	2.25
Woodcock Creek	1.35	6	4.44
Gross Hollow	2.22	15	6.76
Wambold Hollow	1.39	13	9.35
Pigeon Creek	1.08	0	0
Toombs Hollow	.53	2	3.77
Kohler Hollow	1.13	0	0
Dwight Creek	1.16	5	4.31
Peet Brook	2.84	0	0
Lent Brook	1.17	0	0
Prosser Hollow	1.93	2	1.03
Baker Creek	4.69	0	0
Steer Run	2.85	0	0
Reese Hollow	1.17	Not recorded	-
Allegheny Total	36.85	73	1.98
Mill Creek	7.82	51	6.52
Nelson Run	5.21	42	7.87
Bates Hollow	Ephemeral, Not Surveyed		
Trout Run	2.85	10	3.37
Dry Run	1.14	0	0
Lyman Creek	2.36	8	3.43
North Hollow Run	3.21	5	1.62
South Hollow Run	.57	0	0
Mill Creek Total	23.16	116	5.01

IBI scores for study area streams are shown in Table 5. Please note that there are data for multiple sites on some streams. For example, Mill Creek has been sampled numerous times over the years. Looking at these data broadly, the mean IBI score is 80.28 (maximum possible score = 100). This is quite high. For streams having a use designation of Cold Water Fishery (CWF), Pa DEP's criterion for attainment of that use designation is an IBI score equal to or greater than 43. The attainment threshold for streams also having High Quality (HQ) or Exceptional Value (EV) designations, the criterion is an IBI score equal to or greater than 63. Examination of the data in Table 5, discloses that only one of the 39 samples recorded had an IBI score less than 43. A sample taken in Dry Run in late July of 2003 resulted in an IBI score of only 14. The specific circumstances of that sampling are not known; however, given the mid-summer sampling date, the streambed may have been nearly dry. Further examination of the

Table 5. Index of Biotic Integrity (IBI) Scores for Study Area Streams.

PROJECT ID	STREAM NAME	DEP_STATION_ID	LAT	LNG	SURVEY TYPE	IBI Score
16	Allegheny River	20030821-1100-TAS	41.83089	-77.9063	Kick Screen: SSWAP	75.85364
23	Allegheny River	20040607-1730-TAS	41.82213	-77.9699	Kick Screen: SSWAP	98.92964
36	Allegheny River	20040623-1300-TAS	41.79183	-78.0156	Kick Screen: SSWAP	92.0056
18	Woodcock Creek	20030821-1430-TAS	41.83501	-77.8789	Kick Screen: SSWAP	75.98563
8	Gross Hollow	20030728-1300-TAS	41.82544	-77.877	Kick Screen: SSWAP	80.59157
17	Wambold Hollow	20030821-1200-TAS	41.82989	-77.897	Kick Screen: SSWAP	61.3378
28	Toombs Hollow	20040608-1215-TAS	41.82714	-77.9092	Kick Screen: SSWAP	43.46859
9	Dwight Creek	20030728-1405-TAS	41.83759	-77.9181	Kick Screen: SSWAP	87.21658
24	Peet Brook	20040608-0830-TAS	41.83653	-77.9423	Kick Screen: SSWAP	85.27529
26	Peet Brook	20040608-1030-TAS	41.85714	-77.942	Kick Screen: SSWAP	56.53377
25	Tributary to Peet Brook	20040608-0925-TAS	41.85063	-77.9419	Kick Screen: SSWAP	84.95473
22	Lent Brook	20040607-1640-TAS	41.82578	-77.9717	Kick Screen: SSWAP	89.68178
21	Prosser Hollow	20040607-1545-TAS	41.81238	-77.9796	Kick Screen: SSWAP	78.11794
19	Baker Creek	20040607-1330-TAS	41.81242	-77.9996	Kick Screen: SSWAP	82.17836
20	Baker Creek	20040607-1430-TAS	41.8339	-77.988	Kick Screen: SSWAP	85.82367
34	Steer Run	20040609-0830-TAS	41.81612	-78.0087	Kick Screen: SSWAP	89.46054
35	Tributary to Steer Run	20040609-0930-TAS	41.81174	-78.0162	Kick Screen: SSWAP	77.31539
40	Reese Hollow	20040928-1545-TAS	41.79126	-78.0152	Kick Screen: SSWAP	81.4035
1	Mill Creek	19950516-1350-TES	41.77159	-78.0139	RBP	89.31464
3	Mill Creek	19950516-1420-TES	41.76107	-77.9685	RBP	90.07127
5	Mill Creek	19950516-1440-TES	41.75095	-77.9481	RBP	86.76982
6	Mill Creek	19950516-1455-TES	41.73266	-77.9367	RBP	95.51724
10	Mill Creek	20030729-1000-TAS	41.71491	-77.9323	Kick Screen: SSWAP	95.48194
12	Mill Creek	20030729-1430-TAS	41.75265	-77.949	Kick Screen: SSWAP	91.29005
30	Mill Creek	20040608-1420-TAS	41.77168	-77.9883	Kick Screen: SSWAP	87.77988
31	Mill Creek	20040608-1530-TAS	41.76099	-77.9658	Kick Screen: SSWAP	98.28912
33	Mill Creek	20040608-1710-TAS	41.77245	-78.0096	Kick Screen: SSWAP	76.00749
41	Mill Creek	19950517-0000-GRT	41.73266	-77.9367	RBP	90.06761
43	Mill Creek	19950517-0000-GRI	41.75822	-77.9595	RBP	78.46893
44	Mill Creek	19940804-0000-GRD	41.75367	-77.9501	RBP	97.53454
45	Mill Creek	19960227-0000-GRA	41.76108	-77.9686	RBP	70.23328
11	Nelson Run	20030729-1215-TAS	41.73275	-77.9336	Kick Screen: SSWAP	98.34148
7	Trout Run	19950516-1505-TES	41.75386	-77.9451	RBP	79.10428
15	Trout Run	20030730-1305-TAS	41.75353	-77.9445	Kick Screen: SSWAP	60.10424
14	Dry Run	20030730-1245-TAS	41.75795	-77.9207	Kick Screen: SSWAP	14.03721
4	Lyman Creek	19950516-1425-TES	41.75887	-77.9508	RBP	88.35249
13	Lyman Creek	20030730-1130-TAS	41.7642	-77.9442	Kick Screen: SSWAP	97.19581
2	North Hollow Run	19950516-1410-TES	41.7858	-77.9661	RBP	60.46888
42	North Hollow Run	19950516-1410-TES	41.78582	-77.9621	RBP	60.44091

data in Table 5, shows that only six of the 39 samples had an IBI score below the 63 threshold applied to HQ and EV streams, and four of those were above 60. Eleven of the samples resulted in IBI scores above 90, approaching the maximum score of 100. These occurred commonly in Mill Creek.

These benthic macroinvertebrate data reflect the excellent water quality in study area streams. Only one sample yielded an IBI score that might suggest that the stream (Dry Run) does not meet its designated use of Cold Water Fishery.

Fisheries

Most of the data and information discussed in this section were provided personnel of the Pennsylvania Fish and Boat Commission's fisheries management staff in Tionesta, Pennsylvania. In addition, trout censuses were conducted on two Allegheny River sites by Dr. Melvin Zimmerman and his students from Lycoming College to assess the potential for the Allegheny headwaters to be designated a Class A Wild Trout Water.

The fish species captured in the Allegheny River during four electrofishing sampling events – three in 2001 and one in 2003 – by Pa Fish and Boat Commission are shown in Table 6. A total of sixteen species were captured. Most are characteristic of coldwater streams, particularly the blacknose and longnose daces, and the mottled sculpin. A few warm water species were collected. The pumpkinseed sunfish likely originated from a neighboring pond. The largemouth bass may have come from the same source, or was perhaps stocked by an errant fisherman.

Fish species captured by Pa Fish and Boat Commission biologists during historical sampling by electrofishing are enumerated in Table 7. Number of species captured ranges from four (Wambold Hollow) to 12 (Dwight Creek). In general, the number of species is typically lower in first and second order, high gradient, headwaters streams, such as Wambold Hollow and Gross Hollow. Species commonly found in those streams include the brook trout, brown trout, mottled sculpin, and blacknose dace. Somewhat larger streams, such as Dwight Creek and Mill Creek contain a higher number of fish species, but still an assemblage more or less typical of coldwater streams.

Wild trout census data obtained from the Pa Fish and Boat Commission are shown in Table 8. These data were obtained at four sampling sites on the Allegheny River and at nine sampling sites on six tributary streams. The three upstream sites on the river have trout (mixed brook and brown) biomass levels that that exceed the criterion for Class B wild trout waters (greater than or equal to 17.8 pounds per acre). The fourth, downstream, site (near Reese Hollow) held a trout biomass of 12.1 pounds per acre (brown trout only), exceeding the criterion for Class C wild trout waters.

Table 6. Fish species captured in the Allegheny River during historic sampling by Pennsylvania Fish and Boat Commission.

Common Name	Scientific Name	Allegheny River at Peet Brook (RM 313.79) – July 2001	Allegheny River at Lent Hollow (RM 312.0) – July 2003	Allegheny River at Prosser Hollow (RM 311.42) – July 2001	Allegheny River at Reese Hollow (RM 308.42) – July 2001
Brown trout	*Salmo trutta*	x	x	x	x
Brook trout	*Salvelinus fontinalis*	x	x	x	
Rainbow trout (hatchery)	*Oncorhynchus mykiss*	x	x	x	x
Redside dace	*Clinostomus elongates*	x	x	x	
Tongue-tied minnow	*Exoglassum laurae*	x	x	x	x
Bluntnose minnow	*Pimephales notatus*				x
Blacknose dace	*Rhinichthys stratulus*	x	x	x	x
Longnose dace	*Rhinichthys cataractae*	x	x	x	x
Creek chub	*Semotilus atromaculatus*	x	x	x	x
White sucker	*Catostomus Cataractae*	x	x	x	x
Northern hog sucker	*Hypentelium nigricans*	x		x	x
Pumpkinseed	*Lepomis gibbosus*			x	
Largemouth bass	*Micropterus salmoides*	x			
Greenside darter	*Ethiostoma blennioides*				x
Rainbow darter	*Ethiostoma caeruleum*			x	x
Fantail darter	*Ethiostoma flabellare*	x	x	x	x
Johnny darter	*Ethiostomanigrum*				
Mottled sculpin	*Cottus bairdii*		x	x	x
Lamprey species	*Petromyzontidae*	x	x	x	
Species Total		14	12	16	14

Source: Pennsylvania Fish and Boat Commission, Area 2, Fisheries Office, Tionesta, PA.

Table 7. Fish species captured in tributaries to the Allegheny River during historic sampling by the Pennsylvania Fish and Boat Commission.

Common Name	Scientific Name	Gross Hollow June2010	Wambold Hollow June 2010	Dwight Creek August 2000	Dwight Creek August 2002	Baker Creek June 2010	Steer Run June2010	Mill Creek at Sweden Valley – July 1999	Mill Creek at Route 872 – July 1999	Mill Creek at Coudersport – July 1999
Brown trout	*Salmo trutta*	x		x	x	x	x	x	x	x
Brook trout	*Salvelinus fontinalis*	x	x	x	x	x	x	x		
Rainbow trout (hatchery)	*Oncorhynchus mykiss*					x				
Redside dace	*Clinostomus elongates*			x			x			
Tongue-tied minnow	*Exoglassum laurae*				x					
Bluntnose minnow	*Pimephales notatus*									x
Blacknose dace	*Rhinichthys stratulus*		x	x	x	x	x	x	x	x
Longnose dace	*Rhinichthys cataractae*			x	x			x	x	x
Creek chub	*Semotilus atromaculatus*	x		x	x		x			x
Pearl dace	*Margariscus margarita*			x	x					
White sucker	*Catostomus Cataractae*			x	x		x	x	x	x
Pumpkinseed	*Lepomis gibbosus*	x						x		x
Bluegill	*Lepomis microchirus*								x	
Greenside darter	*Ethiostoma blennioides*									x
Fantail darter	*Ethiostoma flabellare*			x		x		x	x	x
Johnny darter	*Ethiostoma nigrum*								x	x
Blackside darter	*Percina maculata*			x						
Mottled sculpin	*Cottus bairdii*	x	x	x	x	x	x	x	x	x
Yellow Perch	*Perca flavescens*							x		
Lamprey species	*Petromyzontidae*			x	x			x		
Species Total		5	4	12	10	6	7	10	8	11

Source: Pennsylvania Fish and Boat Commission, Area 2 Fisheries Office, Tionesta, Pa.

Table 8. Wild trout abundance and biomass estimates for streams in the study area.

Stream/Location	Abundance (number/mile)	Abundance (number/acre)	Biomass (pounds/acre)	Wild Trout Class
Allegheny River at Peet Brook (RM 313.79) – July 2001	ND	207	34.8	B
Allegheny River at Lent Hollow (RM 312.0) – July 2003	251	105	35.4	B
Allegheny River at Prosser Hollow (RM 311.42) – July 2001	170	63	21.1	B
Allegheny River at Reese Hollow (RM 308.42) – July 2001	ND	127	12.9	C
Gross Hollow – June 2010	466	514	28.2	B
Wambold Hollow – June 2010	178	149	4.2	D
Dwight Creek – August 2000	ND	1027	57.7	A
Dwight Creek – August 2002	2060	1851	106.2	A
Baker Creek – June 2010	212	205	27.4	B
Steer Brook – June 2010	656	748	37.1	A
Mill Creek at Sweden Valley – July 1999	ND	357	44.1	A
Mill Creek at Route 872 – July 1999	ND	154	40.2	A
Mill Creek at Coudersport – July 1999	ND	148	59.0	A

Source: Pennsylvania Fish and Boat Commission, Area 2 Fisheries Office, Tionesta, PA.
Note: For reader convenience, the metric units in the original reports (kilograms, kilometers, hectares) have been converted to English units (pounds, miles, acres).

With the exception of Wambold Hollow, all tributary streams contained trout biomass meeting the criteria for listing as Class A or B (Table 8 above). That is not to say that all of the streams are currently classified in accordance with those numbers. Steer Brook (or Steer Run on some maps), for instance, meets the criterion for Class A designation, but has not yet been formally designated as such. This stream was sampled again during the summer of 2014 and found to hold trout at biomass levels exceeding the Class A criterion (35.6 lbs/acre). Peet Brook and Nelson Run, a tributary to Mill Creek, also were sampled by Pa Fish and Boat Commission biologists during the summer of 2014and were found to exceed the biomass criterion for Class A designation. We are told that the Pa Fish and Boat Commission will soon take action to formalize those designations for these three streams (Al Woomer, Pa Fish and Boat Commission. 2014. personal communication).

We offer one final comment regarding the data shown in Table 8. Review of the data discloses little correlation between abundance (number /acre) and biomass (pounds per acre). The explanation lies in the size class distribution of fish in each stream. A given stream may contain many young of the year, yielding high numbers, but little biomass. Another stream may contain fewer but larger fish, resulting in lower numbers but much

higher biomass. The data provided in Table 8 for Gross Hollow and Mill Creek at Coudersport illustrate this phenomenon quite well.

In an effort to assess the potential for reclassifying the headwaters of the Allegheny River as Class A wild trout waters, an electrofishing survey was conducted by Dr. Mel Zimmerman of Lycoming College and his student assistants. Two sites on the Allegheny River were sampled, one immediately upstream of the confluence with Gross Hollow and a second approximately one-half mile downstream. In addition, Gross Hollow was sampled. The sites were 100 meters in length, and sampling was performed following the Pa Fish and Boat Commission's protocol for initial trout census survey. Results of that effort are shown in Table 9.

Table 9. Results of electrofishing survey of the Allegheny River and Gross Hollow – June 18, 2014.

		Allegheny River Site 1	Allegheny River Site 2	Gross Hollow
Brook Trout	**Size Classes**	4	6	6
	Number	22	13	23
Brown Trout	**Size Classes**	-0-	3	-0-
	Number	-0-	6	-0-
Total Trout		22	19	23

Although indicative that natural reproduction is supported, these numbers do not meet the criteria that would trigger a more detailed mark and recapture study to obtain biomass estimates in support of Class A designation.

To summarize, all of the streams in the specified study area contain benthic macroinvertebrate and fish populations indicative of cold, high quality water. All support natural reproduction of trout, and some contain sufficient trout biomass to warrant designation is Class A, meaning they can support a sport fishery unsupported by stocking of trout.

THREATS AND IMPACTS

During the project planning stage there was much discussion of the potential threats and impacts to the coldwater resources of the Allegheny River headwaters region. That discussion led to agreement to investigate the following issues.

- Bank erosion
- Obstruction to aquatic organism passage
- Inadequate riparian buffers
- Invasive plants in riparian zones
- Aquatic invasive species
- Acid precipitation
- Hemlock wooly adelgid
- Agricultural practices
- Illegal dump sites
- Unconventional oil and gas development

Each of these is discussed below.

Accelerated Bank Erosion

Accelerated bank erosion is felt to be one of the major problems in the study area. Trained volunteers who walked the study area streams recorded the coordinates of areas of accelerated bank erosion. The resulting data are shown in Table 10 on the following page. A total of 55 such areas were identified, making accelerated bank erosion one of the most frequent problems identified on study area streams. The greatest numbers of erosion sites were recorded on the Allegheny River, Mill Creek, and North Hollow Run. Notably, these streams have the greatest amount of agricultural and residential development in their riparian areas. Natural riparian vegetation in these areas is sometimes removed right to the top of bank. Both permanent and seasonal homeowners often remove streamside brush and plant grass, giving them an unobstructed view of the stream.

Most of the smaller tributary streams exhibited little or no accelerated bank erosion. Not surprisingly, most of these streams have a very high percentage of intact riparian forest, much of it hemlock palustrine forest.

Obstructions to Aquatic Organism Passage

A total of 44 structures obstructing the passage of aquatic organisms were recorded – 18 in the Allegheny basin and 26 in the Mill Creek basin (see Table 11). Most of these are culverts associated with either public or logging roads; a few are low dams and other structures. Sixteen of the 22 streams surveyed (73 percent) have one or more obstructions to movement of fish and other aquatic organisms. Given the impacts of obstructions on migration, reproductive success, and genetic diversity, we consider the presence of obstructions to be a significant problem.

Table 10. Occurrence of Accelerated Bank Erosion on Study Area Streams.

Stream Name	Miles Surveyed	Erosion Locations	Frequency: #/Mile
Allegheny River	13.34	23	1.72
Woodcock Creek	1.35	0	0
Gross Hollow	2.22	0	0
Wambold Hollow	1.39	0	0
Pigeon Creek	1.08	0	0
Toombs Hollow	.53	0	0
Kohler Hollow	1.13	0	0
Dwight Creek	1.16	1	0.86
Peet Brook	2.84	0	0
Lent Brook	1.17	1	0.85
Prosser Hollow	1.93	5	2.59
Baker Creek	4.69	1	.21
Steer Run	2.85	0	0
Reese Hollow	1.17	0	0
Allegheny Basin Total	36.85	31	.84
Mill Creek	7.82	16	2.04
Nelson Run	5.21	0	0
Bates Hollow[1]			
Trout Run	2.85	0	0
Dry Run	1.14	0	0
Lyman Creek	2.36	0	0
North Hollow Run	3.21	8	2.49
South Hollow Run	.57	0	0
Mill Creek Basin Total	23.16	24	1.04

[1]/ Ephemeral Stream; not surveyed

.

Table 11. Occurrence of Fish Passage Obstructions on Study Area Streams.

Stream Name	Miles Surveyed	Number of FPO Locations	Frequency: #/Mile
Allegheny River	13.34	1	.08
Woodcock Creek	1.35	3	2.22
Gross Hollow	2.22	0	0
Wambold Hollow	1.39	3	2.16
Pigeon Creek	1.08	1	.92
Toombs Hollow	.53	3	5.66
Kohler Hollow	1.13	1	.88
Dwight Creek	1.16	2	1.72
Peet Brook	2.84	0	0
Lent Brook	1.17	0	0
Prosser Hollow	1.93	2	1.04
Baker Creek	4.69	2	.43
Steer Run	2.85	0	0
Reese Hollow	1.17	0	0
Allegheny Basin Total	36.85	18	.49
Mill Creek	7.82	4	.51
Nelson Run	5.21	5	.94
Bates Hollow[1]	ND	ND	ND
Trout Run	2.85	8	2.69
Dry Run	1.14	0	0
Lyman Creek	2.36	2	.86
North Hollow Run	3.21	4	1.29
South Hollow Run	.57	3	5.26
Mill Creek Basin Total	23.16	26	1.12

[1]/ Ephemeral Stream; not surveyed

Riparian Buffers

The importance of native riparian vegetation (and forested riparian areas in particular) to stream health has been documented by just about every fish and wildlife agency in the United States. Truly, land and water are intimately connected, and perturbations to native riparian vegetation have direct, adverse impacts on water quality, temperatures, energy flow, and ultimately the biological communities of coldwater streams.

Riparian vegetation data gathered by trained volunteers were previously shown in Table 3. Most study area streams have adequate riparian vegetation over the vast majority of their lengths; however, there are some exceptions, particularly in the Mill Creek basin.

Table 12 shows the combined percentage of pasture and lawn along the streams of the Mill Creek basin.

Table 12. Combined percentage of pasture and lawn along streams of the Mill Creek basin.

Stream	% Pasture + Lawn
Mill Creek	36%
Nelson Run	7%
Bates Hollow[1]	ND
Trout Run	24%
Dry Run	49%
Lyman Creek	21%
North Hollow Run	45%
South Hollow Run	55%
Mill Creek Basin Total	20%

Mill Creek, Dry Run, North Hollow Run, and South Hollow Run exhibit a very high percentage of riparian zone containing non-native grasses and other plants associated with residential development and pasturage of cattle and horses. Even though Mill Creek is a Class A wild trout water, it is a brown trout fishery. It is felt that the presence of the non-native brown trout, rather than native brook trout, is attributable to the impact of riparian vegetation on water temperatures and other ecological variables.

The only other tributary to the Allegheny River having inadequate riparian vegetation is Steer Run, where the riparian vegetation consists of mowed grass along 77 percent of the stream's length. The landowner along a great deal of the upper portion of Steer Run maintains mowed grass along the stream. The lower portion of Steer Run, however, is bordered by forest and shrub/scrubland. As noted previously, it will soon be re-classified to Class A wild trout water.

Invasive Plants

Trained volunteers recorded the occurrence of invasive plant species within the riparian zones (within 50 feet of stream banks) of study area streams. Results are shown in Table 13 on the following page. These data do not tell the entire story, as volunteers simply recorded the occurrence of invasive plants as single-point coordinates. In some instances extensive stands of multiflora rose and Japanese knotweed were encountered.

In general, invasive plants were found in riparian areas that have been disturbed. In undisturbed areas, particularly hemlock palustrine forests, invasive plants were rare or nonexistent. The species most commonly encountered were multiflora rose (*Rosa multiflora*) and Japanese knotweed (*Fallopia japonica*). Garlic mustard (*Alliaria petiolata*) and Tartarian honeysuckle (*Lonicera tatarica*) were also encountered.

Happily, common reed (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*) were not.

Table 13. Frequency of Invasive Plant Species Occurrence in Riparian Zones.

Stream Name	Miles Surveyed	Invasive plant Incidents	Frequency (#/Mile)
Allegheny River	13.34	38	2.84
Woodcock Creek	1.35	0	0
Gross Hollow	2.22	1	0.45
Wambold Hollow	1.39	0	0
Pigeon Creek	1.08	0	0
Toombs Hollow	.53	4	7.54
Kohler Hollow	1.13	1	0.89
Dwight Creek	1.16	0	0
Peet Brook	2.84	2	0.70
Lent Brook	1.17	4	3.41
Prosser Hollow	1.93	4	2.07
Baker Creek	4.69	4	0.85
Steer Run	2.85	2	0.70
Reese Hollow	1.17	0	0
Allegheny Total	36.85	60	1.62
Mill Creek	7.82	108	13.81
Nelson Run	5.21	0	0
Bates Hollow[1]	ND	ND	ND
Trout Run	2.85	17	5.96
Dry Run	1.14	1	0.88
Lyman Creek	2.36	4	1.69
North Hollow Run	3.21	3	0.93
South Hollow Run	.57	0	0
Mill Creek Total	23.16	133	5.74

1/Not surveyed; ephemeral stream

Invasive plants are more common along the streams of the Mill Creek basin than along the Allegheny River mainstem and tributaries (see Table 13). The highest frequencies of occurrence were recorded along Mill Creek and its tributary Trout Run. The riparian zone along Mill Creek in particular is blighted by invasive plants, mainly Japanese knotweed and multiflora rose. Japanese knotweed occurs in sometimes large stands along the middle and lower portions of Mill Creek. These are thought to have originated from a single stand located on a residential property on Mill Creek above the golf course.

Aquatic Invasive Species

Study area streams were not surveyed for the presence of aquatic invasive species, and to our knowledge none are known to exist there. Nonetheless, due to their presence elsewhere in Pennsylvania and their ease of transport by fishermen and other recreational users, aquatic invasive species are felt to be a threat to the coldwater streams of the Allegheny River headwaters region. In addition to the two plant species noted above – common reed and purple loosestrife – we are wary of several other species, including the New Zealand mud snail (*Potamopyrgus antipodarum*), golden alga (*Prymnesium parvum*), and the diatomaceous alga Didymo (*Didymosphenia germinate*). These species can completely disrupt native biological communities.

Didymo has been found in the West Branch of Pine Creek, which is the drainage basin immediately south of the Mill Creek basin. We are aware that the latest research suggests that Didymo is not a non-native species, but rather is indigenous to many watersheds and blooms when a unique set of nutrient levels and other conditions occur. However, we will continue to treat Didymo as an invasive species until the preponderance of scientific evidence clearly indicates otherwise.

The golden alga is currently confined to southwestern Pennsylvania. However, inadvertent transport in water trucks associated with oil and gas drilling provide a potential means of spread. The New Zealand mud snail has been found in Erie County to the west and in Spring Creek to the south. Given the popularity of trout fishing in those locations and in the study area, it is feared that it could be introduced to study area streams via the boots of anglers and by other means.

Hemlock Woolly Adelgid

Adelges tsugae, the hemlock woolly adelgid, is a serious pest of Eastern hemlock in the northeastern states. This insect was first reported in southeastern Pennsylvania in the late 1960s and has spread to both ornamental and forest hemlocks. Adelgids are small, soft-bodied insects that are closely related to aphids. The hemlock woolly adelgid sucks sap from the young branches which results in premature needle drop and branch dieback (Pa Department of Conservation and Natural Resources. 2014). Ultimately the tree dies. No effective means of killing or controlling the insect has yet been developed.

This insect pest has already killed tracts of Hemlocks in counties south of Potter and is moving north. According to DCNR foresters at the Susquehannock State Forest, the hemlock woolly adelgid has been positively identified near Cherry Springs State Park, just six miles south east of the Mill Creek basin.

Fortunately, the hemlock woolly adelgid has not been identified in the headwaters region of the Allegheny River. However, should it eventually reach this area, its impact would be devastating. Death of riparian hemlock trees would mean loss of their shade-providing canopy cover. An increase in water temperatures would surely follow. In the worst-case scenario, eastern brook trout would be extirpated in some streams.

Acid Precipitation

Acid precipitation is broad term that refers to deposition of materials from the atmosphere containing sulfuric and nitric acids. These acids result from the combination of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) with water in the atmosphere. According to the USEPA, roughly two-thirds of the sulfur dioxide and one quarter of all nitrogen oxides result from electric power generation that relies on burning fossil fuels, like cola (http://www.epa.gov/acidrain/index.html). These acids are deposited on the earth's surface via both wet deposition (i.e., acidic rain, fog and snow) and dry deposition on the surface of dust and smoke particles that settle to the ground.

The acidity of rain and other liquids is measured via pH. Liquids with a pH greater than 7.0 are considered basic, or alkaline, while liquids with a pH less than 7.0 are acidic. Pure water has a pH of 7.0, termed neutral; however, rain is slightly acidic because carbon dioxide (CO_2) dissolves into it, forming weak carbonic acid. Normal rainwater has a pH of 5.6 at typical atmospheric concentrations of CO2. As of the year 2000, the most acidic acid rain falling in the United States had a pH of about 4.3 (USEPA, http://www.epa.gov/acidrain/index.html).

According to the USEPA, acid rain causes a cascade of effects that harm or kill individual fish, reduce fish population numbers, completely eliminate fish species from a water body, and decrease biodiversity. As acid rain flows through soils in a watershed, aluminum is released from soils into the lakes and streams located in that watershed. So, as pH in a lake or stream decreases, aluminum levels increase. Both low pH and increased aluminum levels can be directly toxic to fish. In addition, low pH and increased aluminum levels cause chronic stress that may not kill individual fish, but leads to lower body weight and smaller size and makes fish less able to compete for food and habitat. Low pH also affects the reproductive fecundity of many fish species. Brook trout can tolerate pH levels down to 5.0, while many mayfly species cannot tolerate pH levels below 5.5.

The Clean Air Act Amendments of 1990 brought about regulations to reduce the amount of sulfur dioxide emitted by coal-burning power plants. There has in fact been a significant reduction in SO_2 and NO_x emissions and resultant acidity of precipitation since the implementation of those regulations (National Oceanographic and Atmospheric Administration, 2005). However, in many areas the impacts of earlier deposition will take some time to dissipate, due to buildup of acids in soils.

The streams of the Allegheny headwaters region are freestone streams with low levels of alkalinity with which to buffer against acid inputs. Historically, acid precipitation has had an adverse impact on those streams. The last scientific study of acid precipitation in Potter County was conducted quite a few years ago (1970s?), and it was felt that it would be beneficial to conduct an acid precipitation study as part of this conservation

planning effort. As noted previously, four monitoring sites were established (see overview Map), and the pH levels of rain and snow gathered at these sites was measured. Monitoring began on February 14, 2014. Results are shown in the table below.

Table 14. pH Levels of Rain- and Snowfall.

Site	Mean pH	Minimum pH	Maximum pH
1 – Fishing Creek Valley	4.59	4.02	6.10
2 – Coudersport	4.98	4.49	6.19
3 – Sweden Valley	4.88	4.46	5.86
4 – North or Coudersport	4.69	4.39	5.20

During the period February 14 through the end of June 2014, the average pH of precipitation at all four sites was below 5.0. The minimum pH across the four sites ranged from 4.02 to 4.49. Although limited, these data indicate that acid precipitation remains a distinct threat to study area streams. We plan to continue the study through the spring of 2015 to ensure collection of data over at least one complete hydrologic year.

Agricultural Practices

Agricultural practices within the study area that could adversely affect streams include allowing livestock direct access to streams, and planting of row crops within the riparian zone, sometimes to top of bank. Volunteers who walked the streams recorded the occurrence of these conditions (see Threats Maps in Appendix C). Only a handful of sites where this is occurring were observed. We attribute this to the decline of dairy farming and other agriculture in Potter County, as well as greater awareness on the part of remaining farmers and the existence of programs to reduce these practices, available through the Conservation District, the Penn State Extension Service, and other agencies. Although such practices can adversely affect coldwater streams, it is our view that it is a very low level issue in the headwaters region of the Allegheny River.

Illegal Dump Sites

Keep Pennsylvania Beautiful (formerly PA CleanWays) conducted an inventory of illegal dumpsites on public property in Potter County in 2011. Seven of the 56 sites identified in the county occur in the study area for this conservation plan. Their locations are shown on the Threats Maps in Appendix C. There probably are many more on private property, as most every farm has one or more trash dumps, some of which are still active. Although it is possible for such sites to adversely impact streams via leaching of oils and other pollutants, we are not aware of any such instances. Illegal dump sites are felt to be a low-level issue within the study area.

Unconventional Oil and Gas Development

Potter County lies within the area underlain by the Marcellus, Utica, and presumably other natural gas-bearing shales. Prior to 2012, there was modest Marcellus Shale drilling activity in the county; however, since that time drilling has been curtailed dramatically, as a supply excess brought about a decline in the wellhead price of natural gas. Realistically, this is a short-term situation. Natural gas is a commodity whose pricing is cyclical, and sooner or later drilling activity will ramp back up. There currently are only eight unconventional well pads located within the study area (see Table 15 below). All have at least one active well. Most will ultimately house six or more wells.

Table 15. Marcellus Shale Well Pads within the Study Area.

Name	PaDEP ID No.	Municipality	Coordinates	Owner
Dunn A	147113	Allegany Township	N 41.838966º W 077.914436º	Penn Virginia Oil & Gas Corp.
NE Timberlands	148941	Coudersport	N 41.790281º W 078.033508º	Penn Virginia Oil & Gas Corp
Risser A	149192	Allegany Township	N 41.840103º W 077.879906º	Penn Virginia Oil & Gas Corp
Allegany 1	147712	Allegany Township	N 41.87201º W 077.916805º	Swepi LP
Arch Pot	147735	Sweden Township	N 41.765503º W 077.933225	Chesapeake Appalachia
Sweden Valley A	149394	Sweden Township	N 41.740991º W 077.906525º	Triana Energy
Sweden Valley B	149395	Summit Township	N 41.717171º W 077.899907	Triana Energy
Sweden Valley C	150142	Sweden Township	N 41.721886º W 077.91675º	Triana Energy

Source: Pennsylvania DEP

Unconventional oil and gas development is viewed as a potential threat to the health of the coldwater streams in the Allegheny River headwaters region for the primary reasons enumerated below.

1. Large volumes of water are required for drilling and hydraulic fracturing. There is no guarantee that water withdrawals will be limited to larger streams. Withdrawal of large volumes of water at certain times of the year could disrupt trout spawning and other ecological functions.

2. Land disturbances required for well pads, access roads, compressor stations, and pipelines create the potential for soil erosion and deposition in streams.

3. Spills of toxic materials used in hydraulic fracturing and recovered water from completed wells could easily reach streams, killing aquatic organisms, including

fish. Spills can occur during well drilling, operation, and during transportation of raw materials and waste byproducts.

Potter County has already experienced two incidents. The Genesee Forks of Pine Creek received a significant sediment load originating from construction of a pipeline crossing the stream. The company responsible received a Notice of Violation and a fine from Pennsylvania DEP. And a tank truck containing recovered water from Marcellus wells overturned in Allegany Township near Peet Brook. Luckily, none of the spilled material reached the stream.

Ultimately, unconventional gas wells will proliferate in Potter County and elsewhere in Pennsylvania. We view this as a long-term threat to the health of the streams of the Allegheny headwaters region. Industry, governments, and citizens will have to be diligent in their efforts to minimize the environmental impacts.

Prioritizing Issues

In order the prioritize the expenditure of resources during the subsequent implementation phase, the Upper Allegheny Watershed Association ranked the various threats identified, using the 2 x 2 matrix below. Threats with a score of 1 have the highest priority; those with a score of 3 have the lowest.

		FREQUENCY/PROBABILITY	
		LOW	**HIGH**
SEVERITY	**LOW**	3	2
	HIGH	2	1

The results of that exercise are shown in the table below. As seen in Table 16, accelerated bank erosion, obstructions to passage of fish and other aquatic organisms, and the hemlock woolly adelgid pose the greatest threat to streams in the study area.

Table 16. Ranking of threats based on severity and frequency or probability.

Threat	**Severity**	**Frequency or Probability**	**Score**
Accelerated Bank Erosion	HIGH	HIGH	1
Obstructions to Aquatic Organism Passage	HIGH	HIGH	1
Inadequate Riparian Buffers	HIGH	LOW	2
Invasive Plants	LOW	HIGH	2
Aquatic Invasive Species	HIGH	LOW	2
Hemlock Woolly Adelgid	HIGH	HIGH	1
Acid Precipitation	LOW	HIGH	2
Agricultural Practices	LOW	LOW	3
Illegal Dump Sites	LOW	LOW	3
Unconventional Oil & Gas Development	LOW	HIGH	2

Also, during a public meeting held on June 25, 2014, citizens attending were asked to rank the issues based on their perceived importance. Issues were ranked using a scale of one to 10, with one being not important at all and 10 being very, very important. The results of issues ranking by citizens are shown in Table 17. These citizen rankings will be taken into account when identifying and prioritizing implementation projects.

Table 17. Issue Ranking by Citizens.

ISSUE	AVG. SCORE
Preservation of wetlands and other biologically diverse areas	8.4
Bank erosion	7.8
Inadequate riparian buffers	7.6
Culverts blocking fish passage	7.1
Unconventional oil and gas development	6.9
Illegal dump sites	6.8
Invasive plants in riparian zones	6.4
Aquatic invasive species (AIS)	5.8
Agricultural practices	5.3
Acid precipitation	5.2
Hemlock woolly adelgid	5

Stream Priorities

To establish priorities among the streams within the study area, we rely on collective threats to each stream. Certain threats (e.g., acid precipitation, aquatic invasive species) were felt to have equal impact on all streams and were not used in this analysis. As shown in table 18, four threats were utilized to establish stream priorities for future projects. They are: 1) accelerated bank erosion; 2) obstructions to movement of aquatic organisms; 3) invasive plant occurrence in riparian zones; and 4) the percentage of riparian zone area occupied by agricultural lands (pasture, hay, and row crops) and lawn.

Based on collective threats, five streams were identified as having the highest priority for improvement projects. Of these, Mill Creek is felt to be subject to the greatest collective stress. Those five streams, highlighted in Table 18 include the following.

- Allegheny River mainstem
- Toombs Hollow
- Prosser Hollow
- Mill Creek
- North Hollow Run

Table 18. Threats summary by stream.

Stream Name	Bank Erosion Frequency (#/mile)	Fish Passage Obstruction (#/mile)	Invasive Plant Frequency (#/mile)	% Agricultural + Lawn in Riparian Zone
Allegheny River	1.72	.08	2.84	17%
Woodcock Creek	0	2.22	0	5%
Gross Hollow	0	0	0.45	!5
Wambold Hollow	0	2.16	0	-0-
Pigeon Creek	0	.92	0	1%
Toombs Hollow	0	5.66	7.54	-0-
Kohler Hollow	0	.88	0.89	-0-
Dwight Creek	0.86	1.72	0	-0-
Peet Brook	0	0	0.70	45%
Lent Brook	0.85	0	3.41	-0-
Prosser Hollow	2.59	1.04	2.07	4%
Baker Creek	.21	.43	0.85	29%
Steer Run	0	0	0.70	77%
Reese Hollow	0	0	0	-0-
Mill Creek	2.04	.51	13.81	36%
Nelson Run	0	.94	0	7%
Bates Hollow[1]		ND	ND	ND
Trout Run	0	2.69	5.96	24%
Dry Run	0	0	0.88	49%
Lyman Creek	0	.86	1.69	21%
North Hollow Run	2.49	1.29	0.93	48%
South Hollow Run	0	5.26	0	55%

[1]/ Ephemeral stream; not surveyed

ACTION PLAN

Our plan of action serves as a sort of master plan for the conservation activities of the Upper Allegheny Watershed Association. It takes into account the priorities established in the previous section of this report, as well as the resource and other constraints on the Association.

The three highest-ranking threats identified by the report authors (a ranking score of 1) were: 1) accelerated bank erosion; 2) obstructions to passage of aquatic organisms; and 3) the hemlock woolly adelgid. Bank erosion and obstructions also were ranked highly by citizens, while the hemlock woolly adelgid received the lowest ranking by citizens (perhaps because the meeting presenters failed to adequately communicate the dire consequences of that invasive pest). Conversely, citizens perceptively identified the preservation of wetlands and other biologically diverse areas as the most important single issue. The loss of these areas could be brought about by any number of threats, including the hemlock woolly adelgid, which has the potential to destroy hemlock palustrine forested areas within the study area.

Accelerated Bank Erosion

This ubiquitous problem requires a two-pronged strategy: 1) implementation of bank stabilization projects to rehabilitate existing problem areas; and 2) education of landowners to reduce the frequency of future problems. Within Potter County, the Conservation District traditionally has taken the lead in designing and implementing stream improvement projects. It makes sense then to partner with that organization in securing funding for and implementing projects. There are two major sources of funding for bank stabilization projects – Pennsylvania DEP and Pennsylvania Fish & Boat Commission – although, there are others. The Association will communicate the findings of this study to Conservation District personnel and work with them to prioritize project sites and secure funding. The Association also can provide manpower during project implementation.

The association also will develop a program of public education regarding the importance of natural riparian vegetation, particularly along the stream banks. It makes sense to partner with other organizations that have developed instructional materials on this topic, notably the County Conservation District, the USDA Natural Resource Conservation Service, and the Extension Service of Penn State University.

Obstructions to Passage of Aquatic Organisms

As with accelerated bank erosion, this issue lends itself to dual programs of education and rehabilitation projects. Culverts obstructing passage of fish and other organisms are found on public roadways, logging roads, and private lanes. Potter is a rural county, and the majority of its public roads are unpaved and owned by the townships. Thus, townships personnel form the primary audience for an educational program addressing obstructions, with logging companies and private citizens comprising a secondary

audience. The Association will work with the County Conservation District, the Center for Dirt and Gravel Road Studies at Penn State University, and the Pennsylvania Fish & Boat Commission to develop a local educational program addressing obstructive culverts.

The association also will share its data regarding obstructive culverts with the Conservation District, PennDOT, the townships, and the local Trout Unlimited chapter. We will encourage inclusion of obstructive culvert replacement as an integral part of projects implemented by townships under the statewide dirt and gravel roads environmentally sensitive maintenance program.

Invasive Plants

In most cases the removal of invasive plants is beyond the capabilities of the Upper Allegheny Watershed Association. For instance, multiflora rose and invasive honeysuckles are so ubiquitous as to require massive eradication efforts. And despite their invasive nature, those species do have a fairly high value to wildlife. Japanese knotweed, however, presents a manageable problem. It was not identified in the Allegheny basin above Mill Creek, but it is prolific along Mill Creek. The Association will develop a knotweed eradication plan and seek grant funding for its implementation. Funding may be available through the Pennsylvania Department of Conservation and Natural Resources (DCNR), or perhaps locally through the Act 13 funds or other programs. We will invite the local Trout Unlimited chapter to participate with us.

Hemlock Woolly Adelgid

There is little the Association can do regarding this invasive pest. Other than application of broad-spectrum insecticides, no effective treatment has yet been developed. Research is being conducted on the use of certain predatory beetles as a control measure. For the time being, we will keep a watchful eye on the northerly march of the Hemlock wooly adelgid and keep informed of research efforts directed at its control. We will also train members of the Association and the local Trout Unlimited chapter to identify the hemlock woolly adelgid and ask them to inspect riparian hemlocks when fishing on streams in the study area and surrounding areas. It may be possible then to treat small, initial infestations.

Acid Precipitation

Atmospheric acids originate outside of Potter County, and there is little the Association can do to reduce them. However, we will continue our acid precipitation study through the spring of 2015 and complete the assessment of its impact on local streams. That information will be shared with local and state agencies and lawmakers in an effort to increase their awareness.

Agricultural Practices

This is not a significant problem in the study area; however, the Association will take steps to communicate with the appropriate landowners in an attempt to educate them and, hopefully, convince them to take steps to reduce the impacts of their activities on streams. We will seek the cooperation and participation of the County Conservation District and the local service center of the USDA Natural Resources Conservation Service.

Unconventional Oil and Gas Development

As noted previously, unconventional natural gas development has not yet reached a high level in Potter County and is viewed as more of a long-term threat, rather than an immediate problem. The best course of action is to remain vigilant. The Association will continue its participation in the County's water quality steering committee and local stream monitoring efforts. And association members will continue to serve as "eyes and ears" during construction of access roads, well, pads, pipelines, and other infrastructure. Association members are acquainted with the problem reporting protocols of the Department of Environmental Protect (PaDEP), the Pennsylvania Fish & Boat Commission, and the County Conservation District.

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APPENDIX A

FIELD DATA SHEETS

UAWA Stream Assessment Data Sheet

Assignment:_____ Survey Team:

_____

Date Surveyed: _____ Man-Hours : _____ Mileage Driven:

_____

Start: N41°_____W77°_____ End: N41°_____ W77°_____

Water Ends: N41°_____W77°_____

Note: All coordinates for this assignment will be N41° W77°

Riparian Buffer: 25’ to 50’ each side of stream, Left or Right bank facing upstream

Start		Pasture/ Open	Old field/ scrubland	Forest	Lawn	End	
N41°	W77°					N41°	W77°
N 41°	W77°					N 41°	W77°
N 41°	W77°					N 41°	W77°
N 41	W77°					N 41	W77°
N41°	W77°					N41°	W77°
N 41°	W77°					N 41°	W77°
N 41°	W77°					N 41°	W77°
N 41	W77°					N 41	W77°
N41°	W77°					N41°	W77°
N 41°	W77°					N 41°	W77°
N 41°	W77°					N 41°	W77°
N 41	W77°					N 41	W77°
N41°	W77°					N41°	W77°
N 41°	W77°					N 41°	W77°

Assignment _____ Resources and Threats:

Category	Coordinates		Notes
	N41°	W77°	
	N 41°	W77°	
	N 41°	W77°	
	N 41	W77°	
	N41°	W77°	
	N 41°	W77°	
	N 41°	W77°	
	N 41	W77°	
	N41°	W77°	
	N 41°	W77°	
	N 41°	W77°	
	N 41	W77°	
	N41°	W77°	
	N 41°	W77°	
	N41°	W77°	
	N 41°	W77°	
	N 41°	W77°	
	N 41	W77°	
	N41°	W77°	
	N 41°	W77°	
	N 41°	W77°	

Resources and Threats

Use the following notations on the field data sheet.

AW : Abandoned Well, (oil or gas)
BE : Bank Erosion
FO : Fish passage Obstruction
ICD : Industrial/Commercial Development
IP : Invasive Plants
LWD: Large Woody Debris
LIS : Livestock in Stream
SD : Sediment Deposition
URD: Urban/Residential Development
W : Wetlands