Two Lick Creek Cold Water Heritage Conservation and Restoration Plan

White and Center Township, Indiana County
Indiana and Homer City Borough, Indiana County

Prepared by:
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For:
Cold Water Heritage Partnership of Pennsylvania

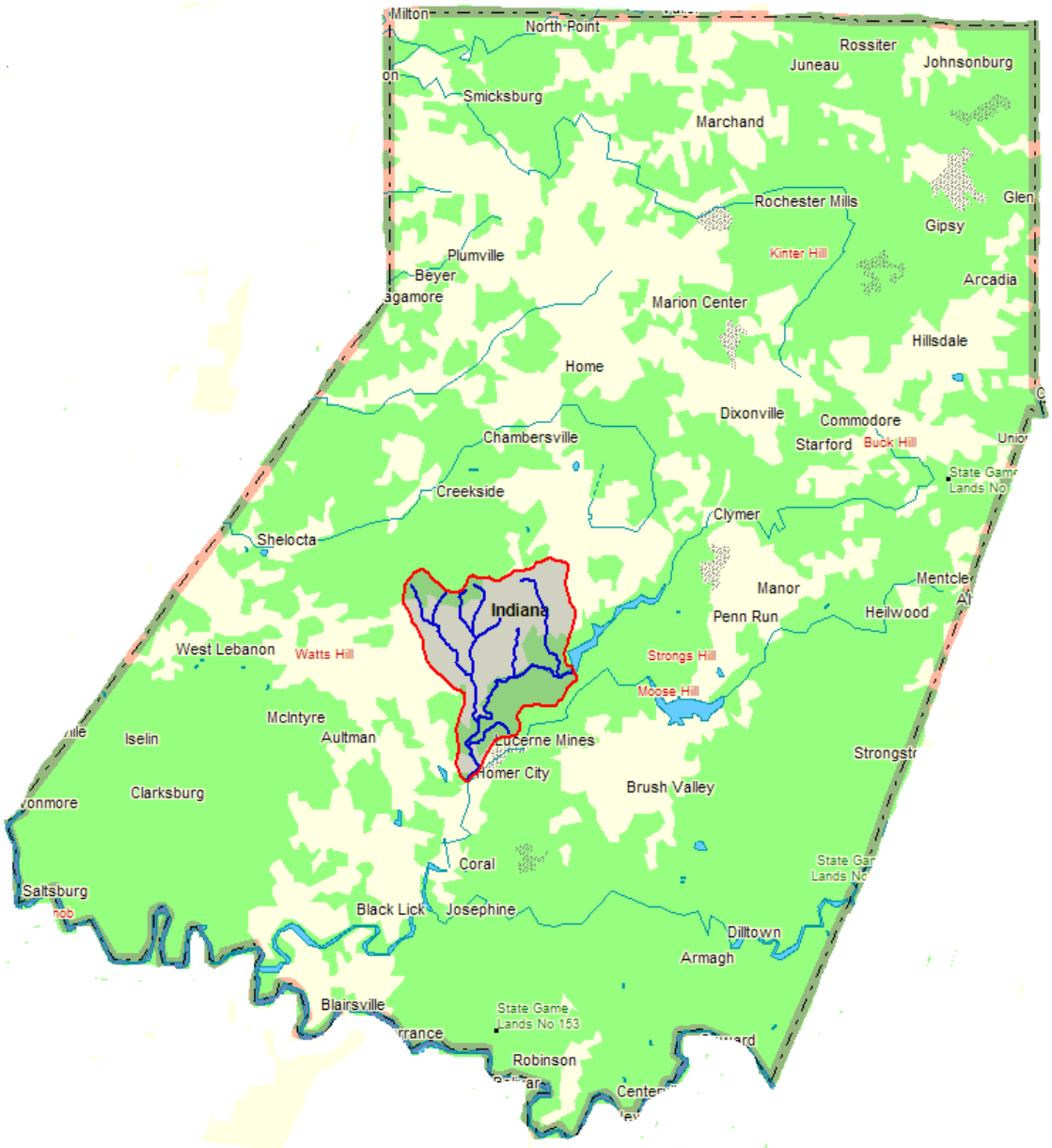

Figure 1. The section of the Two Lick Creek Watershed in Indiana County investigated for this Cold Water Heritage Conservation and Restoration Plan.

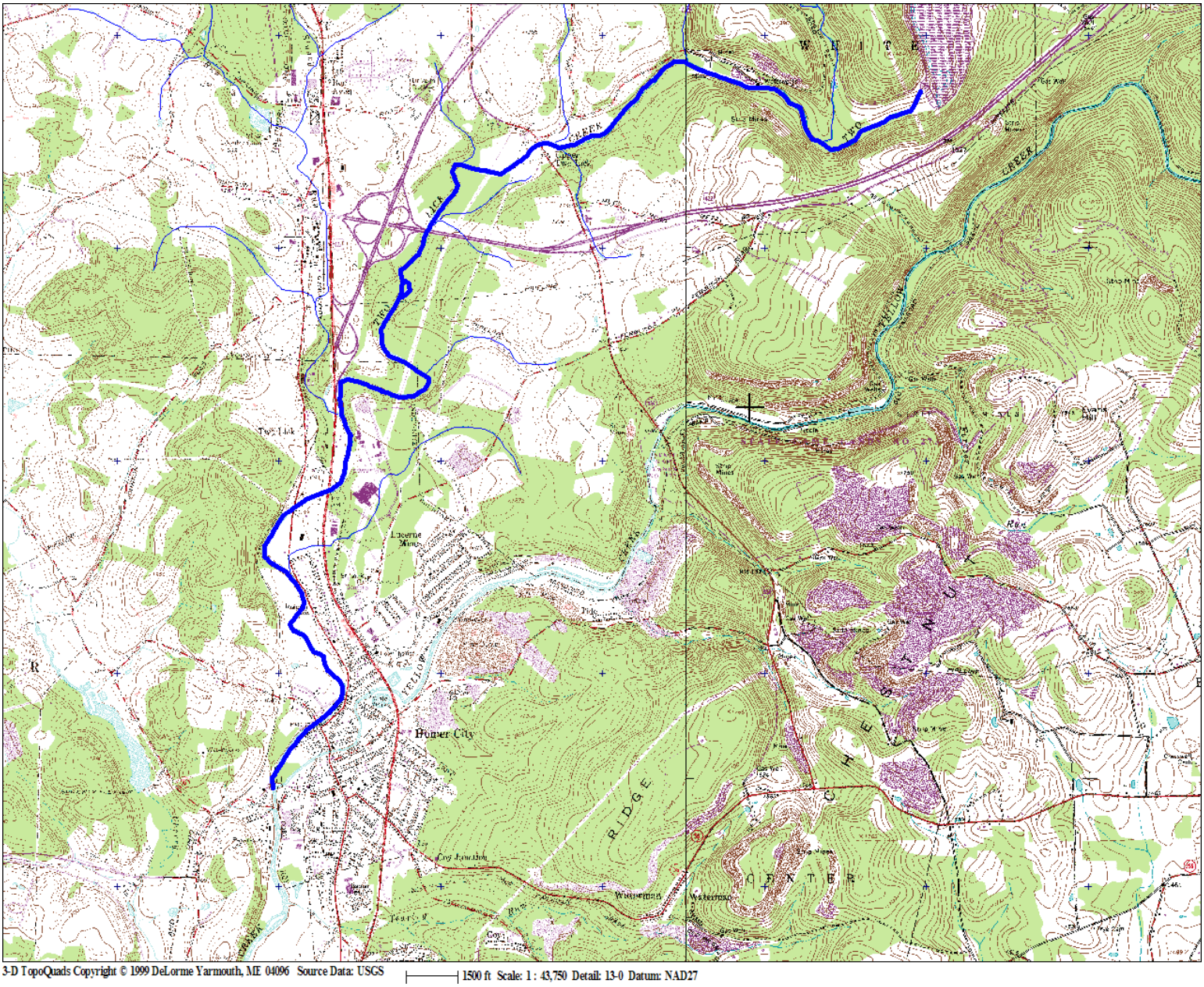

Figure 2. The 7.8 mile reproductive trout section of Two Lick Creek from Two Lick Reservoir to its confluence with Yellow Creek.

Introduction

The Two Lick Creek Watershed, located in State Water Plan (SWP) 18D, is the largest tributary, at approximately 190 square mile, of Blacklick Creek. The confluence of the South Branch and North Branch of Two Lick Creek is located in the town of Wandin Junction, Indiana County. Two Lick Creek then flows generally southwest into Two Lick Reservoir. Two Lick Creek then exits Two Lick Reservoir and travels generally south southwest until its confluence with Blacklick Creek in the town of Blacklick, Indiana County.

Two Lick Creek has been plagued with abandoned mine drainage (AMD) throughout much of its length. This pollution had rendered it virtually lifeless in places. However natural processes and AMD remediation projects completed by the Blacklick Creek Watershed Association (BCWA), the Indiana County Conservation District (ICCD) and the Pennsylvania Department of Environmental Protection (PADEP) have improved portions of Two Lick Creek to the point that fish populations, including a large population of reproductive trout, are recolonizing areas previously devoid of such communities. The largest stretch of this improved water lies between the Two Lick Reservoir and the town of Homer City, approximately 6.5 stream miles.

Two Lick Reservoir was built by the owners of the Homer City Generating Station (Pennsylvania Electric Company and New York Gas and Electric Company) and was placed into service in 1969. The original purpose of the reservoir was to provide sufficient quantities of water for production use at the Homer City Generating Station during times of significant drought thereby keeping the station online. However, even though Two Lick Creek enters Two Lick Reservoir impacted by AMD, water has improved enough that Two Lick Reservoir has become a heavily used recreational destination for sport fisherman and boating enthusiasts.

Within the last decade, Two Lick Reservoir also has been serving in another capacity as an AMD treatment system. Two Lick Creek enters Two Lick Reservoir and is retained which allows it to precipitate its high metal concentration. Water then exits Two Lick Reservoir possessing high pH (>7.0) and alkalinity concentrations and very low metal (iron and aluminum) concentrations (Table 1). This along with the underflow exit of the water creates a high quality, cold water, tailrace fishery for approximately 6.5 miles down to the very large Risinger Discharge that once again impairs Two Lick Creek with excessive amounts of AMD to its confluence with Yellow Creek, 1.3 miles downstream of the Risinger Discharge. Yellow Creek then enters and impairs Two Lick Creek with even more AMD to the point that all cold water and wild trout characteristics found upstream have vanished.

Table 1. Two Lick Creek water quality entering and exiting Two Lick Reservoir.

Location	pH	Conductivity	Alkalinity	Acidity	Fe	Al	SO_4
	Lab	ucm/s	mg/l	mg/l	mg/l	mg/l	mg/l
TLC Upstream of Reservoir	7.23	469.50	67.56	0.00	1.60	1.19	137.89
TLC Downstream of Reservoir	7.47	304.44	33.46	0.00	0.12	<0.50	66.50

Due to this improvement, several sportsmen's clubs began stocking Two Lick Creek in an effort to establish a viable trout fishery in this once heavily polluted stream. Not only did trout recolonize Two Lick Creek, but anecdotal reproduction success was expressed by many fishermen. On August 13th, 2002 several members of the Ken Sink Chapter of Trout Unlimited (KSTU) assisted Tom Clark, the Indiana County Watershed Specialist, and Dr. William Brenneman, Indiana University of Pennsylvania (IUP) Biology Professor, on a fish electro-shocking survey of Two Lick Creek to document this reproductive population. Numerous young of the year brown trout were collected, along with older age classes of wild brown trout, in a relatively short section of Two Lick Creek (Figure 3). Wild rainbow trout, a rarity for

Pennsylvania waters, have even been caught by local anglers occasionally in Two Lick Creek (Figure 4).

Figure 3. Young-of-the-year wild Two Lick Creek brown trout.

Figure 4. Young-of-the-year wild Two Lick Creek rainbow trout caught by a local angler.

Because of this, a petition was sent to and approved by PA DEP to study Two Lick Creek for an upgrade to High Quality-Cold Water Fishery (HQ-CWF) status. They are currently completing this study and we are awaiting a decision. The PA Fish and Boat Commission

(PAFBC) has already submitted comments that Two Lick Creek should at least be upgraded from its present Trout Stocked Fishery (TSF) status to a Cold Water Fishery (CWF) due to the large wild brown trout and small wild rainbow trout populations found within.

In addition, the PAFBC was notified of the incredible improvement of Two Lick Creek's wild trout population and, consequently, conducted a fish population survey of the stream in summer 2004. Data from this survey proved remarkable and surprising, even to the PAFBC. Details of this study are closely examined in the Results section of the document.

With the potential of Two Lick Creek more evident, focus is now being centered on this watershed from numerous area environmental agencies and organizations namely the ICCD, KSTU, BCWA, the Western Pennsylvania Conservancy (WPC), the Evergreen Conservancy (EC), the Indiana County Commissioners, and the Indiana County Chapter of the Pennsylvania Senior Environmental Corp (PASEC).

However, even though this nearly eight mile section of Two Lick Creek has improved to the point that a population of reproductive trout now exists, it is still not without problems. AMD, agricultural runoff, stream access, channel modifications and storm water non-point source pollution (NPS) still can be found along Two Lick Creek limiting the potential of this valuable stream.

Because of Two Lick Creek's massive reproductive trout potential and current problems mentioned above, a conservation and restoration plan for this stretch was needed and we thank the Coldwater Heritage Partnership who awarded a $4,968 grant to complete such a plan. The Two Lick Creek Cold Water Heritage Conservation and Restoration Plan should be used as a guide for all future remediation work throughout this investigated section.

Watershed Characteristics

The Two Lick Creek Watershed, located in State Water Plan (SWP) 18D, is the largest tributary, at approximately 190 square mile, of Blacklick Creek. The confluence of the South Branch (a significant wild brook and brown trout fishery in its own regard) and North Branch of Two Lick Creek is located in the town of Wandin Junction, Indiana County. Two Lick Creek then flows generally southwest into Two Lick Reservoir just downstream of the town of Clymer. Two Lick Creek then exits Two Lick Reservoir and travels generally south-southwest until its confluence with Blacklick Creek in the town of Blacklick, Indiana County.

The reproductive trout section of this stream, studied for this plan, encompasses 24.2 square miles of that drainage (12.7%) and contains approximately 7.8 stream miles of the Two Lick Creek main stem. It begins at the underflow exit of Two Lick Reservoir in White Township and ends at Two Lick Creek's confluence with Yellow Creek in Homer City Borough (Figure 2). The slope of the main stem is only 0.3%.

This reproductive trout section contains two named tributaries, Ramsey Run and Stoney Run, and seven unnamed tributaries; UNT44248, UNT44247, UNT44246, UNT44245, UNT44243, UNT44242 and UNT44227 (Table 2 and Figure 5).

Table 2. The named and unnamed tributaries entering the study stretch of Two Lick Creek

Sub Watershed	Square Miles	Stream Miles
Ramsey Run	4.6	11.9
Stoney Run	11.1	20.3
UNT44248	0.4	0.7
UNT44247	0.5	0.8
UNT44246	1.1	1.7
UNT44245	0.5	0.9
UNT44243	0.4	1.1
UNT44242	0.4	0.9
UNT44227	0.7	1.8
Two Lick Creek - Remaining	4.5	7.8
Total	**24.2**	**47.9**

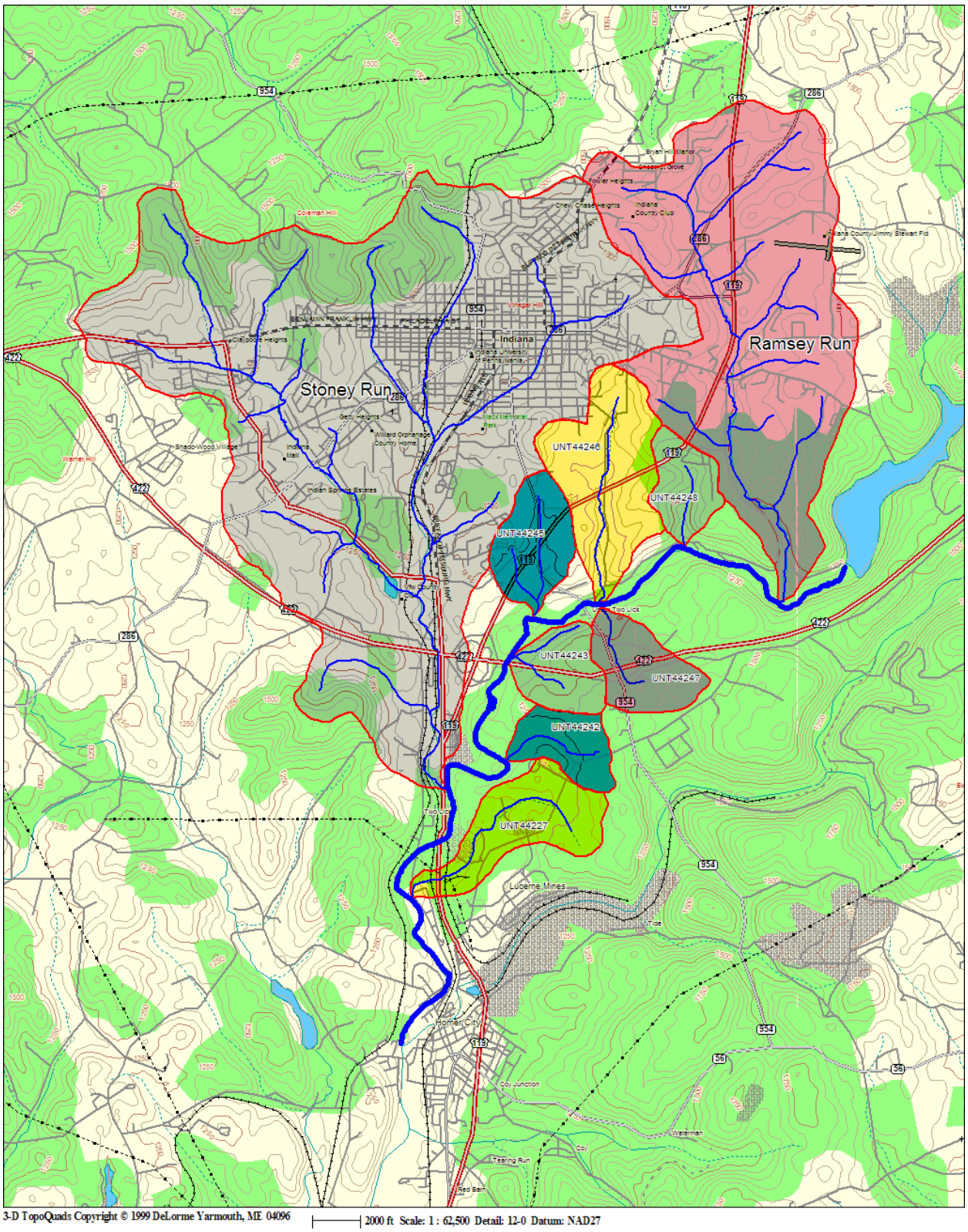

Figure 5. Location of the sub watersheds comprising the reproductive trout section of Two Lick Creek.

This section of the Two Lick Creek Watershed contains many diverse land uses including agriculture, forest, hydrology, manicured grass, non-residential development, residential development, surface mines, transportation, and wetlands.

This section of the watershed contains a significant portion of Indiana Borough (~15,000 residents and ~14,000 IUP students) and a small portion of Homer City Borough (~1,900 residents). It also contains four major roadways, Interstates 422 and 119 and State Routes 286 and 954.

As mentioned, even though this section of the Two Lick Creek Watershed has become a viable wild brown and rainbow trout fishery, a different reputation was held in the recent past. A KSTU officer, to relay how far Two Lick Creek has come from its significantly polluted past, always quotes a story that he heard as an IUP student in the 1970's. The most important line of this story is "…that during times of drought, and since Indiana Borough received their drinking water from Two Lick Creek just below Two Lick Reservoir, borough residents would call family members, friends and acquaintances that lived in the town of Clymer, upstream of Two Lick Reservoir, and told them to all flush their toilets."

Even though this section of Two Lick Creek is much restored from this polluted past, it still contains significant problems that need to be addressed for complete restoration. AMD is still an issue, especially around the Borough of Homer City, where AMD from the Risinger Discharge and Yellow Creek destroy the water quality integrity of Two Lick Creek. Since this section of Two Lick Creek drains significant portions of Indiana and Homer City Boroughs, it suffers from storm water and sewage pollution impacts, particularly in the subwatersheds of Ramsey Run and Stoney Run. Agriculture, though not intense in most of this section, is a major problem in the Ramsey Run subwatershed. And probably the most overlooked issue, thermal

pollution, needs to be addressed throughout this section of Two Lick Creek since the cold water characteristics given to Two Lick Creek by the Two Lick Reservoir underflow exit seem to be decreasing in length every year.

In addition, due to this Two Lick Creek water quality and biological revival, popularly among sportsmen has grown. Consequently, landowner issues, particularly along the main stem of Two Lick Creek, have become a magnified issue.

What follows is an analysis of these impacts, where they are located, what steps can be completed for correction, and a restoration plan that should be used for the restoration of this section of Two Lick Creek, which has become one of the most popular wild trout fisheries in southwestern Pennsylvania.

Methods

Stream and AMD Discharge Water Quality

All known historical instream and discharge water quality samples collected between the entry of Two Lick Creek into Two Lick Reservoir and downstream of its confluence with Yellow Creek were compiled. This historical water quality originated from several sources including the United State Geologic Service (USGS), PFBC, KSTU, ICCD, the Kiski-Conemaugh Stream Team (KCST), the Blacklick Creek Watershed Association (BCWA), the Indiana County Chapter of the Pennsylvania Senior Environmental Corp (PASEC), and the Pennsylvania American Water Company (PAWC). This historical water quality ranged from the years 1986 to 2006.

In addition, all sources of surface water flow entering Two Lick Reservoir were flow determined and sampled, using CWH funding, for water quality on May 10th, 2006 since an improvement in any of these surface water sources would improve the underflow exit quality of the Two Lick Reservoir.

Trout Population Surveys

The PFBC has surveyed this section of Two Lick Creek in 1985, 1993 and 2004. The data collected during these three surveys was utilized for historical trend analysis of the fish population dynamics of Two Lick Creek over those last 20 years.

In addition, using CWH funding, a fish survey was conducted on a section of Two Lick Creek between the Two Lick Reservoir exit and the PAWC Waterworks rarely studied due to property owner issues. The goals of this study included scientifically documenting a population of wild rainbow trout, since this is the area that they were found in 1993 by the PFBC, and a growth analysis of wild brown trout population. This section was selected due to the fact that it is

currently closed to fishing and was as close to a control site as you could have on a stream such as Two Lick Creek.

Identification of Pollution Impact Sites

Most pollution impact sites have already been documented in this section of Two Lick Creek through various other studies and anecdotally; however, they have never been compiled into one source. All documented pollution impact sites and anecdotal sites were investigated and compiled in this Two Lick Creek Cold Water Heritage Conservation and Restoration Plan. Pollution types include AMD, storm water, sewage, agricultural, stream bank erosion, and thermal.

Thermal Pollution Monitoring

Even though Two Lick Creek is cold water blessed by the underflow exit of the deep Two Lick Reservoir, its wide nature (50+ feet in some areas) and low gradient allow for quick temperature increases.

Eight Onset Computer Corporation Optic StowAway Temperature Loggers© were placed in each mile of the wild trout section of Two Lick Creek from July 25, 2006 to September 18, 2006 to document the stream temperatures through this very hot portion of the summer and to document which sections tend to increase in temperature more quickly. The sections that increase in temperature the most may hold potential project sites for minimizing the thermal pollution.

Main Stem Property Owner Analysis

With the improvement of Two Lick Creek into a viable reproducing trout fishery, fishing pressure on the stream has increased accordingly. Because of this increased pressure,

several landowners along he mainstem have posted their property thus eliminating access to portions of Two Lick Creek that are popular to anglers.

With the assistance of the Western Pennsylvania Conservancy, KSTU completed GIS mapping of the mainstem Two Lick Creek, overlaying various layers with digital property owner boundaries. A CD of this GIS database has been completed as well as several large presentation style maps.

Results and Discussion

Stream and AMD Discharge Water Quality

AMD Discharge Water Quality

There are five sources of AMD impacting Two Lick Creek between the effluent of Two Lick Reservoir and Yellow. These include in upstream to downstream order; the Lucerne 3A (Campbell Mine) Discharge, the North Rt. 422 Discharge, the South Rt. 422 Discharge, the Risinger Discharge and Yellow Creek itself (Figure 5). Only three of these (Lucerne 3A Discharge, Risinger Discharge, and Yellow Creek) are worth mentioning in terms of creating a significant impact.

The Lucerne 3A Discharge is the only significant discharge entering Two Lick Creek between the Two Lick Reservoir effluent and the Borough of Homer City (Figure 6). It is of moderate flow, low in pH, and highly acidic with very elevated metal concentrations (Table 3). Consequently, Lucerne 3A was of high priority for treatment for various local agencies and organizations.

Figure 6. Source of the Lucerne 3A Discharge.

Table 3. Average water quality of the three prime AMD sources to Two Lick Creek between Two Lick Reservoir and Yellow Creek.

Discharge	Flow	pH	Alk.	Acid.	Total Fe	Total Al	SO4	TSS
		Lab	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Lucerne 3A Discharge	137.32	2.65	0.00	556.20	53.11	41.54	607.89	12.14
Risinger Discharge	2228.36	3.44	0.00	336.87	105.82	22.43	799.73	61.00
Yellow Creek Mouth	39660.17	5.11	7.90	80.71	18.58	3.89	130.47	63.38
			Alk. Loading	Acid. Loading	Fe Loading	Al Loading		
			lbs/day	lbs/day	lbs/day	lbs/day		
Lucerne 3A Discharge			0.00	918.03	87.66	68.56		
Risinger Discharge			0.00	9023.13	2834.47	600.70		
Yellow Creek Mouth			3764.41	38474.67	8856.69	1854.79		

In 2007, the ICCD received two grants from the PA DEP Growing Greener Program and the PA Department of Conservation and Natural Resources (DCNR) Community Conservation Partnership Program totaling $296,000 for the treatment of the Lucerne 3A Discharge and the construction of a community recreational and environmental educational park, which will be called the Waterworks Conservation Area, surrounding the system on nearly 11 acres donated to Indiana County from the Consolidated Coal Company. A lime dosing silo and metal precipitation pond was constructed for the treatment of the discharge and the Waterworks Conservation Area is now an opened public park managed by the Indiana County Parks Department (Figure 7).

Figure 7. The Lucerne 3A Limestone Dosing Silo.

The Risinger Discharge, at the northern edge of Homer City Borough along Old Route 119, is the largest single source of AMD in the entire Two Lick Creek Watershed, and arguably in the Blacklick Creek Watershed and Indiana County as a whole (Figure 8). It is of tremendous flow, with very high acidity and metal concentrations (Table 3). Due to this high flow, horrible quality, and the fact that it blows out of the stream bank into Two Lick Creek through an old air shaft, treatment will be extremely difficult.

There has been some fleeting interest in the water from the Homer City Generating Station that would use it as cooling water and by the Central Indiana Water Authority who is looking for alternative water sources. However, as mentioned, treatment of this discharge would be very difficult and problematic. There have been discussions by KSTU obtaining funding to complete a mine pool evaluation to determine if the water could be accessed at another area that would make treatment more feasible. Due to completion of the Lucerne 3A treatment system, this mine pool investigation may be the next venture for KSTU and its partners.

Figure 7. Two Lick Creek Downstream of the Risinger Discharge.

Yellow Creek is the largest tributary to Two Lick Creek entering in the Borough of Homer City. Yellow Creek is a good quality stream for most of its length. Three sections (Yellow Creek mainstem, Little Yellow Creek, and Laurel Run) of Yellow Creek upstream of Yellow Creek State Park contain wild reproducing populations of trout and all three are also stocked by the PFBC. Upon exiting Yellow Creek Lake, Yellow Creek is once again stocked by the PFBC until the Rt. 954 Bridge and is one of the more popular cold water streams in the area.

However from the Rt. 954 Bridge to the Rt. 119 Bridge (approximately 2.5 miles), Yellow Creek is pounded by mining impacts to the point that it virtually becomes lifeless at its confluence with Two Lick Creek.

Good news is the BCWA has made this impaired section of Yellow Creek one of its primary work areas for the last decade. Consequently, through projects completed by the BCWA, Yellow Creek has slowly improved. KSTU should support the future project ventures of the BCWA in their ultimate goal of Yellow Creek being a trout stocked waterway to its confluence with Two Lick Creek.

Two Lick Reservoir Influent Water Quality

On May 10, 2006, all 11 known surface water quality influents into the Two Lick Reservoir were sampled to document where additional restoration work may be warranted since the easiest way to improve the Two Lick Reservoir effluent is to improve its influent (Table 4). In terms of acidity loading, there is approximately 83 tons/years entering Two Lick Reservoir with a majority (98.6%) originating from four sources; UNT 44272 (49.6%), Reservoir Discharge 02 (21.1%), Allen Run (15.7%), and Reservoir Discharge 01 (12.2%).

Table 4. May 10, 2006 water quality results of all surface water influents into Two Lick Reservoir.

Location	Flow	pH	Spec. Cond	Alk.	Acid.	Total Fe	Total Al	SO_4	Temp
	GPM	Lab	us/cm	mg/l	mg/l	mg/l	mg/l	mg/l	^oF
Two Lick Creek	6732	7.39	483	77.00	0.00	0.92	0.65	49.00	67.10
Penn Run	1468.29	6.21	488	0.00	0.00	1.38	0.50	143.00	60.20
Penn Hills Treatment System #1	84.15	8.54	819	90.00	0.00	0.32	0.50	43.00	72.20
Penn Hills Treatment System #2	188.50	8.59	810	82.00	0.00	0.18	0.50	69.00	71.20
Reservoir Discharge #01	100.00	3.45	437	0.00	46.00	1.28	1.76	80.00	49.90
UNT 44275	105.36	5.85	334	0.00	5.00	5.42	1.11	19.00	50.80
Allen Run	369.67	4.74	636	0.00	16.00	0.15	2.06	150.00	58.50
Reservoir Discharge 02	48.47	3.17	1715	0.00	164.00	36.78	7.88	348.00	63.10
UNT 44272	166.95	3.20	902	0.00	112.00	1.64	10.85	145.00	58.80
UNT 44270	25.00	7.14	508	129.00	0.00	1.33	0.50	80.00	53.60
UNT 44263	598.16	7.85	149	27.00	0.00	0.11	0.50	6.00	50.70
				Alk. Load	Acid. Load	Fe Load	Al Load		
				lbs/day	lb/day	lb/day	lb/day		
Two Lick Creek				6230.74	0.00	74.45	52.60		
Penn Run				0.00	0.00	24.36	8.82		
Penn Hills Treatment System #1				91.03	0.00	0.32	0.51		
Penn Hills Treatment System #2				185.79	0.00	0.41	1.13		
Reservoir Discharge #01				0.00	55.29	1.54	2.12		
UNT 44275				0.00	6.33	6.86	1.41		
Allen Run				0.00	71.09	0.67	9.15		
Reservoir Discharge 02				0.00	95.55	21.43	4.59		
UNT 44272				0.00	224.75	3.29	21.77		
UNT 44270				38.76	0.00	0.40	0.15		
UNT 44263				194.13	0.00	0.79	3.59		
			Total	6740.45	453.02	134.51	105.84		

In terms of the iron loading, there is approximately 25 tons/year entering Two Lick Reservoir with a majority (89.4%) originating from three sources; Two Lick Creek (55.3%), Penn Run (18.1%), and Reservoir Discharge 02 (15.9%).

In terms of aluminum loading, there is approximately 19 tons/year entering Two Lick Reservoir with a majority (70.3%) from two sources; Two Lick Creek (49.7%) and UNT 44272 (20.6%).

In summary, six of the eleven surface water sources merit additional investigation for possible future restoration projects to improve the water quality of Two Lick Reservoir and

ultimately the Two Lick Reservoir effluent. These include; Two Lick Creek, Penn Run, Reservoir Discharge 01, Allen Run, Reservoir Discharge 02, and UNT 44272.

Two Lick Creek Mainstem Water Quality

As mentioned, Two Lick Creek enters the Two Lick Reservoir impacted by AMD discharges entering upstream. AMD impacts upstream include various small flow discharges and seeps and coal refuse piles in the North Branch of Two Lick Creek, The Diamondville Borehole Discharge, the Richards Discharges, the Buck Run subwatershed, the Dixon Run subwatershed, and the Sample Run subwatershed. Consequently, water entering the Two Lick Reservoir has elevated concentrations of metals, particularly iron (~ 1.50 mg/l) and aluminum (~ 1.20 mg/l). Surprisingly, Two Lick Creek upstream of the Two Lick Reservoir assimilates the acidity loading entering from the various sources mentioned and enters the reservoir circumneutral (~7.2) and net alkaline (~ 68.0 mg/l). This is a very important reason as to why the reservoir acts as a large treatment system and is able to discharge high quality water through its underflow exit.

Trout Population Surveys

PFBC Section 01 – Upstream of Two Lick Reservoir

Sampling in this section of Two Lick Creek upstream of Two Lick Reservoir was completed by the PFBC in 1993 and 2004 and the differences are dramatic. In 1993, a mere 18 years ago, only one species, Largemouth Bass, was collected in this section. More than likely these fish were transients from Two Lick Reservoir. In 2004, only 11 years after the 1993 sampling, 14 fish species were collected, including pollution sensitive species such as Blackside Darter, Brown Trout, Johnny Darter, and Rainbow Darter (Table 5).

Table 5. Two Lick Creek Section 01 fish species and trout population numbers in 1993 and 2004.

Section 01 Upstream of Two Lick Reservoir			
Species Common Name	**Species Scientific Name**	**9/23/1993**	**8/26/2004**
Blacknose Dace	*Rhinichthys atratulus*		X
Blackside Darter	*Percina maculata*		X
Bluegill	*Lepomis macrochirus*		X
Bluntnose Minnow	*Pimephales notatus*		X
Brown Trout - Hatchery	*Salmo trutta*		X
Johnny Darter	*Etheostoma nigrum*		X
Largemouth Bass	*Micropterus salmoides*	X	
Northern Hog Sucker	*Hypentelium nigricans*		X
Pumpkinseed	*Lepomis gibbosus*		X
Rainbow Darter	*Etheostoma caeruleum*		X
Rock Bass	*Ambloplites rupestris*		X
Rosyface Shiner	*Notropis rubellus*		X
Smallmouth Bass	*Micropterus dolomieui*		X
Yellow Bullhead	*Ameiurus natalis*		X
Yellow Perch	*Perca flavescens*		X
	Total Species	**1**	**14**
2004 Hatchery Brown Trout Catch			
Length Group	**Total Catch**	**Estimated #/KM**	
200 mm	1	5	
225 mm	1	5	
300 mm	1	5	
Totals	**3**	**15**	

This improvement has been helped along by passive treatment systems built by BCWA and PADEP upstream of Clymer. Additional restoration work in this section should pay additional biological dividends and should be an emphasis for KSTU.

Upstream of Pennsylvania America Water Company Plant

Fishing is either prohibited or difficult to access in the ~1.0 mile section of stream between the Two Lick Reservoir Outfall and the PAWC Plant. Consequently, this was a great area to investigate a near control population and the elusive wild rainbow trout.

In 2005, sampling was completed in November with some surprises. Only four species were collected, including wild brown trout (Table 6). The population resembled more of a headwater coldwater stream. We have hypothesized that since the water exiting the Two Lick Reservoir remains cool all year through this section, that a headwater coldwater stream fish community was not as surprising.

Many age classes were collected including a nice number of young-of-the-year and much larger fish as well, six over 300mm (~12 inches), one of those around 19 inches in length.

In 2006, the same section was sampled in December. Six species were collected at this time, two more than the previous year, but trout numbers were down by more than half. This may be due to the fact that sampling was completed on a very cold and windy day, which made for many net misses.

Once again, many sizes of wild brown trout were collected, with a near 20 inches in length specimen.

No wild rainbow trout were collected during our sampling and a scientifically documented case on Two Lick Creek still alludes.

A wild trout growth analysis could not be completed as no tagged fish from the 2005 survey were captured during the 2006 survey.

Upstream of the Lucerne 3A Discharge

In 2002, Dr. William Brenneman from IUP completed a quick survey between the Lucerne 3A Discharge and the PAWC Water Plant. Eight species were collected, more resembling the population one would expect in a large stream such as Two Lick Creek

Only seven wild brown trout were collected, however, this was the first time since the PFBC 1993 study that wild trout were documented in Two Lick Creek and in larger numbers This data verified that Two Lick Creek has continued to improve in water quality the nine years between 1993 and 2002.

Table 6. 2005 and 2006 shocking study in the closed-to-fishing section of Two Lick Creek, between Two Lick Reservoir and the PAWC Water Plant.

Upstream of the PAWC Waterworks				
Species Common Name	**Species Scientific Name**	**10/23/2005**	**12/11/2006**	
Blacknose Dace	*Rhinichthys atratulus*		x	
Brown Trout - Wild	*Salmo trutta*	x	x	
Creek Chub	*Semotilus atromaculatus*	x		
Longnose Dace	*Rhinichthys cataractae*		x	
Mottled Sculpin	*Cottus bairdi*	x	x	
White Sucker	*Catostomus commersoni*	x	x	
Yellow Perch	*Perca flavescens*		x	
	Total Species	**4**	**6**	
2005/2006 Wild Brown Trout Catch				
Length Group	**10/23/2005**	**Estimated #/KM**	**12/11/2006**	**Estimated #/KM**
75 mm	18	90		
125 mm			3	15
150 mm	1	5	1	5
175 mm	1	5	1	5
200 mm			4	20
225 mm	4	20	1	5
250 mm	2	10		
300 mm	3	15	3	15
325 mm	1	5		
350 mm	1	5		
425 mm			1	5
475 mm	1	5		
500 mm			1	5
Total	**32**	**160**	**15**	**75**

Section 0201 – Upstream of State Route 954 Bridge

The section of Two Lick Creek upstream of State Route 954 has been sampled three times (1985, 1993, 2004) by PFBC. Vast improvement in the general fish and wild brown trout population has been documented over those years (Table 7 and 8).

In 1985, only four fish species were collected and no hatchery or wild trout. By 1993, the population had improved dramatically with 13 fish species collected, including pollution sensitive species. In addition two wild brown trout and three wild rainbow trout individuals were collected. In 2004, collected species remained relatively the same at 11. The difference was the amount of wild brown trout collected, 91, representing all age classes between 50 mm and 525 mm (~21 inches). Population estimates from the PFBC included 453 wild born trout per hectare and 10.41 kg per hectare. No wild rainbow trout were collected in 2004.

Table 7. Two Lick Creek Section 0201 fish species and trout population numbers in 1985, 1993 and 2004.

Section 0201 @ Route 954 Bridge						
Species Common Name	**Species Scientific Name**	**6/25/1985**	**9/22/1993**	**7/20/2004**		
Blacknose Dace	*Rhinichthys atratulus*		X	X		
Bluegill	*Lepomis macrochirus*	X		X		
Bluntnose Minnow	*Pimephales notatus*	X	X	X		
Brook Trout	*Salvelinus fontinalis*		X			
Brook Trout - Hatchery	*Salvelinus fontinalis*		X			
Brown Trout	*Salmo trutta*		X	X		
Brown Trout - Hatchery	*Salmo trutta*		X			
Central Stoneroller	*Campostoma anomalum*		X	X		
Creek Chub	*Semotilus atromaculatus*	X	X	X		
Golden Shiner	*Notemigonus crysoleucas*		X			
Johnny Darter	*Etheostoma nigrum*		X	X		
Largemouth Bass	*Micropterus salmoides*		X			
Mottled Sculpin	*Cottus bairdi*			X		
Rainbow Trout	*Oncorhynchus mykiss*		X			
Rock Bass	*Ambloplites rupestris*			X		
Smallmouth Bass	*Micropterus dolomieui*			X		
White Sucker	*Catostomus commersoni*	X	X	X		
	Total Species	**4**	**13**	**11**		
Section 0201 Wild Brown Catch	**6/25/85 Total Catch**	**6/25/85 #/KM**	**9/22/93 Total Catch**	**9/22/93 #/KM**	**7/20/04 Total Catch**	**7/20/04 #/KM**
50 mm	-	-	-	-	51	140
75 mm	-	-	-	-	16	44
150 mm	-	-	-	-	10	27
175 mm	-	-	1	3	3	8
200 mm	-	-	1	3	1	3
225 mm	-	-	-	-	1	3
250 mm	-	-	-	-	2	5
275 mm	-	-	-	-	3	8
300 mm	-	-	-	-	1	3
350 mm	-	-	-	-	1	3
375 mm	-	-	-	-	1	3
525 mm	-	-	-	-	1	3
Totals	**0**	**0**	**2**	**6**	**91**	**250**

Table 8. Two Lick Creek Section 0201 Estimated Abundance and Biomass of Brown Trout on 7/20/04.

Size Group	Population Estimate	Low 95% CI	High 95% CI	Estimated Number/Ha	Estimated Kg/Ha	Estimated Number/Km
50 mm	208	115	416	263	0.64	570
75 mm	111	45	276	140	0.88	304
125 mm	1			1	0.04	3
150 mm	14	7	31	18	0.77	38
175 mm	8			10	0.68	22
200 mm	2			3	0.24	5
225 mm	1			1	0.16	3
250 mm	3			4	0.69	8
275 mm	5	2	13	6	1.50	14
300 mm	3			4	1.15	8
350 mm	1			1	0.61	3
375 mm	1			1	0.73	3
525 mm	1			1	2.32	3
Totals	**359**			**453**	**10.41**	**984**
Estimated Abundance Over 175 mm				**31**	**8.08**	**69**
Estimated Abundance Over 225 mm				**18**	**7.16**	**42**
Estimated Abundance Over 350 mm				**3**	**3.66**	**9**

Section 0202 – Upstream of Old Route 119 Bridge

The final section of fish data in the wild trout reach of Two Lick Creek is upstream of the Old Route 119 Bridge outside of the town of Homer City. In 1985, this was the best section of Two Lick Creek with nine species of fish represented, including sport fish such as largemouth bass. By 1993, the fish species numbers stayed relatively the same (10), however, more pollution sensitive species were collected including hatchery brown trout and hatchery and wild rainbow trout. By 2004, species clicked up one to 11, but wild brown trout were found to be the dominant sport fish with 30 individuals representing multiple age classes collected, including a monster near 25 inches in length (Table 9 and 10).

Wild trout numbers were significantly less in this section as compared to Section 0201 due to two theories. First, this section of Two Lick Creek is quite large with deep holes that make collection more difficult. And second, and probably the most important, Two Lick Creek begins

losing its cold water characteristics in Section 0202. This problem will be discussed later in this plan.

Table 9. Two Lick Creek Section 0202 fish species and trout population numbers in 1985, 1993 and 2004.

Section 0202 US of Old Route 119 Bridge				
Species Common Name	**Species Scientific Name**	**6/25/1985**	**9/22/1993**	**7/20/2004**
Blacknose Dace	*Rhinichthys atratulus*	X	X	X
Bluegill	*Lepomis macrochirus*	X		
Bluntnose Minnow	*Pimephales notatus*	X	X	
Brown Bullhead	*Ameiurus nebulosis*	X		
Common Carp	*Cyprinus carpio*	X		
Brown Trout	*Salmo trutta*			X
Brown Trout - Hatchery	*Salmo trutta*		X	X
Central Stoneroller	*Campostoma anomalum*			X
Creek Chub	*Semotilus atromaculatus*	X	X	X
Johnny Darter	*Etheostoma nigrum*		X	
Largemouth Bass	*Micropterus salmoides*	X	X	X
Mottled Sculpin	*Cottus bairdi*			X
Pumpkinseed	*Lepomis gibbosus*	X	X	X
Rainbow Trout	*Oncorhynchus mykiss*		X	
Rainbow Trout - Hatchery	*Oncorhynchus mykiss*		X	
Rock Bass	*Ambloplites rupestris*			X
Smallmouth Bass	*Micropterus dolomieui*			X
White Sucker	*Catostomus commersoni*	X	X	X
	Total Species	**9**	**10**	**11**

Table 10. Two Lick Creek Section 0202 total brown catch and population estimates from 1985, 1993 and 2004.

Section 0202 Wild Brown Catch	**6/25/85 Total Catch**	**6/25/85 #/KM**	**9/23/93 Total Catch**	**9/22/93 #/KM**	**8/18/04 Total Catch**	**8/18/04 #/KM**
75 mm	-	-	-	-	3	9
100 mm	-	-	-	-	8	25
200 mm	-	-	-	-	3	9
225 mm	-	-	-	-	3	9
300 mm	-	-	-	-	2	6
325 mm	-	-	-	-	1	3
350 mm	-	-	-	-	3	9
375 mm	-	-	-	-	2	6
400 mm	-	-	-	-	2	6
525 mm	-	-	-	-	2	6
600 mm	-	-	-	-	1	3
Totals	**0**	**0**	**0**	**0**	**30**	**91**

Thermal Pollution Monitoring

Arguably, the largest impact to the cold water section of Two Lick Creek, is thermal pollution. Two Lick Creek is a large stream of low gradient that completely is cold-water fueled by the underflow exit of the Two Lick Reservoir.

Around 2008 and/or 2009, the underflow exit of Two Lick Reservoir needed repaired and was ceased for a period of time over the summer months. During that time, flow exit from Two Lick Reservoir was not from the bottom, but from the mid-level of the reservoir. Because of that, there seemed to be an anecdotal loss of at least a percentage of the trout population. Upon repair and the resumption of underflow exits, KSTU began to stock adult and fingerling trout to return the population to the seemingly prior repair period levels. However, data has never been collected to either confirm or deny the population decline and/or the population improvement through KSTU's stocking program.

As described above, the cold-water characteristics to Two Lick Creek are tenuous. Consequently and thermal pollution monitoring program was completed to document sections of the stream that warm quickly. Data from this monitoring program can then be used to pinpoint areas where thermal pollution reduction projects can be initiated.

From July 25 to Sept 18, 2006, eight temperature loggers were installed at each mile of Two Lick Creek. Water temperatures were collected every ten minutes over that time span. Figures 8-11 summarizes the data collected.

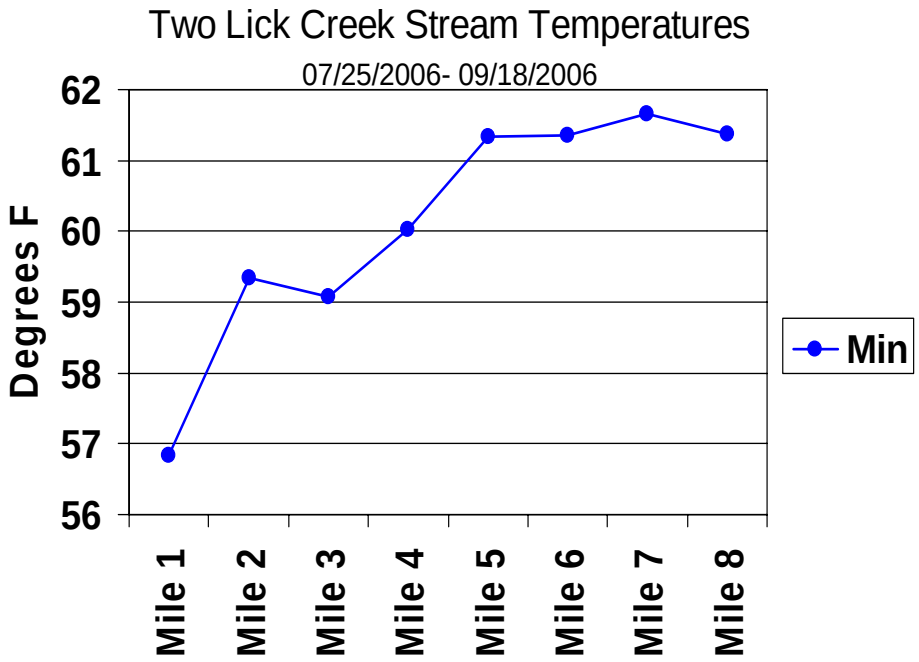

Figure 8. Average minimum Two Lick Creek temperatures during late summer, 2006.

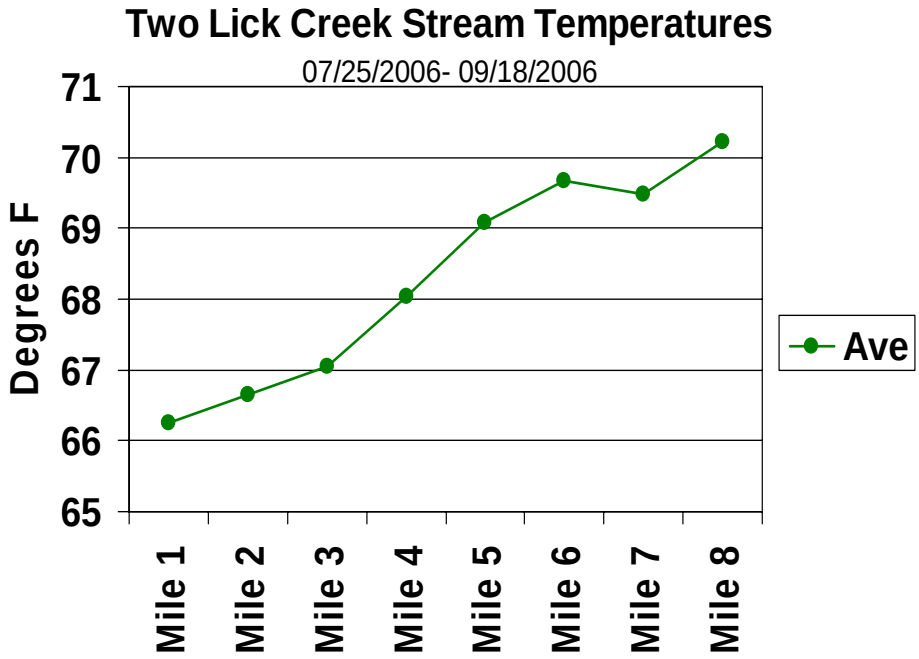

Figure 9. Average Two Lick Creek temperatures during late summer, 2006.

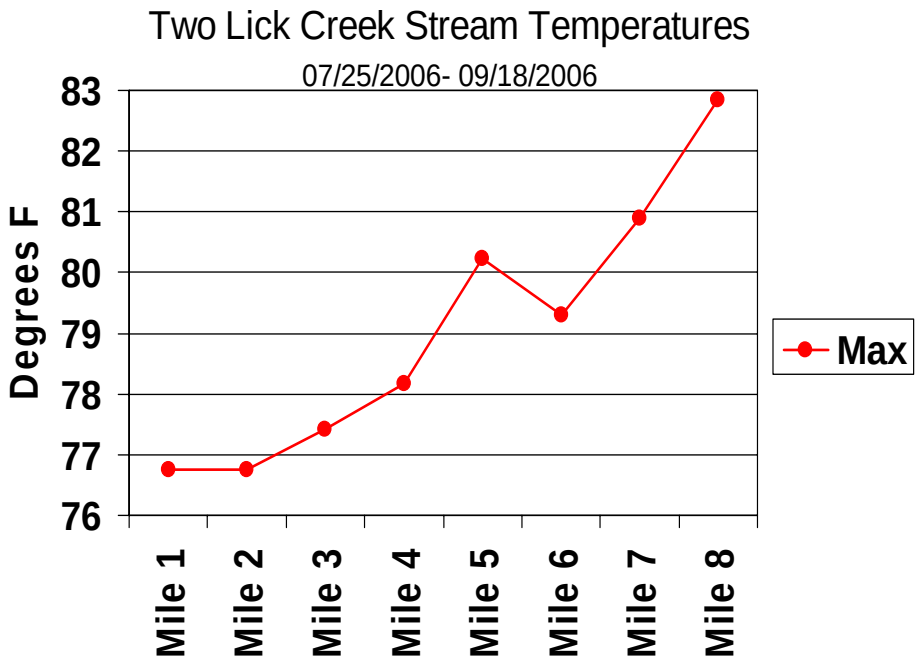

Figure 10. Average high Two Lick Creek temperatures during late summer, 2006.

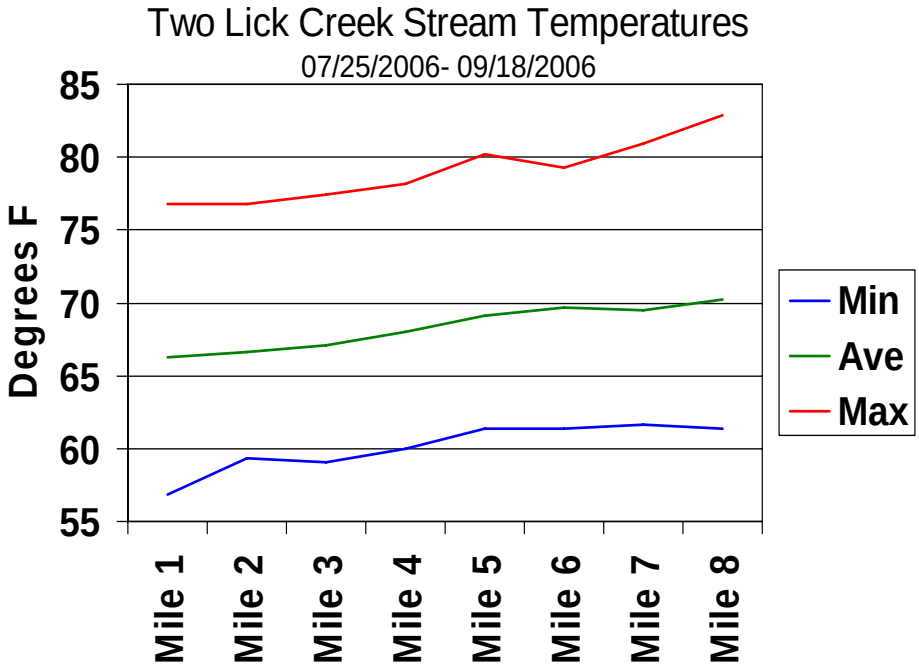

Figure 11. Average minimum, average, and average high Two Lick Creek temperatures during late summer, 2006

When analyzing Figure 8 (Average Minimum Temperature), Two Lick Creek stream temperatures increase significantly between Mile 1 and 2 and between Mile 3 and 5. When analyzing Figure 9 (Average Temperature), Two Lick Creek stream temperatures increase significantly between Mile 3 and 5. When analyzing Figure 10 (Average High Temperature), Two Lick Creek stream temperatures significantly increase between Mile 4 and 5 and between Mile 6 and 8.

In summary, the stream temperatures of Two Lick Creek quickly increase between Mile 1 and 8, however, that rate is most significant between Mile 4 and 5 and secondarily between Mile 3 and 4 and between Mile 1 and 2.

This data should document where thermal pollution reduction projects would have the most benefit.

Possible Pollution Reduction Project Sites

Two Lick Reservoir Influent AMD reduction

The easiest way to improve the water quality of Two Lick Creek's wild trout section is to improve the water exiting Two Lick Reservoir. KSTU could partner with the BCWA on AMD treatment projects that will improve the influent of Two Lick Creek into the reservoir. The main AMD impacts occur on the North Branch of Two Lick Creek, Buck Run, Dixon Run, Sample Run, and Two Lick Creek proper upstream of the town of Clymer.

KSTU could also partner with the BCWA and the Two Lick Reservoir Boating Group to improve smaller sources of impairment that impact Two Lick Reservoir. These sources include the tributaries of Penn Run, Allen Run, and UNT44272 and discharges RD01 and RD02.

Ramsey Run Storm Water and Agriculture

Ramsey Run, the first major tributary entering the cold water wild trout section of Two Lick Creek, drains the eastern side of Indiana Borough and a residential area of White Township. Consequently, Ramsey Run suffers slightly from storm water runoff and agricultural pollution to the point that it is listed as impaired on the Integrated List of Impaired waters for Agriculture/Pathogens; Urban Runoff and Storm Sewers/Pathogens.

Recently, restoration work has been completed on Ramsey Run, led by the ICCD. Stream bank fencing and feed-lot improvements have been installed in the Aultman Farm that parallels Ramsey Run. The Aultman Farm was the largest agricultural impact to Ramsey Run. Visual improvements were noticed immediately, but no known water quality samples have been taken to quantify the improvement.

In addition, stream bank restoration projects have also been completed in the Meadow Lane golf course in the headwaters of Ramsey Run. However, once again, no water quality samples have been taken to verify any improvement.

Due to being listed on the Integrated List of Impaired Waters, a Total Maximum Daily Load (TMDL) study is eventually required for Ramsey Run. Project partners could contact PA DEP to inform them of the restoration measures taken, which may quicken the TMDL process.

Lucerne 3A Discharge

As mentioned, the Lucerne 3A Discharge, the largest AMD pollution impact to the wild trout section until the entrance of the Risinger Discharge, has been treated via a Swedish Bucket Limestone Dosing Silo. The Waterworks Conservation Area, a park managed by Indiana County Parks, has been built on approximately 10 acres surrounding the Lucerne 3A Treatment System.

The Waterworks Conservation Area combines AMD treatment with, an educational mitigation wetland, a walking trail, canoe launch, stream access, and picnic pavilion.

The treatment of the Lucerne 3A Discharge has made positive visual improvements to Two Lick Creek, however, once again, no water quality samples have been taken to verify any improvement.

Thermal Pollution Reduction Site #1

About 0.25 miles upstream of the State Route 954 Bridge is a long wide and shallow section of Two Lick Creek. Because of these characteristics, this section of Two Lick Creek probably warms quickly during the summer.

Access to this section is good from the east side of the stream. Consequently, stream channel modification to lessen the width and increase the depth and velocity of the water will pay cold water benefits not only to this section, but also to the entire Two Lick Creek cold water section that is downstream.

Thermal Pollution Reduction Site #2

A similar wide/shallow/low velocity section of Two Lick Creek can be found just upstream of the Wayne Avenue Exit off of Route 119. Access is available, but more difficult that Site #1. A similar project to modify the channel by lessening the width and increasing depth and velocity of the water would pay positive cold water benefits through the section and downstream.

Wayne Avenue Stream Bank Erosion Site

Near the Wayne Avenue Exit off of Route 119, the west side of Two Lick Creek flows adjacent to the highway, causing a long erosion site on the western bank. Stream bank stabilization measures could be completed here to reduce the sediment loading into Two Lick Creek occurring primarily during precipitation events.

Stoney Run Impairment

Stoney Run drains heavily urbanized section of Indiana Borough and White Township. Consequently, all stream segments within this watershed are listed as impaired for multiple pollution sources (Table 11). A TMDL study was approved by EPA in 2004 for the Marsh Run and McCarthy Run impairments. TMDLs still need completed for the White Run impairments and Stoney Run proper impairments.

Table 11. Integrated List of Impaired Water listings for the Stoney Run Watershed.

Stream Segment	Pollution Listing	TMDL
Whites Run	Channelization - Flow Alterations	No
Marsh Run	Urban Runoff/Strom Sewers - Thermal Modifications	Yes
McCarthy Run	Urban Runoff/Storm Sewers - Thermal Modification, Suspended Solids	Yes
Stoney Run	Bank Modifications - Siltaion	No
Stoney Run	Municipal Point Source - Organic Enrichment, Low Dissolved Oxygen	No

Since TMDLs are completed for Marsh Run and McCarthy Run, funding could be obtained to reduce those pollution sources. However, with any large effort, a large partnership would have to be initiated to progress towards construction. It is recommended that KSTU begin conversations with Indiana Borough and White Township to form such a partnership. If interested on a municipal level, others could then be approached.

Since a TMDL is not completed for Whites Run or Stoney Run proper, it is recommended that KSTU approach PADEP about interest in completing such a study that could lead to restoration recommendations and funding opportunities.

Risinger Discharge

The Risinger Discharge is by far the largest impact to the wild trout section of Two Lick Creek. It is also one of the largest discharges in all of Indiana County and the Blacklick Creek watershed. The Risinger Discharge averages around 2200 GPM and contains acidity concentrations that average over 300 mg/l, iron concentrations that average over 100 mg/l, and aluminum concentrations over 20 mg/l.

Due to the adverse water quality and the fact that the discharge exits an air shaft just adjacent to the stream bank, passive treatment is absolutely not an option. The only real option is active treatment or industrial use followed by treatment.

Another problem is that the treatment of the Risinger Discharge will only restore 1.3 miles of Two Lick Creek since Yellow Creek and its AMD load enters in the town of Homer City. However, restoration of 1.3 miles of wild trout water on a stream the size of Two Lick Creek can also be looked on as significant.

For the extension of the Two Lick Creek wild trout water and the overall restoration of the entire Two Lick Creek, the Risinger Discharge must be dealt with and a success will not be realized without a large partnership between non-profit, local, state, and federal agencies. Consequently, it is recommended that a Risinger Discharge Treatment Committee be formed. Suggested committee members include the Ken Sink Chapter of Trout Unlimited, Evergreen Conservancy, Indiana County Chapter of the Senior Environmental Corp, Blacklick Creek

Watershed Association, Western Pennsylvania Coalition of Abandoned Mine Reclamation, Western Pennsylvania Conservancy, Homer City Borough, Center Township, Central Indiana Water Authority, Indiana County Conservation District, Indiana County Planning and Development, Indiana County Commissioners, Pennsylvania Department of Environmental Protection, and the Office of Surface Mining.

Two Lick Creek Cold Water Heritage Plan Recommendations

- Lead an effort to form a Risinger Discharge Interest Group to move forward a treatment plan.

- Contact PADEP about TMDL study completion for Ramsey Run and segments of Stony Run.

- Partner with the Blacklick Creek Watershed Association on Two Lick Creek mine drainage treatment system projects upstream of the Two Lick Reservoir; particularly on the North Branch, Diamondville Discharge, Buck Run, Dixon Run, and Sample Run.

- Partner with the Blacklick Creek Watershed Association and the Two Lick Creek Boaters Group on mine drainage treatment system projects on sources that enter Two Lick Reservoir, particularly Penn Run, Allen Run, UNT44272, Reservoir Discharge 01, and Reservoir Discharge 02.

- Complete stream channel modification projects on Thermal Pollution Reduction Sites #1 and #2 identified in the restoration plan.

- Approach Indiana Borough and White Township concerning a partnership that will be needed to improve the storm-water plagued Stoney Run Watershed.

- Partner and support the Blacklick Creek Watershed Association in their continuing efforts to restore the Yellow Creek Watershed.

- Continue and expand the adult and fingerling trout stocking program. Monitor success of stocking program every few years through electroshocking studies.

- Utilize the Western Pennsylvania Conservancy produced mapping to assist creating more access points throughout the cold water section of Two Lick Creek.

- Complete a stream bank stabilization project along the Wayne Avenue Exit of Route 119.