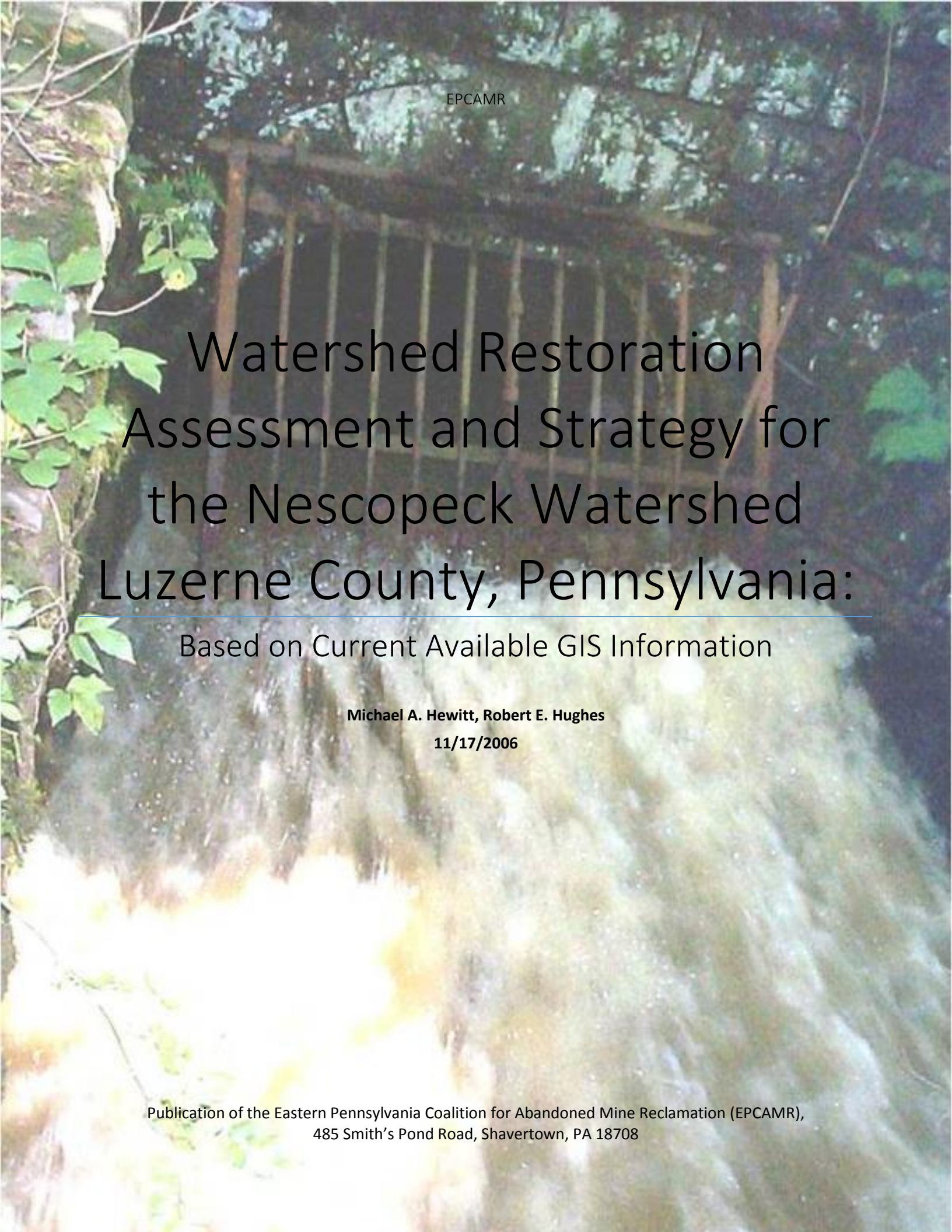

EPCAMR

Watershed Restoration Assessment and Strategy for the Nescopeck Watershed Luzerne County, Pennsylvania:

Based on Current Available GIS Information

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11/17/2006

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Glossary:

EPCAMR	Eastern Pennsylvania Coalition for Abandoned Mine Reclamation
SMCRA	Surface Mining Control and Reclamation Act of 1977
PA DEP	Pennsylvania Department of Environmental Protection
BAMR	PA DEP Bureau of Abandoned Mine Reclamation
BMR	PA DEP Bureau of Mineral Resources
OSM	U. S. Department of the Interior Office of Surface Mining
USGS	U. S. Geological Survey
MRAB	Mining and Reclamation Advisory Board
SRBC	Susquehanna River Basin Commission
AMLF	Abandoned Mine Land Feature

The mining types

S	Surface
U	Underground

Priority 1 and 2 (health & safety problems):

VO	Vertical Opening
P	Dangerous Portal or Mine Opening
SB	Surface Burning (Refuse Pile Burning)
UMF	Underground Mine Fire
GUB	Gasses: Underground Burning (Venting from Mine Fire)
GHE	Gasses: Hazardous / Explosive (Venting from Mine)
DPE	Dangerous Pile or Embankment
DI	Dangerous Impoundment (Water or Slurry)
DH	Dangerous Highwall (>40’ High)
HWB	Hazardous Water Body
S	Subsidence Area
CS	Clogged Stream
CLS	Clogged Stream Lands
HEF	Hazardous Equipment and/or Facilities
DIRW	Dangerous Industrial or Residential Waste
PWHC	Polluted Water for Human Consumption
PWAI	Polluted Water for Ag. & Industrial Use
DS	Dangerous Slide

Priority 3 (environmental degradation problems):

SA, GO	Waste Coal (Spoil, Gob, Culm)	SL	Slurry Area
WA	Water (Discharge or Seep)	BE	Bench Area
PI	Open Pit Mine	IRW	Industrial / Residential Waste
MO	Underground Mine Opening	H	Highwall (>40’ High)
EF	Equipment / Facilities	SP	Slump Area
EP	Erosion Prone Area	HR	Haul Road

Introduction by Author:

"Flying over the Nescopeck Watershed, one would think that the watershed was ground zero in an apocalyptic war. The landscape is lacerated with open stripping pits which are skirted with scabs of culm and bleeding mine drainage. This is the legacy of unregulated coal mining, an environmental disaster area. Although I have never physically flown over the watershed in a helicopter or airplane, I have virtually seen the devastation from above with a state-of-the-art technology known as GIS, a geographic information system. Many people live in this geographic area, but few understand the problems that plague the land and water both above and below the surface. Many blame the coal companies, but since the late 1970's with the advent of the Surface Mining Control and Reclamation Act (SMCRA) the active coal mining industry has cleaned up its act and is actually repaying for past devastation in an economically viable way.

With every disaster there is an opportunity to heal and many new technologies have been developed to do so. Much of this region has been studied and reclaimed since the era when coal was king. It is not a goal of this report to dwell on the very interesting history of mining in the watershed, but to take that historical information, blend it with current technology, and make an environmental impact for generations to come. It is my hope that this collection of data will be used as a tool to continue the reclamation of the land and remediation of water in the Nescopeck Watershed, within the Eastern Middle Coal Fields of Pennsylvania's Anthracite Region." - Michael Hewitt

Sources of Data:

Abandoned Mine Lands and Reclamation

Perhaps the largest source of abandoned mine land data is for Pennsylvania is the Abandoned Mine Land Inventory System (AMLIS). The database was created by the Pennsylvania Department of Environmental Protection's (PA DEP) Bureau of Abandoned Mine Reclamation (BAMR) to show abandoned mine lands throughout both the anthracite and bituminous coal fields of Pennsylvania. The AMLIS Database represents data that was collected by mine inspectors during their investigations of these lands and has been maintained since the early 1980's. In some cases the information on these sites can be 20 or more years old and has not been updates since then. Site information in the AMLIS database is updated on an "as needed" basis. This is satisfactory since most of the blighted land really hasn't changed since the land was abandoned. In Appendix A of this document you will find reports on each of the 33 problem areas in the Nescopeck Watershed including aerial and topographic maps.

AMLIS Database consists of 3 separate types of data; AML Feature Points, AML Feature Polygons (aka Surface Disturbances) and AML Problem Areas. An AML Feature Points consist of features that can be identified by a point such as an open mine tunnel, a deep mine discharge or a abandoned buildings. An AML Feature Polygons consist of features that cover an area such as mine spoil, strip mining pits, or hazardous water bodies. The AML Problem Area is basically a circle drawn around a group of feature points and polygons and usually represents a permit area or mining area boundary.

Feature points and polygons were ranked by a priority system defined by the Office of Surface Mining (OSM). Priority 1 & 2 features are considered human health and safety hazards and are eligible for reclamation through the Surface Mining and Reclamation Control Act (SMCRA) of 1977. For this fact, the database also contains monetary calculations showing the cost to reclaim high priority problems within a problem area. The mine inspector's cost to reclaim estimates are included in the narrative section of each problem area report and are relative to the date when the estimates were done. Several measurements were used and recorded in the database to facilitate the the estimation rocess

such the length, height (or depth), and acreage. Volume was measured in the case of flow of mine drainage, and calculated in the case of volume of fill for a pit or volume of culm in a pile. The problem area narrative also includes an update history section which shows update frequencies and links to who was responsible for the data estimates. Again, some of these cost estimates can be severely outdated, but the DEP BAMR produces a yearly update of unit costs associated with reclamation referred to as the Bond Rate Guidelines. These tables adjust the unit cost for the current year and have been included as Appendix C. Other helpful information comes in the form of comments from the mine inspectors such as relevant mine drainage permit records, deaths or incidents on the site and other information they felt was important to include.

Another part of the database represents the status of reclamation on the site. The information within the AMLIS database represents reclamation work done by the PA DEP BAMR including SMCRA Title 4 and other State or Federal Reclamation Programs. EPCAMR is fortunate to be part of the Mining Resources Advisory Board (MRAB) and receives quarterly updates on BAMR's reclamation projects. This information was added back to the AMLIS Database which is used as reporting mechanism to the United States Department of the Interior Office of Surface Mining (OSM) for SMCRA Title 4 grants which are received. It is important to point out that this does not represent reclamation done by landowner, community or other entities; however, mine inspectors have recorded reclaimed problems within a problem area and made mention of the responsible party when they knew.

Current Active Mining data layers and information are from the PA DEP Bureau of Mineral Resource Management. The data begins in the mid to late 1990's and takes the place of the Mine Drainage Permit records which were kept before the mid 1990's. The data was verified between July and October 2006 using the PA DEPs e-Facts website for the most current status of each mine site. Using this information in conjunction with 2004 USDA Color Infrared Aerial Photos, EPCAMR has been able to draw further conclusions as to the status of reclamation of each problem area. It would be prudent to mention that EPCAMR has not made changes to the actual AMLIS Database. Updates were made to a separate table of information and linked it to the database. See the Narrative Section of each Problem Area for current reclamation status based on the percentage of problems reclaimed.

As a summary of these findings, within ~167 sq. miles of the Luzerne County portion of the Nescopeck Watershed [~174 sq. miles total drainage area], there are 33 Abandoned Mine Land Problem Areas covering ~ 12.76 sq. mi [~ 8% of the watershed]. Within those problem areas are 297 problem features [Feature Points and Polygons].

An analysis of these problem features shows that:

16.6% of High Priority Features are reclaimed [all sources] (49.5)
18.5% of Lower Priority Features are reclaimed [all sources] (55)
35.2% of all features reclaimed (104.5)
19.8% of High Priority Features are unreclaimed (59)
44.9% of Lower Priority Features are unreclaimed (133.5)
64.8% of all problems are unreclaimed (192.5)

Just the Waste Coal (Culm) Piles:

838.28 acres & 31,431,800 cubic yards were reported in the AMLIS Database.
16.5 acres & 504,000 cubic yards were used in reclamation by the PA DEP BAMR
61.6 acres & 2,289,000 cubic yards of additional culm will be eliminated with the completion of the Cranberry Ridge Project by PA DEP BAMR.

21.9 acres & 976,000 cubic yards of culm has been eliminated by remining
This leaves 738.3 acres & 29,722,900 cubic yards of culm yet unreclaimed.

Abandoned Mine Drainage and Remediation

The Nescopeck Watershed has its share of scarred lands, but the most evident legacy of coal mining is the water pollution that flows into its waterways. As reported by the federal list of impaired waters (aka. 303(d) List), there are 218.75 total stream miles in the watershed, 55.38 miles are impacted by abandoned mine drainage. Streams Impacted by Abandoned Mine Drainage are as follows:

Nescopeck Creek, Little Nescopeck Creek, Cranberry Creek, Stony Creek, Black Creek and Oley Creek

These streams have been the center of many studies completed on in the Nescopeck Watershed. The Jeddo Tunnel, both an engineering marvel in its time and curse in the present day has also been the focus of many studies since its inception in 1890. There is debate that it could possibly be the largest abandoned mine discharge (based on flow) in Pennsylvania rivaling the Old Forge Borehole which flows in to the Lackawanna River near Scranton. The highest recorded discharge was read from the weir as 157,000 gpm on March 31, 1940 at 7 a.m. Hazleton had seen a rainfall total 7.77 inches that month more than double the 30 year average rainfall for that month (Ash 1950).

A common source of data for discharges in the Anthracite Region is known as the Water-Resources Investigations Report 95-4243 published by the U.S. Geological Survey (USGS). This is possibly the most complete study which compared mine drainage in Pennsylvania's Anthracite Coal Region (Wood 1996). This report was also converted into a GIS Database and serves as a baseline with respect to water quality and quantity for the over 270 discharges recorded. Not all discharges were recorded however and discharge locations can be dynamic. A few of the discharges have moved or have been moved even since the creation of the GIS database in 1996. EPCAMR has a version of this database that is updated on an "as needed" basis. Smaller discharges were often recorded in the AMLIS Database. This information has also been added to the problem area reports in Appendix A.

There are a total of 11 major abandoned mine discharges (table 1) with a total iron yield of 402,706 Kg per year (887,813 lbs per year or 443.9 tons per year) and a total acid yield of 10,757,067 Kg per year (23,715,245 lbs per year or 11,857.5 tons per year) washing into the Nescopeck Creek and Susquehanna River:

Table 1: Major mine discharges (Wood 1996 & Holowell 1999)

Source	***Discharge Name***	***Flow (cfs) USGS***	***Flow (gpm) BAMR***		
			Median	***Low***	***High***
Surface	McNair Basin Mine	0.5			
Overflows	Woodside Mine	0.1			
	Tomhicken Mine	2.7			
	Black Ridge Mine	1.2			
	Stony Creek Mine	0.3			
	West Hazleton Mine	0.1			
Underground	Jeddo Tunnel	65.0	~ 36,000	~ 24,000	~ 47,000
Tunnels	Dainty Slope	1.6			
	Stony Creek Mine	4.0			
	Gowen Tunnel	6.6	~ 2,300	~ 600	~ 4,100
	Derringer Tunnel	8.8	~ 5,500	~ 2,500	~ 12,500

The Susquehanna River Basin Commission (SRBC) has also published several water quality and quantity reports specific to the Eastern Middle Anthracite Coal Region (Hollowell 1999), the Nescopeck Watershed (Ballaron 1999) and the Jeddo Tunnel (Ballaron 1999). Cost estimates to build treatment systems on 3 discharges, the Jeddo Tunnel, the Derringer Tunnel and the Gowen Tunnel are also included in the appendix. The estimates were created using **AMD Treat©**. **AMD Treat©** was developed as a cooperative effort by the OSM, the PA DEP and the West Virginia DEP. Currently Version 4 of the program provides users a method to predict and model water treatment costs for mine drainage problems based on water quality parameters and flow data. The program provides many different treatment options both for passive and active treatment systems. The descriptions and cost estimates can be found in Appendix B. These treatment scenarios comply with the recommended TMDL reductions for the Little Nescopeck Creek, Black Creek and Unt. to the Little Nescopeck Creek produced in 2005 by the PA DEP (Pennsylvania 2005).

The parameters used to create these estimates were taken from SRBC Publication No. 207: "Surface Overflows of Abandoned Mines in the Eastern Middle Anthracite Field" (Hollowell 1999). There was a lack of high, low and median flow data for the other 8 discharges in the watershed and therefore no estimates could be drawn. Longer term monitoring of flows, through either weir construction or a mechanical flow device, is needed to assess flow characteristics on these additional sites for at least a year.

As the discharges are variable, so are the mine pools that supply their endless disgorgement. There are 10 distinct mine pools in the Nescopeck Watershed (table 3). Water levels rise and fall with changes surface precipitation, underground collapses restrict or block flows, basins intersect several different geologic layers with their own distinctive chemical qualities and many basins are stratified vertically. Four (4) of those mine pools are interconnected by a series of tunnels (table 2) to make up the Jeddo Tunnel Complex which collectively drains approximately 11 sq. mi. of subsurface mine basins but affects a total surface area of about 32 sq. mi. All of this area drains to Jeddo Tunnel Discharge. The Susquehanna River Basin Publication #204 identified and ranked the importance of 29 infiltration points where entire streams and other surface water runoff runs directly into the mine basin (Ballaron 1999). Reclaiming these sites will likely reduce flows from the Jeddo Tunnel. A detailed accounting of all of the basins, their storage capacity and location of overflow can be found in Bureau of Mines Bulletin 491 (Ash 1950).

Table 2: Mine Drainage Tunnels and Lengths (Ballaron 1999)

Mine Drainage Tunnels	***Length***
Jeddo Complex	13,368.71 ft or ~ 2.5 miles
Tunnel A	4,689.68 ft
Tunnel B	1,468.87 ft
Tunnel C	2,840.19 ft
Tunnel D	1,234.19 ft
Tunnel X	2,950.98 ft
Tunnel #93	102.88 ft
Tunnel #96	81.92 ft
Gowen (Haddock) Drainage Tunnel	498.37 ft
Derringer Drainage Tunnel	324.87 ft

Table 3: Mine Pool Basins (Ballaron 1999, Ash 1950)

Mine Pool Basin	***Drainage Area***	***Drains to***	***Stream Affected***
Big Black Creek Basin	~ 4.2 sq. miles	Jeddo Tunnels A, B & X	Little Nescopeck
Little Black Creek Basin	~ 1.1 sq. miles	Jeddo Tunnel A	Little Nescopeck
Hazleton Basin	~ 6.8 sq. miles	Tunnel X (1/2 of area), *Stockton Shaft (1/3 of area) & *Humboldt Overflow (1/6 of area)	Little Nescopeck, *Hazle Creek & *Tomhicken Creek
Cross Creek Basin	~1.9 sq. miles	Jeddo Tunnel D, Little Black Creek Basin (1/2 of area) & *Sandy Run Tunnel (1/2)	Little Nescopeck & *Sandy Run
McNair Basin	~0.2 sq. mi.	McNair Basin Strip Pool Overflow	Oley Creek
Stony Creek Basin	~0.1 sq. mi.	Stony Creek Mine Seepage & Stony Creek Mine Pool Overflow	Stony Creek
Woodside Basins	~0.2 sq. mi.	Woodside Mine Strip Pool Overflow	Intermittent Trib. to Black Creek
Tomhicken Basin	~0.6 sq. mi.	Tomhicken Strip Pool Overflow & Black Ridge Strip Pool Overflows	Black Creek
West Black Creek Basin	~1.5 sq. mi.	Derringer Tunnel	Black Creek
Roberts Run Basin	~0.5 sq. mi.	Gowen (Haddock) Tunnel	Black Creek

* A portion of or all of this water drains outside of the Nescopeck Creek Watershed and into another watershed.

Recommendations:

<u>High Priority Problems:</u>

Pennsylvania DEP Bureau of Abandoned Mine Reclamation is responsible for reclaiming Priority 1 & 2 Problems using SMCRA Title 4 Funding. In many documents from PA DEP to OSM these are referred to as the "funded" projects. PA DEP BAMR has a yearly budget and plans for the reclamation of sites a few years in advance. This report encourages reclamation through PA DEP BAMR and/or mining companies with remining interests placing an added priority on the reclamation of the 29 infiltration points mentioned in SRBC Publication No. 204. The reclamation of these points will in effect reduce surface water from recharging the mine pools and reduce the flows emanating from the Jeddo Mine Tunnel. The problem areas associated with these points are as follows.

Sub Watershed	***Problem Area***
Cranberry Creek	3725, 3213, 0263, 1372, 2112
Black Creek	0265, 2108, 2110, 1381, 2109
Little Black Creek	3218, 3212

Two projects, one in the Cranberry Creek sub watershed and one in the Little Black Creek sub watershed have been completed with this report in mind. Infiltration points for other mine pools have not been scouted, but if when found it would be prudent to record these areas and bring the water back to the surface (see Nescopeck Watershed Map for locations). Although not in the Nescopeck

Watershed, reclaiming infiltration points west of the City of Hazleton in the Hazle Creek Watershed may also reduce flows to the Jeddo Mine Tunnel Discharge.

Lower Priority Problems:

Priority 3 & N Problems, which cannot be reclaimed with SMCRA Title 4 Funding, can be reclaimed using other means. Under current regulations, up to 10 % SMCRA Title 4 Funding is set aside for reclamation of lower priority problems. This report also encourages the reclamation of the land and remediation of waterways through PA DEP BAMR with SMCRA Title 4 "10% set aside" program funding and/or mining companies with remining interests. As mentioned above, many of the infiltration points mentioned in SRBC Publication No. 204 are lower priority features. Placing a higher priority on these points will have the added effect of flow reductions to mine discharges.

Other sources of reclamation involve community groups, such as the Friends of the Nescopeck Watershed Association, non-profit organizations such as EPCAMR or CanDo, local & county government, such as the Luzerne Conservation District or municipalities who can seek grants or philanthropic foundation money to fix features in an environmentally and economically sound way. It is in the landowner advantage to also reclaim land especially in the Greater Hazleton Area, which has recently experienced an upswing of development.

As for treatment of the water, there are several suggested water treatment scenarios in the Appendix B. Discharges which have a mean, high and low flow data associated with them (Jeddo, the Gowen and the Derringer tunnels) have better design and cost estimates calculated. Other discharges should be sampled to characterize their chemistry and flow for at least 1 year before a treatment system can be suggested. To obtain flow measurements a weir could be constructed at the outflow. An added benefit to constructing a weir is that it will often add oxygen to a discharge and may facilitate precipitation of iron. Some maintenance is required to be sure that the flow through the weir is not altered especially in high flow events.

On a larger scale the SMCRA is in jeopardy of sun-setting. If this is allowed to vanish it could mean a halt on the PA DEP BAMR program. This program needs to be reauthorized and possibly strengthened if Pennsylvania is to finish reclamation in a reasonable time period.

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EPCAMR Infiltration Points developed from SRBC Publication 207
Pennsylvania DEP 305(b) Unassessed Waters and 303(d) Impaired Waters Lists Snapshot – 10/2005
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U. S. Department of Agriculture Color Infrared Aerial Photos – 2004

Acknowledgments:

Thank you to reviewers of this report especially representatives from the Friends of the Nescopeck, Luzerne Conservation District, Eastern Middle Anthracite Region Recovery Inc., and the Eastern Pennsylvania Coalition for Abandoned Mine Reclamation. Also thank you to the PA DEP 319 Program, the Western Pennsylvania Watershed Program and the EPCAMR Board of Trustees for their financial support of the EPCAMR program at the Luzerne Conservation District. The views expressed herein are those of the authors and do not necessarily reflect the views of EPA, DEP, or any of their sub agencies.