

## **Chapter 1**

### **Objectives of the Study:**

EPCAMR's focus will be on Capacity Building and Planning to restore water quality and habitats of the Chesapeake Bay and its tributary rivers and streams in the Sugar Notch Run, Solomon Creek, Warrior Creek, Nanticoke Creek, Newport Creek, areas of the Wyoming Valley and Southern Wyoming Valley, along the Susquehanna River. They are all historically mining-impacted priority watersheds. The watersheds have overlapping priorities for Eastern brook trout habitat patches and American black duck habitats that need assessment to protect, restore, or improve aquatic organism passage throughout the Wyoming Valley. Neither of the patch areas and waterfowl habitat areas and populations has been previously surveyed in a substantial portion of the watersheds identified.

EPCAMR will assess these watersheds with our Staff and volunteers with the necessary field equipment and conduct assessments and monitoring of various streamside and habitat conditions, identify sediment-laden areas, structural impediments to aquatic organism passage at culverts and bridges. Our outreach will motivate community members to support and adopt behaviors that benefit water quality, species, and habitat improvements based on our recommendations for future improvement projects. These recommendations will have a significant opportunity to reduce sediment loadings, and stormwater to local streams in our communities, cities, and towns along the Susquehanna River. EPCAMR will develop or improve existing watershed and management plans that will be recommended to municipal governments, private landowners, and non-profit organizations on how to manage properties and public spaces for improved conservation outcomes. We want to look at additional priority watersheds in future grant rounds.

### **Priority and Overall Context:**

The priority watersheds have been passed over for decades due to the anticipated reclamation and stream restoration project costs needed to restore the watersheds. Most municipalities targeted are involved as Municipal Separate Storm Sewer System (MS4) partners with the [Wyoming Valley Sanitary Authority](#) (WVSA). They need to produce holistic approaches to the impacts impervious areas and stormwater are having locally on wildlife habitat. The WVSA

stormwater fee can be a great financial resource to leverage funding. EPCAMR would suggest going towards stormwater management, flooding reduction, sediment load reduction, cleanups, and riparian projects.

All priority watersheds are impacted by past mining and are experiencing sedimentation problems, habitat fragmentation, and failing infrastructure deficiencies that have not been replaced or retrofitted following extensive land reclamation of mined and developed lands. WVSA is working to implement its regional [MS4 Program](#) in these watersheds (WVSA, 2024). There is a strong need for a sound regional watershed approach and strategic planning that is absent in this area of the Wyoming Valley.

The project area includes EPCAMR's [Solomon Creek Coldwater Conservation Plan](#) (Hughes, et al., 2012). [Newport Creek](#) and [Nanticoke Creek](#) have previous historical water quality studies completed by [USGS and Wilkes University](#) (Chaplin, Cravotta III, Weitzel, & Klemow, 2007), an additional Total Maximum Daily Load (TMDL) Report for [Newport Creek](#) (PA DEP, 2009), and historic Scarlift reports for [Newport](#) (Skelly and Loy, 1974), [Nanticoke, Warrior and Solomon Creeks](#) (Geo-technical Services, 1975). These plans establish the existing condition and many recommendations which were and were not completed.

EPCAMR had been a part of the Earth Conservancy's initial [Land Use Plan](#) that was developed by [EDAW, Inc.](#) in 1996 when the Executive Director had participated on a Land Use Planning Advisory Committee to provide input on the master planning layout and future uses, reclamation, development, recreational opportunities, industrial development, housing development, AMD treatment, and watershed restoration (EDAW, 1996). EDAW, Inc. also completed a [Lower Wyoming Valley Open Space Master Plan](#) (EDAW, 1999) for the Earth Conservancy and a [Open Space, Greenways and Outdoor Recreation Master Plan](#) and [Poster](#) (EDAW 2004) for Lackawanna and Luzerne Counties. Many recommendations in these plans show how wildlife habitat can be conserved.

There is a [Newport Township Master Plan: Earth Conservancy Lands](#) (Borton Lawson, 2019) that provides great details on existing land use conditions, proposed development, and local and regional context of the Newport Creek watershed and its tributaries.

In 2020, Earth Conservancy was awarded a grant from the Pennsylvania Department of Conservation and Natural Resources (PA DCNR) to formally assess around 10,000 acres in Newport Township, which is a part of the project area. The study picked up where Earth Conservancy's [ATV Feasibility Study in the Lower Wyoming Valley](#) (Pennoni, 2005) left off, reevaluating partners and demand, conceptualizing a park layout, and, more importantly, ascertaining management options and financial viability. A [Newport Township OHV Recreational Park Feasibility Study](#) (LIARDS, LA, 2022) was completed, in consultation with The Institute and WAR Landscape Architecture for the Earth Conservancy.

A [South Valley Corridor Land-Reuse Analysis and Sustainable Redevelopment Framework](#) (SRA 2008) by SRA International & Vita Nuova, [Hanover Crossings Phase 3 & 4 and Hanover 9 Land Use Plan](#) (McCormick Taylor, 2012), [Master Plan for Bliss, Truesdale, Warrior Run, and Sugar Notch Lands](#) (Borton Lawson, 2018) were completed for the Earth Conservancy. Most recently the [Hanover 7A Recreation Area Master Site Development Plan](#) (K&W Engineers, 2023) and a [Solar Feasibility Study for Abandoned Mines](#) (La Bella Assoc., 2023) were completed on Earth Conservancy's properties that all lie within our project study area.

EPCAMR's effort will focus on identifying sediment removal areas, aquatic passage impediments, wildlife waterfowl habitat, and stream restoration potential. No plans have been completed on the Eastern brook trout and American black duck in the Warrior, Nanticoke, or Newport Creek watersheds to date.

**Summary Statistics for Geographic Area  
Targeted Stream Assessments to Support Sediment Reduction, Habitat Recovery &  
Watershed Improvement in the Wyoming & Southern Wyoming Valley**

The data below was provided by the National Fish & Wildlife Foundation for the Study Area.

Sub-watersheds (HUC 12)

AREAACRES	8951.39	AREAACRES	5901.23
AREASQKM	36.23	AREASQKM	23.88
NAME	Newport Creek	NAME	Warrior Creek-Susquehanna River
HUTYPE	S	HUTYPE	S
HUMOD	NM	HUMOD	NM
HUC12	020501070207	HUC12	020501070208
TOHUC	020501070208	TOHUC	020501070307
AREAACRES	4851.32	AREAACRES	11652.58
AREASQKM	19.63	AREASQKM	47.16
NAME	Nanticoke Creek	NAME	Sugar Notch Run-Solomon Creek
HUTYPE	S	HUTYPE	S
HUMOD	NM	HUMOD	NM
HUC12	020501070206	HUC12	020501070204
TOHUC	020501070208	TOHUC	020501070205

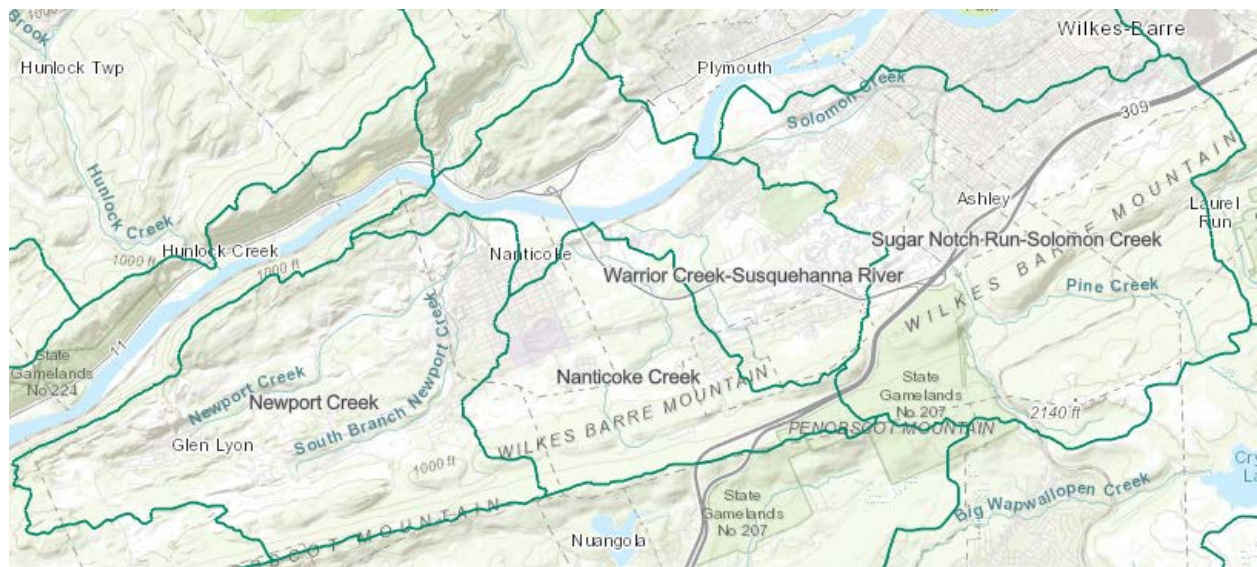


Figure 1: Sub-watersheds in the study area.

Eastern Brook Trout Patches\*

TUID	3006	TUID	3005
Acres	948	acres	791
Focal	Susquehanna	focal	Susquehanna
Name	Sugar Notch Run	Name	Coal Creek
ConStrat	Restore other pops. (low priority)	ConStrat	Restore other pops. (low priority)
NFWFHUC	Tier III	NFWFHUC	Tier III
TUID	2382	TUID	2377
acres	3,202	acres	7,508
focal	Susquehanna	focal	Susquehanna
Name	Pine Run	Name	Solomon Creek
ConStrat	Restore other pops. (low priority)	ConStrat	Restore other pops. (low priority)
NFWFHUC	Tier III	NFWFHUC	Tier III

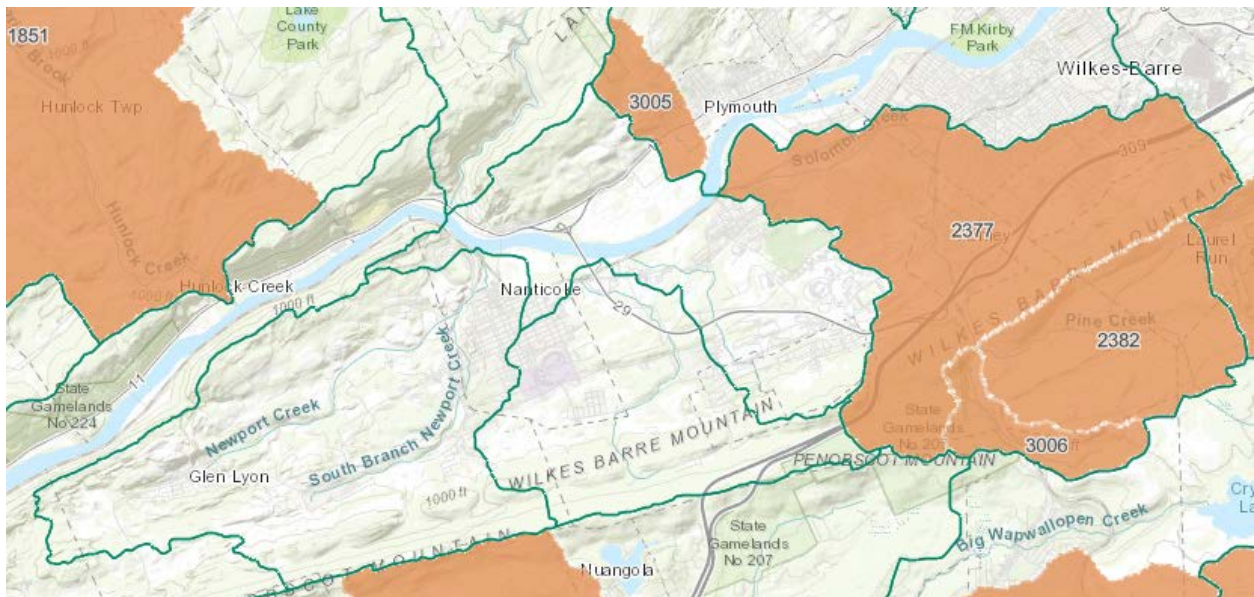


Figure 2 Eastern Brook Trout Patches in the study area

\*The Eastern Brook Trout Patches GIS layer from NFWF were updated between the beginning to the end of this project. Originally there were 8 patches now there are 4. The total area is the same.



## American Black Duck Priority Habitat

AREAACRES	8951.39
AREASQKM	36.23
NAME	Newport Creek
HUTYPE	S
HUMOD	NM
HUC12	020501070207
TOHUC	020501070208
ABDU_Tier	II

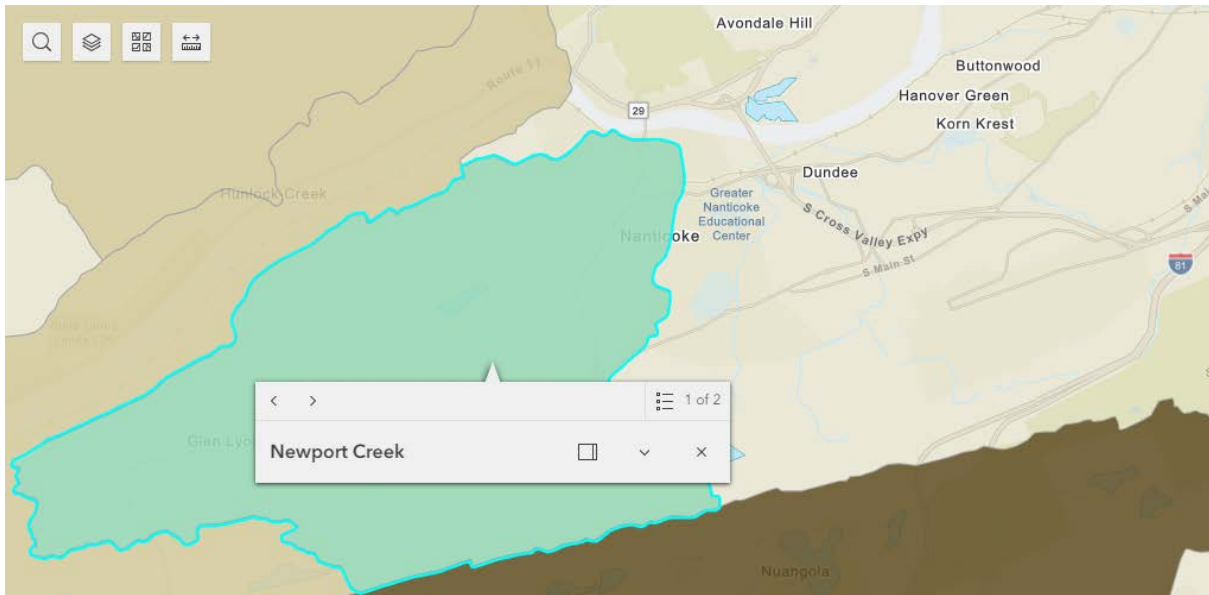


Figure 3 American Black Duck Priority Habitat in the study area.

### Statistics from within the Geographic Area of Focus

**75,347** people living within the Geographic Area of Focus (ESRI Population, 2019)

**51.18** miles of stream impaired by abandoned mine drainage (AMD)  
(Federal List of Impaired Waters List, 2018)

**1470.28** acres of wetlands (National Wetland Inventory- US FWS)

**13,647** acres [**21.32** sq. miles] of abandoned mine land (AML) problem areas  
(EPCAMR RAMLIS, 2020)

**218** AML features (EPCAMR RAMLIS, 2020)

**5** AMD discharge feature points (EPCAMR RAMLIS, 2020)

**Demonstrated Need:**

EPCAMR has been effective state-wide and nationally in raising awareness of environmental issues locally and is a member of the [Choose Clean Water Coalition](#) that has elevated the need for funding of projects within the Chesapeake Bay watershed. EPCAMR has strong, lasting relationships with local government and Congressional leaders who have offered to help promote our work. There is a lack of comprehensive watershed restoration planning within the Wyoming Valley due to the nature of the myriad of municipalities and authorities involved and a focus on watershed scale frameworks and concepts that are needed to assist with restoration efforts.

EPCAMR has completed dozens of on-the-ground projects with community partners over the years to restore, remediate, reclaim, and redevelop abandoned mine lands in the geographic area of focus for this effort. We are focusing on the Wyoming Valley's eastern flank. EPCAMR has received great support from non-profits and local governments, including the City of Nanticoke and Wilkes-Barre, which have provided support letters, and a bipartisan letter of support from Congressman Cartwright and Meuser. It is difficult for these municipalities to maintain public roads, recreation, and sewer infrastructure due to a lack of capital resources and tax base to fund and implement large, watershed-scale restoration projects and activities. EPCAMR has had to pursue much smaller funding sources over the last decade to try and develop watershed planning because it needs more attention at a County level and an inter-municipal cooperative level due to other competing interests and a lack of funding, pursuit of funds, and matching funds.

**Commitment to Implementation:**

EPCAMR will focus on providing planning recommendations and technical assistance on water quality that will provide significant opportunities to reduce sediment load reductions from urban and past mining practice sources. EPCAMR will focus on identifying areas where wildlife and stream habitat improvement projects will improve and restore populations of the Eastern brook trout and the American black duck within the priority sub-watersheds and patches identified within the project's geographic focus area.

EPCAMR's outcome is to promote the conservation objectives and planning tools tied to the [NFWF Chesapeake Bay Business Plan and Watershed Agreement](#) (NFWF 2018) directly to the local governments and project partners.

EPCAMR will commit to work and communicate with the municipalities, the [North Branch Land Trust](#) (NBLT), [Nanticoke Conservation Club](#) (NCC), [Earth Conservancy](#), [Stanley Cooper Chapter #251 Trout Unlimited](#), [Pennsylvania Environmental Council](#) (PEC), [Luzerne Conservation District](#) (LCD), and the [Wyoming Valley Sanitary Authority](#) (WVSA), to come up with prioritized recommendations for project implementation. EPCAMR will create opportunities to allow our partners to go into the field to be trained on how we assess the local watersheds.

EPCAMR will commit to enhancing local capacity to implement future on-the-ground actions more efficiently and effectively. Future projects will need volunteer participation, in-kind resources, and leverage from other funding sources that municipalities can bring forward to fund project implementation. Measurable contributions to priority outcomes will be evaluated by surveying partner interests in pursuing many of the anticipated recommendations that will come out of the planning and capacity-building technical assistance efforts by EPCAMR and any financial commitments that they might offer.

We are keenly aware of abandoned mine drainage (AMD) locations, flow, and discharges that are in these watersheds and our focus will not be on assessing those discharges. We will direct our attention to the stormwater, sedimentation, and habitat restoration potential through the field surveys and assessments that we will conduct and promote to the community partners. We have chosen these watersheds because of their sedimentation issues and stream channel restoration needs and the overlapping Eastern brook trout patches and American black duck habitats on the eastern flank of the Valley because of the severe mining, sedimentation, and stormwater issues.



**Original Work Plan Deliverables:** Anticipated to begin in April (Spring 2021) and end in Spring 2022)

- Promote award to all project partners on the technical assistance, community outreach, and communications on the intended recommendations of community-based efforts to protect and restore the diverse natural resources of the Chesapeake Bay tributaries that will be provided to them in 4/2021. EPCAMR Staff (Bobby Hughes, Mike Hewitt, Steve Cornia, Shawnese Taylor, Denise Hernandez, Laura Rinehimer, Frank Sindaco), 4/2021- Press Release, Social Media Posts, links to articles from any media outlets
- Conduct a literature search of any available projects, existing plans, assessments, fishery reports or plans, mining-related reports, and monitoring of the priority watersheds, and TMDLs, and compile the resources as references and or to establish baseline and historic conditions of the watersheds. EPCAMR Staff, 5/2021- Resources, Reports, and Plans in the References Section
- Inform project partners and invite them to come along into the field and become trained in specific assessment field work that we conduct to identify visual habitats along a stream corridor, measuring sediment loss along streambanks, aquatic and biotic conditions, streambank erosion, culvert assessments, and alignment, identification of waterfowl habitat areas for the American black duck, and aquatic passage impediments for Eastern brook trout. EPCAMR Staff (Bobby Hughes, Mike Hewitt, Steve Cornia, Shawnese Taylor, Denise Hernandez, Laura Rinehimer, Frank Sindaco), 5/2021- Database of new EPCAMR volunteers and local NGOs, Municipal Staff who become trained in field assessments.
- Work with local government officials and neighbors to identify and contact private landowners to determine if they would allow for access to streamside areas to survey conditions that might become eligible as future candidates for implementation projects with their permission and potential grant funding. EPCAMR Staff (Bobby Hughes, Mike Hewitt, Steve Cornia, Shawnese Taylor, Denise Hernandez, Laura Rinehimer, Frank Sindaco), Local Governments, April through 12/2021. ArcGIS Pro Online Integrated Story Map and Final Recommendation Report will include project area locations and landowner identification.

- Conduct field assessments of the Newport Creek (Glen Lyon and Newport Twp.) and Nanticoke Creek watersheds at the lower end of the Southern Wyoming Valley and work our way up back through the City of Nanticoke, the smaller municipalities of Warrior Run, Sugar Notch, Ashley, Hanover Township, then to the City of Wilkes-Barre. EPCAMR, Data will be provided in the Recommendation Report and Online Story Map. EPCAMR Staff, 4-9/2021 and again in 6-11/ 2021
- Research American black duck species, habitat, migratory paths, and holdover areas, and seek information from local wildlife and conservation agencies like the PA Game Commission, Luzerne Conservation District, NCC, NBLT, and DU. The target area is positioned in the Atlantic Flyway as a critical connection point for waterfowl and links species between Canadian breeding and wintering grounds, between Lake Erie, Chesapeake Bay, Delaware Bay, and the Atlantic Coast. EPCAMR Staff, Conservation Partners and PA Agencies. 4/2021-4/2022
- Create ArcGIS Pro Online Integrated Story Map and Final Recommendation Report with uploaded photos, survey results, locations of EPCAMR prioritized projects based on sediment reduction and removal, streambank stabilization, riparian restoration, culvert assessments, wildlife habitat improvement projects for the American black duck, and Eastern brook trout species. A request will be made through a TU to conduct a fishery absence/presence of Eastern brook trout in several headwater tributaries along the Wyoming Valley's eastern flank. Visual Storyboards will be placed in libraries and offered to be presented within the 3 School Districts in the targeted watersheds. EPCAMR Staff, TU. 1-4/2022

## **Quality Assurance Protection Plan**

EPCAMR completed the required [Quality Assurance Project Plan](#) (QAPP) for the project after going through several revisions with Cheryl Hennessy, MBA Senior Project Scientist/Quality Assurance Manager, and Jennifer Wallace, from Cardno Associates, a company that was acquired by [Stantec](#). EPCAMR also attended several webinar trainings for grantees that are all currently available on the NFWF [Quality Assurance](#) webpage. Carley Morton, Program Coordinator and Stephanie Heidbreder, Program Manager from NFWF forwarded the QAPP for approval to the US EPA. Joe Toolan, Manager of the Chesapeake Bay Programs for NFWF, approved the QAPP after it was approved by the US EPA on September 30, 2022. NFWF used a Project Evaluation Form to determine that our project required a QAPP in the grant agreement.

EPCAMR completed our QAPP in accordance with the US Environmental Protection Agency's requirements as detailed in [EPA Requirements for Quality Assurance Project Plans: EPA QA/5](#). Many organizations, including the [U.S. Environmental Protection Agency](#) (EPA), the primary source of funding for [Chesapeake Bay Stewardship Fund](#) (CBSF) grants, require Quality Assurance Project Plans (QAPPs) for projects that collect and use environmental data. Our QAPP documented the project planning process and served as a blueprint for how our project will collect and analyze our field data. Our QAPP aimed to ensure the credibility of the information collected or used and helped ensure that the data collected would be used for its intended purpose. Our QAPP documented our project's technical planning process to provide a clear, concise, and complete plan for environmental data collection and analysis. New versions of QAPP templates developed by Stantec are now available for future grantees to consider prior to applying for funding.

## **Quality Assurance Project Plan (QAPP)**

The approved and signed QAPP can be found in the Appendix.

## **Anthracite Mining History & Legacy in the Wyoming & Southern Wyoming Valley**

*Pennsylvania's Northeast Treasurers, A Visitor's Guide to Scranton, The Lackawanna Valley, and Beyond* (Perry, 2007), estimated that there are approximately 7.3 billion tons of anthracite coal reserves in the United States, nearly all of which (97%) are in and under 8 Northeastern Pennsylvania counties, referred to as the Anthracite Coal Region. It is a 494 square mile area underlaid with hard coal that is spread across the 4 major distinct, Anthracite Coal Fields, with the Wyoming and Lackawanna Valleys comprising the [Northern Anthracite Coal Field](#) and its numerous collieries, outbuildings, and mining infrastructure.

Before coal extraction and timbering for development for early colonial settlements in the Wyoming Valley it can be surmised that trout populations were plentiful based on historical anecdotes. An historical account from *A Connecticut Town and County in Pennsylvania 1774-1782* (Harvey, 1921) by Oscar Jewell Harvey remarked “Speckled or brook trout and other small fish abounded in the brooks and creeks, while the river contained many varieties of fish” in the Wyoming Valley. Another account explained in 1845 that “Pure streams of water come leaping from the mountains, imparting health and pleasure in their course; all of them abounding with the delicious trout. It has been long since this was the case -the mines having been pumping the mine water into the brooks and streams of the valley for many years past, there is not a trout or any other kind of fish in one of them, as no fish or anything else can live in such water” from *Hanover Township Including Sugar Notch , Ashley, and Nanticoke Boroughs* (Plumb, 1885) by Henry Blackman Plumb 1885.

Impacts to Black Duck and Brook Trout habitat during the coal mining history was extensive. Wetland losses and relocation of streams were conducted prior to the PA Clean Streams Law in 1937 and federal Clean Water Act in 1972 or any environmental regulations were established to protect the habitats that were once found in the study area. The coal industry commonly relocated streams without concerns for impacts to aquatic resources and even when streams remained in the historical location, deep mining had impacts on groundwater base flows of the watershed. Streams were likely to be used by the coal industry as sources of water to wash coal before it was sold to users. Wash waters distributed of large quantities of coal sediment in waterways, wetlands, ponds and lakes downstream impacting water quality, quantities and

macroinvertebrates that supported both Black Duck and Brook Trout throughout the original range for both of the species. Additional concerns arose after the mining diminished since the mine companies in the early time periods were not required to have mine bonding or reclamation after the mining operations were completed. Therefore, the mine impacts still exist from companies that no longer are in existence and have no bonds to draw upon due to a lack of requirements in the early mining times. The history description below gives a better understanding of how these habitats were lost within the study area.

Anthracite coal was first discovered in the Wyoming Valley in 1770. Canals used to be the method of transportation constructed to get the coal to markets outside of the coal region before the expansion of the railroad industry. The anthracite canals played an early critical role in transporting coal that eventually fueled the Industrial Revolution with growth and economic development around a single coal economy in Northeastern Pennsylvania. Small cities and “coal patch” towns that were built up around the mine collieries near the mining operations that were both underground and on the surface. Many canal works disrupted small streams from natural confluence with the Susquehanna River, interrupting possible hydraulic connectivity of historic Brook Trout streams. Bottom land hardwoods along the Susquehanna River were lost during the canal construction damaging hard mast food sources for local and migratory Black Ducks following the migratory path of the Susquehanna River.

From 1834 until the end of the Civil War, the Wyoming Valley’s anthracite markets were primarily in southeastern Pennsylvania in Philadelphia and even further south to Baltimore. With the completion of the North Branch Extension Canal from Pittston to New York State in 1858, the Wyoming Valley’s coal was able to move in large, heavy barges pulled by mules, north into New York State and New England. [\*Anthracite and Slackwater: The North Branch Canal \[1828-1901\]\*](#) (Petrillo, 1986).

The design and construction of the canals were challenging along the Susquehanna River within the Wyoming Valley, particularly within the Solomon Creek watershed. The slackwater section of the North Branch Canal mitigated rapids and allowed access to the Susquehanna Coal Company colliery operations along Access Road in the Newport Creek watershed, in the City of

Nanticoke, and along the historic canal locks in Canal Park, across the river in West Nanticoke, Plymouth Township. This is where the river makes a large meander northwest along the southwestern side of Larksville Mountain, creating a section of rapids as it flows downstream towards the southern tip of the Northern Anthracite coalfields located in Mocanaqua and Shickshinny Borough. The canal method of transportation was short-lived. However, the disruption of Brook Trout connectivity from early canal works were never restored. Many historic canal works were backfilled and became railways for steam engines of the time period.

According to local Anthracite historian, World War II veteran, and last survivor of the Knox Mine Disaster who passed away at 101 years of age in 2020, Bill Hastie, early transportation of anthracite from the mountainous terrain of Northeastern Pennsylvania was a formidable undertaking. One-and-a-half-ton loads were shipped by four-horse teams and wagons along the 135 impassable miles from Wilkes-Barre to Philadelphia. The impracticality of substantial shipments over great distances was obvious and eventually, the horse and wagon were relegated to local deliveries. Soon Wilkes-Barre coal floated down the Susquehanna by barge and scow to Baltimore, and Summit Hill coal down the Lehigh and Delaware Rivers to Philadelphia. But scows and barges could not be returned upstream against the current, and then needed dismantling to be sold as lumber in the destination cities.

To overcome this, slackwater canals were built along the rivers and cross-country from river to river. Slack water canals also ensured a year-round adequate level of water. The canal and coal operations damaged large expanses of Brook Trout streams throughout the eastern half of Pennsylvania and throughout the Chesapeake Bay headwaters. Railroads, both steam and gravity powered-came soon on the heels of the canals. Many railroads were built for the explicit purpose of hauling anthracite. Eventually, motor trucks would replace the horse and wagon for local delivery, and great trailers and semi-trailers would give stiff competition to the railroads in long-distance hauling.

The War of 1812 demonstrated the need for a reliable source of fuel for northern cities. Coal from Great Britain was not available and due to the British blockade of the Delaware and Chesapeake Bays, Virginia coal (bituminous) could not reach those cities except by very costly



overland transport. The war also stimulated industrial activity, thus increasing the need for fuel. The Chesapeake Bay ironically played a role in speeding up the demand for anthracite from the Wyoming Valley, Southern Wyoming Valley, and throughout the 3 other major Anthracite Coal Fields of Northeastern Pennsylvania. This period of war and later conflicts in World War I and II began the extensive impacts to the environment from anthracite mining in the study area and throughout the Chesapeake Bay watershed.

Anthracite production reached its zenith during World War I, but industrial activity waned in the post-war years with attendant diminution in the demand for coal. In the 1920s cheap oil began to contest the coal markets-an ominous sign. Then the Great Depression cast a pall over the world, and industry slowed to a crawl. Mines stood idle. At some mines expensive pumping of water was discontinued and the workings filled up. Later, the Commonwealth of Pennsylvania would provide funds for special pumps to drain these mines. All the while, strip mining was accounting for a larger and larger share of production. Giant earth-moving machines made it practical to remove overburden from deeper and yet deeper veins of coal. Several machine operators, along with a handful of truck drivers, could produce as much coal as hundreds of underground miners. The workforce fell off sharply. The deep mines already had impacts on the surface waters that existed at that time. Severe fracturing of the bedrock from dynamite blasts and undermining created new losses of surface waters for all aquatic life over the deep mines. Wetlands and streams lost base flow to the deep voids. Strip mines on the surface created an entire devastation to the surface features that once held Brook Trout and Black Ducks. Mine reclamation was not implemented in the earlier time periods and water quality across the mine scape diminished extensively.

On January 22, 1959, the Susquehanna River broke into the workings of the River Slope section of the Ewen Colliery, which was being worked under lease by the Knox Coal Company. Extensive mining had been done under the river beyond the red-stop line. The old standard required that 50 to 60 feet of solid rock must exist between the river bottom and the coal seam for coal removal. The standard had been relaxed to 35 feet for the Knox and the red stop line established accordingly. Red stop lines appear on mine maps to mark the limits of leases granted to exploiting independent companies. In the case of the Knox, the red line also acted as a

dangerous line beyond which all mining was forbidden. Mine maps show that the test borehole nearest the point where the river broke through showed a reading of one foot-seven inches of rock cover.

On January 13, the last regular shift of coal ever to come out of the River Slope was fired and loaded by the sole remaining coal crew in the section. It was taken with permission from the foreman, but in violation of the mine superintendent's orders, from the very spot where the river eventually entered the mine. Nine days later, with the Susquehanna swollen to near flood level by a January thaw, the thin shell of rock gave way and the river rushed into the mine (Hastie, 2019). The Knox Disaster is commonly charged with causing the end of deep mining in the Wyoming Valley. The charge is not entirely fair. The falling market for anthracite was the true cause. The [Knox Disaster](#) website was developed by Director and Producer, David Brocca, of the documentary on the history of the Knox Mine Disaster. The tragic event was merely a catalyst that brought about the end more abruptly.

Some underground mines pumped the water back down, but by early spring 1959, not one large colliery in the Wyoming Valley was working at full capacity. Most had leased out small sections of their mines to independent operators, as the Pennsylvania Coal Company had done with the vast Ewen Colliery in Port Griffith. Other mines had been idled and allowed to fill up with water, this time forever. The underground-mined coal market continued to fail, and strip mining continued its march to dominate production in the valley.

After the enactment of the [Surface Mining Control and Reclamation Act of 1977](#), coal companies that operated mine permits after October 1977 were held legally liable for cleanup and many simply abandoned operations including pumping and treating the mine pools. By the early 1980s, there were no active mines within the study area.

## **Anthracite Mining Geology in the Wyoming & Southern Wyoming Valley**

The Northern Anthracite Coal Field consists of the Lackawanna Basin and the Wyoming Basin. The City of Scranton is near to the center of the Lackawanna Basin and the City of Wilkes-Barre is near to the center of the Wyoming Basin. The City of Nanticoke is a few miles south of the center of the basin with Wanamie, Honey Pot, Newport Center, Alden, Alden Station, Village of Rhone, Glen Lyon, and the Village of Lee, all smaller municipalities that are located within the southern Wyoming Valley. The study site for this investigation primarily involves watersheds from Wilkes-Barre through Nanticoke over the Northern Anthracite Coal Field.

According to *Hydrology of the Pleistocene sediments in the Wyoming Valley, Luzerne County, Pennsylvania*, “The rocks bordering the Wyoming Valley suggest a simple synclinal structure. However, the area is structurally anomalous to the Appalachians, and the rocks within the valley are complexly folded and faulted, containing many sub-parallel anticlines, synclines, and related faults. These features are discontinuous and are seldom over a few miles in length. The deepest part of the synclinorium is about 1 mile east of the City of Nanticoke (Hollowell J. R., 1971). For example, the Askam shaft was mined to a total depth of 2,133 feet, as shown on **Figure 4** according to (Ladwig, Kleinmann, Erickson, & Posluszny, 1988). Additional information on the geologic structure of the area is found in *Some Structural Features of the Northern Anthracite Coal Basin, Pennsylvania* (Darton, 1940).

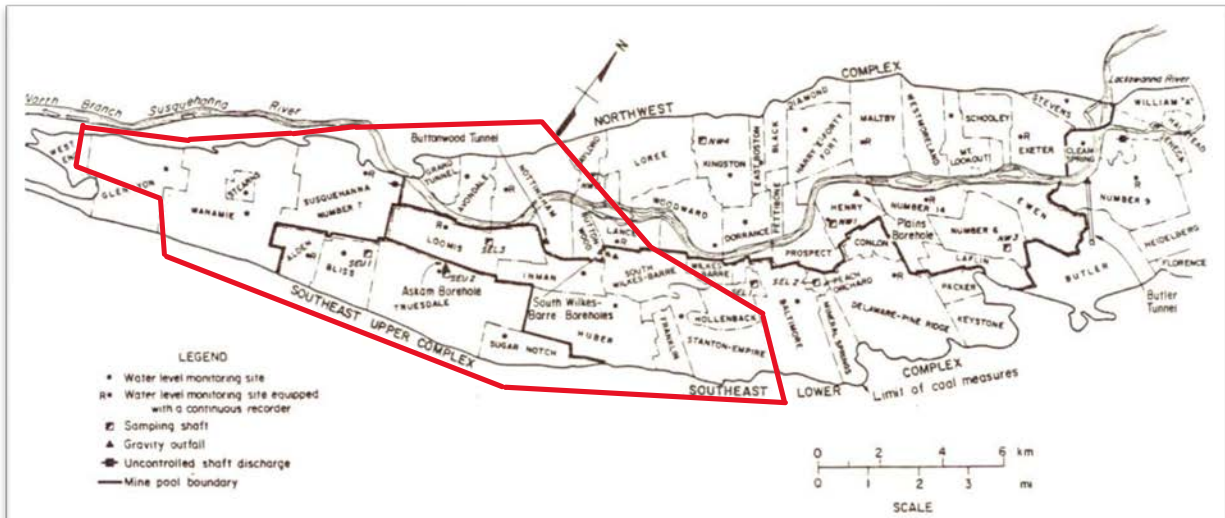


FIGURE 5. - Wyoming Basin, showing colliery names and boundaries, mine complex boundaries, sampled shafts, outfalls, and water-level-monitoring stations.

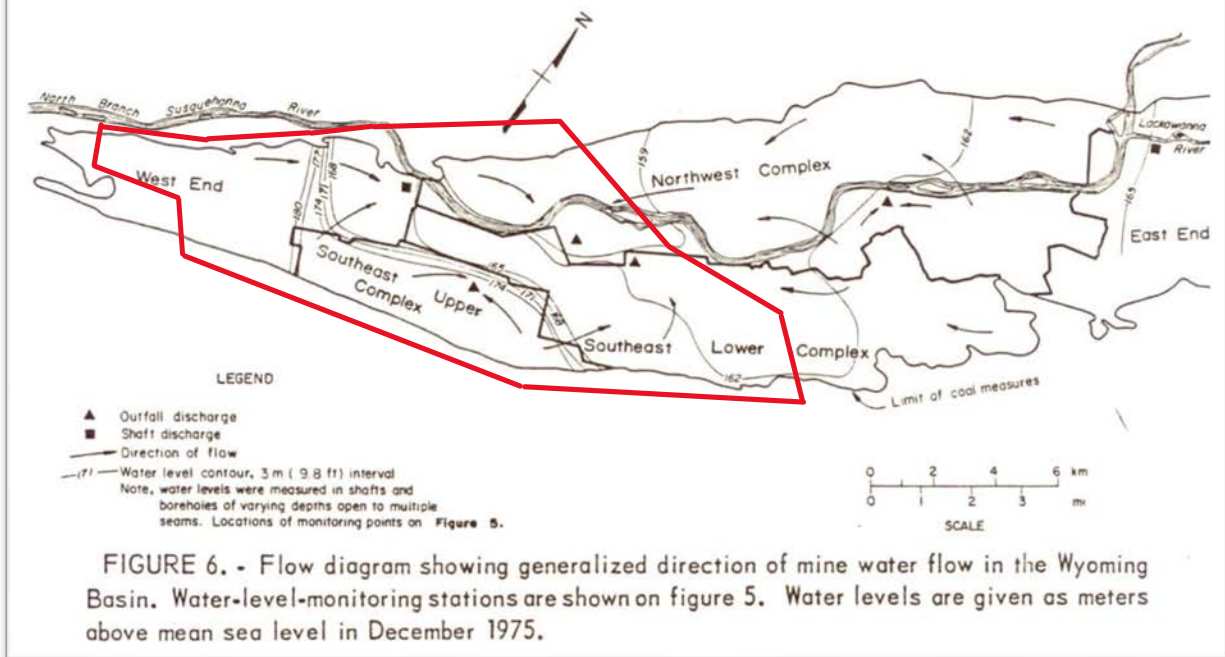


FIGURE 6. - Flow diagram showing generalized direction of mine water flow in the Wyoming Basin. Water-level-monitoring stations are shown on figure 5. Water levels are given as meters above mean sea level in December 1975.

Figure 4 Structure of the Wyoming Basin (Ladwig, et al., 1988) with red boundary limit of study area

## **Mine Pools and Mine Water Flow Impacts on Historic Black Duck and Brook Trout**

Excellent information on the mine pools of the Northern Anthracite Coal Field is contained in two PA Geologic Survey Reports by (Hollowell J. R., 1971) and (Hollowell J. a., 1975). Reasons for the mine pool information within the Black Duck and Brook Trout study is that the mine discharge waters contain constituents that detract from the habitats of both species. However, the mine water discharges average 50 degrees Fahrenheit throughout the year creating thermal refuges in summer for cold water fisheries when contaminants are resolved. Additionally, the reverse effect causes open water refuges to occur for Black Ducks in winter since mine discharges do not freeze during extreme winter conditions.

*Water Quality of Large Discharges from Mines in the Anthracite Region of Eastern PA* lists **16** mine discharges with flows greater than 1 cubic feet per second (cfs). **Table 1** contain flows measured in the low-flow period of October and November of 1991 (Wood, 1996) and flows of the same mine discharges measured by during the high-flow period of April 1975 (Growitz, 1985). When making the determination of flows greater than 1 cfs, the April 1975 discharge measurements were used. Of the **16** major discharges in the Northern Anthracite Coal Field listed in the table, **8** are in the Wyoming Basin and **5** in the study area.

Seasonal variations in the flow of these discharges are important because they can lead to substantial fluctuations in the mine pools and the receiving streams during high flows that could lead to streambank erosion, potential for flooding, increased sedimentation of coal silts, fines, and abandoned mine drainage (AMD) metal loadings depositing on the bottom of the streambeds, that impact both the quality of the water and the health of the streams for the plant life, aquatic life, fish, and wildlife in the area. The largest discharges are the three *South Wilkes-Barre boreholes*, both located in Hanover Township, Luzerne County, at 39 cfs, and the Nottingham-Buttonwood *Airshaft No. 22* at 27 cfs, and they are in the Solomon Creek watershed with the Airshaft No. 22, being located just downstream of the South Wilkes-Barre boreholes less than a .5 mile away.

Table 1 Flows from 5 Major AMD Discharges for the study area (Growitz, 1985)

<b>Major Discharge Point</b>	<b>Flow in cubic feet per second (cfs)</b>	<b>Flow in gallons per minute (gpm)</b>
<b>Solomons Creek Boreholes discharge from the South Wilkes-Barre Mines</b>	39	17,506
<b>Airshaft No. 22 discharge from the Nottingham- Buttonwood Mines</b>	27	12,119
<b>Askam Shaft Borehole discharge from the Truesdale Mine</b>	11	4,937
<b>No. 2 Shaft discharge from the Susquehanna No. 7 Mines</b>	8.5	3,815
<b>Seep discharge from the Susquehanna No. 7 Mines</b>	3.5	1,571

Sugar Notch Run, a tributary to the Solomon Creek, Warrior Creek, Nanticoke Creek, Newport Creek, and floodplain areas of the Wyoming Valley and Southern Wyoming Valley, in Luzerne County, PA all are named tributaries to the Susquehanna River, that eventually contribute flow to the Chesapeake Bay watershed. All the listed waterways are Mine Drainage impaired PA DEP biannual [Integrated Water Quality Report](#).

Every one of the tributaries and creeks has been historically impacted by Anthracite mining, both underground and on the surface of the landscape within the project study area. Locally, these watersheds are commonly referred to geographically as being in the Wyoming and Southern Wyoming Valley by residents who live in the region. Contained within these sub-watersheds are wildlife habitat areas and stream corridor patches that have been identified by the National Fish and Wildlife Foundation as priority areas for the current assessment of both the American Black Duck and the Eastern brook trout populations. The presence and absence of Black Duck and Brook Trout in most cases are directly reflective of the mining industry impacts. See the attached map showing known locations of Eastern Brook Trout presence ending at the former limits of historic mining.



Legacy abandoned mine lands consisting of massive culm banks, remnant foundations of coal breakers and ancillary buildings and colliery grounds are common throughout the study area. Presence of unreclaimed abandoned air shafts for ventilation, slopes, tunnels, drifts, boreholes, wooden and concrete flumes, and abandoned railroad keystone arches and bridge infrastructure, along with many miles of streams polluted by abandoned mine drainage (AMD) are just some of the remains of the single largest dominant industry in this region and study area. The impacts on the lives, well-being, quality of human life, health, and safety are in addition to the environmental impacts on the habitats of both aquatic and avian waterfowl species in Northeastern PA.

Eastern brook trout are native to Pennsylvania and the American black duck utilize the [Atlantic Flyway](#) that runs north and south along the Susquehanna River and both habitats from a freshwater ecological and wildlife habitat perspective have been greatly impacted in the Wyoming Valley and Southern Wyoming Valley. Although the active anthracite mining industry has transitioned in the region, reclamation, and remediation of both the land and water through watershed restoration efforts and economic redevelopment of the abandoned mine lands have made great progress over the last few decades. Nevertheless, the legacy environmental, social, recreational, and economic impacts of the anthracite industry remain.

## **Natural Values: The Importance of Wetlands and Upland Conservation Practices in Watershed Management: Function and Values for Water Quality and Quantity**

Society is dependent upon freshwater, and it is a vital resource for humans, fish, and wildlife. Future sustainability of freshwater as a long-term resource needs to be protected and enhanced and improvements often need to be made to landscape features to ensure that the quality and quantity of the water is conserved, and we become stewards of the land. Wetlands and riparian areas and corridors are natural features on the landscape that are critical and necessary for water resource management for it to become sustainable. Unfortunately, a majority of the negative impacts created by the past coal mining industry in this study area occurred prior to State and Federal protections of wetlands, waterways and water quality. Therefore, the impacts in the study area are extensive from the invasive mining methods used prior to regulation.

Wetlands are natural filters that improve water quality. They neutralize several different contaminants. Wetlands remove nutrients like phosphorus and nitrogen from water that flows into lakes, streams, rivers, and groundwater. Wetlands recharge groundwater. If wetlands are destroyed (drained, or converted to another land use), groundwater levels will be reduced. Wetlands help control floods by storing substantial amounts of water. Conversely, when wetlands are destroyed, the probability of a rainfall event causing flooding and floodwater damage increases dramatically. Wetlands also have the potential to remove and store greenhouse gases from the Earth's atmosphere.

[Ducks Unlimited Canada](#) produced an excellent unpublished report, *Natural Values: The Importance of Wetlands and Upland Conservation Practices in Watershed Management: Function and Values for Water Quality and Quantity* (Gabor, 2004). The paper concentrated its focus on the function and value of wetlands, riparian areas, and permanent cover within watersheds. The paper presented an overview of watershed management including Integrated Watershed Management (IWM) planning and implications of land use for water quality. Wetlands continue to be lost due to a lack of understanding in society about their true environmental and economic value. Wetlands filter and recharge our freshwater, store

greenhouse gases, help prevent flooding, and provide habitat for numerous plant and animal species.

IWM planning is a comprehensive multi-resource management planning process involving all stakeholders within the watershed, who, together as a group, cooperatively work toward identifying the watershed's resource issues and concerns. The process develops and implements a watershed plan with solutions that are environmentally, socially, and economically sustainable.

The approach in this study Southern Wyoming Valley through the involvement with local stakeholders, municipalities, regional non-profits, local conservation and community organizations, conservancy groups, the local Stanely Cooper Chapter Sr. Trout Unlimited in the Wyoming Valley, the Luzerne Conservation District, the North Branch Land Trust, and several State agencies including the Pennsylvania Game Commission, Pennsylvania Fish and Boat Commission, and the Pennsylvania Department of Conservation and Natural Resources-Bureau of Forestry-Pinchot State Forest. Watershed planning completed by EPCAMR was a cyclical, iterative process, involving the following key components: evaluation, planning, implementation, and monitoring.

### **Viewing the National Wetlands Inventory (NWI) with Google Earth Tutorial from the United States Fish & Wildlife Service**

The review and utilization of the U.S. Fish & Wildlife Service's National Wetlands Inventory Keyhole Markup Language (KML) file to view data in two virtual globe software applications, including Google Earth and ArcGIS Pro Online. KML is an XML language focused on geographic visualization, including annotation of maps and images. Google Earth is a free tool available online and to ensure that any viewers have the latest version, it's recommended that an individual launch their web browser and navigate to the [United States Fish and Wildlife Service National Wetlands Inventory data link](#) for Google Earth.

## National Fish & Wildlife Foundation (NFWF) Chesapeake Bay Business Plan Mapping Portal

EPCAMR accessed the NFWF Chesapeake Bay Business Plan [mapping portal](#) to identify the alignment of our planned activities within NFWF's outcome-specific priority areas. The portal includes the ability to display separate priority area maps for each of NFWF's priority outcome areas. Our GIS staff focused our attention on including the water quality, Eastern brook trout, and American black duck priority areas and areas of overlap between the three priority outcomes.

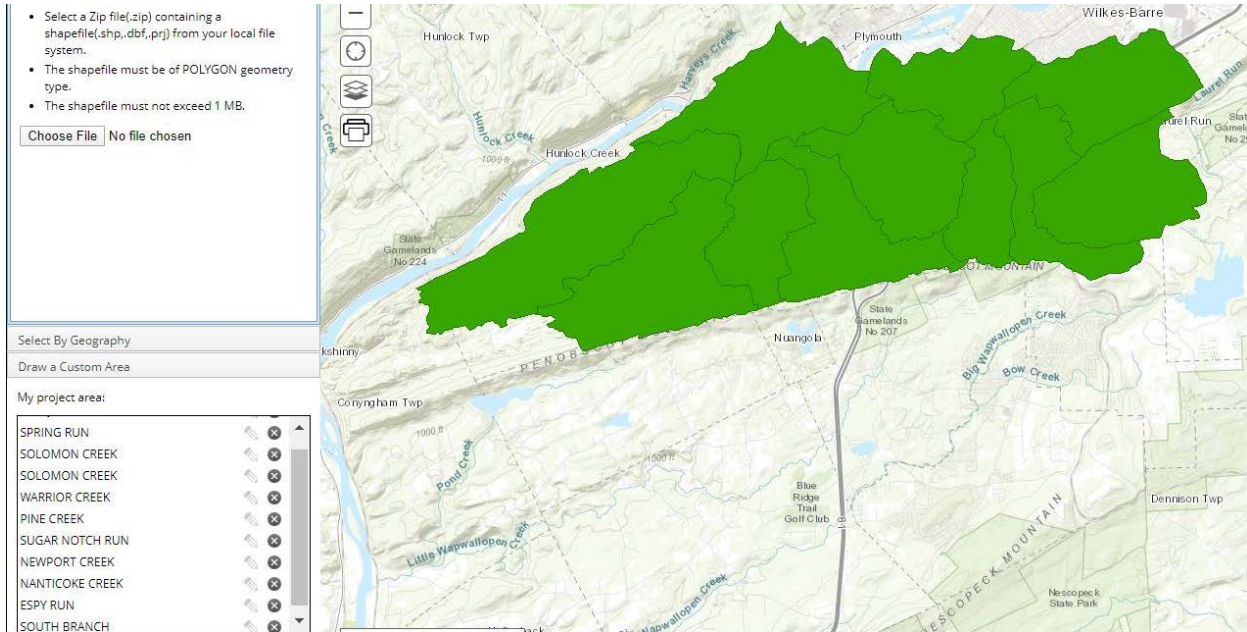


Figure 5. EPCAMR Project Area for the Southern Wyoming Valley

## **Eastern PA Coalition for Abandoned Mine Reclamation (EPCAMR) Community Outreach and Letters of Support**

EPCAMR reached out to all municipalities within the project area initially for letters of support and to inform them of the intentions of the proposal. While not all of them provided a letter of support in time for submission, the letter that went to each of them provided them with some background information on the goals of the project. The Mayor of the [City of Nanticoke](#), Frank Coughlin provided a letter of support. EPCAMR reached out to the [Warrior Run Borough](#) Council President Larry Carbohn, after talking with Luke Matthews from the Borough and received a letter of support from Thomas Shypulefski, Mayor of Warrior Run Borough. EPCAMR requested and received a letter of support from Jeff Collela, Stormwater Division Manager, and Jim Tomaine, Executive Director of the Wyoming Valley Sanitary Authority. EPCAMR received a letter of support from Samuel T. Guesto Jr., Manager, [Hanover Township](#). EPCAMR also received a letter of support from Paul Lumia, Executive Director of the [North Branch Land Trust](#). Upon his departure from the NBLT, we began working with their new Executive Director, Ellen Ferretti. Letters of support are in the Appendix.

EPCAMR reached out to the [Newport Township](#) Board of Commissioners after talking with Paul Czapracki and Joe Hillan and received a letter of support. EPCAMR requested letters from Amy Saraka, who is affiliated with the [Newport Township Women's Activity Group](#) and the [Newport Township Crimewatch](#). EPCAMR received a letter of support from Harry Campbell, Executive Director of the [PA Office](#) of the [Chesapeake Bay Foundation](#), and the [Keystone 10 Million Trees Partnership](#).

EPCAMR spoke with Tom Kashatus, a volunteer with the [Newport Township Community Organization](#) (NTCO), and Stephen E. Phillips, President, of the NTCO, who gladly wrote a letter of support for our project. He mentioned to our Executive Director that when a request comes from EPCAMR's Office for support, they know it is for the betterment of Luzerne County and Newport Township. EPCAMR received another letter of support from J. Scott Brady, President of the [Stanley Cooper Sr. Chapter #251 of Trout Unlimited](#).

EPCAMR received additional support from George C. Brown, the Mayor of the [City of Wilkes-Barre](#), Terry Ostrowski, President & CEO of the [Earth Conservancy](#), Janet Sweeney, President of the [Pennsylvania Environmental Council NE Office](#), Gary Gronkowski, President of the [Nanticoke Conservation Club](#), and Tom Clark, AMD Basin Coordinator from the [Susquehanna River Basin Commission](#). We also received letters of support from Kristen Reilly, Director of the [Choose Clean Water Coalition](#), and Jacquelyn Bonomo, President & CEO of [PennFuture](#) after coordinating with Renee Reber and Emily Rinaldi Baldauff, Campaigns Directors for PennFuture.

We were unable to receive a letter of support in time for the grant submission from [Sugar Notch Borough](#) because support letters had to be voted on by all Council members at a meeting and they were not going to meet until late May 2020 or early June 2020, however, Gloria Kijek, Sugar Notch Borough Secretary wished us luck and at least the Borough officials and solicitor were informed of our intent to submit and that we would keep them apprised of the proposal, should it be funded. We were also unable to receive a letter of support in time for the submission from John Levitsky, Watershed Specialist from the [Luzerne Conservation District](#), however, we had already known that he would be supportive of the project and would be very critical to the successful development of the recommendations that were made in the plan.

A joint letter of support from Congressman Matt Cartwright and Congressman Dan Meuser. The bi-partisan joint letter was coordinated and provided by Jeremy Marcus, Deputy Chief of Staff for Congressman Matt Cartwright, and Mike Shay, Grants Manager for Congressman Dan Meuser's Office. EPCAMR and other partners had commented that this type of joint letter does not happen very often and that it was great to see the collaboration from both in support of clean water goals, cleaning up the Chesapeake Bay, and supporting fish and wildlife habitat improvements in the Southern Wyoming Valley. Cody Forgach, Legislative Director, provided a letter of support from State Representative Gerald Mullery. Erica Boote, Legislative Assistant, provided a letter of support from State Representative Eddie Day Pashinski. Liz O'Brien Gorski, Community Outreach Specialist for Senator John Yudichak provided a letter of support. All legislators in the project coverage area have been ardent supporters of EPCAMR's work in the region.



One important consideration that should be highlighted is that all this initial coordination and communication was being done during the height of the COVID pandemic and personal one-on-one communication was not an option to obtain the letters of support. E-mail communications and follow-up phone calls were only available to the Executive Director to reach out to everyone before the submission of the grant. EPCAMR was thrilled to receive the amount of support that we did. Even when the public announcement on September 2, 2020, was made when EPCAMR received the award notice that was coordinated out of Congressman Matt Cartwright's Office, the event was held outdoors under a pavilion in Scranton at the Nay Aug Avenue Natural Playground where everyone present, including the press was following masking protocols and social distancing that were suggested by the Center for Disease Control and the EPCAMR Personnel Policy. Everyone made the best of the situation and pandemic and still were able to successfully pull off a great publicity event that was shared everywhere through one of the social media posts from Congressman Matt Cartwright's Facebook page. Jacqui Bonomo, President, and CEO of PennFuture, Bernie McGurl, Executive Director of the Lackawanna River Conservation Association and EPCAMR Past President, and our Executive Director's use of a mask during the event can be seen on all people in attendance in the Congressman's post and the other two photos below. EPCAMR prepared a [press release](#) for the event.

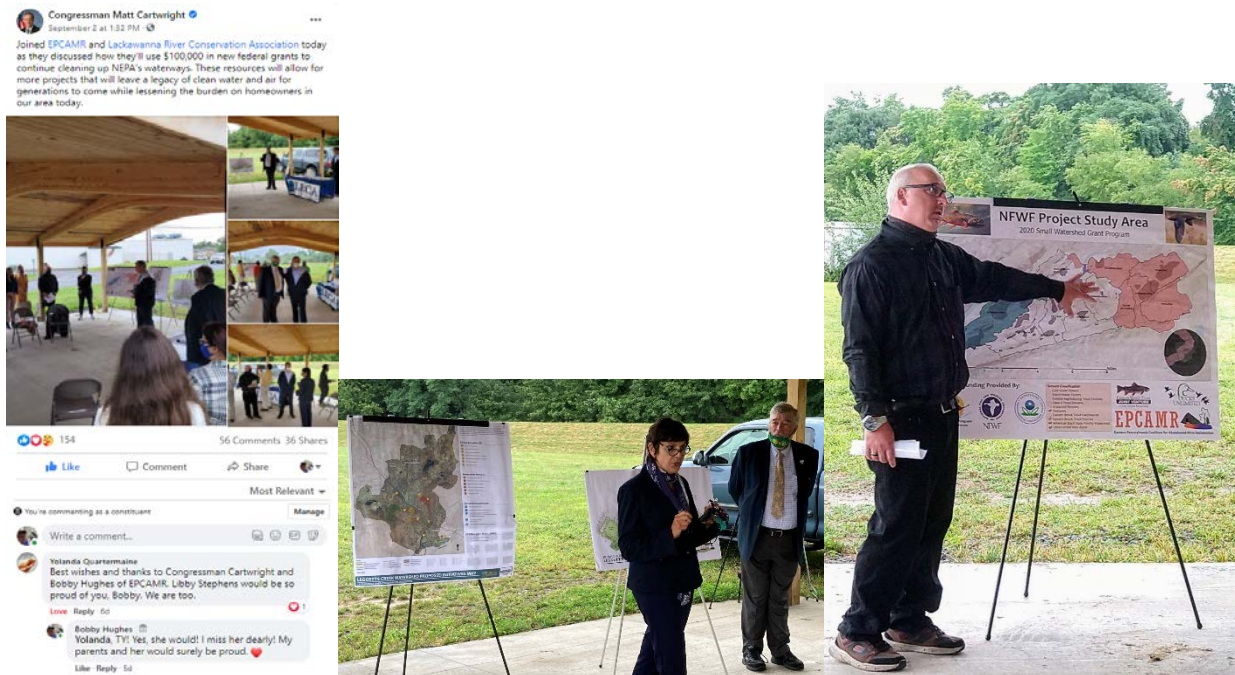


Figure 6. Photo Collage of Press Event held by Congressman Matt Cartwright's Office Announcing NFWF Grants to EPCAMR and the Lackawanna River Conservation Association (LRCA) on September 2, 2020 at Nay Aug Avenue Natural Playground, Lackawanna Co., Scranton, PA

EPCAMR appreciated the technical assistance during this time and guidance that was provided by Liz Feinberg, with [CalVan Environmental-Planning, Policy, and Compliance](#), who assisted with narrowing down the focus for the grant submission. She was a tremendous help and provided some great input to the grant writing process and proposal that was being pulled together by the EPCAMR Executive Director and Staff.

On October 3, 2022, EPCAMR coordinated an abandoned mine lands (AML) tour with the [National Wildlife Federation](#) (NWF) and [ReImagine Appalachia](#) (RA) to highlight reclamation, monitoring, and assessment efforts in the Southern Wyoming Valley by EPCAMR and the [Earth Conservancy](#). A media advisory was sent around to the local newspapers and news stations. The media outreach was coordinated by the EPCAMR Executive Director, Bobby Hughes, Jessica Arriens and Lindsay Kuczera from the NWF Climate Policy Team, Terry Ostrowski, President & CEO, Dr. Elizabeth Hughes, Communications Director, and Jason Tarnowski-Project and Operations Manager, were present and spoke from the Earth Conservancy. Annie Regan from [PennFuture](#) (PF). James Kunz, III, Administrator for the [PA Foundation for Fair Contracting](#) (PAFFC), was a speaker as well. He spoke on labor needs during reclamation and restoration projects, provided a Department of Labor and local State angle of fair labor and highlighted how partners can build a long-term workforce through [high-quality union apprenticeship programs](#) and other means. Jeffrey Lapp, Chief of the [US EPA Region III Wetlands Branch-Water Division](#) attended and spoke as well. Economic Development Coordinator, John Blake, for Congressman Matt Cartwright attended. US Department of Interior Staff were also invited.

A tour of the [Espy Run Stream Restoration Project](#) in the Nanticoke Creek watershed was hosted by the Earth Conservancy and monitored by EPCAMR. 6,250 linear feet of stream channel was reconstructed, realigned, and planted with 1,500 native seedlings to create a riparian zone, with a goal of keeping clean headwater flows on the surface on the former Bliss Colliery grounds. Reconstruction of the stream segment prevented the stream's headwaters from infiltrating underground into the underground mine pool, which the US Army Corps of Engineers, Dr. Ken Klemow from Wilkes University, and EPCAMR believed would reduce AMD discharges downstream. The [Bliss Bank Reclamation](#) is in progress with the Earth Conservancy and to see 200 more acres reclaimed.



Furthermore, a riparian forest buffer was reconstructed which will eventually keep the water cool, improve habitat, and create a wildlife corridor to the top of Wilkes-Barre Mountain.



*Figure 7. Photo Collage of the Espy Run Tributary Stream Channel Restoration and Riparian Streamside Planting by the Earth Conservancy in the Nanticoke Creek Watershed in the Southern Wyoming Valley*

We also visited the [Askam Borehole abandoned mine drainage \(AMD\) Maelstrom Oxidizer Treatment System](#), downstream of the Espy Run Stream Restoration Project along Dundee Road in Hanover Township, also in the Nanticoke Creek watershed.



*Figure 8. Photo Collage of the Askam AMD Borehole Impacts prior to entering the Askam AMD Maelstrom Oxidizer Treatment System within the Nanticoke Creek Watershed along Dundee Road, Hanover Township, Luzerne County, PA*

WBRE News 28 ran a [story](#), an article appeared in The Citizens' Voice, entitled, "[Environmental Groups Tour Acid Mine Drainage \(AMD\)](#)" (that unfortunately was behind a paywall) on October 4<sup>th</sup>, 2022. Annette Larkin with [Renew PR](#) also covered the event for the NWF. RA created a video [TikTok recap](#) of the event that has received several views, shares, and likes. [Fox56 WOLF News](#) also covered the event. The NWF prepared a [blog](#), a [Twitter post](#) and [Facebook post blog](#) on the event.

The media advisory mentioned a recently published a NWF report entitled, [The Climate Benefits of Degraded Lands Reclamation and Restoration](#) on the climate benefits of reclaiming abandoned mine lands as well as orphaned oil and gas wells, Superfund sites, and brownfields. To see an example of successful reclamation of abandoned mine land, reporters were invited to join NWF, Earth Conservancy and EPCAMR on the tour of the Espy Run Stream Restoration Project and the Askam Borehole Maelstrom Oxidizer AMD Treatment System Center. EPCAMR and EC provided details on the sites, EPCAMR's NFWF Project, the history of legacy mining in the Nanticoke Creek watershed, photos of before and after reclamation, and highlighted the economic potential of local and federal investment for continued reclamation efforts in Pennsylvania and around the nation.

Also, EPCAMR is a supporter of ReImagine Appalachia's [Blueprint](#) and encourages municipalities, local governments, and community organizations and non-profits to support the vision and plan. The Blueprint details ReImagine Appalachia's vision and plan. Both rely on our skilled workers and farmers while also offering hope for the next generation—of all races, ethnicities, and genders. The policy priorities outlined in this document would create over half a million good, family-sustaining jobs by investing in people and communities.

On October 19, 2022 EPCAMR attended a public meeting hosted by the Earth Conservancy and K & W Designing Environments, to provide some feedback and comments on the presentation made and our knowledge of the Warrior Creek watershed that is in the study area that runs along the edge of the parcel boundary for the proposed recreational area in Hanover Township called Hanover Lot 7A. We suggested some green infrastructure ideas similar to a [Green Infrastructure Planning and Concept Plan for Public Spaces](#) in the City of Wilkes-Barre that EPCAMR had

provided to Mayor George Brown and the City Council in 2018 that was funded through the NFWF Chesapeake Bay Technical Capacity Program in partnership with [Clauser Environmental, LCC](#). EPCAMR had written a [press release](#) on the development of the Green Infrastructure Concept Plans back in December 2018. An [article](#) appeared in The Citizens' Voice related to the public meeting, EC made the [presentation](#) available on their website, and the entire [Hanover 7A Master Site Development Plan](#) is also available on their page. EPCAMR had written a letter of support for EC to secure funding from PA DCNR, C2P2 for the project in 2020. EC was awarded \$22,000 from PA DCNR and committed \$22,000 from their organization.