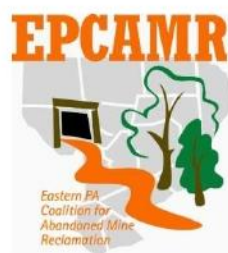
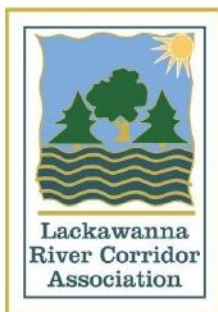


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# Lower Lackawanna River Watershed Restoration and Assessment Plan Executive Summary



Bernard McGurl - LRCA  
Robert E. Hughes - EPCAMR  
Michael Hewitt - EPCAMR  
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## **Acknowledgement**

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- The Willary Foundation
- The Foundation for Pennsylvania (PA) Watersheds (FPW)
- The Lackawanna Environmental Conservation and Outdoor Recreation Partnership Program (LECOR)
- The Susquehanna River Basin Commission (SRBC)
- The Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (EPCAMR)
- The PA Department of Environmental Protection (DEP) Bureaus of Abandoned Mine Reclamation (BAMR) and Conservation and Restoration (BCR)

Staff from SRBC, EPCAMR, LRCA, and PA Tectonics have conducted extensive field work to collect and analyze data from the Old Forge Borehole (OFB), the Duryea Breach (DB), and over twenty monitoring boreholes in the area of the Metropolitan Scranton Mine Pool (MSMP). This work has included the unique, difficult, and dangerous work to install and maintain monitoring equipment in OFB and immersion in chest waders in the outflow channel of the DB and in the Lackawanna River in all seasons and weather conditions.



**Study team collecting a water quality and flow sample from the Duryea Outfall.**

# 1 Introduction

## 1.1 Executive Summary: A Tale of Two Rivers

The confluence of the Lackawanna River with the North Branch Susquehanna River at Coxton Point in the Lackawanna-Wyoming Valley (LWV) of Northeast PA has many distinctions of a historical, cultural, and aesthetic nature. It is also distinct due to the bright orange and yellow plume of iron (Fe) oxide laden water and sediments flowing from the Lackawanna River into the North Branch Susquehanna River. This legacy from the anthracite coal industry continues to mark the confluence located in Luzerne County, between the City of Pittston and the Borough of Duryea, with a special and not necessarily welcome distinction.

Geologists refer to the LWV as the Lackawanna Syncline. It is two valleys in name only. In actuality, it is one physical feature in the Ridge and Valley Physiographic Province of Eastern Pennsylvania. It appears, with some imagination, like a great “stone canoe” running 75 miles from Forest City in the northeast, to Shickshinny in the southwest. It is 5.0 miles athwart at Scranton and 7.0 miles at Wilkes-Barre. Beneath its surface was found the largest and richest anthracite coal basin on the planet, the Northern Anthracite Field (NAF).

Since November 1961, when the last of the deep mine collieries closed down and turned off their pumps, the extensive system of NAF underground mine voids flooded with groundwater as well as river and stream water infiltrating from the surface. What has resulted is a system of subterranean water bodies known as mine pools in a configuration somewhat like the subway system under Manhattan on steroids, 75 miles long and greater than 1,000 feet deep.

The major mine pools in the Lower Lackawanna River are the Metropolitan Scranton Mine Pool (MSMP), the Central Mine Pool (CMP), and the No. 9 Mine Pool (#9MP). MSMP extends from Old Forge upstream under Scranton, Dunmore, and several other mid-valley boroughs to Archbald. CMP and #9MP underlie portions of Duryea, Avoca, Dupont, Hughestown and Pittston Township (Figure 1-1).

It has been anecdotally described as the largest and most visible point source of pollution in the entire Chesapeake Bay Watershed. The source of this Fe loading is primarily from two abandoned mine drainage (AMD) discharges that drain several of these NAF mine pools, the Old Forge Borehole (OFB) and the Duryea Breach (DB) (Figure 1-2 and 1-3). The OFB drains the MSMP and DB drains the CMP and #9MP. These AMD points are respectively the second and sixth highest priority AMD sources impacting the Susquehanna River in the Anthracite Region (Clark 2011).

OFB is 3.0 miles upstream of the Lackawanna/Susquehanna Confluence Area (LSCA), adjacent to Union Street in the Borough of Old Forge, Lackawanna County. OFB discharges an average of ~60.7 million gallons per day (MGD) (~94 cubic feet per second (CFS)) with a Fe loading of ~7,700 pounds per day (lbs/day).

DB discharges an average of ~14.5 MGD (~22.5 CFS) with a loading of ~2,260 lbs/day of Fe. DB is located 0.75 miles upstream of the LSCA.

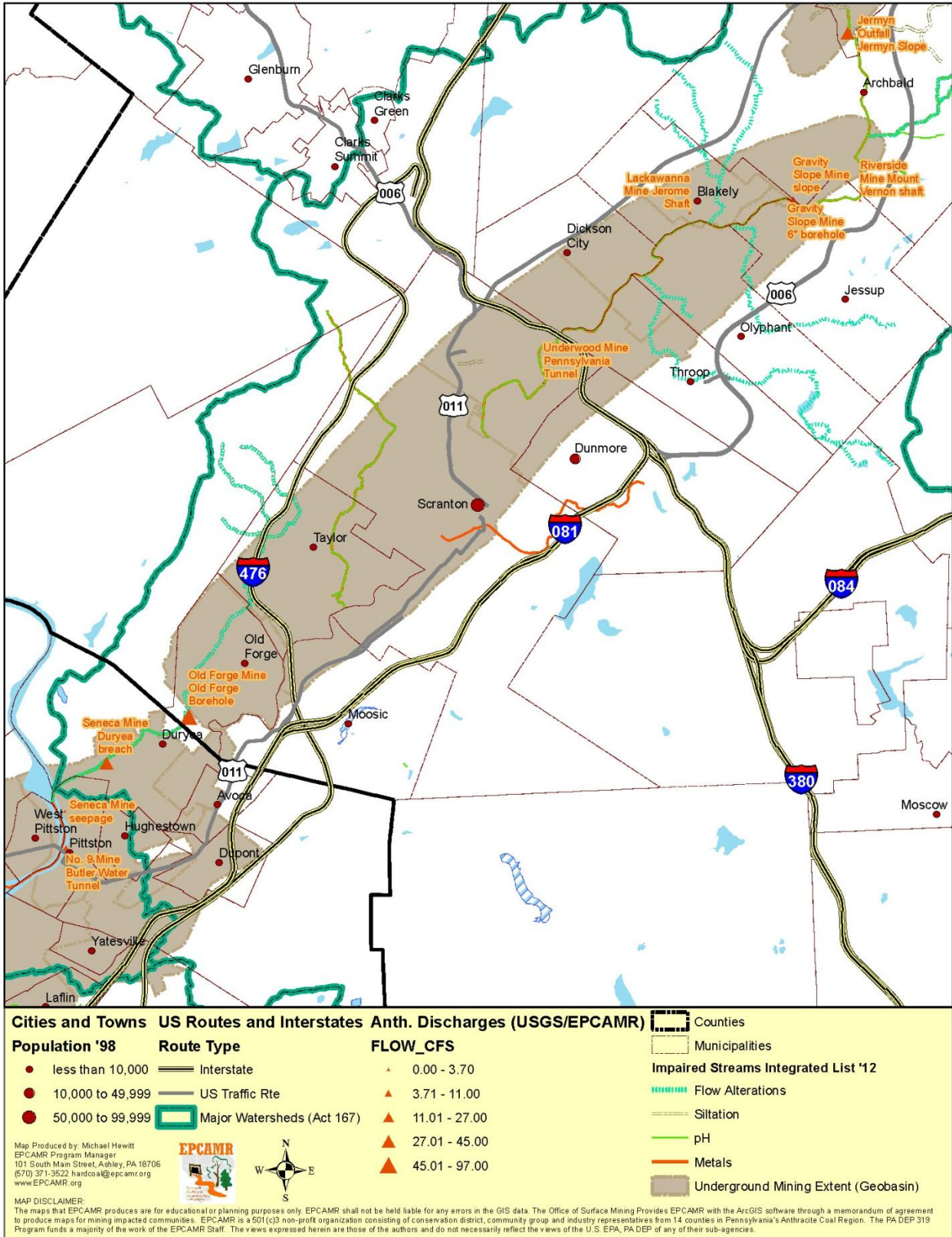


Figure 1-1 The major mine pools in the Lower Lackawanna River (larger version available in appendix).



Figure 1-2 The Old Forge Borehole entering the Lackawanna River's western bank.



Figure 1-3 The Duryea Breach discharge below beaver dam where sampling occurred.

A view from the air shows a large plume of orange colored water flowing into the Susquehanna River from the Lackawanna River just as the North Branch Susquehanna enters the LWV through what we should properly call the Wyoming Gap (Figure 1-4).

Recent monitoring data indicates that OFB and DB are now characterized as very net alkaline, after many years being characterized as net acidic. The amount of metals, particularly Fe, in both discharges is also slowly declining from levels recorded in the 1970's (Table 1-1). However, PA DEP, acting under requirements of the Clean Water Act (CWA), completed a study to assess the Total Maximum Daily Load (TMDL) for several pollutants in the Lackawanna River. Even with the improvement in alkalinity and Fe loading, the TMDL calls for an Fe loading reduction of 92 percent at the Lackawanna River mouth to meet water quality standards (PA DEP 2005). The vast majority of this loading originates from OFB and DB.

**Table 1-1 The change of Old Forge Borehole and Duryea Breach quality over time.**

	<b>OFB pH</b>	<b>OFB Net Acidity</b>	<b>OFB Fe</b>	<b>DB pH</b>	<b>DB Net Acidity</b>	<b>DB Fe</b>
1970s	5.60	210.00	40.00	5.70	233.00	48.00
1980s	5.96	0.84	30.51	5.97	2.11	37.12
2010s	6.54	-69.80	15.18	6.53	-62.75	18.65

SRBC has also recently characterized anthracite mine drainage via the 2011 Anthracite Region Mine Drainage Remediation Strategy. This work recognizes the significance of OFB and DB as contributing ~25 percent of the Fe loading entering the North Branch Susquehanna (Clark 2011). This work also ranks OFB and DB as the second and sixth highest priority discharges in the entire Susquehanna River Anthracite Region.

The Lower Lackawanna River Watershed Restoration and Assessment Plan (LLR-WRAP) contains the information needed to draft a Qualified Hydrologic Unit Plan (QHUP) developed by the Office of Surface Mining (OSM) and implemented by PA DEP. QHUPs assist in prioritizing and qualifying AMD and abandoned mine land (AML) sites for projects funded by the Surface Mining Control and Reclamation Act (SMCRA) as reauthorized by Congress and signed into law by the President in 2008. The Lower Lackawanna River QHUP, which will be drafted in the near future using this LLR-WRAP, will demonstrate that OFB and DB are QHUs that should be recognized by PA DEP and OSM.

The physical conditions and developmental constraints of the ~2,000 acre LSCA between Old Forge, Duryea, and Pittston are the second essential aspect of this LLR-WRAP. In addition to the degraded aesthetics and aquatic habitats affected by AMD, the physical disruption of the landscape and deficiencies in a LSCA transportation network are also a main focus.

In addition, as the first phase of this plan was underway, Duryea and West Pittston Boroughs experienced flood damage resulting from Tropical Storm Lee, a "Flood of Record" for the Susquehanna Basin.

Therefore, this plan makes a series of recommendations for AMD and AML reclamation and reuse, economic development, transportation improvements, flood protection, and natural

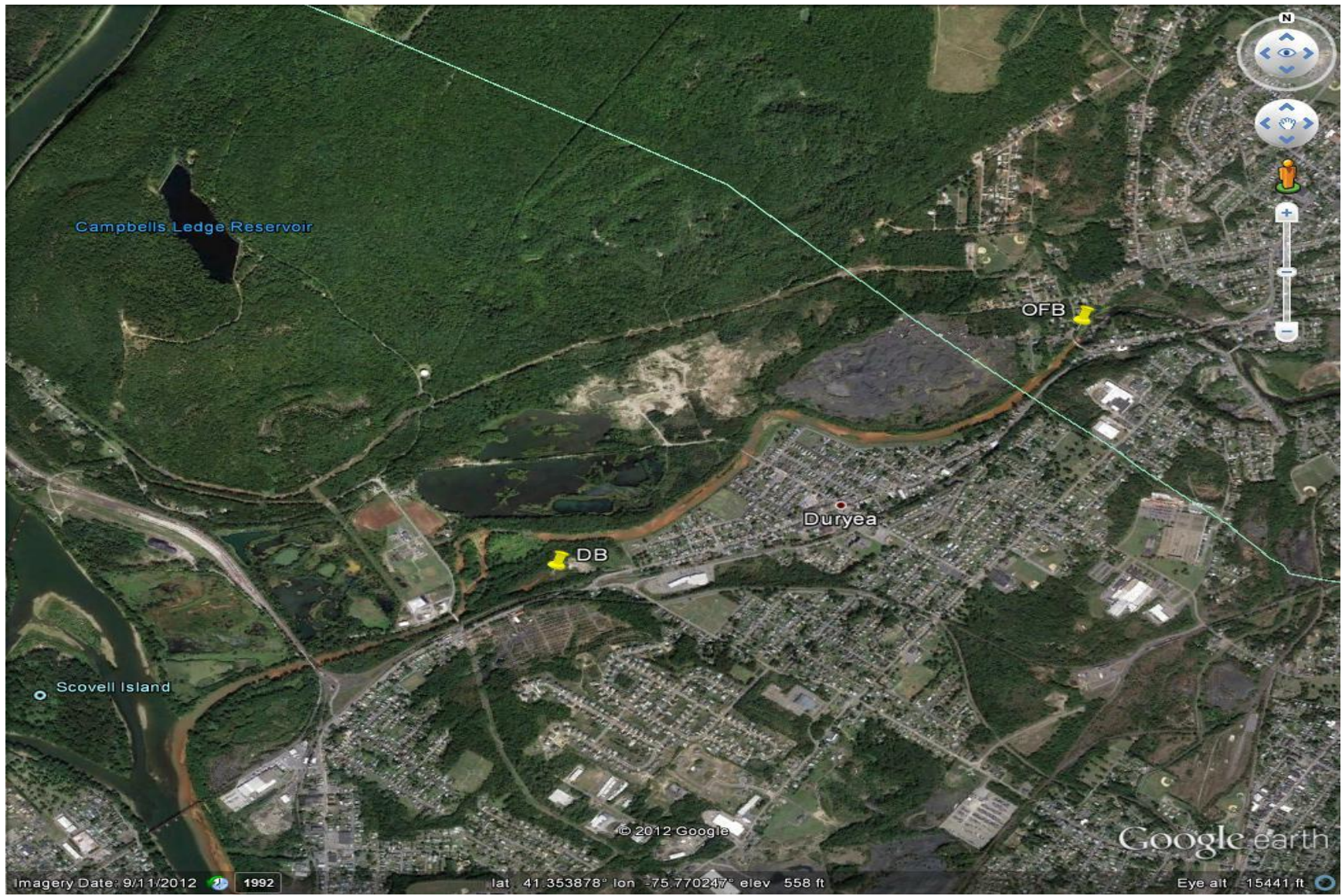


Figure 1-4 Location of the Old Forge Borehole and Duryea Breach. Notice iron staining in the Lackawanna River, mixing into the Susquehanna River in the lower left.

resource conservation and recreation. These recommendations are offered for consideration by local residents, property owners, business interests and municipal, county, state, and federal governments.

This plan and recommendations have been developed by LRCA working with SRBC, EPCAMR, and community stakeholders.

In order to treat the AMD problem in the Lower Lackawanna River, eliminate the Fe loading needed to meet water quality standards, and to utilize the maximum resources to achieve the intent of the reauthorized SMCRA, an active AMD treatment plant is probably a necessity. Passive wetland treatment can be a component of the overall process, but due to the volumes and Fe loading of OFBH and DB, an active treatment plant is more than likely needed to effectively accelerate rates of precipitation to remove a majority of the precipitated metals.

## **1.2 Executive Summary: Recommendations**

- The LLR-WRAP recommends that the PA DEP BAMR and the new BCR utilize the future QHUP and related information in this document to approve QHU status for the Lower Lackawanna River (OFB and DB). The LLR-WRAP then recommends that PA DEP work with the community, the Lower Lackawanna Watershed Stakeholders Group (LLWSG), and eventually a Lower Lackawanna Confluence Coalition (LLCC) to design, build, and operate a mine drainage treatment facility that jointly treats flows from OFB and DB on a site to be determined, but likely along the west bank of the Lackawanna River in the proximity of Stevenson Street in Duryea.
- This LLR-WRAP recommends that the municipal and county governments in Lackawanna County and Luzerne County consider a collaboration to complete a comprehensive master plan that will promote the redevelopment of the ~2,000 acre LSCA. This area encompasses such locally named places and neighborhoods as the Confluence, Coxtan Point, Pittston Junction, Coxtan, Coxtan Rail Yards, Falling Springs, Campbell's Ledge Reservoirs, Red Spring Run, Airport Sand and Gravel quarries, "the Duryea Swamps", Canal Street, West Stevenson Street, the Hallstead Colliery, the William A Colliery, Connell's Patch and Rosemont Estates.
- The LLR-WRAP also recommends that, as part of the comprehensive plan or as a stand-alone plan, a transportation improvement initiative is needed to plan and secure the resources to construct significant roadway, bridge, and traffic circulation improvements, particularly in and surrounding the LSCA.
- Discussions with elected officials indicate that there is no consensus supporting the creation of a public authority to lead the further work to plan and implement a treatment plant or associated economic development at the present time. Therefore, this plan recommends that the study partner agencies and interested stakeholders consider the establishment of a not-for-profit community development corporation with a mission to develop and operate a mine drainage treatment plant and conduct other economic development and environmental restoration needed at the LSCA. The LLR-WRAP



proposes to name this entity the Lower Lackawanna Confluence Coalition (LLCC). The LLCC could form limited liability equity partnerships with several of the larger property owners to fund and build transportation improvements and develop and market multi-use subdivisions for industrial, commercial, residential, and recreational purposes.

- The LLR-WRAP recommends developing the AMD treatment plant as a magnet facility to attract business investment for synergistic industrial uses of adjacent properties for sustainable water and energy related business. Specialized plan and investment studies are recommended to facilitate development of hydroelectric, geothermal, and other renewable energy resources associated with the site. The LLCC and the private consortium should engender collaborations to develop these resources in surplus to what may be developed or required to support the recommended active AMD treatment plant.
- The LLR-WRAP recommends that the existing open space resources of the LSCA include a habitat conservation management program that integrates habitat and aquatic features into the design of the build out environment. The LLR-WRAP also endorses the identification, protection, conservation, and interpretation of historic and prehistoric cultural resources that are present. Open space habitat management and recreational access programs should be initiated to protect resources and create recreational opportunities. The LSCA is linked with several state and federal Heritage Areas, the Lackawanna Heritage Valley, and the Delaware Lehigh Heritage Corridor. The Susquehanna River Greenway Plan also links the LSCA to the Susquehanna River Greenway and other heritage areas. The LLR-WRAP recommends that the recreational and cultural opportunities represented in the LSCA be further developed as part of the proposed comprehensive plan.
- The LLR-WRAP recommends that existing flood plain elevations and values be maintained within the elevations recorded from the 2011 flood event. The plan supports the completion of flood control protection for Duryea and the design and construction of a flood control program for West Pittston. This plan recommends that flood protection and flood proofing be developed for the Lower Lackawanna Valley Sewer Authority (LLVSA) plant on Coxton Road. Flood proofing and flood damage reduction capacities need to be included in the overall development parameters for active and passive AMD treatment facilities proposed for the LSCA.
- The LLR-WRAP also recommends the collaboration of municipalities with the LLVSA and the LRCA to promote community compliance with long-term-controls for the combined sewer overflows (CSO) and additional collaboration with the municipalities for the Municipal Separate Storm Sewer System (MS4).
- The LLR-WRAP recommends that the LLVSA collaborate with LRCA, EPCAMR, and SRBC to advance the development of the LLCC to advance the construction and operation of a mine water treatment plant and related programs.
- The LLR-WRAP recommends that LLWSG continue all efforts to develop and fund feasibility studies and transportation improvement plans for the LSCA and collaborate

with property owners to maximize sustainable resource and economic development opportunities. This can include a research and development consortium with local regional universities, resource conservation and development agencies, and economic development agencies.

- The LLR-WRAP recommends that LRCA continue in collaboration with EPCAMR, SRBC, and local and state agencies as appropriate to identify and secure funding for feasibility studies. Comprehensive planning is necessary to address site constraints and facilitate a sustainable development program for the long-term operation of the treatment facility and related industries.

### **1.3 Consideration for Implementation**

SMCRA is providing over one billion dollars in Mine Reclamation Trust Fund payments to PA. PA DEP may, at its discretion, set aside up to 30 percent of the funding it receives to address AMD pollution. OSM has established the QHUP process to guide the states in prioritizing and allocating the funding. PA DEP has established a prioritization policy to recapitalize existing treatment plants that it had constructed in the 1970's, followed by recapitalization for plants acquired from private sector operators through bankruptcy and /or bond forfeiture.

After those priorities are addressed, the remaining funds are available to develop new treatment systems for sites that have established QHUP's. When the SMCRA reauthorization expires in 2022, there will no longer be a source of federal funds specifically allocated to construct and operate AMD treatment facilities. Consequently, the LRCA suggests that time is of the essence in securing the QHU status and prioritization by PA DEP so that OFB and DB can be treated.

The environmental pollution so evident at the LSCA has been the subject of study by PA going back to at least 1904 as evidenced by the Dodge report. The most recent study by SRBC (2011) demonstrates that the OFB is the largest single source of AMD by volume and, together with the nearby DB, is the source of 25 percent of the total Fe loading in the entire North Branch Susquehanna River. A treatment facility for these two discharges is the top priority of the SRBC study and this LLR-WRAP.

It is incumbent on all elected officials in the Lower Lackawanna Valley to join with LRCA and our fellow stakeholders to prioritize local and state government policy leading to treatment plant development and operation in a long-term sustainable fashion.

LRCA further suggests that a long-term program is necessary to provide perpetual funding sources to insure continuous operation of a treatment plant. Multiple sources of funding may be available through the development of adjacent private investment sites to support related industries in the water resource and energy sectors.

A not-for-profit community development corporation is suggested as a way to maximize the opportunities that can result in a thoughtful and well-planned development of the LSCA.

A development program, such as the one suggested, could engender numerous private investment opportunities that may develop environmentally sustainable businesses, providing family supporting and green technology employment.

Lastly, sustainable development at the LSCA can help restore the value of this site as a strategic crossroads in the heart of the LWV, halfway between our historic downtowns of Scranton and Wilkes-Barre. This development will also build value for Pittston, West Pittston, Duryea, and other nearby communities by providing new economic opportunities and revitalized infrastructure integrated with a rebirth of our rivers and the lands around their confluence.

#### **1.4 Vision for a Revitalized River**

The LLR-WRAP suggests a strategy to clean up and revitalize one of the most visible sources of pollution in the watershed of the Chesapeake Bay. The lower three miles of the Lackawanna River in Northeast Pennsylvania flow with the bright orange and yellow staining of Fe oxide from two sources of AMD (OFBH and DB). OFBH and DB combined average ~75 MGD (116 CFS) and discharge almost 5 tons/day of Fe into the Lackawanna River. As the Lackawanna River flows into the North Branch Susquehanna River at Coxton Point, this Fe trace is visible for quite a length along the eastern bank. It is a visible challenge that can inspire a creative and imaginative response benefiting both our rivers and our community.

The LLR-WRAP is the result of collaborations among local residents, property owners, business interests, and elected officials in dialogue with staff from local, state, and federal agencies. This plan has not been written by consultants, rather it is the product of local people who have been working along the rivers of the NAF for many years.

Twenty-five years ago, in 1987, the people of our communities created the LRCA to speak out for a revitalized river. The LRCA developed a Citizens Master Plan for the Lackawanna River in 1990. The plan does not reside on a shelf. It flows with the water. It is living as the river is living. It looks at the negative impacts from nearly 200 years of abuse and it suggests ways to heal our environment from the abuse of our coal mining legacy, to involve the community with that healing, and to create lasting value with the outcome.

This LLR-WRAP envisions the LSCA revitalized and integrating multiple land uses for conservation, industrial, commercial, and residential developments.

The plan envisions an AMD treatment plant treating the combined flows of OFB and DB. The plant is surrounded by ponds and wetland habitats that provide additional natural treatment of the AMD flows before discharging as clean water back into the Lackawanna River.

This plan envisions other economic investments adjacent to the AMD treatment Plant. An Fe oxide processing plant could take the oxides removed from the AMD flows to market as feedstock for several other industries. A bio-fuels plant could convert waste products from PA agriculture and timber industries into motor vehicle fuels. Several other energy production uses could be associated with the site including vertical axis windmills, geothermal heating, and hydroelectric generation. These industries could help the establishment of a development district at the LSCA.

Additional wastewater treatment facilities and a water withdrawal point related to the nearby Marcellus shale gas industry could provide an income stream to help fund operation of the AMD plant. The management of the treatment flows and mine pool elevations could provide a source of clean water to augment the flows in the Susquehanna River during low flow conditions and provide another income source for the AMD treatment plant. The flows of the AMDs can also provide opportunities for hydroelectric generation potentially producing a surplus of power for the treatment plant and adjacent users. For example, assuming an average OFB flow of 95 CFS, head pressure of 5 feet, and 75 percent efficiency, ~30 kilowatts (KW) could be generated. An additional 30 KW could then be produced for every additional 5 feet of head.

The plan further envisions an improved roadway network to safely expedite truck and automobile traffic through the LSCA and out to regional arterial roadways and highways. An expansion of shipping and transshipping opportunities is also envisioned for the Reading and Northern Coxtan Rail Yard. Long term, the plan also envisions a land reclamation program addressing AML issues along the line of coal outcrops in the upland portions of the site. This could support new residential opportunities, perhaps with a neo-traditional village center and mixed-use housing along the flanks of Campbell's Ledge and West Mountain where Duryea, Old Forge, and Ransom Township boundaries converge.

The comprehensive plan that is recommended can create design parameters to enhance and protect green space and natural habitats such as the wooded ridgeline and the stream corridors of Campbell's Ledge Run and Red Spring Run. All of these new residential sites would overlook the treatment plant and associated industrial sites on the upland terraces, with the wetlands preserved to allow flood storage capacity, and habitats restored with the practices of conservation ecology. These activities will provide wildlife habitat, river access sites, and open space recreation opportunities all throughout the LSCA.

## **1.5 Scope of Work**

The scope of work for the LLR-WRAP includes the following elements:

- A historical review of previous relevant plans and studies
- A characterization of the issues related to the aquatic and terrestrial resources
- A characterization of the mine pools and drainage points
- An active monitoring, data collection, and analysis program
- A community stakeholders committee process and a key-person interview process to develop input, review findings, and build consensus for recommendations
- Publication of the LLR-WRAP as per stakeholders consensus
- All leading to the eventual completion of a QHUP for the Lower Lackawanna River

Primarily, staff from the LRCA, EPCAMR, and SRBC have conducted the research and fieldwork with additional technical field services provided by PA Tectonics. A community stakeholders committee, LLWSG, has been convened at the invitation of LRCA. The LLWSG have met several times during the course of the planning work and have provided review and input into the LLR-WRAP development and its recommendations.

The primary objectives of this scope of work are to produce all of the information necessary to complete the Lower Lackawanna QHUP, which will then be prioritized by PA DEP for the installation and operation of an AMD treatment system and to convene a community-based stakeholders group to support and advance that objective.

The development of additional recommendations is dependent on securing the QHU and building the AMD treatment facility.

*This document is only an executive summary of the full Lower Lackawanna Watershed Restoration Action Plan. For a copy of the full version please contact the Lackawanna River Corridor Association or the Eastern Pennsylvania Coalition for Abandoned Mine Reclamation.*

LRCA • 2006 N. Main Ave. • Scranton, PA 18508 • 570.347.6311  
lrca@lrca.org • www.lrca.org

EPCAMR • 101 S. Main St. • Ashley, PA 18706 • 570.371.3523  
info@epcamr.org • www.epcamr.org

## **Acronyms and Abbreviations**

AMD - abandoned mine drainage  
AML - abandoned mine land  
AMLIS - Abandoned Mine Land Inventory System  
BWT - Butler Water Tunnel  
CMP - Central Mine Pool  
CWA - Clean Water Act  
CSO - combined sewer overflows  
CFS - cubic feet per second  
DB - Duryea Breach  
EPCAMR – Eastern Pennsylvania Coalition for Abandoned Mine Reclamation  
EPA - Environmental Protection Agency  
FPW – Foundation for Pennsylvania Watersheds  
GIS - geographic information system  
Fe - iron  
KW - kilowatts  
LLCC - Lower Lackawanna Confluence Coalition  
LLR-WRAP - Lower Lackawanna River Watershed Restoration and Assessment Plan  
LLVSA - Lower Lackawanna Valley Sewer Authority  
LLWSG - Lower Lackawanna Watershed Stakeholders Group  
LRBSA - Lackawanna River Basin Sewer Authority  
LRCA – Lackawanna River Corridor Association  
LSCA – Lackawanna / Susquehanna Confluence Area  
LWV - Lackawanna-Wyoming Valley  
MSMP - Metropolitan Scranton Mine Pool  
MGD - million gallons per day  
MCHU - multi-colliery hydrogeological units  
MS4 - Municipal Separate Storm Sewer System  
MPO TIP – Metropolitan Planning Organization Transportation Improvement Plan  
NPDES - National Pollution Discharge and Elimination System  
NAF - Northern Anthracite Field  
#9MP - No. 9 Mine Pool  
OFB - Old Forge Borehole  
OSM - Office of Surface Mining (U.S. Department of the Interior)  
PAWC - Pennsylvania American Water Company  
PA DEP – Pennsylvania Department of Environmental Protection  
PEC - Pennsylvania Environmental Council  
PG&W - Pennsylvania Gas and Water Company  
lbs/day - pounds per day  
QHUP - Qualified Hydrologic Unit Plan  
SRBC – Susquehanna River Basin Commission  
SMCRA - Surface Mining Control and Reclamation Act  
TMDL - Total Maximum Daily Load  
USBM – United States Bureau of Mines  
USGS - United States Geologic Service