ABANDONED MINE LAND and RECLAMATION JOINT CONFERENCE

2019

The Point in Pittsburgh, Circa 1900

Restore.Transform.Revitalize.

PENNSYLVANIA'S Annual Conference on Abandoned Mine Reclamation

Pittsburgh 2019 NAAMLP Restore • Transform • Revitalize

pennsylvania

NASLR NATIONAL ASSOCIATION OF STATE LAND RECLAMATIONISTS

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ABANDONED MINE LAND (AML) and RECLAMATION JOINT CONFERENCE

COMMONWEALTH OF PENNSYLVANIA
OFFICE OF THE GOVERNOR

GREETINGS:

It is my pleasure to welcome all gathered to the City of Pittsburgh for the 41st Annual Conference of the National Association of Abandoned Mine Lands (NAAMLP). This year's conference is being conducted jointly with the Pennsylvania Abandoned Mine Reclamation's 21st Annual Conference and the National Association of State Land Reclamationists' 47th Annual Conference.

Pittsburgh has a rich industrial heritage founded on the abundance of coal which helped fuel the industrial revolution. The Pittsburgh Coal Seam is widely considered to be one of the world's most significant energy resources. It was first discovered in the 1760s at the base of Coal Hill, now known as Mount Washington, across the Monongahela River from downtown Pittsburgh. By the time the federal Surface Mining Control and Reclamation Act was passed by Congress in 1977, more than 15 billion tons of coal had been mined in Pennsylvania. As a result of our coal mining heritage, we are also left with a legacy of abandoned mine lands and abandoned mine drainage which scar our landscape, present hazards to our citizens, and degrade our environment. Pennsylvania has more abandoned mine land and more miles of streams impaired by abandoned mine drainage than any other state in the nation.

It is fitting that this year's conference, with the theme of Restore, Transform, and Revitalize, is to be held in Pittsburgh. This once industrial city, known for its coal mining and steel mills, has restored many of its former industrial and mining sites, transformed its economy to one of high-tech and innovative companies, and revitalized the city and its neighborhoods. It is my hope this conference provides a forum for those gathered to exchange ideas, learn from your collective successes, and continue to work collaboratively to restore abandoned mine lands across our commonwealth and across the nation.

As Governor, and on behalf of all the citizens of the Commonwealth of Pennsylvania, I am delighted to welcome you to the 41st Annual Conference of the National Association of Abandoned Mine Lands. Please accept my best wishes for a memorable event and continued success.

TOM WOLF
Governor
September 8, 2019

NATIONAL ASSOCIATION OF ABANDONED MINE LAND PROGRAMS

Welcome to Pittsburgh, Pennsylvania! Thank you for joining us at the National Association of Abandoned Mine Land Program's (NAAMLP) 41st Annual Conference. NAAMLP is proud to be joining the 21st annual Pennsylvania Abandoned Mine Reclamation Conference (PA AMR) and the 47th annual National Association of State Land Reclamationists' Conference (NASLR).

Our three organizations share common goals and interests focused on successful reclamation and environmental restoration of previously and currently mined sites including the abatement or treatment of mine drainage. We hope that the multi-organization focus will provide conference attendees a broader range of mining and reclamation topics and issues as well as increased opportunities for both networking and sponsor & exhibitor outreach.

On behalf of the NAAMLP, I want to thank everyone who has worked to make this event possible, the conference's planners and organizers, sponsors and exhibitors for their hard work.

Key to NAAMLP's mission is to provide a forum to address current issues, discuss common problems and share technologies regarding reclamation of abandoned mine lands. Unfortunately, the future of abandoned mine reclamation is uncertain. We, as mine reclamation professionals, must work together and support each other to ensure that abandoned mine reclamation continues across the United States. To be successful, small programs need support from larger programs, regions need to reach across the country to ask for help and we need to share our technological advancement to bolster everyone's efforts. That is accomplished by attending technical sessions, visiting with exhibitors and networking in the hallways of this conference. No one person holds all the keys to reclamation success, it takes forming a team of experts and applying their experience and knowledge to pull off some of the most complex mine reclamation projects across the United States.

The need for continued abandoned mine land reclamation is very important to all of us and we have this opportunity to raise that profile to the rest of the country. The Pennsylvania Abandoned Mine Reclamation Program sets the gold standard for mine reclamation in the nation and I am very excited that they will show off their good work on the technical tours. These projects are examples of partnership and innovation that have resulted in projects of regional and national importance.

The theme of this year's conference is to Restore, Transform and Revitalize. We have the unique opportunity to RESTORE lands that have been impacted by mineral development, our work has the literal outcome of removing safety and environmental hazards to leave behind land that is functional, useful and has opportunities for the future. To see these once productive lands and waters TRANSFORMED into places we need and we can be proud of is a meaningful driver behind the work we do. Finally, the opportunity to use mine reclamation to REVITALIZE communities and economic opportunities is fundamental to our work. Beyond buildings and business opportunities, abandoned mine reclamation restores lands and waters for our future. Clean safe land and water is key to a healthy economic future. Mine reclamation work is visible, measurable and rewarding. I am lucky to celebrate your successes and share mine at this conference.

Many thanks,

Autumn Coleman
President of NAAMLP

NASLR
NATIONAL ASSOCIATION OF STATE LAND RECLAMATIONISTS

Welcome to beautiful Pittsburgh, Pennsylvania for the 47th Annual Conference of the National Association of State Land Reclamationists (NASLR)! On behalf of NASLR, I would like to extend many thanks to both the National Association of Abandoned Mine Land Programs (NAAMLP) and the Pennsylvania Abandoned Mine Reclamation conference (PA AMR) for welcoming us to be a part of this joint conference. The outstanding employees of the Pennsylvania Department of Environmental Protection (PA DEP) also have our gratitude as they've worked tirelessly to make sure that this conference is a success.

It is amazing to think that NASLR has reached 47 years of existence and service to reclamation professionals working with state agencies, government, and industry. Our association's goal is to promote the use of research, innovative technology, and professional development to foster superior restoration of land and waters affected by mining. The benefits of being part of such an organization are great. If you are interested in joining NASLR or obtaining more information about us, do not hesitate to speak to me, stop by the NASLR booth, or visit our website at www.naslr.org.

I encourage all NASLR members to join us on an excellent, educational field excursion on Wednesday where we will get a chance to visit active and reclaimed surface mines, as well as observe shadow effects of longwall mining. It is a great opportunity for us to discuss the challenges we face on a day-to-day basis and the progress being made in mining and reclamation. In addition, with cooperation and leadership from the Office of Surface Mining Reclamation and Enforcement (OSMRE), we will be offering a hands-on training course on OSMRE's AMDTreat software Thursday morning. Members are encouraged to attend the training course and learn about the software and how it may be beneficial to your state program.

I am happy to announce that the 2020 NASLR Conference will be hosted by the state of New York in their beautiful capital city of Albany the week of October 18-21, 2020! Please stop by our booth to speak with our members and get additional information about next year's Conference!

Once again, I would like to thank NAAMLP, PA AMR, PA DEP, presenters, sponsors, and exhibitors for their efforts in making this a successful conference. To all attendees, I extend my gratitude for your support of this joint conference and its three outstanding host organizations, as well as your everyday efforts in reclamation. I encourage everyone to take full advantage of this week, from attending the technical sessions and conference tours, to networking and visiting our sponsor and exhibitor booths. Have a wonderful conference!

Sincerely,

Danielle M. Duhé
NASLR President

PENNSYLVANIA's Annual Conference on Abandoned Mine Reclamation

On behalf of the PA Abandoned Mine Reclamation Conference Planning Committee, we would like to welcome you to Pittsburgh, PA. We are jointly participating in our 21st Annual Conference with the 41st Annual Conference of the National Association of Abandoned Mine Land Programs (NAAMLP) and the 47th Annual Conference of the National Association of State Land Reclamationists (NASLR). Many months of planning by NAAMLP, NASLR, PA DEP Staff from a number of Bureaus and Offices, along with the Eastern and Western PA Coalitions for Abandoned Mine Reclamation (EPCAMR and WPCAMR) and partners from the PA AMR Conference Planning Committee have led to the development of a packed conference agenda complete with networking, opportunities to build coalitions, presentations on innovative approaches to abandoned mine land reclamation and AMD remediation, economic development successes on abandoned mines across the country, tours, award ceremonies to recognize leaders in reclamation, and recognition of our sponsors and National partners.

We invite you all to come and mix and mingle with our PA AMR community of non-profits, reclamation partners, and coalfield community volunteers from across the State who have dedicated their time to seeing that our land and waterways are reclaimed and improved for future generations. We encourage each of you to find ways that you might be able to support and learn from one another and transfer knowledge to each other so we may all transform our national landscape to one without abandoned mine impacts.

Twenty-one years of conferences by the PA AMR Conference watershed community is a long time for our partners to continuously be able to convene annually to take on the daunting challenges that we continue to face. Our reclamation community addresses water quality, land reclamation, jobs, economic development opportunities, quality of life issues, wildlife habitat restoration, stream restoration, recreational opportunities, private sector investment leveraged with State and Federal funds, and foundation support for projects. We are also working toward the reauthorization of the Surface Mining Control and Reclamation Act by the year 2021. We want to continue to increase our ability to green our landscapes, improve our regional economies, and improve the health and safety of our communities. These annual conference have become our "coming home" event for us to fortify our community connections and friendships beyond our professional responsibilities to our work, to share in the accomplishments that we have done from year to year, and to recognize the dedication of our collective efforts to do what is right and necessary to reclaim our historic mine-scarred lands, rivers, and streams. We are a part of a much larger coalition that is doing a tremendous amount of work and this year's conference will surely showcase these types of public-private partnerships.

We'd like to thank the Conference sponsors that have supported the PA AMR Conference year in and year out. It is through some of those sponsorships that we are able to keep providing scholarships to our watershed community to attend our annual conferences. Be sure to stop by their exhibits and meet with them to see what types of solutions or services that they can provide to you.

The reclamation and AMD remediation work is not done in PA, nor is it completed in many other States across the country and throughout Appalachia. Enjoy your stay at the conference and help us help you to RESTORE, TRANSFORM, AND REVITALIZE our Nation's communities that are impacted by abandoned mines. We encourage you to become a part of our "coming home" event and be sure to have a great time in Pittsburgh! Our 22nd Annual Conference will be held in State College, PA in June 2020. Mark your calendars! See our website for details at 2020.treatminewater.com.

On behalf of the PA AMR Conference Committee

Robert E. Hughes, 2019 PA AMR Conference Co-Chair
Executive Director of EPCAMR

Andy McAllister, 2019 PA AMR Conference Co-Chair
Regional Coordinator of WPCAMR

Conference **AGENDA**

Sunday, September 8, 2019

10:00 AM	–	5:00 PM	NAAMLP Committee Meetings *(Rivers and Brigade Meeting Rooms)*
1:00 PM	–	5:00 PM	Exhibitor Setup *(Ballroom Foyer and Ballroom 2)*
1:00 PM	–	6:00 PM	Registration *(Kings Landing)*
2:00 PM	–	6:00 PM	Speaker Ready Room *(Black Diamond)*
6:00 PM	–	8:00 PM	Welcome Reception with Exhibitors
8:30 PM	–	11:00 PM	Hospitality Suite

Monday, September 9, 2019

6:30 AM	–	8:00 AM	Breakfast with Exhibitors *(Ballroom Foyer and Ballroom 2)*
6:30 AM	–	5:00 PM	Registration and Speaker Ready Room Open
7:00 AM	–	7:30 AM	Plenary Session Preparation *(Ballroom 2)*
8:00 AM	–	10:30 AM	Plenary Session including Reauthorization Panel Discussion
10:30 AM	–	11:00 AM	Break with Exhibitors
11:00 AM	–	12:00 PM	Technical Session *(Five Concurrent)*
11:30 AM	–	12:00 PM	Awards Banquet Preparation *(Ballroom 2)*
12:00 PM	–	1:30 PM	Lunch *(On your own)*
1:30 PM	–	3:00 PM	Technical Sessions *(Five Concurrent)*
3:00 PM	–	3:30 PM	Break with Vendors/Exhibitors
3:30 PM	–	5:00 PM	Technical Sessions *(Five Concurrent)*
5:30 PM	–	6:15 PM	Reception *(Ballroom Foyer)*
6:30 PM	–	9:30 PM	NAAMLP and NASLR Awards Banquet *(Grand Ballroom)*
9:30 PM	–	11:00 PM	Hospitality Suite

Tuesday, September 10, 2019

6:30 AM	–	8:00 AM	"Grab and Go" Breakfast with Exhibitors *(Ballroom Foyer and Ballroom 2)*
7:00 AM	–	4:00 PM	Technical Tours *(Boxed Lunch Provided)*
		7:00 AM – 4:00 PM	Tour 1 – Flight 93 Memorial and AMD Treatment
		7:15 AM – 3:50 PM	Tour 2 – Fallingwater & Indian Creek Restoration
		7:30 AM – 3:50 PM	Tour 3 – Carrie Blast Furnace & Tour-Ed Mine Tour
		8:00 AM – 3:00 PM	Tour 4 – Pittsburgh Botanic Garden & Pittsburgh Airport
6:00 PM	–	9:30 PM	Dinner Cruise on the Gateway Clipper Including PA AMR Mayfly Awards
9:30 PM	–	11:00 PM	Hospitality Suite

Wednesday, September 11, 2019

6:30 AM	–	8:00 AM	Breakfast with Exhibitors *(Ballroom Foyer and Ballroom 2)*
8:00 AM	–	10:30 AM	Technical Sessions *(Five Concurrent)*
10:30 AM	–	11:00 AM	Break with Exhibitors
11:00 AM	–	1:00 PM	Technical Sessions *(Five Concurrent)*
		1:00 PM	Main Conference Concludes
12:30 PM	–	1:30 PM	Lunch for NAAMLP Delegates
1:30 PM	–	5:30 PM	NAAMLP Business Meeting *(Commonwealth 2 Meeting Room)*

Thursday, September 12, 2019

7:30 AM	–	8:30 AM	Breakfast *(On your own)*
8:30 AM	–	12:00 PM	NAAMLP Business Meeting *(Commonwealth 2 Meeting Room)*
12:00 PM	–	1:00 PM	Lunch for NAAMLP Delegates
1:00 PM	–	5:00 PM	NAAMLP Business Meeting *(Commonwealth 2 Meeting Room)*

Conference **Agenda for NASLR**

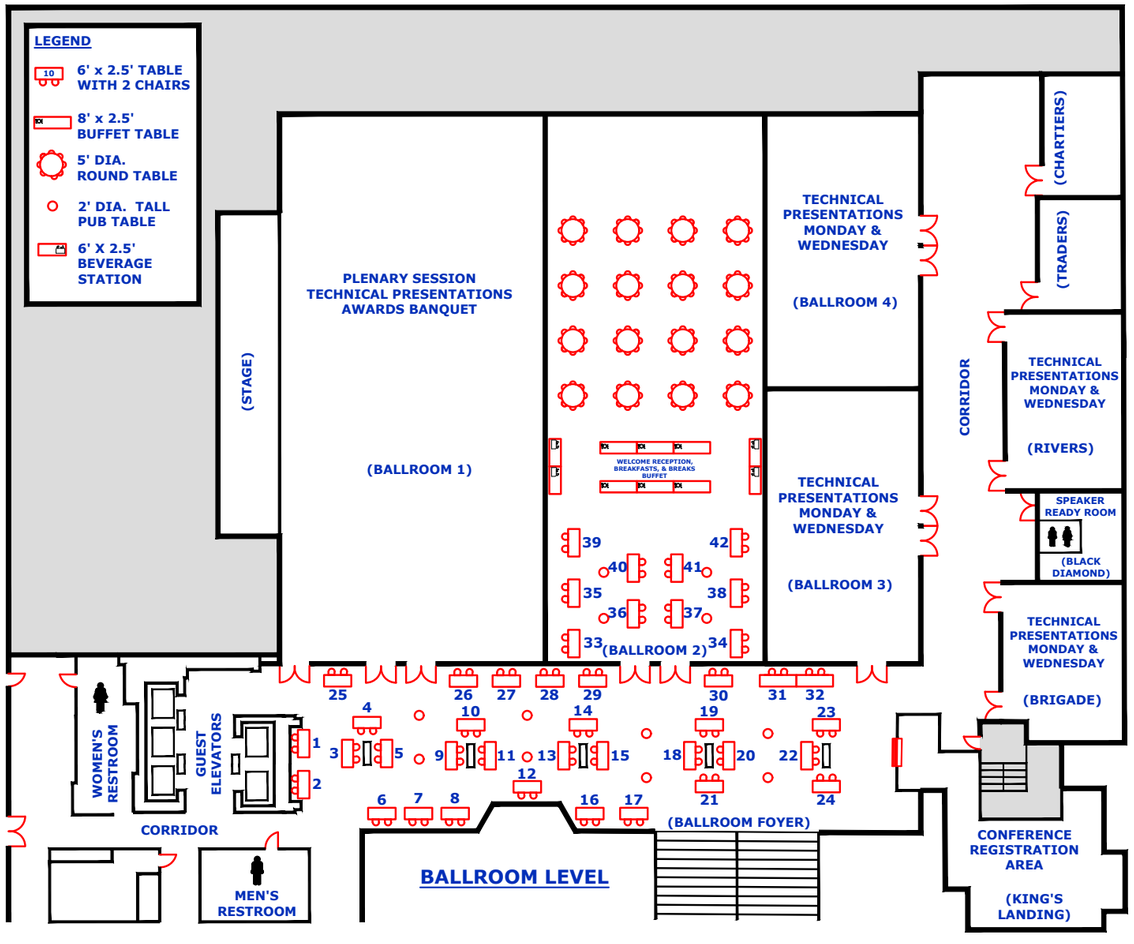
Wednesday, September 11, 2019 (NASLR only)

6:30 AM	–	7:30 AM	Breakfast with Exhibitors *(Ballroom Foyer and Ballroom 2)*
7:30 AM	–	4:30 PM	NASLR Tour of Southwest Pennsylvania Coalfields
7:30 AM	–	11:30 AM	Coal Surface Mine Operation near Ligonier
11:30 AM	–	12:30 PM	Lunch at the California District Mining Office
12:30 PM	–	2:30 PM	Templeton Run and Wetland Restoration Projects
2:30 PM	–	4:30 PM	Tour of Longwall Mining Subsidence
		5:00 PM	Return to Wyndham Grand Hotel

Thursday, September 12, 2019 (NASLR only)

8:30 AM	–	10:30 AM	AMDtreat Workshop (OSMRE Greentree Office)
10:30 AM	–	12:30 PM	NASLR Business Meeting (OSMRE Greentree Office)

Conference **MEETING ROOMS** AND Exhibitor **BOOTH LAYOUT**



LOGO	BOOTH NO.	ORGANIZATION
	1.	RESERVED
	2.	RESERVED
	3.	MILLCREEK COALITION
	4.	RAMBOLL
	5.	FOAM CONCEPTS
	6.	AQUAFIX
	7.	RESERVED
	8.	SOMERSET ENVIRONMENTAL SOLUTIONS
	9.	GSI
	10.	COSMOS TECHNOLOGIES
	11.	MARTLIN
	12.	SME
	13.	COASTAL TECH SALES
	14.	OFFICE OF SURFACE MINING
	15.	TRI HYDRO
	16.	EARTH CONSERVANCY
	17.	DAMIN PRINTING
	18.	PROFILE PRODUCTS
	19.	ARRIPPA
	20.	FLEXAMAT

LOGO	BOOTH NO.	ORGANIZATION
	21.	TOPCON
	22.	EAST COAST EROSION CONTROL
	23.	FULL CIRCLE MUSHROOM COMP
	24.	RESPEC
	25.	RESERVED
	26.	BRIERLEY ASSOCIATES, CORP.
	27.	THEIA
	28.	TENCATE GEOTUBE
	29.	TETRA TECH
	30.	HOWARD PUMPING CONCRETE
	31.	WYOMING DEQ
	32.	PENNSYLVANIA DEPART. OF ENVIRONMENTAL PROTECTION
	33.	SRBC
	34.	ERNST
	35.	COMMONWEALTH EQUIPMENT
	36.	WPCAMR
	37.	WPCAMR
	38.	NASLR
	39.	HARSCO
	40.	EPCAMR
	41.	EPCAMR
	42.	GOLDER

Technical Session **SCHEDULE**

Monday, September 9, 2019

Grand Ballroom 1

8:00 AM – 9:00 AM Plenary Session
9:00 AM – 10:30 AM Panel Discussion on AML Reauthorization

Monday Breaks and Lunch

10:30 AM – 11:00 AM Break
12:00 PM – 1:30 PM Lunch (On Your Own)
3:00 PM – 3:30 PM Break

Time	Rivers	Brigade	Grand ballroom 3	Grand ballroom 4	Grand ballroom 1
11:00 – 11:30	Mine Subsidence Engineering: An Overview **Gennaro G. Marino, Ph.D., P.E., D.GE**	Poultry Litter Biochar Role in Remediation **Tina Metzer**	Preservation and Progress: Protection of AML PTS Clean Water Infrastructure, **John Dawes and Joseph Pizarchik**	Waste Coal-to-Energy: A Quarter-Century Land and Water Restoration Success Story **Dennis C. Simmers**	Website Demonstration for www.ourworksnotdone.org **Eric E. Cavazza, P.E. and Keith Guille**
11:30 – 12:00		An Overview of the Groundwater Data Collected as Part of the 2015 EPS CCR Rule at CCR Landfills and Surface Impoundments **Cecil Slaughter**	Working, Learning, and Thinking Together in the 21st Century **Dr. Bill Bellows and Robert E. Hughes**	Environmental & Economic Benefits of the Coal Refuse Electric Generating Industry, **Jaret Gibbons**	The Legacy of Mining Colorado's Southern Coalfields, **Sarah Russell**
1:30 – 2:00	Impacts of Coal Mining on Structures in Western PA, **Richard E. Gray**	There He Goes Again Another Discussion of Mine-Water Geothermal, **Michael C Korb, P.E.**	Multiple Paths to Progress: How 25 Years of AML Reclamation Has Transformed More than the Land **Elizabeth W. Hughes, EdD**	Restoration of Waste Coal Piles through Public and Private Cooperation **James Panaro and Dean Baker, P.E.**	HQ OSMRE National Environmental Policy Act Program (NEPA), Program Review - Highlighting the 2019 OSMRE NEPA Handbook **Stephanie Hamlett, Michelle Fishburne, and Octavia Conerly**
2:00 – 2:30	Use of Expanding Foam to Fill Small Subsidence Holes at WVU Farms **Dr. Jeff Skousen and Marcus Anderson**	Remote Environmental Monitoring Solutions **Jeff Taylor**	Datashed: An Online Tool for Managing AMD Treatment Systems and Restoration of Impacted Watersheds, **Cliff Denholm**	Scrubgrass Generating Co., L.P. An Overview of the Russelton Minesite and an Overview of the Venango #1 AML Pilot Project, **RJ Shaffer**	
2:30 – 3:00	Is My House Going to Sink? Part 2: Carrie, **Bill Snoddy**	Drones/UAV: Providing Rapid Innovative Leaps in Abandoned Mine Reclamation Strategies **Daniel Bochicchio**	When Elvis Leaves the Building Preserving and Recollecting Institutional Knowledge **Michael C Korb, P.E.**	Remining and Reclamation, Harry E Coal Refuse Site, **Henry Zielinski, P.E. and Matthew Cochran**	
3:30 – 4:00	PHREEQ-N-AMDTreat Model to Evaluate Water-Quality Effects from Passive and Active Treatment of Mine Drainage **Charles A Cravotta III**	Kenilworth Maintenance III Reclamation Project - Stream Stabilization in Highly Erodible Shale and Coal Refuse, **Kent Phillips**	Utilizing UAV Elevation Data to Model Surfaces and Calculate Volumes, **Robert Cammack**	Co-treating Acid Mine Drainage and Municipal Wastewater in an Existing Conventional Wastewater Treatment Plant, **Travis Tasker**	Geomorphic workshop **Alan Edwards**
4:00 – 4:30	Screen to Stream: Engaging Students to Explore Local Watershed Issues and Become Environmentally Alert Citizen Scientists, **Peter M. Smyntek**	The Use of Advanced Membrane Filtration as an AMD Remediation Method, **Michael J. McCluskey**	Characterizing, Prioritizing, and Managing Colorado's Underground Coal Mine Fires, **Tara Tafi and Jeffrey Nuttall, P.G.**	Abatement of AMD at the Germantown AML site in West Central Missouri Daniel P. Wedemeyer and **Paul T. Behum, Ph.D.**	
4:30 – 5:00	Reclaiming our Backyard: Engaging Youth with Gardening Skills, **Laura E Rinehimer**	Batch Extraction Method to Estimate Total Dissolved Solids (TDS) Release from Coal Refuse and Overburden, **Charles A Cravotta III**	How PA Successfully Converted 110,000+ Paper Historic Underground Mine Maps to a Digital Map Repository and GIS **Patrick Jaquay, GISP**	The Skeleton Keys of Turf Reinforcement **Lisa Simms, P.E.**	

Technical Session **SCHEDULE**

Wednesday, September 11, 2019

10:30 AM – 11:00 AM Break

Time	Rivers	Brigade	Grand ballroom 3	Grand ballroom 4	Grand ballroom 1
8:00 – 8:30	Properties and Potential Use of Spent Horizontal Directional Drilling Mud as Soil Amendment, **Amir Hass**	Hydrogeochemical and Microbial Interactions During Field Mixing of Abandoned Mine Drainage and Sewage-Impacted Streams, **Peter Smyntek**	Performance of a Drainable Limestone Bed at the Pittsburgh Botanic Garden Lotus Pond Exhibit **Robert Hedin**	Wins and Losses in Two Years of the AML Pilot Program **Jim Cable**	NAAMLP Hardrock Award Presentation - Remediation of Contamination Impacting the Environment or Human Health
8:30 – 9:00	Recovery of Rare Earth Elements from Acid Mine Drainage Using Geotextile Tubes Containment and Dewatering Technology **Tom Stephens**	Five Fundamentals for Successful Mined Land Rehabilitation - Selected Case Studies **Stephen Zwilling**	Wingfield Pines - A Community and Recreation Driven AMD Remediation Success… With Challenges of Course **Emilie Rzotkiewicz**	Proven Pilot Partnerships: Ohio AML Program and Rural Action **Marissa Lautzenheiser and Terry Van Offeren**	NAAMLP Hardrock Award Presentation - Remediation of Physical Safety Hazards at Legacy Abandoned Hardrock Mines
9:00 – 9:30	Phillips Mine fire - A Containment & Extinguishment Design Plan **Tim Danehy**	Soil Water Quality at Sandstone Spoils Reclaimed Surface Mine Site - Biogeochemical Processes and Implications, **Amir Hass**	Successful Acid Mine Drainage Abatement - A Case Study **Joseph E. Mills**	Ohio AML Pilot Projects - Combining Reclamation with Economic Development **Ben McCament**	Defense-Related Uranium Mines Program, **Jay Glascock and Steve Renner**
9:30 – 10:00	743 Days, From AML Site to Prime Commercial Development Site, The Hazleton Airport Project **Mike Lazorcik, P.E. and Joe Sassaman, P.G.**	Revisiting Carbon Sequestration Potential on Appalachian Legacy Mines: Review and Synthesis **Kenton Sena and Chris Barton**	Tracking the Efficiency of Abandoned Mine Drainage Treatment Facilities through Biological Monitoring in the Indian Creek Watershed, **Carla Ruddock**	Acid Mine Drainage Paint Pigment **Michelle Shively and Dr. Guy Riefler**	How Diverse Are Forests After Using Forestry Reclamation Approach Techniques on Abandoned Mine Lands in PA? **Carol M. Varano, P.E.**
10:00 – 10:30	National AML Award Presentation	Spatiotemporal Changes in Contaminants Occurring in Three Passive Coal Mine Remediation Systems in PA **Michelle M. Valkanas**	Ohio Acid Mine Drainage Watersheds: Changes in Fish Communities, **Jeff Calhoun**	Use of Reclaimed and Abandoned Lands for Income Opportunities and Development **Dr. Jeff Skousen**	AML and "Our Work's Not Done" Video Presentaion
11:00 – 11:30	National Small Program AML Award Presentation	10+ Year Passive Treatment System Performance Evaluation, **Timothy P. Danehy**	Utilization of Survey123 to Simplify and Direct Field Investigations **Lucas Graham**	Cost Effectiveness Analysis of Geomorphic Reclamation **Roger Coupal and Karsyn Lamb**	AML and "Our Work's Not Done" Video Presentaion
11:30 – 12:00	Appalchian Regional AML Award Presentation	Anna S Mine: A Century of Mining, Acid Mine Drainage, and Remediation, **Robert Hedin, Neil Wolfe, and Ted Weaver**	Clarifier Design & Sizing: Implications of AMD Chemistry and Process Design, **Tom Gray, P.E. and Jon Dietz, PH.D.**	Rock Tunnel Passive Treatment Passive Treatment System - Making Bens Creek Great Again **Len Lichvar**	AML and "Our Work's Not Done" Video Presentaion
12:00 – 12:30	Mid-Continent Regional AML Award Presentation	Monitoring Brown Trout Invasion into a Native Brook Trout Stream Post Mine Drainage Remediation: A Cautionary Tale, **Tom Clark & Brianna Hutchison**	Use of Nitrogen Generated Foam to Mitigate a Coal Mine Refuse Fire in Colorado, **Alden Ozment**	Exploring the Latest HP-TRM Technology for stabilizing Critical Situations with Vegetation **Rob Lawson, CPESC**	AML and "Our Work's Not Done" Video Presentaion
12:30 – 1:00	Western Regional AML Award Presentation	Potential Use for Passive Acid Mine Drainage Treatment as Technology - Critical Elements Resource Recovery Systems, **Amir Hass**	Directional Gravity Drainage Boreholes - Proven Very Effective to Drain Abandoned Mine Pools Water to Mitigate Existing Environmental Hazards, **Phillip Mullins, P.E.**	Geomorphic Grading - an Evaluation of Site Performance Across Multiple States **Derrick Thompson, P.E. and Mark Donner, P.E.**	AML and "Our Work's Not Done" Video Presentaion

Plenary Session **SPEAKERS**

Patrick McDonnell

Pennsylvania Department of Environmental Protection Secretary

With 15 years of experience holding a number of positions at Pennsylvania Department of Environmental Protection (DEP), Patrick McDonnell brings a broad perspective to the agency's regulatory and policy development processes.

Prior to being named Acting Secretary, McDonnell served as DEP's director of policy. In addition, he ran the State Energy Office, and was charged with coordination of renewable energy and energy efficiency issues. McDonnell also served several years as executive policy manager for former Commissioner Pamela A. Witmer of the Pennsylvania Public Utility Commission, focusing on electric, natural gas and water issues, as well as cybersecurity and the impact of environmental regulation on energy markets.

Secretary McDonnell began his career at DEP working in the State Energy Office on energy efficiency, renewable energy, and green building projects. Throughout his career, McDonnell has worked to achieve success in the nexus between energy and environmental issues.

A native of Philadelphia, Secretary McDonnell received his Master's degree in Political Science from Lehigh University and his Bachelor's Degree in Politics from DeSales University. He and his wife Colleen have four children, and live in Harrisburg.

Rich Fitzgerald

Allegheny County Executive

County Executive Rich Fitzgerald took office on January 3, 2012, and he's currently in his second term. After more than 19 years in public service, including 12 on County Council, he still relishes his role working with others to make the county a great place to live, work, and play.

Under Rich's leadership, Allegheny County has focused on job creation and economic development to great effect. Last year, the region's unemployment rate reached its lowest level since the 1970s, and since 2012, the county's median household income has risen at nearly double the rate than it has nationally. The region has become a leader in health care, finance, education, manufacturing, arts and culture, and emerging sectors such as robotics, artificial intelligence, autonomous vehicles, and clean energy. And the diversity of opportunity as well as world-class colleges and universities have made the area a magnet for millennials, attracting more than 10,000 over the past five years.

Thanks to that growth and Rich's responsible fiscal stewardship of tax dollars, the county's bond rating was upgraded last year for the fifth time in the past six years, putting it at the highest level since 1983. Additionally, seven straight budgets have passed with no millage increases, and the fund balance has increased substantially providing security and sustainability. The progressive budgets also allow for investment in projects and programs that increase the quality of life for more than 1.2 million residents.

The county's buildings, facilities, vehicles, and nine parks are being upgraded and becoming greener. The Health Department is demonstrating leadership with its aggressive approach to combating complex issues such as the opioid epidemic and air pollution. Pittsburgh International Airport now offers 67 nonstop destinations, almost double the number from just four years ago. And the Port Authority, under new leadership, is enhancing the customer experience and embracing new technology.

Rich says collaboration has been the "secret sauce" to solving the region's toughest problems, and that's why he focuses daily on meeting with constituents and on forming strong partnerships with elected officials at the federal, state, county and local levels, as well as with community leaders in business, labor, and philanthropy.

In addition to his numerous board appointments and memberships as the County Executive, Rich also serves as a member of the board of the County Executives of America, the Remake Learning Council, is Vice Chair of the Southwestern Pennsylvania Commission, and is part of the National Association of County Officials (NACo) Large Urban County Caucus.

Raised in Pittsburgh's Bloomfield-Garfield neighborhood, Rich graduated from Carnegie Mellon University with B.S. in Mechanical Engineering with a business minor. He and his wife, Cathy, a pharmacist, live in Squirrel Hill. They have eight children.

Matt Cartwright

Congressman

U.S. Representative Matt Cartwright represents Pennsylvania's 8th Congressional District, which covers Lackawanna, Pike, and Wayne Counties, as well as parts of Luzerne and Monroe Counties. He was first sworn into Congress on January 3, 2013.

In Congress, Matt is committed to working across the aisle to advocate for hardworking Pennsylvanians. His priorities include strengthening the middle class, creating good-paying jobs, ensuring quality health care, protecting seniors, and supporting veterans and military families.

Over the years, Matt has introduced over 70 pieces of legislation, often with bipartisan support. In fact, he has been recognized for introducing more bipartisan bills than any other House Democrat.

Matt is part of House Leadership, serving as Co-Chair of the Democratic Policy and Communications Committee (DPCC). He is also a member of the powerful House Committee on Appropriations, where he serves as Vice Chair of the Subcommittee on Commerce, Justice, Science, and Related Agencies. Additionally, Matt serves on two other Appropriations subcommittees: Financial Services & General Government, and Military Construction-Veterans' Affairs.

At the start of the 116th Congress, the congressman joined the Committee on Natural Resources, where he serves on the Subcommittee on Energy and Mineral Resources, as well as the Subcommittee on Indigenous Peoples of the United States.

Cartwright's introduced legislation typically expands rights and benefits for Americans who deserve more favorable treatment under the law. His legislative portfolio has focused on cleaning up the environment, helping veterans, securing better pay for federal workers and military personnel, and protecting programs that help our seniors.

Cartwright has been independently recognized for his success in getting legislation passed: his MEGABYTE Act, requiring federal agencies to develop comprehensive software licensing policies, and his Veterans Care Financial Protection Act, protecting veterans from predatory practices, were signed into law by Presidents Obama and Trump, respectively.

Prior to his election to Congress, Cartwright worked as an attorney with Munley, Munley & Cartwright for 25 years. He is a magna cum laude graduate of Hamilton College and a law review graduate of University of Pennsylvania's Law School.

Cartwright is married to Marion Munley Cartwright and is the father of two sons, Jack and Matthew. The Cartwrights live in Moosic.

Glenn Thompson

Congressman

A life-long resident of Howard Township, Congressman Glenn 'GT' Thompson represents Pennsylvania's Fifteenth District in the U.S. House of Representatives.

Prior to being elected to Pennsylvania's geographically largest congressional district, GT spent 28 years as a therapist, rehabilitation services manager and a licensed nursing home administrator. As a result, he has learned firsthand the importance of access to quality healthcare and has become a strong advocate for increased access, affordability, quality of care, and patient choice.

GT is also a former member of the Bald Eagle Area School Board, past vice-chair of the Private Industry Council of the Central Corridor and a former Workforce Investment Board member. Because of these experiences, he was appointed to the House Committee on Education & Workforce in 2008. GT is also serving in his fourth term as Co-Chairman of the bipartisan Congressional Career and Technical Education Caucus. In the 115th Congress, Thompson introduced the Career and Technical Education for the 21st Century Act that passed the House and Senate unanimously and was signed into law by President Donald Trump.

GT has been the No. 1 speaker on the House Floor for the past four years. He views this as a responsibility to be a strong voice for the citizens of the Fifteenth District and an opportunity to influence the Washington legislative agenda.

GT is a proud graduate of Penn State and Temple Universities, where he earned a B.S. and a Master of Education, respectively. He and his wife, Penny Ammerman-Thompson, have three adult sons.

Reauthorization **PANEL DISCUSSION**

Facilitated panel discussion based on the various issues and viewpoints surrounding reauthorization of the fee collection authority and other provisions associated with the Abandoned Mine Land Program as authorized and outlined in Title IV of the federal Surface Mining Control and Reclamation Act (SMCRA).

Each panel member will be given 3-5 minutes for an opening statement. Moderator will bring up key provisions or positions for discussion and for questions from the audience. Moderator will allow sufficient time to get though key topics but will move the discussion along if too much time being spent on a single topic. Audience questions will be limited to one or two per topic. Moderator will solicit a volunteer or two from the panel to respond or will direct the question to the panel member that they believe would be best to answer.

Panel Members/Representing

Industry: **Rachel Gleason**, PA Coal Alliance

AML Contractors: **Frank Howard III,** Howard Concrete Pumping, Inc.

IMCC/NAAMLP: **Autumn Coleman**, NAAMLP President

PA Watershed Groups: **John Dawes**, Foundation for PA Watersheds

TU/NGOs: **Steve Moyer,** National Trout Unlimited

PA AML Campaign: **Andy McAllister**, Executive Director, WPCAMR

Central Appalachia NGOs: **Thom Kay**, Sr. Legislative Representative, App Voices

Administration/OSMRE: **Christian Palich**, Senior Advisor, U.S. DOI, OSMRE

Moderator

Greg Conrad, Retired/Former Executive Director, IMCC

NAAMLP **SCHOLARSHIPS**

Chris Brown
Utah State University

Chris grew up in Salt Lake City, Utah and graduated from Utah State University in 2017 with a BS in Watershed Science and Earth Systems and a minor in GIS. While working as a Mine Land Reclamation Intern on a mine in Southeastern Idaho and as an Abandoned Mine Land Inspector in North Dakota, Chris has found a strong interest in working with, and helping develop land reclamation practices in mining. He is currently pursuing a Master's degree in Rangeland Science from Utah State University, studying under Professor R. Douglas Ramsey. His thesis work entails evaluating coal mine reclamation in Central Utah using drone imagery, and developing methodologies for land managers to effectively apply remote sensing to their reclamation projects. Chris has a wide base of hobbies that include spelunking, climbing, canyoneering, carpentry, and drones.

Chase Carroll
University of Utah

Chase Carroll is a senior in the Mining Engineering department at the University of Utah. Chase was born and raised in Utah and has always had a passion for spending time outdoors. He got involved in mining because of his interest in heavy equipment and digging holes. One time, at the age of 9, Chase dug sprinkler line trenches for a neighbor all day for payment of only pizza and a dollar. He now spends his free time in the local lakes of Utah enjoying watersports and fishing. Chase is the Chapter President for the Society of Mining, Metallurgy, and Exploration at the University of Utah and previously served as the Lead Ambassador for the College of Mines and Earth Sciences for two years. He recently completed his 3rd summer internship with Granite Construction in Salt Lake City where he worked on groundwater management, process efficiency, and mine closure projects. Chase is excited to graduate and get out into the mining industry to make a measurable impact.

Johnathan Prose

Kishwaukee Community College/Iowa State University

Johnathan is a transfer student who will be studying Civil Environmental Engineering at Iowa State University this fall. Previously, he attended Kishwaukee Community College for two years. He received his Associates Degree in Engineering Science in the summer of 2019. While attending Kish, Johnathan was very involved. He served one term as the Student Trustee and as the President of the Phi Theta Kappa Honors Society. Outside of his leadership, Johnathan volunteers his time in the community. Two organizations in which he volunteers his time are 4-H and the Village of Progress.

Johnathan has received a number of awards for his leadership and service in Phi Theta Kappa including the Phi Theta Kappa All-Illinois Academic Team Award and Coca-Cola Bronze Scholar Scholarship. Outside of school, he works part-time as a Physical Assistant for a family member with a disability and seasonally as a youth soccer referee for the Park District. The summer of 2019 he worked full time as a Civil Engineering Intern at IMEG Corp.

Nick Shepherd

University of Oklahoma

Nick Shepherd is a graduate student at the University of Oklahoma (OU), pursuing a doctoral degree in environmental engineering. He began his mining reclamation research as a high school student in 2009 when he conducted independent science research projects at the Tar Creek Superfund Site in northeastern Oklahoma. Nick has earned both his bachelor's in environmental engineering and master's in civil engineering with an emphasis on water resources from the University of Oklahoma. While at OU he joined the Center for Restoration of Ecosystems and Watersheds (CREW) research group. His research interests are largely focused around mine drainage evaluation and treatment. His past projects include long-term water quality monitoring of existing passive treatment systems and mining-impacted watersheds at the Tar Creek Superfund Site with CREW, leachability of spent media from vertical flow bioreactors, impacts of beaver recolonization on mining-impacted streams, and recovery of fish communities following the implementation of passive treatment. Upon graduation, Nick plans to join an engineering consulting firm and continue working in the mining reclamation field.

NASLR **SCHOLARSHIP**

As the 2019 NASLR Scholarship winner, Nicholas Shepherd is an Environmental Engineering PhD student at the University of Oklahoma. Since high school and throughout his college career, he has conducted research in mining impacted areas, specifically the Tar Creek Superfund Site, competed in multiple international competitions, and presented at numerous conferences. As a PhD student, Mr. Shepherd has continued his research at the Tar Creek Superfund Site under Dr. Robert W. Nairn, investigating: the chemical and biological environmental impacts from historic untreated mine drainage discharges; viable approaches to capture and treat historic untreated mine drainage discharges; and the supporting, provisioning, regulating, and cultural ecosystem services provided by mine drainage treatment through passive treatment system implementation in specific sub-watersheds. Mr. Shepherd has excelled academically, and, anticipating graduation in 2022, he is already a certified Engineer-in-Training and has passed the Professional Engineering Exam.

Tour **DESCRIPTIONS**

Tour 1, Flight 93 National Memorial
7:00 AM – 4:00 PM

Tour 2, Fallingwater and Ohiopyle State Park
7:15 AM – 3:50 PM

Tour 3, Underground Mine & Museum and Steel Facilities
7:30 AM – 3:50 PM

Tour 4, Pittsburgh Botanic Garden and Pittsburgh International Airport AML Pilot Site
8:00 AM – 3:00 PM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Tour 1
Flight 93 National Memorial

Once a former coal mine site, now the National Memorial for the passengers and crew of United Flight 93 that prevented terrorists from attacking the U.S. Capitol on September 11, 2001. The Visitor Center Complex includes the Visitor Center with exhibit area, Learning center, Allée and Western Overlook trailheads, and the Flight 93 Path Walkway and Overlook. The Memorial Plaza marks the edge of the crash site, which is the final resting place of the passengers and crew.

There are 40 Memorial Groves, one for each of the passengers and crew, radiate along the Ring Road and Allée from the Visitor Center Complex to the Wetlands Bridge. The Allée, a formal walking path, follows the edge of the grove and connects the Visitor Center Complex and the Memorial Plaza, crossing the wetlands via the Wetlands Bridge. A grant from OSMRE has reclaimed the former coal mine site by installing acid mine drainage treatment facilities, which will be visited on the tour. Considerable efforts to reforest the reclaimed site have been conducted and are ongoing.

Constructed in 2018, the Tower of Voices (TOV) serves as both a visual and audible reminder of the heroism of the forty passengers and crew of United Flight 93. It is conceived as a monumental, 93 feet tall musical instrument holding forty wind chimes. There are no other chime structures like this in the world. The shape and orientation of the Tower are designed to optimize air flow through the TOV walls to reach the interior chime chamber. The chime system is designed using music theory to identify a mathematically developed range of frequencies needed to produce a distinct musical note associated with each chime. The applied music theory allows the sound produced by individual chimes to be musically compatible with the sound produced by the other chimes in the Tower. The intent is to create a set of forty tones (voices) that can connote through consonance the serenity and nobility of the site while also through dissonance recalling the event that consecrated the site.

https://www.nps.gov/flni/index.htm

*There will be additional AML and/or AMD sites in this tour.

Tour 2

Fallingwater and Ohiopyle State Park

Fallingwater is a world-renowned house designed by architect, Frank Lloyd Wright in 1935 for his Pittsburgh clients, the Kaufmann family. Fallingwater is one of Wright's most widely acclaimed works and best exemplifies his philosophy of organic architecture: the harmonious union of art and nature. It has been the focus for many famous photographs and paintings. Fallingwater was entrusted to the Western PA Conservancy in 1963 and was designated as a National Historic Landmark in 1966. It is nestled within the beautiful Laurel Highlands of the Allegheny Mountains, with walking trails surrounding the home.
Today, more than 5.5 million people have visited and explored Fallingwater.

https://www.fallingwater.org/

Boots or solid shoes, with no open toes, should be worn on this tour. This tour is partially outdoors, rain or shine, and weather appropriate clothing should be worn.

Ohiopyle State Park, located on the southern reaches of the Laurel Ridge, encompasses approximately 20,500 acres of rugged natural beauty and serves as the gateway to the Laurel Highlands. Passing through the heart of the park, the rushing waters of the Youghiogheny River Gorge are the centerpiece for Ohiopyle.

Cucumber Falls is one of at least a half-dozen great waterfalls within Ohiopyle State Park. The water cascades over a 30-foot drop and flows into the "Yough" River. The falls are very picturesque amongst the boulders and trees that dot the landscape, especially in Autumn when the leaves change colors.

There are several passive treatment plants that are a part of Ohiopyle State Park that are working to clean up the waters of the Commonwealth.

http://www.discoverohiopyle.com/

Tour 3

Underground Mine & Museum and Steel Facilities

Carrie Furnace is a former blast furnace located along the Monongahela River in the Pittsburgh area industrial town of Swissvale, PA, and it had formed a part of the Homestead Steel Works. The Carrie Furnaces were built in 1884 and they operated until 1982. All that is left of the site are furnaces #6 and #7, which operated from 1907-1978. The furnaces, designated as a National Historic Landmark in 2006, are among the only pre-World War II 20th Century blast furnaces to survive. At one time, the furnaces and the steelworkers who labored in them produced more than 1,000 tons of iron a day. Now these 92-foot-tall structuresstand as sentinels to Pittsburgh's steel heritage.

https://www.riversofsteel.com/things-to-do/event/carrie-furnaces-industrial-tour/

This tour is not recommended for anyone unable to walk great distances, negotiate rough terrain, is claustrophobic, and/ or unable to climb steel stairways and cat walks. Boots or solid shoes with no open toes should be worn on this tour. Much of the tours are outdoors, rain or shine, and weather appropriate clothing should be worn that could become dirty.

Temperatures underground at Tour-Ed are between 52 to 55 degrees, so please dress appropriately.

Tour-Ed Mine & Museum

Experience what it was like to be a coal miner in the 1850s and today. Your guides will treat you to an amazing, educational tour 160 feet below the Earth's surface. All guides are experienced coal miners, educated in mine safety. The tour is in an inspected, safe mine environment modified for group tours and attraction comfort. There will be a live demonstration showcasing the authentic mining tools and methods from the 1850s through today. A light jacket is suggested with a mine temperature of 52 to 55 degrees year-round. https://tour-edmine.com/

The Russellton Coal Refuse Site

is locate in West Deer Township, Allegheny County, about 30 miles northeast of Pittsburgh. It is a multi-million ton coal refuse valley-fill disposal site that was fed for more than six decades by the coal mines in the Upper Freeport "Thick Freeport" coal, and associated coal cleaning plant. In many places the original stream valley was buried more than 100 feet deep by the waste coal. The refuse on site is currently being recovered for electricity generation by a Fluidized Bed Combustion boiler plant, Scrubgrass Generating Station, LP located approximately 70 miles north of the site. Refuse removal and reclamation is expected to take another 10 to 15 years to complete.

Tour 4

Pittsburgh Botanic Garden and Pittsburgh International Airport AML Pilot Site

Boots or solid shoes, with no open toes, should be worn on this tour. This tour is partially outdoors, rain or shine, and weather appropriate clothing should be worn.

Pittsburgh Botanic Garden AML Pilot Site

Since opening to the public in 2015, tens of thousands of visitors have come to Pittsburgh Botanic Garden to enjoy cultivated woodlands, gardens, wildlife, and trails. Pittsburgh Botanic Garden features thousands of native trees, shrubs, and perennials planted since 2010 in an effort to cultivate and restore a native habitat to land once damaged by decades of deep-mining, strip-mining, and clear cutting. Acid mine drainage had polluted a pond in the Woodlands: neither plants or animals could live in the pond. The pond is now the centerpiece of the Japanese Garden, a key feature of the Asian Woodlands. The Woodland's acid mine drainage problem was awarded the 2014 Governor's Award for Environmental Excellence and is a good example of a public-private partnership. Partners in the pond restoration project include the Office of Surface Mining Reclamation and Enforcement and the PA DEP Growing Greener Program, the Allegheny County Conservation District, the Foundation for PA Watersheds, Trout Unlimited, Colcom Foundation, and an anonymous foundation. A 2016 AML Pilot project is underway to reclaim underground mine workings, surface mine cuts, and a dangerous highwall, stabilize 30 subsidence holes, relocate the Lotus Pond's sludge basin, and install a passive mine drainage system for an underground mine discharge. Additional AML reclamation and garden development is continuing using funding from the 2016 AML Pilot Program.

http://pittsburghbotanicgarden.org/

Pittsburgh International Airport AML Pilot Site

The 2016 AML Pilot funding is being used to facilitate the reclamation of two dangerous highwalls on an abandoned surface mine site located on Pittsburgh International Airport property. After the AML conditions are removed, the Allegheny County Airport Authority will develop the "Pittsburgh Airport Innovation Campus." The innovation campus will include office space, research and development facilities, service center retail, mixed-use town center, and an aviation facility immediately adjacent to the Pittsburgh International Airport.

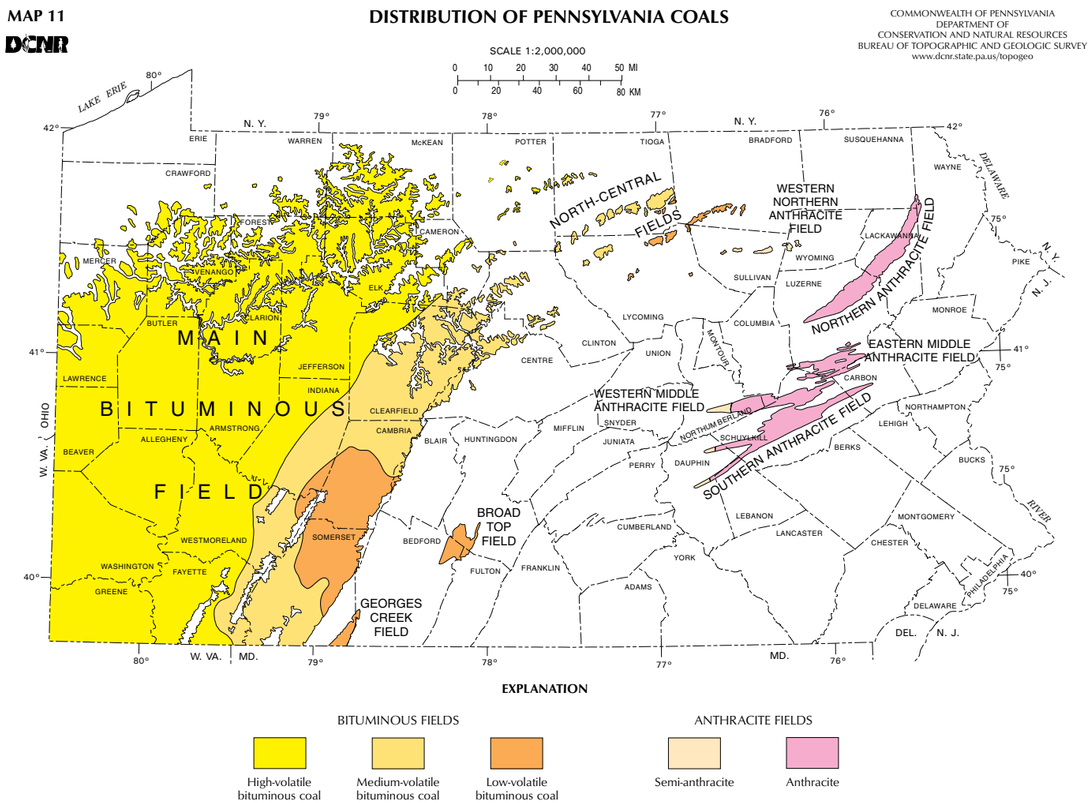
North Fork Montour Run Passive Treatment System

was installed on Pittsburgh International Airport property in 2008 to treat an abandoned underground mine discharge from the Clinton No. 1 Mine, which was mined by the Clinton Block Coal Company around 1938. The system is preventing approximately 32,300 pounds of acid and 32,000 pounds of iron compounds annually from entering the North Fork of Montour Run. The project was funded by the PA Department of Environmental Protection, the Office of Surface Mining Reclamation and Enforcement, and the PA Turnpike Commission. BioMost Inc. designed the passive treatment system that consists of a mine drainage conveyance pipe with alkaline pipe bedding, three settling ponds, two vertical flow ponds that can operate either in parallel or series, and a 1/3-acre wetland. The system also includes three TROMPES, which provide aeration for the mine drainage treatment.

Milk Run Passive Treatment System

Currently in construction, the Milk Run passive treatment system will treat an abandoned underground mine discharge at the headwaters of Milk Run. This AMD discharge, known as MKR3, is the single largest source of acidity and aluminum in the Montour Run Watershed. The design will use natural limestone and gravity to treat the water. Once completed, the system will restore one mile of stream and improve Montour Run for miles by removing an estimated 72,000 pounds of acid and 7,000 pounds of aluminum per year. The project was designed by BioMost Inc. and is funded by Range Resources, the Office of Surface Mining Reclamation and Enforcement, and the Foundation for Pennsylvania Watersheds.

Distribution of **PENNSYLVANIA COALS MAP**



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Technical Session **ABSTRACTS**

Mine Subsidence Engineering: An Overview

Gennaro G. Marino, Ph.D., P.E., D.GE President, Marino Engineering Associates, Inc

This presentation covers key aspects of mine subsidence engineering, a subject that is not well understood, and embraces a number of engineering disciplines. It focuses on the causes of mine subsidence and how mine stability relates to the resulting ground movements. Different mining and geologic conditions determine the mode of failure of the mine. The mode of mine failure in turn affects the resulting subsidence movement. Prediction of subsidence and damage potential are also key aspects of subsidence engineering. Examples of expected subsidence damage as well as mine stabilization will be shown. This presentation will be presented in a manner that will be understandable to anyone that would be interested in learning more about mine subsidence.

Poultry Litter Biochar Role in Remediation

Tina Metzer, Executive Director, Eastern WV Community & Technical College

Poultry biochar is highly effective to selectively absorb heavy metals, such as mercury, lead, cadmium, etc. in remediation. Poultry manure-based carbons possess excellent adsorption properties towards the metal ions of cadmium, copper, and zinc and to a lesser extent nickel. [Lima, WE Marshall] Chem Technol Biotechnol 2005] Biochar is porous making it an efficient filter. Biochar adsorbs a wide variety of both heavy metals (copper, zinc, cadmium and lead) and organophosphates which include pesticides and hydrocarbons. Biochar does this through electrostatic interactions and the functional groups on its surface. After adsorption, biochar can hold onto these adsorbed contaminants for hundreds of years without releasing them back into the environment. Biochar can be used to remediate the toxic soils of former coalmine areas which, when devoid of surface plant material, tend to runoff rainwater into local streams and waterways which then bring their toxins to river waters and the Chesapeake Bay watershed area. By proving a solution for poultry farmers to the abundance of poultry litter, it removes it from their farm operations, and away from waterways which cause pollution runoff. By creating a system that offers income from their litter, it incentivizes farmers to remove this waste, transporting to a biochar center.

An Overview of the Groundwater Data Collected as Part of the 2015 EPS CCR Rule at CCR Landfills and Surface Impoundments

Cecil Slaughter, Hydrologist, U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement

The Environmental Protection Agency (EPA) published a rule to regulate the disposal of coal combustion residuals (CCRs) as solid water under Subtitle D of the Resource Conservation and Recovery Act on April 17, 2015. Although OSMRE is exempt from this rule, we can learn valuable lessons from the groundwater monitoring data collected as part of the rule. The rule called for operators to conduct 8 groundwater sampling events upgradient and downgradient in the uppermost aquifer at existing CCR units for 21 constituents [detection monitoring constituents: boron, calcium, chloride fluoride, pH, total dissolved solids and assessment monitoring constituents: antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, radium 226 and 228 (combined), selenium, and thallium]. Groundwater data collected from 265 coal plant sites were analyzed by a variety of NGO's illustrates the risks involved in the placement of these materials. While abandoned mine land environments may differ from the coal plant sites, an understanding of the nature of groundwater contamination from the disposal of CCRs is important to know. The following are major takeaways regarding constituents detected in the groundwater with health based standards established by the CCR rule: 1) Eighty-nine percent of the coal plants had unsafe levels of one or more constituents; 2) Fifty-two percent of the coal plants had unsafe levels of arsenic; and 3) Sixty percent of the coal plants had unsafe levels of lithium. CCRs are placed on AML sites primarily to mitigate acid mine drainage, restore land surface to original contour, or mitigate dangerous highwalls. A major takeaway from the groundwater data collected as part of the EPA CCR rule is that it's important to conduct meaningful groundwater monitoring prior, during, and after placement of the CCRs to better ensure that CCR placement at AML sites won't cause additional future problem.

Preservation and Progress: Protection of AML PTS Clean Water Infrastructure

John Dawes, Executive Director, Foundation for Pennsylvania Watersheds
Joseph Pizarchik, Pizarchik Advancements

The past few decades have witnessed innovation, invention, and development of various types of passive treatment systems (PTS) to treat coal mine drainage. Several hundred abandoned mine land (AML) PTS have been constructed in the battle to restore our waterways and revitalize coal country communities. Tens of millions of dollars have been invested by states, philanthropy, non-governmental organizations, local governments, industry, watershed groups, and the federal government. Hundreds of miles of streams have been improved. Without adequate funding, however, many AML PTS will fail, millions invested will be lost, and water will again be polluted. The economies and environment of coal country will receive another setback.

We are advancing a solution. In our presentation we will summarize our efforts to secure financial support to monitor, operate, maintain, and rehabilitate AML PTS which will create jobs in coal country, protect decades of accomplishments, further improve water quality, and create new economic revitalization opportunities. There will not be an additional burden placed on the coal industry or on the state AML programs.

Working, Learning, and Thinking Together in the 21st Century

Dr. Bill Bellows, Ph.D, Deming Medal Committee, American Society of Quality
Robert E. Hughes, Executive Director, Eastern PA Coalition for Abandoned Mine Reclamation

Now, more than ever, organizations possess limitless opportunities to improve how they manage resources within a system, with a focus on exploiting interdependency, not unknowingly falling victim to managing tasks in isolation. Such a dramatic change requires a transformation in how organizations both understand and manage systems, variation, people (psychology), and knowledge, the four interdependent elements of the Deming System of Profound Knowledge®. While introduced in the 1980s as a better way to manage product, process, and service quality, the Deming Philosophy is gaining momentum in the 21st century as a better way to manage systems, with applicability to any organization interested in the endless pursuit of being better and smarter at what they do. When these and other teachings and Deming practices are embraced and applied, not only do organizations improve and thrive, but people experience a greater sense of purpose, fulfillment and joy. EPCAMR will provide examples to non-profit watershed organizations and community groups of goals, aims, and processes that can help them transform their organizations to become more efficient in their decision making. Budgeting, managing parts and pieces of so many projects from permits, to designs, construction management, grant writing, administration, management, social media development and planning, education and outreach, and the management of volunteers and or staff will be discussed. EPCAMR is currently adopting and transforming it's operational and management approach to the Deming Philosophy. EPCAMR believes that other non-profits can implement various management strategies and develop standard operating procedures that will greatly improve their mission, purpose, effectiveness and aim as they continue to work in the field of abandoned mine reclamation, mine water pollution remediation, environmental education, community outreach, economic development, and organizational community capacity and coalition building. Learn how a watershed is a system and the volunteers, staff, and professionals you encounter in your work and volunteer efforts are all integral to making people's lives better around you in your community. People need to know what their jobs are and how they can contribute to the system. Cooperation supersedes competition in the abandoned mine reclamation community where we need to continue to work, learn, and think together in the 21st Century to reclaim our abandoned mine land legacies from past coal mining practices.

Waste Coal-to-Energy: A Quarter-Century Land and Water Restoration Success Story

Dennis C. Simmers, EHS Engineer, The Colver Power Project

Abandoned mine lands in Pennsylvania have created the Commonwealth's #1 environmental catastrophe in the way of polluted ground and surface water, select air pollution issues, attractive nuisances endangering the public, and a general blight upon the landscape. It is imperative for community and environmental health reasons that this situation be reversed to near-pre-mining conditions. Conservative estimates place the amount of abandon waste coal piles in Pennsylvania at 800 million tons, thousands of acres affected, and hundreds of miles of waterways impacted. More than ten of these piles are burning at any moment resulting in the worst kind of combustion by-product air pollution……incomplete, inefficient, and uncontrolled emissions. Through a nearly perfect private-public partnership, over 200 million tons of waste coal is no longer sitting on the surface of the planet. Rules were put in place that permitted the creation of the independent power producer industry and that, coupled with circulating fluidized bed boiler technology, provided the gateway to safe use of this fuel to produce energy. The results after more than 25-years of reclamation activity includes extraordinary water quality improvements, elimination of public safety hazards, and increased real estate values of adjoining properties. Waterways once devoid of any kind of aquatic life have roared back in to existence, up to and including designations as "cold water fisheries" again. Entire ecosystems of native mammals, plants and insects have vigorously re-inhabited areas that once rivaled the surface of the moon. The aforementioned #1 catastrophe sat largely unchanged for nearly a century. The past 25-years have witnessed a warp-speed recovery. An estimated $3 billion-dollar reclamation project has happened at a cost of single-digit millions to Pennsylvanians. Land and water restoration companies, that just happen to generate electricity, have turned the tide.

Environmental & Economic Benefits of the Coal Refuse Electric Generating Industry

Jaret Gibbons, Executive Director Appalachian Region Independent Power Producers Association (ARIPPA)

Organized in 1989, the Appalachian Region Independent Power Producers Association (ARIPPA) is a non-profit trade association comprised of independent electric power producers, environmental remediators, and service providers located in Pennsylvania and West Virginia that use coal refuse as a primary fuel to generate electricity. Utilizing circulating fluidized bed (CFB) boiler technology to convert both anthracite and bituminous coal refuse into electricity, ARIPPA plants also provide unique multimedia environmental benefits by combining the production of energy with the removal of coal refuse piles and reclamation of the land for productive purposes.

The coal refuse electric generating industry plays a vital role in the cleanup efforts of abandoned mine lands (AML) and abandoned mine drainage (AMD) in Pennsylvania and West Virginia. Since its inception, the industry has removed and burned as fuel more than 230 million tons of coal refuse, improved or restored more than 1,200 miles of streams, and reclaimed more than 7,000 acres of abandoned mine lands in Pennsylvania alone. In the near future, ARIPPA will release an updated report prepared by Econsult Solutions, Inc. (ESI), a Philadelphia-based economic consulting firm, analyzing the economic and environmental benefits of the coal refuse electric generating industry and the challenges the industry faces. The new report will provide updated figures and data from ARIPPA's 2016 ESI report of the industry. ARIPPA expects this updated report to be published by June 2019. This presentation will focus on the results of this new study as part of the AMR technical session for the 2019 NAAMLP, PA AMR & NASLR Joint Conference.

Website Demonstration for www.ourworksnotdone.org

Eric E. Cavazza, P.E. and **Keith Guille**

Member states of the National Association of Abandoned Mine Land Programs (NAAMLP), led by Wyoming and Pennsylvania, have worked together to develop a national website to provide educational materials about America's abandoned mine land (AML) programs and to highlight the important and beneficial work those AML programs have completed. The primary source of funding for the reclamation of unreclaimed or inadequately reclaimed coal mining sites (which were abandoned prior to August 3, 1977) is the federal AML Trust Fund. Funding for the trust comes from a fee assessed on every ton of coal mined by the active coal mining industry as authorized and specified in Title IV of the Surface Mining Control and Reclamation Act (SMCRA). The authority to collect that fee is set to expire September 30, 2021, and while much reclamation work has been completed, many AML sites remain across the nation's coal fields.

For America's AML Programs, those unreclaimed mine sites signify the "Our Work is not Done". This presentation will present background on the development of the website and also interactively walk through the website to highlight the content that is housed there. Specific items to be covered include a summary of the states that have signed on; an example of the AML reclamation accomplishments contained on the website for each state; presentation of some sample AML-related news items from each state; sample videos and news clips showcasing reclamation accomplishments and also highlighting partnerships and the continued need for reclamation; a brief discussion of social media efforts related to the website and AML education; presentation of a frequently asked questions (FAQ) document covering all aspects of AML; and showcasing of some studies and reports which highlight the economic and social benefits treating acid mine drainage and reclaiming abandoned mine sites.

The Legacy of Mining Colorado's Southern Coalfields

Sarah N. Russell, Historian/Cultural Resource Specialist Colorado Division of Reclamation, Mining and Safety

The discovery of coal in Colorado in 1841 predates even the earliest years of Colorado's Gold Rush. As the national economy began to focus on heavy industrialization near the turn of the twentieth century, coal production in Colorado intensified. The coking-quality coal of the Raton Basin in Southern Colorado was increasingly utilized in the steel-making process. The Colorado Fuel and Iron Company (CF&I), powered by investment from the Rockefellers, became the face of an industry in Colorado as they acquired the diverse resources necessary to support vertical integration of steel production west of the Mississippi. CF&I attempted to regulate their employees through corporate social engineering and, consequently, the mining camps and towns of southern Colorado became a hotbed of labor unrest in the early 1900s. The miners increasingly turned to strikes to protest the poor wages and dangerous conditions that so often embodied their work, and these ultimately led to violent ends. Despite the Eastern influx of capital, many Colorado coal mines were decommissioned by 1930. After the company towns were abandoned much of the land in the Raton Basin converted into open cattle range; and these remnants of the CF&I model punctuate the landscape throughout Huerfano and Las Animas counties. This mix of historic land use combines into a fascinating snapshot where abandoned structures, building foundations, and historic artifacts intermingle with ranches, cattle, and modern dryland farms. Historical and archaeological surveys of these sites not only fulfill legal requirements for abandoned mine land projects, they also provide invaluable documentation of quickly disappearing resources.

Impacts of Coal Mining on Structures in Western Pennsylvania

Richard E. Gray, Principal, DiGioia, Gray & Associates

In 1759, British Soldiers started mining the Pittsburgh Coal Seam on Coal Hill (now Mt. Washington) across the Monongahela River from Fort Pitt (downtown Pittsburgh).

A number of coal seams have been mined in the region. The Pittsburgh Coal with an average thickness of 6 feet extends over an area of 6000 square miles. Active longwall mining in this seam continues in counties south of Pittsburgh. Subsidence over abandoned mines in the Pittsburgh Coal and other seams has to be considered in the design of western Pennsylvania structures. Although, the vertical components of subsidence are usually largest, horizontal movements and the resulting strains and displacements are often most significant in causing structural damage. The most common subsidence feature are sinkholes which develop where the cover above a mine is thin, generally 60 feet. Competent strata above the mine will limit sinkhole development. Troughs develop where a coal pillar or pillars fail by crushing or punching into the mine floor. Subsidence troughs associated with abandoned mines may be up to a few hundreds of feet in diameter. Trough diameters above abandoned mines in the Northern Appalachian Coal Field commonly measure 1.5 to 2.5 times the overburden thickness, reflecting the limit to which the overburden can bridge over local crushed pillars or roof failures before sagging into the distressed area. Unless total coal extraction has occurred, there is no interval above an abandoned mine that is safe from subsidence and subsidence may occur long after mining. If a site is undermined and subsidence cannot be ruled out, options available to design professionals include: • Relocation • Insurance • Flexible or Rigid Designs • If Mine is Shallow – Excavate and Backfill • Deep Foundations Extending Below the Mine. • Mine Stabilization

Use of Expanding Foam to Fill Small Subsidence Holes at WVU Farms[1]

Dr. Jeff Skousen, Professor of Soil Science & Reclamation Specialist, WV University and
Marcus Anderson, Foam Concepts LLC

Coal mining has a long history of underground and surface mining in Appalachia. The Surface Mining Control and Reclamation Act (SMCRA) was passed in 1977 and part of that law imposed a tax on current coal operations for reclaiming abandoned mine lands. Billions of dollars were generated and spent repairing and reclaiming dangerous and hazardous sites including burning refuse and coal seams, removing old structures, filling subsidence holes, grouting streambeds, supporting damaged buildings, backfilling highwalls and eliminating water impoundments. While many acres of land have received reclamation and many miles of streams have been improved (and both are still ongoing), emergency situations are still emerging that present imminent danger to landowners and the public. Such a condition emerged in 2016 at the West Virginia University Animal Sciences Farm. A small 15-ac underground mine was developed in the 1940s, mining the Pittsburgh Coal Seam near Morgantown, WV. The mine removed approximately 50% of the coal by old room and pillar methods. The land was subsequently surface mined around the edges in the 1950s to remove remaining coal pillars, but the center of the area was left intact. Even with substantial sandstone overburden, the land surface has cracked and continued to subside during the past 70 years as the coal pillars crumble and the void space where coal was removed collapses. Due to its closeness to Morgantown and nearby recreational areas, this area receives large numbers of visitors who have established biking trails and other recreational pursuits. Access and control of the area is difficult since there are many uncontrolled access points to the property.

With the continuing development of subsidence holes on the surface and the increasing human activity in the area, scientists and administrators at WVU have attempted to address the dangerous situation. Posting and signage have proved ineffective. An AML Pilot Program application to the WVDEP to daylight the deep mine and reclaim the area to pasture and hayland for the WVU Farm was not funded. Therefore, other solutions were sought. Dr. Jeff Skousen contacted Marcus Anderson of Foam Products, LLC, and asked whether Mr. Anderson would donate material and time to seal some of the larger subsidence holes to eliminate the possibility of human injury and accidents. In October 2016, Marcus arranged to have expanding foam materials delivered to the WVU Farm and, over a 2-day period, sealed over 15 holes that had developed on the site. A group of federal and state regulators, scientists, professors and students, and consultants joined in the project to observe and help. This presentation will explain details of the project and the results of filling small subsidence holes with expanding foam.

Is My House Gonna Sink? Part 2: Carrie

Bill Snoddy, Project Manager, Montana Abandoned Mine Lands Program

In 2015, the State of Montana Abandoned Mine Lands Program completed an investigation of ground conditions underneath the city of Red Lodge, Montana. The purpose of the investigation was to determine if the historic underground mines collapsed how that would affect the town of Red Lodge. Nearly half-way across Montana in Butte, underneath the “Richest Hill on Earth”, there are over 10,000 miles of tunnels from historic copper, silver and gold mining. Occasionally, a subsidence occurs and needs to be repaired. Once in a great while, tragedy strikes, and a subsidence opens underneath someone. These is the subject of this presentation.

It was late spring of 2018m proud owners of a nice Victorian home in Butte had to remove a century old bedroom addition because the foundation was failing. They put sod on the soil exposed by the room removal and began watering. Two weeks later the sod gave way to a 16-foot-deep collapse measuring 9 by 14 feet. The subsidence was an old stope mined that had been mined to surface and bulkheaded. The Carrie Mine, that had operated from 1878 until about 1890 and completely forgotten about is underneath the home. The stope was 150 feet deep and connected to the horizontal workings. Dipping about 5 degrees to the south, the stope went under the home at a depth of 40 feet. The bulkhead had fallen down the stope forming a false floor 40 feet below the surface. Was the family’s home damaged by the collapsed workings? Did the spreading sinkhole migrate onto neighboring homes? What was the solution to the problem? You will have to attend the session to find out!

There He Goes Again! Another Discussion of Mine-Water Geothermal

Michael C. Korb, P.E., Senior Mining Engineer, Tetra Tech, Inc.

Residential, Commercial and Institutional heating, cooling, and hot water consume about 20% of U.S. energy consumption, or about 20 quadrillion (20,000,000,000,000,000) British thermal units. 11 percent of US greenhouse gas emissions are directly from businesses and homes. primarily from fossil fuels burned for heat (not including electricity and transportation). Pennsylvania Residential, Commercial and Institutional activities generate even more of the state’s emissions. Many people are looking toward alternative sources of energy to maintain a comfortable temperature in their homes and businesses, and Pennsylvania is looking for ways to reduce carbon pollution. There are few low carbon alternatives for heat production. One of those, a promising source of heating, and cooling, lies right under our feet. A Geothermal Heat Pump (GHP) is one solution that offers a low-carbon, secure and continuous energy source. GHPs can save 40 to 65 percent in heating costs, 30 percent in cooling costs and 15 percent for hot water costs when compared to conventional air-source heat pumps or natural gas systems, while reducing that portion of the facility’s carbon footprint by 55 to 70 percent. In many regions of Pennsylvania and the nation, abandoned, flooded coal mines offer an almost ready-made way to access this geothermal heat, and these mine pools make an ideal heat sink for geothermal. Community-based district heating and cooling utilizing mine-water geothermal could be a source of economic revitalization and recovery of these coal-region communities. Pennsylvania should recognize that mine pools are underutilized energy sources, should be considered community assets, and should encourage their use for future sustainable energy projects. My past attempts to proselytize engineers, businesses, and. institutions; and my tries to get the public interested in Mine-Water Geothermal have met with little success. Here I go Again!

Remote Environmental Monitoring Solutions

Jeff Taylor, President, Sauls Seismic LLC

Abandoned mine lands provide the obvious possibility of causing negative impacts to surrounding communities should unforeseen circumstances cause non-compliant water or other materials to leave mine boundaries. A 24/7 pro-active approach to monitoring and data collection to prevent or mitigate these type issues is the obvious approach. Technology allows for numerous options when monitoring environmental data, including recent improvements in the accuracy of remote sensors with continuous online data access and alarm notifications. This presentation covers various types of remote access environmental monitoring options such as rain gauges, weather stations and lightning detection/ tracking. Surface and/or groundwater related monitoring includes parameters such as flow levels, pH, turbidity, conductivity, and temperature, etc. Dust and noise monitoring is also available. All data is accessible online 24/7, and is easily downloaded to Excel spreadsheets for regulatory reporting or proprietary data review. The private data network is highly adaptable to specific client needs, and can be monitored, reviewed and reports downloaded in monthly, weekly, daily, hourly or via minute intervals. These systems help mitigate risk by continuous sampling and providing real-time electronic data and alarms when specified parameters of concern are reached. Email or text alerts can be sent immediately notifying an unlimited number of company personnel when specified parameters of concern are met or exceeded; be it rainfall amounts, wind speed/direction, pH, temperature, flow levels, conductivity, turbidity, barometric pressure, etc. More and more entities are choosing to use remote access monitoring to continuously monitor and be immediately alerted when conditions arise that create a danger of off-site impacts.

This presentation provides information and details regarding options available to them.

Drones/UAV: Providing Rapid Innovative Leaps in Abandoned Mine Reclamation Strategies

Dan Bochicchio, Staff Environmental Scientist, Groundwater & Environmental Services, Inc.

Drones, or Unoccupied Aerial Vehicles (UAV), are being broadly adopted across many industries as a safer and more efficient data collection platform. GES will present information on how UAV can enhance AMD discharge identification, reclamation activities, environmental management, and process engineering for remediation design in the AMR practice. By combining UAV-mounted sensor types such as visual light, thermal, LiDAR, laser gas detection, and magnetometers, higher levels of insight can be achieved, allowing for faster and doubtless decision-making. GES will demonstrate the benefits gained by including drone-derived data into traditional practices as well. For example, thermal imaging can be used to highlight AMD-impacted streams within degraded watersheds in areas that would normally be virtually impossible and dangerous to survey on foot. In order to tackle the enormous environmental issues that we face, innovative solutions need to be incorporated to change the perspective of previously unsolvable problems. Incorporating UAV services into workflows also prepares those in the AMR practice for the modern pace of innovation and next generation of technological advancement. The key to adapting with the changing times is to indoctrinate the ideals of coordination and cooperation rather than following the old model of competition and unsustainable, short-term action. GES will promulgate topics of conversation on modern strategies for implementing UAV, starting from the ground up. With innovative technologies comes new and higher perspectives that can guide our community of scientists through the Fourth Industrial Revolution and into a better, brighter, greener future.

Multiple Paths to Progress: How 25 Years of AML Reclamation Has Transformed More than the Land

Elizabeth W. Hughes, EdD | Director of Communications, Earth Conservancy

Now celebrating its 25th anniversary, Earth Conservancy (EC) is a nonprofit organization that has been committed to addressing the impacts of legacy anthracite coal mining in northeastern Pennsylvania.
Thus far, EC has reclaimed 2,000 deeply-scarred acres of mineland, which are now committed to positive reuse across a variety of sectors; operates two acid mine drainage treatment systems; and has constructed community playing fields and several trail systems. Nearly 8,000 acres of its holdings have been conserved for recreational use and greenspace. Over $49.1 million has been invested to date. This presentation will provide an overview of EC's history and work, taking account of the four factors that have proven critical to its success: planning, persistence, pragmatism, and partnerships. Recently, EC has leveraged its positive record to create the Environmental Workforce Training (EWT) Program. Initially funded by an EWDJT grant from the USEPA, the program provides training in surveying, construction safety, and hazardous materials cleanup skills and technologies for unemployed and underemployed residents in the region. Penn State Wilkes-Barre serves as the program's educational provider. What's been particularly noteworthy are the new types of partnerships the program has necessitated for EC. Economic agencies, nonprofit organizations, social service providers, and private industry have all been involved. Furthermore, EC provides graduates ongoing support during their job search for one year. Two cohorts have completed training, with 100% of job-seekers in the first group finding self-sustaining employment. In April 2019, EC received a Pennsylvania Governor's Award for Environmental Excellence for the EWT Program. Through the EWT Program, EC has found another way to continue its mission of environmental and economic revitalization, helping to create a more livable community now and clear the way for positive, progressive change for future generations.

Datashed: An Online Tool for Managing AMD Treatment Systems and Restoration of Impacted Watersheds

Cliff Denholm, Environmental Scientist, Stream Restoration Incorporated

Acid mine drainage (AMD) is one of the largest sources of pollution in Pennsylvania with over 5,500 miles of streams currently impaired. Across Pennsylvania, watershed groups, government agencies and other organizations are working to restore these streams by completing land reclamation projects and constructing water treatment systems. These systems treat an estimated 80 billion gallons of AMD per year resulting in many miles of improved streams. Many of these streams now have good water quality and reproducing fish populations; however, once these projects are constructed, they need to be monitored to make sure they continue to work properly and identify when maintenance is needed to ensure long-term sustained improvements of water quality. To help support these efforts, Stream Restoration Incorporated created Datashed (www.datashed.org), a free, open source, web-based, GIS-enabled database that functions as a maintenance and data management tool.

The website can store a variety of information related to both individual projects and overall watershed restoration efforts including water quality data, documents, maps, engineering design drawings, treatment technologies, photographs, etc. Datashed provides an open centralized repository to preserve this important information so that anyone with internet access can view, print, or download. User accounts are only needed for approved users who will be adding or editing the stored information. The website provides students, researchers, and engineers with real data from existing treatment systems to conduct research and improve designs. Datashed can also be utilized for education/outreach efforts of watershed groups to highlight their projects and provides a certain level of transparency as funding agencies are able to observe the effectiveness of the projects. The presentation will focus on both current features as well as planned future improvements.

WHEN ELVIS LEAVES THE BUILDING
Preserving and Recollecting Institutional Knowledge

Michael C. Korb, P.E., Senior Mining Engineer, Tetra Tech, Inc.

As far as I can remember, every "old timer" I ever worked with was named "Elvis," or maybe "George." The phrase "can remember" is central to any discussion of loss, preserving and restoring institutional knowledge, because most institutions, like mine reclamation, have been around even longer than Elvis. A lot of us don't know much about the history of mine closure.

Elvis is thinking about retiring and writing a memoir. Elvis really isn't an "important person", he's just been working every day for more than 50 years, and it never occurred to him that anyone might be interested in his stories, until someone said he should try to preserve his memories for the good of the organization. Organizations lose when their most veteran and informed employees retire or leave. Part of what's lost is knowledge, history, and culture. When Elvis leaves, we may still know how we do things, but much of why we do things, "where the bodies were buried," how we uncovered them, and what has changed since, all go with him.

Institutional knowledge is a shared set of facts, historical data, notions, experiences, and memories held by a team, society, organization or industry. We will talk about some history and the tools and resources that can be used to preserve the institutional knowledge of mine reclamation, and retrieve and recollect it once Elvis Leaves The Building. Some exist but are under-used, some are not well known, some are new, and some are just part of the Elvis folklore.

Restoration of Waste Coal Piles thru Public and Private Cooperation

James Panaro, Executive Vice President, Robindale Energy Services, Inc.
Dean R. Baker P. E., Environmental Program Manager PA DEP-AAMO, BAMR

The presentation will be a pictorial slide presentation of recent projects undertaken thru partnerships. These partnerships were formed to complete much needed reclamation. Once formed, the partnerships enabled or helped to facilitate and enhance the reclamation of several waste coal sites. These sites had little hope of being reclaimed by conventional methods.

Highlights of the presentation will include how the affected piles had minimal reserves and following review, stood very little chance of ever being reclaimed without the partnerships and extra efforts needed to accomplish a common goal of removing the coal refuse piles. Reclamation of these legacy mine sites reduced and eliminated sedimentation to the receiving stream which helped to ensure cleaner water for the future. Site No. 1 - Jim Panaro will discuss and present information on a project known as Swedtown. The site is a small refuse pile located near the town of Hastings, PA, in Cambria County. The site is an
award -winning project and reclamation efforts featured partnerships that included: members of the mining industry; private citizens; and local government groups all coming together to complete improvements of this property. Site No. 1 - Dean Baker will discuss a refuse pile known as the Steinman Refuse Pile, located in South Fork Borough, Cambria County. The site is a 2017 Pilot Project which will remove an existing refuse pile; build a trail which is an expansion of the Path of the Flood Trail System; and will reduce sedimentation to the Little Conemaugh River. Numerous local partners and stakeholders came together to coordinate reclamation efforts. The project details will be discussed and presented as the success of the project is currently taking place.

Russelton Mine Site Project – Venango No. 1 AML Project

R.J. Shaffer, Scrubgrass Generating Co. L.P.

The Russelton mine site will be on the tour list for the conference. Some project highlights and an overview on the current status of the site. Project Objectives: Eliminate 200 gpm of acidic, metal laden drainage. Remove 10million tons of pollution-generating coal refuse. Eliminate the largest source of acid mine drainage in the West Deer Creek Watershed. Improve ground water quality. Eliminate safety risk of coal refuse pile burning in the proximity of several hundred homes. Enhance economic viability
DEP-managed trust fund dedicated to mine drainage treatment.

Overview of the Venango #1 AML project. Venango #1 project located in Venango County, PA, SGCLP(Scrubgrass Generating Co. L.P) South Sandy Creek Watershed, and PADEP BAMR are project partners in reclaiming 55 acre site. Project Objectives: Remove all acid bearing material from site. Material transported to Scrubgrass Generating Plant for energy recovery. Scrubgrass will be able to successfully burn the high sulfur material while maintaining compliance with emissions limitations under current MATS standards. Sulfur content of the material is up to 18% concentration. Reduce the amount of site runoff that is polluting the local streams and groundwater. Create and sustain jobs in the local area. Water Quality Improvement, Timeline Photos.

Remining and Reclamation, Harry E Coal Refuse Site

Henry Zielinski, P.E. and **Matthew Cochran**, V.P. Fuel Asset Manager, Olympus Power, LLC

With a 170 foot high tower of anthracite waste coal casting its shadow on the former mining town of Swoyersville, PA, the Harry E, an abandoned waste coal site, not only blocks the early morning sunrise for some residents, it contains various AML features that include abandoned retention ponds, mine shafts, and other hazardous mining features spoiling the property. This site contains approximately 4.0 MM tons of coal refuse that would otherwise remain without intervention. Through a private and public partnership, approximately 20 acres of the approximately 55 acre site will be reclaimed. The orphaned site will be reclaimed, within the confines of a GFCC, through excavation of a large majority of the silt. This was made possible through the partnership between Federal, State, Local, Non-Profit Agencies and Private Industry. Approximately one third of the cost, of the five year project, originates from AML and PILOT funding which was leveraged and coupled with Private Industry funds. The coal refuse that will remain will be applied for stabilization and foundation purposes to support the future reclamation of the remaining acreage. The material that is removed will be transported to two coal refuse facilities that are specifically designed to consume coal refuse. As stated in verbal discussions with the PA DEP, Senators, House Representatives, and local Borough Managers, the coal refuse would remain in place and continue to pollute if not for the two waste coal power plants commitment to consume the coal refuse and fund two thirds of the cost to reclaim the AML features. Qualification of the project included the negotiation of a land transfer agreement between the Private Industry party, Keystone Reclamation Fuel Management, LLC and the land owner, Pagnotti Enterprise Inc. This seven acre parcel spans two Abandoned Mine Land Features, silt ponds.

HQ OSMRE National Environmental Policy Act Program (NEPA) Program Review- Highlighting the 2019 OSMRE NEPA Handbook

Stephanie Hamlett, HQ OSMRE, NEPA Coordinator,
Michelle Fishburne, HQ OSMRE, Regulatory Analyst,
Octavia Conerly, HQ OSMRE Special Assistant to the Assistant Director, Program Support Directorate

This session will provide an overview of the HQ OSMRE NEPA Program and focus on the revised HQ OSMRE NEPA Handbook. The presenters will provide a brief overview of the requirements of NEPA, implementing regulations and directives, highlighting Executive Order 13807, Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure Projects (August, 2017) and the Department of the Interior's Secretarial Order 3355, Streamlining National Environmental Policy Act Reviews and Implementation of Executive Order 13807 (August 2017). Both EO 13807 and Secretarial Order 3355 have mandated the establishment of condensed timelines and document preparation standards to increase efficiency and to ensure compliance with NEPA through the evaluation of potential environmental impacts of federal actions as part of federal decision making and prior to implementation of federal actions.

The HQ OSMRE panel will discuss the major changes to the HQ OSMRE NEPA Handbook, to include the removal of NEPA compliance instruction from the HQ OSMRE Federal Assistance Manual, and establishing the HQ OSMRE NEPA Handbook as the one-stop shop for all NEPA compliance instruction for OSMRE staff, state and tribal partners.

PHREEQ-N-AMDTreat Model to Evaluate Water-Quality Effects from Passive and Active Treatment of Mine Drainage

Charles A. Cravotta III, Hydrologist, U.S. Geological Survey

Aqueous geochemical tools are available to simulate changes in pH and solute concentrations resulting from passive and active treatment of coal-mine drainage. The interactive tools utilize PHREEQC equilibrium (aqueous and surface speciation) and kinetics models for gas exchange, iron and manganese oxidation and precipitation, limestone dissolution, and organic carbon oxidation combined with reduction of nitrate, sulfate, and ferric iron. Reactions with caustic chemicals (CaO, Ca(OH)2, NaOH, Na2CO3) or oxidizing agents (H2O2) also may be simulated separately or combined with sequential kinetic steps. A user interface facilitates input of water chemistry and flow data for one or two influent solutions and adjustment of kinetic variables. Graphical and tabular output indicates the changes in pH, specific conductance, total dissolved solids, alkalinity, net acidity, metals, and other solute concentrations of treated effluent plus the cumulative quantity of precipitated solids as a function of retention time or the amount of caustic agent added. By adjusting kinetic variables or chemical dosing, the effects of independent or sequential treatment steps that have different retention times (volume/flow rate), aeration rates, quantities of reactive solids, and temperatures can be simulated for the specified influent quality. The size (land area) of a treatment system can be estimated using reaction time estimates determined from the PHREEQ-N-AMDTreat model. (Volume for a corresponding treatment step is computed as the product of reaction time and flow rate; area is computed as the volume divided by depth.) Then, given the estimated system size to achieve the desired retention time and associated effluent quality, AMDTreat may be used to compute approximate costs for installation (capital) and annual operations and maintenance (O&M) of the treatment. Thus, various passive and/or active treatment strategies can be identified that could potentially achieve the desired effluent quality, but could require different land areas, equipment, and costs for construction and O&M.

Screen to Stream: Engaging Students to Explore Local Watershed Issues and Become Environmentally Alert Citizen Scientists

Peter M. Smyntek, Saint Vincent College, Department of Interdisciplinary Sciences

The Screen to Stream project, which was funded by the Pennsylvania (PA) Department of Environmental Protection, aimed to provide local teachers with training, equipment and opportunities to engage students in grades 3-12 with issues affecting watersheds in Southwestern PA including abandoned mine drainage (AMD). This involved aligning AMD-related activities with current PA academic standards, holding a teaching training workshop, providing online materials and games, and assisting with student stream exploration activities near their school or at the Monastery Run Improvement Project AMD Treatment Wetlands. Activities from the "Nature Interrupted" curriculum, which relate to AMD, were updated and matched to current academic standards relating to the environment and ecology. The teacher training workshop focused on the science of AMD, environmental activities and lesson plans, and practical guidance on the use of water quality monitoring probes for measuring pH, temperature, conductivity and dissolved oxygen. Finally, stream sampling with students from both urban and rural schools provided an opportunity to explore physical, chemical and biological characteristics of local streams and see some of the problems that they face firsthand. In partnership with local watershed groups, conservation districts and other groups concerned AMD and other water quality issues, this Screen to Stream project aimed to continue provide opportunities to engage young students to explore their local watersheds, identify water quality problems, and ask questions about them.

Reclaiming our Backyard: Engaging Youth with Gardening Skills

Laura E. Rinehimer, Watershed Outreach Education Specialist, EPCAMR

The Eastern Pennsylvania Coalition for Abandoned Mine Reclamation developed a curriculum funded by Mental Insight Foundation which helps teach students gardening and healthy decision making using Groasis Growboxx©2 technology. Along with the distribution of Growboxxes© and vegetable seedlings, the curriculum consists of 5 classroom lessons. The lesson topics are soil health, water quality, plant basics, local gardening history, and nutrition. The lessons are engaging and written to the Pennsylvania State Standards. Additionally, a documentary of the project is currently underway which carries the message of the project and helps to educate on proper use of the Growboxx© technology. This presentation will feature both a mix of hands-on STEM projects and video footage of the documentary. A focus of the presentation will be using age-appropriate environmental education best practices in order to engage students to learn effectively.

Kenilworth Maintenance III Reclamation Project Stream Stabilization in Highly Erodible Shale and Coal Refuse

Kent Phillips, Project Manager, Utah Department of Natural Resources

In 1983, the then newly approved Utah Abandoned Mine Reclamation Program (UAMRP) chose the Kenilworth mine as its premier reclamation project in its very first OSM grant request. One facet of the 1983 reclamation was re-establishing natural drainage, a particularly difficult task as nearly the entire drainage below the site had been filled with coal refuse. One of the newly constructed channels ran across the toe of the waste repository over an area of unconsolidated fill – primarily a highly erodible substrate of coal and shale-derived soil. A few years after the 1983 reclamation, a powerful storm blew out the riprapped channel and created gully headcuts ranging from 5-15' deep. After evaluating options, the UAMRP installed multiple gabion basket/grouted drop structures in 2012. Nature responded with another intense storm two years later which destroyed the drop structures and enlarged the primary gully headcut to 25' deep and cut an overall gully 1,700' long. Multiple large tributary gullies also developed in coal refuse on adjacent slopes. Following the gabion failure and continued erosion of the channel, the UAMRP realized that the only practical long term solution was to address the entire affected reach of the channel and completely rework the alignment, gradient, and streambed composition. Following re-grading and alignment to a shallower, constant slope, the design called for the placement of large riprap arranged in a series of twenty stepped drops and basins to slow the water and dissipate its erosive energy. The drops were created by first constructing a foundational arch using the larger riprap (i.e. 3-5' diameter boulders) with the limbs of the arch pointing downstream and tied into the channel slopes. These foundational arches are critical for the structural stability of the channel, acting essentially as legs for the check dams to stand on. Construction of the new channel was completed in September 2018 and consisted of the excavation and removal of 15,000 cy of coal, placement of 30,000 cy of imported and salvaged fill, and the precise placement of 22,500 tons of d50 = 2.5' locally sourced, limestone riprap. Construction costs were finalized at just under $2.1 million, making it the largest construction contract ever awarded by the UAMRP.

The Use of Advanced Membrane Filtration as an AMD Remediation Method

Michael J. McCuskey, President and SME, InnoH2O Solutions, LLC

Acid Mine Drainage, or AMD, constantly poses a challenge to mine operators and state / federal regulators around the country. Specific to Pennsylvania, while mine operators are required to treat AMD, many more discharges exist that are defined as abandoned and have no treatment. While passive or active chemical treatments are always chosen for remediation of such AMD sources, significant capital costs tend to keep the total number of projects to a minimum. Additionally, active systems tend to fall to disrepair due to high operational and maintenance costs. To combat this problem, InnoH2O Solutions partnered with a local coal company to solve these complex remediation problems. InnoH2O spent 5 months evaluating and testing different types of AMD to evaluate the effectivity of advanced membrane filtration on the remediation of AMD. InnoH2O was able to achieve very significant results with significant reductions of Iron, Aluminum and Manganese along with tremendous Sulfate reductions. Net acidic flows were stripped of their dissolved metal load, without the use of any chemicals or additions, and then adjusted to meet NPDES requirements for pH. Typical metal reductions exceeding 99 percent were achieved along with 85 percent reductions in sulfates; conductivity was reduced by greater than 95 percent. Overall water recovery rates of 99.5 percent were achieved during the course of testing. Laboratory testing of the process has been completed and field trials will be beginning in early to mid-2019.

Batch Extraction Method to Estimate Total Dissolved Solids (TDS) Release from Coal Refuse and Overburden

Charles A. Cravotta III, Hydrologist, U.S. Geological Survey

A rapid, batch extraction method was evaluated to estimate potential for total dissolved solids (TDS) release from Appalachian Basin rocks. A 10-g subsample of pulverized rock (<0.5-mm) was mixed with 20-ml deionized water (DI), DI equilibrated with 10% CO2 atmosphere (DI+CO2), or 30% H2O2 under 10% CO2 (H2O2+CO2) in 125-mL flask, then shaken for 4 hours at 50 rpm and 20-22oC. The 65 rock samples were classified as coal (n=3), weathered coal refuse (n=14), unleached coal refuse (n=20), overburden (n=17), shale (n=10), and pyrite (n=1). Extracts were analyzed for specific conductance (SC), TDS, pH, and major and trace elements. The pH of extractant blanks decreased in the order DI (6.0), DI+CO2 (5.1), and H2O2+CO2 (2.6). The DI extractant was effective for mobilizing soluble SO4 and Cl salts. The DI+CO2 extractant increased weathering of carbonates and resulted in equivalent or greater TDS than the DI leach of same material. The H2O2+CO2 extractant increased weathering of sulfides (and carbonates) and resulted in greatest TDS production and lowest pH values. Of the 65 samples, 19 were paired with column experiments and 35 were paired with 10 field sites with leachate data. The TDS from DI and DI+CO2 extractions was strongly correlated to TDS from column experiments while TDS from H2O2+CO2 extractions was not. In contrast to the column experiments, field SC was better correlated to SC measured from H2O2+CO2 extractions versus DI extractions. The SC from H2O2+CO2 extractions was not significantly different from field SC for 9 of 10 paired data sets, while SC from DI extractions underestimated field SC. Upscaling comparisons suggest that (1) weathering reactions in the field are more aggressive than DI water or synthetic rainwater used in batch or column tests, and (2) a batch extraction method utilizing 30% H2O2 could indicate rocks that release high amounts of TDS.

Utilizing Uav Elevation Data To Model Surfaces and Calculate Volumes

Robert Cammack, Kentucky Abandoned Mine Lands

KY AML processes drone imagery with photogrammetry software to develop orthomosaics and point clouds. The raw images are stitched together by the software and deliverables include geotiffs and unclassified .las files. Ground control points are included in the workflow to tie the data down to real world coordinates. Comparing these datasets to statewide Lidar in controlled missions, the elevation values are within centimeters. OSM through its TIPS program provides software to facilitate classifying the point clouds, comparing the point clouds to bare earth Lidar and generating volumes of material. Bare earth datasets can be generated from the unclassified UAV point clouds and be compared to datasets from later flights. By this method material deposited in waste areas can be measured. UAV point clouds can also be compared to existing Lidar point clouds to measure slide events. Dynamic situations can be monitored for change over time. Cross sections and elevation profiles can also be generated. 2d and 3d surface areas can be measured. Volumes of material needed to backfill open highwalls can be estimated.

We have developed workflows that when compared to traditional survey methods are within project tolerances for volumes of material. The elevations are within project tolerance of Lidar bare earth data. By obtaining the elevation data and imagery with UAVs we save time and resources. We are also able to keep personnel away from hazardous slides and working areas.

Characterizing, Prioritizing, and Managing Colorado's Underground Coal Mine Fires

Tara Tafi, Colorado Division on Mining Reclamation and Safety
Jeffrey Nuttall, P.G., Tetra Tech

Colorado has over 35 active underground coal mine fires across the state, which pose a risk to human health and the environment. Often, the coal mine fires are complex, intricate systems, burning in multiple seams, with unpredictable behavior, and varying degrees of activity. These fires are characterized by unstable and uneven ground, subsidence features, high surface temperatures, hazardous gas emissions, and in some cases, extreme wildfire danger. In 2018, the Colorado Division of Reclamation, Mining, and Safety completed an inventory of 38 known coal mine fire sites, assessing the surface and subsurface conditions, evaluating current and potential future risk to human health and the environment, and prioritizing sites for monitoring and abatement. Advances in technology, including Unmanned Aerial Systems (UAS), greatly assisted in the 2018 mine fire inventory by allowing more detailed investigations of mine fire sites and consequently a better understanding of the mine fires and the risks they pose. UAS allowed field teams to safely inspect fire sites for hazards prior to approaching on foot. UAS data collected included orthorectified aerial imagery, snowmelt imagery, digital elevation models (DEM), radiometric thermal imagery, and three-dimensional point clouds. Other data collected and integrated into the risk evaluations includes the geology, historic mine maps, vegetation cover, borehole temperature monitoring, emissions rates/quantities, and gas compositions. For higher priority sites (sites near population centers, or very active sites), all of the data were compiled into a high resolution 3D models to clearly present the collected data. Site monitoring at high risk sites continues to include regular UAS inspections, long-term time-lapse imagery, weather data, and passive seismic recording. The data collected during the mine fire inventory project is assisting DRMS in prioritizing mine fire management and abatement planning, by identifying sites that require immediate attention, and determining what the best management action may be based on fire activity at the site.

How Pennsylvania Successfully Converted 110,000+ Paper Historic Underground Mine Maps to a Digital Map Repository and Geographic Information System

Patrick Jaquay, GISP Geographic Information Specialist, PA Department of Environmental Protection

Over the last decade, Pennsylvania's Department of Environmental Protection (PA DEP) has successfully taken more than 110,000 paper historic underground mine maps and created a state-of-the-art digital geographic information system (GIS). The valuable information contained on these maps can now be preserved in a digital format and is more accessible than ever before to the public, industry operators, and other government agencies. This presentation will discuss why it's important to preserve this information, how the PA DEP went from paper maps to digital images, how those digital images are integrated in GIS, and how features on the maps are extracted to GIS layers to perform spatial analysis. Next, we will discuss how PA DEP utilizes this GIS data in several projects, including: Mine Subsidence Insurance investigations, subsidence risk direct mailing notifications, reclamation projects, barrier distances for underground mine permits, casing depths for oil and gas well permitting, determining sludge injection borehole locations, mine pool studies, etc. Finally, we will cover how the audience can access the digital map images and GIS data from several different online interfaces, including: the PA Mine Map Atlas webmap, the PA Historic Underground Mine Map Inventory System (PHUMMIS) database, the eMapPA webmap, and Pennsylvania Spatial Data Access (PASDA)'s FTP website.

Co-Treating Acid Mine Drainage and Municipal Wastewater in Existing Conventional Wastewater Treatment Plant

Travis Tasker, Saint Francis University, Center for Watershed Research & Service

Acid mine drainage (AMD), a metal-rich and low pH wastewater generated from mining, impacts more than 10,000 km of streams in the eastern U.S. Similarly, nutrient loads from agricultural runoff and municipal wastewater (MWW) discharges are the largest threat to water resources in the U.S. One low-cost option for remediating these two waste streams is potentially through co-treatment in existing conventional wastewater treatment plants. In the current work, we hypothesize that the acidity and high iron and aluminum concentrations in AMD can increase BOD, organics, bacterial coliforms, and nutrient removal from MWW when the two waste streams are co-treated in existing WWTPs. To test this hypothesis, MWW was mixed with AMD at three mixing ratios with increasing amounts of AMD (1:25, 1:15, and 1:5 AMD to MWW). Results showed that co-treatment increased sludge settling at high ratios and significantly reduced effluent phosphate concentrations without impacting effluent pH, biochemical oxygen demand, or total solids.

Co-treating AMD and MWW did impact microbial activity in activated sludge. At the start of respiration rate trials, microbial respiration rates in co-treatment experimental units were lower than treatments with only MWW, suggesting that the AMD additions could influence biological processes in conventional wastewater treatment plants. However, as these trials progressed, the respiration rates eventually converged, suggesting that the microorganisms might be able to adapt to conditions with AMD. In summary, co-treatment of MWW and AMD does appear to be feasible in existing conventional wastewater treatment plants. However, many questions still remain before considering full-scale implementation.

Abatement of AMD at the Germantown AML site in West Central Missouri[1]

Daniel P. Wedemeyer, Environmental Specialist III, Missouri Department of Natural Resources
Paul T. Behum, Hydrologist, OSMRE Mid-Continent Region

Between 2015 and 2018, Missouri Department of Natural Resources, Land Reclamation Program (LRP) completed a two-phase acid-mine drainage (AMD) abatement project at the Germantown abandoned mine land (AML) site in west central Missouri. This poster paper will overview the case history and performance of these AMD abatement efforts. The 971-hectare Germantown AML site was formerly the location of the Peabody Coal Company Power Mine, which extracted the Tebo and Wheeler-Pittsburg coal seams. Starting in 1967, Peabody reclaimed by 1987 about 30% of this historic mine area. An initial abandoned mine lands (AML) reclamation effort by LRP was conducted in 1988 which attempted to address part of the 486 acres of barren spoil that remained as reported in a 1984-1986 U.S. Geological Survey (USGS) study. This area-type surface operation mined though most of the former receiving stream, Horn Branch of Deepwater Creek leaving about 100 impoundments of which 1/2 were reported by the USGS to have a pH < 4.0. More recent LRP effort included the L-Pit Reclamation Project, conducted 2015-2016 followed by the Duck Pond Reclamation Project in 2016-2018. The L-Pit project centered on 127.4 acres of land reclamation. However, two small passive treatments systems were constructed: a surface flow wetland treating a net alkaline discharge, and a variation of a limestone-buffered, sulfate-reducing bioreactor and associated oxidation cells. This bioreactor, termed organics, limestone and aglime (OLA) cell, treats a low-flow highly acidic seep. Three additional passive treatment systems based on OLA-type bioreactors were installed at the Duck Pond Project in 2017.

The Skeleton Keys of Turf Reinforcement

Lisa Simms, P.E., East Coast Erosion Control

Every project has its skeletons, every project has a key. NZTA knows as much about unique challenges as anyone. Facing rural roads designated "high risk" for safety, while preserving grave sites, these two projects take embankments to new heights.

The stretch of SH23 between Hamilton and Raglan was identified as a high-risk rural road by the Safe Roads and Roadside program by the New Zealand Transportation Authority (NZTA). The project required a 25 m high and 60 m long cut face to cut back a corner to improve sight lines.

The Katikati project in the Bay of Plenty had a similar sight line issue and had an embankment that had become unstable. To add an interesting twist, the top of the slope that required improvements was a cemetery. This presented a unique challenge as to how to perform the work without disturbing any of the graves while creating a natural look. The engineers had to take into account a number of factors when designing both projects. How far back do we need to cut the slope back to provide better sight lines? How much space do we have to work with? What kind of equipment will we be limited to? How steep will the slope be? How will we get vegetation to establish? Will we need temporary, permanent or a mix to stabilize the slope? Broadspectrum was selected as the contractor to do the work for SH 23. Broadspectrum knew Cirtex (a distributor for East Coast Erosion Control) had been a part of numerous other Safe Roads and Roadside projects so they reached out to see if they had any recommendations. Due to the geometry of the embankment, it was decided that ECP-2 (a double net with a polypropylene fiber matrix) coupled with 300 mm HD steel pins would be used to stabilize the new slope. EcoTec BOP was selected for the Katikati project. Since the work zone was limited and it was already unstable, a high performance turf reinforcement mat was recommended. T-Recs was selected to secure the embankment along with Platipus anchors. After the grade changes were made, the contractor was able to install T-Recs without using heavy equipment to preserve the gravesites at the top of the slope. The UV stabilized, permanent turf reinforcement mat provided an aesthetically pleasing finish and met the environmental needs for the project. The end result was a safer, aesthetically pleasing landscape for both projects. SH 23 was much safer and taken off the "high risk" list. Visitors to the cemetery in Katikati are content to see a lovely final resting place for their loved ones. Broadspectrum and EcoTec BOP were satisfied at how quickly the turf reinforcement mats on their respective projects were installed and vegetated.

Geomorphic Research Report – Re/Vegetation Initiative Updates

Alan Edwards, Deputy Director Administrator, Wyoming Department of Environmental Quality

The Geomorphic Research Report highlights the value of this reclamation approach that Wyoming and other states are implementing. Re-Vegetation initiatives include a project with the Bureau of Land Management, and the Nature Conservancy, a non-profit that is directly engaged in the sagebrush in prisons project.

Properties and Potential Use of Spent Horizontal Directional Drilling Mud as Soil Amendment

Amir Hass, Associate Research Professor, West Virginia State

The on-going increase in oil and gas exploration and production leads to concurrent increase and expansion in construction of pipeline infrastructure to accommodate downstream delivery of the extracted products. While open-cut trench is the main mode of operation, horizontal directional drilling (HDD) is employed for installation of the pipelines under ecologically sensitive areas (wetlands, rivers, etc.) and/or under heavily used infrastructure (railroad, highways). While preventing landscape disturbance and interruption to commerce, HDD operation produces large volume of spent bentonite drilling mud in need of proper disposal. We examined properties and composition of HDD mud from 34 different stages of operation (pilot hole, reaming, and pullback) and locations along HDD circulation (mud pit/reclaimer) that were collected from different jobsites and operators throughout Pennsylvania, Eastern Ohio, and West Virginia. The potential beneficial use of spent HDD mud as soil amendment was tested on 17 different soil types and at 10 different field sites throughout PA and WV, including reclaimed mine sites. The initially high salinity, sodicity, and elevated (bentonite) clay content, which are characteristic of the virgin mud, changed as the operation progressed, diminishing to more benign composition and levels in the spent mud. Transformation of the mud composition throughout the HDD process and results from field and greenhouse studies, and ensuing recommendation for the use of spent HDD as soil amendment are presented and discussed.

Recovery of Rare Earth Elements from Acid Mine Drainage Using Geotextile Tubes Containment and Dewatering Technology

Tom Stephens, TenCate Geosynthetics, Bedford, VA

Rare Earth Elements (REE) are critical to the global economy because of their use in the communication, aerospace, defense, and energy industry sectors. Areas to mine REE are limited and their recovery is becoming extremely expensive. However, by adapting relatively simple technologies has transformed what is a contaminated waste stream into a valuable commodity.

In the Appalachian region of the US there is a huge and continuing problem of dealing with Acid Mine Drainage (AMD) from existing and abandoned coal mines. The damaging impact of this waste stream on the environment is well documented. Standard treatment of AMD involves introduction of alkaline chemistry to precipitate metals and other solids. However, this treatment creates millions of tons of high water content sludge that is difficult and expensive to manage.

West Virginia University in conjunction with the state Department of Environmental Quality has conducted a multi-year pilot study using geotextile tubes to contain and dewater this AMD high water content slurry to the state that Rare Earth Elements can be recovered economically. 814 samples of AMD were collected from 140 sites in four states. Both untreated raw AMD, and solid precipitated AMD sludge were analyzed. A full scale geotextile tube dewatering and containment operation was installed at one site to facilitate capture of 100% of the sludge generated that contained high concentrations of REE. First, this paper will present the methodologies incorporated and phases of the pilot project that were conducted to create the proof of concept. Second, the paper will detail how the pilot project was scaled to a production facility for economical capture of Rare Earth Element at an abandoned mine site. Finally, this paper will present the cost of the operation, the economic feasibility, and the long term positive economic opportunity for the Appalachia region that is offered by the application of the REE recovery technologies that have been developed.

Phillips Mine Fire – A Containment & Extinguishment Design Plan

Timothy P. Danehy, QEP, Biomost, Inc.

This case study highlights the design and construction approach taken to contain and extinguish a mine fire in the abandoned underground H.C. Frick Coal and Coke Company's Phillips Mine (operational 1907 to 1944 in the Pittsburgh coalbed). The Phillips Mine is located in North Union Twp., Fayette Co. PA (north of Uniontown, PA). The age and origin of the fire are uncertain, as there are indications of sections within the vicinity of the current fire noted on original underground mine maps as 'Barren – Coal Burned Out' and 'Burned Sec' dating back to the 1950's and earlier. Presence of the current fire was first observed / reported to the PA Department of Environmental Protection (DEP) in 1997. Subsurface investigations by the PA Bureau of Abandoned Mine Reclamation (BAMR) performed in 2003 and 2008 evaluated the fire's extent, potential to migrate, and potential to impact man-made structures. It was determined that site conditions within the Phillips Mine appeared conducive for migration toward mine-workings underlaying numerous roadways, residential areas, and occupied structures (including a gas station). These findings led to the 2014 contract with BioMost, Inc. to develop a containment and extinguishment design plan. The approach taken and described in this presentation include drilling and installing 43 steel-cased (capped) monitoring wells between March and April 2014. Selected wells were monitored for: combustible gas (%LEL), carbon monoxide (ppm), oxygen (vol%), and hydrogen sulfide (ppm). Downhole temperature probes were deployed for continuous temperature readings of mine-atmosphere and mine-pool temperatures (where applicable). Monitoring well data contributed to the interpretation of current impacts and communication of the fire within the mine-workings and overlaying carbonaceous zone. This information was used to develop the design that was implemented to contain (via cut-off trench consisting of fire barriers / air barriers) and extinguish (excavate and quench) the Phillips mine fire.

743 Days, from AML Site to Prime Commercial Development Site, The Hazleton Airport Project

Mike Lazorcik, Sr. Civil Engineer, PA DEP-AAMO, BAMR
Joe Sassaman, P.G., PA DEP-AAMO, BAMR

The Hazleton Airport project is located at the intersection of Route 309 and the Airport Beltway in Luzerne County, PA, approximately 1.5 miles north of Hazleton. This AML site contained a Priority 1 dangerous highwall (DH) 1500' long and over 100' high as well as a Priority 2 dangerous pile and embankment (DPE) covering 14 acres. These dangerous abandoned mine features are in the anthracite fields of Northeast Pennsylvania and are the direct result of surface mining performed by Pardee Brothers and Company. The mining was done on the legendary Mammoth Coal Seam, the most prominent seam, where it reaches a thickness of greater than 30'.

The Hazleton Airport reclamation project would complete work begun over 20 years ago by the land owners to reclaim a parcel vital to economic redevelopment. The project involved a few, atypical considerations including, a lack of on-site backfill material, movement of a significant amount of borrow material across Route 309, construction of a runoff retention feature, and the retention-related ripping of bedrock. It also required the cooperation of multiple parties including the PADEP Pottsville District Mining Office, PADOT, Blaschak Coal Corporation, Glenn O. Hawbaker, Inc., and five property owners. One property owner was proactive in the design of the project, which required providing design updates to his engineer for comments, as he was looking for a design that maximized the most acreage for potential reuse of the site.

After 743 days, 67 acres (including two borrow sites) have been reclaimed, abating the dangerous post-mining conditions that existed, resulting in an approximate 22-acre parcel at the intersection of Route 309 and the Airport Beltway. With approximately 14,000 vehicles per day passing thru this intersection that already consists of a mix of residential and commercial development, this site has prime potential for commercial redevelopment.

Hydrogeochemical and Microbial Interactions During Field Mixing of Abandoned Mine Drainage and Sewage-Impacted Streams

Peter M. Smyntek, Saint Vincent College, Department of Interdisciplinary Science

Abandoned mine drainage (AMD) and untreated sewage discharges, as diffuse combinations of improperly functioning on-site sewage treatment (e.g., septic, cesspools) and as direct "wild cat" pipe-discharging point sources from residences, commonly degrade streams in rural areas of the United States that have a legacy of coal mining. Despite their frequent co-occurrence, the interactions of these two pollutant sources are not well characterized. Mixing of sewage and AMD can result in the neutralization of acidity and decreased metals concentrations owing to dilution and other in-stream attenuation processes. Thus, passive co-treatment strategies for AMD and sewage have been explored. However, unmanaged addition of nutrients and fecal bacteria such as Escherichia coli to AMD-impacted streams may exacerbate aquatic ecological and human health risks. Reliable information is needed to understand and manage the combined effects of AMD and untreated sewage. To this end, five sites in southwestern Pennsylvania encompassing a range of physical, chemical and microbiological characteristics were sampled seasonally in 2018-2019 to evaluate spatial and temporal relations among water chemistry, stream flow, and microbial components. Downstream from the near-neutral or acidic AMD inputs, stream pH and alkalinity typically increased compared to the AMD, with relatively conservative transport (flow-normalized concentration) of sulfate and reduction in transport of Fe and Al. E.coli showed flow normalized abundances of 0 – 85% relative to the upstream (pre-AMD-impacted) sites. This variability in survival may imply that some strains of pathogenic bacteria may able to survive despite the dynamic changes in pH and metal concentrations. In addition, phosphate concentrations, which were low at most sites, did exhibit a substantial reduction, while nitrate and dissolved nitrogen concentrations remained largely unchanged. This suggests that AMD may mitigate high phosphate inputs, possibly by interaction with aluminum and iron oxides.

Five Fundamentals for Successful Mined Land Rehabilitation – Selected Case Studies

Stephen R. Zwilling, Eastern U.S. Market Development Manager, Profile Products LLC

Successful rehabilitation of massive soil and vegetation disturbances from surface mining requires a comprehensive and holistic approach. Projects situated in remote and/or difficult to access areas pose additional challenges beyond the universal difficulties encountered in rehabilitating severely disturbed sites. The Five Fundamentals is a proven methodology to integrate and stage several considerations into a working relationship that entails proper planning and execution. "Soil poor" sites associated with mining activities offer considerable challenges when sources of suitable onsite, imported or manufactured "topsoil" may be difficult and costly to obtain with massive hauling and placement costs. The first fundamental employs creative methodologies to develop suitable growing media from less than desirable soils or substrates. This can only be accomplished by first understanding the make-up of the soil or substrate through comprehensive soil testing for agronomic potential and limitations. The second fundamental requires an assessment of suitable plant species for achieving sustainable growth and effective erosion control – while meeting the collective post-reclamation needs of regulatory agencies and mine owners. Once soil and agronomic considerations have been addressed, the third fundamental examines site conditions such as slope lengths, gradients and aspects combined with ditch and channel flow hydraulics to select requisite erosion and sediment control controls. The fourth fundamental insures proper installation practices critical to the success of the rehabilitation program are specified and then implemented by the contractor or installer. Detailed guidelines and details must be developed and combined with onsite supervision. The fifth and final fundamental requires that once rehabilitation measures have been installed, all active sites are routinely inspected and maintained after each significant precipitation or other potentially damaging event. This publication will offer an overview of the "Five Fundamentals" with informative case histories where they have been successfully integrated in mined land reclamation projects over varying geographic areas.

Soil Water Quality at Sandstone Spoils Reclaimed Surface Mine Site – Biogeochemical Processes and Implications

Amir Hass, Associate Research Professor, West Virginia State University

Reclamation of surface mine sites using the Forestry Reclamation Approach (FRA) practices showed to improve reforestation success in the Appalachian coalfields. In this study, we evaluated the effect of FRA practices, namely the use of selected sandstone spoils as topsoil replacement material (brown/oxidized vs. gray/reduced sandstone) and placement thereof (loose vs. compacted) on soil water quality. Experimental plots were established in 2005 and shallow wells and zero-tension pan lysimeters installed in the spring of 2017 (at 30 to 80 cm deep) to sample and monitor soil water quality. Water samples were collected weekly after rain events during 2017 and 2018 growing season (April to late October) and analyzed for elemental composition; total alkalinity; total, and organic and inorganic carbon, and for major ions. Solution pH, temperature, dissolved oxygen, and redox potential were measured in-situ in the field. Results from the 2-year monitoring period point to the role of redox-promote dissolution in governing soil solution properties and composition. Episodes of high total dissolved solids (TDS; in access of the 500 or 300 µS cm-1 regulatory thresholds) were exclusively associated with low redox potential. Temporal seasonal variations in redox potential further govern changes in soil solution pH, TDS, and overall composition. Elevated levels of sulfate and limited development of pedogenic pools of terminal electron acceptors to buffer redox potential (e.g. free iron/manganese oxides, organic matter/nitrate, etc.) seemed to support low redox potential, making these young soils susceptible to redox-promote dissolution processes. The potential role and implications of redox-promote dissolution processes on soil solution, water quality, and on sampling (and data) integrity are discussed.

Revisiting Carbon Sequestration Potential on Appalachian Legacy Mines: Review and Synthesis

Kenton Sena, Lewis Honors College, University of Kentucky
Chris Barton, Department of Forestry, University of Kentucky

An estimated 600,000 ac of surface mines have been reclaimed under SMCRA. Post-SMCRA reclaimed surface mine sites in Appalachia, sometimes called "legacy mines," are typically characterized by plant communities dominated by grasses and shrubs, many of which are non-native. These communities are starkly different from the rich temperate forests that were present on many sites prior to mining. As such, these sites store much less carbon than they did pre-mining and represent an important potential carbon sink. A number of research projects have reported soil carbon sequestration and biomass accumulation on legacy sites that have subsequently been reforested. Assembling and analyzing these reports provides insights into the carbon sequestration potential of legacy sites across the region, with implications for significant mitigation of carbon emissions.

Spatiotemporal Changes in Contaminants Occurring in Three Passive Coal Mine Remediation Systems in Pennsylvania

Michelle M. Valkanas, PhD Candidate, Biological Sciences, Duquesne University
Nancy J. Trun, Associate Professor, Biological Sciences, Duquesne University

Abandoned mine drainage (AMD) from coal mines contains high levels of toxic contaminants, including heavy metals and sulfate. Passive remediation systems (PRS) are increasingly becoming a cost-effective treatment for AMD. Their ability to remediate both acidic and circum-neutral AMD has been successful and 300 PRS have been constructed in Pennsylvania. Three PRS in Pennsylvania were studied to determine abiotic and biotic changes that occurred seasonally. One of the passive systems treats circum-neutral discharge (Lowber) 3 and two treat acidic discharge (Boyce, and Middle Branch)4. Samples were collected quarterly at every pond in each system for ICP-MS (33 elements) and IC (7 elements) and field measurements. Seasonal fluctuations in contaminants entering the PRS occurred. Overall system efficiency was maintained throughout the course of the year, with a few exceptions where system efficiency declined. The pH in the Lowber PRS remained relatively stable throughout and precipitation of iron was visual across the system. Boyce PRS maintained a relatively low pH (<5.5), despite several limestone interventions. Visual precipitation of iron was primarily isolated to pond 4 and large amounts of metal sulfides formed in pond 6. Middle Branch PRS exhibited a steady increase in pH as AMD moved through the system (pH 2.8 – 8). There was no visual precipitation of iron or sulfide observed in the system. Despite spatiotemporal changes that occurred, PRS maintain overall efficiency in the removal of contaminants. These studies provide further support of the success PRS have in removing contaminants and their ability to endure the unpredictability of seasonality.

10+ Year Passive Treatment System Performance Evaluation

Timothy P. Danehy, QEP, BioMost Inc.

The North Fork Montour Run Passive Treatment System installed in two phases to treat acidic, iron- and aluminum-bearing coal mine drainage was evaluated for both chemical and hydraulic performance in 2018, the wettest year on record in Pittsburgh, Pennsylvania, USA. The anoxic limestone drain constructed in 2004 as part of the mine drainage collection and conveyance system situated underneath Pennsylvania Turnpike Route 576 continues to produce alkalinity despite the presence of aluminum. Six additional treatment components were installed in 2008 that include two parallel Jennings-type vertical flow ponds (VFPs). The VFPs were designed to treat the discharge for 15 years based on a maximum/average 6.9/4.3 l s-1 [110/68 gal m-1] flow and 140/56 kg d-1 [309/200 lb d-1] acid load. The record-setting 147 cm [57.8 in] annual precipitation was 50 cm [19.6 in] (51%) above normal and the VFPs experienced inflow up to 27.4 l s-1 [434 gal m-1] and an acid load of at least 303 kg d-1 [669 lb d-1] While the final treated 12.4 l s-1 [235 gal m-1] outflow was measured in April to be acidic for the first time in a decade, the system was able to neutralize 201 kg d-1 [443 lb d-1] of acid. Alkaline system effluent was restored in June even though the inflow to the VFPs was 9.4 l s-1 [149 gal m-1] and contained 179 kg d-1 [395 lb d-1] of acid. The areal acid load reduction as measured at the approximate water surface ranged from 12 g m-2 d-1 to 81 g m-2 d-1. Hydraulic head at each VFP was measured on several occasions with a driving head of 0.99 m [3.25 ft] needed pass up to 14.8 l s-1 [235 gal m-1] Air lock within the underdrain piping appeared to impede flow on at least one occasion when the discharge from one of the VFPs was increased from 2.8 l s-1 to 9.7 l s-1 [44 gal m-1 to 154 gal m-1] after briefly opening the drain valves. Areal hydraulic load ranged from 6.7 l s-1 ha-1 to 134.1 l s-1 ha-1. As the system was overwhelmed both chemically and hydraulically, the maximum performance that can be expected from this seasoned passive treatment system was quantified.

Anna S Mine: A Century of Mining, Acid Mine Drainage, and Remediation

Robert Hedin, Neil Wolfe, and Ted Weaver, Hedin Environmental

The Anna S Mine (Tioga County, Pennsylvania) has supported underground and surface coal mining activities in the Bloss coal seam since the 1890s. The mining is in poorly buffered net acidic strata located above the regional drainage. The mine drainage is low pH with elevated concentrations of Al, Fe, and Mn. In the 1970's surface mining along the crop daylighted portions of the underground workings. Daylighting activities significantly worsened the chemistry of the mine drainage, caused severe water quality problems in Babb Creek, and degraded water quality downstream in Pine Creek, a nationally recognized cold water fishery. The degradation prompted the formation of the Babb Creek Watershed Association (BCWA) who lobbied aggressively for remediation actions. In 2003/04 two passive treatment systems were installed to treat mine water discharging from the Anna S mine at a total cost of $2.5 million. The systems utilize vertical flow ponds and constructed wetlands and are the largest passive treatment project ever undertaken by a non-profit organization in Pennsylvania. The systems have continuously produced net alkaline effluents which has contributed to restoration of good water quality in Babb Creek. In 2010 Babb Creek and Pine Creek were removed from the degraded stream list and reclassified as high quality cold water fisheries. The BCWA has managed the operation of the systems since their installation. This responsibility includes sampling, routine maintenance, and major maintenance projects in 2014 and 2016 when the organic substrates in the VFPs were replaced. The presentation will present the 45 year record of chemical and hydrologic characteristics of mine water discharges from the Anna S mine. The presentation will highlight the degradation caused by the daylighting operations, natural improvements in water chemistry in decades since completion of mining, benefits realized by the passive treatment, and the full cost of the passive systems.

Monitoring Brown Trout Invasion into a Native Brook Trout Stream Post Mine Drainage Remediation: A Cautionary Tale

Tom Clark, Mine Drainage Program Coordinator, Susquehanna River Basin Commission
Brianna Hutchison, CFP - Aquatic Biologist, Susquehanna River Basin Commission

The Susquehanna River Basin Commission, in partnership with the Clearfield County Conservation District, Trout Unlimited, and the Western Pennsylvania Conservancy are working to restore Kratzer Run from abandoned mine drainage (AMD) impacts. Kratzer Run, one of two primary AMD impacted tributaries to Anderson Creek near Curwensville, Pennsylvania in the West Branch Susquehanna River Subbasin, has a unique fish assemblage. Even though impacted by iron, the mainstem of Kratzer Run contains a Class A wild population of mostly brown trout (Salmo trutta) born out of stockings by area residents. Bilger Run, the largest tributary to Kratzer Run, also contains a wild population, but consists almost exclusively of native brook trout (Salvelinus fontinalis) due to pH and acidity impacts from AMD that the brown trout cannot tolerate.

Construction of two AMD treatment systems on Bilger Run may remove this water quality barrier, allowing invasion of brown trout into Bilger Run which could outcompete the native brook trout. This presentation will describe the unique brown/brook interactions in Kratzer and Bilger Runs, how those interactions may change with improving Bilger Run quality, and the methods that have been employed to document that change.

Potential Use for Passive Acid Mine Drainage Treatment as Technology-Critical Elements Resource Recovery Systems

Amir Hass, Associate Research Professor, West Virginia State University

Hi-Tech and advanced clean energy technologies relay heavily on rare earth and other technology critical elements, the supply of which is limited and uncertain. These elements (e.g. Lanthanide group elements, Sc, Y; collectively referred to hereon as REE) are essential for the production of advanced metal alloys, wind turbine and electric vehicles, solar cells, batteries, advanced screen technologies, energy-efficient lighting, etc. While demand for REE rises, the domestic supply thereof is tight and limited. As such, identifying and developing sustainable domestic REE source was identified as a critical national priority by several federal government agencies (e.g. DOD, DOE). This sprung an on-going effort to identify potential domestic REE resources to fill up the demand-gap. While presenting environmental liability for the coal mining industry and landowners, acid-mine drainage (AMD) systems were identified as potential sources for REE. We present results from a study where REE occurrence, composition, and content in selected AMD locations and passive treatment systems therein in central Appalachian coal fields REE were determined. REE content and composition were evaluated with respect to associated coalbed, passive AMD system, as well as conditions and major precipitating elements/phases. This effort is aimed at elucidating the geologic formations, and system/cell conditions and mechanisms conducive to REE abundance and efficient removal and accumulation thereof. Inasmuch as thermodynamic considerations govern the (bio)geochemistry of the systems, design and (mainly) maintenance, and even more notably hydrodynamic conditions (e.g. flow rate, residence time) seemed to pose the major performance impairments. We demonstrate these processes and consideration, using two case studies of AMD wetland systems from southern WV.

Performance of a Drainable Limestone Bed at the Pittsburgh Botanic Garden Lotus Pond Exhibit

Robert Hedin, Hedin Environmental

The primary hydrologic input to the Lotus Pond exhibit at the Pittsburgh Botanic Garden is pH 3.3 mine water containing 18 mg/L Al. In 2013 a drainable limestone bed (DLB) was installed to treat the mine water. The system consists of a concrete tank containing 450 tons of AASHTO #3 limestone. The tank discharge is through a water level control structure containing a gate valve. When the valve is closed the limestone bed is full and the system discharges directly to the Lotus Pond. When the valve opens the bed is emptied and the draining flow is directed to a dedicated sludge basin. The draining is controlled by a solar powered electronic controller. The performance of the DLB has been monitored by routinely measuring the chemistry of the discharge to the Lotus Pond. The DLB effluent has always been alkaline and has averaged pH 6.7 with 0.6 mg/L Al, 0.1 mg/L Fe, and 0.2 mg/L Mn. The quality of the treated water was confirmed when the pond was successfully stocked with bass and sunfish in 2014. During draining events the DLB produces turbid water which is directed to the sludge basin. Two draining events were characterized by taking multiple samples during the draining period. Draining water was always alkaline with pH values 6-7. Concentrations of Al in the draining water were as high as 400 mg/L. Flow rates, determined by a study of the hydraulics of draining events, were assigned to each water sample allowing the calculation of loads. Mass balances were developed that accounted for the retention of metals in the DLB during routine flow, the release of metals from the limestone, and the discharge of metals during draining events. Draining removed 55-70% of the DLB's Al load. The results confirm the effectiveness of the DLB approach for solids management.

Wingfield Pines –A Community and Recreation Driven AMD Remediation Success... with Challenges of Course

Emilie Rzotkiewicz, VP of Land Resources, Allegheny Land Trust

Wingfield Pines is an 87-acre green space in the townships of Upper St. Clair and South Fayette in the southwestern corner of Allegheny County. Located in the flood plain of Chartiers Creek, its trails walk through wetlands, woods, fields, and alongside the creek. The land has seen more than of its share of use and abuse; it was strip mined in the 1940's and later turned into the Wingfield Pines Golf and Swim Club. Once ALT protected the land, a passive Abandoned Mine Drainage treatment system was put in place. A large system treating 1,500 gallons of water a minute mitigating about 90 tons of iron oxide from flowing into Chartiers Creek each year. This system was designed to welcome the community and encouraged the use of the property as a conservation area. The success of habitat creation was evident when a rare bird nested and fledged 3 chicks in the summer of 2016. Visitors can find a variety of wildlife at the green space, including birds, bats, foxes, frogs, and plenty of insects and macroinvertebrates. A winner of the Urban Land Institute's Healthy Place Award, Wingfield Pines is now a community hub for recreation and education in the immersive wetlands that offer an outdoor laboratory for students from local high schools, universities, and public educational programs. Now with a 10 year master plan in place, Wingfield Pines will continue to bring AMD issues to the forefront and educate visitors about its effects.

Successful Acid Mine Drainage Abatement – A Case Study

Joseph E. Mills, Acid Rock Drainage Specialist, Skelly and Loy, Inc.

Forty-two passive Acid Mine Drainage (AMD) treatment systems have been constructed in the Six Mile, Sandy Run and Longs Run watersheds, Broad Top Township, Bedford County, Pennsylvania since 1979. The first AMD treatment system was funded by the Rural Abandoned Mine Program (RAMP) and constructed in 1979. The success of this project and a growing community interest in AMD abatement prompted a watershed study that was completed in 1981. This study identified illegal garbage dumping, sewage and AMD as the major problems in the study area. Broad Top Township has addressed both the garbage and sewage by making garbage disposal affordable to all its residents and by taking ownership of the sewage management practices within the township. By the mid-1990's, additional RAMP and Bureau of Abandoned Mine Reclamation (BAMR) projects were completed. In 2005, a Watershed Implementation Plan (WIP) was completed for Longs, Sandy and Six Mile Runs. Since then, over $3.5 million of CWA Section 319 funds and over $0.5 million of Pa. DEP Growing Greener Grant money has been spent on AMD abatement projects in the watersheds. All of the systems constructed since 2005 have been designed to treat the high flow discharges for a minimum of 20 years. These AMD discharges vary in quantity and quality from site to site. The design goal of all of the AMD treatment systems is to remove 90% of the metal and acid loads entering the streams. Challenging construction conditions were encountered at most of the treatment sites and will be discussed. A variety of passive treatment technologies have been employed. The technology chosen for each site is tailored for that site based on the chemistry and flow at that particular AMD seep location. In 2014, after construction of 13 AMD treatment systems, Longs Run was delisted in the Pennsylvania Integrated Water Quality Monitoring and Assessment Report (Integrated Report). Funding, construction, and operation and maintenance (O&M) of the systems constructed in Broad Top Township as well as chemical and biological improvements will be discussed.

Tracking the Efficiency of Abandoned Mine Drainage Treatment Facilities through Biological Monitoring in the Indian Creek Watershed

Carla Ruddock, Project Manager/Field Technician, Mountain Watershed Association

Mountain Watershed Association (MWA), Inc. is a 501(c)3 nonprofit organization, located in Fayette County Pennsylvania that is dedicated to protecting, preserving, and restoring the Indian Creek and greater Youghiogheny River watersheds. Since forming in 1994, MWA has been active in mine drainage remediation, installing six passive treatment systems and conducting one land-liming project to address some of the 130 discharges identified within the 125 square mile Indian Creek watershed. After spending more than $ 8.5 million installing these systems and over $96,000 annually to keep these systems functioning, it is important to determine what impacts these systems are having. Therefore, in 2011 as part of developing an operation, maintenance, and replacement plan for the abandoned mine drainage treatment systems, a comprehensive monitoring plan was initiated. The expanded monitoring looks beyond the water chemistry and studies how the treatment systems are impacting aquatic life.

Macroinvertebrate surveys are conducted twice a year upstream and downstream of the treatment systems and at several locations for the land liming project. Samples are collected using Pennsylvania's instream comprehensive evaluation protocol. Since monitoring began in 2011 we are seeing trends of improvement based on the Index of Biological Integrity (IBI) scores with an increase in the desired pollution sensitive species being found both upstream and downstream of the treatment system discharges. For example, our Kalp Treatment system during the Fall 2017 surveys demonstrated that aquatic communities have reestablished. The system's discharge has minimal impacts on Indian Creek at best with IBI scores of 65.9 and 63.34 respectively. Before the installation of the Kalp Treatment system the only life that could be found below the discharge was a water strider skipping along the surface of Indian Creek

Ohio Acid Mine Drainage Watersheds; Changes in Fish Communities

Jeff Calhoun, Environmental Specialist, OH Department of Natural Resources, Division of Mineral Resources Management

The Ohio Acid Mine Drainage (AMD) program was formed with the amendment of SMCRA in 1992 which allows up to 30% of the annual federal grant to be set-aside to abate AMD impacts caused by pre-SMCRA coal mining. Since its inception, the Ohio AMD program has completed 66 treatment projects in 7 impaired watersheds; Sunday Creek, Monday Creek, Raccoon Creek, and Huff Run. Monitoring for fish species conducted throughout the life of the program has shown varying levels of recovery. As of 2017, over 94 stream miles meet AMD program targets for recovered streams. Several more stream miles show improved fish communities but are still in a state of recovery. In many streams, fish population sizes have increased dramatically. Some sample sites that were considered ecologically dead in the 1980's with no fish present now support more than 25 species. The changes in fish communities as a result of AMD abatement projects show the true level of biological recovery over time in AMD impaired watersheds.

Utilization of Survey123 to Simplify and Direct Field Investigations

Lucas Graham, Kentucky Abandoned Mine Lands

KY AML receives a considerable amount of citizen complaints every year. Access to complaints would sometimes take days to appear in Frankfort depending upon priority and severity of the problem. Periodically these reports would be missing information that would take additional time to process. KY AML needed a new workflow that would not only simplify the process for quicker field investigation reports, but also directs investigations while ensuring that all information is documented. Surve123 seemed to be the solution to our problem. One advantage of survey is that it would allow KY AML field investigations to be able to send investigations to the server instantly. Survey gives the Frankfort staff the ability to direct the investigation based on answers provided by investigators. This ensures that information will be recorded properly and not left out of the report. Survey123 also has a robust report feature that equips KY AML staff with the ability to print out reports that are similar to the reports used by field staff previously. Using tile packages, we have given our field staff the ability to walk around while at a site on both the LiDAR and GQ maps. These maps can be imported into the survey to be sketched on to make sure nothing is missed. Survey123 has been implemented into Microsoft Flow. Flow allows for emails to be sent containing survey information as soon as a survey is submitted. Emails can even be filtered to different employees based on survey answers. Flow not only generate emails, but can also be used to create/fill out excel sheets for tracking complaints easier and other features that KY AML has yet to explore fully. The analyze tab contained within Survey123 also allows us to express survey information in unique and interesting ways that we never were before. Having multiple GPS points attached to the survey information will allow us to answer more questions as the database grows. Questions like "what type of water quality goes of what coal bed" or "what coal beds produce water seeps without being mined" could all be answered in the future. While survey has solved many of our problems, it is not without its hardships. Being an ESRI product, Survey123 is constantly being updated. During a recent update, survey broke many of our workflows and we were unable to create reports for about three weeks. While these events are few and far between, they seem to be heavily outweighed by the benefits that Survey123 has given KY AML.Clarifier Design & Sizing: Implications of AMD

Chemistry and Process Design

Jon Dietz, Ph.D., Sr. Environmental Engineer, Tetra Tech, Inc.

A number of new active treatment systems are being designed by Tetra Tech, Inc. to treat abandoned mine drainage sources across the Pennsylvania bituminous and anthracite coal regions including: 1) the Quakake Tunnel located in Carbon County; 2) Blacklick Creek located in Indiana County; and 3) Gladden located in Allegheny County. The AMD discharge chemistries cover a broad range from dilute and low acidity containing low to moderate concentrations of aluminum only for the Quakake Tunnel AMD, high acidity with high iron and aluminum for the Blacklick Creek AMD, and net alkaline with high iron for the Gladden AMD. Treatment processes of the discharges ranged from: 1) lime neutralization only for Quakake Tunnel; 2) pre-aeration, lime neutralization, and aeration for the Blacklick Creek; and 3) hydrogen peroxide oxidation and precipitation for Gladden. Each AMD discharge and treatment process posed different and, in some cases, unique challenges in clarifier selection and design with clarifier selection including conventional, recirculating solids contact, and inclined plate (lamella). The presentation will provide information on the various discharges, treatability studies, process design, clarifier selection, clarifier design and challenges encountered in the overall process of clarifier selection.

Use of Nitrogen Generated Foam to Mitigate a Coal Mine Refuse Fire in Colorado

Alden Ozment, President, USF Equipment and Services, Inc.

A coal mine operating in Colorado produces steam coal, also known as thermal coal, that is suitable for electric power generation. Coal mine refuse material resulting from the mining operation is compose of fine coal material and waste rock. The refuse material is typically hauled to a dump site on the mine property. As the pile of refuse material grows, it is compacted and at a predetermined height, is covered with soil and clay to prevent spontaneous combustion. Spontaneous combustion is a naturally occurring phenomenon caused by coal oxidation, a chemical process which produces heat, even at ambient air temperature. This process is a natural balance of heat formation and dissipation and if the heat is allowed to accumulate, the oxidation rate increases exponentially until the point of thermal runaway is achieved, resulting in a spontaneous fire. During the winter of 2018, excessive snow conditions prevented the mining operation from addressing the refuse pile and sometime late in 2018, a spontaneous heating event occurred in the pile and the material ignited. USF Equipment and Services, Inc. was contracted to suppress the burning refuse using their patented gas enhanced foam generation and placement technology. The burning material was first infused in place with gas enhanced foam and as the refuse material was exposed, was quenched with a follow-up application of gas enhanced foam. The treated material was eventually returned to other areas of the refuse pile and covered. Gas enhanced foam when applied to burning material, smothers the fire, reduces heat while conserving water. This paper describes the evolution of the fire, the technologies used to suppress the burning material, methods to prevent a recurrence and the overall results and importance of the work.

Directional Gravity Drainage Boreholes – Proven Very Effective to Drain Abandoned Mine Pools Water to Mitigate Existing Environmental Hazards

Phillip Mullins, P.E.

Abandoned coal and hard rock mines can contain pools of water that can unpredictably and uncontrollably drain from the abandoned mines to the surface causing health, safety and environmental problems, including, but not limited to damage to personal and public property. Strategic placement of directionally drilled surface near horizontal boreholes targeting low elevation points of these pools of water have proven very effective in immediate and long-term, controlled diversion and gravity drainage of these pools of water mitigating landslides and leakage to the surface. The purpose of this presentation is to present the results of directionally drilling gravity water drainage boreholes targeting abandoned old works for both state and federal agencies and the private sector, including VA DMME / AML contracts at Charlie Hollow and Harmon Memorial Baptist Church, and several successful AMD drainage boreholes drilled for operating coal companies. In addition, the presentation will describe in detail the required wellhead design and procedures, directional surface and downhole permissible navigation equipment and directional techniques employed; and briefly describe the use of more complex directional applications for horizontal and vertical-to-horizontal directional drilling techniques used in conjunction with each other to accomplish gravity drainage systems in abandoned mine pools that are present in various coal seam elevations even where rapidly changing surface topography is present. Target's directionally drilled gravity drainage boreholes drilled from surface locations targeting low elevations points in abandoned mines have routinely proven to be a very effective method to drain up to 1,000 gpm initially with continued water production for years with very little disturbance to surface features, mitigation of surface leakage and future landslides.

Wins and Losses in Two Years of the AML Pilot Program

Jim Cable, Environmental Scientist, Kentucky Division of Abandoned Mine Lands

As the Kentucky Division of Abandoned Mine Lands enters the 4th year of the AML Pilot Program, we recognize that each AML Pilot Grant Project has presented a unique set of opportunities and challenges. An assessment of "wins" and "losses" has provided valuable insights. By sharing our experiences and observations with other AML programs, they may benefit as well. This presentation will identify successful and unsuccessful Kentucky AML Pilot Program Grant projects from the 2016 and 2017 grant years. The reasons for success or failure of the highlighted projects will be explored, along with some of the trials faced by the grantees and Kentucky AML as the projects were implemented. A varied spectrum of projects will be presented. Categorically, they will include industrial development, miner retraining and tourism related projects.

Proven Pilot Partnerships: Ohio AML program and Rural Action

Marissa Lautzenheiser and **Terry Van Offeren**

Ohio was included in the federal AML Reclamation Economic Development Pilot program starting in 2017. Since then, $10 million dollars has annually been allocated to the state for implementing reclamation projects that have an economic development nexus. One of the directives of the federal guidance from the Office of Surface Mining Reclamation and Enforcement (OSMRE) is to ensure public engagement at the local level with citizens, economic development programs, and public organizations to achieve economic and community development goals consistent with community and/or regional interests. Rural Action (RA) has been a regional leader in sustainable development since 1991. Partnerships between the Ohio Department of Natural Resources, Division of Mineral Resources Management (ODNR-DMRM) and Rural Action have existed since 1994, and have resulted in numerous successful AML projects. RA watershed staff manage, monitor, and assist in maintaining both active and passive acid mine drainage treatment projects throughout eastern Ohio. The relationship between Rural Action and ODNR-DMRM was recognized as an asset to implementing the Pilot program. A contract was established outlining the counties where education, outreach, and project proposal development assistance would be undertaken. Rural Action then undertook an extensive communication plan, reaching out to the many rural communities and stakeholders that could benefit from the Pilot program. As a result of this Pilot partnership, one project is currently under construction, two have been approved for funding from OSMRE, two Pilot proposals are being co-developed, and many more are being considered. The partnership between Rural Action and ODNR-DMRM can serve as a model for other states and tribes to strengthen their community engagement and, in turn, ensure the local support and long-term commitment necessary for meaningful and successful AML projects. The presentation will review key reasons for success, share communications materials, and overview effective community engagement strategies related to AML programming.

Ohio AML Pilot Projects – Combining Reclamation with Economic Development

Ben McCament, AML Administrator, OH Department of Natural Resources, Division of Mineral Resources Management

OSM awarded Ohio's AML Program Pilot program funds in the amount of $10 million in 2016, 2017, and 2018. The uncertainty associated with these funds included how funding would occur as well as structuring a new program with goals that were different than Ohio AML has strived to achieve. Initially our program reviewed projects that were already in the AML development phase to see if they included long term economic benefits or if it could be incorporated into the project scope. In several cases project scopes were modified and advanced as AML Pilot projects. As additional AML Pilot funding was made available in 2017 and 2018, we shifted our focus to developing projects that prioritized economic development while accomplishing important AML reclamation. Currently Ohio AML Pilot projects will increase recreational opportunities, develop commercial sites, improve historical coal community economies, and develop new innovative products derived from AMD discharges. Most projects underway, 13 of 23, have an outdoor recreational enhancement component. These projects include partnerships with many private and public organizations including the development of bike trails, multi-use rail trails, expanding hunting and camping opportunities and development of new hiking trails. Commercial site development or expansion is the main goal at four sites, including reclamation and drilling and grouting underground mines. Our most innovative project includes building an AMD treatment facility to recover iron for use in pigment production for the paint industry that will dramatically improve stream quality downstream on one of Ohio's largest and damaging AMD seeps in the state. The AML Pilot funding initially challenged Ohio's AML staff due to the change in focus from traditional reclamation to that challenge has been overcome and projects are being implemented that not only reclaim AML sites but will have a lasting economic benefit in our historically coal impacted communities.

Acid Mine Drainage —> Paint Pigment

Michelle Shively, Watershed Coordinator, Rural Action
Dr. Guy Riefler, Civil Engineering Professor, Ohio University

Using an innovative technology, our team is working to bring acid mine drainage impacted streams back to life by removing iron oxide and processing it into pigment, a valuable commodity that can be sold to pay for the treatment process, create jobs in rural communities, and fund additional watershed restoration projects. Acid mine drainage (AMD) impacts thousands of miles of streams across Appalachia in economically depressed communities with few jobs for the current generation. However, through an engineered biochemical process, the polluted water can yield a commercial grade iron pigment that can be sold in industrial quantities. Our first full-scale treatment plant in Millfield, Ohio, will restore 7 miles of currently dead stream, while employing 5 people in an innovative new business. Rural Action is working with Ohio University professors Dr. Guy Riefler and John Sabraw, as well as the Ohio Department of Natural Resources, to scale up the treatment technology, produce effective paint pigments, demonstrate profitability, and create acclaimed artwork to highlight environmental restoration. The United States iron oxide pigments industry is valued at $335 million, and the U.S. uses about 240,000 tons of pigment each year, much of it imported from China. With our first plant, we will produce 1% of that consumption with a natural, sustainable process. We believe this technology can be replicable to many other AMD sites throughout Central Appalachia; our goal is to bring streams back to life, while making the U.S. iron pigment supply chain more sustainable. Our first full-scale True Pigments facility will be located at the Truetown Discharge, the largest single source of AMD in Ohio. Funds from the AML Pilot program will be used for site development at Truetown. Our plans for expansion include other discharge sites in Central Appalachia.

Use of Reclaimed and Abandoned Lands for Income Opportunities and Development

Dr. Jeff Skousen, Professor of Soil Science & Reclamation Specialist, WV University

Appalachia has a long history of surface coal mining and associated reclamation. Surface coal mines prior to 1950 in the US were generally left without any reclamation. After the federal Surface Mining Control and Reclamation Act (SMCRA) was passed in 1977, mine operators were required to conduct pre-mining analyses of the site, provide a mining plan and operation timeline, and to reclaim the area to a land use compatible with the surrounding area. Reclamation on today's American surface coal mines is fully integrated with the mining operation. In the western USA, post-mining land use is often rangeland and wildlife habitat. In the midwestern USA where coal underlies prime farmland, standards require restoration to field crop production at pre-mining levels. In the eastern USA (Appalachia), the humid climate and a scarcity of flat land provides an opportunity for a variety of post-mining land uses to be selected and developed.

This region varies from steep to rolling landscapes and has pre-mining land uses such as crop land, hay land, pasture, forestry, wildlife habitat, and urban and commercial land. Mined land reclamation can create flat land which is valuable for multiple uses, such as hospitals, schools, roadways, parklands, recreation, hunting and fishing, wildlife habitat areas, and specialty horticultural crops. Establishing agricultural enterprises on disturbed lands has recently gained attention because of the large acreages of flat or gently rolling reclaimed and abandoned land that is available. In the past, much of the mined area of WV (about 900,000 acres) has been reclaimed to herbaceous species for grassland and hay land. In the early 2000s, an emphasis was placed on reforestation, and many more mined sites are being reclaimed to hardwood forests. The use of reclaimed land for agriculture and crop growth has only been practiced on a few sites and on relatively small acreages due to much of the reclaimed land having steep slopes and unsatisfactory soil conditions. But it is estimated that as much as 25% of this reclaimed land area may be suitable for agriculture crops such as livestock production, vegetables, grains, and specialty crops. Specialty crops include lavender, hemp, apples and other tree fruits, Christmas tree plantations, and horticultural crop production in greenhouses. A soil resource is necessary for quality and productivity of the crop grown.

(Video Presentation) Land and Water Restoration: Addressing a Legacy (8 Minutes)

YouTube Link to Video: https://www.youtube.com/watch?v=B2hvb01yuel

Cristy Sweeney, Director of Finance & Public Affairs Appalachian Region Independent Power Producers Association (ARIPPA)

Coal refuse is a legacy of previous coal mining and consists of low-quality coal mixed with rock, shale, slate, clay and other material. Also known as waste, culm, gob and boney, it was discarded as a "waste" during the original coal extraction process and randomly disposed in piles near the mine sites. These piles, which can spontaneously combust and leach acid mine water and hazardous substances, are major sources of land, air and water pollution and represent public health and safety hazards. The coal refuse electric generating industry plays a vital role in the cleanup efforts of abandoned mine lands (AML) and abandoned mine drainage (AMD) in Pennsylvania by removing coal refuse piles for electric generation. Since its inception, the industry has removed and burned as fuel more than 230 million tons of coal refuse, improved or restored more than 1,200 miles of streams, and reclaimed more than 7,000 acres of abandoned mine lands in Pennsylvania alone. This approximately 8-minute video explains the environmental benefits of the coal refuse to energy industry, specifically the reclamation activities undertaken by the Colver Power Project and Ebensburg Power Company. These facilities utilize circulating fluidized bed (CFB) boiler technology to convert bituminous coal refuse into electricity and reclaim the underlying land.

(Poster Only) Mill Creek Watershed of Clarion and Jefferson Counties, PA on the Mend

Peter L. Dalby, and **Terry O. Morrow**, Mill Creek Coalition of Jefferson Counties, PA
Janie French, Headwaters Charitable Trust, Headwaters RC & D, PA.

Mill Creek is a 60 square mile watershed shared by two counties (Clarion, Jefferson) which drains into the Clarion River, a PA "River of The Year" awardee, and with parts of it designated as a National Wild & Scenic River. Mill Creek is also the largest AMD contributor to the river with over 60 AMD sites identified. The lowest portion of 6,700 acres is in the public domain as (State Game Lands). The Mill Creek Coalition formed in 1990 and in 1991 constructed its first passive treatment system. At this time, about 40 projects have occurred at an investment of roughly $12 million. Varied methodologies have been utilized during this stream restoration effort; trout are presently released at a second location due to water quality improvements. The diversity of projects, many shown in this poster presentation, include passive treatment systems, the re-mining, contouring, alkalinity addition of older mining sites, lime slurry delivery systems, standard active treatment with highly alkaline solutions, placement of lime fines directly into a stream, and plugging of abandon gas wells. Educational outreach programs are important to the Coalition and include TU's "Trout in the Classroom", and an annual "Ducky Race" on a portion of Mill Creek. The Coalition is also a member of a 501c(3) inter-county community foundation which allows it to receive donations from the community to address the Coalition's financial needs. The Coalition is also developing its second OM&R (Operation, Maintenance and Replacement) plan in order to establish priorities in time and expenses so that all the treatment projects are continually evaluated for operational efficiency. To demonstrate to the community, legislators and agencies the economic benefits of Mill Creeks's restoration, a document is available to interested parties.

Cost Effectiveness Analysis of Geomorphic Reclamation

Roger Coupal, Professor, Agricultural & Applied Economics, University of Wyoming
Karsyn Lamb, Research Associate, Agricultural & Applied Economics, University of Wyoming

Energy development is an important economic activity in Wyoming and many States in the Rocky Mountain West. These activities supply high paying jobs for communities and are a major contributor to the State Government tax base. Along with these activities and contributions though are ecological damages that can affect ecosystem services that other industries depend upon. This analysis assesses the cost effectiveness of geomorphic reclamation compared to traditional using different indicators. The goal of geomorphic reclamation is to achieve a steady-state landscape between forces and resistances (Troy and Chuse 2004), creating a more stable environment ecological restoration. We use the AML project on the Day Loma Uranium Mining District and thein Central Wyoming and the Lionkol abandoned coal mine in Southwest Wyoming as our case studies. In both locations we start with a risk adjusted avoided cost comparison or re-remediation on traditional reclaimed areas that have rill and gully erosional problems. We then expand the analysis using a risk adjusted cost effectiveness approach from ongoing work by Fleisher and Hufford (2019) that measures species richness and biodiversity between the two approaches. This latter approach can be used to manage species of concern that depend on the ecosystems. The evidence to date is that in semi-arid areas in Wyoming, though the costs of geomorphic approaches are higher, the costs of re-remediation on traditional approaches make geomorphic reclamation potentially less expensive. Preliminary discounted cost differential estimates make Geomorphic slightly less expensive ranging from 2.5 percent less to 8 percent more on both sites, depending upon likelihood of erosion events and relative earthwork costs. Biological indicators perform better in cost effectiveness.

Rock Tunnel Passive Treatment
Passive Treatment System – Making Bens Creek Great Again

Len Lichvar

Exploring the Latest HP-TRM Technology for Stabilizing Critical Situations with Vegetation

Rob Lawson, Certified Professional Erosion and Sediment Control

Presentation will include the latest technology for stabilizing critical areas with vegetation in place of hard armor, such as rock and concrete, creating green solutions. Included will be an explanation and uses of Earth Percussion Anchors increasing the margins of safety.

Geomorphic Grading – an Evaluation of Site Performance Across Multiple States

Derrick Thompson, P.E., Trihydro Corporation
Mark Donner, P.E., Trihydro Corporation

Many agencies and reclamation practitioners recognize the benefits of applying geomorphic design concepts to reclaim surface disturbance. When applied correctly, geomorphic grading techniques result in diverse reclaimed landscapes that blend with the native terrain and employ varying slopes, aspects, and channel types. This design method can be applied to alleviate physical and environmental site hazards while also improving long-term site stability. This talk will review approaches and lessons learned through application of geomorphic grading techniques to multiple abandoned surface mines in the Rocky Mountain, Intermountain, and Mid-continent regions. Site conditions, site constraints, and reclamation goals for these surface mines vary across regions and from state to state. Application of geomorphic grading must consider these varied site conditions and adapt to specific site challenges without undermining the underlying geomorphic grading concepts. Across much of the Rocky Mountain and Intermountain regions, conditions are arid and mine sites are often located either on public lands or large private landholdings. Due to ownership and the climate, rangeland is the predominant post-reclamation land use. Re-establishing native vegetation cover can take several years, requiring that the reclamation landform be able to resist erosion in the absence of vegetation. In the Mid-continent region, sites typically receive much more precipitation and ownership is typically private. Post-reclamation land uses may include agricultural pasture and/or hay fields. In these more humid climates and with the correct treatment, vegetation establishes quickly. However, these sites also experience much larger storm events and are more susceptible to water-driven mine drainage issues. Designers must develop reclamation designs that allow for landowner post-reclamation operations, address acid mine drainage or similar issues, and withstand higher storm runoff. The presenters will evaluate select sites reclaimed using geomorphic grading concepts in these regions, each of which were subject to different constraints.

The evaluation is based on landform evaluation models, landowner input, agency input, construction observations, and post-reclamation evaluations. Adaptations and best practices for employing geomorphic grading based on this evaluation will be presented.

Defense-Related Uranium Mines Program

Jay Glascock, U.S. Department of Energy Office of Legacy Management
Steve Renner, Navarro Research and Engineering, Inc.

The Defense-Related Uranium Mines (DRUM) Program provides the structure and basis for the U.S. Department of Energy Office of Legacy Management (LM) to perform the verification and validation (V&V) of defense-related uranium mines (mines) that provided ore to the U.S. Atomic Energy Commission from 1947 to 1970. The V&V activities are conducted to fully understand the scope of potential problems posed by these mines by determining their location, reclamation or remediation status, and potential impacts to public safety, human health, and the environment.

LM developed a Report to Congress on DRUM in 2014 and identified that numerous data gaps exist for most mines regarding location, status, and environmental condition. The DRUM program was established and required that numerous plans as well as a detailed work plan be written to cover programmatic requirements (e.g., methods, safety, quality, and data management). Memoranda of understanding were executed with the U.S. Bureau of Land Management and U.S. Department of Agriculture Forest Service to facilitate a better understanding of the scope of the problem posed by these mines. LM also entered into cooperative agreements with state abandoned mine land (AML) programs to support the inventory of mines on private, state, and federal land. This collaborative effort and partnership with federal land management agencies and state AML programs has led to sharing of information on mines and will result in the V&V of approximately 2,500 mines located on federal public land by 2022.

DRUM activities include: verification of actual mine locations in the field; inventory of mining-related features and assessment of physical hazards; collection of radiological data (gamma surveys), soil samples, and water samples (when applicable); screening of mines using a risk-based screening approach; and reporting the results of these activities to partner agencies. Reports are written to summarize the data and present a risk ranking of physical, radiological, and chemical hazards using multiple lines of evidence for each mine site. LM and their partner agencies will use the reports to assess mine safety closure and restoration priorities and to determine if any further action is warranted.

How Diverse are Forests After Using Forestry Reclamation Approach Techniques on Abandoned Mine Lands in Pennsylvania

Carol M. Varano, P.E., Project Engineer, PA DEP – AAMO, BAMR

Hundreds of years ago, Pennsylvania was heavily forested with valuable mixed hardwoods. Many acres were cleared to provide timber, agricultural land, energy for industrial growth and to reach and process the mineral resources lying below the surface. When early coal mines closed, the sites were frequently unreclaimed and hazards associated with vertical highwalls, steeply sloping spoil piles, and abandoned buildings and equipment remained. Forests began to repopulate many of these sites. In Pennsylvania, the methods used to address public safety hazards, erosion, and slope instability on abandoned mine lands (AML) under the Surface Mining Control and Reclamation Act (SMCRA) (PL 95-87, as amended) have typically involved heavy compaction of spoil material and establishment of thick stands of grasses. The grasslands were frequently not maintained or used for hay or pasturelands, and persist in a state of arrested natural succession with little economic or environmental benefit. The Appalachian Regional Reforestation Initiative (ARRI) published Forestry Reclamation Approach (FRA) techniques to establish productive timber or mixed hardwood forests on previously mined lands. The FRA enhances tree growth by creating a suitable rooting medium to support tree growth that is loosely graded in order to avoid compaction. The Pennsylvania Department of Environmental Protection's Bureau of Abandoned Mine Reclamation (BAMR) used modified FRA techniques on several AML sites to meet the property owners' requests for post reclamation reforestation. Native tree species that are appropriate for site conditions and regional forest-type were planted using FRA techniques. The status of these early reforestation projects will be examined with respect to the establishment of early successional and late successional species, population by desirable and invasive volunteer vegetative species, and the resulting forest diversity when compared to adjacent forested areas.

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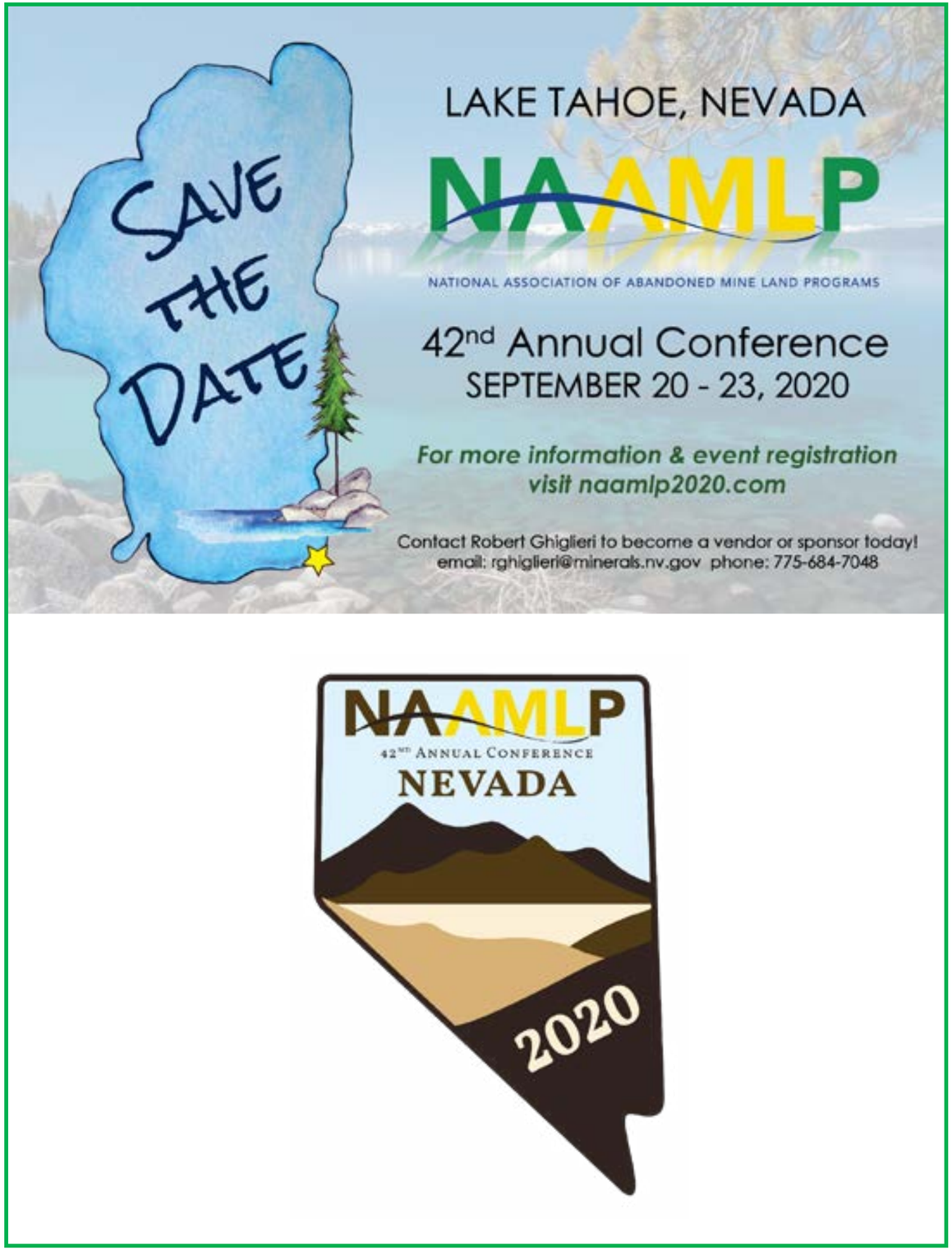

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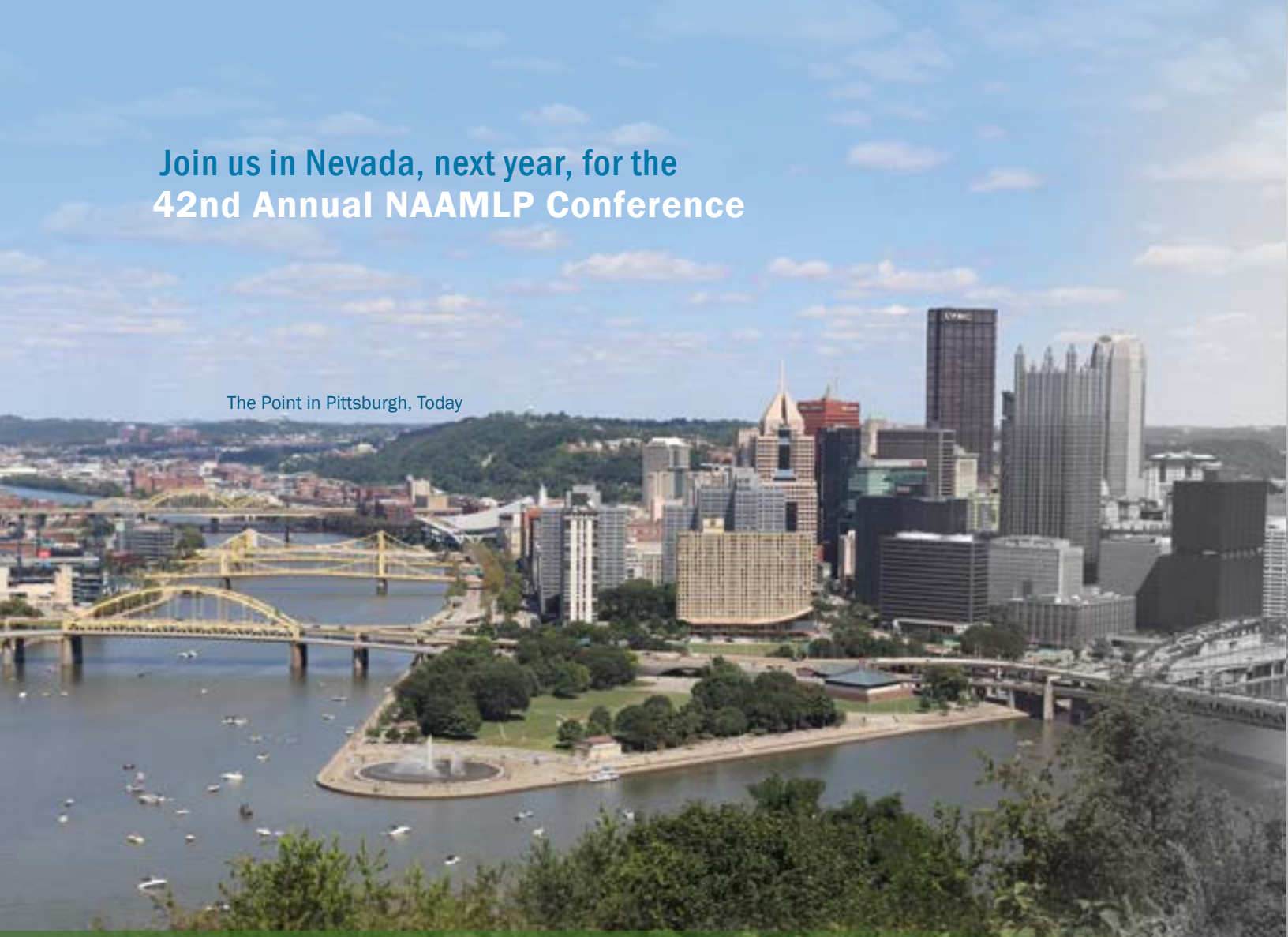

The Point in Pittsburgh, Today

21ST ANNUAL CONFERENCE
Pennsylvania Abandoned Mine Reclamation

41ST ANNUAL CONFERENCE
National Association of Abandoned Mine Land Programs

47TH ANNUAL CONFERENCE
National Association of State Land Reclamationists

Pennsylvania Department of Environmental Protection (DEP)
Active and Abandoned Mine Operations

PENNSYLVANIA'S Annual Conference on Abandoned Mine Reclamation

NAAMLP
NATIONAL ASSOCIATION OF ABANDONED MINE LAND PROGRAMS

NASLR
NATIONAL ASSOCIATION OF STATE LAND RECLAMATIONISTS