N A A M L P

24th Annual Conference

Park City, Utah - Yarrow Hotel

September 15 - 18, 2002

Reclamation 2002:

Partnerships & Project Implementation

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ACKNOWLEDGMENTS

This conference was organized on behalf of the National Association of Abandoned Mine Land Programs by the Utah Abandoned Mine Reclamation Program (AMRP), Division of Oil, Gas and Mining. The Utah AMRP staff - Louis Amodt, Amber Fortner, Tony Gallegos, Connie Jo Garcia, Luci Malin, Jan Morse, Chris Rohrer, Paul Sjoblom, Paul Wisniewski, Ken Wyatt and the program administrator, Mark Mesch, welcome you to Utah and hope you enjoy the conference as well as the many site seeing opportunities Utah has to offer.

This conference could not have happened without the help and work of many people who gave generously of their time and skills. Thank you very much to the following people:

Paul Ehret, Dave Bucknam, John Burghardt, Loretta Pineda, Dick Rol, Fred Sherfy, Vic Anderson, Len Meier, Chuck Meyers, Ginger Kaldenbach, Mary Ann Wright, and Foster Kirby who all moderated technical paper sessions.

Greg Conrad, George Stone, Terry Snyder, Peter Skidmore, Dick Rol, Bob Welsh, Mike Price, Bill Joseph and Kevin Garnett who generously worked to create workshops that added to the level of expertise presented at the conference.

Doug Burnett and Dan Smith provided computer technical assistance. Connie Jo Garcia, Sheila Morrison, Angela Nance, and Vickie Southwick provided secretarial support and ran the registration desk throughout the conference.

ABOUT THE ASSOCIATION

Title IV of the Surface Mining Control and Reclamation Act of 1977 established the national Abandoned Mine Land Reclamation Program under the Department of the Interior's Office of Surface Mining Reclamation and Enforcement. In 1983, states and tribes joined together as the National Association of Abandoned Mine Land Programs to accomplish the common goals and objectives related to the reclamation of abandoned mine lands.

The annual NAAMLP Conference provides a forum for discussion of current issues, common problems and new technologies relating to abandoned mine reclamation. The NAAMLP's 2002 national conference is sponsored by the Utah Division of Oil, Gas and Mining's Abandoned Mine Reclamation Program.

Front Cover Art: After "Hands" by Cheryl DeSellier [dcheryl@clemson.edu]. In "A Celebration of Collaboration." Clemson University web site [http://www.clemson.edu/special/contest/].

National Association of Abandoned Mine Land Programs

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OHIO
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PENNSYLVANIA
TENNESSEE
TEXAS
UTAH
VIRGINIA
WEST VIRGINIA
WYOMING

Dear Participant:

Thank you for taking part in the 24th Annual Conference of the National Association of Abandoned Mine Land Programs in Park City, Utah. And many thanks to our hosts, Mark, Luci and co-workers of the Utah Division of Oil, Gas and Mining for all their efforts in making this one of the finest ever conferences held by the Association.

On August 3, 2002, we passed a significant milestone. It's been 25 years since the enactment of the *Surface Mining Control and Reclamation Act*, and the Abandoned Mine Land Reclamation Program has come to be recognized as one of the most successful environmental improvement efforts in our nation's history. A great deal of measurable progress has been made toward removing safety hazards and other adverse effects of past mining. The twenty-seven (27) states and three (3) tribes which make up our Association have much to be proud of.

With over $6 billion in Priority 1 and 2 problems yet to be reclaimed in the current national inventory, it's clear that much more needs to be done. Income from reclamation fees and interest averages $285 million per year, far exceeding annual appropriations, to the extent that the unappropriated balance of the Fund is approaching $2 billion. Although spending priorities have shifted in the wake of 9/11/01, we've continued to push for full funding of the AML Program, whereby the amount of reclamation fees paid by coal operators into the Fund each year is appropriated, then allocated to the states and tribes to address problems remaining in the AML inventory.

Meanwhile, fee collections for abandoned mine land reclamation are set to expire September 30, 2004. In recent months, several attempts have been made to amend Title IV of SMCRA and reauthorize the AML Program; none have been successful. As time winds down for the 107th Congress, it appears that any legislative changes will have to wait until January.

I'd like to express my appreciation to Greg Conrad (IMCC) for his invaluable assistance in steering us through the budget and legislative processes, and to Gene Krueger (OSM) for working closely with the states and tribes throughout the year.

I've been honored to serve the Association as president during the past year, and have enjoyed working with Murray Balk (KS)-vice president, and Steve Hohmann (KY)-secretary/treasurer, both of whom stayed atop the issues and gave of themselves toward the betterment of the Association. Enjoy the conference!

Sincerely,

Bill Guyette
President - Alabama

National Association of Abandoned Mine Land Programs

ALABAMA
ALASKA
ARIZONA
ARKANSAS
COLORADO
CROW
HOPI
IDAHO
ILLINOIS
INDIANA
IOWA
KANSAS
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MISSOURI
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NAVAJO
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OHIO
OKLAHOMA
PENNSYLVANIA
TENNESSEE
TEXAS
UTAH
VIRGINIA
WEST VIRGINIA
WYOMING

RECLAMATION 2002:
PARTNERSHIPS AND PROJECT IMPLEMENTATION

The Utah Abandoned Mine Reclamation Program is proud to host the 24th Annual Conference of the National Association of Abandoned Mine Land Programs in Park City, Utah, September 15 through 18, 2002.

The conference site is The Yarrow Resort Hotel and Conference Center. Park City, located in the heart of the Wasatch Mountains, is a historic mining town and was the focal point of the 2002 Winter Olympics. It offers spectacular scenery, exciting recreational opportunities and night life. We hope you will be able to see more of Utah than just the Wasatch Mountains during your stay.

The theme of the conference is "Reclamation 2002: Partnerships and Project Implementation." Partnerships are proving to be the way to stretch scarce dollars and achieve reclamation that is more comprehensive and of higher quality than it can be when agencies work in isolation. We want state and federal agencies, counties and other groups to share their experiences about working together cooperatively on abandoned mine reclamation projects. The conference technical sessions will highlight on-the-ground implementation. Over fifty technical papers on will be presented on these topics: Project Management and Implementation; Partnership Policy; Education and Safety; Biology and Vegetation; Partnershipping Projects; Geographic Information Systems; Acid Mine Drainage; Engineering and Design; Watershed Systems; Politics; Cultural Issues and Brownfields.

Eight more focused and interactive workshops will be offered on 1) Stream Restoration (if you are interested in this, sign up at the Registration Desk), 2) Club Fed - Partnerships with Federal Agencies; 3) Clean Water Act Pilot Projects; 4) Cottonwood Wash; 5 & 6) Global Positioning Systems, Geographic Information Systems, and CAD - Parts 1 and 2; and 7 & 8) CAD and AutoCad Parts - 1 and 2.

Four field trips will occur as part of the conference: 1) Big Cottonwood Canyon, 2) Blackhawk and Boyer, abandoned coal mines in Chalk Creek which were reclaimed several years ago, 3) the Crawford Mountain phosphate mines, where some of the most hazardous abandoned mine caused subsidence in the country existed before reclamation, and 4) Kennecott Utah Copper, one of the largest open pit mines in the world. You must stop by the Registration Desk and sign up for the field trips.

We think we have planned a conference that is both fun and intellectually stimulating. We urge you to take advantage of all that Utah has to offer. The Utah Olympic Park is right down the road and is open from 9:00 to 5:00 daily. A self-guided tour of Park City Olympic sites is included in your registration materials. Please do not hesitate to ask any Utah staff member questions about Utah. We are confident that your trip to Utah will be one that you remember fondly for years to come. Enjoy!

The Utah Abandoned Mine Reclamation Program Staff

CONFERENCE INFORMATION

YOUR REGISTRATION BADGE

is your meal ticket! You must present your badge to eat!

Conference registration includes:

- Continental Breakfasts Monday, Tuesday and Wednesday
- Monday Luncheon at 12:15
- Awards Banquet Tuesday evening at 6:30
- All Breaks
- Evening Presentation
- Ice Breaker Reception

Extra luncheon or banquet tickets for spouse/partner or guests may be purchased at the registration desk.

Watch for Random Door Prize Drawings

Hospitality Suite Room 140

SUNDAY
Icebreaker Reception
Hotel Lobby and Exhibit Area
6:30 to 9:00 pm

Don't miss the exhibits!
Ballroom C and hallway outside meeting rooms where the Breaks and Breakfast are!
Monday, Tuesday and Wednesday

Hospitality Suite Room 140

ASSOCIATION MEETINGS

Sunday and Monday
Committee Meetings
Membership
Finance
AMLIS
Public Relations
Reauthorization
Training

Monday, September 17
Delegate's Breakfast
Mountain View Room
7:30am to 8:30 am

Wednesday, September 18
Business Meeting
Mountain View Room
8:30am to 3:00 pm

NAAMLP 24th Annual Conference
Reclamation 2002:
Partnerships & Project Implementation

WELCOME TO PARK CITY

BUS SERVICE

Use free Park City buses leaving from the Yarrow Hotel every 20 minutes from 7:30am to 10:30 pm. Buses go to Main Street, Deer Valley, Park City Mountain Resort and the Outlet Mall at Kimball Junction.

SITES TO SEE

Please see the "This Week In Park City" pamphlet and other materials in your registration packet. Three places not to be missed are the Kimball Art Center at the bottom of Main Street, the Park City Old Town Museum, 528 Main Street, and the Utah Olympic Park.

RESTAURANTS

Park City has many good restaurants ranging from fast food to gourmet. Please see the Menu Guide in your registration packet.

SHOPPING

Park City is noted for a wide variety of shops and galleries on Main Street, as well as the Outlet Mall at Kimball Junction.

HIKING AND BIKING

Hiking and biking opportunities abound in Park City. The Rails to Trails pathway starts on the other side of Albertson's Supermarket and is an easy flat walk or ride that continues for 20 miles to Coalville. Bikes can be rented from a sporting goods store a block away from The Yarrow. A jogging path circles the golf course across the street from the Yarrow. Many other trails take off up the mountainsides.

THE OLYMPIC UTAH PARK

Open daily 9am – 5pm $7 Adults; $5 youth and seniors; $3 for children; children under 3 free. Tour of Park, admission to Joe Quinney Sports Center and Alf Engen Museum are included. Tours run every hour on the hour. You can watch athletes train on the aerial high jump and Nordic ski jump every day but Monday.

THE ALPINE SLIDE AT PARK CITY RESORT

In the spirit of the Olympic Luge and Bobsled, the Alpine Slide rockets you down a fixed track of banked turns and exciting straight-aways. With 2,800 feet of track and 550 feet of vertical decent, this is a bona fide thrill ride for both young and young-at-heart. The specially designed sleds allow you to maintain complete control over your speed and descent. How fast or slow you go is entirely up to you. Must be 48 inches in height to drive your own sled. Must be 2 years old to accompany an adult. Adults $9.00; Children $3.00.

LOCAL INFORMATION

Park City's altitude is 6,700 feet above sea level. Altitude sickness can feel like the flu. You need to drink plenty of water and not overly exert yourself for the first day or two. Because the atmosphere is thinner, you can sunburn more easily. Use of sunblock and chapstick is highly recommended. The morning and evenings may be cool to cold, so grab a sweater if you plan to leave the hotel at these times.

CONFERENCE AT A GLANCE

National Association of Abandoned Mine Land Programs

FRIDAY THROUGH SUNDAY, SEPTEMBER 13 - 15
PRE-CONFERENCE TOUR OF SOUTHEASTERN UTAH

SUNDAY, SEPTEMBER 15

10:00 am - 5:00 pm	Golf Outing
2:00 pm - 9:00 pm	Conference Registration
1:00 pm - 5:00pm	Vendor Set up
6:30 pm - 9:00 pm	Welcome Icebreaker

MONDAY, SEPTEMBER 16

7:00 am - 5:00 pm	Exhibits and Vendors
7:00 am - 8:30 am	Continental Breakfast
7:30 am - 8:30 am	Delegates Business Breakfast
7:30 am - 5:00 pm	Registration
8:30 am - 9:45 am	Welcome and Keynote Address
10:00 am - 5:00 pm	Guest Tour 1 - Mormon History
9:45 am - 10:15 am	Break
10:15 am - 11:45 am	Technical Sessions 1 & 2
12:15 pm - 1:30 pm	Lunch Program Hal Compton *Park City Mining History*
1:45 pm - 3:15 pm	Technical Session 3 & 8 and Workshop 1
1:45 pm - 5:00 pm	Field Trip 1- Big Cottonwood Canyon
3:15 pm - 3:45 pm	Break
3:45 pm - 5:15 pm	Technical Sessions 4 & 5
5:30 pm - 6:50 pm	Guided bike ride
7:30 pm - 8:30 pm	Optional Evening Program Phil Notarianni *Utah's Mining Heritage*

TUESDAY, SEPTEMBER 17

7:00 am - 5:00 pm	Exhibits and Vendors
7:00 am - 8:30 am	Continental Breakfast
8:00 am - Noon	Registration
8:30 am - 10:00 am	Technical Sessions 6 & 7
8:30 am - 5:00 pm	Workshop 2
8:30 am - Noon	Field Trip 2 - Blackhawk & Boyer
10:30 am - 3:00 pm	Guest Tour 2 - Great Salt Lake
10:00 am - 1:00 pm	Guest Tour 3 - Utah Olympic Park
10:00 am - 10:30 am	Break
10:30 am - Noon	Technical Session 9 Workshop 3
Noon - 1:45 pm	Lunch On-Your-Own
1:30 pm - 5:15 pm	Field Trip 3 - Crawford Mts
1:45 pm - 3:15 pm	Technical Sessions 10 & 11 Workshop 4
3:15 pm - 3:45 pm	Break
3:45 pm - 5:15 pm	Technical Session 12 Workshops 5 & 6
6:30 pm - 9:00 pm	Awards Banquet

WEDNESDAY, SEPTEMBER 18

7:00 am - 8:30 am	Continental Breakfast
7:30 am - 3:00 pm	Field Trip 4 & Guest Tour 4 Kennecott Utah Copper
8:30 am - 10:00 am	Technical Sessions 13 & 14 Workshop 7
8:30 am - 3:00 pm	Business Meeting
10:00 am - 10:30 am	Break
10:30 am - Noon	Technical Sessions 15 & 16 Workshop 8
3:00 pm	Adjourn

FEATURED SPEAKERS

David D. Lauriski - Keynote Speaker, Monday Morning

David D. Lauriski is the seventh Assistant Secretary of Labor for Mine Safety and Health. Prior to his confirmation as Assistant Secretary, Mr. Lauriski spent 30 years in the Utah coal mining industry, with a focus on safety for much of his career. Since his confirmation by the U.S. Senate on May 9, 2001, he has been dedicated to carrying out the Mine Safety and Health Administration's mission of protecting the health and safety of the miner. At the time of his leaving the mining business in 1999, Mr. Lauriski was the General Manager of Energy West Mining Company. Under his leadership, Energy West was recognized for its position as one of the largest underground coal producers in the United States and, most importantly, as one of the safest companies in the industry. Prior to his confirmation, Mr. Lauriski was the President of Lauriski and Associates, and served as Chairman of the Utah Board of Oil, Gas, and Mining and as a board member of the Utah Mining Association. He has also served as Chairman of the Coal Mine Safety Committee for the former American Mining Congress and as Chairman of the Safety Committee for the Utah Coal Operators.

Jeffrey Jarrett - Awards Banquet Speaker, Tuesday Evening

Jeffrey D. Jarrett is the 14th Director of the Interior Department's Office of Surface Mining Reclamation and Enforcement (OSM). Mr. Jarrett served as a Deputy Assistant Director for OSM's Regional Office in Pittsburgh, Pennsylvania from 1988 to 1994 and most recently as Deputy Secretary for Mineral Resources Management of the Pennsylvania Department of Environmental Protection (DEP). As Director of OSM, Mr. Jarrett directs policy and has executive responsibility for developing and enforcing surface coal mining regulations under the Surface Mining Control and Reclamation Act. The agency operates with an annual budget of $306.5 million and a work force of 636 employees nationwide. As Deputy Secretary for the Pennsylvania DEP, Mr. Jarrett was responsible for regulatory programs for surface and underground coal and industrial minerals mining, oil and gas exploration, deep mine safety, and abandoned mine lands reclamation. Previously he served as Director of the DEP's Bureau of District Mining Operations where he was responsible for the effective implementation of various environmental laws as they relate to the surface and underground coal and non-coal mining industries in Pennsylvania and for miner health and safety regulations at all surface mining operations. Mr. Jarrett served as an OSM Deputy Assistant Director responsible for overseeing the effective implementation of the Surface Mining Control and Reclamation Act of 1977 in the eastern states. Also for OSM, he managed a number of state and area offices, administered federal grants to the states for the operation of Abandoned Mine Land, insured oversight and management of regulatory programs, and provided technical assistance to the states. Mr. Jarrett previously served as director of planning, division manager, and reclamation director for the Cravat Coal Company and as reclamation supervisor for The Drummond Company. A native of West Virginia, Mr. Jarrett received a B.S. degree in Human Resource Management from Geneva College in Pennsylvania and an A.A.S. degree in Land Stabilization and Reclamation from Belmont Technical College in St. Clairsville, Ohio.

FEATURED SPEAKERS

Hal Compton - Luncheon Speaker, Monday

Hal Compton is the research historian at the Park City Historical Society & Museum. He was born in Brigham City, Utah. He graduated with B.S. Degree in communications from the University of Utah and served in the United States Army Signal Corps as 2nd Lieutenant in Korea. He worked for two years at CBS Radio and Television in Hollywood. He then worked in public relations for GTE in California for 31 years. During that time he gained an interest in mining while exploring the Gold Country of northern California. He took early retirement and settled in Park City in 1987. When not hiking in the mountains and visiting mine sites he works in the Park City Museum and Visitor Information Center on Historic Main Street where he has given many historic walking tours of Main Street. He served as underground tour guide for the Silver Mine Adventure in the Ontario Mine. In 1998, he was selected Museum Volunteer of the Year by the Utah Museum Association. He was designated Park City's historian laureate by the Mayor and the City Council. Currently he is a member of the Board of Directors of Park City Historical Society & Museum and President of the Glenwood Cemetery Association.

Philip Notarianni - Historical Program Speaker, Monday Evening

Philip F. Notarianni is currently Acting Associate Director of the Division of State History, where he has worked for the past twenty-three years. He is an Associate Professor Lecturer in the Ethnic Studies program at the University of Utah. A resident of Magna, Utah, he received B.S. and M.A. degrees in history at the University of Utah, an M.A. degree in history at the University of Minnesota, and a Ph.D. at the University of Utah in 1980. He teaches the "A Peoples of Utah" class at the University of Utah which analyzes the ethnic and cultural diversity of Utah. Dr. Notarianni, a son of Italian immigrants, is married to Maria Teresa Maletta, an immigrant from Calabria, Italy. During the 1987-88 academic year, Dr. Notarianni researched the places of origin of Calabresi in Utah under a Fulbright Research Grant. He frequently serves as a member of the temporary faculty in cultural anthropology for the University of Calabria in Cosenza, Italy. As a staff member of the Utah State Historical Society since 1977, he held positions in the areas of historic preservation and museum services, working widely with various individuals, groups, and institutions statewide. Dr. Notarianni has developed exhibits on Utah, mining, and ethnic history, and has assisted other organizations in similar efforts. He has written numerous books and articles, primarily about the Italian immigrant's experience in Utah.

Tom First Raised - Conference Blessing

Tom First Raised is a full blood member of the Assiniboine Tribe. He was born in Fort Belknap on the Fort Belknap Reservation in Montana on March 5, 1929. He is a U.S. Army veteran of the Korean War. He came to Utah from Montana in 1957 to work at the Intermountain Indian School in Brigham City. He moved to Salt Lake City in 1985 where he now resides. He is active in the local Native American community participating in Pow-Wows and other gatherings. He is often called upon as a spiritual leader for the Native American community. He participated in the Opening Ceremonies at the 2002 Winter Olympics with the NorthWest Band of Shoshone from Northern Utah. He also offered a prayer at the vigil-memorial services for the recently deceased Utah State Senator Pete Suazo.

CONFERENCE SCHEDULE

SUNDAY

MONDAY - Morning

Room	7:00 - 8:30	8:30 - 9:45	9:45 -10:15	10:15 - 11:45
Exhibit Area	Continental Breakfast		BREAK	
Mtn. View Room	7:30 Delegates Breakfast			
Ballroom A		WELCOME and KEYNOTE ADDRESS		1 - Project Management & Implementation
Ballroom B				2 - Partnership Policy
Kearns Room				
Lobby		Registration		

TUESDAY - Morning

Room	7:00 - 8:30	8:30 -10:00	10:00 - 10:30	10:30- 12:00
Exhibit Area	Continental Breakfast		BREAK	
Ballroom A		6 - Partnership Projects		Workshop 3 CWAP Pilot Projects
Ballroom B		7 - GIS Part 1		9 - GIS Part 2
Kearns Room		Workshop 2 - Stream Restoration Classroom session (continues in afternoon with field tour)		
Lobby		Field Trip 2 - Blackhawk & Boyer Registration		

WEDNESDAY - Morning

Room	7:00 - 8:30	8:30 -10:00	10:00 - 10:30	10:30 - 12:00
Exhibit Area	Continental Breakfast		BREAK	
Ballroom A		13 - Watershed Systems		15 - AMD Part 3
Ballroom B		14 - Politics		16 - Cultural & Brownfields
Kearns Room		Workshop 7 AutoCAD Part 1		Workshop 8 AutoCAD Part 2
Mtn. View Room		Association Business Meeting		
Lobby	7:30 Field Trip 4 - Kennecott Utah Copper			

CONFERENCE SCHEDULE

2:00 - 9:00 Registration Hotel Lobby	6:30 - 9:00 Welcome Icebreaker Ballrooms & Lobby

MONDAY - Afternoon

12:15-1:30	1:45-3:15	3:15-3:45	3:45 -5:15	7:30 - 8:30
		BREAK		
LUNCHEON Park City Mining History	3 - AMD Part 1		4 - Stream Restoration	EVENING PROGRAM Utah's Mining Heritage
	Workshop 1 Club Fed		5 - Biology/ Vegetation	
	8 - Education & Safety			
	Field Trip 1 - Big Cottonwood Canyon			

TUESDAY - Afternoon

12:00-1:30	1:45-3:15	3:15-3:45	3:45 -5:15	6:30 -9:00
		BREAK		
LUNCH ON YOUR OWN	10 - AMD Part 2		Workshop 6 Cottonwood Wash	AWARDS BANQUET
	11 - National Award Winners		12 - Engineering & Design	
	Workshop 4 GPS-GIS-CAD Part 1		Workshop 5 GPS-GIS-CAD Part 2	
	1:30 Field Trip 3 - Crawford Mountains 1:30 Workshop 2 Stream Restoration Field Tour			

WEDNESDAY - Afternoon

12:00 - 3:00	
Technical Sessions and Workshops Concluded	**3:00 pm** **CONFERENCE ADJOURNS**
Association Business Meeting, continued	
Field Trip 4, continued	

FIELD TRIPS & TOURS

National Association of Abandoned Mine Land Programs

ALL FIELD TRIP PARTICIPANTS MUST SIGN UP AT THE REGISTRATION DESK - EVEN IF YOU SIGNED UP ON THE REGISTRATION FORM - TO INSURE THAT YOU HAVE A SEAT!!!! SIGN UP AT THE REGISTRATION DESK!!!

CONFERENCE FIELD TRIPS

Field Trip 1: Blackhawk & Boyer - The Blackhawk and Boyer mines were reclaimed under bond forfeiture in the early 1990's. Successful reclamation was achieved even though only minimal funds were available. Coal was discovered in the 1850's when the Mormon pioneers searched for a source of coal close to Salt Lake City. Five hundred pounds of 20-year-old, deteriorating dynamite was found in an old magazine at the Blackhawk mine which required a emergency disposal action.

Field Trip 2: Big Cottonwood Canyon - The Blind Miner and Mutual Metals mines are examples of the extensive lead/zinc/silver mining that took place in the Cottonwood Canyons and Park City. Roy Newman, the Blind Miner, was blinded and nearly killed by a misfire in 1929. He continued to mine however, and dug the mine, by hand, for over 1600 feet on a straight and level plane. No shippable ore was ever produced by the mine. The Mutual Metals mine was notorious for lack of oxygen about 1/4 mile inside the portal. Mining in the area began in the 1860's and ended in 1968. The area is now used for recreation: skiing, hiking, biking and enjoying the splendor of the Wasatch Mountains. The tour is planned to include a short (.07 mile) walking tour of high altitude wetland restoration in Brighton (8,700 feet).

Field Trip 3: Crawford Mountains - The Crawford Mountains in northeastern Utah were the site of the one of the most dangerous subsidence areas in the entire country. Phosphate mining left crown pillar systems that were unstable and daylighting to the surface. Many drops of over 800 feet were inventoried. Mining occurred from the early 1900's until the early 1970's. After the mine shut down, the many dangerous physical hazards caused the residents of Rich County to request that the Utah Abandoned Mine Reclamation Program treat this project as a top priority. The work was conducted in eight phases over 10 years for a total cost of 2.8 million dollars.

Field Trip 4: Kennecott Utah Copper - Kennecott Utah Copper operates one of the largest open pit mines in the world; it is the largest open pit mine in the northern hemisphere. Completed reclamation, current reclamation activities, the tailings drainage system, the Visitor Center, the pit and other highlights of the property will be toured.

SPOUSE/GUEST TOURS

Tour 1: Mormon History - This tour will visit the This Is the Place Monument, the Mormon Heritage State park, Temple Square, the LDS Genealogy Library, and the Mormon Handicraft store.

Tour 2: The Great Salt Lake - The geology and natural history of the unique Great Salt Lake ecosystem will be explained by an expert. You will take a short boat ride on the lake, experience the shoreline and have lunch.

Tour 3: Utah Olympic Park - Visit the Utah Olympic Park near Kimball Junction. A tour includes the luge track, aerial ski jump and Nordic ski jump sites. Athletes practice here daily.

Tour 4: Kennecott Utah Copper - Join the conference attendees and tour the largest open pit mine in the northern hemisphere.

WORKSHOPS

WORKSHOP 1 - Partnerships and Project Funding with Federal Agencies
Greg Conrad and George Stone
Why do so many federal agencies have AML funds? How can weStates and Tribes work together with federal agencies such as the EPA, USDA Forest Service, Bureau of Land Management, Army Corps of Engineers, and others to solve AML problems on the ground rather than fighting over jurisdictions? A panel of experts from various federal agencies will discuss AML funding issues.

WORKSHOP 2 - Stream Restoration
Paul Wisniewski, Dick Rol and Peter Skidmore
This all day intensive workshop looks at geomorphic and bio-engineering perspectives of stream restoration. The group will meet in a classroom setting in the morning and in the afternoon will go on a field tour that includes a hands-on opportunity to install bio-remediation measures. Dress for the field. Sign up at the registration desk is required.

WORKSHOP 3 - Clean Water Action Plan Projects
Terry Snyder
A panel consisting of the project managers for each of the three initial Clean Water Act Action Plan Pilot Projects in the states of Montana, Colorado and Utah will discuss project planning and development, the environmental clearance process, engineering and design, public involvement and project implementation.

WORKSHOP 4 - GPS-GIS-CAD, Part 1
Bob Welsh and Mike Price
This workshop will explore cutting edge uses of CAD, GIS, and GPS technologies in AML project inventory and design. New developments enable integrated mapping and design in the field. The abilities and limitations of each technology will be presented. The workshop will examine a case study of an AML inventory where integrated CAD, GIS, and GPS technologies were applied to a real world situation. There will be a hands-on field demonstration of the hardware and software. This workshop is presented in two consecutive sessions. Attendance at the first is a prerequisite for attending the second.

WORKSHOP 5 - GPS-GIS-CAD, Part 2
Bob Welsh and Mike Price
Continuation of Workshop 4.

WORKSHOP 6 - The Cottonwood Wash Project, Utah
Mark Mesch
The Interagency Technical Committee responsible for the planning, development and execution of this million dollar cooperative project will discuss how they initiated, planned and developed the Cottonwood Wash Project in southeastern Utah. Personnel from three BLM offices, four USDA Forest Service offices, the Utah Division of Water Quality and the Utah Abandoned Mine Reclamation Program will participate.

WORKSHOP 7 - AutoCad, Part 1
Kevin Garnett and Bill Joseph
This workshop will introduce users to the new or updated features of AutoCAD-based products that are available for AML project planning, surveying, design and implementation. Attending Part 1 is a prerequisite for attending Part 2.

WORKSHOP 8 - AutoCad, Part 2
Kevin Garnett and Bill Joseph
Continuation of Workshop 7.

TECHNICAL PAPERS

Technical Paper Session 1: Project Management and Implementation
Moderator: Paul Ehret, Indiana Bureau of Mine Reclamation

Environmental Planning for Mine Cleanup and Demolition Activities; Buck and Zietlow
Mine Reclamation Using Dredged Materials and Coal Ash; Voros, Linnan, Sands and Giovannitti
Approaches to Mine Subsidence in Four U.S. Communities; Meier
Survey Data Collection Associated with an AML Emergency Program; Schottel and Gibson

Technical Paper Session 2: Partnership/Policy
Moderator: Dave Bucknam, Colorado Inactive Mine Program

Federal-State Relations in the Mining Regulatory Arena: Pursuing Productive Partnerships; Conrad
A Team Approach To Evaluating State Abandoned Mine Reclamation Programs; Sassaman
Eastern PA Partnerships Supported through the EPCAMR Regional Watershed Support Initiative (RWSI); Hughes
San Juan County AML Partnerships; Pineda and Bucknam

Technical Paper Session 3: Acid Mine Drainage (AMD): Part 1
Moderator: John Burghardt, National Park Service, Denver

Acid Mine Drainage Abatement in the Lower Rock Creek Watershed - McCreary County, Kentucky; Carew
The Tanoma Passive Mine Drainage Treatment Project; Cavazza and Beam
The Role of AMD in the Treatment of Other Problem Waters; Allbright
Spenceville Mine Closure; Wanket, Pujol, Walker and Reynolds

Technical Paper Session 4: Stream Restoration
Moderator: Dick Rol, Senior Planner, City of San Diego

Natural Channel Design, Construction and Planting on the Middle Fork South Platte River; Windell and August
Natural Channel Design Process Using RIVERmorph Stream Restoration Software; Belcher and Athanasakes
A Categorization of Approaches to Natural Channel Design; Skidmore
Abandoned Mine Land Restoration in a North Idaho Stream: A Geomorphological Perspective; Stevenson, Moore, Kondolf and Piegay

Technical Paper Session 5: Biology/Vegetation
Moderator: Fred Sherfy, OSM, Harrisburg

Effects of Cadmium on White-tailed Ptarmigan in Colorado; Larison
Monitoring and Evaluating Results of Bat Protection Efforts; Grandison, J. Diamond, G. Diamond and Mesch
Revegetation of Nine Square Miles of Copper Tailings; Sauer, Williams and Duvall
Vegetative Community Analysis of Biosolids Test Plots After Five Years of Growth; Black and Borden
Rooting Characteristics of Vegetation Established on a Refuse Pile; Burton, Baker, White, Postle and Collins

TECHNICAL PAPERS

Technical Paper Session 6: Partnershipping Projects
Moderator: Vic Anderson, Montana Mine Waste Cleanup Bureau

Pennsylvania 's Efforts to Address Operation, Maintenance and Replacement of AMD Passive Treatment Systems; Milavec and Seibert
Interagency/Industry Coordination to Respond to Selenium Contamination at Phosphate Mines in Southeastern Idaho; Buck and Jones
Ohio DNR and Cuyahoga Valley N.P.: A Partnering Success Story; Smith and Norley
Watershed Coalition Power in Appalachia - Keepers of Land and Water; Sponaugle and Park

Technical Paper Session 7: Geographic Information Systems (GIS): Part 1
Moderator: Len Meier, OSM, Alton

GPS for GIS Applications; Ingram
Abandoned and Inactive Mine (AIM) Lands Inventory for the USDA - Forest Service, Region 9, Monongahela and Wayne National Forests; Aparicio, Anderson, Stachler, Ewing, Tracy, Brewster and Spagna
GIS Analysis of Mine Reclamation: Solving the Problem of Dredge Material and Abandoned Mines; Mignone and Reid
The Characterization of the Kempton Mine Complex, Maryland and Virginia, Using GIS Technology; Davis and Lyons

Technical Paper and Panel Discussion Session 8: Education and Safety
Moderator: Loretta Pineda, Colorado Inactive Mine Program

Abandoned Mine Safety and Mining Reclamation Education Materials Development Projects; Dalton
Stay Out and Stay Alive Panel; Pineda

Technical Paper Session 9: Geographical Information Systems (GIS): Part 2
Moderator: Len Meier, OSM, Alton

GIS-based Statewide Inventory for Wyoming; Arneson, Green and Bedessem
GIS as a Prioritization and Planning Tool in Abandoned Mine Reclamation; Southwick, Smith and Rohrer
Use of Integrated GPS and GIS Systems in Mine Reclamation; Wesley and Steckelberg
Developing Abandoned Mine Lands; Husted

Technical Paper Session 10: Acid Mine Drainage (AMD): Part 2
Moderator: John Burghardt, National Park Service, Denver

An Ongoing Evaluation of Bauxsol at the Gild Edge Mine, South Dakota; Jonas, Wangerud and McConchie
Rehabilitation of the Old Bevier Passive Treatment Wetland, Macon County, Missouri; Behum, Kim, Garnett , Meier, Glascock, Hicks, Mueller and Phillips
Progress of BLM-Funded Acid Mine Drainage Research; White, Lapakko and Trujillo
Characterization of Anthropogenic and Natural Sources of Acid Rock Drainage at the Cinnamon Gulch Abandoned Mine Land Inventory Site, Summit County, Colorado; Bird

Technical Paper Session 11: 2002 National Award Winners
Moderator: Chuck Meyers, OSM, Washington, D.C.

Appalachian Region Award Winner
Mid-continent Region Award Winner
Western Region Award Winner

Technical Paper Session 12: Engineering and Design
Moderator: Ginger Kaldenbach, OSM, Denver

Manning Canyon Tailings Removal Action; Ford and Ingwell
Dangerous Atmosphere Created by Strip Mine Spoil; Ehler
Designing for 1000 Years; Sanchez and Anderson
Zortman and Landusky with 20/20 Hindsight; Maehl

Technical Paper Session 13: Watershed Systems
Moderator: Dick Rol, Senior Planner, City of San Diego

Abandoned Mine Site Restoration on Pine Creek, Coeur d'Alene Basin, Northern Idaho; Fortier and Moore
Mercury Contamination of Water, Sediment, and Biota in Watersheds Affected by Historic Hydraulic Gold Mining in California; Lawler, Clayton, Alpers, Hunerlach, Hothem, May and Rytuba
High Ore Creek Watershed Restoration, Part 1; Browne, Quinones and Madison
High Ore Creek Watershed Restoration, Part 2; Browne, Quinones and Madison

Technical Paper Session 14: Politics
Moderator: Mary Ann Wright, Utah Division of Oil, Gas and Mining

The EPA Rocky Mountain Regional Hazardous Substance Research Center; Wildeman, Macalady, Shackelford and Woods
Recent Court Rulings on Takings and the Possible Impact on the Abandoned Mine Land Program; Girol
The Politics of a Mega-Project: Institutional Resistance to Innovative Ideas; Voros

TECHNICAL PAPERS

Technical Paper Session 15: Acid Mine Drainage (AMD): Part 3
Moderator: John Burghardt, National Park Service, Denver

Integrating Hydrologic and Geologic Controls on Metal Loading to Streams: Mass-loading Analysis of Mineral Creeek, Colorado; Kimball, Runkel, Walton-Day and Bove
Sulfate Reducing Bioreactor Design and Operating Issues: Is This the Passive Treatment Technology For Your Mine Drainage? Gusek
Longevity of Mine Discharges from Above-Drainage Underground Mines; Skousen, Demchak and McDonald

Technical Paper Session 16: Cultural Resources and Brownfields
Moderator: Foster Kirby, OSM, Denver

Cultural:
Uranium Mining in Cottonwood Wash: A Quick Look at 50+ Years; Bennett
Abandoned Mine Reclamation in Culturally Sensitive Areas: An Example from Cottonwood Wash, Utah; Huppe

Brownfields:
A Brownfields Redevelopment Opportunity at an Abandoned Mine Lands Site; Gendron
Economic and Community Development Opportunities for Mine Scarred Lands; Larosa

The Utah Abandoned Mine Program
invites you to visit
the Hospitality Suite, Room 140
Sunday 9:00 pm to 11:00 pm
Monday 5:30 pm to 7:30 pm
9:00 pm to 11:00 pm
Tuesday 5:00 pm to 6:30 pm
9:30 pm to midnight

24th Annual NAAMLP Conference

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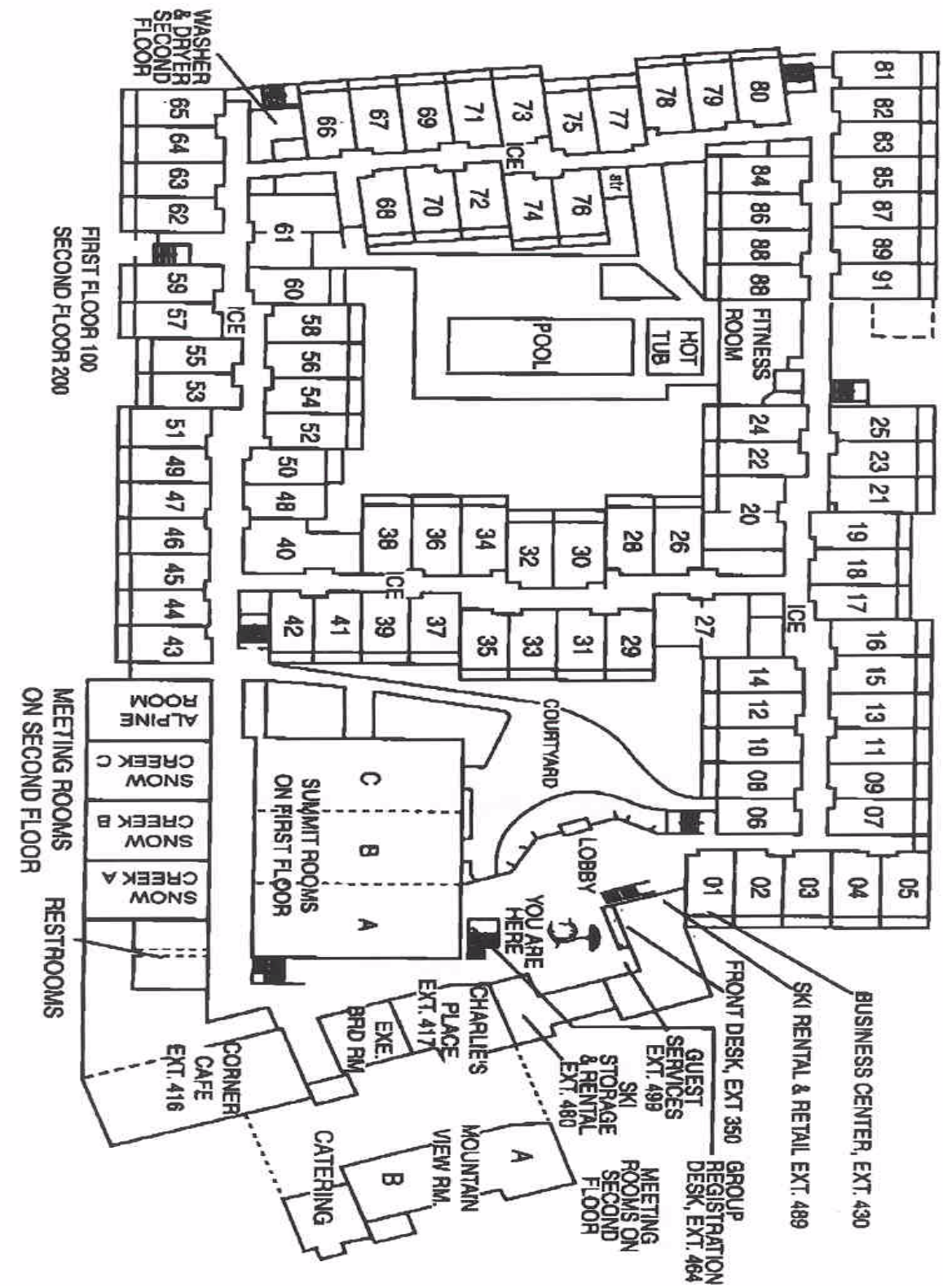

NOTES

* Indicates Conference Speaker

TECHNICAL PAPER SESSION 1: Project Management and Implementation

Environmental Planning for Mine Cleanup and Demolition Activities

Brian Buck, Vice President, JBR Environmental Consultants, Inc. and **Matt Zietlow***, Environmental Manager, Homestake Mining Company

Environmental planning for final cleanup and demolition of mining facilities is a critical step in the overall reclamation of these sites. Identification and proper handling of a myriad of waste streams is important to complete before demolition of facilities commences. Additionally, issues such as utilities, soil and water pollution control, historic concerns, permitting, impact to communities, and post-mining considerations must all receive careful consideration prior to demolition contractors mobilizing on-site. These decisions can affect the schedule and cost of the demolition activities because they may control how the demolition contractor will conduct his activities. Surveys should also be completed to identify special building materials that may need to be abated prior to demolition such as asbestos and lead-based paint. Potentially recyclable materials should be identified and characterized to assess the owner's liability if these materials are recycled including: scrap steel, processing equipment, brick, and wood. Major demolition waste streams also need to be characterized for disposal in on-site or off-site landfills. Finally, all these characterization and environmental planning decisions should be documented in facility records, and written guidance on these matters should be prepared for the demolition contractor before he finalizes his bid for the work. The authors demonstrate how all this was done to plan for the demolition of the mill and numerous support facilities at the renowned Homestake Mine in Lead, South Dakota.

Mine Reclamation Using Dredged Materials and Coal Ash

Andrew S. Voros*, Executive Director, NY/NJ Clean Ocean And Shore Trust; **Paul Linnan**, Pennsylvania DEP, Bureau of Abandoned Mine Reclamation; **Ernest F. Giovannitti**, Former Director, PADEP Bureau of Abandoned Mine Reclamation; and **Steven C. Sands**, President, Consolidated Technologies, Inc.

This is the final report of the project begun in 1995 by Pennsylvania DEP's Bureau of Abandoned Mine Reclamation and a NY/NJ bistate marine resources commission to use dredged materials from New York Harbor, amended with pozzolonic wastes, to restore an abandoned strip mine in west-central Pennsylvania. Since 1998, three quarters of a million tons of amended dredged materials from the Port of NY/NJ were used to return 11,000 feet of a double highwall 120 feet in height to its original contours of 75 years ago. The material was screened and pre-amended for shipping at port-side, railed to the mine site, further amended to initiate a pozzolonic reaction, and placed in lifts to recreate the hillside's original contours, covered with a manufactured soil and planted. Water quality testing from surface runoff and six deep wells below the site over three years showed non-detects for all organics, pesticides, VOCs and semi-VOCs. TCLP testing of the cured material yielded the same results. Over-wintering trout have returned to Bark Camp run below the site for the first time in decades. The United States moves nearly half a billion tons of dredged materials from its navigational channels annually, while hundreds of individual dredging projects, such as those to restore reservoir capacity, can generate additional hundreds of millions of tons each. The US also produces some 130 million tons of coal fly-ash annually. The discussion will examine the feasibility of this technique to the 560,000 known abandoned mine features catalogued thus far in the US. The presentation uses computer animations and GIS analysis along with details of the process and its implementation.

Approaches to Mine Subsidence in Four U.S. Communities

Len Meier*, Physical Scientist, Office of Surface Mining, Mid Continent Regional Coordinating Center and **Robert Gibson**, Abandoned Mine Land Emergency Program, Illinois Department of Natural Resources, Southern Illinois University

Millions of acres of land in the United States have been mined for coal and other mineral resources. Mine subsidence is a widespread problem in many of these areas. Coal mine subsidence has been documented in 31 states and on lands belonging to six Indian tribes. The authors propound the question — how are communities addressing mine subsidence problems? A response was sought from four communities with long histories of subsidence and significantly different State resources available for abating such problems. It was found that communities are seemingly most willing to accept hazard abatement by the State Abandoned Mine Land (AML) Program as a viable solution in addressing mine related problems. They also appear amenable to subsidence prevention via backfilling of mine voids provided State funds are available. One community encourages new construction to be subsidence resistant but does not mandate requirements. Land-use planning that includes zoning,

enhanced building design, and backfilling select areas are favored by the authors but considered an anathema to city officials.tone All four communities encourage or require developers to review mine maps prior to designing new construction. It is believed that, one day, communities will choose a more agressive approach in minimizing the potential impacts associated with mining. When this choice is made, they will need the information we seek as AML Program managers to fully realize the scope of mine problems and have the tools necessary to take action. We suggest that State AML Programs can contribute significantly to minimizing subsidence impacts by collecting and preserving mine maps and by making them readily available so that the public and community officials can use them for making wise land use decisions. We present other ideas for State AML Program managers that may contribute to the implementation of wise land use practices by local communities.

Survey Data Collection Associated with an AML Emergency Program

Bruce Schottel*, Engineer, Illinois Department of Natural Resources, Abandoned Mined Lands Reclamation Division and **Robert Gibson**, Illinois Department of Natural Resources, Abandoned Mined Lands Reclamation Division

Unplanned sag subsidence affects structures of all kinds throughout the coal mining regions of the world. The writers have been involved with investigating and monitoring sag subsidence events in the state of Illinois since 1980 and have found that surveying can provide important data yielding insight on the behavior of the subsidence event. Detailed survey information facilitates subsidence research of ground movements, aids in evaluating structural response and is useful in determining the optimum time for structural repair. Survey data quality is generally limited by factors such as monument design, monument spacing, frequency of measurement, quality of survey equipment, and proper survey technique. The main problem encountered in establishing techniques for the monitoring of a sag subsidence event is the trade-off necessary between physical constraints and time constraints. Since IDNR personnel typically become involved early in the development of a subsidence event, we have the unique opportunity to investigate early ground movements as well as the ability to continue monitoring the ground movements through completion. This paper is meant to provide an introduction to the survey techniques utilized by the IDNR-AMLRD in those investigations designed to collect long term ground movement data associated with coal mine subsidence.

TECHNICAL PAPER SESSION 2: Partnership/Policy

Federal-State Relations in the Mining Regulatory Arena: Pursuing Productive Partnerships

Gregory E.Conrad*, Executive Director, Interstate Mining Compact Commission

Over the course of the past thirty years since the first celebration of Earth Day and the subsequent passage of sweeping national environmental laws, the states have taken the lead in fashioning and then implementing effective programs for the regulation of mining and its impacts on the environment. Significant progress has also been achieved in terms of the working partnerships between the states and the federal government that are critical to the effective implementation of these laws. And yet as we enter the 21st century, there are still pockets of unproductive friction that linger between the states and the federal government that need to be addressed. In the best of times, the federal/state interaction that occurs on an almost daily basis sometimes leads to duplication and confusion; in the worst of times, the tension that attends the intergovernmental balancing act can be almost debilitating. This presentation will address several aspects of state-federal relations in the mining regulatory arena including recent court decisions on the matter, the new Administration's position, examples of some recent success stories and the future of state/federal partnerships. Among the issues to be addressed are multiple use management of natural resources, measuring government performance, renewed emphasis on state sovereignty, and opportunities for states and the federal government to work together to accomplish common goals, objective and strategies related to mining and the environment. Several principles for intergovernmental cooperation, coordination and communication will be suggested. In the end, participants should receive a perspective on how and where government can pursue productive partnerships that will allow us to balance the use of our abundant natural resources with the required environmental protection and preservation, particularly as regards abandoned mine land remediation.

A Team Approach to Evaluating State Abandoned Mine Reclamation Programs

Ronald N. Sassaman*, Environmental Protection Specialist, OSM - Denver Field Division

The Surface Mining Control and Reclamation Act of 1977 (SMCRA or the Act; P.L. 95-87) authorizes the Secretary of the Interior to approve and fund State and Tribal abandoned mine land (AML) reclamation programs through the Office of Surface Mining

(OSM). SMCRA also requires the Secretary, through OSM, to conduct activities necessary to ensure compliance with the Act. OSM's directive AML-22 describes the policies, procedures, and responsibilities OSM should follow to evaluate how States and Indian tribes administer their approved AML programs to ensure that they meet the requirements of SMCRA and the implementing Federal regulations. AML-22 also provides considerable flexibility for structuring and carrying-out those evaluations. OSM's Denver Field Division (DFD) is responsible for evaluating the Colorado Inactive Mine Reclamation Program and the Utah Abandoned Mine Reclamation Program. Since 1996, the "Colorado-Utah AML Review Team" (our team) has been conducting those evaluations annually on OSM's behalf. Our members include representatives of the Colorado and Utah programs and DFD. We decide what topics to review, conduct the reviews, make findings and recommendations, and complete evaluation reports. In evaluation year 2001, we evaluated three performance measures for each State program. Those measures evaluated: Whether completed reclamation met project goals; if the States' project ranking and selection processes evolved to meet their programs' changing needs, and if so, how; and, if the States obligate their grant funds in a timely manner. We concluded that both Programs' reclamation met project goals and the States' obligation rates were satisfactory. We also found that the Programs' changing needs prompted refinements in one ranking and selection process while prompting the need for an AML plan amendment to recognize changes in the other.

Eastern PA Partnerships Supported through the EPCAMR Regional Watershed Support Initiative (RWSI)

Robert E. Hughes*, Regional Coordinator, Eastern PA Coalition for Abandoned Mine Reclamation

PA has a $15 billion AML problem with over 280,000 acres of AML and 3500 stream miles impacted by AMD. The public has little knowledge of reclamation or remediation techniques available to treat AMD and reclaim AML. EPCAMR provides nearly 60 watershed \organizations alone, in Eastern PA, continued support, technical assistance, grant writing assistance, equipment, monitoring and education programs, legal assistance, funding for assessments or implementation of pilot-scale AMD treatment systems. For the last four years EPCAMR, in partnership with the Western PA Coalition for Abandoned Mine Reclamation (WPCAMR) and funding from the PA DEP-Office of Mineral Resources Management (PA DEP-MRM), to administer a small, but, successful mini-grants program, called the EPCAMR RWSI. The goal of the program is to help new groups organize and assist experienced groups in their efforts to restore watersheds impacted by AMD/AML, through sustainable community-led watershed partnerships, and related reclamation/remediation projects. Robert E. Hughes, EPCAMR Regional Coordinator developed the Eastern PA program, in conjunction with the WPCAMR Regional Coordinator from scratch in 1997, based on the needs of local groups working on AMD/AML issues. Examples of the types of watershed improvement projects funded have included: Land Reclamation Projects, Water Monitoring, Organizational Support, Education, Design & Engineering, Implementation of Abatement Measures, Teacher Workshops, Conferences, and Community Meetings. Grants are awarded up to $5000 each, requiring a 20% local match, contributed either in donated services, other grants, or cash. EPCAMR Regional Coordinator will discuss how EPCAMR leveraged $50,000 from the PA DEP-MRM and turned it into $380,000 to complete 11 projects in 2001-2002. Over the last 4 years, EPCAMR has completed 49 projects, through building successful partnerships, with only $200,000 from the PA DEP-MRM and turned it into nearly $2 Million in matching funds by "Inviting the Public IN" to work on watershed reclamation/remediation projects.

San Juan County AML Partnerships

Loretta E. Pineda*, Public Information Officer and **Dave Bucknam**, Director, Abandoned Mine Land Reclamation Program, Colorado Division of Minerals and Geology

Tomorrow's successful abandoned mine reclamation projects will require funding and participation from various levels of government, industry and the private sector. In Colorado there are several abandoned mine reclamation success stories. These stories focus on the components that make up a successful project including, partnerships, creativity, local empowerment, outreach, monitoring, funding and problem solving. This presentation discusses the successful reclamation of abandoned or inactive mines in the San Juan Mining District, where abandoned mine reclamation touches several different interests including historic preservation, economic stability, and environmental clean-up. San Juan County was shown to have an estimated 500 hazardous mine openings – and one of the most heavily mineralized and mining impacted watersheds in the state. Seventy-one miles, a high percentage of all stream miles in San Juan County, are impacted by past mining activity. Heavy metals and acid mine drainage have destroyed the biological integrity of many reaches in the watershed. In addition, the county has significant

historical and cultural resources related to mining that are in need of preservation and recordation. The Colorado Inactive Mine Reclamation Program (IMP) has addressed AML issues - hazards, water quality, and historic preservation - in San Juan County with a multitude of partners. In some cases the IMP has taken the lead, in some it has been a major participant, and in still others it has been quietly in the background helping facilitate activities. These partnerships, tailored to specific activities, are synergistic and have helped make the AML efforts in the county accepted and successful. The ability to work together in San Juan County and leverage assets—human, economic, and civic—has created a unique model that deserves duplicating. The Colorado Inactive Mine Reclamation Program has found unusual partners and new participants to contribute to the state's abandoned mine reclamation problems. We firmly believe that this is the future of abandoned mine land reclamation. Developing strong connections to the local community and working with a variety of groups to leverage funding has enabled the IMP to establish credibility, respond to local needs, and fulfill the goals of the abandoned mine land reclamation program as established under the Surface Mining Control and Reclamation Act.

TECHNICAL PAPER SESSION 3: Acid Mine Drainage (AMD): Part 1

Acid Mine Drainage Abatement in the Lower Rock Creek Watershed – McCreary County, Kentucky

Mark B. Carew*, Registered Geologist, Kentucky Division of Abandoned Mine Lands

Rock Creek above White Oak Junction is a beautiful boulder strewn stream designated as a Kentucky Wild River and is the premier mountain trout stream in Kentucky. Below White Oak Junction acid mine drainage (AMD) from over 40 coal mine portals and eight pyrite-rich refuse dumps has decimated aquatic life and rendered the stream virtually lifeless. The Rock Creek Task Force, a group of 12 state and federal agencies and conservation organizations, was formed to find solutions to the degraded water quality in the lower Rock Creek Watershed. Funding was provided by several of the Task Force partners including an EPA 319 Clean Water Action Plan grant, an Appalachian Clean Streams Initiative grant, a PRIDE grant from NOAA, KYAML's annual grant, and a USGS cost share agreement. In 1998 a biological and water-monitoring program began in the lower Rock Creek watershed. Acid loading was calculated and in spring of 2000 dosing of selected tributaries with sand-sized limestone particles began. Within two months the flow out of Rock Creek into the Big South Fork of the Cumberland River changed from net acidic to net alkaline. After four months similar results were obtained in White Oak Creek, a major source of AMD to Rock Creek. In the fall of 2000 construction began on a reclamation project targeting several of the worst AMD sites in the lower Rock Creek watershed. Pyrite-rich refuse was removed from the banks of Rock Creek. Open limestone channels were installed routing AMD through the limestone before discharging into the stream, and a modified vertical flow wetland was installed at a site with limited distance between the AMD source and the receiving stream. Dosing with limestone sand continued monthly with permanent dosing stations being established farther upstream in the impacted tributaries. Water monitoring results continue to be encouraging with reductions in acidity and dissolved metals in the affected streams. Fish sampling has revealed that fish populations are already being re-established in once lifeless sections of White Oak Creek and lower Rock Creek. Macro-invertebrate sampling indicates that species diversity and numbers are also improving.

The Tonoma Passive Mine Drainage Treatment Project

Eric Cavazza*, Design Section Chief and **Richard L. Beam***, P.G., Licensed Professional Geologist, Pennsylvania DEP Bureau of Abandoned Mine Reclamation

The upper Crooked Creek watershed in Indiana County, Pennsylvania has been adversely impacted by mine drainage from the former Clearfield Bituminous Coal Corporation's underground mines. These mines form an interconnected and partially inundated complex, covering 4,500 acres. The primary mine drainage outlet, the 'Tanoma Borehole', discharged continuously since mining ceased in the 1950s, averaging 2,500 gpm (3.6 mgd) and degrading Crooked Creek for several miles. The borehole was located directly in the stream channel making treatment at the discharge site unfeasible. Beginning in 1995, studies were initiated to evaluate relocating the discharge to a suitable site for passive treatment. Critical to this evaluation was the protection of an aquifer located above the mine used for domestic water supplies. The relationship of mine discharge volume to in-stream iron concentration was evaluated to determine an effective design sizing criteria. A two-phase approach to relocate and treat the discharge was selected and implemented. The first phase, undertaken in 1999, included the installation of cased and grouted boreholes to relocate the discharge. The second phase, undertaken in 2000, included the construction of a passive treatment

system and the sealing of the original boreholes. An overflow borehole was left open for monitoring and for mine pool discharge in the event that system capacity was exceeded. Since December of 2000, the system has removed an average of 90.5% of the total iron while experiencing flows up to 1,792 gpm. Flows have been lower than expected due to drought conditions in Pennsylvania. Since the treatment system went on-line, the in-stream iron concentration has consistently been lower than 1 mg/L. This period includes the historically worst months (the summer and fall months) for water quality impacts. Stream surveys are showing that water quality is rapidly improving and the density and diversity of aquatic life is recovering.

The Role of AMD in the Treatment of Other Problem Waters

Jan C. Allbright*, President, Arizona Wetlands Research Foundation

Acid mine drainage (AMD) may provide a key component to increased efficiency in the treatment of municipal and feed-lot effluent streams. The addition of AMD to these waste-water streams would adjust the pH and Oxidation-Reduction Potential (ORP) of this effluent, resulting in a mixture optimized for an aggressive biological based treatment system. This presentation describes a 30,000 gallon Pilot Project of an algae based, "rapid-flow wetlands" system designed to use AMD for this effluent adjustment. The presentation covers the theory, construction, operations, monitoring measurements, and the preliminary findings. The Pilot Project was designed to investigate the efficiency increases predicted from; Using algae as an aggressive biomass, Adjusting effluent stream pH and ORP, Adjusting effluent stream Carbon:Nitrogen:Phosphate ratios, and Increasing influent / algae contact opportunity through rotational re-circulation. The Pilot Project was constructed from off-the-shelf components that may be found in any well stocked home supply store. The design provides a low cost, small foot-print test environment that may be easily replicated. The Pilot Project occupies an area 60 by 40 feet and was built for less than $20,000, including instrumentation and lab-trailer. Monitoring measurements

TECHNICAL PAPER SESSION 4: Stream Restoration

Natural Channel Design, Construction and Planting on the Middle Fork South Platte River

John T. Windell*, Professor Emeritus, Biology Department, University of Colorado, Boulder and **Eric August**, EIT, Aquatic and Wetland Company, Consulting Division

A 0.83-mile reach of the Middle Fork South Platte River received instream, streambank and riparian habitat restoration treatments after conducting a habitat suitability analysis that revealed a variety of limiting factors. Historically, the land adjacent to the river had been heavily grazed and showed all of the negative signs and symptoms of poorly managed riparian habitat. Stabilizing root structure was intermittently absent, eroded slumping and wasting banks were common, channel sinuosity, pool riffle ratio and thalweg channel were decreased. An excessive width depth ratio dominated the reach that resulted in the absence of high quality pool habitat. Restoring the stream channel involved designing and constructing 23 major habitat units (HU's) including concave bend pools, vortex rock weirs and shelf pools. A minimum of one 30-foot log was anchored under water at each pool to provide bank stabilization and trout cover. Minor improvements included implementation of deflector boulders to concentrate flow patterns, cover logs, pocket water pools and randomly placed boulders to increase riffle roughness, water aeration and macroinvertebrate food production for trout. Bioengineered bank stabilization treatments were implemented on over 1,800 lineal feet of eroding stream bank utilizing willows, transplanted sod, trees, shrubs and anchored cover logs. Riparian habitat was heavily planted to reverse the effects of long-term grazing. Planting involved a diverse selection of native vegetation to the area, and totaled approximately 140 mountain willow clumps (*Salix monticola),* 270 bog birches (*Betula nana)*, 140 wood's rose shrubs (*Rosa woodsii)*, 80 aspen trees (*Populus tremeuloides)*, 70 Colorado spruce trees of various sizes, and 200 narrow-leaf cottonwood trees (*Populus angustifolia*). Before and after spring snowmelt runoff monitoring measurements to evaluate successes and failures will be reported.

Natural Channel Design Process Using RIVERMorph Stream Restoration Software

Brian Belcher, PE, Senior Project Engineer, Fuller, Mossbarger, Scott and May Engineers, Inc. and **George Athanasakes***, Associate, RIVERMorph, LLC

The design of streams using natural channel design methods is a complex process relying heavily on the use of field measurements. In order to properly design a stream, the designer must understand and measure geomorphic parameters within the project reach, have a thorough understanding of the watershed, and must verify that the designed stream will transport sedi-

ment without significant aggredation or downcutting of the existing channel bed. A very popular method for designing natural stream channels consists of measuring geomorphic parameters from a reference reach and then "sizing" the reference reach parameters to match the design reach through the use of dimensionless ratios. A reference reach is a stable stream channel that is neither aggrading nor degrading exhibits a stable planform and does not exhibit excessive erosion. To properly use the reference reach method, extensive geomorphic data must be collected and analyzed during the design process. This data collection and analysis is time consuming and usually requires several iterations to ultimately achieve a design with adequate ability to transport sediment. Through the use of computer software programs, the processing of geomorphic data for stream assessment, monitoring and design can be completed much more quickly and thoroughly. The RIVERMorph stream restoration software was developed specifically to analyze store and retrieve geomorphic data through the use of a comprehensive database and a state-of-the art graphical user interface (GUI). The program has the ability to process all types of geomorphic data typically collected on stream restoration projects including biological and channel stability assessments and features a GIS interface to measure plan form geomorphic parameters from aerial photographs and GIS coverages. In this paper, an overview of the RIVERmorph software program will be provided and the use of the program to design a stream restoration project will be illustrated.

A Categorization of Approaches to Natural Channel Design

Peter Skidmore*, P.G., Hydrologist, Fluvial Geomorphologist, Inter-fluve, Inc.

Approaches to natural channel design can be categorized as analog, empirical, or analytical. Methods and limitations of each approach and considerations for selection of an appropriate approach are discussed. Analog design replicates historic or adjacent channel characteristics and assumes equilibrium sediment and hydrologic conditions. Empirical design uses equations that relate various channel characteristics derived from regionalized or "universal" data sets, and also assumes equilibrium sediment and hydrologic conditions. Analytical design makes use of the continuity equation, roughness equations, hydraulic models, and a variety of sediment transport functions to derive equilibrium channel conditions, and thus is applicable to situations where historic or current channel conditions are not in equilibrium, or where applicable analogs or empirical equations are unavailable. Analog, empirical and analytical approaches each have advantages and limitations. The advantage of the analog and empirical approaches is the intuitive simplicity of replicating desired channel and habitat characteristics from stable systems. Analog and empirical approaches require little or no consideration of sediment transport, as their application assumes equilibrium conditions. Analytical approaches are required when channel equilibrium is in question, and when no analog sites or empirical equations are applicable as a consequence of changing or differing hydrologic character and sediment inputs. The analytical approach often requires substantially more data, more time, and more highly trained personnel to apply.

Abandoned Mine Land Restoration in a North Idaho Stream: A Geomorphological Perspective

Mike Stevenson*, Hydrologist, USDI-BLM; **Steven W. Moore**, Bureau of Land Management, Idaho State Office; **G. Mathias Kondolf**, Department of Landscape Architecture and Environmental Planning University of California, Berkeley; and **Hervé Piégay**, CNRS - UMR 5600

Pine Creek (drainage area 77 mi^2), a tributary to the South Fork Coeur D'Alene River, was heavily impacted by metals mining in the 20th century. By 1960, more than 156,000 ft of mine tunnels had been excavated. In excess of 260,000 yd^3 of rock waste had been dumped, much of which made its way into the East Fork of Pine Creek. The increased sediment load destabilized the stream and resulted in more than a 50% widening of the channel of the East Fork of Pine Creek since 1933. Consequent erosion of stream banks of metals-laden tailings in the floodplain contaminated Pine Creek. Following large-scale flooding in 1996, the Coeur d'Alene Field Office of the Bureau of Land Management (BLM), Idaho and partners undertook efforts to accelerate mined-land reclamation and floodplain stabilization on affected public lands, including Pine Creek. Project work, originally enabled through emergency flood funds, has since been supplemented with funding from the Department of Interior's Central Hazardous Materials Fund and BLM's Abandoned Mine Land (AML) program. Using sequential historical aerial photos that dated from 1933 to present, a reconnaissance-level geomorphic assessment of sediment sources, channel-morphology trends, and riparian vegetation provided a basis for selecting restoration strategies. Additional field investigations were used to develop site-specific recommendations for channel and floodplain restoration, including: stabilization of waste-rock piles, tailings removals, bank armoring, floodplain revegetation, and channel realignment. Possible applications at other AML sites are suggested. Substantial coordination with the local county public works department was helpful on a variety of issues. Though the Pine Creek Restoration Project is ongoing, approximately 80 percent of the priority waste-rock piles have been stabilized through a

combination of grading, armoring, or channel realignment. Preliminary results after three field seasons (with average and below flows) indicate an improving trend in channel and floodplain stability.

TECHNICAL PAPER SESSION 5: Biology/Vegetation

Effects of Cadmium on White-tailed Ptarmigan in Colorado

Dr. James R. Larison*, Professor and Avian Ecologist, Dept. of Fisheries and Wildlife, Oregon State University

Cadmium is known to be toxic to vertebrates when test organisms are exposed to sufficiently high dietary concentrations. But because cadmium occurs as a trace constituent of most ecosystems, it has rarely been observed to have toxic effects on natural populations of wildlife. This paper summarizes the results of a multi-disciplinary study of the effects of metals on wildlife living in the ore-belt region of Colorado. It reports that white-tailed ptarmigan (*Lagopus leucurus*) in this region are 1) exposed to uncharacteristically high levels of cadmium through their diets, 2) accumulate potentially toxic cadmium concentrations in their kidneys after just 700 days of exposure, and that approximately half of adult ptarmigan in the region 3) experience cadmium-induced nephrosis of kidney tissue and, probably as a result, 4) develop calcium-poor leg bones. Additionally, this paper suggests that ptarmigan may not be the only herbivores in the region to be affected by cadmium but rather, may be indicators of a broader problem affecting ecosystems generally in central and southwestern Colorado.

Monitoring and Evaluating the Results of Bat Protection Efforts

K.W. Grandison*, Associate Professor Biology, Southern Utah University; **J.M. Diamond**, Southern Utah University; **G.F. Diamond**, Southern Utah University; and **M.R. Mesch**, Utah Division of Oil, Gas, and Mining

Many States are authorized to close abandoned mines to protect the public from potential hazards. In Utah, abandoned mines are surveyed prior to closure to evaluate their potential as bat habitat. Those mines providing suitable habitat may be sealed with bat-compatible gates that allow bats continued ingress and egress. However, a few studies suggest that for some population sizes and certain species of bats, bat gates may actually decrease bat use of mine openings; few post-gate monitoring studies exist to document long-term effects of this technique for conserving bat populations. In two areas we are monitoring and evaluating the effectiveness of gated mines on existing, known bat populations. Objectives include: evaluating and ranking the effectiveness of techniques [e.g., night vision devices, infrared event counters (Trailmaster 500M), infrared video, ultrasonic detection equipment (Anabat) and mist nets or harp traps] to monitor bat use; using this information to develop a protocol for using the most reliable of these techniques; and establishing long-term monitoring sites. Evaluation criteria include purchase and operating costs, security concerns, equipment reliability and ease of operation, number of personnel necessary to gather and evaluate the data, the ease of analyzing the data, and type of information needed. Results indicate that a combination of monitoring techniques are necessary to meet long-term objectives. Infrared event counters are well suited to record relative bat activity inside mines over long periods of time with minimum observer disturbance and cost, but cannot be used to reliably gather information on bat behavior through gated entrances, or absolute numbers and species identification of bats. Ultrasonic detection equipment and mist net/harp traps are necessary techniques to reliably determine bat species composition. Infrared video cameras provide an accurate, permanent monitoring record of bat numbers and behavior. Protocols specific to each mine may be necessary to minimize observer and equipment effect on bat behavior. Efficient low cost monitoring can be accomplished using minimal equipment and personnel. Preliminary analysis suggests that bat behaviors do differ in gated and un-gated mine openings.

Revegetation of Nine Square Miles of Copper Tailings

Henry Sauer*, Environmental/Soil Scientist, Greystone Environmental Consultants, Inc.; **Tom Williams**, Golder Associates Inc. and Elizabeth Duvall, Golder Associates Inc.

The permanent closure of 5,500 acres of copper tailings at the White Pine Mine Tailings in the upper peninsula of Michigan was performed over a four year period. The most important component of the closure plan in terms of cost and meeting water quality criteria was the design and implementation of a revegetation plan that would control wind and water erosion on the tailings by establishing a low/no maintenance, self-sustaining vegetative cover without the use of imported topsoil. To meet these requirements the revegetation approach employed included extensive site examination, selection of locally available sources of organic amendments, design and execution of greenhouse trials and on-site revegetation trials, development of reclamation specifica-

tions, full-scale implementation, and revegetation performance monitoring. By incorporating a paper mill sludge/wood chips mixture, balancing inorganic fertilizer additions, identifying effective erosion control techniques and selecting adapted plant species a high quality revegetation plan was developed and implemented on site.

Vegetative Community Analysis of Biosolids Test Plots After Five Years of Growth

Rick Black*, Senior Ecologist and Biological Programs Manager, HDR Engineering, Inc. and **Richard K. Borden**, Kennecott Utah Copper

The application of municipal biosolids during reclamation has been gaining acceptance in recent years. A series of reclamation 2001. After five to six years of growth, the biosolids plots generally contained a higher percent cover, about 75% of which was provided by volunteer weed species. On average, cheat grass (*Bromus tectorum*) alone accounted for over half of the total cover at the biosolids plots. The control plots, where biosolids were not applied, generally had less total cover, but weedy species accounted for less than 20% of the cover that was present. On average, the absolute cover provided by non-weedy species at the control plots was about twice as high as at the biosolids plots. The species diversity of non-weedy species at the control plots was also higher than at the biosolids plots. Forbs and woody shrubs were most common on the control plots. These differences between biosolids and control plots were found to be statistically significant at a 0.05 significance level using an ANOVA analysis. The application of biosolids at these rates may favor the growth of weedy species and inhibit the establishment of favorable species. These study results indicate that biosolids application may not always be beneficial, and that application rates of less than 10 tons/acre may be optimal at many reclamation sites.

Rooting Characteristics of Vegetation Established on a Refuse Pile

Priscilla W. Burton*, Soils Reclamation Specialist III; **Paul Baker, Susan White**, Utah Division of Oil, Gas & Mining; **Bob Postle**, OSMBWRCC; and **Patrick Collins**, honorary member, Mt. Nebo Scientific

The root characteristics of vegetation growing on soil covered coal refuse piles was investigated. Soil cover varied from two inches to eighteen inches. The refuse had been seeded in 1983. Established vegetation was compared with that growing on the salvaged and stockpiled subsoil pile (also seeded in 1983). Five pits were excavated with a track hoe in the refuse pile and five pits in the subsoil pile. Pit locations were based on the presence of three shrubs common to each location. Root sizes and quantities were estimated based on the 1998 NRCS publication, Field Book for Describing and Sampling Soils. Soil texture, coarse fragment content, and structure were noted. Representative samples of field measurements of soil pH and electrical conductivity were taken. Resistance to penetration was measured with a pocket penetrometer. Taproots of all shrubs, except Eriogonum corymbosum, dramatically turned to grow along the soil/refuse interface before eventually descending gradually, but not vertically, into the refuse. A mat of fine roots formed at the soil/refuse interface. Medium and coarse roots were limited to the top two feet of the subsoil-covered refuse. At the subsoil pile, all shrub taproots were quite robust and grew straight downwards into the subsoil stockpile as did medium and coarse roots. The subsoil was impenetrable when dry, similar to the refuse. However, when it was moist, resistance to penetration was much lower than the refuse. The difference between the penetration resistance of the refuse and subsurface subsoil, coupled with the location of the subsoil stockpile in a topographic position where precipitation run-on is likely (enhancing water availability), may well have accounted for the vertical taproot penetration into the subsurface subsoil compared to the refuse and the limited growth of medium and coarse roots into the refuse. It is well known that compaction restricts rooting depth. Root growth into soil-covered refuse could be enhanced by ripping of the surface prior to soil cover placement. The recommended depth of ripping is inversely related to the depth of cover, so that a less compacted root zone of four feet is achieved. If the refuse is combustible then the recommended soil cover depth should be four feet to allow for a rooting zone, while protecting against combustion. Working the soil cover into the refuse surface to avoid an abrupt boundary layer is also recommended.

TECHNICAL PAPER SESSION 6: Partnership/Projects

Pennsylvania's Efforts to Address Operation, Maintenance and Replacement of AMD Passive Treatment Systems

Pamela J. Milavec*, Water Pollution Biologist 3, PA Department of Environmental Protection, Bureau of Abandoned Mine

Reclamation and **Daniel R. Seibert***, Resource Conservationist, USDA – Natural Resources Conservation Service

An increasing number of watershed groups, as well as many Federal, State and local agencies, have become active in watershed restoration over the past several years. As a result, a large number of restoration projects are being funded and constructed. In Pennsylvania, a total of nearly $93 million of public money has been spent on all types of watershed restoration implementation projects since 1988. A portion of this funding has gone to construct 153 AMD passive treatment systems statewide. Funds have come from a variety of sources, including the Office of Surface Mining's Title IV program, the Natural Resources Conservation Service's (NRCS) PL 566 program, Pennsylvania's Growing Greener program and the Environmental Protection Agency's 319 Non-Point Source program. Water quality and aquatic habitat improvements are occurring as these projects are implemented. The need for long-term operation, maintenance and replacement (O, M & R) has been increasingly recognized as a requirement to ensure the success of watershed restoration projects. The failure to maintain the systems being constructed could have detrimental impacts to watersheds that are beginning to support an increasing number of stream uses. As a result of growing concern over this issue, the PA Department of Environmental Protection (DEP) established a workgroup to provide recommendations to address this need. The workgroup consisted of individuals from Federal, State and local governments, as well as private consultants and watershed group officials. All had extensive experience in the operation and maintenance of watershed restoration projects, both mining and non-mining related. Recommendations were finalized by late 2001. The NRCS and DEP have taken a lead role in implementation of these recommendations, including the development of maintenance plans and agreements, working with local watershed groups to provide routine maintenance and trouble-shooting to solve problems that arise. Their experiences are providing a greater understanding of the efforts needed to keep systems functioning properly.

Interagency/Industry Coordination to Respond to Selenium Contamination at Phosphate Mines in Southeastern Idaho

Brian Buck, Geological Engineer, JBR Environmental Consultants, Inc. and **Jeffrey L. Jones***, Minerals Management Specialist/ Geologist, USDA, Forest Service

Selenium contaminated vegetation and surface water related to phosphate overburden disposal was discovered in southeast Idaho in 1997. Shortly afterward, phosphate mining companies and regulatory agencies joined in response to the potentially widespread problem throughout the phosphate mining area. Five companies with a vested interest in southeastern Idaho phosphate reserves organized as a committee under the Idaho Mining Association. Under this arrangement they commissioned a regional environmental sampling program to characterize the problem in voluntary collaboration with Federal and State regulatory agencies. In 2000, the agencies in cooperation with tribal authorities agreed to coordinate their regulatory responses under a Memorandum of Understanding (MOU), which identified statutory and regulatory authorities and responsibilities; established priorities, and clarified processes for undertaking area-wide and site-specific investigations. Within the agreement, participating agencies and the Shoshone-Bannock tribes set out frameworks for response actions and regulatory cost recovery. This group of agencies and the Shoshone-Bannock Tribe has since entered into an enforceable Area-Wide Administrative Order of Consent (AOC) with the mining companies to conduct area wide site investigations and risk assessments intended to lead to the development of remedial action objectives, remediation goals, and risk-based cleanup levels for selenium and other contaminants of concern. The U.S. Forest Service, Idaho Department of Environmental Quality, with support from other State, Federal and tribal authorities are cooperating to plan localized site investigations and engineering evaluations/cost analyses at individual mines. Data collected during the course of site-specific and area wide efforts will eventually result in appropriate remediation of the selenium impacts at all previously developed phosphate mines in southeast Idaho. The authors describe the inter-agency and industry cooperative efforts in response to the selenium issue, highlighting the complications, successes, and stumbling points encountered along the way.

Ohio DNR and Cuyahoga Valley N. P.: A Partnering Success Story

Mark Smith*, Environmental Specialist/ Project Officer, Ohio Division of Mineral Resources Management-AML Section and **Kim Norley***, Landscape Architect, National Park Service

Partnering between two diverse government agencies has produced the reclamation of three devastated sites that could not have been accomplished by either agency acting alone. The Cuyahoga Valley National Park (CVNP) preserves 33,000 acres along the Cuyahoga River between Cleveland and Akron, Ohio. Several locations within the Park had been previously disturbed through use as borrow for a ski resort as well as sand and gravel extraction. All of these sites exhibited the same conditions: sparse vegetation and severe erosive soil loss with resultant downstream sedimentation. In 1992 the CVNP approached the Ohio Department of Natural Resources, Division of Mineral Resources Management (ODNR-MRM), about the feasibility of using monies from the State Industrial

Minerals AML account to reclaim the sites. Several factors militated against the reclamation of these sites. The IM-AML account did not contain enough money to accomplish the work. Federal procurement practices required the use of Davis Bacon wage rates, which would place a heavy monetary burden on the State funds. Finally, ODNR had recently undergone personnel cutbacks and lacked the engineering support needed to design the reclamation projects. An agreement was developed between CVNP and ODNR. Parks personnel provided design services to complete the construction plans and specifications with oversight performed by an ODNR engineer. The projects were bid out using the lower State prevailing wage rates. A funding match was provided by the NPS. ODNR provided inspection services and funding to reclaim two sites while CVNP used the 'match' monies to inspect and reclaim a third site. Remaining 'match' monies will be used to perform an extensive stream-cleaning program. The successful completion of these projects has made the possibilities for future work in the Park more likely.

Watershed Coalition Power in Appalachia - Keepers of the Land and Water

Kelley Sponaugle*, Assistant State Conservationist, USDA – Natural Resources Conservation Service and **Patrick C. Park**, AML&R Liaison, West Virginia Office of Abandoned Mine Lands & Reclamation

This presentation will discuss success stories in working with local watershed groups for land water reclamation. It will include examples such as Decker Creek and Pigeon Creek. Decker Creek is using PL-566 and AML funding. Pigeon Creek will be using a combination of funding including Rural Abandoned Mine Program, Abandoned Mine Land, private grants, mitigation and others. We will discuss how agencies and local people can combine state and federal programs for land and water reclamation using examples PL-566 and AML program for successful planning and implementation of projects. Many Appalachians communities and watershed continue to be adversely impacted by unreclaimed minelands that pose public health, safety and welfare concerns. These pre-"SMCRA" mineland in West Virginia equal $ 742 million as referenced in the Abandoned Mine Inventory System (AMLIS). These issues concern local people and they are willing to work with state and federal agencies in co-operation to plan and implement land and water reclamation. They need assistance in organizing, assessing and planning. Including the local Soil and Water Conservation District provides a statutory entity that watershed groups can utilize for long term operations and maintenance of installed improvements. The combination of programs available to AML agencies and Natural Resources Conservation Service including local Soil and Water Conservation District are a perfect fit to meet these needs. Our challenge is to co-operatively utilize agency resources to provide the leadership planning, implementation and funding to make land water reclamation successes, and assure long-term maintenance.

TECHNICAL PAPER SESSION 7: Geographic Information Systems (GIS): Part 1

GPS for GIS Applications

Carma Ingram*, GPS/GIS Specialist, Monsen Engineering

This presentation will include GPS and how it works, GPS for GIS data collection and export, specific applications for GPS in the oil, gas and mining community. GPS can be used as a valuable tool in collection of inventories of mine shafts, area features such as a slag or overburden area, or line features such as roads and trails. Collecting mapping data over wide spread areas can be improved using a GPS system with fast data capture techniques. GPS can also be interfaced with digital cameras and hot linked in your GIS to provide images that are tied to the geographic location. This is very valuable in documenting environmental issues that face the mining community. A new real-time differential radio signal has just come on-line for our area with a beacon radio DGPS transmitter coming from Ft. Duchesne. Some GPS receivers have the built in capability to receive this signal and others require a separate radio receiving device. Using GPS as a tool for data capture can improve mapping accuracy and speed of geographic data implementation into your GIS system.

Abandoned and Inactive Mine (AIM) Lands Inventory for the USDA - Forest Service, Region 9, Monongahela and Wayne National Forests

Hugo Aparicio, P.E., Project Manager; **Michael E Anderson***, GIS Manager, Fuller, Mossbarger, Scott and May Engineers, Inc.; **Pamela M. Stachler,** Forest Hydrologist; **Rebecca R. Ewing,** Forest Biologist, USDA – Forest Service, Wayne National Forest; **Linda L. Tracy,** Forest Geologist, USDA – Forest Service, Monongahela National Forest; **Steve Brewster,** P.G.,

Project Manager; and **Steve Spagna,** P.G., Geologist; USACE-Huntington District

According to the Abandoned Mine Land Inventory System assembled by the Office of Surface Mining (OSM), there are over 575,000 acres of abandoned mine land in the eastern United States, some of these abandoned mines are encountered within National Forests. As a result of the need to better manage public land, the Forest Service was tasked with identifying features associated with abandoned mines. The inventories developed would enable the Forest Service to better understand and improve watersheds impacted by acid mine drainage. In addition, inventories would be a useful component for various resource applications. Region 9 of the Forest Service and the United States Army Corps of Engineers (USACE)-Huntington District joined efforts and developed a format and methodology to perform abandoned mine inventories at the Monongahela Forest and Wayne National Forest (WNF). Corps personnel implemented the methodology and completed the abandoned and inactive mine (AIM) land inventory for the Monongahela Forest, the Ironton District of the WNF, and for 3 additional watersheds within the Athens District of the WNF. Fuller, Mossbarger, Scott, and May Engineers (FMSM), Inc. performed inventory work in the Athens District through the Corps of Engineers' indefinite delivery contract. Successful partnering between the Forest Service, the Corps of Engineers, and FMSM has culminated in the completion of a highly versatile inventory with application and value for many environmental stewardship agencies and organizations throughout the region. This highly successful collaborative effort is expected to continue as the Forest Service plans to extend the inventory into additional basins as funding becomes available.

GIS Analysis of Mine Reclamation: Solving the Problem of Dredge Material and Abandoned Mines

Erica Mignone* and **Matthew Reid*,** State University of New York at Purchase College, New York and New Jersey Clean Ocean And Shore Trust (COAST)

The growing rate of commerce in the United States over the past 100 years has resulted in tremendous need for electricity as well as the maintenance of accessible navigation channels. These twin needs have produced unique large scale problems that may be uniformly approached. Coal and other mining operations have left much of the United States with subterranean and surface voids resulting in human health and subsidence hazards, and the poisoning of entire watersheds with Acid Mine Drainage, while the burning of coal for power generation produces some 130M tons of fly ash annually. Finally, the US annually removes nearly 500 million tons of dredged materials from its navigation channels, reservoirs and dams. Pennsylvania DEP has successfully demonstrated the use of dredged materials from New York Harbor cemented with fly ash to reclaim an abandoned surface mine, restoring the original contours of a stripped hillside and preventing the formation of AMD. However, Pennsylvania represents a fortuitous location where dredging sites and abandoned mines co-exist in relatively close geographic proximity. The feasibility of similar mine reclamation tactics for the nation's other 560,000 Abandoned Mine Land features must be examined to access national applicability. In this project, locations of abandoned mines, dredge sites, power plants (where fly ash is produced) and railroad lines are combined in GIS. By using spatial analyses functions, we offer an estimate as to which areas appear most favorable for reclamation within the contiguous United States. The results show which regions present the most economically feasible abandoned mines to be reclaimed using this method.

The Characterization of the Kempton Mine Complex, Maryland & Virginia, Using GIS Technology

Tamara P. Davis, Natural Resources Planner and GIS Specialist, Research and Development Section, Maryland Department of the Environment, Water Management Administration, Mining Program, Bureau of Mines and **Constance Lyons*,** Natural Resources Planner V, Maryland Department of the Environment, Bureau of Mines

Acid mine drainage (AMD), a legacy left by pre-law coal mining (prior to the 1977 Surface Mine Control and Reclamation Act), affects miles of western Maryland waterways, including the headwaters of the Potomac River. Prior to degradation, the North Branch of the Potomac River (North Branch) supported one of the largest trout and bass fisheries in the eastern United States. The Kempton Deep Mine Complex (Kempton) is the main source of AMD impairment in the North Branch. Kempton covers more than 12 square miles, or 7,680 acres, and discharges an average of five million gallons a day of acidic water into Laurel Run, a tributary that enters the Potomac River. Since 1994, the State of Maryland has maintained six lime dosers to neutralize AMD along more than 32 miles of the mainstream of the North Branch. Trout are stocked annually and populations of native fish and macro-invertebrates have returned to the river. In 1998, the Maryland Bureau of Mines began investigating whether a more permanent technology than in-stream dosing could solve the AMD problems of Kempton. A comprehensive, in-depth investigation of the Kempton Mine and surrounding area was conducted and developed into an accurate, detailed geologic/topographic map and technical database. Geographic Information System (GIS) technology was determined to be the best approach to store, view, and evaluate the large quantities of data and information. The Kempton GIS mapping and database includes

numerous features that affect and impact the Kempton discharges in Maryland. The Kempton GIS has proven to be an invaluable tool to evaluate alternative AMD remediation technologies and was developed using ESRI Arcview and its extensions, Spatial Analyst and 3D. The GIS includes all data and maps collected in the study in an easily viewed format.

TECHNICAL PAPER SESSION 8: Education and Safety

Abandoned Mine Safety and Reclamation Education Materials Development Projects

Edward A. Dalton*, Ed.D., President and CEO, National Energy Foundation

The National Energy Foundation (NEF), as an outgrowth of the Utah Mineral Resources and Mining Education program identified a need for additional supplementary educational resources that could be used by teachers and students to enhance and enrich classroom instruction. As a consequence, NEF initiated and is carrying out the development of two instruction posters and primers dealing with Abandoned Mine Safety and Mining Reclamation. NEF has conducted research, prepared the materials in phases, and is currently distributing the materials in teacher training workshops and directly to teachers in a variety of ways. The reclamation phase was completed first, the abandoned mine safety component is presently under development and will be completed prior to the NAAMLP Conference. The project has been extremely well received by the education community and directly relates to the work of the National Association of Abandoned Mine Land. NEF proposes to describe the materials development process including design and methods. We will explain and distribute items that have been made and show how they are used and explain additional implementation and distribution opportunities. We also intend to share other findings and experiences that have occurred as a result of this project. This project is one of the family of *Out of the Rock* Education Program activities. *Out of the Rock* is the nation's premiere Mineral Resources and Mining Education program.

Moderator: **Loretta Pineda**, Colorado Division of Minerals and Geology, Inactive Mine Program

Stay Out and Stay Alive Panel Discussion

TECHNICAL PAPER SESSION 9: Geographic Information Systems (GIS): Part 2

GIS-based Statewide Inventory for Wyoming

Chris Arneson*, GIS Hydrologist, TriHydro Corp.; Evan Green, Wyoming Department of Environmenal Quality, Abandoned Mine Lands Division; and Jack Bedssem, TriHydro Corp.

The Wyoming Department of Environmental Quality Abandoned Mine Lands Division (WDEQ/AML) required a comprehensively updated statewide database and an efficient method of accessing, querying, and utilizing this information for project management and decision-making purposes. A customized Geographic Information System (GIS) application was envisioned and developed to serve as a user interface to the MS Access database created as part of the ongoing inventory project. This application was built in an ArcView GIS software environment, which provides users with an "always up to date" depiction of the status of AML sites, a user-friendly query system, a single interface for all digital site data, relevant site background information, and a structure for future data. Spatial coordinates were created from newly acquired GPS coordinates and supplemented with historic legal descriptions. These spatial coordinates were used to generate GIS layers which can change daily "on the fly" from the current database. Using custom forms and SQL queries, a menuing system was created that allows querying of sites based on a variety of information. Additional GIS layers including digital USGS quadrangles (DRGs), roads, elevation, and aerial photography are scale-dependent and added to the project automatically as a user zooms in. Custom programming has also been added to the project to allow the "linking" of other types of non-GIS data to the individual sites, including GPS files, photos, scanned field notes, CAD construction drawings, and other digital files. WDEQ/AML personnel are able to add new files (photos, GPS, etc.) to the specific site directory and immediately have that information accessible within the GIS. Future plans for the project call for integrating additional types of data (remediation CAD designs, construction as-builts, etc.) as it becomes available. The addition of this supplemental site information will create a true electronic archive and library tool for project management.

GIS as a Prioritization and Planning Tool in Abandoned Mine Reclamation

Megan Southwick, Reclamation Specialist, **Daniel Smith***, GIS Programmer; and **Chris Rohrer**, Senior Reclamation Specialist, Utah Division of Oil, Gas & Mining

The Utah Abandoned Mine Reclamation Program has developed a new GIS model for selecting reclamation project areas. The selection process utilizes three main factors that would influence the potential hazard for mining areas. These factors include known mining activity or mineral resource occurrence areas, the population density in proximity to the mining areas and the potential access to the mining areas. Mine closure priorities should be ranked according to the degree to which the public is exposed to the dangers associated with abandoned mines. The first step in ranking mines for reclamation is to know where they are or where they are likely to be based on potential mineral resource locations. Known mines and the density of those mines received a higher ranking in the model than potential mining areas or mineral resources. The data sets used in the mining component include Computerized Resource Inventory Base (CRIB), gilsonite veins, phosphate deposit areas, locatable mineral occurrences, historic mining district and un-patented mining claims. The second ranking criteria we use to prioritize abandoned mine closures is the mine's proximity to population centers and the density of the population area. We assumed that mines located near densely populated areas receive greater visitation than mines located far from population centers. The population component of the model uses the census data from 2000. The third major component of the ranking model is access to the mining areas. The easier a mine is to get to, the more likely people are to visit it. Thus a mine's proximity to a high density of roads significantly contributes to it's hazard potential. A roads data set was used to determine the potential access to a mining area. The mining activity, population, and access components were combined to determine which abandoned mines pose the greatest potential risk to the public. The model is then used to generate a map of all areas above a certain hazard-rating threshold. The composite score for each of these areas determines its rank. Thus using GIS, the Utah's AMRP is able to focus abandoned mine reclamation efforts in those areas which pose the greatest threat to public safety.

Use of Integrated GPS and GIS Systems in Mine Reclamation

Oliver P. Wesley*, P.E. and **Alan G. Steckelberg**, Managing Partners, Opal Group, L.L.C.

Development of Global Positioning Systems (GPS) and Geographic Information Systems (GIS) has progressed to a point at which their sophistication and cost allow them to be effectively integrated in reclamation programs. This paper describes how these tools are being economically employed to inventory, prepare closure designs and reclaim former mine and mill sites, playing an increasing role in abandoned mine land reclamation. The GPS system can provide state agencies nearly real-time data regarding the types and locations of abandoned mine sites through uploading of GPS data files onto an agency-accessible web site. The GPS data can subsequently be overlaid onto GIS maps to provide precise routes to, and locations of, those features. The GPS surveying and GIS mapping allows rapid sizing and plotting of mine openings, waste piles and cultural features for accurate drawing and quantity computations during office design of the closures. Tied to state coordinate systems, the maps are accurate with respect to orientation and provide precise information for the preparation of construction documents. The GIS database provides streamlined storage of all pertinent information regarding the mine features including location, access routes, photographs and tabular summaries of dimensions, land ownership and notes regarding each location. Three-dimensional views generated by the GIS system can be used to illustrate the pre- and post reclamation design features. In the final construction phase of reclamation, the integrated GPS and GIS systems can similarly be used to locate the site, monitor closure during construction and provide as-built dimensions and documentation of closure within the database. It is the authors' intent to describe these capabilities and provide examples of their use in recent reclamation activities associated with the Star District, Atlas Mill Tailings and Manning Canyon reclamation projects in Utah.

Developing Abandoned Mine Lands

John Husted*, Ohio AML Program Director

The Ohio DMR Management created the "Ask Before You Build Guide," an educational outreach resource for public and local officials to assist in evaluating past mining sites for development. This can lead to expensive repairs when settling occurs, landslides develop or other types of problems occur. The "Ask Before You Build Guide" should be used before construction begins, so AML concerns can be accommodated as part of the planning process. The AML program does not fund reclamation, water replacement or stabilization projects if the landowner fails to address the AML problems prior to development. Public meetings will be conducted to these guides available to County Soil & Water Conservation Districts, local government agencies and others. The distribution will primarily take place in the coal-bearing region of Southeast Ohio.

TECHNICAL PAPER SESSION 10: Acid Mine Drainage (AMD): Part 2

An Ongoing Evaluation of Bauxsol at the Gilt Edge Mine, South Dakota

Jim Jonas*, Geochemist, CDM Federal Programs Corporation; **Ken Wangerud**; and **David McConchie**

A remediation technology, Bauxsol, is currently being evaluated at the Gilt Edge Mine in Lead, South Dakota, to determine its effectiveness and capacity to treat AMD and AMD sources (i.e. sulfidic wasterock). Bauxsol is created by neutralizing caustic 'red mud' tailings, an iron-rich residue created during the processing of bauxite, in such a way that the reactive alkalinity is retained or increased slightly. Bauxsol has a high capacity for neutralizing acidic waters and immobilizing metals. The effectiveness of Bauxsol for treating wasterock is being evaluated by using a lined trench containing about 25 cubic yards of sulfidic wasterock mixed with Bauxsol to a final concentration of 10% (vol). The leachate was sampled monthly to determine water quality and ongoing sampling will assess the neutralizing and immobilization capacity of the Bauxsol added. 55-gallon drums were also filled with a wasterock/Bauxsol mixture (10%, 5%, and 2%) to determine effectiveness at lower application rates. A pilot passive system for low-flow AMD scenarios was built using a 55-gallon drum, gravel, sand, and Bauxsol and tested in batch mode; both influent and effluent were sampled to determine the effectiveness and ongoing monitoring will establish the capacity of Bauxsol. To simulate treatment of ponded AMD water (i.e., pit lakes), 4,500 gallons were treated in a batch process using Bauxsol and lime; the tank was sampled 6, 9, and 42 days after the last addition. This is the first time that Bauxsol has been evaluated in the United States, however, it has been used to treat AMD at other sites throughout the world and met applicable water quality criteria. This is the first step in the evaluation of Bauxsol at the Gilt Edge Mine, and the results collected to date indicate that Bauxsol may be a viable treatment option.

Rehabilitation of the Old Bevier Passive Treatment Wetland, Macon County, Missouri

Paul T. Behum Jr.*, Hydrologist; **Kwang "Min" Kim**, Hydrologist; **Kevin W. Garnett**, Mining Engineer; **Len Meier**, Physical Scientist, Office of Surface Mining, Mid-Continent Regional Coordinating Center; and **Angela Glascock***, Environmental Specialist, **Brian Hicks**, Hydrologist, **Michael Mueller**, Reclamation Specialist, and **Michael Phillips**, P.E., Civil Engineer, Missouri Department of Natural Resources, Air and Land Protection Division

The Old Bevier Aerobic Wetland in Macon County, Missouri, was constructed between 1990 and 1991 by the Missouri Department of Natural Resources, Land Reclamation Program for the purpose of treating Acid Mine Drainage (AMD). The principle source of the AMD is from an underground mine that operated during the 1920's through 1950's, which was partially exposed during surface mining in the 1950's. Limestone bedding of an AMD collection system provides alkalinity similar to an Anoxic Limestone Drain (ALD). The original aerobic wetland treatment became ineffective when a critical dilution water supply became unavailable. The total acidity of the AMD overwhelmed the limited neutralization ability of the aerobic wetland causing the aquatic vegetation to deteriorate. The Missouri Land Reclamation Program with the assistance of the Office of Surface Mining, Mid-Continent Regional Coordinating Center rehabilitated the Old Bevier Aerobic Wetland in 2001, incorporating newer technologies to improve the performance. An extended AMD collection pipeline, a 2-stage Successive Alkalinity Producing System (SAPS) and associated oxidation cells and aerobic wetlands were constructed. The improved system is designed to treat a 45 GPM AMD discharge with high iron (450 mg/L) and total acidity (760 mg/L), but low aluminum content (<2 mg/L). Initial evaluations of the improved system find that effluent dissolved iron is 4.5 to 56 mg/L, net alkalinity (11 mg/L), and near neutral pH (5.3 to 6.95). Although no specific structures were incorporated in the design for manganese removal, manganese level in the discharge (7.9 mg/L) is lower than the inlet level (10 mg/L). This initial evaluation was conducted during winter months and prior to the establishment of emergent vegetation. Improvements in metal removal are anticipated in spring upon establishment aquatic vegetation and increased biologic activity.

Progress of BLM-funded Acid Rock Drainage Research

William White*, Physical Scientist, Bureau of Land Management, Salt Lake Field Office, **Kim A. Lapakko**, Principal Engineer, Minnesota Dept. of Natural Resources, Lands and Minerals Division; and **Edward M. Trujillo**, Associate Professor, University of Utah, Chemical and Fuels Engineering Dept.

The environmentally sound management of abandoned, existing, and future metal mine wastes on public lands has been identified as the most difficult and costly reclamation problem facing federal and state land-managing agencies. Drainage-quality prediction is essential to environmentally sound mine-waste management. The U.S. Bureau of Land Management

(BLM), in association with the Minnesota Department of Natural Resources Division of Lands and Minerals (MN DNR) and University of Utah Chemical and Fuels Engineering Department (U of U), continued sponsorship of research on predictive modeling of contaminated drainage from metal-mine waste after the U.S. Bureau of Mines closed. BLM-sponsored research showed that the ASTM humidity-cell protocol produced highly reproducible drainage quality, within and among laboratories, on four waste-rock lithologies (MN DNR). A simplified humidity-cell method produced results similar to those from the ASTM protocol with comparable intralaboratory replication. Mine-waste characterization and accelerated-weathering (humidity cell tests ranging from 20 to 278 weeks) were conducted on 74 samples from eight different mine-waste lithologies (MN DNR). Acid production thresholds were identified based on the sulfur content of two mine-waste lithologies. Drainage pH values less than 4.5 were produced by Archean greenstone samples with S > 0.2% and by Duluth Complex samples with S > 0.41%. Pyritic quartz-carbonate lithology exhibited a lag period prior to acid production of 2 to 11 years. The U of U's laboratory model has demonstrated reasonable agreement between modeled output and actual pH, total iron, and sulfate concentrations from weekly humidity-cell drainage produced from accelerated weathering of five different waste-rock lithologies. Results from the BLM-sponsored research are published in five peer-reviewed journal papers, 2 M.S. theses, and 17 contract reports.

Characterization of Anthropogenic and Natural Sources of Acid Rock Drainage at the Cinnamon Gulch Abandoned Mine Land Inventory Site, Summit County, Colorado

David Bird*, Geochemist, Colorado Geological Survey

The Colorado Geological Survey (CGS) has ongoing projects to characterize acid rock drainage (ARD) derived from both abandoned mines and natural sources in Colorado. In cooperation with the U.S. Forest Service (USFS), CGS conducts water quality characterizations of abandoned mines on National Forest System lands, findings from which are published as CGS open-file reports. In a separate project, CGS has produced a Bulletin (in press) that reports on many natural sources of ARD associated with hydrothermal alteration in the State. The report includes water quality data, rock chemistry data, and mapping to characterize the host rock, hydrothermal alteration, mineralization, and structural setting of the source areas. Cinnamon Gulch is among the sites recently evaluated for both the USFS abandoned mine inventory and the Natural ARD study, since the site releases ARD from both natural and anthropogenic sources. The gulch is part of the Snake River watershed, which is a domestic water source for several mountain communities in Colorado's Summit County. The site lies on the northeastern margin of the Oligocene Montezuma Stock, within an area of hydrothermal alteration and mineralization related to the stock. The Montezuma Shear zone, an important localizing structure for hydrothermal alteration and mineralization, transects the gulch. In the latest water sampling event at Cinnamon Gulch, nearly all of the trace metals analyzed in the 18 samples exceeded State hardness-related water quality standards for aquatic life. Average dissolved concentrations of selected metals were 5.5 mg/L aluminum, 5.5 mg/L manganese, 2.8 mg/L zinc, 14 mg/L cadmium, 260 mg/L copper, and 82 mg/L lead. The study attempts to quantify the relative contributions and the metals loadings from the natural versus anthropogenic sources, and to characterize the mineral solubility controls in the surface waters. Geochemical modeling was used to evaluate mineral solubilities and to verify assumptions regarding precipitation of mineral phases.

TECHNICAL PAPER SESSION 11: 2002 National Award Winners

Appalachian Region Award Winner

Midcontinent Region Award Winner

Western Region Award Winner

TECHNICAL PAPER SESSION 12: Engineering and Design

Manning Canyon Tailings Removal Action

Karl Ford*, National Remediation Projects Advisor, U.S. Bureau of Land Management and **Tim Ingwell**, Project Manager,

Bureau of Land Management, Salt Lake Field Office
The Salt Lake Field Office of the Bureau of Land Management proposed a Special Management Recreation Area (SMRA) in an area referred to as Five Mile Pass. An abandoned mine land inventory was conducted jointly with the Bureau of Land Management Utah State Office and the State Abandoned Mine Reclamation Program. As a result of this inventory effort, the Utah State Office recommended that additional characterization of the Manning Canyon tailings was necessary in order to determine how to appropriately reclaim the tailings on BLM administered lands. The Manning Canyon tailings are located in Manning Canyon near Fairfield, Utah on property administered by the Bureau of Land Management (BLM) and on land privately owned. The tailings are associated with the historic Manning Canyon gold mill that operated during the early 1900s. Approximately 720,000 cubic yards of arsenic tailings in four historic tailings ponds have migrated over several hundred acres. Nearly half of the tailings volume has migrated through dam breaches and have moved down gradient to the town of Fairfield, prompting an EPA emergency yard soil removal. Concentrations of arsenic in the tailings range from 2000-10,000 ppm. There is no groundwater within 100 feet of ground surface. The site is heavily used for ORV and other recreational purposes. Beginning in 1999, BLM performed CERCLA site characterization studies and in 2001, selected a remedy to consolidate the tailings into an on-site repository. The Bureau of Reclamation prepared the design package featuring a capillary barrier engineered cap for the repository. Funding for the $8 million cleanup project has been obtained from the Department of Interior's Central Hazardous Materials Fund. Construction is scheduled to begin this summer.

Dangerous Atmosphere Created by Strip Mine Spoil

William C. Ehler*, P.G., Geologist/Project Manager, Office of Surface Mining, Federal Reclamation Programs
Dangerous, low oxygen levels, commonly referred as blackdamp, are often caused by carbon dioxide and methane produced from abandoned underground coalmines. The blackdamp atmosphere from adjacent underground mine voids displaces normal air in homes usually by changes in air pressure. Three homes near and on a recently reclaimed strip mine are affected by blackdamp with no obvious association to deep underground mining. During periods of low barometric pressure, atmospheric levels of 12 to 25 % carbon dioxide (CO_2) and near 10% oxygen by volume entered the basements of these homes for periods exceeding 12 hours. Drilling indicated that CO_2 was concentrated throughout the permeable mine spoil beneath one of the homes. The other two homes were adjacent to the strip mine but not undermined. The source of the CO_2 production in the strip mine was initially unknown. However, three potential sources were identified: 1) deep, open mine entries encountered in the surface mining activities; 2) organic and landfill waste disposed in the mine pits; or 3) the dissolution of carbonate materials from reactive waters deep in the spoil. The source of the blackdamp needed to be identified to allow AML funding for abatement of the project. Stable isotopic analysis ($^{13}C/^{12}C$) of the carbon dioxide identified that the gas was inorganic in origin, specifically, from dissolved carbonate material in the spoil. The water chemistry also supports a high capacity to dissolve carbonate material. The overburden analyses of the mine spoil showed a significant source of carbonate material in a glacial till at the site. The normally attractive neutralization potential of this glacial till, combined with the waters from the adjacent abandoned mine to produce a detrimental source of CO_2..

Designing for 1000 Years

Christopher E. Sanchez*, Senior Project Engineer and **Steven D. Anderson***, P.E., President, Anderson Engineering Company, Inc.
Under requirements of the US Nuclear Regulatory Commission (NRC), Anderson was involved in the design and construction of a waste disposal facility that has a functional life similar to that of the great Egyptian Pyramids. Although this analogy seems extreme, the facility was required to have the design capacity to withstand the elements for a period of 1000 years. In the case of this uranium tailings facility, it was required to provide control release of radiological hazards for the term. The Bluewater Uranium facility was the first non-government Title II site to be approved by the NRC for long-term custody. The accomplishment provided a model for others in the uranium industry to follow for final reclamation of uranium processing. The reclamation was a complex correlation of engineering design, regulatory compliance, environmental clean-up, and radiological health and safety. Although many aspects of this project could be discussed including geotechnical stability, tailings impacted soils, relocation, and radiological source isolation, we focused on the engineering aspect of design and construction of erosion protection to satisfy the demands of the 1000-year term. This design included critical land shaping, runoff controls, erosion controls and overall watershed management to address the long-term stabilization of the radioactive wastes. Approximately 3.2 million cubic yards of tailings impacted soils and evaporation pond residues were excavated, placed in repositories, and reclaimed. Around

2.0 million cubic yards of radon barrier cap material was placed and compacted over the graded features and over 1 million cubic yards of topsoil was hauled and prepared as seedbed for revegetation. Approximately 1,350 acres of former evaporation ponds and the soil borrow areas were revegetated. Approximately 500 cubic yards of rip rap and erosion protection rock was placed as well. Erosion protective covers were constructed on the carefully shaped features that consisted of either topsoil with revegetation or rock armored. The entire repository surface was rock armored and large riprap relief spillways were designed and built for water handling and relief. All outslopes received a filter material and a larger rock size for the protective cap. The entire watershed was designed for extreme rainfall and runoff.

Zortman and Landusky with 20/20 Hindsight

Bill Maehl*, P.E., Vice-President, Spectrum-Engineering Inc.

The Good, The Bad, and The Ugly. Is this the name of an old western or the historical account of the Zortman and Landusky gold mines in north-central Montana? These two mines played an industry-leading role in the development of cyanide heap leach operations of low-grade gold deposits. They have also been in the news for "state-of-the-art" reclamation efforts. **The Good** this mine did for a depressed part of Montana is not in question. Where else could 300 people make a good living for 20 years on 1200 acres? The Bad is a blotchy past, starting over a hundred years ago with the "white man's" dealings with the Fort Belknap Indian Reservation. The Ugly is a present-day bankrupt gold mining company with a bond shortfall and numerous site problems. This paper will provide you with insights into the political climate leading to the development of Pegasus Gold as the golden employer having several Montana gold mines with the State singing their praises and their subsequent fall from grace. Finally, this paper will delve into the present-day engineering and reclamation design phase, which started in June of 1999 with the hiring of Spectrum Engineering. This two-year effort led to many changes and modifications of the BLM and Montana DEQ pre-selected reclamation plans. This was necessitated, in part, by a reclamation bond shortfall of $15.6 million for Zortman and $26.6 million for Landusky. The resulting reclamation designs have been implemented with the majority of the two mines already backfilled, regraded, topsoiled, and revegetated. This paper will provide a list of shafts and other pitfalls to be aware of as part of the reclamation evaluation process. These gold nuggets can be taken home from Park City, refined, and used on a day-to-day basis.

TECHNICAL PAPER SESSION 13: Watershed Systems

Abandoned Mine Site Restoration in Pine Creek, Coeur d'Alene Basin, Northern Idaho

David Fortier*, P.E., Environmental Protection Specialist, USDI, Bureau of Land Management, Coeur d'Alene Field Office and **Steven W. Moore**, Bureau of Land Management, Idaho State Office

Following severe flooding in northern Idaho in 1996, the Bureau of Land Management (BLM) and partners began implementing a systematic restoration of the Pine Creek watershed to reduce the impacts of past mining and milling. This work is continuing to progress as part of the Idaho's Abandoned Mine Lands (AML) program and the Coeur d'Alene Basin Cleanup activities with the Environmental Protection Agency and the State of Idaho. This ongoing, multi-year effort includes a variety of sites in a mountainous 79-square-mile watershed. Actions to date include stream-side tailings removals, millsite cleanups, stabilization of waste rock dumps, and stream restoration. This paper will focus on the mine-waste removals and waste rock dump stabilization aspects of the restoration effort. Contaminants of concern are primarily lead, zinc and cadmium. Site characterization methods included: site surveys, historic information reviews, field sampling with a portable X-Ray Fluorescence (XRF) unit, transect sampling of soils with XRF and laboratory analysis and periodic water-quality monitoring. Limitations and benefits of various characterization and sampling methods are briefly discussed and compared. Interpretation of sampling data, specific-site characteristics, and cost/benefit limitations, were all considered in design of projects. Project design plans, contract administration, on-the-ground implementation, and preliminary results are also presented as examples of factors involved in conducting AML projects.

Mercury Contamination of Water, Sediment, and Biota in Watersheds Affected by Historic Hydraulic Gold Mining in California

David Lawler*, Abandoned Mine Lands Coordinator, BLM – California State Office; **Janine Clayton**, U.S. Forest Service,

Resources Division; **Charles N. Alpers**, U.S. Geological Survey, Water Resources Division; **Michael P. Hunerlach**, U.S. Geological Survey, Water Resources Division; **Roger L. Hothem**, U.S. Geological Survey, Biological Resources Division; and **Jason T. May**, California State University Sacramento Foundation; and James J. Rytuba, U.S. Geological Survey, Geologic Division

Mercury was used extensively at hydraulic gold mining sites in the Sierra Nevada and Trinity-Klamath regions of California during the late 19th and early 20th centuries and has contaminated water, sediment, and biota on a watershed scale. Hydraulic mining methods drastically modified the geomorphology and hydrology of these regions, causing increased turbidity of the natural waters, siltation of river beds, and contamination of the bottom sediments of reservoirs downstream of the mines. Thousands of pounds of elemental mercury were used at each of many hydraulic mines to facilitate recovery of placer gold by amalgamation methods within extensive sluice box systems. Visible concentrations of elemental mercury remain in the sediments of some surface sluice and sluice tunnel systems that drain surface waters from the abandoned mine pits. The continued interaction between the mercury-laden sediments and flowing water is responsible for ongoing mercury and methylmercury contamination of surface waters in these California regions. The Bear River and South Yuba River watersheds of the northern Sierra Nevada are among the most highly impacted areas in California. During 1999-2000, an interagency team including scientists from the USGS, BLM, USDA Forest Service, as well as state and local agencies, sampled water, sediment, and biota from dozens of abandoned mine land (AML) sites and from downstream lakes in these watersheds. Water, sediment, and biota (invertebrates, amphibians, and fish) mercury concentration data in both regions is being used to assist in prioritization of mine sites for remediation. Monitoring of key sites before and after hydraulic mine remediation will allow documentation of the benefits in terms of reduced mercury bioaccumulation and mercury loading to downstream waterbodies.

High Ore Creek Watershed Restoration - Part 1

Mike Browne*, Abandoned Mine Land and Hazardous Materials Program Leader, Bureau of Land Management, Butte Field Office; **Ben Quinones**, Montana Department of Environmental Quality, Mine Waste Cleanup Bureau; and **James Madison**, Assistant Research Professor, Montana Bureau of Mines and Geology

A cooperative effort by the state of Montana, Bureau of Land Management, twenty private landowners, and several contractors resulted in the restoration of four miles of stream channel on High Ore Creek and the reclamation of the Comet, Golconda, King Cole, and Silver Hill mines in the High Ore Creek watershed. High Ore Creek, located east of the town of Basin in Jefferson County, Montana, flows through the abandoned Comet Mine and Mill site and into the Boulder River. Mill tailings and waste rock, from about 400,000 tons of ore milled at the Comet Mine, filled a large area of the High Ore Creek Valley and were retained behind a dam. Failure of the dam allowed mine wastes to erode and be transported downstream to the Boulder River. The Montana Department of Environmental Quality, Mine Waste Cleanup Bureau (MWCB) completed the first phase of reclamation at the Comet mine site in the 1997 and 1998. Approximately 430,000 cubic yards of mine wastes were excavated and placed into the pit area. The Bureau of Land Management, in 1999 and 2000, and the MWCB, in 2001, removed streamside tailings material, a significant source of metal and sediment contamination in the High Ore Creek and Boulder River watersheds. Reclamation included the removal of approximately 62,000 cubic yards of streamside tailings and waste-rock over a 4-mile length of stream channel, stream channel and floodplain reconstruction, and re-vegetation with native plant species. The Montana Bureau of Mines and Geology (MBMG) has been monitoring water quality in the High Ore Creek and Boulder River watersheds since 1997. The MBMG compared post-reclamation analytical results with pre-reclamation water–quality data to determine the success of the Comet Mine and High Ore Creek reclamation projects. Analytical results indicate trace-element concentrations are substantially lower than pre-reclamation conditions.

High Ore Watershed Reclamation - Part 2

Mike Browne, Abandoned Mine Land and Hazardous Materials Program Leader, Bureau of Land Management, Butte Field Office; **Ben Quinones**, Montana Department of Environmental Quality, Mine Waste Cleanup Bureau; and **James Madison***, Assistant Research Professor, Montana Bureau of Mines and Geology

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TECHNICAL PAPER SESSION 14: Politics

The EPA Rocky Mountain Regional Hazardous Substance Research Center

Thomas Wildeman*, Professor of Chemistry and Geochemistry and **D. L. Macalady**, Department of Chemistry and Geochemistry, Colorado School of Mines; **C. D. Shackelford and S. L. Woods**, Department of Civil Engineering, Colorado State University

The Rocky Mountain Regional Hazardous Substance Research Center (RMRHSRC) for remediation of mine waste sites has recently been formed. The RMRHSRC is funded by the U. S. Environmental Protection Agency (EPA), represents EPA Region 8 states, and consists of a consortium of participants from Colorado State University, Colorado School of Mines, and several academic and non-academic participants from other regions of the U. S and Canada. The research goal of the RMRHSRC is to develop new and improve existing methods or technologies for remediation of mine waste sites that are cost effective and lead to clean ups that are protective of human health and the environment. Also, the activities of the RMRHSRC include training, technology transfer and outreach programs that will focus on the development of new technologies. A number of issues were considered in establishing an action plan and in choosing the research projects to fund. Some of these issues, such as cost, apply to every possible method of treatment. Others such as whether to concentrate on abandoned or active operations are somewhat mutually exclusive. The issues that were considered, the conclusions that were made, and how these conclusions affected the decision of which research projects to fund is the subject of this talk. It was decided to concentrate on abandoned mine lands. We are currently surveying our federal clients and are developing a list of concerns upon which our future research will be focused. These concerns will also be presented.

Recent Court Rulings on Takings and the Possible Impact on the Abandoned Mine Land Program

Vaughn P. Girol*, Realty Specialist, Office of Surface Mining Reclamation and Enforcement, Appalachian Regional Coordinating Center

Historically governments from the local to the federal level have used different forms of zoning in addition to eminent domain to control land use. Traditional uses of these powers have been zoning to control the location of industrial, commercial, and residential areas and the acquisition of land for public development. Recently there have been prohibitions on development of land in order to protect against environmental degradation. In recent years, with the increased use of environmental restrictions, have come court challenges. These challenges have asserted that such restrictions have drastically reduced the economic potential and therefore the value of the properties involved. This would constitute a taking without compensation. The purpose of this paper is to review some recent cases, both pending and adjudicated, and to assess possible impacts on the AML program. Potential program activities that could be implemented to lessen the exposure of the AML program to adverse court actions will be addressed.

The Politics of a Mega-Project: Institutional Resistance to Innovative Ideas

Andrew S. Voros*, Executive Director, NY/NJ Clean Ocean And Shore Trust

The Port of NY/NJ is the largest port on the east coast of the Western Hemisphere. It is the largest handler of containers, cars and petroleum imports into the US, and inputs some $20B annually into the region's economy. Naturally shallow, the port depends on the maintenance of its navigational channels, and the removal of between 4 and 7 million tons of mud from them each year. With the impending ban of ocean disposal of this trace-contaminated material, a dredging crisis was first declared in 1993, with no long term, low cost solution to the disposal of this material. In 1995 COAST initiated a demonstration with Pennsylvania DEP's Bureau of Abandoned Mine Reclamation of the use of dredged materials amended with coal ash and other pozzolonic wastes for the reclamation of an abandoned Pennsylvania surface mine. It attained an appropriation from the NJ State Legislature of $20M for the demonstration, and successfully coordinated the agencies of three states and the federal government towards the successful demonstration of a unique concept. The concept is being examined for application in several states and in Europe as well. Yet the project was delayed and prolonged by the very bureaucracies that had the most to gain from its completion. This discussion provides a case study in the political science of mega-project implementation within American mega-bureaucracies, and implications for the region and the nation's future.

TECHNICAL PAPER SESSION 15: Acid Mine Drainage (AMD): Part 3

Integrating Hydrologic and Geologic Controls on Metal Loading to Streams: Mass-loading Analysis of Mineral Creek, Colorado

Briant A. Kimball*, Research Hydrologist, U.S. Geological Survey, West Valley City; **Robert L. Runkel** and **Katherine Walton-Day**, U.S. Geological Survey, Denver; and **Dana J. Bove, U.Su. Geological Survey**, Denver

Stakeholders, including land-management agencies, often are faced with choosing cost-effective remediation of abandoned and inactive mines located in environmentally sensitive mountain watersheds. Remediation decisions require knowledge of the most significant sources of metals to surface waters. The significance of a given source not only depends upon the concentrations of a toxic metal, but also on the total mass, or load of metal added to the stream. To determine loads, we combined tracer-injection methods, to provide reliable discharge measurements on a watershed scale, with synoptic sampling, to provide spatially detailed concentration data. The resulting load profiles indicate which sources have the greatest effect on streams, where ground-water inflows are located, and where natural attenuation of metal loads occurs. Our approach is illustrated with an analysis of zinc loading in the Mineral Creek, Colorado. Along the 15-kilometer study reach, 102 kilograms per day of zinc were added to Mineral Creek. Over half of this load came from well-defined areas that included both mined and non-mined parts of the watershed. However, the combined effect of many smaller inflows also contributed a substantial load that could limit the effectiveness of remediation. Of the total zinc load, 43 kg/day came from stream segments with no visible inflow, indicating the importance of contributions from dispersed subsurface inflow. The subsurface inflow mostly occurred in areas of acid-sulfate alteration, while surface inflow mostly occurred in areas of developed mines. Our approach provides a detailed watershed evaluation of metal load to support remediation decisions, and quantifies processes affecting metal transport.

Sulfate Reducing Bioreactor Design and Operating Issues: Is This The Passive Treatment Technology For Your Mine Drainage?

James J. Gusek*, P.E., Sr. Project Manager, Knight Piesold and Co.

There are basically two kinds of passive treatment cells for treating mine drainage. ***Aerobic Cells*** containing cattails and other plants are typically applicable to coal mine drainage where iron and manganese and mild acidity are problematic. ***Anaerobic Cells*** or ***Sulfate Reducing Bioreactors*** (SRB's) are typically applicable to metal mine drainage with high acidity and a wide range of metals. Most passive treatment systems employ one or both of these cells types. The track record of aerobic cells in treating coal mine AMD is impressive, especially back in the eastern coalfields. SRB's have tremendous potential at metal mines but have not seen as wide an application. This paper presents the advantages of SRB cells in treating metal mine ARD, including the ability to: work in cold, high-altitude environments; handle high flow rates of mildly-affected ARD in moderate acreage footprints; treat low-pH ARD with a wide range of metals and anions including uranium, selenium and sulfate; accept ARD containing dissolved aluminum without clogging with hydroxide sludge; have life-cycle costs on the order of $0.50 per thousand gallons; and be integrated into "semi-passive" systems that might be powered by liquid organic wastes. Sulfate reducing bioreactors might not be applicable in every abandoned mine situation. A phased design program of laboratory, bench and pilot scale testing has been shown to increase the likelihood of a successful design.

Longevity of Mine Discharges From Above-Drainage Underground Mines

Jeff Skousen*, Professor of Soils, West Virginia University; **Jennifer Demchak;** and **Louis McDonald**

The duration of acid mine drainage from above-drainage underground mines is important to watershed restoration and abandoned mine land reclamation projects. Contractors usually employ remediation strategies once (such as regrading, topsoiling, revegetation and the installation of passive treatment systems) with the hope that these methods will adequately improve the site and treat the water for a long-term period. An understanding of the changing acid water conditions from these portals over time will help in designing appropriate and long-term treatment methods. Past studies have reported that underground mines discharge acid water for hundreds of years with little change, while researchers in the U.K. state that poor drainage quality may last from only 20 to 40 years. Several factors are important in making a prediction of the drainage quality over time, such as coal seam characteristics (primarily sulfur content), time since mine closure, mining method and amount of coal remaining, collapse of roof and other disturbances within the mine, and subsequent nearby surface mining. Over 50 underground mine discharges were located and sampled during 1968 in northern West Virginia, and we revisited those sites in 2000 and measured water flow, pH, acidity, alkalinity, Fe, Al, and sulfate. Most of the discharges were from the Pittsburgh and Upper Freeport coal seams, which were mined extensively over the past 70 years in this area. There was no significant difference in flows between years from these discharges, so we felt that these two sampling years were similar and the water quality data could be compared. Across all sites, significant changes in water quality between 1968 and 2000 were found for all parameters: pH increased from 3.1 to 4.0, average acidity declined from 1,140 to 295 mg/L (as $CaCO_3$), Fe decreased from 352 to 61 mg/L, Al decreased from 143 to 38 mg/L, and sulfate declined from 2,918 to 1,037 mg/L. Pittsburgh seam discharge water was much worse in 1968 than Upper Freeport seam water and drainage water from both seams improved from 70 to 80% over 32 years (roughly 1800 and 750 mg/L as $CaCO_3$ in 1968 compared to 375 and 250 mg/L as $CaCO_3$ in 2000). This research provides estimates of the time periods when active treatment of water would be required and when passive treatment systems might be employed to treat the water.

TECHNICAL PAPER SESSION 16: Cultural Resources and Brownfields

Uranium Mining in Cottonwood Wash: A Quick Look at 50+ Years

Lee Bennett*, Archaeologist/Manager, Bennett Management Services, LLC

San Juan County produced the majority of Utah's uranium, and the mines in the South Cottonwood watershed exemplify the role of the independent miner and the impacts on local economy. Through a combination of geological evaluations, archaeological surveys, historic research, and interviews with surviving miners, the story of the watershed's development was revealed through a unique partnership among Utah's Division of Oil, Gas, and Mining, the Bureau of Land Management, Manti-LaSal National Forest, and the San Juan County Historical Commission. Following the 1931 discovery of carnotite ore by a sheepherder, prospecting accelerated. Within a few years a Hollywood movie mogul financed experiments on vanadium recovery, and underwrote the first of three vanadium mills that were constructed at Cottonwood Wash. During World War II and under the guise of assessing the extent of vanadium deposits on the Colorado Plateau, geologists drilled, mapped, and clicked their way through San Juan County while secretly determining the area's uranium reserves. Their successful hunt was not shared with the miners, however, so it was 1952 before a couple of local cowboys found uranium ore in the upper portion of the South Cottonwood watershed. From highways to schools, swimming pools to telephone service, residents of San Juan County experienced major changes in their situation before the boom went bust. But for the people who drilled, mucked, and trucked, the memories of the good old days will always be colored yellow.

Abandoned Mine Reclamation in Culturally Sensitive Areas: An Example from Cottonwood Wash, Utah

Kathy Huppe*, Cultural Resources Coordinator, Cottonwood Wash Abandoned Mine Reclamation Project, Bureau of Land management

In 1997, Cottonwood Wash became the third watershed-based pilot project funded under an expanded Clean Water Act program known as the Clean Water Action Plan. Other projects had been initiated in CO and MT in 1996. Cottonwood's unique challenges were an arid environment, mining focused on vanadium and uranium extraction, and an uncommon density of cultural resources. Partners included the USDA Forest Service, the Bureau of Land Management, the Utah Division of Oil, Gas and

Mining, and the Utah Department of Water Quality. Because cultural resources and Native American consultation had been identified as major issues, I was hired to coordinate that aspect of the project in September, 1999. As expected, cultural resource inventory identified nearly 200 prehistoric sites in the project area. However, very little thought had been given to the importance of historic mining resources in the Wash. Needing a way to incorporate a consideration of historic mines and mining into the larger project framework, we applied two historic preservation concepts – the Programmatic Agreement to allow compliance flexibility, and the idea of rural historic landscapes as an evaluation framework. This paper discusses what these concepts are, how they were applied to the project, what was found and how effective reclamation, which is sensitive to all the cultural resource values in the watershed, is being accomplished.

A Brownfields Redevelopment Opportunity at an Abandoned Mine Lands Site

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In 1999 the Town of Silver City, New Mexico purchased a 500-acre historic mining area known as Boston Hill located immediately southwest of the Town. It was the Town's first open space acquisition. In 2000, the Town received an EPA Brownfields Demonstration Pilot Grant with an extra $50,000 to assess and plan for development of Boston Hill as a greenspace. The Town has also been approved for a grant to develop a trail system on Boston Hill from the New Mexico Recreation Trails Advisory Board and would like to emphasize the mining heritage represented by the landscape. Even though the New Mexico Abandoned Mine Lands Bureau (AMLB) had treated the site in the late 1980's, their work was incomplete and several shafts remain on the property. Efforts to get the AMLB to return to Boston Hill have so far been unsuccessful. The Town has developed a partnership with the Bureau of Land Management to pursue mitigation of remaining mine shafts on adjacent public land with the hope that there will be a spill over effect onto Town owned land. The Town is under severe budget constraints due to the recent layoffs associated with the closing of the Phelps Dodge Chino Mine and does not have funding to address the mitigation of the shafts remaining after the last AMLB project. The Town plans to use a portion of the trail system grant to install educational signage to alert visitors to potential hazards along with low impact and unobtrusive barriers to delineate areas where extra caution is advised. Visitors to the site, therefore, would be educated about remaining abandoned mine hazards as they entered the site at trailheads as well as with site-specific or hazard-specific interior signage. The Boston Hill mining area is adjacent to a community of 12,000 that is struggling to grow beyond the typical boom-bust economy built around mining. Emphasis of the areas mining heritage is seen as an opportunity to attract tourists while preservation of open space and development of a trail system improves the overall quality of life in the community.

Economic and Community Development Opportunities for Mine Scarred Lands

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On January 11, 2002, the Federal Brownfields Revitalization and Environmental Restoration Act of 2001 was enacted. The act codifies a federal brownfields program and authorizes $250 million annually in grants and loans including $50 million to be distributed to state and tribal response programs. In addition, the law provides funding for cleanup and assessment activities and also clarification of federal liability. Historically, brownfields have been viewed as vacant industrial and commercial properties where perceived or real environmental contamination complicates redevelopment. The new federal brownfields law expands this definition to include most property types, including mine-scarred lands. By including mine scarred lands in the definition, abandoned mine lands will benefit from applicable provisions of the brownfields law, and may also be eligible for an array of cleanup and redevelopment resources provided by agencies such as the U.S. Economic Development Administration and the U.S. Department of Housing and Urban Development. These and other resources provide new opportunities to address mine sites that have economic and community development potential. As part of the U.S. EPA's current activities to implement the new law, work has begun on issues including defining the term "mine scarred land," developing related guidance, and identifying types of technical assistance to cleanup and develop mine scarred lands in the brownfields context. The proposed paper and technical session to be presented at the 2002 NAAMLP Annual Conference is a key initial step in information exchange between the brownfields and mine reclamation communities as they collaborate to implement brownfields programs. The paper and technical session will achieve the following: 1) provide a historical background on the evolution of brownfields policy and its linkage to mine reclamation: 2) describe the various financial and technical resources that are available for brownfield redevelopments: 3) based on case study research, suggest general criteria for using a brownfield redevelopment approach at selected mine sites: 4) provide a basic explanation of how state and tribal response programs may benefit from the legislation; and 5) request input on a number of technical and policy items from NAAMLP members through a survey.

NOTES

National Association of Abandoned Mine Land Programs

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