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Issue 2 2008

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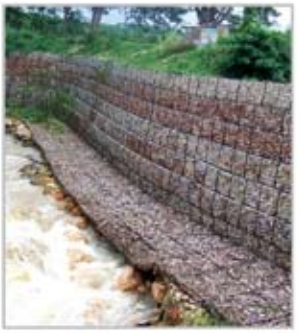


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contents

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Volume 3
Number 2

BY VERN PFANNENSTIEL

In Our World, the Sky's the Limit

Our lives are becoming increasingly more globalized every day. The term "globalization" and the mantra "think globally, act locally" are recurring themes. As reclamation specialists, we are continually made aware of the controversy surrounding global climate change and the significant impact of global issues in our daily lives and careers.

ASMR, along with our associates in the International Affiliation of Land Reclamationists (IALR), has understood the importance of interaction on global scale issues for a number of years. This year's ASMR meeting in Richmond demonstrated this continued global interaction with over 10 international papers, posters, or speakers. Represented countries included Greece, Indonesia, China, England, New Zealand and, of course, our close neighbors from Canada. A quick review of the membership directory shows at least 10 foreign nations represented in ASMR.

ASMR has a long list of distinguished members who have devoted careers to reclamation and remediation. Their efforts have been essential to formulate standard procedures, resolve technical issues, and develop best practices. These are complemented by field practitioners who have worked closely with researchers to achieve practical and effective solutions at operational levels. The annual meetings provide an avenue for presenting the research and applied results and sharing technology or "how to" information. Technology transfer is only a phone call or e-mail away by using the membership directory as a source for networking.

ASMR is much more than a source of technical information or research to be shared with friends and colleagues at the annual meetings. ASMR can also be a service organization providing valuable and objective information. The results of research and field applications by ASMR members and others are increasingly a resource to those in the international community working in reclamation. The resources of ASMR should be of great value to state and federal regulatory efforts or as a source of unbiased technical information to organizations such as the National Mining Association to educate policy makers, government entities, or the public. Last year Congress held hearings on the 30th anniversary of the Surface Mine Control and Reclamation Act (SMCRA) and what it has accomplished. What better organization than ASMR to provide objective testimony regarding SMCRA since ASMR evolved, in part, as a result of the need to achieve success under this landmark federal act? Many of our members have dedicated their careers to achieving successful reclamation results under SMCRA. I feel that ASMR could have provided a valuable service to Congress by providing information based on factual results that demonstrate what has been achieved over the last 30 years.

With this in mind, I ask and challenge each of you to look for innovative ways that our society can serve people not only here in the United States, but also in the international community. Developing and implementing sound operating, reclamation and remediation practices in other countries is becoming increasingly important as global utilization of natural resources intensifies. Conservation of land use, a main tenant of SMCRA, has been achieved here and that success can be shared with the rest of the world. Several years ago I was fortunate to attend the Energy Globe awards on world sustainability. There were over 90 countries represented and following a presentation on reclamation at U.S. coal mines, I was asked repeatedly, Why do you do reclamation?; How do you do it?; and, How can we do it?

So when you ask, What is the value of ASMR?; Will ASMR meet my needs?; Can it make a difference in my career?; or, Will it address meaningful issues?; look into a mirror for the answer. The person who can make a difference and help ASMR continue to grow in value and service is looking right back at you. Get involved and be active in ASMR. The sky's the limit in what we can accomplish as a professional society. ■

Glenn Springs Holdings' Frank Russell Receives National Reclamation Award

Frank Russell, manager of the Copper Basin Project in Polk County, Tenn., was recently awarded "Reclamationist of the Year" by the American Society for Mining and Reclamation. The award was presented to Frank at the annual meeting of the society in Richmond, Va., June 18. Over 200 professionals were in attendance at the meeting from around the United States. The society confers this prestigious award to the practicing reclamation professional which has advanced the field through innovative research, implemented sound proven techniques at a

Frank Russell, manager of the Copper Basin Project

"Frank has taken from the academic community the basics and skills and implemented them in an innovative way at a unique location for decades. He has truly "mastered" the science and art of reclamation and is largely responsible for the dramatic transformation of one of the nation's most challenging environmental sites."

challenging mine site and documents the process by a written presentation. Over 80 papers were presented at the 2008 meeting, including a presentation by the Copper Basin team illustrating the remediation of the London Mill Complex.

Reclamationists worldwide need opportunities for technology transfer, which is one of the primary goals of the society. A national meeting is held annually where information is exchanged between academic professionals, those who are practicing reclamation in the field, students, and all other interested persons. Each year the location is rotated within eastern and western North America to provide opportunities for its members and guests to become familiar with diverse reclamation challenges and accomplishments. The proceedings for the meetings provide valuable references for those concerned with land reclamation, and past proceedings are used by practicing soil scientists, conservationists and land managers as a guide to "state-of-the-art" reclamation practices. The society's goal is also to provide a mechanism to encourage both written and verbal technology transfer.

The award committee considered Frank's lifelong involvement in the development and recovery of the Copper Basin as he began working for the mining and processing interests around Copper Hill immediately after high school in 1967. His career in the basin began in the engineering department and involved design and operation of much of the infrastructure of the complex. He served as senior project and environmental engineer from 1985 to 2000. In 2000, he put his experience to work for Glenn Springs Holdings in its massive remediation efforts in the Copper Basin.

Frank was nominated for the award by Ben Faulkner, environmental consultant to the Copper Basin Project. He was joined by Franklin Miller and Ken Price, vice presidents of Glenn Springs Holdings in preparing Frank's nomination. Quotes from the nomination follow:

Frank Russell has lived and worked in the Copper Basin of Tennessee all his adult life. His focus has always been on minimizing the environmental impact from one of the nation's most important mining and industrial complexes. Recent reclamation and water quality improvement activities coordinated on-site by Frank build on more than four decades of dramatic land restoration efforts of which Frank has been a principal figure. Many of the innovative regrading, soil stabilization, waste disposal, revegetation and reforestation

The Copper Basin of Tennessee
1973 BY EMORY KRISTOFF – NATIONAL GEOGRAPHIC IMAGE COLLECTION

The Copper Basin of Tennessee
2007 BY RON LOWERY AND BEN FAULKNER

techniques that have proven successful were developed by Frank and talented foresters and agronomists from TVA, University of Tennessee, and various federal agencies that shared the vision of reclaiming what many once hailed the "World's largest man-made biological desert." In his own quiet, unassuming way, he will modestly relate the trials and challenges of coordinating the environmental concerns of a vibrant, diverse, sprawling processing and chemical facility, and slowly, but deliberately, taking action to minimize the effects of legacy mining and processing.

The stories may include using three crawler dozers connected with cables and pulleys to safely regrade extremely steep, loose slopes, working with local highway authorities to provide erosion control to keep highways open during storm events, or refining aerial seeding techniques. Frank has firmly, but diplomatically, guided his employees and contractors in material handling, regrading, and total reclamation, sharing the specific methods and techniques he has perfected, like nuggets of precious metal gleaned from years of experience. He has become very particular about the specific planting and seeding rates and composition, knowing what will work on what material, and even the limitations of the Copper Basin growing season.

Where possible, he has shared the heritage and vision with the many visitors who attend Glenn Springs' July 4 Miners' Days celebration and tour the property, and with scouts, 4-H club members and high school students who occasionally assist with the tree planting. When new folks suggest a "new technique" on the project, Frank will kindly indicate he "tried that" and without referring to his notes, give the date, location, application rates, and often the reason for not trying that particular method again, or how he learned from that mistake. He has always been eager to try new methods, and refine those that proved successful in this most challenging environment. He is the quintessential "hands-on" expert that all researchers envision when they present a fledgling technology or method. Frank has taken from the academic community the basics and skills and implemented them in an innovative way at a unique location for decades. He has truly "mastered" the science and art of reclamation and is largely responsible for the dramatic transformation of one of the nation's most challenging environmental sites. ■

NORTH AMERICAN COAL CORPORATION
RED HILLS MINE

BY W. LEE DANIELS, IALR COORDINATOR, CSES DEPT.
VIRGINIA TECH, BLACKSBURG, VA

What's been Happening with IALR?

The International Affiliation of Land Reclamationists (IALR) was originally organized by Bill Plass and a number of colleagues from various countries in 1996. The main objective of this new collaboration was to provide enhanced communication and flow of information among the various organizations and individuals around the world that deal directly with mined and disturbed land reclamation and rehabilitation.

In 2006, Bill Plass handed over the reigns of managing IALR to me (W. Lee Daniels) and I have been trying to keep abreast of what is occurring in our various affiliated societies (beyond ASMR). To that end, I have made it a point to attend at least one international meeting per year. I attended the annual meetings of the Canadian Land Reclamation Association (CLRA) in Halifax, Nova Scotia (2007) and in Kananaskis Alberta (2008). Another contribution we have made since 2006 is the development of an IALR e-mail listserve that allows us to rapidly disseminate information and messages to all IALR affiliates.

For more detail on the current IALR structure and affiliate members, go to: http://ces.ca.uky.edu/asmr/IALR.htm. This page is maintained by Richard Barnhisel (ASMR Executive Secretary) and you can contact him via the links on the IALR Web site if you have any suggestions or contributions to the meeting postings or the bulletin board page.

The annual IALR Newsletter was compiled by Linda Jones of the CLRA for a number of years and we are grateful for her years of service to our organization. That agreement ended in 2007, however, and for the past one-and-a-half years I have been soliciting input for this year's newsletter via e-mail. Unfortunately, I received very little input from outside the United States, primarily due to the fact (as discussed later) that our affiliates in both the United Kingdom and Australia have undergone major reorganization within the past year. I am hopeful that next year's newsletter will have considerably more content from our international affiliates.

W. Lee Daniels at the Powell River Project

Current IALR Structure and Status of Affiliated Organizations

IALR membership is currently open to any person who is already a member of one

of our affiliated organizations (go to IALR Web link above for the current list) and who expresses a desire to become a member of IALR. Expressions of such interest should be directed to wdaniels@vt.edu

The basic structures and organizational contacts for ASMR, CLRA and the China Land Reclamation Society have remained intact since 2006. However, our long-term colleague in Australia, Clive Bell, retired in 2006. In May 2008, it was agreed that professor David Mulligan, director of the Centre for Mined Land Rehabilitation at the University of Queensland in Brisbane, would take over as the main IALR affiliate contact in Australia. We also appreciate the fact that Keith Lindbeck offered to help coordinate on the west coast of Australia and we will keep him involved in all IALR activity. The British Land Reclamation Society (BLRS) has undergone significant restructuring over the past 18 months to broaden its scope to include sustainable urban land regeneration and planning in addition to its historic focus on mine rehabilitation. Our primary contacts with BLRS remain Steve Smith in Wales and Neil Humphries with the URS Corp. in Derby. Contact information for all current affiliates can be found at http://ces.ca.uky.edu/asmr/IALR.htm

Richmond 2008 Meeting

The 2008 Annual ASMR meeting in Richmond this past June also served as the 10th authorized meeting of IALR. We were happy to host international delegates from over 10 countries and six continents that made oral or poster presentations. The plenary session was clearly international in scope, and focused on linkages between long-term mining sustainability, managing global climate change and associated state and federal regulatory programs. The social highlight for IALR was a well-attended dinner reception at a local pub where delegates from each country gave a summary of their outlook and expected focus areas for the coming years.

News and Developments from New Partners

A number of delegates to the Richmond meetings were from countries that do not have recognized IALR affiliations, but are interested in becoming active in IALR. For example, Dr. Luiz Dias from the University of Vicoza in Minas Gerais, Brazil, has been very active in mined land reclamation and acid mine drainage work for over a decade and is planning on hosting a major mine drainage abatement meeting in Brazil in 2009 that IALR will co-sponsor. Similarly, Dr. Marcin Pietrzykowski of the Agricultural University of Cracow in Poland, has a very active research program focused upon reforestation of mined lands and mining wastes and is attempting to set up scientific exchange relationships with the United States and other countries. Professor Zach Agioutantis of the Technical University of Crete, also presented a paper on advances in the reclamation of lignite mines in Greece, and is hosting a major international meeting in 2009 that is posted below. These are just a few examples of potentially significant IALR collaborators that fall beyond the current membership rules that were originally chartered. A proposal to alter the basic membership structure of IALR follows.

Wetlands project at Shirley Plantation, Richmond 2008 ASMR Meeting.

A Proposal to Restructure IALR

As discussed above, Bill Plass and I have recognized a number of deficiencies in the original IALR affiliate and membership structure for a number of years now. In early June 2008, Bill Plass proposed a major change to the existing structure. I intend to circulate the full detailed proposal to all of our current affiliates in the near future and ask for their approval or suggested modifications.

First of all, Bill Plass proposed that the title of "Secretariat" be dropped in lieu of simply using the term "IALR Coordinator." With respect to membership, the new proposal opens membership to any individual, scientific society, research center, organization, or corporate entity that may become a member or sponsor of IALR by simply contacting the coordinator and providing appropriate registration information. No dues or special financial obligations are required. IALR will accept voluntary contributions in support of meeting activities or other needs. IALR's current operating expenses are covered by Virginia Tech, so we are no longer assessing our affiliate organizations annual dues as in the past.

Upcoming International Meetings

SDIMI 2009 – Sustainable Development Indicators in the Minerals Industry.

Gold Coast Queensland, July 6 to 8, 2009.
www.ausimm.com.au/sdimi2009

Calling for Papers –
Deadline Monday, Sept. 29, 2008

SDIMI 2009 is the fourth in a series of international conferences aimed at enhancing the contribution of the global minerals industry to the goal of sustainable development. The purpose of these conferences is best captured in the "Milos Declaration," adopted at the first

ASMR members and IALR member Marcin Pietrzykowski in foreground.

conference held on the island of Milos, Greece, in 2003 and endorsed by leading global professional and scientific organizations active in the sector. The declaration emphasizes that minerals are essential for meeting current and future societal needs and that the minerals professional community has a critical contribution to make to a sustainable future, through the application of scientific, technical, educational, and research skills.

3rd International Conference on: Advances in Resources and Hazardous Waste Management towards Sustainable Development (AMIREG 2009)

Athens, Greece, Sept. 7 to 9, 2009.
http://heliotopos.conferences.gr/amireg2009

The deadline for submitting abstracts is Jan. 23, 2009.

The aim of this third conference is to provide a forum for the world's leading scientific and technical communities to interact and address the main issues and the key challenges related to all aspects of resources and hazardous waste management in the beginning of the 21st century in order to improve industry's sustainability, reduce its environmental and health impacts in substantial and measurable terms, enhance resource recovery efficiency and reduce consumption of resources.

Over the past two years I have met with IALR colleagues in Australia, Brazil, Canada, Greece and Great Britain, and all of them agree there is a clear need for some sort of international collaboration and organization.

Some Closing Words and a Request

Under its current form, IALR is at best a "loose affiliation" of a wide array of people around the world with a common set of interests. Over the past two years I have met with IALR colleagues in Australia, Brazil, Canada, Greece and Great Britain, and all of them agree there is a clear need for some sort of international collaboration and organization. Beyond that, everyone I have spoken with on numerous occasions express clear support for IALR and its overall goals. Many have also told me that face-to-face meetings and associated dialogue and follow-up communications are the best way to foster continued collaboration. Obviously, collaboration at this level requires considerable international travel, and we all have very clear limitations on both our travel budgets and how much time we can devote to long trips.

Frankly, the relatively limited number of "hits" to the IALR Web site coupled with the lack of response to requests for newsletter input over the past 18 months is troubling, but I am hoping that we can "jump-start" more collaboration and active input from our members over the next year.

So, I have a simple closing question for all of our current and/or potential IALR members or sponsoring organizations: Is IALR important to you and how can it best serve your needs over time? Please send me your answers via e-mail to wdaniels@vt.edu or give me a call at 01-540-231-7175. I look forward to hearing from you. ■

BY WILLIAM T. PLASS, IALR SECRETARIAT EMERITUS

Reminiscing *on the History of Reclamation*

As an 85-year-old pioneer in mind land reclamation, I am impressed by the improvement in reclamation technology and the scope and complexity of the ongoing research. The events of years ago offer a fascinating documentary on the progressive improvement in reclamation technology. Do you realize it took 75 years to achieve what we consider acceptable reclamation today?

I don't know when USA coal surface mining began, but evidence indicates it was before 1920. The limited capacity of the early mining equipment restricted mining to coal seams nearest the surface. There was little concern for environmental damage prior to 1930. After 1930, the unsightly spoil banks and the rapid expansion of the area affected by mining resulted in a mounting concern for the environment. Mine operators planted hundreds of acres of trees grown at state and federal nurseries. Reclamation associations were formed in Ohio, Indiana, and Illinois to promote reclamation and exchange information about reclamation practices. They had no guidelines to choose species and they knew very little about the physical and chemical properties of spoils.

Mining companies used shovels and draglines to uncover the coal seams. This created ridges of spoil running parallel to the high wall or first-cut pit. The slopes of these ridges were very rocky and toxic spoils commonly occurred. Planting crews filled planting bags with a mixture of hardwoods or with one coniferous species. Members of the planting crew formed a line and were spaced 6 to 7 feet apart. Trees were planted every two paces (about 6 feet). The planting direction was up and over each ridge. Large rocks prevented even spacing and toxic spoils were not planted. The U.S. Forest Service established a tree planting experiment in 1937 to assess the effects of spoil physical and chemical properties on tree survival and growth. This study indicated that the federal government recognized surface mining disturbance was a national problem. In the 1940s and 1950s, states began enacting laws and regulations requiring reclamation of all land disturbed by mining. Initially, those laws required leveling the tops of spoil ridges. Later, complete leveling to the original contour was required.

The U.S. Congress, in 1945, established a U.S. forest service surface mine reclamation project. The objective was to determine factors affecting the forestation of surface mined land in West Virginia, Ohio, Indiana, Illinois, Kentucky, Alabama, Missouri, Kansas and Oklahoma. The first project was a reconnaissance survey and mapping of all surface mining disturbances in the Midwestern states. The second project established research plots at several locations to determine species adapted to mine land reclamation and to determine specific variables that affected tree survival and growth. Mine operators supported this research by providing labor, the use of equipment and other reclamation materials. It is interesting to note that nearly all reclamation supervisors and research scientists were graduate foresters during this period. A soil scientist assisted in interpreting mine soils' physical and chemical properties. Research programs at academic institutions contributed additional information. Studies concerning

"I am proud to be one of the many reclamation pioneers. They were good men with a respect for the environment."

the planting of legumes and grasses were particularly important. Interest in the chemical and physical characteristics of spoil material developed. The earliest basic research concerning spoil properties and revegetation interactions was published in 1955.

By 1960, thousands of acres had been planted to trees. The growth of the oldest plantations indicated they would become productive forests. The acreage planted by mine operators in pastures and other agricultural crops increased. The last cut pit left open on mined out surface mines often created small impoundments. Many were stocked with fish and became popular fishing and recreational sites. One town used an impoundment for their water supply. The first handbook for reforesting mine spoils was published in 1960. Soil pH and texture were used to determine the plantability of a spoil. Toxic spoils were considered too difficult to plant. The handbook also provided guidelines for grading bare-rooted planting stock.

National concern regarding the environmental impact of surface mining on natural resources caused a rapid expansion of research in the 1960s that continued into the 1970s. Government agencies became involved and colleges and universities made significant contributions in basic and applied research. In particular, surface mining in the Appalachian Mountains became a national concern in the 1960s. Coal seams outcropped on the steep mountain slopes and extended through the mountain on a relatively level plane. Beginning at the outcrop, mining removed the overburden to the limit of the mining equipment and it followed the outcrop around the mountain. The overburden that was removed was disposed of down and over the steep mountain slopes below the outcrop. This mining method

disregarded the environmental impact of uncontrolled spoils on other natural resources. The instability of the fill slope caused massive landslides. Uncontrolled run-off caused sedimentation in streams and rivers and the acidity of some of the run-off polluted streams and rivers.

Federal and state agencies and mine operators cooperated to solve these problems. The state agencies contributed their technical expertise in engineering practices and the mine operators tested mining methods, sediment control structures and run-off controls. Revegetation practices emphasized grass and legume mixtures to control erosion.

The U.S. Forest Service Reclamation Program in Ohio was transferred in 1961 to a new project in Kentucky. The charter specified this research would investigate the hydrological impact of surface mining in mountainous Appalachia. A multidisciplinary team of specialists conducted studies relating to erosion and run-off control measures, causes of fill slope instability and treatments to stabilize the slope, acidity occurrence and treatment, and revegetation practices for erosion control and a return to an economic or social use.

Public and political concerns regarding the environmental impact of coal surface mining nationwide resulted in the passage of the Surface Mine Control and Reclamation Act by the U.S. Congress in 1977. Research was needed to satisfy new requirements of the law. Specialists in many disciplines established studies to determine basic factors affecting vegetation, physical and chemical characteristics of spoils and the overburden, and on-site and off-site hydrologic problems relating to mining. Federal and state governments funded research at academic institutions, research centers and other government agencies. This research continues today as continuing problem areas and new challenges require added research.

I retired in 1979. Preparing this historic summary and reviewing photographs taken during my career brought back memories of the men who pioneered this early reclamation and the problems they faced. They were dedicated to the concept that mined land could be returned to productive use. Although failures were commonplace, they persisted and surface mining reclamation now provides forests, pastures, agricultural crops, industrial sites, home sites, and recreational areas. I am proud to be one of the many reclamation pioneers. They were good men with a respect for the environment. ■

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2009 Joint Conference:

Annual Meeting of the American Society of Mining and Reclamation and The 11th Billings Land Reclamation Symposium

May 30 – June 5, 2009 * Billings, Montana, USA

The Program Committee invites you to attend and participate in the Joint Conference of the 26th Annual Meeting of the ASMR and the 11th BLRS. Our Conference theme is:

Revitalizing the Environment: Proven Solutions and Innovative Approaches

Venue

The Crowne Plaza Hotel in downtown Billings, Mont., will host all meeting functions, technical sessions, and the trade show. The hotel has undergone a complete renovation and will accommodate the anticipated 400+ Conference attendees. Billings is the center of the resource extraction industries for coal, natural gas, oil, and coal bed methane in southeastern Montana and northern Wyoming.

Workshops

Short Courses/Workshops will be presented in the following tentative areas: Soils Reclamation, Riparian/Wetland Restoration, Remote Sensing, Acid Mine Drainage Treatment, Treatment of Coal Bed Methane Water, Stormwater Control in Reclamation, Mine Closure, and Geomorphic Stability.

Suggested Technical Paper Topics

- Innovative Reclamation Techniques
- Watershed Restoration
- Acid Mine Drainage and Treatment
- Stabilization and Restoration of Contaminated Lands
- Land Revitalization Case Studies
- Byproduct utilization in Reclamation
- Geochemistry – fate and transport
- Uranium Mining and Reclamation
- Developing Achievable Success Criteria
- Reforestation
- Post-fire Rehabilitation
- Invasive and Native Species in Restoration
- Phytoremediation
- Superfund and AML Cleanup

Technical Field Tours

Potential Pre-Conference activities include six unique field tours varying from one day to two-and-a-half days. Tours may include the Zortman/Landusky and Kendall gold mines, Wetland Mitigation Projects, the active Stillwater Platinum and Palladium Mine, Coal/Coal Bed Natural Gas and Big Horn Mine, a tour of active gold mine, abandoned hardrock mines, and a mining Superfund Site, and a tour of Wild Horse Management area, Uranium mining, Bentonite reclamation, steep slope and post-fire rehabilitation. Evening discussions will follow daily field tours.

Overall Meeting Schedule

Saturday, May 30	Pre-conference Field Tours and Technical Workshops
Sunday, May 31	Technical Field Tours, Technical Workshops ASMR National Executive Council Meeting Evening Welcome Reception
Monday, June 1	Plenary Session and Panel Discussion – cooperative management to revitalize landscapes Exhibitor Tradeshow begins Concurrent Technical Sessions
Tuesday, June 2	Concurrent Technical Sessions Poster Session and Conference Social
Wednesday, June 4	Concurrent Technical Sessions Evening Dinner with entertainment
Thursday, June 5	Technical Sessions – morning ASMR Awards Luncheon Banquet Post-conference Field Tour

ABSTRACTS due October 15, 2008
Submit Abstract for oral or poster presentation electronically to:
ASMR5@insightbb.com

Joint Conference Web site:
http://billingslandreclamationsymposium.org/

For Additional Information Contact Joint Conference Co-chairs and Conveners

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2008 AWARD WINNERS

Terry Toy – WT Plass Award

Lachlan Ingram – Researcher of the Year

Frank Russell – Reclamationist of the Year

Jim Gusek – Reclamationist of the Year

Mike Jenkins – Life Member

Jack Nawrot – Recruitment

2008 Student Presentation Award Winners

Oral Presentations

Ashlee Dere – 1st Place

Christopher Venot – 2nd Place

Luciana Pereyra – 2nd Place

Chris Fields-Johnston – 3rd Place

Bill Strosnider – 3rd Place

Ben Mack – 3rd Place

2008 Scholarship Winners

Christopher Fields-Johnston – BS Scholarship

Joshua Eldridge – MS Scholarship

Nazmul Haque – PhD Scholarship

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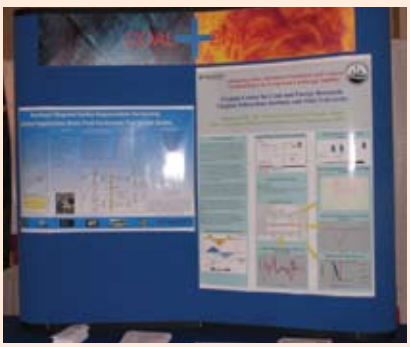

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BY DAVID LANG, ASSOCIATE PROFESSOR, MISSISSIPPI STATE UNIVERSITY
AND GEORGE HAWKEY, ENVIRONMENTAL MANAGER, RED HILLS MINE

Reclamation Success at the Red Hills Mine in Mississippi

Red Hills Mine (RHM) is a surface lignite mine located in Choctaw County near the town of Ackerman in north central Mississippi. RHM is owned and operated by the Mississippi Lignite Mining Company, a subsidiary of The North American Coal Corporation. Mine development began in 1998 with commercial lignite delivery commencing in 2002. Annual RHM coal production is 3.6 million tons, requiring the mining and reclamation of approximately 100 acres of land annually. Mined lignite fuels an adjacent 440-megawatt power plant. The state's mining program is administered by the Mississippi Department of Environmental Quality (MDEQ). RHM is the first and only surface lignite mine operating in Mississippi.

RHM's 5,800-acre mining area is characterized as a pre-mine wooded rural countryside with occasional pasturelands, ponds, sparse residential development and few industrial features. The terrain is gently rolling to moderate slopes with narrow valleys, small streams and dissected uplands. More than 80 percent of the mining area is woodland with deciduous, evergreen and mixed timber stands. The predominate pre- and post-mine land use was, and remains, forest land use, however, pre-mine mixed "undeveloped" timber stands will be replaced with homogeneous stands of loblolly pine to create "commercial" forest land as requested by mine area landowners.

Lignite is located within the Wilcox geological group deposited 40 to 50 million years ago. The area has been heavily influenced by the filling of the Mississippi embayment with unconsolidated sediment that covered multiple lignite seams (A to I) ranging in thickness from 1 foot to 8 feet. Lignite is commercially recovered from seams C to H to a depth of 150 to 300 feet. There are very few consolidated materials in the overburden and interburden layers except for a thin layer (less than 12 inches thick) of sandstone/ironstone that occurs in oxidized upland positions within the permit area (Figure 1).

The rolling topography (the red hills) were farmed for cotton in the1800s resulting in the eventual loss of topsoil, a subsequent decline in productivity and a natural reversion back to forest land by the 1930s. Today the major enterprise is loblolly pine timber with Choctaw County ranking in the top five timber-producing counties in Mississippi. Local timber production is not a highly managed and commercialized operation, but rather one of individual landowners harvesting timber from relatively small land tracts as timber is ready to harvest.

Historic cultivation, more recent logging operations and subsequent erosion caused by 50 to 80 inches of annual rainfall has resulted in a native topsoil layer of only a few inches on upland slopes. The bottomland (alluvial floodplains) native topsoil layer is approximately seven inches thick with most bottomland soils classified as prime farmland soils by the Natural Resource Conservation Service. Extensive clearing and drainage allowed crop production (wheat, corn, and soybean) to occur on the bottomland soils to a limited extent and with limited success until the 1970s. Bottomlands have since reverted back or been planted back to forest lands.

Figure 1. Aerial photo of the mine pit showing the multiple seams of lignite.

Soil fertility of both native bottomland and upland soils is very low with a cation exchange capacity (CEC) of less than 10 cmoles^{+}/kg soil, with an acidic pH of 4.5 to 5.5 and low available P and K levels. They are largely entisols and ultisols that are tired and worn out following thousands of years of high rainfall, soil erosion and hundreds of years of crop cultivation. Red oxidized clay and sandy subsoils occur to depths of 10 to 20 feet above gray reduced regolith materials in upland positions. Bottomland soils are oxidized, but mottled to a depth of 8 to 10 feet. Due to the shallow depth of native topsoil and the further surface disturbance caused by clearing and grubbing prior to mining, its clean recovery is not operationally feasible without including a significant amount of subsoil.

Soil productivity studies were conducted from 2002 to 2005 to evaluate the red oxidized subsoil layer as a potential suitable topsoil replacement material. Results indicated red oxidized subsoil produced bermudagrass biomass equal to that grown in both native prime farmland bottomland topsoil and native upland topsoil. Red Hills Mine was approved to use a minimum of 4 feet of red oxidized subsoil as a substitute in place of, and a supplement to, native upland topsoil for upland soil reconstruction.

Figure 2. Truck and shovel operation salvaging red oxidized overburden as a suitable substitute topsoil material.

Historic cultivation, more recent logging operations and subsequent erosion caused by 50 to 80 inches of annual rainfall has resulted in a native topsoil layer of only a few inches on upland slopes.

This substitute material is salvaged and loaded with a P&H 2800 (40-cubic-yard) electric loading shovel or 5230 (21-cubic-yard) Caterpillar excavators and hauled with 160-ton and 190-ton Caterpillar 785 and 789 haul trucks and dumped in back-to-back piles at reclamation sites ready for respread (Figure 2). The piles are then dozed to final reclamation grade, at a 4-foot minimum depth, with Caterpillar D8, D10 and D11 bulldozers equipped with GPS to insure respread depth and contour control. The salvage method takes the surface soil profile containing soil organic matter and a viable seed bank and the dozer respread method provides a non-compacted soil medium for rapid establishment of grass to control erosion and final forest establishment with minimum seedling mortality.

Mississippi Revegetation Success Standards for Commercial Forest require the Mississippi Forestry Commission to establish a stocking rate on a case-by-case basis in consultation with MDEQ. For RHM, the Forestry Commission recommended a survival rate of at least 500 live seedlings/acre at bond release.

Figure 3. Thirty-day planted stand of browntop millet (inset) is replaced by bermudagrass (above).

Figure 4. Loblolly pine seedlings being planted on a 6-foot by 9-foot spacing (802 trees/acre) into winter dormant bermudagrass.

Figures 5a. Ground photo of four-year planted pines.

Figures 5b and 5c. Aerial photos of four-year planted pines (left and right).

The revegetation gamble is to stabilize the respread landscape as quickly as possible before the next significant precipitation event. Vegetation ground cover ratings greater than 90 percent are achieved within 30 to 60 days and are maintained following pine seedling establishment.

Mississippi's Commercial Forest Revegetation Success Standards further require tree density at bond release be equal to or greater than 90 percent of the recommended rate of the forestry commission or a success standard tree density of 450 trees/acre. RHM initially plants 802 seedlings/acre to offset natural seedling mortality and to avoid re-planting in the future to meet the 450 trees/acre standard. As of February 2008, a total of 550 acres have been reforested with 441,000 pine trees and 30 acres have been planted with 11,000 mixed hardwoods.

The typical revegetation sequence at the RHM, following the respread of substitute topsoil, includes spring plantings of browntop millet (*Panicum ramosum*) at 20 lbs/acre and common bermudagrass (*Cynodon dactylon*) at 30 lbs/acre, planted simultaneously using a Billion seeder. These higher than normal seeding rates are essential for achieving quick and complete ground cover within 30 to 60 days. Reclaimed areas respread in late summer or early fall are planted with wheat (*Triticum aestivum*) into which bermudagrass and millet are planted the following spring; the idea being to establish a winter cover crop to reduce winter soil erosion as much as possible.

Fertilizer, as 17-17-17, is applied at 750 lbs/acre and incorporated into respread soils during seedbed preparation for spring grass and winter grain plantings. Ammonium nitrate (34-0-0) is occasionally applied at 100 lbs/acre during mid-summer to stimulate production of spring planted bermudagrass or spot treat areas within a bermudagrass stand that appear to be weak in appearance.

Additional soil stabilization is provided by wheat or rice straw mulch applied at 2 tons/acre and crimped into the soil. Immediate, but short-term, soil stabilization is provided by the mulch and fast growing millet and wheat cover crops, while the slower growing bermudagrass provides long-term soil stabilization needed while pine seedlings establish and mature to eventually shade out the bermudagrass. Millet is mowed down within a month of spring seeding to not allow it to shade out the germinating bermudagrass. The revegetation gamble is to stabilize the respread landscape as quickly as possible before the next significant precipitation event. Vegetation ground cover ratings greater than 90 percent are achieved within 30 to 60 days and are maintained following pine seedling establishment. Competition from the grass is not suppressed due to the high soil erosion potential and, undoubtedly, results in some seedling mortality and early growth reduction. Nonetheless, tree survival ranges from 60 percent to 80 percent (Table 1) and tree height growth is 2 feet to 4 feet per year three to four years after planting (Table 2). The heavy bermudagrass ground cover in years one to three diminishes due to lack of fertilizer and is replaced by native successional species. Unlike commercial pine plantings, there is nearly a virtual absence of hardwood species during the first round of reclamation. Hardwoods are sparsely volunteering within a normal southeast successional pattern, but they are not present until the pines are 8 to 12 feet tall and appear to have little initial potential to compete. Recruitment of grass and forb species from surrounding areas is also common as the bermudagrass declines (Table 3). ■

Table 1. Tree density from 2003 to 2006 at Red Hills Mine

Year	2003	2004	2005	2006
Planted	———— Trees Per Acre ————			
2001	618	639	625	632
2002	614	578	607	642
2003	569	542	596	632
2004	na	na	560	515

na = Not Applicable

Table 2. Annual tree height and growth from 2003 to 2006 at Red Hills Mine

	Height				Growth		
Year	2003	2004	2005	2006	2003 to 2004	2004 to 2005	2005 to 2006
Planted	———— Inches ————				———— Inches Per Year ————		
2001	47	83	119	155	37	37	36
2002	20	43	72	109	22	30	36
2003	15	31	55	88	15	24	34
2004	na	na	20	34	na	na	15

Table 3. Early successional species invading into bermudagrass

Legumes and Forbs

- Native
  - *Solidago sp.*
  - *Eupatorium sp.*
  - *Gnaphalium sp.*
  - *Aster sp.*
  - *Croton capitatus*
  - *Erigeron sp.*
  - *Krigia cespitosa*
  - *Rudbeckia hirta*
  - *Desmodium marilandicum*
- Introduced
  - *Vicia sp.*
  - *Trifolium sp.*
  - *Lespedeza sp.*
  - *Sonchus asper*

Grasses and Grass-Like Plants

- Native
  - *Andropogon virginicus*
  - *Andropogon glomeratus*
  - *Andropogon gerardii*
  - *Sorghastrum nutans*
  - *Panicum virgatum*
  - *Festuca sciurea*
  - *Agrostis hiemalis*
  - *Hordeum pusillum*
  - *Juncus tenuis*
  - *Juncus marginatus*
  - *Scirpus cyperinus*
- Introduced
  - *Festuca arundinacea*
  - *Lolium multiflorum*
  - *Paspalum notatum*
  - *Paspalum urvillei*
  - *Digitaria ischaemum*
  - *Sorghum halepense*

Shrubs and Trees

- *Liquidambar styraciflua*
- *Liriodendron tulipifera*
- *Juniperus virginiana*
- *Baccharis halimifolia*
- *Pinus taeda*

BY CLIFF DENHOLM, TIM DANEHY, TOM GROTE, SHAUN BUSLER, MARGARET DUNN,
CLEAN CREEK PRODUCTS, INC.

Mine Drainage Sludge:

Helping the environment?

Introduction

Within the recent past, government agencies, watershed groups, nonprofits, universities, and private industry have successfully developed and implemented passive technology to treat abandoned mine drainage. In some instances, these systems have restored lifeless streams to healthy aquatic habitats supporting reproducing fish populations after many decades of being essentially lifeless.

As thousands of tons of metal precipitates are being retained within numerous passive systems every year, this "sludge" has the potential to be either a liability or an asset. Since periodic "cleaning" of some components may be needed to maintain effective treatment, the question then becomes what to do with the metal-bearing precipitates that are removed?

One approach is to develop markets for these "byproducts" with the goals of: 1) helping to sustain watershed restoration efforts of nonprofits and volunteer organizations, 2) creating "green" products, and 3) rejuvenating the treatment medium while essentially eliminating disposal costs.

Resource Recovery Effort

With the ongoing support of the landowner and with funding received from the PA Department of Environmental Protection Bureau of Abandoned Mine Reclamation, the De Sale Phase II passive system in the Slippery Rock Creek Watershed, Venango Twp., Butler Co., Pa., was selected to test conceptual ideas for a portable process with quick set up time to recover manganese-bearing material.

The De Sale Phase II passive treatment system, with the design based on the 75th percentile of raw water monitoring data: 204 gpm, 3.2 lab pH, 233 mg/L acidity, 10 mg/L total iron, 50 mg/L total manganese, 8 mg/L total aluminum (Ref: PA DEP, Knox DMO, 1998), contains the following components: Stream Intake → Forebay → Vertical Flow Ponds (2 in parallel) → Settling Pond → Aerobic Wetland → Horizontal Flow Limestone Bed (HFLB).

As the final component in the system, the HFLB was installed primarily to provide an alkalinity "boost" prior to discharging to the receiving stream. Manganese removal was a secondary consideration at the time of design and installation in 2000. After seven years of continuous operation, however, the HFLB was estimated to contain 60,000 to 80,000 lbs. of manganese-bearing material. The general decrease in manganese concentration in the abandoned mine drainage is depicted in the following table:

Table 1. Raw and Selected Monitoring Data for De Sale Phase II

Mean
min/median/max

Point	Flow	Lab pH	Lab Alk	Acidity	T. Fe	T. Mn	T. Al
Raw (n= 55 to 58)	72 25/53/200	3.3 2.9/3.2/3.7		253 92/250/451	25 7/24/82	52 18/51/84	10 2/10/15
HFLB effluent (n=51 to 58)	95 10/73/445	6.8 5.8/6.8/7.5	75 0	-7 -73/0/35	2 0/<1/15	23 0/19/75	<1 0/<1/3

Lab alkalinity and acidity (mg $CaCO_3$/L); total metals (mg/L); prior to 2004 lab acidity reported as "0" for negative readings; sampling dates vary among individual sampling points.

Figure 1. Manganese material filled the void spaces and coated limestone aggregate prior to recovery.

The earlier components improve the abandoned mine drainage, based on limited sampling, so that the HFLB influent is characteristically net acid with circumneutral pH and essentially no iron or aluminum. Substantial manganese is not typically removed prior to entering the HFLB.

In August and September 2007, a full-scale recovery of manganese oxides with the simultaneous rehabilitation of limestone aggregate in the HFLB was initiated. The HFLB at this site contains 2,900 short tons of 4-inch x ¾-inch, >90% $CaCO_3$, limestone aggregate with a riprap-lined influent spillway and effluent piping with 10-inch, perforated PVC along the outlet end.

Before the recovery process began, the influent flow to the HFLB was bypassed and the component was drained. (During the seasonal low-flow period, the drainage was adequately treated by manipulating the flow through other system components.) Within the HFLB limestone aggregate, two wash pits were excavated, lined with an impermeable membrane, and filled with water pumped from the treatment wetland. Using an excavator with a rotating screen attachment called a FlipScreen (FlipScreen Australia Pty Ltd., New South Wales), the manganese-bearing material was separated from the aggregate by rotating the FlipScreen within the wash pit. Material passing the 3/8-inch (0.95-centimeter) screen settled within the wash pit. The "cleaned" limestone aggregate retained in the bucket was returned to the HFLB. The slurry from the wash pits was pumped into flexible bulk containers for settling and dewatering. In some cases, the wash pit was drained prior to excavating and stockpiling the manganese-bearing material on a pad for additional drying before placement in the containers. Thirty-two containers, each with approximately one ton of recovered material, were removed from the site. An estimated 25 to 50 tons of recovered material remains at the site for future removal.

Material Characterization

X-ray fluorescence provided the following bulk chemical (whole rock) analyses for the recovered material: about 25% MnO, 25% SiO_2, 10% Al_2O_3, 10% CaO, and 25% Loss-on-Ignition. Limestone and quartz were identified by visual examination using a hand-lens. The material fizzed aggressively with 10% HCl also indicating the presence of limestone, as well as with hydrogen peroxide, indicating the presence of manganese oxides. Future efforts will include improvements to the recovery process to try to minimize dilution and examination of beneficiation processes to remove impurities.

Figure 2. Excavator with FlipScreen attachment "washing" manganese covered limestone.

Figure 3. Close up of FlipScreen during manganese recovery operation.

Figure 4. View of recovered manganese material excavated from wash pit.

Figure 5: Examples of pottery with glazes using recovered manganese material and iron oxides formed at low pH.

Material Uses

Investigations into the use of the recovered manganese began in 2004 when ceramic artist, Pam Esch (MEC Clay Studios, Cleveland, Ohio) became intrigued with the possibilities of using the material for pottery glazes in place of the commercially available, imported, manganese oxides. Initially, small batches of different glaze recipes were tested on ceramic shards with small bowls and cups created as interest continued to grow.

The concept that this "Made in the USA" product could potentially help to fund watershed restoration activities was realized in 2007, when the North Country Brewing Company (Slippery Rock, Pa.) commissioned the nearby Pottery Dome (Grove City, Pa.) to use recovered material in the glaze of 300 ceramic beer mugs. Due to the quick sales, and in support of the restoration activities, the brewery donated a portion of the proceeds to the Slippery Rock Watershed Coalition, which was, in turn, placed into a trust fund to offset future maintenance costs.

Encouraged by the interest, the recovery and reuse effort now includes pottery glazes with iron-bearing materials precipitating at low pH, as well as the identification of other potential uses for the manganese material, such as colorants for bricks and concrete.

With positive interest by local newspapers and national publications, and with support from both the mining industry and watershed groups, what was once a liability is now potentially part of the solution.

To learn more about the pottery and other activities of the Slippery Rock Watershed Coalition, see the following Web sites: www.cleancreek.org and www.srwc.org ■

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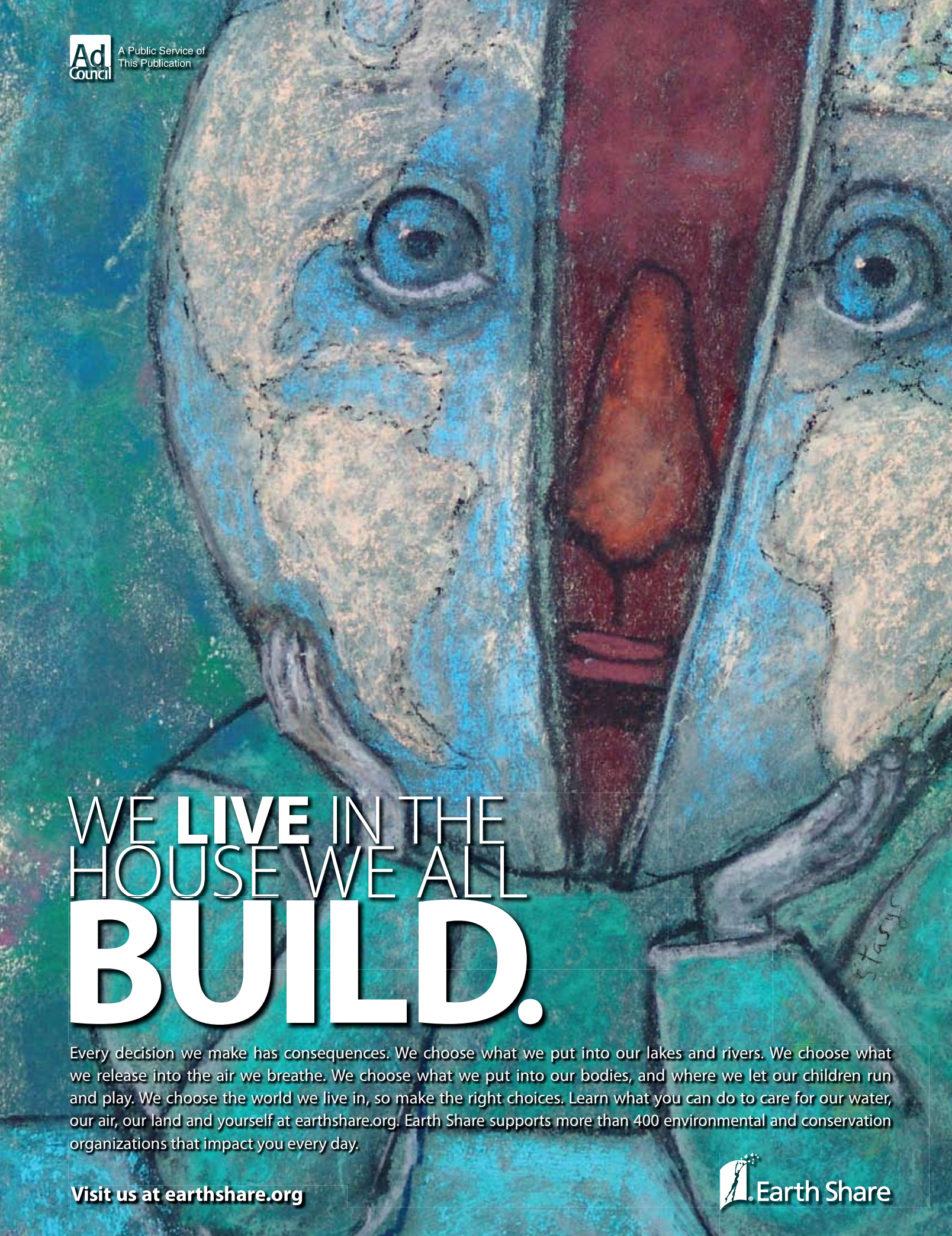
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Final	6.8	-34	2	10	2	1258

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