

# Technology Innovation News Survey

Entries for November 16-30, 2018

## Market/Commercialization Information

### UPPER SALMON BASIN HABITAT IMPROVEMENT PLANNING AND COORDINATION

Department of the Interior, Bureau of Reclamation, Funding Opportunity BOR-PN-18-F033, 2018

The Lemhi, Pahsimeroi, and Upper Salmon rivers have been affected by legacy mining impacts, railroad construction, road construction, and agriculture. These anthropogenic influences, combined with out-of-subbasin sources of mortality, have resulted in high-risk findings for several varieties of salmon. The Bureau of Reclamation invites applicants to submit proposals that will build on the recently completed Integrated Rehabilitation Assessment (IRA) document. At a minimum, these proposals should address (1) completion of reach assessments and final reports for the Lemhi, Pahsimeroi, and Upper Salmon rivers; (2) identification, prioritization, and development of specific projects in these areas; (3) further development of analytical tools (e.g., reach level carrying capacity); (4) habitat monitoring coordination; (5) collection, analysis, management, and sharing of data; and (6) enhanced land owner coordination, outreach, and coordination of technical efforts. The awardee will coordinate and complete one or more reach assessments in each river as identified by the IRA while managing a team of disparate and sometimes competing interests. The award ceiling is \$1.6M, and proposals are due by March 21, 2019. <http://www.grants.gov/web/grants/view-opportunity.html?oppId=311919>

### USACE CHICAGO DISTRICT BUSINESS OPPORTUNITIES OPEN HOUSE

U.S. Army Corps of Engineers, USACE District, Chicago, Federal Business Opportunities, Solicitation W912P6-DistrictOpenHouse, 2019

The U.S. Army Corps of Engineers, Chicago District is hosting a Business Opportunities Open House on February 20, 2019, from 9 AM until noon at the Chicago District Office, 231 South LaSalle Street, 16th Floor, Chicago, IL 60604. Large and small firms, nonprofit agencies, higher education institutions, and partners are invited to attend to meet district leadership, program managers, project engineers, contracting, small business, and other district personnel to discuss upcoming projects, solicitations, and business opportunities. Attendees may arrive and depart any time between 9 AM and noon. Registration by February 15 is mandatory for this free event at <https://www.eventbrite.com/e/usace-chicago-district-business-opportunities-open-house-registration-54659557717>. State or federal government-issued identification is needed. There will be no seating and no presentations. Attendees will navigate an open space, network, and visit with district leadership and staff. The USACE is interested in meeting technically competent, responsible entities within a wide range of NAICS codes, among them 541330 (Engineering Services) and 541620 (Environmental Consulting Services). <https://www.fbo.gov/sgp/USA/COE/DACA23/W912P6-DistrictOpenHouseListing.html>

## Cleanup News

### METAL MASS RETENTION IN PASSIVE TREATMENT SYSTEMS AT THE TAR CREEK SUPERFUND SITE

Nairn, R.

2018 National Meeting of the American Society of Mining and Reclamation, June 3-7, St. Louis, MO: The Gateway to Land Reclamation. 59 slides, 2018

The Tri-State Mining District (TSM) was a major producer of lead and zinc concentrates in the 19th and 20th centuries. Upon cessation of mining operations, mine voids filled with groundwater and several dozen artesian discharges of metal-contaminated waters began flowing in late 1979. U.S. EPA identified four TSM-related CERCLA sites in Oklahoma, Kansas, and Missouri. Mine water discharges were especially pervasive in the Tar Creek Superfund Site. Since 2008, two full-scale mine water passive treatment systems (PTSS) have been installed to address waters showing elevated concentrations of Fe, Zn, Pb, Cd, As, and Ni. The Mayer Ranch PTSS and Southeast Commerce PTSS produce effluents that are circumneutral pH and net alkaline and contain concentrations of ecotoxic metals that meet receiving water in-stream criteria. Based on their annual retention date, these systems, if they continue to function as designed throughout their 20-yr design lifetimes, collectively will retain ~1,700 metric tons of Fe, 110 metric tons of Zn, 8 metric tons of Ni, 600 kg of Pb, 540 kg of As, and 250 kg of Cd. **Longer abstract:** <https://www.asme.org/Assets/Documents/Meetings/2018/Nairn-Pic-Abstract-Basic.pdf>

**Slides:** <https://www.asme.org/Assets/Documents/Meetings/2018/Nairn-Pic-Slides.pdf>

### FORMER GALMOY MINES TAILINGS RESTORATION

Devoy, C., L. Wilton, and K. Collins.

11th ICARD IMWA 2018 Annual Conference, September 10-14, Pretoria, South Africa. IMWA Proceedings (Volume I):9-16(2018)

Galmoys Mines completed the restoration of a tailings management facility (TMF) by incorporating an integrated constructed wetland (ICW) and returning the site to a land use compatible with the surrounding countryside. The ICW also treated surface water runoff efficiently and created an enhanced environment for local and migratory bird species. The wetland system improved post-closure water quality. As the TMF remediation matures, ammonia is stabilizing in the revegetated caps of the TMF, and reductions in sulfate are noted. The successful restoration of the former mine site via the development of a fully functional ICW system within the TMF was the first project to complete mine closure activities under the EU Mining Waste Directive since its introduction in 2006. [https://www.imwa.info/docs/imwa\\_2018/IMWA2018\\_Devoy\\_9.pdf](https://www.imwa.info/docs/imwa_2018/IMWA2018_Devoy_9.pdf)

### THE FARO MINE LEGACY: 70 MILLION TONNES OF TAILINGS AND 320 MILLION TONNES OF WASTE ROCK

Bowie, A.

2018 Federal Contaminated Sites National Workshop, June 13-15, Toronto, Ontario. 13 slides, 2018

The Faro Mine footprint, which spans ~2,500 ha, includes an estimated 70 million tonnes of tailings and 320 million tonnes of waste rock. A significant amount of the waste has an acid generating potential that exceeds its acid neutralization capability. Uncertainties related to geochemical weathering and reactive transport of weathering products present challenges for long-term site management. The proposed stabilize-in-place approach will rely on diverting clean water; collecting and treating contaminated water; reducing seepage through acid-generating material by stabilizing and covering waste rock and tailings; and adaptively managing unacceptable levels of contamination in the downstream environment. A seepage interception system will form a last line of defense for protecting the receiving environment. All aspects of the closure will consider complex cold regions phenomena, including seasonally and permanently frozen ground, ground freezing and ground ice formation, ground thawing and associated settlement, and freeze/thaw cycling. Implementation of the closure plan is expected to start in 2022 and take ~15 years to complete. **Slides:** [http://pic-ihrc.ca/images/2018\\_FCSW/Presentations/5\\_128\\_-\\_Bowie\\_FNG\\_FNI\\_ajp.pdf](http://pic-ihrc.ca/images/2018_FCSW/Presentations/5_128_-_Bowie_FNG_FNI_ajp.pdf)

### FIRST FIVE-YEAR REVIEW REPORT HOLDEN MINE SITE OKANOGAN-WENATCHEE NATIONAL FOREST CHELAN COUNTY, WASHINGTON

USDA, Forest Service, Pacific Northwest Region, 74 pp, 2018

The Holden Mine produced about 200 million lbs of Cu, 40 million lbs of Zn, two million ounces of Ag, and 600,000 ounces of Au from ~10 million tons of ore. Excavation of 60 miles of underground tunnels produced 8.5 million tons of iron tailings placed on 90 acres of U.S. National Forest lands as well as 300,000 yd<sup>3</sup> of waste rock piles. Direct release of hazardous materials from the mine, including acid mine drainage, heavy metals (Al, Cd, Cu, Fe, Pb, and Zn), and iron sulfide, affected about 125 acres of land. The remedy is being conducted in 2 phases. Phase 1, which began in 2013 with completion expected in 2018, includes regrading and capping the tailings and main waste rock piles, constructing a groundwater barrier, and installing a water treatment system. Phase 2, which began in 2017, includes the Lower West Area, constructing a new groundwater treatment facility, beginning in situ soil treatment (e.g., application of agricultural lime) in areas of surface, implementing institutional controls, and initiating performance verification monitoring. Phase 2 is expected to begin in 2023. In situ treatment is still under technical review and consideration for implementation due to environmental constraints, potential destruction of established forests and habitats, rough topography, and practicability of the remedy. [https://www.fs.usda.gov/Internet/FSE\\_DOCUMENTS/fserpt52777.pdf](https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fserpt52777.pdf)

### EVALUATING PERFORMANCE OF COVER DESIGN FOR REMEDIAL OPTIONS ANALYSIS OF MINE CLOSURE, CANTUNG MINE, NWT

Kingston, S. and A. Hudson.

2018 Northern Latitudes Mining Reclamation Workshop, September 10-13, Whitehorse and Carcross, Yukon. 32 slides, 2018

The Cantung Mine site is located near the headwaters of the Flat River, ~300 km north of Watson Lake, just east of the Yukon border in the Northwest Territories (NWT). Tailings at the Cantung mine site are consistently classified as potentially acid generating with elevated metals content and are located in close proximity to the Flat River channel. All of the containment dams for the five tailings ponds are constructed of local glacial till and alluvial materials consisting of a mixture of silts, sands, and gravels, with occasional cobbles and boulders. The 1-3 m of glacial till cover over tailings ponds 1 and 2 (TP1/2) has been in place for ~40 years. The cover appears to prevent acid generation onset effectively, but the mechanism by which the cover is working is not well understood. Predictive geochemical modeling, cover design investigation, infiltration and seepage modeling, and oxygen ingress modeling has been completed as part of a remedial options analysis to evaluate the effectiveness of the TP1/2 cover. The goal is to provide an analog for use in closing the currently uncovered TP3/4/5. Silicate minerals in the cover might be the controlling factor in reactions taking place in the cover. **Slides:** <https://www.yukonmines.org/index.php/abstracts-and-biographies/3n-kingston-scott/files>

**Longer abstract:** <https://www.yukonmines.org/index.php/abstracts-and-biographies/3n-kingston-scott/files>

## Demonstrations / Feasibility Studies

### REMEDATION OF HISTORIC WASTE ROCK BY INJECTION OF GREEN LIQUOR DREGS: RESULTS FROM A FIELD SCALE TRIAL, GLADHAMMAR, SOUTHERN SWEDEN

Sartz, L., S. Sackborg, and M. Backstrom.

11th ICARD IMWA 2018 Annual Conference, September 10-14, Pretoria, South Africa. IMWA Proceedings (Volume II):1124-1129(2018)

Mining in Gladhammar, southern Sweden, started in the 15th century, generating waste rock containing copper, cobalt, and arsenic. During remediation in 2011, some waste rock was preserved, due to its geoscientific value, and placed on a geomembrane surface. Eventually, it became apparent that it had a substantial environmental impact (pH 3.8, Cu 96 mg/L, Co 21 mg/L). In 2017, green liquor dregs were injected to increase pH and decrease trace element mobility. Ten months after injection, the pH was 8.3 and concentrations of Cu and Co 1.3 mg/L and 1.1 mg/L, respectively. Evaluation will continue for at least five years. [http://www.imwa.info/docs/imwa\\_2018/IMWA2018\\_Sartz\\_1124.pdf](http://www.imwa.info/docs/imwa_2018/IMWA2018_Sartz_1124.pdf)

### LIFE CYCLE IMPACT AND BENEFIT TRADEOFFS OF A PRODUCED WATER AND ABANDONED MINE DRAINAGE CO-TREATMENT PROCESS

Wang, Y., S. Tavakkoli, V. Khanna, R.D. Vidic, and L.M. Gilbertson.

Environmental Science & Technology 52(23):13995-14005(2018)

A process for combined treatment of two high-volume wastewater resources, produced water and mine drainage, has been developed and demonstrated at pilot scale to aid in management of wastewater resources in Pennsylvania. Co-treating mine drainage and produced water can be beneficial because, while the chemical composition of each fluid varies from site to site, the two by-products share opposite amounts of barium and sulfates that can be removed via precipitation when combined. The resulting fluid can be used to replace freshwater in future fracking operations, while the barite produced by the process can be used in drilling operations. Primary tradeoffs include co-treatment process environmental impacts, transportation impacts, and environmental benefits resulting from preventing direct mine drainage release to the environment. Electricity use was found to be the dominant contributor to all impact categories. *See a report on earlier work on AMD/process water co-treatment at:* <https://www.osti.gov/biblio/1483708-us-direct-mine-drainage-release-to-the-environment-electricity-use-was-found-to-be-the-dominant-contributor-to-all-impact-categories>

### A PILOT OPTIMIZATION OF SULPHATE PRECIPITATION IN THE HIGH-DENSITY SLUDGE PROCESS

Aube, B., M. Lamares, and S.L. Sang.

11th ICARD IMWA 2018 Annual Conference, September 10-14, Pretoria, South Africa. IMWA Proceedings (Volume II):971-976(2018)

A large study looked at control of sulfate, and the study details the optimization of sulfate removal in the high-density sludge (HDS) process. The HDS process was operated at different pH setpoints, varying sludge recycle rates, and several different reactor retention times for three different water sources. An added step in the process was the addition of carbon dioxide to precipitate calcium carbonate and further minimize the gypsum saturation level. The tests defined optimal HDS conditions to provide improved feed conditions for nonfiltration or for non-scaling process water. [https://www.imwa.info/docs/imwa\\_2018/IMWA2018\\_Aube\\_971.pdf](https://www.imwa.info/docs/imwa_2018/IMWA2018_Aube_971.pdf)

### REAL-TIME ENVIRONMENTAL MONITORING OF MINING EFFLUENTS USING A MICROBIAL FUEL CELL (MFC) BASED SENSOR

Adekunle, A., V. Raghavan, and B. Tartakovsky.

Abstract Book: Canadian Ecotoxicity Workshop, Vancouver, BC, 30 Sep - 3 Oct, 2018.

The study describes an environmental biosensor that exploits the high sensitivity of microbial fuel cells (MFCs) to variations in environmental conditions, such as the presence of electron donors and acceptors. The experiments established fast MFC voltage response to changes in mining water composition. MFC electrical performance could be inferred with the concentration of a target contaminant, thus enabling a low-cost and low-maintenance biosensor capable of detecting abrupt changes in environmental conditions. *See more on this study in A. Adekunle's 2018 thesis at:* [http://digital.library.mcgill.ca/wendigit/DetailViewManager?nid=161068&custom\\_nid\\_2=dlrc](http://digital.library.mcgill.ca/wendigit/DetailViewManager?nid=161068&custom_nid_2=dlrc)

### ON-SITE PILOT-SCALE DEMONSTRATION OF A LOW-COST BIOLOGICAL PROCESS FOR THE TREATMENT OF HIGH-SULPHATE MINE WATERS

Neale, J.W., M. Geisbauer, and M. Mulbauer.

11th ICARD IMWA 2018 Annual Conference, September 10-14, Pretoria, South Africa. IMWA Proceedings (Volume I):164-170(2018)

The study describes the commissioning and operation of a pilot-scale passive biological sulfate reduction (BSR) process to treat mine-impacted water from a South African coal mine. The pilot plant comprises three 7 m<sup>3</sup> reactors with a nominal feed rate of 245 L/d. The substrate comprises woodchips, wood shavings, hay, lucerne, and cow manure. Process performance is evaluated relative to influent pH level, hydraulic residence time, ambient temperature variations, and substrate replenishment rate. Early results demonstrate removal of sufficient sulfate to meet regulatory requirements for discharge or agricultural use. [https://www.imwa.info/docs/imwa\\_2018/IMWA2018\\_Neale\\_164.pdf](https://www.imwa.info/docs/imwa_2018/IMWA2018_Neale_164.pdf)

### OPERATIONAL-SCALE DEMONSTRATION OF PROPAGATION PROTOCOLS AND COMPARATIVE DEMOGRAPHIC MONITORING FOR REINTRODUCING FIVE SOUTHEASTERN ENDANGERED AND AT-RISK PLANTS

Hohmann, M.G. and W.A. Wall.

ESTCP Project RC-201201, ERDC/CERL TR-18-1, 141 pp, 2018

The overall objective of this project was to increase the diversity and success of rare-plant conservation strategies available to managers. An operational-scale demonstration was executed of recently developed protocols for propagating and reintroducing one endangered and four at-risk plant species found on multiple southeastern installations. Over 3 consecutive yrs, 6,075 transplants of different age/size classes of each species were propagated and out-planted to four sites. Monitoring of survivorship, growth, and reproduction of these out-plants and more than 1,500 individuals in natural populations was conducted over four yrs. Demographic matrix modeling, life-table response experiments, and generalized linear models were used to compare the vital rates of the different classes and population growth rates between the natural and reintroduced populations. <https://www.serdp-estcp.org/content/download/47452/452643/file/RC-201201%20Final%20Report.pdf>

## Research

### HYDROLOGY-BASED DESIGN OF GEOMORPHIC EVAPOTRANSPIRATION COVERS FOR RECLAMATION OF MINE LAND

Zhang, Z.F., N. Bugosh, T. Tesfa, M. McDonald, and J. Kretzmann.

35th Annual Meeting of the American Society of Mining and Reclamation, June 3-7, St. Louis, MO: Reclamation. 25 slides, 2018

GeoFluv™, a specific geomorphic grading design method, uses natural analogs for post-mining landscapes and design input values taken from stable natural landscapes to make a reclamation design that provides hydrological function, supports ecosystem integrity, and is cost-effective, sustainable, and more visually attractive. It can produce surface runoff water quality equal to or better than adjacent undisturbed lands and has been used for disturbed lands. To enhance storage



AUSIMM Bulletin June:38-40(2017)

Orphaned and abandoned mines are categorized as those mines for which the owner cannot be found or for which the owner is financially unable or unwilling to remediate the site. Canada's National Orphaned/Abandoned Mines Initiative (NOAMI) was created in 2002. NOAMI does not directly clean up orphaned and abandoned mine sites; instead, it examines the legislative, policy, and program framework in Canada for addressing issues associated with orphaned and abandoned mines and makes recommendations for improvement. A pan-Canadian effort, NOAMI has fulfilled its mandate for over 15 years and is an example of how a collaborative approach to the legacy of past mining practices can advance the objectives of sustainable development. This article highlights two of NOAMI's active projects. [http://www.abandoned-mines.org/wp/wp-content/uploads/2017/11/NOAMI\\_BULLETIN38-40.pdf](http://www.abandoned-mines.org/wp/wp-content/uploads/2017/11/NOAMI_BULLETIN38-40.pdf)

#### **SPOIL TO SOIL: MINE SITE REHABILITATION AND REVEGETATION**

Bolan, N.S., M.B. Kirkham, and Y.S. Ok.  
CRC Press, Boca Raton, FL. ISBN: 9781498767613, 371 pp, 2017

This text presents both fundamental and practical aspects of remediation and revegetation of mine sites. Arranged in three major themes, the chapters examine characterization of mine site spoils; remediation of chemical, physical, and biological constraints of mine site spoils, including post mine-site land-use practices; and revegetation of remediated mine site spoils. Case studies involving successful rehabilitation of mine sites around the world are featured in the final section. View the table of contents at <https://www.crcpress.com/Spoil-to-Soil-Mine-Site-Rehabilitation-and-Revegetation/Bolan-Kirkham-Ok/book/9781498767613>

#### **RETHINKING MINE REMEDIATION: COMMUNITY ENGAGEMENT IN MINE CLOSURE**

Beckett, C. and A. Keeling.  
2018 Northern Latitudes Mining Reclamation Workshop, September 10-13, Whitehorse and Carcross, Yukon. 16 slides, 2018

Can the current approach to mine remediation be changed from a focus on site containment to a broader emphasis on community remediation, reclamation, repair and reconciliation? The Giant Mine and Cyprus Anvil Mine cases illustrate the potential for community activism to shift remediation to include social issues such as environmental justice, reconciliation, and intergenerational equity. This presentation aims to contribute to a broader understanding of the social dimensions of toxic contamination and mine remediation and to the development of best practices for community engagement during mine closure.

Slides: <https://www.yukonminers.org/index.php/presentations/44-beckett-callynn-rethinking-mine-remediation/file>  
Longer abstract: <https://www.yukonminers.org/index.php/abstracts-and-biographies/20-beckett-callynn/file>

#### **METHODS FOR ASSESSMENT OF SPECIES RICHNESS AND OCCUPANCY ACROSS SPACE, TIME, TAXONOMIC GROUPS, AND ECOREGIONS: FIELD GUIDE AND NATURAL HISTORY OF BUTTERFLIES ON THE WESTERN EDGE OF THE GREAT BASIN**

Fleishman, E. and F. Fogarty.  
SERDP Project RC-2202, 90 pp, 2018

This field guide and natural history was written to share information on the ecology and identification of the species of butterflies that the data suggest regularly breed or occur on DoD lands and ecologically similar areas on the western edge of the Great Basin (California/Nevada border). <https://www.serdp-estri.org/content/download/47398/45217/file/RC-2202%20Field%20Guide%20FR.pdf>

#### **ENGAGING STAKEHOLDERS IN NATURAL RESOURCE DECISION-MAKING**

Crawford, B.A., R.A. Katz, and S.K. McKay.  
ERDC/TN EMRRP-SR-83, 15 pp, 2017

Participatory decision-making hinges on stakeholder engagement—a process that includes fostering a shared understanding of the issue, stakeholder buy-in, and co-creation of solutions as an effective means to address an issue. Although many resources have described methods and tools for executing participatory decision-making (e.g., decision analysis), few resources describe effective methods for initiating the process of stakeholder engagement, which often presents a key barrier to participatory decision-making. Steps for initiating the stakeholder engagement process, discussion of common challenges encountered, and best practices for overcoming them are presented.

<https://usace.contentdm.oclc.org/digital/api/collection/p2756001coll1/id/44889/download>

#### **ABSTRACT BOOK: 45TH ANNUAL CANADIAN ECOTOXICITY WORKSHOP, VANCOUVER, BC, SEPT. 30 - OCT. 3, 2018**

CEW Organizing Committee, 178 pp, 2018

The Canadian Ecotoxicity Workshop is Canada's major annual meeting in the field of environmental toxicology and related disciplines. The Science/Application/Action theme of the 2018 workshop reflects the work undertaken to maintain natural ecosystems in a world faced with growing human demands for food, water, land, energy and other products. Meeting sessions included latest advances in metal bioavailability and toxicity to aquatic organisms; watershed-based monitoring and assessment; environmental monitoring of biota and water in the Athabasca oil sands; remediation, reclamation, and risk assessment; and a variety of other topics.

[https://ecotoxcan.ca/media/CEW-2018-Abstract-Book\\_Revised\\_Sept-28.pdf](https://ecotoxcan.ca/media/CEW-2018-Abstract-Book_Revised_Sept-28.pdf)

The Technology Innovation News Survey welcomes your comments and suggestions, as well as information about errors for correction. Please contact Michael Adam of the U.S. EPA Office of Superfund Remediation and Technology Innovation at [michael.adam@epa.gov](mailto:michael.adam@epa.gov) or (703) 603-9915 with any comments, suggestions, or corrections.

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