Minnie Lynch Mine – Project Location

- Project site 143 miles southwest of Colorado Springs, CO in the northern San Luis Valley.
- Approximately 17 miles from Villa Grove and Hwy 285 in the headwaters of Kerber Creek.
  - Kerber Creek flows into San Luis Creek and part of the Upper Rio Grande closed basin.
- Also part of the Bonanza Mining District
  - Initially mined prior to 1900
  - 1920s – 3-4 main tunnels and shafts made up four levels of workings.
  - Primarily produced silver, gold, copper, and lead.
Site Description

- Site divided into nine waste piles ranging in elevation from 9,800 to 10,600 feet.
  - Total volume estimate of 33,167 CY
- Eight collapsed adits with two draining
- Minnie Lynch Gulch contributes ephemeral/groundwater flow into Rawley Gulch, and subsequently Kerber Creek
  - Flow begins at toe of MLG1 at extremely steep slopes
Timeline of Events

1994-2003 – USFS, ASARCO, DRMS, CDPHE completed multimillion dollar cleanup in adjacent Squirrel Creek and Upper Rawley Gulch areas
   – Rawley 12 bulkhead, >100,000CY tailings/waste rock relocated and consolidated, and upper Rawley reclamation

2009-2011 – Concentrated soil sampling and mass balance analysis at Minnie Lynch

March 2013 – Streamlined Ecological Risk Evaluation completed for Minnie Lynch


April 2015 – Finalized EE/CA for Minnie Lynch completed incorporating public comment and partner feedback

May 2015 – Project Agreement between USFS and TU developed and executed

October 2015 – First Phase of Construction completed at Site

October 2016 – Second Phase of Construction completed at Site

August 2017 – Third Phase of Construction completed at Site

Concurrent 319 NPS reclamation in lower Kerber Creek watershed 2007-2016
2009-2011 Soil Sampling Breakdown

Soil sampling at nine waste piles
- 30 point composites, XRF, FLT, SPLP, and 10% XRF confirmation sampling

FLT showed dissolved metal runoff potential via surface and groundwater pathways from waste rock
- Zn concentrations as high as 41,400 ug/L, Cd = 5,250 ug/L, Pb = 29,50 ug/L

Soil concentrations yielded highest results in piles MLG 2, 7, 8, and 9 between 2 years.
Ecological Risk and EE/CA Summary

- Ecological Soil screening levels (SSLs) derived for four groups of ecological receptors: plants, soil invertebrates, birds, and mammals
  - Concentrations of all metals exceeded EcoSSLs for plants, birds, & mammals in at least one case
  - Cd > 4 piles: Cu 7/8 piles : Pb all piles: Zn all piles
- Hazard quotients also calculated for same species using composite soil samples
  - HQ frequently exceeded 1 showing risk associated with metal concentrations present at site
  - Metal concentrations also found phytotoxic to plant community
- Conceptual site model evaluated exposure pathways for contaminants
- Water quality and mass balance showed a 93% increase in zinc concentrations on Rawley Gulch due to Minnie Lynch input.
  - Corresponded to a 2.33 zinc load increase
  - A goal of 20-30% load reduction from Minnie Lynch remediation would have measurable effect on DSWQ
- EE/CA referenced Ecological Risk Assessment when creating roadmap for reclamation
  - Reclamation was divided into three phases with two Alternatives/year
Minnie Lynch Mine Totals

- Three phases of construction completed between 2015 through 2017
- Work completed under CERCLA authority as a Non Time-Critical Removal Action
  - An Engineering Evaluation and Cost Analysis (EE/CA) completed in 2015 guided work.
- Total Construction Costs: $344,070
  - Alt 3 & 4 prioritized for first phase in 2015 (central site)
  - Alt 5 & 6 prioritized for second phase in 2016 (lower site)
  - EE/CA Addendum created early 2017 to address sites changes and input from partners
  - Alt 2, 8 & 9 prioritized for third phase for 2017 based on Addendum (upper site)
Phase I: Alternative 4 – Adit 1 stabilization & wetland construction

Phase 1 – 2015 – Contractor Habitat Construction

- O&M of old, leaking, settling pond
  - Anoxic limestone part of original plan for Adit 1…piezometers convinced us differently
  - 50 tons limestone <2” minus, 3 tons LKD, 8 tons biosol, 10 CY sand, 370 Sq.Yds of 30 mil HDPE liner, and 200 riparian plugs
Non-point source mitigation through channel construction and waste consolidation

- Constructed 240 feet of stream channel
- 220 CY of tailings/waste rock removed from slope into on-site repository
- Used excavated channel soil as cap and 15’ setback material for floodplain
- Re-vegetated floodplain using 20 tons LKD, 1 ton biosol, and native seed mix.
Phase 2 Planning

The moral of the story…..

If unsure of property boundaries on your site...get it professionally surveyed. Lines between the two maps were off by several hundred feet.

This has been the case at several of our sites. (Mtn. Pride, Lion Creek, Evans Gulch)
Phase 2 – 2016 – Contractor H-2 Enterprises

- Focused efforts on revegetation of dead zone near confluence w/Rawley Gulch
- 600 feet of Minnie Lynch Gulch stream channel rehabilitation
  - Divided into 3 sections 16-20%, 10-16%, and <10% grade, each 200 feet long
  - Locally sourced logs for check dams in steeper sections and erosion mat for bank stability
- 1.5 acres of revegetation in dead zone using 120 tons limestone, biosol, native seed, and slash mix.
Phase 2 Before and After: MLG8 Reclamation

- Minnie Lynch Gulch impermeable channel installation
- Limestone Adit channel construction,
- Capping and consolidation of ~1,000 CY of mine tailings/waste.
Phase 3 Before and After: Minnie Lynch Mine

- Phase 3 – 2017 – Contractor Iron Maiden Custom Services
- Upper site defined by difficult access and steep slopes.
- Alternative 2: 500 feet of channel reconstruction along mine waste pile MLG 2, 3, and 4.
  - Involved removal and consolidation of 740 cubic yards of mine waste
- Revegetation of 500 feet of new floodplain using biochar, richlawn, native seed.
Phase 3 Before and After: Alternative 2 500 feet of channel
Phase 3: Alt. 8 - MLG6 capping, revegetation, and runoff control

Re-contoured, capped top of sulfidic MLG 6 waste pile

200’ of run-off ditch constructed connecting to MLG
Phase 3: Alt. 9 – Sedimentation basin construction

Construction of settling basin within Minnie Lynch Gulch
Utilized 30 tons boulders, 100 tons 6” limestone riprap
Goals: Reduction of erosion and transport of contaminated sediment downstream.
Thank You! – Jason Willis – Project Manager – jwillis@tu.org
www.tu.org/aml