

Insights from Optimization Reviews

Tom Kady

US Environmental Protection Agency

Office of Superfund Remediation and Technology Innovation

kady.thomas@epa.gov

Optimization Reviews

- Performed by independent expert teams – fresh eyes review
- Optimization reviews focus on technical issues, not policy. They do not circumvent legal, regulatory and policy requirements.
- Originally performed on pump and treat systems in LTRA, they are now performed on all phases of the Superfund process
- Mine site optimization reviews are a work in process

NOTE: Giving the overwhelmingly complex nature of many mine sites, this presentation is meant to present common, simplistic concepts that may help project teams to prioritize and sequence project activities and pose unique perspectives that may lead to new and innovative approaches.

Optimization is Triage

1. Do what matters most
2. Attack root causes, not symptoms
3. Right skills, right resources, right culture

Guiding Principles

- Investigate with remediation in mind
- Stop the loading!
- Get time and nature working for us, not against
- Attack the root cause, not the symptoms
- Take advantage of the unique opportunities each mining site offers

RI/FS Definition*

The remedial investigation:

1. Determine the nature and extent of contamination
2. Establish site cleanup criteria
- 3. Identify preliminary alternatives for remedial action**
4. Support technical and cost analyses of alternatives.

The feasibility study:

1. Analysis of the practicability of a proposal (e.g., a description and analysis of potential cleanup alternatives),
2. Usually recommends selection of a cost-effective alternative
- 3. Usually starts as soon as the remedial investigation is underway.**

*Superfund Reforms Glossary

Investigate with Remediation in Mind

(If you don't know where you're going...)

Requirements for Action

- Hazardous substance
- Quantity that can cause harm to HH or environment
- Migration pathways
- Sensitive receptors

Remedial Action

- Treat to non-hazardous substance
- Remove – excavate/extract
- Cut off pathways – immobilize or contain
- Remove receptors – last resort

Stop the loading!

(Do what matters most)

- 1 gpm @ 1 ppm = 4.4 lbs per year
- Nature works all the time -- 24/7/365.
- Get time and nature on your side immediately!
 - 20 years of investigation without remediation =
 - bigger footprint,
 - more affected media
 - more complexity
 - more time and money to remediate

Attack the Root Cause

Mining Process

- Extract rock with high concentrations of desired minerals
- Pulverize to increase available surface area
- Subject crushed rock to physical/chemical/biological conditions to liberate mineral from rock

Environmental Loading

- Concentration
- Surface area
- Conditions conducive to migration

Mining operations never cease – nature just takes over the operation

Mining Processes

- Dry gravity separation
- Wet gravity separation
- Chemical leaching

Nature's Processes

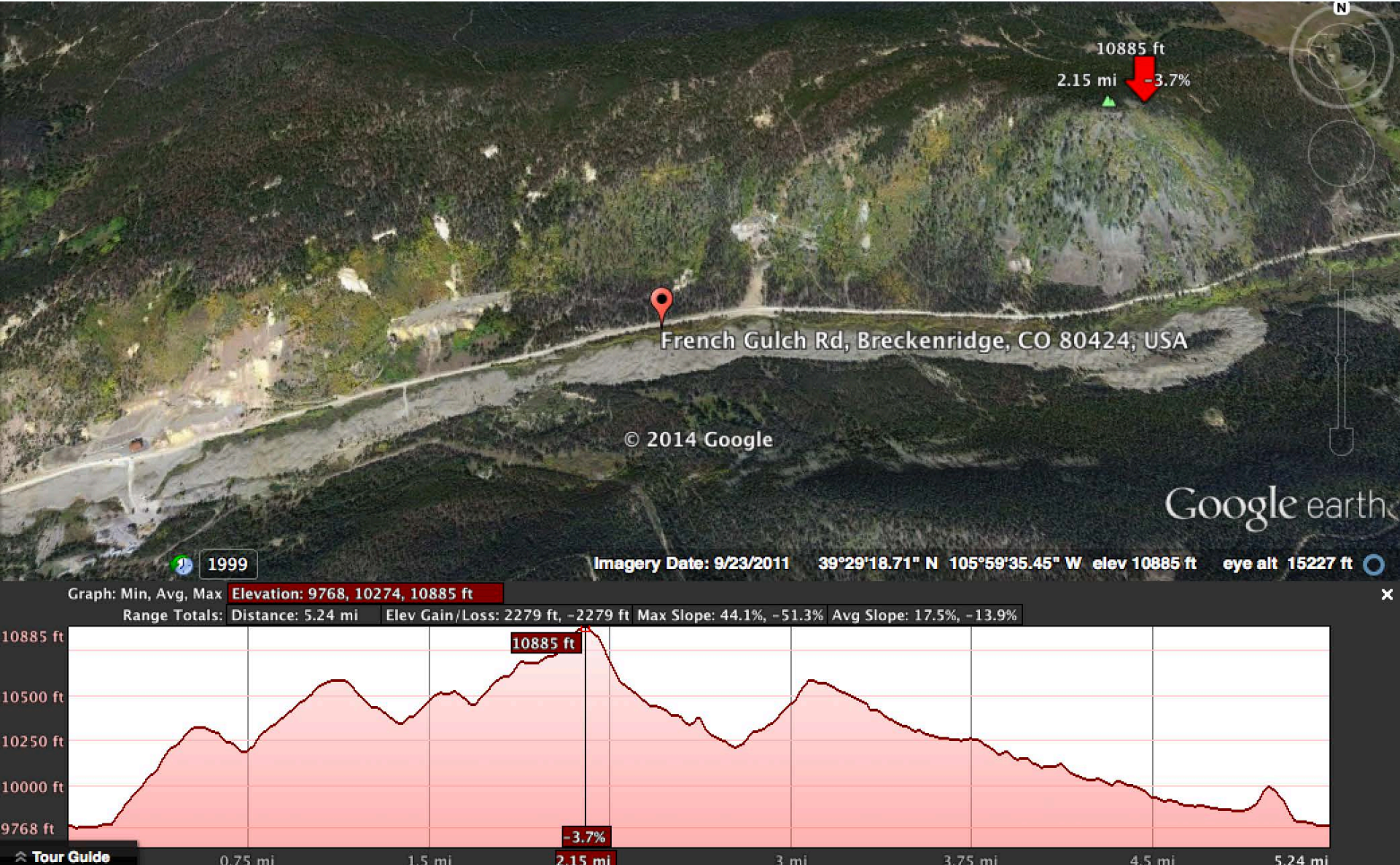
- Wind
- Rain, streams/rivers
- Metal sulfides + Air + H₂O

French Gulch Optimization Breckenridge, CO

Situation:

- Town operates a mine seep treatment plant
123 ppm Zn @ 100 – 500 gpm (>25 tons per year)
- Need to reduce \$2 million annual O&M costs
- When can the system shut down?

French Gulch Treatment Plant



Personal Realizations

French Gulch

- The scale of mining sites is very humbling!
- Can we reduce O&M costs? Yes
- Can we afford to run plants indefinitely? No
- Nature needs to be part of the solution.
- The gifts? Elevation and land
 - Free potential energy – no pumps required
 - Room for passive treatment

Challenges/Opportunities

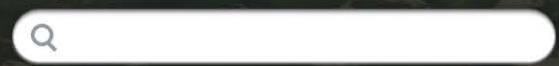
- Aesthetic engineering of passive treatment systems
- Mine seeps are symptoms; not the root cause of discharge. Is it possible to:
 - Investigate miles into an abandoned mine?
 - Remediate miles into an abandoned mine?
 - Eliminate exposed surface area of sulfide minerals? after mines are abandoned
 - Eliminate exposed surface area before mines are abandoned?

Carpenter-Snow Creek Optimization

Neihart, MT

Situation:

- Silver, lead and zinc mining district
- Active mining from 1880's to 1940's
- 96 abandoned mines identified
- 21 mines are sources of surface water impact
- Tailings ponds, tailings piles, adit discharges
- RI/FS Optimization request



Google earth



89

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Image USDA Farm Service Agency





neihart, mt



Google earth



Pioneer Rd

© 2013 Google
Image USDA Farm Service Agency





The Glory Hole

~ 600,000 cubic yards





Neihart, MT



Google earth



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Carpenter-Snow Creek Personal Realizations

- The scale of mining districts can be mind numbing!
- Each mining site presents unique opportunities/gifts
 - elevation
 - distance from receptor
 - glory hole
- Sometimes the root cause of adit charge CAN be addressed
- Need to think big
 - Gondola, pump tailings, convey tailings

Challenges/Opportunities

- Pump or convey, not truck, tailings to the glory hole
 - Automate, reduce labor costs
 - Minimize environmental disturbance
- Eliminate air/water contact with metal sulfides through creative design of glory hole repository
- Eliminate exposed surface area of metal sulfides
- Simple, low cost, passive treatment for minor adit discharges

Carson River Mercury Site

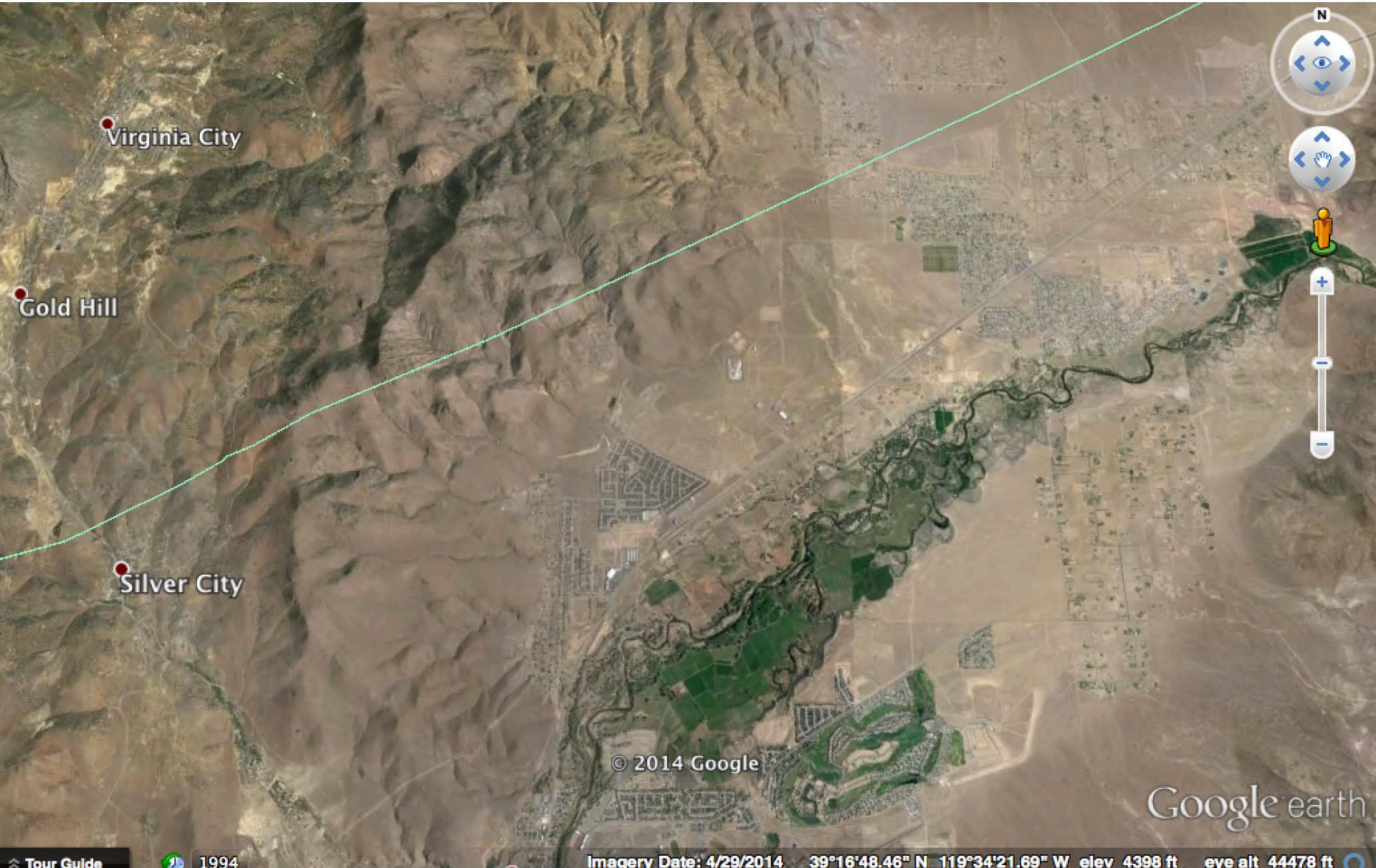
Situation:

- Gold and silver mining since 1850
- Estimated 15 million pounds of mercury released
- Impacts to over 50 miles of the Carson River and adjacent flood plain
- Mercury sediments in Lahontan Reservoir, Carson Lake, Stillwater Wildlife Refuge and Indian Lakes
- RI optimization request – 20 years of data, where do we begin?

Carson River Mercury Site



Carson River Mercury Site



Virginia City

Gold Hill

Silver City

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So what are the “gifts” at Carson River Mercury Site?

- High energy snow melt flushes the foothill canyons
- Carson River has proven its ability to flush mercury to Lahontan Reservoir
- The reservoir acts as a sink (at least since 1915)
- NDEP has good institutional controls in place
- Mining companies are reworking the tailings piles in the foothills
- Mercury volatilizes

Thinking Big

- How do we get the rest of the mercury to the reservoir?
 - High velocity pump stations?
- How do we remediate the reservoir?
 - Build a second reservoir?
 - Dig out the first? Amend it? Let the Hg evaporate?
- As crazy as it may sound, that's what nature is doing in the absence of doing nothing.

Challenges/Opportunities

- Quick, accurate and cost-effective assessment of >80 miles of canyons, river, reservoir, irrigation canals and marsh
 - Incremental composite sampling and x-ray fluorescence
 - Combined downhole cone penetrometer tests with XRF
 - Hyperspectral imaging
 - Spectral imaging of plants
- Understanding and controlling mercury methylation
- Satellite imagery