

RECLAMATION

Managing Water in the West

Emergency Response at the Ute Ulay Mine Tailings Site, Lake City Colorado

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U.S. Department of the Interior
Bureau of Reclamation

Presentation Overview

Ute Ulay Mine, Lake City

Site History

Avalanche

Repository Design

Stability Concerns

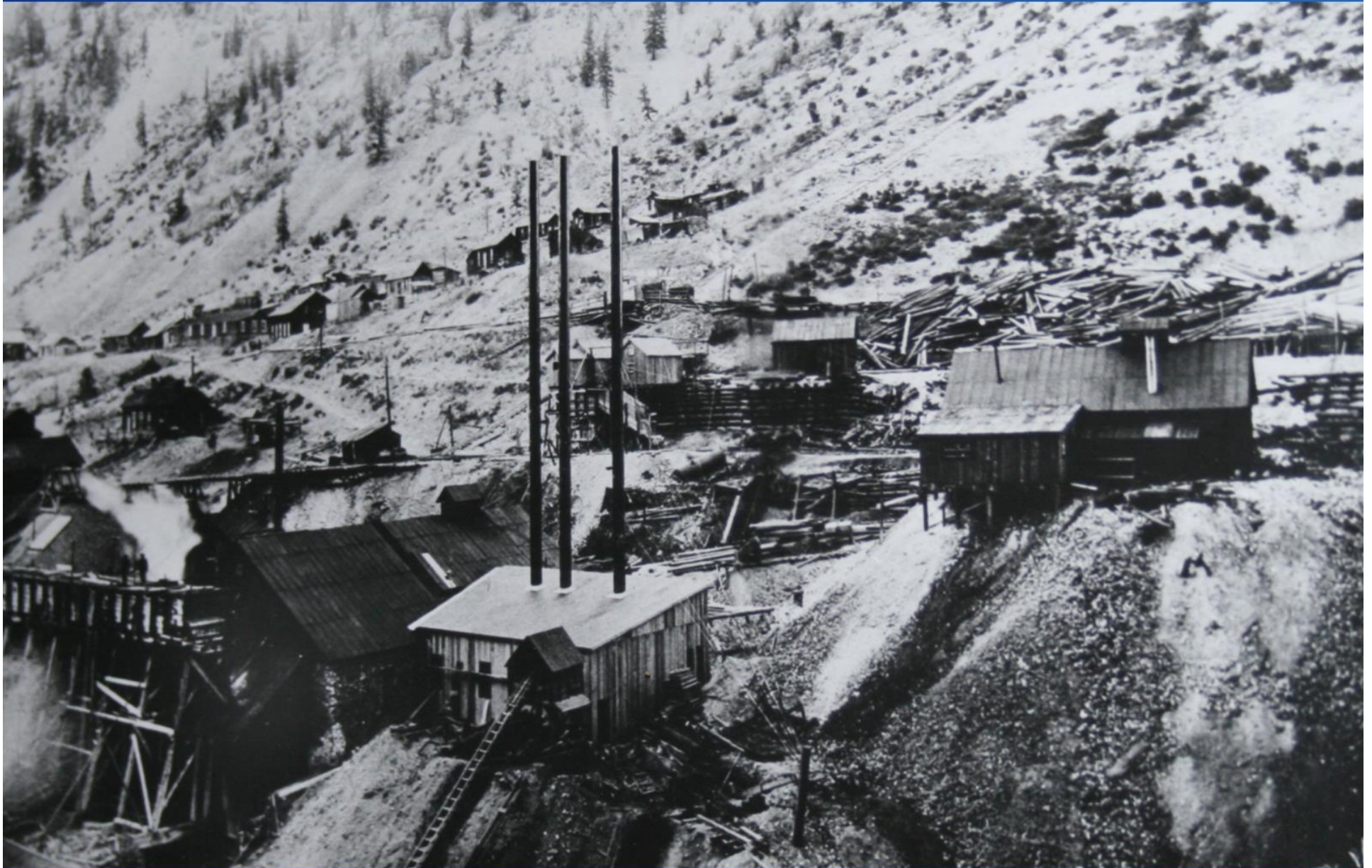
New Excavation Plan

Implementation

Conclusions



History of the Ute Ulay Mine



History of the Ute Ulay Mine

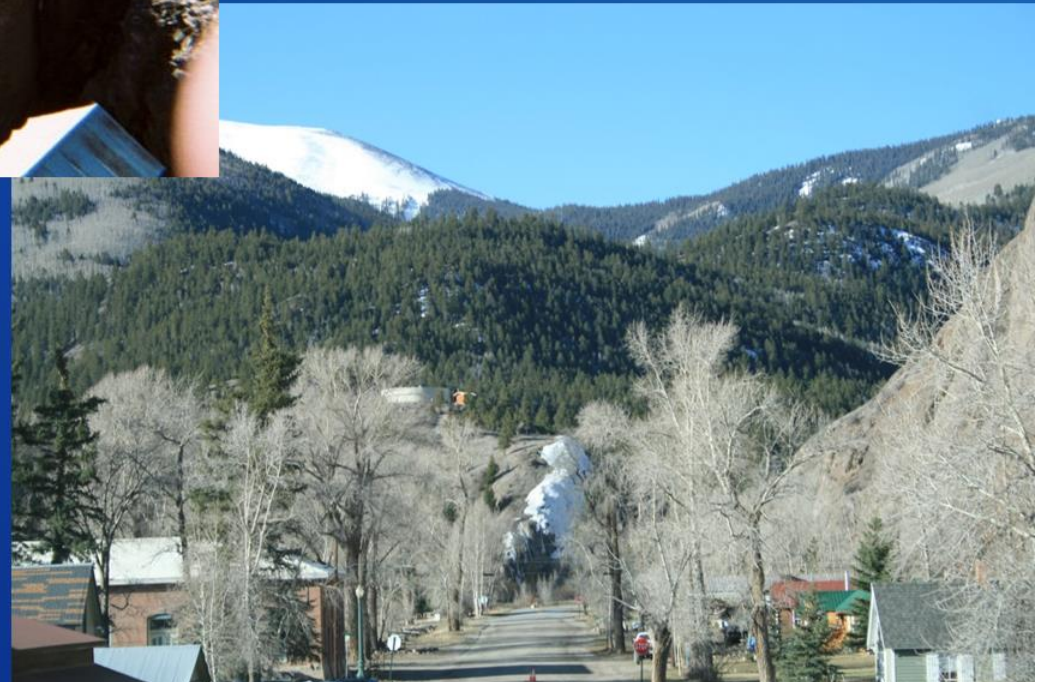
- Ute and Ulay veins discovered August 27, 1871 by Henry Henson, Albert Mead, Charles Godwin, and Joel Mullen
- It was the first patented mining claim in Hinsdale County, Colorado
- Mining started in 1874 and continued until 1903. It had a dam and hydroelectric plant
The mill burned down. A new mill was erected in 1928.
- There was sporadic mining up to the 1960's
- The most productive mine in the County, it produced \$12 million in gold, silver, lead, copper, and zinc.

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Historic Dam supplied water to hydroelectric plant that ran the mill



1973 Dam Break – 14 mile fish kill



Ute Ulay Mill

- The 1928 mill is powered by a diesel Buckeye engine salvaged from a WWI battleship.
- Restarted briefly a few years ago ([Superfund link](#)).



Initial Project

2009 – The State of Colorado DRMS remediated 5 tailings impoundments which were pumped 1 mile upstream from the mine/mill.

BLM funded the cleanup because the waste was on their land. It cost \$1.17 million for 5 acres.

Tailings were converted to a paste sandwich.

Paste tailings foundation with a waste rock layer capped by 6' of paste, soil, and vegetation

The paste is formed by mixing tailings with 6.5% cement and pumped to its deposition area in 3-ft lifts. 7 days curing before adding a lift.

350 yd³/day placement over 2 months.

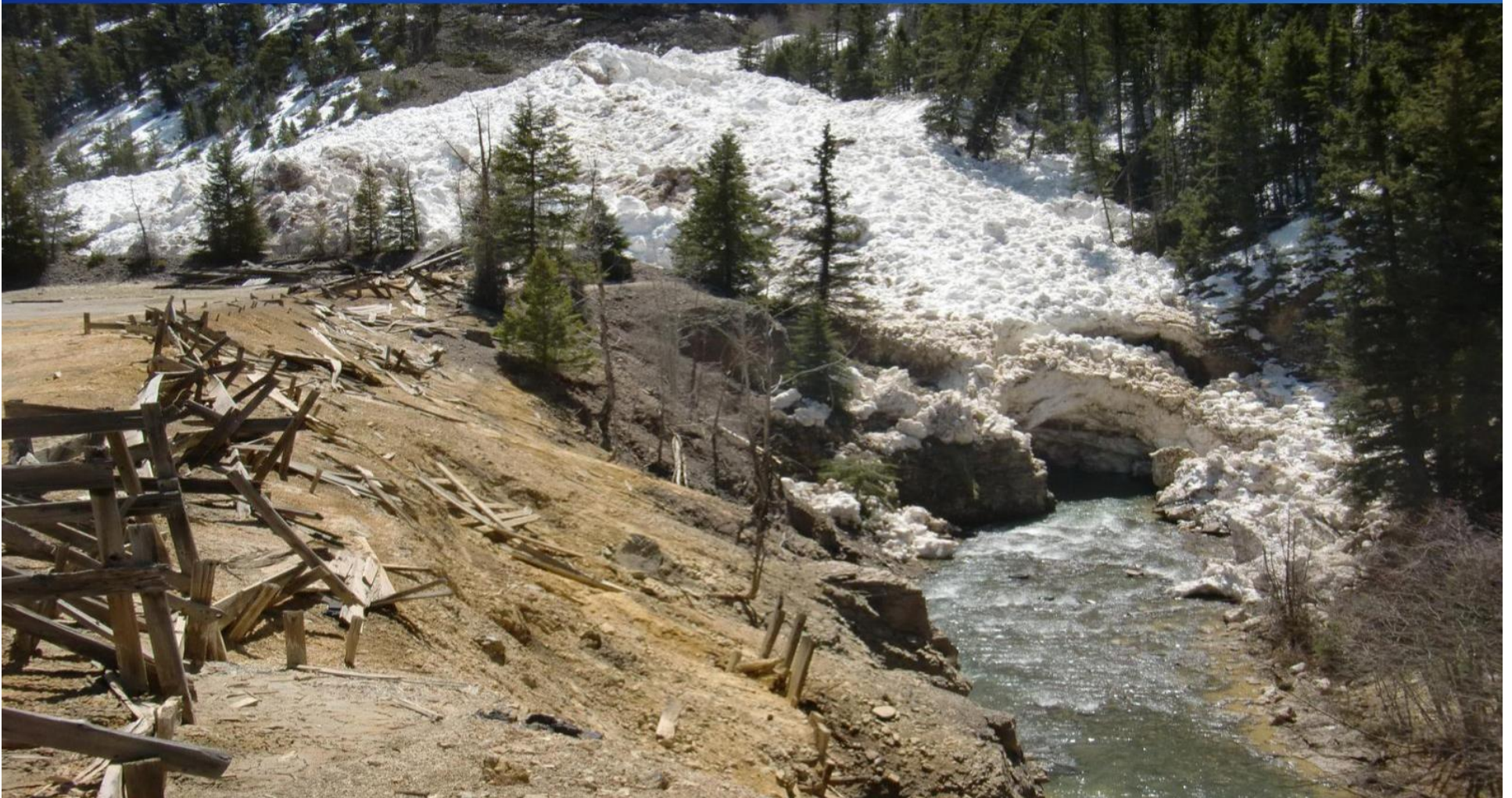
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Site Overview



April 2011 - Avalanche blocks Henson Creek

A 30-ft deep pool formed against the tailings and waste rock. The snow dam failed 24 hours later.



Avalanche path to Henson Creek

Avalanche pathway, likely to reactivate in the future.



Reclamation Planning

State of Colorado DNR - Division of Reclamation, Mining and Safety (DRMS) hired an engineer to prepare a repository design.

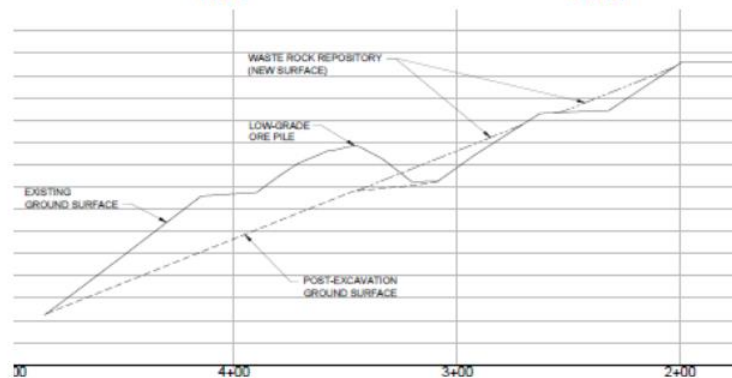
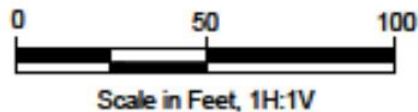
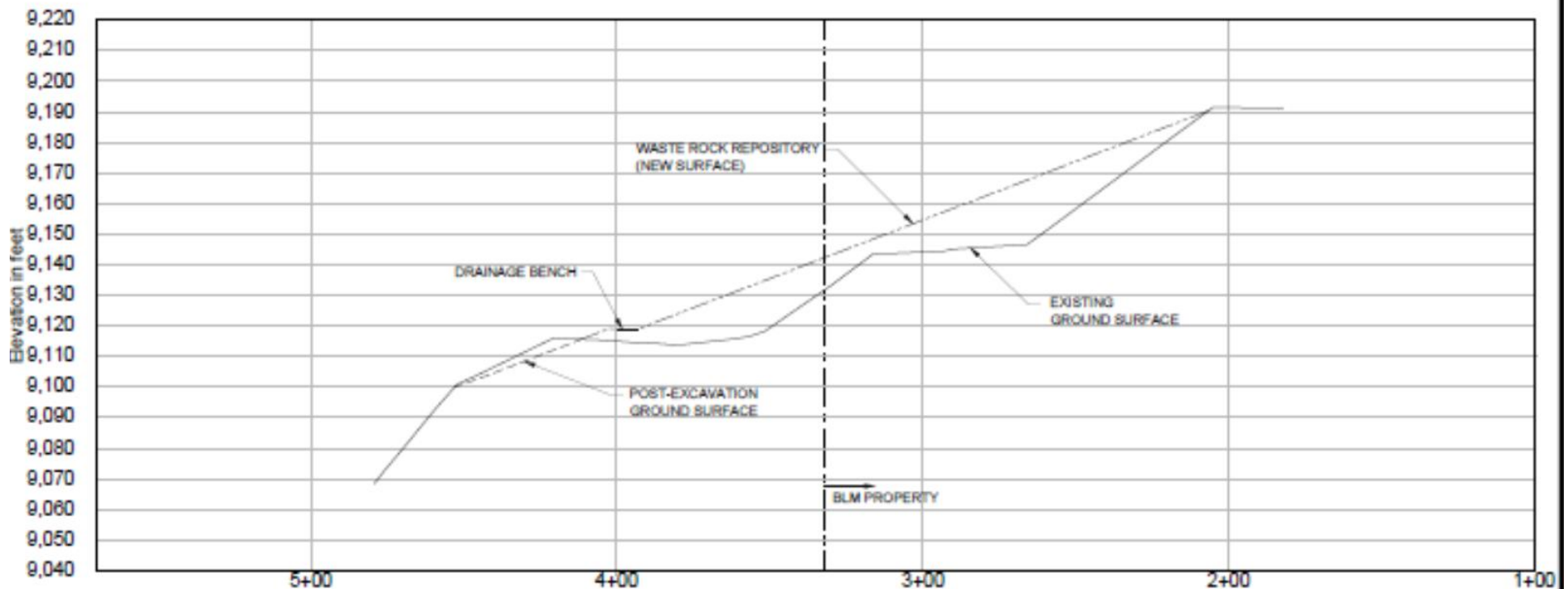
EPA goes after the mining company to pay a share of the cleanup costs.

The company donates the property to the County to cover most of its liability.

Site closure plan about to be bid out in the Spring of 2013 when EPA questioned the design.

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Does this Plan Make Sense?



Division of Reclamation, Mining & Safety
Ute-Ulay Repository Conceptual Design
Hinsdale County, Colorado

SECTION B - B' EXISTING AND RE-GRADED GROUND SURFACE PROFILES

February 2013

23-1-01187-148

Engineer noted the presence of soft materials

3.3.3 Tailings Treatment and Dewatering

Subsurface investigations at the site have identified soft, saturated silt and clay tailings in the former settling basin area. Our design included two items to help mitigate the tailings in this area.

During our meeting with DRMS and EPA, the requirement for a geomembrane liner was removed. However, because of concern about contamination associated with the fine-grained tailings, amending the top 12 inches with Portland cement was discussed as a method to mitigate the environmental hazard. Amending the tailings with cement was also considered as a way to improve the subgrade for the repository fill.

As an additive option, we also included a line item for dewatering the tailings. Possible dewatering methods include wick drains (strips of geofabric drainage material inserted into the tailings using a mandrel) or auger holes backfilled with drain sand. Drainage will improve the post-construction stability of the repository by allowing pore pressures in the tailings to dissipate more quickly. However, it will be difficult to collect the water that drains from the tailings.

3.4 Design Limitations

Consistent with the conceptual-level effort outlined in our scope of work, we did not complete detailed engineering analyses for several aspects of the design. We recommend that these issues be more fully evaluated before initiating any construction at the site.

3.4.1 Stability Analyses

We did not formally evaluate stability of the slopes associated with re-grading the mine waste and construction of the repository. Rather, we relied on stability analyses performed by DRMS (DRMS, 2012) that demonstrate that slopes consistent with the revised design criteria discussed above provide an acceptable factor of safety.

We did not formally evaluate expected settlements associated with construction of the repository. In general, the materials to be placed in the repository are granular, so settlement of the repository fill itself should occur relatively rapidly. Additionally, we do not expect large settlements of the native materials below the repository. However, where the repository will be constructed over the existing settling basin at the east end of the site, long-term consolidation of the soft, saturated silt and clay should be expected.

We did not formally estimate the magnitude of expected settlement associated with consolidation of the tailings, and we did not estimate the duration over which such consolidation might be expected to occur. Large settlements in this area could have an adverse effect on the performance of the drainage bench near the toe of the repository.

Ute-Ule Trench and Borehole Locations



Explanation

- Trench
- Borehole



0 50 100 200 300 400 500 600 Feet

Tailings are 1 to 3 SPT blowcount material, 10 to 20 feet deep!

This would not support a high fill

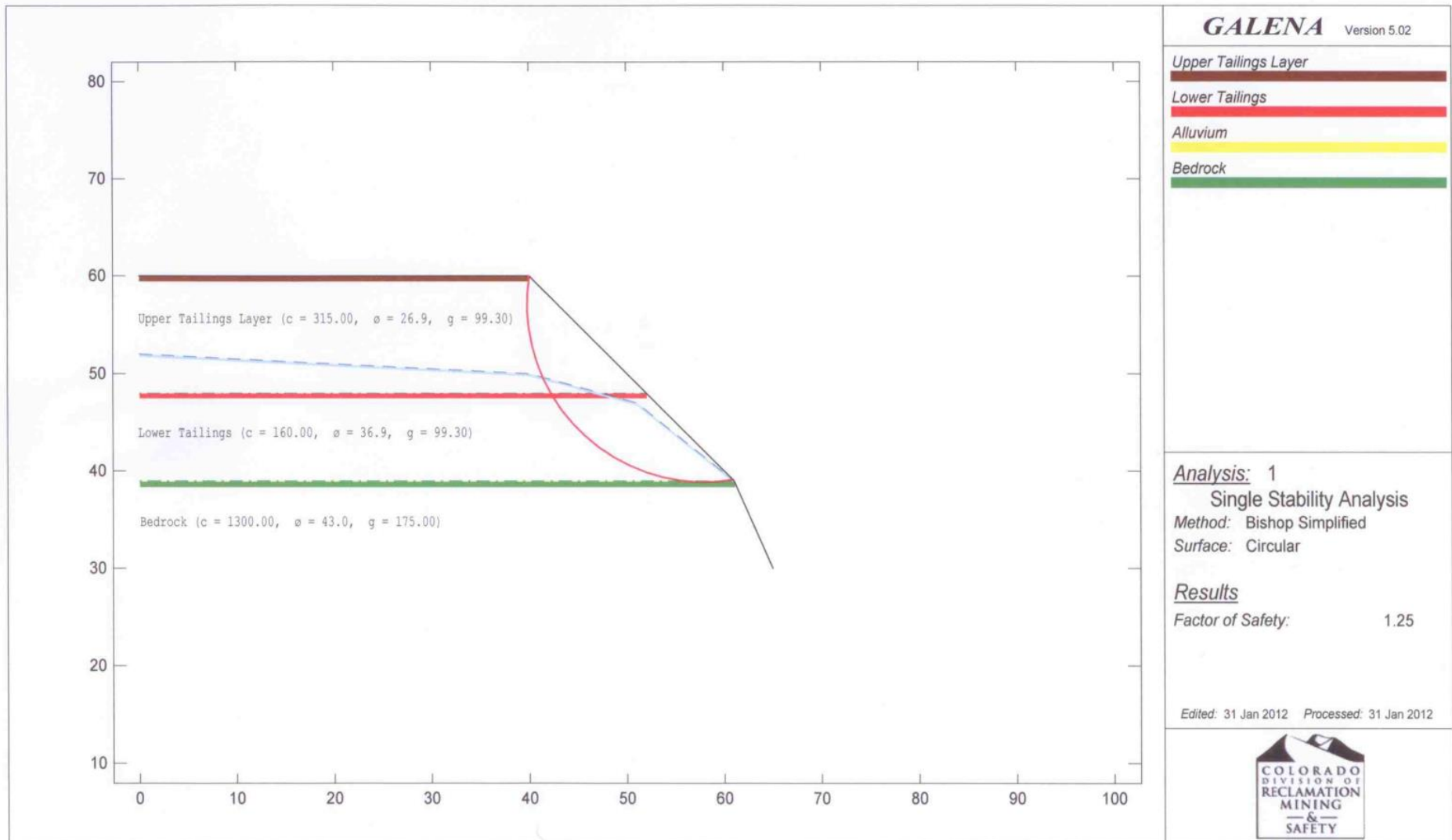
Suggestion to amend the upper 1 ft. of soft tailing with cement to improve support for the fill made EPA question the design

There also was a suggestion to install wick drains to reduce moisture content

The engineering firm should have realized the stability analysis was deeply flawed!

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Improper Stability Modeling



Project: Ute Ulay Stability Analysis
 Cross Section UU-SA-2. 1:1 slope, adjusted for apparent cohesion.

File: C:\tct\galena files\UU_cs_sa_2_2.gmf

Licensed to: Office of Surface Mining

Original design would have led to a massive slope failure





Weak Tailings:

**Incomplete Site
Investigaiton**

**Improper Stability
Analysis**

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Site Investigation



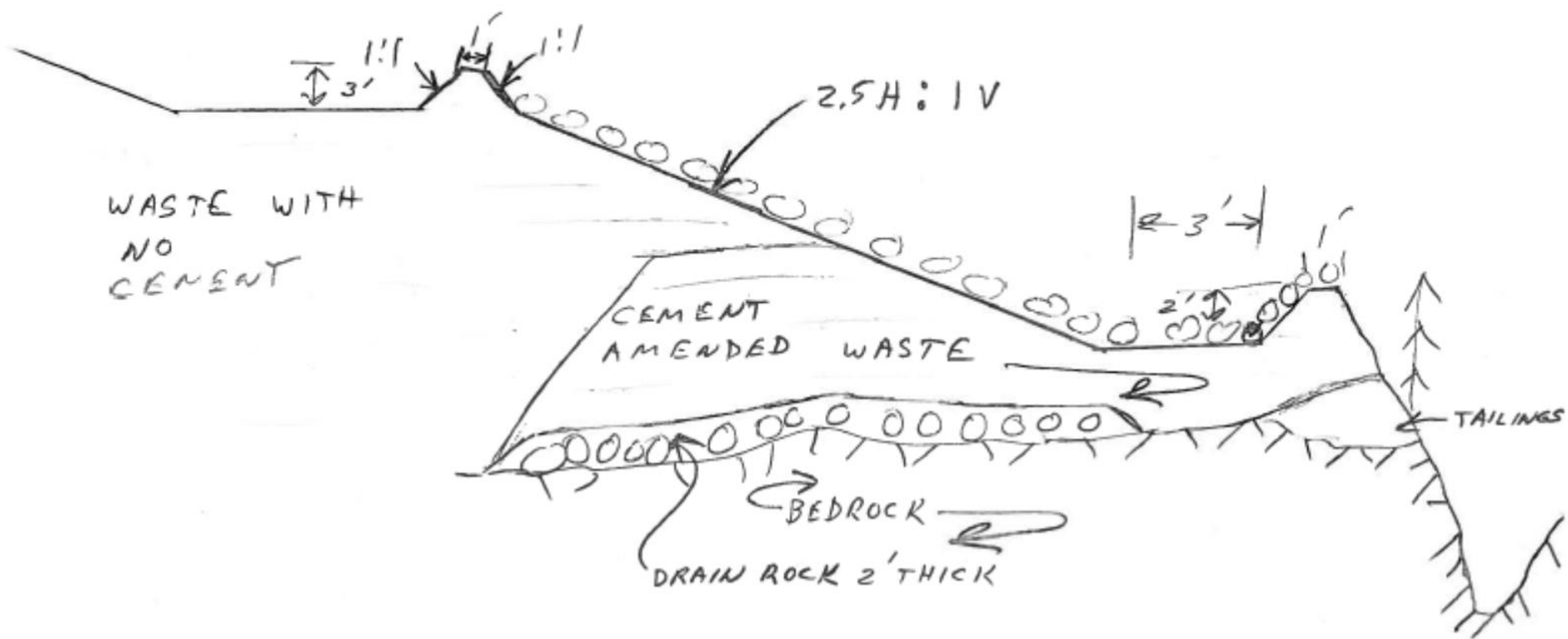
Steep slopes above swift water



Plan to stack 70 ft of fill on this slope



Revised Design



Sequenced the work



Planning kept pressure off of the weak slope



Distractions





Before and After



Reclaimed Site

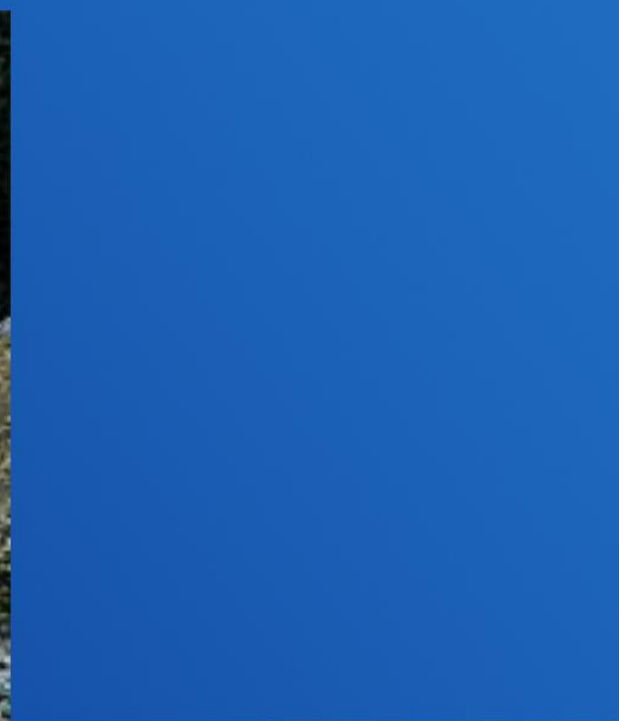


Restoration Project



Restoration Project





Conclusions

- **Insufficient site characterization and improper engineering evaluation almost resulted in a failed project.**
- **EPA's decision to get an independent outside expert review resulted in identification of the mistakes.**
- **Foundation investigations are a critical part of project design.**
- **Engineering evaluation must be carefully executed, reviewed, and for critical structures an outside expert review can be of great value.**

James Creek October 2013



Colorado Floods Scoured Gulches



Erosion of Highway and Tailings

