

Upper Arkansas River Restoration Project Conservation Activity Plan (CAP) Results (Smith and Boylan Ranch Properties)

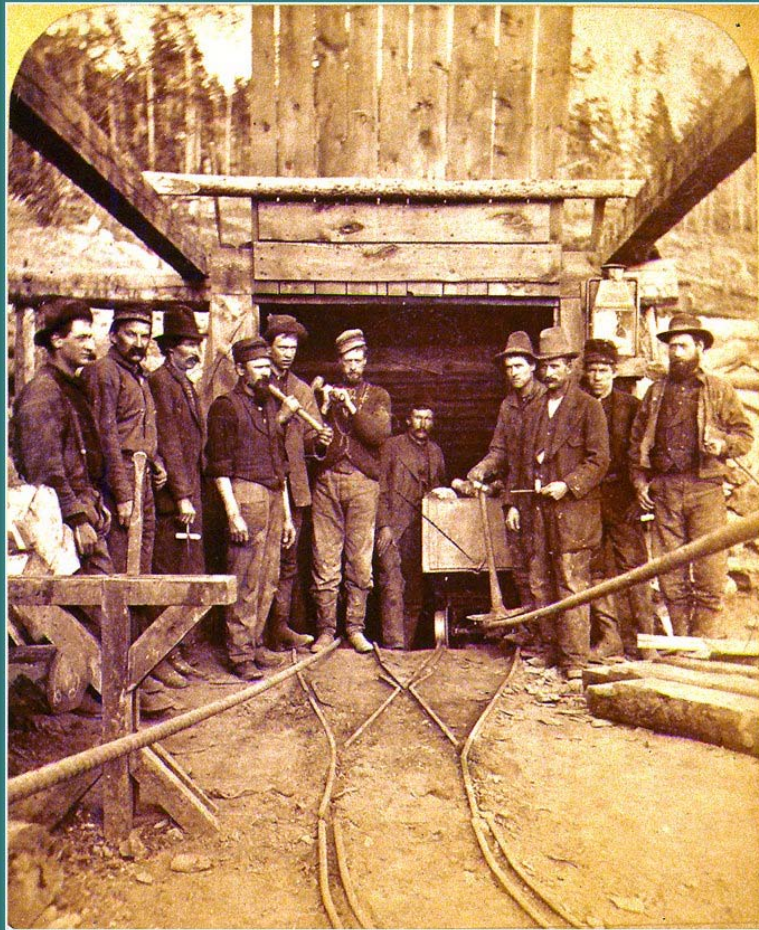
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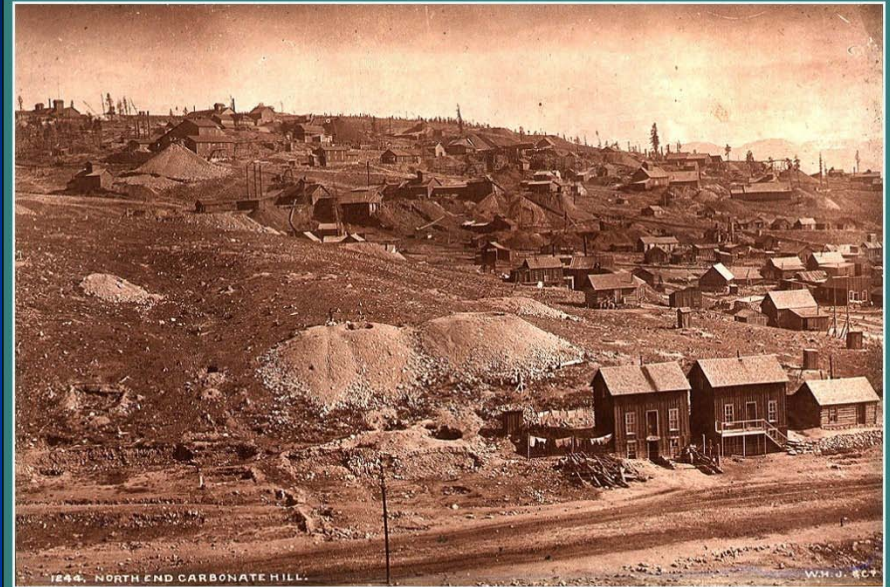
Project Overview Map



150 -40 Years Ago (Mining)



Miners at the Carbonate Mine - Leadville, Colorado - 1881 - Ted Kiersey Collection



1884. NORTH END CARBONATE HILL. - Leadville, Colorado - 1881 - WM Jackson Photo - Ted Kiersey Collection



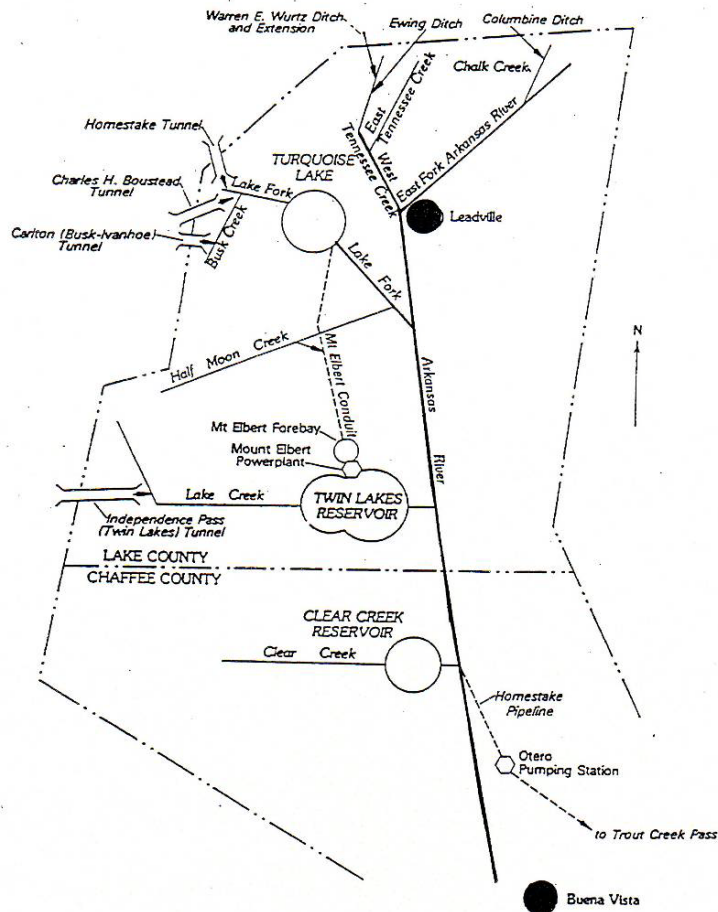
Mining Impacts



- Water quality impairments
- Destruction of riparian vegetation
- Fish die-off
- Mineral imbalances in livestock
- Reduced hay yields
- Channel instability
- Increased sediment loads (Q_s)



100 years ago to present (Flow Diversion)



- Placer mine diversions early 1900s
- Wurtz and Columbine ditches 1929-1930
- Busk-Ivanhoe tunnel 1925
- Homestake 1968 Boustead 1972
- 1968 -1981 consistent flow augmentation (Lake Fork)
- 1981 Mt. Elbert conduit to Twin Lakes
- Augmented flows and rapid drawdown still occur



Preliminary Cost Estimates

- Utilized existing data on real costs of installed practices
- Costs include engineering design, survey, hydraulic modeling, sediment transport analysis, bid documents, construction management
- Unit cost range \$101-\$171/ linear foot
- Economies of scale

-We want a design that mimics stable channel processes

-Riffle/Pool Sequences

-Channel elements (Low flow, Bankfull, Flood Flows) – appropriate width, depth, floodplain connection are key

-Utilize in channel work, structural (elements J Hooks, Cross Vanes and vegetation improvement/sod mats for fill)

-End result will improve channel stability, fish habitat, water quality and riparian conditions



Bringing it together

- Utilize historic air photos (channel history and time trends)
- Field data is used for design parameters, create/validate hydraulic models
- Hydraulic models to test sediment transport (bed stability/structure stability)
- Bank stability surveys/ensure stable bank designs
- Analysis leads to a design that will work and stand the test of time
- Land owner involvement in creation and approval of stream restoration measures

