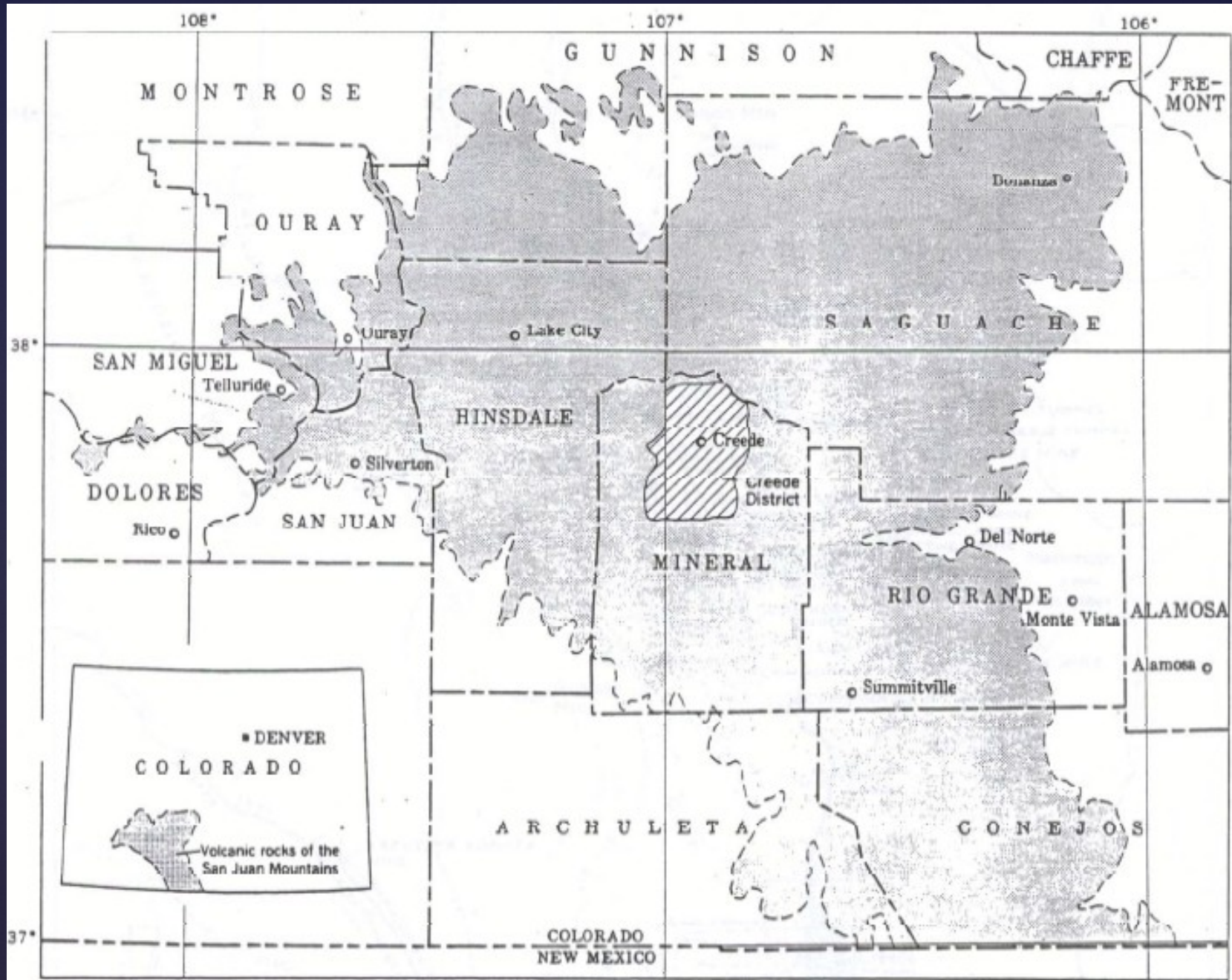
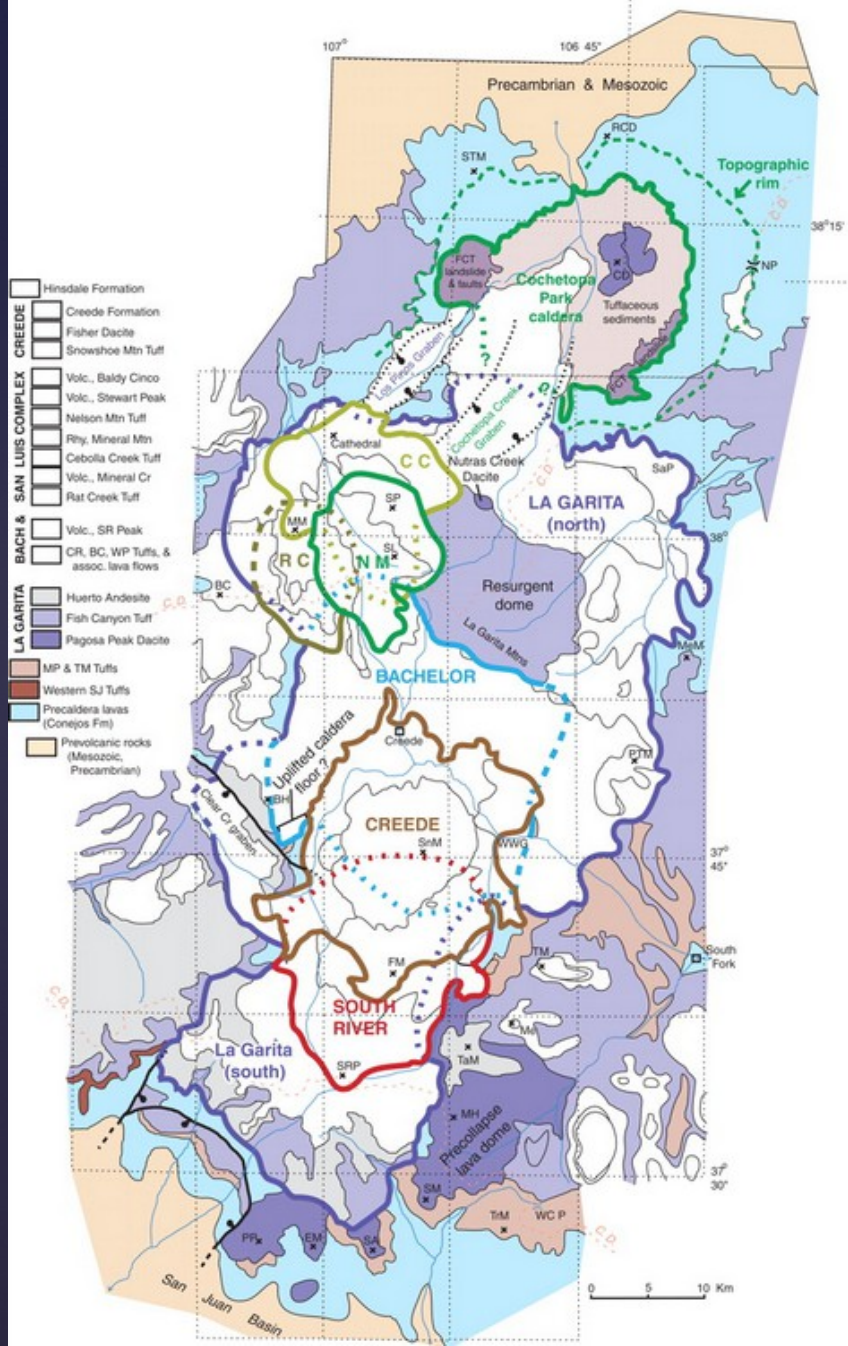


Willow Creek Watershed: A Basin for Collaborative Solutions

Guinevere Nelson
Willow Creek Reclamation Committee/Lower Willow Creek
Restoration Company
Watershed Coordinator





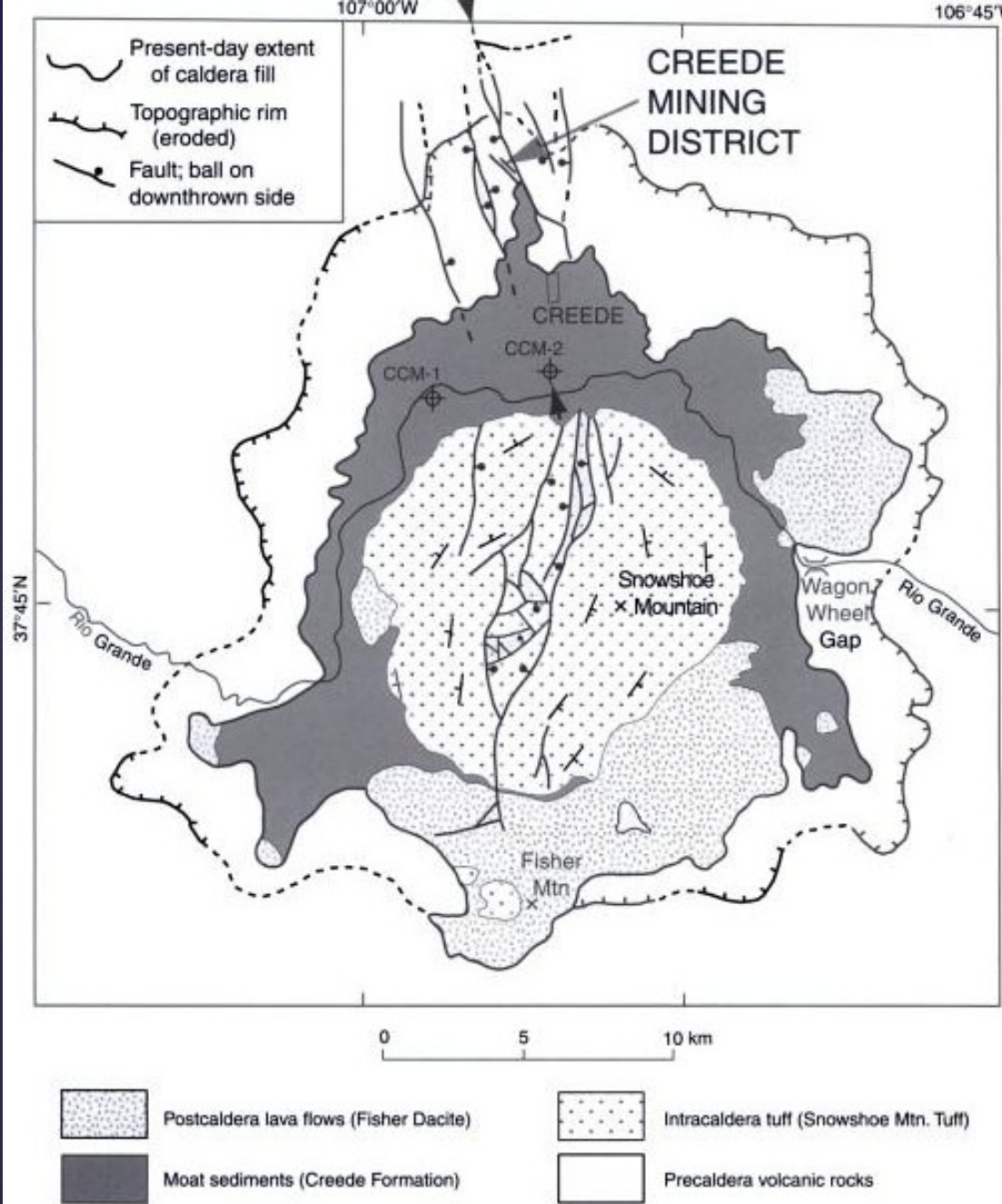


Figure 1. Generalized geologic map of Creede caldera and surrounding area. Arrows show location of cross section shown in Figure 3 (modified after Lipman, this volume). Mtn is abbreviation of Mountain.

Creede Area History

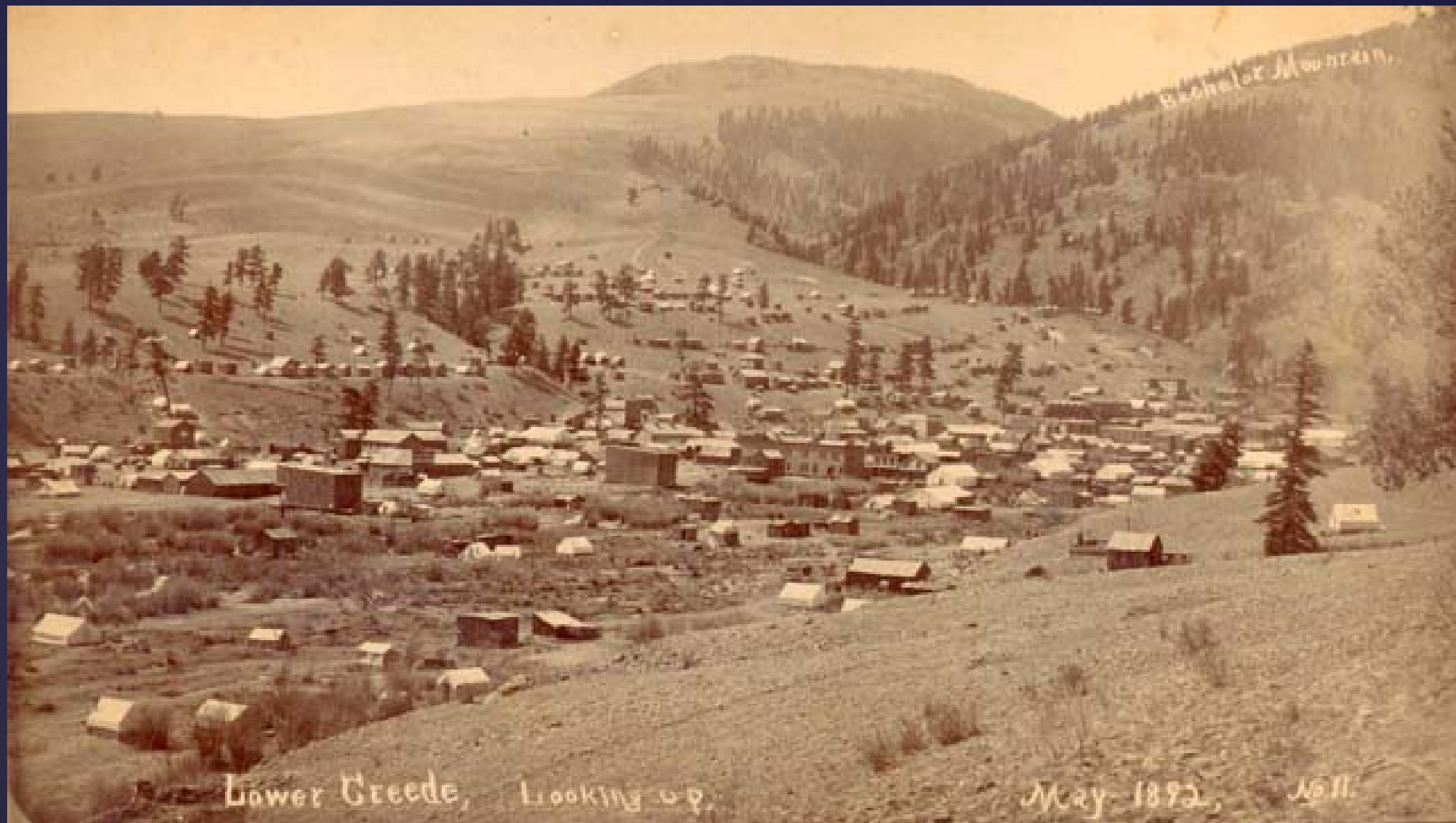
(Historic Photos Courtesy of the Creede Historical Society)



0.26.

Prospectors, Creede, Colo.

E. F. Hilton, Art.



Washoe Mountain

Lower Greede, Looking up.

May 1892, 1611



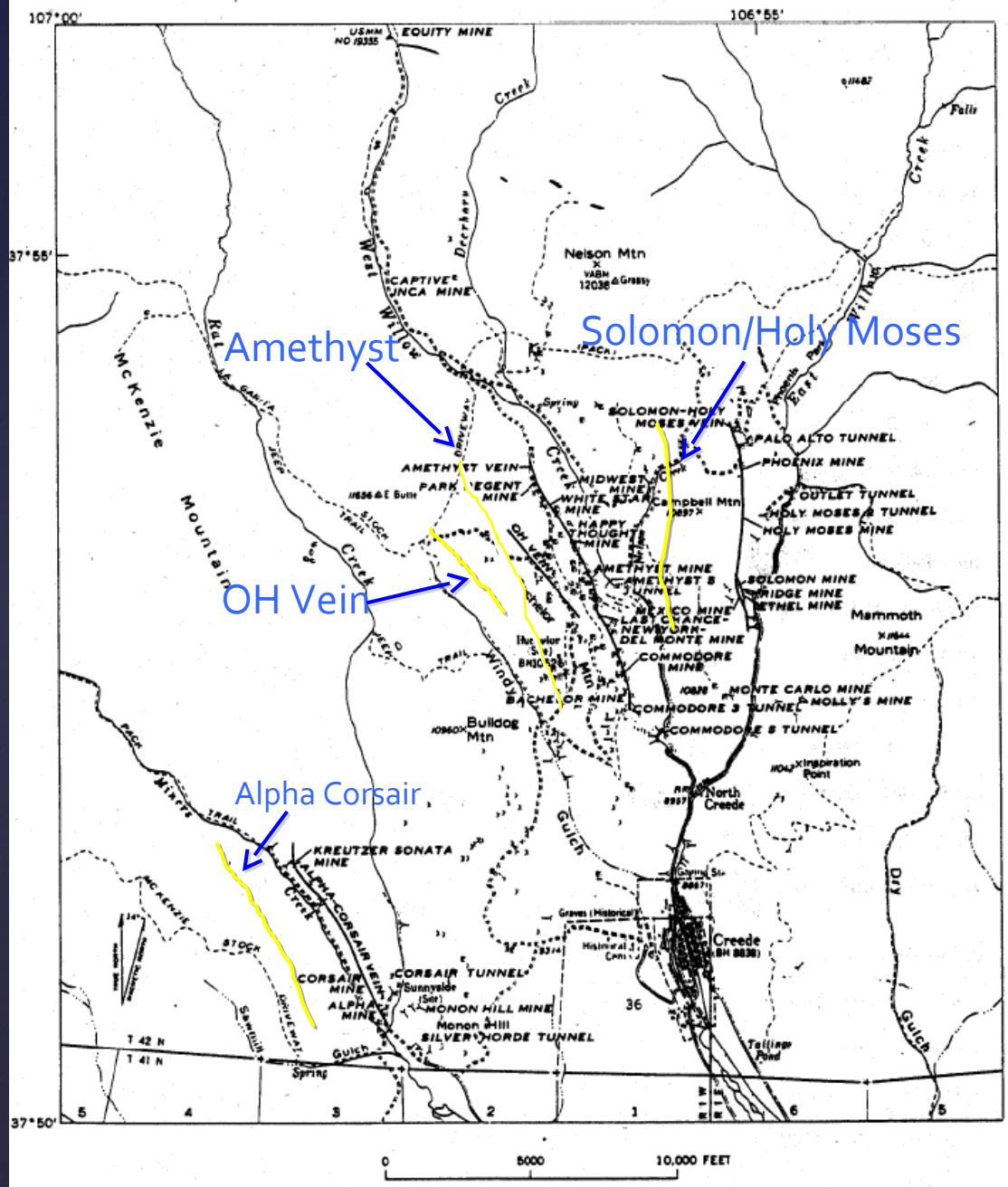
Creede, Colo.

Nov 1892



Creede Mining District

- Amethyst Vein
- Solomon/Holy Moses Vein
- Alpha Corsair Vein
- OH Vein



Amethyst

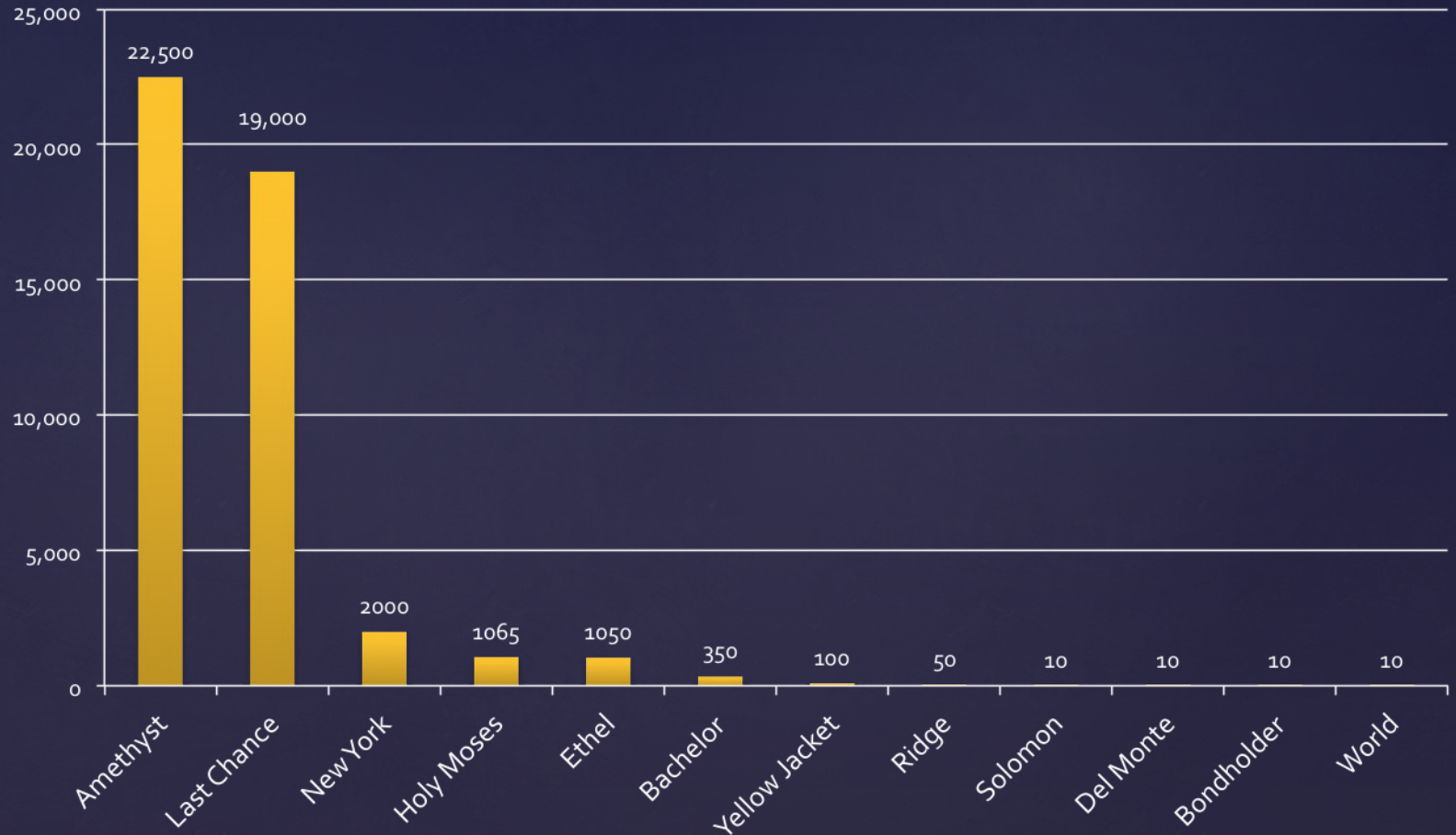
Solomon/Holy Moses

OH Vein

Alpha Corsair

0 5000 10,000 FEET

Creede Mining District Ore Output in Tons from 1889-1892



Total Estimated Value: \$4,215,800

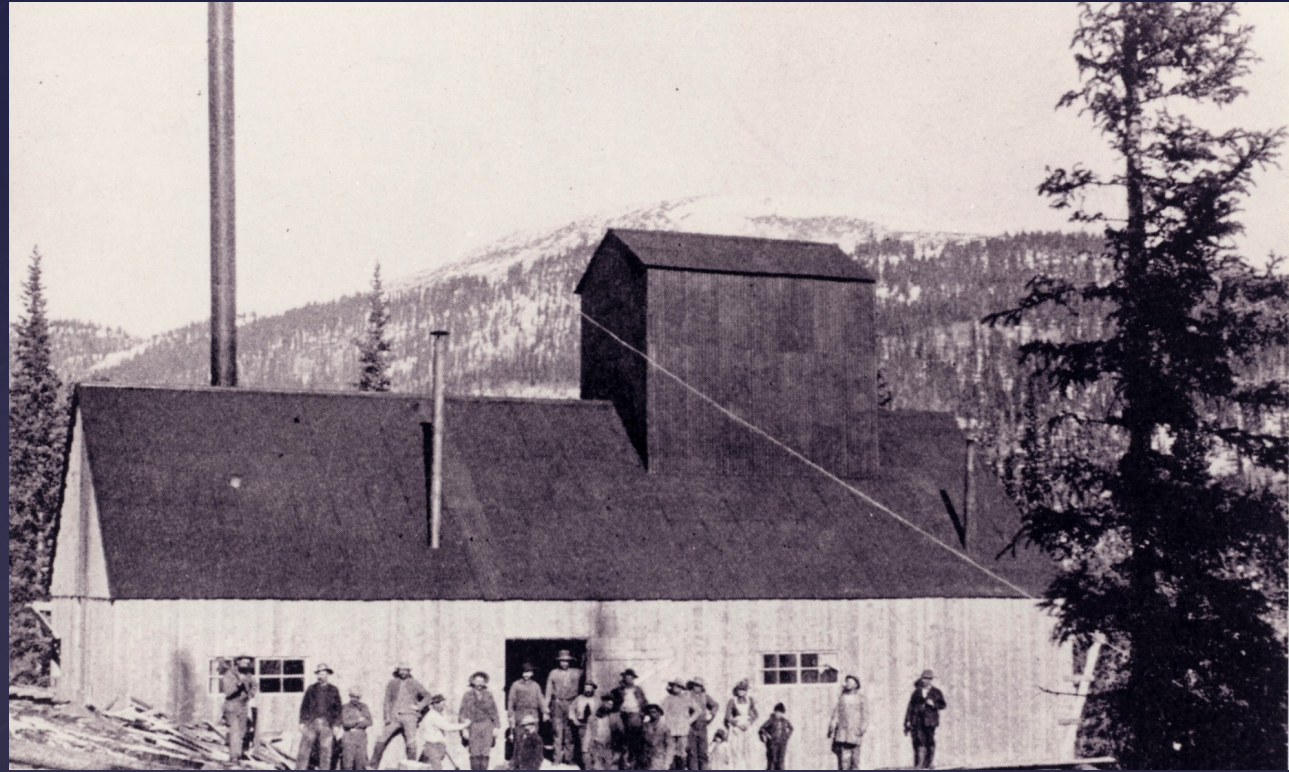
Source: *A Silver Camp Called Creede: A Century of Mining*; Richard C. Houston

Total Extracted from Creede Mining District from 1893-1985 (USGS)

Gold: \$3,255,33	Ounces: 1,056,108
Silver: \$53,917,856	Ounces: 52,661,259
Copper: \$1,576,930	Pounds: 5,188,186
Lead: \$15,857,381	Short tons: 111,772
Zinc \$8,982,599	Short tons: 39,443

Amethyst Mine





Park Regent Mine 1895

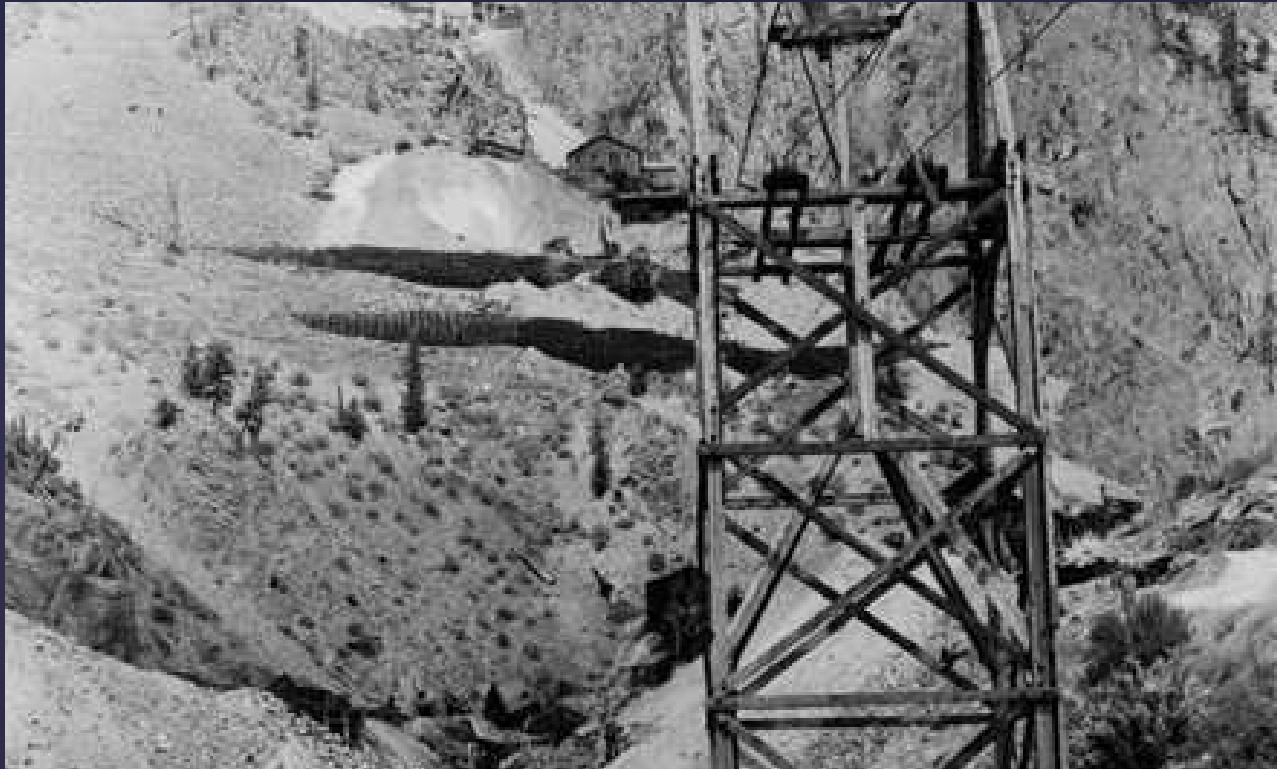


Phoenix Mine

Nelson Tunnel



Commodor (Commodore)





WELCOME
TO
CREEDE
586 NICEFOLKS
&
17 SOREHEADS

Problems

- High loads of heavy metals in Willow Creek (Pb, Zn, Cu, Cd, Al, and Mn),
- 2 large fish kills in the Rio Grande River following flood events,
- Degraded Riparian Habitat,
- Limited or non-existent fish populations in Willow Creek.

Early Watershed Work: 1966-1999

1991

- Colorado Mined Land Reclamation Division (Colorado Division of Reclamation Mining and Safety) installed a Passive Mine Drainage Treatment System in East Willow Creek.



Emperius Tailings Pile

1995-1996





1995-1998

- EPA and CDPHE undertook a Preliminary Assessment of Willow Creek (1995)
- USFS determines the Bulldog Mine clean up needed more work (1995)
- Site Inspections initiated to characterize physical and chemical characteristics of the Creede Mining District (1996)
- The findings provide basis for potential listing of Creede on the National Priorities List under CERCLA (1997)

Genesis of the Willow Creek Reclamation Committee

- NRCS and Rio Grande Conservation District employees, Steve Russell and Mark Haugen joined the Creede City Council held a meeting for the purposes of beginning to address Willow Creek below Creede (1997).
- Creede Resources, Inc. offers lower Willow Creek Floodplain to City of Creede (1998).

WCRC Goals

- 1) **Protect the Rio Grande from future fish kills** associated with nonpoint source releases during unusual hydrologic events
- 2) **Improve the visual and aesthetic aspects** of the Willow Creek watershed and its historical mining district
- 3) Implement appropriate and cost-effective **flood control** and stabilization measures for nonpoint sources
- 4) Protect and preserve **historic structures**
- 5) **Reclaim the Willow Creek floodplain** below Creede to improve the physical, chemical, biological, and aesthetic qualities of the creek as an integral part of the local community
- 6) Continue to **improve water quality and physical habitat** quality in the Willow Creek watershed as part of a long-term watershed management program

1998-2003

WCRC applies for a series of grants to identify problems within the Creede Mining District and Willow Creek.

Efforts were aimed at:

1. Identifying sources of heavy metals
2. Characterizing transport of heavy metals to surface waters
3. Quantifying heavy metals loading to Willow Creek and the Rio Grande River
4. Characterizing mine waste materials
5. Biological assessment of aquatic resources
6. Characterizing hydrological conditions in underground mine workings



Underground Investigations

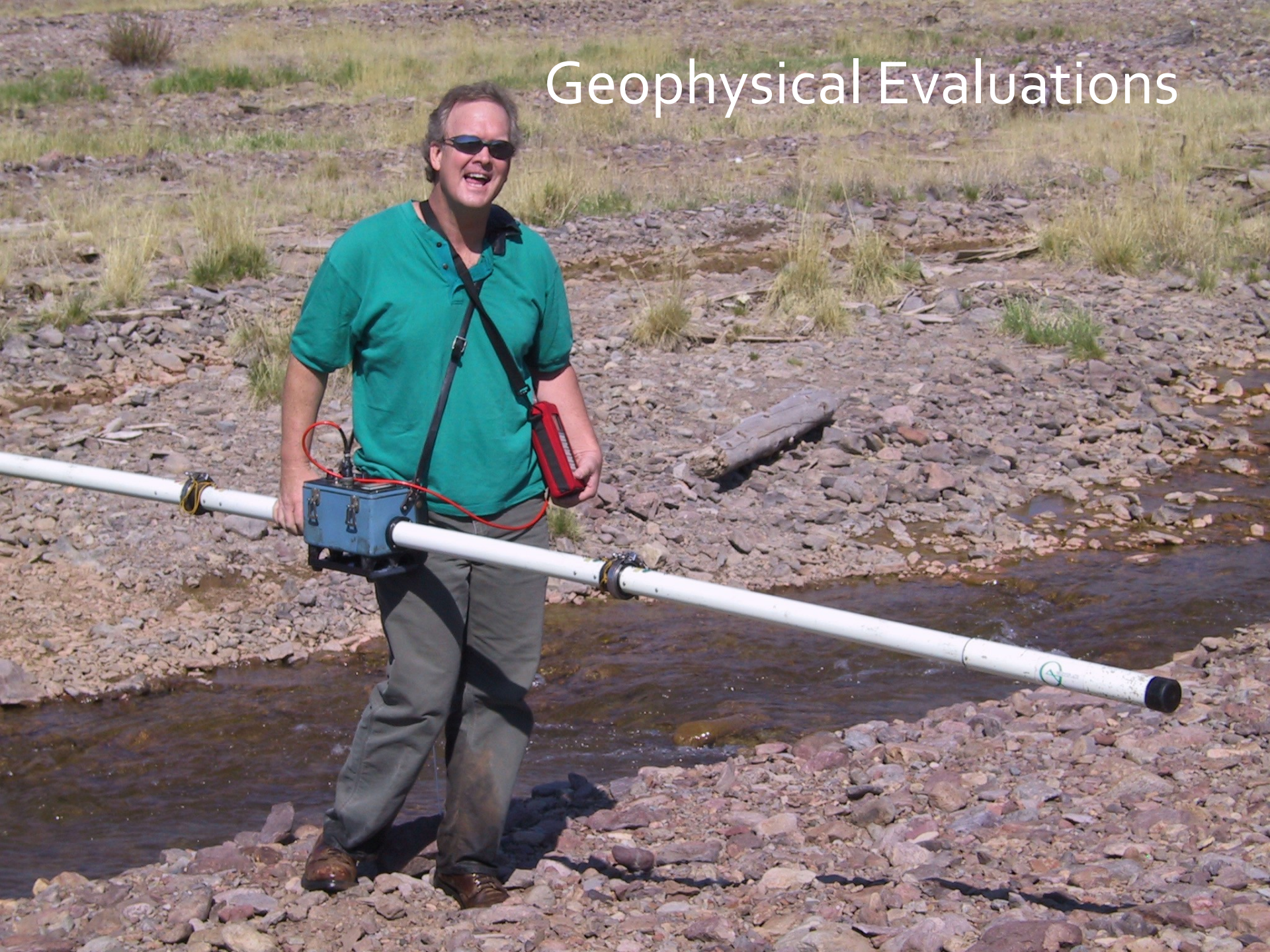
Surface Water Sampling





Biological Evaluations

Geophysical Evaluations



(1) Report on Surface and Groundwater Sampling and Monitoring in Willow Creek Watershed, Mineral County, CO (1999-2002)

(2) Report on Characterization of Groundwater in the Alluvial Deposits beneath the Floodplain of Willow Creek below Creede

(3) Report on Characterization of Waste Rock and Tailings Piles above Creede, Colorado

(4) Report on Characterization of Fish and Aquatic Macroinvertebrates in Willow Creek

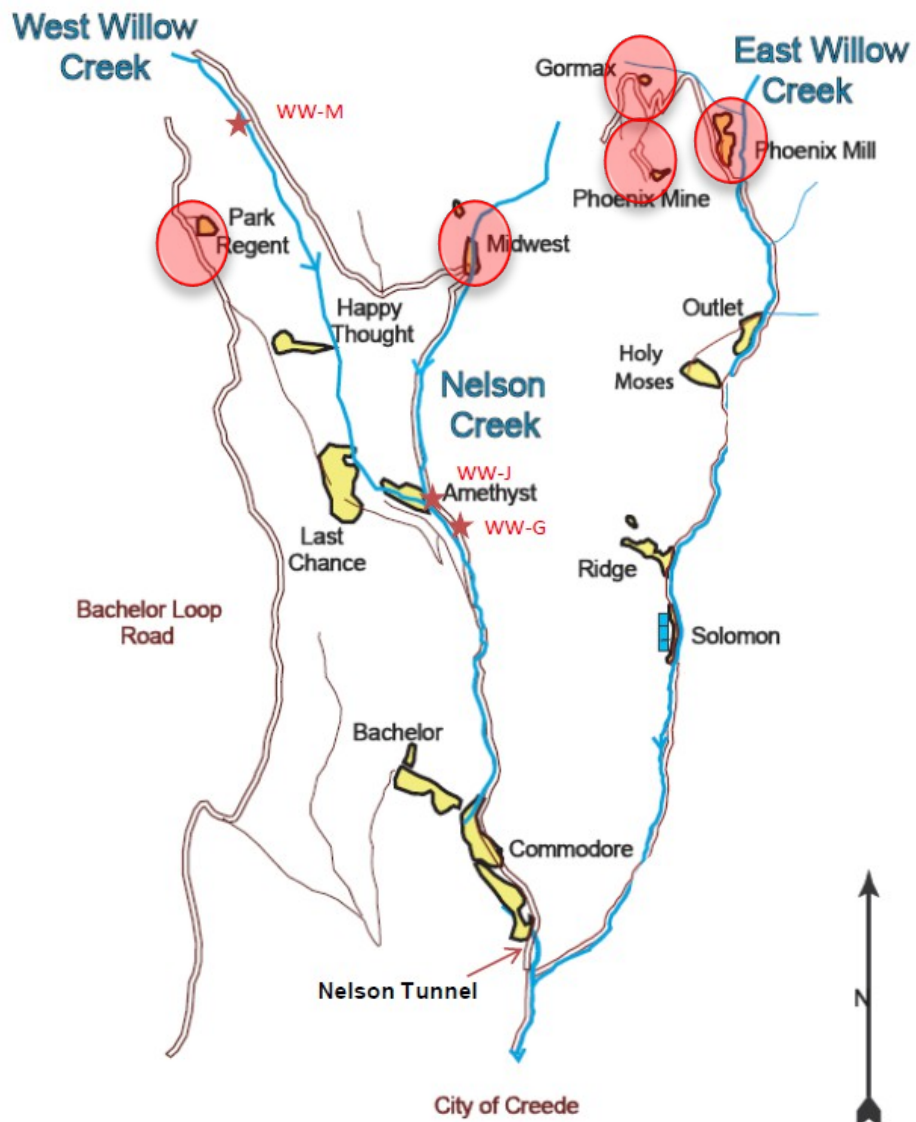
(5) Evaluation of Metal Loading to Streams near Creede, Colorado

Projects that Worked

The Fives Mines Project

(Reclamation of 5 Tailings/Waste Piles)

- Park Regent Mine
- Midwest Mine
- Gormax Mine
- Phoenix Mine
- Phoenix Park Mill Site



Park Regent Mine









Phoenix Park
Mine



Phoenix Park
Mill Site



Phoenix Park Mill Site



Midwest Mine





Nelson Tunnel Dewatering



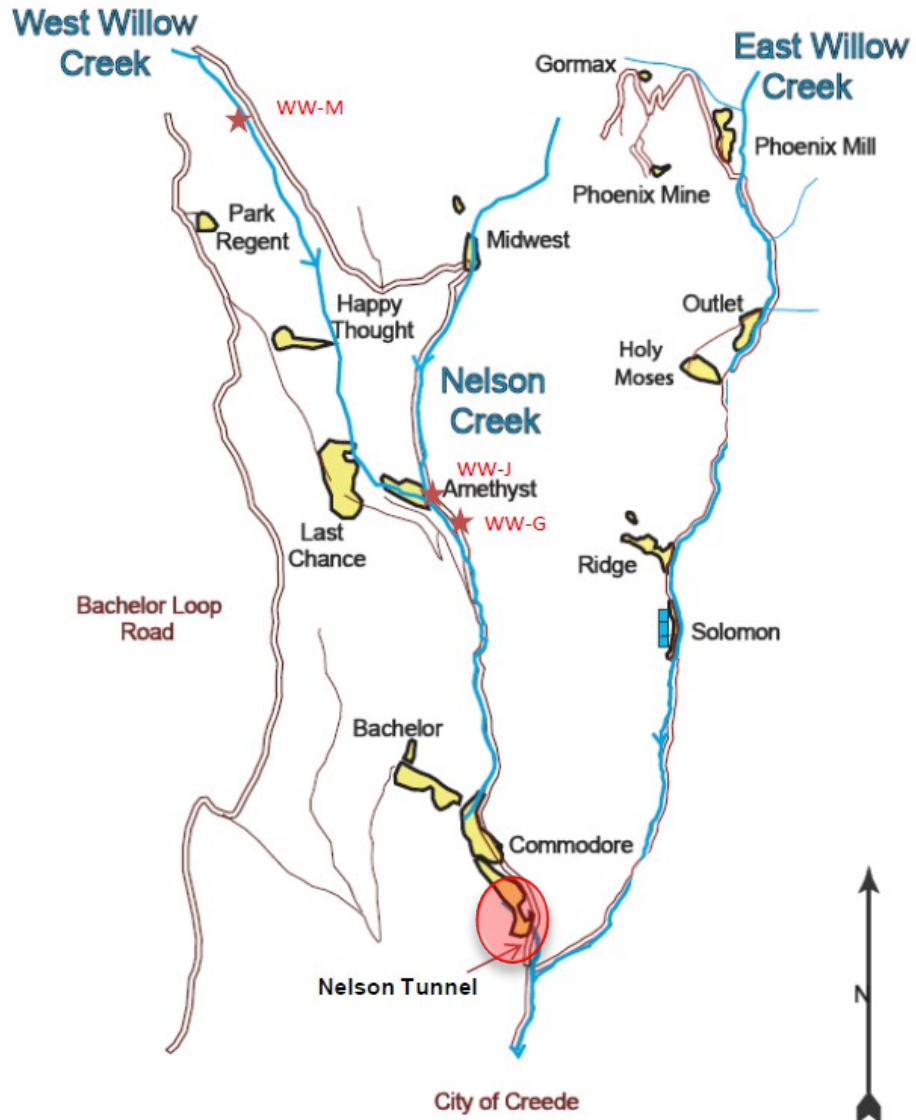
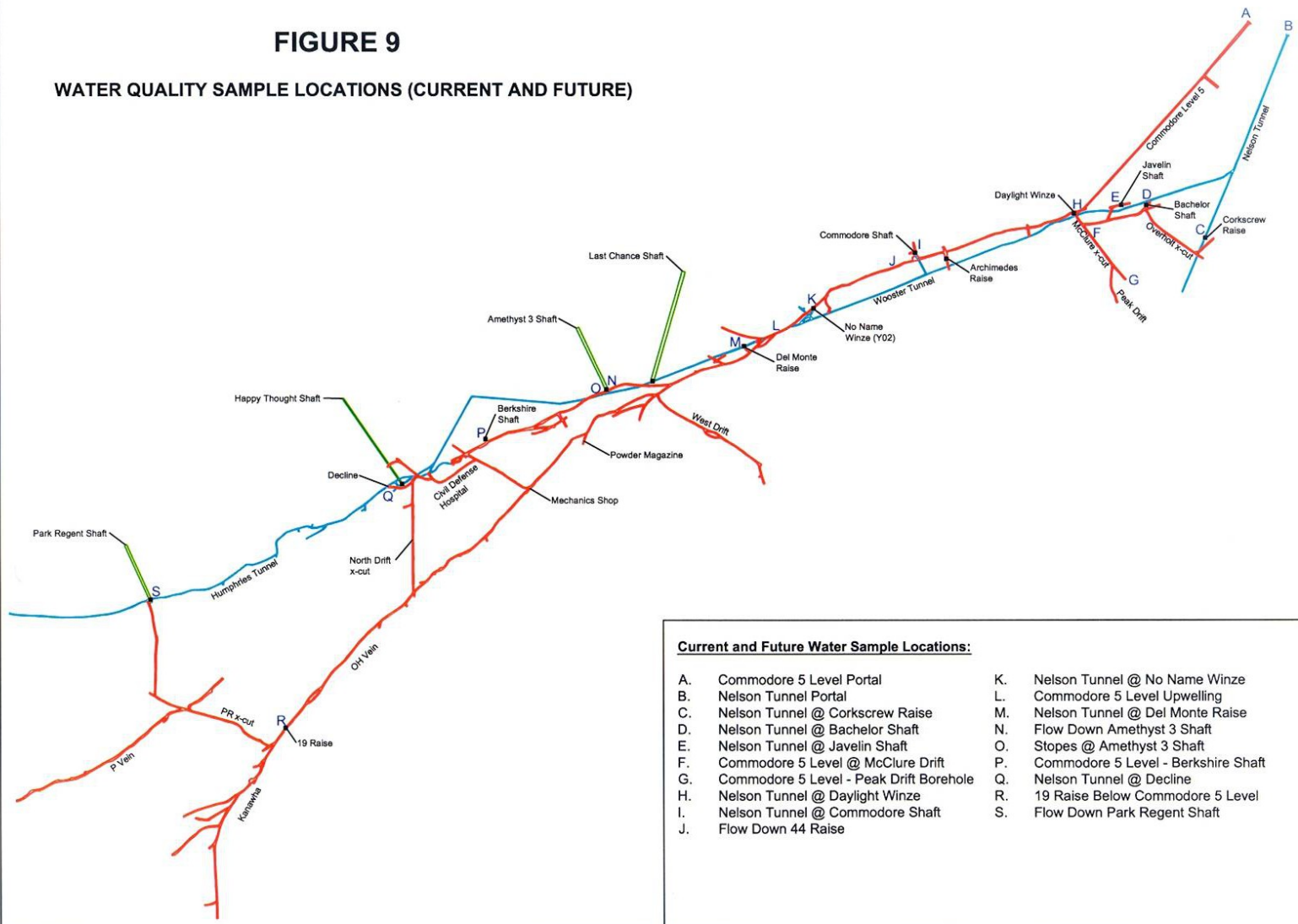


FIGURE 9

WATER QUALITY SAMPLE LOCATIONS (CURRENT AND FUTURE)



Current and Future Water Sample Locations:

- | | |
|--|--|
| A. Commodore 5 Level Portal | K. Nelson Tunnel @ No Name Winze |
| B. Nelson Tunnel Portal | L. Commodore 5 Level Upwelling |
| C. Nelson Tunnel @ Corkscrew Raise | M. Nelson Tunnel @ Del Monte Raise |
| D. Nelson Tunnel @ Bachelor Shaft | N. Flow Down Amethyst 3 Shaft |
| E. Nelson Tunnel @ Javelin Shaft | O. Stopes @ Amethyst 3 Shaft |
| F. Commodore 5 Level @ McClure Drift | P. Commodore 5 Level - Berkshire Shaft |
| G. Commodore 5 Level - Peak Drift Borehole | Q. Nelson Tunnel @ Decline |
| H. Nelson Tunnel @ Daylight Winze | R. 19 Raise Below Commodore 5 Level |
| I. Nelson Tunnel @ Commodore Shaft | S. Flow Down Park Regent Shaft |
| J. Flow Down 44 Raise | |

May 24, 2005







↑

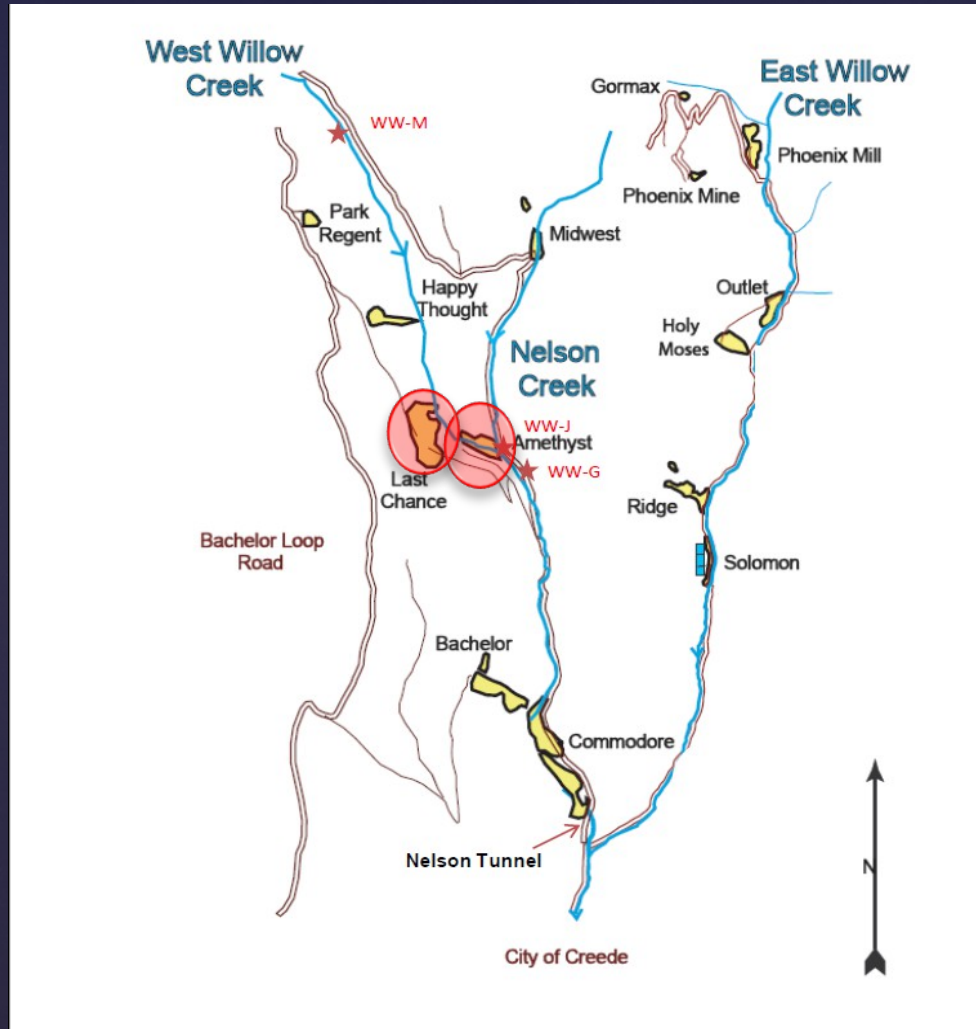








Amethyst and Last Chance Clean Up





Amethyst/Last Chance Mines before reclamation

Amethyst Clean Up Site

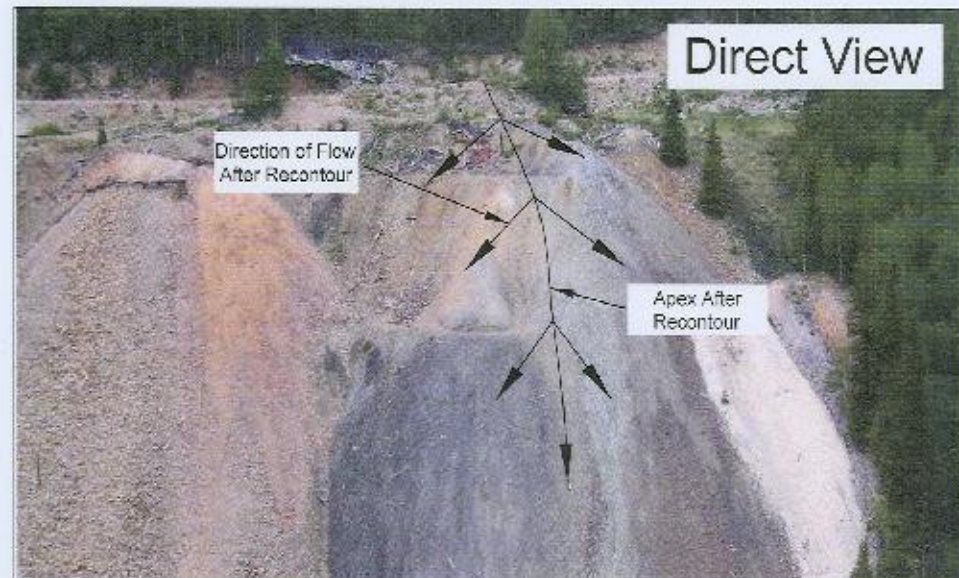


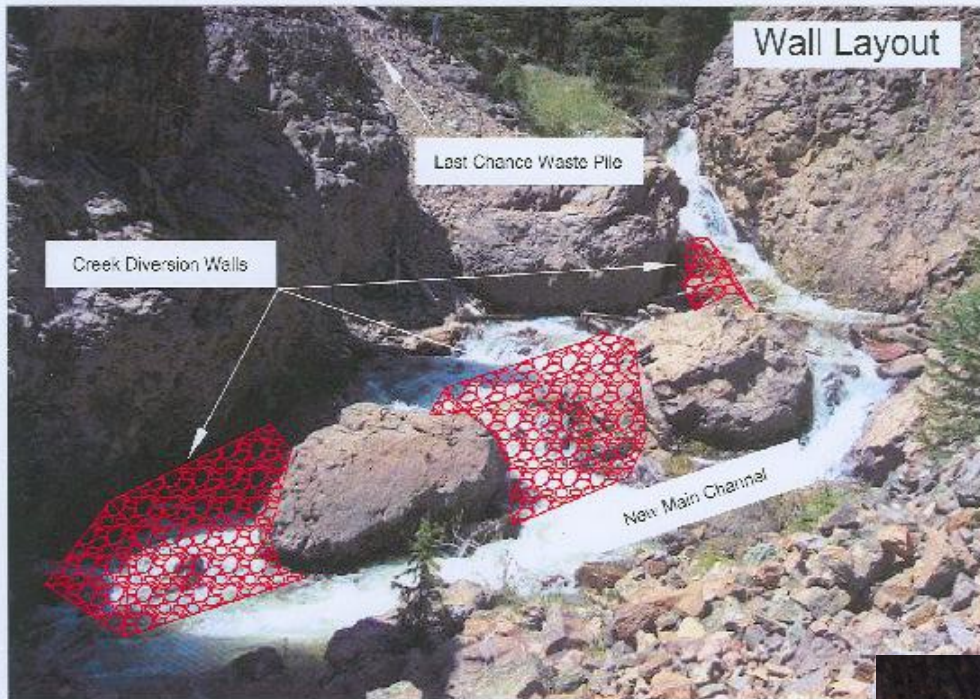




Last Chance Cleanup







The Lower Willow Creek Floodplain Project 2008-Present



0 500 1,000 1,500 2,000 2,500 Feet
aerial imagery taken 10/5/1939

1939



Legend
[Red Outline] Proposed Project Area

0 500 1,000 1,500 2,000 2,500 Feet
aerial imagery taken 9/12/1985



1985



Legend
[Red Outline] Proposed Project Area

June 20, 2011



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Thank You

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