

Geochemical Fingerprinting of Historic Legacy Mine Sources - Jordan Creek Mining District

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Agenda

1

Site Background and History

2

Geochemical Study Objectives

3

Preliminary Thoughts on Legacy Impacts

4

Spatial and Temporal Analysis

5

Groundwater/ Surface Water Interaction

OREGON

IDAHO

- Historic Mining District 1863 to 1914
- Ownership 1977-1993 – Earth Resources and NERCO
- 1993 – Kinross purchase NERCO property from Kennecott
- Kinross production 1993-1998
- Care & Maintenance 1999-2002; Closure began in 2003

Jordan Valley ★

Jordan
Creek

DeLamar

Florida
Mountain

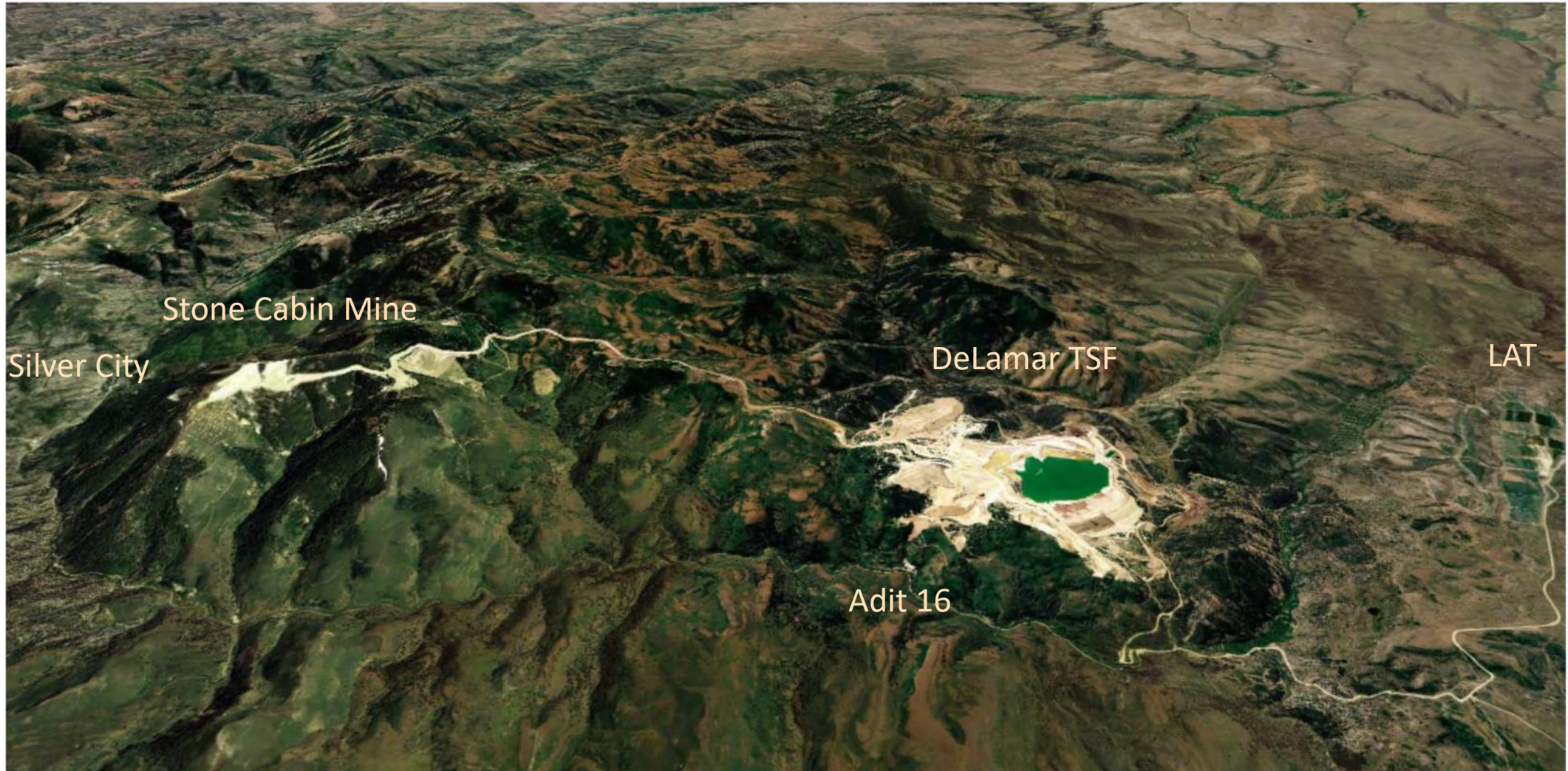
★ Silver City

War
Eagle

War Eagle is not part of the DeLamar Project but provides historical context.



DeLamar Site 2006



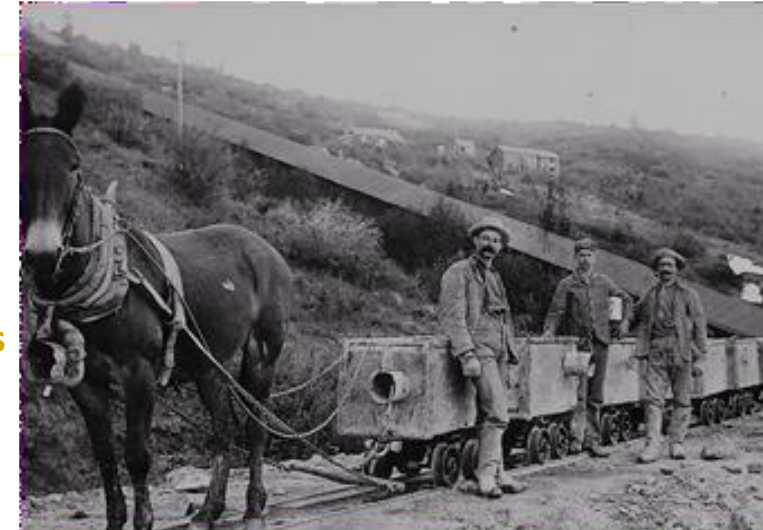


Discovery and Early History 1863 to 1876



Silver City occupies a flat area along Jordan Creek below War Eagle Mountain. This photograph was taken in the summer of 1868.

Placer Gold was discovered in Jordan Creek 1863 and from there followed upstream to Silver City where high-grade veins were found.





DeLamar and Florida Mountain 1876-1914



High grade veins at DeLamar and Florida Mountain discovered in 1889





DeLamar and Florida Mountain 1930-1999

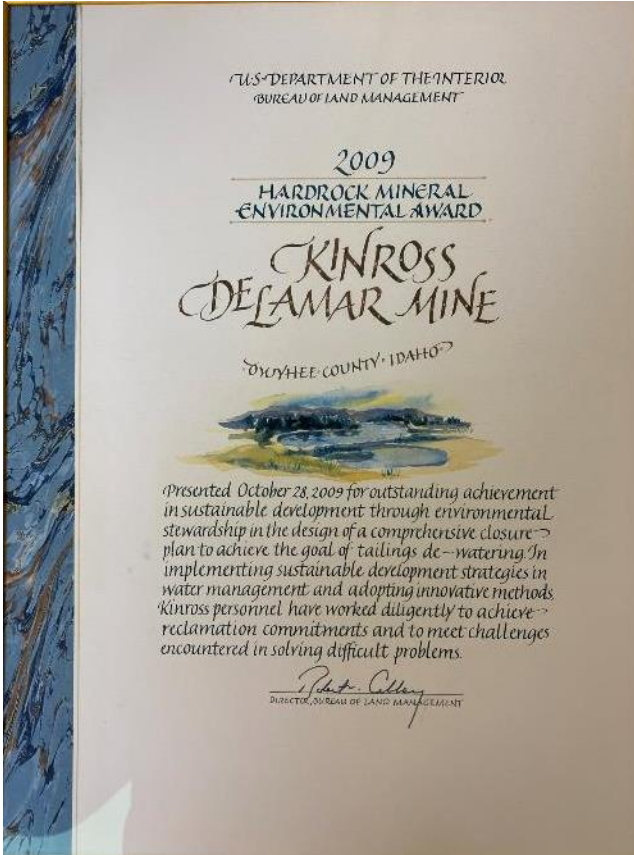


- Mining properties in the DeLamar project area were largely inactive from 1942 until the mid-1960s.
- In 1977, Earth Resources commenced operation of the DeLamar silver-gold mine.
- In September of 1984, the NERCO Minerals Company Inc. purchased interest in the DeLamar project and became the operator of the joint venture.
- NERCO was purchased by the Kennecott Copper Corporation in 1993. Two months later in 1993, Kennecott sold its 100% interest in the DeLamar mine and property to Kinross.
- Kinross ceased exploration work in 1997 and mining was halted at the end of 1998 due to unfavorable metal prices.
- In 1999, milling ceased and Kinross placed the DeLamar mine on care and maintenance. Mine closure activities commenced in 2003.





Kinross Reclamation Activities



In 2004 a closure plan, a water management plan and five engineering design plans were submitted and approved.





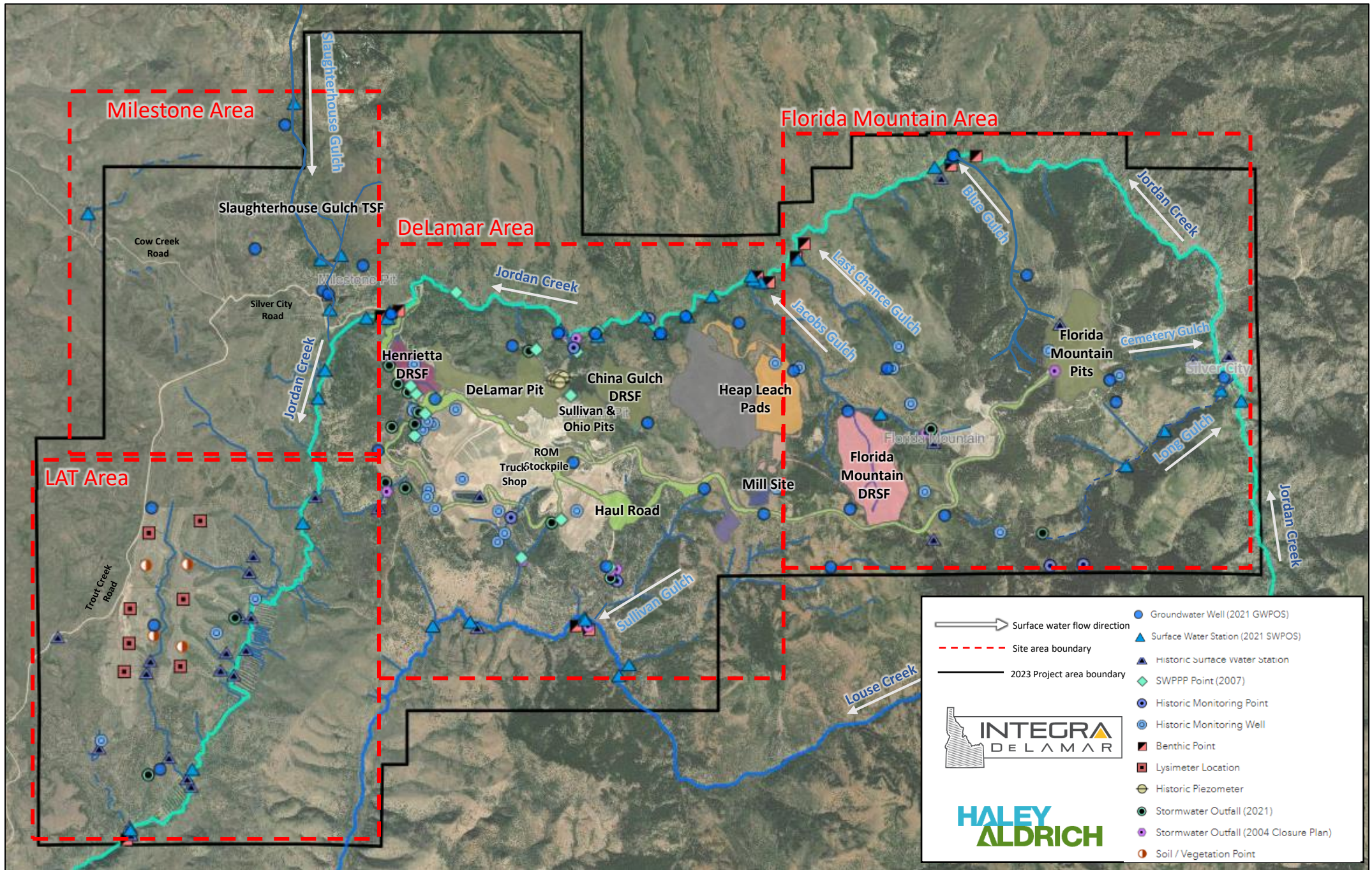
DeLamar and Florida Mountain Today



Objectives of Geochemical Studies

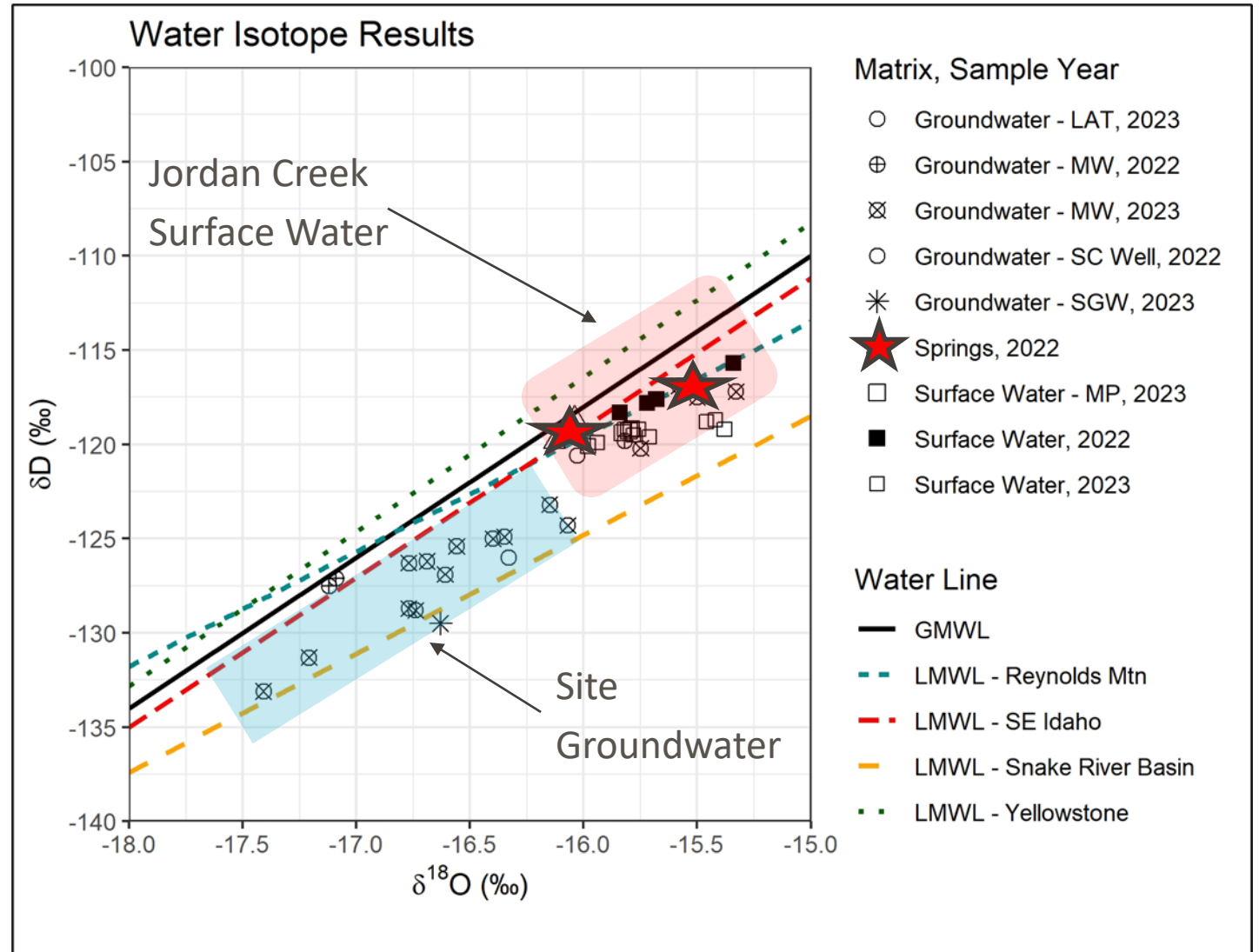
- ★ • Delineate and differentiate between legacy mining impacted areas:
 - Pre- 1940s era mining
 - Post 1970s era mining

} Exploit differences in mining methods
- Determine background conditions for regulated constituents
- ★ • Derive source waters for large perennial seeps and springs
- ★ • Develop understanding for groundwater/ surface water interactions for expansive legacy underground workings near Florida Mountain Pit (3-phase approach).



Origin of Seeps and Springs Investigation

- Investigated two springs East of Florida Mountain near Silver City, ID
- Analyses: stable Isotopes of water and radon concentrations.
- Data suggest source of water to the springs is upper Jordan Creek surface water

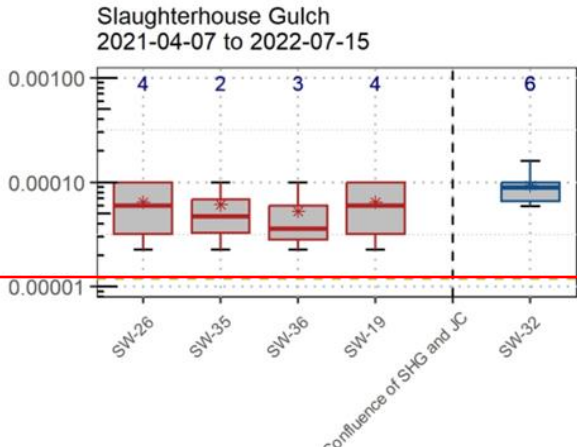
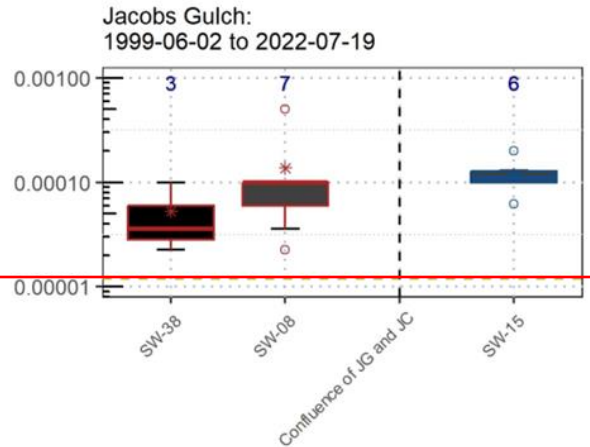
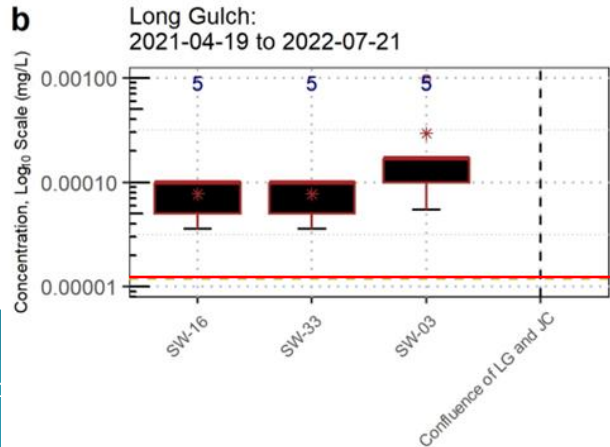
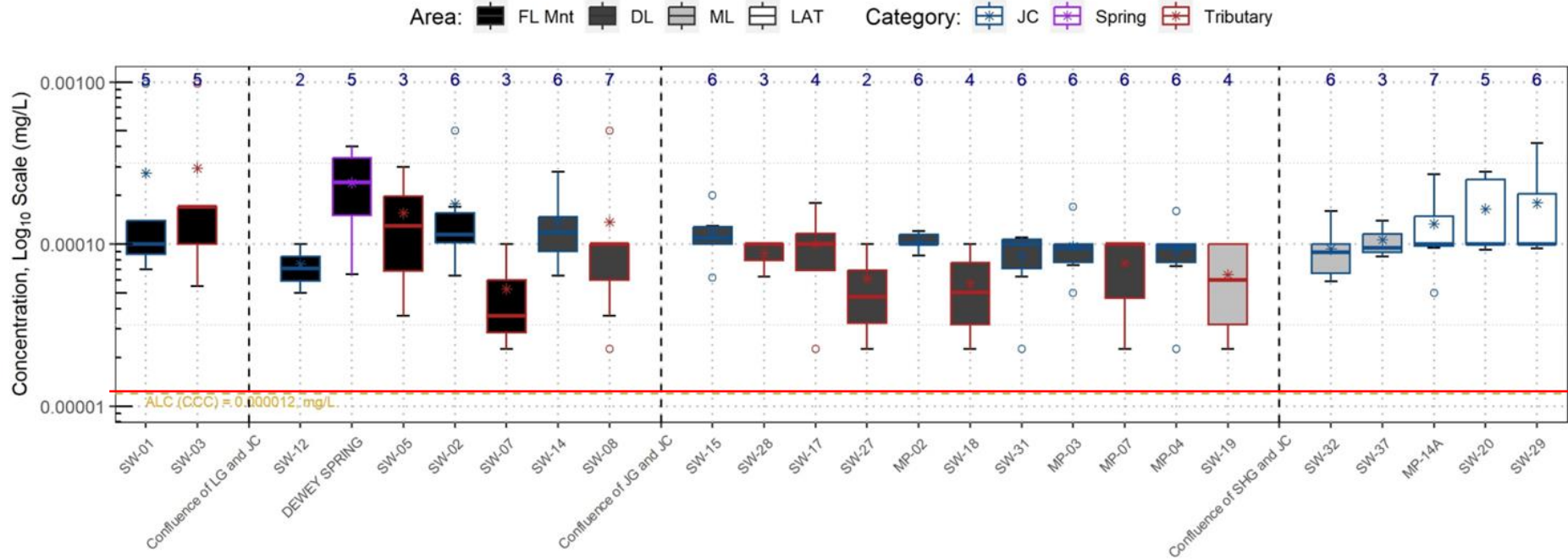


Legacy Mining Impacts (Preliminary Thoughts)



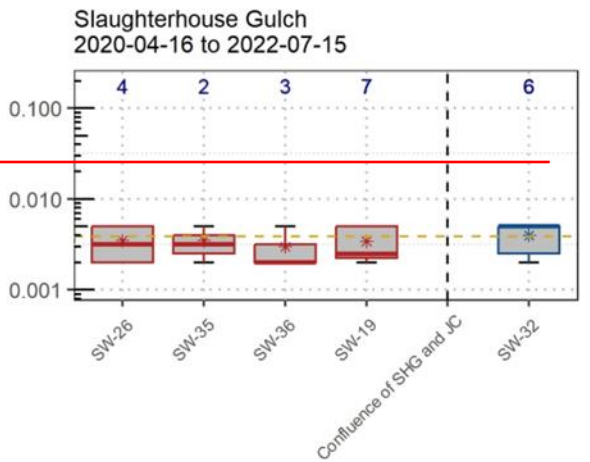
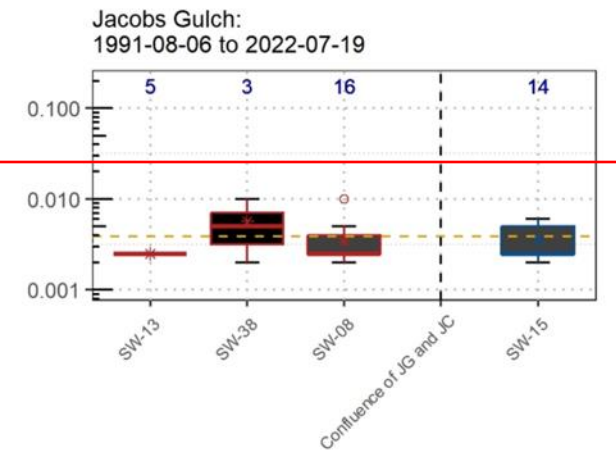
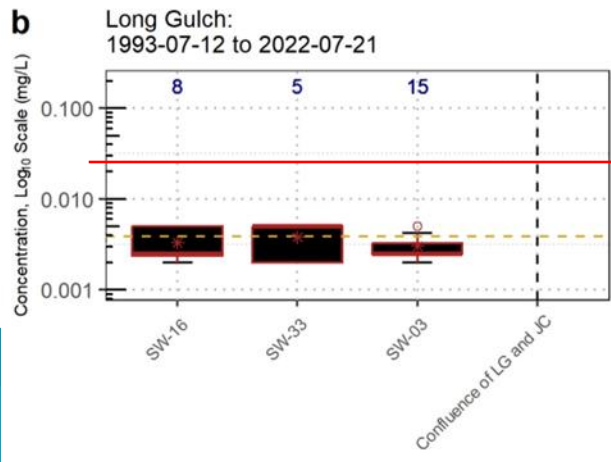
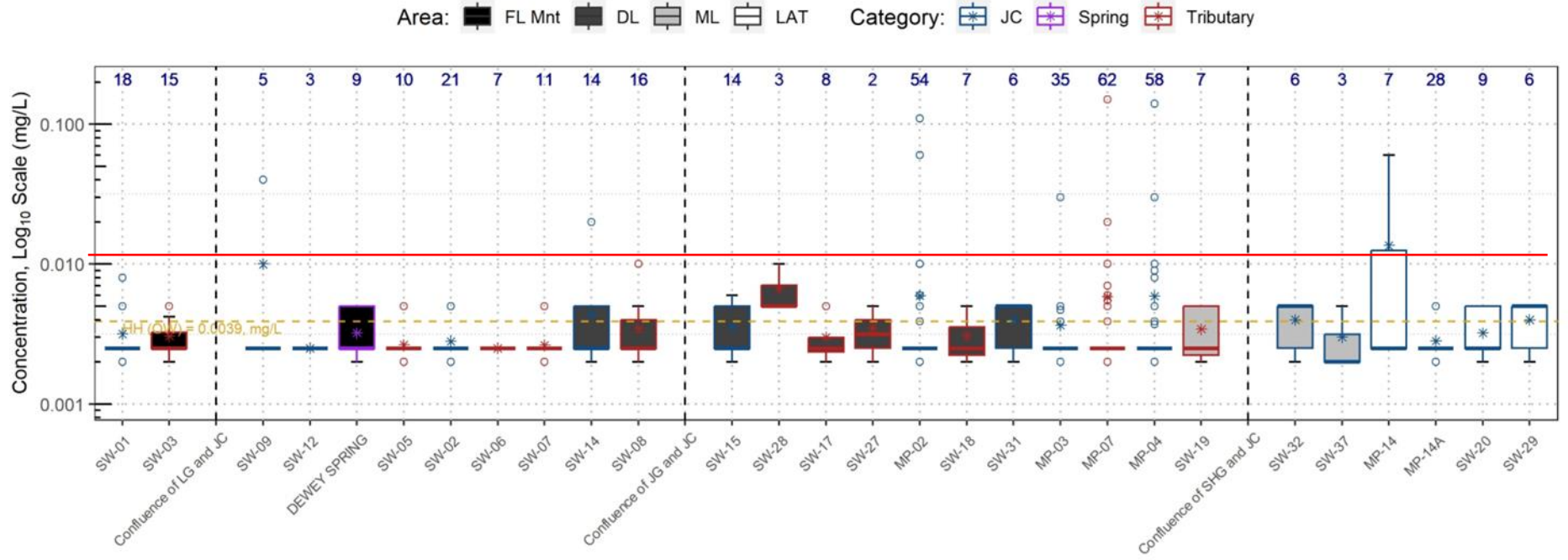
Pre-1940s era Mining Impacts: Total Mercury in Surface Water

Jordan Creek Upstream to Downstream

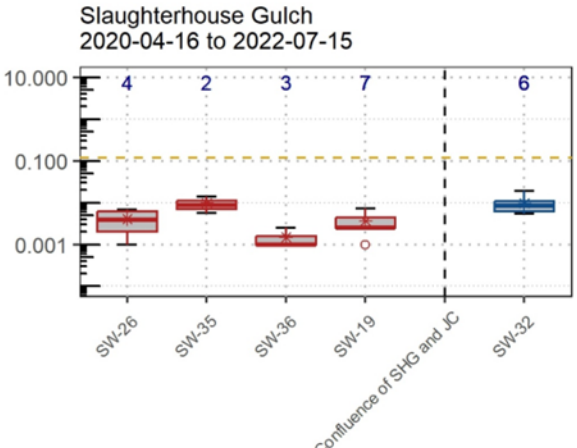
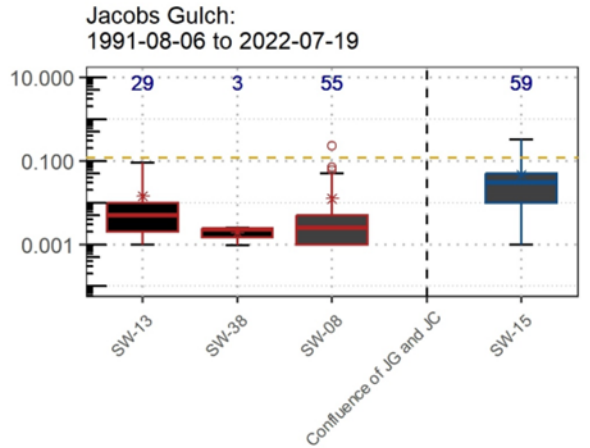
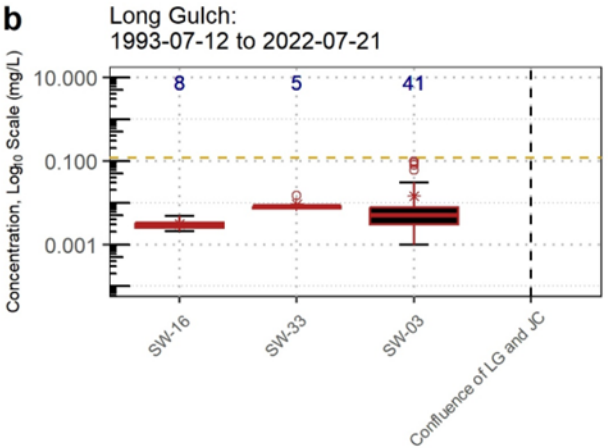
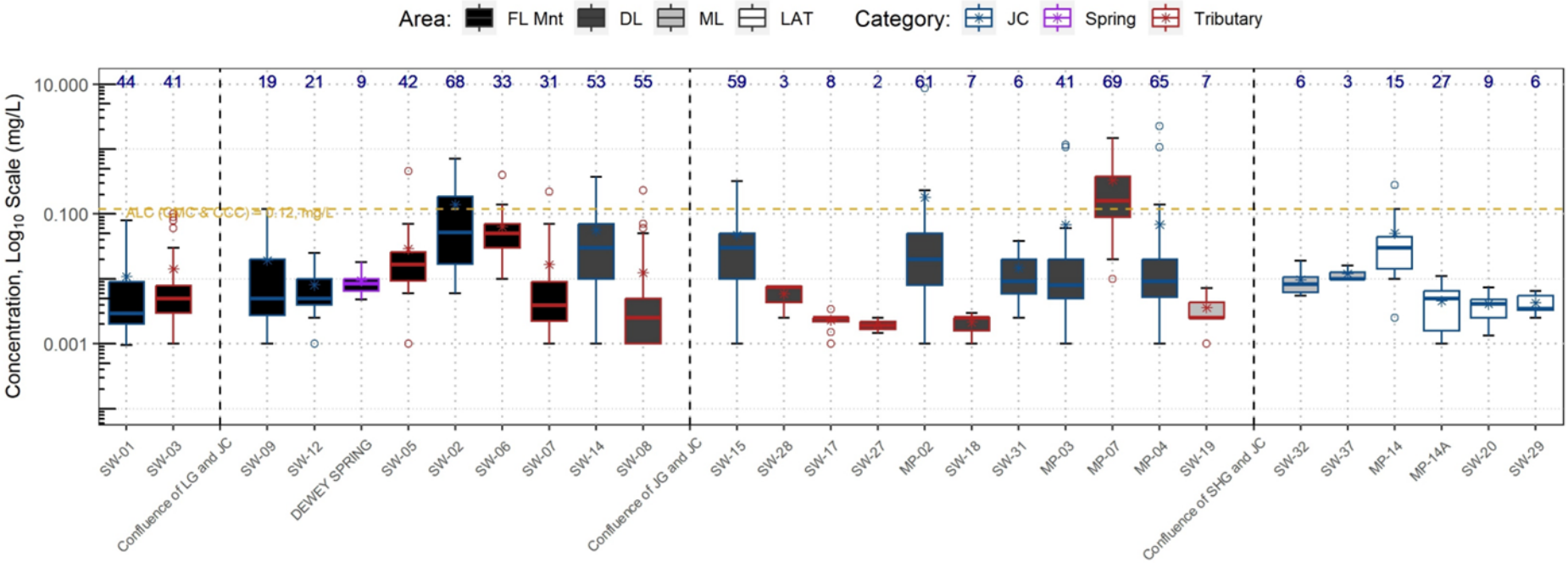


Post-1970s era Mining Impacts: Cyanide in Surface Water

Jordan Creek Upstream to Downstream



Over Water Quality Impact from Historic Mining, Dissolved Zinc

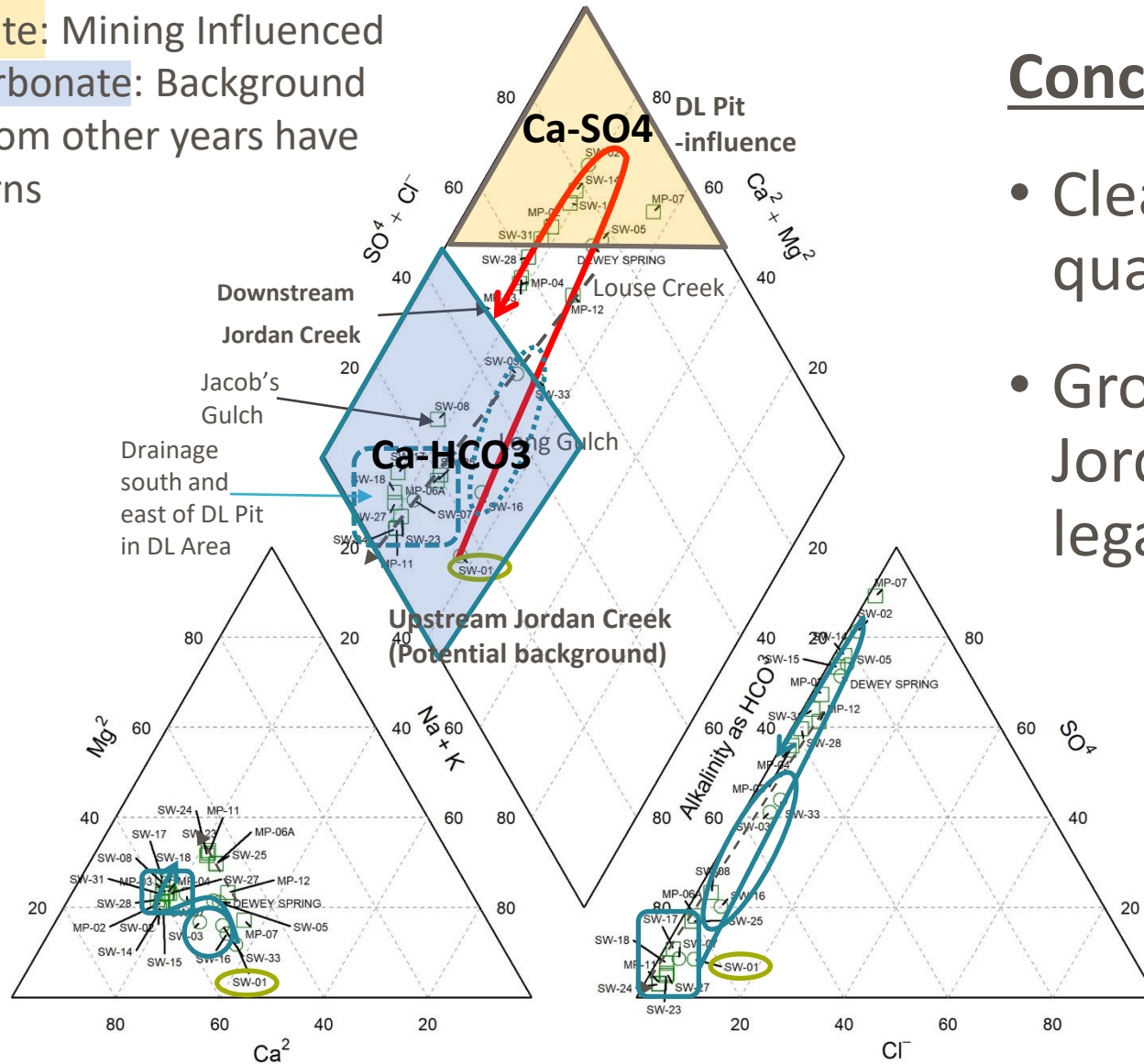


Spatial and Temporal Changes



Spatial Geochemical Evolution Along Flow Path (2022)

- Calcium-sulfate: Mining Influenced
- Calcium-bicarbonate: Background
- Piper plots from other years have similar patterns



Conclusions

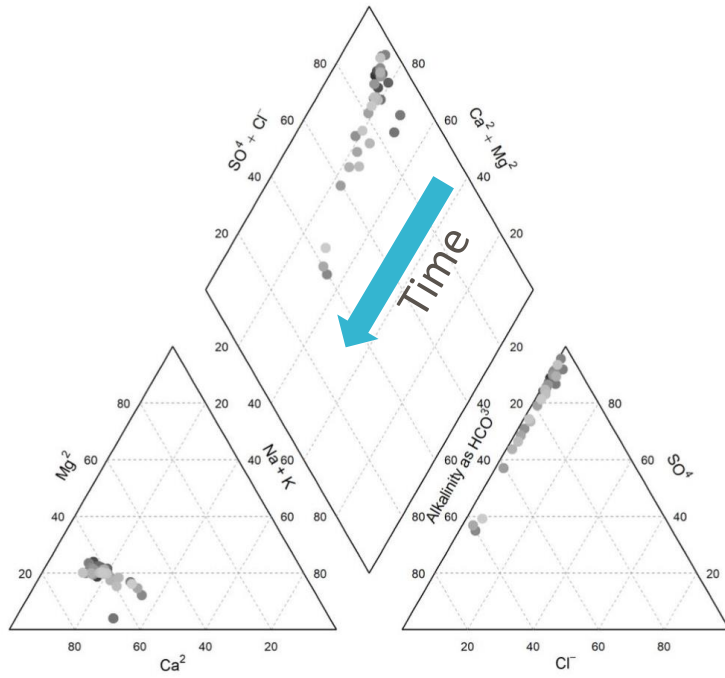
- Clear chemical evolution of water quality along flow-path
- Groundwater and surface water in Jordan Creek remains impacted by legacy mining impacted water.

Temporal Geochemical Evolution (1990 - 2022)

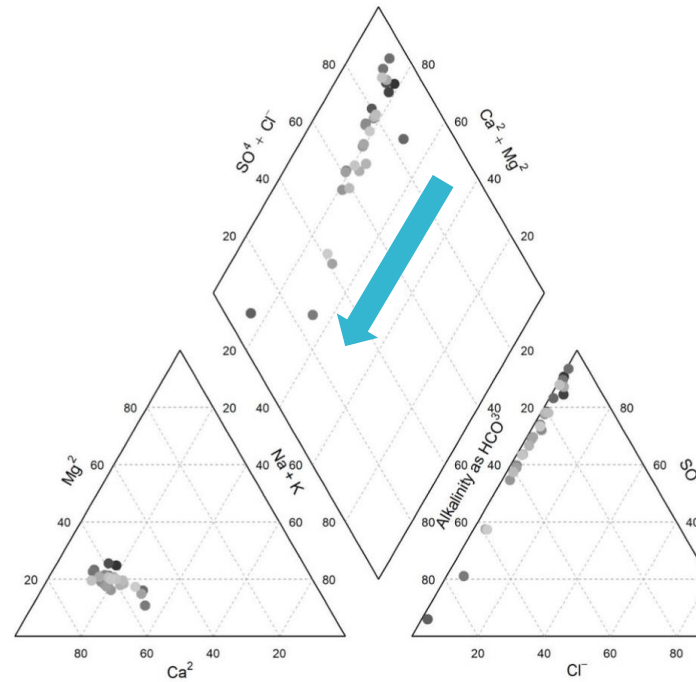
factor(Year)

- 1990 ● 2005
- 1991 ● 2006
- 1992 ● 2007
- 1993 ● 2008
- 1994 ● 2009
- 1995 ● 2010
- 1996 ● 2011
- 1997 ● 2012
- 1998 ● 2013
- 1999 ● 2014
- 2000 ● 2015
- 2001 ● 2020
- 2002 ● 2021
- 2003 ● 2022
- 2004

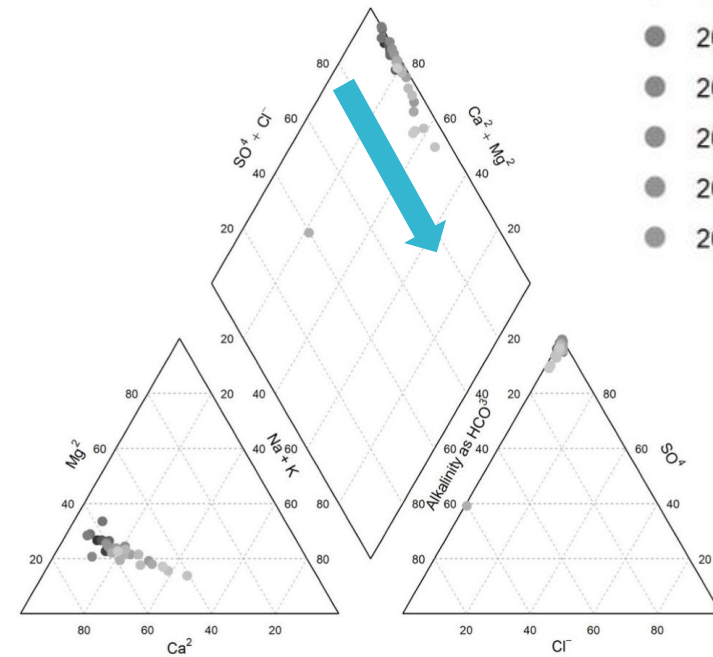
Jordan Creek
Florida Mountain
SW-02



Jordan Creek
DeLamar
SW-15



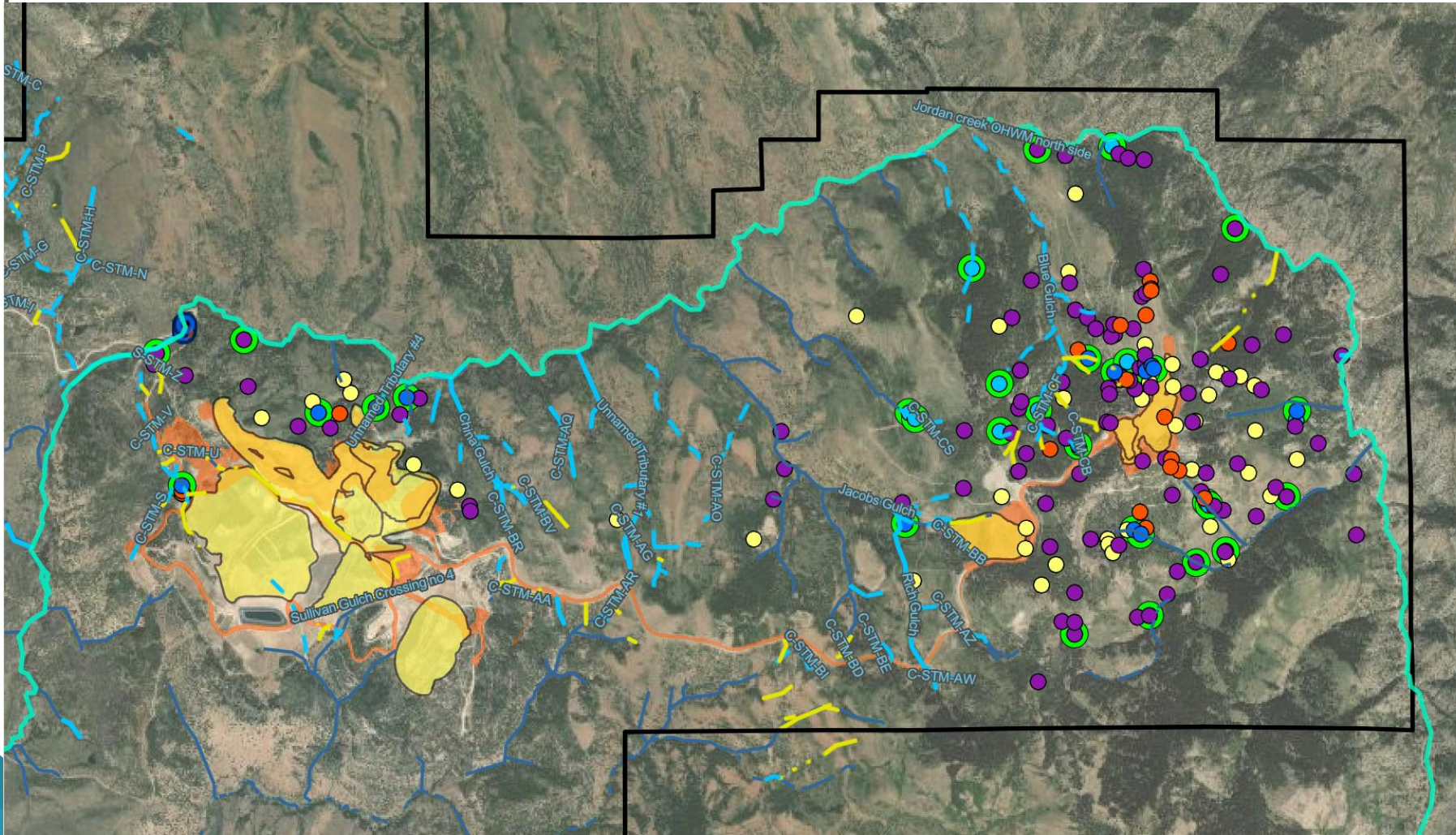
Jordan Creek Tributary
Henrietta Gulch
MP-07



GROUNDWATER/ SURFACE WATER INTERACTION Seep/ Spring Study: Phased Approach



PHASE I: Adit and Spring Prioritization



LEGEND

ADIT/ SEEP INVENTORY

- verified wet
- verified dry
- flow likely, unverified
- likely dry, unverified
- limited info

Geochem sample



PHASE II: Long-Term Monitoring/ Geochemical Sampling

SEEPAGE FACES



BACKGROUND COLLECTION PONDS



PHASE II: Long-Term Monitoring/ Geochemical Sampling

- Long-term remote monitoring stations
 - Staff gages
 - Pressure/ conductivity transducers
- **Water Quality**: for a full geochemical suite of metals, major anions/cations, minor and trace elements, redox and fingerprint indicator parameters.

Historic Flowing Mine Adit Location



Phase III: Tracer Study



QUESTIONS

You Are Here

