

Mancos River – Assessment of metal sources, mobilization, and potential for downstream toxicity



Colin Larrick

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Water Quality Program Manager
Ute Mountain Ute Tribe

Kirstin Brown

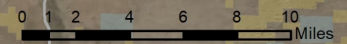
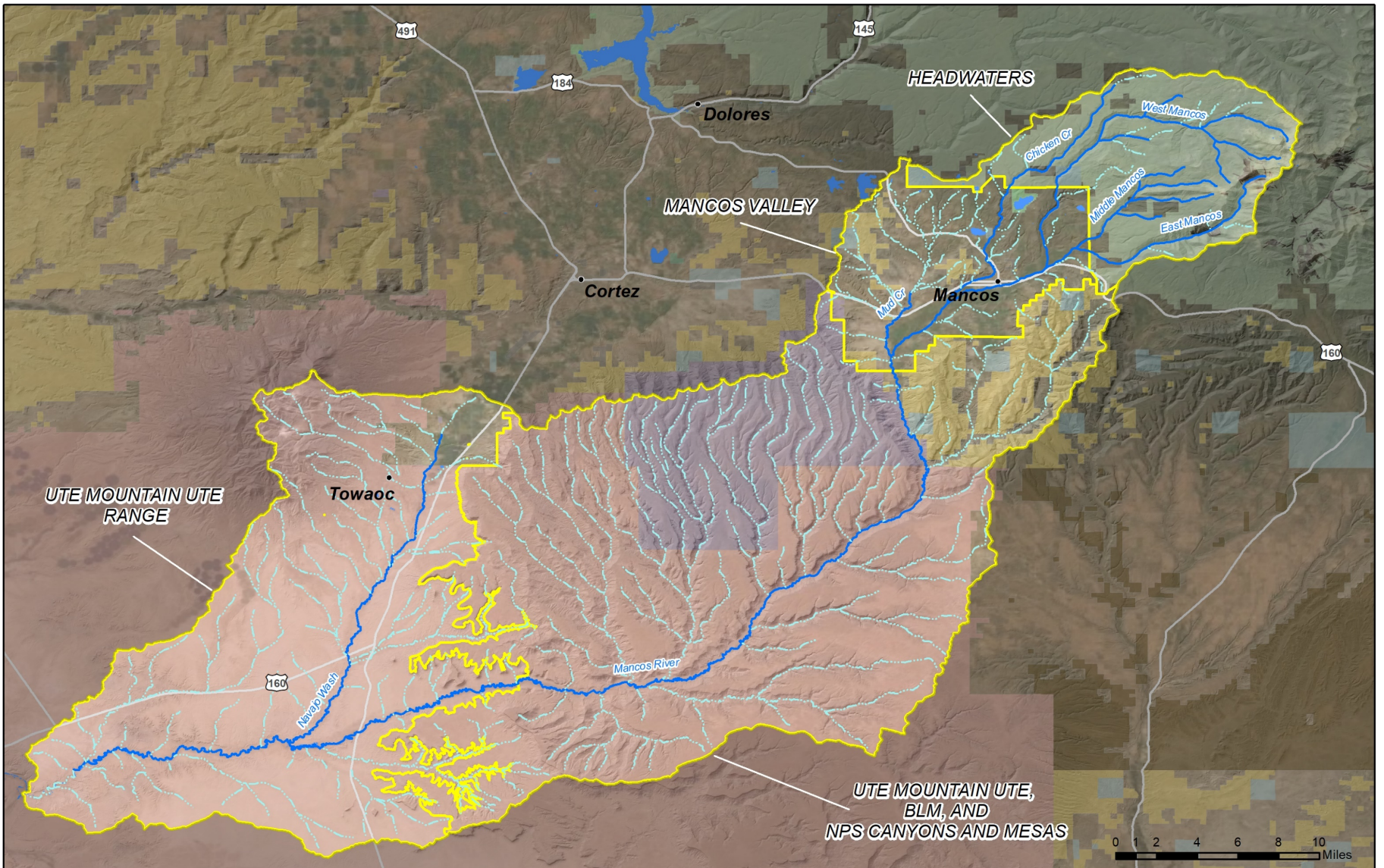
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Division of Reclamation
and Mining Safety

Scott Roberts

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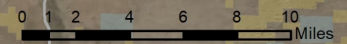
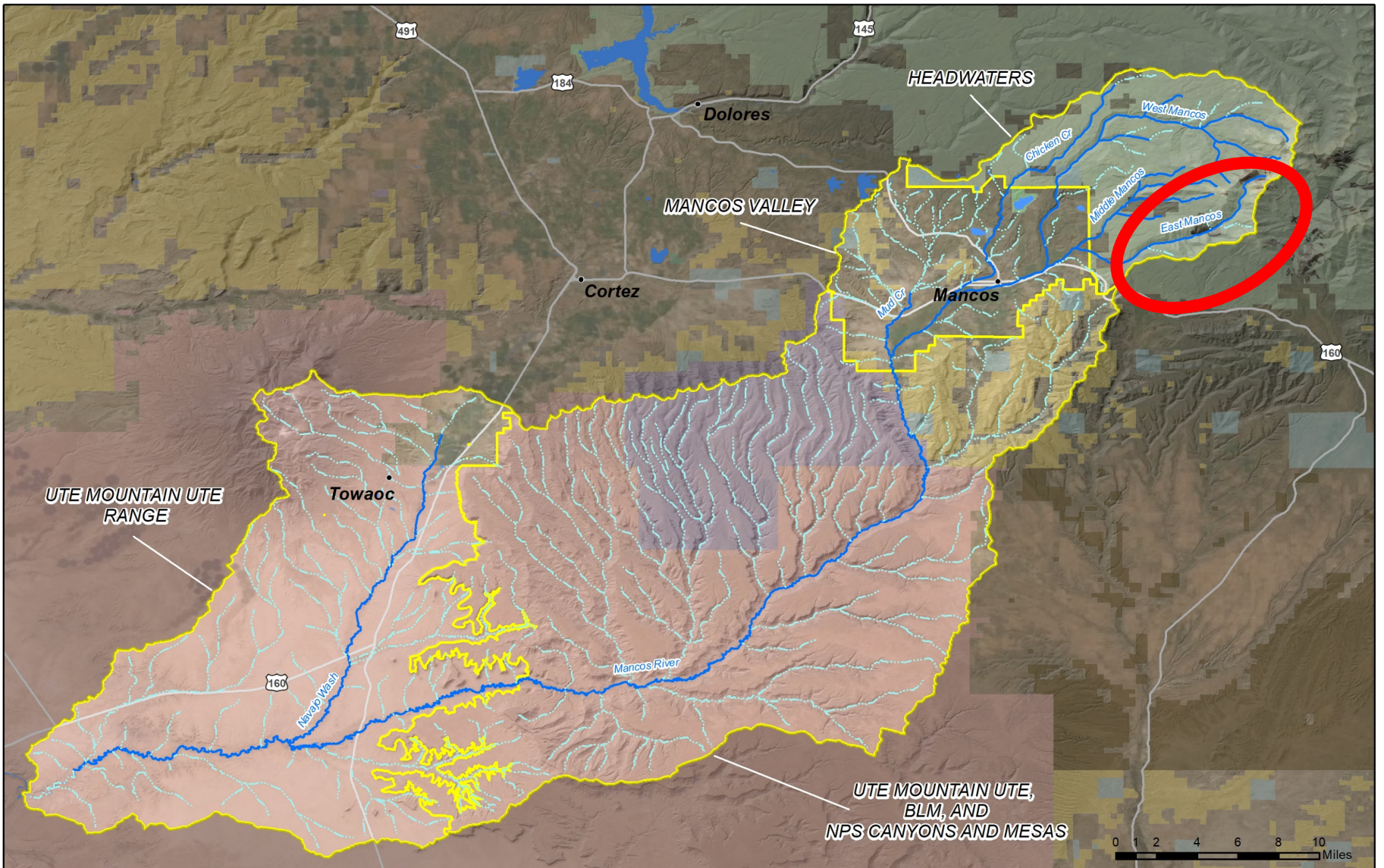
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Mancos River Watershed Regions

- Intermittent Surface Water
- Perennial Surface Water
- Open Water
- Mancos Watershed Regions
- BLM
- BOR
- NPS
- Private
- State
- Southern Ute Tribe
- State, County, City
- USFS
- USFW
- Ute Mountain Ute Tribe





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Natural and legacy mining related sources of metals





East Mancos River

Metal Sources, Aquatic Impacts, Mine Remediation



Win Wright

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M.S. P.E. C.P.H.
Southwest Hydro-Logic



Scott Roberts

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Mountain Studies
Institute



Kirstin Brown

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Draining Mines



Waste Rock



Surface Water

Water Quality Standards

...protective of aquatic life from...



ACUTE
Brief, short-term



CHRONIC
Persistent, long-term

Water Quality Standards

- Simple numeric
- Hardness-based
- Biotic Ligand Model

(incorporates Dissolved Organic Carbon, dissolved major ions, pH, alkalinity)

HAZARD QUOTIENT (HQ)

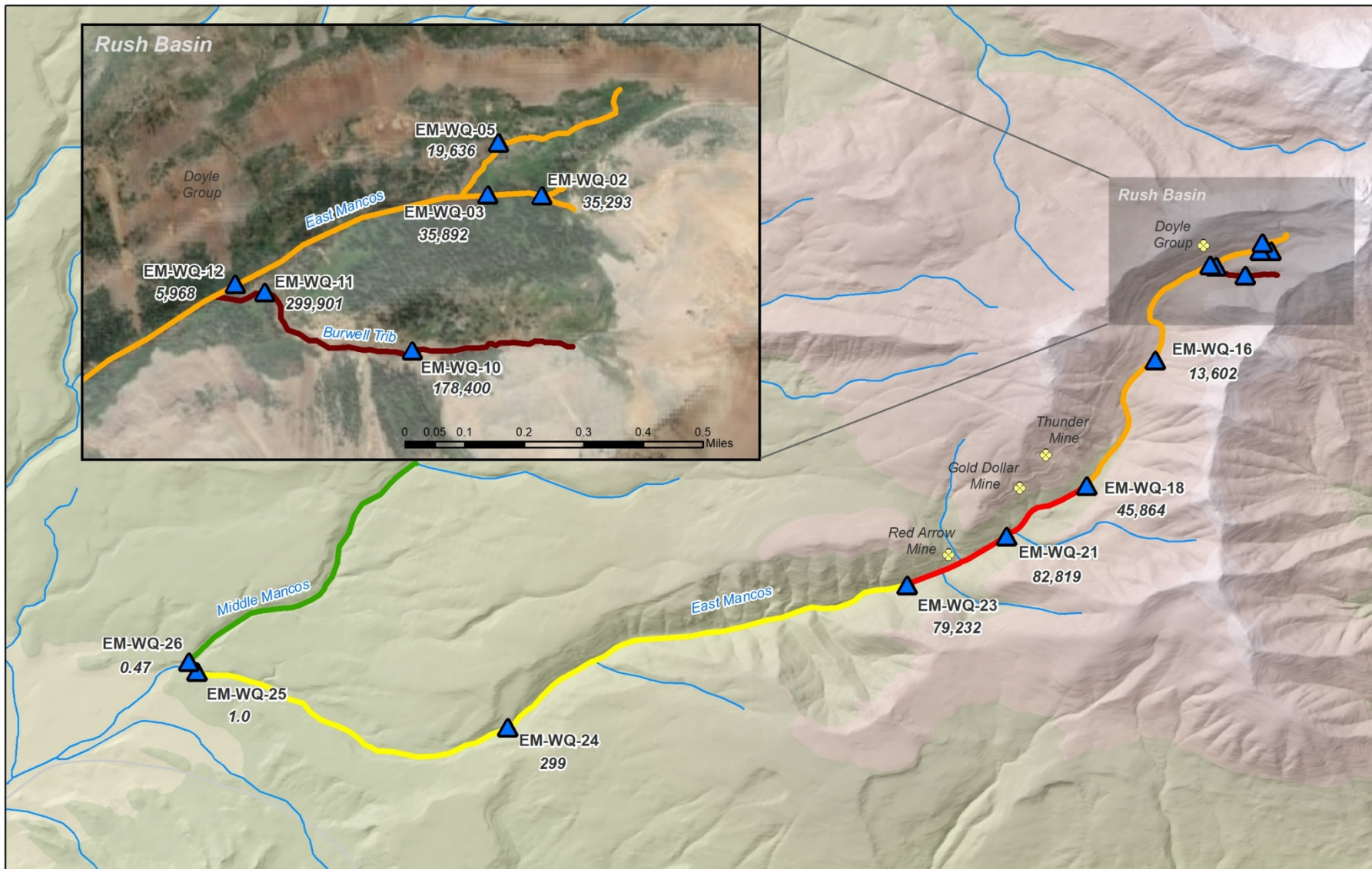
$$\text{HQ} = \frac{\text{Exposure}}{\text{Toxicity Estimate}}$$

Or

How many times greater than
the water quality standard?

HQ > 1.0 = High risk of toxicity

HQ < 1.0 = Low risk of toxicity



East Mancos River

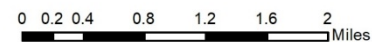
**Low Flow (2018)
Hazard Quotients (HQ)**

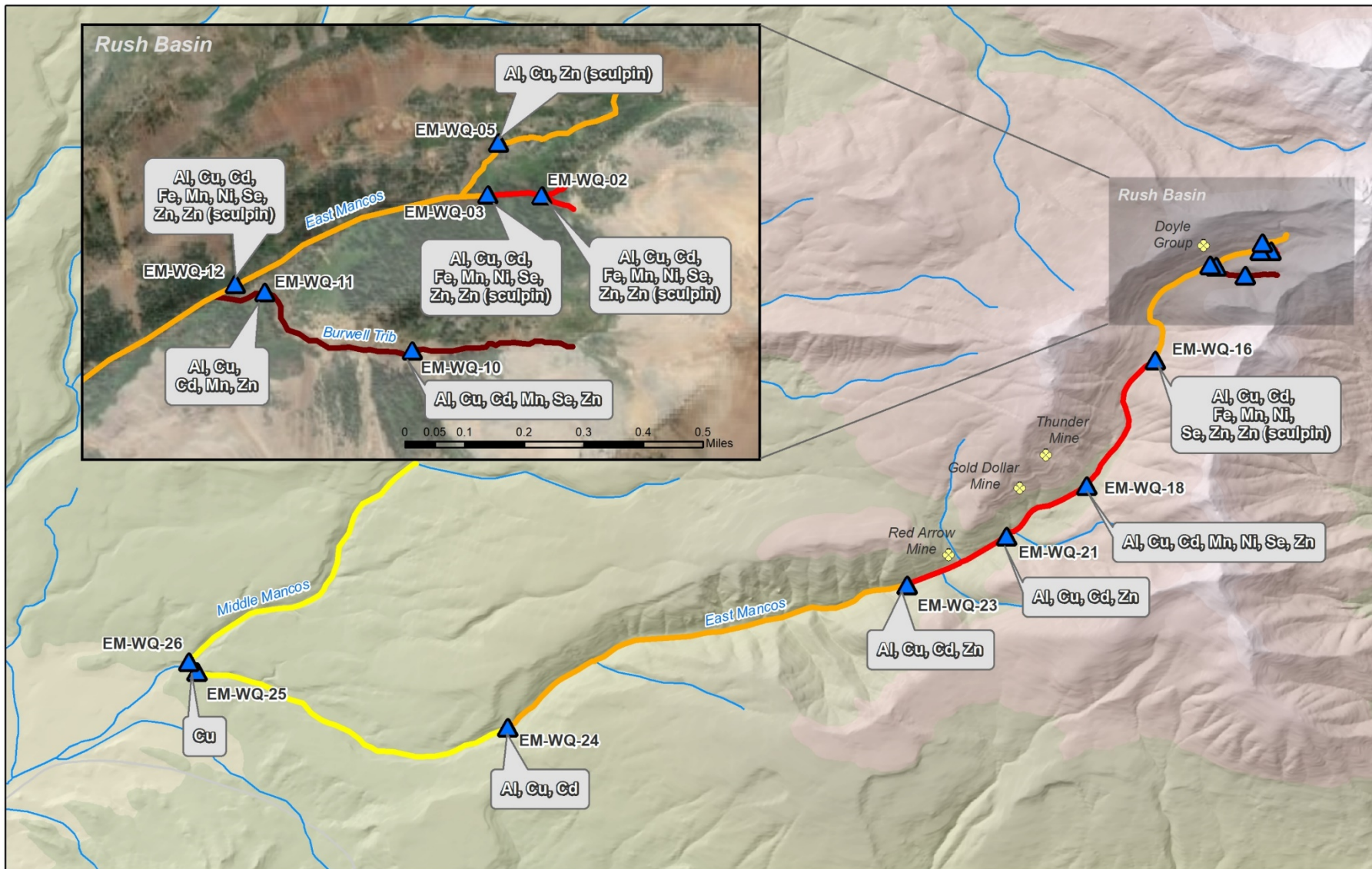


Copper - Chronic Hazard Quotient (Biotic Ligand Model)

- 0 - 1
- 1 - 500
- 500 - 50,000
- 50,000 - 100,000
- 100,000 - 300,000

- ▲ Surface water sampling locations
- ⬢ Notable mine features





East Mancos River

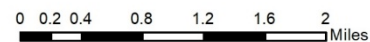
**Low Flow (2018)
Hazard Quotients (HQ)**



Cumulative Criteria Unit (CCU) - Chronic



- Surface water sampling locations
- Notable mine features



COSJLP04a_E Mainstem of E. Mancos River.

Affected Use	Analyte	Category / List	Priority
Aquatic Life Use	pH	3b. - M&E list	NA
Aquatic Life Use	Dissolved Oxygen	3b. - M&E list	NA
Aquatic Life Use	Copper (Dissolved)	4a. - TMDL	NA
Water Supply Use	Manganese (Dissolved)	4a. - TMDL	NA
Aquatic Life Use	Zinc (Dissolved)	5. - 303(d) list	H
Water Supply Use	Sulfate	5. - 303(d) list	L
Aquatic Life Use	Selenium (Dissolved)	5. - 303(d) list	H
Aquatic Life Use	Nickel (Dissolved)	5. - 303(d) list	H
Aquatic Life Use	Iron (Total)	5. - 303(d) list	H
Water Supply Use	Iron (Dissolved)	5. - 303(d) list	L
Agricultural Use	Copper (Total)	5. - 303(d) list	M
Aquatic Life Use	Cadmium (Dissolved)	5. - 303(d) list	H
Water Supply Use	Arsenic (Total)	5. - 303(d) list	L

Low Flow – Sept '18



High Flow – July '19



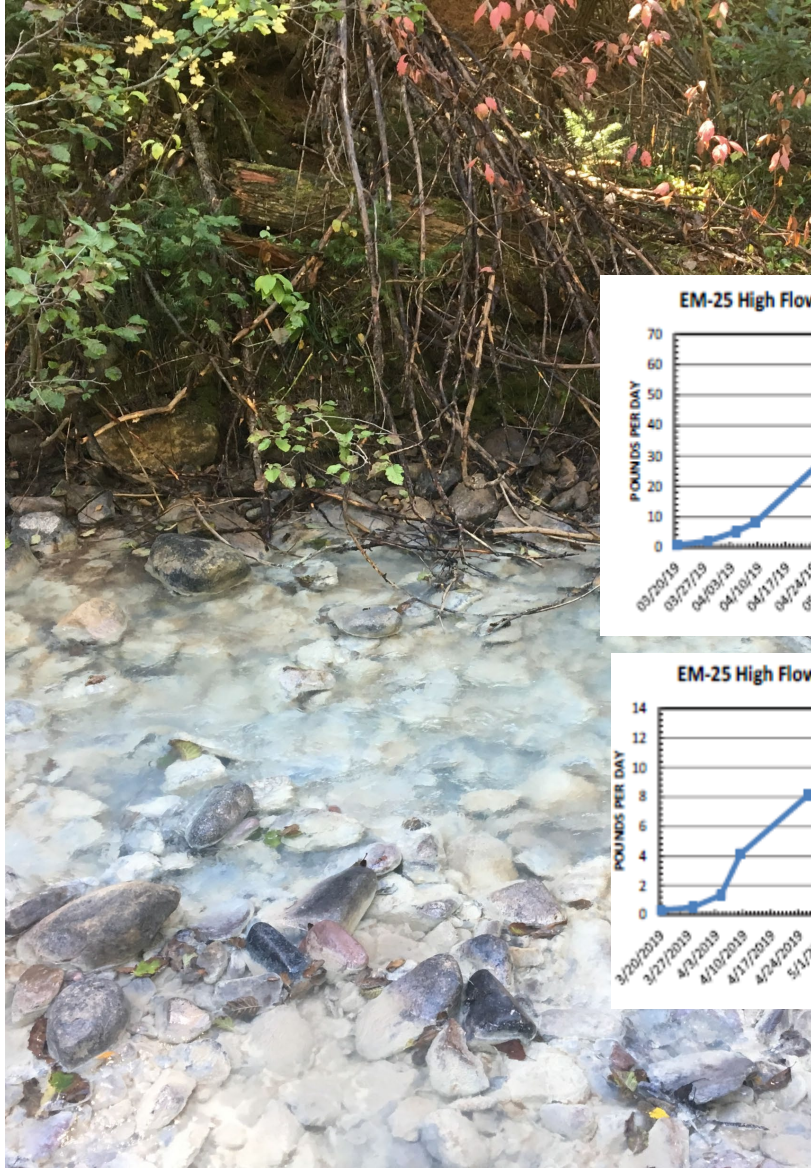
Low Flow – Sept '18



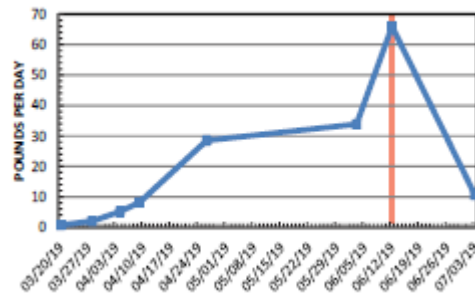
High Flow – June '19



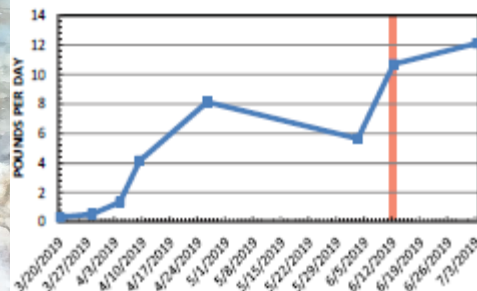
Low Flow – Sept '18



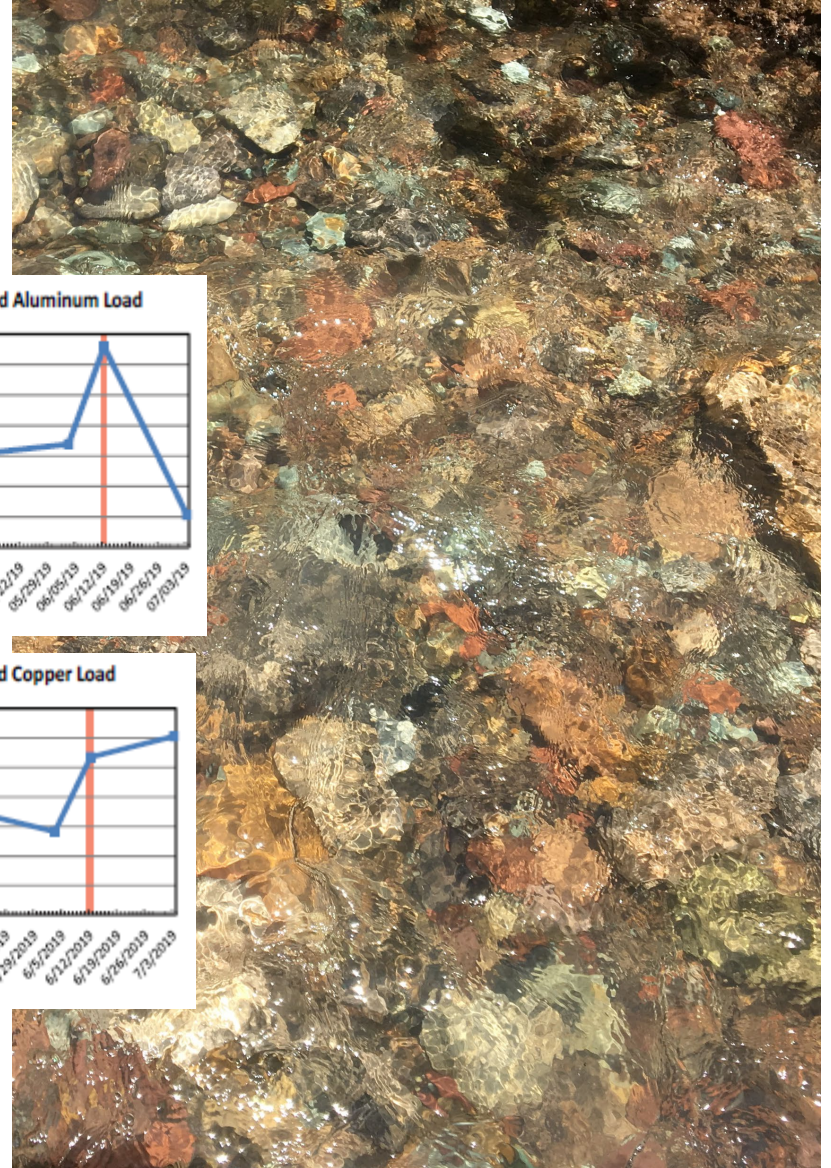
EM-25 High Flow - Dissolved Aluminum Load



EM-25 High Flow - Dissolved Copper Load



High Flow – June '19



How far down the Mancos River are these precipitates mobilized?

...and do metals persist at ecologically-relevant levels during these high-flow flushing events?