

Potential HEA Approach for Surface Water Resources Affected by the Molycorp Mine



Working Presentation
Prepared for Trustees and Molycorp Meeting
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Objective

- Present a draft conceptual framework for HEA for surface water resources at the Molycorp site to facilitate discussion and decision making regarding HEA approaches and restoration scaling

HEA Discussion

- ▶ Conceptual approach
- ▶ Variability
- ▶ Service loss
- ▶ Baseline

Conceptual Approach

- ▶ Combine surface water and aquatic biota resources into common HEA
- ▶ Use “Reasonable Worst Case” approach
 - Maximize use of existing data
 - Protective of resources
 - Framework for addressing uncertainty

Variability - Temporal

- ▶ Timeframe for HEA
- ▶ Changes in river conditions through time
 - What are appropriate time periods given available data?
 - Timing of remedial actions and ecological effects
 - Timing of restoration actions

Variability - Spatial

- ▶ Addressing variability in in-stream resource quality
 - Different areas of river may be affected to varying degree
 - Both within mine influence area and outside
 - Along length of river - longitudinal
 - Across width of river – lateral

Service Loss

- ▶ Development of metric
 - Metric is a measurable characteristic of the environment – river miles or acres are not metrics
 - Representative of the system and impact you want to describe
 - Can adequately describe the reduction in the quality of the system due to contamination AND the benefits of the restoration actions

Service Loss (cont.)

- ▶ Metric can be simple or complex
 - Single representative measure of resources and changes in services to measure both injury and restoration benefits (e.g., number of young of year in river)
 - Combination of chemical and physical measures (e.g., toxicity and community diversity/density)
 - How do you weight components?
- ▶ Challenge of translating physical measure(s) to % change in the resource/services
 - % service loss from injury and % service gain from restoration

Potential Metrics

- ▶ Surface water
 - Exceedence of water quality standards
 - Toxicity to fish
 - Field observations of fish density
- ▶ Sediments
 - Exceedence of screening thresholds
 - Toxicity to invertebrates
 - Field observations of invertebrate density/diversity

Potential Metrics (cont.)

- ▶ Measures of change in trout and macroinvertebrate health and community structure
 - Can address both injury and restoration benefits
- ▶ Pathway through surface water and sediments
- ▶ Effects measures through
 - Surface water and sediments toxicity
 - Field observations on community structure

Exceedence of Water Quality Standards

- ▶ Alternative water quality standards for the area
 - Aquatic life criteria, irrigation, livestock watering
- ▶ Pros –
 - Easy to identify exceedence
- ▶ Cons –
 - Conversion for exceedence to % service loss
 - Increasing exceedence – increasing injury?

Surface Water - Toxicity

- ▶ Use existing literature on COC effects on trout
- ▶ Relate increase in toxic effect to increase in service loss
- ▶ Pros –
 - Existing literature on toxicity for many of the COCs (dose response)
 - Consistent with risk assessment
 - Used in a number of HEA assessments
- ▶ Cons –
 - Uncertainties in extrapolating effects in literature to RR case
 - Only addresses aquatic biota service

Surface Water – Field Observations

- ▶ Field observations on the diversity/density of trout resource
- ▶ Pros –
 - Use of available data
 - Actual field observations from affected area
- ▶ Cons-
 - Confounded with other factors (environmental, habitat quality)
 - Limited sampling
 - Addresses limited number of services

Exceedence of Sediment Screening Thresholds

- ▶ Use of sediment screening thresholds as indication of reduction in services
- ▶ Pros –
 - Easy to identify exceedence
- ▶ Cons –
 - Conversion for exceedence to % service loss
 - Increasing exceedence – increasing injury?

Sediment - Toxicity

- ▶ Use of predicted sediment toxicity on macroinvertebrate diversity and density
- ▶ Increased predicted toxicity leads to increased service loss
- ▶ Pros –
 - Existing literature on toxicity
 - Aggregate across a number of potential effects/species
- ▶ Cons –
 - Based on modeling
 - Confounded effect of habitat quality

Macroinvertebrate Field Observations

- ▶ Use of the density and diversity of macroinvertebrates
- ▶ Pros –
 - Use of available data
 - Field observations from affected area
- ▶ Cons-
 - Confounded with other factors (environmental, habitat quality)
 - Limited sampling

Baseline Considerations

- ▶ Identification of appropriate baseline conditions
 - May vary through spatial extent of river
 - May vary through time

- ▶ Approaches to account for baseline effects
 - Annual calculations
 - Overall adjustment after the fact
 - Single location or average of a number of locations?

Baseline Considerations (cont.)

- ▶ Spatial variation
 - For example
 - Hansen Creek may be good baseline for upstream mine influence area
 - Just downstream of town of Red River, or average of upstream of Hansen Creek, may be good baseline for other stream segments within mine influence area

Baseline Considerations (cont.)

- Temporal variation
 - Low flow versus high flow regimes
 - Early 1980s versus 2003 and beyond

Choice of Metric

- Incorporation into reasonable worst case framework
- A weighted average of the individual options?
 - Combines a number of potential effects
 - Determination of relative weights?
- A single measure
 - The one that describes the largest impact?
 - Protective of trust resources
 - Easier to track