

# Water and mining: protecting and sharing water resources

A Presentation for:

Mining and Metallurgical  
Society of America (MMSA)  
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Presented by:

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# Presenter: Patrick Williamson



- **Principal Hydrogeochemist**
- **BA Geology Colorado College**
- **MS in Geology CU Boulder**
- **36 yrs of consulting experience in hydrogeology & geochemistry**
- **QP and CA RG**
- **Active in the MMSA, SME and ADTI.**
- **Project experience in the US, Mexico, Nicaragua, Colombia, Chile, Peru and Ecuador**





# The Challenge of Water and Mining

- Water resources and access
- Potential for short and long-term contamination
- History of mining impacts on communities and environment
- Social license
- Management/Stewardship



Photo: Frank Garcia, Nicaragua Dispatch



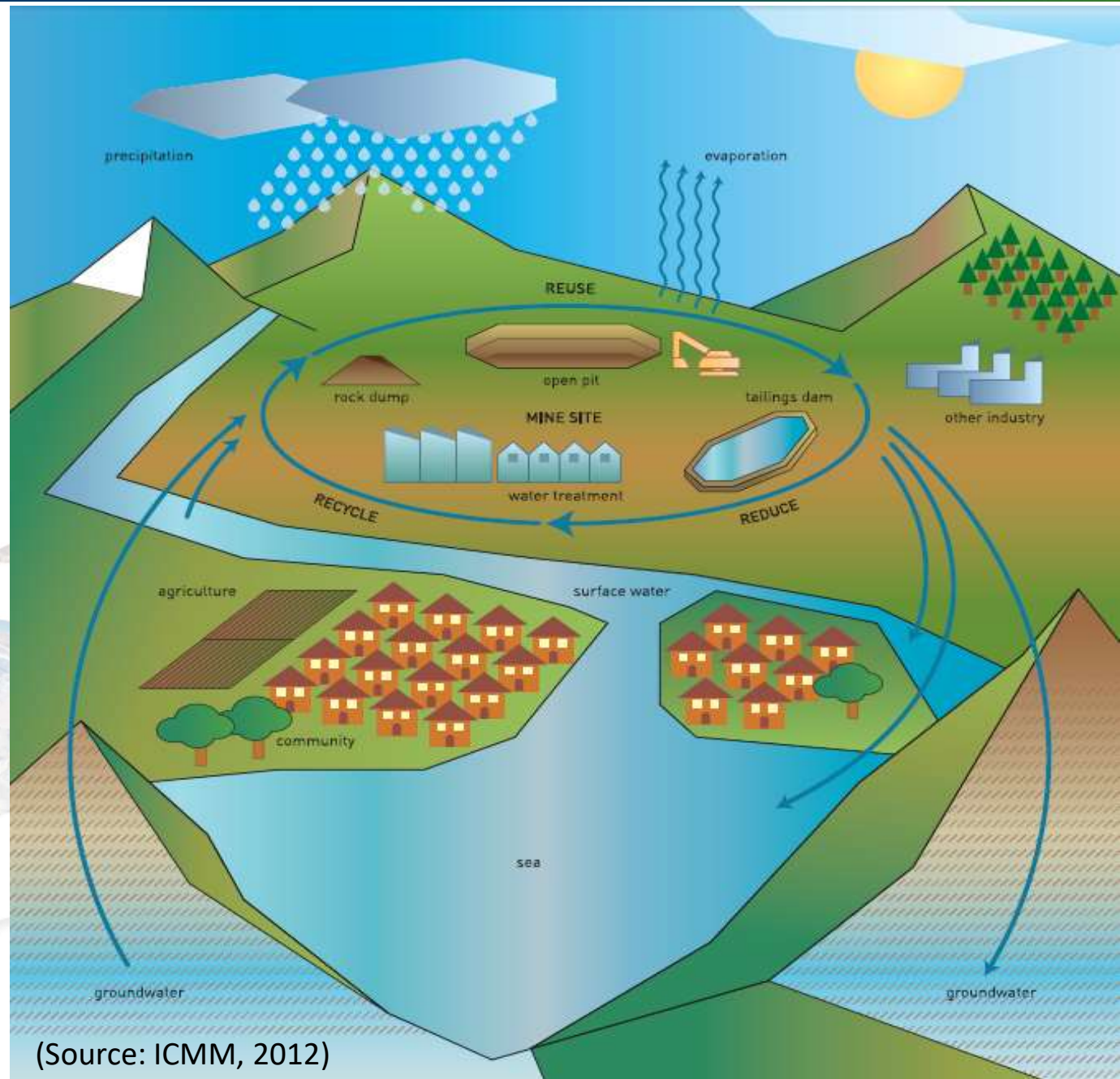
Photo: El Divisadero el 27 de diciembre de 2016

# Water Cycle in Mining

Water interacts with every part of a mine – tailings, pit walls, mills, roads, etc.

Different aspects of water in a mine – groundwater inflow, contact water, runoff and streams.

Mining consumes water- tailings, evaporation



(Source: ICMM, 2012)



# Perceptions Based on Historical Mining





# Perceptions Based on Illegal or Artisanal Mining



*Photo: Christian Braga/Greenpeace*



# Perceptions Based on TSF Failures



Photo: Tailings Info.com



# Closure Success – Golden Cross, NZ



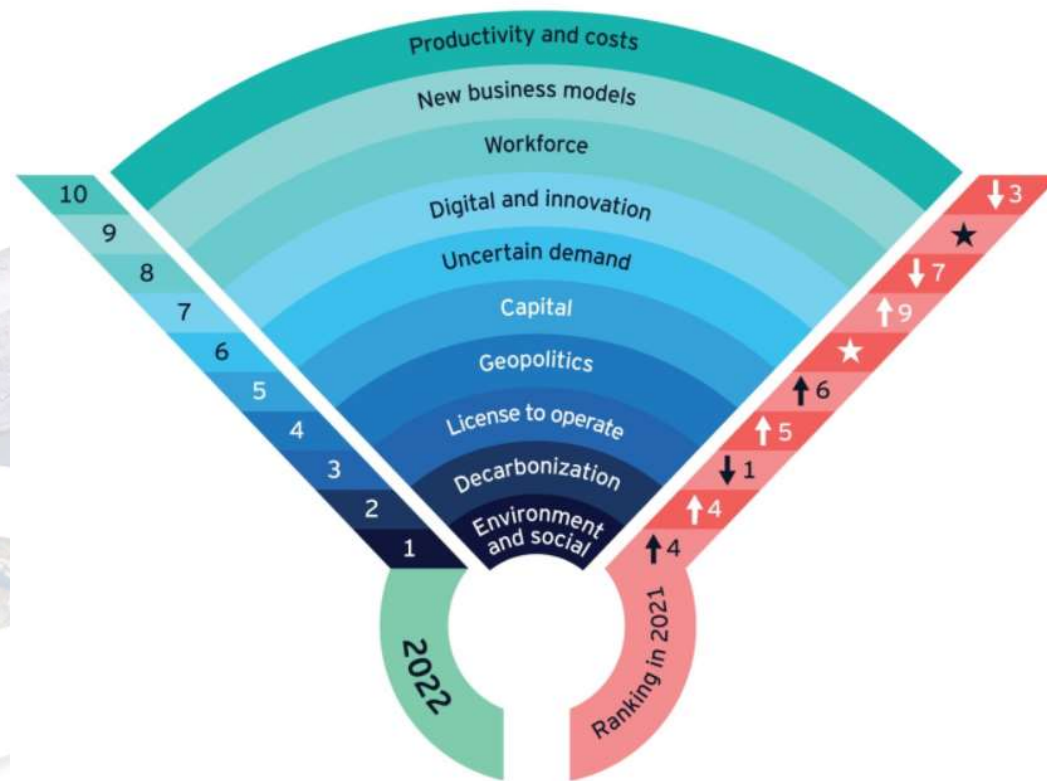
Photo: Mark Samson



# Water-Related Risks

## Risks to mining companies due to poor water stewardship

- Operations,
- Profitability,
- Reputation,
- Social license,
- Access to capital, and
- Environment impacts



↑ Up from 2021 ↓ Down from 2021 — Same as 2021 ★ New to the radar



# Mine Water and Environmental Risk

- **Water is a shared asset**
- **Water is expensive to manage**
- **Water is a growing source of conflict**
- **Citizens have the tools to take action**
- **Mining isn't the only activity that impacts local water resources**
- **Short term data collection period extrapolated to decades of mine operation**
- **Taking advantage of weak regulations**
- **Climate change**



Tia Maria, Peru  
(Economist/AP)



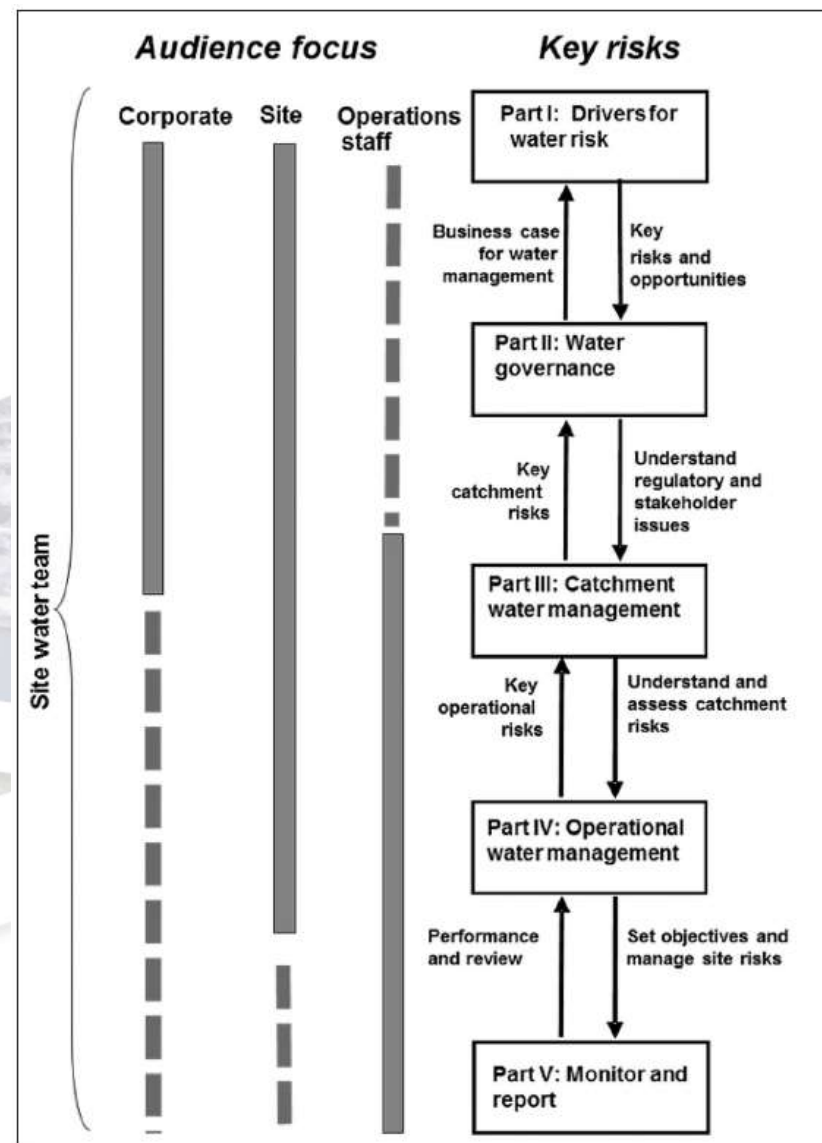
# Mine Water and Operational Risk

## Mine Operation Factors

- Cultural dissonance
- Short-term goals vs. long-term plans
- Deferred investment in closure
- National regulations vs BPs
- Internal water governance

## Community Factors

- Unrealistic community/govt expectations
- Lack of community involvement
- Lack of social license/trust



Source: Govt. of Australia, Leading Practice Sustainable Development Program for the Mining Industry, 2016. Water Stewardship







# Stewardship

**Stewardship – the responsibility to protect, enhance and preserve assets that do not belong to you, but have been temporarily entrusted to you.**

**Water stewardship - The use of water that is socially equitable, environmentally sustainable and economically beneficial, achieved through a stakeholder-inclusive process that involves site and catchment-based actions.**

*(Alliance for Water Stewardship, 2013)*

## **ICMM Water Stewardship Framework (2014)**

- **Engage proactively and inclusively**
- **Adopt a catchment-based approach**
- **Effective water resource management**

# Water Management Framework

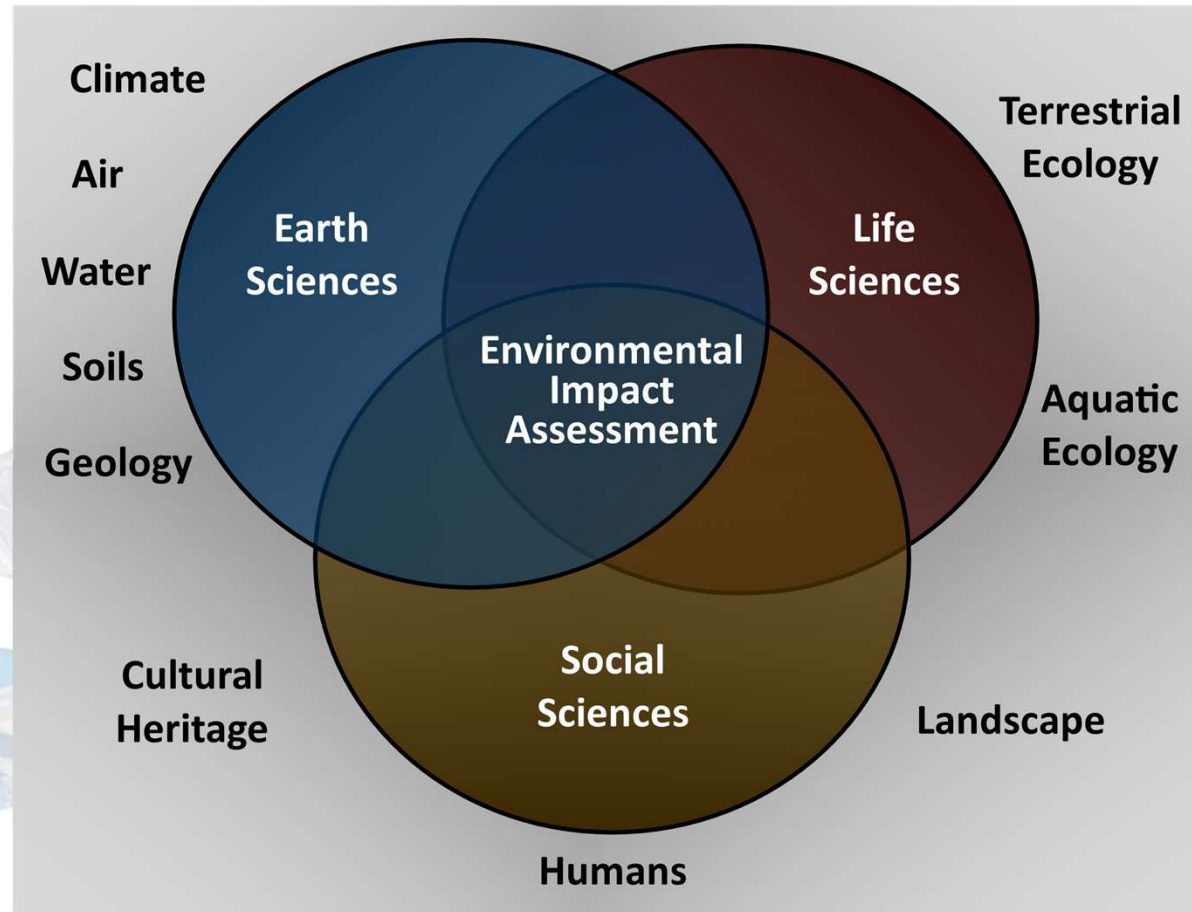
- **Risk assessment and management**
  - Establish the baseline
  - Identify and engage stakeholders
- **Establish water management objectives**
  - Water protection and compliance
  - Water use
- **Governance**
  - Operations
  - Infrastructure

(Source: Agnico Eagle Water Management, 2021)



# Baseline Components

- **Geochemistry**
- **Hydrogeology**
- **Hydrology**
- **Sediments**
- **Hydrochemistry**
- **Meteorology**
- **Archeology**
- **Biology**
- **Roads, bridges & traffic**
- **Social impacts**
- **Emissions and dust**
- **Noise**



# Baseline for Water Stewardship I

- **Hydrogeology and aquifer characteristics**
- **Baseline water quality and flow**
- **Catchment water volumes and quality**
- **Storm and flow intensity/duration/frequency**
- **Sources of water for mine operations**
- **Which resources might be affected**



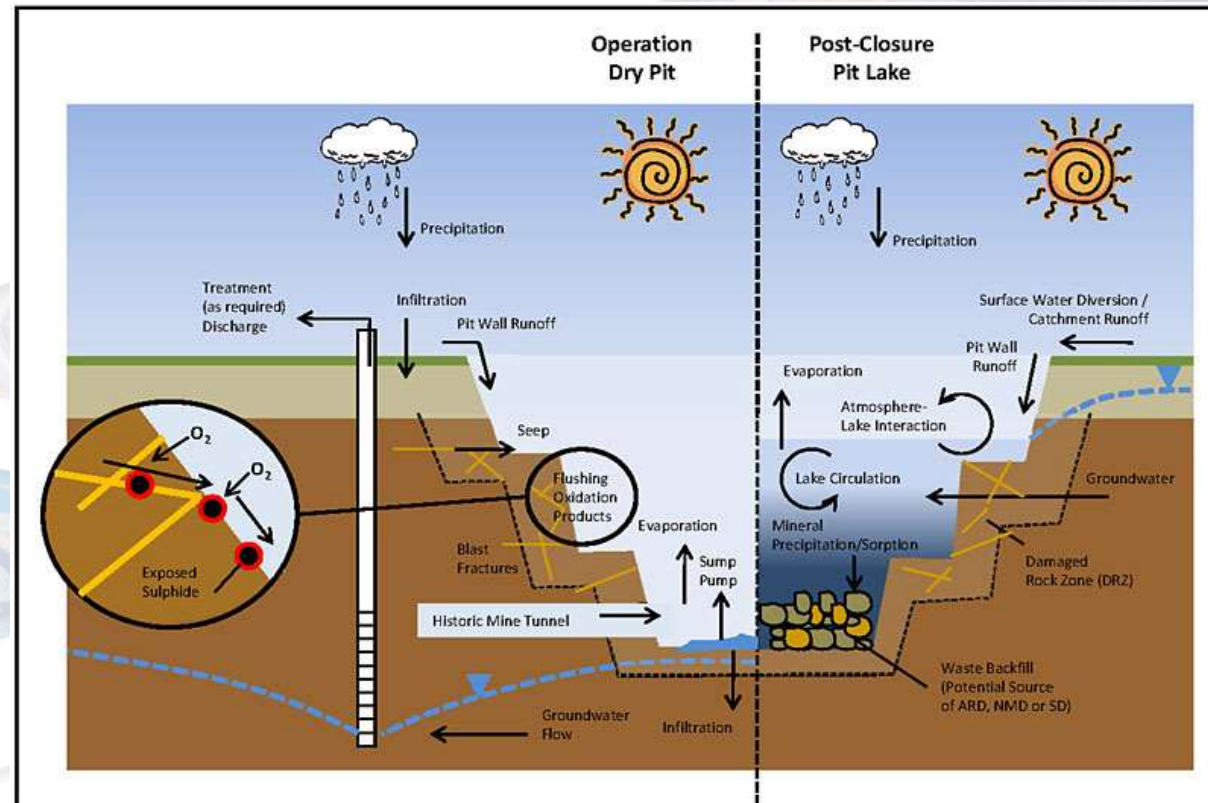
# Baseline for Water Stewardship II

- **What are the geochemical characteristics of the waste?**
- **Mining and processing method**
- **Waste rock, tailings and leached ore management**
- **Potential discharges**
  - **Where, when and concentrations?**
- **Possible impacts on water resources**
- **Exposure routes and receptors**

(After R. Moran, 2003, CIMM, 2014)

# Tools for Water Stewardship: Climate, Flow and Models

- Holistic baseline synthesis of surface/ groundwater flow, quality and use
- Site-specific and regional climate and hydrological model
- Conceptual /numerical groundwater model
- Water balance
- Water quality models
- Source term geochemistry

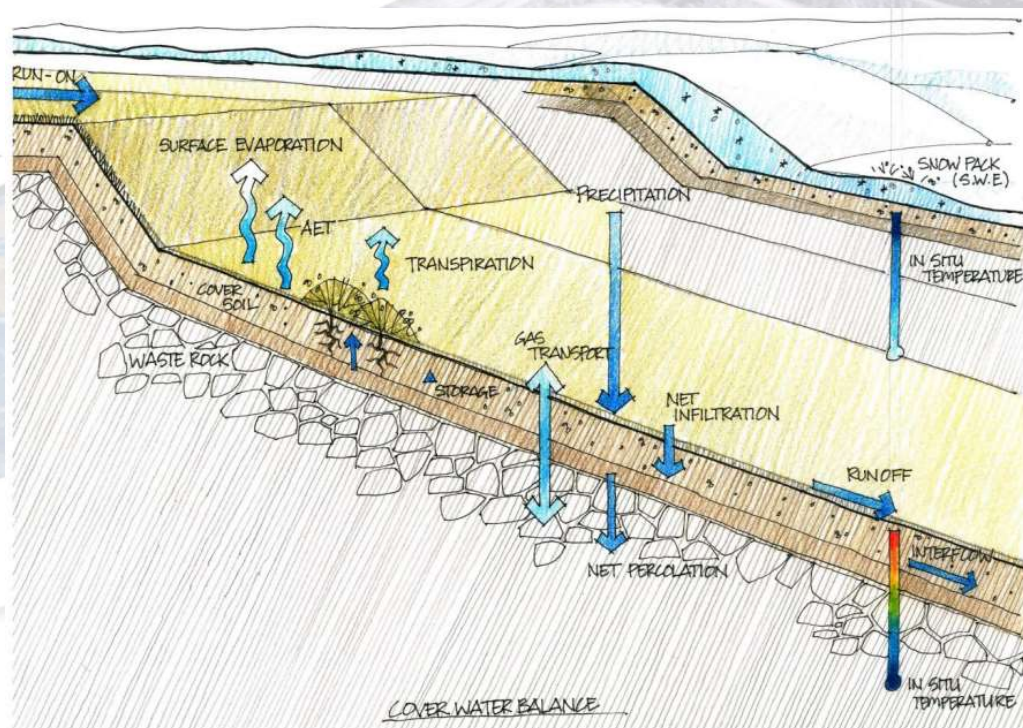


(Source: GARD Guide, 2016)



# Tools to Protect Water Quality

- Flow and water quality monitoring
- Operational waste rock management plan
- Closure Plan
- Quality Assurance Project Plan
- Data management plan/tools



(Source: MEND, 2012)

# Miners as Water Stewards

- **Good science and adequate characterization**
- **Engage stakeholders in an open and transparent manner**
- **Understand the social, cultural, economic and environmental value of water**
- **Effective water resource management**
- **Plan ahead**





# Thank You for Your Time

