

Under the High Patronage of His Majesty King Mohammed VI



XIX WORLD WATER CONGRESS
International Water Resources Association (IWRA)
Marrakech, Morocco | 1-5 December 2025

Kingdom of Morocco



Ministry of
Equipment and Water

Peter van der Keur

Geological Survey of Denmark and Greenland (GEUS)

UNECE Expert Group on Resources Management – Groundwater Resources Working Group

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December 2, 2025



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A Nexus Vision: Aligning Groundwater Security with the Energy and Raw Materials Transition



XIX World Water Congress | Marrakech, Morocco | 1-5 December 2025 | www.worldwatercongress.org

Groundwater in the Energy Transition – Context



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Groundwater is vital for ecosystems, communities, and sustainable development
Access to clean water is a human right

Ground- (and surface) water may be affected by activities necessary for sustainable energy transition (e.g., mining, legacy mining, geo-energy, CO₂/H₂-injection)

UNECE UNFC and UNRMS are globally endorsed tools for sustainable resource Management

UNECE EGRM Groundwater Resources Working Group focuses on safeguarding groundwater in energy and raw materials projects



Overview of UNFC and UNRMS



- **UNFC** A system for classifying natural resources based on sustainability, feasibility, and reliability
- **UNRMS** A comprehensive framework for the integrated management of these resources
- **Link to SDGs** Both frameworks support global sustainability goals



From Extraction to Stewardship Emphasizing long-term resource management



Interconnectedness Understanding how different resources impact each other



Holistic Approach Managing resources with a focus on sustainability and equity



UNFC structure



- **Three Criteria:** Environmental-Social-Economic Viability, Technical Feasibility, Confidence in Estimates
- **Classification System:** UNFC categorizes resources to guide decision-making
- **Consistency:** Ensures that resource evaluation is comparable globally



Integrated and intersectoral work



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UNECE EGRM Working Groups

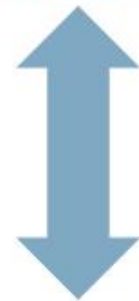
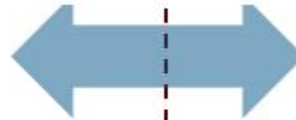
Anthropogenic Resources WG

Renewable Energy WG

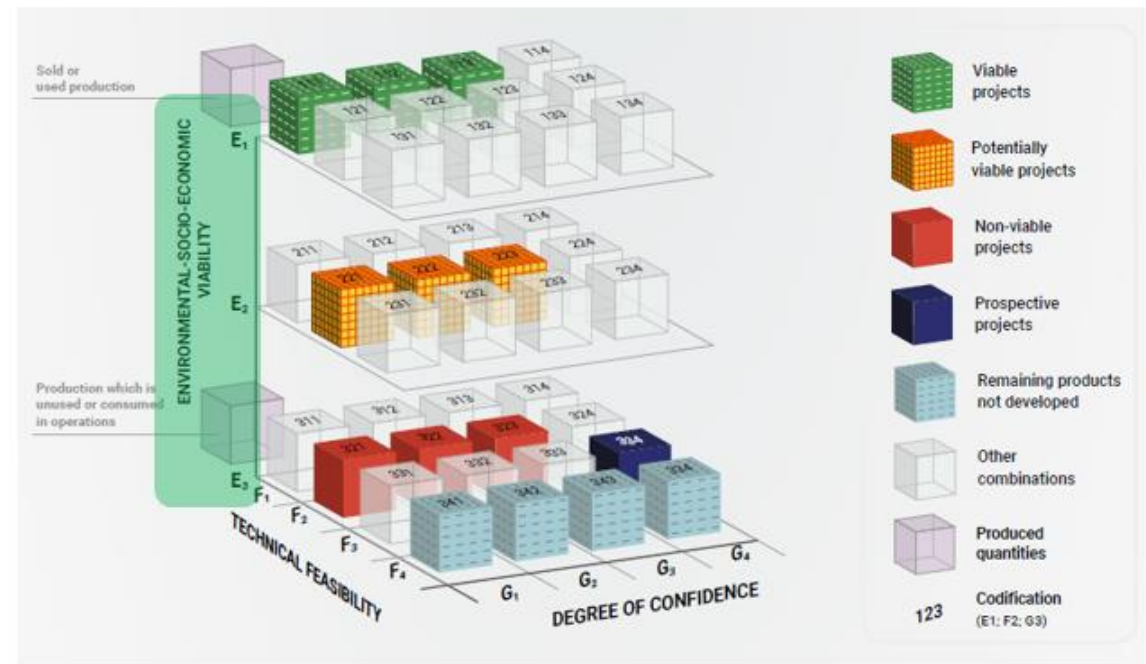
Injection Projects WG

Mineral Resources WG

Groundwater Resources WG



Stakeholders:
UN Water, UNESCO-IHP,
UNECE Water Convention,
IAH, others



Views of a mine

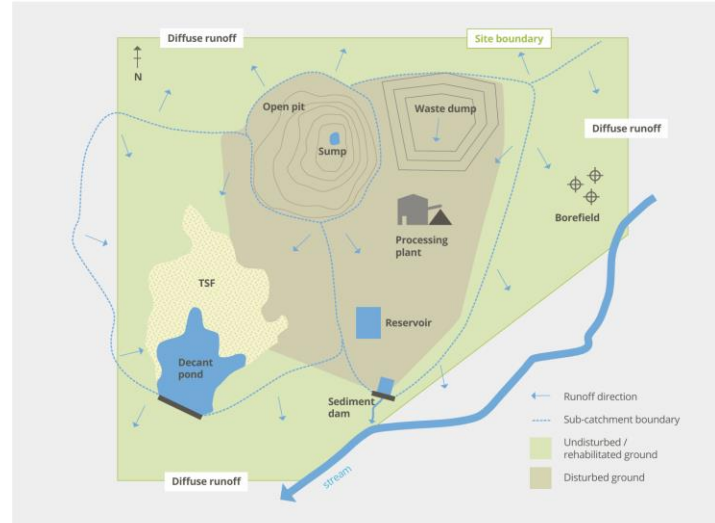


From: Smith, L., 2021. Hydrogeology and mineral resource development. *The Groundwater Project: Guelph, ON, Canada.*

Physical View



FIGURE 4. ILLUSTRATION OF SUB-CATCHMENT AND SITE BOUNDARIES⁴



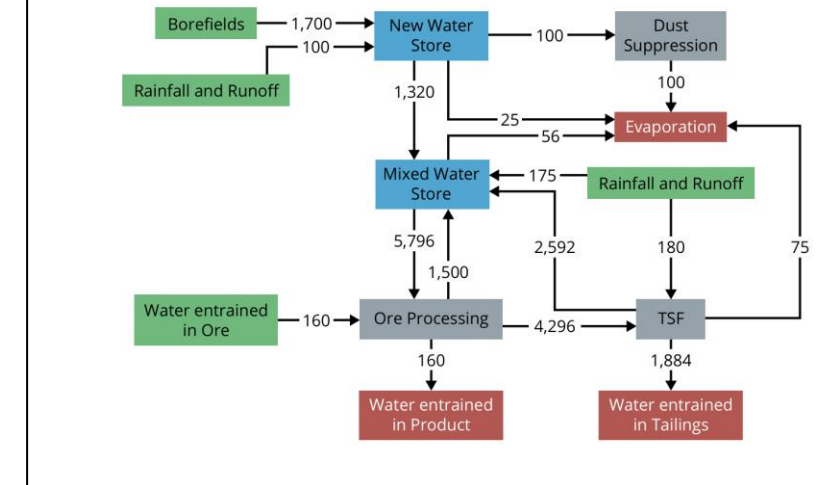
From: Minerals Council of Australia, 2022. *Water Accounting Framework Users Guide V 2.0*

Mine-Layout View



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FIGURE 14. SIMPLIFIED WATER NETWORK DIAGRAM REPRESENTING WAF ELEMENTS



From: Minerals Council of Australia, 2022. *Water Accounting Framework Users Guide V 2.0*

Water-Balance View



Major Challenges with Excess Water in Mining



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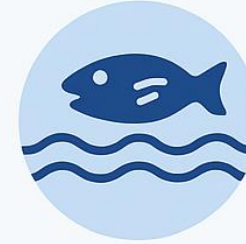
Operational Disruptions

Flooding and water ingress can halt mining operations



Safety Hazards

Excess water increases risks of accidents



Environmental Risks

Potential for contamination of water bodies



High Treatment & Disposal Costs

Managing excess water requires significant investment



Regulatory Compliance

Navigating complex water-- required regulations and permits



Challenges in Dry Climates



Water scarcity

Mining operations require vast amounts of water for extraction and processing, which is a significant challenge in arid regions.



High water demand

The large water needs of mining can strain already limited local and surface water supplies, which are crucial for human consumption, agriculture, and ecosystems.



Groundwater depletion

Mining operations may pump large quantities of groundwater to dewater the mine, altering the natural recharge and discharge capacity of local aquifers.



Increased water stress

Mining in arid and semi-arid areas can push the region into high or extremely high levels of water stress, intensifying competition for water resources with local communities and ecosystems.



Solutions and Management Strategies



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Dewatering and drainage: Use high-capacity pumping systems, storage tanks, and effective drainage networks to control surface runoff and groundwater inflow.



Water treatment: Install active or passive treatment plants to treat contaminated water before discharge or reuse. Techniques include chemical precipitation and membrane filtration.



Recycling and reuse: Implement closed-loop systems to recycle process water, reducing overall water intake and treatment needs.



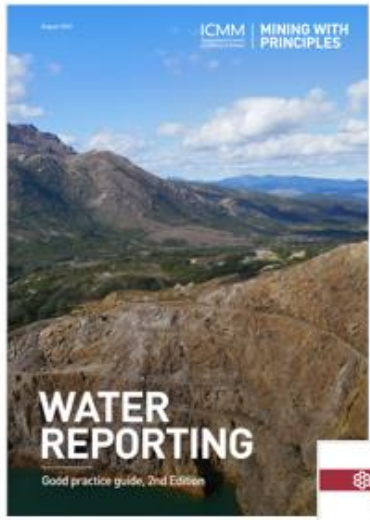
Early flood warning systems: Use weather monitoring and flood forecasting systems to predict and prepare for extreme rainfall events.



Sustainable mine closure planning: Incorporate long-term water management from the project's start, including plans for pit lakes that consider local water balances and potential impacts.



Wide Range in Reporting Frameworks and Regulations



National Instrument 43-101
Standards of Disclosure for Mineral Projects

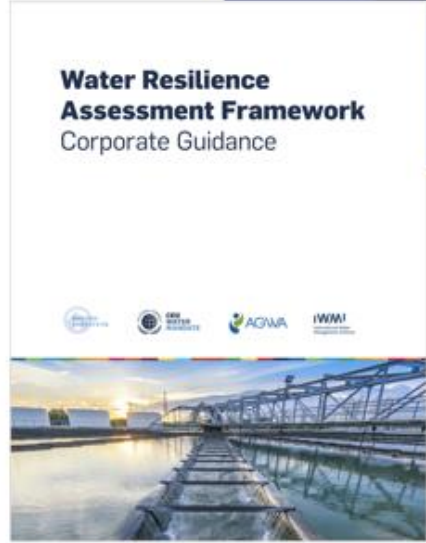
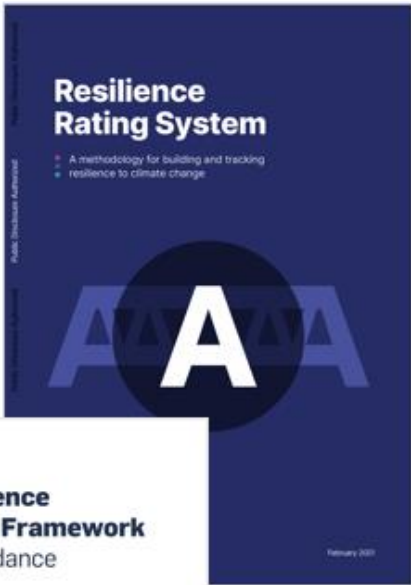
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Minerals Industry
Water Accounting
Framework

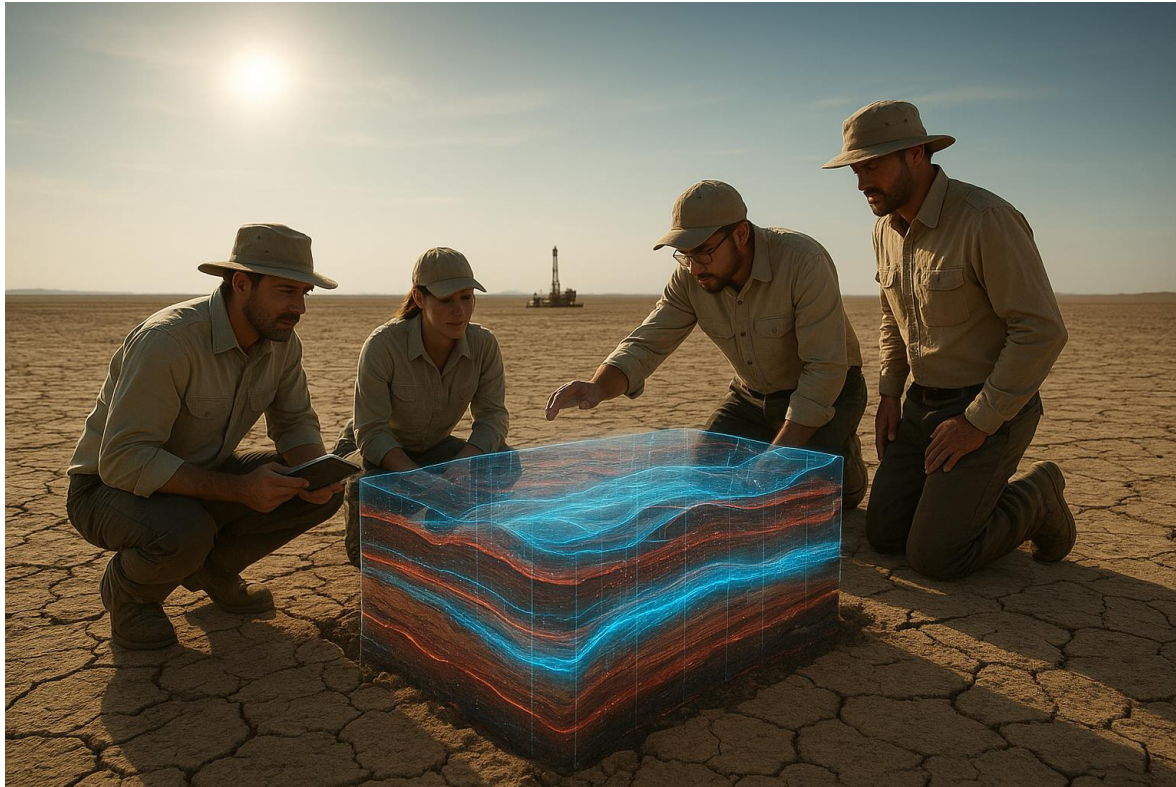
USER GUIDE VERSION 2.0



Gap analysis needed



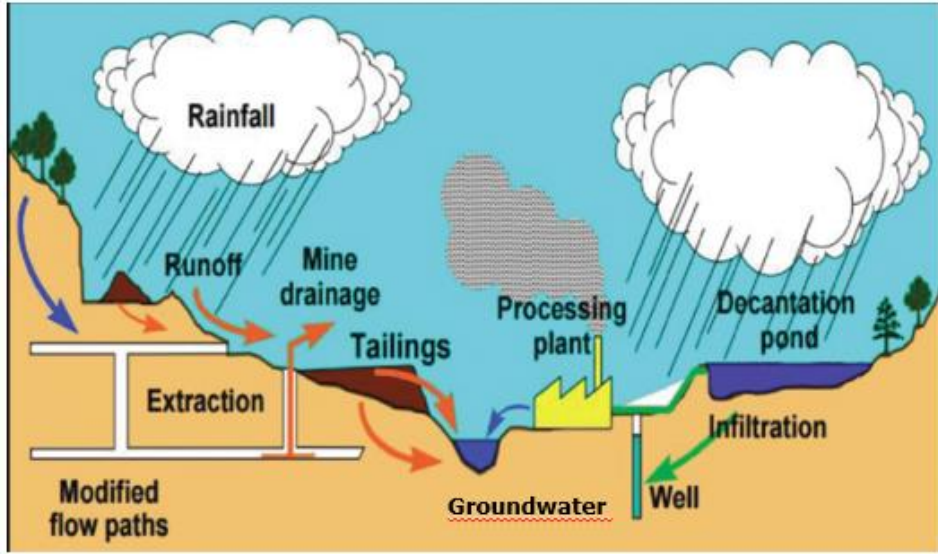
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First step



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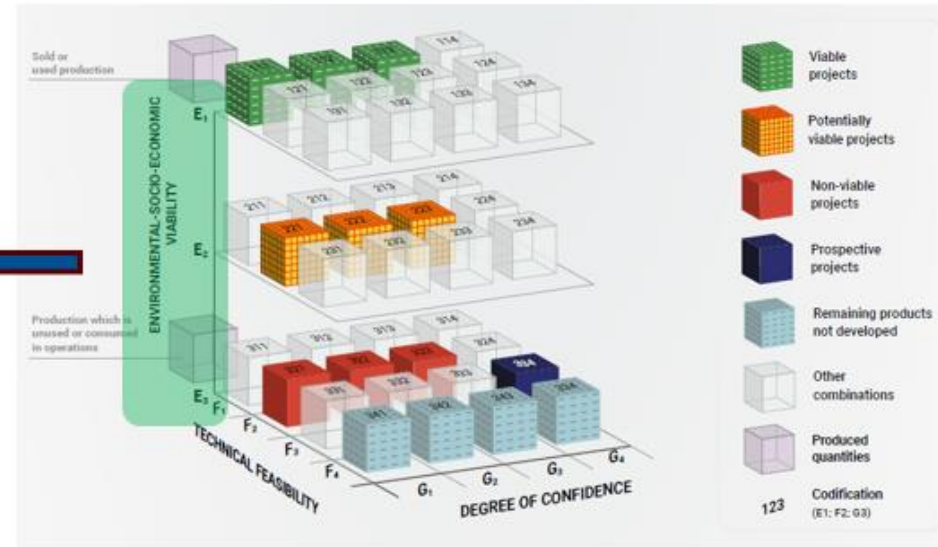
Groundwater Resources Working Group



Mineral Resources Working Group



E-axis: Environmental and socio-economic considerations



Integrating Groundwater and Minerals in UNFC



FIGURE 4. ILLUSTRATION OF SUB-CATCHMENT AND SITE BOUNDARIES?

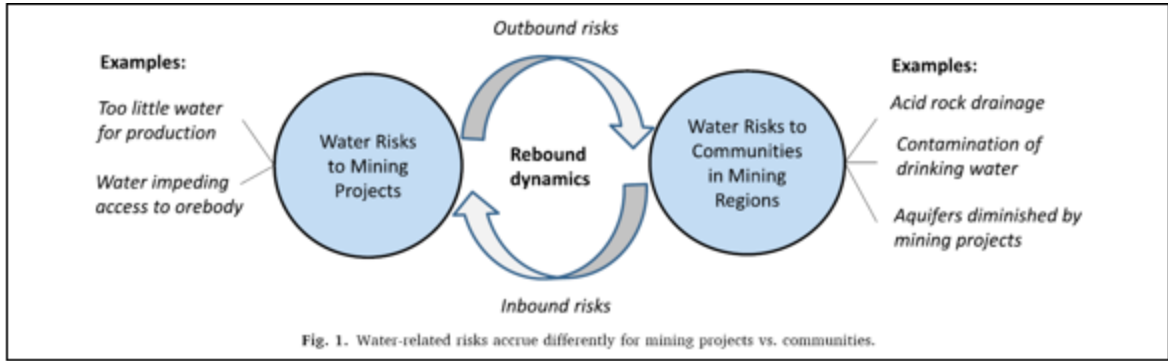
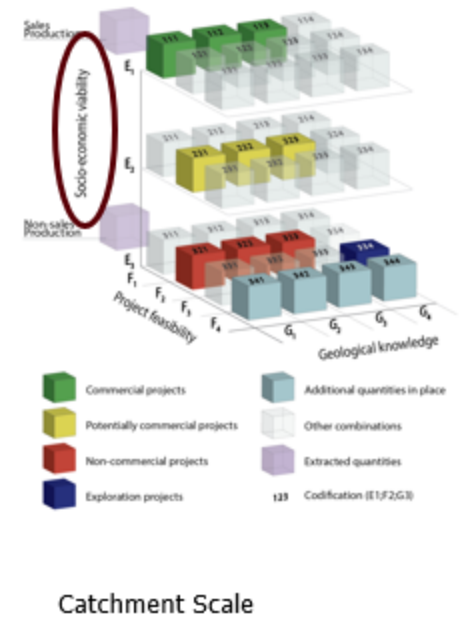
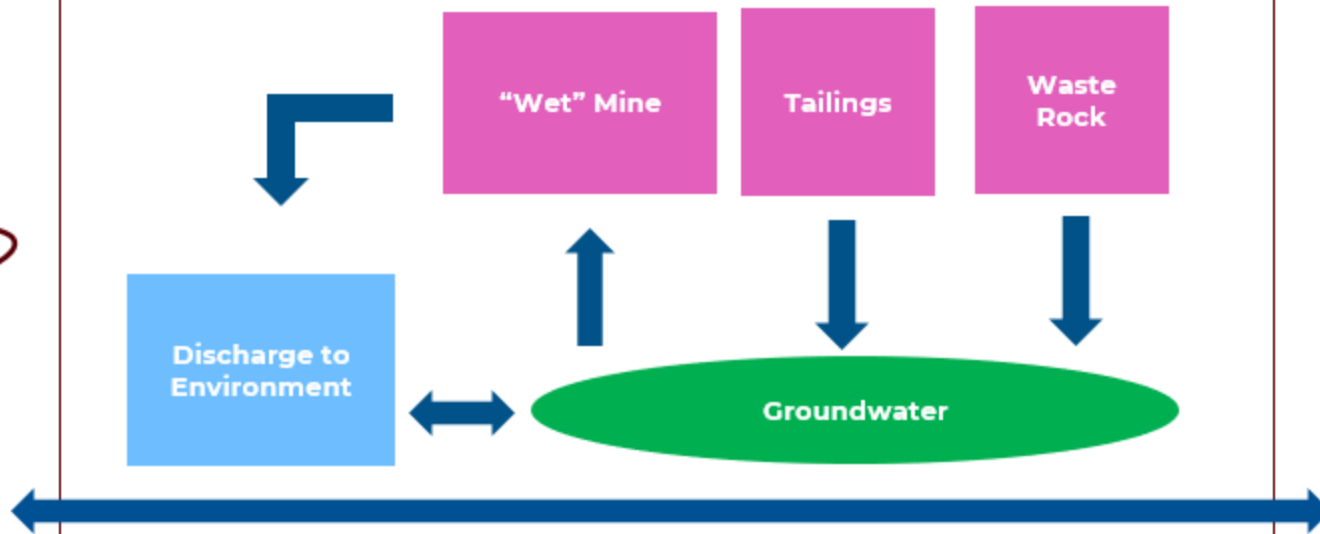
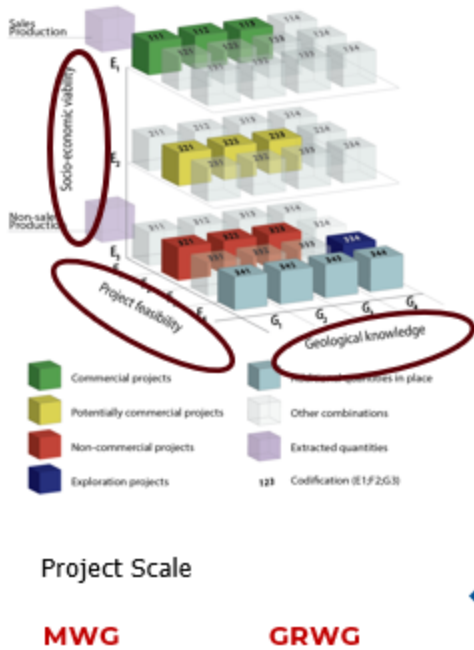
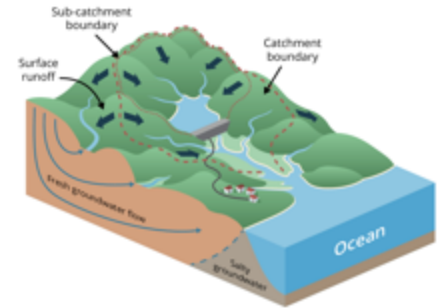


Fig. 1. Water-related risks accrue differently for mining projects vs. communities.

From: Kunz, N.C., 2020. Towards a broadened view of water security in mining regions. *Water Security*, 11, p.100079.

FIGURE 3. ILLUSTRATIVE EXAMPLE OF A CATCHMENT BOUNDARY?



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Thank you!

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<https://unece.org/sustainable-groundwater-resource-management>

LinkedIn / UNECE EGRM Groundwater Resources Working Group

www.worldwatercongress.com