



THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA

CREATE CHANGE

Regional Water Supplies in Mining Regions

Case study: Atacama region, Chile

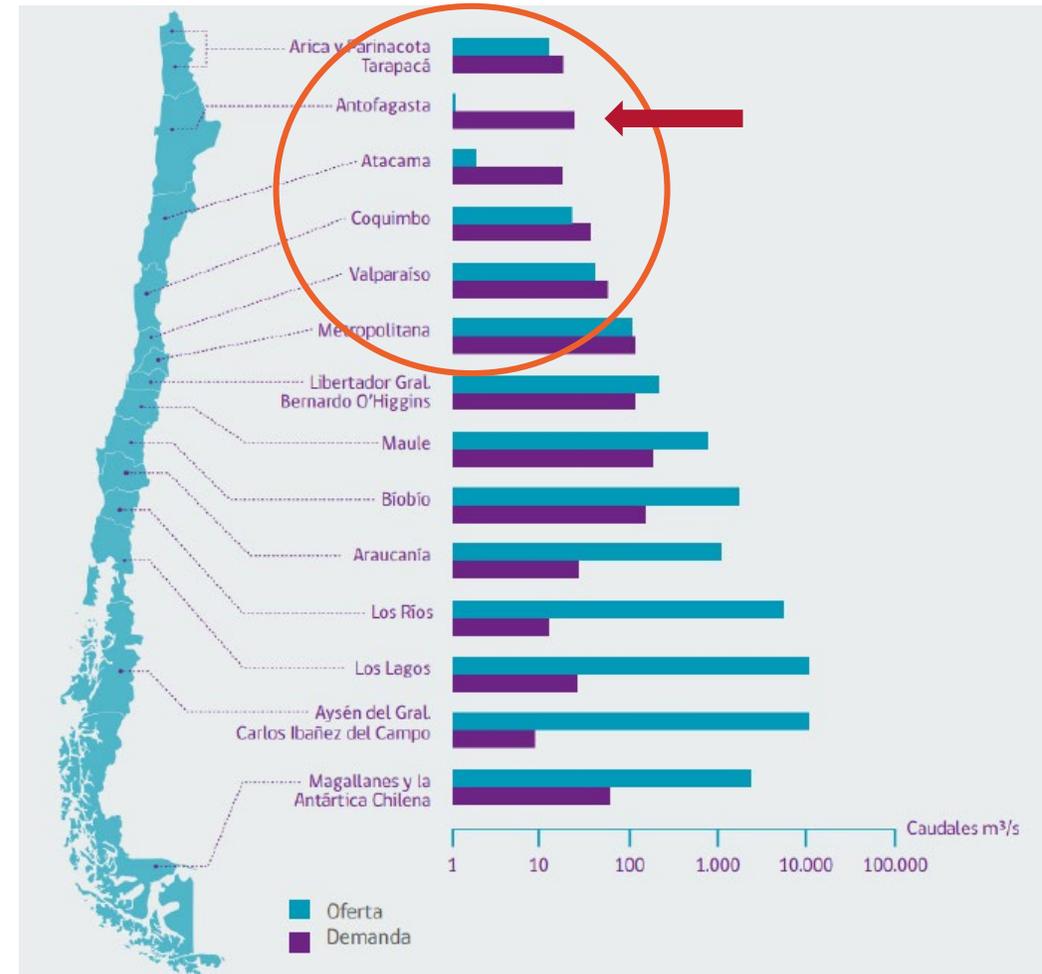
Mining in arid regions



Challenge of mineral deposits that are inaccessible due to lack of water supply

Mining in arid regions – Northern Chile

- Northern Chile case: Rich in mineral resources, but overexploited water resources.
- Desalination of sea water appears as a solution.
- Extreme example: Antofagasta region
 - Annual rainfall ~ 1mm/year
 - Chuquibambata: largest open-pit mine in the world



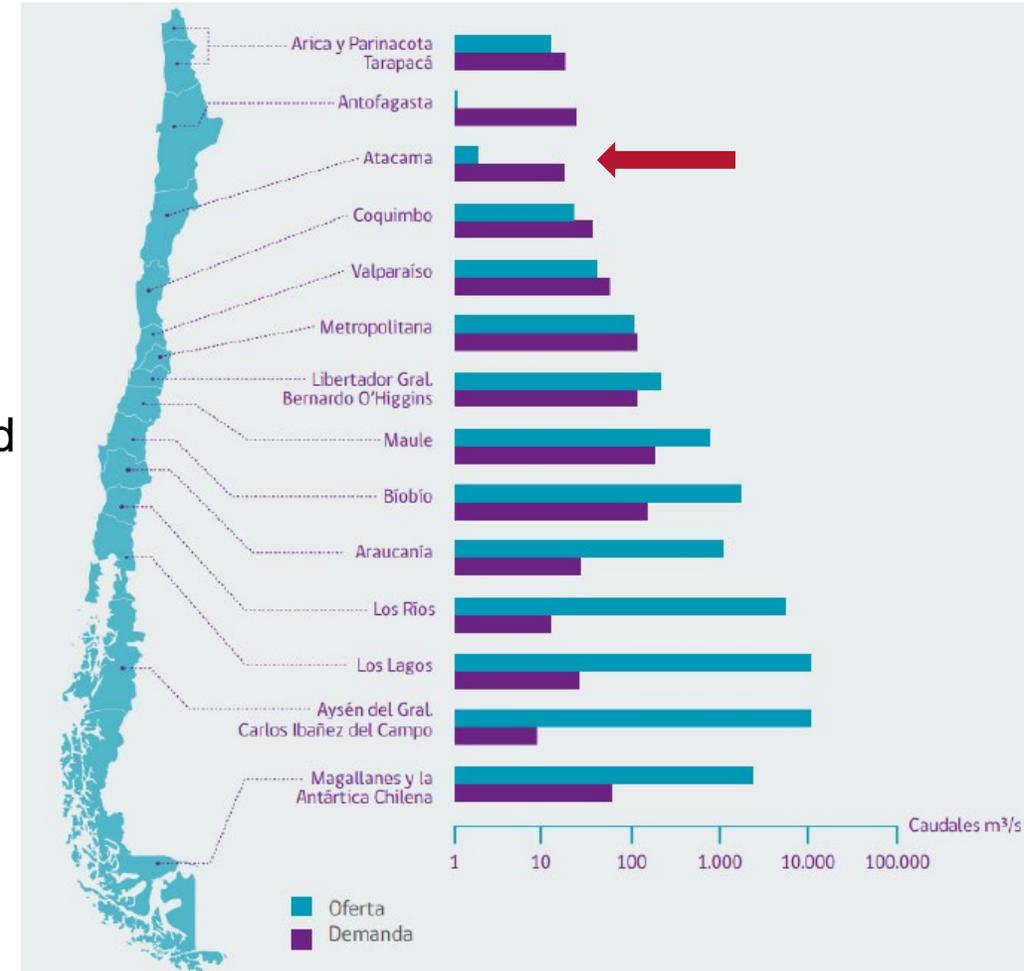
Northern Chile – Antofagasta region



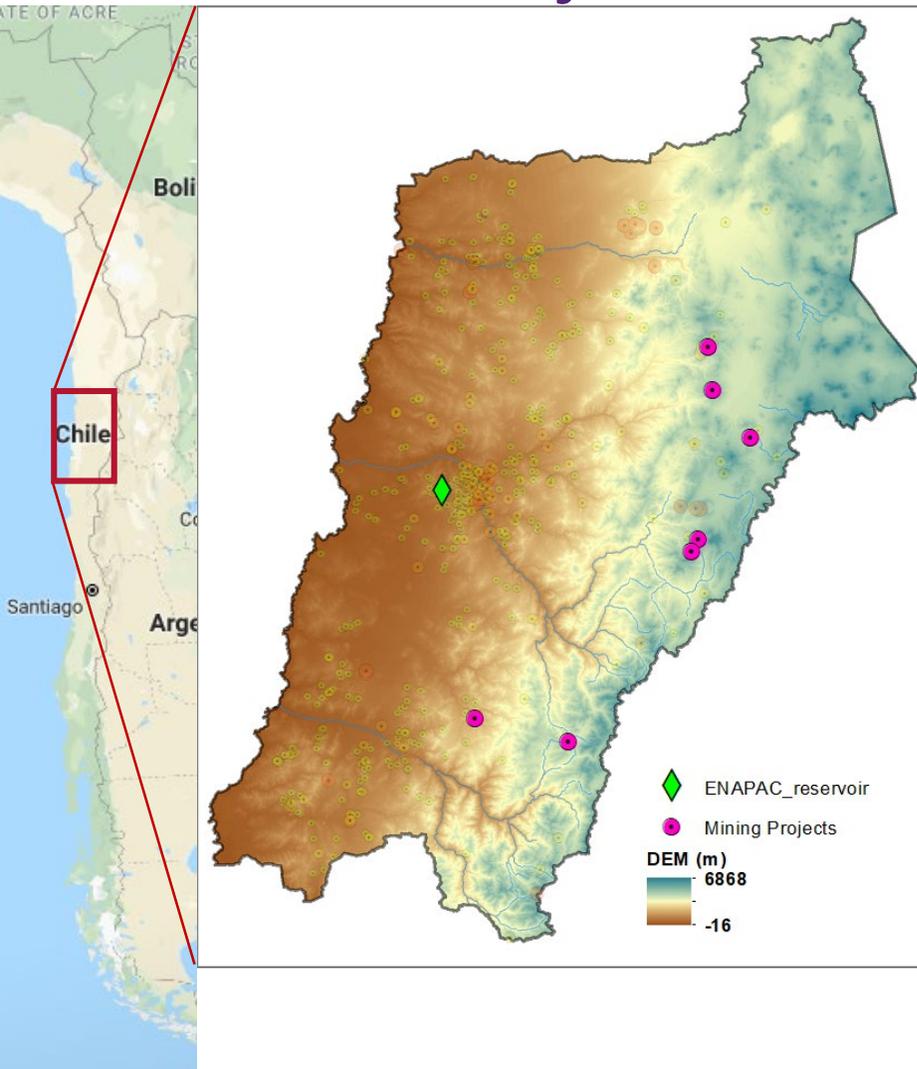
- Several mining companies and potable water company have invested in desalination
- 10 desalination plants, plus 8 projects
- Existing length of pipelines: 2,065 km, travelling up to 180 km with a difference in altitude of up to 3,000 m.
- Individual supply solutions, fractional system
- Inefficient and non optimal solution
- Integrated water supply network

Motivation and objectives

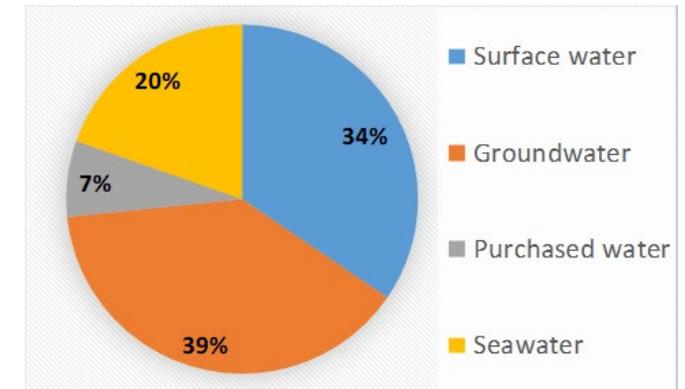
- Opportunity to explore a regional water supply system integrating desalinated water with fresh water resources that optimizes the use of the resource and boosts regional development.
- Objectives:
 - Develop a visual tool to explore and optimize an integrated water supply network.
 - Explore benefits of an integrated approach
 - Using the tool to generate dialogue between government and industry towards the more efficient use of the water resources.
- Implementing and testing the tool using as case study the Atacama region.



Case study: Atacama region, Chile

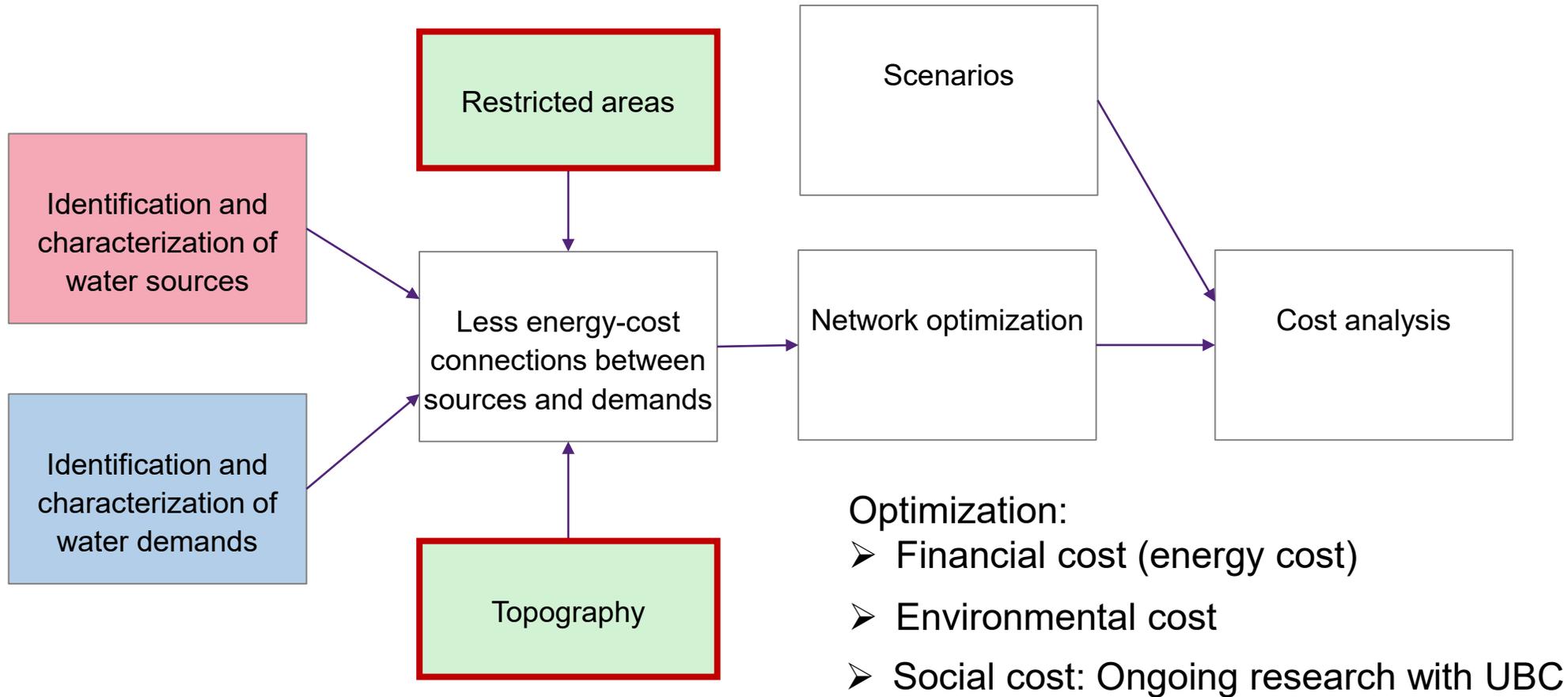


- Cooper
 - Molybdenum
 - Gold
 - Silver
 - Iron
- Sources of water for copper mining (2018)



- 3 Desalination plants operating and 3 more as projects
- **ENAPAC** project: Private desalination plant (1000 l/s), powered by solar plant (100 MW), and reservoir (600,000 m³) to supply water to the region. Initially mining, but open to other users
- Mining projects → Water supply

Regional water supply - Methodology

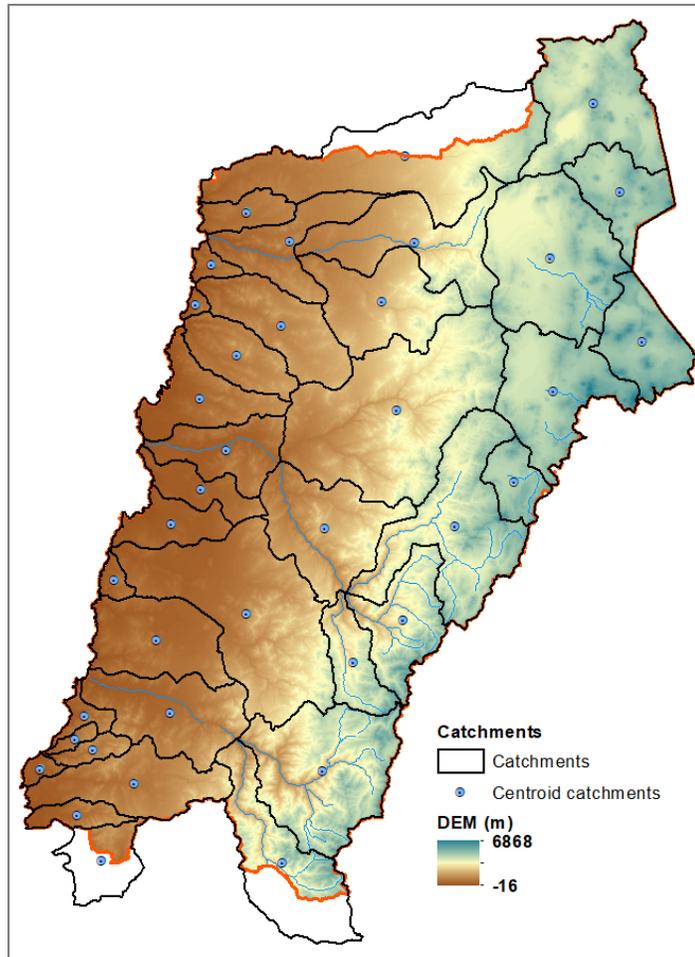


Regional water supply – Lines of work

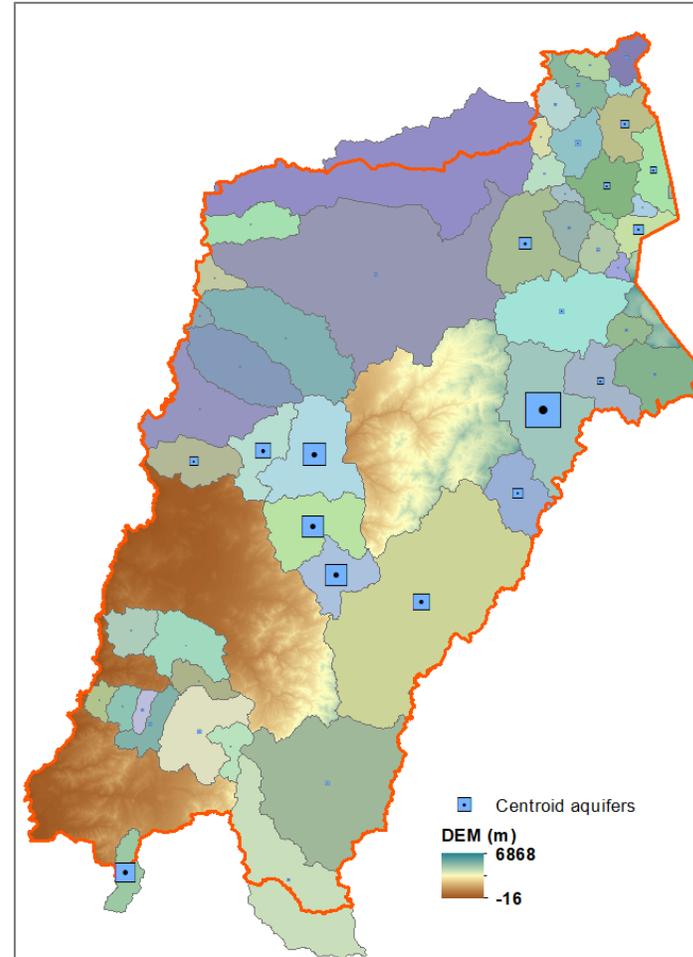
1. Characterization of mining water demands and investigation of scenarios
2. Developing and implementing the tool
3. Investigating optimization algorithms
4. Engaging with government and industry in Chile

Regional water supply system – water sources

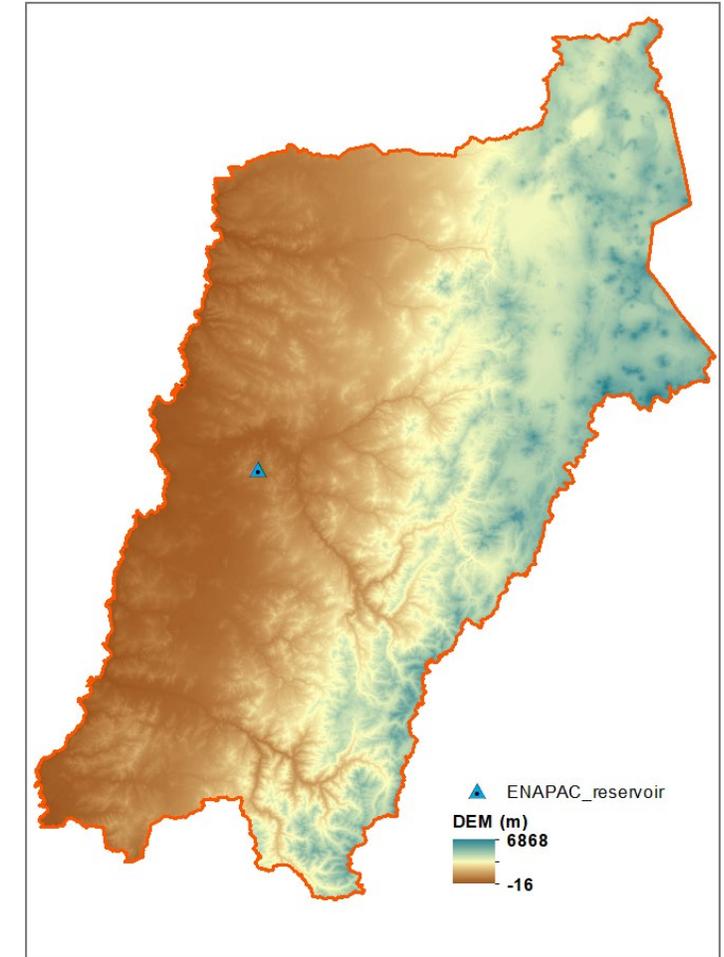
Surface water



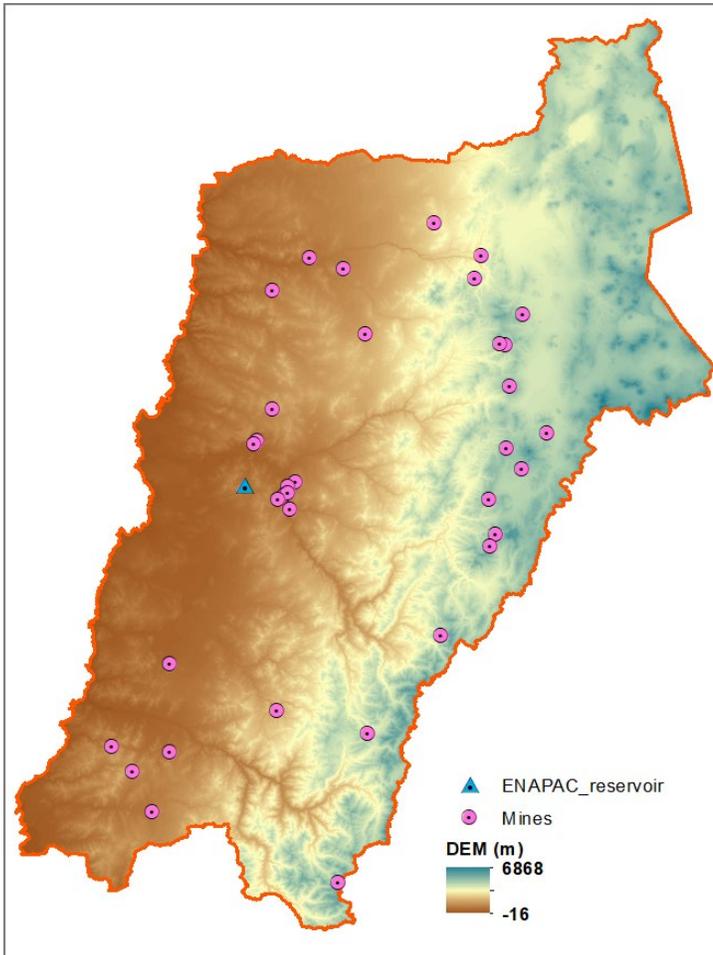
Groundwater



Seawater



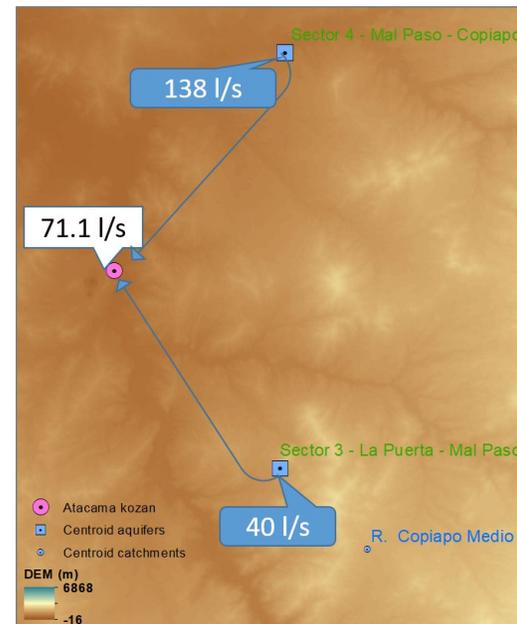
Regional water supply – water demands



35 Mines selected (ENAPAC)

- Projects
- Expansions

Characterization of water use each of the mines



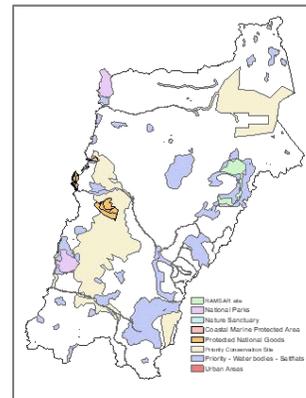
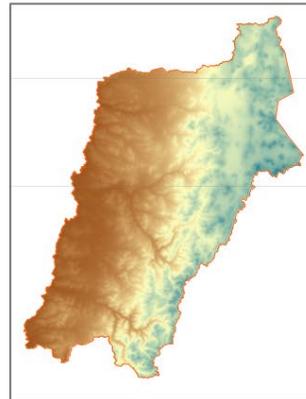
Freely available sources

- EIA
- Mines reports
- Government documents

Regional water supply – Optimal connections

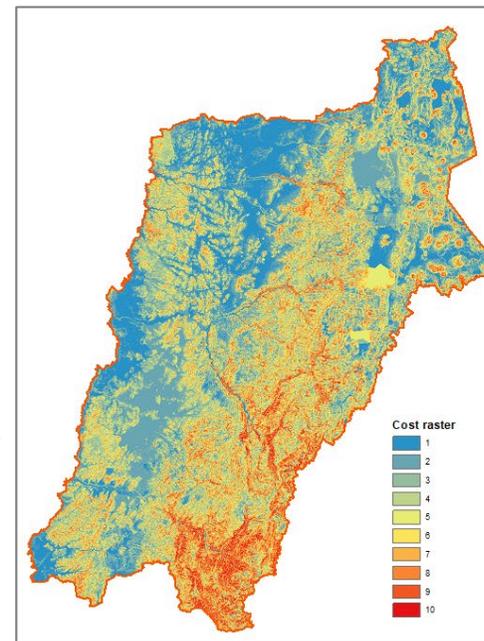
- RAMSAR sites
- National Parks
- Nature Sanctuary
- Coastal Marine Protected Area
- Protected National Goods
- Priority Conservation Site
- Priority – Water bodies – Salt flats
- Urban Areas

Topography

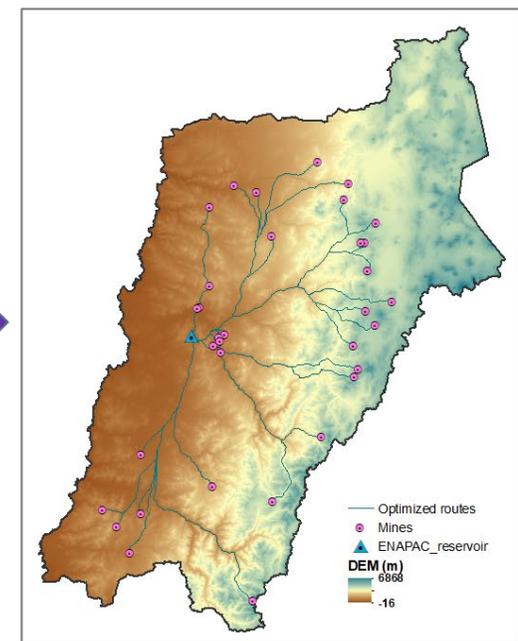


Restrictions

Cost Raster

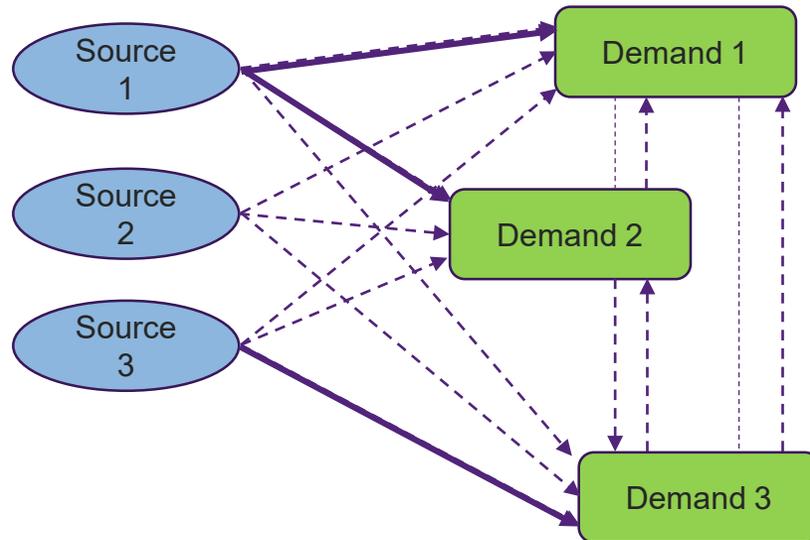


Optimized routes



Regional water supply - Optimization

Based on the Least Cost Method “Transport model”



Regional water supply – Next steps

- Completing first version of the tool
 - Finalizing spatial layers
 - Incorporation of all data
 - Testing and finishing optimization algorithms
- Receiving ENAPAC data (costs)
- Definition of scenarios
- Engaging with industry in Chile
- Submission of proposal to continue the work to the next step
- Preparing a conference presentation in Chile
- Publishing
- Finding information to include existing ore bodies, not yet exploited.



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Thank you

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