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Mining, Water Resources and Sustainability :

Some Ongoing Research Ideas #2

PECC Noumea Water Resources Seminar
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Presentation Overview

- **Reporting on Mining and Water Issues**
  - **eg. Global Reporting Initiative (GRI)**
- **Mining and Water : 'Embodied Water'**
  - **eg. how much water does it take to produce nickel ?**
- **Climate Change & Mining in the Pacific**
- **Summary**

Mining Industry & Water Issues:

The MMSD Final Report stated :

"… Issues related to water are only included where associated with other impacts such as acid drainage. This is partly because water consumption in minerals production, while an important impact, ends when operations end and thus does not constitute a long-term liability. …" (pp 233, IIED and WBCSD 2002)

Reporting on Mining v Water

- Over the past decade, ‘sustainability’ reporting has increased significantly
- The mining industry has been a leader in this reporting (eg. WMC, Placer Dome, …)
- The most popular emerging protocol for sustainability reporting is the UN’s “Global Reporting Initiative” (GRI)
  - *GRI aims to establish uniform reporting for sustainability in same fashion as financial*

Global Reporting Initiative (GRI)

- Broad-based **voluntary** protocol, designed to facilitate consistent reporting on various aspects of sustainability
- GRI covers main areas of environmental, social, economic, human rights, labor practices and product responsibility
- Uses a range of 'indicators' which can be used to assess sustainability performance
- Indicators can be qualititative / quantitative

Today Focus on water

GRI : Water Indicators

- GRI has numerous indicators for water:
  - EN8 : total water used by source (core)
  - EN9 : water resources affected by use (vol)
  - EN10 : extent of water recycling (vol)
  - EN21 : water discharge by quality and destination (core)
- For mining, these may appear to be simple but in reality are difficult to apply

Reporting : One Example (Cu-Au Mine)

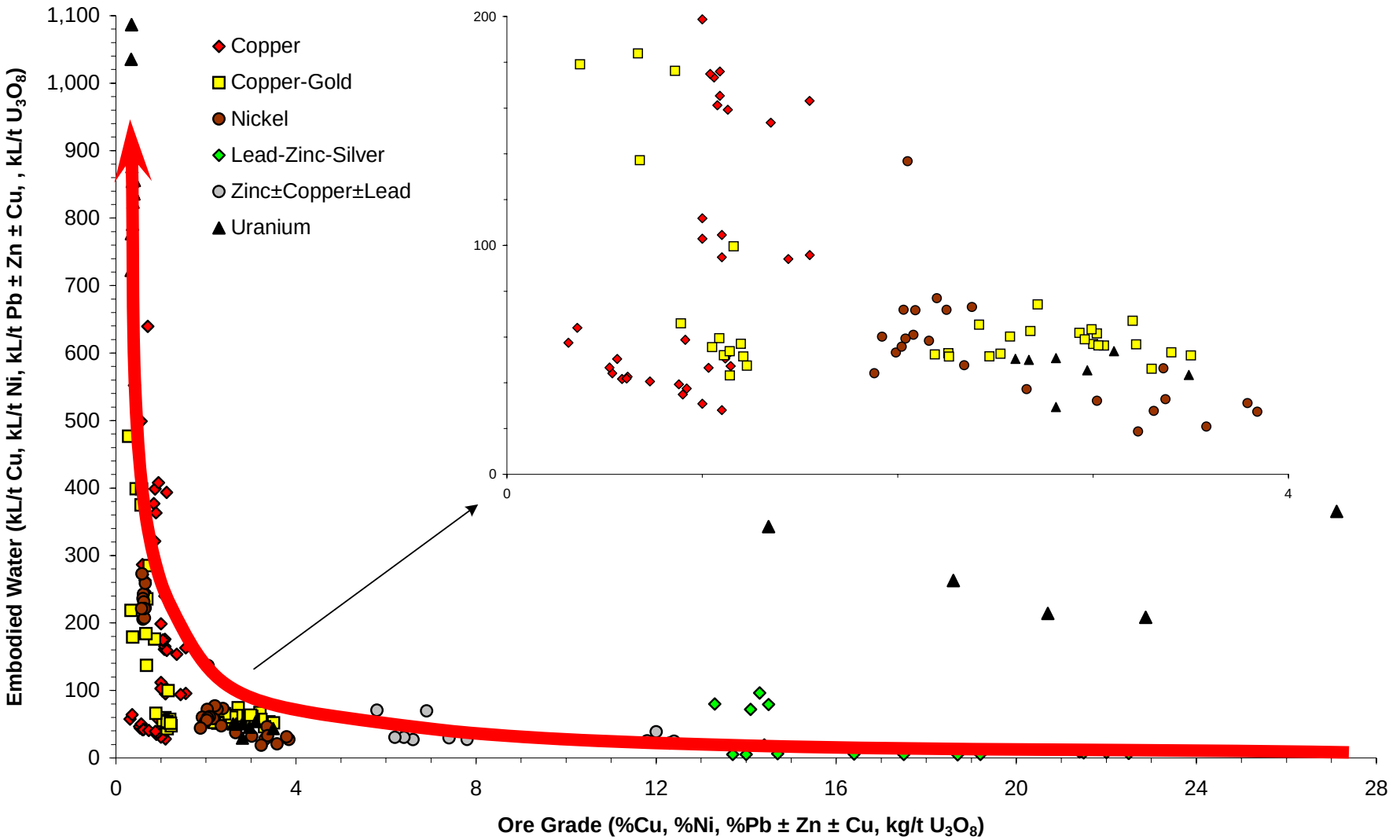
ENVIRONMENTAL		2005
Water Use/Consumed *(Million Gallons)*		
Total Water Used and Consumed		101,234
Surface Water Consumption		6,365
Seawater Used		94,869
Groundwater Consumption		1,024
Mine Dewatering Consumption		1,160
Total Water Consumed		8,550
Fresh		8,550
Brackish		-
Saline		94,869
Hypersaline		0
Dewatering Extraction *(Million Gallons)*		
Total Mine Dewatering Extraction		1,160
Fresh		1,160
Brackish		-
Saline		-
Total Water Use Extraction vs Permitted *(Million Gallons)*		
Surface Water & Seawater	Extracted Volume	101,234
	Permitted Volume	101,234
Groundwater	Extracted Volume	1,024
	Permitted Volume	1,024
Dewatering Extraction	Extracted Volume	1,160
	Permitted Volume	1,160

Mining and 'Embodied Water'

- We can use sustainability reporting to better understand how much water is required to produce metals & minerals
- For 'Life Cycle Assessment' (LCA), energy is often used but water is also critical

"EMBODIED WATER"

Examples : Embodied Water



Examples : Embodied Water

Mineral/metal	Total number of years of data	v. ore throughput (e.g. kL/t ore)		v. ore grade (e.g. kL/t metal)	
		Average	SD	Average	SD
Bauxite (kL/t bauxite)	17	1.09	0.44	–	–
Black coal (kL/t coal)	18	0.30	0.26	–	–
Copper (kL/t ore; kL/t Cu)	48	1.27	1.03	172	154
Copper–gold (kL/t ore; kL/t Cu)	42	1.22	0.49	116	114
Diamonds (kL/t ore; kL/carat)	11	1.32	0.32	0.477	0.170
Gold (kL/t ore; kL/kg Au)[a]	311[a]	1.96[a]	5.03[a]	716[a]	1,417[a]
Zinc ± lead ± silver ± copper ± gold (kL/t ore; kL/t Zn ± Pb ± Cu)	28	2.67	2.81	29.2	28.1
Nickel (sulfide) (kL/t ore; kL/t Ni)	33	1.01	0.26	107	87
Platinum group (kL/t ore; kL/kg PGM)	30	0.94	0.66	260	162
Uranium (kL/t ore; kL/t U_3O_8)	24	1.36	2.47	505	387

GRI & Water & Mining

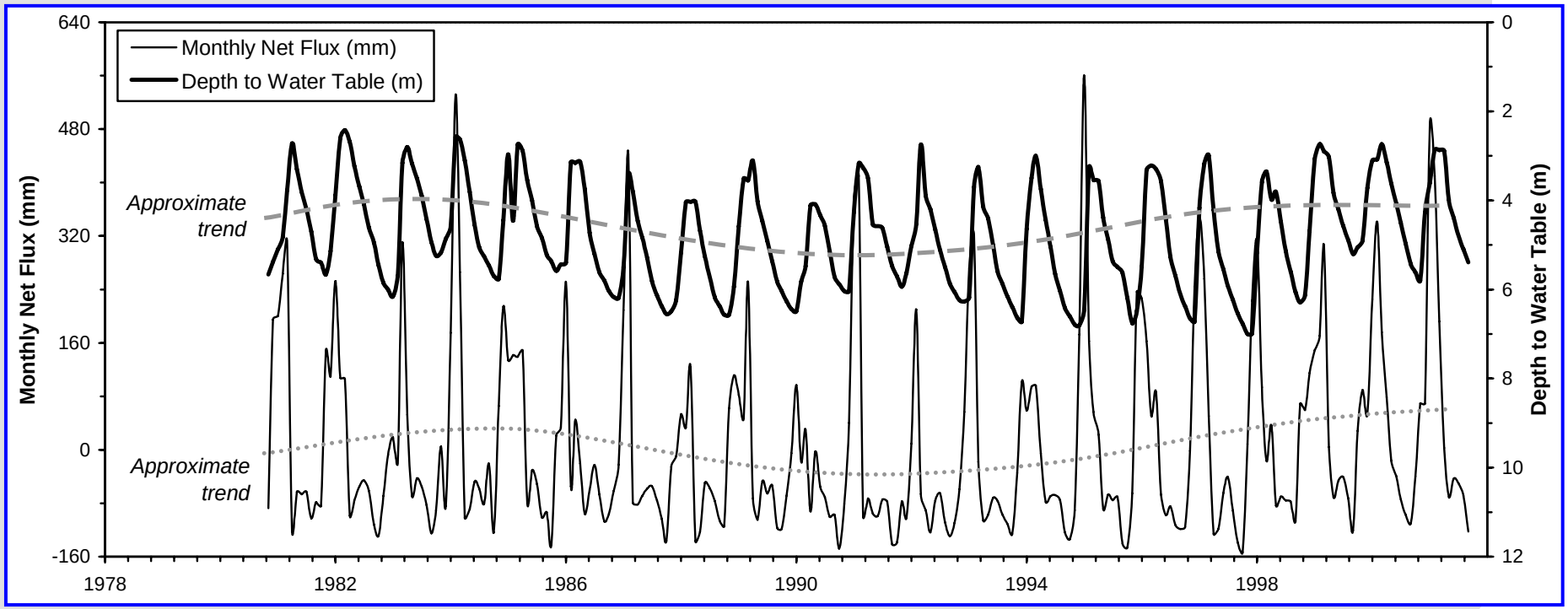
- **Major step forward in understanding water issues associated with mining**
- **Still need for further improvements, eg. :**
  - **impacted water resources still not addressed quantitatively;**
  - **water quality still included in indicators**
  - **some indicators still voluntary**
  - **changing company ownership leads to different practics and new data**

Climate Change, Mining & Water

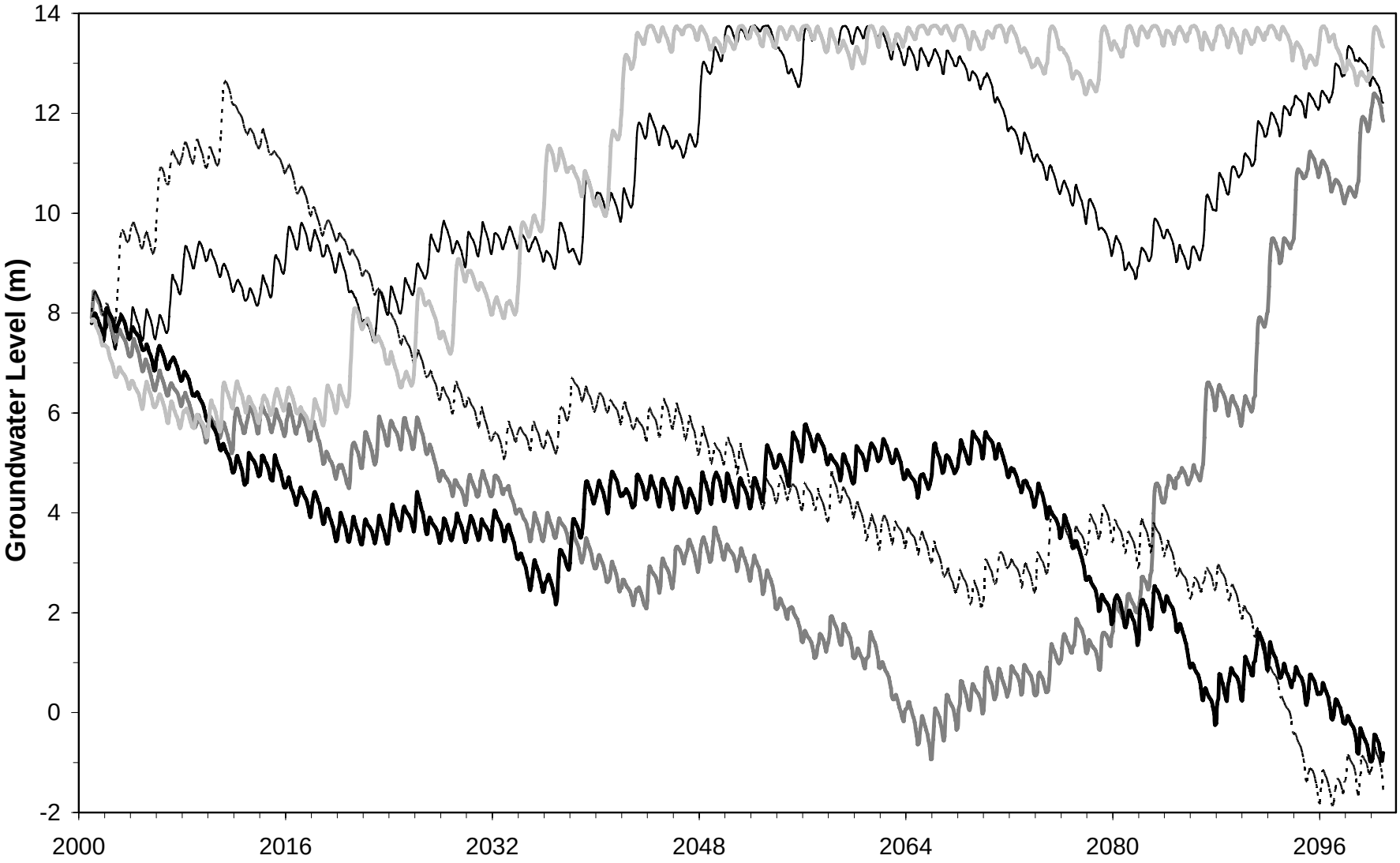
- Across the Pacific, the potential impacts of climate change on water resources could be very significant
- CC has major implications for mining
- Some research in progress in the Kakadu region, is using historical data combined with climate change models to predict future impacts on groundwater
- *Based on models, scenarios & variability*

Climate Change & Groundwater

- **Use historical monitoring data to model groundwater-climate relationships**



Climate Change & Groundwater



Climate Change, Mining & Water

- Overall, difficult to confidently predict the impact of climate change on water resources and mining across the Pacific
- In northern Australia, rainfall is predicted to decline but storm intensity will increase
- Preliminary analysis of results suggest that climate variability is likely to be the more critical factor
- Major need for research …

Summary: Mining & Water

- **Mining and water issues are very closely linked : *critical for long-term sustainability***
- **Major need to provide sound data and information for sustainability reports**
  - ***GRI is a major step forward, but still major scope for improvements***
- **The 'embodied water' of metals and minerals is significant, looks set to rise (?)**
- **Climate change & variability will be critical in the future for mining & water issues**

Acknowledgements

- PECC New Caledonia for supporting this participation
- Numerous colleagues in mining and groundwater circles