

Sea to Sky Parkway ARD/ML Assessment

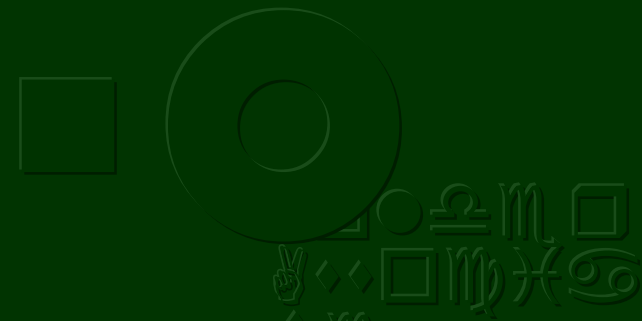
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Al Brown – B.C. Ministry of Transportation

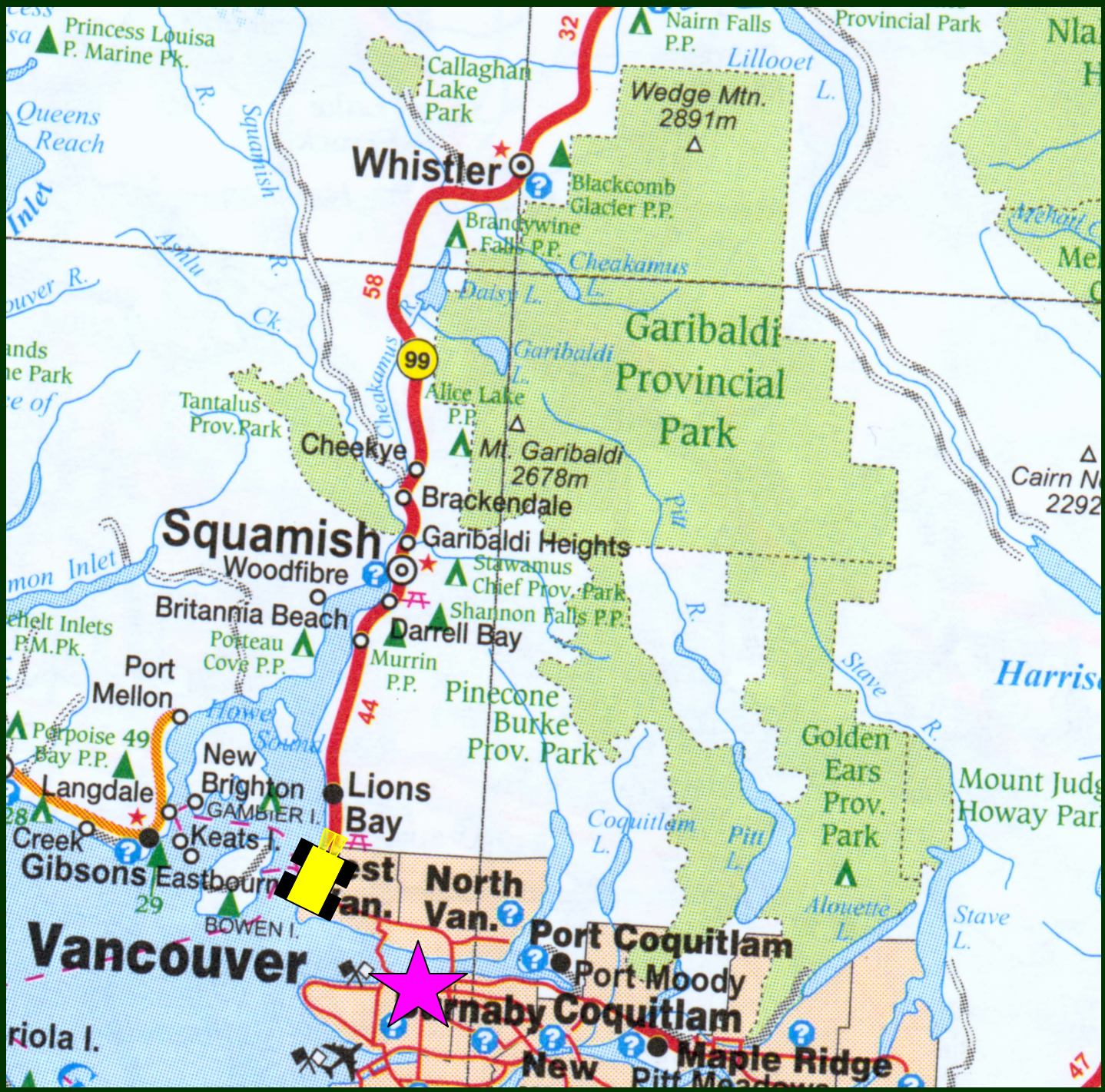




Objective

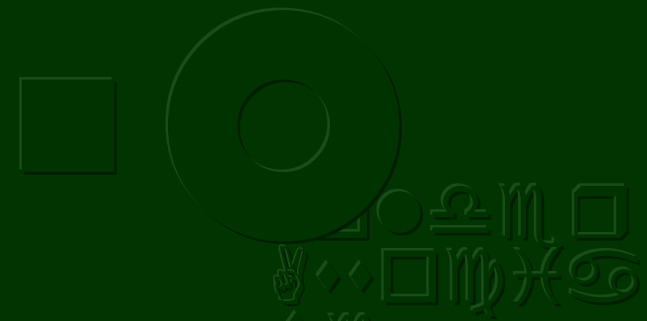
Characterize the *bulk* acid rock drainage (ARD) and metal leaching (ML) potential of rocks along the Sea to Skyway corridor





Overview

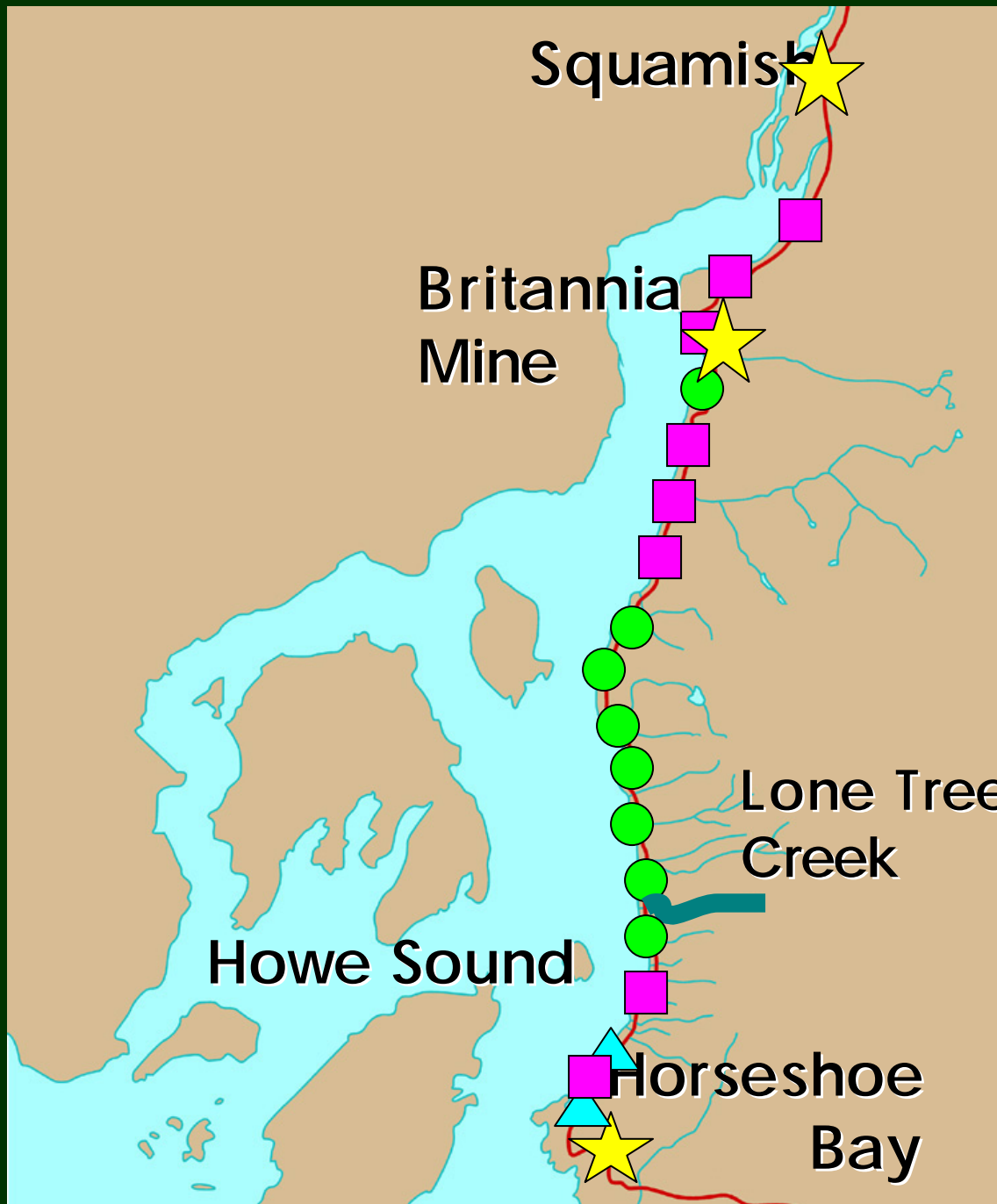
- Data Collection – Rationale and Results
 - Geologic Mapping
 - Static Testing
 - Kinetic Testing
- Impact Assessment Approach
- Ongoing Work



Geologic Mapping

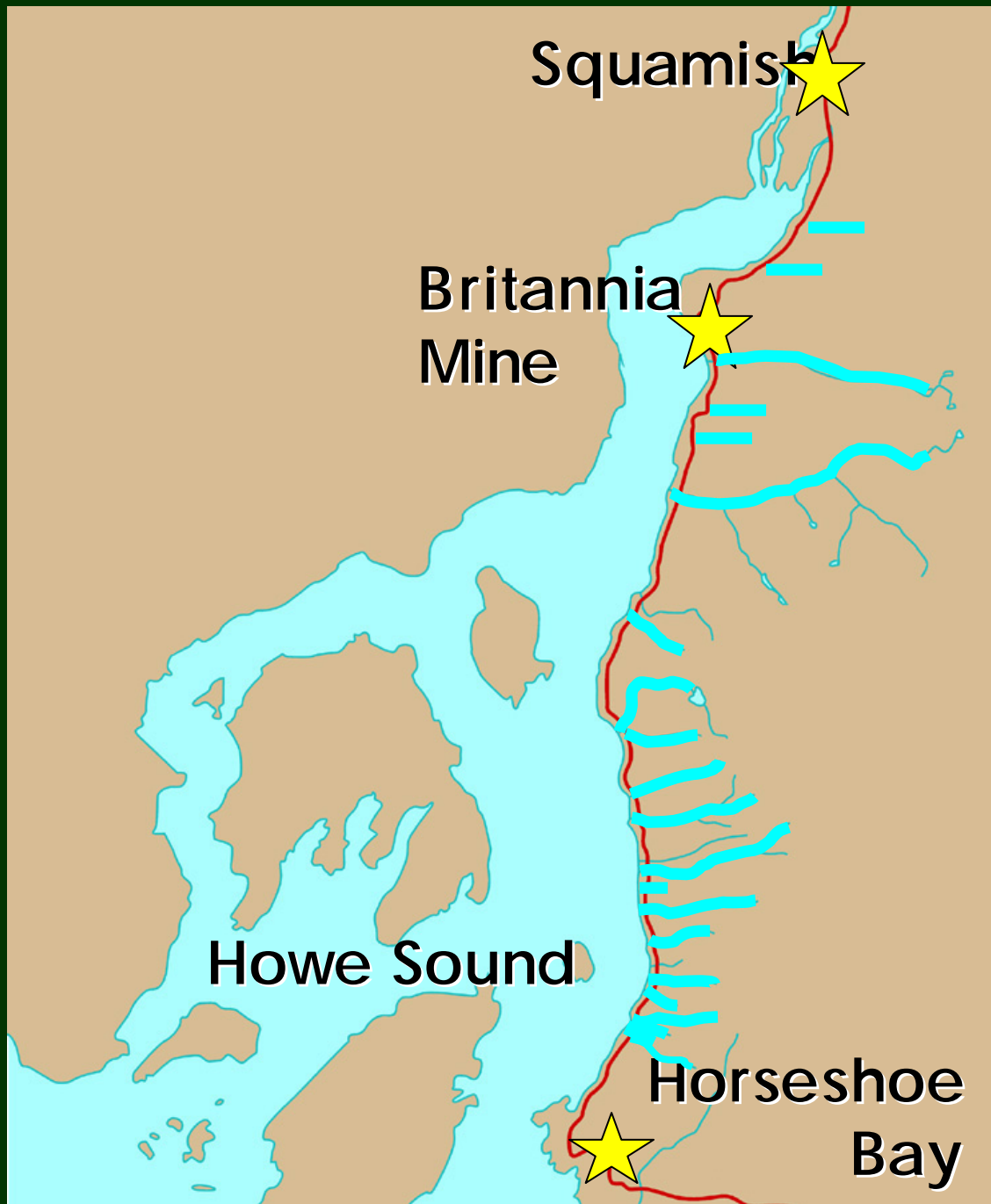


GEOLOGIC MAP



- ▲ Twin Island Group (PJT)
- Gambier Group (IKG)
- Coast Plutonics (CP)





WATER SAMPLING

- 23 creeks
- Exceedances of aquatic freshwater criteria
 - $\text{pH} < 6.5$
 - Aluminum
 - Copper



Static Testing

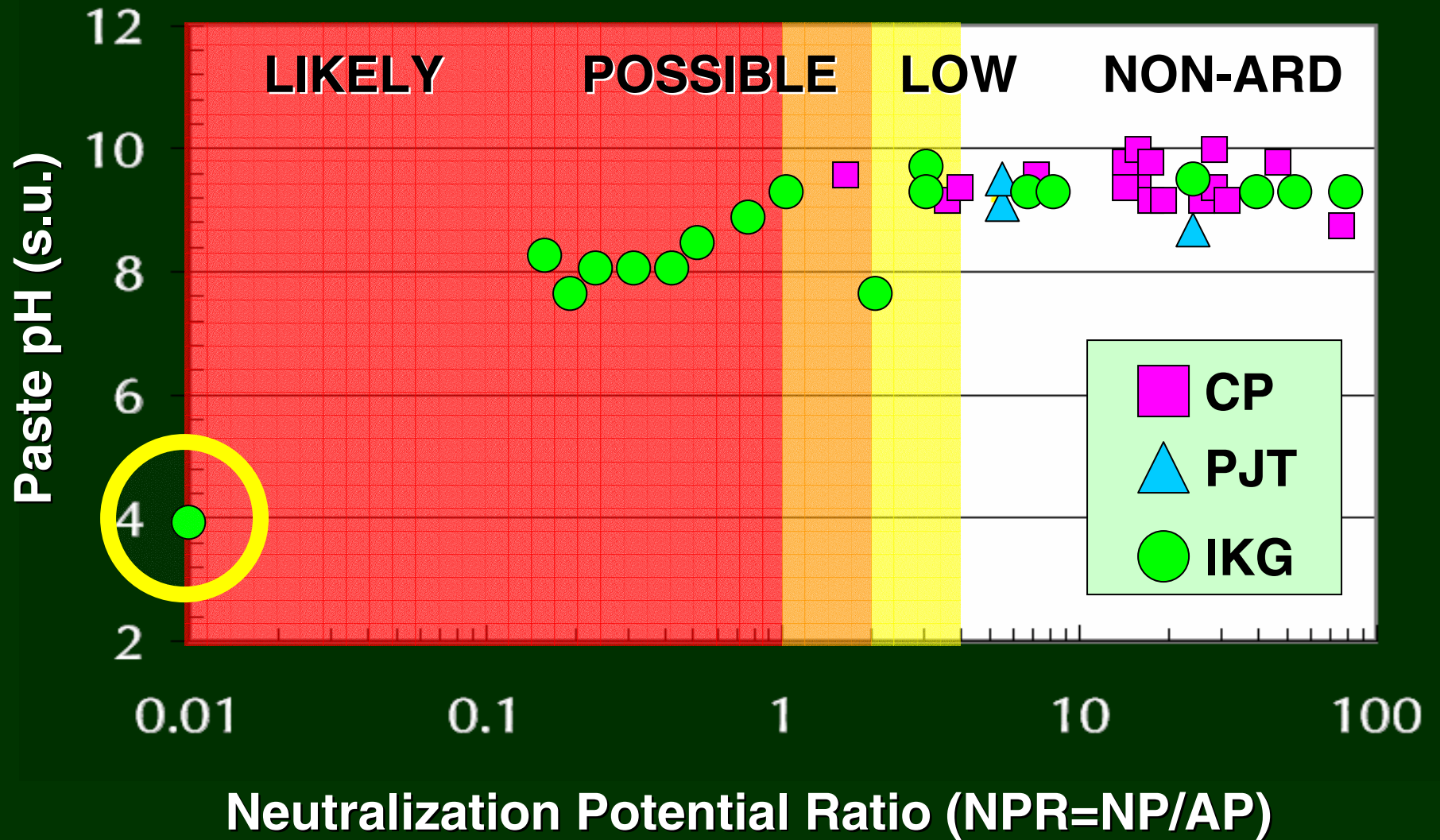
- Acid Base Accounting (ABA)
- Mineralogy (XRD)
- Whole Rock Analysis
- Shake Flask Extraction (SFE)
- Wall Washing



Wall Washing

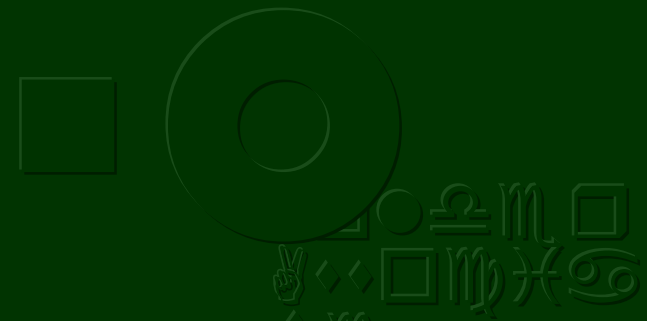
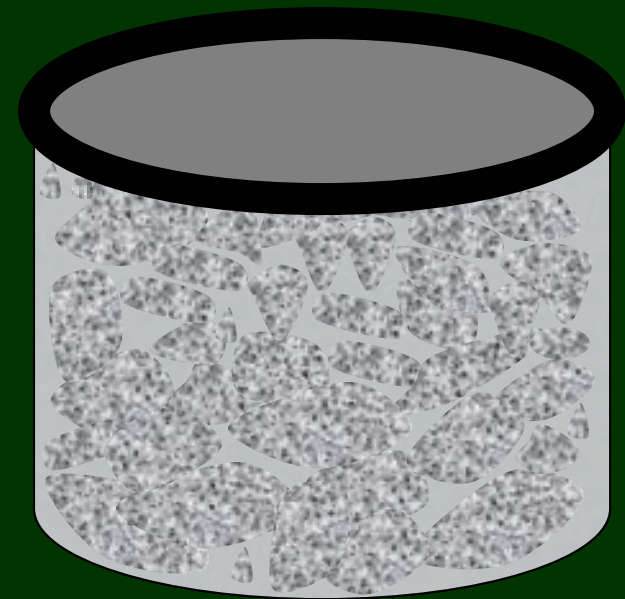


ARD Potential

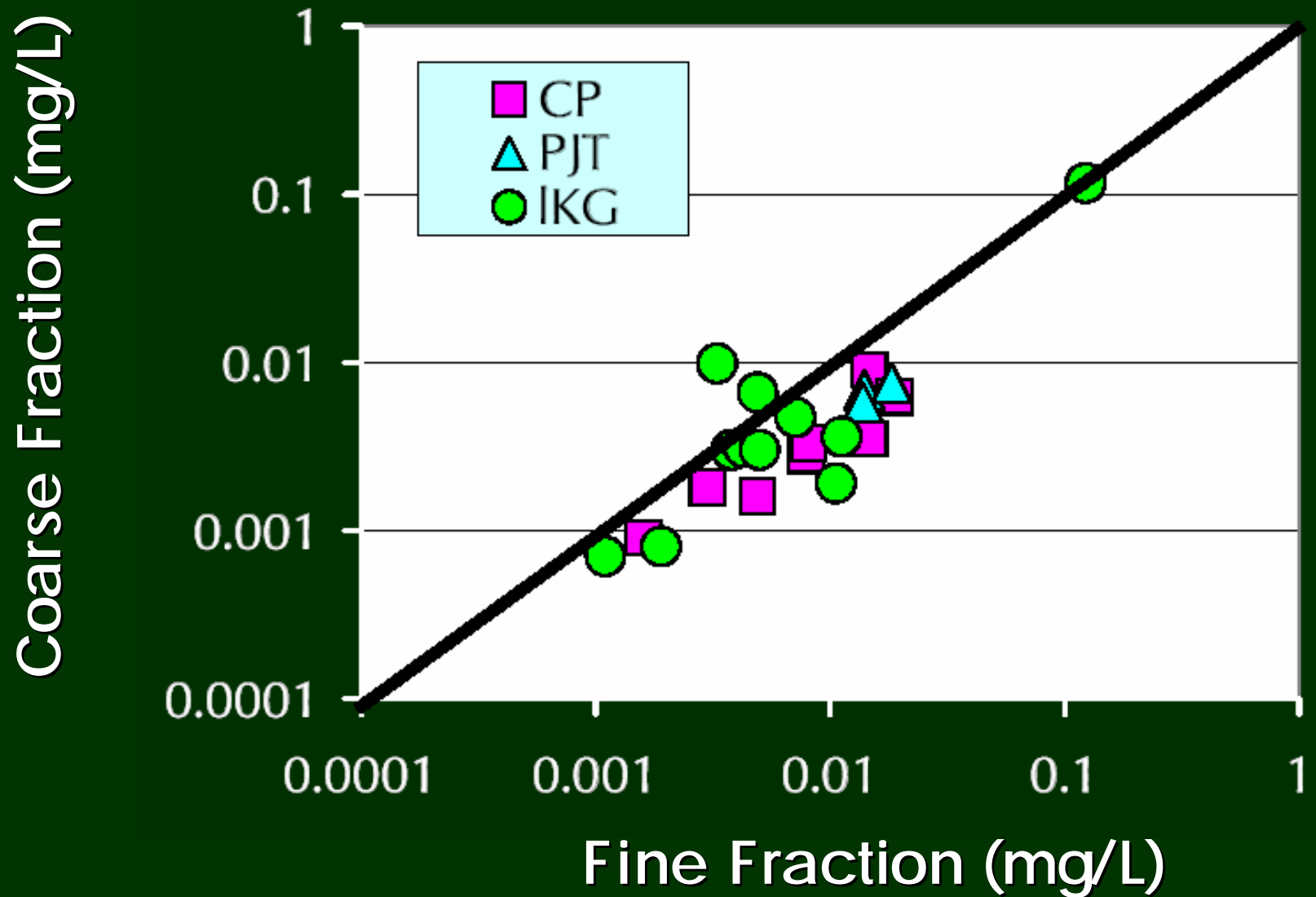


Shake Flask Extraction (SFE)

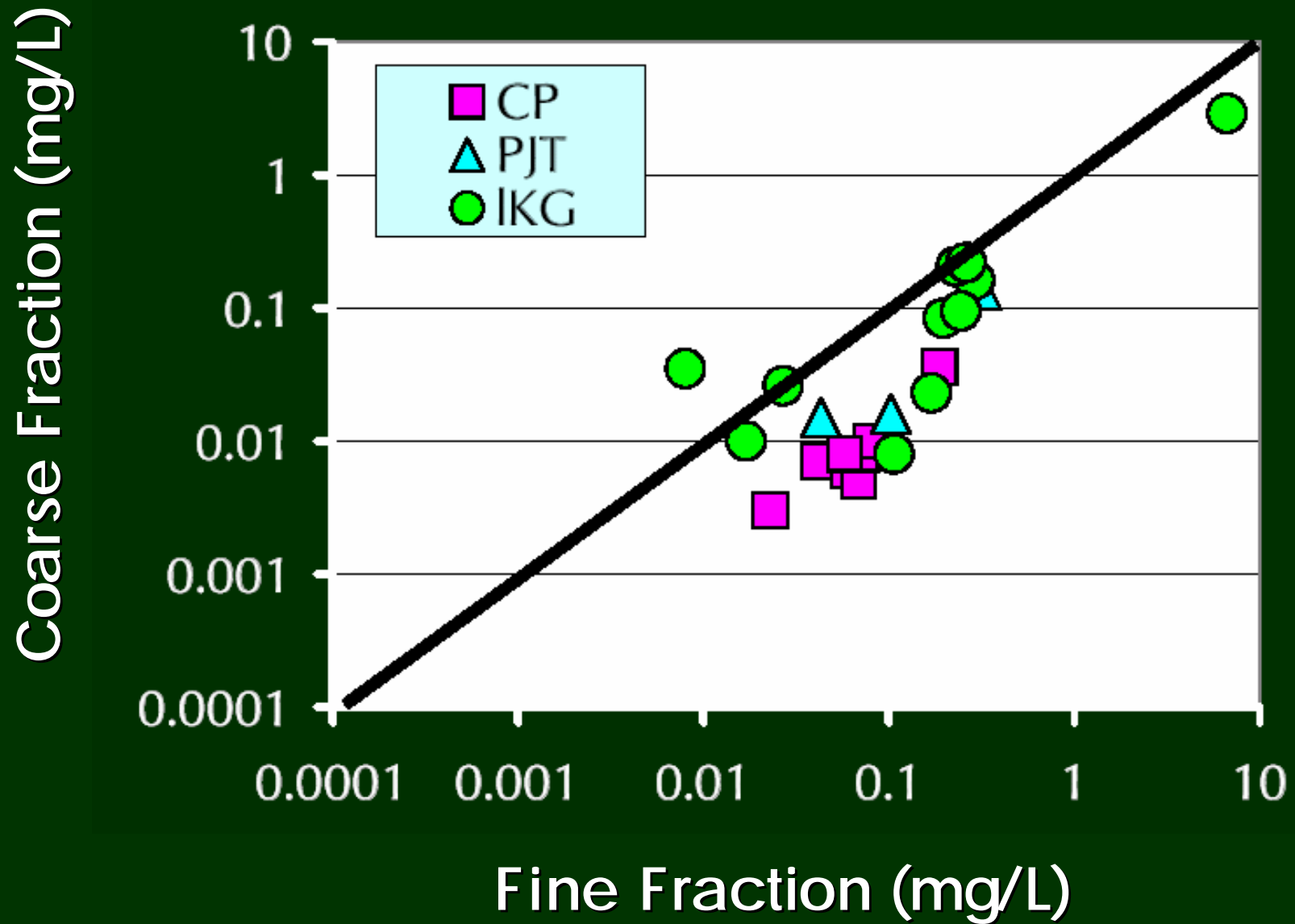
- Crushed sample
 - 2 size fractions
- 3:1 liquid to solid ratio
- Lixiviant
 - Deionized water
 - Salt water
- 24-hour bottle roll



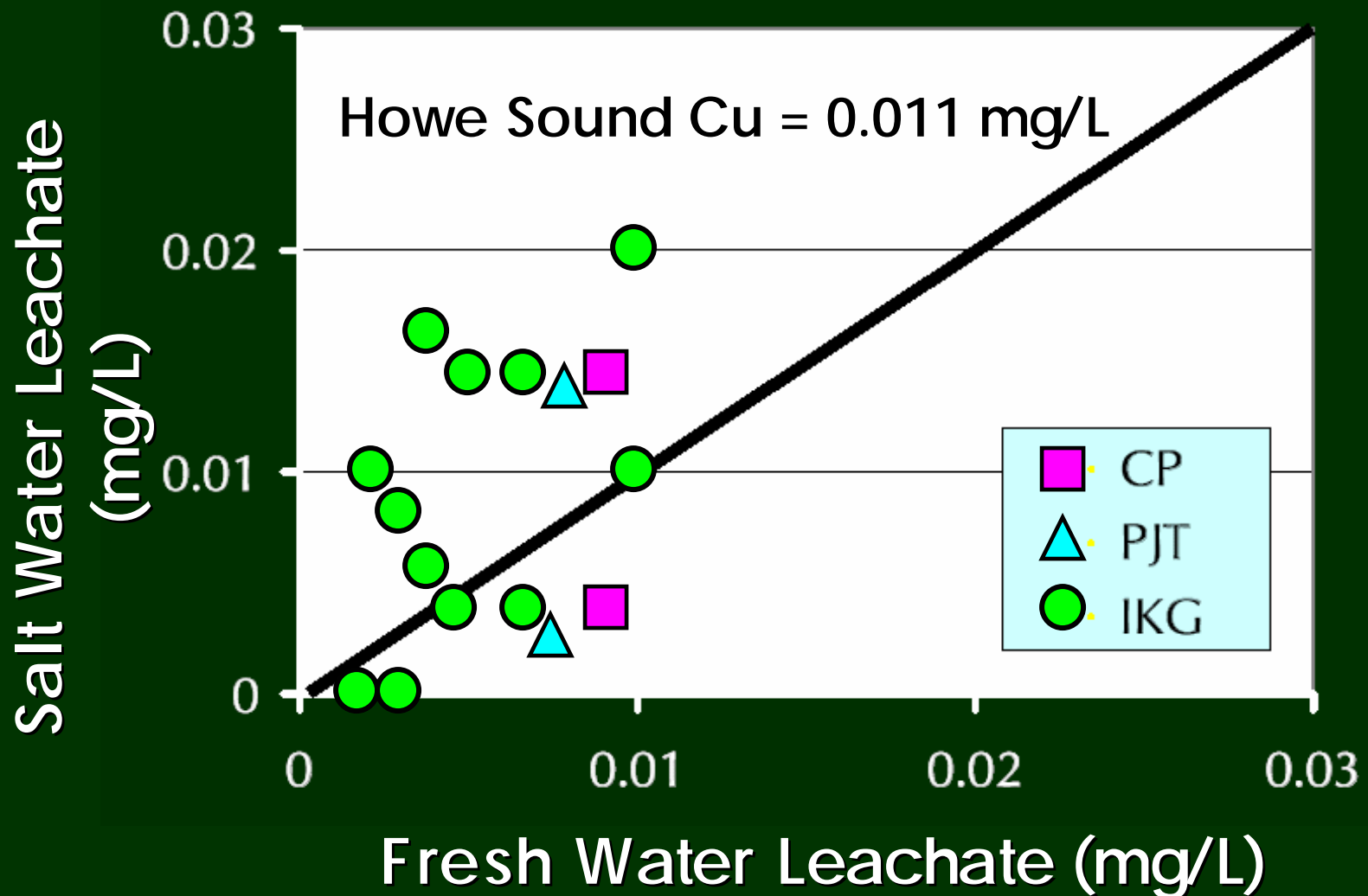
SFE Copper Results



SFE Aluminum Results



Salt Water Vs. Fresh Water SFE Copper

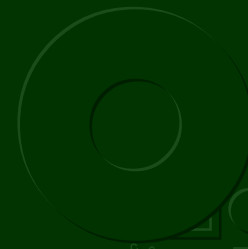




Wall Washing

Wall Washing

- Conducted in early October - prior to start of wet season
- Area - 1 m²
- Leachate volume recorded

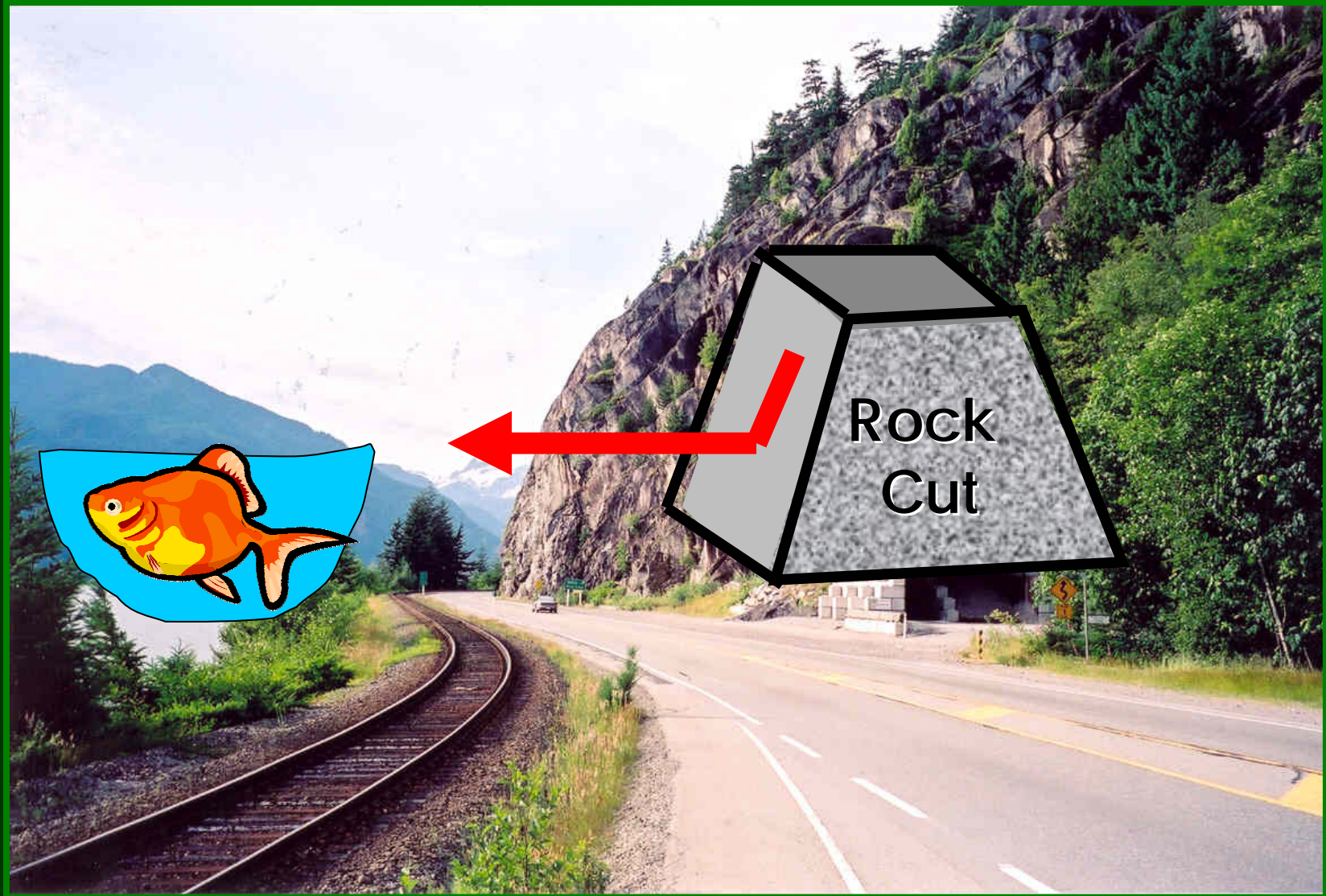


Results Summary

- ARD Potential
 - Coast Plutonics – None
 - Twin Island Group – None
 - Gambier Group – Likely to Possible
- ML Potential
 - Copper and aluminum from all rock types

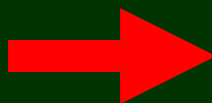


Impact Assessment



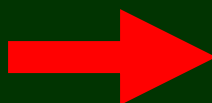
Metal Leaching Rate (SFE)

COARSE



RATE
(kg/m²)

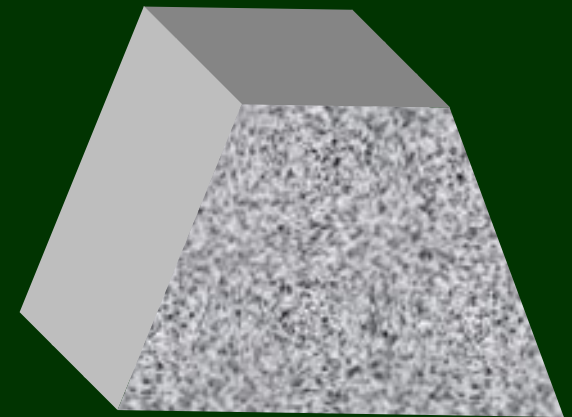
FINE



RATE
(kg/m²)



RATE
(kg/m²)

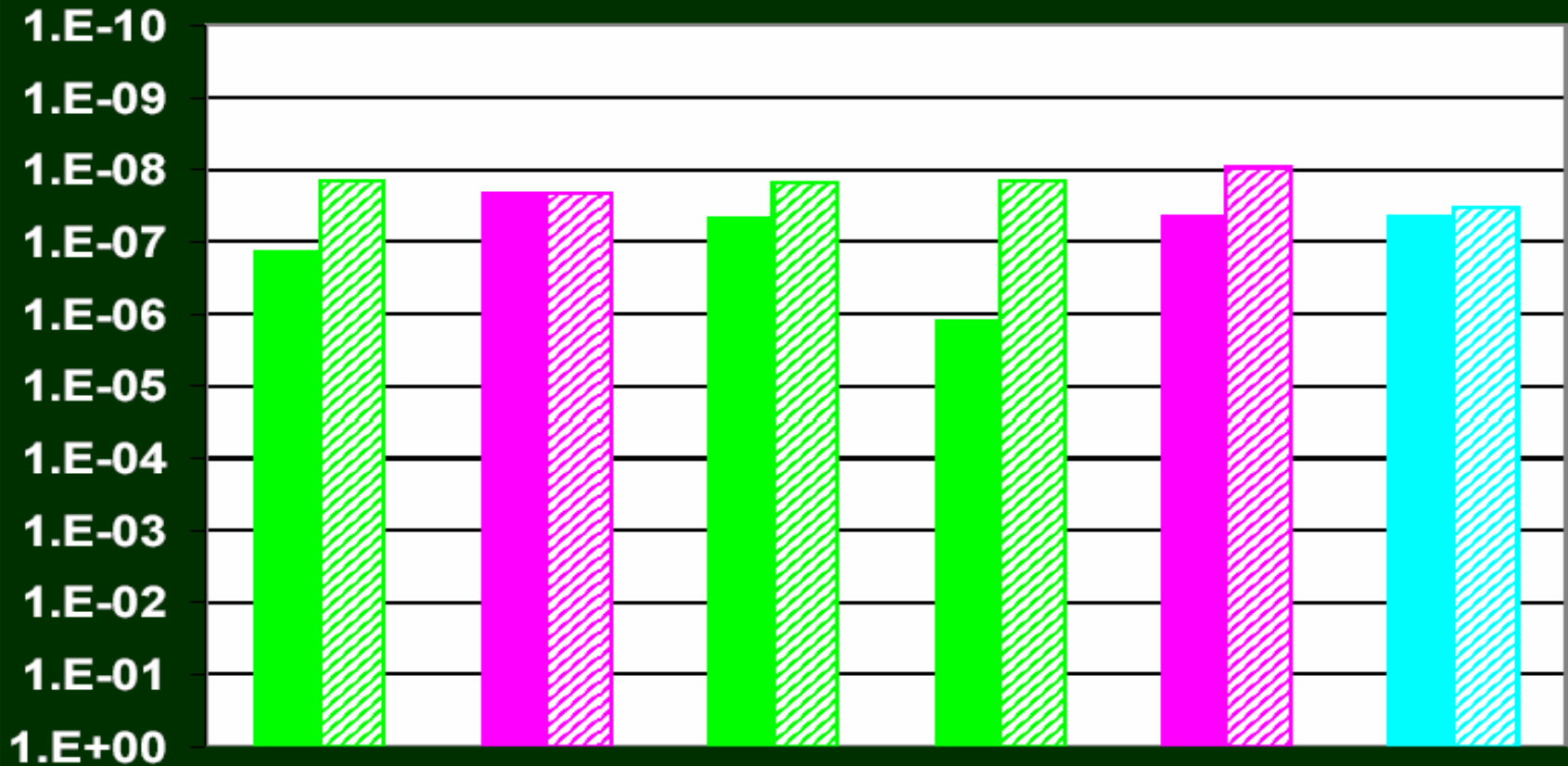


Wall Washing vs. SFE Rates

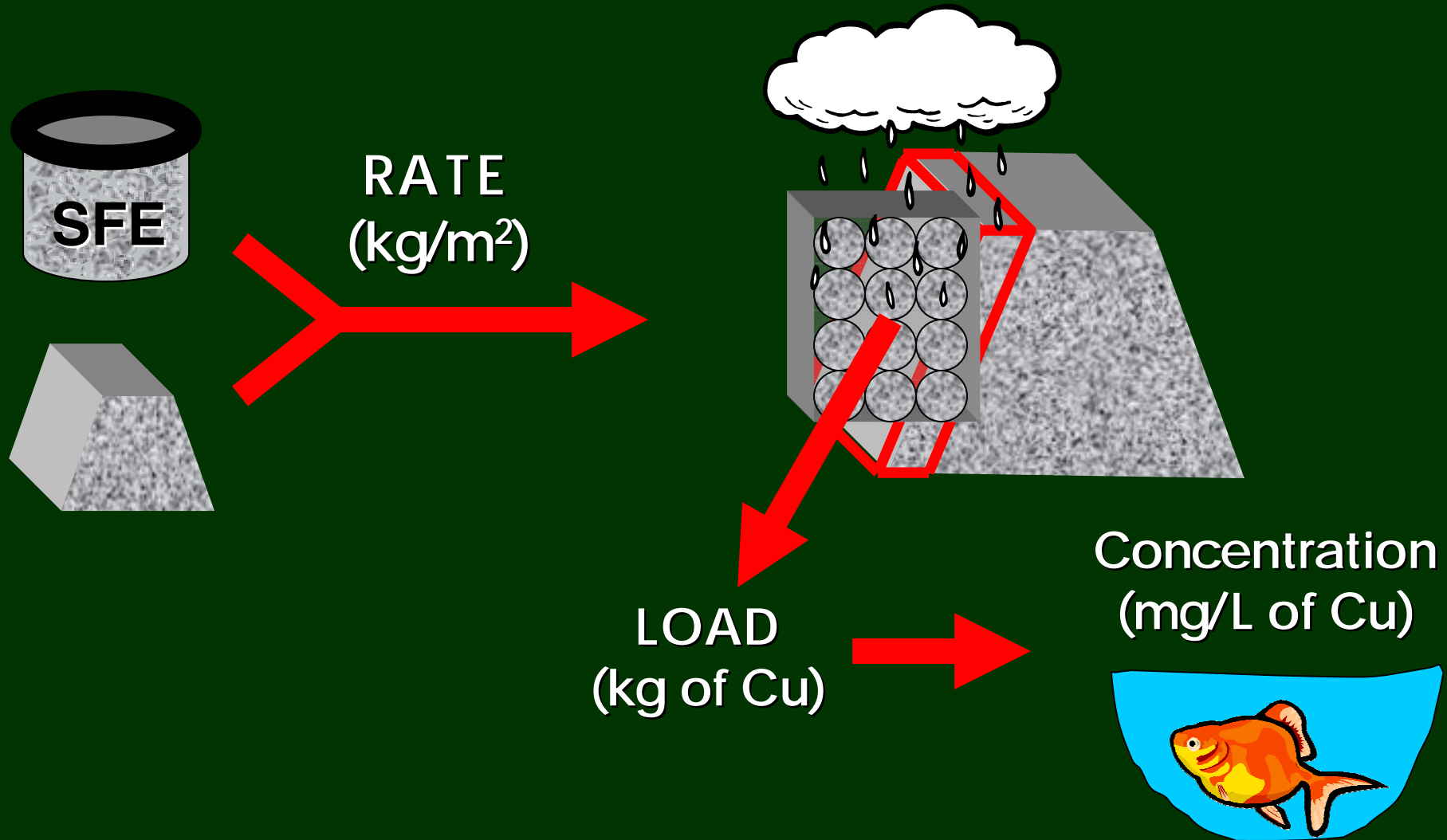
Copper Leaching Rate (kg/m²)

Wall Washing – Solid

SFE Test - Stripes



Metal Loading



Predicted Concentrations

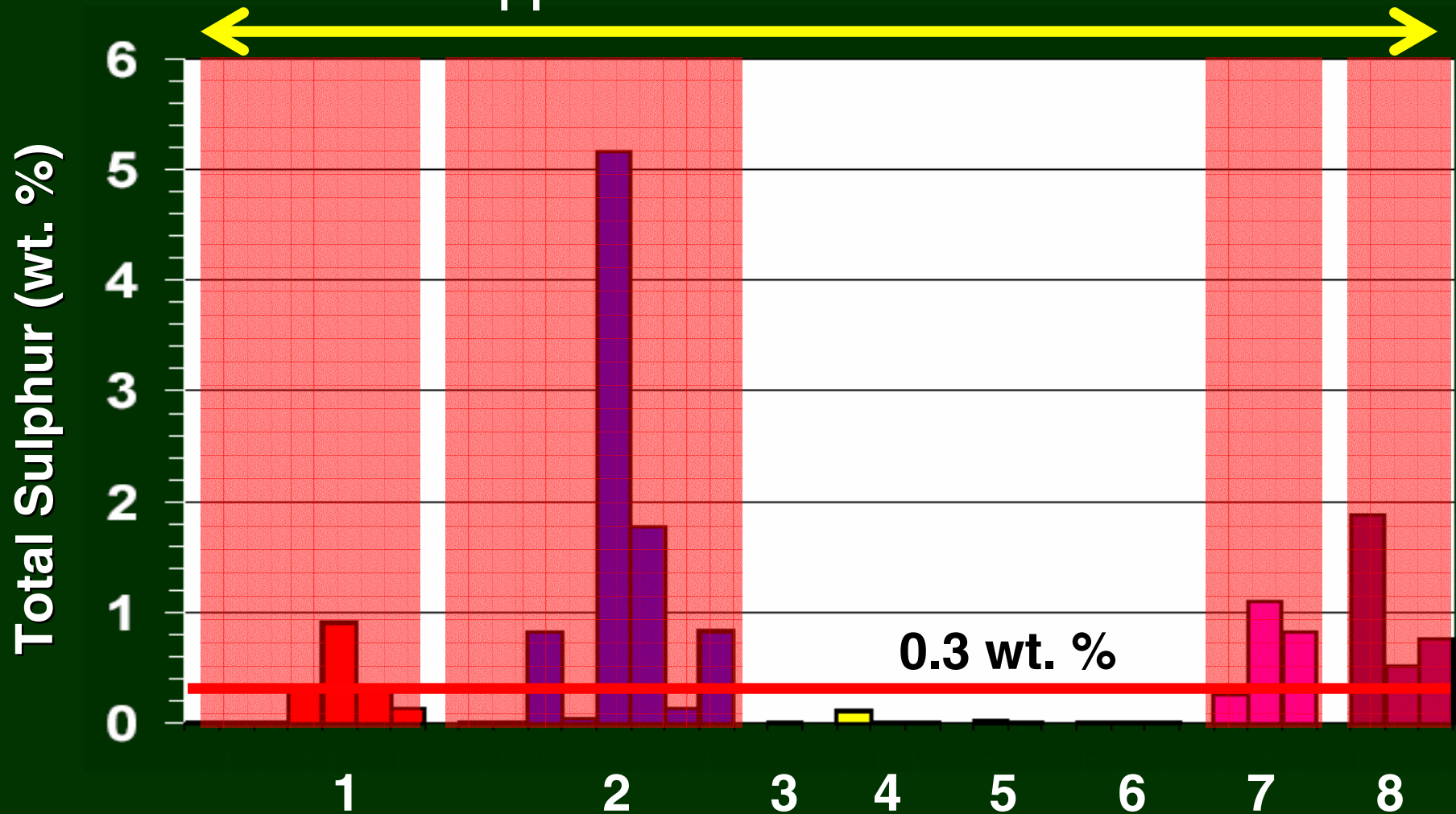
Drainage	Background	CEQG	Rock Cut Drainage	Stream
	(mg/l)			
Sculfield	0.002	0.002	0.029	0.0021
Loggers	0.001		<0.001	0.00099
Britannia	0.044		0.021	0.0439

CEQG – Federal freshwater aquatic standard

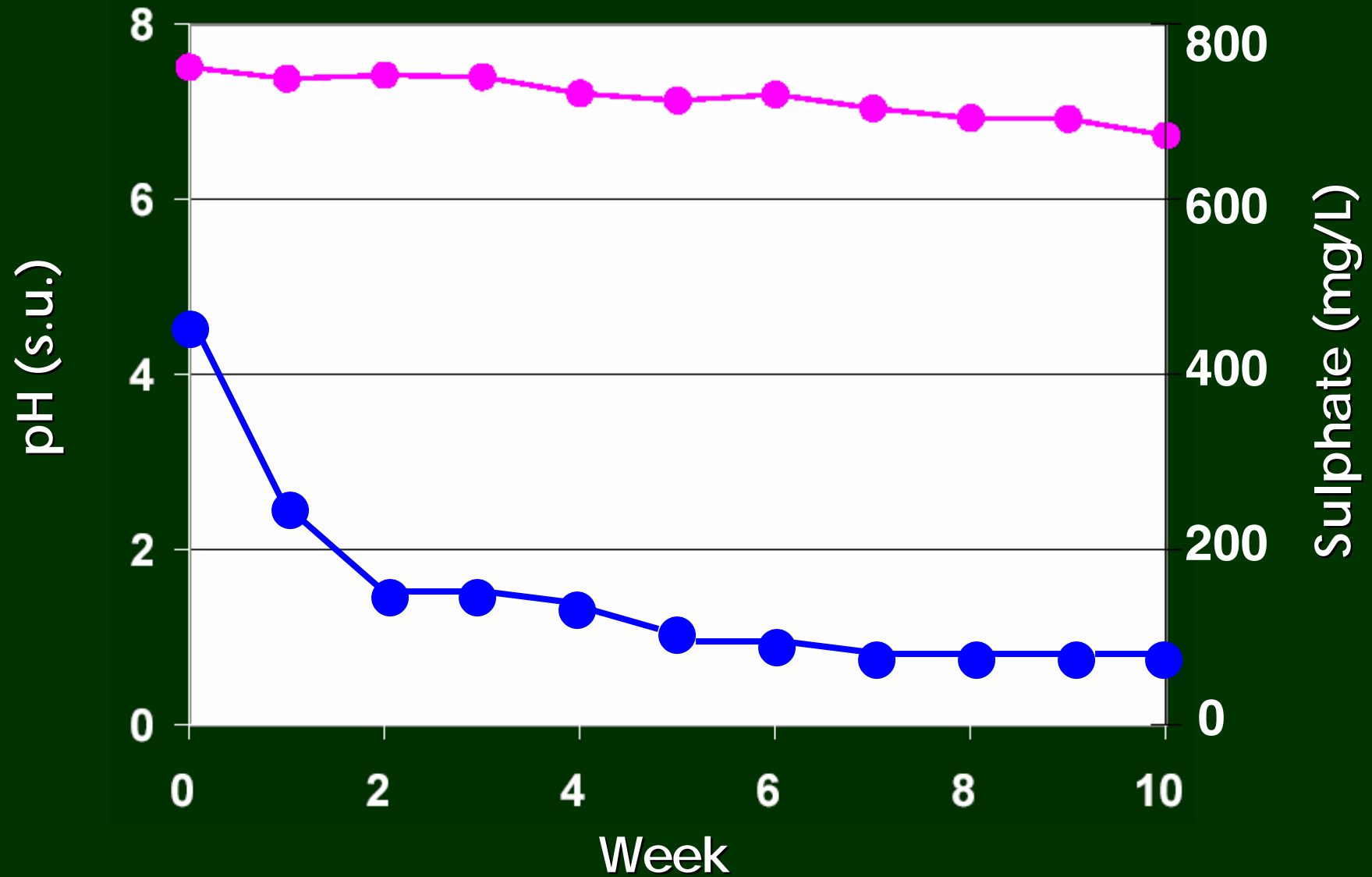


Gambier Group Cuts

Approximate Distance = 5 km



Kinetic Testing



Conclusions

- Metal leaching may result in Cu and Al exceedances in rock cut runoff; however, resultant stream concentrations are predicted to remain below standards
- Metal loading to Howe Sound is predicted to be small
 - 2 g to 9 g in Rundle drainage compared to 5.7 kg loading from Britannia drainage
- Gambier Group andesites have potential to generate ARD



Conclusions

Potential environmental effects from ARD/ML perspective are anticipated to be small, provided suitable re-use and disposal options are chosen for the excavated material



Acknowledgements

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