

## Memorandum

**To:** File  
**CC:**  
**From:** Chris Garrett, SWCA  
**Date:** July 29, 2012  
**Re:** Comparison of Pit Lake Water Quality to Surface Water Quality Standards

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The purpose of this memo is to document the comparison between modeled pit lake water quality and surface water standards. Surface water standards for warm water aquatic species and wildlife were selected for comparison as these are the most likely species to encounter water in the pit lake. Some surface water quality standards are dependent on water hardness. Based on modeled pit lake water quality, an estimated hardness (as CaCO<sub>3</sub>) of 355 milligrams per liter was selected (this is an estimate based on average calcium results [89.9 – 107.7 milligrams per liter] and magnesium results [22.7 to 30.1 milligrams per liter]).

Comparisons are made to both acute and chronic standards; however, acute standards are the most likely to be applicable.

### Summary of Results

Cadmium exceeds the chronic standard for all four scenarios; no scenarios exceed the acute standard.

Copper exceed the acute standard for two scenarios, and the chronic standard for all four scenarios.

Lead exceeds the chronic standard for three scenarios; no scenarios exceed the acute standard.

Mercury exceeds the chronic standard for at least two scenarios and possibly all four (mercury was not detected, but detection limits are not clear); no scenarios exceed the acute standard.

Selenium exceeds the chronic standard for all four scenarios; there is no acute standard for selenium.

Zinc exceeds the chronic and acute standards for all scenarios.

Constituent	Scenario 1: Low Geochemical Loading	Scenario 2: Average Geochemical Loading	Scenario 3: High Geochemical Loading	Scenario 4: Average Loading with Bolsa Quartzite	Surface Water Standard – A&Ww @ Hardness = 355 mg/L CaCO3 ACUTE mg/L	Surface Water Standard – A&Ww @ Hardness = 355 mg/L CaCO3 CHRONIC mg/L	Notes
Aluminum	0.158	0.197	0.260	0.357	-	-	
Antimony	0.003	0.003	0.003	0.003	0.088	0.030	Dissolved
Arsenic	0.004	0.005	Not present	0.003	0.340	0.150	Dissolved
Barium	Not present	Not present	0.009	Not present	-	-	
Beryllium	0.001	0.001	0.001	0.001	-	-	
Bicarbonate	37.3	36.2	37.0	36.0	-	-	
Cadmium	0.002	0.002	0.002	0.002	0.02693	0.00135	Dissolved
Calcium	89.9	99.8	107.7	100.7	-	-	
Chloride	9.9	11.1	12.5	11.1	-	-	
Chromium	0.004	0.005	0.005	0.005	1.608	0.20919	Dissolved, Chromium III
Copper	0.004	0.004	0.005	0.163	0.004434	0.002644	Dissolved
Fluoride	1.1	1.2	1.4	1.2	-	-	
Iron	Not present	Not present	Not present	Not present	-	1.0	Dissolved
Lead	0.004	0.015	0.017	0.015	0.24838	0.00968	Dissolved
Magnesium	22.7	25.7	30.1	25.6	-	-	
Manganese	0.229	0.255	0.243	0.254	-	-	
Mercury	0.002	0.001	Not present	Not present	0.0024	0.00001	Dissolved
Molybdenum	0.137	0.150	0.192	0.154	-	-	
Nickel	0.005	0.006	0.007	0.010	1.368	0.15190	Dissolved
pH	8.1	8.0	8.0	8.0	-	-	
Potassium	5.1	5.7	6.3	5.4	-	-	
Selenium	0.013	0.014	0.016	0.014	-	0.002	Total
Silver	0.004	0.004	0.005	0.004	0.02843	-	Dissolved
Sodium	31.9	35.9	38.6	35.3	-	-	
Sulfate	330.6	374.1	518.5	375.8	-	-	
Thallium	0.005	0.006	0.007	0.006	0.700	0.150	Dissolved
Total Dissolved Solids	527	589	751	590	-	-	
Uranium	0.005	0.006	0.006	0.006	-	-	
Zinc	0.745	0.847	0.959	0.862	0.3428	0.3428	Dissolved

Highlights indicate exceedance for acute or chronic surface water quality standard