KIA-8

Appendix KIA-8-1 Response Memo to Kitikmeot Inuit Association (KIA) for Technical Comment KIA-8

MAC RESOURCES

Memorandum

Date:	December 8, 2015
To:	John Roberts, TMAC Resources Inc.
From:	Mike Henry, ERM
CC:	Jim Chan, ERM and Derek Chubb, ERM
Subject:	**TMAC Resources Inc. – Response to Kitikmeot Inuit Association (KIA) Information Request (IR) #29 (KIA-29 IR) in relation to the amendment application for the Doris North Project Certificate No.003 and the Type A Water Licence (2AM-DOH1323).**

INTRODUCTION

This memorandum responds to the Information Request (KIA-29) provided by the Kitikmeot Inuit Association (KIA) in September 2015 with respect to TMAC Resources Inc.'s (TMAC) amendment application for the Doris North Project Certificate No.003 and the Type A Water Licence (2AM-DOH1323). Provided below is the initial and follow-up responses to the KIA-29 IR.

KIA COMMENT:

What is the distance from the diffuser at which CCME water quality guidelines will be met in Roberts Bay (i.e.: what is the size of the mixing zone)? Please demonstrate how the 20:1dilution will be achieved. Please provide modeling results for all three discharge scenarios (groundwater only, groundwater and TIA, TIA only) in both the open water season when full exchange with Melville Sound is expected and under ice when the water exchange is negligible. We note these seasonal differences specifically as they were highlighted by TMAC in Package 2.

INITIAL TMAC RESPONSE:

The initial TMAC response to the KIA-29 IR submitted in October 2015 follows:

Dilution will be achieved rapidly given the pumping and small portals. Of the Canadian Council of Ministers of the Environment (CCME) metals in effluent, maximum predicted chromium concentrations (0.0062 mg/L; Table 4.5-3, document P4-1) will require the greatest dilution to meet CCME guideline levels (0.0015 mg/L; Table 4.5-1, document P4-1) in the receiving environment of Roberts Bay (baseline: 0.001 mg/L; Table 4.5-2, document P4-1), in this case a 9.2:1 dilution. This will be reached within 1 m of the diffuser portals, and given this parameter requires the greatest dilution, the 'CCME mixing zone' will be 1 m. Modelling results for the 3 requested scenarios during summer and winter can be provided during the technical review portion of the Amendment review process.

FOLLOW-UP TMAC RESPONSE:

This response provides additional modelling results for the three requested discharge scenarios of discharge of TIA and groundwater combined, TIA water only, and groundwater only. With respect to the mixing zone and simulation results for achievable effluent dilutions within Roberts Bay, additional information can be found in *Doris North Gold Mine Project: Discharge of Treated Water to Roberts Bay* (Rescan 2011).

The objective of this exercise was to estimate the water quality concentrations in Roberts Bay for those parameters with Canadian Council of Ministers of the Environment (CCME) marine water quality guidelines for the protection of aquatic life (PAL) based on the three discharge scenarios. The data used in model calculations and the model assumptions are the same as listed in Section 4.5.2.2 of Package 4, with the following additional information:

- For each of the three modelled scenarios, maximum predicted water quality concentrations for the TIA and groundwater, groundwater only, and TIA only discharge were obtained from Table 6-3 of the *Doris North Project – Water and Load Balance* (Package 6 document 10; SRK 2015);
- Combined TIA and groundwater are discharged at a constant rate of 80 L/s during the summer months (June to September), TIA effluent is discharged at 45 L/s during the summer months only, and groundwater is discharged at 35 L/s continuously over the year.

Table 1 presents the background water quality for Roberts Bay, the predicted water quality concentrations in each of the potential discharge scenarios into Roberts Bay (i.e., TIA and groundwater combined, groundwater only, and TIA effluent only), and the associated CCME water quality guidelines for the protection of marine life. These guidelines are conservative empirical thresholds that are meant to be protective of all forms of aquatic life and all aspects of aquatic cycles, including the most sensitive species over the long term. In the case of the marine CCME metals (arsenic, cadmium, chromium, and mercury), each guideline concentration includes a safety factor that is 10× lower than the toxic threshold concentration for the most sensitive species. For conservatism, the *maximum* predicted concentrations that would be discharged from the three effluent streams were used in the modelling exercise.

Results of Roberts Bay water quality concentrations under the three discharge scenarios are presented in Figures 1a through 1c and in Table 2. Results indicate that the maximum water quality concentrations for all parameters are predicted to occur when combined TIA and groundwater are discharged into Roberts Bay (Table 2). Concentrations of nitrate, arsenic, and cadmium were estimated to increase only slightly over baseline conditions (2.7-13.2%), while increases in chromium and mercury concentrations were projected to be greater, between 30 and 91%. Results for mercury should be interpreted cautiously as the modelling exercise used an undetectable concentration (0.0001 mg/L) as an input and this detection limit was far greater than the typically available ultra-low detection limit of 0.0000005 mg/L. Regardless, the resulting concentrations in Roberts Bay are predicted to be far below CCME guidelines for all water quality parameters, with nitrate, arsenic, chromium, and mercury near or more than an order of magnitude lower than their respective guideline limit. Given these low predicted concentrations and that all marine water quality guidelines have 10× safety factors applied to their limits (CCME

2015), the water quality in Roberts Bay is predicted to be safe for marine life for each of the discharge scenarios.

REFERENCES

CCME. 2015. *Canadian Water Quality Guidelines for the Protection of Aquatic Life: Summary Table.* http://ceqg-rcqe.ccme.ca/ (accessed November 2015).

Rescan. 2011. *Doris North Gold Mine Project: Discharge of Treated Water to Roberts Bay.* Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.

Table 1. Roberts Bay Background Water Quality and Predicted Maximum Water Quality in Marine Outfall Mixing Box.

WQ Parameter	CCME WQ Guideline Concentration	Roberts Bay Background Concentration	Predicted Maximum Outfall Concentration (Groundwater + TIA)[a]	Predicted Maximum Outfall Concentration (Groundwater Only)[a]	Predicted Maximum Outfall Concentration (TIA Only)[a]
Nitrate	45	0.067	0.80	0.93	0.40
Salinity	±10% baseline	27.05	26.7	26.7	0
Arsenic	0.0125	0.00094	0.0035	0.0024	0.0092
Cadmium	0.00012	0.000056	0.00018	0.00012	0.00046
Chromium	0.0015	0.001	0.0039	0.00086	0.01
Mercury[b]	0.000016	0.0000013	<0.0001	0.000049	<0.0001

Note: all concentrations are in mg/L except salinity which is parts per thousand.

[a] - all discharge water quality data taken from Table 6-3 of the Doris North project - Water and Load Balance Report (Package 6, Volume 10)

[b] - mercury concentrations for TIA discharge were not available because of poor detection limits for the mill effluent (0.0001 mg/L).

Table 2. Predicted Roberts Bay Water Quality Concentrations based on TIA-Groundwater Combined, Groundwater Only, and TIA Only Discharge.

WQ Parameter	Predicted Roberts Bay Concentration using Maximum Predicted Outfall Levels (TIA + Groundwater)	Predicted Roberts Bay Concentration using Maximum Predicted Outfall Levels (Groundwater Only)	Predicted Roberts Bay Concentration using Maximum Predicted Outfall Levels (TIA Only)	Maximum Allowable Concentrations in Discharge to Meet CCME in Roberts Bay[a]	% Increase over Roberts Bay Background Concentration (TIA and Groundwater)	% Increase over Roberts Bay Background Concentration (Groundwater only)	% Increase over Roberts Bay Background Concentrations (TIA only)
Nitrate	0.076	0.075	0.068	3,730	13.2	11.3	1.6
Salinity	27.046	27.047	27.049	0-260	-0.02	-0.01	0.00
Arsenic	0.00097	0.00095	0.00097	0.96	3.3	1.4	2.9
Cadmium	0.000058	0.000057	0.000057	0.0053	2.7	1.0	2.4
Chromium	0.00015	0.00011	0.00013	0.0425	45.8	6.7	32.6
Mercury[b]	0.0000025	0.0000017	0.0000016	0.0013	91.4	32.3	25.0

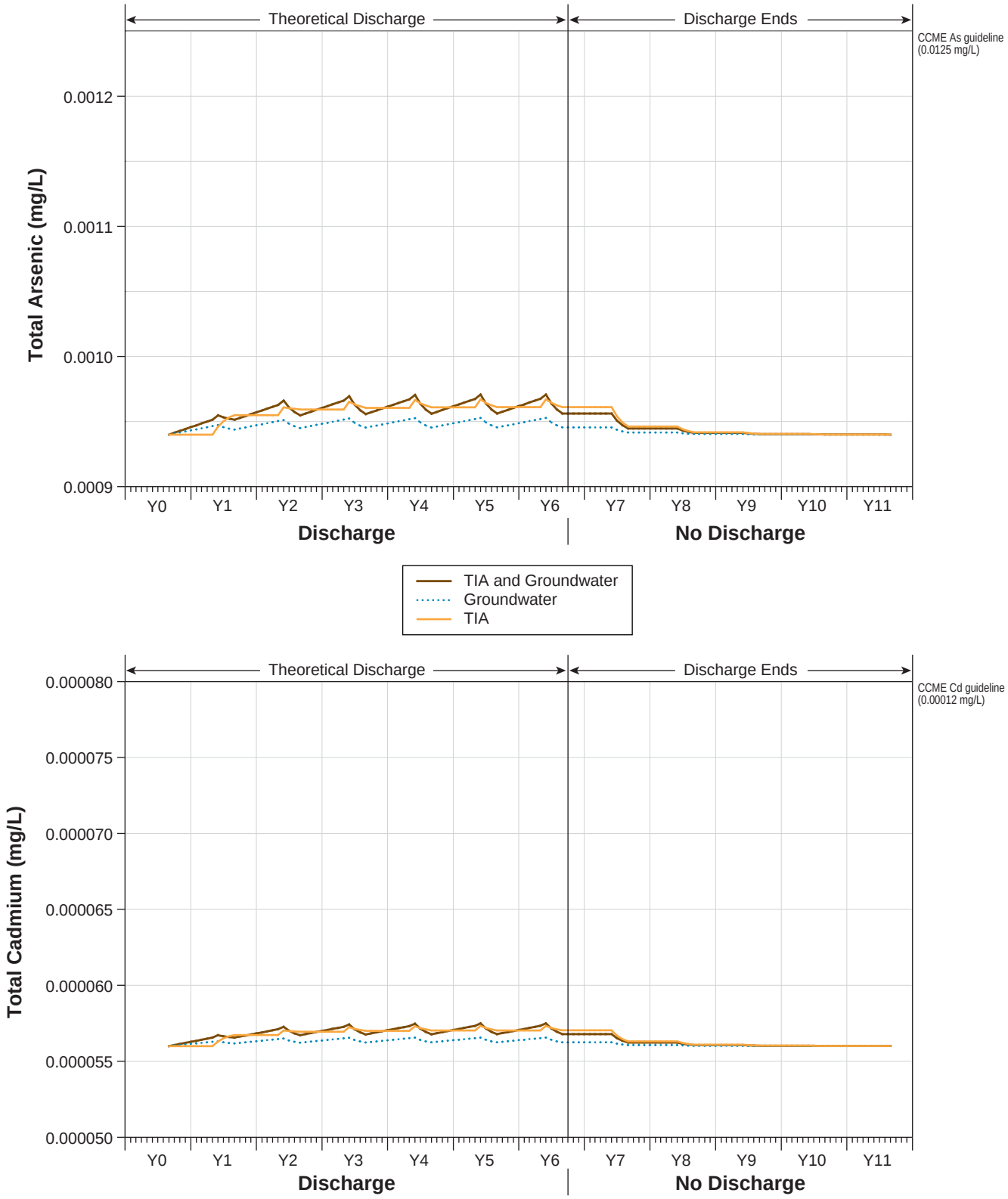
Note: all concentrations are in mg/L except salinity which is parts per thousand.

[a] – concentrations taken from Package 4, Table 4.5-3.

[b] - mercury concentrations for TIA discharge were not available because of poor detection limits for the mill effluent (0.0001 mg/L) . The detection limit was used for modelling purposes.

Figure 1a

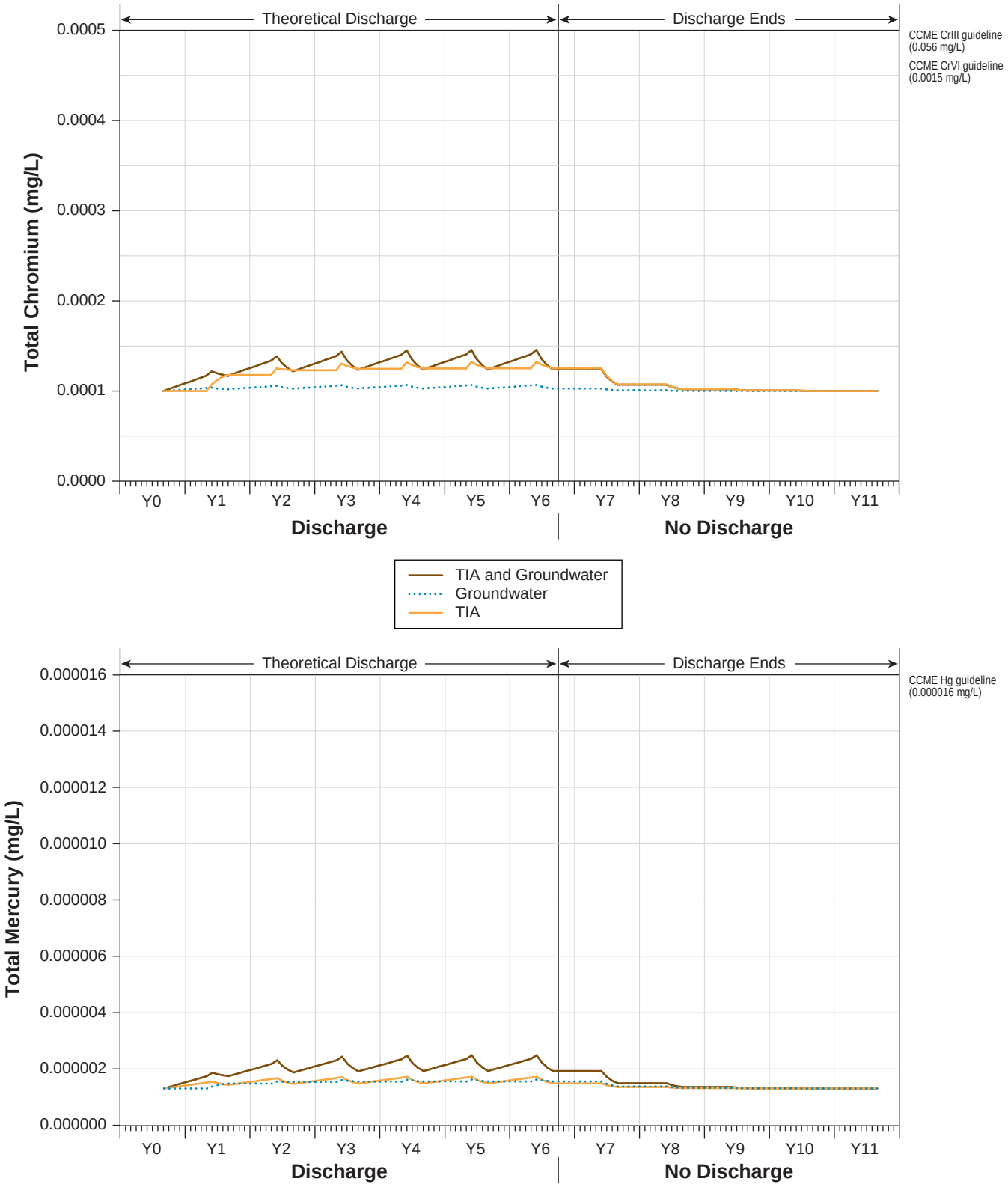
Time Evolution of Total Arsenic and Total Cadmium Concentrations in Roberts Bay during TIA and Groundwater Discharge



Note: Allowable effluent concentrations are based on continuous 80 L/s of TIA and groundwater discharge during the open-water season, 45 L/s of TIA discharge during the open-water season, and 35 L/s of groundwater discharged over the year.

Figure 1b

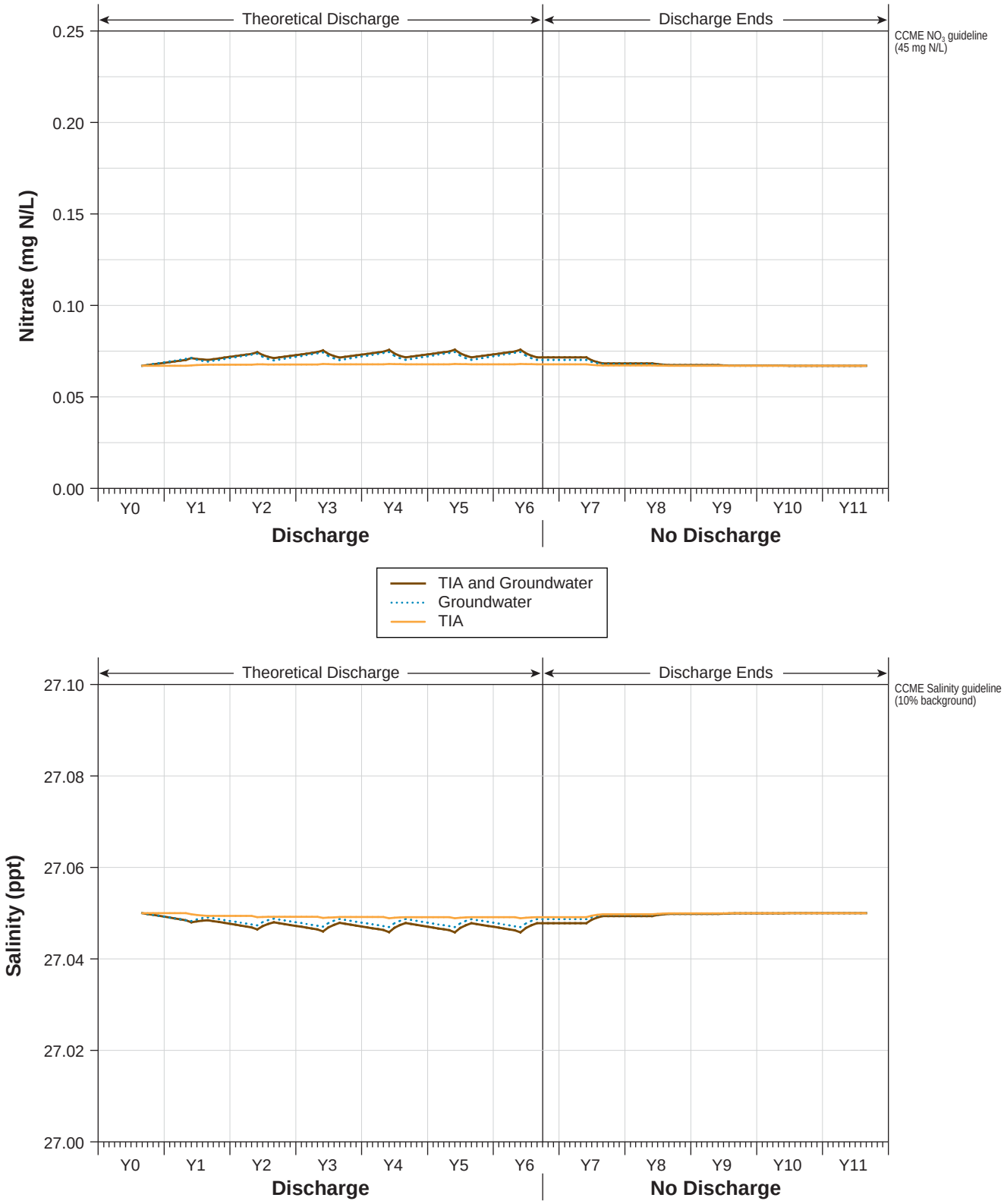
Time Evolution of Total Chromium and Total Mercury Concentrations in Roberts Bay during TIA and Groundwater Discharge



Note: Allowable effluent concentrations are based on continuous 80 L/s of TIA and groundwater discharge during the open-water season, 45 L/s of TIA discharge during the open-water season, and 35 L/s of groundwater discharge over the year. Mercury concentrations for TIA and TIA and Groundwater discharge were unavailable because of poor detection limits for the mill effluent.

Figure 1c

Time Evolution of Total Nitrate Concentrations and Salinity in Roberts Bay during TIA and Groundwater Discharge



Note: Allowable effluent concentrations are based on continuous 80 L/s of TIA and groundwater discharge during the open-water season, 45 L/s of TIA discharge during the open-water season, and 35 L/s of groundwater discharged over the year.

NRCan-3

Appendix NRCan-3-1 Particle Size Distribution

MAC RESOURCES

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TEST CERTIFICATE

Client: MIRAMAR HOPE BAY LIMITED
Project: DORIS NORTH COMBINED FINAL MILL TAILING

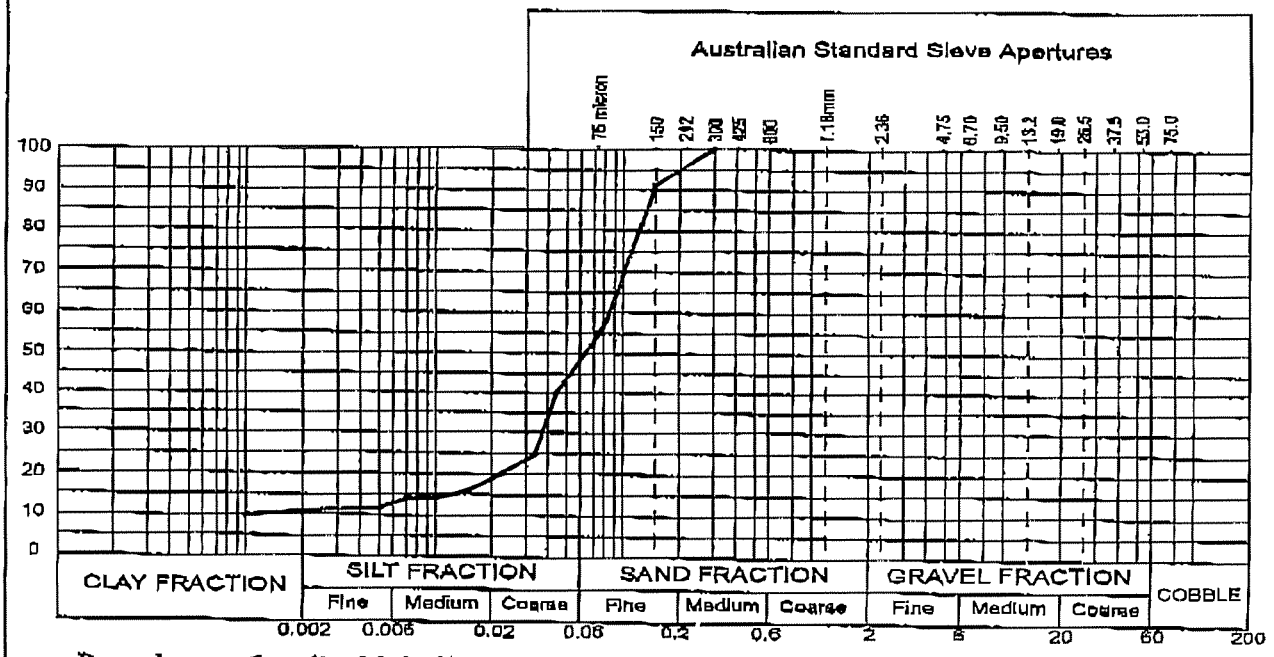
Sheet No.: 2 OF 10
Job No.: S9645
Date Tested: 25.08.03

Sample ID: TAILS

Particle Size Distribution of a Soil

AS 1289.3.6.2: Sieving with Hydrometer

Sieving				Hydrometer			
Sieve Size	% Passing	Sieve Size	% Passing	Diameter	% Passing	Diameter	% Passing
75.0mm		1.18 mm		67 micron	49	10 micron	14
37.5 mm		600 micron		49 micron	40	7 micron	14
19.0 mm		425 micron		35 micron	34	5 micron	12
9.50 mm		300 micron	100	26 micron	25	1 micron	10
4.75 mm		150 micron	92	18 micron	21		
2.36mm		75 micron	56	13 micron	18		



Remarks: Sampling Method/s - Submitted by Client.

This laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its terms of accreditation. This document shall not be reproduced except in full.

Approved: W Rozmianiec

Date: 17.09.03

POCOCK INDUSTRIAL, INC.
PARTICLE SIZE ANALYSIS DATA SHEET

Company: **Newmont Mining Corporation**
Project: **Hope Bay**

Table No.: **BB**
Test Date: 12/30/08
By: GDW/NNN
Location: P.I. Lab

Material: **Doris Flotation Tailing**

Purpose: To determine the particle size distribution of the sample.

Procedure: The sample was wet screened at 400 mesh and the oversize fraction dry screened on a Ro-tap.

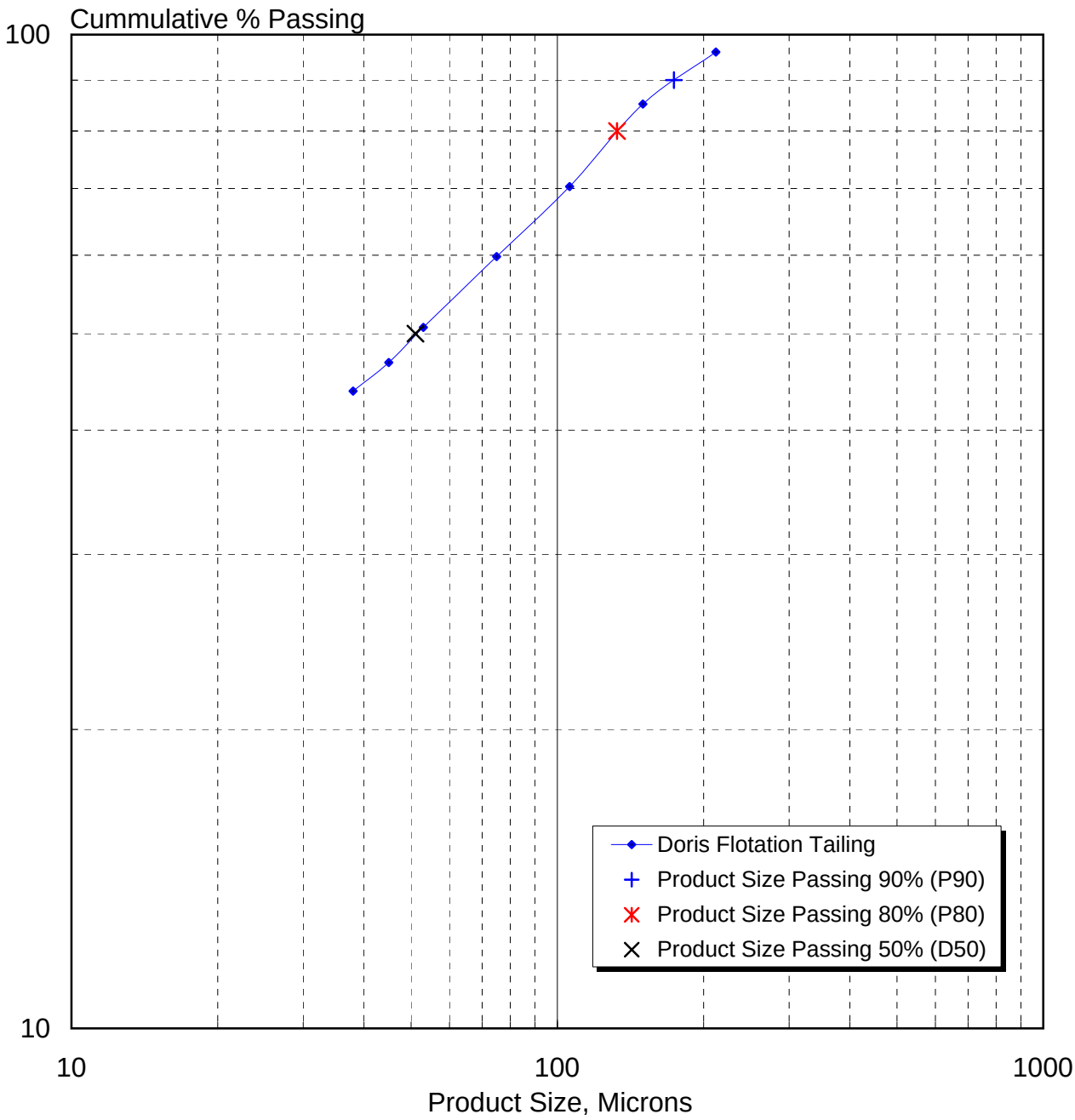
Results:

Screen Size		Sample Weights			
	U.S.	Grams	Wt. %	Cumulative Wt. %	
micron	mesh	Retained	Retained	Passing	Retained
212	70	46.85	3.95	96.05	3.95
150	100	129.26	10.90	85.15	14.85
106	140	175.64	14.81	70.33	29.67
75	200	125.04	10.55	59.79	40.21
53	270	107.16	9.04	50.75	49.25
45	325	47.00	3.96	46.79	53.21
38	400	35.50	2.99	43.79	56.21
-38	-400	519.25	43.79		
	Totals:	1185.70	100%		

Product Size Passing 90% (P_{90}) **174 microns**
Product Size Passing 80% (P_{80}) **133 microns**
Product Size Passing 50% (D_{50}) **51 microns**

FIGURE BB: PARTICLE SIZE DISTRIBUTION

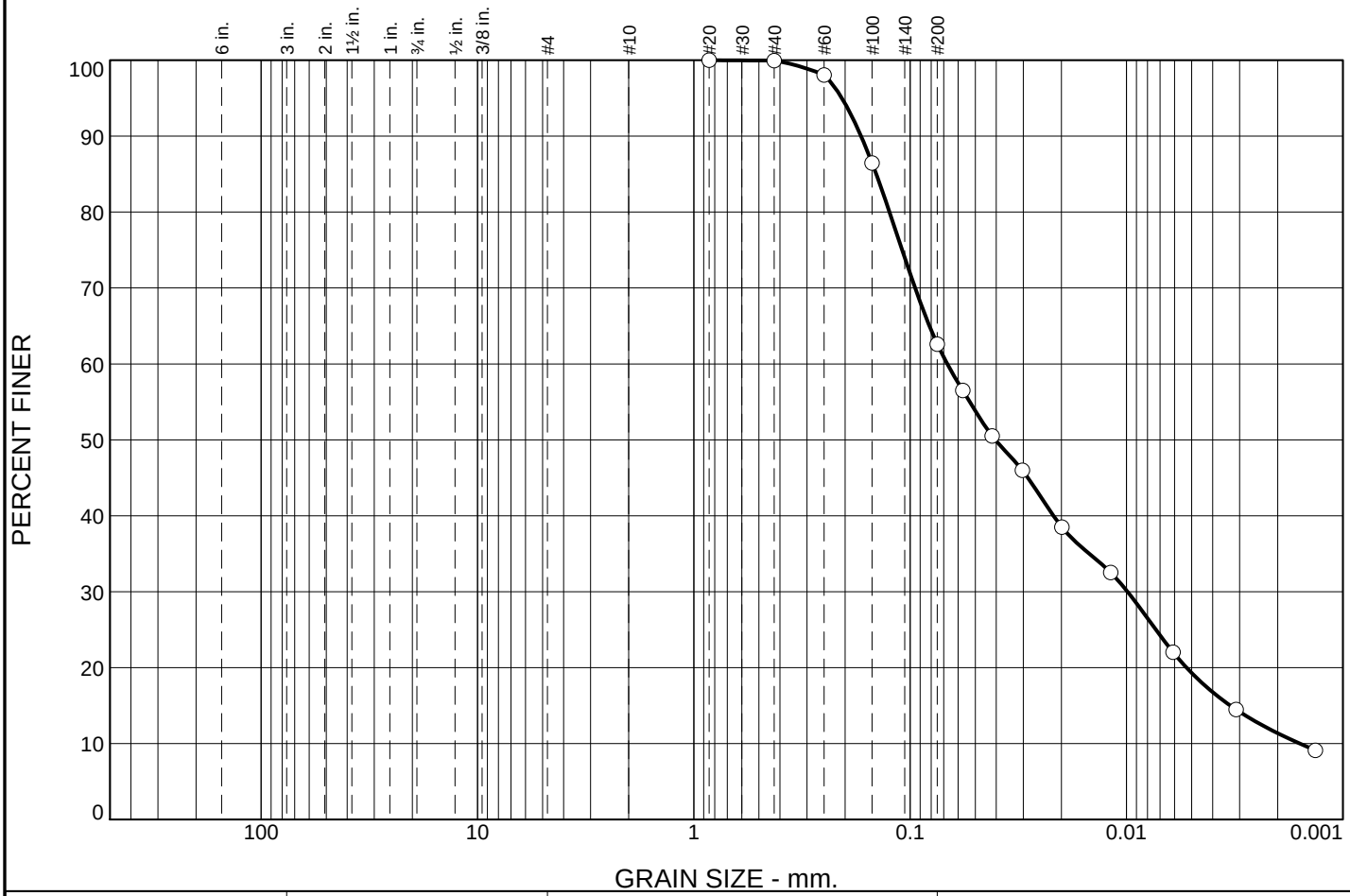
Newmont Mining Corporation
Hope Bay



Material: Doris Flotation Tailing

Product Size Passing 90% (P90) 174 microns
Product Size Passing 80% (P80) 133 microns
Product Size Passing 50% (D50) 51 microns
See Table BB For Parameters

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	37.4	51.2	11.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#20	100.0		
#40	100.0		
#60	98.1		
#100	86.5		
#200	62.6		
0.0571 mm.	56.5		
0.0418 mm.	50.5		
0.0303 mm.	46.0		
0.0199 mm.	38.5		
0.0118 mm.	32.5		
0.0061 mm.	22.0		
0.0031 mm.	14.5		
0.0013 mm.	9.1		

* (no specification provided)

Soil Description

sandy silt

Atterberg Limits

PL= NP LL= 16 PI= NP

Coefficients

D_{85}= 0.1435 D_{60}= 0.0674 D_{50}= 0.0404
D_{30}= 0.0099 D_{15}= 0.0033 D_{10}= 0.0016
C_u= 42.69 C_c= 0.92

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Sample No.: 9 **Source of Sample:** **Date:** 3/3/09
Location: Doris Central Flotation Tailings **Elev./Depth:**

Knight Piésold CONSULTING

Client: Newmont Metallurgical Services
Project: Hope Bay

Project No: 108-147.03 **Fig.**