

**NORTHCLIFF RESOURCES LTD.  
SISSON PROJECT**



**PREDICTIVE WATER QUALITY MODELLING**

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# NORTHCLIFF RESOURCES LTD. SISSON PROJECT

## PREDICTIVE WATER QUALITY MODELLING VA101-447/2-9

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## EXECUTIVE SUMMARY

The water quality predictions for the Sisson Project were modelled from baseline through to Post-closure using the GoldSim© software package, with average monthly outputs over a 100 year period. The model time frame includes:

- Baseline – Model Years -2 and -1
- Operations – Model Years 1 through 27
- Closure – Model Years 28 through 39, and
- Post-closure – Model Years 40 onwards.

The following milestones in the model timeline influence the model results and are key to interpreting the water chemistry predictions:

- Water treatment has been applied to the model for mine site discharge to Sisson Brook during Operations and Post-closure (Model Years 8 through 27 and Year 40 onwards).
- TSF water quality is strongly affected by mill inputs (milled ore and process reagents) during Operations.
- TSF seepage rates are lower in Closure and Post-Closure than during Operations.

Water quality predictions for the model nodes at points downstream of the project along Napadogan Brook (NAP1, NAP2, NAP3, NAP5, NAP7, and NAP8), in the lowest reach of an un-named tributary to Napadogan Brook (UT1 which is immediately upstream of NAP1), and McBean Brook (MBB2) have been compared with the Canadian Environmental Quality Guidelines for the Protection of Aquatic Life (CEQG) and the Health Canada Guidelines for Canadian Drinking Water Quality (HCDW). Water quality in other areas of the Project has also been modelled, but is not compared with guidelines. These areas include the Tailings Storage Facility (TSF), Open Pit, Water Treatment Plant (WTP), two unnamed tributaries (UT3 and UT4), Bird Brook (BB), and Sisson Brook (SB).

The predicted water quality at UT1 has been modelled under the assumption that all seepage from the TSF manifests as surface water upstream of the node. The degree of confidence in the results is lower than that for each of the nodes along Napadogan Brook (*i.e.* NAP1 through NAP8) due to a lack of baseline water quality, hydrological, and hydrogeological information in this area. It is important to note that the UT1 results are indicative only and do not have the same level of accuracy or confidence as the results at other nodes.

While water quality predictions are compared to the guidelines, it must be noted that consequent risks to human, ecological or fish health cannot be directly inferred from any guideline exceedances. These risks are assessed in the Environmental Impact Assessment Report as they relate to the consideration of specific Valued Environmental Components. The results presented herein do not, in and of themselves, necessarily infer the deterioration or protection of environmental quality. The results are meant to provide an indication of the issues that would require further study and confirmation as the Project advances.

Water chemistry changes at the model nodes downstream of the Project along Napadogan Brook are attributed to loading from contact water through two main pathways: (1) Seepage from the TSF and Water Management Ponds, and (2) discharge of surplus treated water through the water treatment plant (WTP) in Operations and Post-closure. The seasonality of the predicted changes is

directly related to the receiving water flow conditions, with higher modelled concentrations in response to lower surface water flow.

Changes in predicted downstream chemistry that are driven by seepage chemistry are observed to increase from baseline concentrations at all of the modelled nodes located downstream of the Project and upstream of NAP5 (Napadogan Brook at the confluence with Sisson Brook). Parameters that change as a result of treated water discharge from the Project are marked by an increase in concentration at NAP5 that coincides with WTP discharge in Model Year 8 and Post-closure WTP discharge in Year 40. There are no additional Project-generated loads downstream of NAP5 and concentrations of all mine affected parameters subsequently decrease with distance downstream.

The parameters that are predicted to exceed at least one guideline at any of the downstream Napadogan Brook model nodes are sodium (Na), manganese (Mn), fluoride (F), aluminum (Al), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), selenium (Se), and lead (Pb). All of the key parameter concentration changes are affected by seepage. Concentrations of Na, F, Cd, and Se are also influenced by discharge of excess treated water from the WTP. The majority of the seepage-driven guideline exceedances occur during the low-flow months (August and September) and remain below guideline limits during months where surface water flow is higher (April and May). The changes in chemistry that result from treated discharge from the WTP are predicted to follow the same seasonal trend as seepage related changes. However, this seasonal trend is not as pronounced for the parameters that are treated in the WTP and through batch processing in the open pit after closure (Al, As, Cd, Cr, Cu, and Mn).

The following is a summary of all predicted guideline exceedances at the model nodes:

- Sodium concentrations are predicted to exceed the HCDW 200 mg/L aesthetic objective at NAP5 during Operations when excess treated water from the TSF is discharged (Years 8 through 27) and at UT1 during Operations due to seepage from the TSF and water management ponds (Years 9 through 15); there is no CEQG limit for this parameter. A maximum sodium concentration of 274 mg/L is predicted at NAP5 in Model Year 16.
- Manganese concentrations are predicted to exceed the HCDW 0.05 mg/L aesthetic objective on a seasonal basis at UT1, NAP1, NAP3, and NAP5 during Operations only; there is no CEQG limit for this parameter. The highest predicted value is 0.055 mg/L at NAP5 in Model Year 16 (Operations), followed by 0.052 mg/L at NAP1 in Year 14.
- Baseline fluoride concentrations are elevated throughout the Project area and average levels generally exceeded the CEQG limit. Fluoride concentrations are not predicted to exceed the HCDW 1.5 mg/L limit, but are predicted to exceed the 0.12 mg/L CEQG limit at each node for the duration of the modelled Project life. The maximum predicted concentration of 1.34 mg/L at UT1 is predicted to occur in Model Year 24 (Operations). The next highest concentration of 1.26 mg/L is predicted to occur at NAP5 in Model Year 11 (Operations).
- Average baseline dissolved aluminum concentrations exceeded the CEQG limit at all sites except in lower Napadogan Brook and occasionally exceeded the HCDW limit at UT1 and NAP1. Aluminum concentrations are predicted to exceed the 0.1 mg/L CEQG limit (pH > 6.5) on a regular basis and the 0.2 mg/L HCDW limit on occasion, but only at UT1 and NAP1. The predicted aluminum concentrations are slightly higher than the baseline concentrations and with



the same seasonal distribution. Maximum concentrations are predicted to occur in Model Year 24 (Operations) for all nodes in Napadogan Brook.

- Arsenic concentrations are predicted to exceed the 0.01 mg/L HCDW limit and the 0.005 mg/L CEQG at UT1. Predicted arsenic concentrations do not exceed the HCDW limit at any other model node. Concentrations are predicted to seasonally exceed the CEQG limit only between NAP1 and NAP5 during Operations and Closure, and only at NAP5 in Post-closure. The predicted concentrations do not exceed the CEQG limit at the nodes downstream of NAP5. Predicted arsenic concentrations peak at all sites in Model Year 14 (Operations) with a maximum concentration of 0.0214 mg/L at UT1, followed by 0.0066 mg/L at NAP1.
- Cadmium concentrations are predicted to exceed the CEQG hardness dependent limit at most model nodes in Napadogan Brook during Operations, Closure, and Post-closure, but remain well below the 0.005 mg/L HCDW limit. It is noted that baseline cadmium concentrations are elevated and generally exceeded the CEQG limit throughout the study area. Predicted cadmium concentrations do not exceed the new proposed short-term cadmium guideline limit at any node, but they do exceed the new proposed short-term guideline limit during Operations and in Post-closure at NAP5 and at UT1.
- Chromium concentrations are predicted exceed the 0.001 mg/L CEQG limit for hexavalent chromium (Cr VI) at NAP5 and the nodes upstream on a seasonal basis concurrent with lower receiving water stream flow. Year-round exceedances are predicted at UT1. Predicted concentrations remain well below the 0.05 mg/L HCDW limit at all nodes. The maximum predicted concentration is 0.0039 mg/L at UT1, followed by 0.0015 mg/L at NAP1. Predicted chromium concentrations generally decrease to levels at or below the CEQG limit in lower Napadogan Brook (NAP7 and NAP8) during all project Phases.
- Copper concentrations are predicted to exceed the hardness dependent CEQG limit. The applicable limit for all model nodes is 0.002 mg/L for hardness of < 83 mg/L CaCO<sub>3</sub>. Predicted concentrations remain well below the 1 mg/L HCDW limit. The maximum predicted concentration is 0.0114 mg/L for UT1, followed by 0.0038 mg/L at NAP1. Predicted copper concentrations generally decrease to levels at or below the CEQG limit in lower Napadogan Brook (NAP7 and NAP8) during all project Phases.
- Selenium concentrations are predicted to be at the 0.001 mg/L CEQG limit at NAP5 during Operations (predicted seasonal range of 0.00097 mg/L to 0.00106 mg/L) as a result of treated water discharge from the WTP. The maximum predicted concentration at UT1 is just above the guideline limit (0.0011 mg/L) during the months with the lowest flow during Operations; this is a result of seepage from the TSF and the water management pond. The predicted selenium concentrations remain well below the 0.01 mg/L HCDW limit.
- Lead concentrations are predicted to seasonally exceed the hardness dependent CEQG limit during Closure at UT1 only. The applicable guideline for this node during Closure is 0.001 mg/L for hardness of less than 60 mg/L CaCO<sub>3</sub>. The maximum predicted value is 0.0011 mg/L in Year 30. Concentrations of lead at all other nodes are predicted to be below the CEQG limit and the HCDW limit of 0.01 mg/L.

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**ABBREVIATIONS**

APT .....	ammonia paratungstate
BB .....	Bird Brook
KP .....	Knight Piesold
m <sup>3</sup> /yr.....	cubic metres per year
mg/L.....	milligrams per litre
Mt .....	million tonnes
MBB .....	McBean Brook
MDL .....	method detection limit
NAP.....	Napadogan Brook
OP .....	Open Pit
Project.....	the project
TSF .....	tailings storage facility
t/d .....	tonnes per day
SS .....	Sisson Brook
UT .....	Unknown Tributary
WMP .....	water management pond
WTP .....	water treatment plant

## 1 – INTRODUCTION

### 1.1 BACKGROUND

Knight Piésold Ltd. (KP) was retained by Northcliff Resources Ltd. to develop a predictive water quality model for the Sisson Project (the Project) to support both the feasibility study and the Environmental Impact Assessment application.

The Sisson Project is a proposed tungsten/molybdenum mine development located approximately 60 km directly northwest of Fredericton, New Brunswick. The Project includes an open pit mine, a concentrator, an ammonium paratungstate (APT) plant, tailings storage facility (TSF), infrastructure and ancillary facilities and will process tungsten and molybdenum containing ore at approximately 30,000 tonnes per day (t/d) when it comes on line at full production in 2017. The Project will have an operational life of approximately 27 years.

The TSF will be an engineered facility constructed using earthfill and rockfill. Approximately 192 Mt of barren rock and 17 Mt of mid-grade ore will be mined from the open pit and stored in the TSF; approximately 78 Mt of barren rock will be backfilled into mined out parts of the open pit during the final mining phase. The potentially acid-generating tailings, barren rock, and mid-grade stockpile will be stored subaqueously in the TSF to effectively mitigate the potential for acid generation.

An overview of the Project area is shown on Figure 1.1.

### 1.2 MODELLING SCOPE AND OBJECTIVES

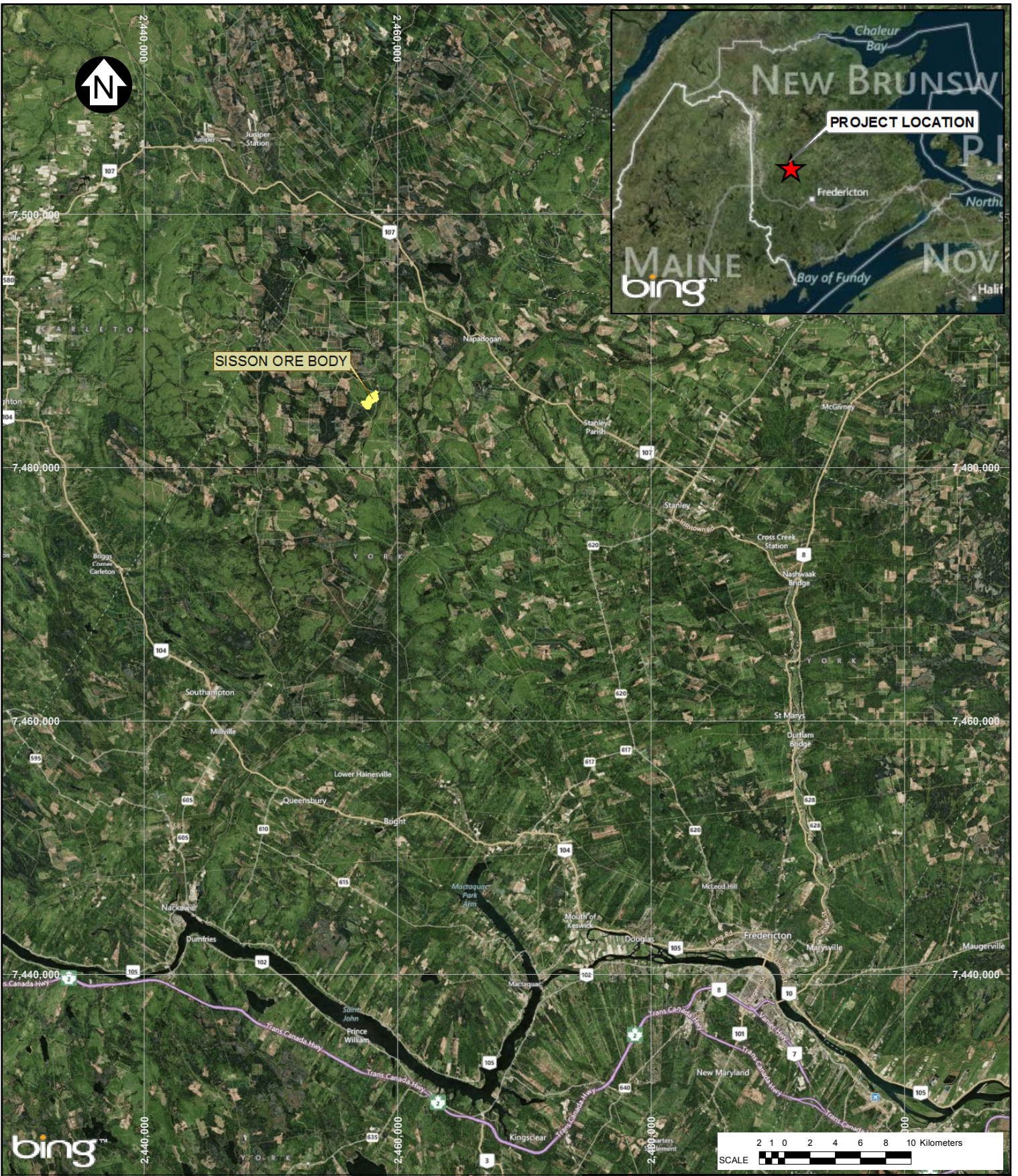
The objective of the predictive modelling is to quantitatively estimate the effects of the Project on the water quality in the downstream environment including Napadogan Brook, McBean Brook, and their tributaries. The methods and results presented in this report are provided as inputs to the effects assessment for the Environmental Impact Assessment for the Project.

Predicted water quality results are presented for seven nodes along Napadogan Brook (NAP1, NAP2, NAP3, NAP5, NAP7, and NAP8), one node along McBean Brook (MBB2), and one unnamed tributary (UT1); these results are presented in Appendix C. The location of the model nodes are shown of Figure 1.2, and a close-up view of the proposed mine site area is shown on Figure 1.3.

The water quality within the Project facilities (e.g. TSF, water management ponds (WMPs), and open pit) was estimated for all phases of the Project including baseline conditions, Start-up, Operations, Closure, and Post-closure to allow prediction of the potential downstream effects. The model is generally based on the design and operating strategies employed in the feasibility study (Samuel Engineering 2013)

The results of the model have been used in an iterative process to help optimize the Project design and reduce the potential Project induced changes on downstream water quality. This optimization process resulted in several changes to the assumed design and operation of the Project when compared to the results of the feasibility study; the modifications are discussed in this report.





**LEGEND:**

SISSON ORE BODY

**NOTES:**

1. BASE MAP: BING AERIAL MAPS.
2. COORDINATE GRID IS IN METRES.  
COORDINATE SYSTEM: NAD 1983 CSRS NEW BRUNSWICK STEREOGRAPHIC.
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PROJECT LOCATION

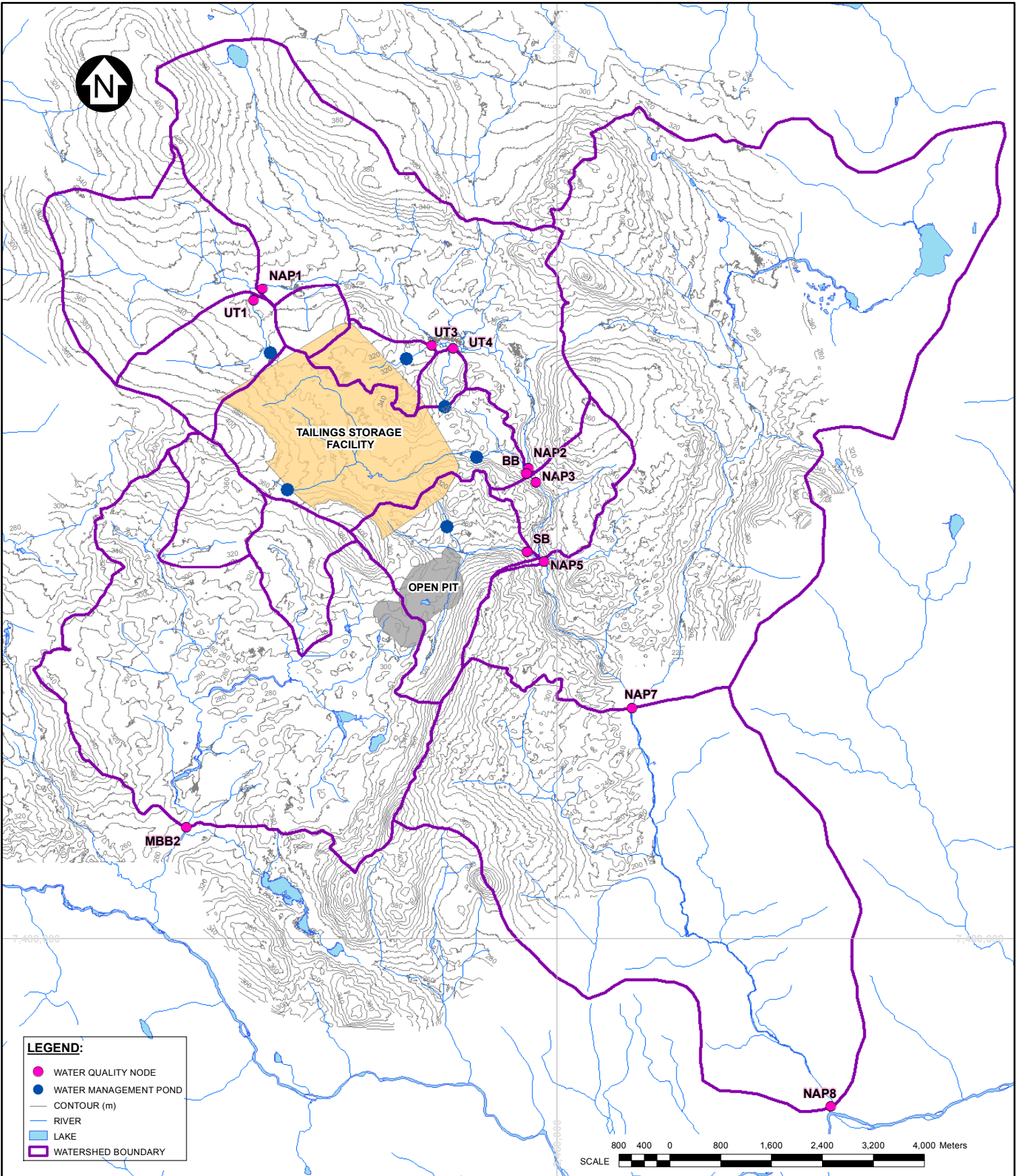
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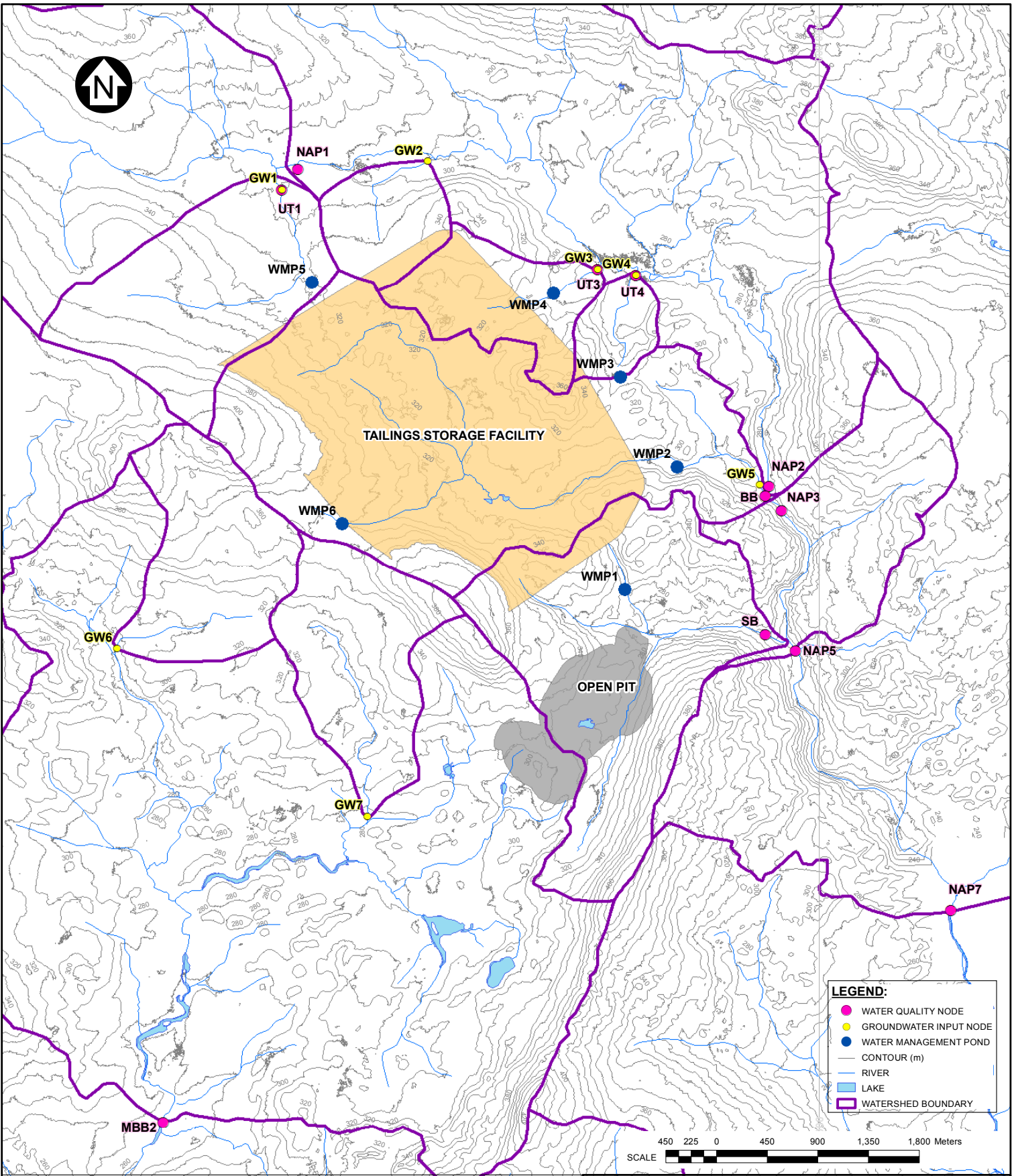
- WATER QUALITY NODE
- WATER MANAGEMENT POND
- CONTOUR (m)
- RIVER
- LAKE
- WATERSHED BOUNDARY

- NOTES:**
1. BASE MAP: CANADA NTS MAPS AND LIDAR CONTOURS.
  2. COORDINATE GRID IS IN METRES.  
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<b>WATER QUALITY MODEL NODES</b>	
<i><b>Knight Piésold</b></i> CONSULTING	PIA NO. VA101-447/2 REF NO. 9 <b>FIGURE 1.2</b>
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**NOTES:**

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**WATER QUALITY MODEL NODES CLOSE-UP**

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**FIGURE 1.3**

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## 2 – PROJECT TIMELINE

### 2.1 PROJECT PHASES

The model timeline encompasses all phases of the Project including Operations, Closure, and Post-Closure as well as two years prior to Operations (Model Years -2 and -1) that represent baseline conditions at the downstream water quality nodes. Following the two baseline years, the model runs continuously from Year 1 (beginning of Operations) to Year 100 (after predicted water quality during Post-Closure reaches a steady state). Predicted water quality changes are driven by the water management strategy in each of the following Project phases.

- **Operations (Years 1-27)** – This phase of mine life begins with the start-up of the mill and ends when ore processing is complete.
  - Diversion ditches are constructed around the open pit area to convey non-contact water from the upslope catchments to McBean Brook and Sisson Brook. This results in some water that would have naturally runoff to Sisson Brook being discharged to McBean Brook.
  - Contact and un-diverted non-contact water from within the TSF and open pit footprints reports to the TSF and to the open pit, respectively.
  - TSF embankment seepage is collected in the water management ponds (WMP) and is continuously pumped back into the TSF. Water will not be stored in the WMPs.
  - TSF basin seepage that bypasses the WMPs mixes with groundwater in the receiving environment and reports to the nearest creek with a five-year lag time.
  - A seepage recovery system is modelled along the northern extent of the TSF down gradient of WMP 5 that is assumed to recover 30% of TSF basin seepage in that portion of the catchment.
  - All contact and non-contact water collected in the open pit is pumped to the TSF.
  - Beginning in Year 8, 6,000,000 m<sup>3</sup>/yr of excess water from the TSF is pumped to a water treatment plant (WTP) and discharged post-treatment to Napadogan Brook at the confluence with Sisson Brook. The WTP discharge rate is generally proportional to the baseline hydrograph of at the point of discharge. The discharge is further reduced during low flow months in late summer and mid-winter.
  - Mill inputs (tailings deposition) to the TSF cease at the end of Year 27.
  
- **Closure (Years 28-39)** – This phase begins when the mill shuts down and ends when the open pit has filled to the point where controlled discharge of excess water is required.
  - Open pit dewatering ceases and the pit begins to fill with water.
  - Pumping from the TSF to the WTP ceases; WTP effluent discharge to Sisson Brook ceases, effecting a change in water quality in Napadogan Brook downstream of Sisson Brook.
  - In Year 28 inputs from the mill to the TSF cease causing changes in water quality in the TSF. This change is generally observed in the downstream nodes along Napadogan Brook in Year 33; these nodes are affected by seepage from the TSF, which arrives with a five-year delay.
  - Water collected in the quarry and TSF flows to the open pit through engineered channels starting in Year 31.
  - Water collected in the WMPs is continuously pumped back to the TSF.

- In Year 38, ferric sulphate batch treatment of the open pit water begins.
- **Post-Closure (Years 40 onwards)** – This phase of mine life begins when the open pit is full and discharge to the receiving environment is required.
  - The open pit water is pumped to a WTP that discharges to Sisson Brook beginning in Year 40. The pit lake is maintained at an elevation that ensures it is a groundwater sink.
  - Water collected in the WMPs is continuously pumped back to the TSF.

### 3 – MASS BALANCE WATER QUALITY MODEL DESCRIPTION

#### 3.1 WATER QUALITY PREDICTION CALCULATIONS

The water quality model for the Project was developed using a mass balance calculation approach in GoldSim© to predict average monthly water chemistry at select locations within and downstream of the Project area. The mass balance method assumes that the incoming flows at any modelled node are thoroughly mixed at that point. The generalized mass balance equation for mixing points on natural streams is:

$$C_{\text{New}} = \frac{C_A \times Q_A + C_B \times Q_B}{(Q_A + Q_B)}$$

Where

- $C_{\text{New}}$  = mixed concentration (mg/L)
- $C_A$  = concentration of Stream A (mg/L)
- $Q_A$  = flow rate of Stream A (m<sup>3</sup>/s)
- $C_B$  = concentration of Stream B (mg/L)
- $Q_B$  = flow rate of Stream B (m<sup>3</sup>/s)

A conservative approach was adopted for the prediction of water quality in the reservoir components of the model including the TSF, WMPs, and open pit. The monthly concentrations within each reservoir are equal to the sum of the stored load and input loads from the current time step (monthly loading), divided by the reservoir volume determined by the water balance model. Loads removed from each reservoir were determined using this concentration multiplied by the volume of water being removed from the reservoir in that time step. The reservoirs are assumed to be fully mixed at all times.

The generalized mass balance equation for reservoirs is:

$$C_{\text{New}} = \frac{(C_A \times V_A) + (C_B \times V_B) - (C_A \times V_C)}{(V_A + P - E)}$$

Where

- $C_{\text{New}}$  = mixed concentration (mg/L)
- $C_A$  = concentration of reservoir A at the previous time step (mg/L)
- $V_A$  = volume of reservoir A (m<sup>3</sup>)
- $C_B$  = concentration of stream B (mg/L)
- $V_B$  = monthly flow of stream B (m<sup>3</sup>/month)
- $V_C$  = monthly flow of outlet stream C (m<sup>3</sup>/month)
- $P$  = monthly precipitation (m<sup>3</sup>)
- $E$  = monthly evaporation (m<sup>3</sup>)

#### 3.2 MODELLED NODES

The site locations where water quality was calculated, or nodes, were chosen at all points along Napadogan Brook and McBean Brook and their tributaries where water from the Project facilities is

expected to mix with water from the receiving environment. The nodes where water quality was modelled are shown on Figure 1.2 and Figure 1.3. Predictive water quality model results are reported for each node in Appendix C, but the results discussion and guideline comparison in this report includes only nodes in Napadogan Brook, one unnamed tributary to Napadogan Brook (UT1), and McBean Brook.

Predicted water chemistry at the following nodes is reported in Appendix C but is not included in the results discussion and guideline comparison:

- Tailings Storage Facility (TSF)
- Open Pit (OP)
- Water Treatment Plant effluent (WTP)
- Two unnamed tributaries upstream of NAP2 (UT3 and UT4)
- Bird Brook immediately upstream of the confluence with Napadogan Brook (BB), and
- Sisson Brook immediately upstream of the confluence with Napadogan Brook (SB).

Predicted water chemistry at the following nodes is reported in Appendix C and is included in the results discussion and guideline comparison:

- Upper reaches of Napadogan Brook (NAP1)
- Napadogan Brook immediately upstream of the confluence with Bird Brook (NAP2)
- Napadogan Brook immediately downstream of the confluence with Bird Brook (NAP3)
- Napadogan Brook immediately downstream of the confluence with Sisson Brook (NAP5)
- Napadogan Brook immediately downstream of the confluence with East Branch Napadogan Brook (NAP7)
- Napadogan Brook immediately upstream of the confluence with the Nashwaak River (NAP8), and
- McBean Brook immediately upstream of the confluence with Chainy Lakes outlet (MBB2).

Node UT1 is located in the tributary immediately upstream of NAP1 and Node UT3and4 is an average of the predicted water quality in the tributaries upstream of NAP2. The water quality at these nodes has been modelled under the assumption that all seepage from the TSF manifests as surface water upstream of the modelled nodes. The degree of confidence in these results is lower than that for each of the nodes along Napadogan Brook (*i.e.* NAP1 through NAP8) due to a lack of baseline water quality, hydrological, and hydrogeological information in this area.

### 3.3 PARAMETERS MODELLED

A total of 77 parameters were modelled, including hardness, alkalinity, organic carbon, major ions, and 33 metals (both total and dissolved). Several metals were reported as below the method detection limit (MDL) in both the source terms and the baseline data (Be, Te, and Sn) and have therefore not been modelled. Metals were only modelled in the dissolved form within the proposed mine facilities, and in the total and dissolved form in downstream locations.

**4 – MODEL INPUTS AND ASSUMPTIONS**

**4.1 CLIMATE, HYDROLOGY, AND GROUNDWATER**

Flow inputs for the mass balance water quality model were derived using a base case monthly operational mine site water balance that was previously developed for the feasibility study engineering using the GoldSim® software package. The original intent of this modelling was to estimate the magnitude and extent of any water surplus and/or deficit conditions in the TSF based on a range of possible climatic conditions. This model was modified to include the various contact water flow pathways defined between the Project and the downstream environment, and incorporated into the predictive mass balance water quality model.

The mean monthly hydrometeorological parameters shown in Table 4.1 are based on the values presented in Knight Piésold (2013). These values were applied to all Project areas that were included in the model. Catchment areas were calculated using the LiDAR topographic data where possible and National Topographic System (NTS) mapping where LiDAR data were not available (e.g. in the upper reaches of East Branch Napadogan Brook).

**Table 4.1 Average Hydrometeorological Inputs**

Parameter	Monthly Value (mm)												Annual (mm)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Precipitation	115	83	107	96	111	114	127	122	119	117	116	123	1350
Rainfall	34	21	45	70	110	114	127	122	119	114	85	51	1012
Snowfall	81	62	62	26	1	0	0	0	0	3	31	72	338
Sublimation	15	15	15	15	0	0	0	0	0	0	0	15	75
Snowmelt	0	0	28	113	121	1	0	0	0	0	0	0	263
Available Precipitation	34	21	73	183	231	115	127	122	119	114	85	51	1275
Lake Evaporation	0	0	0	15	68	100	119	104	65	29	0	0	500
Available Runoff	41	28	65	213	138	49	33	26	25	54	82	73	827

**NOTES:**

1. The precipitation values were estimated for Sisson climate station, which is at an approximate elevation of 305 m.
2. Surface runoff was estimated by multiplying the available precipitation values by the corresponding runoff coefficient for each project area.
3. The lake evaporation values were applied to TSF pond area to estimate evaporative losses.
4. Available runoff values were applied to undisturbed areas within the mine footprint to estimate runoff.

Groundwater baseflow inputs were estimated based on the Bird Brook hydrologic data using a visual qualitative hydrograph separation approach. Flow data were estimated on a monthly basis using

40 years of data from which monthly averages were generated from the data set. The estimated mean monthly baseflow data at each of the modelled groundwater nodes are shown in Table 4.2.

**Table 4.2 Groundwater Baseflow Data**

Parameter	UNIT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Mean Monthly Baseflow	l/s/km <sup>2</sup>	8.2	6.7	10.1	24.9	23.3	10.3	5.9	4.5	4.4	7.5	11.8	11.7
Standard Deviation	l/s/km <sup>2</sup>	3.0	2.8	4.2	4.2	4.9	4.5	2.9	2.7	3.4	5.0	5.0	4.6
Coefficient of Variation		0.36	0.42	0.42	0.17	0.21	0.43	0.49	0.61	0.77	0.67	0.42	0.39
Monthly Baseflow at GW1	m <sup>3</sup> /s	0.025	0.020	0.031	0.076	0.071	0.031	0.018	0.014	0.013	0.023	0.036	0.036
Monthly Baseflow at GW2	m <sup>3</sup> /s	0.008	0.007	0.010	0.024	0.023	0.010	0.006	0.004	0.004	0.007	0.011	0.011
Monthly Baseflow at GW3	m <sup>3</sup> /s	0.012	0.010	0.014	0.035	0.033	0.015	0.008	0.006	0.006	0.011	0.017	0.017
Monthly Baseflow at GW4	m <sup>3</sup> /s	0.004	0.004	0.005	0.013	0.013	0.006	0.003	0.002	0.002	0.004	0.006	0.006
Monthly Baseflow at GW5	m <sup>3</sup> /s	0.065	0.054	0.081	0.199	0.186	0.083	0.047	0.036	0.035	0.060	0.094	0.094
Monthly Baseflow at GW6	m <sup>3</sup> /s	0.019	0.015	0.023	0.057	0.053	0.024	0.013	0.010	0.010	0.017	0.027	0.027
Monthly Baseflow at GW7	m <sup>3</sup> /s	0.018	0.015	0.023	0.056	0.052	0.023	0.013	0.010	0.010	0.017	0.027	0.026

**NOTES:**

1. Sites GW1 through GW7 are reference nodes where baseflow is accounted for in the model; these sites are shown on Figure 1.2.
2. Data are based on average conditions.

**4.2 GEOCHEMICAL SOURCE TERMS**

Geochemical source terms were provided by SRK Consulting (Canada) Inc. (SRK) for the following:

- Open Pit Sump mg/day
- Milled Ore mg/L (based on ~18.5 Mm<sup>3</sup>/y of process water)
- Process Reagents mg/tonne of ore processed
- Low-Grade Stockpile Runoff/Infiltration mg/L
- Barren Rock Runoff/Infiltration mg/L
- Barren Rock Flooding mg/tonne of rock submerged
- TSF Beach Runoff mg/m<sup>2</sup>/week
- TSF Unsaturated Beach Infiltration mg/L
- TSF Embankment Runoff/Infiltration mg/L
- TSF Quarry Sump mg/L
- Pit Walls mg/L
- Water Treatment Plant Effluent mg/L

Details regarding the development of the contact water source terms are provided in SRK (2013).

The source term input data that were used in the predictive water quality modelling are provided in Table A1 of Appendix A.

#### 4.3 WATER TREATMENT PLANT

It was determined early in the predictive water quality modelling process that water treatment may be required to mitigate the effects of the Project on receiving waters. A water treatment plant (WTP) concept that could be incorporated into the mass balance model was subsequently developed by SRK. The estimated removal efficiency by the WTP for each parameter was applied to discharge from the TSF during Operations and from the open pit in post-closure. Estimated WTP discharge concentrations were provided by SRK (2013).

The WTP was represented in the mass balance model by limiting the maximum parameter concentrations in the discharge flow to the estimated WTP discharge concentrations. It was assumed that the WTP would not remove constituents in the influent water when those concentrations were below the estimated WTP discharge concentrations. A water clarification system is also included in the project design to pre-treat water recycled to the mill from the TSF. However, water quality improvements were not credited to this clarification plant, which is a conservative assumption. Additional test work and analysis is underway to better understand the potential contribution of the clarification system to water quality improvements. Additional water treatment has been applied to the model for the open pit in the form of a batch treatment process that will be implemented in the closure phase (approximately Model Year 38). The water treatment discharge concentrations are summarized in Table 4.3.

**Table 4.3 Effluent Concentrations for Water Treatment**

Parameters	Effluent Concentration (mg/L)	
	Operations	Post-Closure
Al	0.2	0.2
Mo	0.05	0.05
Sb	0.01	0.01
As	0.03	0.01
Cd	0.0005	0.0005
Cr	0.01	0.01
Cu	0.002	0.002
Pb	0.0005	0.0005
Mn	0.1	0.1
Se	0.015	0.015

**NOTES:**

1. Water treatment in Post-closure for As, Sb, and Mo are through batch treatment of the Open Pit lake.

#### 4.4 BASELINE WATER QUALITY

##### 4.4.1 Baseline water quality data

The baseline water quality program for the Project began in 2007 with samples collected on a monthly or quarterly (seasonal) basis. The baseline surface water data collected until December



2011 were included for the development of monthly average background water quality inputs for the model, consistent with the baseline water quality report (KP 2012b). In cases where no data were available for a particular month or where data were collected seasonally and not monthly, parameter concentrations were assumed to equal the average concentrations of the previous month.

Groundwater quality data for samples collected between December 2011 and June 2012 were used to generate the background water quality for the mass balance model. Groundwater quality data were generally not applied to the model directly, but were used for comparison to low flow surface water quality data for nearby sites. Piper trilinear diagrams were used to assess the similarity of geochemical facies for the groundwater to low flow surface water quality. The facies were similar and as a result the mid-winter water chemistry data for the nearby surface water sites were assumed to represent the groundwater chemistry. Many parameters are higher in groundwater than in nearby streams during low flow conditions, though it can be assumed that the majority of the flows are generated from groundwater inflows. Complex and simple geochemical processes can occur in the shallow groundwater/surface water environment that can result in some parameters precipitating out of solution. Assuming that low flow surface water chemistry is equivalent to new groundwater inflow chemistry accounts for these processes without the need for additional modelling. Parameter concentrations measured in all samples from each monitoring well location (shallow and deep wells) were averaged and used as baseline groundwater concentrations for each well location. Groundwater quality at nodes without groundwater monitoring wells was assumed to be the same as that of the closest groundwater monitoring site.

It should be noted that surface water and groundwater sample collection is on-going, but the end dates specified above are the cut-off points for data used in the development of the baseline input terms for the model. The baseline conditions provided in this report refer to the average monthly data for each model node that were used as inputs to the model. These data under-represent the measured range for some of the parameters but are inline with the model results, which are predicted monthly average concentrations.

The baseline surface water and groundwater data used in the water quality model are presented in Appendix A.

#### 4.4.2 Baseline water quality calibration model

Baseline water quality at the modelled nodes was assumed to equal to the observed average monthly surface water quality at those points during the period of record. However, several key data inputs to the water quality model required further estimation and calculation. A calibration model was developed in GoldSim to provide estimates for the following information that was not available in the baseline dataset:

- Separation of the surface water and groundwater components of the resulting measured water quality
- Calculation of parameter concentrations in tributaries and modelled nodes for which no baseline data were available
- Estimation of parameter loads attenuated under baseline conditions when groundwater surfaces, and
- Estimation of parameter loads attenuated under baseline conditions between modelled nodes for which baseline data are available.

Inputs to the calibration model included groundwater data from sites in close proximity to each node, groundwater flow data, averaged surface water data from sites in close proximity to each node, and surface water flow data.

Parameters that were predicted to decrease between nodes in the calibration model in at least one month each year under baseline conditions include:

- NAP1 to NAP2: ammonia, nitrate, dissolved manganese, and total copper, lead, phosphorous, tin, vanadium, and zinc
- BB to NAP3: nitrate, dissolved molybdenum, and total molybdenum
- NAP3 to NAP4: hardness, alkalinity, ammonia, nitrate, phosphate, sulphate, chloride, fluoride, and dissolved and total aluminum, arsenic, boron, cadmium, calcium, copper, iron, lead, lithium, manganese, magnesium, mercury, molybdenum, phosphorous, potassium, rubidium, silicon, sodium, strontium, and tungsten.
- SB to NAP5: dissolved and total molybdenum
- NAP5 to NAP7: ammonia, phosphate, sulphate, dissolved aluminum, arsenic, cadmium, lead, molybdenum, phosphorous, silicon, uranium, and zinc, and total aluminum, antimony, arsenic, cadmium, chromium, cobalt, lead, lithium, molybdenum, phosphorous, silicon, tin, uranium, vanadium, and zinc.

The calibrated baseline model was used as basis for the predictive mass balance model for the Operations, Closure, and Post-closure phases of the Project.

#### 4.5 ASSUMPTIONS

The mass balance model was used to make predictions based on the assumptions listed in Tables 4.4 through 4.9. A degree of moderate conservatism has been implemented in the assumptions such that predictions of guideline exceedances serve as indications of potential issues requiring confirmation through monitoring during the Project life or issues potentially requiring adaptive management and are not necessarily predictions of deteriorations in water quality.

**Table 4.4      General**

<b>Area / Model Input</b>	<b>Assumption</b>
APT Waste	APT wastes are assumed to be managed separately and will not interact with the TSF.
Precipitation and evaporation	Precipitation and evaporation are chemically neutral inputs and outputs; the concentration of metals, physical parameters and nutrients in precipitation and in evaporate are assumed to be zero.
Mixing	Mixing for each model component is instantaneous and complete. Thermal stratification and the effects that would result on surface water reservoirs were not modelled.
Dissolved components	Dissolved components remain in solution.
Total/particulate fraction	Total/particulate fraction of metals parameters remained suspended.
Groundwater quality	Groundwater is assumed to contain only dissolved components and no particulate matter.
Groundwater quality	Baseline water quality data reported in the lowest flow month (February) is assumed to be representative of groundwater quality when it surfaces. Piper trilinear diagrams were used to verify the validity of this assumption.
Groundwater flow	Contact water seepage (e.g. from TSF) affects only the groundwater quality and not the flow rate.
Surface water quality	Catchment runoff water quality is assumed to contain the same parameter concentrations as the baseline data for the respective mixing point.
Surface water quality	Non-contact runoff water quality does not change over time, but shows monthly variability through the calendar year equal to the average variability in the baseline data.

**Table 4.5 Downstream Nodes**

Area / Model Input	Assumption
Background water quality data	a. Nodes NAP5 and NAP6 are assumed to have the same water quality as background site NB-1. b. Node NAP2 is assumed to have the same water quality as background site WBNB-1. c. Node NAP1 is assumed to have the same water quality as background site R-1. d. Background water quality at NAP3 is modelled as a combination of NAP2 and Bird Brook in the calibration model.
Contact/non-contact groundwater	Groundwater seepage from the TSF displaces the baseline groundwater flow in the basin, leaving the total groundwater input equal to baseline conditions.
Baseflow	Groundwater flow rates at each node are constant during all years of the Project timeline and only vary seasonally.
Undisturbed catchment water quality	All runoff from undisturbed catchment areas is assumed to have the same water quality as the nearest background water quality site within the same catchment.
Undisturbed surface water	Unit runoff throughout the Project area is assumed to be the same as that of the Bird Brook catchment.
Dissolved parameters in tributaries	Bird Brook and Sisson Brook are assumed to contribute equal loads of total and dissolved parameters to Napadogan Brook ( <i>i.e.</i> total metal concentrations equal dissolved).
Load attenuation between downstream modelled nodes	Any absolute loads of parameters that are attenuated between nodes under background conditions are assumed to attenuate between nodes in the water quality model at the same rate as under background conditions (mg/month).
Undisturbed groundwater	a. Groundwater reporting to the downstream nodes includes the flow and concentration assigned to the TSF seepage with a time delay of five years. b. Any expected groundwater flow in excess of the flow of seepage is assumed to have the same water quality as the background average. c. Undisturbed groundwater is assumed to have the same water quality as the average February ( <i>i.e.</i> lowest flow) surface water samples.
Load attenuation from groundwater	Loads that are greater in the groundwater than the surface water at any given node under baseline conditions are assumed to be attenuated prior to surfacing in both the calibration model and the predictive model.

**Table 4.6 TSF**

Area / Model Input	Assumption
Process Reagents	Reagents are represented in the model based on mill throughput and mill source terms (mg/tonne).
TSF beaches	Precipitation on TSF beach areas is modelled as three components: a. 85% runs off to the pond. b. 10% infiltrates through the tailings deposit below the beach and into the pond. c. 5% infiltrates through the tailings deposit below the beach and into the WMPs.
Barren rock and Mid-Grade Stockpile infiltration/runoff	Precipitation onto the exposed barren rock and mid-grade stockpile in the TSF will contribute loads to the TSF pond based on the source terms (in mg/L)
Barren rock flooding	The barren rock flooding source term (in mg/tonne) is applied to the mass of waste rock estimated to become saturated during each year. The mass of saturated waste rock is an average of the estimate provided for each stage.
Clarification plant	All water exiting the clarification plant has the same water quality as the TSF in each time step. The clarification plant does not provide any water chemistry benefit.
TSF solubility limits	No solubility limits have been applied to the TSF.
Void losses and consolidation	a. Water lost to voids (e.g. in barren rock, mid-grade stockpile, tailings, and clarification slurry) is assumed to have the same water quality as the TSF. b. Void consolidation water is assumed to have the average water quality of all the water lost to voids. c. Void consolidation water is assumed to go back to the TSF pond starting in Year 10 and not to the receiving environment.
TSF seepage	a. TSF basin and embankment seepage to the receiving environment is assumed to have the same water quality as the TSF at the time of seepage. b. Embankment seepage to the WMPs is assumed to be a combination of water from the TSF pond and from beach infiltration resulting from precipitation on the beach. c. Seepage that bypasses the WMPs arrives at the downstream nodes after a five-year lag time. d. Water recycled to the TSF from the seepage recovery wells is assumed to have the same concentration as the TSF at the time that it left the TSF (i.e. given the five-year time delay). e. Water collected in the seepage recovery wells does not include ambient groundwater capture (i.e. it only collects seepage from the TSF).

**Table 4.7 Open Pit**

Area / Model Input	Assumption
Open pit lake mixing	The open pit will be fully mixed throughout the year; the effects of stratification (permanent or seasonal) have not been assessed.
Open pit batch treatment	Water in the pit lake will be batch treated beginning in Year 38.
Open pit groundwater flows	Embankment seepage from the southeast part of the TSF reports to the open pit after a five-year time delay.
Open pit solubility limits	No solubility limits have been applied to the open pit.

**Table 4.8 Water Management Ponds**

<b>Area / Model Input</b>	<b>Assumption</b>												
Minimum volume	During Operations, all water collected in the WMPs is pumped back to the TSF once the ponds reach a minimum volume of 1000 m <sup>3</sup> .												
Embankment runoff	All runoff and infiltration from the embankment reports to the WMPs.												
Leakage calculation	<table border="0"> <tr> <td>WMP 1</td> <td>0.4 l/s</td> </tr> <tr> <td>WMP 2</td> <td>0.4 l/s</td> </tr> <tr> <td>WMP 3</td> <td>0.5 l/s</td> </tr> <tr> <td>WMP 4</td> <td>0.5 l/s</td> </tr> <tr> <td>WMP 5</td> <td>0.6 l/s</td> </tr> <tr> <td>WMP 6</td> <td>0.3 l/s</td> </tr> </table>	WMP 1	0.4 l/s	WMP 2	0.4 l/s	WMP 3	0.5 l/s	WMP 4	0.5 l/s	WMP 5	0.6 l/s	WMP 6	0.3 l/s
WMP 1	0.4 l/s												
WMP 2	0.4 l/s												
WMP 3	0.5 l/s												
WMP 4	0.5 l/s												
WMP 5	0.6 l/s												
WMP 6	0.3 l/s												

**Table 4.9 Water Treatment**

<b>Area / Model Input</b>	<b>Assumption</b>
Ferric sulphate treatment	Ferric sulphate batch treatment is applied to the open pit water, starting in Year 38. This treats for As, Sb, and Mo only.
WTP for discharge	<p>Excess water from the TSF will be discharged via the clarification plant and the WTP beginning in Year 8. Flow rates will vary proportionally to the seasonal flow in Napadogan Brook. Load removed by the WTP is permanently removed from the model.</p> <p>Water from the open pit is pumped to the WTP for discharge beginning in Year 40.</p>

#### 4.6 GUIDELINES AND STANDARDS

Guidelines and standards for comparison with the model output data were determined with respect to the most sensitive receptors in the downstream environment and where specific regulations were applicable. While water quality predictions are compared to these guidelines below, it must be noted that consequent risks to human, ecological or fish health cannot be directly inferred from any guideline exceedances. These risks are assessed in the EIA Report as they relate to the consideration of specific Valued Environmental Components.

The guidelines and standards are:

- Health Canada Guidelines for Canadian Drinking Water Quality (HCDW).
- Canadian Environmental Quality Guideline for the Protection of Aquatic Life (Freshwater) (CEQG).
- Metal Mining Effluent Regulations (MMER) (SOR/2002-222), enabled under the *Fisheries Act*. Schedule 4 – Authorized Limits of Deleterious Substances, with maximum authorized concentrations from the following columns:
  - Column 2 – Maximum Authorized Monthly Mean Concentration
  - Column 3 – Maximum Authorized Concentration in a Composite Sample, and
  - Column 4 – Maximum Authorized Concentration in a Grab Sample.

MMER authorized limits were only applied to water quality at effluent discharge points, which are the outflow from the WTP during Operations and Post-closure. This effluent discharge point is modelled in Napadogan Brook at the confluence with Sisson Brook as shown on Figure 1.2. The MMER comparison focused primarily on Column 2, as this is most consistent with the model outputs that are based on average flow conditions.

The guidelines and regulations are summarized in Table 4.10.

**Table 4.10 Applicable Water Quality Guidelines and Regulations**

Parameter	Guidelines		Regulations
	CEQG	HCDW	MMER - Column 2
pH	pH 6.5 to 9	pH 6.5 to 8.5	
Ammonia	0.499 <sup>(2)</sup>		
Nitrate	3	10	
Sulphate		500	
Boron	1.5		
Bromide		0.01	
Chloride	120		
Fluoride	0.12	1.5	
Aluminum	0.005 to 0.1 <sup>(3)</sup>	0.2	
Antimony		0.006	
Arsenic	0.005	0.01	0.50
Barium		1	
Boron		5	
Cadmium	$10^{(0.86 \cdot (\log(H) - 3.2))} / 1000$ to 0.000055 <sup>(4)</sup>	0.005	
Chromium	0.0089	0.05	
Copper	$e^{(0.8545 \cdot \ln(H) - 1.465)}$ 0.2/1000 to 0.004 <sup>(4)</sup>	1	0.30
Iron	0.3	0.3	
Lead	$e^{((1.273 \cdot \ln(H) - 4.705))} / 1000$ to 0.007 <sup>(4)</sup>	0.01	0.20
Manganese		0.05	
Mercury	0.000026	0.001	
Molybdenum	0.073		
Nickel	$e^{((0.76 \cdot \ln(H) + 1.06))} / 1000$ to 0.15 <sup>(4)</sup>		0.50
Phosphorous	Narrative		
Selenium	0.001	0.01	
Silver	0.0001		
Sodium		200	
Thallium	0.0008		
Uranium	0.015	0.02	
Zinc	0.03	5	0.50

**NOTES:**

1. Units are in mg/L unless otherwise specified.
2. CEQG for ammonia ranges from 0.017 to 192 mg/l; the guideline is inversely proportional to both pH and temperature. The guideline value used for comparison was based on the 90<sup>th</sup> percentile baseline pH and temperature.
3. CEQG limits for Al are pH dependent; limit is 0.005 mg/L for pH < 6.5 and 0.1 mg/L for pH > 6.5.
4. Hardness (H) dependent guideline limits; guidelines are calculated using predicted hardness. Maximum hardness specified is generally based upon an assumed hardness of 180 mg/L CaCO<sub>3</sub>.
5. Metals guidelines were applied to both total and dissolved concentrations generated in the model.



## 5 – MODEL OUTPUT SUMMARY

### 5.1 OVERVIEW

The water quality predictions were modelled from baseline through to post-closure using GoldSim®, with average monthly outputs over a 100 year period as follows:

- Baseline – Model Year -2 through -1
- Operations – Model Years 1 through 27
- Closure – Model Years 28 through 39, and
- Post-closure – Model Years 40 onwards.

The WTP is used to treat excess water from the TSF during Operations and excess water from the Open Pit in Post-closure. There is an 8 year period (Model Years 28 through 39) when the Open Pit is filling and all excess water from the quarry and TSF is routed to the Open Pit; during this period there is no active surface water discharge from the TSF or the Open Pit.

These model time frames and water management milestones are key to interpreting the onsite and downstream water chemistry changes modelled.

While water quality predictions are compared to the guidelines and regulations, it must be noted that consequent risks to human, ecological or fish health cannot be directly inferred from any guideline exceedances. These risks are assessed in the Environmental Impact Assessment Report as they relate to the consideration of specific Valued Environmental Components. The results presented herein do not, in and of themselves, necessarily infer the deterioration or protection of environmental quality. The results are meant to provide an indication of the issues that would require further study and confirmation as the Project advances.

### 5.2 RESULTS

Water chemistry changes are predicted in the receiving waters downstream of the Project including Napadogan Brook and the smaller tributaries within the TSF catchment. These changes are attributed to loading from mine contact water through two main pathways: (1) Seepage from the TSF and Water Management Ponds, and (2) discharge of surplus water from the TSF during Operations and from the Open Pit in Post-closure. The seasonality of the predicted changes is directly related to receiving water flow conditions, with higher concentrations for most parameters observed in response to low surface water flow conditions.

The predicted downstream chemistry that is influenced by seepage from the Project facilities is observed to increase from baseline concentrations at all of the downstream modelled nodes upstream of NAP5 (Napadogan Brook at the confluence with Sisson Brook). Parameters that change as a result of discharge from the WTP are indicated by an increase in concentrations at NAP5 that coincides with discharge from the TSF in Model Year 8, and discharge from the Open Pit in Model Year 40 (Post-closure). There are no additional Project-generated loads modelled downstream of NAP5; therefore, concentrations of all mine affected parameters decrease with distance downstream of NAP5.

Predicted water quality is discussed in this section for the nodes along Napadogan Brook (NAP1 through NAP8), McBean Brook (MBB2), and the unnamed tributary immediately upstream of NAP1 (UT1). Results for all other nodes are presented in Appendix C. While the results for UT1 are

presented in graphs and tables along with results for other nodes on Napadogan Brook and McBean Brook, the degree of uncertainty for the results at this node is greater than for the other nodes due to a lack of baseline water quality, hydrological, and hydrogeological information in this area. It is important to note that the UT1 results are indicative only and do not have the same level of accuracy or confidence as the results at other nodes.

The focus of the discussion for the predicted Project surface water chemistry is on those parameters that are predicted to increase to levels that exceed one or both of the CEQG or HCDW guideline limits at model nodes in Napadogan Brook. Predicted effluent discharge from the WTP does not exceed the MMER for any parameter. The discussion pertains to the dissolved concentrations for these parameters, as only solutes are modelled for the Project facilities. The results for the receiving water quality nodes include predicted total metals concentrations, but these only change from baseline concentrations with the addition of the dissolved loads from the mine site seepage and discharge. The seasonality of the predicted data is summarized for each key parameter along with the duration (or time frame) over which the elevated concentrations are predicted to occur and how the concentrations vary with distance from the source. The parameters of interest have been determined based upon the predicted results exceeding one or more of the guidelines for any of the mine phases; these parameters are sodium (Na), manganese (Mn), fluoride (F), aluminum (Al), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), selenium (Se), and lead (Pb). For brevity, parameters that did not exceed either the CEQG or HCDW guidelines are not discussed here; only those parameters that exceeded either or both of these guidelines are discussed.

All of the key parameter concentration changes are affected by seepage. Concentrations of Na, F, Cd, and Se are also influenced by discharge of excess treated water from the TSF and the Open Pit. Some similarities are evident in the seasonality of the model results for these parameters that are driven by changes in receiving water flow conditions. Seepage rates from the TSF and WMPs are constant set rates for each year in the model and do not follow a seasonal pattern within each year; as a result, concentrations at the downstream surface water quality nodes are predicted to increase in response to seasonal low surface water flow conditions. The mean annual hydrograph for the Project area is bimodal with the lowest stream flows observed in February, August, and September. The majority of the parameters remain below guideline limits for the remainder of the year, but rise to levels that exceed guidelines during these months due to the influence of seepage.

The changes in chemistry that result from treated water discharge are also predicted to follow the same seasonal trend as seepage affected changes. However, there are a few parameters (Al, As, Cd, Cr, Cu, and Mn) for which water treatment is applied and this seasonal trend is not as pronounced.

The predicted McBean Brook water chemistry is not altered by mine seepage; however, changes are modelled as a result of water diverted around the Open Pit from the Sisson Brook catchment to McBean Brook. Surface water diversion structures will route runoff that would naturally have drained through Sisson Brook into the McBean Brook catchment. The modelled data for McBean Brook have been included herein, but a detailed discussion of the results has not been provided. No parameters were noted to increase to a point where guidelines were encroached upon, except for those that were observed to exceed guidelines in the baseline data.

It should be noted that baseline conditions provided in this report refer to the average monthly data for each model node that were used as inputs to the model. These data under-represent the

measured range for some of the parameters but are in-line with the model results, which are predicted monthly average concentrations.

The methods and results in this report have been provided as inputs to the effects assessment for the Environmental Impact Assessment application for the Project. The model output data for the TSF, Open Pit, and the downstream surface water nodes are provided in Appendix C.

#### 5.2.1 Sodium (Na)

Sodium concentrations are predicted to exceed the HCDW 200 mg/L aesthetic objective at NAP5 and at UT1 only during Operations; there is no CEQG limit for this parameter. The objective exceedance at NAP5, is a result of treated water discharge from the TSF to Sisson Brook during Operations (Years 8 through 27); concentrations decrease below the objective limit at the next model node (NAP7). Sodium is predicted to exceed the HCDW objective at NAP5 year-round from Years 8 through 14 (Operations) and then seasonally in association with lower receiving water flow conditions from Years 15 through 27 (generally from September through April). The maximum sodium concentration of 274 mg/L is predicted at NAP5 in Model Year 16 (Operations). The predicted chemistry at UT1 is affected by seepage water from the TSF where sodium concentrations are highest during Operations. Concentrations decrease below the objective limit at the next model node (NAP1). Sodium exceeds the HCDW objective seasonally from Years 9 through 15 (generally in August and September). The maximum sodium concentration of 205 mg/L is predicted at UT1 in Model Year 16 (Operations).

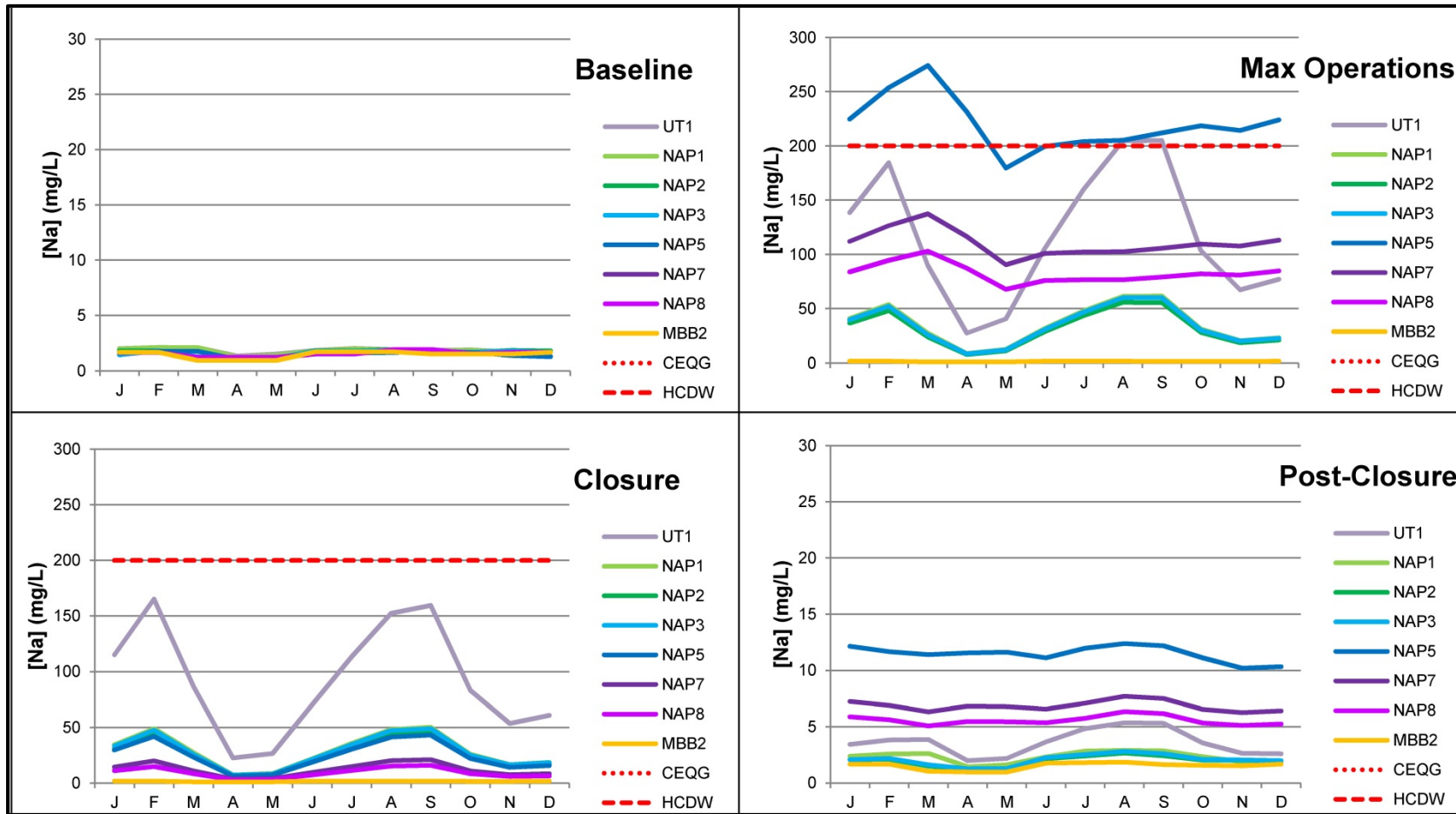
The summary statistics by Project phase are provided in Table 5.1 and the annual distribution of predicted sodium concentrations for one year in each mine phase are provided on Figure 5.1. The years chosen for presentation on the graphs are those that represent the maximum concentration reached during that mine phase; during Operations, these years tend to differ for nodes upstream of the WTP discharge point (NAP5) compared to downstream. The annual range of modelled sodium concentrations is provided graphically for each site in Appendix B1.

**Table 5.1 Summary Statistics by Project Phase for Sodium**

Node	Current					Node	Maximum Operations				
	Minimum	Annual Average	Maximum	HCDW	Year		Minimum	Annual Average	Maximum	HCDW	Year
UT1	1.33	1.83	2.10	200	current	UT1	27.31	116.93	205.00	200	16
NAP1	1.26	1.79	2.10	200	current	NAP1	8.63	34.96	61.51	200	14
NAP2	1.11	1.61	1.91	200	current	NAP2	7.73	31.53	55.73	200	14
NAP3	1.08	1.57	1.85	200	current	NAP3	8.29	33.99	60.09	200	14
NAP5	1.04	1.52	1.80	200	current	NAP5	179.57	220.04	273.98	200	16
NAP7	1.21	1.55	1.91	200	current	NAP7	90.35	110.30	137.28	200	16
NAP8	1.21	1.55	1.91	200	current	NAP8	67.77	82.66	102.82	200	16
MBB2	0.94	1.45	1.71	200	current	MBB2	0.95	1.46	1.73	200	14
Node	Closure					Node	Post-Closure				
	Minimum	Annual Average	Maximum	HCDW	Year		Minimum	Annual Average	Maximum	HCDW	Year
UT1	22.49	92.38	165.25	200	30	UT1	1.98	3.61	5.37	200	50
NAP1	7.36	28.61	50.14	200	30	NAP1	1.44	2.31	2.91	200	50
NAP2	6.59	25.86	45.48	200	30	NAP2	1.24	1.99	2.66	200	50
NAP3	7.06	27.83	48.94	200	30	NAP3	1.27	2.06	2.81	200	50
NAP5	6.24	24.48	43.21	200	30	NAP5	10.20	11.47	12.38	200	50
NAP7	3.60	12.04	20.96	200	30	NAP7	6.25	6.84	7.71	200	50
NAP8	2.96	9.22	15.85	200	30	NAP8	5.08	5.56	6.33	200	50
MBB2	0.97	1.51	1.84	200	30	MBB2	0.97	1.51	1.84	200	50

**NOTES:**

1. Units are mg/L.
2. Blue highlighting indicates values that are at or below all guidelines.
3. Yellow highlighting indicates values that exceed at least one guideline.
4. Current statistics are based upon the average monthly dataset used for the model inputs for each of the nodes. Measured maximum and minimum concentrations are under-represented.
5. There is no CEQG limit specified for sodium.



**NOTES:**

1. "BASELINE" REFERS TO MODEL YEARS -1 AND -2; "CLOSURE" REFERS TO YEAR 30; "POSTCLOSURE" REFERS TO YEAR 50.
2. "MAXIMUM OPERATIONS" REFERS TO THE YEAR FOR WHICH SODIUM REACHES ITS MAXIMUM VALUE (YEAR 14 FOR NAP1, NAP2, NAP3, AND MBB2; YEAR 16 FOR NAP5, NAP7, AND NAP8).
3. THERE IS NO CEQG FOR SODIUM.
4. THE HCDW LIMIT FOR Na IS AN AESTHETIC GUIDELINE BASED ON TASTE AND IS NOT WITHIN THE SCALE OF THE BASELINE AND POST-CLOSURE GRAPHS..

**Figure 5.1 Predicted Sodium Concentrations at Downstream Nodes by Project Phase.**

### 5.2.2 Manganese (Mn)

Manganese concentrations are predicted to exceed the HCDW 0.05 mg/L aesthetic objective on a seasonal basis at UT1, NAP1, NAP3, and NAP5 during Operations and at UT1 during Closure; there is no CEQG limit for manganese. Maximum annual concentrations occur in August in association with low surface water flows; predicted concentrations remain below the objective for the remainder of the year with few exceptions. Maximum annual concentrations are predicted to exceed the objective during Operations in Years 10 through 27 at NAP5, and in Years 10 through 25 at NAP1 and NAP3; however, average annual concentrations at these sites remain below the objective. Maximum annual concentrations are predicted to exceed the objective at UT1 during Operations and Closure in Years 7 through 33; the annual average concentrations are predicted to exceed this objective at UT1 during Operations in Years 9 through 26.

The highest predicted value is 0.055 mg/L for NAP5 in Model Year 16 (Operations), followed by 0.052 mg/L for NAP1 in Model Year 14 (Operations). Changes in manganese concentrations at NAP5 and downstream result from both TSF seepage and WTP discharge, though WTP discharge does not result in a notable change at NAP5 compared to the upstream nodes affected by seepage. Concentrations decrease below the guideline limit at the next downstream model node from both UT1 and NAP5 (NAP1 and NAP7, respectively). It is noted that the seasonal distribution of manganese concentrations is slightly different at NAP7 and NAP8 compared to NAP5 due to manganese loading from unknown existing sources downstream of the Project area.

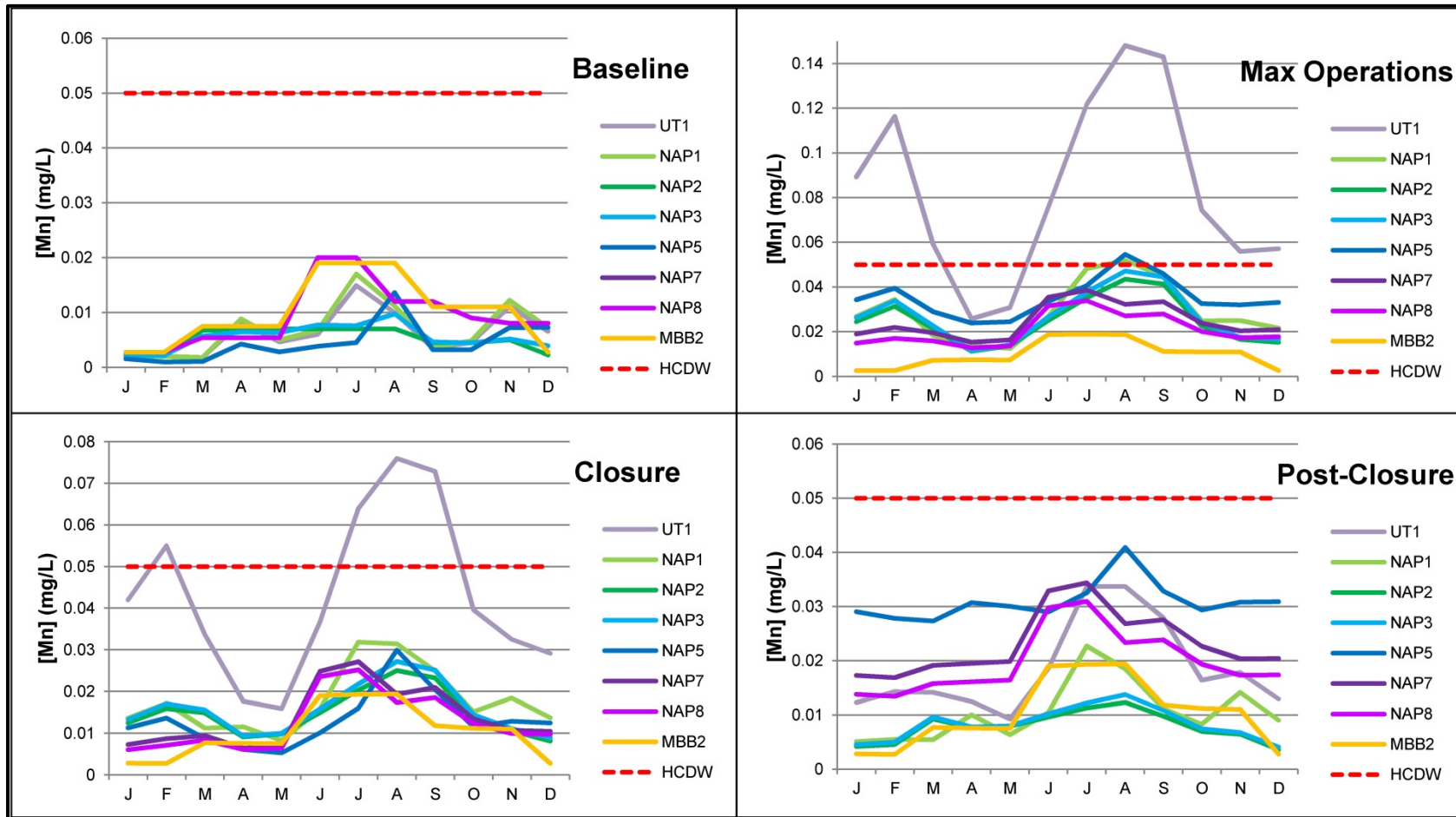
The summary statistics by Project phase are provided in Table 5.2. Annual distributions of predicted manganese concentrations for one year in each mine phase are provided on Figure 5.2. The years chosen for presentation on the graphs are those that represent the maximum concentration reached during that mine phase; these years tend to differ for nodes upstream of the WTP discharge point (NAP5) compared to downstream. The annual range of modelled manganese concentrations is provided graphically for each site in Appendix B2.

**Table 5.2 Summary Statistics by Project Phase for Manganese**

Node	Current					Node	Maximum Operations				
	Minimum	Annual Average	Maximum	HCDW	Year		Minimum	Annual Average	Maximum	HCDW	Year
UT1	0.002	0.006	0.015	0.05	current	UT1	0.026	0.083	0.148	0.05	16
NAP1	0.002	0.007	0.017	0.05	current	NAP1	0.012	0.029	0.052	0.05	14
NAP2	0.002	0.005	0.007	0.05	current	NAP2	0.011	0.025	0.044	0.05	14
NAP3	0.002	0.005	0.010	0.05	current	NAP3	0.012	0.027	0.047	0.05	14
NAP5	0.001	0.004	0.014	0.05	current	NAP5	0.024	0.035	0.055	0.05	16
NAP7	0.003	0.009	0.020	0.05	current	NAP7	0.015	0.025	0.039	0.05	16
NAP8	0.003	0.009	0.020	0.05	current	NAP8	0.013	0.021	0.034	0.05	16
MBB2	0.003	0.010	0.019	0.05	current	MBB2	0.003	0.010	0.019	0.05	14
Node	Closure					Node	Post-Closure				
	Minimum	Annual Average	Maximum	HCDW	Year		Minimum	Annual Average	Maximum	HCDW	Year
UT1	0.016	0.043	0.076	0.05	30	UT1	0.009	0.019	0.034	0.05	50
NAP1	0.008	0.018	0.032	0.05	30	NAP1	0.005	0.011	0.023	0.05	50
NAP2	0.008	0.015	0.025	0.05	30	NAP2	0.004	0.008	0.012	0.05	50
NAP3	0.009	0.016	0.027	0.05	30	NAP3	0.004	0.008	0.014	0.05	50
NAP5	0.005	0.013	0.030	0.05	30	NAP5	0.027	0.031	0.041	0.05	50
NAP7	0.006	0.014	0.027	0.05	30	NAP7	0.017	0.023	0.034	0.05	50
NAP8	0.006	0.013	0.025	0.05	30	NAP8	0.013	0.020	0.031	0.05	50
MBB2	0.003	0.010	0.019	0.05	30	MBB2	0.003	0.010	0.019	0.05	50

**NOTES:**

1. Units are mg/L.
2. Blue highlighting indicates values that are at or below all guidelines.
3. Yellow highlighting indicates values that exceed at least one guideline.
4. Current statistics are based upon the average monthly dataset used for the model inputs for each of the nodes. Measured maximum and minimum concentrations are under-represented.
5. There is no CEQG limit specified for manganese.



**NOTES:**

1. "BASELINE" REFERS TO MODEL YEARS -1 AND -2; "CLOSURE" REFERS TO YEAR 30; "POSTCLOSURE" REFERS TO YEAR 50.
2. "MAXIMUM OPERATIONS" REFERS TO THE YEAR FOR WHICH MANGANESE REACHES ITS MAXIMUM VALUE (YEAR 14 FOR ALL NODES).
3. THERE IS NO CEQG FOR MANGANESE

**Figure 5.2 Predicted Manganese Concentrations at Downstream Nodes by Project Phase**



### 5.2.3 Fluoride (F)

Fluoride concentrations are not predicted to exceed the HCDW 1.5 mg/L limit, but are predicted to exceed the 0.12 mg/L CEQG limit at each node for the duration of the modelled Project life. Baseline fluoride concentrations are elevated throughout the Project area and average levels generally exceeded the CEQG limit. Changes in fluoride concentrations are predicted as a result of seepage and point source discharge from the WTP. The greatest increase is noted at UT1 due to seepage from the TSF and WMP5, reaching a maximum concentration of 1.34 mg/L in Year 24 (Operations). Peak concentrations decrease at NAP 1 (maximum concentration of 0.57 mg/L) and continue to decrease downstream along Napadogan Brook until the confluence with Sisson Brook. The predicted variability at each of these nodes is seasonal with the highest concentrations in the lower flow months in late-summer. Peak concentrations of fluoride increase at NAP5 (maximum concentration of 1.26 mg/L in Year 11) due to the treated water discharge from the WTP during Operations, and to a lesser degree in Post-closure. The concentration of fluoride in the WTP effluent is different during Operations than in Post-closure because of differences in the water management strategy between the Project phases.

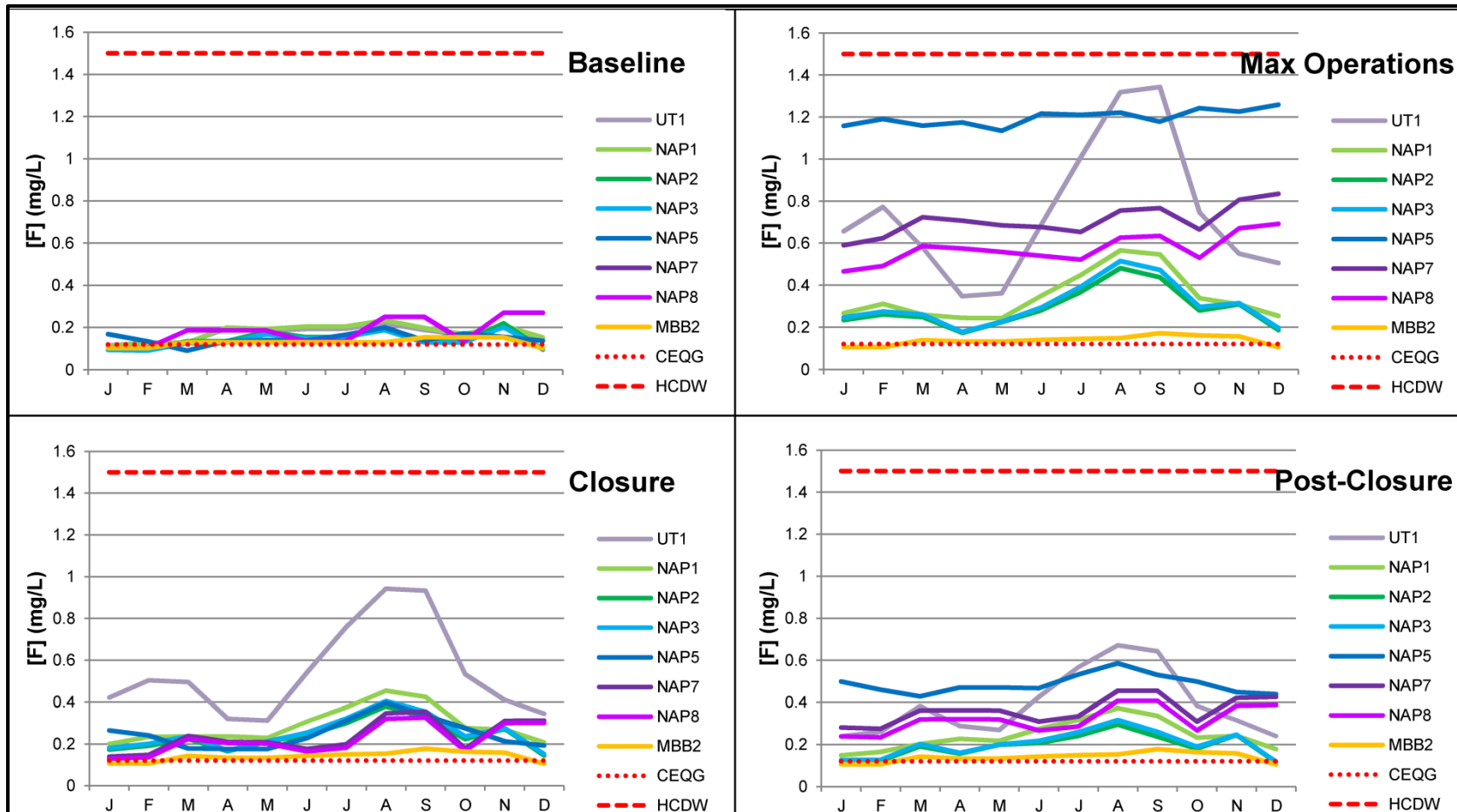
The summary statistics by Project phase are provided in Table 5.3. Annual distribution of predicted fluoride concentrations for one year in each mine phase are provided on Figure 5.3. The years presented on the graphs represent the maximum fluoride concentration reached during that mine phase; these years tend to differ for nodes upstream of the WTP discharge point (NAP5) compared to downstream. The annual range of modelled fluoride concentrations is provided graphically for each site in Appendix B3.

**Table 5.3 Summary Statistics by Project Phase for Fluoride**

Node	Current						Node	Maximum Operations					
	Minimum	Annual Average	Maximum	CEQG	HCDW	Year		Minimum	Annual Average	Maximum	CEQG	HCDW	Year
UT1	0.12	0.17	0.22	0.12	1.5	current	UT1	0.35	0.74	1.34	0.12	1.5	24
NAP1	0.11	0.18	0.23	0.12	1.5	current	NAP1	0.24	0.34	0.57	0.12	1.5	24
NAP2	0.09	0.14	0.22	0.12	1.5	current	NAP2	0.17	0.29	0.48	0.12	1.5	24
NAP3	0.09	0.14	0.20	0.12	1.5	current	NAP3	0.18	0.31	0.51	0.12	1.5	24
NAP5	0.09	0.15	0.20	0.12	1.5	current	NAP5	1.13	1.20	1.26	0.12	1.5	11
NAP7	0.10	0.18	0.27	0.12	1.5	current	NAP7	0.59	0.71	0.83	0.12	1.5	11
NAP8	0.10	0.18	0.27	0.12	1.5	current	NAP8	0.47	0.57	0.69	0.12	1.5	11
MBB2	0.10	0.13	0.15	0.12	1.5	current	MBB2	0.10	0.14	0.17	0.12	1.5	24
Node	Closure						Node	Post-Closure					
	Minimum	Annual Average	Maximum	CEQG	HCDW	Year		Minimum	Annual Average	Maximum	CEQG	HCDW	Year
UT1	0.31	0.54	0.94	0.12	1.5	30	UT1	0.24	0.39	0.67	0.12	1.5	50
NAP1	0.20	0.29	0.45	0.12	1.5	30	NAP1	0.15	0.24	0.37	0.12	1.5	50
NAP2	0.14	0.24	0.38	0.12	1.5	30	NAP2	0.11	0.19	0.29	0.12	1.5	50
NAP3	0.15	0.25	0.40	0.12	1.5	30	NAP3	0.12	0.20	0.32	0.12	1.5	50
NAP5	0.18	0.25	0.40	0.12	1.5	30	NAP5	0.43	0.49	0.58	0.12	1.5	50
NAP7	0.14	0.23	0.35	0.12	1.5	30	NAP7	0.28	0.36	0.46	0.12	1.5	50
NAP8	0.13	0.22	0.33	0.12	1.5	30	NAP8	0.23	0.32	0.41	0.12	1.5	50
MBB2	0.11	0.14	0.18	0.12	1.5	30	MBB2	0.11	0.14	0.18	0.12	1.5	50

**NOTES:**

1. Units are mg/L.
2. Blue highlighting indicates values that are at or below all guidelines.
3. Yellow highlighting indicates values that exceed at least one guideline.
4. Current statistics are based upon the average monthly dataset used for the model inputs for each of the nodes. Measured maximum and minimum concentrations are under-represented.



**NOTES:**

1. "BASELINE" REFERS TO MODEL YEARS -1 AND -2; "CLOSURE" REFERS TO YEAR 30; "POSTCLOSURE" REFERS TO YEAR 50.
2. "MAXIMUM OPERATIONS" REFERS TO THE YEAR FOR WHICH FLUORIDE REACHES ITS MAXIMUM VALUE (YEAR 24 FOR NAP1, NAP2, NAP3, AND MBB2; YEAR 11 FOR NAP5, NAP7, AND NAP8).

**Figure 5.3 Predicted Fluoride Concentrations at Downstream Nodes by Project Phase**

#### 5.2.4 Aluminum (Al)

Aluminum concentrations are naturally elevated in the Project area, particularly at locations in the upper portion of the Napadogan Brook watershed, decreasing with distance downstream. Average baseline dissolved aluminum concentrations exceeded the CEQG limit at all sites except in lower Napadogan Brook and seasonally exceeded the HCDW limit at NAP1 and at UT1 (baseline values are from the average monthly dataset used for the model inputs for each of the nodes and measured maximum and minimum concentrations are under-represented). The predicted aluminum concentrations resulting from the Project are slightly higher than the baseline concentrations, but follow the same seasonal distribution. Aluminum concentrations are predicted to exceed the 0.1 mg/L CEQG limit (pH > 6.5) on a regular basis and the 0.2 mg/L HCDW limit on occasion, but only at NAP1 and UT1 (maximum concentrations of 0.0217 mg/L and 0.271 mg/L respectively). Maximum concentrations are predicted to occur in Model Year 24 (Operations) for all nodes in Napadogan Brook.

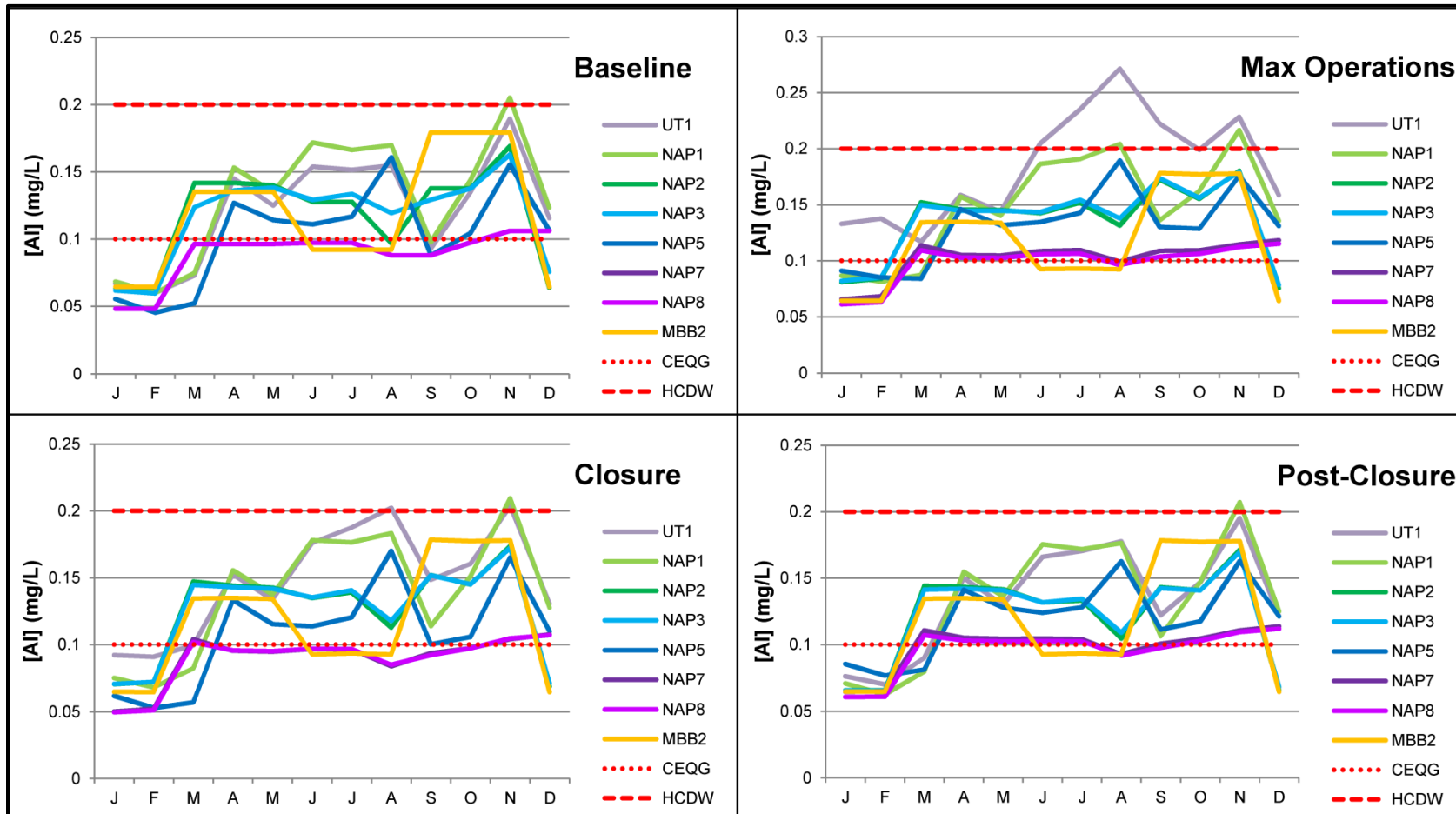
The summary statistics by Project phase are provided in Table 5.4. The annual distribution of predicted dissolved aluminum concentrations for one year in each mine phase are provided on Figure 5.4. The years shown on the graphs represent the maximum concentration reached during that mine phase. The annual range of modelled aluminum concentration is provided graphically for each site in Appendix B4.

**Table 5.4 Summary Statistics by Project Phase for Dissolved Aluminum**

Node	Current						Node	Maximum Operations					
	Minimum	Annual Average	Maximum	CEQG	HCDW	Year		Minimum	Annual Average	Maximum	CEQG	HCDW	Year
UT1	0.060	0.122	0.190	0.1	0.2	current	UT1	0.117	0.184	0.271	0.1	0.2	24
NAP1	0.060	0.131	0.205	0.1	0.2	current	NAP1	0.081	0.149	0.217	0.1	0.2	24
NAP2	0.064	0.118	0.169	0.1	0.2	current	NAP2	0.076	0.135	0.180	0.1	0.2	24
NAP3	0.060	0.117	0.163	0.1	0.2	current	NAP3	0.078	0.136	0.179	0.1	0.2	24
NAP5	0.045	0.103	0.161	0.1	0.2	current	NAP5	0.084	0.131	0.190	0.1	0.2	24
NAP7	0.048	0.089	0.106	0.1	0.2	current	NAP7	0.066	0.102	0.118	0.1	0.2	24
NAP8	0.048	0.089	0.106	0.1	0.2	current	NAP8	0.061	0.099	0.115	0.1	0.2	24
MBB2	0.065	0.118	0.179	0.1	0.2	current	MBB2	0.064	0.117	0.178	0.1	0.2	24
Node	Closure						Node	Post-Closure					
	Minimum	Annual Average	Maximum	CEQG	HCDW	Year		Minimum	Annual Average	Maximum	CEQG	HCDW	Year
UT1	0.091	0.148	0.204	0.1	0.2	30	UT1	0.070	0.135	0.195	0.1	0.2	50
NAP1	0.068	0.138	0.209	0.1	0.2	30	NAP1	0.062	0.134	0.207	0.1	0.2	50
NAP2	0.069	0.125	0.174	0.1	0.2	30	NAP2	0.066	0.121	0.171	0.1	0.2	50
NAP3	0.071	0.125	0.172	0.1	0.2	30	NAP3	0.065	0.121	0.170	0.1	0.2	50
NAP5	0.053	0.109	0.170	0.1	0.2	30	NAP5	0.077	0.120	0.163	0.1	0.2	50
NAP7	0.050	0.090	0.108	0.1	0.2	30	NAP7	0.064	0.098	0.114	0.1	0.2	50
NAP8	0.050	0.089	0.107	0.1	0.2	30	NAP8	0.061	0.096	0.112	0.1	0.2	50
MBB2	0.064	0.117	0.179	0.1	0.2	30	MBB2	0.064	0.117	0.179	0.1	0.2	50

**NOTES:**

1. Units are mg/L.
2. Blue highlighting indicates values that are at or below all guidelines.
3. Yellow highlighting indicates values that exceed at least one guideline.
4. Current statistics are based upon the average monthly dataset used for the model inputs for each of the nodes. Measured maximum and minimum concentrations are under-represented.
5. The CEQG aluminum limit of 0.1 mg/L has been used for comparison which is relevant for water with *in situ* pH of greater than 6.5; a limit of 0.005 mg/L applies when pH is less than 6.5.



**NOTES:**

1. "BASELINE" REFERS TO MODEL YEARS -1 AND -2; "CLOSURE" REFERS TO YEAR 30; "POSTCLOSURE" REFERS TO YEAR 50.
2. "MAXIMUM OPERATIONS" REFERS TO THE YEAR FOR WHICH ALUMINUM REACHES ITS MAXIMUM VALUE (YEAR 24 FOR ALL NODES).

**Figure 5.4 Predicted Aluminum Concentrations at Downstream Nodes by Project Phase**

### 5.2.5 Arsenic (As)

Arsenic concentrations are predicted to exceed the 0.01 mg/L HCDW limit and the 0.005 mg/L CEQG limit at UT1 from Year 9 onwards and predicted to exceed the CEQG on a seasonal basis at NAP1 through NAP5 during Operations and Closure, and at NAP5 in Post-Closure. The predicted concentrations are highest at UT1; however, the results for this node have a lesser degree of certainty than those for other nodes. Annual maximum concentrations at UT1 exceed both the CEQG and HCDW guidelines from Year 9 onwards; annual average concentrations exceed the HCDW guideline from Year 12 to 16 and exceed the CEQG guideline from Year 9 onwards. The predicted concentrations do not exceed the CEQG limit at the nodes downstream of NAP5 (NAP7 and NAP8). Changes in arsenic concentrations upstream of NAP5 are related to seepage from the TSF and WMPs. The changes at NAP5 are also affected by treated water discharge from the WTP during Operations and in Post-closure. The predicted arsenic concentrations are higher under low flow conditions and highest in the summer months (July, August, and September). Predicted arsenic concentrations peak at all sites in Model Year 14 (Operations) with a maximum concentration of 0.0214 mg/L predicted at UT1. The next highest predicted concentration of arsenic is 0.0066 mg/L at NAP1.

The summary statistics by Project phase are provided in Table 5.5. The annual distribution of predicted dissolved arsenic concentrations for one year in each mine phase is provided on Figure 5.5. The years presented on the graphs represent the maximum concentration reached during that mine phase. The annual range of modelled arsenic concentration is provided graphically for each site in Appendix B5.

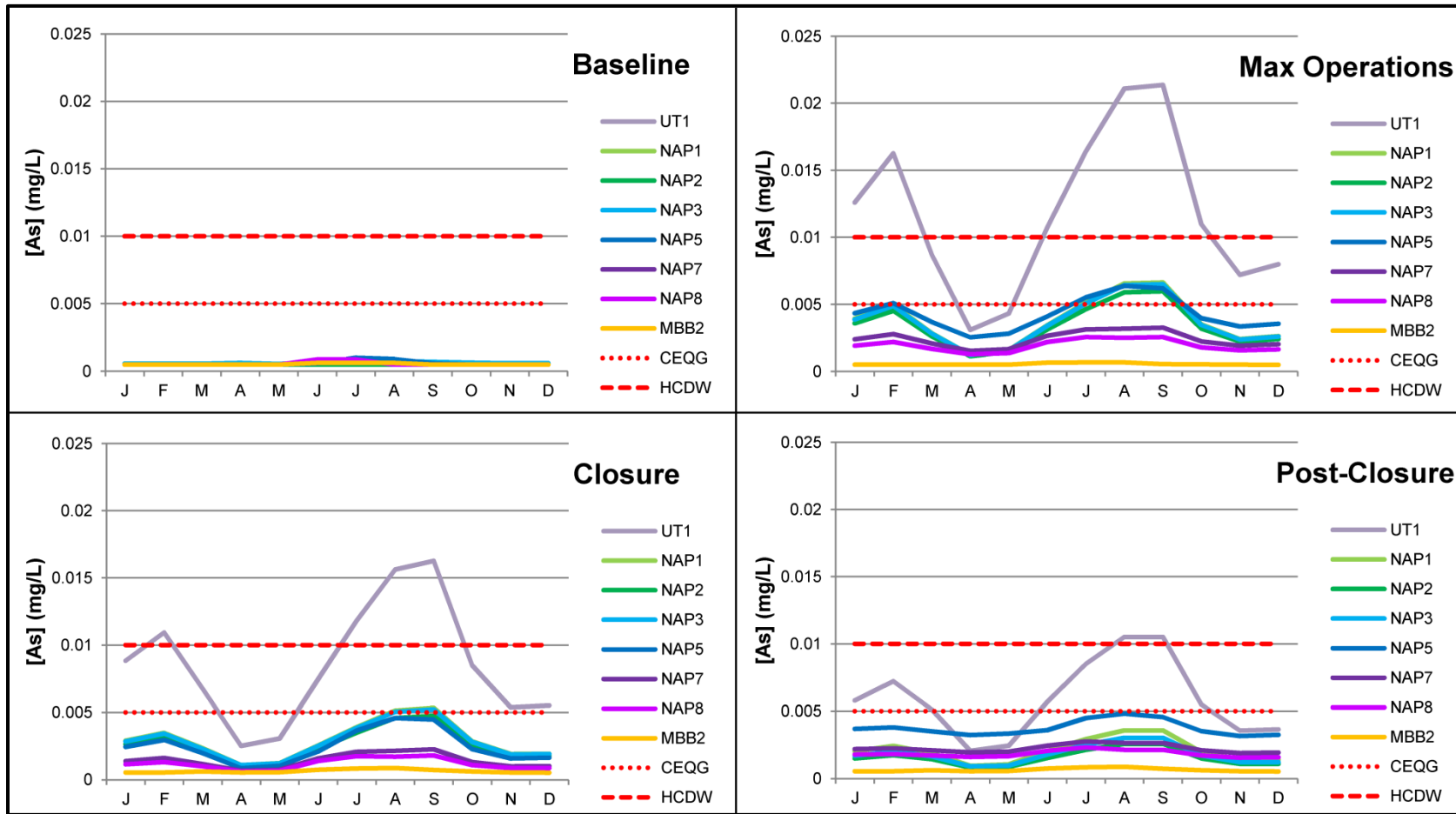
**Table 5.5 Summary Statistics by Project Phase for Dissolved Arsenic**

Node	Current						Node	Maximum Operations					
	Minimum	Annual Average	Maximum	CEQG	HCDW	Year		Minimum	Annual Average	Maximum	CEQG	HCDW	Year
UT1	0.0005	0.0005	0.0005	0.005	0.01	current	UT1	0.0031	0.0117	0.0214	0.005	0.01	14
NAP1	0.0005	0.0005	0.0005	0.005	0.01	current	NAP1	0.0012	0.0037	0.0066	0.005	0.01	14
NAP2	0.0005	0.0005	0.0005	0.005	0.01	current	NAP2	0.0011	0.0034	0.0060	0.005	0.01	14
NAP3	0.0006	0.0006	0.0008	0.005	0.01	current	NAP3	0.0012	0.0037	0.0065	0.005	0.01	14
NAP5	0.0005	0.0006	0.0010	0.005	0.01	current	NAP5	0.0025	0.0043	0.0064	0.005	0.01	14
NAP7	0.0005	0.0006	0.0009	0.005	0.01	current	NAP7	0.0015	0.0024	0.0032	0.005	0.01	14
NAP8	0.0005	0.0006	0.0009	0.005	0.01	current	NAP8	0.0013	0.0019	0.0025	0.005	0.01	14
MBB2	0.0005	0.0005	0.0006	0.005	0.01	current	MBB2	0.0005	0.0006	0.0007	0.005	0.01	14
Node	Closure						Node	Post-Closure					
	Minimum	Annual Average	Maximum	CEQG	HCDW	Year		Minimum	Annual Average	Maximum	CEQG	HCDW	Year
UT1	0.0025	0.0086	0.0163	0.005	0.01	30	UT1	0.0021	0.0059	0.0105	0.005	0.01	50
NAP1	0.0011	0.0029	0.0053	0.005	0.01	30	NAP1	0.0010	0.0021	0.0036	0.005	0.01	50
NAP2	0.0010	0.0026	0.0048	0.005	0.01	30	NAP2	0.0008	0.0016	0.0026	0.005	0.01	50
NAP3	0.0011	0.0028	0.0052	0.005	0.01	30	NAP3	0.0009	0.0018	0.0030	0.005	0.01	50
NAP5	0.0009	0.0025	0.0046	0.005	0.01	30	NAP5	0.0032	0.0037	0.0048	0.005	0.01	50
NAP7	0.0007	0.0014	0.0023	0.005	0.01	30	NAP7	0.0019	0.0022	0.0028	0.005	0.01	50
NAP8	0.0006	0.0012	0.0018	0.005	0.01	30	NAP8	0.0016	0.0018	0.0023	0.005	0.01	50
MBB2	0.0005	0.0006	0.0009	0.005	0.01	30	MBB2	0.0005	0.0006	0.0009	0.005	0.01	50

**NOTES:**

1. Units are mg/L.
2. Blue highlighting indicates values that are at or below all guidelines.
3. Yellow highlighting indicates values that exceed at least one guideline.
4. Current statistics are based upon the average monthly dataset used for the model inputs for each of the nodes. Measured maximum and minimum concentrations are under-represented.





**NOTES:**

1. "BASELINE" REFERS TO MODEL YEARS -1 AND -2; "CLOSURE" REFERS TO YEAR 30; "POSTCLOSURE" REFERS TO YEAR 50.
2. "MAXIMUM OPERATIONS" REFERS TO THE YEAR FOR WHICH ARSENIC REACHES ITS MAXIMUM VALUE (YEAR 14 FOR ALL NODES).

**Figure 5.5 Predicted Arsenic Concentrations at Downstream Nodes by Project Phase**

### 5.2.6 Cadmium (Cd)

It is noted that baseline cadmium concentrations are elevated and generally exceeded the CEQG limit throughout the study area. Cadmium concentrations are predicted to exceed the CEQG hardness dependent limit at most model nodes in Napadogan Brook during Operations, Closure, and Post-closure. Predicted cadmium concentrations remain well below the 0.005 mg/L HCDW limit. The highest predicted concentrations occur at two points late in Operations: Model Year 24 at nodes upstream of NAP5 and Model Year 20 downstream of the WTP discharge point. Changes in cadmium concentrations are primarily influenced by point source discharge from the WTP, but are also affected by seepage, particularly at UT1 where a maximum concentration of 0.00016 mg/L is predicted.

The predicted cadmium concentrations do not exceed the recently proposed short-term cadmium guideline limit at any node, but they do exceed the proposed short-term guideline limit during Operations and in Post-closure at NAP5 and during Operations and Closure, and Post-closure at UT1. Cadmium concentrations are predicted to decrease to levels below the proposed long-term guideline limit further downstream of both UT1 and NAP5 (at NAP1 and NAP7, respectively). It must be noted that the proposed guidelines are currently in unpublished draft form.

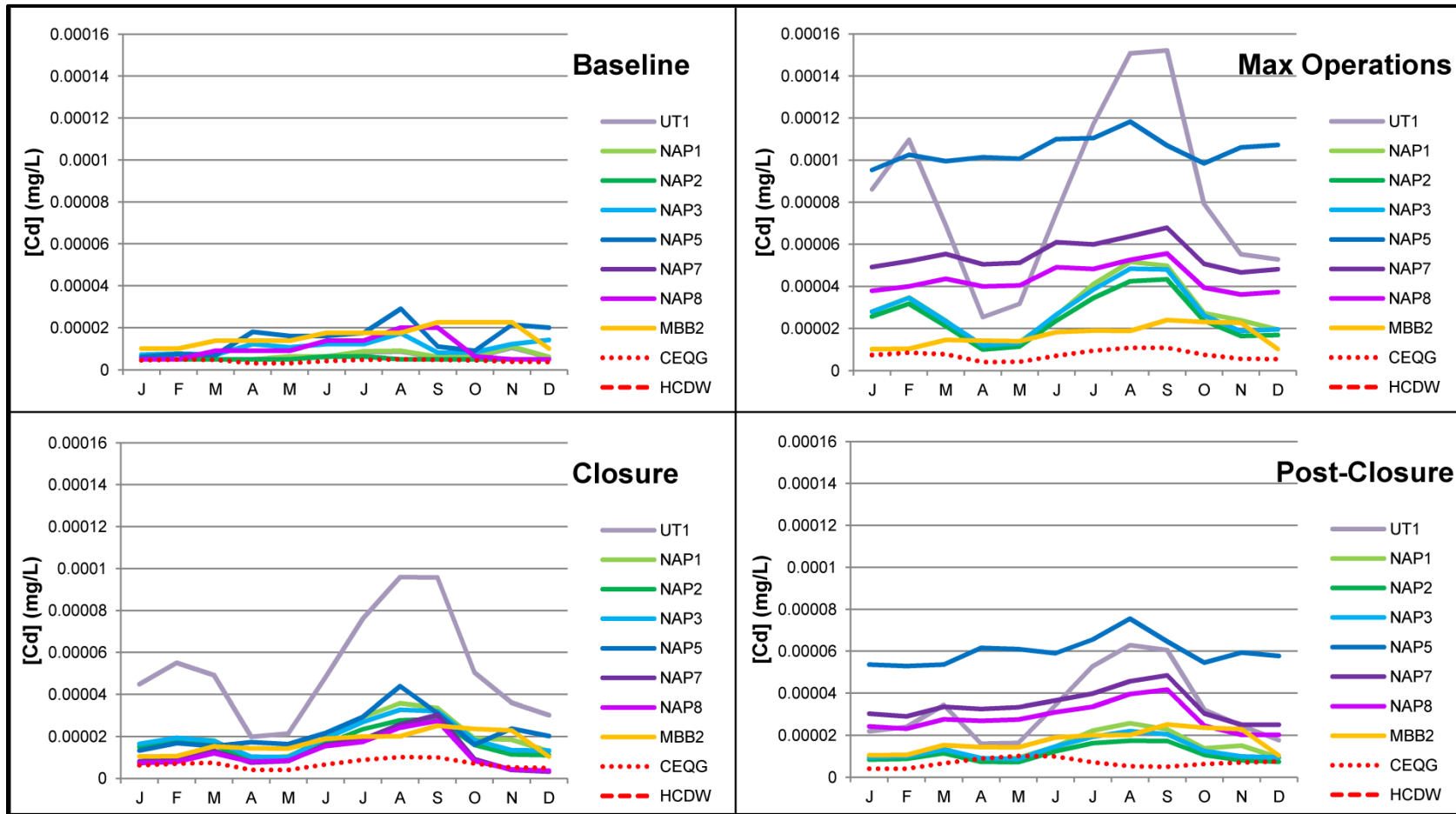
The summary statistics by Project phase are provided in Table 5.6. The annual distribution of predicted dissolved cadmium concentrations for one year in each mine phase is provided on Figure 5.6. The years presented on the graphs represent the maximum concentration reached during that mine phase. The annual range of modelled cadmium concentration is provided graphically for each site in Appendix B6.

**Table 5.6 Summary Statistics by Project Phase for Dissolved Cadmium**

Node	Current						Node	Maximum Operations					
	Minimum	Annual Average	Maximum	CEQG	HCDW	Year		Minimum	Annual Average	Maximum	CEQG	HCDW	Year
UT1	0.000005	0.000006	0.000010	0.000004	0.005	current	UT1	0.000024	0.000081	0.000159	0.000007	0.005	24
NAP1	0.000005	0.000007	0.000011	0.000004	0.005	current	NAP1	0.000010	0.000029	0.000053	0.000007	0.005	24
NAP2	0.000005	0.000005	0.000006	0.000004	0.005	current	NAP2	0.000010	0.000024	0.000045	0.000007	0.005	24
NAP3	0.000007	0.000011	0.000017	0.000004	0.005	current	NAP3	0.000011	0.000027	0.000050	0.000007	0.005	24
NAP5	0.000006	0.000015	0.000029	0.000004	0.005	current	NAP5	0.000095	0.000105	0.000118	0.000013	0.005	20
NAP7	0.000005	0.000010	0.000020	0.000005	0.005	current	NAP7	0.000047	0.000055	0.000068	0.000010	0.005	20
NAP8	0.000005	0.000010	0.000020	0.000005	0.005	current	NAP8	0.000036	0.000043	0.000056	0.000008	0.005	20
MBB2	0.000010	0.000016	0.000023	0.000005	0.005	current	MBB2	0.000010	0.000017	0.000025	0.000005	0.005	24
Node	Closure						Node	Post-Closure					
	Minimum	Annual Average	Maximum	CEQG	HCDW	Year		Minimum	Annual Average	Maximum	CEQG	HCDW	Year
UT1	0.000020	0.000052	0.000096	0.000007	0.005	30	UT1	0.000016	0.000033	0.000063	0.000006	0.005	50
NAP1	0.000009	0.000020	0.000036	0.000007	0.005	30	NAP1	0.000008	0.000015	0.000026	0.000006	0.005	50
NAP2	0.000008	0.000017	0.000028	0.000006	0.005	30	NAP2	0.000007	0.000011	0.000017	0.000005	0.005	50
NAP3	0.000010	0.000019	0.000033	0.000007	0.005	30	NAP3	0.000009	0.000013	0.000022	0.000006	0.005	50
NAP5	0.000013	0.000022	0.000044	0.000006	0.005	30	NAP5	0.000053	0.000060	0.000075	0.000012	0.005	50
NAP7	0.000003	0.000013	0.000030	0.000006	0.005	30	NAP7	0.000025	0.000034	0.000048	0.000009	0.005	50
NAP8	0.000004	0.000012	0.000028	0.000006	0.005	30	NAP8	0.000020	0.000028	0.000042	0.000008	0.005	50
MBB2	0.000010	0.000017	0.000025	0.000005	0.005	30	MBB2	0.000010	0.000017	0.000025	0.000005	0.005	50

**NOTES:**

1. Units are mg/L.
2. Blue highlighting indicates values that are at or below all guidelines.
3. Yellow highlighting indicates values that exceed at least one guideline.
4. Baseline statistics are based upon the average monthly dataset used for the model inputs for each of the nodes. Measured maximum and minimum concentrations are under-represented.



**NOTES:**

1. "BASELINE" REFERS TO MODEL YEARS -1 AND -2; "CLOSURE" REFERS TO YEAR 30; "POSTCLOSURE" REFERS TO YEAR 50.
2. "MAXIMUM OPERATIONS" REFERS TO THE YEAR FOR WHICH CADMIUM REACHES ITS MAXIMUM VALUE (YEAR 24 FOR NAP1, NAP2, NAP3, AND MBB2; YEAR 20 FOR NAP5, NAP7, AND NAP8).
3. THE CEQG IS HARDNESS-DEPENDENT; THE GUIDELINE SHOWN IS CALCULATED FOR HARDNESS AT NAP1.
4. THE HCDW GUIDELINE OF 0.005 mg/L IS NOT SHOWN ON THESE GRAPHS.

**Figure 5.6 Predicted Cadmium Concentrations at Downstream Nodes by Project Phase**

### 5.2.7 Chromium (Cr)

Chromium concentrations are predicted to exceed the 0.001 mg/L CEQG limit for hexavalent chromium (Cr VI) year-round at UT1 only, and on a seasonal basis at NAP1 through NAP5 concurrent with lower receiving water stream flow. The Cr VI guideline has been used for comparison instead of the trivalent chromium limit (CEQG limit of 0.0089 mg/L), as Cr VI is the principal species found in surface waters (CCME 1999). Predicted concentrations remain well below the 0.05 mg/L HCDW limit at all nodes. Chromium concentrations are influenced by seepage and by point source treated water discharge (effluent discharge limit of 0.01 mg/L); however, the point source discharge does not strongly affect the trend of lower predicted concentrations moving from upstream (UT1 and NAP1) to downstream. The changes are predominantly seepage driven and are therefore seasonal, with higher concentrations occurring in during periods of lower stream flow. Concentrations are predicted to exceed the CEQG limit from May through October at NAP5 and the nodes upstream. A second lower peak is also evident in February. Maximum chromium concentrations are reached in late-Operations and early-Closure with a maximum predicted concentration of 0.0039 mg/L at UT1, followed by 0.0015 mg/L at NAP1. Predicted chromium concentrations generally decrease to levels at or below the CEQG limit in lower Napadogan Brook (NAP7 and NAP8) during all project Phases.

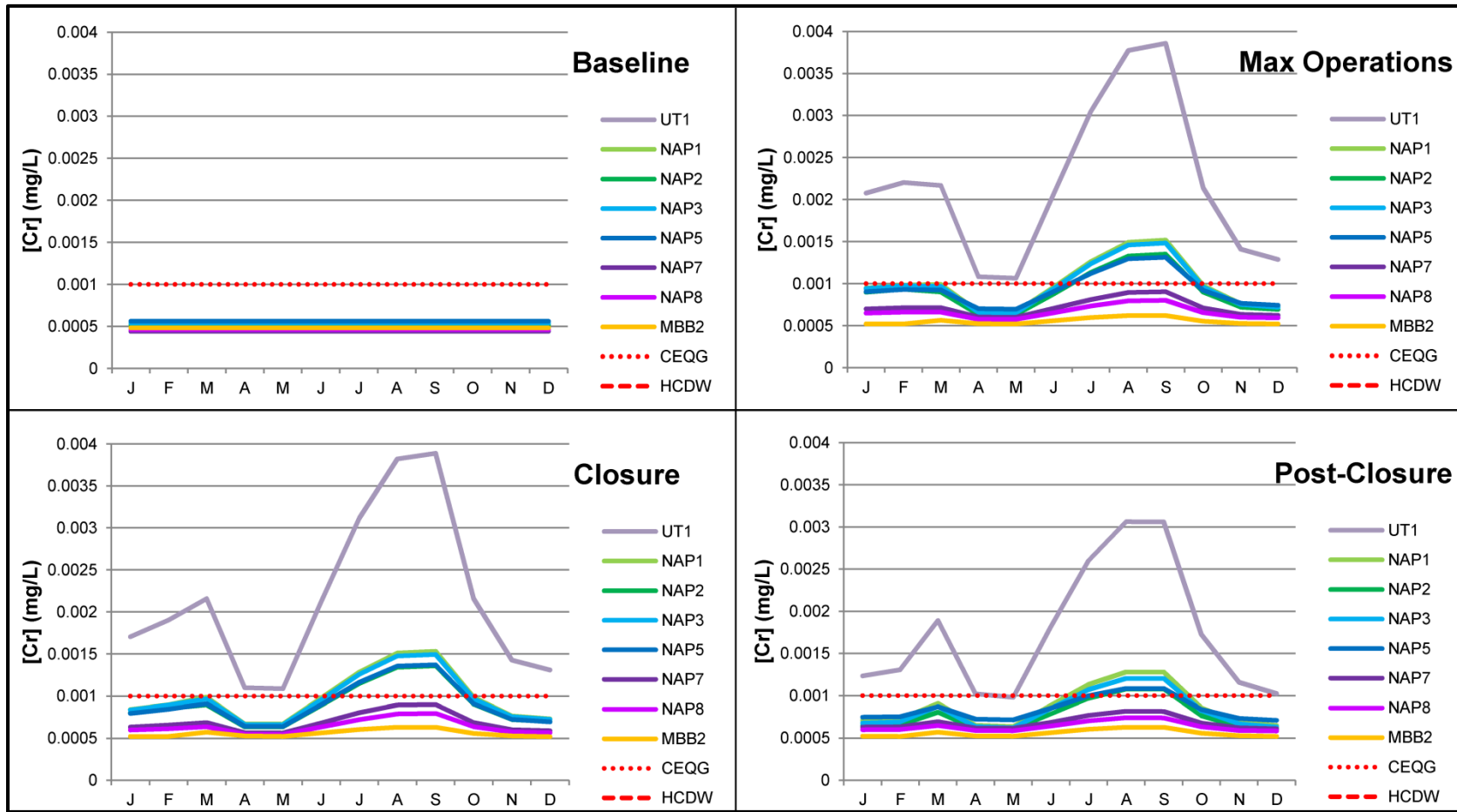
The summary statistics by Project phase are provided in Table 5.7. The annual distribution of predicted dissolved chromium concentration for one year in each mine phase is provided on Figure 5.7. The years presented on the graphs represent the maximum concentration reached during that mine phase. The annual range of modelled chromium concentration is provided graphically for each site in Appendix B7.

**Table 5.7 Summary Statistics by Project Phase for Dissolved Chromium**

Node	Current						Node	Maximum Operations					
	Minimum	Annual Average	Maximum	CEQG	HCDW	Year		Minimum	Annual Average	Maximum	CEQG	HCDW	Year
UT1	0.0005	0.0005	0.0005	0.001	0.05	current	UT1	0.0011	0.0022	0.0039	0.001	0.05	26
NAP1	0.0005	0.0005	0.0005	0.001	0.05	current	NAP1	0.0007	0.0010	0.0015	0.001	0.05	26
NAP2	0.0005	0.0005	0.0005	0.001	0.05	current	NAP2	0.0006	0.0009	0.0014	0.001	0.05	26
NAP3	0.0005	0.0005	0.0005	0.001	0.05	current	NAP3	0.0007	0.0010	0.0015	0.001	0.05	26
NAP5	0.0005	0.0005	0.0005	0.001	0.05	current	NAP5	0.0007	0.0009	0.0013	0.001	0.05	26
NAP7	0.0005	0.0005	0.0005	0.001	0.05	current	NAP7	0.0006	0.0007	0.0009	0.001	0.05	26
NAP8	0.0005	0.0005	0.0005	0.001	0.05	current	NAP8	0.0006	0.0007	0.0008	0.001	0.05	26
MBB2	0.0005	0.0005	0.0005	0.001	0.05	current	MBB2	0.0005	0.0006	0.0006	0.001	0.05	26
Node	Closure						Node	Post-Closure					
	Minimum	Annual Average	Maximum	CEQG	HCDW	Year		Minimum	Annual Average	Maximum	CEQG	HCDW	Year
UT1	0.0011	0.0021	0.0039	0.001	0.05	30	UT1	0.0010	0.0017	0.0031	0.001	0.05	50
NAP1	0.0007	0.0010	0.0015	0.001	0.05	30	NAP1	0.0006	0.0009	0.0013	0.001	0.05	50
NAP2	0.0006	0.0009	0.0014	0.001	0.05	30	NAP2	0.0006	0.0008	0.0011	0.001	0.05	50
NAP3	0.0007	0.0010	0.0015	0.001	0.05	30	NAP3	0.0006	0.0008	0.0012	0.001	0.05	50
NAP5	0.0006	0.0009	0.0014	0.001	0.05	30	NAP5	0.0007	0.0008	0.0011	0.001	0.05	50
NAP7	0.0006	0.0007	0.0009	0.001	0.05	30	NAP7	0.0006	0.0007	0.0008	0.001	0.05	50
NAP8	0.0005	0.0006	0.0008	0.001	0.05	30	NAP8	0.0006	0.0006	0.0007	0.001	0.05	50
MBB2	0.0005	0.0006	0.0006	0.001	0.05	30	MBB2	0.0005	0.0006	0.0006	0.001	0.05	50

**NOTES:**

1. Units are in mg/L.
2. Blue highlighting indicates values that are at or below all guidelines.
3. Yellow highlighting indicates values that exceed at least one guideline.
4. Baseline statistics are based upon the average monthly dataset used for the model inputs for each of the nodes. Measured maximum and minimum concentrations are under-represented.
5. CEQG for Cr VI was applied against the predicted water quality results for chromium.



**NOTES:**

1. "BASELINE" REFERS TO MODEL YEARS -1 AND -2; "CLOSURE" REFERS TO YEAR 30; "POST-CLOSURE" REFERS TO YEAR 50.
2. "MAXIMUM OPERATIONS" REFERS TO THE YEAR FOR WHICH CHROMIUM REACHES ITS MAXIMUM VALUE (YEAR 26 FOR ALL NODES).
3. THE CEQG FOR TRIVALENT CHROMIUM IS 0.0089 mg/L; THE CEQG FOR HEXAVALENT CHROMIUM IS 0.001 mg/L.
4. THE HCDW GUIDELINE OF 0.05 mg/L IS NOT SHOWN ON THIS GRAPH
5. THE CURRENT CONDITIONS INDICATE THAT CHROMIUM IS BELOW THE METHOD DETECTION LIMIT AT ALL NODES.

**Figure 5.7 Predicted Chromium Concentrations at Downstream Nodes by Project Phase**

#### 5.2.8 Copper (Cu)

Copper concentrations are predicted to exceed the hardness dependent CEQG limit. The applicable limit for all model nodes is 0.002 mg/L for hardness of < 83 mg/L CaCO<sub>3</sub>. Predicted concentrations remain well below the 1 mg/L HCDW limit at all nodes. Copper concentrations are influenced by seepage and by treated water discharge (effluent discharge limit of 0.002 mg/L); however, the point source discharge does not affect the trend to lower predicted concentrations moving from UT1 and NAP1 downstream. The changes are predominantly seepage driven and are therefore seasonal, with higher concentrations occurring in during periods of lower stream flow. Concentrations at NAP5 and all upstream nodes are predicted to exceed the CEQG limit from May through October, and again in February. Seasonal fluctuations follow the same trends at UT1, but annual average, minimum and maximum concentrations are predicted to exceed the CEQG limit from Year 15 onwards. Maximum copper concentrations are reached in late-Operations and early-Closure with a predicted peak concentration of 0.0114 mg/L at UT1. The next highest concentration is predicted at NAP1, with a maximum concentration of 0.0038 mg/L. Predicted copper concentrations decrease to levels at or below the CEQG limit in lower Napadogan Brook (NAP7 and NAP8) during all project Phases.

The summary statistics by Project phase are provided in Table 5.7. Annual distributions of predicted dissolved copper concentrations for one year in each mine phase are provided on Figure 5.7. The years presented on the graphs represent the maximum concentration reached during that mine phase. The annual range of modelled copper concentrations is provided graphically for each site in Appendix B8.

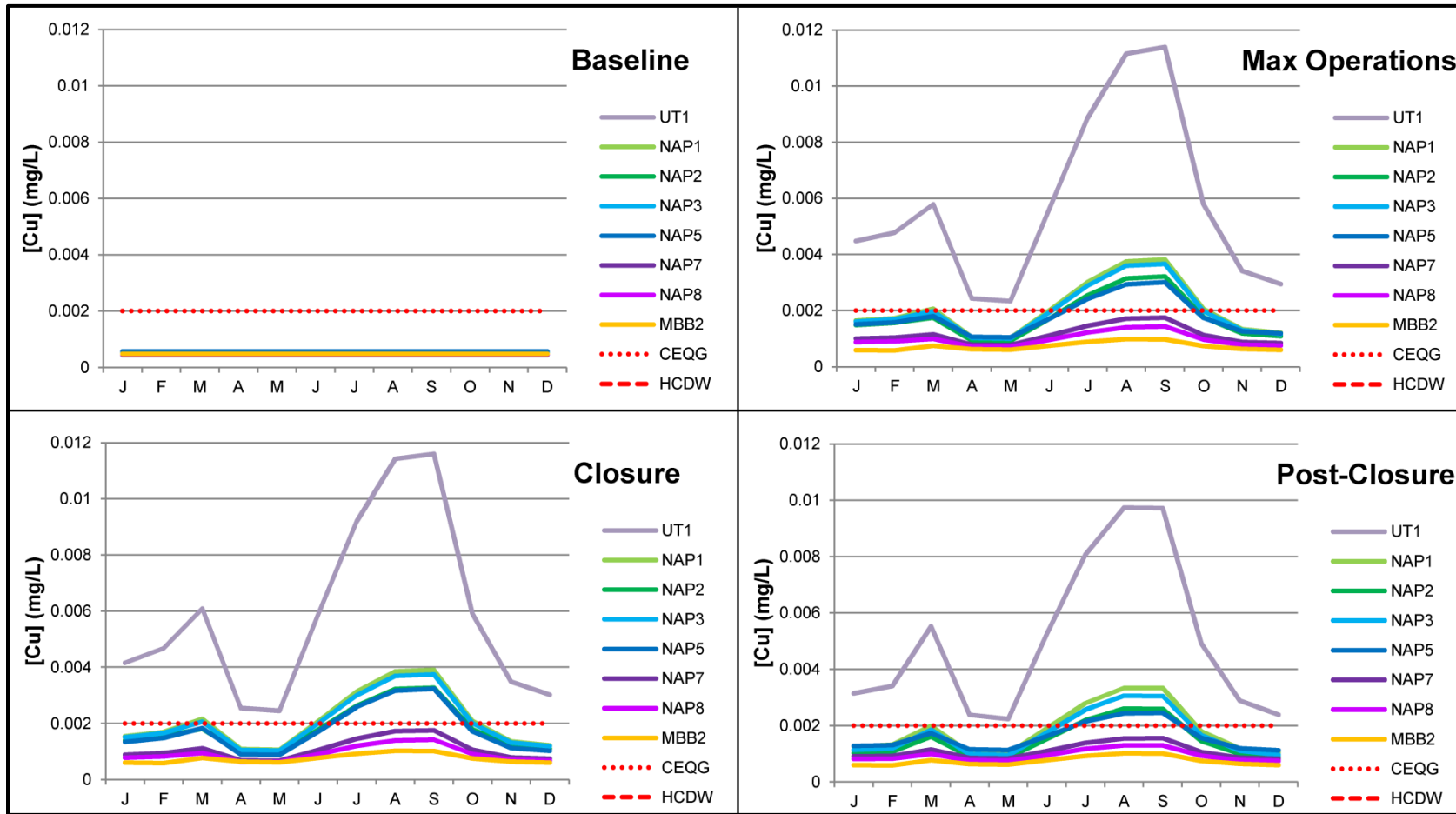


**Table 5.8 Summary Statistics by Project Phase for Dissolved Copper**

Node	Current						Node	Maximum Operations					
	Minimum	Annual Average	Maximum	CEQG	HCDW	Year		Minimum	Annual Average	Maximum	CEQG	HCDW	Year
UT1	0.0005	0.0005	0.0005	0.002	1	current	UT1	0.0023	0.0057	0.0114	0.002	1	26
NAP1	0.0005	0.0005	0.0005	0.002	1	current	NAP1	0.0010	0.0021	0.0038	0.002	1	26
NAP2	0.0005	0.0005	0.0005	0.002	1	current	NAP2	0.0009	0.0018	0.0032	0.002	1	26
NAP3	0.0005	0.0005	0.0005	0.002	1	current	NAP3	0.0010	0.0020	0.0037	0.002	1	26
NAP5	0.0005	0.0005	0.0005	0.002	1	current	NAP5	0.0010	0.0018	0.0030	0.002	1	26
NAP7	0.0005	0.0005	0.0005	0.002	1	current	NAP7	0.0008	0.0011	0.0017	0.002	1	26
NAP8	0.0005	0.0005	0.0005	0.002	1	current	NAP8	0.0007	0.0010	0.0014	0.002	1	26
MBB2	0.0005	0.0005	0.0005	0.002	1	current	MBB2	0.0006	0.0007	0.0010	0.002	1	26
Node	Closure						Node	Post-Closure					
	Minimum	Annual Average	Maximum	CEQG	HCDW	Year		Minimum	Annual Average	Maximum	CEQG	HCDW	Year
UT1	0.0025	0.0059	0.0116	0.002	1	30	UT1	0.0025	0.0059	0.0116	0.002	1	50
NAP1	0.0011	0.0021	0.0039	0.002	1	30	NAP1	0.0010	0.0018	0.0033	0.002	1	50
NAP2	0.0009	0.0018	0.0033	0.002	1	30	NAP2	0.0009	0.0015	0.0026	0.002	1	50
NAP3	0.0010	0.0020	0.0037	0.002	1	30	NAP3	0.0009	0.0017	0.0031	0.002	1	50
NAP5	0.0009	0.0017	0.0032	0.002	1	30	NAP5	0.0011	0.0016	0.0025	0.002	1	50
NAP7	0.0007	0.0011	0.0018	0.002	1	30	NAP7	0.0008	0.0011	0.0016	0.002	1	50
NAP8	0.0006	0.0009	0.0014	0.002	1	30	NAP8	0.0007	0.0009	0.0013	0.002	1	50
MBB2	0.0006	0.0007	0.0010	0.002	1	30	MBB2	0.0006	0.0007	0.0010	0.002	1	50

**NOTES:**

1. Units are in mg/L.
2. Blue highlighting indicates values that are at or below all guidelines.
3. Yellow highlighting indicates values that exceed at least one guideline.
4. Baseline statistics are based upon the average monthly dataset used for the model inputs for each of the nodes. Measured maximum and minimum concentrations are under-represented.



**NOTES:**

1. "BASELINE" REFERS TO MODEL YEARS -1 AND -2; "CLOSURE" REFERS TO YEAR 30; "POSTCLOSURE" REFERS TO YEAR 50.
2. "MAXIMUM OPERATIONS" REFERS TO THE YEAR FOR WHICH COPPER REACHES ITS MAXIMUM VALUE (YEAR 26 FOR ALL NODES).
3. THE HCDW GUIDELINE IS 1.0 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
4. CEQG IS HARDNESS-DEPENDENT, WITH A MINIMUM OF 0.002 mg/L FOR HARDNESS <83 mg/L.

**Figure 5.8 Predicted Copper Concentrations at Downstream Nodes by Project Phase**

#### 5.2.9 Selenium (Se)

Selenium concentrations are predicted to exceed the 0.001 mg/L CEQG limit seasonally at UT1 during the lowest flow months (August and September) as a result of seepage from the TSF and WMP5. The concentrations are predicted to fluctuate seasonally around the CEQG limit at NAP5 during Operations as a result of treated water discharge from the WTP starting in Model Year 8 (Operations). Concentrations at both nodes are predicted to remain well below the 0.01 mg/L HCDW limit and to drop below the CEQG limit by the end of Operations. The predicted concentrations at NAP5 during Operations are effectively at the guideline limit (range of 0.00097 mg/L to 0.00106 mg/L) and the maximum predicted concentration at UT1 is just above the guideline limit (0.0011 mg/L).

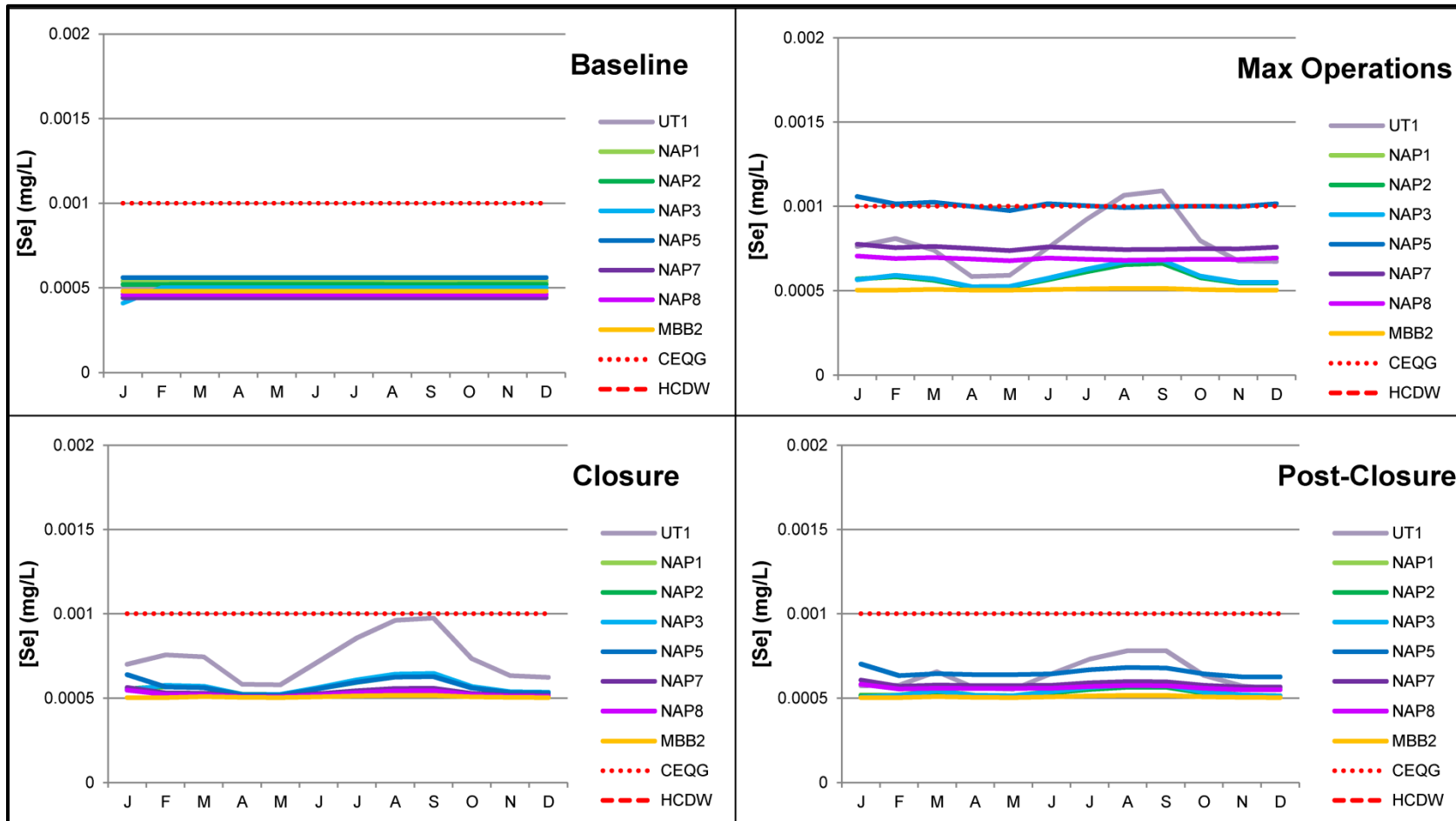
The summary statistics by Project phase are provided in Table 5.9. The annual distribution of predicted dissolved selenium concentrations for one year in each mine phase is provided on Figure 5.9. The years presented on the graphs represent the maximum concentration reached during that mine phase. The annual range of modelled selenium concentrations is provided graphically for each site in Appendix B9.

**Table 5.9 Summary Statistics by Project Phase for Dissolved Selenium**

Node	Current						Node	Maximum Operations					
	Minimum	Annual Average	Maximum	CEQG	HCDW	Year		Minimum	Annual Average	Maximum	CEQG	HCDW	Year
UT1	0.00050	0.00050	0.00050	0.001	0.01	current	UT1	0.00058	0.00079	0.00109	0.001	0.01	24
NAP1	0.00050	0.00050	0.00050	0.001	0.01	current	NAP1	0.00052	0.00058	0.00067	0.001	0.01	24
NAP2	0.00050	0.00050	0.00050	0.001	0.01	current	NAP2	0.00052	0.00058	0.00066	0.001	0.01	24
NAP3	0.00041	0.00049	0.00050	0.001	0.01	current	NAP3	0.00052	0.00058	0.00068	0.001	0.01	24
NAP5	0.00050	0.00050	0.00050	0.001	0.01	current	NAP5	0.00097	0.00101	0.00106	0.001	0.01	11
NAP7	0.00050	0.00050	0.00050	0.001	0.01	current	NAP7	0.00074	0.00075	0.00077	0.001	0.01	11
NAP8	0.00050	0.00050	0.00050	0.001	0.01	current	NAP8	0.00068	0.00069	0.00070	0.001	0.01	11
MBB2	0.00050	0.00050	0.00050	0.001	0.01	current	MBB2	0.00050	0.00051	0.00051	0.001	0.01	24
Node	Closure						Node	Post-Closure					
	Minimum	Annual Average	Maximum	CEQG	HCDW	Year		Minimum	Annual Average	Maximum	CEQG	HCDW	Year
UT1	0.00058	0.00074	0.00097	0.001	0.01	30	UT1	0.00055	0.00063	0.00078	0.001	0.01	50
NAP1	0.00052	0.00057	0.00064	0.001	0.01	30	NAP1	0.00051	0.00054	0.00058	0.001	0.01	50
NAP2	0.00052	0.00056	0.00063	0.001	0.01	30	NAP2	0.00051	0.00053	0.00056	0.001	0.01	50
NAP3	0.00052	0.00057	0.00065	0.001	0.01	30	NAP3	0.00051	0.00053	0.00058	0.001	0.01	50
NAP5	0.00052	0.00057	0.00064	0.001	0.01	30	NAP5	0.00063	0.00065	0.00070	0.001	0.01	50
NAP7	0.00051	0.00053	0.00056	0.001	0.01	30	NAP7	0.00057	0.00058	0.00061	0.001	0.01	50
NAP8	0.00051	0.00052	0.00055	0.001	0.01	30	NAP8	0.00055	0.00056	0.00058	0.001	0.01	50
MBB2	0.00050	0.00051	0.00052	0.001	0.01	30	MBB2	0.00050	0.00051	0.00052	0.001	0.01	50

**NOTES:**

1. Units are in mg/L.
2. Blue highlighting indicates values that are at or below all guidelines.
3. Yellow highlighting indicates values that exceed at least one guideline.
4. Baseline statistics are based upon the average monthly dataset used for the model inputs for each of the nodes. Measured maximum and minimum concentrations are under-represented.



**NOTES:**

1. "BASELINE" REFERS TO MODEL YEARS -1 AND -2; "CLOSURE" REFERS TO YEAR 30; "POSTCLOSURE" REFERS TO YEAR 50.
2. "MAXIMUM OPERATIONS" REFERS TO THE YEAR FOR WHICH SELENIUM REACHES ITS MAXIMUM VALUE (YEAR 24 FOR NAP1, NAP2, NAP3, AND MBB2; YEAR 11 FOR NAP5, NAP7, AND NAP8).
3. THE HCDW GUIDELINE IS 0.01 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
4. THE CURRENT CONDITIONS INDICATE THAT SELENIUM IS BELOW THE METHOD DETECTION LIMIT AT ALL NODES.

**Figure 5.9 Predicted Selenium Concentrations at Downstream Nodes by Project Phase**

#### 5.2.10 Lead (Pb)

Lead concentrations are predicted to exceed the hardness dependent CEQG limit during Closure at UT1 only as a result of seepage from the TSF and WMP5; the applicable guideline for this node during Closure is 0.001 mg/L for hardness of less than 60 mg/L CaCO<sub>3</sub>. Guideline exceedances are predicted to occur only in the lowest flow months (August and September). The maximum predicted concentration of lead at UT1 during Closure is 0.0011 mg/L in Year 30. Lead concentrations at UT1 during the last two years of Operations seasonally increase slightly above 0.001 mg/L. However, the CEQG limit also increases during those months because of the increased predicted hardness; this results in no CEQG guideline exceedance during Operations. Lead concentrations in Post-closure are predicted to approach the CEQG limit in August, but remain slightly below it (maximum concentration of 0.00098 mg/L at UT1 during Post-closure). Concentrations of lead at all other nodes are predicted to be below the CEQG limit and the HCDW limit of 0.01 mg/L.

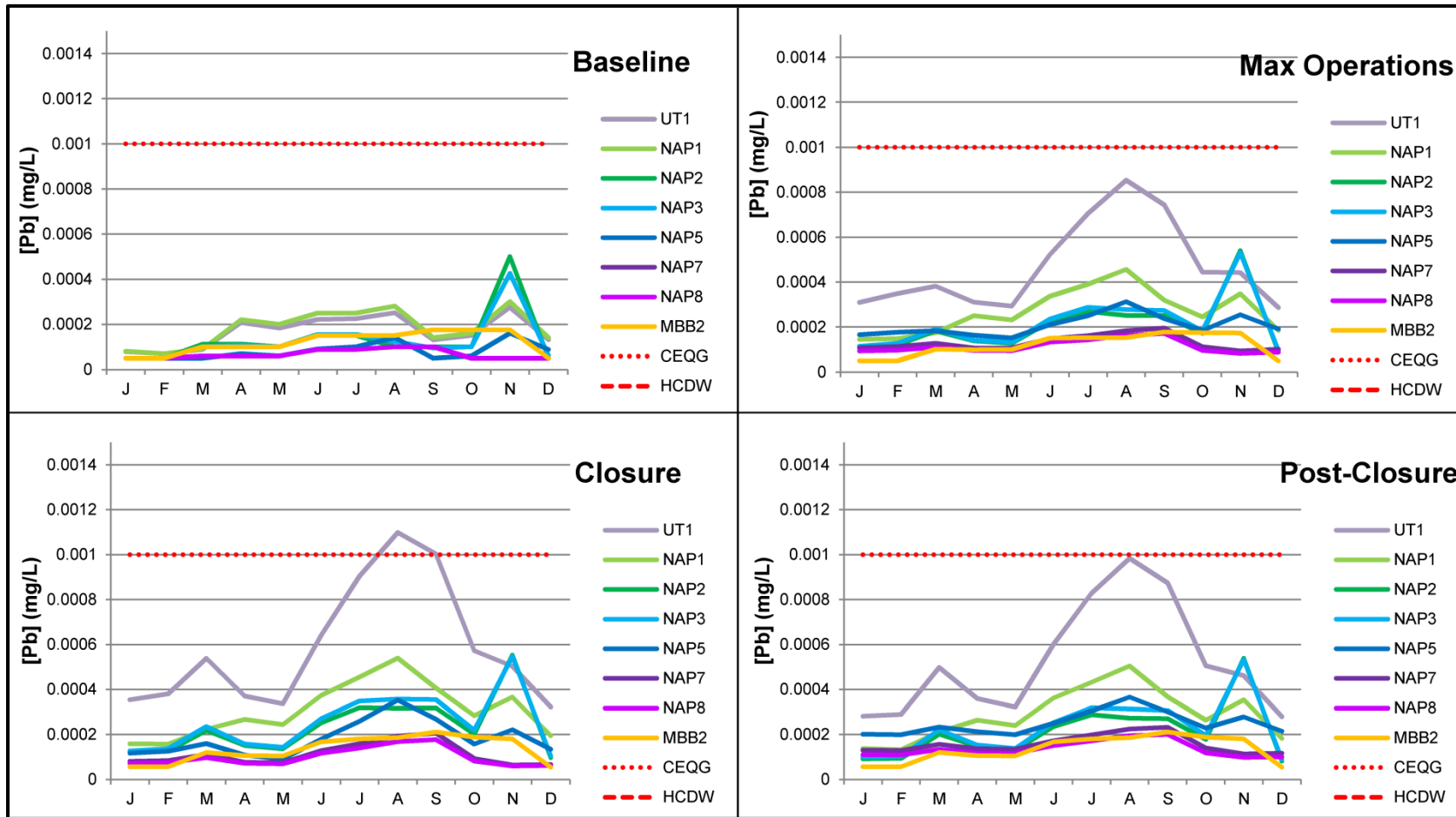
The summary statistics by Project phase are provided in Table 5.10. The annual distribution of predicted dissolved lead concentrations for one year in each mine phase is provided on Figure 5.10. The years presented on the graphs represent the maximum concentration reached during that mine phase. The annual range of modelled lead concentrations is provided graphically for each site in Appendix B10.

**Table 5.10 Summary Statistics by Project Phase for Dissolved Lead**

Node	Current						Node	Maximum Operations					
	Minimum	Annual Average	Maximum	CEQG	HCDW	Year		Minimum	Annual Average	Maximum	CEQG	HCDW	Year
UT1	0.00007	0.00017	0.00028	0.001	0.01	current	UT1	0.00029	0.00047	0.00085	0.001	0.01	14
NAP1	0.00007	0.00018	0.00030	0.001	0.01	current	NAP1	0.00014	0.00027	0.00046	0.001	0.01	14
NAP2	0.00005	0.00013	0.00050	0.001	0.01	current	NAP2	0.00009	0.00021	0.00054	0.001	0.01	14
NAP3	0.00005	0.00013	0.00043	0.001	0.01	current	NAP3	0.00010	0.00022	0.00053	0.001	0.01	14
NAP5	0.00005	0.00008	0.00016	0.001	0.01	current	NAP5	0.00015	0.00021	0.00031	0.001	0.01	14
NAP7	0.00005	0.00007	0.00010	0.001	0.01	current	NAP7	0.00009	0.00013	0.00019	0.001	0.01	14
NAP8	0.00005	0.00007	0.00010	0.001	0.01	current	NAP8	0.00008	0.00011	0.00017	0.001	0.01	14
MBB2	0.00005	0.00012	0.00018	0.001	0.01	current	MBB2	0.00005	0.00012	0.00018	0.001	0.01	14
Node	Closure						Node	Post-Closure					
	Minimum	Annual Average	Maximum	CEQG	HCDW	Year		Minimum	Annual Average	Maximum	CEQG	HCDW	Year
UT1	0.00032	0.00059	0.00110	0.001	0.01	30	UT1	0.00028	0.00052	0.00098	0.001	0.01	50
NAP1	0.00016	0.00031	0.00054	0.001	0.01	30	NAP1	0.00013	0.00029	0.00050	0.001	0.01	50
NAP2	0.00010	0.00023	0.00055	0.001	0.01	30	NAP2	0.00008	0.00021	0.00054	0.001	0.01	50
NAP3	0.00011	0.00025	0.00055	0.001	0.01	30	NAP3	0.00009	0.00023	0.00053	0.001	0.01	50
NAP5	0.00009	0.00018	0.00035	0.001	0.01	30	NAP5	0.00020	0.00025	0.00037	0.001	0.01	50
NAP7	0.00006	0.00011	0.00021	0.001	0.01	30	NAP7	0.00011	0.00016	0.00023	0.001	0.01	50
NAP8	0.00006	0.00010	0.00018	0.001	0.01	30	NAP8	0.00010	0.00014	0.00020	0.001	0.01	50
MBB2	0.00005	0.00013	0.00021	0.001	0.01	30	MBB2	0.00005	0.00013	0.00021	0.001	0.01	50

**NOTES:**

1. Units are in mg/L.
2. Blue highlighting indicates values that are at or below all guidelines.
3. Yellow highlighting indicates values that exceed at least one guideline.
4. Baseline statistics are based upon the average monthly dataset used for the model inputs for each of the nodes. Measured maximum and minimum concentrations are under-represented.
5. The CEQG limit for lead is hardness-dependent. The applicable guideline for all nodes is 0.001 mg/L, except during the lowest flow months during Operations, where the guideline can be up to 0.002 mg/L.



**NOTES:**

1. "BASELINE" REFERS TO MODEL YEARS -1 AND -2; "CLOSURE" REFERS TO YEAR 30; "POSTCLOSURE" REFERS TO YEAR 50.
2. "MAXIMUM OPERATIONS" REFERS TO THE YEAR FOR WHICH LEAD REACHES ITS MAXIMUM VALUE DURING OPERATIONS (YEAR 26 FOR ALL NODES).
3. THE HCDW GUIDELINE IS 0.1 mg/L AND IS NOT WITHIN THE SCALE OF THESE GRAPHS.
4. CURRENT AND PROPOSED MMR GUIDELINES FOR Cu ARE NOT WITHIN THE SCALE OF THISGRAPH.
5. CEQG IS HARDNESS-DEPENDENT, WITH A MINIMUM OF 0.001 mg/L FOR HARDNESS <60 mg/L.

**Figure 5.10 Predicted Lead Concentrations at Downstream Nodes by Project Phase**



## REFERENCES

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**APPENDIX A**  
**WATER QUALITY MODEL INPUTS**

(Pages A-1 to A-10)

TABLE A1  
APPENDIX A - WATER QUALITY MODEL INPUTS  
CONTACT WATER SOURCE TERMS

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Units <sup>(1)</sup>	Milled Ore mg/L	Low Grade Ore mg/L	Waste Rock mg/L	Waste Rock Flooding (per tonne saturated) mg/tonne saturated	TSF Beach Runoff mg/m2/week	TSF Beach Infiltration (variable by years)							TSF Embankment mg/L	Quarry Sump mg/L	Pit Walls mg/L	Process Reagents mg/tonne
						Years 1 through 2	Years 3 through 9	Years 10 through 14	Years 14 through 19	Years 20 through 24	Years 25 through 26	Closure - Years 27 onward				
						mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L				
pH		6.7	7		8.0	8	8	8	8	8	8	8	7.7	7.7	7	
Sulphate	9.5	520	230	53000	20	290	290	290	290	290	290	290	270	270	160	1200
Alkalinity	3	50	100	23000	110	110	110	110	110	110	110	110	56	56	100	867
Chloride	0.09	7.4	6	1400	1.4	70	70	70	70	70	70	70	80	80	5.1	
Fluoride	0.34	31	7.1	1600	4.4	7.1	7.1	7.1	7.1	7.1	7.1	7.1	3.8	3.8	6.2	
Al	0.014	7.7	0.86	200	0.61	1.6	1.6	1.6	1.6	1.6	1.6	1.6	0.31	0.31	0.72	
Sb	0.00061	0.0069	0.003	0.69	0.005	0.2	0.65	0.33	0.33	0.33	0.33	0.33	0.01	0.01	0.0042	
As	0.000031	0.21	0.0065	1.5	0.037	1.6	5.1	2.6	2.6	2.6	2.6	2.6	0.03	0.03	0.011	
Ba	0.0009	0.1	0.021	4.8	0.0058	0.25	0.8	0.41	0.4	0.41	0.41	0.41	0.0093	0.0093	0.017	
Be	<i>0.000032</i>	<i>0.0051</i>	<i>0.00085</i>	<i>0.019</i>	<i>0.0003</i>	<i>0.00094</i>	<i>0.003</i>	<i>0.0015</i>	<i>0.0015</i>	<i>0.0015</i>	<i>0.0015</i>	<i>0.0015</i>	<i>0.0006</i>	<i>0.0006</i>	<i>0.000061</i>	
Bi	0.00032	0.0034	0.00017	0.039	0.00029	0.0012	0.0039	0.002	0.002	0.002	0.002	0.002	0.00033	0.00033	0.0002	
B	0.0073	0.4	0.39	90	0.078	3.4	11	5.4	5.4	5.5	5.4	5.4	3.1	3.1	0.3	
Cd	0.000055	0.011	0.00023	0.052	0.00041	0.0018	0.0056	0.0028	0.0028	0.0029	0.0028	0.0028	0.0004	0.0004	0.00057	
Ca	4.6	200	49	26000	110	28	28	28	28	28	28	28	71	71	90	
Cr	0.00012	0.0086	0.021	4.7	0.0014	0.059	0.19	0.094	0.094	0.095	0.094	0.094	0.02	0.02	0.016	
Cs	0.000015	0.001	0.001	0.23	0.0003	0.013	0.041	0.021	0.02	0.021	0.021	0.021	0.0077	0.0077	0.00079	
Co	0.000095	0.066	0.0075	1.7	0.0002	0.0085	0.027	0.014	0.014	0.014	0.014	0.014	0.0019	0.0019	0.0059	
Cu	0.00032	0.18	0.018	4.1	0.0044	0.19	0.61	0.31	0.31	0.31	0.31	0.31	0.071	0.071	0.013	
Fe	0.0015	1.8	0.086	20	0.048	0.000092	0.000092	0.000092	0.000092	0.000092	0.000092	0.000092	0.00011	0.00011	0.079	
La	0.000013	0.0082	0.00041	0.094	0.000078	0.0034	0.011	0.0054	0.0054	0.0055	0.0054	0.0054	0.0071	0.0071	0.0003	
Pb	0.000038	0.0084	0.00071	0.16	0.00024	0.01	0.033	0.016	0.016	0.017	0.016	0.016	0.006	0.006	0.00089	
Li	0.001	0.087	0.034	7.7	0.011	0.46	1.5	0.74	0.74	0.75	0.74	0.74	0.05	0.05	0.024	
Mg	0.28	13	19	4300	2.1	110	110	110	110	110	110	110	25	25	13	
Mn	0.085	9.1	0.43	98	0.05	2.1	6.9	3.5	3.4	3.5	3.5	3.5	0.13	0.13	0.75	
Hg	0.00032	0.000017	0.000016	0.0038	0.0000072	0.00031	0.00099	0.0005	0.0005	0.00051	0.0005	0.0005	0.00014	0.00014	0.000013	
Mo	0.00013	0.0016	0.023	5.3	0.034	1.5	4.7	2.4	2.4	2.4	2.4	2.4	0.07	0.07	0.035	
Ni	0.00014	0.12	0.0086	2	0.00057	0.025	0.079	0.04	0.039	0.04	0.04	0.04	0.0096	0.0096	0.0078	
P	0.002	0.078	0.08	18	0.013	0.56	1.8	0.9	0.9	0.91	0.9	0.9	0.57	0.57	0.063	
K	0.91	41	17	3900	5.7	15	15	15	15	15	15	15	130	130	14	
Rb	0.0032	0.21	0.098	22	0.032	1.4	4.4	2.2	2.2	2.2	2.2	2.2	0.38	0.38	0.078	
Se	0.00048	0.021	0.0012	0.28	0.00015	0.0065	0.021	0.01	0.01	0.011	0.01	0.01	0.0028	0.0028	0.0015	
Si	0.41	27	16	3600	8.1	88	88	88	88	88	88	88	68	68	14	758
Ag	0.0000073	0.000098	0.000039	0.009	0.000089	0.00038	0.0012	0.00062	0.00062	0.00063	0.00062	0.00062	0.0003	0.0003	0.000031	
Na	0.1	5.4	3.4	770	0.74	5.5	18	8.8	8.8	8.9	8.8	8.8	21	21	2.5	1147
Sr	0.017	0.8	0.42	97	0.13	5.6	18	9	9	9.1	9	9	0.77	0.77	0.3	
S	3.5	190	83	19000	4.7								490	490	62	
Te	<i>0.000033</i>	<i>0.00017</i>	<i>0.00018</i>	<i>0.041</i>	<i>0.00038</i>	<i>0.0017</i>	<i>0.0053</i>	<i>0.0027</i>	<i>0.0027</i>	<i>0.0027</i>	<i>0.0027</i>	<i>0.0027</i>	<i>0.0012</i>	<i>0.0012</i>	<i>0.00014</i>	
Tl	0.0000099	0.00081	0.00079	0.18	0.00011	0.0049	0.016	0.0079	0.0078	0.0079	0.0079	0.0079	0.0019	0.0019	0.00048	
Th	<i>0.0000073</i>	<i>0.000055</i>	<i>0.000041</i>	<i>0.0095</i>	<i>0.000078</i>	<i>0.00034</i>	<i>0.0011</i>	<i>0.00054</i>	<i>0.00054</i>	<i>0.00055</i>	<i>0.00054</i>	<i>0.00054</i>	<i>0.0003</i>	<i>0.0003</i>	<i>0.000032</i>	
Sn	<i>0.000058</i>	<i>0.0033</i>	<i>0.004</i>	<i>0.9</i>	<i>0.0013</i>	<i>0.058</i>	<i>0.19</i>	<i>0.094</i>	<i>0.093</i>	<i>0.094</i>	<i>0.094</i>	<i>0.094</i>	<i>0.03</i>	<i>0.03</i>	<i>0.0032</i>	
Ti	0.00012	0.004	0.0049	1.1	0.003	0.13	0.41	0.21	0.21	0.21	0.21	0.21	0.044	0.044	0.0041	
W	0.0017	0.016	0.018	4.1	0.016	0.17	0.55	0.28	0.27	0.28	0.28	0.28	0.29	0.29	0.017	
U	0.00042	0.0047	0.0042	0.96	0.0025	0.11	0.35	0.17	0.17	0.18	0.17	0.17	0.0024	0.0024	0.0051	
V	0.000045	0.0024	0.014	3.3	0.009	0.4	1.3	0.65	0.64	0.65	0.65	0.65	0.13	0.13	0.009	
Zn	0.0016	0.78	0.032	7.3	0.0027	0.12	0.37	0.19	0.19	0.19	0.19	0.19	0.09	0.09	0.022	
Zr	0.000015	0.0008	0.00078	0.18	0.00019								0.006	0.006	0.0006	
NO3					0.19	8.3	8.3	8.3	8.3	8.3	8.3	8.3				
NO2					0.023	1	1	1	1	1	1	1				
NH3					0.44	19	19	19	19	19	19	19				

M:\101\00447\02A\Report9 - Water Quality Model Report\Appendices\Appendix A - Water Quality Inputs (JEM).xlsx\TABLE A1 - Source Terms

**NOTES:**

- All parameters are provided in mg per unit volume (L), mass (tonne), or area/time (m2/week) except for Hg which is provided in ug and pH which is unitless.
- Colour + italics scheme  
  - < DL
  - < 10X DL
- Process reagents mass loading values are provided based on the addition of sodium hydroxide, sodium carbonate, sodium silicate, and sodium sulphide in teh mill circuit. Other reagents are proposed, but none of these contained parameters that are currently modled.

TABLE A2

APPENDIX A - WATER QUALITY MODEL INPUTS  
BACKGROUND SURFACE WATER QUALITY DATA FOR SISSON BROOK

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Parameter	MDL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Hardness	0.2	8.4	9.5	9.8	5.8	6.1	8.0	9.0	9.4	9.6	8.3	7.0	6.5
Alkalinity	2.0	6.0	7.4	7.0	3.2	4.5	6.3	6.8	7.2	7.8	5.8	3.8	5.0
Ammonia	0.05	0.025	0.07	0.025	0.025	0.025	0.03125	0.03	0.025	0.065	0.025	0.025	0.025
Nitrate	0.05	0.182	0.216	0.218	0.087	0.041	0.034	0.066	0.058	0.060	0.049	0.097	0.093
Phosphate	0.01	0.0050	0.0100	0.0080	0.0160	0.0063	0.0050	0.0088	0.0090	0.0080	0.0090	0.0070	0.0050
Sulphate	1	1.9	2.4	1.4	1.4	1.1	1.6	0.9	0.8	2.0	1.7	1.6	1.9
Bromide	0.01	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Chloride	0.5	0.99	1.06	0.98	0.79	0.875	1.05	1.15	1.1	1.16	1.54	1.38	0.94
Fluoride	0.05	0.11	0.11	0.12	0.10	0.12	0.15	0.16	0.17	0.13	0.16	0.14	0.10
Dissolved Aluminum	0.001	0.060	0.052	0.058	0.100	0.082	0.101	0.113	0.116	0.095	0.095	0.123	0.086
Dissolved Antimony	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Arsenic	0.001	0.0009	0.0009	0.0008	0.0007	0.001	0.0015	0.00225	0.002	0.0014	0.0014	0.0006	0.0005
Dissolved Barium	0.001	0.002	0.002	0.002	0.002	0.002	0.00225	0.002	0.0022	0.0022	0.0026	0.0024	0.0017
Dissolved Bismuth	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Boron	0.001	0.0009	0.001	0.001	0.0008	0.00125	0.00175	0.002	0.0017	0.0017	0.0014	0.0014	0.001
Dissolved Cadmium	0.00001	0.000015	0.000020	0.000020	0.000022	0.000020	0.000030	0.000043	0.000038	0.000028	0.000028	0.000028	0.000022
Dissolved Calcium	0.05	2.33	2.66	2.80	1.63	1.68	2.24	2.53	2.63	2.69	2.28	1.93	1.76
Dissolved Chromium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Cobalt	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Copper	0.001	0.001	0.0009	0.0009	0.0016	0.0015	0.00175	0.00175	0.0021	0.0018	0.0017	0.0016	0.0014
Dissolved Iron	0.02	0.094	0.096	0.114	0.078	0.07	0.165	0.2825	0.234	0.192	0.16	0.142	0.078
Dissolved Lead	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.000075	0.0001125	0.00009	0.00007	0.00005	0.00008	0.00006
Dissolved Lithium	0.0001	0.00034	0.00036	0.0004	0.0003	0.00035	0.00045	0.0004	0.00044	0.00042	0.00042	0.0004	0.00036
Dissolved Magnesium	0.01	0.61	0.66	0.67	0.43	0.45	0.58	0.62	0.66	0.68	0.60	0.54	0.49
Dissolved Manganese	0.001	0.0024	0.0024	0.0026	0.007	0.003	0.00475	0.00925	0.0096	0.0092	0.0062	0.0064	0.0052
Dissolved Mercury	0.000025	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000017	0.000013	0.000013	0.000013	0.000013	0.000020
Dissolved Molybdenum	0.0001	0.0040	0.0048	0.0052	0.0021	0.0034	0.0050	0.0061	0.0067	0.0052	0.0030	0.0026	0.0024
Dissolved Nickel	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Phosphorous	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Dissolved Potassium	0.02	0.36	0.39	0.41	0.35	0.32	0.35	0.35	0.42	0.39	0.41	0.39	0.33
Dissolved Rubidium	0.0001	0.0015	0.0015	0.0015	0.0014	0.0014	0.0016	0.0018	0.0020	0.0017	0.0017	0.0017	0.0015
Dissolved Selenium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Silicon	0.1	9.3	10.0	9.4	5.4	4.8	5.9	6.7	7.8	9.0	7.9	7.1	7.9
Dissolved Silver	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Sodium	0.05	1.5	1.6	1.7	1.1	1.2	1.5	1.5	1.6	1.7	1.5	1.3	1.2
Dissolved Strontium	0.001	0.013	0.015	0.015	0.010	0.011	0.013	0.015	0.016	0.016	0.014	0.012	0.010
Dissolved Thallium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Titanium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Dissolved Tungsten	0.0001	0.0021	0.0021	0.0021	0.0021	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0021
Dissolved Uranium	0.001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Vanadium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Zinc	0	0.0016	0.0018	0.0019	0.0024	0.0015	0.0015	0.0023	0.0024	0.0018	0.0022	0.0030	0.0024
Total Aluminum	0.0001	0.0598	0.0518	0.0584	0.0996	0.08225	0.10075	0.113	0.1164	0.095	0.095	0.123	0.0858
Total Antimony	0.001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Arsenic	0.001	0.0009	0.0009	0.0008	0.0007	0.001	0.0015	0.00225	0.002	0.0014	0.0014	0.0006	0.0005
Total Barium	0.0001	0.002	0.002	0.002	0.002	0.002	0.00225	0.002	0.0022	0.0022	0.0026	0.0024	0.0017
Total Bismuth	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Boron	0.00001	0.0009	0.001	0.001	0.0008	0.00125	0.00175	0.002	0.0017	0.0017	0.0014	0.0014	0.001
Total Cadmium	0.05	0.000015	0.000020	0.000020	0.000022	0.000020	0.000030	0.000043	0.000038	0.000028	0.000028	0.000028	0.000022
Total Calcium	0.001	2.3	2.7	2.8	1.6	1.7	2.2	2.5	2.6	2.7	2.3	1.9	1.8
Total Chromium	0.0001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Cobalt	0.001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Copper	0.02	0.001	0.0009	0.0009	0.0016	0.0015	0.00175	0.00175	0.0021	0.0018	0.0017	0.0016	0.0014
Total Iron	0.0001	0.094	0.096	0.114	0.078	0.07	0.165	0.2825	0.234	0.192	0.16	0.142	0.078
Total Lead	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.000075	0.0001125	0.00009	0.00007	0.00005	0.00008	0.00006
Total Lithium	0.01	0.00034	0.00036	0.0004	0.0003	0.00035	0.00045	0.0004	0.00044	0.00042	0.00042	0.0004	0.00036
Total Magnesium	0.001	0.61	0.66	0.67	0.43	0.45	0.58	0.62	0.66	0.68	0.60	0.54	0.49
Total Manganese	0.000025	0.0024	0.0024	0.0026	0.007	0.003	0.00475	0.00925	0.0096	0.0092	0.0062	0.0064	0.0052
Total Mercury	0.0001	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000017	0.000013	0.000013	0.000013	0.000013	0.000020
Total Molybdenum	0.001	0.0040	0.0048	0.0052	0.0021	0.0034	0.0050	0.0061	0.0067	0.0052	0.0030	0.0026	0.0024
Total Nickel	0.02	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Phosphorous	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total Potassium	0.0001	0.36	0.386	0.41	0.352	0.3175	0.345	0.3525	0.416	0.39	0.41	0.392	0.334
Total Rubidium	0.001	0.00148	0.00148	0.00146	0.00136	0.0014	0.00155	0.00175	0.00204	0.00174	0.00166	0.0017	0.00146
Total Selenium	0.0001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Silicon	0.1	9.28	10.04	9.42	5.44	4.825	5.925	6.7	7.84	9	7.9	7.14	7.94
Total Silver	0.05	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Sodium	0.001	1.484	1.622	1.68	1.116	1.155	1.4525	1.4675	1.558	1.682	1.494	1.276	1.214
Total Strontium	0.0001	0.013	0.015	0.015	0.010	0.011	0.013	0.015	0.016	0.016	0.014	0.012	0.010
Total Thallium	0.005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Titanium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total Tungsten	0.001	0.00208	0.0021	0.00208	0.00206	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.00208
Total Uranium	0.001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Vanadium	0	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Zinc	0.5	0.0016	0.0018	0.0019	0.0024	0.0015	0.0015	0.00225	0.0024	0.0018	0.0022	0.003	0.0024
Total Carbon	0	3.4	3.3	3.7	5.1	4.8	6.8	8.6	9.2	7.7	6.9	8.2	4.3

M:\10100447\02\A\Report9 - Water Quality Model Report\Appendices\Appendix A - Water Quality Inputs (JEM).xlsx\TABLE A2

**NOTES:**

1. DATA ARE AVERAGE MONTHLY VALUES.
2. UNITS ARE mg/L UNLESS OTHERWISE SPECIFIED.
3. WATER QUALITY SITE IS CALLED SB-03

TABLE A3

APPENDIX A - WATER QUALITY MODEL INPUTS  
BACKGROUND SURFACE WATER QUALITY DATA FOR BIRD BROOK

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Parameter	MDL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Hardness	0.2	8.3	9.4	9.8	5.3	5.7	7.7	9.0	9.3	9.4	7.9	7.7	6.5
Alkalinity	2.0	7.8	8.8	9.3	2.8	3.8	6.8	8.0	7.0	8.5	6.3	4.3	4.3
Ammonia	0.05	0.025	0.025	0.025	0.025	0.08	0.025	0.025	0.025	0.0775	0.025	0.025	0.076667
Nitrate	0.05	0.175	0.205	0.165	0.025	0.025	0.043	0.068	0.039	0.048	0.135	0.097	0.098
Phosphate	0.01	0.0200	0.0050	0.0063	0.0088	0.0113	0.0163	0.0238	0.0088	0.0050	0.0063	0.0050	0.0050
Sulphate	1	1.1	0.5	0.5	0.5	0.5	0.6	1.3	0.9	1.1	0.5	1.0	1.3
Bromide	0.01	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.00625	0.005	0.005	0.005	0.005
Chloride	0.5	0.7625	1.2	0.825	0.775	1	1	0.925	0.9625	1.2	1.45	1.1	1
Fluoride	0.05	0.09	0.08	0.09	0.11	0.12	0.12	0.16	0.17	0.13	0.12	0.13	0.12
Dissolved Aluminum	0.001	0.054	0.043	0.053	0.114	0.131	0.135	0.156	0.206	0.096	0.137	0.139	0.122
Dissolved Antimony	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Arsenic	0.001	0.000875	0.000875	0.000875	0.001125	0.00075	0.0015	0.00175	0.00175	0.0015	0.00125	0.001	0.001
Dissolved Barium	0.001	0.002	0.002	0.002	0.002	0.002	0.00225	0.0025	0.00325	0.002	0.003	0.0023333	0.002
Dissolved Bismuth	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Boron	0.001	0.002	0.00175	0.0015	0.001	0.00175	0.002	0.002	0.002	0.00175	0.00175	0.0016667	0.0016667
Dissolved Cadmium	0.00001	0.000015	0.000018	0.000015	0.000040	0.000033	0.000035	0.000035	0.000065	0.000020	0.000021	0.000040	0.000050
Dissolved Calcium	0.05	2.50	2.85	2.98	1.59	1.71	2.35	2.71	2.76	2.83	2.35	2.29	1.92
Dissolved Chromium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Cobalt	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.0000625	0.0000625	0.0000875	0.00005	0.00005	0.00005	6.667E-05
Dissolved Copper	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Iron	0.02	0.065	0.0525	0.07	0.08	0.0975	0.1475	0.2125	0.235	0.13	0.1675	0.1266667	0.1033333
Dissolved Lead	0.0001	0.00005	0.00005	0.00005	0.0000875	0.0001	0.000175	0.000175	0.0002125	0.000075	0.0001	0.0001333	0.0001
Dissolved Lithium	0.0001	0.00045	0.0005	0.0005	0.000325	0.0004	0.0005	0.00055	0.0006	0.00055	0.000525	0.0005	0.0004
Dissolved Magnesium	0.01	0.50	0.55	0.58	0.33	0.35	0.46	0.51	0.53	0.56	0.48	0.49	0.40
Dissolved Manganese	0.001	0.0015	0.00175	0.001625	0.005	0.00375	0.0105	0.00975	0.02025	0.005	0.00425	0.0056667	0.0103333
Dissolved Mercury	0.000025	0.000013	0.000013	0.000013	0.000013	0.000017	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013
Dissolved Molybdenum	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Dissolved Uranium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Phosphorous	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02
Dissolved Potassium	0.02	0.36	0.37	0.39	0.32	0.32	0.31	0.33	0.35	0.38	0.36	0.34	0.30
Dissolved Rubidium	0.0001	0.0005	0.0008	0.0008	0.0009	0.0009	0.0009	0.0010	0.0011	0.0010	0.0010	0.0009	0.0009
Dissolved Selenium	0.001	0.00005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Silicon	0.1	0	11.8	10.9	6.2	6.2	7.9	9.4	9.2	11.3	9.9	9.8	9.0
Dissolved Silver	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Sodium	0.05	0	1.8	1.8	1.0	1.2	1.6	1.7	1.9	1.9	1.6	1.5	1.2
Dissolved Strontium	0.001	0.000	0.014	0.014	0.009	0.009	0.012	0.014	0.015	0.014	0.012	0.012	0.010
Dissolved Thallium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Titanium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Dissolved Tungsten	0.005	0.0001	0.0019	0.0019	0.0019	0.0019	0.0019	0.0025	0.0025	0.0025	0.0025	0.0025	0.0017
Dissolved Vanadium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.0000625	0.00005	0.00005	0.00005	0.00005
Dissolved Zinc	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0003875	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Aluminum	0.001	0.05375	0.04325	0.05325	0.11425	0.13125	0.13475	0.15575	0.20625	0.096	0.1365	0.1386667	0.1223333
Total Antimony	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Arsenic	0.001	0.000875	0.000875	0.000875	0.001125	0.00075	0.0015	0.00175	0.00175	0.0015	0.00125	0.001	0.001
Total Barium	0.001	0.002	0.002	0.002	0.002	0.002	0.00225	0.0025	0.00325	0.002	0.003	0.0023333	0.002
Total Bismuth	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Boron	0.001	0.002	0.00175	0.0015	0.001	0.00175	0.002	0.002	0.002	0.00175	0.00175	0.0016667	0.0016667
Total Cadmium	0.00001	0.000015	0.000018	0.000015	0.000040	0.000033	0.000035	0.000035	0.000065	0.000020	0.000021	0.000040	0.000050
Total Calcium	0.05	2.5	2.8	3.0	1.6	1.7	2.4	2.7	2.8	2.8	2.3	2.3	1.9
Total Chromium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Cobalt	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.0000625	0.0000625	0.0000875	0.00005	0.00005	0.00005	6.667E-05
Total Copper	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Iron	0.02	0.065	0.0525	0.07	0.08	0.0975	0.1475	0.2125	0.235	0.13	0.1675	0.1266667	0.1033333
Total Lead	0.0001	0.00005	0.00005	0.00005	0.0000875	0.0001	0.000175	0.000175	0.0002125	0.000075	0.0001	0.0001333	0.0001
Total Lithium	0.0001	0.00045	0.0005	0.0005	0.000325	0.0004	0.0005	0.00055	0.0006	0.00055	0.000525	0.0005	0.0004
Total Magnesium	0.01	0.50	0.55	0.58	0.33	0.35	0.46	0.51	0.53	0.56	0.48	0.49	0.40
Total Manganese	0.001	0.0015	0.00175	0.001625	0.005	0.00375	0.0105	0.00975	0.02025	0.005	0.00425	0.0056667	0.0103333
Total Mercury	0.000025	0.000013	0.000013	0.000013	0.000013	0.000017	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013
Total Molybdenum	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Total Nickel	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Phosphorous	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02
Total Potassium	0.02	0.3575	0.37	0.3875	0.3175	0.315	0.3125	0.3325	0.35	0.375	0.36	0.34	0.3
Total Rubidium	0.0001	0.0005	0.000775	0.000775	0.000925	0.0009	0.000875	0.001025	0.0011	0.001025	0.001	0.0009	0.0008667
Total Selenium	0.001	0.00005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Silicon	0.1	0.0085	11.825	10.925	6.225	6.175	7.9	9.4	9.225	11.325	9.85	9.7666667	9.0333333
Total Silver	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Sodium	0.05	0.013	1.825	1.845	0.9875	1.245	1.565	1.665	1.605	1.875	1.6225	1.5233333	1.2466667
Total Strontium	0.001	0.000	0.014	0.014	0.009	0.009	0.012	0.014	0.015	0.014	0.012	0.012	0.010
Total Thallium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Titanium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total Tungsten	0.005	0.00005	0.0018875	0.0018875	0.0018875	0.0018875	0.0018875	0.0025	0.0025	0.0025	0.0025	0.0025	0.0016833
Total Uranium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.0000625	0.00005	0.00005	0.00005	0.00005
Total Vanadium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0003875	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Zinc	0.001	0	0.00125	0.001625	0.002	0.00225	0.002625	0.00225	0.003	0.001125	0.0015	0.002	0.0023333
Total Carbon	0.5	3.1	2.9	3.5	5.4	7.0	7.6	9.9	12.8	7.4	8.9	7.7	6.6

M:\10100447\02\A\Report9 - Water Quality Model Report\Appendices\Appendix A - Water Quality Inputs (JEM).xlsx\TABLE A3

**NOTES:**

1. DATA ARE AVERAGE MONTHLY VALUES.
2. UNITS ARE mg/L UNLESS OTHERWISE SPECIFIED.
3. WATER QUALITY SITE IS CALLED BB-1

TABLE A4

APPENDIX A - WATER QUALITY MODEL INPUTS  
BACKGROUND SURFACE WATER QUALITY DATA FOR THE TSF AREA

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Parameter	MDL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Hardness	0.2	6.0	7.2	7.0	3.7	4.1	6.2	7.0	7.5	8.0	5.8	5.0	4.5
Alkalinity	2.0	4.3	6.3	5.5	1.4	2.8	6.4	5.3	6.5	7.8	3.3	2.5	3.5
Ammonia	0.05	0.03875	0.025	0.025	0.025	0.038	0.025	0.045	0.05375	0.08	0.025	0.025	0.025
Nitrate	0.05	0.185	0.253	0.190	0.055	0.032	0.045	0.045	0.525	0.064	0.025	0.063	0.081
Phosphate	0.01	0.0050	0.0163	0.0050	0.0150	0.0150	0.0190	0.0088	0.0113	0.0063	0.0050	0.0063	0.0050
Sulphate	1	0.9	0.5	0.5	0.9	1.1	0.6	0.5	0.9	0.6	0.5	0.6	1.1
Bromide	0.01	0.00625	0.005	0.005	0.005	0.005	0.007	0.01125	0.015	0.01125	0.0075	0.005	0.005
Chloride	0.5	0.95	1.3	1.05	1.18	0.88	1.1	1.3	1.05	1.15	1.35	1.125	0.95
Fluoride	0.05	0.10	0.09	0.11	0.13	0.16	0.18	0.23	0.19	0.16	0.16	0.15	0.11
Dissolved Aluminum	0.001	0.141	0.136	0.182	0.246	0.219	0.320	0.400	0.309	0.226	0.237	0.278	0.198
Dissolved Antimony	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Arsenic	0.001	0.002	0.0025	0.0025	0.0012	0.0018	0.0026	0.0035	0.00375	0.00275	0.002	0.0015	0.00125
Dissolved Barium	0.001	0.002	0.002	0.002	0.003	0.0024	0.0034	0.00425	0.0035	0.0025	0.004	0.00325	0.0025
Dissolved Bismuth	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Boron	0.001	0.00125	0.0015	0.00175	0.002	0.0022	0.0022	0.003	0.002	0.001625	0.00175	0.00225	0.00175
Dissolved Cadmium	0.00001	0.000020	0.000023	0.000028	0.000048	0.000036	0.000044	0.000063	0.000053	0.000024	0.000030	0.000050	0.000035
Dissolved Calcium	0.05	1.70	2.05	2.00	1.04	1.14	1.78	1.99	2.12	1.78	1.63	1.38	1.25
Dissolved Chromium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Cobalt	0.0001	0.00005	0.0000625	0.00005	0.00009	0.00006	0.00009	0.0001875	0.0001625	0.000075	0.0000625	0.000125	0.0000625
Dissolved Copper	0.001	0.0005	0.0005	0.0005	0.0006	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Iron	0.02	0.165	0.16	0.215	0.226	0.178	0.338	0.5175	0.4725	0.2925	0.2725	0.2475	0.185
Dissolved Lead	0.0001	0.00015	0.00015	0.0001625	0.00028	0.00018	0.0003	0.000375	0.000325	0.000175	0.000175	0.000325	0.00015
Dissolved Lithium	0.0001	0.0004	0.00045	0.0004	0.00032	0.0004	0.00048	0.000575	0.00045	0.00045	0.00045	0.000425	0.000375
Dissolved Magnesium	0.01	0.42	0.50	0.49	0.27	0.29	0.43	0.48	0.51	0.43	0.42	0.38	0.33
Dissolved Manganese	0.001	0.0065	0.00625	0.00775	0.027	0.0116	0.0166	0.031	0.02825	0.009125	0.01375	0.0235	0.01525
Dissolved Mercury	0.000025	0.000013	0.000013	0.000013	0.000013	0.000013	0.002510	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013
Dissolved Molybdenum	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Dissolved Nickel	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Phosphorous	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Dissolved Potassium	0.02	0.36	0.37	0.39	0.50	0.42	0.38	0.42	0.39	0.30	0.40	0.42	0.34
Dissolved Rubidium	0.0001	0.0010	0.0010	0.0010	0.0013	0.0012	0.0011	0.0015	0.0014	0.0007	0.0012	0.0013	0.0010
Dissolved Selenium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Silicon	0.1	9.5	10.4	8.9	4.5	4.6	6.3	7.1	8.7	10.1	7.8	7.1	7.5
Dissolved Silver	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Sodium	0.05	1.6	1.7	1.5	0.9	1.1	1.4	1.5	1.6	1.4	1.4	1.1	1.1
Dissolved Strontium	0.001	0.011	0.013	0.013	0.006	0.007	0.012	0.014	0.014	0.012	0.011	0.009	0.008
Dissolved Thallium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Titanium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Dissolved Tungsten	0.005	0.0019	0.0019	0.0019	0.0020	0.0020	0.0020	0.0025	0.0025	0.0025	0.0025	0.0025	0.0019
Dissolved Uranium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.0000625	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Vanadium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.00041	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Zinc	0.001	0.0030	0.0028	0.0028	0.0068	0.0030	0.0035	0.0055	0.0038	0.0030	0.0028	0.0038	0.0035
Total Aluminum	0.001	0.17975	0.4255	0.4595	2.9934	2.6884	3.966	1.4125	3.7525	0.261	3.0525	3.8775	2.8125
Total Antimony	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Arsenic	0.001	0.002	0.0025	0.00275	0.0034	0.0018	0.0026	0.0035	0.00375	0.00275	0.00225	0.00175	0.00125
Total Barium	0.001	0.00225	0.0035	0.00375	0.0114	0.0024	0.0038	0.00925	0.004	0.00275	0.004	0.00375	0.003
Total Bismuth	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Boron	0.001	0.00125	0.00175	0.00175	0.0024	0.0022	0.0022	0.00325	0.002	0.001625	0.002	0.00225	0.00175
Total Cadmium	0.00001	0.000020	0.000023	0.000028	0.000050	0.000036	0.000044	0.000063	0.000053	0.000024	0.000038	0.000050	0.000035
Total Calcium	0.05	1.9	2.2	2.2	1.2	1.2	1.9	2.1	2.2	1.9	1.7	1.5	1.3
Total Chromium	0.001	0.0005	0.0005	0.000625	0.0022	0.0005	0.0005	0.001375	0.0005	0.0005	0.0005	0.0005	0.0005
Total Cobalt	0.0001	0.00005	0.0001875	0.0000875	0.00071	0.00007	0.00012	0.000425	0.000225	0.0001	0.0000875	0.00015	0.0000875
Total Copper	0.001	0.0005	0.0005	0.0005	0.0014	0.0005	0.0005	0.000875	0.0005	0.000875	0.0005	0.0005	0.0005
Total Iron	0.02	0.1925	0.3125	0.3675	1.778	0.208	0.398	1.0475	0.5375	0.345	0.31	0.3125	0.2375
Total Lead	0.0001	0.000175	0.0003	0.00035	0.00212	0.00022	0.00034	0.000775	0.000375	0.000225	0.000225	0.0004	0.0002
Total Lithium	0.0001	0.00045	0.0007	0.0006	0.00202	0.00042	0.00056	0.0015	0.00055	0.000475	0.000525	0.000525	0.00045
Total Magnesium	0.01	0.45	0.55	0.55	0.58	0.31	0.45	0.65	0.53	0.45	0.43	0.41	0.36
Total Manganese	0.001	0.0075	0.01025	0.012	0.0644	0.013	0.0192	0.04425	0.03275	0.012875	0.01725	0.02625	0.0175
Total Mercury	0.000025	0.000013	0.000013	0.000013	0.000013	0.000013	0.002510	0.000017	0.000013	0.000013	0.000013	0.000013	0.000013
Total Molybdenum	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Total Nickel	0.001	0.0005	0.0005	0.0005	0.0014	0.0005	0.0005	0.001125	0.0005	0.0005	0.0005	0.0005	0.0005
Total Phosphorous	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total Potassium	0.02	0.38	0.445	0.48	1.022	0.444	0.4	0.67	0.4225	0.3225	0.4025	0.4525	0.3875
Total Rubidium	0.0001	0.00105	0.00145	0.001475	0.00624	0.00136	0.00126	0.003225	0.001525	0.0008125	0.00125	0.00145	0.00115
Total Selenium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Silicon	0.1	9.475	10.425	8.85	4.54	4.6	6.26	7.075	8.7	10.1	7.8	7.125	7.475
Total Silver	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Sodium	0.05	1.6375	1.855	1.6525	1.11	1.19	1.512	1.69	1.6675	1.5075	1.41	1.165	1.2025
Total Strontium	0.001	0.011	0.014	0.014	0.008	0.008	0.013	0.015	0.015	0.013	0.011	0.010	0.009
Total Thallium	0.0001	0.00005	0.00005	0.00005	0.00008	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Titanium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total Tungsten	0.005	0.0018875	0.0018875	0.0018875	0.00201	0.00201	0.00201	0.0025	0.0025	0.0025	0.0025	0.0025	0.0018875
Total Uranium	0.0001	0.00005	0.0000625	0.0000625	0.00022	0.00005	0.00005	0.00015	0.00005	0.00005	0.00005	0.00005	0.00005
Total Vanadium	0.001	0.0005	0.000625	0.000875	0.0033	0.0005	0.00051	0.001875	0.0005	0.0005	0.0005	0.0005	0.0005
Total Zinc	0.001	0.0035	0.00275	0.00275	0.0068	0.003	0.0035	0.0055	0.00375	0.00375	0.0035	0.00375	0.0035
Total Carbon	0.5	4.5	4.7	5.9	8.3	7.7	11.1	14.8	11.8	10.0	9.3	10.0	6.5

M:\10100447\02\A\Report9 - Water Quality Model Report\Appendices\Appendix A - Water Quality Inputs (JEM).xlsx\TABLE A4

**NOTES:**

1. DATA ARE AVERAGE MONTHLY VALUES.
2. UNITS ARE mg/L UNLESS OTHERWISE SPECIFIED.
3. WATER QUALITY SITE IS CALLED FR-1

TABLE A5

APPENDIX A - WATER QUALITY MODEL INPUTS  
BACKGROUND SURFACE WATER QUALITY DATA FOR NAP1

Print May/31/13 14:18:09

Parameter	MDL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Hardness	0.2	9.7	10.7	10.6	6.3	6.4	8.9	10.6	11.1	10.5	9.9	8.1	7.9
Alkalinity	2.0	9.8	11.0	10.6	4.2	5.5	8.3	9.0	10.0	9.2	9.0	5.6	7.4
Ammonia	0.05	0.025	0.034	0.025	0.025	0.04	0.025	0.0325	0.046	0.065	0.174	0.025	0.025
Nitrate	0.05	0.186	0.206	0.204	0.078	0.025	0.025	0.064	0.038	0.068	0.060	0.072	0.105
Phosphate	0.01	0.0090	0.0090	0.0130	0.0180	0.0175	0.0100	0.0175	0.0230	0.0140	0.0150	0.0090	0.0080
Sulphate	1	1.3	1.0	0.8	1.4	0.9	1.3	1.0	0.8	1.1	0.9	1.7	1.5
Bromide	0.01	0.005	0.005	0.005	0.005	0.005	0.005	0.00625	0.006	0.005	0.005	0.005	0.005
Chloride	0.5	0.94	0.79	1	0.87	0.975	1.225	1.25	1.3	1.24	1.62	1.46	1.1
Fluoride	0.05	0.11	0.13	0.13	0.20	0.19	0.21	0.21	0.23	0.20	0.17	0.21	0.15
Dissolved Aluminum	0.001	0.068	0.060	0.075	0.153	0.135	0.172	0.166	0.170	0.098	0.144	0.205	0.123
Dissolved Antimony	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Arsenic	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Barium	0.001	0.0014	0.0018	0.0018	0.0018	0.002	0.002	0.0025	0.0024	0.0019	0.0024	0.0024	0.0017
Dissolved Bismuth	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Boron	0.001	0.0009	0.0009	0.001	0.001	0.0015	0.00175	0.002	0.0018	0.0014	0.0016	0.0016	0.0012
Dissolved Cadmium	0.00001	0.000005	0.000005	0.000005	0.000005	0.000006	0.000006	0.000009	0.000009	0.000006	0.000006	0.000011	0.000006
Dissolved Calcium	0.05	3.13	3.48	3.45	2.01	2.05	2.90	3.39	3.46	2.95	2.80	2.56	2.52
Dissolved Chromium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Cobalt	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.0000875	0.00006	0.00005	0.00005	0.00007	0.00005
Dissolved Copper	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Iron	0.02	0.108	0.096	0.118	0.156	0.115	0.2125	0.2825	0.272	0.158	0.198	0.226	0.138
Dissolved Lead	0.0001	0.00008	0.00007	0.00009	0.00022	0.0002	0.00025	0.00025	0.00028	0.00014	0.00016	0.0003	0.00014
Dissolved Lithium	0.0001	0.0024	0.00258	0.00256	0.00146	0.001575	0.002075	0.002375	0.0021	0.0026	0.0022	0.00206	0.002
Dissolved Magnesium	0.01	0.44	0.47	0.48	0.29	0.30	0.40	0.46	0.49	0.39	0.45	0.40	0.37
Dissolved Manganese	0.001	0.0022	0.002	0.0018	0.0088	0.005	0.00675	0.017	0.0112	0.0037	0.0048	0.0122	0.0072
Dissolved Mercury	0.000025	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013
Dissolved Molybdenum	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Dissolved Nickel	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Phosphorous	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.03	0.03	0.03	0.03	0.03	0.03
Dissolved Potassium	0.02	0.28	0.29	0.31	0.27	0.23	0.25	0.27	0.33	0.27	0.32	0.28	0.25
Dissolved Rubidium	0.0001	0.0013	0.0013	0.0014	0.0012	0.0012	0.0013	0.0015	0.0017	0.0014	0.0015	0.0014	0.0013
Dissolved Selenium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Silicon	0.1	12.4	13.1	9.8	6.9	6.7	8.2	9.6	10.1	11.7	11.0	10.0	10.9
Dissolved Silver	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Sodium	0.05	2.0	2.1	2.1	1.3	1.4	1.8	2.0	1.9	1.8	1.9	1.6	1.7
Dissolved Strontium	0.001	0.016	0.018	0.018	0.011	0.011	0.016	0.019	0.018	0.015	0.015	0.014	0.013
Dissolved Thallium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Titanium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Dissolved Tungsten	0.005	0.0020	0.0020	0.0020	0.0020	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0020
Dissolved Uranium	0.0001	0.00022	0.00024	0.00028	0.00022	0.000225	0.00035	0.00035	0.00032	0.0003	0.00023	0.00034	0.00026
Dissolved Vanadium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Zinc	0.001	0.0013	0.0013	0.0016	0.0022	0.0021	0.0018	0.0020	0.0013	0.0009	0.0016	0.0031	0.0013
Total Aluminum	0.001	0.0866	0.1018	0.0928	0.2234	0.159	0.23275	0.28525	0.1984	0.1329	0.1662	0.2392	0.1644
Total Antimony	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Arsenic	0.001	0.0005	0.0005	0.0006	0.0005	0.0005	0.0005	0.000625	0.0005	0.0007	0.0008	0.0005	0.0005
Total Barium	0.001	0.0018	0.002	0.002	0.002	0.002	0.0025	0.003	0.0028	0.0019	0.0028	0.0024	0.0017
Total Bismuth	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Boron	0.001	0.0009	0.0011	0.001	0.001	0.0015	0.00175	0.00225	0.0018	0.0014	0.0018	0.0016	0.0014
Total Cadmium	0.00001	0.000005	0.000006	0.000005	0.000005	0.000006	0.000006	0.000011	0.000009	0.000006	0.000016	0.000012	0.000009
Total Calcium	0.05	3.4	3.6	3.7	2.1	2.2	3.0	3.5	3.5	3.1	2.9	2.8	2.7
Total Chromium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Cobalt	0.0001	0.00005	0.00005	0.00005	0.00006	0.00005	0.00005	0.0001375	0.00006	0.00005	0.00005	0.00007	0.00006
Total Copper	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Iron	0.02	0.122	0.13	0.142	0.198	0.135	0.2475	0.3575	0.302	0.19	0.214	0.242	0.16
Total Lead	0.0001	0.00011	0.00014	0.00014	0.00028	0.0002	0.0003	0.000475	0.00046	0.00016	0.00052	0.00036	0.00022
Total Lithium	0.0001	0.00252	0.00284	0.0027	0.00156	0.0017	0.002225	0.002525	0.00268	0.00276	0.0023	0.00218	0.00216
Total Magnesium	0.01	0.46	0.48	0.50	0.31	0.31	0.42	0.48	0.50	0.40	0.46	0.43	0.40
Total Manganese	0.001	0.0032	0.0038	0.0032	0.0114	0.00625	0.00925	0.0305	0.0142	0.0055	0.007	0.014	0.009
Total Mercury	0.000025	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000016	0.000013	0.000013	0.000013
Total Molybdenum	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Total Nickel	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Phosphorous	0.02	0.02	0.01	0.01	0.02	0.01	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Total Potassium	0.02	0.294	0.31	0.322	0.296	0.24	0.2625	0.2875	0.34	0.29	0.332	0.31	0.282
Total Rubidium	0.0001	0.0014	0.00148	0.00146	0.00144	0.001225	0.0014	0.00165	0.0019	0.00145	0.00154	0.00154	0.00138
Total Selenium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Silicon	0.1	12.44	13.06	9.77	6.92	6.65	8.15	9.55	10.14	11.68	10.98	9.98	10.92
Total Silver	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Sodium	0.05	2.062	2.226	2.214	1.306	1.48	1.84	2.0625	2.076	1.89	1.924	1.746	1.762
Total Strontium	0.001	0.017	0.019	0.019	0.011	0.012	0.017	0.020	0.020	0.016	0.016	0.015	0.014
Total Thallium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Titanium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total Tungsten	0.005	0.00201	0.00201	0.00201	0.00201	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.00351
Total Uranium	0.0001	0.00026	0.0003	0.0003	0.00024	0.000275	0.000425	0.00045	0.00042	0.00034	0.00025	0.00036	0.0003
Total Vanadium	0.001	0.0005	0.0005	0.0005	0.0014	0.0005	0.000625	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Zinc	0.001	0.0013	0.0013	0.0018	0.0022	0.002125	0.00175	0.0025	0.0014	0.0009	0.0042	0.0033	0.0035
Total Carbon	0.5	4.3	4.1	5.1	8.8	8.1	11.4	12.5	13.3	10.4	10.8	13.2	7.4

M:\10100447\02\A\Report9 - Water Quality Model Report\Appendices\Appendix A - Water Quality Inputs (JEM).xlsx\TABLE A5

**NOTES:**

1. DATA ARE AVERAGE MONTHLY VALUES.
2. UNITS ARE mg/L UNLESS OTHERWISE SPECIFIED.
3. WATER QUALITY SITE IS CALLED R-1



TABLE A6

APPENDIX A - WATER QUALITY MODEL INPUTS  
BACKGROUND SURFACE WATER QUALITY DATA FOR NAP2

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Parameter	MDL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Hardness	0.2	9.3	9.3	5.8	5.8	5.9	10.1	10.1	12.2	9.3	9.3	10.1	9.3
Alkalinity	2.0	8.8	8.8	3.5	3.5	5.0	10.5	10.5	11.0	8.8	8.8	8.0	8.8
Ammonia	0.05	0.025	0.025	0.04625	0.04625	0.025	0.025	0.025	0.025	0.045	0.045	0.025	0.025
Nitrate	0.05	0.183	0.183	0.044	0.044	0.025	0.050	0.050	0.120	0.025	0.025	0.070	0.183
Phosphate	0.01	0.0063	0.0063	0.0113	0.0113	0.0100	0.0325	0.0325	0.0200	0.0088	0.0088	0.0100	0.0063
Sulphate	1	1.4	1.4	0.5	0.5	2.0	1.3	1.3	0.5	0.9	0.9	5.0	1.4
Bromide	0.01	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Chloride	0.5	0.825	0.825	0.95	0.95	1.2	0.85	0.85	1.4	1.475	1.475	1.9	0.825
Fluoride	0.05	0.10	0.10	0.14	0.14	0.18	0.16	0.16	0.19	0.13	0.13	0.22	0.10
Dissolved Aluminum	0.001	0.064	0.064	0.142	0.142	0.140	0.128	0.128	0.097	0.138	0.138	0.169	0.064
Dissolved Antimony	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Arsenic	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Barium	0.001	0.002	0.002	0.002	0.002	0.002	0.00225	0.00225	0.002	0.003	0.003	0.003	0.002
Dissolved Bismuth	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Boron	0.001	0.0015	0.0015	0.00125	0.00125	0.002	0.002	0.002	0.002	0.0015	0.0015	0.002	0.0015
Dissolved Cadmium	0.00001	0.000005	0.000005	0.000005	0.000005	0.000005	0.000006	0.000006	0.000005	0.000005	0.000005	0.000005	0.000005
Dissolved Calcium	0.05	2.97	2.97	1.84	1.84	1.81	3.23	3.23	3.97	2.77	2.77	3.23	2.97
Dissolved Chromium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Cobalt	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Copper	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Iron	0.02	0.0825	0.0825	0.125	0.125	0.09	0.205	0.205	0.2	0.1825	0.1825	0.19	0.0825
Dissolved Lead	0.0001	0.00005	0.00005	0.0001125	0.0001125	0.0001	0.00015	0.00015	0.0001	0.0001	0.0001	0.0005	0.00005
Dissolved Lithium	0.0001	0.0015	0.0015	0.000925	0.000925	0.001	0.00165	0.00165	0.0009	0.0014	0.0014	0.0017	0.0015
Dissolved Magnesium	0.01	0.45	0.45	0.30	0.30	0.29	0.47	0.47	0.57	0.46	0.46	0.50	0.45
Dissolved Manganese	0.001	0.0025	0.0025	0.00675	0.00675	0.007	0.007	0.007	0.007	0.0045	0.0045	0.005	0.0025
Dissolved Mercury	0.000025	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013
Dissolved Molybdenum	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001
Dissolved Nickel	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Phosphorous	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Dissolved Potassium	0.02	0.32	0.32	0.28	0.28	0.20	0.29	0.29	0.36	0.34	0.34	0.38	0.32
Dissolved Rubidium	0.0001	0.0011	0.0011	0.0011	0.0011	0.0008	0.0013	0.0013	0.0014	0.0014	0.0014	0.0014	0.0011
Dissolved Selenium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Silicon	0.1	11.3	11.3	6.3	6.3	6.3	8.9	8.9	10.3	10.2	10.2	10.0	11.3
Dissolved Silver	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Sodium	0.05	1.8	1.8	1.1	1.1	1.1	1.8	1.8	1.9	1.7	1.7	1.8	1.8
Dissolved Strontium	0.001	0.013	0.013	0.008	0.008	0.008	0.015	0.015	0.017	0.012	0.012	0.014	0.013
Dissolved Thallium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Titanium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Dissolved Tungsten	0.005	0.0019	0.0019	0.0019	0.0019	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0019
Dissolved Uranium	0.0001	0.0002	0.0002	0.000225	0.000225	0.0003	0.00035	0.00035	0.0002	0.000225	0.000225	0.0004	0.0002
Dissolved Vanadium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Zinc	0.001	0.0006	0.0006	0.0011	0.0011	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0080	0.0006
Total Aluminum	0.001	0.085	0.085	0.181	0.181	0.153	0.18725	0.18725	0.097	0.1865	0.1865	0.169	0.085
Total Antimony	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.0000875	0.0000875	0.00005	0.00005	0.00005	0.00005	0.00005
Total Arsenic	0.001	0.0005	0.0005	0.000625	0.000625	0.0005	0.0005	0.0005	0.000625	0.000625	0.000625	0.0005	0.0005
Total Barium	0.001	0.002	0.002	0.002	0.002	0.002	0.0025	0.0025	0.002	0.00325	0.00325	0.003	0.002
Total Bismuth	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Boron	0.001	0.0015	0.0015	0.00125	0.00125	0.002	0.002	0.002	0.002	0.0015	0.0015	0.002	0.0015
Total Cadmium	0.00001	0.000005	0.000005	0.000005	0.000005	0.000005	0.000006	0.000006	0.000005	0.000006	0.000006	0.000012	0.000005
Total Calcium	0.05	3.2	3.2	2.0	2.0	1.8	3.3	3.3	4.0	2.9	2.9	3.2	3.2
Total Chromium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Cobalt	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.000075	0.000075	0.00005	0.00005	0.00005	0.00005	0.00005
Total Copper	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Iron	0.02	0.0975	0.0975	0.1525	0.1525	0.09	0.255	0.255	0.2	0.2225	0.2225	0.19	0.0975
Total Lead	0.0001	0.0000625	0.0000625	0.0002	0.0002	0.0002	0.000225	0.000225	0.0001	0.000175	0.000175	0.0005	0.0000625
Total Lithium	0.0001	0.001625	0.001625	0.001025	0.001025	0.001	0.001775	0.001775	0.0019	0.001475	0.001475	0.0017	0.001625
Total Magnesium	0.01	0.48	0.48	0.31	0.31	0.29	0.49	0.49	0.57	0.47	0.47	0.50	0.48
Total Manganese	0.001	0.00425	0.00425	0.00975	0.00975	0.008	0.01525	0.01525	0.007	0.0075	0.0075	0.005	0.00425
Total Mercury	0.000025	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013
Total Molybdenum	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0003	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001
Total Nickel	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Phosphorous	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total Potassium	0.02	0.33	0.33	0.305	0.305	0.2	0.3	0.3	0.42	0.35	0.35	0.38	0.33
Total Rubidium	0.0001	0.0012	0.0012	0.001175	0.001175	0.0009	0.0014	0.0014	0.0015	0.0014	0.0014	0.0014	0.0012
Total Selenium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Silicon	0.1	11.3	11.3	6.25	6.25	6.3	8.9	8.9	10.3	10.225	10.225	10	11.3
Total Silver	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Sodium	0.05	1.88	1.88	1.165	1.165	1.12	1.8725	1.8725	2.16	1.7225	1.7225	1.83	1.88
Total Strontium	0.001	0.014	0.014	0.009	0.009	0.008	0.016	0.016	0.017	0.013	0.013	0.014	0.014
Total Thallium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Titanium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total Tungsten	0.005	0.0018875	0.0018875	0.0018875	0.0018875	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0018875
Total Uranium	0.0001	0.00025	0.00025	0.000275	0.000275	0.0003	0.000375	0.000375	0.0004	0.00025	0.00025	0.0004	0.00025
Total Vanadium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Zinc	0.001	0.000625	0.000625	0.001375	0.001375	0.001	0.001	0.001	0.002	0.001	0.001	0.008	0.000625
Total Carbon	0.5	3.5	3.5	7.2	7.2	7.2	8.9	8.9	7.3	9.5	9.5	12.5	3.5

M:\10100447\02\A\Report9 - Water Quality Model Report\Appendices\Appendix A - Water Quality Inputs (JEM).xlsx\TABLE A6

**NOTES:**

1. DATA ARE AVERAGE MONTHLY VALUES.
2. UNITS ARE mg/L UNLESS OTHERWISE SPECIFIED.
3. WATER QUALITY SITE IS CALLED WBNB-1
4. DATA WERE COLLECTED QUARTERLY

TABLE A7

APPENDIX A - WATER QUALITY MODEL INPUTS  
BACKGROUND SURFACE WATER QUALITY DATA FOR NAP5

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Parameter	MDL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Hardness	0.2	9.1	10.2	10.3	6.2	6.4	8.7	9.6	10.2	10.2	9.5	8.2	7.1
Alkalinity	2.0	8.4	9.3	9.2	3.8	4.6	7.2	7.8	8.4	8.8	8.0	4.8	5.0
Ammonia	0.05	0.025	0.025	0.025	0.038	0.063	0.025	0.01875	0.025	0.061	0.025	0.025	0.06375
Nitrate	0.05	0.180	0.228	0.214	0.055	0.025	0.044	0.040	0.036	0.036	0.025	0.079	0.128
Phosphate	0.01	0.0210	0.0513	0.0110	0.0130	0.0150	0.0120	0.0088	0.0100	0.0080	0.0100	0.160	0.0063
Sulphate	1	1.5	1.3	1.2	1.0	1.2	1.0	1.1	1.1	1.3	1.0	1.2	1.8
Bromide	0.01	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Chloride	0.5	1	1.25	1.04	0.88	0.9	1.02	0.925	1.09	1.06	1.28	1.24	0.975
Fluoride	0.05	0.17	0.14	0.09	0.14	0.14	0.14	0.17	0.20	0.14	0.17	0.16	0.14
Dissolved Aluminum	0.001	0.055	0.045	0.052	0.127	0.114	0.111	0.117	0.161	0.088	0.104	0.155	0.107
Dissolved Antimony	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Arsenic	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0006	0.001	0.0009	0.0006	0.0005	0.0005	0.0005
Dissolved Barium	0.001	0.0044	0.00425	0.004	0.004	0.0042	0.0042	0.00475	0.005	0.0044	0.0056	0.0052	0.00425
Dissolved Bismuth	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Boron	0.001	0.0014	0.0015	0.0012	0.0014	0.0018	0.002	0.002	0.0018	0.0018	0.0016	0.0018	0.0015
Dissolved Cadmium	0.00001	0.000006	0.000008	0.000007	0.000018	0.000016	0.000016	0.000018	0.000029	0.000011	0.000009	0.000021	0.000020
Dissolved Calcium	0.05	2.84	3.25	3.27	1.93	2.01	2.76	3.04	3.21	3.23	2.96	2.57	2.18
Dissolved Chromium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Cobalt	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00008	0.00005	0.00005	0.00005	0.0000625
Dissolved Copper	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Iron	0.02	0.07	0.065	0.07	0.102	0.084	0.132	0.1825	0.214	0.132	0.15	0.156	0.0825
Dissolved Lead	0.0001	0.00005	0.00005	0.00005	0.00007	0.00006	0.00009	0.0001	0.00014	0.00005	0.00006	0.00016	0.0000875
Dissolved Lithium	0.0001	0.001	0.001175	0.00114	0.00068	0.00076	0.00104	0.0011	0.00118	0.0012	0.00104	0.00094	0.000775
Dissolved Magnesium	0.01	0.46	0.50	0.51	0.32	0.33	0.43	0.47	0.50	0.52	0.50	0.44	0.37
Dissolved Manganese	0.001	0.0016	0.001	0.0011	0.0042	0.0028	0.0038	0.0045	0.0136	0.0032	0.0032	0.0072	0.00725
Dissolved Mercury	0.000025	0.000013	0.000013	0.000013	0.000013	0.000016	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013
Dissolved Molybdenum	0.0001	0.0002	0.0002	0.0003	0.0001	0.0001	0.0003	0.0003	0.0004	0.0003	0.0002	0.0001	0.0001
Dissolved Nickel	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Phosphorous	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
Dissolved Potassium	0.02	0.31	0.33	0.34	0.30	0.27	0.28	0.29	0.32	0.34	0.35	0.33	0.28
Dissolved Rubidium	0.0001	0.0011	0.0011	0.0011	0.0010	0.0010	0.0011	0.0013	0.0013	0.0013	0.0013	0.0012	0.0010
Dissolved Selenium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Silicon	0.1	10.4	11.2	10.2	5.7	5.9	7.4	8.3	8.6	9.8	9.4	8.5	8.8
Dissolved Silver	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Sodium	0.05	1.6	1.7	1.7	1.0	1.2	1.5	1.6	1.8	1.8	1.6	1.4	1.3
Dissolved Strontium	0.001	0.013	0.015	0.015	0.009	0.010	0.013	0.014	0.016	0.015	0.014	0.010	0.011
Dissolved Thallium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Titanium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Dissolved Tungsten	0.005	0.0020	0.0019	0.0020	0.0020	0.0020	0.0020	0.0025	0.0025	0.0025	0.0025	0.0025	0.0019
Dissolved Uranium	0.0001	0.00009	0.0001	0.0001	0.00016	0.00018	0.00021	0.00025	0.0003	0.00019	0.00015	0.0002	0.00015
Dissolved Vanadium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.00042	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Zinc	0.001	0.0009	0.0015	0.0010	0.0015	0.0013	0.0009	0.0011	0.0020	0.0009	0.0011	0.0046	0.0009
Total Aluminum	0.001	0.0878	0.06425	0.068	0.1748	0.1414	0.1488	0.1575	0.2024	0.1166	0.1172	0.196	0.138
Total Antimony	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.0001	0.00005	0.00008	0.00005	0.00005
Total Arsenic	0.001	0.0005	0.000625	0.0005	0.0006	0.0006	0.0008	0.00125	0.0009	0.0006	0.0009	0.0005	0.0005
Total Barium	0.001	0.0044	0.0045	0.0042	0.0044	0.0044	0.0056	0.00525	0.006	0.0052	0.0058	0.0054	0.0045
Total Bismuth	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Boron	0.001	0.0014	0.00175	0.0012	0.0014	0.0018	0.002	0.002	0.0018	0.0018	0.0018	0.0018	0.0015
Total Cadmium	0.00001	0.000006	0.000010	0.000007	0.000018	0.000016	0.000016	0.000018	0.000029	0.000013	0.000009	0.000021	0.000020
Total Calcium	0.05	3.0	3.4	3.5	2.1	2.1	2.9	3.2	3.4	3.4	3.1	2.7	2.3
Total Chromium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.001	0.0005	0.0005	0.0005
Total Cobalt	0.0001	0.00005	0.00005	0.00005	0.00008	0.00005	0.00005	0.00005	0.00011	0.00005	0.00005	0.00007	0.0000625
Total Copper	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Iron	0.02	0.078	0.0825	0.09	0.136	0.106	0.172	0.235	0.248	0.178	0.17	0.194	0.1025
Total Lead	0.0001	0.00005	0.0000625	0.00009	0.00016	0.00013	0.00018	0.000175	0.00019	0.00011	0.00009	0.00021	0.0001125
Total Lithium	0.0001	0.0011	0.00125	0.00126	0.00074	0.0008	0.0011	0.001175	0.0013	0.0013	0.0011	0.001	0.00085
Total Magnesium	0.01	0.48	0.51	0.53	0.33	0.34	0.45	0.49	0.51	0.54	0.51	0.46	0.39
Total Manganese	0.001	0.0022	0.0035	0.0035	0.0094	0.0054	0.0102	0.0115	0.0214	0.0082	0.0074	0.0112	0.00975
Total Mercury	0.000025	0.000016	0.000013	0.000013	0.000013	0.000016	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013
Total Molybdenum	0.0001	0.0002	0.0002	0.0003	0.0001	0.0001	0.0003	0.0003	0.0004	0.0003	0.0002	0.0001	0.0001
Total Nickel	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Phosphorous	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
Total Potassium	0.02	0.324	0.3575	0.362	0.314	0.286	0.296	0.3075	0.33	0.356	0.354	0.342	0.295
Total Rubidium	0.0001	0.00112	0.001175	0.00112	0.00114	0.00112	0.00122	0.00135	0.00146	0.00138	0.00138	0.0013	0.0011
Total Selenium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Silicon	0.1	10.44	11.175	10.16	5.66	5.88	7.4	8.275	8.6	9.84	9.44	8.46	8.825
Total Silver	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Sodium	0.05	1.666	1.865	1.848	1.084	1.278	1.6	1.7075	1.688	1.886	1.69	1.448	1.375
Total Strontium	0.001	0.014	0.016	0.015	0.010	0.010	0.014	0.015	0.017	0.016	0.015	0.011	0.011
Total Thallium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Titanium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total Tungsten	0.005	0.00201	0.0018875	0.00201	0.00201	0.00201	0.00201	0.00201	0.00201	0.00201	0.00201	0.00201	0.0018875
Total Uranium	0.0001	0.00014	0.000125	0.00014	0.00018	0.0002	0.00023	0.000275	0.00032	0.0002	0.00015	0.00022	0.000175
Total Vanadium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.00044	0.0005	0.0005	0.00022	0.0005	0.0005	0.0005
Total Zinc	0.001	0.0009	0.00225	0.001	0.0015	0.0013	0.0009	0.001125	0.002	0.0009	0.0013	0.0046	0.000875
Total Carbon	0.5	3.2	2.8	3.4	6.4	6.3	6.8	8.7	11.7	7.3	7.7	9.7	6.1

M:\10100447\02\A\Report9 - Water Quality Model Report\Appendices\Appendix A - Water Quality Inputs (JEM).xlsx\TABLE A7

**NOTES:**

1. DATA ARE AVERAGE MONTHLY VALUES.
2. UNITS ARE mg/L UNLESS OTHERWISE SPECIFIED.
3. WATER QUALITY SITE IS CALLED NB-2

TABLE A8

APPENDIX A - WATER QUALITY MODEL INPUTS  
BACKGROUND SURFACE WATER QUALITY DATA FOR NAP7

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Parameter	MDL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Hardness	0.2	10.2	10.2	7.6	7.6	7.6	11.4	11.4	13.2	13.2	10.3	11.2	11.2
Alkalinity	2.0	9.0	9.0	4.6	4.6	4.6	9.0	9.0	9.0	9.0	8.0	8.0	8.0
Ammonia	0.05	0.025	0.025	0.03	0.03	0.03	0.04	0.04	0.025	0.025	0.03375	0.025	0.025
Nitrate	0.05	0.203	0.203	0.232	0.232	0.232	0.061	0.061	0.090	0.090	0.031	0.025	0.025
Phosphate	0.01	0.0050	0.0050	0.0130	0.0130	0.0130	0.0063	0.0063	0.0300	0.0300	0.0063	0.0200	0.0200
Sulphate	1	1.3	1.3	1.4	1.4	1.4	1.4	1.4	2.0	2.0	0.5	5.0	5.0
Bromide	0.01	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Chloride	0.5	1.17	1.17	1.16	1.16	1.16	1.25	1.25	1.6	1.6	1.5	2.1	2.1
Fluoride	0.05	0.10	0.10	0.19	0.19	0.19	0.14	0.14	0.25	0.25	0.14	0.27	0.27
Dissolved Aluminum	0.001	0.048	0.048	0.096	0.096	0.096	0.097	0.097	0.088	0.088	0.098	0.106	0.106
Dissolved Antimony	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Arsenic	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.000875	0.000875	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Barium	0.001	0.00475	0.00475	0.0042	0.0042	0.0042	0.0055	0.0055	0.005	0.005	0.0055	0.005	0.005
Dissolved Bismuth	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Boron	0.001	0.00125	0.00125	0.0012	0.0012	0.0012	0.00225	0.00225	0.002	0.002	0.002	0.002	0.002
Dissolved Cadmium	0.00001	0.000005	0.000005	0.000009	0.000009	0.000009	0.000014	0.000014	0.000020	0.000020	0.000006	0.000005	0.000005
Dissolved Calcium	0.05	3.24	3.24	2.37	2.37	2.37	3.66	3.66	4.30	4.30	3.25	3.57	3.57
Dissolved Chromium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Cobalt	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.0000875	0.0000875	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Copper	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Iron	0.02	0.095	0.095	0.096	0.096	0.096	0.2425	0.2425	0.26	0.26	0.185	0.16	0.16
Dissolved Lead	0.0001	0.00005	0.00005	0.00006	0.00006	0.00006	0.0000875	0.0000875	0.0001	0.0001	0.00005	0.00005	0.00005
Dissolved Lithium	0.0001	0.000725	0.000725	0.00046	0.00046	0.00046	0.0007	0.0007	0.0009	0.0009	0.000675	0.0007	0.0007
Dissolved Magnesium	0.01	0.50	0.50	0.36	0.36	0.36	0.51	0.51	0.60	0.60	0.52	0.55	0.55
Dissolved Manganese	0.001	0.00275	0.00275	0.0054	0.0054	0.0054	0.02	0.02	0.012	0.012	0.009	0.008	0.008
Dissolved Mercury	0.000025	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013
Dissolved Molybdenum	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0004	0.0004	0.0001	0.0001	0.0001
Dissolved Nickel	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Phosphorous	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Dissolved Potassium	0.02	0.32	0.32	0.29	0.29	0.29	0.30	0.30	0.36	0.36	0.33	0.38	0.38
Dissolved Rubidium	0.0001	0.0010	0.0010	0.0009	0.0009	0.0009	0.0012	0.0012	0.0014	0.0014	0.0011	0.0011	0.0011
Dissolved Selenium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Silicon	0.1	9.4	9.4	5.3	5.3	5.3	6.6	6.6	8.0	8.0	7.7	7.6	7.6
Dissolved Silver	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Sodium	0.05	1.6	1.6	1.2	1.2	1.2	1.5	1.5	1.9	1.9	1.5	1.7	1.7
Dissolved Strontium	0.001	0.014	0.014	0.010	0.010	0.010	0.017	0.017	0.018	0.018	0.014	0.015	0.015
Dissolved Thallium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Titanium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Dissolved Tungsten	0.005	0.0019	0.0019	0.0020	0.0020	0.0020	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Dissolved Uranium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.000125	0.000125	0.0002	0.0002	0.0000875	0.0001	0.0001
Dissolved Vanadium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Zinc	0.001	0.0005	0.0005	0.0013	0.0013	0.0013	0.0018	0.0018	0.0010	0.0010	0.0008	0.0030	0.0030
Total Aluminum	0.001	0.07875	0.07875	0.1346	0.1346	0.1346	0.27125	0.27125	0.097	0.097	0.14125	0.106	0.106
Total Antimony	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Arsenic	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.001375	0.001375	0.0005	0.0005	0.00075	0.0005	0.0005
Total Barium	0.001	0.005	0.005	0.0046	0.0046	0.0046	0.008	0.008	0.005	0.005	0.0055	0.005	0.005
Total Bismuth	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Boron	0.001	0.00125	0.00125	0.0012	0.0012	0.0012	0.00225	0.00225	0.002	0.002	0.002	0.002	0.002
Total Cadmium	0.00001	0.000005	0.000005	0.000011	0.000011	0.000011	0.000021	0.000021	0.000020	0.000020	0.000006	0.000005	0.000005
Total Calcium	0.05	3.5	3.5	2.5	2.5	2.5	3.9	3.9	4.4	4.4	3.4	3.6	3.6
Total Chromium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Cobalt	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00035	0.00035	0.00005	0.00005	0.0000625	0.00005	0.00005
Total Copper	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.000625	0.000625	0.0005	0.0005	0.0005	0.0005	0.0005
Total Iron	0.02	0.1275	0.1275	0.136	0.136	0.136	0.485	0.485	0.29	0.29	0.2275	0.16	0.16
Total Lead	0.0001	0.0000625	0.0000625	0.00009	0.00009	0.00009	0.0003625	0.0003625	0.0001	0.0001	0.00005	0.00005	0.00005
Total Lithium	0.0001	0.000825	0.000825	0.0005	0.0005	0.0005	0.0009	0.0009	0.0009	0.0009	0.000725	0.0007	0.0007
Total Magnesium	0.01	0.53	0.53	0.38	0.38	0.38	0.56	0.56	0.61	0.61	0.56	0.55	0.55
Total Manganese	0.001	0.007	0.007	0.0104	0.0104	0.0104	0.0795	0.0795	0.013	0.013	0.01375	0.008	0.008
Total Mercury	0.000025	0.000017	0.000017	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013
Total Molybdenum	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0004	0.0004	0.0001	0.0001	0.0001
Total Nickel	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.000625	0.000625	0.0005	0.0005	0.0005	0.0005	0.0005
Total Phosphorous	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total Potassium	0.02	0.335	0.335	0.308	0.308	0.308	0.33	0.33	0.36	0.36	0.3425	0.38	0.38
Total Rubidium	0.0001	0.00105	0.00105	0.00094	0.00094	0.00094	0.0014	0.0014	0.0014	0.0014	0.00115	0.0011	0.0011
Total Selenium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Silicon	0.1	9.425	9.425	5.32	5.32	5.32	6.625	6.625	8	8	7.725	7.6	7.6
Total Silver	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Sodium	0.05	1.7325	1.7325	1.258	1.258	1.258	1.5725	1.5725	1.91	1.91	1.58	1.65	1.65
Total Strontium	0.001	0.015	0.015	0.011	0.011	0.011	0.018	0.018	0.019	0.019	0.014	0.015	0.015
Total Thallium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Titanium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total Tungsten	0.005	0.0018875	0.0018875	0.00201	0.00201	0.00201	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Total Uranium	0.0001	0.0000625	0.0000625	0.00006	0.00006	0.00006	0.000125	0.000125	0.0002	0.0002	0.0000875	0.0001	0.0001
Total Vanadium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.000625	0.000625	0.0005	0.0005	0.0005	0.0005	0.0005
Total Zinc	0.001	0.0005	0.0005	0.0013	0.0013	0.0013	0.00175	0.00175	0.001	0.001	0.00075	0.003	0.003
Total Carbon	0.5	3.1	3.1	5.6	5.6	5.6	8.6	8.6	9.6	9.6	8.0	9.8	9.8

M:\10100447\02\A\Report9 - Water Quality Model Report\Appendices\Appendix A - Water Quality Inputs (JEM).xlsx\TABLE A8

**NOTES:**

1. DATA ARE AVERAGE MONTHLY VALUES
2. UNITS ARE mg/L UNLESS OTHERWISE SPECIFIED.
3. WATER QUALITY SITE IS CALLED NB-1
4. DATA WERE COLLECTED QUARTERLY

TABLE A9

APPENDIX A - WATER QUALITY MODEL INPUTS  
BACKGROUND SURFACE WATER QUALITY DATA FOR MBB2

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Parameter	MDL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Hardness	0.2	13.3	15.3	14.6	7.4	7.6	10.4	12.6	14.3	13.8	12.6	10.6	8.5
Alkalinity	2.0	10.8	12.8	11.2	4.2	5.8	7.3	9.3	10.2	10.4	7.6	5.4	5.4
Ammonia	0.05	0.025	0.048	0.049	0.036	0.04375	0.025	0.025	0.03	0.044	0.045	0.025	0.054
Nitrate	0.05	0.138	0.190	0.146	0.034	0.025	0.031	0.039	0.032	0.032	0.100	0.025	2.592
Phosphate	0.01	0.0120	0.0060	0.0080	0.0160	0.0063	0.0063	0.0050	0.0060	0.0080	0.0140	0.0240	0.0080
Sulphate	1	2.1	1.6	1.4	1.0	1.1	1.8	1.8	1.3	1.9	2.1	1.5	2.3
Bromide	0.01	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Chloride	0.5	2	1.26	1.28	0.94	0.95	1.525	1.1	1.38	1.42	1.94	1.52	1.12
Fluoride	0.05	0.13	0.12	0.13	0.16	0.16	0.13	0.18	0.24	0.16	0.23	0.18	0.15
Dissolved Aluminum	0.001	0.062	0.051	0.066	0.106	0.113	0.120	0.128	0.182	0.108	0.145	0.158	0.119
Dissolved Antimony	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Arsenic	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.00075	0.001125	0.0009	0.0005	0.0005	0.0005	0.0005
Dissolved Barium	0.001	0.002	0.0022	0.002	0.002	0.002	0.00225	0.00275	0.0036	0.0023	0.0036	0.003	0.0017
Dissolved Bismuth	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Boron	0.001	0.0014	0.0016	0.0016	0.0012	0.002	0.002	0.00225	0.0024	0.0017	0.002	0.002	0.0016
Dissolved Cadmium	0.00001	0.000018	0.000020	0.000018	0.000022	0.000025	0.000033	0.000038	0.000050	0.000023	0.000032	0.000039	0.000032
Dissolved Calcium	0.05	4.24	5.00	4.79	2.37	2.41	3.28	4.01	4.59	3.91	4.03	3.39	2.66
Dissolved Chromium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Cobalt	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00006	0.00005	0.00005	0.00005	0.00005
Dissolved Copper	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Iron	0.02	0.078	0.08	0.112	0.09	0.0725	0.1275	0.17	0.198	0.126	0.182	0.152	0.096
Dissolved Lead	0.0001	0.00005	0.00005	0.00007	0.00011	0.0000875	0.0001125	0.0001125	0.00017	0.0001	0.00012	0.00016	0.00013
Dissolved Lithium	0.0001	0.0003	0.00034	0.00032	0.0002	0.00025	0.000325	0.000375	0.00038	0.00027	0.00032	0.0003	0.00026
Dissolved Magnesium	0.01	0.61	0.68	0.64	0.34	0.37	0.50	0.58	0.63	0.51	0.58	0.52	0.42
Dissolved Manganese	0.001	0.0048	0.009	0.0104	0.01	0.0045	0.0115	0.0155	0.0196	0.0059	0.0106	0.01	0.0124
Dissolved Mercury	0.000025	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013
Dissolved Molybdenum	0.0001	0.0008	0.0010	0.0012	0.0006	0.0009	0.0022	0.0020	0.0017	0.0008	0.0008	0.0005	0.0006
Dissolved Nickel	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Phosphorous	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
Dissolved Potassium	0.02	0.35	0.41	0.45	0.33	0.27	0.30	0.33	0.34	0.26	0.35	0.35	0.26
Dissolved Rubidium	0.0001	0.0010	0.0011	0.0012	0.0010	0.0009	0.0010	0.0011	0.0011	0.0008	0.0011	0.0011	0.0009
Dissolved Selenium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Silicon	0.1	9.9	10.5	7.6	4.9	4.0	4.3	5.4	6.1	6.7	7.0	6.6	6.9
Dissolved Silver	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Sodium	0.05	1.4	1.5	1.5	0.9	1.0	1.2	1.3	1.3	1.1	1.3	1.1	1.0
Dissolved Strontium	0.001	0.021	0.024	0.023	0.011	0.013	0.017	0.021	0.023	0.020	0.021	0.014	0.014
Dissolved Thallium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Titanium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Dissolved Tungsten	0.005	0.0020	0.0020	0.0020	0.0020	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0020
Dissolved Uranium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Vanadium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Zinc	0.001	0.0019	0.0019	0.0024	0.0022	0.0025	0.0015	0.0023	0.0028	0.0014	0.0024	0.0038	0.0020
Total Aluminum	0.001	0.0686	0.0634	0.0988	0.127	0.12625	0.14625	0.152	0.2122	0.1158	0.1568	0.1694	0.1454
Total Antimony	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00017	0.00005	0.00005
Total Arsenic	0.001	0.0005	0.0006	0.0005	0.0006	0.0005	0.000875	0.001125	0.0009	0.0005	0.0008	0.0005	0.0005
Total Barium	0.001	0.002	0.0022	0.0024	0.002	0.002	0.0025	0.00275	0.0038	0.0027	0.0038	0.003	0.0017
Total Bismuth	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Boron	0.001	0.0014	0.0016	0.0016	0.0012	0.002	0.002	0.00225	0.0024	0.0017	0.002	0.002	0.0016
Total Cadmium	0.00001	0.000018	0.000020	0.000026	0.000022	0.000025	0.000033	0.000038	0.000050	0.000023	0.000032	0.000039	0.000032
Total Calcium	0.05	4.5	5.2	5.1	2.5	2.6	3.5	4.1	4.7	4.1	4.2	3.5	2.8
Total Chromium	0.001	0.0005	0.0005	0.0008	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Cobalt	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.0000625	0.000075	0.00009	0.00005	0.00005	0.00005	0.00005
Total Copper	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Iron	0.02	0.086	0.092	0.152	0.104	0.085	0.1475	0.19	0.224	0.136	0.19	0.162	0.106
Total Lead	0.0001	0.00006	0.00005	0.00012	0.00015	0.0001	0.000175	0.000175	0.00024	0.00012	0.00016	0.00019	0.00013
Total Lithium	0.0001	0.0003	0.00034	0.0004	0.00022	0.000275	0.00035	0.000375	0.00042	0.00029	0.0004	0.0003	0.00028
Total Magnesium	0.01	0.63	0.69	0.68	0.35	0.39	0.52	0.60	0.64	0.52	0.60	0.54	0.43
Total Manganese	0.001	0.006	0.0104	0.0124	0.0122	0.00725	0.017	0.02125	0.0238	0.0087	0.0126	0.0216	0.0146
Total Mercury	0.000025	0.000026	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000024	0.000013	0.000013	0.000013
Total Molybdenum	0.0001	0.0009	0.0010	0.0013	0.0006	0.0010	0.0024	0.0022	0.0019	0.0009	0.0009	0.0005	0.0006
Total Nickel	0.001	0.0005	0.0005	0.0006	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Phosphorous	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
Total Potassium	0.02	0.362	0.42	0.474	0.344	0.2775	0.3025	0.33	0.342	0.262	0.354	0.356	0.274
Total Rubidium	0.0001	0.00104	0.00112	0.00124	0.00106	0.0009	0.001	0.00115	0.00118	0.00081	0.00114	0.0011	0.00092
Total Selenium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Silicon	0.1	9.86	10.52	7.55	4.9	4	4.325	5.35	6.06	6.74	7.02	6.58	6.92
Total Silver	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Sodium	0.05	1.412	1.602	1.556	0.878	0.9875	1.2625	1.37	1.314	1.184	1.364	1.176	1.026
Total Strontium	0.001	0.022	0.025	0.024	0.012	0.013	0.018	0.022	0.024	0.021	0.022	0.014	0.015
Total Thallium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Titanium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total Tungsten	0.005	0.00201	0.00201	0.00201	0.00204	0.0025	0.003625	0.0025	0.0025	0.0025	0.0025	0.0025	0.00201
Total Uranium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Vanadium	0.001	0.0005	0.0005	0.0006	0.0005	0.0005	0.000625	0.0005	0.0005	0.00022	0.0005	0.0005	0.00012
Total Zinc	0.001	0.0023	0.0019	0.0034	0.0022	0.0025	0.0015	0.00225	0.003	0.0014	0.0024	0.0038	0.002
Total Carbon	0.5	4.6	4.1	6.0	7.3	7.8	9.6	12.0	17.1	12.4	12.4	13.3	8.3

M:\10100447\02\A\Report9 - Water Quality Model Report\Appendices\Appendix A - Water Quality Inputs (JEM).xlsx\TABLE A9

**NOTES:**

1. DATA ARE AVERAGE MONTHLY VALUES
2. UNITS ARE mg/L UNLESS OTHERWISE SPECIFIED.
3. WATER QUALITY SITE IS CALLED MBB-1

TABLE A10

APPENDIX A - WATER QUALITY MODEL INPUTS  
BACKGROUND GROUNDWATER DATA

Print May/31/13 14:18:09

Parameter	MDL	GW1	GW3	GW4	GW5	GW6	TSF	OPEN PIT
Hardness	0.2	10.7	9.3	9.3	9.4	9.5	7.2	9.5
Alkalinity	2.0	11.0	8.8	8.8	8.8	7.4	6.3	7.4
Ammonia	0.05	0.034	0.025	0.025	0.025	0.07	0.025	0.07
Nitrate	0.05	0.206	0.183	0.183	0.205	0.216	0.253	0.216
Phosphate	0.01	0.0090	0.0063	0.0063	0.0050	0.0100	0.0163	0.0100
Sulphate	1	1.0	1.4	1.4	0.5	2.4	0.5	2.4
Bromide	0.01	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Chloride	0.5	0.79	0.825	0.825	1.2	1.06	1.3	1.06
Fluoride	0.05	0.13	0.10	0.10	0.08	0.11	0.09	0.11
Dissolved Aluminum	0.001	0.060	0.064	0.064	0.043	0.052	0.136	0.052
Dissolved Antimony	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Arsenic	0.001	0.0005	0.0005	0.0005	0.000875	0.0009	0.0025	0.0009
Dissolved Barium	0.001	0.0018	0.002	0.002	0.002	0.002	0.002	0.002
Dissolved Bismuth	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Boron	0.001	0.0009	0.0015	0.0015	0.00175	0.001	0.0015	0.001
Dissolved Cadmium	0.00001	0.000005	0.000005	0.000005	0.000018	0.000020	0.000023	0.000020
Dissolved Calcium	0.05	3.48	2.97	2.97	2.85	2.66	2.05	2.66
Dissolved Chromium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Cobalt	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.0000625	0.00005
Dissolved Copper	0.001	0.0005	0.0005	0.0005	0.0005	0.0009	0.0005	0.0009
Dissolved Iron	0.02	0.096	0.0825	0.0825	0.0525	0.096	0.16	0.096
Dissolved Lead	0.0001	0.00007	0.00005	0.00005	0.00005	0.00005	0.00015	0.00005
Dissolved Lithium	0.0001	0.00258	0.0015	0.0015	0.0005	0.00036	0.00045	0.00036
Dissolved Magnesium	0.01	0.47	0.45	0.45	0.55	0.66	0.50	0.66
Dissolved Manganese	0.001	0.002	0.00225	0.00225	0.00175	0.0024	0.00625	0.0024
Dissolved Mercury	0.000025	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013
Dissolved Molybdenum	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Dissolved Nickel	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Phosphorous	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Dissolved Potassium	0.02	0.29	0.32	0.32	0.37	0.39	0.37	0.39
Dissolved Rubidium	0.0001	0.0013	0.0011	0.0011	0.0008	0.0015	0.0010	0.0015
Dissolved Selenium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Silicon	0.1	13.1	11.3	11.3	11.8	10.0	10.4	10.0
Dissolved Silver	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Sodium	0.05	2.1	1.8	1.8	1.8	1.6	1.7	1.6
Dissolved Strontium	0.001	0.018	0.013	0.013	0.014	0.015	0.013	0.015
Dissolved Thallium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Dissolved Titanium		0.001	0.001	0.001	0.001	0.001	0.001	0.001
Dissolved Tungsten	0.005	0.0020	0.0019	0.0019	0.0019	0.0021	0.0019	0.0021
Dissolved Uranium	0.0001	0.00024	0.0002	0.0002	0.00005	0.00005	0.00005	0.00005
Dissolved Vanadium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Zinc	0.001	0.0013	0.0006	0.0006	0.0013	0.0018	0.0028	0.0018
Total Aluminum	0.001	0.06	0.06375	0.06375	0.04325	0.0518	0.13575	0.0518
Total Antimony	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Arsenic	0.001	0.0005	0.0005	0.0005	0.000875	0.0009	0.0025	0.0009
Total Barium	0.001	0.0018	0.002	0.002	0.002	0.002	0.002	0.002
Total Bismuth	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Boron	0.001	0.0009	0.0015	0.0015	0.00175	0.001	0.0015	0.001
Total Cadmium	0.00001	0.000005	0.000005	0.000005	0.000018	0.000020	0.000023	0.000020
Total Calcium	0.05	3.5	3.0	3.0	2.8	2.7	2.1	2.7
Total Chromium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Cobalt	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.0000625	0.00005
Total Copper	0.001	0.0005	0.0005	0.0005	0.0005	0.0009	0.0005	0.0009
Total Iron	0.02	0.096	0.0825	0.0825	0.0525	0.096	0.16	0.096
Total Lead	0.0001	0.00007	0.00005	0.00005	0.00005	0.00005	0.00015	0.00005
Total Lithium	0.0001	0.00258	0.0015	0.0015	0.0005	0.00036	0.00045	0.00036
Total Magnesium	0.01	0.47	0.45	0.45	0.55	0.66	0.50	0.66
Total Manganese	0.001	0.002	0.00225	0.00225	0.00175	0.0024	0.00625	0.0024
Total Mercury	0.000025	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013	0.000013
Total Molybdenum	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Total Nickel	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Phosphorous	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total Potassium	0.02	0.294	0.315	0.315	0.37	0.386	0.3675	0.386
Total Rubidium	0.0001	0.00134	0.001125	0.001125	0.000775	0.00148	0.000975	0.00148
Total Selenium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Silicon	0.1	13.06	11.3	11.3	11.825	10.04	10.425	10.04
Total Silver	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Sodium	0.05	2.096	1.79	1.79	1.825	1.622	1.7025	1.622
Total Strontium	0.001	0.018	0.013	0.013	0.014	0.015	0.013	0.015
Total Thallium	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Total Titanium		0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total Tungsten	0.005	0.00201	0.0018875	0.0018875	0.0018875	0.0021	0.0018875	0.0021
Total Uranium	0.0001	0.00024	0.0002	0.0002	0.00005	0.00005	0.00005	0.00005
Total Vanadium	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Zinc	0.001	0.0013	0.000625	0.000625	0.00125	0.0018	0.00275	0.0018
Total Carbon	0.5	4.1	3.5	3.5	2.9	3.3	4.7	3.3

M:\10100447\02A\Report\9 - Water Quality Model Report\Appendices\Appendix A - Water Quality Inputs (JEM).xlsx\TABLE A10

**NOTES:**

1. DATA ARE AVERAGE FEBRUARY LOW FLOW VALUES AT THE CLOSEST SURFACE WATER MONITORING SITE.
2. UNITS ARE mg/L UNLESS OTHERWISE SPECIFIED.

**APPENDIX B**

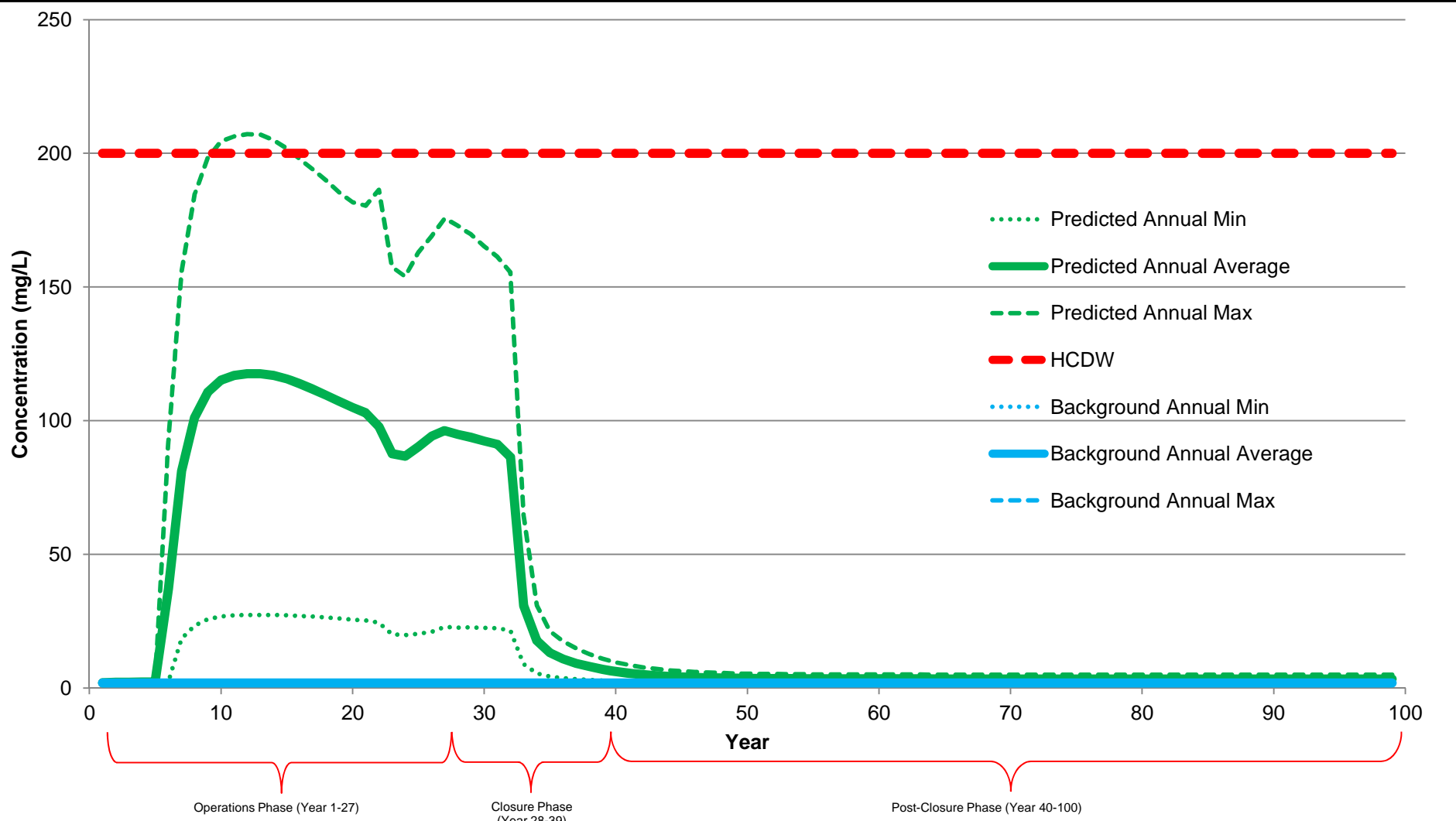
**MODEL OUTPUT GRAPHS**

Appendix B1	Sodium
Appendix B2	Manganese
Appendix B3	Fluride
Appendix B4	Aluminum
Appendix B5	Arsenic
Appendix B6	Cadium
Appendix B7	Chromium
Appendix B8	Copper
Appendix B9	Selenium
Appendix B10	Lead

**APPENDIX B1**

**SODIUM**

(Figures B1-1 to B1-8)

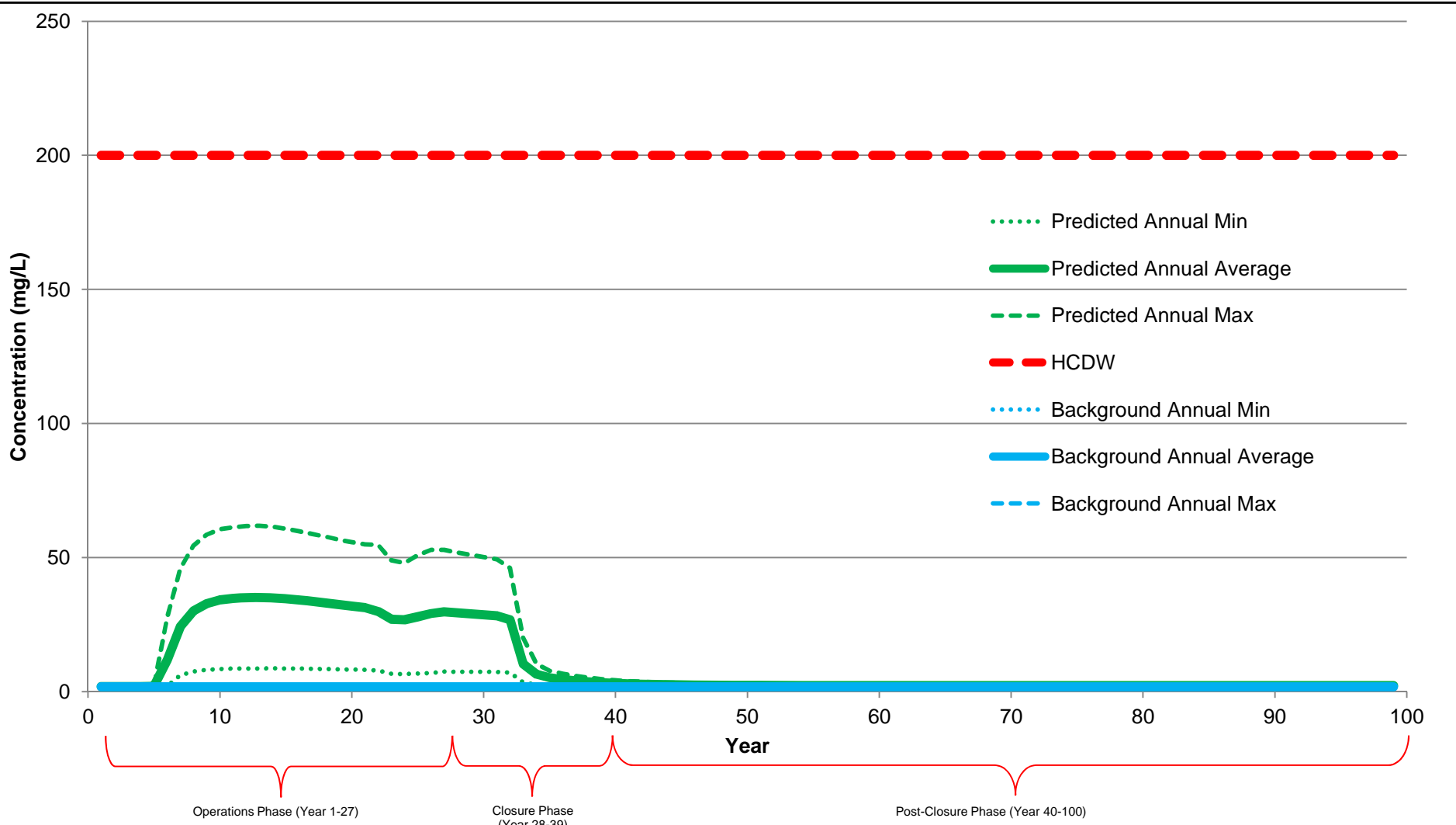


- NOTES:**
1. THERE IS NO CEQG FOR Na.
  2. THERE IS NO MMER GUIDELINE FOR Na.
  3. THE HCDW LIMIT FOR Na IS AN AESTHETIC GUIDELINE BASED ON TASTE.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF SODIUM IN UT1</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B1.1</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

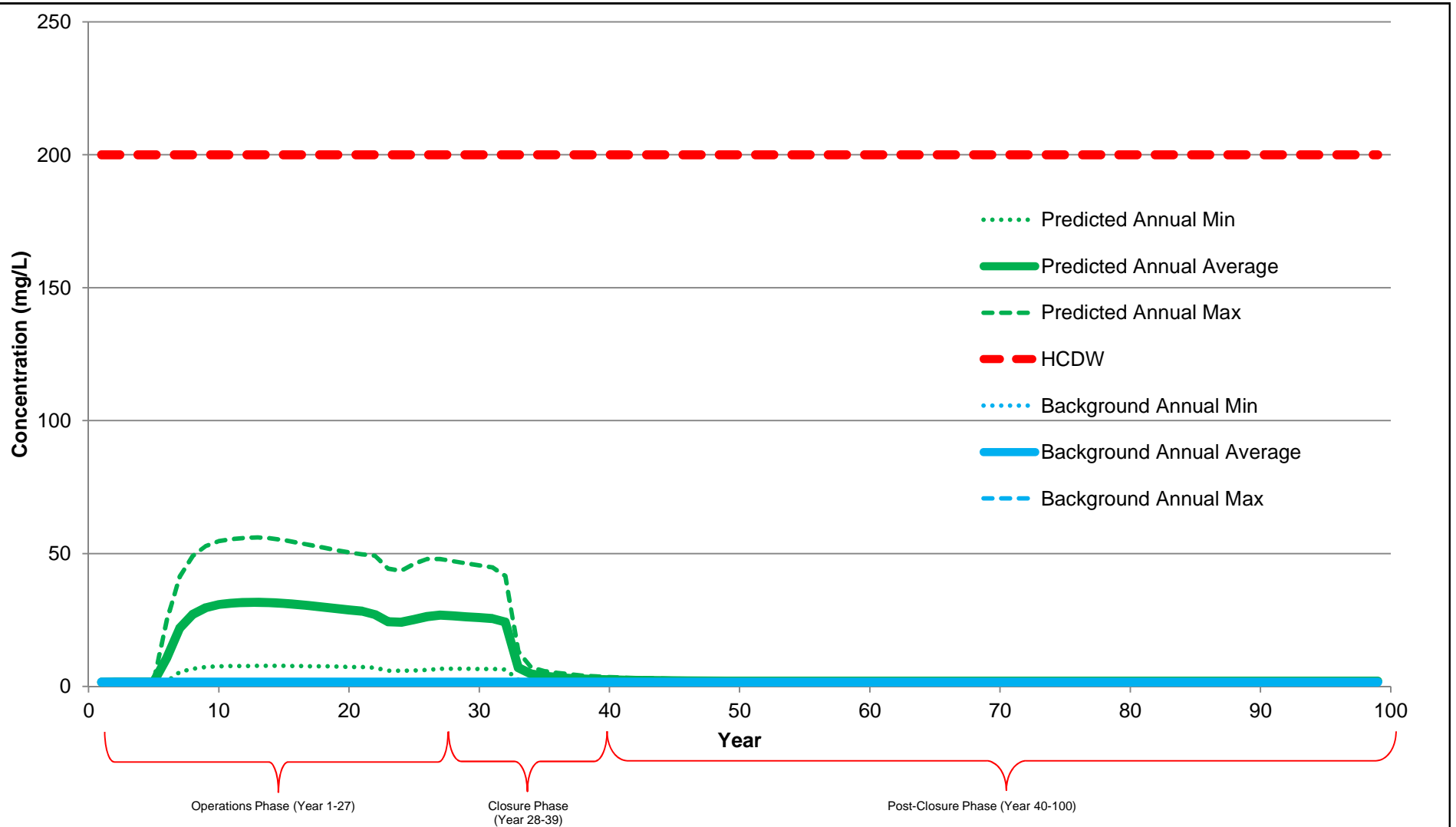




- NOTES:**
1. THERE IS NO CEQG FOR Na.
  2. THERE IS NO MMER GUIDELINE FOR Na.
  3. THE HCDW LIMIT FOR Na IS AN AESTHETIC GUIDELINE BASED ON TASTE.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF SODIUM IN NAP1</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B1.2</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

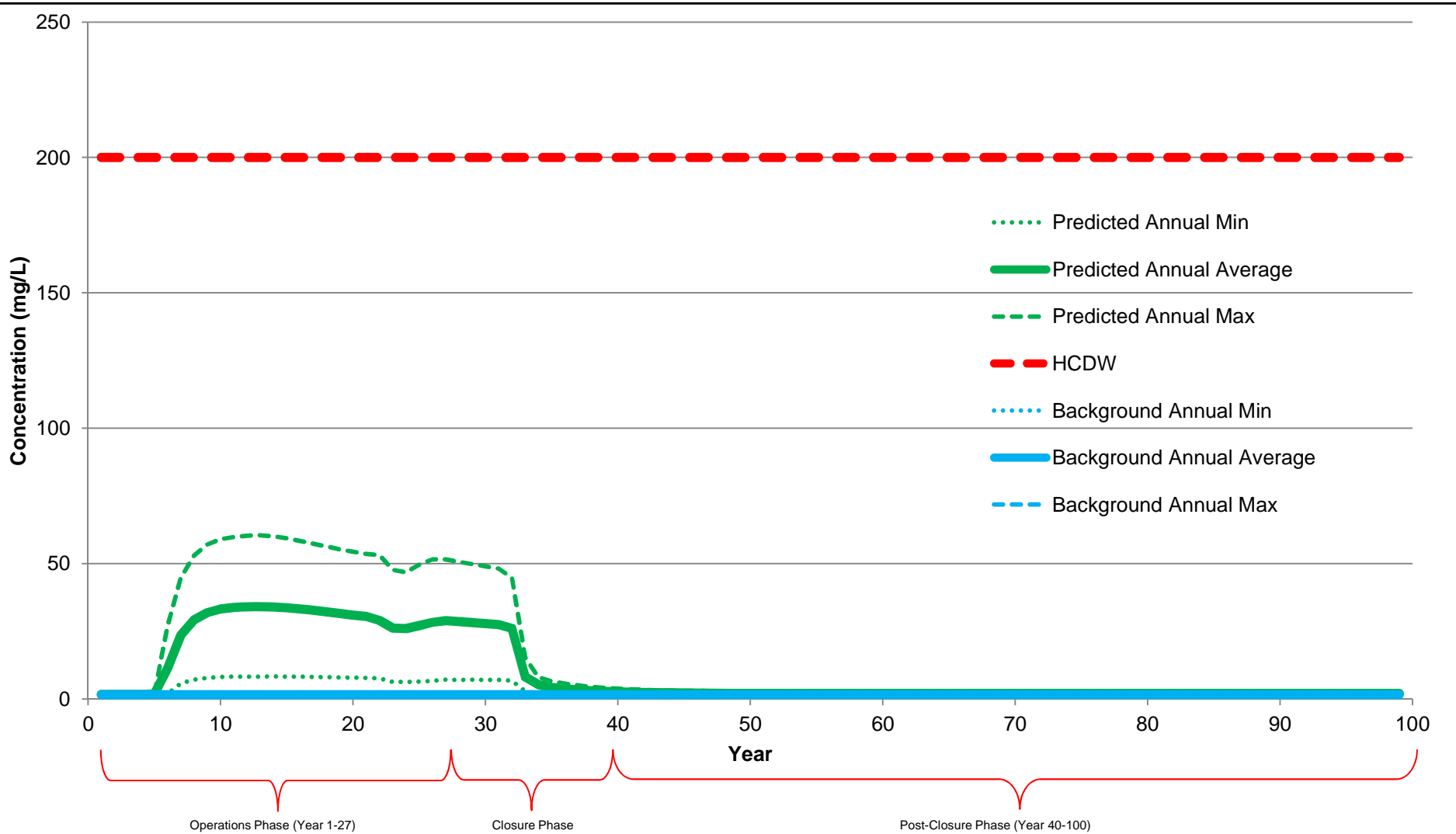


**NOTES:**

1. THERE IS NO CEQG FOR Na.
2. THERE IS NO MMER GUIDELINE FOR Na.
3. THE HCDW LIMIT FOR Na IS AN AESTHETIC GUIDELINE BASED ON TASTE.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF SODIUM IN NAP2</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B1.3</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

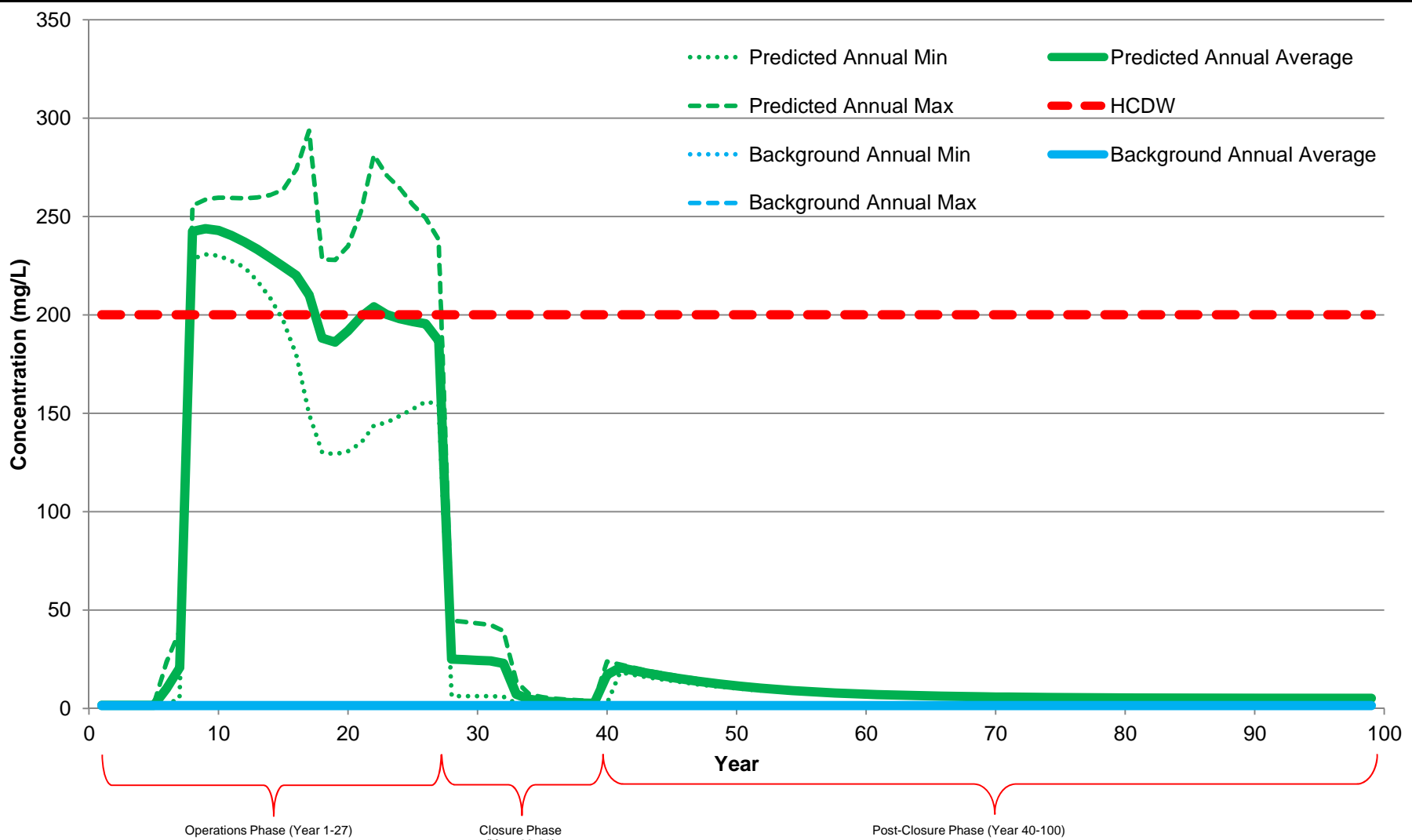


**NOTES:**

1. THERE IS NO CEQG FOR Na.
2. THERE IS NO MMER GUIDELINE FOR Na.
3. THE HCDW LIMIT FOR Na IS AN AESTHETIC GUIDELINE BASED ON TASTE.

<b>NORTHCLIFF RESOURCES LTD.</b>		
<b>SISSON PROJECT</b>		
<b>PREDICTED CONCENTRATION OF SODIUM IN NAP3</b>		
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2	REF. NO. 9
	<b>Figure B1.4</b>	
		REV 0

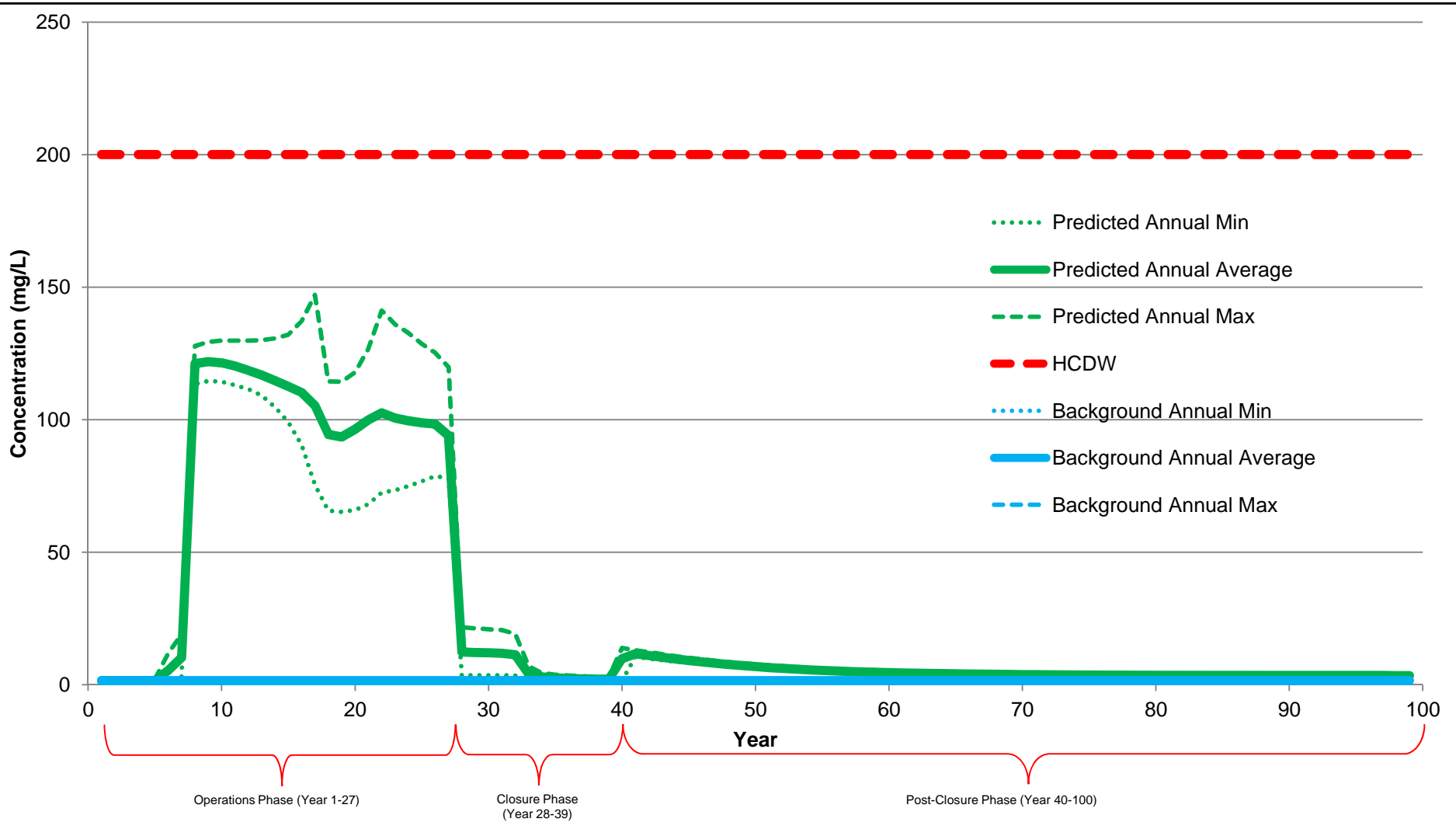
0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**  
 1. THERE IS NO CEQG FOR Na.  
 2. THERE IS NO MMR GUIDELINE FOR Na.  
 3. THE HCDW LIMIT FOR Na IS AN AESTHETIC GUIDELINE BASED ON TASTE.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF SODIUM IN NAP5</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B1.5</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

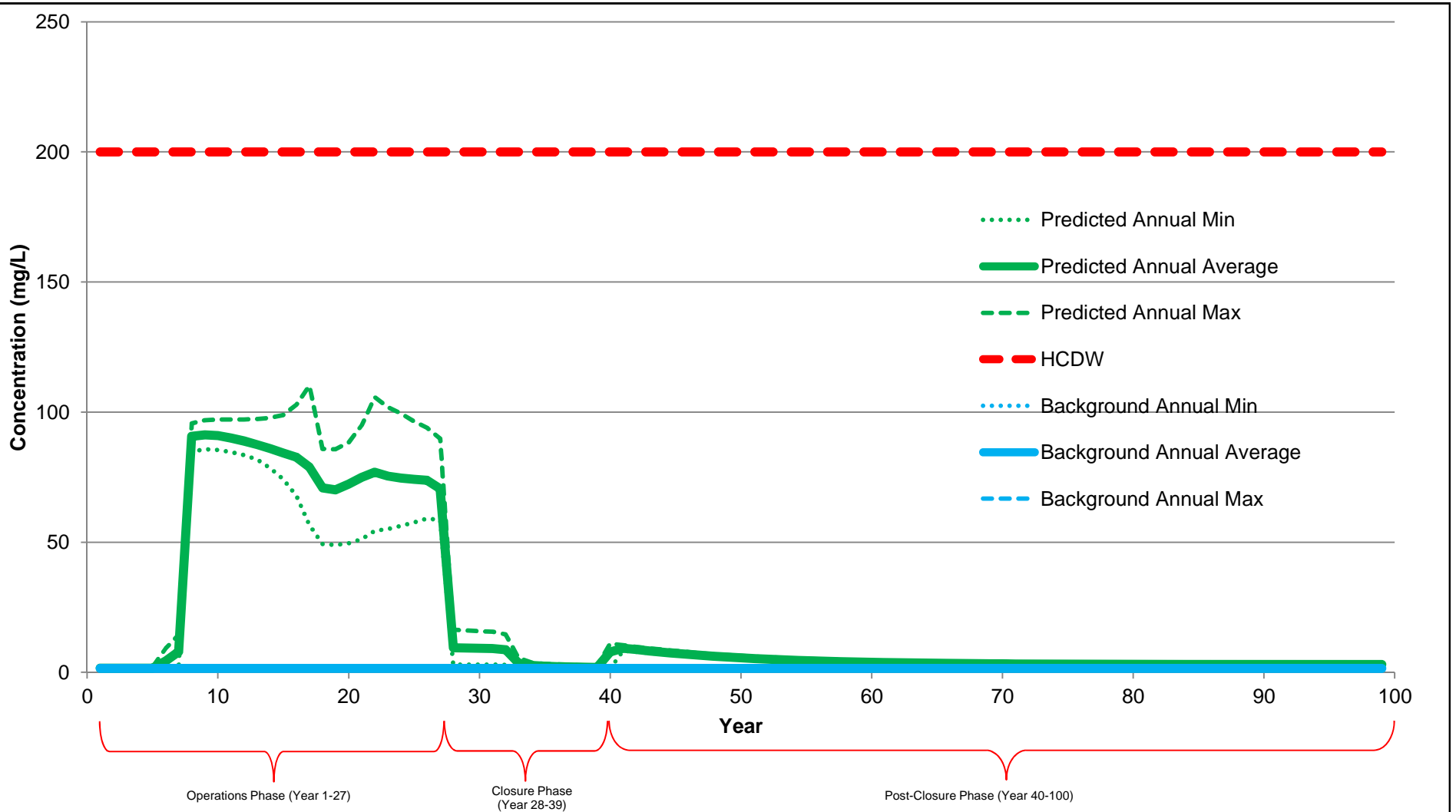


**NOTES:**

1. THERE IS NO CEQG FOR Na.
2. THERE IS NO MMER GUIDELINE FOR Na.
3. THE HCDW LIMIT FOR Na IS AN AESTHETIC GUIDELINE BASED ON TASTE.

<b>NORTHCLIFF RESOURCES LTD.</b>		
<b>SISSON PROJECT</b>		
<b>PREDICTED CONCENTRATION OF SODIUM IN NAP7</b>		
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2	REF. NO. 9
	<b>Figure B1.6</b>	
REV 0		

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

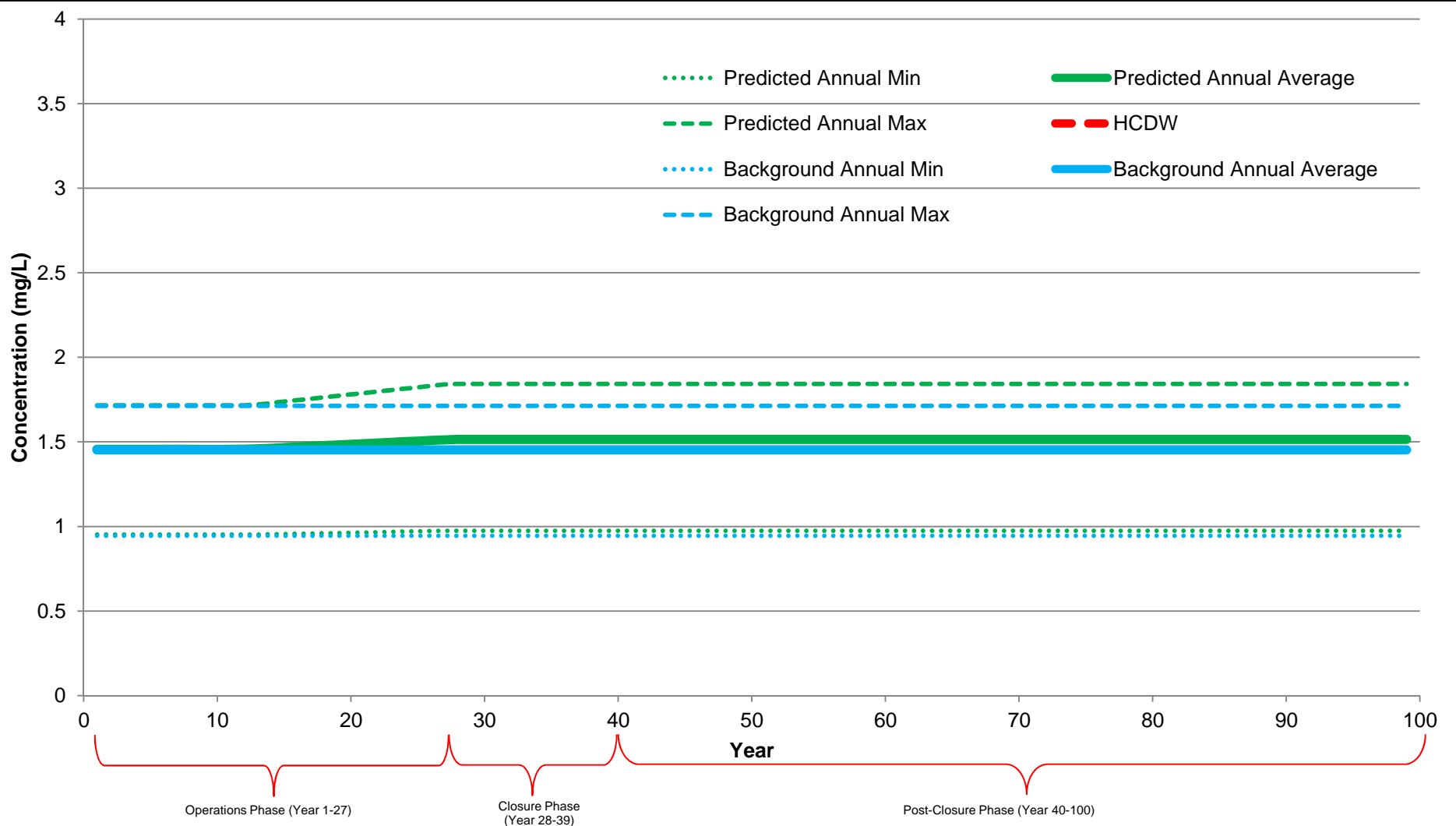


**NOTES:**

1. THERE IS NO CEQG FOR Na.
2. THERE IS NO MMER GUIDELINE FOR Na.
3. THE HCDW LIMIT FOR Na IS AN AESTHETIC GUIDELINE BASED ON TASTE.

<b>NORTHCLIFF RESOURCES LTD.</b>		
<b>SISSON PROJECT</b>		
<b>PREDICTED CONCENTRATION OF SODIUM IN NAP8</b>		
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2	REF. NO. 9
	<b>Figure B1.7</b>	
REV 0		

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**

1. THERE IS NO CEQG FOR Na.
2. THERE IS NO MMR GUIDELINE FOR Na.
3. THE HCDW LIMIT FOR Na IS AN AESTHETIC GUIDELINE BASED ON TASTE.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF SODIUM IN MBB2</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B1.8</b>	
REV 0	

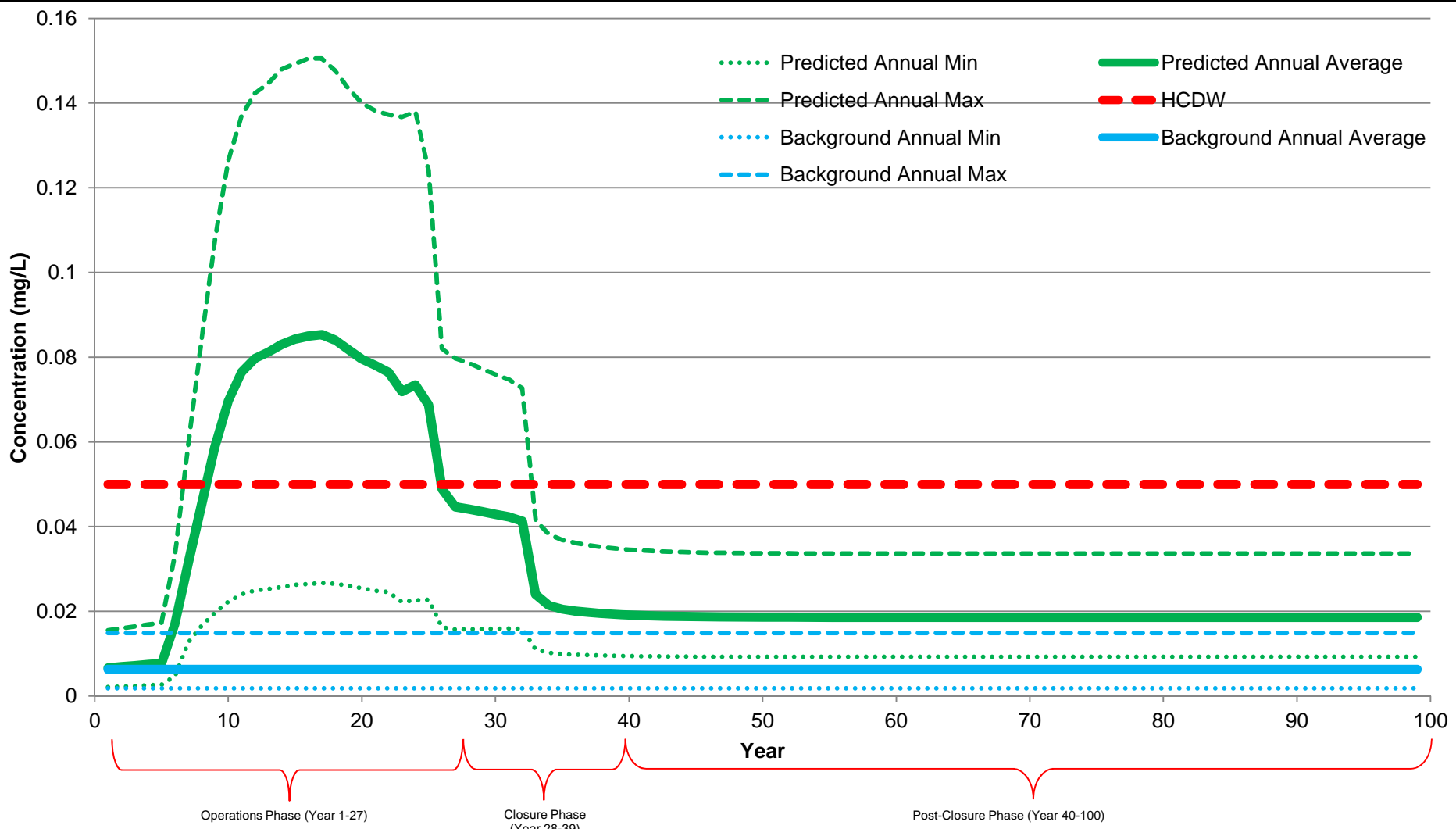
0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

**APPENDIX B2**

**MANGANESE**

(Figures B2-1 to B2-8)



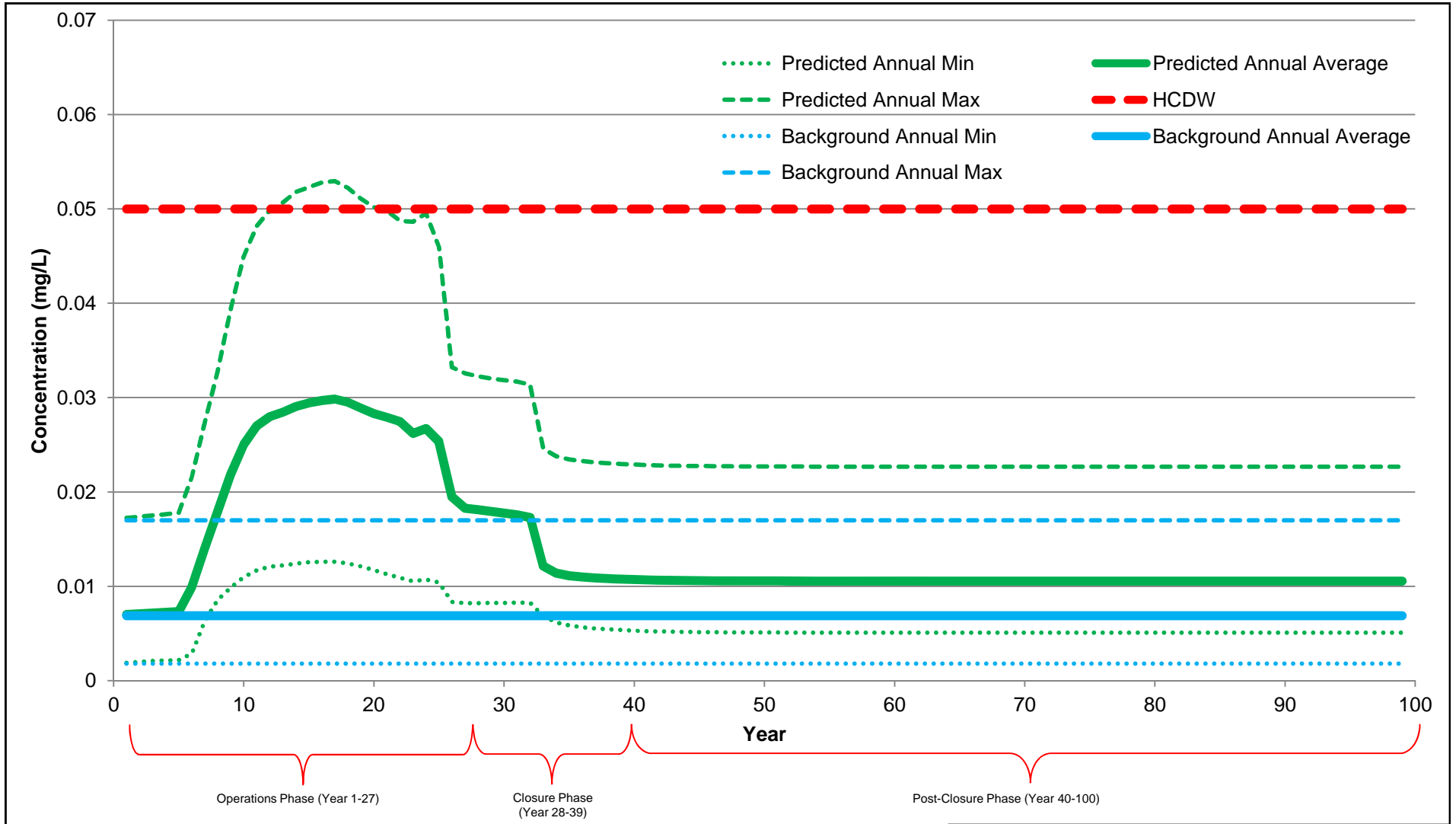


**NOTES:**

1. THERE IS NO CEQG FOR Mn.
2. THE HCDW LIMIT FOR Mn IS AN AESTHETIC GUIDELINE BASED ON TASTE.

<b>NORTHCLIFF RESOURCES LTD.</b>		
<b>SISSON PROJECT</b>		
<b>PREDICTED CONCENTRATION OF MANGANESE IN UT1</b>		
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2	REF. NO. 9
	<b>Figure B2.1</b>	
		REV 0

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

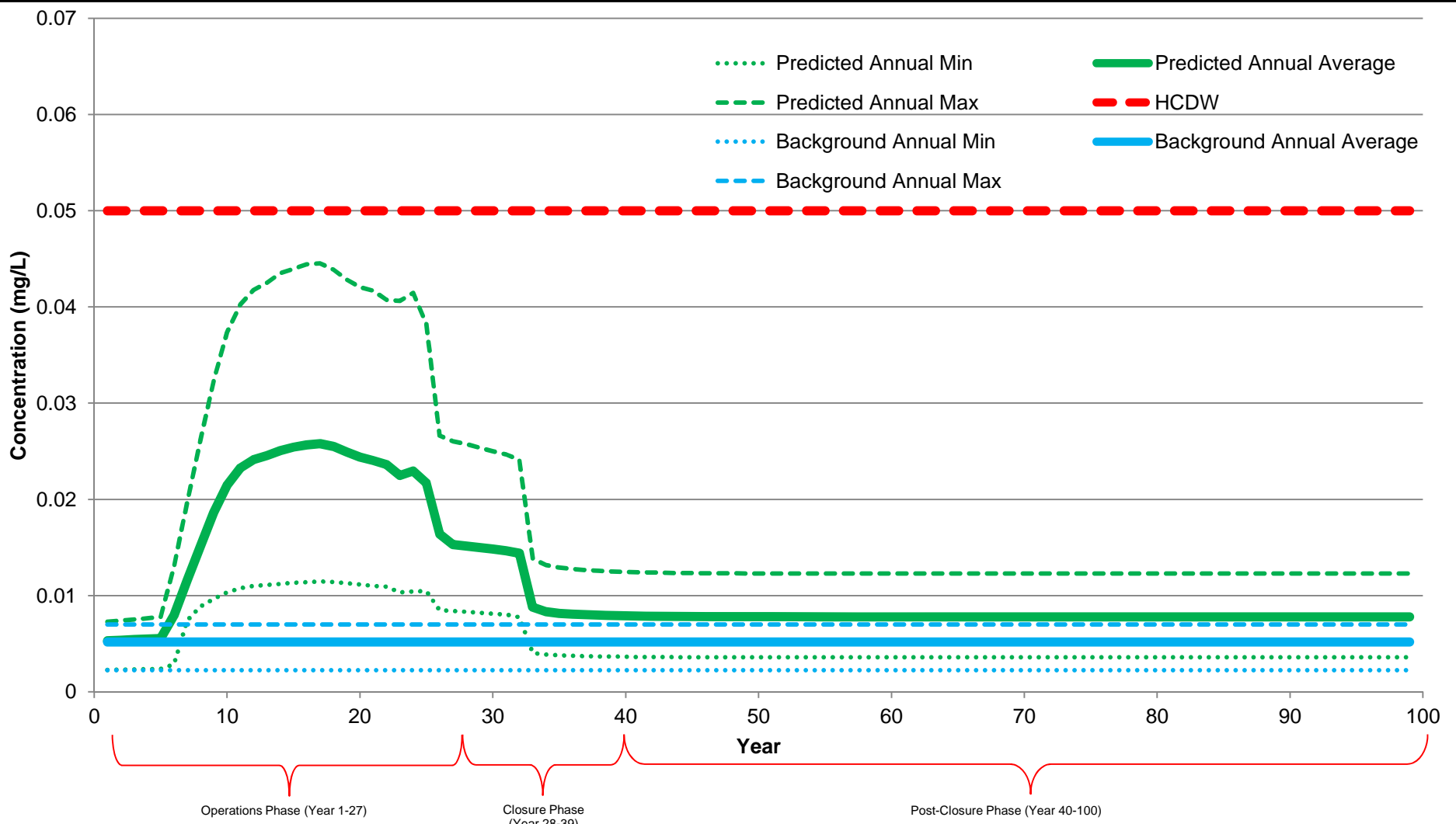


**NOTES:**

1. THERE IS NO CEQG FOR Mn.
2. THE HCDW LIMIT FOR Mn IS AN AESTHETIC GUIDELINE BASED ON TASTE.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF MANGANESE IN NAP1</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B2.2</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

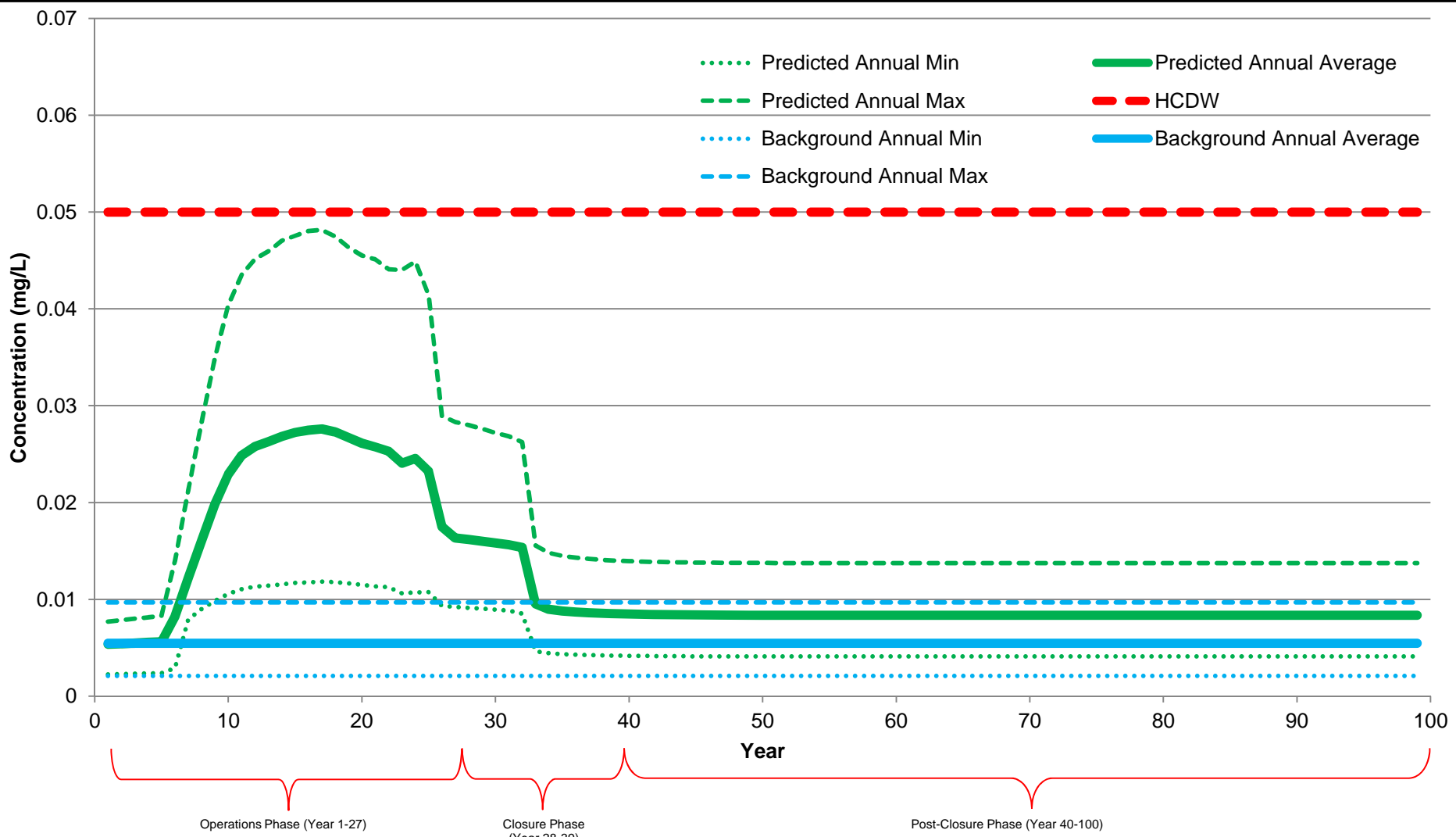


**NOTES:**

1. THERE IS NO CEQG FOR Mn.
2. THE HCDW LIMIT FOR Mn IS AN AESTHETIC GUIDELINE BASED ON TASTE.

<b>NORTHCLIFF RESOURCES LTD.</b>		
<b>SISSON PROJECT</b>		
<b>PREDICTED CONCENTRATION OF MANGANESE IN NAP2</b>		
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2	REF. NO. 9
	<b>Figure B2.3</b>	
		REV 0

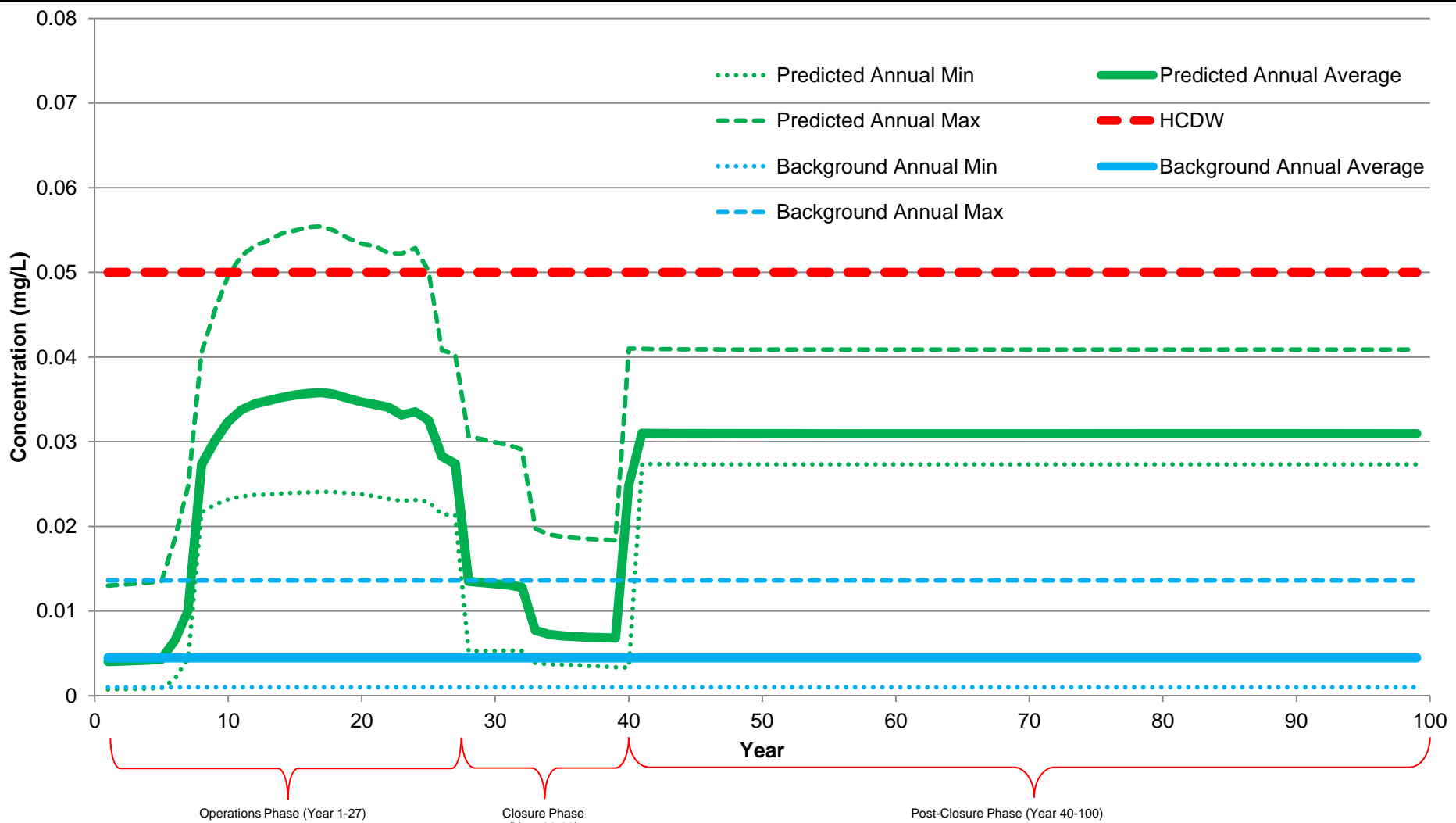
0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**  
 1. THERE IS NO CEQG FOR Mn.  
 2. THE HCDW LIMIT FOR Mn IS AN AESTHETIC GUIDELINE BASED ON TASTE.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF MANGANESE IN NAP3</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B2.4</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

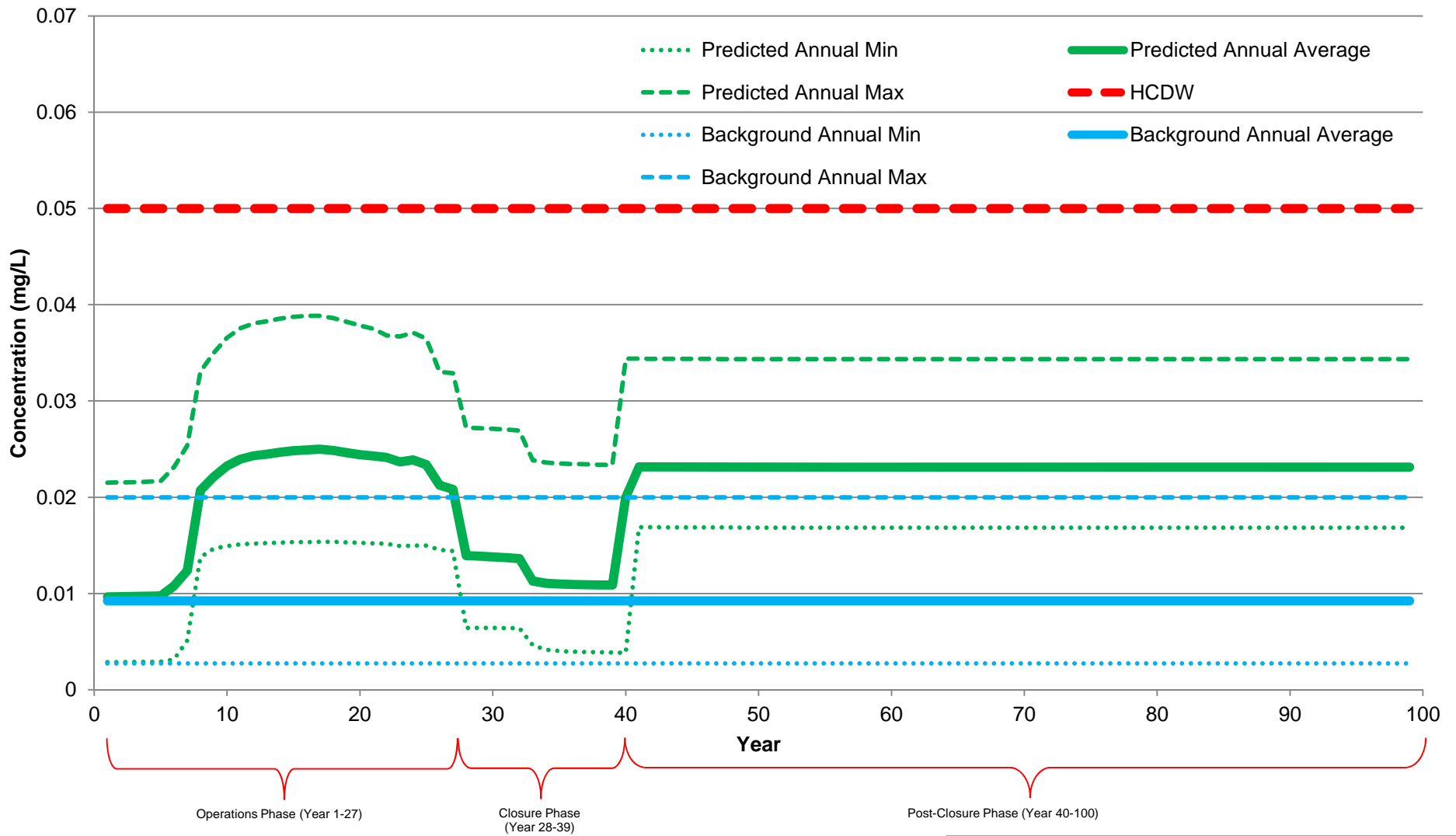


**NOTES:**

1. THERE IS NO CEQG FOR Mn.
2. THE HCDW LIMIT FOR Mn IS AN AESTHETIC GUIDELINE BASED ON TASTE.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF MANGANESE IN NAP5</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B2.5</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

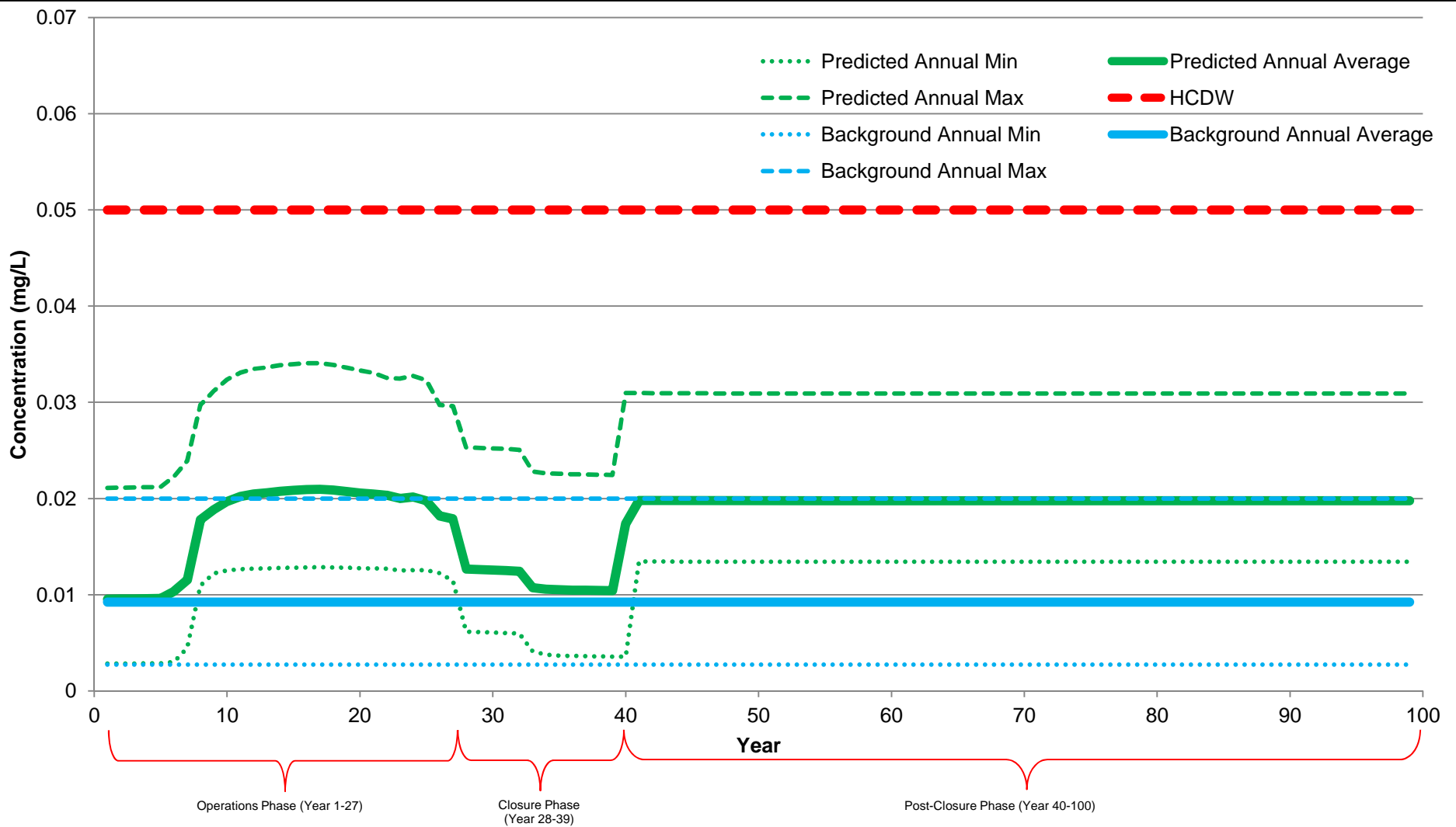


**NOTES:**

1. THERE IS NO CEQG FOR Mn.
2. THE HCDW LIMIT FOR Mn IS AN AESTHETIC GUIDELINE BASED ON TASTE.

<b>NORTHCLIFF RESOURCES LTD.</b>		
<b>SISSON PROJECT</b>		
<b>PREDICTED CONCENTRATION OF MANGANESE IN NAP7</b>		
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2	REF. NO. 9
	<b>Figure B2.6</b>	
		REV 0

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

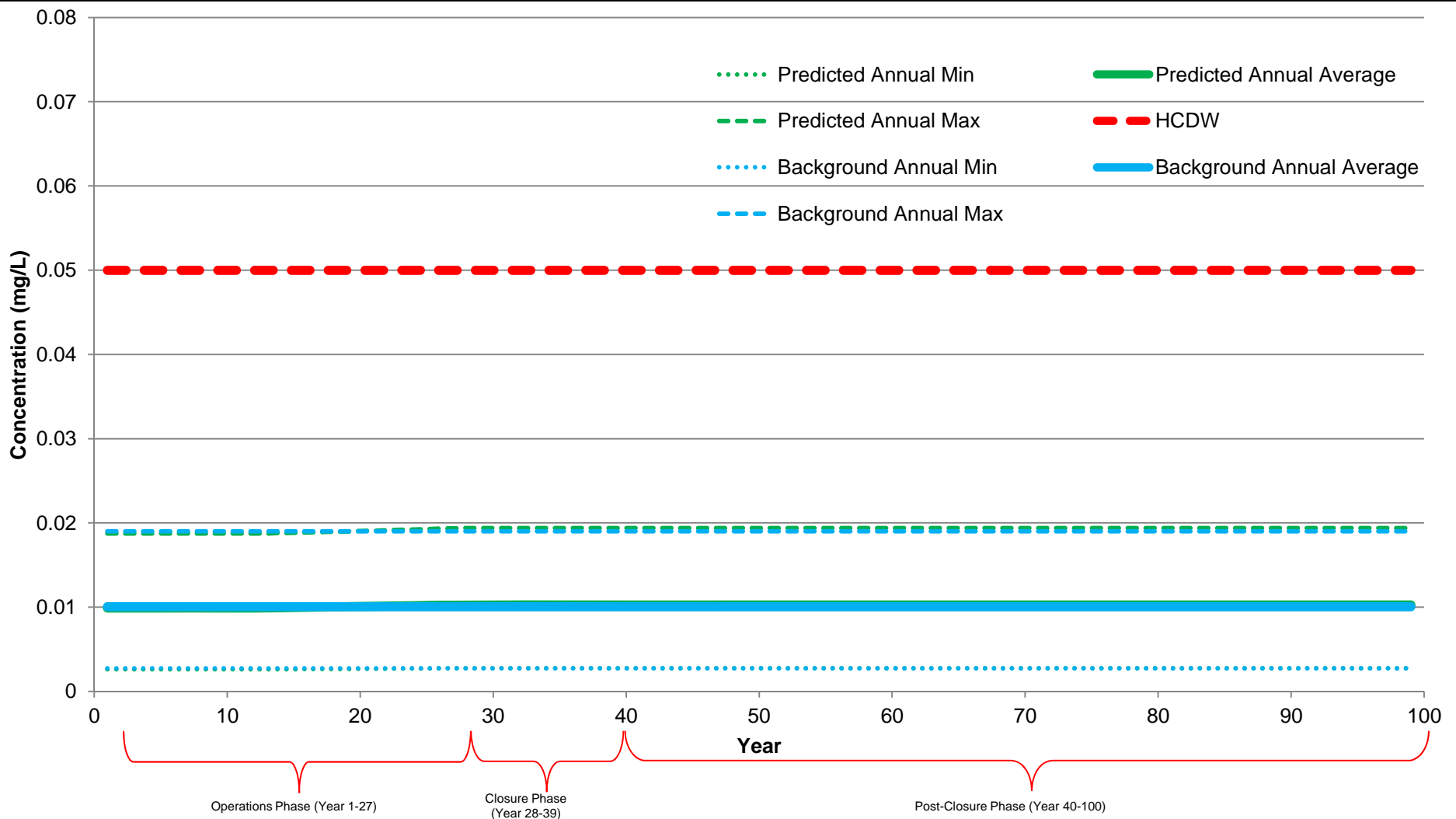


**NOTES:**

1. THERE IS NO CEQG FOR Mn.
2. THE HCDW LIMIT FOR Mn IS AN AESTHETIC GUIDELINE BASED ON TASTE.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF MANGANESE IN NAP8</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B2.7</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**

1. THERE IS NO CEQG FOR Mn.
2. THE HCDW LIMIT FOR Mn IS AN AESTHETIC GUIDELINE BASED ON TASTE.

<b>NORTHCLIFF RESOURCES LTD.</b>		
<b>SISSON PROJECT</b>		
<b>PREDICTED CONCENTRATION OF MANGANESE IN MBB2</b>		
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2	REF. NO. 9
	<b>Figure B2.8</b>	
		REV 0

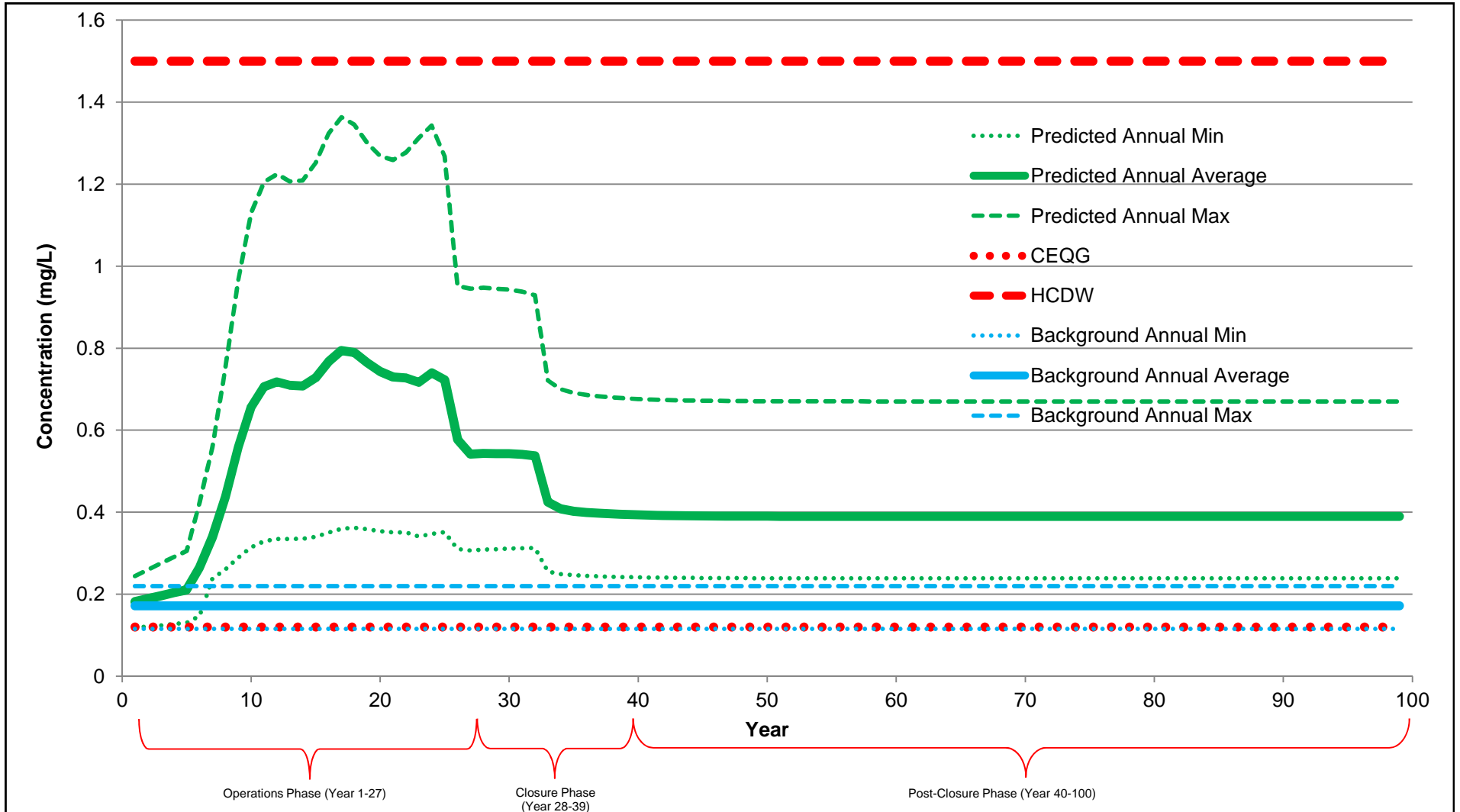
0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**APPENDIX B3**

**FLURIDE**

(Figures B3-1 to B3-8)

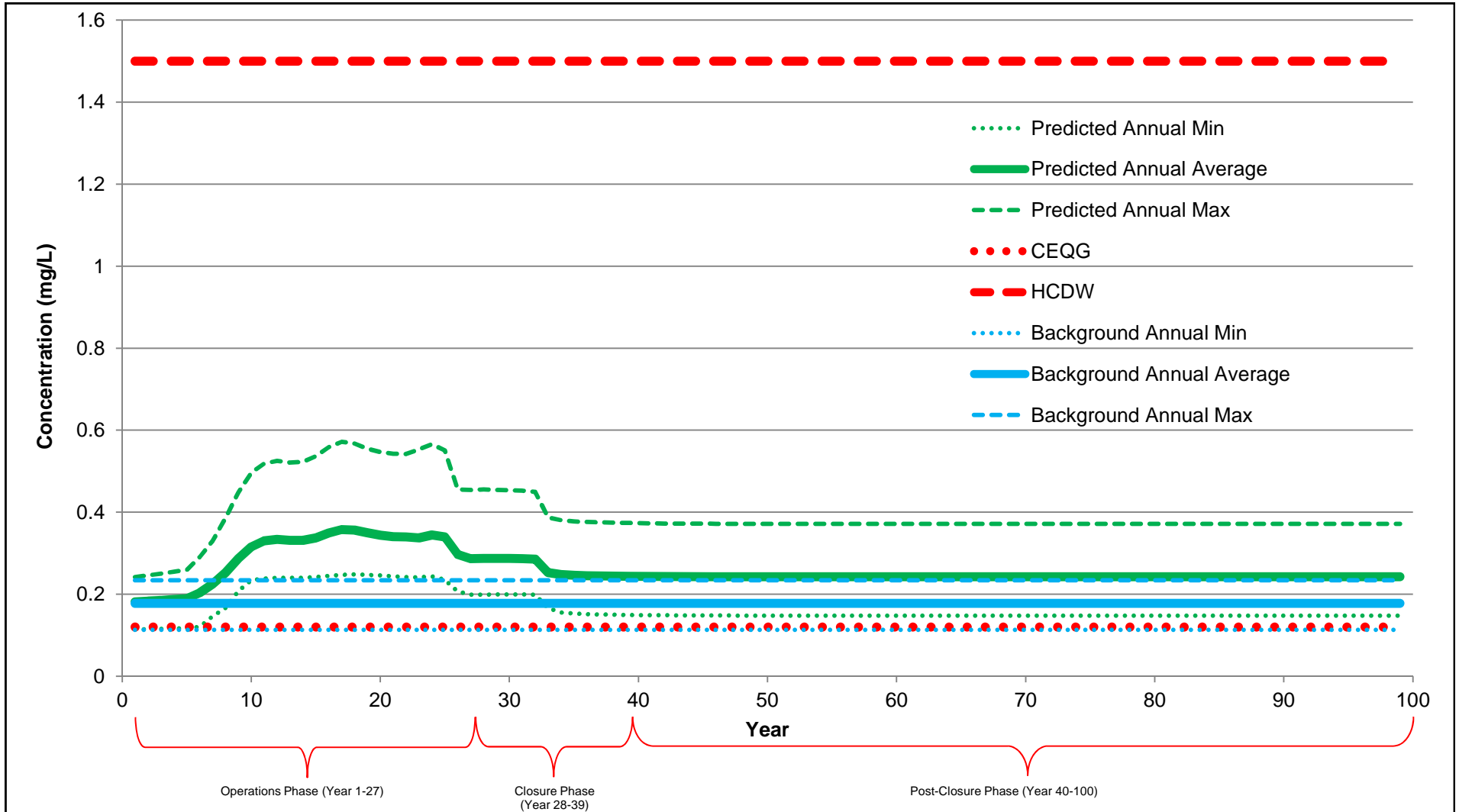


**NOTES:**

1. NO MMER GUIDELINE FOR F.

<b>NORTHCLIFF RESOURCES LTD.</b>		
<b>SISSON PROJECT</b>		
<b>PREDICTED CONCENTRATION OF FLUORIDE IN UT1</b>		
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2	REF. NO. 9
	<b>Figure B3.1</b>	
		REV 0

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

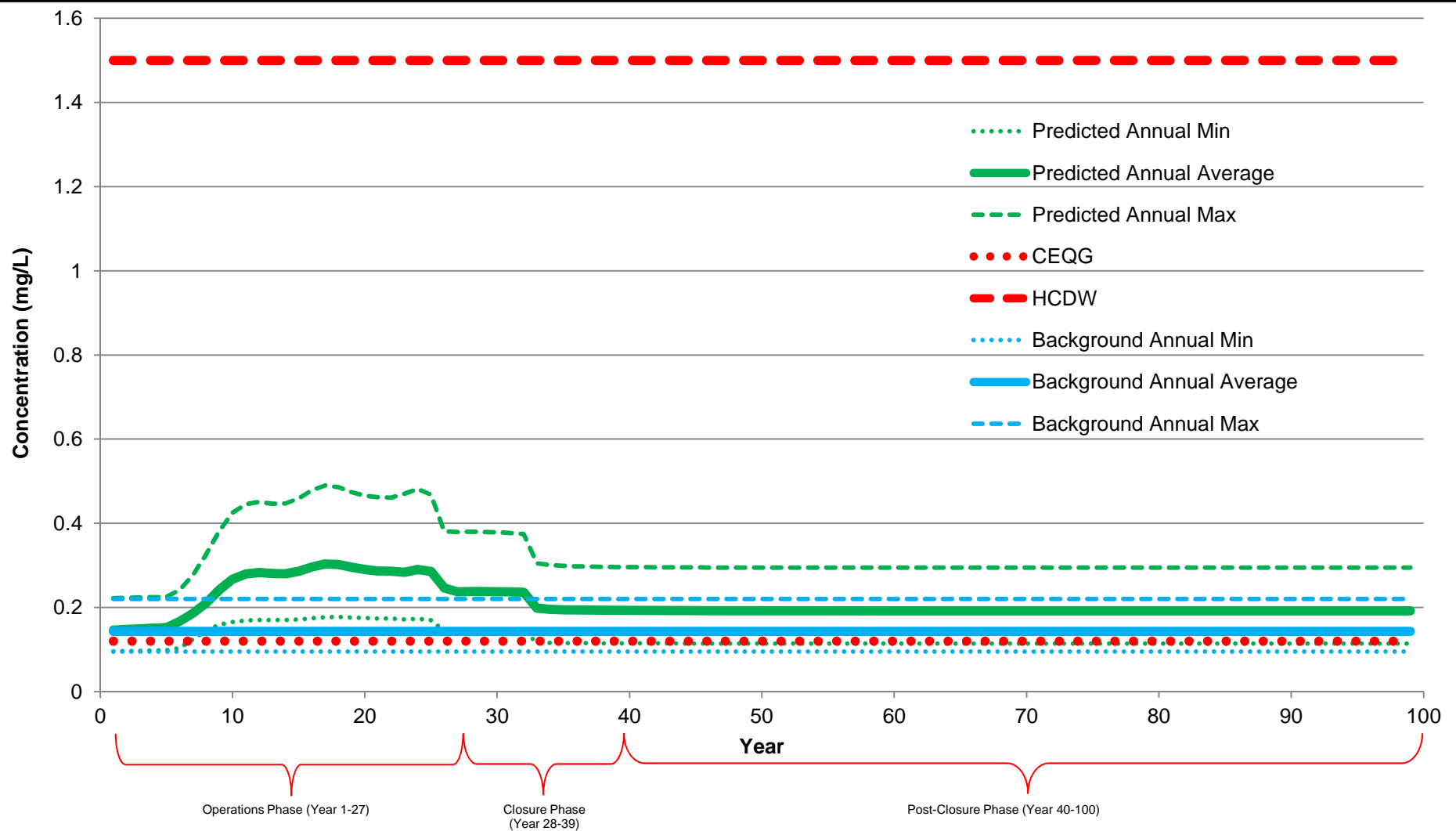


**NOTES:**

1. NO MMER GUIDELINE FOR F.

<b>NORTHCLIFF RESOURCES LTD.</b>		
<b>SISSON PROJECT</b>		
<b>PREDICTED CONCENTRATION OF FLUORIDE IN NAP1</b>		
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2	REF. NO. 9
	<b>Figure B3.2</b>	
REV 0		

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

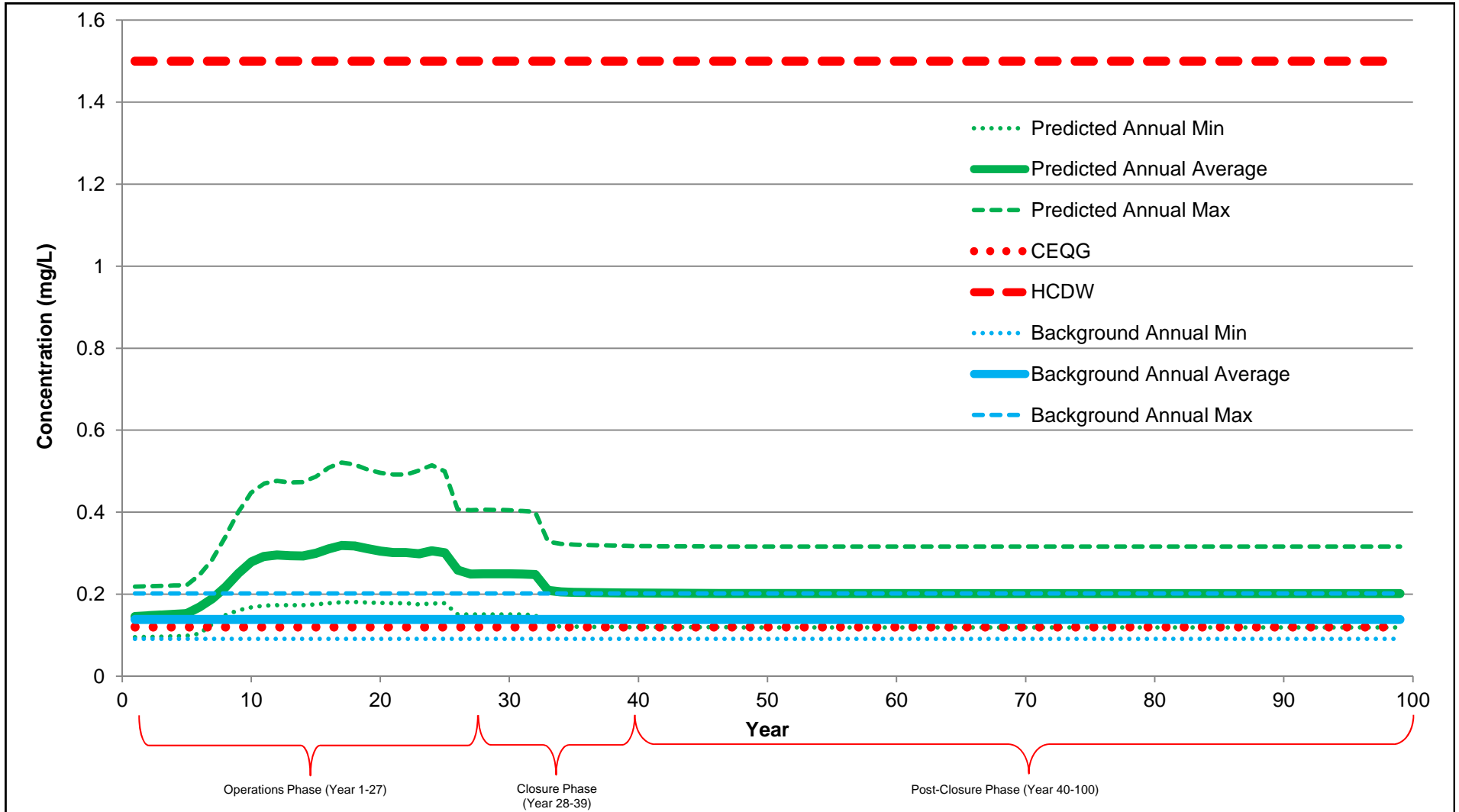


**NOTES:**

1. NO MMER GUIDELINE FOR F.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF FLUORIDE IN NAP2</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B3.3</b>	
REV 0	

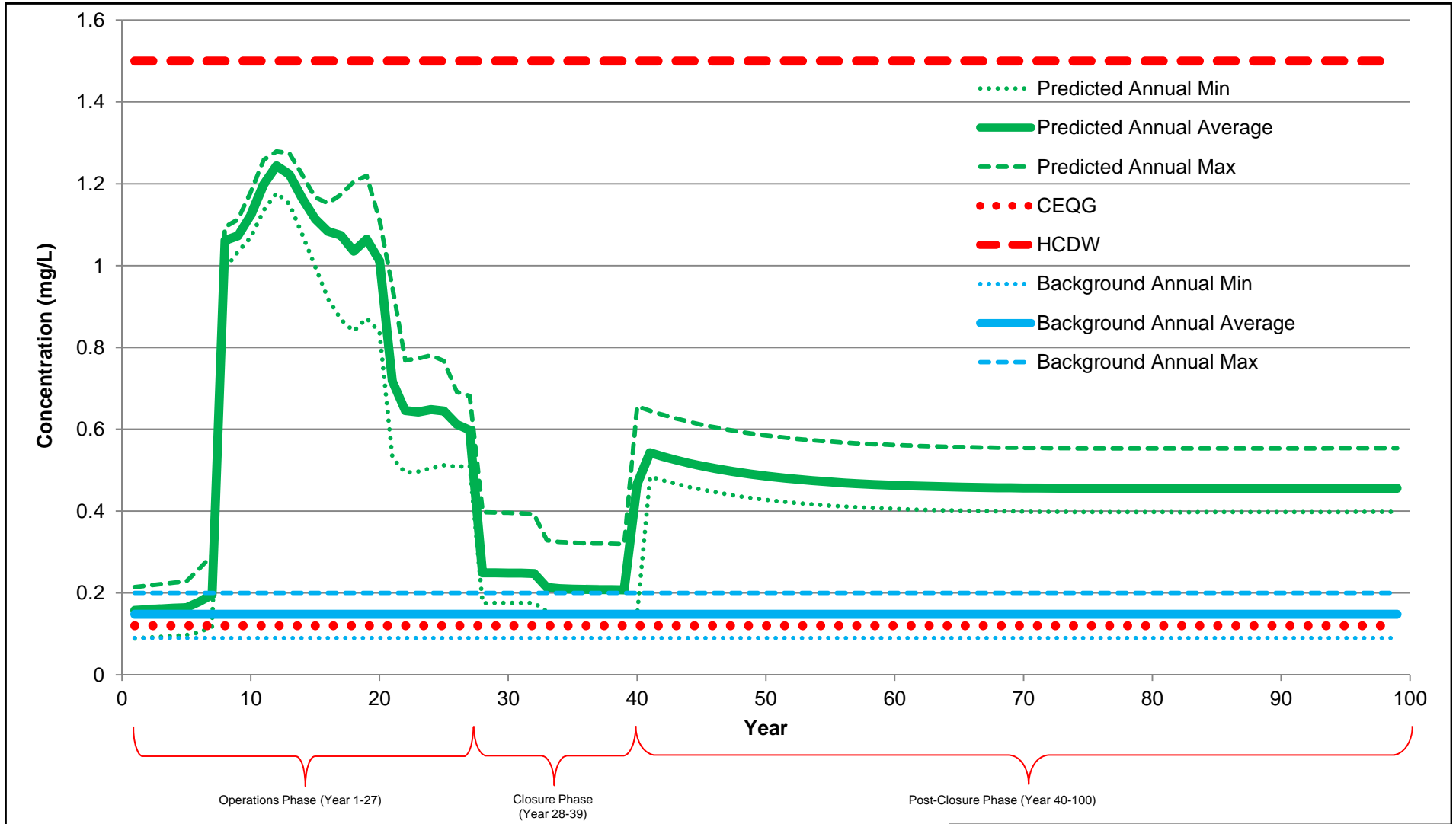
0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**  
1. NO MMER GUIDELINE FOR F.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF FLUORIDE IN NAP3</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B3.4</b>	
REV 0	

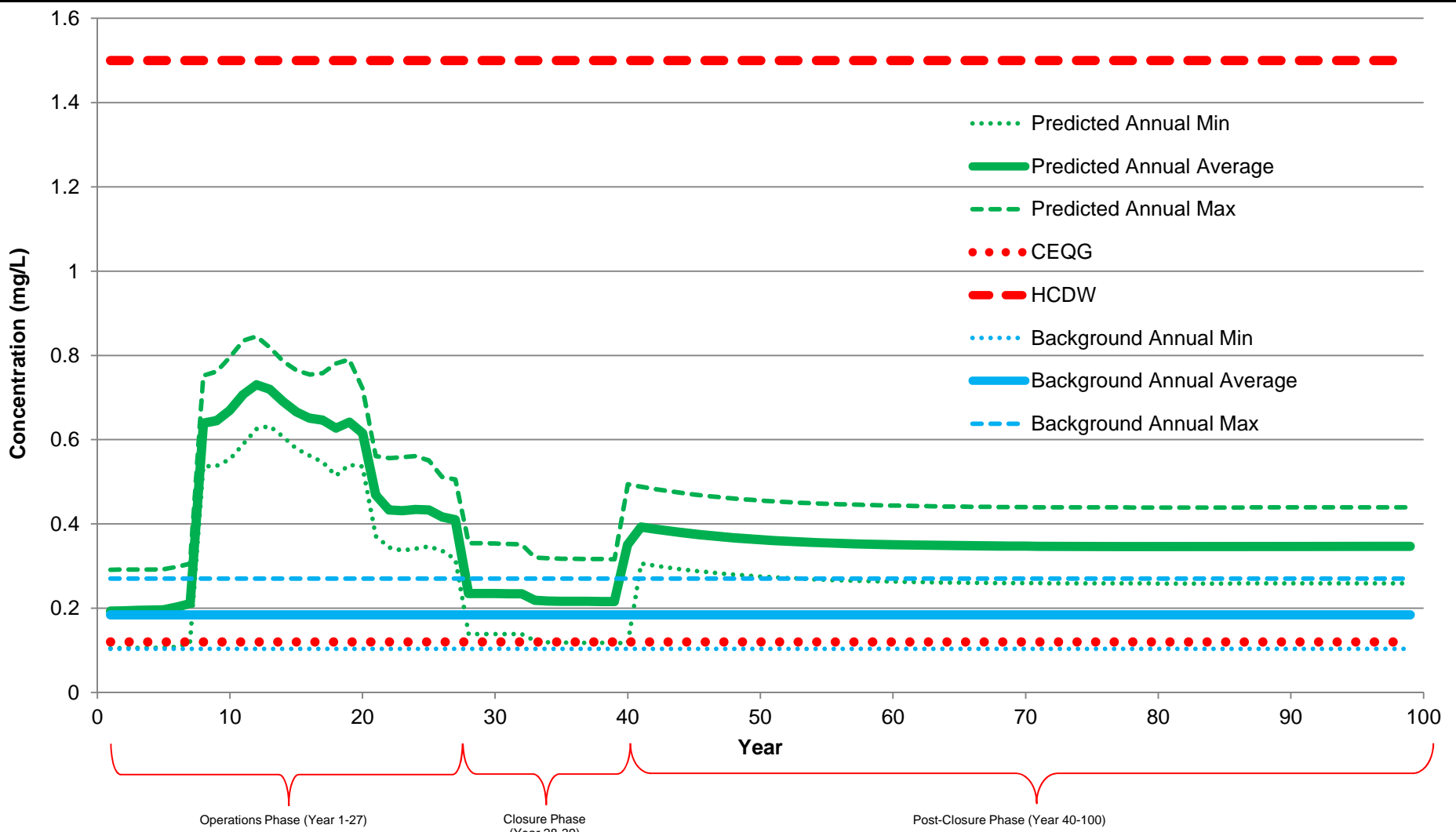
0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**  
1. NO MMR GUIDELINE FOR F.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF FLUORIDE IN NAP5</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2  REF. NO. 9  <b>Figure B3.5</b>
REV 0	REV 0

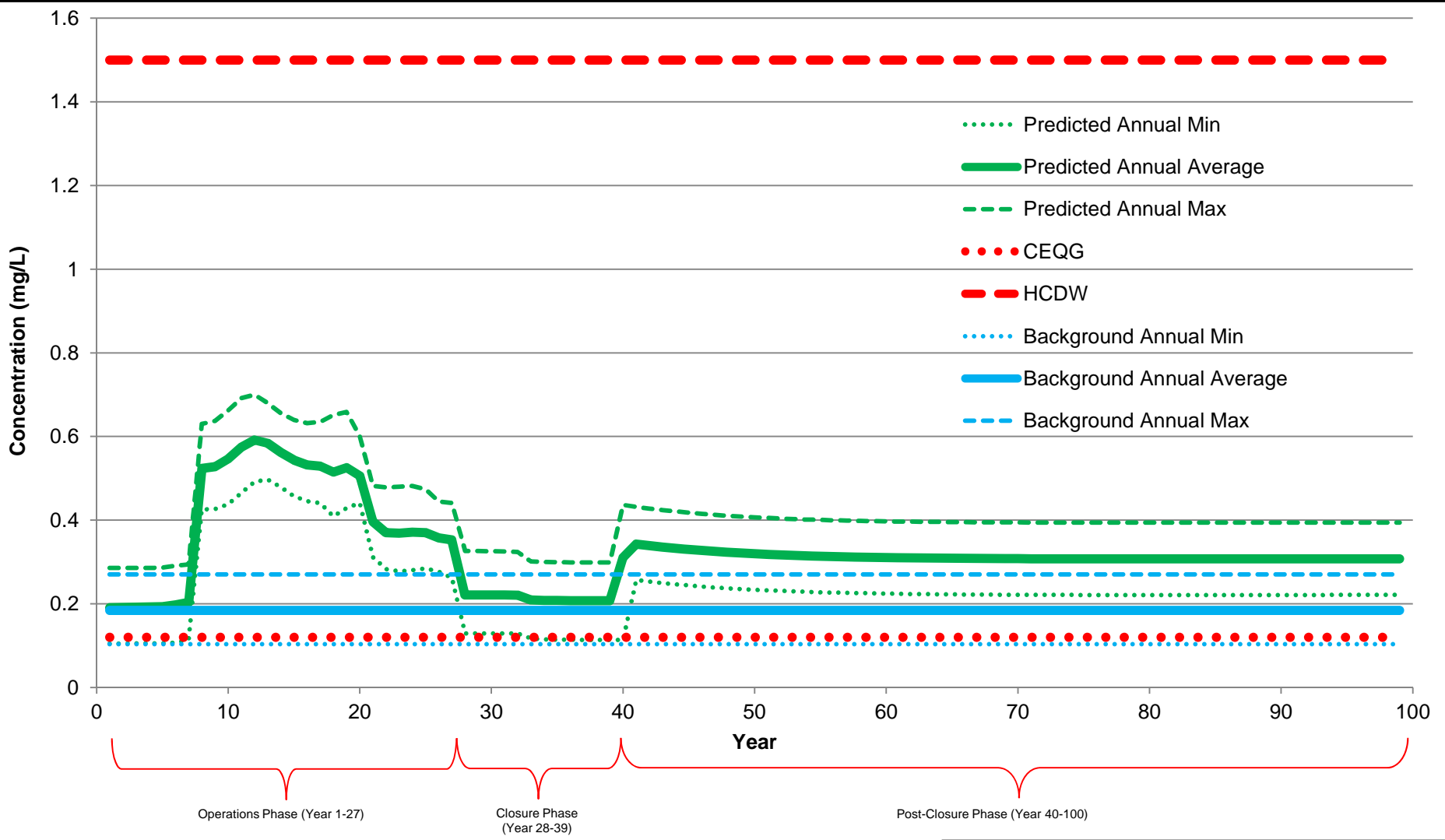
0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**  
1. NO MMER GUIDELINE FOR F.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF FLUORIDE IN NAP7</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B3.6</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

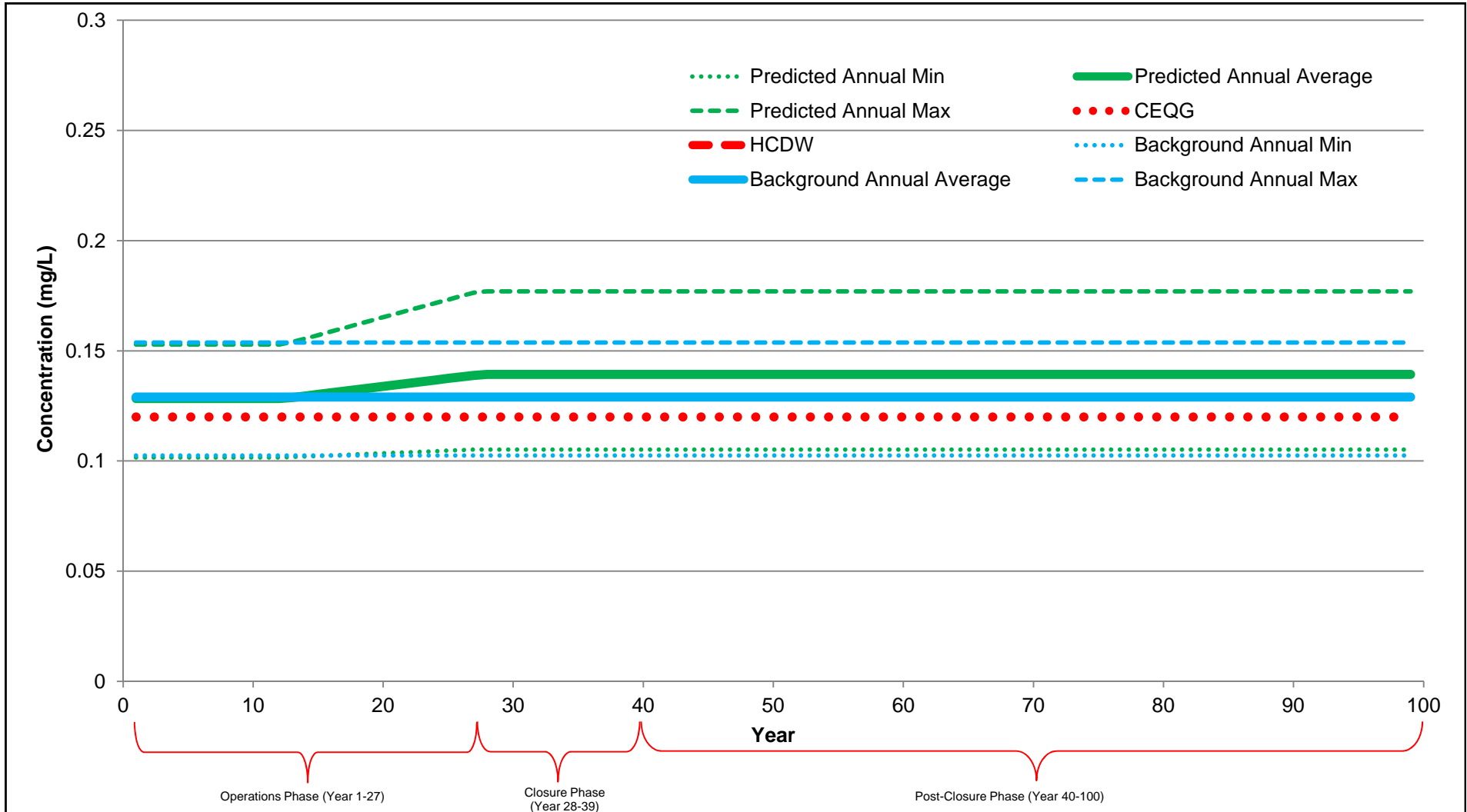


**NOTES:**  
1. NO MMR GUIDELINE FOR F.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF FLUORIDE IN NAP8</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B3.7</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D





**NOTES:**

- 1. NO MMER GUIDELINE FOR F.
- 2. HCDW GUIDELINE FOR F IS 1.5 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.

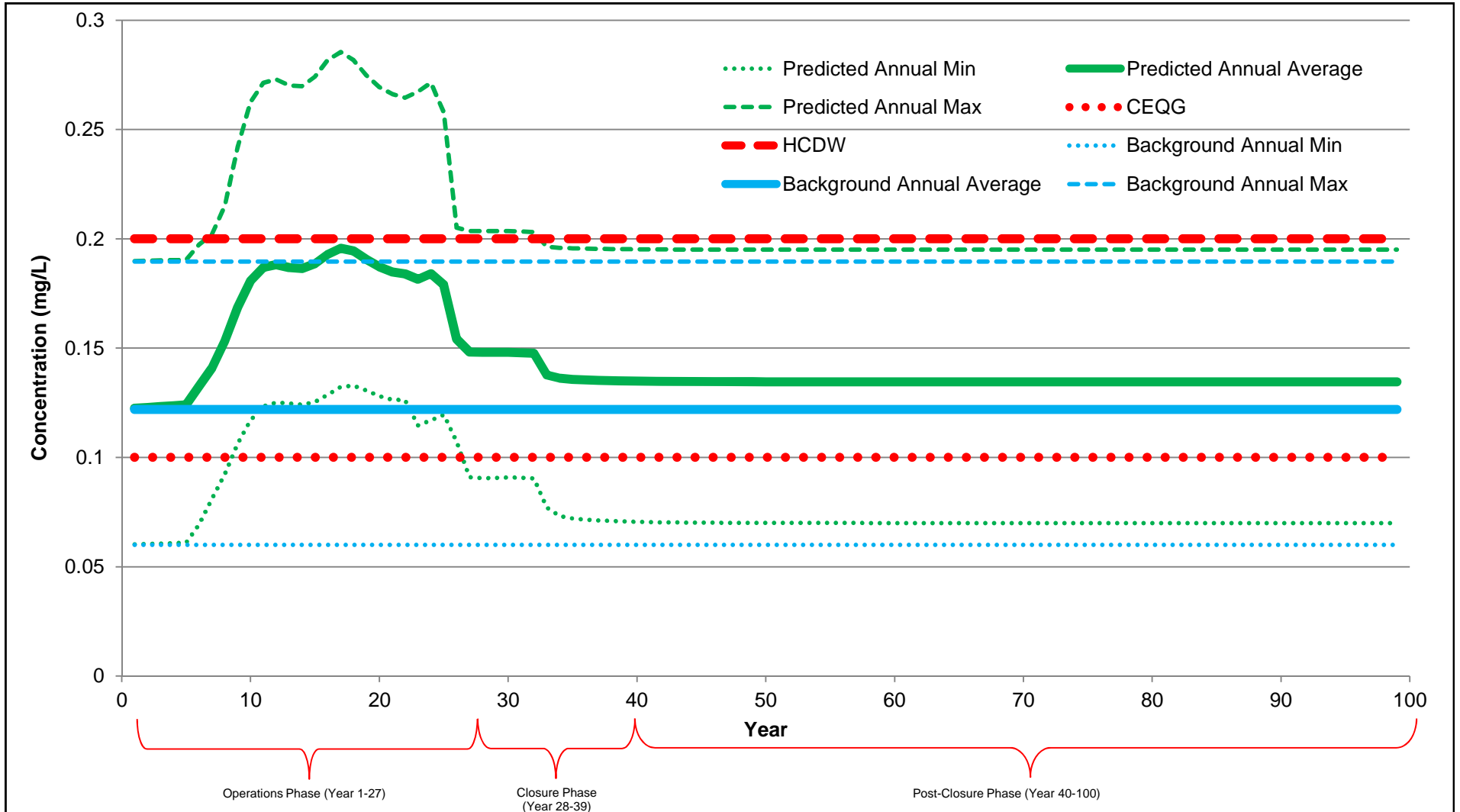
<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF FLUORIDE IN MBB2</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2
REF. NO. 9	
<b>Figure B3.8</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

**APPENDIX B4**

**ALUMINUM**

(Figures B4-1 to B4-8)

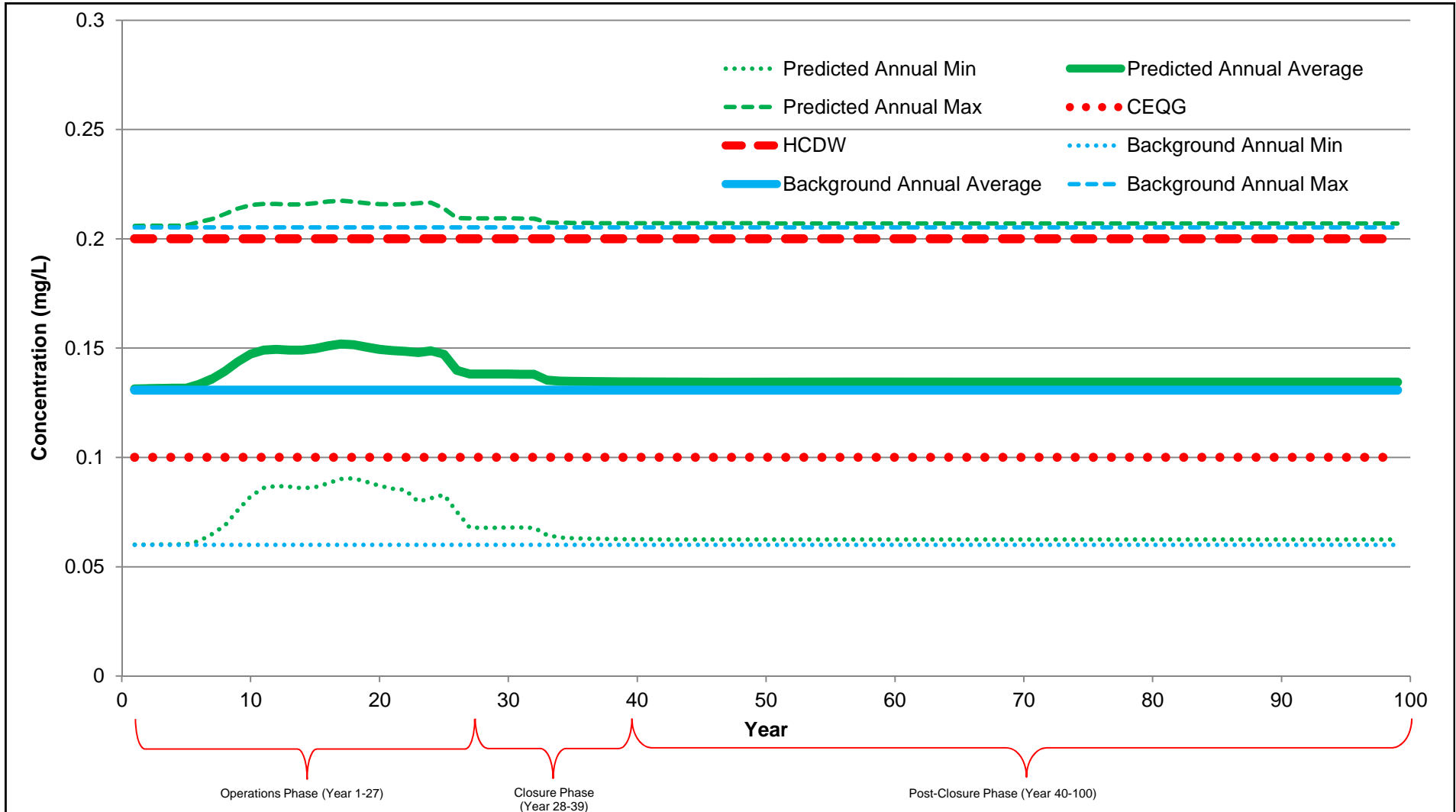


**NOTES:**

1. NO MMER GUIDELINE FOR AI.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF ALUMINUM IN UT1</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B4.1</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**

1. NO MMER GUIDELINE FOR AI.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF ALUMINUM IN NAP1</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B4.2</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

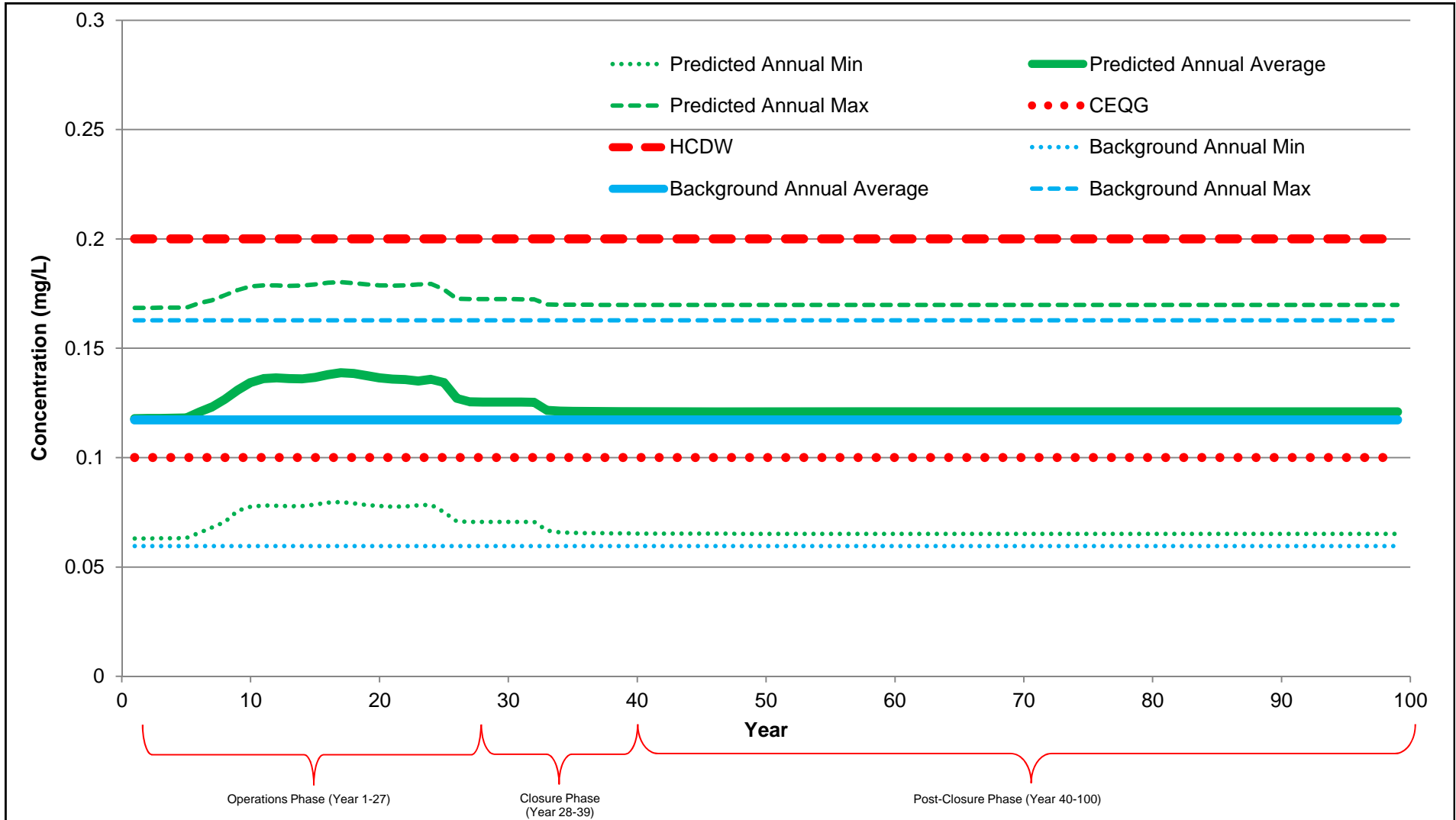


**NOTES:**

1. NO MMER GUIDELINE FOR AI

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF ALUMINUM IN NAP2</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B4.3</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

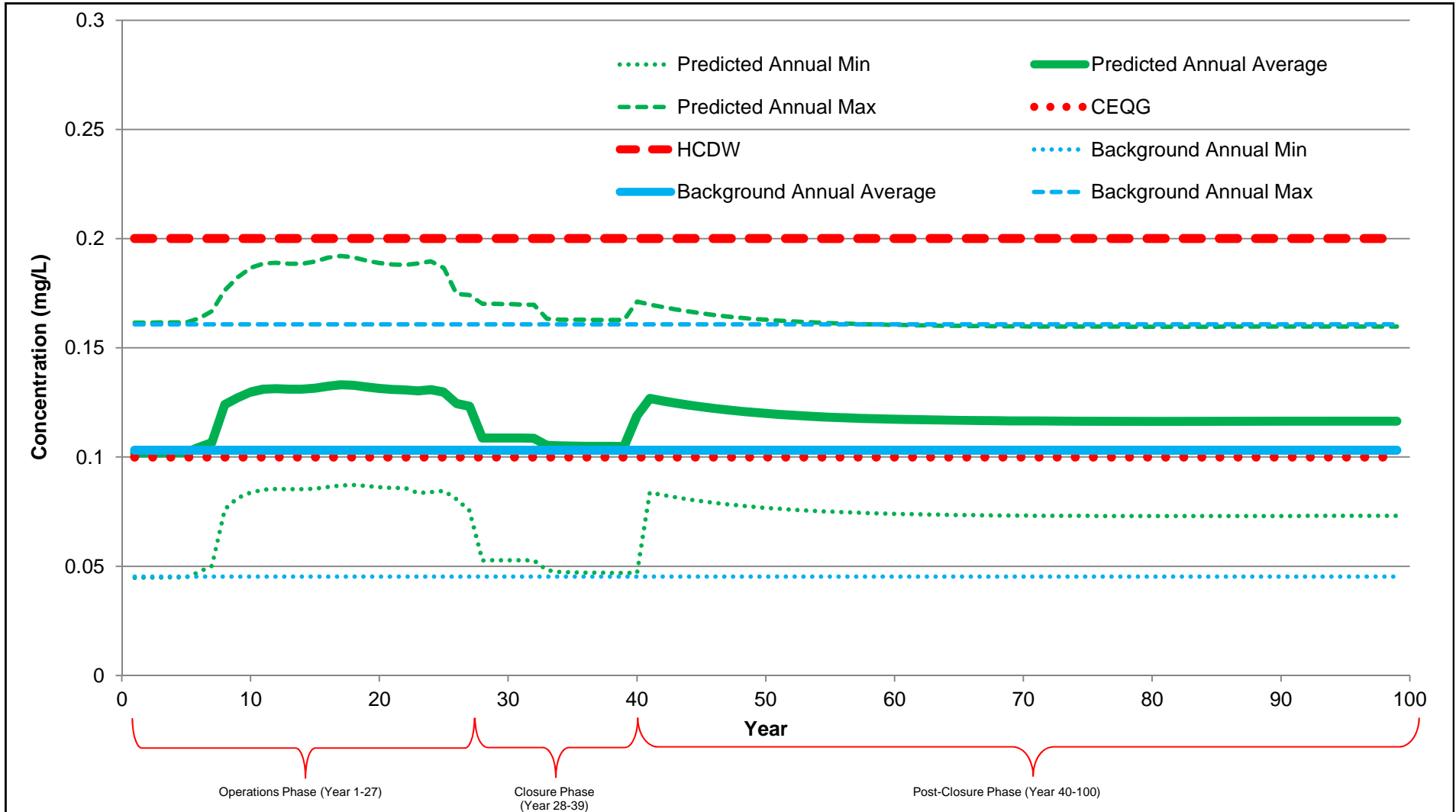


**NOTES:**

1. NO MMER GUIDELINE FOR AI

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF ALUMINUM IN NAP3</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B4.4</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

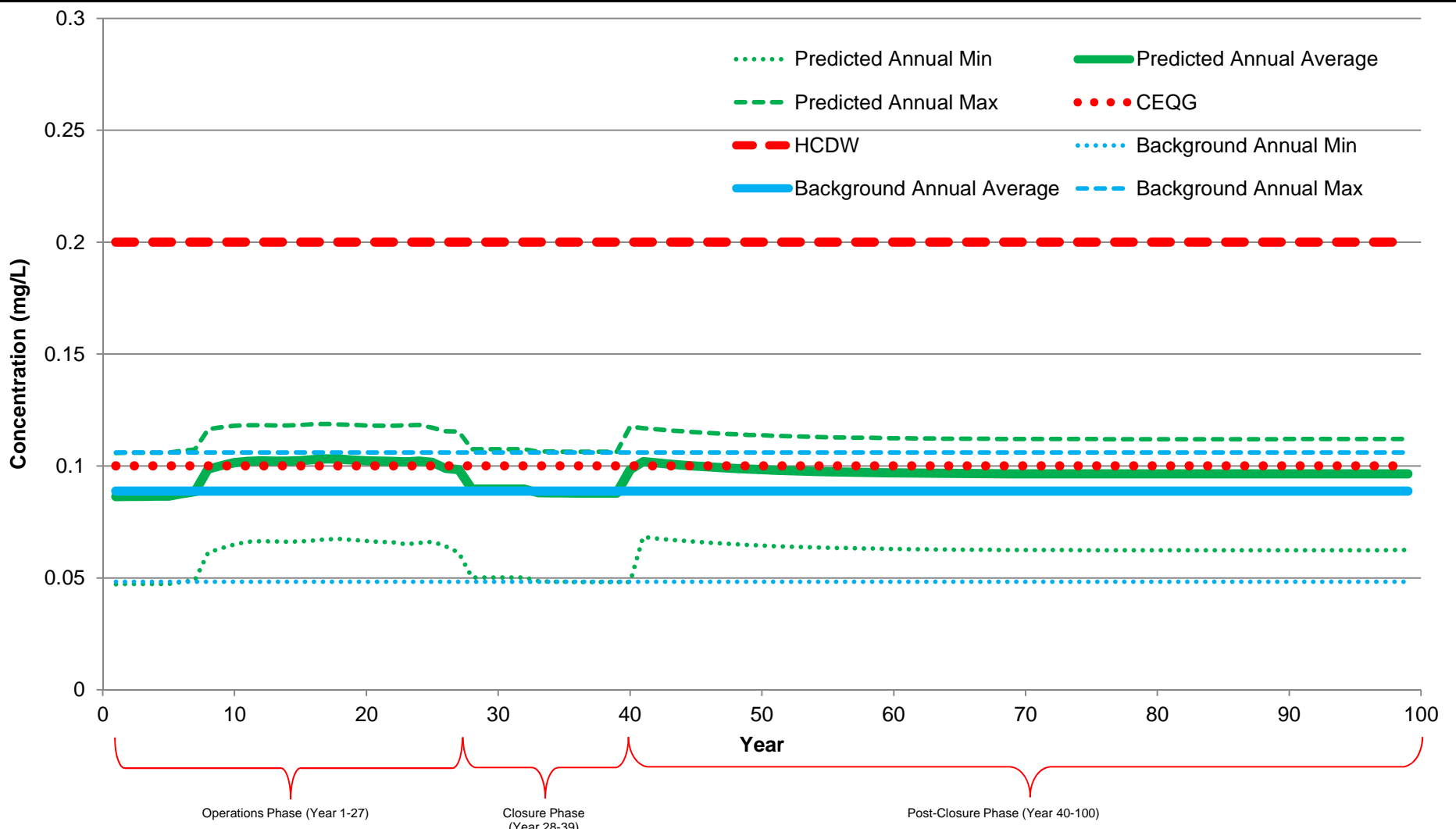


**NOTES:**

1. NO MMER GUIDELINE FOR AI

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF ALUMINUM IN NAP5</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2 REF. NO. 9 <b>Figure B4.5</b> REV 0

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



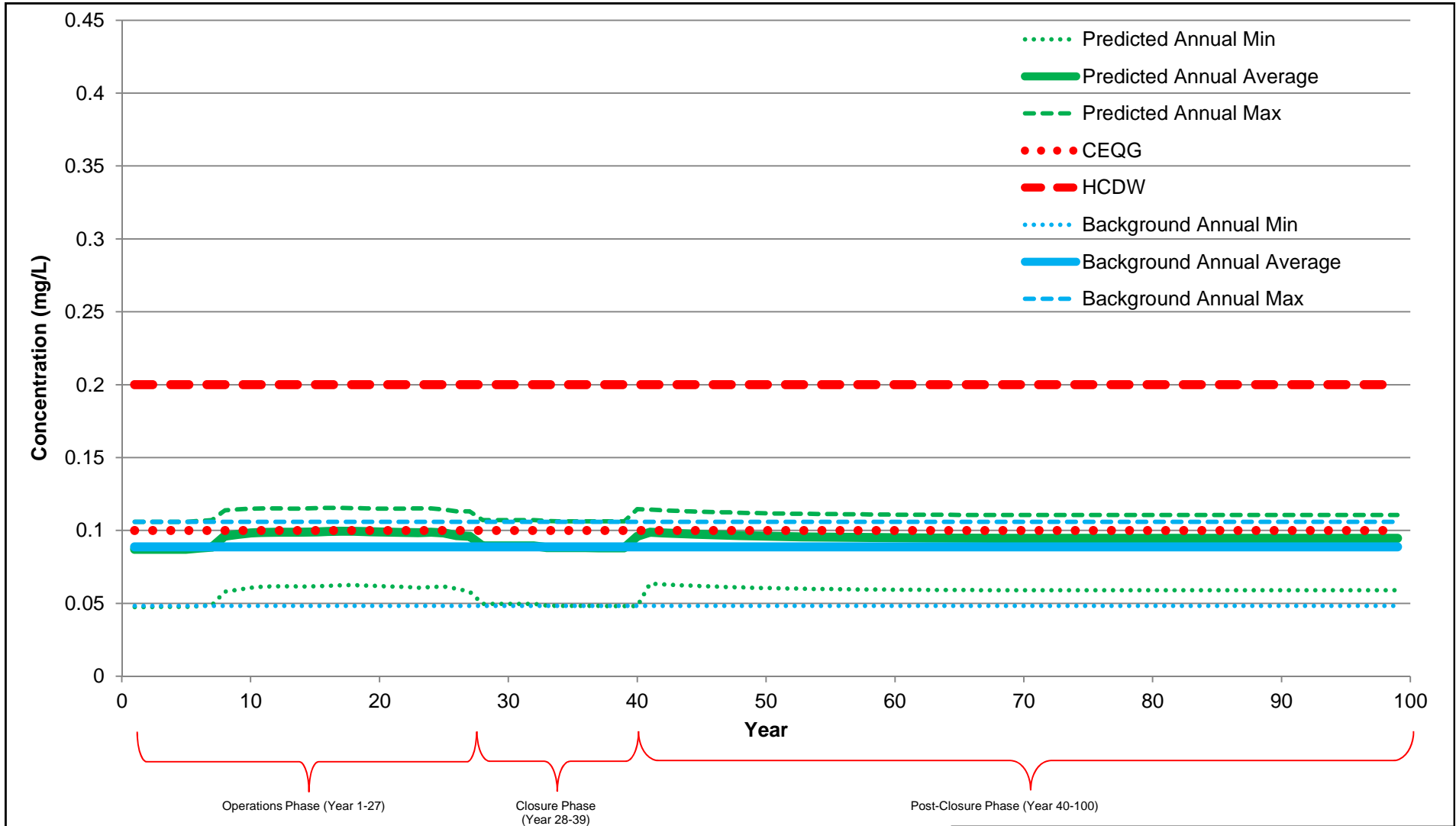
**NOTES:**

1. NO MMER GUIDELINE FOR AI.

<b>NORTHCLIFF RESOURCES LTD.</b>		
<b>SISSON PROJECT</b>		
<b>PREDICTED CONCENTRATION OF ALUMINUM IN NAP7</b>		
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2	REF. NO. 9
	<b>Figure B4.6</b>	
		REV 0

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

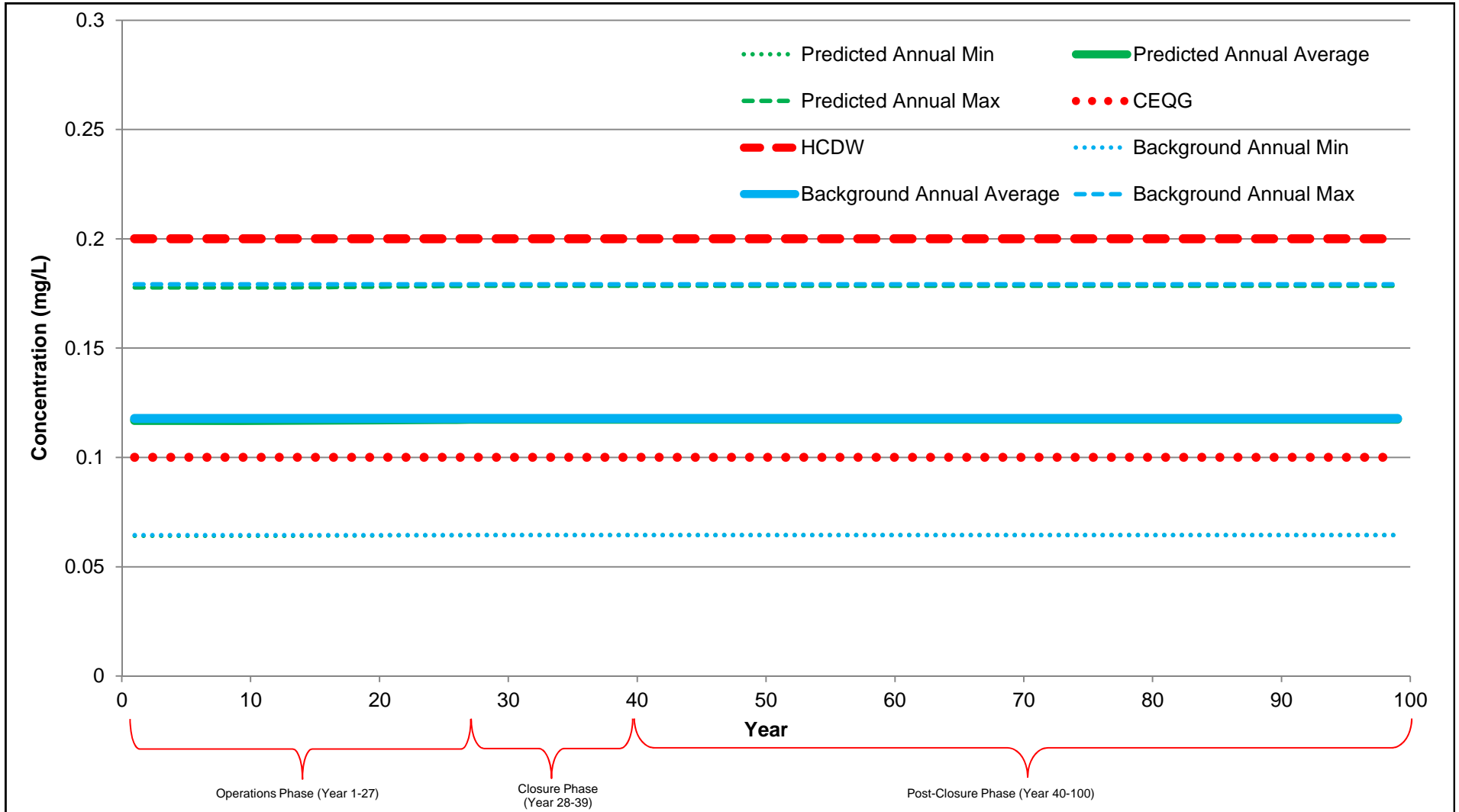




**NOTES:**  
1. NO MMR GUIDELINE FOR Al.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF ALUMINUM IN NAP8</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B4.7</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**

1. NO MMER GUIDELINE FOR AI.

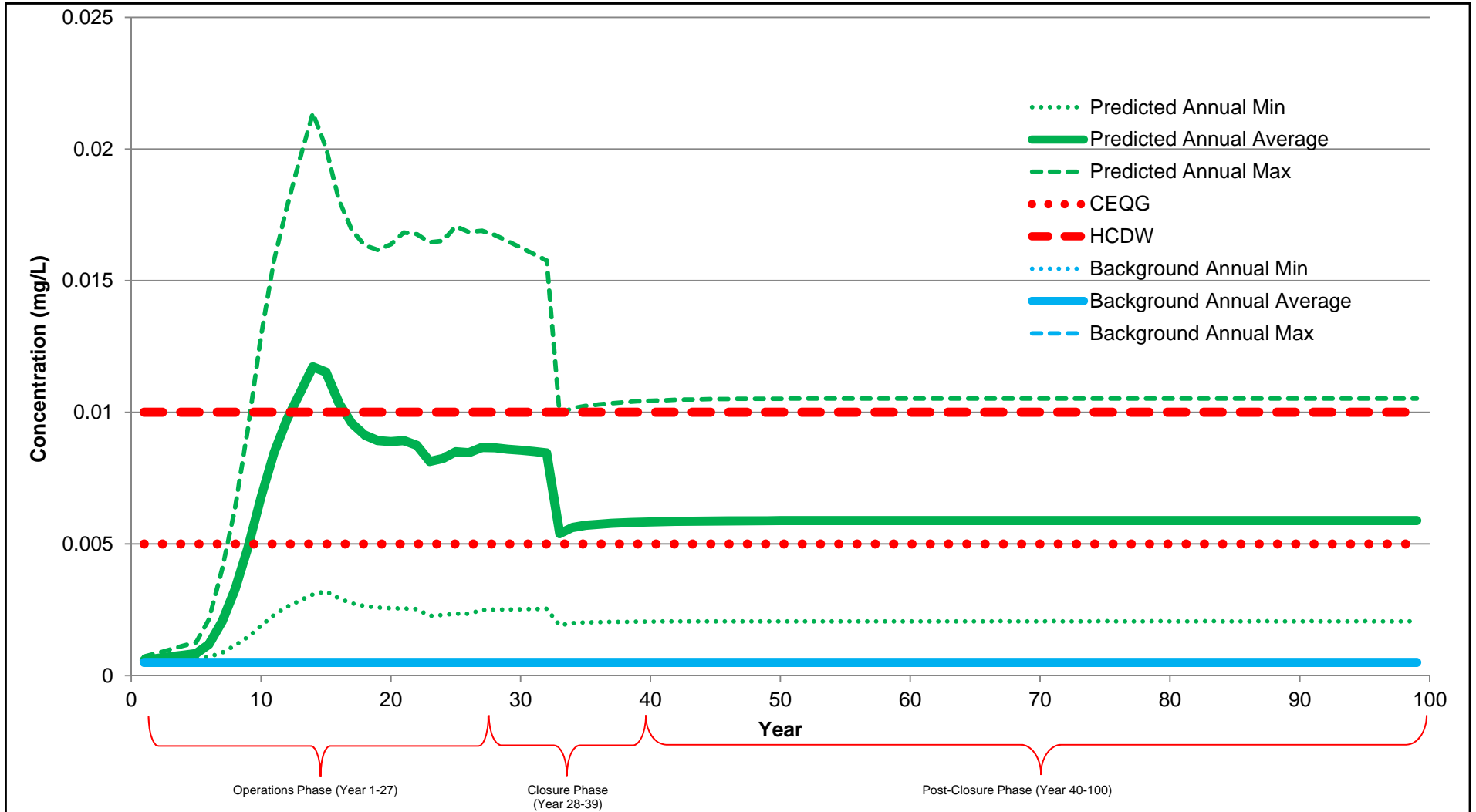
<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF ALUMINUM IN MBB2</b>	
<i><b>Knight Piésold</b></i> <b>CONSULTING</b>	P/A NO. VA101-447/2 REF. NO. 9 <b>Figure B4.8</b> REV 0

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

**APPENDIX B5**

**ARSENIC**

(Figures B5-1 to B5-8)

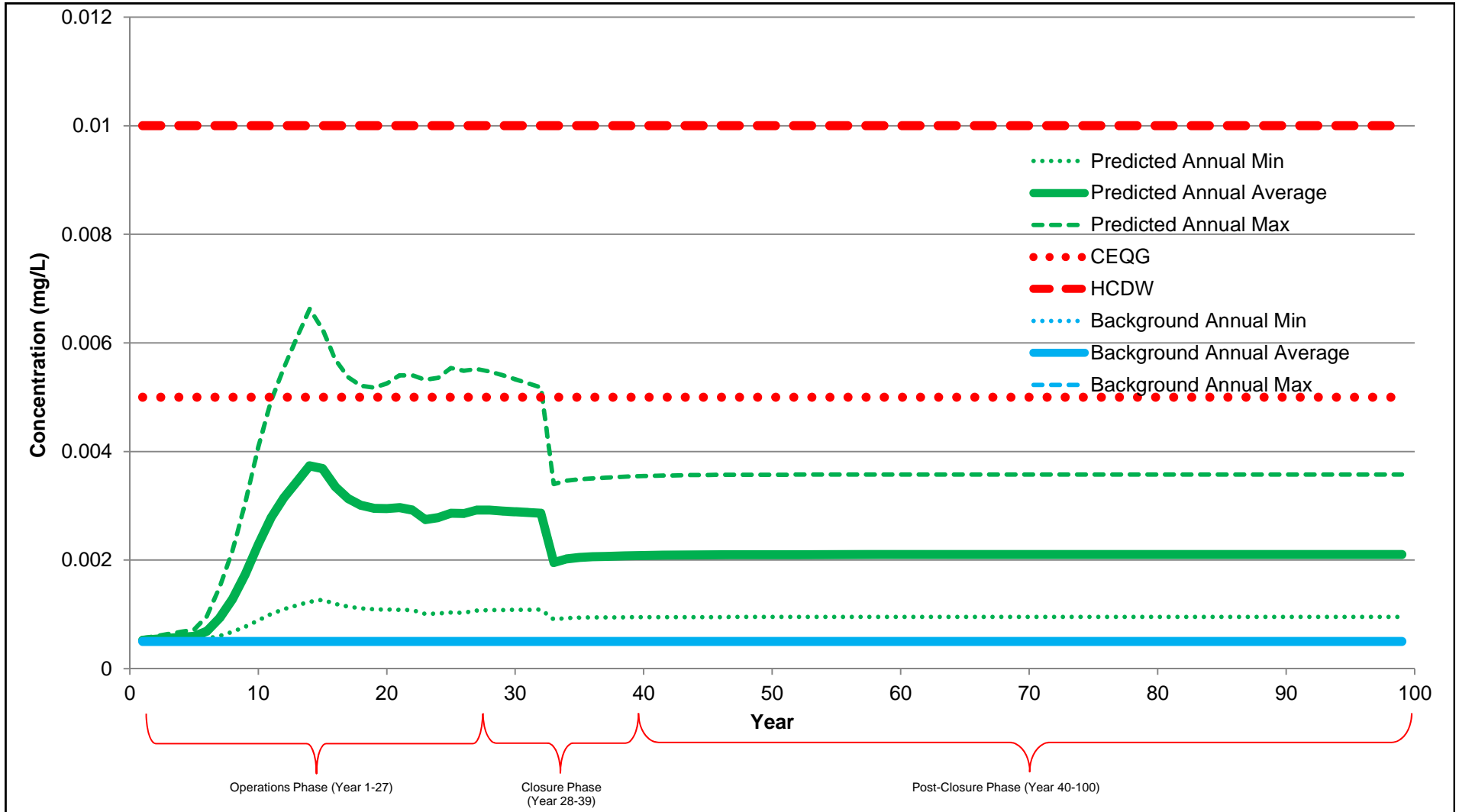


**NOTES:**

1. CURRENT AND PROPOSED MMER GUIDELINES FOR As ARE NOT WITHIN THE SCALE OF THIS GRAPH.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF ARSENIC IN UT1</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B5.1</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

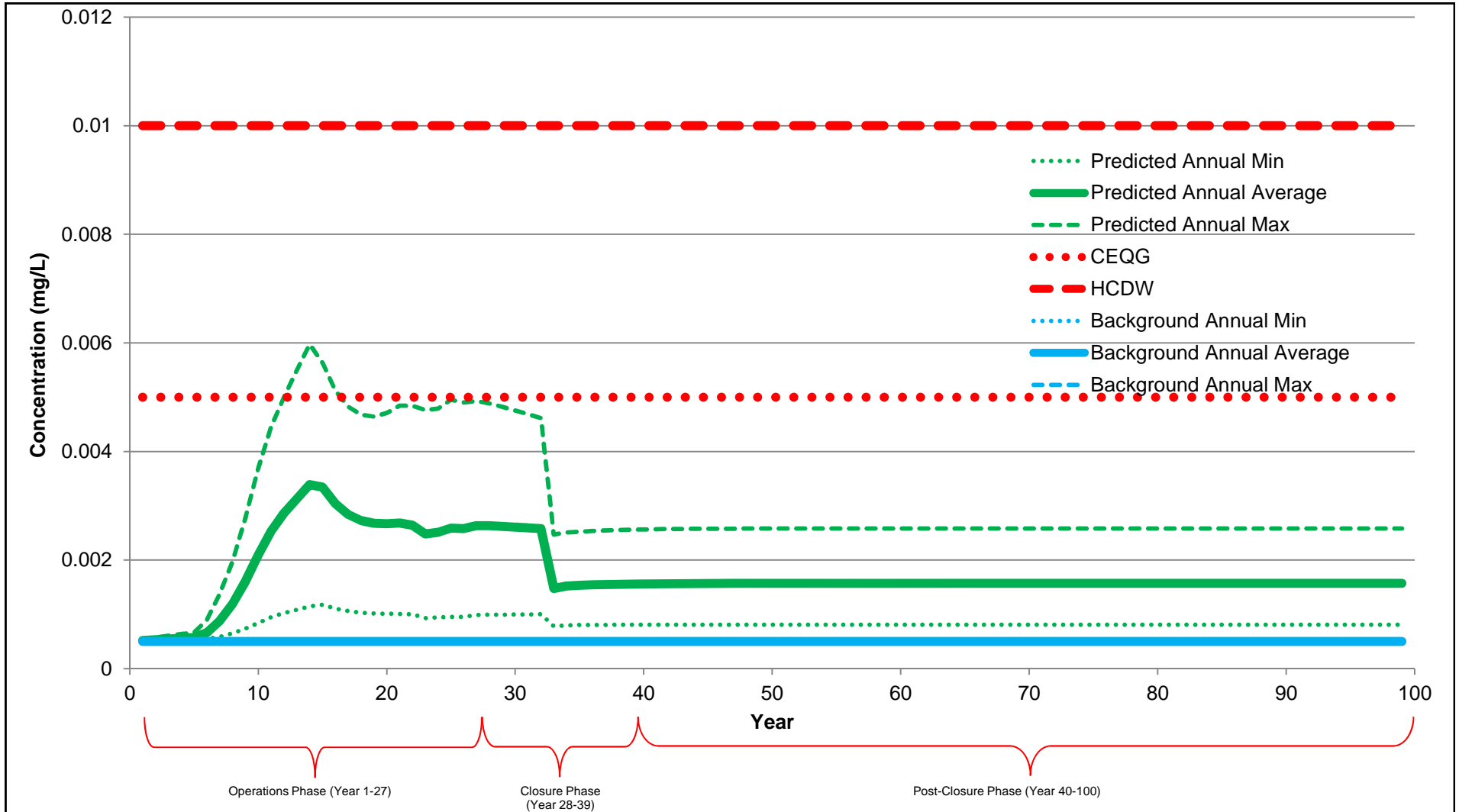


**NOTES:**

1. CURRENT AND PROPOSED MMER GUIDELINES FOR As ARE NOT WITHIN THE SCALE OF THIS GRAPH.

<b>NORTHCLIFF RESOURCES LTD.</b>		
<b>SISSON PROJECT</b>		
<b>PREDICTED CONCENTRATION OF ARSENIC IN NAP1</b>		
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2	REF. NO. 9
	<b>Figure B5.2</b>	
		REV 0

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

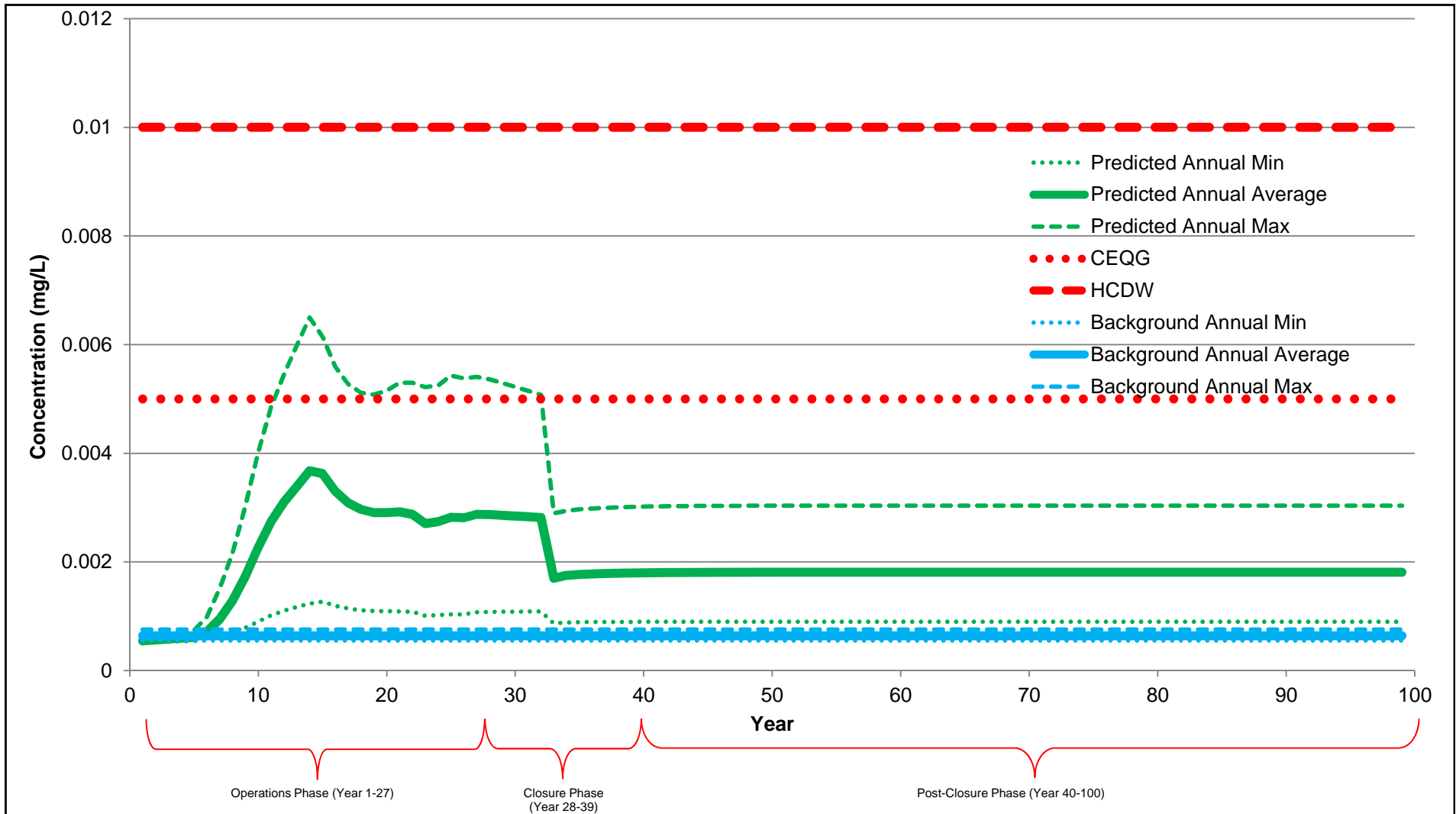


**NOTES:**

1. CURRENT AND PROPOSED MMER GUIDELINES FOR As ARE NOT WITHIN THE SCALE OF THIS GRAPH.

<b>NORTHCLIFF RESOURCES LTD.</b>		
<b>SISSON PROJECT</b>		
<b>PREDICTED CONCENTRATION OF ARSENIC IN NAP2</b>		
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2	REF. NO. 9
	<b>Figure B5.3</b>	
		REV 0

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

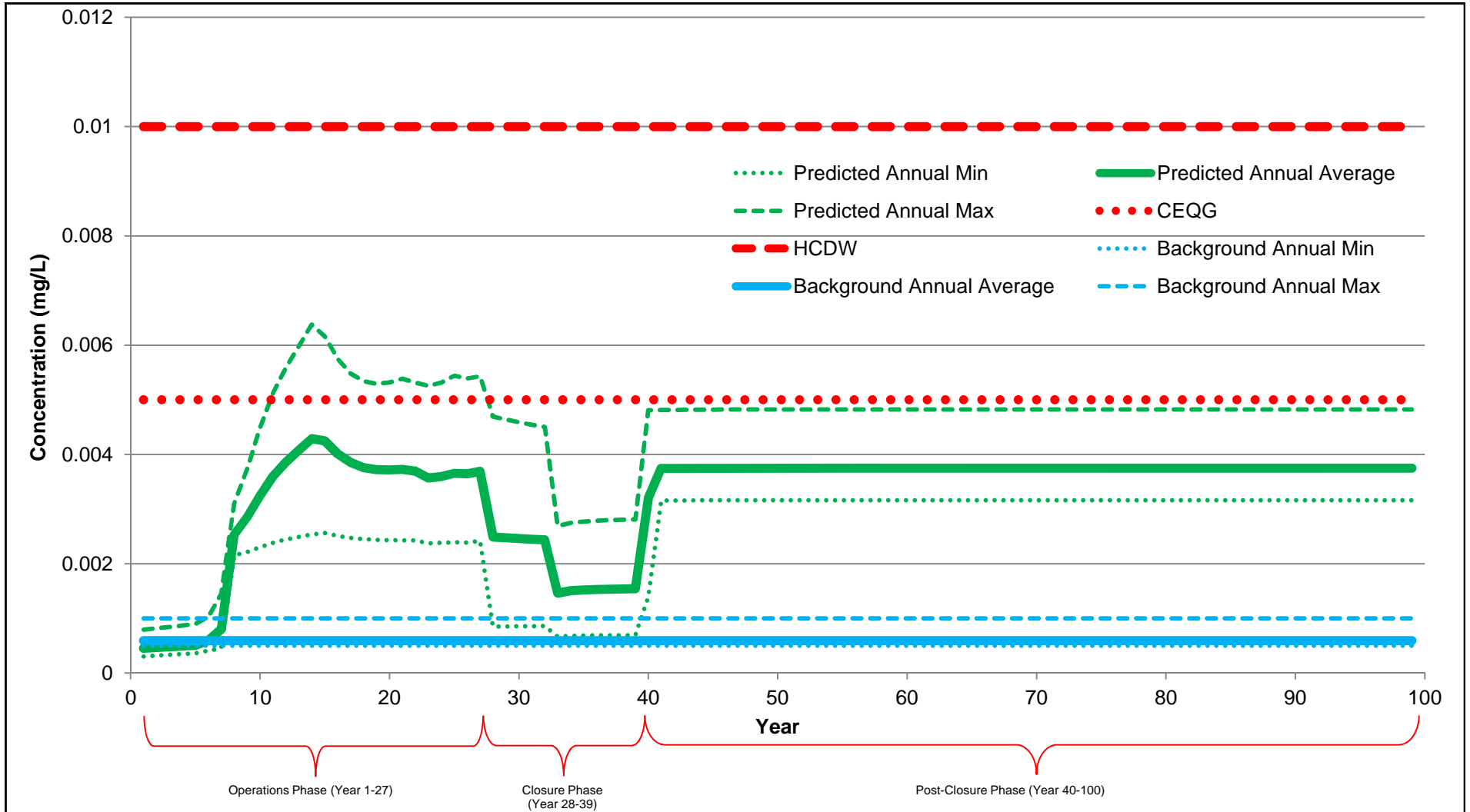


**NOTES:**

1. CURRENT AND PROPOSED MMER GUIDELINES FOR As ARE NOT WITHIN THE SCALE OF THIS GRAPH.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF ARSENIC IN NAP3</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B5.4</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



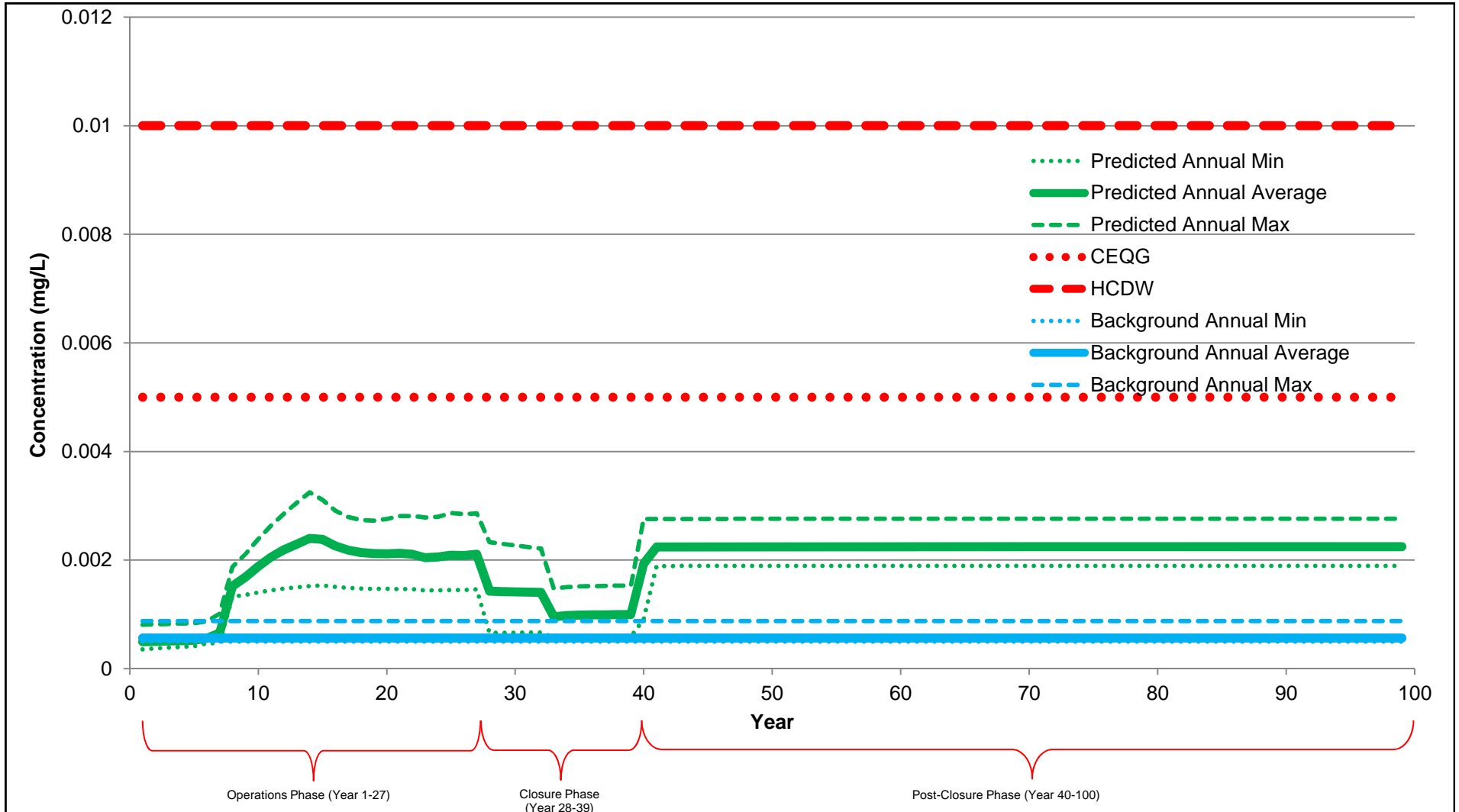
**NOTES:**

1. CURRENT AND PROPOSED MMR GUIDELINES FOR As ARE NOT WITHIN THE SCALE OF THIS GRAPH.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF ARSENIC IN NAP5</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B5.5</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

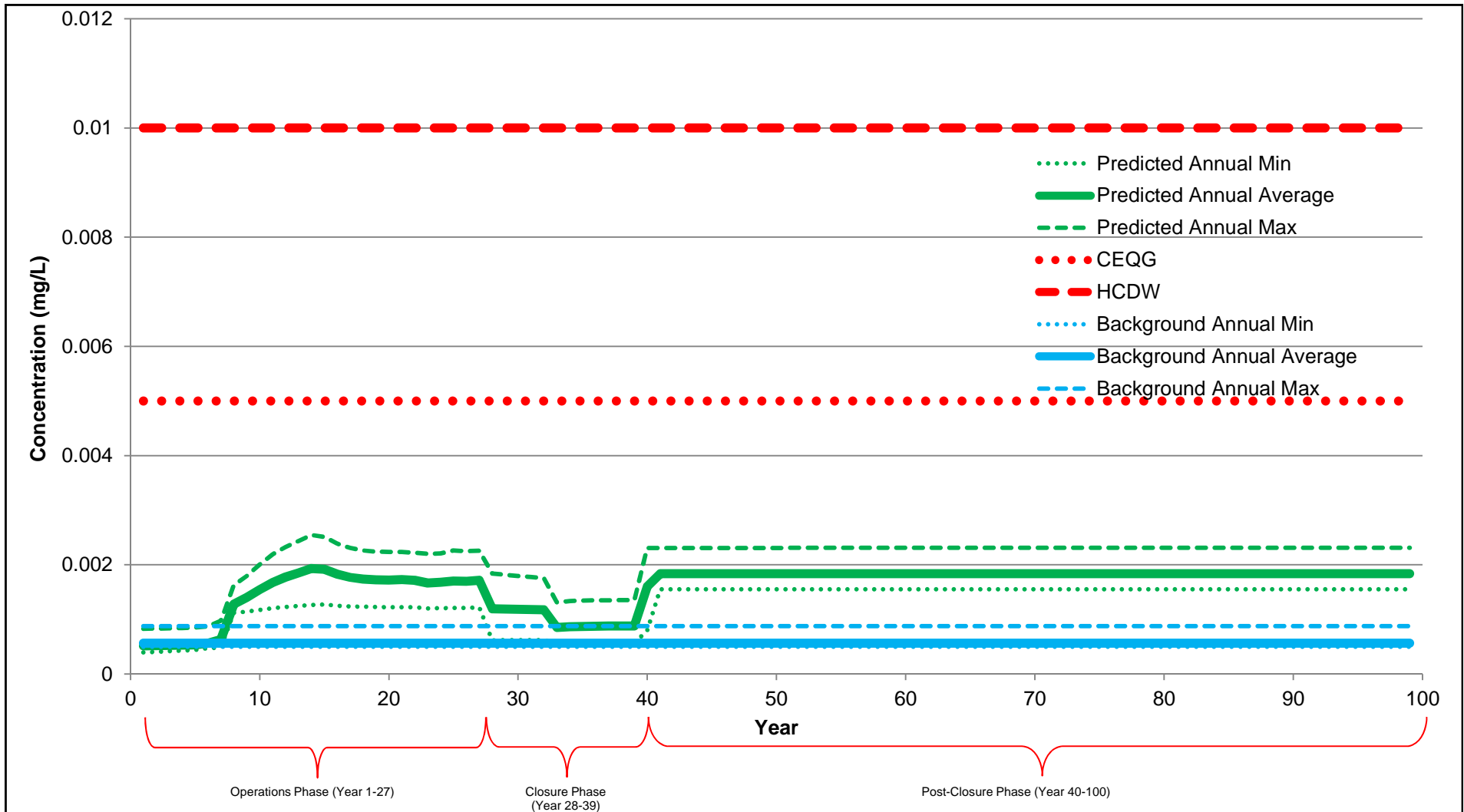




**NOTES:**  
 1. CURRENT AND PROPOSED MMER GUIDELINES FOR As ARE NOT WITHIN THE SCALE OF THIS GRAPH.

<b>NORTHCLIFF RESOURCES LTD.</b>		
<b>SISSON PROJECT</b>		
<b>PREDICTED CONCENTRATION OF ARSENIC IN NAP7</b>		
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2	REF. NO. 9
	<b>Figure B5.6</b>	
		REV 0

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

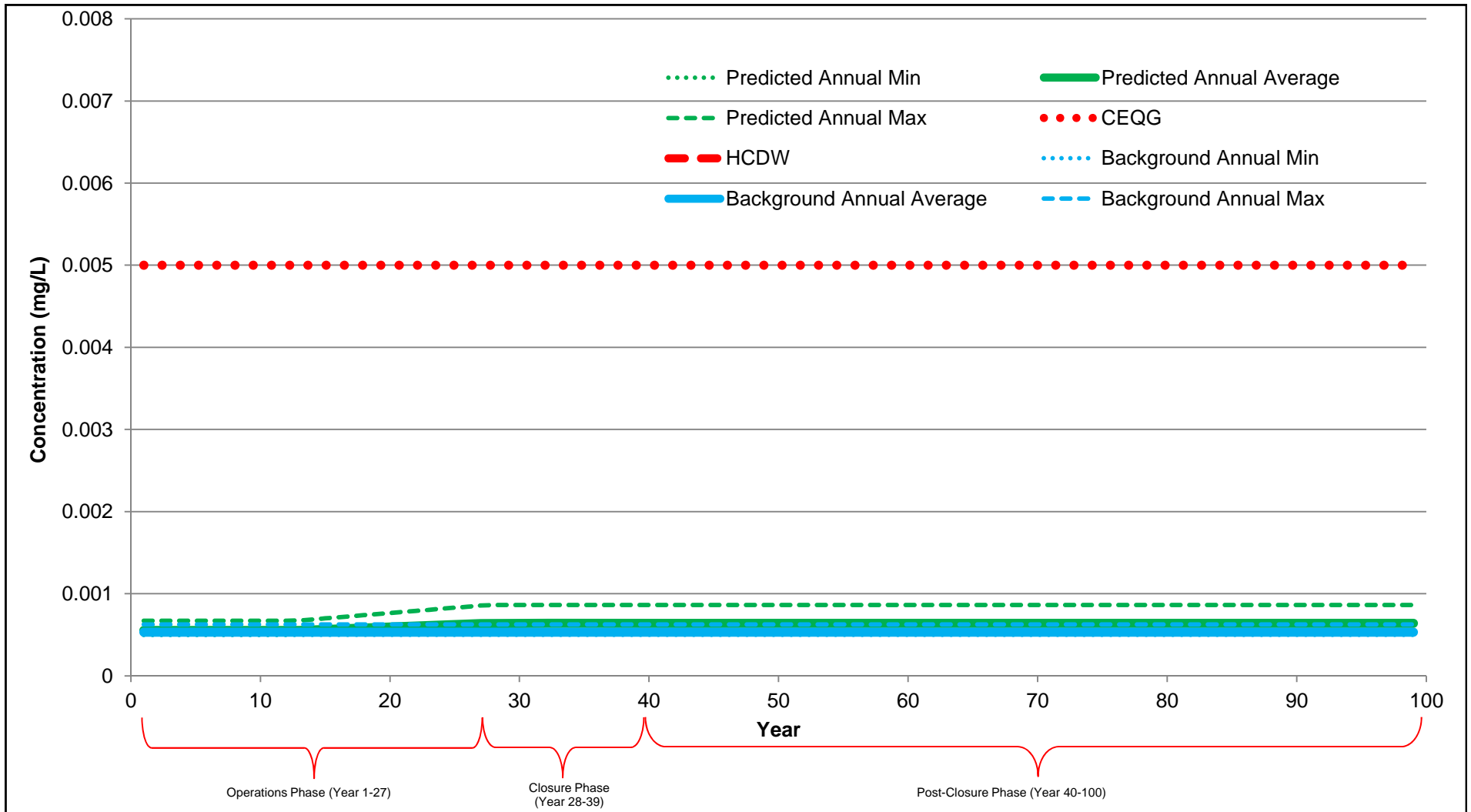


**NOTES:**

1. CURRENT AND PROPOSED MMER GUIDELINES FOR As ARE NOT WITHIN THE SCALE OF THIS GRAPH.

<b>NORTHCLIFF RESOURCES LTD.</b>		
<b>SISSON PROJECT</b>		
<b>PREDICTED CONCENTRATION OF ARSENIC IN NAP8</b>		
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2	REF. NO. 9
	<b>Figure B5.7</b>	
		REV 0

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**

1. CURRENT AND PROPOSED MMER GUIDELINES FOR As ARE NOT WITHIN THE SCALE OF THIS GRAPH.
2. HCDW GUIDELINE IS 0.1 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.

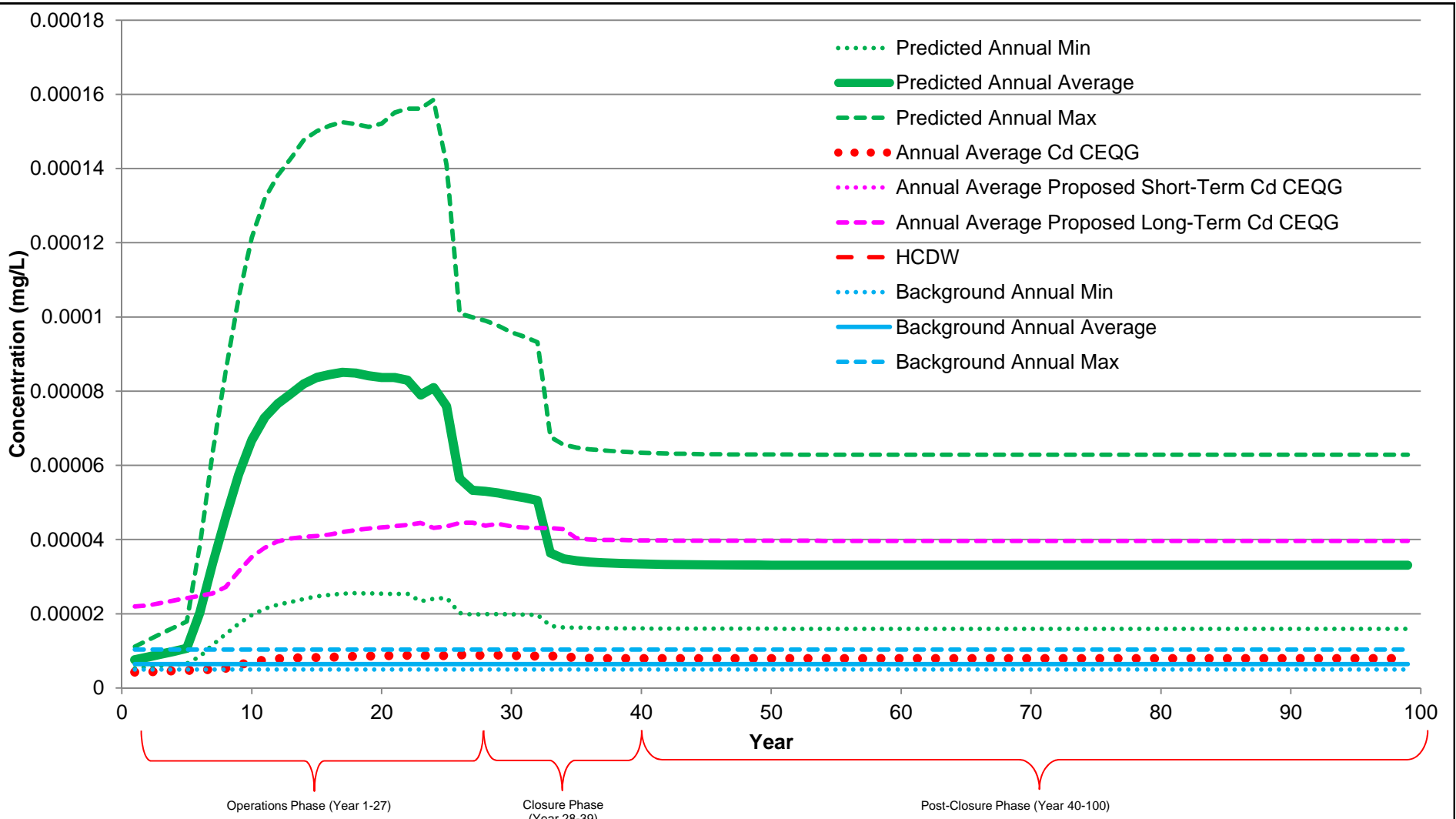
<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF ARSENIC IN MBB2</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B5.8</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

**APPENDIX B6**

**CADMIUM**

(Figures B6-1 to B6-8)

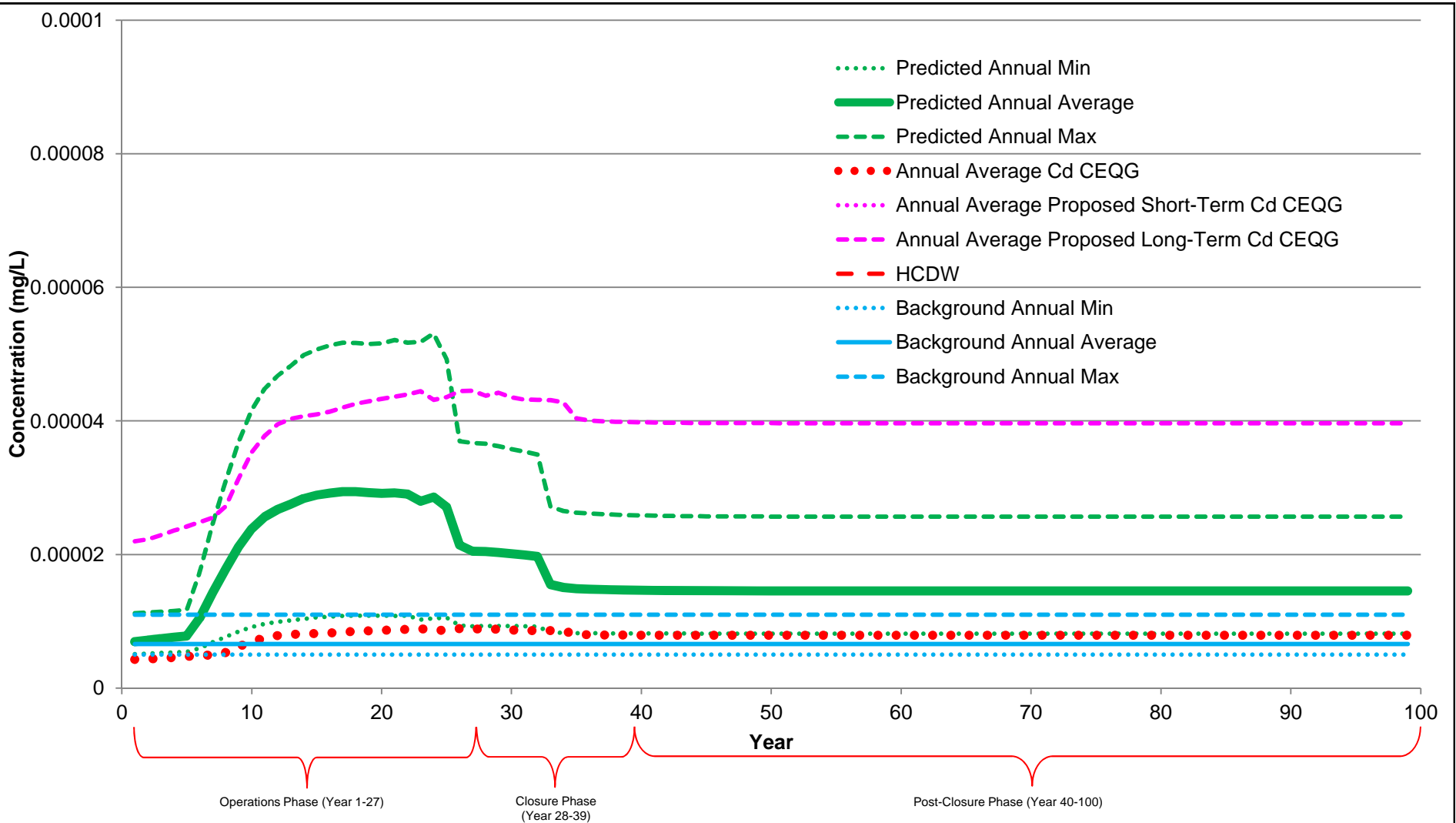


**NOTES:**

1. THE CEQG IS HARDNESS-DEPENDENT AND HAS BEEN CALCULATED BASED ON AVERAGE ANNUAL HARDNESS.
2. THE PROPOSED GUIDELINE FOR SHORT-TERM EXPOSURE IS NOT WITHIN THE SCALE OF THIS GRAPH.
3. THE HCDW GUIDELINE OF 0.005 mg/L IS NOT SHOWN ON THIS GRAPH.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF CADMIUM IN UT1</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2  REF. NO. 9  <b>Figure B6.1</b>  REV 0

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

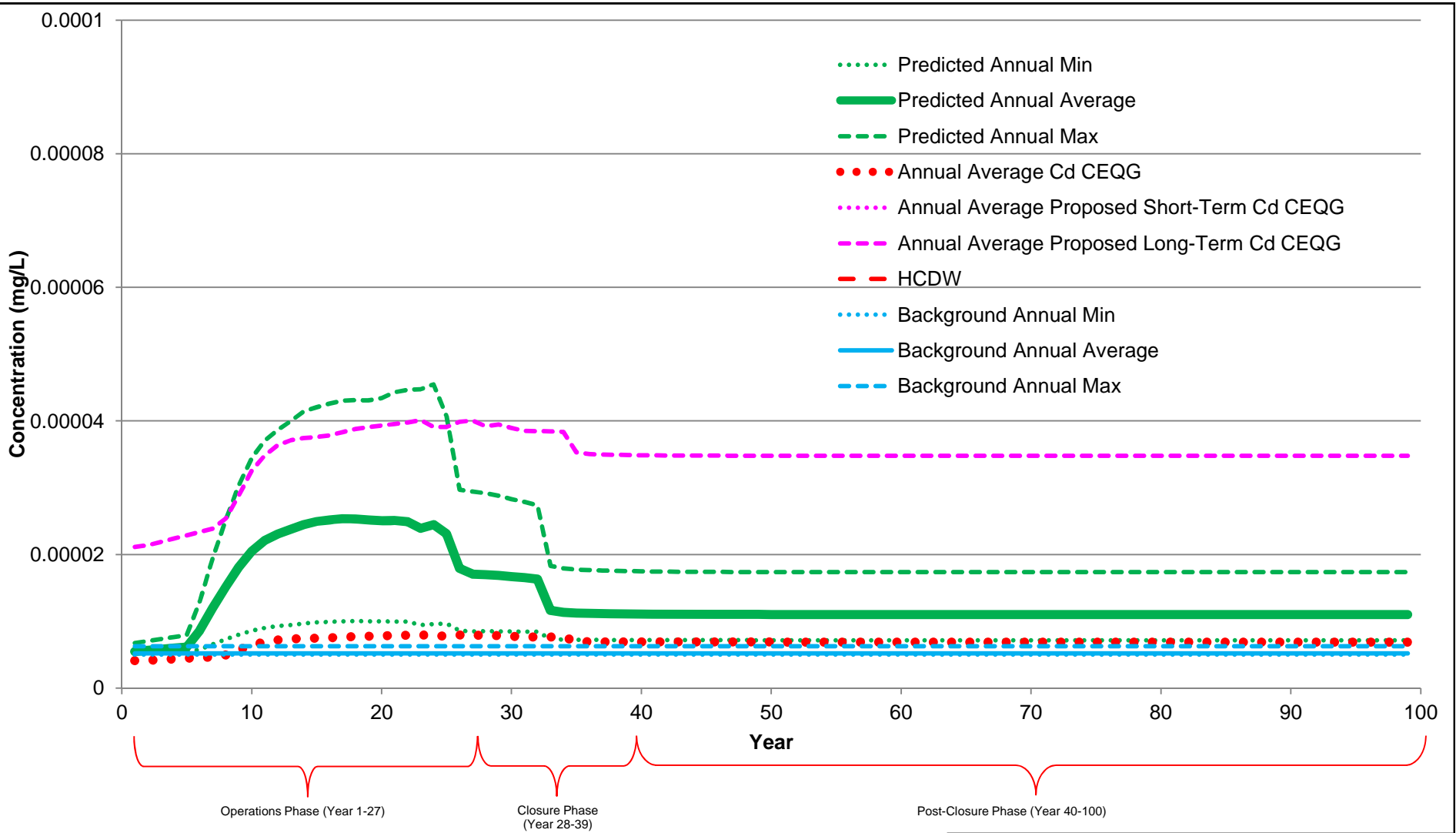


**NOTES:**

1. THE CEQG IS HARDNESS-DEPENDENT AND HAS BEEN CALCULATED BASED ON AVERAGE ANNUAL HARDNESS.
2. THE PROPOSED GUIDELINE FOR SHORT-TERM EXPOSURE IS NOT WITHIN THE SCALE OF THIS GRAPH.
3. THE HCDW GUIDELINE OF 0.005 mg/L IS NOT SHOWN ON THIS GRAPH.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF CADMIUM IN NAP1</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B6.2</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

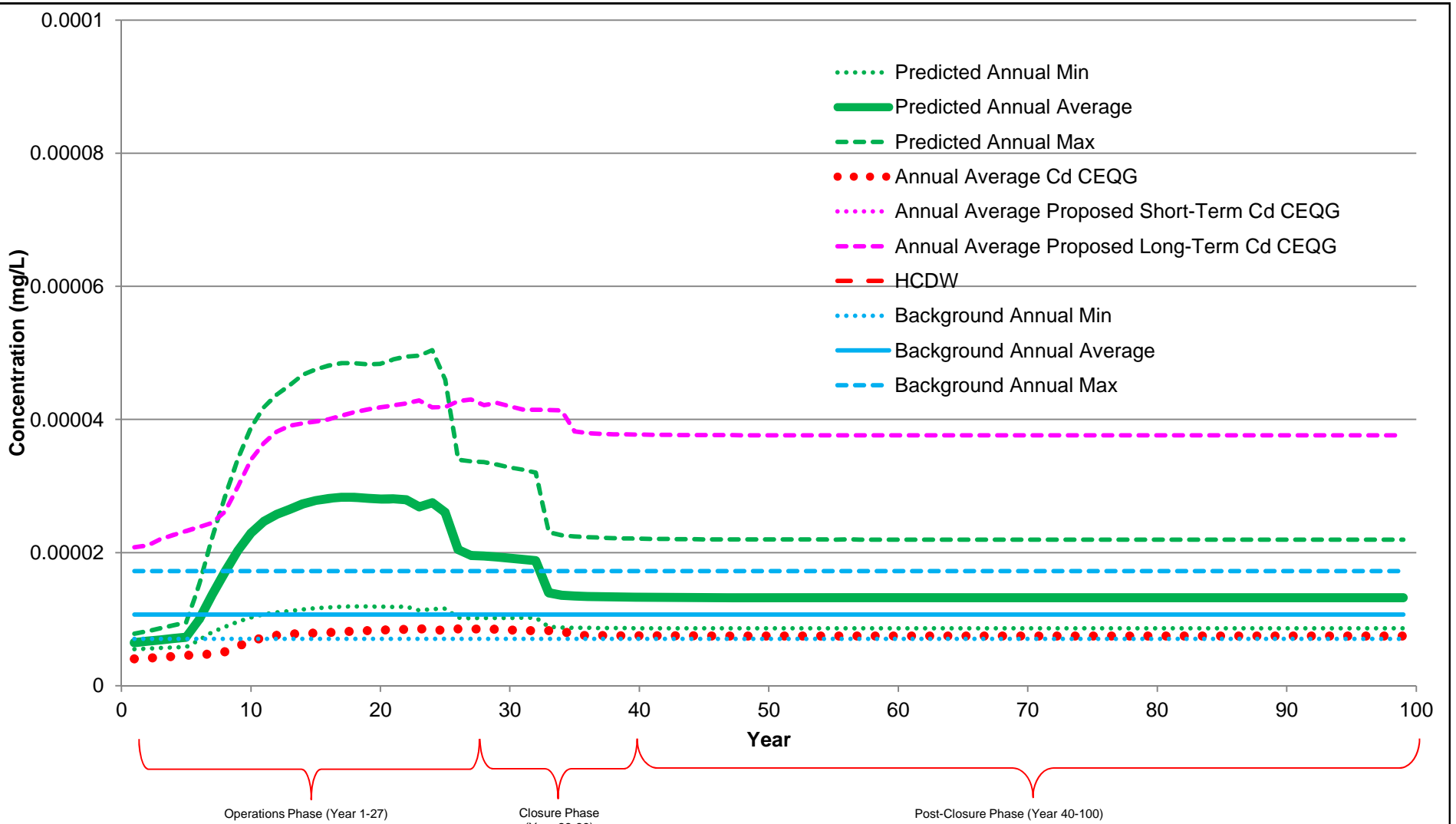


**NOTES:**

1. THE CEQG IS HARDNESS-DEPENDENT AND HAS BEEN CALCULATED BASED ON AVERAGE ANNUAL HARDNESS.
2. THE PROPOSED GUIDELINE FOR SHORT-TERM EXPOSURE IS NOT WITHIN THE SCALE OF THIS GRAPH.
3. THE HCDW GUIDELINE OF 0.005 mg/L IS NOT SHOWN ON THIS GRAPH.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF CADMIUM IN NAP2</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B6.3</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



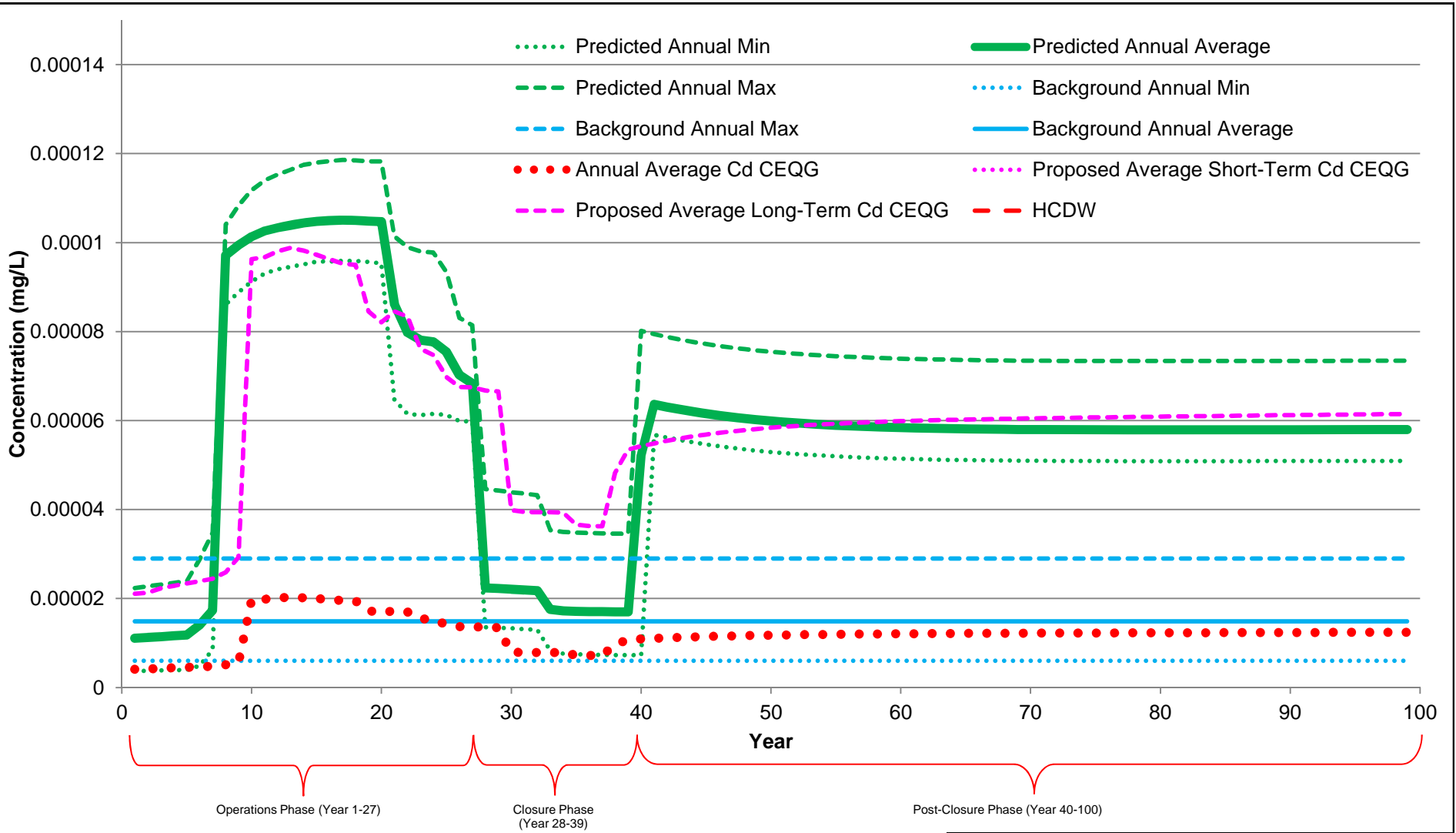
**NOTES:**

1. THE CEQG IS HARDNESS-DEPENDENT AND HAS BEEN CALCULATED BASED ON AVERAGE ANNUAL HARDNESS.
2. THE PROPOSED GUIDELINE FOR SHORT-TERM EXPOSURE IS NOT WITHIN THE SCALE OF THIS GRAPH.
3. THE HCDW GUIDELINE OF 0.005 mg/L IS NOT SHOWN ON THIS GRAPH.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF CADMIUM IN NAP3</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2  REF. NO. 9  <b>Figure B6.4</b>
	REV 0

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



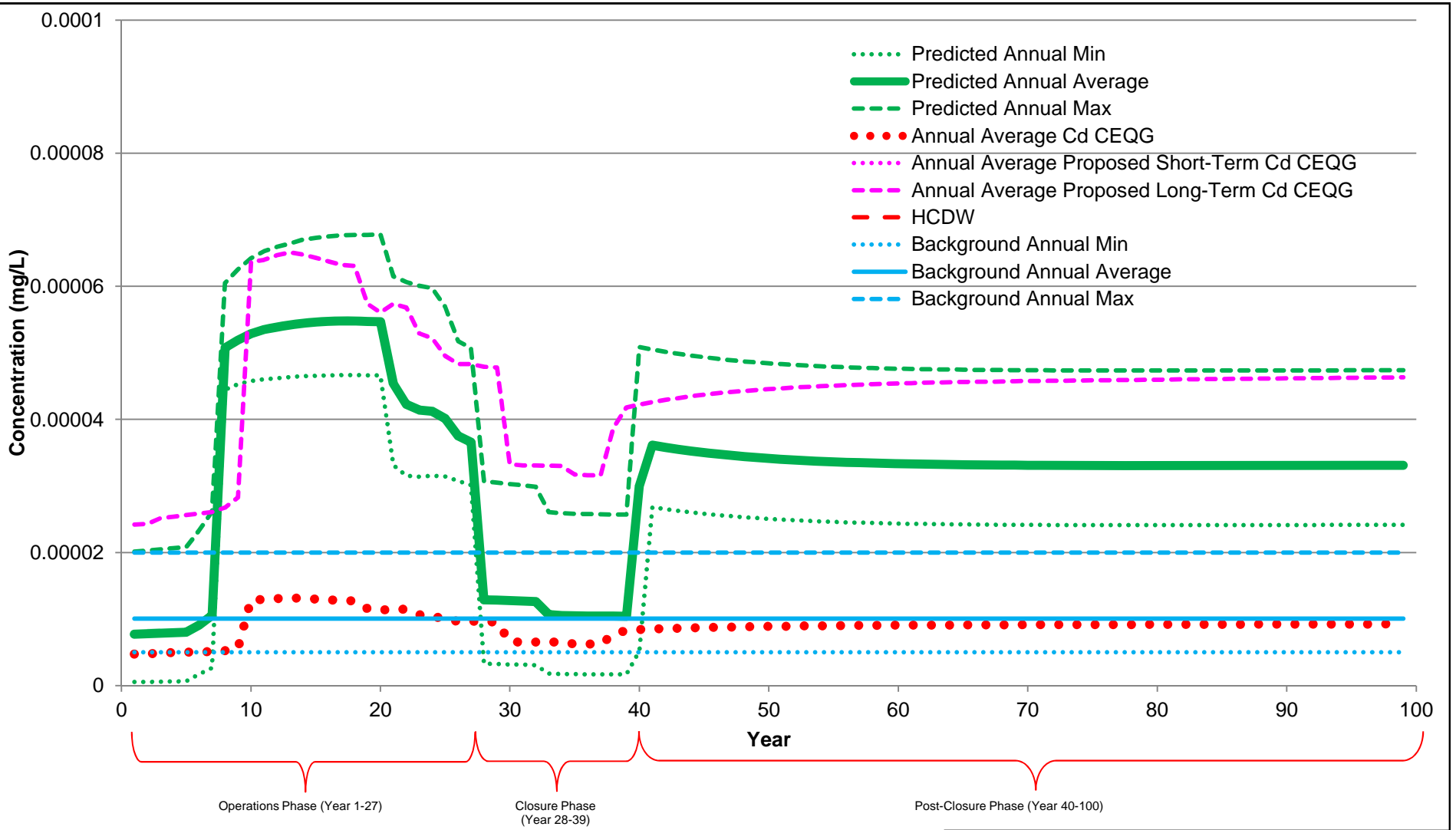


**NOTES:**

1. THE CEQG IS HARDNESS-DEPENDENT AND HAS BEEN CALCULATED BASED ON AVERAGE ANNUAL HARDNESS.
2. THE PROPOSED GUIDELINE FOR SHORT-TERM EXPOSURE IS NOT WITHIN THE SCALE OF THIS GRAPH.
3. THE HCDW GUIDELINE OF 0.005 mg/L IS NOT SHOWN ON THIS GRAPH.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF CADMIUM IN NAP5</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B6.5</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

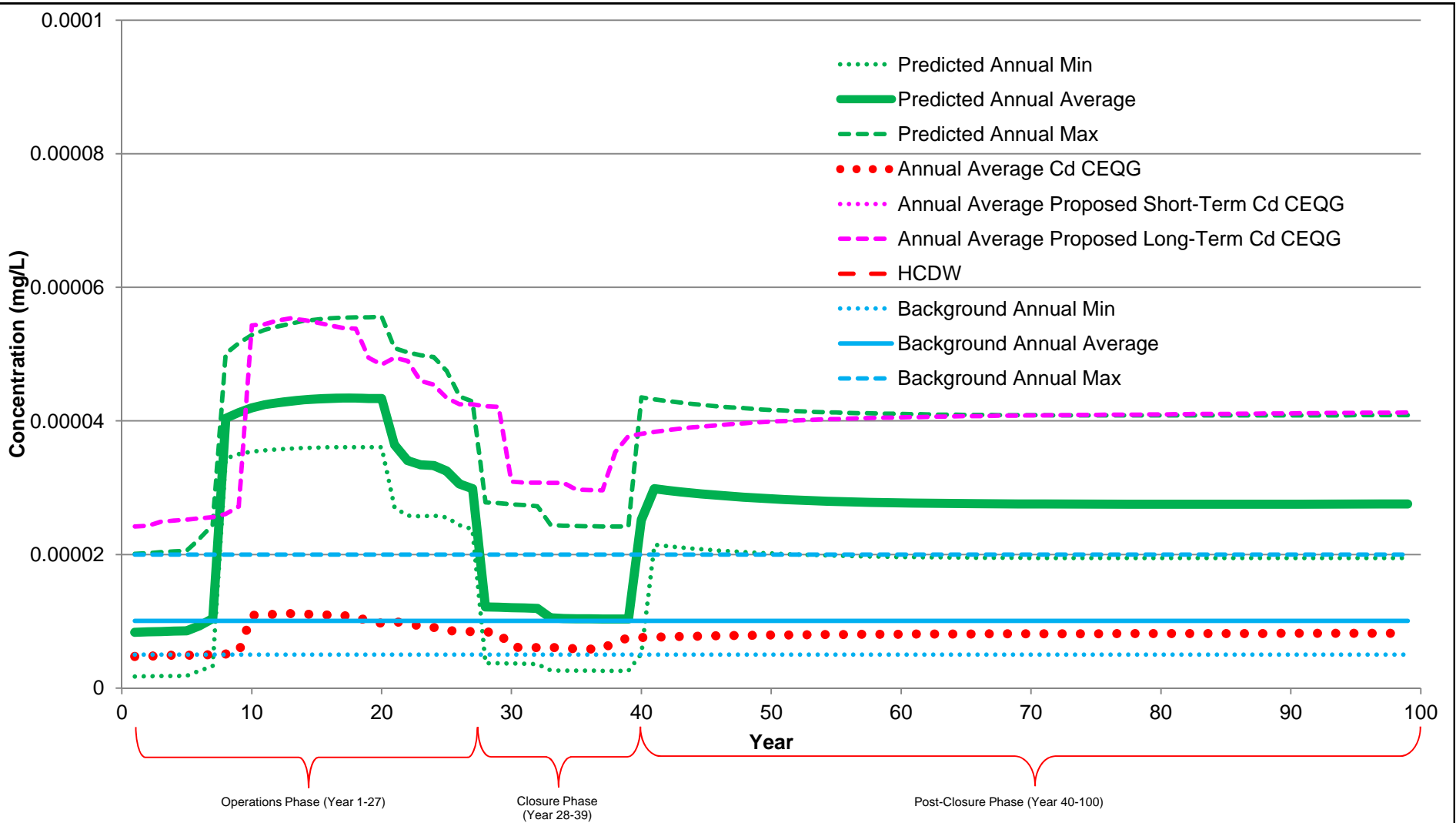


**NOTES:**

1. THE CEQG IS HARDNESS-DEPENDENT AND HAS BEEN CALCULATED BASED ON AVERAGE ANNUAL HARDNESS.
2. THE PROPOSED GUIDELINE FOR SHORT-TERM EXPOSURE IS NOT WITHIN THE SCALE OF THIS GRAPH.
3. THE HCDW GUIDELINE OF 0.005 mg/L IS NOT SHOWN ON THIS GRAPH.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF CADMIUM IN NAP7</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B6.6</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

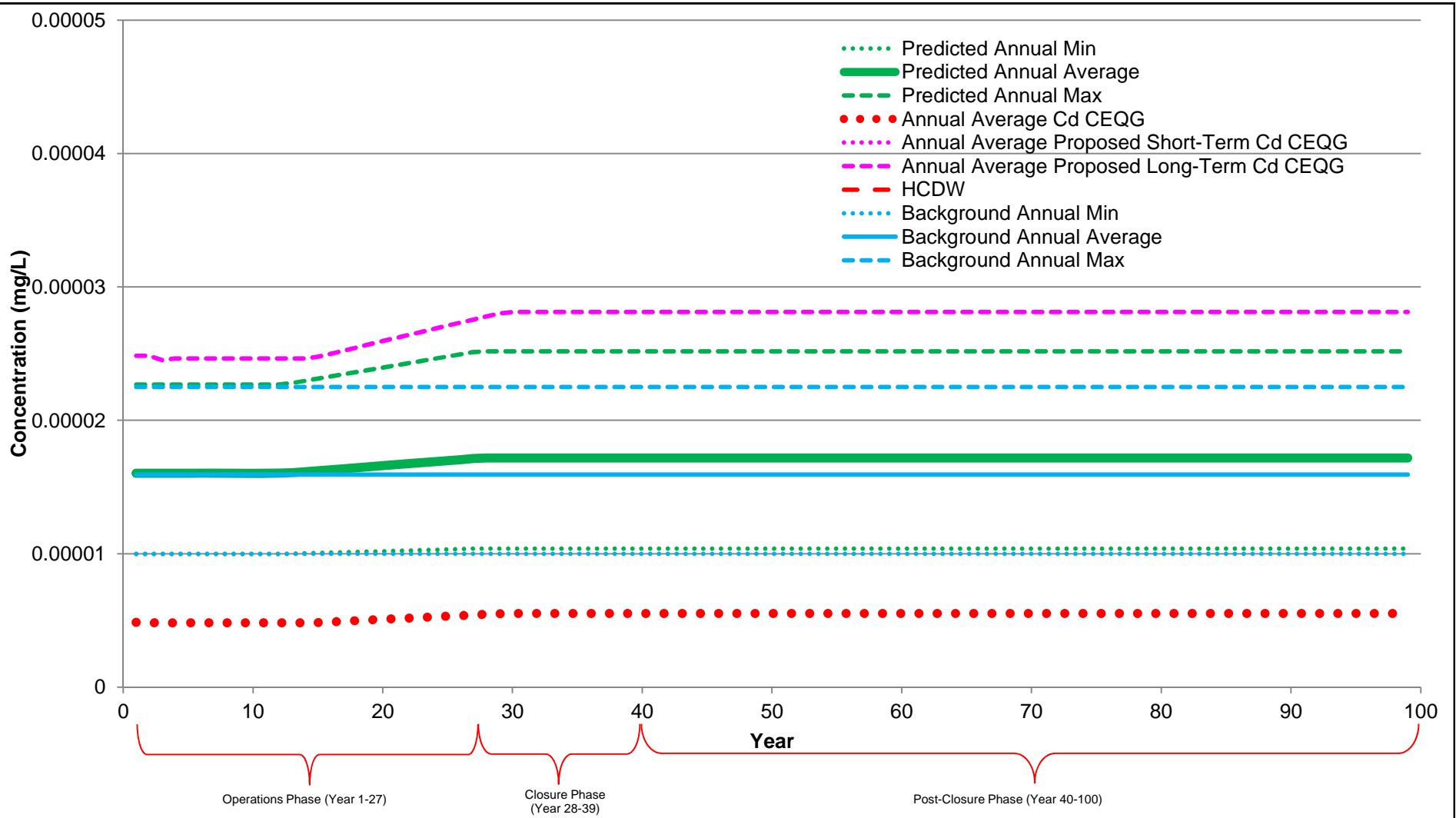


**NOTES:**

1. THE CEQG IS HARDNESS-DEPENDENT AND HAS BEEN CALCULATED BASED ON AVERAGE ANNUAL HARDNESS.
2. THE PROPOSED GUIDELINE FOR SHORT-TERM EXPOSURE IS NOT WITHIN THE SCALE OF THIS GRAPH.
3. THE HCDW GUIDELINE OF 0.005 mg/L IS NOT SHOWN ON THIS GRAPH.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF CADMIUM IN NAP8</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B6.7</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**

1. THE CEQG IS HARDNESS-DEPENDENT AND HAS BEEN CALCULATED BASED ON AVERAGE ANNUAL HARDNESS.
2. THE PROPOSED GUIDELINE FOR SHORT-TERM EXPOSURE IS NOT WITHIN THE SCALE OF THIS GRAPH.
3. THE HCDW GUIDELINE OF 0.005 mg/L IS NOT SHOWN ON THIS GRAPH.

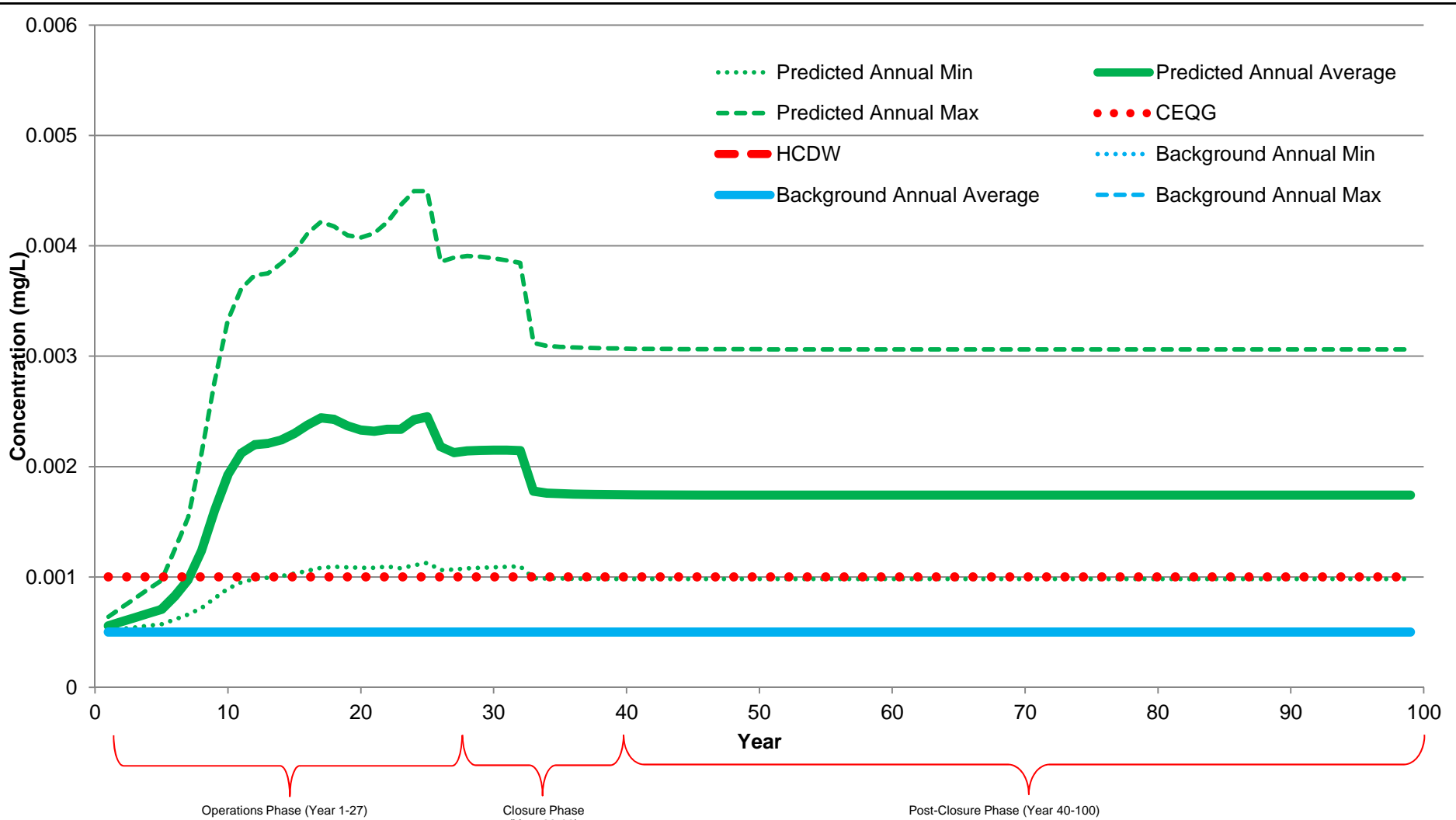
<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF CADMIUM IN MBB2</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B6.8</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

**APPENDIX B7**

**CHROMIUM**

(Figures B7-1 to B7-8)

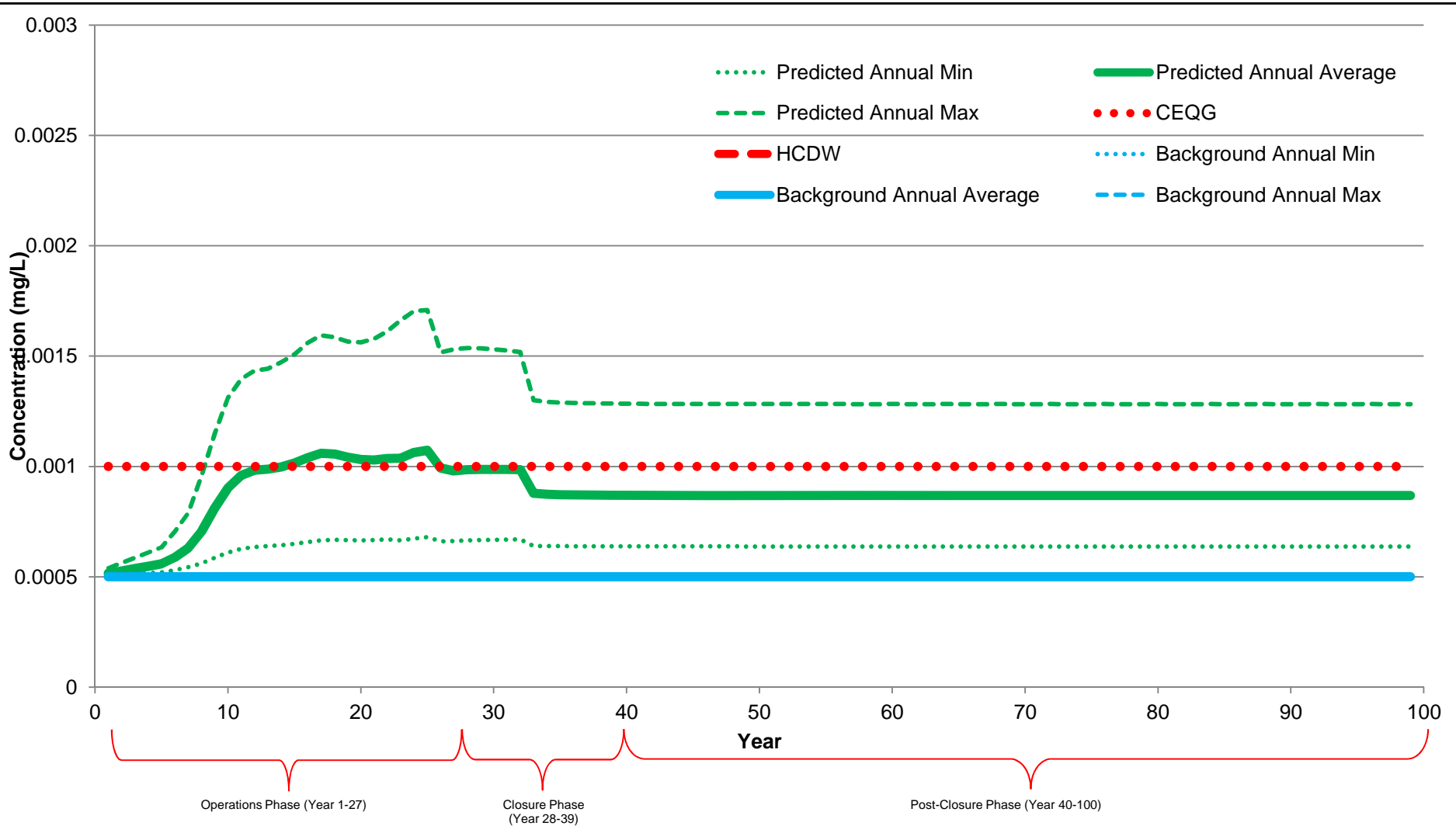


**NOTES:**

1. THE CEQG FOR TRIVALENT Cr IS 0.0089 mg/L; THE CEQG FOR HEXAVALENT CHROMIUM IS 0.001 mg/L.
2. NO MMER GUIDELINE FOR Cr.
3. THE HCDW GUIDELINE OF 0.05 mg/L IS NOT SHOWN ON THIS GRAPH

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF CHROMIUM IN UT1</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B7.1</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

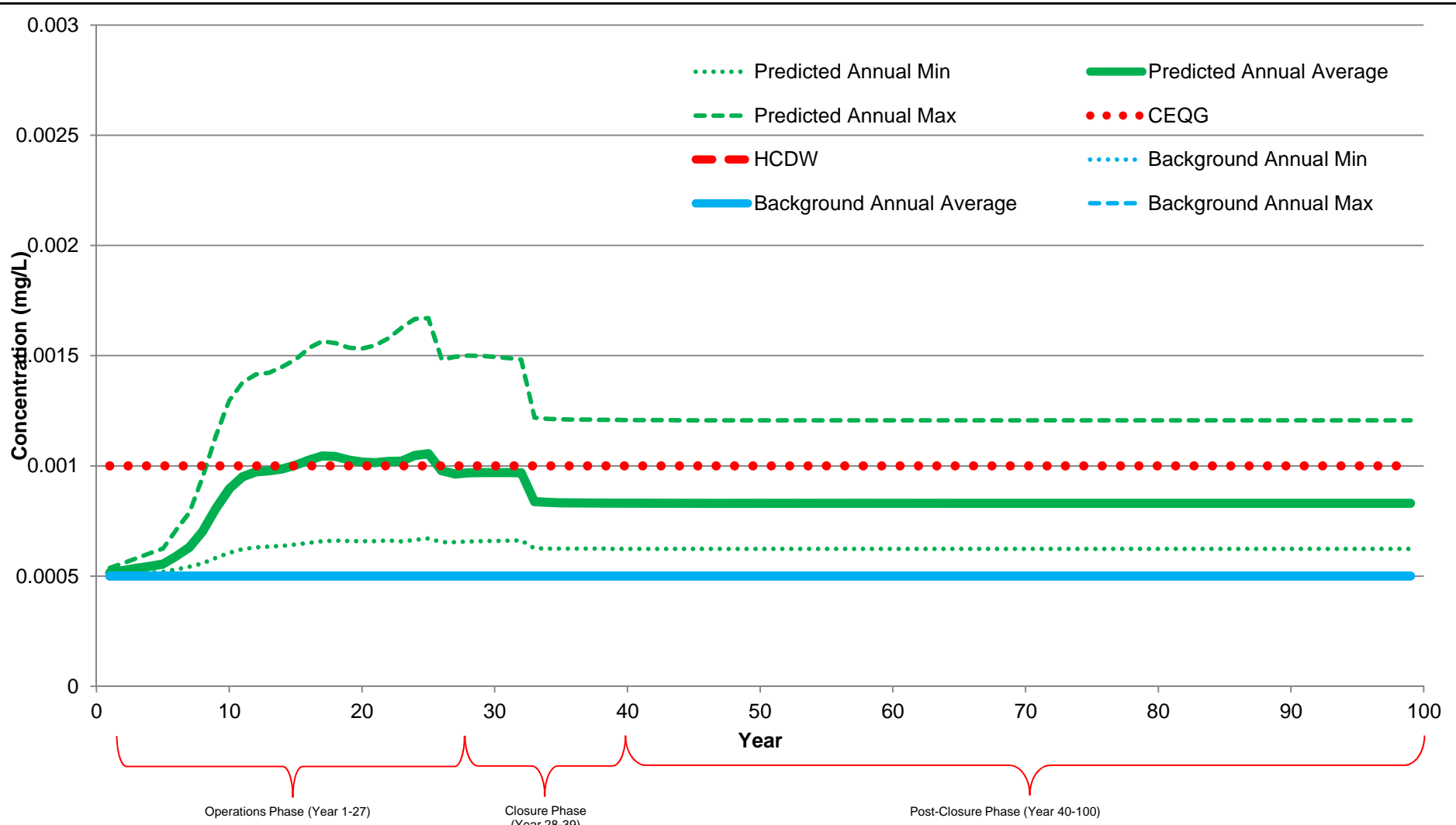


**NOTES:**

1. THE CEQG FOR TRIVALENT Cr IS 0.0089 mg/L; THE CEQG FOR HEXAVALENT CHROMIUM IS 0.001 mg/L.
2. NO MMR GUIDELINE FOR Cr.
3. THE HCDW GUIDELINE OF 0.05 mg/L IS NOT SHOWN ON THIS GRAPH

<b>NORTHCLIFF RESOURCES LTD.</b>		
<b>SISSON PROJECT</b>		
<b>PREDICTED CONCENTRATION OF CHROMIUM IN NAP1</b>		
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2	REF. NO. 9
	<b>Figure B7.2</b>	
		REV 0

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



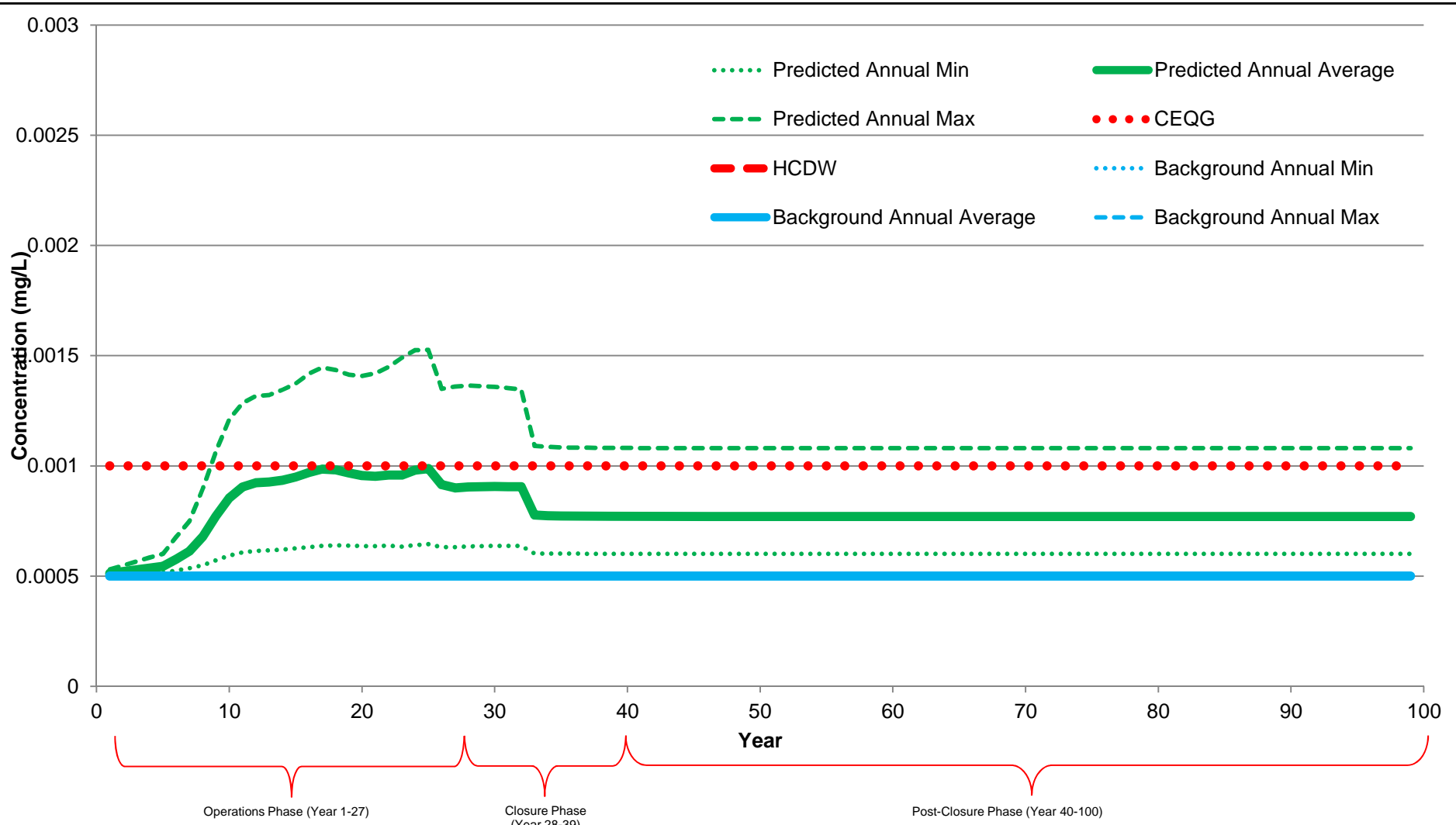
**NOTES:**

1. THE CEQG FOR TRIVALENT Cr IS 0.0089 mg/L; THE CEQG FOR HEXAVALENT CHROMIUM IS 0.001 mg/L.
2. NO MMR GUIDELINE FOR CHROMIUM.
3. THE HCDW GUIDELINE OF 0.05 mg/L IS NOT SHOWN ON THIS GRAPH

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF CHROMIUM IN NAP3</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B7.4</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



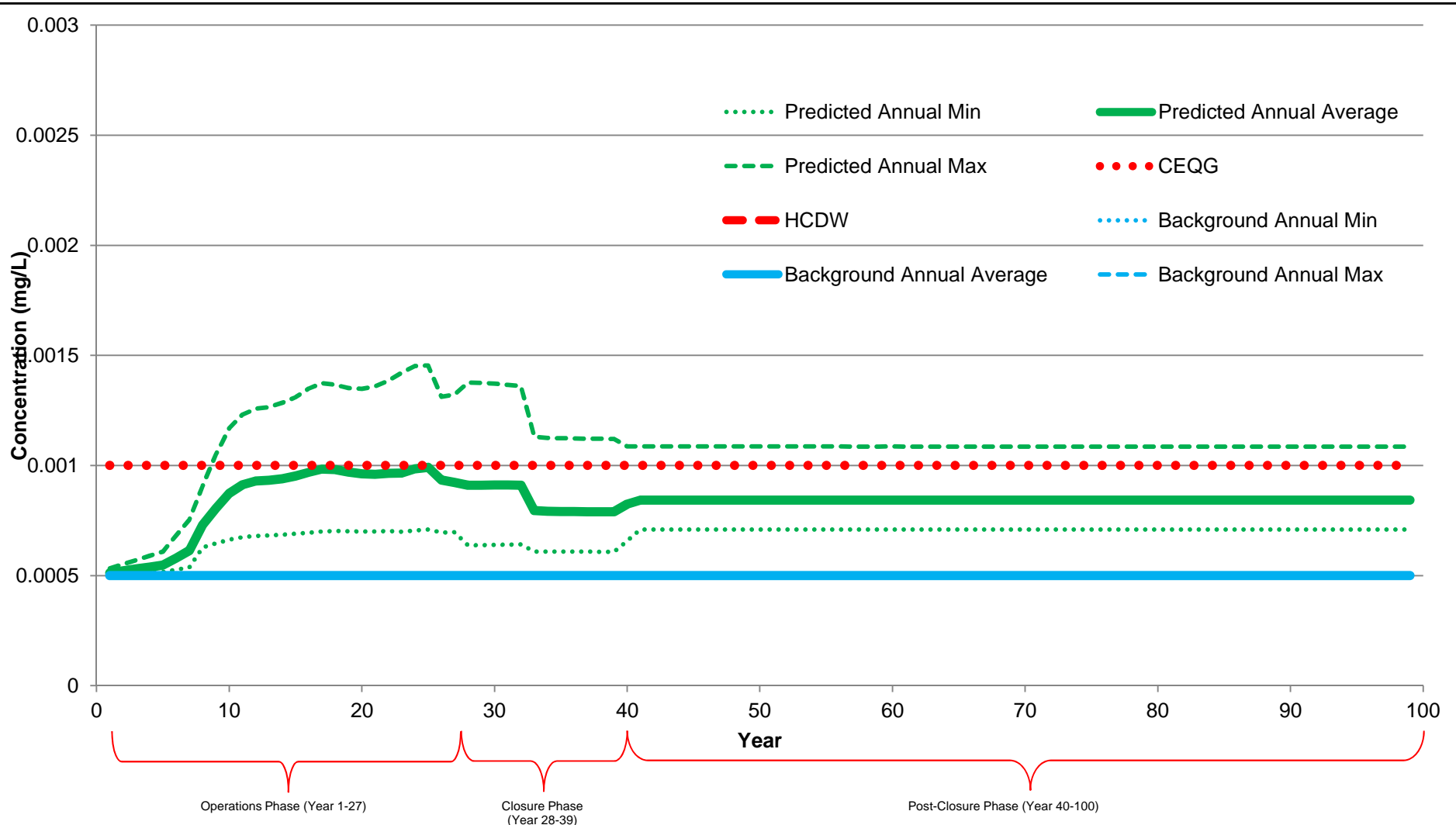


**NOTES:**

1. THE CEQG FOR TRIVALENT Cr IS 0.0089 mg/L; THE CEQG FOR HEXAVALENT CHROMIUM IS 0.001 mg/L.
2. NO MMR GUIDELINE FOR CHROMIUM.
3. THE HCDW GUIDELINE OF 0.05 mg/L IS NOT SHOWN ON THIS GRAPH

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF CHROMIUM IN NAP2</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2
REF. NO. 9	
<b>Figure B7.3</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

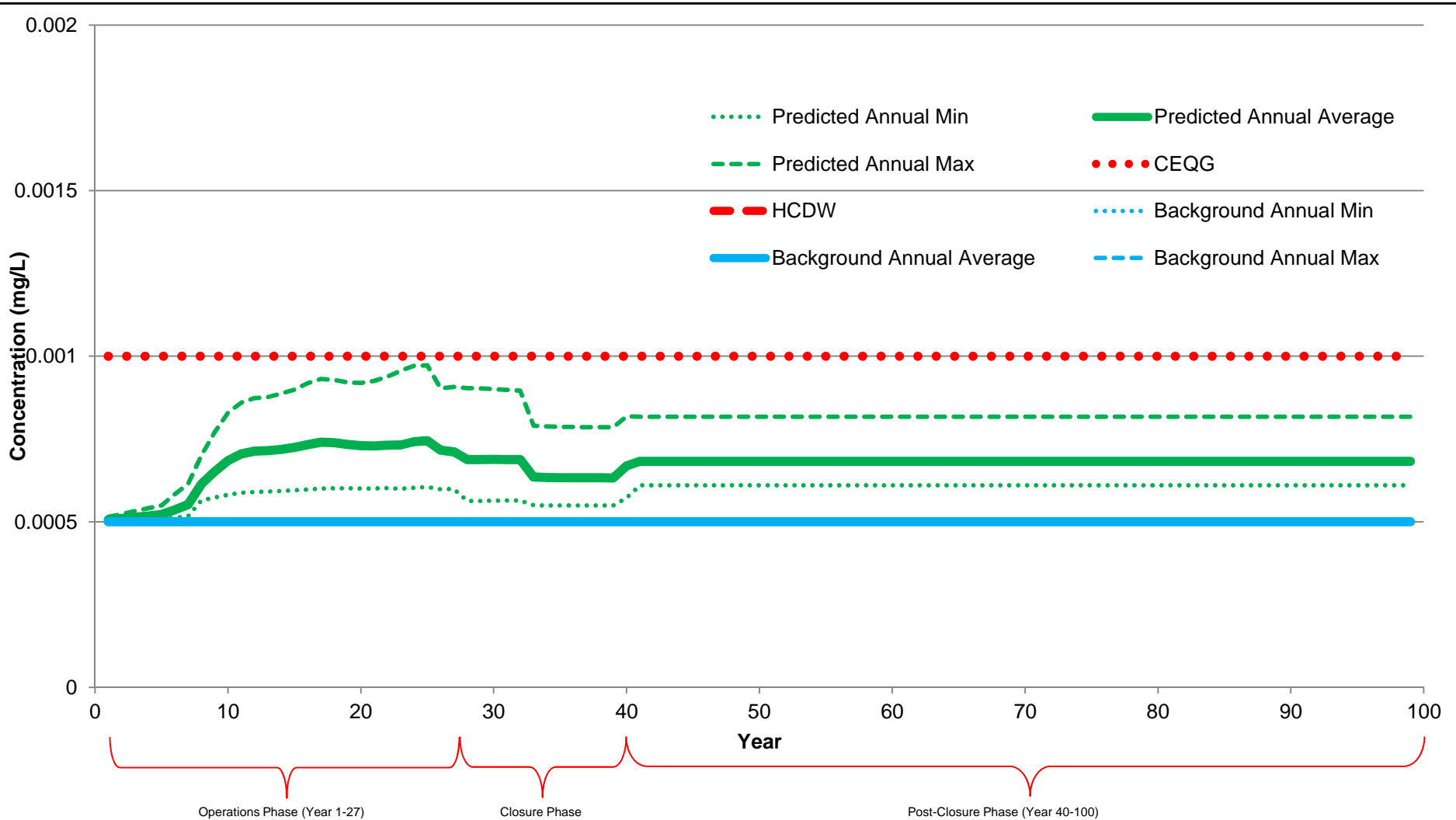


**NOTES:**

1. THE CEQG FOR TRIVALENT Cr IS 0.0089 mg/L; THE CEQG FOR HEXAVALENT CHROMIUM IS 0.001 mg/L.
2. NO MMER GUIDELINE FOR CHROMIUM.
3. THE HCDW GUIDELINE OF 0.05 mg/L IS NOT SHOWN ON THIS GRAPH

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF CHROMIUM IN NAP5</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B7.5</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**

1. THE CEQG FOR TRIVALENT Cr IS 0.0089 mg/L; THE CEQG FOR HEXAVALENT CHROMIUM IS 0.001 mg/L.
2. NO MMER GUIDELINE FOR Cr
3. THE HCDW GUIDELINE OF 0.05 mg/L IS NOT SHOWN ON THIS GRAPH

<b>NORTHCLIFF RESOURCES LTD.</b>		
<b>SISSON PROJECT</b>		
<b>PREDICTED CONCENTRATION OF CHROMIUM IN NAP7</b>		
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2	REF. NO. 9
	<b>Figure B7.6</b>	
		REV 0

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

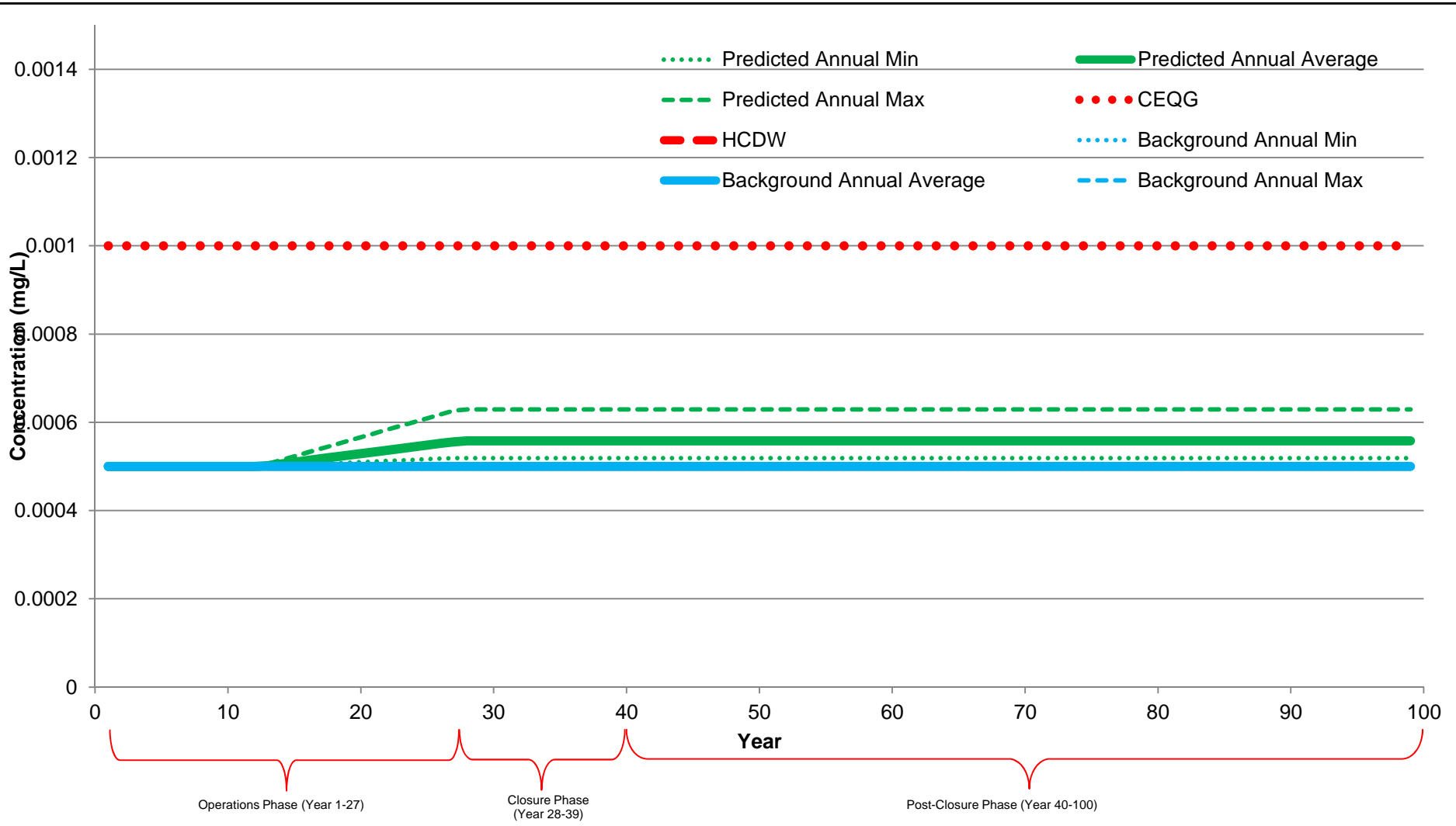


**NOTES:**

1. THE CEQG FOR TRIVALENT Cr IS 0.0089 mg/L; THE CEQG FOR HEXAVALENT CHROMIUM IS 0.001 mg/L.
2. NO MMR GUIDELINE FOR Cr.
3. THE HCDW GUIDELINE OF 0.05 mg/L IS NOT SHOWN ON THIS GRAPH

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF CHROMIUM IN NAP8</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2
REF. NO. 9	
<b>Figure B7.7</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**

1. THE CEQG FOR TRIVALENT Cr IS 0.0089 mg/L; THE CEQG FOR HEXAVALENT CHROMIUM IS 0.001 mg/L.
2. NO MMER GUIDELINE FOR Cr.
3. THE HCDW GUIDELINE OF 0.05 mg/L IS NOT SHOWN ON THIS GRAPH

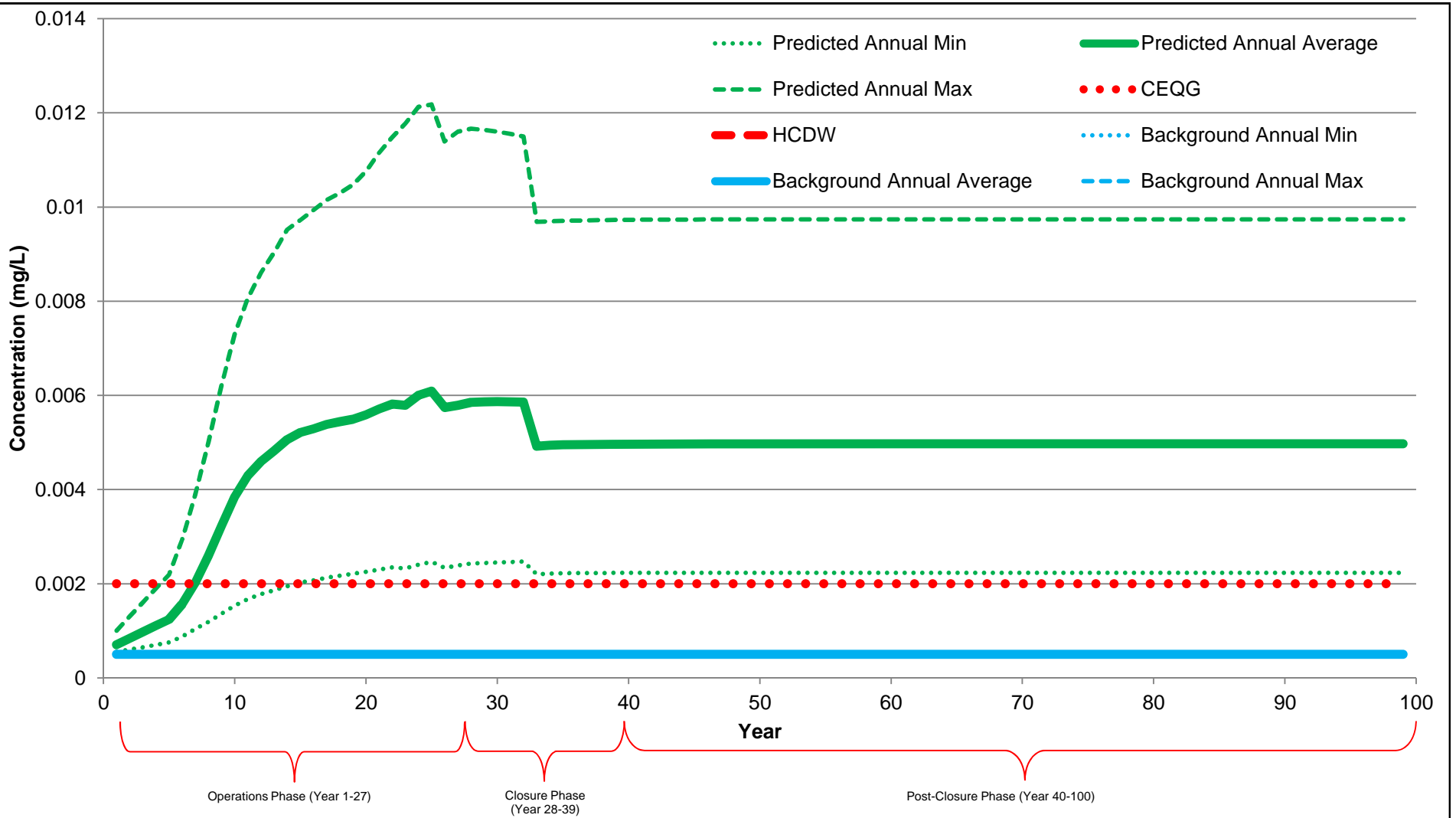
<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF CHROMIUM IN MBB2</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B7.8</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

**APPENDIX B8**

**COPPER**

(Figures B8-1 to B8-8)

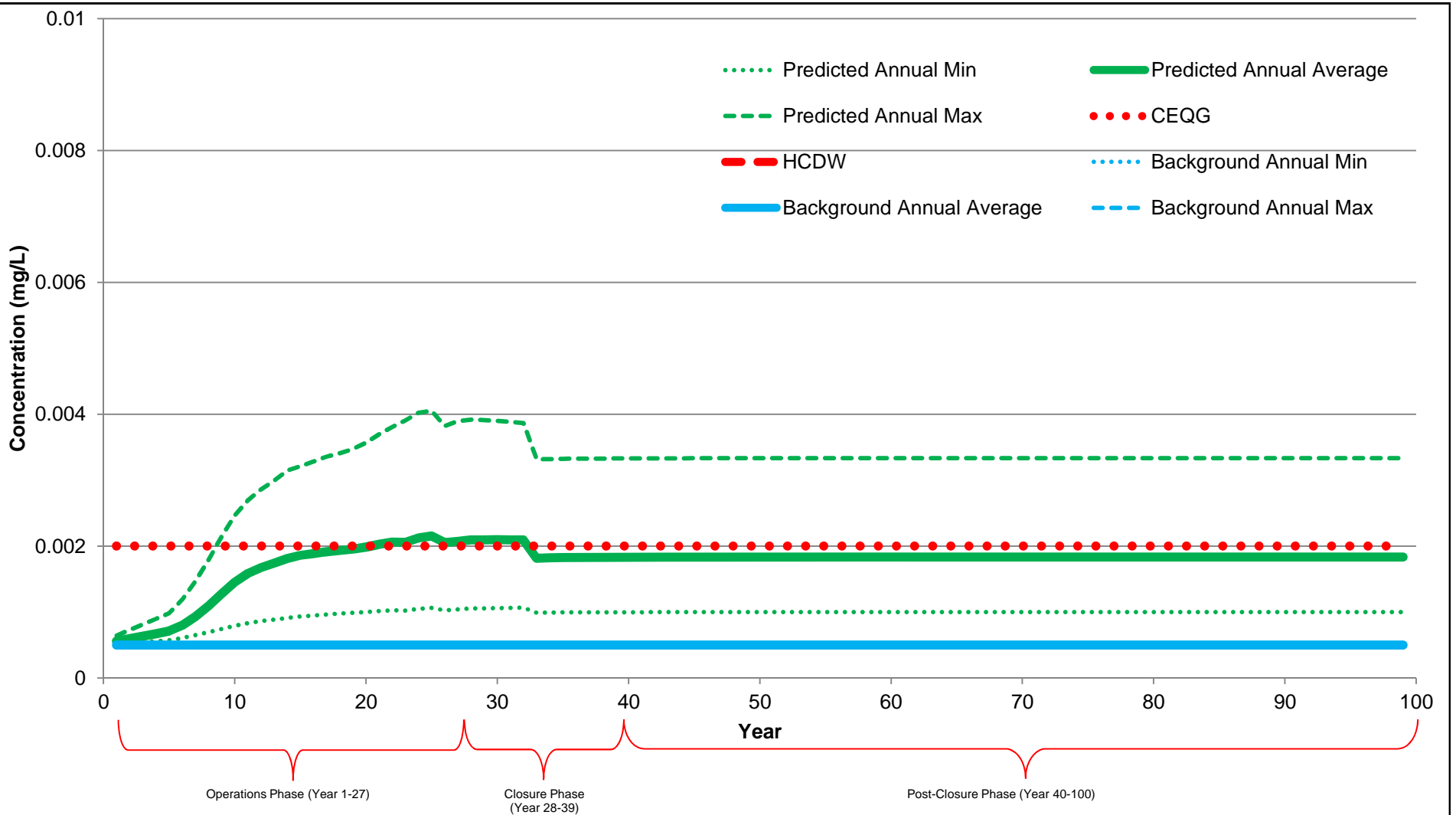


**NOTES:**

1. THE HCDW GUIDELINE IS 1.0 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
2. CURRENT AND PROPOSED MMR GUIDELINES FOR Cu ARE NOT WITHIN THE SCALE OF THIS GRAPH.
3. CEQG IS HARDNESS-DEPENDENT, WITH A MINIMUM OF 0.002 mg/L FOR HARDNESS <83 mg/L.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF COPPER IN UT1</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B8.1</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



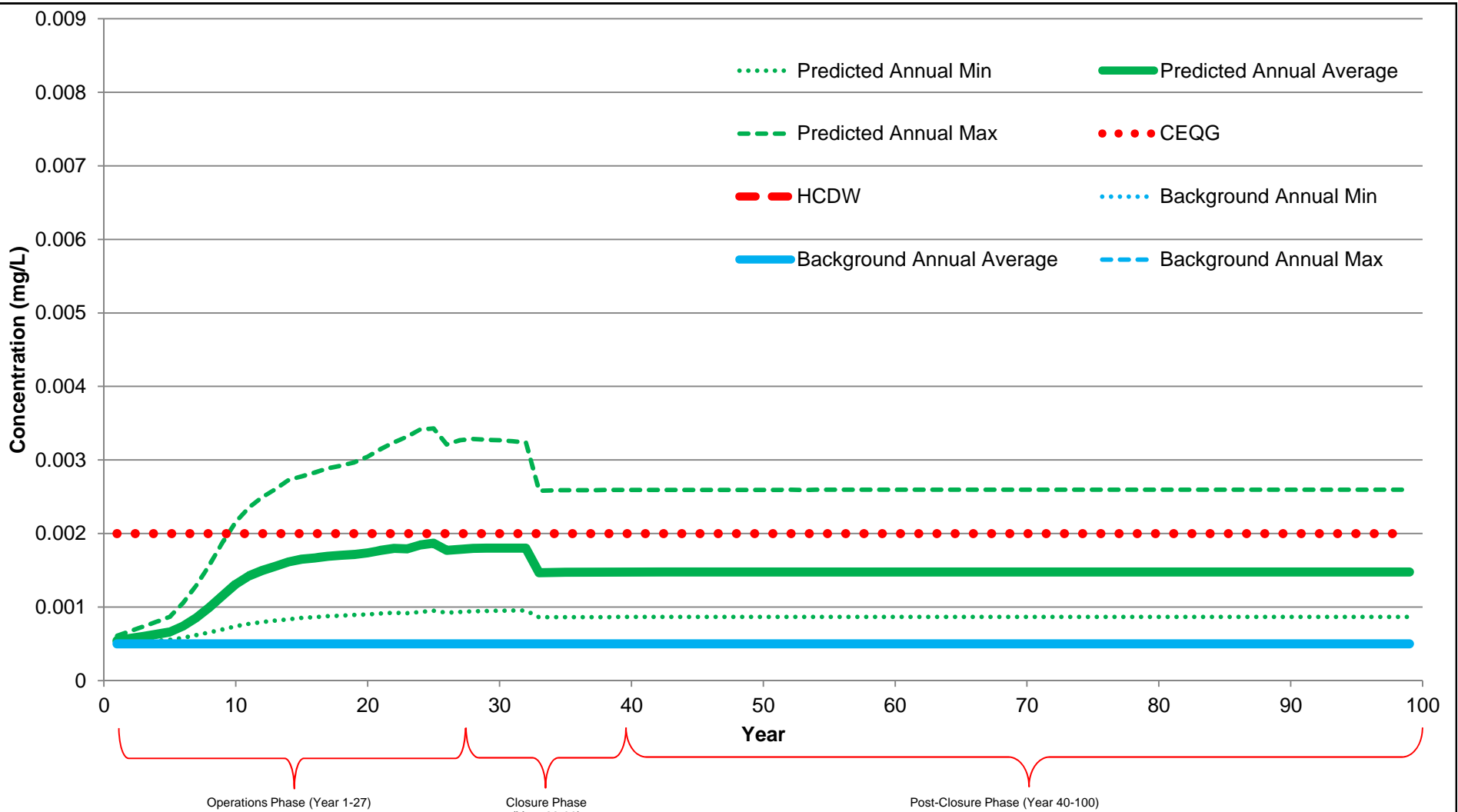
**NOTES:**

1. THE HCDW GUIDELINE IS 1.0 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
2. CURRENT AND PROPOSED MMR GUIDELINES FOR Cu ARE NOT WITHIN THE SCALE OF THIS GRAPH.
3. CEQG IS HARDNESS-DEPENDENT, WITH A MINIMUM OF 0.002 mg/L FOR HARDNESS <83 mg/L.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF COPPER IN NAP1</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2
REF. NO. 9	
<b>Figure B8.2</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



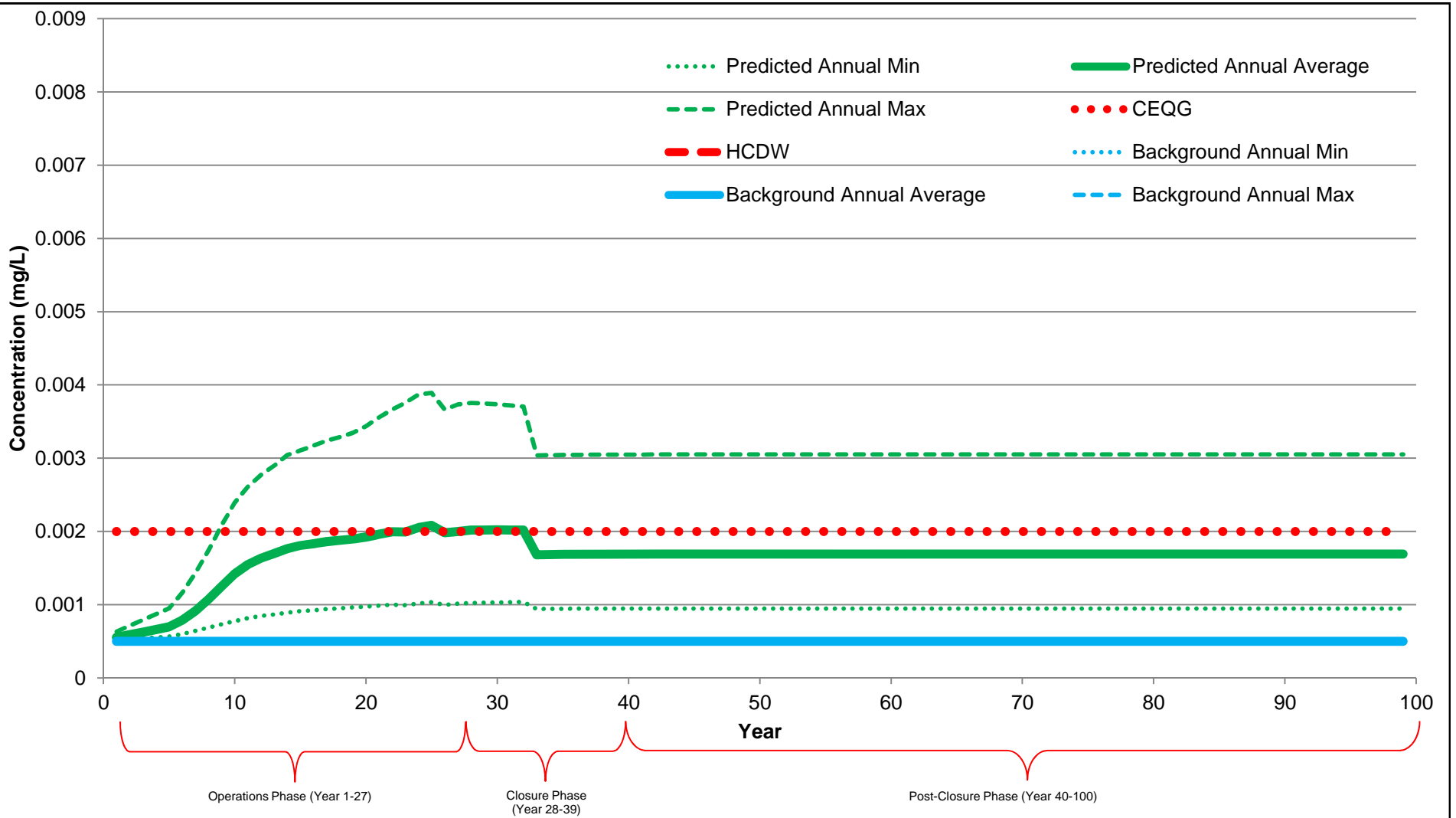


**NOTES:**

1. THE HCDW GUIDELINE IS 1.0 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
2. CURRENT AND PROPOSED MMER GUIDELINES FOR Cu ARE NOT WITHIN THE SCALE OF THIS GRAPH.
3. CEQG IS HARDNESS-DEPENDENT, WITH A MINIMUM OF 0.002 mg/L FOR HARDNESS <83 mg/L.

<b>NORTHCLIFF RESOURCES LTD.</b>		
<b>SISSON PROJECT</b>		
<b>PREDICTED CONCENTRATION OF COPPER IN NAP2</b>		
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2	REF. NO. 9
	<b>Figure B8.3</b>	
REV 0		

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

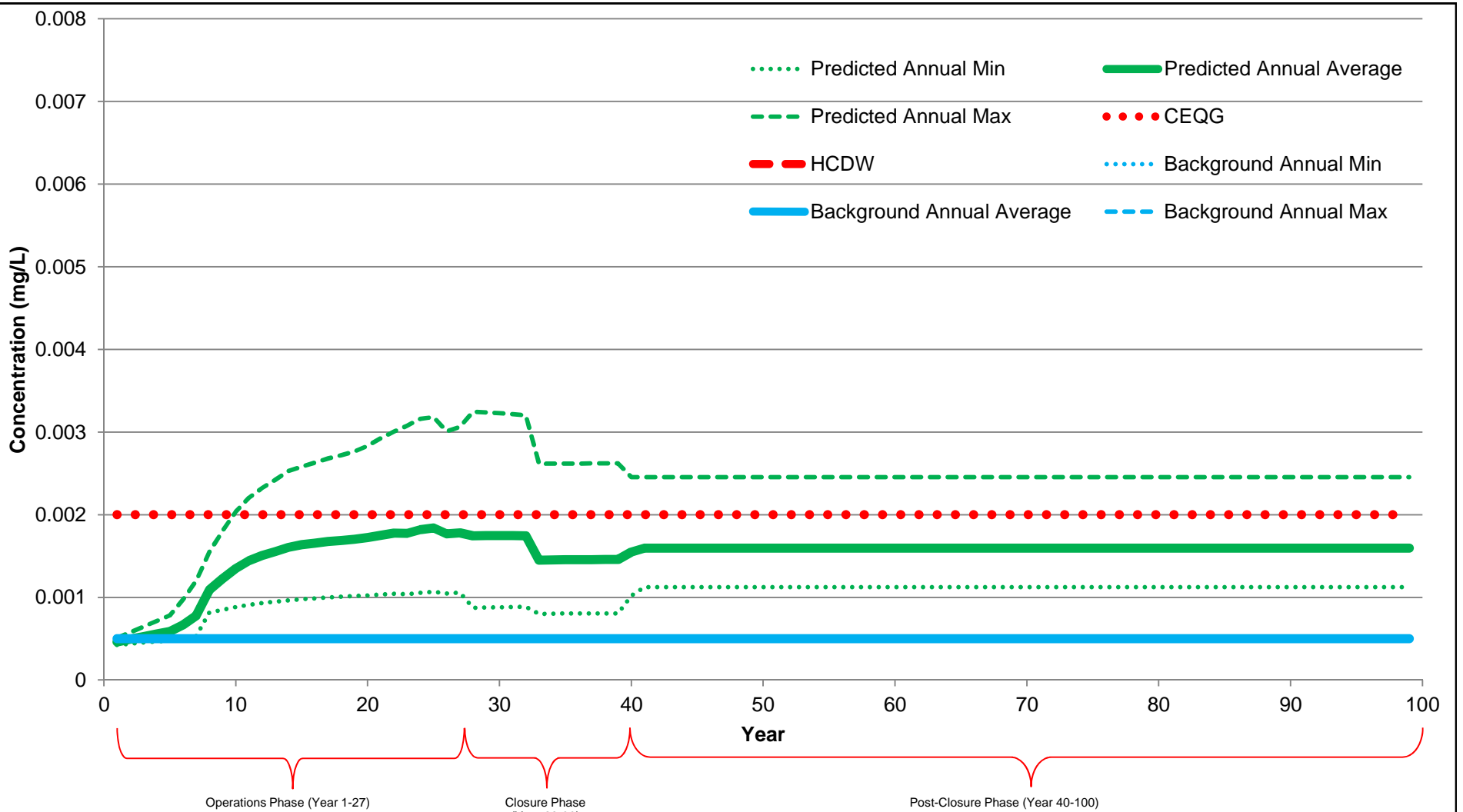


**NOTES:**

1. THE HCDW GUIDELINE IS 1.0 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
2. CURRENT AND PROPOSED MMER GUIDELINES FOR Cu ARE NOT WITHIN THE SCALE OF THIS GRAPH.
3. CEQG IS HARDNESS-DEPENDENT, WITH A MINIMUM OF 0.002 mg/L FOR HARDNESS <83 mg/L.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF COPPER IN NAP3</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B8.4</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

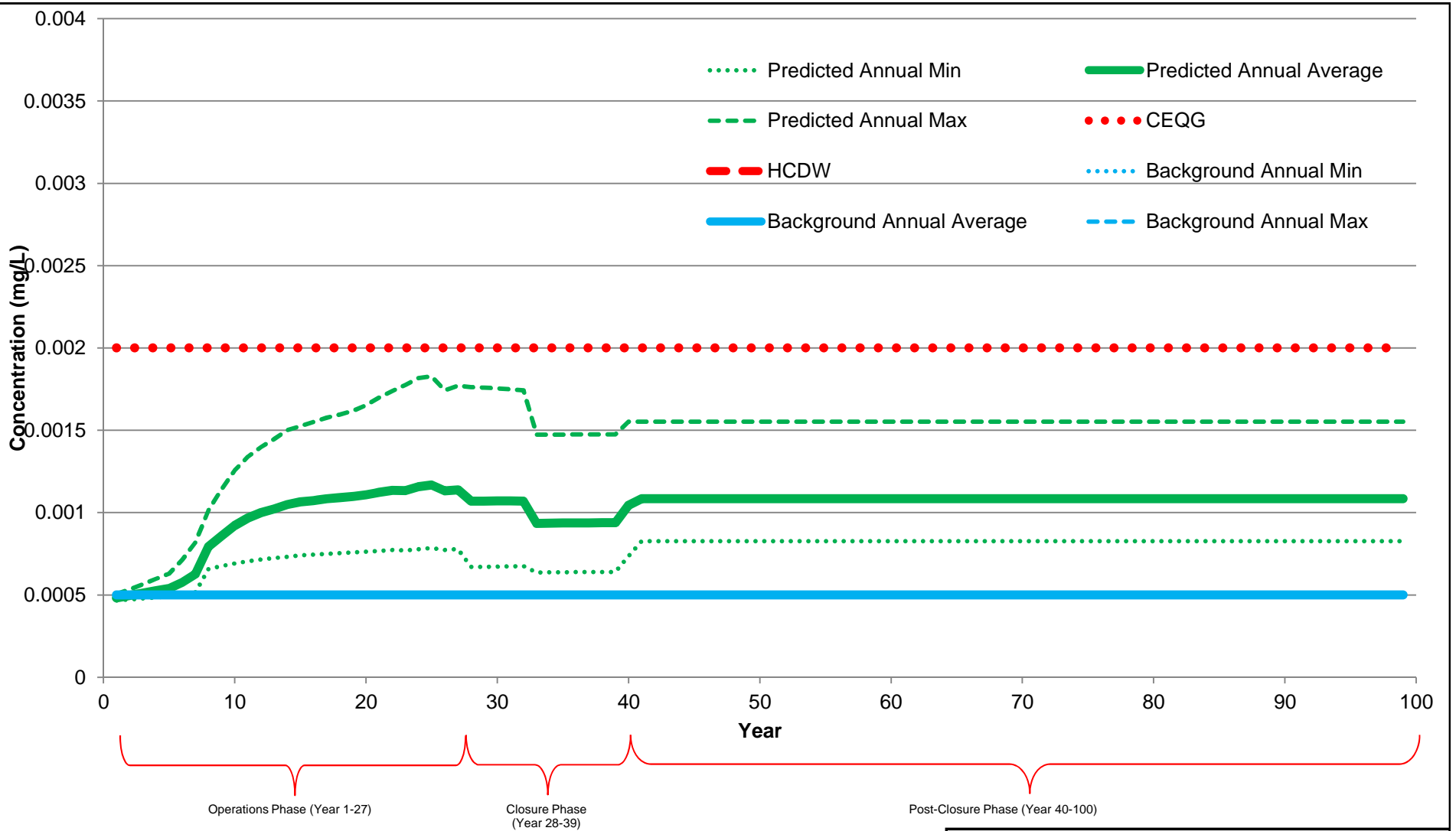


**NOTES:**

1. THE HCDW GUIDELINE IS 1.0 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
2. CURRENT AND PROPOSED MMER GUIDELINES FOR Cu ARE NOT WITHIN THE SCALE OF THIS GRAPH.
3. CEQG IS HARDNESS-DEPENDENT, WITH A MINIMUM OF 0.002 mg/L FOR HARDNESS <83 mg/L.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF COPPER IN NAP5</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B8.5</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

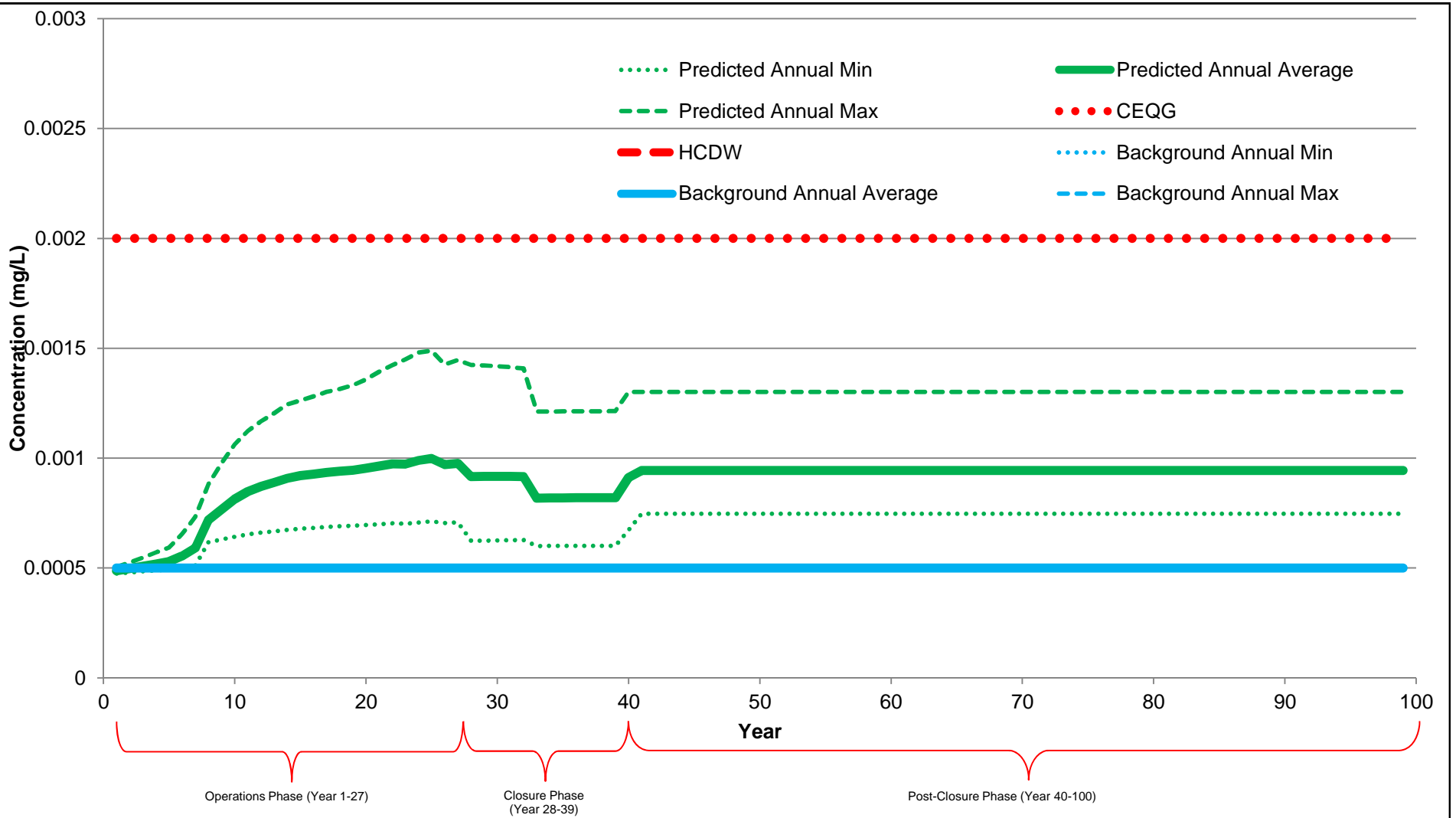


**NOTES:**

1. THE HCDW GUIDELINE IS 1.0 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
2. CURRENT AND PROPOSED MMR GUIDELINES FOR Cu ARE NOT WITHIN THE SCALE OF THIS GRAPH.
3. CEQG IS HARDNESS-DEPENDENT, WITH A MINIMUM OF 0.002 mg/L FOR HARDNESS <83 mg/L.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF COPPER IN NAP7</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2
REF. NO. 9	
<b>Figure B8.6</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

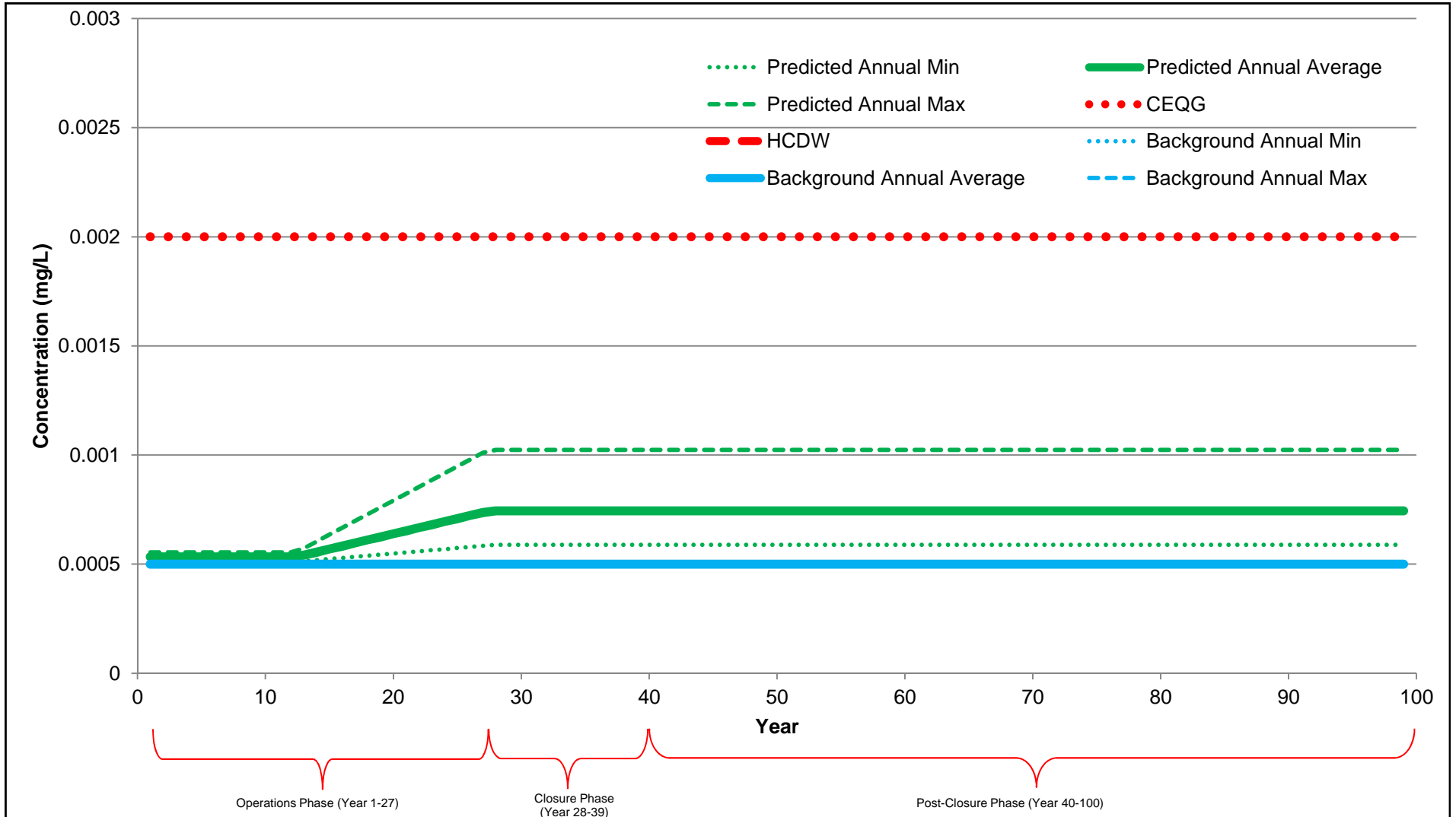


**NOTES:**

1. THE HCDW GUIDELINE IS 1.0 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
2. CURRENT AND PROPOSED MMER GUIDELINES FOR Cu ARE NOT WITHIN THE SCALE OF THIS GRAPH.
3. CEQG IS HARDNESS-DEPENDENT, WITH A MINIMUM OF 0.002 mg/L FOR HARDNESS <83 mg/L.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF COPPER IN NAP8</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B8.7</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**

1. THE HCDW GUIDELINE IS 1.0 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
2. CURRENT AND PROPOSED MMR GUIDELINES FOR Cu ARE NOT WITHIN THE SCALE OF THIS GRAPH.
3. CEQG IS HARDNESS-DEPENDENT, WITH A MINIMUM OF 0.002 mg/L FOR HARDNESS <83 mg/L.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF COPPER IN MBB2</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B8.8</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

**APPENDIX B9**

**SELENIUM**

(Figures B9-1 to B9-8)



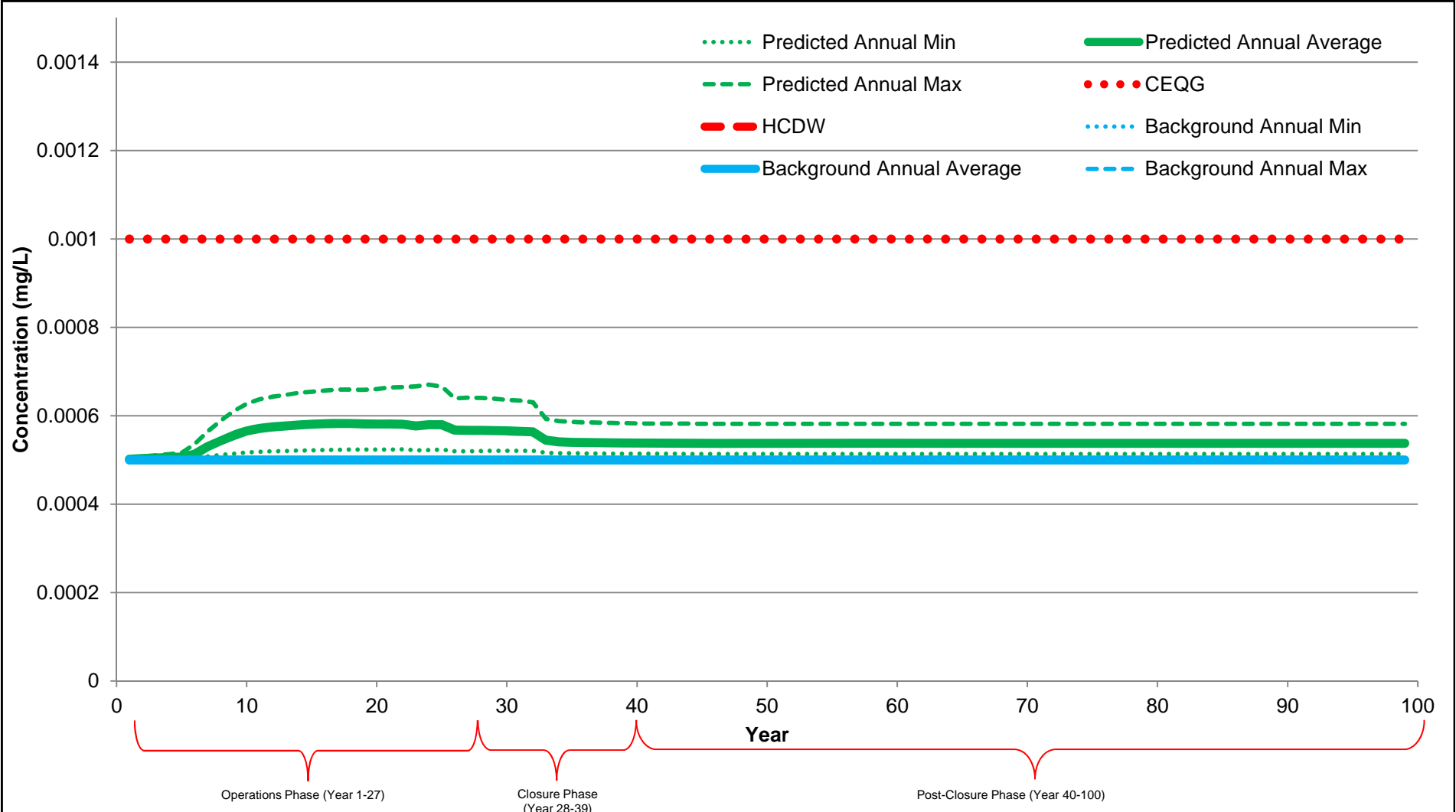
**NOTES:**

1. THE HCDW GUIDELINE IS 0.01 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
2. THERE IS NO MMER GUIDELINE FOR Se.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF SELENIUM IN UT1</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B9.1</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

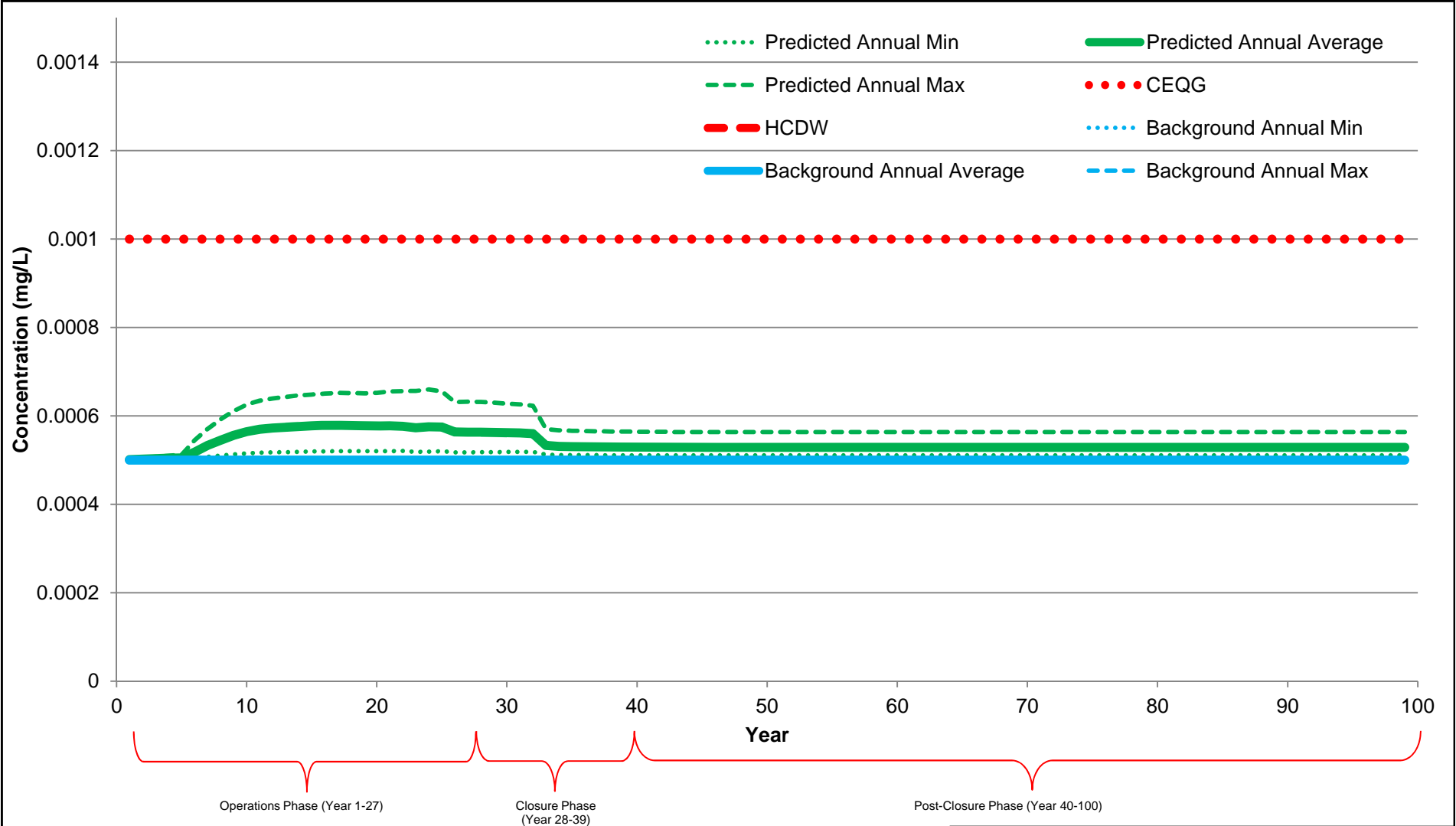




**NOTES:**  
 1. THE HCDW GUIDELINE IS 0.01 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.  
 2. THERE IS NO MMER GUIDELINE FOR Se.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF SELENIUM IN NAP1</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2 REF. NO. 9 <b>Figure B9.2</b> REV 0

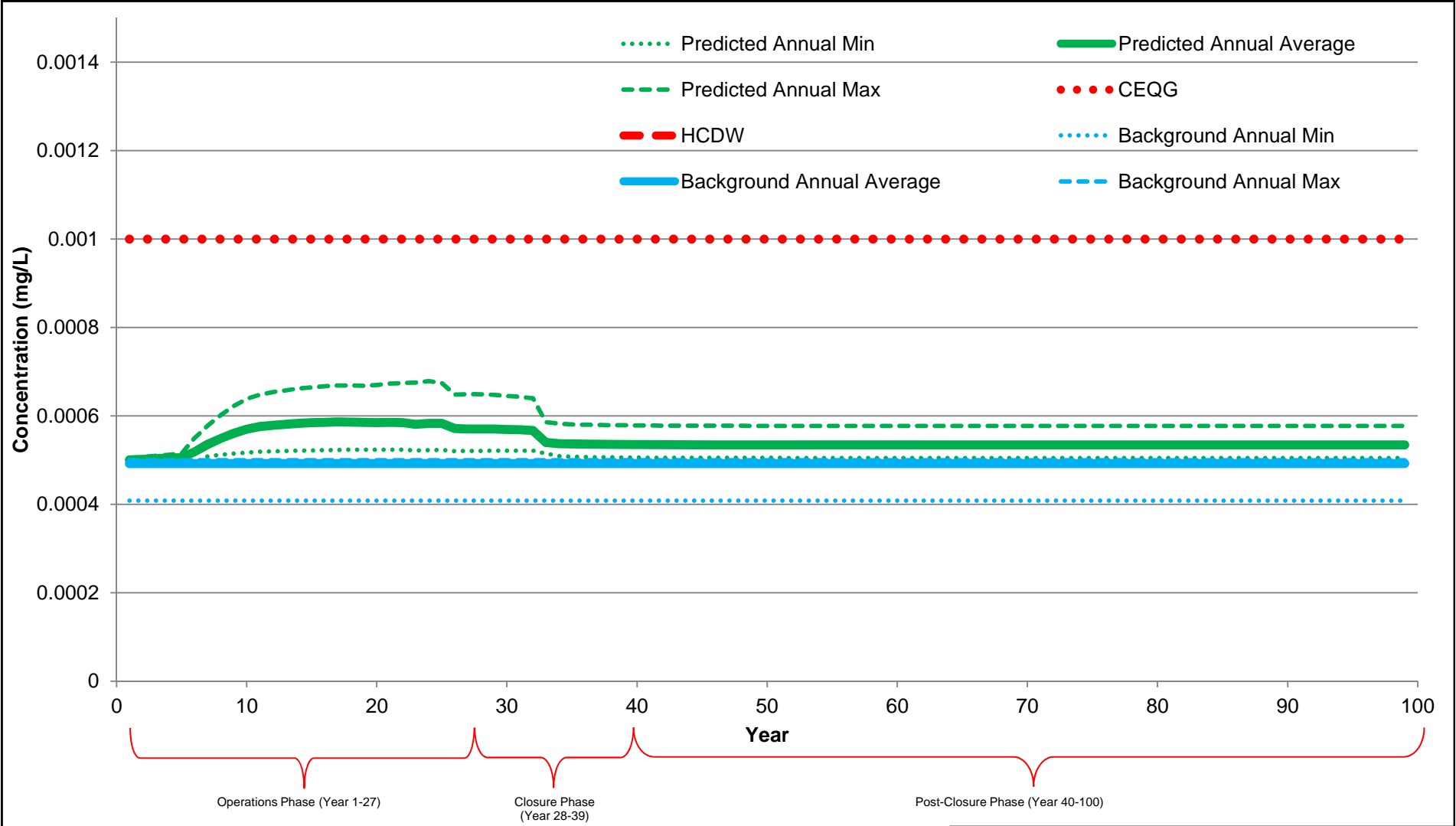
0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**  
 1. THE HCDW GUIDELINE IS 0.01 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.  
 2. THERE IS NO MMER GUIDELINE FOR Se.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF SELENIUM IN NAP2</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B9.3</b>	
REV 0	

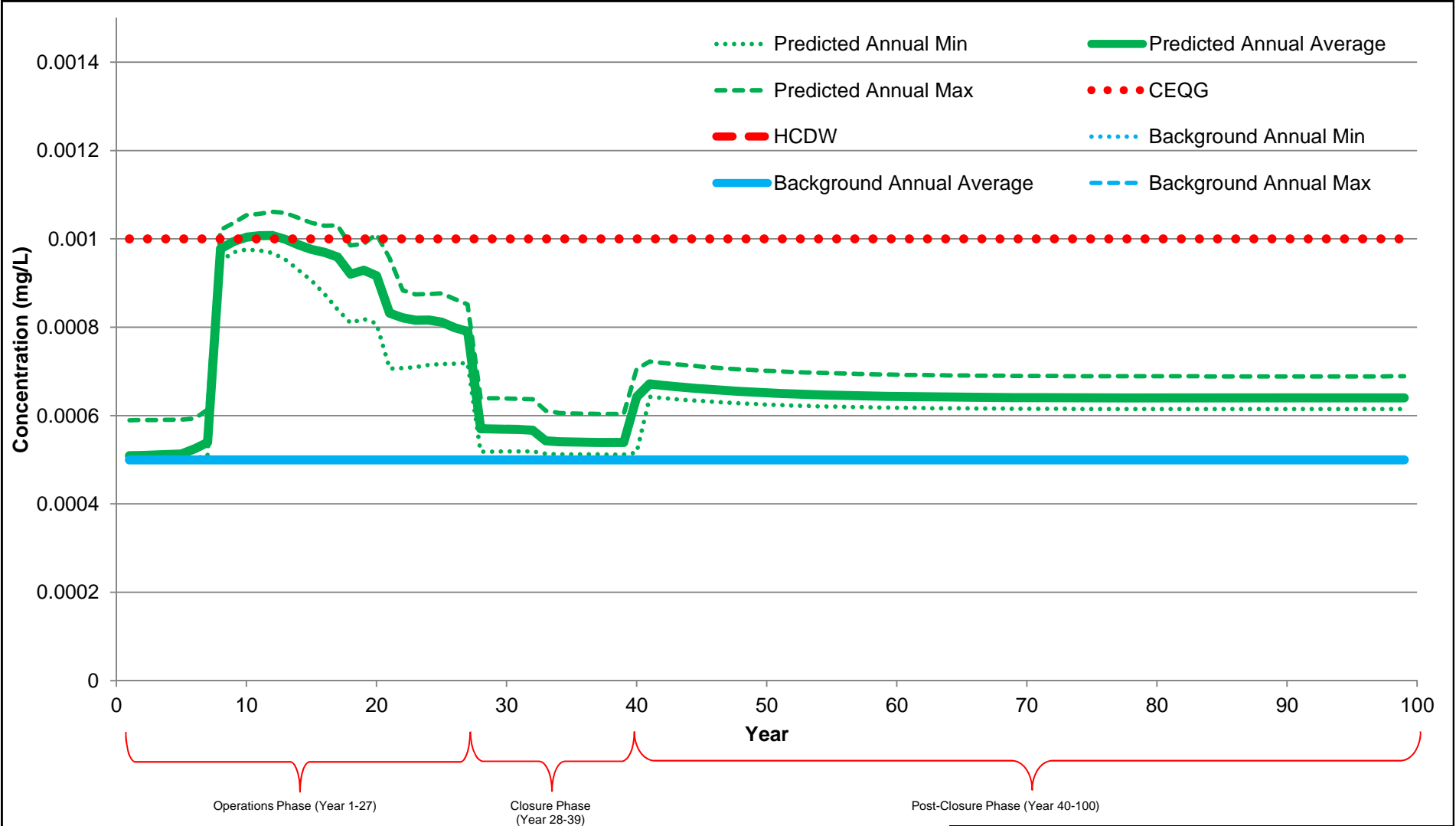
0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**  
 1. THE HCDW GUIDELINE IS 0.01 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.  
 2. THERE IS NO MMR GUIDELINE FOR SELENIUM.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF SELENIUM IN NAP3</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2 REF. NO. 9 <b>Figure B9.4</b> REV 0

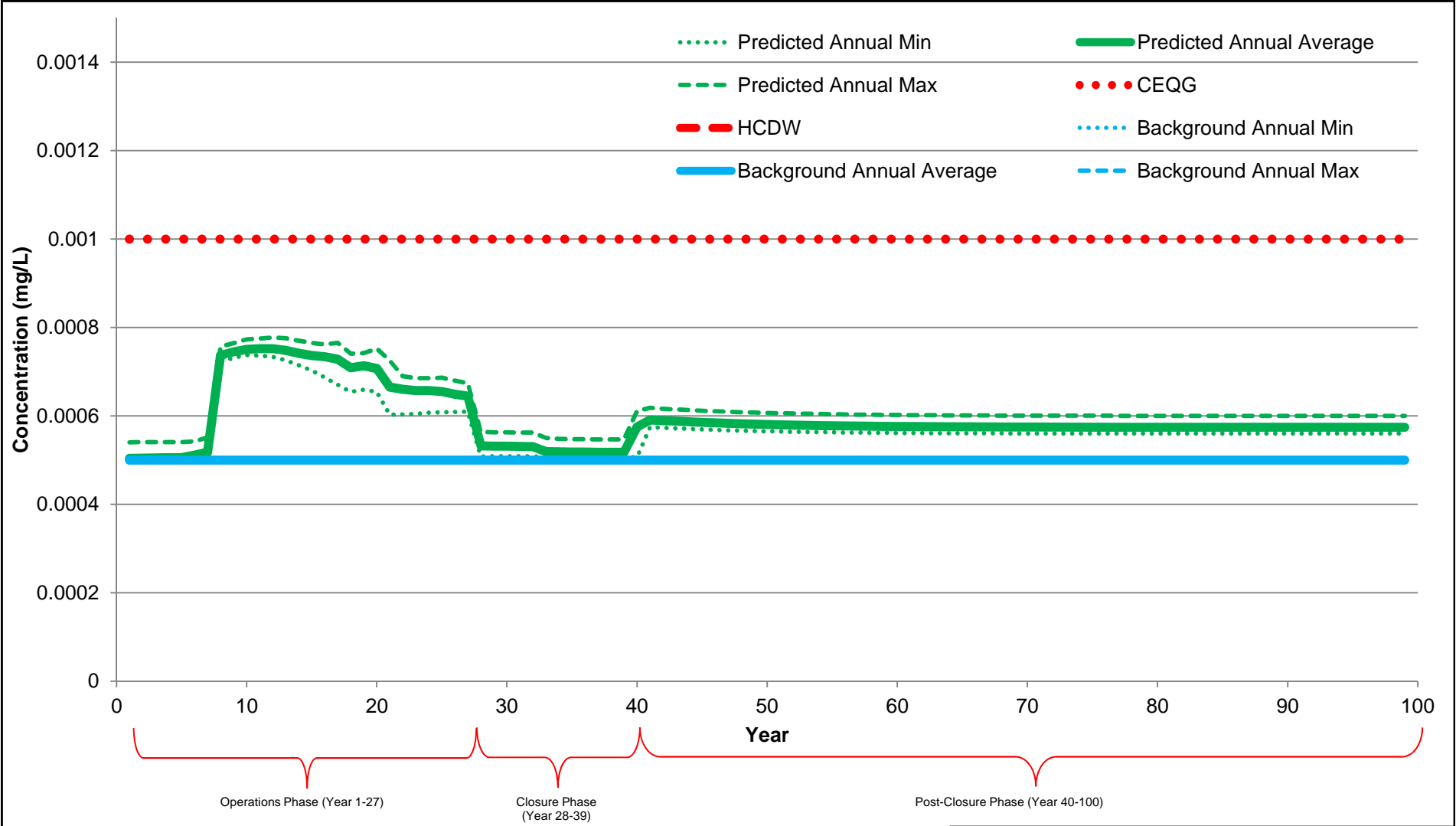
0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**  
 1. THE HCDW GUIDELINE IS 0.01 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.  
 2. THERE IS NO MMR GUIDELINE FOR Se.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF SELENIUM IN NAP5</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2 REF. NO. 9 <b>Figure B9.5</b> REV 0

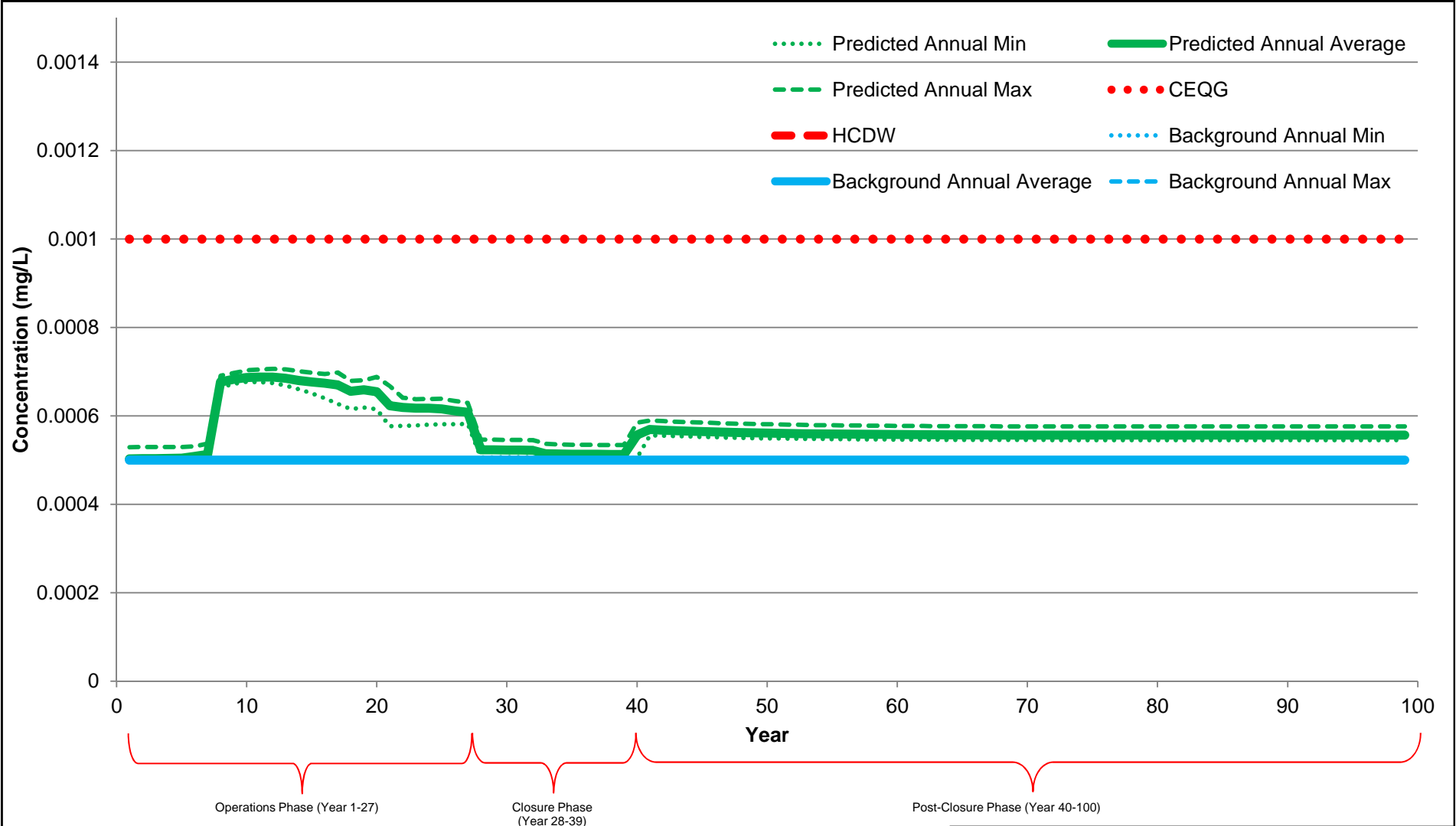
0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**  
 1. THE HCDW GUIDELINE IS 0.01 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.  
 2. THERE IS NO MMER GUIDELINE FOR Se

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF SELENIUM IN NAP7</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2 REF. NO. 9 <b>Figure B9.6</b> REV 0

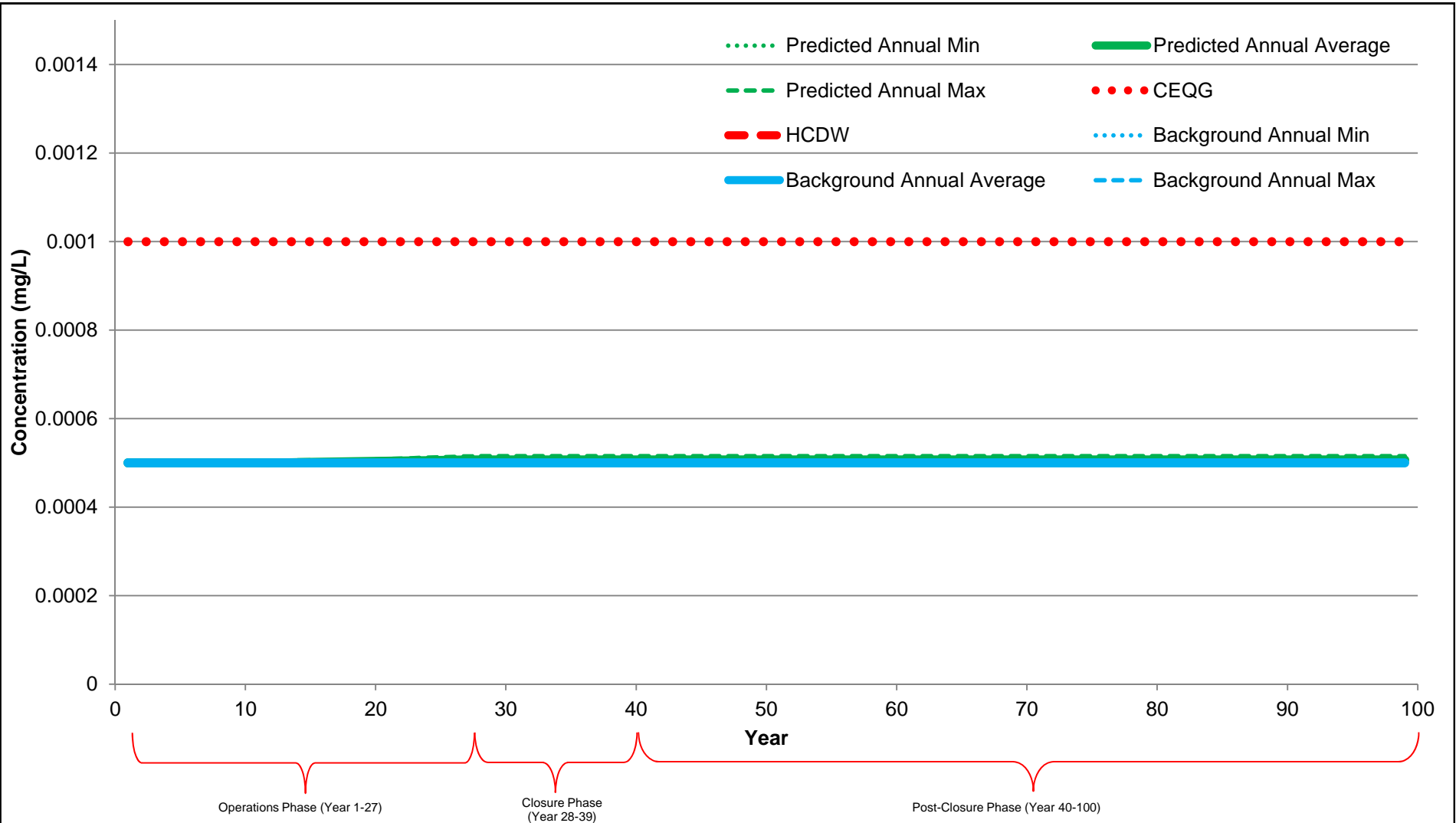
0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**  
 1. THE HCDW GUIDELINE IS 0.01 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.  
 2. THERE IS NO MMER GUIDELINE FOR Se.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF SELENIUM IN NAP8</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B9.7</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**

- 1. THE HCDW GUIDELINE IS 0.01 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
- 2. THERE IS NO MMER GUIDELINE FOR Se.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF SELENIUM IN MBB2</b>	
<i><b>Knight Piésold</b></i> <b>CONSULTING</b>	P/A NO. VA101-447/2
REF. NO. 9	REV 0
<b>Figure B9.8</b>	

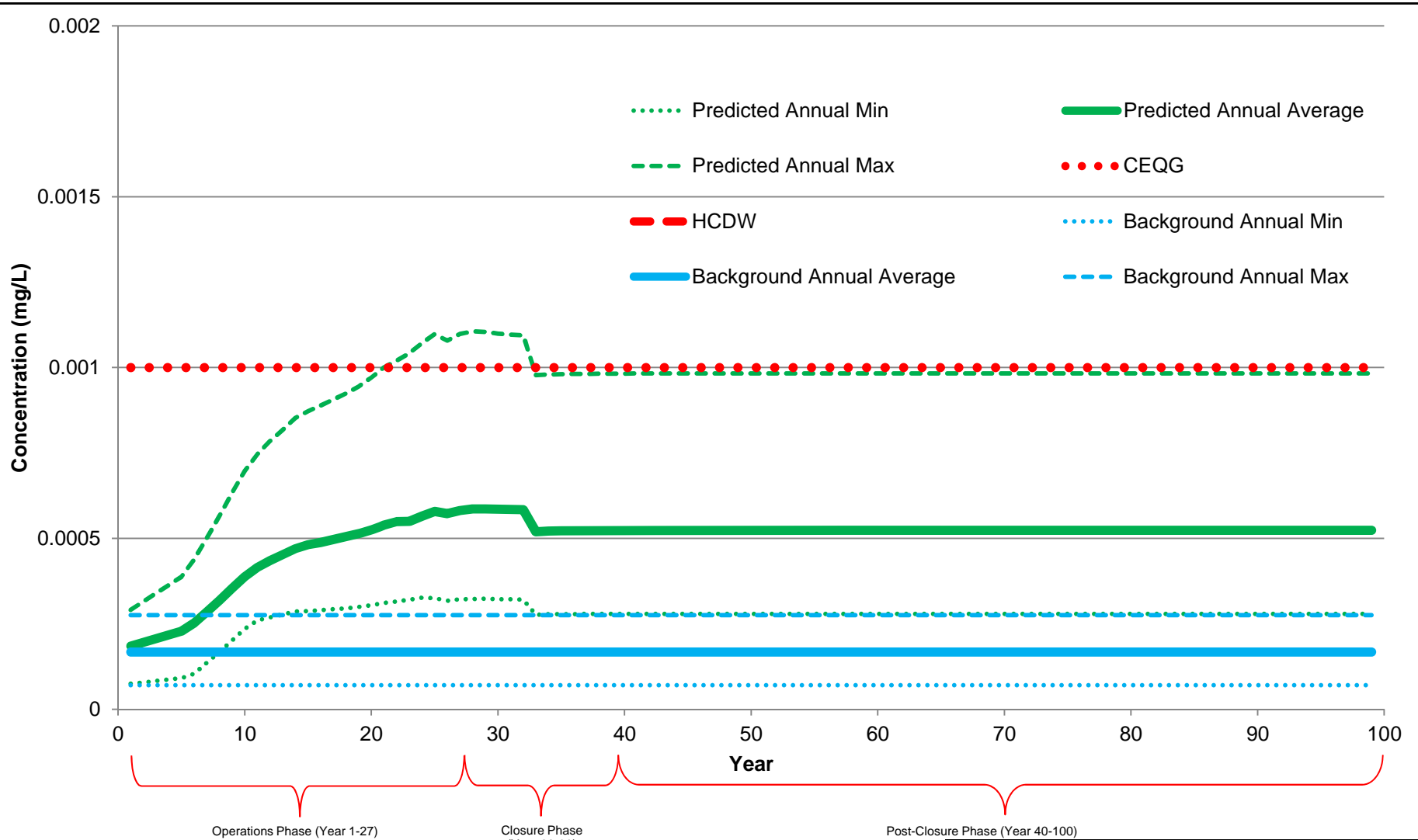
0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

**APPENDIX B10**

**LEAD**

(Figures B10-1 to B10-8)



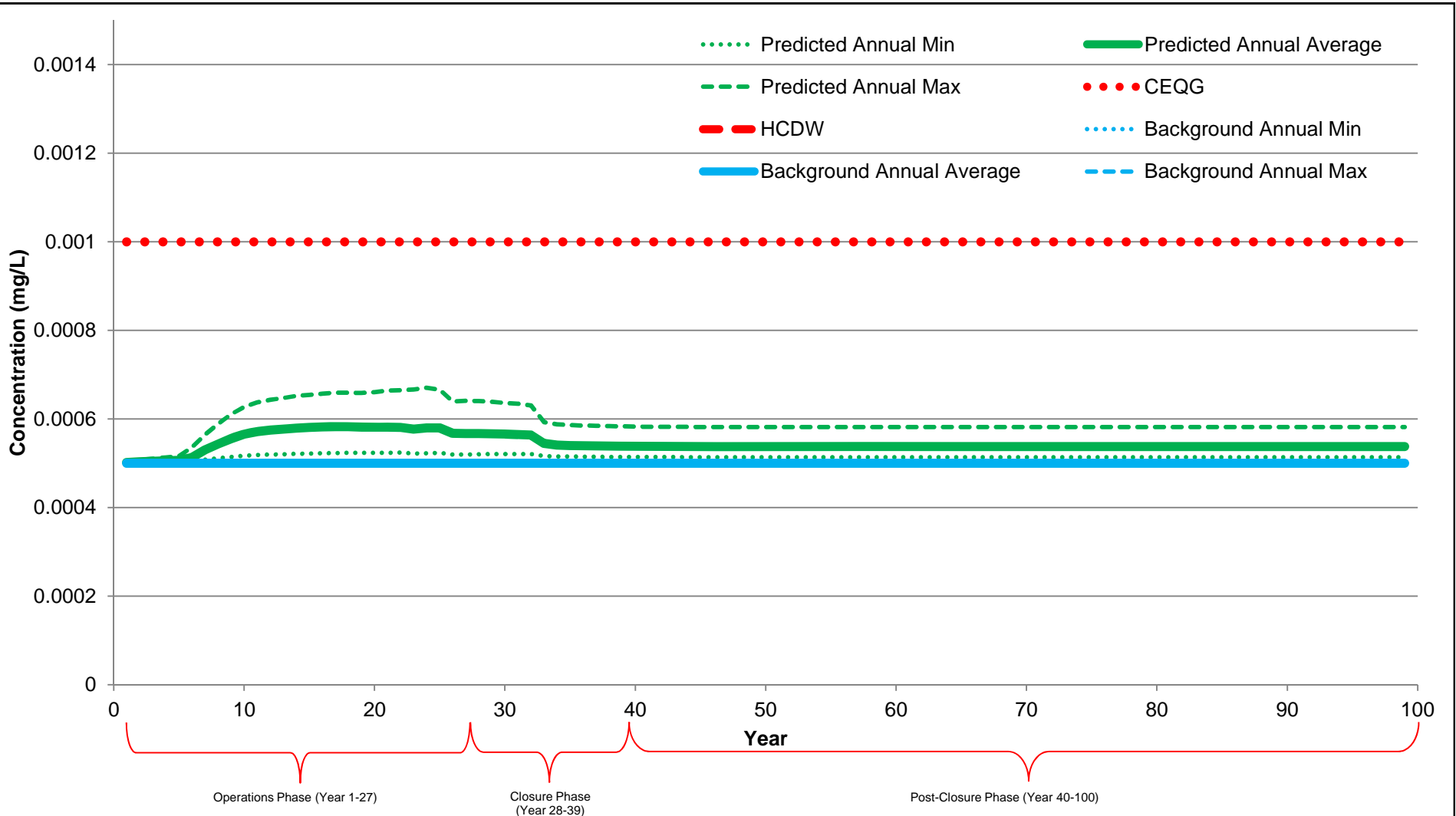


**NOTES:**

1. THE HCDW GUIDELINE IS 0.1 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
2. CURRENT AND PROPOSED MMR GUIDELINES FOR Cu ARE NOT WITHIN THE SCALE OF THIS GRAPH.
3. CEQG IS HARDNESS-DEPENDENT, WITH A MINIMUM OF 0.001 mg/L FOR HARDNESS <60 mg/L.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF LEAD IN UT1</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-1/1
REF. NO. 1	
<b>Figure B10.1</b>	
REV 0	

0	28JUN 13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

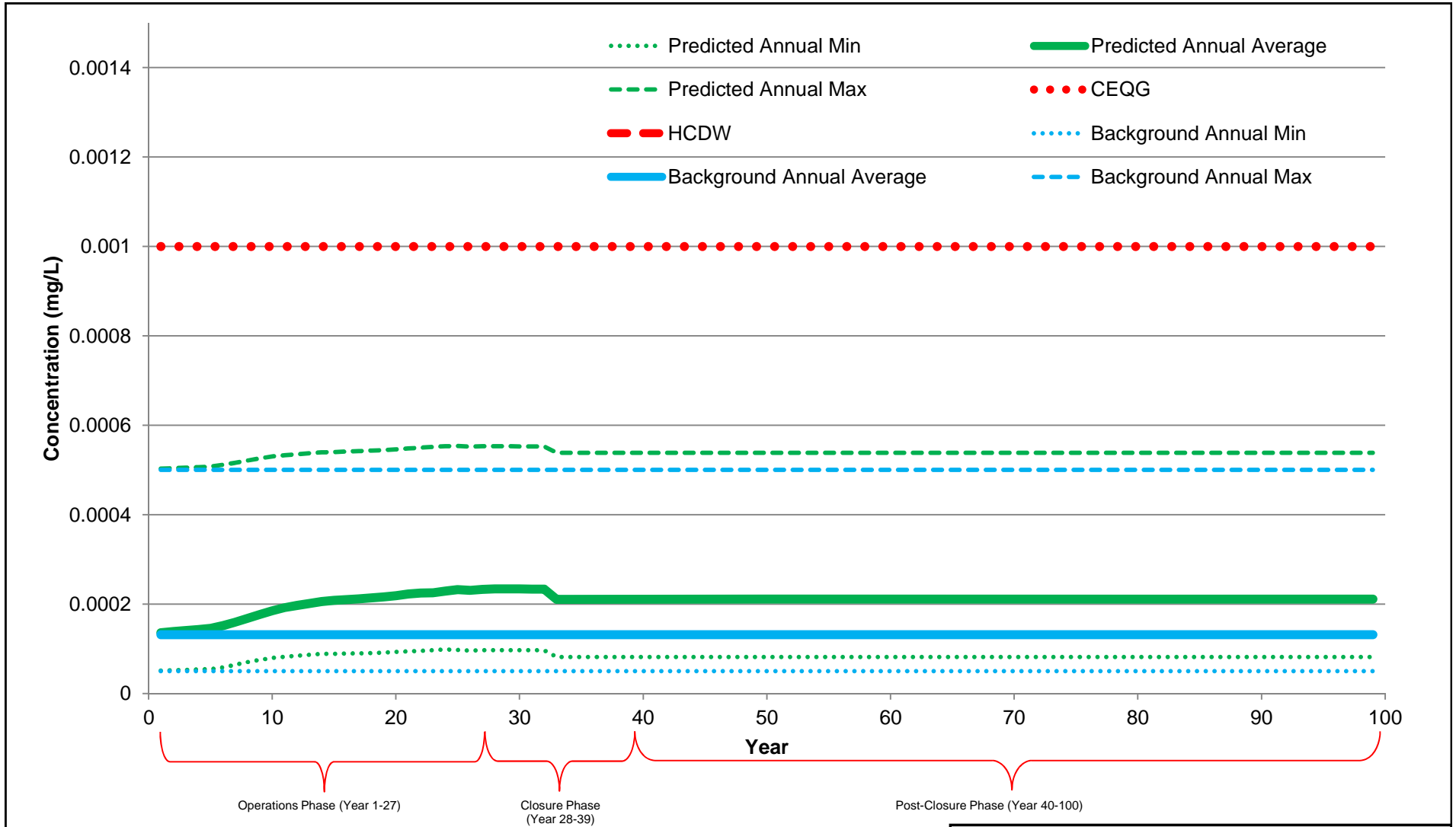


**NOTES:**

1. THE HCDW GUIDELINE IS 0.1 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
2. CURRENT AND PROPOSED MMR GUIDELINES FOR Cu ARE NOT WITHIN THE SCALE OF THIS GRAPH.
3. CEQG IS HARDNESS-DEPENDENT, WITH A MINIMUM OF 0.001 mg/L FOR HARDNESS <60 mg/L.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF LEAD IN NAP1</b>	
<i><b>Knight Piésold</b></i> CONSULTING	P/A NO. VA101-447/2
REF. NO. 9	
<b>Figure B10.2</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

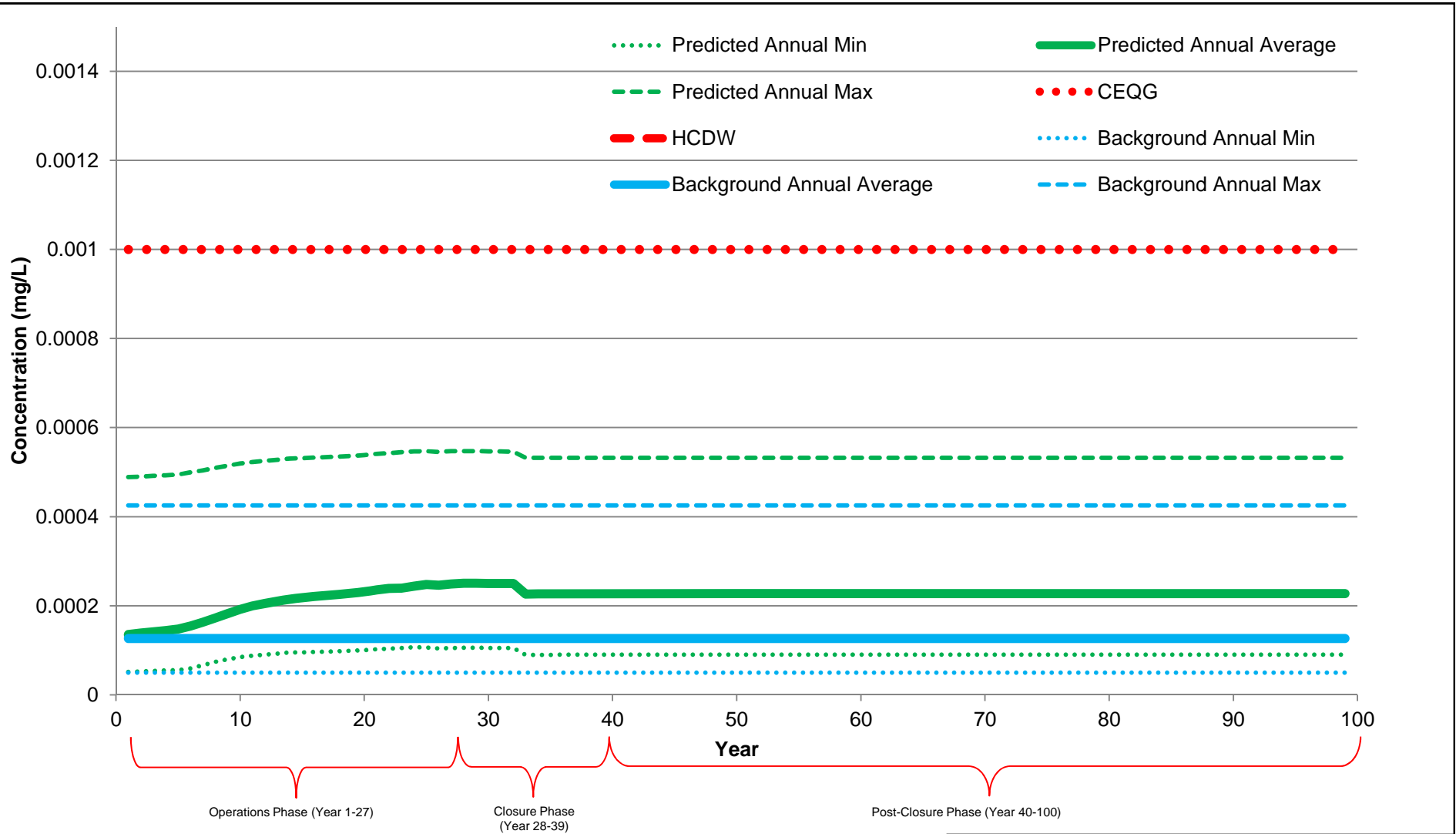


**NOTES:**

1. THE HCDW GUIDELINE IS 0.1 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
2. CURRENT AND PROPOSED MMR GUIDELINES FOR Cu ARE NOT WITHIN THE SCALE OF THIS GRAPH.
3. CEQG IS HARDNESS-DEPENDENT, WITH A MINIMUM OF 0.001 mg/L FOR HARDNESS <60 mg/L.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF LEAD IN NAP2</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B10.3</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

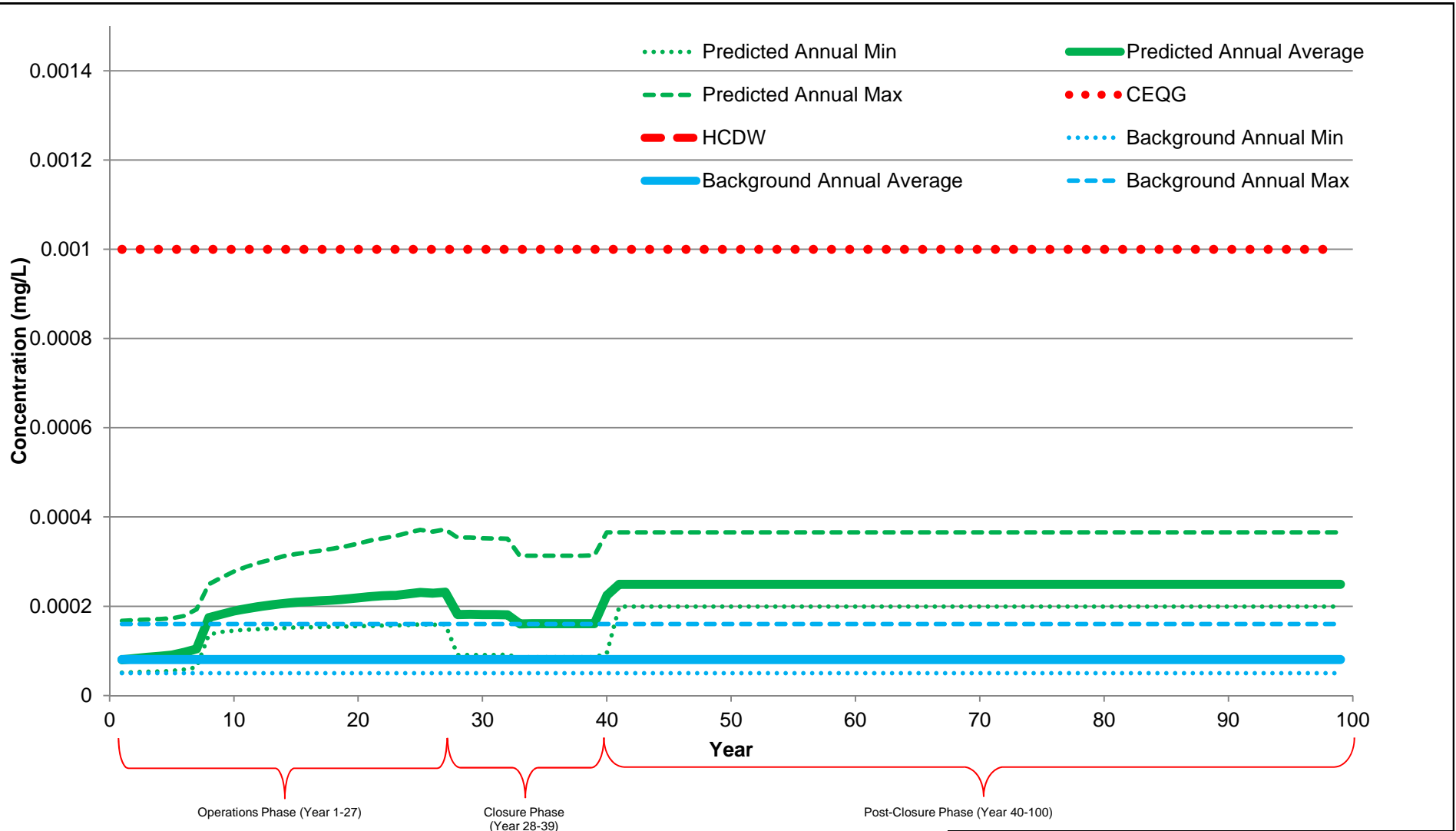


**NOTES:**

1. THE HCDW GUIDELINE IS 0.1 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
2. CURRENT AND PROPOSED MMR GUIDELINES FOR Cu ARE NOT WITHIN THE SCALE OF THIS GRAPH.
3. CEQG IS HARDNESS-DEPENDENT, WITH A MINIMUM OF 0.001 mg/L FOR HARDNESS <60 mg/L.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF LEAD IN NAP3</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B10.4</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

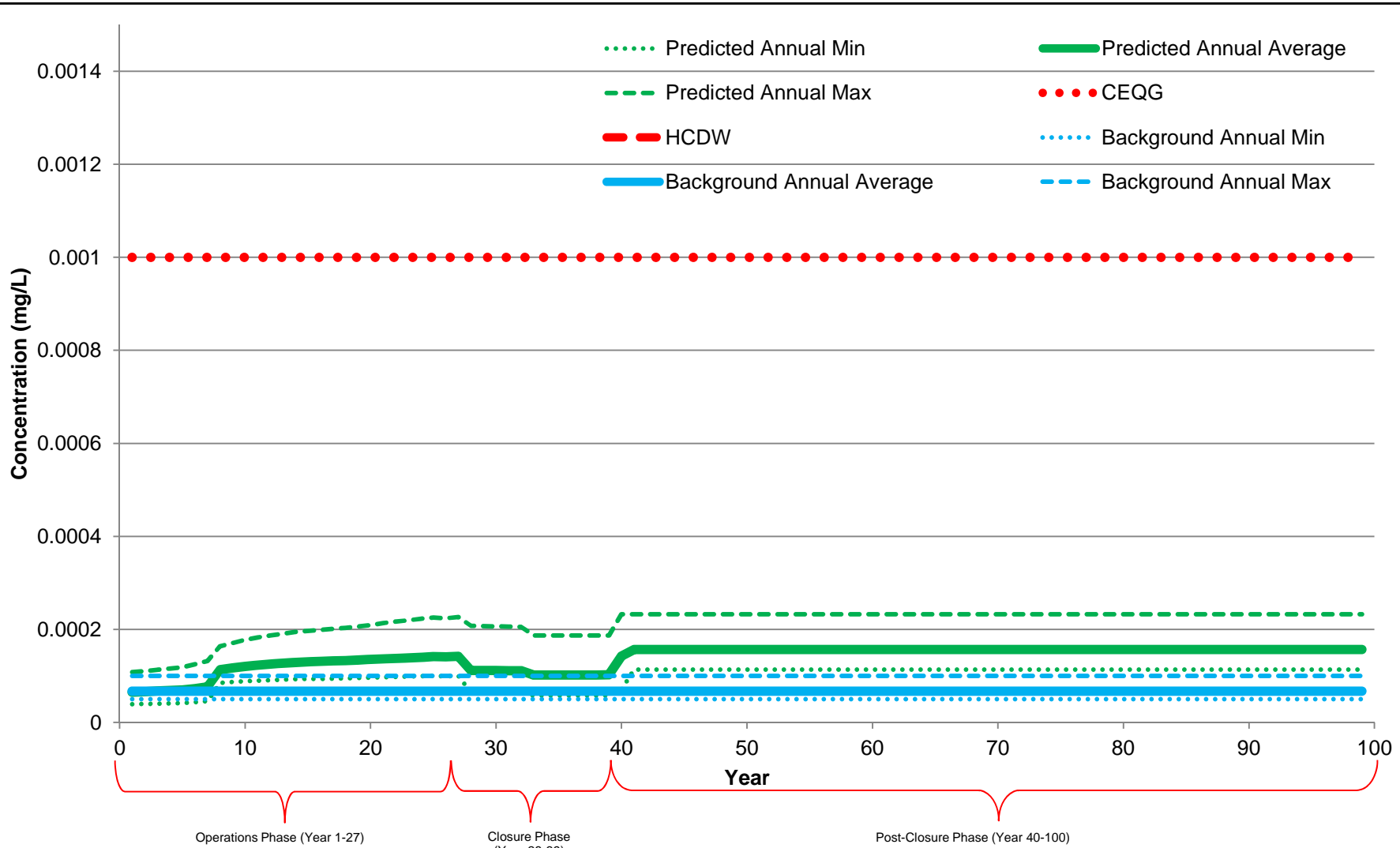


**NOTES:**

1. THE HCDW GUIDELINE IS 0.1 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
2. CURRENT AND PROPOSED MMER GUIDELINES FOR Cu ARE NOT WITHIN THE SCALE OF THIS GRAPH.
3. CEQG IS HARDNESS-DEPENDENT, WITH A MINIMUM OF 0.001 mg/L FOR HARDNESS <60 mg/L.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF LEAD IN NAP5</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
REF. NO. 9	
<b>Figure B10.5</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

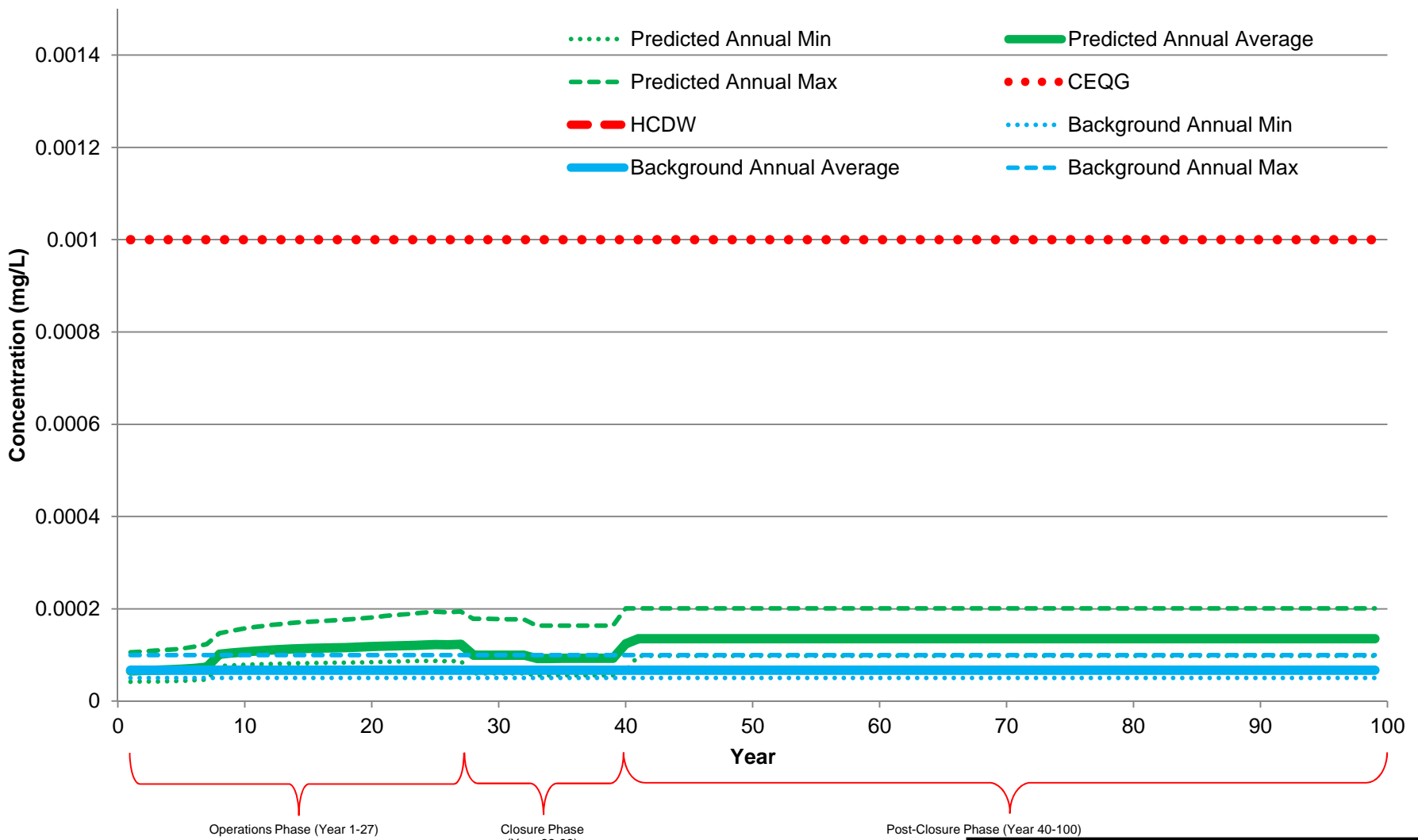


**NOTES:**

1. THE HCDW GUIDELINE IS 0.1 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
2. CURRENT AND PROPOSED MMR GUIDELINES FOR Cu ARE NOT WITHIN THE SCALE OF THIS GRAPH.
3. CEQG IS HARDNESS-DEPENDENT, WITH A MINIMUM OF 0.001 mg/L FOR HARDNESS <60 mg/L.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF LEAD IN NAP7</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B10.6</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

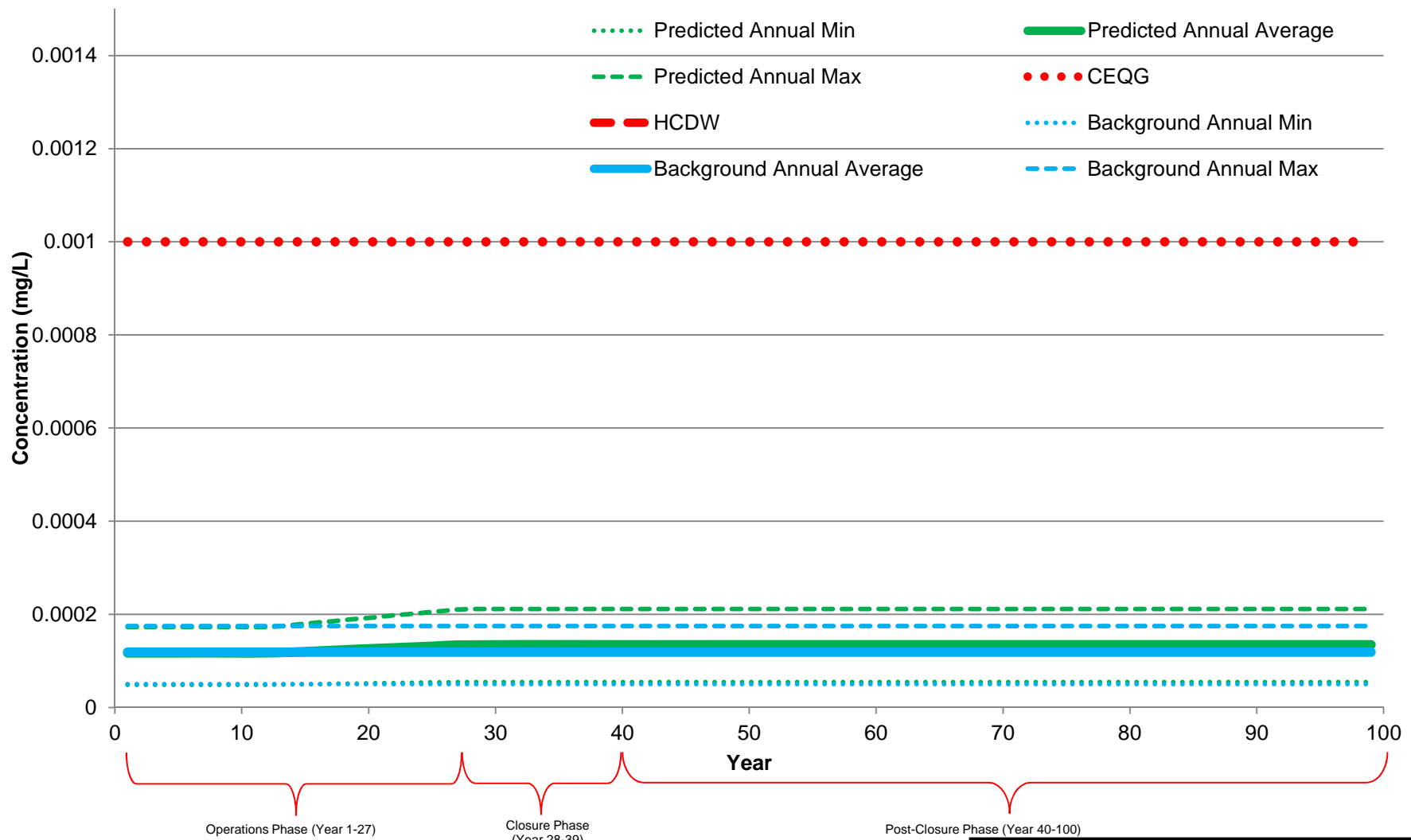


**NOTES:**

1. THE HCDW GUIDELINE IS 0.1 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
2. CURRENT AND PROPOSED MMR GUIDELINES FOR Cu ARE NOT WITHIN THE SCALE OF THIS GRAPH.
3. CEQG IS HARDNESS-DEPENDENT, WITH A MINIMUM OF 0.001 mg/L FOR HARDNESS <60 mg/L.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF LEAD IN NAP8</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B10.7</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**NOTES:**

1. THE HCDW GUIDELINE IS 0.1 mg/L AND IS NOT WITHIN THE SCALE OF THIS GRAPH.
2. CURRENT AND PROPOSED MMR GUIDELINES FOR Cu ARE NOT WITHIN THE SCALE OF THIS GRAPH.
3. CEQG IS HARDNESS-DEPENDENT, WITH A MINIMUM OF 0.001 mg/L FOR HARDNESS <60 mg/L.

<b>NORTHCLIFF RESOURCES LTD.</b>	
<b>SISSON PROJECT</b>	
<b>PREDICTED CONCENTRATION OF LEAD IN MBB2</b>	
<b><i>Knight Piésold</i></b> CONSULTING	P/A NO. VA101-447/2
	REF. NO. 9
<b>Figure B10.8</b>	
REV 0	

0	28JUN'13	ISSUED WITH REPORT	CJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



**APPENDIX C**

**MODEL OUTPUT SUMMARY**

Appendix C1	Model Output Tables
Appendix C2	Model Output Data

**APPENDIX C1**

**MODEL OUTPUT TABLES**

(Pages C1-1 to C1-14)

APPENDIX C1 - MODEL OUTPUT SUMMARY STATISTICS BY PROJECT PHASE

SISSON PROJECT  
TABLE C1.1 - TSF

Units	Background						Operations						Closure						Post-Closure						
	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	
<b>Conventional Parameters and Major Ions</b>																									
Hardness	mg/L	8.3	11.4	11.4	14.8	2.3	0.21	14.7	193.6	218.4	294.0	68.8	0.36	80.4	89.1	85.7	133.4	9.5	0.107	79.1	80.7	80.9	82.7	0.9	0.01
Alkalinity	mg/L	5.4	6.9	7.1	8.7	1.0	0.15	7.2	2591.1	2704.3	3635.4	517.2	0.20	94.3	415.4	264.0	2269.3	414.2	0.997	45.2	49.3	46.5	93.7	8.1	0.16
Ammonia	mg/L	0.025	0.031	0.033	0.036	0.004	0.13	0.034	0.434	0.491	0.659	0.163	0.38	0.544	0.650	0.657	0.679	0.027	0.042	0.657	0.672	0.672	0.682	0.007	0.01
Nitrate	mg/L	0.070	0.104	0.073	0.189	0.050	0.48	0.074	0.232	0.254	0.323	0.063	0.27	0.271	0.307	0.309	0.317	0.008	0.027	0.307	0.313	0.313	0.318	0.003	0.01
Phosphate	mg/L	0.009	0.011	0.010	0.016	0.002	0.19	0.002	0.004	0.003	0.029	0.002	0.45	0.001	0.002	0.001	0.003	0.000	0.176	0.001	0.001	0.001	0.001	0.000	0.01
Sulphate	mg/L	1.31	3.6	3.2	6.3	1.8	0.49	6.3	144.8	161.3	212.3	47.6	0.33	66.8	73.7	71.1	108.3	7.4	0.101	65.8	67.1	67.3	68.8	0.7	0.01
Bromide	mg/L	0.005	0.005	0.005	0.005	0.000	0.02	0.001	0.002	0.002	0.005	0.001	0.44	0.001	0.001	0.001	0.002	0.000	0.156	0.001	0.001	0.001	0.001	0.000	0.01
Chloride	mg/L	0.82	1.12	1.07	1.41	0.19	0.17	1.41	12.11	12.59	14.4	4.35	0.36	16.37	18.63	18.75	19.27	0.54	0.029	18.64	19.03	19.04	19.32	0.20	0.01
Fluoride	mg/L	0.092	0.185	0.176	0.272	0.064	0.35	0.271	4.227	4.875	6.536	1.644	0.39	1.150	1.356	1.265	2.470	0.243	0.179	1.118	1.141	1.143	1.179	0.13	0.01
Dissolved Aluminum	mg/L	0.0918	0.0941	0.1040	0.1196	0.0265	0.28	0.1194	0.5779	0.6854	0.9050	0.2488	0.43	0.1449	0.1369	0.1559	0.2641	0.0217	0.132	0.1420	0.1447	0.1450	0.1486	0.015	0.01
Dissolved Antimony	mg/L	0.0000	0.0001	0.0001	0.0002	0.0000	0.40	0.0002	0.0124	0.0134	0.0190	0.0041	0.33	0.0121	0.0135	0.0136	0.0139	0.0003	0.024	0.0134	0.0137	0.0137	0.0139	0.001	0.01
Dissolved Arsenic	mg/L	0.0000	0.0011	0.0011	0.0014	0.0002	0.16	0.0013	0.0802	0.0860	0.1327	0.0036	0.75	0.0095	0.0948	0.0958	0.0990	0.0039	0.042	0.0958	0.0979	0.0979	0.0999	0.0011	0.01
Dissolved Barium	mg/L	0.0020	0.0022	0.0022	0.0025	0.0002	0.08	0.0024	0.0234	0.0240	0.0352	0.0080	0.34	0.0165	0.0170	0.0170	0.0182	0.0003	0.018	0.0165	0.0168	0.0169	0.0171	0.0002	0.01
Dissolved Bismuth	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.02	0.0005	0.0011	0.0011	0.0014	0.0002	0.17	0.0002	0.0003	0.0003	0.0009	0.0001	0.357	0.0002	0.0002	0.0002	0.0002	0.0000	0.01
Dissolved Boron	mg/L	0.0017	0.0125	0.0109	0.0237	0.0079	0.63	0.0237	0.5976	0.6496	0.9021	0.1937	0.32	0.7163	0.8102	0.8148	0.8367	0.0222	0.027	0.8090	0.8258	0.8264	0.8388	0.0089	0.01
Dissolved Cadmium	mg/L	0.000015	0.000031	0.000033	0.000040	0.000009	0.30	0.00040	0.00075	0.000658	0.000841	0.000219	0.38	0.000188	0.000209	0.000201	0.000313	0.000023	0.108	0.000185	0.000189	0.000189	0.000193	0.000022	0.01
Dissolved Calcium	mg/L	2.5	3.4	3.4	4.5	0.7	0.21	4.4	58.2	67.4	90.1	21.8	0.37	17.4	20.4	19.0	36.4	3.5	0.172	16.9	17.3	17.3	17.8	0.2	0.01
Dissolved Chromium	mg/L	0.0005	0.0007	0.0007	0.0010	0.0002	0.22	0.0010	0.0117	0.0129	0.0170	0.0041	0.35	0.0075	0.0078	0.0077	0.0090	0.0003	0.034	0.0074	0.0076	0.0076	0.0077	0.0001	0.01
Dissolved Cobalt	mg/L	0.00005	0.00013	0.00012	0.00020	0.00005	0.42	0.00020	0.00451	0.00540	0.00734	0.00221	0.49	0.00094	0.01008	0.01002	0.01085	0.00017	0.154	0.00092	0.00094	0.00094	0.00096	0.00001	0.01
Dissolved Copper	mg/L	0.0006	0.0010	0.0010	0.0014	0.0003	0.27	0.0014	0.0257	0.0272	0.0364	0.0080	0.31	0.0228	0.0253	0.0254	0.0260	0.0006	0.022	0.0251	0.0257	0.0257	0.0261	0.0003	0.01
Dissolved Iron	mg/L	0.07	0.09	0.09	0.10	0.01	0.15	0.04	0.12	0.14	0.17	0.04	0.37	0.02	0.02	0.02	0.05	0.01	0.243	0.02	0.02	0.02	0.02	0.00	0.01
Dissolved Lead	mg/L	0.00005	0.00009	0.00010	0.00013	0.00003	0.32	0.00013	0.00157	0.00171	0.00222	0.00045	0.29	0.00160	0.00178	0.00179	0.00183	0.00004	0.023	0.00177	0.00181	0.00181	0.00184	0.00002	0.01
Dissolved Lithium	mg/L	0.00042	0.00083	0.00075	0.00125	0.00029	0.35	0.00124	0.03953	0.04142	0.05842	0.01333	0.34	0.03332	0.03629	0.03641	0.03722	0.00064	0.018	0.03587	0.03657	0.03664	0.03714	0.00039	0.01
Dissolved Magnesium	mg/L	0.53	0.69	0.69	0.89	0.13	0.19	0.88	11.73	12.84	16.81	3.74	0.32	9.01	9.31	9.28	10.32	0.22	0.323	8.99	9.15	9.18	9.31	0.10	0.01
Dissolved Manganese	mg/L	0.002	0.011	0.011	0.019	0.006	0.56	0.020	0.643	0.713	0.937	0.243	0.38	0.159	0.191	0.177	0.361	0.037	0.196	0.154	0.157	0.158	0.163	0.002	0.01
Dissolved Mercury	mg/L	0.000012	0.000013	0.000013	0.000013	0.000003	0.02	0.00004	0.000007	0.000005	0.000013	0.000002	0.40	0.00002	0.00002	0.00002	0.000005	0.000000	0.194	0.000002	0.000002	0.000002	0.000002	0.000000	0.01
Dissolved Molybdenum	mg/L	0.0011	0.0015	0.0015	0.0019	0.0009	0.22	0.0019	0.0813	0.0888	0.1275	0.0286	0.35	0.0834	0.0966	0.0974	0.1004	0.0033	0.034	0.0971	0.0991	0.0991	0.1007	0.0011	0.01
Dissolved Nickel	mg/L	0.00050	0.00060	0.00058	0.00069	0.00007	0.12	0.00069	0.00786	0.00904	0.01184	0.00323	0.41	0.00347	0.00364	0.00360	0.00437	0.00015	0.041	0.00345	0.00352	0.00353	0.00358	0.00004	0.01
Dissolved Phosphorous	mg/L	0.010	0.012	0.012	0.015	0.002	0.16	0.016	0.116	0.125	0.170	0.033	0.29	0.133	0.148	0.149	0.152	0.003	0.023	0.147	0.150	0.151	0.153	0.022	0.01
Dissolved Potassium	mg/L	0.36	0.81	0.74	1.28	0.33	0.40	1.28	21.36	22.87	33.05	6.65	0.31	24.96	27.12	27.20	27.86	0.071	0.172	26.80	27.31	27.37	27.74	0.29	0.01
Dissolved Rubidium	mg/L	0.0008	0.0028	0.0026	0.0047	0.0014	0.50	0.0047	0.1388	0.1543	0.1886	0.0432	0.31	0.1385	0.1538	0.1544	0.1580	0.0034	0.022	0.1528	0.1559	0.1561	0.1583	0.0017	0.01
Dissolved Selenium	mg/L	0.0002	0.0004	0.0005	0.0005	0.0000	0.24	0.0005	0.0026	0.0028	0.0034	0.0006	0.25	0.0010	0.0012	0.0011	0.0020	0.0004	0.146	0.0010	0.0010	0.0011	0.0010	0.000	0.01
Dissolved Silicon	mg/L	2.38	6.65	6.93	8.21	1.51	0.23	7.58	193.24	200.35	267.67	36.70	0.19	23.88	45.85	35.55	173.38	28.40	0.619	20.15	20.74	20.59	23.84	0.59	0.03
Dissolved Silver	mg/L	0.00005	0.00005	0.00005	0.00005	0.00000	0.01	0.00005	0.00008	0.00009	0.00011	0.00001	0.14	0.00008	0.00009	0.00009	0.00009	0.000001	0.015	0.00009	0.00009	0.00009	0.00009	0.000001	0.01
Dissolved Sodium	mg/L	0.39	1.19	1.28	1.38	0.29	0.24	1.37	1175.14	1227.00	1655.90	233.88	0.10	39.69	187.22	117.65	1038.70	190.25	1.016	17.26	19.06	17.72	19.06	3.71	0.19
Dissolved Strontium	mg/L	0.00002	0.00003	0.00003	0.00003	0.00000	0.35	0.00124	0.03953	0.04143	0.05842	0.01333	0.34	0.03332	0.03629	0.03641	0.03722	0.00064	0.018	0.03587	0.03657	0.03664	0.03714	0.00039	0.01
Dissolved Thallium	mg/L	0.0005	0.0006	0.0006	0.0007	0.00007	0.12	0.00069	0.00786	0.00904	0.01184	0.00323	0.41	0.00347	0.00364	0.00360	0.00437	0.00015	0.041	0.00345	0.00352	0.00353	0.00358	0.00004	0.01
Dissolved Titanium	mg/L	0.010	0.012	0.012	0.015	0.002	0.16	0.016	0.116	0.125	0.170	0.033	0.29	0.133	0.148	0.149	0.152	0.003	0.023	0.147	0.150	0.151	0.153	0.022	0.01
Dissolved Tungsten	mg/L	0.00057	0.00250	0.00257	0.00368	0.00099	0.40	0.00365	0.04644	0.04720	0.07198	0.01579	0.34	0.06096	0.06841	0.06873	0.07051	0.00172	0.025	0.06818	0.06957	0.06964	0.07067	0.00074	0.01
Dissolved Uranium	mg/L	0.00005	0.00011	0.00010	0.00016	0.00004	0.37	0.00016	0.00740	0.00781	0.01151	0.00249	0.34	0.00616	0.00653	0.00655	0.00681	0.00010	0.015	0.00641	0.00653	0.00655	0.00663	0.00007	

APPENDIX C1 - MODEL OUTPUT SUMMARY STATISTICS BY PROJECT PHASE

SISSON PROJECT  
TABLE C1.2 - OPEN PIT

Parameter	Units	Closure						Post-Closure					
		Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation
<b>Conventional Parameters and Major Ions</b>													
Hardness	mg/L	73.2	99.1	100.8	103.3	4.8	0.05	76.5	79.2	77.0	94.5	4.1	0.05
Alkalinity	mg/L	105.4	257.8	257.5	331.5	50.2	0.19	41.3	65.8	47.0	189.8	36.6	0.56
Ammonia	mg/L	0.037	0.479	0.500	0.515	0.079	0.16	0.515	0.533	0.535	0.536	0.005	0.01
Nitrate	mg/L	0.100	0.247	0.256	0.258	0.024	0.10	0.256	0.257	0.257	0.000	0.000	0.00
Phosphate	mg/L	0.0025	0.003	0.003	0.006	0.000	0.14	0.002	0.002	0.002	0.002	0.000	0.08
Sulphate	mg/L	44.2	74.4	75.9	77.7	5.2	0.07	61.1	62.8	61.5	72.4	2.6	0.04
Bromide	mg/L	0.0014	0.002	0.002	0.003	0.000	0.16	0.001	0.001	0.001	0.001	0.000	0.07
Chloride	mg/L	3.67	15.18	15.82	16.02	2.08	0.14	15.96	16.04	16.04	16.07	0.02	0.00
Fluoride	mg/L	1.476	1.691	1.722	1.999	0.073	0.04	1.160	1.218	1.169	1.557	0.091	0.08
Dissolved Aluminum	mg/L	0.1964	0.2122	0.2154	0.2476	0.0084	0.04	0.1493	0.1562	0.1504	0.1968	0.0109	0.07
Dissolved Antimony	mg/L	0.00151	0.0098	0.0100	0.0106	0.0014	0.15	0.0100	0.0100	0.0100	0.0100	0.0000	0.00
Dissolved Arsenic	mg/L	0.0063	0.0271	0.0100	0.0722	0.0268	0.99	0.0100	0.0100	0.0100	0.0100	0.0000	0.00
Dissolved Barium	mg/L	0.0057	0.0146	0.0150	0.0153	0.0016	0.11	0.0142	0.0143	0.0142	0.0149	0.0002	0.01
Dissolved Bismuth	mg/L	0.00031	0.0003	0.0003	0.0004	0.0000	0.05	0.0002	0.0002	0.0002	0.0003	0.0000	0.08
Dissolved Boron	mg/L	0.1428	0.6574	0.6853	0.6940	0.0918	0.14	0.6905	0.6924	0.6924	0.6936	0.0007	0.00
Dissolved Cadmium	mg/L	0.000131	0.000208	0.000211	0.000216	0.000012	0.06	0.000174	0.000178	0.000175	0.000201	0.000006	0.03
Dissolved Calcium	mg/L	22.7	25.5	26.0	30.2	1.1	0.04	17.5	18.4	17.7	23.5	1.4	0.07
Dissolved Chromium	mg/L	0.00430	0.0077	0.0079	0.0081	0.0006	0.08	0.0068	0.0069	0.0068	0.0076	0.0002	0.03
Dissolved Cobalt	mg/L	0.00134	0.00146	0.00148	0.00183	0.00007	0.05	0.00097	0.00102	0.00097	0.00133	0.00008	0.08
Dissolved Copper	mg/L	0.0054	0.0209	0.0217	0.0220	0.0028	0.13	0.0215	0.0216	0.0216	0.0218	0.0001	0.00
Dissolved Iron	mg/L	0.038	0.04	0.04	0.08	0.01	0.14	0.03	0.03	0.03	0.04	0.00	0.10
Dissolved Lead	mg/L	0.000364	0.00146	0.00152	0.00154	0.00019	0.13	0.00152	0.00152	0.00152	0.00153	0.00000	0.00
Dissolved Lithium	mg/L	0.00755	0.02965	0.03089	0.03123	0.00394	0.13	0.03026	0.03041	0.03035	0.03090	0.00014	0.00
Dissolved Magnesium	mg/L	3.99	8.62	8.87	9.03	0.82	0.09	7.96	8.07	7.99	8.69	0.17	0.02
Dissolved Manganese	mg/L	0.154	0.206	0.209	0.221	0.010	0.05	0.152	0.158	0.153	0.191	0.009	0.06
Dissolved Mercury	mg/L	0.000036	0.000004	0.000004	0.000008	0.000001	0.15	0.000003	0.000003	0.000003	0.000004	0.000000	0.08
Dissolved Molybdenum	mg/L	0.0139	0.0557	0.0500	0.0769	0.0127	0.23	0.0500	0.0500	0.0500	0.0500	0.0000	0.00
Dissolved Nickel	mg/L	0.00221	0.00366	0.00373	0.00380	0.00025	0.07	0.00318	0.00324	0.00319	0.00360	0.00010	0.03
Dissolved Phosphorus	mg/L	0.034	0.123	0.128	0.129	0.016	0.13	0.127	0.127	0.127	0.128	0.000	0.00
Dissolved Potassium	mg/L	6.26	22.75	23.68	23.95	2.91	0.13	23.24	23.36	23.32	23.70	0.10	0.00
Dissolved Rubidium	mg/L	0.0290	0.1247	0.1300	0.1314	0.0171	0.14	0.1295	0.1299	0.1299	0.1307	0.0002	0.00
Dissolved Selenium	mg/L	0.00073	0.0011	0.0011	0.0011	0.0001	0.06	0.0009	0.0009	0.0009	0.0011	0.0000	0.04
Dissolved Silicon	mg/L	15.54	33.12	33.57	37.64	3.86	0.12	17.90	19.71	18.35	28.79	2.67	0.14
Dissolved Silver	mg/L	0.000041	0.00008	0.00008	0.00009	0.00001	0.09	0.00008	0.00008	0.00008	0.00008	0.00000	0.01
Dissolved Sodium	mg/L	35.17	110.98	110.64	145.14	23.18	0.21	14.45	25.46	17.11	80.58	16.35	0.64
Dissolved Strontium	mg/L	0.1043	0.3904	0.4065	0.4110	0.0512	0.13	0.3979	0.3999	0.3991	0.4065	0.0019	0.00
Dissolved Thallium	mg/L	0.000195	0.00058	0.00060	0.00061	0.00007	0.12	0.00057	0.00058	0.00058	0.00060	0.00000	0.01
Dissolved Titanium	mg/L	0.00277	0.0129	0.0134	0.0136	0.0018	0.14	0.0136	0.0137	0.0137	0.0138	0.0000	0.00
Dissolved Tungsten	mg/L	0.01196	0.05515	0.05745	0.05818	0.00774	0.14	0.05805	0.05843	0.05844	0.05856	0.00009	0.00
Dissolved Uranium	mg/L	0.00132	0.00526	0.00547	0.00551	0.00069	0.13	0.00537	0.00540	0.00539	0.00547	0.00002	0.00
Dissolved Vanadium	mg/L	0.0061	0.0377	0.0394	0.0401	0.0057	0.15	0.0401	0.0407	0.0408	0.0409	0.0002	0.00
Dissolved Zinc	mg/L	0.0084	0.0227	0.0235	0.0239	0.0025	0.11	0.0221	0.0223	0.0222	0.0233	0.0003	0.01
Total Aluminum	mg/L	0.1964	0.2131	0.2163	0.2476	0.0084	0.04	0.1503	0.1571	0.1514	0.1978	0.0109	0.07
Total Antimony	mg/L	0.00151	0.0098	0.0100	0.0106	0.0014	0.15	0.0100	0.0100	0.0100	0.0100	0.0000	0.00
Total Arsenic	mg/L	0.0063	0.0271	0.0100	0.0722	0.0268	0.99	0.0100	0.0100	0.0100	0.0100	0.0000	0.00
Total Barium	mg/L	0.0057	0.0146	0.0150	0.0153	0.0016	0.11	0.0142	0.0143	0.0142	0.0149	0.0002	0.01
Total Bismuth	mg/L	0.00031	0.0003	0.0003	0.0004	0.0000	0.05	0.0002	0.0002	0.0002	0.0003	0.0000	0.08
Total Boron	mg/L	0.1428	0.6574	0.6853	0.6940	0.0918	0.14	0.6905	0.6924	0.6924	0.6936	0.0007	0.00
Total Cadmium	mg/L	0.000131	0.000208	0.000211	0.000216	0.000012	0.06	0.000174	0.000178	0.000175	0.000201	0.000006	0.03
Total Calcium	mg/L	22.7	25.5	26.0	30.2	1.1	0.04	17.5	18.4	17.7	23.5	1.4	0.07
Total Chromium	mg/L	0.00430	0.0077	0.0079	0.0081	0.0006	0.08	0.0068	0.0069	0.0068	0.0076	0.0002	0.03
Total Cobalt	mg/L	0.00134	0.00146	0.00148	0.00183	0.00007	0.05	0.00097	0.00102	0.00097	0.00133	0.00008	0.08
Total Copper	mg/L	0.0054	0.0209	0.0217	0.0220	0.0028	0.13	0.0215	0.0216	0.0216	0.0218	0.0001	0.00
Total Iron	mg/L	0.038	0.04	0.04	0.08	0.01	0.14	0.03	0.03	0.03	0.04	0.00	0.10
Total Lead	mg/L	0.000364	0.00146	0.00152	0.00154	0.00019	0.13	0.00152	0.00152	0.00152	0.00153	0.00000	0.00
Total Lithium	mg/L	0.00755	0.02965	0.03089	0.03123	0.00394	0.13	0.03026	0.03041	0.03036	0.03090	0.00014	0.00
Total Magnesium	mg/L	3.99	8.62	8.87	9.03	0.82	0.09	7.96	8.07	7.99	8.69	0.17	0.02
Total Manganese	mg/L	0.154	0.206	0.209	0.221	0.010	0.05	0.152	0.158	0.153	0.192	0.009	0.06
Total Mercury	mg/L	0.000036	0.000004	0.000004	0.000008	0.000001	0.15	0.000003	0.000003	0.000003	0.000004	0.000000	0.08
Total Molybdenum	mg/L	0.0139	0.0557	0.0500	0.0769	0.0127	0.23	0.0500	0.0500	0.0500	0.0500	0.0000	0.00
Total Nickel	mg/L	0.00221	0.00366	0.00373	0.00380	0.00025	0.07	0.00318	0.00324	0.00319	0.00360	0.00010	0.03
Total Phosphorus	mg/L	0.034	0.123	0.128	0.129	0.016	0.13	0.127	0.127	0.127	0.128	0.000	0.00
Total Potassium	mg/L	6.26	22.75	23.68	23.95	2.91	0.13	23.24	23.36	23.32	23.70	0.10	0.00
Total Rubidium	mg/L	0.0290	0.1247	0.1300	0.1314	0.0171	0.14	0.1295	0.1299	0.1299	0.1307	0.0002	0.00
Total Selenium	mg/L	0.00073	0.0011	0.0011	0.0011	0.0001	0.06	0.0009	0.0009	0.0009	0.0011	0.0000	0.04
Total Silicon	mg/L	15.54	33.12	33.57	37.64	3.86	0.12	17.90	19.71	18.35	28.79	2.67	0.14
Total Silver	mg/L	0.000041	0.00008	0.00008	0.00009	0.00001	0.09	0.00008	0.00008	0.00008	0.00008	0.00000	0.01
Total Sodium	mg/L	35.17	110.98	110.64	145.14	23.18	0.21	14.45	25.46	17.11	80.58	16.35	0.64
Total Strontium	mg/L	0.1043	0.3904	0.4065	0.4110	0.0512	0.13	0.3979	0.3999	0.3991	0.4065	0.0019	0.00
Total Thallium	mg/L	0.000195	0.00058	0.00060	0.00061	0.00007	0.12	0.00057	0.00058	0.00058	0.00060	0.00000	0.01
Total Titanium	mg/L	0.00277	0.0129	0.0134	0.0136	0.0018	0.14	0.0136	0.0137	0.0137	0.0138	0.0000	0.00
Total Tungsten	mg/L	0.01196	0.05515	0.05745	0.05818	0.00774	0.14	0.05805	0.05843	0.05844	0.05856	0.00009	0.00
Total Uranium	mg/L	0.00132	0.00526	0.00547	0.00552	0.00069	0.13	0.00538	0.00540	0.00539	0.00547	0.00002	0.00
Total Vanadium	mg/L	0.0061	0.0377	0.0394	0.0401	0.0057	0.15	0.0401	0.0407	0.0408	0.0409	0.0002	0.00
Total Zinc	mg/L	0.0											

APPENDIX C1 - MODEL OUTPUT SUMMARY STATISTICS BY PROJECT PHASE

SISSON PROJECT  
TABLE C1.3 - WTP EFFLUENT

Parameter	Units	Operations						Post-Closure					
		Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation
<b>Conventional Parameters and Major Ions</b>													
Hardness	mg/L	106.0	206.3	231.0	294.0	56.8	0.28	76.5	79.1	77.0	94.0	4.0	0.05
Alkalinity	mg/L	1581.4	2632.5	2658.2	3635.4	397.2	0.15	41.3	65.3	47.0	187.0	35.8	0.55
Ammonia	mg/L	0.347	0.518	0.526	0.659	0.066	0.13	0.515	0.533	0.535	0.536	0.005	0.01
Nitrate	mg/L	0.191	0.264	0.267	0.323	0.027	0.10	0.256	0.257	0.257	0.257	0.000	0.00
Phosphate	mg/L	0.002	0.003	0.003	0.005	0.001	0.21	0.002	0.002	0.002	0.002	0.000	0.08
Sulphate	mg/L	84.7	155.0	171.6	212.3	37.1	0.24	61.1	62.8	61.5	72.1	2.5	0.04
Bromide	mg/L	0.001	0.002	0.002	0.003	0.000	0.21	0.001	0.001	0.001	0.001	0.000	0.07
Chloride	mg/L	9.46	14.13	13.88	19.44	2.71	0.19	15.96	16.04	16.04	16.07	0.02	0.00
Fluoride	mg/L	1.991	4.459	5.214	6.536	1.485	0.33	1.160	1.216	1.169	1.547	0.089	0.07
Dissolved Aluminum	mg/L	0.2190	0.5973	0.7287	0.9050	0.2473	0.41	0.1493	0.1560	0.1504	0.1955	0.0106	0.07
Dissolved Antimony	mg/L	0.0093	0.0139	0.0138	0.0190	0.0021	0.15	0.0100	0.0100	0.0100	0.0100	0.0000	0.00
Dissolved Arsenic	mg/L	0.0562	0.0910	0.0891	0.1327	0.0165	0.18	0.0100	0.0100	0.0100	0.0100	0.0000	0.00
Dissolved Barium	mg/L	0.0151	0.0253	0.0263	0.0352	0.0061	0.24	0.0142	0.0143	0.0142	0.0149	0.0002	0.01
Dissolved Bismuth	mg/L	0.0007	0.0011	0.0011	0.0014	0.0002	0.17	0.0002	0.0002	0.0002	0.0003	0.0000	0.07
Dissolved Boron	mg/L	0.5043	0.6887	0.6663	0.9021	0.0765	0.11	0.6905	0.6924	0.6924	0.6936	0.0007	0.00
Dissolved Cadmium	mg/L	0.000271	0.000609	0.000729	0.000841	0.000209	0.34	0.000174	0.000178	0.000175	0.000200	0.000006	0.03
Dissolved Calcium	mg/L	28.9	61.3	69.7	90.1	19.0	0.31	17.5	18.4	17.7	23.4	1.3	0.07
Dissolved Chromium	mg/L	0.0073	0.0127	0.0137	0.0170	0.0030	0.24	0.0068	0.0069	0.0068	0.0076	0.0002	0.03
Dissolved Cobalt	mg/L	0.00151	0.00474	0.00583	0.00734	0.00214	0.45	0.00097	0.00102	0.00097	0.00132	0.00008	0.08
Dissolved Copper	mg/L	0.0192	0.0286	0.0300	0.0364	0.0043	0.15	0.0215	0.0216	0.0216	0.0218	0.0001	0.00
Dissolved Iron	mg/L	0.04	0.11	0.13	0.16	0.05	0.42	0.03	0.03	0.03	0.04	0.00	0.10
Dissolved Lead	mg/L	0.00132	0.00177	0.00180	0.00222	0.00017	0.10	0.00152	0.00152	0.00152	0.00153	0.00000	0.00
Dissolved Lithium	mg/L	0.02905	0.04379	0.04451	0.05842	0.00797	0.18	0.03026	0.03040	0.03035	0.03088	0.00013	0.00
Dissolved Magnesium	mg/L	8.22	12.94	13.42	16.81	2.36	0.18	7.96	8.07	7.99	8.67	0.16	0.02
Dissolved Manganese	mg/L	0.308	0.678	0.794	0.937	0.225	0.33	0.152	0.158	0.153	0.190	0.009	0.06
Dissolved Mercury	mg/L	0.000004	0.000005	0.000005	0.000008	0.000001	0.21	0.000003	0.000003	0.000003	0.000004	0.000000	0.07
Dissolved Molybdenum	mg/L	0.0585	0.0924	0.0914	0.1275	0.0143	0.15	0.0500	0.0500	0.0500	0.0500	0.0000	0.00
Dissolved Nickel	mg/L	0.00359	0.00837	0.00999	0.01184	0.00300	0.36	0.00318	0.00324	0.00319	0.00359	0.00009	0.03
Dissolved Phosphorous	mg/L	0.098	0.131	0.128	0.170	0.013	0.10	0.127	0.127	0.127	0.128	0.000	0.00
Dissolved Potassium	mg/L	18.59	24.43	24.16	33.05	3.30	0.14	23.24	23.36	23.32	23.69	0.09	0.00
Dissolved Rubidium	mg/L	0.1141	0.1565	0.1600	0.1886	0.0173	0.11	0.1295	0.1299	0.1299	0.1306	0.0002	0.00
Dissolved Selenium	mg/L	0.0016	0.0027	0.0029	0.0034	0.0005	0.20	0.0009	0.0009	0.0009	0.0011	0.0000	0.03
Dissolved Silicon	mg/L	122.98	197.26	199.39	267.67	27.25	0.14	17.90	19.67	18.35	28.58	2.61	0.13
Dissolved Silver	mg/L	0.00007	0.00009	0.00009	0.00011	0.00001	0.08	0.00008	0.00008	0.00008	0.00008	0.00000	0.01
Dissolved Sodium	mg/L	713.16	1197.33	1212.60	1655.90	179.84	0.15	14.45	25.24	17.09	79.39	15.99	0.63
Dissolved Strontium	mg/L	0.3818	0.5619	0.5696	0.7278	0.0911	0.16	0.3979	0.3998	0.3991	0.4063	0.0018	0.00
Dissolved Thallium	mg/L	0.00053	0.00077	0.00079	0.00094	0.00011	0.14	0.00057	0.00058	0.00058	0.00060	0.00000	0.01
Dissolved Titanium	mg/L	0.0096	0.0140	0.0139	0.0172	0.0014	0.10	0.0136	0.0137	0.0137	0.0138	0.0000	0.00
Dissolved Tungsten	mg/L	0.03935	0.05378	0.05162	0.07199	0.00900	0.17	0.05805	0.05843	0.05844	0.05856	0.00009	0.00
Dissolved Uranium	mg/L	0.00569	0.00819	0.00809	0.01151	0.00151	0.18	0.00538	0.00540	0.00539	0.00547	0.00002	0.00
Dissolved Vanadium	mg/L	0.0269	0.0402	0.0401	0.0497	0.0042	0.10	0.0401	0.0407	0.0408	0.0409	0.0002	0.00
Dissolved Zinc	mg/L	0.0226	0.0474	0.0552	0.0676	0.0147	0.31	0.0221	0.0223	0.0222	0.0233	0.0003	0.01
Total Aluminum	mg/L	0.2200	0.5979	0.7295	0.9054	0.2471	0.41	0.1503	0.1570	0.1514	0.1964	0.0106	0.07
Total Antimony	mg/L	0.0093	0.0139	0.0138	0.0190	0.0021	0.15	0.0100	0.0100	0.0100	0.0100	0.0000	0.00
Total Arsenic	mg/L	0.0562	0.0910	0.0891	0.1327	0.0165	0.18	0.0100	0.0100	0.0100	0.0100	0.0000	0.00
Total Barium	mg/L	0.0151	0.0253	0.0263	0.0352	0.0061	0.24	0.0142	0.0143	0.0142	0.0149	0.0002	0.01
Total Bismuth	mg/L	0.0007	0.0011	0.0011	0.0014	0.0002	0.17	0.0002	0.0002	0.0002	0.0003	0.0000	0.07
Total Boron	mg/L	0.5043	0.6887	0.6663	0.9021	0.0765	0.11	0.6905	0.6924	0.6924	0.6936	0.0007	0.00
Total Cadmium	mg/L	0.000271	0.000609	0.000729	0.000841	0.000209	0.34	0.000174	0.000178	0.000175	0.000200	0.000006	0.03
Total Calcium	mg/L	28.9	61.3	69.8	90.1	19.0	0.31	17.5	18.4	17.7	23.4	1.3	0.07
Total Chromium	mg/L	0.0073	0.0127	0.0137	0.0170	0.0030	0.24	0.0068	0.0069	0.0068	0.0076	0.0002	0.03
Total Cobalt	mg/L	0.00151	0.00474	0.00583	0.00734	0.00214	0.45	0.00097	0.00102	0.00097	0.00132	0.00008	0.08
Total Copper	mg/L	0.0192	0.0286	0.0300	0.0364	0.0043	0.15	0.0215	0.0216	0.0216	0.0218	0.0001	0.00
Total Iron	mg/L	0.04	0.11	0.13	0.16	0.05	0.42	0.03	0.03	0.03	0.04	0.00	0.10
Total Lead	mg/L	0.00132	0.00177	0.00180	0.00222	0.00017	0.10	0.00152	0.00152	0.00152	0.00153	0.00000	0.00
Total Lithium	mg/L	0.02905	0.04379	0.04451	0.05842	0.00797	0.18	0.03026	0.03040	0.03035	0.03088	0.00013	0.00
Total Magnesium	mg/L	8.22	12.94	13.42	16.81	2.36	0.18	7.96	8.07	7.99	8.67	0.16	0.02
Total Manganese	mg/L	0.308	0.678	0.794	0.937	0.225	0.33	0.152	0.158	0.153	0.190	0.009	0.06
Total Mercury	mg/L	0.000004	0.000005	0.000005	0.000008	0.000001	0.21	0.000003	0.000003	0.000003	0.000004	0.000000	0.07
Total Molybdenum	mg/L	0.0585	0.0924	0.0914	0.1275	0.0143	0.15	0.0500	0.0500	0.0500	0.0500	0.0000	0.00
Total Nickel	mg/L	0.00359	0.00837	0.00999	0.01184	0.00300	0.36	0.00318	0.00324	0.00319	0.00359	0.00009	0.03
Total Phosphorous	mg/L	0.098	0.131	0.128	0.170	0.013	0.10	0.127	0.127	0.127	0.128	0.000	0.00
Total Potassium	mg/L	18.59	24.43	24.16	33.05	3.30	0.14	23.24	23.36	23.32	23.69	0.09	0.00
Total Rubidium	mg/L	0.1141	0.1565	0.1600	0.1886	0.0173	0.11	0.1295	0.1299	0.1299	0.1307	0.0002	0.00
Total Selenium	mg/L	0.0016	0.0027	0.0029	0.0034	0.0005	0.20	0.0009	0.0009	0.0009	0.0011	0.0000	0.03
Total Silicon	mg/L	122.98	197.26	199.39	267.67	27.25	0.14	17.90	19.67	18.35	28.58	2.61	0.13
Total Silver	mg/L	0.00007	0.00009	0.00009	0.00011	0.00001	0.08	0.00008	0.00008	0.00008	0.00008	0.00000	0.01
Total Sodium	mg/L	713.16	1197.33	1212.60	1655.90	179.84	0.15	14.45	25.24	17.09	79.39	15.99	0.63
Total Strontium	mg/L	0.3818	0.5619	0.5696	0.7278	0.0911	0.16	0.3979	0.3998	0.3991	0.4063	0.0018	0.00
Total Thallium	mg/L	0.00053	0.00077	0.00079	0.00094	0.00011	0.14	0.00057	0.00058	0.00058	0.00060	0.00000	0.01
Total Titanium	mg/L	0.0096	0.0140	0.0139	0.0172	0.0014	0.10	0.0136	0.0137	0.0137	0.0138	0.0000	0.00
Total Tungsten	mg/L	0.03935	0.05378	0.05162	0.07199	0.00900	0.17	0.05805	0.05843	0.05845	0.05856	0.00009	0.00
Total Uranium	mg/L	0.00569	0.00819	0.00809	0.01151	0.00151	0.18	0.00538	0.00540	0.00539	0.00547	0.00002	0.00
Total Vanadium	mg/L	0.0269	0.0402	0.0401	0.0497	0.0042	0.10	0.0401	0.0407	0.0408	0.0409	0.0002	0.00

APPENDIX C1 - MODEL OUTPUT SUMMARY STATISTICS BY PROJECT PHASE

SISSON PROJECT  
TABLE C1.4 - UT1

Parameter	Units	Background					Operations					Closure					Post-Closure								
		Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation
<b>Conventional Parameters and Major Ions</b>																									
Hardness	mg/L	6.8	9.7	10.4	11.7	1.7	0.18	7.0	29.8	25.5	71.8	17.2	0.58	13.4	28.7	26.8	58.2	12.9	0.45	13.3	25.5	20.4	44.7	10.9	0.43
Alkalinity	mg/L	4.8	8.5	9.3	11.0	2.0	0.24	4.9	187.1	174.1	461.2	139.8	0.75	8.1	105.7	51.2	382.7	109.2	1.03	6.3	12.8	12.8	27.5	3.9	0.31
Ammonia	mg/L	0.026	0.045	0.033	0.159	0.039	0.86	0.026	0.068	0.052	0.196	0.044	0.65	0.30	0.074	0.056	0.195	0.041	0.56	0.031	0.067	0.056	0.175	0.38	0.56
Nitrate	mg/L	0.049	0.101	0.086	0.206	0.055	0.54	0.041	0.107	0.086	0.212	0.055	0.52	0.048	0.108	0.086	0.212	0.055	0.51	0.048	0.108	0.086	0.209	0.055	0.51
Phosphate	mg/L	0.008	0.013	0.013	0.021	0.004	0.31	0.008	0.012	0.012	0.021	0.004	0.31	0.008	0.011	0.018	0.004	0.004	0.30	0.008	0.012	0.011	0.019	0.004	0.30
Sulphate	mg/L	0.5	1.4	1.5	1.9	0.3	0.23	1.2	18.5	15.6	54.1	13.8	0.75	7.1	19.7	17.1	46.0	11.3	0.57	7.1	17.0	10.3	34.3	9.7	0.57
Bromide	mg/L	0.005	0.005	0.005	0.006	0.000	0.08	0.004	0.005	0.005	0.006	0.000	0.07	0.004	0.005	0.005	0.000	0.006	0.004	0.005	0.005	0.005	0.000	0.005	0.005
Chloride	mg/L	0.79	1.20	1.23	1.64	0.27	0.23	0.85	3.87	3.06	11.94	2.51	0.65	2.72	5.92	5.14	12.02	3.07	0.52	2.75	5.70	3.81	10.86	2.93	0.52
Fluoride	mg/L	0.128	0.180	0.195	0.229	0.032	0.18	0.118	0.571	0.521	1.363	0.329	0.58	0.242	0.461	0.409	0.947	0.193	0.42	0.238	0.390	0.316	0.676	0.150	0.38
Dissolved Aluminum	mg/L	0.0600	0.1271	0.1350	0.1897	0.0389	0.31	0.0602	0.1669	0.1579	0.2855	0.0500	0.30	0.0707	0.1409	0.1475	0.2036	0.0392	0.28	0.0700	0.1345	0.1302	0.1952	0.0389	0.29
Dissolved Antimony	mg/L	0.0001	0.0001	0.0001	0.0001	0.0000	0.16	0.0001	0.0011	0.0009	0.0034	0.0009	0.80	0.0004	0.0013	0.0011	0.0032	0.0007	0.56	0.0004	0.0011	0.0010	0.0021	0.0006	0.51
Dissolved Arsenic	mg/L	0.0005	0.0005	0.0005	0.0006	0.0000	0.05	0.0005	0.0067	0.0057	0.0214	0.0054	0.80	0.0019	0.0069	0.0056	0.0167	0.0037	0.54	0.0021	0.0059	0.0057	0.0105	0.0027	0.46
Dissolved Barium	mg/L	0.0017	0.0020	0.0020	0.0024	0.0003	0.13	0.0015	0.0037	0.0035	0.0075	0.0015	0.41	0.0021	0.0033	0.0032	0.0056	0.0009	0.27	0.0021	0.0029	0.0029	0.0041	0.0006	0.22
Dissolved Bismuth	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0005	0.0005	0.0006	0.0006	0.0005	0.0005	0.0005	0.0005	0.0006	0.0000	0.40	0.0005	0.0005	0.0005	0.0005	0.0000	0.22
Dissolved Boron	mg/L	0.0011	0.0047	0.0039	0.0102	0.0032	0.69	0.0032	0.1209	0.0907	0.4419	0.132	0.85	0.0723	0.1970	0.1674	0.4452	0.1201	0.61	0.0735	0.1863	0.1105	0.3878	0.1138	0.61
Dissolved Cadmium	mg/L	0.00005	0.00007	0.00006	0.00011	0.00002	0.27	0.00005	0.00059	0.00054	0.000159	0.00043	0.72	0.00016	0.00042	0.00035	0.00099	0.00022	0.53	0.00016	0.00033	0.00025	0.00063	0.00016	0.49
Dissolved Calcium	mg/L	2.2	3.0	3.0	3.6	0.5	0.17	2.2	8.8	7.7	20.1	4.9	0.56	3.8	7.8	7.3	15.5	3.3	0.42	3.8	6.8	5.7	11.7	2.7	0.39
Dissolved Chromium	mg/L	0.0005	0.0005	0.0005	0.0006	0.0000	0.04	0.0005	0.0018	0.0016	0.0045	0.0011	0.59	0.0010	0.0019	0.0017	0.0039	0.0009	0.45	0.0010	0.0017	0.0013	0.0031	0.0007	0.43
Dissolved Cobalt	mg/L	0.00005	0.00006	0.00005	0.00009	0.00001	0.20	0.00005	0.00045	0.00041	0.00123	0.00034	0.75	0.00010	0.00023	0.00019	0.00053	0.00012	0.50	0.00010	0.00018	0.00014	0.00032	0.00008	0.43
Dissolved Copper	mg/L	0.0005	0.0006	0.0006	0.0007	0.0001	0.12	0.0006	0.0041	0.0033	0.0122	0.0030	0.72	0.0022	0.0053	0.0048	0.0117	0.0029	0.55	0.0022	0.0050	0.0034	0.0097	0.0027	0.54
Dissolved Iron	mg/L	0.10	0.17	0.15	0.26	0.05	0.32	0.09	0.16	0.15	0.26	0.05	0.31	0.09	0.15	0.14	0.23	0.05	0.31	0.09	0.15	0.13	0.23	0.05	0.31
Dissolved Lead	mg/L	0.0007	0.0018	0.0018	0.0028	0.00007	0.38	0.0007	0.0042	0.0035	0.0110	0.00023	0.54	0.00028	0.00055	0.00050	0.0111	0.00025	0.46	0.00028	0.00052	0.00046	0.00098	0.00024	0.45
Dissolved Lithium	mg/L	0.00157	0.00225	0.00229	0.00273	0.00036	0.16	0.00161	0.00603	0.00529	0.01391	0.00331	0.55	0.00298	0.00647	0.00059	0.01296	0.00268	0.41	0.00300	0.00592	0.00561	0.01002	0.00228	0.38
Dissolved Magnesium	mg/L	0.31	0.44	0.47	0.55	0.07	0.16	0.34	1.85	1.56	5.01	1.20	0.65	0.93	2.16	2.00	4.54	1.08	0.50	0.93	1.97	1.48	3.70	0.96	0.49
Dissolved Manganese	mg/L	0.002	0.007	0.006	0.015	0.004	0.61	0.002	0.057	0.054	0.151	0.042	0.74	0.009	0.030	0.025	0.079	0.018	0.60	0.009	0.019	0.015	0.035	0.008	0.43
Dissolved Mercury	mg/L	0.00012	0.00013	0.00012	0.00012	0.00000	0.00	0.00010	0.00012	0.00012	0.00013	0.00013	0.00013	0.00011	0.00013	0.00012	0.00012	0.00001	0.05	0.00010	0.00011	0.00012	0.00012	0.00012	0.00012
Dissolved Molybdenum	mg/L	0.0001	0.0002	0.0001	0.0003	0.0001	0.59	0.0001	0.0074	0.0061	0.0227	0.0062	0.84	0.0025	0.0087	0.0073	0.0214	0.0050	0.57	0.0026	0.0075	0.0072	0.0145	0.0040	0.53
Dissolved Nickel	mg/L	0.00050	0.00051	0.00051	0.00053	0.00001	0.02	0.00051	0.00129	0.00117	0.00292	0.00065	0.50	0.00072	0.00115	0.00107	0.00208	0.00040	0.34	0.00072	0.00107	0.00086	0.00168	0.00034	0.32
Dissolved Phosphorus	mg/L	0.010	0.020	0.028	0.029	0.010	0.47	0.010	0.041	0.037	0.105	0.022	0.55	0.023	0.054	0.045	0.105	0.026	0.48	0.023	0.052	0.045	0.095	0.025	0.47
Dissolved Potassium	mg/L	0.27	0.42	0.37	0.66	0.14	0.33	0.36	5.03	3.78	17.90	3.63	0.82	3.12	8.15	6.86	18.04	4.89	0.60	3.15	7.72	4.40	15.96	4.65	0.60
Dissolved Rubidium	mg/L	0.0013	0.0018	0.0016	0.0026	0.0005	0.26	0.0015	0.0205	0.0160	0.0645	0.0159	0.78	0.0105	0.0284	0.0259	0.0643	0.0162	0.57	0.0107	0.0261	0.0181	0.0526	0.0148	0.57
Dissolved Selenium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0007	0.0007	0.0011	0.0002	0.23	0.0006	0.0007	0.0007	0.0010	0.0001	0.17	0.0006	0.0006	0.0006	0.0008	0.0001	0.13
Dissolved Silicon	mg/L	7.46	10.26	10.36	13.06	1.74	0.17	7.52	24.25	23.18	46.09	11.40	0.47	8.94	20.00	17.20	42.85	9.01	0.45	8.75	13.54	14.02	19.00	2.77	0.20
Dissolved Silver	mg/L	0.00005	0.00005	0.00005	0.00005	0.00000	0.00	0.00005	0.00006	0.00006	0.00008	0.00001	0.13	0.00006	0.00006	0.00006	0.00008	0.00001	0.14	0.00006	0.00006	0.00006	0.00008	0.00001	0.14
Dissolved Sodium	mg/L	1.33	1.83	1.91	2.10	0.24	0.13	1.36	83.09	77.05	207.17	63.26	0.76	2.77	46.26	21.54	172.90	49.88	1.08	1.93	2.59	3.44	9.60	2.23	0.34
Dissolved Strontium	mg/L	0.014	0.014	0.018	0.029	0.017	0.17	0.011	0.062	0.0574	0.1778	0.049	0.65	0.036	0.2789	0.277	0.1633	0.0386	0.49	0.032	0.0713	0.0414	0.396	0.032	0.47
Dissolved Thallium	mg/L	0.00005	0.00005	0.00005	0.00006	0.00000	0.00	0.00005	0.00014	0.00012	0.00035	0.00008	0.54	0.00009	0.00018	0.00016	0.00034	0.00008	0.43	0.00009	0.00017	0.00012	0.00029	0.00007	0.42
Dissolved Titanium	mg/L	0.0010	0.0010	0.0010	0.0011	0.0000	0.04	0.0010	0.0029	0.0024	0.0077	0.0016	0.55	0.0020	0.0039	0.0036	0.0077	0.0018	0.45	0.0021	0.0037	0.0028	0.0067	0.0016	0.44
Dissolved Tungsten	mg/L	0.00202	0.00259	0.00267	0.00044	0.00044	0.17	0.00223	0.01256	0.00958	0.04212	0.00911	0.73	0.00870	0.01997	0.01707	0.04243	0.01104	0.55	0.00875	0.01907	0.01161	0.03763	0.01052	0.55
Dissolved Uranium	mg/L	0.00022	0.00028	0.00028	0.00034	0.00005	0.16	0.00022	0.00082	0.00076	0.00205	0.00048	0.58	0.00033	0.00075	0.00068	0.00161	0.00031	0.47	0.00033	0.00063	0.00057	0.00098	0.00020	0.32
Dissolved Vanadium	mg/L	0.0005	0.0006	0.0006	0.0009	0.0001	0.20	0.0006	0.0061	0															

APPENDIX C1 - MODEL OUTPUT SUMMARY STATISTICS BY PROJECT PHASE

SISSON PROJECT  
TABLE C1.5 UT3 AND UT4

Parameter	Units	Background					Operations					Closure					Post-Closure								
		Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation
<b>Conventional Parameters and Major Ions</b>																									
Hardness	mg/L	4.6	9.3	10.1	13.6	2.6	0.284	7.1	93.1	85.3	235.9	64.8	0.696	27.4	72.1	62.8	164.6	37.5	0.520	27.3	56.3	38.4	103.7	26.7	0.475
Alkalinity	mg/L	1.5	8.0	8.8	11.2	3.2	0.395	2.3	819.5	793.5	2018.4	620.1	0.757	13.3	390.3	112.6	1741.6	469.5	1.203	8.8	19.5	17.1	50.2	7.5	0.384
Ammonia	mg/L	0.004	0.027	0.025	0.053	0.014	0.534	0.004	0.140	0.130	0.362	0.099	0.703	0.037	0.132	0.098	0.353	0.085	0.645	0.040	0.082	0.083	0.123	0.025	0.298
Nitrate	mg/L	0.030	0.088	0.067	0.212	0.064	0.731	0.0005	0.100	0.082	0.226	0.066	0.660	0.032	0.104	0.083	0.224	0.065	0.625	0.034	0.095	0.078	0.206	0.062	0.651
Phosphate	mg/L	0.005	0.013	0.008	0.036	0.011	0.862	0.003	0.011	0.007	0.035	0.009	0.864	0.003	0.009	0.007	0.029	0.008	0.842	0.004	0.010	0.006	0.029	0.008	0.815
Sulphate	mg/L	0.4	2.1	1.8	6.3	1.5	0.720	1.4	71.4	64.7	183.9	51.8	0.726	22.0	61.6	54.0	144.8	34.0	0.552	21.8	48.2	32.6	91.9	25.4	0.526
Bromide	mg/L	0.005	0.005	0.005	0.000	0.000	0.037	0.001	0.004	0.004	0.005	0.001	0.264	0.001	0.003	0.004	0.005	0.001	0.247	0.003	0.004	0.004	0.005	0.001	0.166
Chloride	mg/L	0.81	1.28	1.01	2.06	0.47	0.366	1.02	11.05	8.09	34.57	7.94	0.719	6.64	16.25	15.34	34.72	8.40	0.517	6.68	14.70	9.76	27.79	7.59	0.516
Fluoride	mg/L	0.077	0.134	0.132	0.214	0.040	0.300	0.091	1.832	1.676	4.723	1.325	0.723	0.374	1.098	0.917	2.644	0.607	0.553	0.368	0.776	0.586	1.421	0.361	0.465
Dissolved Aluminum	mg/L	0.0409	0.1090	0.1262	0.1568	0.0377	0.346	0.0420	0.3029	0.2739	0.6831	0.1588	0.524	0.0646	0.1711	0.1649	0.3165	0.0535	0.313	0.0640	0.1435	0.1465	0.2048	0.0398	0.277
Dissolved Antimony	mg/L	0.0001	0.0001	0.0001	0.0001	0.0000	0.282	0.0001	0.0047	0.0041	0.0138	0.0037	0.787	0.0011	0.0041	0.0029	0.0109	0.0026	0.625	0.0012	0.0028	0.0028	0.0050	0.0013	0.461
Dissolved Arsenic	mg/L	0.0005	0.0006	0.0005	0.0007	0.0001	0.107	0.0006	0.0274	0.0245	0.0887	0.0226	0.826	0.0047	0.0215	0.0175	0.0592	0.0145	0.671	0.0050	0.0139	0.0138	0.0235	0.0060	0.430
Dissolved Barium	mg/L	0.0019	0.0024	0.0021	0.0033	0.0005	0.219	0.0020	0.0099	0.0093	0.0252	0.0062	0.633	0.0030	0.0065	0.0054	0.0151	0.0031	0.474	0.0030	0.0048	0.0045	0.0072	0.0012	0.254
Dissolved Bismuth	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.001	0.0005	0.0007	0.0007	0.0010	0.0002	0.224	0.0004	0.0005	0.0005	0.0008	0.0001	0.170	0.0004	0.0004	0.0005	0.0005	0.0000	0.052
Dissolved Boron	mg/L	0.0021	0.0087	0.0071	0.0204	0.0064	0.731	0.0108	0.4431	0.3619	1.3749	0.3408	0.769	0.2380	0.6195	0.5672	1.3798	0.3394	0.548	0.2411	0.5465	0.3327	1.0556	0.2989	0.547
Dissolved Cadmium	mg/L	0.00003	0.00005	0.00005	0.00007	0.00001	0.194	0.00005	0.000231	0.000211	0.000588	0.000176	0.760	0.000038	0.000122	0.000098	0.000200	0.000075	0.612	0.000038	0.000081	0.000061	0.000152	0.000040	0.494
Dissolved Calcium	mg/L	1.4	2.9	3.1	4.4	0.9	0.293	2.1	27.2	25.1	69.0	18.9	0.696	7.1	18.9	16.4	43.3	9.8	0.520	7.1	14.4	10.2	26.4	6.7	0.464
Dissolved Chromium	mg/L	0.0005	0.0005	0.0005	0.0006	0.0000	0.074	0.0006	0.0058	0.0052	0.0146	0.0041	0.698	0.0021	0.0051	0.0045	0.0115	0.0026	0.512	0.0021	0.0041	0.0029	0.0074	0.0019	0.471
Dissolved Cobalt	mg/L	0.00004	0.00005	0.00005	0.00006	0.00001	0.098	0.00005	0.00177	0.00163	0.00484	0.00143	0.807	0.00021	0.00065	0.00050	0.00170	0.00040	0.620	0.00021	0.00041	0.00032	0.00074	0.00019	0.459
Dissolved Copper	mg/L	0.0005	0.0007	0.0006	0.0009	0.0001	0.220	0.0007	0.0145	0.0121	0.0325	0.0105	0.729	0.0021	0.0159	0.0148	0.0359	0.0085	0.533	0.0062	0.0135	0.0090	0.0254	0.0070	0.517
Dissolved Iron	mg/L	0.06	0.13	0.15	0.18	0.04	0.328	0.05	0.13	0.13	0.20	0.04	0.305	0.05	0.10	0.10	0.15	0.03	0.317	0.05	0.10	0.10	0.15	0.03	0.309
Dissolved Lead	mg/L	0.0002	0.0012	0.0009	0.0053	0.0014	1.176	0.0004	0.0107	0.0104	0.0295	0.0073	0.682	0.00049	0.01133	0.00127	0.00287	0.00067	0.503	0.00049	0.00116	0.00110	0.00212	0.00057	0.493
Dissolved Lithium	mg/L	0.00040	0.00113	0.00123	0.00160	0.00038	0.338	0.00089	0.01723	0.01570	0.04601	0.01263	0.733	0.00533	0.01525	0.01284	0.03671	0.00824	0.540	0.00542	0.01169	0.00984	0.02085	0.00529	0.452
Dissolved Magnesium	mg/L	0.26	0.49	0.53	0.71	0.14	0.282	0.41	6.13	5.50	16.12	4.34	0.707	2.29	6.03	5.49	13.74	3.17	0.525	2.29	4.95	3.43	9.21	2.45	0.495
Dissolved Manganese	mg/L	0.001	0.005	0.005	0.008	0.002	0.517	0.001	0.230	0.217	0.598	0.182	0.790	0.019	0.088	0.056	0.268	0.072	0.817	0.019	0.037	0.037	0.067	0.016	0.427
Dissolved Mercury	mg/L	0.00012	0.00012	0.00012	0.00012	0.00000	0.002	0.00004	0.00010	0.00010	0.00012	0.000002	0.225	0.000005	0.000009	0.000010	0.000011	0.000002	0.211	0.000007	0.000010	0.000010	0.000011	0.000001	0.143
Dissolved Molybdenum	mg/L	0.0001	0.0002	0.0002	0.0006	0.0002	0.721	0.0003	0.0307	0.0270	0.0930	0.0246	0.804	0.0076	0.0281	0.0205	0.0740	0.0174	0.618	0.0079	0.0197	0.0196	0.0355	0.0092	0.467
Dissolved Nickel	mg/L	0.00050	0.00052	0.00051	0.00056	0.00002	0.036	0.00053	0.00379	0.00347	0.00933	0.00257	0.677	0.00123	0.00261	0.00234	0.00561	0.00120	0.460	0.00122	0.00216	0.00158	0.00369	0.00089	0.415
Dissolved Phosphorus	mg/L	0.003	0.007	0.006	0.011	0.003	0.479	0.005	0.086	0.070	0.251	0.061	0.706	0.046	0.117	0.105	0.252	0.060	0.512	0.046	0.105	0.068	0.194	0.053	0.508
Dissolved Potassium	mg/L	0.28	0.61	0.56	1.15	0.29	0.481	0.70	17.66	14.32	55.07	13.44	0.761	9.89	25.11	23.41	54.95	13.71	0.546	9.90	22.43	13.21	43.38	12.34	0.550
Dissolved Rubidium	mg/L	0.0009	0.0020	0.0020	0.0036	0.0009	0.459	0.0022	0.0757	0.0634	0.2109	0.0566	0.747	0.0314	0.0873	0.0798	0.2029	0.0477	0.546	0.0318	0.0727	0.0501	0.1379	0.0380	0.523
Dissolved Selenium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.009	0.0005	0.0014	0.0013	0.0027	0.0007	0.476	0.0007	0.0011	0.0010	0.0021	0.0004	0.349	0.0007	0.0009	0.0007	0.0013	0.0002	0.245
Dissolved Silicon	mg/L	5.63	9.25	10.18	11.51	1.96	0.211	6.28	71.09	69.44	159.09	46.43	0.653	11.82	45.24	28.57	136.78	34.87	0.771	11.35	19.08	17.66	30.58	5.79	0.303
Dissolved Silver	mg/L	0.00005	0.00005	0.00005	0.00005	0.00000	0.010	0.00005	0.00008	0.00015	0.00002	0.303	0.00007	0.00010	0.00009	0.00015	0.00003	0.269	0.00007	0.00009	0.00007	0.00013	0.00002	0.257	
Dissolved Sodium	mg/L	0.83	1.60	1.75	2.01	0.39	0.243	1.17	370.90	358.15	915.42	281.85	0.760	5.13	176.59	48.67	797.96	215.34	0.629	3.00	6.41	5.75	19.23	2.75	0.429
Dissolved Strontium	mg/L	0.0056	0.0129	0.0137	0.0199	0.0043	0.332	0.0104	0.2308	0.2043	0.6037	0.1694	0.734	0.0745	0.2171	0.1834	0.5205	0.1191	0.548	0.0755	0.1689	0.1342	0.3107	0.0813	0.481
Dissolved Thallium	mg/L	0.00005	0.00005	0.00005	0.00006	0.00000	0.070	0.00006	0.00041	0.00035	0.00106	0.00027	0.663	0.00020	0.00045	0.00042	0.00098	0.00022	0.492	0.00020	0.00039	0.00027	0.0070	0.0018	0.469
Dissolved Titanium	mg/L	0.0010	0.0011	0.0011	0.0013	0.0001	0.081	0.0011	0.0080	0.0069	0.0222	0.0054	0.672	0.0044	0.0103	0.0097	0.0222	0.0051	0.495	0.0045	0.0089	0.0062	0.0162	0.0043	0.476
Dissolved Tungsten	mg/L	0.00187	0.00285	0.00288	0.00415	0.00080	0.281	0.00268	0.03960	0.03203	0.12538	0.02939	0.742	0.02348	0.05806	0.05421	0.12586	0.03089	0.532	0.02361	0.05195	0.03128	0.09897	0.02767	0.533
Dissolved Uranium	mg/L	0.00017	0.00025	0.00023	0.00040	0.00008	0.312	0.00019	0.00267	0.00241	0.00770	0.00199	0.747	0.00054	0.00187	0.00134	0.00505								

APPENDIX C1 - MODEL OUTPUT SUMMARY STATISTICS BY PROJECT PHASE

SISSON PROJECT  
TABLE C1.6 - BIRD BROOK (BB)

Parameter	Units	Background					Operations					Closure					Post-Closure								
		Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation
<b>Conventional Parameters and Major Ions</b>																									
Hardness	mg/L	5.3	8.1	8.0	9.8	1.6	0.20	6.2	28.9	24.5	72.6	17.1	0.59	15.3	32.3	29.7	63.9	15.2	0.47	15.2	30.0	21.6	54.5	14.1	0.47
Alkalinity	mg/L	2.8	6.3	6.8	9.3	2.2	0.35	3.6	147.1	137.2	361.2	109.2	0.74	7.5	86.9	44.9	301.2	82.9	0.95	5.6	12.2	12.4	28.0	4.4	0.36
Ammonia	mg/L	0.025	0.039	0.025	0.080	0.020	0.025	0.024	0.055	0.051	0.124	0.025	0.45	0.029	0.062	0.057	0.123	0.022	0.35	0.030	0.060	0.057	0.104	0.020	0.33
Nitrate	mg/L	0.025	0.086	0.067	0.205	0.060	0.70	0.032	0.106	0.101	0.208	0.054	0.51	0.033	0.107	0.100	0.207	0.054	0.50	0.033	0.107	0.111	0.207	0.054	0.50
Phosphate	mg/L	0.005	0.009	0.006	0.024	0.006	0.65	0.004	0.009	0.006	0.020	0.005	0.54	0.004	0.008	0.006	0.017	0.004	0.50	0.004	0.008	0.007	0.017	0.004	0.54
Sulphate	mg/L	0.5	0.9	0.7	1.4	0.4	0.43	0.8	19.0	15.3	57.7	14.6	0.77	9.2	24.1	20.5	53.1	14.1	0.59	9.1	22.2	12.5	45.5	13.2	0.60
Bromide	mg/L	0.005	0.005	0.005	0.006	0.000	0.07	0.004	0.005	0.005	0.006	0.000	0.06	0.004	0.005	0.005	0.005	0.000	0.56	0.004	0.005	0.005	0.005	0.000	0.06
Chloride	mg/L	0.78	1.06	1.01	1.48	0.20	0.19	0.95	4.54	3.47	14.55	3.11	0.68	3.47	7.35	6.24	14.66	3.92	0.53	3.49	7.26	4.50	14.07	3.86	0.53
Fluoride	mg/L	0.075	0.123	0.121	0.176	0.028	0.23	0.079	0.490	0.432	1.228	0.306	0.62	0.234	0.463	0.421	0.961	0.221	0.48	0.232	0.411	0.284	0.774	0.195	0.48
Dissolved Aluminum	mg/L	0.04	0.12	0.13	0.21	0.05	0.37	0.04	0.14	0.13	0.28	0.05	0.35	0.06	0.13	0.13	0.22	0.04	0.32	0.06	0.12	0.12	0.20	0.04	0.32
Dissolved Antimony	mg/L	0.0001	0.0001	0.0001	0.0001	0.0000	0.00	0.0001	0.0011	0.0009	0.0031	0.0008	0.77	0.0005	0.0014	0.0013	0.0031	0.0007	0.52	0.0005	0.0013	0.0012	0.0025	0.0007	0.51
Dissolved Arsenic	mg/L	0.0008	0.0012	0.0011	0.0018	0.0004	0.05	0.0008	0.0064	0.0054	0.0185	0.0046	0.71	0.0028	0.0075	0.0068	0.0154	0.0007	0.47	0.0030	0.0071	0.0066	0.0126	0.0032	0.45
Dissolved Barium	mg/L	0.0020	0.0023	0.0020	0.0033	0.0004	0.19	0.0020	0.0037	0.0035	0.0072	0.0013	0.36	0.0024	0.0035	0.0033	0.0058	0.0009	0.25	0.0024	0.0033	0.0031	0.0050	0.0008	0.23
Dissolved Bismuth	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0005	0.0005	0.0006	0.0000	0.05	0.0005	0.0005	0.0005	0.0005	0.0000	0.40	0.0005	0.0005	0.0005	0.0005	0.0000	0.03
Dissolved Boron	mg/L	0.0012	0.0025	0.0023	0.0040	0.0009	0.36	0.0052	0.1482	0.1072	0.5416	0.1267	0.86	0.1002	0.2552	0.2044	0.5458	0.1552	0.61	0.1015	0.2066	0.1395	0.5172	0.1523	0.61
Dissolved Cadmium	mg/L	0.00015	0.00034	0.00035	0.00065	0.00015	0.45	0.00016	0.00076	0.00072	0.00132	0.00038	0.51	0.00036	0.00068	0.00059	0.00142	0.00026	0.38	0.00035	0.00062	0.00054	0.00119	0.00023	0.37
Dissolved Calcium	mg/L	1.6	2.4	2.4	3.0	0.5	2.0	1.9	8.2	7.0	20.0	4.7	0.58	4.1	8.6	8.0	16.8	3.9	0.46	4.1	7.8	5.7	14.0	3.5	0.45
Dissolved Chromium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.01	0.0005	0.0019	0.0016	0.0048	0.0011	0.59	0.0012	0.0023	0.0020	0.0044	0.0010	0.46	0.0012	0.0021	0.0015	0.0039	0.0010	0.46
Dissolved Cobalt	mg/L	0.0005	0.0006	0.0005	0.0009	0.0001	0.21	0.0005	0.0039	0.0035	0.0106	0.0028	0.72	0.0012	0.0026	0.0024	0.0055	0.0012	0.48	0.0012	0.0022	0.0016	0.0042	0.0010	0.46
Dissolved Copper	mg/L	0.0005	0.0005	0.0005	0.0006	0.0000	0.03	0.0006	0.0045	0.0035	0.0138	0.0033	0.74	0.0028	0.0066	0.0056	0.0137	0.0037	0.55	0.0029	0.0064	0.0041	0.0127	0.0036	0.55
Dissolved Iron	mg/L	0.05	0.13	0.13	0.23	0.06	0.45	0.05	0.11	0.10	0.20	0.04	0.38	0.05	0.10	0.09	0.17	0.04	0.37	0.05	0.10	0.09	0.17	0.04	0.37
Dissolved Lead	mg/L	0.0005	0.0012	0.0010	0.0022	0.0005	0.47	0.0006	0.0040	0.0031	0.0122	0.0027	0.68	0.0028	0.0059	0.0049	0.0123	0.0032	0.54	0.0028	0.0058	0.0038	0.0116	0.0031	0.54
Dissolved Lithium	mg/L	0.0033	0.0050	0.0051	0.0063	0.0009	0.18	0.0043	0.0046	0.0061	0.01259	0.00324	0.73	0.00231	0.00570	0.00532	0.01208	0.00301	0.53	0.00235	0.00541	0.00422	0.01042	0.00283	0.52
Dissolved Magnesium	mg/L	0.33	0.48	0.49	0.58	0.09	0.18	0.40	2.02	1.69	5.57	1.28	0.63	1.21	2.65	2.36	5.31	1.33	0.50	1.21	2.54	1.78	4.77	1.27	0.50
Dissolved Manganese	mg/L	0.002	0.007	0.008	0.020	0.005	0.76	0.002	0.047	0.0042	0.129	0.005	0.74	0.010	0.026	0.025	0.076	0.016	0.56	0.009	0.029	0.017	0.045	0.010	0.50
Dissolved Mercury	mg/L	0.00012	0.00013	0.00012	0.00017	0.00001	0.10	0.00010	0.00012	0.00013	0.00016	0.00001	0.11	0.00010	0.00011	0.00011	0.00015	0.00001	0.12	0.00010	0.00012	0.00011	0.00015	0.00001	0.12
Dissolved Molybdenum	mg/L	0.0001	0.0001	0.0001	0.0001	0.0000	0.23	0.0001	0.0069	0.0056	0.0209	0.0056	0.82	0.0032	0.0095	0.0086	0.0208	0.0051	0.54	0.0033	0.0090	0.0085	0.0174	0.0047	0.53
Dissolved Nickel	mg/L	0.00050	0.00050	0.00050	0.00051	0.00000	0.00	0.00051	0.00127	0.00113	0.00289	0.00062	0.49	0.00080	0.00131	0.00119	0.00231	0.00048	0.37	0.00080	0.00126	0.00095	0.00206	0.00046	0.36
Dissolved Phosphorus	mg/L	0.010	0.016	0.020	0.020	0.005	0.34	0.011	0.040	0.033	0.114	0.024	0.60	0.028	0.059	0.051	0.115	0.030	0.50	0.028	0.058	0.042	0.109	0.029	0.50
Dissolved Potassium	mg/L	0.32	0.38	0.37	0.47	0.05	0.33	0.51	6.28	4.51	22.34	5.17	0.82	4.28	10.66	8.50	22.53	6.39	0.60	4.29	10.45	5.74	21.38	6.27	0.60
Dissolved Rubidium	mg/L	0.0008	0.0010	0.0010	0.0013	0.0002	0.18	0.0010	0.0224	0.0169	0.0737	0.0179	0.80	0.0137	0.0346	0.0294	0.0741	0.0201	0.58	0.0139	0.0336	0.0212	0.0679	0.0195	0.58
Dissolved Selenium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0007	0.0007	0.0011	0.0002	0.27	0.0003	0.0007	0.0007	0.0010	0.0002	0.24	0.0003	0.0007	0.0006	0.0009	0.0002	0.23
Dissolved Silicon	mg/L	6.18	9.26	9.43	11.83	1.87	2.0	4.74	21.16	20.08	40.16	9.67	0.46	7.55	18.86	18.10	38.78	7.79	0.41	6.81	13.67	13.91	21.05	4.03	0.29
Dissolved Silver	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0006	0.0006	0.0009	0.00001	0.16	0.0006	0.0007	0.00007	0.00009	0.00001	0.18	0.0006	0.0007	0.0006	0.0009	0.00001	0.17
Dissolved Sodium	mg/L	0.99	1.55	1.62	1.87	0.28	0.18	0.74	65.29	61.11	161.94	49.33	0.76	2.78	38.02	18.18	136.09	37.73	0.99	1.91	3.72	3.61	10.30	3.51	0.41
Dissolved Strontium	mg/L	0.0093	0.0133	0.0133	0.0150	0.0021	0.17	0.0043	0.0268	0.0243	0.1849	0.0455	0.68	0.0378	0.0875	0.0811	0.1808	0.0459	0.51	0.0384	0.0835	0.0477	0.1588	0.0427	0.51
Dissolved Thallium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.01	0.0005	0.0015	0.0013	0.0040	0.0009	0.56	0.0011	0.0021	0.0018	0.0040	0.0010	0.46	0.0011	0.0020	0.0014	0.0037	0.0009	0.45
Dissolved Titanium	mg/L	0.0010	0.0010	0.0010	0.0010	0.0000	0.01	0.0010	0.0032	0.0026	0.0089	0.0019	0.59	0.0024	0.0047	0.0040	0.0090	0.0022	0.47	0.0024	0.0046	0.0032	0.0084	0.0022	0.47
Dissolved Tungsten	mg/L	0.00172	0.00222	0.00195	0.00271	0.00040	0.18	0.00107	0.01498	0.01091	0.05162	0.01156	0.77	0.01072	0.02514	0.02049	0.05201	0.01450	0.58	0.01077	0.02474	0.01458	0.04960	0.01426	0.58
Dissolved Vanadium	mg/L	0.0005	0.0005	0.0005	0.0006	0.0000	0.08	0.0005	0.0053	0.0046	0.01533	0.00040	0.75	0.0019	0.0055	0.0048	0.0124	0.0027	0.49	0.0019	0.0048	0.0045	0.0086	0.0022	0.45
Dissolved Vanadium	mg/L	0.0004	0.0005	0.0005	0.0006	0.0000	0.09	0.0006	0.0071	0.0053	0.0244	0.0056	0.79	0.0048	0.0117	0.0097	0.0246	0.0067	0.57	0.0049					



APPENDIX C1 - MODEL OUTPUT SUMMARY STATISTICS BY PROJECT PHASE

SISSON PROJECT  
TABLE C1.7 - SISSON BROOK (SB)

Parameter	Units	Background						Operations						Closure						Post-Closure					
		Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation
<b>Conventional Parameters and Major Ions</b>																									
Hardness	mg/L	5.8	8.1	8.3	9.8	1.5	0.18	5.8	122.1	118.3	233.1	77.4	0.63	5.8	8.1	8.4	9.8	1.4	0.17	8.4	69.4	68.2	83.1	5.2	0.08
Alkalinity	mg/L	3.2	5.9	6.3	7.8	1.6	0.26	3.2	1516.3	1927.6	2857.8	933.7	0.62	3.2	5.9	6.1	7.8	1.4	0.24	6.0	57.2	41.4	163.8	31.2	0.55
Ammonia	mg/L	0.025	0.034	0.025	0.070	0.17	0.50	0.025	0.312	0.394	0.517	0.171	0.55	0.025	0.033	0.025	0.070	0.16	0.47	0.025	0.465	0.466	0.477	0.028	0.06
Nitrate	mg/L	0.034	0.093	0.066	0.218	0.063	0.70	0.034	0.194	0.218	0.268	0.068	0.35	0.034	0.100	0.077	0.218	0.068	0.47	0.182	0.236	0.233	0.252	0.009	0.04
Phosphate	mg/L	0.005	0.008	0.008	0.016	0.003	0.36	0.003	0.005	0.004	0.016	0.002	0.45	0.005	0.008	0.008	0.016	0.003	0.36	0.002	0.003	0.003	0.010	0.001	0.19
Sulphate	mg/L	0.8	1.5	1.6	2.4	0.5	0.31	0.8	89.8	94.3	167.1	57.8	0.64	0.8	1.6	1.6	2.4	0.5	0.29	1.4	54.4	53.8	63.1	4.1	0.07
Bromide	mg/L	0.005	0.005	0.005	0.005	0.000	0.00	0.002	0.003	0.003	0.005	0.001	0.37	0.005	0.005	0.005	0.005	0.000	0.00	0.002	0.002	0.002	0.005	0.000	0.14
Chloride	mg/L	0.79	1.09	1.06	1.54	0.22	0.20	0.79	8.58	10.09	15.43	4.79	0.56	0.79	1.08	1.06	1.54	0.20	0.18	0.98	13.99	14.07	14.23	1.85	0.06
Fluoride	mg/L	0.102	0.132	0.134	0.166	0.023	0.17	0.102	2.619	2.229	5.160	1.776	0.68	0.102	0.130	0.126	0.166	0.022	0.17	0.105	1.067	1.036	1.365	0.099	0.09
Dissolved Aluminum	mg/L	0.0518	0.0928	0.0950	0.1834	0.0224	0.24	0.0518	0.1533	0.1734	0.1834	0.0394	0.26	0.0518	0.0901	0.0950	0.1230	0.0225	0.25	0.0518	0.1468	0.1443	0.1842	0.0113	0.08
Dissolved Antimony	mg/L	0.0001	0.0001	0.0001	0.0001	0.0000	0.00	0.0001	0.0058	0.0077	0.0080	0.0034	0.59	0.0001	0.0000	0.0001	0.0001	0.0000	0.00	0.0001	0.0086	0.0086	0.0088	0.0006	0.06
Dissolved Arsenic	mg/L	0.0005	0.0012	0.0010	0.0023	0.0006	0.48	0.0005	0.0062	0.0080	0.0083	0.0034	0.48	0.0005	0.0012	0.0010	0.0023	0.0005	0.46	0.0008	0.0088	0.0088	0.0090	0.0005	0.06
Dissolved Barium	mg/L	0.0017	0.0021	0.0020	0.0026	0.0002	0.11	0.0017	0.0154	0.0165	0.0281	0.0089	0.57	0.0017	0.0021	0.0020	0.0026	0.0002	0.11	0.0020	0.0126	0.0126	0.0133	0.0007	0.06
Dissolved Bismuth	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0008	0.0009	0.0012	0.0009	0.27	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0003	0.0003	0.0003	0.0005	0.0000	0.08
Dissolved Boron	mg/L	0.0008	0.0014	0.0014	0.0020	0.0004	0.29	0.0008	0.3964	0.504	0.7004	0.2390	0.60	0.0008	0.0013	0.0013	0.0020	0.0004	0.29	0.0009	0.5978	0.5987	0.6088	0.0390	0.07
Dissolved Cadmium	mg/L	0.00020	0.00027	0.00028	0.00043	0.00008	0.28	0.00015	0.000266	0.000304	0.000404	0.000152	0.57	0.00015	0.00026	0.00025	0.00043	0.00008	0.29	0.00015	0.000157	0.000156	0.000179	0.00010	0.07
Dissolved Calcium	mg/L	1.6	2.3	2.3	2.8	0.4	0.20	1.6	36.2	32.4	71.4	23.8	0.66	1.6	2.3	2.3	2.8	0.4	0.18	2.3	16.2	15.7	20.7	1.5	0.09
Dissolved Chromium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0008	0.0009	0.0009	0.0002	0.22	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0009	0.0009	0.0009	0.0000	0.03
Dissolved Cobalt	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.00274	0.00169	0.00578	0.00214	0.78	0.0005	0.00005	0.00005	0.00005	0.00000	0.00	0.00005	0.00089	0.00086	0.00116	0.00009	0.10
Dissolved Copper	mg/L	0.0009	0.0015	0.0016	0.0021	0.0004	0.24	0.0009	0.0018	0.0019	0.0021	0.0003	0.15	0.0009	0.0015	0.0016	0.0021	0.0004	0.25	0.0009	0.0019	0.0019	0.0020	0.0001	0.04
Dissolved Iron	mg/L	0.07	0.15	0.14	0.28	0.07	0.47	0.07	0.12	0.13	0.28	0.05	0.39	0.07	0.14	0.13	0.28	0.06	0.46	0.03	0.04	0.04	0.11	0.01	0.22
Dissolved Lead	mg/L	0.0005	0.0007	0.0006	0.0011	0.00002	0.17	0.0005	0.0032	0.0040	0.0041	0.00015	0.47	0.0005	0.0007	0.0006	0.0011	0.00002	0.17	0.0005	0.00044	0.00044	0.00045	0.00003	0.06
Dissolved Lithium	mg/L	0.00030	0.00039	0.00040	0.00045	0.00004	0.11	0.00030	0.02534	0.02971	0.04615	0.01570	0.62	0.00030	0.00039	0.00040	0.00045	0.00004	0.11	0.00034	0.02629	0.02641	0.02714	0.00170	0.06
Dissolved Magnesium	mg/L	0.43	0.58	0.60	0.68	0.09	0.16	0.43	7.69	8.96	13.31	4.49	0.58	0.43	0.58	0.60	0.68	0.08	0.14	0.61	7.05	7.03	7.67	0.44	0.06
Dissolved Manganese	mg/L	0.002	0.006	0.006	0.010	0.003	0.45	0.002	0.060	0.078	0.081	0.032	0.54	0.002	0.006	0.006	0.010	0.003	0.46	0.002	0.087	0.087	0.089	0.006	0.06
Dissolved Mercury	mg/L	0.00013	0.00014	0.00013	0.00029	0.00003	0.18	0.00005	0.00009	0.00007	0.00020	0.00002	0.37	0.00013	0.00013	0.00013	0.00020	0.00003	0.17	0.00014	0.00004	0.00004	0.00013	0.00001	0.15
Dissolved Molybdenum	mg/L	0.0021	0.0042	0.0048	0.0067	0.0016	0.38	0.0021	0.0306	0.0395	0.0408	0.0156	0.51	0.0021	0.0042	0.0044	0.0067	0.0015	0.35	0.0040	0.0437	0.0438	0.0448	0.0026	0.06
Dissolved Nickel	mg/L	0.00050	0.00050	0.00050	0.00050	0.00000	0.00	0.00050	0.00502	0.00401	0.00935	0.00334	0.67	0.00050	0.00050	0.00050	0.00050	0.00000	0.00	0.00050	0.00287	0.00285	0.00320	0.00017	0.06
Dissolved Phosphorus	mg/L	0.010	0.010	0.010	0.010	0.0000	0.00	0.010	0.080	0.098	0.134	0.042	0.53	0.010	0.010	0.010	0.010	0.0000	0.00	0.010	0.111	0.112	0.114	0.007	0.06
Dissolved Potassium	mg/L	0.32	0.37	0.39	0.42	0.03	0.09	0.32	14.20	17.81	25.74	8.47	0.60	0.32	0.37	0.37	0.42	0.03	0.08	0.36	20.21	20.31	20.84	1.30	0.06
Dissolved Rubidium	mg/L	0.0014	0.0016	0.0016	0.0020	0.0002	0.13	0.0014	0.0906	0.1161	0.1467	0.0539	0.59	0.0014	0.0016	0.0015	0.0020	0.0002	0.12	0.0015	0.1124	0.1129	0.1149	0.0072	0.06
Dissolved Selenium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0018	0.0019	0.0028	0.0008	0.47	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0009	0.0009	0.0010	0.0000	0.04
Dissolved Silicon	mg/L	4.83	7.47	7.84	10.04	1.66	0.22	4.83	116.67	147.62	212.32	67.18	0.58	4.83	7.62	7.87	10.04	1.60	0.21	9.28	18.03	16.97	25.77	2.33	0.13
Dissolved Silver	mg/L	0.00005	0.00005	0.00005	0.00005	0.00000	0.00	0.00005	0.00007	0.00008	0.00009	0.00001	0.19	0.00005	0.00005	0.00005	0.00005	0.00000	0.00	0.00005	0.00008	0.00008	0.00008	0.00000	0.02
Dissolved Sodium	mg/L	1.12	1.43	1.47	1.68	0.21	0.15	1.12	689.12	877.04	1301.30	424.95	0.62	1.12	1.43	1.48	1.68	0.19	0.13	1.48	21.98	14.97	69.48	13.90	0.63
Dissolved Strontium	mg/L	0.0005	0.0005	0.0005	0.0005	0.00000	0.00	0.0005	0.00006	0.00007	0.00007	0.00002	0.60	0.0005	0.0005	0.0005	0.0005	0.00000	0.00	0.0005	0.00004	0.00004	0.00004	0.00000	0.06
Dissolved Thallium	mg/L	0.0005	0.0005	0.0005	0.0005	0.00000	0.00	0.0005	0.00046	0.00056	0.00074	0.00025	0.55	0.0005	0.00005	0.00005	0.00005	0.00000	0.00	0.00005	0.00051	0.00051	0.00053	0.00003	0.06
Dissolved Thallium	mg/L	0.0005	0.0005	0.0005	0.0005	0.00000	0.00	0.0005	0.00046	0.00056	0.00074	0.00025	0.55	0.0005	0.00005	0.00005	0.00005	0.00000	0.00	0.00005	0.00051	0.00051	0.00053	0.00003	0.06
Dissolved Vanadium	mg/L	0.0005	0.0005	0.0005	0.0005	0.00000	0.00	0.0005	0.00233	0.0299	0.0386	0.0138	0.59	0.0005	0.0005	0.0005	0.0005	0.00000	0.00	0.0005	0.0352	0.0353	0.0359	0.0023	0.06
Dissolved Zinc	mg/L	0.0015	0.0021	0.0022	0.0030	0.0005	0.22	0.0015	0.0281	0.0252	0.0530	0.0183	0.65	0.0015	0.0021	0.0021	0.0030	0.0004	0.21	0.0016	0.0195	0.0196	0.0207	0.0012	0.06
Total Aluminum	mg/L	0.0518	0.0928	0.0950	0.1834	0.0224	0.24	0.0518	0.3820	0.2614	0.950														

APPENDIX C1 - MODEL OUTPUT SUMMARY STATISTICS BY PROJECT PHASE

SISSON PROJECT  
TABLE C1.8 - NAP1

Parameter	Units	Background						Operations						Closure						Post-Closure					
		Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation
<b>Conventional Parameters and Major Ions</b>																									
Hardness	mg/L	6.4	9.3	10.0	11.3	1.8	0.19	6.4	15.1	13.5	28.9	5.9	0.39	8.2	14.9	14.6	25.2	4.9	0.33	8.2	14.0	13.4	21.3	4.3	0.31
Alkalinity	mg/L	4.2	8.2	9.0	11.0	2.2	0.27	4.2	59.9	55.2	141.6	41.7	0.70	5.1	37.0	20.2	118.3	33.2	0.90	4.6	9.5	10.5	15.2	2.6	0.27
Ammonia	mg/L	0.025	0.047	0.032	0.174	0.044	0.94	0.025	0.052	0.035	0.185	0.042	0.80	0.026	0.054	0.040	0.185	0.041	0.77	0.026	0.052	0.033	0.179	0.041	0.78
Nitrate	mg/L	0.025	0.086	0.068	0.206	0.063	0.74	0.019	0.092	0.068	0.206	0.064	0.70	0.022	0.092	0.068	0.205	0.064	0.69	0.023	0.093	0.071	0.205	0.064	0.69
Phosphate	mg/L	0.008	0.014	0.014	0.023	0.005	0.34	0.008	0.013	0.013	0.023	0.004	0.34	0.008	0.013	0.013	0.022	0.004	0.69	0.008	0.013	0.013	0.022	0.004	0.33
Sulphate	mg/L	0.8	1.2	1.1	1.8	0.3	0.24	0.9	6.2	5.5	17.2	4.1	0.66	2.7	6.7	5.9	14.9	3.4	0.51	2.7	5.9	4.1	11.3	2.9	0.50
Bromide	mg/L	0.005	0.005	0.005	0.006	0.000	0.09	0.005	0.005	0.005	0.006	0.000	0.08	0.005	0.005	0.005	0.006	0.000	0.07	0.005	0.005	0.005	0.006	0.000	0.07
Chloride	mg/L	0.79	1.19	1.25	1.65	0.26	0.22	0.81	1.95	1.69	4.53	0.83	0.43	1.45	2.58	2.42	4.57	1.04	0.40	1.45	2.52	2.16	4.25	1.00	0.40
Fluoride	mg/L	0.128	0.185	0.200	0.237	0.037	0.93	0.114	0.293	0.260	0.572	0.107	0.36	0.149	0.263	0.236	0.455	0.077	0.29	0.148	0.242	0.227	0.373	0.067	0.28
Dissolved Aluminum	mg/L	0.0600	0.1365	0.1439	0.2052	0.0443	0.32	0.0601	0.1436	0.1432	0.2174	0.0446	0.31	0.0626	0.1362	0.1424	0.2094	0.0445	0.33	0.0624	0.1343	0.1364	0.2071	0.0446	0.33
Dissolved Antimony	mg/L	0.0001	0.0001	0.0001	0.0001	0.0000	0.06	0.0001	0.0004	0.0003	0.0010	0.0003	0.73	0.0001	0.0004	0.0003	0.0010	0.0002	0.53	0.0002	0.0004	0.0003	0.0007	0.0002	0.48
Dissolved Arsenic	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.02	0.0005	0.0023	0.0020	0.0066	0.0016	0.69	0.0009	0.0024	0.0020	0.0055	0.0011	0.48	0.0009	0.0021	0.0020	0.0036	0.0002	0.40
Dissolved Barium	mg/L	0.0017	0.0021	0.0020	0.0025	0.0003	0.15	0.0014	0.0025	0.0024	0.0039	0.0006	0.23	0.0016	0.0024	0.0023	0.0034	0.0004	0.19	0.0016	0.0023	0.0021	0.0029	0.0004	0.18
Dissolved Bismuth	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0005	0.0005	0.0005	0.0005	0.01	0.0005	0.0005	0.0005	0.0005	0.0000	0.01	0.0005	0.0005	0.0005	0.0005	0.0000	0.01
Dissolved Boron	mg/L	0.0010	0.0025	0.0023	0.0042	0.0012	0.48	0.0015	0.0363	0.0287	0.1365	0.0312	0.86	0.0219	0.0598	0.0496	0.1377	0.0376	0.63	0.0223	0.0567	0.0324	0.1204	0.0356	0.63
Dissolved Cadmium	mg/L	0.00005	0.00007	0.00006	0.00011	0.00002	0.29	0.00005	0.00022	0.00020	0.00053	0.00013	0.59	0.00008	0.00017	0.00015	0.00037	0.00007	0.43	0.00008	0.00015	0.00014	0.00026	0.00006	0.39
Dissolved Calcium	mg/L	2.0	2.9	2.9	3.5	0.6	0.19	2.0	4.6	4.0	8.4	1.7	0.37	2.5	4.3	4.2	7.1	1.3	0.30	2.5	4.0	3.9	5.9	1.1	0.28
Dissolved Chromium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.01	0.0005	0.0009	0.0008	0.0017	0.0003	0.36	0.0006	0.0009	0.0009	0.0015	0.0003	0.29	0.0006	0.0009	0.0007	0.0013	0.0002	0.27
Dissolved Cobalt	mg/L	0.00005	0.00006	0.00005	0.00009	0.00001	0.22	0.00005	0.00017	0.00016	0.00040	0.00010	0.59	0.00006	0.00011	0.00009	0.00020	0.00004	0.36	0.00006	0.00009	0.00009	0.00015	0.00003	0.31
Dissolved Copper	mg/L	0.0005	0.0005	0.0005	0.0006	0.0000	0.04	0.0005	0.0015	0.0013	0.0041	0.0009	0.57	0.0010	0.0019	0.0017	0.0039	0.0009	0.47	0.0010	0.0018	0.0013	0.0033	0.0008	0.46
Dissolved Iron	mg/L	0.10	0.18	0.16	0.28	0.06	0.35	0.09	0.17	0.16	0.28	0.06	0.35	0.09	0.17	0.15	0.27	0.06	0.35	0.09	0.17	0.15	0.27	0.06	0.35
Dissolved Lead	mg/L	0.0007	0.00019	0.00020	0.00030	0.00008	0.40	0.0007	0.00026	0.00024	0.00054	0.00011	0.41	0.00013	0.00030	0.00026	0.00054	0.00011	0.39	0.00013	0.00029	0.00026	0.00050	0.00011	0.39
Dissolved Lithium	mg/L	0.00146	0.00216	0.00214	0.00264	0.00039	0.18	0.00147	0.00325	0.00297	0.00600	0.00112	0.34	0.00186	0.00341	0.00325	0.00573	0.00100	0.29	0.00187	0.00326	0.00320	0.00485	0.00089	0.27
Dissolved Magnesium	mg/L	0.30	0.42	0.41	0.51	0.07	0.17	0.30	0.83	0.73	1.85	0.38	0.46	0.47	0.93	0.89	1.72	0.36	0.39	0.47	0.87	0.75	1.47	0.33	0.37
Dissolved Manganese	mg/L	0.002	0.007	0.007	0.017	0.005	0.64	0.002	0.022	0.020	0.053	0.013	0.61	0.005	0.014	0.012	0.052	0.007	0.51	0.005	0.011	0.009	0.023	0.005	0.50
Dissolved Mercury	mg/L	0.00012	0.00012	0.00012	0.00012	0.00000	0.00	0.00012	0.00012	0.00012	0.00012	0.00000	0.03	0.00012	0.00012	0.00012	0.00012	0.00000	0.03	0.00012	0.00012	0.00012	0.00012	0.00000	0.03
Dissolved Molybdenum	mg/L	0.0001	0.0001	0.0001	0.0002	0.0001	0.48	0.0001	0.0022	0.0018	0.0068	0.0018	0.84	0.0007	0.0026	0.0022	0.0067	0.0016	0.59	0.0008	0.0023	0.0022	0.0046	0.0013	0.55
Dissolved Nickel	mg/L	0.00050	0.00050	0.00050	0.00051	0.00000	0.01	0.00050	0.00073	0.00069	0.00123	0.00019	0.26	0.00056	0.00069	0.00067	0.00098	0.00012	0.18	0.00056	0.00067	0.00060	0.00086	0.00011	0.16
Dissolved Phosphorus	mg/L	0.010	0.020	0.030	0.030	0.011	0.50	0.010	0.027	0.028	0.054	0.012	0.46	0.014	0.031	0.030	0.054	0.014	0.44	0.014	0.031	0.025	0.051	0.013	0.44
Dissolved Potassium	mg/L	0.23	0.32	0.31	0.44	0.06	0.18	0.26	1.67	1.26	5.67	1.25	0.75	1.06	2.63	2.21	5.72	1.53	0.58	1.06	2.50	1.47	5.13	1.46	0.58
Dissolved Rubidium	mg/L	0.0012	0.0015	0.0014	0.0020	0.0002	0.15	0.0013	0.0069	0.0055	0.0206	0.0048	0.70	0.0038	0.0094	0.0086	0.0206	0.0051	0.54	0.0039	0.0088	0.0062	0.0173	0.0047	0.53
Dissolved Selenium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0006	0.0005	0.0007	0.0000	0.08	0.0005	0.0006	0.0005	0.0006	0.0000	0.06	0.0005	0.0005	0.0005	0.0006	0.0000	0.05
Dissolved Silicon	mg/L	6.65	9.82	9.99	13.06	1.95	0.20	6.63	13.92	13.79	21.47	4.22	3.00	7.02	12.77	12.45	20.96	3.58	0.28	6.97	10.89	11.21	13.75	2.06	0.19
Dissolved Silver	mg/L	0.00005	0.00005	0.00005	0.00005	0.00000	0.00	0.00005	0.00005	0.00005	0.00006	0.00000	0.04	0.00005	0.00005	0.00005	0.00006	0.00000	0.05	0.00005	0.00005	0.00005	0.00006	0.00000	0.05
Dissolved Sodium	mg/L	1.26	1.78	1.84	2.10	0.27	0.15	1.26	25.33	23.11	61.88	18.57	0.73	1.67	14.95	7.40	51.86	14.96	1.00	1.43	2.31	2.30	4.21	1.50	0.22
Dissolved Strontium	mg/L	0.0017	0.0156	0.017	0.030	0.004	0.19	0.0198	0.0308	0.0283	0.0558	0.0143	0.46	0.0148	0.0341	0.0325	0.0635	0.0132	0.39	0.0148	0.0319	0.0305	0.0527	0.0117	0.37
Dissolved Thallium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00000	0.00	0.00005	0.00008	0.00007	0.00014	0.00002	0.30	0.00006	0.00009	0.00008	0.00014	0.00002	0.27	0.00006	0.00008	0.00007	0.00012	0.00002	0.26
Dissolved Titanium	mg/L	0.0010	0.0010	0.0010	0.0010	0.0000	0.01	0.0010	0.0015	0.0014	0.0030	0.0005	0.31	0.0013	0.0019	0.0017	0.0030	0.0005	0.29	0.0013	0.0018	0.0015	0.0027	0.0005	0.28
Dissolved Tungsten	mg/L	0.00201	0.00242	0.00257	0.00276	0.00031	0.13	0.00207	0.00529	0.00434	0.01464	0.00281	0.53	0.00393	0.00757	0.00656	0.01474	0.00353	0.47	0.00394	0.00731	0.00506	0.01330	0.00337	0.46
Dissolved Uranium	mg/L	0.00022	0.00028	0.00028	0.00035	0.00005	0.18	0.00022	0.00044	0.00042	0.00083	0.00016	0.36	0.00025	0.00042	0.00041	0.00070	0.00012	0.28	0.00025	0.00038	0.00036	0.00052	0.00009	0.24
Dissolved Vanadium	mg/L	0.0005	0.0005	0.0005	0.0006	0.0000	0.07	0.0005	0.0021	0.0017	0.0067	0													

APPENDIX C1 - MODEL OUTPUT SUMMARY STATISTICS BY PROJECT PHASE

SISSON PROJECT  
TABLE C1.9 - NAP2

Parameter	Units	Background						Operations						Closure						Post-Closure						
		Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	
<b>Conventional Parameters and Major Ions</b>																										
Hardness	mg/L	5.8	8.9	9.4	12.4	2.1	0.24	5.8	14.0	13.3	27.4	5.3	0.38	7.2	13.4	12.8	24.0	4.3	0.32	7.2	12.4	11.2	19.8	3.6	0.29	
Alkalinity	mg/L	3.5	7.9	8.8	11.0	2.7	0.34	3.5	54.6	50.5	130.0	37.8	0.69	4.1	32.8	16.6	107.9	30.6	0.93	3.8	8.8	9.4	14.5	2.8	0.31	
Ammonia	mg/L	0.025	0.032	0.025	0.046	0.010	0.10	0.025	0.039	0.037	0.069	0.011	0.28	0.026	0.039	0.034	0.068	0.011	0.28	0.027	0.036	0.031	0.053	0.010	0.26	
Nitrate	mg/L	0.025	0.074	0.050	0.182	0.060	0.81	0.022	0.084	0.049	0.186	0.063	0.75	0.024	0.084	0.049	0.186	0.063	0.75	0.024	0.083	0.049	0.183	0.062	0.75	
Phosphate	mg/L	0.006	0.014	0.010	0.032	0.010	0.68	0.006	0.014	0.010	0.033	0.009	0.67	0.006	0.013	0.010	0.032	0.009	0.67	0.006	0.013	0.010	0.032	0.009	0.67	
Sulphate	mg/L	0.5	1.5	1.3	5.0	1.3	0.86	0.6	5.7	5.6	14.4	3.4	0.60	2.0	5.7	5.3	12.1	2.6	0.66	2.0	4.9	4.3	8.5	2.1	0.43	
Bromide	mg/L	0.005	0.005	0.005	0.005	0.000	0.00	0.005	0.005	0.005	0.005	0.000	0.01	0.005	0.005	0.005	0.000	0.000	0.01	0.005	0.005	0.005	0.005	0.000	0.01	
Chloride	mg/L	0.83	1.17	0.96	1.91	0.37	0.31	0.84	1.78	1.55	4.11	0.73	0.41	1.21	2.23	2.12	4.13	0.87	0.39	1.21	2.14	1.94	3.67	0.82	0.38	
Fluoride	mg/L	0.095	0.148	0.135	0.221	0.038	0.26	0.096	0.246	0.237	0.490	0.092	0.37	0.115	0.212	0.209	0.380	0.064	0.30	0.114	0.192	0.191	0.296	0.054	0.28	
Dissolved Aluminum	mg/L	0.0637	0.1226	0.1378	0.269	0.0336	0.27	0.0638	0.1301	0.1425	0.1810	0.0344	0.26	0.0656	0.1228	0.1399	0.1739	0.0348	0.26	0.0655	0.1208	0.1333	0.1713	0.0350	0.29	
Dissolved Antimony	mg/L	0.0001	0.0001	0.0001	0.0001	0.0000	0.04	0.0001	0.0003	0.0003	0.0009	0.0002	0.72	0.0001	0.0003	0.0003	0.0009	0.0002	0.56	0.0001	0.0003	0.0002	0.0005	0.0001	0.46	
Dissolved Arsenic	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.01	0.0005	0.0021	0.0018	0.0060	0.0014	0.67	0.0008	0.0020	0.0017	0.0049	0.0010	0.51	0.0008	0.0016	0.0015	0.0026	0.0006	0.37	
Dissolved Barium	mg/L	0.0020	0.0023	0.0020	0.0030	0.0004	0.19	0.0020	0.0027	0.0027	0.0044	0.0006	0.22	0.0021	0.0026	0.0024	0.0039	0.0005	0.19	0.0021	0.0025	0.0022	0.0034	0.0004	0.18	
Dissolved Bismuth	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0000	0.0000	0.0005	0.0005	0.0005	0.0005	0.0005	0.0000	0.18
Dissolved Boron	mg/L	0.0014	0.0024	0.0025	0.0038	0.0008	0.34	0.0020	0.0298	0.0228	0.1097	0.0250	0.84	0.0169	0.0465	0.0396	0.1106	0.0291	0.63	0.0171	0.0424	0.0234	0.0902	0.0266	0.63	
Dissolved Cadmium	mg/L	0.00005	0.00005	0.00005	0.00006	0.00001	0.10	0.00005	0.00019	0.00017	0.00045	0.00011	0.60	0.00007	0.00014	0.00012	0.00029	0.00006	0.43	0.00007	0.00011	0.00009	0.00017	0.00004	0.34	
Dissolved Calcium	mg/L	1.8	2.8	3.0	4.0	0.7	0.24	1.8	4.3	4.2	8.3	1.6	0.37	2.1	3.9	3.7	7.0	1.2	0.60	2.1	3.7	3.4	5.8	1.0	0.28	
Dissolved Chromium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.01	0.0005	0.0008	0.0008	0.0015	0.0003	0.33	0.0006	0.0008	0.0008	0.0014	0.0002	0.26	0.0006	0.0008	0.0007	0.0011	0.0002	0.22	
Dissolved Cobalt	mg/L	0.00005	0.00005	0.00005	0.00005	0.00000	0.01	0.00005	0.00015	0.00014	0.00036	0.00009	0.58	0.00006	0.00009	0.00008	0.00018	0.00003	0.33	0.00006	0.00008	0.00007	0.00011	0.00002	0.22	
Dissolved Copper	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.03	0.0005	0.0014	0.0012	0.0034	0.0007	0.54	0.0009	0.0016	0.0015	0.0033	0.0007	0.44	0.0009	0.0015	0.0011	0.0026	0.0006	0.42	
Dissolved Iron	mg/L	0.08	0.15	0.18	0.20	0.05	0.34	0.08	0.15	0.15	0.21	0.05	0.34	0.08	0.14	0.15	0.20	0.05	0.34	0.08	0.14	0.12	0.20	0.05	0.34	
Dissolved Lead	mg/L	0.00005	0.00014	0.00010	0.00050	0.00012	0.89	0.00005	0.00019	0.00015	0.00055	0.00012	0.64	0.00008	0.00022	0.00020	0.00055	0.00012	0.56	0.00008	0.00021	0.00018	0.00054	0.00012	0.58	
Dissolved Lithium	mg/L	0.00093	0.00133	0.00143	0.00171	0.00032	0.24	0.00094	0.00232	0.00226	0.00440	0.00089	0.39	0.00123	0.00235	0.00218	0.00414	0.00071	0.30	0.00123	0.00214	0.00209	0.00308	0.00056	0.26	
Dissolved Magnesium	mg/L	0.29	0.43	0.46	0.58	0.10	0.22	0.29	0.78	0.74	1.71	0.43	0.42	0.83	0.78	1.59	0.31	0.37	0.42	0.77	0.67	0.67	1.30	0.27	0.35	
Dissolved Manganese	mg/L	0.002	0.005	0.007	0.007	0.002	0.34	0.002	0.018	0.016	0.045	0.011	0.60	0.004	0.011	0.026	0.005	0.47	0.004	0.008	0.008	0.012	0.023	0.005	0.34	
Dissolved Mercury	mg/L	0.00012	0.00012	0.00012	0.00012	0.00000	0.00	0.00012	0.00012	0.00012	0.00013	0.00000	0.01	0.00013	0.00013	0.00013	0.00000	0.01	0.00013	0.00013	0.00013	0.00013	0.00013	0.00000	0.00	
Dissolved Molybdenum	mg/L	0.0001	0.0001	0.0001	0.0002	0.0001	0.57	0.0001	0.00019	0.0016	0.0059	0.0016	0.84	0.0005	0.0021	0.0016	0.0057	0.0013	0.64	0.0006	0.0016	0.0015	0.0033	0.0009	0.55	
Dissolved Nickel	mg/L	0.00050	0.00050	0.00050	0.00050	0.00000	0.00	0.00050	0.00070	0.00067	0.00114	0.00017	0.24	0.00055	0.00065	0.00063	0.00090	0.00010	0.15	0.00055	0.00062	0.00057	0.00077	0.00008	0.13	
Dissolved Phosphorus	mg/L	0.010	0.010	0.010	0.010	0.000	0.01	0.010	0.015	0.014	0.030	0.005	0.30	0.013	0.018	0.017	0.030	0.005	0.29	0.013	0.017	0.014	0.026	0.005	0.28	
Dissolved Potassium	mg/L	0.21	0.34	0.33	0.44	0.07	0.20	0.23	1.42	1.13	4.64	1.00	0.71	0.82	2.11	1.82	4.68	1.19	0.57	0.82	1.96	1.21	3.95	1.10	0.56	
Dissolved Rubidium	mg/L	0.0008	0.0013	0.0014	0.0016	0.0003	0.19	0.0009	0.0058	0.0048	0.0172	0.0040	0.69	0.0028	0.0074	0.0066	0.0171	0.0041	0.55	0.0028	0.0066	0.0044	0.0129	0.0035	0.53	
Dissolved Selenium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0006	0.0005	0.0007	0.0000	0.08	0.0005	0.0005	0.0006	0.0000	0.0000	0.08	0.0005	0.0005	0.0005	0.0006	0.0000	0.04	
Dissolved Silicon	mg/L	6.25	9.10	10.01	11.31	1.97	0.22	6.24	12.89	12.80	19.39	3.95	0.31	6.57	11.67	11.77	18.82	3.34	0.29	6.53	9.96	10.90	11.94	1.98	0.20	
Dissolved Silver	mg/L	0.00005	0.00005	0.00005	0.00005	0.00000	0.00	0.00005	0.00005	0.00005	0.00006	0.00000	0.04	0.00005	0.00005	0.00005	0.00006	0.00000	0.04	0.00005	0.00005	0.00005	0.00006	0.00000	0.04	
Dissolved Sodium	mg/L	1.11	1.60	1.79	1.92	0.32	0.20	1.11	22.85	20.97	56.04	16.79	0.73	1.38	12.97	5.82	47.05	13.79	1.06	1.23	1.98	2.01	3.49	0.44	0.22	
Dissolved Strontium	mg/L	0.0001	0.0001	0.0001	0.0001	0.0000	0.25	0.0001	0.0001	0.0001	0.0001	0.0001	0.24	0.0001	0.0001	0.0001	0.0001	0.0001	0.22	0.0001	0.0001	0.0001	0.0001	0.0001	0.21	
Dissolved Thallium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00000	0.01	0.00005	0.00007	0.00007	0.00013	0.00002	0.26	0.00006	0.00008	0.00007	0.00012	0.00002	0.24	0.00006	0.00008	0.00006	0.00010	0.00002	0.22	
Dissolved Titanium	mg/L	0.0010	0.0010	0.0010	0.0010	0.0000	0.01	0.0010	0.0014	0.0013	0.0027	0.0004	0.27	0.0012	0.0017	0.0016	0.0027	0.0004	0.26	0.0012	0.0016	0.0013	0.0023	0.0004	0.24	
Dissolved Tungsten	mg/L	0.00189	0.00235	0.00255	0.00269	0.00035	0.15	0.00193	0.00466	0.00392	0.01224	0.00230	0.49	0.00328	0.00631	0.00560	0.01232	0.00281	0.45	0.00329	0.00596	0.00439	0.01056	0.00261	0.44	
Dissolved Uranium	mg/L	0.00020	0.00026	0.00023	0.00040	0.00007	0.28	0.00020	0.00040	0.00038	0.00070	0.00013	0.33	0.00024	0.00037	0.00036	0.00060	0.00010	0.27	0.00024	0.00033	0.00029	0.00046	0.00007	0.22	
Dissolved Vanadium	mg/L	0.0005	0.0005	0.0005	0.0006	0.0000	0.00	0.0005	0.0018	0.0015																

APPENDIX C1 - MODEL OUTPUT SUMMARY STATISTICS BY PROJECT PHASE

SISSON PROJECT  
TABLE C1.10 - NAP3

Parameter	Units	Background					Operations					Closure					Post-Closure								
		Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation
<b>Conventional Parameters and Major Ions</b>																									
Hardness	mg/L	5.7	8.7	9.3	11.8	1.9	0.21	5.9	14.6	13.8	29.4	5.8	0.40	7.6	14.2	13.5	25.8	4.7	0.33	7.6	13.2	11.6	21.4	4.1	0.31
Alkalinity	mg/L	3.3	7.6	8.3	10.2	2.3	0.31	3.5	58.4	53.9	139.6	40.8	0.70	4.3	35.1	17.9	115.7	32.9	0.94	3.9	9.0	9.5	15.1	2.8	0.31
Ammonia	mg/L	0.025	0.034	0.036	0.052	0.009	0.28	0.025	0.039	0.038	0.071	0.011	0.29	0.028	0.040	0.035	0.071	0.011	0.27	0.028	0.038	0.033	0.055	0.009	0.25
Nitrate	mg/L	0.025	0.076	0.054	0.187	0.074	0.25	0.024	0.085	0.051	0.187	0.061	0.72	0.025	0.084	0.051	0.187	0.061	0.72	0.025	0.084	0.051	0.184	0.061	0.73
Phosphate	mg/L	0.006	0.013	0.010	0.031	0.009	0.67	0.006	0.013	0.010	0.032	0.009	0.66	0.006	0.013	0.010	0.031	0.009	0.66	0.006	0.013	0.010	0.031	0.009	0.66
Sulphate	mg/L	0.5	1.4	1.2	4.2	0.76	0.6	0.6	6.2	6.1	16.3	3.9	0.63	2.4	6.5	5.8	14.0	3.1	0.48	2.3	5.7	5.1	10.1	2.6	0.46
Bromide	mg/L	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Chloride	mg/L	0.87	1.15	0.93	1.75	0.32	0.27	0.84	1.89	1.63	4.58	0.82	0.44	1.30	2.45	2.37	4.61	1.00	0.41	1.30	2.37	2.19	4.14	0.95	0.40
Fluoride	mg/L	0.091	0.143	0.133	0.202	0.034	0.24	0.095	0.256	0.247	0.521	0.100	0.39	0.120	0.223	0.213	0.406	0.070	0.31	0.119	0.202	0.200	0.317	0.059	0.29
Dissolved Aluminum	mg/L	0.0596	0.1223	0.1294	0.1629	0.0294	0.24	0.0630	0.1306	0.1421	0.1802	0.0338	0.26	0.0653	0.1229	0.1407	0.1725	0.0340	0.28	0.0652	0.1208	0.1346	0.1698	0.0342	0.28
Dissolved Antimony	mg/L	0.0001	0.0001	0.0001	0.0001	0.0000	0.04	0.0001	0.0004	0.0003	0.0010	0.0003	0.73	0.0001	0.0004	0.0003	0.0010	0.0002	0.56	0.0001	0.0003	0.0003	0.0006	0.0001	0.48
Dissolved Arsenic	mg/L	0.0006	0.0007	0.0006	0.0008	0.0001	0.12	0.0005	0.0023	0.0020	0.0065	0.0015	0.68	0.0009	0.0022	0.0019	0.0054	0.0011	0.50	0.0009	0.0018	0.0017	0.0030	0.0007	0.38
Dissolved Barium	mg/L	0.0020	0.0023	0.0023	0.0030	0.0004	0.17	0.0020	0.0028	0.0027	0.0045	0.0006	0.22	0.0021	0.0026	0.0025	0.0040	0.0005	0.19	0.0021	0.0025	0.0022	0.0034	0.0004	0.18
Dissolved Bismuth	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	0.000	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Boron	mg/L	0.0014	0.0025	0.0025	0.0039	0.0009	0.35	0.0021	0.0347	0.0261	0.1292	0.0294	0.85	0.0203	0.0555	0.0464	0.1302	0.0349	0.63	0.0205	0.0515	0.0282	0.1095	0.0324	0.63
Dissolved Cadmium	mg/L	0.00007	0.00011	0.00012	0.00017	0.00003	0.28	0.00005	0.00021	0.00019	0.00050	0.00012	0.59	0.00009	0.00016	0.00014	0.00034	0.00007	0.42	0.00009	0.00013	0.00010	0.00022	0.00005	0.35
Dissolved Calcium	mg/L	1.8	2.7	2.8	3.8	0.6	0.22	1.8	4.4	4.2	8.7	0.38	2.2	4.1	3.8	7.5	1.3	0.38	2.2	4.1	3.8	7.5	1.1	2.9	
Dissolved Chromium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.01	0.0005	0.0009	0.0008	0.0017	0.0003	0.35	0.0006	0.0009	0.0008	0.0015	0.0003	0.28	0.0006	0.0008	0.0007	0.0012	0.0002	0.25
Dissolved Cobalt	mg/L	0.00005	0.00005	0.00005	0.00006	0.00000	0.05	0.00005	0.00016	0.00015	0.00039	0.00010	0.60	0.00006	0.00010	0.00009	0.00019	0.00003	0.34	0.00006	0.00008	0.00007	0.00012	0.00002	0.25
Dissolved Copper	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.03	0.0005	0.0015	0.0013	0.0039	0.0008	0.57	0.0009	0.0018	0.0017	0.0038	0.0008	0.46	0.0009	0.0017	0.0012	0.0031	0.0008	0.45
Dissolved Iron	mg/L	0.08	0.15	0.17	0.21	0.05	0.34	0.08	0.15	0.15	0.21	0.05	0.34	0.08	0.14	0.15	0.20	0.05	0.34	0.08	0.14	0.12	0.20	0.05	0.34
Dissolved Lead	mg/L	0.00005	0.00014	0.00010	0.00043	0.00010	0.75	0.00005	0.00020	0.00016	0.00055	0.00012	0.61	0.00009	0.00024	0.00022	0.00055	0.00013	0.53	0.00009	0.00023	0.00020	0.00053	0.00012	0.54
Dissolved Lithium	mg/L	0.00081	0.00116	0.00126	0.00146	0.00026	0.22	0.00092	0.00241	0.00231	0.00476	0.00098	0.41	0.00128	0.00249	0.00231	0.00450	0.00080	0.32	0.00128	0.00229	0.00216	0.00341	0.00064	0.28
Dissolved Magnesium	mg/L	0.30	0.44	0.47	0.58	0.09	0.19	0.30	0.83	0.77	1.88	0.38	0.45	0.45	0.91	0.85	1.75	0.36	0.39	0.45	0.84	0.71	1.45	0.31	0.37
Dissolved Manganese	mg/L	0.002	0.006	0.006	0.010	0.002	0.36	0.002	0.020	0.012	0.048	0.012	0.62	0.004	0.012	0.008	0.028	0.006	0.48	0.004	0.008	0.007	0.014	0.003	0.35
Dissolved Mercury	mg/L	0.00012	0.00013	0.00012	0.00013	0.00000	0.03	0.00012	0.00012	0.00012	0.00013	0.00000	0.01	0.00012	0.00012	0.00012	0.00012	0.00000	0.01	0.00012	0.00012	0.00012	0.00013	0.00000	0.01
Dissolved Molybdenum	mg/L	0.0000	0.0001	0.0001	0.0002	0.0000	0.51	0.0001	0.0021	0.0017	0.0065	0.0018	0.84	0.0007	0.0024	0.0018	0.0063	0.0015	0.62	0.0007	0.0019	0.0018	0.0039	0.0011	0.56
Dissolved Nickel	mg/L	0.00050	0.00050	0.00050	0.00051	0.00000	0.00	0.00050	0.00072	0.00069	0.00121	0.00019	0.26	0.00056	0.00068	0.00066	0.00097	0.00012	0.17	0.00056	0.00065	0.00059	0.00083	0.00010	0.15
Dissolved Phosphorus	mg/L	0.010	0.011	0.012	0.012	0.001	0.10	0.010	0.016	0.015	0.034	0.005	0.33	0.013	0.020	0.018	0.034	0.006	0.32	0.013	0.019	0.015	0.030	0.006	0.31
Dissolved Potassium	mg/L	0.23	0.35	0.33	0.44	0.06	0.18	0.24	1.62	1.27	5.44	1.19	0.73	0.96	2.48	2.10	5.48	1.43	0.58	0.97	2.32	1.40	4.74	1.34	0.58
Dissolved Rubidium	mg/L	0.0008	0.0012	0.0013	0.0016	0.0002	0.19	0.0009	0.0065	0.0053	0.0197	0.0046	0.71	0.0032	0.0086	0.0077	0.0197	0.0048	0.56	0.0033	0.0078	0.0051	0.0154	0.0043	0.55
Dissolved Selenium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0006	0.0005	0.0007	0.0000	0.07	0.0005	0.0006	0.0005	0.0006	0.0000	0.07	0.0005	0.0005	0.0005	0.0006	0.0000	0.05
Dissolved Silicon	mg/L	6.25	9.13	9.96	11.41	1.82	0.20	6.27	13.24	13.00	20.23	4.14	0.31	6.68	11.98	11.72	19.72	3.48	0.29	6.63	10.13	11.06	12.29	1.97	0.19
Dissolved Silver	mg/L	0.00005	0.00005	0.00005	0.00005	0.00000	0.00	0.00005	0.00005	0.00005	0.00006	0.00000	0.04	0.00005	0.00005	0.00005	0.00006	0.00000	0.05	0.00005	0.00005	0.00005	0.00006	0.00000	0.05
Dissolved Sodium	mg/L	1.08	1.59	1.72	1.86	0.28	0.18	1.11	24.59	22.57	60.44	18.15	0.74	1.44	14.04	6.56	50.63	14.81	1.05	1.26	0.65	2.06	3.80	0.48	0.23
Dissolved Strontium	mg/L	0.0031	0.0125	0.0129	0.0169	0.0028	0.22	0.0032	0.0274	0.0255	0.0629	0.0139	0.51	0.0134	0.0297	0.0261	0.0677	0.0136	0.42	0.0135	0.0269	0.0231	0.0474	0.015	0.39
Dissolved Thallium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00000	0.00	0.00005	0.00008	0.00007	0.00014	0.00000	0.29	0.00006	0.00008	0.00008	0.00014	0.00002	0.26	0.00006	0.00008	0.00007	0.00012	0.00002	0.24
Dissolved Titanium	mg/L	0.0010	0.0010	0.0010	0.0010	0.0000	0.01	0.0010	0.0015	0.0014	0.0030	0.0005	0.30	0.0013	0.0018	0.0017	0.0030	0.0005	0.29	0.0013	0.0017	0.0014	0.0026	0.0005	0.27
Dissolved Tungsten	mg/L	0.00188	0.00232	0.00244	0.00269	0.00035	0.15	0.00190	0.00509	0.00418	0.01402	0.00270	0.53	0.00358	0.00712	0.00622	0.01411	0.00334	0.47	0.00359	0.00678	0.00480	0.01233	0.00314	0.46
Dissolved Uranium	mg/L	0.00017	0.00022	0.00019	0.00033	0.00006	0.26	0.00019	0.00041	0.00039	0.00073	0.00014	0.35	0.00024	0.00038	0.00037	0.00062	0.00010	0.27	0.00024	0.00034	0.00030	0.00047	0.00007	0.22
Dissolved Vanadium	mg/L	0.0005	0.0005	0.0005	0.0006	0.0000	0.06	0.0005	0.0021	0.0016	0.0064														

APPENDIX C1 - MODEL OUTPUT SUMMARY STATISTICS BY PROJECT PHASE

SISSON PROJECT  
TABLE C1.11 - NAP5

Parameter	Units	Background						Operations						Closure						Post-Closure					
		Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation
<b>Conventional Parameters and Major Ions</b>																									
Hardness	mg/L	6.2	8.8	9.6	10.4	1.6	0.18	6.4	36.6	40.6	62.1	17.8	0.49	8.0	13.7	13.5	22.8	4.2	0.31	11.2	30.0	29.4	39.3	3.3	0.11
Alkalinity	mg/L	3.8	7.0	7.8	9.3	2.0	0.29	4.1	354.3	442.6	649.4	209.3	0.59	4.7	31.1	16.1	102.7	28.9	0.93	10.8	23.0	19.1	59.7	9.7	0.42
Ammonia	mg/L	0.019	0.036	0.025	0.064	0.018	0.49	0.017	0.097	0.111	0.159	0.041	0.42	0.022	0.042	0.033	0.079	0.017	0.40	0.028	0.167	0.161	0.194	0.017	0.10
Nitrate	mg/L	0.025	0.083	0.044	0.227	0.074	0.90	0.008	0.111	0.077	0.243	0.071	0.64	0.010	0.091	0.051	0.237	0.078	0.86	0.072	0.134	0.112	0.239	0.057	0.43
Phosphate	mg/L	0.006	0.015	0.011	0.051	0.012	0.85	0.005	0.015	0.011	0.064	0.013	0.89	0.005	0.017	0.012	0.064	0.015	0.91	0.004	0.013	0.009	0.064	0.011	0.88
Sulphate	mg/L	1.0	1.2	1.2	1.9	0.1	0.17	1.1	23.0	27.3	40.2	13.4	0.58	2.7	5.7	5.0	12.8	2.9	0.50	3.3	19.9	19.1	26.6	2.5	0.12
Bromide	mg/L	0.005	0.005	0.005	0.005	0.000	0.00	0.004	0.005	0.004	0.005	0.000	0.00	0.005	0.005	0.005	0.000	0.00	0.02	0.004	0.004	0.004	0.005	0.000	0.03
Chloride	mg/L	0.88	1.08	1.05	1.30	0.14	0.13	0.90	3.17	3.40	5.73	1.33	0.42	1.28	2.22	2.14	3.84	0.77	0.35	1.59	5.74	5.46	6.96	0.65	0.11
Fluoride	mg/L	0.090	0.147	0.140	0.202	0.028	0.19	0.089	0.746	0.767	1.279	0.401	0.54	0.148	0.226	0.213	0.397	0.061	0.27	0.148	0.468	0.463	0.656	0.052	0.11
Dissolved Aluminum	mg/L	0.0453	0.1075	0.110	0.1609	0.0360	0.34	0.0447	0.1229	0.1289	0.1921	0.0345	0.28	0.0469	0.1065	0.1104	0.1702	0.0367	0.34	0.0469	0.1178	0.1204	0.1711	0.0277	0.24
Dissolved Antimony	mg/L	0.0001	0.0001	0.0001	0.0001	0.0000	0.04	0.0001	0.0015	0.0019	0.0021	0.0008	0.56	0.0001	0.0003	0.0003	0.0009	0.0002	0.55	0.0002	0.0028	0.0027	0.0031	0.0002	0.09
Dissolved Arsenic	mg/L	0.0005	0.0006	0.0005	0.0010	0.0002	0.30	0.0003	0.0029	0.0031	0.0064	0.0006	0.57	0.0007	0.0019	0.0016	0.0047	0.0010	0.54	0.0014	0.0037	0.0035	0.0048	0.0006	0.05
Dissolved Barium	mg/L	0.0040	0.0045	0.0043	0.0056	0.0005	0.12	0.0046	0.0079	0.0082	0.0112	0.0019	0.24	0.0046	0.0054	0.0052	0.0068	0.0006	0.11	0.0047	0.0077	0.0076	0.0086	0.0005	0.06
Dissolved Bismuth	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0006	0.0006	0.0007	0.0000	0.09	0.0005	0.0005	0.0005	0.0005	0.0000	0.11	0.0004	0.0004	0.0004	0.0005	0.0000	0.02
Dissolved Boron	mg/L	0.0014	0.0023	0.0023	0.0035	0.0008	0.32	0.0019	0.1072	0.1271	0.2076	0.0622	0.58	0.0180	0.0488	0.0408	0.1146	0.0306	0.63	0.0235	0.1216	0.2035	0.2617	0.0277	0.13
Dissolved Cadmium	mg/L	0.00007	0.00016	0.00016	0.00029	0.00007	0.43	0.00004	0.00073	0.00091	0.00119	0.00038	0.52	0.00007	0.00019	0.00017	0.00045	0.00008	0.42	0.00007	0.00059	0.00058	0.00080	0.00007	0.12
Dissolved Calcium	mg/L	1.9	2.8	3.0	3.2	0.5	0.19	2.0	11.0	11.7	17.1	5.4	0.49	2.4	4.1	4.1	6.5	1.2	0.29	3.4	7.6	7.6	10.3	0.7	0.12
Dissolved Chromium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.01	0.0005	0.0008	0.0008	0.0015	0.0002	0.30	0.0006	0.0008	0.0008	0.0014	0.0002	0.26	0.0007	0.0008	0.0008	0.0011	0.0001	0.16
Dissolved Cobalt	mg/L	0.00005	0.00005	0.00005	0.00008	0.00001	0.18	0.00005	0.00069	0.00058	0.00137	0.00048	0.70	0.00006	0.00010	0.00008	0.00020	0.00003	0.35	0.00007	0.00028	0.00031	0.00047	0.00004	0.11
Dissolved Copper	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.03	0.0004	0.0013	0.0012	0.0032	0.0007	0.51	0.0008	0.0016	0.0014	0.0032	0.0007	0.46	0.0010	0.0016	0.0013	0.0025	0.0005	0.30
Dissolved Iron	mg/L	0.06	0.12	0.13	0.21	0.05	0.39	0.06	0.12	0.11	0.21	0.04	0.35	0.06	0.12	0.11	0.20	0.04	0.38	0.05	0.09	0.09	0.16	0.03	0.35
Dissolved Lead	mg/L	0.00005	0.00008	0.00007	0.00016	0.00004	0.45	0.00005	0.00018	0.00018	0.00037	0.00007	0.41	0.00009	0.00017	0.00015	0.00035	0.00007	0.43	0.00009	0.00025	0.00023	0.00037	0.00005	0.21
Dissolved Lithium	mg/L	0.00068	0.00101	0.00105	0.00123	0.00019	0.19	0.00079	0.00698	0.00821	0.01146	0.00356	0.51	0.00110	0.00218	0.00206	0.00413	0.00082	0.38	0.00170	0.00935	0.00920	0.01084	0.00084	0.09
Dissolved Magnesium	mg/L	0.32	0.45	0.48	0.53	0.08	0.17	0.31	2.20	2.64	3.55	1.07	0.49	0.45	0.85	0.80	1.56	0.32	0.37	0.63	2.67	2.60	3.30	0.28	0.10
Dissolved Manganese	mg/L	0.001	0.005	0.004	0.014	0.004	0.76	0.001	0.026	0.029	0.055	0.014	0.55	0.003	0.010	0.008	0.031	0.006	0.62	0.003	0.031	0.030	0.041	0.004	0.12
Dissolved Mercury	mg/L	0.00012	0.00013	0.00013	0.00015	0.00001	0.08	0.00010	0.00012	0.00011	0.00015	0.00001	0.09	0.00012	0.00012	0.00012	0.00015	0.00001	0.08	0.00009	0.00010	0.00010	0.00013	0.00001	0.08
Dissolved Molybdenum	mg/L	0.0001	0.0002	0.0002	0.0004	0.00001	0.52	0.0001	0.0074	0.0094	0.0116	0.0042	0.57	0.0006	0.0023	0.0019	0.0059	0.0014	0.60	0.0015	0.0141	0.0138	0.0162	0.0013	0.09
Dissolved Nickel	mg/L	0.00050	0.00050	0.00050	0.00000	0.00000	0.00	0.00050	0.00159	0.00161	0.00255	0.00076	0.47	0.00055	0.00066	0.00064	0.00091	0.00010	0.16	0.00057	0.00131	0.00128	0.00156	0.00010	0.07
Dissolved Phosphorus	mg/L	0.010	0.014	0.010	0.020	0.005	0.37	0.009	0.032	0.033	0.056	0.012	0.38	0.013	0.022	0.021	0.041	0.007	0.34	0.014	0.049	0.046	0.062	0.006	0.12
Dissolved Potassium	mg/L	0.28	0.34	0.34	0.41	0.04	0.12	0.29	4.12	4.77	8.03	2.28	0.55	0.92	2.20	1.88	4.84	1.25	0.57	1.16	7.57	7.21	9.56	1.06	0.14
Dissolved Rubidium	mg/L	0.0010	0.0012	0.0012	0.0015	0.0002	0.16	0.0011	0.0234	0.0296	0.0384	0.0130	0.55	0.0031	0.0076	0.0070	0.0174	0.0042	0.55	0.0043	0.0387	0.0379	0.0461	0.0042	0.11
Dissolved Selenium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0008	0.0009	0.0011	0.0002	0.24	0.0005	0.0006	0.0005	0.0006	0.0000	0.07	0.0005	0.0006	0.0006	0.0007	0.0000	0.04
Dissolved Silicon	mg/L	5.66	8.53	8.63	11.18	1.70	0.20	5.58	33.99	40.85	56.01	15.29	0.45	5.95	11.20	10.83	17.93	3.30	0.29	9.19	12.20	12.35	16.94	1.60	0.13
Dissolved Silver	mg/L	0.00005	0.00005	0.00005	0.00005	0.00000	0.00	0.00005	0.00006	0.00006	0.00006	0.00000	0.07	0.00005	0.00005	0.00005	0.00006	0.00000	0.05	0.00005	0.00006	0.00006	0.00006	0.00000	0.03
Dissolved Sodium	mg/L	0.04	1.52	1.63	1.81	0.25	0.16	1.05	159.59	199.71	293.54	95.23	0.60	1.39	12.42	5.95	44.69	12.99	1.05	2.55	49.97	5.94	23.86	2.26	0.53
Dissolved Strontium	mg/L	0.0093	0.0130	0.014	0.021	0.006	0.20	0.0092	0.0260	0.0267	0.0423	0.0153	0.51	0.0139	0.0283	0.0270	0.0549	0.0132	0.41	0.0213	0.1236	0.1202	0.1435	0.0116	0.09
Dissolved Thallium	mg/L	0.00005	0.00005	0.00005	0.00000	0.00000	0.01	0.00005	0.00015	0.00018	0.00023	0.00006	0.40	0.00006	0.00008	0.00008	0.00013	0.00002	0.24	0.00006	0.00021	0.00024	0.00024	0.00002	0.09
Dissolved Titanium	mg/L	0.0010	0.0010	0.0010	0.0010	0.0000	0.01	0.0010	0.0029	0.0034	0.0045	0.0011	0.38	0.0012	0.0017	0.0016	0.0027	0.0005	0.26	0.0013	0.0048	0.0047	0.0055	0.0004	0.09
Dissolved Tungsten	mg/L	0.00189	0.00227	0.00206	0.00266	0.00033	0.14	0.00192	0.01042	0.01139	0.02020	0.00505	0.48	0.00340	0.00650	0.00570	0.01268	0.00295	0.45	0.00392	0.01970	0.01867	0.02427	0.00254	0.13
Dissolved Uranium	mg/L	0.00010	0.00018	0.00018	0.00030	0.00006	0.33	0.00010	0.00126	0.00150	0.00219	0.00066	0.52	0.00017	0.00032	0.00028	0.00070	0.00013	0.40	0.00017	0.00160	0.00157	0.00189	0.00015	0.09
Dissolved Vanadium	mg/L	0.0004	0.0005	0.0005	0.0006	0.0000	0.07	0.0005	0.0063	0.00															

APPENDIX C1 - MODEL OUTPUT SUMMARY STATISTICS BY PROJECT PHASE

SISSON PROJECT  
TABLE C1.12 - NAP7

Parameter	Units	Background						Operations						Closure						Post-Closure					
		Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation
<b>Conventional Parameters and Major Ions</b>																									
Hardness	mg/L	7.6	10.5	11.2	13.3	2.1	0.20	7.4	24.3	26.6	37.2	9.1	0.37	8.5	12.9	12.5	19.3	3.1	0.24	9.4	21.6	20.9	28.8	2.8	0.13
Alkalinity	mg/L	4.6	7.5	8.0	9.0	1.9	0.26	4.2	180.4	224.5	324.6	104.2	0.58	5.1	18.7	11.8	52.2	13.5	0.72	5.0	16.1	14.5	36.7	5.4	0.33
Ammonia	mg/L	0.025	0.030	0.030	0.040	0.006	0.19	0.19	0.060	0.067	0.088	0.020	0.34	0.022	0.032	0.031	0.048	0.007	0.23	0.027	0.100	0.099	0.116	0.009	0.09
Nitrate	mg/L	0.025	0.117	0.090	0.232	0.089	0.76	0.14	0.136	0.108	0.259	0.087	0.64	0.015	0.128	0.095	0.258	0.093	0.73	0.046	0.145	0.119	0.258	0.081	0.56
Phosphate	mg/L	0.005	0.015	0.013	0.030	0.009	0.62	0.004	0.014	0.013	0.033	0.010	0.70	0.004	0.014	0.013	0.033	0.010	0.70	0.003	0.013	0.012	0.028	0.009	0.68
Sulphate	mg/L	0.5	2.1	1.4	5.0	1.5	0.71	0.5	12.9	15.5	23.8	6.8	0.53	2.1	4.2	3.5	7.3	1.8	0.43	2.2	11.9	11.2	15.8	1.6	0.14
Bromide	mg/L	0.005	0.005	0.005	0.005	0.000	0.00	0.005	0.005	0.005	0.005	0.000	0.03	0.005	0.005	0.005	0.005	0.000	0.01	0.004	0.004	0.004	0.005	0.000	0.02
Chloride	mg/L	1.16	1.47	1.26	2.11	0.36	0.25	1.18	2.51	2.47	3.94	0.76	0.30	1.37	2.02	1.93	2.92	0.51	0.25	1.42	3.91	3.70	4.75	0.47	0.12
Fluoride	mg/L	0.103	0.192	0.186	0.270	0.061	0.32	0.105	0.484	0.535	0.845	0.209	0.43	0.117	0.224	0.207	0.354	0.073	0.32	0.117	0.353	0.346	0.494	0.065	0.18
Dissolved Aluminum	mg/L	0.0483	0.0925	0.0964	0.1060	0.0157	0.17	0.0472	0.0978	0.1049	0.1187	0.0181	0.19	0.0482	0.0887	0.0952	0.1075	0.0185	0.21	0.0481	0.0972	0.1028	0.1175	0.0162	0.17
Dissolved Antimony	mg/L	0.0001	0.0001	0.0001	0.0001	0.0000	0.00	0.0001	0.0007	0.0010	0.0011	0.0004	0.54	0.0001	0.0002	0.0002	0.0004	0.0001	0.47	0.0001	0.0015	0.0015	0.0017	0.0001	0.09
Dissolved Arsenic	mg/L	0.0005	0.0006	0.0005	0.0009	0.0002	0.02	0.0004	0.0017	0.0018	0.0032	0.0008	0.47	0.0006	0.0012	0.0010	0.0023	0.0005	0.39	0.0009	0.0022	0.0021	0.0028	0.0003	0.14
Dissolved Barium	mg/L	0.0042	0.0049	0.0050	0.0055	0.0005	0.10	0.0045	0.0066	0.0067	0.0085	0.0010	0.16	0.0045	0.0053	0.0054	0.0062	0.0005	0.10	0.0046	0.0065	0.0066	0.0073	0.0005	0.07
Dissolved Bismuth	mg/L	0.0005	0.0005	0.0005	0.0005	0.000	0.00	0.0005	0.0005	0.0005	0.0006	0.0000	0.05	0.0005	0.0005	0.0005	0.0005	0.0000	0.01	0.0005	0.0005	0.0005	0.0005	0.0000	0.01
Dissolved Boron	mg/L	0.0013	0.0021	0.0022	0.0029	0.0007	0.33	0.0014	0.0542	0.0641	0.1041	0.0311	0.57	0.0085	0.0233	0.0195	0.0539	0.0143	0.62	0.0113	0.1139	0.1090	0.1426	0.0159	0.14
Dissolved Cadmium	mg/L	0.00005	0.00011	0.00009	0.00020	0.00006	0.54	0.00001	0.00039	0.00046	0.00068	0.51	0.00002	0.00011	0.00008	0.00031	0.00008	0.67	0.00005	0.00033	0.00032	0.00051	0.00007	0.00001	0.22
Dissolved Calcium	mg/L	2.4	3.3	3.6	4.3	0.7	0.21	2.3	7.4	8.0	11.6	2.8	0.37	2.6	4.0	3.9	6.0	1.0	0.24	2.8	5.9	5.7	8.1	0.8	0.14
Dissolved Chromium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0007	0.0006	0.0010	0.0001	0.19	0.0005	0.0007	0.0006	0.0009	0.0001	0.16	0.0006	0.0007	0.0006	0.0008	0.0001	0.11
Dissolved Cobalt	mg/L	0.00005	0.00006	0.00005	0.00009	0.00002	0.27	0.00005	0.00037	0.00031	0.00073	0.00024	0.64	0.00005	0.00008	0.00007	0.00013	0.00002	0.29	0.00006	0.00020	0.00019	0.00029	0.00002	0.12
Dissolved Copper	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.01	0.0005	0.0009	0.0009	0.0018	0.0003	0.37	0.0006	0.0010	0.0009	0.0018	0.0003	0.34	0.0007	0.0011	0.0009	0.0016	0.0003	0.24
Dissolved Iron	mg/L	0.09	0.17	0.16	0.26	0.07	0.41	0.09	0.17	0.16	0.27	0.07	0.40	0.10	0.17	0.17	0.27	0.07	0.41	0.09	0.15	0.15	0.24	0.06	0.39
Dissolved Lead	mg/L	0.00005	0.00007	0.00006	0.00010	0.00002	0.31	0.00004	0.00012	0.00011	0.00023	0.00004	0.37	0.00006	0.00011	0.00008	0.00021	0.00005	0.43	0.00007	0.00016	0.00014	0.00023	0.00004	0.25
Dissolved Lithium	mg/L	0.00046	0.00068	0.00070	0.00016	0.24	0.0047	0.00363	0.00424	0.00588	0.00180	0.50	0.00061	0.00118	0.00105	0.00221	0.00043	0.36	0.00088	0.00513	0.00499	0.00614	0.00052	0.10	
Dissolved Magnesium	mg/L	0.36	0.50	0.52	0.61	0.09	0.19	0.34	1.37	1.56	2.10	0.54	0.40	0.42	0.68	0.67	1.09	0.19	0.27	0.52	1.68	1.62	2.11	0.19	0.11
Dissolved Manganese	mg/L	0.003	0.010	0.008	0.020	0.006	0.59	0.003	0.020	0.039	0.090	0.46	0.004	0.012	0.009	0.027	0.007	0.56	0.004	0.023	0.020	0.034	0.006	0.000	0.25
Dissolved Mercury	mg/L	0.00012	0.00012	0.00012	0.00013	0.00000	0.00	0.00011	0.00012	0.00013	0.00013	0.00000	0.03	0.00012	0.00012	0.00012	0.00012	0.00000	0.01	0.00011	0.00011	0.00011	0.00012	0.00000	0.02
Dissolved Molybdenum	mg/L	0.0001	0.0002	0.0001	0.0004	0.0001	0.82	0.0001	0.0037	0.0047	0.0060	0.0021	0.56	0.0003	0.0011	0.0008	0.0029	0.0007	0.63	0.0007	0.0075	0.0073	0.0090	0.0008	0.11
Dissolved Nickel	mg/L	0.00050	0.00050	0.00050	0.00000	0.00	0.00050	0.00104	0.00105	0.00152	0.00038	0.36	0.00052	0.00057	0.00056	0.00069	0.00005	0.08	0.00053	0.00093	0.00091	0.00107	0.00005	0.06	
Dissolved Phosphorus	mg/L	0.010	0.010	0.010	0.010	0.000	0.01	0.009	0.019	0.021	0.027	0.005	0.29	0.011	0.013	0.013	0.019	0.002	0.18	0.012	0.029	0.028	0.034	0.003	0.09
Dissolved Potassium	mg/L	0.29	0.34	0.33	0.40	0.04	0.13	0.30	2.22	2.55	4.18	1.14	0.51	0.59	1.19	1.02	2.43	0.58	0.49	0.70	4.19	3.98	5.36	0.60	0.14
Dissolved Rubidium	mg/L	0.0009	0.0011	0.0011	0.0015	0.0002	0.19	0.0009	0.0122	0.0153	0.0197	0.0065	0.53	0.0018	0.0040	0.0037	0.0088	0.0020	0.51	0.0025	0.0211	0.0206	0.0256	0.0025	0.12
Dissolved Selenium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0007	0.0007	0.0008	0.0001	0.15	0.0005	0.0005	0.0005	0.0006	0.0000	0.03	0.0005	0.0006	0.0006	0.0000	0.02	
Dissolved Silicon	mg/L	5.32	7.06	7.60	9.43	1.34	0.19	4.70	19.75	23.28	29.43	7.72	0.39	5.17	8.23	8.09	12.42	2.05	0.25	5.16	9.16	9.07	12.91	1.40	0.15
Dissolved Silver	mg/L	0.00005	0.00005	0.00005	0.00005	0.00000	0.00	0.00005	0.00005	0.00005	0.00006	0.00000	0.04	0.00005	0.00005	0.00005	0.00005	0.00000	0.02	0.00005	0.00006	0.00006	0.00006	0.00000	0.02
Dissolved Sodium	mg/L	1.21	1.54	1.53	1.92	0.25	0.16	1.15	80.19	100.16	147.11	47.44	0.59	1.37	6.54	3.54	21.64	5.98	0.92	1.52	9.98	4.04	13.92	2.29	0.46
Dissolved Strontium	mg/L	0.0102	0.0144	0.0142	0.020	0.21	0.0190	0.0123	0.021	0.0297	0.0329	0.44	0.0124	0.0216	0.0188	0.0366	0.0067	0.21	0.0151	0.0727	0.0703	0.0870	0.0275	0.10	
Dissolved Thallium	mg/L	0.00005	0.00005	0.00005	0.00000	0.00000	0.00	0.00005	0.00010	0.00012	0.00014	0.00003	0.30	0.00005	0.00006	0.00006	0.00008	0.00001	0.14	0.00006	0.00013	0.00013	0.00015	0.00001	0.08
Dissolved Titanium	mg/L	0.0010	0.0010	0.0010	0.0010	0.0000	0.00	0.0010	0.0020	0.0022	0.0027	0.0006	0.29	0.0011	0.0013	0.0013	0.0018	0.0002	0.16	0.0012	0.0030	0.0030	0.0034	0.0003	0.08
Dissolved Tungsten	mg/L	0.00189	0.00234	0.00252	0.00258	0.00029	0.12	0.00190	0.00637	0.00682	0.01128	0.00255	0.40	0.00267	0.00426	0.00387	0.00718	0.00143	0.34	0.00281	0.01159	0.01089	0.01428	0.00147	0.13
Dissolved Uranium	mg/L	0.00005	0.00010	0.00010	0.00020	0.00006	0.54	0.00005	0.00064	0.00075	0.00112	0.00033	0.53	0.00006	0.00016	0.00012	0.00038	0.00009	0.56	0.00008	0.00086	0.00083	0.00106	0.00010	0.12
Dissolved Vanadium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.02	0.0005	0.0034	0.0041	0.0058	0.0017	0.50	0.0008	0.0015	0.0									

APPENDIX C1 - MODEL OUTPUT SUMMARY STATISTICS BY PROJECT PHASE

SISSON PROJECT  
TABLE C1.13- NAP8

Parameter	Units	Background					Operations					Closure					Post-Closure								
		Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation
<b>Conventional Parameters and Major Ions</b>																									
Hardness	mg/L	7.6	10.5	11.2	13.3	2.1	0.20	7.5	20.8	21.8	31.1	6.9	0.33	8.2	12.2	12.1	17.7	2.8	0.23	8.9	18.9	18.4	25.1	2.5	0.13
Alkalinity	mg/L	4.6	7.5	8.0	9.0	1.9	0.26	4.3	136.5	169.5	243.5	77.7	0.57	4.9	15.7	11.1	40.6	10.1	0.64	4.9	14.1	13.2	30.1	4.2	0.30
Ammonia	mg/L	0.025	0.030	0.030	0.040	0.006	0.19	0.021	0.052	0.057	0.075	0.016	0.30	0.023	0.031	0.029	0.046	0.007	0.21	0.026	0.083	0.081	0.097	0.008	0.09
Nitrate	mg/L	0.025	0.117	0.090	0.232	0.089	0.76	0.017	0.133	0.103	0.252	0.087	0.65	0.018	0.127	0.093	0.251	0.091	0.72	0.041	0.140	0.112	0.252	0.082	0.58
Phosphate	mg/L	0.005	0.015	0.013	0.030	0.009	0.62	0.004	0.014	0.013	0.032	0.009	0.68	0.004	0.014	0.013	0.032	0.010	0.69	0.004	0.013	0.012	0.029	0.009	0.67
Sulphate	mg/L	0.5	2.1	1.4	5.0	1.5	0.73	0.5	10.1	12.0	19.1	5.3	0.51	1.7	3.6	2.9	6.3	1.6	0.44	2.0	9.6	8.8	12.5	1.4	0.15
Bromide	mg/L	0.005	0.005	0.005	0.005	0.000	0.00	0.005	0.005	0.005	0.005	0.000	0.02	0.005	0.005	0.005	0.005	0.000	0.01	0.004	0.005	0.005	0.005	0.000	0.01
Chloride	mg/L	1.16	1.47	1.26	2.10	0.36	0.25	1.17	2.23	2.20	3.37	0.62	0.28	1.31	1.86	1.78	2.57	0.45	0.24	1.35	3.32	3.10	4.00	0.41	0.12
Fluoride	mg/L	0.103	0.192	0.186	0.270	0.061	0.32	0.105	0.408	0.445	0.700	0.161	0.40	0.114	0.213	0.201	0.326	0.069	0.32	0.113	0.312	0.307	0.436	0.063	0.20
Dissolved Aluminum	mg/L	0.0483	0.0925	0.0964	0.1060	0.0157	0.17	0.0475	0.0955	0.1028	0.1155	0.0180	0.19	0.0482	0.0887	0.0955	0.1071	0.0186	0.21	0.0482	0.0952	0.1015	0.1147	0.0168	0.18
Dissolved Antimony	mg/L	0.0001	0.0001	0.0001	0.0001	0.0000	0.01	0.0001	0.0006	0.0007	0.0008	0.0003	0.53	0.0001	0.0001	0.0001	0.0003	0.0001	0.43	0.0001	0.0012	0.0011	0.0013	0.0001	0.10
Dissolved Arsenic	mg/L	0.0005	0.0006	0.0005	0.0009	0.0002	0.27	0.0004	0.0014	0.0015	0.0025	0.0006	0.43	0.0006	0.0010	0.0009	0.0018	0.0004	0.35	0.0008	0.0018	0.0017	0.0023	0.0003	0.14
Dissolved Barium	mg/L	0.0042	0.0049	0.0050	0.0055	0.0005	0.10	0.0044	0.0061	0.0063	0.0077	0.0008	0.14	0.0044	0.0052	0.0053	0.0060	0.0005	0.10	0.0045	0.0061	0.0062	0.0069	0.0005	0.07
Dissolved Bismuth	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0005	0.0005	0.0006	0.0000	0.04	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0005	0.0005	0.0005	0.0000	0.01
Dissolved Boron	mg/L	0.0013	0.0020	0.0022	0.0027	0.0006	0.31	0.0014	0.0408	0.0483	0.0781	0.0232	0.57	0.0065	0.0075	0.0147	0.0400	0.0105	0.60	0.0086	0.0869	0.0831	0.1092	0.0123	0.14
Dissolved Cadmium	mg/L	0.00005	0.00011	0.00009	0.00020	0.00006	0.54	0.00002	0.00031	0.00036	0.00056	0.00015	0.49	0.00003	0.00011	0.00008	0.00028	0.00007	0.63	0.00005	0.00028	0.00027	0.00044	0.00007	0.24
Dissolved Calcium	mg/L	2.4	3.3	3.6	4.3	0.7	0.21	2.3	6.4	6.7	9.7	2.1	0.33	2.5	3.8	3.8	5.5	0.9	0.23	2.7	5.2	5.2	7.2	0.8	0.15
Dissolved Chromium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0006	0.0006	0.0009	0.0001	0.15	0.0005	0.0006	0.0006	0.0008	0.0001	0.12	0.0006	0.0006	0.0006	0.0007	0.0001	0.09
Dissolved Cobalt	mg/L	0.00005	0.00006	0.00005	0.00009	0.00002	0.27	0.00005	0.00029	0.00025	0.00057	0.00018	0.61	0.00005	0.00007	0.00006	0.00012	0.00002	0.27	0.00006	0.00017	0.00016	0.00024	0.00002	0.13
Dissolved Copper	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.01	0.0005	0.0008	0.0008	0.0015	0.0003	0.31	0.0006	0.0009	0.0008	0.0014	0.0002	0.29	0.0007	0.0009	0.0008	0.0013	0.0002	0.21
Dissolved Iron	mg/L	0.09	0.17	0.16	0.26	0.07	0.40	0.09	0.17	0.16	0.27	0.07	0.40	0.10	0.17	0.16	0.27	0.07	0.41	0.09	0.15	0.15	0.24	0.06	0.40
Dissolved Lead	mg/L	0.0005	0.0007	0.0006	0.0010	0.0002	0.30	0.0004	0.0010	0.0010	0.0019	0.0004	0.35	0.0006	0.0010	0.0007	0.0018	0.0004	0.40	0.0006	0.0014	0.0012	0.0020	0.0003	0.26
Dissolved Lithium	mg/L	0.00046	0.00067	0.00070	0.00091	0.00016	0.24	0.00047	0.00288	0.00334	0.00457	0.00135	0.47	0.00057	0.00104	0.00096	0.00186	0.00034	0.33	0.00077	0.00405	0.00395	0.00489	0.00043	0.11
Dissolved Magnesium	mg/L	0.36	0.50	0.52	0.61	0.09	0.19	0.35	1.15	1.29	1.72	0.41	0.36	0.41	0.63	0.62	0.96	0.15	0.24	0.48	1.39	1.35	1.75	0.16	0.11
Dissolved Manganese	mg/L	0.003	0.010	0.008	0.020	0.006	0.59	0.003	0.017	0.016	0.034	0.008	0.46	0.004	0.011	0.009	0.025	0.006	0.57	0.004	0.020	0.017	0.031	0.006	0.29
Dissolved Mercury	mg/L	0.00012	0.00012	0.00012	0.00012	0.00000	0.00	0.00012	0.00012	0.00012	0.00012	0.00000	0.03	0.00012	0.00012	0.00012	0.00012	0.00000	0.01	0.00011	0.00011	0.00011	0.00012	0.00000	0.01
Dissolved Molybdenum	mg/L	0.0001	0.0002	0.0001	0.0004	0.0001	0.82	0.0001	0.0028	0.0035	0.0046	0.0016	0.56	0.0002	0.0008	0.0006	0.0023	0.0005	0.64	0.0005	0.0058	0.0056	0.0069	0.0007	0.12
Dissolved Nickel	mg/L	0.00050	0.00050	0.00050	0.00050	0.0000	0.00	0.00050	0.00091	0.00091	0.00126	0.00012	0.31	0.00052	0.00055	0.00055	0.00064	0.00013	0.60	0.00052	0.00083	0.00081	0.00094	0.00004	0.05
Dissolved Phosphorus	mg/L	0.010	0.010	0.010	0.010	0.0000	0.00	0.0009	0.017	0.018	0.023	0.004	0.24	0.010	0.013	0.012	0.016	0.002	0.14	0.011	0.024	0.024	0.028	0.002	0.08
Dissolved Potassium	mg/L	0.29	0.34	0.32	0.39	0.40	0.12	0.30	1.74	1.98	3.20	0.85	0.49	0.51	0.96	0.84	1.88	0.43	0.44	0.60	3.26	3.09	4.17	0.47	0.14
Dissolved Rubidium	mg/L	0.0009	0.0011	0.0011	0.0015	0.0002	0.19	0.0009	0.0093	0.0117	0.0150	0.0048	0.52	0.0016	0.0033	0.0030	0.0068	0.0015	0.47	0.0021	0.0163	0.0159	0.0199	0.0020	0.12
Dissolved Selenium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0006	0.0006	0.0007	0.0001	0.12	0.0005	0.0005	0.0005	0.0005	0.0000	0.02	0.0005	0.0006	0.0006	0.0006	0.0000	0.02
Dissolved Silicon	mg/L	5.32	7.06	7.60	9.43	1.34	0.19	4.87	16.57	19.23	24.32	5.84	0.35	5.21	7.96	7.89	11.61	1.84	0.23	5.20	8.70	8.67	12.07	1.38	0.16
Dissolved Silver	mg/L	0.00005	0.00005	0.00005	0.00005	0.00000	0.00	0.00005	0.00005	0.00005	0.00006	0.00000	0.03	0.00005	0.00005	0.00005	0.00005	0.00000	0.02	0.00005	0.00005	0.00005	0.00006	0.00000	0.01
Dissolved Sodium	mg/L	1.21	1.54	1.52	1.91	0.25	0.16	1.17	60.20	75.08	110.16	35.40	0.59	1.39	5.19	2.96	16.35	4.40	0.85	1.43	1.15	3.46	11.07	0.74	0.42
Dissolved Strontium	mg/L	0.0012	0.0012	0.0012	0.0012	0.00000	0.00	0.0012	0.0012	0.0012	0.0012	0.00000	0.03	0.0012	0.0012	0.0012	0.0012	0.00000	0.01	0.0011	0.0011	0.0011	0.0012	0.00000	0.01
Dissolved Thallium	mg/L	0.0005	0.0005	0.0005	0.0005	0.00000	0.00	0.0005	0.0009	0.0010	0.0012	0.00002	0.40	0.0005	0.0006	0.0006	0.0008	0.0001	0.11	0.0005	0.0011	0.0011	0.0013	0.0001	0.07
Dissolved Titanium	mg/L	0.0010	0.0010	0.0010	0.0010	0.0000	0.00	0.0010	0.0017	0.0019	0.0023	0.0004	0.24	0.0011	0.0012	0.0012	0.0016	0.0002	0.12	0.0011	0.0025	0.0025	0.0029	0.0002	0.08
Dissolved Tungsten	mg/L	0.00189	0.00233	0.00252	0.00256	0.00028	0.12	0.00190	0.00533	0.00566	0.00904	0.00193	0.36	0.00249	0.00372	0.00344	0.00592	0.00109	0.29	0.00256	0.00934	0.00876	0.01148	0.00117	0.13
Dissolved Uranium	mg/L	0.00005	0.00010	0.00010	0.00020	0.00006	0.54	0.00005	0.00050	0.00059	0.00086	0.00025	0.51	0.00006	0.00014	0.00012	0.00033	0.00008	0.55	0.00007	0.00068	0.00065	0.00086	0.00009	0.13
Dissolved Vanadium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.02	0.0005	0.0027	0.0032	0.0044	0.0013	0.48	0.0007											

APPENDIX C1 - MODEL OUTPUT SUMMARY STATISTICS BY PROJECT PHASE

SISSON PROJECT  
TABLE C1.14 - MBB2

Parameter	Units	Background					Operations					Closure					Post-Closure								
		Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation	Minimum	Mean	Median	Maximum	Standard Deviation	Coefficient of Variation
<b>Conventional Parameters and Major Ions</b>																									
Hardness	mg/L	6.2	10.7	11.2	13.8	3.0	0.28	6.2	10.9	11.8	15.3	2.8	0.26	6.5	11.5	12.1	15.4	3.0	0.26	6.5	11.5	12.1	15.4	3.0	0.26
Alkalinity	mg/L	3.5	8.4	7.5	13.0	3.8	0.45	3.5	8.5	8.9	13.1	3.5	0.41	3.5	8.6	9.0	13.1	3.5	0.41	3.5	8.6	10.1	13.1	3.5	0.40
Ammonia	mg/L	0.025	0.039	0.044	0.059	0.015	0.38	0.024	0.038	0.035	0.059	0.014	0.37	0.024	0.038	0.035	0.059	0.014	0.37	0.024	0.038	0.026	0.059	0.014	0.37
Nitrate	mg/L	0.045	0.088	0.055	0.193	0.055	0.63	0.045	0.093	0.074	0.193	0.053	0.57	0.045	0.093	0.074	0.193	0.053	0.57	0.045	0.093	0.092	0.193	0.053	0.57
Phosphate	mg/L	0.005	0.009	0.010	0.011	0.003	0.29	0.005	0.009	0.009	0.011	0.002	0.26	0.005	0.009	0.009	0.011	0.002	0.26	0.005	0.009	0.009	0.011	0.002	0.26
Sulphate	mg/L	0.6	1.0	1.0	1.4	0.3	0.27	0.6	1.3	1.2	2.8	0.4	0.35	0.9	1.8	1.7	2.9	0.6	0.33	0.9	1.8	1.7	2.9	0.6	0.33
Bromide	mg/L	0.005	0.005	0.005	0.006	0.001	0.11	0.005	0.005	0.005	0.006	0.001	0.10	0.005	0.005	0.005	0.006	0.001	0.10	0.005	0.005	0.005	0.006	0.001	0.10
Chloride	mg/L	0.90	1.20	1.08	1.78	0.37	0.31	0.90	1.25	1.07	2.27	0.37	0.30	0.99	1.41	1.25	2.28	0.42	0.30	0.99	1.41	1.18	2.28	0.42	0.30
Fluoride	mg/L	0.103	0.131	0.130	0.154	0.018	0.14	0.102	0.131	0.131	0.176	0.020	0.15	0.105	0.139	0.143	0.177	0.023	0.16	0.105	0.139	0.142	0.177	0.023	0.16
Dissolved Aluminum	mg/L	0.0645	0.1227	0.1353	0.1793	0.0443	0.36	0.0642	0.1171	0.1136	0.1785	0.0430	0.37	0.0644	0.1175	0.1137	0.1785	0.0430	0.37	0.0644	0.1174	0.0934	0.1785	0.0429	0.37
Dissolved Antimony	mg/L	0.0001	0.0001	0.0001	0.0001	0.0000	0.00	0.0001	0.0001	0.0001	0.0001	0.0000	0.00	0.0001	0.0001	0.0001	0.0001	0.0000	0.00	0.0001	0.0001	0.0001	0.0001	0.0000	0.00
Dissolved Arsenic	mg/L	0.0005	0.0005	0.0005	0.0006	0.0001	0.11	0.0005	0.0006	0.0005	0.0009	0.0001	0.15	0.0005	0.0006	0.0006	0.0009	0.0001	0.18	0.0005	0.0006	0.0006	0.0009	0.0001	0.18
Dissolved Barium	mg/L	0.0020	0.0028	0.0030	0.0040	0.0009	0.31	0.0020	0.0027	0.0025	0.0040	0.0008	0.30	0.0020	0.0028	0.0025	0.0040	0.0008	0.30	0.0020	0.0028	0.0020	0.0040	0.0008	0.30
Dissolved Bismuth	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	0.00	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0005	0.0005	0.0005	0.0000	0.00
Dissolved Boron	mg/L	0.0018	0.0019	0.0018	0.0020	0.0001	0.07	0.0017	0.0044	0.0024	0.0020	0.0041	0.00	0.0018	0.0019	0.0018	0.0025	0.0005	0.59	0.0018	0.0019	0.0018	0.0025	0.0005	0.59
Dissolved Cadmium	mg/L	0.00010	0.00016	0.00018	0.00023	0.00005	0.28	0.00010	0.00016	0.00016	0.00025	0.00005	0.29	0.00010	0.00017	0.00017	0.00025	0.00005	0.30	0.00010	0.00017	0.00015	0.00025	0.00005	0.30
Dissolved Calcium	mg/L	1.9	3.3	3.5	4.3	1.0	0.29	1.9	3.4	3.7	4.7	0.9	0.26	2.0	3.5	3.7	4.7	0.9	0.26	2.0	3.5	3.8	4.7	0.9	0.26
Dissolved Chromium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0005	0.0005	0.0006	0.0000	0.05	0.0005	0.0006	0.0005	0.0006	0.0000	0.07	0.0005	0.0006	0.0005	0.0006	0.0000	0.07
Dissolved Cobalt	mg/L	0.00005	0.00005	0.00005	0.00005	0.00000	0.00	0.00005	0.00005	0.00005	0.00006	0.00000	0.05	0.00005	0.00006	0.00005	0.00006	0.00000	0.07	0.00005	0.00006	0.00005	0.00006	0.00000	0.07
Dissolved Copper	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0006	0.0006	0.0010	0.0001	0.17	0.0006	0.0007	0.0007	0.0010	0.0002	0.21	0.0006	0.0007	0.0006	0.0010	0.0002	0.21
Dissolved Iron	mg/L	0.08	0.15	0.16	0.22	0.05	0.37	0.08	0.14	0.14	0.22	0.05	0.38	0.08	0.14	0.13	0.22	0.05	0.38	0.08	0.14	0.11	0.22	0.05	0.37
Dissolved Lead	mg/L	0.00005	0.00012	0.00015	0.00018	0.00005	0.38	0.00005	0.00012	0.00013	0.00021	0.00005	0.41	0.00005	0.00013	0.00014	0.00021	0.00006	0.42	0.00005	0.00013	0.00012	0.00021	0.00006	0.42
Dissolved Lithium	mg/L	0.00035	0.00050	0.00055	0.00060	0.00010	0.20	0.00035	0.00055	0.00055	0.00092	0.00012	0.23	0.00041	0.00065	0.00060	0.00093	0.00017	0.26	0.00041	0.00065	0.00058	0.00093	0.00017	0.25
Dissolved Magnesium	mg/L	0.34	0.57	0.61	0.70	0.15	0.27	0.34	0.59	0.64	0.86	0.15	0.25	0.37	0.65	0.67	0.86	0.16	0.25	0.37	0.65	0.67	0.86	0.16	0.25
Dissolved Manganese	mg/L	0.003	0.011	0.011	0.019	0.006	0.56	0.003	0.010	0.009	0.019	0.006	0.59	0.003	0.009	0.009	0.019	0.006	0.59	0.003	0.010	0.008	0.019	0.006	0.59
Dissolved Mercury	mg/L	0.00013	0.00013	0.00013	0.00000	0.00	0.00013	0.00013	0.00013	0.00013	0.00000	0.01	0.00013	0.00013	0.00013	0.00013	0.00000	0.01	0.00013	0.00013	0.00013	0.00013	0.00013	0.00000	0.01
Dissolved Molybdenum	mg/L	0.0001	0.0004	0.0003	0.0008	0.0003	0.77	0.0001	0.0005	0.0004	0.0014	0.0003	0.60	0.0002	0.0007	0.0005	0.0014	0.0004	0.57	0.0002	0.0007	0.0005	0.0014	0.0004	0.57
Dissolved Nickel	mg/L	0.00050	0.00050	0.00050	0.00050	0.00000	0.00	0.00050	0.00051	0.00050	0.00056	0.00001	0.02	0.00051	0.00053	0.00052	0.00056	0.00002	0.04	0.00051	0.00053	0.00051	0.00056	0.00002	0.04
Dissolved Phosphorus	mg/L	0.010	0.010	0.010	0.010	0.0000	0.00	0.010	0.010	0.010	0.014	0.001	0.07	0.010	0.012	0.011	0.014	0.001	0.10	0.010	0.012	0.011	0.014	0.001	0.10
Dissolved Potassium	mg/L	0.37	0.41	0.41	0.46	0.03	0.08	0.37	0.52	0.46	1.30	0.18	0.35	0.52	0.80	0.70	1.32	0.29	0.36	0.52	0.80	0.60	1.32	0.29	0.36
Dissolved Rubidium	mg/L	0.0009	0.0010	0.0011	0.0012	0.0002	0.15	0.0009	0.0014	0.0012	0.0037	0.0006	0.43	0.0012	0.0022	0.0020	0.0038	0.0009	0.42	0.0012	0.0022	0.0017	0.0038	0.0009	0.42
Dissolved Selenium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0005	0.0005	0.0005	0.0000	0.01	0.0005	0.0005	0.0005	0.0005	0.0000	0.01
Dissolved Silicon	mg/L	5.23	7.80	7.75	10.78	1.97	0.25	5.24	8.11	8.30	10.81	1.95	0.24	5.31	8.24	8.35	10.82	1.94	0.24	5.31	8.24	8.50	10.82	1.94	0.23
Dissolved Silver	mg/L	0.00005	0.00005	0.00005	0.00005	0.00000	0.00	0.00005	0.00005	0.00005	0.00005	0.00000	0.01	0.00005	0.00005	0.00005	0.00005	0.00000	0.01	0.00005	0.00005	0.00005	0.00005	0.00000	0.01
Dissolved Sodium	mg/L	0.94	1.43	1.30	1.71	0.33	0.23	0.95	1.47	1.65	1.84	0.30	0.21	0.97	1.51	1.66	1.84	0.31	0.21	0.97	1.51	1.67	1.84	0.31	0.21
Dissolved Strontium	mg/L	0.00035	0.00035	0.00035	0.00035	0.00000	0.00	0.00035	0.00035	0.00035	0.00035	0.00000	0.00	0.00035	0.00035	0.00035	0.00035	0.00000	0.01	0.00035	0.00035	0.00035	0.00035	0.00000	0.01
Dissolved Thallium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00000	0.00	0.00005	0.00005	0.00005	0.00006	0.00000	0.00	0.00005	0.00006	0.00005	0.00006	0.00000	0.07	0.00005	0.00006	0.00005	0.00006	0.00000	0.07
Dissolved Titanium	mg/L	0.0010	0.0010	0.0010	0.0010	0.0000	0.00	0.0010	0.0010	0.0010	0.0013	0.0001	0.06	0.0010	0.0011	0.0011	0.0013	0.0001	0.08	0.0010	0.0011	0.0011	0.0013	0.0001	0.08
Dissolved Tungsten	mg/L	0.00189	0.00222	0.00250	0.00250	0.00032	0.14	0.00189	0.00243	0.00250	0.00436	0.00056	0.23	0.00217	0.00305	0.00293	0.00441	0.00084	0.27	0.00217	0.00305	0.00292	0.00441	0.00084	0.27
Dissolved Uranium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00000	0.00	0.00005	0.00005	0.00005	0.00007	0.00000	0.06	0.00005	0.00006	0.00006	0.00007	0.00000	0.09	0.00005	0.00006	0.00005	0.00007	0.00000	0.09
Dissolved Vanadium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0000	0.00	0.0005	0.0006	0.0005	0.0013														

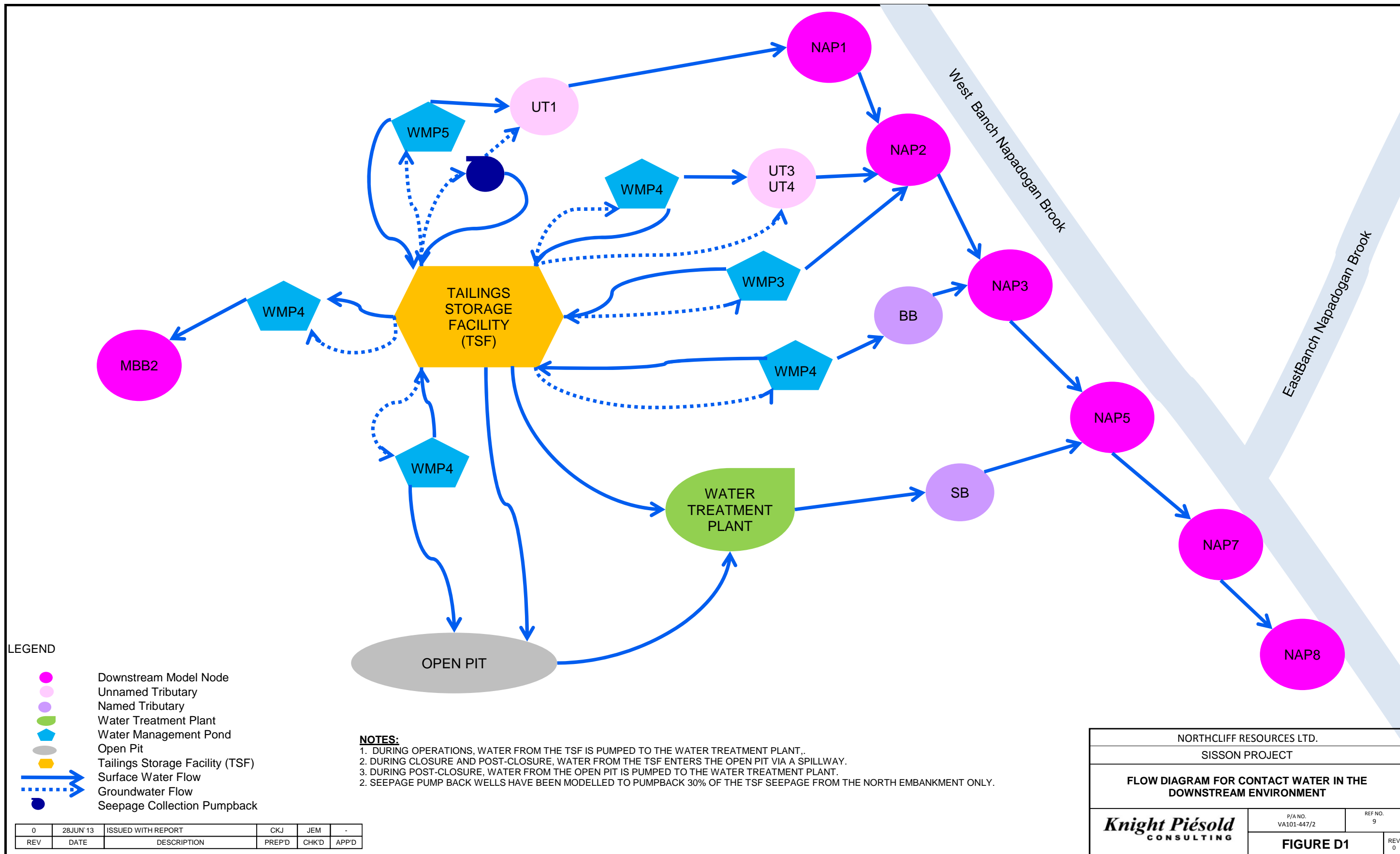


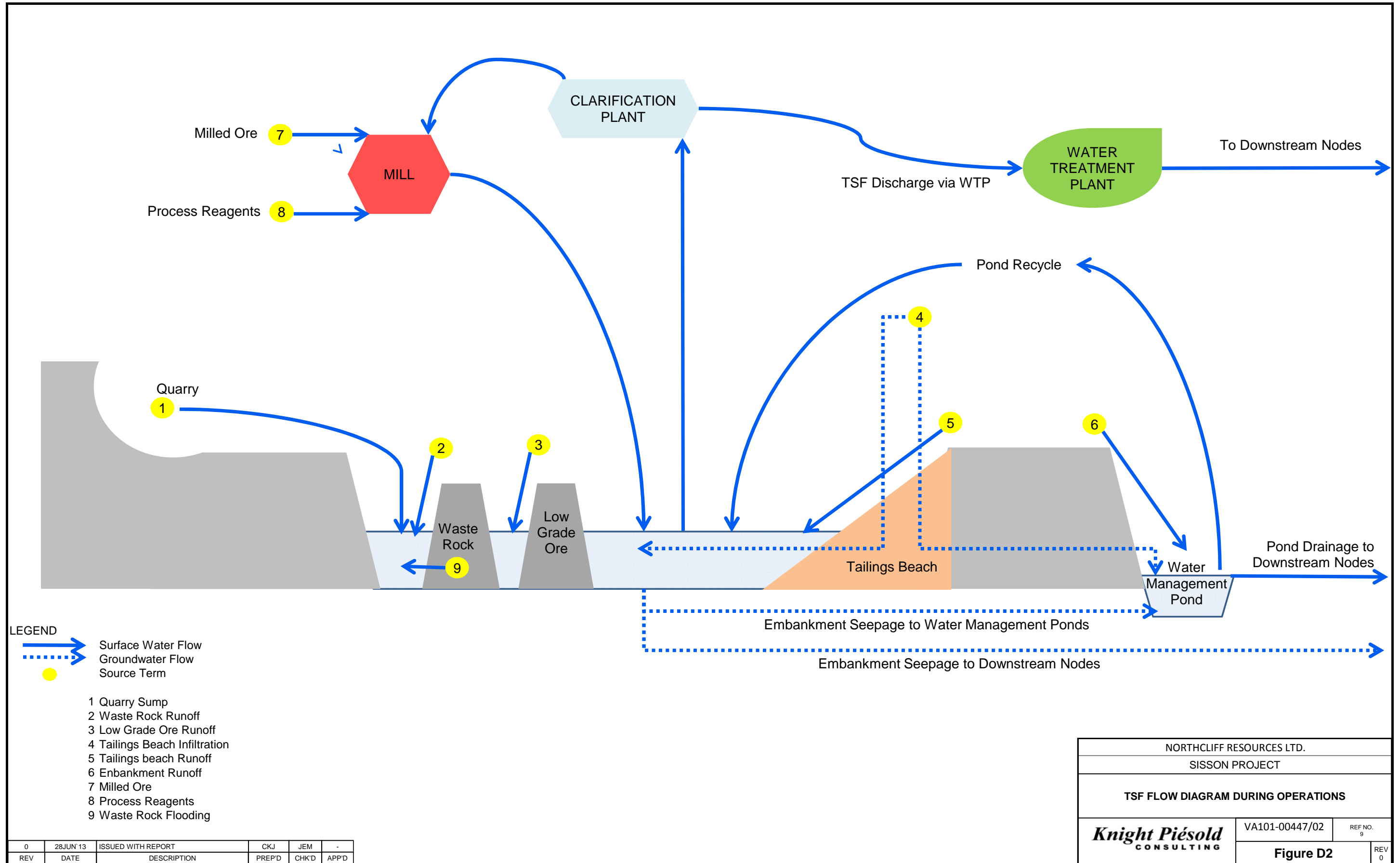
**APPENDIX C2**

**MODEL OUTPUT DATA**

(Included as separate file)

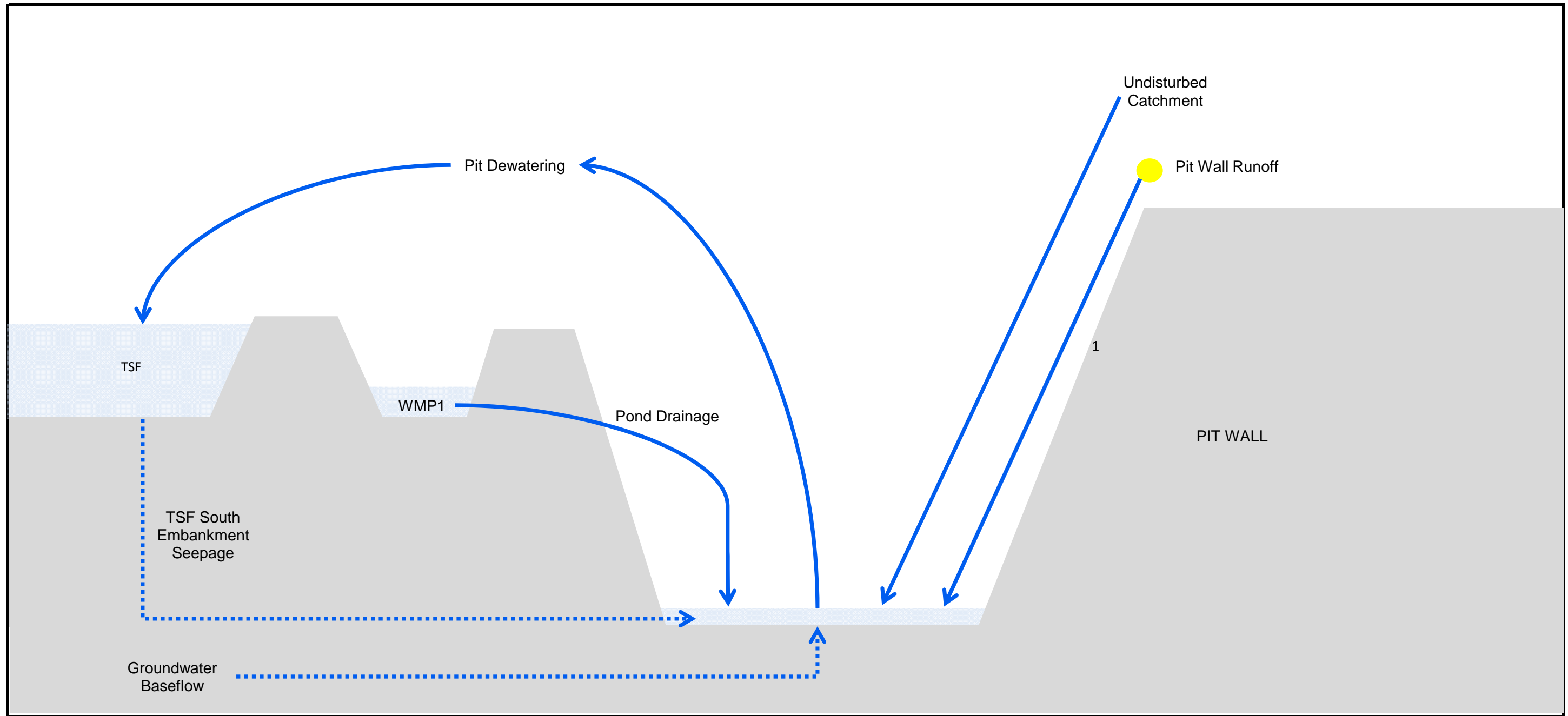
**APPENDIX D**  
**FLOW DIAGRAMS**  
(Pages D-1 to D-3)





NORTHCLIFF RESOURCES LTD.	
SISSON PROJECT	
TSF FLOW DIAGRAM DURING OPERATIONS	
<b>Knight Piésold</b> CONSULTING	VA101-00447/02 REF NO. 9 REV 0
Figure D2	

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	28JUN'13	ISSUED WITH REPORT	CKJ	JEM	-



**LEGEND**  
 Surface Water Flow  
 Groundwater Flow  
 Source Term

**NOTES:**  
 1. DURING OPERATIONS, WATER FROM THE OPEN PIT IS PUMPED TO THE TSF; DURING POST-CLOSURE, WATER FROM THE OPEN PIT IS PUMPED TO THE WATER TREATMENT PLANT.  
 2. DRAINAGE FROM WATER MANAGEMENT POND 1 IS ASSUMED TO FLOW TO THE OPEN PIT.  
 3. SEEPAGE FROM THE TSF SOUTH EMBANKMENT FLOWS TO THE OPEN PIT.

0	28JUN'13	ISSUED WITH REPORT	CKJ	JEM	-
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

NORTHCLIFF RESOURCES LTD.		
SISSON PROJECT		
<b>OPEN PIT FLOW DIAGRAM DURING OPERATIONS</b>		
<b><i>Knight Piesold</i></b> CONSULTING	VA101-00447/02	REF. NO. 9
	<b>FIGURE D3</b>	
		REV 0