APPENDIX 3.III

Water Management Plan

Table of Contents

TABLES

FIGURES

3.III.1 INTRODUCTION

The Water Management Plan of the Developer's Assessment Report (DAR) for the Fortune Minerals Limited (Fortune) NICO Cobalt-Gold-Bismuth-Copper Project (NICO Project) describes the management of water that comes into contact with the mine facilities during construction, operations, and closure.

Water released from the site during construction, operations, or closure must meet the site-specific water quality objectives (SSWQO) that have been established for Nico Lake and for Peanut Lake. Design features will be in place throughout operations to collect, monitor, and treat water that does not meet SSWQO. Facilities for the post-closure collection and management of contact water will be constructed progressively during operations.

This plan is organized into several sections discussing the following:

- key water management facilities that will be constructed at the NICO Project;
- discussion of the inflows and outflows associated with the NICO Project;
- site water management during key NICO Project phases (i.e., construction, operations, and closure/post-closure);
- effluent treatment;
- sewage treatment; and
- adaptive management.

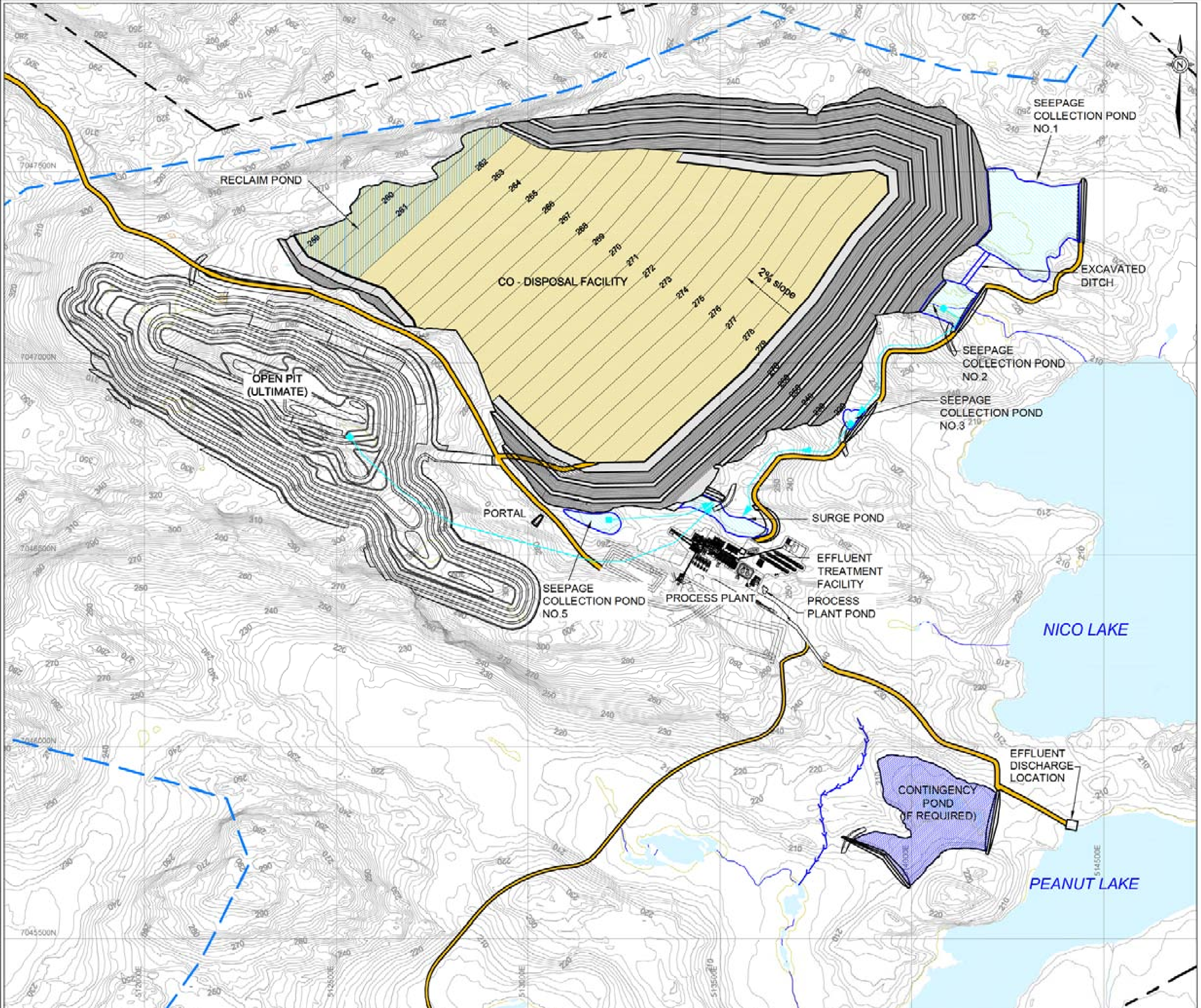
3.III.2 WATER MANAGEMENT SYSTEM SUMMARY

3.III.2.1 Layout

3.III.2.1.1 Construction and Operations

Figure 3.III.2-1 shows the general arrangement of the Co-Disposal Facility (CDF), used for permanent storage of tailings and Mine Rock, and associated water management facilities during operations. The major components of the water management system will comprise:

- Reclaim Pond on the CDF. This pond will be relocated throughout the operating life as the CDF develops;
- five seepage collection ponds (SCPs) located downstream of the CDF;
- Surge Pond near the Mineral Processing Plant (the Plant);
- Mineral Processing Plant Site Runoff Pond;
- Sewage Treatment Plant (STP);
- Effluent Treatment Facility (ETF);
- Contingency Pond (will be constructed if required for additional settling or polishing of ETF effluent, or if the site requires additional storage capacity [Section 3.III.10.4]); and
- related water management facilities, including drainage ditches, emergency spillways, pump stations, and the reclaim water pipeline system.



LEGEND

- DIVERSION DITCH
- PROJECT LEASE BOUNDARY
- WATERSHED
- RECLAIM BARGE / PUMP STATION
- ACCESS ROAD
- CO-DISPOSED TAILINGS AND MINE ROCK
- CONTINGENCY POND
- PERIMETER DYKE OF CO-DISPOSAL FACILITY
- RECLAIM POND
- SEEPAGE COLLECTION POND / SURGE POND
- WATER BODY

NOTES

1. All elevations (geodetic datum) and grid coordinates (UTM NAD83, Zone 11) shown in this drawing are in metres.
2. Configuration shown assumes sub-economic ore is not processed.
3. Wetland treatment systems No. 1, 2 and 3 will be constructed and tested prior to closure, but will not operate until closure

REFERENCE

Base mapping provided in digital format by Fortune Minerals Limited received 20 February 2004.

Process plant and mine infrastructure provided by Aker Solutions filename 0000g001d (plant site oct252010).dwg provided 26 October 2010. Revised pits provided by P & E Mining Consultants, ultimate pit and topo.dxf on 26 January 2010.

Project lease boundary provided by Fortune (8 October 2008) with comments provided 19 December 2009.

200 0 200 400
SCALE 1:10,000 METRES

FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

TITLE **GENERAL ARRANGEMENT PLAN OF THE CO-DISPOSAL FACILITY AND ASSOCIATED WATER MANAGEMENT FACILITIES DURING OPERATIONS (YEAR 10)**

FILE No: E-WM-001-CAD.dwg

PROJECT No: 09-1373-1004			SCALE AS SHOWN	REV. 0
DESIGN	IM	10 May 2011		
CAD	TDR	10 May 2011	FIGURE: 3.III.2-1	
CHECK	IM	10 May 2011		
REVIEW	KAB	10 May 2011		

Golder Associates
Edmonton, Alberta

PLOT DATE: May 11, 2011
FILENAME: T:\Projects\2010\10-1118-0046 (FML, NWT)\-KA-Nico water management figures\10111180046KA3III2-1.dwg

Seepage Collection Ponds No. 1, 2, and 3 will be located in 3 topographic lows adjacent to the western end of the CDF and are designed to intercept seepage from the CDF, which would otherwise flow to Nico Lake. Seepage Collection Ponds No. 4 and 5 will be located north and southeast of the Open Pit, to collect localized seepage from the CDF. The Surge Pond will be located in a topographic low north of the Plant to temporarily store contact water pumped back from the SCPs and the Reclaim Pond. The Plant surface runoff pond will be a small pond to be constructed within the area of the Plant to collect and manage local runoff, particularly during and following the construction period. During operations, the decision may be made to construct the Contingency Pond on the western shore of Peanut Lake. The Contingency Pond would only be built if it became apparent during operations that post-treatment polishing or flow balancing would be advantageous.

A subset of the water management facilities will need to be completed during in the construction period, prior to the construction of the perimeter dykes, to impound water that cannot be released without treatment in the ETF. These construction phase facilities, which will need to be constructed during the summer season prior to Plant start-up, will be constructed in the following order:

- the Surge Pond;
- SCP No. 3; and
- SCPs No.1 and 2, which will be built at the same time since the water they impound will eventually combine into a single pond.

The construction and operations water management strategies are further discussed in Sections 3.III.5 and 3.III.6, respectively.

3.III.2.1.2 Closure

At closure, pumping of water out of the Open Pit will cease and the Open Pit will slowly fill with water. The rate of flooding will be increased by directing CDF runoff (and seepage reporting to SCP No. 4) into the Open Pit by breaching the SCP No. 4 dam.

As a base case, it is assumed that water which accumulates in SCP Nos. 1, 2, 3, and 5, as well as the Surge Pond, will be passively treated in a Wetland Treatment Systems and then released directly into Nico Lake. Overflow from the Open Pit, will be passively treated in Wetland Treatment System No. 4 and released into Peanut Lake. This is subject to the demonstration of the technical performance of the Wetland Treatment Systems.

The post-closure water management strategy is further discussed in Section 3.III.7.

3.III.2.2 Water Management Concept

The general water management concept is as follows:

- All water, which has been in contact with ore or mine waste, will be collected in one of the following: the SCPs, the Open Pit sump or the Reclaim Ponds. Collected water in these ponds will be pumped to the Surge Pond.
- Water will be pumped from the Surge Pond either the Plant for reuse or the ETF for treatment.
- Treated effluent from both the ETF and STP will be pumped through a diffuser directly into Peanut Lake.

- The Contingency Pond would only be built if it became apparent during operations that post-treatment polishing or flow balancing would be advantageous. If it is built and only when required, water from the ETF would be discharged into the Contingency Pond prior to release into Peanut Lake.

3.III.2.3 Description of the Water Management Ponds

3.III.2.3.1 Pond Characteristics

Table 3.III.2-1 provides the preliminary design elevations for the Water Management Ponds. It also provides the preliminary storage volumes at the normal operating water levels for each pond.

Table 3.III.2-1: Summary of Water Management Components

Component	Crest Elevation (masl)	Normal Operating Water Level (masl)	Spillway Invert (masl)	Storage Volume at Normal Operating Water Levels (m^3)
Reclaim Pond	varies	varies	not applicable	15 000 – 120 000
Surge Pond	254	251.5	253	14 000
SCP 1	222	219	through ditch to SCP 2	50 000
SCP 2	222	219	221	26 000
SCP 3	224	219	223	4 500
SCP 4	269	265	268	15 000
SCP 5	252	250	251	10 000
Plant Site Surface Runoff Pond	250			700
Contingency Pond (if required)	212	209	210	48 000

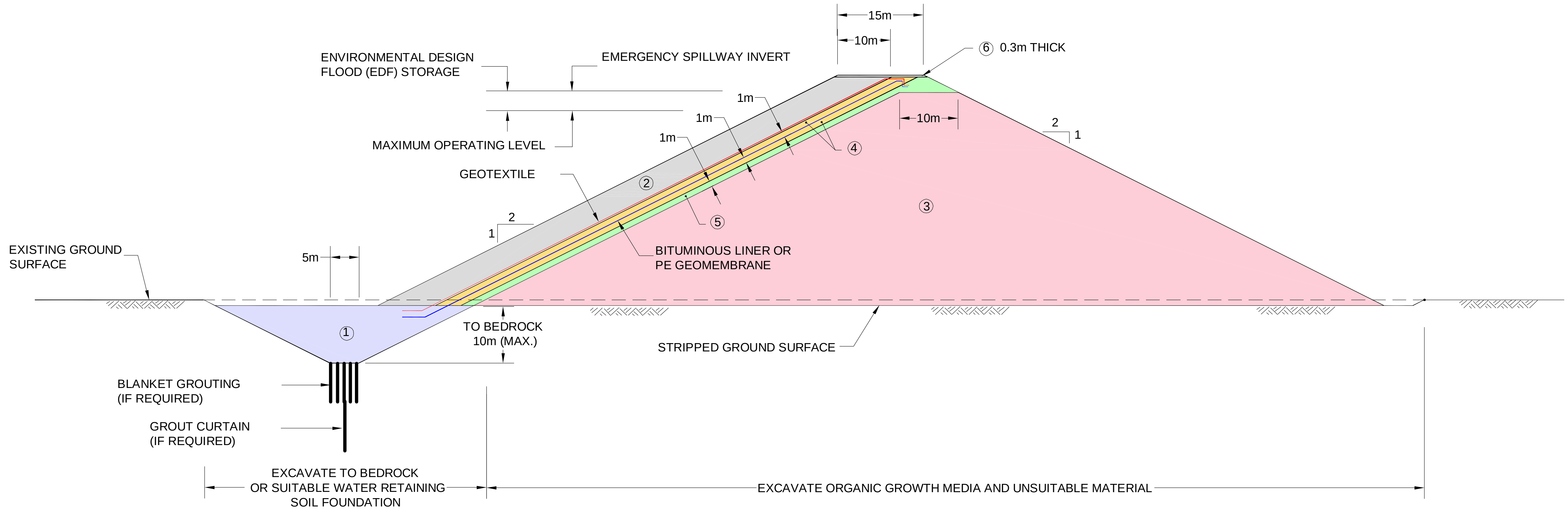
SCP = Seepage Collection Pond; masl = metres above sea level; m^3 = cubic metre

As discussed in Appendix 3.II, an Emergency Spill Containment Pond will also be built as part of the tailings distribution system. This pond does not function as a site water management pond; consequently, it is discussed in Appendix 3.II, but not herein.

3.III.2.3.2 Dam Design

The Plant Surface Runoff Pond is intended to remove suspended solids from the Plant site runoff by means of sedimentation. This pond does not need to be lined, nor do the dams forming the pond need to be watertight; they simply need to retain solids. All of the other dams forming the Water Management Ponds will be constructed as low permeability structures. The typical cross-section of the low permeability dams is shown on Figure 3.III.2-2.

The general characteristics of the dams are shown in Table 3.III.2-2.



TYPICAL CROSS-SECTION OF WATER MANAGEMENT DAMS

NOT TO SCALE

DAM ZONES:

1 - KEY TRENCH (CLAYEY GLACIAL TILL OR BENTONITE-SAND MIX)

2 - UPSTREAM (U/S) SHELL (TYPE 2 MINE ROCK)

3 - DOWNSTREAM (D/S) SHELL (TYPE 1 MINE ROCK / QUARRIED ROCKFILL OR GRANULAR BORROW)

4 - FILTER/BEDDING (PROCESSED SAND)

5 - TRANSITION(PROCESSED SAND & GRAVEL, <150MM)

6 - ROAD SURFACE (PIT-RUN SAND & GRAVEL)

LEGEND:

NON-WOVEN GEOTEXTILE

BITUMINOUS LINER OR PE GEOMEMBRANE

GROUTING (IF REQUIRED)

NOTES:

1. BEDROCK GROUTING IS NOT REQUIRED AT SCP NO. 4 OR 5 OR THE CONTINGENCY POND.
2. KEY TRENCH IS NOT REQUIRED AT SCP NO. 5 DAM OR CONTINGENCY POND.

FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

TITLE

TYPICAL CROSS-SECTION OF WATER MANAGEMENT FACILITIES DAMS

Golder Associates
Edmonton, Alberta

FILE No: E-WM-002-CAD.dwg			
PROJECT No: 09-1373-1004		SCALE AS SHOWN	REV. 0
DESIGN	IM	10 May 2011	FIGURE 3.III.2-2
CAD	TDR	10 May 2011	
CHECK	KH	10 May 2011	
REVIEW	KAB	10 May 2011	

PLOT DATE: May 11, 2011
FILENAME: T:\Projects\2010\10-1118-0046 (FML, NWT)\-KA-Nico water management figures\10111180046KA3III2-2.dwg

Table 3.III.2-2: Dam Design Criteria

Item	Design Criteria
Crest width	10 m
Upstream slope	2H:1V
Downstream slope	2H:1V
Low permeability element of dam	Geosynthetic liner
Low permeability element of foundation	Key trench – (plus slurry cut-off wall or bedrock curtain grouting if necessary) (required for SCP No. 1, 2, and 3, and the Surge Pond, but not for SCP No. 4 or 5, or the Contingency Pond)

SCP = Seepage Collection Pond; m = metre

The following are the major zones of the dams:

- upstream key trench (clayey glacial till or bentonite-granular till mix) or slurry cut-off wall (not required for SCP No. 4 and 5, or the Contingency Pond dams);
- upstream shell (selected Mine Rock-Type 1);
- upstream geotextile cushion (≥ 600 grams per square metre non-woven geotextile);
- upstream bedding (processed sand);
- upstream geosynthetic liner;
- downstream bedding (processed sand);
- downstream transition (processed sand and gravel, <150 millimetres [mm]);
- downstream shell (quarried rockfill, clean granular fill or Type 1 Mine Rock); and
- road surface on the dam crest (pit-run sand and gravel).

The key trench will be constructed to intercept seepage that could otherwise pass though the permeable overburden soils. The upstream and downstream faces of the trench will have a minimum of 2H:1V slope to verify stability and the bottom of the trench should be a minimum of 5 metres (m) wide to allow access for vehicles to grout the bedrock, if required. The key trench excavations are expected to be generally shallow. The trench will be backfilled with soils of low permeability such as clayey glacial till or bentonite-granular till mix. If such materials are not available at reasonable cost, the key trench could be replaced with a slurry cut-off wall.

A synthetic liner will be used as the water retaining element of the Water Management Pond dams. The liner system will be anchored at the bottom within the upstream key trench (or slurry cut-off wall), a minimum of 2 m below the top elevation of the trench. At the top, the liner will be anchored about 1 m below the crest elevation.

Both the upstream and the downstream shells of the dam will be constructed out of rockfill (i.e., quarried rockfill or clean granular fill or Type 1 Mine Rock). Since the rockfill and the sand bedding will not be filter compatible, a non-woven geotextile will be required downstream of the upstream shell and a transition material will be required upstream of the downstream shell. The transition zone can be select sand and gravel borrow material if it is available; otherwise processed quarried rockfill will have to be used.

For the case of the Plant Surface Runoff Pond that will be constructed south of the Plant site, the structure will be constructed to collect water that has contacted surface materials within the Plant site and return that runoff to the process at the thickener. Surface runoff waters from the Plant site area may contain elevated levels of suspended solids. The pond will be designed to retain solids; however, it does not need to be watertight; consequently, the pond and the dams will not be lined. The pond will be surface-contoured within a topographical low and a pump will be installed to permanently return runoff to the process. It is anticipated that the suspended loads will be greatest following construction due to localized disturbance. Over subsequent years, the suspended solids content of the surface runoff around the Plant should subside due to the reestablishment of vegetation along areas of construction disturbance.

3.III.3 WATER INFLOWS

3.III.3.1 Fresh Water Intake

Fresh water is required for potable water production, process water requirements such as gland water, reagent mixing, hose water and make-up process water (during periods of low precipitation and runoff into the CDF containment), dust control, emergency site heating, and during the construction phase for the mixing of concrete. The fresh water intake will be set in Lou Lake to provide fresh water for the Plant and potable water for the proposed camp. Potable water will be sterilized in a modularized potable treatment plant package. The intake structure will be designed to meet Department of Fisheries and Oceans Canada (DFO) guidelines for water intakes (Section 3.9.2 of the Project Description).

The fresh water requirement of the Plant is 4.8 percent (%) of the total flow through the mill (Aker 2010), or 0.86 Litres per section (L/s) (0.027 million cubic metres [M-m^3]/year). Additional freshwater requirements are potable water (0.012 M-m^3/year), and water for dust control (0.031 M-m^3/year from May to September). Under typical operating and average climate conditions, where the water recycled from the Surge Pond to the Plant is maximized, the total operating fresh water requirement of the mine is 2.6 L/s (0.070 M-m^3/year). In a 25-yr dry year, where runoff and direct precipitation is reduced by almost 30%, the fresh water requirement would increase to 3.6 L/s, which is less than the available withdrawal rate from Lou Lake.

There is a potential to reduce the NICO Project fresh water requirements by using treated effluent for dust control when possible. This option would require the installation of a surge tank to store treated effluent (or alternatively to draw treated water from the Contingency Pond, if it is constructed).

3.III.3.2 Precipitation, Runoff, and Infiltration

3.III.3.2.1 Climate

The NICO Project area has a sub-arctic climate characterized by long cold winters and short cool summers. Average daily temperatures typically fall to below freezing in October and remain at sub-zero levels until late April or early May. The average freezing index in the region varies between 3500 to 4000 °C-days (Boyd 1973).

3.III.3.2.2 Precipitation

The currently available climate data collected for the NICO Project meteorological station covers a period less than 6 years (2004 to 2010) and does not provide winter precipitation data. Data were compared against the corresponding years of data from the few long-term climatic stations in close proximity to the NICO Project. The comparison indicated that climate data from the Yellowknife Airport, which is located 171 km from the NICO Project, can generally be accepted for use at the NICO Project without correction (Annex G). The average monthly meteorological data of the station (1953 to 2008) is presented on Table 3.III.3-1. The precipitation data has been adjusted for the undercatch of precipitation falling as snow.

Table 3.III.3-1: Average Meteorological Data

Month	Monthly Average Precipitation (mm)	Monthly Average Lake Evaporation (mm)	Daily Average Temperature (°C)
January	21.5	0.0	-27.0
February	19.5	0.0	-23.8
March	19.0	0.0	-17.6
April	14.5	0.0	-5.9
May	20.5	0.0	4.7
June	25.2	118.6	13.2
July	40.1	154.4	16.6
August	44.1	120.7	14.0
September	36.0	66.8	6.8
October	38.8	18.0	-1.5
November	37.1	0.0	-13.7
December	27.1	0.0	-22.8
Annual[a]	**343.5**	**478.5**	**-4.7**

[a] Annual temperature is the average temperature
mm = millimetres; °C = degrees Celsius

While the annual lake evaporation exceeds the annual precipitation, watersheds in the region still produce runoff. That is because the precipitation applies to the entire watershed area, while lake evaporation only applies to the areas of ponded areas within a watershed. A frequency analysis was used to calculate the annual precipitation for wet and dry years with different periods of return. Table 3.III.3-2 presents the results.

Table 3.III.3-2: Precipitation in Wet and Dry Years

Return Period (Years)	Annual Precipitation (mm)	
	Wet Year	Dry Year
5	395	286
10	436	266
25	489	248
50	528	237
100	566	228
1000	694	206

mm = millimetres

3.III.3.2.3 Watershed Areas

The NICO Project is located within the Marian River drainage, which eventually drains into Great Slave Lake. Two local watersheds, in which the key lakes relative to the NICO Project are Burke Lake and Lou Lake, collect runoff from the NICO Project area and both flow south through creeks to the Marian River (Figure 3.III.3-1). Only limited mine infrastructure will be constructed inside the Lou Lake watershed, mostly consisting of explosive magazine storage water intake pump house, continued use of the existing float plane dock, and borrow sources. Lou Lake will be the main source of fresh water for the NICO Project. Most of the mine infrastructure will be constructed in the Burke Lake watershed.

Most of the mine infrastructure will be located on the sub-watershed of Burke Lake, referred to as BL2. Treated water will discharge into the Peanut Lake, located in the sub-watershed of Burke Lake referred to as BL4. During operations, the ETF will actively treat the mine water for discharge through a diffuser into Peanut Lake. At closure, wetlands will be constructed to passively treat CDF runoff and seepage water from SCP No. 1, 2, and 3. The effluent from the Wetland Treatment Systems No. 1, 2, and 3 will flow by gravity into Nico Lake. When the Open Pit overflows following closure, water will be directed into Wetland Treatment System No. 4 to passively treat the water before discharge into Peanut Lake. Treatment of effluent is discussed in more detail in Sections 3.III.8 through 3.III.10.

The runoff areas of the NICO Project water management components are shown in Table 3.III.3-3. Each runoff area includes the disturbed areas, pond surfaces, and natural ground for each element.

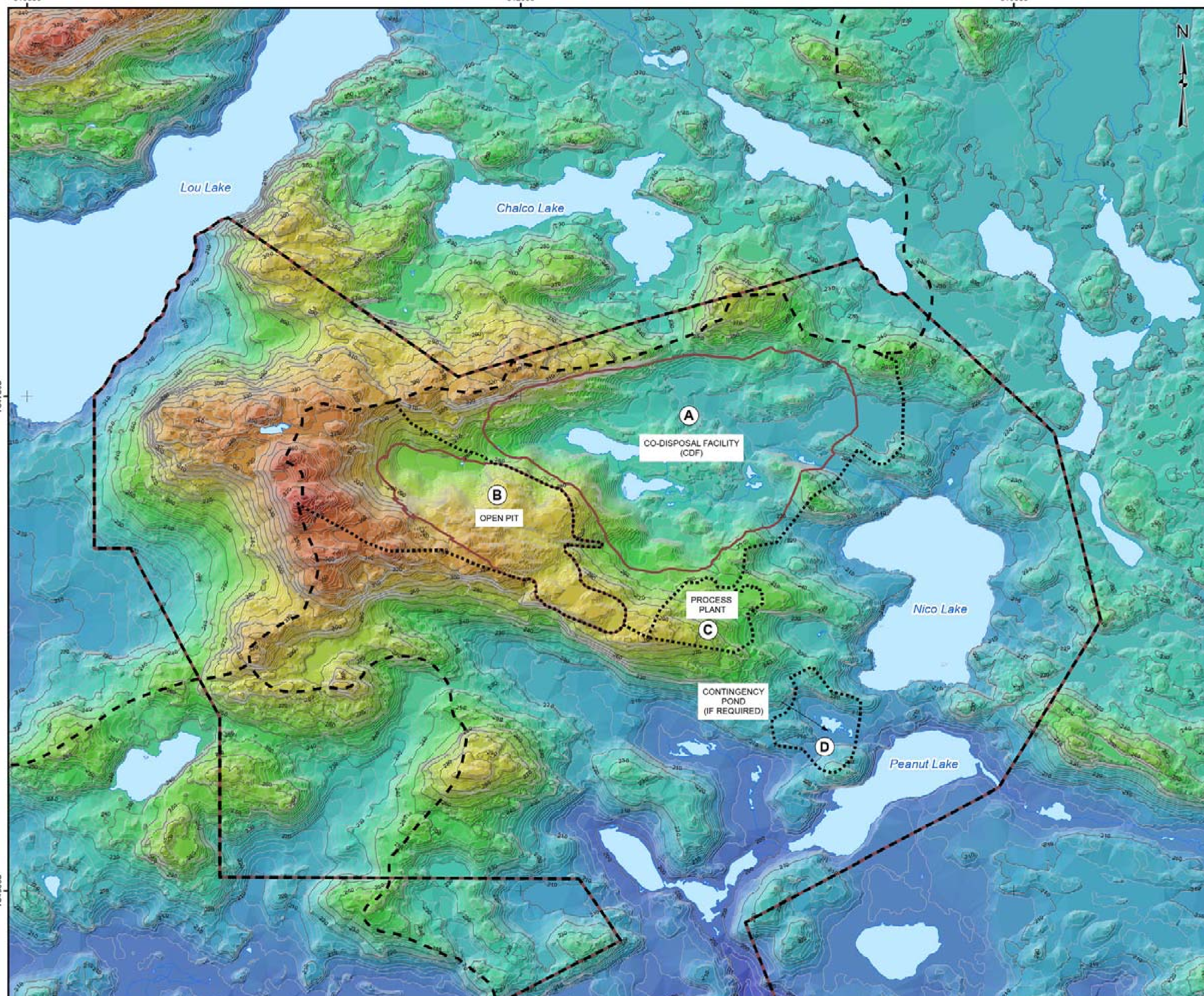
Table 3.III.3-3: Runoff Areas

Watershed	Area (ha)			
	Construction	Operations – Start-up	Operations – End	Closure
Plant Site	17	17	17	7
CDF, Grid Ponds, and SCPs	211	211	211	211
Open Pit Area	8.6	55	89	89
Surge Pond	1	1	1	1
Contingency Pond (if constructed)	0	15	0	0
Wetlands 1 and 2	0	0	0	15
Wetlands 3	0	0	0	10
Wetlands 4	0	0	0	19

CDF = Co-Disposal Facility; SCP = Seepage Collection Pond; ha = hectare

3.III.3.2.4 Runoff

Runoff from the areas shown in Table 3.III.3-3 will be directed to one of the water management components shown in Table 3.III.2-1. The runoff will then either be pumped to the Plant or treated and discharged. The volume of runoff is estimated by multiplying the precipitation by a monthly runoff coefficient. The runoff coefficients assumed (based on project experience in similar climate and geographic areas) for each surface type is shown in Table 3.III.3-4. For water management purposes, it is assumed that precipitation falling during the winter months (mid-October to mid-May) accumulates as snow. The accumulated snowpack is assumed to melt from mid-May to mid-June to become runoff.



LEGEND

- PROJECT LEASE BOUNDARY
- PROPOSED NICO MINE SITE
- WATERCOURSE
- CONTOUR - *(2 m INTERVAL)*
- CONTOUR - *(10 m INTERVAL)*
- WATERSHED BOUNDARY
- SUB-WATERSHED BOUNDARY
- WATERBODY

ELEVATION (m)

HIGH: 380.0

LOW: 190.0

WATERSHED AREAS

WATERSHED	NATURAL GROUND AREA (ha)	FACILITY AREA (ha)	TOTAL AREA (ha)
A	76	136	212
B	39	50	89
C	4	6.5	10.5
D	8	7	15

REFERENCE

Topographic mapping obtained from Eagle Mapping, Fortune Minerals Limited, 2006 (File: Basemapping FML, 20060718).dwg)

Open Pit Configuration - Provided by P & E Mining Consultants Inc. (File: End_of_year2031.dxf Received August 26, 2010)

Advanced Exploration Infrastructure - Provided by Aker Solutions (File: 0000g001D.dwg Received October 25, 2010)

Projection: UTM Zone11 Datum: NAD 83

500 0 500

SCALE 1:20,000 METRES

FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

TITLE

REGIONAL DRAINAGE AREAS

Golder Associates
Edmonton, Alberta

FILE No. E-WM-003-GIS.mxd				
PROJECT NO. 09-1373-1004			SCALE AS SHOWN	REV. 0
DESIGN	SC	16 Feb. 2011	FIGURE: 3.III.3.1	
GIS	SC	9 May. 2011		
CHECK	AC	9 May. 2011		
REVIEW	KAB	9 May. 2011		

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Table 3.III.3-4: Assumed Runoff Coefficients

Month	Runoff Coefficients (%)								Precipitation Released as Runoff (%)
	From Natural Ground	From Prepared Ground	From Ponds	From Wet Tailings	From Dry Tailings Beach	From Open Pit	From Mine Rock	From Sloped Till Cover	
January	0.60	0.80	1.00	0.70	0.50	0.90	0.40	0.60	0
February	0.60	0.80	1.00	0.70	0.50	0.90	0.40	0.60	0
March	0.60	0.80	1.00	0.70	0.50	0.90	0.40	0.60	0
April	0.60	0.80	1.00	0.70	0.50	0.90	0.40	0.60	0
May	0.50	0.70	1.00	0.70	0.30	0.70	0.20	0.50	50
June	0.40	0.60	1.00	0.70	0.30	0.70	0.20	0.40	100
July	0.30	0.60	1.00	0.70	0.30	0.70	0.20	0.30	100
August	0.30	0.60	1.00	0.70	0.30	0.70	0.20	0.30	100
September	0.30	0.60	1.00	0.70	0.30	0.70	0.20	0.30	100
October	0.40	0.70	1.00	0.70	0.30	0.70	0.20	0.40	50
November	0.60	0.80	1.00	0.70	0.50	0.90	0.40	0.60	0
December	0.60	0.80	1.00	0.70	0.50	0.90	0.40	0.60	0
Average	**0.48**	**0.72**	**1.00**	**0.70**	**0.40**	**0.80**	**0.30**	**0.48**	**-**

% = percent

3.III.3.2.5 Infiltration

The infiltration factors (expressed as a percentage of precipitation) that were used to estimate the hydraulic performance of the uncovered CDF top surface and Perimeter Dyke before closure, and of the covered CDF area after closure are:

- CDF: 30%
- Perimeter dyke: 50%
- Till cover: 10%

Water that infiltrates the CDF is assumed to ultimately report as toe seepage to one of the SCPs.

3.III.3.3 Mine Dewatering

Groundwater will enter the surface water balance of the site from the following sources:

- It is estimated that approximately 50 000 cubic metres (m^3) of water will have to be pumped from the currently flooded underground workings before underground rehabilitation and mining operations can commence. Dewatering will begin approximately 2 months before the start of underground mining.
- After the dewatering of the underground workings is competed, there will still be steady state inflows into the workings. It is anticipated that an additional 40 m^3/day of water will be pumped from underground mine workings during the underground mining period. Underground mining will cease after 2 years and the adit (a sub-horizontal passage leading into a mine) and fresh air raise will be sealed with a bulkhead.
- Water will also be pumped from the base of the Open Pit throughout the mining period. The volume of water pumped will be the sum of groundwater inflows and runoff from the Open Pit watershed, less evaporation. This volume will increase progressively over the years as the Open Pit becomes deeper and

the Open Pit watershed area increases, as well as the surface area of the pit walls exposed for groundwater exfiltration. It is estimated that the volume pumped will be about 130 000 m^3 during the start-up year, increasing to about 285 000 m^3 during the final year of mining.

- Post-closure, the groundwater will continue to seep into the Open Pit. Modelling indicates that approximately 120 years will be required for the pit water level to rise to Elev. 260 m, at which time the Flooded Open Pit would begin to overflow through the former haul road ramp.

3.III.3.4 Moisture in Ore and Tailings

Table 3.III.3-5 provides the operating data for the Plant and the tailings operations.

Table 3.III.3-5: Operating Data

Operating Data	Source	Value	Units (metric)
Ore Production			
- Ore reserve *(design tonnage)*	Fortune	31 040 383	t
- Planned annual plant throughput *(nominal production rate)*	Fortune	4 650	t/d
- Plant availability	Fortune	90.0	%
- Factor of safety on the design value	Fortune	1.00	-
- Design daily milling rate	Calculated	5 167	t/d
Tailings Production			
- Tailings / ore ratio *(the difference is concentrate)*	Fortune	0.964	-
- Specific gravity of tailings particles	Golder	3.30	-
- Discharge slurry density of the tailings from the Plant to the thickener(s)	Golder	32.4	% solids
- Discharge slurry density of the tailings from the thickener to disposal facility	Golder	75.0	% solids
- Assumed deposited void ratio *(Void volume / total volume)*	Golder	0.90	-
- Water volume in tailings slurry	Calculated	545 383	m^3/year
- Total tailings produced	Calculated	17 228 353	m^3
- Moisture retained in settled tailings	Calculated	446,222	m^3/year
Flows Impacting the Plant Water Balance			
- Moisture content of the ore going into the Plant	Fortune	6.9	%
- Moisture content of the concentrate leaving the Plant	Fortune	8.8	%
- Fresh (clean) make-up water required in the Plant	Aker	3.1	m^3/h
- Water lost in the Plant to evaporation	Aker	0.2	m^3/h
Miscellaneous Flows Impacting the Flow Model			
- Water used for dust control *(taken from Lou Lake)*	Aker	8.3	m^3/h
- Potable water from Lou Lake	Aker	1.4	m^3/h
- Assumed sewage volume *(estimated as a % of potable water)*	Golder	90	%
Mine Rock			
- Specific gravity	Micon	2.75	-
- Assumed porosity of the deposited mine rock (voids vol. / total vol.)	Golder	0.30	-
- Assumed percentage of the void space that could be occupied by tailings	Golder	50.0	%
- Total mine rock produced	P&E	90 381 882	t

Table 3.III.3-5: Operating Data (continued)

Operating Data	Source	Value	Units (metric)
Sub-Economic Mineralized Rock			
- Specific gravity	Micon	2.75	-
- Total sub-economic ore	P&E	6 469 485	t
Co-Disposal Facility			
- Mine Rock (including sub-economic mineralized rock)	Calculated	50 312 398	m^3
- Mine Rock to be used for Co-Disposal Facility Dyke construction (not available for co-disposal)	Calculated	6 144 000	m^3
- Thickened tailings that will be stored within Mine Rock voids	Calculated	6 625 260	m^3
- Thickened tailings disposed in cells within the Co-Disposal Facility	Calculated	10 603 094	m^3
- Co-Disposal Facility total storage capacity (including perimeter dyke)	Calculated	60 915 492	m^3

Note: Nominal values are based on the planned annual Plant throughput averaged over 365 days per year.
Design values are larger and take into account the availability of the Plant plus an appropriate factor of safety.
t = tonnes; t/day = tonnes per day; m^3 = cubic metre; m^3/h = cubic metre per hour; % = percent

The following flows are related to the ore and tailings production:

- water in the tailings discharge;
- water tied up in the deposited tailings after consolidation;
- fresh make-up water going into the Plant for reagent mixing, gland water, hose water, etc.;
- moisture going into the Plant in the ore;
- moisture leaving the system in the concentrate;
- losses in the Plant such as evaporation and spillage; and
- water re-circulated to the Plant from the Surge Pond.

It is expected that the ore entering the Plant will have an average nominal moisture content of 6.9%. This represents a small water inflow into the site water balance.

The planned milling rate will be 1 695 060 tonnes (t) of ore per year. A mass of concentrate averaging 3.6% of the ore mass will be shipped off-site. The remaining 96.4% of the ore will report as tailings to the CDF. The tailings will be thickened to a solids content of 75 ± 2% before it is pumped into the CDF for co-disposal with the Mine Rock. The water delivered to the CDF in the tailings slurry is calculated to be 545 383 m^3/year.

3.III.4 WATER OUTFLOW AND LOSSES

3.III.4.1 Effluent Discharge

To the extent that is required, water that accumulates in the Surge Pond will be pumped back to the Plant for use. Amounts in excess of that required in the Plant will be pumped to the ETF for treatment. The ETF will operate year round. Treated water will be pumped to discharge through a diffuser into Peanut Lake.

3.III.4.2 Evaporation

Water will evaporate from the surface of each of the Water Management Ponds. Evaporation will also occur from the Open Pit sump and from the CDF (i.e., both from the Reclaim Pond and from the exposed wetted surfaces of tailings). The amount of the evaporation is proportional to the evaporative surface area times the monthly lake evaporation values in Table 3.III.3-1.

A small volume of water will also evaporate from the Plant Runoff Pond.

3.III.4.3 Seepage Losses

The CDF Perimeter Dyke is a pervious structure. Seepage through the Perimeter Dyke will all be captured in SCP Nos. 1 through 5 where it will mix with surface runoff. As discussed in Section 3.III.3.2.5, the toe seepage is assumed to be equal to the amount of infiltration into the CDF. During operations, flows from the SCPs will be pumped to the Surge Pond. In the long-term after closure, a state of equilibrium will become established whereby the amount of the toe seepage will be equal to the average amount of infiltration through the CDF cover.

The dams forming the Water Management Ponds will be low permeability structures. No dam is completely impervious; however, there will be small seepage losses through the dams and their foundations. Seepage through the dams of SCP No. 1, 2, ands 3 will report to Nico Lake. Seepage through the other dams will be internal to the mine site.

3.III.4.4 Losses to Co-Disposal Facility Voids

After co-disposal in the CDF, it is expected that the tailings will retain a moisture content of 27% over the long-term within the void spaces of the consolidated tailings and Mine Rock. In terms of the balance of free water, this amounts to a loss of 446 222 m^3/year during operations assuming deposition occurs at the projected rates.

3.III.4.5 Other Losses

The concentrate shipped off-site is expected to have an average moisture content of about 8.8% of the dry mass of concentrate. This amounts to a site water loss of 5998 m^3/year of water.

3.III.5 WATER MANAGEMENT DURING CONSTRUCTION

3.III.5.1 Construction Schedule

The construction water management plan is based on the current construction schedule received from Fortune on 1 February 2011. Table 3.III.5-1 summarises elements of the schedule relevant to pre-start-up water management.

The Water Management Plan currently assumes that Plant start-up occurs in May. It is recognized that this may change. Given the seasonality of site runoff, it should be noted that details of construction water management may change if the start-up occurs in a different month of the year.

Table 3.III.5-1: NICO Construction Schedule

Site Component	Dates (Years)
Augmented Pioneer Camp	-2 to -1
Permanent Camp, construction phase	-1 to 0
Open Pit Pre-strip Type 1 for CDF	-1 to -0.5
Dewatering of underground mine	-0.7 to -0.5
Underground mining	-0.5 to 0
Open Pit mining	-0.2 to 0
Plant start-up	1

Key aspects of the construction schedule are as follows:

- **Sewage Effluent:** Sewage from the construction camp will be treated using a pair of rotary biologic contactors (RBC) installed in parallel. After construction, one of the RBC units will be sold and removed from the site, leaving one operational. Because the ammonia levels of the RBC effluent (3 milligrams per litre [mg/L]) predicted by the manufacturer are below the SSWQO of 4.16 mg/L, effluent can be discharged directly to Peanut Lake. If, in practice, the effluent ammonia levels exceed the SSWQO, RBC effluent flows will have to be contained on site until it can be further treated in the ETF.

- **Water from the Open Pit:** Once the pre-production mining operation begins and explosives are first utilized, the water which collects in the Open Pit sump will likely contain elevated concentrations of ammonia; it will therefore have to be impounded for treatment in the ETF. For water management planning purposes, it is assumed that the Open Pit flows will be stored in the in the SCPs prior to Plant start-up.

- **Water Impounded in the Grid Pond Watershed:** The 2 Grid Ponds have a combined volume of approximately 42 450 m^3. Section 3.III.5.4 discusses the management of runoff from the Grid Pond watershed during the period of construction. As part of normal construction dewatering, the net runoff from the Grid Pond watershed will be pumped across the dam foundation areas and discharged downstream along its natural flow path. Once the SCP dams have been completed, natural runoff will begin to impound in the Grid Ponds. The volume will include the estimated initial volume of the 2 Grid Ponds plus any runoff that accumulates over the impoundment period. The water in the Grid Ponds has elevated background levels of arsenic from natural sources. (Subsequently, during operations, the water in the Grid Ponds will merge with the Reclaim Pond and will be re-used in the process or be treated and released.)

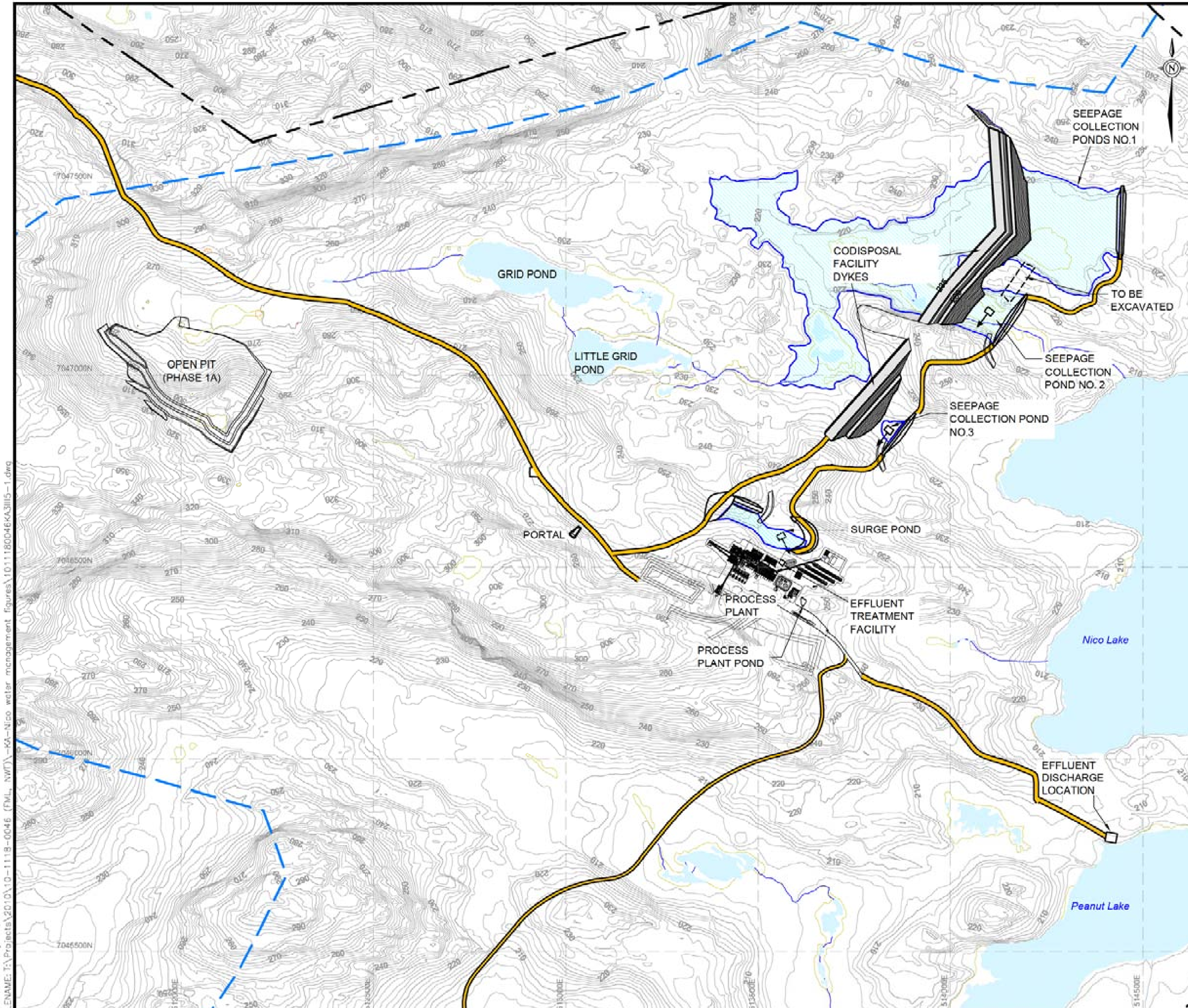
- **Underground Mine Dewatering:** It is estimated that 50 000 m^3 will be pumped from the currently flooded underground workings in the 2 months before underground mining starts. It is estimated that the quality of first 20 000 m^3 of the pumped water will likely be good enough to discharge because it is not in contact with the ore. However, operational monitoring will be required to confirm that water can be directly discharged, as concentrations of a few metals could occur at concentrations greater than the SSWQO. For water management planning purposes it has been assumed that that the full dewatered volume will be impounded until start-up when it can either be directed to the process water tank or pumped to the ETF for treatment and discharge to the environment.

3.III.5.2 Construction Water Management Components

Of the water management facilities mentioned in Section 3.III.2.1, the following facilities, in their order of construction are components of the site construction water management plan (shown in Figure 3.III.5-1):

- **Surge Pond**. The Surge Pond is closest to both the Open Pit and the portal to the underground workings, thereby having the smallest pumping requirement of any of the water management ponds. It is currently planned to have a storage capacity of 14 000 m^3 at a normal operating water level of 251.5 masl.
- **Seepage Collection Pond No. 3.** Once the Surge Pond exceeds its capacity, SCP No. 3 is the next closest pond. It has a storage capacity of 4500 m^3 at a normal operating water level of 219 masl.
- **Seepage Collection Ponds No. 1 and 2**. Prior to start-up, SCP No. 1 and 2 will be joined at their upstream ends and will act as a single pond. The dams for SCP No. 1 and 2 must therefore be constructed at the same time. It was decided to construct these ponds last to delay the impoundment of the Grid Pond watershed flows. SCP No. 1 and 2 have a combined storage of 246 000 m^3 at its normal operating water level of 219 masl.
- **Construction Dewatering**. As described in Section 3.III.5.4, during the period of construction of the dams for SCP No. 1, 2, and 3, the net runoff from the Grid Ponds watershed will be pumped past the construction areas and discharged into the wetlands downstream from whence it will flow into Nico Lake.
- **Co-Disposal Facility)**. The CDF Perimeter Dyke starter is scheduled to be constructed in the summer construction season immediately preceding the commissioning of the Plant; however, because of its porous nature, it is not designed to impound water. This concept is displayed in Figure 3.III.5-1 where, although the CDF Perimeter Dyke starter is shown in place, the water shown is actually being impounded by the SCP No 1 and 2 dams.
- **Effluent Treatment Facility**. The ETF will have to be operational before all the water management ponds have reached their full capacities or in time for the start-up of the Plant, whichever occurs first. The required treatment rates during start-up are described as a part of the operations water management (Section 3.III.6).

A small Plant Site Runoff Collection Pond will be constructed at the Plant site prior to site preparation for the Plant and camp. However, because this pond is not designed to be a water retaining structure; rather it is designed for the collection of suspended solids generated on the site during construction and operation; the capacity of this pond has been discounted as a source of long term storage during construction It has therefore not been included in the construction water management plan shown in Figure 3.III.5-2.



LEGEND

- RECLAIM BARGE / PUMP STATION
- DIVERSION DITCH
- PROJECT LEASE BOUNDARY
- WATERSHED
- ACCESS ROAD
- CONTINGENCY POND
- PERIMETER DYKE OF CO-DISPOSAL FACILITY
- SEEPAGE COLLECTION POND / SURGE POND
- WATER BODY

NOTES

1. All elevations (geodetic datum) and grid coordinates (UTM NAD83, Zone 11) shown in this drawing are in metres.
2. Configuration shown assumes sub-economic ore is not processed.

REFERENCE

Base mapping provided in digital format by Fortune Minerals Limited received 20 February 2004.

Process plant and mine infrastructure provided by Aker Solutions filename 0000g001d (plant site oct252010).dwg provided Oct.26, 2010. Revised pits provided by P & E Mining Consultants, ultimate pit and topo.dxf on 26 January 2010.

Project lease boundary provided by Fortune (October 8, 2008) with comments provided 19 December 2009.

200 0 200 400

SCALE 1:10,000 METRES

FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

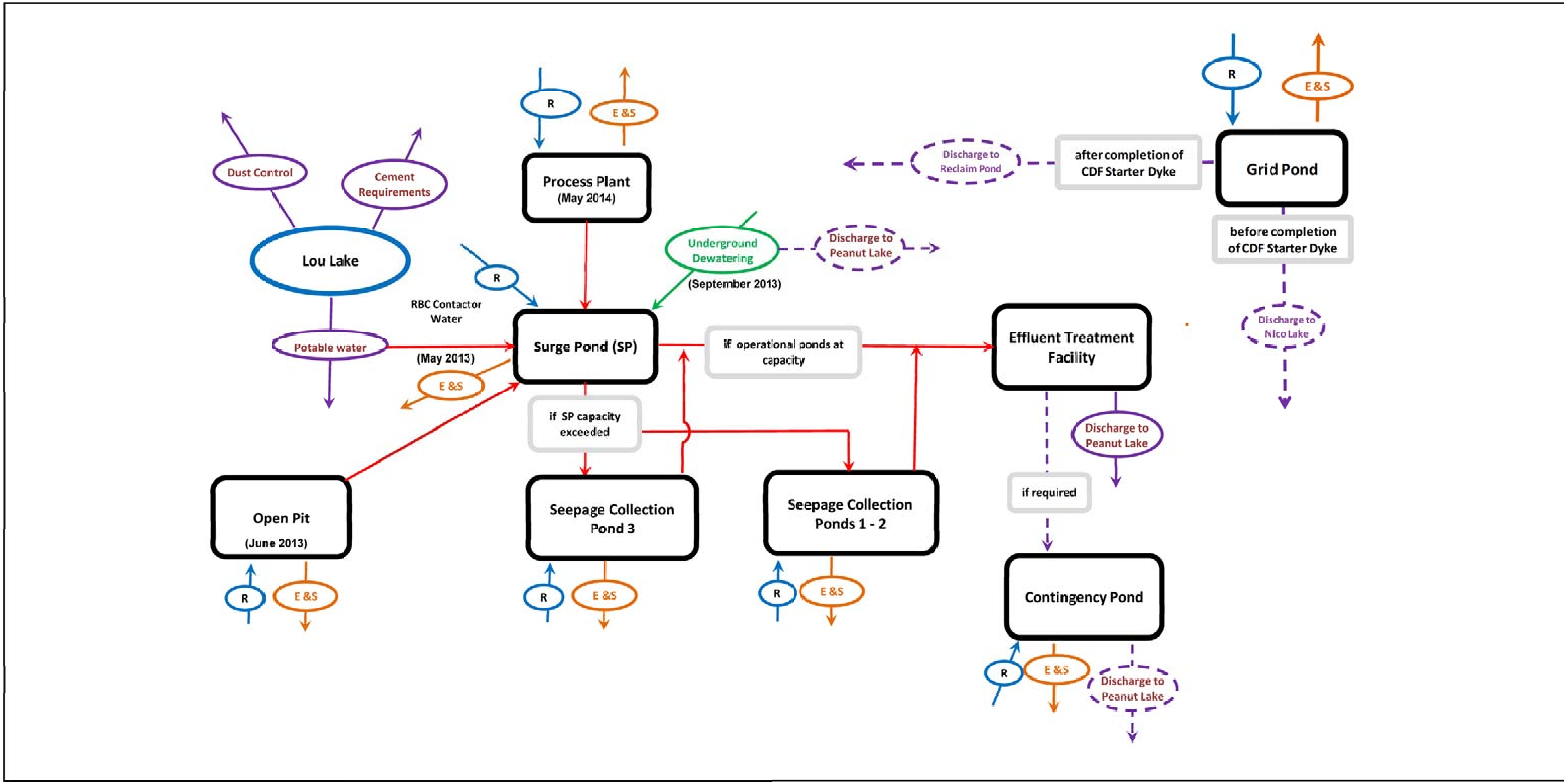
TITLE
LAYOUT OF WATER MANAGEMENT FACILITIES AT END OF CONSTRUCTION PHASE

FILE No: E-WM-004-CAD.dwg

PROJECT No. 09-1373-1004			SCALE AS SHOWN	REV. 0
DESIGN	IM	10 May 2011	FIGURE 3.III.5-1	
CAD	TDR	10 May 2011		
CHECK	IM	10 May 2011		
REVIEW	KAB	10 May 2011		

Golder Associates
Edmonton, Alberta

PLOT DATE: May 11, 2011



LEGEND

- Rainfall, Runoff
- Evaporation, Seepage and Spillage Losses
- Other Losses
- Other Inflows
- Internal Flows
- Conditional Flows
- Conditional Operations

NOTES

1. Flows are all in m^3/year
2. The diagram represents the water management elements present during the construction phase. At a given point in time, not all elements may be active.
3. Discharge to Peanut Lake is contingent on meeting effluent water quality criteria. It is assumed in the model that the criteria is not met and that flows must be contained.
4. Dates shown on the schematic are projected start dates for flows.
5. If treated effluent from the STP does not meet SSWQOs, it will have to be impounded until further treatment or until it can be recycled to the plant after start-up.

REFERENCE

Drawing Provided by Golder Associates Ltd (April 2011)

FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

TITLE

CONSTRUCTION WATER MANAGEMENT SCHEMATIC

Golder Associates
Edmonton, Alberta

FILE No. E-WM-003-GIS.mxd				
PROJECT NO. 09-1373-1004			NO SCALE	REV. 0
DESIGN	SC	25 Feb. 2011	FIGURE: 3.III.5.2	
GIS	SC	26 Apr. 2011		
CHECK	AC	26 Apr. 2011		
REVIEW	KAB	26 Apr. 2011		

3.III.5.3 Construction Water Balance

3.III.5.3.1 Objectives of Water Balance Modelling

A construction water balance model was prepared to represent the NICO Project site during the construction stage. The water balance was used to predict the following:

- the required staging of the construction of key water management components during the construction period;
- the volume of water that will be impounded between the time that the SCP dams are closed and the start-up of the Plant;
- whether the ETF needs to be operational prior to the start-up of the Plant;
- whether the ETF needs to be designed with additional capacity in order to draw down the inventory of water impounded prior to start-up in the SCPs and the Grid Ponds that represent the initial Reclaim Pond volume at the CDF; and
- The overall management strategy of the water that will accumulate in the Grid Pond basin once the SCP dams are closed.

The deterministic, monthly water balance model was run from the completion of the permanent camp to the end of the first year after start-up. The requirements for and use of water were provided by Aker Solutions (Aker 2010).

3.III.5.3.2 Model Inputs and Assumptions

Significant flows that will impact construction water management include the following:

- **Underground Dewatering**: As stated in Section 3.III.5.1, about 50 000 m^3 will be pumped from the flooded underground workings in the 2 months before underground mining starts.
- **Potable water:** Potable water requirements are estimated based on the camp population assuming a usage of 0.27 m^3/person/day. Potable water estimates are as follows:
  - Pioneer camp at Lou Lake (up to 28 people): 7.6 m^3/day
  - Permanent camp, construction phase (up to 250 people): 67.5 m^3/day
    - with the pioneer camp moved to the plant Site: (up to 278 people): 75.1 m^3/day
  - Permanent camp (up to 125 people): 33.8 m^3/day
    - with the additional use of the present pioneer camp moved to the permanent camp site (up to 158 people): 42.7 m^3/day
- **Sewage/Grey Water**: Sewage/grey water flows are estimated to be 90% of the potable water values. For operation of the camps at maximum capacity:
  - Pioneer camp: 6.8 m^3/day

- Permanent Camp, construction phase: 60.8 m^3/day
  - with Pioneer Camp at Plant Site: 67.6 m^3/day
- Permanent Camp, operations phase: 30.4 m^3/day
  - with Pioneer Camp at Plant Site: 33.8 m^3/day

- **Dust Control/Drilling**: Operations: 8.3 m^3/hr (Aker 2010).
- **Water for the Concrete Plant:** Assuming 2500 t of concrete mix used for construction, 1250 t of water is required (2:1 concrete mix to water ratio)
- **Runoff from site**: The climate data, runoff areas and runoff and infiltration coefficients used to calculate runoff are all described in Section 3.III.3.2

3.III.5.3.3 Modelling Results – Sequence of Construction and Pond Filling

The water balance results indicate that, in order to contain the anticipated flows from construction phase runoff areas, flow components and a possible environmental design flood (EDF), the latest each of the water management ponds can be built is shown in Table 3.III.5-2.

Table 3.III.5-2: Water Management Construction Schedule

Water Management Component	To Be Completed by (Year)	Reaches Capacity by (Year)	Volume impounded by Plant Start-up (m^3)
Surge Pond	-1	-0.7	14 033
Seepage Collection Pond 3	-0.7	-0.7	4 478
Seepage Collection Ponds 1 and 2	-0.7	-	51 266
CDF/ Reclaim Pond[a]	1 (Start-up)		42 450
Effluent Treatment Facility	1 (Start-up)	-	-

[a] At start-up, the Reclaim Pond volume is composed entirely of Grid Pond water.
CDF = Co-Disposal Facility; m^3 = cubic metres

The dates in Table 3.III.5-2 assume that:

- The treated sewage water from the permanent camp in construction phase will be treated in a RBC and the treated liquid will be released into Peanut Lake.
- Surface runoff flows from the camp and plant construction site will be collected by the Plant Site Surface Runoff Pond for the removal of suspended solids. After the sediments have been removed the clarified water can be released into local natural drainage courses.
- Operations of borrow sources will be subject to sediment control plans. Once the water has been clarified, it will be released into the local watershed following the natural local drainage courses.
- Open Pit operations will commence 2 months prior Plant commissioning.

- Underground operations, commencing 6 months prior to Plant commissioning, will be preceded by 2 months of dewatering during the underground rehabilitation, meaning in the case presented, at least the Surge Pond and SCP No. 3 will have been completed.

3.III.5.4 Management of Water in the Grid Ponds

Earth structures that need to be constructed prior to start-up of the Plant include:

- the first lift (i.e., the starter dyke) of the CDF perimeter dyke, and
- the dams for SCP No. 1, 2, and 3.

To carry out this construction, the foundations of these dykes/dams need to be maintained in a dewatered condition for the initial period of construction. Normal construction practice will be followed, including the construction of temporary cofferdams upstream of the work areas and the pumping of water from the upstream watershed around the dewatered areas. Cofferdams may also be constructed on the downstream end of the construction area, if necessary. The pumping will continue until the CDF perimeter dyke and the SCP dams have sufficient freeboard to contain the upstream runoff plus a design storm. It is not intended to materially lower the water levels in the Grid Ponds, only to divert the net runoff around the construction areas. The total volume of water pumped will be roughly equal to the net runoff from the Grid Pond watershed over the period of initial construction. At the end of the construction period, the inventory of water in the Grid Pond watershed will be roughly the same as that which occurs under natural conditions.

A sediment control plan will be in effect throughout the period of the construction to ensure that water discharged downstream of the construction areas will not contain unacceptable levels of total suspended solids. The quality of the discharged water is expected to be the same as that which is typically discharged from the Grid Pond watershed into Nico Lake. It should be noted that the background levels of certain parameters, such as arsenic, are naturally elevated in the water that discharges from the Grid Ponds into Nico Lake. It is not intended to treat the water diverted around the construction areas to meet the SSWQO values that will apply during operation of the NICO Project.

After start-up, the progressive co-disposal of tailings and mine rock upstream of the Perimeter Dyke will impound runoff from the Grid Pond watershed and will progressively displace the impounded water further and further to the west. The pond of impounded water will act as the Reclaim Pond. At start-up, an estimated 42 450 m^3 of water will be impounded in the Grid Pond area. This initial volume can be drawn down gradually from the Reclaim Pond over the life of the mine. This inventory represents only about 1.5% of the total volume of tailings slurry water that will report to the CDF over the life of the mine; consequently, the chemistry of the water impounded in the Grid Ponds will have little influence on the chemistry of the pore water in the CDF. There is therefore no need to design the ETF to treat the Grid Pond water immediately upon start-up. The ETF capacity can be based on the design flows occurring during operations (Golder 2010).

3.III.6 WATER MANAGEMENT DURING OPERATIONS

3.III.6.1 Water Management Concept

The operational water management concept is as follows:

- Lou Lake will provide fresh water for the Plant, potable water and dust control requirements;

- As the camp population during operations will be reduced by half, one of the RBC water treatment modules will be dismantled and sold. Water that is produced from the treatment of sewage in a RBC will be discharged into Peanut Lake;
- Contact and tailings water will be pumped to the Surge Pond from the SCPs, underground, Open Pit sumps and tailings Reclaim Pond;
- Water collected by the Plant Site Runoff Pond for suspended solids removal will be pumped to the thickener;
- Water will be pumped from the Surge Pond either to the process water tank in the Plant for reuse, or to the ETF for treatment; and
- Under normal conditions, treated water from the ETF will be pumped through a diffuser directly into Peanut Lake.

The Layout of the Operation water Management is shown in Figure 3.III.2-1.

3.III.6.2 Operations Water Management Components

The following is a brief description of significant components of NICO's operational water management system

- **Underground Mine**. During underground mining operations, mine water will be collected in sumps, and pumped to the Surge Pond for treatment or use in the Plant. Underground mining will cease in early in Year 3, and mining will continue by Open Pit mining alone.
- **Open Pit**. During operations, the Open Pit will collect direct precipitation, run-off and groundwater seepage. This mine water will be collected in sumps and pumped to the Surge Pond for treatment or use in the Plant.
- **Co-Disposal Facility**. During operations, the CDF will collect tailings water and precipitation as surface runoff. This water will be stored in the Reclaim Pond that will be created within the CDF. The Reclaim Pond(s) will be created upstream of, or on, active and inactive tailings disposal cells. A movable pump barge will be used to pump the decanted supernatant and runoff water back to the Surge Pond for re-use by the Plant.
- **Seepage Collection Ponds No. 1 to 5**. SCPs No. 1, 2, and 3, located in 3 topographic lows below the eastern end of the CDF, are designed to intercept seepage and runoff from and into the CDF which would otherwise flow to Nico Lake. Seepage Collection Ponds No. 4 and 5 are located to the west and south, respectively of the CDF, to collect seepage from CDF and local runoff.
- **Surge Pond**. The Surge Pond is located at the topographic low north of the Plant to temporarily store contact water pumped back from the SCPs and the tailings Reclaim Pond(s). Water will be pumped from the Surge Pond through the Plant for reuse, or pumped on to the ETF for treatment and release to the environment. Because of topographical constraints, this pond is not sized to store a large storm event; a sufficiently large pump is therefore required to maintain the water level under the design event.
- **Plant Site Surface Runoff Pond**. Surface contact water containing suspended solids will be collected by the pond for recycle back to the tailings thickener.
- **Lou Lake**. Fresh water source for Plant, dust control on mine and site roads, and potable water.

- **Effluent Treatment Facility**. The ETF will treat excess mine water prior to discharge to the environment. The ETF is described in more detail in Section 3.III.8.
- **Sewage Treatment Plant**. The STP will treat sewage water prior to discharge to the environment. The STP is described in more detail in Section 3.III.9.
- **Contingency Pond**. The Contingency Pond would only be built if it became apparent during operations that post-treatment polishing or flow balancing would be advantageous. If it is built and only when required, water from the ETF would be discharged into the Contingency Pond prior to release into Peanut Lake.
- **Additional Water Management Components.** Drainage ditches, emergency spillways, and floating pump stations.

3.III.6.3 Operational Site-Wide Water Balance

3.III.6.3.1 General

The purpose of the site wide water balance model is to estimate the flows between the Plant, the CDF, and the associated water management facilities. It includes the Plant water requirements, availability of water in the system to run the Plant, and the water to be discharged to the environment.

The water balance is based on the planned annual Plant throughput averaged over 365 days per year. This is the basis for the “nominal” values. The “design” values are larger and take into account the instantaneous operating rate of the Plant. The design values were used to size pipelines and pumping systems.

3.III.6.3.2 Flow Modelling Procedure

Deterministic analyses were performed on a monthly basis under average, 25 year dry and 25 year wet climatic conditions (Golder 2010). To characterize the mine water management over the Operations period, 2 Operations water balances have been developed:

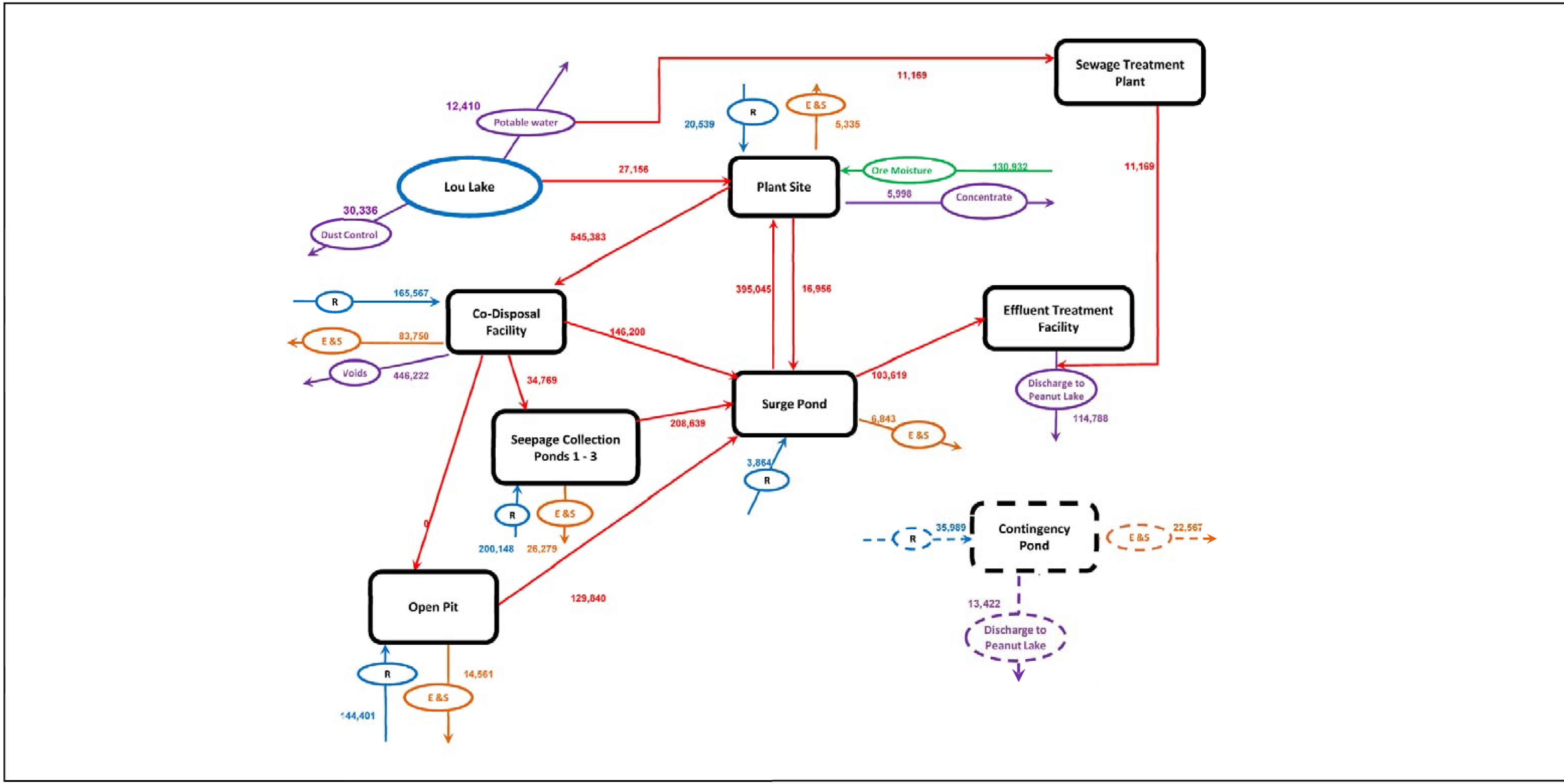
- An operational water balance for the first year that the mine will be at full production (i.e., planned annual ore processing of 1 698 000 t).
- An operational water balance for the last year that the mine will be at full production.

3.III.6.3.3 Operational Water Balance Results

3.III.6.3.3.1 Annual Water Balance Results

Figures 3.III.6-1 and 3.III.6-2 provide a graphical summary of annual flows during the first and last years of full operations. The following observations are made:

- The operational discharge to Peanut Lake (from both the STP and ETF) will range from 115 500 m^3 to 291 000 m^3 under average conditions (Table 3.III.6-1).
- Under average climatic conditions, the annual Plant fresh water requirements are not expected to change during operations (Table 3.III.6-2).
- In the last year of operations, the volume of discharge will be equal to the fresh water intake into the Plant plus approximately 220 000 m^3 per year (for a total of 290 643 m^3/yr). Increasing the fresh water intake would increase the discharge by a similar volume



LEGEND

- Rainfall, Runoff
- Evaporation, Seepage and Spillage Losses
- Other Losses
- Other Inflows
- Internal Flows
- Conditional Flows
- Conditional Operations

NOTES

1. Flows are all in m^3/year and they take into account 90% availability for all facility flows.
2. The Co-disposal Facility includes the Reclaim Pond and Seepage Collection Ponds No. 4 and 5.
3. Slurry water flow assumes a solids content of 75%. If a lower solids content were used, this flow would increase; however, the reclaim would increase by the same amount.
4. The fresh water requirement of the plant is 3.1t/hr at 90% availability, which is based Aker Solutions Water Balance, Revision D, dated November 15, 2010.
5. Runoff and evaporation assume long term average values.
6. In the event that adequate storage is avaliable at the ETF, treated effluent can be used for dust control instead of fresh water.
7. It is not currently planned to construct the Contingency Pond. A decision to construct would be made during operations if if it is deemed advantageous to do so.

REFERENCE

Drawing Provided by Golder Associates Ltd (February 2011)

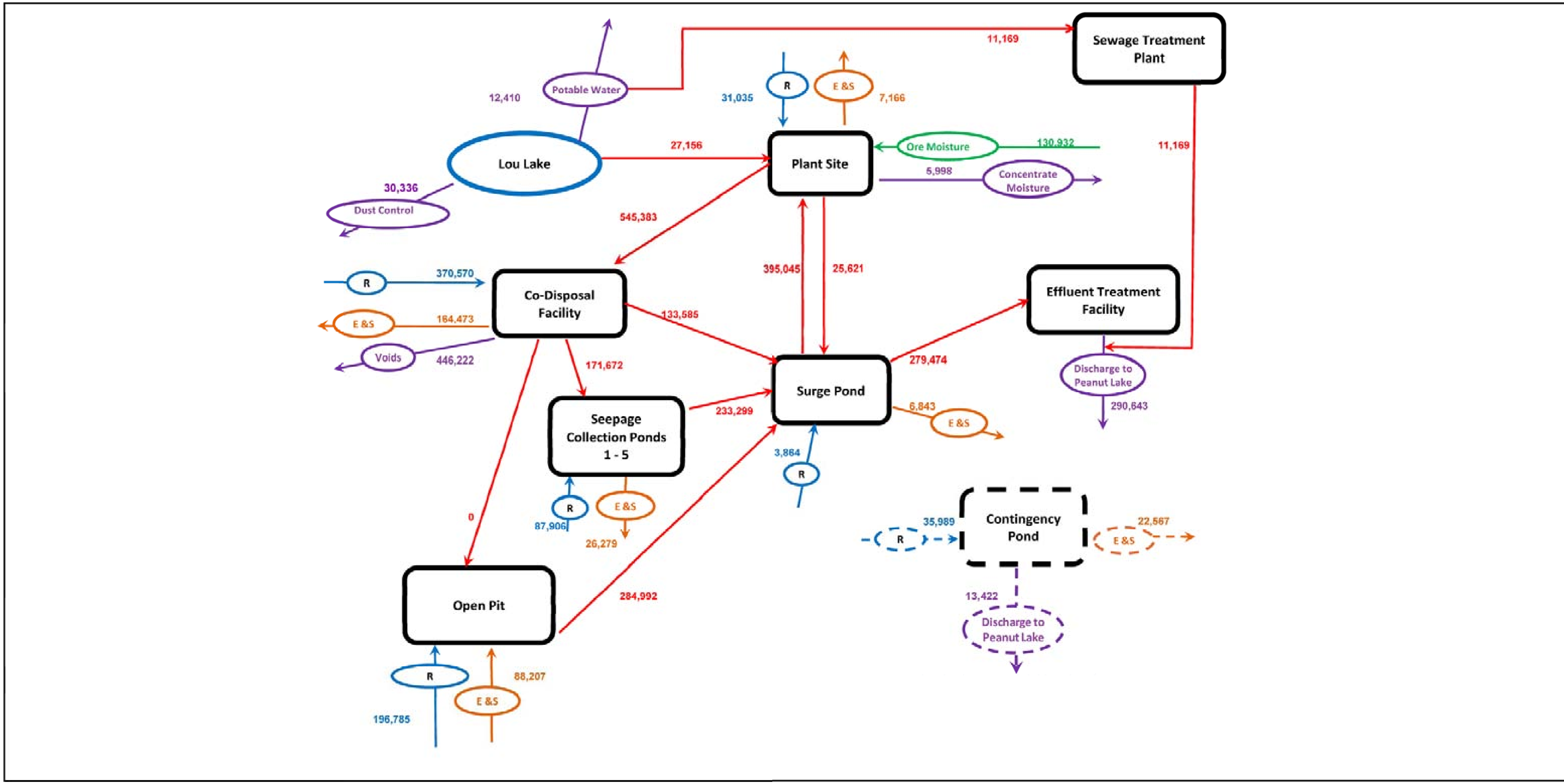
FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

TITLE

START-UP WATER BALANCE

Golder Associates
Edmonton, Alberta

FILE No. E-WM-006-GIS.mxd				
PROJECT NO. 09-1373-1004			NO SCALE	REV. 0
DESIGN	SC	25 Feb. 2011	**FIGURE: 3.III.6.1**	
GIS	SC	26 Apr. 2011		
CHECK	AC	26 Apr. 2011		
REVIEW	KAB	26 Apr. 2011		



LEGEND

- Rainfall, Runoff
- Evaporation, Seepage and Spillage Losses
- Other Losses
- Other Inflows
- Internal Flows
- Conditional Flows

NOTES

1. Flows are all in m<sup>3>/sup>/year and they take into account 90% availability for all facility flows.
2. The Co-disposal Facility includes the Reclaim Pond and Seepage Collection Ponds 4 and 5.
3. Slurry water flow assumes a solids content of 75%. If a lower solids content were used, this flow would increase; however, the reclaim would increase by the same amount.
4. The fresh water requirement of the plant is 3.1t/hr at 90% availability, which is based Aker Solutions Water Balance, Revision D, dated November 15, 2010.
5. Runoff and evaporation assume long-term average values.
6. In the event that adequate storage is avaliable at the ETF, treated effluent can be used for dust control instead of fresh water.
7. It is not currently planned to construct the Contingency Pond. A decision to construct would be made during operations if it is deemed advantageous to do so.

REFERENCE

Drawing Provided by Golder Associates Ltd (February 2011)

FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

TITLE

END OF OPERATIONS WATER BALANCE

Golder Associates
Edmonton, Alberta

FILE No. E-WM-007-GIS.mxd				
PROJECT NO. 09-1373-1004			NO SCALE	REV. 0
DESIGN	SC	25 Feb. 2011	**FIGURE: 3.III.6.2**	
GIS	SC	28 Apr. 2011		
CHECK	AC	28 Apr. 2011		
REVIEW	KAB	28 Apr. 2011		

- The predicted discharge to the environment is relatively small, indicating that the water management system has been optimized in terms of internal recycling within the Plant, including thickening of the tailings, and achieving a high level of reclaim from the CDF back to the Plant.
- On an annualized basis, there is more than enough water reporting to the Surge Pond under normal climatic conditions to supply the Plant reclaim requirements.
- Water in the CDF will have to be managed to ensure that sufficient water is available in the Reclaim Pond to supply the Plant throughout the winter season. If not, it would be necessary to increase the intake of freshwater during the winter, which would correspondingly increase the effluent volume which would report at freshet.
- As stated in Section 3.III.3.1, there is a potential to reduce the annual fresh water requirements from Lou Lake by up to 30 300 m^3 (the dust control from May to September) if treated effluent from the ETF can be used for dust control. This option would require the installation of a surge tank to store treated effluent (or alternatively to draw treated water from the Contingency Pond, if it is constructed).

3.III.6.3.3.2 Effects of Climate Variability

Tables 3.III.6-1 and 3.III.6-2 summarize the potential effects of climate variability on the operational water balances.

For the first year of operation, if the climatic conditions are wetter than the 5-year dry period, the fresh water requirement for the Plant will remain at the minimum, which is about 27 160 m^3 per year. The CDF reclaim will provide the remainder of the Plant water requirements (up to 48 m^3/h). These climatic conditions will also generate excess contact water that will require treatment in the ETF prior to release to the environment. When the climatic conditions are drier than the 5-year dry period, the reclaim water from the CDF will not be able to meet all of the water requirements of the Plant. In such dry periods, the deficit in the water requirement of the Plant will need to be replaced with additional fresh water from Lou Lake. The ETF may not be operational during such dry periods as there will no be excess reclaim water from the NICO Project.

By about Year 10, however, for climate conditions up to the 100-yr dry year, the fresh water requirements will remain the same. This is due to the significant annual runoff into the pit (due to the large disturbed area) which will be collected in the pit sump and pumped to the Surge Pond, even under dry conditions.

The excess water that would require treatment prior to discharge to the environment is summarized in Table 3.III.6-1.

Table 3.III.6-1: Summary of Annual Water Balance for Operational Years

Source of Water	Total Water Volume (M-m³)					
	Start-up			End of Operations		
	25-Year Dry	Average	25-Year Wet	25-Year Dry	Average	25-Year Wet
Inflows						
- Runoff	0.386	0.535	0.761	0.498	0.534	0.982
- Seepage into Open Pit	0.009	0.009	0.009	0.110	0.110	0.110
- Fresh water from Lou Lake	0.114	0.070	0. 070	0. 070	0. 070	0. 070
- Ore moisture content	0.131	0.131	0.131	0.131	0.131	0.131
Net Inflows	**0.640**	**0.745**	**0.971**	**0.820**	**1.001**	**1.293**
Losses						
- Water retained in tailings void	0.446	0.446	0.446	0.446	0.446	0.446
- Spillage in plant area	0.002	0.002	0.002	0.002	0.002	0.002
- Evaporation losses	0.132	0.132	0.132	0.212	0.212	0.212
- Seepage losses	0.012	0.012	0.012	0.012	0.012	0.012
- Dust control	0.030	0.030	0.030	0.030	0.030	0.030
- Potable water loss (10%)	0.001	0.001	0.001	0.001	0.001	0.001
- Moisture of concentrate	0.006	0.006	0.006	0.006	0.006	0.006
- Discharge from the ETF to Peanut Lake	0.000	0.104	0.330	0.088	0.280	0.572
- Discharge from STP to Peanut Lake	0.011	0.011	0.011	0.011	0.011	0.011
- Total Discharge to Peanut Lake	0.011	0.115	0.341	0.099	0.291	0.583
Net Losses	**0.640**	**0.745**	**0.971**	**0.820**	**1.001**	**1.293**

Note: The treated effluent from the ETF and from the Sewage Treatment Plant will both discharge together through the same diffuser into Peanut Lake.
M-m³ = million cubic metres

Table 3.III.6-2: Annual Freshwater Requirements of the Plant from the Lou Lake

Operational year	Total Water Volume (m³)						
	25-Year wet	Average	5-Year Dry	10-Year Dry	25-Year Dry	50-Year Dry	100-Year Dry
Start-up	27 156	27 156	27 156	32 966	70 976	78 093	126 332
End of Operations	27 156	27 156	27 156	27 156	27 156	27 156	27 156

Note: There are additional fresh water requirements for dust control and for potable water.
m³ = cubic metre

3.III.7 POST CLOSURE WATER MANAGEMENT

3.III.7.1 Co-Disposal Facility

At closure, cover material will be placed over the entire surface area of the CDF, effectively encapsulating the co-disposed tailings and mine rock. The proposed closure cover has been selected to minimize wind and water erosion, and to reduce infiltration into the CDF. Over the long-term, reducing infiltration will reduce the volume of water which will seep out of the toe of the CDF and report to the SCPs. The proposed closure cover system is intended to be effective at shedding water (primarily of benefit during the spring freshet), and also to provide adequate store and release capacity to minimize infiltration during the dry summer months.

Figure 3.III.7-1 provides 2 details for the proposed cover design. Detail 1 applies where the cover is underlain by co-disposed tailings and mine rock (i.e., on the top surface of the CDF), while Detail 2 applies where the cover will be underlain by Mine Rock alone (i.e., on the sloped perimeter dyke). In Detail 1, the surface of the cover will comprise 0.5 m of overburden (i.e., select glacial till) underlain by 0.25 m of sand. In Detail 2, the cover will comprise a single 1.0 m thick layer of select glacial till, (without an underlying sand layer). The top surface of the closed CDF will slope towards the west at about 2% to enhance the water shedding capacity, reducing net infiltration rates to 10 to 15% of the total precipitation. The 0.25 m sand layer will serve as a capillary break, to minimize the potential for upward flux of tailings pore water, reducing the potential for metals uptake by vegetation. Because the glacial till and mine rock alone will not be a significant source of arsenic uptake, there is no need to include a capillary break under the perimeter dyke cover.

Field testing of both cover details will be carried out to evaluate their relative performance in terms of net infiltration rates. This could be achieved by constructing two large scale lysimeters, one containing co-mingled tailings and mine rock and one containing mine rock, and then covering these materials with Detail 1 and Detail 2 covers, respectively.

3.III.7.2 Open Pit

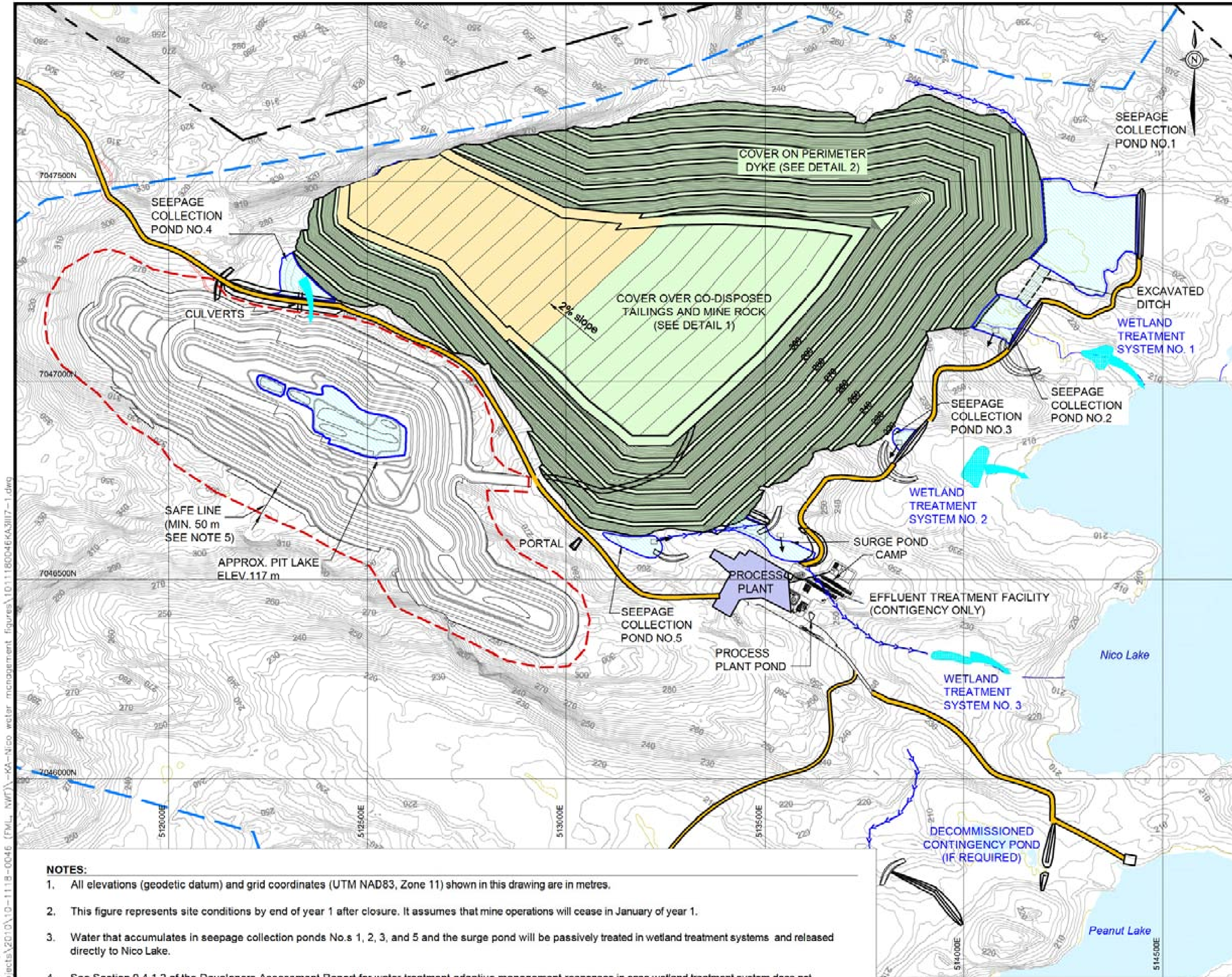
At closure, pumping of water out of the Open Pit will cease and the Open Pit will slowly fill with water. Flooding of the Open Pit is beneficial because higher water levels will reduce localized areas of potentially acid generating rock exposed to atmospheric conditions, thus reducing the total metal loading from the pit wall runoff over time. The rate of flooding will be increased by directing runoff from the top surface of the CDF into the Open Pit.

Modelling indicates that it will take approximately 120 years for the pit water level to rise to Elev. 260 m, at which time the Flooded Open Pit may begin to overflow through the former haul road ramp. In later years of pit flooding, prior to the potential overflow, the water quality will be evaluated for the purpose of assessing the need for long term water treatment when overflow occurs. The base case to manage the overflow water is to drain it through a ditch to Wetland Treatment System No. 4 shown in Figure 3.III.7-2. Contingencies for treatment of the overflow water are discussed in Section 3.III.10.

3.III.7.3 Treatment of Co-Disposal Facility Toe Seepage

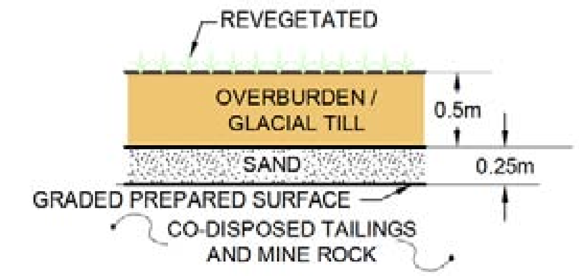
It is assumed that water which accumulates in SCP No. 1, 2, 3, and 5, as well as the Surge Pond, will be passively treated in Wetland Treatment Systems No. 1, 2, and 3 (shown on Figures 3.III.7-1 and 3.III.7-2) and then released directly into Nico Lake. This is subject to the demonstration of the technical feasibility of wetland treatment.

It is proposed that the Wetland Treatment Systems be constructed and tested during the operating life of the mine. If the technical feasibility of wetland treatment is not demonstrated prior to closure, then the contingency will be to continue to pump water from SCP No. 1, 2, 3, and 5, as well as from the Surge Pond, into the Open Pit.

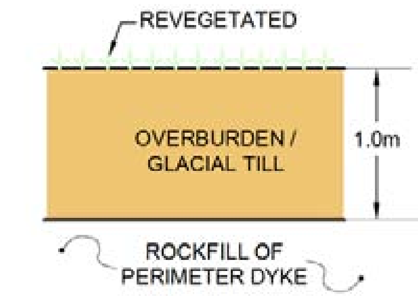


LEGEND

- PUMP STATION (CONTINGENCY ONLY)
- BOULDER WALL
- DIVERSION DITCH
- PROJECT LEASE BOUNDARY
- WATERSHED
- ACCESS ROAD
- SEEPAGE COLLECTION POND DAM
- EMERGENCY SPILLWAY
- CO-DISPOSED TAILINGS AND MINE ROCK
- CONSTRUCTED WETLAND TREATMENT SYSTEM
- DEMOLISHED AND REVEGETATED
- RE-VEGETATED COVER OVER CO-DISPOSED TAILINGS AND MINE ROCK
- WATER BODY



DETAIL 1



DETAIL 2

REFERENCE

Base mapping provided in digital format by Fortune Minerals Limited received 20 February 2004.

Process plant and mine infrastructure provided by Aker Solutions filename 0000g001d (plant site oct252010).dwg provided 26 October 2010. Revised pits provided by P & E Mining Consultants, ultimate pit and topo.dxf on 26 January 2010.

Project lease boundary provided by Fortune (October 8, 2008) with comments provided 19 December 2009.

200 0 200 400

SCALE 1:10,000 METRES

NOTES:

1. All elevations (geodetic datum) and grid coordinates (UTM NAD83, Zone 11) shown in this drawing are in metres.
2. This figure represents site conditions by end of year 1 after closure. It assumes that mine operations will cease in January of year 1.
3. Water that accumulates in seepage collection ponds No.s 1, 2, 3, and 5 and the surge pond will be passively treated in wetland treatment systems and released directly to Nico Lake.
4. See Section 9.4.1.2 of the Developers Assessment Report for water treatment adaptive management responses in case wetland treatment system does not operate as planned.
5. A boulder wall will be constructed around the open pit for safety reasons (to prevent inadvertent human access) a minimum safe line of 50 m has been assumed, this will be confirmed in the open pit stability and set-back study to be carried out by the end of the mine life operation.

FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

TITLE

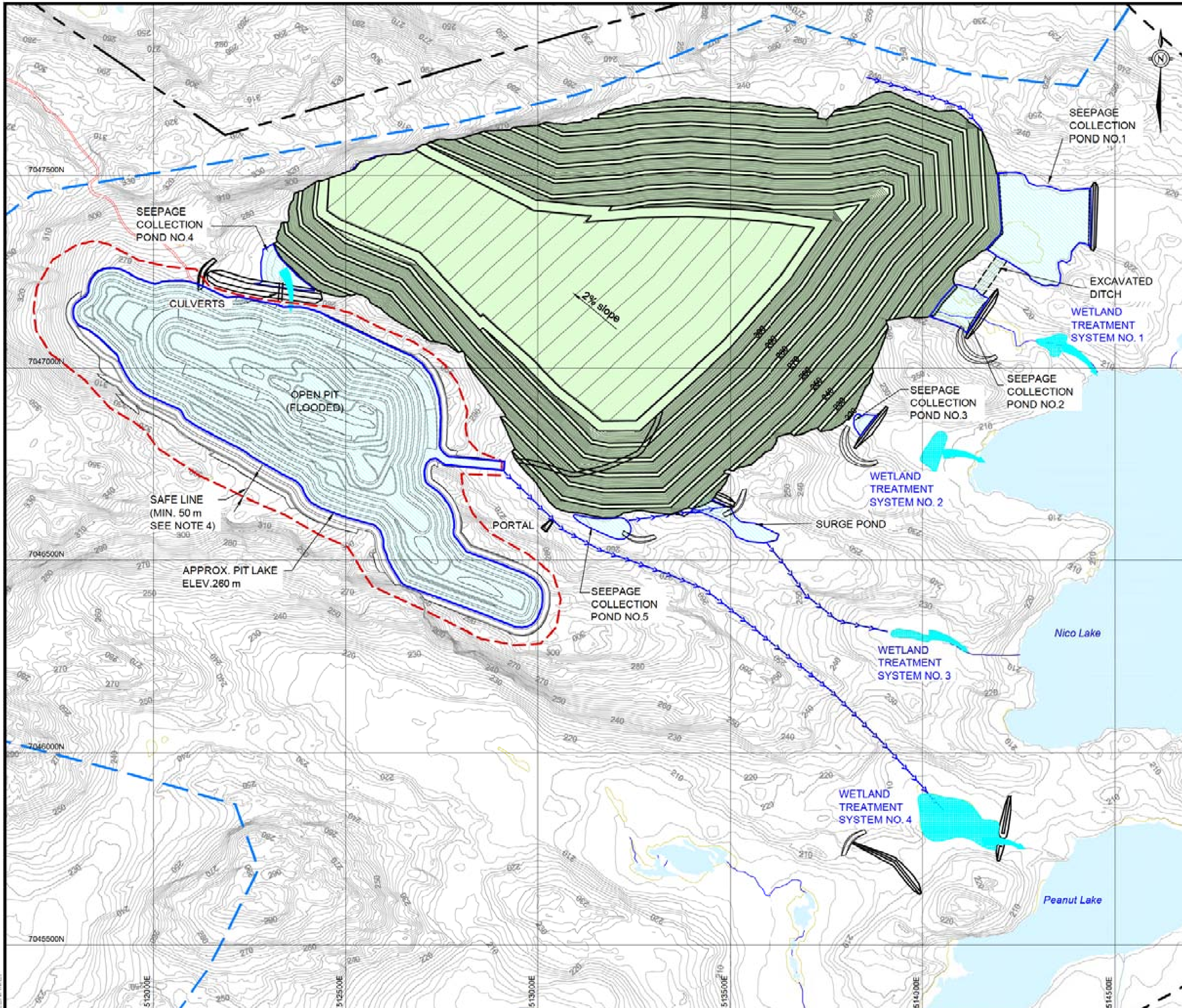
LAYOUT OF THE POST CLOSURE WATER MANAGEMENT BEFORE PIT OVERFLOW

FILE No: E-WM-008-CAD.dwg

PROJECT No: 09-1373-1004			SCALE AS SHOWN	REV. 0
DESIGN	IM	10 May 2011	FIGURE 3.III.7-1	
CAD	TDR	10 May 2011		
CHECK	IM	10 May 2011		
REVIEW	KAB	10 May 2011		

Golder Associates
Edmonton, Alberta

PLOT DATE: May 11, 2011
FILENAME: T:\Projects\2010\10-1118-0046 (FML_NWT)\-KA-Nico water management figures\1011180046KA3III7-1.dwg



LEGEND

- BOULDER WALL
- DIVERSION DITCH
- PROJECT LEASE BOUNDARY
- WATERSHED
- SEEPAGE COLLECTION POND DAM
- EMERGENCY SPILLWAY
- CONSTRUCTED WETLAND TREATMENT SYSTEM
- REVEGETATED
- WATER BODY

NOTES:

1. All elevations (geodetic datum) and grid coordinates (UTM NAD83, Zone 11) shown in this drawing are in metres.
2. Water that accumulates in seepage collection ponds No.'s 1, 2, 3, and 5 and the surge pond will be passively treated in wetland treatment systems and released directly to Nico Lake.
3. Water from the open pit will be passively treated in wetland treatment system No.4 from where it will be discharged into Peanut Lake.
4. See Section 9.4.1.2 of the Developers Assessment Report for water treatment adaptive management responses in case wetland treatment system does not operate as planned.
5. A boulder wall will be constructed around the open pit for safety reasons (to prevent inadvertent human access) a minimum safe line of 50 m has been assumed, this will be confirmed in the open pit stability and set-back study to be carried out by the end of the mine life operation.

REFERENCE

Base mapping provided in digital format by Fortune Minerals Limited received 20 February 2004.

Process plant and mine infrastructure provided by Aker Solutions filename 0000g001d (plant site oct252010).dwg provided 26 October 2010. Revised pits provided by P & E Mining Consultants, ultimate pit and topo.dxf on 26 January 2010.

Project lease boundary provided by Fortune (October 8, 2008) with comments provided 19 December 2009.

200 0 200 400
SCALE 1:10,000 METRES

FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

TITLE

LAYOUT OF THE POST CLOSURE WATER MANAGEMENT AFTER PIT OVERFLOW

Golder Associates
Edmonton, Alberta

FILE No: E-WM-009-CAD.dwg

PROJECT No. 09-1373-1004			SCALE AS SHOWN	REV. 0
DESIGN	IM	10 May 2011	FIGURE 3.III.7-2	
CAD	TDR	10 May 2011		
CHECK	IM	10 May 2011		
REVIEW	KAB	10 May 2011		

PLOT DATE: May 11, 2011
FILENAME:

3.III.7.4 Post-Closure Water Balances

Post-closure water balances have been developed to predict the flows that may need to be treated before and after the pit overflow. Figures 3.III.7-3 and 3.III.7-4 provide graphical representations of the post-closure water management and annual water balances.

3.III.7.4.1 Model Inputs and Assumptions

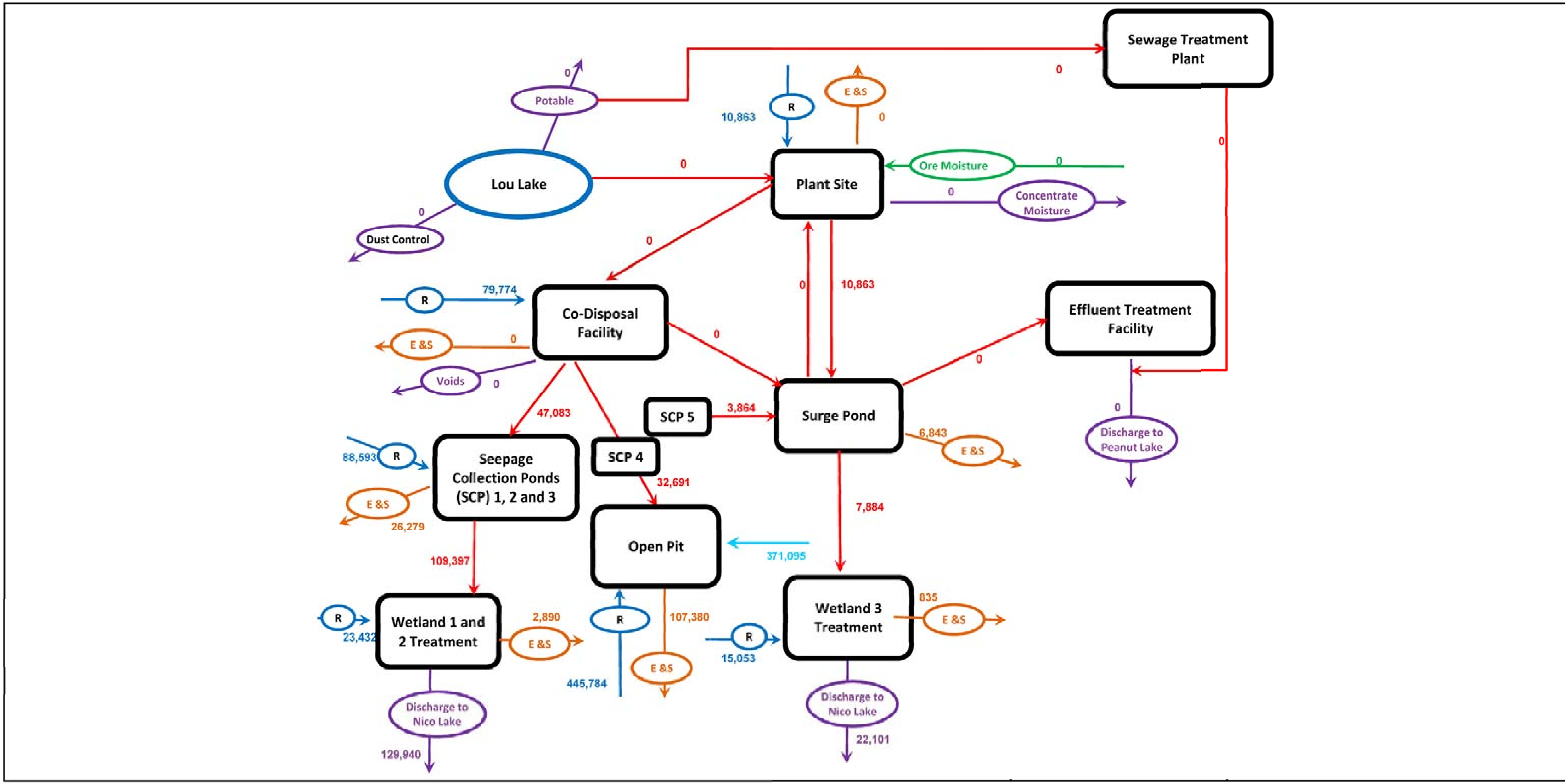
The model inputs post-closure are similar to those during operations (Section 3.III.6.2), with the following exceptions:

- flows related to the ore and tailings production have been removed; and
- fresh water inflows from Lou Lake have been removed (fresh water will no longer be required for ore processing, potable water, or dust control).

3.III.7.4.2 Post-Closure Water Balance Results

The post-closure volumes of water that requires treatment through the constructed wetlands under various climatic conditions are summarized in Table 3.III.7-1. The following points are noted:

- While the Open Pit is filling (prior to overflow), the total discharge into Nico Lake through Wetland Treatment Systems No. 1, 2, and 3 will vary from 100 000 to 232 000 m^3 per year (average 152 000 m^3 per year).
- If constructed, the Contingency Pond will be decommissioned as part of closure.
- Operation of the ETF will cease at closure (unless Wetland Treatment Systems No. 1, 2, and 3 prove to be inadequate). After closure, and prior to pit overflow, there will be no discharge to Peanut Lake.
- After Open Pit overflow occurs, the discharge into Peanut Lake through the Wetland Treatment System No. 4 will vary from 242 000 to 601 000 m^3 per year (average 385 000 m^3 per year) for the climatic scenarios evaluated. The high discharge rate is primarily due to precipitation on the Open Pit surface which would result in high dilution of the overflow water.



LEGEND

- Rainfall, Runoff
- Evaporation, Seepage and Spillage Losses
- Other Losses
- Other Inflows
- Internal Flows
- Conditional Flows

NOTES

1. Flows are all in m^3/year.
2. The diagram represents the intial post closure period when the open pit is filling (i.e., prior to spill over).
3. Water which accumulates in Seepage Collection Ponds 1, 2, 3, 5 and the Surge Pond will be passively treated in wetlands and released directly to Peanut and Nico Lakes. This is subject to demonstration of the technical feasibility of wetland treatment. If not feasible, adaptive measures, as described in Section 3.III.10.5 may be considered.

REFERENCE

Drawing Provided by Golder Associates Ltd (February 2011)

FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

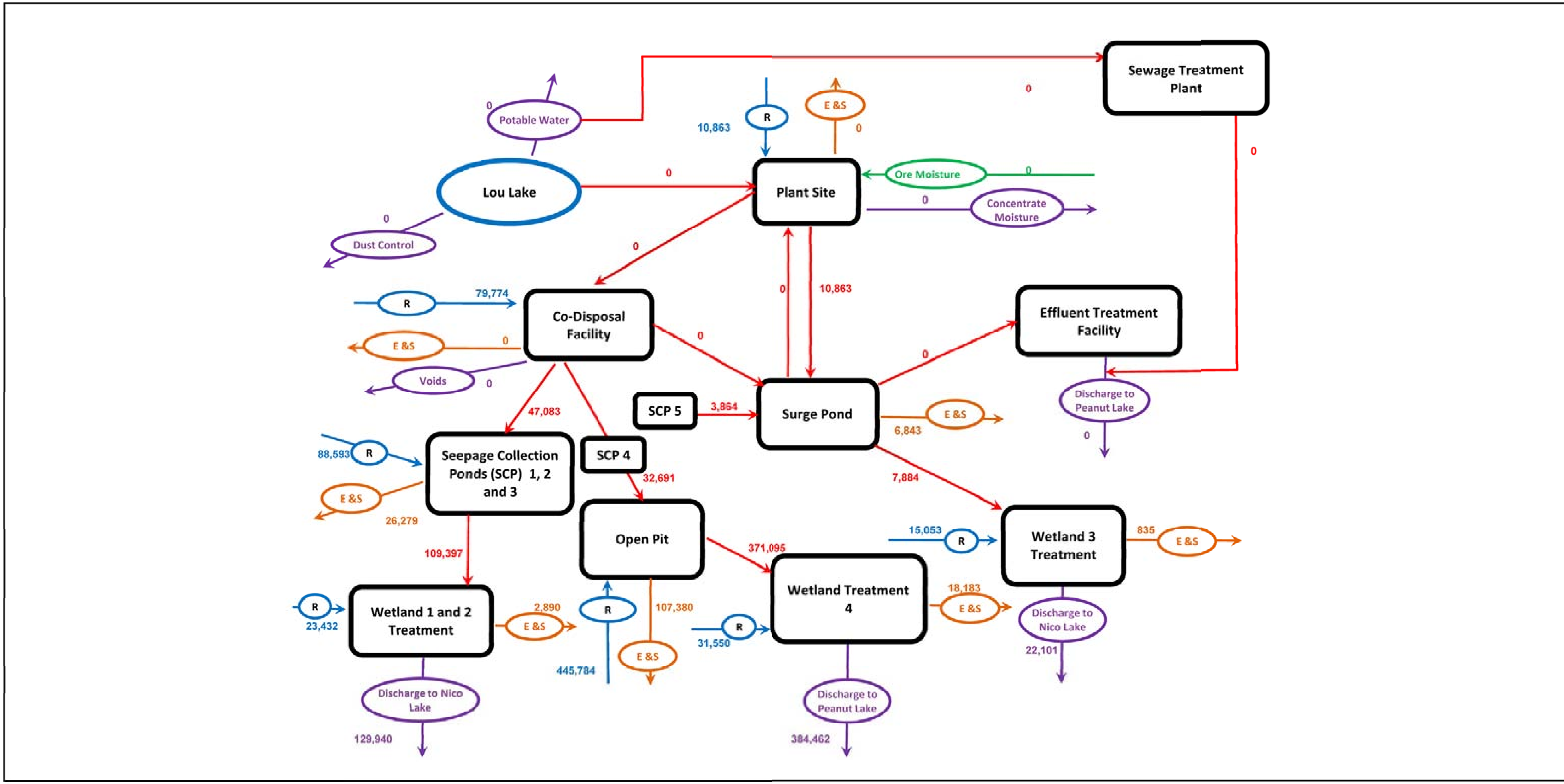
TITLE

POST-CLOSURE WATER BALANCE - BEFORE PIT OVERFLOW

FILE No. E-WM-010-GIS.mxd

PROJECT NO. 09-1373-1004			NO SCALE	REV. 0
DESIGN	SC	25 Feb. 2011	FIGURE:	
GIS	SC	28 Apr. 2011		
CHECK	AC	28 Apr. 2011	3.III.7.3	
REVIEW	KAB	28 Apr. 2011		

Golder Associates
Edmonton, Alberta



LEGEND

- Rainfall, Runoff
- Evaporation, Seepage and Spillage Losses
- Other Losses
- Other Inflows
- Internal Flows

NOTES

1. Flows are all in m^3/year.
2. The diagram represents the final post closure period after the open pit spills over.
3. Water which overflows from the open pit, plus water which accumulates in Seepage Collection Ponds 1, 2, 3, 5 and the Surge Pond will be passively treated in wetlands and released directly to Peanut and Nico Lakes. This is subject to demonstration of the technical feasibility of wetland treatment. If not feasible, adaptive measures, as described in Section 3.III.10.5 may be considered.

REFERENCE

Drawing Provided by Golder Associates Ltd (February 2011)

FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

TITLE

WATER BALANCE AFTER CLOSURE AFTER PIT OVERFLOW

Golder Associates
Edmonton, Alberta

FILE No. E-WM-011-GIS.mxd

PROJECT NO. 09-1373-1004			NO SCALE	REV. 0
DESIGN	SC	25 Feb. 2011	**FIGURE: 3.III.7.4**	
GIS	SC	11 Apr. 2011		
CHECK	KS	11 Apr. 2011		
REVIEW	MR	11 Apr. 2011		

Table 3.III.7-1: Summary of Annual Water Balance for Closure Years

Source of water	Total Water Volume (M-m^3)					
	Closure – Prior to Pit Overflow			Closure – After Pit Overflow		
	25-Year Dry	Average	25-Year Wet	25-Year Dry	Average	25-Year Wet
Inflows						
- Precipitation	0.482	0.667	0.950	0.505	0.699	0.995
- Seepage into Open Pit	0.110	0.110	0.110	0.110	0.110	0.110
Net Inflows	**0.591**	**0.777**	**1.060**	**0.614**	**0.808**	**1.104**
Losses						
- Evaporation losses	0.243	0.243	0.243	0.261	0.261	0.261
- Seepage losses	0.011	0.011	0.011	0.011	0.011	0.011
- Water stored in/lost from Open Pit	0.238	0.371	0.574	0	0	0
- Discharged to Nico Lake	0.100	0.152	0.232	0.100	0.152	0.232
- Discharged to Peanut Lake	0	0	0	0.242	0.385	0.601
Net Losses	**0.591**	**0.777**	**1.060**	**0.614**	**0.808**	**1.104**

M-m^3 = million cubic metres

3.III.8 SITE EFFLUENT TREATMENT

3.III.8.1 Design Basis during Construction

Except for sewage, there is no planned treatment of site water during the construction period. Sewage treatment is discussed in Section 3.III.9. Other site flows during construction will be impounded until start-up when they will either be pumped to the process water tank or treated in the ETF.

3.III.8.2 Design Basis during Operations

The purpose of the proposed treatment process is to reduce concentrations of aluminum, ammonia, arsenic, cadmium, cobalt, iron, lead, selenium, and uranium. The end of pipe effluent treatment goals are based on the SSWQO.

Assumptions made regarding the treatment process and preliminary design basis for the ETF were:

- The hydraulic basis of design for equipment was a predicted flow volume of 1597 m^3/day, which is the maximum design flow rate based on a 25 year wet return at the end of operations.
- The average ETF influent (0.192 M-m^3 or 525 m^3/day) used for the estimation of operations and maintenance costs was the average of the start-up (284 m^3/day) and end of operations (766 m^3/day) flows to the ETF.
- The ETF design basis assumes that water will be treated and released 12 months per year.
- The composition of the influent reporting to the ETF was based on a range of “worst case” and “early operation” conditions (Table 3.III.7-2). The influent design basis was based on the results of geochemical predictions of mine water quality during operations.

- Chemicals that could be used in the treatment process for ion exchange regeneration (assuming the mine life average treatment rate of 555 m^3/day include 35% hydrochloric acid (1.47 m^3/year), and 50% sodium hydroxide (1.06 m^3/year). Ion exchange regenerant rates will be 563 m^3/year (hydrochloric acid), and 222 m^3/year 50% sodium hydroxide. Note that regenerant rates are based on the flow rates required during a regeneration cycle which is typically several minutes to a few hours. This is the reason that the regenerant rate is higher than the total annual quantity of each chemical required on an annual basis.

Table 3.III.7-2: Influent Water Quality

Parameter	Worst Case Values	Early Operations Values
pH	6.2	5.4
Aluminum (mg/L)	6.0	3.0
Ammonia (mg/L)	15.0	15.0
Arsenic (mg/L)	0.7	0.37
Cadmium (mg/L)	0.0007	0.0007
Cobalt (mg/L)	0.3	0.25
Iron (mg/L)	10.0	8.0
Lead (mg/L)	0.02	0.0074
Selenium (mg/L)	0.1	0.046
Uranium (mg/L)	0.1	0.07

mg/L = milligram per Litre

3.III.8.3 Treatment Process and System during Operations

Figure 3.III.8-1 provides a schematic diagram of the process to be used in the ETF. The process steps are as follows:

- equalization;
- micro-filtration, at approximately 5 microns, for reduction of total suspended solids; and
- conventional anion and cation exchange for gross contaminant removal followed by polishing with specialty media or ion exchange resins.

Raw effluent from the Surge Pond will be pumped to the ETF where the solution will be filtered. Micro-filtration is necessary for the optimum operation of the ion exchange system to prevent suspended solids from clogging or blinding the ion exchange system. After filtration, water will undergo treatment in the ion exchange and polishing systems. Conventional cation exchange resin (hydrogen form) and anion exchange resin (hydroxide form) will be used in the ion exchange process. The cation exchange resin will be regenerated using hydrochloric acid, and the anion exchange resin with sodium hydroxide. The final stage of treatment will be a polishing step, using a speciality polishing media. It is assumed that the projected ETF effluent will achieve the SSWQO at the end-of-pipe for all parameters (except selenium) during operations. The projection of the ETF effluent quality is based on standard practise theoretical calculations. The actual removal of parameters from the ETF water matrix will be confirmed with treatability studies during detailed design.

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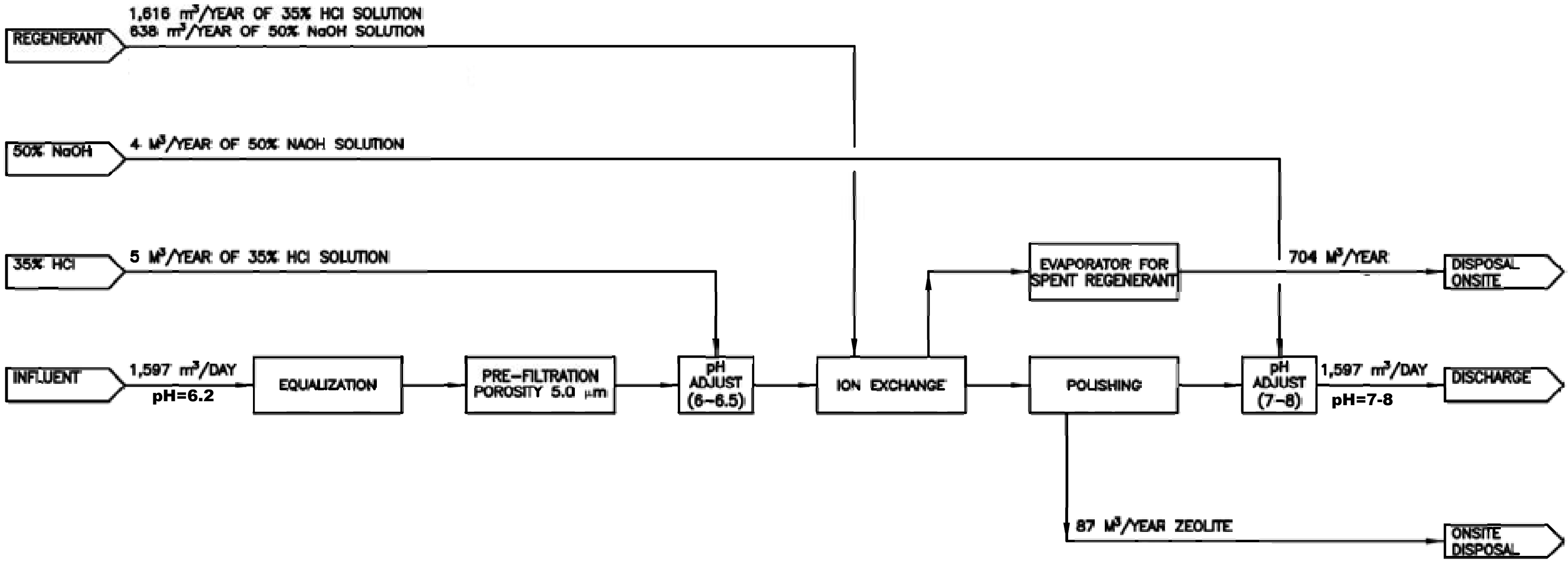

NOTES

1. Quantities shown are for the sizing of equipment based on the maximum flow values.
2. Quantities shown on the operating cost estimates are based on the annual average values and therefore do not match the values shown above.

REFERENCE

Drawing Provided by Golder Associates (2010)

FORTUNE MINERALS LIMITED
NICO DEVELOPER'S ASSESSMENT REPORT

TITLE
SCHEMATIC DIAGRAM OF THE EFFLUENT TREATMENT FACILITY PROCESS

Golder Associates
Edmonton, Alberta

FILE No. E-WM-012-GIS.mxd

PROJECT NO. 09-1373-1004			SCALE AS SHOWN	REV. 0
DESIGN	SC	8 Apr. 2011	FIGURE: 3.III.8.1	
GIS	SC	9 May. 2011		
CHECK	AC	9 May. 2011		
REVIEW	KAB	9 May. 2011		

Ion exchange will create a secondary waste in the form of the spent regenerant solutions. The projected average regenerant volume during the highest flow conditions will be 2.7 m^3/day. Evaporation of the regenerant could reduce the spent regenerant solution by approximately 75%, with subsequent disposal of the concentrated waste at an appropriate off-site disposal facility.

3.III.8.3.1 Effluent Treatment Rate

The predicted volumes to the ETF during operations for average and wet year conditions are shown in Table 3.III.8-1. The values assume the annual operating schedule for the ETF will be 12 months.

Table 3.III.8-1: Predicted Effluent Flow Volumes

	Average Flow (m^3)		25 Year Wet Flow (m^3)	
	Start-up	**End of Operation**	**Start-up**	**End of Operation**
Monthly Operating	8 600	23 000	27 500	47 500
Annual Operating	103 600	279 000	330 000	572 000

m^3 = cubic metre

3.III.8.4 Post Closure Passive Treatment

Wetland treatment has been selected as the base case for post-closure treatment of water that accumulates in SCP No. 1, 2, 3, and 5, and the Surge Pond. Passive treatment may also be implemented to treat Flooded Open Pit overflow if it is necessary and appropriate. Passive treatment options could include anaerobic treatment in biochemical reactors (BCRs), and/or aerobic wetlands. Passive treatment options have been developed for the purpose of initial evaluation. Conceptual design of the post-closure passive treatment options will take place prior to the detailed design stage of the NICO Project and will be submitted during water licensing. Field trials, based on actual site conditions and detailed from conceptual designs, will take place during mine operations. The detailed engineering design will be completed following scale-up of the field trial cells, using design criteria and operating parameters optimized from those trials.

If passive treatment proves to be an unsustainable option for post-closure treatment of site discharge, then alternative treatment methods will be investigated as discussed in Section 3.III.10.4.

A brief overview of the 2 main passive treatment options, anaerobic (BCRs) and aerobic (wetlands), is provided below. It is probable that the design of the passive treatment options for the NICO Project will be based on a combination of the two.

Biochemical Reactors

Biochemical reactors use a combination of biological, chemical, and physical processes to reduce metal concentrations. Metal removal can occur via biological sulphate reduction to sulphide and subsequent precipitation of metal sulphides, hydroxide precipitation, and sorption to iron and aluminum hydroxides. Selenium removal occurs via dissimilatory (i.e. via microbial activity) reduction of dissolved selenium species to insoluble elemental selenium. Metal removal in BCRs is well documented, and design criteria have been established.

Typical BCRs are designed as geomembrane-lined ponds, which are filled with a mixture of locally available organic carbon sources such as peat, wood chips and hay; and a buffering agent such as limestone. The mixture is usually selected based on site-specific bench and/or pilot scale test results. In the proposed development schedule, the field trial mixture will be determined by bench/or pilot scale results, whereas, the final designs will be augmented by the design criteria established by the field cells.

Influent typically flows downward through the BCR, passing through the organic media mixture in the process. In this mode, treated water is typically collected via a network of piping and inert gravel in the bottom of the cell, which enables the system to operate under a gravity flow regime. The metal precipitates remain in the cell. Over time, biological processes in the BCRs will consume the organic carbon supply, the limestone will dissolve, and metal precipitates may reduce the hydraulic conductivity of the cell. As a result, BCRs require periodic replacement of the organic media mixture every ten to twenty years of operation. BCR effluent water is typically anoxic, contains varying amounts of total suspended solids, and elevated biochemical oxygen demand. Aerobic wetlands are frequently utilized to remove total suspended solids, reduce the biochemical oxygen demand load, add dissolved oxygen to the BCR effluent, and polish for any parameters that require aerobic rather than anaerobic treatment.

Aerobic Wetlands

In an aerobic wetland, metal removal can occur via consumption by a microbial population, sorption to organic matter, plant uptake, and oxidation in aerobic sections of the wetland, precipitation as metal sulphides in anaerobic wetland sediments, and sorption to iron and aluminum hydroxides. Selenium removal can occur via plant uptake, biological reduction in anaerobic sediments, and volatilization by algae and bacteria. Trace metal removal in wetlands is well documented, but design criteria are not well established and must be determined for each site. The relatively low velocity flows through a passive treatment system also allow for removal of suspended solids if present. Constructed wetlands treatment is a relatively new technology and is generally applicable to lower flow rate waste streams at remote locations where power and operations personnel are not readily available. This will be the situation at NICO following closure. The key design parameters are the surface area and the contact time required to achieve the desired constituent removal level. Routine maintenance activities may be limited to occasional monitoring of the microbial populations and the addition of micronutrients. Long-term maintenance activity may include periodic sludge or solids removal.

Aerobic wetlands typically include both vegetated cells with wetland plant species and free surface water cells, which resemble shallow mixing basins. Typical wetlands are constructed as a series of lined and bermed cells, with water depths of about 0.5 m, which resemble natural vegetated wetlands. The discharge water from aerobic wetlands does not require polishing treatment and can be discharged directly to the environment.

3.III.8.4.1 Passive Treatment in Cold Environments

Appropriately designed BCRs are effective in cold environments similar to those experienced at the NICO Project. Golder has designed and constructed systems at cold sites in the Canadian Rocky Mountains (Rutkowski and Hanson, 2010), central Montana (Blumenstein et al. 2008), Peruvian Andes Mountains, Colorado (Reisman et al. 2008), Northern Ontario, and Pennsylvania. Although the reaction rates of the biological treatment decrease in response to lower temperatures, the processes do continue and are effective even when influent temperatures approach freezing. Multiple BCR systems function effectively with influent water temperatures of 1 or 2°C (Reisman et al. 2008). An existing pilot BCR for selenium removal in west central Alberta has been operating effectively for 2 winters with ambient and water temperatures as low as -40°F and 1°C, respectively (Rutkowski and Hanson, 2010). At cold sites, BCRs can be designed as buried cells covered with geomembrane and soil cover for insulation.

Cold weather performance of aerobic wetlands can vary as any freezing of the wetland surface will decrease oxygen transfer from the atmosphere to the water and will thereby affect dissolved oxygen and redox conditions in the wetland water and sediments. Natural wetlands have been shown to alternate between metal removal and metal release on a seasonal basis (August et al. 2002) due to changing redox conditions. Although engineered wetlands can reduce seasonal variability, redox sensitive metals such as arsenic, selenium, and iron, can be susceptible to re-mobilization in engineered systems. It is unclear how the lack of flow during winter months at the NICO Project would affect the potential for seasonal variability for metal removal. Pilot testing is recommended to characterize seasonal performance of an aerobic wetland.

3.III.9 SEWAGE TREATMENT FACILITY

The camp sewage will be treated in a modular RBC sewage treatment plant, which will be located adjacent to the mine incinerator. The Plant will be designed for up to 153 permanent operational personnel and up to 278 construction workers. The ability of the plant to deal with the increased treatment rate during the construction period will be facilitated by the purchase of 2 units. Following the completion of construction, one of the modular units will be dismantled and sold.

The design inflow characteristics and predicted effluent quality (OEM RFP Package 2010) is shown in Table 3.III.9-1.

Table 3.III.9-1: Rotary Biologic Contactors Sewage Treatment Plant Influent and Effluent Characteristics

	Influent	Effluent
Average Flow (m^3/day)	0 to 68.8	
BOD5, (mg/L)	250	<15
TSS (mg/L)	250	<15
NH_3-N (mg/L)	35	2
pH	6.5 to 8.5	
Fecal coliform, M.P.N./100 mL		<400
Fat, oils, and greases		Non-detect

m^3 = cubic metre; mg/L = milligram per Litre

To ensure proper operation of the RBC, grease traps will be installed within the camp kitchen.

Treated sewage effluent will be discharged through the diffuser into Peanut Lake. The sludge will be filtered and incinerated. Ash from the incinerator will be placed in the landfill.

3.III.10 ADAPTIVE MANAGEMENT

3.III.10.1 Inspections

An Operations, Management, and Surveillance manual for the CDF will be prepared prior to the start of operations. This will follow the guidelines of the Mining Association of Canada (MAC 2005). The Operations, Management, and Surveillance manual will explicitly list the responsibilities of the operators, and will state the requirements and schedule for inspections of the CDF, water management pond dams, spillways, and related infrastructure.

As stated in Section 3.III.8.4, wetland treatment field trials will take place during operations to evaluate the performance of the closure Wetland Treatment Systems. The program and schedule for the field trials will be defined in a water treatment manual to be prepared for the NICO Project.

After closure, physical inspections of the Water Management Pond dams and spillways will continue on a regular basis. The schedule and program for the post-closure physical inspections will be set out in the Closure and Reclamation Plan.

Whenever the inspections indicate that it is necessary, maintenance, or corrective measures will be scheduled and implemented.

3.III.10.2 Extreme Climatic Events

3.III.10.2.1 Extreme Precipitation Events

Based on the measured daily rainfall data of Yellowknife Airport, the annual maxima for extreme 24 hours rainfall events were extracted and analysed to calculate the corresponding extreme rainfall events for different statistical periods of return. The results of the analysis are presented in Table 3.III.10-1. The table also includes the 30-day rainfall plus snowmelt event obtained from Environment Canada (2010). The probable maximum precipitation was approximated based on typical values within the region.

Table 3.III.10-1: Extreme Rainfall and Rainfall Plus Snowmelt Events

Return Period (Years)	24 hours Precipitation (mm)	30-day Precipitation + Snowmelt (mm)
5	42.4	106
10	52.4	132
25	65.0	166
50	74.3	191
100	83.6	215
1000[a]	115.4	N/A
PMP	241.7	N/A

[a] Interpolated data

PMP = probable maximum precipitation; mm = millimetres

3.III.10.2.2 Spillway Design Criteria

Seepage Collection Ponds No. 1 to 5, and the Surge Pond (and the Contingency Pond if built), will be sized to store an EDF (on top of the normal operating water level), without a discharge to the environment (i.e., without activation of the emergency spillway). The selected EDF is the runoff resulting from the 30-day, 100 year rainfall plus snowmelt event (215 mm). To protect against overtopping of the dams, storm flows in excess of the EDF will be allowed to discharge over the emergency spillway unimpeded.

The SCPs and Surge Pond will be generally shallow ponds that will retain a limited volume of water and no tailings. Failure of the dams would release untreated water into Nico Lake. No infrastructure is located downstream of the dams. Therefore, release of the untreated water is envisioned to *temporarily* impact the water quality of the downstream lakes. Accordingly, the dams are collectively classified as “Low Consequence”.

Canadian Dam Association (2007) recommends that low consequence dams be designed to safely convey the inflow design flood resulting from 1 in 100 year storm events to avoid overtopping. The guideline also suggests that the dams should be designed to withstand the 1 in 500 year earthquake event.

Seepage Collection Ponds No. 2 and 3, and the Surge Pond, will require spillways capable of safely conveying at least the 1 in 100 year, 24 hour storm event (which is 83.6 mm). Seepage Collection Pond No. 1 will be connected to SCP 2 through a ditch; thus it will be protected by the SCP 2 spillway. A swale will be constructed in the road to control the overflow from SCP No. 4 during extreme events. Because this swale crosses the site service road, a culvert will also be placed under the road. The culvert will be sized to convey the inflow design flood from the CDF. Seepage Collection Pond No. 5 does not require a spillway because it is topographically contained and excess water will be pumped out regularly.

Much of the water from the Surge Pond will be pumped directly to the Plant to meet processing water requirements and the remaining water will be pumped to the ETF for treatment and release. Because of topographical constraints, this pond is not sized to store a large storm event; therefore, a sufficiently large pump is required to maintain the water level under the design event. During a design event, if the ETF cannot handle the flow, then the water reporting to the Surge Pond would be pumped to the Reclaim Pond or the Open Pit.

3.III.10.3 Response to Large Precipitation Events

3.III.10.3.1 During Operations

The design is such that the SCPs will be able to contain the runoff from events up to the selected EDF, which is the 30-day, 100 year rainfall plus snowmelt event (215 mm). Larger events could result in a discharge through the spillways of SCP No. 2 or 3 into Nico Lake. Strategies available to prevent or reduce spillway discharges are to:

- pump down the water level in SCP No. 1, 2, and 3 below their normal operating water levels prior to an anticipated event such as a large spring melt;
- accelerate the rate of treatment in the ETF;
- pump excess water from SCP No. 1, 2, and 3 into the Reclaim Pond for temporary holding; or
- pump excess water from SCP No. 1, 2, and 3 into the Open Pit for temporary holding.

The water held temporarily in the Reclaim Pond or in the Open Pit will have to be subsequently eliminated by treating in the ETF.

3.III.10.3.2 After Closure

The base case for water management after closure is to passively treat water in SCP No. 1, 2, 3, and 5, and the Surge Pond by allowing it to drain by gravity through Wetland Treatment Systems No. 1, 2, and 3 into Nico Lake. The water levels in these ponds will be raised to the spillway invert level to enable gravity drainage.

The ETF and the pumping systems will be left in place for about 10 years after closure, and after that they will be demolished. In the first 10 years after closure, the following actions are available as a contingency in response to anticipated events such as a heavy spring snow melt:

- pump down the water level in SCP No. 1, 2, and 3 below the spillway inverts prior to the heavy spring melt;

- pump water out of the ponds for treatment in the ETF; or
- pump water from the ponds into the Open Pit, which will be slowly flooding.

After the ETF and pumps are decommissioned, the ponds and the Wetland Treatment Systems will operate passively, without active intervention to manage high flow events. If active management appeared necessary, the pumping capacity would have to be brought to site.

3.III.10.4 Contingent Water Treatment during Operations

As described in Section 3.III.8, the water quality of the effluent from the ETF will be good enough to discharge directly to Peanut Lake. If, for any reason, the ETF produces effluent which cannot be released, then the effluent should be sent to the Surge Pond, the Reclaim Pond, or the Open Pit (in that order).

If it becomes apparent during operations that regular post-treatment polishing or flow balancing would be advantageous, the decision may be made to construct a Contingency Pond on the western shore of Peanut Lake, as shown on Figure 3.III.2-1. If a Contingency Pond was constructed, flow from the ETF would be routed through the pond prior to discharge into Peanut Lake, only when it is necessary to do so. At all other times, the ETF effluent would discharge directly through the diffuser into Peanut Lake.

3.III.10.5 Contingent Water Treatment after Closure

3.III.10.5.1 Water from Co-Disposal Facility Seepage

If, immediately after closure, the quality of the water discharged from Wetland Treatment Systems No. 1, 2, and 3 fails to meet the SSWQOs for discharge into Nico Lake, the ETF can be used to actively treat the water for discharge into Peanut Lake. Alternatively, the pumping systems can be used to pump water from SCP No. 1, 2, 3, and 5 and the Surge Pond into the Open Pit.

Once SSWQOs are met by the wetland treatment, the ETF and pumping systems can be decommissioned. The Wetland Treatment Systems will then be operating in a fully passive mode, with no further opportunity for contingent treatment or alternate discharge (to the Open Pit or the Surge Pond). Note that the water quality entering the wetlands as seepage from the CDF should conceptually improve over time as metals are rinsed out of the CDF and immobilized by treatment at the ETF or in the wetlands.

3.III.10.5.2 Open Pit Overflow Water

As stated in Section 3.III.7.2, it will take approximately 120 years for the pit to flood. Ideally, the overflow water would then be passively treated in Wetland Treatment System No. 4 prior to discharge into Peanut Lake. If the water quality in the Open Pit is not amenable to wetland treatment, then several other alternatives are available for the treatment of the overflow water, including the following:

- treating the water in the Flooded Open Pit prior to overflow by chemical or biological means and then allowing it to discharge through the ditch into Peanut Lake; or
- building a new ETF for active treatment prior to discharge into Peanut Lake (i.e., the same general type of treatment as during the operational period of the mine).

3.III.10.6 REFERENCES

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