Snap Lake Mine

Water Management Plan

October 1, 2013

DE BEERS

GROUP OF COMPANIES

De Beers Snap Lake Mine

Water Management Plan

(Water License MV2011L2-0004)

1 October 2013

Rev 1.0

De Beers Canada Mining Inc.

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UNITS

M	metre
m^3/d	cubic metres per day
mg/L	milligrams per litre
Mt	mega tonne
T	tonne

ACRONYMS

EAR	environmental assessment report
non-PAG	not potentially acid-generating
PAG	potentially acid-generating
PK	processed kimberlite
PKC	processed kimberlite containment
PWCS	perimeter water control structures
PWTP	potable water treatment plant
PS	perimeter sump
SBR	sequencing batch reactor
SNP	surveillance network program
STP	sewage treatment plant
TWTP	temporary water treatment plant
TSS	total suspended solids
WMP	water management pond
WTP	water treatment plant

1 INTRODUCTION

1.1 PURPOSE

The purpose of the Snap Lake Mine Water Management Plan (the Plan) is to provide a description of the design and management of water systems at the Snap Lake mine site. The plan describes water management activities during the operational phase, which commenced in 2007 and will continue through to closure. The Plan applies to all operations.

The Plan updates prior water management information presented in the Environmental Assessment Report (EAR) for the Project (De Beers 2002) in accordance with the previously approved 2009 Water Management Plan. The update of the Plan will incorporate changes to the water management facilities and will take into account the most recent information available, along with criteria contained in Schedule 5 of Water License MV2011L2-0004. The Plan is intended to complement other related documents, including the Aquatic Effects Monitoring Plan, North Pile Management Plan, and future Plans such as the Waste Management Plan, Strontium Response Plan, TDS Response Plan, and Nitrogen Response Plan.

1.2 OVERVIEW

Mine activities during the operational phase include camp operation and underground mining and processing. There are for distinct sources of water on the mine site: underground water divided between upper bench (lake infiltration), lower bench (connate) water, water from the North Pile and precipitation. These activities and related water sources require management of water quantity and quality to prevent adverse environmental effects throughout the Life of Mine. De Beers is committed to managing this water, and the Plan has been developed to meet the requirement of Water License MV2011L2-0004.

Specifically Part F, Item 5:

The Licensee shall submit to the Board for approval an update of the Water Management Plan on October 1, 2013 and at the following times:

a) If the Licensee seeks changes to the plan;
b) Every three (3) years following approval of the plan; or
c) Upon the request of the Board.

Updates to the Water Management Plan shall describe how the Licensee is meeting the objectives listed in Part F, Item 4 of this License and satisfy the requirements of Schedule 5, Item 1.

For the purposes of the Plan, water management is defined as the collection, storage, treatment, and recycling of water at the mine site, in a safe, efficient, and compliant manner.

The water management system comprises of the infrastructure and practices that are designed to manage water quantity and quality. It is a requirement of the water license to include a Response Framework for the Water Management Pond. This will be included in future submissions as a means to link monitoring results to the corrective actions necessary to ensure the objective of minimizing the impacts of the Project on the quantity and quality of Water in the Receiving Environment. The water management system can be divided into two parts:

- The water and wastewater facilities system contains infrastructure for water supply, potable water treatment and distribution, sewage collection and treatment, and return of treated effluent to Snap Lake; and
- The mine water system contains facilities for collection and conveyance of surface water runoff and of groundwater seepage into the underground mine workings, for storage and treatment of this water and for the return of treated effluent to Snap Lake.

The Plan for the operational phase will describe process water management.

<u>The Plan contains three sections:</u>

Water and Wastewater Management

- a presentation of a water balance to describe inflows, outflows and internal water transfers related to project activities;
- a description of the management of core facilities water systems, including raw water and fire suppression water supply, potable water treatment, and sewage treatment and discharge; and
- a description of the management of mine water systems, including North Pile Starter Cell and East Cell drainage, core and outlying facilities drainage, Water Management Pond, and Water Treatment Plant and discharge.

Monitoring

- monitoring details, including a rationale for the components of the Water management system;
- linkages to other monitoring programs

Responses to Monitoring results-Framework

This section describes the Response Framework for the Snap Lake Water Management Pond. The Response Framework links monitoring results to actions with the purpose of maintaining the Assessment Endpoints.

This section is provided to comply with the following specific Water License conditions [Schedule 5, Item 1(c) of MVLWB (2012)]:

i. *A description of the Response Framework that will be implemented by the Licensee to link the results of monitoring to those corrective actions necessary to ensure that the objectives listed in Part F, Item 5 are met including:*

a. *definitions, with rationale for Action Levels applicable to the performance of the Water Management Pond with respect to geotechnical stability;*

b. *for each Action Level, a description of how exceedances of the Action Level will be assessed and generally which types of actions may be taken if the Action Level is exceeded.*

2 INFORMATION REGARDING WATER AND WASTEWATER MANAGEMENT

The goal of water management is to minimize the impact of the Mine on the aquatic ecosystems including Snap Lake. Based on this, the two primary objectives of the water management plan are:

1. to minimize the impacts from the Mine on the quantity of surface water; and
2. to minimize the impacts from the Mine on the quality of surface and groundwater.

2.1 COMPONENTS OF THE WATER MANAGEMENT SYSTEM AND ALL THE WATER AND WASTE WATER STREAMS THAT REPORT TO IT

The site water balance provides a basis for design of the water management plan. The water balance describes the quantity of inflow [gains] to the site, outflow [losses] from the site, and the quantity of water conveyed internally within the mine site. A summary describing the site water balance is provided in Table 2-3, and a corresponding schematic showing the locations of water management facilities is provided in Figure 2-1. Major water management facilities considered in the water balance include:

- Site water systems, including:
  - Raw water intake;
  - Potable Water Treatment Plant (PWTP);
  - Domestic water supply to camp;
  - Sewage collection system;
  - Sewage Treatment Plant (STP);
  - Water Treatment Plant and Portable Water Treatment Plant(s) (WTP) and;
  - Treated domestic effluent discharge.
- Mine water systems, including:
  - Core and outlying facilities runoff collection system;
  - Underground mine workings;

- North Pile drainage system;
- Water Management Pond (WMP);
- Water Treatment Plant; and
- Treated mine water discharge via the diffuser assembly.

2.1.1 Water Inflows

Water inflows considered in the mine water balance for the operational phase program include:

- Raw water withdrawn from Snap Lake for domestic and industrial water supply;
- Seepage into the underground mine workings;
- Direct precipitation to mine facilities; and
- Runoff to mine facilities from adjacent catchments.

The approximate amount of fresh water to be drawn from Snap Lake during the operational phase program is expected to be 100-400 m^3/d. Precipitation and runoff managed by the mine water management facilities will vary seasonally and are expected to be small, relative to North Pile seepage volumes.

2.1.2 Water Outflows

Water outflows considered in the mine water balance for the operational phase program include:

- Treated minewater, discharged to Snap Lake;
- Treated minewater used for dust suppression;
- Losses to groundwater seepage from water management facilities; and
- Losses to evaporation from water management facilities.

The approximate amount of water used for dust suppression is estimated to be 30-350 m^3/d, during months when road surfaces are dry and unfrozen, which is usually June to September. The approximate amount of treated domestic water to be discharged to Snap Lake during the operational phase program is estimated to be 200 m^3/d. The amount of treated mine water to be discharged to Snap Lake during the operational phase program is estimated to increase with inflows into the underground workings. Seepage from the North Pile will vary seasonally and is expected to be small, relative the mine waste discharge volumes.

2.1.3 Raw Water Supply System

Raw water and fire suppression water supply is withdrawn from Snap Lake. Fresh water is withdrawn from the west arm of Snap Lake via the submerged intake. The planned water withdrawal from Snap Lake is expected to be approximately 100-200 m^3/d. Fresh water will be used for:

- potable water supply; and
- fire suppression and dust suppression

Water used in the Process Plant is recycled, however, water for fire suppression and dust suppression will be drawn directly from Snap Lake and distributed through a pressured system to the Process Plant, Service Complex, accommodations, fuel storage area, power and water treatment plants, and utilidors.

A single intake pipe is used for domestic potable water use (daily use) and for fire suppression (rare event). The peak domestic water withdrawal rate will be 200 m^3/d (2.3 L/s) and the peak fire suppression withdrawal rate will be 12,960 m^3/d (150 L/s) for a maximum total as per Water License MV2011L2-0004 of 188,000 m^3/yr.

2.1.4 Potable Water

Raw water is pumped from Snap Lake by overland pipeline to the Potable Water Treatment Plant. Water is treated with Ultra-Violet light for disinfection, chlorinated and stored in a storage tank in the Potable Water Treatment Plant. Treated water is piped to areas in the Process Plant requiring potable water and to the Accommodations and Service Complex. Insulated and heat-traced pipes are used to distribute water through utilidors between the plants, service complex and camp. Potable water is trucked to the underground mine and remote buildings as required.

2.1.5 Sewage Treatment

Sewage will be treated in Membrane Bioreactors (MBR) once the new sewage treatment plant is online in December 2013. This technology utilizes a biological process (bacteria and aeration) to break down sewage influent. At the final stage of the process, liquid that meets discharge criteria set out in the De Beers Water License MV2011L2-0004 is decanted as effluent and pumped to the Water Management Pond. The effluent is treated through the TWTP and WTP prior to release to Snap Lake.

This plant is an Activated Sludge Treatment plant with one C_x9 external membrane designed for a maximum capacity of 135 cubic meters per day. The plant with one membrane required the installation of automatic pre-filters, one membrane feed pump, one membrane circulation pump. The modular design allows the plant to be relocated as necessary.

The sewage treatment plants includes phosphorus removal as part of an overall water management strategy to meet the total phosphorus loading limit set out in the Water License. Alum and caustic soda will be added to control total phosphorus (TP) level and pH adjustment in the effluent. Existing chemical storage and metering pump system will be used. Alum dosage will be manually set to minimum chemical usage while keeping TP under 1 ppm. Caustic soda dosage will be manually set to minimum chemical usage while keeping pH above 6.5. Management of sewage treatment is linked with the Aquatic Effects Monitoring Plan, as one component of the monitoring is to evaluate the effects of nutrients from the mine on productivity within Snap Lake.

Solids produced during sewage treatment are caked and pressed in the filter press to remove additional water. Dewatered solids are bagged and usually land filled, however, on some occasions they may be incinerated.

2.1.6 North Pile Water Control Structures

The design objective of the North Pile Water Control Structures (PWCS), comprising ditches and sumps, is to collect surface water runoff and internal seepage from the North Pile (Appendix I) for pumping to the WTP via the WMP. The runoff and seepage from the North Pile is controlled to prevent it from reporting to the downstream environment.

In addition to the existing PWCS of the Starter Cell and the East Cell, an additional ditch was constructed to intercept the December 2011 overtopping flows from TS4, direct them to Inland Lake 6 (IL6), and provide redundancy for flow containment at the area west of the Starter and East cells. The IL6 Ditch will become redundant upon the construction of the PWCS.

The North Pile PWCS are inspected annually by an independent geotechnical engineer to assess performance.

The PWCS ditches intercept and route surface water runoff and internal seepage from the North Pile to the sumps. The sumps provide for collection prior to pumping to the WMP. The ditch flow direction is based on ground surface topography to provide gravity flow to the sumps. The sumps are dewatered to maintain the water levels at the minimum practicable levels at all times.

The sequencing of any pump is reliant upon the level within the sump it receives, but is ultimately reliant upon the level and nitrate concentration within the WMP. As nitrate concentration relates to mass per litre, regulating the volume of high nitrates reporting to the WMP is the most effective means of dilution control. Selecting the sump to pump is observational and must be directed by the person designated to manage the pumping of the North Pile PWCS.

An independent geotechnical engineer visually inspected the water control structures during construction and operations to identify the requirements for mineral soil and bedrock surface treatment types, locations, and extents such that the design intent of the structures is achieved. The inspections have not identified the requirement for mineral soil or bedrock surface treatment. A similar evaluation will be carried out during construction of the West Cell PWCS. A grout curtain was constructed as a method for limiting the flow of water from the lake into the PWCS (Golder 2008b). The grout curtain acts as a barrier to flows between the PWCS and Snap Lake. EBA Engineering Consultants Ltd. performed the necessary quality control activities while Golder Associates Ltd. provided quality assurance during construction.

Peak runoff occurs during the spring freshet. The ditches and sumps are inspected on a daily basis during spring freshet and during periods of prolonged rain. Current capacities for the temporary and perimeter sumps are presented in Table 2-1. Any water collected in the sumps is pumped as soon as practical to the WMP and then to the TWTP and WTP for treatment before discharge to the environment and to maintain the minimum possible water level at all times.

Table 2-1 Volume of Water Containment Structures

Location	Maximum Storage Capacity [m^3]
Perimeter Sump 1	3,161
Perimeter Sump 2	4,893
Perimeter Sump 3	65,000
Perimeter Sump 4	10,683
Perimeter Sump 5	18,905
Water Management Pond	92,762
Temporary Sump 4	4,053

m^3 = cubic metres.

All water from the North Pile is diverted to the WMP and then treated at the WTP before discharge. Ditches around the North Pile were constructed to direct and convey runoff from areas affected by operations of the Starter Cell, as well as from a limited area upstream of the Starter Cell that would otherwise drain through the affected area. Managed water will include runoff from granite quarries, as these areas are within the footprint of the North Pile. Snap Lake Mine operates with two points of discharge of treated effluent to Snap Lake; both of which split off of the main line from the Water Treatment plant where sampling station 02-17B is located.

Ditches and sumps in mineral soil with high hydraulic conductivity are lined using a geo-synthetic clay liner to prevent seepage to Snap Lake. Additional seepage control measures, such as grouting of previous fractured rock zones, was applied when such zones were encountered.

2.1.7 Core and Outlying Facilities Runoff Water

Surface water runoff is seasonal. It generally commences with snowmelt in May and continues with snowmelt and rainfall runoff through October. Surface water runoff from the core facilities is conveyed to the WMP (flow path Q19 on Figure 2-1). Surface runoff that is conveyed to natural receiving streams is not considered in the mine water balance.

2.1.8 Water Management Pond

During the Advanced Exploration Project (AEP), water from the underground workings and Processed Kimberlite (PK) were stored in the Processed Kimberlite Containment (PKC) facility. The PKC has been renamed the “Water Management Pond” (WMP as defined earlier) because of its revised function. The WMP receives water from the catchment area, underground workings, Process Plant, North Pile, and can receive water from the Sewage Treatment Plant. The WMP was created by two dams that were constructed in 2000. The dams consist of a rock fill embankment supporting an 80-mil textured HDPE liner on the upstream side. The liner is keyed into the underlying intact bedrock (using a mixture of sand and powdered bentonite) and compacted into a key trench to minimize the seepage beneath the dams. Suitable granular bedding and cover layers were placed on either side of the liners. Small seepage losses from the WMP are expected and were scoped during the Environmental Assessment for the project.

2.1.9 Water Treatment Plant/Temporary Water Treatment Plant

The Water Treatment Plant (WTP) includes a pumping station to decant water from the WMP. The treatment facilities consist of a temporary, portable filtration plant that was constructed in 2004 on a granite pad near the WMP causeway. The temporary WTP is expected to operate as required to augment the permanent WTP. It was designed to treat the relatively low flows in the mine pre-production period and the water stored in the WMP, and has a nominal capacity of 5,000 m^3/d In the event that monitoring of underground water inflows shows potential for higher than predicted levels, the plant can be expanded via additional filters and higher flow pumps. The permanent plant was commissioned in 2006. The WTP is capable of treating approximately 75,000 m^3/day with the addition of a portable WTP that is connected in to the pH adjustment tank. Further capacity expansions are underway to offset the additional underground inflows.

The process includes a bank of filtration units. The filters in the Water Treatment Plant(s) are regularly cleaned by backwashing with treated water. Backwash water containing suspended solids are pumped to the Process Plant. Treated water is discharged to Snap Lake via two diffusers. These diffusers direct the discharge through multiple ports and increase mixing of effluent with Snap Lake water. Sulphuric acid is used for pH control/adjustment and to reduce potential ammonia toxicity.

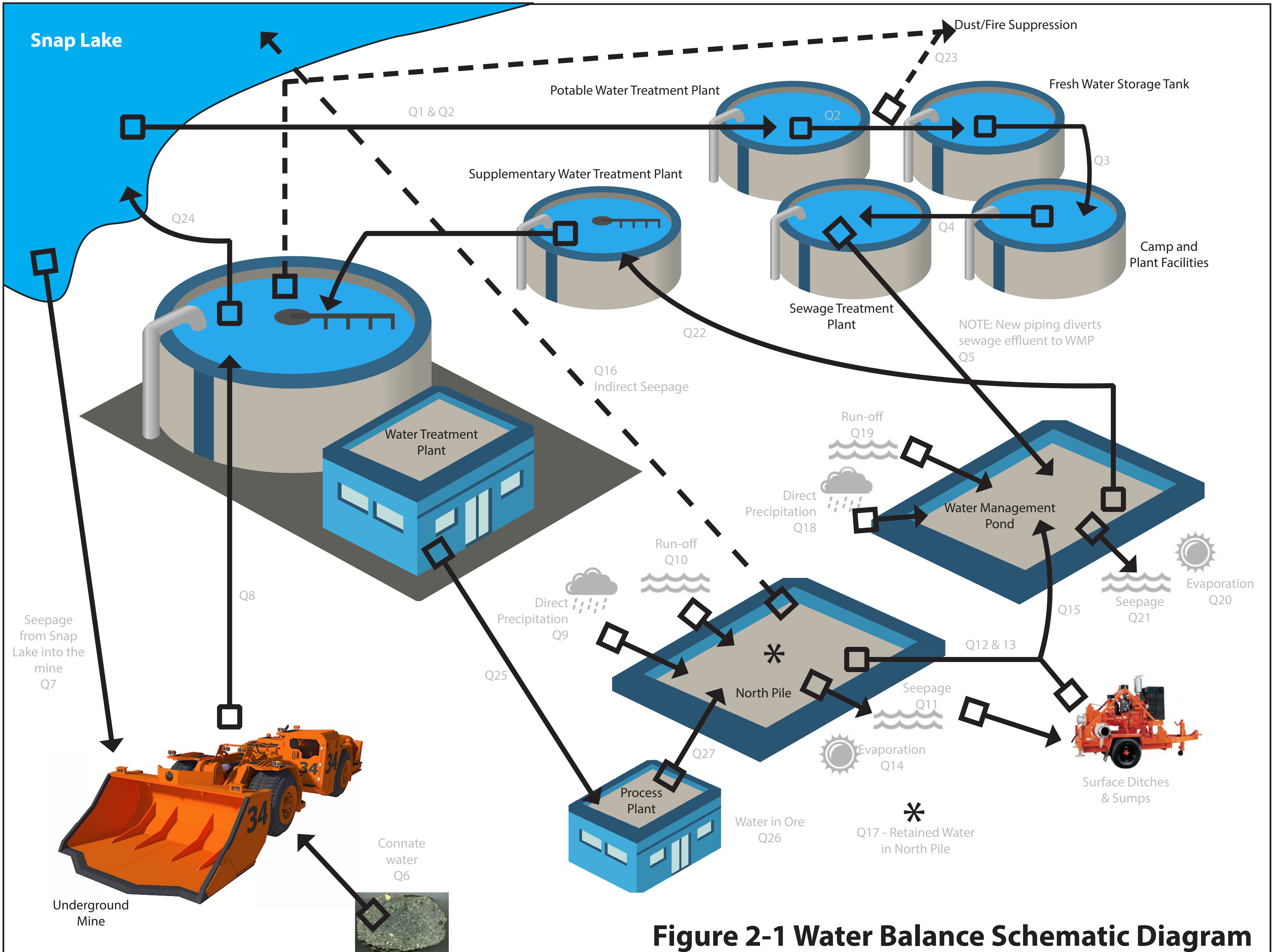


Figure 2-1 Water Balance Schematic Diagram

2.2 A DESCRIPTION OF THE PROCESS AND FACILITIES INTENDED FOR THE PURPOSES OF OBTAINING FRESH WATER FROM SNAP LAKE FOR USE AT THE SNAP LAKE DIAMOND MINE

The monthly quantities of freshwater removed from Snap Lake between January and December 2012 are listed in Table 2-3. The freshwater was used for domestic use, process use as well as dust suppression. The total amount of freshwater removed from Snap Lake during 2012 was 40,132 cubic metres (m^3). De Beers attempts to reduce freshwater intake by recycling water and encouraging environmental awareness. In 2012, De Beers recycled 353,954 m^3 of water from the Water Treatment Plant for use in the Processing Plant. Recycled water that meets effluent quality criteria is also used for dust suppression on the roads during the summer months.

Table 2-2 Snap Lake Freshwater Intake (m^3), 2012

Date	Volume [m^3]
Jan	3,464
Feb	2,950
Mar	3,574
Apr	3,414
May	3,862
Jun	3,221
Jul	3,125
Aug	3,013
Sep	2,878
Oct	3,308
Nov	4,176
Dec	3,149
Annual Total	**40,134**

m^3 = cubic metres.

2.2.1 Potable Water

Water will be supplied to the potable water treatment plant from the Snap Lake intake, as described by flow path Q1 on Figure 2-1. Potable water for domestic use is piped to users, as described by flow path Q3 on Figure 2-1.

The water intake pump well is housed within a rock-filled embankment on the north shore of the northwest peninsula of Snap Lake. The pump well, consisting of vertical pump wells fitted with vertical turbine pumps which receives water through the single pipe buried under the rock-filled granite embankment. The intake pipe will exit at the bottom of the embankment into Snap Lake and will be fitted with a stainless steel screen. The screen selected meets the Department of Fisheries and Oceans (DFO) 1995 criteria for the combined water withdrawal rate for fire suppression and domestic potable water use. As per the DFO policy intake screens are cleaned every 2 years. A habitat compensation plan was finalized with DFO Yellowknife for the habitat affected by the installation of the water intake embankment. This fisheries authorization is now closed.

2.3 THE PROCESS AND FACILITIES FOR THE COLLECTION AND MANAGEMENT OF SURFACE RUNOFF GENERATED ON SITE

External drainage around the North Pile includes the following components:

- Direct precipitation to the system (flow path Q9 and Q18 on Figure 2-1);
- Runoff from adjacent catchments (flow path Q10 and Q19 on Figure 2-1);
- Evaporation from the system (flow path Q14 and Q20 on Figure 2-1);
- Seepage from the system (flow path Q11, Q16, and Q21 on Figure 2-1); and
- Discharge from the system to the Water Management Pond (flow path Q12 and Q13 on Figure 2-1).

2.3.1 North Pile

The objectives of drainage facilities at the North Pile Starter Cell, East Cell and future West Cell are to collect water that is affected by mining activities and convey it to the Water Management Pond.

The Starter Cell initial embankments and perimeter water control structures were designed by Golder between 2004 and 2005. The water control structures of the Starter Cell were constructed between 2005 and 2007. The majority of the construction for the Starter Cell initial embankments was performed by Nuna Logistics Limited (Nuna) under construction supervision of AMEC commencing in July of 2005. Thermistor and Piezometer instrumentation for the Starter Cell were installed in Q1/Q2 of 2006. Tli'Cho Logistics Inc. and Ke Te Whii/Ledcor continued Starter Cell embankment construction under the supervision by AMEC in November 2006 until completion in Q3 of 2007.

The perimeter water control structures of the East Cell were constructed between 2008 and 2010 by the De Beers. In 2010, as part of the construction works for the East Cell perimeter water control structures, a grout curtain was constructed from SP3 to SP5 along the access road, adjacent to Snap Lake, to reduce the flow of water from Snap Lake into SP4. Grouting works were performed by McCaw North Drilling under quality assurance supervision performed by Golder (Golder 2010b).

In late December 2011 a surge water flow event to Temporary Sump 4 (TS4) resulted in an overtopping event and the loss of water from containment. In March 2012, Golder provided De Beers the design report of the IL6 ditch to route the water to IL6 (Golder 2012a). The construction of the IL6 ditch was performed by Nuna with quality assurance supervision by Golder. The IL6 ditch provides redundancy flow containment for the western PWCS of the Starter Cell and East Cell. The IL6 ditch will be made redundant the development of the West Cell.

2.3.2 Runoff Water

The objectives of the core and outlying facilities runoff water management system are to:

- Collect runoff from the core facilities (camp and plant site) that may be contaminated by mine activities;
- Convey that runoff to the WMP for storage and subsequent treatment;
- Maintain the exploration pit water sump level at below capacity; and
- Convey uncontaminated surface runoff from outlying facilities to natural receiving streams after polishing to remove sediment.

A site plan showing existing material stockpiles and surface water runoff, as well as layout for perimeter drainage ditches and sumps, is provided in Appendix II. The design basis for core facility drainage was presented by Golder (2004c). In general, natural drainage for the plant site area flows from a local topographic high, east of the mine portal, and collects in the WMP to the west of the plant site area. Grading within the natural catchment area is designed to collect and promote positive drainage towards the WMP. Any core facility development located beyond the natural catchment area is contained within a perimeter drainage system to collect surface water runoff and active layer groundwater, and flow is conveyed back to the WMP from a terminal sump. Perimeter drainage measures include gravity flow ditches, sumps and pumps, and are protected for seasonal operating conditions.

In areas where the near-surface sub grade is in mineral soil with high hydraulic conductivity, or bedrock fractures are encountered, perimeter ditch and sump designs contain linings to limit seepage losses.

- Perimeter drainage, including drainage ditches and sumps, was established around the north, east and south sides of the plant site to collect surface water runoff and active layer groundwater for discharge to the WMP.
- The storage pads have positive drainage to promote surface water runoff.

2.4 THE PROCESS AND FACILITIES FOR THE COLLECTION, MANAGEMENT AND TREATMENT OF ANY WASTEWATER AND DISCHARGE OF EFFLUENT RESULTING FROM MINING ACTIVITIES

This section corresponds to Schedule 5, Part F of the Water Licence, items iv and v. Figure 2-2 provides an illustration of the facilities and pumping system for purposes of collection and management of wastewater and treated effluent. The Starter Cell and East Cell components of the North Pile are covered more thoroughly in sections 2.1.1 and 2.1.6 of the report.

The main components of the Mine with regard to process and facilities of wastewater collection and management pertain to the following:

- North Pile Facility Components
- Water Management Pond
- Water Treatment Plant/Temporary Water Treatment Plant
- Diffusers

2.4.1 North Pile Facility Components

The North Pile Waste Rock and Processed Kimberlite Storage Facility is the surface storage facility for waste rock and processed kimberlite (PK) produced during the operation of the Mine.

Starter Cell

The estimated storage capacity of the Starter Cell is approximately 3.2 million cubic metres. Deposition of slurry is expected to occur throughout the complete development of the Starter Cell.

East Cell

The estimated storage capacity of the East Cell is approximately 2.6 million cubic meters.

West Cell

The detailed design of the West Cell has not yet been completed. This section will be updated as and when appropriate.

Perimeter Water Control Structures

The ditches surrounding the North Pile are designed to capture seepage and surface runoff water and provide gravity flow of the water into the sumps. The northern portion of the ditch along the shoreline will be constructed to promote positive flow of water from Snap Lake towards the ditch to reduce the risk of seepage from the North Pile entering Snap Lake.

The sumps are collection points for flows from the ditches and the North Pile to enable pumping of water to the WMP before treatment at the WTP and discharge to the environment.

Inland Lake 6 Ditch

The IL6 ditch, located within the future development area of the West Cell on the western side of the East Cell, is to intercept surface water runoff and route it to IL6 for pumping to the WMP. The ditch provides redundancy to the western perimeter water control system of the Starter Cell and East Cell should flows bypass these structures.

Processed Kimberlite Distribution Systems

The PK distribution piping system for transporting paste and slurry from the Process Plant to the North Pile and for deposition into the Starter and East Cell are in place along the perimeter of the Starter Cell Northern perimeter embankment, centre pipe bench of the Starter Cell and will be installed along the North embankment of the Starter Cell for deposition into the East Cell.

Water Management System and Piping

Water collected from the perimeter ditches and sumps are pumped to the WMP prior to treatment at the WTP. Following treatment at the WTP, the water will be discharged to the environment.

Water reporting to and from the North Pile components is managed through a network of pipes and pumps.

2.4.2 Water Management Pond

The WMP is the collection point for all water pumped from the sumps around the north pile. The two main potential challenges are elevated nitrate and turbidity levels. Nitrate and turbidity levels can be controlled by understanding the sources of nitrate and turbidity, and then adjusting pumping rates from sumps into the WMP as well as water pumped out of the pond to the WTP. Therefore, having information such as nitrate and turbidity levels of each source before pumps are activated provides a valuable tool to managing surface water in an environmentally responsible manner. The water mixing spreadsheet model is useful for predicting the effect on the WMP and WTP discharge quality and the surface water balance, as a result of the flows from the sumps.

2.4.3 Water Treatment Plant/Temporary Water Treatment Plant

The objectives of the water treatment plant are to treat mine-affected waters to ensure that water quality guidelines are met, prior to release to Snap Lake.

Mine-affected water will be pumped to the WTP from the underground and WMP (flow path Q19 on Figure 2-1). Treated water will be discharged to Snap Lake (flow path Q21 on Figure 2-1). Small quantities of treated water will be used for dust suppression (flow path Q20 on Figure 2-1).

The temporary WTP is expected to operate as required to augment the permanent WTP. It was designed to treat the relatively low flows in the mine pre-production period and the water stored in the WMP, and has a nominal capacity of 7,500 m^3/d In the event that monitoring of underground water inflows shows potential for higher than predicted levels, the plant can be expanded via additional filters and higher flow pumps..

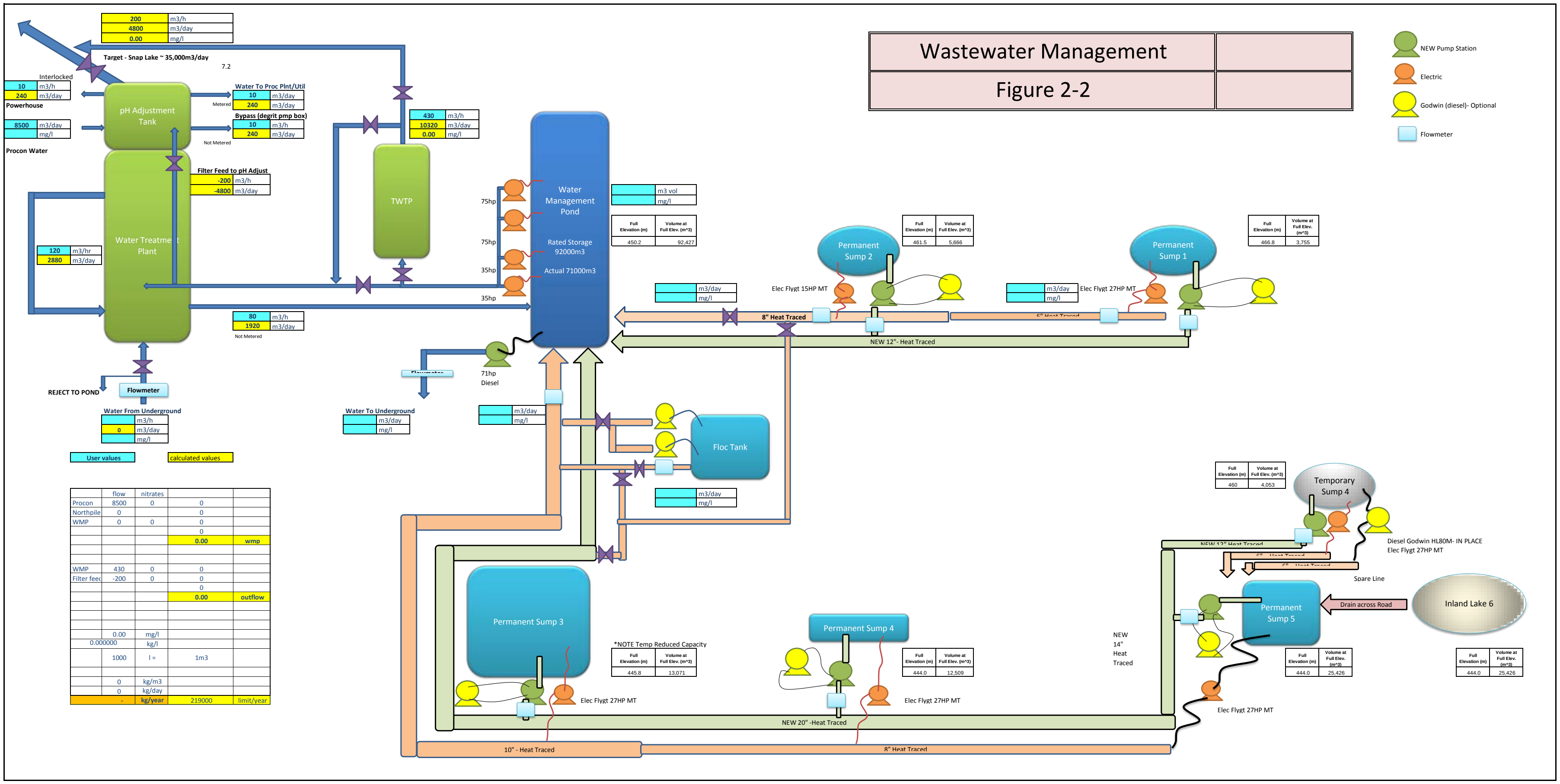
The process includes a bank of filtration units. Sulphuric acid is used for pH control/adjustment and to reduce potential ammonia toxicity.

Performance of the Water Treatment Plant will be optimized by comparison of the quality of water before and after treatment. The Water Treatment Plant(s) are equipped with instrumentation for continuous monitoring of effluent flow rate, ammonia, pH, temperature, conductivity and turbidity, in accordance with the requirements of the Water Licence. Measurements of these parameters will be used to adjust the addition rates of reagents in order to ensure discharge quality targets are met.

2.4.4 Diffuser

The minewater outfalls are located on the eastern shoreline of the northwest peninsula. The area affected by the outfalls includes part of a constructed shoreline embankment and a submerged area to approximately 24 m in water depth (2 locations at approximately 12m each). The submerged pipelines are weighted down near the lake bottom and cover an area of approximately 125 m out from the shore. At the end of the pipelines, there is a 60 m long diffuser structure with five evenly spaced outlet ports. Note that the pipelines do not lie on the substrate of the lake but rather are weighted to sit slightly above the substrate.

SURFACE WATER MANAGEMENT FLOW DIAGRAM



2.5 DETAILS OF THE HYDRAULIC DESIGN OF ALL WATER MANAGEMENT STRUCTURES AND WATER BALANCE ESTIMATES ON A MONTHLY BASIS FOR EACH YEAR OF THE PROPOSED LICENCE

Water balance estimates have been provided in table 2-3 below.

Table 2-3 Summary of Water Balance for Operational Phase (2011 to 2020)[(a)]

	Snap Lake	Core Facilities Water Systems				Underground			North Pile Sumps								
Stream Description	Raw Water Withdrawal	Raw Water to WTP	Domestic Water to Camp	Sanitary Sewage to STP	Treated Effluent to Snap Lake	Seepage from Concatenate Water	Seepage from Snap Lake	Minewater to WTP	Direct Precipitation on Sumps	Runoff from Land Areas	Process Flows	Draindown	Infiltration	Evaporation	Drainage to WMP	Seepage to Snap Lake	Water Retained in the Pile Source of draindown flows)
Stream Number	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17
Data Source	Calculated =Q3	Calculated =Q1		Calculated =Q3	Calculated =Q4			Calculated =Q6									Calculated =Q28-Q11
Sign Convention	+ From Lake	+ To Site	+ To Site	+ To STP	+ From STP	+ To Mine	+ To Mine	+ From Mine	+ To North Pile	+ To North Pile	+ From North Pile To North Pile Sumps	+ From North Pile To North Pile Sumps	+ From North Pile To North Pile Sumps	+ From North Pile	+ From North Pile	+ From North Pile	+ To North Pile
Month-Year	m³/day	m³/day	m³/day	m³/day	m³/day	m³/day		m³/day	m³/day	m³/day	m³/day	m³/day	m³/day	m³/day	m³/day	m³/day	m³/day
Jan-11	64	64	64	64	64	2,246	21,344	23,590	0	0	1,034	0	117	0	1,621	1	407
Feb-11	76	76	76	76	76	2,371	21,379	23,751	0	0	890	0	117	0	1,288	1	402
Mar-11	69	69	69	69	69	2,506	21,806	24,312	0	1	865	0	117	0	1,148	1	373
Apr-11	66	66	66	66	66	2,631	21,993	24,624	4	28	837	0	117	0	866	1	271
May-11	68	68	68	68	68	2,807	22,068	24,875	165	1,345	891	0	133	38	2,554	1	385
Jun-11	66	66	66	66	66	2,893	22,291	25,184	40	299	907	0	183	161	1,353	1	359
Jul-11	60	60	60	60	60	2,979	22,375	25,354	64	471	893	0	217	241	1,270	1	397
Aug-11	62	62	62	62	62	2,982	22,924	25,906	72	534	778	0	192	182	1,046	1	406
Sep-11	71	71	71	71	71	2,938	23,456	26,394	50	373	801	0	144	65	1,576	1	407
Oct-11	65	65	65	65	65	3,021	23,668	26,689	24	178	643	0	117	0	324	1	366
Nov-11	73	73	73	73	73	3,027	23,930	26,957	1	8	581	0	117	0	1,121	1	545
Dec-11	66	66	66	66	66	2,979	24,061	27,040	0	1	685	0	117	0	798	1	426
Jan-12	80	80	80	80	80	3,066	24,315	27,380	0	0	569	684	442	0	1,308	1	389
Feb-12	81	81	81	81	81	3,152	24,579	27,731	0	0	594	418	316	0	1,240	1	471
Mar-12	81	81	81	81	81	3,155	24,917	28,072	0	0	1,070	297	258	0	1,603	1	543
Apr-12	78	78	78	78	78	3,152	24,978	28,130	0	0	1,090	224	223	0	1,301	1	235
May-12	81	81	81	81	81	3,197	24,752	27,949	524	4,300	1,464	175	217	40	6,879	1	15
Jun-12	75	75	75	75	75	3,239	25,006	28,244	125	922	1,937	140	251	164	3,030	1	68
Jul-12	78	78	78	78	78	3,450	25,062	28,512	38	280	1,317	114	269	237	1,594	1	274
Aug-12	78	78	78	78	78	3,712	26,430	30,142	99	732	1,162	94	240	189	1,603	1	302
Sep-12	76	76	76	76	76	3,802	28,080	31,882	50	367	1,194	79	195	98	2,235	1	343
Oct-12	77	77	77	77	77	3,927	27,746	31,673	14	105	824	67	158	22	804	1	470
Nov-12	77	77	77	77	77	4,019	27,973	31,992	0	0	881	57	144	0	1,181	1	575
Dec-12	73	73	73	73	73	3,974	29,058	33,033	0	0	830	49	140	0	934	1	608
Jan-13	74	74	74	74	74	4,016	29,674	33,690	0	0	1,223	42	137	0	1,638	1	444
Feb-13	89	89	89	89	89	4,144	30,350	34,494	0	0	1,163	37	134	0	1,322	1	422
Mar-13	78	78	78	78	78	4,317	30,430	34,747	0	1	943	32	132	0	1,127	1	343
Apr-13	79	79	79	79	79	4,406	29,894	34,300	4	28	1,066	28	130	0	1,321	1	387

	Snap Lake	Core Facilities Water Systems				Underground			North Pile Sumps								
Stream Description	**Raw Water Withdrawal**	**Raw Water to WTP**	**Domestic Water to Camp**	**Sanitary Sewage to STP**	**Treated Effluent to Snap Lake**	**Seepage from Concatenate Water**	**Seepage from Snap Lake**	**Minewater to WTP**	**Direct Precipitation on Sumps**	**Runoff from Land Areas**	**Process Flows**	**Draindown**	**Infiltration**	**Evaporation**	**Drainage to WMP**	**Seepage to Snap Lake**	**Water Retained in the Pile Source of draindown flows)**
Stream Number	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**Q12**	**Q13**	**Q14**	**Q15**	**Q16**	**Q17**
Data Source	**Calculated =Q3**	**Calculated =Q1**		**Calculated =Q3**	**Calculated =Q4**			**Calculated =Q6**									**Calculated =Q28-Q11**
Sign Convention	**+ From Lake**	**+ To Site**	**+ To Site**	**+ To STP**	**+ From STP**	**+ To Mine**	**+ To Mine**	**+ From Mine**	**+ To North Pile**	**+ To North Pile**	**+ From North Pile To North Pile Sumps**	**+ From North Pile To North Pile Sumps**	**+ From North Pile To North Pile Sumps**	**+ From North Pile**	**+ From North Pile**	**+ From North Pile**	**+ To North Pile**
Month-Year	**m³/day**	**m³/day**	**m³/day**	**m³/day**	**m³/day**	**m³/day**		**m³/day**	**m³/day**	**m³/day**	**m³/day**	**m³/day**	**m³/day**	**m³/day**	**m³/day**	**m³/day**	**m³/day**
May-13	73	73	73	73	73	4,365	31,650	36,015	356	2,915	1,224	24	148	47	4,353	1	444
Jun-13	76	76	76	76	76	4,278	34,442	38,720	40	299	1,206	21	200	176	1,738	1	438
Jul-13	74	74	74	74	74	4,275	35,382	39,658	64	471	1,015	18	220	228	1,314	1	369
Aug-13	74	74	74	74	74	4,320	35,505	39,825	72	534	1,015	16	179	132	1,322	1	369
Sep-13	74	74	74	74	74	4,362	35,474	39,836	50	373	1,015	14	144	49	1,795	1	369
Oct-13	74	74	74	74	74	4,281	35,920	40,201	24	178	1,015	12	130	17	1,077	1	369
Nov-13	74	74	74	74	74	4,105	36,508	40,614	1	8	1,015	11	122	0	1,286	1	369
Dec-13	74	74	74	74	74	4,019	36,500	40,519	0	1	1,015	10	121	0	967	1	369
Jan-14	74	74	74	74	74	3,849	38,055	41,904	0	0	1,015	8	121	0	1,370	1	369
Feb-14	74	74	74	74	74	3,674	40,154	43,828	0	0	1,015	7	120	0	1,086	1	369
Mar-14	74	74	74	74	74	3,629	40,070	43,699	0	1	1,015	7	120	0	1,275	1	369
Apr-14	74	74	74	74	74	3,712	39,020	42,732	4	28	1,015	6	120	0	940	1	369
May-14	74	74	74	74	74	3,760	39,083	42,843	356	2,915	1,015	5	139	47	4,466	1	369
Jun-14	74	74	74	74	74	3,799	39,735	43,534	40	299	1,015	5	192	166	1,477	1	369
Jul-14	74	74	74	74	74	3,972	39,627	43,599	64	471	1,015	4	213	199	1,405	1	369
Aug-14	74	74	74	74	74	4,228	39,226	43,454	72	534	1,015	4	173	115	1,309	1	369
Sep-14	74	74	74	74	74	4,365	42,859	47,223	50	373	1,015	3	139	43	1,832	1	369
Oct-14	74	74	74	74	74	4,195	48,206	52,400	24	178	1,015	3	125	15	1,046	1	369
Nov-14	74	74	74	74	74	4,144	49,516	53,660	1	8	1,015	2	118	0	1,286	1	369
Dec-14	74	74	74	74	74	4,275	48,245	52,520	0	1	1,015	2	118	0	963	1	369
Jan-15	74	74	74	74	74	4,613	46,798	51,411	0	0	1,015	2	118	0	1,366	1	369
Feb-15	74	74	74	74	74	4,841	46,605	51,447	0	0	1,015	2	118	0	1,078	1	369
Mar-15	74	74	74	74	74	4,710	46,578	51,288	0	1	1,015	2	118	0	1,269	1	369
Apr-15	74	74	74	74	74	4,833	45,768	50,600	4	28	1,015	1	117	0	932	1	369
May-15	74	74	74	74	74	5,095	45,187	50,282	356	2,915	1,015	1	137	41	4,473	1	369
Jun-15	74	74	74	74	74	5,142	45,104	50,246	40	299	1,015	1	190	153	1,467	1	369
Jul-15	74	74	74	74	74	4,930	47,063	51,993	64	471	1,015	1	212	199	1,399	1	369
Aug-15	74	74	74	74	74	4,668	48,788	53,456	72	534	1,015	1	172	115	1,306	1	369
Sep-15	74	74	74	74	74	4,746	48,047	52,793	50	373	1,015	1	138	43	1,829	1	369
Oct-15	74	74	74	74	74	4,925	47,194	52,119	24	178	1,015	1	124	15	1,044	1	369
Nov-15	74	74	74	74	74	5,008	49,910	54,919	1	8	1,015	1	117	0	1,289	1	369
Dec-15	74	74	74	74	74	4,847	52,771	57,618	0	1	1,015	1	117	0	966	1	369
Jan-16	74	74	74	74	74	4,496	50,759	55,254	0	0	1,015	0	117	0	1,365	1	369
Feb-16	74	74	74	74	74	4,698	48,920	53,619	0	0	1,015	0	117	0	1,080	1	369
Mar-16	74	74	74	74	74	5,053	48,300	53,353	0	1	1,015	0	117	0	1,230	1	369
Apr-16	74	74	74	74	74	5,515	47,627	53,142	32	262	1,015	0	117	0	973	1	369
May-16	74	74	74	74	74	5,878	46,751	52,629	328	2,688	1,015	0	136	41	4,533	1	369
Jun-16	74	74	74	74	74	6,123	46,943	53,065	40	299	1,015	0	190	153	1,410	1	369
Jul-16	74	74	74	74	74	6,689	47,893	54,582	64	471	1,015	0	211	199	1,393	1	369
Aug-16	74	74	74	74	74	6,536	52,899	59,435	72	534	1,015	0	172	115	1,298	1	369

Stream Description	Snap Lake	Core Facilities Water Systems				Underground			North Pile Sumps								
	Raw Water Withdrawal	Raw Water to WTP	Domestic Water to Camp	Sanitary Sewage to STP	Treated Effluent to Snap Lake	Seepage from Concatenate Water	Seepage from Snap Lake	Minewater to WTP	Direct Precipitation on Sumps	Runoff from Land Areas	Process Flows	Draindown	Infiltration	Evaporation	Drainage to WMP	Seepage to Snap Lake	Water Retained in the Pile Source of draindown flows)
Stream Number	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**Q12**	**Q13**	**Q14**	**Q15**	**Q16**	**Q17**
Data Source	Calculated =Q3	Calculated =Q1		Calculated =Q3	Calculated =Q4			Calculated =Q6									Calculated =Q28-Q11
Sign Convention	+ From Lake	+ To Site	+ To Site	+ To STP	+ From STP	+ To Mine	+ To Mine	+ From Mine	+ To North Pile	+ To North Pile	+ From North Pile To North Pile Sumps	+ From North Pile To North Pile Sumps	+ From North Pile To North Pile Sumps	+ From North Pile	+ From North Pile	+ From North Pile	+ To North Pile
Month-Year	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day		m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day
Sep-16	74	74	74	74	74	6,677	54,625	61,302	50	373	1,015	0	137	43	1,879	1	369
Oct-16	74	74	74	74	74	7,090	50,402	57,492	24	178	1,015	0	124	15	1,008	1	369
Nov-16	74	74	74	74	74	6,286	52,595	58,880	1	8	1,015	0	117	0	1,287	1	369
Dec-16	74	74	74	74	74	5,449	53,813	59,262	0	1	1,015	0	117	0	939	1	369
Jan-17	74	74	74	74	74	5,187	51,996	57,183	0	0	1,015	0	117	0	1,425	1	369
Feb-17	74	74	74	74	74	5,056	51,656	56,712	0	0	1,015	0	117	0	1,051	1	369
Mar-17	74	74	74	74	74	5,304	50,759	56,062	0	1	1,015	0	117	0	1,230	1	369
Apr-17	74	74	74	74	74	5,574	50,093	55,667	4	28	1,015	0	117	0	972	1	369
May-17	74	74	74	74	74	5,321	50,003	55,324	356	2,915	1,015	0	136	41	4,366	1	369
Jun-17	74	74	74	74	74	5,056	50,299	55,355	40	299	1,015	0	190	153	1,379	1	369
Jul-17	74	74	74	74	74	5,346	49,769	55,115	93	770	983	686	610	227	1,951	1	401
Aug-17	74	74	74	74	74	5,619	49,596	55,215	106	884	1,016	393	430	132	2,045	1	368
Sep-17	74	74	74	74	74	5,864	49,090	54,953	74	618	1,016	278	342	49	2,474	1	368
Oct-17	74	74	74	74	74	6,137	48,601	54,739	35	294	1,016	210	296	17	1,428	1	368
Nov-17	74	74	74	74	74	6,340	48,264	54,605	2	14	1,016	164	267	0	1,529	1	368
Dec-17	74	74	74	74	74	6,862	49,206	56,068	0	2	1,016	131	252	0	1,297	1	368
Jan-18	74	74	74	74	74	7,377	49,750	57,127	0	0	1,016	107	240	0	1,406	1	368
Feb-18	74	74	74	74	74	7,523	49,152	56,675	0	0	1,016	89	232	0	1,274	1	368
Mar-18	74	74	74	74	74	7,260	49,128	56,389	0	2	1,016	76	225	0	1,422	1	368
Apr-18	74	74	74	74	74	6,754	50,111	56,864	6	46	1,016	64	220	0	1,072	1	368
May-18	74	74	74	74	74	6,182	50,491	56,673	523	4,880	1,016	55	235	47	6,524	1	368
Jun-18	74	74	74	74	74	5,839	49,671	55,511	59	495	1,016	47	284	176	1,780	1	368
Jul-18	74	74	74	74	74	5,574	49,605	55,179	94	630	1,016	40	303	228	1,695	1	368
Aug-18	74	74	74	74	74	5,864	48,997	54,861	106	708	1,016	35	260	132	1,646	1	368
Sep-18	74	74	74	74	74	6,221	48,646	54,867	74	495	1,016	30	224	49	2,017	1	368
Oct-18	74	74	74	74	74	6,179	48,390	54,569	35	236	1,016	26	208	17	1,225	1	368
Nov-18	74	74	74	74	74	6,134	48,420	54,554	2	11	1,016	23	200	0	1,392	1	368
Dec-18	74	74	74	74	74	5,758	49,647	55,405	0	2	1,016	20	198	0	1,039	1	368
Jan-19	74	74	74	74	74	5,315	49,839	55,154	0	0	1,016	17	197	0	1,486	1	368
Feb-19	74	74	74	74	74	5,270	48,902	54,172	0	0	1,016	15	196	0	1,187	1	368
Mar-19	74	74	74	74	74	5,270	48,986	54,256	0	2	1,016	13	195	0	1,347	1	368
Apr-19	74	74	74	74	74	5,270	48,908	54,179	6	37	1,016	12	195	0	1,021	1	368
May-19	74	74	74	74	74	5,270	48,813	54,084	523	4,292	1,016	10	213	47	5,918	1	368
Jun-19	74	74	74	74	74	5,270	48,777	54,048	59	397	1,016	9	266	176	1,659	1	368
Jul-19	74	74	74	74	74	5,229	48,643	53,872	94	625	1,016	8	287	228	1,647	1	368
Aug-19	74	74	74	74	74	4,933	49,605	54,538	106	708	1,016	7	247	132	1,619	1	368
Sep-19	74	74	74	74	74	4,582	50,171	54,753	74	495	1,016	6	212	49	1,992	1	368
Oct-19	74	74	74	74	74	4,493	49,680	54,173	35	236	1,016	5	199	17	1,205	1	368
Nov-19	74	74	74	74	74	4,535	49,638	54,173	2	11	1,016	5	191	0	1,377	1	368
Dec-19	74	74	74	74	74	4,579	49,719	54,298	0	2	1,016	4	191	0	1,022	1	368

	Snap Lake	Core Facilities Water Systems				Underground			North Pile Sumps								
Stream Description	**Raw Water Withdrawal**	**Raw Water to WTP**	**Domestic Water to Camp**	**Sanitary Sewage to STP**	**Treated Effluent to Snap Lake**	**Seepage from Concatenate Water**	**Seepage from Snap Lake**	**Minewater to WTP**	**Direct Precipitation on Sumps**	**Runoff from Land Areas**	**Process Flows**	**Draindown**	**Infiltration**	**Evaporation**	**Drainage to WMP**	**Seepage to Snap Lake**	**Water Retained in the Pile Source of draindown flows)**
Stream Number	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**Q12**	**Q13**	**Q14**	**Q15**	**Q16**	**Q17**
Data Source	**Calculated =Q3**	**Calculated =Q1**		**Calculated =Q3**	**Calculated =Q4**			**Calculated =Q6**									**Calculated =Q28-Q11**
Sign Convention	**+ From Lake**	**+ To Site**	**+ To Site**	**+ To STP**	**+ From STP**	**+ To Mine**	**+ To Mine**	**+ From Mine**	**+ To North Pile**	**+ To North Pile**	**+ From North Pile To North Pile Sumps**	**+ From North Pile To North Pile Sumps**	**+ From North Pile To North Pile Sumps**	**+ From North Pile**	**+ From North Pile**	**+ From North Pile**	**+ To North Pile**
Month-Year	**m^3/day**	**m^3/day**	**m^3/day**	**m^3/day**	**m^3/day**	**m^3/day**		**m^3/day**	**m^3/day**	**m^3/day**	**m^3/day**	**m^3/day**	**m^3/day**	**m^3/day**	**m^3/day**	**m^3/day**	**m^3/day**
Jan-20	74	74	74	74	74	4,663	50,062	54,725	0	0	1,016	4	191	0	1,476	1	368
Feb-20	74	74	74	74	74	4,752	49,868	54,620	0	0	1,016	3	191	0	1,177	1	368
Mar-20	74	74	74	74	74	4,752	49,421	54,173	0	2	1,016	3	190	0	1,294	1	368
Apr-20	74	74	74	74	74	4,752	49,379	54,131	47	383	1,016	3	190	0	1,067	1	368
May-20	74	74	74	74	74	4,752	49,376	54,128	483	3,956	1,016	2	210	47	5,965	1	368

Stream Description	Water Management Pond (WMP)					Water Treatment Plant (WTP)			Process Plant	
	Direct Precipitation	**Runoff from Land Areas**	**Evaporation**	**Seepage**	**Net Flow Pumped to TWTP/WTP**	**Dust Suppression**	**Discharge to Snap Lake**	**Pumped to Process**	**Water in Ore**	**Pumped to North Pile**
Stream Number	**Q18**	**Q19**	**Q20**	**Q21**	**Q22**	**Q23**	**Q24**	**Q25**	**Q26**	**Q27**
Data Source										
Sign Convention	**+ To WMP**	**+ To WMP**	**+ From WMP**	**+ From WMP**	**+ From WMP**	**+ From WTP**	**+ From WTP**	**+ From WTP**	**+ To Process Plant**	**+ From Process Plant**
Month-Year	**m^3/day**	**m^3/day**	**m^3/day**	**m^3/day**	**m^3/day**	**m^3/day**	**m^3/day**	**m^3/day**	**m^3/day**	**m^3/day**
Jan-11	0	0	0	32	-629	0	21,723	1,388	19	1,442
Feb-11	0	0	0	36	915	0	23,591	1,279	19	1,292
Mar-11	0	0	0	32	1,021	0	24,277	1,213	19	1,238
Apr-11	3	10	0	33	845	0	24,505	1,072	19	1,107
May-11	126	476	26	32	4,609	0	28,374	1,265	19	1,276
Jun-11	31	103	107	33	2,744	300	26,533	1,248	19	1,266
Jul-11	49	162	161	32	1,681	300	25,699	1,266	19	1,290
Aug-11	55	184	122	32	1,043	300	25,729	1,159	19	1,184
Sep-11	39	129	44	33	1,954	300	26,929	1,193	19	1,208
Oct-11	18	61	0	32	294	300	25,737	1,008	19	1,010
Nov-11	1	3	0	33	815	0	26,890	1,124	19	1,126
Dec-11	0	0	0	32	787	0	27,047	1,063	19	1,112
Jan-12	0	0	0	32	-124	0	26,582	968	19	958
Feb-12	0	0	0	36	1,320	0	28,350	1,000	19	1,066
Mar-12	0	0	0	32	415	0	27,145	1,596	19	1,612
Apr-12	0	0	0	33	3,879	0	30,906	1,395	19	1,325
May-12	401	1,525	27	32	9,284	0	36,123	1,493	19	1,480
Jun-12	95	318	109	33	3,503	300	29,750	1,992	19	2,005
Jul-12	29	96	159	32	1,411	300	28,340	1,531	19	1,591
Aug-12	76	252	126	32	2,008	300	30,881	1,431	19	1,465
Sep-12	38	127	66	33	1,893	300	32,750	1,487	19	1,536
Oct-12	11	36	15	32	689	300	31,655	1,264	19	1,293
Nov-12	0	0	0	33	-352	0	30,853	1,431	19	1,455
Dec-12	0	0	0	32	288	0	32,414	1,411	19	1,438
Jan-13	0	0	0	32	1,282	0	33,850	1,628	19	1,667

Stream Description	Water Management Pond (WMP)					Water Treatment Plant (WTP)			Process Plant	
	Direct Precipitation	Runoff from Land Areas	Evaporation	Seepage	Net Flow Pumped to TWTP/WTP	Dust Suppression	Discharge to Snap Lake	Pumped to Process	Water in Ore	Pumped to North Pile
Stream Number	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27
Data Source										
Sign Convention	+ To WMP	+ To WMP	+ From WMP	+ From WMP	+ From WMP	+ From WTP	+ From WTP	+ From WTP	+ To Process Plant	+ From Process Plant
Month-Year	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day
Feb-13	0	0	0	36	2,697	0	36,274	1,562	19	1,585
Mar-13	0	0	0	32	2,619	0	36,995	1,308	19	1,286
Apr-13	3	10	0	33	1,356	0	35,387	1,428	19	1,453
May-13	273	1,033	31	32	6,358	0	42,143	1,636	19	1,668
Jun-13	31	103	117	33	1,832	300	40,273	1,653	19	1,644
Jul-13	49	162	152	32	1,372	300	41,040	1,363	19	1,384
Aug-13	55	184	88	32	1,372	300	41,288	1,363	19	1,384
Sep-13	39	129	33	33	1,539	300	41,599	1,363	19	1,384
Oct-13	18	61	11	32	1,372	300	41,924	1,363	19	1,384
Nov-13	1	3	0	33	1,144	0	42,710	1,363	19	1,384
Dec-13	0	0	0	32	817	0	42,465	1,363	19	1,384
Jan-14	0	0	0	32	1,327	0	44,695	1,363	19	1,384
Feb-14	0	0	0	36	1,136	0	46,951	1,363	19	1,384
Mar-14	0	0	0	32	1,149	0	47,099	1,363	19	1,384
Apr-14	3	10	0	33	1,084	0	46,197	1,363	19	1,384
May-14	273	1,033	31	32	3,626	0	49,104	1,363	19	1,384
Jun-14	31	103	117	33	3,368	300	50,086	1,363	19	1,384
Jul-14	49	162	152	32	1,372	300	48,825	1,363	19	1,384
Aug-14	55	184	88	32	1,533	300	48,882	1,363	19	1,384
Sep-14	39	129	33	33	1,788	300	53,786	1,363	19	1,384
Oct-14	18	61	11	32	1,372	300	60,736	1,363	19	1,384
Nov-14	1	3	0	33	1,197	0	64,381	1,363	19	1,384
Dec-14	0	0	0	32	813	0	63,584	1,363	19	1,384
Jan-15	0	0	0	32	1,327	0	62,934	1,363	19	1,384
Feb-15	0	0	0	36	1,134	0	63,289	1,363	19	1,384
Mar-15	0	0	0	32	1,147	0	63,375	1,363	19	1,384
Apr-15	3	10	0	33	1,078	0	62,694	1,363	19	1,384
May-15	273	1,033	31	32	3,626	0	67,488	1,363	19	1,384
Jun-15	31	103	117	33	3,368	300	68,514	1,363	19	1,384
Jul-15	49	162	152	32	1,372	300	68,582	1,363	19	1,384
Aug-15	55	184	88	32	1,533	300	71,503	1,363	19	1,384
Sep-15	39	129	33	33	1,788	300	69,881	1,363	19	1,384
Oct-15	18	61	11	32	1,372	300	67,373	1,363	19	1,384
Nov-15	1	3	0	33	1,202	0	71,209	1,363	19	1,384
Dec-15	0	0	0	32	812	0	74,638	1,363	19	1,384
Jan-16	0	0	0	32	1,327	0	72,870	1,363	19	1,384
Feb-16	0	0	0	36	1,134	0	71,133	1,363	19	1,384
Mar-16	0	0	0	32	1,154	0	71,095	1,363	19	1,384
Apr-16	25	93	0	33	1,076	0	71,072	1,363	19	1,384
May-16	252	953	31	32	3,706	0	73,064	1,363	19	1,384
Jun-16	31	103	117	33	3,285	300	73,481	1,363	19	1,384
Jul-16	49	162	152	32	1,372	300	84,514	1,363	19	1,384
Aug-16	55	184	88	32	1,533	300	96,709	1,363	19	1,384
Sep-16	39	129	33	33	1,788	300	93,545	1,363	19	1,384
Oct-16	18	61	11	32	1,372	300	87,833	1,363	19	1,384

Stream Description	Water Management Pond (WMP)					Water Treatment Plant (WTP)			Process Plant	
	Direct Precipitation	Runoff from Land Areas	Evaporation	Seepage	Net Flow Pumped to TWTP/WTP	Dust Suppression	Discharge to Snap Lake	Pumped to Process	Water in Ore	Pumped to North Pile
Stream Number	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27
Data Source										
Sign Convention	+ To WMP	+ To WMP	+ From WMP	+ From WMP	+ From WMP	+ From WTP	+ From WTP	+ From WTP	+ To Process Plant	+ From Process Plant
Month-Year	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day
Nov-16	1	3	0	33	1,172	0	88,871	1,363	19	1,384
Dec-16	0	0	0	32	840	0	89,050	1,363	19	1,384
Jan-17	0	0	0	32	1,327	0	94,236	1,363	19	1,384
Feb-17	0	0	0	36	1,126	0	96,616	1,363	19	1,384
Mar-17	0	0	0	32	1,154	0	92,488	1,363	19	1,384
Apr-17	3	10	0	33	1,073	0	91,822	1,363	19	1,384
May-17	273	1,033	31	32	3,774	0	93,768	1,363	19	1,384
Jun-17	31	103	117	33	3,036	300	93,065	1,363	19	1,384
Jul-17	49	162	152	32	1,855	300	90,813	1,363	19	1,384
Aug-17	55	184	88	32	2,177	300	90,675	1,363	19	1,384
Sep-17	39	129	33	33	2,537	300	90,795	1,363	19	1,384
Oct-17	18	61	11	32	1,533	300	89,641	1,363	19	1,384
Nov-17	1	3	0	33	1,372	0	89,793	1,363	19	1,384
Dec-17	0	0	0	32	1,372	0	91,873	1,363	19	1,384
Jan-18	0	0	0	32	1,372	0	93,484	1,363	19	1,384
Feb-18	0	0	0	36	1,372	0	93,312	1,363	19	1,384
Mar-18	0	0	0	32	1,272	0	92,579	1,363	19	1,384
Apr-18	3	10	0	33	1,303	0	92,739	1,363	19	1,384
May-18	273	1,033	31	32	5,711	0	96,819	1,363	19	1,384
Jun-18	31	103	117	33	3,618	300	93,308	1,363	19	1,384
Jul-18	49	162	152	32	1,775	300	91,050	1,363	19	1,384
Aug-18	55	184	88	32	1,855	300	90,682	1,363	19	1,384
Sep-18	39	129	33	33	2,038	300	90,867	1,363	19	1,384
Oct-18	18	61	11	32	1,372	300	89,822	1,363	19	1,384
Nov-18	1	3	0	33	1,372	0	89,933	1,363	19	1,384
Dec-18	0	0	0	32	989	0	90,189	1,363	19	1,384
Jan-19	0	0	0	32	1,327	0	90,348	1,363	19	1,384
Feb-19	0	0	0	36	1,347	0	89,488	1,363	19	1,384
Mar-19	0	0	0	32	1,181	0	89,185	1,363	19	1,384
Apr-19	3	10	0	33	1,242	0	89,082	1,363	19	1,384
May-19	273	1,033	31	32	5,035	0	92,609	1,363	19	1,384
Jun-19	31	103	117	33	3,535	300	90,598	1,363	19	1,384
Jul-19	49	162	152	32	1,694	300	88,495	1,363	19	1,384
Aug-19	55	184	88	32	1,775	300	89,908	1,363	19	1,384
Sep-19	39	129	33	33	2,038	300	90,517	1,363	19	1,384
Oct-19	18	61	11	32	1,372	300	88,602	1,363	19	1,384
Nov-19	1	3	0	33	1,372	0	88,860	1,363	19	1,384
Dec-19	0	0	0	32	960	0	88,361	1,363	19	1,384
Jan-20	0	0	0	32	1,327	0	89,144	1,363	19	1,384
Feb-20	0	0	0	36	1,324	0	89,214	1,363	19	1,384
Mar-20	0	0	0	32	1,183	0	88,584	1,363	19	1,384
Apr-20	25	93	0	33	1,209	0	88,399	1,363	19	1,384
May-20	252	953	31	32	5,113	0	92,124	1,363	19	1,384

2.6 ANY OTHER INFORMATION REQUIRED TO DESCRIBE HOW WATER AND WASTEWATER WILL BE MANAGED

This section corresponds to Schedule 5, Part 1a, item vii of Water License MV2011L2-0004.

2.6.1 Surface Water Management Protocols

Effective management of surface water at Snap Lake Mine is critical to adhere to water license agreements by preventing spills from occurring. Surface water management is comprised primarily of the North Pile Sumps, WMP, TWTP, WTP, as well as influent from underground that becomes part of the surface system en route to the WTP or WMP. There are a large number of personnel that contribute to the overall success of effective surface water management.

2.6.1.1 Freshet Management

The purpose of freshet management is to provide a clear description of the steps that must be followed daily as well as during an emergency event, for consistency between personnel and for the understanding of new employees to the team. It is up to every individual to ensure a clear understanding of every aspect of his/her role and how it fits into water management.

2.6.1.2 North Pile Perimeter Water Control Structures

Water captured by the north pile sumps is pumped to the WMP. There are five permanent sumps (PS1, PS2, PS3, PS4 and PS5), one temporary sump (TS4), three water collection/diversion ditches (IL6 Ditch, West Ditch, PS3-PS4 Ditch) and the WMP. The purpose of the sumps is to capture water draining off the north pile, and then pump to the WMP. During precipitation events such as the annual freshet (it is often necessary to have storage in the sumps, however this is only on a temporary basis. During freshet, due to increased inflows, there is a requirement for a close watch on the system for the duration of freshet to prevent spillage events. Outside of the freshet period, even though water volumes may be lower, water management is no less important as a spill can occur at anytime. The sump water levels are monitored by means of:

- Daily survey report
- Remote instrumentation network
- Field/visual checks (level poles, marker pylons/rocks, etc.)

2.6.1.3 Freshet Flocculation Tank

De Beers installed a 400 cubic meter settling tank structure in 2013 which has been erected for operation during Freshet to aid in turbidity control by pre-treating and settling high turbidity water before allowing it to enter the WMP. The main objective of this flocculation tank is to ensure that there is no hindrance to pumping from the WMP to the WTP due to turbidity issues.

The flocculation tank has been set up adjacent to PS3 on a gravel pad which has been leveled within grader tolerance during construction. The location was set to allow for mixing of chemicals in pipelines prior to discharge into the flocculation tank and also for the proximity to a perimeter sump in the event of very high flows or malfunction which will require draining of the flocculation tank into an existing sump structure. Piping in and out of the flocculation tank has been developed to accommodate both temporary and permanent perimeter sump piping system lines; there should be no changes required in piping infrastructure going forward.

2.6.1.4 Ice Management

During winter, sumps need to be maintained at a level where pumps can remain in recirculation, to prevent lines and suction wells from freezing, control the surface ice formation, and ensure there is always adequate pumping capacity available. De- icing is a regular practice to ensure that ice buildup is prevented and/or kept to a minimum. This requires continual monitoring and job planning to ensure that manpower and equipment are available to maintain all sump ice levels. Diligent maintenance of infrastructure such as pumps, lines, and generators, is especially critical during winter to manage the water amidst challenging conditions.

Ice accumulation in sumps requires action, as ice reduces the available storage volume and puts upstream water management at risk. In other words, water and ice must both be managed in sumps, whether by pumping or excavating. Sump icing is to be monitored during daily field checks, with the de-icing schedule for the following days formed accordingly, as different sumps are subject to ice formation at varying rates.

When water is not visible, survey will report ice levels instead. The absence of water or an ice survey reading does not indicate that a sump does not need maintenance, but rather may indicate that it is time to de-ice the sump to recover its storage capacity.

Ice formation must also be monitored and removed in the critical flow ditches which need to remain clear for water management, i.e. West Ditch.

2.6.1.5 IL6 Ditch

The primary purpose of IL6 Ditch is to capture runoff flow from the tundra between TS4 and IL6 Ditch during freshet. This area was impacted by the TS4 overtopping in December 2011, which contaminated the ground with elevated nitrate levels. The IL6 Ditch is only a mitigation tool to minimize a potential spill event from TS4. It is not a water control structure to be used in managing TS4.

The IL6 Ditch directs any captured flow into IL6 and this area is monitored, pumped, and de-iced. Environmental/Permitting permission has been granted to de-ice IL6 similar to all other sumps as of December 2012.

2.6.1.6 Water Management Pond

The WMP is the collection point for all water pumped from the sumps around the north pile. The two main potential challenges are heightened nitrate and turbidity levels. Nitrate and turbidity levels can be controlled by understanding the sources of nitrate and turbidity, and then adjusting pumping rates from sumps into the WMP as well as water pumped out of the pond to the WTP. Therefore, having information such as nitrate and turbidity levels of each source before pumps are activated provides a valuable tool to managing surface water in an environmentally responsible manner. The water mixing spreadsheet model is useful for predicting the effect on the WMP and WTP discharge quality and the surface water balance, as a result of the flows from the sumps.

2.6.1.7 Temporary Sump 4

TS4 is a critical sump as it is a receiving area for elevated flows of water from the North Pile, which in extreme cases can result in a spill, as occurred in December 2011. It is unacceptable to have a repeat spill, therefore, additional monitoring and manpower, additional pumping capacity, and increased communication between site personnel is provided at this location when required.

2.6.1.8 Conclusion

Successful surface water management is a team effort. Responsibilities, accountability, and diligent following of procedures are essential. This planning serves as the minimum baseline guide to surface water management at Snap Lake Mine.

2.7 INFORMATION REGARDING MONITORING

2.7.1 Details of Monitoring, Including a Rationale for Each Component of the Water Management System

The Water Management Plan will incorporate all necessary measures and procedures to comply with the requirements of Water License MV2011L2-0004. A Surveillance Network Program (SNP) has been established to satisfy water License requirements, and locations of mine site SNP stations are shown on in Appendix III. Specific requirements and standards for water monitoring and compliance, as per Part F of the Water Licence, include the following:

- *The total quantity of fresh Water drawn from Snap Lake and used by the Snap Lake Diamond Project shall not exceed one hundred and eighty-eight thousand (188,000) cubic metres annually.*
- *The Licensee shall install meters for all structures used to withdraw Water or Discharge Waters or Waste to the satisfaction of an Inspector.*
- *The Licensee shall construct and maintain the Water intake in accordance with the Department of Fisheries and Ocean's (DFO's) requirements to prevent entrainment of fish. Dimensions should follow DFO's Freshwater Intake End-of-Pipe Fish Screen Guidelines.*
- *The Licensee shall manage Water and Wastewater with the objective of minimizing the impacts of the Project on the quantity and quality of Water in the Receiving Environment through the use of appropriate mitigation measures, monitoring, and follow-up actions.*
- *The Licensee shall submit to the Board for approval an update of the Water Management Plan on October 1, 2013 and at the following times:*

  a) If the Licensee seeks changes to the plan;

  b) Every three (3) years following approval of the plan; or

  c) Upon the request of the Board.

  Updates to the Water Management Plan shall describe how the Licensee is meeting the objectives listed in Part F, Item 4 of this License and satisfy the requirements of Schedule 5, Item 1.

The Licensee shall operate in accordance with the plan referred to Part F, Item 5 as and when approved by the Board.

- *The Licensee shall operate in accordance with the plan referred to Part F, Item 5 as and when approved by the Board.*

- *The results of any monitoring performed in a calendar year under the approved Water Management Plan described shall be reported in the Annual Water License Report as per Part B, Item 7 and Schedule 1, Item 1.s.*

- *Effluent from the Sewage Treatment Plant shall be tested prior to mixing with the effluent from the Water Treatment Plant at Surveillance Network Program StationNumber 02-16i and will meet the following effluent quality requirements:*

Parameter	Maximum Concentration of any Grab Sample	Average Monthly Limit
BOD_5	25.0 mg/L	15.0 mg/L
Oil and Grease	5.0 mg/L	3.0 mg/L
Faecal Coliforms	20 CFU/100mL	10 CFU/100mL

- *Effluent quality criteria requirements:*

  All Water or Waste from the Project that enters the Receiving Environment, including all Discharges from Surveillance Network Program Station 02-17b (permanent Water treatment plant) and 02-17 (temporary Water treatment plant), shall meet the following effluent quality criteria:

Parameter	Effluent Quality Criteria in mg/L	
	Maximum Average	**Maximum Grab**
Total Suspended Sediments	7	14
Ammonia as N	10	20
Nitrite as N	0.5	1.0
Nitrate as N (up to December 31, 2014)	22	44
Nitrate as N (from January 1, 2015)	4	8
Chloride (up to December 31, 2014)	310	620
Chloride (from January 1, 2015)	160	320
Fluoride (from January 1, 2015)	0.15	0.3
Sulphate	75	150
Aluminum	0.1	0.2
Arsenic	0.007	0.014
Chromium	0.01	0.02
Copper	0.003	0.006
Lead	0.005	0.01
Nickel	0.05	0.1
Zinc	0.01	0.02

N = nitrogen; mg/L = milligrams per litre.

- *Any Water or Waste from the Project that enters the Receiving Environment shall have a pH between 6.0 and 9.0, except surface runoff which shall have a pH between 5.0 and 9.0.*

- *The monthly average limit for Extractable Petroleum Hydrocarbons shall be 4.6 mg/L for F1 (C6-C10) and 2.1 mg/L for F2 (C11-C16) and the Discharge shall be managed to prevent the appearance of any visible film from the Discharge on the surface of Snap Lake in the vicinity of the outfall.*

- *The Licensee shall ensure that the effluent discharged to Snap Lake shall not be acutely toxic to aquatic life, using protocols described in the Surveillance Network Program annexed to this Licence.*

- *The pH of the final effluent discharged to Snap lake at SNP station 02-17 and 02-17b shall be managed as necessary by the Licensee to prevent acute toxicity of ammonia in the final effluent discharged. Adjustment of the pH shall be made only when* *necessary to prevent acute ammonia toxicity and shall not result in a pH in the final effluent below the ambient pH of Snap lake at any time.*

- *Total phosphorus loads from the Water and Sewage Treatment Plants discharging to Snap Lake must be controlled, as per approved operations plans, such that loads of total phosphorus do not exceed an annual loading of 256 (two hundred and fifty-six) kg per year in any calendar year during the life of the Project.*

- *The Licensee shall direct all Water or Waste from the Project that does not meet the effluent quality criteria specified under Part F, Item 9 to the Water Treatment Plant or Water Management Pond. The Inspector may authorize the divergence of Water to an alternate location if necessary. The Licensee shall notify the Board in writing within twenty-four (24) hours of this authorization being granted.*

- *The calculated whole lake average of total dissolved solids (TDS), (as described in the Surveillance Network Program) at sampling locations comprising Surveillance Network Program Station Number 02-18 shall remain below 350 mg/L at all times.*

- *The Licensee shall submit to the Board for approval a Plume Characterization Study to assess the performance of the outfall diffuser installed in 2011 and the distribution of the diffuser plume in Snap Lake under a variety of conditions (including under ice in late winter) by January 31, 2013.*

- *The Licensee shall submit for approval by December 31, 2013 a Strontium Response Plan that satisfies the requirements of Schedule 5, Item 2.*

- *The Licensee shall submit for approval by December 31, 2013 a TDS Response Plan that satisfies the requirements of Schedule 5, Item 3.*

- *The Licensee shall submit for approval by December 31, 2013 a Nitrogen Response Plan that satisfies the requirements of Schedule 5, Item 4.*

- *If not approved by the Board, the plans referred to in Part F, Items 5, 15, 16, and 17 shall be revised and resubmitted in accordance with directives from the Board.*

- *The Licensee shall implement the plans referred to in Part F, Items 15, 16, and 17 as and when approved by the Board.*

- *The Licensee will re-evaluate the Best Available Technology for treatment of the effluent discharged to Snap Lake and submit their findings at the request of the Board.*

The SNP includes a number of sampling stations on the mine site that are not explicitly referenced in the Water Licence. The locations of mine site SNP stations are shown in Appendix III, and are discussed in Table 2-4.

Table 2-4 Summary of SNP Sampling Stations

SNAP LAKE SNP SAMPLING REQUIREMENTS

Water License (MV2011L2-004)

Station Number	Area Description	Frequency of Sample	Lab Analyzing Sample	# of Bottles	Bottles Used	Tests Performed
SNP 02-01	Final Minewater Collection Sump	Continuous	Internal	0	None	Flow, Conductivity, Temperature, Turbidity, pH
		Weekly	ALS Global	3	Routine, Nutrients	pH, Turbidity, TDS/TSS, Total Ammonia, Calcium, Chloride
		Monthly	ALS Global	11	Routine, Nutients, Total and Dissolved Metals, BTEX, F1/F2, TOC, Oil and Grease	Turbidity, TDS/TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX, Oil and Grease.
SNP 02-02	North Pile Drainage Collection Ditch	Continuous	Internal	0	None	Flow, Conductivity, Temperature, Turbidity, pH
		Weekly during spring freshet and heavy rainfall events	ALS Global	1	Routine	TSS and turbidity
		Monthly	ALS Global	10	Routine, Nutients, Total and Dissolved Metals, BTEX, F1/F2, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX
SNP 02-03	Core Facilities Area Collection Ditch Near Water Management Pond	Continuous	Internal	1	None	Flow, Conductivity, Temperature, Turbidity, pH
		Weekly during spring freshet and heavy rainfall events	ALS Global	1	Routine	TSS and turbidity
		Monthly	ALS Global	10	Routine, Nutients, Total and Dissolved Metals, BTEX, F1/F2, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX
SNP 02-04	Uncontrolled Surface Runoff at Culvert by Airstrip	Twice per week during spring freshet	ALS Global	10	Routine, Nutients, Total and Dissolved Metals, BTEX, F1/F2, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX

		Daily during heavy heavy rain if measurable flow is present	ALS Global	10	Routine, Nutients, Total and Dissolved Metals, BTEX, F1/F2, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX
SNP 02-05	Uncontrolled Surface Runoff at Bulk Sample Mine Rock Pad	Twice per week during spring freshet	ALS Global	10	Routine, Nutients, Total and Dissolved Metals, BTEX, F1/F2, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX
		Daily during heavy heavy rain if measurable flow is present	ALS Global	10	Routine, Nutients, Total and Dissolved Metals, BTEX, F1/F2, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX
SNP 02-06	Uncontrolled Surface Runoff at Quarry Site	Twice per week during spring freshet	ALS Global	10	Routine, Nutients, Total and Dissolved Metals, BTEX, F1/F2, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX
		Daily during heavy heavy rain if measurable flow is present	ALS Global	10	Routine, Nutients, Total and Dissolved Metals, BTEX, F1/F2, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX
SNP 02-07	Uncontrolled Runoff at Road to Bulk Emulsion Plant	Twice per week during spring freshet	ALS Global	10	Routine, Nutients, Total and Dissolved Metals, BTEX, F1/F2, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX
		Daily during heavy heavy rain if measurable flow is present	ALS Global	10	Routine, Nutients, Total and Dissolved Metals, BTEX, F1/F2, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX
SNP 02-08	Uncontrolled Surface Runoff at Winter Access Road	Twice per week during spring freshet	ALS Global	10	Routine, Nutients, Total and Dissolved Metals, BTEX, F1/F2, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX
		Daily during heavy heavy rain if measurable flow is present	ALS Global	10	Routine, Nutients, Total and Dissolved Metals, BTEX-TEH, F1/F2, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX

SNP 02-09	Uncontrolled Surface Runoff at Emulsion Plant Road	Twice per week during spring freshet	ALS Global	10	Routine, Nutrients, Total and Dissolved Metals, BTEX-TEH, F1/F2, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX
		Daily during heavy heavy rain if measurable flow is present	ALS Global	10	Routine, Nutrients, Total and Dissolved Metals, BTEX, F1/F2, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX
SNP 02-10	Any Other Point Where Observable Flow to Snap Lake of IL5 is Oberserved	Twice per week during spring freshet	ALS Global	10	Routine, Nutrients, Total and Dissolved Metals, BTEX, F1/F2, TOC	Turbidity, TDS/TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, Extractable Petroleum Hydrocarbons, (F1 & F2), BTEX
		Daily during heavy heavy rain if measurable flow is present	ALS Global	10	Routine, Nutrients, Total and Dissolved Metals, BTEX, F1/F2, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX
SNP 02-11	Seepage Well Down Gradient From Dam 1 Near Snap Lake Shoreline	Monthly	Internal	0	None	Water Level
		Quarterly when water is present	ALS Global	10	Routine, Nutrients, Total and Dissolved Metals, BTEX, F1/F2, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX
SNP 02-12	Seepage Well Down Gradient From Dam 1 at Water Management Pond	Monthly	Internal	0	None	Water Level
		Quarterly when water is present	ALS Global	10	Routine, Nutrients, Total and Dissolved Metals, BTEX, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX
SNP 02-13	Seepage Well Down Gradient from Dam 2 at Water Management Pond	Monthly	Internal	0	None	Water Level
		Quarterly when water is present	ALS Global	10	Routine, Nutrients, Total and Dissolved Metals, BTEX, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX
SNP 02-14	Water Mangement Pond	Continuous	Internal	0	None	Flow
		Weekly when pumping to the WMP	ALS Global	10	Routine, Nutrients, Total and Dissolved Metals, BTEX-THE, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, TEH, F1/F2, BTEX

		Quarterly (when not pumping to the WTP)	ALS Global	10	Routine, Nutrients, Total and Dissolved Metals, BTEX, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury,TEH, F1/F2, BTEX
SNP 02-15	Water Intake from Snap Lake	Monthly	ALS Global	3	Routine, Nutrients, Feacal Coliform	E. Coli, Major Ions, Nitrate, TDS (calc)
		Quarterly	ALS Global	3	1x20L, 2x Faecal Coliform	Microbial Pathogens (Giardia, Cryptosporidium and total heterotrophic plate count)
		Annually	ALS Global	5	Routine, Nutrients, Total and Dissovled Metals, TOC	Colour, Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, ICP-MS Metal Scan, Total Mercury, Cyanide
SNP 02-16 i	Sewage discharge from Sewage Treatment Plant, Prior to Mixing with Water treatment Plant Effluent	Continuous	Internal	0	None	Flow, Conductivity, Temperature, Turbidity, pH
		Every 6 Days	ALS Global	5	Routine, Nutrients, Oil & Grease, BacT, BOD	BOD, Nutrients, Total Oil and Grease, TSS, E. Coli & Faecal Coliform
		Annually	ALS Global	2	Total and Dissolved Metals	ICP-MS Metals scan, colour, cyanide
SNP 02-17	Final Combined Water Treatment Plant and Sewage Treatment Plant Effluent	Continuous	Internal	0	None	Flow, Conductivity, Temperature, Turbidity, pH
		Every 6 Days	ALS Global	4	Routine, Nutrients, TOC, Total Metals	Nutrients, TSS/TDS, Turbidity, Conductivity, Chloride, Calcium, Total metals, TOC
		Monthly	ALS Global	13	Routine, Nutrients, Total and Dissolved Metals, BOD, BTEX, F1, F2, Fecal Coliform, Oil and Grease, TOC	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, BOD, ICP-MS Metal Scan, Total Mercury, F1/F2, BTEX, E. Coli, Total Oil and Grease, Dissolved Oxygen, TOC
		Quarterly	HydroQual	4-20L	80 Liters	Acute lethality to*Oncorhyncus mykiss*, Acute lethality to *Daphnia magna*, Chronic toxicity to the *Ceriodaphnia dubia*, Chronic toxicity to the algea *Pseudokirchneriella subcapitata*
SNP 02-20	Snap lake on the edge of the mixing zone around the diffuser (SNP 02-20d, e, f, and g)	Monthly (during safe ice conditions and during open water) at maximum conductivity	ALS Global	13	Routine, Nutrients, Total and Dissolved Metals, BOD, BTEX, F1, F2, Fecal Coliform, Oil and Grease, TOC, E.coli	Turbidity, TSS, pH, Conductivity, Major Ions, Nutrients, BOD, ICP-MS Metal Scan, Total Mercury, F1/F2, BTEX, E. Coli, Total Oil and Grease, Dissolved Oxygen, TOC

		Annually	HydroQual	4	40 liters	Chronic Toxicity (Ceriodaphnia dubia, Pseudokirchneriella subcapitata)
		Annually	HydroQual	4	60 liters	7-Day Early Life Stage (ELS) egg/alevin Toxicity test with rainbow trout
		Annually	HydroQual	4	60 liters / week for a total of 300 liters	30-Day Early Life Stage (ELS) egg/alevin Toxicity test with rainbow trout

3 INFORMATION ABOUT RESPONSES TO MONITORING RESULTS

3.1 REGULATORY REQUIREMENTS

This section describes the Response Framework for the Snap Lake Water Management Pond. The Response Framework links monitoring results to actions with the purpose of maintaining the Assessment Endpoints within an acceptable range. The framework provides a systematic approach to responding to the results of monitoring activities.

This section is provided to comply with the following specific Water License conditions [Schedule 5, Item 1(c) of MVLWB (2012)]:

ii. *A description of the Response Framework that will be implemented by the Licensee to link the results of monitoring to those corrective actions necessary to ensure that the objectives listed in Part F, Item 5 are met including:*

c. *definitions, with rationale for Action Levels applicable to the performance of the Water Management Pond with respect to geotechnical stability;*

d. for each Action Level, a description of how exceedances of the Action Level will be assessed and generally which types of actions may be taken if the Action Level is exceeded.

3.2 DEFINITIONS AND APPROACH

An "effect" is a change that follows an event or cause. An effect is not inherently negative or positive. A linkage must be established between a measured change and a cause (e.g., mining activity) before appropriate management actions can be determined. Should an effect be detected during monitoring activities, a corresponding "action" will occur. The type of action taken depends on the magnitude or severity of an effect relative to an assessment endpoint. This is termed the *Action Level*.

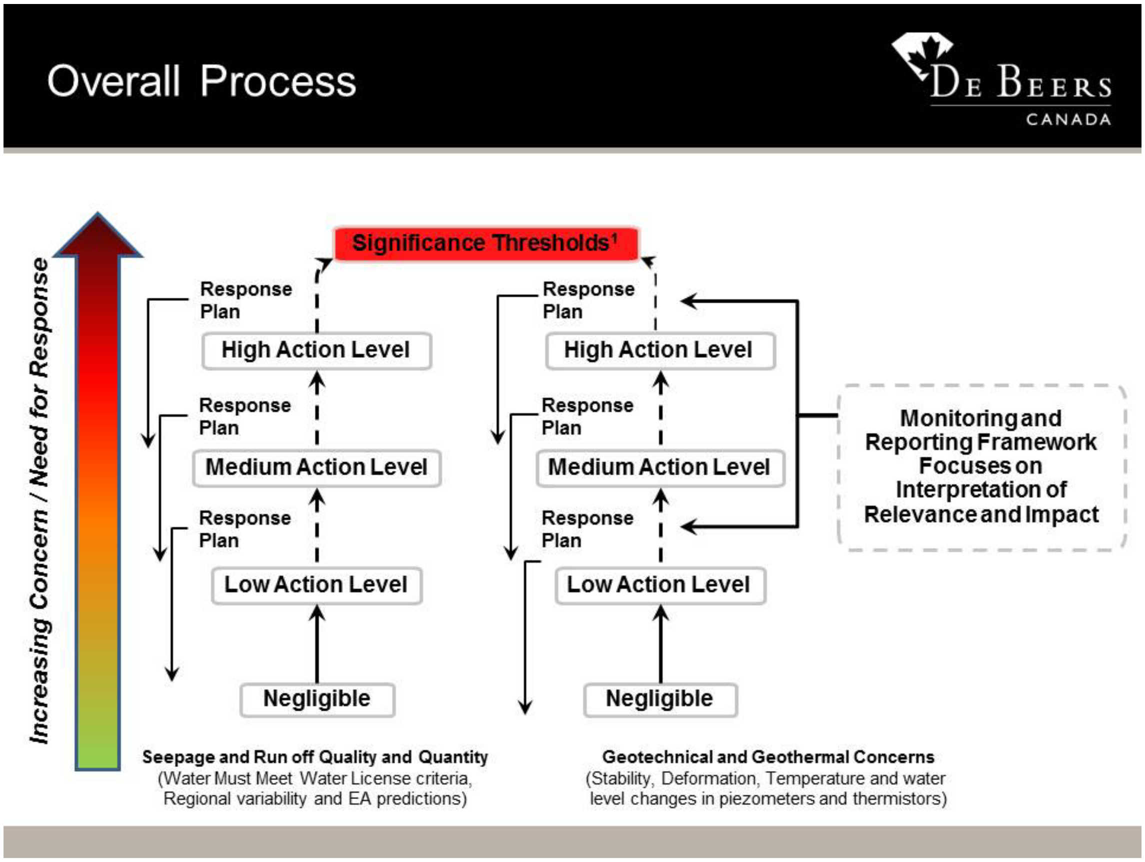
The goal of the Response Framework is to systematically respond to monitoring results such that the potential for significant adverse effects is identified and any necessary mitigation actions are undertaken. This is accomplished by implementing appropriate mitigation at predefined Action Levels, which are triggered before a significant adverse effect could occur. A level of change that, if exceeded, would result in a significant adverse effect is termed a *Significance Threshold*.

The magnitude of an effect is determined by comparing reference areas, background values, or benchmark values for Water Quality and Quantity. For geotechnical thresholds magnitude of effect is based on deformation. For geothermal thresholds it is more discrete dependent on the normal range of variability, however the dams do not rely on freezing to remain stable so thermal characteristics are not a useful measurement of dam stability. Piezometric and stability monitoring are performed. However, the monitoring to date shows that the piezometric conditions are not adversely affecting the stability of the dams. Geotechnical monitoring is performed through regular inspections by De Beers (on a biweekly basis) and Golder (the annual inspection).

A magnitude of effect that falls within the normal range of variability for the Snap Lake region for Water quality and quantity or is well below an applicable benchmark value would not lead to action and is termed a *Negligible Action Level*. A magnitude of effect that falls outside the range of normal variability for the region but is considered to be of low ecological consequence would be classified as a *Low Action Level* and constitutes a “red flag” for careful scrutiny and possible proactive management actions.

Effects at the *Medium Action Level* are either of ecological or stability concern. For example, for water quality, results that are above regional variability or water license criteria or for geotechnical signs of sloughing or deformation that could indicate concern for long term stability Any effect that falls within the *Medium Action Level* poses a potential threat to the Snap Lake ecosystem and must be dealt with by management actions that begin with further investigation to determine both significance and causation, and thus allow effective management intervention if such is required. Should the initial management intervention not be sufficient to remove the potential threat to the Snap Lake ecosystem, then the magnitude of the effect is classified as a *High Action Level* and further, timely management intervention to reverse the effect will be required.

Figure 3-1 Overview of Monitoring Response Framework



- Action Levels related to Geotechnical Stability are not set for each hypothesis because they are based on monitored changes and discussed in consultation with the geotechnical engineer.

- Action levels related to thermal characteristics are not set. In the environmental Assessment Report it noted that water management pond's retention dikes and dams are founded on prepared bedrock, so that they are to be stable even if the pile material remains unfrozen. However, monitoring data is reviewed and reported on should thermal conditions cause concern.

- Action levels related seepage and run off quality and quantity are not set for each hypothesis because they are based on measured chemical concentrations. Therefore, where a linkage exists, it is relatively simple to link chemical concentrations to Mine effluent and activities and develop response plans accordingly (i.e., metals, ions, nutrients come directly from Mine, so whatever substance reaches an Action Level, must be managed). It was acknowledged in the EA Decision Report that small volumes of water will seep into Snap Lake from the Water Management Pond, therefore the low action level is set above this threshold.

Note that the Monitoring framework does not prevent an Action Level from being triggered. A role of the monitoring is to determine whether to trigger the Action Levels for geotechnical/geothermal concern or seepage/run off quality and quantity. As well action Levels were not developed for every substance and monitoring scenario measured in the SNP. The Response Framework thus consists of Action Levels and Significance Thresholds for key indicators as well as types of action that may be taken. The specific action to be taken will depend on the type and severity of effect detected. Specifics on the Significance Thresholds, Action Levels, and types of actions that may be taken are outlined below. This is the first Response Framework that has been developed for the Snap Lake Water Management Plan; it is anticipated that future development and consultation will result in refinement of this Response Framework.

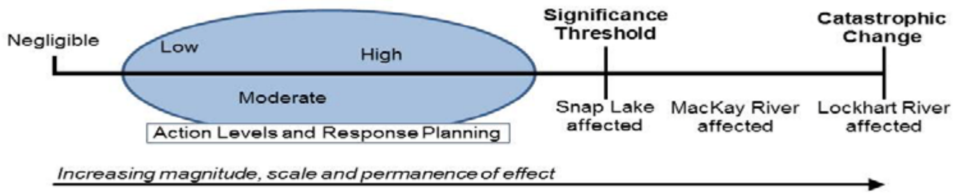
3.2.1 Identification of Significance Thresholds

Significance Thresholds were not explicitly defined in the EAR for the Snap Lake Project and as such had to be developed for this framework. They were developed based on project level risk assessments carried out for the water management pond. Bow ties from this activity are located in Appendix IV.

It was discussed during the EA process that seepage would occur to Snap Lake from the WMP at a rate of approximately 17m^3/day and as per the Water License Annual report, some loadings to the lake due to water quality was acknowledged (Appendix 4). However, these loadings are not significant in terms of mass loading as reported on in the WLAR. However it was noted that geotechnical issues with the WMP dams or seepage resulting in changes to the Lockhart River and to the East arm of Great Slave Lake were also deemed unacceptable, if not “catastrophic”

(Figure 3-2.) The Significance Threshold and Action Levels were therefore designed around changes in Snap Lake only, since such changes would precede possible downstream changes.

Figure 3-2 Conceptual Overview of Action Levels relative to Significance Thresholds



In the Environmental Assessment, the WMP was designed to be located next to the water treatment plant. This pond will store excess water in case inflows exceed the water treatment facility's capacity or the treatment facility shuts down. It was also acknowledged that Drainage from the North Pile, Water conveyance and storage structures and the air Strip will be intercepted and diverted to the Water Management Pond, treated and discharged to Snap Lake during all phases of the mine until post-closure water quality is considered to be acceptable and the original overland runoff to Snap Lake can be restored. As such MVEIRB directed De Beers to monitor inflows to the Water Management pond. This is detailed in Q16, Q17, and Q20 of Table 2-3. It was also acknowledged in the MVEIRB EAR that small portions (0.1%) of water will seep into Snap Lake from the WMP.

3.3 SIGNIFICANCE THRESHOLDS

The significant thresholds for the WMP are provided in Table 3-1. These thresholds encompass the conditions representing a significant adverse effect to the WMP due to seepage quality/quantity or geotechnical stability and, in turn, the monitoring endpoint being evaluated.

Table 3-1 Water Management Pond Action/Significance Thresholds

Concern	Component
Water Management Pond Dam Failure	Geotechnical Stability
Uncontrolled release of water	Seepage/Run off Water Quality and Quantity
Water License Non compliance	Seepage/Run off Water Quality and Quantity

3.3.1 Proposed Action Levels and Response Framework

3.3.1.1 Geotechnical Stability

	Cause/Action threshold	Controls
Key Information	1) Inadequate design: -Seismic event -Extreme Storm or freshet event -Inadequate construction 2) –Dam overtopping -Rise in groundwater below structure - Erosion of embankment	1) Design by Experienced geotechnical professional 2) –Dedicated water management team -Biweekly dam inspections -Third party geotechnical inspections -Safe water levels established -Water Management Plan - Geotechnical monitoring -Armoring on Dam face
Negligible	• Dam performing as per design • No concerns raised during • inspections or visible sloughing, heaving, changes	
Low	• Visible heaving or erosion	• Monitoring as per design • Consultation with Geotechnical Engineer
Medium	TBD	
High	TBD	
Consequences	1) Property damage 2) Water Quality Impacts 3) Terrestrial impacts 4) Reputation 5) Clean-up and Reclamation 6) Legal Investigations 7) Production Interruption	

3.3.1.2 Thermal Characteristics

As per section 2.8.2 action levels related to thermal characteristics are not set. In the environmental Assessment Report it noted that water management pond's retention dikes and dams are founded on prepared bedrock, so that they are to be stable even if the pile material remains unfrozen. However, monitoring data is reviewed and reported on in the WLAR should thermal conditions cause concern.

3.3.1.3 Seepage/Run off Quality and Quantity

Primary concerns of seepage quality and quantity are related to compliance with the Water License, specifically Section, item 9(a) of MVLWB (2012):

All Water or Waste from the Project that enters the Receiving Environment, including all Discharges from Surveillance Network Program Station 02-17b (permanent Water treatment plant) and 02-17 (temporary Water treatment plant), shall meet the following effluent quality criteria:

Parameter	Max Average (mg/L) June 14, 2912	Max Grab (mg/L) June 14, 2012	Max Average (mg/L) January 1, 2015	Max Grab (mg/L) January 1, 2015
Total suspended solids	7	14		
Ammonium as N	10	20		
Nitrate as N	0.5	1.0		
Nitrate as N	22	44	4	8
Chloride	310	640	160	320
Flouride	n/a	n/a	0.15	0.3
Sulphate	75	150		
Aluminum	0.1	0.2		
Arsenic	0.007	0.014		
Cadmium	n/a	n/a		
Chromium	0.01	0.02		
Copper	0.003	0.006		
Lead	0.005	0.01		
Nickel	0.05	0.1		
Zinc	0.01	0.02		
F1 Fractions		4.6		
F2 Fractions		2.1		

Figure 3-3: Uncontrolled Release of Water

Tiered Action Level	Cause/Action Threshold	Controls
Key Information	1) Climate variability beyond design assumptions 2) Sequential / frequent major precipitation events 3) Excess precipitation 4) Poor understanding of natural/hydrogeological flows 5) Artificial infiltration 6) Unforeseen water accumulation 7) Poor design 8) Change in mine structure or flows 9) Human error 10) Inadequate resourcing 11) Infrastructure failure	1) -Modelling & forecasting of weather pattern -Including historical dataset in design 2) Water balance management 3) -Adequate infrastructure design -Storm water management (clean/dirty water separation and minimization of surface/catchment area 4) -Circulation System 5) Decommissioning of boreholes 6) -Unforeseen underground inrushes -Geological drilling and modeling 7) -Mine Design -Design regulations -Water level surveys -Audits and Inspections 8) Change of management 9) –Training -Coaching -Emergency Drills 10) Proper communication 11) –Preventative maintenance –Inspections and monitoring
Negligable	• WMP maintained below acceptable freeboard level; no concern with levels	• Monitoring program for water control structures, dams and SNP
Low	• Water within 1 meter of free board level • Concern over underground or surface storage due to inundation	• Pre-authorization for controlled release • Sufficient dam capacity design • Monitoring mine water storage capacity • Emergency response procedure • Mine water balance
Medium	TBD	
High	TBD	
Consequence		

Figure 3-4: Nonconformance of Water License

Tiered Action Level	Cause/Action Threshold	Controls
Key Information	1) Training 2) Criteria Awareness and appropriate QA/QC 3) Monitoring discrepancies 4) Equipment breakdown	1) Training programs in place for operators/ sampling technicians 2) Adherence to QA/QC and sampling procedures as approved -Posting of license in Laboratory 3) Duplicate sampling procedures, lab and field blanks 4) -Secondary Monitoring -Calibration
Negligable	All Water license samples meet license criteria	
Low	Trend of samples below Water Management Pond dams exceeding EQC criteria for Maximum average.	
Medium	TBD	
High	TBD	
Consequence	1) Environmental Contamination 2) Legal nonconformance 3) Reputational Damage	

The AEMP is designed to specifically monitor concerns due to Nutrient Enrichment and Toxicological Impairment, as well as impacts to drinking water and aesthetics. For specific Action Thresholds in lake please see Chapter 6 of the AEMP design plan.

3.3.2 Suggested Responses

Table 3-2 provides a summary of suggested responses to be taken (Actions) when an Action Level is reached. For any Action Level, the following Water Management “Best Practices” will be followed monthly if appropriate and at a minimum each year when interpreting Monitoring results:

- Assess cause/linkage to Mine;
- Examine trends;
- Predict trends, where appropriate;
- Examine ecological or geotechnical significance; and,
- Confirm that existing monitoring is appropriate, and revise if warranted.

Additional responses detailed in the Response Plan will depend on the component affected (e.g., geotechnical, geothermal, run off and/or water quality or quanitity), the likely cause of the effect as determined by the internal review and in consultation with relevant personnel, and the type and magnitude of effect.

Table 3-2 Suggested Types of Actions to be taken if an Action Level is Exceeded

Action Level	Types of Actions
Negligible	**Response Actions that would be taken:** • Monitoring best-practices
Low	**Response Actions that would be taken:** • Monitoring best-practices • Confirm Low Action level • Set Medium and High Action Levels • Develop Response Plan **Potential additional Response Actions:** • Revise Low Action level, if warranted and scientifically/technically defensible • Set site-specific benchmarks if appropriate • If trending towards Medium, identify potential mitigation options • Increase monitoring frequency • Desk-top or field special study to examine significance, causation, and/or linkage to Mine
Medium	**Response Actions that would be taken:** • Monitoring best-practices • Develop Response Plan • Confirm Medium Action Level • If Medium Action Level confirmed, implement mitigation(s) to stop or slow trend **Potential additional Response Actions:** • Desk-top or field special study(ies) to examine significance, causation, and/or linkage to Mine • Maintain increased monitoring frequency for plankton, benthos, and/or fish to confirm that mitigation is working • Refine Medium and High Action Levels if warranted and scientifically/technically defensible
High	**Response Actions that would be taken:** • Monitoring best-practices • Develop Response Plan • Confirm HighAction Level • If High Action Level confirmed, implement mitigation(s) to stop or slow trend **Potential additional Response Actions:** • Special study to examine effectiveness of mitigation, and long-term monitoring of mitigation effectiveness • Special study to examine significance and reversibility, causation, and/or linkage to Mine

3.3.3 Water Management Response Plan

If an Action Level of the Water Management Response Framework is triggered, a Monitoring Response Plan will be submitted to the Board. Additional consultation with regulators and communities may be required prior to completion and approval of a Response Plan, depending on the severity of the monitoring result.

4 STRONTIUM RESPONSE PLAN

Information regarding the Strontium Response Plan will be submitted to the Board under a separate cover on December 31, 2013.

5 TDS RESPONSE PLAN

Information regarding the TDS Response Plan will be submitted to the Board under a separate cover on December 31, 2013.

6 NITROGEN RESPONSE PLAN

Information regarding the Nitrogen Response Plan will be submitted to the Board under a separate cover on December 31, 2013.

7 REFERENCES

De Beers. 2002. Environmental Assessment Report – Snap Lake Diamond Project. Submitted to the Mackenzie Valley Land and Water Board. February 2002.

De Beers. 2006 . Aquatic Effects Monitoring Plan – Snap Lake Diamond Project. Prepared by Golder Associates Ltd. Submitted to the Mackenzie Valley Land and Water Board

De Beers. 2006. Ore Storage, Waste Rock – Snap Lake Mine, Processed Kimberlite Management Plan. Prepared by De Beers. Submitted to the Mackenzie Valley Land and Water Board.

De Beers. 2008. Spill Contingency Plan – Snap Lake Mine. Submitted to the Mackenzie Valley Land and Water Board

De Beers. 2006. Domestic Waste and Sewage Management Plan – Snap Lake Mine. Submitted to the Mackenzie Valley Land and Water Board.

Golder. 2004a. Technical Memorandum Re: Water Level Projections, Water Management Pond, Snap Lake Diamond Project, Northwest Territories. Golder Associates Ltd. Project Number 04-1328-003/6300, prepared for De Beers Canada Mining Inc., dated 15 June 2004.

Golder. 2004b. Snap Lake Diamond Project Site Capture Program – Detailed Design Report, North Pile Drainage Ditch. Golder Associates Ltd. Project Number 04-1413-436/5100, prepared for De Beers Canada Mining Inc., 38 p. + appendices.

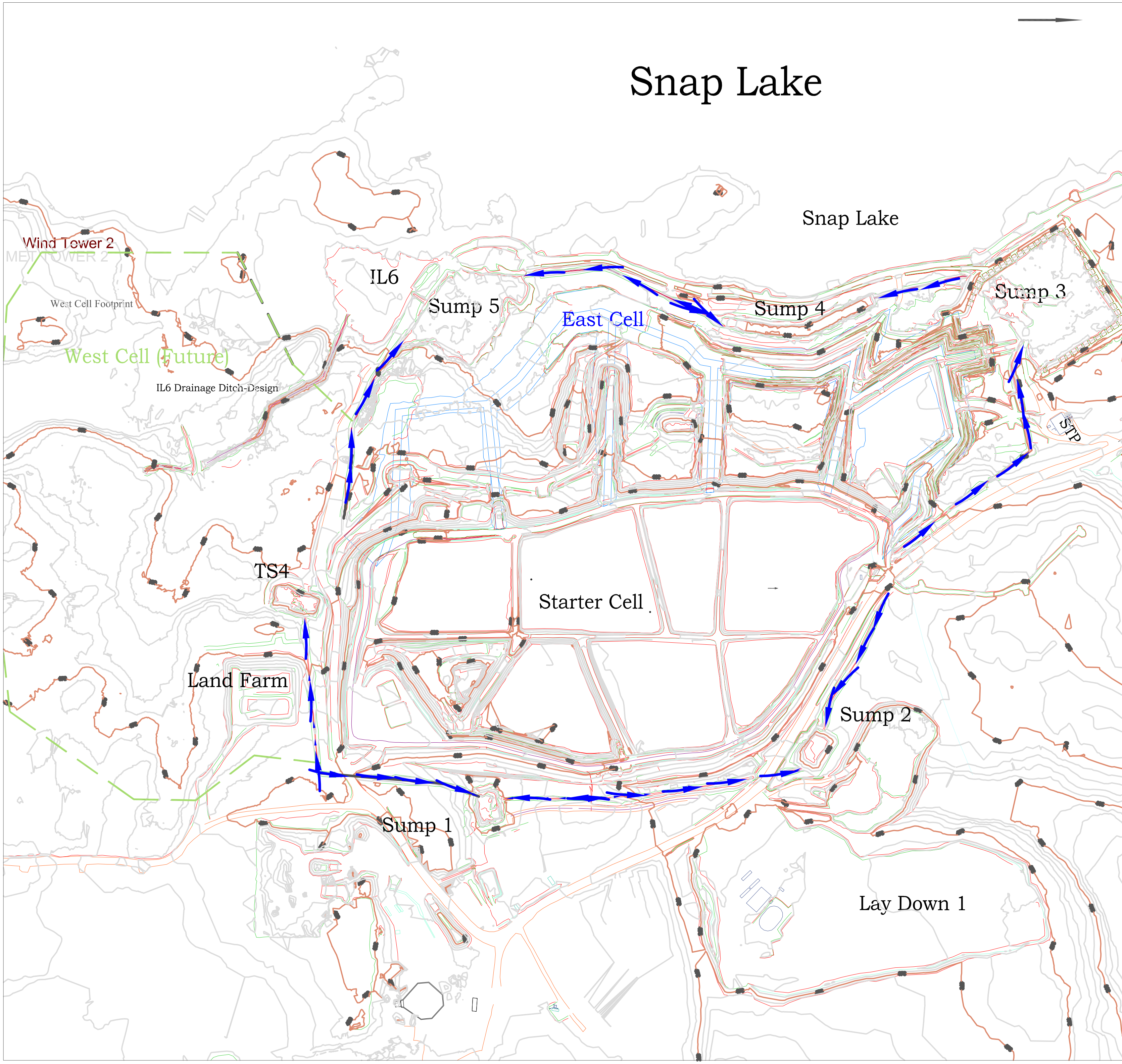
Golder. 2004c. Snap Lake Diamond Project Site Capture Program – Plant Site Infrastructure, Geotechnical Site Preparation. Golder Associates Ltd. Project Number 04-1413-436/5200, prepared for De Beers Canada Mining Inc., 50 p. + appendices.

Roster of Drawings related to Mine Water Management Plan

Drawing No.	Title
Appendix I	Surface Plan – Drainage Direction
Appendix II	Stockpiles
Appendix III	SNP Stations
Appendix IV	WMP – Major Ion Concentration Trends, WMP – Metals Concentration Trends

APPENDIX A

SURFACE PLAN – DRAINAGE DIRECTION



DeBeers Snap Lake Diamond Mine

General Surface Plan

Scale: 1:10,0000(metric)

N

Grid North- Local

UTM Surface Control

Surface Control Stations

Point #	Northing	Easting	Elevation	Description
100001AEL	7,052,975.023	506,400.678	453.539	AEL Original Control
100003AEL	7,053,163.881	506,675.305	461.737	AEL Original Control
100006CLS	7,052,959.094	506,743.269	466.003	By Comm Modules
1030SAS	7,052,364.711	506,395.999	458.330	On Hill West Dam1
Nmpc001	7,052,639.132	506,714.268	461.004	On Transformer base by Pcamp
1031SAS			452.549	On Dam1
SAS-AEL-1061	7,052,114.187	504,660.607	477.531	10m off road heading to Emul Plant
DB03	7,052,592.386	506,121.495	468.675	South Cell Control
DB10	7,052,509.736	506,891.655	469.295	South Cell Control
DB04	7,052,219.401	505,191.645	480.728	South Cell Control
DB05	7,052,406.889	504,962.632	478.554	South Cell Control
DB07	7,052,692.858	505,175.793	460.494	South Cell Control
DB08	7,052,639.586	505,395.647	469.543	South Cell Control
DB09	7,052,749.138	505,636.679	455.725	South Cell Control
DB02	7,052,685.454	505,994.510	458.521	South Cell Control
DB01	7,052,859.008	506,543.102	458.611	South Cell Control

Surface Parameters WGS84

Calibration Horizontal Adjustment

Translation North: 13.132m	Origin North: 7052597.750m
Translation East: 1.134m	Origin East: 505790.415m
Rotation: 00° 00' 02.08232"	Scale Factor: 0.99999013

Calibration Vertical Adjustment

Constant Adjustment: 10.756m	Origin North: 7052959.087
Slope North: -13.314ppm	Origin East: 506743.275
Slope East: 0.397ppm	

Geoid Model: GSD95

Underground Co-ordinates

Surface Co-ords

Point	Northing	Easting	Elev.	Description
100001AEL	7,052,975.023	506,400.678	453.549	AEL Original Control
100003AEL	7,053,163.867	506,675.311	461.727	AEL Original Control
TP2	7,052,972.970	506,713.361	467.155	Temp nail in ground
TP1B	7,053,163.641	506,514.950	453.120	Temp nail in ground
UG-1 (S-1)	7,052,997.974	506,645.102	461.047	Hilti Nail in Conc
UG-2 (S-2)	7,052,988.516	506,582.567	459.384	Hilti Nail in Conc

Under Ground Co-ords

Point	Northing	Easting	Elev.	Description
100001AEL	7,052,975.101	506,400.513	453.560	AEL Original Control
100003AEL	7,053,163.939	506,675.316	461.763	AEL Original Control
TP2	7,052,972.936	506,713.323	467.197	Temp nail in ground
TP1B	7,053,163.753	506,514.897	453.152	Temp nail in ground
UG-1 (S-1)	7,052,997.971	506,645.049	461.058	Hilti Nail in Conc
UG-2 (S-2)	7,052,988.531	506,582.479	459.384	Hilti Nail in Conc

Underground Parameters

Translate Underground to Surface

Calibration Horizontal Adjustment

Translation North: 0.040m	Origin North: 7,052,988.516
Translation East: -0.065m	Origin East: 506,582.567
Rotation:00°- 01'- 08"	Scale Factor: 1.00042101

Calibration Vertical Adjustment

Constant Adjustment: 0.017m	Origin North:7,052,988.516
Slope North: 85.164ppm	Origin East:506,582.567
Slope East: 63.532pp	

Geoid Model: GSD95

Surface Asbuilt Plan

Legend

Asbuilt Toe	Asbuilt Pag Toe
Asbuilt Crest	Asbuilt Pag Crest
Asbuilt Point Elevations	Asbuilt Berm
Asbuilt Grubbing Elevations	
Contour Interval = 0.2m	
SP/TH08-08 2000-2012Piezo/Thermistors	
Test Pits	
Bore Hole	
Top Surface Asbuilt Elevations	
Golder Design Phase III After Revised NW Corner and Valve House Areas	Ditch Flow

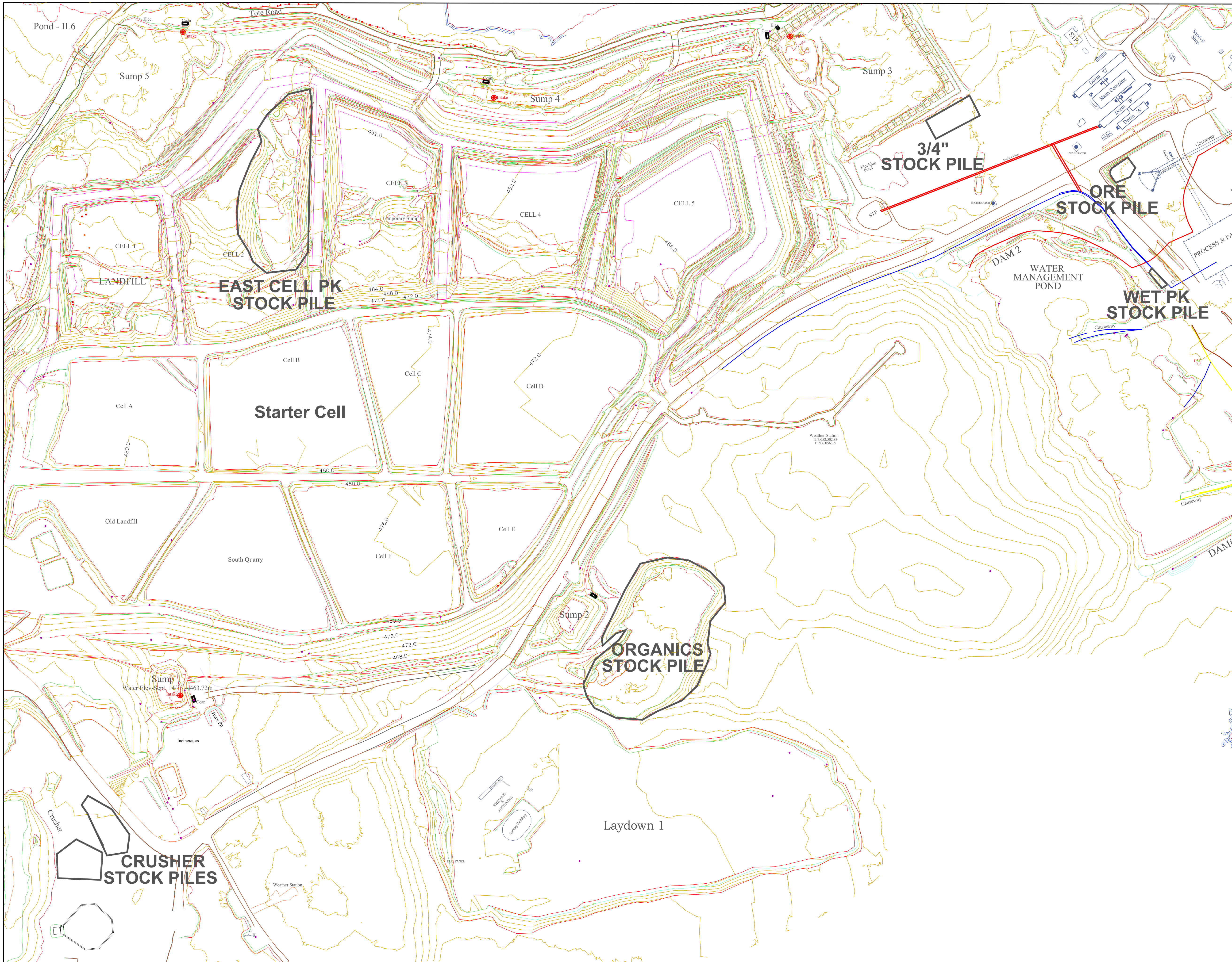
Date: May 26-2012

Dwg File: \\Dbcm-dcs-fi-243\common$\25-Nampcy Survey Data\Snaplake-08\Stat Map\2012\

Dwg By: Nampcy Solutions Ltd.

APPENDIX B

MATERIAL STOCKPILES



DeBeers Snap Lake Diamond Mine

EXISTING STOCK PILES

Not to Scale

N

Grid North- Local

Date: September 24 - 2013

Dwg File:

APPENDIX C

SURVEILLANCE NETWORK STATIONS

SURVEILLANCE NETWORK PROGRAMME SAMPLING STATIONS

http://dbcm-dca-fs-244/dep/she/EnvironMonitor/Shared Documents/Daily Entry Files/Maps and Drawings/Site

SURVEILLANCE NETWORK PROGRAMME SAMPLING STATIONS

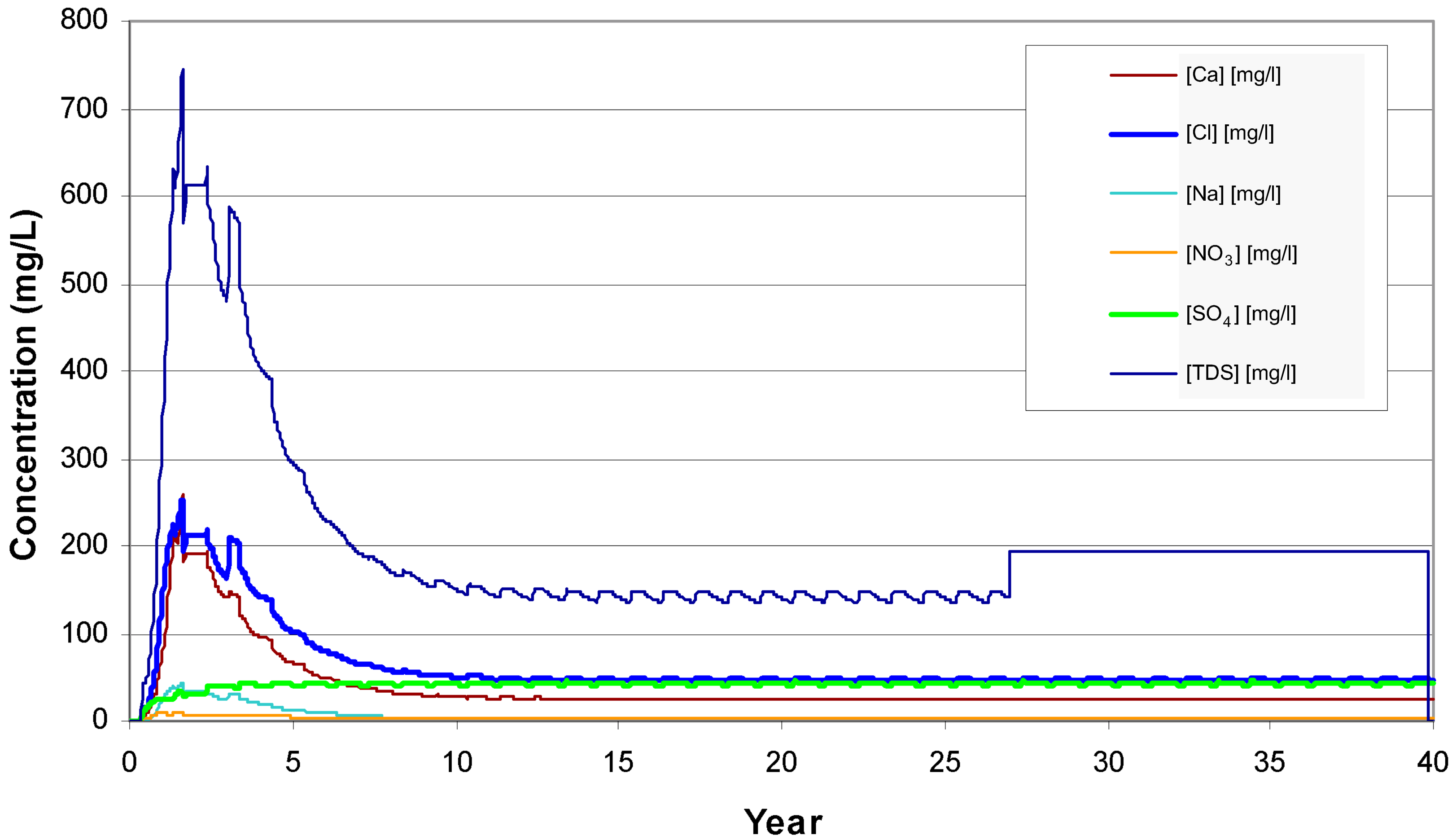
http://dbcm-dca-fs-244/dep/she/EnvironMonitor/Shared Documents/Daily Entry Files/Maps and Drawings/Site

APPENDIX D

WMP – MAJOR ION CONCENTRATION TRENDS

AND

WMP – METALS CONCENTRSTION TRENDS

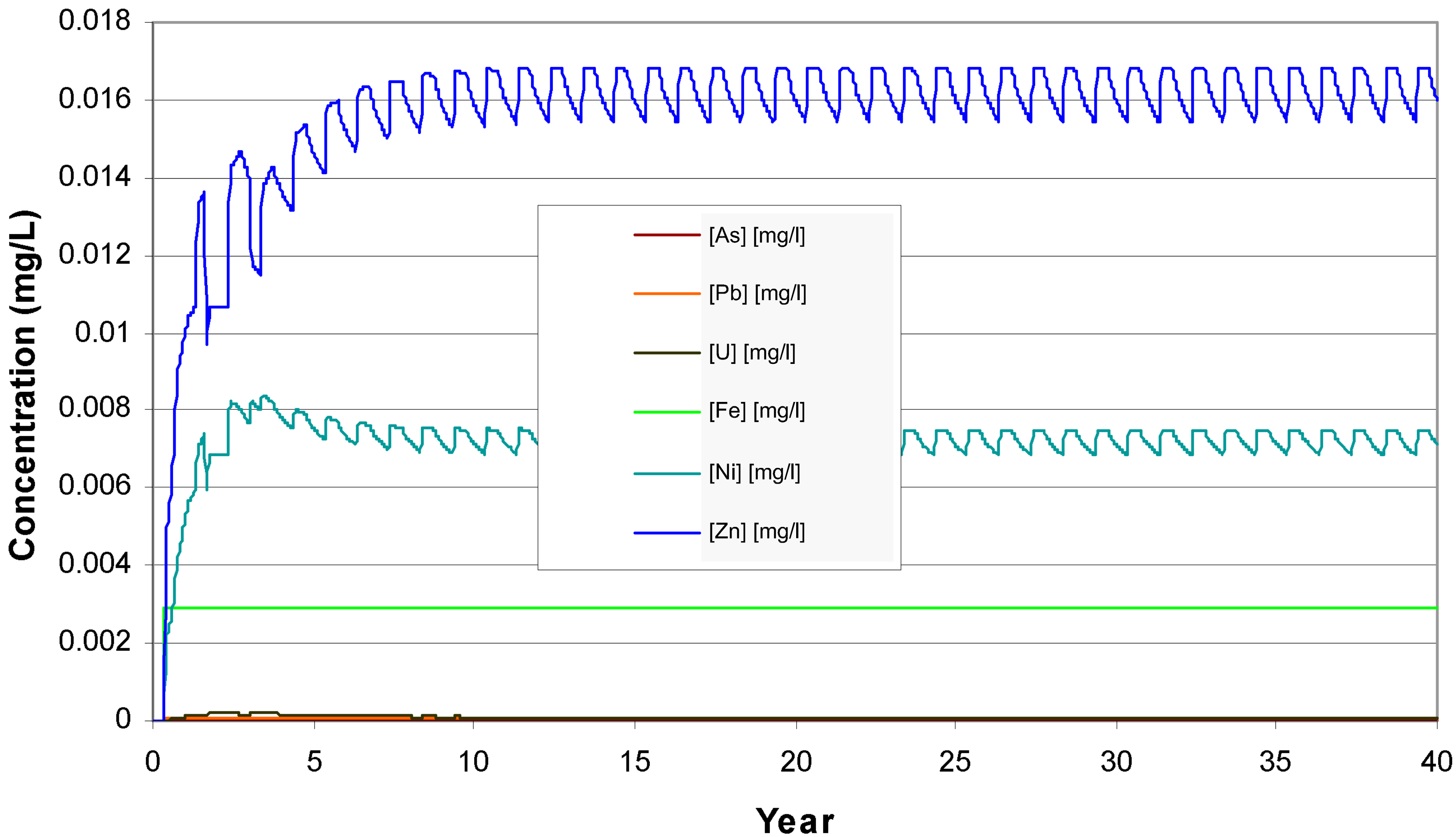


Ca = calcium; Cl = chloride; Na = sodium; NO_3 = nitrate; SO_4 = sulfate; TDS = total dissolved solids

PROJECT	DE BEERS
TITLE	SELECTED MAJOR ION CONCENTRATIONS TRENDS FOR WATER MANAGEMENT POND SEEPAGE ESTIMATES

Golder Associates
Saskatoon, Saskatchewan

PROJECT No.		012-6492	FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
CADD	GNS	18/02/02	FIGURE: 9.2-16	
CHECK				
REVIEW				



As = arsenic; Pb = lead; U = uranium; Fe = iron; Ni = nickel; Zn = zinc

PROJECT
DE BEERS

TITLE
SELECTED METAL CONCENTRATION TRENDS FOR WATER MANAGEMENT POND SEEPAGE ESTIMATES

Golder Associates
Saskatoon, Saskatchewan

PROJECT No.		012-6492	FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
CADD	GNS	18/02/02	**FIGURE: 9.2-17**	
CHECK				
REVIEW				