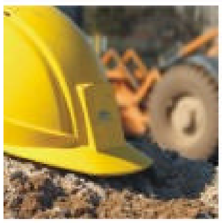
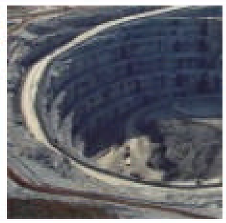
SHEAR DIAMONDS LTD.

INTERIM CLOSURE AND RECLAMATION PLAN JERICHO DIAMOND MINE, NUNAVUT

REPORT

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SHEAR DIAMONDS LTD.

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ACRONYMS & ABBREVIATIONS

AA	Atomic Absorption Spectrophotometry
ABA	Acid Base Accounting
ACM	Asbestos-containing Material
AEM	Aquatic Effects Monitoring
AIA	Aquatic Impact Assessment
AIRS	Adaptation and Impacts Research Section
ANCOVA	Analysis of Covariance
ANFO	Ammonium Nitrate Fuel Oil Explosives
ANOVA	Analysis of Variance
APEC	Areas of Potential Environmental Concern
ARD	Acid Rock Drainage
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
BACI	Before-after-control-impact
CALA	Canadian Association for Laboratory Accreditation
CCME	Canadian Council of Ministers of the Environment
CDA	Canadian Dam Association
CPK	Coarse Processed Kimberlite
DIAND	Department of Indian Affairs and Northern Development
DFO	Department of Fisheries and Oceans
DO	Dissolved Oxygen
EBA	EBA, A Tetra Tech Company
EC	Electric Conductivity
EIS	Environmental Impact Statement
EOC	Emergency Operations Centre
EPP	Emergency Preparedness Plan
ERP	Emergency Response Plan
ESA	Environmental Site Assessment
FSCF	Fuel Storage Containment Facility
FPK	Fine Processed Kimberlite
GC/FID	Gas Chromatograph - Flame Ionization Detector
GTC	Ground Temperature Cable
Hazmat	Hazardous Materials
HDPE	High Density Polyethylene
HVAS	High Volume Air Sampling
HWTA	Hazardous Waste Transfer Area
ICP-MS	Inductively Coupled Plasma – Mass Spectrometry
IDLH	Immediately Dangerous to Life and Health
INAC	Indian and Northern Affairs Canada
KIA	Kitikmeot Inuit Association
LBP	Lead-based Paint
LPRM	Long-term Post-reclamation Monitoring
MANOVA	Multivariate Analysis of Variance

MSDS	Material Safety Data Sheets
NIRB	Nunavut Impact Review Board
NP	Neutralization Potential
NWB	Nunavut Water Board
PHC	Petroleum Hydrocarbons
PKCA	Processed Kimberlite Containment Area
PPE	Personal Protection Equipment
QA	Quality Assurance
QC	Quality Control
RBC	Rotating Biological Contactor
RCM	Reclamation Construction Monitoring
ROM	Run of Mine
RPD	Relative Percent Difference
RRPK	Recovery Rejects Processed Kimberlite
SCBA	Self-contained Breathing Aparatus
Shear	Shear Diamonds (Nunavut) Corp.
SOP	Standard Operating Procedure
SPRM	Short-term Post-reclamation Monitoring
TDC	Tahera Diamonds Corporation
TDGR	Transportation of Dangerous Goods Act (RSNWT 1988) and Regulations
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TSS	Total Suspended Solids
WSCC	Workers' Safety and Compensation Commission of the Northwest Territories and Nunavut
WHMIS	Workplace Hazardous Materials Information System
WWTP	Wastewater Treatment Plant

2011 Water Licence Renewal Documents

AEMP	Aquatic Effects Monitoring Plan
AQMP	Air Quality Management Plan
CAMP	Care and Maintenance Plan
CMP	Contingency Management Plan
EP-RP	Emergency Preparedness and Response Plan for Dam Emergencies
GMP	General Monitoring Plan
ICRP	Interim Closure and Reclamation Plan
LDP	Preliminary Landfill Design Plan
LMP	Landfill Management Plan
LFDP	Preliminary Landfarm Design Plan
LFMP	Landfarm Management Plan
OMS	Operations, Maintenance, and Surveillance Manual
PKMP	PKCA Management Plan
SWMP	Site Water Management Plan
WEMP	Wildlife Effects Management Plan

WMP	Waste Management Plan
WRMP	Waste Rock Management Plan
WTMP	Wastewater Treatment Management Plan

1.0 INTRODUCTION

1.1 General

The Jericho Interim Closure and Reclamation Plan (ICRP) has been developed to provide a framework for the design and construction of works related to the closure of the Jericho Diamond Mine (Jericho). The ICRP is a concept level document, subject to review and modification, based on ongoing mine development, observational data and the results of progressive reclamation. It is a living document that will be updated and modified as mining progresses.

This closure plan has been prepared and submitted as required under the Jericho Mine Water Licence NWB1JER0410 (issued December 21, 2004). This plan is being submitted to the Nunavut Water Board (NWB) in the absence of complete historical information as Shear Diamonds (Nunavut) Corp. (Shear) only assumed control of the project in August 2010. Since that time, Shear has discovered that detailed information on the present site conditions and mine plan is limited. Comprehensive historical monitoring and maintenance records were not well maintained under previous ownership and management, so the available information is incomplete or lacking detail.

Section M, Part 5 of the licence requires that a final closure and reclamation plan be submitted at the time of water licence renewal; however, this project has been on care and maintenance since June of 2008 and was recently acquired by Shear. For this reason, this plan is being submitted as an interim plan until such time as Shear has determined the fate of the project

In developing this plan, it has been assumed that there are no changes to the original mine plan (TDC 2005). It reflects the assumed on-site conditions interpreted from existing plans and drawings, site photographs and anecdotal site knowledge.

Once Shear has had an opportunity to thoroughly investigate the site, gather information in 2011 and confirm the mine plan, the ICRP will be revised and submitted for review and approval prior to resuming mining operations or commencing closure and reclamation activities.

The ICRP has been prepared in accordance with the Mine Site Reclamation Guidelines for the Northwest Territories (INAC 2007), as required in Part M, Section 2 of the water licence. The Mine Site Reclamation Policy for Nunavut (INAC 2002) was also referenced in its development.

1.2 Objectives of the Interim Closure and Reclamation Plan

The primary objective of the ICRP is to provide Shear and its designated contractors with a working document to design, plan, and execute the closure of the Jericho Diamond Mine.

At the time of the water licence renewal application, mining operations have been suspended and the site is under care and maintenance. The ICRP will address closure requirements for the mine in both its current condition and its expected condition at the end of mining, based on the existing mine plan.

The ICRP includes the following:

- A summary of the reclamation objectives;

- An overview of the mine site, including the proposed mine plan;
- A description of the individual site components and proposed reclamation strategy for each;
- An assessment of the required reclamation materials;
- Identification of data gaps and requirement for further studies;
- Plans for progressive reclamation; and
- Requirements for post-closure monitoring.

1.3 Background Information

The Jericho Diamond Mine is located approximately 260 km southeast of Kugluktuk, NU, and 30 km north of Lupin Mine. The Jericho Mine was constructed and operated by Tahera Diamond Corporation (TDC) between 2004 and 2008. In January 2008, mining operations were suspended by TDC, and the site was placed under care and maintenance. Shortly thereafter, Indian and Northern Affairs Canada (INAC) assumed control of the care and maintenance activities for the site. In August 2010, Shear purchased the Jericho Mine and its assets and assumed the responsibility for the site.

Presently, the mine remains under care and maintenance as Shear evaluates the mineral resource. Once the evaluation is complete, a mine plan and operations schedule for the project will be established.

1.4 Linkages to Other Management Plans

The ICRP should be considered as part of the site wide management system and is linked to all other management plans.

2.0 RECLAMATION OBJECTIVES

Shear is committed to employing the best practices in environmental stewardship to minimize to the extent practical the environmental impact of mining operations, and to maintain the overall present productivity of the site.

The ultimate goal for reclamation, as referenced in the Nunavut mine site reclamation policy (INAC 2002) is to return the mine site to viable and, where practical, self-sustaining ecosystems that are compatible with a healthy environment and with human activities.

Achieving this goal requires consideration and application of three global objectives, as set out in the NWT Mine Site Reclamation Guidelines (INAC 2007):

- Physical Stability – Any mine component that would remain after mine closure should be constructed or modified at closure to be physically stable such that it does not erode, subside, or move from its intended location under natural extreme events or disruptive forces to which it may be subjected after closure. Mine site reclamation will not be successful into the long-term unless all physical structures are designed such that they do not pose a hazard to humans, wildlife, or environment health and safety.

- Chemical Stability - Any mine component, including wastes, that remains after mine closure should be chemically stable; chemical constituents released from the mine components should not endanger public, wildlife, or environmental health and safety, should not result in the inability to achieve the water quality objectives in the receiving environment, and should not adversely affect soil or air quality into the long term.
- Future Use and Aesthetics – The site should be compatible with the surrounding lands once reclamation activities have been completed. The selection of reclamation objectives at a project site should consider:
  - Naturally occurring bio-physical conditions, including any physical hazards of the area (pre- and post-development).
  - Characteristics of the surrounding landscape pre- and post-development (air photo documentation before, during, and after development is suggested).
  - Level of ecological productivity and diversity prior to mine development and intended level of ecological productivity and diversity for post-mine closure.
  - Local community values and culturally significant or unique attributes of the land.
  - Level and scale of environmental impact.
  - Land use of surrounding areas, including the proximity to protected areas, prior to mine development and expected end land use activity for each area on site for humans and wildlife.

3.0 SITE DESCRIPTION

3.1 Property Location

The Jericho Diamond Mine is located approximately 260 km southeast of Kugluktuk, NU, and 30 km north of Lupin Mine in the Contwoyto-Itchen Region. At 65°47’ north latitude, the site is approximately 60 km south of the Arctic Circle. Daylight is, therefore, almost continuous at the beginning of the summer and virtually absent at the beginning of the winter (SRK 2003b).

3.2 Climate

The climate of the region is marked by short, cool summers and cold winters. Air temperatures range from about +20°C during the summer to -30°C in the winter months. The mean annual temperature is -11.8°C. Wind direction and speeds are variable but tend to favour a northeast-southwest orientation.

Climate data collection at Jericho has been discontinuous, with the installation of an automated weather station on the eastern shores of Carat Lake only since the summer of 1995. The available data collected are sufficient to confirm a relatively good correlation with the climate data collected at the Lupin Mine weather station, 30 km south of site. The Lupin Mine weather station has been in operation since 1959, with climate data available through the Environment Canada website (http://climate.weatheroffice.ec.gc.ca), which has been compiled as “Canadian Climate Normals 1971-2000” (SRK 2003b).

According to data published by Environment Canada, the key climate values for nearby Lupin Mine are:

- Mean annual ambient temperature: -11.1°C.
- Maximum temperature ever recorded: 31°C.
- Minimum temperature ever recorded: -49 °C.
- Average annual precipitation: 299.2 mm (161.1 mm as rain and 138.1 mm as snow).
- Average Days with maximum temperature greater than 0°C: 130.2.
- Average Days with maximum temperature less or equal to 0°C: 235.
- Average Days with minimum temperature greater than 0°C: 89.2.
- Average Days with minimum temperature less or equal to 0°C: 276.1.
- Average Air thawing index: 929.3°C-days.
- Average Air freezing index: -4931.2°C-days.

Various estimates of evaporation have been made at approximately 250 mm per year. Evaporation takes place almost entirely during the four snow-free months of the year.

Wind speed data collected at Jericho are somewhat consistent with those collected at Lupin Mine. Lupin Mine wind data indicate mean monthly wind speeds range from 11 to 20 km per hour in December and October respectively. Wind directions measured at Carat Lake for 1995 and 1996 were predominantly from the west-southwest, and wind directions collected at the Jericho airstrip were predominantly north-northwest in both 1997 and 1998. Predominant wind direction in 1999 was due west.

Climate Change

A technical guide for climate change adaptation has been prepared by Canadian Standards Association (CSA 2010) for designing infrastructure on permafrost. Rates of climate change in the CSA document are based on a study by The Adaptation and Impacts Research Section (AIRS) of Environment Canada. The climate modelling assessment for the Arctic was based on an ensemble approach (multi-model means/medians) to reduce the uncertainty associated with any individual model. The four best ranking models within each sector were used to produce projections of temperature change in the 2020s, 2050s, and 2080s for both the 'A1B' (middle of the road emission), and 'A2' (high emission) scenarios.

The Jericho site is located at the Arctic Zone C2 (CSA 2010). The predicted mean temperature changes from 1970-2000 baseline under the moderate green-house gas emission scenario in Arctic Zone C2 are presented in Table 1. The mean annual air temperature is estimated to rise by 4.4 °C within 100 years. Permafrost is expected to remain at the site under this climate warming scenario.

Table 1 Predicted Seasonal Air Temperature Changes at Jericho (CSA 2010)

Period	Predicted Seasonal Air Temperature Changes from 1971-2000 Baseline under Moderate Green-house Gas Emission Scenario Zone C2 (°C)				
	Winter	Spring	Summer	Autumn	Annual
2011–2040	1.8	1.4	0.6	1.8	1.4
2041–2070	4.5	2.7	1.5	4	3.2
2070-2100	6.5	3.6	2.2	5.2	4.4

Many model projections of future climates and their extremes suggest that the water (hydrologic) cycle will intensify, with higher precipitation rates and enhanced storm intensity. Recent projections and observed analyses of trends of the North American climate indicate shifts in both the location and intensity of severe or high-impact climatic events, including precipitation, wind, and temperature extremes. The IPCC's most recent comprehensive report indicates that, while the length of the snow season and snow depths are very likely to decrease over most of North America, the northernmost (Arctic) parts of Canada will likely see greater maximum snow depths. The latest IPCC results also indicate that annual precipitation amounts in North America will very likely increase, with median annual precipitation increases of around 5% and with higher percentage increases in the North.

3.3 Geology

Jericho is situated within the Canadian Shield. The oldest rocks in the area are comprised of Archean tonalites or granodiorites that outcrop in the immediate vicinity of the Jericho kimberlite pipe. The region is regarded as being very geologically stable and not subject to active tectonic movement. The last tectonic event is believed to have been emplacement of Proterozoic diabase dykes approximately 1.3 billion years ago. The Jericho kimberlite pipe, on the south shore of Carat Lake, was formed from multiple emplacement events, comprising a precursor dyke and three diatreme intrusive stages (SRK 2003b, 2005).

The project site was glaciated several times during the Pleistocene era. The last deglaciation was accompanied by deposition of a discontinuous, but locally thick, blanket of gravel and silty sand till with many cobbles and boulders. Glaciofluvial and glaciolacustrine deposition was also part of this deglaciation. Glaciofluvial deposits include eskers, outwash deltas, kame deltas and supra-glacial deltas. These sediments range from clean sand and gravel to very coarse thick boulder and block accumulations. Glaciolacustrine sediments consist mainly of silt and sand. Periglacial processes have caused mechanical breakdown and mass wasting of near-surface rock. Organic soils have developed in some poorly drained areas (SRK 2003b, 2005).

Local topographic relief is primarily the result of previous glaciations. The water surface elevation in Carat Lake is approximately 470 m above mean sea level (AMSL), and the topographic highs in the vicinity of the site facilities typically range from approximately 500 to 550 m AMSL (SRK 2003b).

3.4 Permafrost

The Jericho Diamond Mine lies in a region of continuous permafrost, with permafrost present everywhere except beneath large lakes, rivers, and some streams that do not freeze to the bottom. Thermistor data extrapolation suggests permafrost depth is approximately 540 m below ground level (bgl) near the Jericho kimberlite pipe. Temperature profiles show that the zero-annual amplitude depth is approximately 15 m 18 m bgl (SRK 2003b).

In surficial soils on site, the active layer typically ranges in thickness from less than 1 m in organic soil to slightly more than 3 m where well drained granular soils are present. Active layer thickness in exposed rock exceeds 3 m. On-site ground penetrating radar and drilling have revealed stratified ground ice in surficial materials, including massive ice deposits at the base of the Carat Lake outwash delta and within the esker complex to the north (SRK 2003b).

4.0 MINE OVERVIEW

4.1 Development and Operation of History

The permitting and regulatory process for the Jericho Diamond Mine, under the previous mine ownership, was complete in early 2005. Mobilization of construction materials and supplies followed in March 2005, with the ensuing construction complete the follow spring. Full production and operation of the Jericho Diamond Mine was underway by July 2006. The mine was in operation from 2006 to the end of 2007. In January 2008, the mine was placed under care and maintenance and remains so today.

The mine will remain under care and maintenance as Shear evaluates the mineral resource and investigates the milling and processing facilities. Once the evaluation and investigation is complete, a mine plan and operations schedule will be established.

4.2 Mine Plan

The ICRP has been based on the mine plan submitted in the EIS, modified for the expected time the Jericho site will remain under care and maintenance. This mine plan will be reviewed and updated as part of Shear's investigations, and the ICRP updated accordingly.

The current mine plan, as detailed in the EIS (TDC 2003), calls for mine development of over one year, followed by six years of active mining, three years of which would comprise underground mining operations. Years eight and nine would comprise processing of underground ore, followed by reclamation work in years 9 and 10.

Mining operations ceased in the first quarter of 2008, within the proposed open pit mining schedule. There is an estimated four years of active mining left at mine site, based on the proposed mining schedule.

Figure 9 provides a chronology of the current plan, accounting for the existing period of care and maintenance, and subsequent care and maintenance as Shear evaluated the property. Care and maintenance is expected to continue until 2013, followed by the resumption of mining activities. Approximately one year of open pit mining remains, followed by an additional three years of underground mining.

4.3 Mine Methodology

The identified ore body is concentrated in three lobes, mined through a single pit. Mining will be completed through a combination of open pit and underground mining. Open pit mining is expected to extend to the 310 m level, followed by underground operations to the 230 m level.

4.3.1 Open Pit Mining

Prior to entering care and maintenance, open pit mining was completed using conventional truck and shovel open pit mining methods. Overburden, waste rock and ore is first drilled and blasted then loaded into haul trucks using a mining shovel, excavator or front end loader. Waste rock is hauled to one of two waste rock dumps and ore is hauled to a stockpile near the process plant. The target plant feed is 2,000 tonnes per day.

Till overburden materials were intended to be hauled and stockpiled separately in segregated portion of Waste Dump 1, in order to be used for future reclamation activities. There is presently some question regarding available till in Waste Dump 1. This will be investigated by Shear and use to develop subsequent editions of the ICRP.

Blasting material initially comprised ANFO but was modified to a 70/30 emulsion/ANFO blend upon completion of the emulsion plant. Blasts are typically 50,000 to 100,000 tonnes in size, occurring approximately once or twice a week, depending on excavation and drill productivity.

The ultimate pit plan, as presented in TDC 2005, is shown in Figure 2. The open pit was designed by SRK (Tahera 2003, FEIS, Section 5), with some modifications as recommended by Piteau Associates (2005). The ultimate pit will be approximately 350 m wide by 400 m long and will cover an area of approximately 10 ha (the pit is roughly oval). Permafrost extends to a depth of approximately 540 m; thus, it is assumed there will be essentially no groundwater seepage into the pit. The small stream crossing the northern pit area is diverted into Carat Lake via the C1 Diversion.

4.3.2 Underground Mining

Several underground mining techniques are available to access kimberlite below the 310 level. The current mine plan, as outlined in the EIS, favours an open bench approach, similar to the approach employed at the EKATI Diamond Mine, NT.

Open benching is similar in concept to open pit mining; however, access to the “benches” is provided within the waste rock and kimberlite. In essence, this method produces a very steep walled pit (as steep as the walls of the pipe). Additional information on the proposed underground mining methodology is available in the project description (TDC 2003).

4.4 Ore Processing and Waste Handling

Mined kimberlite will be processed on site by the use of heavy media separation. The nominal ore feed rate is approximately 1000 to 2000 tonnes per day, with the upper limit dependent on the conversion of certain inferred resourced into economic reserves.

Kimberlite coarse rejects area trucked to one of four coarse processed kimberlite (CPK) stockpiles, as shown in Figure 2. Fine processed kimberlite (FPK) will be pumped as a slurry to the processed kimberlite containment area. (Figure 4)

The kimberlite ore will only be stockpiled to separate mining and processing operations and provide a surge against weather and mine delays. It is expected that no more than one month's supply will be stockpiled at any given time (<30,000 m^3 of kimberlite). The kimberlite ore stockpile will be situated immediately east of the plant facility and will be limited to blending piles. The kimberlite ore stockpile was graded so that any runoff is directed to the east sump for recycling or pumping to the PKCA.

4.5 Kimberlite Ore, Coarse Processed Kimberlite and Recovery Circuit Rejects

The Jericho Waste Rock Management Plan (WMP, EBA 2011k) provides design information on the kimberlite ore storage, coarse processed kimberlite storage and recovery circuit rejects storage. Four CPK stockpiles are planned, with CPK Stockpile 2 being incorporated in the East and Southeast Dams (Figure 2). At the end of December 2006, all CPK was stored adjacent to the diamond plant (designated CPK Stockpile 4). Recovery circuit rejects are stored in the same location, separated from the rest of the CPK pending construction of CPK Stockpile 1.

4.6 Processed Kimberlite Containment Area

The PKCA is located within the existing Long Lake Basin that is at the south end of the project site. The site and mine infrastructure layout are shown in Figures 1 through 3. A plan of the PKCA facility is presented in Figure 3.

The original lake level of Long Lake was 515.4 m. The maximum operating storage water level of the PKCA is defined as 523 m. Four dams have been or will be constructed around the facility to allow the water level to potentially rise to this level and remain stored within the PKCA. Once the perimeter berms have been constructed, the maximum operating storage level of fine processed kimberlite (FPK) in Cell A will be increased to 527.5 m. Water inflow to the PKCA comes from numerous sources including precipitation, runoff from the surrounding catchment area, site water pumped to the facility from the pit and other containment facilities, wastewater from the camp, and supernatant water from FPK deposition.

The PKCA was to be ultimately divided into three cells: Cell A, Cell B, and Cell C. FPK would first be deposited into Cell A, between the East and Southeast Dams and Divider Dyke A. Once Cell A is full and Divider Dyke B has been constructed, FPK will be deposited in Cell B. Water will then filter through the divider dykes into the western portion (Cell C) of the PKCA.

No FPK is to be deposited in Cell C. It was to remain as a 'polishing pond' to facilitate the settlement of any remaining suspended solids such that excess water can be discharged to Stream C3 during the summer and fall.

The water level in the facility would ultimately be controlled by the discharge of compliant water over the West Dam located at the west end of the PKCA. The stage storage volume for the combined Cell B and Cell C is shown in Figure 5.

Currently, the PKCA is divided into two cells with only Divider Dyke A partially constructed.

4.6.1 PKCA Infrastructure

The PKCA facility requires dams and dykes to control the water level and discharge, and contain FPK. The existing and proposed structures are listed in Table 2 and are shown in Figures 2 and 4. Dams and dykes that have been partially constructed or completed were designed using the 1999 Canadian Dam Safety Guidelines. The designs for the North Dam and Divider Dyke B will be reviewed to ensure compliance with the 2007 Canadian Dam Safety Guidelines before construction begins. Detailed design and construction drawings will be submitted to the NWB at least 60 days prior to construction.

Table 2 Summary and Status of PKCA Dams and Dykes

Structure	Status	Design Crest (m)	As-Built Crest (approx) (m)	Function	Construction Period*	Design Reference
West Dam	Partially Complete	528 Crest 524 Core	525 (min) Crest 520 (min) Core	Water Control at outlet of PKCA	2005-2007, 2012	EBA 2005c
East Dam	Complete	524.5 Crest 523.5 Liner	524.5 Crest 523.5 Liner	Containment of FPK	2005-2006	EBA 2005a
Southeast Dam	Complete	524.5 Crest 523.5 Liner	524.5 Crest 523.5 Liner	Containment of FPK	2006-2007	EBA 2005a
Divider Dyke A	Partially Complete	524	Varies – low point 521.5	Containment of FPK – flow through structure	2005-2007, 2012	EBA 2005b
Divider Dyke B	Not in place	524	-	Containment of FPK – flow through structure	2012	To be prepared
North Dam	Not in place	528 Crest 524 Core	-	Water Control	2012	EBA 2007
Cell A Coarse PK Perimeter Dyke	Not in place	528.5	-	Containment of FPK	Stage 1 2012-2013 Stage 2 2014-2015	To be prepared
West Settling Pond Dam	Optional	-	-	Water Control	Optional	To be prepared
*Construction period is estimated and is based on processing resuming mid-2012.						

4.7 Waste Rock Dumps

Waste rock generated from open pit and underground mining is hauled to a stockpile in one of two waste rock dumps. The Jericho WRMP (EBA 2011k) provides details of the construction and operation of the waste rock dumps.

The layout of the waste dumps is illustrated Figure 2 and was selected to:

- Minimize the number of catchments potentially affected by drainage from the waste dumps;

- Facilitate the design and operation of seepage control structures related to the waste dumps;
- Maintain an adequate buffer zone between the toe of Waste Dump 1 and Carat Lake;
- Optimize the offsetting impacts associated with the minimized project footprint and
- Conformity with the natural relief in the immediate area; and
- Minimize haul distances.

The waste dumps were originally designed as two distinct piles; however, during mining operations, the pile limits encroached on one another. This connection does not affect the function of the piles. As well, no surface drainage is impacted by their connection.

Waste Dump 1 is primarily waste rock. The construction of the dump was designed such that the contour elevations allow any runoff to flow to the open pit and be handled by pit sumps. In the event that seepage water quality is questionable and/or the volume of water from Waste Dump 1 is sufficient enough, Pond A will be constructed to capture this water as discussed in the Jericho Site Water Management Plan (SWMP, EBA 2011i)

Waste Dump 2 stores overburden and waste rock. Any drainage from the Waste Dump 2 initially flows to a sump in the open pit. Pond B will be constructed to capture runoff if significant quantities of water are encountered.

Dump designs were developed on the basis of the properties of dump materials, the foundations conditions at the dump sites and the approximate volume of mine waste that was to be produced under the original mine plan. The thickness of each dump lift was predicted to be approximately 10 m, but depending on the projected height of the structure and the number of benches, the lift thickness could be modified in order to develop relatively uniform bench heights. Overall slopes of between 2.6:1 to 1.4:1 depending on location and dump performance. During mine operations, the slopes between benches will correspond to the angle of repose of the dump material, which is expected to be about 1.4H:1V (35 degrees) dump capacity can be increased through design modifications if required.

4.8 Surface Water Management

4.8.1 C1 Diversion

The C1 Diversion diverts natural flow around open pit mining activities, from C1 Lake to Carat Lake. Detailed design of the diversion and construction monitoring was provided by EBA, A Tetra Tech Company. Details of the channel construction are available in the C1 Diversion Construction Summary (EBA 2011m).

The C1 Diversion consists of three reaches, referred to as Reaches A, B, and C. Reach A collects flow from C1 Lake routing it through a low-lying inlet area and into a rock chasm. The inlet portion of Reach A is lined with a HDPE liner to promote flow into the rock chasm. Reach B is a steep rip-rapped channel intended to transfer flows from Reach A to Reach C. Immediately upstream of Reach B is 900 mm diameter culvert which passes flow under Carat Lake Road. Reach C is a wide channel flanked by two granular berms with frozen sand and gravel cores to contain high flow events. Low flows meander between the granular berms before reconnecting the natural stream and discharging to Carat Lake.

4.8.2 Sediment Ponds, Sumps and Ditches

Runoff around the site is controlled by a series of ditches and collection ponds as detailed in the Jericho SWMP (EBA 2011i).

Facilities listed below are staged contingency structures that would be constructed during operations if and as required to maintain adequate control of site water quantity and quality (EBA 2011i).

- Pond A - to collect runoff and potential seepage from Waste Dump 1.
- Pond B - to collect runoff and potential seepage from Waste Dump 2 that is not directed to the pit.
- Pond C – to collect runoff and potential seepage from the Ore and Coarse Rejects piles if required.

To date, water quality has not required that these structures be built; however, their proposed locations are shown in Figures 2 and 3.

Surface water flow is controlled by roads and culverts where necessary. Other than the culverted C1 Diversion, where surface water passes beneath the freshwater intake access road, the only culverts are located on the airport access road to pass small, mostly intermittent streams.

Sumps will be constructed within the open pit to keep the working area of the pit dewatered and to allow pumping of runoff inflows from the pit to the East Sump for possible reclaim use or onward to the PKCA. The location and size of the pit sump(s) will vary as the pit is developed. During the construction period all the pit water was pumped to the East Sump for containment and construction use.

The East Sump is a natural surface depression located in the area of the plant site, fuel farm, and ore stockpiles. During the construction phase, this natural topographic feature was determined to be well suited for area drainage for the plant and ore stock pile areas, and as an interim storage and transfer point for the pit discharge water. During operations, excess water from this sump will be either pumped to the PKCA and used for plant reclaim, construction, and/or road maintenance.

4.9 Site Infrastructure

4.9.1 Buildings

The main camp complex comprises the Process Plant, Truck Shop, and accommodations complex. These buildings are connected by a series of exterior corridors allowing personnel to travel between the buildings without going outside. A series of temporary and/or portable structures are placed around the complex, including the Wastewater Treatment Plant, and at the airstrip. The emulsion plant is the only other permanent building on site.

4.9.2 Airstrip

The airstrip was initially constructed in 1997 on an esker north of the exploration camp to be 1,000 m long by approximately 30 m wide taxi and takeoff surface (total width 223 m). The strip was extended in 2006 to 1,374 m length and widened on the extension to 360 m. Strip extension was accomplished by leveling the existing esker surface and adding fill of crushed mine rock where required. The airstrip is equipped with runway lights powered by a small generator at the airstrip. Two 62,000 L bermed tanks are located at the south apron for refueling of aircraft if required.

4.9.3 Tank Farm / Fuel Berms

The Jericho Fuel Tank Farm consists of two bermed enclosures lined with a high density polyethylene line which acts as secondary containement in the event of a fuel spill. The first enclosure (Phase 1) contains eight 500,000 L single wall steel tanks. The Phase two enclosure contains four single wall 1,500,000 L tanks. A third phase (Phase 3) of the tank farm may be built in the future and is decribed in EBA 2011n.

The layout of the existing Fuel Farm is shown in Figure 2.

4.9.4 Water Intake Causeway

The causeway design plan is provided in (SRK 2005). The following description is from the SRK (*op. cit.*) report:

The fresh water intake causeway [was] constructed in order to provide water for the Jericho kimberlite processing plant and potable camp water. The causeway [was] constructed of clean coarse rock fill and [extends] approximately 90 m into Carat Lake. A steel intake well [was] installed within the rock fill. The intake well [is] comprised of a vertical section, the base of which [is] located in [4.5 m] depth of water to allow operation under the ice during winter, and an approximately horizontal section that [extends] beyond the limits of the rock fill. A stainless steel fish screen [is] set at the end of the intake pipe.

4.9.5 Pads and Roads

Roads on site are designed to accommodate both haul traffic and light vehicles. Existing road locations are shown on Figure 2.

The haul roads and ramps are designed for two-lane traffic to accommodate Cat 777D trucks. From the maintenance shop to the open pit, the roads are 24 m wide. Pit ramps are wider to accommodate crest blast over-break, ditches and shoulder barriers three-quarters the height of the Cat 777 tire. The surface roads are constructed of run-of-mine granite waste and capped with a mixture of esker and -2 inch or -3/4 inch crush to minimize tire wear and improve operator comfort. The height of the roads is about 2m and incorporate a 5H:1V sideslope for those that have a height greater than 3m. The sideslopes provide ease of maintenance and emergency run-out capability.

All other roads are constructed in a manner similar to the main haul road but with a running surface of 10 m to 18 m.

Facilities pads are composed of crushed rock of variable thickness to provide a level surface for placement or construction of buildings. The average pad thickness is approximately 2 m principally to insulate the tundra and prevent permafrost melt. The diamond processing plant DMS and other heavy plant equipment are exceptions, being founded directly on bedrock.

The following pads were constructed:

- accommodations complex, truck shop, crusher

- emulsion plant
- ammonium nitrate storage
- explosives magazines
- laydown area opposite the waste transfer area
- laydown area at the south end of the airstrip

4.10 Waste Management

4.10.1 Landfarm

A landfarm will be constructed to facilitate on site remediation of petroleum hydrocarbon contaminated soils. The landfarm location has not yet been finalized but will be included in the investigation to be conducted in 2011 during the summer months. A discussion of the landfarm can be found in the Jericho Landfarm Management Plan (EBA 2011f) and the Jericho Preliminary Landfarm Design Plan (EBA 2011o).

4.10.2 Landfill

Under the previous mine ownership, non-hazardous wastes were landfilled in a landfill located on Waste Dump 2. It is assumed that debris was placed in lifts and covered with intermediate fill forming waste cells. Solids from the waste water clarifier were apparently placed in a segregated sludge pit located away from the waste cells.

In 2011, Shear will investigate decommissioning the existing landfill and establishing a new landfill within Waste Dump 1 as originally designed in the EIS. The landfill be constructed using the same methodology used for the existing landfill. Design and operation details for the new landfill are available in EBA 2011g and EBA 2011p.

4.10.3 Hazardous Waste Management

The hazardous waste management plan provides Shear and their designated contractors with operational guidelines to minimize the generation of wastes at points of use, optimize the usage of materials before disposal, and facilitate the collection and processing of wastes with the least adverse effects on the physical and biological environment on site.

Waste is collected, sorted, packaged, and stored at the Hazardous Waste Transfer Area for winter backhaul to a registered hazardous waste receiver or management facility

4.11 Borrow Areas

The Borrow Management Plan (Tahera 2005d) previously submitted by Tahera was approved under the current water licence. Limited information has been available to Shear with regard to the current status of the borrow areas. Areas of the proposed borrow sites were as follows and are shown in Figure 1

- Area A 95,320 m^2
- Area C 89,960 m^2

- Area D 155,400 m^2
- Total 340,680 m^2

In 2011, Shear will investigate and document the status of these three borrow areas and will update the ICRP accordingly.

5.0 RECLAMATION OVERVIEW

5.1 Reclamation Objectives

The reclamation plan has been developed based on the best available information at the time of report preparation. There is limited or incomplete information available for several mine components developed under the previous mine ownership. Shear cannot commit to specific reclamation activities without a clear understanding of the site conditions and a complete evaluation of the mineral resources. As such the reclamation strategy presented herein provides preliminary closure concepts subject to ongoing review and appropriate updates.

Shear is committed to developing and executing a reclamation plan which will produce a productive post-closure environment. Shear will work with regulators and stakeholders to develop a plan that respects the interests of all parties concerned. To that end, Shear will undertake stakeholders meetings following the 2011 investigation work to review the site status and development of reclamation plans.

Shear will also develop cooperative working relationships with other mine sites in the circumpolar Arctic with respect to closure initiatives. It is expected that such relationships will be mutually beneficial for all parties and lead to improved closure plans.

5.2 Reclamation Overview

The following section provides an overview of the proposed reclamation strategy for Jericho. Detailed closure activities relating to specific mine components are provided in Section 7.0.

The closure plan is designed to provide long-term physical and chemical stability of all structures which remain on site. Where applicable, closure designs also provide features which contribute to the future ecological productivity of the site and the development of effective wildlife habitat. Keeping in mind the objectives laid out in Section 2.0, specific short-term and long-term reclamation goals include:

Short Term

- Demobilize equipment and buildings – All buildings, equipment, and other man-made structures will be dismantled and buried or hauled off site.
- Manage site water flow – Clean water from outside the mine footprint will be directed around site facilities consistent with the site water management plan. Mine area drainage will be directed to the open pit which will act as a sink until it eventually fills and flows into the C1 discharge.
- Minimize the risk and impact of water erosion and sediment transport – Erosion will be controlled principally by slope angles of constructed facilities being kept less than the angle of repose or by rock

armouring, as appropriate. Long-term sediment control will consist of revegetation, where feasible, or rock armouring.

- Stabilize slopes – The existing waste rock slopes, coarse processed kimberlite piles and upper pit slopes will be flattened to provide long-term stability for the structures.
- Construct ground covers – Ground covers (topdressing) will be constructed to provide long-term stability (reduce dust and erosion) and encourage future ecological development. These covers range from scarifying and grading existing pads, to till placement and seeding.

Long Term

- Maintain or improve the level of wildlife habitat – Habitat and ecological productivity are expected to develop over time. The quality of the habitat will be evaluated as part of post-closure monitoring.
- Create an aesthetically pleasing environment – Shear will address, to the extent practical, the issue of aesthetics on closure. Man-made structures will be removed and vegetation established where possible; however, some evidence of past mining will remain. It will not be practical to level the waste rock dumps nor to completely refill the open pit prior to final closure Processes such as revegetation take decades on the Arctic tundra and therefore, bare rock and till will be visible for many years after mining

5.3 Revegetation

Previous ICRPs have relied heavily on revegetating the site following completion of mining activities, and requires the placement of till prior to seeding. The original mine plan called for overburden soils to be stripped and stockpiled separately in Waste Dump 2 for use in reclamation activities. Some till material were stockpiled in Waste Dump 2 however precise till volumes are unknown and portions of the material may be buried within the rock.

Shear considers establishment of vegetation to be a viable reclamation option for the Jericho site; however, until till quantity and availability can be confirmed through on site investigation, the extent to which revegetation can be used as part of the closure landscape is uncertain.

Shear will continue with the vegetation studies initiated by TDC. Shear has begun discussion with the University of Alberta and is finalizing the design of a greenhouse study. Additional details on the revegetation work completed to date are available in Section 8.0.

6.0 RECLAMATION MATERIALS

Materials used for reclamation will be predominantly natural materials, processed to some degree to achieve the desirable engineering or biological properties. The use of manmade materials, such as liners or concrete, will generally be avoided due to uncertainty surrounding their longevity. In the case of some existing structures, it is less detrimental to leave man-made materials in place than it is to remove them (such as the liner in the dams and C1 diversions).

6.1 Till

Till has been identified as primary growth medium for revegetation work. TDC 2006 estimated that approximately 1.5 million m^3 of till was salvaged during operations. The largest proportion of overburden tills was removed in Year 1 and 2 (2005/2006) and is stockpiled on the till stockpile portion of Waste Dump 2.

As noted above, there is some uncertainty surrounding the accuracy of this value and the portion of which is exposed and not buried in the pile. Once Shear has investigated the site in 2011, they will be better able to comment on the quality and quantity of till available for reclamation activities.

The estimated till requirements for cover materials are summarized in Table 3 (from TDC 2006).

Table 3 contains a summary of top dressing material requirements for reclamation. Top dressing material will be till (preferred) or esker (alternate). Till is a mine unit that is already disturbed, whereas use of esker will require additional disturbance.

Table 3 Till Requirements for Cover Materials

Facility	Requirements for 0.3 m Cover 31 December 2006 areas (Year 2) (m^3)	Requirements for 0.3 m Cover Final Mine Configuration (m^3)
Waste Dump 1 Top	0	35,900
Waste Dump 2 Top	29,790	29,790
PKCA Slurry containment cells	28,137	35,259
Coarse Kimberlite Tops[1]	8,979	20,200
Pads: Camp Storage, Explosives Storage, Crusher Site, Laydown, Waste Transfer	69,800	69,800
Airstrip	0	0
Total	**136,706**	**190,949**

Notes
[1] Should revegetation trials indicate successful plant growth on CPK, no top dressing will be applied.

Design of the till stockpile as part of Waste Dump 2 is documented in the Jericho Waste Rock Management Plan (WRMP, EBA 2011k) and was constructed under the previous mine ownership. Construction details will be confirmed during the 2011 site investigation work.

Most of the till was excavated in a frozen condition and stockpiled in Waste Dump 2. The surface of the Till Stockpile thaws during the summer months and requires confinement. The design of the Till Stockpile was based on the use of waste rock to provide confinement to the till in the event it thaws and, due to excess water, shows a propensity to slump or "run." The Till Stockpile is located on the north central side of the present Waste Rock Dump 2 confined by a toe berm. Performance of the rock berm in 2005 and 2006 confirmed its effectiveness at preventing runout of thawed till.

In order to preserve the frozen conditions within the base of the waste rock, a frozen foundation layer was developed at the base of the overburden.

The summer prior to the need for material from the stockpile, the anticipated quantity will be windrowed if to facilitate handling when frozen and to increase the active layer depth if required. Rehandling will be minimized to the extent practical because rehandling negatively affects top dressing material

For reclamation, top dressing material will be windrowed along the area to be dressed in preparation for a dozer to place the material. Stockpiles located remote to the replacement area will be hauled by truck, and windrowed along the top dressing area for placement.

The placement of the top dressing material will be supervised by Jericho Environment Department personnel. Remediation activities will be somewhat dictated by weather and material conditions. Any amendments to material required for reclamation will be added during placement.

6.2 Processed Rock

Processed waste rock may be used in the construction of slope stabilization materials, erosion protection or other general earthworks. Materials may be sorted for use as rip-rap or crushed to achieve specific gradations for use in filter, structural fill or other applications. Requirements for waste rock will be further refined during development of the final closure plan and detailed design of specific reclamation components.

6.3 Coarse Processed Kimberlite

CPK could be used in select applications as an alternative for filter or bedding material. The suitability of this material will require further investigation, specifically with respect to its durability and long-term performance.

7.0 RECLAMATION PLAN

Specific reclamation objective and activities for specific mine components are discussed in the following sections.

7.1 Open Pit

7.1.1 Development Status

The ultimate pit will be approximately 350 m wide by 400 m long and will cover an area of approximately 10 ha (the pit is roughly oval). Permafrost extends to a depth of approximately 540 m, thus it is assumed there will be essentially no groundwater seepage into the pit. The small stream crossing the northern pit area is diverted into Carat Lake via the Stream C1 Diversion.

7.1.2 Reclamation Activities

A safety berm will be established beyond the ultimate crest of the till slope. The berm will be constructed with a steep outer face to discourage caribou entry and a flatter inner face to allow any caribou to exit. The setback distance will be adjusted as necessary to allow snowmobiles and caribou that happen to cross over the berm sufficient time and space to stop before reaching the pit edge. As required by the mine water licence, the lip of the ultimate pit will be examined and graded for long term stability.

The final pit will have steep walls and a ramp road connecting the bottom and top of the pit. Walls will be entirely in bedrock. The pit will be allowed to flood on closure. Prior to filling, warning signs and inukshuks will be placed at the perimeter edge to keep people and animals away from the pit lip.

Open pit fill time was estimated at approximately 20 years (TDC 2007). Flows to Stream C1 diversion will be maintained during mine operation, closure, and post-closure to ensure the diversion remains acceptable for fish habitat. Prior reports indicate partial diversion of Stream C1 diversion into the natural channel; however, this reclamation activity will not be pursued by Shear. Shear will therefore recalculate open pit fill time prior to mine closure.

Open pit filling should flush and remove any blasting residues from the dumps. Freeze back of the dumps is expected to occur in the first few years following deposition, which will reduce the exposed surface area and therefore, the available loading from the rock. Shear will remodel long-term pit water quality based on the updated open pit fill time. Monitoring of seepage and runoff during operations will result in improved estimates of long term pit water quality.

Runoff, precipitation, and meltwater will not exit the pit until it is filled. The pit will form a deep, relatively small lake. Some shallows will be present near the lip of the pit, especially where the access ramp enters and the 8 m mining catch bench lies below the final pit water level. Once the pit is filled and meets water discharge criteria, Shear will construct a discharge channel from the pit into the Stream C1 lower natural channel to discharge into Carat Lake.

In the unlikely event that pit water quality should not meet water discharge criteria, contingency measures such as in-pit biological treatment could be used to reduce concentrations to acceptable levels for discharge.

7.1.3 Long-term Stability

The open pit and future shallow lake are considered very stable as they are constructed entirely in bedrock; however, Shear will conduct a long-term pit slope stability analysis, focusing on the upper slopes, to confirm. Post-closure, slopes within the pit may ravel or degrade to a slope as flat as approximately 15°. The bedrock below the till will also ravel back over the very long term. This is common in all rock slopes, and is the reason why no requirement for long-term stabilization of pit slopes exists in most mine reclamation guidelines. Stability monitoring through the mine life will allow prediction of future slope performance.

7.1.4 Alternatives Considered

An alternative to allowing the pit to flood would be to backfill with waste rock. This alternative was examined and rejected on economic and practical grounds as well as concern for additional introduction of ammonia nitrate to the pit water. Cost to backfill the pit would be approximately $2 per tonne; total cost $16 million plus mobilization/demobilization. Backfill could not occur until the end of mining. At that time much of the mass of waste rock dumps is expected to be infiltrated by permafrost. Any use of this rock would require re-blasting, which would further raise costs. Finally, because there would be void spaces in the backfilled rock, only about two thirds of the 13 million tonnes of waste rock could be backfilled into the pit without overtopping the pit rim. Any runoff water from the pit would require treatment for some years after pit backfill to reduce ammonia levels to acceptable discharge concentrations. This alternative approach to reclaiming the pit would make mining the deposit uneconomic and also increase, rather than decrease, environmental impacts.

7.2 Waste Rock Dumps

7.2.1 Development Status

The waste rock dumps were originally designed as two separate piles. Waste Dump 1 stores primarily waste rock. Waste Dump 2 stores overburden and waste rock. During mining operations, the two pile limits encroached on each other. There are still two primary pile areas (referred to as Waste Dump 1 and Waste Dump 2); however, there is some connection between the two. This connection does not affect the function of the piles.

7.2.2 Reclamation Activities

Waste rock dumps will remain active until the end of open pit mining. Dumps will be constructed in step-back lifts; final regrading of slopes will be to attain an average slope of approximately 19° by pushing material down onto benches. Top surfaces will be compacted from traffic use and will be ripped or scarified to loosen the surface. Dumps are expected to be dry microhabitats and inimical to plant growth.

If revegetation trials were to indicate the potential for successful revegetation of the dump tops, salvaged overburden top dressing material could be placed in a 1 m strips across the flat surface of the dump.

The sideslopes will be left in a stable condition to minimize the effects of water or wind erosion, but will not be revegetated. The principal reasons for this are:

- The impracticality of making granular mineral overburden remain in place on angle of repose rock slopes;
- The low probability of successful revegetation on these slopes considering the high probability of very low moisture content; and
- The probable scarcity of overburden available for top dressing, making its use in areas with a low probability of successful revegetation unwise.

7.2.3 Long-term Stability

The final angle on the waste rock dumps will be an average 19°, slightly more than half the angle of repose of 33°. Stability of the dumps during operations will be monitored annually by a qualified geotechnical engineer as required by the water licence; monitoring will continue as required after closure until the water licence is cancelled. Any modifications of dump configurations suggested from monitoring results will be implemented during the life of the mine.

7.2.4 Alternatives Considered

Alternatives for cover and soil amendments for the tops of the waste dumps will be assessed in light of revegetation trials. If revegetation does not prove practical, due to low survival of plants in test plots, the use of coarse run-of-mine rock in erosion prone areas will be evaluated.

7.3 Coarse Kimberlite and Recover Circuit Rejects Stockpiles

7.3.1 Development Status

The current mine plan calls for separation of CPK into three stockpiles. This configuration was chosen to allow for better environmental control of the CPK, particularly of recovery plant rejects which will be stockpiled immediately south of the PKCA east end. Management of CPK is discussed in detail in the Jericho Waste Rock Management Plan (EBA 2011k).

7.3.2 Reclamation Activities

The remainder of the CPK and RRPK stockpiles not used for reclamation will be sloped to approximately 18°. Stockpiles should be covered with up to 0.3 m of overburden if dust generation from fines becomes problematic (although not expected since coarse rejects are thoroughly washed in the processing plant). A small amount of runoff may occur in the spring when the stockpile surface is frozen. Runoff will be monitored as discussed in Section 11.4 and rock buffers implemented if export of sediment overland becomes an issue.

7.3.3 Long-term Stability

A stability analysis will need to be conducted on CPK stockpiles.

The factor of safety at the face of the stockpile is based on the guidelines published by the BC Mine Waste Rock Pile Research Committee in 1991 and a simple infinite slope analysis. Since the material is end-dumped, the stockpile slope will conform to the angle of repose which in the absence of a water table. The dump face safety factor will be evaluated.

7.3.4 Alternatives Considered

Alternatives to overburden cover include rock armouring should overburden cover not prove practical. Based on experience at the EKATI Diamond Mine, direct placement of vegetation on CPK is unlikely to be successful. However, creation of microhabitats to prevent sand drifting will be investigated as part of revegetation trials.

7.4 Process Kimberlite Containment Area

7.4.1 Development Status

The PKCA is used to store the fine fractions generated by the processing operation, discharge from the waste water treatment system, and runoff from the mine site. The facility is described in Section 4.6.

7.4.2 Reclamation Activities

During operation, the PKCA will be progressively filled from east to west based on the PKMP (EBA 2011h). As areas are filled to design height, they will be reclaimed.

The reclamation plan for the FPK surface will depend on the amount of till available for reclamation and the success of vegetation trials. .

One of three possible scenarios will be implemented:

- EKATI has had some success at planting directly onto dried fine kimberlite in the mine's PKCA and, pursuant to further favourable results, PKCA beaches at Jericho will be treated the same way, i.e., by direct planting on the dry beaches. Run-of-mine bands would be placed for erosion control, and artificial stream channels would be constructed.
- If vegetation trials indicate overburden promotes successful revegetation, a combination of vegetated overburden areas and run of mine areas will be constructed. The run-of-mine rock areas will be underlain with CPK. Water will be directed to the vegetated overburden areas and stream channels placed through the areas. .
- If vegetation cannot be demonstrated to establish successfully, PKCA finished areas will be covered with CPK and run-of-mine rock to retard erosion.

Organic overburden will be retained for reclamation of the PKCA as this facility has the best chance of successful revegetation. The proposed facility will occupy a shallow valley, where water naturally collects, and therefore, with the proposed impermeable east and west embankments, can be expected to provide a moist microhabitat for plant growth after closure.

7.4.3 Long-term Stability

Shear will evaluate best options for PKCA cover design based on long-term stability evaluations and reclamation trials conducted at other PKCA facilities.

Long-term stability for the dams and impoundment requires different considerations. Stability after closure will be monitored throughout the closure and post-closure period by mine staff and independent geotechnical engineers as a requirement of the mine water licence.

7.4.3.1 Impoundment

Physical stability of the section of the impoundment containing FPK will be achieved by placement of CPK, run-of-mine rock, and top dressing materials if revegetation trials indicate probable success, or CPK and run-of-mine rock if not. Chemical stability post-closure was discussed in detail in SRK Technical Memorandum P (SRK 2004) submitted to the NWB in support of water licence application. Water in the western end of the PKCA is forecast to meet water discharge criteria; monitoring during operations will provide additional evaluation information. If the water does not meet criteria, the water will be treated prior to discharge into Stream C1.

If trends in water quality indicate discharge on closure may be problematic, at least one year prior to closure, testing of PKCA supernatant water will be undertaken with the goal of selecting a system that will treat the water to Water Licence objectives.

7.4.3.2 Dams

Stability analyses were completed for all dams which indicated Canadian Dam Association (CDA) guidelines for factors of safety would be met. The performance of the dams will be monitored during operations to verify stability and any adjustments that are required will be made prior to closure. The dams will be inspected during operations and post-closure by an independent geotechnical engineer until such time as the water licence is cancelled.

East, Southeast and North Dams

The East, Southeast, and North dams are relatively low structures (maximum 8 m for East and Southeast dams and 3 m for the North Dam) that will remain in place at closure; the dams will not have water against their upstream faces at closure.

Design details for the east and southeast dams can be found in EBA Engineering (EBA) design reports (EBA 2005 a, b). Preliminary design details for the North Dam can be found in EBA (2007).

Divider Dykes

Divider dyke design details can be found in EBA design reports (EBA 2005c). The divider dykes on closure will have FPK and no free water against the upstream face for Divider Dyke B, and both faces for Divider Dyke A. The divider dykes will be inspected post-closure by an independent geotechnical engineer until such time as the water licence is cancelled.

A small amount of pore water may be expelled by the freezing process but will have negligible effect on the much larger volume of water in the downstream pond (SRK 2004).

West Dam

Design details for the West Dam can be found in EBA (2005a). The West Dam is designed to hold water against the upstream face. Long-term thermal and dam stability monitoring will be instituted as part of PKCA operation as recommended by EBA (2005e).

At closure, ponded supernatant water will be pumped to Stream C3 if water meets discharge criteria or treated as indicated from operational experience prior to closure to meet these criteria. To minimize long-term stability risks, the dam will be breached; the final discharge elevation will be determined as part of final closure planning. The West Dam will, therefore, no longer perform or be classified as a dam. The discharge elevation will be set so that FPK in the upstream pond does not wash out through the discharge. Natural discharge from the basin is expected to be restored with these measures.

Figure 8 provides a conceptual closure spillway located at the north abutment of the West Dam.

7.4.4 Alternatives Considered

Alternatives considered for closure include final disposal of PKCA pond water and methods for breaching the West Dam. No alternatives for recontouring of east, southeast, and north dams were considered.

- Should PKCA pond water not meet Water Licence discharge criteria on closure, water will be treated or pumped to the open pit.
- Alternatives to breaching the West Dam include a proposed conceptual spillway or breaching the dam approximately in the centre after water is pumped from the PKCA pond, and rock armouring the breach with clean, non-acid-generating run-of-mine rock.

7.5 Sediment Ponds, Berms and Ditches

7.5.1 Development Status

Sediment ponds, berms, and ditches will be required on site to train runoff water around site operations and facilities. Upon closure, a site inventory of ponds, berms, and ditches will be conducted for reclamation purposes.

7.5.2 Reclamation Activities

All available mine drainage that meets water discharge guidelines will be directed to the open pit. Sediment ponds, berms, and ditches that are no longer required will be reclaimed. Ditches will be stabilized where they pass through overburden; ditch portions in bedrock will remain as constructed. To the greatest extent possible, ditches will be altered to return drainage to pre-disturbance conditions. For pre-mining areas draining to Lake C1, this would pre-suppose runoff meets water discharge guidelines; otherwise, water should be directed to the open pit.

Sediment in ponds will be kept in place and covered with waste rock or overburden to retard wind or water erosion.

Petroleum tank berms and bases will be evaluated to determine if the soils are contaminated and if so will be treated and disposed of accordingly. Berms will be removed and the construction materials placed in a waste rock dump. Liners will be removed, decontaminated, and buried along with inert waste in the landfill facility and covered with waste rock. If decontamination of liners is not feasible, they will be transported off site to a registered waste facility.

Any remnant of berms or pond dykes left after reshaping would be stabilized and revegetated, assuming reclamation trials suggest probable success and based on the outcome of discussions with stakeholders.

7.5.3 Long-term Stability

Reclaimed ponds, berms, and ditches should be visually monitored throughout closure and post-closure period until the pit overflows to ensure permafrost and erosion stability.

7.5.4 Alternatives Considered

Alternatively, any sediment in ponds could be removed and placed on one of the dumps, then covered with waste rock or overburden to retard wind or water erosion. In addition, all dykes and berms (regardless of bedrock construction) could be flattened and revegetated.

7.6 Stream C1 Diversion

7.6.1 Development Status

The footprint of the pit included a section of Stream C1. A channel was constructed along the western pit perimeter to divert water around the pit. The diversion system consists of a dyke to divert water out of Stream C1, a diversion channel to transport the water around the mine pit, and an outlet at the downstream end of the channel to return diverted water back into Stream C1.

The diversion system is designed to accommodate a 1-in-200 year return period flow event, thereby ensuring the long-term stability of the structure. The dyke diverts all flow from Stream C1 into the diversion channel at a point 761 m upstream from Carat Lake. The water is transported around the pit and discharged back into Stream C1 at a point 232 m upstream of Carat Lake.

The dyke consists of mined rock materials and is approximately 20 m wide. The diversion channel consists of three sections. Reach A of the diversion (first 174 m) is excavated into the bedrock. Reach B of the diversion transitions through a rock chute 146 m long and terminates into a small dissipation pond. Water then flows into a 150 m long, lined channel excavated into the overburden material active layer (Reach C) and discharged back into Stream C1 via a small transition pond upstream of Carat Lake.

7.6.2 Reclamation Activities

Upon closure, Stream C1 flow will continue in the diversion. The dyke to divert water will remain in place.

7.6.3 Long-term Stability

The Stream C1 diversion is designed to be a stable structure. Reach A is cut in bedrock, and Reach B is armoured with rock and designed to be stable enough to handle flood conditions. The flow in Reach C follows a meandering pattern that will have stabilized to a natural channel prior to pit overflow; Reach C was constructed to preserve natural vegetation and is inherently stable. Shear will visually monitor and evaluate Stream C1 diversion long-term stability throughout mine life, closure, and post-closure period until the pit overflows.

Preservation of the permafrost between the open pit and the channel is of utmost importance. Permafrost degradation could result in seepage losses toward the pit wall resulting in possible pit wall instability. To avoid seepage losses, the up-gradient and pit side embankment of the Stream C1 diversion is designed with a minimum 5 m wide running surface to permit heavy equipment traffic and to positively preserve and aggrade permafrost. Furthermore, an approximate 2 m insulating sand and gravel/rock cover will be used in the zone between Reach C and the pit crest in areas suspected to contain high levels of ground ice. Fills used for the embankment adjacent to the channel will be chosen selectively to provide low permeability when frozen to act as a natural liner/cutoff. Geothermal and hydrogeological considerations will determine the berm dimensions and therefore the berm dimension will exceed those that would be required to control runoff if the channel was simply lined with a geosynthetic liner.

Stability is not of concern for Stream C1's lower natural channel.

7.6.4 Alternatives Considered

Alternatives considered include returning the Stream C1 diversion to the natural channel through the pit once the open pit is full and meets discharge guidelines. This option is not recommended as approximately 20 years of fish habitat development in the Stream C1 diversion will be forfeited.

7.7 Freshwater Intake Causeway

7.7.1 Development Status

A water intake and transfer system supplies potable water from Carat Lake to the camp and raw water to the mine and processing plant. The system consists of an intake pump, intake pump well casing, pipeline, and causeway. The causeway, which is needed to access deeper water and for operational and maintenance reasons, is constructed as follows:

- The length of the causeway is 93.6 m which corresponds to the minimum length possible to insure that the intake pipe will be 0.5 m off the lake bottom and 2 m below the design bottom of the maximum ice thickness. The area surrounding the pump house is not widened.
- The causeway width is constructed to provide a minimum 5 m maintenance roadway surface plus room for a pipeline and power cable as well as suitable safety barriers.

A layer of clean rock was added as cover material to contain and prevent erosion of fines into Carat Lake upon recommendation by DFO on August 18, 2005.

7.7.2 Reclamation Activities

Upon closure, the freshwater pump intake and causeway are to be removed. The causeway itself will be cut to 2 m below the normal Carat Lake summer water level from the northern extent back to a water depth of 3.5 m. From a water depth of 3.5 m to 1 m, the causeway will taper up. The reclaimed causeway will intersect surface near the shoreline. Monitoring of suspended sediment levels will occur during reclamation activities.

The causeway below water level is to be developed into a rock reef fish habitat. The use of larger rock materials (up to 0.5 m in diameter) along the causeway margins will increase the amount and quality of habitat that is presently available to fish along the affected shoreline. Use of clean rock fill and construction during the winter period will largely eliminate water quality degradation through introduction of sediments.

Predictions indicate the habitat losses associated with the causeway footprint will be fully mitigated on closure and these measures will result in a net gain in fish habitat.

7.7.3 Long-term Stability

There are no long-term stability issues associated with the causeway reclamation. The causeway will be largely removed and the remaining portion will be below water level.

7.7.4 Alternatives Considered

Alternately, the entire causeway and potential rock reef fish habitat can be removed and placed in the waste rock dump. This alternative is not ideal as the potential for water quality degradation through introduction of sediments is higher than partial removal of the causeway.

7.8 Stockpile Pads

7.8.1 Development Status

The stockpile pads are approximately 2 m thick, principally to insulate the tundra and prevent permafrost melt.

7.8.2 Reclamation Activities

Assuming there will be no continued third-party use of the mine site, at closure, the ore stockpile pad will be graded, scarified, and left for natural revegetation.

7.8.3 Long-term Stability

The ore stockpile pad is not near any waterbodies and is a low structure of approximately 2 m deep. Sufficient material should remain to insulate the tundra and prevent permafrost melt.

Minor sediment from wind or water erosion may be deposited onto the adjacent tundra.

7.8.4 Alternatives Considered

Depending on revegetation trials, overburden and snow catchments may be added to increase soil moisture retention on the pads.

7.9 Mine and Access Roads

7.9.1 Development Status

The Jericho Diamond Mine uses both permanent and winter roads. The permanent road network requires two stream crossings that contain fish habitat. The first crossing, on Stream C1, is needed to access the Carat Lake water intake and is located immediately downstream of the diversion dyke. The crossing consists of a culvert overlain by rock fill built up to the appropriate elevation. The second crossing, on Stream C2, is located along the existing road alignment that connects the exploration camp to the mine area.

A winter road along an established route is used to access Contwoyto Lake. The winter road traverses two intermittent watercourses (Streams D1 and D2) and crosses Lynne Lake. By necessity, winter road construction and operation occurs when the water courses and lakes are frozen.

7.9.2 Reclamation Activities

Assuming there will be no continued third-party use of the mine site, at closure, the bridges and culverts should be removed from all site roads and roads re-contoured. Breaches should be back-sloped and graded to allow runoff to follow natural drainage patterns, yet minimize additional disturbance of the tundra. Breaches should be armoured as necessary to minimize erosion.

Road surfaces could be revegetated (depending on revegetation trials) to establish a self-sustaining vegetative cover to further stabilize the surface.

The road between the camp and the airstrip will be left in a stable condition until final closure and may be left un-reclaimed at final closure, if requested by a government agency or by a third party who agreed to assume responsibility for its maintenance.

7.9.3 Long-term Stability

All-weather roads are crossed by a number of small, mostly ephemeral, streams. At stream crossings, culverts will be removed, the road approaches pulled back with an excavator, and banks rock armoured to prevent erosion.

7.9.4 Alternatives Considered

Presently, no alternatives for the roads are being considered.

7.10 Airstrip

7.10.1 Development Status

The airstrip was constructed in 1998 northeast of Carat Lake on an esker. Constructed in a NNE-SSW orientation, the airstrip was lengthened to the north in 2006. The airstrip is not near any waterbody, and no drainages cross the strip.

7.10.2 Reclamation Activities

If long-term alternative sustainable uses of the property and facilities are identified, the airstrip should be left intact to support such activity. Similarly, a decision may be made following discussions with regulatory authorities even in the absence of such use to leave the airstrip intact for emergency landings and use in support of fire-fighting or other emergency situations. A government agency or third party will need to assume responsibility for the airstrip continued maintenance after mine closure.

7.10.3 Long-term Stability

No wind or runoff erosion issues have been evident on the existing airstrip since its construction in 1998. Armouring will not be used except in areas that indicate propensity to erode over the life of the airstrip, as armouring will only serve to prevent or greatly slow natural revegetation of the esker material.

7.10.4 Alternatives Considered

The airstrip will be kept open until final closure for use by Shear reclamation personnel. Assuming there will be no continued third-party use of the mine site, at closure, the airstrip should be graded and scarified for natural revegetation.

7.11 Infrastructure

7.11.1 Development Status

Structures at mine closure will include:

- Accommodation complex and mine office;
- Processing plant;
- Fuel farm;
- Airport and generator day tanks;
- Generator;
- Emulsion plant;
- Explosives magazine cache;
- Truck shop;
- Freshwater intake pump house;
- Airstrip generator and storage sheds;
- Portal to the underground access ramp;
- Vent raise (if outside the pit);
- Laydown areas;
- Landfarm; and
- Landfill.

Upon closure, Jericho infrastructure should be inventoried for an accurate assessment of reclamation work.

7.11.2 Reclamation Activities

Assuming there will be no continued third-party use of the mine site, at final closure, all structures will be removed from site or deposited in a secondary landfill to be designed for closure. All necessary removal of infrastructure should take place the first winter of final closure, thus obviating the need to construct the winter road beyond the end of mine life plus one year.

Hazmat Study

On all structures suspected to be constructed of potentially hazardous materials, a detailed hazardous building materials (Hazmat) study should be completed prior to demolition, and a friable Hazmat study completed prior to movement. Potential hazardous materials include, but are not limited to, asbestos containing materials (ACM) and lead based paints (LBP). Procedure planning for the safe demolition of hazardous material constructed building and the safe and appropriate handling and disposal of all potentially hazardous building materials will be developed with input from regulatory authorities upon mine closure.

Infrastructure Associated with Explosives

Infrastructure associated with explosives (emulsion plant, ammonium nitrate storage, explosives truck shop) will be removed and the areas reclaimed/revegetated at the end of the mining phase.

Salvageable Structures

Any salvageable structures that are not required for the underground mining phase will be backhauled off site during the winter resupply. If not salvageable, structures will be demolished, decontaminated if required, and buried in the waste rock dump. All hazardous materials will be backhauled off site to a contaminated waste contractor for disposal or return to suppliers (e.g., oil cubes; barrels). This procedure will serve to reduce the amount of material to deal with at final closure.

All mine-related mobile equipment will be trucked out on the winter road the first opportunity after completion. Since the equipment will belong to the mine contractors, this will be the contractor's responsibility. Shear, as holder of the land leases for the site, will however retain ultimate responsibility for removal of equipment from Jericho.

Non-Salvageable Structures

Non-salvageable scrap metal left at closure will be placed in the waste dumps and covered.

All remaining structures will be torn down. Smaller demolition scrap will be placed on the edge of the waste dumps and covered during final resloping efforts. Large volume demolition scrap will be placed in the open pit and covered with waste rock. Foundations will be covered with top dressing materials.

The fuel farm tanks will be emptied into tanker trucks, decontaminated, disassembled and buried in the open pit, as with all warehousing and trailers. The explosives magazine trailers (steel bulk shipping containers) will be removed. Pipes will be removed from the water intake causeway and buried.

All pads used for buildings will be scarified, top dressed, and possibly revegetated.

Trailer Modules and Portable Housing

Most of the mine camp, including trailer modules, will be removed on final closure or demolished and buried as scrap in the open pit. Portable housing, such as tents which can be flown off site by aircraft, will be used by reclamation crews once buildings are removed. Alternatively, if a third party agrees to assume the land lease for the camp, the applicable part of the mine camp will be retained and signed over to the third party assuming the land lease.

Site Facilities

Upon decommissioning of the landfarm, PHC-impacted soils that do not respond to bioremediation treatment may be incinerated, disposed of off-site, or, with prior approval, may be used as intermediate fill within an engineered on-site facility.

Landfarm berms will be treated as remediated soils and disposed of accordingly. Berms will be removed and the construction materials placed in the waste rock dump. Liners will be removed, decontaminated, and buried along with inert waste in the waste rock dumps and covered with waste rock. If decontamination of liners is not feasible, they will be transported off site to a registered hazardous waste facility.

7.11.3 Long-term Stability

No long-term stability issues are foreseen in re-sloping and re-vegetating infrastructure pads.

7.11.4 Alternatives Considered

No alternatives are considered at this time.

7.12 Soils Testing

7.12.1 Development Status

Potential petroleum hydrocarbon (PHC) contamination has been identified in soils and facilities at various locations around the Jericho site in connection with diesel, oil, and gasoline storage, distribution, and use.

Upon closure, a Phase III Environmental Site Assessment (ESA) is recommended to identify Areas of Potential Environmental Concern (APEC) and delineate the extent of PHC-impacted soils. The Phase III ESA will provide the basis for planning future work to better estimate the total volume of soil that will need to be remediated.

7.12.2 Reclamation Activities

Upon closure, any soils suspected to be impacted with PHC, and not previously remediated, will be tested and compared to landfarm soil acceptance criteria. Soils that meet landfarm soil acceptance criteria will be transported to the landfarm for remediation. Soils that do not meet landfarm soil acceptance criteria, or are not approved for landfarm treatment by the VP Operations and/or Site Manager, should be considered hazardous waste and disposed of accordingly.

7.12.3 Long-term Stability

The long-term stability objective for PHC-impacted areas is to return APECs to agriculture/wildland Tier I Criteria for F1 to F4 hydrocarbons or to natural background conditions as determined by a site-specific risk assessment.

7.12.4 Alternatives Considered

PHC-impacted soils that meet landfarm acceptance criteria could be bioremediated in-place or transported to a registered off-site disposal facility.

7.13 Borrow Areas

7.13.1 Development Status

Borrow areas are exclusively on eskers or kame deltas. Borrow pit areas will be managed to minimize any potential for water erosion, and reclaimed throughout mine operation. An inventory of borrow areas should be tallied upon mine closure to identify not yet reclaimed areas.

7.13.2 Reclamation Activities

Any borrow areas active to the end of mine life will be reclaimed and revegetated upon mine close. Steep slopes will be graded to the angle of repose or 3:1, and revegetated as indicated by reclamation trials.

7.13.3 Long-term Stability

Borrow areas should have shallow sloping banks that are not subject to erosion. Bank performance should be monitored during site reclamation when no longer subject to disturbance, and banks made more shallow than indicated (between 4:1 and 5:1) if monitoring indicates.

Soils are granular and, therefore, not presenting surfaces easily eroded by wind.

Sufficient material should remain or overburden should be applied to insulate the tundra and prevent permafrost or ice-lens melt, and potential for erosion. Overburden can be used as revegetation substrate for establishing self-sustaining vegetative cover to stabilize the borrow area surfaces and encourage natural revegetation.

7.13.4 Alternatives Considered

Alternatively, borrow pit reclamation activities themselves may cause greater destruction than the long-term effects of the borrow pit areas. Because of esker and kame location on granular soils, it may be most beneficial to leave areas for natural reclamation.

8.0 STUDIES

8.1 Revegetation Studies

Shear considers establishment of vegetation to be a viable reclamation option for the Jericho site. The objective of revegetation is to reclaim mining disturbances to conditions most closely resembling the pre-development environment.

Shear will continue vegetation studies and reclamation trials to:

- Determine which substrates are most effective for plant establishment and growth.

- Determine which soil amendments are most effective at enhancing substrate properties and plant establishment.
- Determine which groups and individual native plant species are able to establish and survive on a variety of substrates.

In January 2011, a reclamation literature review was conducted and reclamation experimental designs developed for Jericho. The research proposed in Appendix A has been started as of February 2011.

Potential locations for revegetation trials will be identified in the site assessment.

8.2 Engineering Studies

Shear will examine opportunities for engineering studies upon site investigation.

9.0 TEMPORARY SHUTDOWN

A temporary shutdown is defined as a cessation of mining and processing operations for a finite period with the intention of resuming operations as soon as possible after the reason for the shutdown has been resolved. Possible causes for a temporary shutdown include, but are not limited to, a major mechanical equipment failure, late delivery of critical equipment or supplies, or a labour conflict.

In the event of a temporary shutdown, mining activities will cease and the Jericho CAMP will be followed. Reclamation activities in progress and revegetation studies will continue in accordance with the project certificate.

10.0 PROGRESSIVE RECLAMATION

Shear has not yet had the opportunity to conduct any site investigations under snow-free conditions. Until Shear can conduct a full site investigation during the spring and summer months, it is difficult to assess and determine opportunities for progressive reclamation.

11.0 MONITORING

11.1 General

The Jericho Mine Closure and Reclamation Monitoring program has been developed to; evaluate the environmental effects during the reclamation activities, detect the short- and long- term environmental effects after the reclamation is completed and to measure the effectiveness of reclamation efforts The monitoring program fulfills the requirements specified in Schedule M, Item 1o and p of the Jericho Mine Water Licence NWB1JER0410 (issued December 21, 2004). This section provides a summary of the monitoring parameters, locations, frequencies, and timeframes.

11.2 Monitoring Timeframe

The ICRP monitoring program is divided into three phases:

- Reclamation Construction Monitoring (RCM):

  This phase will start when reclamation activities are initiated. The reclamation activities outlined in this plan have the potential to affect water and air quality therefore the monitoring programs established and undertaken during operations will continue during the reclamation activities. The reclamation construction phase is expected to last two years.

- Short-term Post-reclamation Monitoring (SPRM):

  Upon closure, short-term post-reclamation monitoring will begin. Monitoring will be conducted to detect any instability of the remaining mine structures and potential impacts to the environment from the mine. A minimum of five years of monitoring will be conducted during this phase. Once three consecutive years of monitoring data indicate no effects from the reclaimed site the next phase of monitoring is triggered.

- Long-term Post-reclamation Monitoring (LPRM):

  Once the results of the monitoring program indicate that the reclaimed site has stabilized, the long-term post-reclamation monitoring program will be initiated. The frequency and number of sampling locations will be reduced. It is anticipated that the LPRM could continue for 25 years following the completion of the reclamation activities.

11.3 Geotechnical Monitoring

11.3.1 Methods

The geotechnical monitoring will consist mainly of visual assessments of the remaining structures. Site-wide geotechnical inspections will be conducted by a qualified geotechnical engineer as per the schedule presented in Section 11.3.2.

The following specific tasks should be completed during the geotechnical inspections:

- Each structure and surrounding area visually examined for signs of settlement, seepage, cracking, or any other signs of distress.
- Observations made during the inspection are photographed and recorded. Photographs of the general condition of each structure area taken to track year by year changes in each structure.
- Settlement surveys are completed where necessary to assess any movement in the structures.
- Ground temperature data is collected for several structures at various intervals throughout the year. This data is reviewed in conjunction with site observations from each structure to verify acceptable structure performance.

Following the inspection, a report will be prepared summarizing the assessment and monitoring data, a copy of which will be submitted to the NWB for review and approval.

11.3.2 Frequency

11.3.2.1 Reclamation Construction Monitoring

A qualified geotechnical engineer will be available at the mine during the construction activities. The engineer will be responsible for supervising the rock pile re-sloping and the collection of associated geotechnical monitoring data.

11.3.2.2 Short-term Post-Reclamation Monitoring

An annual geotechnical inspection will be performed by a qualified geotechnical engineer during the short-term monitoring phase. When possible, the inspections will take place during freshet.

11.3.2.3 Long-term Post-Reclamation Monitoring

Once the stability of the rock piles is confirmed, the frequency of the geotechnical inspection will be reduced to triennial (once in three years). When possible, the geotechnical inspections will take place during freshet.

11.4 Seepage Water Quality Monitoring

11.4.1 Methods

Metal leaching due to acid rock drainage (ARD) of the waste rock may occur over time after the mine closure. The seepage water quality monitoring program was established to detect changes in geochemical stability inside of the waste rock piles at Jericho. The waste rock piles have been designed to minimize the potential for ARD. Seepage monitoring will continue following closure once reclamation activities have been completed.

Based on the current available design information for the Jericho Mine, the monitoring station locations will include the toes of Waste Rock Pile 1, Waste Rock Pile 2, Ore Stockpile, the Low-grade Ore Stockpile, CPK Stockpiles 1, 2, 3, and 4. Table 4 summarizes the proposed seepage monitoring locations and parameters to be sampled. During the care and maintenance activities in 2011, Shear will confirm the locations and sizes of the existing rock piles, and may modify the proposed seepage sample locations if necessary.

Seepage from the rock piles is expected to exit from a number of locations at the toe. Composite samples will be collected. In general, no more than three visible turbid streams, originating along a 30 m length of the rock pile, will be combined into a single composite sample.

All incidents of seepage, including each of the streams in a composite sample, will be documented, including a written description, photographs, as well as UTM coordinates for each source. Field measurements including temperature, pH, dissolved oxygen, and electric conductivity for each sample will be recorded. The seepage water samples will be submitted to a CALA accredited laboratory for the analysis of routine water chemistry, total metal, dissolved metal, and nutrients. The detailed analytical parameters and QA/QC methodologies are described in the Jericho GMP (EBA 2011d).

Table 4 Rock Pile Seepage Quality Monitoring

Station	Location	Analysis	Comment
JER-SPG-01	Waste Dump 1	Routine, total and dissolved metals, nutrients	Minimum one composite sample
JER-SPG-02	Waste Dump 2	Routine, total and dissolved metals, nutrients	Minimum one composite sample
JER-SPG-03	CPK Stockpile 1	Routine, total and dissolved metals, nutrients	Minimum one composite sample
JER-SPG-04	CPK Stockpile 2	Routine, total and dissolved metals, nutrients	Minimum one composite sample
JER-SPG-05	CPK Stockpile 3	Routine, total and dissolved metals, nutrients	Minimum one composite sample
JER-SPG-06	CPK Stockpile 4	Routine, total and dissolved metals, nutrients	Minimum one composite sample
JER-SPG-07	Ore Stockpile	Routine, total and dissolved metals, nutrients	Minimum one composite sample
JER-SPG-08	Low Grade Ore Stockpile	Routine, total and dissolved metals, nutrients	Minimum one composite sample

Note:
1. Sampling locations are based on the available mine design.

11.4.2 Frequency

11.4.2.1 Reclamation Construction Monitoring

Rock pile re-sloping activities may cause geochemistry instability within the rock piles by disturbing the waste rocks. For this reason, the seepage monitoring program will continue annually during the reclamation construction phase. Sampling will take place in July or August of each year to coincide with maximum seepage concentrations while avoiding dilution from surface runoff during the freshet period in June.

11.4.2.2 Short-term Post-reclamation Monitoring

During the short-term monitoring phase the seepage quality monitoring will continue to be performed in July or August annually.

11.4.2.3 Long-term Post-reclamation Monitoring

Since ARD may potentially begin to develop after the mine has closed, annual seepage monitoring will be performed during the first three years of long-term monitoring. If the analytical results show no signs of declining water quality, the monitoring frequency will be reduced to once in five years until the end of the LPRM.

11.5 Site Water Quality Monitoring

11.5.1 Methods

During the reclamation construction phase, the wastewater treatment plant along with other temporary water retention structures will be demolished. The open pit will be gradually flooded naturally. Drainage at the mine will also be directed to the mine pit if possible and practical. The West Dam of the PKCA will be breached to the level that the drainage from the PKCA will flow into Stream C3 in a natural pattern. The surface runoff at the site will naturally enter the receiving environment. Site water quality monitoring will continue during the post-closure and reclamation phases. The purpose of the program will be to:

- Ensure the runoff water quality meeting the discharge criteria specified in the Water Licence, and
- Provide early warning of potential declining water quality due to unexpected causes.

The surface water quality monitoring stations will be located at the open pit and the PKCA.

Based on the pit sump monitoring records from 2006 and 2007, nitrate and ammonia, resulting from blasting, were the only constituents of concern. It is anticipated that nitrate and ammonia will be flushed into the pit during the first few years after the completion of mining activities. Multiple water samples at various locations and depths of the pit are required to assess the quality of the pit water and to calibrate the chemistry modelling for the final pit water quality. During each monitoring event, one sample in the middle of the pit is initially required. When the depth of the pit water is over 3 m, two samples (one near surface and one near bottom) will be required. Depending on the analytical results of the water, sampling at multiple locations in the pit may be necessary.

Field measurements including temperature, pH, dissolved oxygen, and electric conductivity for each sample will be recorded. Water depth should also be recorded at the centre of the open pit. The water samples will be submitted to a CALA accredited laboratory for the analysis of routine water chemistry, total metal, dissolved metal, and nutrients. The detailed analytical parameters and QA/QC methodologies are described in the Jericho General Monitoring Plan (EBA 2011d). Table 5 summarizes the site water quality sampling locations and sample analysis.

Table 5 Site Water Quality Monitoring

Station	Location	Analysis	Comment
JER-SWQ-02	Open Pit	Routine, total and dissolved metals, nutrients	Depending on the volume of impound water, collect one or more samples at multiple locations and depths
JER-SWQ-04	PKCA Basin	Routine, total and dissolved metals, nutrients. If PKCA discharge is required, conduct *Oncorhynchus mykiss* and *Daphnia magna* prior to discharge.	Collect one sample at the west side of the PKCA

11.5.2 Frequency

11.5.2.1 Reclamation Construction Monitoring

During the reclamation construction phase, the water quality in the Open pit and the PKCA will be monitored monthly during the open water season (June through October).

Before breaching the West Dam, site water may still be pumped to the PKCA for temporary storage, and the PKCA impounded water will then be discharged to Stream C3. The impounded water will be analyzed prior to discharge to ensure water discharge criteria have been met prior to discharge. Water quality will be monitored at the downstream side of the West Dam (JER-AEM-04) during discharge as described in the AEMP.

11.5.2.2 Short-term Post-reclamation Monitoring

During the SPRM phase, the water quality in the open pit and the PKCA will be monitored biannually, once in June during the freshet period and once in September. If the results of the water quality monitoring programs indicate that there is no decline in the quality of the water, the LPRM phase of the monitoring will commence.

11.5.2.3 Long-term Post-reclamation Monitoring

During the first three years of the LPRM phase, an annual water quality monitoring program will be conducted in the open pit and the PKCA during early to mid August of each year. If consecutive monitoring data indicates no change in the water quality, the monitoring frequency will be reduced to once in five years until the end of the LPRM.

11.6 Aquatic Effects Monitoring

The aquatic effects monitoring program was designed to monitor the abiotic and biotic qualities and health of the downstream waterbodies from the Jericho site.

The monitoring activities of the program include the following parameters:

- Abiotic Parameters:
  - Water Quality (WQ)
  - Sediment Quality (SQ)
  - Sediment Deposition (SD)
  - Dissolved Oxygen and Temperature profile (DO)
- Biotic Parameters:
  - Phyto/Zooplankton (PZ)
  - Periphyton (PP)
  - Benthic Macro-invertebrates (BM)

– Fish migration and community

The detailed sampling methodology and QA/QC procedures for the aforementioned parameters are described in the AEMP (EBA, 2011a). Shear will conduct additional aquatic baseline and background studies during the care and maintenance phase, beginning 2011.

Table 6 summarizes the proposed AEM sampling locations and potential parameters, based on the proposed AEMP (EBA 2011a).

Table 6 AEM Sampling Locations and Potential Parameters

Lake Group	Station (1)	Location	Sample Parameters (2)	Comments
Reference Lakes	JER-AEM-01	Reference Lake 1	WQ, SQ, SD, DO, PZ, PP, BM	Refer to AEMP for SD, PZ, PP and BM sampling locations
	JER-AEM-02	Reference Lake 2	WQ, SQ	The sampling locations will be determined in 2011
Jericho River Group	JER-AEM-03	Control Lake	WQ, SQ, DO	Refer to AEMP for SD sampling location
	JER-AEM-04	PKCA Discharge in Stream C3	WQ (3)	Only monitored prior to breaching the West Dam
	JER-AEM-05	Stream C3 upstream of Mouth	WQ (3), PP, BM	Refer to AEMP for PP and BM sampling locations
	JER-AEM-06	Lake C3 near Stream C3 outlet	WQ, SD, BM	Only monitored prior to breaching the West Dam
	JER-AEM-07	Lake C3 South Basin	WQ, DO, PZ,	N/A
	JER-AEM-08	Lake C3 Outlet	WQ, SD	N/A
	JER-AEM-09	Lake C1	WQ, SQ	N/A
	JER-AEM-10	Stream C1 Upstream of Mouth	WQ, PP, BM	Refer to AEMP for PP and BM sampling locations
	JER-AEM-11	Stream C1 outlet in Carat Lake	WQ, SD, BM	Refer to AEMP for BM sampling locations
	JER-AEM-12	Freshwater intake in Carate Lake	WQ	N/A
	JER-AEM-13	Lake C4	WQ	N/A
	JER-AEM-14	Stream C2 Upstream of Mouth	WQ, BM	Refer to AEMP for BM sampling locations
	JER-AEM-15	Carat Lake Centre Basin	WQ, SQ, DO	N/A
	JER-AEM-16	Carat Lake Outlet	WQSD, DO, PZ	N/A
	JER-AEM-17	Jericho Lake	WQ, SD, DO	N/A
	JER-AEM-18	Jericho River Downstream of Jericho Lake	WQ	N/A
O-Lake Group	JER-AEM-19	Lake O1	WQ, SQ, DO	N/A
	JER-AEM-20	Lake O2	WQ, SQ, DO, PZ, BM	Refer to AEMP for BM sampling locations
	JER-AEM-21	Lake O4	WQ	N/A

Table 6 AEM Sampling Locations and Potential Parameters

Lake Group	Station (1)	Location	Sample Parameters (2)	Comments
Lynne Lake Group	JER-AEM-22	Ash Lake	WQ	N/A
	JER-AEM-23	Key Lake	WQ, SQ, SD, DO, PZ	N/A
	JER-AEM-24	Lynne Lake	WQ, SQ, DO, BM	Refer to AEMP for BM sampling locations
	JER-AEM-25	Contwoyto Lake near Stream D1 Mouth	WQ	N/A

Note:

1. The monitoring stations are citied from the AEMP (EBA, 2011a).
2. WQ – Water Quality; SQ – Sediment Quality; SD – Sediment Deposition; DO – Dissolved oxygen/Temperature profile; PZ – Phyto/Zooplankton; PP – Periphyton; BM – Benthic Macro-invertebrates.
3. During the PKCA discharge, water quality monitoring parameters will include additional *Oncorhynchus mykiss and Daphnia magna* tests in JER-AEM-04; and *Ceriodaphnia dubia* test in JER-AEM-06.

11.6.1 Frequency

11.6.1.1 Reclamation Construction Monitoring

During the RCM phase, site water may still be pumped to the PKCA and further discharged into Stream C3. Sampling locations and frequency will remain the same during this phase as established during production.

11.6.1.2 Short-term Post-reclamation Monitoring

The AEM monitoring program will be reduced to biannual during this phase. If the results of this program indicate that the systems have stabilized, the monitoring program will transition to the LPRM phase. The sampling frequencies and locations are summarized in Table 7.

11.6.1.3 Long-term Post Reclamation Monitoring

During the LPRM phase, the frequency of the AEM monitoring will be further reduced. For the first three years sampling will be conducted annually. If there are no signs of decline in the overall health and environmental qualities of the downstream waterbodies, the monitoring frequency will be reduced to once in every five years. The proposed AEM sampling schedule and locations are summarized in Table 7.

Table 7 AEM Sampling Frequencies and Locations

Station [1]	Location	Sample Parameters [2]	Reclamation Phase		Short-term Post-reclamation Monitoring					Long-term Reclamation Monitoring			
			Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8	Yr9	Yr10	Yr 11-Yr 27
JER-AEM-01	Reference Lake 1	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		SQ	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
		SD	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
		DO	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		PZ	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
		PP	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
		BM	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
JER-AEM-02	Reference Lake 2	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		SQ	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
JER-AEM-03	Control Lake	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		SQ	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
		DO	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
JER-AEM-04	PKCA Discharge in Stream C3	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
JER-AEM-05	Stream C3 upstream of Mouth	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		PP	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
		BM	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
JER-AEM-06	Lake C3 near Stream C3 outlet	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		SD	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
		BM	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
JER-AEM-07	Lake C3 South Basin	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		DO	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		PZ	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
JER-AEM-08	Lake C3 Outlet	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		SD	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
JER-AEM-09	Lake C1	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		SQ	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
JER-AEM-10	Stream C1 Upstream of Mouth	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		PP	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
		BM	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD

Table 7 AEM Sampling Frequencies and Locations

Station (1)	Location	Sample Parameters (2)	Reclamation Phase		Short-term Post-reclamation Monitoring					Long-term Reclamation Monitoring			
			Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8	Yr9	Yr10	Yr 11-Yr 27
JER-AEM-11	Stream C1 outlet in Carat Lake	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		SD	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
		BM	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
JER-AEM-12	Freshwater intake in Carate Lake	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
JER-AEM-13	Lake C4	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
JER-AEM-14	Stream C2 Upstream of Mouth	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		BM	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
JER-AEM-15	Carat Lake Centre Basin	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		SQ	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
		DO	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
JER-AEM-16	Carat Lake Outlet	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		SD	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
		DO	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		PZ	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
JER-AEM-17	Jericho Lake	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		SD	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
		DO	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
JER-AEM-18	Jericho River Downstream of Jericho Lake	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
JER-AEM-19	Lake O1	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		SQ	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
		DO	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
JER-AEM-20	Lake O2	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		SQ	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
		DO	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		PZ	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
		BM	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD

Table 7 AEM Sampling Frequencies and Locations

Station (1)	Location	Sample Parameters (2)	Reclamation Phase		Short-term Post-reclamation Monitoring					Long-term Reclamation Monitoring			
			Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8	Yr9	Yr10	Yr 11-Yr 27
JER-AEM-21	Lake O4	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
JER-AEM-22	Ash Lake	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
JER-AEM-23	Key Lake	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		SQ	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
		SD	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
		DO	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		PZ	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
JER-AEM-24	Lynne Lake	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		SQ	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
		DO	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
		BM	TBD	TBD	A1	A1	A1	A1	A1	A1	A1	A1	TBD
JER-AEM-25	Contwoyto Lake near Stream D1 Mouth	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD
JER-AEM-25	Contwoyto Lake near Stream D1 Mouth	WQ	TBD	TBD	A2	A2	A2	A2	A2	A1	A1	A1	TBD

Note:

1. The monitoring stations are citied from the AEMP (EBA, 2011a).
2. WQ – Water Quality; SQ – Sediment Quality; SD – Sediment Deposition; DO – Dissolved oxygen/Temperature profile; PZ – Phyto/Zooplankton; PP – Periphyton; BM – Benthic Macro-invertebrates.
3. Sampling frequency: A1 – Annual, A2 – Biannual.

11.6.2 Air Quality Monitoring

The air quality monitoring program will be adjusted to reflect the level of activity associated with each phase of reclamation. The frequency and effort will reflect the monitoring objectives.

11.6.3 Frequency

11.6.3.1 Reclamation Construction Monitoring

During reclamation, the objectives of air quality monitoring will be to ensure that any effect created during the construction activities is captured in the monitoring efforts and to manage any necessary mitigative measures. The ongoing monitoring of long term effects of operations will also be required at this stage.

These objectives will be accomplished by monitoring fuel usage for emissions estimates, dustfall collection to measure the effects of wind erosion, visual inspection of areas adjacent to stockpiles and the PKCA and lichen collection for metals analysis. The high volume air sampling (HVAS) will be not modified at this stage as the emissions will be remain largely the same in spatial distribution and abundance within the mine site foot print.

The frequency of these monitoring efforts will not be adjusted during the reclamation construction stage.

11.6.3.2 Short-term Post-reclamation Monitoring

The contributing sources that would require monitoring for total settlable matter, particulate matter and emissions will have been removed at this stage. Monitoring during short term post closure will be for measuring the effectiveness of reclamation efforts in mitigating wind erosion. Air quality monitoring will consist of dustfall monitoring and lichen metals analysis. Sustained stabilization indicated by no effect shown for three consecutive years in a five-year period will be the catalyst for a reduction of monitoring frequency and effort.

11.6.3.3 Long-term Post-reclamation Monitoring

During long-term post-closure monitoring the objective will be to check that stabilization achieved in the short term post closure stage is sustainable in the long term. Visual investigations of vegetated areas proximal to potential dust generation will be conducted coincidentally with water quality monitoring.

11.6.4 Wildlife Monitoring

Shear has not had the opportunity determine if the wildlife monitoring conducted to date effectively addressing the objectives of measuring and managing for necessary mitigative measures, and we are not aware if the work described in the approved wildlife monitoring plan (TDC 2007) was conducted. Shear will work with the HTO, the Government of Nunavut, and the Canadian Wildlife Service while the project remains on care and maintenance to design a wildlife monitoring program for operations and closure. Until Shear has had the opportunity to thoroughly review the wildlife issues associated with Jericho and developed a plan for approval, we are unable to address specific monitoring requirements.

12.0 CLOSURE

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FIGURES

APPENDIX A

APPENDIX A RECLAMATION OF DISTURBED SITES AT JERICHO DIAMOND MINE