SHEAR DIAMONDS LTD.

PKCA MANAGEMENT PLAN CARE AND MAINTENANCE JERICHO DIAMOND PROJECT, NUNAVUT



REPORT

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ACRONYMS & ABBREVIATIONS

AA Atomic Absorption Spectrophotometry

AEMP Aquatic Effects Monitoring Plan
AIA Aquatic Impact Assessment
ANCOVA Analysis of Covariance

ANOVA Analysis of Variance

AQMP Air Quality Management Plan

BTEX Benzene, Toluene, Ethylbenzene, and Xylene

BACI Before-after-control-impact

CAEAL Canadian Association for Environmental Analytical Laboratories

CAMP Care and Maintenance Plan
CMP Contingency Management Plan
CPK Coarse Processed Kimberlite

DO Dissolved Oxygen EC Electric Conductivity

EIS Environmental Impact Statement

FPK Fine Processed Kimberlite

GC/FID Gas Chromatograph - Flame Ionization Detector

GMP General Monitoring Plan

ICP-MS Inductively Coupled Plasma – Mass Spectrometry

ICRP Interim Closure and Reclamation Plan
INAC Indian and Northern Affairs Canada

LFMP Landfarm Management Plan
LFP Landfill Management Plan
KIA Kitikmeot Inuit Association
MANOVA Multivariate Analysis of Variance
NIRB Nunavut Impact Review Board

NWB Nunavut Water Board
PHC Petroleum Hydrocarbons

PKCA Processed Kimberlite Containment Area

PKMP PKCA Management Plan
RPD Relative Percent Difference
Shear Shear Diamonds (Nunavut) Corp.
SWMP Site Water Management Plan
TDC Tahera Diamonds Corporation

TDS Total Dissolved Solids
TSS Total Suspended Solids

WEMP Wildlife Effects Management Plan

WMP Waste Management Plan
WRMP Waste Rock Management Plan

WTMP Wastewater Treatment Management Plan

WWTP Wastewater Treatment Plant



1.0 INTRODUCTION

1.1 General

The Jericho Processed Kimberlite Management Plan (PKMP) – Care and Maintenance has been developed to provide a methodology for managing the Processed Kimberlite Containment Area (PKCA) and the processed kimberlite and water contained within the facility.

The plan fulfills the requirements specified in Part H, Item 1 and Schedule H of 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 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.

The PKMP is based on these existing records including previous management plans, regulator comments, and external anecdotal information where available. The plan has been redeveloped for the current regulatory regime and to reflect Shear's commitment to the best practices in environmental stewardship.

The plan presents general descriptions of existing and planned infrastructure in the PKCA as well as revised procedures for operation of the facility while it remains under care and maintenance. Once Shear has an opportunity to thoroughly investigate the site and gather information in 2011, the PKMP will be revised. Subsequent revisions of the PKMP will also be prepared prior to resuming mining operations or commencing closure and reclamation activities.

1.2 Objective of Processed Kimberlite Management Plan

The primary objective of the Processed Kimberlite Management Plan (PKMP) is to provide Shear and its designated contractors with a working document to operate the PKCA including the discharge of compliant water to receiving environment.

At the time of the water licence renewal application, mining operations have been suspended and the site is under care and maintenance. This document will therefore address the specific requirements at the present time. The PKCA serves a dual purpose at Jericho:

- The storage of fine processed kimberlite from mining and processing operations; and
- The treatment and storage of site and supernatant process water.

While Jericho is under care and maintenance, processed kimberlite will not be discharged to the PKCA with the possible exception of a relatively small volume discharged during the evaluation of the processing plant. Site water management will therefore be the PKCA's prime function. In 2011, Shear will undertake a resource evaluation and a processing evaluation in order to make critical decisions regarding the future of the Jericho mine. The activities associated with these evaluations will be conducted while the project remains on care and maintenance and will help to determine when and if the project will go back into



operations. Unfortunately, site water management while the project was suspended was limited to minimal handling and discharge from the PKCA. This has resulted in the accumulation of melt and storm water in the pit and the PKCA. Currently, the water elevation in the PKCA is such that real concern exists with regard to the ability to manage the inflow during freshet. Additionally, the water that has accumulated in the pit seriously impedes Shear's ability to conduct an evaluation of the resource. Shear will need to dewater the pit in 2011 to ensure success of the worked planned for the year (WRSI 2011).

In addition to being a management tool, the PKMP was developed to assist Shear and the regulatory agencies with mine closure planning and the development of Jericho's Interim Closure and Reclamation Plan (EBA 2011e).

1.3 Background Information

The Jericho Diamond Mine is located approximately 260 km southeast of Kugluktuk, NU and 20 km north of Lupin Mine. The Jericho Mine was constructed and operated by Tahera Diamond Corporation (TDC) from 2004 to 2008. In January of 2008, mining operations were suspended by TDC and the site was subsequently 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 of 2010, Shear Diamonds Ltd. purchased the Jericho Mine and its assets and assumed responsibility for the site.

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

1.4 Linkage to Other Management Plans

Numerous interlinked site plans exist for mine and environmental management at the Jericho. The PKCA should be considered as part of the site wide management system. Other management plans that are related to or refer to the PKCA include:

- Aquatic Effects Monitoring Plan (AEMP);
- Site Water Management Plan (SWMP)
- Site Water Monitoring Plan (GMP);
- Waste Rock Management Plan (WRMP);
- Wastewater Treatment Management Plan (WTMP); and
- Interim Closure and Reclamation Plan (ICRP).

2.0 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 and 2. 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 processed kimberlite deposited in the facility.

The PKCA is divided into three cells: Cell A, Cell B, and Cell C. FPK will 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 filter through the divider dykes into the western portion (Cell C) of the PKCA.

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

The water level in the facility is ultimately controlled by discharging 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 6.

3.0 FINE PROCESSED KIMBERLITE DISPOSAL MANAGEMENT

During care and maintenance activities, production of FPK will be limited to a small amount produced during the evaluation of the process plant. Presently, Cell A has sufficient capacity for commissioning; however, before full production resumes, a detailed deposition plan will be developed and included in a revised PKMP. The revised PKMP will be submitted to the NWB for review and approval a minimum of 60 days prior to resuming processing activities.

4.0 DAM AND DYKE DESIGN

The PKCA facility requires dams and dykes to control the water level and discharge and FPK. The existing and proposed structures are listed in Table 1 and are shown in Figures 3 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 1: 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	n period is estir	*Construction period is estimated and is based on processing resuming mid-2012.					

^{4.1} West Dam

The West Dam design is described in EBA (2005c). The design criteria for the West Dam are as follows:

- The dam should retain water within the PKCA.
- The dam will remain physically stable during the operational life of the mine.
- The dam will remain physically stable during the operational life of the mine and will not be required after mine closure

The main water retention element in the dam is a frozen core overlying a frozen foundation. An effective frozen core dam requires that the central core and foundation remain frozen year-round to act as an impervious barrier against seepage. The core and foundation must be nearly saturated with ice to produce a well-bonded and impermeable mass, and the permafrost must be sustained. A geosynthetic liner on the upstream face of the frozen core provides a secondary seepage barrier.

The upstream shell consists primarily of rockfill. A small till zone has been placed at lower elevations to reduce convective water movement through the open graded rockfill. The downstream shell of the dam is constructed of rockfill. The rockfill shells are designed to be constructed with 3H:1V outside slopes.

The dam includes piping for the installation of thermosyphons. The need for thermosyphons will be based on the ground temperatures of the dam and foundation at the end of construction and over the life of the dam.

The West Dam was inspected in late September 2010 during the Jericho Annual Geotechnical Inspection (EBA 2010) and was performing satisfactorily.

4.2 East and Southeast Dam Design

The design of the East and Southeast dams are described in EBA (2005a). The design criteria for the East and Southeast dams are as follows:

- The dams will retain FPK solids.
- The water in the PKCA is to be maintained at a low level; therefore, water will not be impounded
 against the East and Southeast dams for long periods of time. However, the dams have been designed
 as water retaining structures since water may pond against the dams for short periods of time.
- The dams will remain physically stable during the operational life of the mine and following mine closure.

The main water retention element in the dams is the geomembrane liner. The liner is keyed into the ground using frozen saturated fill. Additional water retention is provided by FPK and coarse processed kimberlite (CPK) and till placed upstream of the liner. The dam foundation is designed to remain in a frozen condition thereby minimizing or eliminating seepage through the foundation.

The East Dam was constructed during the winter of 2005 and 2006. The Southeast Dam was constructed during the winter of 2006 and 2007. Construction details for the dams can be found in the East and Southeast Dam As-built Construction Report (EBA 2007)

The East and Southeast Dams were inspected in late September 2010 during the Jericho Annual Geotechnical Inspection (EBA 2010) and were performing well.

4.3 Divider Dyke A and B Design

The design of Divider Dyke A is described in EBA (2005b). The design criteria for the divider dykes are as follows:

- The dykes should retain the FPK solids to the extent practical. It will not be possible, or necessary, to prevent the movement of all colloidal particles through the dyke. These particles will combine and settle in the deposition cell following flocculation.
- The dyke should allow the movement of water from upstream (east) to downstream (west), as seepage flows through the dyke. If seepage is impeded by the development of frozen zones or filter blinding, a surface overflow channel will be constructed in the dyke.
- The dyke will remain physically stable during the operational life of the mine and following mine closure.



- Divider Dyke A construction began in 2005 but has not yet been completed. A second dyke, Divider Dyke B, will be constructed during future mine operations as the area upstream of Divider Dyke A fills with FPK or as required for water quality.
- Divider Dyke A will be used a haul road for the construction of the West Dam.

Divider Dyke A was partially constructed between 2005 and 2007. The filter material zone has been constructed a minimum elevation of 521.5 m. Divider Dyke A will need to be constructed to the final elevation of 524 m shortly after resuming processing activities.

The Divider Dyke A was inspected in late September 2010 during the Jericho Annual Geotechnical Inspection (EBA 2010) and was performing well.

Divider Dyke B has not been constructed but will be required once Cell A is nearing capacity. The final design of Divider Dyke B will be similar to Divider Dyke A and will be submitted to the NWB a minimum of 60 days prior to construction.

4.4 Perimeter Berm

CPK stockpiles and berms will be placed around the perimeter of Cell A to increase the volume of the facility. The perimeter berms are required when the FPK level is above elevation 523 m. A detailed design, including a projection on when the perimeter berms will be required, will be added to the PKMP and submitted to the NWB a minimum of 60 days prior to prior to resuming processing activities.

4.5 North Dam

The proposed location of the North Dam is in a low area at the north side of Cell C. The dam is required to allow the water level to rise to the maximum design level of the PKCA (523 m) and prevent water from the PKCA area flowing into the drainage basin north of the PKCA. The natural ground at the saddle of the North Dam is approximately 518.2 m and will restrict pond elevations in the PKCA to 517.2 m until the North Dam has been completed.

Construction of the North Dam is planned for 2012, pending results of resource evaluation. It will be constructed as a frozen core dam keyed into the frozen ground and bedrock. The design and construction drawings for the North Dam will be submitted to the NWB for approval at least 60 days prior to construction.

4.6 Settling Pond Dam

Construction of an additional settling pond may be required downstream of the West Dam if additional settling time is needed to reduce the suspended solids level in the PK supernatant. The final design of the settling pond dam would be determined based on calculated settling requirements. If the dam is required, the final design will be submitted to the NWB a minimum of 60 days prior to construction.

5.0 OPERATIONAL WATER MANAGEMENT

5.1 Water Balance

5.1.1 Objectives

Water balance for the PKCA was carried out for the following objectives:

- Projecting water elevations in PKCA for Cell B and C; and
- Estimating the discharge volume and rate for the water released from Cell B and C to Stream C3;

5.1.2 Water Sources

The catchment areas of the mine are shown in Figure 3 and a flowsheet of the site water management plan is shown in Figures 4. The PKCA area is currently divided into Cell A and Cell B/C by Divider Dyke A. Site water inflows to the PKCA consist of the following:

- Direct precipitation onto the pond surface;
- Runoff from the catchment area of PKCA:
- Water released from deposited FPK as a result of settling and consolidation in Cell A; and
- Runoff water collected from Pit Sump, Collection Ponds, East Sump and treated wastewater effluent, and water from other water retention facilities.

Water outflows from the PKCA consist of the following sources:

- Evaporation from the pond surface;
- Reclaim water pumped from the PKCA to the process plant; and
- Water discharged from the PKCA to Stream C3.

5.1.3 Methodology

A water balance for the Jericho site and PKCA will be produced using current on-site quantity and quality information obtained from an investigation program in February 2011. The water balance will be modelled using monthly time steps and will evaluate inflows and outflows from the PKCA including fully dewatering the pit in the summer of 2011. The seepage volume through the Divider Dyke A as well as the downstream pond levels in Cells B and C will be estimated for the time period. The monthly PKCA discharge schedule for 2011 will be developed based on the findings of the water balance.

5.2 Water Balance Model Basis and Assumptions

5.2.1 Climatic and Hydrological Data

The climatic and hydrological data required for the water balance analyses includes precipitation, lake surface evaporation, and runoff for watershed areas near the mine site. A detailed study of the climate and



hydrology for the Jericho Mine project has been carried out (SRK 2003b). Based on the findings in the study, the following parameters were adopted in the current water balance analyses:

- Annual precipitation of 330 mm for a mean (1-in-2 return period) year;
- Mean annual runoff of 225 mm corresponding to a mean runoff coefficient of 0.682;
- Annual lake surface evaporation of 270 mm; and
- Annual precipitation of 500 mm for a 1:100 event wet year.

The monthly distributions of the runoff and lake surface evaporation are listed in Table 2.

Table 2: Monthly Distributions of Runoff and Lake Surface Evaporation

Month	Monthly Percentage of Runoff (%)	Monthly Runoff (Mean) (mm)	Monthly Runoff (1:100 Wet) (mm)	Monthly Lake Surface Evaporation (mm)
May	3	7	10	14
June	57	128	194	78
July	16	36	55	97
August	10	23	34	57
September	13	29	44	24
October	1	2	3	0
November to April	0	0	0	0
Annual	100	225	340	270

5.2.2 Storage Curves and Initial Pond Elevations

The stage storage curves for the combined Cells B and C in the PKCA is shown in Figure 6. As of September 30, 2010, the staff gauge in the cells indicated that the pond elevation was 516.1 m.

5.2.3 Mine Site Runoff Water, Pit Seepage Water, and Sewage to PKCA

The catchment areas within the Jericho mine site are shown in Figure 3 and summarized in Table 3. Runoff from Catchment Areas A and B, the Plant Site and the Pit Area, will be collected and pumped to the PKCA as described in the Jericho Site Water Management Plan (EBA 2011i).

Table 3: Mine Site Catchment Areas

Catchment Area	Area (m²)
PKCA (Cell A)	215,300
PKCA (Cell B)	127,500
PKCA (Cell C)	191,900
Catchment Area A	557,000
Catchment Area B	178,800
Plant Site Catchment Area	308,200
Pit Area Catchment	241,700

Based on the available records of the site water management infrastructure, Waste Rock Dumps 1 and 2 are constructed in Catchment Area A and B, respectively. Surface runoff and seepage from waste rock dumps are collected in the collector ditches and then flow into the Pit Sump. Surface runoff and seepage collected from Catchment Area B and the Pit Area Catchment will be pumped to the PKCA.

Runoff from Catchment Areas A and B and the Plant Site and Pit Area Catchment will be pumped to the PKCA. It is assumed that all water from the C1 Catchment is diverted through the C1 diversion. Permafrost is expected to exist throughout the Jericho pit with the exception of the active layer. Ground temperatures of approximately -5° C were measured from two thermistor strings installed in the Jericho kimberlite pipe at depths of 40 m and 223.5 m (SRK, 2003a). The seepage through the permafrost into the open pit is expected to be negligible.

Sewage effluent from the camp facility will be treated in the Wastewater Treatment plant and pumped to Cell A.

5.2.4 Seepage through Divider Dykes A

Water flow between Cell A and Cell B is controlled by seepage through the internal Divider Dyke A when the water elevation in Cell A is below the dyke's present elevation of 521.5 m. The filter material is much finer than the transition material, so run-of-mine waste rock in the dyke dictates the seepage rate through the dyke. When estimating the seepage volume through the dyke, both the transition zone and waste rock zone can be practically ignored without introducing significant errors. Therefore, the design geometry of the filter was used in estimating the seepage through Divider Dyke A. The standing water elevation in Cell A is assumed to be controlled such that it will be below the top of the filter zone.

As Cell A becomes full, a second divider dyke (Divider Dyke B) will be constructed between Cell B and Cell C. Water flow from Cell B to Cell C will be via seepage through the internal Divider Dyke B. It is assumed that Dyke B will have a design cross-section similar to that for Dyke A; however, operating experience from Divider Dyke A's performance, will be used to optimize the design of Dyke B. A vertical profile along the proposed axis of Dyke B was used to calculate the vertical filter area for seepage calculations.



The hydraulic conductivity of a dyke filter material sample tested in EBA's laboratory was 1.3×10^{-2} cm/s. This value will be used as the average hydraulic conductivity for the filter material for Dykes A and B in estimating seepage volume through the dykes.

It is assumed that the FPK will completely block the filter area below the FPK surface elevation; thus, no seepage water will pass through the blocked filter area.

Ice covers have been observed on the pond surfaces during previous winter seasons. Once discharge to the PKCA resumes, the thickness of the ice cover in Cell B and/or Cell C will be monitored on an annual basis. The model will assume that there will be no seepage through the ice covered filter area.

5.2.5 Discharge Water from Cell C to Stream C3

Previous years' care and maintenance activities have demonstrated that it is critical to discharge water from the PKCA to maximize the storage volume in preparation for freshet. In 2009 and 2010, before Shear acquired the project, only a limited amount of water was discharged from the PKCA, and no water was pumped from the pit. After the acquisition, Shear discharged water from the PKCA for approximately one month until weather conditions prohibited continuing. The final elevation was 516.08 m as measured during the annual formal geotechnical inspection on September 30, 2010 (EBA 2010).

The current situation is such that water must be discharged before June to avoid exceeding the maximum allowable freeboard when freshet waters enter the PKCA. If water is not discharged before June, the consequences could be dire given that the current capacity is equal to the predicted mean year monthly runoff for June. In addition, the Jericho pit will need to be dewatered during 2011 to allow Shear to conduct a resource evaluation. The quantity and quality of the pit water will be determined in February 2011, and the information will be used to produce a discharge schedule. This will be submitted as an addendum at least 30 days prior to commencing discharge. Discharge is expected to have to continue throughout the open water season to dewater the pit and to achieve the desired elevation of 514.0 m in the PKCA.

Water that meets licence discharge criteria will be annually discharged from the PKCA over the West Dam to Stream C3. The annual outflow from the PKCA will be maximized such that the water levels in Cells B and C are maintained at a lower level than the pre-existing natural level. The minimum operating pond surface elevation in Cell C will be 513.5 m to provide a sufficient water depth to avoid disturbing the lake bottom sediment.

A detailed study of receiving water quality for a series of discharge scenarios was conducted (SRK 2004a). The study indicated that the minimum dilution of approximately 10:1 could occur within 200 m of the mouth of Stream C3 in Lake C3 during the brief period immediately prior to break-up of the ice (assumed to be June 18 in the modelling) for the scenario with release of a total water volume of 959,500 m³ within six months (25,000 m³, 551,600 m³, 153,100 m³, 87,400 m³, 121,300 m³, and 21,000 m³ from May to October respectively). Dilutions would then increase rapidly to approximately 20:1 by the beginning of July.

The discharge rate from the PKCA will be managed to achieve minimum 10:1 dilution at the edge of the mixing zone in Lake C3. The water balance analyses assume that a discharge schedule and monthly distribution objectives would be applied to achieve the dilution ratio. Monthly percentage of the total discharge to Stream C3 was assumed to be 40%, 25%, 15% and 20% from June to September.

The discharge to Stream C3 will assume during the period of June to September 2011 as presented in the Site Water Management Plan (EBA 2011i). The monthly percentage of the total discharge to Stream C3 in 2011 was assumed to be 50%, 35%, and 15% from July to September.

5.2.6 Reclaim Water from Cell C

During the mine production phase, water in Cell C will be reclaimed to the processing plant to reduce the freshwater intake from Carat Lake. It is anticipated that during the care and maintenance activities water will only be reclaimed from the PKCA for the evaluation and commissioning of the process plant.



6.0 CLOSURE

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2011 WATER LICENCE RENEWAL DOCUMENTS

Management Plans

- EBA, A Tetra Tech Company (EBA), 2011a. Aquatic Effects Monitoring Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.
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FIGURES

Figure 1	General Site Plan
Figure 2	Site Infrastructure Plan
Figure 3	Catchment Areas Plan
Figure 4	Existing PKCA Plan
Figure 5	Sitewater Management Flowsheet
Figure 6	Stage Storage Curve for Cells B and C

