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August 15, 2011

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Dear Ms. Beaulieu:

Re: Renewal Application of Type A Water Licence 2AM-JER0411
Updated Plan – Processed Kimberlite Containment Area Management Plan and Operations, Maintenance and Surveillance Manual

In accordance with the commitments made by Shear Diamonds Ltd. (Shear) during the Technical Meeting and Pre-Hearing Conference held on June 20 and 21, 2011 in Cambridge Bay, we are pleased to submit for your review an updated Processed Kimberlite Containment Area Management Plan. Accompanying this Plan you will find an updated Operations, Maintenance and Surveillance Manual.

If you have any questions, or require any additional information, please do not hesitate to contact Stephanie Autut, VP, Environment and Community Affairs, either by email at sautut@sheardiamonds.com or by phone at (780) 435-0045.

Sincerely,

Pamela Strand, M.Sc., P. Geol.
President

Julie Lassonde Gray
Executive Chairman & CEO

cc: Bernie MacIsaac, Director of Operations, AANDC – NU Region
Geoff Clark, Director of Lands and Environment, KIA

SHEAR DIAMONDS (NUNAVUT) CORP.

PROCESSED KIMBERLITE MANAGEMENT PLAN
JERICHO PROJECT, NUNAVUT

REPORT

AUGUST 2011
ISSUED FOR USE
EBA FILE: E14101140

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eba
A TETRA TECH COMPANY

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ACRONYMS & ABBREVIATIONS

AEMP	Aquatic Effects Monitoring Plan
DMS	Dense Medium Separation
Fine PK	Fine Processed Kimberlite
NWB	Nunavut Water Board
PKCA	Processed Kimberlite Containment Area
PKMP	PKCA Management Plan
Shear	Shear Diamonds (Nunavut) Corp.
TDC	Tahera Diamonds Corporation
WRMP	Waste Rock Management Plan

1.0 INTRODUCTION

The Jericho Diamond Mine, Nunavut, is located approximately 260 km southeast of Kugluktuk, NU, 20 km north of the Lupin Mine and 420 km northeast of Yellowknife, NWT. The mine produces crushed kimberlite as a by-product of the diamond extraction process. Crushed kimberlite is separated into “coarse processed kimberlite” (coarse PK) and a fine processed kimberlite (fine PK). The coarse PK is placed in stockpiles as described in the Waste Rock Management Plan (EBA 2011). The fine PK and supernatant water is deposited in the Processed Kimberlite Containment Area (PKCA).

This document has been prepared as a management tool and to fulfill the requirements of the Jericho Mine Water License (2AM-JER0410), Part H - Item 1, Schedule H - Item 1, Part D – Item 5, and Schedule D – Item 5 of the water license. This document is intended primarily for use by Shear Diamonds Ltd. (Shear) and its designated contractors to ensure that appropriate management procedures are followed during any construction activities and operation of the mine and that the appropriate information is obtained for mine closure planning. This document replaces all previous submissions, including:

- Jericho Project, Processed Kimberlite Management Plan, February 2006, prepared by EBA Engineering Consultants Ltd.; and
- PKCA Management Plan, Care and Maintenance, Jericho Diamond Project, Nunavut, January 2011, prepared by EBA, a Tetra Tech Company.

This document incorporates the comments received by the Nunavut Water Board in a letter dated October 10, 2006, the responses prepared by EBA Engineering, dated October 25, 2006, and the Technical Submissions provided by interveners for the Technical Meeting on the Type A Water Licence renewal application filed by Shear on February 28, 2011.

The plan includes the following:

- Design criteria for the fine PK and PKCA,
- Stage-Volume curves and water, solids and ice balance calculations showing the life expectancy of the PKCA Facility,
- Water and supernatant water management within the PKCA,
- A summary of fine PK and water containment structures for the PKCA and a construction schedule for the PKCA infrastructure,
- Monitoring requirements for the performance of the PKCA,
- A description of the use of the flocculant and coagulant in the treatment process and controls for their uses,
- A description of how discharge rates will be managed to ensure a minimum 10:1 dilution ratio at the edge of the mixing zone in Lake C3,
- Operational and/or structural modifications and contingency components, which may be implemented that affect the management of the PKCA.

1.1 Background

1.1.1 Supporting Documentation

The design of the PKCA and supporting information was prepared as part of the original water licence application to the Nunavut Water Board. The following lists the pertinent documents prepared for that water licence application:

- Design of the Process Kimberlite Containment Area – Technical Memorandum P, August 2004, prepared by SRK Consulting (Canada) Inc.
- Site Water Management, August 2004 – Technical Memorandum W, August 2004, prepared by SRK Consulting (Canada) Inc.
- Estimates of Receiving Water Quality - Technical Memorandum N, August 2004, prepared by SRK Consulting (Canada) Inc.
- Supplemental Climate and Hydrology – Technical Memorandum C, October 2003, prepared by SRK Consulting (Canada) Inc.

The following lists the pertinent additional documents that were prepared subsequent to the issuance of the Type A water licence, and that were referenced in the development of documents prepared for the Type A water licence application filed by Shear on February 28, 2011:

- Jericho Project East and Southeast Dam Design Report, August 2005, prepared by EBA Engineering Consultants Ltd.
- Jericho Project Long Lake Divider Dyke A Design Report, June 2005, prepared by EBA Engineering Consultants Ltd.
- Jericho Project West Dam Design Report, September 2005, prepared by EBA Engineering Consultants Ltd.
- East and Southeast Dams Construction Record Report, Jericho Project, October 2007, prepared by EBA Engineering Consultants Ltd.

The site water management plan was updated in the following documents:

- Site Water Management Plan, October 2005, prepared by Tahera Diamond Corporation.
- Water Management Report, Jericho Mine, April 2009, prepared by EBA Engineering Consultants Ltd.
- Site Water Management Plan, Care and Maintenance, January 2011, prepared by EBA, a Tetra Tech Company.

The aquatic effects monitoring plan was updated in the following document:

- Aquatic Effects Monitoring Plan, Care and Maintenance, January 2011, prepared by EBA, a Tetra Tech Company.

The coarse PK stockpiles were constructed adjacent to the PKCA area. The construction and layout of the coarse PK stockpiles are described in the following documents:

- Waste Rock Management Plan (Part 1 Waste Rock and Overburden), May 2005, prepared by SRK Consulting (Canada) Inc.
- Waste Rock Management Plan (Part 2, Kimberlite Ore, Coarse Processed Kimberlite and Recovery Circuit Rejects), January 2006, prepared by SRK Consulting (Canada) Inc.
- Waste Rock Management Plan, February 2011, prepared by EBA, a Tetra Tech Company.

Operations at the Jericho Project have been suspended since June 2008 after Tahera Diamond Corporation (TDC) went into receivership. The mine operated between January 2006 to April 2008 for a total of 28 months. Shear acquired the project in late August 2011. Since that time, Shear applied to assign the Type A water licence, amended the term of the licence until March 1, 2012, and filed a Type A water licence renewal application on February 28, 2011. Shear has also been reviewing previously submitted plans, reports and data, and began sampling and monitoring programs in April 2011 in an effort to increase the technical information available and address data gaps identified during the compliance audit and data review.

2.0 FACILITY DESCRIPTION

2.1 Production Rate:

Shear's review of Tahera Diamond Corporation's ("TDC") production rates indicated that TDC was never able to achieve the nameplate production rate of 2000 tonnes per day (tpd) in the diamond recovery plant. Shear whilst basing all its future production plans on the mine plan as submitted by TDC, and approved by regulators, expects to run the diamond recovery plant at the more achievable rate of 1250 tpd. This rate of production is based on the rates achieved by TDC during the production years 2006-2008. The maximum rate of production achieved by TDC was 1450 tpd, and Shear does not expect to be able to exceed this rate during the course of the life of mine. Thus, it is important to note that all calculations in the PKCA Management Plan are based on a production rate of 1250 tpd.

The PKCA is located within the Long Lake Basin that is at the south end of the project site. The project site layout is shown in Figure 1 and the catchment areas and monitoring stations are shown in Figure 2. The PKCA facility is presented in Figure 3. The current construction status of the dams and dykes within the PKCA is summarized in Table 1 below.

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, Future	EBA 2005c
East Dam	Complete	524.5 Crest 523.5 Liner	524.5 Crest 523.5 Liner	Containment of Fine PK	2005-2006	EBA 2005a
Southeast Dam	Complete	524.5 Crest 523.5 Liner	524.5 Crest 523.5 Liner	Containment of Fine PK	2006-2007	EBA 2005a
Divider Dyke A	Partially Complete	524	Varies – low point 521.5	Containment of Fine PK – flow through structure	2005-2007, Future	EBA 2005b
Divider Dyke B	Not in place	524	-	Containment of Fine PK – flow through structure	Future	To be prepared
North Dam	Not in place	528 Crest 524 Core	-	Water Control	Future	EBA 2007
Cell A Coarse PK Perimeter Dyke	Not in place	528.5	-	Containment of Fine PK	Future	To be prepared
West Settling Pond Dam	Optional	-	-	Water Control	Optional	To be prepared

*Construction period is estimated and is based on processing resuming August Year 1

The PKCA facility was operated between January 2006 and April 2008 and currently stores approximately 579,489 m^3 of fine PK.

Permafrost is present throughout the Jericho Mine area except for limited areas below lakes of substantial width and depth. A closed talik is believed to exist under the PKCA based on the width of Long Lake, and the permafrost thickness at the site. As a result, the groundwater around the PKCA is expected to exist only within the thin active layer when the ground is unfrozen during thawing seasons.

The design intent for the containment dams and berms along the perimeter of the PKCA is to eliminate seepage through the dams and berms from the PKCA to the outside environment. The performance of these structures will be monitored during the life of mine operation as stated in Section 6.0 of this plan. In addition, the fine PK will be deposited from the perimeter berms around Cell A towards the center of Cell A such that the standing water will be displaced from these dams/berms enhancing permafrost growth into the exposed beaches. This will further limit the risk of seepage from the PKCA to the outside environment.

The original water level of Long Lake was 515.4 m. The maximum operating storage water level of the PKCA is defined as 523 m. Four dams and a perimeter dyke will have to 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 spigot elevation of fine PK in Cell A will be increased to 527.5 m. The staged development of the PKCA in Cell A is presented in Figure 4A. 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 will ultimately be divided into three cells: Cell A, Cell B, and Cell C. fine PK will first be deposited into Cell A, between the East and Southeast Dams, Perimeter Berm, and Divider Dyke A. Once Cell A is full and Divider Dyke B has been constructed, fine PK will be deposited in Cell B. The staged development of the fine PK in Cell B is presented in Figure 4B. Water will filter through the divider dykes into the western portion (Cell C) of the PKCA. The design intent for the containment dams and berms along the perimeter of the PKCA is to eliminate seepage through the dams and berms from the PKCA to the outside environment. The performance of these structures has been monitored since construction and will continue to be monitored during the life of the mine, and is reported in the annual geotechnical inspections.

No fine PK 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 compliant water over the West Dam located at the west end of the PKCA. The stage storage volume for each cell is shown in Figure 5.

Details of the fine PK disposal and water management are described in the following sections.

3.0 FINE PK DISPOSAL MANAGEMENT

3.1 Quantities

During care and maintenance activities, production of fine PK will be limited to a small amount produced during the evaluation of the process plant using stockpiled material. Presently, Cell A has sufficient capacity for this evaluation work.

The production rate for the fine PK has been estimated based on processing all of the kimberlite mined. This is summarized in Table 2 as provided by Shear, based on the original mine plan submitted by TDC, and assumes all low grade ore is processed. Test work estimates the percentage of fine PK will be 15% of plant ore feed. This may vary depending on actual processing characteristics.

Table 2: Estimated Production Rates for Kimberlite Ore and Fine PK (Annual Production)

Year	Kimberlite Ore (tonnes)	Fine PK (Solids Weight) (tonnes)	Fine PK – Placed and Consolidated Volume (m^3)*
1	190,000	28,500	32,948
2	456,250	68,437	99,909
3	456,250	68,437	99,909
4	456,250	68,437	99,909
5	456,250	68,437	99,909
6	456,250	68,437	99,909
7	456,250	68,437	99,909
8	456,250	68,437	99,909
9	298,250	44,738	51,720
Total	3,682,000	552,300	806,277
*Assumes placed at a dry density of 0.685 t/m^3			

3.2 Processed Kimberlite Characteristics

The kimberlite ore will be processed using conventional diamond processing techniques and the main steps are as follows:

- Crushing – breakage of ore to liberate the diamonds;
- Scrubbing – breakage of soft conglomerates;
- Dense medium separation (DMS) – gravity concentration to separate heavy and light particles;
- Interparticle crushing – reduction of large particles without diamond breakage;
- X-ray sorting; and
- Cleaning and sorting.

Processing of the kimberlite will produce three process kimberlite (PK) products:

- Coarse PK, comprised of gravely sand will make up about 81% of the total PK by weight. The management of the coarse PK is presented in the Waste Rock Management Plan (WRMP), (EBA 2011). A portion of the coarse PK will be stockpiled in the vicinity of the PKCA as shown in Figure 2 and used for progressive capping of the fine PK within Cell A once Cell A is full. Properties of the coarse PK are discussed in Section 5.4.1 of this report.
- Recovery plant rejects, comprised of a medium sand and fine gravel will make up about 4% of the total PK by weight. The management of the plant rejects is included in the coarse PK management (WRMP, EBA 2011).
- Fine PK (less than 0.1 mm grain size) comprised of 70 to 85% silt and 15 to 30 % clay. Fine PK will make up about 15% of the total PK product by weight. The fine PK will be pumped as a slurry to the PKCA. Properties of the fine PK are discussed in the following section.

3.3 Fine PK Properties

Testing of the fine PK was carried out on samples from the Jericho bulk processing plant and samples taken from the fine PK beached deposits in Cell A, in 1997 and 2011. The properties of the fine PK presented below are based on these tests.

At the time of preparation of this report operations of the Jericho Processing Plant have been suspended since June 2008.

In April 2011 the Shear environmental team noticed that the fine PK had been dispersed by the wind beyond the extent of the PKCA. The full extent to which the fine PK has been deposited is not yet known.

3.3.1 Fine PK Dispersion Monitoring

Sampling stations were added to the under ice sampling program to evaluate potential effects to nearby and downstream water bodies from the wind blown fine PK,. These water bodies include: Lynn Lake, Key Lake, Ash Lake and two unnamed lakes (since named Southeast Lake and Shine Lake). Ash Lake and the two unnamed lakes were frozen solid to the bottom. Water samples were collected at both Lynn (2 m above the lake bottom and 1 m below the ice) and Key Lake (1 m below the ice). These water bodies are shown on Figure 2.

The AEMP was amended to include summer sampling of Southeast and Shine lakes and under ice sampling at Lynn and Key Lake. Lynn, Key and Ash Lake are already included in the summer AEMP sampling program.

In May 2011, Shear mobilized six dustfall monitoring stations in the vicinity of the potentially affected areas specifically to gather information on the deposition of the fine PK. The dustfall monitoring stations have been placed at cardinal and ordinal locations within a kilometer of the PKCA and have been MESHED with the larger draft Air Quality Monitoring Program to indicate dispersion over distance. The locations are shown in Figure 2

Shear has contracted EBA to assist in the development of a mitigation plan to address the wind dispersal and associated deposition of the FPK. The mitigation plan will identify options to control and minimize the deposition of FPK outside of the PKCA. These options will be employed and tested over the next year.

3.3.2 Fine PK Dispersion Mitigation Plan

During May 2011, EBA undertook a walkover survey and a shallow sampling program of the fine PK beach deposits within Cell A of the PKCA. This work found that the fine PK material near the surface had dried and the granular material was susceptible to wind erosion. In the upper reaches of Cell A towards East Dam and Southeast Dam there was clear evidence, in the form of sand ripples, that wind erosion and particle movement (saltation) was active within this area. There are a number of options to mitigate wind erosion, namely;

- Artificially reduce the near surface wind velocity by installing windbreaks perpendicular to the wind direction or roughening the surface by placing objects (old tires) across the erodible surface;

- Chemically binding the near surface particle using dust suppressants, thereby bonding the particles together and reducing the potential for wind erosion and saltation; or
- Periodically wetting the surface, thereby binding the surface particles together by capillary suction.

Shear has initially adopted the option to artificially reduce the near surface wind velocity by installing snow fencing within Cell A in areas that have shown signs of wind erosion and saltation. The snow fencing was installed during July 2011 and Shear is currently developing a monitoring program to monitor the effectiveness of this mitigation plan.

3.3.3 Particle Size and Plasticity Index

The typical particle size distribution of the fine PK samples in 2007 is shown in Figure 6, and in 2011 in Figure 7.

The plasticity of the in-place fine PK varies from being non-plastic to medium plasticity (CI). Samples of the finer portion of the in-place fine PK had an average Liquid Limit of 32%, Plastic Limit of 22%, and a Plasticity Index of 11%. The laboratory reports are attached in Appendix C.

3.3.4 Discharge Solids Content

The fine PK will be discharged as the underflow from the process plant thickener. The average solids content between 2006 to 2007 operating years was 29%. It is anticipated that, under normal operations, it will be discharged from the thickener at approximately 30% solids content. This is equivalent to dry density of 0.37 t/m^3.

3.3.5 Specific Gravity

Specific gravity testing of one sample of the coarse PK was carried out by EBA in January 2006. The measured apparent specific gravity was 2.74. It has been assumed the specific gravity of the fine PK is equal to that of the coarse PK.

3.3.6 Entrained Ice

The current percentage or volume of entrained ice within the deposited fine PK is not known. However close to two years of fine PK deposition within Cell A have been used to back calculate an in situ dry density of 0.685 t/m^3 based on a measured tonnage occupying a surveyed volume. As this is the average in situ density it will account for the volume of entrained ice. It is anticipated future fine PK discharge techniques will not be dissimilar to historical techniques, therefore the in situ dry density of 0.685 t/m^3 has been adopted for the balance of fine PK planning.

3.3.7 Settling and Placed Density Based on Operational Data

On the basis of actual mine operational data between January 2006 to April 2008 and the fine PK surface survey on April 22, 2008, the average dry density of the fine PK (including entrained excess ice) placed in the PKCA is estimated to be 0.685 t/m^3. The existing fine PK surface geometry is shown in Figure 4A, which indicates an average operational beach slope of 2.9%.

3.4 Flocculants and Coagulants

A coagulant and flocculent polymer treatment is performed in conjunction with a thickening reagent which is used to clarify the supernatant thickener. This is done in order to allow 90% of the water to be recycled to the plant and, thicken the fine PK to a 30% solids content prior to discharge to the PKCA.

The polymers are added at the head of the feed launder prior to entering the thickener. The coagulants and flocculants are added separately. The thickener uses highly interactive water clarification and compaction processes to produce relatively clear overflow water and a thickened fine PK underflow.

The polymer treatment causes the water to be clarified in the feed well of the thickener through the formation of fine PK flocs. The floc density increases until it settles into the compaction zone. The density of the flocculated material in the compaction zone increases through floc consolidation which is enhanced by a dewatering process.

The fine PK particles are small and negatively charged and therefore tend to remain in suspension. The coagulant is added to the feed and used to change the negative charge of the particles to a slightly positive charge overall. This is as a result of the coagulant's very strong positive charge.

As the particles are bonded together to form a long string of floc particles, the mass of the particles increases. Once the mass is great enough the particles sink to the bottom of the thickener. The fine PK underflow at the base of the thickener is then pumped to the PKCA.

The polymers currently being used are:

- Flocculant - SNF Flo Polymer AF 4400
- Coagulant - SNF Flo Polymer CV4120B

The toxicological and ecological information for the polymers is contained within the MSDS sheets presented in Appendix B of this report. The ecological information indicates that the concentrations of free polymer required to elicit significant biological responses to fish/daphnia/algae is > 100 mg/L for the flocculant (SNF Flo Polymer AE 4500) and > 10 mg/L for the coagulant (SNF Flo Polymer CV4120B). The calculated overall concentration in the fluid (water plus fine PK) pumped to the PKCA is approximately 30 mg/L for the flocculant and 19 mg/L for the coagulant based on information presented in Table 3. The free concentration of the polymers in the water would be significantly less since the polymer is bound to solid particles

The TDC process plant operators reported using the following dosage rates as listed in Table 3. The dosages will be modified accordingly to obtain a material that will settle and clarify.

Table 3: Typical Coagulant and Flocculant Application

	Solution Concentration (g/l)	Maximum Flow Rate of Solution Concentration Application (l/min)	Concentration in fine PK (based on dry weight)* (g/t)
Flocculant	2.5	4.2	81
Coagulant	5	1.3	50

* Concentration based on ore production rate of 1250 t/day and 15% fine PK output

3.5 Deposition and Construction Plan

3.5.1 Fine PK Deposition Plan

Currently the volume of fine PK within Cell A is approximately 579,489 m^3 at a dry density of 0.685 t/m^3 including entrained excess ice. Future mining operations will generate 552,300 tonnes of fine PK that will equate to approximately 806,277m^3 at a similar dry density.

The remaining capacity of Cell A in the existing PKCA (without constructing additional berms), is estimated to be approximately 134,000 m^3. This is estimated to be enough capacity for 9 months of full production.

Shortly after recommencement of mining operations it will be necessary to complete the construction of the Cell A perimeter berms to elevation 528.5m. This will provide an additional fine PK storage of 559,467 m^3 at a spigot elevation of 527.5m along the upstream face of the Cell A perimeter berm. This volume will equate approximately 383,234 tonnes of fine PK. The proposed staged discharge plan for Cell A is shown in Figure 4A which based on the current plan will commence in Year 1 and will be complete in Cell A in February 2019.

The balance of 169,066 tonnes of fine PK will be spigoted from the downstream face of Divider Dyke A into Cell B and is expected to occupy a volume of approximately 195,452m^3. The proposed staged discharge plan for Cell B is shown in Figure 4B which based on the current plan will commence Year 7 and will be complete in Cell B in Year 9.

The fine PK stage storage curve for both Cell A and Cell B are presented in Figure 5 Charts IV and V. Figure 8 to shows the Fine PK elevations in Cell A and Cell B with time.

Figures 4A and 4B also show the staged filling of Cell A and B. The spigot locations will be varied during operations to produce the desired beach. The PK discharge pipeline is a 100 mm HDPE insulated and heat traced pipe.

3.5.2 PKCA Construction Plan

In order to provide sufficient fine PK storage and water storage within the PKCA it will be necessary to raise and construct the structures as presented previously in Table 1.

4.0 OPERATIONAL WATER MANAGEMENT

4.1 Water Balance

4.1.1 Objectives

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

- Projecting water elevations in PKCA for Cells A, B, and C;
- Estimating the discharge volume and rate for the water released from Cell C to Stream C3;
- Estimating total retention time of the PKCA under a "Zero Discharge" scenario when no water is allowed to be discharged to the environment (Lake C3);
- Providing information to determine future construction requirements and contingency measures.

4.1.2 Water Sources

The drainage basins of Jericho Mine and a schematic of the site water management plan is shown in Figures 2 and 9 respectively. The PKCA area is divided into three cells: Cells A, B and C. Water inflows to each of the cells consist of the following:

- Direct precipitation onto the pond surface;
- Runoff from the watershed of each cell;
- Water released from deposited fine PK as a result of settling and consolidation (Cell A or Cell B only);
- Seepage through the up-gradient divider dyke from the up-gradient cell; and
- Runoff water collected from Pit Sump, Collection Ponds and/or East Sump and treated sewage effluent discharged into the PKCA (Cells A or B only).

Water outflows from each of the cells consist of the following sources:

- Evaporation from the pond surface;
- Seepage through the downgradient divider dyke of the cell;
- Reclaimed water pumped from the PKCA to the process plant (Cell C only); and
- Water discharged from the PKCA to Stream C3 (Cell C only).

4.1.3 Methodology

A water quantity balance model was developed using daily time steps for the remaining life of mine. The mine was assumed to recommence mining and processing operations at the beginning of August of Year One. Fine PK storage elevation, water elevation, water surface area, and fine PK elevation on the upstream face of the divider dykes were inferred from a series of stage storage and elevation relationships developed using AutoCAD Civil 3D. These together with the proposed fine PK discharge plan and construction schedule were used to develop a water balance model that took account of the solids and water management within the PKCA, as well as modeling the seepage through Divider Dykes A and B.

4.2 Water Balance Model Basis and Assumptions

4.2.1 Climatic and Hydrological Data

The climatic and hydrological data required for the water balance analyses included precipitation, lake surface evaporation, and runoff for watershed areas in the vicinity of 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 4.

Table 4: 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

4.2.2 Storage Curves and Initial Pond Elevations

The stage storage curves for the PKCA Cells A, B, and C are shown in Figure 5 as charts 1, 11, and 111.

The initial pond elevations that were used in the water balance model (using the assumption that mining operations will resume in August) are;

520 m for Cell A;

516 m for Cell B; and

516 m for Cell C.

The historical water elevations measured in Cell A have ranged between approximately 513 m and 517 m in 2006, 515 m and 517 m in 2007, and 517 m and 519 m in 2008. The historical water elevations measured in Cell B have ranged between approximately 512 m and 517 m in 2006, 514 m and 516 m in 2007, and 515 m and 516 m in 2008.

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

The catchment areas within the Jericho mine site are shown in Figure 2 and summarized in Table 5. Runoff from Catchment Areas A, B, Plant Site and the Pit Area, will be collected and to the PKCA as described in the Site Water Management Plan (EBA, 2011).

Table 5: Mine Site Catchment Areas

Catchment Area	Area (m^2)
PKCA (Cell A)	215,300
PKCA (Cell B)	127,500
PKCA (Cell C)	191,900
Catchment Area A	703,428
Catchment Area B	178,800
Plant Site Catchment Area	308,200
Pit Area Catchment	241,700

Runoff from Catchment Areas A and B, and the Plant Site and Pit Area Catchment, will be pumped to the PKCA. It was 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^{0}C were measured from two thermistor strings installed in the Jericho kimberlite pipe at depths of 40 m and 223.5 m (SRK, 2003a). It is expected that the seepage through the permafrost into the open pit will be negligible. The seepage water into the pit was thus ignored in the current water balance.

The treated sewage water line is discharged adjacent to the sewage treatment plant into the Cell A of the PKCA. The sewage treatment plant is located at the SE corner of the camp. The pipe size for the sewage line is similar to that for the fine PK discharge line. The assumed flow rate for the sewage line is 0.31 l/sec (or 9,855 m^3/year).

4.2.4 Seepage through Divider Dykes A and B

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 523.0 m. The design cross-section and profile for Divider Dyke A is presented in Figure 10. The filter material is much finer than the transition material and run-of-mine waste rock in the dyke thus dominates the seepage rate through the dyke. For the purpose of 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.

It is assumed that the standing water elevation in Cell A will be controlled such that it will be below elevation, 523.0 m. The coarse PK will be used to raise Dyke A above its original design crest elevation of 524.0 m. When required, an overflow ditch across Dyke A may be excavated to drain freely any extra water above the elevation of 523.0 m in Cell A to Cell B.

As Cell A becomes full, a second divider dyke 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. 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 1.3E-02 cm/sec and is generally found to be consistent with field observations. This value was used as the average hydraulic conductivity for the filter material for Dykes A and B in estimating seepage volume through the dykes.

It was assumed that the fine PK would completely block the filter area below the fine PK surface elevation; thus, no seepage water will pass through the blocked filter area.

It is expected that ice cover will form on the pond surfaces during winter. Based on measured ice cover thicknesses on similar ponds at the EKATI Diamond Mine site and past experience, the ice cover thickness in Cells A, B, and C of the PKCA was assumed to be 0.5 m in December, 0.8 m in January, 1.2 m in February, and 1.5 m from March to May. It was assumed that there would be no seepage through the ice covered filter area.

4.2.5 Discharge Water from Cell C to Stream C3

It is planned to discharge water in compliance with the water licence criteria, annually from the PKCA over the West Dam to Stream C3. This maximizes the storage volume in Cell C in the event that water cannot be discharged from the PKCA. Where possible 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. In order to achieve this, the discharge rate will exceed the natural seasonal flows in Stream C3 that were estimated in *Supplemental Climate and Hydrology* (SRK 2003b) (See Table 6). Historical discharge rates are presented in Table 7.

Table 6: Estimated Monthly Flow at Outlet of Former Long Lake

Month	Akkutuak distribution (m^3/month)	Atitok Distribution (m^3/month)
May	3,348	3,348
June	88,128	69,984
July	6,696	20,088
August	6,696	10,714
September	15,552	15,552
Annual Total	**120,420**	**119,686**

Table 7: Historical Discharge Quantities from PKCA to C3

Year	Quantity
2006	412,907
2007	302,280
2008	308,081
2009	121,050

The most conservative scenario is that total volume all water inflows and discharge occurring the following year

Surface water dispersion models were created using a series of PKCA discharge scenarios (SRK, 2004a), whereby the most conservative scenario assumes storage of total volume of water in the PKCA for one year with no discharge. This would include all water inflow sources. Discharge occurs in the following year . Based on this model the total volume of water discharged into the PKCA would be 959,500 $m^{3.}$ In order to simulate natural seasonal flow patterns while achieving the minimum 10:1 dilution in the mixing zone in Lake C3, discharge rates from May to October, respectively, would be 25,000 m^3, 551,600 m^3, 153,100 m^3, 87,400 m^3, 121,300 m^3 and 21,000 m^3.

The model indicates that the minimum dilution in Lake C3 is approximately 10:1 within 200 m of the outflow from Stream C3 occurs immediately prior to ice break-up. The dilution ratio increases rapidly to approximately 20:1 by early July. Based on the review of the water quality record in 2007, the modeled dilution ratios are deemed to be adequate to achieve aquatic thresholds, (EBA 2011).

The discharge rate from the PKCA will be managed to ensure a minimum 10:1 dilution at the edge of the mixing zone in Lake C3. This will be achieved by:

- Not discharging to Stream C3 prior to ice break-up;
- Maintaining discharge rates into Stream C3 below the modeled monthly rates.

Water quality at the stream outlet and within Lake C3 will be monitored, as described in Section 6.0, to ensure that the dilution ratio is being achieved.

4.2.6 Reclaim Water from Cell C

The reclaim line is installed downstream of Divider Dyke A, and will be extended to the downstream of the Proposed Divider Dyke B into Cell C after Divider Dyke B is constructed. The reclaim water line is 100 mm diameter. The line is not heat traced, and is not expected to be used during the winter.

An annual volume of 28,900 m^3 of water will be reclaimed from Cell C or the East Sump, to the process plant, as described in the “Site Water Management Plan” (EBA, 2011). The historical volumes of recycled water volumes from the PKCA to the process plant was approximately 11,000 m^3 in 2006 and 52,000 m^3 in 2007.

4.2.7 Construction of Divider Dyke B

Water balance results indicate that water elevation in Cell A will reach the maximum design specifications of 523.0 m in the second year of full production based on a mean precipitation year. This maximum design specification may be exceeded by the third year of production if a wet year occurs. Divider Dyke B will be required, prior to the freshet of the second year of production to avoid water in Cell A overflowing directly into Cell C. In the current water balance analyses, the following assumptions were applied:

- Construction of Divider Dyke B will be completed prior to the freshet of the second year of production;
- Construction of North Dam in the first year of production;

Cell A Coarse PK Perimeter Dyke Stage 1 between the first and second year of production, and Stage 2 between the third and fourth year of production.

Raise Divider Dyke A to elevation 524m during the first year of production.

Raise West Dam to elevation 528m during the first year of production.

Mine site runoff water and sewage will be pumped to Cell A until the completion of Divider Dyke B, after which it will be pumped to Cell B.

4.3 Results and Discussions

4.3.1 Water Levels

The water balance was carried out to project water elevations in Cells A, B, and C during the production period of the mine. Three scenarios were investigated to predict water elevations in the cells under mean and 1:100 wet year precipitation conditions. Annual discharge from Cell C to Stream C3 was a standard assumption in each scenario.

Figure 8 presents the predicted water elevations over time in Cells A, B, and C under mean precipitation years. The water elevations fluctuate over the mine life and cycle annually in response to the annual freshet and water discharge from Cell C to Stream C3. Table A2 summarizes the annual inflows and outflows of the three cells under mean precipitation years. The detailed monthly water balance results are presented in Table A1 in Appendix A of this report.

The maximum predicted water elevations in the Cells, A, B and C, for mean conditions and 1:100 wet year conditions are summarized in Table 9. The maximum predicted water elevations in Cell B and C are below the maximum operating water elevation of 523.0 m. As expected the water elevation in Cell A reaches maximum elevation in the third year of production due to blinding off of the filter dyke with fine PK material. Therefore, excess water entering Cell A will be allowed to overflow into Cell B in a controlled manner using a spillway.

Table 9: Predicted Maximum Water Elevations with Annual Discharge

Precipitation	Maximum Predicted Water Elevation (m)		
	Cell A	Cell B	Cell C
Mean during the whole production period	522.6	518.1	517.5
One 1:100 wet year in Yr 3 and mean for other years	523.0	520.1	519.5
One 1:100 wet year in Yr 8 and mean for other years	523.0	521.4	520.7

4.3.2 Water Discharge over West Dam

Water which meets licenced discharge criteria in Cell C will be pumped over West Dam into Stream C3 annually from June 15 to September 30 as described in Section 4.. The estimated annual discharge water volume under mean precipitation years is summarized in Table 10 (last column). The discharge pumping rates are shown in Figure 8 for mean precipitation years. The maximum annual discharge volumes and pumping rates for the three scenarios are summarized in Table 10.

Table 10: Maximum Annual Discharge Volumes and Pumping Rates

Precipitation	Maximum Annual Discharge Volume (m^3)	Maximum Pumping Rate (l/sec)
Mean precipitation during the entire production period	439,800	135
One 1:100 wet year in Yr 3 and mean precipitation for other years	527,760	162
One 1:100 wet year in Yr 8 and mean precipitation for other years	659,700	202

4.3.3 Dilution Ratio in Lake C3

As described in Section 4.2.5, one of the scenarios modeled in SRK (2004a) assumed an annual discharge of 959,500 m^3 of water from Cell C into Lake C3 with based on average natural seasonal inflows. Table 11 lists the discharge water volumes and the predicted minimum dilution ratios during specified periods for this scenario. For comparison, Table 11 also lists the anticipated maximum monthly discharge during the same periods for a mean precipitation year. The predicted maximum discharge volumes are lower than that simulated in SRK (2004a); therefore, the minimum dilution is expected to be greater than 10:1.

Table 11: Discharge Volumes and Predicted Minimum Dilution Ratio

Time Period	Discharge Volume Simulated in SRK (2004a) (m^3)	Predicted Minimum Dilution Ratio within 200 m from the Stream C3 Mouth in Lake C3 (SRK, 2004a)	Anticipated PKCA Discharge for a Mean Precipitation Year
June	551,570	10 to 20	175,200
July	153,138	>20	109,500
August	87,411	>20	65,700
September	121,291	>20	89,400

4.3.4 Seepage through Divider Dykes

Seepage volumes through Divider Dykes A and B were estimated based on the assumptions presented in Section 4.2.4. The water flows freely between Cell B and Cell C prior to completion of Dyke B. It was also assumed that water in Cell A will flow freely to Cell B after the average fine PK surface elevation is greater than the original Divider Dyke A design crest elevation of 524.0 m. The annual volumes of water flowing between the cells (including seepage through the dykes) are summarized in Table 8.

The seepage rates are dependent on the permeability of the dyke filter. The permeability may vary from the assumed values, and may reduce over time as the filter blinds off. As additional monitoring information becomes available water balance should be recalibrated and rerun. This is discussed further in Section 6.0 of this report.

4.3.5 Water Retention Time with Zero Discharge

Analyses were conducted to estimate the retention time of the PKCA if no water is allowed to discharge from Cell C to Stream C3 for a period of time. Four different start dates of a no discharge condition were evaluated. Mean year precipitation was assumed for each case. The predicted water retention time for the water level to reach elevation 523 m is listed in Table 12.

Table 12: Water Retention Time with Zero Discharge

Start Date with Zero Discharge	Predicted Date when Water Level in Cell B or C reaches 523.0 m	Total Retention Time (Year)
January Year 3	June Year 4	1.83
October Year 4	June Year 6	1.58
October Year 5	June Year 6	1.42
October Year 8	> August Year 9	> 0.83

4.3.6 Freeboard

The "maximum operating water level" for the PKCA has been defined as elevation 523 m. The water level may rise above this level while flood waters are discharged and will also be higher due to waves and wave run-up.

The maximum wave height for the West Dam is estimated to be 0.5 m (EBA 2005c). The wave heights at the divider dykes and East and Southeast Dams are slightly less.

The "maximum water level" that includes waves and a temporary rise during flood routing has been defined as 524 m for the PKCA. The water retention elements in the dams have been specified to be at elevation 524 m.

The difference between the "maximum operating water level" and "maximum water level" is the freeboard.

4.3.7 Extreme Events

The 24-hour probable maximum precipitation (PMP) event for the site is estimated, in SRK 2003b, to be 160 mm. For comparison, the greatest daily rainfall measured at either the Contowoyto Lake station or Lupin Airport was 42 mm, or a quarter of the estimated 24-hour PMP.

The total volume of the runoff water from the PKCA basin will be 85,500 m^3 during the PMP event, assuming a runoff coefficient of 1.0. The water level in PKCA Cells B and C will rise to 523.5 m if no water is discharged during the PMP event (assuming Cell A is filled with fine PK at the time of the event). The water level can be pumped down to the maximum operating level of 523 m in seven days assuming a discharge rate of 150 l/sec.

Additional water from the other site areas may be pumped to the PKCA following an extreme event; however the inflow rate will be controlled to maintain the water level in the facility below the operating level.

4.3.8 Limitations

The water balance analyses has been conducted based on current available information and a number of assumptions based on our current knowledge and understanding. It is envisioned that actual water elevations in the cells of the PKCA may be different from those predicted in this report for the following reasons:

- Precipitation, lake surface evaporation, and runoff will vary from the assumed monthly means;
- Actual fine PK deposition plan and mine operating plan may be different from those adopted in this report;
- Actual fine PK properties such as settled dry density may be different from those used in this study;
- Actual discharge water volume and reclaim water volume from Cell C may be different from those presented in this report;
- Actual hydraulic conductivities and as-built geometries of the dyke filters may be different from those used in the report.

The water balance should be reviewed on an annual basis.

5.0 DAM AND DYKE DESIGNS

The PKCA facility requires the construction of dams and dykes to control the water level and the discharge of fine PK. The dams and dykes are listed in Table 1 and shown in Figure 3. The dams and dykes were designed using Canadian Dam Safety Guidelines (1999) and comply with Canadian Dam Safety Guidelines (2007). The construction schedule for these structures was preliminarily developed based on projected water/fine PK levels and expected water quality in the PKCA over the remaining mine life. A number of assumptions were made in projecting the water/fine PK levels and predicting water quality when the report was prepared. These assumptions will be annually re-evaluated based on actual mine operational conditions, the mine plan, and information collected during the mine operation. The construction schedule can be then adjusted, when required, based on updated projections of water and fine PK levels and observed/predicted water quality in the PKCA.

All structures require that the detailed design and construction drawings be submitted to the Nunavut Water Board (NWB) 60 days prior to construction. A summary brief description of the structures is presented in the following sections.

5.1 West Dam

The West Dam design is described in EBA 2005c and was partially constructed to an elevation of 525 m during 2005 to 2007. This dam will require completion to final design elevation prior to commencement of mining operations. 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 not be required after mine abandonment.

The typical cross-section of the West Dam is shown in Figure 11. 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 secondary seepage barrier is provided by a geosynthetic liner on the upstream face of the frozen core. Similar designs have been developed by EBA for the EKATI Diamond Mine.

The upstream shell primarily consists 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 will be constructed of rockfill. This will provide a strong material and will have minimal settlement. The rockfill shells are designed to be constructed with 3.0H: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.

5.2 East and Southeast Dam Design

The design of the East and Southeast Dams are described in EBA 2005a. The construction of East Dam was completed in 2006 and Southeast Dam was completed in 2007. The design criteria for the East and Southeast Dams are as follows:

- The dams will retain fine PK solids.
- The water in the PKCA will be maintained at low level; therefore water will not impoundagainst the East and Southeast Dams for long periods of time.
- The dams will remain physically stable during the operational life of the mine and following mine closure.
- A typical cross section of the dams is shown in Figure 11 and 12. The main water retention element in the dams is a geomembrane liner. The liner is keyed into the ground using frozen saturated fill. Additional water retention will be provided by the fine processed, coarse processed kimberlite 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 dam foundation.

5.3 Divider Dyke "A" and "B" Design

The design of Divider Dyke A is described in EBA 2005b and was partially completed to a low point elevation of 521.5 between 2005 and 2007. The design criteria for the divider dykes are as follows:

- The dykes should retain the fine PK solids, to the extent practical. It will not be possible, or necessary, to prevent the movement of all colloidal particles through the dyke.
- The dyke should allow the movement of water from upstream (east) to downstream (west), as seepage flow through the dyke. In the event that 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.
- The completion of Divider Dyke A will be required prior to recommencement of full production.
- A second dyke, Divider Dyke B, will also be constructed prior to mining operations.

The design cross section of Divider Dyke A is shown in Figure 10. The design for Divider Dyke B will be similar to Divider Dyke B. The final design of Divider Dyke B will be submitted to the NWB prior to construction.

5.4 Perimeter Berm

Coarse PK stockpiles and berms will be placed around the perimeter of Cell A as shown in Figure 2. Fine PK will be deposited against the coarse PK stockpiles and berms. The perimeter berms will require stage construction during year one through year four after recommencement of mining operations in year one. The final design of the perimeter berms will be carried out with detailed stability evaluations of both the berms and the underlain dams/dyke. The design documents and construction drawings will be submitted to NWB 60 days prior to construction.

The properties of the coarse PK and the Perimeter Berms are discussed in the following sections.

5.5 Coarse PK geotechnical properties

Samples of coarse PK were provided to EBA by TDC in January 2006 for geotechnical property testing. The following tests were carried out:

- Particle Size Analyses
- Specific Gravity
- Permeability
- Micro-Deval Abrasion
- Moisture Density Relationship

The coarse PK properties are variable depending on whether they include finer particles from the process plant high pressure grind circuit (HPGR). The HPGR circuit runs on a part time basis. The material that contains the HPGR feed is well-graded coarse sand with some fine gravel and trace of silt. Material without the HPGR feed is uniformly graded medium sand with some fine gravel.

Particle size analyses were carried out on samples with and without the HPGR feed. The remainder of tests were carried out on a sample that contained HPGR feed. Test Results are presented in Appendix C.

One permeability test was conducted. The sample was tested at density of 95% maximum dry density (as determined by ASTM 698). The measured hydraulic conductivity was 1.4 x 10^{-2} cm/s.

Micro-Deval Abrasion tests were carried out to determine the amount of material breakdown. Tests were carried out according to CAN/CSA A23.2-29A. The first two tests were conducted on oven dried (110 °C) samples. The oven dried samples had a loss of 11% and 15% coarse and fine aggregate respectively.

5.5.1 Perimeter Berm Design

A perimeter berm is planned for the retention of fine PK above elevation 523 m in Cell A. The fine PK will be stacked against the berm.

Construction materials planned for the berm will consist ofcoarse PK or overburden till. Both materials are relatively permeable; however, the intent is that no water will pond against the perimeter berms as the water level in Cell A will be maintained below the level of the fine PK. Free water adjacent to the berms will be minimized by depositing fine PK in a manner that it slopes away from the perimeter berms and stockpiles. Seepage will be collected on the downstream side of the berms if necessary. A typical cross section of the perimeter berm is shown in Figures 13.

The final design and construction drawings of the Perimeter Berms will be submitted to the NWB prior to their construction, as per the conditions of the water license.

5.6 North Dam

The North Dam is proposed to be constructed 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 elevation at the saddle of the North Dam is approximately 518 m.

Construction of the North Dam will be required before recommencement of mining operations. It will be constructed as a lined dam with a liner keyed into the frozen ground and bedrock. The design and construction drawings for the North Dam will be submitted to the NWB for approval prior to construction. A typical cross-section of the North Dam is shown in Figure 12.

5.7 Settling Pond Dam

The water quality in the PKCA will be monitored to determine whether the measured concentrations of the suspended solids in the supernatant follow a clear trend approaching the upper limits specified in Part G (6) of the Type "A" Water Licence for the Jericho Mine. When the trend is observed, an additional settling pond may be constructed downstream of the West Dam to remove the additional suspended solids in the supernatant.

A preliminary design of the settling pond dam was described in the water license application supporting documents (SRK 2004c). The final design will be submitted to the NWB for approval prior to construction.

6.0 MONITORING

6.1 Dam Safety Monitoring

Visual Inspections

Daily visual inspections of the dams and tailings discharge will be carried out. Signs of instability, such as deformations, slumping and cracks should be reported to the design engineers. Signs of seepage from the dams and dykes should also be reported.

Ground Temperature Measurements

Ground temperature cables are installed within the West, East and Southeast Dams. Ground temperature cables will also be installed in the North Dam once it has been constructed. Ground temperature cables are measured on a monthly basis and are reported in the monthly water licence report to the Nunavut Water Board and the Inspector.

Annual Geotechnical Inspections

The dams are inspected annually by a geotechnical engineer. The inspection will include a visual assessment and review of the ground temperature data, deformation monitoring data, water and fine PK levels. A report will be prepared summarizing the visual assessment and review of the monitoring information. The report will be submitted to the NWB and the Inspector within sixty (60) days of the inspection in accordance with Part G, 2 (g) of the water licence.

Dam Settlement

Settlement monitoring points will be installed in the dams at the end of construction. The elevation and location of the monitoring points will be surveyed and recorded on a monthly basis. The monitoring schedule should be reviewed if there are signs of movement.

Thermosyphons

Thermosyphon evaporator piping was installed at the West Dam. Thermosyphon radiators will be installed if necessary. The operational temperature of the thermosyphon evaporators will be monitored via installed ground temperature cables. The operation of the thermosyphons should also be checked visually by observing for presence or absence of frost on the thermosyphons.

Topographic Survey

An annual topographic survey of the dam crest will be conducted to identify any settlement areas of the dams.

Volume Occupation

The volume of fine PK will be monitoredusing staff gauges at fine PK locations above water level.A topographic survey and/or a bathymetric survey of the top of the fine PK will be carried out on an annual basis. The surveys will also be used to confirm the slope of the deposited fine PK.

The fine PK will be sampled to determine if fines segregation is occurring. The fine PK will also be sampled to determine in-situ density and ice content.

Ice in the processed kimberlite occurs due to the freezing of the fine PK prior to settling and consolidation, and will also occur if waterbodies are covered with frozen PK. Winter placement of fine PK over significant waterbodies will be minimized.

6.2 Water Balance

The water balance will be verified on an annual basis. The following components will be examined:

- hydrologic assumptions (precipitation, evaporation, and runoff),
- water levels in the PKCA cells
- discharge rates and quantities

6.3 Freeboard

The water level and freeboard in the PKCA will be monitored weekly during periods of open water using surveyed rock bolts within the containment.

6.4 Seepage

Seepage out of the dams and perimeter berms will be monitored. Any seepage identified will be returned to the PKCA.

6.5 Precipitation

Daily precipitation will be measurements and recorded in order to assist with the calibration of the water balance and forecast freshet events.

6.6 Discharges

Discharge quantities into and out of the PKCA will be monitored as specified in the Surveillance Monitoring Program.. The measured quantities will include:

- Discharge quantity from process plant to the PKCA,
- Discharge from East Sump, Collection Ponds and Pit Area to the PKCA,
- Reclaim water from the East Sump or PKCA, and
- Discharge quantity to the Stream C3

6.7 Water Quality

The water quality monitoring programs at Jericho include the site water quality monitoring, seepage water monitoring, and receiving water quality monitoring. The monitoring stations and the sampling frequencies are specified in the General Monitoring Plan (EBA 2011) and Aquatic Effects Monitoring Plan (EBA 2011).

7.0 ADAPTIVE MANAGEMENT

The following highlights some of the key parameters that will be monitored and may be adjusted if necessary.

- Fine PK Settling and Density: The settling density of the fine PK used for this plan is based on the operational records and survey information from TDC.
- Supernatant Water Quality: The clarity and water quality of the supernatant water will be monitored.
- The water quality of the PKCA discharge, Stream C3 and Lake C3 will be monitored. The discharge rates may be adjusted to optimize the water quality if required.
- Runoff: The runoff coefficient assumed for the water balance was based on hydrology studies at the site. Lower runoff coefficients may also be applicable for waste rock areas. The pumping rates and discharge quantities should be reviewed annually to determine if the runoff coefficients are as assumed. Lower runoff coefficients will reduce the discharge quantities and pumping requirements.
- Ice Management: The goal is to avoid entrapping large ice layers under a large cover of fine PK tailings. In the winter time this is accomplished by depositing the fine tails under water where sufficient water depth exists and similarly avoiding depositing over shallow water areas that are frozen to the bottom. Since relatively shallow standing water in winter in Cell A is projected, the under-water deposition of the fine PK in Cell A during winter may be not practical. Therefore, the standing water in Cell A of the PKCA will be limited to avoid burying of ice sheet/blocks during winter deposition of the fine PK. If practical, the fine PK may be deposited under water in winter in Cell B during late stage of the mine operation to reduce the amount of ice entrained within the fine PK.

- Fine PK Slopes: The design height of the dams and dykes has been based on an operational fine PK slope of 2.9%. These slopes should be monitored on an annual basis and the information used to optimize the Fine PK spigot location plan.
- Ponding Water in Cell A: Fine PK spigoted above the maximum water level within the PKCA will be placed around the perimeter of Cell A in a manner to reduce the amount of ponded water against the perimeter coarse PK berms. The performance to date indicates that surface water on the fine PK surface generally flows away from the East and Southeast Dams. The spigot locations will be adjusted over time to achieve this.
- Divider Dyke seepage: The seepage rates through the divider dykes are based on laboratory tests and existing operational data. If the permeability changes significantly or the filter becomes blocked with fine PK it may be necessary to decant water from one cell to another. The water can be decanted via pumps or siphons or an overflow structure across the dyke can be constructed.
- Divider Dyke Filter: The specified particle size distribution of the divider dykes has been based on properties of the fine PK from the bulk process plant in 1997. The performance of the dyke filter will be monitored and filter testing using actual supernatant water may be carried out to refine the dyke filter particle size distribution for the remaining construction of the Dyke A filter and the construction of the Dyke B filter. Fine PK was observed in 2007 coming through the Dyke A filter. The fine PK flow was mitigated by placing coarser fine PK on the dyke face. It was postulated that the fine PK was coming through cracks in the bedrock foundation. Divider Dyke B will be constructed prior to future full operations to deal with this issue. The Dyke B design will be modified to deal with these potential issues.
- Perimeter Coarse PK Berm: The final design and construction drawings of the coarse PK perimeter berm will be prepared prior to construction.Additional Settling Pond: The original design of the PKCA (SRK, 2004) included the provision for a settling pond downstream of West Dam. The need for an additional settling pond will be evaluated over the following years based on the performance of the facility and the discharge water quality.

8.0 OPERATIONS, MAINTENANCE, & SURVEILLANCE

This update to the PKCA Management plan includes a revised Operations, Maintenance, & Surveillance (OMS) Manual PKCA Dams which supports the resumption of mining operations. This update to the OMS Manual can be found in Appendix D, and thus the PKCA Management Plan together with the OMS Manual will constitute a central reference document that will provide a complete set of operating protocols for the dams and appurtenant structures for the PKCA.

9.0 CLOSURE

We trust this satisfies your present requirements. If you have any questions, please contact the undersigned at your convenience.

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EBA ENGINEERING CONSULTANTS LTD.
Signature
Date August 15, 2011
PERMIT NUMBER: P 018
The Association of Professional Engineers, Geologists and Geophysicists of the NWT / NU

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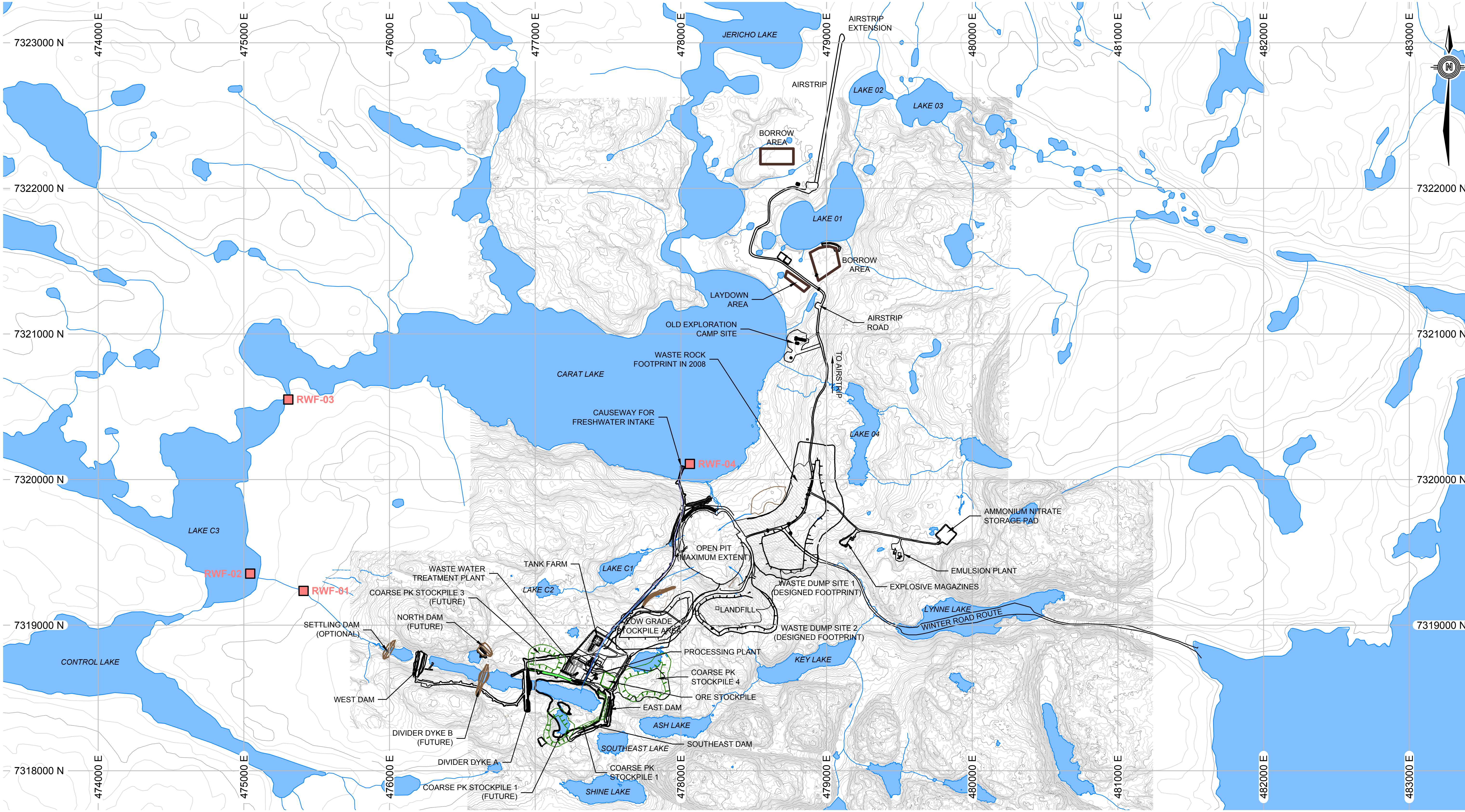
Tahera 2005. Site Water Management Plan, Jericho Project, Nunavut. Prepared by Tahera Diamond Corporation and reviewed by AMEC Earth & Environmental, October 2005.

FIGURES



Q:\Edmonton\Drafting\CIVIL3D\E141\E14101140\Production Drawings\E14101140_FIG 1_R0.dwg [FIGURE 1] August 15, 2011 - 1:25:24 pm (BY: LEE, ELVIN)

LEGEND

- RWF, RECEIVING WATERBODY FLOW MONITORING STATION

0 — 1 000 m

Scale: 1: 25 000

NOTES

1. LAYOUTS ARE APPROXIMATE AND MAY NOT REFLECT ACTUAL SIZE AND LOCATIONS.
2. LOCATIONS OF MONITORING STATIONS ARE CONCEPTUAL, ACTUAL LOCATIONS MAY VARY.
3. FOOTPRINTS OF WASTE ROCK PILES, COARSE PK STOCKPILES AND ORE STOCKPILES ARE SHOWN IN MAXIMUM LIMITS, ACTUAL FOOTPRINTS MAY VARY.

STATUS
ISSUED FOR USE

CLIENT
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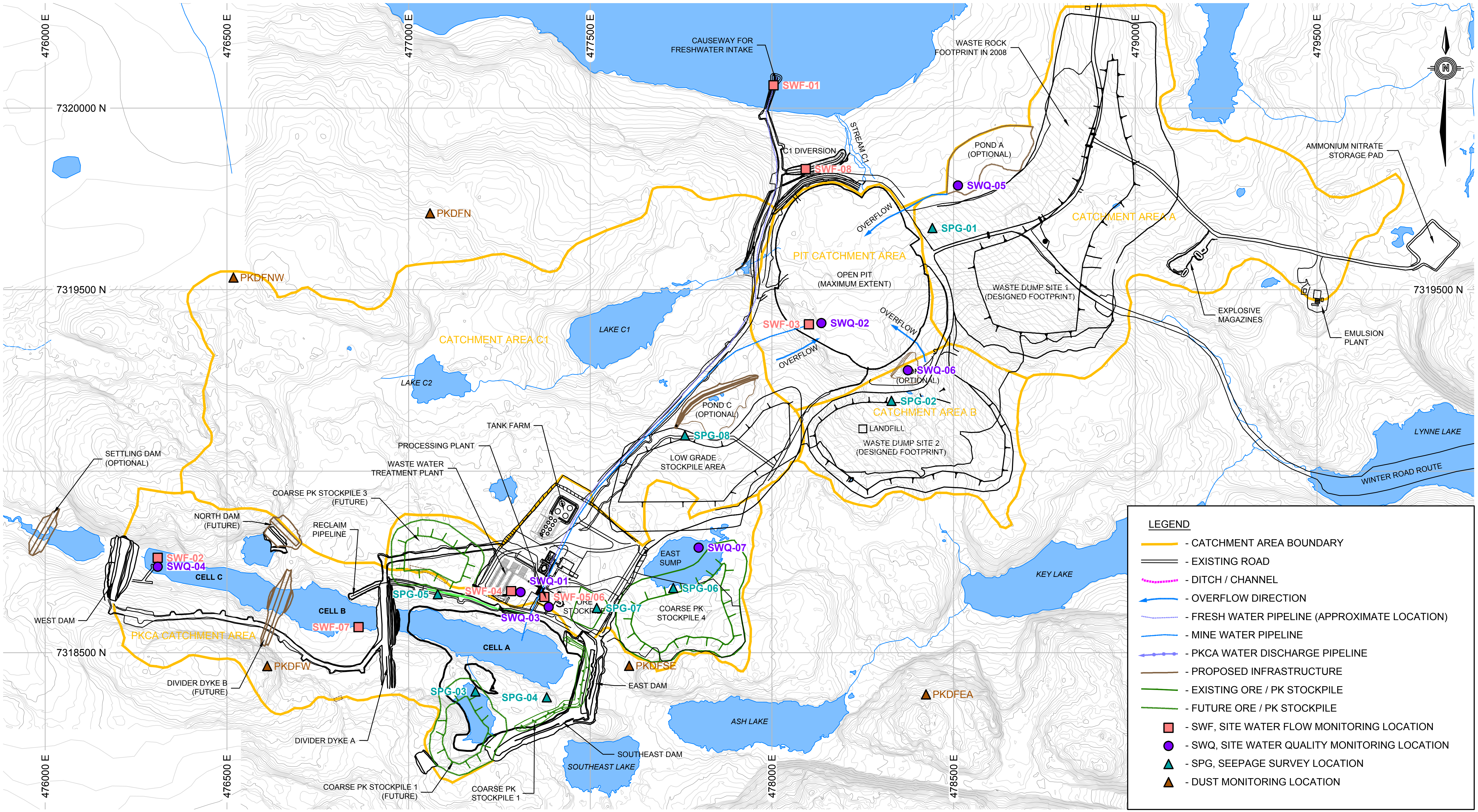
PROCESSED KIMBERLITE MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

GENERAL SITE PLAN

PROJECT NO.	DWN	CKD	REV
E14101140	EL	NG	0

OFFICE	DATE
EDM	August 15, 2011

Figure 1



Q:\Edmonton\Drafting\CIVIL3D\E141\E14101140\Production Drawings\E14101140_FIG 2_R0.dwg [FIGURE 2] August 15, 2011 - 1:24:48 pm (BY: LEE, ELVIN)

NOTES

1. LAYOUTS ARE APPROXIMATE AND MAY NOT REFLECT ACTUAL SIZE AND LOCATIONS.
2. LOCATIONS OF MONITORING STATIONS ARE CONCEPTUAL, ACTUAL LOCATIONS MAY VARY.
3. FOOTPRINTS OF WASTE ROCK PILES, COARSE PK STOCKPILES AND ORE STOCKPILES ARE SHOWN IN MAXIMUM LIMITS, ACTUAL FOOTPRINTS MAY VARY.
4. LOCATIONS OF SWF-09, 10 AND 11 WILL BE DETERMINED ON-SITE IN 2011.

STATUS
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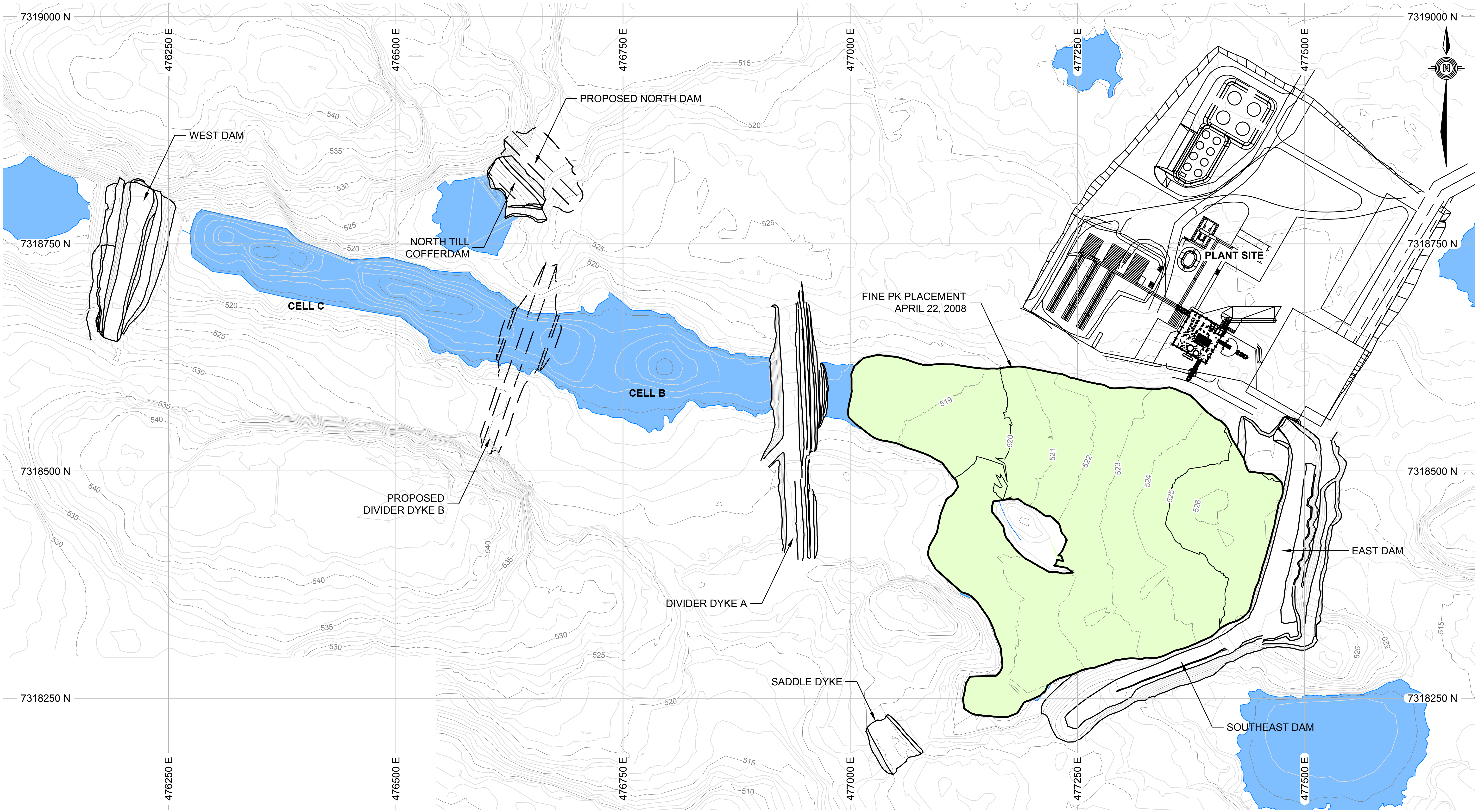
PROCESSED KIMBERLITE MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

CATCHMENT AREAS AND MONITORING STATIONS

PROJECT NO.	DWN	CKD	REV
E14101140	EL	NG	0
OFFICE	DATE		
EDM	August 15, 2011		

Figure 2



NOTES

PROCESSED KIMBERLITE CONTOURS EXTRAPOLATED FROM APRIL 22, 2008 SURVEY.

0 — 200 m

Scale: 1: 4 000

STATUS
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PROCESSED KIMBERLITE MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

PLAN OF EXISTING PROCESSED KIMBERLITE CONTAINMENT AREA

PROJECT NO.	DWN	CKD	REV
E14101140	EL	NG	0

OFFICE	DATE
EDM	August 11, 2011

Figure 3

LEGEND

- - - - - WATER STORAGE OUTLINE

0 250 m

Scale: 1: 5 000

NOTES

EXISTING PROCESSED KIMBERLITE CONTOURS EXTRAPOLATED FROM APRIL 22, 2008 SURVEY.

STATUS
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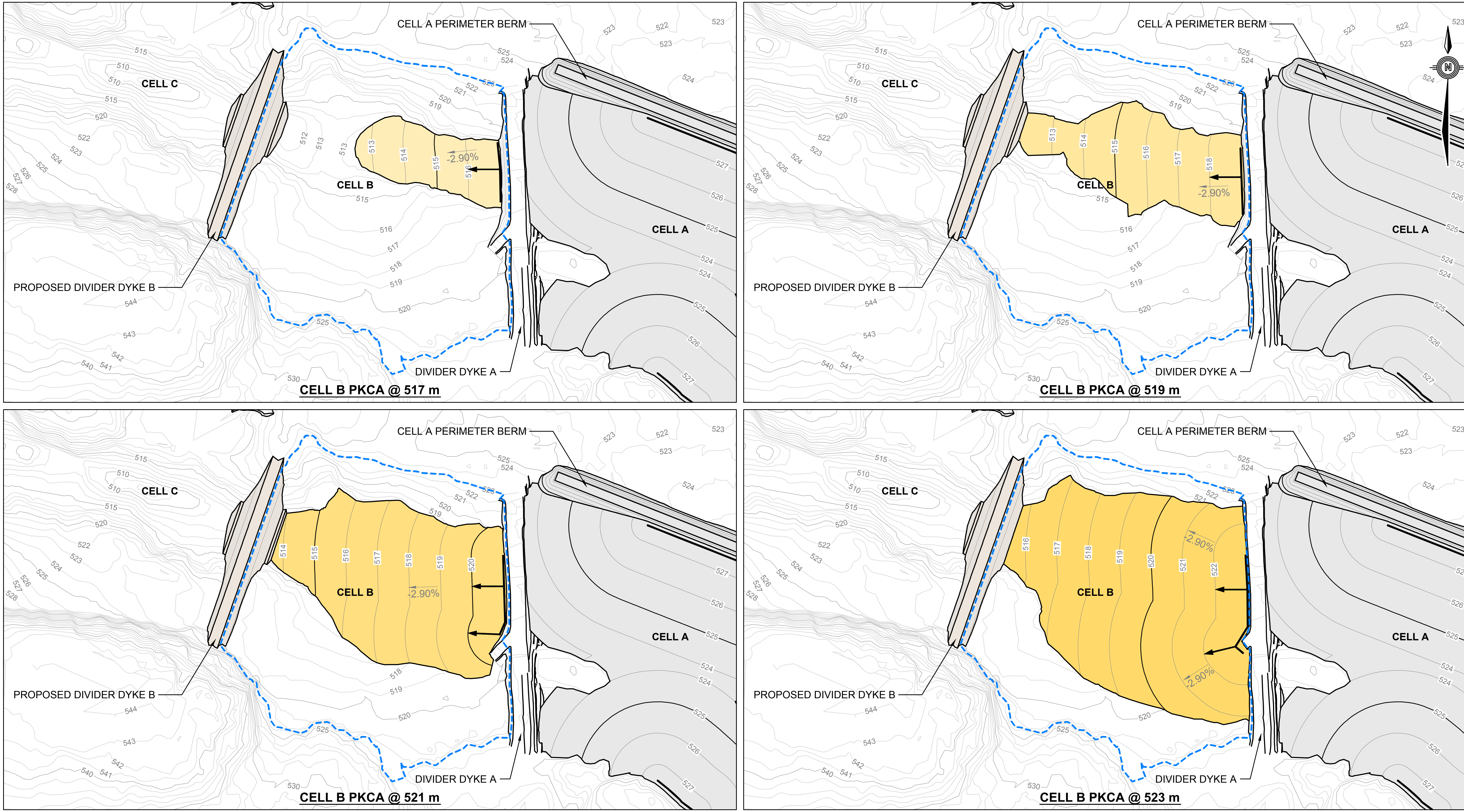
PROCESSED KIMBERLITE MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

STAGED DEVELOPMENT OF PKCA
CELL A

PROJECT NO.	DWN	CKD	REV
E14101140	EL	NG	0
OFFICE	DATE		
EDM	August 13, 2011		

Figure 4A



LEGEND

- WATER STORAGE OUTLINE

0 200 m

Scale: 1: 4 000

STATUS
ISSUED FOR USE

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PROCESSED KIMBERLITE MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

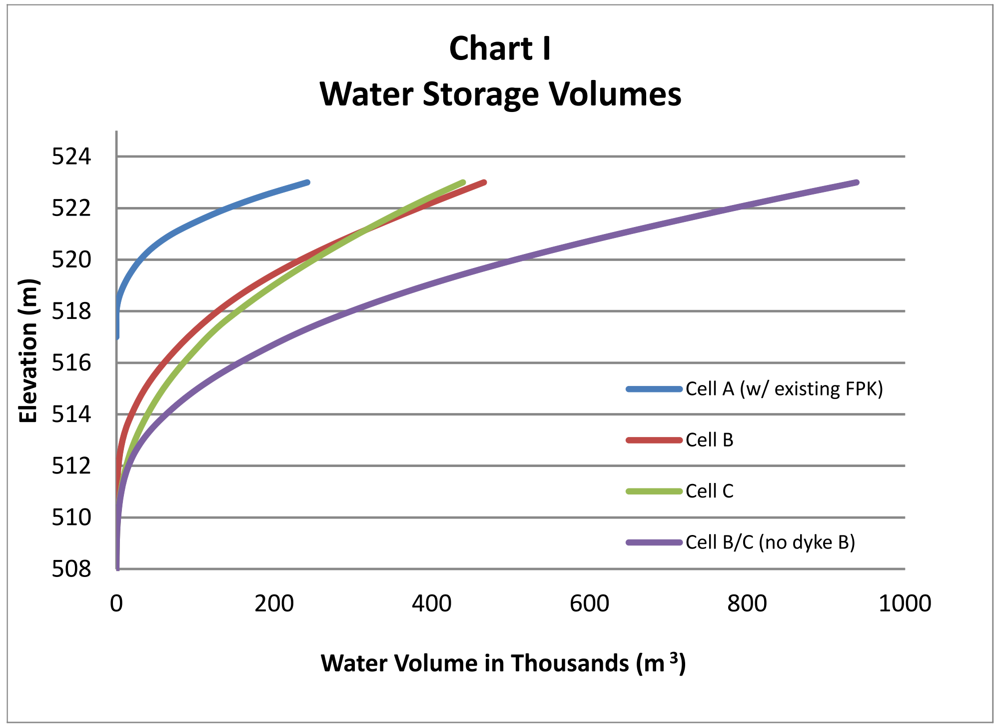
STAGED DEVELOPMENT OF PKCA
CELL B

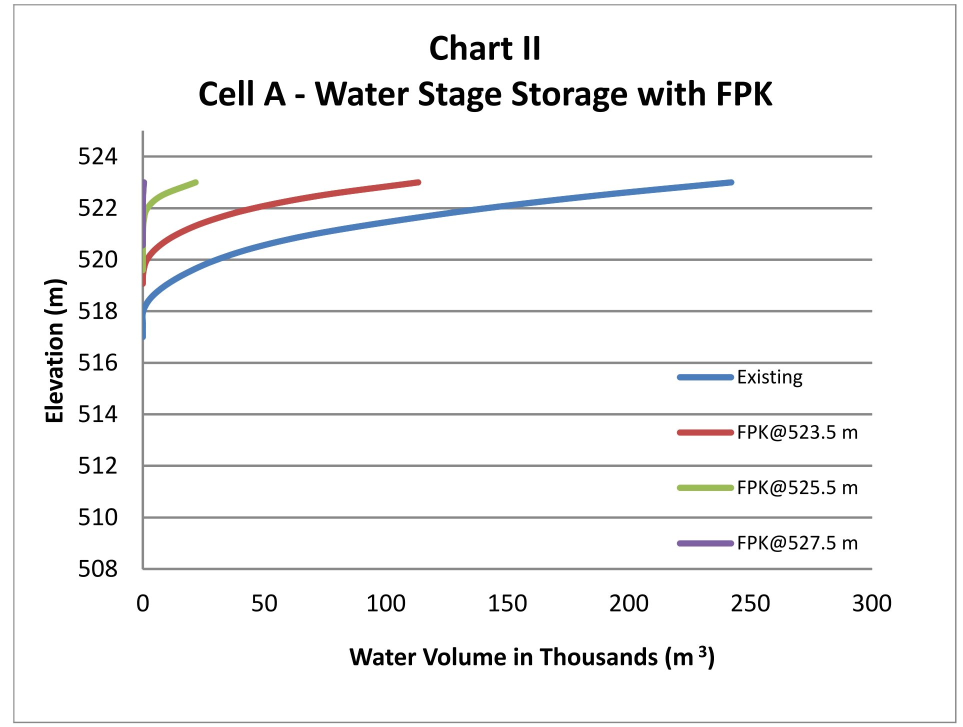
PROJECT NO.	DWN	CKD	REV
E14101140	EL	NG	0

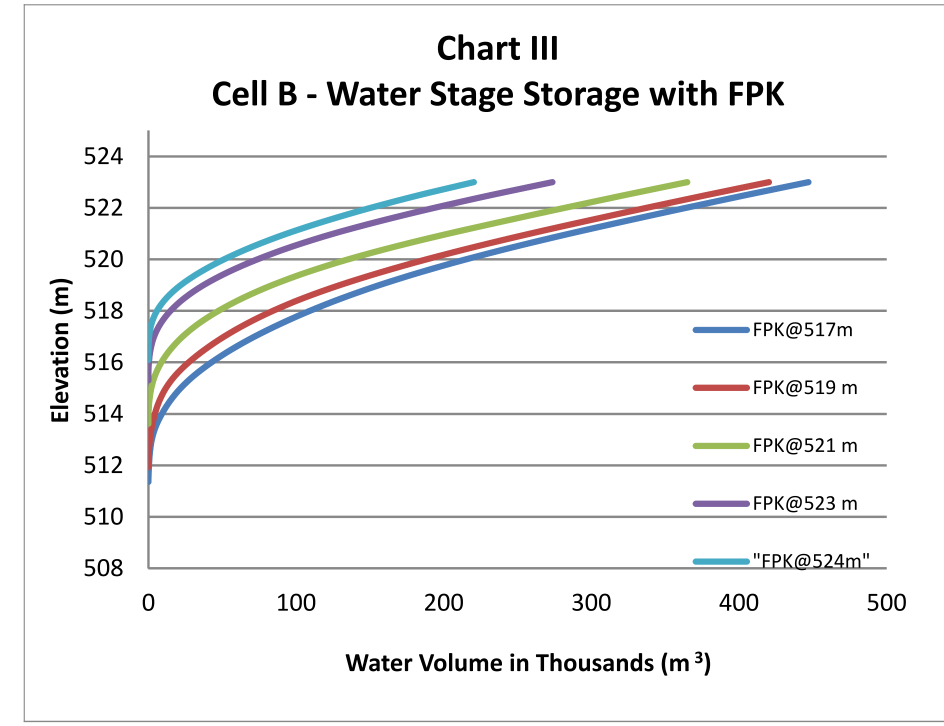
OFFICE	DATE
EDM	August 14, 2011

Figure 4B

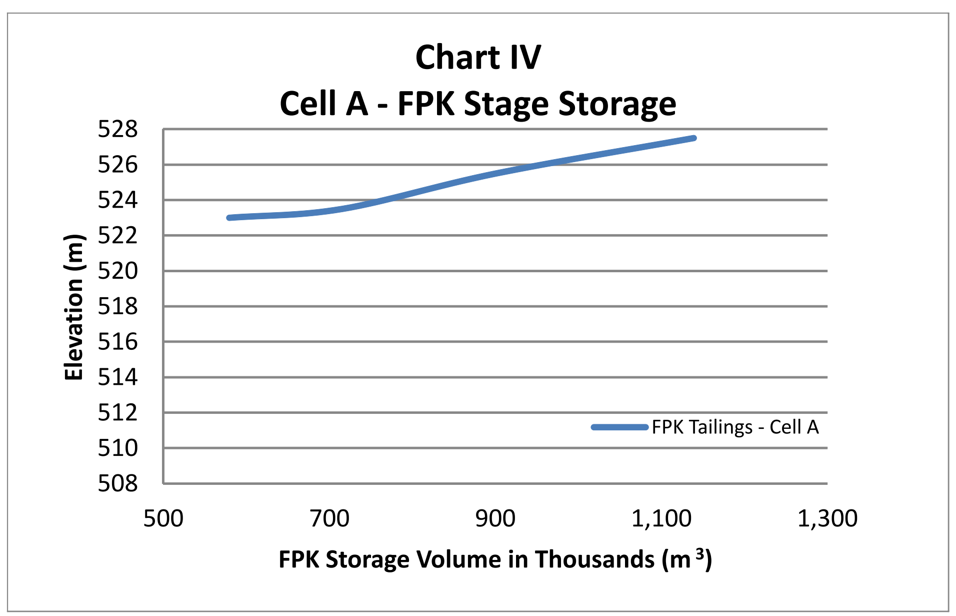
Water Storage Relationships

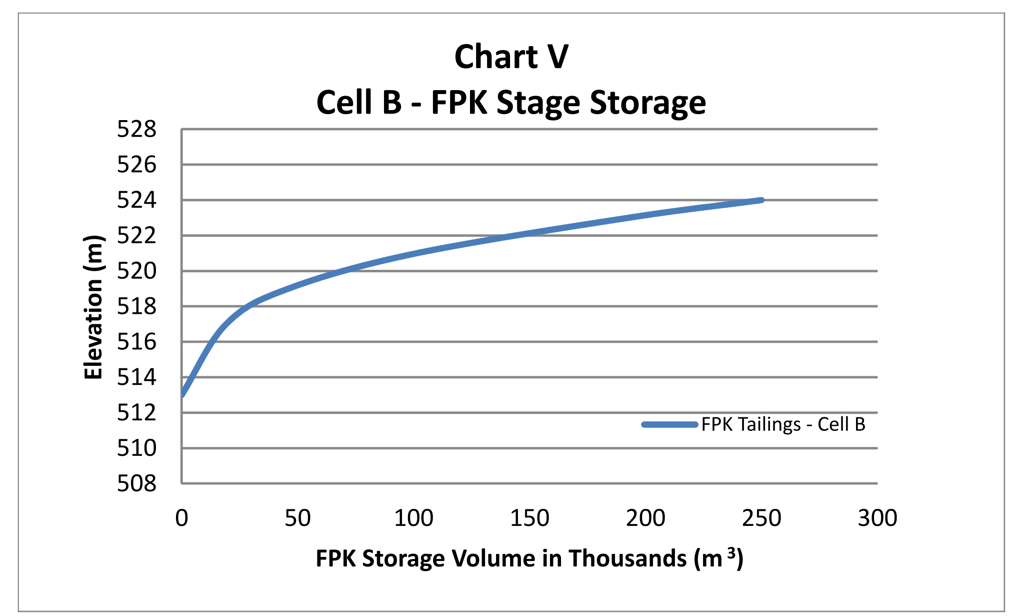






FPK Storage Relationships





LEGEND

STATUS
ISSUED FOR REVIEW

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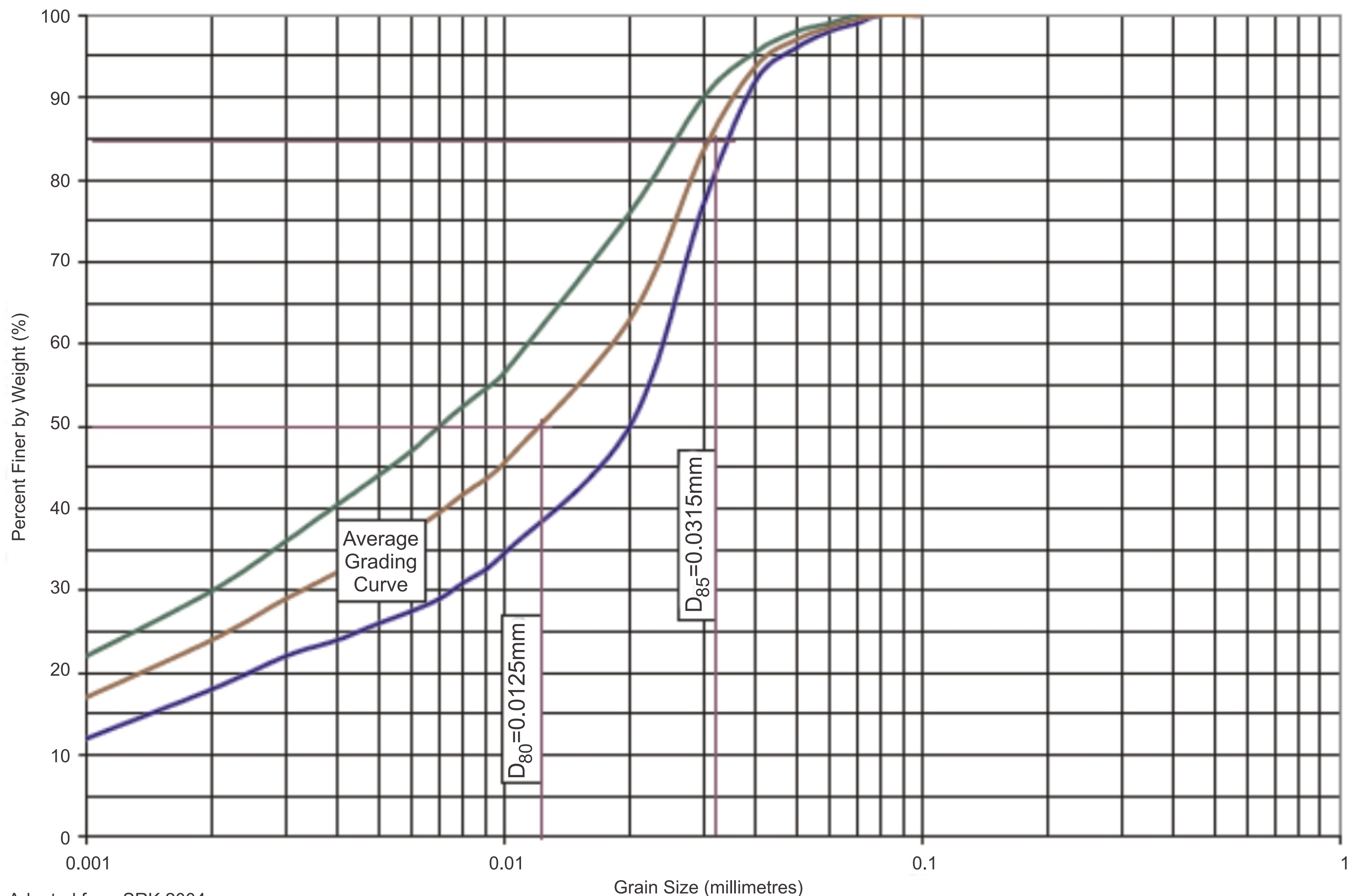
PROCESSED KIMBERLITE MANAGEMENT PLAN JERICHO DIAMOND MINE, NUNAVUT

STAGE STORAGE CURVES

PROJECT NO.	DWN	CKD	APVD	REV
E14101140	CLS	NL	NG	0

OFFICE	DATE
EBA-EDM	August 2011

Figure 5



Reference: Adapted from SRK 2004c

LEGEND

NOTES

STATUS
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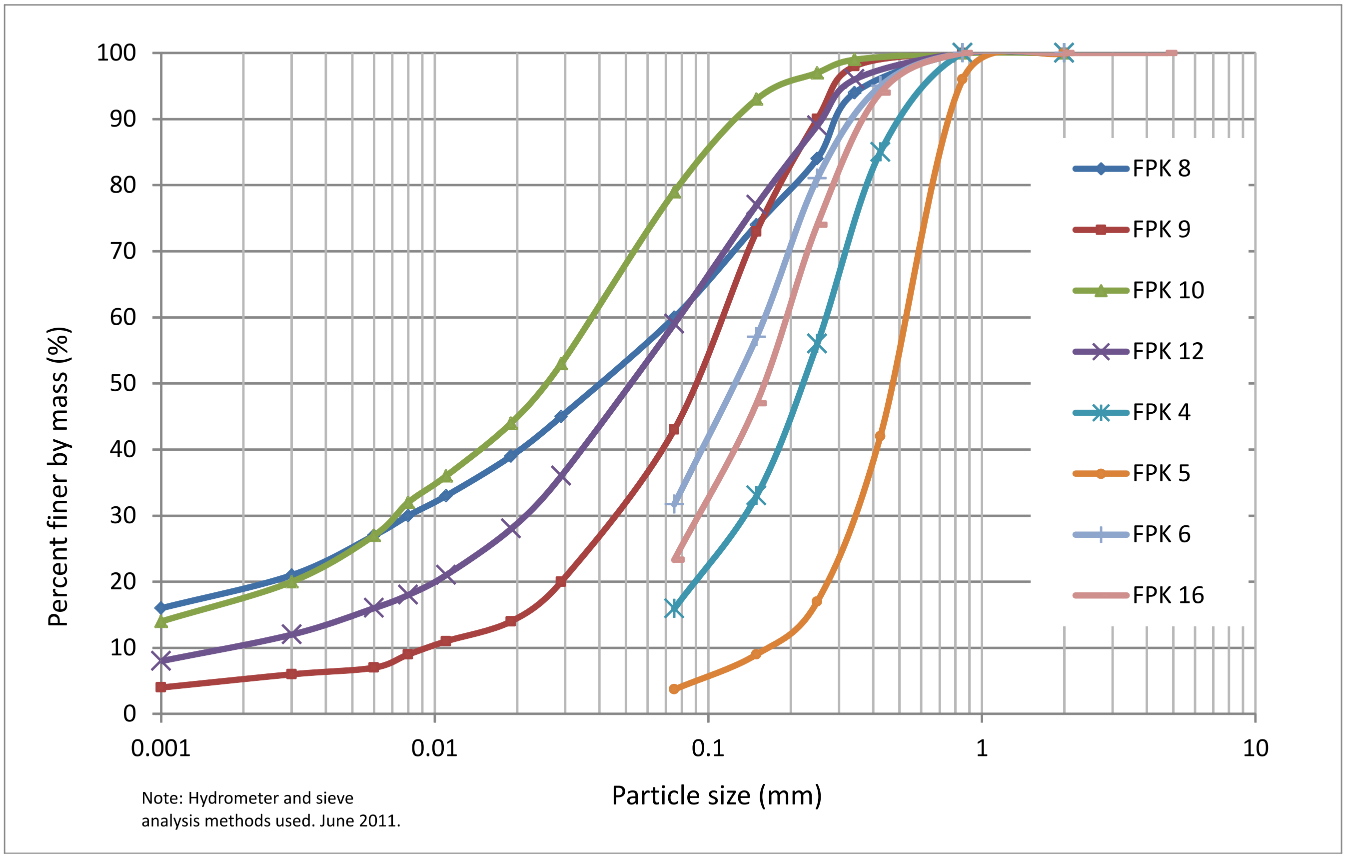
PROCESSED KIMBERLITE MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

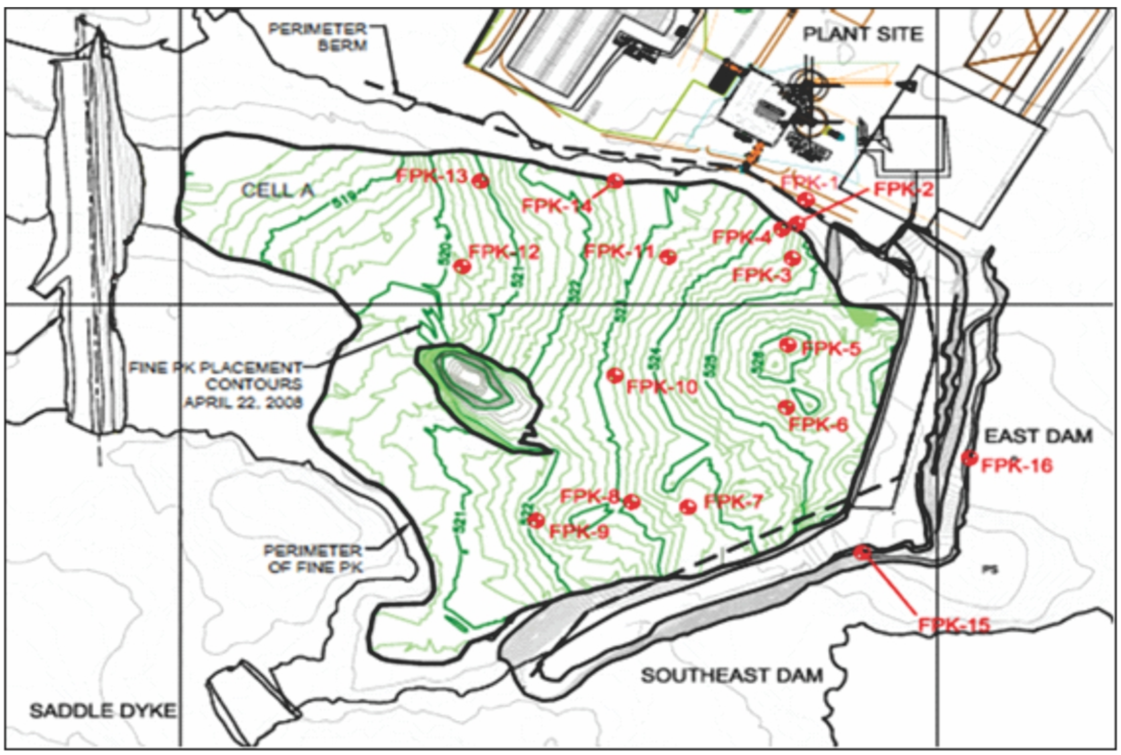
FINE PK PARTICLE SIZE DISTRIBUTION (1997)

PROJECT NO.	DWN	CKD	APVD	REV
E14101140	CLS	NL	NG	0

OFFICE	DATE
EBA-EDM	August 2011

Figure 6





LEGEND

NOTES

STATUS
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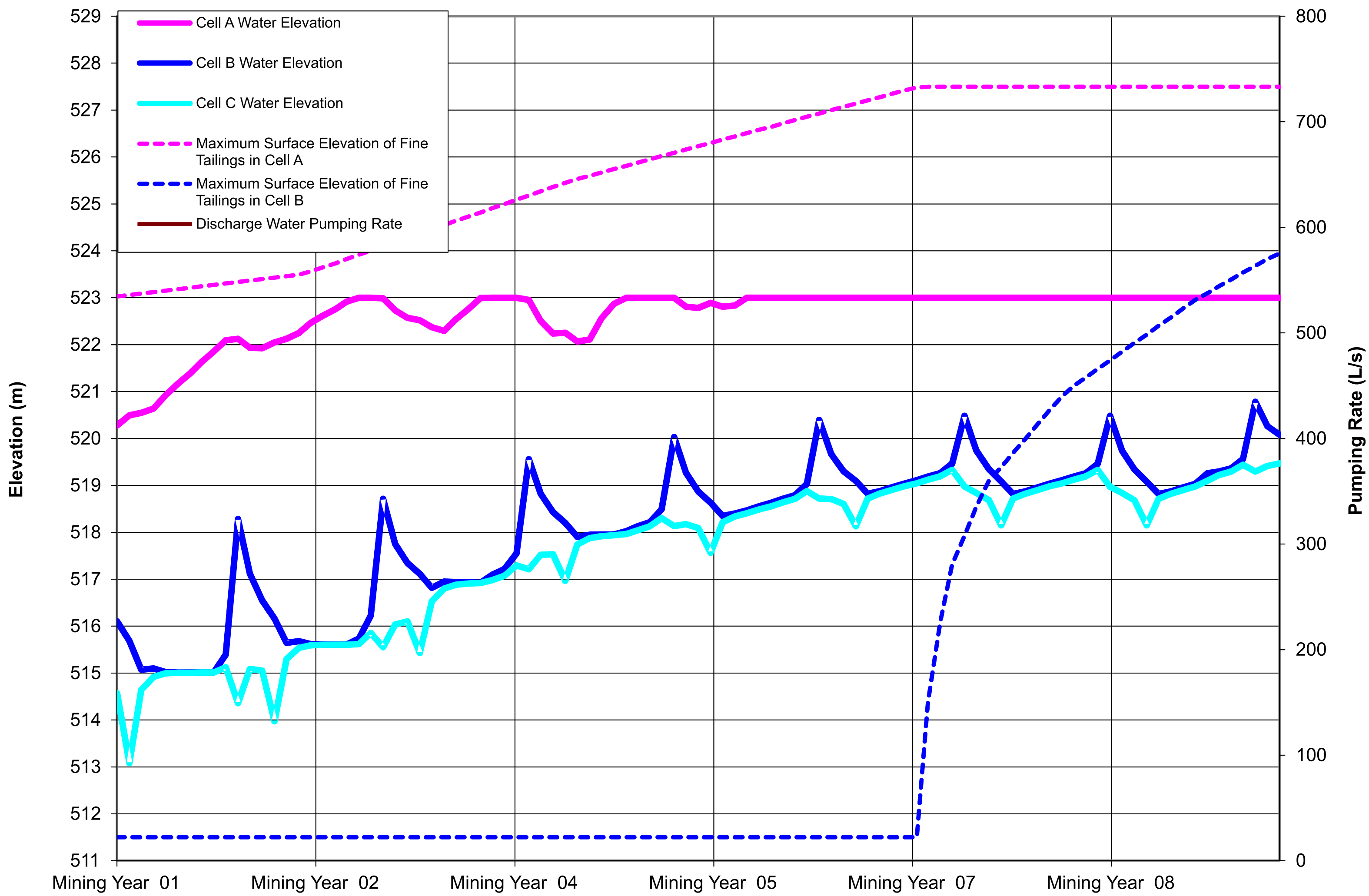
PROCESSED KIMBERLITE MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

FINE PK PARTICLE SIZE DISTRIBUTION (2011)

PROJECT NO.	DWN	CKD	APVD	REV
E14101140	CLS	NL	NG	0

OFFICE	DATE
EBA-EDM	August 2011

Figure 7



NOTES

Cell A Water Elevation
Cell B Water Elevation
Cell C Water Elevation

Cell A Fine PK Average Elevation*
Cell B Fine PK Average Elevation*
Discharge Water Pumping Rate

Note: Fine PK elevations based on level surface of FPK.

Elevations will vary due to surface slope of FPK.

STATUS
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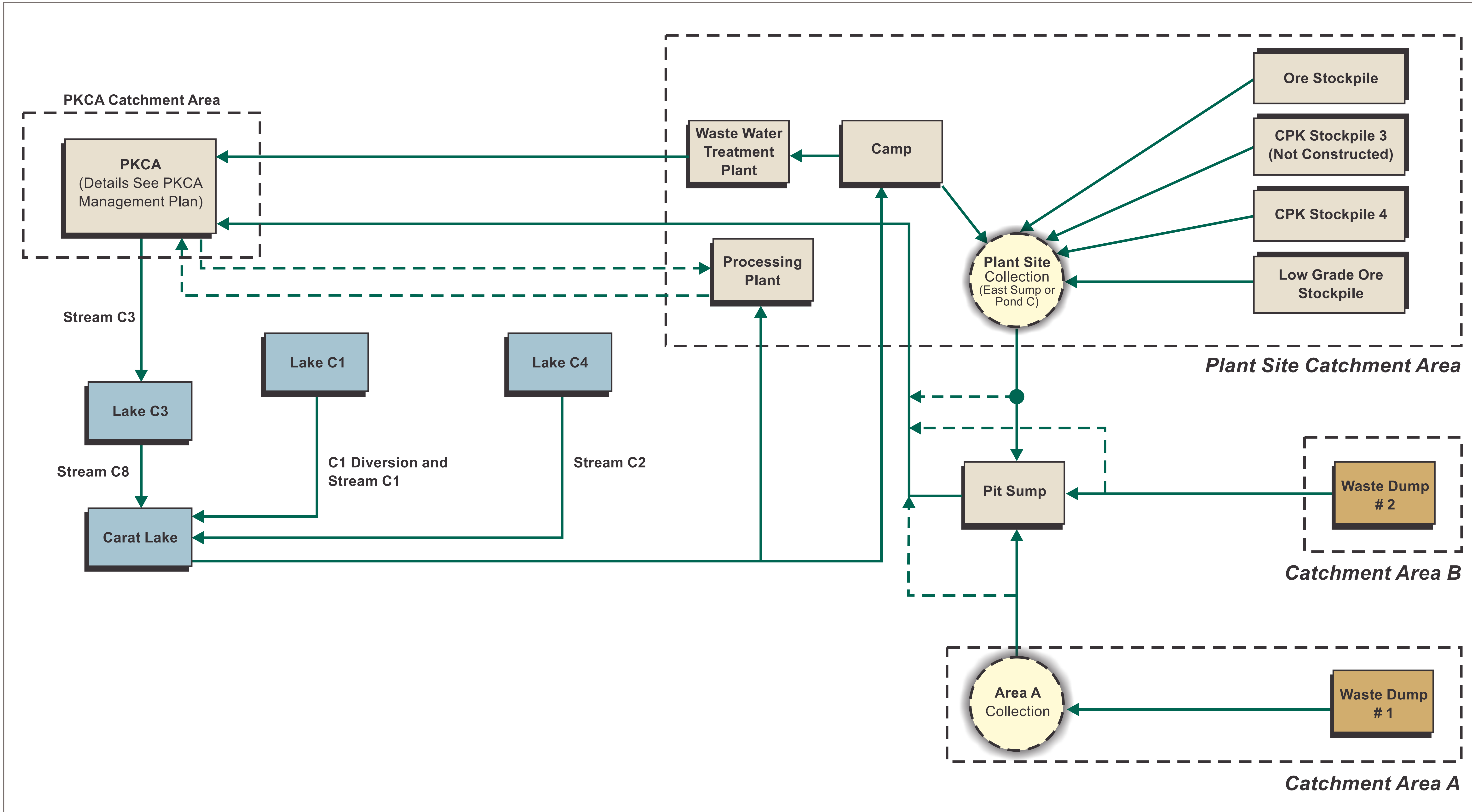
PROCESSED KIMBERLITE MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

WATER LEVELS AND FPK ELEVATIONS FOR MEAN PRECIPITATION YEARS

PROJECT NO.	DWN	CKD	APVD	REV
E14101140	CLS	NL	NG	0

OFFICE	DATE
EBA-EDM	August 2011

Figure 8



LEGEND

- Sub-Watershed in Area of Impact
- Flow
- Potential Flow Path

Area A Collection : Collector Ditch or Potential Pond A
Area B Collection : Collector Ditch or Potential Pond B
Area C Collection : East Sump or Potential Pond C

STATUS
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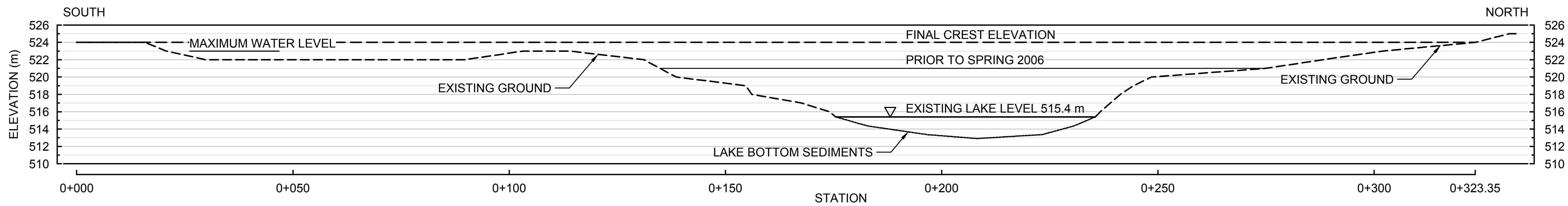
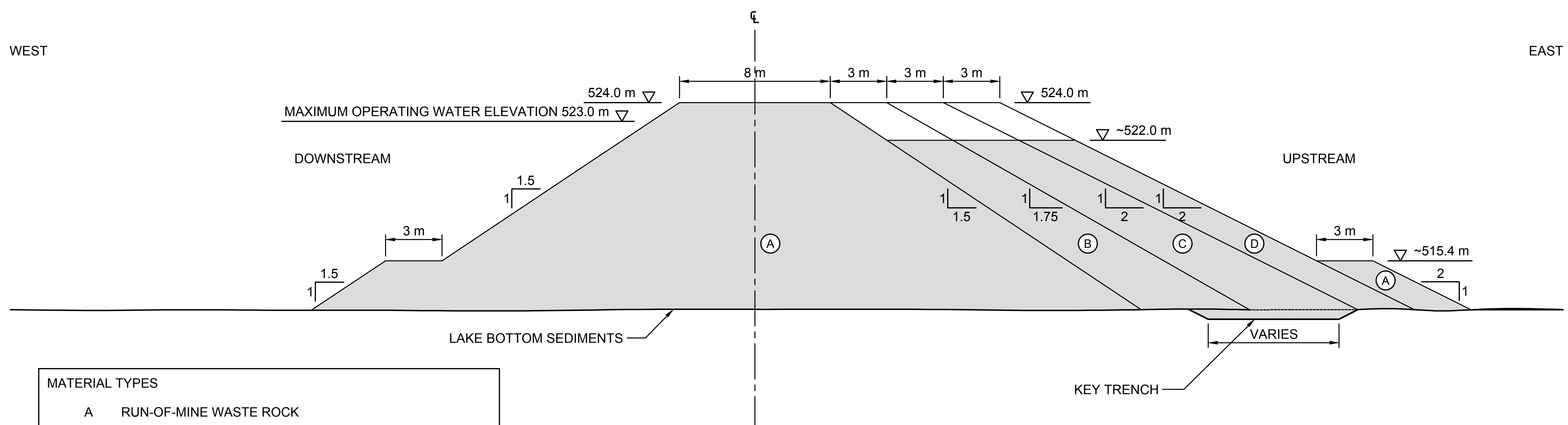
PROCESSED KIMBERLITE MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

SITE WATER MANAGEMENT FLOWSHEET

PROJECT NO.	DWN	CKD	APVD	REV	
E14101140	CLS	NG	NG	0	Figure 9
OFFICE	DATE				
EBA-EDM	August 2011				



DIVIDER DYKE A - PROFILE
1:1000



DIVIDER DYKE A - TYPICAL CROSS-SECTION
1:250

MATERIAL TYPES	
A	RUN-OF-MINE WASTE ROCK
B	TRANSITION ZONE (MINUS 150 mm OR 200 mm ROCKFILL)
C	FILTER ZONE (20 mm MINUS CRUSH)
D	RIP RAP
(shaded)	CONSTRUCTED TO DATE

Q:\Edmonton\Drafting\CIVIL3D\E141\E14101140\Production Drawings\E14101140_FIG 10-13_R0.dwg [FIGURE 10] August 15, 2011 - 1:13:52 pm (BY: LEE, ELVIN)

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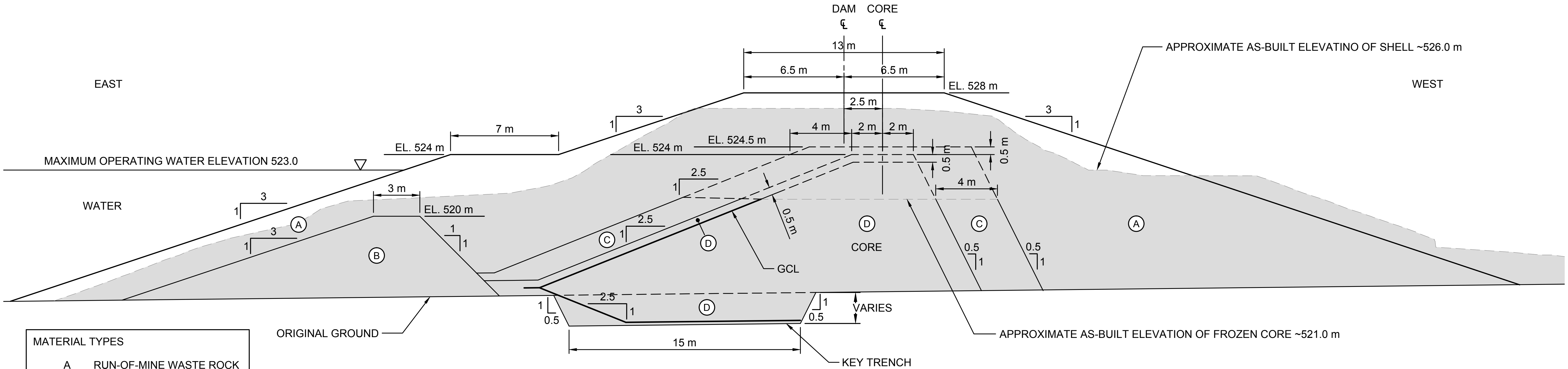
PROCESSED KIMBERLITE MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

DIVIDER DYKE A
PROFILE AND TYPICAL CROSS-SECTION

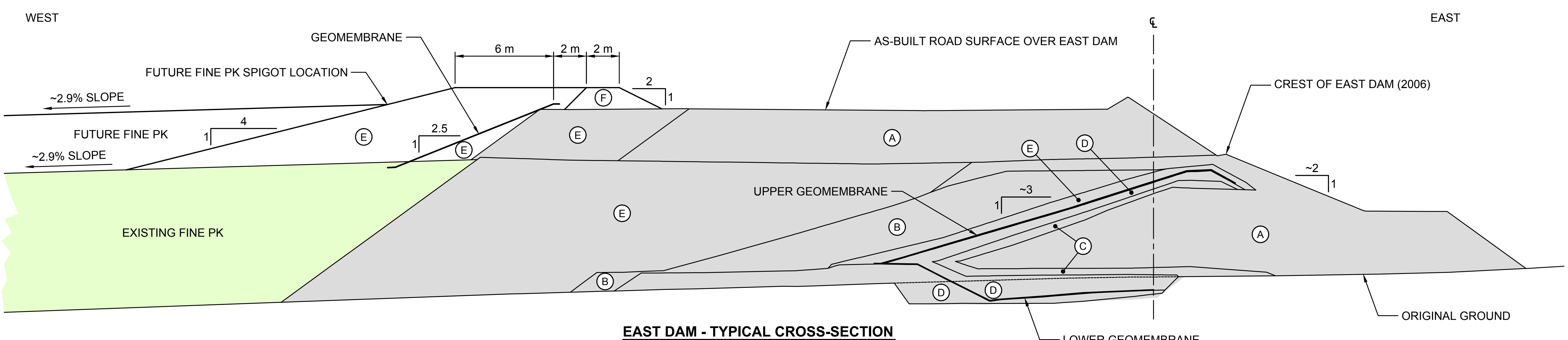
PROJECT NO.	DWN	CKD	REV
E14101140	EL	NG	0
OFFICE	DATE		
EDM	August 15, 2011		

Figure 10



MATERIAL TYPES	
A	RUN-OF-MINE WASTE ROCK
B	TILL
C	200 mm MINUS ROCKFILL
D	20 mm MINUS CRUSH
E	COARSE PK
F	150 mm MINUS ROCKFILL
(shaded)	CONSTRUCTED TO DATE

WEST DAM - TYPICAL CROSS-SECTION
1:250



EAST DAM - TYPICAL CROSS-SECTION
1:250

STATUS
ISSUED FOR USE

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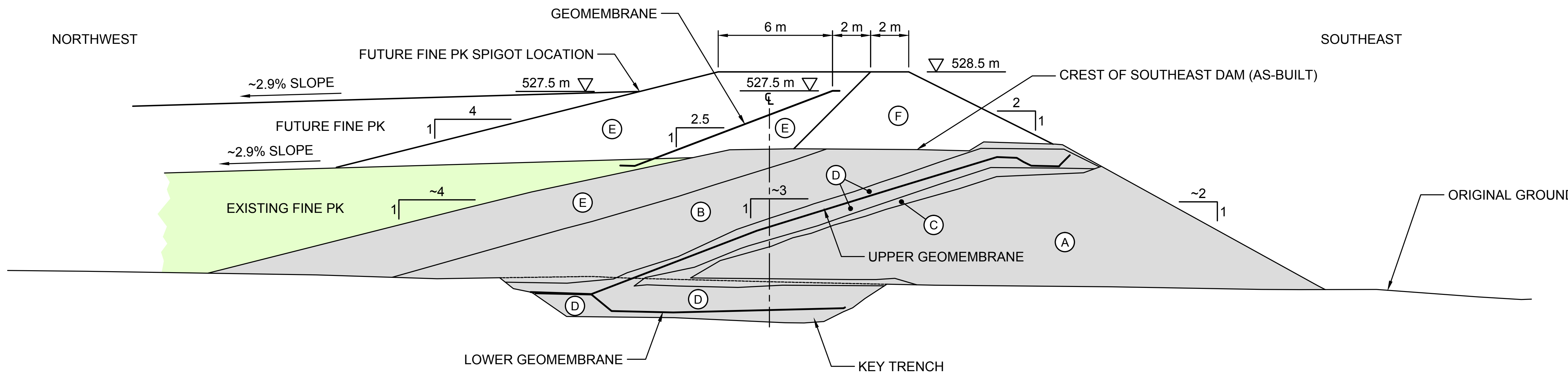
PROCESSED KIMBERLITE MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

WEST DAM AND EAST DAM
TYPICAL CROSS-SECTIONS

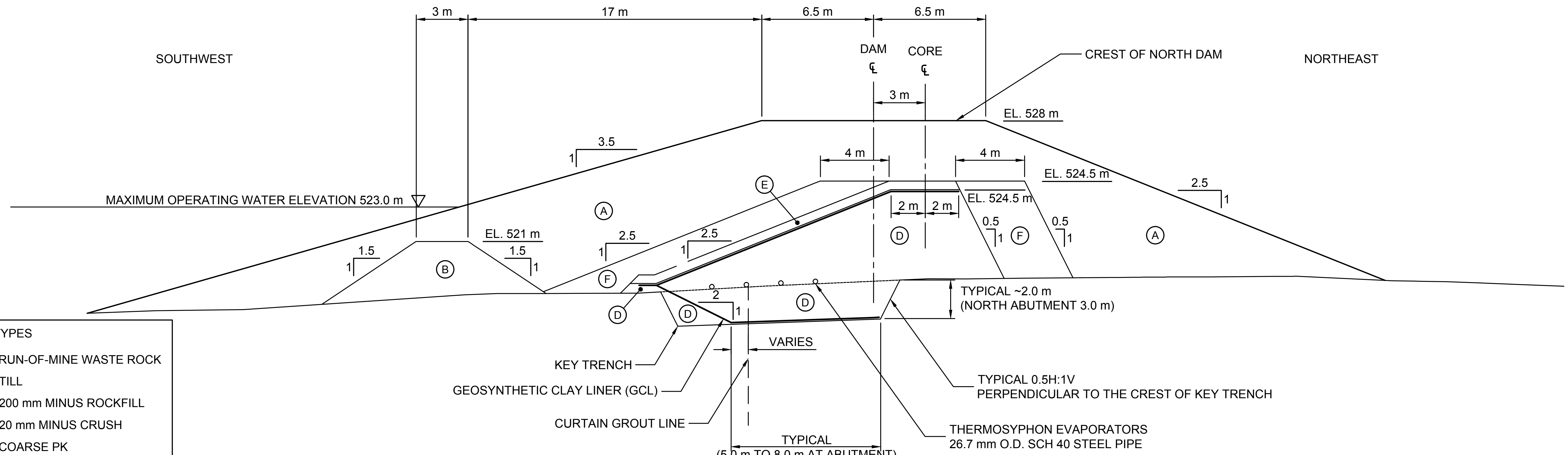
PROJECT NO.	DWN	CKD	REV
E14101140	EL	NG	0
OFFICE	DATE		
EDM	August 15, 2011		

Figure 11



RAISED SOUTHEAST DAM - TYPICAL CROSS-SECTION

1:250



NORTH DAM - TYPICAL CROSS-SECTION

1:250

MATERIAL TYPES

A	RUN-OF-MINE WASTE ROCK
B	TILL
C	200 mm MINUS ROCKFILL
D	20 mm MINUS CRUSH
E	COARSE PK
F	150 mm MINUS ROCKFILL
(grey box)	CONSTRUCTED TO DATE

STATUS
ISSUED FOR USE

CLIENT
shear diamonds

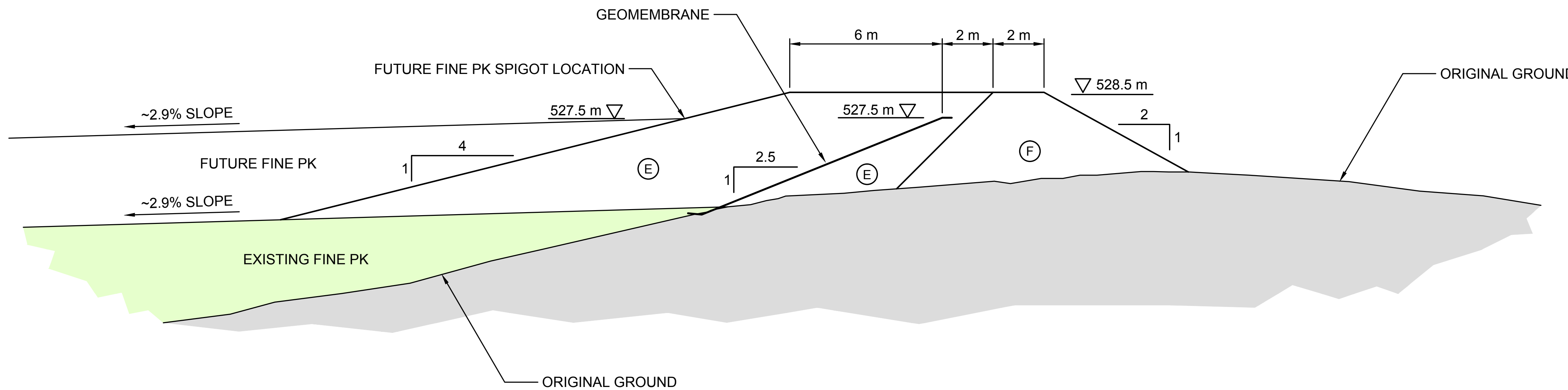
eba
A TETRA TECH COMPANY

PROCESSED KIMBERLITE MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

RAISED SOUTHEAST DAM AND NORTH DAM TYPICAL CROSS-SECTIONS

PROJECT NO.	DWN	CKD	REV
E14101140	EL	NG	0
OFFICE	DATE		
EDM	August 15, 2011		

Figure 12



PERIMETER BERM - TYPICAL CROSS-SECTION
1:200

MATERIAL TYPES	
A	RUN-OF-MINE WASTE ROCK
B	TILL
C	200 mm MINUS ROCKFILL
D	20 mm MINUS CRUSH
E	COARSE PK
F	150 mm MINUS ROCKFILL

Q:\Edmonton\Drafting\CIVIL3D\E141\E14101140\Production Drawings\E14101140_FIG 10-13_R0.dwg [FIGURE 13] August 15, 2011 - 1:18:19 pm (BY: LEE, ELVIN)

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PROCESSED KIMBERLITE MANAGEMENT PLAN
JERICHO DIAMOND MINE, NUNAVUT

PERIMETER BERM
TYPICAL CROSS-SECTIONS

PROJECT NO.	DWN	CKD	REV	
E14101140	EL	NG	0	**Figure 13**
OFFICE	DATE			
EDM	August 15, 2011			

APPENDIX A

APPENDIX A WATER BALANCE SUMMARY

Jericho PKCA Water/Solid Balance

Table A1 Summary of Monthly Water & Fine PK Balance of PKCA for Mean Precipitation Years

	Cell A Monthly Water Balance					Cell B Monthly Water Balance						Cell C Monthly Water Balance					Monthly Fine Tailings Balance			
Month & Mining Year	Month-End Water Pond Elevation of Cell A	Direct Cell A Percipitation - Evaporation + Runoff from Watershed of Cell A	Runoff Water Collected from Catchments of Areas A and B, Plant Site Area, and Pit Area and Sewage into Cell A	Free Water from Tailings Placed in Cell A	Water Flowing from Cell A to Cell B (Seeping through Divider Dyke A When Fine PK Ele. In Cell A < 523.0 m)	Month-End Pond Water Elevation of Cell B	Direct Cell B Percipitation - Evaporation + Runoff from Watershed of Cell B	Runoff Water Collected from Catchments of Areas A and B, Plant Site Area, and Pit Area and Sewage into Cell B	Free Water from Tailings Placed in Cell B	Water Flowing from Cell A to Cell B (Seeping through Divider Dyke A When Fine PK Ele. In Cell A < 523.0 m)	Water Flowing from Cell B into Cell C (Seeping through Divider Dyke B after Aug Year 1)	Month-End Pond Elevation of Cell C	Direct Cell C Percipitation - Evaporation + Runoff from Watershed of Cell C	Water Flowing from Cell B into Cell C (Seeping through Divider Dyke B after Aug Year 1)	Water Reclaimed from Cell C to Plant	Water Release from Cell C to Stream C3	Month-End Cumulative Volume of Fine Tailings to Cell A	Maximum Surface Elevation of Fine Tailings in Cell A	Month-End Cumulative Volume of Fine Tailings to Cell B	Maximum Surface Elevation of Fine Tailings in Cell B
	(m)	(m^3)	(m^3)	(m^3)	(m^3)	(m)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m)	(m^3)	(m)
Jul - Year -1	520.00					516.00						516.00								
Aug - Year 1	520.28	3,458	837	7,013	4,084	516.10	1,584	32,225	0	4,084	34,939	514.57	3,256	34,939	7,300	65,700	587,701	523.03	0	511.50
Sep - Year 1	520.50	5,946	810	6,787	9,028	515.68	3,449	41,892	0	9,028	65,523	513.08	5,437	65,523	7,150	89,400	595,913	523.06	0	511.50
Oct - Year 1	520.55	521	837	7,013	8,908	515.08	310	3,222	0	8,908	26,675	514.64	451	26,675	0	0	604,398	523.09	0	511.50
Nov - Year 1	520.64	0	810	6,787	6,406	515.10	0	0	0	6,406	5,931	514.92	0	5,931	0	0	612,610	523.12	0	511.50
Dec - Year 1	520.92	0	837	7,013	0	515.02	0	0	0	0	1,610	515.00	0	1,610	0	0	621,096	523.15	0	511.50
Jan - Year 1	521.17	0	837	7,013	0	515.01	0	0	0	0	250	515.01	0	250	0	0	629,581	523.18	0	511.50
Feb - Year 1	521.39	0	756	6,334	0	515.01	0	0	0	0	53	515.01	0	53	0	0	637,245	523.21	0	511.50
Mar - Year 1	521.63	0	837	7,013	0	515.01	0	0	0	0	17	515.01	0	17	0	0	645,731	523.24	0	511.50
Apr - Year 1	521.86	0	810	6,787	0	515.01	0	0	0	0	7	515.01	0	7	0	0	653,942	523.27	0	511.50
May - Year 1	522.10	794	837	7,013	0	515.39	623	9,667	0	0	1,765	515.13	1,047	1,765	0	0	662,428	523.31	0	511.50
Jun - Year 1	522.13	26,476	810	6,787	37,920	518.28	15,687	183,681	0	37,920	141,630	514.36	24,287	141,630	7,150	175,200	670,639	523.34	0	511.50
Jul - Year 1	521.94	3,148	837	7,013	28,658	517.12	1,545	51,560	0	28,658	127,370	515.09	5,039	127,370	7,300	109,500	679,125	523.37	0	511.50
Aug - Year 2	521.93	2,438	837	7,013	16,519	516.55	1,374	32,225	0	16,519	68,776	515.05	3,216	68,776	7,300	65,700	687,610	523.40	0	511.50
Sep - Year 2	522.05	5,765	810	6,787	12,724	516.16	3,421	41,892	0	12,724	69,345	513.97	5,406	69,345	7,150	89,400	695,822	523.43	0	511.50
Oct - Year 2	522.13	540	837	7,013	9,901	515.65	314	3,222	0	9,901	27,337	515.30	455	27,337	0	0	704,307	523.46	0	511.50
Nov - Year 2	522.25	0	810	6,787	6,715	515.68	0	0	0	6,715	5,898	515.54	0	5,898	0	0	712,519	523.49	0	511.50
Dec - Year 2	522.47	0	837	7,013	0	515.62	0	0	0	0	1,581	515.60	0	1,581	0	0	721,004	523.56	0	511.50
Jan - Year 2	522.62	0	837	7,013	0	515.61	0	0	0	0	227	515.60	0	227	0	0	729,490	523.65	0	511.50
Feb - Year 2	522.76	0	756	6,334	0	515.61	0	0	0	0	42	515.61	0	42	0	0	737,154	523.74	0	511.50
Mar - Year 2	522.92	0	837	7,013	0	515.61	0	0	0	0	13	515.61	0	13	0	0	745,639	523.83	0	511.50
Apr - Year 2	523.00	0	810	6,787	0	515.74	0	0	0	0	391	515.62	0	391	0	0	753,851	523.92	0	511.50
May - Year 2	523.00	587	837	7,013	0	516.23	563	9,667	0	0	5,295	515.85	1,003	5,295	0	0	762,336	524.01	0	511.50
Jun - Year 2	522.99	26,219	810	6,787	33,507	518.71	15,596	183,681	0	33,507	149,958	515.55	24,185	149,958	7,150	175,200	770,548	524.10	0	511.50
Jul - Year 2	522.73	2,306	837	7,013	30,170	517.76	1,157	51,560	0	30,170	125,344	516.03	4,603	125,344	7,300	109,500	779,033	524.19	0	511.50
Aug - Year 3	522.57	2,249	837	7,013	23,259	517.35	1,126	32,225	0	23,259	72,013	516.10	2,965	72,013	7,300	65,700	787,519	524.28	0	511.50
Sep - Year 3	522.52	5,794	810	6,787	19,444	517.12	3,362	41,892	0	19,444	72,958	515.43	5,334	72,958	7,150	89,400	795,731	524.37	0	511.50
Oct - Year 3	522.37	529	837	7,013	16,908	516.82	321	3,222	0	16,908	30,457	516.53	462	30,457	0	0	804,216	524.46	0	511.50
Nov - Year 3	522.29	0	810	6,787	12,833	516.95	0	0	0	12,833	8,445	516.80	0	8,445	0	0	812,428	524.55	0	511.50
Dec - Year 3	522.54	0	837	7,013	2,082	516.94	0	0	0	2,082	2,543	516.88	0	2,543	0	0	820,913	524.64	0	511.50
Jan - Year 3	522.76	0	837	7,013	747	516.94	0	0	0	747	851	516.91	0	851	0	0	829,398	524.73	0	511.50
Feb - Year 3	522.99	0	783	6,560	0	516.93	0	0	0	0	321	516.92	0	321	0	0	837,336	524.82	0	511.50
Mar - Year 3	523.00	0	837	7,013	0	517.10	0	0	0	0	1,824	516.98	0	1,824	0	0	845,822	524.91	0	511.50
Apr - Year 3	523.00	0	810	6,787	0	517.22	0	0	0	0	3,308	517.08	0	3,308	0	0	854,033	525.00	0	511.50
May - Year 3	523.00	918	837	7,013	0	517.55	464	9,667	0	0	6,787	517.30	921	6,787	0	0	862,519	525.09	0	511.50
Jun - Year 3	522.95	26,784	810	6,787	39,995	519.56	15,406	183,681	0	39,995	155,413	517.21	24,039	155,413	7,150	175,200	870,731	525.18	0	511.50
Jul - Year 3	522.51	5,106	837	7,013	31,916	518.82	265	51,560	0	31,916	124,047	517.52	3,697	124,047	7,300	109,500	879,216	525.27	0	511.50

Aug - Year 4	522.24	3,976	837	7,013	19,047	518.43	631	32,225	0	19,047	71,105	517.53	2,437	71,105	7,300	65,700	887,701	525.36	0	511.50
Sep - Year 4	522.25	6,150	810	6,787	15,957	518.20	3,261	41,892	0	15,957	71,323	516.97	5,246	71,323	7,150	89,400	895,913	525.45	0	511.50
Oct - Year 4	522.07	495	837	7,013	11,995	517.90	330	3,222	0	11,995	28,201	517.75	473	28,201	0	0	904,398	525.53	0	511.50
Nov - Year 4	522.11	0	810	6,787	7,174	517.95	0	0	0	7,174	5,529	517.88	0	5,529	0	0	912,610	525.60	0	511.50
Dec - Year 4	522.56	0	837	7,013	2,018	517.96	0	0	0	2,018	1,639	517.92	0	1,639	0	0	921,096	525.67	0	511.50
Jan - Year 4	522.87	0	837	7,013	777	517.96	0	0	0	777	782	517.94	0	782	0	0	929,581	525.75	0	511.50
Feb - Year 4	523.00	0	756	6,334	0	518.03	0	0	0	0	1,064	517.96	0	1,064	0	0	937,245	525.81	0	511.50
Mar - Year 4	523.00	0	837	7,013	0	518.13	0	0	0	0	3,341	518.04	0	3,341	0	0	945,731	525.88	0	511.50
Apr - Year 4	523.00	0	810	6,787	0	518.22	0	0	0	0	3,735	518.13	0	3,735	0	0	953,942	525.95	0	511.50
May - Year 4	523.00	1,149	837	7,013	0	518.49	368	9,667	0	0	6,953	518.30	823	6,953	0	0	962,428	526.02	0	511.50
Jun - Year 4	523.00	27,136	810	6,787	23,222	520.03	15,279	183,681	0	23,222	150,933	518.13	23,855	150,933	7,150	175,200	970,639	526.09	0	511.50
Jul - Year 4	522.81	5,951	837	7,013	17,669	519.27	-181	51,560	0	17,669	115,403	518.18	3,362	115,403	7,300	109,500	979,125	526.16	0	511.50
Aug - Year 5	522.78	3,934	837	7,013	12,842	518.87	394	32,225	0	12,842	67,098	518.10	2,297	67,098	7,300	65,700	987,610	526.23	0	511.50
Sep - Year 5	522.89	6,093	810	6,787	12,427	518.63	3,210	41,892	0	12,427	69,145	517.56	5,185	69,145	7,150	89,400	995,822	526.30	0	511.50
Oct - Year 5	522.81	504	837	7,013	10,315	518.35	335	3,222	0	10,315	27,164	518.22	476	27,164	0	0	1,004,307	526.37	0	511.50
Nov - Year 5	522.84	0	810	6,787	7,738	518.40	0	0	0	7,738	5,399	518.34	0	5,399	0	0	1,012,519	526.44	0	511.50
Dec - Year 5	523.00	0	837	7,013	0	518.47	0	0	0	0	2,739	518.40	0	2,739	0	0	1,021,004	526.51	0	511.50
Jan - Year 5	523.00	0	837	7,013	0	518.55	0	0	0	0	3,735	518.49	0	3,735	0	0	1,029,490	526.58	0	511.50
Feb - Year 5	523.00	0	756	6,334	0	518.63	0	0	0	0	3,118	518.56	0	3,118	0	0	1,037,154	526.65	0	511.50
Mar - Year 5	523.00	0	837	7,013	0	518.72	0	0	0	0	3,780	518.64	0	3,780	0	0	1,045,639	526.72	0	511.50
Apr - Year 5	523.00	0	810	6,787	0	518.79	0	0	0	0	3,705	518.72	0	3,705	0	0	1,053,851	526.79	0	511.50
May - Year 5	523.00	1,308	837	7,013	0	519.04	298	9,667	0	0	6,827	518.88	785	6,827	0	0	1,062,336	526.86	0	511.50
Jun - Year 5	523.00	27,397	810	6,787	864	520.40	15,192	183,681	0	864	151,092	518.72	23,793	151,092	7,150	175,200	1,070,548	526.93	0	511.50
Jul - Year 5	523.00	6,869	837	7,013	0	519.67	-541	51,560	0	0	113,129	518.71	3,101	113,129	7,300	109,500	1,079,033	527.00	0	511.50
Aug - Year 6	523.00	4,391	837	7,013	0	519.30	165	32,225	0	0	66,151	518.61	2,154	66,151	7,300	65,700	1,087,519	527.07	0	511.50
Sep - Year 6	523.00	6,211	810	6,787	0	519.10	3,156	41,892	0	0	70,172	518.13	5,155	70,172	7,150	89,400	1,095,731	527.14	0	511.50
Oct - Year 6	523.00	492	837	7,013	0	518.83	341	3,222	0	0	26,003	518.72	480	26,003	0	0	1,104,216	527.21	0	511.50
Nov - Year 6	523.00	0	810	6,787	0	518.88	0	0	0	0	4,952	518.83	0	4,952	0	0	1,112,428	527.28	0	511.50
Dec - Year 6	523.00	0	837	7,013	0	518.96	0	0	0	0	3,640	518.90	0	3,640	0	0	1,120,913	527.35	0	511.50
Jan - Year 6	523.00	0	837	7,013	0	519.04	0	0	0	0	3,761	518.98	0	3,761	0	0	1,129,398	527.42	0	511.50
Feb - Year 6	523.00	0	756	6,334	0	519.11	0	0	0	0	3,036	519.05	0	3,036	0	0	1,137,063	527.48	0	511.50
Mar - Year 6	523.00	0	162	1,357	0	519.19	0	675	5,655	0	3,684	519.12	0	3,684	0	0	1,138,957	527.50	6,591	514.37
Apr - Year 6	523.00	0	0	0	0	519.26	0	810	6,787	0	3,610	519.19	0	3,610	0	0	1,138,957	527.50	14,803	516.09
May - Year 6	523.00	1,454	0	0	0	519.46	242	10,504	7,013	0	6,293	519.33	755	6,293	0	0	1,138,957	527.50	23,288	517.31
Jun - Year 6	523.00	27,620	0	0	0	520.49	15,147	184,491	6,787	0	140,791	518.98	23,750	140,791	7,150	175,200	1,138,957	527.50	31,500	517.92
Jul - Year 6	523.00	7,753	0	0	0	519.74	-628	52,397	7,013	0	107,540	518.84	3,015	107,540	7,300	109,500	1,138,957	527.50	39,985	518.56
Aug - Year 7	523.00	4,846	0	0	0	519.35	129	33,062	7,013	0	63,676	518.69	2,125	63,676	7,300	65,700	1,138,957	527.50	48,471	519.09
Sep - Year 7	523.00	6,299	0	0	0	519.08	3,154	42,702	6,787	0	67,356	518.15	5,151	67,356	7,150	89,400	1,138,957	527.50	56,682	519.39
Oct - Year 7	523.00	485	0	0	0	518.82	341	4,059	7,013	0	25,003	518.72	480	25,003	0	0	1,138,957	527.50	65,168	519.70
Nov - Year 7	523.00	0	0	0	0	518.88	0	810	6,787	0	4,857	518.82	0	4,857	0	0	1,138,957	527.50	73,380	519.99
Dec - Year 7	523.00	0	0	0	0	518.96	0	837	7,013	0	3,637	518.90	0	3,637	0	0	1,138,957	527.50	81,865	520.30
Jan - Year 7	523.00	0	0	0	0	519.04	0	837	7,013	0	3,769	518.98	0	3,769	0	0	1,138,957	527.50	90,350	520.61
Feb - Year 7	523.00	0	0	0	0	519.11	0	783	6,560	0	3,150	519.05	0	3,150	0	0	1,138,957	527.50	98,288	520.89
Mar - Year 7	523.00	0	0	0	0	519.19	0	837	7,013	0	3,687	519.12	0	3,687	0	0	1,138,957	527.50	106,774	521.12
Apr - Year 7	523.00	0	0	0	0	519.26	0	810	6,787	0	3,611	519.19	0	3,611	0	0	1,138,957	527.50	114,985	521.30
May - Year 7	523.00	1,454	0	0	0	519.46	242	10,504	7,013	0	6,292	519.33	755	6,292	0	0	1,138,957	527.50	123,471	521.49
Jun - Year 7	523.00	27,620	0	0	0	520.49	15,147	184,491	6,787	0	140,788	518.97	23,750	140,788	7,150	175,200	1,138,957	527.50	131,682	521.67
Jul - Year 7	523.00	7,753	0	0	0	519.74	-627	52,397	7,013	0	107,541	518.84	3,016	107,541	7,300	109,500	1,138,957	527.50	140,168	521.85
Aug - Year 8	523.00	4,846	0	0	0	519.35	130	33,062	7,013	0	63,677	518.69	2,125	63,677	7,300	65,700	1,138,957	527.50	148,653	522.04
Sep - Year 8	523.00	6,299	0	0	0	519.08	3,154	42,702	6,787	0	67,356	518.15	5,151	67,356	7,150	89,400	1,138,957	527.50	156,865	522.22
Oct - Year 8	523.00	485	0	0	0	518.82	341	4,059	7,013	0	25,003	518.72	480	25,003	0	0	1,138,957	527.50	165,350	522.40

Nov - Year 8	523.00	0	0	0	0	518.87	0	810	6,787	0	4,858	518.82	0	4,858	0	0	1,138,957	527.50	173,562	522.58
Dec - Year 8	523.00	0	0	0	0	518.96	0	837	7,013	0	3,637	518.90	0	3,637	0	0	1,138,957	527.50	182,047	522.77
Jan - Year 8	523.00	0	0	0	0	519.04	0	837	7,013	0	3,771	518.98	0	3,771	0	0	1,138,957	527.50	190,533	522.96
Feb - Year 8	523.00	0	0	0	11,575	519.26	0	756	6,334	11,575	6,057	519.10	0	6,057	0	0	1,138,957	527.50	198,197	523.10
Mar - Year 8	523.00	0	0	0	0	519.30	0	837	7,013	0	5,896	519.22	0	5,896	0	0	1,138,957	527.50	206,682	523.25
Apr - Year 8	523.00	0	0	0	0	519.36	0	810	6,787	0	3,851	519.30	0	3,851	0	0	1,138,957	527.50	214,894	523.39
May - Year 8	523.00	613	0	0	0	519.56	228	10,504	7,013	0	6,292	519.44	748	6,292	0	0	1,138,957	527.50	223,380	523.54
Jun - Year 8	523.00	26,130	0	0	26,726	520.79	15,105	184,491	6,787	26,726	151,593	519.30	23,729	151,593	7,150	175,200	1,138,957	527.50	231,591	523.68
Jul - Year 8	523.00	1,873	0	0	24,701	520.26	-1,008	52,397	7,013	24,701	119,828	519.41	2,803	119,828	7,300	109,500	1,138,957	527.50	240,077	523.83
Aug - Year 9	523.00	1,547	0	0	14,480	520.08	-170	25,596	5,429	14,480	57,938	519.47	1,501	57,938	5,652	50,865	1,138,957	527.50	246,646	523.94

TABLE 8: ANNUAL INFLOWS AND OUTFLOWS TO CELLS UNDER MEAN PRECIPITATION YEARS

Month Beginning Year	Cell A Yearly Water Balance					Cell B Yearly Water Balance						Cell C Yearly Water Balance				
	Year-End Pond Water of Cell A*	Direct Cell A Precipitation – Evaporation + Runoff from Watershed of Cell A	Runoff Water Collected from Catchments of Areas A and B, Plant Site Area, and Pit Area and Sewage into Cell A	Free Water from Tailings Placed in Cell A	Water Flowing from Cell A to Cell B (Seeping through Divider Dyke A when Fine PK Ele. In Cell A <524.0 m	Year End Pond Water Elevation of Cell B	Direct Cell B Precipitation -- Evaporation + Runoff from Watershed of Cell B	Runoff Water Collected from Catchments of Areas A and B, Plant Site Area, and Pit Area and Sewage into Cell B	Free Water from Tailings Placed in Cell B	Water Flowing from Cell A to Cell B (Seeping through Divider Dyke A when fine PK Ele. In Cell A <524.0 m)	Water Flowing from Cell B into Cell C (Seeping through Divider Dyke B after Year 1	Year End Pond Water Elevation of Cell C	Direct Cell C Precipitation – Evaporation + Runoff from Watershed of Cell C	Water Flowing from Cell B to Cell C (Seeping through Divider Dyke B after Year 1	Water Reclaimed from Cell C to Plant	Water Release from Cell C to Stream C3
	(m)	(m^3)	(m^3)	(m^3)	(m^3)	(m)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m)	(m^3)	(m^3)	(m^3)	(m^3)
Aug-Year 1	520.28	40,343	9,855	82,570	95,003	516.10	23,197	322,247	0	95,003	405,769	514.57	39,517	405,769	28,900	439,800
Aug-Year 2	521.93	37,854	9,855	82,570	109,535	516.55	22,424	322,247	0	109,535	454,206	515.05	38,867	454,206	28,900	439,800
Aug-Year 3	522.57	41,380	9,882	82,796	147,184	517.35	20,943	322,247	0	147,184	478,967	516.10	37,417	478,967	28,900	439,800
Aug-Year 4	522.24	44,856	9,855	82,570	97,859	518.43	19,688	322,247	0	97,859	460,008	517.53	36,196	460,008	28,900	439,800
Aug-Year 5	522.78	46,105	9,855	82,570	44,185	518.87	18,889	322,247	0	44,185	456,932	518.10	35,637	456,932	28,900	439,800
Aug-Year 6	523.00	47,920	5,886	49,316	0	519.30	18,421	326,216	33,254	0	439,634	518.61	35,309	439,634	28,900	439,800
Aug-Year 7	523.00	48,455	0	0	0	519.35	18,385	332,129	82,796	0	433,367	518.69	35,277	433,367	28,900	439,800
Aug-Year 8	523.00	40,246	0	0	63,002	519.35	17,949	332,102	82,570	63,002	461,819	518.69	35,036	461,819	28,900	439,800
Aug-Year 9	523.00	1,547	0	0	14,480	520.08	-170	25,596	5,429	14,480	57,938	519.47	1,501	57,938	5,652	50,865

APPENDIX B

APPENDIX B FLOCCULANT DATA SHEETS

MATERIAL SAFETY DATA SHEET

1. IDENTIFICATION OF THE PRODUCT AND THE COMPANY

Product name : **FLO POLYMER CV4120B**

Company : **SNF INC**

PO BOX 250

Riceboro, GA 31324

Telephone number : 912-884-3366 ***Fax :*** 912-884-5031

Product Use : Process aid for industrial applications.

2. COMPOSITION/INFORMATION ON INGREDIENTS

Identification of the preparation : Cationic water-soluble polymer

Components		*CAS-No*	*Weight %*
Polydiallyldimethylammonium chloride (PolyDADMAC)	R52/53	26062-79-3	> 85

3. HAZARDS IDENTIFICATION

Aqueous solutions or powders that become wet render surfaces extremely slippery.

Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

4. FIRST AID MEASURES

Inhalation : No hazards which require special first aid measures.

Skin contact : No hazards which require special first aid measures. Wash with water and soap as a precaution. In case of persistent skin irritation, consult a physician.

Eye contact : Rinse thoroughly with plenty of water, also under the eyelids. In case of persistent eye irritation, consult a physician.

Ingestion : No hazards which require special first aid measures. The product is not considered toxic based on studies on laboratory animals.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media : water, water spray, foam, carbon dioxide (CO2), dry powder

Fire extinguishing agents to avoid : None.

Special fire-fighting precautions : Aqueous solutions or powders that become wet render surfaces extremely slippery.

Special protective equipment for firefighters : No special protective equipment required..

6. ACCIDENTAL RELEASE MEASURES

Personal precautions : No special precautions required.

Environmental precautions : Do not contaminate water.

Methods for cleaning up : Do not flush with water. Clean up promptly by scoop or vacuum. Keep in suitable and closed containers for disposal. After cleaning, flush away traces with water.

7. HANDLING AND STORAGE

Handling : Avoid contact with skin and eyes. Avoid dust formation. Do not breathe dust. Wash hands before breaks and at the end of workday.

Storage : Keep in a dry, cool place (0 - 35°C).

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures to reduce exposure: Use local exhaust if dusting occurs. Natural ventilation is adequate in absence of dusts.

Personal protection equipment

- ***Respiratory protection :*** Dust safety masks are recommended where concentration of total dust is more than 10 $mg/m^{3.}$
- ***Hand protection :*** Rubber gloves.
- ***Eye protection :*** Safety glasses with side-shields. Do not wear contact lenses.
- ***Skin and body protection :*** Chemical resistant apron or protective suit if splashing or repeated contact with solution is likely.

Hygiene measures : Wash hands before breaks and at the end of workday. Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form : granular solid

Colour : white

Odour : slight

pH : 2.5 - 4.5 @ 5g/l for product series. See Technical Bulletin for specific value.

Melting point (°C) : Not applicable.

Flash point (°C) : Not applicable.

Autoignition temperature (°C) : Not applicable.

Vapour pressure (mm Hg) : Not applicable.

Bulk density : See Technical Bulletin.

Water solubility : See Technical Bulletin.

Viscosity (mPa.s) : See Technical Bulletin.

10. STABILITY AND REACTIVITY

Stability : Product is stable, no hazardous polymerization will occur.

Materials to avoid : Oxidizing agents may cause exothermic reactions.

Hazardous decomposition products : Thermal decomposition may produce : hydrogen chloride gas, nitrogen oxides (NOx), carbon oxides.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

- Oral : Based on studies on similar products, this material is not expected to be toxic.

- Dermal : Based on studies on similar products, this material is not expected to be toxic.

- Inhalation : Based on studies on similar products, this material is not expected to be toxic.

Irritation

- Skin : By analogy with similar products, this product is not expected to be irritating.

- Eyes : By analogy with similar products tested according to the Draize technique this material should produce no corneal or iridial effects and only slight transitory conjuctival effects similar to those which all granular materials have on conjuctivae.

Sensitization : By analogy with similar products, this product is not expected to be sensitizing.

Chronic toxicity : By analogy with similar products, this product is not expected to demonstrate chronic toxic effects.

12. ECOLOGICAL INFORMATION

Acute aquatic toxicity

- Fish : LC50/*Danio rerio* /96 hours > 10 mg/L (OECD 203) (Based on results obtained from tests on analogous products.)

- Daphnids : EC50/*Daphnia magna* /48 hours > 10 mg/L (OECD 202) (Based on results obtained from tests on analogous products.)

- Algae : Algal inhibition tests are not appropriate. The flocculating characteristics of the product interfere directly in the test medium preventing homogenous distribution which invalidates the test.

- Hydrolysis: Does not hydrolyse.

- Biodegradation: Not readily biodegradable.

- LogP$_{OW}$: 0

- Bioaccumulation : Does not bioaccumulate.

Other ecological information

The effects of this product on aquatic organisms are rapidly and significantly mitigated by the presence of dissolved organic carbon in the aquatic environment.

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products : In accordance with local and national regulations.

Contaminated packaging : Rinse empty containers with water and use the rinse water to prepare the working solution. Can be landfilled or incinerated, when in compliance with local regulations.

14. TRANSPORT INFORMATION

Remarks : Not classified as dangerous in the meaning of transport regulations.

15. REGULATORY INFORMATION

The product is classified and labelled in accordance with EC directives or respective national laws.

R -phrase(s) : R52/53 - Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

S -phrase(s) : S61 -Avoid release to the environment. Refer to special instructions/Safety data sheets.

Inventory status :

EINECS (Europe) : Existing polymer according to the definition in the 7th Amendment to Directive 67/548/EEC. All starting materials and additives are listed in EINECS.

TSCA (USA) : Complies with all applicable rules or orders under TSCA.

16. OTHER INFORMATION

Further information :

This MSDS was prepared in accordance with the following:

Council Directive 92/32/EEC of 30 April 1992 amending for the seventh time Directive 67/548/EEC on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances and all subsequent adaptations to technical progress

Directive 1999/45/EC of the European Parliament and of the Council of 31 May 1999 concerning the approximation of the laws, regulations and administrative provisions of the Member States relating to the classification, packaging and labelling of dangerous preparations

Commission Directive 2001/58/EC of 27 July 2001 amending for the second time Directive 91/155/EEC defining and laying down the detailed arrangements for the system of specific information relating to dangerous preparations in implementation of Article 14 of European Parliament and Council Directive 1999/45/EC and relating to dangerous substances in implementation of Article 27 of Council Directive 67/548/EEC (safety data sheets)

ISO 11014-1: Material Safety Data Sheet for Chemical Products.

Person to contact : Regulatory Affairs

MATERIAL SAFETY DATA SHEET

1. IDENTIFICATION OF THE PRODUCT AND THE COMPANY

FLO POLYMER AE 4500

Supplier :

SNF INC

PO Box 250

Riceboro, Georgia 31323

Tel : 912-884-3366 Fax : 912-884-5031

2. COMPOSITION/INFORMATION ON INGREDIENTS

Identification of the preparation : Anionic water-soluble polymer

3. HAZARDS IDENTIFICATION

Aqueous solutions or powders that become wet render surfaces extremely slippery

4. FIRST AID MEASURES

Inhalation : Move to fresh air.

Skin contact : Wash with water and soap as a precaution. In case of persistent skin irritation, consult a physician

Eye contact : Rinse thoroughly with plenty of water, also under the eyelids. In case of persistent eye irritation, consult a physician.

Ingestion : The product is not considered toxic based on studies on laboratory animals

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media : Water, water spray, foam, carbon dioxide (CO2), dry powder

Special fire-fighting precautions : Aqueous solutions or powders that become wet render surfaces extremely slippery

Protective equipment for firefighters : No special protective equipment required.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions : No special precautions required.

Environmental precautions : Do not contaminate water.

Methods for cleaning up : Do not flush with water. Clean up promptly by sweeping or vacuum. Keep in suitable and closed containers for disposal. After cleaning, flush away traces with water.

7. HANDLING AND STORAGE

Handling : Avoid contact with skin and eyes. Avoid dust formation. Do not breathe dust. Wash hands before breaks and at the end of workday.

Storage : Keep in a dry, cool place (0-35ˆ°ˆC).

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering controls : Use local exhaust if dusting occurs. Natural ventilation is adequate in absence of dusts

<u>Personal protection equipment</u>

- ***Respiratory protection :*** Dust safety masks are recommended where concentration of total dust is more than 10 mg/m^3
- ***Hand protection :*** Rubber gloves.
- ***Eye protection :*** Safety glasses with side-shields. Do not wear contact lenses.
- ***Skin protection :*** Chemical resistant apron or protective suit if splashing or contact with solution is likely.

Hygiene measures : Wash hands before breaks and at the end of workday.Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form :	granular solid
Color :	white
Odor :	none
pH :	4-9 @ 5 g/l
Melting point (°C) :	Not applicable
Flash point (°C) :	Not applicable
Autoignition temperature (°C) :	Not applicable
Vapour pressure (mm Hg) :	Not applicable
Bulk density :	See Technical Bulletin
Water solubility :	See Technical Bulletin
Viscosity (mPa s) :	See Technical Bulletin

10. STABILITY AND REACTIVITY

Stability : Product is stable. No hazardous polymerization will occur.

Conditions to avoid : Oxidizing agents may cause exothermic reactions

Hazardous decomposition products : Thermal decomposition may produce: nitrogen oxides (NOx), carbon oxides

11. TOXICOLOGICAL INFORMATION

<u>Acute toxicity</u>

- Oral : LD50/oral/rat > 5000 mg/kg

- Dermal : The results of testing on rabbits showed this material to be non-toxic even at high dose levels.

- Inhalation : The product is not expected to be toxic by inhalation.

<u>Irritation</u>

- Skin : The results of testing on rabbits showed this material to be non-irritating to the skin.

- Eyes : Testing conducted according to the Draize technique showed the material produces no corneal or iridial effects and only slight transitory conjuctival effects similar to those which all granular materials have on conjuctivae.

Sensitization : The results of testing on guinea pigs showed this material to be non-sensitizing.

Chronic toxicity : A two-year feeding study on rats did not reveal adverse health effects. A two-year feeding study on dogs did not reveal adverse health effects.

12. ECOLOGICAL INFORMATION

- Fish LC50/Danio rerio/96 hr > 100 mg/L (OECD 203) (Based on results obtained from tests of analogous products.)

- Algae : IC50/Scenedesmus subspicatus/72hr > 100 mg/L (OECD 201) (Based on results obtained from tests of analogous products.)

- Daphnia : EC50 /Daphnia magna/48 hr > 100 mg/L (OECD 202) (Based on results obtained from tests of analogous products.)

Bioaccumulation : Does not bioaccumulate.

Persistence / degradability : Not readily biodegradable.

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products : In accordance with federal, state and local regulations.

Contaminated packaging : Rinse empty containers with water and use the rinse water to prepare the working solution. Can be landfilled or incinerated, when in compliance with local regulations.

14. TRANSPORT INFORMATION

Not regulated by DOT.

15. REGULATORY INFORMATION

All components of this product are on the TSCA and DSL inventories

RCRA status : Not a hazardous waste.

Hazardous waste number : Not applicable

Reportable quantity (40 CFR 302) : Not applicable

Threshold planning quantity (40 CFR 355) Not applicable

California Proposition 65 information : The following statement is made in order to comply with the CA Safe Drinking Water and Toxic Enforcement Act of 1986: This product contains a chemical known to the State of California to cause cancer: residual acrylamide.

HMIS & NFPA Ratings	HMIS	NFPA
Health :	1	1
Flammability :	1	1
Reactivity :	0	0

16. OTHER INFORMATION

Person to contact : Regulatory Affairs Manager

APPENDIX C

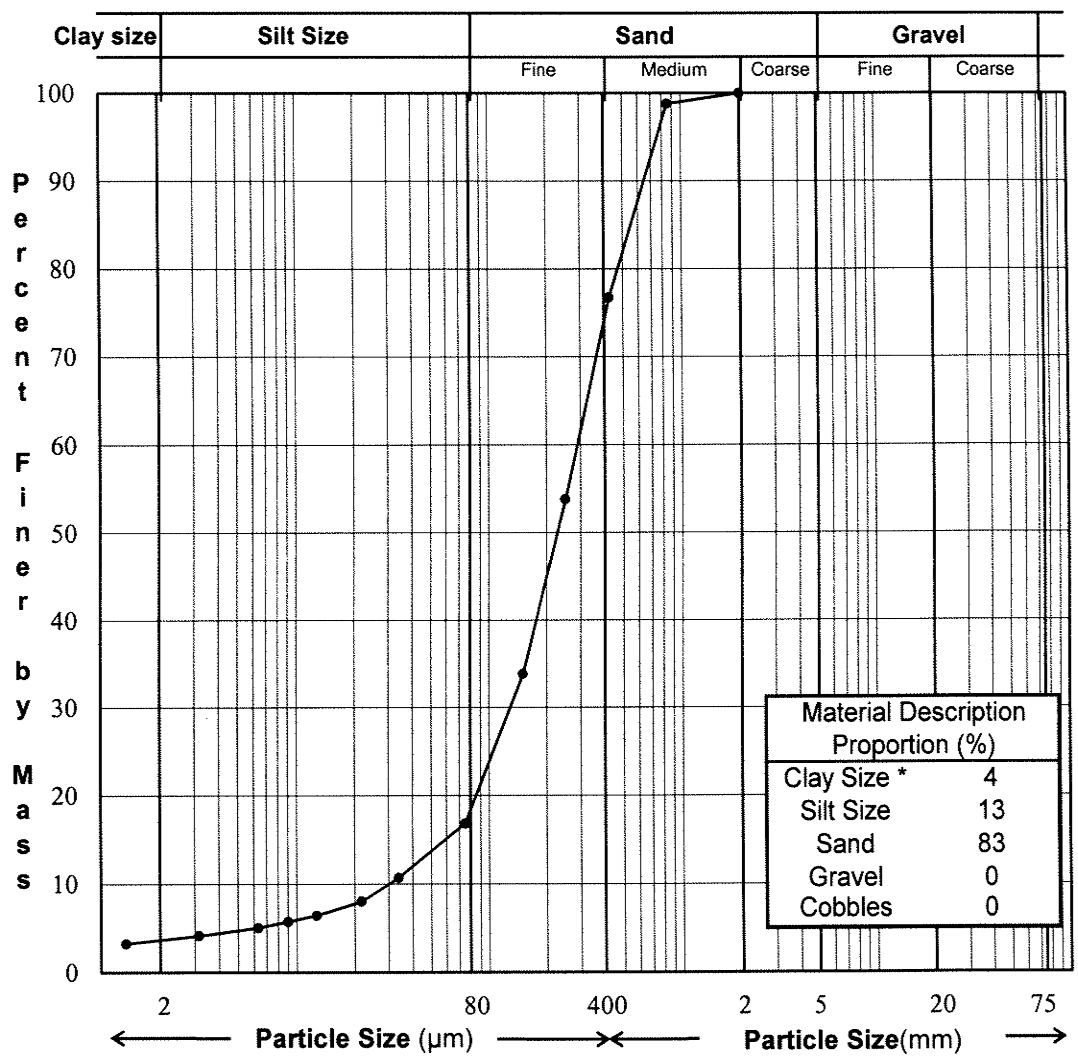
APPENDIX C COARSE AND FINE PK GEOTECHNICAL TEST RESULTS

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project:	Water Lic. Renewal-Jericho Mine	Sample No.:	PDK 1 (6321.1)
Client:	Shear Minerals Ltd.	Borehole/ TP:	
Project No.:	E14101118	Depth:	
Location:		Date Tested	10-Jun-11 By: KTP
Description **:	SAND, some silt, trace clay.		

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
38 mm	
25 mm	
19 mm	
13 mm	
10 mm	
5 mm	
2 mm	100
850 μm	99
425 μm	77
250 μm	54
150 μm	34
75 μm	17
34 μm	11
22 μm	8
13 μm	6
9 μm	6
6 μm	5
3 μm	4
1 μm	3



Material Description	Proportion (%)
Clay Size *	4
Silt Size	13
Sand	83
Gravel	0
Cobbles	0

Remarks: * The upper clay size of 2 μm is as per the Canadian Foundation Manual.
** The description is behaviour based & subject to EBA description protocols.

Reviewed By: ______________________ P.Eng.

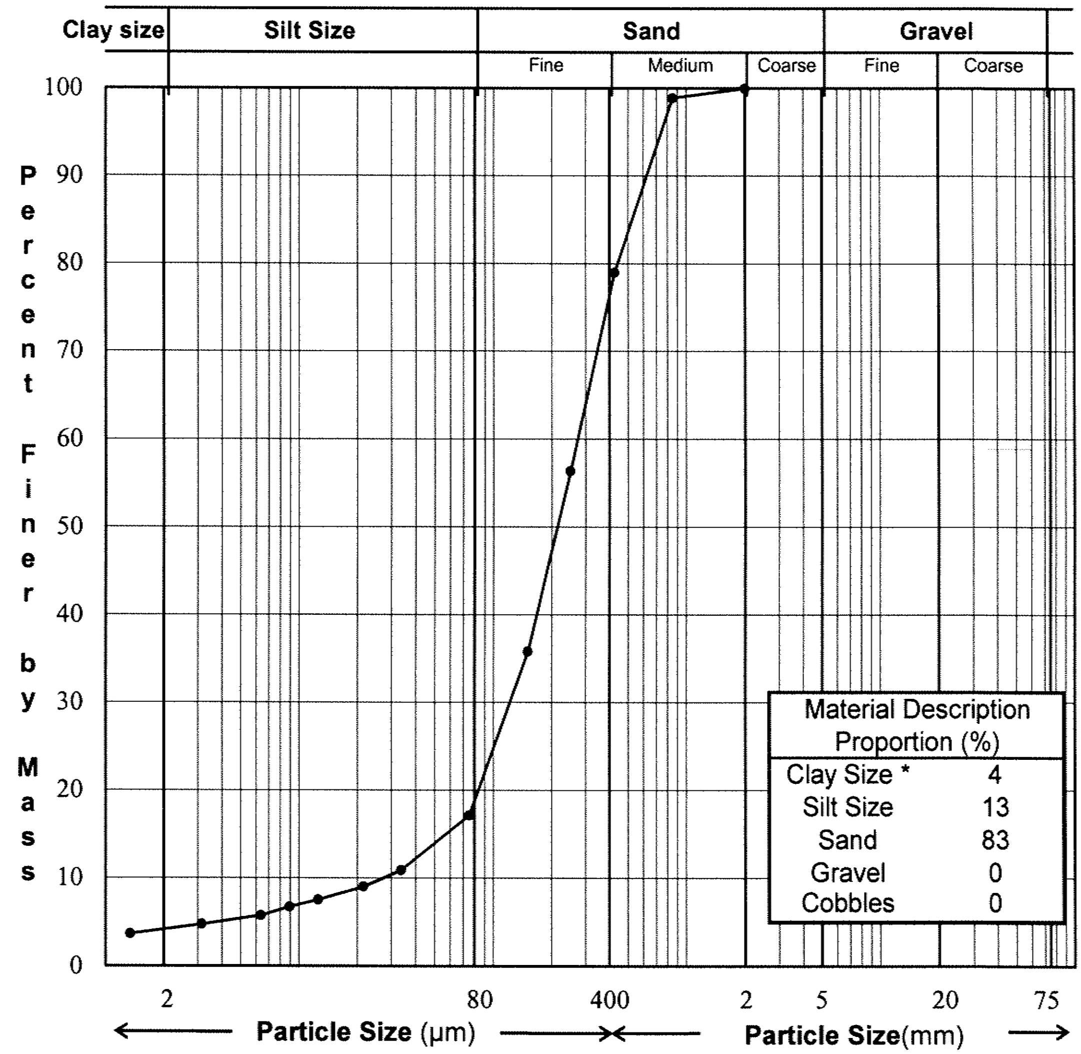
eba A TETRA TECH COMPANY

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project:	Water Lic. Renewal-Jericho Mine	Sample No.:	PDK 2 (6321.2)
Client:	Shear Minerals Ltd.	Borehole/ TP:	
Project No.:	E14101118	Depth:	
Location:		Date Tested	10-Jun-11 By: KTP
Description **:	SAND, some silt, trace clay.		

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
38 mm	
25 mm	
19 mm	
13 mm	
10 mm	
5 mm	
2 mm	100
850 μm	99
425 μm	79
250 μm	56
150 μm	36
75 μm	17
34 μm	11
22 μm	9
13 μm	8
9 μm	7
6 μm	6
3 μm	5
1 μm	4



Remarks: * The upper clay size of 2 μm is as per the Canadian Foundation Manual.
** The description is behaviour based & subject to EBA description protocols.

Reviewed By: ______________________ P.Eng.

ATTERBERG LIMITS TEST FORM

ASTM D4318

Project: Water Lic. Renewal - Jericho Mine

Sample Number: FPK 10

Borehole Number:

Project Number: E14101118

Source:

Sample Description:

Date Sampled:

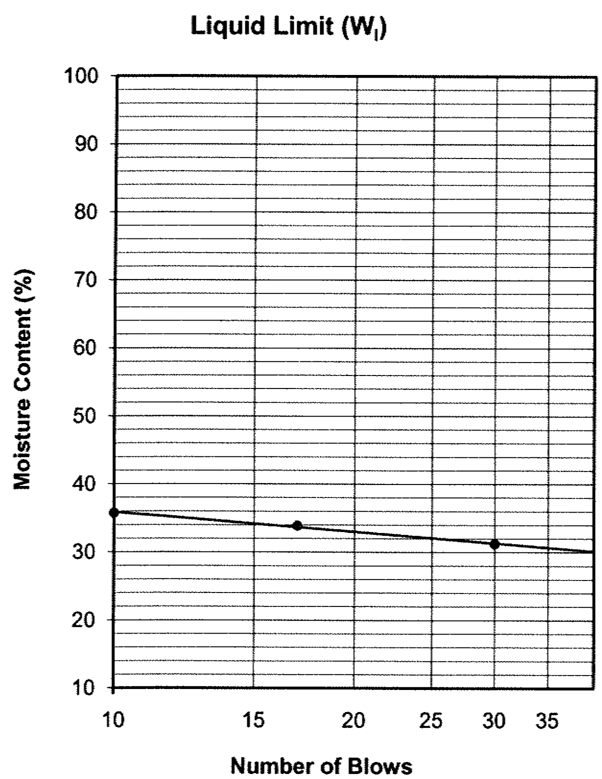
Sampled By:

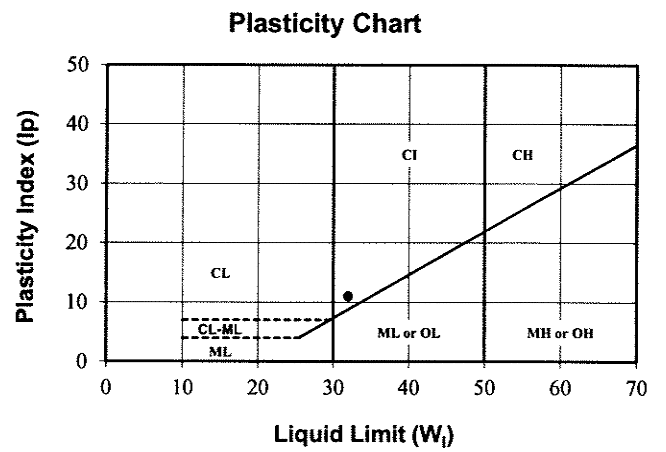
Date Tested: 23-Jun-11

Tested By: KTP

Plastic Limit Test			Natural Moisture
Trial Number	1	2	
Tare Number	a	b	
Mass Wet Soil + Tare	11.70	11.77	
Mass Dry Soil + Tare	10.29	10.34	
Mass of Tare	3.53	3.45	
Mass of Water	1.41	1.43	
Mass of Dry Soil	6.76	6.89	
Moisture Content (%)	20.9	20.8	

Liquid Limit Test			
Trial Number	1	2	3
No. of Blows	30	17	10
Tare Number	c	d	e
Mass Wet Soil + Tare	41.12	41.83	39.40
Mass Dry Soil + Tare	32.23	32.26	30.02
Mass of Tare	3.75	4.01	3.76
Mass of Water	8.89	9.57	9.38
Mass of Dry Soil	28.48	28.25	26.26
Moisture Content (%)	31.2	33.9	35.7





Natural Moisture (%)	
Liquid Limit (%)	32
Plastic Limit (%)	21
PLASTICITY INDEX	**11**
Soil Plasticity:	Medium
Mod.USCS Symbol:	CI

Remarks:

This Form is for Internal use only, see Report

reviewed by: ____

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ATTERBERG LIMITS TEST FORM

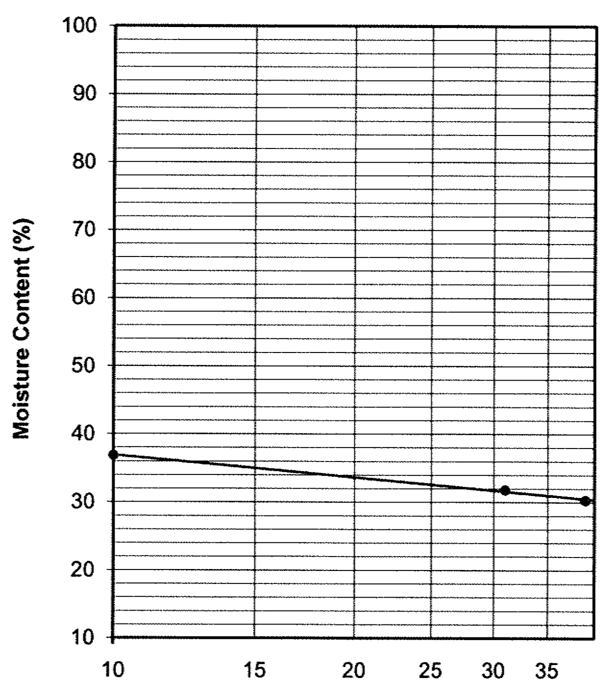
ASTM D4318

Project:	Water Lic. Renewal - Jericho Mine	Sample Number:	FPK 11
		Borehole Number:	
Project Number:	E14101118	Source:	
Sample Description:		Date Sampled:	Sampled By:
		Date Tested: 23-Jun-11	Tested By: KTP

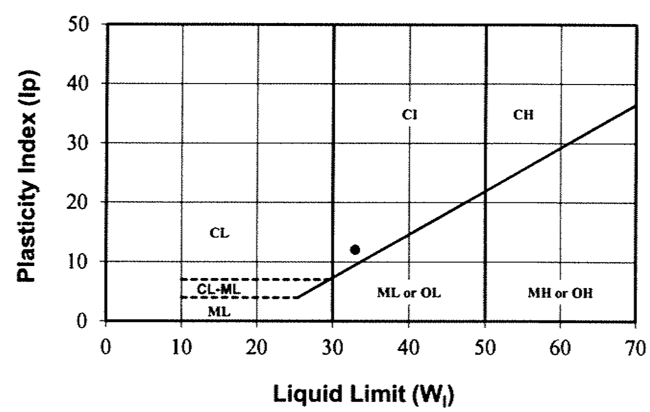
Plastic Limit Test			Natural Moisture
Trial Number	1	2	
Tare Number	a	b	
Mass Wet Soil + Tare	12.46	12.41	
Mass Dry Soil + Tare	10.93	10.90	
Mass of Tare	3.51	3.50	
Mass of Water	1.53	1.51	
Mass of Dry Soil	7.42	7.40	
Moisture Content (%)	20.6	20.4	

Liquid Limit Test			
Trial Number	1	2	3
No. of Blows	39	31	10
Tare Number	c	d	e
Mass Wet Soil + Tare	39.55	42.00	42.69
Mass Dry Soil + Tare	31.18	32.72	32.22
Mass of Tare	3.56	3.55	3.83
Mass of Water	8.37	9.28	10.47
Mass of Dry Soil	27.62	29.17	28.39
Moisture Content (%)	30.3	31.8	36.9

Liquid Limit (W_l)



Plasticity Chart



Natural Moisture (%)	
Liquid Limit (%)	33
Plastic Limit (%)	21
PLASTICITY INDEX	**12**
Soil Plasticity:	Medium
Mod.USCS Symbol:	CI

Remarks:

This Form is for Internal use only, see Report

reviewed by: ____

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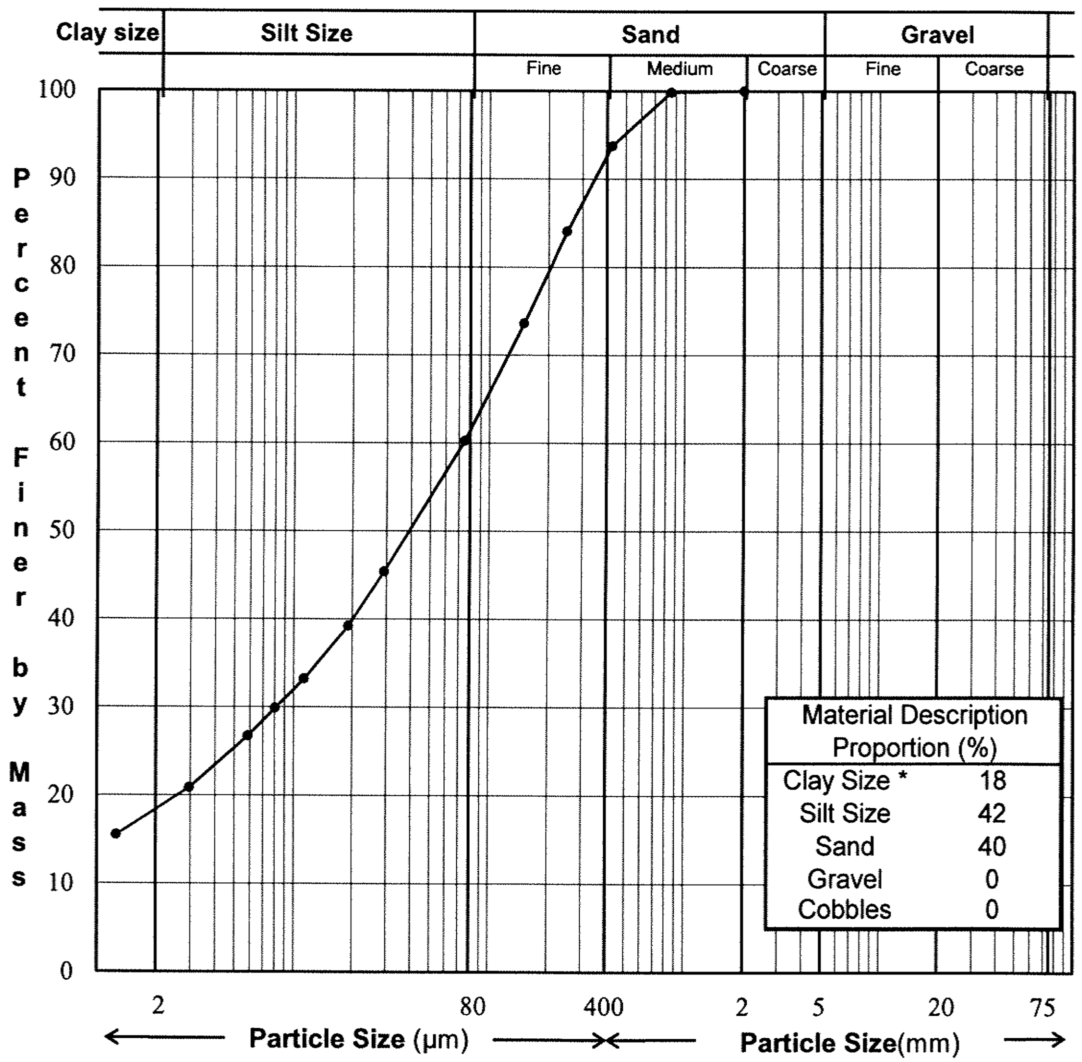
PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project:	Water Lic. Renewal-Jericho Mine	Sample No.:	FPK 8
Client:	Shear Minerals Ltd.	Borehole/ TP:	
Project No.:	E14101118	Depth:	
Location:		Date Tested	23-Jun-11 By: KTP
Description **:	SILT and SAND, clayey.		

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
38 mm	
25 mm	
19 mm	
13 mm	
10 mm	
5 mm	
2 mm	100
850 μm	100
425 μm	94
250 μm	84
150 μm	74
75 μm	60
29 μm	45
19 μm	39
11 μm	33
8 μm	30
6 μm	27
3 μm	21
1 μm	16



Material Description	Proportion (%)
Clay Size *	18
Silt Size	42
Sand	40
Gravel	0
Cobbles	0

Remarks: * The upper clay size of 2 μm is as per the Canadian Foundation Manual.
** The description is behaviour based & subject to EBA description protocols.

Reviewed By: ______________________ P.Eng.

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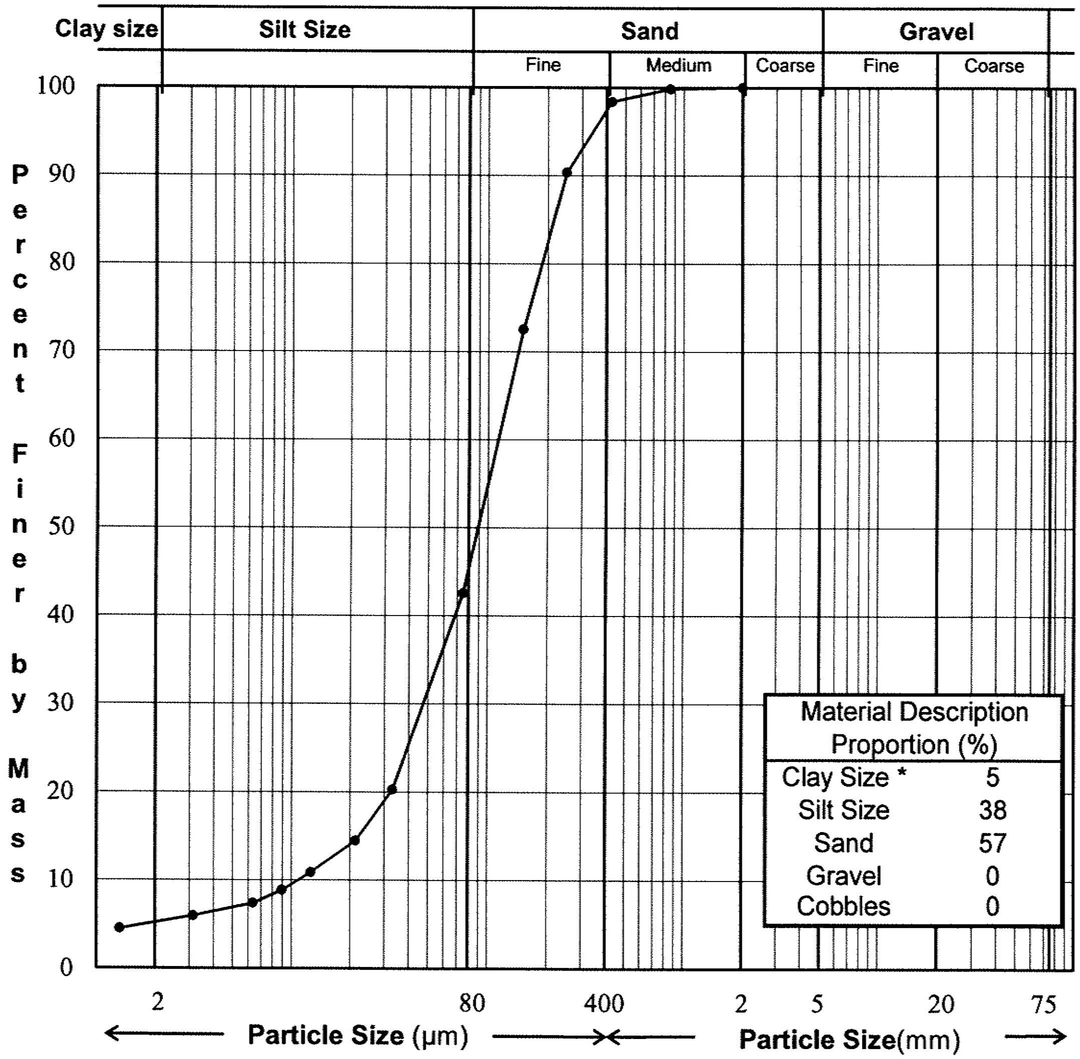
PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project:	Water Lic. Renewal-Jericho Mine	Sample No.:	FPK 9
Client:	Shear Minerals Ltd.	Borehole/ TP:	
Project No.:	E14101118	Depth:	
Location:		Date Tested	23-Jun-11 By: KTP
Description **:	SAND and SILT, trace clay.		

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
38 mm	
25 mm	
19 mm	
13 mm	
10 mm	
5 mm	
2 mm	100
850 µm	100
425 µm	98
250 µm	90
150 µm	73
75 µm	43
33 µm	20
21 µm	14
13 µm	11
9 µm	9
6 µm	7
3 µm	6
1 µm	4



Material Description	Proportion (%)
Clay Size *	5
Silt Size	38
Sand	57
Gravel	0
Cobbles	0

Remarks: * The upper clay size of 2 µm is as per the Canadian Foundation Manual.
** The description is behaviour based & subject to EBA description protocols.

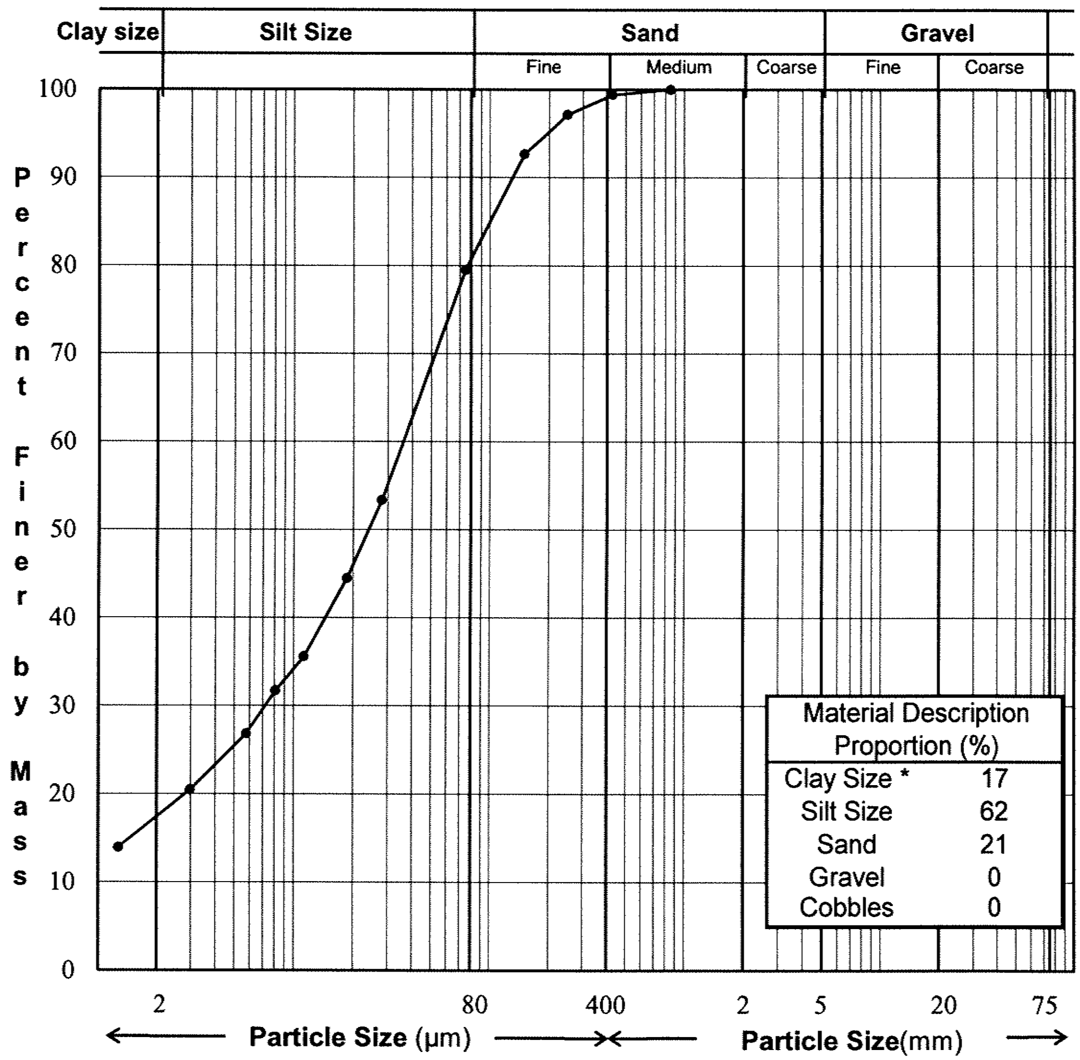
Reviewed By: ______________________ P.Eng.

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project:	Water Lic. Renewal-Jericho Mine	Sample No.:	FPK 10
Client:	Shear Minerals Ltd.	Borehole/ TP:	
Project No.:	E14101118	Depth:	
Location:		Date Tested	23-Jun-11 By: KTP
Description **:	SILT, clayey, sandy.		

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
38 mm	
25 mm	
19 mm	
13 mm	
10 mm	
5 mm	
2 mm	
850 μm	100
425 μm	99
250 μm	97
150 μm	93
75 μm	79
28 μm	53
19 μm	44
11 μm	36
8 μm	32
6 μm	27
3 μm	20
1 μm	14



Material Description	Proportion (%)
Clay Size *	17
Silt Size	62
Sand	21
Gravel	0
Cobbles	0

Remarks: * The upper clay size of 2 μm is as per the Canadian Foundation Manual.
** The description is behaviour based & subject to EBA description protocols.

Reviewed By: ______________________ P.Eng.

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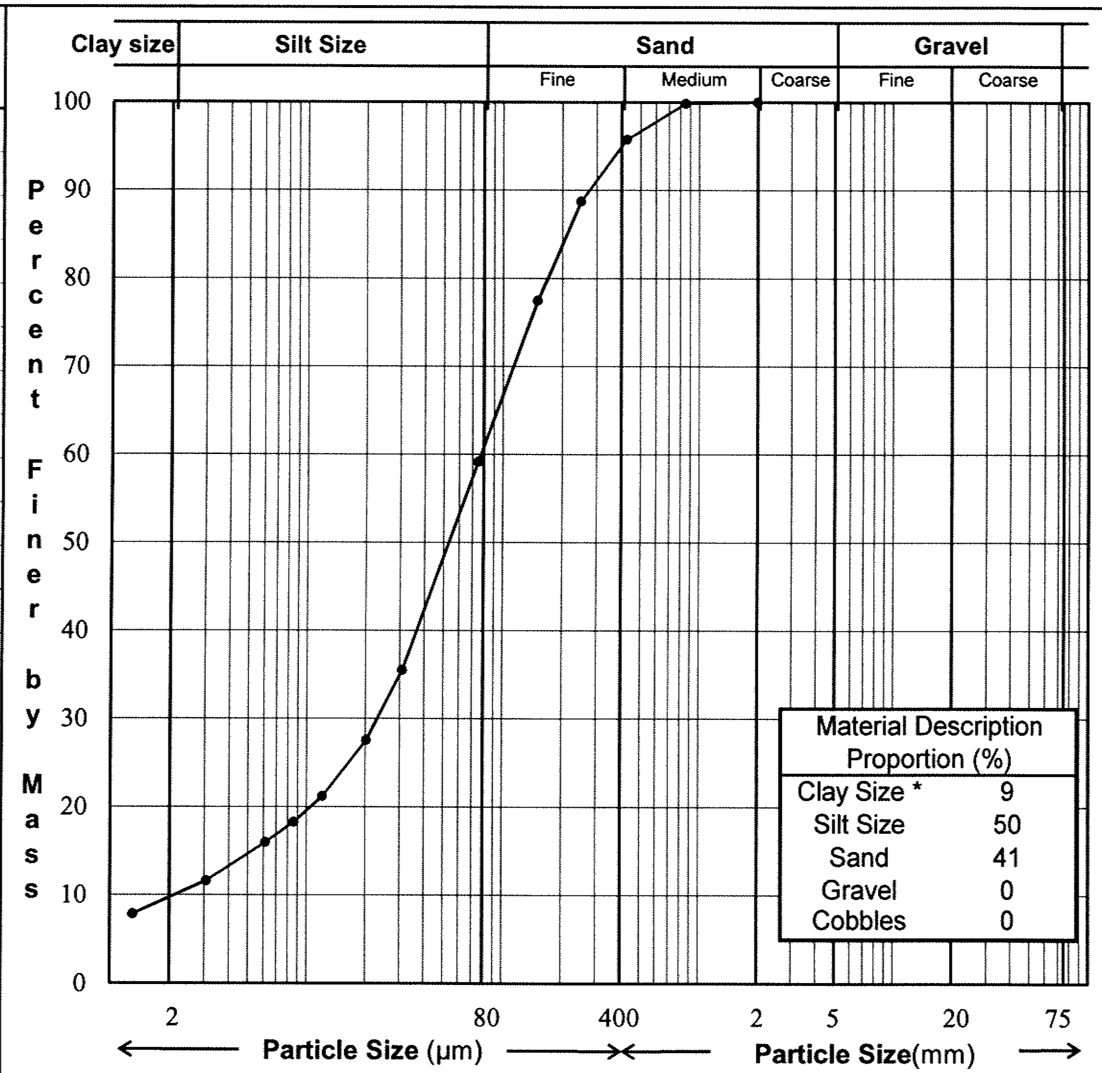
PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project:	Water Lic. Renewal-Jericho Mine	Sample No.:	FPK 12
Client:	Shear Minerals Ltd.	Borehole/ TP:	
Project No.:	E14101118	Depth:	
Location:		Date Tested	23-Jun-11 By: KTP
Description **:	SILT and SAND, some clay.		

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
38 mm	
25 mm	
19 mm	
13 mm	
10 mm	
5 mm	
2 mm	100
850 µm	100
425 µm	96
250 µm	89
150 µm	77
75 µm	59
31 µm	36
20 µm	28
12 µm	21
9 µm	18
6 µm	16
3 µm	12
1 µm	8



Material Description	Proportion (%)
Clay Size *	9
Silt Size	50
Sand	41
Gravel	0
Cobbles	0

Remarks: * The upper clay size of 2 µm is as per the Canadian Foundation Manual.
** The description is behaviour based & subject to EBA description protocols.

Reviewed By: ______________________ P.Eng.

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SIEVE ANALYSIS REPORT

Washed Sieve: ASTM C136 and C117

Project No.: Water Licence Renewal - Jericho Mine

Project: E14101118

Client: Shear Minerals Ltd.

Attention: Michelle Tanguay

Email: michelle@shearminerals.com

Description: SAND, some silt.

Source:

Supplier:

Sample Location:

Specification:

Sample No.: FPK 4

Date Sampled:

Sampled by:

Date Tested: June 24, 2011

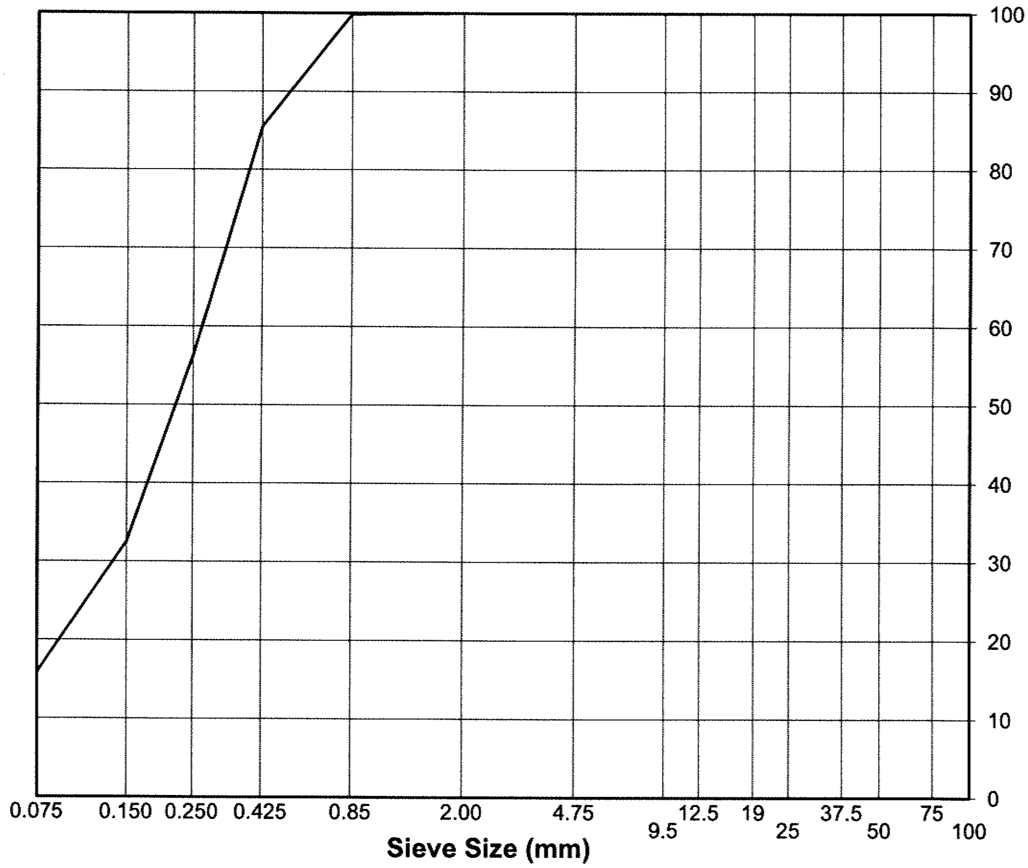
Tested by: KTP Office: Edmonton

Moisture Content (as received): 10.6%

No. Crushed Faces: Two (2) or Three (3)

By particle mass:

Sieve Size	Percent Passing
2.00	100
0.85	100
0.425	85
0.250	56
0.150	33
0.075	15.9



Remarks:

Reviewed By: ______________________ C.E.T.

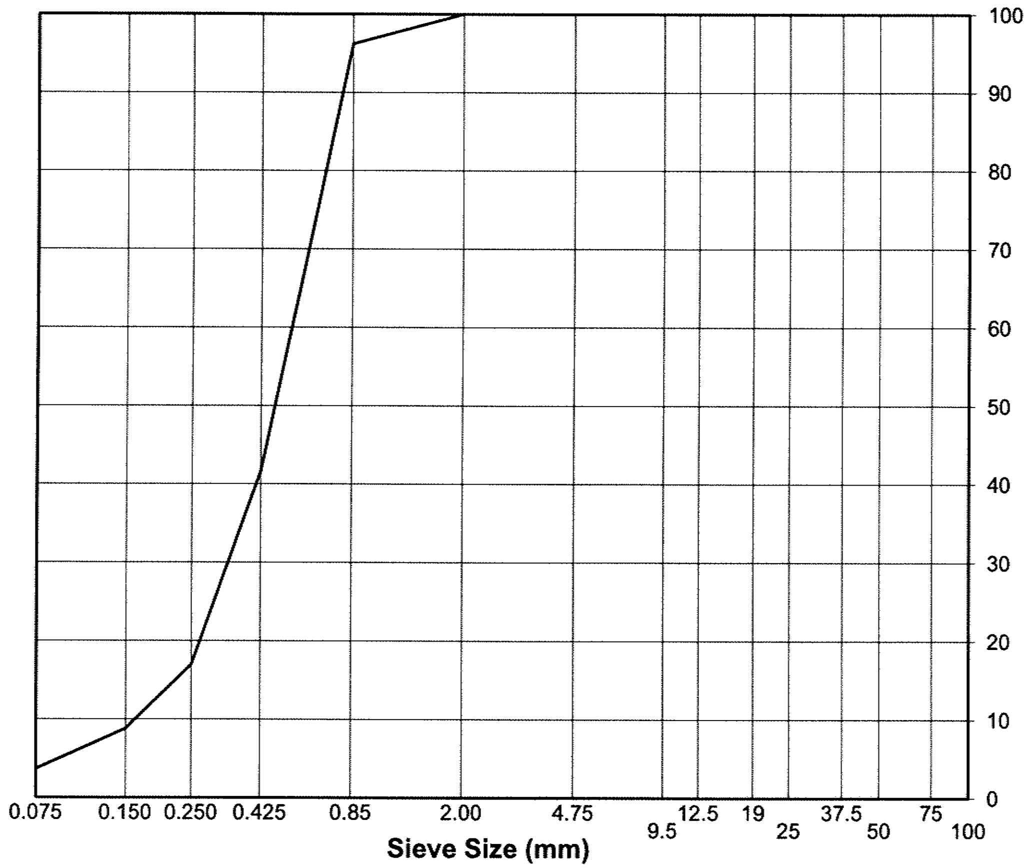
eba A TETRA TECH COMPANY

SIEVE ANALYSIS REPORT

Washed Sieve: ASTM C136 and C117

Project No.:	Water Licence Renewal - Jericho Mine	Sample No.:	FPK 5
Project:	E14101118	Date Sampled:	
Client:	Shear Minerals Ltd.	Sampled by:	
Attention:	Michelle Tanguay	Date Tested:	June 24, 2011
Email:	michelle@shearminerals.com	Tested by:	KTP Office: Edmonton
Description:	SAND, trace silt.	Moisture Content (as received):	3.7%
		No. Crushed Faces:	Two (2) or Three (3)
Source:		By particle mass:	
Supplier:			
Sample Location:			
Specification:			

Sieve Size	Percent Passing
2.00	100
0.85	96
0.425	42
0.250	17
0.150	9
0.075	3.7



Remarks:

Reviewed By: ____________________ C.E.T.

eba A TETRA TECH COMPANY

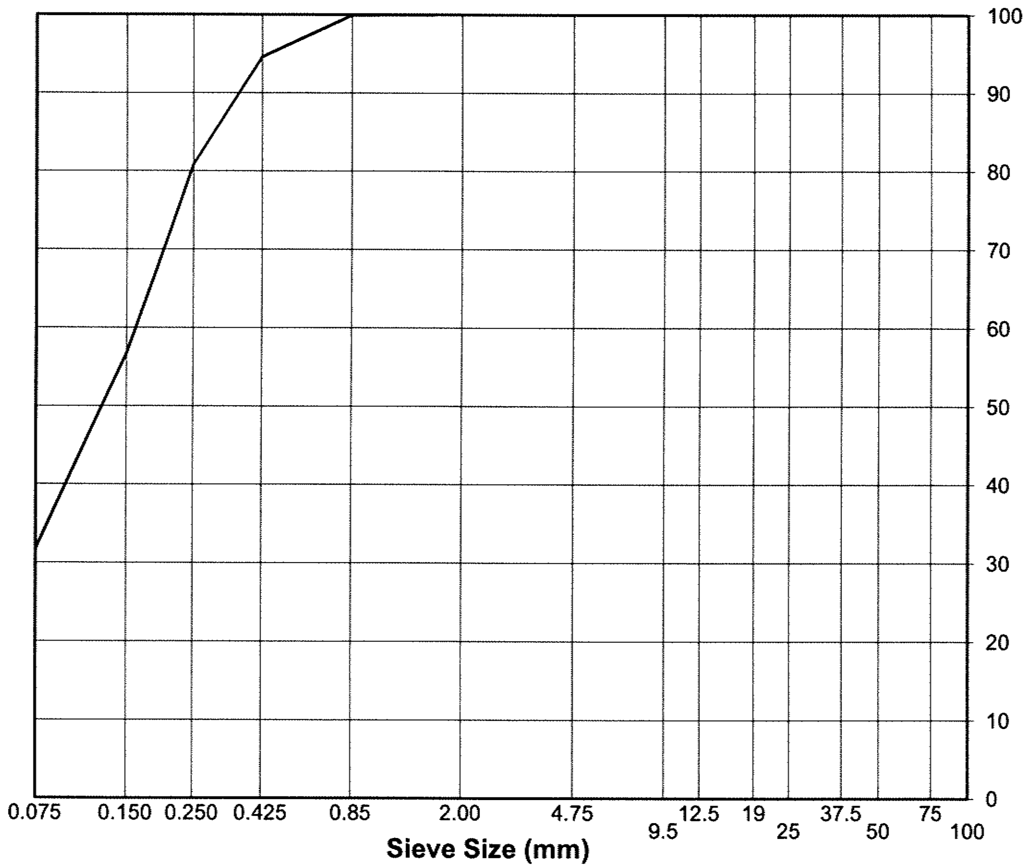
SIEVE ANALYSIS REPORT

Washed Sieve: ASTM C136 and C117

Project No.: Water Licence Renewal - Jericho Mine
Project: E14101118
Client: Shear Minerals Ltd.
Attention: Michelle Tanguay
Email: michelle@shearminerals.com
Description: SAND and SILT, trace to some clay.
Source:
Supplier:
Sample Location:
Specification:

Sample No.: FPK 6
Date Sampled:
Sampled by:
Date Tested: June 24, 2011
Tested by: KTP Office: Edmonton
Moisture Content (as received): 26.3%
No. Crushed Faces: Two (2) or Three (3)
By particle mass:

Sieve Size	Percent Passing
2.00	100
0.85	100
0.425	95
0.250	81
0.150	57
0.075	31.7



Remarks:

Reviewed By: ______________ C.E.T.

eba A TETRA TECH COMPANY

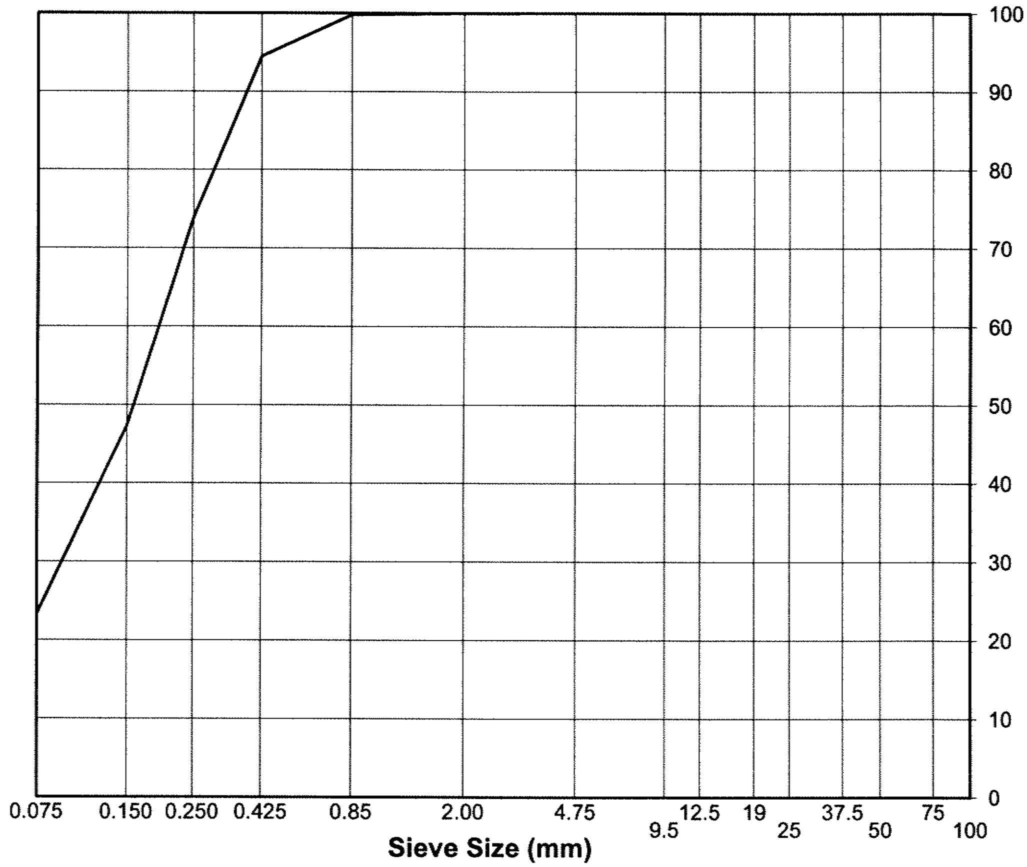
SIEVE ANALYSIS REPORT

Washed Sieve: ASTM C136 and C117

Project No.: Water Licence Renewal - Jericho Mine
Project: E14101118
Client: Shear Minerals Ltd.
Attention: Michelle Tanguay
Email: michelle@shearminerals.com
Description: SAND, silty, trace clay.
Source:
Supplier:
Sample Location:
Specification:

Sample No.: FPK 16
Date Sampled:
Sampled by:
Date Tested: June 24, 2011
Tested by: KTP Office: Edmonton
Moisture Content (as received): 29.8%
No. Crushed Faces: Two (2) or Three (3)
By particle mass:

Sieve Size	Percent Passing
4.75	100
2.00	100
0.85	100
0.425	94
0.250	74
0.150	47
0.075	23.3



Remarks:

Reviewed By: ____________ C.E.T.

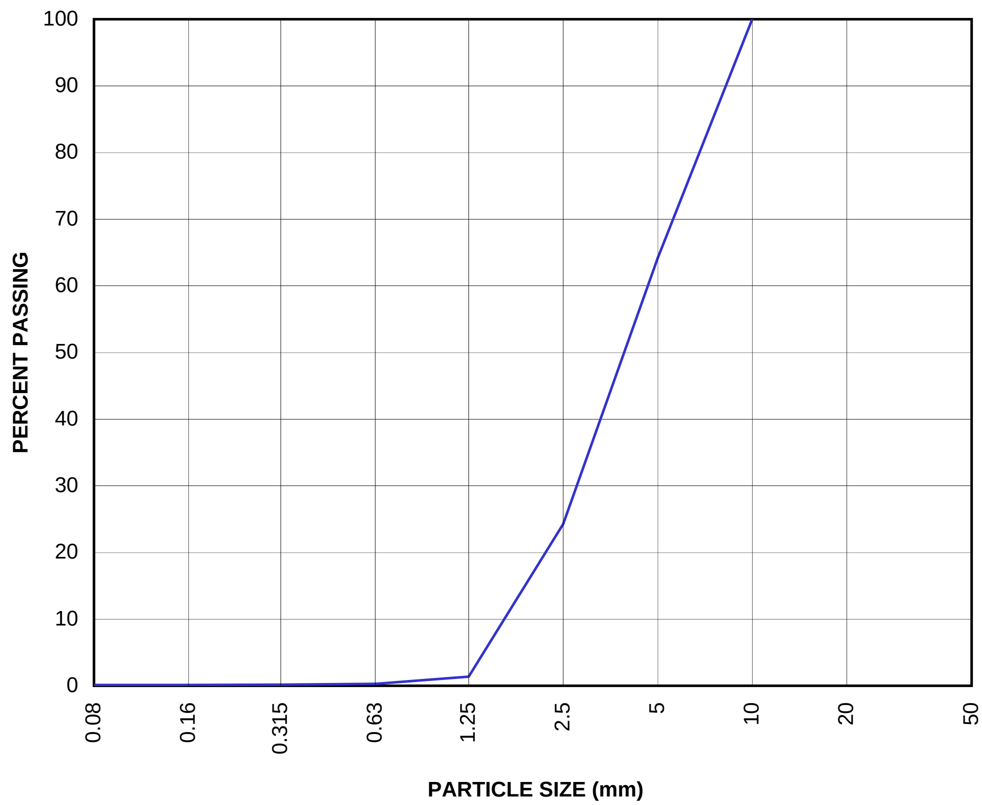
eba
A TETRA TECH COMPANY

EBA Engineering Consultants Ltd.

AGGREGATE ANALYSIS REPORT

PROJECT:	PKCA Dams	SAMPLE NO:	Tailings_Coarse_007
ADDRESS:	Jericho Diamond Project	SAMPLE DESCRIPTION:	
PROJECT NO:	0101-04-1100060.007	Coarse Tailings from PP without HPGR	
DATE TESTED:	Feb 13/06 By: MM		
CLIENT:	Tahera Diamond Corp.	NAT. MOISTURE CONT.:	13.7%
		COLOUR PLATE #:	n/a
		BULK REL DENSITY:	n/a
ATTENTION:	Roland Jones/Harold Gates	BULK REL. DENSITY (SSD):	n/a
		APPARENT REL. DENSITY:	n/a
		ABSORPTION:	n/a

PARTICLE SIZE	PERCENT PASSING
10	100
5	64
2.5	24
1.25	1
0.630	0
0.315	0
0.160	0.1
0.080	0.1



Remarks: Coarse tailings sample without HPGR running was produced by the Process Plant.

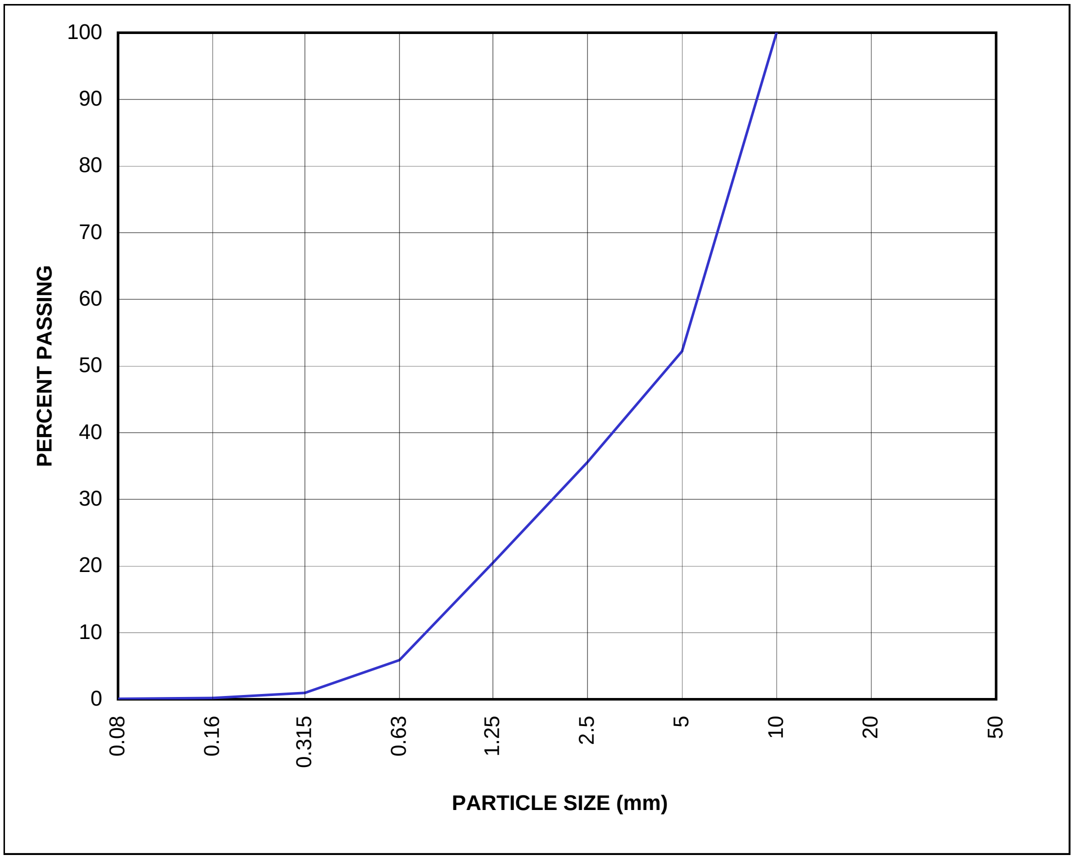
Reviewed by: ______________________

EBA Engineering Consultants Ltd.

AGGREGATE ANALYSIS REPORT

PROJECT:	PKCA Dams	SAMPLE NO:	Tailings_Coarse_006
ADDRESS:	Jericho Diamond Project	SAMPLE DESCRIPTION:	
PROJECT NO:	0101-04-1100060.007		Coarse Tailings from PP with HPGR
DATE TESTED:	Feb 13/06 By: MM		
CLIENT:	Tahera Diamond Corp.	NAT. MOISTURE CONT.:	10.9%
		COLOUR PLATE #:	n/a
		BULK REL DENSITY:	n/a
ATTENTION:	Roland Jones/Harold Gates	BULK REL. DENSITY (SSD):	n/a
		APPARENT REL. DENSITY:	n/a
		ABSORPTION:	n/a

PARTICLE SIZE	PERCENT PASSING
10	100
5	52
2.5	36
1.25	20
0.630	6
0.315	1
0.160	0.2
0.080	0.1



Remarks: Coarse tailings sample with HPGR running was produced by the Process Plant.

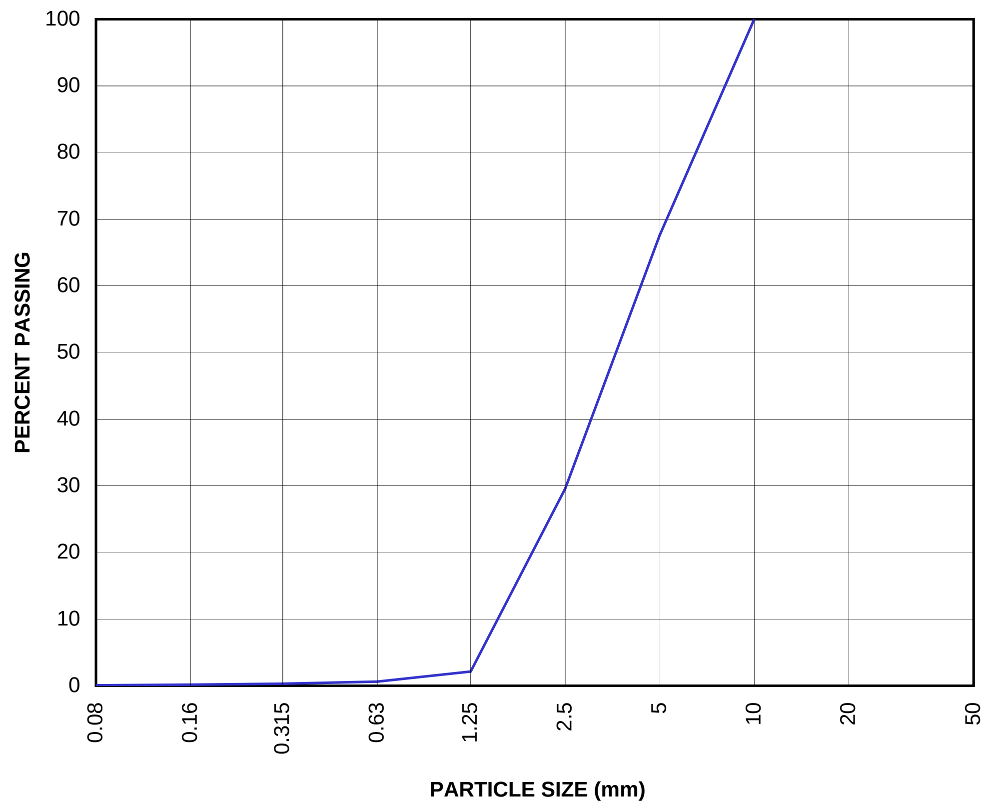
Reviewed by: ______________________

EBA Engineering Consultants Ltd.

AGGREGATE ANALYSIS REPORT

PROJECT:	PKCA Dams	SAMPLE NO:	Tailings_Coarse_005
ADDRESS:	Jericho Diamond Project	SAMPLE DESCRIPTION:	
PROJECT NO:	0101-04-1100060.007	Coarse Tailings from PP without HPGR	
DATE TESTED:	Feb 13/06 By: MM		
CLIENT:	Tahera Diamond Corp.	NAT. MOISTURE CONT.:	8.1%
		COLOUR PLATE #:	n/a
		BULK REL DENSITY:	n/a
ATTENTION:	Roland Jones/Harold Gates	BULK REL. DENSITY (SSD):	n/a
		APPARENT REL. DENSITY:	n/a
		ABSORPTION:	n/a

PARTICLE SIZE	PERCENT PASSING
10	100
5	68
2.5	30
1.25	2
0.630	1
0.315	0
0.160	0.2
0.080	0.1



Remarks: Coarse tailings sample without HPGR running was produced by the Process Plant.

Reviewed by: ______________________

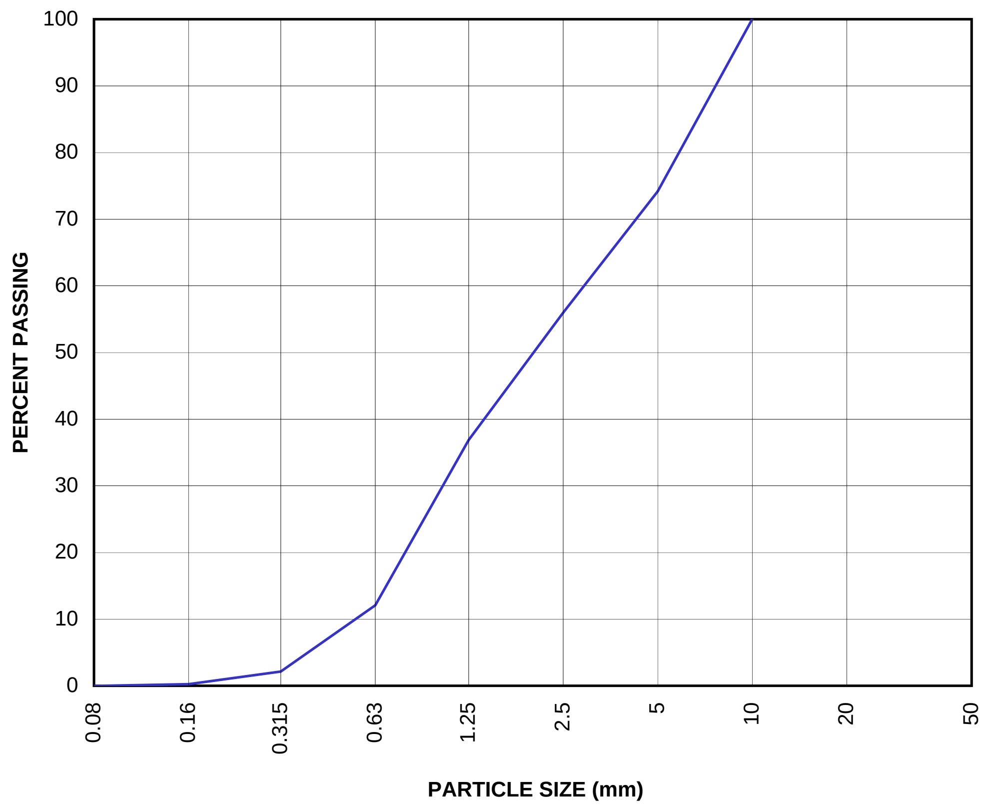
eba

EBA Engineering Consultants Ltd.

AGGREGATE ANALYSIS REPORT

PROJECT:	PKCA Dams	SAMPLE NO:	Tailings_Coarse_008
ADDRESS:	Jericho Diamond Project	SAMPLE DESCRIPTION:	
PROJECT NO:	0101-04-1100060.007	Coarse Tailings from PP with HPGR	
DATE TESTED:	Feb 13/06 By: PEP		
CLIENT:	Tahera Diamond Corp.	NAT. MOISTURE CONT.:	14.9%
		COLOUR PLATE #:	n/a
		BULK REL DENSITY:	n/a
ATTENTION:	Roland Jones/Harold Gates	BULK REL. DENSITY (SSD):	n/a
		APPARENT REL. DENSITY:	n/a
		ABSORPTION:	n/a

PARTICLE SIZE	PERCENT PASSING
10	100
5	74
2.5	56
1.25	37
0.630	12
0.315	2
0.160	0.2
0.080	0.0



Remarks: Coarse tailings sample with HPGR running was produced by the Process Plant.

Reviewed by: ______________________

EBA Engineering Consultants Ltd.

Relative Density and Absorption of Fine Aggregate

(CSA Designation A23.2-6A)

Project: Jericho Project
EBA Project No.: 0101-1100060.004
Sample No.: 739

Test Date: 8-Feb-06
Technician: RR
Office: Edmonton

SPECIFIC GRAVITY (-5000 mm)

TRIAL NO.		1		2
Pychnometer		6		7
Mass of Pychnometer, g		167.1		165.9
Mass of Pychnometer filled with Water, g	B	664.2		663.2
Mass of Pychnometer, SSD Fine Aggregate, g		669.7		665.5
Mass of Saturated Surface-Dry Fine Aggregate, g	M_f	502.6		499.6
Mass of Pychnometer, Aggregate and Water, g	C	972.7		970.5
Tare I.D.		e		a
Mass of Oven Dry Aggregate & Tare, g		1773.8		1386.3
Tare, g		1286.9		902.7
Mass of Oven Dry Aggregate, g	A	486.9		483.6

		Trial 1	Trial 2	Average
BULK RELATIVE DENSITY	$A/(B+M_f-C)$	2.509	2.515	**2.51**
BULK RELATIVE DENSITY S.S.D.	Mf/(B+Mf-C)	2.589	2.598	**2.59**
APPARENT RELATIVE DENSITY	A/(B+A-C)	2.729	2.743	**2.74**
ABSORPTION	(B-A)/A*100	3.22	3.31	**3.3**

eba

EBA Engineering

Micro-Deval Abrasion of Fine Aggregate
CAN/CSA A23.2 - 23A

Project No: 1100060.004

Project: Jericho Project

Client : Tahera Diamond Corporation

Attention: Harold Gates Fax:

Date Sampled: 31-Jan-06

Sampled By: JP

Date Tested: 8-Feb-06

Tested By: RR

Sample:

Sample Description: 12.5 mm crushed aggregate

Source: Coarse PK #1

Sample Location:

Initial Weight (g): 501.8

Final Weight (g): 427.4

Weight Loss (g): 74.4

Loss (%): 14.8%

Comments: CSA A23.2, Table 12: Maximum Abrasion Loss 20%

Reviewed By: ______________________ P. Eng.

eba

EBA Engineering Consultants Ltd.

Micro-Deval Abrasion of Coarse Aggregate
CAN/CSA A23.2 - 29A

Project No: 1100060.004
Project: Jericho Project
Client : Tahera Diamond Corporation

Attention: Harold Gates Fax:

Date Sampled: 31-Jan-06
Sampled By: JP
Date Tested: 8-Feb-06
Tested By: RR

Sample: # 739
Sample Description: 12.5 mm crushed aggrgate
Source: Coarse PK # 1
Sample Location:

Initial Weight (g): 1504.6
Final Weight (g): 1340
Weight Loss (g): 164.6
Loss (%): 10.9%

Comments: CSA A23.2-04, Table 12: Maximum Abrasion Loss 17%

Reviewed By: ______________________ P. Eng.

EBA Engineering Consultants Ltd.

CONSTANT HEAD PERMEABILITY TEST | **JERICHO DIAMOND MINE**

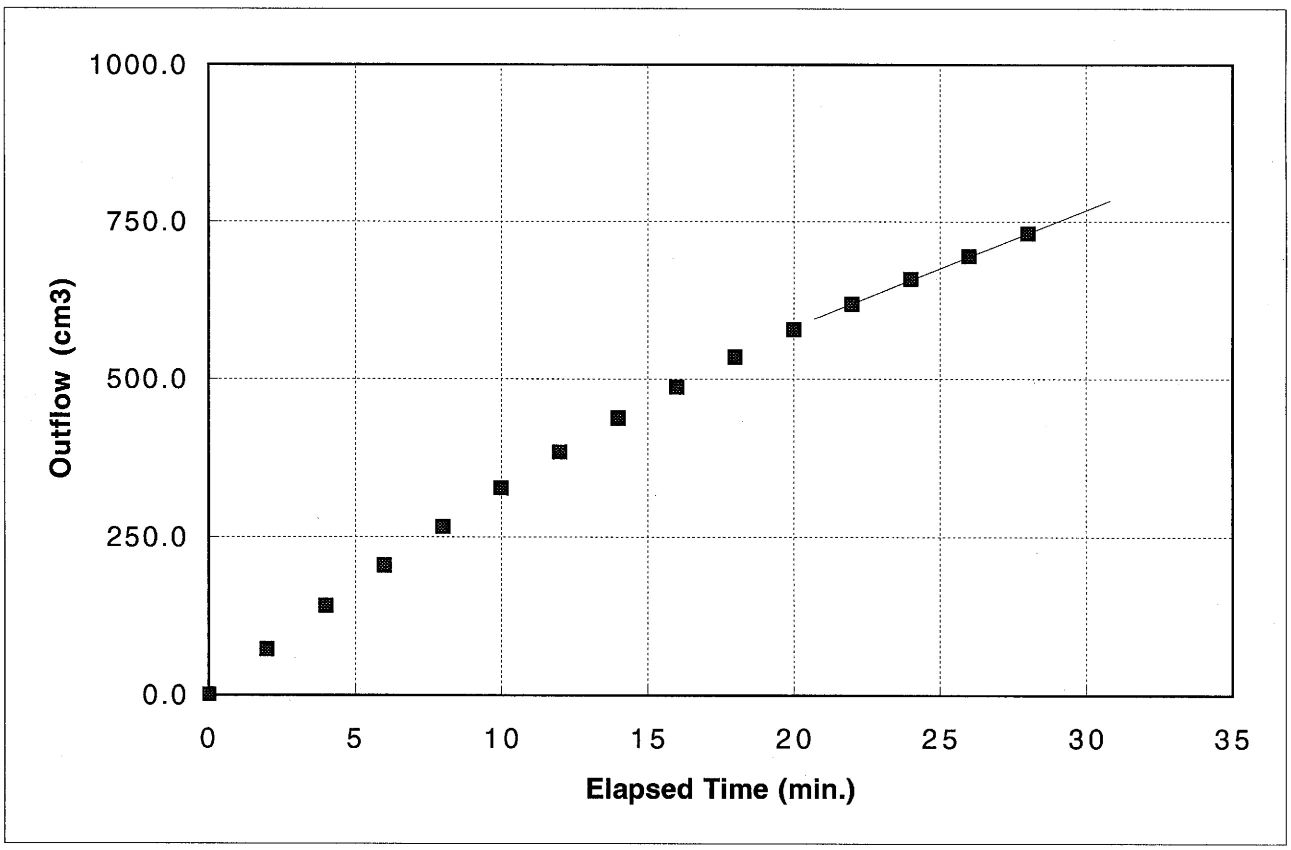
Job Number: 1100060.004
Sample No.: 739 Coarse PK #1

Date: 06-02-20
Test No: P-1

Time	Buret (cc)	Elap. (min)	Outflow (cc)
9:22	0.0	0	0.0
9:24	71.5	2	71.5
9:26	140.7	4	140.7
9:28	204.1	6	204.1
9:30	266.3	8	266.3
9:32	326.6	10	326.6
9:34	383.7	12	383.7
9:36	437.4	14	437.4
9:38	487.3	16	487.3
9:40	534.3	18	534.3
9:42	578.1	20	578.1
9:44	618.8	22	618.8
9:46	657.5	24	657.5
9:48	694.6	26	694.6
9:50	730.5	28	730.5

Diameter=	88.9	mm
Height=	88.6	mm
Volume=	549.95	cm^3
Head Diff.=	0.044	psi
Q=	0.31	cm^3/sec
i=	0.35	
A=	62.07	cm^2

K= 1.43E-02 cm/sec



EBA Engineering Consultants Ltd.

MOISTURE - DENSITY RELATIONSHIP

ASTM D698, D1557, or D2049

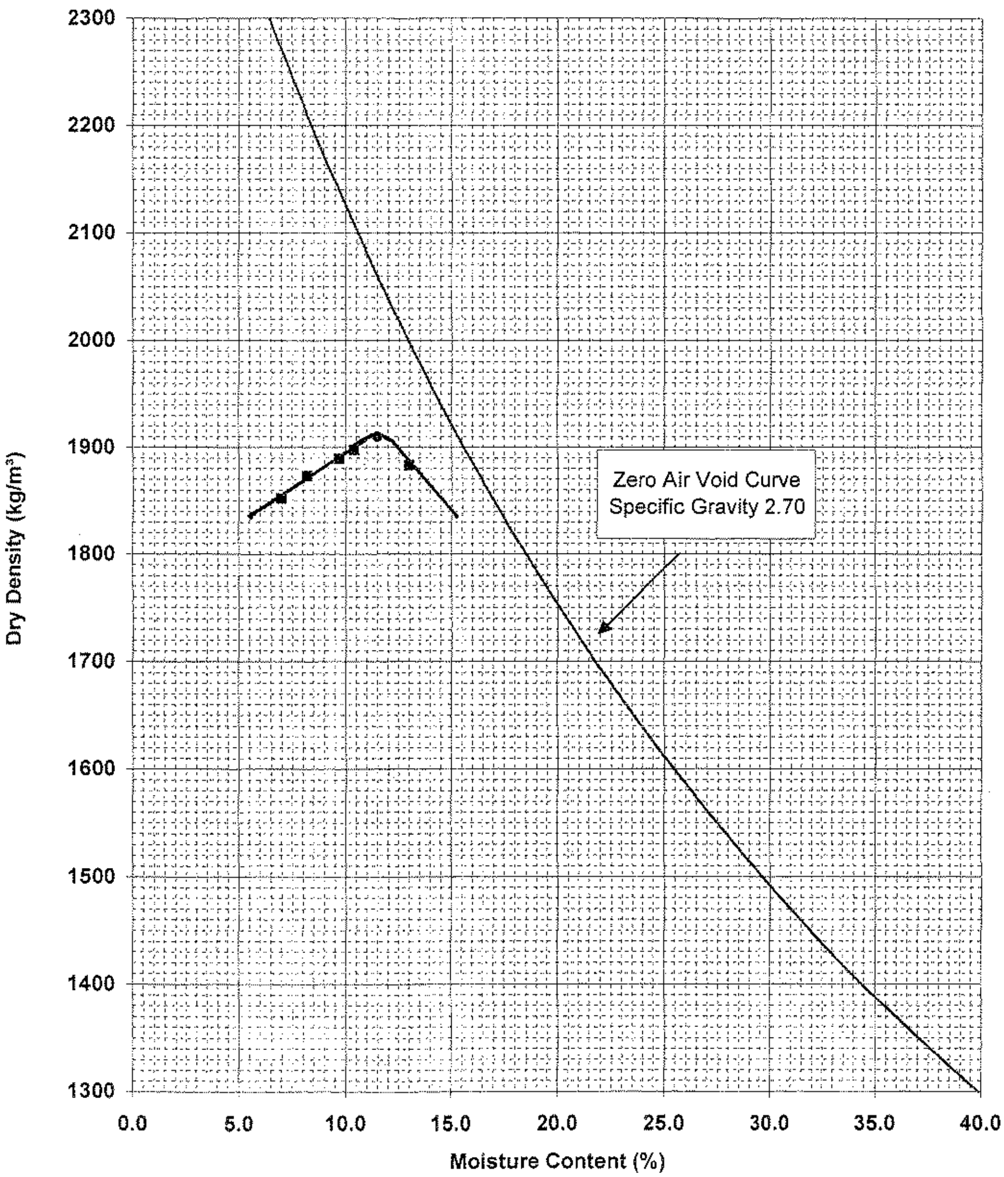
Project: Dam and Diversion Earthworks Monitoring Service - Jericho Project Site, NWT **Sample Number:** 739

Project No.: 0101-1100060.007 **Date Tested:** 06/02/13

Client: Tahera Diamond Corporation c/o Nuna Logistics **Moisture Content (as received):** N/A

Soil Description: SAND, gravelly (12.5mm max.), tr. silt - grey **Maximum Dry Density:** 1910 kg/m³

Sample Location: Coarse Pk #1 **Optimum Moisture Content:** 11.5%



STANDARD PROCTOR

ASTM D698

Hammer Mass: 2.494 kg

Hammer Drop: 304.8 mm

Number of Layers: 3

Number of Blows/Layer: 56

Diameter of Mould: 152.3 mm

Height of Mould: 116.5 mm

Mould Volume: 0.00212 m³

Compactive Effort: 590.3 kJ/m³

REVIEWED BY:

REMARKS:

APPENDIX D

APPENDIX D OPERATIONS, MAINTENANCE, AND SURVEILLANCE MANUAL

SHEAR DIAMONDS (NUNAVUT) CORP.

OPERATIONS, MAINTENANCE, & SURVEILLANCE MANUAL PKCA DAMS JERICHO DIAMOND MINE, NUNAVUT

REPORT

AUGUST 2011
ISSUED FOR USE
EBA FILE: E14101140

shear diamonds

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LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Shear Diamonds (Nunavut) Corp. and their agents. EBA, A Tetra Tech Company, does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Shear Diamonds (Nunavut) Corp., or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

EBA, A Tetra Tech Company
14940 - 123 Avenue
Edmonton, AB T5V 1B4 CANADA
p. 780.451.2121 f. 780.454.5688

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FIGURES

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ACRONYMS & ABBREVIATIONS

CDA	Canadian Dam Association
CPK	Coarse Processed Kimberlite
EBA	EBA, A Tetra Tech Company
EP-RP	Emergency Preparedness and Response Plan for Dam Emergencies
FPK	Fine Processed Kimberlite
GMP	General Monitoring Plan
GTC	Ground Temperature Cable
NWB	Nunavut Water Board
OMS	Operations, Maintenance, and Surveillance Manual
PKCA	Processed Kimberlite Containment Area
PKMP	PKCA Management Plan
Shear	Shear Diamonds (Nunavut) Corp.
SWMP	Site Water Management Plan
TDC	Tahera Diamonds Corporation
WTMP	Wastewater Treatment Management Plan

1.0 INTRODUCTION

1.1 Purpose/Scope

The purpose of this manual is to define the requirements for operation, monitoring, and surveillance (OMS) of the Jericho PKCA dams so that Shear Diamonds Ltd. (Shear) can safely operate the facility, maintain it in good condition, and monitor its performance to be able to provide early warning of any developing distress that could affect the safety of the dams.

The format for this document is based on the Canadian Dam Association Dam Safety Guidelines (CDA 2007) and a template provided by Alberta Environment. Submitting this document to the Nunavut Water Board (NWB) will satisfy the requirements relating to dam operations and safety issues stated in:

- Part F, Item 1 and Schedule F
- Part H, Item 1 and Schedule H
- Part J, Item 1 and Schedule J

The most recent version of this document must be kept in any archive of operational procedures on site, within the offices of the individuals responsible for operation of the Processed Kimberlite Containment Area (PKCA), and elsewhere within the Shear organization as deemed necessary by Shear.

1.2 Linkages to Other Plans

The OMS Manual is part of the site wide management system. Other management and emergency plans that are related to or refer to the OMS Manual include:

- General Monitoring Plan (GMP);
- Processed Kimberlite Management Plan (PKMP)
- Site Water Management Plan (SWMP);
- Wastewater Treatment Management Plan (WTMP); and
- Emergency Preparedness and Response Plan for Dam Emergencies (EP-RP)

1.2.1 Signed Authorizations and Assigned Administrator

The following individuals or entities have reviewed and authorized this manual.

Table 1 OMS Manual Summary Report Chain of Command Requirements

	Name	Position	Signature	Date
Prepared by	Nigel Goldup, P.Eng.	Project Director		
Reviewed by				
Approved by				
OMS Administrator				

1.2.2 Record of OMS Manual Holders

The following individuals or entities have been issued copies of this document.

Table 2: Record of OMS Manual Holders

Name	Position	Organization	Location of Report	Contact Information

1.2.3 Record of OMS Revisions

This document has been subject to the following revisions:

Table 3: Record of Revisions

Date of Revision	Reason	Person Requesting Change	Position	Signature
August 15, 2011	Merge with PKMP	Julie Lassonde	CEO, Shear	

1.3 Organizational Chart and Reporting Lines

The organizational chart and reporting lines for the operation, maintenance, and surveillance of the Jericho facility and the associated dams are presented in Figure 7.

1.4 Access

Jericho is a remote mine and access to the site (and the PKCA) is restricted to air travel throughout most of the year, except for the short period when the seasonal ice road is open. The facility is regularly monitored by operations personnel and/or site security.

1.5 Basin/Watershed Characteristics

1.5.1 Basin Maps

Figure 3 presents a basin map of the hydrologic catchments for the PKCA, mine site, and surrounding areas that provide inflows to the PKCA either directly or through site water management activities.

1.5.2 Key Tributaries and Other Inflow Sources

No tributaries flow into the Jericho PKCA; however, accumulated site water from mining operations is pumped into the PKCA.

1.5.3 Weather Stations

Shear gathers and logs weather data while personnel are on site. Parameters monitored include:

- Precipitation,

- Wind speed and direction,
- Relative humidity, and
- Temperature.

Shear is investigating installing a weather monitoring station with data logging capabilities for future operations.

1.6 Water Management Overview

1.6.1 Ownership

The Jericho PKCA reservoir, dams, and associated infrastructure are owned and operated by Shear Diamonds Ltd.

1.6.2 General Description of Facility

1.6.2.1 Description of PKCA Dams

The three dams that provide impoundment for the PKCA are:

- West Dam (constructed to a partial elevation; crest at 525 m and core at 520 m),
- East Dam, and
- Southeast Dam.

A fourth dam (North Dam) will need to be constructed, and the West Dam completed, before the PKCA can be operated at maximum capacity. The locations of these dams are presented in Figures 1 through 4. Each dam is briefly described in Table 6 (Section 1.6.6).

1.6.2.2 Appurtenant Structures

A divider dyke is used to retain FPK solids in Cell A while allowing supernatant water to flow into Cell B/C. The dyke does not serve to impound water and, therefore, is considered an appurtenant structure within the containment area. Divider Dyke A divides Cell A from Cell B/C. The dyke is partially complete and not yet at design elevation. The dyke is briefly described in Table 6 (Section 1.6.6).

A second divider dyke (Divider Dyke B) is to be constructed once mining processing operations resume. Divider Dyke B will be constructed between Divider Dyke A and the West Dam, and will allow FPK placement in Cell B. No FPK will be placed in Cell C.

Presently, a failure of Divider Dyke A would allow FPK solids into Cell B/C. Similarly, a failure of the proposed Divider Dyke B would allow FPK solids into Cell C. In either case, the release would be retained by the West Dam and not pose a risk to human safety or to the receiving environment.

The locations of the appurtenant structures are presented on Figure 1.

1.6.2.3 Operation of Facility

FPK slurry is pumped from the process plant and discharged along the eastern boundary of Cell A using spigot points. The solids from the spigotted slurry settle out to form a beach deposit, and the expelled supernatant water, together with some suspended solids, flows westwards towards and is impounded against Divider Dyke A. FPK is prevented from flowing eastwards into the receiving environment by the East and Southeast dams.

Water flow between Cell A and Cell B is controlled by the seepage rate through the internal Divider Dyke A. The filter material is much finer than the transition material and run-of-mine waste rock zones, and therefore dictates the rate. As deposition continues and Cell A becomes full, Divider Dyke B will be constructed between Cell B and Cell C.

As the water passes through a divider dyke, the FPK sediments and turbidity are removed and the water impounds against the West Dam. Once the water is confirmed to meet the discharge criteria in the Water Licence, it will be pumped over the West Dam and released into Stream C3. Further discussions on the controlled release of PKCA water can be found in the PKMP (EBA 2011) and the water quality aspects are covered in the Jericho GMP (EBA 2011). In addition to FPK effluents, site water and treated wastewater are pumped into either Cell A or Cell B.

1.6.3 Consequence Classification

1.6.3.1 General

The CDA Guidelines suggest that the classification of a dam be conducted in terms of the reasonably foreseeable incremental consequences of failure. The loss of life consequences should be evaluated separately from the socio-economic, financial, and environmental consequences, and the higher of the two classifications shall be used. The classification system suggested by the CDA Guidelines is presented in Table 4.

Table 4: Dam Classification

Dam Class	Population at Risk[1]	Incremental Losses		
		Loss of Life[2]	Environmental and Cultural Values	Infrastructure and Economics
Low	None	0	▪ Minimal short-term loss ▪ No long-term loss	Low economic losses; area contains limited infrastructure or services
Significant	Temporary only	Unspecified	▪ No significant loss or deterioration of fish or wildlife habitat ▪ Loss of *marginal* habitat only ▪ Restoration or compensation in kind highly possible	Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes
High	Permanent	10 or fewer	▪ Significant loss or deterioration of *important* fish or wildlife habitat ▪ Restoration or compensation in kind highly possible	High economic losses affecting infrastructure, public transportation, and commercial facilities
Very High	Permanent	100 or fewer	▪ Significant loss or deterioration of *critical* fish or wildlife habitat ▪ Restoration or compensation in kind	Very high economic losses affecting important infrastructure or services (e.g., highway, industrial facility,

Table 4: Dam Classification

			possible but impractical	storage facilities or dangerous substances)
Extreme	Permanent	More than 100	▪ Major loss of *critical* fish or wildlife habitat ▪ Restoration or compensation in kind impossible	Extreme losses affecting critical infrastructure or services (e.g., hospital, major industrial complex, major storage facilities for dangerous substances)

[1] Definitions for population at risk:

- **None** – No identifiable population at risk, so no possibility of loss of life other than through unforeseeable misadventure.
- **Temporary** – People are only temporarily in the dam-breach inundation zone (e.g., seasonal cottage use, passing through on transportation routes, participating in recreational activities)
- **Permanent** – The population at risk is ordinarily located in the dam-breach inundation zone (e.g., as permanent residents); three consequence classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life (to assist in decision-making if the appropriate analysis is carried out)

[2] Implications for loss of life:

- **Unspecified** – The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

The consequences from a release of FPK or a direct release of water from the PKCA vary from dam to dam. A plan of the area is presented in Figure 2. The classification and the consequences of failure for each structure are presented in Table 5.

Table 5: Jericho Dam Classification

Structure	Classification	Consequences of failure
West Dam	High Consequence	Uncontrolled release of PKCA water into Stream C3 system
East Dam	High Consequence	Uncontrolled release of FPK and supernatant water into the unnamed pond and/or the Lynne Lake Group watershed
Southeast Dam	High Consequence	

1.6.4 Key Operating Structures, Elevations and Capacities

Key attributes of the operating structures that control inflow and discharges from the PKCA are described in the following sections.

1.6.4.1 West Dam

The West Dam extends across the west end of the PKCA. The dam is approximately 190 m in length and has a maximum core height of 9 m and a maximum dam height of 13 m from the original ground surface. 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.

A cross-section of the West Dam is presented in Figure 5, and the location of the structure is presented in Figure 1.

1.6.4.2 East and Southeast Dams

The East and Southeast dams are located along the eastern perimeter of the PKCA. Both dams are approximately 250 m in length and have a maximum height of approximately 7 m from the original ground surface. 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.

Cross-sections of the East and Southeast dams are presented in Figure 5, and the location of the structure is presented in Figure 1.

1.6.4.3 Divider Dyke

The purpose of Divider Dyke A is to filter and retain FPK solids within Cell A while allowing supernatant water to flow into Cell B/C. A cross-section of Divider Dyke A is presented in Figure 6, and the location of the structure is presented in Figure 1.

The key features of this structure are described as follows:

- 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 in estimating seepage volume through Dykes A and B.
- During mining operations the estimated quantity of seepage moving through Divider Dyke A is less than 40,000 m^3/month at its current operating level.

1.6.4.4 FPK Discharge

FPK and process water are discharged to the PKCA during processing operations. The mine is currently under care and maintenance and therefore is not currently discharging FPK into the PKCA. Shear has not proposed any changes to the mine plan previously submitted by Tahera Diamond Corp. (TDC).

1.6.4.5 Site and Wastewater Management

Accumulated site water and effluent from the Wastewater Treatment Plant are discharged into Cell A of the PKCA which amounts to a volume of 9,855 m^3/year.

1.6.4.6 Reclaim Water Intake

Water will be reclaimed from Cell B/C and used for process operations. The mine is currently under care and maintenance and therefore opportunities to reclaim water will be limited. However, once processing operations resume, Shear will continue reclaiming water from Cell B/C for the process plant.

1.6.4.7 Discharge from PKCA

Water that meets licence discharge criteria will be discharged from the PKCA over the West Dam to Stream C3. The annual outflow from the PKCA will maintain water levels in Cells B and C at a lower level than the pre-existing natural level. Where possible 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.

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 and pumping rates will be revised annually to meet the operational requirements of the mine and the limits of Stream C3.

1.6.5 Partnerships

No partnerships are associated with the operation of the dams.

1.6.6 Brief History of Project

A brief chronology of PKCA infrastructure and the status of each structure are presented in Table 6.

Table 6: 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, Future	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, Future	EBA 2005b
Divider Dyke B	Not in place	524	-	Containment of FPK – flow through structure	Future	To be prepared
North Dam	Not in place	528 Crest 524 Core	-	Water control	Future	EBA 2007
Cell A CPK Perimeter Dyke	Not in place	528.5	-	Containment of FPK	Future	To be prepared
West Settling Pond Dam	Optional	-	-	Water control	Optional	To be prepared

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1.7 Utilities and Significant Infrastructure

The Jericho PKCA has several utilities and pieces of infrastructure adjacent to the facility that are associated with its operation. These items are:

- FPK discharge pipeline and spigot points;
- Wastewater Treatment Plant discharge pipeline;
- Process water reclaim pipeline;
- Process water reclaim pump electrical line; and
- PKCA access and perimeter road.

An unplanned release of water from the facility from the West Dam is not expected to affect any utilities or significant infrastructure. A release of FPK from the East or Southeast Dam may affect the FPK discharge pipeline and spigot points depending on the location and severity of the release.

2.0 FACILITY OPERATIONS

2.1 General

A summary of key criteria and parameters is provided in the following sections, which also include references to details in other documents.

2.1.1 Design Engineers

EBA Engineering Consultations Ltd. (now EBA, A Tetra Tech Company) was the designer of record for the PKCA dams. A reference list of documents, including site investigation, design, construction, instrumentation, and post-impoundment performance monitoring and maintenance, is provided in the references section.

2.1.2 Water Management Overview

A detailed discussion of the PKCA Water Management can be found in the main body of this plan (EBA, 2011h) under Section 5.0 – Operational Water Management.

2.1.3 Information Management

Shear will be developing a comprehensive document and information management system. The system will address the need to control both electronic and hard copy documentation.

2.2 Normal Operations

2.2.1 Operational Logs

Pond level data should be recorded weekly while there is open water in the PKCA. Ice level surveys should be completed while there is ice cover on the pond area. Readings should be taken daily in the two weeks preceding the expected freshet date and should continue on a daily basis for at least two weeks after freshet has passed.

2.2.2 Flow Regulation

Inflows and discharges from the PKCA are regulated based on the pond's elevation. The PKCA does not have a spillway or other pond elevation control structure; therefore, water level control in the facility requires active measures. Currently, the only options are limiting process and site water flows into the PKCA and discharge of compliant water into Stream C3.

Pond elevations are presently measured using a staff gauge installed downstream of Divider Dyke A.

2.2.3 Ice Management

Ice management is generally not an issue at the PKCA facility, as long as sufficient care is taken during FPK discharge. Spigot points must be managed so that water does not collect and freeze on the FPK surface but instead flows to Divider Dyke A. The formation of ice lenses in the PKCA can significantly reduce the storage volume of the facility.

Shifting ice on the pond could cause damage to the rip-rap along the dams or dykes; however, no damage has been observed to date.

2.3 General Flood Operating Procedures

For the purposes of the PKCA, a Flood Event is defined as an unanticipated rise in water level such that the pond nears or exceeds the 1 m freeboard limit set forth in the Jericho Water Licence. The PKCA dams are not equipped with any type of overflow structure and water has to be pumped from the facility to lower the pond elevation (excluding evaporation). If the rise in recorded pond elevations exceeds the predictions in the PKMP and are at risk of exceeding the allowable freeboard, the following steps should be taken:

1. If discharging water into Stream C3, increase the pumping rate to the maximum allowable discharge rate specified in the Operational Water Management section of the PKMP (EBA, 2011h).
2. If it is predicted that the increase in pumping rate will not prevent the pond elevation from exceeding the freeboard, all site water management discharges into the PKCA should be suspended.
3. If, after increasing pumping to Stream C3 and suspending site water inflows to the PKCA, it is still predicted that pond elevations may exceed freeboard, any processing activities should be suspended.
4. If, in extreme cases, steps 1 through 3 are not able to control the rise in pond elevations, and it is expected that that the water will exceed 0 m freeboard, the discharge of water into Stream 3 should be increased to the maximum possible rate (pump limited). If the decision to exceed the maximum allowable discharge rate is made, the NWB must be notified immediately. Detailed records of the volume discharged, the flow rate, and the length of time the discharge exceeded the maximum allowable rate is to be recorded and submitted to the NWB.

2.4 Emergency Preparedness and Response

An Emergency Preparedness and Response Plan for the PKCA dams (EBA 2011r) is in place. A copy of the manual will be kept in the Mine, Environment and Process Plant Managers' site offices as well as the Process Plant control room and the Shear Head Office.

3.0 FACILITY MAINTENANCE

3.1 General

Three types of maintenance are undertaken at the PKCA facility: routine, predictive, and event-driven. The following sections present general examples of the three types of maintenance, as well as details of maintenance documenting and reporting procedures.

3.2 Routine Maintenance

Routine maintenance of the PKCA dams involves small-scale activities to repair or prevent deterioration of the facilities infrastructure. These activities include, but are not limited to:

- Keeping geotechnical instrumentation in working order;
- Making sure the dam access roads remain open and in usable condition; and
- Replacing settling rip-rap or eroded material.

Additional routine maintenance activities may be undertaken as Shear becomes more familiar with the operations.

3.3 Predictive Maintenance

Predictive maintenance is based on the expected operating conditions of the facility in the future. These tasks are typically non-recurring work items that are scheduled months in advance. Predictive maintenance activities that will be conducted include, but are not limited to:

- Raising the elevations of the dam crests to accommodate future volumes of FPK material; and
- Installing and commissioning the thermosyphon system in the West Dam if dam core temperature conditions fail to meet the thermal predictions.

3.4 Event-driven Maintenance

Event-driven maintenance is the result of an event that results in unanticipated repairs to the facility. These events may be naturally occurring, such as high levels of rainfall or seismic activity, but may also include repairing damage to the facility and equipment due to operational errors. No event-driven maintenance was required at the time of the last geotechnical inspection (September 2010).

Event-driven maintenance should be conducted as soon as possible, within days of the event or observation of the condition that caused the need for maintenance.

3.5 Maintenance Documentation, Records, and Reporting

Any repair or modifications to the infrastructure of the Jericho PKCA should be documented through photographs and reporting by qualified personnel and maintained in Shear's document management system. Hard copies of the reports and photographs will be kept in a binder for review by the engineer during the annual Formal Geotechnical Inspection. Any changes that could affect the integrity of the facility should be reviewed and documented by a qualified geotechnical engineer.

4.0 FACILITY STRUCTURE SURVEILLANCE AND MONITORING

4.1 Surveillance Requirements

Surveillance measures employed for the dams should consist of:

- Regular, documented visual inspections;
- Regular review of pond level data collected from daily or weekly manual readings using the staff gauge located in Cell B/C;
- Regular reading of Ground Temperature Cables (GTCs) installed to monitor the thermal regime of the dams;
- Monitor long-term weather forecasts and winter snow pack to provide advance warning of upcoming flood events by facility operators and management; and
- Inspect dams and appurtenances after a significant flood event or after a noticeable seismic event (ground motions felt at plant site).

Individual surveillance tasks are described in Section 4.2.

4.2 Surveillance Procedures

4.2.1 General

Regular visual monitoring of site infrastructure is a critical component of PKCA management activities at Jericho. Inspections are completed regularly to identify potential problems with these earth structures before they risk damaging human health and the environment. Visual inspections are completed on both the dam structures and surrounding landforms.

Inspections are broken into two categories: operational inspections and formal inspections.

4.2.2 Operational Geotechnical Inspections

Weekly Operational Geotechnical Inspections are to be performed by site personnel. The purpose of the operational inspection is to identify and document any hazards and damage to or deterioration of the structure. If a condition is deemed to be serious, a qualified geotechnical engineer will be brought to site to inspect the structure. More frequent geotechnical inspections may be required under certain conditions, as identified by the geotechnical engineer.

All site personnel tasked with the operational inspections will be trained in the identification of hazards and will be provided with an inspection form prepared by a qualified geotechnical engineer to assist with the identification of maintenance issues and hazardous conditions. An example of an operational geotechnical inspection form is included in Appendix 1A. Observations made during the inspection will be photographed and recorded. Photographs of the general condition of each structure are to be taken to track year by year changes in each structure.

A copy of each operational inspection form and the associated photographs will be stored in Shear's document management system. Additionally, a hard copy will be maintained in a binder on site for review by the geotechnical engineer during the formal inspection. Any identified deficiencies or features should be highlighted in the inspection forms so the geotechnical engineer can assess whether conditions are deteriorating. Shear expects that the inspection process and form will evolve as more information about the structures and their condition become available during care and maintenance activities.

4.2.3 Formal Geotechnical Inspections

As discussed in the Jericho GMP (EBA 2011d), the annual Formal Geotechnical Inspection will be conducted by a qualified Geotechnical Engineer familiar with dam engineering as well as the design and construction of the dams and appurtenance structures. In the past, the inspections have taken place in the late summer or early fall; however, in July 2011.

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

- Visually examine each structure and surrounding area for signs distress including:
  - Cracking (longitudinal, transverse, or centered in a localized area in a circular pattern),
  - Settlement or slumping along the dam crest or slopes,
  - Seepage from the slope or toe of the dam,
  - Deflection of linear features such as the crest of the dam,
  - Evidence of erosion,
  - Any other signs of distress, and
  - Any change in the state of the dams or appurtenant structures that cannot be explained.
- Photograph and document all deficiencies.
- Take photographs of each dam from a wide aspect to monitor year on year changes to the dams. Attempt to take the photograph from a similar aspect to the previous year's formal inspection.
- Read dam instrumentation.

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

4.2.4 Impounded Water Level Data

Shear should monitor pond levels regularly during normal operating conditions and during flood events. This data can be used to trigger an inspection if monitoring indicates water has exceeded the freeboard limits.

4.2.5 Instrumentation

GTCs have been installed in the West, East, and Southeast dams to monitor ground temperatures within these structures. Temperature readings will be collected monthly while personnel are on site. Monthly inspections will continue until a clear pattern has been established, at which point the geotechnical engineer may recommend reducing the reading frequency to quarterly. In addition, a full set of readings will be taken during the annual Formal Geotechnical Inspection.

The equipment for obtaining readings from the GTCs consists of a multimeter and a 16 channel switchbox. Significant care should be taken when handling the instrumentation cables because they can be easily damaged. The threaded connection between the cable and the switchbox should be smooth and must not be forced. The cable number must be recorded along with each set of readings. If the numbering label is missing from the cable it should be replaced without delay. Each reading must be cross-referenced to the bead number indicated on the switchbox. Often, malfunctioning beads may give an erroneous reading or no reading at all. Such readings should be noted as a null reading on the record sheet. The typical range of readings is somewhere between 10 and 30 kilo-ohms (kΩ) but can vary depending on the season. In general, if the bead is giving a reading in kilo-ohms, the unit is operating correctly. Sometimes the readings may “float” and not provide an exact measurement for a considerable time. In such cases, the operator should wait at least one minute to allow time for the reading to settle. If the reading continues to float, an estimated reading should be recorded and an “F” placed next to the value on the record sheet. Upon completion of the readings, gently remove the cable from the switch box and ensure that the cable is replaced and adequately protected from the weather and wildlife.

All personnel who are assigned to read the GTCs must be suitably trained.

4.2.6 Surveys

Settlement monitoring points have been installed on the dams or will be installed at the end of construction. The elevation and location of the monitoring points should be measured monthly during the summer providing personnel are on site. The monitoring schedule will be reviewed by the geotechnical engineer if there are no signs of significant movement.

Settlement and topographic surveys of the dam crest will be carried out annually as part of the Formal Geotechnical Inspection. The topographic survey will be carried out to identify any settlement areas or deterioration on the surface of the dams.

4.2.7 Surveillance Schedule

The following schedule should be followed during ongoing dam operation:

- Operations Inspections – Brief operations inspections of the dams should be undertaken once per week. These inspections should be conducted during or immediately after a significant flood event or after a noticeable seismic event.
- Engineering Inspections - A qualified geotechnical engineer with experience in dam engineering shall conduct an annual Formal Geotechnical Inspection of all dams and appurtenant structures. Additional inspections may be required after a significant flood event or a noticeable seismic event.
- Dam Safety Reviews – Dam Safety Reviews should be undertaken at a frequency recommended in the latest Dam Safety Review/Audit Reports.
- Pond Water Level – During normal operating conditions, readings should be taken, at a minimum, weekly with a staff gauge or by pond level instrumentation in the process plant control room or by using a datalogger. Before and during freshet, or during high rainfall events, reading should be taken daily. These values should be recorded as part of the control room record.
- Instrumentation – As discussed in the Jericho GMP and Section 4.2.5, GTCs are to be read monthly while personnel are on site. Monthly readings are to continue until a clear pattern has been established, at which point the geotechnical engineer may recommend reducing the reading frequency to quarterly. An additional set of readings will be taken yearly as part of the Formal Geotechnical Inspection.

4.3 Collation and Analysis of Data

4.3.1 General

The collation and analysis of operation, maintenance, and surveillance data will be shared between site staff and an engineering consultant retained by Shear (presently EBA). Shear is responsible for performing and documenting Operational Inspections as well as collecting ground temperature data. EBA will review the weekly inspections annually during the Formal Geotechnical Inspection or more frequently if required. EBA will enter the ground temperature data collected by Shear into a database. Plots of the ground temperature data will be generated as part of the Formal Geotechnical Inspection process.

4.3.2 Documentation, Analysis, and Reporting

Inspection reports are to be prepared and submitted to Shear after each inspection is complete. The results of the inspection will be used in Shear's monthly and annual reports to the NWB.

5.0 CLOSURE

We trust this satisfies your present requirements. If you have any questions, please contact the undersigned at your earliest convenience.

EBA, A Tetra Tech Company

REGISTERED PROFESSIONAL ENGINEER
N.J. GOLDUP
LICENSEE
Aug 15, 2011
NWT/NU

REGISTERED PROFESSIONAL ENGINEER
W.T. HORNE
LICENSEE
Aug 15, 2011
N.W.T.

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Reviewed by Shear Diamonds Ltd.

Michelle Tanguay
Environment Manager
Shear Diamonds Ltd.

PERMIT TO PRACTICE
EBA ENGINEERING CONSULTANTS LTD.
Signature
Date August 15, 2011
PERMIT NUMBER: P 018
The Association of Professional Engineers, Geologists and Geophysicists of the NWT / NU

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.

EBA, A Tetra Tech Company (EBA), 2011b. Care and Maintenance Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011c. Contingency Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011d. General Monitoring Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011e. Interim Closure and Reclamation Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011f. Landfarm Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011g. Landfill Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011h. Processed Kimberlite Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., August 2011.

EBA, A Tetra Tech Company (EBA), 2011i. Site Water Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011j. Waste Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011k. Waste Rock Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011l. Wastewater Treatment Management Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

Design Reports

EBA, A Tetra Tech Company (EBA), 2011m. C1 Diversion Construction Summary, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011n. Fuel Storage Containment Facility Design Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011o. Preliminary Landfarm Design Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011p. Preliminary Landfill Design Plan, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

Additional Plans

EBA, A Tetra Tech Company (EBA), 2011q. Operations, Surveillance, and Maintenance Manual, PCKA Dams, Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

EBA, A Tetra Tech Company (EBA), 2011r. Emergency Preparedness and Emergency Response Plan for Dam Emergencies at the Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., February 2011.

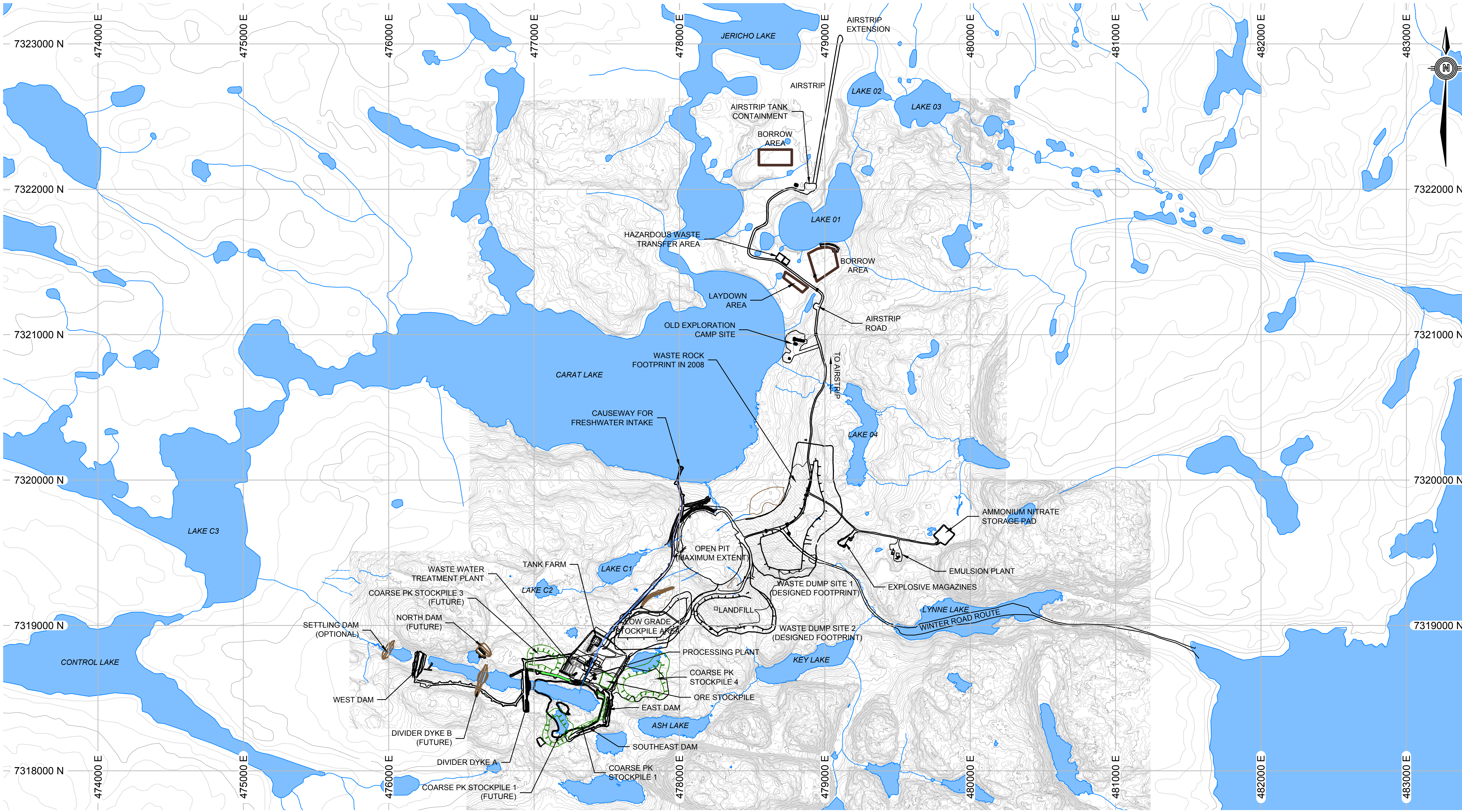
EBA, A Tetra Tech Company (EBA), 2011s. 2011 Pit Dewatering Addendum to Processed Kimberlite Management Plan Jericho Diamond Mine, Nunavut. Prepared for Shear Diamonds Ltd., May 2011.

REFERENCES

Canadian Dam Association (CDA), 2007. Dam Safety Guidelines.

Alberta Environment, 2003. Emergency Preparedness for Flood Emergencies at Dams – Guideline

FIGURES



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NOTES

1. LAYOUTS ARE APPROXIMATE AND MAY NOT REFLECT ACTUAL SIZE AND LOCATIONS.
2. FOOTPRINTS OF WASTE ROCK PILES, COARSE PK STOCKPILES AND ORE STOCKPILES ARE SHOWN IN MAXIMUM LIMITS, ACTUAL FOOTPRINTS MAY VARY.

STATUS
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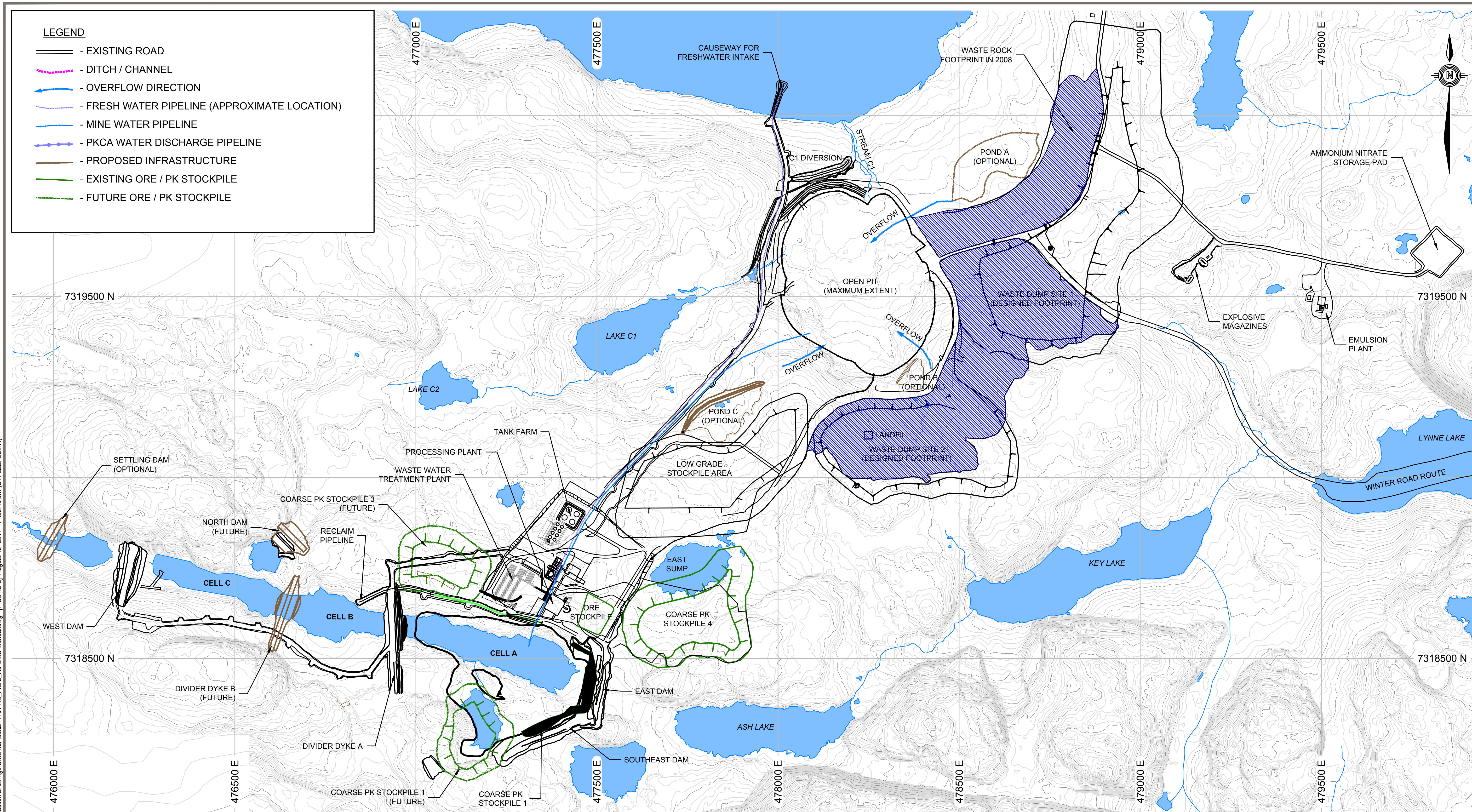
GENERAL SITE PLAN

PROJECT NO.	DWN	CKD	REV
E14101140	EL	NG	0
OFFICE	DATE		
EDM	August 15, 2011		

Figure 1



NOTES

1. LAYOUTS ARE APPROXIMATE AND MAY NOT REFLECT ACTUAL SIZE AND LOCATIONS.
2. FOOTPRINTS OF WASTE ROCK PILES, COARSE PK STOCKPILES AND ORE STOCKPILES ARE SHOWN IN MAXIMUM LIMITS, ACTUAL FOOTPRINTS MAY VARY.

0 500 m

Scale: 1: 10 000

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SITE INFRASTRUCTURE PLAN

PROJECT NO.	DWN	CKD	REV
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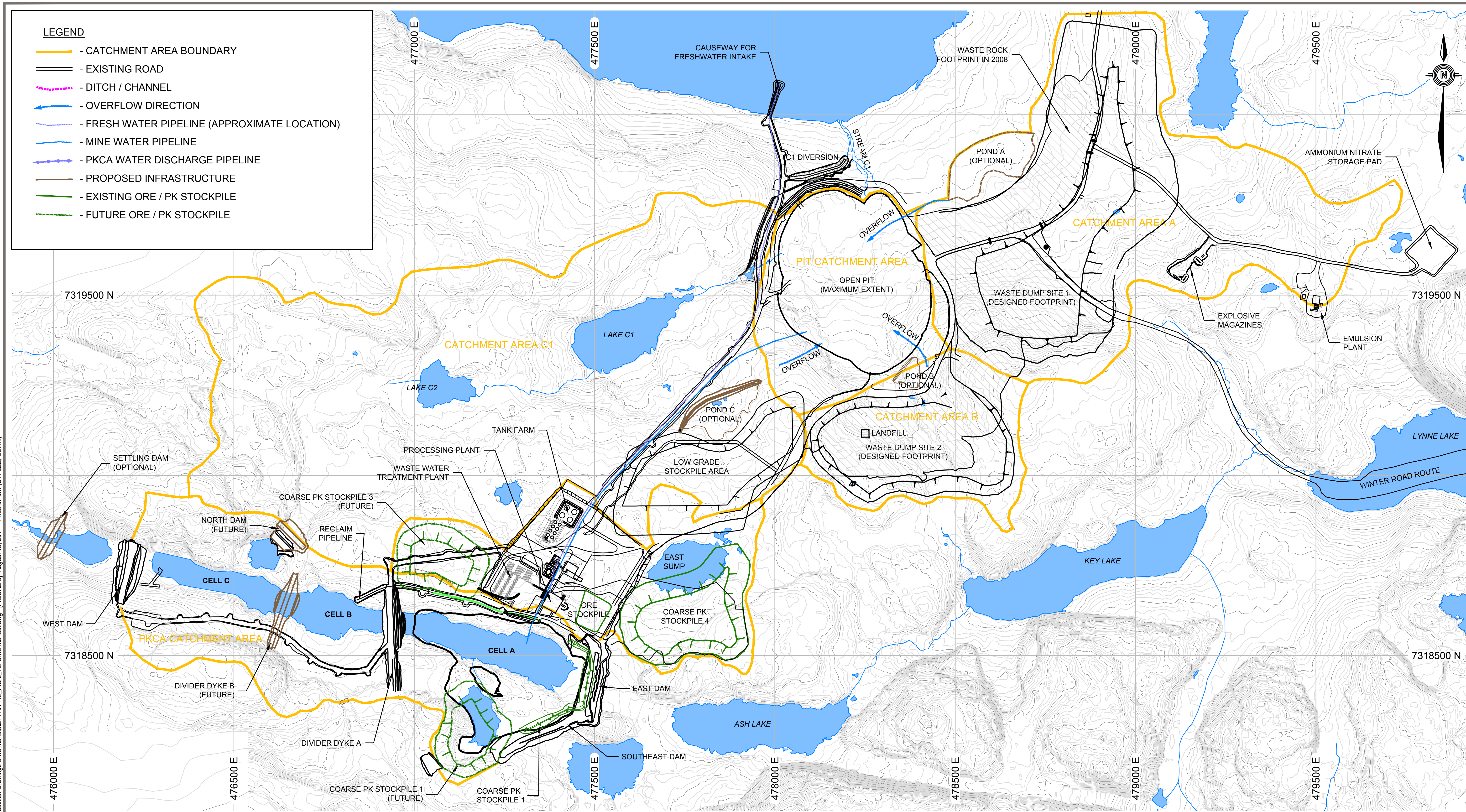
OFFICE	DATE		
EDM	August 15, 2011		

Figure 2



NOTES

1. LAYOUTS ARE APPROXIMATE AND MAY NOT REFLECT ACTUAL SIZE AND LOCATIONS.
2. FOOTPRINTS OF WASTE ROCK PILES, COARSE PK STOCKPILES AND ORE STOCKPILES ARE SHOWN IN MAXIMUM LIMITS, ACTUAL FOOTPRINTS MAY VARY.

0 500 m

Scale: 1: 10 000

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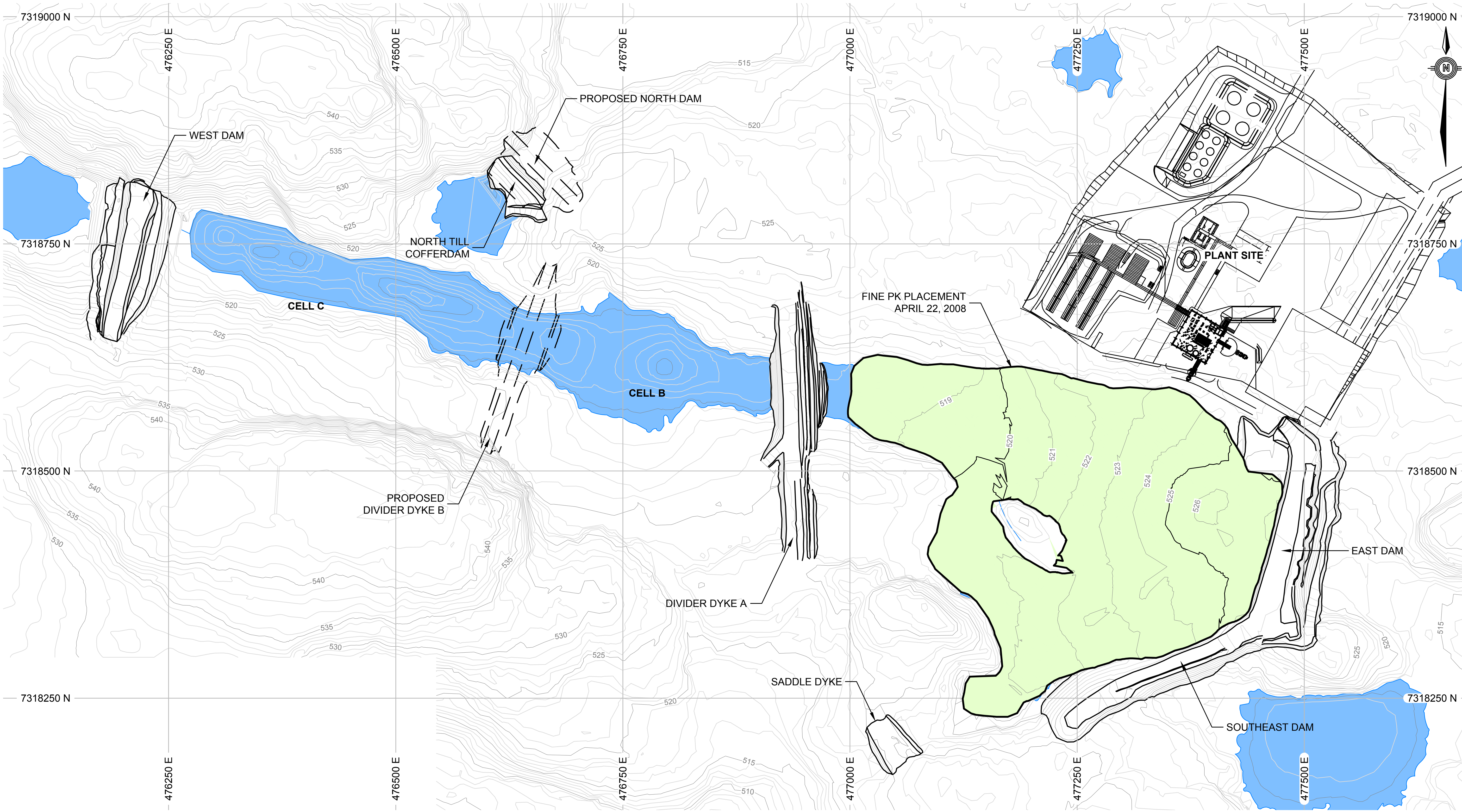
CATCHMENT AREAS PLAN

PROJECT NO.	DWN	CKD	REV
E14101140	EL	NG	0

OFFICE	DATE
EDM	August 15, 2011

Figure 3



NOTES
PROCESSED KIMBERLITE CONTOURS EXTRAPOLATED FROM APRIL 22, 2008 SURVEY.

0 200 m
Scale: 1: 4 000

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EXISTING PKCA PLAN

PROJECT NO.	DWN	CKD	REV
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Figure 4

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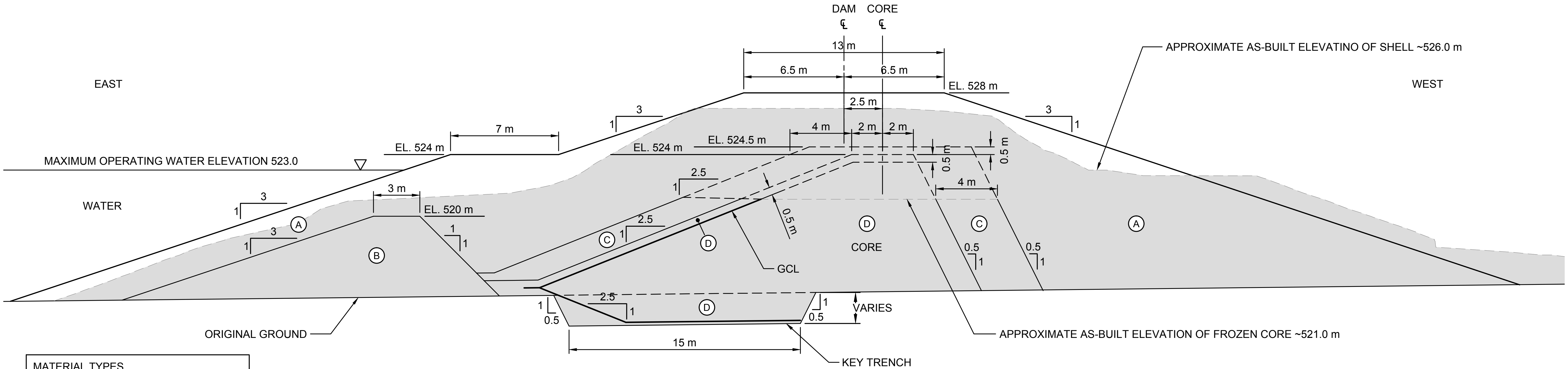
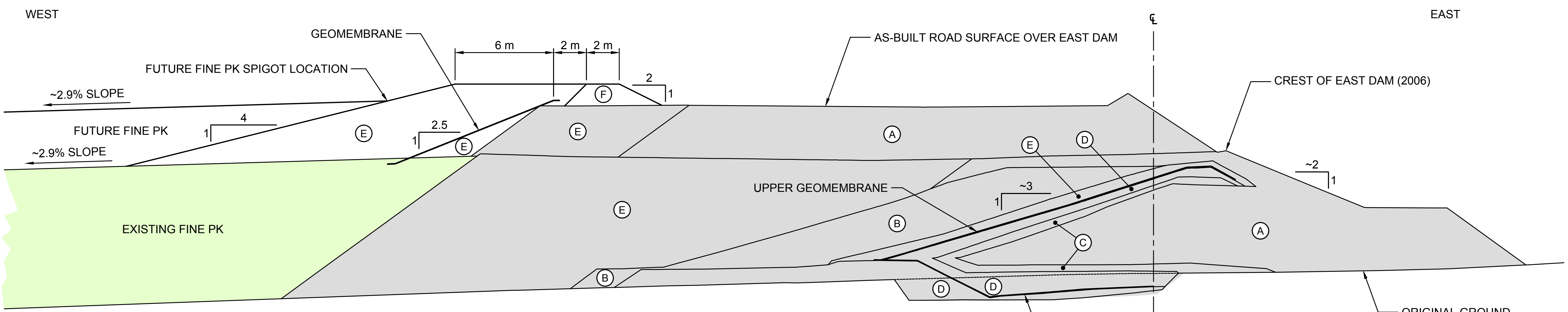


WEST DAM - TYPICAL CROSS-SECTION
1:250

MATERIAL TYPES	
A	RUN-OF-MINE WASTE ROCK
B	TILL
C	200 mm MINUS ROCKFILL
D	20 mm MINUS CRUSH
E	COARSE PK
F	150 mm MINUS ROCKFILL



EAST DAM - TYPICAL CROSS-SECTION
1:250

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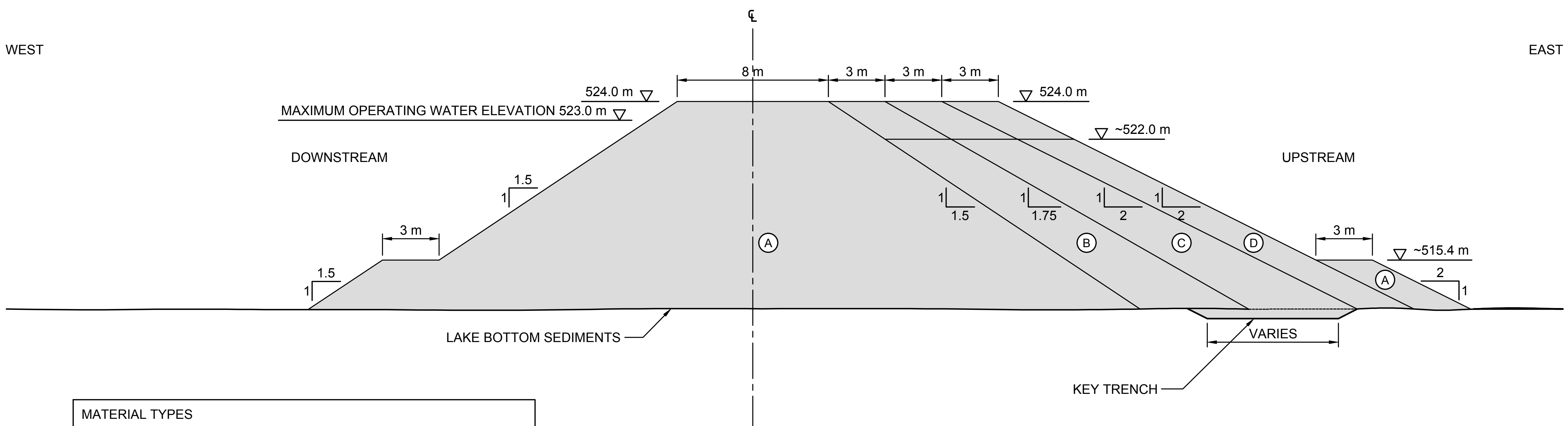
WEST DAM AND EAST DAM
TYPICAL CROSS-SECTIONS

PROJECT NO.	DWN	CKD	REV	
E14101140	EL	NG	0	**Figure 5**
OFFICE	DATE			
EDM	August 15, 2011			



MATERIAL TYPES

A	RUN-OF-MINE WASTE ROCK
B	TRANSITION ZONE (MINUS 150 mm OR 200 mm ROCKFILL)
C	FILTER ZONE (20 mm MINUS CRUSH)
D	RIP RAP

DIVIDER DYKE - TYPICAL CROSS-SECTION

1:250

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DIVIDER DYKE
TYPICAL CROSS-SECTION

PROJECT NO.	DWN	CKD	REV
E14101140	EL	NG	0

OFFICE	DATE
EDM	August 15, 2011

Figure 6

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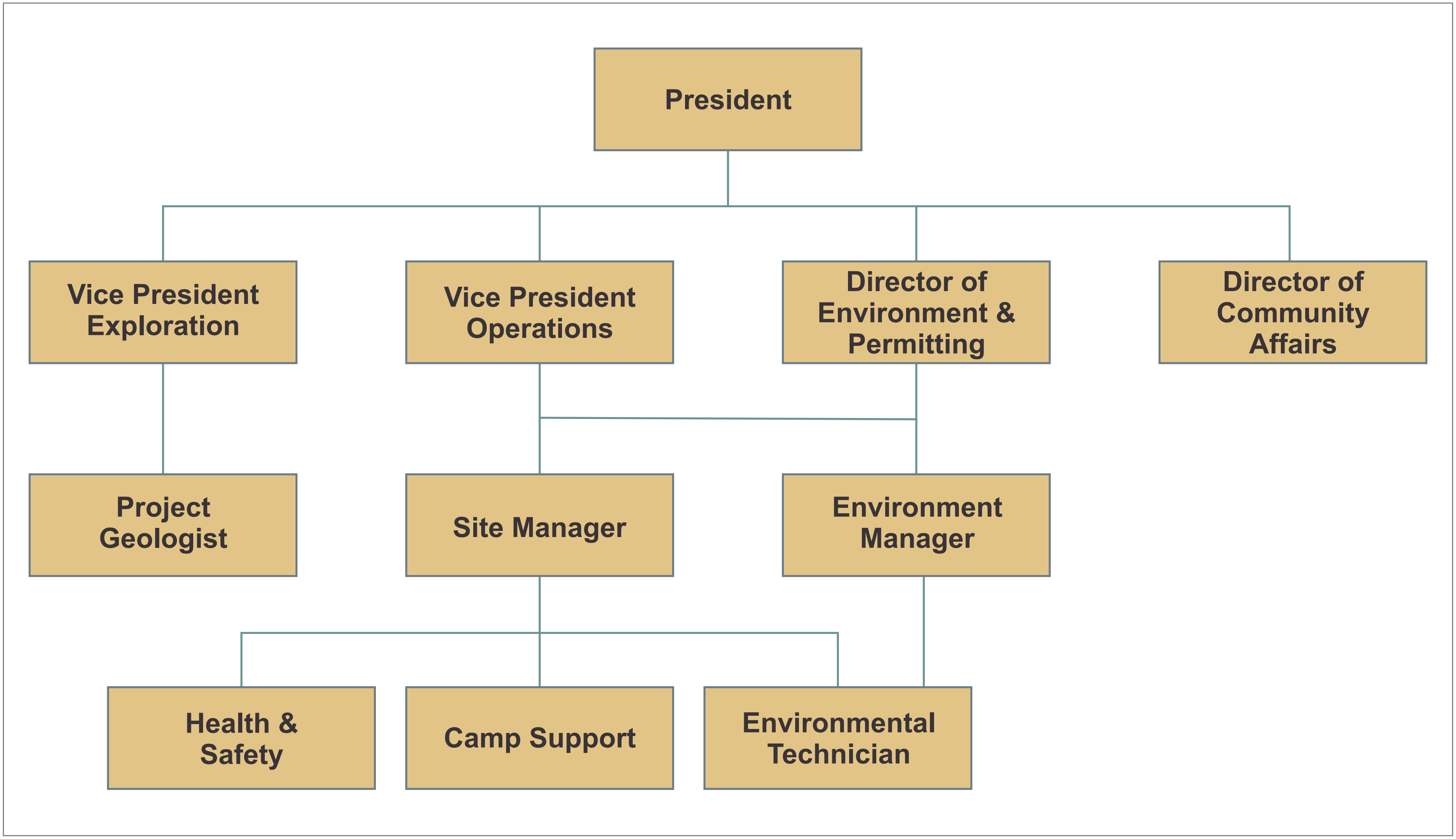

LEGEND

NOTES

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COMMUNICATION ORGANIZATION CHART

PROJECT NO.	DWN	CKD	APVD	REV
E14101140	CLS	NL	NG	0

OFFICE	DATE
EBA-EDM	August 2011

Figure 7

APPENDIX A

APPENDIX A WEEKLY GEOTECHNICAL INSPECTION SUMMARY

WEEKLY GEOTECHNICAL INSPECTION SUMMARY

Observation Date: ______________________ **Weather:** ______________________

Time (Start/Finish): ______________________ **Inspected by:** ______________________

West Dam

Y/N Seepage | Y/N Cracking | Y/N Erosion | Y/N Instruments Read

Y/N Settlement or Slumping | Y/N Ponded Water | Y/N Damage by equipment

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

East Dam

Y/N Seepage | Y/N Cracking | Y/N Erosion | Y/N Instruments Read

Y/N Settlement or Slumping | Y/N Ponded Water | Y/N Damage by equipment

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

Southeast Dam

Y/N Seepage | Y/N Cracking | Y/N Erosion | Y/N Instruments Read

Y/N Settlement or Slumping | Y/N Ponded Water | Y/N Damage by equipment

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

Divider Dyke A

Y/N Downstream Turbidity | Y/N Cracking | Y/N Erosion | Cell B/C water level

Y/N Settlement or Slumping | Y/N Ponded Water | Y/N Damage by equipment | ______ m

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

Fuel Tank Farm

Y/N Seepage | Y/N Cracking | Y/N Erosion | Y/N Evidence of Spillage

Y/N Settlement or Slumping | Y/N Ponded Water | Y/N Damage by equipment

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

Generator Containment Area

Y/N Seepage | Y/N Cracking | Y/N Erosion | Y/N Evidence of Spillage

Y/N Settlement or Slumping | Y/N Ponded Water | Y/N Damage by equipment

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

Airstrip Containment Area

Y/N Seepage | Y/N Cracking | Y/N Erosion | Y/N Evidence of Spillage

Y/N Settlement or Slumping | Y/N Ponded Water | Y/N Damage by equipment

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

Landfill

Y/N Seepage | Y/N Cracking | Y/N Erosion

Y/N Settlement or Slumping | Y/N Ponded Water | Y/N Damage by equipment

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

Waste Transfer Area

Y/N Seepage | Y/N Cracking | Y/N Erosion

Y/N Settlement or Slumping | Y/N Ponded Water | Y/N Damage by equipment

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

C1 Diversion Channel

Y/N Water Flowing | Y/N Cracking | Y/N Erosion/Sloughing | Y/N Culverts Open

Y/N Settlement or Slumping | Y/N Ponded Water | Y/N Free of Snow

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

East Sump

Y/N Seepage/Over topping | Y/N Cracking | Y/N Damage by equipment | Pond water level

Y/N Settlement or Slumping | Y/N Erosion | ____ m

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

Collector Ditches and Culverts

Y/N Water Flowing | Y/N Cracking | Y/N Erosion | Y/N Culverts Open

Y/N Settlement or Slumping | Y/N Ponded Water | Y/N Damage by equipment

Notes: (Location/description, extent, dimensions of feature)

Y/N Require Inspection by Engineer

Additional Notes:

Photo List:

SITE MAP
to be included

APPENDIX E

APPENDIX E GENERAL CONDITIONS

GENERAL CONDITIONS

GEOTECHNICAL REPORT

This report incorporates and is subject to these "General Conditions".

1.0 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of EBA's Client. EBA does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than EBA's Client unless otherwise authorized in writing by EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. EBA's instruments of professional service will be used only and exactly as submitted by EBA.

Electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, EBA has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

4.0 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. EBA does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

5.0 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

6.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. EBA does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

7.0 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

8.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

9.0 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

10.0 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

11.0 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

12.0 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

13.0 SAMPLES

EBA will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client’s expense upon written request, otherwise samples will be discarded.

14.0 INFORMATION PROVIDED TO EBA BY OTHERS

During the performance of the work and the preparation of the report, EBA may rely on information provided by persons other than the Client. While EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.