Aboriginal Affairs and
Northern Development Canada

Affaires autochtones et
Développement du Nord Canada

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License # 2AM-JER1119
Our file - Notre référence

April 25, 2012

Ms. Julie Lassonde
President and Chief Executive Officer
Shear Diamonds Ltd.
6 Adelaide Street East
Suite 220
Toronto, Ontario M5C 1H6

Re : Quality Assurance/Quality Control Plan as per the Nunavut Water Board License No. 2AM-JER1119, Jericho Diamond Mine – Shear Diamonds, Ltd.

Submitted : April 23, 2012
Reviewed : April 25, 2012

Thank you for the submission of the Quality Assurance and Quality Control Plan prepared for the Jericho Diamond Mine, Nunavut as part of the SNP outlined in accordance with the Jericho Water License (2AM-JER1119).

Upon review, it has been found that the Plan is complete. Approval of the Plan is hereby granted.

Should you require further information, please do not hesitate to contact me at (867) 669-2781.

Sincerely,

Angèlique Ruzindana, M.Sc., Ph.D
Analyst Under the
Northwest Territories and Nunavut Waters Act

cc: Phyllis Beaulieu, Nunavut Water Board
Allison Rippin Armstrong, Shear Diamonds Ltd.

SHEAR DIAMONDS (NUNAVUT) CORP.

QUALITY ASSURANCE AND QUALITY CONTROL PLAN JERICHO DIAMOND MINE, NUNAVUT

UNDER JERICHO WATER LICENCE NO. 2AM-JER1119

REPORT

APRIL 2012
ISSUED FOR USE
EBA FILE: E14101206

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DOCUMENT REVISION HISTORY

Document Version	Date of Revision	Authors	Description of Changes / Comments
Previous Release	May 2007	Tahera Diamond Corporation	▪ Approved by an Analyst on May 14, 2007
Initial Revision (V1.0) by Shear Diamonds Ltd.	April 2012	W. Liu, M.Eng., E.I.T. K. Beaudet, B.Sc., P.Chem. L. Levinson, M.A.Sc. D. Bachand, B.Sc. D. Felske, P.Eng. A. Rippin Armstrong J. Lassonde	▪ Redeveloped the plan based on Jericho Water Licence (Licence No. 2AM-JER1119) and the revised monitoring and management plans; ▪ Updated sampling locations and frequencies; ▪ Revised field sampling protocols and methods; ▪ Revised laboratory analysis protocols; and ▪ Revised data management protocols.

ACRONYMS & ABBREVIATIONS

AANDC	Aboriginal Affairs and Northern Development Canada
AEMP	Aquatic Effects Monitoring Plan
CAEAL	Canadian Association for Environmental Analytical Laboratories
CALA	Canadian Association for Laboratory Accreditation
CCV	Continuing Calibration Verifications
CoC	Chain of Custody
CPK	Coarse Processed Kimberlite
DL	Detection Limit
DO	Dissolved oxygen
EBA	EBA Engineering Consultants Ltd. operating as EBA, A Tetra Tech Company
EDA	Exploratory Data Analysis
FLAG	Fundamental Laboratory Acceptance Guideline
GMP	General Monitoring Plan
IQR	Interquartile range
Maxxam	Maxxam Analytics Inc.
MDL	Method Detection Limit
MSDS	Material Safety Data Sheet
Jericho	Jericho Diamond Mine
PKCA	Processed Kimberlite Containment Area
ORP	Oxidation-Reduction Potential
QA	Quality Assurance
QC	Quality Control
QMS	Quality Management System
RDL	Reported Detection Limit
RSD	Relative Standard Deviation
SD	Standard deviation
Shear	Shear Diamonds Ltd.
SOP	Standard Operation Procedure
TAT	Turnaround time
WWTP	Wastewater treatment plant

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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, NT. The Jericho quality assurance/quality control (QA/QC) Plan has been developed in accordance with the Jericho Water Licence (2AM-JER1119), Part I, Item 12 through 15 (inclusive) and Schedule I.

This plan documents the QA/QC program and has been developed in accordance with the Aboriginal Affairs and Northern Development Canada (AANDC) 1996 *'Guideline For Use by Class "A" Licensees in Meeting SNP Requirements and For Submission of a QA/QC Plan'*, which includes definitions for:

- Quality Assurance: the system of activities designed to better ensure that quality control is done effectively, and
- Quality Control: the use of established procedures to achieve standards of measurement for the three principal components of quality – precision, accuracy, and reliability.

The AANDC QA/QC guidelines cover field sampling (including both methods and quality control), laboratory analysis, and reporting. General guidelines are provided which are accepted practices and will be employed in Jericho sampling programs as detailed in the Aquatic Effects Monitoring Plan (AEMP) (EBA 2011a) and General Monitoring Plan (GMP) (EBA 2011b). Reporting requirements generally follow accepted standards and will be followed by Shear Diamonds Ltd. (Shear) environment personnel and consultants.

Shear is committed to quality assurance in monitoring programs for the Jericho Project as part of the company's submission for project approval. Quality assurance has been integrated into environmental monitoring programs by design. Each component of the QA process contributes to the overall QA/QC program. Continual improvement is a key focus of the QA/QC program and an integral part of the mine's adaptive management plan. Data gathered through the monitoring programs will provide the factual basis required for this adaptive management approach to environmental control at the Jericho Diamond Mine.

Quality assurance and quality control are used to identify and implement methodologies, which limit the introduction of error into data and procedures.

An assessment of environmental data is used to evaluate whether data meet the objectives of the survey and whether the data are sufficient to answer questions required to implement adaptive environmental management at the site (i.e., Is there an effect caused by mining and is it significant?).

Data verification is an integral part of quality control. Data verification ensures that the requirements stated in this and monitoring plans are implemented as prescribed. Deficiencies or problems that occur during surveys will be documented.

Performance of equipment requires checking through calibration and monitoring. Calibration checks need to be recorded and reviewed to identify and remedy equipment problems.

This QA/QC plan covers environmental monitoring at the Jericho Mine site specified in the NWB Water Licence and detailed in the AEMP (EBA 2011a) and GMP (EBA 2011b). The objective of the QA/QC Plan is to help ensure that the data collected, analyzed, and evaluated under the monitoring plans are focused on relevant variables, are of high quality, and reliably reflects actual conditions.

2.0 SAMPLING TYPE, LOCATION, AND FREQUENCY

This document outlines the QA/QC protocols and procedures for the water quality monitoring programs described in Jericho's AEMP and GMP including Site Water Quality Monitoring and stipulated in the Jericho Water Licence (2AM-JER1119).

The sampling types, locations, and frequencies during the care and maintenance period are detailed in the AEMP and GMP for Care and Maintenance (EBA, 2011), and are summarized in this section. These plans will be revised in the future to reflect requirements during operations in accordance with the Water Licence. The AEMP and GEP sampling frequencies for operations are included in Appendix B.

2.1 Aquatic Effects Monitoring Plan

The AEMP has been developed to provide methodologies for collecting and analyzing abiotic and biotic parameters in the receiving water bodies near Jericho. The objective of the water quality monitoring program under the AEMP is:

- To monitor any change in water quality in the receiving environment resulted from the mine's effluent discharge, surface runoff and airborne emissions;
- To provide early warning of the declining aquatic environment quality; and
- To trigger any adaptive management for the operation.

The AEMP sampling types, locations, and frequencies during the care and maintenance period are summarized in Table 1. The corresponding sampling locations are shown in Figure 1.

Table 1: AEMP Water Chemistry Monitoring

Station	Location	Analysis(1)	Frequency (2)
JER-AEM-01	Reference Lake 1	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-02	Reference Lake 2 (3)	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-03	Control Lake	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-04	Stream C3 near PKCA Discharge	R, ICP-T, ICP-D, N, B, PHC2	Weekly during discharge, monthly until freeze up
		Tox-1, Tox-2	Once prior to completion of the effluent discharge
JER-AEM-05	Stream C3 upstream of Lake C3	R, ICP-T, ICP-D, N, B	A2
JER-AEM-06	Stream C3 outlet in Lake C3	R, ICP-T, ICP-D, N	A1, A2
		Tox-2	Once one week following the start of the discharge, and once prior to completion of the discharging
JER-AEM-07	Lake C3 South Basin	R, ICP-T, ICP-D, N	A1, A2

Table 1: AEMP Water Chemistry Monitoring

Station	Location	Analysis(1)	Frequency (2)
JER-AEM-08	Lake C3 Outlet	R, ICP-T, ICP-D, N	A2
JER-AEM-09	Lake C1	R, ICP-T, ICP-D, N	A2
JER-AEM-10	Stream C1 Upstream of Carat Lake	R, ICP-T, ICP-D, N	A2
JER-AEM-11	Stream C1 outlet in Carat lake	R, ICP-T, ICP-D, N	A2
JER-AEM-12	Carat Lake Freshwater Intake	R, ICP-T, ICP-D, N, B	M1
JER-AEM-13	Lake C4	R, ICP-T, ICP-D, N	A2
JER-AEM-14	Stream C2 Upstream of Carat Lake	R, ICP-T, ICP-D, N	A2
JER-AEM-15	Carat Lake Centre Basin	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-16	Carat Lake Outlet	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-17	Jericho Lake North Basin	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-18	Jericho River Downstream of Jericho Lake	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-19	Lake O1	R, ICP-T, ICP-D, N	A2
JER-AEM-20	Lake O2	R, ICP-T, ICP-D, N	A2
JER-AEM-21	Lake O4	R, ICP-T, ICP-D, N	A2
JER-AEM-22	Ash Lake	R, ICP-T, ICP-D, N	A2
JER-AEM-23	Key Lake	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-24	Lynne Lake	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-25	Contwoyto Lake near Stream D1 Mouth	R, ICP-T, ICP-D, N	A2

Reference:

Aquatic Effects Monitoring Plan under Care and Maintenance Plan (EBA 2011a)

Technical Memorandum C: Proposed Changes to the Aquatic Effects Monitoring Plan (Shear 2011)

Jericho Diamond Mine Type A Water Licence (Licence No.: 2AM-JER1119, NWB 2012)

Note:

1. Detailed analytical parameters are presented in Appendix A and also detailed in Schedule I, Table 1 of the Water Licence. Tox-1 (acute lethality) is described in Part F Item 19 and Tox-2 (chronic toxicity) is described in Schedule I Item 2.

2. Monitoring frequency:

A1	Annual once in Winter (Standard Operating Procedure SOP-AEMP-02);
A2	Annual once in Summer (Standard Operating Procedure SOP-AEMP-03);
M1	Monthly;

3. Reference Lake 2 will be identified during the 2012 AEM program.

The corresponding location and frequency table relevant to mine operations is provided in Appendix B.

2.2 General Monitoring Plan

The General Monitoring Plan and associated Standard Operating Procedures (SOPs) were developed to provide methodology for monitoring on site environmental influences to the receiving environment. The monitoring programs under this plan include the routine geotechnical inspections, site water quality monitoring (SOP-GEN-01), seepage quality survey (SOP-GEN-02), and water flow monitoring (SOP-GEN-03). The sampling types, locations, and frequency for the seepage quality survey and site water quality monitoring program are summarized in Sections 2.2.1 and 2.2.2.

2.2.1 Seepage Quality Survey

The seepage quality survey involves identifying and monitoring the quality of seeps from the waste rock dumps, ore stock piles, coarse processed kimberlite stockpiles, and explosive area. It has been conducted annually in the summer. Table 2 summarizes the sampling types, locations, and frequency of the seepage quality survey program during the care and maintenance period. The sampling locations are shown in Figure 2.

Table 2: Annual Seepage Quality Survey

Station	Location	Analysis (1)	Frequency	Comment
JER-SPG-01	Waste Rock Dump 1	R, ICP-T, ICP-D, N	July or August	Under development
JER-SPG-02	Waste Rock Dump 2	R, ICP-T, ICP-D, N	July or August	Under development
JER-SPG-03	CPK Stockpile 1	TBD	No monitoring	Not developed
JER-SPG-04	CPK Stockpile 2	TBD	No monitoring	Not developed
JER-SPG-05	CPK Stockpile 3	TBD	No monitoring	Not developed
JER-SPG-06	CPK Stockpile 4	R, ICP-T, ICP-D, N	July or August	Under development
JER-SPG-07	Ore Stockpile	R, ICP-T, ICP-D, N	July or August	Under development
JER-SPG-08	Low Grade Ore Stockpile	R, ICP-T, ICP-D, N	July or August	Under development

Reference:

General Monitoring Plan under Care and Maintenance Plan (EBA 2011)

Note:

1. Detailed analytical parameters are presented in Appendix A.

Detailed sample collection methods for site staff are provided in Standard Operating Procedure SOP-GEN - 02.

2.2.2 Site Water Quality Monitoring

The Site Water Quality Monitoring Program for care and maintenance has been designed to monitor the variation in site water quality at the mine. The objective of the program is to ensure that the water quality in each area of the mine is maintained at an acceptable level, and that the quality of the water in the Processed Kimberlite Containment Area (PKCA) is not unduly impacted from inflows from other mine areas. Table 3 summarizes the sampling types, locations, and frequency of the site water quality monitoring program during the care and maintenance period. The sampling locations are shown in Figure 2.

Table 3: Site Water Quality Monitoring Program

Station	Location	Analysis [(1)]	Frequency	Comment
JER-SWQ-01	Wastewater Treatment Effluent	R, ICP-T, ICP-D, N, TKN, B	Weekly	N/A
JER-SWQ-02	Pit Sump	R, ICP-T, ICP-D, N	Weekly during pit dewatering, then Monthly until freeze up	Containing approx. 250,000 m^3 water as of April 2011; pit dewatering will be conducted in Summer 2012
JER-SWQ-03	Process Plant Supernatant	R, ICP-T, ICP-D, N	Weekly during processing	N/A
JER-SWQ-04	PKCA Pond Water	R, ICP-T, ICP-D, N, B, PHC2	Weekly during PKCA discharge, then monthly thereafter	N/A
		Tox 1, Tox 2	Once prior to effluent discharge	N/A
JER-SWQ-05	Collection Pond A	TBD	No monitoring	Collection pond not constructed
JER-SWQ-06	Collection Pond B	TBD	No monitoring	Collection pond not constructed
JER-SWQ-07	East Sump or Collection Pond C	R, ICP-T, ICP-D, N	Monthly during open water season	Sample currently collected from the East Sump

Reference:

General Monitoring Plan under Care and Maintenance Plan (EBA 2011)

Note:

1. Detailed analytical parameters are presented in Appendix A and also detailed in Schedule I, Table 1 of the Water Licence.

Detailed sample collection methods for site staff are provided in Standard Operating Procedure SOP-GEN - 01. The corresponding location and frequency table relevant to mine operations is provided in Appendix B.

3.0 FIELD SAMPLING

3.1 Sampling Preparation

Water quality monitoring will be performed by Shear's environmental personnel or qualified external environmental consultants. The field preparation is a critical step in assuring the quality of the water quality monitoring programs. The following sections summarize the main components for the field sampling preparation.

3.1.1 Field Initiation Meeting

The purpose of the field initiation meeting is to prepare field personnel and to review the requirements of the field sampling. All field personnel will be familiar with the field sampling SOPs and environmental monitoring plans prior to conducting any sampling. During the field initiation meeting, field personnel, the environment manager, and/or the site manager will review and discuss the sampling schedule, sample locations, sample types, required field equipment and sample containers, field safety protocols and supplies, and contingency measures.

3.1.2 Field Equipment

3.1.2.1 Sampling Equipment

Van Dorn or Kemmerer samplers will be used during the near-bottom lake water sampling and under-ice water sampling. The water samplers will be cleaned before and after each day of sampling.

Prior to each day of sampling, the water samplers will be thoroughly rinsed three times using deionized water supplied from the laboratory. A rinsate blank sample will be collected following the decontamination of the equipment to verify the removal of any potential contaminant on the sampler. The procedure for collecting the rinsate blank is described in Standard Operating Procedures SOP-AEMP-02 (winter sampling) and SOP-AEMP-03 (summer sampling).

Following each sampling program, the water sampler should be rinsed using 10% hydrochloric acid solution to remove any inorganic residuals. The sampler should then be thoroughly rinsed three times using deionized water, and air dried in the on-site environment laboratory. The sampler will then be stored, with the caps at the both end opened, in a closed cabinet or storage container.

3.1.2.2 Field Parameter Meter

The required field parameters under the GMP, AEMP, and Jericho Water Licence (2AM-JER1119) include pH, dissolved oxygen (DO), oxidation-reduction potential (ORP), conductivity, temperature, and turbidity. The pH, DO, ORP, conductivity, and temperature will be measured by a multi-parameter meter and the turbidity will be measured by a portable turbidity meter.

The multi-parameter meter and the turbidity meter should be calibrated daily, or prior to each usage. Prior to each calibration, Shear environmental personnel should first visually inspect the integrity of the field parameter meters. Any deformation, scratch or crack to the sensors should be noted, and the subsequent reparation or replacement should be performed under the manufacturer's instructions.

Procedures for calibration, maintenance and reparation are instrument-specific, and Shear environmental personnel will follow the procedures described in the manufacturer's manual and Standard Operating Procedure SOP-AEMP-01. An equipment maintenance logbook, detailing the instrument calibration, operation, and maintenance records, will be kept in the on-site environmental laboratory.

Parameters including pH, conductivity, and turbidity will also be analyzed in the laboratory, and the results will be compared with the field measurement as a part of the data quality assurance process. The protocols of comparing and interpreting analytical results against the field measurements are detailed in Section 5.2 of this plan. If it is determined that the field parameters are malfunctioned or the calibrations are improperly performed, Shear environment personnel will inform the manufacturer for further instruction or preparation.

3.1.3 Sample Containers, Filter and Preservatives

The sample containers, filters, and preservatives will be supplied by the designated accredited laboratory in sealed coolers. Table 4 summarizes the required sample containers, filtration, and preservatives for each analysis.

Table 4: Sample Containers and Preservatives

Analysis package	Type of Sample Containers	Field filtration	Preservatives
Total Metals (ICP-T)	One 250 mL Plastic Bottle One 100 mL Amber Glass Bottle	No	2 mL 50% nitric acid
Dissolved Metals (ICP-D)	One 250 mL Plastic Bottle One 100 mL Amber Glass Bottle	Yes	2 mL 50% nitric acid
Nutrients (N)	One 250 mL Plastic Bottle	No	2 mL 50% sulphuric acid
Routine (R)	One 500 mL Plastic Bottle	No	No preservatives
Biological (B)	250mL sterile plastic bottle (for coliforms, HPC, SRB, IRB)	No	Precharged with sodium thiosulphate
	500mL plastic bottle (for BOD)	No	No Preservatives
Petroleum Hydrocarbon (PHC1 and PHC2)	Three 40 mL Glass Vial	No	Sodium bisulphate, precharged in tablets
	Two 250 mL Amber Glass Bottle	No	Sodium bisulphate, precharged in tablets

Prior to the field sampling program, the sample containers will be pre-labelled, including sample station code, sample location, types of analysis, and sample date. Pre-fieldwork checklists are provided in Standard Operating Procedures SOP-AEMP-02 (winter sampling) and SOP-AEMP-03 (summer sampling). The containers with the same monitoring station code will be packed in a clear plastic bag to avoid potential cross-contamination. The packed sample containers will be placed in a clean cooler with either ice pack or warm water bottles depending on the season of the sampling program in an effort to maintain a temperature between 0°C and 4°C.

3.2 Water Sample Collection

The water quality monitoring programs at Jericho consist of AEM water quality monitoring, on site seepage water quality monitoring, and the site water quality monitoring. The following sections describe the general water sampling protocols as quality assurance measures. The detailed water sampling procedures are described in Shear's Standard Operation Procedures (SOPs), including SOP-AEMP-02 for winter sampling (i.e., under-ice sampling) and SOP-AEMP-03 for summer sampling (i.e., stream and lake sampling).

3.2.1 Aquatic Effects Monitoring

3.2.1.1 Open Water Sampling

The AEMP water quality monitoring during the open water season includes stream water and lake water sampling.

- **Stream Water Sampling**

  Wherever practical, the stream samples will be collected in the middle of the stream cross-section to avoid any influence form the stream shore. The environment personnel will identify the monitoring station, and wade into the stream downstream of the sample site. This will avoid the disbursement of the sediment at the sample site. For streams with multiple sampling stations (e.g. Stream C3), field personnel will collect samples from the furthest downstream monitoring station first.

  With the exception of the petroleum hydrocarbon and biological sample containers, all the sample containers will be rinsed three times using the stream water. The water sample for dissolved metal analysis will be filtered prior to being filled into the sample bottle. Preservatives will be added into the appropriate sample bottle after the bottles have been filled. The samples from the same sample station will be packed in a clear plastic bag, and placed in a cooler with an ice pack to maintain a temperature between 0°C and 4°C. Field parameters including pH, DO, ORP, conductivity, and temperature will be measured by placing the multi-parameter probe in the stream. Field turbidity will be measured using the turbidity meter prior to sample collection. Field personnel will wear nitrile gloves during the data and sample collection. All sampling activities and observations as described in Section 3.4 will be recorded in the field logbook and photographs of the samples and sampling conditions will be recorded.

- **Lake Water Sampling**

  The near-surface water samples will be collected from a boat by submersing the water bottles 0.25 m below the lake water surface. While submerged, the bottles will be uncapped, allowed to fill, and recapped prior to resurfacing.

  At the monitoring stations that require sediment sampling, additional near-bottom water samples will be collected at the same monitoring station using a Kemmerer or Van Dorn sampler at approximately 1 m above the lake bottom. Prior to launching the water sampler, the approximate lake bed depth will be measured using a fish finder radar. This will prevent the sampler from touching the lake bottom and disturbing the sediment. Field parameters including pH, DO, ORP, conductivity, temperature, and depth will be measured by lowering the multi-parameter probe directly into the lake. The field turbidity will be measured using the turbidity meter.

  Sample bottles will be rinsed three times using the lake water. The water sample for dissolved metal analysis will be filtered prior to being filled into the sample bottle. Preservatives will be added into the appropriate sample bottle after they are filled with water samples. The samples from the same sample station will be packed in a clear plastic bag, and placed in a cooler with ice pack to maintain the temperature between 0°C and 4°C. Field personnel will wear nitrile gloves during sampling. All sampling activities and observations as described in Section 3.4 will be recorded in the field logbook and photographs of the samples and sampling conditions will be recorded.

3.2.1.2 Under Ice Sampling

A winter water quality sampling event will be conducted annually in April based on the AEMP (EBA 2011) and as described in the Standard Operating Procedure SOP-AEMP-02. During this period, the ice on the lakes in the Jericho area is typically over 1 m thick. The lake water samples need to be collected from a drill hole augered through the ice cover.

After clearing the loose snow, the hole will be drilled using a power ice auger. Fuel and oil for the ice auger will be kept away from the drill hole. Ice chips surrounding the drill hole will be cleared to avoid any contamination. After the hole is drilled through the ice, the floating slush should be moved using a plastic sieve.

Prior to collecting the samples, a minimum of 10 L of water will be bailed from the hole using a Kemmerer or Van Dorn sampler. Samples will be collected approximately 1 m below the bottom of the ice using a Kemmerer or Van Dorn sampler. If the water depth under the ice is deeper than 10 m, an additional sample will be collected 1 m above the bottom of the lake.

Rinsing sample containers with in-situ water and performing field filtering can be impractical in cold weather; therefore, samples will be directly filled in the laboratory prepared sample bottles. The samples from the same monitoring station will be packed in a clear plastic bag, and placed in an insulated cooler with warm water bottles to avoid any freezing. Sample filtering and chemical preservation will be performed in the on-site environment laboratory immediately after the field staffs return to the camp. All sampling activities and observations as described in Section 3.4 will be recorded in the field logbook and photographs of the samples and sampling conditions will also be recorded.

3.2.2 Seepage Quality Survey

Seeps are defined as actively flowing water emerging from the toe of waste rock dumps, coarse processed kimberlite, and ore stockpiles. The flow rates of the seeps are typically low in the summer and the depth of the seepage flow can be as shallow as 1 cm.

Wherever practical, the seepage water samples will be collected within a meter of the toe of the rock pile where water is evident. The field personnel will make every effort not to disturb the sediment at the bottom of the seep. Once the water samples are collected, the field personnel will visually inspect the water in the sample bottles. If the turbidity in the bottle appears to be higher than the seep flow, the water sample will be discarded, and the sample will be recollected using an unopened sample bottle.

Due to the low seep flow, collecting excessive water for rinsing the bottles may cause the suspension of the sediment, and reduce the reliability of the analytical results. Therefore, the seepage samples will be directly filled into the laboratory prepared sample bottles. The water sample for dissolved metal analysis will be filtered prior to being filled into the sample bottle. Preservatives will be added into the appropriate sample bottle after they are filled with water samples. The samples from the same sample station will be packed in a clear plastic bag, and placed in a cooler with ice pack to maintain the temperature between 0°C and 4°C.

Field parameters including pH, DO, ORP, conductivity, and temperature will be measured by placing the multi-parameter probe in a water container containing the water sample. Field turbidity will be measured by the turbidity meter prior to the sample collection. Field personnel will wear nitrile gloves to conduct all sampling. All sampling activities and observations as described in Section 3.4 will be recorded in the field logbook and photographs of the samples and sampling conditions will be recorded in accordance with Standard Operating Procedure SOP-DOC-01.

3.2.3 Site Water Quality Monitoring

Any water collected from engineered water retention structures and processing facilities, such as the pit sump, east sump, wastewater treatment plant (WWTP), and processing plant, will be directed to and stored in the PKCA. Impounded water in the PKCA will not be discharged into the receiving environment until receiving the laboratory verification that water quality meets the Jericho water licence discharge criteria.

As shown previously in Table 3, Section 2.2.2, the site water sampling protocol can be grouped as impounded water sampling, (including pit sum, east sump, and PKCA), and discharge water sampling (including processing plant supernatant water discharge and WWTP discharge).

- **Impound Water Sampling**

  Impounded water sampling involves collecting grab samples from a specified location at the edge of the water retention structures. To produce comparable water quality data, the sampling location at the edge of the water retention structures will be kept consistent. If the sampling location needs to be changed due to safety concerns or other conditions, the details, including the locations and reasons, will be recorded in the field logbook. For example, the sampling location at monitoring station JER-SWQ-04 is situated at the west end of the PKCA. However, the discharge confirmation sampling is typically performed in May, when the edge of the PKCA is still covered by snow and ice. The sampling location for JER-SWQ-04 would then be moved towards the centre of the PKCA.

  During the open water season, the water sample should be collected directly using the water bottle at the edge of the water retention structures. The field personnel will make every attempt not to disturb the sediment at the bottom of the sampling location. During the winter season, the water sample will be collected from a drill hole augered through the ice. The AEMP under-ice sampling protocol will be implemented for the under-ice site water quality monitoring.

- **Discharge Water Sampling**

  The discharge water sampling will be conducted at the WWTP's and process plant's effluent discharge points into the PKCA. The sample water will be collected directly using the sample bottles.

With the exception of the petroleum hydrocarbon and biological sample containers (with precharged preservatives), all sample containers will be rinsed three times using the sample water. The water sample for dissolved metal analysis will be filtered prior to being filled into the sample bottle. Preservatives will be added into the appropriate sample bottle after they are filled with water samples. During the winter sampling season, the water samples will be directly filled into the sample bottles without rinsing and the field filtering and chemical preservation will be performed in the on-site laboratory immediately after the field personnel returning to the camp.

The samples from the same sample station will be packed in a clear plastic bag, and, depending on the season, placed in a cooler with ice pack or warm water bottles to maintain the temperature between 0ºC and 4ºC. Field parameters including pH, DO, ORP, conductivity, and temperature will be measured by placing the multi-parameter probe in a water container containing the water sample. Field turbidity will be measured by the turbidity meter prior to the sample collection. All actions will be performed wearing nitrile gloves. All sampling activities and observations as described in Section 3.4 will be recorded in the field logbook and photographs of the samples and sampling conditions will also be recorded.

3.3 Field Quality Control

3.3.1 Trip Blanks

The trip blank sample reflects the potential contamination that resulted from the container, cap or preservative during the transport and storage of the sample.

The trip blank bottles are prefilled with deionized water in the laboratory and shipped to site with the other bottles. These prefilled bottles will be preserved in the on-site laboratory, and packed in a clear plastic bag. They will be placed in the cooler with other sample bottles throughout the field program, and transported back to the laboratory with other samples for the same analysis.

One trip blank will be processed for each monitoring event.

3.3.2 Field Blanks

Field blank samples are prepared by exposing the deionized water to the ambient environment at the sample site, but are not in contact with the sample water. They reflect the ambient conditions during the sampling program and are used to measure potential contamination from the handling technique and through the exposure to the ambient atmosphere.

Field blank samples are prepared in the field by pouring the deionized water into the pre-labelled sample bottles. Preservatives will be added into the associated sample bottles. The field blank bottles will then be placed in a clear plastic bag, and placed in the cooler with other sample bottles throughout the field program. They will be transported to the laboratory with other samples for the same analysis.

One field blank will be processed for every ten water samples, with a minimum of one replicate taken per sampling event.

3.3.3 Rinsate Blanks

The rinsate blank sample reflects the adequacy of the equipment decontamination processes.

Prior to each sampling event, the water sampling equipment will be cleaned using deionized water as described in Section 3.1.2 and SOP-AEMP-01. After the cleaning, deionized water will be poured over and through the decontaminated sampling equipment, and collected in the sample bottles. Preservatives will be added into the associated bottles. The sample bottles will be placed in a clear plastic bag, and transported to the laboratory with other samples for the same analysis.

The rinsate samples are only required when the water samplers are used. One equipment blank will be prepared at the beginning of each day of sampling.

3.3.4 Replicate Samples

The analysis of replicate samples is the most important tool in the field QC program. They are prepared in the field to verify the precision of the entire sampling and analytical process.

After the water sample is collected, field filtered, and preserved, a replicate sample will be prepared by recollecting the water sample immediately from the same location and depth, and with the same sampling technique. The replicate sample will be field filtered, preserved, and analyzed in the same manner as the host sample.

One replicate sample will be processed for every ten water samples, with a minimum of one replicate sample taken per sampling event. The replicate samples will be labelled in a fashion that the associated host sample or the location cannot be identified.

3.3.5 Split Samples

To check on the laboratory's precision and accuracy, a split sample will be prepared in the field, and submitted to a different laboratory for analysis.

A split sample is a discrete water sample separated in two sets of water containers for two identical analyses. Care will be taken to ensure that a sample is split in a way to ensure homogeneity of the sample. The individual test results from the split samples should be identical when analyzed using the same analytical techniques.

One split will be processed for every 20 water samples. The spilt sample will be preserved and packed in the same manner as the host sample and will be submitted to a different analytical laboratory. The other analytical laboratory will be accredited by the Canadian Association of Laboratory Accreditation (CALA) for the requested analysis.

3.3.6 Spiked Samples

Spiked samples for each variable being tested are prepared by spiking aliquots of a single water sample with known amounts of the variable of interest. The analytical results from the spiked sample will be compared with the unspiked sample, which reveals any systematic errors or bias in the laboratory's analytical method. The spike solution will be provided by the laboratory prior to the field program.

During the field program, a split sample will be prepared at a selected monitoring station, and the aliquot of spike solution will be added into one of the spilt sample bottle. The prelabelled spiked sample bottle will be transported along with the unspiked water sample to the laboratory for the same analysis.

One spiked sample will be processed for every 20 water samples.

3.4 Field Records Documentation

3.4.1 Field Notes

Field documentation is a critical part of the sampling program. Information documented in the field logbook will form the basis of the laboratory data interpretation and monitoring reports preparation.

The field notes will be recorded, using pencil or indelible ink, on waterproof field data sheet or a bound all-weather logbook. All field measurements and observations will be directly recorded in the field logbook in the field. The information on the logbook will also be entered into the mine's environmental database immediately when the field personnel return to the camp. The field data sheet and field logbook will be stored at a designated area in the on-site environment office for future references. More details on record-keeping for water quality monitoring are provided to staff in Standard Operating Procedure SOP-DOC-01.

The information to be recorded in the field notes is, but not limited to, the following:

- Daily weather conditions during sampling including approximate temperature, cloudiness, wind, precipitation, and any changed weather condition during the field program;
- Sample code, monitoring station, GPS coordinates (UTM Datum: NAD 27), depth, sampling date and time, and photography log number;
- Records of all QC samples including trip blanks, field blanks, rinsate blanks, replicate samples, split samples, spiked samples, and their associated host samples.
- Names and roles of the field personnel;
- Measured field parameters including pH, DO, ORP, conductivity, temperature, and turbidity;
- Description of the water sample including clearness, colour, odour, algae growth, and any suspended solids;
- Requested analysis and associated sample bottles; and
- Sample filtration and chemical preservation in the field or in the on-site laboratory.

In addition, the field notes will include the documentation of any unusual occurrences and observations in the field, and rationales and actions of any resulting deviation from the standard sampling and field QC protocols. These may include:

- Any unusual colour or odour of the water, excessive algae growth, oil slicks, and/or fish kills, and any interpretations, additional follow-up sampling and/or reporting;
- The changed or missed sampling locations due to safety concerns to the field personnel or lack of available water samples; and
- Delay in sample collection or transport due to unexpected weather conditions or plane delay.

3.4.2 Photograph Logs

Photograph logs of the samples and the sampling condition provide important supplemental information to the field notes. The photographs will assist the personnel that are not involved in the field sampling to understand the field conditions and the appearance of the water samples. They will be used to interpret the laboratory results and report preparation.

The photographs for each sample will include the sample label, source of the water sample, appearance of the water sample, reference location of the sample site. A high resolution (over 10 megapixel) waterproof digital camera will be used to take the photographs.

When the field personnel return to the camp, the photographs will be downloaded and stored in the field photograph folders in the environment database. The photos will be organized by the sampling date and monitoring site. The photograph logs will be updated including the photo numbers, date, sample sites, and description of the photos.

3.5 Sample Handling and Transport

3.5.1 Sample Labelling

Every sample bottle will be attached with a water-proof adhesive label that contains information for distinguishing and sorting the samples. As described in Section 3.1.3, the sample containers arrive to the site, and they will be sorted and pre-labelled in order to save time in the field. Additional field specific information on the sample label will also be filled in while in the field.

The sample label will typically be marked by an indelible ink pen in the summer season and by a pencil in the winter season. The pre-labelled information will include sample station code, sample location, types of analysis, sample date and the number of containers for each analysis. The information to be marked in the field would include the sampler's initials, the confirmation of sample filtration and chemical preservation, and any changes to the pre-labelled information.

3.5.2 Temporary Sample Storage

All samples that require filtration and chemical preservation will be filtered and preserved in the field or immediately after the field personnel returning to the camp. All sample containers will be visually checked for integrity and labelling errors. If any settled sediments are noted at the bottom of the sample bottles, it will be noted in the field logbook. If the settled sediments is not consistent with the field observation or field turbidity measurement, additional confirming samples may be collected based on the environment personnel's discretion.

All glass containers will be wrapped in bubble bags. The sample containers with the same monitoring station code will be packed in clear plastic bags to avoid cross-contaminations, and placed in the coolers with ice packs or in a designated fridge in the on-site environment laboratory. The storage temperature will be maintained between 0 °C and 4 °C. If the samples have to be held at the site overnight, all samples will be stored in the designated fridge, which maintains a steady storage temperature.

Table 5 describes the holding time for each analysis. It typically takes one to two days to ship the samples from Jericho to the laboratory's Alberta or British Columbia facility for extraction and processing. Therefore, the sampling schedule will be designed according to the charter flight schedule, so that the on-site sample storage interval is as short as possible. If, under unexpected circumstances (such as poor weather or plane delay), the samples arrive to the laboratory after the recommended holding time, Shear's environment manager will inform the NWB in a timely matter, and indicate the delayed samples in the subsequent monthly report.

Table 5: Sample Holding Time

Analysis package	Holding Time
Total Metals (ICP-T)	6 Months With exception of Mercury for 28 days
Dissolved Metals (ICP-D)	6 Months With exception of Mercury for 28 days
Nutrients (N)	7 Days
Routine (R)	7 Days
Biological (B)	24 Hours for Coliform 48 Hourse for BOD
Petroleum Hydrocarbon (PHC1 and PHC2)	14 Days

3.5.3 Sample Transport

Once the charter flight arrival and departure schedule is verified, the environment personnel will inform the laboratory's client manager immediately regarding the plane's estimated arrival time to the Yellowknife airport, number of samples and required analysis, and required turnaround time.

In the morning of the charter flight arrival date, environment personnel will pack all the bags containing sample bottles in the coolers. The voids between the bags will be filled with ice packs and bubble wrap, or clean packing materials to prevent them from shifting.

A Chain of Custody (CoC) will be prepared prior to each sample shipment. All required information will include:

- Shear's contact and billing information;
- Sample submission reference number, project number, and field personnel's initials;
- Sample identification codes, sample matrix, sampling date and time, and number of submitted containers;
- Required analysis package for each sample. The detailed parameters and detection limits under each analysis package will be communicated and agreed with the laboratory prior to the sample submission; and,
- Any special instructions on sample analysis and holding.

The first page of each CoC will be sealed in a clear plastic bag, and shipped with the samples in the same cooler. Fragile signs and shipping labels, indicating the laboratory's shipping address, contact phone number, and the number of coolers, will be attached to the top and the side of each cooler. The coolers will then be wrapped with shipping tapes for transport. When the coolers arrive to the charter company's air base in Yellowknife, the laboratory's contact person will pick up the coolers and arrange for the coolers to be shipped to the Alberta or British Columbia laboratory.

Environmental personnel will keep the second page of each CoC in a designated storage area in the environmental office, and the sample submission logs in the environment database will be updated.

4.0 LABORATORY ANALYSIS

4.1 Methods Used for Analysis

Brief method descriptions for each parameter are provided in Appendix C. The analytical methods used by Maxxam are based on industry accepted methods by USEPA, SW846, Standard Methods, or methods developed by Federal or Provincial regulatory bodies such as CCME, Ontario Ministry of Environment, or British Columbia Ministry of Environment.

4.2 Laboratory Quality Assurance Management

Maxxam has a strong Quality Management System (QMS) which encompasses both quality assurance and quality control. More than 30 people are employed on Maxxam's Quality Assurance (QA) team as Regional Managers, Specialists, and Coordinators. QA staff is responsible for carrying out the monitoring, documentation, and training required by the company's QMS. To ensure independence, integrity, and effectiveness of their functions, these employees report to the National Director of Quality, who reports directly to Maxxam's CEO.

Maxxam laboratories are accredited to ISO/ IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories" which is the global standard for laboratory quality management programs. Maxxam laboratories also participate in many national and international proficiency testing and double-blind-check sample programs to assess turnaround time (TAT), data accuracy, and traceability.

4.3 Sample Containers and Preservatives

The goal of the analysis is to provide analytical results that are representative of actual site conditions. Post collection, changes in temperature, oxygen, and exposure to light can alter the concentration of the target analytes. To minimize the change of concentration post analysis, the following are utilized:

Addition of Preservatives: preservatives such as acid for metals samples will limit chemical reactions (i.e. reduction, oxidation), physical changes (metals precipitating out) or biological changes (biodegradation of organics due to the presence of in-situ bacteria). Preservatives are parameter specific.

Temperature: many analytes will change concentration based on temperature fluctuations. It is recommended that samples are kept cool, less than 10°C post collection.

Container Type: the container type and even shape are specifically designed to reduce any interfering compounds from biasing the results (such as plastizers biasing organic data).

Holding Time: even with the proper preservatives, containers, and temperature, some analytes will change over time. It is important to analyze samples within the published holding time as recognized by regulatory agencies.

Maxxam will provide all necessary sample containers, chemical preservatives, labels, chain-of-custody (CoC) forms, shipping containers, and packing material. Bottle orders can be picked up at the Maxxam Service Centre in Yellowknife.

All sample containers and chemical preservatives used at Maxxam are "proofed" before use to ensure they meet the requirements of the analysis. Proofing includes a tracking system to aid in problem solving should the integrity of the container or preservative be in question. When ultra trace metals are requested, the bottles will be specially ordered from the Vancouver location. They are the same bottles as other locations; however, they are proofed as per the low-level method. Maxxam Vancouver also prepares their nitric acid preservative in house and validates it for the low level method.

All reagents, chemicals, and preservatives used by Maxxam are obtained from reliable manufacturers and catalogued before being used. Cataloguing involves recording the date received, inputting an expiry date, recording the manufacturer's lot number, and confirming a valid Material Safety Data Sheet (MSDS) exists before introducing it to the laboratory for use. Any preparations or dilutions of reagents and preservatives are recorded by the analyst carrying out the task, and includes the appropriate tracking information to trace it back to the original supply.

Sample collection instructions summarizing the bottle requirements and preservation method are provided in Table 4, Section 3.1.3.

4.4 Chain of Custody

The CoC provides an unbroken trail of accountability that ensures the physical security of samples, data, and records.

Maxxam requires that all samples submitted to the laboratory are accompanied with a uniquely numbered CoC form. Maxxam treats the CoC not only as a sample submission form, but as a legal document. A proper COC validates the data that is generated by the laboratory; it is a controlled document under the Quality Assurance Program and one of the key components of Quality Assurance. It is critical in tracking samples from the field to the laboratory and is designed to record important information that may affect sample integrity. The CoC becomes part of the final data reporting process. All official versions of the CoC come with a unique number for tracking purposes. See Appendix D for a sample of the CoC.

A CoC form with the following information must be completed and accompany every shipment of samples. The CoC needs to contain the following information:

- Company name and sampler's name;
- Sample identification number for each sample submitted
- Time and date of sampling;
- Presence and type of preservative and whether the sample was filtered or not;
- Requested analytical parameters for each bottle;
- Applicable regulatory guidelines or standards
- The number of containers collected per sample

- Any hazardous sample information (i.e. highly impacted, flammable or toxic samples)
- Quotation number
- Report and invoice information
- Required TAT
- Time and date of shipping; and
- Analytical laboratory address and contact person.

The CoC must be signed and dated to provide the laboratory authorization to proceed with the testing. One copy of the form is included with the shipment and one copy remains at the mine site for reference.

4.5 Sample Receipt and Inspection

All samples from Shear Diamonds will be dropped off at the Maxxam Service Center in Yellowknife where they will be checked, repacked with ice, and sent to the appropriate Maxxam laboratory for extraction and analysis (see Appendix D for Flow Chart).

All sample shipments are recorded with the date, time, and the signature of the sample reception staff receiving the samples. Each cooler in the shipment is opened to check and record the temperature of the samples upon receipt, and the CoC Form is examined to determine priorities according to rush analyses, hold time concerns, and regular analyses.

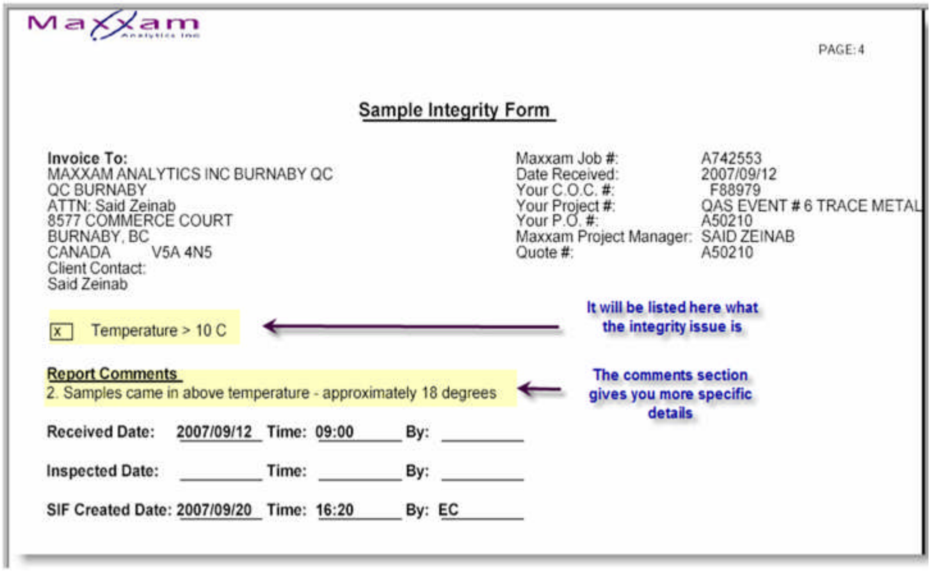
To aid in tracking sample submission issues and reduce non-conformance issues, Maxxam has developed a Fundamental Laboratory Acceptance Guideline (FLAG) checklist that is part of their SOPs for sample receipt and inspection. Some of the most common issues that are checked are in the list below.

Maxxam's FLAG Checklist (alphabetical)

- Analysis Requirement Not Clear
- Bottles On Chain-of-Custody Form But Not Submitted
- Bottles Submitted But Not On Chain-of-Custody Form
- Broken Bottle in Transit
- Chain-of-Custody Form Incomplete
- Chain-of-Custody Form Not Signed/Dated
- Chain-of-Custody Form Outdated
- Custody Seal Not Intact
- Incorrect Preservative or Headspace Present
- Incorrect Sample Bottles Used
- Insufficient Number of Bottles

- Insufficient Sample Volume For Analysis
- Labeling Issue (Missing and/or Incorrect)
- No Chain-of-Custody Form
- Sample Cap is Missing or Broken
- Sample Container Received Is Empty
- Sample Received After 5 Days of Sampling
- Sample Received After Hold Time
- Sample Received Frozen
- Sample Requiring Filtration Is Preserved
- Temperature >10°C
- Water Contains >1 cm of Sediment

This FLAG checklist is used by sample reception staff and documents the condition of all samples received at the laboratory. It addresses the most common issues associated with samples such as broken bottles in transit, temperature of samples exceeding 10°C, no CoC form, labelling issues, and other similar issues. It is emailed to the client as part of the sample receipt confirmation. An example of a FLAG notification is provided below.



PAGE: 4

Sample Integrity Form

Invoice To:
MAXXAM ANALYTICS INC BURNABY QC
QC BURNABY
ATTN: Said Zeinab
8577 COMMERCE COURT
BURNABY, BC
CANADA V5A 4N5
Client Contact:
Said Zeinab

Maxxam Job #: A742553
Date Received: 2007/09/12
Your C.O.C. #: F88979
Your Project #: QAS EVENT # 6 TRACE METAL
Your P.O. #: A50210
Maxxam Project Manager: SAID ZEINAB
Quote #: A50210

☒ Temperature > 10 C

It will be listed here what the integrity issue is

Report Comments
2. Samples came in above temperature - approximately 18 degrees

The comments section gives you more specific details

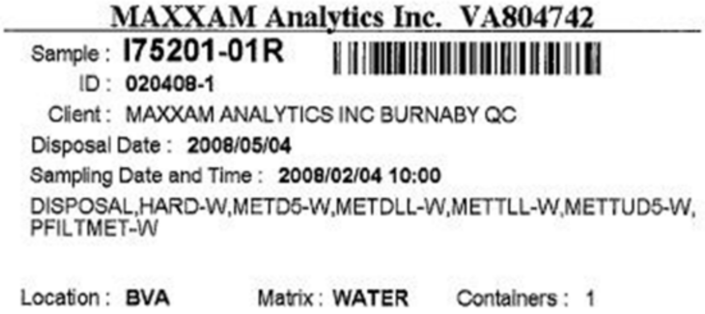
Received Date: 2007/09/12 **Time:** 09:00 **By:** ________

Inspected Date: ________ **Time:** ________ **By:** ________

SIF Created Date: 2007/09/20 **Time:** 16:20 **By:** EC

4.6 Sample Labelling and Tracking

Every sample that is submitted to the laboratory is issued a laboratory sample label with a bar-code. This also includes samples that have been submitted "on hold" in addition to regular samples submitted for analysis. Every time a sample is handled by laboratory staff, the bar-code on the sample label is scanned into the system and its whereabouts are tracked. An example of a Maxxam laboratory sample label is provided below.



MAXXAM Analytics Inc. VA804742
Sample : I75201-01R
ID : 020408-1
Client : MAXXAM ANALYTICS INC BURNABY QC
Disposal Date : 2008/05/04
Sampling Date and Time : 2008/02/04 10:00
DISPOSAL,HARD-W,METD5-W,METDLL-W,METTLL-W,METTUD5-W,
PFILTMET-W

Location : BVA Matrix : WATER Containers : 1

The sample tracking information that is collected is also used to determine the analytical stage of a particular sample. This is particularly helpful when a sample undergoes multiple sample preparation stages (i.e. filtration, drying, weighing, extraction, etc.).

4.7 Sample Hold Time

Sample hold time is the amount of time (days or hours) between the time of sampling and the time sample analysis should commence to maintain sample integrity. Refer to Table 5, Section 3.5.2 for a table of sample hold times.

4.8 Sample Turn Around Times

The standard turnaround time (TAT) for routine analysis at all Maxxam's laboratories is five working days and 10 to 15 working days for non-routine or specialty analysis. Rush requests are projects on which the turnaround time requested is shorter than four days. If you require expedited turnaround times, check the rush box on the Chain of Custody form. It is advisable to write the date you require your results rather than ASAP.

It is requested that rush analyses be discussed with the laboratory in advance and confirmed before samples are submitted to ensure adequate resources are available in the laboratory, especially if analyses are required outside of the normal operating hours of the laboratory..

4.9 Detection Limits

The Detection Limit (DL) or Method Detection Limit (MDL) expressed as a concentration is derived from the smallest measure that can be detected by a single measurement with reasonable certainty for a given analytical procedure. [IUPAC 1975]. It is determined from data produced by analyzing a sample in a given matrix containing the measurand (quantity intended to be measured). Depending on the matrix, the measurand and the instrumentation, the EPA has outlined several specific procedures for determining MDL in their "Methods for the Determination of Metals in Environmental Samples - EPA/600 4-91/010" publication.

The Reported Detection Limit (RDL) is the lowest concentration that will be reported for a specific method. Typically, the RDL is approximately ten times the MDL. Maxxam's RDL for each parameter are provided in Appendix A.

Maxxam uses only in-house validated detection limits and follows the protocol for determining MDLs. The MDL is determined statistically by measuring the signal-to-noise ratio and applying a 95% or 99% confidence limit, a t-distribution (or Student's t), and the Relative Standard Deviation (RSD) of the population to arrive at a numerical value.

As a minimum requirement, Maxxam conducts comprehensive MDL determinations every two years for every analytical method and whenever a significant change has been made to any of the procedures within the method. A Standard Operating Procedure for determining MDLs is available upon request.

It is sometimes necessary to raise RDLs. The most common reasons are sample dilution and matrix interference. Sample dilution is sometimes necessary to bring an analyte within the calibration range. It is not typically commented on the report because the analyte is detectable. Sample dilution may be necessary due to the presence of non-target (interfering) compounds. Typically a comment is added to the report because the analyte was not detected.

4.10 Trip Blanks and Field Blanks

Trip blanks and field blanks are used to monitor sampling collection, preservation, and transport methods. When Maxxam receives a trip blank or field blank, it is analyzed in the same manner as all other samples. If the results indicate a source of contamination, the blank will be rerun to verify the data.

4.11 Field Duplicates

Field (Blind) Duplicates are a second aliquot of sample placed in a separate container and submitted blind to the lab. A field duplicate provides a check on laboratory data repeatability/precision and sample homogeneity (sampling technique). The purpose of a Blind Field Duplicate is to check the use of good sampling practices in the field to minimize the effects of sample non-homogeneity.

4.12 Surrogate Standards

A surrogate is used in organic compounds and is similar to analytes of interest; however, they are not normally found in environmental samples. Surrogates are added to all blanks, spikes, and samples and carried through the entire analytical process for organic analytes. It measures overall efficiency of the analytical method for every sample.

The recoveries are then compared to specific criteria defined by the analyte/matrix. If the results are outside the specified limits, another sample aliquot is analyzed. If results are still outside criteria limits, the results are reported with a data flag and comment added to the report.

4.13 Laboratory Duplicate

A laboratory duplicate is an intra-laboratory split sample used to document the precision of a method in a given sample matrix. Split samples are aliquots of samples taken from the same container and analyzed independently. Both samples are treated identically and carried through the entire analytical procedure including sample preparation.

4.14 Matrix Spikes

A matrix spike is an aliquot of sample spiked with known quantities of the analytes of interest and carried through the entire analytical process. It indicates the appropriateness of the method for the matrix by measuring the recovery of analytes (extraction efficiency and interference effects).

4.15 Method Blanks

Method blanks are a blank control consisting of all reagents, internal and surrogate standards carried through the entire analytical procedure. A method blank defines the level of laboratory background and reagent contamination. It is monitored for the introduction of laboratory contaminants and or analytical artifacts into the reported results.

4.16 Instrument Calibrations

Calibration and maintenance requirements for each piece of equipment are established so that the re-calibration and maintenance occurs prior to any anticipated significant change in measurement capability. An up-to-date inventory of all equipment used in instrumental analysis including inventory number, description, and location is maintained.

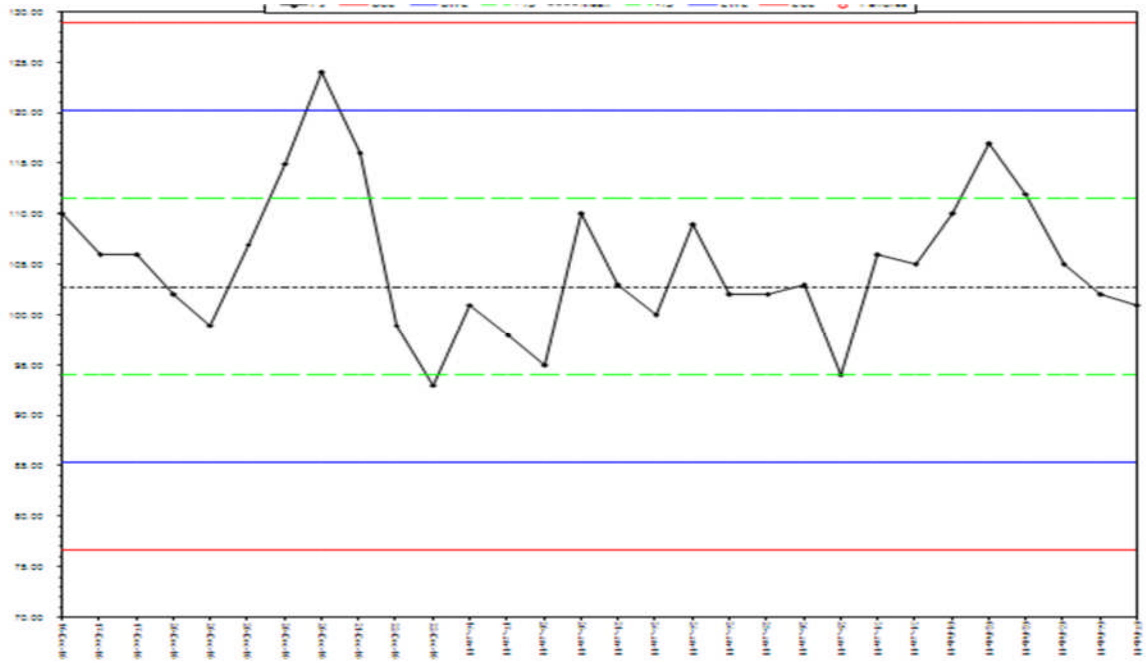
Maxxam ensures that all measuring and testing equipment is kept in a state of current calibration and new equipment is calibrated before initial use. Lab Managers ensure that all measuring and test equipment calibrations and maintenance activities done at Maxxam Labs are performed according to a procedure and records are kept. Analytical instrumentation calibration and maintenance records are available for customer review.

4.17 Continuing Calibration Verification

In general, analytical procedures involve an initial multi-standard calibration followed by continuing calibration verifications (CCVs) at regular intervals, typically after every 20 samples. Maxxam follows a work instruction detailing the operating principles for CCV acceptance or rejection and the required actions in different scenarios.

4.18 Control Charts

A control chart is a graphical representation of laboratory control sample data generated under routine operating conditions over time. Control charts are statistical tools that can help in establishing process capabilities, when used to identify problems that cause out of control conditions and to maintain control of a process. Control charts are an important tool in a laboratory's quality assurance program. Control charts help assure that Maxxam's analytical processes are in control and that equipment and processes are behaving consistently within predetermined acceptance criteria.



Above is an example of a control chart. Once a minimum of 20 data points are collected the mean and standard deviation (SD) are calculated and the control chart is constructed on which the mean, ±1SD, ± 2 SD, ± 3 SD are marked.

4.19 Laboratory Accreditation

Maxxam Analytics' Quality Assurance Program adheres to ISO 17025 requirements and complies with the data quality objectives of the Canadian federal and provincial regulatory agencies. Maxxam's laboratory facilities in Alberta are accredited by the Canadian Association for Laboratory Accreditation (CALA), formerly known as the Canadian Association for Environmental Analytical Laboratories (CAEAL*),* for a large list of specific parameters. Accreditation status has been maintained since the inception of the CAEAL in 1991. A copy of the CALA Certificate is provided in Appendix E. The scope of accredited parameters can be found at:

http://www.cala.ca/scopes/2996.pdf for Burnaby CALA accreditation

http://www.cala.ca/scopes/1596.pdf for Calgary CALA accreditation

http://www.cala.ca/scopes/2996.pdf for Edmonton CALA accreditation.

Table 6: Accreditations by Province

Alberta	Atlantic	British Columbia
Calgary - CALA Edmonton - CALA Edmonton Petroleum - SCC Fort McMurray – CALA & SCC Joffree - CALA	Bedford - SCC St. John’s - SCC Sydney - SCC	Burnaby – CALA & SCC Victoria - CALA
Manitoba	**Quebec**	**Ontario**
Winnipeg - CALA	Saint Laurent - SCC	Guelph – SCC Mississauga – CALA & SCC Ottawa - SCC

4.20 Data Storage and Historical Retrieval

All customer results are stored in the laboratory management system and historical information is available for ten years.

4.21 Maxxam Experience and Qualifications

Maxxam has a formal training program in place for all employees. The purpose of the program is to ensure that all employees receive the same basic training. This is important in ensuring that all policies and procedures are fully understood.

Staff commitment and adequate resources are essential elements to meeting project deliverables. For the deliverables required in the scope of work with Shear Diamonds, a significant level of project support has been organized to provide thorough coverage to minimize any potential service issues that may occur. Brief biographies of all key project team members are provided in Appendix F.

4.22 Data Verification

Maxxam has procedures in place describing activities and checks to be performed to ensure data released by Maxxam meets prescribed standards to ensure data quality. Management and specified supervisory personnel are responsible for ensuring that these procedures are followed before they proceed to release data in the form of final reports.

5.0 DATA MANAGEMENT

5.1 Data Management

The purpose of a data management plan is:

- To capture, store, protect, and ensure the integrity of data;
- To continually improve the quality of data, including accuracy, integrity, integration, relevance, and usefulness of data. Decision-making is negatively affected by poor data quality;
- To manage information consistently;

- To ensure privacy and confidentiality, and to prevent unauthorised or inappropriate use of data;
- To embed compliance and regulatory into the data management process;
- To maximize the effective use and value of data (i.e., analysis of trends, maxima/minima, statistical analysis); and,
- To enable changes/growth to the analytical plan.

Data in the form of tables, instrument recordings, and electronic copies of analytical reports should be given suitable identification numbers and maintained in a manner consistent with good record-keeping practices.

Field notes, laboratory record books, and other primary records shall be kept and stored in a designated area. It is prudent to have electronic back-up of all primary records. Errors made in primary records should be corrected by crossing out the erroneous value and substituting the new value. Other individuals making the changes should initial the entry and add a note as to why the changes were made. No erasures of records or data should be permitted on primary records. Bound notebooks are preferable to loose sheets.

Other documentation that should be kept is equipment maintenance and calibrations. Changes in site equipment used for environmental data (such as the brand or model of water meter) should be noted in primary records.

Shear is currently evaluating the suitability of environmental data management software tools to assist in the process of handling future datasets including sampling, observational, and monitoring field data. Most data management tools can import electronic data including analytical lab results and GPS sampling location data. Data outputs include labels for collected samples, Chain of Custody generation, and lab data reports in pre-determined formats. A useful feature is an interface to manage, query, and view information. Most packages support the exportation of electronic data for user services such as GIS tools and spreadsheets thus sampling data may be further analyzed and incorporated into report writing and deliverables. Electronic data management systems are also helpful for long-term data retention, making baseline and historical data as accessible as current data.

5.2 Data Validation

Data validation is an essential part of data quality assurance, in that the dataset is reviewed against a set of criteria to ensure that the information is adequate for the intended use. The validation process includes flagging questionable results and apparent anomalies.

This section describes the checks that are part of the validation process.

5.2.1 Data Identification

Check sampling dates, sample locations, laboratory identifications, analytical methods, and the QA samples that were submitted with the remaining samples. Check that proper hold times and sample receipt procedures were followed, and check the temperature information for the received samples. Ensure that the method detection limits are adequate in the case of compliance reporting (i.e., for effluent discharge).

5.2.2 Unusual Events

When out of the ordinary events occur such as blasting, extreme weather, construction or other unexpected or unusual occurrences at site, all sampling data (and especially field blanks and equipment blanks) should be examined and crosschecked for possible effects resulting from the extraordinary events noted.

5.2.3 Transmittal Errors and Errors in Automatic Data Processing

Ensure that the Excel file data corresponds to the laboratory certificates (PDF-version) and also designate personnel to conduct random, documented, manual checks of data rows. Potential transmittal and/or transfer errors will be checked using check plots of data and spatial viewing of all positional data (i.e., GPS co-ordinates).

Data checks will be undertaken to verify that reported concentrations that are below detection limits are dealt with as null values or by an agreed upon method. Any statistical analysis will be calculated and reported in the appropriate number of significant digits and recorded on certified laboratory certificates.

5.2.4 Temporal Continuity

For data that is recorded continuously (such as flow volume), check for continuity with respect to time and look for breaks, gaps, or other discontinuities.

5.2.5 Ion Balances

For routine water analyses, check that the theoretical sum of the anions is equal to the cations when expressed in milliequivalents per litre.

5.2.6 Data Completeness

Check that the sample program is complete, meaning that all samples that were planned to be collected were analyzed and then found to be valid.

5.2.7 Data Comparability

Check that the datasets are comparable, meaning that the sampling techniques, analyses, data processing procedures, handling, QA/QC protocols, detection limits and reporting units are similar, allowing for the comparison of datasets. This is especially true when attempting to compare analytical results between different laboratories.

5.2.8 Data Review and Evaluation

Perform final review and evaluation of data to ensure that the samples were collected, processed, handled, analyzed, and reported accurately and in accordance with accepted standard procedures. Perform other verification checks including:

- Check of field-based measurements versus laboratory-reported measurements (i.e., pH, conductivity, and turbidity) for consistency and expected changes. The field-measured pH will be expected to differ from the laboratory-measured pH due to the changes in temperature and dissolved gases. Parameters that gauge the strength of ionic constituents (salts), such as electrical conductivity, should have similar laboratory versus field readings.

- Check laboratory codes for any QA/QC information, and reasons as to why particular analyses were not performed (i.e., insufficient sample submitted, broken bottles etc.) or why particular samples were flagged or invalid (i.e., not preserved in the field, hold times exceeded).
- Evaluate the field quality control samples collected (trip, field, rinsate blanks, replicate samples, split samples and spiked samples). Any indications of the presence of contamination in field or laboratory blanks will be recorded and be part of the validation process. Frequent occurrences of blank contamination are a possible sign that field collection procedures need to be audited and evaluated.

5.3 Exploratory Data Analysis

Plotting is a type of Exploratory Data Analysis (EDA) technique used to detect reveal patterns such as seasonality and/or the existence of outliers or blunders in the data, but does not provide for an explanation or resolution for the unusual value. EDA procedures often are the 'first look' at data. If a value is identified as erroneous, it should be removed from the dataset. Patterns and theories of how the system behaves are developed by observing graphed data. Graphical methods are inductive procedures, meaning that the data are summarized rather than tested. The results provide guidance for the selection of appropriate deductive hypothesis testing procedures. For example, in cases where it is uncertain as to whether a data point is erroneous or not the value should be retained, but then nonparametric statistical tests may be more appropriate because they are more robust to the effects of outliers and blunders in the data.

Graphs provide crucial information to the data analyst, providing visual summaries of data quickly and concisely. Graphing can also reveal water data trends and seasonality effects.

Graphs are essential for two purposes:

- To provide insight for the analyst into the data under scrutiny; and,
- To illustrate important concepts when presenting the results to others.

As a first step, Shear staff will start by plotting the data as a time series. Plots of the data may reveal patterns such as seasonality and/or the existence of outliers or blunders in the data. Outliers are values that appear to be unusually high or low when compared to the other values. Outliers may be valid data or may arise from unusual circumstances unrelated to the process being measured. Blunders are outright errors made in recording the data, transcription, or calculations. A common blunder is a mistake in the units of measure.

5.4 Statistical Analyses

An important part of the assessment of water quality data is the collection of data by a large network of stations at which samples are collected and analyzed according to a standard protocol and on a regular basis. The proper interpretation of these data for trends requires proper standardization of methods (standard operating procedures), adequate quality assurance, and the proper application of statistical techniques suited to the characteristics of the data and to the public and regulatory questions of interest.

Examination of the raw data must be completed prior to proceeding to statistical analysis. Thereafter, the two key sample statistics that may be calculated from a dataset are a measure of the central tendency of the sample distribution and of the spread of the data about this central tendency.

Descriptive statistics and graphical plots of the dataset, including the mean, median, maximum, minimum, percentiles, and/or other derived value may be calculated using software such as EXCEL™ and SIGMAPLOT™.

Larger datasets than what is currently available will be needed for any statistical analysis including multiple regression, analysis of covariance, or log-linear analysis. This includes answering questions about trends in concentrations of chemicals of interest that could be associated with the volume of flow, seasonality effects, and longer-term trends in background concentrations or site parameters of interest, such as loadings of nitrogen compounds. Censored data, or a dataset containing "less-than" values (i.e., below the method detection limit) present special problems in statistical analysis (Hesel 1990). Censored data prohibits the use of ordinary least squares for regression. Coefficients for slopes and intercept cannot be computed without assigning values for the censored observations, and doing so generally produces poor results. In this case, alternative methods capable of incorporating censored observations must be used.

To reduce the influence of outliers and not violate the assumptions required for parametric tests, nonparametric statistical analyses are often used to evaluate differences between sampling sites and determine monotonic time trends. Nonparametric statistical tests are more powerful when applied to non-normally distributed data, and almost as powerful as parametric tests when applied to normally distributed data (Helsel and Hirsch 1992).

5.4.1 Data Characteristics

Typically, water quality data are not normally distributed (Helsel and Hirsch 1992), have missing values, and samples are collected at uneven time intervals. The analysis of water quality data is challenging because of the following additional characteristics:

- A lower bound of zero and no negative values are possible;
- Presence of 'outliers', or observations considerably higher or lower than previous data, which infrequently but regularly occur. Outliers on the high side are more common in water quality analyses;
- Positive skewness (such as lognormal distribution). Skewness can be observed when outlying values occur in only one direction;
- Symmetric data with more observations;
- Data reported only as below or above some threshold (censored data), including concentrations below one or more detection limits. Censored records limit the types of statistical methods that can be used on the dataset because residual values cannot be computed for censored data values;
- Seasonal patterns. Values tend to be higher or lower in certain seasons of the year;
- Autocorrelation, where consecutive observations tend to be strongly correlated with each other. High values tend to follow high values and low values tend to follow low values; and,

- Dependence on other uncontrolled variables, such as water discharge, hydraulic conductivity, sediment grain size, or some other variable;

5.4.2 Outliers

Outliers are observations whose values are quite different than others in the data set and often cause unwarranted concern or alarm. However, outliers may be the most important points in the data set, and should be investigated further. If outliers are deleted, there is a risk that only the expected results will be registered.

Outliers are a result of one of three causes:

- A measurement or recording error;
- An observation from a population not similar to that of most of the data, such as after a rainstorm, freshet, blasting, construction, etc.; and,
- A rare event from a single population that is quite skewed.

Graphical methods are very helpful in identifying outliers. Whenever outliers occur, Shear staff will first verify that no copying, decimal point, or other obvious error has been made. If not, it may not be possible to determine if the point is a valid one. The effort put into verification, such as re-running the sample in the laboratory, will depend on the benefit gained versus the cost of verification. Past events may not be able to be duplicated. If no error can be detected and corrected, outliers should not be discarded based solely on the fact that they appear unusual.

5.4.3 Measures of Location

The most commonly-used measures of location are the mean and the median. The mean is an appropriate measure of centre when the strong influence of a few outlying observations needs to be retained. However, sample means cannot be computed when censored data are present.

Rather than eliminating actual (and possibly important) data in order to use statistical analysis procedures requiring symmetry or normality, procedures which are resistant to outliers should instead be employed. For example, if computing a mean appears of little value because of an outlier, the median has been shown to be a more appropriate measure of location for skewed data. The other advantage of the median relates to censored data: when less than 50% of the data are below the reporting limit, the sample median is still known. No adjustments need to be made to the estimate because of the presence of censored data.

Selection of measures of location will be guided by the actual dataset.

5.4.4 Measure of Spread

A classical measure of spread is the sample variance; however, like the mean it is strongly influenced by outlying values. A more robust measure of spread, and the most commonly used for water data, is the interquartile range (IQR), which measures the central 50 percent of the data. The IQR is not affected by the 25 percent of data on either end. The other advantage of the IQR relates to censored data: when less than 25% of the data are censored, the sample IQR can be calculated. No adjustments need to be made to the estimate because of the presence of censored data.

Selection of measures of spread will be guided by the actual dataset.

5.4.5 Seasonality of Water Quality Data

Seasonality is a cyclical, repeating pattern in water quality measurements. An annual seasonal pattern has a cycle which can span 12 months or 4 quarters. A seasonal index measures how far the average for a particular period is above (or below) the average for all periods. Seasonal corrections will not be applied to any discharge criteria that are required under Water Licence 2AM-JER1119; however and understanding of seasonal trends is useful for understanding the behaviour of water quality parameters related to general monitoring around the site and in the receiving environment.

There should be a good physical explanation for the seasonal fluctuation as well as good empirical evidence for seasonality. At least three complete cycles of the seasonal pattern should be observed on a time series plot before attempting to make any water quality predictions (USEPA 2009). Seasonal fluctuations can be studied by using non-parametric methods such as the seasonal Mann-Kendall trend test or graphical methods to evaluate seasonal patterns.

5.4.6 Temporal Trends

Trend analysis can be used to answer questions such as whether concentrations and loading of nitrogen species (nitrate and ammonium) are changing over time. Another question of interest is whether concentrations change with changing flow conditions. The use of a statistical procedure to investigate trends in water quality data adjusted for flow should be based primarily on the study objectives. If the purpose of the study is to assess the effect of trends in ambient concentrations on the suitability of water to aquatic organisms, then the removal of variability in concentration due to flow (or other natural causes) is normally not desirable.

Major issues in detecting and estimating the magnitude of temporal trends include (Hirsch et al 1991):

- Type of trend, i.e., a gradual change over time that is consistent in direction (monotonic) or an abrupt shift at a specific point in time (step trend);
- General category of statistical methods to employ, i.e., parametric versus non-parametric;
- The kind of data to analyze, i.e., concentration data versus flux data; and,
- Issues related to data manipulation to achieve the best results from the trend analysis.

The type of trend analysis to evaluate the effects of a water quality project depends on the monitoring design. Data from a watershed project that has logical groups of data, such as upstream/downstream or before/after study, and where intensive land treatment occurs over a short period of time generating an abrupt or step change may be evaluated for a step trend. A variety of parametric and nonparametric tests are available, including the two sample t-test, paired t-test, sign test, analysis of (co)variance, or Kruskal-Wallis test.

If temporal trend analysis proves to be a useful or desirable addition to the project, the type of analysis will be determined at a later date based on an examination of the dataset and the expected type of trend.

5.5 Exceedance Reporting

The general QA/QC methods in this Plan relate to normal operating conditions, also relevant during Care and Maintenance. Emergency conditions may require short-term changes to normal processes while repairs and/or mitigation measures are implemented. During these conditions Shear will continue to meet its obligations as per the Water Licence, including discharge criteria. Discharging will be suspended in the event of a verified exceedance. Shear will investigate the cause of the noted exceedance and report any findings to the Board and the Inspector in a timely manner, along with planned mitigation measures (if applicable).

Exceedances as per Licence No. 2AM-JER1119 will be reported for the following parameters in Table 7:

Table 7: Exceedance Reporting under 2AM–JER1119

Parameter	Location	Reference
Total Suspended Solids	Any construction area, including construction within the PKCA	Part D, Item 15 Part F, Item 17
Benzene Ethylbenzene Toluene Xylenes F1 (C 6-C10) F1-BTEX F2 (>C10-C16)	Contact water collected within the fuel and waste containment berms and within landfarm sumps prior to discharge to the PKCA	Part F, Item 4
pH Total Suspended Solids (TSS) Total Dissolved Solids (TDS) Chloride - Cl Total -Al Dissolved (D)-Al Total-As Total -Cd Total -Cr Total-Cu Total-Pb Total-Mo Total-Ni Total-U Total-P Total-Zn NH3-N T-NO3-N T-NO2-N BOD_5 Oil and Grease	Effluent discharged from the PKCA to Stream C3 at location "JER-AEM-04"	Part F, Item 16 Part F, Item 19a and 19b for acute toxicity)

Table 7: Exceedance Reporting under 2AM–JER1119

Parameter	Location	Reference
Fecal Coliforms Total Extractable Hydrocarbons (mg/L) Acute toxicity (*O. mykiss, D.magna*)		

5.6 Reporting Requirements

Chemical analysis results should be reported within the reporting deadlines as specified by the Water Licence, as applicable. Water quality results will be reported in the body of the report and included in a laboratory-issued analytical report containing all relevant QA/QC data needed to assess the validity of the data. The Annual Report will be prepared accurately, clearly, unambiguously, and objectively, in accordance with the requirements as outlined in Schedule B of the Water Licence No. 2AM-JER1119.

6.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Sincerely,

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Director of Environment and Permitting for
Shear Diamonds Ltd.

Julie Lassonde

Julie Lassonde
President and Chief Executive Officer
Shear Diamonds Ltd.

PERMIT TO PRACTICE
EBA ENGINEERING CONSULTANTS LTD.
Signature
Date APRIL 30, 2012
PERMIT NUMBER: P 018
NWT/NU Association of Professional
Engineers and Geoscientists

REFERENCES

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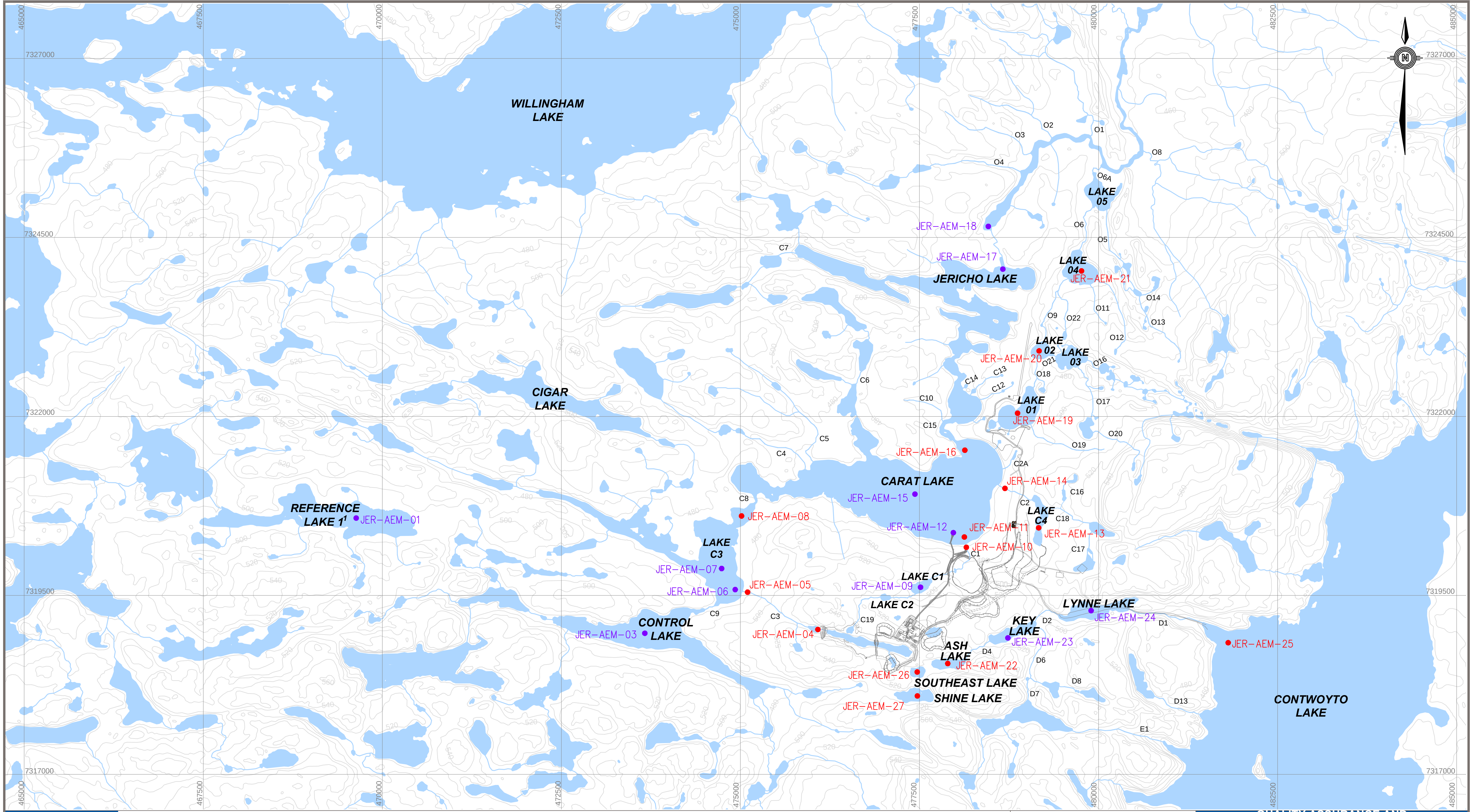
FIGURES

\\eba.local\corp\Edmonton\Drafting\CIVIL3D\E141\E14101206\E14101206_FIG 1.dwg [FIGURE 1] April 30, 2012 - 9:20:38 am (BY: MARSH, MAUREEN)



LEGEND

- ● - AEM - AEMP WATER QUALITY SAMPLE LOCATIONS IN OPEN-WATER SEASON
- ● - AEM - AEMP WATER QUALITY SAMPLE LOCATIONS IN BOTH OPEN-WATER AND WINTER SEASON

0 2 500

Scale: 1: 50 000 (metres)

NOTES

1. REFERENCE LAKE 2 WILL BE IDENTIFIED IN 2012. JER-AEM-02 WILL BE LOCATED AT REFERENCE LAKE 2.
2. DRAWING BASED ON NTS MAPS 76E13, 76E14, 76L03, 76L04

STATUS
ISSUED FOR USE

CLIENT
shear diamonds

eba
A TETRA TECH COMPANY

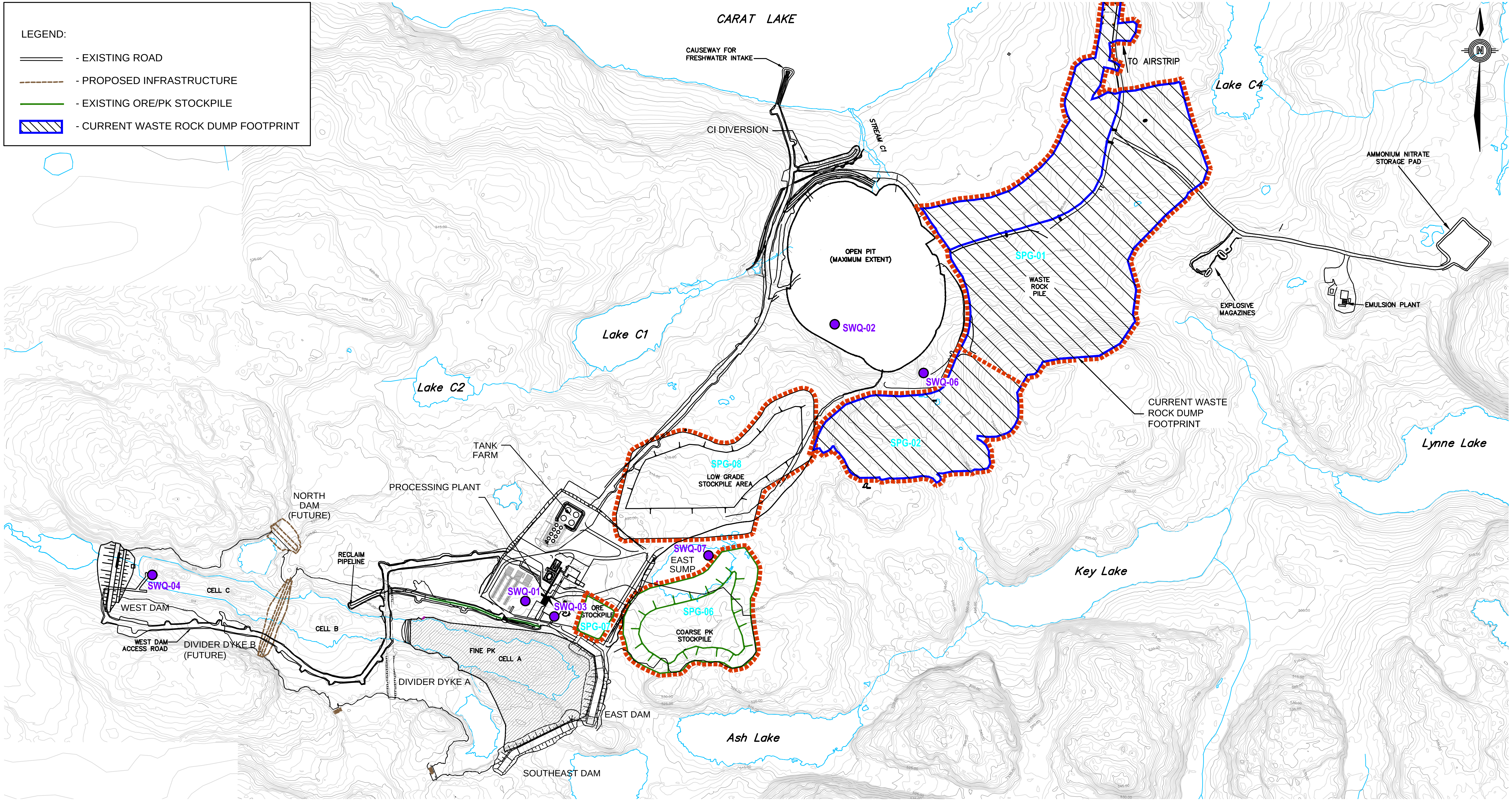
QUALITY ASSURANCE AND QUALITY CONTROL PLAN JERICHO DIAMOND MINE, NUNAVUT

AEMP WATER QUALITY MONITORING SAMPLE LOCATIONS

PROJECT NO.	DWN	CKD	REV
E14101206	MM	WL	0
OFFICE	DATE		
EBA-EDM	April 30, 2012		

Figure 1

\\eba.local\corp\Edmonton\Drafting\CIVIL3D\E141\E14101206\E14101206_FIG 2.dwg [FIGURE 2] April 30, 2012 - 11:37:59 am (BY: MARSH, MAUREEN)



LEGEND:

- EXISTING ROAD
- PROPOSED INFRASTRUCTURE
- EXISTING ORE/PK STOCKPILE
▨ - CURRENT WASTE ROCK DUMP FOOTPRINT

MONITORING LOCATIONS:

● - SWQ, SITE WATER QUALITY SAMPLE LOCATIONS
SPG-07 - SPG, SEEPAGE SURVEY AREA

0 500
Scale: 1: 10 000 (metres)

NOTES:

1. LAYOUTS ARE APPROXIMATE, AND MAY NOT REFLECT ACTUAL SIZE AND LOCATIONS
2. FOOTPRINT OF CURRENT WASTE ROCK DUMP IS PLOTTED BASED ON SURVEY DATA AND HANDHELD GPS TRACKS IN 2011
3. MONITORING STATIONS JER-SWQ-05, JER-SWQ-06, JER-SPG-03, JER-SPG-04 AND JER-SPG-05 ARE NOT ESTABLISHED, AS THE ASSOCIATED STRUCTURES ARE NOT CONSTRUCTED

STATUS
ISSUED FOR USE

CLIENT
shear diamonds

A TETRA TECH COMPANY

QUALITY ASSURANCE AND
QUALITY CONTROL PLAN
JERICHO DIAMOND MINE, NUNAVUT

SITE WATER QUALITY MONITORING AND
SEEPAGE SURVEY SAMPLE LOCATIONS

PROJECT NO.	DWN	CKD	REV
E14101206	DBD/MM	WL	0

OFFICE
EBA-EDM

DATE
April 30, 2012

Figure 2

APPENDIX A

ANALYTICAL PARAMETERS AND DETECTION LIMITS

Analytical Parameters and Detection Limits

Analytical Package	Parameters	Detection Limits (1)	Unit
Total and Dissolved Metals (ICP-T, ICP-D)	Aluminum (Al)	0.0002	mg/L
	Antimony (Sb)	0.00002	mg/L
	Arsenic (As)	0.00002	mg/L
	Barium (Ba)	0.00002	mg/L
	Beryllium (Be)	0.00001	mg/L
	Bismuth (Bi)	0.000005	mg/L
	Boron (B)	0.05	mg/L
	Cadmium (Cd)	0.000005	mg/L
	Calcium (Ca)	0.01	mg/L
	Chromium (Cr)	0.0001	mg/L
	Cobalt (Co)	0.000005	mg/L
	Copper (Cu)	0.00005	mg/L
	Iron (Fe)	0.001	mg/L
	Lead (Pb)	0.000005	mg/L
	Lithium (Li)	0.0005	mg/L
	Magnesium (Mg)	0.01	mg/L
	Manganese (Mn)	0.00005	mg/L
	Mercury (Hg)	0.00001	mg/L
	Molybdenum (Mo)	0.00005	mg/L
	Nickel (Ni)	0.00002	mg/L
	Phosphorus (P)	0.002	mg/L
	Potassium (K)	0.01	mg/L
	Selenium (Se)	0.00004	mg/L
	Silicon (Si)	0.1	mg/L
	Silver (Ag)	0.000005	mg/L
	Sodium (Na)	0.01	mg/L
	Strontium (Sr)	0.00005	mg/L
	Thallium (Tl)	0.000002	mg/L
	Tin (Sn)	0.00001	mg/L
	Titanium (Ti)	0.0005	mg/L
	Uranium (U)	0.000002	mg/L
	Vanadium (Va)	0.0002	mg/L
	Zinc (Zn)	0.0001	mg/L

Analytical Package	Parameters	Detection Limits (1)	Unit
Routine Parameters (R)	Alkalinity ($CaCO_3$)	0.5	mg/L
	Acidity ($CaCO_3$)	0.5	mg/L
	Chloride (Cl)	1	mg/L
	Carbonate (CO_3)	0.5	mg/L
	Bicarbonate (HCO_3)	0.5	mg/L
	Total Hardness ($CaCO_3$)	0.5	mg/L
	Hydroxide (OH)	0.5	mg/L
	Sulphate (SO_4)	1	mg/L
	Total Suspended Solids (TSS)	1	mg/L
	Total Dissolved Solids (TDS)	10	mg/L
	Total Organic Carbon (TOC)	0.5	mg/L
	Total Inorganic Carbon (TIC)	0.5	mg/L
	pH	N/A	-
	Conductivity (uS/cm)	1	uS/cm
	Turbidity	0.1	NTU
Nutrients (N) (2)	Nitrate (NO_3)	0.003	mg/L
	Nitrite (NO_2)	0.003	mg/L
	Ammonia (NH3)	0.05	mg/L
	Orthophosphate	0.003	mg/L
	Total Phosphorus	0.003	mg/L
Biological (B)	Biochemical Oxygen Demand (BOD)	2	mg/L
	Fecal Coliforms	1	CFU/100 mL
Petroleum Hydrocarbons 1 (PHC 1)	Benzene	0.0004	mg/L
	Ethylbenzene	0.0004	mg/L
	Toluene	0.0004	mg/L
	Xylenes	0.0008	mg/L
	F1(C6-C10)	0.1	mg/L
	F1-BTEX	0.1	mg/L
	F2 (>C10-C16)	0.1	mg/L
	F2 (>C10-C16)	0.1	mg/L
Petroleum Hydrocarbons 2 (PHC 2)	Total Extractable Hydrocarbon (TEH)	0.1	mg/L

Note:
1. The Reporting Detection Limits are provided by Maxxam Analytics
2. At Station JER-SWQ-01, the Nutrients (N) package includes additional Total Kjehldahl Nitrogen (TKN) analysis

APPENDIX B

AEMP WATER CHEMISTRY MONITORING- OPERATIONS AND SITE WATER QUALITY MONITORING PROGRAM

AEMP Water Chemistry Monitoring - Operations

Station	Location	Water Chemistry (1)	Frequency (2)
JER-AEM-01	Reference Lake 1	R, ICP-T, ICP-D, N	M1
JER-AEM-02	Reference Lake 2 (3)	R, ICP-T, ICP-D, N	M1
JER-AEM-03	Control Lake	R, ICP-T, ICP-D, N	M1
JER-AEM-04	Stream C3 near PKCA Discharge	R, ICP-T, ICP-D, N, B, PHC2	Weekly during discharge, monthly until freeze up
		Tox-1, Tox-2	Once prior to completion of the effluent discharge
JER-AEM-05	Stream C3 upstream of Lake C3	R, ICP-T, ICP-D, N, B	M2
JER-AEM-06	Stream C3 outlet in Lake C3	R, ICP-T, ICP-D, N	M1
		Tox-2	Once one week following the start of the discharge, and once prior to completion of the discharging
JER-AEM-07	Lake C3 South Basin	R, ICP-T, ICP-D, N	M1
JER-AEM-08	Lake C3 Outlet	R, ICP-T, ICP-D, N	M2
JER-AEM-09	Lake C1	R, ICP-T, ICP-D, N	M1
JER-AEM-10	Stream C1 Upstream of Carat Lake	R, ICP-T, ICP-D, N	M2
JER-AEM-11	Stream C1 outlet in Carat lake	R, ICP-T, ICP-D, N	M2
JER-AEM-12	Carat Lake Freshwater Intake	R, ICP-T, ICP-D, N, B	M1
JER-AEM-13	Lake C4	R, ICP-T, ICP-D, N	M2
JER-AEM-14	Stream C2 Upstream of Carat Lake	R, ICP-T, ICP-D, N	M2
JER-AEM-15	Carat Lake Centre Basin	R, ICP-T, ICP-D, N	M1
JER-AEM-16	Carat Lake Outlet	R, ICP-T, ICP-D, N	M2
JER-AEM-17	Jericho Lake North Basin	R, ICP-T, ICP-D, N	M1
JER-AEM-18	Jericho River Downstream of Jericho Lake	R, ICP-T, ICP-D, N	M1
JER-AEM-19	Lake O1	R, ICP-T, ICP-D, N	A2
JER-AEM-20	Lake O2	R, ICP-T, ICP-D, N	A2
JER-AEM-21	Lake O4	R, ICP-T, ICP-D, N	A2
JER-AEM-22	Ash Lake	R, ICP-T, ICP-D, N	A2
JER-AEM-23	Key Lake	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-24	Lynne Lake	R, ICP-T, ICP-D, N	A1, A2
JER-AEM-25	Contwoyto Lake near Stream D1 Mouth	R, ICP-T, ICP-D, N	A2

Reference:

Aquatic Effects Monitoring Plan under Care and Maintenance Plan (EBA 2011)

Technical Memorandum C: Proposed Changes to the Aquatic Effects Monitoring Plan (Shear 2011)

Note:

1. Detailed analytical parameters are presented in Appendix A and also detailed in Schedule I, Table 1 of the Water Licence. Tox-1 (acute lethality) is described in Part F Item 19 and Tox-2 (chronic toxicity) is described in Schedule I Item 2.

2. Monitoring frequency:

	A1	Annual once in Winter;
	A2	Annual once in Summer;
	M1	Monthly (Mid-Apr, Jun, Jul, Aug, Sep, Mid-Dec);
	M2	Monthly (Jun, Jul, Aug, Sep);

3. Reference Lake 2 will be identified during the 2012 AEM program.

Site Water Quality Monitoring Program - Operations

Station	Location	Analysis (1)	Frequency	Comment
JER-SWQ-01	Wastewater Treatment Effluent	R, ICP-T, ICP-D, N, TKN, B	Weekly	N/A
JER-SWQ-02	Pit Sump	R, ICP-T, ICP-D, N	Monthly until freeze up	N/A
JER-SWQ-03	Process Plant Supernatant	R, ICP-T, ICP-D, N	Weekly	N/A
JER-SWQ-04	PKCA Pond Water	R, ICP-T, ICP-D, N, B, PHC2	Weekly during PKCA discharge, then monthly thereafter	N/A
		Tox 1, Tox 2	Once prior to effluent discharge	N/A
JER-SWQ-05	Collection Pond A	TBD	No monitoring	Collection pond not constructed
JER-SWQ-06	Collection Pond B	TBD	No monitoring	Collection pond not constructed
JER-SWQ-07	East Sump or Collection Pond C	R, ICP-T, ICP-D, N	Monthly until freeze up	Sample currently collected from the East Sump
JER-SWQ-08	Hydrocarbon Water Treatment Unit	PHC 1	Prior to effluent discharge into PKCA	N/A

Reference:

General Monitoring Plan under Care and Maintenance Plan (EBA 2011)

Note:

1. Detailed analytical parameters are presented in Appendix A and also detailed in Schedule I, Table 1 of the Water Licence.

APPENDIX C

ANALYTICAL METHODS

ANALYTICAL METHODS

ANALYTICAL METHOD SUMMARIES

ICPAB-T/-D - AB SOP-00042

Metals on Liquids and Solids by ICPOES

An aqueous solution is nebulized and the resulting aerosol is transported into inductively coupled argon plasma generated by radio frequency power. The high temperature (6000-10000 K) of the plasma results in almost complete dissociation of molecules, efficient atomization and ionization in the sample. Emission spectra are produced when the excited atoms and ions return to lower energy states. The spectra are dispersed by high resolution echelle polychromator and the intensities of the lines are monitored by a Charged Coupled Device (CCD). A background correction technique is required to compensate for variable background contribution for the determination of trace elements. In optical emission spectroscopy, the power of the radiation emitted by an analyte after excitation is directly proportional to the analyte concentration.

ICPMSABL-T/-D, CDLOW-T/-D – AB SOP-00043

Metals Analysis on Soils and Waters Using ICPMS

This method describes the multi-elemental determination of trace elements by ICP-MS. The method measures ions produced by a radio-frequency inductively coupled plasma. Analyte species originating in a liquid are pneumatically nebulized and the resulting aerosol transported byargon gas into the plasma torch. The ions produced are caught in the plasma gas and extracted, by means of a differentially pumped vacuum interface, into a mass spectrometer. The ions produced in the plasma are sorted according to their mass-to-charge ratios by a quadrupole mass spectrometer having a minimum resolution capability of 1 atomic mass unit (AMU) peak width at 5% peak height. The ions are transmitted through the quadrupole (and an octopole if the instrument contains one) and are quantified by a discrete dynode detector and the ion information is processed by a data handling system. Interference correction must include compensation for background ions contributed by the plasma gas, reagents, and constituents of the sample matrix. Drift as well as suppressions or enhancements of instrument response caused by the sample matrix must be corrected for by the use of internal standards.

HGW-T – EENV SOP-00031

Mercury in Water Samples by Cold Vapour Atomic Absorption Spectrometry

Mercury and organo-mercury compounds are oxidized via HCl, $KMnO_4$ and $K_2S_2O_8$. Using an automated system the mercury compounds are then reduced to elemental mercury using stannous chloride. A stream of argon is introduced into the system, which purges the elemental mercury from a gas liquid separator and into the dryer tube. The Hg^0/carrier gas mixture exits the dryer and enters the sample cell for measurement of transmitted radiant power at 253.7 nm. The responses are linear and the unknown concentrations are calculated by comparing them to a standard curve.

PHALK, ALK, EC – AB SOP-00005

Alkalinity Conductivity Fluoride and pH by PC-Titrate

pH, alkalinity, conductivity and fluoride are determined sequentially on a sample using a fully automated instrument. Electrometric methods are calibrated daily to account for probe drift and fluctuations in temperature.

NOIC – AB SOP-00023

Nitrite and Nitrate by Ion Chromatography

A small portion of a filtered, homogeneous aqueous sample is injected into an ion chromatograph. The sample merges with the eluent stream and is pumped through an anionic column. The anions are separated on the basis of their affinity for the active sites of the column packing material and elute at specific times from the column. The eluent and the separated anions pass through a variable wavelength detector set at 215 nm. The separated anions are identified on the basis of their retention time as compared to known standards. Peak area readings are used to calculate concentrations as compared to those of the standards.

SO4AC-W – AB SOP-00018

Sulfate by Konelab - Automated Turbidimetry Method

Sulfate ion (SO_4^{2-}) is precipitated in an acidic medium (HCl) with barium chloride ($BaCl_2$) to form barium sulfate ($BaSO_4$) crystals of uniform size. The precipitating reagent contains gelatin to hold the crystals in suspension. Light absorbance of the $BaSO_4$ suspension is measured by a photometer and the SO_4^{2-} concentration is determined by comparison of the reading with a standard curve and is measured photometrically at 420 nm. Also, the BaSO4 particles scatter the incident light preventing it from reaching the detector; some adsorption may also occur. This combined phenomenon is called extinction. Sulfate concentration is proportional to the amount of light removed from the incident beam.

CLAC-W – AB SOP-00020

Chloride by Konelab - Automated Ferric Thiocyanate Method

The thiocyanate ion is displaced from mercuric thiocyanide by the chloride ion from the water sample (Reaction 1). The thiocyanate ion then reacts with the ferric ion from the ferric nitrate in the reagent (Reaction 2). This forms a red color proportional to the chloride content of the water, which is determined at 480nm. As the chloride concentration increases, Reaction 3 becomes more significant. Since this competing reaction removes the color produced by the Fe $(SCN)_3$, a deviation from a straight-line results.

1. $2Cl^- + Hg\,(SCN)_2 \rightarrow HgCl_2 + 2SCN^-$

2. $3SCN^{-} + Fe^{+3} \rightarrow Fe(SCN)_3$

red color

3. $2Fe(SCN)_3 + 6HgCl_2 \rightarrow 2FeCl_3 + 3[Hg(SCN)_2 \cdot HgCl_2]$

NH4AC-W – AB SOP-00007

Ammonia-Nitrogen by Konelab - phenate colorimetric method

Ammonia is commonly encountered in domestic, wastewater, and industrial effluents. It is also found as a biochemical reduction product in ground waters. The presence of ammonia is indicative of domestic pollution, while its presence in ground water indicates microbiological processes. Ammonia is toxic to fish. It exerts a high oxygen demand as it converts to nitrite and nitrate. It interferes with water treatment processes by reacting with chlorine to form chloramines, which reduce the effectiveness of the treatment process. It also acts as a nutrient, promoting the growth of algae and other aquatic plants. Ammonia is seldom found in concentrations high enough to be harmful to man. In terms of water treatment processes ammonia is indicative of the effectiveness of the treatment.

Ammonia is determined colorimetrically using the Berthelot reaction (indophenol blue reaction; see attachment, section 18). In the first stage of the reaction, the sample's acid preservative is neutralized to a target pH of 6.5 to 7.0; the ammonia then undergoes a chlorination reaction with hypochlorite to form a monochloramine. In the second stage the monochloramine is reacted with phenate, under alkaline conditions (approximately pH 10) and in the presence of nitroprusside, to form quinonechlorimine. In the third stage quinonechlorimine reacts further with phenate to form the blue indophenol complex. The amount of indophenol is proportional to the amount of ammonia present and is measured colorimetrically at 660 nm.

PO4AC-W – AB SOP-00025

Ortho-phosphate (Dissolved) by Konelab - Ascorbic Acid Reduction Method

Orthophosphate (reactive phosphorus) is the phosphate that responds to colorimetric tests without preliminary hydrolysis or oxidative digestion of the sample; however a small fraction of condensed phosphates are usually hydrolyzed unavoidably. Orthophosphate can occur both in the suspended and dissolved forms.

Orthophosphate analysis in this method is performed by direct colorimetric determination using the ascorbic acid reduction method. In this method, ammonium molybdate and potassium antimonyl tartrate react with orthophosphate in an acid medium to form an antimony-phosphomolybdate complex which, on reduction with ascorbic acid, yields an intense blue color proportional to the phosphorus concentration. The absorbance of this colored species is then measured at 880nm.

BTEXHSAB-W – AB SOP-00039

BTEX/F1 and Light Hydrocarbons by Headspace GC/MS/FID

BTEX analytes and aromatic >C_8 to C_{10} are analyzed by Gas Chromatography and Mass Selective Detector (GC/MS). Light hydrocarbons and aliphatics are analyzed by Gas Chromatography and Flame Ionization Detector (GC/FID).

Samples are introduced into the GC via Headspace technique. The samples are heated and agitated in the autosampler to allow the headspace to equilibrate with the sample in the vial. An aliquot of the headspace is injected into the GC where it is split between two separate columns, and where the separation of analytes is based on compound size, boiling point, polarity and mass-to-charge (m/z) ratio.

For BTEX analysis the sample is then analyzed by MS in SIM mode. Qualitative determination is performed by comparison of the sample mass spectra to that of the calibration standards and by comparison of their retention time to those of the calibration standards. The analytes are quantified by comparing the response of a major (quantification) ion relative to an internal standard. For the light hydrocarbons the sample is analyzed by FID, and is quantified against the response factor of toluene.

F24FIDE-W, TEH30TE-W, F2FIDE-W – AB SOP-00040

Analysis of Extractable Hydrocarbons in Water and Soils by GCFID

This method is used for the analysis of Petroleum Hydrocarbons as per the Canada Wide Standard for Petroleum Hydrocarbons (CWS-PHC). Hydrocarbon extracts are analyzed by gas chromatography with 100% dimethylpolysiloxane and flame ionization detector. The separation is based on compound size and boiling point of the hydrocarbons and the concentration is determined using a calibration based on the average response factor for nC10, nC16 and nC34. Petroleum Hydrocarbons are extracted from water samples using a liquid-liquid extraction with hexane. 240 mL of sample is mixed with hexane using a rotary tumbler or equivalent apparatus. The efficiency of extraction is monitored by the addition of a surrogate to the sample prior to extraction.

BOD – AB SOP-00017

Biochemical Oxygen Demand

Biochemical oxygen demand (BOD) is an empirical test used to measure the amount of biodegradable organic material in a sample of water (or soil extract). This is done by adding microbial organisms to an aliquot of sample and measuring, by probe or titration, the dissolved oxygen (DO) present before and after a 5 day ± 6 hr incubation period. The difference in the amount of DO is the result of the biochemical activity of the microbes consuming the organic material of the sample, which also provides an estimation of amount of biochemical demand. BOD can be attributed to the degradation of organic material (carbonaceous demand), the oxidation of inorganic materials such as sulfides and ferrous iron, and the oxidation of reduced forms of nitrogen (nitrogenous demand). This method has BOD as the measurement of all components. Inhibited BOD (BODI) inhibits the nitrogenous demand, measuring only the carbonaceous demand; often referred to as carbonaceous BOD (CBOD).

Sample aliquots are transferred into BOD bottles and are seeded with microbial organisms. The bottles are then filled with dilution water to the point of overflowing and the initial DO is measured. Bottles are then stoppered, creating an air-tight environment, and incubated for 5 days ± 6 hrs at 20 ± 1 ^{o}C and a final DO reading is taken. The difference between the two DO readings is BOD.

TPACTL-W

Total Phosphorus by Konelab - Ascorbic Acid Reduction Method

Total phosphorus is the term used to describe the sum of all of the phosphorus species present in a sample regardless of form, as measured by the persulphate digestion procedure. It includes, total orthophosphate, total hydrolysable phosphorus (or condensed phosphates in the form of pyrophosphates, metaphosphates and polyphosphates) and total organic phosphorus. Total orthophosphate (reactive phosphorus) is the phosphate that responds to colorimetric tests without preliminary hydrolysis or oxidative digestion of the sample; however a small fraction of condensed phosphates are usually hydrolyzed unavoidably. Acid hydrolysis at boiling temperatures converts condensed phosphates into dissolved orthophosphate. The hydrolysis unavoidably releases some phosphate from organic compounds. The term “acid-hydrolysable phosphorus” is preferred over “condensate phosphorus”. The phosphate fractions that are converted to orthophosphate only by oxidative destruction of the organic matter present are considered “organic” or “organically bound phosphorus”. All three forms can occur both in the suspended and dissolved forms.

Phosphorus analyses embody two general procedural steps; conversion of the phosphorus form of interest to dissolved orthophosphate and colorimetric determination of the dissolved orthophosphate. Since phosphorus may occur in combination with organic matter, a digestion method must be able to oxidize organic matter effectively to release all organic phosphorus as orthophosphate. The digestion method used is the persulphate oxidation technique. After digestion, the liberated orthophosphate is determined colorimetrically using the ascorbic acid reduction method. In this method, ammonium molybdate and potassium antimonyl tartrate react with orthophosphate in an acid medium to form an antimony-phosphomolybdate complex which, on reduction with ascorbic acid, yields an intense blue color proportional to the phosphorus concentration. The absorbance of this colored species is then measured at 880nm.

TURB – EENV SOP-00066

Turbidity - Nephelometric Method

Turbidity is the property of a sample to scatter or absorb light rather than to transmit light in straight lines. The higher the intensity of scattered light, the higher the turbidity.

Turbidity is measured with a nephelometric turbidimeter, or nephelometer, which determines turbidity by the light scattered at an angle of 90° from the incident beam. Light, from a tungsten filament lamp, is passed through a sample in order to measure the light scattered by the particles suspended in the sample. A 90° detector, a forward scatter detector and a transmitted light detector measure the intensity of the scattered light. The intensities of the scattered light and the transmitted light are mathematically calculated in order to determine the concentration of the turbidity in the sample.

This method is based upon a comparison of the intensity of light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension containing a known concentration of Formazin polymer standards.

TSS – EENV SOP-00073

Total Suspended Solids, Total Fixed Solids, and Total Volatile Solids

A well-mixed sample is filtered through a Gelman magnetic filter funnel fitted with a preweighed glass fiber filter. The residue retained by the filter after drying to constant weight at 105 ± 5°C is the total suspended solids. Total fixed solids is the material left on the glass fiber filter after ignition at 550 ± 5°C for 30 minutes in a furnace. Total volatile solids is the term applied to the weight loss during ignition.

TDS – EENV SOP-00072

Total Dissolved Solids (TDS)

A well-mixed sample is filtered through a standard glass fibre filter, and the filtrate is evaporated to dryness in a pre-weighed disposable glass tube and dried to constant weight at 180 ± 5°C. The increase in the glass tube weight represents the filterable residue or total dissolved solids (TDS).

TOCCOLE-W – EENV SOP-00060

Organic Carbon Technicon

Sample is introduced into an autoanalyzer where acidification and sparging removes inorganic carbon. The organic material in the sparged sample is then oxidized with a UV digestor in an acid-persulphate mixture. The resulting carbon dioxide passes through a semi-permeable membrane, where it reacts with a phenolphthalein reagent. The intensity of the phenolphthalein colour is inversely proportional to the dissolved organic carbon concentration. This colour change is measured at a wavelength of 550 nm. Dissolved organic carbon is determined on samples that have been filtered through 0.45um Teflon filters.

COLTMFE – EENV SOP-00157

Total and Fecal Coliforms by Membrane Filtration

Coliforms are facultative anaerobes, Gram negative, non-spore forming, oxidase negative, rod-shaped bacteria belonging to the family Enterobacteriaceae. This group is widely distributed in nature and can be isolated from raw water, plants, soil and sediment and fecal matter. Coliforms are divided into two main groups – Total and Fecal.

The entire group called total coliforms have the ability to ferment lactose within 24-48 hours at 35º C. Total coliforms will form a red colony with metallic golden sheen on m-Endo media incubated at 35 ± 0.5°C for 23 ± 1 hours. Fecal coliforms are a thermotolerant subgroup that are differentiated by their ability to develop blue colonies on m-FC media after incubation at 44.5 ± 0.2°C for 24 ± 2 hours. Total coliforms are chosen as the primary indicators of water quality because although they are not usually pathogens themselves, they will be present and recoverable in septic discharges for longer periods of time than pathogenic organisms. Fecal coliforms found in warm-blooded animal sources are, primarily, *E. coli*. *Klebsiella pneumoniae* may also be present, but in much lower numbers. The presence of these *Klebsiellae* may not indicate fecal pollution, as they can also be prevalent in pulp mill waste.

In the membrane filtration method, portions of a water sample are filtered through a 0.45-micron filter under aseptic conditions. Filters are then placed in petri dishes containing selective media (m-Endo for total coliforms & mFC for fecal coliforms) and incubated appropriately. After incubation, the colonies are enumerated.

TIC – CAL SOP-00076

Total Inorganic Carbon and Dissolved Inorganic Carbon - Auto IR Analysis

In an automated system, the sample is acidified to convert inorganic carbon to CO_2, which is stripped from solution. The resulting $CO_2$is measured by an IR analyzer and compared with standard inorganic carbon solutions.

APPENDIX D

LABORATORY FORMS AND CHARTS

Maxxam Analytics

Calgary: 4000 19st St. NE, T2E 6P8. Ph: (403) 291-3077, Fax: (403) 735-2240, Toll free: (800) 386-7247

Edmonton: 9331 - 48 Street, T6B 2R4. Ph: (780) 465-1212, Fax: (780) 450-4187, Toll free: (877) 465-8889

Chain of Custody

Page: ____ of ____

	Invoice To: Require Report? Yes ☐ No ☐		**Report To:**		PO# / AFE#:
Company Name:					Quotation #:
Contact Name:					Project #:
Address:					Proj. Name:
	Prov:	PC:	Prov:	PC:	Location:
Contact #s:	Ph:	Fax:	Ph:	Fax:	Sampler's Initials:

DETECTION LIMIT REQUIREMENTS:

Check the applicable criterion and indicate land use

☐ AT1 ____________________

☐ CCME ____________________

☐ OTHER ____________________

REPORT DISTRIBUTION:

EMAIL ADDRESS(S):

____

____

____

SERVICE REQUESTED:

☐ **RUSH** (Please ensure you contact the lab to reserve)

Date Required: ____________________

☐ REGULAR Turnaround (5 to 7 Days)

				SOILS (footnotes defined on back)										WATERS (footnotes defined on back)								OTHER TEST(S)								
	Sample Identification	Matrix S/W	Date & Time Sampled Year/Month/Day	BTEX F1-F4	Sieve (75 micron)	Salinity 4	Regulated Metals (CCME / AT1)[1]	Assessment ICP Metals[2]	☐ Paint Filter ☐ Flashpoint ☐ pH (1:1)	TCLP ☐ BTEX ☐ Metals	CLASS II LANDFILL PKGE			☐BTEX F1 ☐VOCs	☐BTEX F1-F2 ☐BTEX F1-F4	Routine Water Package ☐ Turb ☐ F	REGULATED METALS (CCME / AT1)[3] Total ☐ Preserved ☐ Not Preserved	Dissolved ☐ Preserved ☐ Not Preserved ☐ Filtered ☐ Not Filtered	Mercury ☐ Total ☐ Dissolved	☐ Ammonia ☐ TKN ☐ COD	☐ TOC ☐ DOC	EC	pH	TSS	Cl				*HOLD for 60 Days	# of Containers Submitted
1																														
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
10																														
11																														
12																														

** All samples are held for 60 calendar days after sample receipt. For long term storage please contact your project manager.*

Maxxam Job #:

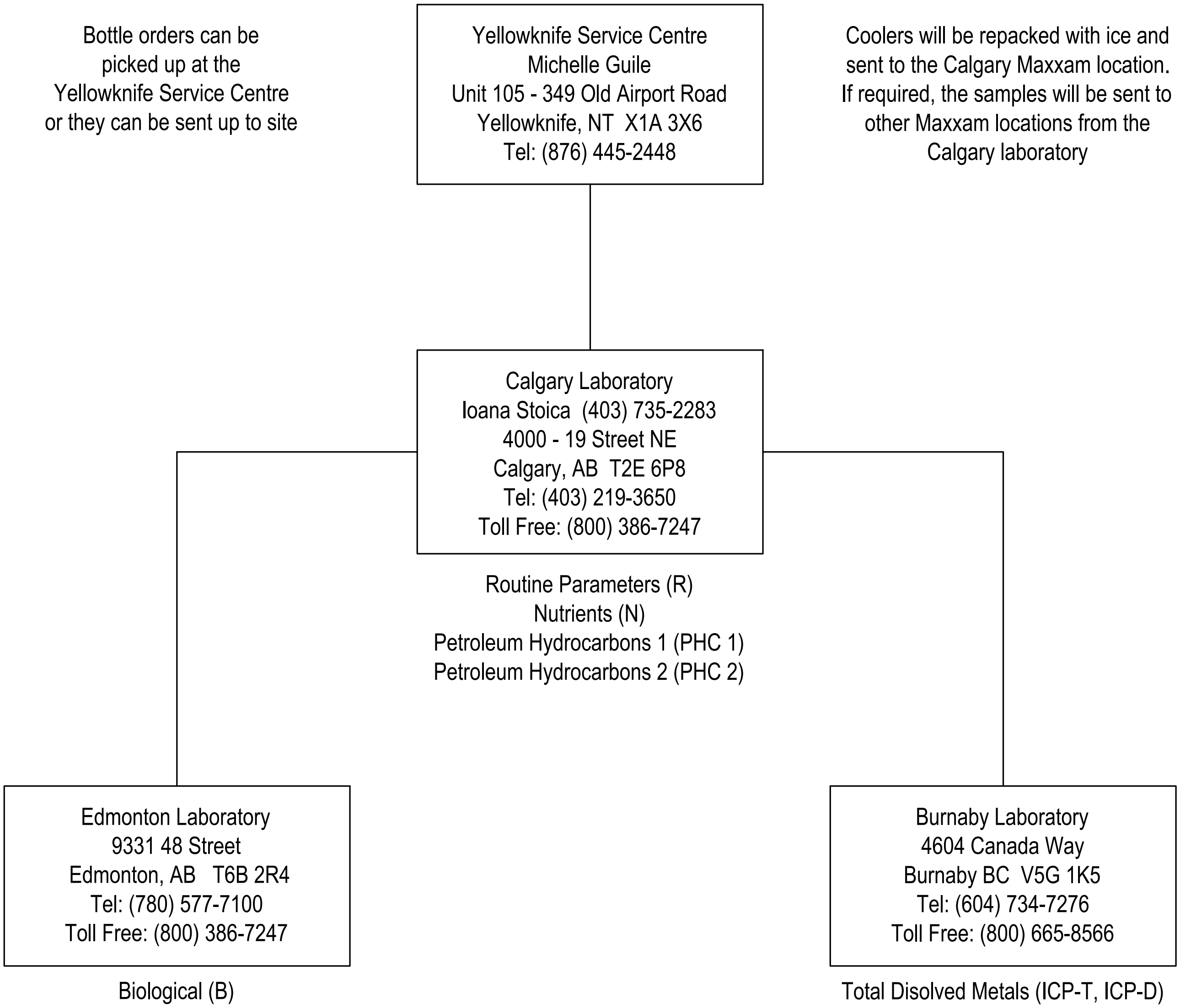
Relinquished By: ____________________ **Date/Time:** ____________________

Sign and Print: ____________________

COMMENTS/SPECIAL INSTRUCTIONS:

# JARS USED & NOT SUBMITTED	Received By	Temperature			Ice
	CUSTODY SEAL YES / NO				

MAXXAM FLOW CHART



Bottle orders can be
picked up at the
Yellowknife Service Centre
or they can be sent up to site

Yellowknife Service Centre
Michelle Guile
Unit 105 - 349 Old Airport Road
Yellowknife, NT X1A 3X6
Tel: (876) 445-2448

Coolers will be repacked with ice and
sent to the Calgary Maxxam location.
If required, the samples will be sent to
other Maxxam locations from the
Calgary laboratory

Calgary Laboratory
Ioana Stoica (403) 735-2283
4000 - 19 Street NE
Calgary, AB T2E 6P8
Tel: (403) 219-3650
Toll Free: (800) 386-7247

Routine Parameters (R)
Nutrients (N)
Petroleum Hydrocarbons 1 (PHC 1)
Petroleum Hydrocarbons 2 (PHC 2)

Edmonton Laboratory
9331 48 Street
Edmonton, AB   T6B 2R4
Tel: (780) 577-7100
Toll Free: (800) 386-7247

Biological (B)

Burnaby Laboratory
4604 Canada Way
Burnaby BC V5G 1K5
Tel: (604) 734-7276
Toll Free: (800) 665-8566

Total Disolved Metals (ICP-T, ICP-D)

APPENDIX E

CALA CERTIFICATE OF ACCREDITATION

CALA CERTIFICATE OF ACCREDITATION

CALA

Canadian Association
for Laboratory Accreditation Inc.

Certificate of Accreditation

Maxxam Analytics (Edmonton)
Maxxam Analytics International Corporation
9331 48th Street NW
Edmonton, Alberta

This laboratory is accredited in accordance with the recognised International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Accreditation No.: A 2996
Issued on: October 13, 2010
Accreditation Date: February 2, 2005
Expiry Date: October 13, 2013

ilac-MRA CALA

Chief Executive Officer

This certificate is the property of the Canadian Association for Laboratory Accreditation Inc. and must be returned on request; reproduction must follow guidelines in place at date of issue. For the specific tests to which this accreditation applies, please refer to the laboratory's scope of accreditation at www.cala.ca.

APPENDIX F

BIOGRAPHIES OF KEY MAXXAM PERSONNEL

BIOGRAPHIES OF KEY PERSONNEL

Michelle Guile
Customer Service Representative, Yellowknife

Michelle Guile has lived in Yellowknife for 17 years and has over 20 years' experience with high volume, fragile, and temperature-sensitive shipments. Michelle is well-acquainted with the challenging shipping logistics that are unique to the Canadian North.

Michelle will deliver Maxxam's front-line service to Shear Diamonds in Yellowknife: receiving samples, responding to customer inquiries, conferring sample status and lab capacity and defining customer requirements.

Michelle Guile
Contact Information
Office phone (direct line): (867) 873-2112
Office fax: (867) 873-2114
Cell: (867) 445-2448
Email: mguile@maxxam.ca

Ioana Stoica
Project Manager, Calgary

Ioana Stoica (B.Sc, M.Sc) will be fulfilling the role as the Project Manager for all work submitted by Shear Diamonds. This will include all day-to-day activities such as arranging bottle orders, sample receipt notifications, data reporting, invoicing, and technical inquiries. Ms. Stoica started at Maxxam Analytics in Calgary in 2008 working in Sample Reception. She took on the role of Project Manager in 2011 where she is currently in charge of several accounts, including Shear Diamonds.

Ioana Stoica
Contact Information
Office phone (direct line): (403) 735-2283
Office fax: (403) 735-2240
Toll Free:(800) 386-7247
Email: istoica@maxxam.ca

Danielle Bachand
Account Manager, Environmental Services Edmonton

Danielle Bachand (B.Sc.) acquired extensive customer service and management skills through a number of communication and marketing positions, including 3 years in the Canadian Armed Forces, prior to joining Maxxam in 2010. Her present position is Account Manager, Environmental Services.

Danielle will oversee the Shear Diamonds projects and provide day-to-day management of the account. Her primary responsibilities will include project set-up, quote preparation, service agreements and customer reviews. Moreover, Danielle will act as Maxxam’s go-to contact person and will both facilitate and supplement customer communications with the Project Manager.

Danielle Bachand

Contact Information

Office phone (direct line): (780) 577-7121

Office fax: (780) 450-4187

Cell: (780) 499-0344

Email dbachand@maxxam.ca

Kris Beaudet
Scientific Specialist, Edmonton

Kris Beaudet (B.Sc., P.Chem) joined Maxxam in 2005 as a Senior Analyst. He managed the Organics Laboratory for several years before transitioning to a more client-focused role as the Customer Service Manager. In 2010, he became the Scientific Specialist for Alberta. In his current position, Kris supports Maxxam's Environmental line of business in Alberta and provides technical assistance to clients and consultants both in project planning stages and in response to specific inquiries.

Kris will serve Shear Diamonds in this important supporting role, and will provide technical assistance as required, in conjunction with the Project Manager.

Kris Beaudet

Contact Information

Office phone (direct line):
780-577-7125

Cell: 780-913-6954

Email: kbeaudet@maxxam.ca

MAXXAM'S SHEAR DIAMONDS MANAGEMENT TEAM

Lawrence Levinson
Business Development Manager-Alberta/Saskatchewan/NWT
Environmental Services

Lawrence Levinson (B.A., B.Sc., M.A.Sc.) has been with Maxxam since January 2009 and has managed the Business Development groups in Québec, Alberta and Saskatchewan. Lawrence has a background in the Biological Sciences and Analytical Chemistry, with focus on the Oil Sands Environmental Assessment process. He has 8+ years of Management, Sales and Business Development experience in scientific domains delivering quality service to stakeholders in Industry, Consulting and Government. He is currently responsible for the Alberta / Saskatchewan Account Managers and Sales Support staff in Calgary.

Lawrence Levinson
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Mobile: (403) 835-6530
Office fax: (403) 291-9468
Email: llevinson@maxxam.ca

Scott Cantwell
Alberta General Manager Operations

Scott Cantwell (B.Sc, C.H.T) is the Alberta General Manager of Maxxam Environmental Operations. Mr Cantwell has over 20 years' experience in environmental analytical chemistry and 13 years of management experience in laboratory operations. He also has 5 years of management experience within the field of environmental consulting in the United States. In addition to laboratory operations, his background and experience includes extensive focus on method development and optimization, technology evaluations, project design, quality assurance programs, and data validation / interpretation. He is responsible for the operations of Maxxam's Alberta environmental laboratories located in Calgary and Edmonton.

Scott Cantwell
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Email: scantwell@maxxam.ca