Appendix 1 Supporting Environmental Data

ACCESS

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Memorandum

To: Vanessa Benwood, Alexco Keno Hill Mining Corp.

From: Anthony Bier, Access Consulting Group, Catherine Henry, Access Consulting Group

CC: Tiffany Lunday, Access Consulting Group

Date: March 28, 2012

Re: Data Summary for 2011 Flam and Moth Meteorological Station, Keno, YT

INTRODUCTION

This memo describes the data collected in 2011 at the Flame and Moth meteorological station located above the Alexco Flame and moth Mill and below the old Keno City dump near Keno, YT (UTM coordinates: 08 V 048409 7086872, elevation: 936m).

OBSERVATIONS AND EQUIPMENT CONDITIONS 2011:

- The Flame and Moth weather station was assembled in the spring of 2011 and was operational on June 2, 2011 at 10 am PDT.
- The station uses Campbell Scientific hardware which included sensors for the measurement of temperature, relative humidity, rainfall, wind speed and wind direction (see Appendix I for a list of components and photos)
- The station was downloaded September 25th 2011 and it was found that the tipping bucket rain gauge was not functioning. The site was visited and the rain gauge went online October 14th 2011.
- The station was visited and downloaded on December 17th 2011 and again on March 18th 2011.
- Upon analysis of the 2011 data C. Henry investigated a suspicious lack of variation in the relative humidity record and found an error in the program code.
- The Flame and Moth Meteorological station does not have a pyranometer at this time.

METHODS AND RESULTS:

Monthly averages for the 2011 period of record were calculated from hourly values recorded by the data logger for the following parameters: temperature, daily maximum temperature, daily minimum temperature, and wind speed (Table 1, Appendix II). Monthly extreme maximum temperature, extreme minimum temperature, maximum wind speed and total rainfall are also shown in Table 1 for 2011. Occasional freezing of the wind monitor occurred, as well as the above mentioned gauge issues. Those are that the tipping bucket was not functional until October 14th and there was an error in the program code which resulted in inaccurate relative humidity readings.

Evapotranspiration was estimated for 2011 using a model provided by the University of California. The model used both the Penman-Monteith equation and the Hargreaves and Samani equation (Snyder and Eching, 2002). Using a spreadsheet provided the various climate parameters were used to calculate values for total monthly evapotranspiration. Input parameters required include average daily max temperature, average daily min temperature, average daily wind speed and average dew point temperature. These values were taken from Flame and Moth where available and filled in with values from Galena hill secondly and lastly from the Environment Canada station at the Mayo airport. Therefore, these data provide only a rough approximation of evapotranspiration (Table 2, Appendix II). Furthermore, evapotranspiration is calculated for different theoretical average vegetation height and more detailed vegetation data is required to increase the degree of confidence in the model. It should be noted that negative condensation values correspond to sublimation (i.e. frost). Negative evapotranspiration during the winter months is expected.

CONCLUSIONS AND RECOMMENDATIONS:

- A pyranometer should be installed at the Flame and Moth meteorological station, to allow the incorporation to the datalogger program of an instruction calculating evapotranspiration. Additionally, an evaporation pan may also be considered to validate estimates of evaporation.

- A program revision has been written for the Campbell Scientific data logger which fixes the code for the relative humidity sensor and should be sent to the data logger at the next site visit.

- Hourly data for the period of recorded has been requested from Environment Canada for the MAYO A meteorological station and can be used to extend the record of rainfall and relative humidity at the Flame and Moth station.

REFERENCES:

Snyder, R.L. and Eching, S. 2002. Peman-Monteith daily (24-hour) and Hargreaves Samani Equations for Estimating Reference Evapotranspiration from Monthly Data. Regents of the University of California. Supplement provided by UofC, Davis, California.

Appendix I: Meteorological Station Components

Component	Model	Serial #
Air Temperature and Relative Humidity Sensor	HMP45C212	n/a
Tipping Bucket Rain Gauge	TE525M	45303-910
Wind Speed and Direction Sensor	05103AP-10-L	WM105907
Solar Panel	SX320J	T21008289B30EC8
Datalogger	CR800	16119
Battery	PS-12120 F2	06299-HC



Appendix II: Tables

Table 1: Monthly statistic for meteorological parameters collected at Flame and Moth Station

	Monthly Avg. Temp (°C)	Monthly Avg. Max Temp (°C)	Monthly Extreme Max Temp (°C)	Monthly Avg. Min Temp (°C)	Monthly Extreme Min Temp (°C)	Monthly Total Rain (mm)	Monthly Avg. Wind Speed (m/s)	Monthly Max Wind Speed (m/s)
Jun-11[1]	11.96	18.59	24.72	6.3	-2.56		1.35	9.14
Jul-11	12.91	18.5	25.67	8	5.09		1.15	8.02
Aug-11	9.78	15.58	22.32	5.37	1.93		1.18	9.15
Sep-11	6.07	11.29	17.97	1.85	-2.47		1.43	11.36
Oct-11	-2.74	0.2	7.2	-5.41	-9.84	*2.602*	0.94	13.12
Nov-11	-19.54	-16.79	-4.23	-22.47	-34.99	0	0.58	12.05
Dec-11	-12.95	-9.37	-2.61	-16.47	-24.17	0	0.81	14.52

1. 29 complete days – station was commissioned on June 2
2. Partial month (16 complete days) - also some rainfall was recorded at temperatures below 0C and may be due to snowmelt

Table 2: Evapotranspiration estimates at Flame and Moth site

Month	PM ETr ($mm\ d^{-1}$)	HS ETo ($mm\ d^{-1}$)	PM ETo ($mm\ d^{-1}$)	Rs ($MJ\ m^{-2}d^{-1}$)	Tx (°C)	Tn (°C)	U2 ($m\ s^{-1}$)	Td (°C)	Monthly Total (mm)		
									PM ETr	HS ETo	PM ETo
Jan	0.04	0.01	-0.07	0.85	-12.9	-17.2	1.4	-18.3	1.11	0.24	-2.06
Feb	0.25	-0.01	0.14	2.96	-15.8	-21.7	2.7	-21.9	7.05	-0.38	3.79
Mar	0.62	0.07	0.4	9.7	-13.1	-18.1	2.3	-22.1	19.24	2.15	12.42
Apr	1.11	0.63	0.85	16.48	-4.4	-10.2	2.9	-11.2	33.41	18.91	25.38
May[1]	6.66	3.85	4.7	21.87	20.4	8.1	3.1	0.4	206.51	119.26	145.58
Jun	3.67	4.11	3.14	20.1	18.6	6.3	1.4	7.1	109.97	123.38	94.24
Jul	3.08	3.63	2.73	15.9	18.5	8	1.1	9.3	95.5	112.39	84.63
Aug	2.3	2.48	2	12.9	15.6	5.4	1.2	7.1	71.35	76.79	62.14
Sep	1.65	1.26	1.28	8.9	11.3	1.9	1.4	2.3	49.62	37.94	38.43
Oct	0.02	0.27	0.12	3.5	0.2	-5.4	0.9	-0.4	0.73	8.28	3.83
Nov	0	-0.01	-0.02	0.9	-16.8	-22.5	0.6	-19.1	-0.11	-0.28	-0.52
Dec	-0.17	0.01	-0.25	0.3	-9.4	-16.5	0.8	-12.7	-5.28	0.22	-7.86

[1] Likely over estimates ET at Flame and Moth due to MAYO A data

Legend:

Data from Galena Hill Met. Station
Date from MAYO A Met. Station

PM Etr	Calculated reference evapotranspiration for 0.5 m tall reference surface using Penman-Monteith equation
HS Eto	Calculated reference evapotranspiration using Hargreaves-Samani (1985) equation
PM Eto	Calculated reference evapotranspiration for 0.12 m tall reference surface using Penman-Monteith equation
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Tx	Avergae Daily Maximum Temperature
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From: Anthony Bier, Access Consulting Group, Catherine Henry, Access Consulting Group

CC: Tiffany Lunday, Access Consulting Group

Date: March 28, 2012

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Aug	2.3	2.48	2	12.9	15.6	5.4	1.2	7.1	71.35	76.79	62.14
Sep	1.65	1.26	1.28	8.9	11.3	1.9	1.4	2.3	49.62	37.94	38.43
Oct	0.02	0.27	0.12	3.5	0.2	-5.4	0.9	-0.4	0.73	8.28	3.83
Nov	0	-0.01	-0.02	0.9	-16.8	-22.5	0.6	-19.1	-0.11	-0.28	-0.52
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Memorandum

To: Vanessa Benwood, Alexco Keno Hill Mining Corp.

From: Anthony Bier, Access Consulting Group

CC: Brad Thrall, Alexco Keno Hill Mining Corp, Tiffany Lunday, Access Consulting Group

Date: August 1, 2012

Re: Keno District Mine Operations Snow Survey Summary, 2011 and 2012 Winter Programs

DRAFT

1 INTRODUCTION

The following memo describes the snow survey undertaken in and around Keno City, the Bellekeno Mine and the District Mill during the 2012 winter season by Access Consulting Group (ACG). Results for the 2011 snow sampling program are also provided herein. The sampling program was initiated in 2011, and consists of ten regular sampling locations.

2 METHODS

One sample was taken at each of ten designated locations (Figure 1) once monthly from January to April 2012 (inclusive).

There are several different methods to observe snow. Among these are:

- Utilizing a catch gauge to measure volumetric snowfall as snow water equivalent
- Recording snow depth and density to manually calculate snow water equivalent (SWE)
- Utilizing a snow sampler or snow tube to take a snowpack core for which the weight and length (snow depth) are recorded.

ACG utilized a Federal (US) specification snow sampler which was on loan from EBA Engineering Consultants Ltd. The spring scale was carefully checked for to ensure proper calibration. The spring scales are calibrated to show weight in snow water equivalent (SWE) in either inches or cm. In March of 2012 ACG purchased a Federal type snow sampler from Geo Scientific Ltd. (Vancouver), which was used for the month of April. It is

recommended that in the future the snowpack also be sampled in May to better understand the rate at which the snowpack melts.

The basic action is to sample the snowpack in an open area to limit the impact of interception on the sample. The snow tube is equipped with a cutter and slowly rotated straight into the snowpack until the ground surface is felt. The snow depth is then noted. Using the cutter, the sampler will cut into the ground surface by twisting and pushing down. The tube is then leaned to the side and pulled out to avoid the core sliding out. The tube is then weighed together with the soil core, at which point the soil core is removed and weighed on its own. The tube must be weighed to find the tare weight prior to each sample.

In the winter of 2012 the soil core was weighed with the snow core but not weighed following the sample. As a result the assumption is made that 5cm moss core equals about 1 gram, every centimeter of mineral soil would equate to 1 gram and every 2.5 cm of organic soil would equate to 1gram. Since detailed descriptions of the soil core or moss plug were taken this was possible. One gram is equal to 2.65 mm of snow water equivalent in the snow tube.

3 RESULTS

Table 1 shows the SWE in cm for 2011 for each month at each site as well as the mean monthly SWE.

Table1: 2011 Snow survey results in cm of SWE

	Date 2011		
Station	Jan-12	Feb-10	Mar-22
BKS-1	7.6	7.6	5.1
BKS-2	7.6	7.6	7.6
BKS-3	7.6	10.2	7.6
BKS-4	7.6	7.6	7.6
BKS-5	5.1	7.6	5.1
BKS-6	2.5	2.5	0.0
BKS-7	7.6	10.2	7.6
BKS-8	7.6	7.6	5.1
BKS-9	7.6	10.2	10.2
BKS-10	10.2	7.6	5.1
Mean	7.1	7.9	6.1

Table 2 shoes the SWE in cm in 2012 for each month at each site as well and the mean monthly SWE. It should be noted that in January 2012 BKS-5 was sampled next to BKS-10 (figure 1). However, a discrepancy was noticed between the location co-ordinates and the location description and the sample site was move to a new location to reflect the description. It is not known whether BKS-5 samples were taken next to BKS-6 or BKS-10 in 2011.

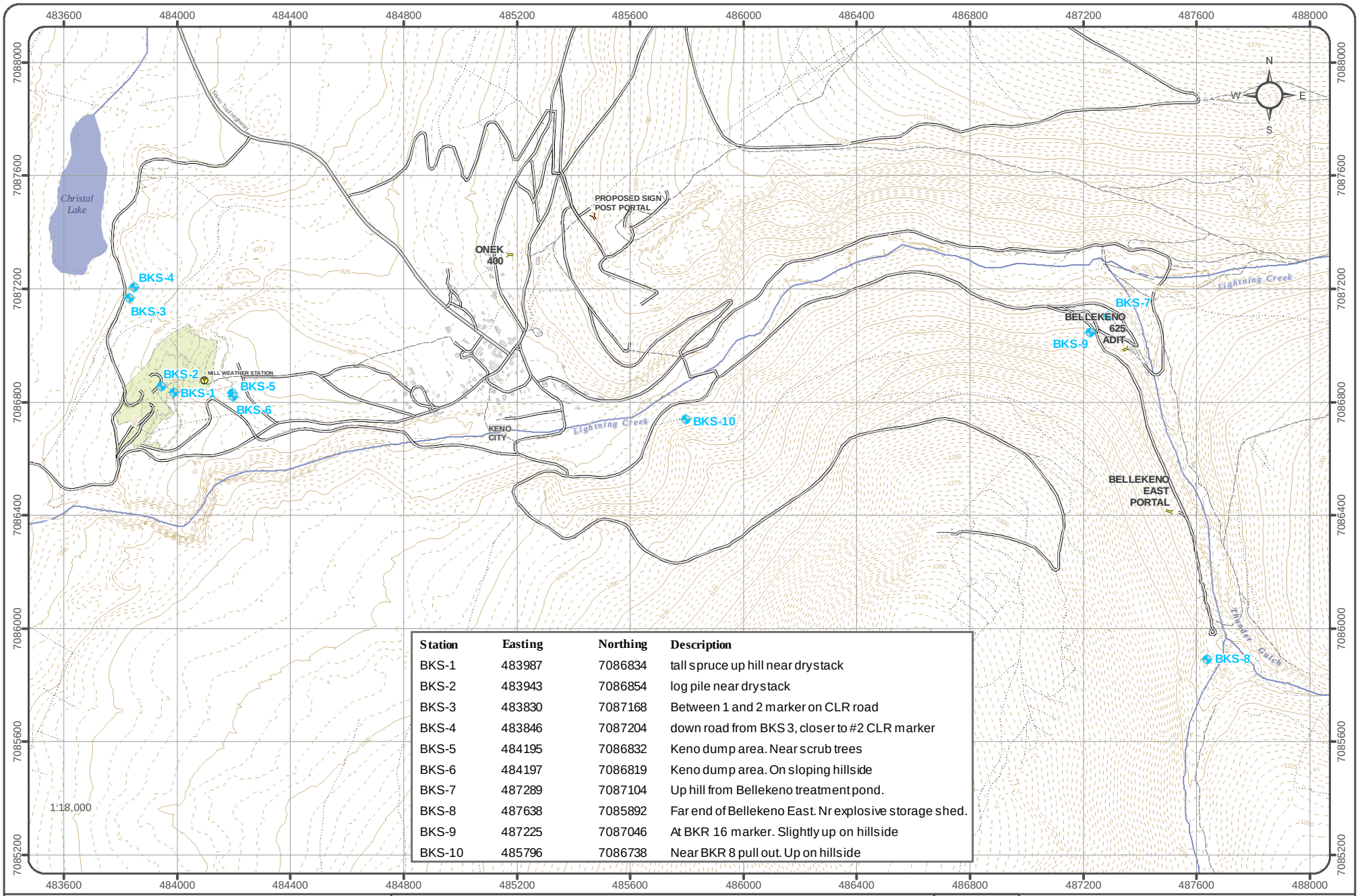
Table 2: 2012 Snow survey results in cm of SWE

	Date 2012			
Station	Jan-18	Feb-12	Mar-17	Apr-13
BKS-1	6.0	16.1	18.7	8.7
BKS-2	12.2	13.6	9.3	20.8
BKS-3	9.6	12.5	4.4	7.7
BKS-4	8.5	17.6	12.3	8.8
BKS-5.0	13.7			
BKS-5.1		11.3	12.2	9.6
BKS-6	11.2	12.6	14.8	19.8
BKS-7	12.5	13.7	4.8	8.5
BKS-8	9.9	13.8	17.4	19.5
BKS-9	12.4	13.3	17.1	0.0
BKS-10	13.3	16.5	27.7	10.7
Mean	10.9	14.1	13.9	11.4

The survey results show that the snowpack reached its peak in February. According the Yukon Snow Survey Bulletin & Water Supply Forecast April 1, 2012 peak snowpack in the Stewart River Sub-Basin is usually the end of March/beginning of April, as was the case in 2012(Government of Yukon, 2012). Two possible explanations have been found for the departure in results obtained in the Keno District from those obtained for the Stewart Basin by GY. It may be the case that there are an insufficient number of locations to represent the snowpack in the Keno District. This can be resolved by expanding the sampling network to include more locations and capture more aspects in 2013, which is the intent for 2013. Another potential cause of the apparent decrease from February to March could be due to snow drifting, as there was a marginal increase in accumulation from February to March in the Stewart River Basin (Government of Yukon, 2012). An expanded network may also resolve issues associated with snow drift.

REFERENCES

Government of Yukon, 2012. Yukon Snow Survey Bulletin and Water Supply Forecast April 1, 2012, Water Resources Branch, Department of Environment, Government of Yukon. Box 2703, Whitehorse, Yukon Y1A 2C6.



Station	Easting	Northing	Description
BKS-1	483987	7086834	tall spruce up hill near drystack
BKS-2	483943	7086854	log pile near drystack
BKS-3	483830	7087168	Between 1 and 2 marker on CLR road
BKS-4	483846	7087204	down road from BKS 3, closer to #2 CLR marker
BKS-5	484195	7086832	Keno dump area. Near scrub trees
BKS-6	484197	7086819	Keno dump area. On sloping hillside
BKS-7	487289	7087104	Up hill from Bellekeno treatment pond.
BKS-8	487638	7085892	Far end of Bellekeno East. Nr explosive storage shed.
BKS-9	487225	7087046	At BKR 16 marker. Slightly up on hillside
BKS-10	485796	7086738	Near BKR 8 pull out. Up on hillside

National Topographic Data Base (NTDB) compiled by Natural Resources Canada at a scale of 1:50,000. Cadastral data compiled by Natural Resources Canada. Reproduced underlicense from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Site contours derived from 2006 aerial imagery obtained from Aero Geometrics, Calgary Alberta.

Datum: NAD 83; Map Projection: UTM Zone 8N

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- Snow Monitoring Station
- Weather Station
- Proposed Adit
- Adit
- Highway
- Secondary Road
- Track
- Trail
- 5 Meter Contours
- 25 Meter Contours
- Buildings
- Mill Site

AKHM

ACCESS

WINTER 2011 & 2012
KENO SNOW SURVEY SUMMARY

FIGURE 1:
AKHM SNOW SURVEY SAMPLE LOCATIONS

AUGUST 2012

D:\Project\AllProjects\ALEX-05-01\Bellekeno\GIS\mxd\Overview_Maps\WQ_Stations\snowsurvey\SnowMonitoring_20120801.mxd
(Last edited by: jlindeman; 01/08/2012/15:15 PM)

Appendix 2 Typical Waste Containment Facility Design, EBA 2008

Alexco Resource Canada Corp.

TYPICAL WASTE CONTAINMENT FACILITY DESIGN
KENO HILL SILVER DISTRICT, YT
CONSTRUCTION SPECIFICATIONS
ISSUED FOR USE

W14101142

July 2008

EBA Engineering Consultants Ltd.
p. 867.668.3068 • f. 867.668.4349
Calcite Business Centre • Unit 6, 151 Industrial Road • Whitehorse, Yukon Y1A 2V3 • CANADA

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Section 1004	Fill Placement	2
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Section 1007	Design Alternatives	2
Section 1008	Operation and Maintenance	2

APPENDICES

Appendix A Construction Drawings

Section 1001

DEFINITIONS

DEFINITIONS

1.0 General

.1 Definitions of terms used throughout the Construction Specifications are presented in this Section.

2.0 Definitions

Construction Drawings:	the drawings, as issued for construction, of the Typical Waste Containment Facility Design.
Construction Specifications:	this document.
Contract:	the legal and binding agreement between the Contractor and Alexco Resource Corp. regarding construction of the Waste Containment Facility.
Contractor:	the general contractor responsible for constructing the Waste Containment Facility.
Engineer:	the Professional Geotechnical Engineer registered in the Yukon who is associated with the construction process.
Owner:	Alexco Resource Corp.
Site:	the area in which construction of the Waste Containment Facility or related activity is occurring.
Unsuitable:	not meeting the requirements stated herein or not receiving the Engineer's approval.
Facility:	all components of the Waste Containment Facility.

END OF SECTION

Section 1002

GENERAL

GENERAL

1.0 General

.1 Alexco Resource Canada Corp. intends to construct a containment facility to store waste rock from the Bellekeno advanced underground exploration and development program. As the company advances through the Keno Hill Silver District, it is anticipated further underground exploration and development programs will require similar containment facilities. Therefore, a typical design has been developed to account for the various potential site and construction material conditions.

.2 The Facility is to be located within previously disturbed areas, all of which will be incorporated within a district wide closure plan. This district wide closure plan is required under the water license QZ06-074.

.3 Site specific conditions and Facility location have not been provided or considered. Once Facility location and site specific conditions are known, they must be reviewed by the Engineer. Furthermore, the base of the Facility must be approved by the Engineer prior to fill placement.

.4 The Facility will be lined with a suitable geomembrane. Water in the Facility will flow towards the vertical culvert and pond within the voids of the waste material.

.5 Water in the Facility will be monitored and tested on a regular basis. Based on water quality analysis, the waste water will be extracted via pump truck and discharged to the environment or treated in a designated treatment facility.

.6 Once the Facility reaches its ultimate capacity, the Facility will be capped and reclaimed.

2.0 Scope of Work

.1 The scope of work for the construction of the Facility is as follows:

a. Construct the liner subgrade and berms with Zone B material at the specified grade. This could include cut/fill operations should the foundation material be satisfactory;
b. If required, install a geotextile layer to act as separator for Zone A and Zone B materials;
c. Construct the liner bedding with Zone A material;

d. Install the liner system consisting of a suitable liner material and if required, protective geotextile layers above and below the liner, and a geocomposite reinforcing layer;
e. Place and compact cover material, Zone A material, over the liner system;
f. Install vertical culvert as specified on the Construction Drawings;
g. Place and compact the waste material;
h. Regrade the waste material and place and compact capping material;
i. Install vegetative cover.

END OF SECTION

Section 1003

FILL MATERIALS

FILL MATERIALS

1.0 General

.1 This section describes the construction material specifications for the Waste Containment Facility.

2.0 Reference Standards

.1 The most recent copy of American Society for Testing Materials, ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregate.

3.0 Material Sources

.1 No material of any type shall be borrowed or excavated without the Owner's prior approval.

.2 Pits and quarries shall be maintained and managed in accordance with the requirements set out in the Owner's Land Use and Quarry Permits.

.3 Zone A material shall be obtained from sources approved by the Owner, provided the final product meets the requirements specified herein. Processing may be required to achieve the specified gradation.

.4 Zone B material shall be obtained from sources approved by the Owner, provided the final product meets the requirements specified herein. Processing may be required to achieve the specified gradation.

.5 The parent rock from which all fill materials are derived shall consist of sound, hard, durable material free from soft, thin, elongated or laminated particles and shall contain no unsuitable substances. The potential quarry source shall be approved by the Engineer.

.6 The quarry source for the Facility fill materials shall be inspected by the Engineer throughout material processing to ensure the product meets the requirements stated herein.

4.0 Material Specifications

.1 Zone A Material

The Zone A material shall consist of hard, durable particles, shall be free of roots, topsoil, and deleterious material and shall have a particle size distribution, as measured by ASTM C136, as presented in Table 1003.1.

TABLE 1003.1: ZONE A MATERIAL (10 MM MINUS) - PARTICLE SIZE DISTRIBUTION LIMITS

Sieve Size (mm)	% Passing Fine Limit	% Passing Coarse Limit
10	100	100
5	80	100
2	55	100
0.63	25	65
0.25	10	40
0.08	2	15

.2 Zone B Material

The Zone B material shall be free of roots, topsoil and other deleterious material and shall have a particle size distribution within the limits presented in Table 1003.2.

TABLE 1003.2: ZONE B MATERIAL (200 MM MINUS) - PARTICLE SIZE DISTRIBUTION LIMITS

Sieve Size (mm)	% Passing Fine Limit	% Passing Coarse Limit
200	100	100
100	85	100
50	65	100
25	40	100
5	20	55
2	0	20

END OF SECTION

Section 1004

FILL PLACEMENT

FILL PLACEMENT

1.0 General

.1 The fill placement methods to be used during construction of the Waste Containment Facility are described in this Section.

.2 Construction shall be performed in accordance with the best modern practice and with equipment best adapted to the work being performed. Embankment materials shall be placed so that each zone is homogeneous; free of stratifications; ice chunks, lenses or pockets; and layers of material with different texture grading not conforming to the requirements stated herein.

.3 No fill material shall be placed on any part of the foundation until it has been prepared, as specified herein. Placement of fill material shall conform to the lines, grades and elevations shown on the Construction Drawings.

.4 Embankment construction shall not proceed when the work cannot be performed in accordance with the requirements of the Construction Specifications. Any part of the embankment that has been damaged by the action of rain, snow or any other cause shall be removed and replaced with the appropriate material conforming to the requirements stated herein.

.5 Stockpiling, loading, transporting, placing, and spreading of all materials shall be carried out in such a manner to avoid segregation. Segregated materials shall be removed and replaced with the materials meeting the requirements stated herein.

.6 The Contractor shall remove all debris, vegetation or any other material not conforming to the requirements stated herein. The Contractor shall dispose of these materials in an area approved by the Owner.

2.0 Zone B Material Placement

.1 The Zone B material shall be placed to the design elevation as specified in the Construction Drawings in lifts no greater than 500 mm in uncompacted thickness.

.2 The design elevation for the top of the Zone B berm material shall be no less than 0.5 m above original ground.

.3 Moisture condition and compact using the minimum number of passes established in accordance with section 1006.4.2.

3.0 Zone A Material Placement

.1 The Zone A material shall be placed as bedding for the liner system (minimum 300 mm thick) to the design grade specified in the Construction Drawings.

.2 Subsequent to the liner installation, the Zone A material shall be placed as liner system cover material. The liner system cover material shall be placed to the minimum thickness specified in Table 1004.1 dependent on the type of liner selected.

TABLE 1004.1: RECOMMENDED MINIMUM COVER THICKNESSES

Liner Material	Minimum Required Thickness
Enviro Liner® 4040 (Without Geocomposite)	1.3 m
Enviro Liner® 4040 (With Geocomposite)	0.3 m
HDPE 60	0.3 m
PVC 40 (With Geocomposite)	0.3 m

.3 The Construction Drawings are based on the selection of Enviro Liner® 4040 with the installation of a geocomposite reinforcing material. Other design alternatives are detailed in Section 1007.

.4 Zone A material shall be placed in lifts not exceeding 300 mm in uncompacted thickness. Vehicle traffic is prohibited from maneuvering within the Facility until the cover material has reached the minimum thickness required as specified in Table 1004.1.

.5 Moisture condition and compact with using the minimum number of passes established in accordance with section 1006.4.1.

.6 Equipment with ground pressures higher than 380 kPa should not be permitted inside the Facility once the liner system has been placed. Care is required to provide the appropriate thickness of fill beneath a vehicle when placing material above the liner system to ensure it is not damaged. Traffic in the area should be restricted to low ground pressure equipment.

END OF SECTION

Section 1005

LINER SYSTEM

LINER SYSTEM

1.0 General

.1 The product and installation specifications for the non-woven geotextile, liner systems and geocomposite materials to be used in the Waste Containment Facility are presented in this section.

.2 The liner system will be provided by the Owner and installed by the Contractor.

2.0 Reference Standards

.1 The most recent copy of the following American Society for Testing Materials standards:

a. ASTM D638 Standard Methods for Tensile Properties of Plastics.

b. ASTM D792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

c. ASTM D1004 Standard Test Methods for Initial Tear Resistance of Plastic Film and Sheeting.

d. ASTM D1603 Standard Test Methods for Carbon Black in Olefin Plastics.

e. ASTM D1777 Standard Test Methods for Thickness of Textile Materials.

f. ASTM D4533 Standard Test Methods for Trapezoidal Tearing Strength of Geotextiles.

g. ASTM D4632 Standard Test Methods for Grab Breaking Load and Elongation of Geotextile.

h. ASTM D4751 Standard Test Methods for Determining Apparent Opening Size of a Geotextile.

i. ASTM D4833 Standard Test Methods for Index Puncture Resistance for Geotextile, Geomembranes, and Related Products.

j. ASTM D5199 Standard Test Methods for Measuring the Nominal Thickness of Geosynthetics.

k. ASTM D5261 Standard Test Methods for Measuring Mass per Unit Area of Geotextiles.

l. ASTM D5994 Standard Test Methods for Measuring Core Thickness of textured Geomembranes

.2 Federal Test Method

a. FTM Standard 101.

3.0 Materials

.1 Geotextile

a. The non-woven geotextile shall have a weight of 542 g/m^2. The manufacturer shall, prior to shipment of materials, provide to the Engineer a signed manufacturing certification that materials to be shipped to site have test values that meet or exceed the requirements listed in Table 1005.1.

TABLE 1005.1: RECOMMENDED MINIMUM GEOTEXTILE PROPERTIES

Physical Property	Minimum Average Roll Value (Weakest Principle Direction)
Thickness – Typical (ASTM D5199)	3.6 mm
Grab Tensile Strength (ASTM D4632)	1690 N
Elongation at Failure (ASTM D4632)	50 %
Trapezoidal Tear Strength (ASTM D4533)	645 N
Puncture (ASTM D4833)	1070 N
Apparent Opening Size (ASTM D4751)	150 microns
Weight – Typical (ASTM D5261)	542 g/m^2

b. Any visible damage to the shipment of geotextile shall be noted on the freight receipt and project records.

c. Storage of geotextile rolls on site shall be in a secure location that will minimize exposure to the elements, UV light and physical damage.

.2 Enviro Liner® 4040

a. The Enviro Liner® shall be 1.0 mm (40 mil) thick geomembrane or equivalent. The manufacturer shall, prior to shipment of materials, provide to the Engineer a signed manufacturing certification that materials to be shipped to site have test values that meet or exceed the requirements listed in Table 1005.2.

TABLE 1005.2: RECOMMENDED MINIMUM GEOMEMBRANE PROPERTIES

Property	Enviro Liner® 4040
Minimum Average Thickness (ASTM D5994)	1.0 mm
Relative Density (ASTM D792)	0.939
Tensile Strength at Yield (ASTM D638)	26.6 N/mm
Elongation at Yield (ASTM D638)	800 %
Tear Resistance (ASTM D1004)	98 N
Puncture Resistance (FTMS 101)	271 N
Carbon Black Content (ASTM D1603)	2.0 – 3.0 %

b. The liner material supplied under the specifications shall not have any blisters, holes, undispersed raw materials or any signs of contamination or inclusions of foreign matter. Such defects shall be repaired using techniques in accordance with manufacturer's recommendations. Excessive defects may be grounds for rejecting the entire roll of liner.

c. Storage of geomembrane rolls on site shall be in a secure location that will minimize exposure to the elements and physical damage.

d. Enviro Liner® geomembrane is suitable for secondary containment of hydrocarbons and other chemicals, and primary containment of water and water based effluents or as approved by manufacturer.

.3 HDPE Liner

a. The HDPE geomembrane shall be 1.5 mm (60 mil) thick geomembrane or equivalent. The manufacturer shall, prior to shipment of materials, provide to the Engineer a signed manufacturing certification that materials to be shipped to site have test values that meet or exceed the requirements listed in Table 1005.3.

TABLE 1005.3: RECOMMENDED MINIMUM GEOMEMBRANE PROPERTIES

Property	Textured HDPE 60
Minimum Average Thickness (ASTM D5994)	1.5 mm
Relative Density (ASTM D792)	0.94
Tensile Strength at Yield (ASTM D638)	22.0 kN/m
Elongation at Yield (ASTM D638)	12 %
Tear Resistance (ASTM D1004)	187 N
Puncture Resistance (FTMS 101)	480 N
Carbon Black Content (ASTM D1603)	2.0 – 3.0 %

b. The liner material supplied under the specifications shall not have any blisters, holes, undispersed raw materials or any signs of contamination or inclusions of foreign matter. Such defects shall be repaired using welding techniques in accordance with manufacturer's recommendations. Excessive defects may be grounds for rejecting the entire roll of liner.

c. Extrusion resin used for extrusion joining of sheets and for repairs should be HDPE from the same resin batch as the sheet resin. Physical properties must be the same as the liner sheets.

d. HDPE liner is suitable for containment of hydrocarbons and chemicals as well as water and water based effluents or as approved by manufacturer.

e. Storage of geomembrane rolls on site shall be in a secure location that will minimize exposure to the elements and physical damage.

.4 PVC Liner

a. The PVC geomembrane shall be 0.95 mm (38 mil) thick geomembrane or equivalent. The manufacturer shall, prior to shipment of materials, provide to the

Engineer a signed manufacturing certification that materials to be shipped to site have test values that meet or exceed the requirements listed in Table 1005.4.

TABLE 1005.4: RECOMMENDED MINIMUM GEOMEMBRANE PROPERTIES

Property	PVC 40
Minimum Average Thickness (ASTM D5994)	0.95 mm
Tensile Strength at Yield (ASTM D638)	17 N/mm
Elongation at Yield (ASTM D638)	430 %
Tear Resistance (ASTM D1004)	44 N

b. The liner material supplied under the specifications shall not have any blisters, holes, undispersed raw materials or any signs of contamination or inclusions of foreign matter. Such defects shall be repaired using techniques in accordance with manufacturer's recommendations. Excessive defects may be grounds for rejecting the entire roll of liner.

c. PVC liner is suitable for containment of water and water based effluents or as approved by manufacturer. It is not suitable for containment of hydrocarbons.

d. Storage of geomembrane rolls on site shall be in a secure location that will minimize exposure to the elements, UV light and physical damage.

.5 Geocomposite

a. The geocomposite reinforcing material shall be 5 mm (200 mil) thick or equivalent. The manufacturer shall, prior to shipment of materials, provide to the Engineer a signed manufacturing certification that materials to be shipped to site have test values that meet or exceed the requirements listed in Table 1005.5.

TABLE 1005.5: RECOMMENDED MINIMUM GEOCOMPOSITE PROPERTIES

Property	Geo-Comp 5
Minimum Average Thickness (ASTM D5994)	5 mm
Relative Density (ASTM D792)	0.94
Tensile Strength at Yield (ASTM D638)	79 N/cm
Puncture Resistance (FTMS 101)	489 N
Carbon Black Content (ASTM D1603)	2.0 %

b. The geocomposite material supplied under the specifications shall not have defects or any signs of contamination or inclusions of foreign matter. Excessive defects may be grounds for rejecting the entire roll of geocomposite.

4.0 Installation - Enviro Liner® 4040 Design (with Geocomposite)

.1 The liner system consists of the following layers (starting from the top layer):

- Geo-Comp 5 or equivalent geocomposite
- Enviroliner 4040 or equivalent geomembrane

.2 The liner should line the entire surface of the Facility, which includes the crest of the berms, inside slopes, and floor. The geocomposite material is only required on the floor and approach berm of the Facility.

.3 The Contractor shall ensure that the integrity of the liner system and its components are not compromised during construction. Precautions the Contractor may take to avoid damaging the liner system may include, but will not be limited to, providing light plants in the work area to improve visibility or using pylons to mark the lift/liner system interface.

.4 Any damage to the liner system and/or its components shall be repaired as soon as possible. Fill placement shall cease immediately in an area where the integrity of the liner system has been compromised. Fill surrounding the damaged liner system may have to be excavated, without further damaging the integrity of the liner, to permit repairs to be made. Hand excavation shall be used to expose damaged portions of the liner for repair.

.5 The liner system shall be anchored at the top of the berm so that movement downslope does not occur during backfilling at any stage of construction.

.6 The Contractor shall take the necessary steps to ensure that backfilling does not induce tensile stress in the liner system. Care shall be taken to avoid making sharp turns, sudden stops or sudden starts adjacent to the liner system. Non-essential heavy equipment traffic in the immediate vicinity of the liner system shall not be permitted.

Enviro Liner® Installation

.7 The Enviro Liner® should be deployed subsequent to the placement of Zone A bedding material.

.8 The Engineer should walk the liner to observe for any defects caused by on-site equipment and tools. Any liner area showing injury due to excessive scuffing, puncture, or distress from any cause should be replaced or repaired with an additional piece of Enviro Liner® installed as per the manufacturer's specifications over the defective area. All patches should have rounded edges and extend a minimum of 150 mm beyond the affected area.

.9 Low ground pressure equipment should be used to deploy the liner material. No equipment shall be allowed on the liner.

Geocomposite Reinforcing Installation

.10 The geocomposite material should be deployed subsequent to the placement of the Liner.

.11 No equipment is permitted on the liner material during the placing of the geocomposite reinforcing material. The geocomposite reinforcing material must rolled out by hand and the cover material placed in accordance with Section 1004.

Material Quantities

.12 Estimated material quantities required for the lined pad are listed in Table 1005.6

TABLE 1005.6: MATERIAL QUANTITY ESTIMATES

Material	Total Area (m^2)
Enviro Liner® 4040	1900
Geo-Comp 5	905

5.0 Installation - HDPE 60 Design

.1 The liner system consists of the following layers (starting from the top layer):

- HDPE 60 mil or equivalent geomembrane

.2 The liner should line the entire surface of the Facility, which includes the crest of the berms, inside slopes, and floor.

.3 The Contractor shall ensure that the integrity of the liner system and its components are not compromised during construction. Precautions the Contractor may take to

avoid damaging the liner system may include, but will not be limited to, providing light plants in the work area to improve visibility or using pylons to mark the lift/liner system interface.

.4 Any damage to the liner system and/or its components shall be repaired as soon as possible. Fill placement shall cease immediately in an area where the integrity of the liner system has been compromised. Fill surrounding the damaged liner system may have to be excavated, without further damaging the integrity of the liner, to permit repairs to be made. Hand excavation shall be used to expose damaged portions of the liner for repair.

.5 The liner system shall be anchored at the top of the berm so that movement downslope does not occur during backfilling at any stage of construction.

.6 The Contractor shall take the necessary steps to ensure that backfilling does not induce tensile stress in the liner system. Care shall be taken to avoid making sharp turns, sudden stops or sudden starts adjacent to the liner system. Non-essential heavy equipment traffic in the immediate vicinity of the liner system shall not be permitted.

HDPE Liner Installation

.7 The HDPE liner should be deployed subsequent to the placement of Zone A bedding material. The liner should be placed with no horizontal seams on the slopes. Tie-in seams should be located on the floor at a minimum of 1.5 m from the toe of the slopes.

.8 The liner panels shall be welded together along the full length of the seam to the top of the berm.

.9 Both the wedge and the extrusion welding equipment should be qualified by conducting trial seam tests prior to start-up each day and at approximately 4-hour intervals during seaming operations. During the trial seam, the minimum peel and shear strength criteria set by the manufacturer for the 60 mil HDPE geomembrane should be met. The industry-accepted peel and shear strengths for 60 mil HDPE geomembrane are 78 ppi (pounds/inch) and 120 ppi, respectively.

.10 The Engineer should walk the liner to observe for any defects caused by on-site equipment and tools. Any liner area showing injury due to excessive scuffing, puncture, or distress from any cause should be replaced or repaired with an additional

piece of HDPE liner extrusion welded over the defective area. All patches should have rounded edges and extend a minimum of 150 mm beyond the affected area.

.11 Low ground pressure equipment should be used to deploy the liner material. No track-wheel equipment shall be allowed on the liner. Equipment travel on the liner material should be kept to a minimum.

Material Quantities

.12 Estimated material quantities required for the lined pad are listed in Table 1005.7

TABLE 1005.7: MATERIAL QUANTITY ESTIMATES

Material	Total Area (m^2)
HDPE 60 Liner	1900

6.0 Installation - PVC 40 Design

.1 The liner system consists of the following layers (starting from the top layer):

- Geo-Comp 5 or equivalent geocomposite
- PVC 40 mil or equivalent geomembrane

.2 The liner system should line the entire surface of the Facility, which includes the crest of the berms, inside slopes, and floor. The geocomposite material is only required on the floor and approach berm of the Facility.

.3 The Contractor shall ensure that the integrity of the liner system and its components are not compromised during construction. Precautions the Contractor may take to avoid damaging the liner system may include, but will not be limited to, providing light plants in the work area to improve visibility or using pylons to mark the lift/liner system interface.

.4 Any damage to the liner system and/or its components shall be repaired as soon as possible. Fill placement shall cease immediately in an area where the integrity of the liner system has been compromised. Fill surrounding the damaged liner system may have to be excavated, without further damaging the integrity of the liner, to permit repairs to be made. Hand excavation shall be used to expose damaged portions of the liner for repair.

.5 The liner system shall be anchored at the top of the berm so that movement downslope does not occur during backfilling at any stage of construction.

.6 The Contractor shall take the necessary steps to ensure that backfilling does not induce tensile stress in the liner system. Care shall be taken to avoid making sharp turns, sudden stops or sudden starts adjacent to the liner system. Non-essential heavy equipment traffic in the immediate vicinity of the liner system shall not be permitted.

PVC Liner Installation

.7 The PVC liner should be deployed subsequent to the placement of Zone A bedding material.

.8 The Engineer should walk the liner to observe for any defects caused by on-site equipment and tools. Any liner area showing injury due to excessive scuffing, puncture, or distress from any cause should be replaced or repaired with an additional piece of PVC liner installed as per the manufacturer's specifications over the defective area. All patches should have rounded edges and extend a minimum of 150 mm beyond the affected area.

.9 Low ground pressure equipment should be used to deploy the liner material. No equipment shall be allowed on the liner.

Geocomposite Reinforcing Installation

.10 The geocomposite material should be deployed subsequent to the placement of the Liner.

.11 No equipment is permitted on the liner material during the placing of the geocomposite reinforcing material. The geocomposite reinforcing material must rolled out by hand and the cover material placed in accordance with Section 1004.

Material Quantities

.12 Estimated material quantities required for the lined pad are listed in Table 1005.8

TABLE 1005.8: MATERIAL QUANTITY ESTIMATES

Material	Total Area (m^2)
PVC 40 Liner	1900
Geo-Comp 5	905

END OF SECTION

Section 1006

QUALITY ASSURANCE

QUALITY ASSURANCE

1.0 General

.1 The quality assurance testing suggested is described in this section.

2.0 Reference Standards

.1 The most recent edition of the following American Society for Testing Materials standards:

a. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

b. ASTM D698 – Standard -Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

d. ASTM D4437 – Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes.

.2 Geosynthetic Research Institute

a. GRI Test Method GM6 – Pressurized Air Channel Test for Dual Seamed Geomembranes.

3.0 Fill Particle Size Testing Requirements

.1 Zone A Material

a. Samples of the Zone A material should be evaluated from locations within the borrow source prior to construction. One sample will be evaluated every 500 m^3 placed during construction to ensure the placed gradation meets the specification stated herein. The required tests and testing frequency for the Zone A material are presented in Table 1006.1.

TABLE 1006.1: TESTING AND FREQUENCY OF ZONE A MATERIAL	
Test	**Test Frequency**
Particle Size Analysis	One (1) test every 500 m^3 during construction.

.2 Zone B Material

a. Samples of the Zone B material will be evaluated from the foundation material within the Facility prior to construction and every 2000 m^3 placed during construction to ensure the placed gradation meets the specification stated herein. The required tests and testing frequency for the Zone B material are presented in Table 1006.2.

TABLE 1006.2: TESTING AND FREQUENCY OF ZONE B MATERIAL	
Test	**Test Frequency**
Particle Size Analysis	One (1) location within the Facility and One (1) test every 2000 m^3 during construction.

4.0 Fill Compaction Testing Requirements

.1 Zone A Material

a. Compact each lift with a minimum of six passes using a large smooth-drum, vibratory compactor. The optimum vibratory frequency and number of passes should be determined during construction using proof-roll tests, which demonstrate optimum compaction. The Engineer should inspect the compaction effort to ensure that this effort results in a density equivalent to about 95% MDD.

.2 Zone B Material

a. Compact each lift with a minimum of six passes using a large smooth-drum, vibratory compactor. The optimum vibratory frequency and number of passes should be determined during construction using proof-roll tests, which demonstrate optimum compaction. The Engineer should inspect the compaction effort to ensure that this effort results in a density equivalent to about 98% MDD.

b. The foundation material (Zone B or subcut material) should also be compacted as specified in section 1006.4.1.

5.0 Geomembrane Testing Requirements

.1 General

a. The Contractor is responsible for obtaining mill certificates from the manufacturer and forwarding them to the Engineer.

b. If applicable, the Contractor shall record all seam parameters (i.e. time, date, operator, welding speed and temperature) on the liner.

c. If applicable, the Contractor shall be responsible for completing the vacuum box testing and pressure testing for the appropriate seams. The Contractor shall mark the test number and parameters on the liner.

d. If applicable, the Contractor shall supply and use a field tensiometer for testing liner seams for shear and peel strength.

e. The Contractor is responsible for maintaining testing records.

f. All coupons and test specimens remain the property of the Owner.

.2 Qualifying Welds

a. Qualifying seams shall be conducted on fragmented pieces of material at the following times:

- At the start of each shift of production seaming, and at 4 hour intervals during production seaming;
- When a new operator or new machine starts welding;
- When a machine is restarted after repairs;
- When welding is stopped for sixty (60) minutes or more;
- When there is a change in the ambient conditions; and
- At the discretion of the Engineer.

b. Qualifying seams shall be 1 m long, and shall be subject to shear and peel testing. The test seam shall meet the minimum requirements stated herein for seam strength, when tested on a field tensiometer. If a qualifying seam fails, the seaming procedure shall be reviewed and the test shall be repeated.

.3 Non-Destructive Testing

a. Test all wedge-welded seams over their full length using a vacuum unit or air pressure test.

- Seam intersections will also be subject to vacuum box testing, regardless of seaming method employed.
- The Contractor shall supply all apparatus and personnel for this type of test.
- The tests shall be witnessed and documented by the Engineer.

b. Clean all seams to permit proper inspection.

c. Repair any seams which fail non-destructive testing in accordance with this Specification. Repairs shall be fully documented by the Contractor.

.4 Vacuum Box Testing

a. Extrusion welded seams should be tested using either vacuum box testing or pick-testing. Vacuum box testing involves placing the extrusion weld under a vacuum. The weld is first coated with a soapy water solution and any holes in a weld would be indicated by a stream of bubbles when vacuum is applied.

b. No leaks shall be permitted while conducting vacuum box testing.

c. Pick-testing is conducted on uneven surfaces where a vacuum cannot be maintained. During pick testing, attention should be paid to the following specific items:

- The width of the weld;
- Weld bond to the underlying geomembrane;
- Joints between three panels ("T" joints);
- Defects such as bubbles created within the weld due to moisture; and
- Textured weld surfaces due to temperature fluctuation in the extrusion welder.

.5 Air Pressure Testing

a. Wedge welded seams should be air-pressure tested over their full lengths using an air pressure test. Air pressure testing involves pressurizing the air channel located between the dual tracks of the seams to a minimum pressure of 40 psi for a period of five minutes.
b. During the test, the air pressure is not allowed to drop more than 4 psi (10% allowance). Any leaks and bubbling in the seams found during the non-destructive tests must be repaired by extruding a patch of HDPE material over the defect.
c. Air pressure testing shall be carried out according to GRI Test Method GM6, Pressurized Air Channel Test for Dual Seamed Geomembranes.

.6 Destructive Testing for Production Seams

a. Cut-out coupons shall be taken at a minimum frequency of one (1) per 150 m of seam, or once per seam. Coupons shall be cut by the contractor at the location directed by the Engineer. Coupons shall generally be taken from a location that does not affect the performance of the liner. All cut-outs shall have rounded corners. Care shall be taken to ensure that no slits penetrate the parent liner.
b. All holes left by cut outs shall be patched immediately.

.7 Testing of Repairs

a. All repairs shall be tested using the Vacuum Box in accordance with test method ASTM 4437.

END OF SECTION

Section 1007

DESIGN ALTERNATIVES

DESIGN ALTERNATIVES

1.0 General

.1 This section provides design alternatives for the Facility should the fill materials available on or near site not adhere to the gradation specifications stated in Tables 1003.1 and 1003.2.

.2 Should Zone A, Zone B or both materials not meet the gradation specifications stated in Tables 1003.1 and 1003.2 then the recommended design alternatives are available in Table 1007.1.

TABLE 1007.1: RECOMMENDED DESIGN ALTERNATIVES FOR GRADATION NON-COMPLIANCE

		Zone B		
		Meets Specifications	Gradation Below Fine Limit	Gradation Above Coarse Limit
Zone A	Meets Specifications	This section does not apply	This section does not apply	See Section 1007.2
	Gradation Below Fine Limit	See Section 1007.2	See Section 1007.2	See Section 1007.2
	Gradation Above Coarse Limit	See Section 1007.3	See Section 1007.3	See Section 1007.4

2.0 Detailed Design Alternatives – Non-Compliance Criteria I

.1 If the fill materials do not comply with gradation specifications as per Table 1007.1 geotextile material is required at the interface between Zone A and Zone B materials.

.2 The geotextile material should be deployed prior to the placement of Zone A material.

.3 The geotextile should be placed with a minimum overlap of 150 mm and connected at the seam by heat bonding. If heat bonding is not available an overlap of 300 mm should be used. Horizontal seams should be kept to a minimum on the side slopes. If a horizontal seam is unavoidable, the overlap shall be capped with a 300 mm wide strip of the same geotextile and heat bonded to the underlying material.

.4 Any tears or holes made in the geotextile should be repaired by placing a patch of geotextile on the defect and held in place by heat bonding. The patch should extend at least 300 mm beyond the damage, in all directions.

3.0 Detailed Design Alternatives – Non-Compliance Criteria II

.1 If the fill materials do not comply with gradation specifications as per Table 1007.1 geotextile material is required above and below the liner system.

.2 The geotextile material should be deployed prior to the deployment of the liner system as well as subsequent to the deployment of the liner system.

.3 The geotextile should be placed with a minimum overlap of 150 mm and connected at the seam by heat bonding. If heat bonding is not available an overlap of 300 mm should be used. Horizontal seams should be kept to a minimum on the side slopes. If a horizontal seam is unavoidable, the overlap shall be capped with a 300 mm wide strip of the same geotextile and heat bonded to the underlying material.

.4 Any tears or holes made in the geotextile should be repaired by placing a patch of geotextile on the defect and held in place by heat bonding. The patch should extend at least 300 mm beyond the damage, in all directions.

4.0 Detailed Design Alternatives – Non-Compliance Criteria III

.1 If the fill materials do not comply with gradation specifications as per Table 1007.1 geotextile material is required above and below the liner system as well as at the interface between Zone A and Zone B materials.

.2 The geotextile material should be placed prior to the placing of Zone A material, prior to the deployment of the liner system as well as subsequent to the deployment of the liner system.

.3 The geotextile should be placed with a minimum overlap of 150 mm and connected at the seam by heat bonding. If heat bonding is not available an overlap of 300 mm should be used. Horizontal seams should be kept to a minimum on the side slopes. If a horizontal seam is unavoidable, the overlap shall be capped with a 300 mm wide strip of the same geotextile and heat bonded to the underlying material.

.4 Any tears or holes made in the geotextile should be repaired by placing a patch of geotextile on the defect and held in place by heat bonding. The patch should extend at least 300 mm beyond the damage, in all directions.

END OF SECTION

Section 1008

OPERATION AND MAINTENANCE

OPERATION AND MAINTENANCE

5.0 General

.1 This section provides a general guideline for the operation and maintenance of the Waste Containment Facility.

6.0 Geomembrane Lined Pad

.1 Structure Maintenance

a. This section refers to the structure as the berm, side slopes, and floor of the Facility.

b. The structure shall be inspected regularly. Attention shall be concentrated on the following:

- Eroded and/or damaged granular slope and floor surfaces and
- Exposed liner material

c. Any identified problems should be repaired immediately. The repair can be conducted by reconstructing the damaged or eroded slopes with a material of similar gradation to Zone A material. Any exposed liner material can be recovered with Zone A material; however, if the liner material is damaged, liner installation personnel shall be retained to repair the liner.

.2 Surface Water Management

a. The Facility is designed to drain all surface water to the installed vertical culvert. Each month, the water lever must be inspected, pumped and disposed of appropriately.

b. The frequency of monitoring must be increased during times of high precipitation or snow melt within the Facility.

7.0 Filling Procedure

.1 The filling procedure for the Facility is as follows:

a. Waste material is not to exceed a height of 3.0 m above the level of the top of the berm unless approved by the Engineer;

b. Waste material is not to be placed higher than relative elevation 0.5 m below the crest of the liner unless approved by the Engineer.

8.0 Closure

.1 Upon reaching capacity the Facility will be capped with material meeting the specifications outlined in Table 1008.1 or as approved by the Engineer.

TABLE 1008.1: CAPPING MATERIAL- PARTICLE SIZE DISTRIBUTION LIMITS

Sieve Size (mm)	% Passing Fine Limit	% Passing Coarse Limit
100	100	100
50	95	100
25	90	100
20	85	100
5	65	90
0.63	35	60
0.08	5	20

.2 The capping material shall have a minimum thickness of 0.5 m.

.3 The vegetative cover must be capable of self-regeneration without continuous dependence on fertilizer or re-seeding.

.4 The vegetative cover must have sufficient density and species diversity to stabilize the surface against the effects of long term erosion.

.5 Closure monitoring should include inspection for any ponding water. If ponded water is present capping material should be added or re-graded.

END OF SECTION

APPENDIX

APPENDIX A CONSTRUCTION DRAWINGS

NOTES

1. CONTAINMENT FACILITY SIZED FOR 4900 m³ OF DEWATERED ASH. CONFIGURATION OF BASE AREA CAN BE MODIFIED SHOULD SITE CONDITIONS WARRANT. HOWEVER, SPECIFIED BERM CROSS-SECTION, FILL MATERIAL & LINER SYSTEM AND GENERAL DESIGN CRITERIA MUST BE ADHERED TO.
2. SPECIFIC CONDITIONS AND FACILITY LOCATION HAVE NOT BEEN PROVIDED OR CONSIDERED. ONCE FACILITY LOCATION AND SITE SPECIFIC CONDITIONS ARE KNOWN, THEY MUST BE APPROVED BY THE ENGINEER PRIOR TO CONSTRUCTION.
3. ALL ELEVATIONS ON PLAN ARE FOR TOP OF ZONE B MATERIAL.

REVISIONS						
MLM	DATE	DWN	CKD	APR	DESCRIPTION	

DRAWING STATUS				
NUM	DATE	APR	DESCRIPTION	
B	09/07/06	JPS	ISSUED FOR CONSTRUCTION	
A	03/26/06	JPS	ISSUED FOR REVIEW	

PERMIT

PROFESSIONAL SEAL

ORIGINAL
SIGNED AND SEALED

Permit: J. Richard Tribble, P.Eng. Seal: Jason Dobson, P.Eng.
Date: July 6, 2006 Date: July 6, 2006

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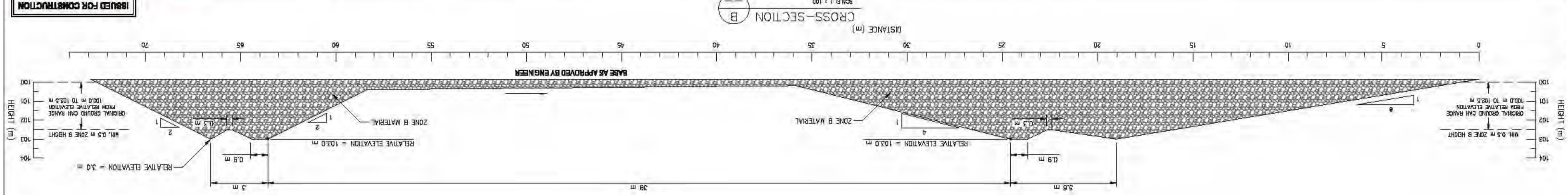
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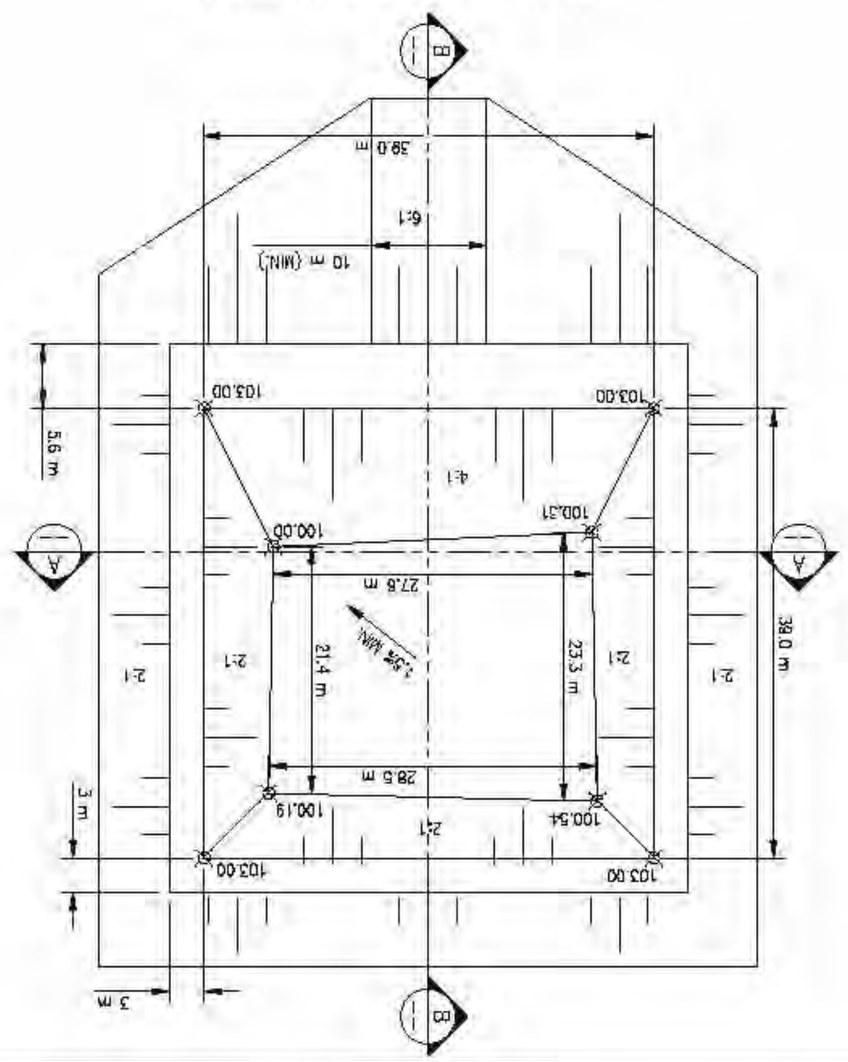
TYPICAL WASTE CONTAINMENT FACILITY DESIGN
KENO HILL SILVER DISTRICT, YT

ZONE B MATERIAL PLAN & CROSS SECTIONS

PROJECT No.	DRAWN	DSN	CHD	REV	DRAWING
VA10-142	CP/SE	DWB	JPS	0	WCF-1
DATE	SCALE AS NOTED	APP			
June 26, 2006	1 of 4	KLT	JRT	B	

ISSUED FOR CONSTRUCTION





NOTES

1. CONTAINMENT FACILITY SIZED FOR 1800 m^3 OF GENERATED ASH. CONFIGURATION OF BASE AREA CAN BE MODIFIED SHOULD SITE CONDITIONS WARRANT. HOWEVER, SPECIFIED BERM CROSS-SECTION, FILL MATERIALS, LINER SYSTEMS AND GENERAL DESIGN CRITERIA MUST BE ADHERED TO.
2. SPECIFIC CONDITIONS AND FACILITY LOCATION HAVE NOT BEEN PROVIDED OR CONSIDERED. ONCE FACILITY LOCATION AND SITE SPECIFIC CONDITIONS ARE KNOWN, THEY MUST BE APPROVED BY THE ENGINEER PRIOR TO CONSTRUCTION.
3. ALL ELEVATIONS ON PLAN ARE FOR TOP OF ZONE A MATERIAL.

REVISIONS						
MLM	DATE	DWN	CKD	APR	DESCRIPTION	

DRAWING STATUS			
NUM	DATE	APR	DESCRIPTION
B	09/27/06	JPS	ISSUED FOR CONSTRUCTION
A	09/26/06	JPS	ISSUED FOR REVIEW

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Date: July 6, 2006 Date: July 31, 2006

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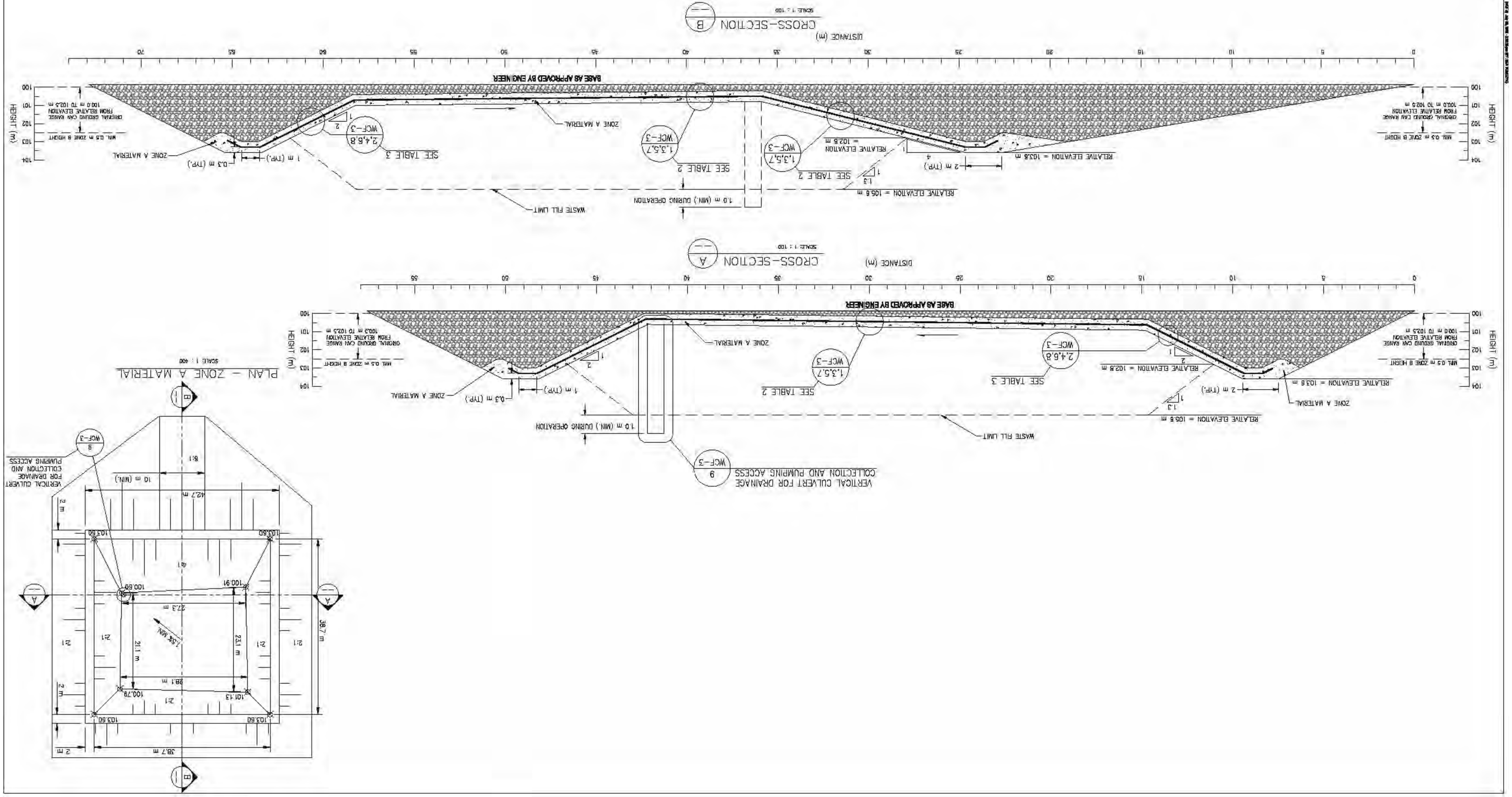
TYPICAL WASTE CONTAINMENT FACILITY DESIGN
KENO HILL SILVER DISTRICT, YT

ZONE A MATERIAL PLAN & CROSS SECTIONS

PROJECT No.	DESIGN	DRAWN	CHECKED
VH10142	VH/BE	JTP	JPS
DATUM	SCALE/As	DWG	APP
UTM	2 of 4	KLT	JRT
June 26, 2006			

WCF-2

ISSUED FOR CONSTRUCTION



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NOTES

1. CONTAINMENT FACILITY SIZED FOR 4900 m³ OF GENERATED ASH. CONFIGURATION OF BASE AREA CAN BE MODIFIED SHOULD SITE CONDITIONS WARRANT. HOWEVER, SPECIFIED BERM CROSS-SECTION, FILL MATERIALS, LINER SYSTEMS AND GENERAL DESIGN CRITERIA MUST BE ADHERED TO.
2. SPECIFIC CONDITIONS AND FACILITY LOCATION HAVE NOT BEEN PROVIDED OR CONSIDERED. ONCE FACILITY LOCATION AND SITE SPECIFIC CONDITIONS ARE KNOWN, THEY MUST BE APPROVED BY THE ENGINEER PRIOR TO CONSTRUCTION.

REVISIONS

MLM	DATE	DWN	CKD	APR	DESCRIPTION

DRAWING STATUS

NUM	DATE	APR	DESCRIPTION
2	09/27/06	JPS	ISSUED FOR CONSTRUCTION
1	09/26/06	JPS	ISSUED FOR REVIEW

PERMIT

PROFESSIONAL SEAL

ORIGINAL
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Date: July 6, 2006 Date: July 6, 2006

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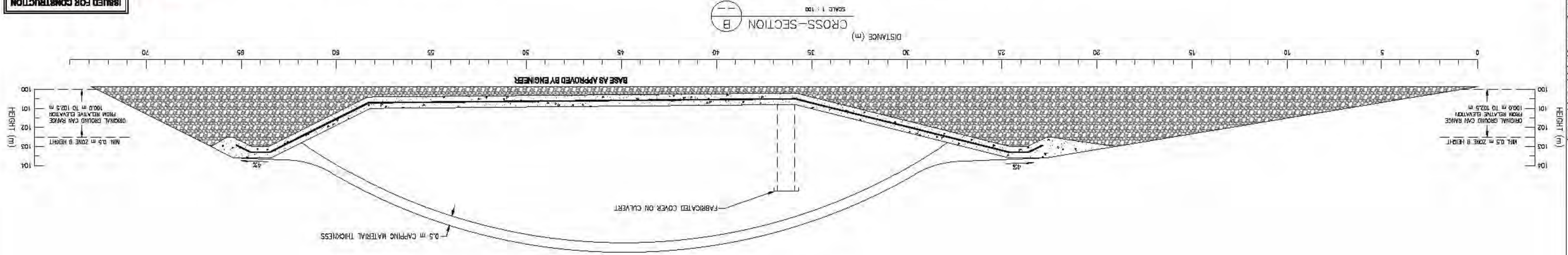
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DATE	DRWG No.	APP	KLT	JRT
June 26, 2006	4 of 4			B

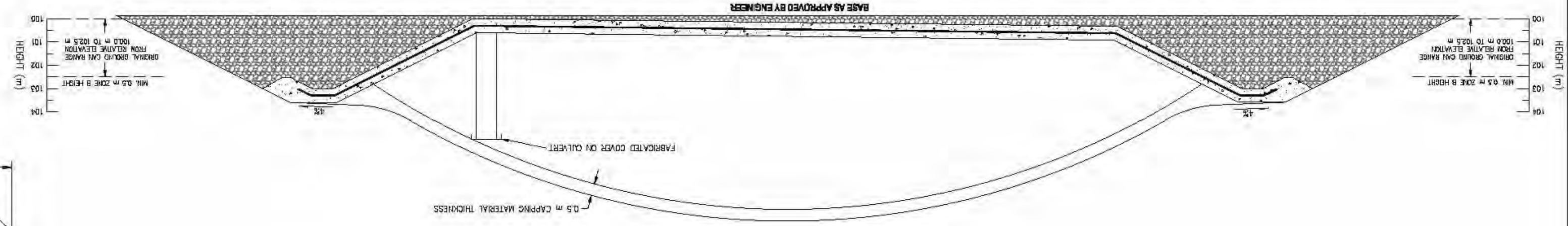
WCF-4

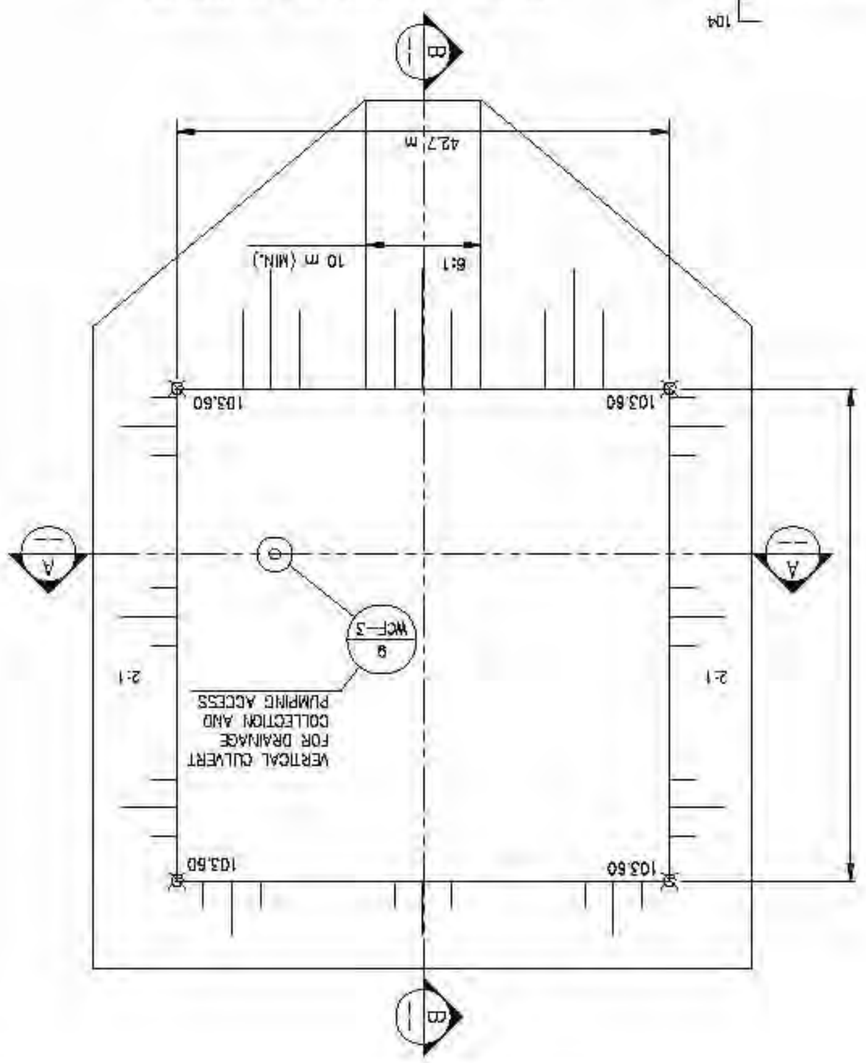
TYPICAL WASTE CONTAINMENT FACILITY DESIGN
KENO HILL SILVER DISTRICT, YT

FACILITY CLOSURE PLAN & CROSS SECTIONS

ISSUED FOR CONSTRUCTION







Appendix 3 Silver King In Situ Demonstration Test Interim Report



SILVER KING IN SITU TREATMENT

PROGRESS REPORT

Revision 0

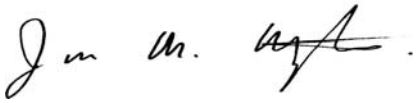
Deliverable Number 5002-033-2

31 March 2015

Prepared for:

ELSA RECLAMATION AND DEVELOPMENT COMPANY LTD.

ACCESS CONSULTING GROUP SIGNATURES

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EXECUTIVE SUMMARY

A pilot study was initiated in September 2014 to examine the feasibility of in situ mine pool treatment in the Silver King (SK) mine workings, specifically to lower the cadmium and zinc concentrations in water leaving the Silver King mine (by adit or by pumping). The SK mine pool was dewatered via a borehole that accessed the SK 100 decline so that water no longer flowed from the SK 100 adit. A recirculation system was then set up where a fraction of the pumped groundwater was returned to the mine pool by either injection into a second borehole that accessed a different portion of the flooded subsurface mine workings, or injection into the SK pit and allowed to infiltrate into the workings below. Molasses and salt tracer were continuously titrated into the re-injected water to provide dissolved organic carbon (DOC) for indigenous microorganisms in the mine pool and help establish the residence time of the "active" mine pool, respectively.

Salt tracer and DOC breakthrough occurred within 10 days of injection and was showing signs of stabilization 5 to 6 weeks after constant injection was started, however, the molasses and tracer injection was suspended to conserve supply before this stabilization could be confirmed. Within a month of the start of DOC delivery to the mine pool, microbial iron-reducing conditions started to develop as evidenced by elevated iron levels and a declining oxidation-reduction potential (ORP) in the mine pool water. Arsenic concentrations also increased concomitantly with iron as arsenic was released from iron oxyhydroxide mineral hosts as they dissolved under the iron-reducing conditions. A near simultaneous sharp decline in the ORP and sulphate concentrations suggested that the target sulphate-reducing conditions were becoming established in early March, approximately 11 weeks after molasses injection first began. This was associated with a drop in the zinc and cadmium concentration in the mine pool water, which exhibited 70% and >96% removal, respectively. This was likely due to the reaction of these metals with the sulphide produced during sulphate-reduction to form insoluble zinc and cadmium sulphide phases which scavenged zinc and cadmium from solution and coated the walls of the mine workings. Similar declines in the concentrations of copper, lead and thallium were observed at this time, supporting the establishment of sulphate-reducing conditions since these elements are known to easily form insoluble metal sulphide phases.

Dissolved cadmium has been below the limit of detection for the past two sampling events (early March), whereas total and dissolved zinc levels are now below the effluent quality standard for discharge to the environment. It is expected that zinc concentrations will continue to decline under the sulphate-reducing conditions. The in situ treatment program is continuing into FY 2015/16 and monitoring data will continue to be collected to determine the efficacy of this treatment regime.

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Figure 8: Change in lead, and thallium concentrations in SK mine pool water (collected via the 2011 dewatering borehole) during the dewatering and molasses amendment phases of the in situ mine pool treatment testing. The shaded areas indicate when continuous injection of salt and molasses was ongoing with recirculation to either the shaft or pit; data collected prior to this were sampled when the mine pool was undergoing dewatering only. 13

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APPENDIX A WATER QUALITY DATA FOR SILVER KING MINE POOL SAMPLES COLLECTED VIA THE 2011 DEWATERING BOREHOLE

1 INTRODUCTION

The aim of this work element was to assess the effectiveness of in situ mine pool treatment, via the addition of dissolved organic carbon to subsurface waters within the SK mine workings, with the goal of achieving sufficiently good water quality that direct discharge without further treatment may be possible. This study is in its early stages and will be ongoing into FY 2015/16 with further testing and associated data collection planned. This report summarizes the data collected to mid-March 2015 with discussion of changes observed in water level and geochemistry, both in the Silver King mine pool and near field groundwater environment. More detailed reporting will be supplied in FY2015/16 at the conclusion of the pilot study.

2 METHODS

2.1 OVERVIEW

In October 2011, Alexco installed a 110 m deep well that accessed the lower levels of the Vein 5 area of the SK mine at the base of the ramp (Figure 1). The well was equipped with a 25 hp pump, a 584 m HDPE pipeline to the SK water treatment plant (Figure 2), and controls/monitoring equipment to do dewatering tests (Alexco Resource US Corp. 2012).

In brief, the SK mine pool was dewatered by pumping via the well drilled in 2011. Water pumped from this well is piped to the exisiting SK water treatment plant (WTP) for treatment prior to discharge to the environment. Once the SK mine pool water levels had been lowered below the SK 100 level, a fraction of the pumped water was returned to the mine pool via the the 8 inch borehole that was installed in the 1980's into the top of the Vein 5 area, creating a reciculation loop. The water that is returned to the SK mine pool is amended with a salt tracer and molassess in order to assess the residence time of the mine pool and stimulate indigenous microbial activity, respectively.

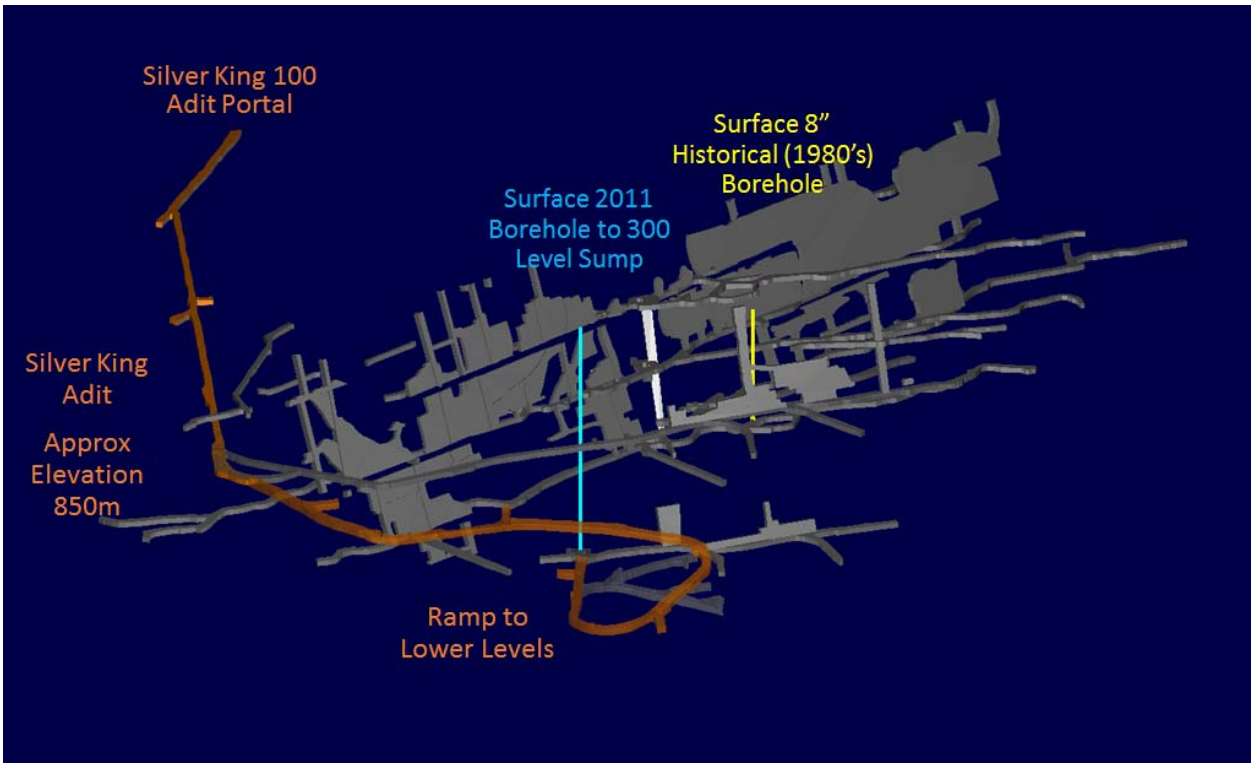
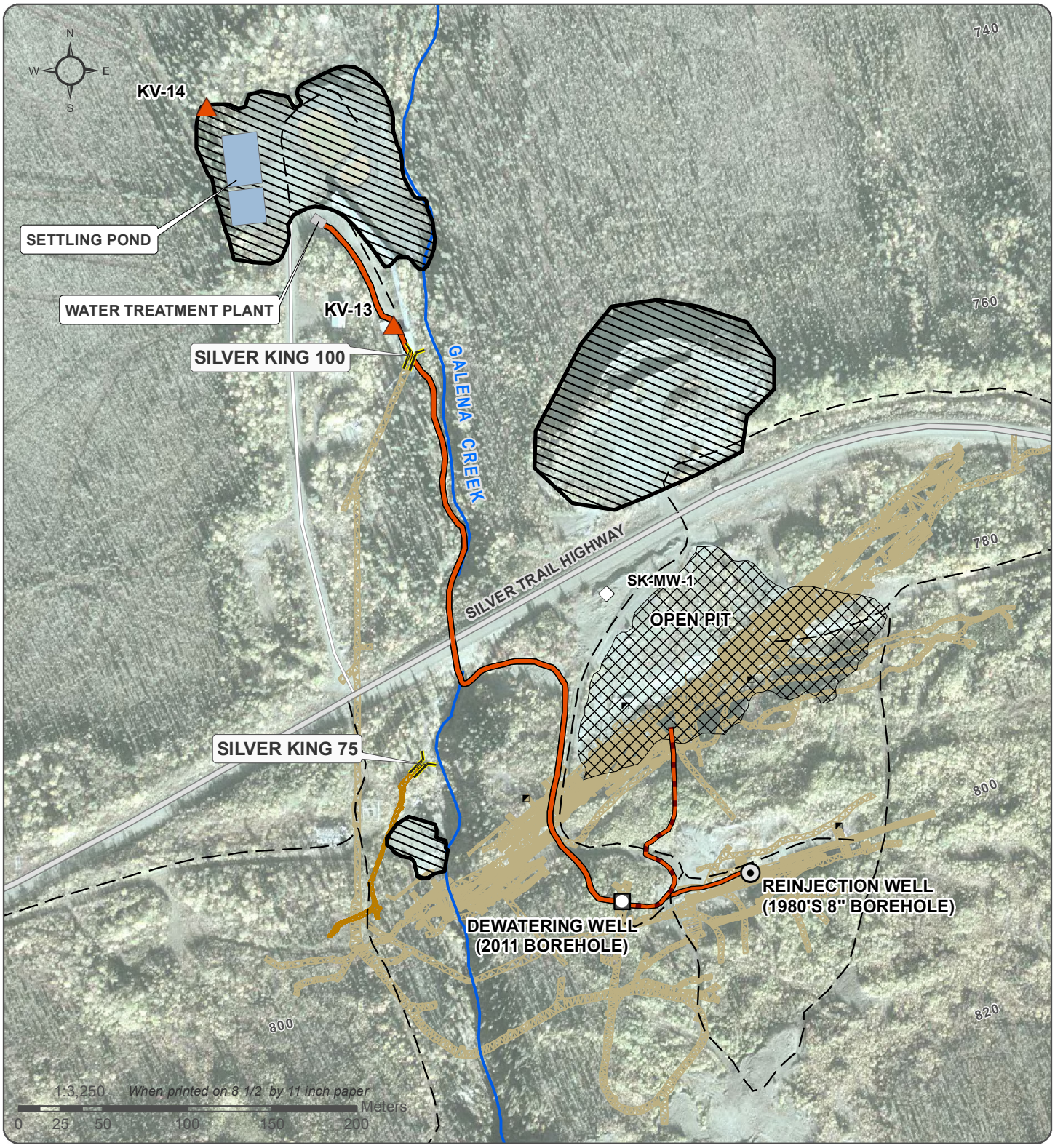


Figure 1: Silver King underground workings indicating the locations of the borehole drilled in 2011 used for dewatering of the SK mine pool and the 1980's 8" borehole used for reinjection with salt tracer and molasses amendment.

2.2 RHODAMINE DYE TRACER

In 2013, rhodamine dye was added to the 8 inch borehole that was installed in the 1980's. No rhodamine was detected in the SK100 adit discharge water and it was suspected that the borehole had been sealed with cement in the past as part of efforts to fill an unstable stope. During the July 2014 preparations for the in situ testing, the rhodamine dye was discovered to be still down the well due to a plug. On August 4, 2014, this cement plug was drilled out, and flushed with water, allowing the rhodamine dye into the mine pool. Following this, rhodamine dye concentrations in the SK100 adit discharge water ware monitored with a datalogger, sampling every five minutes. No accurate data are available regarding the mass of dye injected into the mine pool, since some was lost during the drilling and flushing, thus this can be viewed as a qualitative test of the SK mine pool residence time.



Surface Water Station
Reinjection Well
Dewatering Well
Monitoring Well
Adit
Watercourse

Contours (20 meter)
Silver Trail Highway
Local Road
Limited-Use Road
Pipeline
Proposed Pipeline

Underground Workings (75 level)
Underground Workings (100 level)
Settling Pond
Open Pit
Waste Rock Dump

Aerial photograph obtained from Aero Geometrics. Imagery acquired September 13th and 14th 2006.
Site hydrography and contours derived from 2006 aerial imagery obtained from Aero Geometrics,
Datum: NAD 83; Projection: UTM Zone 8N

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SILVER KING IN SITU TEST

FIGURE 2

SILVER KING LAYOUT

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2.3 SK MINE POOL DEWATERING AND MOLASSES AND SALT INJECTION

In situ treatment was planned to be initiated after water from the mine was only coming from the dewatering well, and no longer overflowing into and coming out the Silver King 100 adit. Dewatering of the SK mine pool (via the 2011 borehole) commenced on Sep 2, 2014, pumping at approximately 14 L/s with the pumped water piped directly to the SK WTP for treatment. Between Nov 29, 2014 and Dec 21, 2014, the dewatering pumping rate was progressively slowed from 14 L/s down to approximately 8 L/s.

Recirculation of the pumped water back into the mine was started on Dec 22, 2014 with approximately 2 L/s returned to the SK mine pool (following molasses and salt tracer amendment) via the historic 8 inch borehole and 9 L/s sent to the SK WTP. From Jan 11, 2015 to Feb 3, 2015, approximately 3 L/s was reinjected into the SK mine pool and approximately 8 L/s sent to the SK WTP. Between Feb 4, 2015 and Feb 24, 2015, the reinjection rate was increased to 3.5 – 4 L/s, with between 6 and 7 L/s directed to the SK WTP. On Feb 25, 2015, the reinjection point was moved to the Silver King open pit (Figure 2), with the pit reinjection rate remaining at approximately 3.3 L/s, but the flow sent to the SK WTP declined to around 5 L/s. In order to allow some rebound in the mine pool water level and create a larger mine pool volume (and hence longer residence time), the flow sent to the SK WTP was progressivly stepped down to 3 L/s since March 12, 2015, while the flow recirculated back to the mine remained constant at approximately 3.3 L/s.

Salt (1,000 kg) was mixed with molasses in approximately 4,000 L of water. Injection of this mixture into the SK mine pool via the historic 8 inch borehole began on Dec 23, 2014. The molasses and salt tracer mixture was continuously titrated into the reinjected water at a rate of 180 – 240 mL/min. On Feb 3, 2015, the molasses and salt tracer addition was suspended to conserve the remaining supply in anticipation of switching the reinjection point from the historic 8 inch borehole to the Silver King open pit (Figure 2).

The SK mine pool water was sampled on a weekly basis (collected at the 2011 dewatering borehole) and analyzed for a range of constituents including a standard suite of total and dissolved concentrations of 35 elements, dissolved organic carbon, alkalinity, acidity, ammonia and major anions (sulphate, chloride, nitrate, nitrite, fluoride). Other physicochemical parameters including pH, ORP and conductivity were measured using an inline datalogger installed at the Silver King water treatment plant building.

On February 25, recirculation water with molasses and salt mixture was sent to the Silver King open pit, which was created when the crown piller was removed from the 1 and 2 veins. No ponded water has yet been observed in the pit; all of the water infiltrates rapidly into the underground workings below this open pit. On March 21, 2015, the molasses supply temporarily ran out, however, all water geochemistry data presented here were collected before this event. New molasses delivery is anticipated in early April.

3 RESULTS AND DISCUSSION

3.1 RHODAMINE DYE

The total amount of rhodamine dye added to the well is unknown due to the method of dye addition therefore the results are qualitative. The data logger recorded rhodamine concentrations in the SK100 adit discharge

water between on August 4 and August 23, 2014. A spike in rhodamine concentrations was noted on August 22, 2014 (Figure 3), some 22 days after its injection.

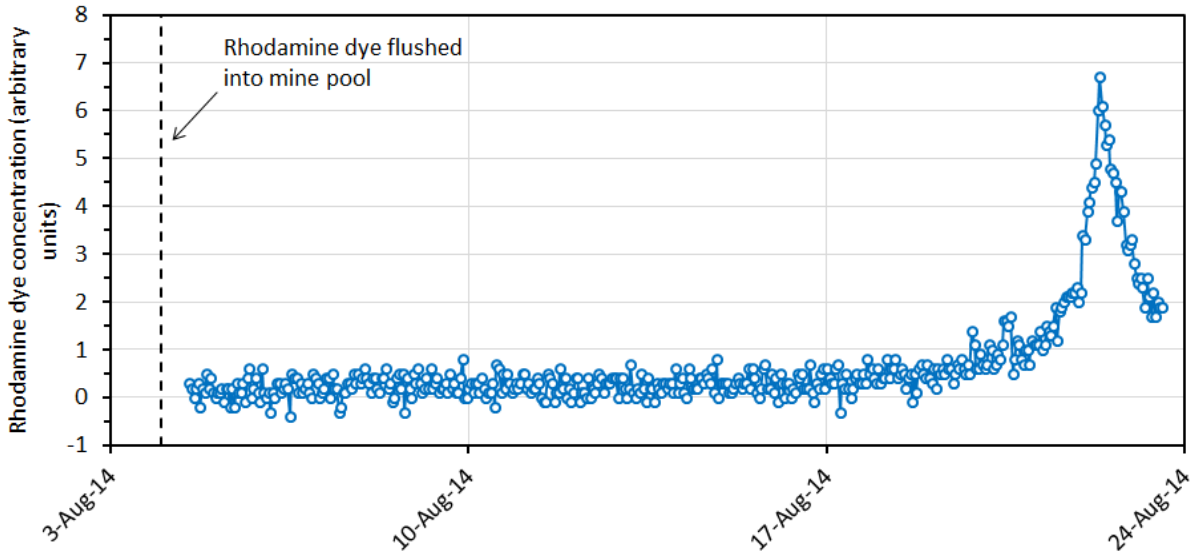


Figure 3: Change in Rhodamine dye level in SK100 adit discharge water following flushing of dye into SK mine pool on Aug 4, 2014.

3.2 DEWATERING

Significant drawdown of the SK groundwater table began on Nov 9, 2014 (Figure 4) and declined below the SK 100 adit level on Nov 12, 2014, causing flow from the adit to cease. The water table continued to decline steadily, with changes to the rate of decline dictated by changes to both the dewatering pumping rate and the start of reinjection into the mine pool (Figure 4). Following the switch to reinjection at the Silver King pit and the increase in the fraction of abstracted water that is reinjected, the mine pool water level has risen progressively. At present, the SK mine pool water table stands at approximately 729 masl, approximately 17 m below the level where water would start to drain from the SK 100 level adit.

Data obtained from an in-line pressure transducer situated in the Silver King monitoring well (SK-MW-1) indicated that the near field water table also declined during dewatering of the mine pool (Figure 5), although the extent of the drawdown (4 m) was lower than that observed in the SK mine pool (ca. 23 m). The groundwater table at SK-MW-1 responded rapidly to the switch to the SK pit as the reinjection location (Figure 5), which was expected since the pit is located immediately adjacent to, and upgradient of SK-MW-1 (Figure 2).

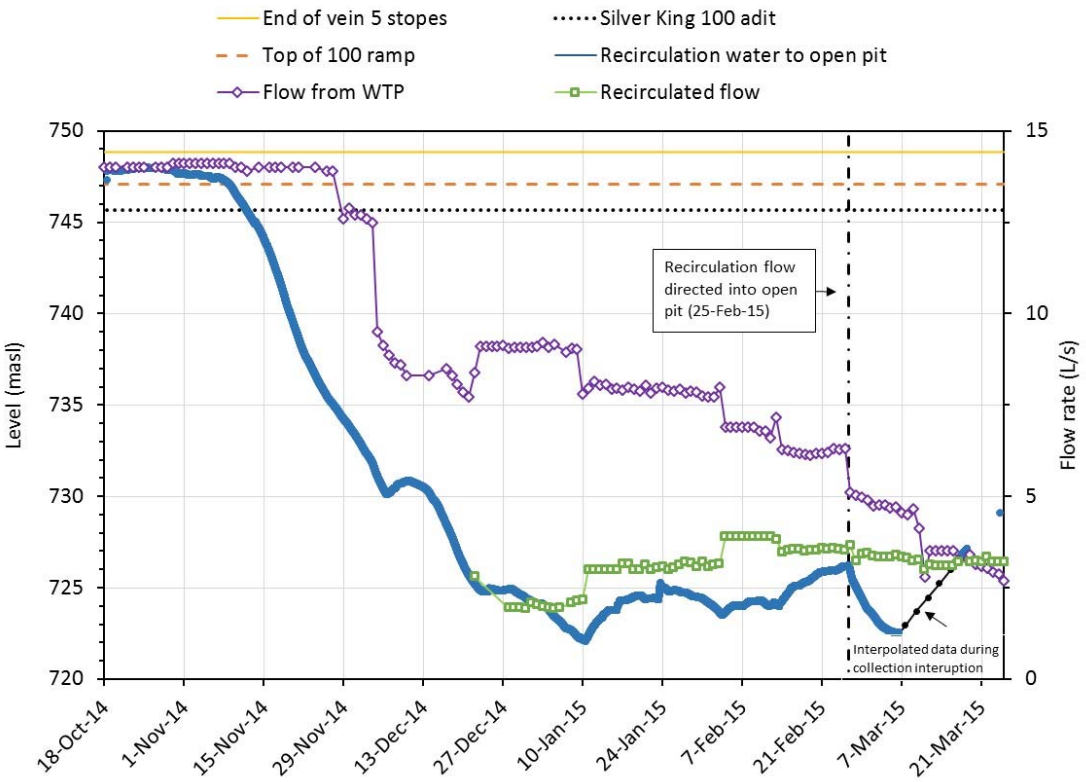


Figure 4: Response of groundwater level in SK mine pool during dewatering only and dewatering-recirculation phases of testing at different pumping flow rates. The level of the end of the Vein 5 stopes, top of the 100 ramp and SK100 adit are shown for reference.

3.3 MINE POOL GEOCHEMISTRY

Water quality data from samples collected from the 2011 borehole used to dewater the SK mine pool are presented in Appendix A.

When dewatering was started (Sep 2, 2014), the first water sample from the SK mine pool (collected Sep 3, 2014) showed a depressed alkalinity and elevated concentrations of acidity, sulphate, iron, arsenic, zinc and cadmium (Appendix A). We hypothesize that the installation of the borehole in 2011 and subsequent test preparation activities in the summer of 2014 introduced oxygen into the SK mine pool, which promoted localized oxidative dissolution of metal sulphide minerals, causing the release of iron, arsenic, cadmium and zinc into solution, accompanied by acidity. Continued pumping caused oxygen-poor groundwater from elsewhere within the SK mine pool to migrate to the 2011 borehole area, leading to the rebound in alkalinity and comparatively lower metal(loid) and acidity concentrations. This first high data point was removed from the figures displayed here in order to more clearly present the trends in mine pool water geochemistry during the molasses amendment phase of the pilot test, however, it is included in Appendix A.

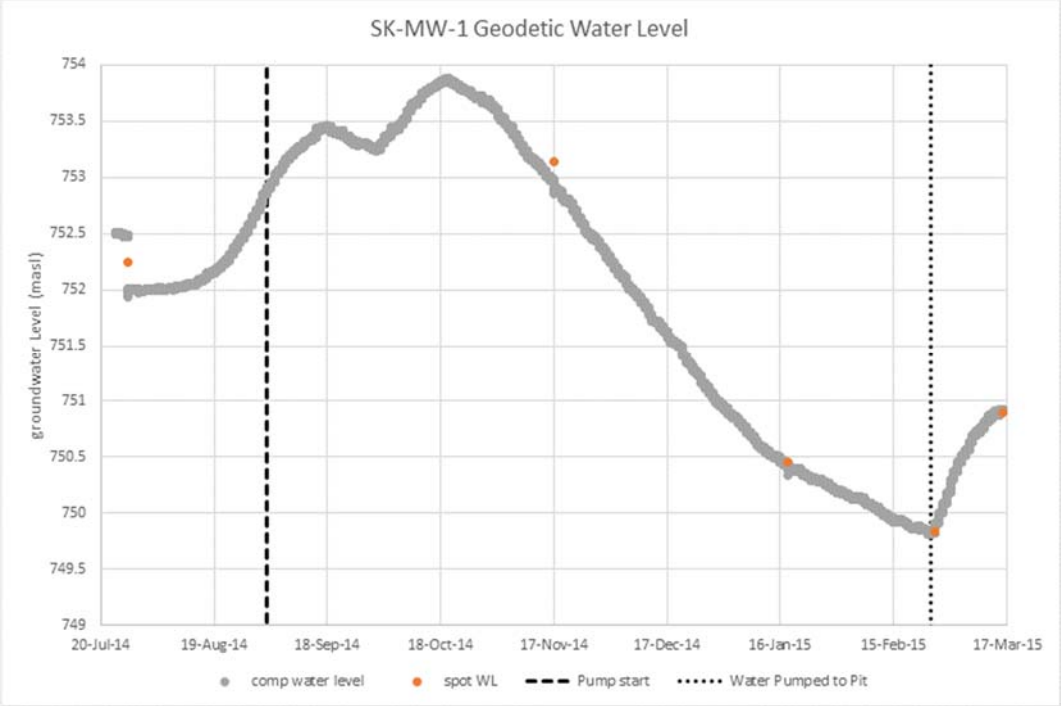


Figure 5: Water table in Silver King groundwater monitoring well SK-MW-1

As dewatering continued, alkalinity, cadmium and zinc concentrations varied minimally, whereas arsenic, iron and sulphate levels started to climb (Figure 6and Figure 7Figure 7), possibly due to the influx of groundwater from elsewhere in the SK mine pool that contains higher levels of these constituents. Indeed, groundwater samples collected from the monitoring well installed in 2013 (SK-MW-1), located downgradient of the SK mine pool, contain dissolved arsenic concentrations of 0.6 – 0.8 mg/L, some two orders of magnitude higher than the dissolved arsenic concentration range observed in the early stages of the SK mine pool dewatering (0.003 – 0.007 mg/L;Figure 6). The sulphate (750 – 840 mg/L) and dissolved iron (7.1 – 8.7 mg/L) concentrations measured at SK-MW-1 are also higher that those observed in the SK mine pool during the early period of dewatering (420 – 500 mg/L sulphate; 1.5 – 6 mg/L iron). In addition the drawdown of the SK mine pool would desaturate mineralized rock within the mine, making it more vulnerable to oxidation. Rinsing of the metal sulphide oxidation products that may have formed following dewatering by oxic recharge water from Galena Creek may also have contributed to the rise in metal(loid) and sulphate concentrations observed.

The first SK mine pool water sample collected (Jan 2, 2015) following the start of molasses injection (Dec 23, 2014) showed elevated levels of sodium, chloride and dissolved organic carbon (Figure 6), indicating that the water amended with salt and molasses that was re-injected into the top of the Vein 5 area via the historic 8" borehole was arriving at the base of the SK ramp (accessed by the 2011 borehole used for dewatering) within 10 days. Potassium levels also increased, mirroring those of dissolved organic carbon (DOC), suggesting that the molasses contained enough potassium for use as a tracer.

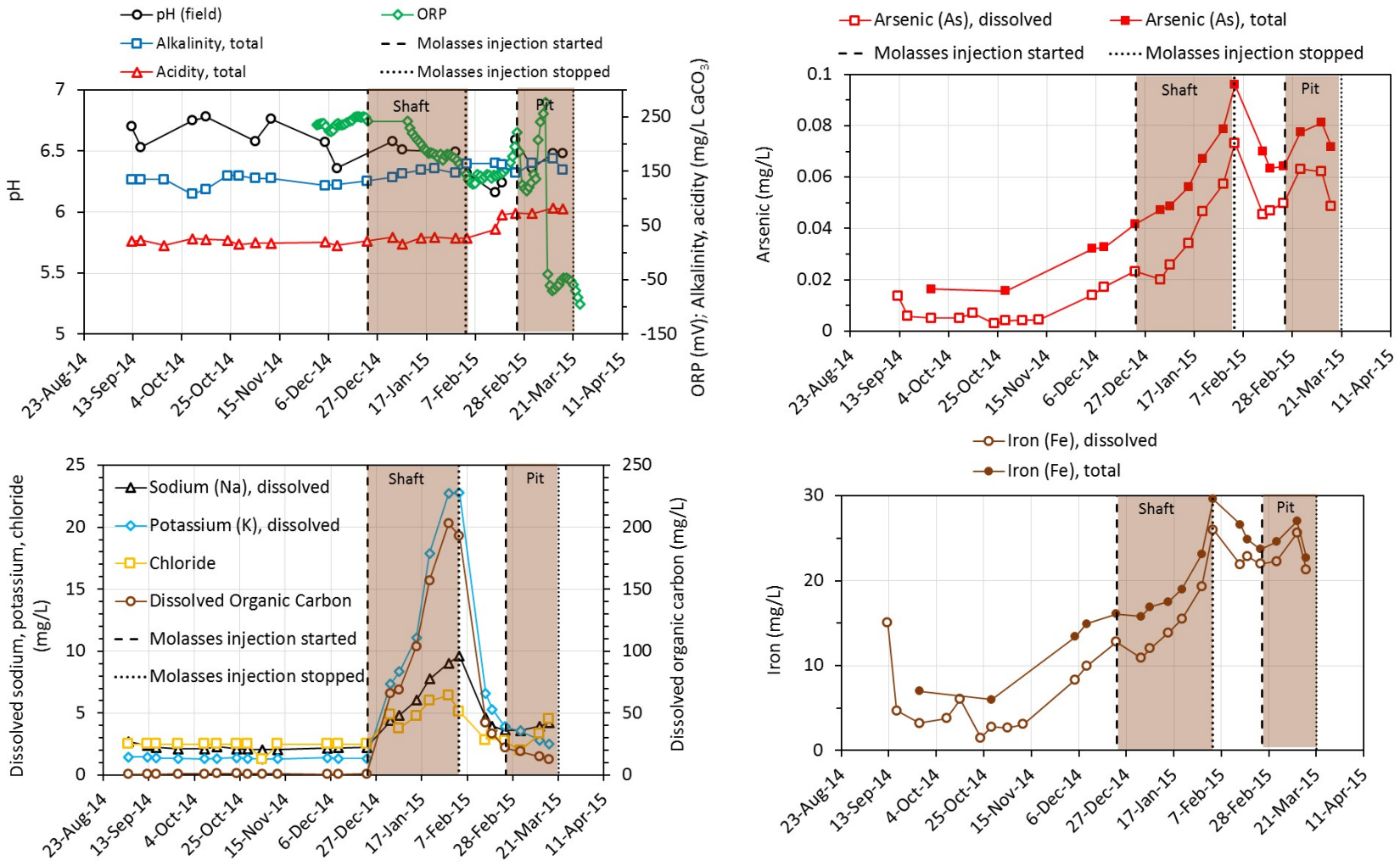


Figure 6: Change in selected constituents in SK mine pool water (collected via the 2011 dewatering borehole) during the dewatering and molasses amendment phases of the in situ mine pool treatment testing. The shaded areas indicate when continuous injection of salt and molasses was ongoing with recirculation to either the shaft or pit; data collected prior to this were sampled when the mine pool was undergoing dewatering only. ORP is measured via an in line probe at the SK WTP.

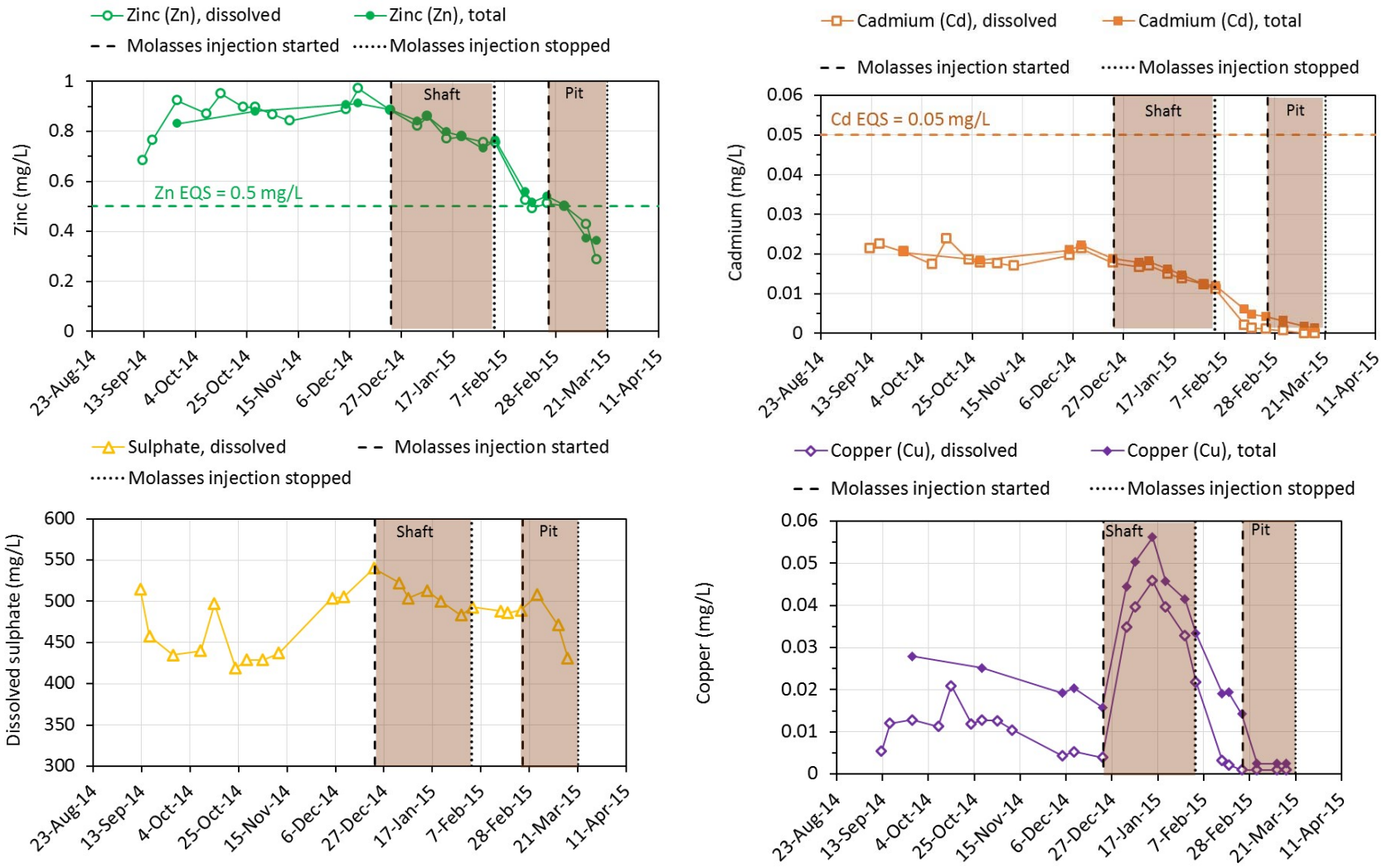


Figure 7: Change in zinc, cadmium, sulphate, and copper concentrations in SK mine pool water (collected via the 2011 dewatering borehole) during the dewatering and molasses amendment phases of the in situ mine pool treatment testing. The shaded areas indicate when continuous injection of salt and molasses was ongoing with recirculation to either the shaft or pit; data collected prior to this were sampled when the mine pool was undergoing dewatering only. EQS = effluent quality standard.

The concentrations of sodium, chloride and potassium continued to rise and appeared to stabilize between Jan 29, 2015 and Feb 3, 2015, indicating that the "active" mine pool became better mixed between 5 and 6 weeks after continuous injection was started. The tracer and DOC levels then declined sharply as the molasses and salt tracer injection was suspended on Feb 3, 2015. A slight rebound in chloride and sodium was observed approximately two weeks after molasses and tracer injection via the SK pit was established.

As molasses injection continued, the ORP has declined (Figure 6), while alkalinity and dissolved arsenic concentrations have increased markedly, accompanied by a more moderate rise in iron (Figure 6). Such behaviour is consistent with the development of microbially-mediated Fe(III)-reducing conditions in the SK mine pool, which caused the solubilisation of iron via reductive dissolution of poorly crystalline hydrous ferric oxide (HFO) phases and the release of arsenic that is commonly adsorbed on or co-precipitated with such HFO minerals. The initial rise in copper concentrations may also be related to release from an iron-bearing host during reductive dissolution (Figure 7). Similar to prior dewatering of the mine, some of the arsenic increase may be due to the influx of higher arsenic water from upgradient areas; the drawdown of the mine pool level may have led to this water entering the mine.

The concentration of dissolved sulphate started to decline markedly over the past few sampling points in March 2015 (Figure 7), in concert with a sharp fall in the ORP of over 200 mV to be close to -100 mV (Figure 6; note these data are not corrected to the standard hydrogen electrode scale). This suggests that sulphate-reducing conditions were becoming established in the mine pool around this time. This is reflected in the concentrations of zinc and cadmium, which have declined by 70% and >96% since the molasses injected began, likely due to the formation of insoluble cadmium and zinc sulphide phases produced via reaction with the sulphide formed during sulphate-reduction. Indeed, dissolved cadmium concentrations have been below the limit of detection for (<0.0001 mg/L) for the past two sampling events, whereas total and dissolved zinc levels have declined below the effluent quality standard (0.5 mg/L) during this time. Sequestration of cadmium and zinc appeared to occur slightly before the marked drop in sulphate concentration was observed, suggesting that pockets of sulphate-reducing conditions had started to develop within the SK mine pool. Although still elevated, the concentrations of arsenic and iron were lower than their previous peak. The concentrations of iron and arsenic may decline under sulphate-reducing conditions as authigenic iron sulphide minerals form; further data collection will help determine the extent that this occurs.

Other chalcophile elements such as copper, lead and thallium also showed dramatic declines in their dissolved concentration as sulphate-reducing conditions became established (Figure 7 and Figure 8), allowing them to precipitate in sulphide-bearing phases.

Elements such as lead and iron have a significant particulate fraction which may be expected under these circumneutral conditions. Although iron reduction would be expected to dissolve the particulate iron, crystalline forms of iron oxyhydroxide are more recalcitrant to reductive dissolution, whereas reduced iron phases such as siderite ($FeCO_3$) may also precipitate following HFO reduction. The close association of arsenic with iron also explains the sizeable particulate arsenic fraction; this arsenic is likely adsorbed on, or co-precipitated with the iron mineral assemblages rather than forming discrete arsenic-bearing minerals.

At present, no breakthrough of salt tracer or DOC has been observed at the SK-MW-1 groundwater monitoring well site and no substantive changes in the range of cadmium, zinc, iron, or arsenic concentrations have been recorded. Continued monitoring of this site will be inspected for any such changes.

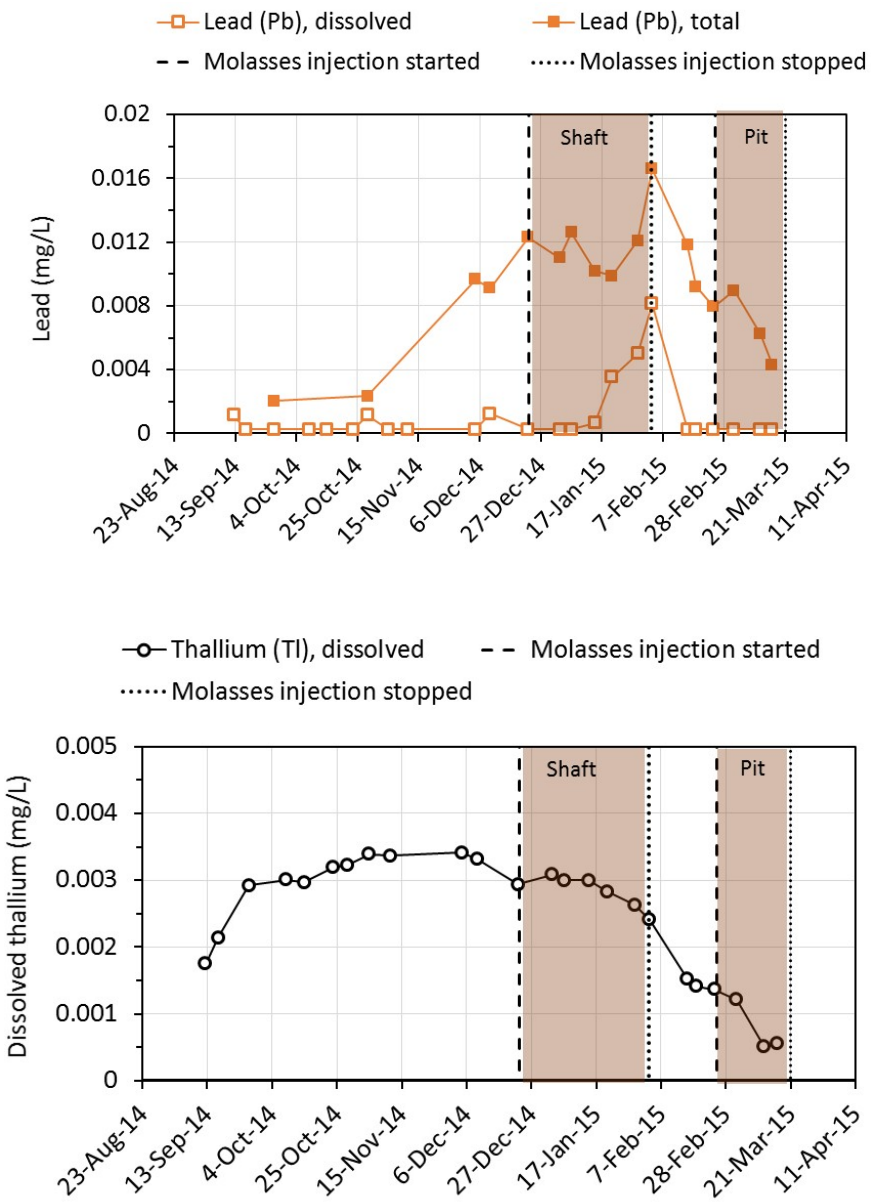


Figure 8: Change in lead and thallium concentrations in SK mine pool water (collected via the 2011 dewatering borehole) during the dewatering and molasses amendment phases of the in situ mine pool treatment testing. The shaded areas indicate when continuous injection of salt and molasses was ongoing with recirculation to either the shaft or pit; data collected prior to this were sampled when the mine pool was undergoing dewatering only.

4 INTERIM CONCLUSIONS

Dewatering of the SK mine pool via the 2011 borehole, which accesses the base of the SK ramp, commenced in early Sep, 2014. The SK mine pool has been dewatered to below the SK 100 level, such that water no longer flows from the SK100 adit. Elevated levels of dissolved sodium, chloride potassium and organic carbon were observed at the 2011 borehole dewatering well within 10 days of starting the continuous injection of salt tracer and molasses into the SK mine pool in the Vein 5 area (via the historic 8" borehole). The elevated dissolved organic carbon has stimulated the indigenous community of metal- and sulphate-reducing microorganisms within the SK workings; the decline in ORP and increase in dissolved iron and arsenic indicate that Fe(III)-reducing conditions were rapidly established within the mine pool. The subsequent decline in cadmium, zinc, and dissolved sulphate concentrations, combined with a simultaneous precipitous drop in ORP suggests that sulphate-reducing conditions were developing in the SK mine pool that promote the precipitation of metal sulphide minerals. As sulphate-reducing conditions become established more broadly in the Silver King mine pool in the coming weeks/months, it is expected that the zinc concentrations in the SK mine pool will diminish significantly (dissolved cadmium is already below the limit of detection).

5 FUTURE WORK

Regular monitoring of the SK mine pool geochemistry will continue and molasses injection will be restarted once further molasses are delivered to site, which is anticipated in mid-April. Once sulphate-reducing conditions have become firmly established, water samples will be collected for fish toxicity testing to determine if such water would be safe for discharge without further treatment. Evaluation of a passive aeration system that could enhance removal of any residual DOC or unreacted sulphide will also be performed. Molasses injection will also be suspended when a redox buffered mine has been established, and samples will continue to be collected to establish the longevity of treatment by residual stored reactive minerals (such as amorphous FeS) or stored organic carbon, and help establish the frequency of DOC injection that is required to sustain the treatment processes. Some supplemental water chemistry, mineralogy, and microbiology data may be collected as the analysis of trends and evaluation of treatment processes continues.

6 REFERENCES

Alexco Resource US Corp. (2012). Silver King Mine Dewatering System As Built Documentation. Report submitted to Elsa Reclamation and Development Company, May 2012.

APPENDIX A

WATER QUALITY DATA FOR SILVER KING MINE POOL SAMPLES COLLECTED VIA THE 2011 DEWATERING BOREHOLE

Analyte	Units	EQS Exceedance Values		Station ID					
				SKDW	SKDW	SKDW	SKDW	SKDW	SKDW
Description		Type B WUL QZ12-057 C&M EQS	Type B WUL QZ12-057 C&M EQS-DM	Silver King Dewatering Well	Silver King Dewatering Well	Silver King Dewatering Well	Silver King Dewatering Well	Silver King Dewatering Well	Silver King Dewatering Well
Sample Date	dd/mm/yyyy			03/09/2014	12/09/2014	16/09/2014	26/09/2014	08/10/2014	14/10/2014
Physical Tests									
Discharge (Flow)	L/s				14	14			
Total Suspended Solids	mg/L	25	25	**31.2**			16.4		
pH (field)	pH units	6.5-9.5	6.5-9.5		6.7	6.53		6.75	6.78
pH (lab)	pH units	6.5-9.5	6.5-9.5	**5.12**	7.03	7.01	6.85	6.73	6.92
Specific Conductance (field)	µS/cm				1197	1128		1109	1188
Specific Conductance (lab)	µS/cm			1620	1070	992	938	968	991
Temperature (field)	°C				3.1	3.1		1.9	2.5
Hardness (from total)	mg/L						567		
Hardness (from dissolved)	mg/L			825	671	610	568	577	613
Anions and Nutrients									
Total Acidity	mg/L			210	21.2	23.1	13.5	26.0	24.5
Alkalinity, total	mg/L			11.2	134	135	135	108	117
Chloride	mg/L			<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Fluoride	mg/L			0.72	0.36	0.30	0.24	0.24	0.28
Sulphate, dissolved	mg/L			965	515	458	435	440	497
Ammonia (N)	mg/L			0.197	0.179	0.184	0.137	0.122	0.127
Nitrite (N)	mg/L			<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrate (N)	mg/L			<0.050	<0.050	0.055	<0.050	<0.050	<0.050
Dissolved Organic Carbon	mg/L			0.64	0.64	0.84	0.96	0.98	1.29
Total Metals									
Aluminum (Al), total	mg/L						0.117		
Antimony (Sb), total	mg/L						0.0201		
Arsenic (As), total	mg/L	0.5					0.0164		
Barium (Ba), total	mg/L						0.00943		
Beryllium (Be), total	mg/L						<0.0010		
Bismuth (Bi), total	mg/L						<0.0050		
Boron (B), total	mg/L						<0.10		
Cadmium (Cd), total	mg/L	0.05					0.0204		
Calcium (Ca), total	mg/L						162		
Chromium (Cr), total	mg/L						<0.0010		
Cobalt (Co), total	mg/L						0.0169		
Copper (Cu), total	mg/L	0.3					0.0279		
Iron (Fe), total	mg/L						7.01		
Lead (Pb), total	mg/L	0.2					0.00204		
Lithium (Li), total	mg/L						0.0147		
Magnesium (Mg), total	mg/L						39.3		
Manganese (Mn), total	mg/L						2.50		
Mercury (Hg), total	mg/L						<0.000050		
Molybdenum (Mo), total	mg/L						0.00080		
Nickel (Ni), total	mg/L	0.5					0.0630		
Phosphorus (P), total	mg/L						<0.050		
Potassium (K), total	mg/L						1.34		
Selenium (Se), total	mg/L						<0.0010		
Silicon (Si), total	mg/L						5.22		
Silver (Ag), total	mg/L	0.1					<0.00010		
Sodium (Na), total	mg/L						2.13		
Strontium (Sr), total	mg/L						0.249		
Sulphur (S), total	mg/L						143		
Thallium (Tl), total	mg/L						0.00304		
Tin (Sn), total	mg/L						<0.0010		
Titanium (Ti), total	mg/L						<0.10		
Uranium (U), total	mg/L						0.00430		
Vanadium (V), total	mg/L						<0.010		
Zinc (Zn), total	mg/L	0.5					**0.830**		
Zirconium (Zr), total	mg/L						<0.0080		
Dissolved Metals									
Aluminum (Al), dissolved	mg/L			3.18	0.122	0.072	0.044	0.034	0.065
Antimony (Sb), dissolved	mg/L			0.0012	0.0084	0.0119	0.0166	0.0168	0.0139
Arsenic (As), dissolved	mg/L		0.5	0.0193	0.0136	0.0058	0.0051	0.0051	0.0070
Barium (Ba), dissolved	mg/L			0.00645	0.00645	0.00762	0.00910	0.00878	0.00807
Beryllium (Be), dissolved	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth (Bi), dissolved	mg/L			<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Boron (B), dissolved	mg/L			<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd), dissolved	mg/L		0.05	0.0419	0.0214	0.0225	0.0206	0.0174	0.0239
Calcium (Ca), dissolved	mg/L			238	200	179	163	166	175
Chromium (Cr), dissolved	mg/L			0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt (Co), dissolved	mg/L			0.0454	0.0178	0.0163	0.0161	0.0159	0.0185
Copper (Cu), dissolved	mg/L		0.3	**0.322**	0.0054	0.0120	0.0129	0.0113	0.0210
Iron (Fe), dissolved	mg/L			90.7	15.1	4.68	3.21	3.77	6.04
Lead (Pb), dissolved	mg/L		0.2	0.00441	0.00116	<0.00050	<0.00050	<0.00050	<0.00050
Lithium (Li), dissolved	mg/L			0.0392	0.0246	0.0195	0.0164	0.0174	0.0208
Magnesium (Mg), dissolved	mg/L			55.9	41.5	39.7	39.3	39.2	42.8
Manganese (Mn), dissolved	mg/L			7.57	3.01	2.64	2.73	2.44	2.83
Mercury (Hg), dissolved	mg/L			<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo), dissolved	mg/L			<0.00050	<0.00050	0.00053	0.00064	0.00073	0.00068
Nickel (Ni), dissolved	mg/L		0.5	0.182	0.0692	0.0629	0.0607	0.0585	0.0681
Phosphorus (P), dissolved	mg/L			<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium (K), dissolved	mg/L			1.46	1.45	1.36	1.34	1.32	1.33
Selenium (Se), dissolved	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silicon (Si), dissolved	mg/L			4.01	4.28	4.71	5.14	5.34	4.75
Silver (Ag), dissolved	mg/L		0.1	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Sodium (Na), dissolved	mg/L			2.70	2.37	2.23	2.12	2.11	2.28
Strontium (Sr), dissolved	mg/L			0.455	0.342	0.281	0.260	0.233	0.267
Sulphur (S), dissolved	mg/L			301	173	153	141	140	156
Thallium (Tl), dissolved	mg/L			0.00458	0.00175	0.00214	0.00292	0.00301	0.00297
Tin (Sn), dissolved	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Titanium (Ti), dissolved	mg/L			<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Uranium (U), dissolved	mg/L			0.00667	0.00473	0.00372	0.00357	0.00351	0.00392
Vanadium (V), dissolved	mg/L			<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Zinc (Zn), dissolved	mg/L		0.5	**1.76**	**0.683**	**0.764**	**0.924**	**0.871**	**0.951**
Zirconium (Zr), dissolved	mg/L			<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080

Values in Red exceed the EQS threshold

Analyte	Units	EQS Exceedance Values		Station ID					
				SKDW	SKDW	SKDW	SKDW	SKDW	SKDW
Description		Type B WUL QZ12-057 C&M EQS	Type B WUL QZ12-057 C&M EQS-DM	Silver King Dewatering Well	Silver King Dewatering Well	Silver King Dewatering Well	Silver King Dewatering Well	Silver King Dewatering Well	Silver King Dewatering Well
Sample Date	dd/mm/yyyy			23/10/2014	28/10/2014	04/11/2014	11/11/2014	04/12/2014	09/12/2014
Physical Tests									
Discharge (Flow)	L/s								
Total Suspended Solids	mg/L	25	25						
pH (field)	pH units	6.5-9.5	6.5-9.5			6.58	6.76	6.57	**6.36**
pH (lab)	pH units	6.5-9.5	6.5-9.5	7.18	7.38	7.29	7.19	7.44	7.30
Specific Conductance (field)	µS/cm					1099	1093	1130	1088
Specific Conductance (lab)	µS/cm			937	964	965	968	1080	1050
Temperature (field)	°C					1.8	2.0	2.5	1.9
Hardness (from total)	mg/L				574			636	658
Hardness (from dissolved)	mg/L			566	575	573	561	632	651
Anions and Nutrients									
Total Acidity	mg/L			23.3	15.2	18.0	17.3	19.9	13.7
Alkalinity, total	mg/L			142	142	137	137	124	125
Chloride	mg/L			<5.0	<5.0	<2.5	<5.0	<5.0	<5.0
Fluoride	mg/L			0.24	0.24	0.22	0.23	0.32	0.39
Sulphate, dissolved	mg/L			419	429	429	437	504	505
Ammonia (N)	mg/L			0.117	0.131	0.104	0.119	0.126	0.130
Nitrite (N)	mg/L			<0.010	<0.010	<0.0050	<0.010	<0.010	<0.010
Nitrate (N)	mg/L			<0.050	<0.050	<0.025	<0.050	<0.050	<0.050
Dissolved Organic Carbon	mg/L			1.16	0.97	1.03	1.00	0.85	0.80
Total Metals									
Aluminum (Al), total	mg/L				0.097			0.125	0.125
Antimony (Sb), total	mg/L				0.0208			0.0238	0.0222
Arsenic (As), total	mg/L	0.5			0.0156			0.0321	0.0327
Barium (Ba), total	mg/L				0.00957			0.00963	0.00883
Beryllium (Be), total	mg/L				<0.0010			<0.0010	<0.0010
Bismuth (Bi), total	mg/L				<0.0050			<0.0050	<0.0050
Boron (B), total	mg/L				<0.10			<0.10	<0.10
Cadmium (Cd), total	mg/L	0.05			0.0184			0.0210	0.0222
Calcium (Ca), total	mg/L				163			183	186
Chromium (Cr), total	mg/L				<0.0010			<0.0010	<0.0010
Cobalt (Co), total	mg/L				0.0161			0.0215	0.0228
Copper (Cu), total	mg/L	0.3			0.0252			0.0192	0.0204
Iron (Fe), total	mg/L				5.99			13.4	14.9
Lead (Pb), total	mg/L	0.2			0.00235			0.00968	0.00911
Lithium (Li), total	mg/L				0.0171			0.0198	0.0220
Magnesium (Mg), total	mg/L				40.6			43.8	47.0
Manganese (Mn), total	mg/L				2.32			3.03	3.15
Mercury (Hg), total	mg/L				<0.000050			<0.000050	<0.000050
Molybdenum (Mo), total	mg/L				0.00095			0.00100	0.00081
Nickel (Ni), total	mg/L	0.5			0.0622			0.0827	0.0858
Phosphorus (P), total	mg/L				<0.050			<0.050	<0.050
Potassium (K), total	mg/L				1.34			1.49	1.40
Selenium (Se), total	mg/L				<0.0010			<0.0010	<0.0010
Silicon (Si), total	mg/L				5.40			4.83	4.94
Silver (Ag), total	mg/L	0.1			<0.00010			<0.00010	<0.00010
Sodium (Na), total	mg/L				2.08			2.22	2.25
Strontium (Sr), total	mg/L				0.242			0.265	0.275
Sulphur (S), total	mg/L				144			163	169
Thallium (Tl), total	mg/L				0.00321			0.00354	0.00342
Tin (Sn), total	mg/L				<0.0010			<0.0010	<0.0010
Titanium (Ti), total	mg/L				<0.10			<0.10	<0.10
Uranium (U), total	mg/L				0.00374			0.00548	0.00483
Vanadium (V), total	mg/L				<0.010			<0.010	<0.010
Zinc (Zn), total	mg/L	0.5			**0.880**			**0.908**	**0.912**
Zirconium (Zr), total	mg/L				<0.0080			<0.0080	<0.0080
Dissolved Metals									
Aluminum (Al), dissolved	mg/L			0.031	0.033	0.031	0.028	0.035	0.040
Antimony (Sb), dissolved	mg/L			0.0191	0.0182	0.0176	0.0170	0.0173	0.0163
Arsenic (As), dissolved	mg/L		0.5	0.0030	0.0041	0.0043	0.0044	0.0141	0.0172
Barium (Ba), dissolved	mg/L			0.00906	0.00923	0.00961	0.00909	0.00913	0.00828
Beryllium (Be), dissolved	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth (Bi), dissolved	mg/L			<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Boron (B), dissolved	mg/L			<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd), dissolved	mg/L		0.05	0.0185	0.0178	0.0177	0.0170	0.0197	0.0214
Calcium (Ca), dissolved	mg/L			161	164	161	160	181	184
Chromium (Cr), dissolved	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt (Co), dissolved	mg/L			0.0154	0.0159	0.0163	0.0162	0.0212	0.0226
Copper (Cu), dissolved	mg/L		0.3	0.0119	0.0128	0.0127	0.0105	0.0043	0.0053
Iron (Fe), dissolved	mg/L			1.49	2.81	2.64	3.11	8.32	9.93
Lead (Pb), dissolved	mg/L		0.2	<0.00050	0.00114	<0.00050	<0.00050	<0.00050	0.00123
Lithium (Li), dissolved	mg/L			0.0176	0.0169	0.0170	0.0167	0.0193	0.0209
Magnesium (Mg), dissolved	mg/L			40.1	40.4	41.6	39.2	43.6	46.4
Manganese (Mn), dissolved	mg/L			2.39	2.32	2.41	2.44	3.02	3.21
Mercury (Hg), dissolved	mg/L			<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo), dissolved	mg/L			0.00070	0.00076	0.00076	0.00071	0.00080	0.00060
Nickel (Ni), dissolved	mg/L		0.5	0.0605	0.0604	0.0618	0.0603	0.0809	0.0853
Phosphorus (P), dissolved	mg/L			<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium (K), dissolved	mg/L			1.41	1.33	1.28	1.32	1.40	1.34
Selenium (Se), dissolved	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silicon (Si), dissolved	mg/L			5.20	5.29	5.11	5.28	4.64	4.65
Silver (Ag), dissolved	mg/L		0.1	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Sodium (Na), dissolved	mg/L			2.11	2.09	2.05	2.06	2.18	2.21
Strontium (Sr), dissolved	mg/L			0.237	0.232	0.227	0.227	0.264	0.266
Sulphur (S), dissolved	mg/L			138	143	143	139	159	166
Thallium (Tl), dissolved	mg/L			0.00319	0.00323	0.00339	0.00337	0.00341	0.00331
Tin (Sn), dissolved	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Titanium (Ti), dissolved	mg/L			<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Uranium (U), dissolved	mg/L			0.00333	0.00339	0.00336	0.00297	0.00504	0.00423
Vanadium (V), dissolved	mg/L			<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Zinc (Zn), dissolved	mg/L		0.5	**0.897**	**0.897**	**0.868**	**0.843**	**0.888**	**0.972**
Zirconium (Zr), dissolved	mg/L			<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080

Values in Red exceed the EQS threshold

Analyte	Units	EQS Exceedance Values		Station ID					
				SKDW	SKDW	SKDW	SKDW	SKDW	SKDW
Description		Type B WUL QZ12-057 C&M EQS	Type B WUL QZ12-057 C&M EQS-DM	Silver King Dewatering Well	Silver King Dewatering Well	Silver King Dewatering Well	Silver King Dewatering Well	Silver King Dewatering Well	Silver King Dewatering Well
Sample Date	dd/mm/yyyy			22/12/2014	02/01/2015	06/01/2015	14/01/2015	20/01/2015	29/01/2015
Physical Tests									
Discharge (Flow)	L/s								
Total Suspended Solids	mg/L	25	25						
pH (field)	pH units	6.5-9.5	6.5-9.5	6.63	6.58	6.51	**6.47**	**6.27**	**6.49**
pH (lab)	pH units	6.5-9.5	6.5-9.5	6.98	7.04	7.29	6.95	7.03	7.12
Specific Conductance (field)	µS/cm			1254	1224	1274	1267	1218	1331
Specific Conductance (lab)	µS/cm			1060	1080	1100	1100	1070	1120
Temperature (field)	°C			2.5	2	2.1	2.6	3	2
Hardness (from total)	mg/L			645	653	698	657	678	607
Hardness (from dissolved)	mg/L			666	662	684	654	675	631
Anions and Nutrients									
Total Acidity	mg/L			21.7	28.8	15.3	27.4	28.3	26.5
Alkalinity, total	mg/L			132	139	146	152	155	147
Chloride	mg/L			<5.0	4.89	3.76	4.77	5.98	6.43
Fluoride	mg/L			0.41	0.52	0.440	<0.50	<0.70	<0.80
Sulphate, dissolved	mg/L			540	522	504	513	500	483
Ammonia (N)	mg/L			0.139	0.146	0.146	0.198	0.230	0.243
Nitrite (N)	mg/L			<0.010	<0.010	0.0156	0.0153	0.0135	0.0150
Nitrate (N)	mg/L			<0.050	0.114	0.102	0.081	0.152	0.176
Dissolved Organic Carbon	mg/L			0.97	65.6	69.0	104	157	203
Total Metals									
Aluminum (Al), total	mg/L			0.122	0.125	0.140	0.148	0.155	0.178
Antimony (Sb), total	mg/L			0.0218	0.0227	0.0228	0.0222	0.0259	0.0243
Arsenic (As), total	mg/L	0.5		0.0416	0.0473	0.0487	0.0561	0.0672	0.0787
Barium (Ba), total	mg/L			0.00896	0.0102	0.00999	0.0102	0.0118	0.0114
Beryllium (Be), total	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth (Bi), total	mg/L			<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Boron (B), total	mg/L			<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd), total	mg/L	0.05		0.0188	0.0179	0.0182	0.0162	0.0146	0.0124
Calcium (Ca), total	mg/L			184	186	196	188	192	174
Chromium (Cr), total	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt (Co), total	mg/L			0.0227	0.0230	0.0237	0.0228	0.0233	0.0220
Copper (Cu), total	mg/L	0.3		0.0158	0.0445	0.0503	0.0562	0.0457	0.0415
Iron (Fe), total	mg/L			16.1	15.8	16.9	17.5	19.0	23.1
Lead (Pb), total	mg/L	0.2		0.0123	0.0110	0.0126	0.0102	0.00988	0.0121
Lithium (Li), total	mg/L			0.0225	0.0193	0.0226	0.0205	0.0233	0.0179
Magnesium (Mg), total	mg/L			44.7	46.1	50.8	45.3	47.9	42.1
Manganese (Mn), total	mg/L			3.35	3.33	3.35	3.33	3.44	3.06
Mercury (Hg), total	mg/L			<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo), total	mg/L			0.00090	0.00103	0.00099	0.00106	0.00123	0.00119
Nickel (Ni), total	mg/L	0.5		0.0853	0.0867	0.0880	0.0851	0.0836	0.0796
Phosphorus (P), total	mg/L			<0.050	<0.050	<0.050	<0.050	0.055	0.080
Potassium (K), total	mg/L			1.34	7.41	9.11	11.3	17.5	22.5
Selenium (Se), total	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silicon (Si), total	mg/L			4.47	4.71	4.58	4.51	4.72	4.45
Silver (Ag), total	mg/L	0.1		<0.00010	<0.00010	0.00011	<0.00010	0.00023	0.00033
Sodium (Na), total	mg/L			2.29	4.48	4.85	6.25	7.79	8.47
Strontium (Sr), total	mg/L			0.280	0.287	0.311	0.312	0.303	0.276
Sulphur (S), total	mg/L			173	173	181	171	173	157
Thallium (Tl), total	mg/L			0.00303	0.00305	0.00312	0.00302	0.00300	0.00254
Tin (Sn), total	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Titanium (Ti), total	mg/L			<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Uranium (U), total	mg/L			0.00616	0.00673	0.00667	0.00688	0.00724	0.00693
Vanadium (V), total	mg/L			<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Zinc (Zn), total	mg/L	0.5		**0.886**	**0.841**	**0.861**	**0.798**	**0.783**	**0.732**
Zirconium (Zr), total	mg/L			<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Dissolved Metals									
Aluminum (Al), dissolved	mg/L			0.045	0.046	0.052	0.058	0.087	0.101
Antimony (Sb), dissolved	mg/L			0.0160	0.0168	0.0160	0.0178	0.0204	0.0202
Arsenic (As), dissolved	mg/L		0.5	0.0233	0.0202	0.0257	0.0342	0.0466	0.0573
Barium (Ba), dissolved	mg/L			0.00868	0.00975	0.00957	0.00991	0.0114	0.0122
Beryllium (Be), dissolved	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth (Bi), dissolved	mg/L			<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Beryllium (Be), dissolved	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth (Bi), dissolved	mg/L			<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Boron (B), dissolved	mg/L			<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd), dissolved	mg/L		0.05	0.0178	0.0167	0.0171	0.0150	0.0138	0.0124
Calcium (Ca), dissolved	mg/L			190	190	189	188	194	178
Chromium (Cr), dissolved	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt (Co), dissolved	mg/L			0.0227	0.0224	0.0237	0.0219	0.0229	0.0227
Copper (Cu), dissolved	mg/L		0.3	0.0039	0.0349	0.0397	0.0459	0.0396	0.0328
Iron (Fe), dissolved	mg/L			12.8	10.9	12.0	13.9	15.5	19.3
Lead (Pb), dissolved	mg/L		0.2	<0.00050	<0.00050	<0.00050	0.00066	0.00354	0.00501
Lithium (Li), dissolved	mg/L			0.0218	0.0204	0.0223	0.0260	0.0226	0.0197
Magnesium (Mg), dissolved	mg/L			46.4	45.5	51.2	44.7	46.4	45.2
Manganese (Mn), dissolved	mg/L			3.45	3.30	3.41	3.40	3.36	3.21
Mercury (Hg), dissolved	mg/L			<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo), dissolved	mg/L			0.00074	0.00088	0.00080	0.00098	0.00107	0.00109
Nickel (Ni), dissolved	mg/L		0.5	0.0860	0.0845	0.0883	0.0834	0.0815	0.0813
Phosphorus (P), dissolved	mg/L			<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium (K), dissolved	mg/L			1.35	7.38	8.35	11.1	17.9	22.7
Selenium (Se), dissolved	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silicon (Si), dissolved	mg/L			4.46	4.61	4.33	4.34	4.50	4.51
Silver (Ag), dissolved	mg/L		0.1	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Sodium (Na), dissolved	mg/L			2.22	4.38	4.84	6.04	7.75	9.04
Strontium (Sr), dissolved	mg/L			0.281	0.292	0.303	0.327	0.295	0.289
Sulphur (S), dissolved	mg/L			173	168	174	165	160	160
Thallium (Tl), dissolved	mg/L			0.00294	0.00308	0.00300	0.00300	0.00283	0.00263
Tin (Sn), dissolved	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Titanium (Ti), dissolved	mg/L			<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Uranium (U), dissolved	mg/L			0.00547	0.00647	0.00600	0.00656	0.00652	0.00704
Vanadium (V), dissolved	mg/L			<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Zinc (Zn), dissolved	mg/L		0.5	**0.885**	**0.822**	**0.860**	**0.770**	**0.780**	**0.757**
Zirconium (Zr), dissolved	mg/L			<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080

Values in Red exceed the EQS threshold

Analyte	Units	EQS Exceedance Values		Station ID				
				SKDW	SKDW	SKDW	SKDW	SKDW
Description		Type B WUL QZ12-057 C&M EQS	Type B WUL QZ12-057 C&M EQS-DM	Silver King Dewatering Well	Silver King Dewatering Well	Silver King Dewatering Well	Silver King Dewatering Well	Silver King Dewatering Well
Sample Date	dd/mm/yyyy			03/02/2015	15/02/2015	18/02/2015	24/02/2015	03/03/2015
Physical Tests								
Discharge (Flow)	L/s							
Total Suspended Solids	mg/L	25	25					
pH (field)	pH units	6.5-9.5	6.5-9.5	**6.32**	**6.16**	**6.24**	6.59	**6.36**
pH (lab)	pH units	6.5-9.5	6.5-9.5	7.07	7.12	6.66	6.68	6.65
Specific Conductance (field)	µS/cm			1306	1156	1246	1337	1255
Specific Conductance (lab)	µS/cm			1130	1100	1090	1080	1090
Temperature (field)	°C			2.2	2.5	3.5	3	2.3
Hardness (from total)	mg/L			656	650	627	617	683
Hardness (from dissolved)	mg/L			671	636	650	624	693
Anions and Nutrients								
Total Acidity	mg/L			27.5	42.8	70.3	72.9	72.0
Alkalinity, total	mg/L			164	165	162	147	165
Chloride	mg/L			5.12	2.83	3.20	2.74	2.0
Fluoride	mg/L			<0.80	<0.60	<0.80	<0.60	<0.50
Sulphate, dissolved	mg/L			493	488	486	489	508
Ammonia (N)	mg/L			0.195	0.0601	0.0543	0.0537	0.0707
Nitrite (N)	mg/L			0.0147	0.0038	0.0033	<0.0020	<0.0020
Nitrate (N)	mg/L			0.159	0.011	<0.010	<0.010	<0.010
Dissolved Organic Carbon	mg/L			193	42.4	33.6	22.0	19.0
Total Metals								
Aluminum (Al), total	mg/L			0.219	0.194	0.189	0.175	0.149
Antimony (Sb), total	mg/L			0.0272	0.0184	0.0165	0.0157	0.0139
Arsenic (As), total	mg/L	0.5		0.0960	0.0701	0.0635	0.0641	0.0774
Barium (Ba), total	mg/L			0.0129	0.0105	0.00977	0.00990	0.00939
Beryllium (Be), total	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth (Bi), total	mg/L			<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Boron (B), total	mg/L			<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd), total	mg/L	0.05		0.0120	0.00605	0.00479	0.00418	0.00321
Calcium (Ca), total	mg/L			186	185	179	176	195
Chromium (Cr), total	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt (Co), total	mg/L			0.0238	0.0210	0.0206	0.0215	0.0218
Copper (Cu), total	mg/L	0.3		0.0334	0.0191	0.0194	0.0142	<0.0050
Iron (Fe), total	mg/L			29.6	26.6	24.9	23.7	24.6
Lead (Pb), total	mg/L	0.2		0.0166	0.0118	0.00922	0.00794	0.00897
Lithium (Li), total	mg/L			0.0242	0.0267	0.0249	0.0256	0.0250
Magnesium (Mg), total	mg/L			46.5	45.8	43.4	43.5	47.4
Manganese (Mn), total	mg/L			3.46	3.26	3.23	3.40	3.48
Mercury (Hg), total	mg/L			<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo), total	mg/L			0.00124	0.00104	0.00104	0.00107	0.00111
Nickel (Ni), total	mg/L	0.5		0.0825	0.0715	0.0684	0.0709	0.0709
Phosphorus (P), total	mg/L			0.075	<0.050	<0.050	<0.050	<0.050
Potassium (K), total	mg/L			22.6	6.54	5.14	3.88	3.60
Selenium (Se), total	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silicon (Si), total	mg/L			4.75	4.20	4.03	4.08	4.18
Silver (Ag), total	mg/L	0.1		0.00042	<0.00010	<0.00010	<0.00010	<0.00010
Sodium (Na), total	mg/L			9.68	4.57	3.84	3.62	3.73
Strontium (Sr), total	mg/L			0.308	0.296	0.304	0.306	0.321
Sulphur (S), total	mg/L			173	169	163	160	180
Thallium (Tl), total	mg/L			0.00257	0.00188	0.00175	0.00167	0.00137
Tin (Sn), total	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Titanium (Ti), total	mg/L			<0.10	<0.10	<0.10	<0.10	<0.10
Uranium (U), total	mg/L			0.00846	0.00784	0.00765	0.00759	0.00856
Vanadium (V), total	mg/L			<0.010	<0.010	<0.010	<0.010	<0.010
Zinc (Zn), total	mg/L	0.5		**0.766**	**0.557**	**0.517**	**0.541**	**0.505**
Zirconium (Zr), total	mg/L			<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Dissolved Metals								
Aluminum (Al), dissolved	mg/L			0.134	0.082	0.077	0.073	0.089
Antimony (Sb), dissolved	mg/L			0.0211	0.0115	0.0109	0.0110	0.0092
Arsenic (As), dissolved	mg/L		0.5	0.0733	0.0454	0.0470	0.0499	0.0632
Barium (Ba), dissolved	mg/L			0.0125	0.00987	0.00961	0.00963	0.00911
Beryllium (Be), dissolved	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth (Bi), dissolved	mg/L			<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Boron (B), dissolved	mg/L			<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd), dissolved	mg/L		0.05	0.0111	0.00214	0.00138	0.00104	0.00072
Calcium (Ca), dissolved	mg/L			192	178	185	181	200
Chromium (Cr), dissolved	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt (Co), dissolved	mg/L			0.0236	0.0207	0.0209	0.0211	0.0219
Copper (Cu), dissolved	mg/L		0.3	0.0219	0.0032	0.0022	<0.0020	<0.0020
Iron (Fe), dissolved	mg/L			26.0	21.9	22.9	22.0	22.3
Lead (Pb), dissolved	mg/L		0.2	0.00812	<0.00050	<0.00050	<0.00050	<0.00050
Lithium (Li), dissolved	mg/L			0.0235	0.0268	0.0261	0.0257	0.0262
Magnesium (Mg), dissolved	mg/L			46.8	46.8	45.7	42.0	47.3
Manganese (Mn), dissolved	mg/L			3.39	3.20	3.31	3.39	3.52
Mercury (Hg), dissolved	mg/L			<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum (Mo), dissolved	mg/L			0.00106	0.00088	0.00093	0.00095	0.00106
Nickel (Ni), dissolved	mg/L		0.5	0.0810	0.0698	0.0700	0.0702	0.0708
Phosphorus (P), dissolved	mg/L			<0.050	<0.050	<0.050	<0.050	<0.050
Potassium (K), dissolved	mg/L			22.8	6.57	5.30	3.90	3.55
Selenium (Se), dissolved	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silicon (Si), dissolved	mg/L			4.62	4.01	4.08	4.05	4.12
Silver (Ag), dissolved	mg/L		0.1	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Sodium (Na), dissolved	mg/L			9.62	4.61	3.93	3.63	3.59
Strontium (Sr), dissolved	mg/L			0.296	0.293	0.299	0.296	0.322
Sulphur (S), dissolved	mg/L			165	163	164	152	174
Thallium (Tl), dissolved	mg/L			0.00241	0.00152	0.00141	0.00137	0.00121
Tin (Sn), dissolved	mg/L			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Titanium (Ti), dissolved	mg/L			<0.10	<0.10	<0.10	<0.10	<0.10
Uranium (U), dissolved	mg/L			0.00779	0.00724	0.00726	0.00754	0.00868
Vanadium (V), dissolved	mg/L			<0.010	<0.010	<0.010	<0.010	<0.010
Zinc (Zn), dissolved	mg/L		0.5	**0.755**	**0.525**	0.493	**0.512**	**0.502**
Zirconium (Zr), dissolved	mg/L			<0.0080	<0.0080	<0.0080	<0.0080	<0.0080

Values in Red exceed the EQS threshold

Appendix 4 Galkeno 900 Bioreactor Performance



GALKENO 900 SULPHATE-REDUCING BIOREACTOR 2008-2011 OPERAITONS

FINAL REPORT

March 2012

Prepared for:

ELSA RECLAMATION AND DEVELOPMENT CORP.

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APPENDIX A SUMMARY REPORT ON OPTICAL AND ELECTRON MICROPROBE ANALYSIS OF GALKENO 900 BIOREACTOR AT KENO HILLS

1 EXECUTIVE SUMMARY

Alexco Environmental Group has operated a test bioreactor at the Galkeno 900 mine site since October 2008. Bioreactor technology is considered a closure option for some adit drainage sites in the Keno Hill Silver District (KHSD) and this closure pilot study has been performed to validate the effectiveness of this treatment technology with special consideration of engineering a stable bioreactor for the KHSD climate. In general, once sulphate reduction onset occurred after a commissioning period, effective treatment (significant mass reduction averaging over 90% during operational periods, and achieving discharge criteria at lower flow rates) was accomplished with a test flow rate range of 0.5-1.0 litres per second (lps). The configuration of the bioreactor was suboptimal due to the very limited footprint available near the Galkeno 900 adit, and the regulatory requirement to operate the bioreactor upstream of the lime treatment system. However, the key objectives of the study were accomplished; specifically sulphate reducing rates were determined across year-round operation, and it was demonstrated that the sulphate bioreactor technology could achieve under some operational flow rates discharge water quality standards as set under the existing water licence QZ06-074. The primary failure mode of the bioreactor was failure of the pumping systems due to power outages, which happened several times during the study, which led to freezing of the antisiphon valves and loss of water by siphoning from the bioreactor.

During the operational treatment phase at 0.5 lps, results showed removal of close to 99.8% zinc was achieved (5-6 mg/L reduced to 0.011 mg/L). During the operational treatment phase at 1.0 lps a maximum of 97.8% removal was occasionally achieved. Section 6, Bioreactor Performance, provides additional information concerning other metals that have also been substantially removed in the bioreactor at flow rates between 0.5 lps and 1.0 lps respectively. While zinc is the primary Constituent Of Concern (COC), the reduction of these other constituents will have beneficial effects in the reduction of toxicity where elevated metals have a combined toxicity more than any one metal alone. Iron and manganese, which had good removal during the recirculation phase (99% for both metals) showed a dissolution and production from the bioreactor during the reduction onset and initial through flow phases. Manganese currently passes through the reactor unchanged, while iron is still slowly releasing from the reactor. Conservative elements show less than 10% change during passage through the bioreactor, including calcium, magnesium, silica, sodium and strontium, demonstrating that dilution is not a significant factor causing metal removal in the reactor.

Mineralogical analysis was performed on materials removed from the bioreactor to identify minerals and mineral phases that had been formed in the bioreactor. The purpose of this work was to strengthen the conclusions about the ultimate fate of metals removed in the bioreactor, and to determine if the inferences about removal mechanisms are confirmed when examining the solid phases formed. The results showed that micron sized grains of ZnS were precipitated with a molar ratio of 1:1 indicating bacteriological sphalerite (ZnS) was being formed. The sphalerite formed bands which were indicative of biofilm deposition in successive layers. Some of the ZnS layers were immediately adjacent to or surrounding layers of Fe and Mn oxide or hydroxide, which is consistent with the operational phases of the bioreactor which initially had zinc removal coinciding with manganese and iron removal. When the bioreactor became anaerobic the Mn and later Fe was partially mobilized but the Zn which was removed with Mn and Fe became bacterially sequestered as ZnS. These results show that Zn removal in carbon source-fed bioreactors is predominantly performed by microbial sulfate reduction, producing predominantly a biofilm-enclosed ZnS phase.

2 BACKGROUND

A bioreactor was constructed and operated in the Keno Hill Silver District (KHSD) at the Galkeno 900 adit beginning in May 2008. The bioreactor ceased operations in late Spring 2011.. These results demonstrate the viability of sulphate reduction technology for the removal of metals, especially zinc and other metals that react with aqueous sulphide, in the KHSD.

The bioreactor solid phase substrate utilized to construct the bioreactor was coarse rock from a nearby placer mining operation. Solid organic carbon forms were not utilized to allow for the simplest assessment of metals removal due to sulphate reduction only. The organic substrate supplied to the bioreactor included dissolved organic carbon forms, with sugars, alcohols and complex carbohydrates and proteins from milk used during the growth phase of the bioreactor operation, and sugars and alcohols used during the maintenance phase. The purpose of the organic substrate was initially to support microbial growth until sulphate reduction became the predominant microbial activity in the reactor, and during the treatment phase to support microbial sulphate reduction. Sulphate reduction is a chemical transformation performed by microbes that transfers electrons from organic carbon to sulphate, causing sulphate to be reduced to sulphide. Sulphide then reacts with many dissolved metals, forming very insoluble metal precipitates. The reactor also had the potential for other reactions to occur as a result of alkalinity being generated from the oxidation of organic carbon, and such as carbonate mineral formation within the bioreactor.

The bioreactor demonstration is part of a multipurpose program to assess the potential of adding an organic substrate to mine adit water to support metals removal, whether within a constructed bioreactor, within a mine pool, or in a naturally permeable zone outside a mine such as in a naturally occurring bog or gravel bed. Conceptually, the sulphide- and carbonate-based mineral precipitation that occurs in a bioreactor is similar to what would occur in a mine pool or natural sulphate reduction zone outside of a mine pool. The sulfate reduction rate observed in the bioreactor is similar to what would be achieved in these other settings.

Alexco has extensive experience with these types of in situ sulphate reduction systems, and owns six patents and has additional patents allowed and pending for the in-situ use of organic substrates and nutrients in earthen materials to stabilize metals. Alexco's technologies and patents provide in-situ encapsulation technologies, whereby soluble toxic metals including arsenic, cadmium, nickel, selenium, and zinc are geochemically encapsulated by more benign minerals within the groundwater aquifer or within and downgradient of sources of contamination such as within a pit lake, tailings impoundment, heap leach pad, or waste storage area. One patent that is applicable to this treatment approach is US patent #5,710,361, which describes amendment of metals-containing water with a carbon source to cause precipitation of metals during flow through rock or earthen materials via sulphate reduction.

Several adit discharge locations are being considered in the Closure Option assessment process for treatment in a bioreactor (Alexco Environmental Group, 2011). At this time, Silver King 100, Bermingham 200, Ruby 400, No Cash 500, Galkeno 900, Onek 400, Sadie Ladue 600 and Keno 700 are all considered as possible locations where bioreactor technology could be employed. Galkeno 900 has water chemistry and flow characteristics that are typical of these other adits in the KHSD. This test was of sufficient scale and operated long enough to provide design information that allows for the design of either a large scale bioreactor or an in-situ reduction field at several other adit drainage locations in the KHSD. The test was operated in a lined bioreactor allowing for the performance of the technology to be assessed while still in containment, but the

results of the tests (reaction rates and stoichiometry) can be extended in the design of either a lined or an unlined system. The operation of the reactor continued through the winter season to demonstrate durability of metals removal mechanisms. During the course of the bioreactor demonstration, the conventional lime treatment system was maintained to ensure water license discharge compliance criteria were met.

3 GALKENO 900 TREATMENT LAYOUT

Figure 1 shows the piping and instrumentation setup of the bioreactor and treatment facility at Galkeno 900.

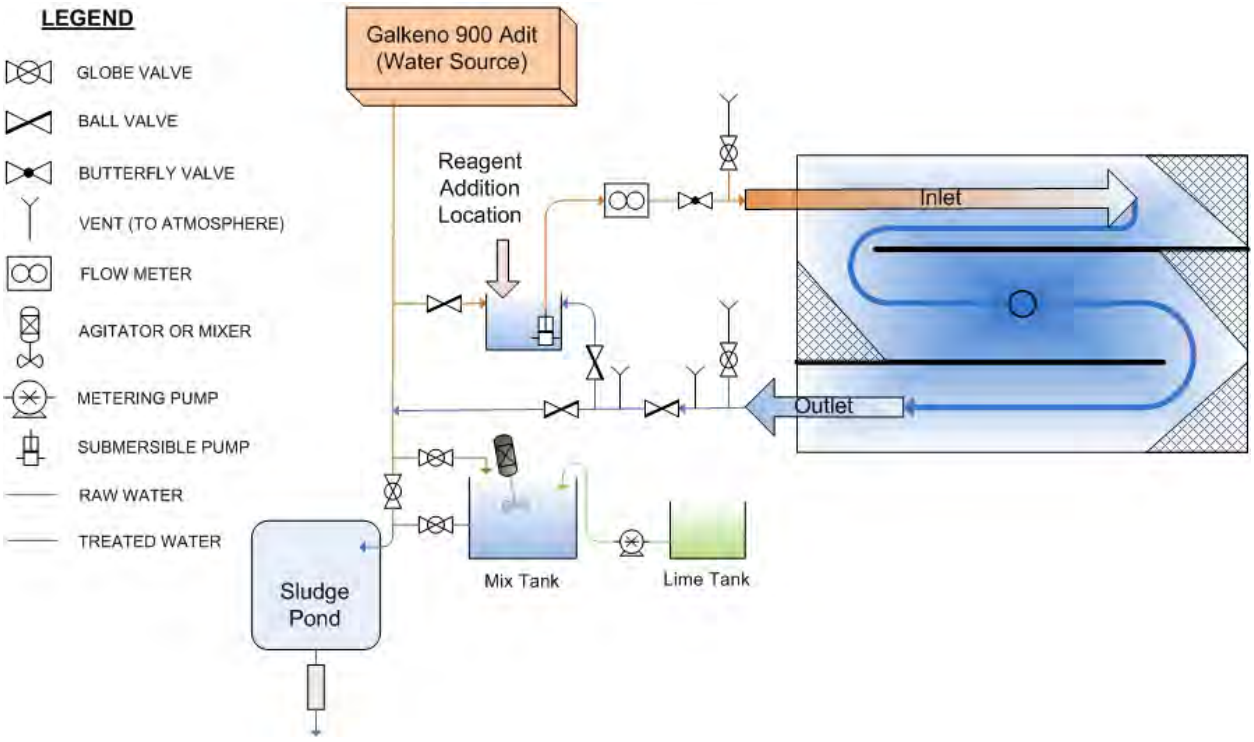


Figure 1 - Galkeno 900 Layout

Water drains from the Galkeno 900 adit at an average annual rate of 4 lps. This water is collected in a pipe and gravity flows away from the adit. Before the bioreactor system was installed, the water traveled directly to the treatment facility where it was mechanically agitated in a mix tank and dosed with lime slurry through a metering pump. Then the water was discharged to a sludge pond where the heavier particles where allowed to settle at the bottom in the form of sludge, and clean water was decanted and released. When the bioreactor treatment system was installed, additional valves and piping were added upstream of the lime treatment system so that a portion of the untreated adit water could pass through the bioreactor system for the purposes of this study.



Figure 2 - Inlet Valve

Water is supplied to the bioreactor through an initial valve that when opened allows water to travel to the bioreactor's influent sump. Because of the harsh conditions in the Yukon, this valve, and all piping used in this setup was buried over 1 meter below surface, thereby reducing the possibility of freezing. Figure 2 shows the buried vertical pipe that contains this initial valve. In this figure, water travels downward from

the adit to the lime treatment area. Opening this valve allows water to flow into the bioreactor's inlet sump.

The bioreactor inlet sump, shown in Figure 3, has a 48 inch diameter and is also located below surface. It is accessed through a cover that allows for reagent addition and water sampling as needed. Normal operation of the bioreactor requires the frequent dosing (constant dosing up to as infrequently as every two weeks, depending on flow rates) of a carbon source such as sugar, ethanol, or methanol. These reagents are slowly added to this sump via a metering pump for the liquids, or as dry powder for the sugar. During initial start-up, and on a few other occasions, an addition of milk sugars/protein as dry milk powder was required to aid the growth of microbes in the bioreactor. These reagents were also added at this location.



Figure 3 - Bioreactor Influent Sump

Within in the bioreactor inlet sump is a 1-horsepower submersible pump. The cable seen in Figure 3, stretching from lower left to upper right, attaches to a chain allowing the pump to be removed from the mix tank for servicing and/or replacement. The discharge from this pump is shown in Figure 4.



Figure 4 - Bioreactor Inlet

From the bottom of Figure 4 moving toward the top is a blue datalogger attached to the black Magnetic Flowmeter (Magmeter), a throttling globe valve, and finally a vertical anti-siphon standpipe. The datalogger records and stores the flow rates from the magmeter, allowing the system's operation rate to be tracked and analyzed. The globe valve is used to adjust the flow rate into the bioreactor. The vertical anti-siphon standpipe is exposed to the atmosphere. The system is designed so that in the event of pump failure, air will be pulled into the pipe and breaks the siphon. This series of instruments and valves is also located below grade in an insulated box and can be accessed through a cover.

The bioreactor is roughly 90 feet by 100 feet and has a liquid-filled portion that is 10 feet deep. It was dug partially into the native ground with an excavator, and the remaining depth was created by forming a berm around the excavated area. The bermed/excavated area was lined with 0.060 inch thick HDPE liner to form a pond, and then filled with waste rock recovered from a local placer mine. Figures 5 and 6 were taken during construction

of the bioreactor and Figure 7 shows the overall design.

After the pond was filled with placer oversize rock, a geofabric was laid across the bioreactor, and soil from the excavated area and hillside was used to provide a 4 foot soil cover over the bioreactor. This soil cover layer acted as an insulating layer, minimizing the amount of ice formation in the top layer of the bioreactor. When the bioreactor solids were sampled in March 2011, the ice layer was approximately 18 inches to 2 feet thick.

Water enters the bioreactor through an inlet pipe that transports water to the far side of the bioreactor (see Figure 7 for an overall view of the layout). The last half of the pipe is perforated with ¾" holes, allowing water to fill the bioreactor and flow back and forth before final release.



Figure 5 - Bioreactor Construction



Figure 6 - Bioreactor Standpipe

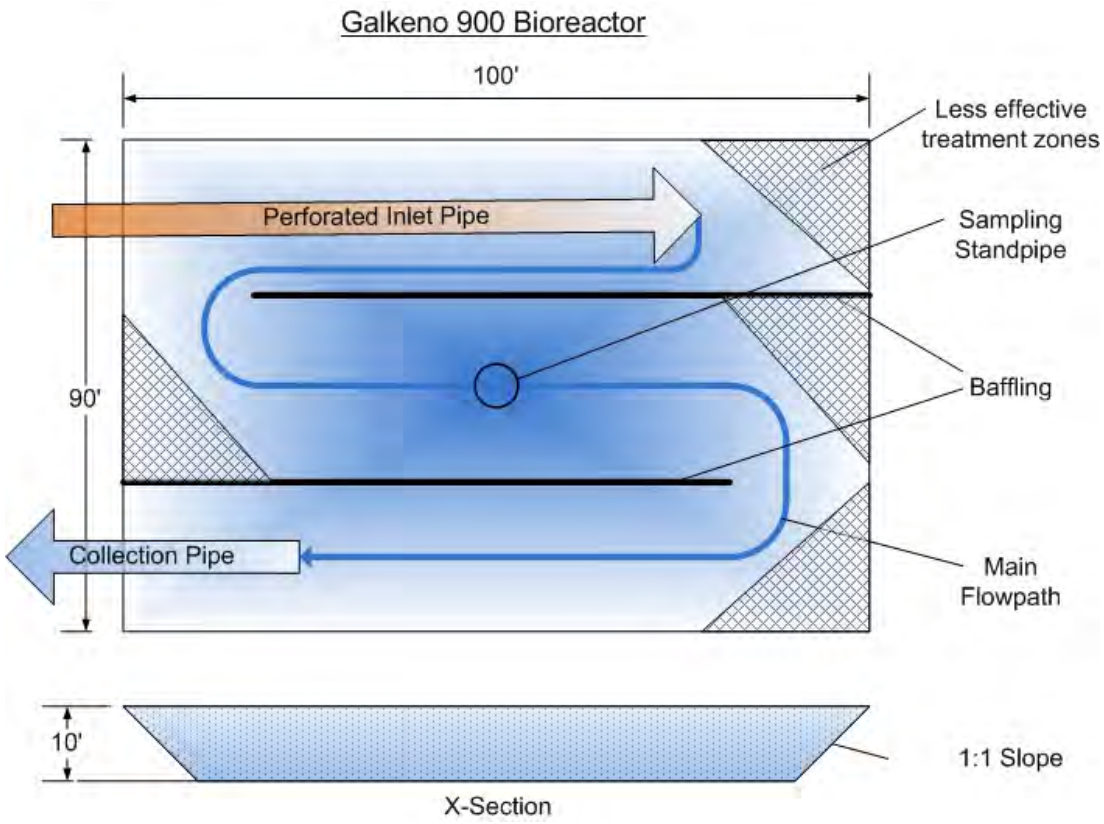


Figure 7 - Bioreactor Layout

Baffling was installed in two locations to create a torturous flow path and increase the contact time of the water with the media within the bioreactor,. This forces the water to travel a greater distance within the bioreactor before final release and to contact a greater fraction of the media. Also present at the center of the bioreactor is a sampling standpipe that can be seen in Figure 6. This allows samples to be collected and analyzed once water has passed midway through the bioreactor.

The discharge from the bioreactor is collected in a pipe and can then be either sent back to the bioreactor influent sump for recirculation or mixed with untreated adit water from the Galkeno 900 adit. This co-mingled water then passes through the lime treatment system mentioned earlier and is released into a sludge pond where heavy particulate settles and clean water is decanted and released. Figure 8 is the bioreactor discharge valve set-up. Water travels from the bioreactor on the right (not shown) and can either be sent up (as shown in the photo) to the bioreactor influent sump or to the left (as shown in the photo) to be co-mingled with adit water from the Galkeno adit. This setup is below surface grade and is accessible through a cover.



Figure 8 - Bioreactor Discharge Valves

Overall, the system was constructed to provide the operator with the maximum amount of flexibility to study the performance of a bioreactor without introducing the risk of releasing untreated water from the adit. Based on the positions of several valves, the system could be run in one of the following operation modes:

1) Bioreactor influent valve closed – collected adit water bypasses the bioreactor and is treated at the lime treatment facility.

2) Bioreactor influent valve and discharge valve closed – water pumped from the bioreactor influent sump fills the bioreactor and once filled, this mode allowed the water in the bioreactor to be continuously re-circulated. This was important to allow for the initial growth phase of the bioreactor, allowing the carbon source to be consumed in the bioreactor rather than being released from the discharge.

3) Bioreactor influent valve open and discharge valve open – untreated adit water was pumped into the bioreactor, sampled along several key locations, then discharged from the bioreactor and co-mingled with the untreated adit water where it was transferred to the lime treatment facility.

The water from the adit was a significant heat source for the bioreactor; therefore some amount of influent water from the adit was desired even during the initial growth phase of the bioreactor. In a full scale installation without the requirement of the downstream secondary treatment plant, these valving systems would not be required other than to provide a bypass from the adit if desired, and a temporary recirculation loop to allow discharged water to be sent back to the influent sump.

4 BIOREACTOR OPERATIONAL SUMMARY

Operational notes are included in this report to capture a few of the issues experienced during construction and operation of the bioreactor. The bioreactor construction began in the summer of 2008 with operation starting soon after. The following timeline outlines milestones, as well as issues, that were noted during operation:

- July-August 2008: Pond constructed and lined (see Figures 5 & 6).
- September 2008: Pond filled with oversize rock from a local placer mining operation (some small amounts of fines were present).
- October 4th, 2008: Start filling the bioreactor with untreated adit water.
- October 10th & 11th, 2008: Started recirculation of bioreactor water, added 182 kg sucrose to support microbial sulfate reduction.
- October 16th, 2008: 110 gal methanol and 1.8 kg dried milk solids added.
- October 2008: Bioreactor covered with geofabric and several feet of topsoil.
- October 2008 through May 2009: Occasional "top up" of untreated mine water to maintain full conditions in bioreactor. Make-up water averages ~ 1 m3/day or approximately 1 liter per minute average.
- January 23rd, 2009: 110 gal methanol added.
- January 2009: Determination of slow leakage rate from bioreactor ~ 1.09 m3/day.
- February 19th, 2009: Anti-siphon valve on the return recirculation line iced over, draining the bioreactor and flooding covers/box. Estimated ~135 m3 water was lost from the bioreactor through overflow of the tank.
- April 8th, 2009: Bioreactor standpipe blocked with ice – unable to sample.
- May 17th, 2009: Began adding methanol at the bioreactor influent sump at a rate of 1.0 litre per day.
- July 11th & 12th, 2009: Added 10 kg sucrose each day to jumpstart reduction, continued methanol addition at 1.0 litre per day.
- August 25th, 2009: Installed totalizer and flowmeter on the inlet to the bioreactor.

Once methanol was added at a constant rate, the bioreactor began through-flow operation. During that time, the following events occurred:

- October 8th, 2009: Initiated flow-through at a rate of 0.5 litre per second.
- December 18th, 2009: Initiated flow-through at a rate of 1.0 litre per second.
- January 7th-20th, 2010: Valve box flooded and frozen, thawed and repaired on January 20.
- February 15th, 2010: Power loss to submersible and metering pump.

- February 16th - 18th, 2010: Power loss while anti-siphon frozen which resulted in the loss of approximately half the bioreactor water volume through the sump; power restoration and line thawed; refilled bioreactor.
- August 6th, 2010: Reduced flow rate to 0.75 l/s to improve treatment.
- March 17th &18th, 2011: Return line frozen.
- May 11, 2011: cessation of active operations; bioreactor sampled for solids mineralogical analysis.

A review of the operator's log provides some important details that will guide future design. On February 19th 2009 and February 16th 2010, loss of power and a lack of continued pumping of water, which maintained heat in the bioreactor lines, resulted in ice formation in the anti-siphon valve. With the transfer pump stopped, the bioreactor siphoned water into the sump, which overflowed on the ground around the sump.

5 METALS REMOVAL MECHANISMS IN BIOREACTOR TREATMENT

The removal of metals from mine waters by bioreactors is done around the world, utilizing a variety of approaches. Doshi (2006) summarizes the many different types of bioreactors that are in operation, and discusses the relative advantages and disadvantages of these different bioreactor systems. The bioreactor utilized at Galkeno 900 is one type of reactor, where the only carbon source added to the bioreactor was added in a dissolved form semi-continuously during the operation of the bioreactor. Bioreactors are often constructed utilizing a mixture of substrates which either act as a carbon source for microbial reactions, or these substrates can act as sorptive surface for metals precipitation. However, bioreactors with solid phase carbon sources are often limited in their sulphate reduction rates by the availability of soluble organic carbon (Buccambuso et al, 2007) indicating that the constant supply of a carbon source as was done in Galkeno 900 bioreactor will tend to prevent microbial limitations on treatment.

For context of this discussion, the operation of the Galkeno 900 bioreactor can be divided into three distinct time periods. They are:

- **Recirculation Phase – Operation Mode 2 (October 2009 - July 2009):** During this period, the bioreactor was placed into service with water from the adit entering at an average rate of one litre per minute (1 lpm), which provided makeup water to replace slow leakage, and also to provide some heat from the adit water during the cold season. An initial carbon source addition consisting of (1.8 kg) milk powder and (182 kg) table sugar (sucrose) and (110 gal) methanol was added to provide an energy and nutrient source for an initial microbial growth phase. No source of microbes other than what was present on the placer rock and what is carried in the mine water was added to the bioreactor. However, researchers studying mine water and sediment at the Penn Mine Church et al (2007) showed that mine water even in an pH 4 mine drainage with high concentrations of heavy metals contained sulphate reducing bacteria and accounted for metals removal processes. The water in the bioreactor was re-circulated at a rate of one to two liters per second to mix and distribute water in the bioreactor. The water was periodically sampled to evaluate microbial growth and activity indirectly by evaluating water quality changes that could be inferred to be caused by microbial action. During this period there was incomplete formation of reducing conditions and the bioreactor likely had both aerobic and anaerobic zones. During the recirculation phase, metal concentrations were decreased over several months (discussed more below) and the removal mechanisms during this time may have included oxidative mechanisms (iron and manganese oxide formation) with metal co-precipitation on the iron and manganese oxides, carbonate mineral formation, and microbial sulphate reduction and metal sulphide precipitation.
- **Reduction Onset Phase – Operation Mode 2 (July 2009 – September 2009):** During this period, water within the bioreactor continued to be re-circulated while additional carbon sources were added at the bioreactor influent sump. This resulted in elevated carbon concentrations and the onset of more strongly sulphate-reducing conditions. During this time, the development of stronger reducing conditions were observed, characterized by greater sulphate reduction, the dissolution of manganese and iron from the reactor solid phase (likely manganese and iron oxides formed during initial bioreactor operations, as well

as structural iron and manganese minerals in the placer rocks), and greater metals removal as sulphides.

- **Operational Treatment Phase – Operation Mode 3 (October 2009 – May 2011):** An initial flow rate of 0.5 lps was established into the reactor, and after stable metal removal conditions were observed this flow rate was maintained for several consecutive bimonthly samples. Soon after, the flow rate was increased to 1.0 lps in December 2009. In August 2010, the flow rate of the bioreactor was reduced to 0.75 lps, or approximately 19% of the adit flow. This flow rate was then maintained for the remaining operation of the bioreactor.

The results displayed in this report focus primarily within the operational treatment phase. The other phases, while important, are reflective of treatment performance during the transition of the bioreactor from construction to operation.

5.1 LITERATURE REVIEW AND BACKGROUND DISCUSSION

The formation of metal precipitates in a bioreactor that has carbon sources added to or present in the solid phase of the bioreactor has been extensively studied for 30+ years. There are several different styles of bioreactors, both in terms of carbon sources and flow dynamics. Some very large bioreactors have been created to treat flows as large as 20 lps or greater, and some bioreactors are designed to treat very acidic or concentrated metal-containing mine drainage. Each bioreactor must be designed to reflect the environmental conditions, the water chemistry of the mine water being treated, and other relevant variables as discussed in this report.

To understand the processes that occur in bioreactors many studies have attempted to identify directly by examination of mineral formation or by inference from water chemistry signatures what primary mechanisms are responsible for metals removal. When complex carbon sources are added as a solid phase in the bioreactor construction (i.e., peat, straw, compost, wood chips, etc.), a broad range of mechanisms has been documented (Gusek, 2002; Doshi, 2007; Gusek et al, 2008), that include:

- Sorption of metals on organic matter.
- Precipitation of iron hydrous oxides including ferric and mixed valence minerals, which then provide mineral surfaces for sorptive removal of metals, or metals can also be co-precipitated within the iron mineral matrix.
- Precipitation of manganese oxides including manganese (IV) oxides and mixed valence (III/IV) oxides and manganese carbonates, which then provide mineral surfaces sorptive removal of metals, or metals can also be co-precipitated within the manganese mineral matrix.
- Precipitation of metal sulphides, including primary metal sulphides such as ZnS or CdS, as well as precipitation of iron sulphides such as amorphous FeS and co-precipitation of metals within the FeS matrix. Depending on the pH of the bioreactor and the availability of structural iron, a very large amount of FeS minerals can be formed by aqueous sulphide formed by microbes reductively dissolving iron from the rock matrix, creating a “bank” of amorphous sulphide which has reactivity toward dissolved metals.

- Precipitation of some metals in their reduced forms, for example selenium reduction from a Se(VI or IV) anion to elemental selenium precipitates Se.
- Precipitation of metals as carbonate minerals. Some of the relevant metals have somewhat soluble carbonate minerals (e.g., zinc carbonate minerals including smithsonite, and hydrozincite) which are relatively more soluble than sulphides. When sulphide is not present, these minerals may provide a precipitation-removal mechanism.

Sorption of metals on organic matter is not a relevant metals removal mechanism by design in the Galkeno 900 bioreactor because only coarse rock was used as a solid substrate. The metal removal mechanisms in this reactor appear to initially relate to removal of iron and manganese during the recirculation phase, and then over time the removal mechanism transitioned to a metal sulphide removal mechanism (inferred because metals removal continued to occur when iron and manganese ceased being removed and actually increased in concentration during flow through the reactor). The precipitation and removal of metals in their reduced forms is not a significant potential mechanism for most of the metals present in Galkeno 900 adit water, with the potential exception of uranium which was only present in very low concentrations in the influent water. Consequently, the formation of sulphide from sulphate, which is a chemical reaction that is catalyzed by microbes and relies on the availability of organic carbon, is the primary performance variable that is relevant in the Galkeno 900 bioreactor performance evaluation. In typical evaluation of bioreactors where sulphate reduction/sulphide precipitation is a dominant mechanism, the Sulphate Reduction Rate (SRR) is determined as a primary design variable.

In a bioreactor with available sulphate and a soluble carbon source added, Dar et al (2007) showed that sulphate reducing bacteria (SRB) are the dominant microbe that accumulates in the bioreactor, and by inference the vast majority of the carbon consumption is performed by SRB. In their study, only a few different strains accounted for the majority of the cells present, indicating that microbes capable of utilizing the carbon source and reduce sulphate will become dominant in the bioreactor.

After the bioreactor entered stable operation, metals removal mechanisms appear to have shifted from the mixed reaction that were discussed in the prior report (Alexco Resource US Corp, 2009) to primarily a sulphide-based precipitation process. The stability of metals removed as sulphides are consequently an important consideration for the performance of the bioreactor. Jong and Perry (2004) studied the form of metals that were precipitated from solution as a result of the sulphate reduction process, and determined that arsenic, copper, iron, nickel, and zinc were primarily bound up in a sulphide phase that was also associated with residual organics, and that carbonate or hydroxide phases were relatively minor phases that held the metals removed from solution. The United States Environmental Protection Agency SITE program studied the stability of these sulphate-reducing bioreactor precipitates at the Leviathan Mine, in California. Using a series of different tests, the EPA determined that the metals in the bioreactor precipitates were below regulated total metals thresholds (California standards), the WET extraction test showed that the metals in the bioreactor did not leach above regulated soluble threshold standards, and that as defined by TCLP extraction testing the bioreactor solid materials were not hazardous.

The effectiveness of this sulphate reduction bioreactor process is sensitive to important variables including the hydraulic residence time in the bioreactor, the sulphate reduction rate, and the filtration capacity of the media.

Because the products of the sulphate reduction reaction include both sulphide and bicarbonate alkalinity, it is possible that carbonate precipitation is also an important mode of precipitation for some of the metals removed in the reactor. However, for most of the metals being removed in the bioreactor, including antimony, arsenic, cadmium, cobalt, iron, nickel, and zinc, a sulphide precipitation mechanism appears more likely because sulphide precipitates are less soluble than the carbonate precipitates of these elements. The mineralogical analysis discussed in Section 6.2.1.1 confirms that sulphide is the solid phase form of zinc precipitates formed in the bioreactor. Thus the sulphate reduction reaction is the primary reaction that we will focus on optimizing in the bioreactor operations.

5.2 DETERMINATION OF THE SULPHATE REDUCTION RATE

Microbial production of sulphide from sulphate is dependent on the presence of sufficient numbers of sulphate-reducing bacterial (SRB) cells, and the availability of organic carbon, according to the following reaction:

4 moles methanol + 3 moles sulphate → 3 moles sulphide + 4 moles bicarbonate

The rate of the reaction is nearly the same at temperatures in natural environments where the long-term temperature is around freezing (-2^{0}C to 2^{0}C) as it is in natural environments where the long-term temperature is around 20 ^{0}C when the abundance of SRB is the same (Knoblauch, Jorgensen, and Harder, 1999). This is due to the development of psychrophilic (i.e., 'cold loving") SRB. The growth rate of psychrophilic SRB is typically far slower than temperate SRB, which is reflected in the long growth period (October 2008 to August 2009) required for the Galkeno 900 bioreactor to reach maturity so that it could sufficiently treat mine water. However, once the bioreactor was competent to perform sulphate reduction (as evidenced by net sulphide concentrations leaving the reactor in the 1 to 10 µM range, indicating that there is excess aqueous sulphide created above what was required to react with the soluble and solid phase metals) then the bioreactor SRR could be assessed. (Note: it was possible to add more organic carbon to the reactor and support additional sulphate reduction, however it would result in higher dissolved sulphide which would not be required for metals precipitation, and could result in reduction of oxygen in the surface receiving streams. At the amount of sulphide precipitation that was achieved (1 to 10 µM range) dissolved oxygen consumption would be less than 1 mg/L, or less than 10% of what is normally in surface water.)

The SRR is measured in terms of mM sulphate reduced per m^3 of bioreactor substrate per day. The influent sulphate compared to the effluent sulphate is compared to determine the amount of sulphate removal. The average sulphate removal amount during the treatment phase was 128 mg/L, or 1.33 mM. With a known bioreactor volume of approximately 2,550 m^3, and a flow rate of 1 lps, the total sulphate removal per day was 115,200 mM, which yields a SRR of 45 mM/m^3/day. For comparison, artic ocean sediments have SRRs in the range of 5-40 mM/m3/day (Knoblauch, Jorgensen, and Harder, 1999), showing that the bioreactor has a similar rate as natural systems that have long term adaptation to cold environments.

The SRR calculated for the Galkeno 900 bioreactor is conservatively calculated based on dividing the amount of sulphate reduced by the volume of the entire bioreactor. However, less effective treatment zones or "dead zones" are identified in Figure 7 and were expected based on the sub-optimal configuration that was available at Galkeno 900. These areas can limit the exchange of organic carbon and therefore it is likely that minimization or elimination of these dead zones will improve the performance of the bioreactor.

5.3 RECIRCULATION DYE TEST

The volume of the bioreactor voids needed to be determined independently to assess residence time and other performance characteristics of the bioreactor. The dimensions of the reactor were measured to be approximately 100 feet by 90 feet and 10 feet in depth. Assuming an estimated porosity of 0.35, the volume was calculated to be roughly 890 m3 or approximately 235,000 gallons. Starting on August 25th, 2009, a dye test was completed to independently assess the volume in the reactor.

Roughly eight ounces of rhodamineWT dye was added to the bioreactor on August 25 2009, and water was re-circulated in the bioreactor at a rate of two litres per second. After equilibrium conditions were reached in six days, a final dye concentration of 0.25 ppm dye was measured. The volume of the bioreactor was determined by the following formula:

Volume of reactor =mass of dye added÷concentration measured

Using this formula, the volume of the bioreactor was calculated to be approximately 909 m^3, or approximately 240,000 gallons, which is consistent with the estimated volume based on the dimensions of the bioreactor and the estimated porosity of the rock.

Understanding the volume of the bioreactor is necessary to understand the potential hydraulic residence time for water passing through the reactor. At 0.5 lps, assuming the total porosity of the bioreactor is utilized, approximately 21 days of residence time is available, and at 1.0 lps, approximately 10.5 days of residence time is available. A 2 lps flow rate should result in a residence time of approximately 5.25 days.

The dye test was run under re-circulating conditions at a relatively fast rate (2 l/s). By definition, when the peak concentration of dye is measured in the effluent, 50% of the dye has passed through the reactor. The time for the peak dye to exit the bioreactor at 2 lps recirculation was determined to be approximately 1.03 days into the bioreactor operation. This much faster flow rate indicates breakthrough of the dye along flow paths that “short circuit” i.e., do not interact with the entire porosity of the bioreactor. Figure 9 shows conceptualization of flow in the bioreactor.

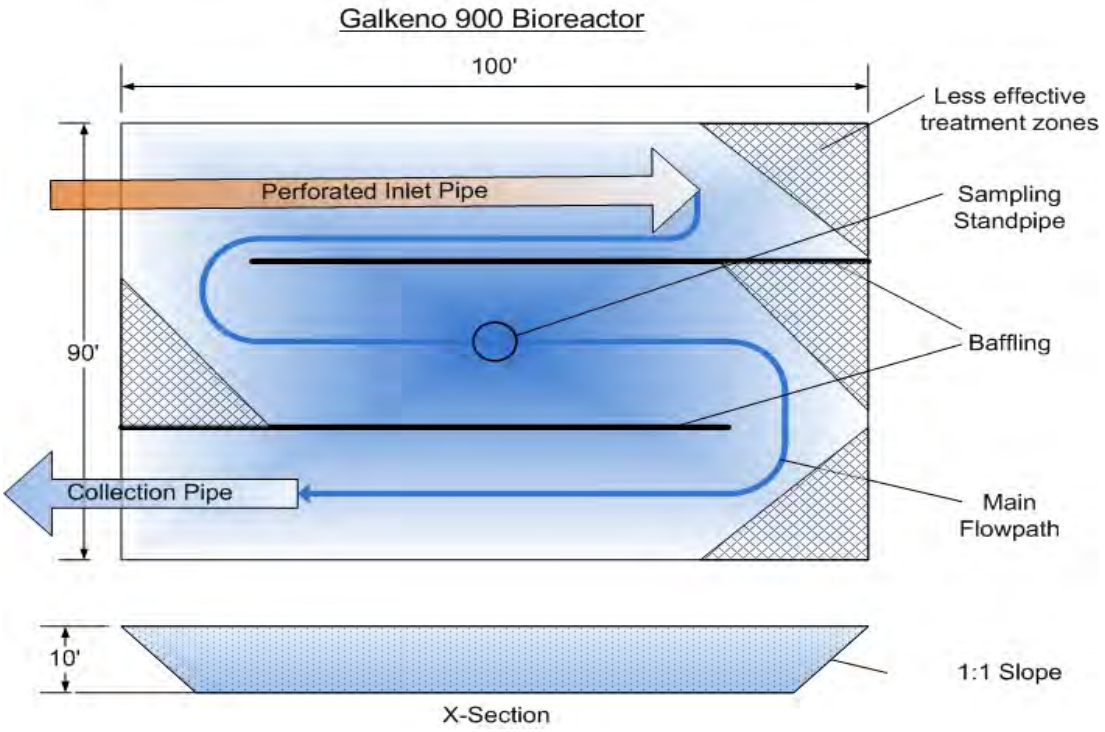


Figure 9 - Conceptualization of Flow Path in the Bioreactor

The "less effective treatment zones" are where water entering the bioreactor does not interact as much with the media and hence these zones are likely to only minimally contribute to the treatment performance. The activity in these areas is dependent on the availability of carbon sources diffusing from the actively flowing areas to support sulphate reduction. The practical residence time in the bioreactor can be estimated as two times the breakthrough time of the dye peak. This residence time corresponds to the volume of the reactor that participates in rapid exchange of influent water to the bioreactor discharge (this will be termed the "effective residence time"). (Note, in most porous media, there is a tailing phenomenon, where dye concentrations do not behave "normally" in a bell shape curve, but the second half of the curve "tails", i.e., there is a slow bleed out of dye from slower flowing zones in the reactor which increases the time required for the washout of the dye. For the design of bioreactors these less effective zones cannot be relied upon for treatment and hence the 2X dye peak is used for design purposes.)

Table 1 – Residence Time within the Bioreactor per Flow Rate

Flow Rate	Residence time (total porosity)	Residence Time (active porosity)
0.5 lps	21.0 days	9.00
1.0 lps	10.5 days	4.50
2.0 lps	5.25 days	2.25

6 BIOREACTOR PERFORMANCE

The performance of the bioreactor with respect to water chemistry is summarized in the following tables, graphs, and discussion. To better understand the treatment goals, Table 2 provides the Galkeno 900 effluent quality standards per the Conditions of Water Licence QZ06-074. In order to release water from any adit in the KHSD that is currently under the Care and Maintenance of ERDC, the water discharge must meet these standards. It is important to note that some sites such as Keno 700 do not need to meet discharge standards in order to attain aquatic standards in the receiving environment (Lightning Creek) Targeting a mass reduction goal of 90% may be more relevant for some sites of this nature.

Table 2 - Effluent Quality Standards per Water Licence

Parameter	Maximum Concentration in a Grab Sample Measured in mg/L
pH	6.5 – 9.5 pH units
Suspended Solids	25.0 mg/L
Arsenic (total)	0.50 mg/L
Cadmium (total)	0.05 mg/L
Copper (total)	0.30 mg/L
Lead (total)	0.20 mg/L
Nickel (total)	0.50 mg/L
Silver	0.10 mg/L
Zinc (total)	0.50 mg/L

6.1 GENERAL PARAMETERS

The pH of the reactor did not substantially change through the operational period, with the inflow and outflow from the reactor in the same range as the pH of the adit drainage. Figure 10 illustrates the pH of the influent and effluent from the reactor.

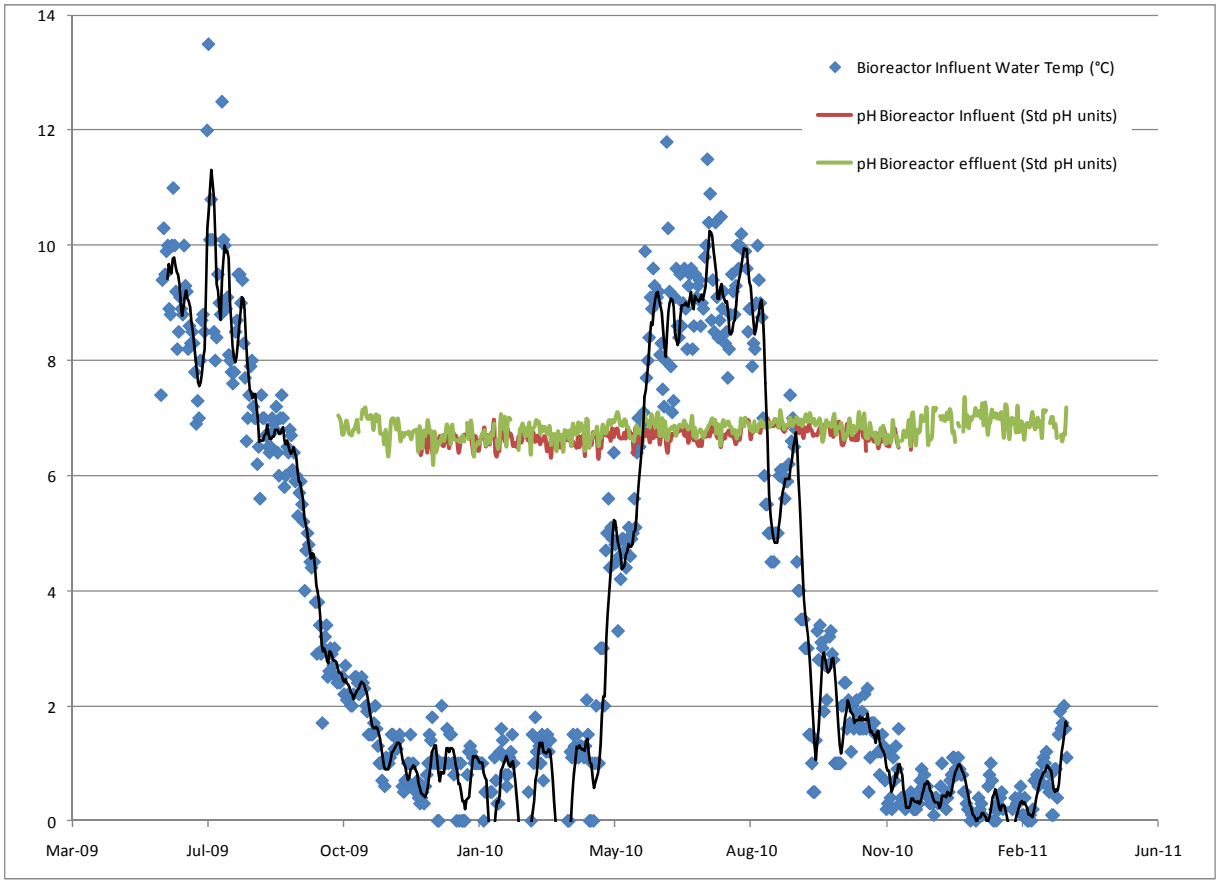


Figure 10 - Comparison of Galkeno 900 Adit pH and Bioreactor pH vs. Temp

In addition to pH, Figure 10 also displays water temperatures of the bioreactor influent water recorded during operation. Notice how the influent water temperature decreases to less than 2°C from October through April each year. This emphasizes how important it is to keep water moving through both the bioreactor and the piping systems at all times to avoid freezing.

6.2 DISSOLVED METALS

The primary metal that exceeds discharge criteria at the Galkeno 900 adit is zinc, which is true of most of the adit discharge locations in the KHSD. There are other metals that potentially contribute to the toxicity of water and this and other discharge locations, and hence the water chemistry of all dissolved metals present in the Galkeno 900 water has been evaluated.

To better understand the performance of the bioreactor during operation, several graphs have been generated that plot each constituent of concern. These graphs display the results of samples taken at the adit, midway through the bioreactor, and at the discharge from the bioreactor. Within each graph, a blue and green transparent box was added to signify flow rates during operation. Within the blue box, the average

flow rate through the bioreactor was 0.5 lps. Within the green box, the flow rate was increased to 1.0 lps and then subsequently to 0.75 lps.

6.2.1 Zinc

The concentrations of zinc in the bioreactor were approximately 90% reduced during the recirculation phase where only minor additions of water (approximately one litre per minute) was being added to the reactor. During the onset of more strongly reducing conditions in the summer of 2009, dissolved zinc concentrations were decreased to below detection limits (0.01 mg/L). After this removal was confirmed for several consecutive sampling periods, the bioreactor treatment phase was initiated at 0.5 lps in October 2009. Figure 11 illustrates the removal efficiency of the bioreactor during both treatment periods, including the 0.5 lps flow rate (blue rectangle), and the 1.0 lps flow rate (green rectangle). During the 0.5 lps time period approximately three pore volumes were exchanged (calculated on a total porosity basis) and when calculated on a reactive volume estimated by 2X the dye peak, nearly eight pore volumes would have been exchanged during this period. This shows that the treatment cannot be attributed to dilution by previously treated water.

During the 1.0 lps treatment phase, approximately six pore volumes (calculated on a total porosity basis) passed through the bioreactor prior to the loss of power and pump failure that led to the bioreactor being back-siphoned out. The loss of complete treatment that occurred after the refilling of the bioreactor is attributed to the refilling of the bioreactor with approximately half of the volume of the reactor in February 2010. However, even with this refilling, the bioreactor still removed over 95% of the zinc in the sample taken immediately after refilling. (Note: data from the period after refilling the bioreactor indicates that the removal efficiency dropped to closer to 60-80% in the period immediately after the bioreactor siphoned out and was refilled, indicating that the pipe freeze-up and refilling of the reactor has temporary negative effects for a period of a few weeks after an upset.) This rapid reactivity of the bioreactor to recover from upset conditions indicates a residual treatment phase, most likely an amorphous FeS phase, has been formed in the bioreactor, which provides for rapid reaction with soluble zinc.

The conclusions that can be reached from the bioreactor's operation, before the pump failure, are that dissolved zinc can be effectively removed at 0.5 lps flow rate with an effective residence time of nine days, or a total residence of 21 days, and the first two months of operation at 1.0 lps also effectively removed dissolved zinc. However, there was a difference between dissolved zinc removal and total zinc removal within the bioreactor at the faster flow rate. Table 3 outlines the difference between dissolved and total zinc removal during the different operational phases.

Table 3 - Total vs. Dissolved Zinc per Operation Phase

	Average total zinc concentration (mg/L)	Average dissolved zinc concentration (mg/L)	% total zinc that is dissolved
Recirculation phase	0.64	0.65	100%
Reduction onset phase	0.32	0.27	86%
0.5 lps treatment phase	0.28	0.012	4%
1.0 lps treatment phase	0.74	0.13	17%
0.75 lps treatment phase	0.29	0.018	6%

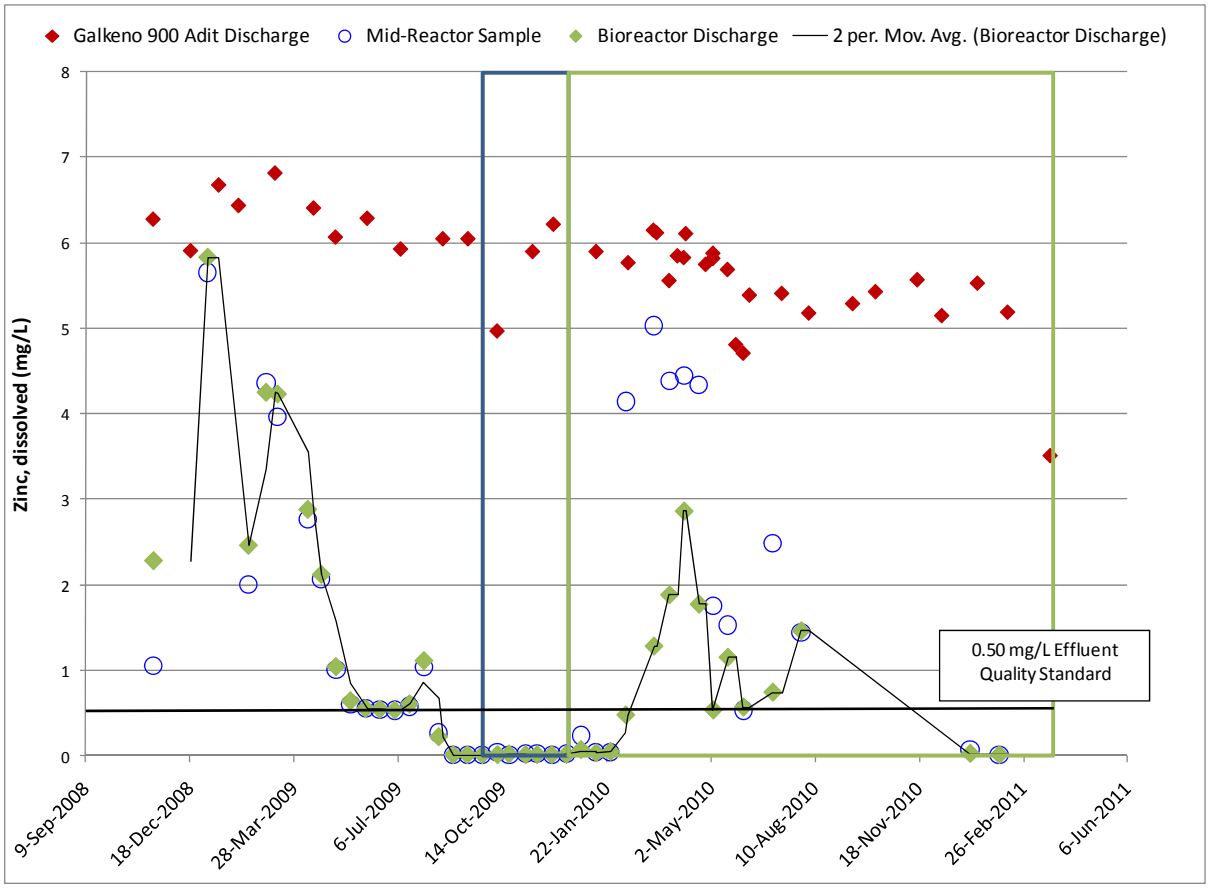


Figure 11 - Zinc removal by the Galkeno 900 Bioreactor

The difference between total and dissolved zinc is that total zinc can be filtered out, i.e., it is the particulate zinc in the bioreactor samples that has been reduced from the soluble phase and become a solid zinc phase. Because of the coarseness of the bioreactor rock (see Figure 5) the media does not act as a very good filter. This is consistent with what was observed at a bioreactor in Montana (Gammons and Frandsen, 2001), where fine ZnS particulates passed as colloids through the reactor but could be filtered out with a 0.45 µm filter. As discussed later, design of future bioreactors would include finer grained rock than coarse oversize placer rock to encourage some filtration. In addition, freshly formed sulphides are very fine particulates. In rapidly flowing systems, small or colloidal particles can remain suspended and exit the bioreactor without being agglomerated into larger particles that would drop out via gravity or by being caught in bioreactor media pore throats. Dissolved zinc averaged below the discharge treatment objective of 0.5 mg/L during both the 0.5 and 1.0 lps treatment regimes. However, the treatment objective was not achieved for total zinc for the higher flow rate (1.0 lps) regime (0.74 mg/L) except for the final two data points collected in January and February 2011. This indicates that additional residence time may be required in the bioreactor to filter the particulate materials, or a subsequent filtration treatment step could be taken in the discharge if the higher flow rate were to be used. An example of natural filtration is a wetlands or bog system, or infiltration into an underground porous aquifer. Active semi-passive or passive filtration systems such as sand filters, multimedia filters, or sedimentation ponds are other alternatives that could improve filtration.

6.2.1.1 Mineralogical Analysis of Zinc Precipitates

After decommissioning the bioreactor in the spring of 2011, samples were removed of the solids formed in the bioreactor utilizing a backhoe to dig through the cover layers into the bioreactor media. Bioreactor solids were preserved in epoxy to keep sulphide minerals stable which might be affected by exposure to oxygen. Preserved samples were evaluated with electron microprobe analysis using backscattered electrons and mapped for Mn, Fe, S, and Zn to examine elemental associations. Quantitative analysis of areas with elevated levels of zinc was further performed to determine elemental ratios, which allowed for mineralogical determination.

Micron-sized ZnS particles were found extensively within a biofilm layer on the bioreactor media. Appendix A "Summary Report on optical and electron microprobe analysis of Galkeno 900 Bioreactor at Keno Hills" shows the visual evidence of the biofilm containing the zinc sulphide materials. Consistent with the inference of the formation of iron sulphides, iron was observed coincident with the ZnS phases within the biofilms, as well as more broadly spread throughout the bioreactor materials. The atomic proportions of Zn:S of 1:1 was at a very high level of correlation (R^2 0.98) which verified the identification of sphalerite as the mineral into which zinc was being sequestered in the bioreactor.

The significance of ZnS as the storage phase for zinc in the bioreactor is that in a saturated setting it will remain stable and at a very low solubility. A buried, lined bioreactor is a feature that can readily be closed in place if desired, with no route for metals remobilization due to the physical encased (by liner and capping) structure of the reactor, and further certainty about the long term stability is provided by the very low solubility geochemical phases that the metals are stored in.

6.2.2 Antimony

Antimony concentrations declined approximately 80% during the test (0.0025 mg/L reduced to below the detection limit (0.0005 mg/L) for most of the phases of the test (See Figure 12). Antimony removal in an organic carbon-rich reducing system is typically attributed to an antimony sulphide phase, or by sorption to iron or manganese oxides, carbonates, or sulphides that are stable in reducing conditions.

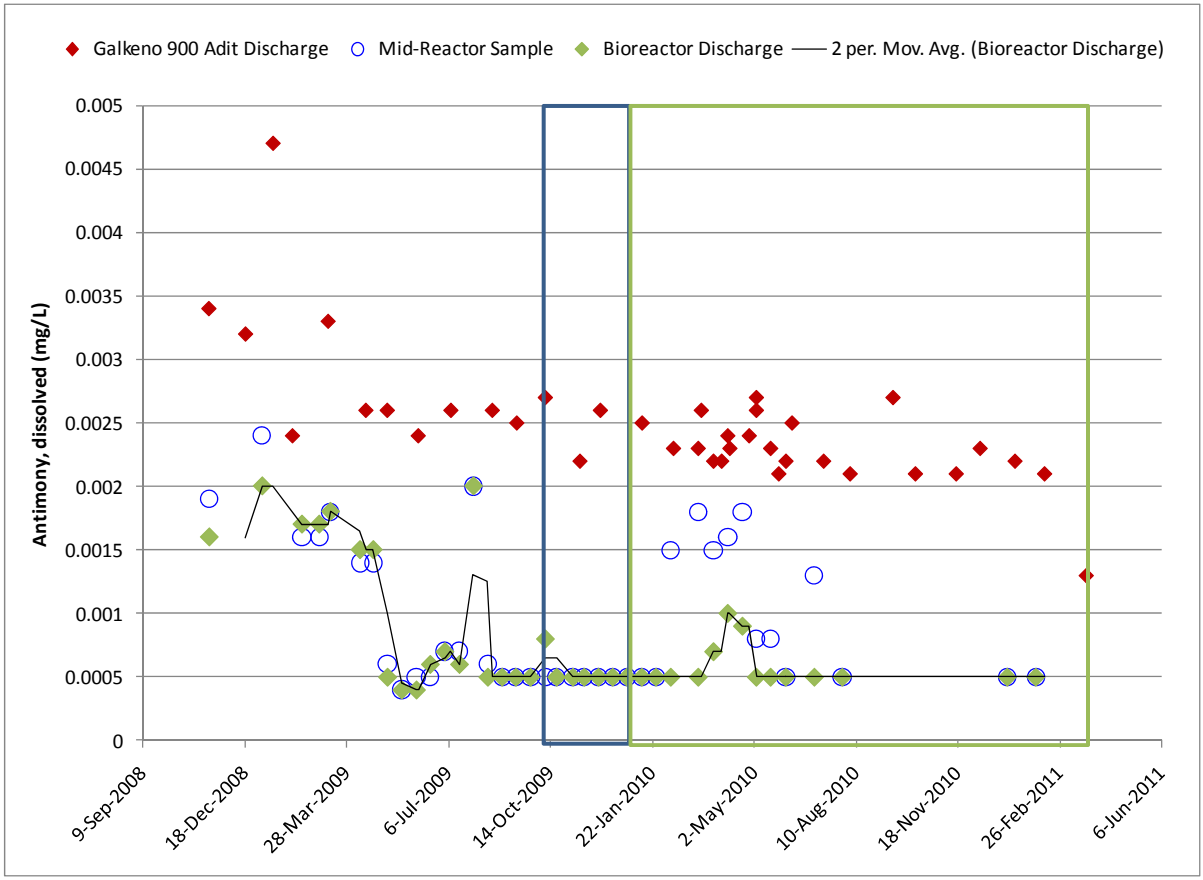


Figure 12 - Antimony Removal by the Galkeno 900 Bioreactor

6.2.3 Arsenic

Arsenic concentrations declined approximately 97% (0.068 mg/L reduced to 0.0015 mg/L average of last two months) during the recirculation phase (See Figure 13). Arsenic concentrations increased during the reduction onset phase, indicating a temporary dissolution of arsenic-bearing mineral phases during this transition period. During both treatment phases, arsenic removal increased again as sulphate reducing conditions were established. During the treatment phases, arsenic removal averaged 58% for the 0.5 lps period, and 80% during the 1.0 lps. The performance during the 0.5 lps period was likely affected by the residual washout of dissolved arsenic released during the reduction onset period, so a long term average removal would more likely be similar to the 1.0 lps performance.

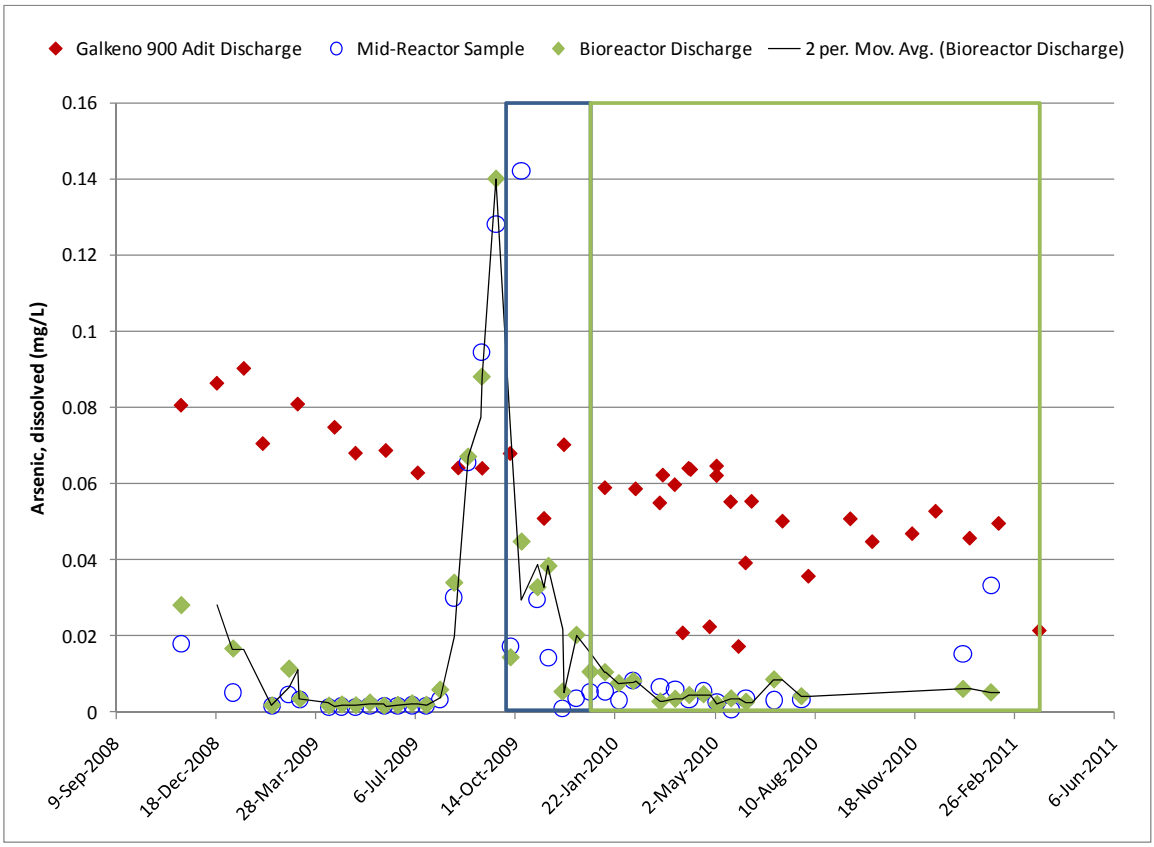


Figure 13 - Arsenic Removal by the Galkeno 900 Bioreactor

6.2.4 Cadmium

Cadmium concentrations declined approximately 60% (0.0015 mg/L reduced to 0.0005 mg/L average of last two months) during the recirculation phase (See Figure 14). After the beginning of the reduction onset phase, cadmium has been removed to below the detection limit and has remained at those levels during all the recirculation phases.

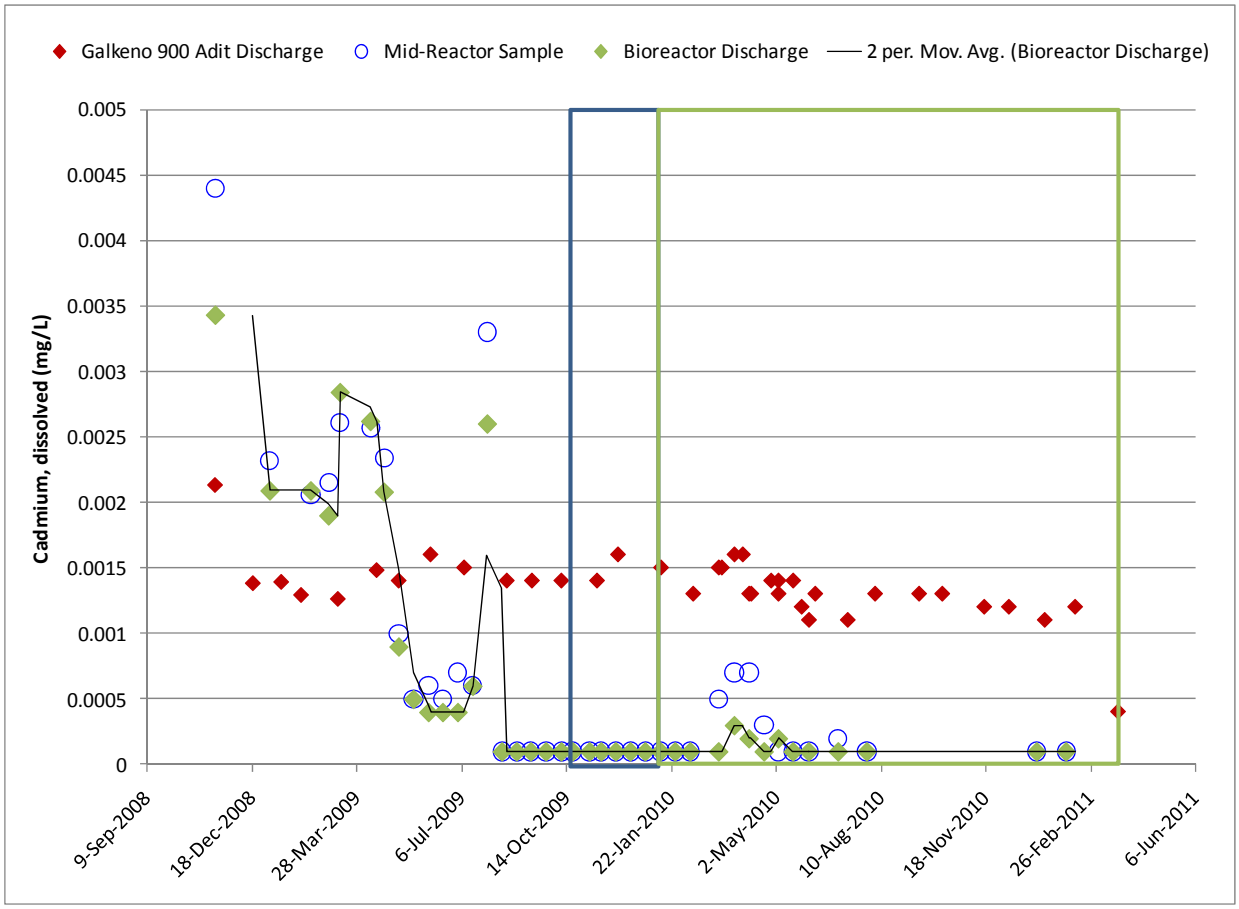


Figure 14 - Cadmium Removal by the Galkeno 900 Bioreactor

6.2.5 Iron

Iron concentrations declined approximately 97% reduction (1.75 mg/L reduced to 0.032 mg/L average of last two months) during the recirculation phase (See Figure 15). During this phase, iron appears to have been removed primarily by precipitation as an oxide. During the reduction onset phase, iron dissolved from the reactor and has been released at a rate higher than the amount entering the reactor through the recent operations.

Iron removal in the bioreactor provided sorption and co-precipitation phases for other trace metals removal during the recirculation phase. Some of the iron was likely also removed as sulphides in their initial amorphous precipitate form (operationally called Acid Volatile Sulphides or AVS). The rate of formation of this phase may be limited by the residence time provided in the bioreactor. An operational objective could include operating the reactor to create AVS.

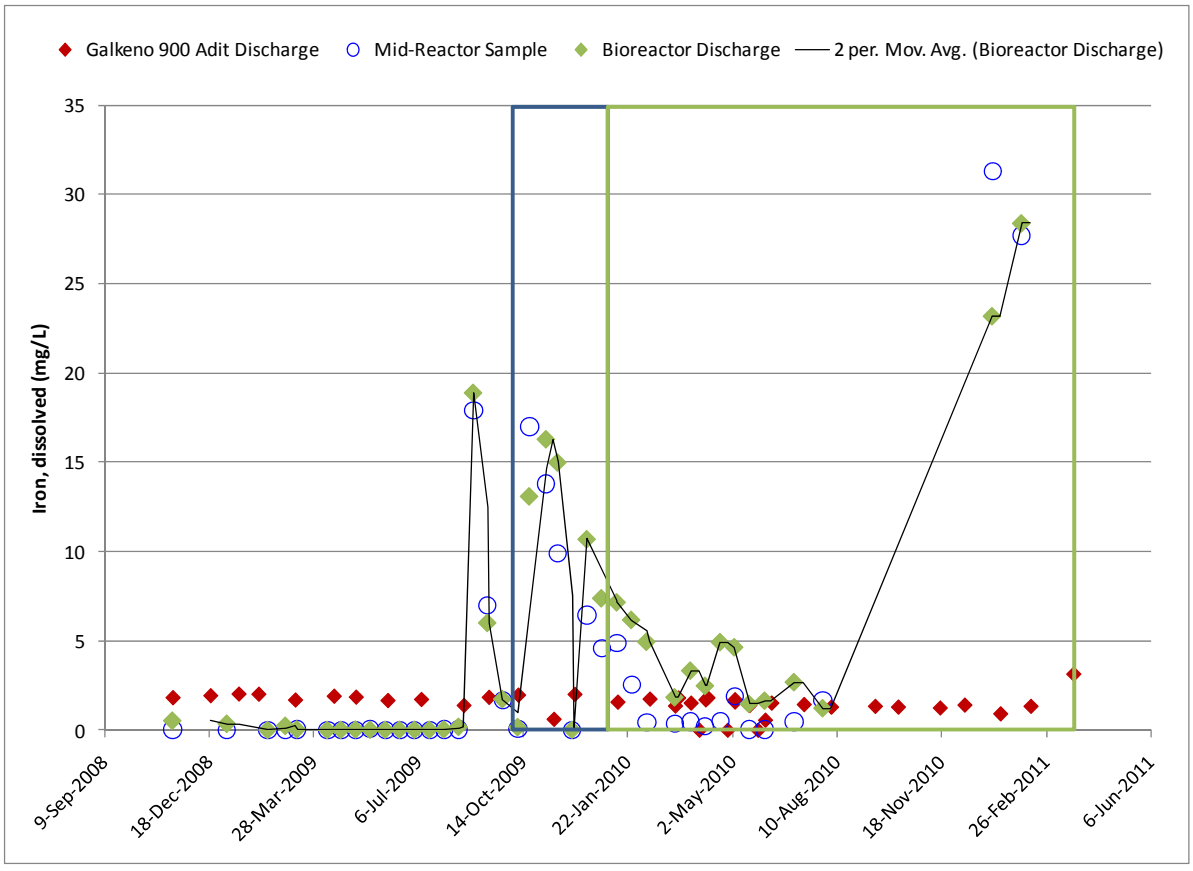


Figure 15 - Iron Removal by the Galkeno 900 Bioreactor

6.2.6 Manganese

Manganese concentrations declined approximately 98% (18 mg/L reduced to 0.25 mg/L) during the recirculation phase (See Figure 16). During the reduction onset phase, some manganese was released from the bioreactor, indicating that some of the manganese removal in the recirculation phase was as a manganese oxide. In through flow treatment phases the manganese concentrations entering the bioreactor and exiting the bioreactor were nearly the same, indicating manganese is not being removed from the reaction in the bioreactor under the more strongly reducing conditions and at the hydraulic residence times provided under the current flow regime.

Similar to iron, manganese removal in the bioreactor has important effects for other metals. Manganese carbonates and oxides that may have formed during the initial bioreactor operation phase have good sorption capacity for trace metals. Manganese precipitates may play a significant role in the removal of metals in the bioreactor.

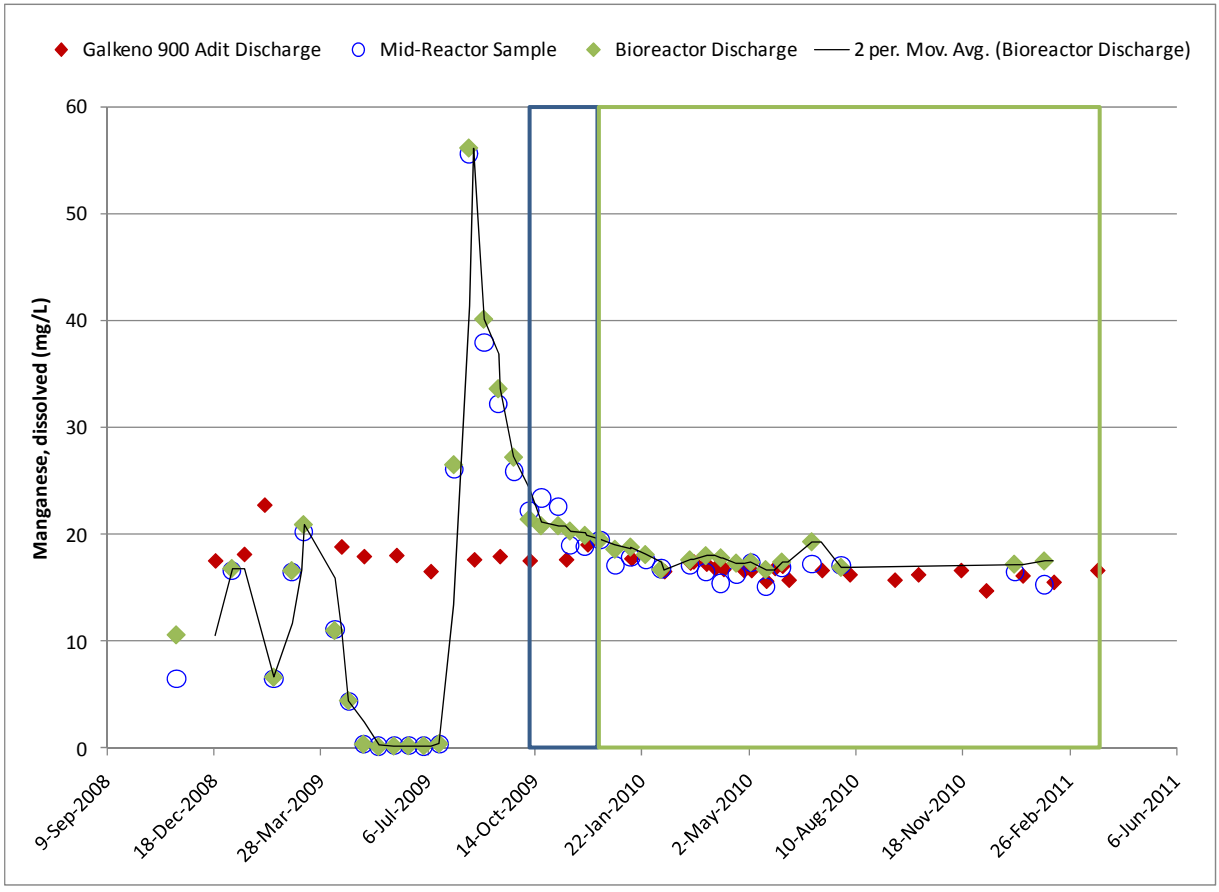


Figure 16 - Manganese Removal by the Galkeno 900 Bioreactor

6.2.7 Nickel

Nickel concentrations declined approximately 80% (0.2 mg/L reduced to 0.04 mg/L average of last two months) during the recirculation phase (See Figure 17). During the reduction onset, a portion of the nickel was returned to solution, but during the slower flow periods, the nickel concentrations decreased to detection limits. Nickel removal during the 0.5 lps was 97.5%, but declined during the 1.0 lps flow rate. The treatment capacity of the reactor appears to be more sensitive for nickel than some other metals, as the mid-reactor sample increased during the switch to the higher flow rate. If nickel removal were an objective, operation of the bioreactor at a slower flow rate appears to be beneficial. However, the transition back to 0.75 lps improved the nickel removal.

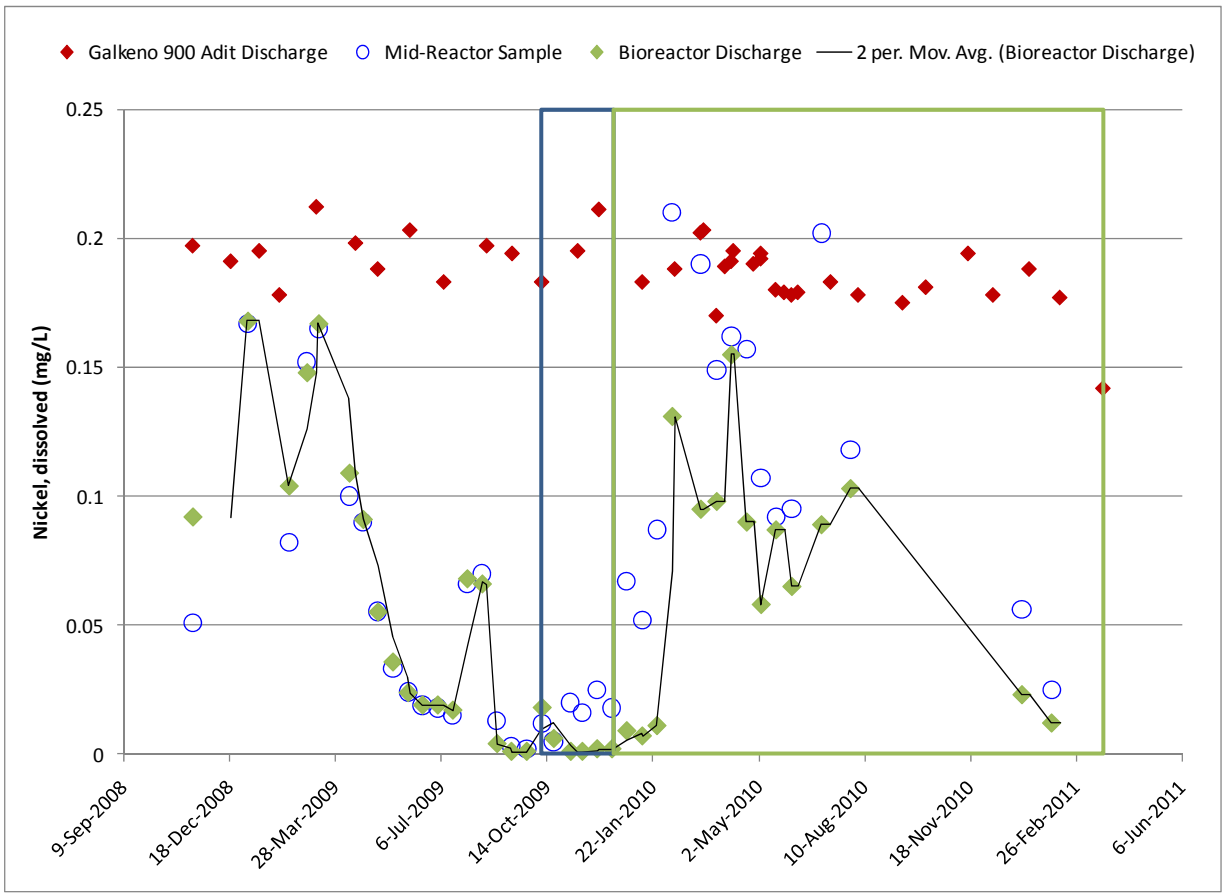


Figure 17 - Nickel Removal by the Galkeno 900 Bioreactor

7 BIOREACTOR ENGINEERING DISCUSSION

Evaluation of the metals removal obtained in the bioreactor and determination of the SRR that can be achieved in the wintertime at the 0.5 and 1.0 lps flow rates enables an evaluation of the potential scaling factor for the size of the bioreactor that could treat the entire flow from the Galkeno 900 adit. Design improvements would focus on increasing contact with all of the bioreactor, and decreasing 'dead zones'. Experience at other sites has shown an elongated rather than square bioreactor has better contact parameters and fewer dead zones. In rough parameters, the flow from the Galkeno 900 adit is approximately 4 lps and remains consistent throughout the year and with the improvements and balancing the appropriate conservatism in design an approximate scale factor of four times the volume of bioreactor media would be used to design and cost a bioreactor for a full scale at Galkeno 900.

The minimum goal of 0.5 mg/L zinc was consistently achievable during normal operation of the bioreactor as long as the system remained in operation without interruptions. As shown in the data, a pump failure and/or pipe freezing can have a detrimental effect on the water quality results. This experience has shown the improvements to the design must focus on ensuring flow at all times, not dependent on power availability, and further improvements to insulation could also achieved.

The removal of other metals was also consistently achieved with the exception of a short period when reduction onset occurred, when some metals were released with the reductive dissolution of iron and manganese.

7.1 GENERAL BIOREACTOR DESIGN IMPROVEMENTS

The following is an assessment of the Galkeno 900 design components that worked well and design components that did not work well. This information will provide the basis of design and inform the construction of future bioreactors within the district.

The following components worked well and should be repeated in future designs:

1.) **Torturous Path** - Creating a torturous path within the bioreactor using liner for baffling was needed with the Galkeno 900 design to minimize short-circuiting and increase residence time. However, the use of baffling created zones that did not provide effective treatment and these zones should be minimized or eliminated in future designs if possible. One way to do this is to create a bioreactor that is laid out as a long, gently sloping trench sections. Finding land where trenches could be constructed near adits in the Keno Hill area may be difficult in some areas.

2.) **Bioreactor Dead Zones** - As discussed earlier, approximately 60% of the media appears to be actively participating in treating the water as it passes through the bioreactor. The remaining volume is for practical purposes considered as dead zones. These dead zones can be minimized by creating longer and narrower flow paths. This design improvement should be considered for future bioreactors.

3.) **Flowing Water** - Water must be kept flowing - This is critical during the winter months in the Keno Hills district. Mine drainage and groundwater is above freezing, and the water temperature must be maintained while passing through the bioreactor. As long as the pump was working and water was continuously flowing through the bioreactor, freezing was avoided. Every freezing failure of the bioreactor was caused by power failures which lead to cessation of pumping and a loss of the heat capacity of the adit influent water. In future bioreactor designs, allowing adit water to flow via gravity through a bioreactor will eliminate the potential for pump failure and maintain flow through the bioreactor. The exact design for each bioreactor will be carefully considered to minimize power usage and prevent the potential for power interruptions to cause treatment failures.

4.) **Back-up Treatment System** – During this study, the discharge from the Galkeno 900 bioreactor was co-mingled with the untreated raw water from the adit. This combined water was then treated with a lime slurry and allowed to decant from a settling pond. It is possible to have a mobile system to treat water while the bioreactor until the discharged water meets the applicable standards or performance objectives. Once the bioreactor can demonstrate effective treatment with discharged water meeting standards, the treatment system could be removed or placed on stand-by.

The following components were sources of problems and should be eliminated or redesigned for future bioreactors in the district:

1) **Fill Material** - The fill material used in the Galkeno 900 bioreactor was too coarse. As seen in Figure 5, the material was a mixture of larger, broken rocks mixed with smaller pebbles and sand. By using a consistent fill material that is a smaller, crushed rock (between 3/8" to 2" diameters) additional surface areas will be available for bio-growth and will help avoid short circuiting.

2) **Metering Pump** - If the metering pump that provided a carbon source to the bioreactor stopped working, there was at best a limited stored carbon source available within the media. For future bioreactor designs, a limited amount of solid phase carbon source such as course sawdust or wood chips, and/or peat should be mixed with the media to provide a secondary source of carbon to sustain the bioreactor if the soluble/primary carbon source is interrupted.

3) **Pumps and Heat Trace** - As mentioned earlier, power failures were not planned for in the existing design. Inclusion of heat trace lines and backup power to pumps could have avoided the problems experienced in the Galkeno 900 bioreactor. In most cases, the location of the bioreactors could be placed in a downgradient location where power would only be required for the addition of a soluble carbon source. The carbon source could be designed to not require power by using an educator system where flow from the adit would draw in the carbon substrate by a venturi force. If utilized for backup power, a generator would be a very minimal size. The design would also consider placing the valves and controls inside the adit to minimize freezing.

Neither iron nor manganese were removed by the reactor during through flow operational phase. The natural attenuation studies in the district shows that these are readily removed in a very short distance by turbulent flow creating a natural oxidation system. This could be a designed as a cascading discharge or could be performed in a natural setting such as an existing stream.

8 DISCUSSION AND CONCLUSIONS

When continuous flow was maintained to the bioreactor at acceptable flow rates, effective treatment was maintained. At higher flow rates the transformation of metals from their dissolved forms to an insoluble form was accomplished, but the filtration efficiency of the coarse rock in the bioreactor did not filter the insoluble precipitates effectively. Full scale application of the sulphate reduction bioreactor technology appears feasible if slight design modifications are made to ensure gravity flow from the adit, avoidance of siphoning due to freezing, and improved sizing of the bioreactor media.

Evaluation of longer term bioreactor studies have been conducted at the Leviathin mine since 1997 by the US EPA. The US EPA SITE program (2006) ranked the bioreactor technology for metals treatment at the Leviathan mine using the criteria shown below. The Discussion of the Galkeno 900 bioreactor in terms of how it performed is presented relative to the same evaluation criteria.

- For Overall Protection of Human Health and the Environment, it was determined that the sulphate reducing bioreactor was effective for reducing metals concentration, and produced non-toxic and stable precipitates. A similar conclusion can be reached for the Galkeno 900 bioreactor; confirmation of stable non-toxic precipitates is underway in additional was confirmed with the mineralogical studies. , but with lower influent metals concentration in the Galkeno 900 bioreactor it is reasonable to believe similar results will be determined.

- For Compliance with Applicable or Relevant and Appropriate Requirements (ARAR), it was determined that the bioreactor generally produced compliant discharge, and with minor adjustments compliance was improved further. Similar conclusions can be stated for the Galkeno 900 bioreactor.

- For Long Term Effectiveness and Performance, it was determined that the bioreactor consistently met the applicable standards over many years, and suggested that with additional engineering a more passive (wind and/or solar powered) system appeared to be feasible. The strength of this conclusion for Galkeno 900 reactor is weakened primarily due to power and freezing issues, but these issues can be engineered in future applications to be less significant and thereby increase the long term effectiveness and performance.

- For Reduction in Toxicity, Mobility, or Volume through Treatment, it was determined that the bioreactor concentrated the metals in a stable form. Similar conclusions can be reached for the Galkeno 900 bioreactor: on average over 90% of the metals were removed from solution and filtered out of the bioreactor during operational times. Confirmation that zinc was removed in a ZnS precipitate also shows that the bioreactor created a dense, low volume precipitate; compared to zinc precipitated as metal hydroxides, ZnS is multiple times denser and therefore lower volume.

- For Short Term Effectiveness, it was determined that the bioreactor effluent was protective of human health, and that the chemicals required for bioreactor operation could be handled safely with the appropriate engineering controls. Conclusions for the Galkeno 900 bioreactor are that it had short term effectiveness when operating at lower flow rates, and

consequently that by appropriate sizing and cold weather engineering a bioreactor can have high short term effectiveness in the KHSD.

- For Implementability, it was determined that the technology is simple, could be operated with limited operator involvement, and that it was stable over a long time. For the Galkeno 900 bioreactor, the technology is very simple and required little operator involvement, and if pumping and siphoning the bioreactor could be avoided through gravity feed, the Galkeno 900 bioreactor process has a high implementability ranking.

- For Cost, it was determined that it cost approximately $15 per 1000 gallons to operate the Leviathan bioreactor. By way of comparison, the Galkeno 900 bioreactor costs are in the range of $5 per 1000 gallons. The main difference is the lower level of reagent requirements due to lower metals concentration and neutral pH at the Galkeno 900 bioreactor.

- For Community Acceptance, it was determined that the operation of the bioreactor presented minimal risk to the community, with diesel generation and transportation of chemicals to the bioreactor being the main risks. With the lower chemical usage required for a bioreactor in the neutral drainages in the KHSD, and the availability of line power the Community Acceptance criteria should be even better in the KHSD.

- For State Acceptance, it was noted that California has allowed it to be the only water treatment technology used year-round at the Leviathan Mine site. The Galkeno 900 bioreactor is currently approved for pilot scale trials on the Keno Closure program and was approved as part of the environmental assessment and water licencing ofat the Bellekeno Mine.

The bioreactor testing program is now considered complete. If desired, a subsequent study utilizing a buried trench design without the use of power could be considered for a next phase of testing to demonstrate the effectiveness of this approach for sites where power is available only by generator.

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APPENDIX A

SUMMARY REPORT ON OPTICAL AND ELECTRON MICROPROBE ANALYSIS OF GALKENO 900 BIOREACTOR AT KENO HILLS

Summary Report on optical and electron microprobe analysis of Galkeno 900 Bioreactor at Keno Hills

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Submitted, November 25, 2011

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Executive Summary

Samples of sediment from the Galkeno Bioreactor and also from a column experiment were analyzed using optical microscopy and an electron microprobe at the University of Manitoba. The first samples from the column experiment and from the Galkeno Bioreactor were oven dried in an aerobic environment prior to making polished thin sections. The second set of Galkeno Bioreactor sediments were kept in a wet anaerobic state before being sealed in epoxy resin.

Column samples contained Mn and Zn coatings on lithic grain.

The results showed that micron sized grains of ZnS were precipitated with a molar ratio of 1:1 indicating bacteriological sphalerite was being formed. The samples preserved anaerobically contained significantly more sphalerite than the first set of samples. The sphalerite formed bands indicative of biofilm deposition. Some if the ZnS layers were immediately adjacent to or surrounding layers of Fe and Mn oxide or hydroxide. This result fits with the water data from the Bioreactor. During the initiation the reactor was in an aerobic state and Mn and Fe oxides and hydroxides were deposited sequestering some Zn. When the Bioreactor became anaerobic the Mn and later Fe was mobilized but the Zn was now bacterially sequestered as ZnS. Some of this was formed on the remaining FeOOH biofilm layers.

1. Introduction

This study was initiated to investigate the form of Zn that was attenuated in column tests and in the Galkeno 900 Bioreactor. The initial set of samples had been oven dried prior to making the polished thin sections. This set consisted of duplicate thin sections (A and B) from 6 samples from the upper, middle, and lower section of four column tests (samples #3-8) and of two other samples from the bioreactor sediments (Sherriff 2011a) .

A second set of samples were obtained during the decommissioning of the Bioreactor (BioR Sed., and GK900 Sed.) These samples were sent to Vancouver Petrographics in jars as slurries. They were air dried and immediately sealed in eposxy resin to preserve minerals that might be unstable in an oxidizing environment. Two thin sections were made of sample BioR (A and B) (Sherriff 2011b).

2. Methodology

Polished thin sections were made by Vancouver Petrographics. The thin sections were examined optically to determine overall composition and delineate areas of interest. Selected areas were imaged on the electron microprobe (EMP) at the University of Manitoba using back scattered electrons (BSE) and mapped for Mn, Fe, S, and Zn. Points of further interest were the quantitatively analyzed.

The microprobe was operated at an acceleration potential of 15 kV and a beam current of 3 nA measured on the Faraday cup, with a 1 μm diameter beam. The standards for the quantitative analysis were albite (Na), olivine (Mg), andalusite (Al), diopside (Si, Ca), pyrite (S , Fe), orthopyroxene (K), sphene (Ti), spessartine (Mn), pentlandite(Ni), chalcopyrite (Cu), Gahnite (Zn), cobaltite (As), barite (Ba), chromite (Cr), and galena (Pb). The results of quantitative point analyses are given in wt. % elements with oxygen added to the Mn coating analyses to balance the cations.

3. Results

3.1 FM Column Tests

Only samples #5A FM Peat Bottom and #8A FM Silt and Clay Bottom were analyzed using the electron microprobe. Under optical microscopy thin section #5A FM Peat Bottom showed just plant fragments in a red mud whereas thin sections 8A FM Silt and Clay Bottom had lithic grains in fine grained matrix. The results from the column samples were rather ambiguous. Small areas (~1μm) in sample 5A had high Zn and S with Zn:S molar ratio of about 1:1 indicating possible precipitation of sphalerite. Sample 8A had a thin black coating of Mn and Zn around lithic grains with an average concentration is 8.1 wt. % Mn and 1.2 wt. % Zn giving an average Mn:Zn molar ratio of 3.4 (Figure 1)

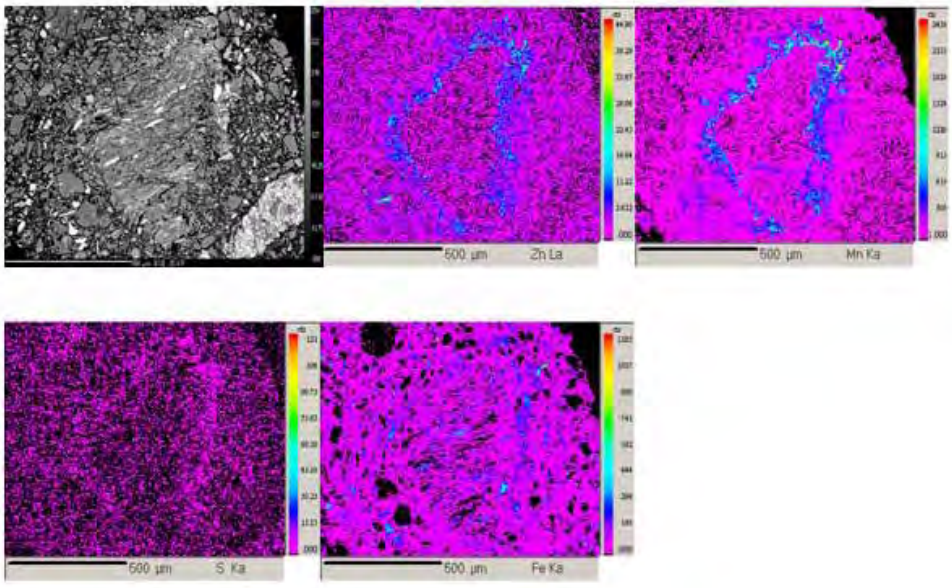


Figure 1: BSE images and element scans of Sample 8A FM Silt and Clay Bottom showing Mn and Zn rich coating around a lithic grain

3.2 Galkeno Bioreactor

The first set of Galkeno Bioreactor samples showed a few small areas that contained micron sized areas of Zn and S in a ratio of about 1:1indicating the presence of ZnS (Figure 2).

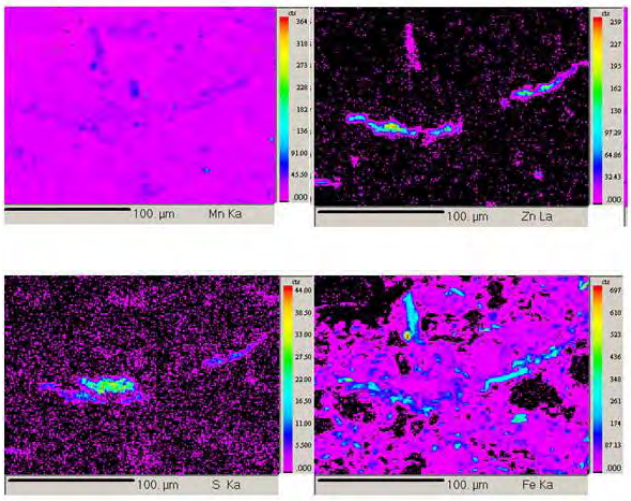


Figure 2: 1B G900 BIO BSE images and element maps

The second set of Galkena 900 samples (BioR Sediment and GK900 sediment) were kept under water and hence in an anaerobic environment until analyzed. These have a much higher concentration of micron sized ZnS grains, many of which formed bands indicating bacterial precipitation of sphalerite within a biofilm layer (Figure 3).

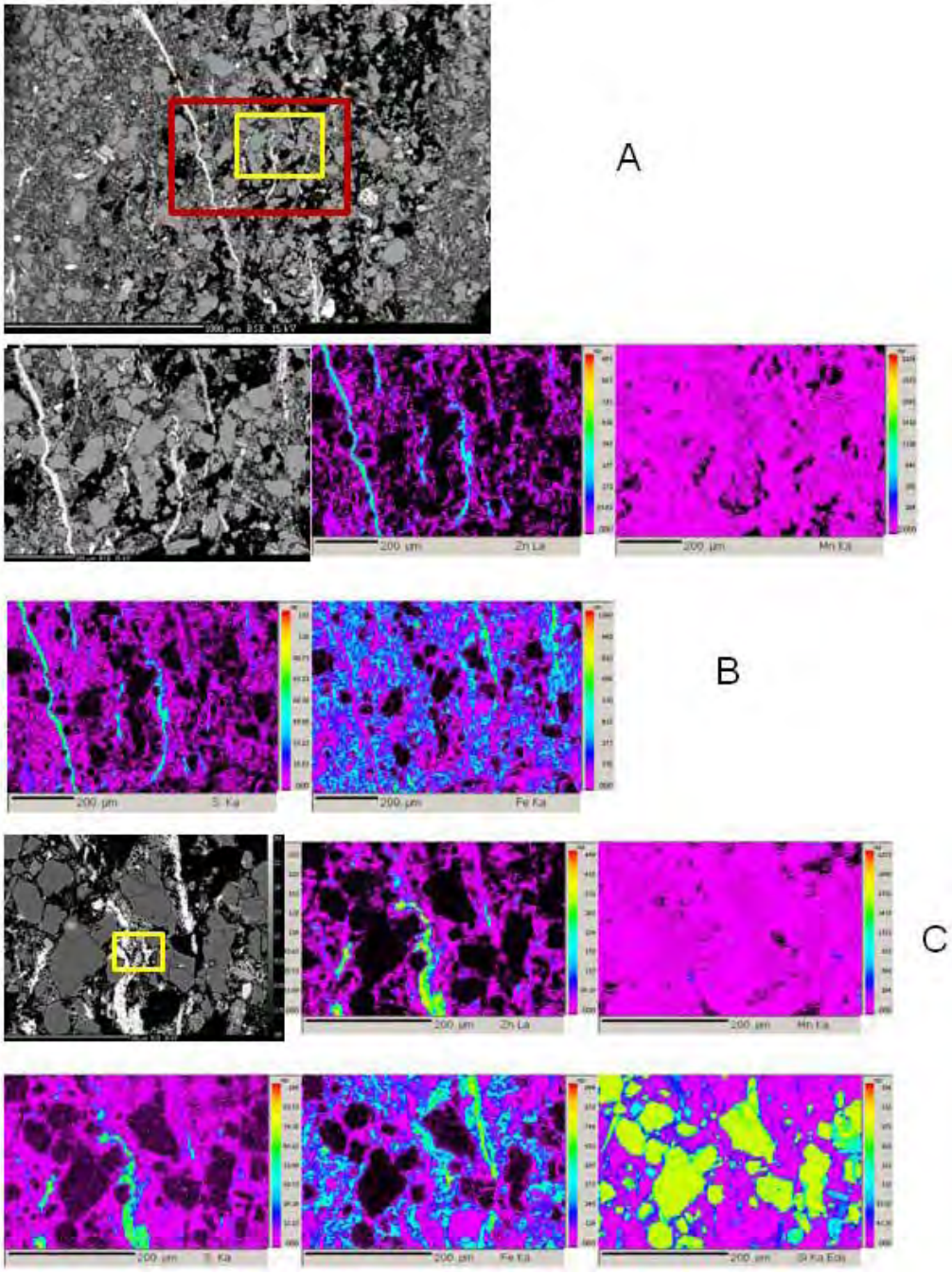


Figure 3 GK900 Bioreactor sample. (A) BSE image showing extensive bright bands of ZnS and Fe(B) BSE image and element scans of area in red box in (A) (C) BSE image and element scans of area yellow box in (A)

There were also areas containing Fe and Mn but not Zn or S (Figure 4). An elemental line scan across this area indicates regions rich in Zn and S adjacent to areas rich in Fe and Mn. Scatter plots of the quantitative analyses along the same line show that firstly Zn and S are related in atomic proportions of 1:1 (R^2 0.98) verifying the presence of sphalerite (ZnS) and secondly that Fe and Mn are precipitated together in a separate band (R^2 0.83). The concentrations of Mn are very low and there is no correlation between Fe and Zn or between Mn and Zn.

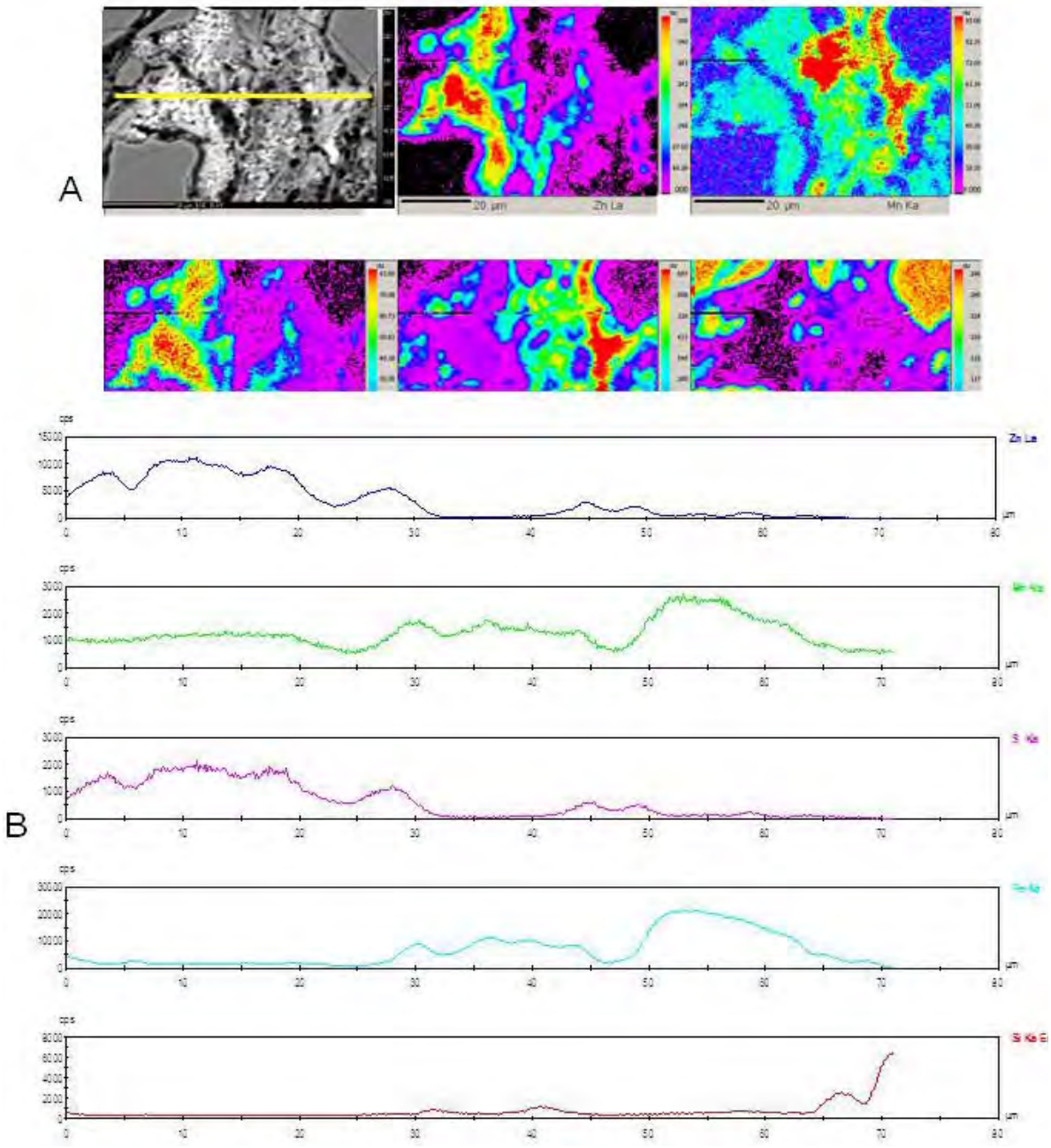


Figure 4: GK900. BSE image and element scans of area in yellow box in Figure 3 Element scans along the yellow line in BSE image (A)

In thin section BioR sediment A, a number of areas were imaged and mapped. A total of 160 points were selected within areas rich in Zn and S for quantitative analysis. In one area, two ZnS regions in the image have a thin band of Fe through the centre (Figure 5). The ZnS and Fe-rich bands were analyzed separately. A scatter plot of the concentrations of the ZnS band gives a 1:1 molar ratio of Zn to S indicating the presence of sphalerite. The Fe-rich bands have much lower concentrations of Zn and S and higher Fe and Mn. A plot of molar proportions of Zn and S indicates that there are still some grains of sphalerite in this region (Figure 5). In the Fe-rich band, there is a weak positive trend between the values of wt. % Fe and Mn (Figure 5).

Appendix 5 Preliminary Assessment of Performance of WRSA Closure Cover Systems, Okane Consulting 2015

O'Kane Consultants Inc.
Integrated Mine Waste Management and Closure Services
Specialists in Geochemistry and Unsaturated Zone Hydrology

March 30, 2015

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Ms. Fougere:

Re: Keno Hill Silver District – Preliminary Assessment of Performance for Closure Cover Systems for Waste Rock Storage Areas

O'Kane Consultants Inc. (OKC) was retained by Alexco Environmental Group (AEG) in February 2015 to provide technical support related to cover system designs for closure of waste rock storage areas (WRSAs) at the Keno Hill Silver District (KHSD) in the Yukon. This report outlines the project context, objectives, and work scope, followed by preliminary estimates of hydrological performance for three different cover system types.

Project Context, Objectives, and Work Scope:

Approximately 60 WRSAs exist within the KHSD, ranging from a few thousand tonnes from exploration trenches to 1.5 M tonnes. They are located in five different drainages; namely, Flat Creek, Christal Creek, No Cash, Sadie Ladue, and Lightning Creek. Based on previous characterization work, about 25 WRSAs have been prioritized for some type of re-contouring / cover / revegetation. Of those, about 10 WRSAs merit consideration of a lower net percolation cover system on some or all of the surfaces. Waste material in the WRSAs is not considered to be net acid-generating; the primary concern is metal leaching with Zn and Cd being of greatest concern. Much of the waste material is unmineralized quartzite or greenstones; the vein structures and schists are the primary sources of metal leaching and acidity. The surrounding peat landscape provides relatively good attenuation within a short migration flowpath.

The KHSD WRSAs are >30 years old and many have vegetation established on some or all of the surfaces. This is considerable time for generation of oxidation products, but on the same hand, the pore spaces have been flushed thoroughly as a result of percolating meteoric waters. Most WRSAs have angle-of-repose slopes on steeper slopes adjacent to adits. Considering the relatively low environmental impact to surface waters or groundwater from most WRSAs, it is difficult to justify the increased footprint, disturbance, and release of stored soluble load that a very low net percolation cover system would incur.

The currently planned end land-use for the reclaimed WRSAs is natural habitat (wilderness). Given this and the geochemical conditions of the waste materials, the primary design objectives of the KHSD WRSA closure cover systems are to:

a) provide an adequate rooting zone for growth of native plants;
b) eliminate dust emissions from the waste deposits;
c) prevent direct contact between waste material and incident meteoric waters; and
d) reduce net percolation rates and thus seepage flows to the greatest extent possible.

The overall objective of OKC's work was to develop conceptual-level or indicative cover system design alternatives for closure cover systems for WRSAs at KHSD. Specifically, AEG requires preliminary estimates of hydrological performance (i.e. long-term net percolation rates) and construction costs for three difference cover system types. This information is required to support an update to the KHSD ESM Reclamation Plan. Preliminary costs for remediation of the WRSAs were submitted to AEG in a separate memorandum.

The following tasks were completed to address the above project objectives:

- Project orientation including review of pertinent background information and participation in a project planning / kickoff meeting in Vancouver on February 19, 2015;
- Development of a conceptual model of hydrological performance of a typical soil cover system for the KHSD site;
- Base case numerical simulations of cover system performance using the soil-plant-atmosphere (SPA) model VADOSE/W[1];
- Provision of technical support on various matters related to cover system design; and
- Development of indicative-level cost estimates (-20% to +30%) for cover system construction.

Conceptual Model of Cover System Performance:

A conceptual model of hydrological performance of cover systems for KHSD was developed prior to the start of SPA numerical modelling. This required consideration of the following water balance fluxes:

- precipitation (Ppt),
- potential evapotranspiration (PET),
- actual evapotranspiration (AET),
- runoff (RO),
- sublimation (Sub), and
- net percolation (NP).

The mean annual precipitation (MAP) for the KHSD and how it is influenced by elevation was previously estimated by Clearwater Consultants in 1996 (Access, 1996)[2]. Clearwater Consultants developed a linear relationship between elevation and MAP:

$$MAP = 0.27 * Elev + 190$$

[1] Geo-Slope International Ltd. 2014. GeoStudio 2012. Version 8.14.1.10087. Online. www.geo-slope.com.

[2] Access Mining Consultants Ltd., 1996a. United Keno Hill Mines Limited, Site Characterization Report, Report No. UKH96/01. Prepared for United Keno Hill Mines Limited.

where:

MAP = mean annual precipitation (mm/yr); and

Elev = elevation above sea level (masl).

OKC performed their own review of the MAP estimate and found it reasonable. Hence, the equation above was used to estimate MAP. Three elevations were simulated for this project: 750 masl, 1,000 masl, and 1,500 masl. Hence, the MAP at each elevation is estimated to be 390 mm/yr, 460 mm/yr, and 530 mm/yr, respectively.

Given the relatively high latitude of KHSD, slope aspect and angle highly influences the amount of solar energy and resultant PET applied to various areas of the site (MEND, 2012)[3]. Hence, for an exposed plateau (i.e. a flat area with no slope influences) or east- or west-facing slope (referred to hereinafter as a middle aspect), average annual PET is estimated to be 370 mm/yr with an annual range from 200 mm/yr to 1,400 mm/yr. However, PET is estimated to be 60% less on north-facing aspects and 50% more on south-facing aspects, resulting in average annual PET rates for these two aspects of 150 mm/yr and 560 mm/yr, respectively.

In general, the ratio of annual AET to precipitation ranges from 40 to 60% for study areas similar to KHSD (Kane and Yang, 2004)[4]. This results in a typical AET:PET ratio of 50 to 70%. However, it must be noted that results for north or south aspects may be outside of the general ranges.

Runoff to precipitation ratios for northern sites typically have an increasing trend with increasing latitude (Kane and Yang, 2004). A runoff rate of 0 to 20% of precipitation is expected for KHSD given the latitude at which the site is located combined with the current knowledge of locally available materials and the range of vegetation conditions.

Sublimation and redistribution of snow constitutes a significant portion of the water balance in several seasonally snow-covered areas of the Canadian North such as KHSD (Pomeroy *et al.*, 1995)[5]. Snow interception and sublimation are important hydrological processes that occur as a result of complex mass and energy exchanges. Comparing KHSD to other northern sites at a similar latitude, a sublimation rate of 25 to 35% of annual snowfall is expected (Kane and Yang, 2004). This corresponds to a sublimation rate of approximately 10 to 15% of total annual precipitation.

NP is a vital component of the water balance for northern climates. Basic water balance accounting of the estimates supplied above leaves between 5 to 50% of precipitation available for NP for a middle aspect. NP is functionally halted during the winter months due to frozen ground conditions. In general, the majority of NP at the KHSD site occurs during spring-melt. Through the summer months, NP rates are lower due to the store and release function of a vegetated soil profile. NP rates generally increase in the fall due to lower PET rates.

[3] MEND (Mine Environment Neutral Drainage). 2012. Cold regions cover system design technical guidance document. Canadian Mine Environment Neutral Drainage Program, Project 1.61.5c, March.

[4] Kane, D. and Yang, D. 2004. Northern Research Basins Water Balance. International Association of Hydrological Sciences. Oxfordshire, United Kingdom.

[5] Pomeroy, J., Hedstrom, N., and Parvianinen., J. 1995. *The Snow Mass Balance of Wolf Creek, Yukon: Effects of Snow Sublimation and Redistribution*. National Hydrology Research Center. Environment Canada: Saskatoon.

Preliminary Estimates of Cover System Performance:

Cover Systems Modelled:

Four reclamation scenarios were evaluated with SPA models (see Figure 1); namely, three cover system types as well as a 'do-nothing' scenario (i.e. bare waste rock with no revegetation effort). A description of the modelled scenarios is as follows:

- *Type 1a – Very Low Net Percolation Cover System:* 0.3 m of compacted silty-clay material underlying a 1.0 m well-graded local soil layer. Surface re-graded to promote runoff, then revegetated with native plants;
- *Type 1b – Lower Net Percolation Cover System:* 0.3 m well-graded local soil layer. Surface re-graded to promote runoff, then revegetated with native plants;
- *Type 3 – Revegetation Cover System:* direct seeding of waste rock to promote revegetation (assumes sufficient fines content to support plant growth). Scarifying and contouring of surface to promote vegetation and enhance physical stability of landform.
- *Type 4 – Bare Waste Rock Surface:* no cover system or site preparation.

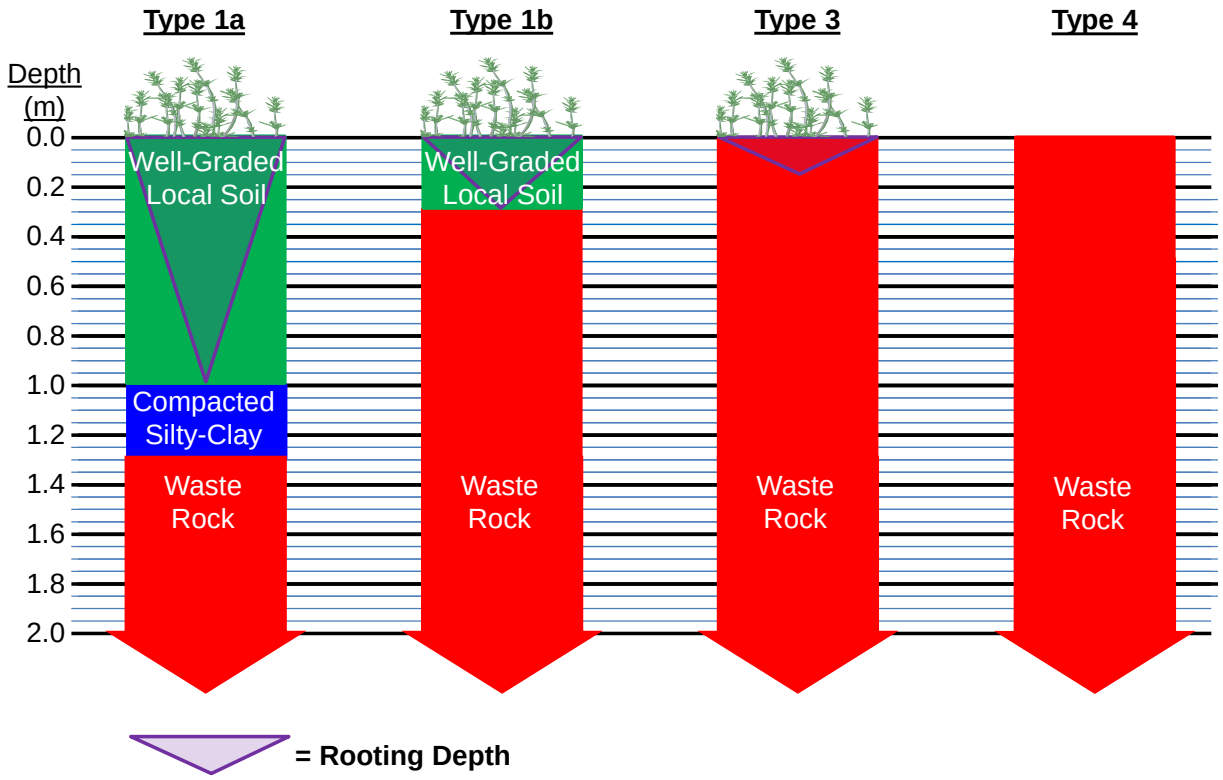


Figure 1 Schematic of four reclamation scenarios modelled for possible closure of WRSAs.

OKC was provided with particle size distribution (PSD) data for various potential borrow materials for cover system construction as well as waste rock materials. For the current SPA modelling program, OKC focused on PSD data for soil samples collected at the Husky site. OKC developed estimates of hydraulic material properties for a growth medium layer based on the following PSD, with the range of percentages for each particle size provide in parentheses:

- Gravel, cobbles, and boulders: 29% (13 to 36%);
- Sand: 32% (26 to 40%);
- Silt: 30% (18 to 40%); and
- Clay: 9% (6 to 14%).

A growth medium layer with the above average PSD is ideal for supporting plant growth as well as storing and releasing meteoric waters back to the atmosphere. However, a growth medium layer with a 39% fines content (i.e. material finer than 0.075 mm) could be susceptible to higher, and potentially unacceptable, rates of erosion and frost action, both of which could result in higher rates of net percolation. Frost action may not be an issue given the drained nature of most WRSAs and thus limited water supply in the subsurface to generate frost action. Nonetheless, some caution is required when evaluating potential borrow sources within or near the KHSD site for WRSA cover system construction; ideally, growth medium layers would consist of well-graded glacial till material with a fines content in the range of 20 to 35%.

Key Inputs and Assumptions:

The inputs into a SPA model can be divided into five categories; namely, geometry, lower and edge boundary conditions, initial conditions, material properties, and upper boundary conditions.

All the models simulated a one-metre-wide column of waste rock overlain with one of the four reclamation scenarios described above. The base of the waste rock was simulated as a unit hydraulic gradient, with the edges of the models simulated as no flow boundaries (i.e. no lateral flows) to simulate a one-dimensional (1D) system. The initial model profiles were started at a constant pressure head of -2 m. Waste rock below a depth of 1.5 m was set at a constant temperature of 2°C so that permafrost would not form in the models. It is presumed that discontinuous permafrost exists at some locations on the KHSD site, particularly at higher elevations and for north-facing slopes; hence, net percolation rates estimated by the SPA models and presented herein are conservative for areas with discontinuous permafrost.

Three materials were defined for SPA modelling; namely, waste rock, well-graded local soil, and compacted silty-clay soil. The required properties or functions for each material are as follows:

- water retention curve (WRC - suction versus volumetric water content);
- hydraulic conductivity function (k-function - suction versus hydraulic conductivity);
- thermal conductivity function (volumetric water content versus thermal conductivity); and
- volumetric specific heat function (volumetric water content versus volumetric specific heat).

Hydraulic properties (i.e. WRCs and k-functions) for each of these materials were estimated by comparing previously measured PSDs and other geotechnical properties to materials in the SoilVision[6] and OKC material databases with similar geotechnical and known hydraulic properties. The hydraulic properties from the databases were compared with those previously measured for each material and found to be similar. Each material was then defined using the van Genuchten[7] or Durner[8] method. A summary of the hydraulic properties estimated for the three materials is provided in Table 1. The thermal properties were estimated using modules included in the VADOSE/W software.

[6] SoilVision Systems Ltd., 2005. Software. SoilVision 4.23. www.soilvision.com
[7] van Genuchten, M. Th., A closed-form equation for predicting the hydraulic conductivity of unsaturated soils, Soil Sci. Soc. Am. J., 44, 892-898, 1980.
[8] Durner, W., Hydraulic conductivity estimation for soils with heterogeneous pore structure, Water Resour. Res., 32(9), 211-223, 1994.

Table 1
Summary of key properties for materials included in the SPA modelling program.

Material Type	k_{sat} (cm/s)	Porosity (m^3/m^3)	Residual VWC (m^3/m^3)	Van Genuchten or Durner parameters							
				w1	a1 (cm^{-1})	n1	m1	w2	a2 (cm^{-1})	n2	m2
Waste rock	$1.0X10^{-1}$	0.28	0.0	0.5	1.0	1.35	0.26	0.5	20	4.0	0.75
Well-graded local soil	$5.0X10^{-5}$	0.33	0.0	-	$3X10^{-4}$	1.25	0.20	-	-	-	-
Compacted silty-clay	$1.0X10^{-7}$	0.40	.0.0	-	$1X10^{-4}$	1.15	0.13	-	-	-	-

The upper boundary conditions can be divided into two parts: climate and vegetation. To define the climate for KHSD, a synthetic 80-year climate database was developed by comparing measurements from the Galena Hill weather station (also referred to as the Calumet weather station) to measurements taken at the Environment Canada weather station in Mayo, YT, between 2007 and 2012. Based on this comparison, the Mayo climate data from 1934 to 2012 were adjusted to represent conditions at Galena Hill. Climate data from Galena Hill were also compared to the Valley Tailings and Flame and Moth weather stations to determine additional variations required to account for elevation. These comparisons indicated that only precipitation needed to be varied with elevation using the linear relationship provided in the conceptual model section. Finally, potential evaporation rates were estimated for three slope aspects (i.e. north, south, and middle aspect). Table 2 provides the monthly average climate estimated for the KHSD site.

Table 2
Monthly average values for the 80-year synthetic climate database developed for the KHSD site.

Month	Temperature (°C)		RH (%)	Precipitation (mm) for each Elevation (masl)			Wind Speed (m/s)	Potential Evapotranspiration (mm) for each Aspect		
	High	Low	%	750	1,000	1,250		North	Middle	South
January	-22	-26	80	27	32	37	1.6	0	0	0
February	-16	-21	79	23	27	31	1.8	0	0	0
March	-8	-15	76	21	24	28	2.3	0	0	0
April	2	-3	73	19	23	26	2.3	0	5	10
May	10	4	64	29	34	40	2.2	30	70	100
June	16	9	70	41	49	56	1.8	40	95	140
July	17	10	73	51	60	69	1.8	40	100	150
August	14	7	77	48	56	65	1.8	30	70	105
September	7	2	79	39	46	53	1.6	10	30	50
October	-3	-5	84	34	40	46	1.6	0	0	5
November	-15	-17	85	30	35	41	1.6	0	0	0
December	-21	-24	83	28	34	39	1.0	0	0	0
Annual	*-1*	*-7*	*77*	*390*	*460*	*530*	*1.8*	*150*	*370*	*560*

Vegetation was simulated as grasses and shrubs, with each growing season starting seven days following spring-melt and ending when daily low air temperatures consistently stay below 0°C. The vegetation was simulated as having a rooting depth the thickness of the well-graded local soil layer or 0.15 cm for the bare waste rock scenario. The vegetation was estimated to have a maximum ground cover of 50%. Vegetation was assumed to have its transpiration rate limited when the suction within the growth material increased above 100 kPa. Transpiration was estimated to cease when suction conditions in the growth material increased above 1,500 kPa.

Key Modelling Results:

Tables 3 provides average annual, long-term water balance fluxes for all the model scenarios completed for this project. All modelling completed for this project used the computer modelling program VADOSE/W[9]. The estimated net percolation rates are summarized in Figure 2. It must be emphasized that the values provided in Table 3 and Figure 2 are averages; the components of the water balance will vary greatly from year-to-year, and during any given year. For example, RO averages 175 mm/yr for the Type 1a cover system at 1,000 masl, but ranges from 40 to 360 mm/yr with most of the RO occurring during spring-melt.

Practical Construction Issues for Consideration:

The current stage of this project is to provide conceptual or indicative-level design details for reclamation of the KHSD WRSAs. However, based on OKC's experience with cover system design and performance in cold regions, the following guidelines are provided for consideration as the state of the WRSA closure cover system designs progresses:

- Avoid north-facing slopes to the greatest extent possible due to higher available waters for net percolation.
- Different moisture regimes will exist on south and north slopes; therefore, use natural analogues at site to determine revegetation plans for different slope aspects.
- North slopes should be steeper than south slopes to promote additional runoff and thus reduce net percolation; however, this needs to be balanced against the potential for soil erosion.
- Drainage channels, particularly bench / lateral channels, should be avoided on north slopes to the greatest extent possible due to higher potential for glaciation (this is the formation of ice features in a drainage course as defined in MEND (2012)).
- Plateau catchments should not drain to the north to avoid potential effects of glaciation.
- Coarser-textured materials are preferred on north slopes to reduce potential for solifluction (i.e. silts and clays are more prone to solifluction due to higher water retention).

[9] Geo-Slope International Ltd. 2014. GeoStudio 2012. Version 8.14.1.10087. Online. www.geo-slope.com.

Table 3
Summary of average annual water balance fluxes for 80-year model scenarios.

Aspect	Elevation / PPT (masl / mm/yr)	Reclamation Scenario	Water Balance Flux as Percent of PPT (mm/yr in brackets)			
			Sub	RO	AET	NP
North	750 / 390	1a	5% (60)	30% (117)	33% (130)	21% (83)
		1b	16% (61)	5% (21)	33% (128)	46% (180)
		3	16% (61)	1% (4)	32% (126)	51% (199)
		4	16% (61)	1% (4)	27% (105)	56% (220)
	1,000 / 460	1a	14% (62)	38% (175)	27% (125)	21% (98)
		1b	14% (62)	4% (20)	27% (124)	55% (254)
		3	14% (62)	1% (4)	26% (122)	59% (272)
		4	13% (61)	1% (3)	22% (103)	64% (293)
	1,250 / 530	1a	12% (61)	45% (241)	22% (119)	20% (109)
		1b	12% (62)	4% (20)	22% (118)	62% (329)
		3	12% (62)	1% (4)	22% (116)	66% (347)
		4	12% (62)	1% (4)	19% (100)	69% (364)
Middle	750 / 390	1a	16% (61)	9% (35)	73% (283)	3% (12)
		1b	16% (61)	3% (10)	67% (261)	15% (58)
		3	16% (61)	1% (3)	57% (221)	27% (105)
		4	16% (61)	1% (3)	51% (199)	33% (128)
	1,000 / 460	1a	14% (62)	18% (84)	62% (285)	6% (29)
		1b	14% (62)	3% (13)	58% (269)	25% (117)
		3	14% (62)	1% (3)	50% (228)	36% (167)
		4	14% (62)	1% (3)	44% (204)	41% (191)
	1,250 / 530	1a	12% (63)	27% (141)	53% (278)	9% (48)
		1b	12% (62)	3% (15)	50% (266)	35% (186)
		3	12% (62)	1% (4)	43% (230)	44% (234)
		4	12% (62)	1% (4)	39% (206)	49% (258)
South	750 / 390	1a	16% (61)	5% (19)	78% (306)	1% (4)
		1b	16% (61)	2% (10)	73% (284)	9% (35)
		3	16% (61)	1% (3)	63% (244)	21% (82)
		4	16% (61)	1% (3)	57% (224)	26% (103)
	1,000 / 460	1a	14% (62)	10% (46)	74% (341)	2% (11)
		1b	14% (62)	2% (10)	67% (305)	18% (83)
		3	14% (62)	1% (3)	56% (257)	30% (138)
		4	14% (62)	1% (3)	51% (236)	35% (159)
	1,250 / 530	1a	12% (62)	18% (95)	67% (356)	3% (16)
		1b	12% (62)	2% (10)	61% (322)	25% (135)
		3	12% (62)	1% (4)	50% (265)	38% (199)
		4	12% (62)	1% (3)	46% (244)	42% (220)
Conceptual Model*			10% - 15%	0% - 20%	40% - 60%	5% - 50%

*Conceptual model is based on general water balances for the area; hence, more comparable to middle aspects.

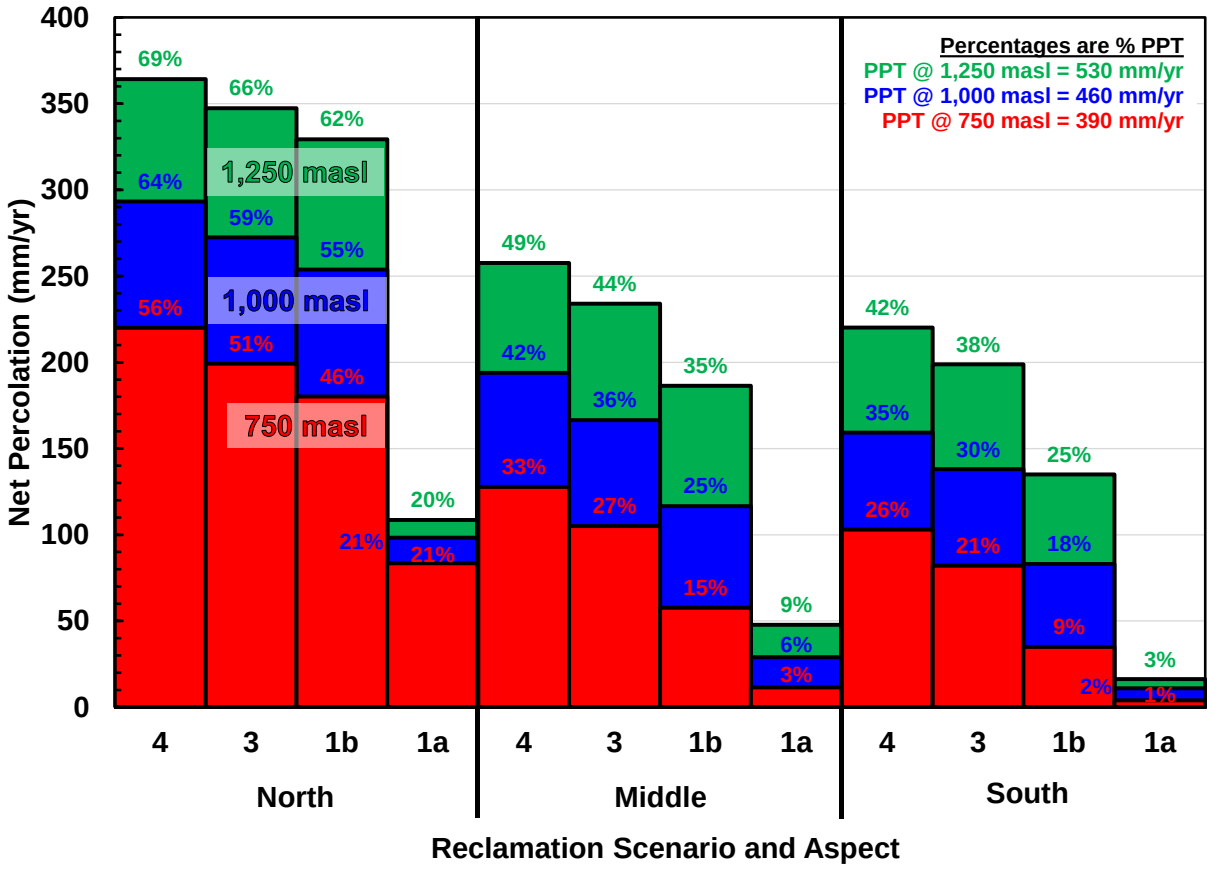


Figure 2 Annual average net percolation rates estimated for range of reclamation scenarios, elevations, and slope aspects.

The following issues should be taken into consideration when developing final landforms for larger WRSAs:

- The maximum slope recommended to support construction and long-term sustainability of a barrier layer such as a compacted silty-clay layer is 3H:1V.
- Slopes to support a simpler cover system can be steeper (e.g. range of 2H:1V to 2.5H:1V), but the potential for soil erosion to occur should be considered, which is generally a function of slope length, vegetation type and time to establishment, rainfall intensities, and texture of surface material.
- Concave slopes are preferred over linear slopes, and most definitely over a benched-landform slope profile.
- Upper slopes can be steeper and coarser-textured, while lower slopes can be flatter and finer-textured, if material availability / balancing requires this flexibility.
- A cover system profile can be thinner in upper slopes, but must be thick enough to support growth of the anticipated climax vegetation species.
- Plateau surface waters must never be allowed to discharge over the crest of a slope without a properly engineered channel.
- A common location for failure of drainage channels is where plateau channels transition to slope channels; an intermediate-slope is recommended at these locations with additional riprap protection.

Closure:

Thank you for the opportunity to assist AEG with closure planning at the KHSD site. Please do not hesitate to contact the undersigned should you have any questions or comments.

Sincerely yours,



Brian Ayres, M.Sc., P.Eng.
Senior Geotechnical Engineer / Chief Operating Officer

cc: Linda Broughton – Alexco Environmental Group
Robert Shurniak and Mike O'Kane – O'Kane Consultants Inc.

Appendix 6 Kinetic Testing Results for Bellkeno Tailings

Description	Sample Date	Sample Comments	Total Volume In	Total Volume Out	Total Acidity	pH (lab)	Specific Conductance (lab)	Hardness (from dissolved)	Alkalinity, total	Chloride	Fluoride	Bromide	Sulphate, dissolved	Nitrite (N)	Nitrate (N)	Aluminum (Al), dissolved	Antimony (Sb), dissolved	Arsenic (As), dissolved	Barium (Ba), dissolved	Beryllium (Be), dissolved	Bismuth (Bi), dissolved	Boron (B), dissolved	Cadmium (Cd), dissolved	Calcium (Ca), dissolved	Chromium (Cr), dissolved	Cobalt (Co), dissolved	Copper (Cu), dissolved	Iron (Fe), dissolved	Lead (Pb), dissolved	Lithium (Li), dissolved	Magn
			mL	mL	mg/L	pH units	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Type A WUL QZ09-092 BK EQS-DM						6.5-9.5											0.1						0.01					0.1		0.2	
Bellekeno Mill Tailings Humidity Cell	17/08/2011	Week 0	750	550	5.0	7.89	1950	43.0	15.6	0.354	<0.050	1150	0.0845	10.1	<0.010	0.0230	0.00081	0.0985	<0.00020	<0.0010	0.166	**0.0264**	439	<0.0010	0.00155	0.0049	<0.030	0.192	0.0608	17.3
Bellekeno Mill Tailings Humidity Cell	24/08/2011	Week 1	500	460	4.8	7.70	1050	45.0	7.4	0.37	<0.50	513	0.089	3.36	<0.010	0.0241	0.00195	0.0560	<0.00020	<0.0010	0.157	**0.0216**	217	<0.0010	0.00089	<0.0010	<0.030	0.161	0.0495	10.6
Bellekeno Mill Tailings Humidity Cell	31/08/2011	Week 2	500	460	5.8	7.86	1050	68.3	<5.0	0.34	<0.5	595	0.011	<0.050	<0.010	0.0222	0.00248	0.0372	<0.00020	<0.0010	0.185	**0.0339**	240	<0.0010	0.00289	<0.0010	<0.030	0.137	0.0488	10.3
Bellekeno Mill Tailings Humidity Cell	07/09/2011	Week 3	500	450	10.9	7.81	822	64.5	<5.0	0.34	<0.50	455	<0.010	<0.050	<0.0050	0.0178	0.00150	0.0359	<0.00010	<0.00050	0.117	**0.0292**	192	<0.00050	0.00318	<0.00050	<0.030	0.104	0.0269	6.94
Bellekeno Mill Tailings Humidity Cell	14/09/2011	Week 4	500	450	5.0	7.91	648	49.6	<0.50	0.288	<0.050	320	0.0064	0.0148	<0.0050	0.0159	0.00139	0.0387	<0.00010	<0.00050	0.075	**0.0228**	150	<0.00050	0.00179	<0.00050	<0.030	0.111	0.0196	4.64
Bellekeno Mill Tailings Humidity Cell	21/09/2011	Week 5	500	475	3.4	7.81	553	62.7	<0.50	0.270	<0.050	248	<0.0010	0.0065	<0.0050	0.0166	0.00104	0.0347	<0.00010	<0.00050	0.076	**0.0263**	119	<0.00050	0.00198	<0.00050	<0.030	0.128	0.0162	3.70
Bellekeno Mill Tailings Humidity Cell	28/09/2011	Week 6	500	435	5.6	7.91	523	68.4	<0.50	0.254	<0.050	230	0.0036	0.0096	<0.0050	0.0159	0.00079	0.0371	<0.00010	<0.00050	0.054	**0.0249**	121	<0.00050	0.00200	<0.00050	<0.030	0.123	0.0113	2.89
Bellekeno Mill Tailings Humidity Cell	05/10/2011	Week 7	500	485	7.1	7.86	415	78.3	<0.50	0.208	<0.050	158	0.0046	0.0052	<0.0050	0.0160	0.00091	0.0381	<0.00010	<0.00050	0.037	**0.0205**	90.3	<0.00050	0.00150	<0.00050	<0.030	0.0971	0.00832	1.89
Bellekeno Mill Tailings Humidity Cell	12/10/2011	Week 8	500	475	7.2	7.84	463	73.7	<0.50	0.183	<0.050	189	<0.0010	<0.0050	0.0219	0.0164	0.00080	0.0395	<0.00010	<0.00050	0.134	**0.0294**	101	<0.00050	0.00223	<0.00050	<0.030	0.0956	0.00740	2.05
Bellekeno Mill Tailings Humidity Cell	19/10/2011	Week 9	500	450	6.3	7.79	435	73.9	<0.50	0.164	<0.050	172	0.0016	<0.0050	<0.0050	0.0154	0.00080	0.0368	<0.00010	<0.00050	0.029	**0.0292**	94.3	<0.00050	0.00200	<0.00050	<0.030	0.107	0.00656	1.71
Bellekeno Mill Tailings Humidity Cell	26/10/2011	Week 10	500	500	10.4	7.91	438	72.1	<0.50	0.161	<0.050	181	0.0012	0.0070	<0.0050	0.0155	0.00083	0.0389	<0.00010	<0.00050	0.025	**0.0333**	100	<0.00050	0.00223	<0.00050	<0.030	0.104	0.00592	1.67
Bellekeno Mill Tailings Humidity Cell	02/11/2011	Week 11	500	460	5.1	7.83	428	75.6	<0.50	0.179	<0.050	184	0.0043	0.0066	<0.0050	0.0152	0.00078	0.0371	<0.00010	<0.00050	0.024	**0.0328**	94.2	<0.00050	0.00219	<0.00050	<0.030	0.0985	0.00589	1.46
Bellekeno Mill Tailings Humidity Cell	09/11/2011	Week 12	500	460	6.2	7.85	359	71.3	<0.50	0.138	<0.050	128	0.0046	0.0064	<0.0050	0.0141	0.00075	0.0397	<0.00010	<0.00050	0.019	**0.0272**	79.2	<0.00050	0.00164	<0.00050	<0.030	0.0893	0.00417	1.09
Bellekeno Mill Tailings Humidity Cell	16/11/2011	Week 13	500	480	7.5	7.91	408	71.7	<0.50	0.125	<0.050	159	0.0052	0.0062	<0.0050	0.0146	0.00087	0.0441	<0.00010	<0.00050	0.018	**0.0329**	94.6	<0.00050	0.00213	0.00050	<0.030	0.0894	0.00426	1.28
Bellekeno Mill Tailings Humidity Cell	23/11/2011	Week 14	500	450	5.8	7.87	362	72.3	<0.50	0.124	<0.050	129	0.0056	0.0141	<0.0050	0.0145	0.00076	0.0397	<0.00010	<0.00050	0.015	**0.0318**	79.7	<0.00050	0.00183	0.00062	<0.030	0.0927	0.00365	1.04
Bellekeno Mill Tailings Humidity Cell	30/11/2011	Week 15	500	475	7.7	7.95	374	72.4	<0.50	0.113	<0.050	138	0.0046	0.0061	<0.0050	0.0142	0.00084	0.0417	<0.00010	<0.00050	0.017	**0.0342**	80.6	<0.00050	0.00194	0.00074	<0.030	0.0918	0.00339	1.09
Bellekeno Mill Tailings Humidity Cell	07/12/2011	Week 16	500	470	4.8	7.90	362	72.7	<0.50	0.111	<0.050	130	0.0040	<0.0050	<0.0050	0.0130	0.00083	0.0415	<0.00010	<0.00050	0.015	**0.0351**	80.6	<0.00050	0.00188	0.00078	<0.030	0.0886	0.00291	1.00
Bellekeno Mill Tailings Humidity Cell	14/12/2011	Week 17	500	450	5.7	7.83	341	71.2	<0.50	0.174	<0.050	119	0.0069	0.0101	<0.0050	0.0129	0.00082	0.0389	<0.00010	<0.00050	0.012	**0.0343**	79.5	<0.00050	0.00173	0.00056	<0.030	0.0852	0.00267	0.904
Bellekeno Mill Tailings Humidity Cell	21/12/2011	Week 18	500	460	7.8	7.93	397	64.9	<0.50	0.097	<0.050	129	0.0054	0.0137	<0.0050	0.0130	0.00089	0.0427	<0.00010	<0.00050	0.014	**0.0372**	76.7	<0.00050	0.00175	0.00073	<0.030	0.0830	0.00280	0.974
Bellekeno Mill Tailings Humidity Cell	28/12/2011	Week 19	500	410	6.2	7.95	512	58.2	<0.50	0.106	<0.050	194	0.0049	<0.0050	<0.0050	0.0124	0.00092	0.0465	<0.00010	<0.00050	0.013	**0.0391**	102	<0.00050	0.00184	<0.00050	<0.030	0.0794	0.00297	1.28
Bellekeno Mill Tailings Humidity Cell	04/01/2012	Week 20	500	445	7.1	7.88	525	48.7	<0.50	0.111	<0.050	206	0.0026	0.0061	<0.0050	0.0107	0.00076	0.0450	<0.00010	<0.00050	0.011	**0.0465**	103	<0.00050	0.00188	<0.00050	<0.030	0.0943	0.00282	1.39
Bellekeno Mill Tailings Humidity Cell	11/01/2012	Week 21	500	425	6.2	7.84	505	62.8	<0.50	0.108	<0.050	193	0.0056	0.0100	<0.0050	0.00990	0.00084	0.0431	<0.00010	<0.00050	0.010	**0.0485**	104	<0.00050	0.00201	0.00059	<0.030	0.0898	0.00284	1.45
Bellekeno Mill Tailings Humidity Cell	18/01/2012	Week 22	500	420	6.2	7.84	472	66.3	<0.50	0.098	<0.050	175	0.0045	0.0096	<0.0050	0.00986	0.00098	0.0413	<0.00010	<0.00050	0.011	**0.0479**	97.4	<0.00050	0.00209	0.00099	<0.030	0.0966	0.00252	1.28
Bellekeno Mill Tailings Humidity Cell	25/01/2012	Week 23	500	490	8.8	7.89	435	66.1	<0.50	0.101	<0.050	148	0.0025	0.0076	<0.0050	0.0103	0.00145	0.0464	<0.00010	<0.00050	<0.010	**0.0528**	85.3	<0.00050	0.00241	0.00101	<0.030	0.0898	0.00247	1.28
Bellekeno Mill Tailings Humidity Cell	01/02/2012	Week 24	500	425	4.1	7.97	409	58.2	<0.50	0.092	<0.050	141	0.0052	0.0104	<0.0050	0.00943	0.00110	0.0407	<0.00010	<0.00050	<0.010	**0.0433**	83.5	<0.00050	0.00195	0.00082	<0.030	0.0809	0.00238	1.07
Bellekeno Mill Tailings Humidity Cell	08/02/2012	Week 25	500	475	6.8	7.91	410	58.2	<0.50	0.094	<0.050	141	0.0074	0.0091																	
Bellekeno Mill Tailings Humidity Cell	15/02/2012	Week 26	500	425	8.8	7.89	410	61.9	<0.50	0.082	<0.050	142	0.0021	0.0060	<0.0050	0.00910	0.00126	0.0415	<0.00010	<0.00050	<0.010	**0.0515**	80.9	<0.00050	0.00240	0.00208	<0.030	0.0781	0.00234	1.03
Bellekeno Mill Tailings Humidity Cell	22/02/2012	Week 27	500	500	5.3	7.86	345	53.6	<0.50	0.077	<0.050	116	0.0017	<0.0050																	
Bellekeno Mill Tailings Humidity Cell	29/02/2012	Week 28	500	450	10.8	7.94	407	61.9	<0.50	0.080	<0.050	140	0.0013	<0.0050	<0.0050	0.00901	0.00131	0.0418	<0.00010	<0.00050	<0.010	**0.0497**	81.4	<0.00050	0.00254	0.00158	<0.030	0.0871	0.00231	0.999
Bellekeno Mill Tailings Humidity Cell	07/03/2012	Week 29	500	460	5.4	7.91	382	65.5	<0.50	0.080	<0.050	124	0.0015	0.0063																	
Bellekeno Mill Tailings Humidity Cell	14/03/2012	Week 30	500	475	7.4	7.85	344	64.8	<0.50	0.080	<0.050	109	0.0019	0.0074	<0.0050	0.00812	0.00155	0.0393	<0.00010	<0.00050	<0.010	**0.0491**	62.1	<0.00050	0.00256	0.00192	<0.030	0.0779	0.00172	0.862
Bellekeno Mill Tailings Humidity Cell	21/03/2012	Week 31	500	500	8.3	7.94	351	59.8	<0.50	0.073	<0.050	112	0.0014	0.0085																	
Bellekeno Mill Tailings Humidity Cell	28/03/2012	Week 32	500	470	9.0	7.91	369	54.9	<0.50	0.071	<0.050	122	0.0017	0.0095	<0.0050	0.00817	0.00129	0.0424	<0.00010	<0.00050	<0.010	**0.0486**	67.0	<0.00050	0.00268	0.00240	<0.030	0.0847	0.00184	0.987
Bellekeno Mill Tailings Humidity Cell	04/04/2012	Week 33	500	425	11.5	7.93	383	57.1	<0.50	0.071	<0.050	131	0.0019	0.0056								**0.0498**									
Bellekeno Mill Tailings Humidity Cell	11/04/2012	Week 34	500	480	6.9	7.79	322	49.0	<0.50	0.059	<0.050	102	0.0018	0.0057	<0.0050	0.00804	0.00168	0.0388	<0.00010	<0.00050	<0.010	**0.0538**	58.2	<0.00050	0.00277	0.00225	<0.030	0.0834	0.00099	0.939
Bellekeno Mill Tailings Humidity Cell	18/04/2012	Week 35	500	455	10.3	7.92	341	61.2	<0.50	0.068	<0.050	112	0.0010	<0.0050								**0.0604**									
Bellekeno Mill Tailings Humidity Cell	25/04/2012	Week 36	500	475	15.0	7.91	332	58.8	<0.50	0.067	<0.050	106	0.0014	0.0069	<0.0050	0.00749	0.00145	0.0419	<0.00010	<0.00050	<0.010	**0.0485**	67.9	<0.00050	0.00299	0.00315	<0.030	0.0850	0.00162	1.12
Bellekeno Mill Tailings Humidity Cell	02/05/2012	Week 37	500	475	12.8	7.89	309	49.2	<0.50	0.059	<0.050	94.3	0.0012	<0.0050								**0.0564**									
Bellekeno Mill Tailings Humidity Cell	09/05/2012	Week 38	500	500	8.0	7.85	294	55.3	<0.50	0.050	<0.050	88.7	<0.0010	0.0194	<0.0050	0.00858	0.00154	0.0408	<0.00010	<0.00050	<0.010	**0.0525**	55.3	<0.00050	0.00307	0.00261	<0.030	0.0926	0.00148	1.02
Bellekeno Mill Tailings Humidity Cell	16/05/2012	Week 39	500	455	6.2	7.88	330	49.3	<0.50	0.058	<0.050	108	<0.0010	0.0061								**0.0505**									
Bellekeno Mill Tailings Humidity Cell	23/05/2012	Week 40	500	485	8.8	7.80	299	57.9	<0.50	0.052	<0.050	92.9	<0.0010	0.0054	<0.0050	0.00770	0.00160	0.0446	<0.00010	<0.00050	<0.010	**0.0596**	53.9	<0.00050	0.00350	0.00241	<0.030	0.0831	0.00207	1.32
Bellekeno Mill Tailings Humidity Cell	30/05/2012	Week 41	500	495	14.9	7.86	299	55.5	<0.50	0.050	<0.050	90.9	<0.0010	0.0067								**0.0614**									
Bellekeno Mill Tailings Humidity Cell	06/06/2012	Week 42	500	490	14.3	7.80	292	62.8	<0.50	0.048	<0.050	87.4	0.0019	<0.0050	<0.0050	0.00800	0.00168	0.0465	<0.00010	<0.00050	<0.010	**0.0611**	56.6	<0.00050	0.00402	0.00315	<0.030	0.0867	0.00093	1.43
Bellekeno Mill Tailings Humidity Cell	13/06/2012	Week 43	500	475	8.7	7.91	281	58.8	<0.50	0.044	<0.050	81.8	0.0018	<0.0050								**0.0614**									
Bellekeno Mill Tailings Humidity Cell	20/06/2012	Week 44	500	475	7.7	7.90	277	48.5	<0.50	0.041	<0.050	82.7	<0.0010	<0.0050	<0.0050	0.00729	0.00137	0.0468	<0.00010	<0.00050	<0.010	**0.0481**	52.8	<0.00050	0.00360	0.00261	<0.030	0.0875	0.00165	1.46
Bellekeno Mill Tailings Humidity Cell	27/06/2012	Week 45	500	475	12.9	7.93	274	47.4	<0.50	0.037	<0.050	82.3	0.0013	<0.0050								**0.0493**									
Bellekeno Mill Tailings Humidity Cell	04/07/2012	Week 46	500	470	5.3	7.87	271	49.1	<0.50	0.038	<0.050	79.9	0.0019	<0.0050	<0.0050	0.00719	0.00141	0.0479	<0.00010	<0.00050	<0.010	**0.0513**	51.2	<0.00050	0.00407	0.00311	<0.030	0.0901	0.00158	1.54
Bellekeno Mill Tailings Humidity Cell	11/07/2012	Week 47	500	475	6.8	7.87	270	56.2	<0.50	0.040	<0.050	78.0	0.0012	0.0150								**0.0596**									
Bellekeno Mill Tailings Humidity Cell	18/07/2012	Week 48	500	475	14.9	7.92	256	57.4	<0.50	0.033	<0.050	75.6	<0.0010	<0.0050	<0.0050	0.00753	0.00169	0.0509	<0.00010	<0.00050	<0.010	**0.0601**	50.2	<0.00050	0.00446	0.00463	<0.030	0.0860	0.00155	1.51
Bellekeno Mill Tailings Humidity Cell	25/07/2012	Week 49	500	480	6.2	7.91	260	59.1	<0.50	0.035	<0.050	74.4	0.0016	<0.0050								**0.0582**									

Description	Sample Date	Sample Comments	Total Volume In	Total Volume Out	Total Acidity	pH (lab)	Specific Conductance (lab)	Hardness (from dissolved)	Alkalinity, total	Chloride	Fluoride	Bromide	Sulphate, dissolved	Nitrite (N)	Nitrate (N)	Aluminum (Al), dissolved	Antimony (Sb), dissolved	Arsenic (As), dissolved	Barium (Ba), dissolved	Beryllium (Be), dissolved	Bismuth (Bi), dissolved	Boron (B), dissolved	Cadmium (Cd), dissolved	Calcium (Ca), dissolved	Chromium (Cr), dissolved	Cobalt (Co), dissolved	Copper (Cu), dissolved	Iron (Fe), dissolved	Lead (Pb), dissolved	Lithium (Li), dissolved	Magn
			mL	mL	mg/L	pH units	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Type A WUL QZ09-092 BK EQS-DM						6.5-9.5												0.1					0.01						0.1		0.2	
Bellekeno Mill Tailings Humidity Cell	01/08/2012	Week 50	500	475	7.6	7.88	245	51.4	<0.50	0.031	<0.050	68.4	<0.0010	<0.0050	<0.0050	0.00729	0.00185	0.0487	<0.00010	<0.00050	0.011	**0.0578**	48.7	<0.00050	0.00458	0.00341	<0.030	0.0800	0.00194	1.27
Bellekeno Mill Tailings Humidity Cell	08/08/2012	Week 51	500	475	7.5	7.89	265	61.6	<0.50	0.032	<0.050	73.8	<0.0010	0.0128								**0.0638**									
Bellekeno Mill Tailings Humidity Cell	15/08/2012	Week 52	500	470	8.6	7.93	254	55.3	<0.50	0.031	<0.050	70.7	0.0012	<0.0050	<0.0050	0.00757	0.00152	0.0502	<0.00010	<0.00050	<0.010	**0.0489**	44.5	<0.00050	0.00442	0.00333	<0.030	0.0865	0.00127	1.49
Bellekeno Mill Tailings Humidity Cell	22/08/2012	Week 53	500	475	9.0	7.91	245	58.0	<0.50	0.030	<0.050	64.4	0.0017	<0.0050								**0.0533**									
Bellekeno Mill Tailings Humidity Cell	29/08/2012	Week 54	500	480	6.6	7.91	246	57.4	<0.50	0.034	<0.050	66.9	0.0027	0.0128	<0.0050	0.00735	0.00156	0.0499	<0.00010	<0.00050	<0.010	**0.0482**	47.6	<0.00050	0.00433	0.00304	<0.030	0.0835	0.00172	1.53
Bellekeno Mill Tailings Humidity Cell	05/09/2012	Week 55	500	475	9.4	7.87	228	63.4	<0.50	0.028	<0.050	56.9	<0.0010	0.0123								**0.0503**									
Bellekeno Mill Tailings Humidity Cell	12/09/2012	Week 56	500	490	5.9	7.87	224	54.6	<0.50	0.026	<0.050	60.3	0.0016	<0.0050	<0.0050	0.00690	0.00161	0.0510	<0.00010	<0.00050	<0.010	**0.0550**	44.8	<0.00050	0.00483	0.00325	<0.030	0.0772	0.00124	1.47
Bellekeno Mill Tailings Humidity Cell	19/09/2012	Week 57	500	470	7.2	7.91	241	59.8	<0.50	0.026	<0.050	64.6	0.0016	<0.0050								**0.0523**									
Bellekeno Mill Tailings Humidity Cell	26/09/2012	Week 58	500	495	9.1	7.99	226	49.4	<0.50	0.026	<0.050	62.7	0.0017	<0.0050	<0.0050	0.00733	0.00159	0.0487	<0.00010	<0.00050	<0.010	**0.0489**	44.7	<0.00050	0.00465	0.00327	<0.030	0.0844	0.00144	1.48
Bellekeno Mill Tailings Humidity Cell	03/10/2012	Week 59	500	475	7.3	7.91	230	56.5	<0.50	0.024	<0.050	60.6	0.0022	<0.0050								**0.0499**									
Bellekeno Mill Tailings Humidity Cell	10/10/2012	Week 60	500	500	6.1	7.80	213	55.6	<0.50	0.023	<0.050	52.8	0.0024	<0.0050	<0.0050	0.00643	0.00154	0.0516	<0.00010	<0.00050	<0.010	**0.0490**	40.4	<0.00050	0.00489	0.00361	<0.030	0.0833	0.00111	1.33
Bellekeno Mill Tailings Humidity Cell	17/10/2012	Week 61	500	500	6.7	7.88	206	58.8	<0.50	<0.020	<0.050	47.8	0.0019	0.0055								**0.0460**									
Bellekeno Mill Tailings Humidity Cell	24/10/2012	Week 62	500	450	7.1	7.86	197	48.8	<0.50	0.021	<0.050	46.1	0.0026	<0.0050	<0.0050	0.00642	0.00146	0.0456	<0.00010	<0.00050	<0.010	**0.0430**	35.7	<0.00050	0.00404	0.00323	<0.030	0.0708	0.00076	1.12
Bellekeno Mill Tailings Humidity Cell	31/10/2012	Week 63	500	475	3.4	7.90	198	59.9	<0.50	<0.020	<0.050	45.5	0.0029	<0.0050								**0.0419**									
Bellekeno Mill Tailings Humidity Cell	07/11/2012	Week 64	500	475	2.9	7.26	116	30.6	<0.50	<0.020	<0.050	24.7	0.0026	<0.0050	<0.0050	0.00415	0.00102	0.0300	<0.00010	<0.00050	<0.010	**0.0293**	20.1	<0.00050	0.00210	0.00115	<0.030	0.0574	<0.00050	0.630
Bellekeno Mill Tailings Humidity Cell	14/11/2012	Week 65	500	475	4.5	7.93	223	57.5	<0.50	0.023	<0.050	57.1	0.0066	0.0068								**0.0395**									
Bellekeno Mill Tailings Humidity Cell	21/11/2012	Week 66	500	475	4.3	7.83	215	55.9	<0.50	0.023	<0.050	53.4	0.0025	0.0120	<0.0050	0.00653	0.00132	0.0545	<0.00010	<0.00050	<0.010	**0.0474**	41.1	<0.00050	0.00538	0.00386	<0.030	0.0866	0.00140	1.45
Bellekeno Mill Tailings Humidity Cell	28/11/2012	Week 67	500	450	3.1	7.91	207	51.7	<0.50	<0.020	<0.050	50.1	0.0017	0.0052								**0.0373**									
Bellekeno Mill Tailings Humidity Cell	05/12/2012	Week 68	500	400	3.7	7.94	215	56.3	<0.50	0.021	<0.050	51.5	0.0060	0.0050	<0.0050	0.00689	0.00156	0.0715	<0.00010	<0.00050	<0.010	**0.0498**	39.0	<0.00050	0.00540	0.00450	<0.030	0.0811	0.00143	1.82
Bellekeno Mill Tailings Humidity Cell	12/12/2012	Week 69	500	460	5.3	7.97	193	58.7	<0.50	0.020	<0.050	42.7	0.0133	<0.0050								**0.0355**									
Bellekeno Mill Tailings Humidity Cell	19/12/2012 12:00	Week 70	500	475	4.8	7.92	202	57.8	<0.50	<0.020	<0.050	45.0	0.0051	<0.0050	<0.0050	0.00663	0.00168	0.0531	<0.00010	<0.00050	<0.010	**0.0428**	37.0	<0.00050	0.00459	0.00305	<0.030	0.0827	0.00131	1.31
Bellekeno Mill Tailings Humidity Cell	26/12/2012	Week 71	500	475	3.7	7.96	196	65.9	<0.50	<0.020	<0.050	42.4	0.0017	<0.0050								**0.0397**									
Bellekeno Mill Tailings Humidity Cell	02/01/2013	Week 72	500	500	5.0	7.93	188	55.9	<0.50	0.021	<0.050	38.8	0.0026	<0.0050	<0.0050	0.00623	0.00187	0.0500	<0.00010	<0.00050	<0.010	**0.0359**	33.9	<0.00050	0.00418	0.00275	<0.030	0.0809	0.00060	1.18
Bellekeno Mill Tailings Humidity Cell	09/01/2013	Week 73	500	405	9.0	7.97	197	51.2	<0.50	0.025	<0.050	44.1	0.0060	0.0093								**0.0365**									
Bellekeno Mill Tailings Humidity Cell	16/01/2013	Week 74	500	500	5.2	7.86	199	54.7	<0.50	<0.020	<0.050	44.5	0.0024	0.0055	<0.0050	0.00611	0.00192	0.0520	<0.00010	<0.00050	<0.010	**0.0421**	36.1	<0.00050	0.00470	0.00269	<0.030	0.0743	<0.00050	1.29
Bellekeno Mill Tailings Humidity Cell	23/01/2013	Week 75	500	450	3.9	7.88	196	58.1	<0.50	<0.020	<0.050	42.6	0.0026	0.0052								**0.0437**									
Bellekeno Mill Tailings Humidity Cell	30/01/2013	Week 76	500	465	3.8	7.94	188	55.3	<0.50	<0.020	<0.050	41.1	0.0017	<0.0050	<0.0050	0.00587	0.00151	0.0467	<0.00010	<0.00050	<0.010	**0.0314**	35.1	<0.00050	0.00373	0.00242	<0.030	0.0794	0.00102	1.21
Bellekeno Mill Tailings Humidity Cell	06/02/2013	Week 77	500	475	2.9	7.89	196	54.6	<0.50	<0.020	<0.050	43.5	0.0020	<0.0050								**0.0321**									
Bellekeno Mill Tailings Humidity Cell	13/02/2013	Week 78	500	460	4.0	7.86	192	63.9	<0.50	<0.020	<0.050	40.4	0.0034	<0.0050	<0.0050	0.00606	0.00188	0.0618	<0.00010	<0.00050	<0.010	**0.0489**	37.4	<0.00050	0.00573	0.00374	<0.030	0.0802	<0.00050	1.54
Bellekeno Mill Tailings Humidity Cell	20/02/2013	Week 79	500	425	5.5	7.94	190	55.1	<0.50	<0.020	<0.050	39.9	0.0028	0.0070								**0.0303**									
Bellekeno Mill Tailings Humidity Cell	27/02/2013	Week 80	500	500	4.1	7.98	192	63.7	<0.50	<0.020	<0.050	39.9	0.0027	<0.0050	<0.0050	0.00582	0.00153	0.0508	<0.00010	<0.00050	<0.010	**0.0394**	34.3	<0.00050	0.00505	0.00304	<0.030	0.0785	0.00071	1.28
Bellekeno Mill Tailings Humidity Cell	06/03/2013	Week 81	500	450	7.9	7.98	186	55.7	<0.50	<0.020	<0.050	39.1	0.0029	<0.0050								**0.0290**									
Bellekeno Mill Tailings Humidity Cell	13/03/2013	Week 82	500	475	3.2	7.97	180	52.4	<0.50	<0.020	<0.050	36.9	0.0022	0.0053	<0.0050	0.00537	0.00128	0.0479	<0.00010	<0.00050	<0.010	**0.0328**	34.7	<0.00050	0.00415	0.00239	<0.030	0.0721	0.00054	1.20
Bellekeno Mill Tailings Humidity Cell	20/03/2013	Week 83	500	475	3.8	7.94	187	52.9	<0.50	<0.020	<0.050	38.1	0.0019	0.0060								**0.0381**									
Bellekeno Mill Tailings Humidity Cell	27/03/2013	Week 84	500	455	2.0	7.97	176	52.1	<0.50	<0.020	<0.050	35.9	0.0026	0.0053	<0.0050	0.00515	0.00125	0.0440	<0.00010	<0.00050	<0.010	**0.0299**	32.0	<0.00050	0.00356	0.00240	<0.030	0.0663	0.00091	1.23
Bellekeno Mill Tailings Humidity Cell	03/04/2013	Week 85	500	475	2.9	8.00	190	58.4	<0.50	<0.020	<0.050	40.5	0.0018	<0.0050								**0.0315**									
Bellekeno Mill Tailings Humidity Cell	10/04/2013 12:00	Week 86	500	465	3.2	7.95	185	54.2	<0.50	<0.020	<0.050	37.1	0.0019	<0.0050	<0.0050	0.00524	0.00135	0.0458	<0.00010	<0.00050	<0.010	**0.0379**	33.3	<0.00050	0.00527	0.00268	<0.030	0.0750	0.00086	1.35
Bellekeno Mill Tailings Humidity Cell	17/04/2013 12:00	Week 87	500	460	3.5	7.98	182	58.3	<0.50	<0.020	<0.050	34.8	0.0063	0.0053								**0.0402**									
Bellekeno Mill Tailings Humidity Cell	24/04/2013 12:00	Week 88	500	475	4.4	7.91	203	61.0	<0.50	0.022	<0.050	40.6	0.0020	<0.0050	<0.0050	0.00552	0.00172	0.0511	<0.00010	<0.00050	<0.010	**0.0456**	37.5	<0.00050	0.00583	0.00293	<0.030	0.0746	0.00161	1.51
Bellekeno Mill Tailings Humidity Cell	01/05/2013 12:00	Week 89	500	475	2.9	7.87	194	64.7	<0.50	<0.020	<0.050	39.8	0.0020	0.0066								**0.0416**									
Bellekeno Mill Tailings Humidity Cell	08/05/2013 12:00	Week 90	500	450	3.7	7.91	171	55.2	<0.50	<0.020	<0.050	33.6	<0.0010	0.0061	<0.0050	0.00520	0.00154	0.0406	<0.00010	<0.00050	<0.010	**0.0315**	33.3	<0.00050	0.00382	0.00191	<0.030	0.0623	0.00071	1.33
Bellekeno Mill Tailings Humidity Cell	15/05/2013	Week 91	500	475	2.7	7.98	197	63.3	<0.50	0.023	<0.050	40.0	0.0024	<0.0050								**0.0368**									
Bellekeno Mill Tailings Humidity Cell	22/05/2013	Week 92	500	450	2.6	8.02	186	62.3	<0.50	0.023	<0.050	40.6	0.0043	<0.0050	<0.0050	0.00503	0.00151	0.0433	<0.00010	<0.00050	<0.010	**0.0254**	36.6	<0.00050	0.00295	0.00174	<0.030	0.0665	0.00104	1.80
Bellekeno Mill Tailings Humidity Cell	29/05/2013	Week 93	500	460	3.0	7.94	180	55.2	<0.50	0.021	<0.050	38.7	0.0014	<0.0050								**0.0231**									
Bellekeno Mill Tailings Humidity Cell	05/06/2013 12:00	Week 94	500	460	6.7	7.97	178	66.6	<0.50	<0.020	<0.050	35.7	<0.0010	<0.0050	<0.0050	0.00428	0.00188	0.0457	<0.00010	<0.00050	<0.010	**0.0359**	34.9	<0.00050	0.00436	0.00186	<0.030	0.0608	0.00107	1.94
Bellekeno Mill Tailings Humidity Cell	12/06/2013 12:00	Week 95	500	465	6.3	8.00	194	57.0	<0.50	0.021	<0.050	41.4	0.0018	<0.0050								**0.0355**									
Bellekeno Mill Tailings Humidity Cell	19/06/2013 12:00	Week 96	500	425	3.0	7.96	181	54.5	<0.50	0.021	<0.050	37.5	0.0015	<0.0050	<0.0050	0.00396	0.00155	0.0404	<0.00010	<0.00050	<0.010	**0.0238**	33.7	<0.00050	0.00291	0.00140	<0.030	0.0510	0.00110	2.01
Bellekeno Mill Tailings Humidity Cell	26/06/2013 12:00	Week 97	500	455	4.9	8.01	190	63.1	<0.50	0.021	<0.050	37.9	<0.0010	0.0060								**0.0325**									
Bellekeno Mill Tailings Humidity Cell	03/07/2013	Week 98	500	455	1.9	8.05	185	62.0	<0.50	0.021	<0.050	38.0	<0.0010	<0.0050	<0.0050	0.00454	0.00145	0.0426	<0.00010	<0.00050	<0.010	**0.0284**	35.5	<0.00050	0.00353	0.00152	<0.030	0.0650	0.00122	2.08
Bellekeno Mill Tailings Humidity Cell	10/07/2013 12:00	Week 99	500	465	2.7	8.00	208	57.8	<0.50	0.020	<0.050	38.5	0.0037	<0.0050								**0.0384**									
Bellekeno Mill Tailings Humidity Cell	17/07/2013 12:00	Week 100	500	460	6.7	7.94	225	111	71.9	<0.50	0.022	<0.050	41.7	0.0044	<0.0050	<0.0050	0.00440	0.00150	0.0523	<0.00010	<0.00050	<0.010	**0.0450**	40.5	<0.00050	0.00625	0.00257	<0.030	0.0715	0.00148	2.46

Description	Sample Date	Sample Comments	Total Volume In	Total Volume Out	Total Acidity	pH (lab)	Specific Conductance (lab)	Hardness (from dissolved)	Alkalinity, total	Chloride	Fluoride	Bromide	Sulphate, dissolved	Nitrite (N)	Nitrate (N)	Aluminum (Al), dissolved	Antimony (Sb), dissolved	Arsenic (As), dissolved	Barium (Ba), dissolved	Beryllium (Be), dissolved	Bismuth (Bi), dissolved	Boron (B), dissolved	Cadmium (Cd), dissolved	Calcium (Ca), dissolved	Chromium (Cr), dissolved	Cobalt (Co), dissolved	Copper (Cu), dissolved	Iron (Fe), dissolved	Lead (Pb), dissolved	Lithium (Li), dissolved	Magn
			mL	mL	mg/L	pH units	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Type A WUL QZ09-092 BK EQS-DM						6.5-9.5												0.1					0.01					0.1		0.2	
Bellekeno Mill Tailings Humidity Cell	24/07/2013 12:00	Week 101	500	450	2.4	7.98	216		67.0	<0.50	<0.020	<0.050	39.0	0.0049	<0.0050								**0.0393**								
Bellekeno Mill Tailings Humidity Cell	31/07/2013 12:00	Week 102	500	460	4.2	7.98	199	98.9	64.1	<0.50	<0.020	<0.050	34.3	0.0016	<0.0050	<0.0050	0.00401	0.00149	0.0440	<0.00010	<0.00050	<0.010	**0.0402**	36.3	<0.00050	0.00552	0.00197	<0.030	0.0585	0.00092	2.00
Bellekeno Mill Tailings Humidity Cell	07/08/2013 12:00	Week 103	500	475	4.3	7.92	221		73.9	<0.50	0.020	<0.050	40.4	0.0038	<0.0050								**0.0443**								
Bellekeno Mill Tailings Humidity Cell	14/08/2013 12:00	Week 104	500	460	7.9	7.94	199	94.4	62.5	<0.50	<0.020	<0.050	31.9	0.0015	<0.0050	<0.0050	0.00424	0.00123	0.0417	<0.00010	<0.00050	<0.010	**0.0406**	34.7	<0.00050	0.00553	0.00206	<0.030	0.0586	<0.00050	1.88
Bellekeno Mill Tailings Humidity Cell	21/08/2013 12:00	Week 105	500	475	4.6	7.99	198		64.3	<0.50	<0.020	<0.050	34.6	0.0015	<0.0050								**0.0308**								
Bellekeno Mill Tailings Humidity Cell	28/08/2013 12:00	Week 106	500	470	2.4	8.01	213	106	64.3	<0.50	<0.020	<0.050	38.0	0.0028	<0.0050	<0.0050	0.00413	0.00127	0.0449	<0.00010	<0.00050	<0.010	**0.0384**	38.9	<0.00050	0.00570	0.00189	<0.030	0.0595	0.00124	2.08
Bellekeno Mill Tailings Humidity Cell	04/09/2013 12:00	Week 107	500	450	14.4	7.94	207		68.6	<0.50	<0.020	<0.050	35.5	<0.0010	<0.0050								**0.0404**								
Bellekeno Mill Tailings Humidity Cell	11/09/2013 12:00	Week 108	500	460	8.8	7.94	207	99.8	67.1	<0.50	<0.020	<0.050	35.2	0.0025	<0.0050	<0.0050	0.00420	0.00114	0.0445	<0.00010	<0.00050	<0.010	**0.0399**	36.6	<0.00050	0.00583	0.00205	<0.030	0.0519	0.00089	2.01
Bellekeno Mill Tailings Humidity Cell	18/09/2013 12:00	Week 109	500	470	1.3	7.99	197		66.5	<0.50	<0.020	<0.050	33.9	0.0038	<0.0050								**0.0337**								
Bellekeno Mill Tailings Humidity Cell	25/09/2013 12:00	Week 110	500	475	5.4	8.04	227	113	72.0	<0.50	0.021	<0.050	43.5	0.0104	<0.0050	<0.0050	0.00448	0.00122	0.0453	<0.00010	<0.00050	0.011	**0.0306**	41.2	<0.00050	0.00493	0.00182	<0.030	0.0514	0.00147	2.39
Bellekeno Mill Tailings Humidity Cell	02/10/2013 12:00	Week 111	500	500	3.8	7.99	208		68.2	<0.50	<0.020	<0.050	35.7	0.0027	0.0058								**0.0312**								
Bellekeno Mill Tailings Humidity Cell	09/10/2013 12:00	Week 112	500	450	2.4	7.98	211	106	70.6	<0.50	<0.020	<0.050	38.1	0.0023	<0.0050	<0.0050	0.00385	0.00141	0.0430	<0.00010	<0.00050	<0.010	**0.0338**	38.8	<0.00050	0.00521	0.00153	<0.030	0.0468	0.00154	2.21
Bellekeno Mill Tailings Humidity Cell	16/10/2013 12:00	Week 113	500	470	2.8	7.97	220		75.4	<0.50	0.020	<0.050	40.3	0.0031	<0.0050								**0.0376**								
Bellekeno Mill Tailings Humidity Cell	23/10/2013 12:00	Week 114	500	450	3.0	7.98	217	114	75.7	<0.50	<0.020	<0.050	36.9	0.0043	<0.0050	<0.0050	0.00411	0.00143	0.0473	<0.00010	<0.00050	<0.010	**0.0384**	42.2	<0.00050	0.00623	0.00181	<0.030	0.0519	0.00128	2.14
Bellekeno Mill Tailings Humidity Cell	30/10/2013 12:00	Week 115	500	450	1.9	8.03	207		64.9	<0.50	0.021	<0.050	35.5	0.0058	<0.0050								**0.0247**								
Bellekeno Mill Tailings Humidity Cell	06/11/2013 12:00	Week 116	500	450	3.0	7.92	212	101	66.1	<0.50	<0.020	<0.050	36.8	0.0026	<0.0050	<0.0050	0.00370	0.00131	0.0397	<0.00010	<0.00050	<0.010	**0.0376**	36.8	<0.00050	0.00551	0.00152	<0.030	0.0469	0.00137	2.19
Bellekeno Mill Tailings Humidity Cell	13/11/2013 12:00	Week 117	500	465																											
Bellekeno Mill Tailings Humidity Cell	20/11/2013 12:00	Week 118	500	460																											
Bellekeno Mill Tailings Humidity Cell	27/11/2013 12:00	Week 119	500	455																											
Bellekeno Mill Tailings Humidity Cell	04/12/2013 12:00	Week 120	500	475	3.7	7.94	235	116	70.3	<0.50	0.023	<0.050	43.9	0.0039	<0.0050	<0.0050	0.00371	0.00094	0.0419	<0.00010	<0.00050	<0.010	**0.0399**	42.1	<0.00050	0.00624	0.00169	<0.030	0.0418	0.00080	2.60
Bellekeno Mill Tailings Humidity Cell	11/12/2013 12:00	Week 121	500	440																											
Bellekeno Mill Tailings Humidity Cell	18/12/2013 12:00	Week 122	500	455																											
Bellekeno Mill Tailings Humidity Cell	24/12/2013 12:00	Week 123	500	435																											
Bellekeno Mill Tailings Humidity Cell	31/12/2013 12:00	Week 124	500	450	3.1	8.07	235	113	64.2	<0.50	0.028	<0.050	49.5	0.0056	<0.0050	<0.0050	0.00322	0.00107	0.0330	<0.00010	<0.00050	<0.010	**0.0194**	40.0	<0.00050	0.00224	0.00088	<0.030	0.0396	0.00147	3.21
Bellekeno Mill Tailings Humidity Cell	08/01/2014 12:00	Week 125	500	450																											
Bellekeno Mill Tailings Humidity Cell	15/01/2014 12:00	Week 126	500	450																											
Bellekeno Mill Tailings Humidity Cell	22/01/2014 12:00	Week 127	500	450																											
Bellekeno Mill Tailings Humidity Cell	29/01/2014 12:00	Week 128	500	445	1.2	8.02	246	127	73.7	<0.50	0.029	<0.050	50.5	0.0072	<0.0050	<0.0050	0.00315	0.00105	0.0345	<0.00010	<0.00050	<0.010	**0.0243**	44.4	<0.00050	0.00316	0.00108	<0.030	0.0390	0.00121	3.84
Bellekeno Mill Tailings Humidity Cell	05/02/2014 12:00	Week 129	500	450																											
Bellekeno Mill Tailings Humidity Cell	12/02/2014 12:00	Week 130	500	470																											
Bellekeno Mill Tailings Humidity Cell	19/02/2014 12:00	Week 131	500	450																											
Bellekeno Mill Tailings Humidity Cell	26/02/2014 12:00	Week 132	500	450	<1.0	8.05	239	125	72.2	<0.50	0.028	<0.050	47.8	0.0035	0.0053	<0.0050	0.00287	0.00093	0.0244	<0.00010	<0.00050	<0.010	**0.0175**	44.1	<0.00050	0.00198	0.00098	<0.030	0.0255	0.00101	3.61
Bellekeno Mill Tailings Humidity Cell	04/03/2014 12:00	Week 133	500	440																											
Bellekeno Mill Tailings Humidity Cell	12/03/2014 12:00	Week 134	500	440																											
Bellekeno Mill Tailings Humidity Cell	19/03/2014 12:00	Week 135	500	450																											
Bellekeno Mill Tailings Humidity Cell	26/03/2014 12:00	Week 136	500	440	1.2	8.03	238	127	78.7	<0.50	0.029	<0.050	47.6	0.0044	<0.0050	<0.0050	0.00256	0.00092	0.0213	<0.00010	<0.00050	<0.010	**0.0170**	44.3	<0.00050	0.00206	0.00086	<0.030	0.0208	0.00070	3.91
Bellekeno Mill Tailings Humidity Cell	02/04/2014 12:00	Week 137	500	460																											
Bellekeno Mill Tailings Humidity Cell	09/04/2014 12:00	Week 138	500	450																											
Bellekeno Mill Tailings Humidity Cell	16/04/2014 12:00	Week 139	500	440																											
Bellekeno Mill Tailings Humidity Cell	23/04/2014 12:00	Week 140	500	530	3.2	7.90	248	133	86.2	<0.50	0.026	<0.050	46.5	0.0075	<0.0050	<0.0050	0.00250	0.00091	0.0262	<0.00010	<0.00050	<0.010	**0.0324**	46.8	<0.00050	0.00437	0.00111	<0.030	0.0233	0.00095	3.82
Bellekeno Mill Tailings Humidity Cell	30/04/2014 12:00	Week 141	500	485																											
Bellekeno Mill Tailings Humidity Cell	07/05/2014 12:00	Week 142	500	480																											
Bellekeno Mill Tailings Humidity Cell	14/05/2014 12:00	Week 143	500	500																											
Bellekeno Mill Tailings Humidity Cell	21/05/2014 12:00	Week 144	500	495	1.6	8.02	240	125	87.8	<0.50	0.021	<0.050	40.6	0.0029	0.0050	<0.0050	0.00241	0.00108	0.0242	<0.00010	<0.00050	<0.010	**0.0292**	45.2	<0.00050	0.00434	0.00085	<0.030	0.0206	0.00122	2.89
Bellekeno Mill Tailings Humidity Cell	28/05/2014 12:00	Week 145	500	480																											
Bellekeno Mill Tailings Humidity Cell	03/06/2014 12:00	Week 146	500	500																											
Bellekeno Mill Tailings Humidity Cell	11/06/2014 12:00	Week 147	500	475																											
Bellekeno Mill Tailings Humidity Cell	18/06/2014 12:00	Week 148	500	510	1.4	8.10	243	129	95.2	<0.50	<0.020	<0.050	42.4	0.0033	<0.0050	<0.0050	0.00253	0.00101	0.0219	<0.00010	<0.00050	<0.010	**0.0270**	46.9	<0.00050	0.00427	0.00088	<0.030	0.0165	0.00104	2.76
Bellekeno Mill Tailings Humidity Cell	25/06/2014 12:00	Week 149	500	500																											
Bellekeno Mill Tailings Humidity Cell	02/07/2014 12:00	Week 150	500	475																											
Bellekeno Mill Tailings Humidity Cell	09/07/2014 12:00	Week 151	500	450																											

Description	Sample Date	Sample Comments	Total Volume In	Total Volume Out	Total Acidity	pH (lab)	Specific Conductance (lab)	Hardness (from dissolved)	Alkalinity, total	Chloride	Fluoride	Bromide	Sulphate, dissolved	Nitrite (N)	Nitrate (N)	Aluminum (Al), dissolved	Antimony (Sb), dissolved	Arsenic (As), dissolved	Barium (Ba), dissolved	Beryllium (Be), dissolved	Bismuth (Bi), dissolved	Boron (B), dissolved	Cadmium (Cd), dissolved	Calcium (Ca), dissolved	Chromium (Cr), dissolved	Cobalt (Co), dissolved	Copper (Cu), dissolved	Iron (Fe), dissolved	Lead (Pb), dissolved	Lithium (Li), dissolved	Magn
			mL	mL	mg/L	pH units	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Type A WUL QZ09-092 BK EQS-DM						6.5-9.5											0.1						0.01					0.1	0.2		
Bellekeno Mill Tailings Humidity Cell	16/07/2014 12:00	Week 152	500	475	1.6	7.90	217	117	78.2	<0.50	0.021	<0.050	38.5	0.0019	<0.0050	<0.0050	0.00190	0.00094	0.0177	<0.00010	<0.00050	<0.010	**0.0206**	42.5	<0.00050	0.00327	0.00065	<0.030	0.00845	0.00076	2.51
Bellekeno Mill Tailings Humidity Cell	23/07/2014 12:00	Week 153	500	565																											
Bellekeno Mill Tailings Humidity Cell	30/07/2014 12:00	Week 154	500	475																											
Bellekeno Mill Tailings Humidity Cell	06/08/2014 12:00	Week 155	500	475																											
Bellekeno Mill Tailings Humidity Cell	13/08/2014 12:00	Week 156	500	480	3.6	7.96	247	130	88.6	<0.50	0.020	<0.050	37.9	0.0065	<0.0050	<0.0050	0.00229	0.00094	0.0238	<0.00010	<0.00050	<0.010	**0.0241**	47.7	<0.00050	0.00433	0.00100	<0.030	0.0199	0.00077	2.63
Bellekeno Mill Tailings Humidity Cell	20/08/2014 12:00	Week 157	500	500																											
Bellekeno Mill Tailings Humidity Cell	27/08/2014 12:00	Week 158	500	495																											
Bellekeno Mill Tailings Humidity Cell	03/09/2014 12:00	Week 159	500	475																											
Bellekeno Mill Tailings Humidity Cell	10/09/2014 12:00	Week 160	500	500	3.7	7.96	243	127	89.4	<0.50	<0.020	<0.050	38.2	0.0026	<0.0050	<0.0050	0.00210	0.00086	0.0190	<0.00010	<0.00050	<0.010	**0.0236**	46.4	<0.00050	0.00378	0.00075	<0.030	0.0110	0.00086	2.64
Bellekeno Mill Tailings Humidity Cell	17/09/2014 12:00	Week 161	500	495																											
Bellekeno Mill Tailings Humidity Cell	24/09/2014 12:00	Week 162	500	480																											
Bellekeno Mill Tailings Humidity Cell	01/10/2014 12:00	Week 163	500	500																											
Bellekeno Mill Tailings Humidity Cell	08/10/2014 12:00	Week 164	500	500	3.6	7.75	235	124	81.1	<0.50	<0.020	<0.050	40.0	0.0020	<0.0050	<0.0050	0.00180	0.00080	0.0171	<0.00010	<0.00050	0.010	**0.0227**	45.3	<0.00050	0.00363	0.00076	<0.030	0.00800	0.00101	2.68
Bellekeno Mill Tailings Humidity Cell	15/10/2014 12:00	Week 165	500	470																											
Bellekeno Mill Tailings Humidity Cell	22/10/2014 12:00	Week 166	500	510																											
Bellekeno Mill Tailings Humidity Cell	29/10/2014 12:00	Week 167	500	500																											
Bellekeno Mill Tailings Humidity Cell	05/11/2014 12:00	Week 168	500	475	2.0	7.89	210	107	74.0	<0.50	<0.020	<0.050	36.2	0.0026	<0.0050	<0.0050	0.00157	0.00073	0.0126	<0.00010	<0.00050	<0.010	**0.0144**	38.7	<0.00050	0.00201	0.00054	<0.030	0.00385	0.00081	2.62
Bellekeno Mill Tailings Humidity Cell	12/11/2014 12:00	Week 169	500	485																											
Bellekeno Mill Tailings Humidity Cell	19/11/2014 12:00	Week 170	500	475																											
Bellekeno Mill Tailings Humidity Cell	26/11/2014 12:00	Week 171	500	475																											
Bellekeno Mill Tailings Humidity Cell	03/12/2014 12:00	Week 172	500	470	1.6	7.88	191	106	74.1	<0.50	<0.020	<0.050	33.6	0.0254	<0.0050	<0.0050	0.00155	0.00072	0.0108	<0.00010	<0.00050	<0.010	**0.0111**	38.0	<0.00050	0.00158	0.00054	<0.030	0.00378	0.00072	2.61
Bellekeno Mill Tailings Humidity Cell	10/12/2014 12:00	Week 173	500	485																											
Bellekeno Mill Tailings Humidity Cell	17/12/2014 12:00	Week 174	500	475																											
Bellekeno Mill Tailings Humidity Cell	22/12/2014 12:00	Week 175	500	450																											
Bellekeno Mill Tailings Humidity Cell	30/12/2014 12:00	Week 176	500	425	2.9	8.08	247	121	74.9	<0.50	0.030	<0.050	52.0	0.0165	<0.0050	<0.0050	0.00187	0.00114	0.0137	<0.00010	<0.00050	<0.010	**0.0103**	43.1	<0.00050	0.00145	0.00054	<0.030	0.0111	0.00099	3.12
Bellekeno Mill Tailings Humidity Cell	07/01/2015 12:00	Week 177	500	425																											
Bellekeno Mill Tailings Humidity Cell	14/01/2015 12:00	Week 178	500	425																											
Bellekeno Mill Tailings Humidity Cell	21/01/2015 12:00	Week 179	500	450																											
Bellekeno Mill Tailings Humidity Cell	28/01/2015 12:00	Week 180	500	425	2.0	7.96	205	101	58.8	<0.50	<0.020	<0.050	44.9	0.0089	<0.0050	<0.0050	0.00124	0.00173	0.00910	<0.00010	<0.00050	<0.010	0.00980	33.9	<0.00050	0.00091	<0.00050	<0.030	0.000955	0.00089	3.99
Bellekeno Mill Tailings Humidity Cell	04/02/2015 12:00	Week 181	500	445																											
Bellekeno Mill Tailings Humidity Cell	11/02/2015 12:00	Week 182	500	425																											
Bellekeno Mill Tailings Humidity Cell	18/02/2015 12:00	Week 183	500	450																											
Bellekeno Mill Tailings Humidity Cell	25/02/2015 12:00	Week 184	500	435	1.5	8.02	263	134	77.5	0.54	0.023	<0.050	58.9	0.0276	<0.0050	<0.0050	0.00155	0.00082	0.0159	<0.00010	<0.00050	<0.010	**0.0184**	44.6	<0.00050	0.00271	<0.00050	<0.030	0.00542	0.00109	5.45
Bellekeno Mill Tailings Humidity Cell	04/03/2015 12:00	Week 185	500	440																											
Bellekeno Mill Tailings Humidity Cell	11/03/2015 12:00	Week 186	500	450																											
Bellekeno Mill Tailings Humidity Cell	18/03/2015 12:00	Week 187	500	475																											
Bellekeno Mill Tailings Humidity Cell	25/03/2015 12:00	Week 188	500	425	<1.0	8.10	197	97.3	60.9	<0.50	0.021	<0.050	40.0	0.0071	<0.0050	<0.0050	0.00122	0.00056	0.00823	<0.00010	<0.00050	<0.010	0.00780	32.5	<0.00050	0.00063	0.00063	<0.030	0.00124	0.00087	3.88
Bellekeno Mill Tailings Humidity Cell	01/04/2015 12:00	Week 189	500	465																											
Bellekeno Mill Tailings Humidity Cell	08/04/2015 12:00	Week 190	500	430																											
Bellekeno Mill Tailings Humidity Cell	15/04/2015 12:00	Week 191	500	450																											
Bellekeno Mill Tailings Humidity Cell	22/04/2015 12:00	Week 192	500	450	2.6	7.91	259	125	81.7	0.52	0.025	<0.050	55.2	0.0130	<0.0050	<0.0050	0.00137	0.00062	0.0127	<0.00010	<0.00050	<0.010	**0.0134**	41.7	<0.00050	0.00198	<0.00050	<0.030	0.00280	0.0011	5.18
Bellekeno Mill Tailings Humidity Cell	29/04/2015 12:00	Week 193	500	435																											
Bellekeno Mill Tailings Humidity Cell	06/05/2015 12:00	Week 194	500	450																											
Bellekeno Mill Tailings Humidity Cell	13/05/2015 12:00	Week 195	500	450																											
Bellekeno Mill Tailings Humidity Cell	20/05/2015 12:00	Week 196	500	440	2.0	8.01	236	118	75.8	0.51	0.021	<0.050	48.9	0.0120	<0.0050	<0.0050	0.00121	0.00054	0.0114	<0.00010	<0.00050	<0.010	**0.0143**	39.7	<0.00050	0.00199	<0.00050	<0.030	0.00257	<0.0010	4.61
Bellekeno Mill Tailings Humidity Cell	27/05/2015 12:00	Week 197	500	450																											

Description	Sample Date	Sample Comments	esium (Mg), dissolved mg/L	Manganese (Mn), dissolved mg/L	Mercury (Hg), dissolved mg/L	Molybdenum (Mo), dissolved mg/L	Nickel (Ni), dissolved mg/L	Phosphorus (P), dissolved mg/L	Potassium (K), dissolved mg/L	Selenium (Se), dissolved mg/L	Silicon (Si), dissolved mg/L	Silver (Ag), dissolved mg/L	Sodium (Na), dissolved mg/L	Strontium (Sr), dissolved mg/L	Sulphur (S), dissolved mg/L	Thallium (Tl), dissolved mg/L	Tin (Sn), dissolved mg/L	Titanium (Ti), dissolved mg/L	Uranium (U), dissolved mg/L	Vanadium (V), dissolv mg/L	Zinc (Z mg/L
Type A WUL QZ09-092 BK EQS-DM							0.5					0.01									0.5
Bellekeno Mill Tailings Humidity Cell	17/08/2011	Week 0	3.69	<0.000010	0.00463	0.0037	0.61	27.1	0.00176	2.48	0.00801	67.5	1.33	459	0.000564	<0.00020	<0.010	0.000725	<0.0020	0.478
Bellekeno Mill Tailings Humidity Cell	24/08/2011	Week 1	1.81	<0.000010	0.00467	0.0015	<0.30	13.0	0.00109	2.82	0.000588	23.3	0.623	249	0.000455	<0.00020	<0.010	0.000413	<0.0020	**0.587**
Bellekeno Mill Tailings Humidity Cell	31/08/2011	Week 2	4.07	<0.000010	0.00422	0.0042	<0.30	8.75	0.00076	4.61	<0.000020	10.4	0.565	198	0.000381	<0.00020	<0.010	0.000698	<0.0020	**1.97**
Bellekeno Mill Tailings Humidity Cell	07/09/2011	Week 3	3.71	<0.000010	0.00327	0.00415	<0.30	4.78	0.00075	3.76	<0.000010	3.64	0.382	147	0.000248	<0.00010	<0.010	0.000526	<0.0010	**2.16**
Bellekeno Mill Tailings Humidity Cell	14/09/2011	Week 4	2.11	<0.000010	0.00376	0.00193	<0.30	3.74	0.00054	4.07	<0.000010	2.14	0.276	111	0.000147	<0.00010	0.016	0.000315	<0.0010	**1.16**
Bellekeno Mill Tailings Humidity Cell	21/09/2011	Week 5	2.13	<0.000010	0.00393	0.00223	<0.30	2.88	0.00044	4.28	<0.000010	1.35	0.249	86.1	0.000189	<0.00010	0.014	0.000276	<0.0010	**1.77**
Bellekeno Mill Tailings Humidity Cell	28/09/2011	Week 6	2.08	<0.000010	0.00387	0.00209	<0.30	2.23	0.00042	4.42	<0.000010	0.853	0.245	78.8	0.000218	<0.00010	<0.010	0.000261	<0.0010	**1.82**
Bellekeno Mill Tailings Humidity Cell	05/10/2011	Week 7	1.53	<0.000010	0.00361	0.00154	<0.30	1.57	0.00028	4.11	<0.000010	0.562	0.179	53.1	0.000232	<0.00010	<0.010	0.000179	<0.0010	**1.56**
Bellekeno Mill Tailings Humidity Cell	12/10/2011	Week 8	1.81	<0.000010	0.00333	0.00264	<0.30	1.58	0.00031	3.97	<0.000010	0.746	0.185	63.5	0.000105	<0.00010	<0.010	0.000243	<0.0010	**2.34**
Bellekeno Mill Tailings Humidity Cell	19/10/2011	Week 9	1.59	<0.000010	0.00314	0.00217	<0.30	1.30	0.00029	3.98	<0.000010	0.460	0.166	58.5	0.000097	<0.00010	<0.010	0.000193	<0.0010	**2.23**
Bellekeno Mill Tailings Humidity Cell	26/10/2011	Week 10	1.72	<0.000010	0.00299	0.00238	<0.30	1.29	0.00028	4.07	<0.000010	0.477	0.168	60.9	0.000099	<0.00010	<0.010	0.000212	<0.0010	**2.71**
Bellekeno Mill Tailings Humidity Cell	02/11/2011	Week 11	1.60	<0.000010	0.00319	0.00209	<0.30	1.17	0.00026	4.17	<0.000010	0.426	0.187	57.7	0.000263	<0.00010	<0.010	0.000188	<0.0010	**2.87**
Bellekeno Mill Tailings Humidity Cell	09/11/2011	Week 12	1.18	<0.000010	0.00295	0.00158	<0.30	0.846	0.00020	3.67	<0.000010	0.350	0.129	43.4	0.000076	<0.00010	<0.010	0.000127	<0.0010	**2.14**
Bellekeno Mill Tailings Humidity Cell	16/11/2011	Week 13	1.50	<0.000010	0.00277	0.00200	<0.30	0.923	0.00022	3.71	<0.000010	0.352	0.148	54.1	0.000079	<0.00010	0.010	0.000184	<0.0010	**2.69**
Bellekeno Mill Tailings Humidity Cell	23/11/2011	Week 14	1.22	<0.000010	0.00268	0.00161	<0.30	0.807	0.00017	3.73	<0.000010	0.295	0.147	44.3	0.000243	<0.00010	0.011	0.000124	<0.0010	**2.55**
Bellekeno Mill Tailings Humidity Cell	30/11/2011	Week 15	1.47	<0.000010	0.00265	0.00175	<0.30	0.794	0.00020	3.51	<0.000010	0.305	0.144	46.7	0.000267	<0.00010	<0.010	0.000147	<0.0010	**2.71**
Bellekeno Mill Tailings Humidity Cell	07/12/2011	Week 16	1.27	<0.000010	0.00259	0.00163	<0.30	0.727	0.00019	3.62	<0.000010	0.289	0.134	43.5	0.000222	<0.00010	<0.010	0.000129	<0.0010	**2.76**
Bellekeno Mill Tailings Humidity Cell	14/12/2011	Week 17	1.15	<0.000010	0.00248	0.00140	<0.30	0.642	0.00017	3.36	<0.000010	0.264	0.119	40.5	0.000176	<0.00010	<0.010	0.000103	<0.0010	**2.64**
Bellekeno Mill Tailings Humidity Cell	21/12/2011	Week 18	1.15	<0.000010	0.00226	0.00148	<0.30	0.652	0.00018	3.21	<0.000010	0.285	0.111	44.4	0.000074	<0.00010	<0.010	0.000115	<0.0010	**2.72**
Bellekeno Mill Tailings Humidity Cell	28/12/2011	Week 19	1.13	<0.000010	0.00268	0.00157	<0.30	0.715	0.00022	3.01	<0.000010	0.338	0.147	65.8	0.000078	<0.00010	<0.010	0.000200	<0.0010	**2.18**
Bellekeno Mill Tailings Humidity Cell	04/01/2012	Week 20	1.20	<0.000010	0.00266	0.00125	<0.30	0.702	0.00020	2.95	<0.000010	0.322	0.174	70.6	0.000238	<0.00010	0.011	0.000178	<0.0010	**2.69**
Bellekeno Mill Tailings Humidity Cell	11/01/2012	Week 21	1.23	<0.000010	0.00231	0.00143	<0.30	0.618	0.00017	2.98	<0.000010	0.315	0.146	65.8	0.000091	<0.00010	<0.010	0.000153	<0.0010	**2.98**
Bellekeno Mill Tailings Humidity Cell	18/01/2012	Week 22	1.30	<0.000010	0.00233	0.00141	<0.30	0.583	0.00017	2.94	<0.000010	0.282	0.143	59.3	0.000287	<0.00010	<0.010	0.000130	<0.0010	**2.91**
Bellekeno Mill Tailings Humidity Cell	25/01/2012	Week 23	1.36	<0.000010	0.00219	0.00180	<0.30	0.627	0.00016	3.25	<0.000010	0.309	0.120	50.5	0.000098	<0.00010	<0.010	0.000112	<0.0010	**3.47**
Bellekeno Mill Tailings Humidity Cell	01/02/2012	Week 24	1.04	<0.000010	0.00223	0.00145	<0.30	0.497	0.00017	2.87	<0.000010	0.241	0.119	50.7	0.000058	<0.00010	<0.010	0.000099	<0.0010	**2.76**
Bellekeno Mill Tailings Humidity Cell	08/02/2012	Week 25																		**3.02**
Bellekeno Mill Tailings Humidity Cell	15/02/2012	Week 26	1.06	<0.000010	0.00204	0.00180	<0.30	0.481	0.00017	2.73	<0.000010	0.242	0.107	49.1	0.000048	<0.00010	<0.010	0.000093	<0.0010	**3.02**
Bellekeno Mill Tailings Humidity Cell	22/02/2012	Week 27																		**3.46**
Bellekeno Mill Tailings Humidity Cell	29/02/2012	Week 28	1.05	<0.000010	0.00193	0.00191	<0.30	0.439	0.00017	2.57	<0.000010	0.226	0.118	46.1	0.000046	<0.00010	<0.010	0.000091	<0.0010	**3.34**
Bellekeno Mill Tailings Humidity Cell	07/03/2012	Week 29																		**4.25**
Bellekeno Mill Tailings Humidity Cell	14/03/2012	Week 30	1.09	<0.000010	0.00178	0.00188	<0.30	0.385	0.00014	2.72	<0.000010	0.209	0.104	36.7	0.000038	<0.00010	<0.010	0.000049	<0.0010	**3.72**
Bellekeno Mill Tailings Humidity Cell	21/03/2012	Week 31																		**3.14**
Bellekeno Mill Tailings Humidity Cell	28/03/2012	Week 32	0.958	<0.000010	0.00175	0.00189	<0.30	0.374	0.00015	2.43	<0.000010	0.200	0.112	39.4	0.000059	<0.00010	<0.010	0.000066	<0.0010	**3.11**
Bellekeno Mill Tailings Humidity Cell	04/04/2012	Week 33																		**3.35**
Bellekeno Mill Tailings Humidity Cell	11/04/2012	Week 34	1.03	<0.000010	0.00158	0.00204	<0.30	0.331	0.00012	2.41	<0.000010	0.184	0.101	34.7	0.000039	<0.00010	<0.010	0.000042	<0.0010	**3.48**
Bellekeno Mill Tailings Humidity Cell	18/04/2012	Week 35																		**4.28**
Bellekeno Mill Tailings Humidity Cell	25/04/2012	Week 36	0.978	<0.000010	0.00165	0.00221	<0.30	0.349	0.00014	2.58	<0.000010	0.202	0.103	36.7	0.000042	<0.00010	<0.010	0.000050	<0.0010	**3.01**
Bellekeno Mill Tailings Humidity Cell	02/05/2012	Week 37																		**3.87**
Bellekeno Mill Tailings Humidity Cell	09/05/2012	Week 38	1.01	<0.000010	0.00162	0.00234	<0.30	0.317	0.00013	2.45	<0.000010	0.172	0.103	29.6	0.000041	<0.00010	<0.010	0.000037	<0.0010	**3.29**
Bellekeno Mill Tailings Humidity Cell	16/05/2012	Week 39																		**2.60**
Bellekeno Mill Tailings Humidity Cell	23/05/2012	Week 40	1.14	<0.000010	0.00139	0.00278	<0.30	0.329	0.00015	2.57	<0.000010	0.183	0.0966	31.1	0.000039	<0.00010	<0.010	0.000035	<0.0010	**3.86**
Bellekeno Mill Tailings Humidity Cell	30/05/2012	Week 41																		**3.65**
Bellekeno Mill Tailings Humidity Cell	06/06/2012	Week 42	1.20	<0.000010	0.00133	0.00313	<0.30	0.318	0.00015	2.62	<0.000010	0.179	0.0928	29.3	0.000042	<0.00010	<0.010	0.000031	<0.0010	**3.61**
Bellekeno Mill Tailings Humidity Cell	13/06/2012	Week 43																		**4.07**
Bellekeno Mill Tailings Humidity Cell	20/06/2012	Week 44	1.06	<0.000010	0.00138	0.00282	<0.30	0.311	0.00015	2.48	<0.000010	0.159	0.0919	27.4	0.000037	<0.00010	<0.010	0.000030	<0.0010	**2.63**
Bellekeno Mill Tailings Humidity Cell	27/06/2012	Week 45																		**2.89**
Bellekeno Mill Tailings Humidity Cell	04/07/2012	Week 46	1.20	<0.000010	0.00131	0.00332	<0.30	0.311	0.00013	2.49	<0.000010	0.160	0.0854	27.0	0.000040	<0.00010	<0.010	0.000028	<0.0010	**2.96**
Bellekeno Mill Tailings Humidity Cell	11/07/2012	Week 47																		**3.96**
Bellekeno Mill Tailings Humidity Cell	18/07/2012	Week 48	1.28	<0.000010	0.00118	0.00378	<0.30	0.306	0.00012	2.63	<0.000010	0.159	0.0778	25.3	0.000037	<0.00010	<0.010	0.000028	<0.0010	**3.43**
Bellekeno Mill Tailings Humidity Cell	25/07/2012	Week 49																		**4.06**

Description	Sample Date	Sample Comments	...esium (Mg), dissolved mg/L	Manganese (Mn), dissolved mg/L	Mercury (Hg), dissolved mg/L	Molybdenum (Mo), dissolved mg/L	Nickel (Ni), dissolved mg/L	Phosphorus (P), dissolved mg/L	Potassium (K), dissolved mg/L	Selenium (Se), dissolved mg/L	Silicon (Si), dissolved mg/L	Silver (Ag), dissolved mg/L	Sodium (Na), dissolved mg/L	Strontium (Sr), dissolved mg/L	Sulphur (S), dissolved mg/L	Thallium (Tl), dissolved mg/L	Tin (Sn), dissolved mg/L	Titanium (Ti), dissolved mg/L	Uranium (U), dissolved mg/L	Vanadium (V), dissolv... mg/L	Zinc (Z... mg/L
Type A WUL QZ09-092 BK EQS-DM						0.5						0.01									0.5
Bellekeno Mill Tailings Humidity Cell	01/08/2012	Week 50	1.27	<0.000010	0.00112	0.00404	<0.30	0.283	0.00014	2.60	<0.000010	0.135	0.0742	23.1	0.000034	<0.00010	<0.010	0.000019	<0.0010	**3.48**
Bellekeno Mill Tailings Humidity Cell	08/08/2012	Week 51																		**4.14**
Bellekeno Mill Tailings Humidity Cell	15/08/2012	Week 52	1.16	<0.000010	0.00122	0.00389	<0.30	0.283	0.00014	2.50	<0.000010	0.134	0.0736	23.7	0.000036	<0.00010	<0.010	0.000023	<0.0010	**2.59**
Bellekeno Mill Tailings Humidity Cell	22/08/2012	Week 53																		**3.53**
Bellekeno Mill Tailings Humidity Cell	29/08/2012	Week 54	1.22	<0.000010	0.00127	0.00376	<0.30	0.288	0.00014	2.50	<0.000010	0.135	0.0753	22.8	0.000036	<0.00010	<0.010	0.000021	<0.0010	**2.34**
Bellekeno Mill Tailings Humidity Cell	05/09/2012	Week 55																		**2.52**
Bellekeno Mill Tailings Humidity Cell	12/09/2012	Week 56	1.41	<0.000010	0.00109	0.00436	<0.30	0.286	0.00013	2.39	<0.000010	0.130	0.0666	19.8	0.000032	<0.00010	<0.010	0.000016	<0.0010	**2.98**
Bellekeno Mill Tailings Humidity Cell	19/09/2012	Week 57																		**2.92**
Bellekeno Mill Tailings Humidity Cell	26/09/2012	Week 58	1.36	<0.000010	0.00123	0.00426	<0.30	0.268	0.00015	2.42	<0.000010	0.123	0.0713	20.3	0.000039	<0.00010	<0.010	0.000020	<0.0010	**2.55**
Bellekeno Mill Tailings Humidity Cell	03/10/2012	Week 59																		**2.76**
Bellekeno Mill Tailings Humidity Cell	10/10/2012	Week 60	1.50	<0.000010	0.00102	0.00466	<0.30	0.248	0.00012	2.28	<0.000010	0.109	0.0629	17.3	0.000034	<0.00010	<0.010	0.000013	<0.0010	**2.75**
Bellekeno Mill Tailings Humidity Cell	17/10/2012	Week 61																		**2.50**
Bellekeno Mill Tailings Humidity Cell	24/10/2012	Week 62	1.13	<0.000010	0.00112	0.00379	<0.30	0.224	0.00011	1.97	<0.000010	0.089	0.0560	14.6	0.000031	<0.00010	<0.010	0.000011	<0.0010	**2.21**
Bellekeno Mill Tailings Humidity Cell	31/10/2012	Week 63																		**2.19**
Bellekeno Mill Tailings Humidity Cell	07/11/2012	Week 64	0.699	<0.000010	0.000631	0.00203	<0.30	0.119	<0.00010	1.02	<0.000010	0.052	0.0328	8.17	0.000016	<0.00010	<0.010	<0.000010	<0.0010	**0.981**
Bellekeno Mill Tailings Humidity Cell	14/11/2012	Week 65																		**1.71**
Bellekeno Mill Tailings Humidity Cell	21/11/2012	Week 66	1.50	<0.000010	0.000987	0.00501	<0.30	0.273	0.00012	2.20	<0.000010	0.113	0.0635	17.3	0.000034	<0.00010	<0.010	0.000015	<0.0010	**2.51**
Bellekeno Mill Tailings Humidity Cell	28/11/2012	Week 67																		**1.62**
Bellekeno Mill Tailings Humidity Cell	05/12/2012	Week 68	1.48	<0.000010	0.00117	0.00497	<0.30	0.380	0.00011	2.10	<0.000010	0.157	0.0642	17.0	0.000042	<0.00010	<0.010	0.000015	<0.0010	**2.17**
Bellekeno Mill Tailings Humidity Cell	12/12/2012	Week 69																		**1.63**
Bellekeno Mill Tailings Humidity Cell	19/12/2012 12:00	Week 70	1.31	<0.000010	0.00101	0.00435	<0.30	0.252	<0.00010	2.14	<0.000010	0.173	0.0641	14.7	0.000034	<0.00010	<0.010	0.000011	<0.0010	**2.06**
Bellekeno Mill Tailings Humidity Cell	26/12/2012	Week 71																		**1.91**
Bellekeno Mill Tailings Humidity Cell	02/01/2013	Week 72	1.26	<0.000010	0.000989	0.00398	<0.30	0.244	<0.00010	1.98	<0.000010	0.097	0.0591	12.7	0.000033	<0.00010	<0.010	<0.000010	<0.0010	**1.65**
Bellekeno Mill Tailings Humidity Cell	09/01/2013	Week 73																		**1.61**
Bellekeno Mill Tailings Humidity Cell	16/01/2013	Week 74	1.30	<0.000010	0.000910	0.00460	<0.30	0.246	<0.00010	1.98	<0.000010	0.098	0.0608	15.0	0.000032	<0.00010	<0.010	0.000014	<0.0010	**1.95**
Bellekeno Mill Tailings Humidity Cell	23/01/2013	Week 75																		**2.15**
Bellekeno Mill Tailings Humidity Cell	30/01/2013	Week 76	1.09	<0.000010	0.000948	0.00374	<0.30	0.233	<0.00010	1.78	<0.000010	0.094	0.0590	13.5	0.000032	<0.00010	<0.010	0.000011	<0.0010	**1.36**
Bellekeno Mill Tailings Humidity Cell	06/02/2013	Week 77																		**1.31**
Bellekeno Mill Tailings Humidity Cell	13/02/2013	Week 78	1.52	<0.000010	0.000870	0.00576	<0.30	0.291	<0.00010	1.94	<0.000010	0.129	0.0619	14.1	0.000033	<0.00010	<0.010	0.000010	<0.0010	**2.20**
Bellekeno Mill Tailings Humidity Cell	20/02/2013	Week 79																		**1.28**
Bellekeno Mill Tailings Humidity Cell	27/02/2013	Week 80	1.28	<0.000010	0.000827	0.00496	<0.30	0.236	<0.00010	1.87	<0.000010	0.097	0.0616	13.2	0.000031	<0.00010	<0.010	0.000010	<0.0010	**1.91**
Bellekeno Mill Tailings Humidity Cell	06/03/2013	Week 81																		**1.15**
Bellekeno Mill Tailings Humidity Cell	13/03/2013	Week 82	1.09	<0.000010	0.000818	0.00409	<0.30	0.220	<0.00010	1.70	<0.000010	0.096	0.0579	11.7	0.000030	<0.00010	<0.010	<0.000010	<0.0010	**1.42**
Bellekeno Mill Tailings Humidity Cell	20/03/2013	Week 83																		**1.76**
Bellekeno Mill Tailings Humidity Cell	27/03/2013	Week 84	0.973	<0.000010	0.000812	0.00355	<0.30	0.217	<0.00010	1.62	<0.000010	0.084	0.0580	11.6	0.000031	<0.00010	<0.010	<0.000010	<0.0010	**1.17**
Bellekeno Mill Tailings Humidity Cell	03/04/2013	Week 85																		**1.25**
Bellekeno Mill Tailings Humidity Cell	10/04/2013 12:00	Week 86	1.21	<0.000010	0.000690	0.00550	<0.30	0.252	<0.00010	1.74	<0.000010	0.100	0.0633	12.0	0.000030	<0.00010	<0.010	<0.000010	<0.0010	**1.81**
Bellekeno Mill Tailings Humidity Cell	17/04/2013 12:00	Week 87																		**1.92**
Bellekeno Mill Tailings Humidity Cell	24/04/2013 12:00	Week 88	1.40	<0.000010	0.000692	0.00626	<0.30	0.253	0.00010	2.04	<0.000010	0.104	0.0659	13.3	0.000031	<0.00010	<0.010	0.000011	<0.0010	**2.13**
Bellekeno Mill Tailings Humidity Cell	01/05/2013 12:00	Week 89																		**1.86**
Bellekeno Mill Tailings Humidity Cell	08/05/2013 12:00	Week 90	0.944	<0.000010	0.000689	0.00411	<0.30	0.211	<0.00010	1.59	<0.000010	0.087	0.0621	11.2	0.000035	<0.00010	<0.010	<0.000010	<0.0010	**1.21**
Bellekeno Mill Tailings Humidity Cell	15/05/2013	Week 91																		**1.66**
Bellekeno Mill Tailings Humidity Cell	22/05/2013	Week 92	0.758	<0.000010	0.000786	0.00319	<0.30	0.247	<0.00010	1.64	<0.000010	0.104	0.0758	13.5	0.000035	<0.00010	<0.010	0.000011	<0.0010	**0.871**
Bellekeno Mill Tailings Humidity Cell	29/05/2013	Week 93																		**0.654**
Bellekeno Mill Tailings Humidity Cell	05/06/2013 12:00	Week 94	0.981	<0.000010	0.000500	0.00469	<0.30	0.232	<0.00010	1.53	<0.000010	0.098	0.0768	11.6	0.000029	<0.00010	<0.010	<0.000010	<0.0010	**1.25**
Bellekeno Mill Tailings Humidity Cell	12/06/2013 12:00	Week 95																		**1.28**
Bellekeno Mill Tailings Humidity Cell	19/06/2013 12:00	Week 96	0.672	<0.000010	0.000503	0.00324	<0.30	0.226	<0.00010	1.37	<0.000010	0.103	0.0775	12.2	0.000026	<0.00010	<0.010	<0.000010	<0.0010	**0.739**
Bellekeno Mill Tailings Humidity Cell	26/06/2013 12:00	Week 97																		**1.17**
Bellekeno Mill Tailings Humidity Cell	03/07/2013	Week 98	0.743	<0.000010	0.000512	0.00400	<0.30	0.220	0.00010	1.49	<0.000010	0.104	0.0946	12.7	0.000032	<0.00010	<0.010	0.000013	<0.0010	**0.857**
Bellekeno Mill Tailings Humidity Cell	10/07/2013 12:00	Week 99																		**1.40**
Bellekeno Mill Tailings Humidity Cell	17/07/2013 12:00	Week 100	1.18	<0.000010	0.000415	0.00744	<0.30	0.237	0.00010	1.85	<0.000010	0.111	0.0850	13.7	0.000036	<0.00010	<0.010	0.000013	<0.0010	**1.92**

Description	Sample Date	Sample Comments	esium (Mg), dissolved	Manganese (Mn), dissolved	Mercury (Hg), dissolved	Molybdenum (Mo), dissolved	Nickel (Ni), dissolved	Phosphorus (P), dissolved	Potassium (K), dissolved	Selenium (Se), dissolved	Silicon (Si), dissolved	Silver (Ag), dissolved	Sodium (Na), dissolved	Strontium (Sr), dissolved	Sulphur (S), dissolved	Thallium (Tl), dissolved	Tin (Sn), dissolved	Titanium (Ti), dissolved	Uranium (U), dissolved	Vanadium (V), dissolv	Zinc (Z
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Type A WUL QZ09-092 BK EQS-DM						0.5						0.01									0.5
Bellekeno Mill Tailings Humidity Cell	24/07/2013 12:00	Week 101																			**1.58**
Bellekeno Mill Tailings Humidity Cell	31/07/2013 12:00	Week 102	1.12	<0.000010	0.000317	0.00673	<0.30	0.226	0.00011	1.65	<0.000010	0.098	0.0729	11.2	0.000031	<0.00010	<0.010	<0.000010	<0.0010		**1.65**
Bellekeno Mill Tailings Humidity Cell	07/08/2013 12:00	Week 103																			**1.87**
Bellekeno Mill Tailings Humidity Cell	14/08/2013 12:00	Week 104	1.11	<0.000010	0.000332	0.00702	<0.30	0.217	<0.00010	1.58	<0.000010	0.144	0.0795	10.6	0.000029	<0.00010	<0.010	<0.000010	<0.0010		**1.65**
Bellekeno Mill Tailings Humidity Cell	21/08/2013 12:00	Week 105																			**1.05**
Bellekeno Mill Tailings Humidity Cell	28/08/2013 12:00	Week 106	1.15	<0.000010	0.000282	0.00778	<0.30	0.221	0.00012	1.57	<0.000010	0.094	0.0762	12.7	0.000030	<0.00010	<0.010	0.000014	<0.0010		**1.49**
Bellekeno Mill Tailings Humidity Cell	04/09/2013 12:00	Week 107																			**1.69**
Bellekeno Mill Tailings Humidity Cell	11/09/2013 12:00	Week 108	1.09	<0.000010	0.000271	0.00745	<0.30	0.237	0.00011	1.57	<0.000010	0.094	0.0697	11.6	0.000039	<0.00010	<0.010	0.000013	<0.0010		**1.62**
Bellekeno Mill Tailings Humidity Cell	18/09/2013 12:00	Week 109																			**1.20**
Bellekeno Mill Tailings Humidity Cell	25/09/2013 12:00	Week 110	0.970	<0.000010	0.000371	0.00641	<0.30	0.232	0.00013	1.60	0.000012	0.119	0.0835	14.3	0.000035	<0.00010	<0.010	0.000023	<0.0010		**1.14**
Bellekeno Mill Tailings Humidity Cell	02/10/2013 12:00	Week 111																			**1.04**
Bellekeno Mill Tailings Humidity Cell	09/10/2013 12:00	Week 112	1.02	<0.000010	0.000235	0.00663	<0.30	0.225	0.00011	1.57	<0.000010	0.094	0.0735	12.5	0.000030	<0.00010	<0.010	0.000012	<0.0010		**1.19**
Bellekeno Mill Tailings Humidity Cell	16/10/2013 12:00	Week 113																			**1.33**
Bellekeno Mill Tailings Humidity Cell	23/10/2013 12:00	Week 114	1.13	<0.000010	0.000282	0.00820	<0.30	0.212	0.00013	1.71	<0.000010	0.097	0.0776	12.8	0.000040	<0.00010	<0.010	0.000018	<0.0010		**1.59**
Bellekeno Mill Tailings Humidity Cell	30/10/2013 12:00	Week 115																			**0.843**
Bellekeno Mill Tailings Humidity Cell	06/11/2013 12:00	Week 116	1.07	<0.000010	0.000182	0.00740	<0.30	0.228	0.00011	1.48	<0.000010	0.090	0.0775	11.9	0.000029	<0.00010	<0.010	0.000012	<0.0010		**1.41**
Bellekeno Mill Tailings Humidity Cell	13/11/2013 12:00	Week 117																			
Bellekeno Mill Tailings Humidity Cell	20/11/2013 12:00	Week 118																			
Bellekeno Mill Tailings Humidity Cell	27/11/2013 12:00	Week 119																			
Bellekeno Mill Tailings Humidity Cell	04/12/2013 12:00	Week 120	1.22	<0.000010	0.000187	0.00846	<0.30	0.232	0.00014	1.54	<0.000010	0.108	0.0823	15.2	0.000036	<0.00010	<0.010	0.000019	<0.0010		**1.59**
Bellekeno Mill Tailings Humidity Cell	11/12/2013 12:00	Week 121																			
Bellekeno Mill Tailings Humidity Cell	18/12/2013 12:00	Week 122																			
Bellekeno Mill Tailings Humidity Cell	24/12/2013 12:00	Week 123																			
Bellekeno Mill Tailings Humidity Cell	31/12/2013 12:00	Week 124	0.493	<0.000010	0.000231	0.00297	<0.30	0.218	0.00015	1.14	<0.000010	0.122	0.0806	16.4	0.000030	<0.00010	<0.010	0.000026	<0.0010	0.402	
Bellekeno Mill Tailings Humidity Cell	08/01/2014 12:00	Week 125																			
Bellekeno Mill Tailings Humidity Cell	15/01/2014 12:00	Week 126																			
Bellekeno Mill Tailings Humidity Cell	22/01/2014 12:00	Week 127																			
Bellekeno Mill Tailings Humidity Cell	29/01/2014 12:00	Week 128	0.594	<0.000010	0.000195	0.00446	<0.30	0.242	0.00018	1.31	<0.000010	0.112	0.0704	16.4	0.000034	<0.00010	<0.010	0.000029	<0.0010	**0.593**	
Bellekeno Mill Tailings Humidity Cell	05/02/2014 12:00	Week 129																			
Bellekeno Mill Tailings Humidity Cell	12/02/2014 12:00	Week 130																			
Bellekeno Mill Tailings Humidity Cell	19/02/2014 12:00	Week 131																			
Bellekeno Mill Tailings Humidity Cell	26/02/2014 12:00	Week 132	0.478	<0.000010	0.000169	0.00300	<0.30	0.223	0.00015	1.04	<0.000010	0.098	0.0603	15.7	0.000028	<0.00010	<0.010	0.000027	<0.0010	0.378	
Bellekeno Mill Tailings Humidity Cell	04/03/2014 12:00	Week 133																			
Bellekeno Mill Tailings Humidity Cell	12/03/2014 12:00	Week 134																			
Bellekeno Mill Tailings Humidity Cell	19/03/2014 12:00	Week 135																			
Bellekeno Mill Tailings Humidity Cell	26/03/2014 12:00	Week 136	0.493	<0.000010	0.000153	0.00327	<0.30	0.197	0.00020	1.02	<0.000010	0.097	0.0593	15.8	0.000022	<0.00010	<0.010	0.000026	<0.0010	0.363	
Bellekeno Mill Tailings Humidity Cell	02/04/2014 12:00	Week 137																			
Bellekeno Mill Tailings Humidity Cell	09/04/2014 12:00	Week 138																			
Bellekeno Mill Tailings Humidity Cell	16/04/2014 12:00	Week 139																			
Bellekeno Mill Tailings Humidity Cell	23/04/2014 12:00	Week 140	0.968	<0.000010	0.000105	0.00684	<0.30	0.206	0.00019	1.19	<0.000010	0.082	0.0539	15.7	0.000027	<0.00010	<0.010	0.000022	<0.0010	**0.988**	
Bellekeno Mill Tailings Humidity Cell	30/04/2014 12:00	Week 141																			
Bellekeno Mill Tailings Humidity Cell	07/05/2014 12:00	Week 142																			
Bellekeno Mill Tailings Humidity Cell	14/05/2014 12:00	Week 143																			
Bellekeno Mill Tailings Humidity Cell	21/05/2014 12:00	Week 144	1.05	<0.000010	0.000091	0.00654	<0.30	0.189	0.00017	1.23	<0.000010	0.075	0.0530	13.6	0.000025	<0.00010	<0.010	0.000020	<0.0010	**0.890**	
Bellekeno Mill Tailings Humidity Cell	28/05/2014 12:00	Week 145																			
Bellekeno Mill Tailings Humidity Cell	03/06/2014 12:00	Week 146																			
Bellekeno Mill Tailings Humidity Cell	11/06/2014 12:00	Week 147																			
Bellekeno Mill Tailings Humidity Cell	18/06/2014 12:00	Week 148	1.11	<0.000010	0.000114	0.00628	<0.30	0.207	0.00018	1.23	<0.000010	0.071	0.0501	14.6	0.000026	<0.00010	<0.010	0.000026	<0.0010	**0.851**	
Bellekeno Mill Tailings Humidity Cell	25/06/2014 12:00	Week 149																			
Bellekeno Mill Tailings Humidity Cell	02/07/2014 12:00	Week 150																			
Bellekeno Mill Tailings Humidity Cell	09/07/2014 12:00	Week 151																			

Description	Sample Date	Sample Comments	...esium (Mg), dissolved	Manganese (Mn), dissolved	Mercury (Hg), dissolved	Molybdenum (Mo), dissolved	Nickel (Ni), dissolved	Phosphorus (P), dissolved	Potassium (K), dissolved	Selenium (Se), dissolved	Silicon (Si), dissolved	Silver (Ag), dissolved	Sodium (Na), dissolved	Strontium (Sr), dissolved	Sulphur (S), dissolved	Thallium (Tl), dissolved	Tin (Sn), dissolved	Titanium (Ti), dissolved	Uranium (U), dissolved	Vanadium (V), dissolv...	Zinc (Z...
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Type A WUL QZ09-092 BK EQS-DM							0.5					0.01									0.5
Bellekeno Mill Tailings Humidity Cell	16/07/2014 12:00	Week 152	0.809	<0.000010	0.000105	0.00464	<0.30	0.184	0.00018	1.02	<0.000010	0.067	0.0454	13.0	0.000018	<0.00010	<0.010	0.000022	<0.0010	**0.573**
Bellekeno Mill Tailings Humidity Cell	23/07/2014 12:00	Week 153																		
Bellekeno Mill Tailings Humidity Cell	30/07/2014 12:00	Week 154																		
Bellekeno Mill Tailings Humidity Cell	06/08/2014 12:00	Week 155																		
Bellekeno Mill Tailings Humidity Cell	13/08/2014 12:00	Week 156	0.821	<0.000010	0.000136	0.00630	<0.30	0.193	0.00017	1.22	0.000018	0.070	0.0515	12.3	0.000024	<0.00010	<0.010	0.000026	<0.0010	**0.864**
Bellekeno Mill Tailings Humidity Cell	20/08/2014 12:00	Week 157																		
Bellekeno Mill Tailings Humidity Cell	27/08/2014 12:00	Week 158																		
Bellekeno Mill Tailings Humidity Cell	03/09/2014 12:00	Week 159																		
Bellekeno Mill Tailings Humidity Cell	10/09/2014 12:00	Week 160	0.916	<0.000010	0.000104	0.00516	<0.30	0.198	0.00017	1.12	<0.000010	0.075	0.0494	12.9	0.000026	<0.00010	<0.010	0.000026	<0.0010	**0.744**
Bellekeno Mill Tailings Humidity Cell	17/09/2014 12:00	Week 161																		
Bellekeno Mill Tailings Humidity Cell	24/09/2014 12:00	Week 162																		
Bellekeno Mill Tailings Humidity Cell	01/10/2014 12:00	Week 163																		
Bellekeno Mill Tailings Humidity Cell	08/10/2014 12:00	Week 164	0.930	<0.000010	0.000099	0.00517	<0.30	0.188	0.00017	1.14	<0.000010	0.164	0.0495	13.4	0.000019	<0.00010	<0.010	0.000022	<0.0010	**0.721**
Bellekeno Mill Tailings Humidity Cell	15/10/2014 12:00	Week 165																		
Bellekeno Mill Tailings Humidity Cell	22/10/2014 12:00	Week 166																		
Bellekeno Mill Tailings Humidity Cell	29/10/2014 12:00	Week 167																		
Bellekeno Mill Tailings Humidity Cell	05/11/2014 12:00	Week 168	0.635	<0.000010	0.000087	0.00273	<0.30	0.181	0.00017	0.922	<0.000010	0.087	0.0426	11.9	0.000017	<0.00010	<0.010	0.000023	<0.0010	0.324
Bellekeno Mill Tailings Humidity Cell	12/11/2014 12:00	Week 169																		
Bellekeno Mill Tailings Humidity Cell	19/11/2014 12:00	Week 170																		
Bellekeno Mill Tailings Humidity Cell	26/11/2014 12:00	Week 171																		
Bellekeno Mill Tailings Humidity Cell	03/12/2014 12:00	Week 172	0.557	<0.000010	0.000106	0.00227	<0.30	0.179	0.00017	0.859	<0.000010	0.066	0.0413	11.3	0.000019	<0.00010	<0.010	0.000028	<0.0010	0.228
Bellekeno Mill Tailings Humidity Cell	10/12/2014 12:00	Week 173																		
Bellekeno Mill Tailings Humidity Cell	17/12/2014 12:00	Week 174																		
Bellekeno Mill Tailings Humidity Cell	22/12/2014 12:00	Week 175																		
Bellekeno Mill Tailings Humidity Cell	30/12/2014 12:00	Week 176	0.364	<0.000010	0.000205	0.00199	<0.30	0.178	0.00022	0.887	<0.000010	0.078	0.0501	17.9	0.000021	<0.00010	<0.010	0.000051	<0.0010	0.227
Bellekeno Mill Tailings Humidity Cell	07/01/2015 12:00	Week 177																		
Bellekeno Mill Tailings Humidity Cell	14/01/2015 12:00	Week 178																		
Bellekeno Mill Tailings Humidity Cell	21/01/2015 12:00	Week 179																		
Bellekeno Mill Tailings Humidity Cell	28/01/2015 12:00	Week 180	0.371	<0.000010	0.000075	0.00145	<0.30	0.146	0.00019	0.613	<0.000010	0.083	0.0392	16.1	0.000015	<0.00010	<0.010	0.000026	<0.0010	0.140
Bellekeno Mill Tailings Humidity Cell	04/02/2015 12:00	Week 181																		
Bellekeno Mill Tailings Humidity Cell	11/02/2015 12:00	Week 182																		
Bellekeno Mill Tailings Humidity Cell	18/02/2015 12:00	Week 183																		
Bellekeno Mill Tailings Humidity Cell	25/02/2015 12:00	Week 184	0.688	<0.000010	0.000133	0.00387	<0.30	0.222	0.00029	0.950	<0.000010	0.104	0.0564	21.5	0.000025	<0.00010	<0.010	0.000040	<0.0010	0.470
Bellekeno Mill Tailings Humidity Cell	04/03/2015 12:00	Week 185																		
Bellekeno Mill Tailings Humidity Cell	11/03/2015 12:00	Week 186																		
Bellekeno Mill Tailings Humidity Cell	18/03/2015 12:00	Week 187																		
Bellekeno Mill Tailings Humidity Cell	25/03/2015 12:00	Week 188	0.294	<0.000010	0.000090	0.00117	<0.30	0.167	0.00020	0.585	<0.000010	0.066	0.0393	14.4	0.000014	<0.00010	<0.010	0.000022	<0.0010	0.102
Bellekeno Mill Tailings Humidity Cell	01/04/2015 12:00	Week 189																		
Bellekeno Mill Tailings Humidity Cell	08/04/2015 12:00	Week 190																		
Bellekeno Mill Tailings Humidity Cell	15/04/2015 12:00	Week 191																		
Bellekeno Mill Tailings Humidity Cell	22/04/2015 12:00	Week 192	0.554	<0.0000050	0.000095	0.00283	<0.30	0.219	0.00025	0.836	<0.000010	0.090	0.0538	18.2	0.000022	<0.00010	<0.010	0.000039	<0.0010	0.312
Bellekeno Mill Tailings Humidity Cell	29/04/2015 12:00	Week 193																		
Bellekeno Mill Tailings Humidity Cell	06/05/2015 12:00	Week 194																		
Bellekeno Mill Tailings Humidity Cell	13/05/2015 12:00	Week 195																		
Bellekeno Mill Tailings Humidity Cell	20/05/2015 12:00	Week 196	0.563	<0.0000050	0.000059	0.00298	<0.30	0.182	0.00027	0.771	<0.000010	0.073	0.0483	17.0	0.000023	<0.00010	<0.010	0.000028	<0.0010	0.341
Bellekeno Mill Tailings Humidity Cell	27/05/2015 12:00	Week 197																		

Description	Sample Date	Sample Comments	Total Volume In	Total Volume Out	Total Acidity	pH (lab)	Specific Conductance (lab)	Hardness (from dissolved)	Alkalinity, total	Chloride	Fluoride	Bromide	Sulphate, dissolved	Nitrite (N)	Nitrate (N)	Aluminum (Al), dissolved	Antimony (Sb), dissolved	Arsenic (As), dissolved	Barium (Ba), dissolved	Beryllium (Be), dissolved	Bismuth (Bi), dissolved	Boron (B), dissolved	Cadmium (Cd), dissolved	Calcium (Ca), dissolved	Chromium (Cr), dissolved	Cobalt (Co), dissolved	Copper (Cu), dissolved	Iron (Fe), dissolved	Lead (Pb), dissolved	Lithium (Li), dissolved	Magnesium (Mg), dissolved	Mangane
			mL	mL	mg/L	pH units	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Type A WUL QZ09-092 FM EQS-DM						6.5-9.5													0.1				0.01					0.1		0.2		
Flame and Moth Tailings Humidity Cell	10-Jul-13	Week 0	750	510		7.79	1880	1140	39.2	<5.0	0.560	<0.50	1130	<0.010	0.178	0.0094	0.0226	0.00580	0.07350	<0.00020	<0.0010	0.168000	**0.0110**	402.00000	<0.00050	0.00220	0.044	<0.030	0.0174	0.0	31.8	8.740000
Flame and Moth Tailings Humidity Cell	17-Jul-13	Week 1	500	470		7.79	878	486	62.7	<5.0	0.480	<0.50	404	<0.010	<0.050	<0.0050	0.0220	0.00697	0.02910	<0.00010	<0.00050	0.145000	0.00590	181.00000	<0.00050	0.00112	0.056	<0.030	0.0259	0.0	8.13	3.760000
Flame and Moth Tailings Humidity Cell	24-Jul-13	Week 2	500	470		7.87	506	254	49.2	<0.50	0.285	<0.050	186	<0.0010	0.0072	<0.0050	0.0236	0.00803	0.02440	<0.00010	<0.00050	0.097000	0.00434	95.80000	<0.00050	0.00089	0.052	<0.030	0.0266	0.0	3.63	2.610000
Flame and Moth Tailings Humidity Cell	31-Jul-13	Week 3	500	450		7.89	347	173	46.5	<0.50	0.261	<0.050	119	<0.0010	<0.0050	<0.0050	0.0240	0.00609	0.02070	<0.00010	<0.00050	0.059000	0.00214	66.20000	<0.00050	0.00050	0.027	<0.030	0.0180	0.0	1.87	1.700000
Flame and Moth Tailings Humidity Cell	7-Aug-13	Week 4	500	475		7.92	380	184	60.8	<0.50	0.241	<0.050	128	0.0023	<0.0050	<0.0050	0.0303	0.00666	0.02470	<0.00010	<0.00050	0.055000	0.00407	70.80000	<0.00050	0.00083	0.042	<0.030	0.0301	0.0	1.62	2.130000
Flame and Moth Tailings Humidity Cell	14-Aug-13	Week 5	500	465		7.91	364	188	49.0	<0.50	0.193	<0.050	118	<0.0010	<0.0050	<0.0050	0.0236	0.00586	0.02360	<0.00010	<0.00050	0.032000	0.00350	73.50000	<0.00050	0.00075	0.037	<0.030	0.0227	0.0	1.17	2.070000
Flame and Moth Tailings Humidity Cell	21-Aug-13	Week 6	500	475		7.88	329	158	48.2	<0.50	0.162	<0.050	105	0.0014	<0.0050	<0.0050	0.0269	0.00569	0.02010	<0.00010	<0.00050	0.028000	0.00285	61.60000	<0.00050	0.00063	0.030	<0.030	0.0204	0.0	0.904	1.670000
Flame and Moth Tailings Humidity Cell	28-Aug-13	Week 7	500	450		7.94	368	186	48.3	<0.50	0.120	<0.050	120	<0.0010	<0.0050	<0.0050	0.0276	0.00700	0.02440	<0.00010	<0.00050	0.029000	0.00405	72.80000	<0.00050	0.00092	0.040	<0.030	0.0268	0.0	0.918	2.190000
Flame and Moth Tailings Humidity Cell	4-Sep-13	Week 8	500	445		7.90	310	149	55.7	<0.50	0.126	<0.050	90.5	<0.0010	<0.0050	<0.0050	0.0280	0.00756	0.01950	<0.00010	<0.00050	0.022000	0.00353	58.70000	<0.00050	0.00073	0.036	<0.030	0.0250	0.0	0.696	1.620000
Flame and Moth Tailings Humidity Cell	11-Sep-13	Week 9	500	470	10.70	7.90	290	143	52.4	<0.50	0.107	<0.050	85.3	<0.0010	<0.0050	<0.0050	0.0270	0.00723	0.01860	<0.00010	<0.00050	0.020000	0.00321	56.10000	<0.00050	0.00060	0.032	<0.030	0.0224	0.0	0.658	1.390000
Flame and Moth Tailings Humidity Cell	18-Sep-13	Week 10	500	470	1.10	7.92	282	137	49.2	<0.50	0.083	<0.050	83.8	0.0017	<0.0050	<0.0050	0.0272	0.00687	0.01700	<0.00010	<0.00050	0.018000	0.00266	53.90000	<0.00050	0.00053	0.026	<0.030	0.0184	0.0	0.650	1.420000
Flame and Moth Tailings Humidity Cell	25-Sep-13	Week 11	500	475	4.10	7.94	282	139	49.1	<0.50	0.087	<0.050	80.8	<0.0010	<0.0050	<0.0050	0.0275	0.00748	0.01740	<0.00010	<0.00050	0.018000	0.00278	54.50000	<0.00050	0.00055	0.027	<0.030	0.0186	0.0	0.677	1.350000
Flame and Moth Tailings Humidity Cell	2-Oct-13	Week 12	500	450	5.90	7.87	266	129	44.1	<0.50	0.065	<0.050	75.5	<0.0010	<0.0050	<0.0050	0.0274	0.00751	0.01490	<0.00010	<0.00050	0.016000	0.00169	50.40000	<0.00050	0.00035	0.018	<0.030	0.0137	0.0	0.631	1.070000
Flame and Moth Tailings Humidity Cell	9-Oct-13	Week 13	500	445	2.00	7.89	236	118	44.5	<0.50	0.065	<0.050	62.7	<0.0010	<0.0050	<0.0050	0.0290	0.00745	0.01340	<0.00010	<0.00050	0.015000	0.00181	46.30000	<0.00050	0.00034	0.017	<0.030	0.0122	0.0	0.642	0.983000
Flame and Moth Tailings Humidity Cell	16-Oct-13	Week 14	500	445	3.00	7.87	235	114	46.6	<0.50	0.045	<0.050	58.9	<0.0010	<0.0050	<0.0050	0.0276	0.00842	0.01440	<0.00010	<0.00050	0.014000	0.00236	44.50000	<0.00050	0.00042	0.022	<0.030	0.0142	0.0	0.708	1.150000
Flame and Moth Tailings Humidity Cell	23-Oct-13	Week 15	500	440	2.10	7.86	225	114	46.6	<0.50	0.053	<0.050	54.6	<0.0010	<0.0050	<0.0050	0.0277	0.00799	0.01310	<0.00010	<0.00050	0.012000	0.00226	44.40000	<0.00050	0.00039	0.021	<0.030	0.0138	0.0	0.699	1.010000
Flame and Moth Tailings Humidity Cell	30-Oct-13	Week 16	500	475	1.50	7.89	220	110	46.5	0.51	0.052	<0.050	52.1	<0.0010	<0.0050	<0.0050	0.0290	0.00856	0.01230	<0.00010	<0.00050	0.014000	0.00211	42.90000	<0.00050	0.00039	0.021	<0.030	0.0133	0.0	0.755	1.040000
Flame and Moth Tailings Humidity Cell	6-Nov-13	Week 17	500	440	1.60	7.95	207	95.6	47.2	0.64	0.044	<0.050	46.2	<0.0010	<0.0050	<0.0050	0.0294	0.00952	0.01140	<0.00010	<0.00050	0.012000	0.00202	37.10000	<0.00050	0.00034	0.019	<0.030	0.0135	0.0	0.726	0.944000
Flame and Moth Tailings Humidity Cell	13-Nov-13	Week 18	500	450	1.00	7.92	200	95.9	49.0	0.77	0.040	<0.050	39.9	0.0036	<0.0050	<0.0050	0.0307	0.0119	0.01140	<0.00010	<0.00050	0.012000	0.00213	37.10000	<0.00050	0.00034	0.020	<0.030	0.0122	0.0	0.788	1.000000
Flame and Moth Tailings Humidity Cell	20-Nov-13	Week 19	500	450	4.90	7.95	191	91.3	47.9	0.95	0.041	<0.050	37.9	<0.0010	<0.0050	<0.0050	0.0304	0.00913	0.01010	<0.00010	<0.00050	0.013000	0.00179	35.30000	<0.00050	0.00030	0.016	<0.030	0.0118	0.0	0.768	0.846000
Flame and Moth Tailings Humidity Cell	27-Nov-13	Week 20	500	450	1.70	7.97	209	93.9	54.8	1.25	0.041	<0.050	40.6	<0.0010	<0.0050	<0.0050	0.0314	0.00949	0.01120	<0.00010	<0.00050	0.012000	0.00201	36.20000	<0.00050	0.00036	0.019	<0.030	0.0130	0.0	0.888	0.971000
Flame and Moth Tailings Humidity Cell	4-Dec-13	Week 21	500	460	3.00	7.97	195	92.8	53.8	1.33	0.039	<0.050	35.5	<0.0010	<0.0050	<0.0050	0.0322	0.00967	0.01050	<0.00010	<0.00050	0.013000	0.00188	35.70000	<0.00050	0.00032	0.018	<0.030	0.0117	0.0	0.899	0.922000
Flame and Moth Tailings Humidity Cell	11-Dec-13	Week 22	500	445	3.60	7.97	168	82.9	45.6	1.25	0.033	<0.050	28.9	<0.0010	<0.0050	0.0050	0.0329	0.00890	0.00789	<0.00010	<0.00050	0.012000	0.00114	31.90000	<0.00050	0.00019	0.012	<0.030	0.00854	0.0	0.779	0.597000
Flame and Moth Tailings Humidity Cell	18-Dec-13	Week 23	500	450	2.40	7.98	177	90.2	50.0	1.50	0.032	<0.050	28.9	0.0020	<0.0050	<0.0050	0.0334	0.0117	0.00937	<0.00010	<0.00050	0.012000	0.00163	34.60000	<0.00050	0.00028	0.015	<0.030	0.0104	0.0	0.942	0.846000
Flame and Moth Tailings Humidity Cell	24-Dec-13	Week 24	500	425	1.30	7.99	172	80.7	49.5	1.42	0.031	<0.050	25.5	0.0013	<0.0050	<0.0050	0.0327	0.0107	0.00853	<0.00010	<0.00050	0.014000	0.00140	30.80000	<0.00050	0.00024	0.014	<0.030	0.00916	0.0	0.920	0.716000
Flame and Moth Tailings Humidity Cell	31-Dec-13	Week 25	500	425	2.60	7.95	184	87.9	56.4	1.80	0.033	<0.050	28.0	0.0012	<0.0050	0.0095	0.0320	0.0127	0.00972	<0.00010	<0.00050	0.015000	0.00178	33.40000	<0.00050	0.00039	0.016	<0.030	0.0106	0.0	1.11	0.888000
Flame and Moth Tailings Humidity Cell	8-Jan-14	Week 26	500	420	2.20	7.95	172	83.2	66.3	1.80	0.031	<0.050	25.3	<0.0010	<0.0050	<0.0050	0.0312	0.0116	0.00869	<0.00010	<0.00050	0.013000	0.00167	31.70000	<0.00050	0.00027	0.015	<0.030	0.0101	0.0	1.01	0.763000
Flame and Moth Tailings Humidity Cell	15-Jan-14	Week 27	500	475	1.30	8.03	192	95.2	58.7	2.12	0.033	<0.050	30.9	<0.0010	<0.0050	<0.0050	0.0308	0.0108	0.01000	<0.00010	<0.00050	0.014000	0.00182	35.90000	<0.00050	0.00034	0.018	<0.030	0.0107	0.0	1.34	0.983000
Flame and Moth Tailings Humidity Cell	22-Jan-14	Week 28	500	450	1.80	8.01	180	93.3	51.9	1.88	0.033	<0.050	29.8	<0.0010	<0.0050	<0.0050	0.0320	0.0110	0.00833	<0.00010	<0.00050	0.012000	0.00109	35.20000	<0.00050	0.00020	0.012	<0.030	0.00815	0.0	1.32	0.661000
Flame and Moth Tailings Humidity Cell	29-Jan-14	Week 29	500	425	1.50	8.05	161	82.5	60.8	1.44	0.031	<0.050	22.0	<0.0010	<0.0050	0.0055	0.0302	0.0116	0.00897	<0.00010	<0.00050	0.012000	0.00119	30.50000	<0.00050	0.00029	0.012	<0.030	0.00724	0.0	1.53	0.787000
Flame and Moth Tailings Humidity Cell	5-Feb-14	Week 30	500	470	2.00	7.97	179	89.1	61.3	1.80	0.029	<0.050	26.4	<0.0010	<0.0050	<0.0050	0.0282	0.0131	0.00860	<0.00010	<0.00050	0.012000	0.00165	33.40000	<0.00050	0.00033	0.015	<0.030	0.00834	0.0	1.39	0.987000
Flame and Moth Tailings Humidity Cell	12-Feb-14	Week 31	500	425	1.20	7.97	160	81.6	56.2	1.42	0.027	<0.050	20.2	<0.0010	<0.0050	<0.0050	0.0272	0.0109	0.00747	<0.00010	<0.00050	0.010000	0.00135	30.70000	<0.00050	0.00023	0.013	<0.030	0.00761	0.0	1.18	0.741000
Flame and Moth Tailings Humidity Cell	19-Feb-14	Week 32	500	490	2.90	7.95	181	89.0	59.4	1.78	0.027	<0.050	27.3	<0.0010	<0.0050	<0.0050	0.0254	0.0119	0.00834	<0.00010	<0.00050	0.012000	0.00164	33.20000	<0.00050	0.00033	0.015	<0.030	0.00778	0.0	1.47	0.996000
Flame and Moth Tailings Humidity Cell	26-Feb-14	Week 33	500	430	<1.0	8.01	156	78.3	47.6	1.36	0.031	<0.050	25.0	<0.0010	<0.0050	0.0061	0.0257	0.0123	0.00578	<0.00010	<0.00050	<0.010	0.000855	29.40000	<0.00050	0.00013	0.008	<0.030	0.00502	0.0	1.23	0.464000
Flame and Moth Tailings Humidity Cell	5-Mar-14	Week 34	500	420	1.50	8.04	163	83.6	58.5	1.28	0.032	<0.050	24.3	<0.0010	<0.0050	<0.0050	0.0238	0.0114	0.00691	<0.00010	<0.00050	0.012000	0.00122	31.20000	<0.00050	0.00022	0.010	<0.030	0.00587	0.0	1.40	0.754000
Flame and Moth Tailings Humidity Cell	12-Mar-14	Week 35	500	475	1.20	7.97	191	100	63.0	1.69	0.031	<0.050	31.5	<0.0010	<0.0050	<0.0050	0.0228	0.00934	0.00872	<0.00010	<0.00050	0.011000	0.00158	37.30000	<0.00050	0.00036	0.014	<0.030	0.00596	0.0	1.73	1.070000
Flame and Moth Tailings Humidity Cell	19-Mar-14	Week 36	500	440	2.80	8.02	180	92.8	61.2	1.45	0.032	<0.050	30.9	<0.0010	<0.0050	<0.0050	0.0220	0.00801	0.00718	<0.00010	<0.00050	0.011000	0.000982	34.50000	<0.00050	0.00021	0.010	<0.030	0.00464	0.0	1.60	0.697000
Flame and Moth Tailings Humidity Cell	26-Mar-14	Week 37	500	475	2.50	7.95	191	98.5	65.7	1.49	0.034	<0.050	31.0	<0.0010	<0.0050	<0.0050	0.0213	0.00781	0.00849	<0.00010	<0.00050	0.012000	0.00158	36.30000	<0.00050	0.00038	0.014	<0.030	0.00535	0.0	1.89	1.180000
Flame and Moth Tailings Humidity Cell	2-Apr-14	Week 38	500	420	1.90	7.97	170	85.3	62.5	1.42	0.033	<0.050	23.3	<0.0010	<0.0050	<0.0050	0.0188	0.00818	0.00678	<0.00010	<0.00050	<0.010	0.00118	31.70000	<0.00050	0.00027	0.011	<0.030	0.00442	0.0	1.51	0.858000
Flame and Moth Tailings Humidity Cell	9-Apr-14	Week 39	500	425	2.80	7.87	186	94.8	65.7	1.61	0.035	<0.050	27.4	<0.0010	<0.0050	<0.0050	0.0180	0.00898	0.00796	<0.00010	<0.00050	0.010000	0.00152	35.00000	<0.00050	0.00039	0.013	<0.030	0.00447	0.0	1.81	1.140000
Flame and Moth Tailings Humidity Cell	16-Apr-14	Week 40	500	470	<1.0	7.99	204	108	68.2	1.60	0.035	<0.050	35.1	<0.0010	<0.0050	<0.0050	0.0187	0.00870	0.00863	<0.00010	<0.00050	0.011000	0.00175	40.10000	<0.00050	0.00048	0.014	<0.030	0.00439	0.0	2.00	1.450000
Flame and Moth Tailings Humidity Cell	23-Apr-14	Week 41	500	450	2.30	7.86	189	98.0	66.0	1.36	0.038	<0.050	31.3	0.0011	<0.0050	<0.0050	0.0176	0.0105	0.00801	<0.00010	<0.00050	0.010000	0.00156	36.30000	<0.00050	0.00038	0.013	<0.030	0.00459	0.0	1.81	1.120000
Flame and Moth Tailings Humidity Cell	30-Apr-14	Week 42	500	450	6.30	8.01	178	93.1	64.1	1.14	0.034	<0.050	25.4	<0.0010	<0.0050	<0.0050	0.0177	0.00721	0.00701	<0.00010	<0.00050	<0.010	0.00157	34.50000	<0.00050	0.00037	0.012	<0.030	0.00410	0.0	1.69	1.100000
Flame and Moth Tailings Humidity Cell	7-May-14	Week 43	500	450	2.30	7.96	182	95.9	64.1	1.33	0.035	<0.050	28.0	<0.0010	<0.0050	<0.0050	0.0164	0.00685	0.00706	<0.00010	<0.00050	<0.010	0.00151	35.50000	<0.00050	0.00035	0.012	<0.030	0.00351	0.0	1.77	1.140000
Flame and Moth Tailings Humidity Cell	14-May-14	Week 44	500	460	1.10	7.94	189	96.8	67.0	1.37	0.037	<0.050	30.1	0.0011	<0.0050	<0.0050	0.0155	0.00693	0.00729	<0.00010	<0.00050	0.011000	0.00169	35.50000	<0.00050	0.00042	0.013	<0.030	0.00390	0.0	1.98	1.270000
Flame and Moth Tailings Humidity Cell	21-May-14	Week 45	500	455	<1.0	8.08	195	106	70.3	1.32	0.036	<0.050	31.0	<0.0010	0.0053	<0.0050	0.0159	0.00715	0.00760	<0.00010	<0.00050	0.013000	0.00165	38.70000	<0.00050	0.00045	0.013	<0.030	0.00351	0.0	2.18	1.340000
Flame and Moth Tailings Humidity Cell	28-May-14	Week 46	500	460	1.40	7.92	181	93.1	68.3	1.12	0.035	<0.050	27.2	<0.0010	<0.0050	<0.0050	0.0159	0.00665	0.00688	<0.00010	<0.00050	0.011000	0.00133	34.10000	<0.00050	0.00031	0.011	<0.030	0.00323	0.0	1.96	1.040000
Flame and Moth Tailings Humidity Cell	3-Jun-14	Week 47	500	430	2.80	7.99	173	91.2	66.7	1.06	0.034	<0.050	24.3	<0.0010	<0.0050	<0.0050	0.0141	0.00628	0.00630	<0.00010	<0.00050	<0.010	0.00149	33.40000	<0.00050	0.00034	0.011	<0.030	0.00291	0.0	1.88	1.060000
Flame and Moth Tailings Humidity Cell	11-Jun-14	Week 48	500	470	1.10	7.94	187	96.5	77.2	1.12	0.033	<0.050	27.3	<0.0010	<0.0050	<0.0050	0.0144	0.00648	0.00682	<0.00010	<0.00050	0.010000	0.00181	35.10000	<0.00050	0.00041	0.012	<0.030	0.00294	0.0	2.18	1.300000
Flame and Moth Tailings Humidity Cell	18-Jun-14	Week 49	500	465	<1.0	8.04	188	99.6	76.1	1.11	0.030	<0.050	28.2	<0.0010	<0.0050	<0.0050	0.0147	0.00618	0.00676	<0.00010	<0.00050	<0.010	0.00168	36.20000	<0.00050	0.00041	0.012	<0.030	0.00246	0.0	2.22	1.350000
Flame and Moth Tailings Humidity Cell	25-Jun-14	Week 50	500	450	1.70	8.08	189	99.4	72.3	1.13	0.030	<0.050	29.5	0.0015	<0.0050	<0.0050	0.0143	0.00596	0.00633	<0.00010	<0.00050	0.012000	0.00125	35.90000	<0.00050	0.00032	0.009	<0.030	0.00209	0.0	2.39	1.150000
Flame and Moth Tailings Humidity Cell	2-Jul-14	Week 51	500	445	2.80	8.12	190	97.7	72.6	0.95	0.029	<0.050	29.9	0.0031	<0.0050	<0.0050	0.0134	0.00585	0.00551	<0.00010	<0.00050	0.012000	0.000907	35.20000	<0.00050	0.00023	0.008	<0.030	0.00159	0.0	2.39	0.870000
Flame and Moth Tailings Humidity Cell	9-Jul-14	Week 52	500	450	<1.0	8.02	164	85.8	66.4	0.88	<0.020	<0.050	23.4	<0.0010	<0.0050	<0.0050	0.0114	0.00482	0.00515	<0.00010	<0.00050	0.013000	0.00118	31.00000	<0.00050	0.00030	0.007	<0.030	0.00148	0.0	2.06	1.020000

Description	Sample Date	Sample Comments	Total Volume In	Total Volume Out	Total Acidity	pH (lab)	Specific Conductance (lab)	Hardness (from dissolved)	Alkalinity, total	Chloride	Fluoride	Bromide	Sulphate, dissolved	Nitrite (N)	Nitrate (N)	Aluminum (Al), dissolved	Antimony (Sb), dissolved	Arsenic (As), dissolved	Barium (Ba), dissolved	Beryllium (Be), dissolved	Bismuth (Bi), dissolved	Boron (B), dissolved	Cadmium (Cd), dissolved	Calcium (Ca), dissolved	Chromium (Cr), dissolved	Cobalt (Co), dissolved	Copper (Cu), dissolved	Iron (Fe), dissolved	Lead (Pb), dissolved	Lithium (Li), dissolved	Magnesium (Mg), dissolved	Mangane
			mL	mL	mg/L	pH units	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Type A WUL QZ09-092 FM EQS-DM						6.5-9.5											0.1						0.01				0.1		0.2			
Flame and Moth Tailings Humidity Cell	16-Jul-14	Week 53	500	450																												
Flame and Moth Tailings Humidity Cell	23-Jul-14	Week 54	500	475	2.10	7.94	211	104	69.6	1.36	0.024	<0.050	32.9	<0.0010	<0.0050	<0.0050	0.0121	0.00551	0.00685	<0.00010	<0.00050	0.012000	0.00199	37.20000	<0.00050	0.00049	0.011	<0.030	0.00176	0.0	2.79	1.630000
Flame and Moth Tailings Humidity Cell	30-Jul-14	Week 55	500	420																												
Flame and Moth Tailings Humidity Cell	6-Aug-14	Week 56	500	455	1.20	8.12	193	96.4	67.7	0.89	0.023	<0.050	26.0	0.0047	<0.0050	<0.0050	0.0123	0.00522	0.00584	<0.00010	<0.00050	0.011000	0.00146	34.70000	<0.00050	0.00038	0.008	<0.030	0.00127	0.0	2.39	1.350000
Flame and Moth Tailings Humidity Cell	13-Aug-14	Week 57	500	450																												
Flame and Moth Tailings Humidity Cell	20-Aug-14	Week 58	500	450	2.00	8.10	204	102	73.8	0.88	<0.020	<0.050	29.9	0.0048	<0.0050	<0.0050	0.0109	0.00457	0.00573	<0.00010	<0.00050	0.011000	0.00152	36.30000	<0.00050	0.00039	0.007	<0.030	0.000998	0.0	2.75	1.410000
Flame and Moth Tailings Humidity Cell	27-Aug-14	Week 59	500	450																												
Flame and Moth Tailings Humidity Cell	3-Sep-14	Week 60	500	470	<1.0	8.01	209	104	73.5	0.95	<0.020	<0.050	31.0	0.0028	0.0054	<0.0050	0.0107	0.00460	0.00578	<0.00010	<0.00050	0.012000	0.00201	36.90000	<0.00050	0.00046	0.009	<0.030	0.00133	0.0	3.00	1.570000
Flame and Moth Tailings Humidity Cell	10-Sep-14	Week 61	500	450																												
Flame and Moth Tailings Humidity Cell	17-Sep-14	Week 62	500	460	3.80	7.98	169	84.5	61.0	0.72	<0.020	<0.050	24.1	0.0033	0.0052	<0.0050	0.00785	0.00340	0.00443	<0.00010	<0.00050	0.011000	0.00162	29.90000	<0.00050	0.00031	0.006	<0.030	0.000495	0.0	2.42	1.320000
Flame and Moth Tailings Humidity Cell	24-Sep-14	Week 63	500	470																												
Flame and Moth Tailings Humidity Cell	1-Oct-14	Week 64	500	470	1.70	7.88	142	63.6	46.7	0.55	<0.020	<0.050	19.4	<0.0010	<0.0050	<0.0050	0.00560	0.00189	0.00313	<0.00010	<0.00050	0.012000	0.00106	22.30000	<0.00050	0.00017	0.003	<0.030	0.000291	0.0	1.93	0.838000
Flame and Moth Tailings Humidity Cell	8-Oct-14	Week 65	500	440																												
Flame and Moth Tailings Humidity Cell	15-Oct-14	Week 66	500	450	1.70	7.95	170	84.0	55.9	0.80	<0.020	<0.050	28.5	0.0015	0.0053	<0.0050	0.00697	0.00255	0.00429	<0.00010	<0.00050	0.013000	0.00133	28.90000	<0.00050	0.00029	0.005	<0.030	0.000419	0.0	2.86	1.260000
Flame and Moth Tailings Humidity Cell	22-Oct-14	Week 67	500	455																												
Flame and Moth Tailings Humidity Cell	29-Oct-14	Week 68	500	450	2.30	7.92	203	105	73.8	0.95	<0.020	<0.050	33.6	0.0056	0.0068	<0.0050	0.00809	0.00312	0.00509	<0.00010	<0.00050	0.012000	0.00192	36.70000	<0.00050	0.00046	0.007	<0.030	0.000571	0.0	3.33	1.690000
Flame and Moth Tailings Humidity Cell	5-Nov-14	Week 69	500	450																												
Flame and Moth Tailings Humidity Cell	12-Nov-14	Week 70	500	425	2.60	8.03	175	89.8	67.3	0.88	<0.020	<0.050	28.9	0.0074	<0.0050	<0.0050	0.00624	0.00256	0.00353	<0.00010	<0.00050	0.015000	0.000983	30.50000	<0.00050	0.00026	0.004	<0.030	0.000217	0.0	3.32	1.150000
Flame and Moth Tailings Humidity Cell	19-Nov-14	Week 71	500	450																												
Flame and Moth Tailings Humidity Cell	26-Nov-14	Week 72	500	460	2.90	7.66	165	82.9	58.3	0.84	<0.020	<0.050	26.7	0.0099	<0.0050	<0.0050	0.00511	0.00227	0.00322	<0.00010	<0.00050	<0.010	0.00120	28.20000	<0.00050	0.00025	0.004	<0.030	0.000176	0.0	3.07	1.050000
Flame and Moth Tailings Humidity Cell	3-Dec-14	Week 73	500	425																												
Flame and Moth Tailings Humidity Cell	10-Dec-14	Week 74	500	425	1.50	8.04	181	91.8	61.5	0.87	<0.020	<0.050	28.4	0.0115	0.0063	<0.0050	0.00508	0.00215	0.00294	<0.00010	<0.00050	0.011000	0.000883	30.70000	<0.00050	0.00021	0.003	<0.030	0.000176	0.0	3.69	1.100000
Flame and Moth Tailings Humidity Cell	17-Dec-14	Week 75	500	450																												
Flame and Moth Tailings Humidity Cell	22-Dec-14	Week 76	500	450	3.60	7.78	240	122	86.7	1.17	<0.020	<0.050	38.7	0.0131	0.0055	<0.0050	0.00764	0.00316	0.00492	<0.00010	<0.00050	0.013000	0.00167	40.90000	<0.00050	0.00050	0.006	<0.030	0.000425	0.0	4.85	1.930000
Flame and Moth Tailings Humidity Cell	30-Dec-14	Week 77	500	390																												
Flame and Moth Tailings Humidity Cell	7-Jan-15	Week 78	500	375																												
Flame and Moth Tailings Humidity Cell	14-Jan-15	Week 79	500	410																												
Flame and Moth Tailings Humidity Cell	21-Jan-15	Week 80	500	400	1.50	7.94	155	73.7	48.6	1.03	<0.020	<0.050	26.3	0.0240	<0.0050	<0.0050	0.00413	0.00165	0.00187	<0.00010	<0.00050	<0.010	0.000501	23.70000	<0.00050	<0.00010	0.002	<0.030	0.000090	0.0	3.54	0.382000
Flame and Moth Tailings Humidity Cell	28-Jan-15	Week 81	500	400																												
Flame and Moth Tailings Humidity Cell	4-Feb-15	Week 82	500	430																												
Flame and Moth Tailings Humidity Cell	11-Feb-15	Week 83	500	440																												
Flame and Moth Tailings Humidity Cell	18-Feb-15	Week 84	500	450	1.40	8.00	142	66.9	53.2	0.81	<0.020	<0.050	19.8	0.0158	<0.0050	<0.0050	0.00296	0.00120	0.00182	<0.00010	<0.00050	<0.010	0.000614	21.20000	<0.00050	0.00016	0.002	<0.030	<0.000050	0.0	3.41	0.654000
Flame and Moth Tailings Humidity Cell	25-Feb-15	Week 85	500	425																												
Flame and Moth Tailings Humidity Cell	4-Mar-15	Week 86	500	445																												
Flame and Moth Tailings Humidity Cell	11-Mar-15	Week 87	500	470																												
Flame and Moth Tailings Humidity Cell	18-Mar-15	Week 88	500	460	<1.0	8.04	153	74.3	57.0	0.85	<0.020	<0.050	22.1	0.0058	<0.0050	<0.0050	0.00269	0.00102	0.00207	<0.00010	<0.00050	<0.010	0.000563	23.70000	<0.00050	0.00012	0.002	<0.030	<0.000050	0.0	3.64	0.619000
Flame and Moth Tailings Humidity Cell	25-Mar-15	Week 89	500	460																												
Flame and Moth Tailings Humidity Cell	1-Apr-15	Week 90	500	420																												
Flame and Moth Tailings Humidity Cell	8-Apr-15	Week 91	500	430																												
Flame and Moth Tailings Humidity Cell	15-Apr-15	Week 92	500	450	1.30	8.15	185	94.7	72.2	0.91	<0.020	<0.050	23.2	0.0067	<0.0050	<0.0050	0.00313	0.00131	0.00178	<0.00010	<0.00050	0.012000	0.000669	30.10000	<0.00050	0.00021	0.002	<0.030	0.000054	<0.0010	4.74	0.950000
Flame and Moth Tailings Humidity Cell	22-Apr-15	Week 93	500	425																												
Flame and Moth Tailings Humidity Cell	29-Apr-15	Week 94	500	455																												
Flame and Moth Tailings Humidity Cell	6-May-15	Week 95	500	440																												
Flame and Moth Tailings Humidity Cell	13-May-15	Week 96	500	440	1.30	8.06	181	89.0	69.8	0.96	<0.020	<0.050	23.7	0.0055	<0.0050	<0.0050	0.00270	0.00100	0.00160	<0.00010	<0.00050	<0.010	0.000795	28.40000	<0.00050	0.00023	0.003	<0.030	<0.000050	<0.0010	4.38	1.030000
Flame and Moth Tailings Humidity Cell	20-May-15	Week 97	500	450																												
Flame and Moth Tailings Humidity Cell	27-May-15	Week 98	500	445																												

Description	Sample Date	Sample Comments	[illegible]se (Mn), dissolved	Mercury (Hg), dissolved	Molybdenum (Mo), dissolved	Nickel (Ni), dissolved	Phosphorus (P), dissolved	Potassium (K), dissolved	Selenium (Se), dissolved	Silicon (Si), dissolved	Silver (Ag), dissolved	Sodium (Na), dissolved	Strontium (Sr), dissolved	Sulphur (S), dissolved	Thallium (Tl), dissolved	Tin (Sn), dissolved	Titanium (Ti), dissolved	Uranium (U), dissolved	Vanadium (V), dissolved	Zinc (Zn), dissolved	Total Anion Sum	Total Cation Sum	Ion B[illegible]
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L	
Type A WUL QZ09-092 FM EQS-DM						0.5					0.02									0.5			
Flame and Moth Tailings Humidity Cell	10-Jul-13	Week 0	0.000060	0.00251	0.01	0.75	8.46	0.00442	2.020000	0.000454	11.3	1.46	367	0.00040	<0.00020	<0.010	0.000815	<0.0020	**0.777**	24.40	23.7	0.99	
Flame and Moth Tailings Humidity Cell	17-Jul-13	Week 1	0.000043	0.00274	0.00	<0.30	2.67	0.00110	1.750000	0.000290	2.18	0.645	155	0.00024	<0.00010	<0.010	0.000173	<0.0010	**0.568**	9.69	10.0	1.02	
Flame and Moth Tailings Humidity Cell	24-Jul-13	Week 2	0.000092	0.00213	0.00	<0.30	1.34	0.00051	1.630000	0.000977	0.701	0.325	74.5	0.00012	<0.00010	<0.010	0.000042	<0.0010	0.436	4.88	5.25	1.04	
Flame and Moth Tailings Humidity Cell	31-Jul-13	Week 3	0.000022	0.00204	0.00	<0.30	0.955	0.00029	1.350000	0.000374	0.266	0.180	43.0	0.00009	<0.00010	<0.010	0.000011	<0.0010	0.174	3.42	3.56	1.02	
Flame and Moth Tailings Humidity Cell	7-Aug-13	Week 4	0.000019	0.00207	0.00	<0.30	0.873	0.00032	1.420000	0.000328	0.196	0.186	49.3	0.00012	<0.00010	<0.010	0.000017	<0.0010	0.355	3.89	3.79	0.99	
Flame and Moth Tailings Humidity Cell	14-Aug-13	Week 5	0.000025	0.00159	0.00	<0.30	0.721	0.00031	1.320000	0.000380	0.147	0.112	46.3	0.00008	<0.00010	<0.010	0.000011	<0.0010	0.303	3.45	3.88	1.06	
Flame and Moth Tailings Humidity Cell	21-Aug-13	Week 6	0.000016	0.00177	0.00	<0.30	0.618	0.00025	1.140000	0.000475	0.106	0.0975	40.1	0.00008	<0.00010	<0.010	<0.000010	<0.0010	0.227	3.17	3.24	1.01	
Flame and Moth Tailings Humidity Cell	28-Aug-13	Week 7	0.000017	0.00155	0.00	<0.30	0.600	0.00031	1.230000	0.000474	0.100	0.0999	46.4	0.00010	<0.00010	<0.010	0.000013	<0.0010	0.369	3.47	3.82	1.05	
Flame and Moth Tailings Humidity Cell	4-Sep-13	Week 8	0.000025	0.00172	0.00	<0.30	0.488	0.00023	1.140000	0.000653	0.076	0.0783	34.3	0.00009	<0.00010	<0.010	<0.000010	<0.0010	0.298	3.00	3.07	1.01	
Flame and Moth Tailings Humidity Cell	11-Sep-13	Week 9	0.000026	0.00162	0.00	<0.30	0.451	0.00023	1.120000	0.000972	0.069	0.0642	32.5	0.00008	<0.00010	<0.010	<0.000010	<0.0010	0.236	2.83	2.93	1.02	
Flame and Moth Tailings Humidity Cell	18-Sep-13	Week 10	0.000022	0.00148	0.00	<0.30	0.408	0.00024	0.948000	0.000929	0.056	0.0592	33.2	0.00008	<0.00010	<0.010	<0.000010	<0.0010	0.189	2.73	2.81	1.01	
Flame and Moth Tailings Humidity Cell	25-Sep-13	Week 11	0.000035	0.00147	0.00	<0.30	0.389	0.00023	1.050000	0.00128	0.063	0.0559	32.4	0.00008	<0.00010	<0.010	<0.000010	<0.0010	0.199	2.67	2.85	1.03	
Flame and Moth Tailings Humidity Cell	2-Oct-13	Week 12	0.000030	0.00146	0.00	<0.30	0.391	0.00022	0.943000	0.00154	0.060	0.0485	31.4	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.102	2.46	2.62	1.03	
Flame and Moth Tailings Humidity Cell	9-Oct-13	Week 13	0.000027	0.00138	0.00	<0.30	0.355	0.00018	0.944000	0.00178	<0.050	0.0413	26.2	0.00007	<0.00010	0.010	<0.000010	<0.0010	0.103	2.20	2.41	1.05	
Flame and Moth Tailings Humidity Cell	16-Oct-13	Week 14	0.000024	0.00136	0.00	<0.30	0.348	0.00017	0.907000	0.00149	0.060	0.0411	24.9	0.00008	<0.00010	<0.010	<0.000010	<0.0010	0.149	2.16	2.34	1.04	
Flame and Moth Tailings Humidity Cell	23-Oct-13	Week 15	0.000022	0.00127	0.00	<0.30	0.297	0.00016	0.881000	0.00154	<0.050	0.0377	24.2	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.139	2.07	2.32	1.06	
Flame and Moth Tailings Humidity Cell	30-Oct-13	Week 16	0.000025	0.00131	0.00	<0.30	0.312	0.00017	0.922000	0.00228	0.050	0.0384	21.0	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.130	2.03	2.26	1.05	
Flame and Moth Tailings Humidity Cell	6-Nov-13	Week 17	0.000019	0.00116	0.00	<0.30	0.299	0.00014	0.861000	0.00196	0.051	0.0341	19.0	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.117	1.93	1.96	1.01	
Flame and Moth Tailings Humidity Cell	13-Nov-13	Week 18	0.000016	0.00122	0.00	<0.30	0.325	0.00012	0.803000	0.000942	<0.050	0.0343	16.7	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.120	1.83	1.97	1.03	
Flame and Moth Tailings Humidity Cell	20-Nov-13	Week 19	0.000017	0.00115	0.00	<0.30	0.277	0.00012	0.804000	0.00170	0.057	0.0308	16.0	0.00006	<0.00010	<0.010	<0.000010	<0.0010	0.0989	1.77	1.87	1.03	
Flame and Moth Tailings Humidity Cell	27-Nov-13	Week 20	0.000021	0.00112	0.00	<0.30	0.302	0.00016	0.768000	0.00155	0.072	0.0336	14.9	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.114	1.98	1.93	0.99	
Flame and Moth Tailings Humidity Cell	4-Dec-13	Week 21	0.000012	0.00112	0.00	<0.30	0.265	0.00018	0.879000	0.00209	0.053	0.0321	14.3	0.00006	<0.00010	<0.010	<0.000010	<0.0010	0.106	1.85	1.90	1.01	
Flame and Moth Tailings Humidity Cell	11-Dec-13	Week 22	0.000011	0.00111	<0.00050	<0.30	0.259	0.00010	0.758000	0.00199	<0.050	0.0265	12.1	0.00006	<0.00010	<0.010	<0.000010	<0.0010	0.0542	1.55	1.69	1.04	
Flame and Moth Tailings Humidity Cell	18-Dec-13	Week 23	0.000011	0.00102	0.00	<0.30	0.261	0.00012	0.826000	0.00205	<0.050	0.0279	11.7	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0821	1.65	1.84	1.06	
Flame and Moth Tailings Humidity Cell	24-Dec-13	Week 24	0.000014	0.00105	<0.00050	<0.30	0.265	<0.00010	0.783000	0.00204	<0.050	0.0266	10.2	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0701	1.56	1.65	1.03	
Flame and Moth Tailings Humidity Cell	31-Dec-13	Week 25	0.000016	0.00103	0.00	<0.30	0.282	<0.00010	0.817000	0.00221	0.076	0.0311	11.9	0.00008	<0.00010	<0.010	<0.000010	<0.0010	0.0979	1.76	1.80	1.01	
Flame and Moth Tailings Humidity Cell	8-Jan-14	Week 26	<0.000010	0.000969	<0.00050	<0.30	0.251	<0.00010	0.737000	0.00188	<0.050	0.0276	10.5	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0841	1.91	1.70	0.94	
Flame and Moth Tailings Humidity Cell	15-Jan-14	Week 27	0.000010	0.000987	0.00	<0.30	0.287	0.00012	0.848000	0.00219	0.099	0.0314	12.3	0.00008	<0.00010	<0.010	<0.000010	<0.0010	0.101	1.88	1.95	1.02	
Flame and Moth Tailings Humidity Cell	22-Jan-14	Week 28	<0.000010	0.000992	<0.00050	<0.30	0.269	0.00012	0.784000	0.00215	<0.050	0.0287	12.0	0.00008	<0.00010	<0.010	<0.000010	<0.0010	0.0559	1.71	1.90	1.05	
Flame and Moth Tailings Humidity Cell	29-Jan-14	Week 29	<0.000010	0.00123	<0.00050	<0.30	0.299	<0.00010	0.714000	0.00157	0.250	0.0310	8.62	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0580	1.72	1.72	1	
Flame and Moth Tailings Humidity Cell	5-Feb-14	Week 30	<0.000010	0.000819	0.00	<0.30	0.245	0.00010	0.750000	0.00179	<0.050	0.0300	10.9	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0912	1.83	1.83	1	
Flame and Moth Tailings Humidity Cell	12-Feb-14	Week 31	<0.000010	0.000796	<0.00050	<0.30	0.238	<0.00010	0.735000	0.00125	<0.050	0.0256	8.34	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0656	1.59	1.67	1.02	
Flame and Moth Tailings Humidity Cell	19-Feb-14	Week 32	<0.000010	0.000727	0.00	<0.30	0.227	<0.00010	0.712000	0.00127	<0.050	0.0288	9.98	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0980	1.81	1.82	1	
Flame and Moth Tailings Humidity Cell	26-Feb-14	Week 33	<0.000010	0.000833	<0.00050	<0.30	0.238	0.00014	0.558000	0.000765	<0.050	0.0232	8.79	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0371	1.51	1.59	1.03	
Flame and Moth Tailings Humidity Cell	5-Mar-14	Week 34	<0.000010	0.000722	<0.00050	<0.30	0.241	0.00013	0.647000	0.000471	<0.050	0.0251	8.33	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0573	1.71	1.71	1	
Flame and Moth Tailings Humidity Cell	12-Mar-14	Week 35	<0.000010	0.000640	0.00	<0.30	0.256	0.00010	0.797000	0.000193	0.057	0.0303	10.6	0.00008	<0.00010	<0.010	<0.000010	<0.0010	0.0956	1.96	2.05	1.02	
Flame and Moth Tailings Humidity Cell	19-Mar-14	Week 36	<0.000010	0.000718	<0.00050	<0.30	0.242	<0.00010	0.649000	0.000193	0.051	0.0281	10.9	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0503	1.91	1.89	0.99	
Flame and Moth Tailings Humidity Cell	26-Mar-14	Week 37	<0.000010	0.000692	0.00	<0.30	0.248	0.00011	0.714000	0.000195	0.067	0.0304	10.3	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.102	2.00	2.02	1.01	
Flame and Moth Tailings Humidity Cell	2-Apr-14	Week 38	<0.000010	0.000573	<0.00050	<0.30	0.224	<0.00010	0.634000	0.000207	<0.050	0.0258	7.94	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0673	1.78	1.74	0.99	
Flame and Moth Tailings Humidity Cell	9-Apr-14	Week 39	<0.000010	0.000582	0.00	<0.30	0.231	0.00011	0.702000	0.000092	<0.050	0.0295	9.30	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0901	1.93	1.95	1	
Flame and Moth Tailings Humidity Cell	16-Apr-14	Week 40	<0.000010	0.000522	0.00	<0.30	0.243	0.00013	0.735000	0.000044	<0.050	0.0337	19.3	0.00008	<0.00010	<0.010	<0.000010	<0.0010	0.129	2.14	2.23	1.02	
Flame and Moth Tailings Humidity Cell	23-Apr-14	Week 41	<0.000010	0.000530	0.00	<0.30	0.235	0.00013	0.663000	0.000069	<0.050	0.0300	10.6	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0953	2.01	2.01	1	
Flame and Moth Tailings Humidity Cell	30-Apr-14	Week 42	<0.000010	0.000487	0.00	<0.30	0.232	0.00010	0.647000	0.000080	<0.050	0.0294	8.65	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0984	1.84	1.91	1.02	
Flame and Moth Tailings Humidity Cell	7-May-14	Week 43	<0.000010	0.000506	0.00	<0.30	0.223	0.00013	0.625000	0.000080	<0.050	0.0294	9.57	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0953	1.90	1.97	1.02	
Flame and Moth Tailings Humidity Cell	14-May-14	Week 44	<0.000010	0.000454	0.00	<0.30	0.208	0.00012	0.645000	0.000079	<0.050	0.0307	9.83	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.108	2.01	1.99	1	
Flame and Moth Tailings Humidity Cell	21-May-14	Week 45	<0.000010	0.000432	0.00	<0.30	0.231	0.00010	0.683000	0.000093	<0.050	0.0318	10.4	0.00008	<0.00010	<0.010	<0.000010	<0.0010	0.113	2.09	2.17	1.02	
Flame and Moth Tailings Humidity Cell	28-May-14	Week 46	<0.000010	0.000486	0.00	<0.30	0.229	0.00010	0.619000	0.000101	<0.050	0.0286	9.30	0.00008	<0.00010	<0.010	<0.000010	<0.0010	0.0808	1.96	1.91	0.98	
Flame and Moth Tailings Humidity Cell	3-Jun-14	Week 47	<0.000010	0.000465	0.00	<0.30	0.216	0.00016	0.624000	0.000111	<0.050	0.0275	8.73	0.00006	<0.00010	<0.010	<0.000010	<0.0010	0.0875	1.87	1.87	1	
Flame and Moth Tailings Humidity Cell	11-Jun-14	Week 48	<0.000010	0.000424	0.00	<0.30	0.225	0.00011	0.632000	0.000102	<0.050	0.0292	9.32	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.114	2.14	1.99	0.96	
Flame and Moth Tailings Humidity Cell	18-Jun-14	Week 49	<0.000010	0.000447	0.00	<0.30	0.232	0.00010	0.649000	0.000082	<0.050	0.0292	9.32	0.00008	<0.00010	<0.010	<0.000010	<0.0010	0.109	2.14	2.05	0.98	
Flame and Moth Tailings Humidity Cell	25-Jun-14	Week 50	<0.000010	0.000426	0.00	<0.30	0.217	<0.00010	0.611000	0.000108	<0.050	0.0298	9.87	0.00006	<0.00010	<0.010	<0.000010	<0.0010	0.0733	2.09	2.04	0.99	
Flame and Moth Tailings Humidity Cell	2-Jul-14	Week 51	<0.000010	0.000570	<0.00050	<0.30	0.225	<0.00010	0.574000	0.000142	<0.050	0.0280	10.0	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0467	2.10	1.99	0.97	
Flame and Moth Tailings Humidity Cell	9-Jul-14	Week 52	<0.000010	0.000352	0.00	<0.30	0.210	<0.00010	0.549000	0.000076	0.094	0.0241	7.86	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0696	1.84	1.76	0.98	

Description	Sample Date	Sample Comments	...se (Mn), dissolved	Mercury (Hg), dissolved	Molybdenum (Mo), dissolved	Nickel (Ni), dissolved	Phosphorus (P), dissolved	Potassium (K), dissolved	Selenium (Se), dissolved	Silicon (Si), dissolved	Silver (Ag), dissolved	Sodium (Na), dissolved	Strontium (Sr), dissolved	Sulphur (S), dissolved	Thallium (Tl), dissolved	Tin (Sn), dissolved	Titanium (Ti), dissolved	Uranium (U), dissolved	Vanadium (V), dissolved	Zinc (Zn), dissolved	Total Anion Sum	Total Cation Sum	Ion B...
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L	
Type A WUL QZ09-092 FM EQS-DM					0.5						0.02									0.5			
Flame and Moth Tailings Humidity Cell	16-Jul-14	Week 53																					
Flame and Moth Tailings Humidity Cell	23-Jul-14	Week 54	<0.000010	0.000327	0.00	<0.30	0.247	0.00011	0.629000	0.000092	<0.050	0.0286	11.6	0.00008	<0.00010	<0.010	<0.000010	<0.0010	0.122	2.12	2.16	1.01	
Flame and Moth Tailings Humidity Cell	30-Jul-14	Week 55																					
Flame and Moth Tailings Humidity Cell	6-Aug-14	Week 56	<0.000010	0.000359	0.00	<0.30	0.244	<0.00010	0.581000	0.000120	0.052	0.0240	8.74	0.00008	<0.00010	<0.010	<0.000010	<0.0010	0.0820	1.92	1.99	1.02	
Flame and Moth Tailings Humidity Cell	13-Aug-14	Week 57																					
Flame and Moth Tailings Humidity Cell	20-Aug-14	Week 58	<0.000010	0.000319	0.00	<0.30	0.223	<0.00010	0.600000	0.000094	<0.050	0.0242	10.2	0.00008	<0.00010	<0.010	<0.000010	<0.0010	0.0797	2.12	2.09	0.99	
Flame and Moth Tailings Humidity Cell	27-Aug-14	Week 59																					
Flame and Moth Tailings Humidity Cell	3-Sep-14	Week 60	<0.000010	0.000342	0.00	<0.30	0.219	<0.00010	0.614000	0.000080	<0.050	0.0232	10.4	0.00008	<0.00010	<0.010	<0.000010	<0.0010	0.109	2.14	2.15	1	
Flame and Moth Tailings Humidity Cell	10-Sep-14	Week 61																					
Flame and Moth Tailings Humidity Cell	17-Sep-14	Week 62	<0.000010	0.000268	0.00	<0.30	0.229	<0.00010	0.468000	0.000034	<0.050	0.0173	8.13	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0635	1.74	1.74	1	
Flame and Moth Tailings Humidity Cell	24-Sep-14	Week 63																					
Flame and Moth Tailings Humidity Cell	1-Oct-14	Week 64	<0.000010	0.000217	<0.00050	<0.30	0.166	<0.00010	0.332000	<0.000010	<0.050	0.0125	6.39	0.00005	<0.00010	<0.010	<0.000010	<0.0010	0.0307	1.35	1.31	0.98	
Flame and Moth Tailings Humidity Cell	8-Oct-14	Week 65																					
Flame and Moth Tailings Humidity Cell	15-Oct-14	Week 66	<0.000010	0.000214	0.00	<0.30	0.231	0.00010	0.515000	0.000017	<0.050	0.0165	9.83	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0514	1.73	1.73	1	
Flame and Moth Tailings Humidity Cell	22-Oct-14	Week 67																					
Flame and Moth Tailings Humidity Cell	29-Oct-14	Week 68	<0.000010	0.000221	0.00	<0.30	0.265	<0.00010	0.691000	0.000057	<0.050	0.0181	11.3	0.00008	<0.00010	<0.010	<0.000010	<0.0010	0.0995	2.20	2.18	0.99	
Flame and Moth Tailings Humidity Cell	5-Nov-14	Week 69																					
Flame and Moth Tailings Humidity Cell	12-Nov-14	Week 70	<0.000010	0.000236	0.00	<0.30	0.234	<0.00010	0.506000	0.000032	<0.050	0.0158	9.20	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0306	1.97	1.84	0.97	
Flame and Moth Tailings Humidity Cell	19-Nov-14	Week 71																					
Flame and Moth Tailings Humidity Cell	26-Nov-14	Week 72	<0.000010	0.000227	0.00	<0.30	0.206	<0.00010	0.430000	0.000029	<0.050	0.0137	8.80	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0364	1.75	1.71	0.99	
Flame and Moth Tailings Humidity Cell	3-Dec-14	Week 73																					
Flame and Moth Tailings Humidity Cell	10-Dec-14	Week 74	<0.000010	0.000188	<0.00050	<0.30	0.246	<0.00010	0.453000	0.000016	0.050	0.0144	9.14	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0242	1.85	1.88	1.01	
Flame and Moth Tailings Humidity Cell	17-Dec-14	Week 75																					
Flame and Moth Tailings Humidity Cell	22-Dec-14	Week 76	<0.000010	0.000208	0.00	<0.30	0.280	0.00011	0.663000	0.000030	0.053	0.0194	12.6	0.00009	<0.00010	<0.010	<0.000010	<0.0010	0.0723	2.57	2.52	0.99	
Flame and Moth Tailings Humidity Cell	30-Dec-14	Week 77																					
Flame and Moth Tailings Humidity Cell	7-Jan-15	Week 78																					
Flame and Moth Tailings Humidity Cell	14-Jan-15	Week 79																					
Flame and Moth Tailings Humidity Cell	21-Jan-15	Week 80	<0.000010	0.000257	<0.00050	<0.30	0.182	<0.00010	0.252000	<0.000010	<0.050	0.00904	9.85	0.00006	<0.00010	<0.010	<0.000010	<0.0010	0.0104	1.55	1.49	0.98	
Flame and Moth Tailings Humidity Cell	28-Jan-15	Week 81																					
Flame and Moth Tailings Humidity Cell	4-Feb-15	Week 82																					
Flame and Moth Tailings Humidity Cell	11-Feb-15	Week 83																					
Flame and Moth Tailings Humidity Cell	18-Feb-15	Week 84	<0.000010	0.000263	<0.00050	<0.30	0.168	<0.00010	0.284000	<0.000010	<0.050	0.00875	6.49	0.00006	<0.00010	<0.010	<0.000010	<0.0010	0.0159	1.50	1.37	0.95	
Flame and Moth Tailings Humidity Cell	25-Feb-15	Week 85																					
Flame and Moth Tailings Humidity Cell	4-Mar-15	Week 86																					
Flame and Moth Tailings Humidity Cell	11-Mar-15	Week 87																					
Flame and Moth Tailings Humidity Cell	18-Mar-15	Week 88	<0.000010	0.000138	<0.00050	<0.30	0.178	<0.00010	0.270000	<0.000010	<0.050	0.00917	7.42	0.00005	<0.00010	<0.010	<0.000010	<0.0010	0.0129	1.62	1.51	0.96	
Flame and Moth Tailings Humidity Cell	25-Mar-15	Week 89																					
Flame and Moth Tailings Humidity Cell	1-Apr-15	Week 90																					
Flame and Moth Tailings Humidity Cell	8-Apr-15	Week 91																					
Flame and Moth Tailings Humidity Cell	15-Apr-15	Week 92	<0.0000050	0.000144	0.00	<0.30	0.239	<0.00010	0.386000	<0.000010	0.203	0.0117	8.35	0.00007	<0.00010	<0.010	<0.000010	<0.0010	0.0165	1.95	1.94	1	
Flame and Moth Tailings Humidity Cell	22-Apr-15	Week 93																					
Flame and Moth Tailings Humidity Cell	29-Apr-15	Week 94																					
Flame and Moth Tailings Humidity Cell	6-May-15	Week 95																					
Flame and Moth Tailings Humidity Cell	13-May-15	Week 96	<0.0000050	0.000113	0.00	<0.30	0.196	<0.00010	0.350000	<0.000010	<0.050	0.0100	8.14	0.00005	<0.00010	<0.010	<0.000010	<0.0010	0.0261	1.92	1.82	0.97	
Flame and Moth Tailings Humidity Cell	20-May-15	Week 97																					
Flame and Moth Tailings Humidity Cell	27-May-15	Week 98																					

Description	Sample Date	Sample Comments	Total Volume In	Total Volume Out	Total Acidity	pH (lab)	Specific Conductance (lab)	Hardness (from dissolved)	Alkalinity, total	Chloride	Fluoride	Bromide	Sulphate, dissolved	Nitrite (N)	Nitrate (N)	Aluminum (Al), dissolved	Antimony (Sb), dissolved	Arsenic (As), dissolved	Barium (Ba), dissolved	Beryllium (Be), dissolved	Bismuth (Bi), dissolved	Boron (B), dissolved	Cadmium (Cd), dissolved	Calcium (Ca), dissolved	Chromium (Cr), dissolved	Cobalt (Co), dissolved	Copper (Cu), dissolved	Iron (Fe), dissolved	Lead (Pb), dissolved	Lithium (Li), dissolved	Magnesium (Mg), dissolved	Mangane
			mL	mL	mg/L	pH units	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Type A WUL QZ09-092 FM EQS-DM						6.5-9.5												0.1					0.01					0.1		0.2		
Flame and Moth N-AML Humidity Cell	3-Jul-13	Week 0	750	375		8.40	577		104	3.99	0.629	<0.050	183	0.0081	0.0973	0.235	0.0105	0.00071	0.114	<0.00010	<0.00050	0.050	<0.000010	31.6	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.0283	14.0	0.0141
Flame and Moth N-AML Humidity Cell	10-Jul-13	Week 1	500	475		8.35	648	112	127	1.87	0.970	<0.050	155	0.0034	0.0103	0.277	0.00766	0.00097	0.0379	<0.00010	<0.00050	0.073	0.000011	25.9	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.0229	11.5	0.0185
Flame and Moth N-AML Humidity Cell	16-Jul-13	Week 2	500	425		8.30	470	97.1	102	0.58	1.03	<0.050	107	0.0040	0.0056	0.251	0.00946	0.00096	0.0400	<0.00010	<0.00050	0.061	<0.000010	24.8	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.0182	8.56	0.0215
Flame and Moth N-AML Humidity Cell	24-Jul-13	Week 3	500	500		8.25	470	117	95.1	<0.50	0.842	<0.050	123	<0.0010	<0.0050	0.209	0.00847	0.00084	0.0352	<0.00010	<0.00050	0.067	0.000012	29.8	<0.00050	<0.00010	0.00067	<0.030	<0.000050	0.0188	10.3	0.0273
Flame and Moth N-AML Humidity Cell	31-Jul-13	Week 4	500	460		8.21	382	126	89.3	<0.50	0.720	<0.050	98.9	0.0011	0.0052	0.191	0.00690	0.00090	0.0424	<0.00010	<0.00050	0.045	0.000012	32.8	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.0130	10.7	0.0329
Flame and Moth N-AML Humidity Cell	7-Aug-13	Week 5	500	460		8.22	417	143	92.1	0.51	0.616	<0.050	113	0.0025	<0.0050	0.156	0.00631	0.00081	0.0405	<0.00010	<0.00050	0.048	0.000012	37.6	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.0115	11.9	0.0384
Flame and Moth N-AML Humidity Cell	14-Aug-13	Week 6	500	465		8.26	434	166	88.3	5.69	0.558	<0.050	111	0.0032	<0.0050	0.135	0.00571	0.00076	0.0342	<0.00010	<0.00050	0.042	0.000012	44.6	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.0108	13.2	0.0466
Flame and Moth N-AML Humidity Cell	21-Aug-13	Week 7	500	485		8.13	429	170	86.2	7.63	0.513	<0.050	113	0.0020	<0.0050	0.127	0.00490	0.00075	0.0328	<0.00010	<0.00050	0.037	0.000013	45.7	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00942	13.5	0.0574
Flame and Moth N-AML Humidity Cell	28-Aug-13	Week 8	500	480		8.13	463	201	85.1	8.53	0.410	<0.050	127	0.0044	<0.0050	0.115	0.00477	0.00074	0.0332	<0.00010	<0.00050	0.036	0.000015	53.3	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00895	16.4	0.0668
Flame and Moth N-AML Humidity Cell	4-Sep-13	Week 9	500	450		8.14	437	181	80.8	7.91	0.427	<0.050	120	0.0016	<0.0050	0.110	0.00446	0.00072	0.0319	<0.00010	<0.00050	0.031	0.000014	49.1	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00802	14.2	0.0641
Flame and Moth N-AML Humidity Cell	11-Sep-13	Week 10	500	450	16.9	8.17	422	182	82.7	7.16	0.408	<0.050	110	0.0029	<0.0050	0.109	0.00391	0.00084	0.0337	<0.00010	<0.00050	0.029	0.000017	50.0	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00795	13.8	0.0602
Flame and Moth N-AML Humidity Cell	18-Sep-13	Week 11	500	475	<1.0	8.13	437	203	93.6	6.98	0.359	<0.050	129	0.0035	0.0056	0.0945	0.00403	0.00077	0.0304	<0.00010	<0.00050	0.031	0.000022	54.6	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00700	16.1	0.0648
Flame and Moth N-AML Humidity Cell	25-Sep-13	Week 12	500	475	2.3	8.15	416	188	82.6	6.33	0.376	<0.050	115	0.0012	<0.0050	0.0965	0.00397	0.00082	0.0321	<0.00010	<0.00050	0.029	0.000019	52.0	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00733	14.2	0.0590
Flame and Moth N-AML Humidity Cell	2-Oct-13	Week 13	500	465	5.1	8.11	384	169	78.6	5.97	0.334	<0.050	102	<0.0010	<0.0050	0.100	0.00364	0.00081	0.0361	<0.00010	<0.00050	0.026	0.000015	48.1	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00705	11.8	0.0504
Flame and Moth N-AML Humidity Cell	9-Oct-13	Week 14	500	470	<1.0	8.12	361	167	81.6	5.81	0.350	<0.050	93.1	0.0011	<0.0050	0.100	0.00380	0.00085	0.0371	<0.00010	<0.00050	0.024	0.000015	47.5	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00608	11.6	0.0485
Flame and Moth N-AML Humidity Cell	16-Oct-13	Week 15	500	440	1.1	8.12	322	148	76.7	5.13	0.320	<0.050	74.1	0.0018	<0.0050	0.119	0.00356	0.00091	0.0470	<0.00010	<0.00050	0.022	0.000013	42.2	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00556	10.4	0.0465
Flame and Moth N-AML Humidity Cell	23-Oct-13	Week 16	500	485	1.3	8.11	315	146	77.3	5.12	0.343	<0.050	68.2	0.0029	<0.0050	0.114	0.00350	0.00095	0.0488	<0.00010	<0.00050	0.021	0.000017	42.3	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00496	9.89	0.0406
Flame and Moth N-AML Humidity Cell	30-Oct-13	Week 17	500	455	1.6	8.13	268	122	72.2	4.24	0.338	<0.050	53.0	0.0015	<0.0050	0.132	0.00319	0.00097	0.0538	<0.00010	<0.00050	0.019	<0.000010	35.3	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00501	8.34	0.0332
Flame and Moth N-AML Humidity Cell	6-Nov-13	Week 18	500	450	1.4	8.18	253	110	66.9	4.35	0.431	<0.050	46.9	0.0022	<0.0050	0.136	0.00315	0.00107	0.0593	<0.00010	<0.00050	0.017	0.000011	31.3	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00461	7.66	0.0309
Flame and Moth N-AML Humidity Cell	13-Nov-13	Week 19	500	465	<1.0	8.15	239	107	74.0	4.08	0.290	<0.050	41.0	0.0054	<0.0050	0.146	0.00294	0.00115	0.0630	<0.00010	<0.00050	0.015	<0.000010	30.7	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00429	7.45	0.0266
Flame and Moth N-AML Humidity Cell	20-Nov-13	Week 20	500	410	3.3	8.15	241	109	80.3	4.51	0.295	<0.050	40.8	0.0036	<0.0050	0.147	0.00307	0.00122	0.0691	<0.00010	<0.00050	0.017	<0.000010	31.8	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00405	7.11	0.0259
Flame and Moth N-AML Humidity Cell	27-Nov-13	Week 21	500	530	1.0	8.15	240	105	70.5	4.17	0.265	<0.050	37.9	0.0030	<0.0050	0.147	0.00307	0.00127	0.0728	<0.00010	<0.00050	0.017	0.000011	29.6	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00412	7.55	0.0256
Flame and Moth N-AML Humidity Cell	4-Dec-13	Week 22	500	450	3.0	8.19	200	87.4	69.1	3.51	0.265	<0.050	32.8	0.0020	<0.0050	0.183	0.00269	0.00154	0.0807	<0.00010	<0.00050	0.015	<0.000010	24.7	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00322	6.22	0.0183
Flame and Moth N-AML Humidity Cell	11-Dec-13	Week 23	500	450	2.9	8.14	201	86.4	61.3	3.36	0.237	<0.050	29.6	0.0021	<0.0050	0.176	0.00254	0.00145	0.0808	<0.00010	<0.00050	0.016	0.000011	24.8	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00353	5.96	0.0193
Flame and Moth N-AML Humidity Cell	18-Dec-13	Week 24	500	465	2.4	8.20	193	84.7	62.8	3.33	0.222	<0.050	27.0	0.0029	<0.0050	0.189	0.00243	0.00170	0.0956	<0.00010	<0.00050	0.013	<0.000010	24.2	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00303	5.93	0.0191
Flame and Moth N-AML Humidity Cell	24-Dec-13	Week 25	500	460	1.2	8.16	198	84.2	64.0	3.30	0.205	<0.050	26.6	0.0042	<0.0050	0.188	0.00242	0.00165	0.0999	<0.00010	<0.00050	0.015	<0.000010	23.9	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00366	5.97	0.0171
Flame and Moth N-AML Humidity Cell	31-Dec-13	Week 26	500	450	3.3	8.16	200	83.1	68.7	3.40	0.199	<0.050	25.6	0.0042	<0.0050	0.171	0.00248	0.00165	0.0977	<0.00010	<0.00050	0.015	<0.000010	23.0	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00378	6.24	0.0177
Flame and Moth N-AML Humidity Cell	8-Jan-14	Week 27	500	450	1.9	8.18	183	80.7	70.6	3.13	0.176	<0.050	22.5	0.0656	0.0265	0.187	0.00186	0.00186	0.113	<0.00010	<0.00050	0.011	<0.000010	23.1	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00315	5.57	0.0177
Flame and Moth N-AML Humidity Cell	15-Jan-14	Week 28	500	450	1.1	8.21	181	81.5	62.9	3.12	0.158	<0.050	21.7	0.0021	0.102	0.181	0.00220	0.00183	0.114	<0.00010	<0.00050	0.011	<0.000010	23.1	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00342	5.78	0.0166
Flame and Moth N-AML Humidity Cell	22-Jan-14	Week 29	500	470	1.4	8.17	180	82.5	59.9	3.01	0.161	<0.050	21.6	0.0018	0.0347	0.170	0.00207	0.00181	0.119	<0.00010	<0.00050	0.010	<0.000010	23.5	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00292	5.75	0.0171
Flame and Moth N-AML Humidity Cell	29-Jan-14	Week 30	500	450	1.2	8.20	175	79.6	64.1	2.87	0.158	<0.050	20.4	0.0050	0.0150	0.187	0.00188	0.00204	0.122	<0.00010	<0.00050	0.010	<0.000010	22.6	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00318	5.62	0.0152
Flame and Moth N-AML Humidity Cell	5-Feb-14	Week 31	500	455	1.7	8.19	175	79.7	67.5	2.90	0.141	<0.050	20.1	0.0027	0.0119	0.167	0.00183	0.00193	0.115	<0.00010	<0.00050	0.011	<0.000010	22.6	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00295	5.68	0.0133
Flame and Moth N-AML Humidity Cell	12-Feb-14	Week 32	500	450	1.2	8.17	162	73.7	58.9	2.27	0.136	<0.050	17.9	0.0023	0.0097	0.191	0.00152	0.00202	0.122	<0.00010	<0.00050	<0.010	<0.000010	21.2	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00251	5.05	0.0105
Flame and Moth N-AML Humidity Cell	19-Feb-14	Week 33	500	460	4.7	8.16	179	82.8	70.0	2.81	0.149	<0.050	19.6	0.0031	0.0128	0.161	0.00184	0.00195	0.130	<0.00010	<0.00050	0.011	<0.000010	23.4	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00296	5.88	0.0114
Flame and Moth N-AML Humidity Cell	26-Feb-14	Week 34	500	450	<1.0	8.13	168	77.4	63.4	2.33	0.120	<0.050	18.6	0.0028	0.0116	0.166	0.00158	0.00187	0.119	<0.00010	<0.00050	<0.010	<0.000010	21.9	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00291	5.51	0.0104
Flame and Moth N-AML Humidity Cell	4-Mar-14	Week 35	500	475	1.4	8.26	154	71.7	60.5	1.88	0.111	<0.050	16.9	0.0026	0.0079	0.200	0.00147	0.00222	0.130	<0.00010	<0.00050	<0.010	<0.000010	20.3	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00284	5.10	0.00770
Flame and Moth N-AML Humidity Cell	12-Mar-14	Week 36	500	460	<1.0	8.14	154	69.7	59.4	2.13	0.099	<0.050	16.4	0.0014	0.0088	0.185	0.00134	0.00211	0.127	<0.00010	<0.00050	<0.010	<0.000010	19.7	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00270	4.97	0.00506
Flame and Moth N-AML Humidity Cell	19-Mar-14	Week 37	500	475	2.3	8.20	161	73.4	62.0	2.34	0.097	<0.050	17.5	0.0029	0.0102	0.187	0.00153	0.00207	0.138	<0.00010	<0.00050	<0.010	<0.000010	20.5	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00248	5.37	0.00400
Flame and Moth N-AML Humidity Cell	26-Mar-14	Week 38	500	435	<1.0	7.99	153	71.1	62.0	2.08	0.094	<0.050	16.8	0.0018	0.0056	0.181	0.00130	0.00198	0.118	<0.00010	<0.00050	<0.010	<0.000010	20.2	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00213	5.03	0.00398
Flame and Moth N-AML Humidity Cell	2-Apr-14	Week 39	500	490	1.9	7.57	178	72.4	54.9	2.07	0.091	<0.050	16.7	0.0018	0.0139	0.185	0.00130	0.00221	0.145	<0.00010	<0.00050	<0.010	<0.000010	20.6	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00248	5.11	0.00454
Flame and Moth N-AML Humidity Cell	9-Apr-14	Week 40	500	465	2.0	8.15	152	71.3	54.8	2.09	0.086	<0.050	16.7	0.0021	0.0059	0.184	0.00131	0.00224	0.133	<0.00010	<0.00050	0.011	<0.000010	20.2	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00264	5.07	0.00491
Flame and Moth N-AML Humidity Cell	16-Apr-14	Week 41	500	420	<1.0	8.19	138	66.4	54.5	2.07	0.069	<0.050	14.1	0.0014	0.0086	0.214	0.00111	0.00217	0.138	<0.00010	<0.00050	<0.010	<0.000010	18.5	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00213	4.89	0.00491
Flame and Moth N-AML Humidity Cell	23-Apr-14	Week 42	500	500	2.1	8.12	147	70.9	58.9	1.81	0.080	<0.050	16.2	<0.0010	0.0060	0.178	0.00119	0.00214	0.136	<0.00010	<0.00050	<0.010	<0.000010	20.0	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00235	5.11	0.00385
Flame and Moth N-AML Humidity Cell	30-Apr-14	Week 43	500	450	4.5	8.24	137	64.2	54.1	1.76	0.070	<0.050	13.9	<0.0010	0.0077	0.210	0.00099	0.00237	0.144	<0.00010	<0.00050	<0.010	<0.000010	18.0	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00255	4.66	0.00455
Flame and Moth N-AML Humidity Cell	7-May-14	Week 44	500	450	3.2	8.03	142	64.7	57.1	1.93	0.071	<0.050	15.2	0.0014	0.0060	0.207	0.00109	0.00232	0.149	<0.00010	<0.00050	<0.010	<0.000010	18.0	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00235	4.82	0.00376
Flame and Moth N-AML Humidity Cell	14-May-14	Week 45	500	475	<1.0	8.25	125	59.0	49.5	1.55	0.056	<0.050	12.4	0.0011	<0.0050	0.244	0.00078	0.00247	0.148	<0.00010	<0.00050	<0.010	<0.000010	17.0	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00193	4.03	0.00512
Flame and Moth N-AML Humidity Cell	21-May-14	Week 46	500	460	<1.0	8.19	140	66.2	54.0	1.96	0.058	<0.050	14.1	0.0017	0.0063	0.211	0.00098	0.00230	0.153	<0.00010	<0.00050	<0.010	<0.000010	19.0	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00246	4.58	0.00576
Flame and Moth N-AML Humidity Cell	28-May-14	Week 47	500	460	1.2	8.15	139	66.7	59.1	1.82	0.063	<0.050	14.3	0.0011	0.0068	0.203	0.00103	0.00231	0.152	<0.00010	<0.00050	<0.010	<0.000010	18.6	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00246	4.94	0.00443
Flame and Moth N-AML Humidity Cell	3-Jun-14	Week 48	500	460	2.7	8.22	147	71.4	63.4	1.87	0.064	<0.050	16.7	0.0022	<0.0050	0.177	0.00108	0.00224	0.145	<0.00010	<0.00050	<0.010	<0.000010	19.9	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00252	5.28	0.00447
Flame and Moth N-AML Humidity Cell	11-Jun-14	Week 49	500	475	<1.0	8.37	120	56.3	47.0	1.42	0.047	<0.050	11.3	0.0012	<0.0050	0.248	0.00074	0.00232	0.149	<0.00010	<0.00050	<0.010	<0.000010	15.8	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00206	4.07	0.00439
Flame and Moth N-AML Humidity Cell	18-Jun-14	Week 50	500	470	<1.0	8.27	137	63.8	63.9	1.85	0.053	<0.050	14.4	<0.0010	0.0068	0.204	0.00089	0.00233	0.147	<0.00010	<0.00050	<0.010	<0.000010	17.7	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00240	4.75	0.00435
Flame and Moth N-AML Humidity Cell	25-Jun-14	Week 51	500	480	1.2	8.35	130	63.4	56.0	1.60	0.047	<0.050	12.7	0.0017	0.0060	0.226	0.00077	0.00236	0.151	<0.00010	<0.00050	<0.010	<0.000010	18.0	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00216	4.48	0.00579
Flame and Moth N-AML Humidity Cell	2-Jul-14	Weel 52	500	450	1.7	8.28	141	68.5	59.2	1.77	0.050	<0.050	15.2	0.0027	<0.0050	0.205	0.00081	0.00238	0.156	<0.00010	<0.00050	<0.010	<0.000010	19.1	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00190	5.06	0.00648

Description	Sample Date	Sample Comments	Total Volume In	Total Volume Out	Total Acidity	pH (lab)	Specific Conductance (lab)	Hardness (from dissolved)	Alkalinity, total	Chloride	Fluoride	Bromide	Sulphate, dissolved	Nitrite (N)	Nitrate (N)	Aluminum (Al), dissolved	Antimony (Sb), dissolved	Arsenic (As), dissolved	Barium (Ba), dissolved	Beryllium (Be), dissolved	Bismuth (Bi), dissolved	Boron (B), dissolved	Cadmium (Cd), dissolved	Calcium (Ca), dissolved	Chromium (Cr), dissolved	Cobalt (Co), dissolved	Copper (Cu), dissolved	Iron (Fe), dissolved	Lead (Pb), dissolved	Lithium (Li), dissolved	Magnesium (Mg), dissolved	Mangane
			mL	mL	mg/L	pH units	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Type A WUL QZ09-092 FM EQS-DM						6.5-9.5												0.1					0.01				0.1		0.2		
Flame and Moth N-AML Humidity Cell	9-Jul-14	Week 53	500	430																												
Flame and Moth N-AML Humidity Cell	16-Jul-14	Week 54	500	430	<1.0	8.28	125	60.3	46.2	1.45	0.045	<0.050	13.6	<0.0010	<0.0050	0.214	0.00074	0.00244	0.144	<0.00010	<0.00050	<0.010	<0.000010	16.8	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00189	4.45	0.00420
Flame and Moth N-AML Humidity Cell	23-Jul-14	Week 55	500	550																												
Flame and Moth N-AML Humidity Cell	30-Jul-14	Week 56	500	475	3.6	8.34	143	66.6	53.8	1.53	0.042	<0.050	15.6	0.0026	<0.0050	0.199	0.00077	0.00237	0.146	<0.00010	<0.00050	<0.010	<0.000010	18.5	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00194	4.96	0.00612
Flame and Moth N-AML Humidity Cell	6-Aug-14	Week 57	500	430																												
Flame and Moth N-AML Humidity Cell	13-Aug-14	Week 58	500	490	2.8	8.32	134	64.2	49.7	1.49	0.036	<0.050	15.3	0.0028	<0.0050	0.211	0.00065	0.00219	0.129	<0.00010	<0.00050	<0.010	<0.000010	18.3	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00190	4.52	0.00640
Flame and Moth N-AML Humidity Cell	20-Aug-14	Week 59	500	450																												
Flame and Moth N-AML Humidity Cell	27-Aug-14	Week 60	500	465	5.8	8.34	136	63.6	48.7	1.31	0.034	<0.050	15.9	<0.0010	<0.0050	0.208	0.00071	0.00230	0.137	<0.00010	<0.00050	<0.010	<0.000010	18.1	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00208	4.48	0.00375
Flame and Moth N-AML Humidity Cell	3-Sep-14	Week 61	500	480																												
Flame and Moth N-AML Humidity Cell	10-Sep-14	Week 62	500	420	1.2	8.24	142	68.1	58.4	1.51	0.033	<0.050	17.6	<0.0010	0.0057	0.174	0.00073	0.00205	0.129	<0.00010	<0.00050	<0.010	<0.000010	19.5	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00213	4.74	0.00388
Flame and Moth N-AML Humidity Cell	17-Sep-14	Week 63	500	515																												
Flame and Moth N-AML Humidity Cell	24-Sep-14	Week 64	500	465	3.5	8.38	148	70.2	55.2	1.48	0.039	<0.050	19.1	<0.0010	<0.0050	0.163	0.00074	0.00211	0.132	<0.00010	<0.00050	<0.010	<0.000010	19.9	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00215	5.00	0.00354
Flame and Moth N-AML Humidity Cell	1-Oct-14	Week 65	500	475																												
Flame and Moth N-AML Humidity Cell	8-Oct-14	Week 66	500	470	<1.0	8.26	154	75.2	54.3	1.60	0.033	<0.050	22.0	<0.0010	<0.0050	0.144	0.00075	0.00182	0.111	<0.00010	<0.00050	<0.010	<0.000010	21.2	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00235	5.38	0.00419
Flame and Moth N-AML Humidity Cell	15-Oct-14	Week 67	500	470																												
Flame and Moth N-AML Humidity Cell	22-Oct-14	Week 68	500	470	<1.0	8.30	146	71.9	56.5	1.45	0.032	<0.050	20.2	<0.0010	0.0059	0.165	0.00075	0.00212	0.139	<0.00010	<0.00050	<0.010	<0.000010	20.1	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00229	5.31	0.00223
Flame and Moth N-AML Humidity Cell	29-Oct-14	Week 69	500	425																												
Flame and Moth N-AML Humidity Cell	5-Nov-14	Week 70	500	500	<1.0	8.26	150	73.1	54.4	1.44	0.029	<0.050	22.3	<0.0010	<0.0050	0.160	0.00071	0.00198	0.120	<0.00010	<0.00050	<0.010	<0.000010	20.4	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00233	5.37	0.00290
Flame and Moth N-AML Humidity Cell	12-Nov-14	Week 71	500	455																												
Flame and Moth N-AML Humidity Cell	19-Nov-14	Week 72	500	455	1.6	8.10	154	74.7	57.2	1.42	0.027	<0.050	22.3	0.0019	<0.0050	0.156	0.00073	0.00197	0.112	<0.00010	<0.00050	<0.010	<0.000010	20.9	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00227	5.45	0.00338
Flame and Moth N-AML Humidity Cell	26-Nov-14	Week 73	500	470																												
Flame and Moth N-AML Humidity Cell	3-Dec-14	Week 74	500	450	<1.0	8.14	150	77.4	60.7	1.40	0.023	<0.050	21.6	0.0041	0.0057	0.181	0.00064	0.00191	0.123	<0.00010	<0.00050	<0.010	<0.000010	21.9	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00200	5.52	0.00626
Flame and Moth N-AML Humidity Cell	10-Dec-14	Week 75	500	435																												
Flame and Moth N-AML Humidity Cell	17-Dec-14	Week 76	500	455	<1.0	8.24	166	81.0	58.4	1.71	0.027	<0.050	25.5	0.0138	0.0105	0.158	0.00065	0.00179	0.119	<0.00010	<0.00050	<0.010	<0.000010	22.9	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00233	5.82	0.00585
Flame and Moth N-AML Humidity Cell	22-Dec-14	Week 77	500	450																												
Flame and Moth N-AML Humidity Cell	30-Dec-14	Week 78	500	425	1.6	8.21	171	77.2	52.4	1.69	0.027	<0.050	28.1	0.0011	0.0053	0.143	0.00074	0.00184	0.0881	<0.00010	<0.00050	<0.010	<0.000010	21.2	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00252	5.91	0.00300
Flame and Moth N-AML Humidity Cell	7-Jan-15	Week 79	500	450																												
Flame and Moth N-AML Humidity Cell	14-Jan-15	Week 80	500	460																												
Flame and Moth N-AML Humidity Cell	21-Jan-15	Week 81	500	450																												
Flame and Moth N-AML Humidity Cell	28-Jan-15	Week 82	500	475	<1.0	8.22	159	76.8	55.5	1.37	0.020	<0.050	25.7	0.0012	<0.0050	0.144	0.00058	0.00162	0.0890	<0.00010	<0.00050	<0.010	<0.000010	21.5	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00241	5.59	0.00409
Flame and Moth N-AML Humidity Cell	4-Feb-15	Week 83	500	465																												
Flame and Moth N-AML Humidity Cell	11-Feb-15	Week 84	500	460																												
Flame and Moth N-AML Humidity Cell	18-Feb-15	Week 85	500	440																												
Flame and Moth N-AML Humidity Cell	25-Feb-15	Week 86	500	440	<1.0	8.23	160	80.7	56.1	1.33	<0.020	<0.050	24.8	0.0039	0.0058	0.150	0.00060	0.00166	0.0924	<0.00010	<0.00050	<0.010	<0.000010	23.4	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00244	5.39	0.00643
Flame and Moth N-AML Humidity Cell	4-Mar-15	Week 87	500	460																												
Flame and Moth N-AML Humidity Cell	11-Mar-15	Week 88	500	460																												
Flame and Moth N-AML Humidity Cell	18-Mar-15	Week 89	500	460																												
Flame and Moth N-AML Humidity Cell	25-Mar-15	Week 90	500	450	<1.0	8.31	152	73.4	49.1	1.24	0.021	<0.050	25.3	<0.0010	<0.0050	0.139	0.00060	0.00172	0.0867	<0.00010	<0.00050	<0.010	<0.000010	20.6	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.00238	5.36	0.00422
Flame and Moth N-AML Humidity Cell	1-Apr-15	Week 91	500	450																												
Flame and Moth N-AML Humidity Cell	8-Apr-15	Week 92	500	455																												
Flame and Moth N-AML Humidity Cell	15-Apr-15	Week 93	500	475																												
Flame and Moth N-AML Humidity Cell	22-Apr-15	Week 94	500	455	<1.0	8.30	150	72.3	49.8	1.11	<0.020	<0.050	23.3	0.0024	<0.0050	0.142	0.00061	0.00174	0.103	<0.00010	<0.00050	<0.010	<0.000010	20.5	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.0022	5.17	0.00375
Flame and Moth N-AML Humidity Cell	29-Apr-15	Week 95	500	450																												
Flame and Moth N-AML Humidity Cell	6-May-15	Week 96	500	455																												
Flame and Moth N-AML Humidity Cell	13-May-15	Week 97	500	460																												
Flame and Moth N-AML Humidity Cell	20-May-15	Final Leach	3000	2910	<1.0	8.59	104	49.2	39.0	<0.50	<0.020	<0.050	15.0	0.0013	0.0083	0.283	0.00038	0.00243	0.172	<0.00010	<0.00050	<0.010	<0.000010	14.1	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.0020	3.38	0.00049
Flame and Moth N-AML Humidity Cell	20-May-15	Week 98	500	465	1.0	8.24	147	72.5	55.7	1.26	<0.020	<0.050	21.8	0.0019	<0.0050	0.149	0.00055	0.00180	0.105	<0.00010	<0.00050	<0.010	<0.000010	20.4	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	0.0020	5.25	0.00540

Description	Sample Date	Sample Comments	se (Mn), dissolved	Mercury (Hg), dissolved	Molybdenum (Mo), dissolved	Nickel (Ni), dissolved	Phosphorus (P), dissolved	Potassium (K), dissolved	Selenium (Se), dissolved	Silicon (Si), dissolved	Silver (Ag), dissolved	Sodium (Na), dissolved	Strontium (Sr), dissolved	Sulphur (S), dissolved	Thallium (Tl), dissolved	Tin (Sn), dissolved	Titanium (Ti), dissolved	Uranium (U), dissolved	Vanadium (V), dissolved	Zinc (Zn), dissolved	Total Anion Sum	Total Cation Sum	Ion B
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L	
Type A WUL QZ09-092 FM EQS-DM					0.5						0.02								0.5				
Flame and Moth N-AML Humidity Cell	3-Jul-13	Week 0	<0.000010	0.00399	0.00119	<0.30	63.9	0.00282	1.91	<0.000010	34.9	0.204	65.1	0.000115	<0.00010	<0.010	0.00145	0.0015	<0.0030	6.06	5.90	0.99	
Flame and Moth N-AML Humidity Cell	10-Jul-13	Week 1	<0.000010	0.0276	<0.00050	<0.30	72.2	0.00115	1.99	0.000031	37.3	0.210	58.9	0.000086	<0.00010	<0.010	0.000899	0.0011	<0.0030	5.85	5.73	0.99	
Flame and Moth N-AML Humidity Cell	16-Jul-13	Week 2	<0.000010	0.0242	<0.00050	<0.30	49.9	0.00086	2.03	<0.000010	19.4	0.191	37.6	0.000059	<0.00010	<0.010	0.000685	<0.0010	<0.0030	4.35	4.09	0.97	
Flame and Moth N-AML Humidity Cell	24-Jul-13	Week 3	<0.000010	0.0229	<0.00050	<0.30	45.2	0.00099	2.15	<0.000010	15.9	0.206	41.8	0.000061	<0.00010	<0.010	0.000681	<0.0010	<0.0030	4.51	4.20	0.96	
Flame and Moth N-AML Humidity Cell	31-Jul-13	Week 4	<0.000010	0.0151	<0.00050	<0.30	36.3	0.00118	2.22	<0.000010	8.64	0.225	32.9	0.000049	<0.00010	<0.010	0.000595	<0.0010	<0.0030	3.88	3.85	1	
Flame and Moth N-AML Humidity Cell	7-Aug-13	Week 5	<0.000010	0.0159	<0.00050	<0.30	32.6	0.00159	2.15	<0.000010	6.63	0.237	38.5	0.000050	<0.00010	<0.010	0.000710	<0.0010	<0.0030	4.24	3.99	0.97	
Flame and Moth N-AML Humidity Cell	14-Aug-13	Week 6	<0.000010	0.0160	<0.00050	<0.30	27.4	0.00202	2.29	<0.000010	5.02	0.248	38.4	0.000058	<0.00010	<0.010	0.000801	<0.0010	<0.0030	4.26	4.24	1	
Flame and Moth N-AML Humidity Cell	21-Aug-13	Week 7	<0.000010	0.0156	<0.00050	<0.30	22.2	0.00231	2.29	<0.000010	3.66	0.246	37.3	0.000058	<0.00010	<0.010	0.000892	<0.0010	<0.0030	4.31	4.14	0.98	
Flame and Moth N-AML Humidity Cell	28-Aug-13	Week 8	<0.000010	0.0161	<0.00050	<0.30	21.0	0.00306	2.47	<0.000010	3.45	0.258	42.2	0.000061	<0.00010	<0.010	0.00109	<0.0010	<0.0030	4.61	4.71	1.01	
Flame and Moth N-AML Humidity Cell	4-Sep-13	Week 9	<0.000010	0.0145	<0.00050	<0.30	16.6	0.00282	2.41	<0.000010	2.54	0.251	39.4	0.000056	<0.00010	<0.010	0.00110	<0.0010	<0.0030	4.35	4.17	0.98	
Flame and Moth N-AML Humidity Cell	11-Sep-13	Week 10	<0.000010	0.0123	<0.00050	<0.30	14.8	0.00221	2.51	<0.000010	1.98	0.228	36.4	0.000053	<0.00010	<0.010	0.00108	<0.0010	<0.0030	4.17	4.11	0.99	
Flame and Moth N-AML Humidity Cell	18-Sep-13	Week 11	<0.000010	0.0138	<0.00050	<0.30	15.0	0.00234	2.60	<0.000010	2.03	0.243	42.9	0.000055	<0.00010	<0.010	0.00122	<0.0010	<0.0030	4.77	4.54	0.97	
Flame and Moth N-AML Humidity Cell	25-Sep-13	Week 12	<0.000010	0.0123	<0.00050	<0.30	13.3	0.00171	2.68	<0.000010	1.68	0.225	37.5	0.000049	<0.00010	<0.010	0.00115	<0.0010	<0.0030	4.24	4.19	0.99	
Flame and Moth N-AML Humidity Cell	2-Oct-13	Week 13	<0.000010	0.0118	<0.00050	<0.30	11.8	0.00139	2.75	<0.000010	1.40	0.211	33.4	0.000050	<0.00010	<0.010	0.00100	<0.0010	<0.0030	3.87	3.75	0.98	
Flame and Moth N-AML Humidity Cell	9-Oct-13	Week 14	<0.000010	0.0126	<0.00050	<0.30	10.7	0.00129	2.89	<0.000010	1.32	0.213	30.4	0.000046	<0.00010	0.010	0.000995	0.0010	<0.0030	3.75	3.67	0.99	
Flame and Moth N-AML Humidity Cell	16-Oct-13	Week 15	<0.000010	0.0112	<0.00050	<0.30	10.0	0.00101	2.73	<0.000010	1.19	0.203	23.8	0.000044	<0.00010	<0.010	0.000885	0.0012	<0.0030	3.24	3.29	1.01	
Flame and Moth N-AML Humidity Cell	23-Oct-13	Week 16	<0.000010	0.0112	<0.00050	<0.30	8.83	0.00097	2.94	<0.000010	1.07	0.195	23.5	0.000045	<0.00010	<0.010	0.000835	0.0013	<0.0030	3.13	3.21	1.01	
Flame and Moth N-AML Humidity Cell	30-Oct-13	Week 17	<0.000010	0.00881	<0.00050	<0.30	8.10	0.00074	2.82	<0.000010	0.871	0.183	17.2	0.000038	<0.00010	<0.010	0.000668	0.0014	<0.0030	2.68	2.71	1	
Flame and Moth N-AML Humidity Cell	6-Nov-13	Week 18	<0.000010	0.00868	<0.00050	<0.30	7.80	0.00074	2.79	<0.000010	0.810	0.169	15.4	0.000039	<0.00010	<0.010	0.000633	0.0016	<0.0030	2.46	2.44	1	
Flame and Moth N-AML Humidity Cell	13-Nov-13	Week 19	<0.000010	0.00823	<0.00050	<0.30	7.52	0.00071	2.64	<0.000010	0.723	0.184	13.8	0.000036	<0.00010	<0.010	0.000606	0.0018	<0.0030	2.46	2.38	0.98	
Flame and Moth N-AML Humidity Cell	20-Nov-13	Week 20	<0.000010	0.00917	<0.00050	<0.30	6.89	0.00070	2.90	<0.000010	0.772	0.178	13.1	0.000037	<0.00010	<0.010	0.000676	0.0019	<0.0030	2.60	2.40	0.96	
Flame and Moth N-AML Humidity Cell	27-Nov-13	Week 21	<0.000010	0.00987	<0.00050	<0.30	6.83	0.00071	2.79	<0.000010	0.785	0.183	12.5	0.000036	<0.00010	<0.010	0.000696	0.0019	<0.0030	2.33	2.33	1	
Flame and Moth N-AML Humidity Cell	4-Dec-13	Week 22	<0.000010	0.00700	<0.00050	<0.30	6.17	0.00057	2.65	<0.000010	0.622	0.170	11.4	0.000031	<0.00010	<0.010	0.000618	0.0024	<0.0030	2.18	1.95	0.94	
Flame and Moth N-AML Humidity Cell	11-Dec-13	Week 23	<0.000010	0.00697	<0.00050	<0.30	5.82	0.00056	2.59	<0.000010	0.587	0.167	9.56	0.000034	<0.00010	<0.010	0.000625	0.0022	<0.0030	1.95	1.92	0.99	
Flame and Moth N-AML Humidity Cell	18-Dec-13	Week 24	<0.000010	0.00645	<0.00050	<0.30	5.44	0.00056	2.83	<0.000010	0.517	0.163	9.36	0.000034	<0.00010	<0.010	0.000584	0.0026	<0.0030	1.92	1.88	0.99	
Flame and Moth N-AML Humidity Cell	24-Dec-13	Week 25	<0.000010	0.00722	<0.00050	<0.30	5.73	0.00060	2.78	<0.000010	0.529	0.173	8.68	0.000034	<0.00010	<0.010	0.000676	0.0025	<0.0030	1.94	1.87	0.98	
Flame and Moth N-AML Humidity Cell	31-Dec-13	Week 26	<0.000010	0.00703	<0.00050	<0.30	5.48	0.00058	2.67	<0.000010	0.554	0.169	8.35	0.000030	<0.00010	<0.010	0.000680	0.0025	<0.0030	2.01	1.84	0.96	
Flame and Moth N-AML Humidity Cell	8-Jan-14	Week 27	<0.000010	0.00541	<0.00050	<0.30	5.11	0.00050	2.72	<0.000010	0.498	0.159	7.46	0.000027	<0.00010	<0.010	0.000563	0.0028	<0.0030	1.98	1.79	0.95	
Flame and Moth N-AML Humidity Cell	15-Jan-14	Week 28	<0.000010	0.00660	<0.00050	<0.30	5.05	0.00053	2.81	<0.000010	0.484	0.179	8.15	0.000030	<0.00010	<0.010	0.000699	0.0028	<0.0030	1.81	1.80	1	
Flame and Moth N-AML Humidity Cell	22-Jan-14	Week 29	<0.000010	0.00633	<0.00050	<0.30	4.66	0.00055	2.82	<0.000010	0.471	0.174	7.13	0.000032	<0.00010	<0.010	0.000709	0.0029	<0.0030	1.74	1.81	1.02	
Flame and Moth N-AML Humidity Cell	29-Jan-14	Week 30	<0.000010	0.00562	<0.00050	<0.30	4.64	0.00052	2.80	<0.000010	0.410	0.176	6.73	0.000029	<0.00010	<0.010	0.000722	0.0030	<0.0030	1.80	1.75	0.99	
Flame and Moth N-AML Humidity Cell	5-Feb-14	Week 31	<0.000010	0.00609	<0.00050	<0.30	4.21	0.00050	2.69	<0.000010	0.416	0.187	6.60	0.000027	<0.00010	<0.010	0.000718	0.0030	<0.0030	1.86	1.74	0.97	
Flame and Moth N-AML Humidity Cell	12-Feb-14	Week 32	<0.000010	0.00409	<0.00050	<0.30	3.93	0.00045	2.68	<0.000010	0.374	0.144	6.09	0.000022	<0.00010	<0.010	0.000631	0.0031	<0.0030	1.62	1.61	1	
Flame and Moth N-AML Humidity Cell	19-Feb-14	Week 33	<0.000010	0.00632	<0.00050	<0.30	4.23	0.00055	2.74	<0.000010	0.403	0.184	6.41	0.000028	<0.00010	<0.010	0.000760	0.0029	<0.0030	1.90	1.80	0.97	
Flame and Moth N-AML Humidity Cell	26-Feb-14	Week 34	<0.000010	0.00499	<0.00050	<0.30	3.81	0.00050	2.61	<0.000010	0.367	0.175	6.02	0.000026	<0.00010	<0.010	0.000711	0.0029	<0.0030	1.73	1.68	0.99	
Flame and Moth N-AML Humidity Cell	4-Mar-14	Week 35	<0.000010	0.00400	<0.00050	<0.30	3.57	0.00045	2.60	<0.000010	0.336	0.173	5.52	0.000024	<0.00010	<0.010	0.000681	0.0032	<0.0030	1.62	1.56	0.98	
Flame and Moth N-AML Humidity Cell	12-Mar-14	Week 36	<0.000010	0.00461	<0.00050	<0.30	3.36	0.00046	2.48	<0.000010	0.304	0.174	5.71	0.000021	<0.00010	<0.010	0.000678	0.0031	<0.0030	1.59	1.51	0.97	
Flame and Moth N-AML Humidity Cell	19-Mar-14	Week 37	<0.000010	0.00560	<0.00050	<0.30	3.37	0.00053	2.64	<0.000010	0.345	0.176	5.84	0.000022	<0.00010	<0.010	0.000743	0.0031	<0.0030	1.68	1.59	0.97	
Flame and Moth N-AML Humidity Cell	26-Mar-14	Week 38	<0.000010	0.00509	<0.00050	<0.30	2.95	0.00054	2.52	<0.000010	0.293	0.183	5.58	0.000020	<0.00010	<0.010	0.000726	0.0031	<0.0030	1.65	1.53	0.96	
Flame and Moth N-AML Humidity Cell	2-Apr-14	Week 39	<0.000010	0.00484	<0.00050	<0.30	3.05	0.00052	2.58	<0.000010	0.299	0.170	5.55	0.000021	<0.00010	<0.010	0.000718	0.0032	<0.0030	1.51	1.56	1.02	
Flame and Moth N-AML Humidity Cell	9-Apr-14	Week 40	<0.000010	0.00490	<0.00050	<0.30	2.96	0.00051	2.52	<0.000010	0.295	0.166	5.65	0.000029	<0.00010	<0.010	0.000733	0.0032	<0.0030	1.51	1.53	1.01	
Flame and Moth N-AML Humidity Cell	16-Apr-14	Week 41	<0.000010	0.00487	<0.00050	<0.30	2.69	0.00051	2.27	<0.000010	0.252	0.157	4.75	0.000024	<0.00010	<0.010	0.000654	0.0034	<0.0030	1.44	1.43	0.99	
Flame and Moth N-AML Humidity Cell	23-Apr-14	Week 42	<0.000010	0.00454	<0.00050	<0.30	2.79	0.00051	2.56	<0.000010	0.266	0.171	5.58	0.000018	<0.00010	<0.010	0.000692	0.0031	<0.0030	1.57	1.52	0.98	
Flame and Moth N-AML Humidity Cell	30-Apr-14	Week 43	<0.000010	0.00442	<0.00050	<0.30	2.55	0.00049	2.41	<0.000010	0.251	0.165	4.61	0.000015	<0.00010	<0.010	0.000663	0.0035	<0.0030	1.42	1.38	0.98	
Flame and Moth N-AML Humidity Cell	7-May-14	Week 44	<0.000010	0.00504	<0.00050	<0.30	2.68	0.00046	2.33	<0.000010	0.243	0.165	5.03	0.000022	<0.00010	<0.010	0.000686	0.0034	<0.0030	1.52	1.40	0.96	
Flame and Moth N-AML Humidity Cell	14-May-14	Week 45	<0.000010	0.00371	<0.00050	<0.30	2.15	0.00038	2.22	<0.000010	0.194	0.147	4.06	0.000014	<0.00010	<0.010	0.000617	0.0037	<0.0030	1.29	1.27	0.99	
Flame and Moth N-AML Humidity Cell	21-May-14	Week 46	<0.000010	0.00518	<0.00050	<0.30	2.36	0.00046	2.40	<0.000010	0.228	0.169	4.74	0.000017	<0.00010	<0.010	0.000678	0.0034	<0.0030	1.43	1.42	0.99	
Flame and Moth N-AML Humidity Cell	28-May-14	Week 47	<0.000010	0.00458	<0.00050	<0.30	2.38	0.00044	2.50	<0.000010	0.225	0.156	4.76	0.000020	<0.00010	<0.010	0.000674	0.0033	<0.0030	1.53	1.43	0.96	
Flame and Moth N-AML Humidity Cell	3-Jun-14	Week 48	<0.000010	0.00529	<0.00050	<0.30	2.47	0.00044	2.50	<0.000010	0.239	0.174	5.87	0.000016	<0.00010	<0.010	0.000722	0.0032	<0.0030	1.67	1.52	0.95	
Flame and Moth N-AML Humidity Cell	11-Jun-14	Week 49	<0.000010	0.00363	<0.00050	<0.30	1.93	0.00040	2.13	<0.000010	0.168	0.144	3.85	0.000015	<0.00010	<0.010	0.000587	0.0036	<0.0030	1.22	1.21	1	
Flame and Moth N-AML Humidity Cell	18-Jun-14	Week 50	<0.000010	0.00501	<0.00050	<0.30	2.20	0.00041	2.33	<0.000010	0.195	0.155	5.01	0.000015	<0.00010	<0.010	0.000648	0.0033	<0.0030	1.63	1.36	0.91	
Flame and Moth N-AML Humidity Cell	25-Jun-14	Week 51	<0.000010	0.00415	<0.00050	<0.30	1.94	0.00040	2.24	<0.000010	0.196	0.147	4.30	0.000015	<0.00010	<0.010	0.000589	0.0034	<0.0030	1.43	1.35	0.97	
Flame and Moth N-AML Humidity Cell	2-Jul-14	Weel 52	<0.000010	0.00428	<0.00050	<0.30	2.15	0.00039	2.40	<0.000010	0.206	0.141	4.96	0.000013	<0.00010	<0.010	0.000595	0.0034	<0.0030	1.55	1.45	0.97	

Description	Sample Date	Sample Comments	...se (Mn), dissolved	Mercury (Hg), dissolved	Molybdenum (Mo), dissolved	Nickel (Ni), dissolved	Phosphorus (P), dissolved	Potassium (K), dissolved	Selenium (Se), dissolved	Silicon (Si), dissolved	Silver (Ag), dissolved	Sodium (Na), dissolved	Strontium (Sr), dissolved	Sulphur (S), dissolved	Thallium (Tl), dissolved	Tin (Sn), dissolved	Titanium (Ti), dissolved	Uranium (U), dissolved	Vanadium (V), dissolved	Zinc (Zn), dissolved	Total Anion Sum	Total Cation Sum	Ion B...
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L	
Type A WUL QZ09-092 FM EQS-DM					0.5						0.02								0.5				
Flame and Moth N-AML Humidity Cell	9-Jul-14	Week 53																					
Flame and Moth N-AML Humidity Cell	16-Jul-14	Week 54	<0.000010	0.00414	<0.00050	<0.30	1.75	0.00038	2.12	<0.000010	0.161	0.146	4.46	0.000013	<0.00010	<0.010	0.000601	0.0034	<0.0030	1.25	1.28	1.01	
Flame and Moth N-AML Humidity Cell	23-Jul-14	Week 55																					
Flame and Moth N-AML Humidity Cell	30-Jul-14	Week 56	<0.000010	0.00498	<0.00050	<0.30	1.86	0.00038	2.26	<0.000010	0.170	0.157	5.14	0.000016	<0.00010	<0.010	0.000633	0.0033	<0.0030	1.45	1.41	0.99	
Flame and Moth N-AML Humidity Cell	6-Aug-14	Week 57																					
Flame and Moth N-AML Humidity Cell	13-Aug-14	Week 58	<0.000010	0.00494	<0.00050	<0.30	1.57	0.00036	2.17	<0.000010	0.151	0.147	5.03	0.000012	<0.00010	<0.010	0.000616	0.0035	<0.0030	1.36	1.35	1	
Flame and Moth N-AML Humidity Cell	20-Aug-14	Week 59																					
Flame and Moth N-AML Humidity Cell	27-Aug-14	Week 60	<0.000010	0.00450	<0.00050	<0.30	1.60	0.00032	2.31	<0.000010	0.150	0.142	5.28	0.000010	<0.00010	<0.010	0.000631	0.0032	<0.0030	1.34	1.34	1	
Flame and Moth N-AML Humidity Cell	3-Sep-14	Week 61																					
Flame and Moth N-AML Humidity Cell	10-Sep-14	Week 62	<0.000010	0.00525	<0.00050	<0.30	1.48	0.00031	2.44	<0.000010	0.151	0.154	5.95	0.000015	<0.00010	<0.010	0.000639	0.0028	<0.0030	1.58	1.43	0.95	
Flame and Moth N-AML Humidity Cell	17-Sep-14	Week 63																					
Flame and Moth N-AML Humidity Cell	24-Sep-14	Week 64	<0.000010	0.00538	<0.00050	<0.30	1.52	0.00033	2.51	<0.000010	0.161	0.153	6.38	0.000013	<0.00010	<0.010	0.000636	0.0027	<0.0030	1.55	1.47	0.97	
Flame and Moth N-AML Humidity Cell	1-Oct-14	Week 65																					
Flame and Moth N-AML Humidity Cell	8-Oct-14	Week 66	<0.000010	0.00616	<0.00050	<0.30	1.51	0.00035	2.50	<0.000010	0.214	0.156	7.29	0.000011	<0.00010	<0.010	0.000634	0.0026	<0.0030	1.59	1.57	0.99	
Flame and Moth N-AML Humidity Cell	15-Oct-14	Week 67																					
Flame and Moth N-AML Humidity Cell	22-Oct-14	Week 68	<0.000010	0.00543	<0.00050	<0.30	1.42	0.00034	2.39	<0.000010	0.155	0.153	6.71	0.000013	<0.00010	<0.010	0.000606	0.0026	<0.0030	1.59	1.50	0.97	
Flame and Moth N-AML Humidity Cell	29-Oct-14	Week 69																					
Flame and Moth N-AML Humidity Cell	5-Nov-14	Week 70	<0.000010	0.00601	<0.00050	<0.30	1.37	0.00036	2.45	<0.000010	0.159	0.151	7.35	0.000013	<0.00010	<0.010	0.000630	0.0026	<0.0030	1.59	1.52	0.98	
Flame and Moth N-AML Humidity Cell	12-Nov-14	Week 71																					
Flame and Moth N-AML Humidity Cell	19-Nov-14	Week 72	<0.000010	0.00587	<0.00050	<0.30	1.33	0.00033	2.50	<0.000010	0.143	0.150	7.44	0.000018	<0.00010	<0.010	0.000620	0.0026	<0.0030	1.65	1.55	0.97	
Flame and Moth N-AML Humidity Cell	26-Nov-14	Week 73																					
Flame and Moth N-AML Humidity Cell	3-Dec-14	Week 74	<0.000010	0.00569	<0.00050	<0.30	1.25	0.00034	2.42	<0.000010	0.138	0.147	7.44	<0.000010	<0.00010	<0.010	0.000646	0.0025	<0.0030	1.71	1.61	0.97	
Flame and Moth N-AML Humidity Cell	10-Dec-14	Week 75																					
Flame and Moth N-AML Humidity Cell	17-Dec-14	Week 76	<0.000010	0.00707	<0.00050	<0.30	1.28	0.00031	2.48	<0.000010	0.129	0.152	8.49	0.000012	<0.00010	<0.010	0.000613	0.0024	<0.0030	1.75	1.68	0.98	
Flame and Moth N-AML Humidity Cell	22-Dec-14	Week 77																					
Flame and Moth N-AML Humidity Cell	30-Dec-14	Week 78	<0.000010	0.00652	<0.00050	<0.30	1.25	0.00035	2.52	<0.000010	0.145	0.148	8.85	0.000011	<0.00010	<0.010	0.000674	0.0025	<0.0030	1.68	1.60	0.97	
Flame and Moth N-AML Humidity Cell	7-Jan-15	Week 79																					
Flame and Moth N-AML Humidity Cell	14-Jan-15	Week 80																					
Flame and Moth N-AML Humidity Cell	21-Jan-15	Week 81																					
Flame and Moth N-AML Humidity Cell	28-Jan-15	Week 82	<0.000010	0.00591	<0.00050	<0.30	1.05	0.00031	2.41	<0.000010	0.135	0.139	9.03	<0.000010	<0.00010	<0.010	0.000576	0.0022	<0.0030	1.68	1.58	0.97	
Flame and Moth N-AML Humidity Cell	4-Feb-15	Week 83																					
Flame and Moth N-AML Humidity Cell	11-Feb-15	Week 84																					
Flame and Moth N-AML Humidity Cell	18-Feb-15	Week 85																					
Flame and Moth N-AML Humidity Cell	25-Feb-15	Week 86	<0.000010	0.00574	<0.00050	<0.30	1.00	0.00033	2.47	<0.000010	0.128	0.150	8.80	0.000012	<0.00010	<0.010	0.000614	0.0022	<0.0030	1.68	1.66	0.99	
Flame and Moth N-AML Humidity Cell	4-Mar-15	Week 87																					
Flame and Moth N-AML Humidity Cell	11-Mar-15	Week 88																					
Flame and Moth N-AML Humidity Cell	18-Mar-15	Week 89																					
Flame and Moth N-AML Humidity Cell	25-Mar-15	Week 90	<0.000010	0.00457	<0.00050	<0.30	0.929	0.00028	2.49	<0.000010	0.115	0.135	8.94	<0.000010	<0.00010	<0.010	0.000531	0.0022	<0.0030	1.54	1.51	0.99	
Flame and Moth N-AML Humidity Cell	1-Apr-15	Week 91																					
Flame and Moth N-AML Humidity Cell	8-Apr-15	Week 92																					
Flame and Moth N-AML Humidity Cell	15-Apr-15	Week 93																					
Flame and Moth N-AML Humidity Cell	22-Apr-15	Week 94	<0.0000050	0.00413	<0.00050	<0.30	0.868	0.00033	2.43	<0.000010	0.123	0.135	7.81	<0.000010	<0.00010	<0.010	0.000482	0.0022	<0.0030	1.51	1.49	0.99	
Flame and Moth N-AML Humidity Cell	29-Apr-15	Week 95																					
Flame and Moth N-AML Humidity Cell	6-May-15	Week 96																					
Flame and Moth N-AML Humidity Cell	13-May-15	Week 97																					
Flame and Moth N-AML Humidity Cell	20-May-15	Final Leach	<0.0000050	0.000926	<0.00050	<0.30	0.828	0.00024	2.35	<0.000010	0.126	0.129	4.53	<0.000010	<0.00010	<0.010	0.000329	0.0032	<0.0030	1.09	1.04	0.98	
Flame and Moth N-AML Humidity Cell	20-May-15	Week 98	<0.0000050	0.00389	<0.00050	<0.30	0.830	0.00032	2.41	<0.000010	0.109	0.133	7.41	<0.000010	<0.00010	<0.010	0.000454	0.0022	<0.0030	1.60	1.49	0.96	

Appendix 7 Waste Storage Facility Design, EBA 2014

TETRA TECH EBA

October 2, 2014

ISSUED FOR USE
FILE: W14103485
Via Email: kwoloshyn@alexcoresource.com

Alexco Resource Corp.
3-151 Industrial Road
Whitehorse, YT Y1A 2V3

Attention: Kai Woloshyn, Environmental Manager

Subject: Waste Storage Facility Design – Revision I
Flame & Moth Property, Keno City, Yukon

1.0 INTRODUCTION

Alexco Resource Corp. (Alexco) retained Tetra Tech EBA Inc. (Tetra Tech EBA) to provide a preliminary design for a waste containment facility for the storage of potentially acid metal leaching (P-AML) material at their Flame & Moth property west of Keno City, Yukon.

This letter summarizes the site specific foundation conditions, provides foundation preparation recommendations, and includes facility design drawings for two proposed facility locations. It also includes recommendations for the disposal of P-AML within the existing Dry Stacked Tailings Facility (DSTF). Tetra Tech EBA has reviewed the structural stability of the DSTF assuming co-mingling of produced tailings and P-AML waste rock. We have assumed the chemical implications of P-AML disposal in the DSTF will be reviewed by others. For additional information regarding the use of this report, please refer to Tetra Tech EBA's General Conditions included in Appendix A.

2.0 FLAME & MOTH WASTE STORAGE FACILITY

The Flame & Moth waste storage facility design is based on the previously completed "Typical Waste Containment Facility Design, Keno Hill Silver District, YT – Construction Specifications" (EBA 2008). The overall facility dimensions were determined based on the storage of 4,500 m^3 of waste material, as requested by Alexco.

2.1 Location I

Location I for the proposed Flame & Moth facility is southeast of the existing mill building between the Flame and Moth portal and the proposed Dry Stack Phase II Expansion. The proposed facility location and footprint are shown on the attached Figure 1.

Tetra Tech EBA has site specific historic subsurface information from a testpit excavated within the proposed footprint in 2009. W14101178.002-TP03 was excavated to a final depth of 4.0 m through roughly 3.5 m of frozen peat and SILT, over ice-poor SAND. The detailed testpit log is included in Appendix B.

2.1.1 Location I Waste Storage Facility Recommendations

Tetra Tech EBA considers Location I for the Flame & Moth waste storage facility suitable provided the following recommendations are adhered to and the facility is constructed to the dimensions and specifications in the attached Drawings.

- Tetra Tech EBA understands Alexco is currently excavating a pad for access to the Flame & Moth portal to an elevation of 907 m adjacent to the proposed waste storage facility footprint. The excavation will be about 2 m

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61 Wasson Place
Whitehorse, YT Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

below existing grade, exposing frozen peat and silt in the upslope wall. The disturbance caused by the portal pad excavation increases the potential for thaw settlement in the ice rich peat and silt under the proposed facility – it should be removed.

- The portal pad excavation should be extended under the facility footprint to remove all frozen peat and silt, exposing the underlying sand. Any visible ice in the sand must also be removed.
- Subsequent to peat removal, 16 oz. non-woven geotextile should be placed over the entire footprint of the facility (including beneath perimeter berms and armoured slopes graded to meet original ground).
- 0.6 m of "Zone B" material should be placed and compacted over the frozen sand prior to facility construction.
- If thicker peat/silt deposits are encountered, additional "Zone B" material will be required to prepare a level working surface. The "Zone B" material should be placed in lifts no thicker than 0.5 m in uncompacted thickness and compacted to at least 95% of maximum dry density using standard effort (as per ASTM D698).
- The excavation walls beyond the footprint of the facility should be shaped at 1.5:1 (horizontal:vertical) to meet original ground, lined with non-woven geotextile as described above, and armoured with waste rock as shown on the attached Drawings.

2.2 Location II

Location II for the proposed Flame & Moth facility is east of the existing coarse ore stockpile concrete pads. The proposed facility location and footprint are shown on the attached Figure 1.

Tetra Tech EBA has site specific historic subsurface information from a testpit excavated near the proposed footprint in 2009. W14101178.002-TP07 was excavated to a final depth of 5.4 m through shallow frozen peat, 2.5 m of gravelly SAND, and 3 m SILT (till). The detailed testpit log is included in Appendix B.

2.2.1 Location II Waste Storage Facility Recommendations

Tetra Tech EBA considers Location II for the Flame & Moth waste storage facility suitable provided the following recommendations are adhered to and the facility is constructed to the dimensions and specifications in the attached Drawings.

- The existing organic cover should be left in place to reduce the risk of thaw related settlement of the facility after construction.
- A level surface for facility construction should be prepared by constructing a waste rock pad as shown on the attached Drawings.

3.0 DSTF WASTE STORAGE

The existing DSTF is a lined facility designed for the long term storage of tailings waste generated during the milling process. Tetra Tech EBA has reviewed the stability of the DSTF with respect to the storage of P-AML waste rock and determined that the calculated factors of safety increase slightly with its inclusion. This is expected as the waste rock has a larger angle of internal friction due to its angularity. Additionally, its placed weight is less than that of tailings due to its clast nature and the associated voids.

The calculated factors of safety in the most critical scenario (permafrost condition) originally presented in the "Dry Stacked Tailings Facility – Risk Assessment Stability Model Update" (EBA 2013) are compared with the

calculated factors of safety when waste rock is co-mingled with tailings in the following Table 1. Detailed stability results, including critical failure surfaces, are available upon request.

Table 1: DSTF Slope Stability Factors of Safety – Fully Frozen Case

Stability Condition	Factor of Safety Suggested Minimum[1]	Calculated Factor of Safety		Calculated Factor of Safety (Waste Rock Included)	
		Alignment A	Alignment B	Alignment A	Alignment B
Stability of Surface					
Short-term (during construction – static)	1.0	2.0	2.2	2.1	2.3
Long-term (after construction – static)	1.1	2.0	2.3	2.1	2.3
Deep Seated Stability					
Short-term (during construction – static)	1.1-1.3	2.0	2.0	2.0	2.0
Short-term (during construction – pseudo-static)	1.0	1.4	1.4	1.4	1.5
Long-term (after closure – static)	1.3	1.5	1.4	1.5	1.4
Long-term (after closure – pseudo-static)	1.0	1.4	1.5	1.4	1.5

[1] Mined Rock and Overburden Piles Investigation and Design Manual (BC Mine Waste Rock Pile Research Committee, 1991)

3.1 DSTF Disposal Recommendations

Tetra Tech EBA considers the disposal of P-AML waste rock within the DSTF acceptable provided the following recommendations are adhered to:

- Waste rock should be placed in lifts no thicker than 1.0 m to limit the risk of void formation within the facility as tailings naturally filter into the voids within the placed rock during and after compaction.
- At least 0.5 m of tailings must be placed and compacted between subsequent waste rock lifts to reduce the risk of preferred pathways for water infiltration through the DSTF.
- Waste rock should not be placed within 1.0 m of the extents or final surface of the DSTF to allow for adequate encapsulation.
- Waste rock may be placed in isolated partial lifts at differing locations throughout the DSTF. In fact this approach is preferred to limit the regional variability of material used to construct the DSTF.

4.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Alexco Resource Corp and their agents. Tetra Tech EBA Inc. (Tetra Tech EBA) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Alexco Resource Corp, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech EBA's Services Agreement. Tetra Tech EBA's General Conditions are provided in Appendix A of this report.

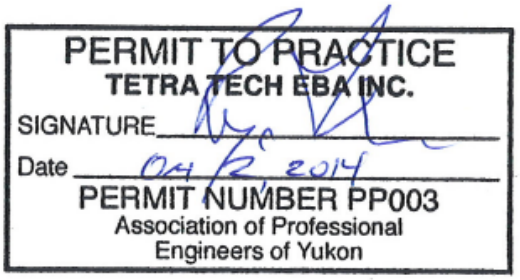
5.0 CLOSURE

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

Respectfully submitted,
Tetra Tech EBA Inc.



Justin Pigage, P.Eng.
Geotechnical Engineer, Arctic Region
Direct Line: 867.668.9213
Justin.Pigage@tetratech.com



REVISION I SUMMARY:

Added recommendations for alternate facility location (Location II).

REFERENCES

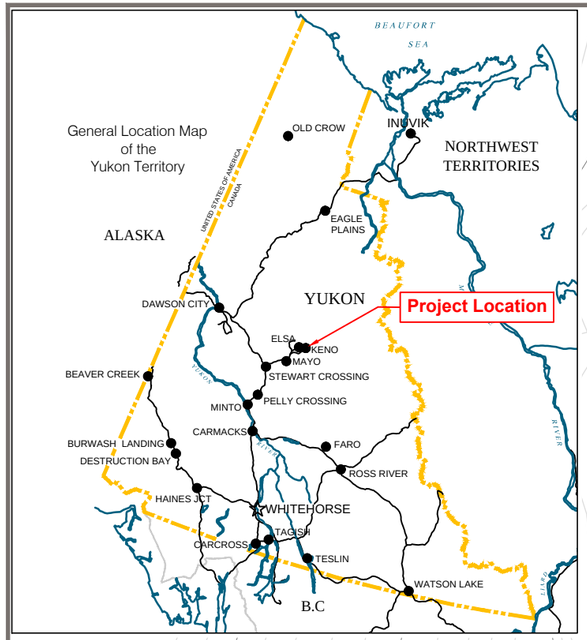
EBA, A Tetra Tech Company “Dry Stacked Tailings Facility – Risk Assessment Stability Model Update, Keno Hill District Mill Site, Yukon” February 2013.

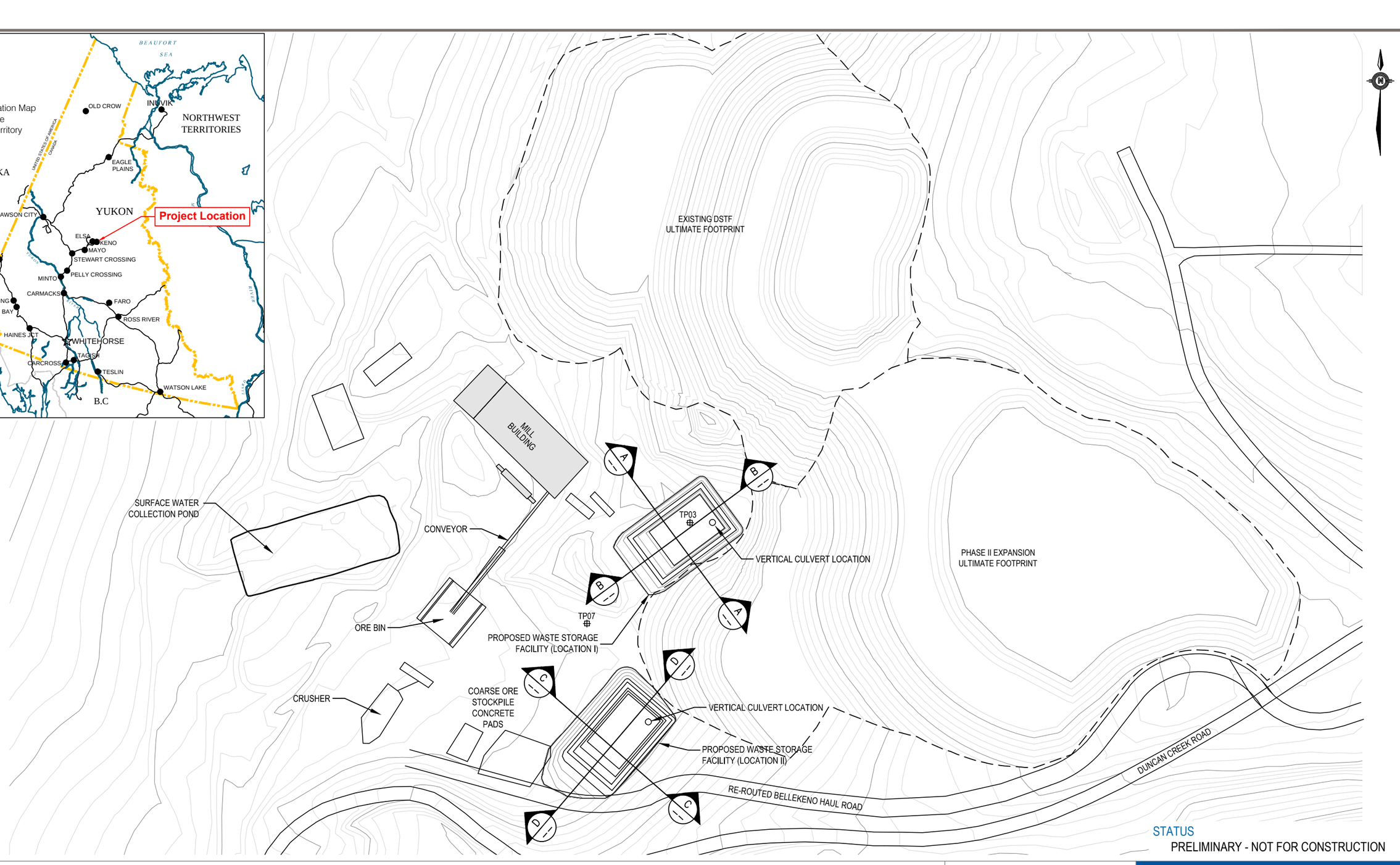
EBA Engineering Consultants Ltd. “Typical Waste Containment Facility Design, Keno Hill Silver District, YT – Construction Specifications” July 2008.

Piteau Associates Engineering Ltd. “Investigation and Design of Mine Dumps – Interim Guidelines.” Prepared for British Columbia Mine Waste Rock Pile Research Committee, May 1991.

FIGURES

Figure 1 Site Plan
Figure 2 Location I Cross-Sections
Figure 3 Location II Cross Sections
Figure 3 Details and Notes





STATUS

PRELIMINARY - NOT FOR CONSTRUCTION

LEGEND

⌗ - TESTPIT LOCATION (2009)

0 100 m

Scale: 1 : 1750 @ 11"x17"

CLIENT

ALEXCO

FLAME AND MOTH WASTE STORAGE FACILITY
KENO HILL DISTRICT, YUKON

SITE PLAN

TETRA TECH EBA

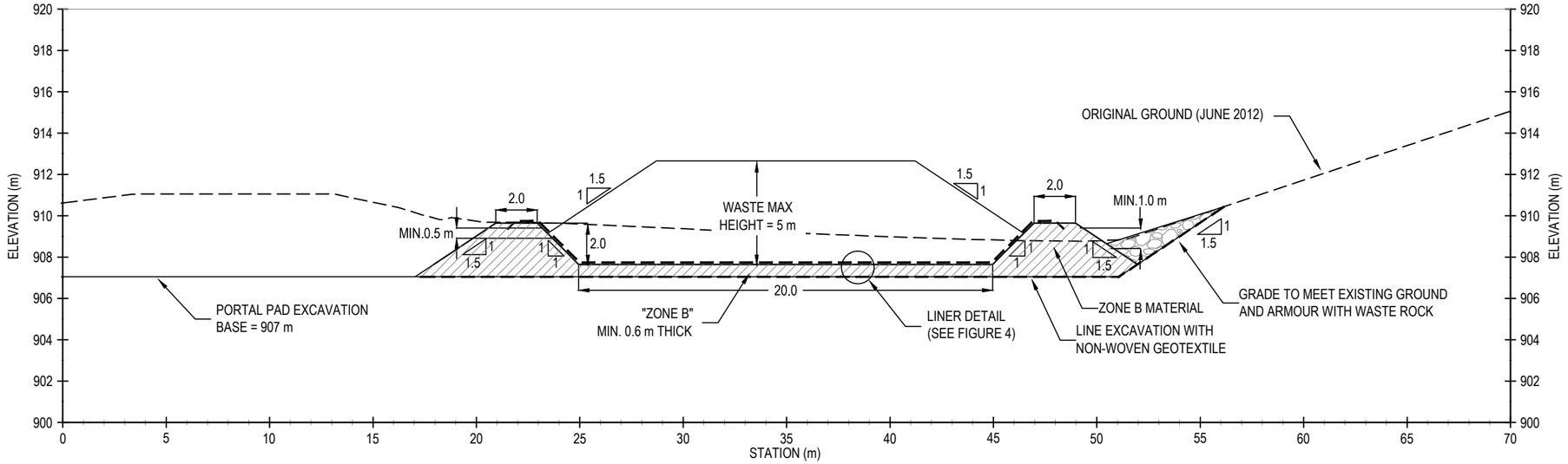
PROJECT NO.	DWN	CKD	REV
W14103485-01	CB	JTP	0

OFFICE: EBA-WHSE

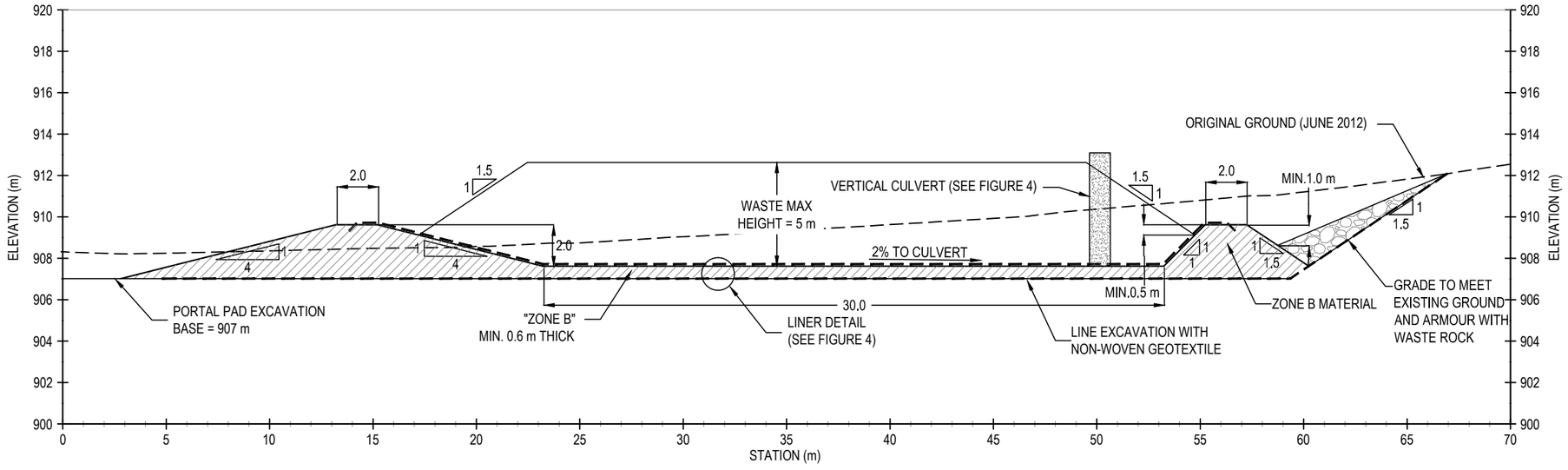
DATE: September 25, 2014

Figure 1

Q:\Whitehorse\Data\0201drawings\Keno\W14103485-01 Flame & Moth P-AML Design\W14103485-01 Figs 1-3_R0.dwg [FIGURE 1] October 01, 2014 - 2:19:36 pm (BY: BUCHAN, CAMERON)



SECTION A - A'



SECTION B - B'

STATUS
PRELIMINARY - NOT FOR CONSTRUCTION

0 10 m
Scale: 1:250 @ 11"x17"

CLIENT
ALEXCO

FLAME AND MOTH WASTE STORAGE FACILITY
KENO HILL DISTRICT, YUKON

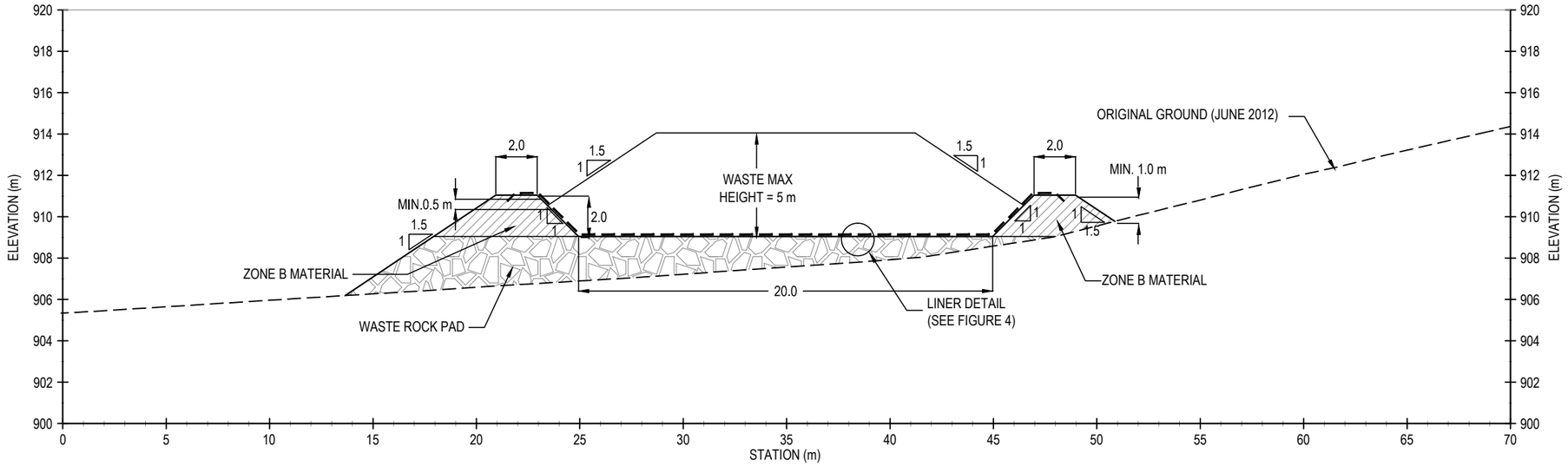
LOCATION I CROSS-SECTIONS

TETRA TECH EBA

PROJECT NO.	DWN	CKD	REV
W14103485-01	CB	JTP	0
OFFICE: EBA-WHSE	DATE: September 25, 2014		

Figure 2

Q:\Whitehorse\Data\0201drawings\Keno\W14103485-01 Flame & Moth P-AML Design\W14103485-01 Figs 1-3 R0.dwg [FIGURE 2] October 01, 2014 - 2:20:40 pm BY: BUCHAN, CAMERON



SECTION C - C'

SECTION D - D'

STATUS
PRELIMINARY - NOT FOR CONSTRUCTION

0 10 m
Scale: 1:250 @ 11"x17"

CLIENT
ALEXCO

TETRA TECH EBA

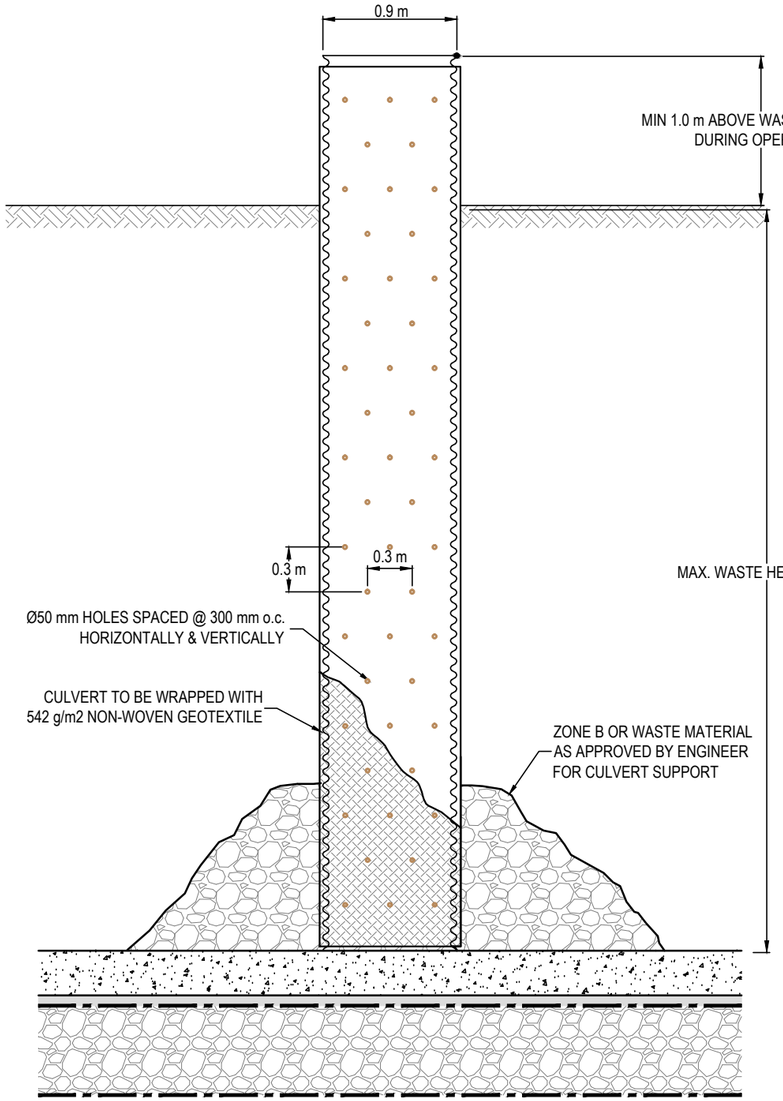
FLAME AND MOTH WASTE STORAGE FACILITY
KENO HILL DISTRICT, YUKON

LOCATION II CROSS-SECTIONS

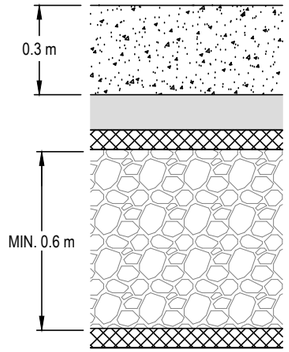
PROJECT NO.	DWN	CKD	REV
W14103485-01	CB	JTP	0
OFFICE: EBA-WHSE	DATE: September 25, 2014		

Figure 3

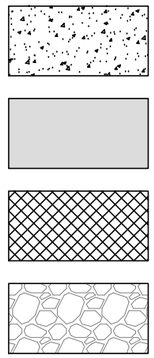
Q:\Whitehorse\Data\0201drawings\Keno\W14103485-01 Flame & Moth P-AML Design\W14103485-01 Figs 1-3 R0.dwg [FIGURE 3] October 01, 2014 - 2:21:44 pm (BY: BUCHAN, CAMERON)



DETAIL 1 - VERTICAL SUMP CULVERT



DETAIL 2 - FACILITY FLOOR AND BERMS



LINER SYSTEM DETAIL KEY

NOTES :

These specifications, relevant to construction of the Flame & Moth Waste Storage Facility, have been extracted from the Typical Waste Containment Facility Design Construction Specifications, Keno Hill Silver District, YT (EBA July 2008).

The Flame & Moth Waste Storage Facility shall be constructed to the specifications below and the dimensions indicated on the Construction Drawings.

Water in the facility will flow towards and pond in the vertical culvert where it will be monitored and tested on a regular basis. Based on water quality analysis, the waste water will be extracted via pump truck and discharged to the environment or treated in a designated treatment facility.

The facility has been sized based on containment of approximately 4,500 m3 of waste, when the ultimate capacity is reached a 0.5 m soil cover will be placed over the entire facility.

The Zone A material shall consist of hard, durable particles, shall be free of roots, topsoil, and deleterious material and shall have a particle size distribution, as measured by ASTM C136, as presented in Table 1, or as approved by the Engineer.

The Zone B material shall consist of hard, durable particles, shall be free of roots, topsoil, and deleterious material and shall have a particle size distribution, as measured by ASTM C136, as presented in Table 1, or as approved by the Engineer.

The fill materials shall be placed in lifts not exceeding 0.5 m in uncompacted thickness and compacted to at least 95% of maximum dry density using standard effort as per ASTM D698.

The non-woven geotextile shall be 542 g/m2 Layfield LP16 or equivalent approved by the Engineer.

The HDPE geomembrane shall be 1.6 mm (60 mil) thick Layfield HDPE 60 or equivalent approved by the Engineer.

The HDPE geomembrane seems shall be welded by a suitably qualified contractor. Trial seems shall be conducted prior to start-up each day and at approximately 4-hour intervals during seaming operations. During the trial seam, the minimum strength criteria set by the manufacturer for the geomembrane should be met.

No construction equipment shall be allowed to travel on the liner prior to the placement of the protective Zone A cover material.

Table 1: Particle Size Distribution Limits

Zone B Material		Zone A Material	
Particle Size (mm)	% Passing by Mass	Particle Size (mm)	% Passing by Mass
200	100		
100	85 – 100		
50	65 – 100		
25	40 – 100	10	100
5	20 – 55	5	80 – 100
2	0 – 20	2	55 – 100
		0.63	25 – 65
		0.25	10 – 40
		0.08	2 – 15

STATUS

PRELIMINARY - NOT FOR CONSTRUCTION

NOTE

- THIS PLAN IS NOT TO SCALE

CLIENT

ALEXCO

TETRA TECH EBA

FLAME AND MOTH WASTE STORAGE FACILITY
KENO HILL DISTRICT, YUKON

DETAILS AND NOTES

PROJECT NO.	DWN	CKD	REV
W14103485-01	CB	JTP	0

OFFICE: EBA-WHSE

DATE: September 26, 2014

Figure 4

Q:\Whitehorse\Data\0201drawings\Keno\W14103485-01 Flame & Moth P-AML Design\W14103485-01 Fig 3_R0.dwg [FIGURE 3] September 30, 2014 - 3:02:12 pm (BY: BUCHAN, CAMERON)

APPENDIX A

TETRA TECH EBA'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOTECHNICAL REPORT

This report incorporates and is subject to these “General Conditions”.

1.0 USE OF REPORT AND OWNERSHIP

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

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

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

2.0 ALTERNATE REPORT FORMAT

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

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

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

3.0 ENVIRONMENTAL AND REGULATORY ISSUES

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

4.0 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

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

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

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

5.0 LOGS OF TESTHOLES

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

6.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

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

7.0 PROTECTION OF EXPOSED GROUND

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

8.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES

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

9.0 INFLUENCE OF CONSTRUCTION ACTIVITY

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

10.0 OBSERVATIONS DURING CONSTRUCTION

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

11.0 DRAINAGE SYSTEMS

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

12.0 BEARING CAPACITY

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

13.0 SAMPLES

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

14.0 INFORMATION PROVIDED TO TETRA TECH EBA BY OTHERS

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

APPENDIX B
HISTORIC TESTPIT LOGS

Flame and Moth Mill & DSTF	CLIENT: Alexco	PROJECT NO. - TESTPIT NO.
Mill Pad	EXCAVATOR: Hitachi 270 LC	W14101178.002-TP03
near Keno City, YT	7086760N; 484004E; Zone 8	ELEVATION: 907.4m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	TEMP (°C)	STANDARD PENETRATION (N) 20 40 60 80 / POCKET PEN. (kPa) 100 200 300 400 / PLASTIC M.C. LIQUID 20 40 60 80	GROUND ICE DESCRIPTION	Elevation (m)
0	PEAT - amorphous granular, roots, organics, black and brown, frozen					Frozen	907.0
1			SA01		354		906.0
			SA02		1158		
2							905.0
3	SILT - some sand, trace clay, soft (est.), low-plastic, massive, frozen, olive grey		SA03	-1.7		Vs (35%) ice lens up to 10cm thick	904.0
	SAND - silty, gravelly, trace clay, firm (est.), non-plastic, massive, frozen, olive grey		SA04			Vs and Vc (5%)	
4	EOH - target depth						903.0
5							902.0
6							

EBA Engineering Consultants Ltd.

LOGGED BY: CJD	COMPLETION DEPTH: 4m
REVIEWED BY: JRT	COMPLETE: 5/6/2009
DRAWING NO: Figure 2	Page 1 of 1

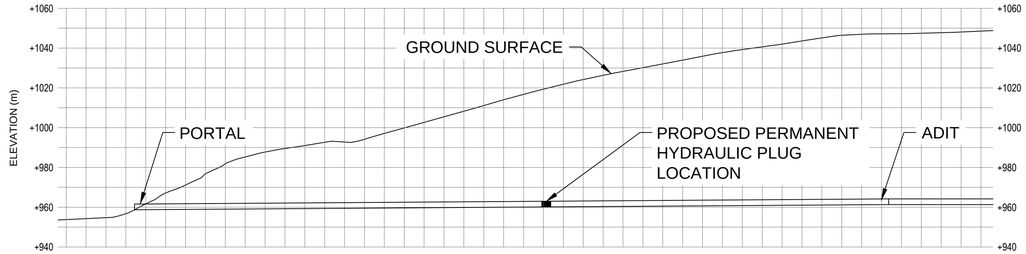
Flame and Moth Mill & DSTF	CLIENT: Alexco	PROJECT NO. - TESTPIT NO.
Mill Pad	EXCAVATOR: Hitachi 270 LC	W14101178.002-TP07
near Keno City, YT	7086712N; 483955E; Zone 8	ELEVATION: 906.7m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

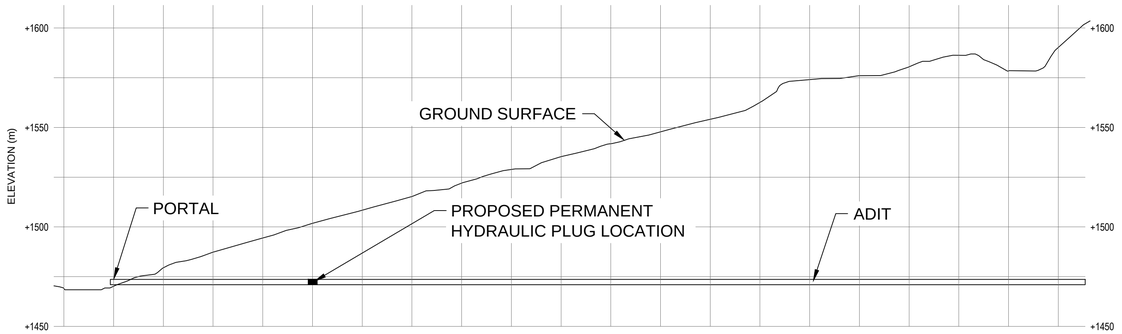
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	TEMP (°C)	STANDARD PENETRATION (N) 20 40 60 80 / POCKET PEN. (kPa) 100 200 300 400 / PLASTIC M.C. LIQUID 20 40 60 80	GROUND ICE DESCRIPTION	Elevation (m)
0	PEAT - some silt, woody, roots, black					Frozen	
	SILT - sandy, some gravel, medium, non-plastic, frozen, brown, organics, roots		SA01				
	SAND - gravelly, trace cobbles, trace silt,, compact (est.), medium grained, well graded, damp to moist, brown, sub-rounded						906.0
1			SA02				
						Unfrozen	905.0
	- seepage						
2						Frozen Nbn	
	SILT - sandy, some gravel, trace clay, stiff (est.), low plastic, massive, olive grey						904.0
3			SA03	-0.1	H	Vx, Vc (<5%)	
							903.0
						Unfrozen	
4							
			SA04	1.5	▲		902.0
5							
	EOH - refusal at probable bedrock (quarzite)						901.0
6							

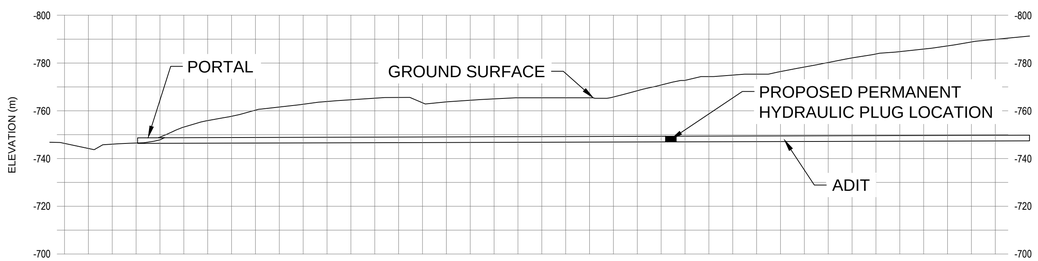
Appendix 8 Preliminary Adit Bulkhead Design, EBA 2015



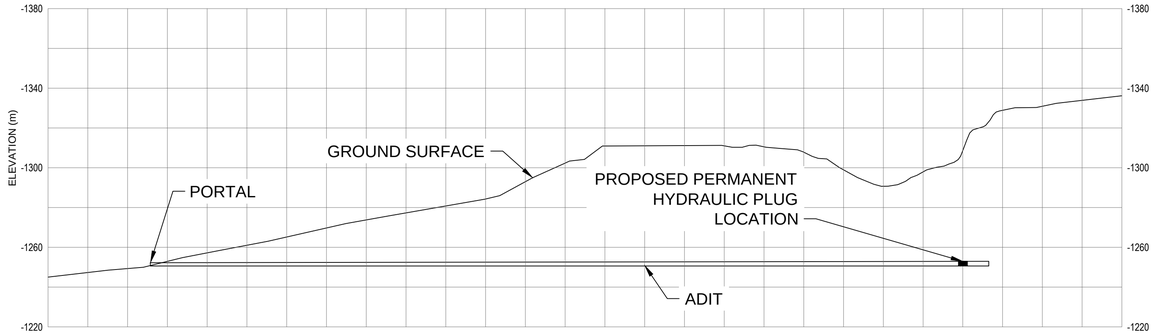
NO CASH 500 ADIT
SCALE 1:1500
10 0 10 30 60m



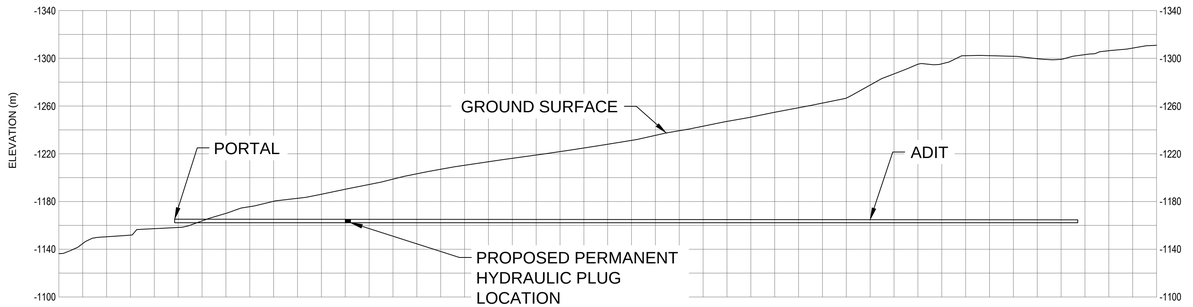
KENO 700 ADIT
SCALE 1:1500
10 0 10 30 60m



SILVER KING 100 ADIT
SCALE 1:1250
10 0 10 30 50m



BERMINGHAM CROSS SECTION ALONG ADIT
SCALE 1:1500
10 0 10 30 60m



RUBY CROSS SECTION ALONG ADIT
SCALE 1:2500
20 0 20 60 100m

NOT ISSUED FOR CONSTRUCTION

LEGEND

NOTES

1. ALL UNITS ARE IN METERS UNLESS NOTED OTHERWISE.

NUM	DATE	DWN	CKD	APR	DESCRIPTION

REVISIONS

NUM	DATE	APR	DESCRIPTION

DRAWING STATUS

PERMIT

PROFESSIONAL SEAL

CLIENT

ERDC

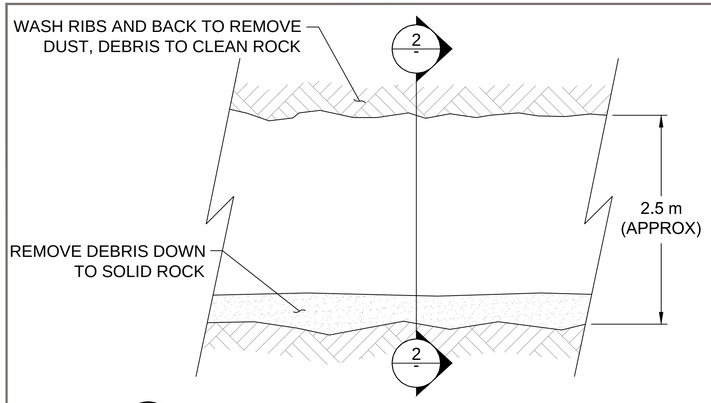
TETRA TECH EBA

ESM RECLAMATION PLAN - ADIT & SHAFT CLOSURE, KENO HILL, YT

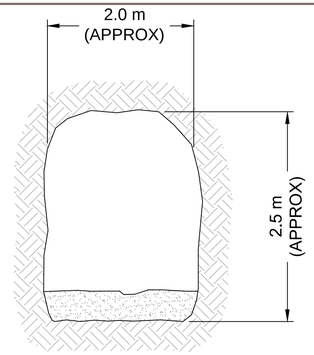
HYDRAULIC ADIT PLUG DETAILS NO CASH 500, KENO 700, SILVER KING 100, BERMINGHAM AND RUBY ADITS

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
W14103428-01.003	VANC	CC	CC	0	D101c
DATE: March 27, 2015	SHEET No. 4 of 7	DWN SF	APP MH	STATUS A	

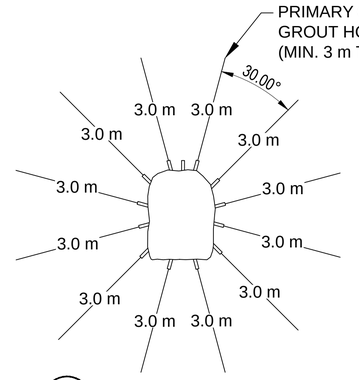
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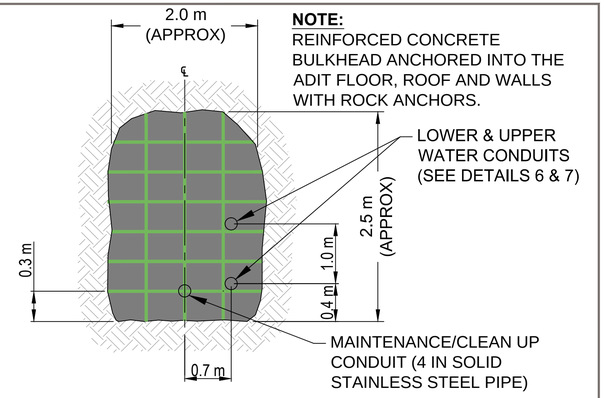
1 - PREPARE PLUG LOCATION - LONGITUDINAL SECTION VIEW
NOT TO SCALE



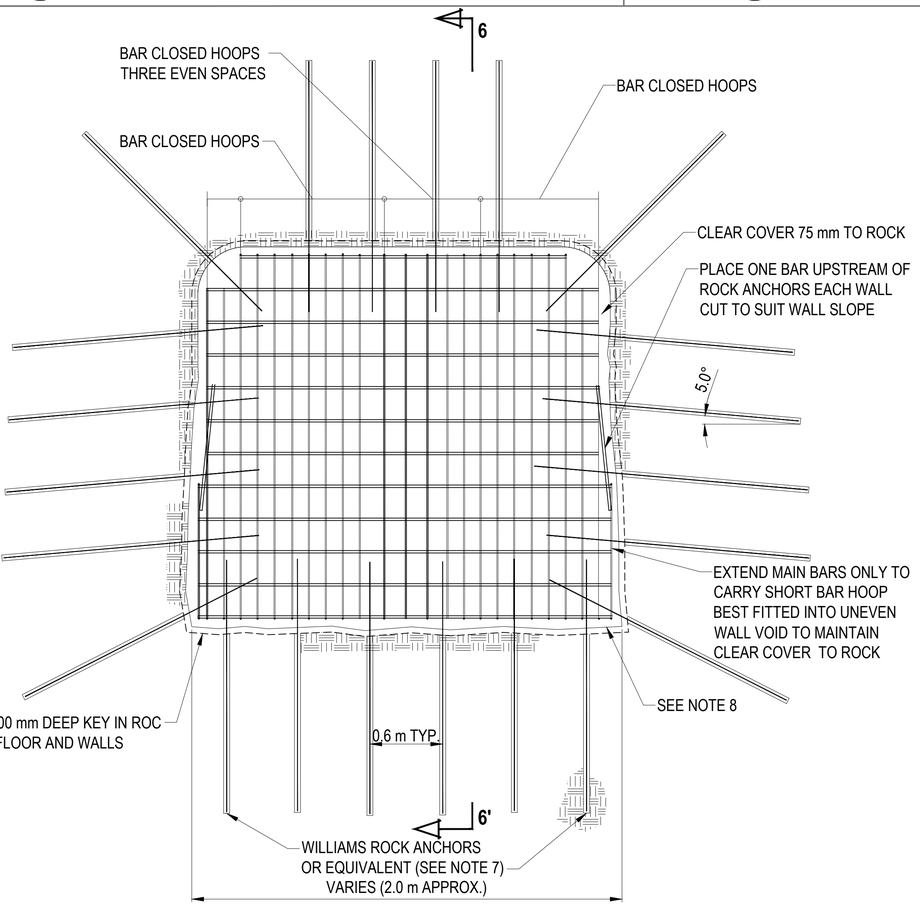
2 - ADIT CROSS SECTION
NOT TO SCALE



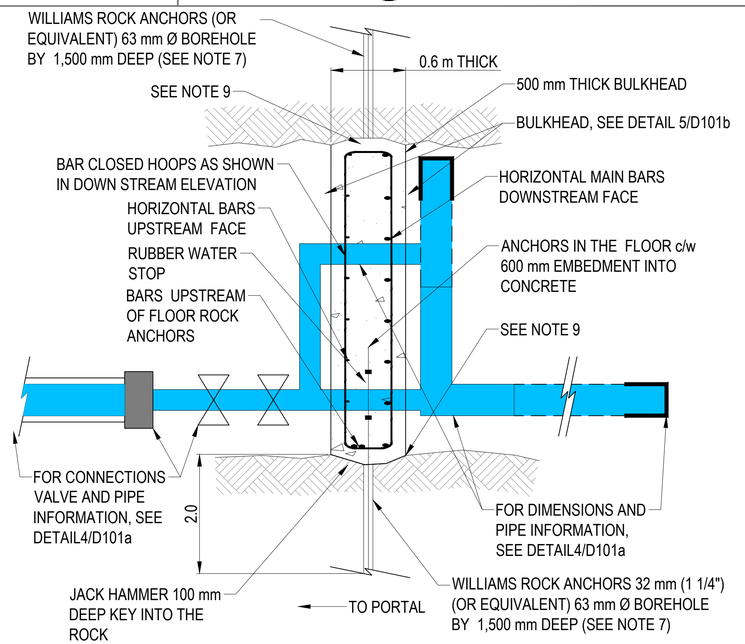
3 - PRESSURE GROUTING
NOT TO SCALE



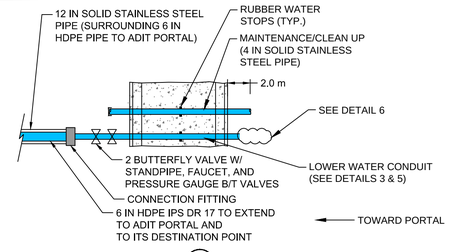
4 - BULKHEAD SITE - TRANSVERSAL SECTION VIEW
NOT TO SCALE



5 - BULKHEAD DOWNSTRAM ELEVATION
NOT TO SCALE



6 - BULKHEAD SITE - LONGITUDINAL SECTION VIEW
NOT TO SCALE



7 - BULKHEAD SITE - PLAN VIEW
NOT TO SCALE

NOTES:

1. Bulkhead designed in accordance with CSA Standard A23.3-04 Design of Concrete Structures.
2. Bulkhead designed to retain 6.0 m of hydrostatic head of fresh water factored by 1.5 for Ultimate Strength Design
3. Consequence of failure is high.
4. Concrete shall have a minimum 40 MPa compressive strength at 28 days.
5. Steel reinforcement shall have a minimum yield strength of 415 MPa (60ksi) and be weldable type.
6. Site preparation shall remove loose rock and weathered rock from the walls, roof and invert of the adit from the footprint of the concrete bulkhead to a depth where the bulkhead will be in contact with and keyed into competent rock. This work shall be performed by hand using suitable scaling bars and may include scaling by compressed air in a controlled manner, or by means of hydraulic splitters. Competency of final rock face shall be reviewed by a professional engineer or geologist. Final rock face shall be fresh, unaltered (not faulty), and with a minimum intact compressive strength of 40 MPa.
7. Rock Anchors shall be hot dip galvanized 32 mm (1 1/4 inch) Ø Williams R-61-6R75 all thread (or equivalent). The boreholes shall be 63 mm Ø to a depth of 2000 mm below the surface on the walls, roof and floor. The wall anchors shall be drilled at 5 degrees from the horizontal, the floor and roof anchors shall be installed vertical.
8. The mine owner/operator shall seal any leaks immediately upon detection with approved quick seal grout on the downstream side or de-water and seal upstream.
9. Grout – Cemented Grout Bolts
   - Cement grout shall be used for all rock anchors installed as part of the water retention bulkhead.
   - Cement grouting for rock anchors shall be a non-shrink, non-sanded grout mixed with the proportion 0.4 water:cement by weight, capable of achieving a minimum compressive strength of 28 MPa at 7 days and 40 MPa at 28 days when tested in accordance with CAN/CSA A23.2-1B.
   - Equipment for mixing and pumping grout shall be capable of satisfactorily mixing and agitating grout and pumping it into the holes at the required water cement ratio.
10. Installation – Cemented Grout Bolts
    - Completely clean holes of all drill cuttings, sludge, debris and water using clean water and air.
    - Grout shall be placed in the hole from the bottom up using a grout tube extending to the lower end of the hole.
    - Rock bolts shall be fully encapsulated in grout to the drill hole collar.
    - If seepage of grout into cracks in the rock prevents the hole from being filled with grout, the hole shall be sealed with an approved grout material, and then redrilled. This sequence shall be repeated until the hole is sealed.
11. Grout and Concrete Testing
    - The Sub-Contractor will retain an independent testing agency recommended by the Consultant for the testing of grout and concrete to establish that minimum grout strength required for anchors and minimum concrete strength for bulkhead has been obtained.
    - The testing agent shall (i) Review and confirm that the grout mix submitted by the Contractor will provide the properties specified herein, (ii) take sample of grout from each continuous mix (Contractor can cast the grout samples under the directions of the testing agency) and (iii) test grout samples to determine compressive strength. The contractor shall provide a minimum of 48 hours notice to the testing agency.

BULKHEAD LOCATIONS AND DETAILS

MINE SITE	APPROX. DIST. FROM PORTAL (m)	ROCK TYPE	BULKEAD WIDTH, W (m)	APPROX. VOLUME (m^3)	DESIGN HYDRAULIC HEAD[1](m)	GROUTING RING	AIM	ADIT ICE PLUG PREVENTION
GALKENO 300	AT 110 m (±10)	QUARTZITE	0.5	2.5	2	YES	DIRECT WATER IN A CONTROLLED MANNER TO WATER TREATMENT PLANT	AT ONEK 400 AND GALKENO 300, INSTALL HEAT TRACING ALONG PIPE FROM PLUG LOCATION TO PORTAL FOR ADIT ICE PLUG PREVENTION
GALKENO 900	AT 75 m (±10)	QUARTZITE	0.5	2.5	2	YES		
ONEK 400	AT 105 m (±10)	QUARTZITE	0.5	2.5	2	YES		

[1] DESIGN HYDRAULIC HEAD ABOVE ADIT ROOF (APPROXIMATELY 4.5 m ABOVE ADIT INVERT)

NOT ISSUED FOR CONSTRUCTION

LEGEND

NOTES

1. ALL UNITS ARE IN METERS UNLESS NOTED OTHERWISE.

NUM	DATE	DWN	CKD	APR	DESCRIPTION

REVISIONS

NUM	DATE	APR	DESCRIPTION

DRAWING STATUS

PERMIT

PROFESSIONAL SEAL

CLIENT

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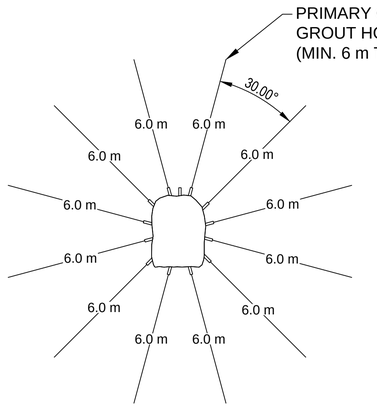
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ESM RECLAMATION PLAN - ADIT & SHAFT CLOSURE, KENO HILL, YT

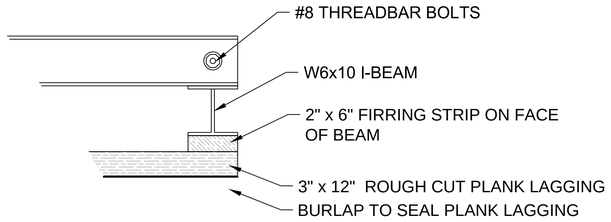
CONCRETE BULKHEAD GALKENO 300, GALKENO 900 AND OVER 400 ADITS

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
W14103428-01.003	VANC	CC	CC	0	D102a
DATE: March 27, 2015	SHEET No. 5 of 7	DWN SF	APP MH	STATUS A	

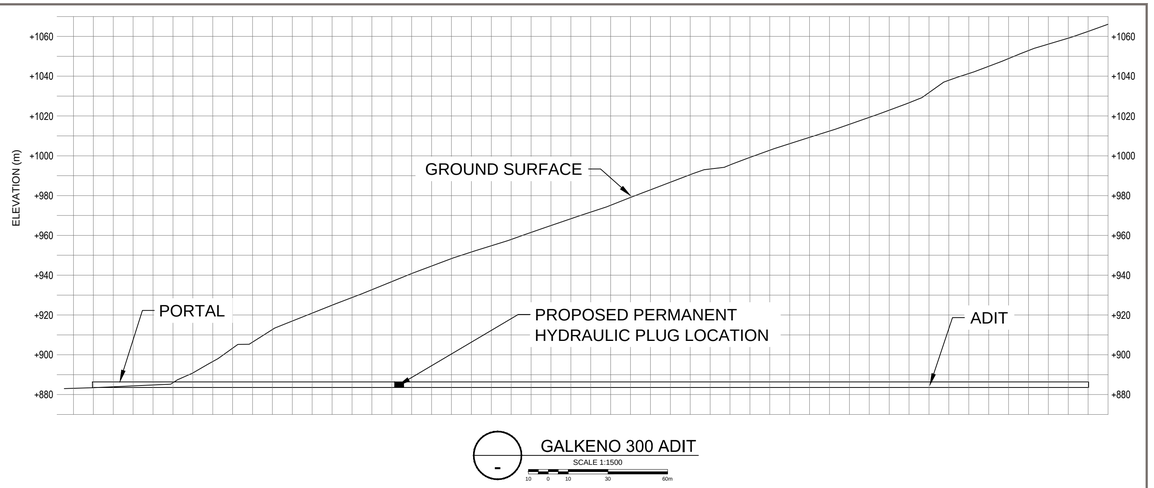
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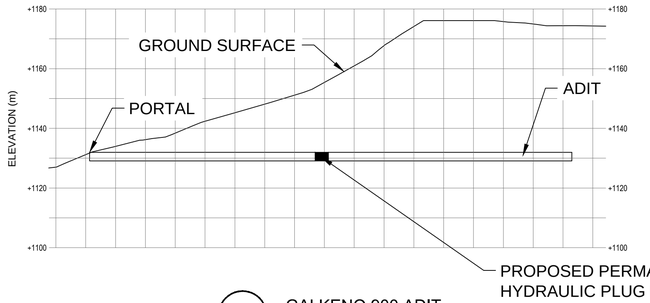
8 - PRESSURE GROUTING
NOT TO SCALE



TOP VIEW

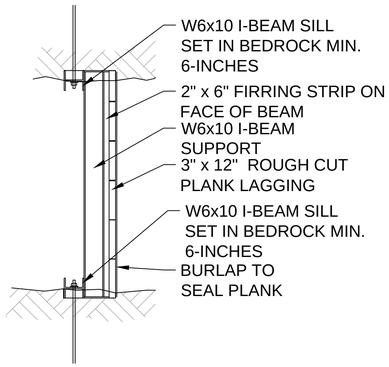


- GALKENO 300 ADIT



- GALKENO 900 ADIT

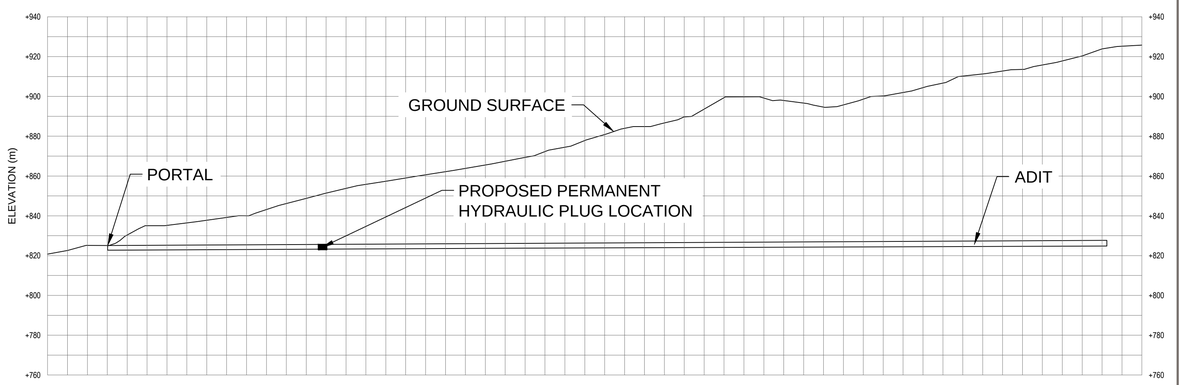
FRONT VIEW



SIDE VIEW

9 - TEMPORARY BULKHEAD DETAIL
NOT TO SCALE

NOTES
1. TOP AND BOTTOM BEAMS INSET IN BEDROCK
2. EMBEDMENT DISTANCE FOR ROCK BOLTS IS 6-FT



- ONEK 400 ADIT

NOT ISSUED FOR CONSTRUCTION

LEGEND

NOTES
1. ALL UNITS ARE IN METERS UNLESS NOTED OTHERWISE.

NUM	DATE	DWN	CKD	APR	DESCRIPTION

REVISIONS

NUM	DATE	APR	DESCRIPTION

DRAWING STATUS

PERMIT

PROFESSIONAL SEAL

CLIENT
ERDC

TETRA TECH EBA

ESM RECLAMATION PLAN - ADIT & SHAFT CLOSURE, KENO HILL, YT

CONCRETE BULKHEAD
GALKENO 300, GALKENO 900 AND
OVER 400 ADITS

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
W14103428-01.003	VANC	CC	CC	0	D102b
DATE: March 27, 2015	SHEET No. 6 of 7	DWN SF	APP MH	STATUS A	

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Shaft Closure Methods

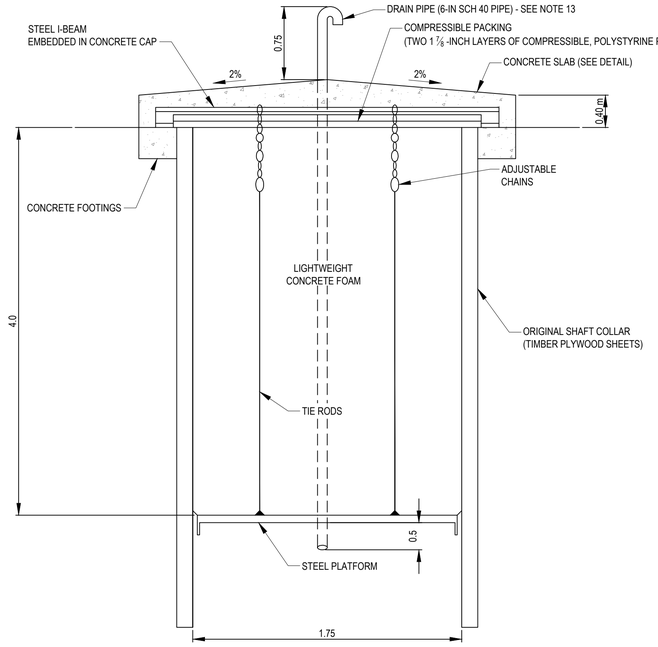
SHAFT NAME	PWGSC REF SITE	SHAFT CLOSURE METHOD [3]
Silver King Vent Raise	Silver King	Light concrete with concrete slab cap [1]
Silver King Shaft #1 (Open Pit Shaft)	Silver King	Light concrete with concrete slab cap [1]
Silver King Shaft #2	Silver King	Shaft Backfill (Dry Seal) [4]
Silver King Raise #1	Silver King	Shaft Backfill (Dry Seal) [4]
Husky Raise	Husky #2	Light concrete with concrete slab cap [1]
Husky Shaft	Husky #2	Light concrete with concrete slab cap [1]
Husky SW Shaft	Husky SW	Light concrete with concrete slab cap [1]
Ruby Shaft	Bermingham & Ruby	Light concrete with concrete slab cap [2]
McLeod shaft	Galkeno Mine	Shaft PUF with Concrete Cap[3]
Shafts SW of Gravel Level Adit	Elsa Mine	Shaft PUF with Concrete Cap[3]
Dixie Shaft	Dixie	Light concrete with concrete slab cap [1]
Brefalt Shaft	No Cash Mine	Light concrete with concrete slab cap [1]
Jock Shaft	Hector-Caulmet	Shaft PUF with Concrete Cap[3]
Coral and Wigwam Shaft #1	Coral and Wigwam	Shaft Backfill (Dry Seal) [4]
Coral and Wigwam Shaft #2	Coral and Wigwam	Shaft Backfill (Dry Seal) [4]
Betty shafts	Betty	Shaft Backfill (Dry Seal) [4]
Tin Can Shaft #1	Tin Can	Shaft Backfill (Dry Seal) [4]
Tin Can Shaft #2	Tin Can	Shaft Backfill (Dry Seal) [4]
Rico Shaft	Rico	Shaft Backfill (Dry Seal) [4]
Sadie Ladue Shaft (No. 1 Shaft)	Sadie Ladue - Wernecke	Light concrete with concrete slab cap [1]
Lucky Queen Shaft #1	Lucky Queen	Light concrete with concrete slab cap [1]
Lucky Queen Shaft #2	Lucky Queen	Shaft PUF with Concrete Cap[3]
Shamrock J18 Raise	Keno No. 9	Shaft PUF with Concrete Cap[3]
Prospect Shaft	Shamrock (Original)	Shaft Backfill (Dry Seal) [4]
Porcupine Shaft	Porcupine Comstock	Shaft Backfill (Dry Seal) [4]
Unknown Shaft near 5-2 Adit	Keno	Shaft PUF with Concrete Cap[3]
Lower Lake Shaft	Lake	Shaft Backfill (Dry Seal) [4]
Upper Lake Shaft	Lake	Shaft Backfill (Dry Seal) [4]
Silver Basin Hand Shafts (Shaft #1)	Silver Basin	Shaft Backfill (Dry Seal) [4]
APEX Shaft	APEX	Shaft Backfill (Dry Seal) [4]
Christal Shaft #1	Christal	Shaft Backfill (Dry Seal) [4]
Christal Shaft #2	Christal	Shaft Backfill (Dry Seal) [4]

[1] Remove steel pits, cables wihin the shaft to bottom of further light concrete

[2] Presently filled with waste dump fill; remove waste material to bottom of further light concrete

[3] If presentely backfilled, remove backfill material to bottom of further further PUF

[4] If presentely backfilled, complete backfilling (if needed) and make ground surface to conform as presented in this drawing.

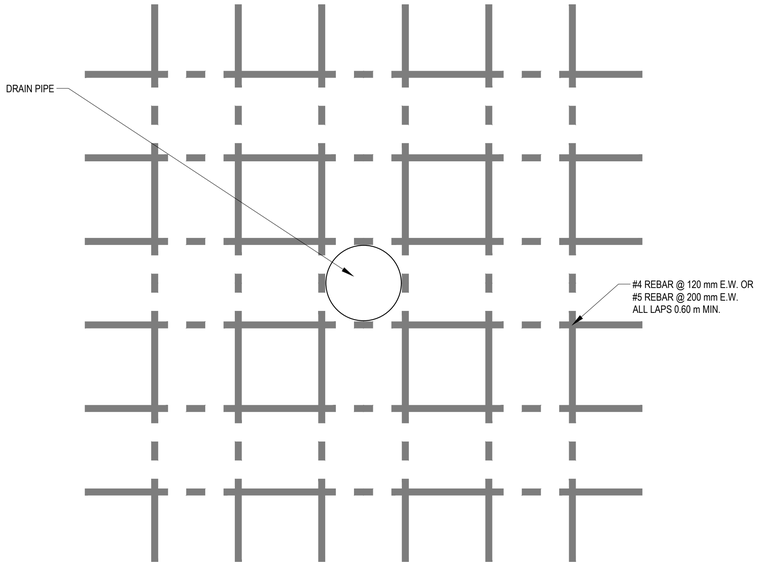


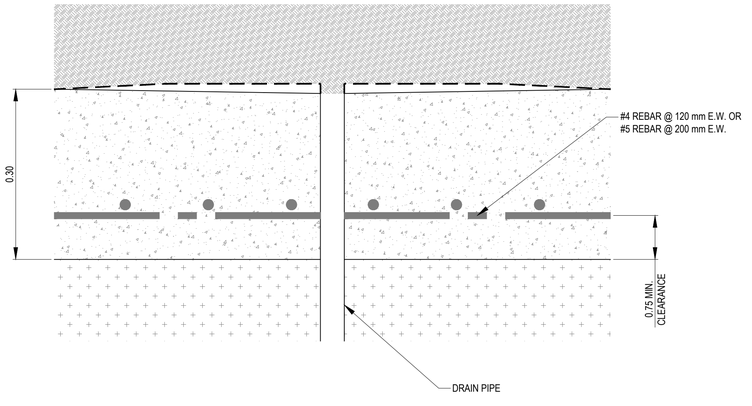
LIGHTWEIGHT CONCRETE WITH CONCRETE SLAB CAP CLOSURE

NOT TO SCALE

NOTES

1. Safety protocols related to working near or in the shaft should be followed during the project implementation.
2. A Geotechnical Engineer should assess the ground conditions at the site to determine the bearing capacity of the ground for footing design. Footing design should be completed by a qualified Geotechnical Engineer.
3. Existing steel pipe, cables and other utilities and materials inside the shaft shall be removed to the depth of the lightweight concrete foam
4. Clean the shaft walls to a minimum depth of 300 mm below the base of the steel platform by power-washing to provide a suitable construction surface.
5. All construction surfaces and material should have a water proofing sealant applied. Cover the steel platform and shaft walls with a geomembrane prior to placing concrete.
6. The reinforced concrete cap designed for a 20 KPa (3 psi) live load not designated to resist hydrolic uplift loads..
7. Install a layer of compressible packing (Styrofoam polystyrene or similar) between the lightweight concrete and the concrete cap to allow for differential movement.
8. Install a 6 in SC 40 PVC drain pipe extending from below the steel platform, through the lightweight concrete, to above the concrete cap. Use an 8 inch SC 40 PVC as a sleeve pipe between 1 m below the bottom of concrete slab to 0.2 m above the top of the concrete slab.
9. Concrete shall have a minimum 20 MPa compressive strength at 28 days
10. The Sub-Contractor will retain an independent testing agency recommended by the Consultant for the testing of concrete to establish that minimum strength required for concrete slab has been obtained.
11. Concrete mix for lightweight (foam) concrete:
    - Type II cement.....326.6 kg (720 lb)
    - Water.....134.8 L (35.62 gal)
    - Foaming Agent 0.5 m3 (18.62 ft3)
    - Superplasticizer.....0.81 L/m3 (1 qt per yd3)
    - Silica fume (6.5% by weight).....0.5 kg/m (50lb/yd)
    - Water/Cement Ratio.....0.41
    - Calculated Wet Density.....714.4 kg/m3 (44.6 lbs/ft3)
    - 28-day compressive strength (average) .....1.6 MPa (226 psi)
    -
12. Concrete mix for the footings and concrete cap:
    - Type II cement.....213.2 kg (470 lb)
    - Fly Ash.....31.8 kg (70 lb)
    - Water.....104.5 L (27.6 gal)
    - Sand.....600.6 kg (1324 lb)
    - No. 57 limestone.....807.4 kg (1780 lb)
    - Water-reducing admixture.....2.8 g/kg (5 ozs/cwt)
    - Air-entraining agent.....0.6 g/kg (1.10 ozs/cwt)
    - Design Unit Weight.....2298.3 kg/m3 (143.48 lb/ft3)
    - Slump.....76 mm (3in)
    - Air Content.....7.5%
    - Water/Cement Ratio.....0.426
    - 28-day compressive strength (average) .....1.6 MPa (226 psi)
13. Capture water at exit of drain pipe and route it to the assigned destination.





CONCRETE SLAB DETAILS

NOT TO SCALE

NOT ISSUED FOR CONSTRUCTION

GENERAL NOTES

ALL UNITS ARE IN METERS IN UNLESS NOTED OTHERWISE.

NUM	DATE	DWN	CKD	APR	DESCRIPTION

REVISIONS

NUM	DATE	APR	DESCRIPTION

DRAWING STATUS

PERMIT

PROFESSIONAL SEAL

CLIENT

ERDC

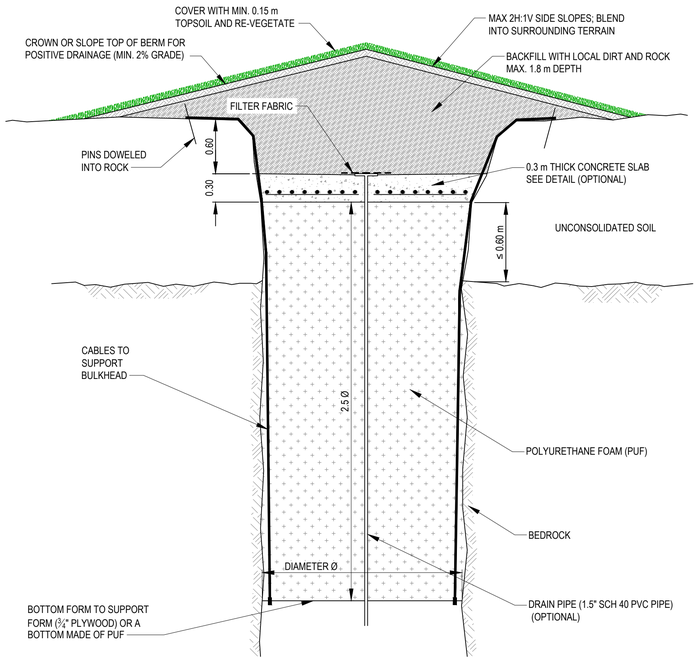
TETRA TECH EBA

ESM RECLAMATION PLAN - ADIT & SHAFT CLOSURE, KENO HILL, YT

SHAFT CLOSURE METHODS AND DETAILS

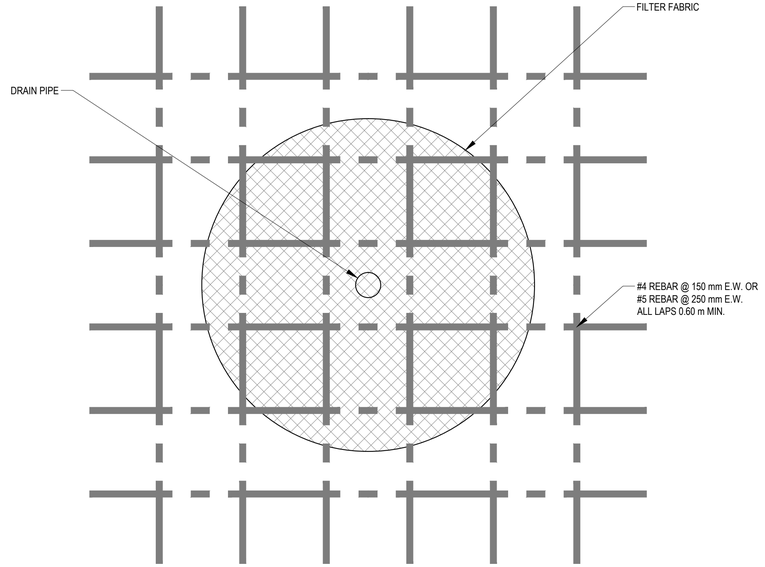
PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
W14103428-01.003	VANC	CC	CC	0	D103a
DATE: March 27, 2015	SHEET No. 6 of 7	DWN SF	APP MH	STATUS A	

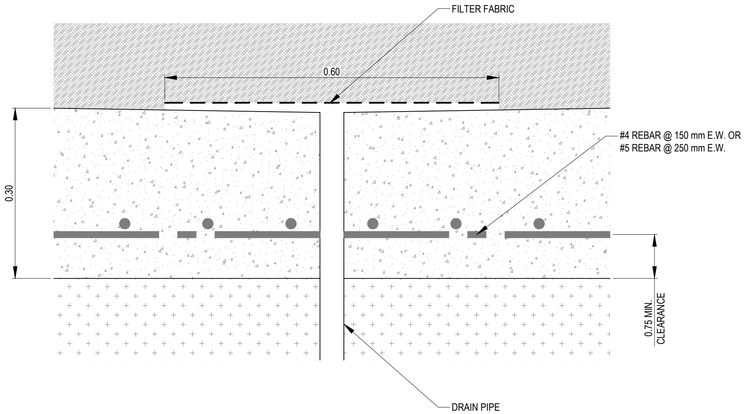
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SHAFT PUF WITH CONCRETE SLAB CLOSURE

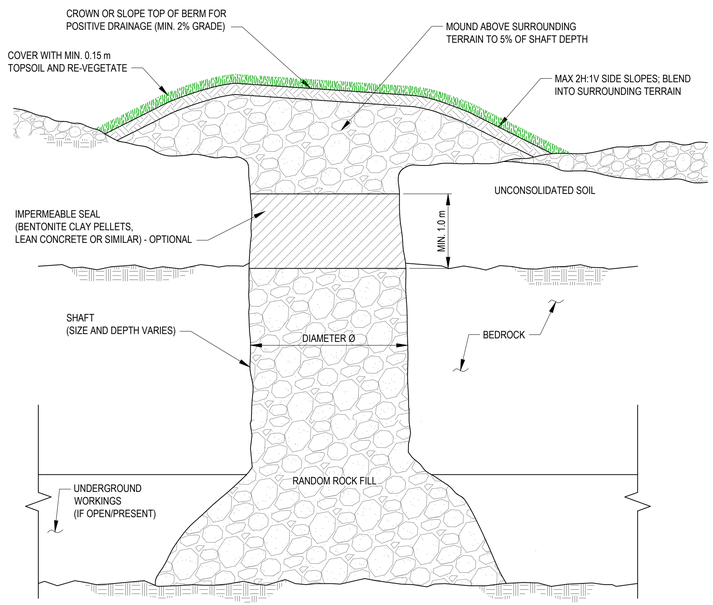
NOT TO SCALE





CONCRETE SLAB DETAILS

NOT TO SCALE



SHAFT BACKFILL (DRY SEAL) CLOSURE

NOT TO SCALE

NOTES

1. Safety protocols related to working near or in the shaft should be followed during the project implementation.
2. Lower the bottom form into the shaft to the final depth of the Polyurethane foam (PUF)
3. Install drain pipe (1.5 " SC 40 PVC) extending from below the bottom form to planned top of concrete cap.
4. Place seals into the cracks between the edges of the bottom form to prevent foam from falling down the shaft.
5. Pour the mixed PUF foam onto the bottom form to form the plug.
6. Construct the 0.3 m concrete slab. Concrete slab sloped outwards to drain (2%)
7. Back fill on top of the concrete slab with local dirt and rock.
8. Concrete shall have a minimum 20 MPa compressive strength at 28 days
9. The Sub-Contractor will retain an independent testing agency recommended by the Consultant for the testing of concrete to establish that minimum strength required for concrete slab has been obtained.

NOTES

1. Safety protocols related to working near or in the shaft should be followed during the project implementation.
2. Quantities will vary with shaft depth, connection to underground workings, and other conditions.
3. Mobile equipment must never operate on ground that shows signs of subsidence without taking adequate precautions.
4. Remove as practical, if present, and dispose of timber, trash, brush, topsoil and other debris in and around shaft area, prior to backfilling. Strip down to bedrock surface at collar where practical.
5. Existing steel pipe, concrete rubble (if present) should be removed or incorporated into backfill as directed by engineer.
6. Random rock fill must be:
   a. Non-acid generating rock fill
   b. Sized to contain no rocks greater than ½ the diameter of the shaft.
7. Every effort should be made to keep all debris other than rock fill from going underground.

NOT ISSUED FOR CONSTRUCTION

GENERAL NOTES

1. All units are in meters unless noted otherwise.

NUM	DATE	DWN	CKD	APR	DESCRIPTION
REVISIONS					

NUM	DATE	APR	DESCRIPTION
DRAWING STATUS			

PERMIT

PROFESSIONAL SEAL

CLIENT

ERDC

TETRA TECH EBA

ESM RECLAMATION PLAN - ADIT & SHAFT CLOSURE, KENO HILL, YT

SHAFT CLOSURE CAPPING METHODS AND DETAILS

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
W14103428-01.003	VANC	CC	CC	0	D103b
DATE: March 27, 2015	SHEET No. 7 of 7	DWN SF	APP MH	STATUS A	

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APPENDIX A

HYDRAULIC PLUG AND BULKHEAD CLOSURE – CONSTRUCTION STEPS

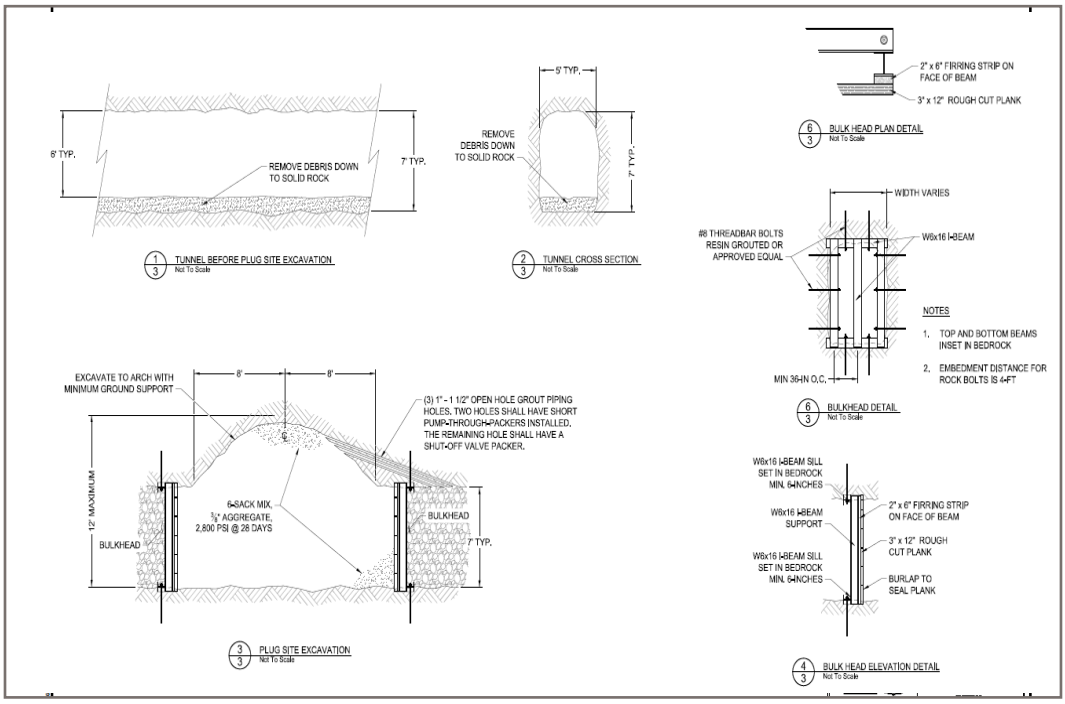


Photo 1: Hydraulic Adit Details



Photo 2: Geotechnical mapping of adit to determine plug site suitability. All ribs (walls) and back (roof) are to be removed of existing electrical and mechanical appurtenances, if present shall be removed from the plug footprint.



Photo 3: Intersected location of the workings is located and installation of grout and cement pumping lines.



Photo 4: Installation of grout rings All walls and roof should be cleaned and washed free of dust and debris. Grouting rings are installed around the hydraulic plugs and proposed bulk head location.



Photo 5: Building of the temporary bulkheads.
6 Inch Steel High beams installed in preparation for lower seal.



Photo 6: Temporary bulkhead
Braced timber sets for back end of the plug.



Photo 7: Jimmy window allows for access and installation and inspection of cement and grout pumping lines.



Photo 8: Pumping of grout / cement in several stages



Photo 9: Temporary Bulkhead - Perimeter of lagging packed with burlap and grouted



Photo 12: Water tight temporary Bulkhead

APPENDIX B

HYDRAULIC PLUG AND BULKHEAD CLOSURE – GEOTECHNICAL ASSESSMENT AND CALCULATIONS

1.0 ROCK MASS CHARACTERIZATION AND PERMANENT HYDRAULIC PLUGS AND BULKHEADS PRELIMINARY DESIGN

Two important parameters relating to bulkhead design are rock mass strength, which in part will control the position and length of the hydraulic plugs and bulkheads, and rock mass permeability, which will control the risk of leakage past the bulkhead. These parameters are both functions of rock mass quality.

Section 2.0 presents the rock mass classification methods used to assess the quality of the rock mass. Section 3.0 a preliminary geotechnical characterization of the adits based on available information, and Section 4.0 the preliminary design of the permanent hydraulic plugs and bulkheads.

2.0 ROCK MASS CLASSIFICATION

As described in Section 4.0 of the report the geotechnical information was obtained from:

- Tetra Tech's site visit in September 2014. During the site visit, only the first 30 m of the Galkeno 300 adit, the first 50 m of the Silver King 100 and the first 100 m of the Ruby adit (from their portals) were accessed for inspection.
- Rock Quality Designation (RQD) data included in the logs of boreholes drilled between 2006 and 2014.

Rock mass classification systems to estimate rock mass properties (rock quality) constitute an integral part for decision making for design. These systems are used to group areas of similar geomechanical characteristics, based on ratings of three principal properties: the intact rock strength, the frictional properties of the discontinuities, and the geometry of intact blocks of rock defined by the discontinuities.

Table B-1 provides comparison of RMR and NGI-Q ratings to the quality of rock. Sections 2.1 and 2.2 below present an overview of the classification systems. Table B-2 presents the Rock Quality Designation (RQD) ratings to the quality of the rock, and Section 2.3 presents an overview of the RQD classification system.

Table B-1: Summary RMR and Q Rating Values

RMR Value	RMR Rating	Q Value	Q Rating
0	Very Poor Rock	0.001-0.01	Exceptionally Poor
<20	Very Poor Rock	0.01-0.1	Extremely Poor
21-40	Poor Rock	0.1-1	Very Poor
41-60	Fair Rock	1-4	Poor
		4-10	Fair
61-80	Good Rock	10-40	Good
		40-100	Very Good
81-100	Very Good Rock	100-400	Extremely Good
		400-1000	Exceptionally Good

Table B-2: Summary of RQD Rating Values

RDQ (%)	Rock Quality
<25	Very Poor

25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

2.1 Overview of Rock Mass Rating System

The RMR system is a geomechanical classification system for rocks, developed by Z.T. Bieniawski (1989). The following six parameters are used to classify a rock mass using the RMR system:

1. Uniaxial compressive strength of rock material.
2. Rock Quality Designation (RQD).
3. Spacing of discontinuities.
4. Condition of discontinuities.
5. Groundwater conditions.
6. Orientation of discontinuities.

Each of the six parameters is assigned a value corresponding to the characteristics of the rock. The sum of the six parameters is the "RMR value", which ranges between 0 and 100.

2.2 Overview of NGI Q-System

The NGI Q-system is an empirically based system developed by Barton, Lien, and Lund (1974) through analysis (initially) of over 200 case studies. Further development since the initial publication of the paper has refined the system based on over 1,000 case studies.

The NGI Q-system uses six parameters to determine a numerical value (Q) which represents the quality of a given rock mass. The parameters assign numerical values to various features of the rock mass, including RQD, number of joint sets, joint alteration, joint surface roughness, stress conditions, and water inflow intensity. These are combined in a simple formula to derive a "Q-value", which is indicative of the overall quality of the rock mass for the purpose of underground excavation and support design. This formula can be thought of as the function of three geomechanical rock properties:

- Block size given by RQD/Jn.
- Inter-block shear strength given by Jr/Ja.
- Active stress given by Jw/SRF.

The formula for determining Q is as follows:

$$Q = \left(\frac{RQD}{Jn}\right) \cdot \left(\frac{Jr}{Ja}\right) \cdot \left(\frac{Jw}{SRF}\right)$$

Where: *RQD* = rock quality designation.

Jn = joint set number.

Jr = joint roughness number.

Ja = joint alteration number.

Jw = joint water reduction number.

SRF = stress reduction factor.

The description of the six parameters can be found in the report by Barton et al. (1974). The numerical value of Q ranges from 0.001 (for exceptionally poor quality, squeezing ground) to 1000 (for exceptionally good quality, massive rock).

The formula for determining Q is as follows:

$$Q = \left(\frac{RQD}{Jn}\right) \cdot \left(\frac{Jr}{Ja}\right) \cdot \left(\frac{Jw}{SRF}\right)$$

2.3 Overview of Rock Quality Designation (RQD)

RQD was introduced by D.U. Deere (1964) as an index of assessing rock quality quantitatively. It is a more sensitive index of core quality than the core recovery.

The RQD is a modified percent core recovery which incorporates only sound pieces of core that are 100 mm (4 inches) or greater in length along the core axis,

RQD (%) = ((Sum of core pieces ≥ 10cm)/(total drill run))* 100

3.0 GEOTECHNICAL CHARACTERIZATION

Geotechnical characterization was based on the data collected during the Tetra Tech's site visit in September 2014, and the RQD data recorded on logs of boreholes drilled between 2006 and 2014..

3.1 September Site Visit

As described in Section 4.0 of the report, Tetra Tech's visited the project site in September 2014. During the site visit, only the first 30 m of the Galkeno 300 adit, the first 50 m of the Silver King 100 and the first 100 m of the Ruby adit (from their portals) were accessed for inspection.

3.1.1 Intact Rock Strength

The ISRM (1981) divides the rock strengths from R0 to R6 according to the UCS of the intact rock. R0 has UCS<1 MPa, R1: 1≤UCS1≤5 (very weak), R2: 5≤UCS1≤25 (weak), R3:25≤UCS1≤50 (medium strong), R4:50≤UCS1≤100 (strong), R5:1005≤UCS1≤250 (very strong), R6:> 250 (extremely strong),

Intact rock strength was estimated from field identification using a geological hammer. The rock at the adit location described above required more than one blow of geological hammer to fracture, and in occasions required many blows. This indicate the uniaxial compressive strength varies between strong and very strong rocks.

3.1.2 Material Properties - Strength

The permanent hydraulic plugs and bulkheads and the surrounding rock can be regarded as a discontinuum consisting of a series of blocks of intact rock and concrete, separated by various planes of weakness. The behavior of this system will be controlled by both the strength and deformation moduli of the intact material and the strength and stiffness along the planes of weakness.

The rock mass quality was estimated from field observations and measurements carried out during the September 2014 site visit. Tables B-3, B-4 and B-5 presents the estimated rock mass quality based on the RQD, RMR and NGI-Q classification systems, respectively.

Table B-3: RQD Rating Values

Geotechnical Parameter	Location		
	Galkeno 300 Adit 20-30 m from Portal	**Silver King 100 Adit 40- 50 m from Portal**	**Ruby Adit 60- 80 m from Portal**
Primary rock type	Quartzite with interbedded schist	Quartzite with interbedded schist	Quartzite with interbedded schist
Rock Quality Designation (RQD).	50-60%	50-60%	50-60%

Table B-4: RMR89 Rating Values

Geotechnical Parameter	Location		
	Galkeno 300 Adit 20-30 m from Portal	**Silver King 100 Adit 40- 50 m from Portal**	**Ruby Adit 60- 80 m from Portal**
Primary rock type	Quartzite with interbedded schist	Quartzite with interbedded schist	Quartzite with interbedded schist
Strength of intact rock (Uniaxial compressive strength of rock material)	12	12	7
Rock Quality Designation (RQD).	13	13	13
Spacing of discontinuities.	10	10	10
Condition of discontinuities.	20	20	20
Groundwater conditions.	10-15	10-15	10-15
Adjustment for Joint Orientation	-5	-5	-6
Total RMR Rating	60-65	60-65	55-60

Table B-5: NGI Q Rating Values

Geotechnical Parameter	Location		
	Galkeno 300 Adit 20-30 m from Portal	**Silver King 100 Adit 40- 50 m from Portal**	**Ruby Adit 60- 80 m from Portal**
Primary rock type	Quartzite with interbedded schist	Quartzite with interbedded schist	Quartzite with interbedded schist

RQD	55	50	55
Number of Discontinuity Sets	4	4	5
Roughness of Most Unfavorable Discontinuity	2	2	2
Degree of Alteration of Filling along the Weakest Discontinuity	1	1	1
Water Inflow	0.66	0.66	0.66
Stress Condition	2.5	2.5	2.5
Total NGI Q Rating	7.2	6.6	5.8

From Tables B-3, B-4 and B-5, the quality of the rock mass according to the RQD, RMR89 and NGI-Q designations, is 'fair' for all the rock mass classifications.

It should be emphasized that the ratings presented in Tables B-3, B-4 and B-5 are from data collected within 100 m from the portal. The rock mass quality further into the adits is expected to improve as the adits are deeper in relation to the ground surface.

3.2 RQD from Boreholes

Tetra Tech EBA received spread sheets with RQD records for 180 boreholes drilled between 2006 and 2014. Tetra Tech reviewed the RQD data and split it by its lithology. The depths of the boreholes varies mostly from 100 to 400 m.

Tables B-6 through B-10 presents the average of the RQD for each lithology unit for each boreholes. Also presents the average RQD of all the boreholes at the same location. The RQD data is not in agreement with the data presented in Section 3.1. The RQD data from boreholes are much lower. Tetra Tech believes that one of the main reasons of this is that the drill holes were targeting the vein zones where the rock quality is of poorer conditions. Also, in Tetra Tech EBA's experience when RQD data is collected as part of a geological investigation, the measurements also considers mechanical fractures which should not be part of the RQD ratings.

It is important the dedicated geotechnical boreholes be drilled to investigate it further.

4.0 PRELIMINARY DESIGN

Two important parameters relating to bulkhead design are rock mass strength, which in part will control the position and length of the hydraulic plugs and bulkheads, and rock mass permeability, which will control the risk of leakage past the bulkhead. These parameters are both functions of rock mass quality.

This section presents the preliminary design of the permanent hydraulic plugs and bulkheads.

TABLE B-6: RQD DATA SUMMARY

Borehole I.D.	OVB	SCH	QTZT	GSCH	SSCH	CHSCH	GNST	CQTZT	CSCH	CAS	VN	TQTZT	MCQ	ICQS	FLT	VM	SM	Location
K-06-0028			9.8	16.7		2.6												BERMINGHAM
K-06-0029			0.0															BERMINGHAM
K-06-0031			28.1															BERMINGHAM
K-09-0219			38.5	33.4	56.4						24.4							BERMINGHAM
K-09-0220			39.9	32.9	49.8													BERMINGHAM
K-10-0287	0.0		42.3	29.5	48.7		30.6				51.0	36.9		48.0	0.0	60.9		BERMINGHAM
K-10-0290	0.0		48.0	22.3	40.8							46.1		43.9	8.4	82.0		BERMINGHAM
K-10-0293			40.4	39.1	35.6		57.8				70.1	52.9		38.7	5.7			BERMINGHAM
K-10-0301			51.2		46.7		86.2					49.2		38.1	19.6	44.3	62.9	BERMINGHAM
K-10-0307	7.4		37.8	28.9	28.1							35.4		31.2	24.4		47.9	BERMINGHAM
K-10-0310			40.6	40.1	45.7		51.3				60.1	32.6		35.3	10.7	13.2	51.2	BERMINGHAM
K-10-0315	20.9		40.7	10.2	64.6		90.2				27.1	37.0		38.7	27.6	23.9	54.7	BERMINGHAM
K-10-0319			60.3	65.6	37.0	59.6	67.2					43.9		35.6	12.2		42.4	BERMINGHAM
K-11-0358	6.0		52.6	32.6	38.1							39.7			16.3	13.0		BERMINGHAM
K-11-0359	0.0		49.2	56.3	35.3		17.3					40.7			16.0	39.5		BERMINGHAM
K-11-0360	0.0		65.6	43.3	9.3							42.6				52.2	47.9	BERMINGHAM
K-11-0361	0.0		45.2	17.6	50.2	52.8						51.2			29.2		50.6	BERMINGHAM
K-11-0363	0.0		43.6	39.6								49.3			0.0	40.7		BERMINGHAM
K-11-0364	5.0		26.6	22.1	20.4		7.5								2.7	19.7	10.0	BERMINGHAM
K-11-0366	6.0		11.5	16.3	6.3							3.2			1.0	69.7		BERMINGHAM
K-11-0368	28.0		21.2	15.8	38.4	3.6	15.8					24.9			0.0	37.0		BERMINGHAM
K-11-0369	22.1		48.4	36.6	29.1		72.2					28.5				40.0	41.3	BERMINGHAM
K-11-0370	42.2		29.0	3.3								20.9			2.5			BERMINGHAM
K-11-0372	0.0		54.8	36.5			49.3				11.3	22.3			18.5		45.1	BERMINGHAM
K-11-0373	0.8		40.9	34.5	34.5		63.9					14.7			26.3			BERMINGHAM
K-11-0376	0.0		56.7	39.7	35.6		74.5					32.1			12.6	45.2		BERMINGHAM
K-11-0378	1.4		40.6	33.7			46.9								16.2			BERMINGHAM
K-11-0380	0.0		29.6	19.2								26.3			6.5			BERMINGHAM
K-11-0381	0.0		54.9	40.2		63.4	72.3	64.5				49.4			23.9		27.3	BERMINGHAM
K-11-0385			49.2	30.9	6.3		56.3					30.3			10.5			BERMINGHAM
K-11-0388			66.0	48.2	12.3							41.7				47.3	46.5	BERMINGHAM

TABLE B-6: RQD DATA SUMMARY – CONTINUATION

Borehole I.D.	OVB	SCH	QTZT	GSCH	SSCH	CHSCH	GNST	CQTZT	CSCH	CAS	VN	TQTZT	MCQ	ICQS	FLT	VM	SM	Location
K-11-0389	5.0		52.8	40.7	43.9		64.3				45.3	53.7			22.4	38.3	64.9	BERMINGHAM
K-11-0390	0.0		26.6	21.8	37.1		47.3					38.9			14.3	41.0	44.0	BERMINGHAM
K-11-0392	6.9		40.9	25.8	71.7		87.1					45.5			15.3	66.4		BERMINGHAM
K-11-0393	3.6		47.0	25.0	56.3							35.7			16.0			BERMINGHAM
K-11-0394			66.3	37.5	44.1							55.2				69.9		BERMINGHAM
K-11-0395	6.0		51.2	35.4	49.2		85.1					61.6			15.0	68.7		BERMINGHAM
K-12-0403	11.8		21.6	0.0	38.2		23.0					31.7			7.7			BERMINGHAM
K-12-0408	5.4		25.4	29.8	29.4		83.6					7.3			58.2		13.7	BERMINGHAM
K-12-0412			24.8	41.0	48.0	37.8	31.1				3.3	33.9						BERMINGHAM
K-12-0415	0.0		40.5	29.5	45.3		75.7				83.3	32.7			11.5		18.7	BERMINGHAM
K-12-0422	0.0		42.2	27.1	51.9		15.8	57.2				36.7			9.3		41.9	BERMINGHAM
K-12-0426	0.0		37.8	37.9	29.7		37.5	38.6			33.0	40.1			29.7		20.8	BERMINGHAM
K-12-0434	11.5		59.6	41.7	58.3		79.7					47.1			26.8			BERMINGHAM
K-12-0440	3.8		31.6	36.5	28.9		53.8				48.0	30.6			31.0		57.3	BERMINGHAM
K-12-0444	0.0		33.3	22.9		11.5	39.5				33.7	25.1			12.7		20.3	BERMINGHAM
K-12-0446	0.0		39.3	28.1	17.3		48.3	21.0			38.7	32.9			25.0		64.4	BERMINGHAM
K-12-0449	0.0		35.6	32.5			40.8				38.7	29.3			31.1			BERMINGHAM
K-12-0452	1.8		42.5	37.8	47.0		42.4	45.0			35.0	24.8			18.0		56.0	BERMINGHAM
K-12-0459	0.0		39.0	20.8	30.7		46.7	44.0				33.7			28.0	74.7	46.7	BERMINGHAM
K-12-0465	0.0		37.9	28.6	21.8		42.4	12.0			40.1	34.1			29.3		29.6	BERMINGHAM
K-12-0473	0.0		29.7	20.9	31.2		34.9					22.7			34.1			BERMINGHAM
K-14-0524			14.2	20.4			16.7				6.3				1.3	56.7		BERMINGHAM
K-14-0529	0.0		20.0	22.1	26.3		7.9								4.1	25.3		BERMINGHAM
K-14-0531	225.0		26.1	16.8	7.1		66.8				33.3				20.4	44.7	43.8	BERMINGHAM
K-14-0535	0.0		48.0	10.9	62.7		33.7					26.1			4.0		43.5	BERMINGHAM
K-14-0537			10.4	14.2	24.1		31.0					133.4			0.0	25.3		BERMINGHAM
K-14-0538	2.5		26.3	9.3	3.8		22.4					12.8			3.0		8.3	BERMINGHAM
K-14-0539	8.3		88.2	5.5	8.1		48.0				3.9	10.8			2.2		451.7	BERMINGHAM
K-14-0542			93.4	21.1	188.3		47.8					32.3			8.3	33.0		BERMINGHAM
Average RQD	**9.8**		**40.2**	**28.5**	**39.0**	**33.1**	**49.1**	**40.3**			**36.1**	**36.4**		**38.7**	**15.4**	**45.1**	**55.5**	
Standard Deviation	**33.9**		**17.9**	**13.1**	**27.8**	**27.4**	**24.1**	**22.4**			**22.4**	**19.3**		**13.8**	**11.9**	**20.7**	**78.6**	

TABLE B-7: RQD DATA SUMMARY

Borehole I.D.	OVB	SCH	QTZT	GSCH	SSCH	CHSCH	GNST	CQTZT	CSCH	CAS	VN	TQTZT	MCQ	ICQS	FLT	VM	SM	Location
K-11-0389	41.0		54.2	11.1				50.3				36.0		36.7				GALKENO
K-10-0292			47.4	32.4		30.8		72.1				32.5		35.0	0.0	5.9	52.6	GALKENO
K-10-0297	2.2		56.5	0.0	2.3							42.9		44.5	0.0			GALKENO
K-12-0439	0.0		32.5	21.6				40.8			14.7				17.4			GALKENO
K-12-0447	0.0		37.1	22.4	56.3		77.3	53.6							10.3		15.2	GALKENO
K-14-0522	5.0		47.2	22.0				22.0			32.7	25.1			5.6			GALKENO
Average RQD	**9.6**		**45.8**	**18.2**	**29.3**	**30.8**	**77.3**	**47.7**			**23.7**	**34.1**		**38.7**	**6.7**	**5.9**	**33.9**	
Standard Deviation	**17.7**		**9.4**	**11.2**	**38.2**			**18.3**			**12.7**	**7.4**		**5.1**	**7.4**		**26.5**	

TABLE B-8: RQD DATA SUMMARY

Borehole I.D.	OVB	SCH	QTZT	GSCH	SSCH	CHSCH	GNST	CQTZT	CSCH	CAS	VN	TQTZT	MCQ	ICQS	FLT	VM	SM	Location
K-08-0160			31.5	15.1	39.3		57.6		32.1	0.0								KENO
K-08-0162				35.9			67.5											KENO
K-08-0163	4.1		37.7	13.8	15.5	26.3	60.2											KENO
K-08-0165	0.0	25.3	35.6		14.0	17.8	68.6											KENO
Average RQD	**2.0**	**25.3**	**34.9**	**21.6**	**22.9**	**22.1**	**63.5**		**32.1**	**0.0**								
Standard Deviation	**2.9**		**3.1**	**12.4**	**14.2**	**6.0**	**5.4**											

TABLE B-9: RQD DATA SUMMARY

Borehole I.D.	OVB	SCH	QTZT	GSCH	SSCH	CHSCH	GNST	CQTZT	CSCH	CAS	VN	TQTZT	MCQ	ICQS	FLT	VM	SM	Location
K-07-0069	2.3	31.2	46.7		23.8													ONEK
K-07-0072		37.2	42.3		30.5	18.7	61.6											ONEK
K-07-0074			53.2	25.7	42.8													ONEK
K-07-0116		31.4	36.0				49.8	62.4	27.7									ONEK
K-07-0118			40.6	39.5	33.2		66.9			0.0								ONEK
K-07-0119		40.6	35.5	26.8	32.8		60.0	40.7										ONEK
K-07-0120			39.8	24.9	45.9		42.1											ONEK
K-07-0121		26.1	32.7	44.7			54.2											ONEK
K-07-0122		51.8	30.9	31.3	25.4		65.1											ONEK
K-07-0123	0.0		33.0	28.5		21.6	64.1											ONEK
K-07-0124			38.7	41.9		73.1	64.5	51.8										ONEK
K-07-0125		19.9	20.8			31.8	45.9											ONEK
K-07-0126	0.0		21.5	9.5		5.3												ONEK
K-08-0129			55.3	32.6				60.3	64.3									ONEK
K-08-0134			54.8	64.0	79.4	86.1	86.6			0.0								ONEK
K-08-0135		21.0	26.4	27.6	61.4		35.8	31.4	17.5	0.0								ONEK
K-08-0136			44.6	41.8			60.3	56.4										ONEK
K-08-0137	0.0		30.9	28.5		47.5	76.1											ONEK
K-08-0138		41.6	42.3	41.4	65.5		60.8	53.2										ONEK
K-08-0139		34.6	28.6	18.4			47.2	29.4		0.0								ONEK
K-08-0140			43.2	40.2	55.9		35.3	71.8		0.0								ONEK
K-08-0141			49.3	45.1		60.9	68.0			0.0								ONEK
K-08-0142			42.3	28.1	63.9	56.9	65.6	43.6										ONEK
K-08-0143		31.8	45.7	22.2	52.5		69.9	44.9		0.0								ONEK
K-08-0144	0.0			73.6			73.1	37.6										ONEK
K-08-0145	0.0	75.4	40.3	10.2		36.9	62.3											ONEK
K-08-0146			46.4	40.5			63.9	71.2		0.0								ONEK

TABLE B-9: RQD DATA SUMMARY – CONTINUATION

Borehole I.D.	OVB	SCH	QTZT	GSCH	SSCH	CHSCH	GNST	CQTZT	CSCH	CAS	VN	TQTZT	MCQ	ICQS	FLT	VM	SM	Location
K-08-0147	0.0		45.2	56.3	88.2		26.5	27.7										ONEK
K-08-0148		45.6	47.0	17.7			27.6	62.4	75.7	4.8								ONEK
K-08-0149			51.7	54.9	53.0					0.0								ONEK
K-08-0150	0.0	87.5	33.8	40.2	39.5		51.2	20.0										ONEK
K-08-0151			46.4	15.0		24.8	49.9	41.2		0.0								ONEK
K-08-0152			59.6	61.1	88.6		77.6	75.0										ONEK
K-08-0153		54.0	72.6			91.4	89.7			0.0								ONEK
K-08-0154	0.0	77.3	70.8		87.1		91.1		83.6									ONEK
K-08-0155			70.3	47.1	89.6		92.5			0.0								ONEK
K-08-0156	0.0		69.1	70.0														ONEK
K-08-0157			68.0	55.6					49.2	0.0								ONEK
K-08-0158	0.0		62.9	70.0	56.0													ONEK
K-08-0175			40.6	38.6		63.9	94.0	60.4										ONEK
K-08-0177			56.6	52.1		58.4	76.3		56.7									ONEK
K-10-0237			21.2									26.6		6.4				ONEK
K-10-0239			12.2											5.1		26.9		ONEK
K-10-0240			49.3											9.7		49.6		ONEK
K-10-0241	12.8		46.5	16.6								30.7		15.0		34.9		ONEK
K-10-0244			30.2	12.5	17.2							30.5		24.8		53.1		ONEK
K-10-0245			28.0	48.2	50.8							41.1		34.1		69.6		ONEK
K-10-0247	5.1		72.6		10.7		63.2					31.1		36.4		45.7		ONEK
K-10-0248			50.2	24.7	15.1							40.2		16.7	20.3	54.5		ONEK
K-10-0249	5.1		40.2	41.9	36.7		52.9					36.1		30.1		61.1		ONEK
K-10-0250	3.8		76.7	65.2	80.4		82.8					67.7		75.5		77.1		ONEK
K-10-0251			51.4		71.2		84.1					50.4		65.1	66.9			ONEK
K-10-0252	6.4		40.3		70.0		82.6					61.0		21.9				ONEK
K-10-0253	0.0		34.4		61.2		67.4					34.6		12.0	6.8	27.5		ONEK
K-10-0254	0.0		74.8		52.5		85.0					42.9		10.0	31.8	78.7		ONEK
K-10-0255	28.7		39.5	15.1			57.1					36.3		23.4		0.0		ONEK
K-10-0256	0.0		54.7				41.7					30.5		26.9		49.2		ONEK

TABLE B-9: RQD DATA SUMMARY – CONTINUATION

Borehole I.D.	OVB	SCH	QTZT	GSCH	SSCH	CHSCH	GNST	CQTZT	CSCH	CAS	VN	TQTZT	MCQ	ICQS	FLT	VM	SM	Location
K-10-0262			44.8		45.1		62.6					30.7		26.4		78.4		ONEK
K-10-0263			25.0		37.5	15.3	41.9					20.6		3.3				ONEK
K-10-0265	0.0		28.1			42.7	43.4					36.6		44.4		28.0		ONEK
K-10-0267			70.3	35.8			92.4					61.8		45.5		44.3		ONEK
K-10-0306	12.4		16.9		25.6		57.9					21.5		16.2	25.3	56.9		ONEK
K-10-0308			41.2	34.4		56.7	64.4					35.2		29.0	43.3	51.5	62.1	ONEK
K-10-0309	0.0		42.1		61.0		46.6					37.9		34.9		46.1	42.8	ONEK
K-10-0311	0.0		50.9				40.3					50.0		36.2		57.6	55.7	ONEK
K-11-0324	0.0		54.4				35.4					29.8		0.0	15.5			ONEK
K-11-0325	0.0		41.4		41.5		87.6					28.2		17.9	26.2	9.2		ONEK
K-11-0326	0.0		52.2	47.6	33.3		86.9					41.1		18.3		93.4	66.6	ONEK
K-11-0327	5.6		55.7	36.1	77.1		92.2					31.6		23.5		29.0		ONEK
K-11-0328			40.0	15.6			51.4					28.6		47.3				ONEK
K-11-0329			51.7	35.1	47.7		61.1					36.3		25.7			35.4	ONEK
K-11-0330			49.8	24.4	34.4		63.3					49.7		33.7	29.5			ONEK
K-11-0331			33.2	27.6			31.8					38.8		28.0	28.3	51.5		ONEK
K-11-0332			52.9				58.6					36.6		21.2		53.6	25.9	ONEK
K-11-0333			44.7	30.1			54.1	51.0				42.2		44.9				ONEK
K-11-0334			46.2	4.3			62.4					36.9		22.8	52.7	50.8		ONEK
K-11-0335			58.8	51.1	26.1		40.8					54.5		36.2				ONEK
K-11-0337			42.5	7.7		56.7	59.3					27.8	28.8	43.8				ONEK
K-11-0339			52.1	25.2			60.3					42.8		43.6	23.5	36.5		ONEK
K-12-0488	0.0		39.7	30.1	7.7		76.6	29.3										ONEK
K-12-0491	34.3		38.8	39.9	46.7		68.2	65.3										ONEK
Average RQD	**3.9**	**44.2**	**45.2**	**35.7**	**49.2**	**47.2**	**62.3**	**49.4**	**53.5**	**0.3**		**38.3**	**28.8**	**27.8**	**30.8**	**48.7**	**48.1**	
Standard Deviation	**8.1**	**23.9**	**15.4**	**17.7**	**24.1**	**27.2**	**20.2**	**20.6**	**31.6**	**1.2**		**13.7**		**17.0**	**18.8**	**23.8**	**26.0**	

TABLE B-10: RQD DATA SUMMARY

Borehole I.D.	OVB	SCH	QTZT	GSCH	SSCH	CHSCH	GNST	CQTZT	CSCH	CAS	VN	TQTZT	MCQ	ICQS	FLT	VM	SM	Location
K-06-0001	0.0	26.1	51.5	28.4	33.8													SK
K-06-0002	0.0		54.4	28.9		38.7												SK
K-06-0003	0.0		43.4	30.5														SK
K-06-0004	0.0		46.2	26.5			0.0											SK
K-06-0006	0.0		42.8	32.2	46.3													SK
K-06-0007	0.0	20.1	53.9	18.8	56.1		23.3											SK
K-06-0009	0.0		48.0	41.7	75.5													SK
K-07-0112		81.0	75.2	15.0	85.4													SK
K-07-0113		43.1	48.0		18.4		34.1											SK
K-09-0218	0.0		54.4	47.1	61.1		82.3											SK
K-10-0221			39.3	9.7	54.9					15.8		53.4	17.7	53.0				SK
K-10-0222			61.7	19.9	45.1		85.6			0.0		52.8	0.0	42.9	0.0			SK
K-10-0223	33.9		59.4	38.2	45.8		59.0					46.7	48.5	31.2	16.4			SK
K-10-0224			53.8	23.6	23.6		35.2			1.4		38.7	0.0	40.1				SK
K-10-0225	54.3		60.8	37.8	74.0							48.7	17.1	44.2	8.5			SK
K-10-0226	28.9		25.7	8.0								37.2	32.8	33.2				SK
K-10-0227	3.2		45.5	22.7			51.6					33.5		32.7				SK
K-10-0228	35.8		45.5	15.9			31.4					60.4		27.7				SK
K-10-0229	5.4		69.6	4.8								58.4	56.4	42.4				SK
K-10-0230	0.0		50.6	10.8	62.3		61.6					41.2		48.3		10.9		SK
K-10-0231	0.0		28.1	54.0	32.2		52.8					29.2		39.1		28.2		SK
K-10-0232	1.2		50.6	18.7	47.7		71.2					38.4	41.8	36.2	0.0			SK
K-10-0233			52.9	14.8			46.7					44.4	37.7	19.7	57.4			SK
K-10-0234	2.1		50.9	41.0	20.0							38.9		35.0	60.9			SK
K-10-0236	15.7		67.0	0.0	56.9							45.6		55.5	13.9	73.4		SK
K-10-0238	4.3		45.2	19.9	11.8					4.9		40.8		32.7		42.3		SK
K-10-0242	1.9		17.6	1.4	0.0		56.1					29.0	72.8	16.0		38.7		SK
K-10-0243	8.1		54.6		18.7		59.2					39.4		21.8	0.0			SK
K-10-0246	3.0		71.4	0.0								40.5		30.6				SK
Average RQD	**8.6**	**42.6**	**50.6**	**22.6**	**43.5**	**38.7**	**50.0**			**5.5**		**43.0**	**32.5**	**35.9**	**19.6**	**38.7**		
Standard Deviation	**14.9**	**27.4**	**12.8**	**14.6**	**23.2**		**22.6**			**7.2**		**8.8**	**23.9**	**10.6**	**25.2**	**22.9**		

Lithology Codes 2012

BX	Hydrothermal Breccia	Typically zones of monomictic breccia typically composed of angular rock and/or vein clasts cementedby later quartz, carbonate (calcite, dolomite, siderite) with pyrite, galena or sphalerite.
CHSCH	Chlorite Schist	Light green to green-grey, or silvery green chlorite - sericite schist (phyllite), locally containing siliceous laminations. May have prominent lineation. Possible meta-tuffaceous rock. If rock makes up less than 5% of unit the chloritic modifier "chl" can be used.
CQTZT	Calcareous Quartzite	Quartzite characterized by brownish speckled texture or banding of primary carbonate that reacts to acid test. If rock makes up less than 5% of unit the calcareous modifier "c" can be used.
CSCH	Calcareous Schist	Light coloured schist, with carbonate as a major constituent. If rock makes up less than 5% of unit, the calcareous modifier "c" can be used.
DM	Disseminated Mineralization	Zone of disseminated galena or sphalerite (excluding pyrite), shown in Lith_2
FLT	Fault	Always placed in Lith_1 except where VM or VL occupies the same interval, when it is placed in Lith_2. Use Lith_2 if the rubbled or gouged rock type can be determined, but do not show it asa > 49% as the presence of the fault is more important. Includes Fault Breccia.
GNST	Greenstone	Generally massive greyish green to dark green, chlorite - actinolite - calcite sills locally with relict phaneritic texture and sometimes schistose particularly on margins.
GRIT	Gritty Schist	Schist containing clear, grey, and/or blue quartz grains (to 1mm) in a quartz-mica schist matrix. The quartz grains can generally only be seen on a freshly broken surface and not on the drill core surface. Petrology suggests these rocks may be meta-felsic volcanics.
GSCH	Graphitic Schist	Grey to dark grey to black schist (phyllite) with graphite as a major constituent, with well developed foliation, comprising > about 80%, with common quartzite bands generally < 1cm thick. A soft, Weak rock that breaks along foliation. Commonly contain plications, wrinkle laminations, small drag folds and crenulations. Most contain irregular masses of quartz as stringers or boudins. If rock makes up less than 5% of unit the graphite modifier "g" can be used.
LMST	Limestone	Light - medium grey to black crystalline limestone, sometimes banded with irregular lens-like layers of white or buff carbonate, or schistose (phyllitic) limestone.
NR	No Recovery	Loss of core, record in the Lith_2 field if VM or VL is present as these must show in Lith_1. Outside of mineralized zones, the % of the interval that NR represents determines its placement in Lith_1 or Lith_2, because core loss commonly represents faults.
OVB	Overburden	Quartenary alluvium, colluvium comprising interbeded sandy to bouldery fluvio-glacial beds.
QFP	Quartz Feldspar Porphyry	Fine to medium grained, brown to pinkish, quartz porphyritic ± biotite-bearing, felsic (dyke) intrusive.

QTZT	Quartzite	Massive buff, light to medium grey to white or bluish grey, may have a weak schistosity defined by sericite. Some are very fine grained, white and resemble re-crystallized cherts. Bedding may be visible throughout. Some are very fine grained, with a sugary texture and resemble re-crystallized cherts. Minor GSCH (to about 5%) is generally present as very narrow bands.
SCH	Undifferentiated Schist (Phyllite)	Fine grained, light to dark greyish - black or green depending on the dominant mineral content. Fracture surfaces generally have a distinctive sheen and show well developed foliation. Generally plications, wrinkle laminations, small drag folds and crenulations. Most contain irregular masses of quartz as stringers or boudins. Siliceous schist may be interbedded throughout, but must comprise less than 10% of the unit.
SM	Stringer Mineralization	Zone of stringers (< 1 cm true width) that contain hypogene mineralization (not syngenetic sulphide). Put in Lith_2 field unless they comprise > 25% of the interval in which case put in Lith_1.
SSCH	Sericite Schist	Light green or mottled greenish yellow fine grained schist (phyllite), commonly with a silvery luster. Commonly show marked schistosity, plications, crenulations and contain numerous stringers, masses and boudins of white quartz. If rock makes up less than 5% of unit the sericite modifier "s" can be used.
TQTZT	Thin Bedded Quartzite	Grey quartzite bands 5 - >10 cm in thickness, with mud/graphitic schist bands up to about 20% (ONLY TO BE USED IN MSQ)
VL	Mineralized Veinlet	Zone of veinlets (1 - 10 cm true width) comprising > 25% of interval, that contain hypogene mineralization (not syngenetic sulphide). Put in Lith_1 field.
VM	Mineralized Vein	Zone of veins (> 10 cm true width) that contain hypogene mineralization (not syngenetic sulphide). Put in Lith_1 field.
VN	Unmineralized Vein	Veins, veinlets and stringers lacking hypogene mineralization, but usually containing quartz, calcite or dolomite

Lithology Modifiers	
a	argillaceous
c	calcareous
chl	chloritic
cty	cherty
g	graphitic
m	massive (quartzite or schist)
s	sericitic
tnb	Thin bedded <30 cm bands QTZT, GSCH
mb	Medium bedded 30-120 cm bands QTZT, GSCH
tkb	Thick bedded >120 cm bands QTZT, GSCH

TETRA TECH EBA

Job Number	W14103428-01.003
Sheet No.	1 of 2
Made by	JV
Date	17/03/2015
Reviewed by	CC

Contract/Client	Alexco Environmental Group
Design Topic	Plug DimensionDesign

10 m Hydraulic Head

1.) Punching Shear Design

Shear Strength for unreinforced concrete

f'_s = 107.7 psi concrete shear strength
742.2 Kpa

Inputs

where f'_c = 2900.75476 concrete compressive strength **(psi)**

NOTES:

* **Changing from kPa to to psi**

f'_c = 20000 (kPa)
f'_c = 2900.8 (psi)

Shear Strength of the rock mass (U)
Use the fair rock in the table on the right
This corresponds to U = 600 kPa

Therefore, punchiing shear failure is controlled by the shear strenght of the rock mass.

Recommended design shear strengths and hydraulic gradients for tunnel plugs (after Lang, 2012)

Rock Condition CSIR Rock Mass Rating	Design Shear Strength (kPa)	Allowable Hydraulic Gradient*
Very Good Rock Massive, hard, widely jointed 81<RMR<100	1500	15-30
Good Rock Hard to Moderately hard, moderately jointed 61<RMR<80	900	10-14
Fair Rock Moderate to Weak, Moderately jointed 41<RMR<60	600	7-9
Poor Rock Weak, closely jointed or sheared 21<RMR<40	300	5-6
Poor Rock Very weak, possible erodible RMR<20	150	3-4

*Allowable gradients can be higher if formation grouting is performed.

2.) Plug length for static loading

L = 0.0908 Length without considering F.S
L = 0.2725 **Final length considering F.S.**

Inputs

where	**h**	2.5	Adit height **(m)**
	w	2	Adit width **(m)**
	U	600000	**(Pa)** Allowable shear strength rock mass, **U** should be substituted for ***f's*** if ***f's*** is lower
	H	10	Head of fluid on plug **(m)**
	ρ	1000	Density of fluid **(kg/m^3)**
	g	9.81	Gravitational constant **(9.81 m/s^2)**
	FS	3	Factor of Safety

3.) Additional Pressure (Seismic)

PH 144 (kPa) considering Vmax

Inputs

where	**c**	1437	acoustic velocity of water **(1437 m/s)**	1437
	v		ground velocity **(m/s)**	
	ρ	1000	Density of fluid **(kg/m^3)**	1000
	V_{max}	0.1001	**m/s**	0
	a_{max}	0.182	**g**	0.182

The relationship between Vmax and amax is given approximately by Seed and Idriss (1983) as

$$\frac{V_{max}}{a_{max}} = \frac{55\frac{cm}{seg}}{g}(for\ rock)$$

* V_{max}/a_{max}= 55 cm/seg/g

NOTES:

*notice V_{max} is dependent on a_{max}

TETRA TECH EBA

		Job Number	W14103428-01.003
		Sheet No.	2 of 2
Contract/Client	Alexco Environmental Group	Made by	JV
Design Topic	Plug DimensionDesign	Date	17/03/2015
	10 m Hydraulic Head	Reviewed by	CC

NELPCO NND-EBA LAND PROTECTION CORP.

4.) Hydraulic Jacking

CRM = minimum rock cover measured to the nearest point on the ground surface

		CRM	5.3209	m Condition met
		Inputs	**Inputs**	
where	h_s		10	**(m)** static design water head
	Υ_w		1000	**(kg/m^3)**unit weight of water
	Υ_r		2600	**(Kg/m^3)**unit weight of rock
	β (°)	**20**	0.3491	slope angle of topography
	F		1.3	FoS (**between 1.1 and 1.3** Bergh-Christiansen and Dannevig, 1971)

NOTES:

C_{RM} = minimum rock cover measured to the nearest point on the ground surface

* **β (°)** **degree**: enter value in degrees on green celd

5.) Allowable Hydraulic Gradient

The length of the plug is reviewed by the allowable hydraulic gradient for the rock condtitions that will prevent piping and downstream erosion of the adit walls or by maximum accetable seepage

$$\text{Hydraulic Gradient} = \frac{\text{Design head of water [m]}}{\text{Lengh of the plug [m]}}$$

$$\text{Length of Plug [m]} = \frac{\text{Design head of water [m]}}{\text{Hydraulic Gradient}}$$

Hydraulic gradient = 8 Based on a fair rock (from table on previous page)

Design of head water = 10 m

Then length of Plug = 1.3 m However, 3 m long is recommended to meet conditions of plug length > adit width or height

7.0 PROTECTION OF EXPOSED GROUND

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

8.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES

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

9.0 INFLUENCE OF CONSTRUCTION ACTIVITY

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

10.0 OBSERVATIONS DURING CONSTRUCTION

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

11.0 DRAINAGE SYSTEMS

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

12.0 BEARING CAPACITY

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

13.0 SAMPLES

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

14.0 INFORMATION PROVIDED TO TETRA TECH EBA BY OTHERS

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

Appendix 9 2012 DSTF Interim Reclamation and Cover Summary Report

3 Calcite Business Centre, 151 Industrial Road
Whitehorse, Yukon Y1A 2V3
Phone (867) 668-6463 Fax (867) 667-6680
www.accessconsulting.ca

Memorandum

To: Alexco Keno Hill Mining Corp.

From: Access Consulting Group

CC:

Date: March 20, 2013

Re: 2012 Dry Stack Tailings Facility Cover Trial

Alexco Resource Corp. (Alexco) through its wholly owned subsidiary Alexco Keno Hill Mining Corp. owns and operates the Bellekeno Mine located in the Keno Hill Silver District. The Bellekeno Mine is licenced under Quartz Mining License QML-0009 and Water Use Licence QZ09-092.

Progressive reclamation of the Dry Stack Tailings Facility (DSTF), one of several mine components licenced under the authorizations above and shown in Figure 1. The reclamation was initiated during the summer of 2012 as outlined in the Reclamation and Closure Plan (Access, 2012) to prevent infiltration of meteoric water and prevention of dusting and erosion of exposed tailings slopes. The progressive reclamation included four areas (block A, B, C, & D) on the DSTF to be covered with granular material and seeded to test various cover trials.

Progressive reclamation of the DSTF is scheduled to occur after mill generated tailings are deposited, followed by recontouring of the slopes, and placement of a cover consisting of course soil and seeding with suitable vegetation. Reclamation was initiated in 2012 and on schedule with the year 2 start date (EBA 2010b). Ground surface preparation of the tailings prior to soil cover placement was not necessary (EBA 2010a) given that tailings are hauled from the mill at least once daily, and compacted with a drum packer to ensure proper compaction.

Phase I of the progressive reclamation tailings program covered an area of approximately 2,188 m^2 (~0.22 ha) which would correspond to a volume of ~547 m^3 of cover material for a cover thickness of 0.25 m. There was sufficient suitable granular material in the area of the DSTF to allow for construction of the proposed evapotranspiration cover. A conceptual evapotranspiration cover design is shown in Figure 2 and is based on the successful cover design constructed at the Brewery Creek Mine.



DSTF Cover Trial
Duncan Creek Road
Mill Access
Haul Road

1:3,000 *When printed on 8.5 by 11 inch paper*

0 50 100 150 Meters

Aerial photography flight date: July 13th 2006. Ortho-rectification produced by Challenger Geomatics Ltd. Site hydrography and contours derived from 2006 aerial imagery. Mill pond survey (Y.E.S. Sept 2010), mill structures, current DSTF footprint and roads survey (ACG, December 2011). Design data obtained from EBA.

Datum: NAD 83; Projection: UTM Zone 8N

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ALEXCO KENO HILL MINING CORP.

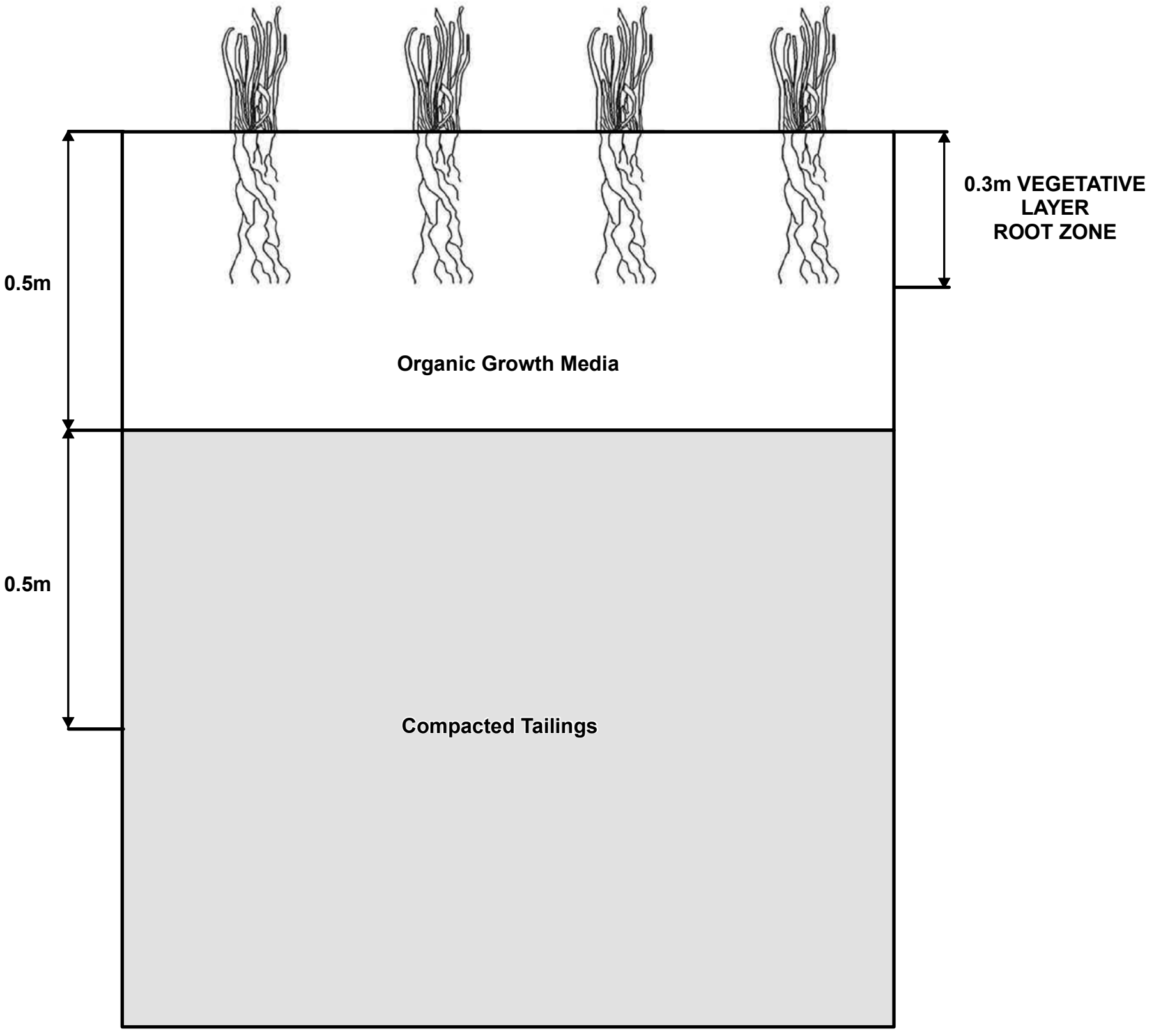
FIGURE 1
DSTF VEGETATION COVER TRIAL 2012

AKHM ACCESS

MARCH 2013

t:\ALEX-05-01\Bellekeno\GIS\mxd\Annual_Reports\2012\Groundwater_MillSite_Memo20130314.mxd
(Last edited by: jpan; 3/20/2013/09:16 AM)

CONCEPTUAL SOIL COVER DESIGN



Conceptual drawing only. Drawing is not to scale.

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AKHM

ACCESS

ALEXCO KENO HILL MINING CORP.
RECLAMATION AND CLOSURE PLAN

FIGURE 2

CONCEPTUAL SOIL COVER DESIGN

DRAWN BY JP	NOVEMBER 2011	VERIFIED BY BT

I:\ALEX-05-01\Bellekeno\GIS\mxd\Closure\2011\Submitted_Nov2011\Fig6-11_Soil_Cover_System20111117.mxd
(*Last edited by: jpan;11/17/2011/12:25 PM*)

In general, there is no dominant type of cover specifically designed for cold climates; rather, the type of cover design is site specific depending on the physical and chemical characteristics of the tailings facility (SRK, 2009). The cover design in this instance is defined as a store-and-release cover, which makes use of a generally thick layer of soil to store water until it can be taken up and evapo-transpired by plants (SRK, 2009).

As stated above and in the Preliminary Engineering Design and Management Plan of the DSTF (EBA, 2010b), progressive reclamation consists of placing an evapo-transpirative cover (a minimum of 0.25 m of loosely placed gravel soil) over the surface of the compacted tailings to temporarily store runoff and allow it to evaporate or be used by plants. Analogous to the successful results realized at the Brewery Creek Mine, the Reclamation Plan includes re-vegetation of the DSTF with plants that promote soil evapo-transpiration such that pore water is released to the atmosphere reducing the net infiltration across the soil system (Tremblay et al., 2001). The performance results of those covers indicate precipitation infiltration rates between 7% – 22% with the variation related to differences in cover thickness and site topography (Access, 2010).

The four stockpiles of growth media that were set aside during development of the mill site and ancillary support buildings (for the future use as DSFT cover material) were surveyed and the volumes calculated (Table 1). To prepare for the upcoming cover program activities over the summer, samples were obtained from each pile and sent to an outside laboratory for analysis of available nutrients, metals and physical properties in late spring, 2012. Nutrient levels ranged from very low to moderate as shown in the Appendix A laboratory analysis while soil pH ranged from neutral to mildly acidic. Physical locations, soil properties, and volumes of the piles are presented below in Table 1.

Table 1 Stockpiled Growth Media for Use as DSTF Cover

Stock Pile Number	Location	Soil Type	Volume (m^3)
1	483987E, 7087017N	Loam	205.5
2	484007E, 7086993N	Loam	301.3
3	483770E, 7086777N	Sandy Loam	3102.9
4	483750E, 7086744N	Sandy Loam	615.0
		Total	4,224.7

The DSTF was constructed to the preliminary engineering design specification and as such has a slope of 3:1. The cover therefore, has a similar slope except in Block D where a small area, by design, has a steeper slope.

As discussed above, the area requiring a cover was estimated to be 2,188 m^2. Block A of the cover trial received a minimum cover thickness of 0.5 m, whereas Blocks B, C and D had a minimum cover thickness of 0.25 m. The actual thickness of the cover on the individual Blocks will vary due to the various types of surface landscaping included in the trial Blocks. The minimum total volume of material used for placement on the DSTF was calculated to be 687 m^3 using the above compacted thicknesses; however, the actual volume of growth media placed is most likely greater due to a compaction factor and the surface landscaping, where the cover was placed thicker than the minimum thickness specification. This cover material was transferred from the stock piles to the DSTF using the Volvo trucks, which have a capacity of 17 m^3 per load. It should be noted that unsuitable material such as boulders and organics were set aside and not used in the construction of the

cover. After the material was placed and profiles construction completed, the growth media was compacted by backtracking the hoe parallel to the slope which also created an irregular surface and therefore limiting the susceptibility of soil erosion. Prior to seeding, the dimensions of the individual blocks were measured (Table 2) to determine the appropriate mass of seed required per section. Cross sections of the individual block are presented in Appendix B and a photo log of the cover trial is presented in Appendix C.

Table 2 Area by Section of DSTF Cover

Block	Dimensions (m)	Area (m^2)	Minimum Cover Thickness (m)
A	15.5 m x 36 m	558	0.50
B	16.75 m x 37.5 m	628.13	0.25
C	12 m x 37.5 m	450	0.25
D	16 m x 34.5 m	552	0.25
Total	**60.25 m x ~36 m**	**2,188.13**	**0.25**

The Keno District Dry Land Seed Mix (Table 3) was selected using a blend of suitable species seeded at the Brewery Creek and Minto mine sites, which was custom mixed by Brett-Young Seeds of Alberta and was applied using a seeding rate of 35 kg/ ha. All species used in the seed mix are Yukon natives except for Sheep Fescue which is native to Eurasia; however, it resembles many tufted fine-leaved fescues in North America (Matheus and Omtzigt 2011). This species was chosen because it is closely related to the Yukon native alpine fescue (*Festuca brachyphylla*) which is an ideal native fescue to sow on acidic alpine and subalpine sites; however this seed is not currently available commercially (Matheus and Omtzigt 2011).

Table 3 Seed Mix Used on DSTF (Matheus and Omtzigt 2011)

Common Name	Botanical Name	Origin	Seeds per kg	Percent Mix (%)
Violet Wheatgrass	*Elymus alaskanus*	*native to Yukon*	330,000	40.0
Sheep Fescue	*Festuca ovina*	*not native (Eurasian)*	1,100,000	23.5
Rocky Mountain Fescue	*Festuca saximontana*	*native to Yukon*	1,430,000	23.0
Glaucous Bluegrass	*Poa glauca*	*native to Yukon*	2,907,000	13.5

Fertilizer was applied at a calculated rate of 130 kg/ha (Matheus and Omtzigt 2011). In total, 25 kg of 19-19-19 was used. Individual blocks were seeded and fertilized using a grid and track-back method, using hand held hoppers for dispersal. Seeded areas that had been constructed with a slope greater than 3:1 were raked to ensure good seed-soil contact was made and to reduce the risk of seeds washing downslope in the event of a high intensity rainfall.

A follow up site visit was conducted in August 2012 to assess the progress of the seeding program. Seedlings were present on the cover and areas where seed had been raked into the soil appeared to a higher density of seedlings.

Follow up monitoring later spring 2013 will assess winterkill and survival rates. At this time additional seeding and fertilizing application rates will be calculated. The blocks will also be inspected for signs of rill erosion and will be mitigated should any be present

REFERENCES

Access Consulting Group. 2012. Preliminary Reclamation and Closure Plan, Keno Hill Silver District Mining Operations. Prepared for Alexco Keno Hill Mining Corporation

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EBA Engineering Ltd., 2010a. Operation, Maintenance, and Surveillance Manual Dry Stack Tailings Facility, Keno Hill District Mill, YT. Revision 2010-1. Prepared for Alexco Hill Mining Corp. EBA File: W14101178.009

EBA Engineering Ltd., 2010b. Preliminary Engineering Design and Management Plan: Dry-Stacked Tailings Facility, Bellekeno Mine Mill Site, Yukon. Prepared for Alexco Resource Corp. Issued for Use. EBA File: W14101178.003

O'Kane Consultants Inc. (editors) 2004. Design, Construction and Performance Monitoring of Cover Systems for Waste Rock and Tailings. MEND 2.21.4. Volume 4: Field Performance Monitoring and Sustainable Performance of Cover Systems. Prepared for MEND.

SRK Consulting (Canada) Inc. 2009. Mine Waste Covers in Cold Regions. Prepared for Mine Environmental Neutral Drainage Program (MEND).

Tremblay, Gilles and Hogan, Charlene, 2001. "MEND Manual Volume 4 – Prevention and Control". Mine Environment Neutral Drainage (MEND) Program.

APPENDIX A

SOIL ANALYSIS

Your Project #: ALEX-12-BELLE-02
Your C.O.C. #: 08351389

Attention: Scott Davidson
ACCESS CONSULTING GROUP
#3 Calcite
151 Industrial Road
WHITEHORSE, YT
CANADA Y1A 3C8

Report Date: 2012/05/28

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B241340
Received: 2012/05/18, 08:30

Sample Matrix: Soil
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Cation Exchange Capacity (1)	4	2012/05/25	2012/05/25	AB SOP-00009	SSMA 18.2, EPA 200.7
Conductivity (Soluble)	4	2012/05/24	2012/05/24	BBY6SOP-00029	SM-2510 B
Elements by ICPMS (total)	4	2012/05/24	2012/05/24	BBY7SOP-00001	EPA 6020A
Potassium (Available) (1)	4	2012/05/25	2012/05/25	AB SOP-00042	EPA 200.7
Nitrate-N (Available) (1)	4	2012/05/25	2012/05/25	AB SOP-00023	SM 4110-B
Phosphorus (Available by ICP) (1)	4	2012/05/25	2012/05/25	AB SOP-00042	EPA 200.7
pH (2:1 DI Water Extract)	4	2012/05/24	2012/05/24	BBY6SOP-00028	Carter, SSMA 16.2
Saturated Paste	4	2012/05/24	2012/05/24	BBY6SOP-00030	Carter SSMA 18.2.2
Total Organic Carbon LECO Method (1)	4	2012/05/25	2012/05/25	CAL SOP-00243	LECO# 203-821-170
Texture by Hydrometer (1)	4	N/A	2012/05/25	AB SOP-00030	MMFSPA Ch9
Texture Class (1)	4	N/A	2012/05/25	AB SOP-00030	MMFSPA Ch9
Total Nitrogen in Soil by LECO (1)	4	2012/05/28	2012/05/28	CAL SOP-00243	LECO# 203-821-170

* Results relate only to the items tested.

(1) This test was performed by Maxxam Calgary Environmental

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

LANOY LUANGKHAMDENG, Burnaby Project Manager
Email: LLuangkhamdeng@maxxam.ca
Phone# (604) 638-2636

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Analytics - Partial/Rush Results

Maxxam Job #: B241340
Report Date: 2012/05/28

ACCESS CONSULTING GROUP
Client Project #: ALEX-12-BELLE-02

Sampler Initials: LK

NPK (AVAILABLE)

Maxxam ID		DL5561		DL5562		DL5563	DL5564		
Sampling Date		2012/05/14 13:30		2012/05/14 13:30		2012/05/14 13:30	2012/05/14 13:30		
	Units	**WP1 (DSTF)**	**RDL**	**WP2 (DSTP)**	**RDL**	**WP3 (MILL WASTE)**	**WP4 (MILL WASTE)**	**RDL**	**QC Batch**
Nutrients									
Available (NH4F) Nitrogen (N)	mg/kg	<10(1)	10	<2.0	2.0	11(1)	<10(1)	10	5868444
Available (NH4F) Phosphorus (P)	mg/kg	10	5.0	<1.0	1.0	17	77	5.0	5867906
Available (NH4OAc) Potassium (K)	mg/kg	52	10	29	2.0	25	29	10	5867902

RESULTS OF CHEMICAL ANALYSES OF SOIL

Maxxam ID		DL5561	DL5562	DL5563		DL5564		
Sampling Date		2012/05/14 13:30	2012/05/14 13:30	2012/05/14 13:30		2012/05/14 13:30		
	Units	**WP1 (DSTF)**	**WP2 (DSTP)**	**WP3 (MILL WASTE)**	**QC Batch**	**WP4 (MILL WASTE)**	**RDL**	**QC Batch**
Elements								
Cation exchange capacity	cmol+/Kg	24	13	33	5867085	13	10	5867085
Soluble Parameters								
Soluble Conductivity	uS/cm	197	2540	512	5863576	276	1.0	5863576
Saturation %	%	90.5	53.0	88.7	5863551	74.8	1.0	5863551
Physical Properties								
% sand by hydrometer	%	44	53	58	5866937	50	2.0	5866937
% silt by hydrometer	%	44	37	31	5866937	43	2.0	5866937
Clay Content	%	12	11	10	5866937	6.9	2.0	5866937
Texture	N/A	LOAM	LOAM	SANDY LOAM	5860280	SANDY LOAM	N/A	5861607

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) - Detection limits raised due to sample matrix.

Maxxam Analytics - Partial/Rush Results

Maxxam Job #: B241340
Report Date: 2012/05/28

ACCESS CONSULTING GROUP
Client Project #: ALEX-12-BELLE-02

Sampler Initials: LK

MISCELLANEOUS (SOIL)

Maxxam ID		DL5561		DL5562		DL5563		DL5564		
Sampling Date		2012/05/14 13:30		2012/05/14 13:30		2012/05/14 13:30		2012/05/14 13:30		
	Units	**WP1 (DSTF)**	**RDL**	**WP2 (DSTP)**	**RDL**	**WP3 (MILL WASTE)**	**RDL**	**WP4 (MILL WASTE)**	**RDL**	**QC Batch**
Misc. Inorganics										
Total Nitrogen	%	0.28	0.20	<0.20	0.20	0.25	0.20	0.23	0.20	5871016
Total Organic Carbon (C)	%	7.4(1)	0.040	2.4	0.020	5.8(1)	0.20	4.0	0.020	5867097

RDL = Reportable Detection Limit
(1) - Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics - Partial/Rush Results

Maxxam Job #: B241340
Report Date: 2012/05/28

ACCESS CONSULTING GROUP
Client Project #: ALEX-12-BELLE-02

Sampler Initials: LK

CSR/CCME METALS IN SOIL (SOIL)

Maxxam ID		DL5561	DL5562	DL5563	DL5564		
Sampling Date		2012/05/14 13:30	2012/05/14 13:30	2012/05/14 13:30	2012/05/14 13:30		
	Units	**WP1 (DSTF)**	**WP2 (DSTP)**	**WP3 (MILL WASTE)**	**WP4 (MILL WASTE)**	**RDL**	**QC Batch**
Physical Properties							
Soluble (2:1) pH	pH Units	5.67	6.33	7.25	5.53	0.010	5863833
Total Metals by ICPMS							
Total Aluminum (Al)	mg/kg	12100	9370	9130	11500	100	5863755
Total Antimony (Sb)	mg/kg	1.10	39.5	2.01	2.32	0.10	5863755
Total Arsenic (As)	mg/kg	29.2	712	65.1	58.2	0.50	5863755
Total Barium (Ba)	mg/kg	217	182	188	289	0.10	5863755
Total Beryllium (Be)	mg/kg	<0.40	<0.40	<0.40	<0.40	0.40	5863755
Total Bismuth (Bi)	mg/kg	0.19	1.03	0.44	0.21	0.10	5863755
Total Cadmium (Cd)	mg/kg	1.17	148	2.13	2.66	0.050	5863755
Total Calcium (Ca)	mg/kg	4750	5760	10400	4050	100	5863755
Total Chromium (Cr)	mg/kg	19.0	15.9	17.2	20.5	1.0	5863755
Total Cobalt (Co)	mg/kg	7.39	11.6	9.73	9.90	0.30	5863755
Total Copper (Cu)	mg/kg	19.0	87.0	35.4	28.0	0.50	5863755
Total Iron (Fe)	mg/kg	23200	47000	23300	27600	100	5863755
Total Lead (Pb)	mg/kg	38.9	3730	50.2	134	0.10	5863755
Total Lithium (Li)	mg/kg	11.7	10.1	11.2	11.9	5.0	5863755
Total Magnesium (Mg)	mg/kg	3400	4050	4960	3790	100	5863755
Total Manganese (Mn)	mg/kg	597	7790	610	674	0.20	5863755
Total Mercury (Hg)	mg/kg	0.057	0.223	<0.050	0.062	0.050	5863755
Total Molybdenum (Mo)	mg/kg	1.20	1.66	1.63	1.50	0.10	5863755
Total Nickel (Ni)	mg/kg	15.5	20.7	22.1	21.3	0.80	5863755
Total Phosphorus (P)	mg/kg	469	511	685	659	10	5863755
Total Potassium (K)	mg/kg	494	394	402	435	100	5863755
Total Selenium (Se)	mg/kg	0.72	1.19	0.91	0.76	0.50	5863755
Total Silver (Ag)	mg/kg	0.491	29.0	0.921	1.79	0.050	5863755
Total Sodium (Na)	mg/kg	<100	<100	<100	<100	100	5863755
Total Strontium (Sr)	mg/kg	18.7	15.4	29.0	18.5	0.10	5863755
Total Thallium (Tl)	mg/kg	0.116	0.131	0.101	0.127	0.050	5863755
Total Tin (Sn)	mg/kg	0.42	11.0	0.93	0.44	0.10	5863755
Total Titanium (Ti)	mg/kg	226	197	197	238	1.0	5863755
Total Uranium (U)	mg/kg	0.609	0.643	0.835	0.706	0.050	5863755
Total Vanadium (V)	mg/kg	39.5	28.1	29.0	34.3	2.0	5863755
Total Zinc (Zn)	mg/kg	123	11800	219	251	1.0	5863755
Total Zirconium (Zr)	mg/kg	0.55	<0.50	1.32	<0.50	0.50	5863755

RDL = Reportable Detection Limit

Maxxam Analytics - Partial/Rush Results

Maxxam Job #: B241340
Report Date: 2012/05/28

ACCESS CONSULTING GROUP
Client Project #: ALEX-12-BELLE-02

Sampler Initials: LK

Package 1	1.7°C

Each temperature is the average of up to three cooler temperatures taken at receipt

General Comments

.

NPK (AVAILABLE) Comments

Sample DL5561-01 Phosphorus (Available by ICP): Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Sample DL5563-01 Phosphorus (Available by ICP): Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Sample DL5564-01 Phosphorus (Available by ICP): Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Sample DL5561-01 Potassium (Available): Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Sample DL5563-01 Potassium (Available): Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Sample DL5564-01 Potassium (Available): Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Maxxam Analytics - Partial/Rush Results

Maxxam Job #: B241340
Report Date: 2012/05/28

ACCESS CONSULTING GROUP
Client Project #: ALEX-12-BELLE-02

Sampler Initials: LK

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
5863551	Saturation %	2012/05/24			99	80 - 120	<1.0	%	0.4	30		
5863576	Soluble Conductivity	2012/05/24			111	70 - 130	<1.0	uS/cm	2.5	35		
5863755	Total Antimony (Sb)	2012/05/24	NC	75 - 125	93	75 - 125	<0.10	mg/kg			39	N/A
5863755	Total Arsenic (As)	2012/05/28	NC	75 - 125	102	75 - 125	<0.50	mg/kg	0.5	30	192	N/A
5863755	Total Barium (Ba)	2012/05/24	NC	75 - 125	97	75 - 125	<0.10	mg/kg			470	N/A
5863755	Total Beryllium (Be)	2012/05/24	104	75 - 125	106	75 - 125	<0.40	mg/kg			1.8	N/A
5863755	Total Cadmium (Cd)	2012/05/24	98	75 - 125	105	75 - 125	<0.050	mg/kg			5.0	N/A
5863755	Total Chromium (Cr)	2012/05/24	100	75 - 125	97	75 - 125	<1.0	mg/kg			72	N/A
5863755	Total Cobalt (Co)	2012/05/24	96	75 - 125	98	75 - 125	<0.30	mg/kg			25	N/A
5863755	Total Copper (Cu)	2012/05/24	NC	75 - 125	99	75 - 125	<0.50	mg/kg			367	N/A
5863755	Total Lead (Pb)	2012/05/24	NC	75 - 125	97	75 - 125	<0.10	mg/kg			274	N/A
5863755	Total Lithium (Li)	2012/05/24	95	75 - 125	96	75 - 125	<5.0	mg/kg			31	N/A
5863755	Total Manganese (Mn)	2012/05/24	NC	75 - 125	98	75 - 125	<0.20	mg/kg			1060	N/A
5863755	Total Mercury (Hg)	2012/05/24	111	75 - 125	109	75 - 125	<0.050	mg/kg			44	N/A
5863755	Total Molybdenum (Mo)	2012/05/24	98	75 - 125	88	75 - 125	<0.10	mg/kg			29	N/A
5863755	Total Nickel (Ni)	2012/05/24	88	75 - 125	95	75 - 125	<0.80	mg/kg			104	N/A
5863755	Total Selenium (Se)	2012/05/24	117	75 - 125	118	75 - 125	<0.50	mg/kg			1.3	N/A
5863755	Total Silver (Ag)	2012/05/24	83	75 - 125	89	75 - 125	<0.050	mg/kg			20	N/A
5863755	Total Strontium (Sr)	2012/05/24	NC	75 - 125	91	75 - 125	<0.10	mg/kg			417	N/A
5863755	Total Thallium (Tl)	2012/05/24	94	75 - 125	88	75 - 125	<0.050	mg/kg			43	N/A
5863755	Total Tin (Sn)	2012/05/24	NC	75 - 125	85	75 - 125	<0.10	mg/kg			33	N/A
5863755	Total Titanium (Ti)	2012/05/24	NC	75 - 125	94	75 - 125	<1.0	mg/kg			2070	N/A
5863755	Total Uranium (U)	2012/05/24	99	75 - 125	94	75 - 125	<0.050	mg/kg			2.7	N/A
5863755	Total Vanadium (V)	2012/05/24	NC	75 - 125	97	75 - 125	<2.0	mg/kg			82	N/A
5863755	Total Zinc (Zn)	2012/05/24	NC	75 - 125	115	75 - 125	<1.0	mg/kg			981	N/A
5863755	Total Aluminum (Al)	2012/05/24					<100	mg/kg				
5863755	Total Bismuth (Bi)	2012/05/24					<0.10	mg/kg				
5863755	Total Calcium (Ca)	2012/05/24					<100	mg/kg				
5863755	Total Iron (Fe)	2012/05/24					<100	mg/kg				
5863755	Total Magnesium (Mg)	2012/05/24					<100	mg/kg				
5863755	Total Phosphorus (P)	2012/05/24					<10	mg/kg				
5863755	Total Potassium (K)	2012/05/24					<100	mg/kg				
5863755	Total Sodium (Na)	2012/05/24					<100	mg/kg				
5863755	Total Zirconium (Zr)	2012/05/24					<0.50	mg/kg				
5863833	Soluble (2:1) pH	2012/05/24			101	96 - 104			0.2	20		
5866937	% sand by hydrometer	2012/05/25							17.9	35	99	75 - 125
5866937	% silt by hydrometer	2012/05/25							11.1	35	108	75 - 125
5866937	Clay Content	2012/05/25							3.3	35	85	75 - 125
5867085	Cation exchange capacity	2012/05/25							NC	35		
5867097	Total Organic Carbon (C)	2012/05/25			100	75 - 125	<0.020	%	7.7	50	108	75 - 125

Maxxam Analytics - Partial/Rush Results

Maxxam Job #: B241340
Report Date: 2012/05/28

ACCESS CONSULTING GROUP
Client Project #: ALEX-12-BELLE-02

Sampler Initials: LK

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
5867902	Available (NH4OAc) Potassium (K)	2012/05/25			105	80 - 120	<2.0	mg/kg	3.4	35		
5867906	Available (NH4F) Phosphorus (P)	2012/05/25			102	80 - 120	<1.0	mg/kg	12.6	35		
5868444	Available (NH4F) Nitrogen (N)	2012/05/25	NC	80 - 120	100	90 - 110	<2.0	mg/kg	NC	35		
5871016	Total Nitrogen	2012/05/28			100	75 - 125	<0.20	%	NC	35	101	75 - 125

N/A = Not Applicable
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
QC Standard: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Maxxam Analytics - Partial/Rush Results

Maxxam Analytics Inc
8577 Commerce Court
Burnaby, BC V5A 4N5
www.maxxamanalytics.com
Phone: (604) 444-4808
Fax.: (604) 444-4511
Toll-Free: 1-800-440-4808

CHAIN-OF CUSTODY RECORD AND ANALYSIS REQUEST

08351389

LAB USE ONLY
MAXXAM JOB #: B241340

ANALYSIS REQUEST

LAB USE ONLY
COC #:

COMPANY NAME:	Access Consulting Group
CLIENT PROJECT NO.:	ALEX-12-BELLE-02
COMPANY ADDRESS:	#3 Calcite Business Center 151 Industrial Rd. Whitehorse, YT Y1A 2V3
TEL.:	867-668-6463
E-MAIL:	
FAX:	867-667-6680
SAMPLER NAME (PRINT):	Lisa Knight
PROJECT MANAGER:	Scott Davidson
LABORATORY CONTACT:	Lanoy Luangkhamdeng

	FIELD SAMPLE ID	MAXXAM LAB # (LAB USE ONLY)	MATRIX: GROUNDWATER	SURFACE WATER	DRINKING WATER	SOIL	OTHER	SAMPLING: DATE DD/MM/YY	TIME	# CONTAINERS	ICP Metals	pH/EC	Texture	TOC	C:N Ration	CEC	Total N	Nutrients	Phosphorus
1	WP1 (DSTF)	DL5561				X		14/05/12	13:30	1	X	X	X	X	X	X	X	X	X
2	WP2 (DSTP)	562				X		↓	↓	1	X	X	X	X	X	X	X	X	X
3	WP3 (Mill Waste)	563				X				1	X	X	X	X	X	X	X	X	X
4	WP4 (Mill Waste)	564				X				1	X	X	X	X	X	X	X	X	X
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			

B241340

TAT (Turnaround Time)
LESS THAN 5 DAY TAT MUST HAVE PRIOR APPROVAL
* Some exceptions apply - please contact laboratory

STANDARD	5 BUSINESS DAYS
RUSH	3 BUSINESS DAYS
RUSH	2 BUSINESS DAYS
URGENT	1 BUSINESS DAY
OTHER BUSINESS DAYS	

CUSTODY RECORD

PO NUMBER OR QUOTE NUMBER:

SPECIAL DETECTION LIMITS / CONTAMINANT TYPE:

CCME
CSR
AB TIER 1
OTHER

LAB USE ONLY*

ARRIVAL TEMPERATURE °C:	DUE DATE:	LOG IN CHECK:
1, 2, 2		

ACCOUNTING CONTACT:

SPECIAL REPORTING OR BILLING INSTRUCTIONS:

JARS USED:

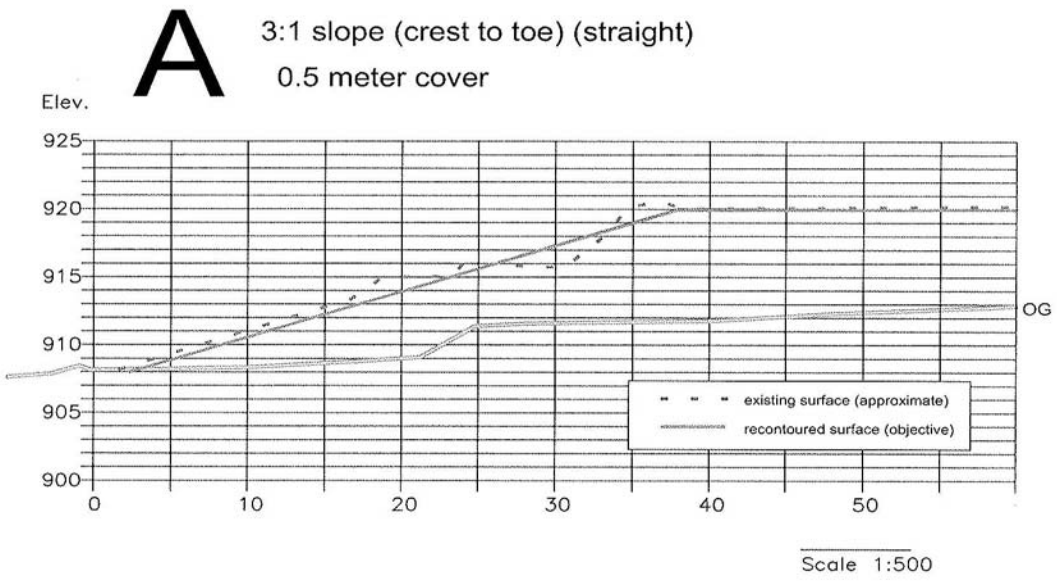
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RELINQUISHED BY:	DATE: DD/MM/YY 18/05/12	TIME: 08:30	RECEIVED BY: NICOLE LOCKYER
RELINQUISHED BY: Lisa Knight	DATE: DD/MM/YY	TIME:	RECEIVED BY LABORATORY:

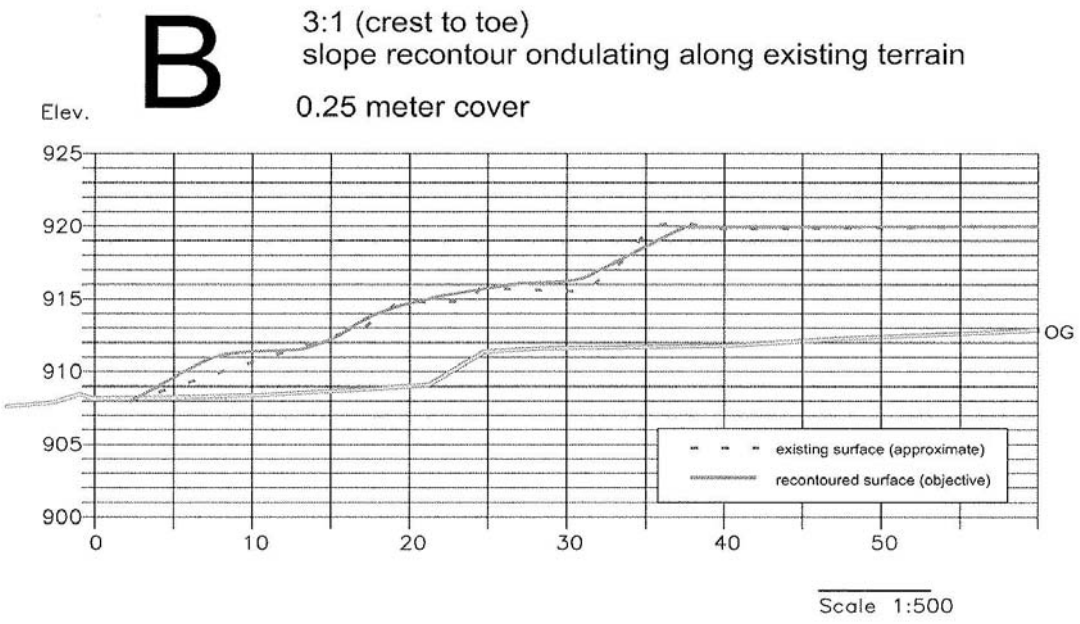
COCFORM - BC - 20070823

APPENDIX B

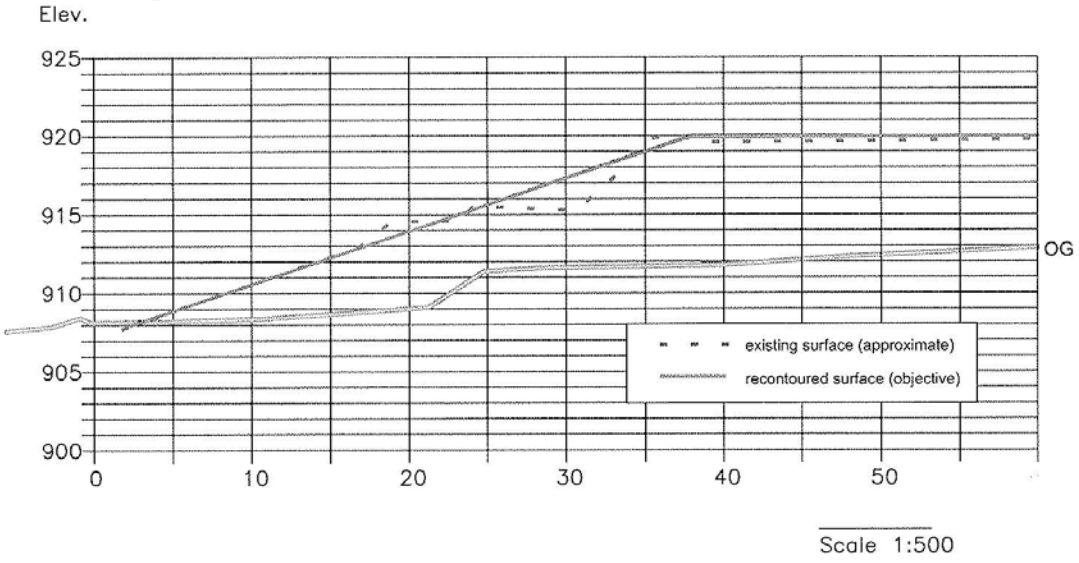
BLOCK PROFILES

DSTF Phase I Reclamation - Slope Profiles



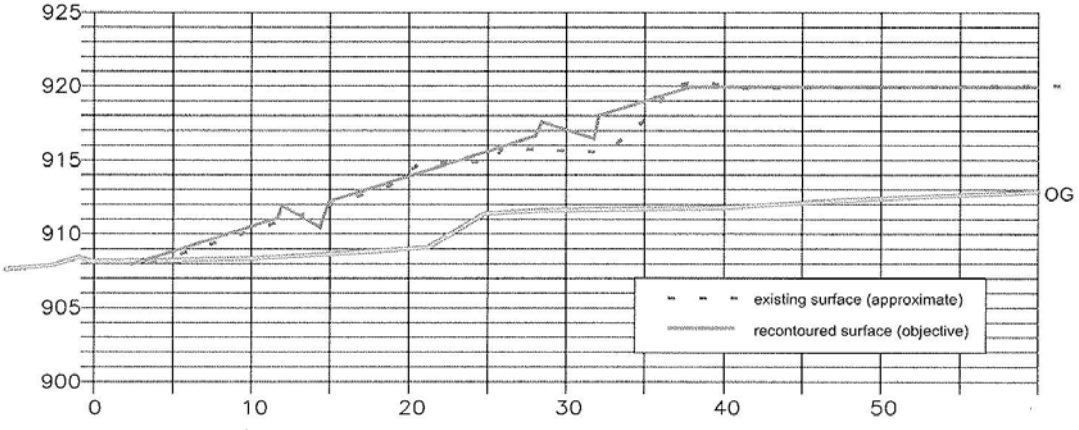


C 3:1 slope (straight)
0.25 meter cover



Scale 1:500

D 0.25 meter cover
3:1 (crest to toe)
slope with random ondulating



Section 2
Scale 1:500

APPENDIX C

PHOTO LOG



Photo 1: Growth Media Pile 1



Photo 2: Growth Media Pile 2



Photo 3: Growth Media Pile 2



Photo 4: Growth Media Pile 3



Photo 5: Growth Media Pile 4



Photo 6: Growth Media Pile 4



Photo 7: Covered DSTF toe looking north



Photo 8: Covered DSTF mid-slope looking south



Photo 9: Covered DSTF crest looking north



Photo 10: Covered DSTF crest looking south



Photo 11: Grass sprouts DSTF looking south from crest



Photo 12: Grass sprouts DSTF looking west from crest

Appendix 10 DSTF Risk Assessment

Bellekeno Mine - Dry Stack Failure Modes and Effects Analysis
Final Draft

Prepared for

Alexco Resource Corp.



Prepared by

SRK Consulting (Canada) Inc.
1CA009.006
July 2013

Bellekeno Mine - Dry Stack Failure Modes and Effects Analysis
Final Draft

July 2013

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Project No: 1CA009.006

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List of Appendices

Appendix A: Introductory PowerPoint Presentations

1 Introduction

Alexco Resource Corp. entered into a contract with SRK Consulting (Canada) Inc. to perform a Failure Modes and Effects Analysis (FMEA) for the Ken District Mill Dry Stack Tailings Facility. Alexco owns and operates the Bellekeno Mine (silver, lead and zinc) in the Keno Hill Silver District of the central Yukon.

Based on concerns raised by technical staff and consultants of Na-cho Nyak Dun regarding the suitability and long-term stability of the DSTF and ice rich permafrost in foundation soils, Alexco commissioned the FMEA workshop to address these concerns using an objective risk-based approach. Following some preparatory work, the FMEA for the DSTF was completed in a workshop on September 24, 2012 at the Whitehorse, Yukon office of Alexco. This report describes the approach to the project and the results.

2 Objective

The overall objective of the FMEA for the Bellekeno Dry Stack Tailings Facility is to evaluate the risks associated with the presence of permafrost in the foundation materials adjacent to the dry stack facility. The objectives of the workshop were to evaluate the likelihood of occurrence and consequences associated with a series of failure modes for the dry stack at the site and to identify high concern issues.

3 The Boundaries of the Risk Assessment

The physical boundaries of the FMEA were the immediate surroundings of the dry stack, however; surface water impacts on facilities downstream of the facility, e.g. Christal Lake, were included. The temporal boundaries included operations as well as long-term considerations, assumed to be about 50 years.

4 FMEA Process

4.1 Preparation

Preparation for the workshop included the following activities:

- Review of site information;
- Identification of workshop participants; and
- Circulation of failure likelihood and severity of consequence descriptions for review by the participants.

4.2 Workshop

The FMEA workshop was held on September 24, 2012 at the Alexco's office in Whitehorse, Yukon. The workshop participants and their affiliations were:

- Brad Thrall, Alexco Resource Corp.;
- Richard Trimble, EBA, a Tetra Tech Company;
- Justin Pigage, EBA, a Tetra Tech Company;
- Kim Winnicky, consultant to First Nation of Na-cho Nyak Dun (NND);
- Bill Slater, consultant to First Nation of Na-cho Nyak Dun (NND);
- Rob McIntyre, Alexco Resource Corp.; and
- Dirk van Zyl, SRK Consulting (Canada) Inc. (facilitator).

As an introduction to the workshop, EBA made a presentation of site conditions. The presentation is provided in Appendix A.

Failure modes were identified, described and discussed during the workshop. A participant described the failure mode and its effect (or manifestation of the failure mode). During this discussion, descriptions were added in the FMEA table for the columns labelled ID, Failure Mode and Consequence Type.

There was open discussion amongst the workshop participants to review and agree on the description of the failure mode and its effects, i.e. reach consensus on the description in the FMEA table for the columns above. Based on this discussion, initial suggestions for the following columns in the FMEA table were made: Likelihood (using the descriptions in Table 1 as guidance) and Consequence Severity (using the descriptions in Table 2 as guidance).

Participants discussed the initial ratings with a view to obtaining consensus on the likelihood, severity, and notes for further consideration. The Risk Rating Descriptive Column was completed using the Risk Matrix in Table 3.

5 FMEA Results

In total, 15 failure modes were identified and discussed at the workshop. The FMEA outcome for the workshop is presented in Table 4.

The cells in Table 4 describing the risks are shaded using the colors in the attached Risk Table (Table 3). The colors indicate the various risks posed by a combination of the likelihood of a failure occurring and the consequence severity of the failure mode if it should occur. For example, dark orange to red correspond to high to very high risk failure modes while the green colors correspond to a low risk failure mode. None of the failure modes identified in the workshop received a high or very high risk rating.

Twelve of the fifteen failure modes identified resulted in a low risk rating (refer to Table 4). Two resulted in medium risk and one in a moderately high risk rating. The failure modes resulting in medium risk ratings are:

- Large differential settlement in the long-term (~50 years) leading to tailings exposure on the surface from compromised covers (environmental consequence).
- Large precipitation event erodes through the surface cover, exposes the tailings resulting in transport of tailings into natural environment (special considerations consequence).

The moderately high risk rating was linked to large differential settlement in the long-term (~50 years) leading to tailings exposure on the surface from compromised cover (special considerations consequence).

The special considerations consequences were identified as being of specific concern to the NND and comments are provided in Table 4 for the further evaluation and mitigation of these, as well as the medium risk associated with the environmental consequences.

Table 1: Likelihood Terminology

Likelihood	Descriptor 2	Frequency Descriptor	Probability of occurrence over twenty years	Probability of occurrence in any one year
Almost Certain	Happens often	High frequency (more than once every 5 years)	98%	17.8%
Likely	Could easily happen	Event does occur, has a history, once every 15 years	75%	6.7%
Possible	Could happen and has happened elsewhere	Occurs once every 40 years	40%	2.5%
Unlikely	Hasn't happened yet but could	Occurs once every 200 years	10%	0.5%
Very Unlikely	Conceivable, but only in extreme circumstances	Occurs once every 1000 years	2%	0.1%

Table 2: Consequence Severity Matrix

Consequence Categories	Low	Minor	Moderate	Major	Critical
1. Environmental Impact	No impact.	Minor localized or short-term impacts.	Significant impact on valued ecosystem component.	Significant impact on valued ecosystem component and medium-term impairment of ecosystem function.	Serious long-term impairment of ecosystem function.
2. Special Considerations	Some disturbance but no impact to traditional land use.	Minor or perceived impact to traditional land use.	Some mitigable impact to traditional land use.	Significant temporary impact to traditional land use.	Significant permanent impact on traditional land use.
3. Legal Obligations	Informal advice from a regulatory agency.	Technical/Administrative non-compliance with permit, approval or regulatory requirement. Warning letter issued.	Breach of regulations, permits, or approvals (e.g. 1 day violation of discharge limits). Order or direction issued.	Substantive breach of regulations, permits or approvals (e.g. multi-day violation of discharge limits). Prosecution.	Major breach of regulation – wilful violation. Court order issued.
4. Consequence Costs	< $100,000	$100,000 - $500,000	$500,000 - $2.5 Million	$2.5-$10 Million	>$10 Million
5. Community/ Media Reputation	Local concerns, but no local complaints or adverse press coverage.	Public concern restricted to local complaints or local adverse press coverage.	Heightened concern by local community, criticism by NGOs or adverse local /regional media attention.	Significant adverse national public, NGO or media attention.	Serious public outcry/demonstrations or adverse International NGO attention or media coverage.
6. Human Health and Safety	Low-level short-term subjective symptoms. No measurable physical effect. No medical treatment.	Objective but reversible disability/impairment and/or medical treatment injuries requiring hospitalization.	Moderate irreversible disability or impairment to one or more people.	Single fatality and /or severe irreversible disability or impairment to one or more people.	Multiple fatalities.

Table 3: Risk Matrix

Likelihood	Consequence Severity				
	Low	Minor	Moderate	Major	Critical
Almost Certain	Moderate	Moderately High	High	Very High	Very High
Likely	Moderate	Moderate	Moderately High	High	Very High
Possible	Low	Moderate	Moderately High	High	High
Unlikely	Low	Low	Moderate	Moderately High	Moderately High
Very Unlikely	Low	Low	Low	Moderate	Moderately High

Table 4: FMEA Results for Bellekeno Dry Stack Tailings

ID	Failure Mode	Consequence Type	Severity	Likelihood	Risk Rating Descriptive	NOTES
1	Large differential settlement in the long-term (~50 years) leading to tailings exposure on surface from compromised cover.	Env. Imp.	Minor	Likely	Moderate	Check for other examples in the district for settling. Look at additional modeling with real data.
2	Large differential settlement in the long-term (~50 years) leading to tailings exposure on surface from compromised cover.	Spec. Cons.	Moderate	Likely	Moderately High	Check for other examples in the district for settling. Look at additional modeling with real data. Cover maintenance.
3	Large differential settlement in the long-term (~50 years) leading to breach of liner/drainage blanket/containment system resulting in contamination of localized GW from tailings porewater.	Env. Imp.	Minor	Unlikely	Low	
4	Large differential settlement in the long-term (~50 years) leading to breach of liner/drainage blanket/containment system resulting in upwelling of GW/melt water into the tailings resulting in slope instability	Env. Imp.	Minor	Very Unlikely	Low	
5	Large differential settlement in the long-term (~50 years) leading to breach of liner/drainage blanket/containment system resulting in contamination of surface water (i.e. Christal Lake)	Env. Imp.	Minor	Very Unlikely	Low	Took into account present state of Christal Lake.
6	Large precipitation event erodes through surface cover, exposes tailings resulting in transport of tailings into natural environment	Env. Imp.	Minor	Unlikely	Low	
7	Large precipitation event erodes through surface cover, exposes tailings resulting in transport of tailings into natural environment	Spec. Cons.	Moderate	Unlikely	Moderate	Mitigate by cleaning up the tailings released during the large precipitation event.
8	Poor cover performance (vegetation, other) leads to increased infiltration and increased pore water transport resulting in metals migration	Env. Imp.	Minor	Unlikely	Low	
9	Metals uptake in soil cover vegetation leads to introduction into food chain and human health impacts	Human H&S	Low	Unlikely	Low	Used guidance from Env. Impact to rate.
10	Metals uptake in soil cover vegetation leads to introduction into food chain and human health impacts	Spec. Cons.	Minor	Unlikely	Low	
11	Earthquake larger than design event leads to slope failure resulting in exposure of tailings long-term	Env. Imp.	Minor	Very Unlikely	Low	
12	Earthquake larger than design event leads to slope failure resulting in exposure of tailings long-term	Spec. Cons.	Moderate	Very Unlikely	Low	
13	Modeling has underestimated the foundation pore pressures leading to slope failure and exposure of tailings long-term	Env. Imp.	Minor	Very Unlikely	Low	
14	Failure to follow OMS manual leads to stack not performing to design, resulting in environmental impacts	Env. Imp.	Minor	Unlikely	Low	OMS in place, 3rd party QA/QC every 6 weeks.
15	Dust migration from DSTF leads to (i.e. temporary closure, construction, not following OMS) environmental impacts	Env. Imp.	Minor	Unlikely	Low	OMS in place, 3rd party QA/QC every 6 weeks.

This final draft report, "Bellekeno Mine - Failure Modes and Effects Analysis", was prepared by SRK Consulting (Canada) Inc.

Dirk van Zyl

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Principal Consultant (Associate)

and reviewed by

Cam Scott, P.Eng.
Principal Consultant

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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The opinions expressed in this report have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

Appendix A: Introductory PowerPoint Presentations

DSTF Risk Assessment

- Introductions
- Participants
- Objectives
- Risk Assessment Process Overview
- DSTF Overview
- DSTF Risk Assessment

Keno District Timeline

- **2005** Company Founded
- **2006** Acquired Keno Hill Silver District, Care maintenance change over
- **2007** District wide closure plan studies begins
- **2008** Advanced exploration/development Bellekeno
- **2009** QML Granted - Bellekeno Construction Begins
- **2010** Comprehensive Cooperation Agreement with FNNND
- **2010** Water License Granted – mill/DSTF commissioned
- **2011** Commercial Production – Bellekeno mine/mill
- **2012** Lucky Queen/ Onek new mine development, YESAB/QML

Dry Stack Tailings Technology

- **Advantages**
  - Reduced makeup water – increased recycle
  - Progressive reclamation enhanced
  - Decreased footprint from higher compaction, stack heights
  - Higher geotechnical stability if constructed appropriately
  - Pore water seepage significantly reduced – groundwater contamination eliminated if operated appropriately

Dry Stack Tailings Technology

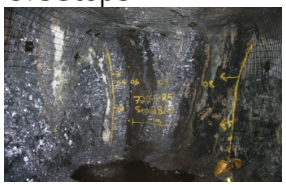
- **Disadvantages**
  - Increased capital and operating costs
  - Increased process bottlenecks – decreased operating flexibility
  - Potential dust migration due to lower moisture content

Mill Area Layout



Mill Process Flowsheet

Underground Ore Stope



Drill/Blast Ore



Load Ore



Ore Haulage



ing

Crushing



Grinding

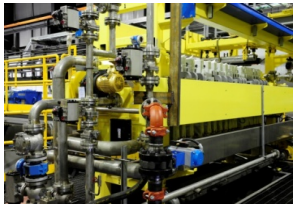


Classification





Thickening/Filtration



Concentrate Storage



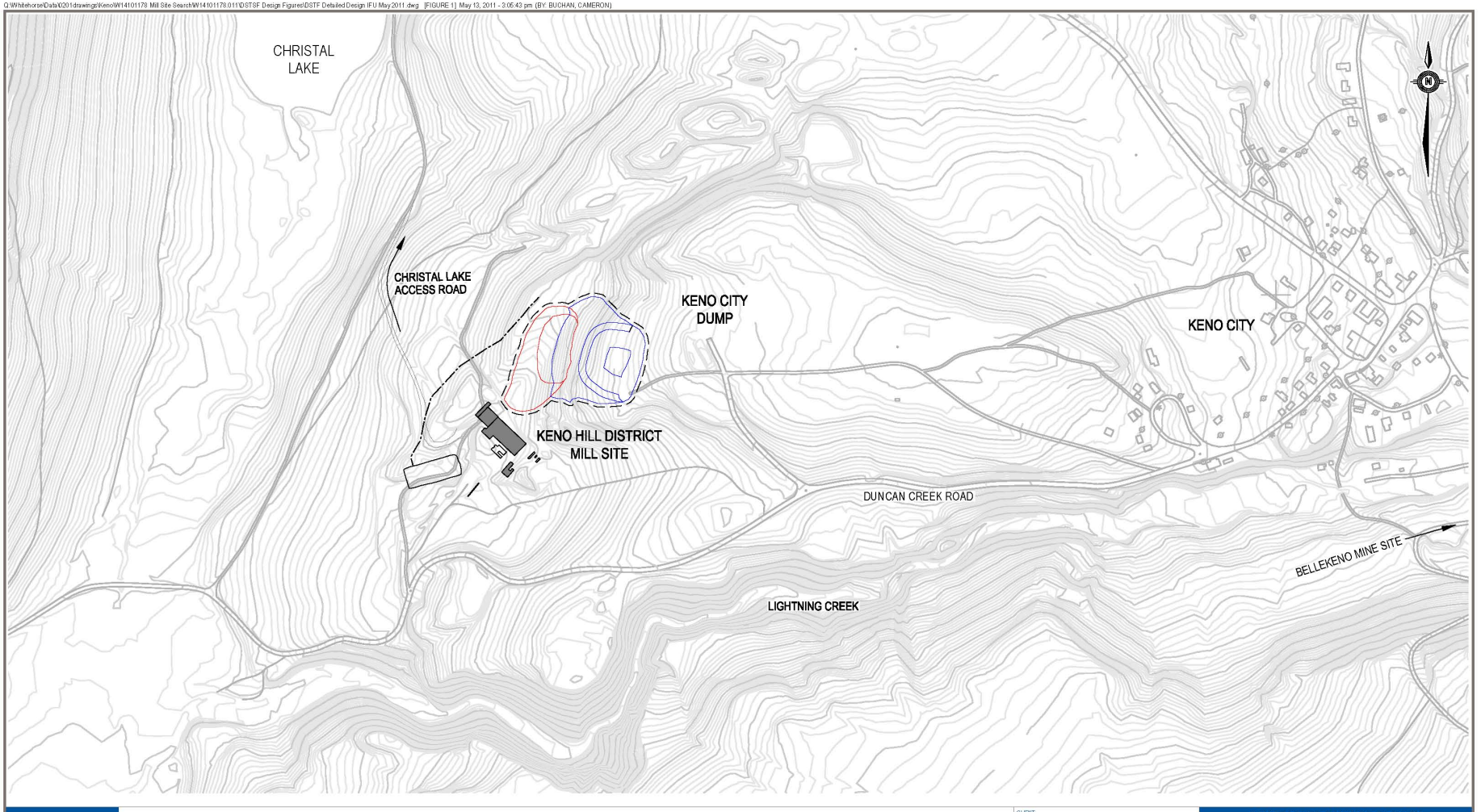
Concentrate Shipment (Ag, Pb, Zn)



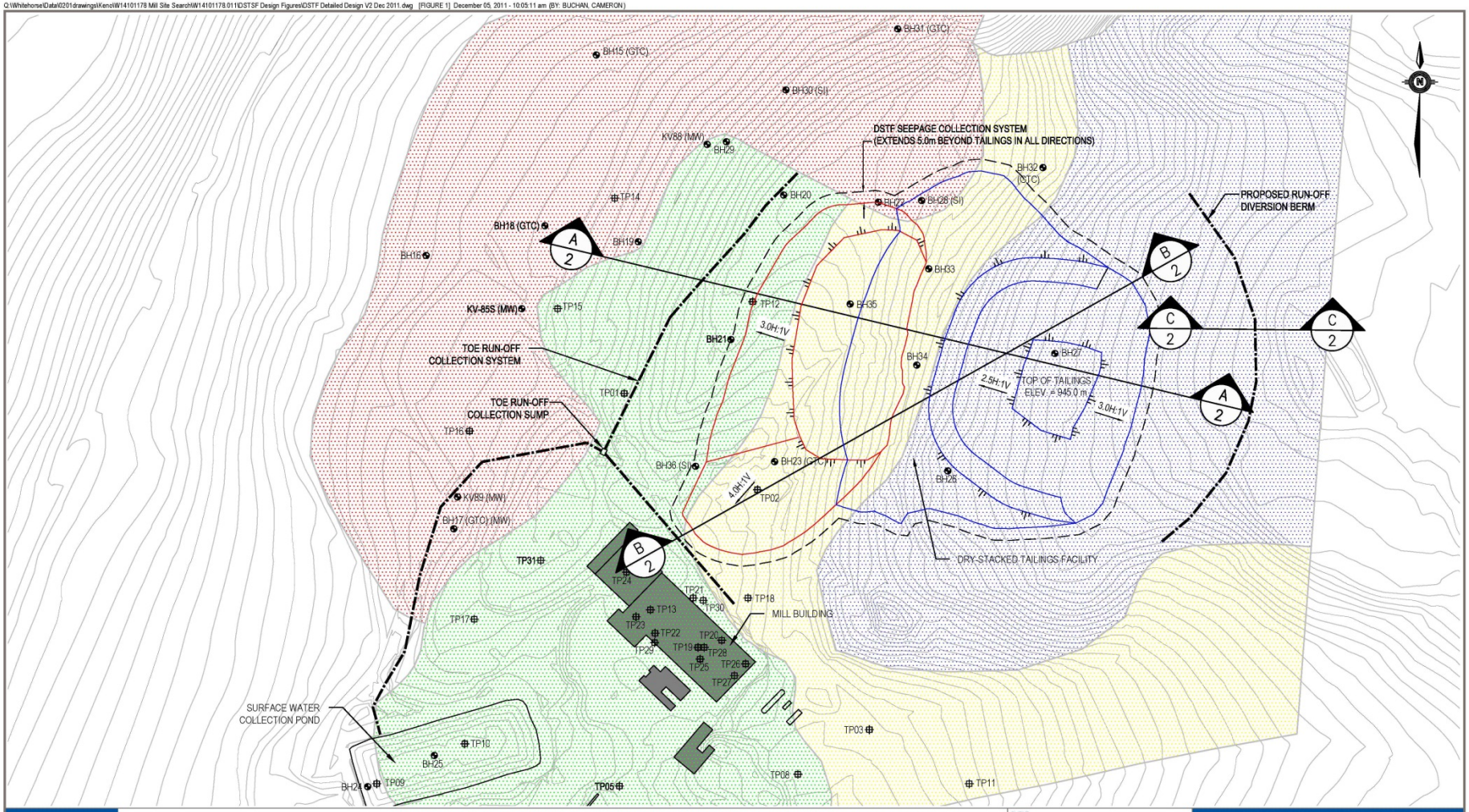


Dry Stack Tailings Storage

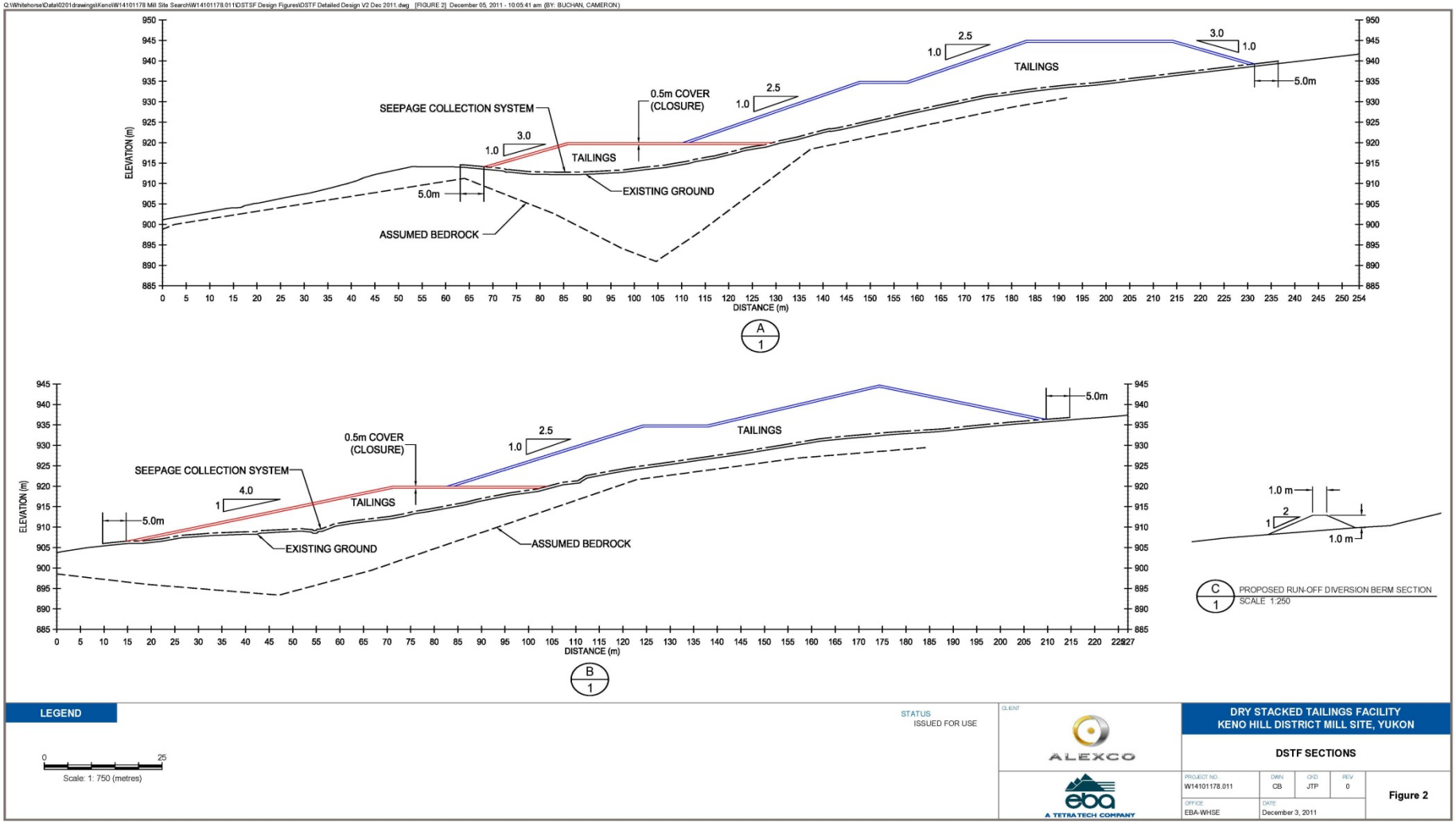
DSTF Design


Q:\Whitehorse\Data\2012drawings\Keno\W14101178 Mill Site Search\W14101178.011\DSTSF Design Figures\DSTF Detailed Design IFU May 2011.dwg [FIGURE 1] May 13, 2011 - 2:05:43 pm (BY: BUCHAN, CAMERON)
CHRISTAL LAKE
CHRISTAL LAKE ACCESS ROAD
KENO CITY DUMP
KENO CITY
KENO HILL DISTRICT MILL SITE
DUNCAN CREEK ROAD
BELLEKENO MINE SITE
LIGHTNING CREEK
N
LEGEND
0
250
Scale: 1: 5 000 (metres)
STATUS
ISSUED FOR USE
CLIENT
ALEXCO
DRY STACKED TAILINGS FACILITY
KENO HILL DISTRICT MILL SITE, YUKON
SITE LOCATION PLAN
PROJECT NO.
W14101178.011
DWN
CB
CKD
JTP
REV
0

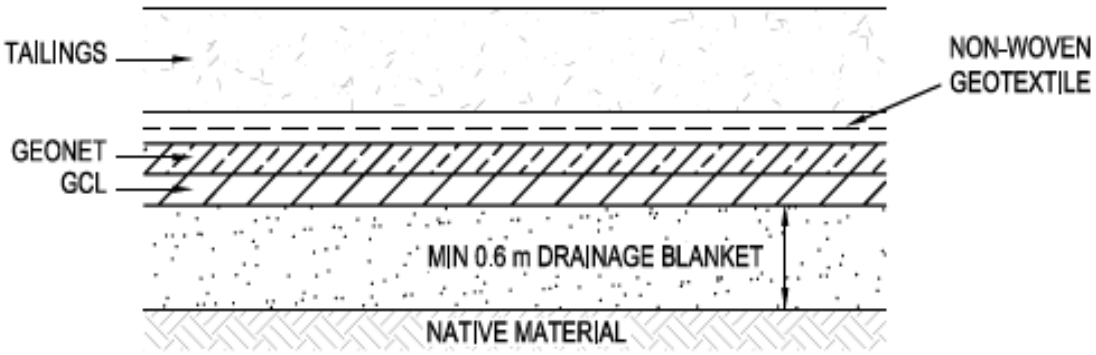
DSTF Design


Q:\Whitehorse\Data\0201drawings\Keno\W14101178 Mill Site Search\W14101178.011\DSTSF Design Figures\DSTF Detailed Design V2 Dec 2011.dwg [FIGURE 1] December 05, 2011 - 10:05:11 am (BY: BUCHAN, CAMERON)
BH31 (GTC)
BH15 (GTC)
BH30 (SI)
KV88 (MW)
BH29
DSTF SEEPAGE COLLECTION SYSTEM
(EXTENDS 5.0m BEYOND TAILINGS IN ALL DIRECTIONS)
BH32 (GTC)
PROPOSED RUN-OFF DIVERSION BERM
TP14
BH20
BH22
BH28 (SI)
BH18 (GTC)
BH19
BH16
BH33
KV-85S (MW)
TP15
TP12
BH35
3.0H:1V
BH21
TOE RUN-OFF COLLECTION SYSTEM
BH34
BH27
2.5H:1V
TOP OF TAILINGS ELEV. = 945.0 m
3.0H:1V
TP01
TOE RUN-OFF COLLECTION SUMP
TP16
BH36 (SI)
BH23 (GTC)
BH26
4.0H:1V
TP02
KV89 (MW)
BH17 (GTC) (MW)
DRY-STACKED TAILINGS FACILITY
TP31
TP24
TP21
TP18
TP13
TP30
MILL BUILDING
TP17
TP23
TP22
TP20
TP19
TP28
TP29
TP25
TP26
TP27
SURFACE WATER COLLECTION POND
TP10
TP03
BH25
BH24
TP09
TP05
TP08
TP11
A 2
B 2
C 2
N
LEGEND
- BOREHOLE LOCATION (CONFIRMATORY DRILLING)
- TESTPIT LOCATION
- GRAVEL
- MASSIVE ICE
- ICE RICH SILT TILL
- SHALLOW BEDROCK
STATUS
ISSUED FOR USE
0
50
Scale: 1: 1 500 (metres)
CLIENT
ALEXCO
DRY STACKED TAILINGS FACILITY
KENO HILL DISTRICT MILL SITE, YUKON
SITE PLAN SHOWING BOREHOLE LOCATIONS AND ASSUMED SUBSURFACE CONDITIONS
eba
A TETRA TECH COMPANY
PROJECT NO.
W14101178.011
DWN
CB
CKD
JTP
REV
0
OFFICE
EBA-WHSE
DATE
December 3, 2011
Figure 1

DSTF Design

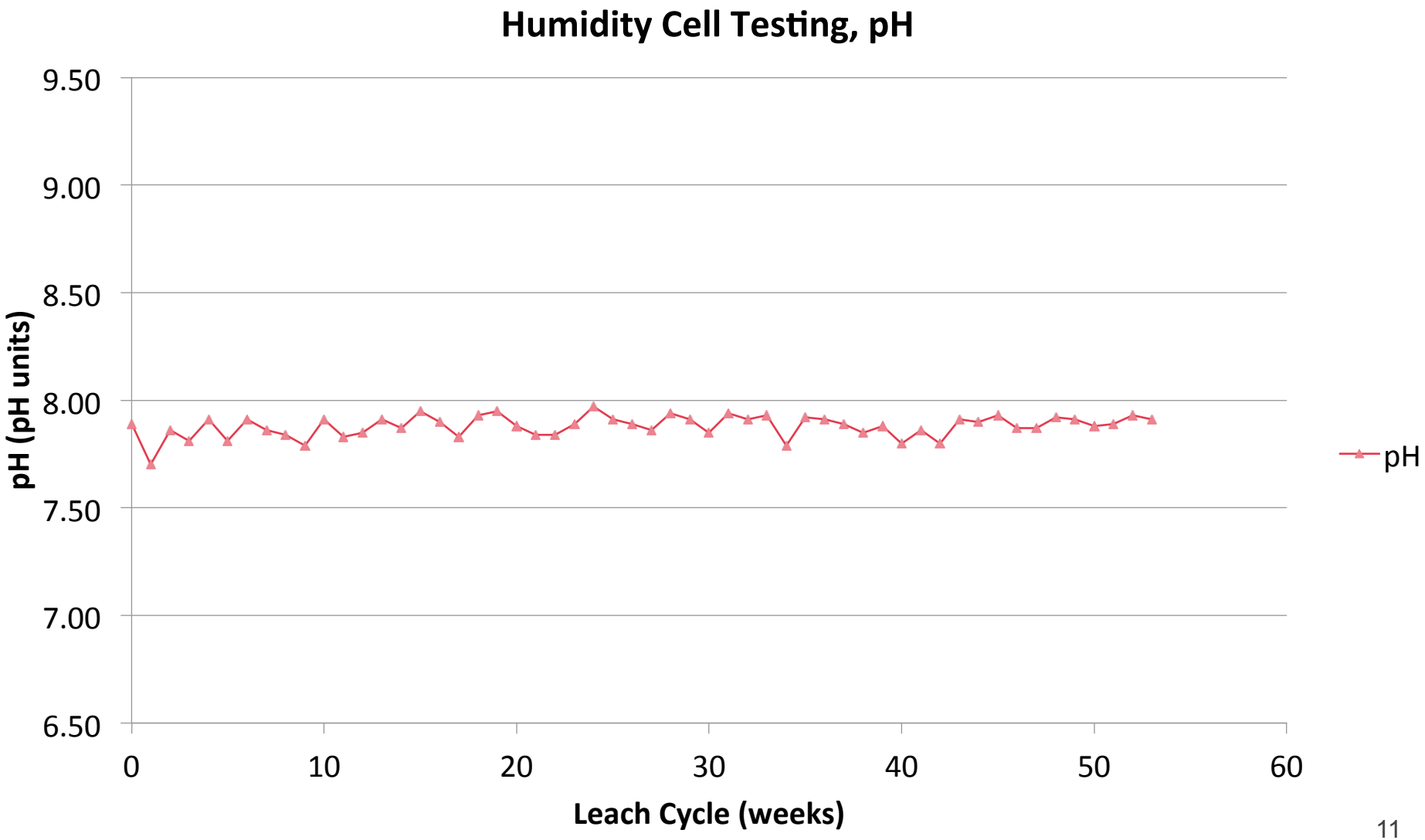

Q:\Whitehorse\Data\0201drawings\Keno\W14101178 Mill Site Search\W14101178.011\DSTSF Design Figures\DSTF Detailed Design V2 Dec 2011.dwg [FIGURE 2] December 05, 2011 - 10:05:41 am (BY: BUCHAN, CAMERON)
ELEVATION (m)
DISTANCE (m)
SEEPAGE COLLECTION SYSTEM
0.5m COVER (CLOSURE)
TAILINGS
EXISTING GROUND
ASSUMED BEDROCK
5.0m
2.5
1.0
3.0
1.0
4.0
1
A
1
B
1
C
1
1.0 m
2
PROPOSED RUN-OFF DIVERSION BERM SECTION
SCALE 1:250
LEGEND
Scale: 1: 750 (metres)
STATUS
ISSUED FOR USE
CLIENT
ALEXCO
A TETRA TECH COMPANY
DRY STACKED TAILINGS FACILITY
KENO HILL DISTRICT MILL SITE, YUKON
DSTF SECTIONS
PROJECT NO. W14101178.011
DWN CB
CKD JTP
REV 0
OFFICE EBA-WHSE
DATE December 3, 2011
Figure 2

DSTF Design

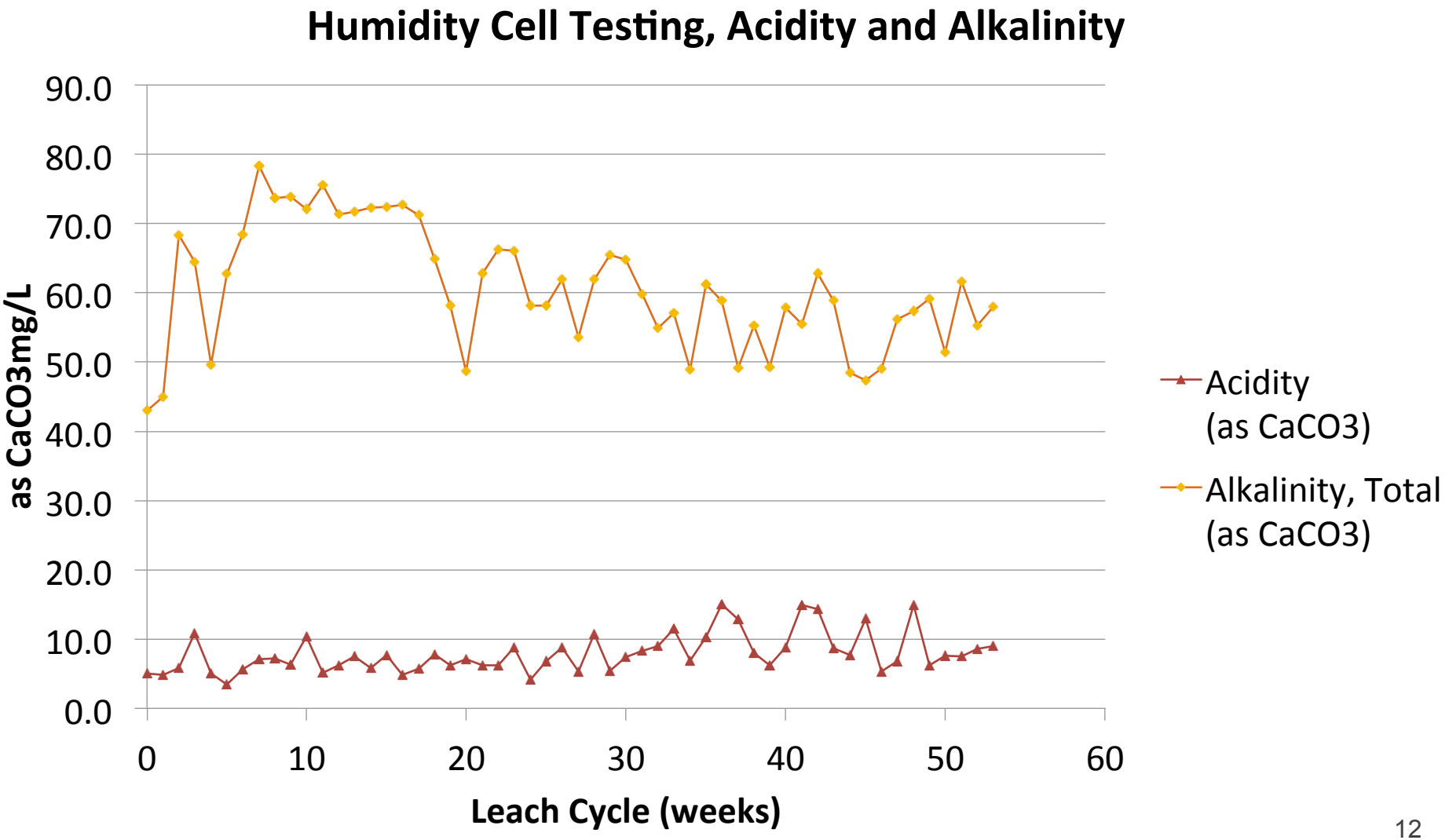


SEEPAGE COLLECTION SYSTEM DETAIL

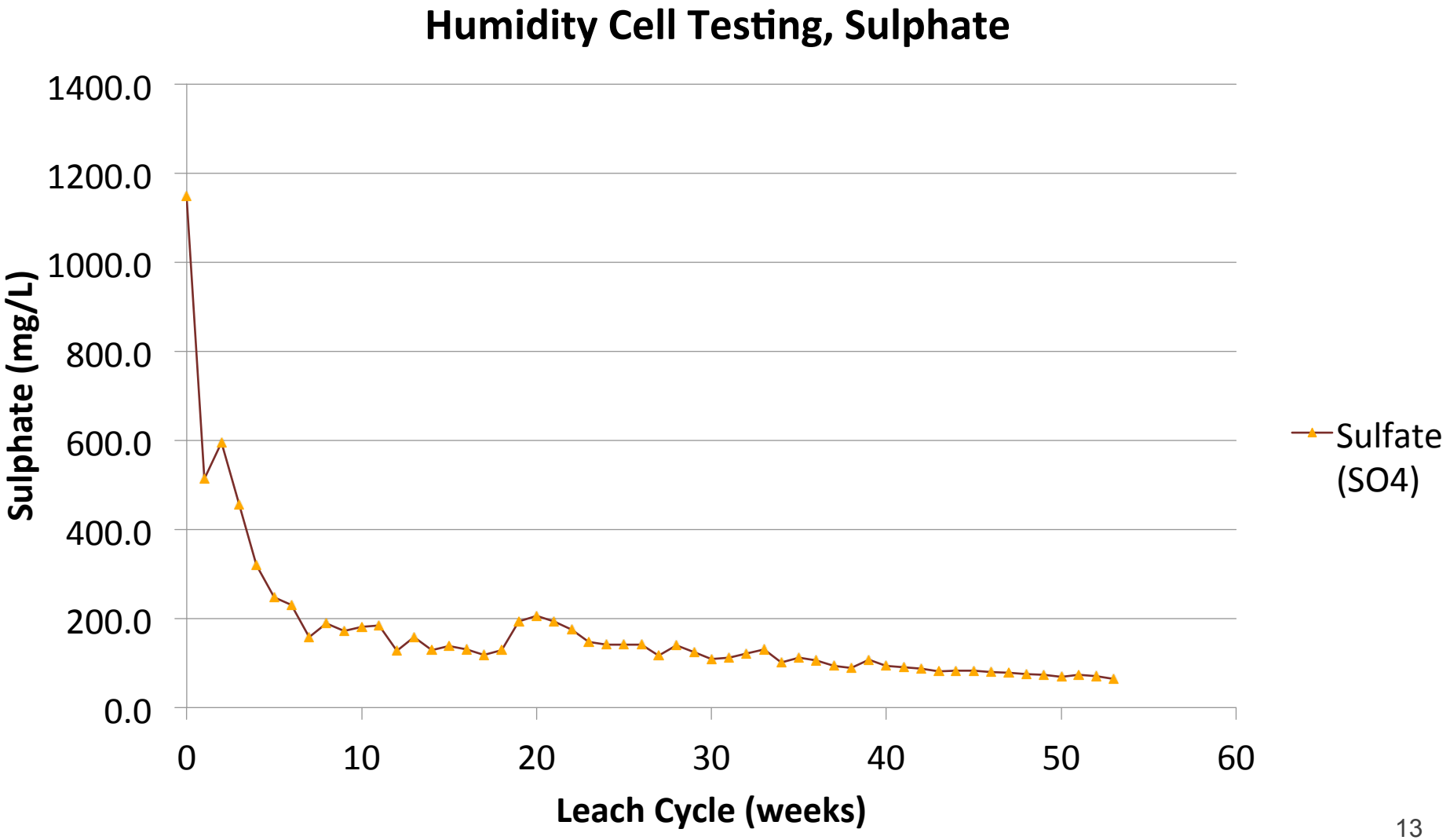
DSTF Performance



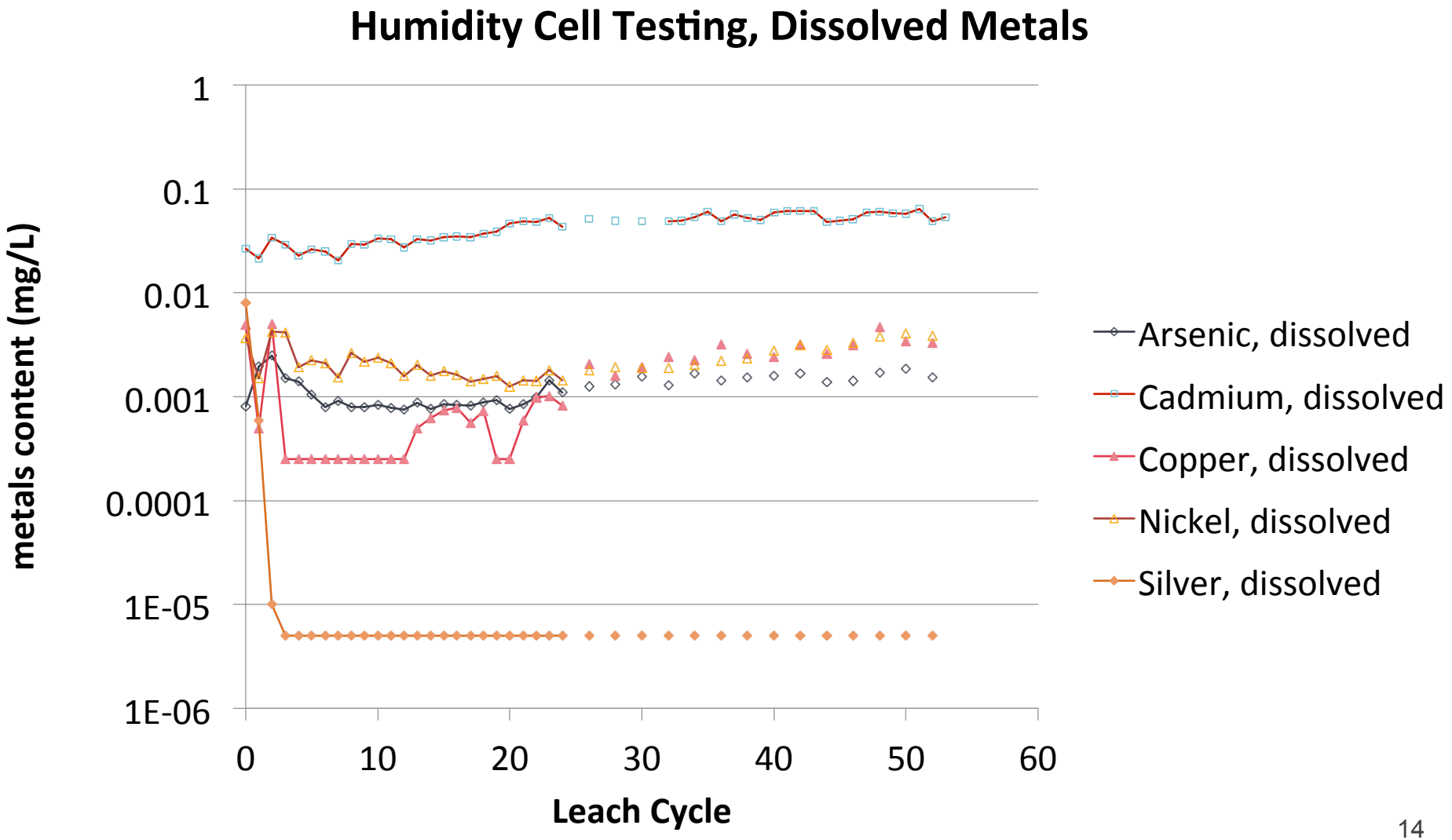
DSTF Performance



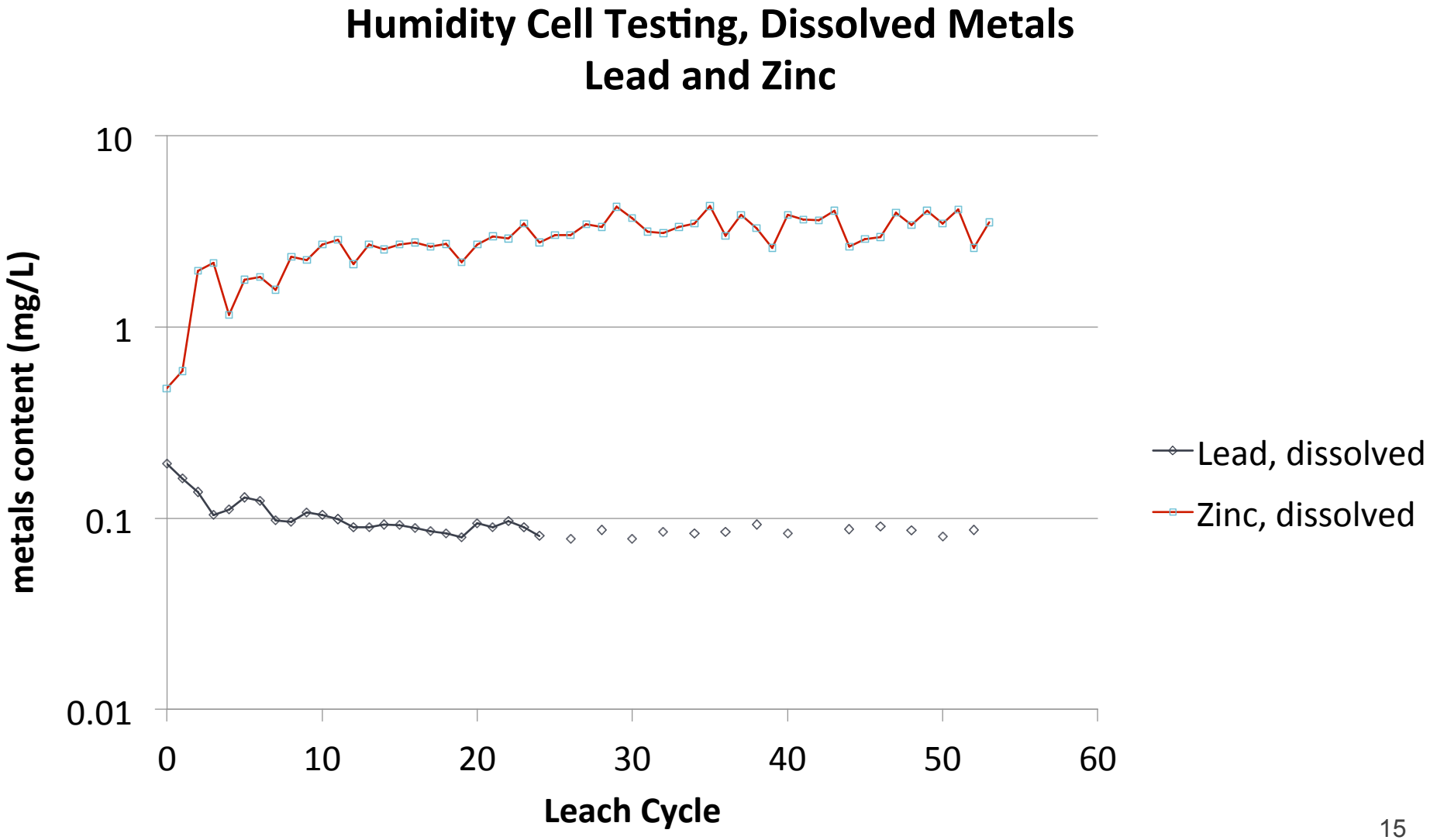
DSTF Performance



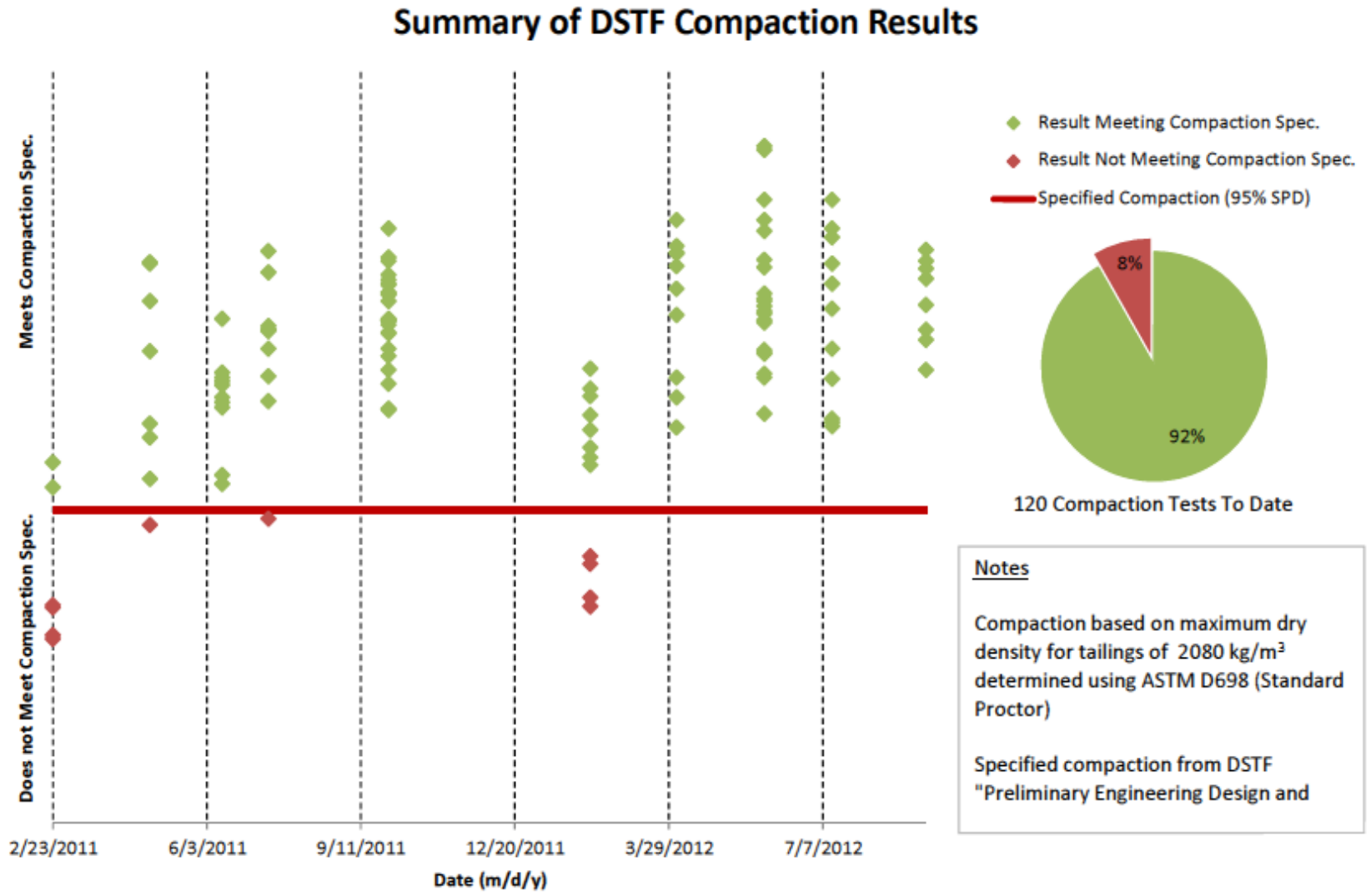
DSTF Performance



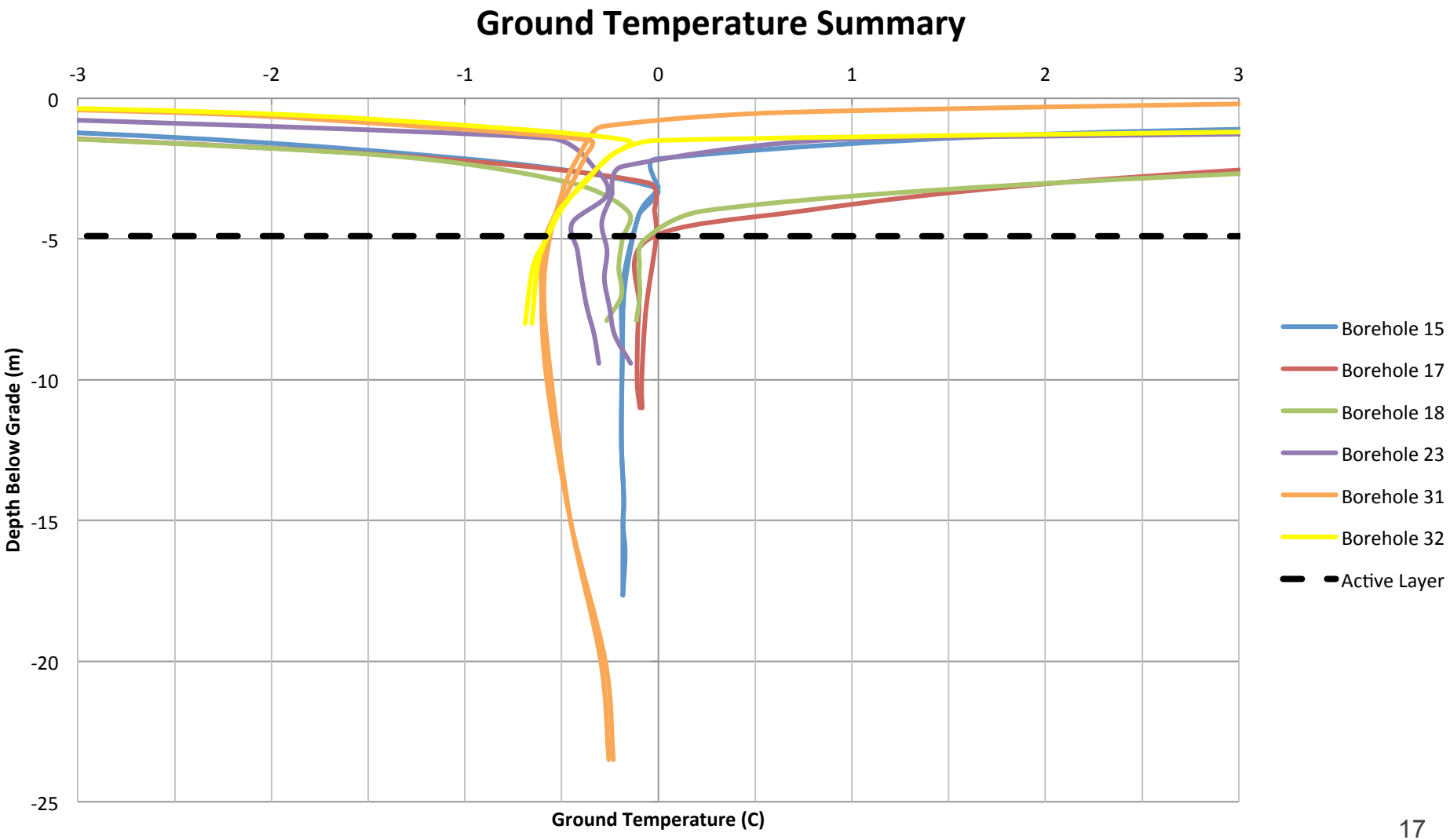
DSTF Performance



DSTF Performance - Compaction



DSTF Performance - Temperature



DSTF Progressive Reclamation



DSTF Progressive Reclamation



DSTF Progressive Reclamation

ALEXCO

