KENO HILL SILVER DISTRICT MINING OPERATIONS

WATER MANAGEMENT PLAN

September 2017

Prepared for:

ALEXCO KENO HILL MINING CORP.

TABLE OF CONTENTS

LIST OF FIGURES

Appendices

1 INTRODUCTION

1.1 PURPOSE OF PLAN

The Water Management Plan was originally submitted to fulfill the conditions set out in Part H, Clause 74 of Water Licence QZ09-092 issued to Alexco Keno Hill Mining Corp (AKHM) on August 19th, 2010. A revised Water Management Plan was prepared for the Yukon Water Board to include the Onek and Lucky Queen Mines. This updated plan outlines the methodology that will be followed to comply with the requirements of the water licence for the Bellekeno, Onek and Lucky Queen Mines and District Mill for AHKM's Keno Hill Silver District Mining Operations and to include the proposed features for the Flame and Moth and Bermingham Mines.

2 LOCATION AND DESCRIPTION

The Keno Hill Silver District (KHSD) is located in central Yukon (63° 54' 32" N, 135° 19’ 18” W; NTS 105M/14 & 105M/13) approximately 354 km due north of Whitehorse. Access to the property is via the Alaska, Klondike and Silver Trail Highways from Whitehorse to Mayo (407 km) and an all-weather gravel road northeast from Mayo to Elsa (45 km); a total distance of 452 km.

The KHSD is located on and around Galena Hill, Keno Hill and Sourdough Hill which. The property lies along the broad South McQuesten River valley with the three prominent hills to the south of the valley. The existing Bellekeno Mine is located approximately 3 km east of Keno City. Lucky Queen is located approximately 4 km northeast of Keno City, Bermingham is located approximately 7 km west of Keno City and Onek is situated about 500 m northeast of Keno City. The Keno District Mill and associated Dry Stack Tailings Facility (hereinafter referred to as the “DSTF”) are located approximately 1 km west of Keno City on the Flame and Moth property.

3 WATER MANAGEMENT PROTOCOLS

Protocols for decision making on water management have been developed and are summarized in the following section.

3.1 BELLEKENO MINE WATER REQUIREMENTS

Water use requirements for the Bellekeno Mine are currently supplied from the recharge to the underground mine pool. Makeup water is also available and permitted for withdrawal from Lightning Creek and Thunder Gulch as well as Bellekeno 625 treatment facility decant water at a rate of up to 245.5 m^3/day. Groundwater seepage through bedrock and vein fractures is collected in the Bellekeno Mine and is pumped to surface for treatment and release. A certain portion of the underground mine pool water is used for various mine development and operations requirements including equipment operation and paste backfill. The overall Bellekeno mine water balance presented is shown in Figure 1.

There may be instances and operational requirements to use water from other permitted sources (i.e. Lightning Creek, Thunder Gulch, Bellekeno 625 treated decant) instead of or in addition to the primary source of the underground mine pool.

Variations in water quality from the underground mine pool may necessitate withdrawing water from Lightning Creek rather than the underground mine pool. As an example, poor settling of suspended solids underground may limit the use of the underground mine pool water for equipment use due to potential damage of mechanical systems. Enhanced total suspended solids (TSS) settling in the surface ponds at Bellekeno 625 would be utilized to continue to treat and discharge to compliant levels but a lack of makeup water from high TSS underground could result in the use of Lightning Creek instead of the underground mine pool water.

Similar to the example of TSS, high ammonia in the underground mine pool from excessive recirculation may result in direct pumping to surface where enhanced ammonia reduction can occur. Additional make up water from Lightning Creek or Thunder Gulch could be required under this scenario.

Operational changes underground may result in an extended period where mine pool water is not available for reuse and the need for withdrawal from Lightning Creek or Bellekeno 625 treated decant would be required. As an example, construction of larger underground sumps would result in the loss of makeup water for a period of time when the new sump is filling before a new decant pump can be installed. During this period, water from either Bellekeno 625 decant or Lightning Creek would be used to supplement mine operations requirements.

The combined water sourcing rate from Lightning Creek for Bellekeno Mine, Onek Mine and District Mill will not exceed the currently licenced maximum rate of 245 m^3/day licenced under QZ09-092.

In terms of protocols and decision making, the Mine Manager is the primary person responsible for determining if these types of operational changes would require alternative water sources. In conjunction with support from Alexco's environmental department professionals, the decision would then be made to either withdraw water from Lightning Creek or Bellekeno 625 decant.

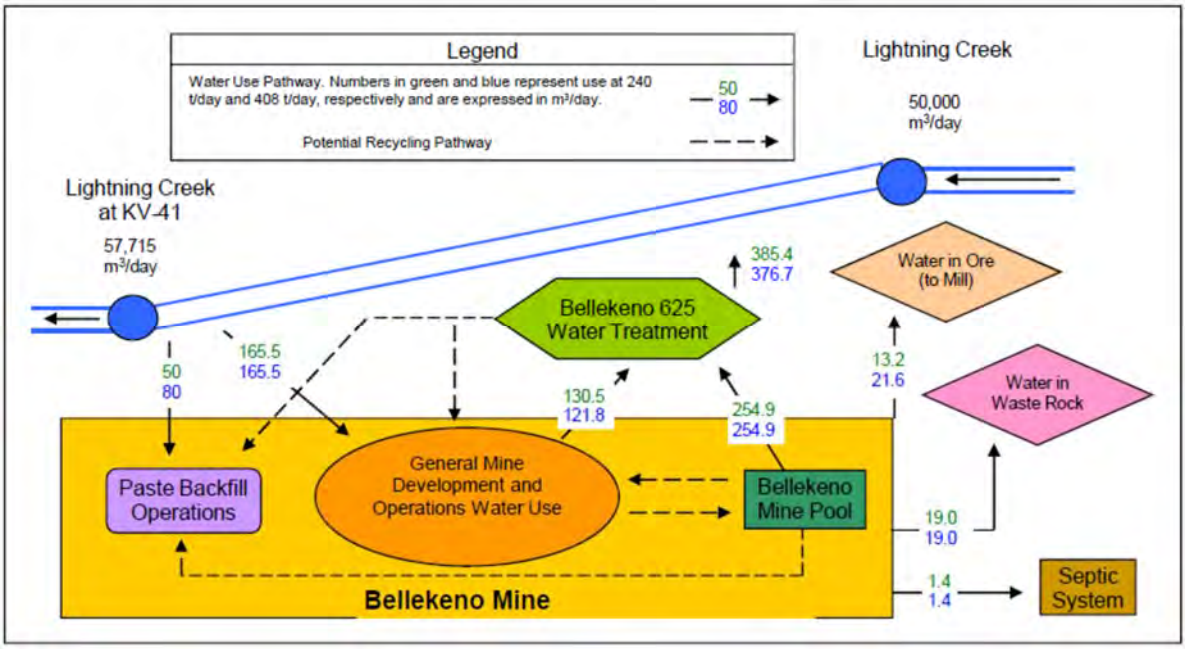


Figure 1 Bellekeno Water Balance Schematic

3.2 BERMINGHAM MINE WATER REQUIREMENTS

The proposed Bermingham underground development and production will require up to 140.1 m^3/day which includes a contingency of 25%. Daily water usage during ongoing underground mine development and operation is estimated at 112.5 m^3/day when mining at an estimated maximum rate of 400 tpd. This water will be used to support activities including percussion drilling, dust suppression, equipment cooling and minor use for sanitation. The surface water management structures for Bermingham include a storage pond, diversion ditches and a water treatment plant.

Reused process water from the underground workings will be the primary source of water for Berminham mine to the greatest degree possible. This water will be supplemented by water sourced from groundwater encountered in the underground workings and any additional water initially will be sourced from the a well. Water will be pumped out of the workings from an underground settling sump into the proposed water treatment plant There it will be treated to meet the proposed standards. Water with then be discharged to a receiving pond prior to be discharged to ground.

Variations in water quality in the reused water from the underground workings may necessitate using the a groundwater well or treated water for the proposed water treatment plant in addition to the reuse of water from underground. For example, poor settling of suspended solids in the underground sumps may limit the use of this water with equipment due to potential damage of mechanical systems. Makeup water could then be sourced from the well or the proposed water treatment plant in this situation.

Operational changes underground may also result in an extended period where water used in the underground workings is not available for reuse. Water from the well or treated water for the proposed water treatment plant would be used to supplement mine operations requirements in these cases.

In terms of protocols and decision-making, the Mine Manager is the primary person responsible for determining if certain scenarios would require alternative water sources. In conjunction with Alexco's environmental department professionals the decision would then be made to withdraw water from the mill supply well or use water from the proposed water treatment plant.

3.3 DISTRICT MILL SITE WATER REQUIREMENTS

There may be operational or water quality changes that necessitate mill makeup water coming from sources other than Galkeno 900 treatment facility discharge or the mill pond. The mill water balance schematic is shown in Figure 2.

The two primary sources of water usage for mill makeup water are the Mill well and surface runoff collected in the mill pond. Surface water collected in the mill pond is generally only an option in the early spring – late fall period when active runoff is available. Alternative sources of mill makeup water other than these two sources may be necessary based on various operating conditions and changes. These potential conditions and changes include but are not limited to:

- Change in process water chemistry requiring alternative makeup water chemistry. There may be times when the water in the mill pond requires treatment and release due to buildup of metals or pH fouling from excessive recycling. Treatment and release in accordance with current effluent quality standards under QZ09-092 would be conducted and fresh water from other sources would then be used to make up the volume released.
- Sludge generated in the Galkeno 900 lined treatment pond may inadvertently be collected in the vacuum truck and transported to the mill pond. If this occurs, an alternative location may be required.
- Icing conditions on the surface of the Galkeno 900 treatment pond may create liner damage if water removed from the pond for mill makeup requirements drops the ice layer on top of the liner.
- Reduced flow from the Galkeno 900 adit which could result in insufficient volumes to supply mill makeup water requirements.
- Insufficient surface runoff into the mill pond to provide makeup water.

In the event of these potential operations changes, alternative assessed water sources may be used to supply mill makeup water. Alternative water sources include Christal Lake, shallow groundwater wells (currently installed) down gradient of the mill and Bellekeno 625 treated water. In these examples, the Mill Manager would be in consultation with support from Alexco's environmental department professionals and a determination made if alternative water sources need to be used or developed.

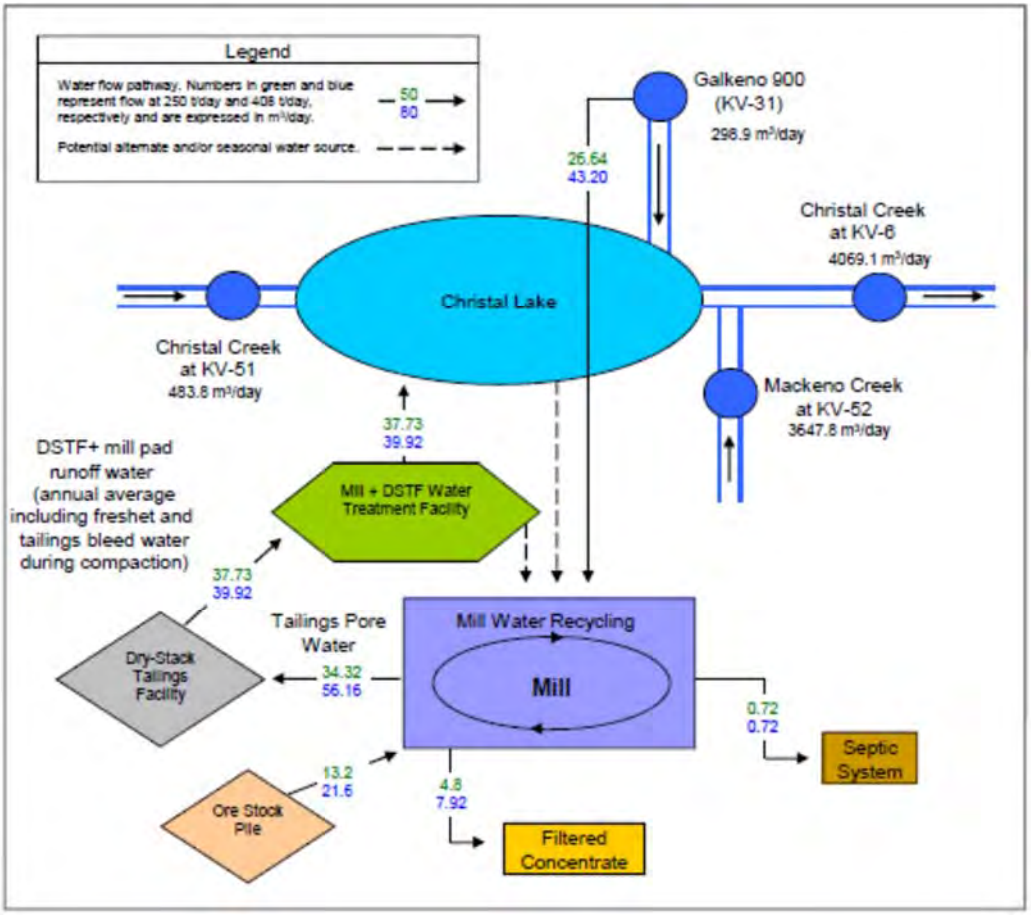


Figure 2 District Mill Water Balance Schematic

3.4 FLAME AND MOTH MINE WATER REQUIREMENTS

The proposed Flame and Moth underground development and production will require up to 140.1 m^3/day which includes a contingency of 25%. Daily water usage during ongoing underground mine development and operation is estimated at 112.5 m^3/day when mining at an estimated maximum rate of 400 tpd. This water will be used to support activities including percussion drilling, dust suppression, equipment cooling and minor use for sanitation. The site infrastructure and water management structures for Flame and Moth are shown on Figure 3.

Reused process water from the underground workings will be the primary source of water for Flame and Moth mine to the greatest degree possible. This water will be supplemented by water sourced from groundwater encountered in the underground workings and any additional water initially will be sourced from the well supplying the Mill which currently is licenced at a rate of 81 m^3/day. Water will be pumped out of the workings from an underground settling sump into the proposed water treatment plant located within and adjacent to the District Mill. There it will be treated to meet the proposed standards. If further ammonia treatment is required, it will be sent for an additional water treatment step. Water with then be discharged to a receiving pond prior to be discharged to ground. The overall Flame and Moth Mine water management schematic is presented in Figure 3.

Variations in water quality in the reused water from the underground workings may necessitate using the mill supply well or treated water for the proposed water treatment plant in addition to the reuse of water from underground. For example, poor settling of suspended solids in the underground sumps may limit the use of this water with equipment due to potential damage of mechanical systems. Makeup water could then be sourced from mill supply well or the proposed water treatment plant in this situation.

Operational changes underground may also result in an extended period where water used in the underground workings is not available for reuse. Water from the mill supply well or treated water for the proposed water treatment plant would be used to supplement mine operations requirements in these cases.

In terms of protocols and decision-making, the Mine Manager is the primary person responsible for determining if certain scenarios would require alternative water sources. In conjunction with Alexco's environmental department professionals the decision would then be made to withdraw water from the mill supply well or use water from the proposed water treatment plant.

Surface Water Quality Station
Current DSTF
Phase 1 DSTF Footprint
Proposed Feature
Proposed Mill Pond
Structures Footprint

Existing Building
Proposed Building
Diffuser
Pipeline

Proposed DSTF Access Road
Existing Diversion Ditch
Proposed Diversion Ditch
Watershed Boundaries
Alternate Flow Direction
Flow Direction

Satelite imagery obtained from Yukon Geomatics map service http://mapservices.gov.yk.ca/ArcGIS/services on November 2017

Datum: NAD 83; Projection: UTM Zone 8N

AKHM

AEG

KENO HILL SILVER DISTRICT MINING OPERATIONS

FIGURE 5-6

FLAME AND MOTH WATER MANAGEMENT

NOVEMBER 2017

D:\Project\AllProjects\Keno_Area_Mines\FM\Map\02_Permit\WUL_2016\Fig5-6_Water_Management_Pipeline_Ltr_20161221.mxd
(*Last edited by: mheynen; 11/6/2017/12:37 PM*)

3.5 ONEK 990 WATER REQUIREMENTS

Onek underground development and production will require up to 112.5 m^3/day which includes a contingency of 25%. Daily water usage during ongoing underground mine development and operation is estimated at 90 m^3/day when mining at an estimated maximum rate of 300 tpd. This water will be used to support activities including percussion drilling, dust suppression, equipment cooling and minor use for sanitation. The site infrastructure and water management structures for Onek are shown on Figure 4.

Reused process water from the underground workings will be the primary source of water for Onek 990 to the greatest degree possible. This water will be supplemented by water sourced from meteoric infiltration into the underground workings and any additional water initially will be sourced from Lightning Creek at rate up to 90 m^3/day which is less than the currently licenced rate in WUL QZ09-092 of 245.5 m^3/day. Water may be pumped out of the workings and stored in a water storage pond (225 m^3) located at the 990 portal pad. If there is excess water in the pond at the Onek 990 portal and the water meets effluent quality standards it may be discharged to ground. If the water does not meet effluent quality standards, then it will be trucked to the Keno District Mill or Bellekeno water treatment plant. There it will be treated to meet standards and discharged. The overall Onek Mine water balance schematic is presented in Figure 5.

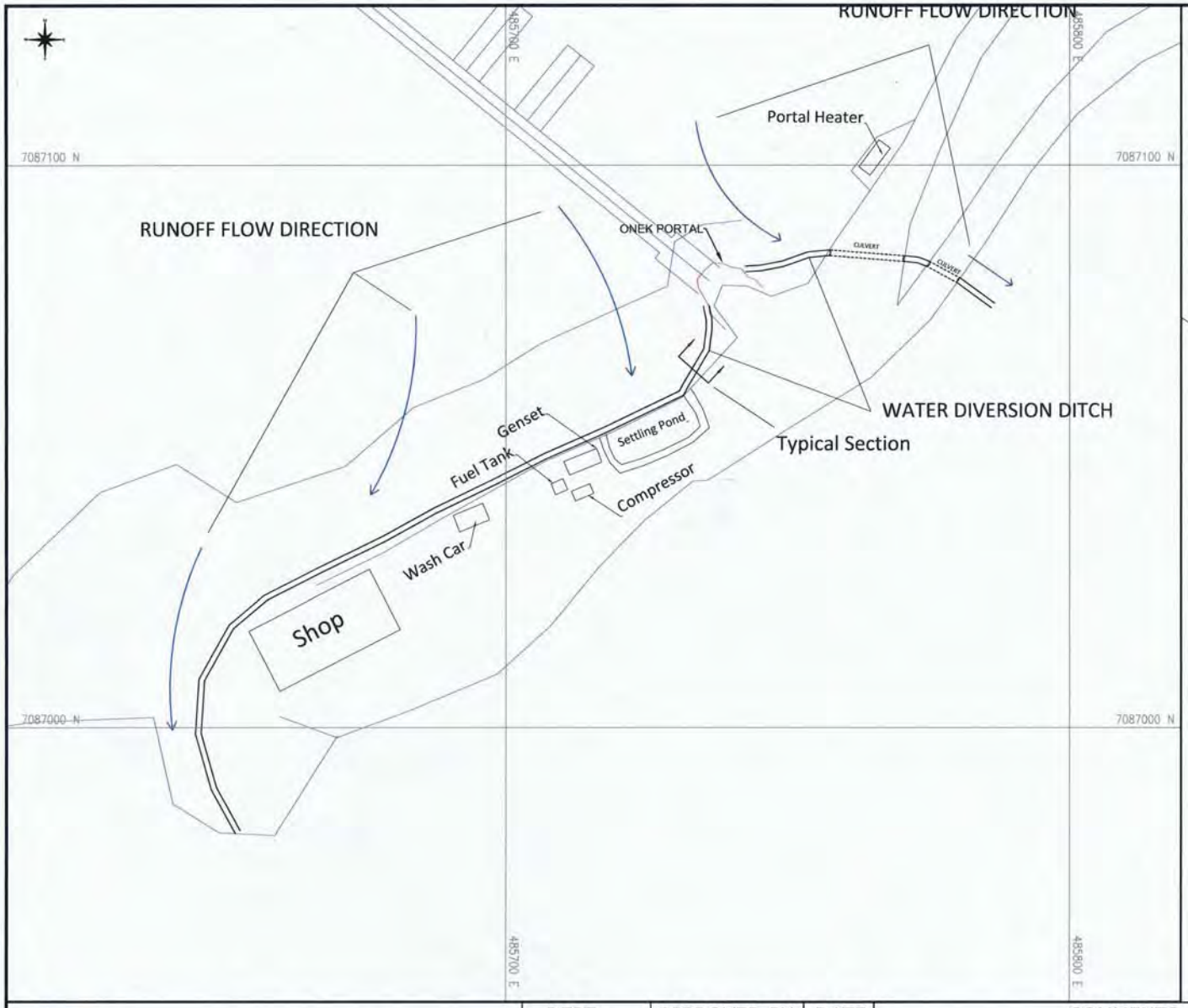
Variations in water quality in the reused water from the underground workings may necessitate withdrawing water from Lightning Creek rather in addition to the reuse of water from underground. For example, poor settling of suspended solids in the small temporary water collection pond and water storage ponds may limit the use of this water with equipment due to potential damage of mechanical systems. Reused water may necessitate longer residences in the storage ponds to allow for settlement of sediments. Makeup water could then be sourced from Lightning Creek in this situation.

Similar to the example of suspended solids, high ammonia in the recycled water from underground workings from excessive recirculation may also necessitate longer residences of water in the storage ponds to allow for ammonia reduction to occur. Additional makeup water from Lightning Creek could be required under this scenario.

Operational changes underground may also result in an extended period where water used in the underground workings is not available for reuse. Water from Lightning Creek would be used to supplement mine operations requirements in these cases.

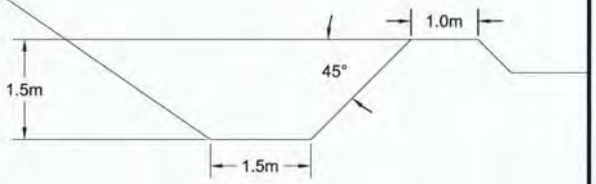
The combined water sourcing from Lightning Creek for Bellekeno Mine, Onek Mine and Keno District Mill will not exceed the currently licenced maximum rate of 245 m^3/day under QZ09-092.

In terms of protocols and decision-making, the Mine Manager is the primary person responsible for determining if certain scenarios would require alternative water sources. In conjunction with Alexco's environmental department professionals, the decision would then be made to withdraw water from Lightning Creek.



GENERAL ARRANGEMENT
NOT FOR CONSTRUCTION

Water Diversion Ditch



Typical Section
Looks NW

Scale 1:75

PROFESSIONAL ENGINEER
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SCOTT A. SMITH

ALEXCO

ALEXCO KENO HILL MINING CORP.

DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: ONEK DIVERSION DITCH

Figure 4

Drawn by: N.Chambers | Scale: 1:750

Date: 11/23/2012 | Approval: | Date:

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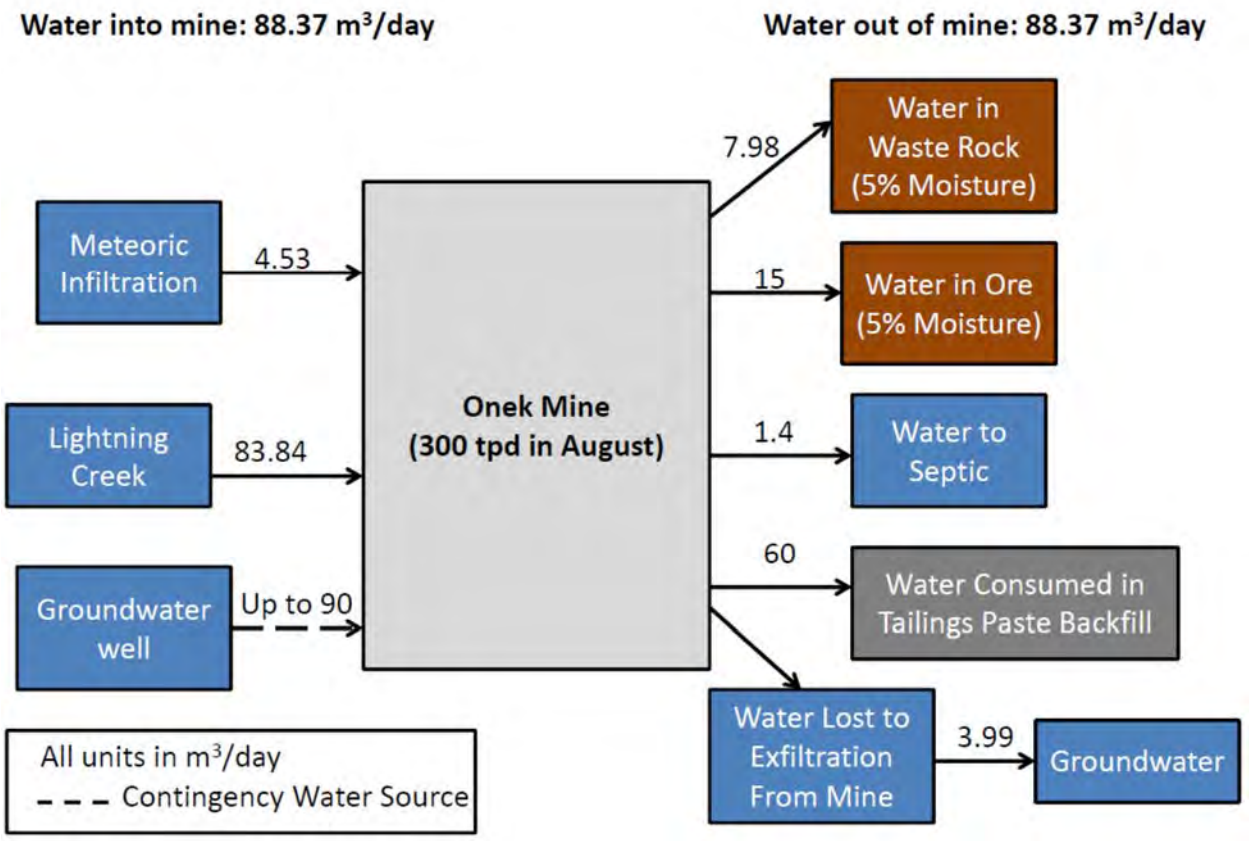


Figure 5 Onek Mine Water Balance Schematic

3.6 LUCKY QUEEN WATER REQUIREMENTS

Lucky Queen underground development and production will require up to 56.25 m^3/day which includes a 25% contingency. Daily water usage during ongoing underground mine development and operation is estimated at 45 m^3/day when mining at an estimated maximum rate of 150 tpd. This water will be used to support activities including percussion drilling, dust suppression and equipment cooling, and minor use for sanitation. The site infrastructure and water management structures for Lucky Queen are shown on Figure 6.

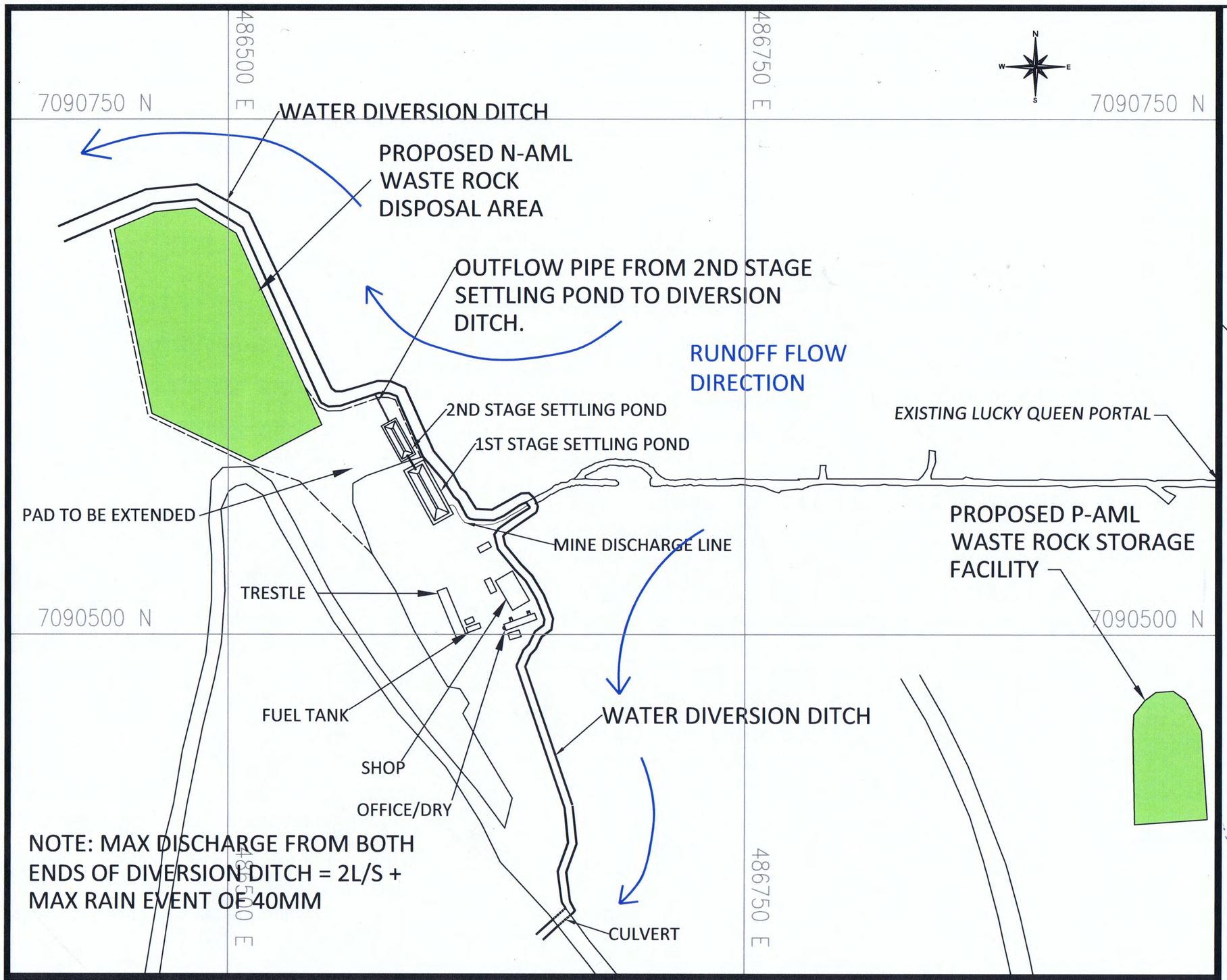
The primary source of water for Lucky Queen will be meteoric infiltration into the underground workings. Infiltration will be collected and temporarily stored in underground sumps to settle and be used as required for drilling purposes and dust suppression. Water will be used, and reused, if necessary, from the underground workings to the extent possible as the primary source. Water in excess of the operational requirements will drain out of the workings to a settling pond first then passing to a water storage pond on the portal pad. From there it may be re-used or if it meets the effluent quality standards it will be directed to a conveyance network that may include ditches and pipes and ultimately discharged to ground. No water treatment facility has been proposed as the existing Lucky Queen adit discharge meets the proposed effluent quality standards and the predicted adit discharge concentration will not increase significantly from baseline. The overall Lucky Queen Mine water balance schematic is shown in Figure 7.

In the event that the Lucky Queen adit discharge water quality is worse than predicted and shows an increasing trend in degradation of water quality above the AMP action threshold, a water treatment facility would be installed at Lucky Queen.

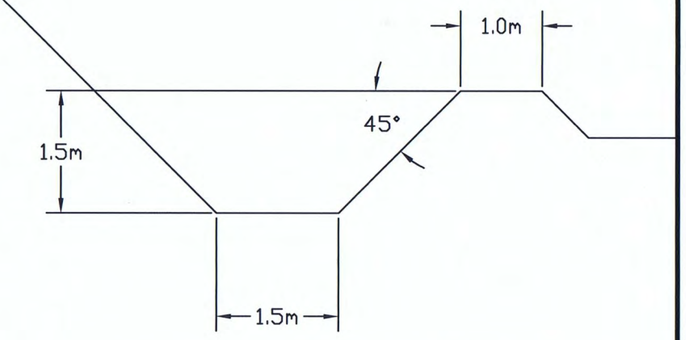
There may be instances and operational requirements where a secondary water source is required instead of or in addition to the infiltration and reused water stored in underground sumps and storage pond. If necessary, a 4 inch groundwater supply well will be constructed near the adit portal as a contingency water source. For example, poor settling of suspended solids in the underground sumps may limit the use of this water with equipment due to potential damage of mechanical systems. Underground water may necessitate longer residences in the sumps to allow for settlement of sediments. Makeup water could then be sourced from the groundwater well in this situation.

Similar to the example of suspended solids, high ammonia in the recycled water from underground workings from excessive recirculation may also necessitate longer residences of water in the storage ponds to allow for ammonia reduction to occur. Additional makeup water from the groundwater supply well could be required under this scenario.

GENERAL ARRANGEMENT
NOT FOR CONTRUCTION



Water Diversion Ditch



Typical Section
Looks North
Scale 1:75

PROFESSIONAL ENGINEER
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DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: *LUCKY QUEEN DIVERSION DITCH*

Figure 6

Drawn by: *N.Chambers*	Scale: *1:2000*
Date: *11/27/2012*	Approval: Date:
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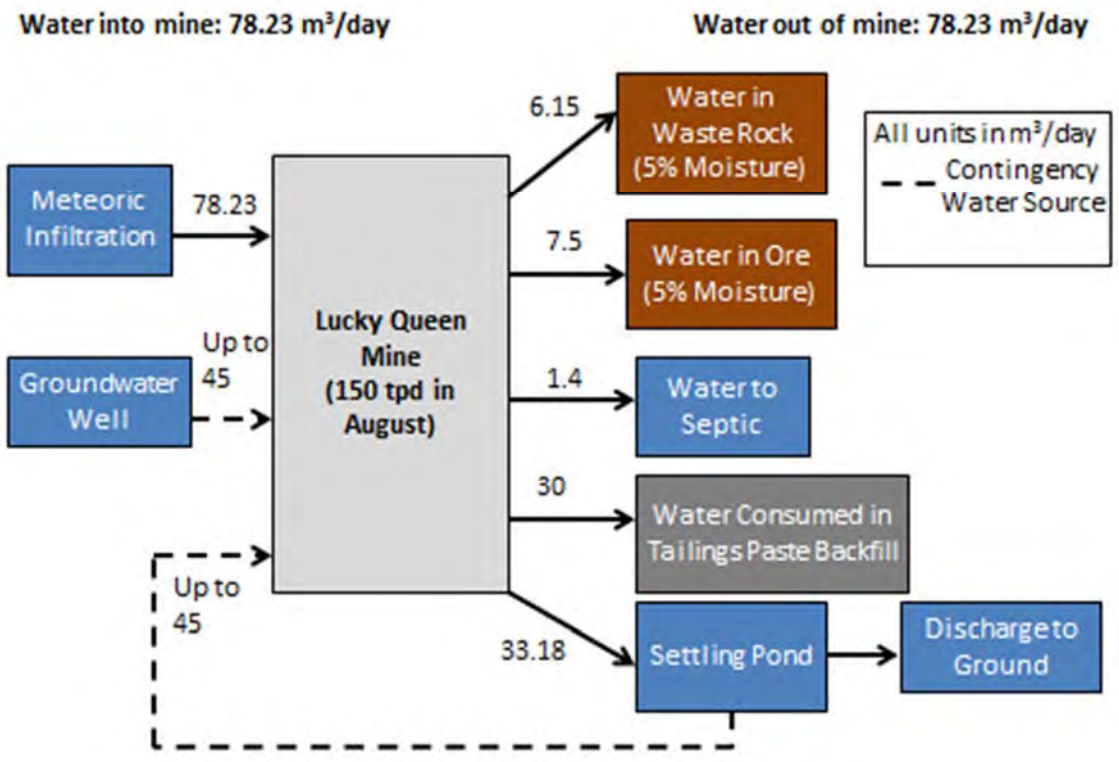


Figure 7 Lucky Queen Mine Water Balance Schematic

3.7 WATER MANAGEMENT STRUCTURES

Storage and settling ponds will be constructed at Onek and Lucky Queen. A settling and storage pond will be constructed outside of the Onek 990 portal. The pond will have a capacity of 93 m^3 (18 m by 6 m by 2 m) with additional capacity of 48 m^3 from a freeboard of 0.50 m to accommodate for 24 hour maximum rain event of 37.7 mm at all times during operations and will be lined with HDPE (Figure 7). The calculations of the 24 hour maximum rain events for Onek and Lucky Queen are presented in Appendix A.

Lucky Queen will have a two stage settling pond consisting of a 285 m^3 capacity primary settling pond and a 93 m^3 capacity secondary settling pond down gradient with additional capacity to ensure that there is adequate freeboard at all time during operations (Figure 8). Both ponds will have freeboard of 0.5 m and a combined freeboard capacity of 147 m^3 for the 24 hour maximum rain event of 40.3 mm. The secondary pond will have a pipe that will direct the discharge to the diversion ditch. In the event that treatment is required at Lucky Queen, the ponds would be lined with HDPE or another suitable type of synthetic liner.

Berms will be built up around all water settling and storage ponds to ensure no surface runoff enters the ponds.

A diversion ditch will be excavated up gradient of the Onek 990 portal (Figure 4). The purpose of this ditch is to divert surface water runoff from above the portal from reaching the portal pad and associated infrastructure, including the temporary storage pond. The ditch will run northeast from the portal along the access road diverting the water to ground prior to entering Lightning Creek without interaction with mining activities. The surface water to be managed is intended to be minimal at the portal site and is designed to accommodate the 24 hour maximum rain event of 37.7 mm. A typical section design drawing for the Onek ditch is shown on Figure 3.

A diversion ditch currently excavated up gradient of the Lucky Queen 500 adit to divert surface water runoff from reaching the portal pad, infrastructure and collection pond will be extended around the N-AML waste rock disposal area to divert clean water around the portal pad and waste rock disposal area. The water within the diversion ditch will discharge to ground approximately 3Km uphill from Christal Creek. A typical section design drawing for the Lucky Queen ditch is shown on Figure 6. The diversion ditch has been designed to convey the maximum discharge of 2 L/s and the 24 hour maximum rain event of 40.3 mm.

A diversion ditch will be excavated up gradient of the Flame and Moth portal (Figure 3). The purpose of this ditch is to divert surface water runoff from above the portal from reaching the portal pad and associated infrastructure, including the proposed pond. The ditch will run west from above the portal diverting the water to the diversion ditch being proposed for the dry stack tailings facility expansion. The surface water to be managed is intended to be minimal at the portal site and is designed to accommodate the 24 hour maximum rain event of 37.7 mm which was calculated for the Onek 990 mine which is at 990masl. This estimate is conservative as the Flame and Moth portal will be at a lower elevation (910masl) and thus a smaller 24 hour rain event would be expected. The ditches constructed for the Flame and Moth site will be consistent with the typical section design drawing shown for the Onek ditch on Figure 4.

The Flame and Moth Mine will be discharged up to 35 L/s to both Lightning and Christal Creek following treatment depending on the total discharge rate. Discharge from the Flame and Moth pond to Christal Creek and Lightning Creek will be via a pipeline to diffuser structures consisting of rip rap (Appendix C). The proposed Flame and Moth water treatment pond design is provided in Appendix B. The pond freeboard is designed to accommodate the 24 hour maximum rain event of 37.7 mm.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED

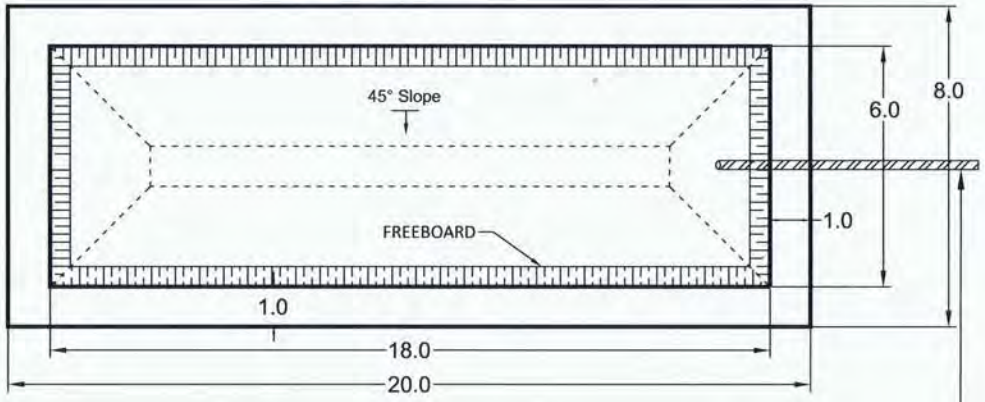
POND VOLUME = 93 CUBIC METERS

FREEBOARD VOLUME CAPACITY = 48 CUBIC METERS

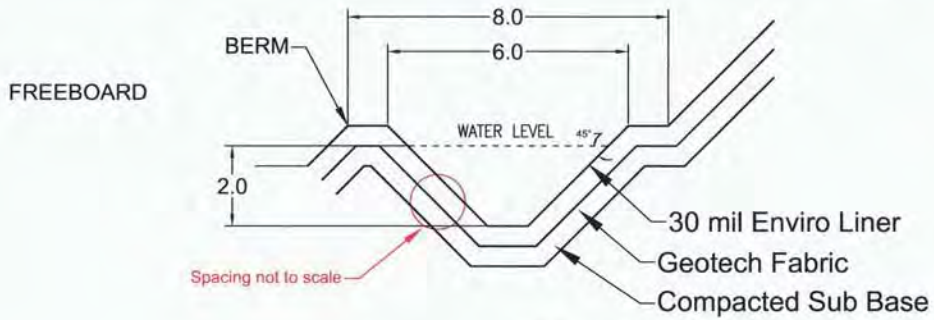
GENERAL ARRANGEMENT
NOT FOR CONSTRUCTION

A

Settling Pond



PLAN VIEW



SECTION A

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SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: *ONEK SETTLING POND*
Single Pond
Figure 8

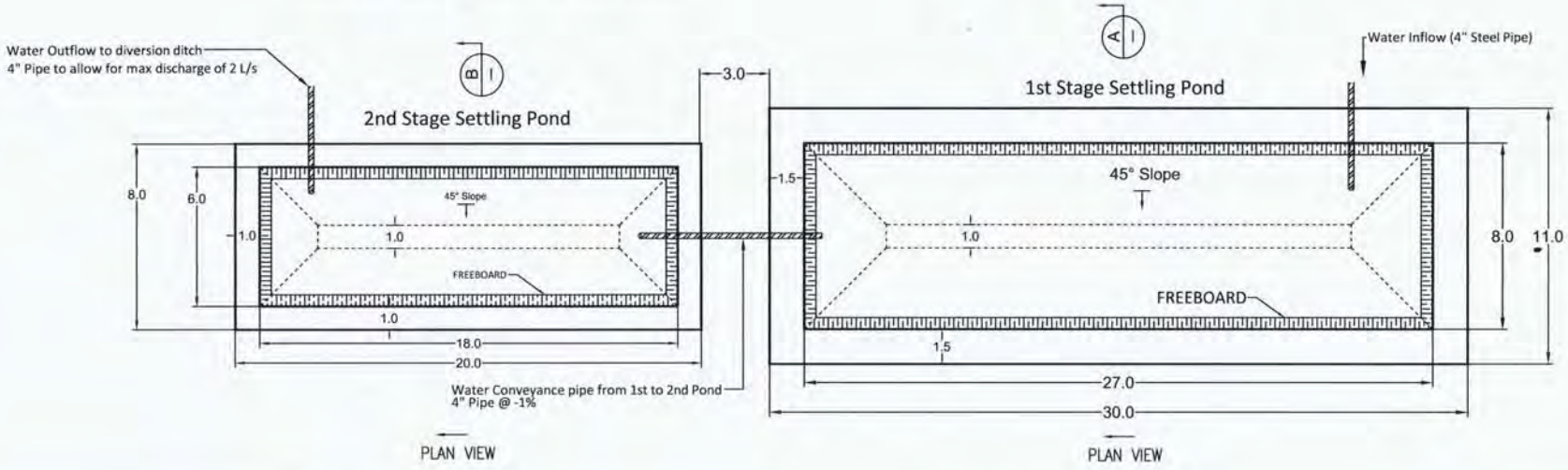
Drawn by: *N. Chambers* | Scale: *1:125*
Date: *11/23/2012* | Approval: | Date:
File: *H:\Onek\Surface Construction\Water Management\Onek Settling Pond Rev 1.dwg*

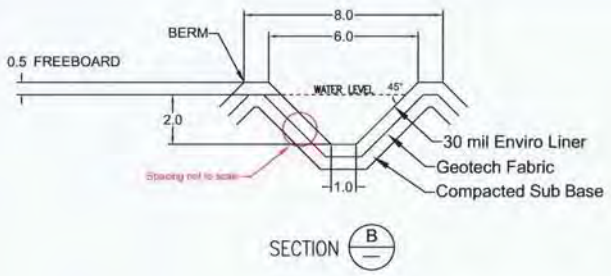
ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED

GENERAL ARRANGEMENT
NOT FOR CONSTRUCTION

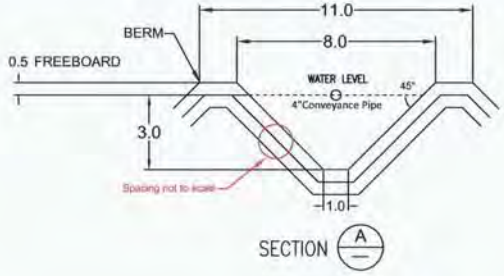
2nd STAGE POND VOLUME = 93 CUBIC METERS
FREEBOARD VOLUME CAPACITY = 48 CUBIC METERS

1st STAGE POND VOLUME = 285 CUBIC METERS
FREEBOARD VOLUME CAPACITY = 99 CUBIC METERS





2nd Stage Settling Pond



1st Stage Settling Pond

NOTE: - 1st Stage Settling Pond dimensions based on actual as-built construction.

- Presently constructed and used as temporary single stage settling pond.

- Section A-A

PROFESSIONAL ENGINEER
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SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: LUCKY QUEEN SETTLING PONDS
2 Stage Settling Ponds
Figure 9

Drawn by: N.Chambers	Scale: 1:200
Date: 11/23/2012	Approval: Date:
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3.8 SEDIMENT AND EROSION CONTROL

Water management structures and good operating practise will be the primary tools used to mitigate sediment and erosion risks throughout the district. Effective sediment and erosion control measures will be installed before starting construction to reduce the potential for introduction of sediment into watercourses and waterbodies. Mitigation of sediment and erosion will proactive at disturbance site by implementing the following best management practices:

- Control runoff and manage stormwater (e.g., rainfall or snow melt) and direct it away from construction areas where excavation, soil placement, and staging activities occur;
- Stabilize slopes by maintaining ground cover or using materials such as geotextiles/erosion control cloth;
- Incorporate perimeter channels, as required, to catch and transport site runoff from new construction sites and equipment staging areas;
- Maintain ditches along access and site roads, as required, to control surface runoff and sediment transport;
- Operate machinery on land above the high water mark in a manner that reduces disturbance to the banks of watercourses;
- Remove sediment control measures, such as plastic sheeting and silt fencing, when no longer required;
- Identify natural drainages that occur in cleared areas and incorporate appropriate sediment and erosion control measures into site planning;
- Silt fences, berms, swales, ditches, check dams, settling ponds, and other sediment and erosion control facilities will be installed prior to construction at site-specific locations, as required; and
- Contingency supplies of sediment and erosion control materials will be maintained and workers will be sufficiently trained in their appropriate installation and maintenance.

Sediment and erosion control measures will be continually monitored and maintained until the mechanism has stabilized and there is no longer a potential risk. Once the risk is mitigated excess sediment and control measures will be removed.

4 CONTINGENCY PLANS

Contingency plans for flood or drought conditions have been considered to ensure unexpected climatic conditions do not adversely affect mine/mill operations or result in significant environmental impact.

4.1 DROUGHT CONDITIONS

The Bellekeno Mine produces excess water that must be collected and treated. Although the Bellekeno Mine produces approximately 4 L/s of constant discharge, only about 50% of the mine recharge volume is required for mine development and operations (equipment, paste backfill). The amount of water required to sustain mine operations is a small portion (1-2%) of the flow at Lightning Creek where mine makeup water is currently permitted for withdrawal. Similar to the mill makeup water requirements, a drought scenario does not represent a current operational concern for the Bellekeno Mine and a contingency plan is currently not in effect.

The Onek Mine requires 112.5 m^3/day of water for development and operations with a 25% contingency. It is estimated that 25% of the underground water can be reused. AKHM is currently licenced to source 245 m^3/day of water from Lightning Creek. Considering the limited water required for the Bellekeno Mine and Mill, elevated water requirements for the Onek Mine will be well within the currently licenced rate from Lightning Creek.

The Lucky Queen Mine requires 56.25 m^3/day. Approximately 25% of water used in underground developments. A contingency groundwater supply well will be constructed. Typical water discharge from the Lucky Queen adit from meteoric infiltration is 56.16 m^3/day. In drought conditions, this infiltration rate may decrease. The reusable fraction of underground water and the groundwater sourced from the proposed contingency well will be able to supplement the meteoric infiltration in the event of drought conditions.

The current make-up water requirements at the mill are approximately 30 m^3/day. This make-up water requirement is less than 5% of the combined flow emanating from Galkeno 900 and Bellekeno 625. The make-up water requirements at the mill also represent a very small portion of the Christal Creek drainage which has its headwaters near the mill site location. Given the relatively small volume of make-up water compared to current source levels, a reduction in make-up water available for mill operations due to a drought condition does not represent a concern from an operational standpoint and therefore no unique contingency plans are deemed necessary for a drought scenario.

The Bermingham and Flame and Moth Mines both requires up to 112.5 m^3/day of water for development and operations with a 25% contingency. Both mines are located below the water table and are anticipated to encounter mine inflows well greater than water use. As contingency, the Flame and Moth mine can use the mill well and the Bermingham 200 adit discharge has been document to discharge the similar amount of water the Bermingham mine requires.

4.2 FLOOD CONDITIONS

High flow or flood conditions at the mill do not necessarily pose an extreme case from an operational perspective as the mill site water management design already incorporates ditching and pond volumes based on extreme precipitation events (design capacity in excess of 1:100 year event). In addition, the mill site location is situated with a very small, headwater drainage basin (<3 km^2), effectively minimizing the potential

for flooding conditions. In the case of a flood event, active milling operations may be temporarily suspended to ensure operations personnel and equipment are appropriately allocated to managing and maintaining ditches and conveyance structures until the peak flows have decreased to normal levels.

Diversion ditches have been constructed at the Bellekeno and Lucky Queen Mine portals to divert surface water runoff from the portal and portal pads to prevent infiltration into water storage and settlement ponds and into the mine workings. Diversion ditches will be constructed at the Onek 990 portal and Onek storage ponds to divert surface water runoff from the portal and portal pad to prevent infiltration into water storage and settlement ponds.

4.3 HIGH MINE INFLOW CONDITIONS

Contingency and response plans for high or unexpected underground mine flows fall under the protocols of the company's emergency response plan.

The first priority in a high mine inflow condition is the safety and protection of the employees and contractors working underground at Bellekeno, Onek and Lucky Queen. If the water in-rush was of a nature that required immediate evacuation, the specific protocols for mine evacuation would be initiated by the Mine Manager or his designate (Section 8, Keno Hill Emergency Response Plan).

Once the safety of underground employees and contractors have been established, the nature of the water in-rush would be immediately investigated by the General Manager or his designate. Securing underground facilities and infrastructure would become the next priority after employee safety. Depending on the nature and level of the mine flow in-rush or high flow condition, a determination would be made if mobile equipment needed to be removed from certain levels and locations in the mine and brought to surface or to the central decline. Electrical utilities and infrastructure would be assessed to determine if areas of the mine needed to be isolated or removed from electrical power distribution.

The cause and extent of the high mine water flow condition would then be assessed by the General Manager, Mine Manager and other specialist positions on the site (i.e. Chief Engineer) to determine if the extent of the high mine flow was expected to continue or if flow conditions are expected to recede. Based on the level of high mine flow, the rate of dewatering would be increased to the maximum levels permitted in order to reduce the volume of mine pool. Standby pumps would be established if necessary to increase the volume of water being pumped from the underground mine. The Bellekeno 625 water treatment plant is permitted and capable of treating 10 L/s which is approximately double the current steady state flow conditions of the Bellekeno Mine. If the volume required for dewatering were to exceed permitted levels or if the Bellekeno 625 water treatment plant was not meeting effluent quality standards due to high sustained flows, the appropriate regulatory agencies would be contacted and consulted. If necessary, consideration would be given to applying for an Emergency Amendment under QZ09-092 to manage the high inflow conditions if all other measures were not effective.

5 REPORTING

The results of the Water Management Plan will be included with the annual report for Water Licence QZ12-053. Further to the identified reporting requirements previously identified in clause 79 additional reporting requirements are outlined in clause 26 and 27 of Water Licence QZ12-053:

> Unless otherwise specified in this licence, all monitoring data, reports, plans, studies, study results, designs or manual shall be submitted to the Board in the following format:
>
> a) The Licensee shall provide to the Board one unbound, single sided, paper copy of all reports required by this licence. All reports must be reproducible by standard photocopier.
>
> b) The Licensee shall upload electronic copies of all reports required by this licence to the Yukon Water Board's online licensing registry, the WATERLINE. Electronic copies shall be submitted in one of the following formats: word97-2003, Excel 97-2003 workbooks, or Adobe .pdf format. Water quality results uploaded to the WATERLINE must be presented in Excel 97-2003 .xls format.

APPENDIX A

24 HOUR PRECIPITATION RETURN PERIODS MEMORANDUM

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: Anthony Bier

CC: Kai Woloshyn

Date: November 7, 2012

Re: 24 hour Precipitation Return Periods

MAXIMUM ANNUAL 24- HOUR PRECIPITATION RETURN PERIOD

Meteorological Services Canada (MSC) provides rainfall intensity-duration-frequency (IDF) curves for currently operated meteorological stations including those at Mayo Airport, Dawson City and Pelly Ranch. Since the Mayo Airport station (Mayo A) is the closest to Keno City, approximately 40kms Southwest of Keno Hill, and there are data from 1974-1981 from the Keno Hill MSC station we can draw on this data to establish a relationship between large rainfall events at Mayo A and Keno City.

The Keno Hill weather station was located within a few kilometers of both the Onek and Lucky Queen mines and between the elevations of the two mines. As such, the average maximum annual 24 hour precipitation event from 1974-1981 was plotted against elevation for Mayo A and Keno Hill. A straight line was then fitted and the slope of that line was used to extrapolate the maximum annual 24 hour precipitation events from Mayo to Onek and Lucky Queen (Figure 1)

Appendix I shows the IDF for Mayo Airport and Appendix II shows the data in tabular form. The 1 in 100 year 24-hour precipitation event is 35mm at Mayo A which translates to 37.7mm and 40.3 mm at Onek and Lucky Queen, respectively (Table 1), based in the relationship in Figure 1. Table 1 shows the Environment Canada 24 hour event return periods for Mayo (Appendix I) and the calculated events for Onek and Lucky Queen using the relationship in Figure 1.

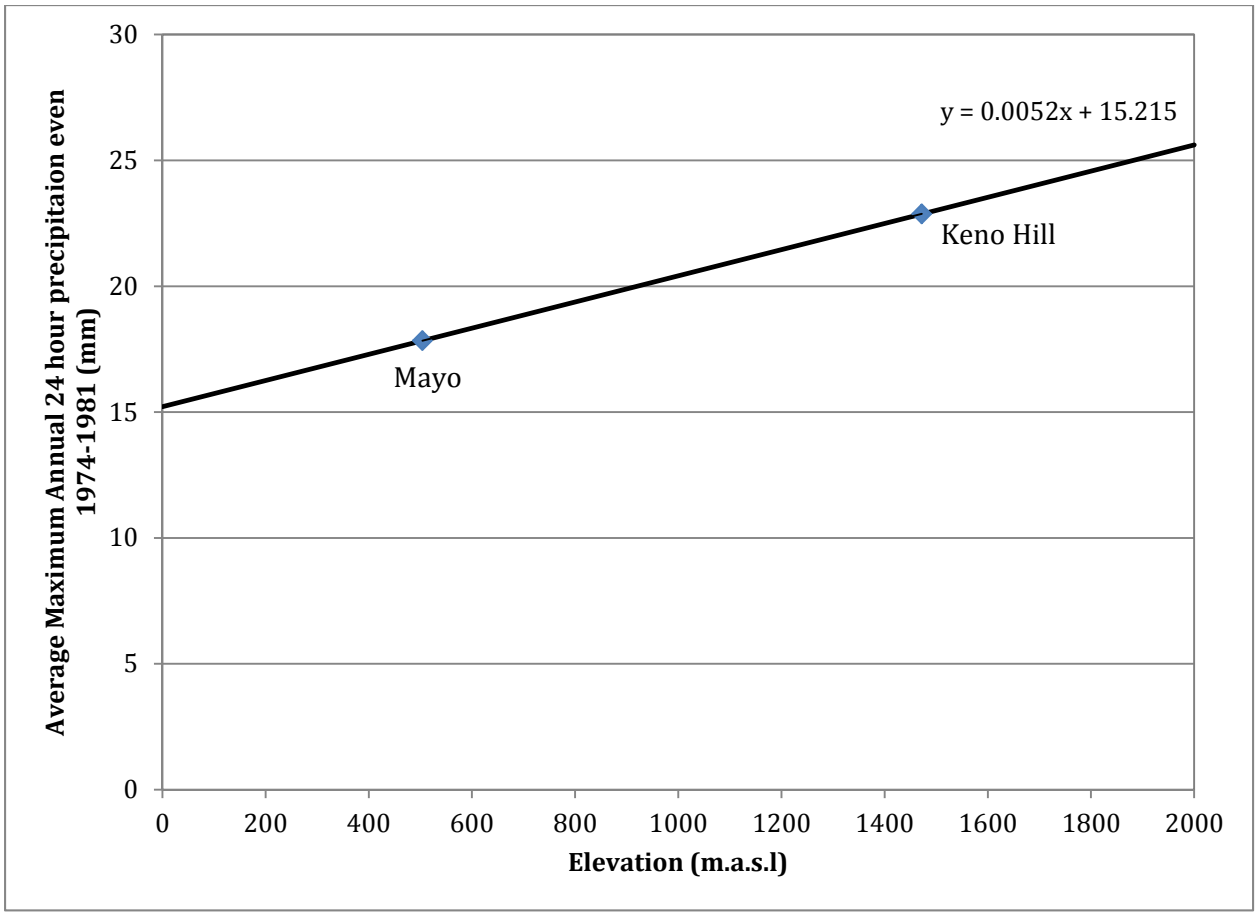


Figure 1: Relationship between size of Average Maximum Annual 24 hour precipitation event at Mayo and Keno Hill, 1974-1981

Table 1: Maximum annual 24 hour precipitation event for various return periods for Mayo A, Onek 990 and Lucky Queen underground workings catchments

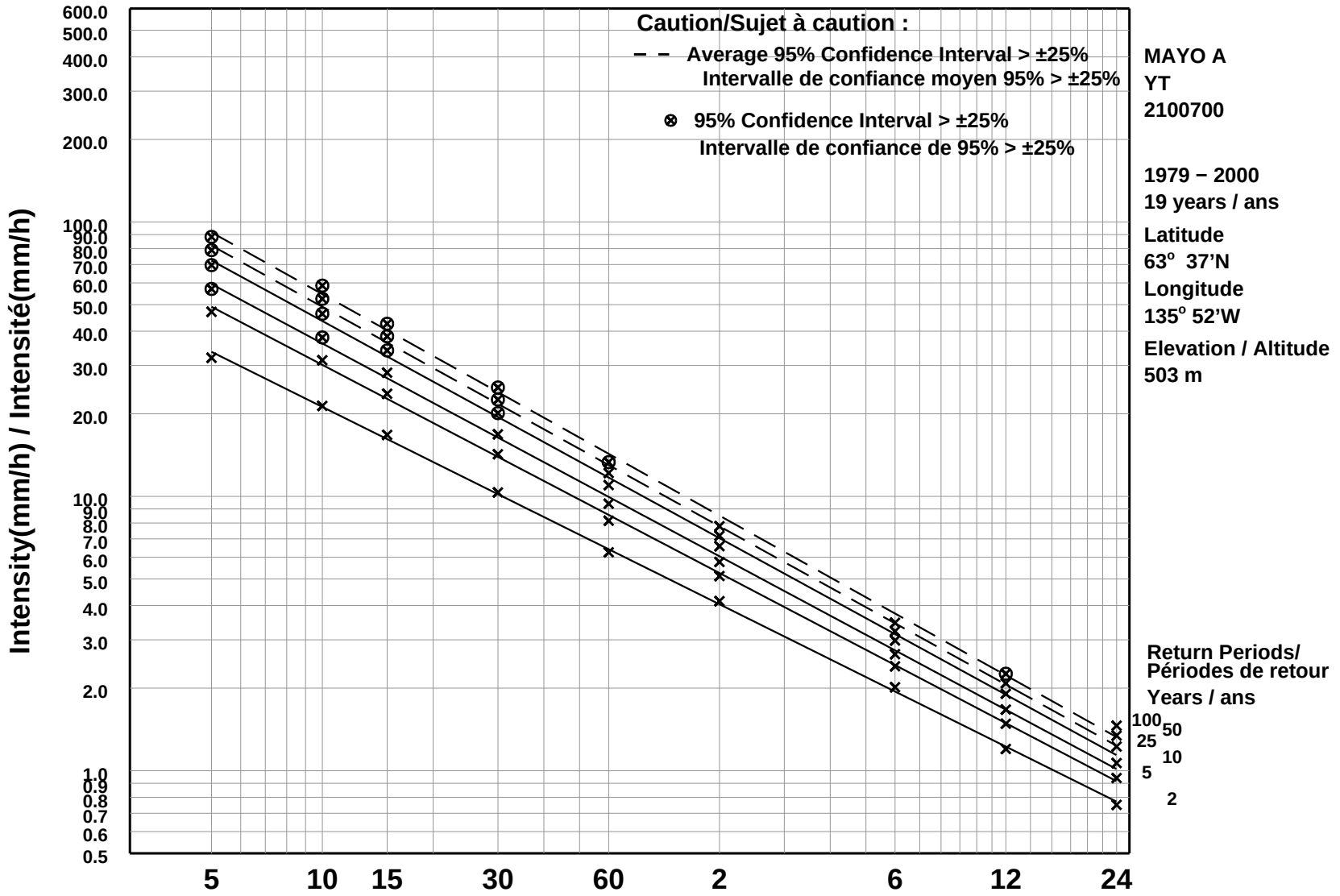
	Maximum Annual 24 hour precipitation event (mm)		
Return Period (years)	**Mayo A**	**Onek**	**Lucky Queen**
2	18.0	20.7	23.3
5	22.6	25.3	27.9
10	25.6	28.3	30.9
25	29.4	32.1	34.7
50	32.2	34.9	37.5
100	35.0	37.7	40.3

APPENDIX I

Short Duration Rainfall Intensity−Duration−Frequency Data

2012/02/09

Données sur l'intensité, la durée et la fréquence des chutes de pluie de courte durée



Environment Canada Environnement Canada

Canada

APPENDIX II

Environment Canada/Environnement Canada

Short Duration Rainfall Intensity-Duration-Frequency Data
Données sur l'intensité, la durée et la fréquence des chutes de pluie de courte durée

Gumbel - Method of moments/Méthode des moments

2012/02/09

==========

MAYO A YT 2100700

Latitude: 63 37'N Longitude: 135 52'W Elevation/Altitude: 503 m

Years/Années : 1979 - 2000 # Years/Années : 19

==========

****

Table 1 : Annual Maximum (mm)/Maximum annuel (mm)

****

Year Année	5 min	10 min	15 min	30 min	1 h	2 h	6 h	12 h	24 h
1979	3.8	3.8	3.8	3.8	5.6	6.7	11.3	14.1	18.9
1980	2.5	3.1	3.5	5.7	6.1	10.1	11.8	13.3	14.8
1981	-99.9	-99.9	-99.9	-99.9	7.4	13.2	14.4	15.0	15.4
1982	2.3	3.1	3.3	4.6	4.6	6.4	9.1	14.3	18.0
1983	2.0	2.0	2.4	2.8	4.6	5.9	10.4	13.4	20.2
1984	2.4	2.8	3.5	4.0	4.8	7.5	11.1	13.4	14.2
1985	5.0	7.6	7.6	7.6	7.6	7.6	12.8	15.6	20.7
1986	1.7	2.6	3.2	4.3	6.1	9.3	9.3	10.7	20.4
1987	1.8	2.2	2.9	3.7	6.1	9.8	16.2	20.0	22.2
1988	2.3	3.5	4.8	7.8	8.9	9.6	11.2	11.8	16.4
1989	3.0	5.0	6.2	9.3	10.5	10.6	13.2	13.8	16.2
1990	2.2	3.6	5.3	7.8	9.8	10.0	11.3	13.7	20.7
1991	3.2	3.8	4.1	5.8	5.8	8.2	14.0	14.4	20.2
1992	3.3	4.8	6.0	6.0	6.3	9.0	18.0	18.2	18.2
1993	2.1	2.7	2.8	2.8	2.9	4.6	-99.9	-99.9	20.2
1994	3.6	4.1	4.1	4.1	5.2	6.2	-99.9	-99.9	13.9
1995	2.0	2.6	3.5	4.6	5.2	7.5	8.6	10.2	12.5
1996	1.6	1.8	2.3	3.7	6.3	10.6	15.0	25.4	35.0
1997	2.7	4.6	5.4	5.8	6.2	9.7	15.1	16.2	26.7
1998	3.5	5.8	6.6	6.6	6.6	7.0	10.1	11.0	11.2
1999	7.9	9.4	10.2	11.3	12.3	13.1	15.1	21.3	22.8
2000	2.0	2.4	3.2	4.1	6.5	8.0	-99.9	-99.9	16.4
# Yrs. Années	21	21	21	21	22	22	19	19	22

Mean Moyenne	2.9	3.9	4.5	5.5	6.6	8.7	12.5	15.0	18.9
Std. Dev. Écart-type	1.4	1.9	2.0	2.2	2.1	2.2	2.6	3.8	5.2
Skew. Dissymétrie	2.44	1.65	1.43	1.06	1.11	0.36	0.36	1.31	1.42
Kurtosis	10.35	6.15	5.48	4.14	4.75	3.28	2.74	5.11	6.76

*-99.9 Indicates Missing Data/Données manquantes

Warning: annual maximum amount greater than 100-yr return period amount
Avertissement : la quantité maximale annuelle excède la quantité pour une période de retour de 100 ans

Year/Année	Duration/Durée	Data/Données	100-yr/ans
1999	5 min	7.9	7.4

****

Table 2a : Return Period Rainfall Amounts (mm)
Quantité de pluie (mm) par période de retour

****

Duration/Durée	2 yr/ans	5 yr/ans	10 yr/ans	25 yr/ans	50 yr/ans	100 yr/ans	#Years Années
5 min	2.7	3.9	4.8	5.8	6.6	7.4	21
10 min	3.6	5.2	6.3	7.7	8.7	9.8	21
15 min	4.2	5.9	7.1	8.5	9.6	10.6	21
30 min	5.2	7.1	8.4	10.1	11.3	12.5	21
1 h	6.3	8.2	9.4	11.0	12.2	13.3	22
2 h	8.3	10.2	11.5	13.2	14.4	15.6	22
6 h	12.1	14.4	16.0	17.9	19.3	20.8	19
12 h	14.4	17.8	20.1	22.9	25.0	27.1	19
24 h	18.0	22.6	25.6	29.4	32.2	35.0	22

****

Table 2b :

Return Period Rainfall Rates (mm/h) - 95% Confidence limits
Intensité de la pluie (mm/h) par période de retour - Limites de confiance de 95%

****

Duration/Durée	2 yr/ans	5 yr/ans	10 yr/ans	25 yr/ans	50 yr/ans	100 yr/ans	#Years Années
5 min	32.0	47.1	57.0	69.7	79.0	88.3	21
	+/- 6.7	+/- 11.3	+/- 15.2	+/- 20.5	+/- 24.6	+/- 28.6	21
10 min	21.4	31.4	38.0	46.3	52.5	58.6	21
	+/- 4.4	+/- 7.5	+/- 10.1	+/- 13.6	+/- 16.3	+/- 18.9	21
15 min	16.8	23.7	28.2	34.0	38.3	42.6	21
	+/- 3.1	+/- 5.2	+/- 7.0	+/- 9.4	+/- 11.3	+/- 13.1	21
30 min	10.3	14.3	16.8	20.1	22.5	24.9	21
	+/- 1.7	+/- 2.9	+/- 4.0	+/- 5.3	+/- 6.4	+/- 7.4	21

1 h	6.3	8.2	9.4	11.0	12.2	13.3	22
	+/- 0.8	+/- 1.4	+/- 1.9	+/- 2.5	+/- 3.0	+/- 3.5	22
2 h	4.2	5.1	5.8	6.6	7.2	7.8	22
	+/- 0.4	+/- 0.7	+/- 1.0	+/- 1.3	+/- 1.5	+/- 1.8	22
6 h	2.0	2.4	2.7	3.0	3.2	3.5	19
	+/- 0.2	+/- 0.3	+/- 0.4	+/- 0.6	+/- 0.7	+/- 0.8	19
12 h	1.2	1.5	1.7	1.9	2.1	2.3	19
	+/- 0.1	+/- 0.2	+/- 0.3	+/- 0.4	+/- 0.5	+/- 0.6	19
24 h	0.8	0.9	1.1	1.2	1.3	1.5	22
	+/- 0.1	+/- 0.1	+/- 0.2	+/- 0.3	+/- 0.3	+/- 0.4	22

****

Table 3 : Interpolation Equation / Équation d'interpolation: R = A*T^B

R = Interpolated Rainfall rate (mm/h)/Intensité interpolée de la pluie (mm/h)
RR = Rainfall rate (mm/h) / Intensité de la pluie (mm/h)
T = Rainfall duration (h) / Durée de la pluie (h)

****

Statistics/Statistiques	2 yr/ans	5 yr/ans	10 yr/ans	25 yr/ans	50 yr/ans	100 yr/ans
Mean of RR/Moyenne de RR	10.5	14.9	17.9	21.5	24.3	27.0
Std. Dev. /Écart-type (RR)	10.8	16.0	19.5	23.9	27.1	30.4
Std. Error/Erreur-type	0.7	1.0	1.3	1.7	1.9	2.3
Coefficient (A)	6.4	8.6	10.0	11.7	13.0	14.3
Exponent/Exposant (B)	-0.667	-0.703	-0.719	-0.733	-0.741	-0.748
Mean % Error/% erreur moyenne	2.7	2.9	3.9	5.0	5.6	6.1

APPENDIX B

WATER STORAGE POND DESIGN, TETRA TECH EBA 2014

TETRA TECH EBA

September 2, 2016

ISSUED FOR USE
FILE: ENG.WARC03158-01
Via Email: kwoloshyn@alexcoresource.com

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

Attention: Kai Woloshyn, Environmental Manager

Subject: Water Storage Pond Conceptual Design
Flame & Moth Property, Keno City, Yukon

1.0 INTRODUCTION

Alexco Resource Corp. (Alexco) retained Tetra Tech EBA Inc. (Tetra Tech EBA) to prepare a conceptual design for a water storage pond at the Flame & Moth property west of Keno City, Yukon. This letter summarizes the design, and presents conceptual design drawings. For additional information regarding the use of this letter, please refer to the attached General Conditions.

Tetra Tech EBA previously completed a water storage pond design at a slightly different location at the subject site, "Water Storage Pond Design Flame & Moth Property, Keno City, Yukon" (Tetra Tech EBA October 2, 2014). Results of the geotechnical investigation completed for the above pond design were used in the preparation of this conceptual pond design.

2.0 FLAME & MOTH WATER STORAGE POND

2.1 Pond Location

Alexco intends to shift the location of the proposed pond to immediately south of the existing surface water collection pond to minimize earth works associated with pond construction by taking advantage of a natural basin that exists in this location.

2.2 Foundation Conditions

Tetra Tech EBA completed a geotechnical investigation consisting of three testpits at the subject site in fall 2014. General subsurface conditions in the location of the proposed pond consist of fill over a thin organic layer (original ground surface) underlain by silt till.

The organic layer (original ground surface) was encountered at 0.3 m below existing grade in the single testpit excavated within the proposed pond footprint. Tetra Tech EBA anticipates the organic layer associated with original ground surface will merge with the current ground surface somewhere in the northern half of the proposed pond footprint. The subcut for the pond shown on the attached conceptual design drawings facilitates the removal of the organic layer to prepare a suitable bearing surface for pond construction.

Permafrost was not encountered in any of the testpits, and is not expected to exist within the footprint of the proposed pond.

Tetra Tech EBA Inc.
61 Wasson Place
Whitehorse, YT Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

2.3 Storage Capacity

The base of the proposed pond is about 3.0 m below the existing base of the natural basin as shown on the attached conceptual design drawings. The resulting storage capacity is 6,500 m^3 with an operating freeboard of 1.0 m.

To reduce the amount of cut associated with construction of the pond it may be desirable to elevate the pond base. Based on the results of the previous geotechnical investigation a subcut of at least 1.0 m is recommended to remove the organic layer associated with the original ground surface. Lifting the pond base the permissible 2.0 m would result in a storage capacity of 4,900 m^3.

Tetra Tech EBA can provide updated design drawings and capacity calculations during subsequent design phases once Alexco has determined a desired storage capacity for the proposed pond.

2.4 Pond Liner

Tetra Tech EBA has assumed the pond will be lined with a synthetic liner but has omitted liner details from this conceptual design. Liner configurations and recommendations will be evaluated during subsequent design phases prior to pond construction.

3.0 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.

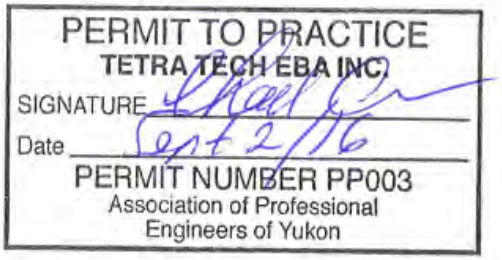
4.0 CLOSURE

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

Respectfully submitted,
Tetra Tech EBA Inc.

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

Reviewed by:
J. Richard Trimble, P.Eng., FEC
Principal Consultant, Arctic Region
Direct Line: 867.668.9216
Richard.Trimble@tetratech.com

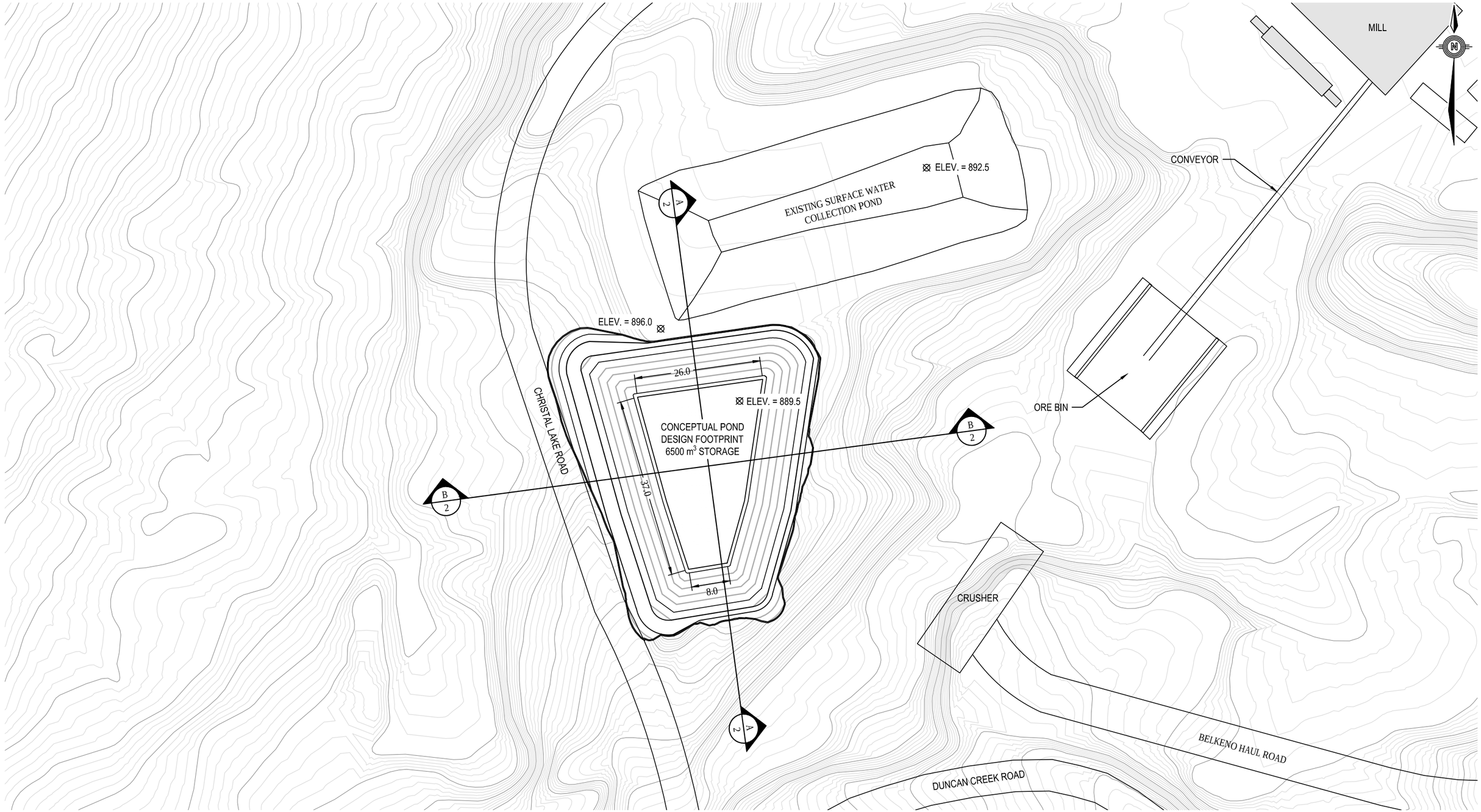


REFERENCES

EBA Engineering Consultants Ltd. “Runoff Diversion Structure Specs, Dry Stack Tailings Facility, Keno Hill District Mill, YT” September 2010.

Tetra Tech EBA Inc. “Water Storage Pond Design, Flame & Moth Property, Keno City, Yukon” October 2, 2014.

FIGURES



APPROXIMATE CONSTRUCTION VOLUMES (m^3)
CUT = 5200 m^3
FILL = 500 m^3

NOTE
CONTOURS FROM LIDAR DATA (DATED NOVEMBER 2014)

0 25m
Scale: 1:750 @ 11"x17"

CONCEPTUAL - NOT FOR CONSTRUCTION

CLIENT
ALEXCO

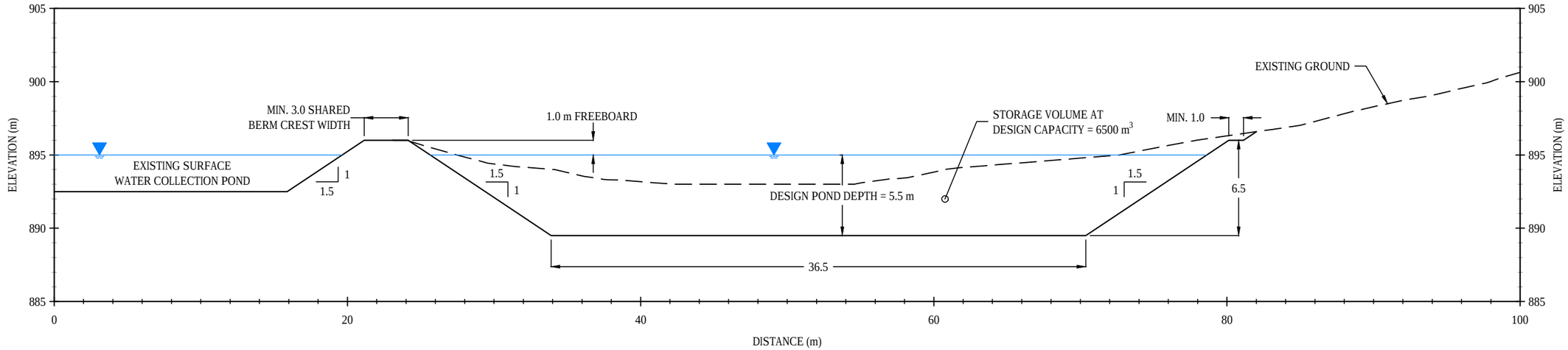
TETRA TECH EBA

CONCEPTUAL POND DESIGN
KENO HILL DISTRICT MILL SITE

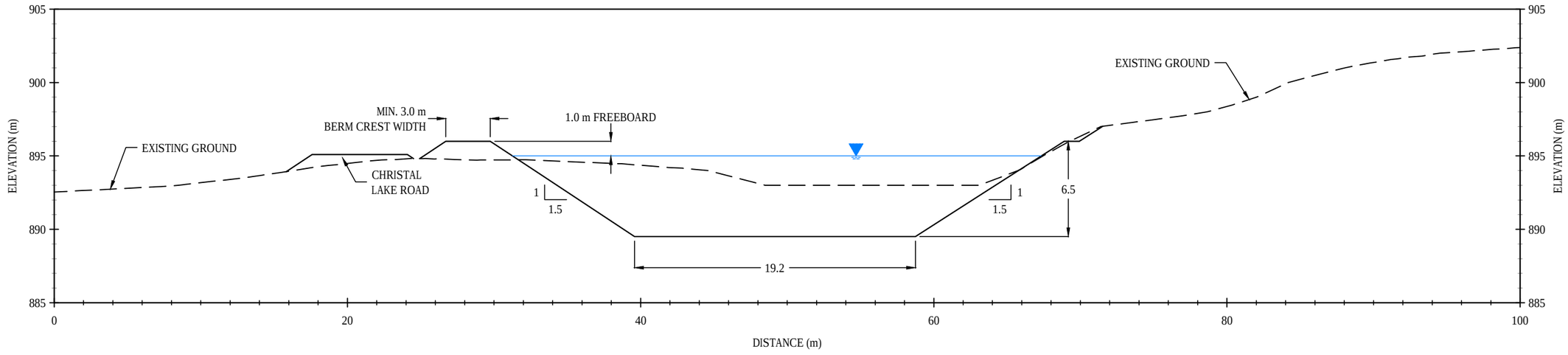
SITE PLAN

PROJECT NO.	DWN	CKD	REV
ENG.WARC03158-01	CB	JTP	0
OFFICE: EBA-WHSE	DATE: August 26, 2016		

Figure 1



SECTION A - A'



SECTION B - B'

0 15m

Scale: 1:300 @ 11"x17"

CONCEPTUAL - NOT FOR CONSTRUCTION

CLIENT

ALEXCO

TETRA TECH EBA

CONCEPTUAL POND DESIGN
KENO HILL DISTRICT MILL SITE

CROSS-SECTIONS

PROJECT NO.	DWN	CKD	REV
ENG.WARC03158-01	CB	JTP	0

OFFICE	DATE
EBA-WHSE	August 26, 2016

Figure 2

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 C

FLAME AND MOTH DIFFUSER DESIGN

ALEXCO

December 27, 2016

Flame & Moth IWTP: Engineering details
Topic: Diffuser design

Alexco is currently designing a water treatment plant capable of treatment/releasing all collected water from the underground Flame and Moth mine. This treatment plant will be designed for a maximum treatment capacity of 35 litres per second (lps). The discharge from the treatment plant will be piped and released at surface at two designated locations; near Christal Lake in a 6" pipe and near Lightning Creek in an 8" pipe. To ensure that the released water does not erode soil or cause harm to the environment, the end of the discharge pipe should be installed with a diffuser and other necessary features that include the following details:

- Discharge pipe release section to be positioned a minimum of 30 metres away from any streambed or lake to allow for sufficient disbursement prior to joining the water way (See attached drawing, View #1).
- Rip rap two layers thick to be placed along the release section of the pipe (View #1).
- End of the pipe to be elevated and blocked/buried in rip rap to minimize impacts from potential surging (View #2).
- Final length of pipe to include a minimum of 40 holes, ½" diameter or larger, positioned vertically downward, and up to 90° of the pipeline (View #3).

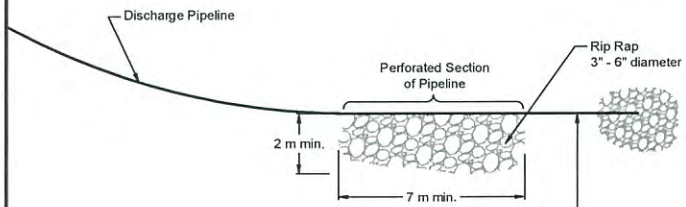
Implementation of the listed design requirements will minimize environmental impacts of the discharge from the pipe while allowing it to freely drain when not in use.

If you have any questions regarding this information, please feel free to contact me.

Sincerely,

PROFESSIONAL ENGINEER YUKON TERRITORY ERIC J. LANCASTER

Eric J. Lancaster, P. Eng
Senior Project Manager
T. 303-862-3929
F. 303-862-3926
Alexco Environmental Group

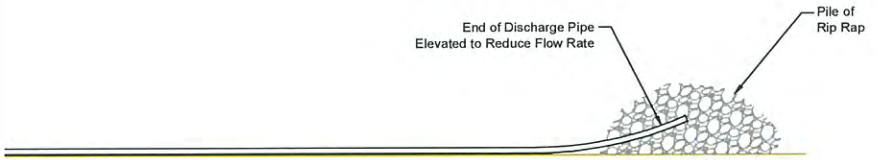


30 m min.

STREAM OR LAKE BED

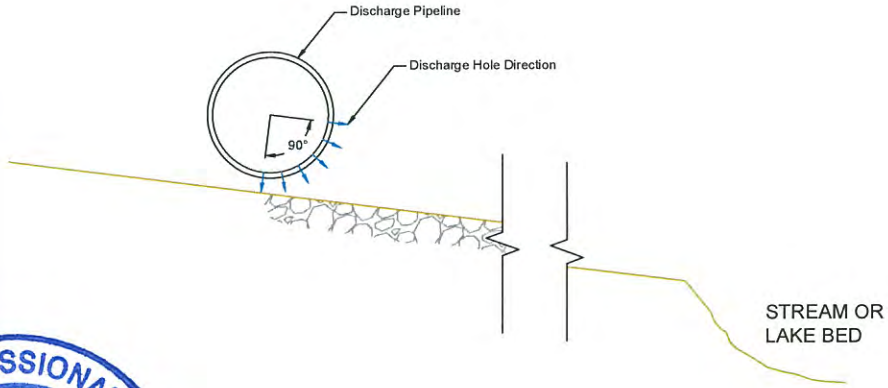
1 Plan View

NTS (typ.)



2 Pipe End Profile

NTS (typ.)



3 Pipe Cross-Section

NTS (typ.)

DATE	ISSUE/REVISION	REV No.	DRW.	APP.
2016-12-08	Draft for review	A	KAB	EL

PROFESSIONAL ENGINEER YUKON TERRITORY ERIC J. L. CASTER

12/27/16

ALEXCO ENVIRONMENTAL GROUP

Flame & Moth
Water Use License
Drawing No: ALEX-13-NMP-02-G-0000

Discharge Pipe Diffuser Details

REVISION: A	2016-12-08	PROJECT No: ALEX-13-NMP-02
DRAWN BY: KAB	DESIGNED BY: EL	REVIEWED BY: BT

E:\Users\Admin\BIP\Projects\Flame_Moth\Production Drawings\0000-General\ALEX-13-NMP-02-G-0000-DiffuserDetails.dwg (last edited by: kbodt, 2016/12/08 - 10:27 AM)