Klohn Crippen Berger

Huakan International Mining Inc.

Greenwood Gold Project

Tailings Storage Facility - Dam Safety Review

November 2014
P09951A01

Huakan International Mining Inc.

Greenwood Gold Project

Tailings Storage Facility - Dam Safety Review

Klohn Crippen Berger

November 25, 2014

Huakan International Mining Inc.
Suite 850 – 580 Hornby Street
Vancouver, British Columbia
V6C 3B6

Mr. Paul Cowley
Mine Manager

Dear Mr. Cowley:

Greenwood Gold Project
Tailings Storage Facility - Dam Safety Review

Please find attached the Dam Safety Review (DSR) final report. The DSR is a requirement of the Ministry of Mines, as recommended under the guidance of the Canadian Dam Association.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

Steven R. Ahlfield, P.Eng.,
Principal, Geotechnical

SRA/TJ/HM:tj

141125R-Greenwood 2014DSR
M09951A01.730

EXECUTIVE SUMMARY

This report presents the results of a Dam Safety Review (DSR) that was performed by Klohn Crippen Berger Ltd. (KCB) for the Greenwood Gold Project Tailings Pond and Emergency Water Storage Pond. The DSR included a site visit by the Dam Safety Review Engineer, Mr. Steven R. Ahlfield, P.Eng. This 2014 Dam Safety Review report follows the guidelines provided by the Canadian Dam Association (2013) and the Association of Professional Engineers and Geoscientists of BC (2014).

The tailings storage facility was constructed to the Starter Dam design grades in 2007. The Greenwood mill operated for 8 months before suspending operations in late 2008. The Greenwood project is currently in a state of care-and-maintenance. A preliminary dam breach analysis was completed for the existing tailings starter dam for this Dam Safety Review. The original "High" consequence classification was based on the 1999 Canadian Dam Association "Dam Safety Guidelines for the ultimate design height and storage capacity of the TSF. The recommended TSF failure consequence classification in the current state is reduced to "Significant" as defined by the 2013 Canadian Dam Association "Dam Safety Guidelines". The original Flood Discharge and Seismic design criteria for the tailings storage dam exceed the current CDA design criteria for both "Significant" and "High" consequence classifications.

The conclusion of this DSR assessment is that the tailings facility dams are in good condition and reasonably safe with the installation of emergency spillways at the Emergency Water Pond and the Tailings Storage Facility following the dam safety inspection site visit. However, the dam safety review revealed some deficiencies and non-conformances, and opportunities for improvement. These are summarized in Table 6.1.

Table 1 DSR Non-Conformance and Deficiency Recommendations

Deficiency (D) or Non-Conformance (NC) - Description	No. (Report Section)	Recommended Action	Schedule
(D) Tailings Pond Surface Water Diversion System	4.2.1	Install gates or other barriers on inlet culverts at dam abutment to control in-flow of surface water from diversion ditches while under Care and Maintenance conditions.	Prior to 2015 Freshet
(NC) Training	5.6.1	Provide a training workshop for custodians, which includes potential failure modes and effects, dam safety monitoring, emergency preparedness and emergency response procedures and refresh annually.	2014
(NC) Annual Inspections	5.6.1	Annual inspections to be conducted by a professional engineer registered in British Columbia with experience in dam safety.	2015
(NC) Inspection Records	5.6.1	Document inspections of the tailings facility and maintain records at the mill office.	Implemented November 2014
(D) Incident Reporting	5.6.1	The document management system should include a system for incident reporting.	2014
(D) - OMS Document	5.6.2	Review the OMS annually and update as required.	2015

Recommended maintenance and surveillance items are summarized in Table 6.1.

Table 2 Maintenance and Surveillance Recommendations

Maintenance (M) or Surveillance (S) -Description	No. (Report Section)	Recommended Action	Schedule
(M) Drainage Ditches	4.2.1 5.4.3	Clean out remaining site drainage ditches and install erosion protection in ditches and at culvert outlets, as per design, to reduce maintenance frequency.	Prior to 2015 Dam Safety Inspection
(S) Tailings Storage	5.5.2	Survey the existing tailings beach surface to assess existing tailings volume.	Prior to 2015 Dam Safety Inspection
(S) Piezometric Levels	5.4.2	Monitor piezometric levels quarterly and document in annual inspection report.	Prior to 2015 Dam Safety Inspection
(S) Piezometer Identification	4.2.7	Piezometers should be clearly labelled in the field to facilitate collection of readings.	Prior to 2015 Dam Safety Inspection
(S) Water Quality	5.4.2	Monitor groundwater and tailings pond water quality annually.	Prior to 2015 Dam Safety Inspection
(S) Crest Monuments	4.2.7 5.4.2	Install 4 survey monuments on dam crest for monitoring settlement and lateral displacements. Monitor quarterly for one year and annually thereafter. Document results in the annual report.	Prior to 2015 Dam Safety Inspection
(M) Dam Clearing	4.1.1 4.2.2	Clear trees and small shrubs on emergency water pond embankment and tailings dam from upstream crests to downstream toes.	2015
(M) Seepage Recovery Clearing	4.2.3	Clear vegetation between downstream toe of tailings dam and seepage recovery ditch and pond to permit visual assessment of seepage in weekly inspections.	2015
(M) Pond Liner	4.2.4	Inspect pond liner and repair damaged areas using sealants or procedures approved by the LLDPE liner manufacturer.	2015
(S) Water Level Gauge	4.2.4	Install a water level gauge at the Emergency Water Pond and correct the water level marks on the geomembrane liner at the tailings pond.	Prior to 2015 Dam Safety Inspection
(M) Submergence of tailings	5.5.2	The OMS manual states that tailings will be submerged to reduce the risk of tailings acid generation. Although water quality is currently moderately affected, tailings oxidation has the potential to turn the tailings pond from neutral to acidic once the “lag” time is exceeded, if tailings composition is as predicted in the design phase of the project.	Following 2015 Spring freshet.

The recommended “Significant” consequence classification for the current “Care and Maintenance” conditions requires Dam Safety Reviews at 10 year intervals in accordance with the BC Mining Dam Requirements (2014). The consequence classification should be reviewed if mill operations recommence or closure is implemented.

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

List of Tables

List of Figures

List of Appendices

TABLE OF CONTENTS
(continued)

1 INTRODUCTION

This report presents the results of a Dam Safety Review (DSR) performed by Klohn Crippen Berger Ltd. (KCB) for the Greenwood (formerly Zip) Tailings Storage Facility (TSF) and Emergency Water Pond (EWP) dams. The Dam Safety Review Engineer is Mr. Steven R. Ahlfield, P.Eng. The DSR was commissioned by Huakan International Mining Ltd. (Huakan), of Vancouver, BC, on August 6, 2014.

The DSR has been prepared in compliance with The Association of Professional Engineers and Geoscientists of British Columbia (APEGBC) document: "Professional Practice Guidelines – Legislated Dam Safety Reviews in BC" (2013), which provides guidance on the scope of work and reporting requirements for a DSR. The Qualified Professional, Mr. Steven R. Ahlfield, P.Eng., is a geotechnical engineer with 38 years of experience in water storage and tailings dams worldwide. As recommended by APEGBC (2013), Huakan will arrange for an independent peer review of this DSR report by others.

The Canadian Dam Association (CDA) Dam Safety Guidelines (CDA 2013) define a DSR as "a systematic review and evaluation of all aspects of design, construction, maintenance, operation, processes, and systems affecting a dam's safety, including the dam safety management system." These guidelines provide a suggested frequency of DSRs based on consequence classification. The Greenwood TSF was classified as a "High" consequence structure (KCB 2007) and therefore the suggested frequency is every 7 years. This is the first DSR since completion of dam construction in 2007. The DSR is based on the condition of the dam that was observed during the site visit by Mr. Ahlfield on September 11 and 12, 2014. Subsequent corrective actions by Huakan have responded to some of the identified non-conformances and deficiencies as noted in this review.

The Ministry of Energy and Mines (MEM) of BC classifies the tailings impoundment and dam as "Major" according to the Health, Safety and Reclamation Code for Mines in British Columbia (MEMPR, 2008).

2 BACKGROUND INFORMATION

2.1 Project Background

The Greenwood Gold Project is composed of the underground Lexington gold-copper mine, Golden Crown high grade gold-copper deposit and a 200 tonne-per-day gravity-flotation mill and tailings facility located at the Greenwood (formerly Zip) property located between the towns of Greenwood and Grand Fork, BC.

Figure 2.1 Greenwood Mill ("Mill") Location Relative to Associated Mines (per Huakan – www.huakanmining.com)

The project was constructed between September 2007 and May 2008 by then owner Merit Mining Corp. of Vancouver, BC, which changed its name in 2010 to Huakan International Mining Inc. On May 8, 2008, the project received mine and mill operating permits from Province of BC to operate at 72,000 tonnes per year for the Lexington-Grenoble mineralization. The Greenwood mill operated for 8 months before suspending operations in late 2008 (source: www.Huakanmining.com/projects/greenwood-project/).

The Greenwood project is currently in a state of care-and-maintenance.

2.1.1 Management

The key management personnel of the Greenwood TSF are listed in the Greenwood ERP (Huakan 2014). The organization chart presented in the Greenwood OMS manual had not been updated since the mine and tailings facility changed to Care and Maintenance status in 2008. Huakan updated the OMS in November 2014 and reports that a copy was placed at the mine site on November 14, 2014.

Key management positions for the current care-and-maintenance status from the November 2014 update to the OMS are:

- CEO – Huakan: Mr. Jeffrey Ren.
- Mine Manager: Mr. Paul Cowley, P.Geo.

2.2 Document Review

Table 2.1 and Table 2.2 summarise the available documents and unpublished data, respectively, available to KCB for the Dam Safety Review.

Table 2.1 Design, Construction, and Inspection Records Reviewed for DSR

Date	Prepared By	Title	Key Items of Interest
14-Jun-2007	Klohn Crippen Berger Ltd.	Greenwood Tailings Storage Facility – Detailed Design Report	Design Report
27-Nov-2007	MESH Environmental	Design Memorandum	Tailings ARD/ML Potential
31-Jan-2008a	Klohn Crippen Berger Ltd.	2007 Greenwood Tailings Facility – Starter Dam – "As-Constructed" Report	Construction record report and drawings
20-Feb-2008b	Klohn Crippen Berger Ltd.	Greenwood Tailings Storage Facility – Operation, Maintenance and Surveillance Manual – Rev.2008-B	OMS Manual, including an emergency response plan framework.
9-Apr-2008c	Klohn Crippen Berger Ltd.	Greenwood Tailings Storage Facility – Drainage Plan	Drainage and diversion ditch design for mill and TSF site
31-Mar-2010	Merit Mining Corp.	Annual Dam Safety Inspection Report for 2009 on the Greenwood (Zip) Tailings Facility	Inspection
23-Mar-2012	Gold Crown, LLC	Annual Dam Safety Inspection Report for 2011, Mines Act Permit Number: M-233, Greenwood (Zip) Tailings Facility	Inspection
23-Mar-2013a	Gold Crown, LLC	Annual Reclamation Report for 2012, Mines Act Permit Number: M-233, Greenwood (Zip) Mill Processing Ore from the Lexington-Grenoble Mine	Inspection
23-Mar-2013b	Gold Crown, LLC	Annual Dam Safety Inspection Report for 2012, Mines Act Permit Number: M-233, Greenwood (Zip) Tailings Facility	Status Report
31-Mar-2014	Huakan International Mining Inc.	Annual Reclamation Report for 2013, Mines Act Permit Number: M-233, Greenwood (Zip) Mill Processing Ore from the Lexington-Grenoble Mine	Status Report
9-Jul-2014	BC Ministry of Energy and Mines	Report of Geotechnical Inspector	Ministry's order for DSR
14-Aug-2014	Huakan International Mining Inc.	Emergency Response Plan for Care-and-Maintenance Huakan International Mining Inc. Lexington Mine and Greenwood Mill Property	
23-Oct-2014	Klohn Crippen Berger Ltd.	Greenwood Gold Tailings Storage Facility - Temporary Spillway Design	Design Report

Table 2.2 Data Available for DSR

Data Owner	Prepared By	Description	Key Items of Interest
Huakan	ALS	Greenwood Project Water Samples – Sampled 03-June-2014	WQ data at monitoring locations in Snowshoe Creek, Lexington #2 Portal, Goosmus Creek
Huakan	ALS	Mill Site – Zip Water Samples – Sampled January 2008 and October 2014.	WQ data for TSF pond
Huakan	Paul Cowley	Photographs of the site subsequent to the September 11 and 12, 2014 site visit	Newly installed spillway in both Greenwood TSF and Emergency Water Storage Pond

2.2.1 Management Review and Reporting

A management and reporting system is in place, but appear to be limited to:

- Verbal but undocumented site reports from security personnel to management. Huakan indicates that this has subsequently been upgraded to weekly documented inspections;
- Annual reports on the tailings facility by Merit/Huakan and Gold Crown; and
- Annual Reclamation Reports for the Greenwood Mill and TSF site.

2.2.2 Design

The existing TSF design is documented in the following design reports:

- TSF Design: “Greenwood Tailings Storage Facility – Detailed Design Report”, by KCB, dated June 14, 2007.
- Site Drainage and TSF Diversions: “Greenwood Tailings Storage Facility – Drainage Plan”, by KCB, dated April 9, 2008.
- Spillway: “Greenwood Gold Tailings Storage Facility - Temporary Spillway Design”, by KCB, dated October 23, 2014.

The Engineer of Record (EoR) for the Greenwood TSF is Klohn Crippen Berger Ltd.
Terence K. Jibiki, P.Eng. led the design and associated studies, and construction monitoring works.

2.3 Regulatory

2.3.1 Ministry of Energy and Mines

The Greenwood Tailings Facility is regulated under the Mines Act of British Columbia and must comply with the requirements of the Health Safety and Reclamation Code (HSRC or the “Code”) for Mines in BC (BC MEMPR 2008). The requirements related to tailings impoundments in the Code include the following:

- Dams must be designed in accordance with the criteria provided in the Canadian Dam Association, Dam Safety Guidelines (HSRC 10.1.5).

- The Operation, Maintenance and Surveillance (OMS) manual must be revised regularly during operations (HSRC 10.5.2).
- Annual Dam Safety Report (HSRC 10.5.3) must be carried out and submitted to the Ministry of Mines.
- There must be an Emergency Preparedness Plan for any dam with a consequence classification of "High" or "Very High." (HSRC 10.6.8).

The Ministry of Mines follows the guidance of the Canadian Dam Association, which has recently issued the Technical Bulletin entitled "Application of Dam Safety Guidelines to Mining Dams". The Bulletin includes the need to consider seepage/groundwater quality impacts and the various stages of a tailings dam. The Bulletin also considers higher design criteria for long term closure.

2.4 Current Operational Status

The Lexington-Grenoble Mine operated under a "Notice of Work" bulk sample permit between July 2007 and May 2008 where portal rehabilitation, decline dewatering, and the mining of a 10,000 tonne bulk sample were performed by Merit Mining Corp. Subsequently, Merit Mining operated the Lexington-Grenoble Mine under current Mines Permit M-234 until December 3, 2008 when production was suspended due to high costs and low metal prices. The operation has remained under care and maintenance since December 2008.

2.5 Incidents

There have been no reported dam safety incidents at the Greenwood Gold TSF based on the documents reviewed for the DSR.

2.6 Interviews

Interviews were held with key staff during the DSR site visit on September 11-12, 2014. A summary of interview notes is provided below:

2.6.1 Paul Cowley, P.Geo. – Mine Manager

Mr. Paul Cowley accompanied the DSR engineer on the site visit, and was Huakan's primary contact and source of input to the DSR.

2.6.2 Greenwood Mill Custodians

Custodians are present at the Greenwood site 24/7 and normally work two weeks on site and two weeks off with a one to two hour overlap between shifts. Both custodians were on site during the September 11 to 12, 2014 site inspection. Both custodians appear to be resourceful individuals with experience in operating at remote sites. However, neither custodian had received any training in dam surveillance or emergency preparedness or response. The 2008 Operations, Maintenance and

Surveillance (OMS) Manual was not available on site and neither custodian was aware of the OMS requirements.

The custodians carry out a weekly inspection of the site including the Emergency Water Pond and Tailings Storage Facility. However, no inspection report is prepared and the conditions are not documented photographically.

Huakan updated the OMS manual subsequent to the DSR site visit and reports that a copy of the updated OMS was on site effective November 14, 2014. Huakan also reports that weekly documented inspections by the custodians were initiated subsequent to the site inspection.

2.6.3 Terence Jibiki, P.Eng. - Engineer of Record

Mr. Jibiki provided the DSR engineer with the following input during preparation of this DSR:

- KCB has not been engaged by the owner (Merit Mining or Huakan) since preparation of the OMS Manual and Construction Record report (2008).
- The detailed design report included separate tailings storage facilities for a Potentially Acid Generating (PAG) tailings stream at “Site B” and a Non-Acid Generating (NAG) tailings stream at “Site A”.
- Merit Mining elected to combine the PAG and NAG tailings in a single tailings storage facility located at “Site A”.
- The “Site A” dam was designed for storage of NAG tailings with an upstream zone of low permeability fill as a seepage barrier. An upstream geomembrane liner was installed in lieu of the upstream low permeability zone during the construction phase to allow for storage of both NAG and PAG tailings streams and to mitigate any potential concerns with seepage. The geomembrane liner was installed over the entire tailings pond area.
- The internal zones of the dam were also revised due to the availability of blasted rockfill from excavations within the tailings pond area.
- The geomembrane anchor trench was backfilled and the seepage collection ditch excavated after KCB staff left the site in December 2007.
- The spillway channel was not completed during the 2007 construction period. Merit Mining was to complete the spillway channel excavation in 2008 before the 2009 freshet.
- A surface water management system was designed by KCB in 2008(c). The construction of the surface water management facilities were not monitored by KCB.
- KCB did not design or monitor the construction of the Emergency Water Pond.

3 FACILITY DESCRIPTION

3.1 General

The Greenwood TSF is located in Southern British Columbia 11 km northwest of Grand Forks. The Greenwood Gold Project consists of an underground “small mine” development for an initial capacity of 72,000 tonnes per year from the Lexington-Grenoble deposit. Construction Record Drawings referenced throughout the text are presented in Appendix I. See Drawing D-7001 (Rev.1) for project location and Drawing D-7002 (Rev.1) for a General Arrangement showing the mill and tailings facilities.

Ore was transported from the Lexington-Grenoble underground mine, located approximately 9.5 km to the southwest, to the mill site located adjacent to the TSF. One tailings stream is produced: a pyrite bearing final tailings. The wastes have been stored within the geomembrane-lined tailings impoundment. Geochemical testing of the tailings during the design phase indicated if a separate pyrite tailings was produced; it had the potential for developing acid rock drainage. Therefore, the facility was designed for tailings storage in a saturated impoundment with a saturated rockfill cover on closure and with zero-discharge of contact water.

3.2 Land Tenure

The Greenwood Process Plant and TSF site lie on the Zip 2-post mineral claims. The Crown owns the surface rights on the property. Gold City Industries Ltd., the previous owners, contacted Land and Water British Columbia Inc. (LWBC), a corporation of the government of British Columbia, to investigate the surface rights status of the process plant and tailings site. The area falls within district lot DL2701, SDYD and confirmed as untitled, Crown-owned with no private surface owners. The only Land Act Tenure existing is a SECTION 16 RESERVE for an abandoned Railway, in the name of LWBC over DL2059s and DL2061s for planning purposes.

3.3 Facility Components

3.3.1 Tailings Impoundment and Dam

The entire tailings impoundment is lined with a 40-mil LLDPE geomembrane liner up to the starter dam crest at approximately El. 1197.5 m (minimum crest elevation).

The starter dam is a zoned rockfill embankment dam, constructed from earthfill and rockfill borrowed mainly from within the impoundment (see Figure 3.1). The starter dam is approximately 15 m high, with the ultimate dam designed to be approximately 25 m high. The starter dam has upstream and downstream slopes of approximately 2H:1V and a crest width of 10 m. The downstream toe is built up with a rockfill toe-berm up to El. 1187 m. Drawings D-7006 (Rev.1) and D-7008 (Rev.1) show the plan and cross-sections of the Greenwood TSF starter dam. Construction record drawings are provided in Appendix I.

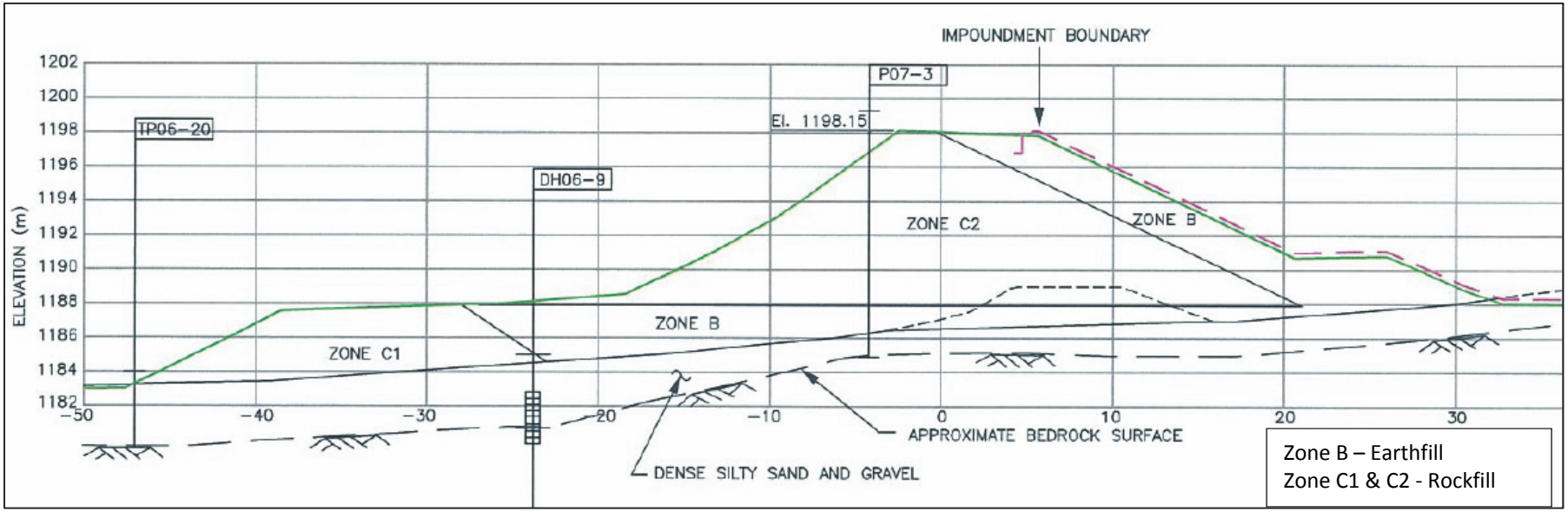

Figure 3.1 Typical Starter Dam Embankment Cross Section (Sta. 3+50)

The as-built starter dam impoundment storage capacity, assuming horizontal layers, is presented in Table 3.1.

Table 3.1 Impoundment Storage Capacity Rating Curve

Elevation (m)	Horizontal Surface Area (m^2)	Cumulative Storage (m^3)
1186	108	0
1187	845	418
1188	1,780	1,700
1189	5,350	5,100
1190	7,590	11,500
1191	10,200	20,400
1192	12,500	31,700
1193	14,400	45,200
1194	16,200	60,500
1195	17,900	77,500
1196	19,600	96,200
1197	21,200	116,600
1197.4	22,200	125,300

3.3.2 Diversion Ditches

The TSF was designed to operate as a zero-discharge system. The average annual water balance was intended to be managed, as far as practical, to minimize storage of excess water from year to year. Accordingly, the drainage plan was designed to divert runoff from catchment areas, which are not required for the water balance, around the tailings storage facility. The remaining areas, under average year conditions, will report to the TSF.

The drainage plan was designed with capacity for peak flows from a 200-year return period precipitation event over the Greenwood TSF site and catchment area.

Flows from disturbed areas, such as the mill area, were designed to be routed to the TSF. Freshwater flows were designed to be diverted around the tailings storage facility. The surface water management system was design with the option to divert freshwater to the tailings storage facility for recycling to the process plant if additional water was required. A copy of the Greenwood mill and TSF site drainage plan is included in Appendix II.

3.3.3 TSF Spillway

The TSF was designed to store the 200 year flood and larger flows will be routed through the impoundment and discharged via an emergency spillway. During operation, the tailings impoundment will require an emergency spillway to pass flows equivalent to a 1 in 10,000 year event as the dam is raised. The spillway will be excavated in the dam abutment, and relocated as the tailings dam crest is raised.

3.3.4 Seepage Collection System

A seepage collection ditch and pond is located downstream of the tailings dam to collect potential seepage and local runoff. The quality of the pond water will be monitored. If it meets discharge quality criteria, it could be released. Otherwise, it will be pumped back to the tailings impoundment. For the approximate location of the seepage collection ditch, see Drawing D-7006 (Rev.1) in Appendix I.

3.3.5 Tailings Pipeline and Water Reclaim Pump and Pipeline

During operation, the tailings flow from the process plant was by gravity to the TSF via a 76.2 mm diameter, DR 11, HDPE pipe. Tailings were spigotted into the impoundment at the north (left) abutment of the starter dam, forming a beach adjacent to the spigot and a pond at the south side of the impoundment where supernatant was reclaimed to the mill via a submersible pump.

3.4 Site Conditions

The following site condition information was gathered from the KCBL report, “Greenwood Tailings Storage Facility – Detailed Design Report”, issued to Merit on June 14, 2007 (KCB, 2007). Additional details are provided in the report.

3.4.1 Physical Setting and Geology

The TSF is located about 400 m southeast of the mill site. The local topography forms a semicircular basin in the hill slope and then flattens out at the base. The area is overlain by a thin veneer of well-graded glacial till and colluvial/outwash soils up to 8 m in depth. The glacial till appears as a veneer up to several metres thick overlying bedrock. Details of the geotechnical site investigations completed for the Greenwood TSF design is reported by KCB (2007).

3.4.2 Climate

The mill and tailings site lies in the Okanagan Highland Hydrological Zone, on the slopes of the Midway Range.

Precipitation

The average monthly distribution of precipitation assumed for the TSF design is shown in Table 3.2.

Table 3.2 Average Precipitation - Monthly Distribution

Event	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Rainfall (mm)	0	0	0	0	0	0	29	39	45	22	35	19	189
Snowfall (mm)	29	52	63	47	44	49	0	0	0	0	0	0	284
Total Precipitation (mm)	29	52	63	47	44	49	29	39	45	22	35	19	473

Evaporation

The average annual lake evaporation is 356 mm. The monthly distribution is shown in Table 3.3.

Table 3.3 Average Evaporation - Monthly Distribution

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Evaporation (mm)	0	0	0	0	0	0	0	71	86	88	70	41	356
Evaporation (%)	0%	0%	0%	0%	0%	0%	0%	20%	24%	25%	20%	11%	100%

Temperature

Temperature recorded at Grand Forks for the period of 1970 to 1977 in presented in Table 3.4.

Table 3.4 Mean Monthly Temperature

Month	Temperature[(1)] (C)
January	-9
February	-4
March	-3
April	2
May	7
June	11
July	15
August	15
September	10
October	4
November	-3
December	-7

1. (Phoenix Mine Site)

3.4.3 Hydrogeology

The geology of the tailings areas consists of shallow soils (typically 2m to 6 m) overlying bedrock. The soils range from gravely sands with silt, to silty sands and gravels with some clay, and one localized deposit of peat north of the mill site. The bedrock is moderately weathered near surface. The groundwater level is typically 2 m above the soil – bedrock contact. The vertical hydraulic gradients, observed from dual piezometer installations, vary from slightly downwards to slightly upwards. The horizontal hydraulic gradients are typically 5% to 10% and mirror the local topography.

The main hydrogeologic unit is considered to be near the soil/bedrock contact, with slightly lower permeability materials typically above this unit and lower permeability bedrock with depth.

3.4.4 Foundation Conditions

The overburden material consists of primarily of silty sand and gravel with cobbles and trace to some clay. The material is medium dense to dense, with equivalent SPT values > 60 blows per foot (3 large penetration tests results indicated >12 blows for 50 mm). An average friction angle (ϕ') of 32 degrees was determined based on the gradation and density of the material.

A grain size analysis and permeability test was conducted on a composite sample from the Site A (current impoundment) test pits. The material generally consists of a well graded silty sand and gravel, with trace clay. The average in situ permeability was 5 x 10^{-7} m/sec.

3.4.5 Seismicity

Seismic Hazard

The most recent seismic hazard assessment was completed in 2007 (KCB).

The probabilistic seismic hazard assessment was carried out for the project site using both the GSC-H and GSC-R seismic source zonal models developed by the Geological Survey of Canada for the new National Building Code of Canada-NBCC 2005 (Adams and Halchuk, 2003). These results are summarized in Table 3.5.

Table 3.5 Probabilistic Evaluation of Peak Ground Acceleration at the Project Site

Annual Exceedance Probability	Return Period (years)	Peak Ground Acceleration PGA (g)
0.01	100	0.03
0.0021	475	0.07
0.001	1,000	0.10
0.0040	2,475	0.14
0.0001	10,000	0.20

A deterministic assessment considered the possibility of a magnitude M 6 located directly beneath the site and an M 7.5 event located near the Purcell Trench, which is the western extent of the Rocky Mountain trench (100 km), and deterministic results are summarized in Table 3.6.

Table 3.6 Summary of Deterministic Assessment

Fault Source	Magnitude	Distance to Fault	Depth	PGA
Local	M 6	0	3 km	0.2
Purcell Trench	M 7.5	100 km	3 km	0.11

3.4.6 Fisheries and Aquatic Resources

At the Greenwood Gold Process Plant and TSF, Snowshoe Creek is characterized as a very small creek with moderate gradient and seasonal intermittent flow. Two waterfalls are located 400 metres

downstream of the plant site and TSF, precluding the presence of fish and aquatic resources in these areas. Snowshoe Creek flows into July Creek (approximately 1.6 km), which is reported as fish bearing.

3.4.7 Vegetation

The major vegetation in the area consists of hemlock, tamarack, cedar, pine and some deciduous trees. Some of the land has been logged in the recent past. There are local areas of thick underbrush and areas of natural grassland. The TSF area was logged by others prior to development of the mine. Some of the catchment area, above the access road, remains forested.

3.4.8 Wildlife

The most common wildlife in the area is deer. There are also occasional sightings of black bear, moose, coyotes, cougar and various small mammals such as squirrels. Bird life includes a variety of small birds plus eagles, hawks, owls and ravens.

A reconnaissance biodiversity assessment report was prepared in October 2004 by Doug Wahl, RPBio, Habitat Biologist and Jenine Mylymok, Habitat Technician on the Greenwood Process Plant and Tailings Facility area. More detailed surveys of fish, birds, bats, mammals, reptiles and amphibians were conducted in 2006 and 2007.

4 SITE INSPECTION AND CONDITION ASSESSMENT

The site inspection and condition assessment was carried out by Steven R. Ahlfield, P.Eng. of Klohn Crippen Berger on September 11 and 12, 2014. Paul Cowley, P.Geo. of Huakan International Mining accompanied Mr. Ahlfield on the site inspection. The major water and tailings storage structures at the mill site consist of an emergency water storage pond and the lined tailings storage facility.

Photographs taken during the site inspection are included in Appendix III.

4.1 Emergency Water Storage Pond

4.1.1 Dam Embankment

Design and construction records for the emergency water pond dam embankment were not available and may not exist as this structure was not designed by Klohn Crippen Berger, the tailings dam consultant.

The embankment is in good condition and is nominally 2.5 m high. The dam embankment appears to be constructed of homogeneous silty sand and gravel fill with side slopes of about 1.5H:1V. The embankment crest is nominally 3 m wide and slopes slightly upstream. The crest and downstream slope of the embankment has sparse vegetation cover and some small trees (see Photo 1). The trees should be cut at ground surface as part of the embankment maintenance program. There are no indications of settlement, instability, or erosion of the dam embankment. No seepage was visible in the vicinity of the dam embankment.

No survey monuments for settlement or displacement monitoring could be located on the dam crest during the DSR site visit and the monuments likely were not installed following construction of the starter dam in 2007.

4.1.2 Pond Liner

The entire water storage pond is lined with a 40 mil thick LLDPE geomembrane (see Photo III-1). The geomembrane is in very good condition with no visible tears or punctures. The geomembrane extends to the upstream crest of the embankment and appears to be anchored in a trench at the embankment crest. No UV light degradation of the LLDPE is apparent from visual observations.

The entire pond area is enclosed with 2.1 m high light wire fencing supported by wooden posts to prevent animal ingress. The fencing is in good condition with one local area of low fence height on the southwest side where the power panel is leaning against the fence (see Photo III-2). The power panel supports and the fence should be repaired. Huakan removed the electrical panel and tightened the sagging fence subsequent to the site visit and provided photographic evidence.

4.1.3 Water Release and Recovery Facilities

The water recovery system consists of a reclaim pump located on the west side. The power panel is leaning against the fence and the reclaim pump is sitting on the embankment crest (see Photo III-2). Both the power system and the pump do not appear to be operational.

The water level in the pond is nominally 0.75 m below the lowest point on the dam crest. A 125 mm PVC outlet pipe is installed through the liner at the east edge of the pond (see Photo 3). The invert of the pipe is nominally 200 mm below the dam crest level. The PVC pipe extends downslope to the northwest edge of the tailings pond and discharges onto the LLDPE tailings pond liner (see Photo III-4). The high water mark on the emergency storage pond liner is about 100 mm above the invert of the outlet pipe; therefore, the pipe has released excess water to the tailings pond historically.

No spillway existed at the emergency water storage pond at the time of the DSR site visit. The release capacity of the PVC outlet pipe is not likely sufficient to carry a 100 year return period inflow design flood appropriate for a Low consequence category structure. Overtopping of the dam embankment would release water into the tailings pond.

Subsequent to the September 11-12, 2014 DSR site visit, Huakan reports that they installed a spillway structure (photo VI-1) on the left abutment of the dam embankment. According to Huakan, the invert of the spillway was constructed at the same elevation as the base of the PVC outlet pipe, which was removed in the process. The spillway invert is 4 m wide and the invert and sides are lined with geomembrane from the inlet to the downstream side of the embankment crest. Rip-rap was placed on the outlet channel on the downstream embankment slope to disperse any flow and prevent erosion of the embankment. KCB did not design or monitor the construction of the spillway structure.

4.2 Tailings Storage Facility

4.2.1 Surface Water Diversion System

Surface water interception ditches are located in the tailings pond catchment area downslope of the plantsite on both the north and south sides. The inverts of the interception ditches are nominally 0.4 m to 0.6 m wide with a ditch depth of nominally 0.15 m to 0.45 m. The locations of the surface water diversion ditches are in general accordance with Kohn Crippen Berger's "Drainage Plan" design report dated April 9, 2008; however, none of the ditches are lined with erosion protection as recommended in the design report.

The surface water diversion ditches have some shrub and small tree growth (see Photo III-5). Minor erosion is evident in the steeper gradient sections. Sand has been deposited in the lower gradient sections of the diversion ditches around the perimeter of the tailings pond and reduces the flow capacity. The vegetation should be cut, the ditches cleaned out to re-establish the design cross-sections and riprap lining installed to reduce erosion as recommended in the 2008 design report (KCB 2008c). Subsequent to the September 11-12, 2014 DSR site visit, Huakan reports that they have cleaned out the sections of the diversion ditch that were filled with sand. Rip rap lining has not been installed to reduce erosion.

The surface water diversion system was designed with inlet culverts at the southwest (see Photo III-6) and northeast (see Photo III-7) ends of the dam embankment to divert water into the tailings pond if additional process water was required by the mill. These 600 mm diameter inlet culverts have bypass channels and culverts to convey surface water past the inlet culverts when additional process water is

not required. The southwest and northeast bypass channels are shown in Photos III-8 and III-9. The inlet culverts were designed with control gates to prevent inflow when additional process water is not required. The control gates or alternate methods to prevent inflow to the tailings pond have not been installed. Annual inspection reports prepared by the Owners incorrectly identified these inlet culverts as spillway outlets. While these inlet culverts do provide some outlet capacity at high reservoir level, the inlet culvert inverts are nominally 600 mm below the top of the geomembrane liner and the combined flow capacity of the two culverts is not sufficient to satisfy the spillway design requirements.

4.2.2 Dam Embankment

The crest of the dam embankment is nominally El. 1197.5 m. The starter dam has not been raised since the original construction in 2007. The crest is nominally 10 m wide and slopes upstream towards the tailings impoundment at about 2%. The surficial fill material is silty sand and gravel with sparse vegetation growth as shown in Photo III-10. There are no indications of surface water erosion. Huakan reports that the sparse vegetation growth on the embankment crest was cut subsequent to the September 11-12, 2014 DSR site visit.

The downstream slope is comprised primarily of rockfill with an overall slope of nominally 2H:1V and a 5 m wide toe berm. The dam is in good condition with no indications of cracking, instability, bulging, or surface water erosion. The downstream slope and toe area were dry. Scattered small trees have grown on the downstream slope and toe area, which should be cut as part of the maintenance program. Larger trees have grown downstream of the toe berm as shown in Photo III-10.

4.2.3 Seepage Recovery Ditch and Pond

A seepage recovery ditch and reclaim pond are located downstream of the dam. The intent of the seepage recovery ditch and reclaim pond was to pump water back to the tailings pond if the water quality was not suitable for release to the environment. Both the ditch and pond were dry at the time of the site inspection. There are no indications of historic water flow other than runoff from direction precipitation and local runoff during the snowmelt period. .

Small trees obscure visual inspection of the seepage recovery ditch and reclaim pond from the dam crest. These trees should be cut to the downstream side of the ditch to facilitate visual inspection.

4.2.4 Pond Liner

The entire tailings pond is lined with a LLDPE geomembrane (see Photo III-11). The geomembrane is generally in very good condition. The geomembrane extends to the upstream crest of the embankment and is anchored in a gravel filled trench. No UV light degradation of the LLDPE is apparent from visual observations. However, the liner was not designed for long-term UV exposure and the condition of the geomembrane should be monitored.

Local punctures and tears were noted in the southwest corner of the impoundment (Photos III-12 and III-13) where the reclaim pump was located during mill operations in 2008. The damage was likely

caused by installation and removal of the reclaim pump. A small tear in the liner was also observed in the northeast corner of the pond at the location of the culvert inlet pipe (Photo III-14). The geomembrane liner should be inspected and minor punctures and tears should be repaired using a sealant approved by Nilex, the geomembrane supplier.

Small trees have grown in the anchor trench backfill at the crest of the geomembrane liner. These trees should be cutoff at ground level. Huakan reports that the small trees in the anchor trench backfill have been cut subsequent to the September 11-12, 2014 DSR site visit.

4.2.5 Tailings Impoundment

The entire tailings pond and dam area is enclosed with 2.1 m high light wire fencing supported by wooden posts to prevent animal ingress. The fencing is in good condition, with the exception of two areas where entrance appears to have been gained recently (Photo III-9). The site custodians effected immediate temporary repairs and will perform more permanent repairs as time permits.

Elevations have been spray painted on the geomembrane liner near the centre of the dam embankment (Photo III-15). The marked elevations indicate that the crest of the dam is at nominally El. 1255.5 m; however, the construction records indicate that the starter dam was constructed to nominally El. 1197.5 m. Therefore, the elevation marks on the geomembrane liner appear to be 58 m too high. This should be confirmed and new elevation marks installed on the geomembrane liner to facilitate recording of water levels. Assuming the water level labels accurately reflect 0.5 m increments of elevation, the water level marks on the geomembrane liner indicate the following levels:

- Current Water Level: Marked El. 1251.8 m Inferred Actual Level El. 1193.8 m
- Historic High Water Level: Marked El. 1252.5 m Inferred Actual Level El. 1194.5 m

The freeboard at the time of the DSR inspection was about 3.7 m and the historic low freeboard was about 3.0 m. Huakan International Mining could not locate records of previous reservoir level measurements.

The 2011 Annual Inspection Report prepared by Gold Crown, LLC indicates that the mill operated intermittently from approximately July 2007 to December 2008. Tailings were discharged from a spigot point on the northeast dam abutment. The tailings beach is shown in Photos III-11 and III-15. The tailings consist of sand to silty sand with trace gravel at the discharge point. The maximum tailings elevation is 1.0 to 1.5 m above the present reservoir level and the tailings beach slopes at nominally 1% toward the pond area. The tailings above pond level are oxidized, medium dense and supported foot access to the pond level.

The tailings pond contains approximately 52,000 tonnes of tailings, which is approximately 40,000 m^3 and currently stores approximately 20,000 m^3 of water. The remaining storage volume up to the dam crest is approximately 65,000 m^3.

4.2.6 Spillway

The construction record report (KCB 2008a) indicates that there was insufficient time to construct the design spillway on the left abutment prior to the onset of winter weather. The report recommended that the spillway be excavated prior to the 2009 freshet. The spillway was not excavated prior to termination of mill operations in 2008.

KCB provided design drawings for a left abutment spillway in October 2014 (KCB 2014) after the completion of the DSR inspection. Huakan constructed the spillway in October 2014 and forwarded construction photos as verification of the work (see Appendix VII). The photographs appear to be generally consistent with the design intent although KCB did not monitor the construction of the spillway to verify conformance with the design intent.

4.2.7 Water Reclaim

The water reclaim facilities were located in the southwest corner of the tailings impoundment during mill operations. The reclaim pump has been removed from the impoundment. Power cables are located on the embankment crest, but do not appear to be operational. Therefore, no methods to control the pond level are currently operational.

4.2.8 Instrumentation

Piezometers were installed in the 2006 site investigations and additional piezometers and monitoring wells were installed during construction in 2007. Installation details and water level measurements recorded during the site visit are summarised in Table 5.3. The piezometers were not labeled and identification was based on construction record report drawings and sounding of the depth to the bottom of each piezometer as confirmation. All of the instruments should be clearly marked in the field.

The 2008 Operations, Maintenance and Surveillance Manual indicates that four settlement monuments will be installed on the dam crest and monitored quarterly. No settlement monuments were identified on the dam crest during the DSR inspection and may not have been installed.

5 DAM SAFETY ASSESSMENT

5.1 Emergency Water Pond

5.1.1 Dam Classification for Regulatory Purposes

The EWP dam is approximately 2.5 m high and appears to be capable of storing in the order of 10,000 m^3 of water at crest level (according to drawing D-7006 Rev.1). As such the EWP does not meet the definition of a "dam" under CDA Dam Safety Guidelines and is not regulated under BC Dam Safety Regulation (Section 2) as long as the failure consequence classification is "Low". Since the EWP is within the catchment of the TSF, and contains fresh water according to discussions with the Mine Manager, a "Low" classification is appropriate.

Although non-regulated dams do not fall under the BC Dam Safety Regulation, and are not specifically referenced in the Code, owners of non-regulated dams must demonstrate due diligence in their construction, operation, maintenance, and closure (MEM "BC Mining Dams – "At-A-Glance" Requirements" v. January 2014).

5.1.2 Dam Inspections

An MEM geotechnical inspection report dated July 9, 2014 requires Huakan to develop a plan for release of water in a flood event. This plan was not available for review during the DSR.

We agree that flood discharge capacity should be increased above the current 125 mm diameter pipe outlet in place during the inspection. The 2007 CDA Guidelines recommend a 100 year return period inflow design flood for a Low consequence class.

The Emergency Water Pond should be included in the OMS manual and included in routine and formal visual inspections for signs of distress or instability. The water level should be recorded during the site inspections.

Huakan reports that they installed a spillway structure (photo VI-1) on the left abutment of the dam embankment subsequent to the September 11-12, 2014 DSR site visit. Huakan reports that the invert of the spillway was constructed at the same elevation as the base of the PVC outlet pipe, which was removed in the process. The spillway invert is 4 m wide and the invert and sides are lined with geomembrane from the inlet to the downstream side of the embankment crest. Rip-rap was placed in the outlet channel on the downstream embankment slope to disperse any flow and prevent erosion of the embankment. KCB did not design or monitor the construction of the spillway structure.

5.2 Tailings Storage Facility

The TSF design has not been revisited since the Greenwood mill and TSF ceased operations. The current "High" consequence classification is based on the ultimate design height and storage capacity of the TSF. The following sections review the TSF failure consequence in the current state.

5.2.1 Credible Failure Modes and Relevant Hazards

Inundation Hazards

The most relevant TSF dam failure modes include:

- Dam breach by overtopping (extreme precipitation or snow melt); and
- Dam breach by embankment instability (seismic or seepage induced).

The existing tailings and water level within the TSF is significantly lower than the dam crest, with a high water mark noted during the site visit near El. 1194.5 m. Given the fully lined pond and primarily rockfill embankment, a seepage induced failure is unlikely. The embankment and foundation soils are unsaturated, based on the latest water level readings; therefore, seismic liquefaction is not possible in these soils.

As discussed in Section 4.2.6, an emergency spillway was constructed in the left abutment of the TSF in October 2014. The design spillway invert is El. 1196 m, 1.5 m below the minimum crest level. The spillway has a design capacity of the probable maximum flood (PMF), therefore overtopping likelihood is low.

Environmental Hazards

Environmental failure modes of the TSF include:

- Release of contact water from the TSF spillway if pond water exceeds permitted discharge water quality; and
- Excessive seepage through the liner resulting in exceedances at water quality compliance points downstream.

Recent water quality results from the TSF pond show the water quality is currently within BC Water Quality Guidelines for aquatic life (BCWQ. Water quality data provided by Huakan is included in Appendix V. In the TSF pond sample dated 5 October 2014.

Huakan (2009) reports that 52,000 tonnes of tailings were deposited in the TSF before operations were suspended. This is approximately 11% of the original (ultimate) TSF design capacity, and roughly 40% of the existing Starter Dam capacity.

5.2.2 Consequence Classification Review

The Canadian Dam Association Dam Safety Guidelines (2007, revised in 2013) provide a classification of dams based on the consequences of failure, as shown in Table 5.1. The dam consequence classification should be selected based on the highest classification in any single criteria.

Table 5.1 Dam Consequence Classification Criteria (after CDA, 2013)

Dam Class	Population at Risk	Incremental Losses		
		Loss of Life	Environmental and Cultural Values	Infrastructure and Economics
Low	None	0	Minimal short-term No long term loss	Low economic losses; area contains limited infrastructure or services
Significant	Temporary only	Unspecified	No significant loss or deterioration of fish or wildlife habitat Loss of marginal habitat only Restoration or compensation in kind highly possible	Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes
High	Permanent	10 or fewer	Significant loss or deterioration of *important* fish or wildlife habitat Restoration or compensation in kind is highly possible	High economic losses affecting infrastructure, public transportation, and commercial facilities
Very high	Permanent	100 or fewer	Significant loss or deterioration of *critical* fish or wildlife habitat Restoration or compensation in kind possible but impractical	Very high economic losses affecting important infrastructure or services (e.g., highway, industrial facility, storage facilities, for dangerous substances)
Extreme	Permanent	More than 100	Major loss of *critical* fish or wildlife habitat Restoration or compensation in kind impossible	Extreme losses affecting critical infrastructure or services, (e.g., hospital, major industrial complex, major storage facilities for dangerous substances

See Table 2-1 in the CDA 2013 Guidelines for notes related to population at risk and implications of loss of life.

In 2007 a consequence category of "High" was selected using 1999 CDA Dam Safety Guidelines. The Greenwood OMS Manual (KCB 2008b) summarises the classification:

> *"Given the potential for environmental damage and substantial clean-up costs, the Greenwood TSF is classified as a "High" consequence facility."*
>
> *"If the TSF were to store entirely non-potentially acid generating tailings, the consequence of failure would, therefore, be significantly less and the dam would be classified as a "Low" consequence facility."*

When the CDA Guidelines were revised in 2007 (and including the recent revisions in 2013), the consequence classes changed from four categories (Very Low, Low, High and Very High) to five categories (Low, Significant, High, Very High, and Extreme) as shown in Table 5.1.

The dam consequence classification in 2007 was based on the Ultimate Dam configuration. However, the existing impoundment only stored tailings for approximately 8 months of operation and, therefore, the consequence of failure of the Starter Dam embankment is expected to be lower than the Ultimate Dam. To support a review of the consequence classification KCB carried out a preliminary dam break assessment, which considered release of approximately 110,000 m^3 of tailings and stored water (overtopping failure). The design memorandum for dam breach analysis is presented in Appendix III.

Figure 5.1 shows the expected inundation flow path, which follows Snowshoe Creek and into July Creek, where it parallels Highway 3 and passes by several residences.

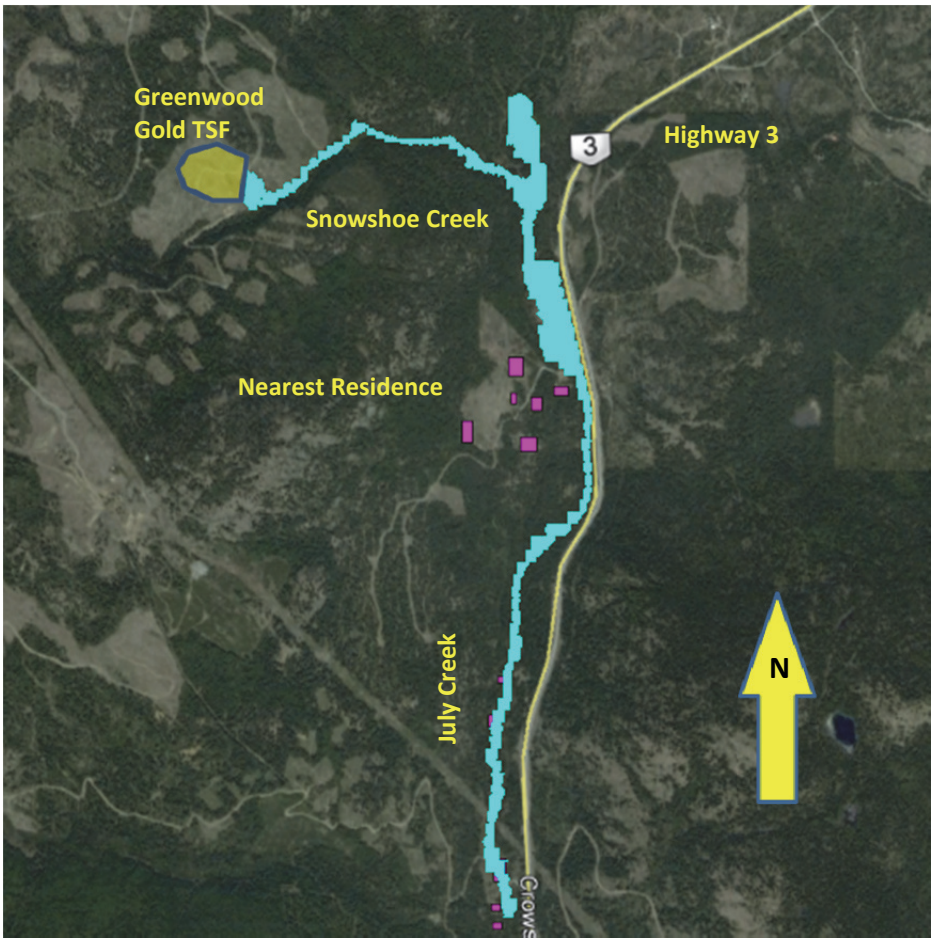

Figure 5.1 Maximum Inundation Area for Rainy Day Dam Breach- 1.7 km from base of TSF to Highway 3 (12% grade) and 2.2 km to nearest permanent dwelling (average 10% grade) (Google Earth 2014)

The revised classification of the TSF, using CDA 2013 and the inundation study was reviewed with respect to the revised 2007 categories as follows, based on review of available information:

- **Population at Risk & Loss of Life**: The nearest permanent residents (unconfirmed) are located approximately 2.2 km downstream of the TSF along July Creek. Provincial Highway No.3 runs

adjacent to July Creek. At its nearest point to the potential inundation path, Hwy. No.3 is approximately 1.7 km downstream of the TSF, at the base of the relatively steep and narrow Snowshoe Creek drainage path. The flood wave depth in this reach is on the order of < 1 m. Recreational activities (hunting, fishing, etc.) in the inundation zone are infrequent. Recommended consequence classification: Significant.

- **Environmental and Cultural Values**: Snowshoe Creek and July Creek are not known to represent high importance aquatic habitat; however, if tailings were to enter the river system they could travel further downstream into the Kettle River system, an important regional water catchment. According to recent data (see Appendix V), TSF pond water remains neutral, meeting the BCWQ criteria for aquatic life. However, this does not preclude the potential for the tailings to begin generating acidic runoff in the future if they are not submerged; instead it is an indication of the lag time or neutralizing capacity within the tailings. Given the smaller amount of tailings in the impoundment, and the lag time to acid generation in the tailings), restoration of a dam breach would appear possible. Recommended consequence classification: Significant.
- **Infrastructure and Economics**: The infrastructure nearest the Greenwood TSF is Highway No. 3 at the base of Snowshoe Creek, where it joins July Creek. An inundation zone resulting from a dam breach with a full impoundment has the potential to impact Hwy. No. 3. Google Earth topography suggests that the highway is about 10 m above July Creek at this location and the inundation zone may be below the highway. The dam breach assessment indicates a flood wave depth on the order of < 1.5 m, which would reach the highway. Recommended consequence classification: Significant.

On the basis of the above, we recommend a dam consequence classification of “Significant” for the existing dam. If and when operations continue and the impoundment is raised, the dam consequence classification will need to be reassessed.

5.3 Regulatory Compliance

Section 2.3 of this DSR report outlines a number of dam safety regulations which apply to this TSF. The following is a summary of observed compliance/non-compliance with document submittals:

- The Operation, Maintenance and Surveillance (OMS) manual (HSRC 10.5.2): The Greenwood OMS manual was developed following construction of the Starter Dam, in 2008. The OMS had not been updated since suspension of operations in December 2008. Huakan updated the OMS manual to reflect the current state of care and maintenance and contact information following the September 11-12, 2014 DSR site visit. The OMS should be update annually.
- Annual Dam Safety Report (HSRC 10.5.3): Dam safety reporting has not been prepared annually since the TSF was constructed. Dam Safety Inspection reports were prepared by the owner in 2009, 2011 and 2012.
- Emergency Preparedness Plan (HSRC 10.6.8): Huakan has prepared an emergency preparedness and response plan.

5.4 Geotechnical and Hydrotechnical Design

5.4.1 Design Basis

As per the Code requirements, the Greenwood TSF dam is designed in accordance with CDA Dam Safety Guidelines applicable at the time. At the time of issuance of the design (June 2007) the 1999 CDA guidelines were in use in the industry. Since this time, revised guidelines have been issued (2007 and 2013). Table 5.2 summarises the differences in minimum criteria of the Dam Safety Guideline versions, and the apparent values used for design.

The inflow design flood (IDF) and design basis earthquake (DBE) both exceed the 2013 CDA criteria for a "Significant" or High" consequence dam.

Table 5.2 Summary of TSF Design Criteria

Item	TSF Design Criteria (KCB 2007)	Current Standards-Based Criteria		Actual Design Input
Dam Safety Guidelines	CDA (1999) for "High" Consequence Structures	CDA (2013) for "Significant" Consequence Structures	CDA (2013) for "High" Consequence Structures	-
Environmental Flood Storage	200 year return period, 30 day precipitation + seasonal storage	Not related to dam safety	Not related to dam safety	200 year return period, 30 day precipitation + seasonal storage
Flood Discharge (Emergency Spillway)	1/10,000 AEP	Between 1/100 AEP and 1/1000 AEP	1/3 between 1/1000 AEP and PMF	PMF (Temporary Emergency Spillway)
Design Basis Earthquake	10,000 year return period PGA = 0.20g (Design checked for deterministic seismic event)	Between 1/100 AEP and 1/1000 AEP 1/475 AEP PGA = 0.07g (NBCC 2010)	1/2475 AEP PGA = 0.14g (NBCC 2010)	PGA = 0.2g (pseudo-static seismic coefficient = 0.12g (0.6 x PGA))
Geotechnical Factors of Safety: ▪ Static ▪ Pseudo-static, seismic coefficient ▪ Post-earthquake liquefaction case	 ▪ 1.5 ▪ 1.15 ▪ 1.1	 ▪ 1.5 ▪ 1.0 ▪ 1.2-1.3	 ▪ 1.5 ▪ 1.0 ▪ 1.2-1.3	Starter Dam (not updated with as-built cross section) ▪ 1.58 ▪ 1.17 ▪ 1.58
	AEP – Annual exceedance probability NBCC – National Building Code of Canada PGA – Peak ground acceleration PMF – Probable maximum flood			

5.4.2 Geotechnical Assessment

Instrumentation

Piezometers were installed in the 2006 site investigations for detailed design and additional piezometers and monitoring wells were installed during construction in 2007. Piezometer and observation well locations are shown in Drawing D-7006 from the 2008 "As-Constructed" report by KCB (2008a). Installation details and water level measurements are shown in Table 5.3. The water level measurements in 2008 and 2009 were extracted from the 2009 Dam Safety Inspection Report prepared by Merit Mining Corporation. The water level measurements were assumed to be relative to the top of the standpipe and observation well casings. The water levels in Table 5.3 were corrected to approximate elevations based on estimated top of standpipe elevations. Standpipe elevations should be surveyed the next time a surveyor is on site. No water level measurements were recorded from 2010 to 2013.

Piezometric levels are generally the same as installation in 2006 / 2007 or lower; however, the data is limited and seasonal variations cannot be evaluated.

Table 5.3 Piezometer and Observation Well Monitoring Records

Designation	DH06-07A	DH06-07B	DH06-08	DH06-09A	DH06-09B	P07-01	P07-02	P07-03	MW07-01	MW07-02
Approx. Ground or Fill Elevation (m)	1193	1193	1174.5	1185 / 1189	1185 / 1189	1196.0	1186.9	1196.6	1181.01	1166.81
Approx. Rock El. (m)	1188.4	1188.4	1172.7	1180.7	1180.7				1175.9	1166.3
Approx. El. Piezometer Tip (m)	1187.6	1189.0	1171.5	1169.2	1181.1	1183.0	1181.2	1184.8	1166.8	1152.1
Standpipe Stick-up (m) (2014)[1]	0.59	0.46	0.30	1.60	1.56	2.20	3.04	2.66	1.33	1.75
Approx. El. Top of Standpipe (m) (2014)	1193.6	1193.5	1174.8	1190.6	1190.6	1198.2	1189.9	1199.3	1182.3	1168.0
Date	Approximate Water Level Elevation (m)									
2006	NR	1189.0	1171.8	1181.1	1180.0					
2007	NR	NR	NR	NR	NR	Dry	Dry	Dry	Dry	Dry
March 31, 2008	NR	1188.4	NR	NR	NR	Dry	Dry	Dry	NR	NR
May 4, 2008	NR	1188.4	1174.0		NR	Dry	1181.8	1186.4	NR	NR
May 26, 2008	NR	1188.5	1173.6	1184.8	NR	Dry	1181.9	1186.1	1176.7	1166.4
August 24, 2008	NR	1189.1	1172.2	1184.7	NR	Dry	Dry	1184.8	1176.4	1155.1
April 30, 2009	NR	NR	NR	NR	NR	NR	NR	NR	1176.9	1166.8
June 25, 2009	NR	1188.8	1172.9	1184.4	NR	Dry	1182.8	1186.0	NR	NR
September 11, 2014[1]	1192.4	1189.0	1171.9	1183.1	1183.2	Dry	Dry	Dry	1175.8	1154.2

1. Measured by Klohn Crippen Berger

The OMS requires quarterly monitoring of piezometric levels and groundwater quality in the monitoring wells. This monitoring schedule should be implemented and the readings documented in the annual inspection report or the OMS must be updated to reflect other monitoring frequencies under the current care and maintenance conditions.

The 2008 Operations, Maintenance and Surveillance Manual indicates that four settlement monuments will be installed on the dam crest and monitored quarterly. No settlement monuments were identified on the dam crest during the DSR inspection and may not have been installed. These monuments should be installed and monitored for settlement and lateral displacements quarterly for one year and annual thereafter.

Seepage and Piping

The most recent piezometer measurements are similar to historical measurements which indicate that the dam fill is not saturated.

A seepage collection ditch and sump has been installed downstream of the dam, and appears to be bottomed in overburden. The seepage collection ditches were observed to be dry during the DSR site visit, nor was there evidence of seepage flows in the past. Huakan reports that no flows have been observed in the seepage recovery pond.

There is no evidence of changing (rising) water levels since construction, suggesting the liner is reducing seepage as designed.

Stability Analysis

The most recent stability analysis for the Starter Dam was completed in 2007, prior to modification of the embankment cross section during construction. The modifications include:

- Re-zoning the embankment, using more higher strength rockfill and less earthfill;
- Changing the downstream slope from 2H:1V to a benched slope with overall slope of approximately 3H:1V;
- Addition of a geomembrane liner.

These modifications all increase the factor of safety; therefore, an update to the stability analysis is not required.

There were no indications of instability observed during the DSR site visit. Huakan also does not report any signs of instability in annual reporting.

Seismic Hazard

The 2013 CDA seismic design criteria reduce the design earthquake return period from 10,000 years to 475 years for a “Significant” Hazard structure. Therefore, the current design exceeds the seismic criteria. The 475 year return period earthquake peak ground acceleration was checked using the revised seismic hazard model utilized in the 2010 Edition of the National Building Code of Canada and found to be unchanged from 2007. The seismic hazard calculation is included in Appendix V.

Geotechnical investigations (KCB, 2007) indicate that the foundation soils are non-liquefiable. The additional of the geomembrane liner has reduced seepage through the dam embankment and monitoring indicates that the dam fills are not saturated; therefore, liquefaction is not possible in the dam fill zones.

5.4.3 Hydrotechnical Assessment

Inflow Design Flood

The inflow design flood event selected for temporary spillway design is the PMF (KCB, 2014) which is higher than necessary. This was done since the incremental peak flow increase to accommodate the higher design event is small on account of the small catchment area of the TSF. Furthermore, the data set on which to base probabilistic flood event return periods is small for the project area so selecting a larger event adds greater confidence to the design at little to no extra cost.

A temporary emergency spillway design was commissioned by Huakan following the DSR site visit. This design was completed by KCB (2014), and reportedly constructed by Huakan on October 24, 2014 (e-mail correspondence from Mr. Paul Cowley). Photographs of the spillway construction provided by Huakan are included in Appendix VII, as is a copy of the construction drawing.

Site Drainage and Diversions

Surface water diversion ditches and culverts are designed for a 200 year return period event, in coordination with the stored environmental design flood. Diversion ditches and culvert outlets were noted to lack the design erosion protection, likely contributing to the sediment accumulation observed in the lower reaches of the drainage ditches. We recommend the drainage ditches be cleared routinely, and rip rap lining be installed as a means of reducing erosion and sedimentation.

TSF Pond Management

An operational criterion for the TSF is to provide adequate freeboard below the discharge spillway to store a 200 year – 30 day flood event. This was to be achieved by adjusting reclaim rates and site drainage collection, and through dam raising. With the exception of events greater than 200 year return period, the TSF was designed to be operated with zero discharge. Under the current care and maintenance setup there are no controls in place to manage the water pond. The 200 year – 30 day flood storage was developed for operations and may not be applicable for the care and maintenance phase of the project. For example, if the water quality of the impoundment water meets BCWQ guidelines for discharge, this storage would not be required.

The observed condition of the pond suggests that the pond is near a neutral water balance. The current water level is below the maximum water level mark on the liner. It may not be possible to assess trends in the pond water level as there have been no pond level measurements reported by Huakan; however, photographic records show a relatively consistent water level.

We recommend that a plan be developed for a condition where the 200 year storage pond level is exceeded, and this plan added to the OMS manual.

5.5 Mining Dam Considerations

5.5.1 Closure

The APEGBC Guidelines (2014) and the CDA technical bulletin for Mining Dams (2014) introduce requirements for consideration of closure and environmental objectives of the dams. A closure concept is presented in Appendix I of the OMS. The closure plan should also consider the potential for degradation of the LLDPE liner during the care and maintenance phase. The CDA technical bulletin for Mining Dams (2014) recommends higher design criteria for closure-passive care, which should be considered in the development of the closure plan.

5.5.2 Water Quality

Water quality from samples collected in 2014 by Huakan at the TSF pond and compliance monitoring locations are presented in Appendix V.

TSF pond water quality data is within BCWQ criteria for freshwater aquatic life. The operating criteria for the TSF included submerging the tailings beach due to the presence (30% of the tailings stream) of PAG (pyrite) tailings. The existing pond level exposes approximately 20% to 30% of the tailings beach to the atmosphere, and there is visible oxidation on the surface. However, this has not translated to poor or acidic water quality, suggesting there is adequate neutralising potential in the combined tailings. Neutralising potential can be consumed eventually; therefore, the current conditions may not last indefinitely. We recommend water be diverted into the impoundment to flood the tailings. We recommend the existing tailings beach surface be surveyed to allow an assessment of TSF storage capacity.

The Greenwood OMS manual includes the following water quality monitoring:

- TSF pond;
- Downstream groundwater monitoring wells; and
- Surface water sampling sites (e.g. Snowshoe Creek and July Creek).

Huakan have monitored these sites intermittently since suspending operations. This data is reported in annual reclamation reports. Huakan updated the OMS manual in November 2014 to reflect the current sampling program.

5.6 Dam Safety Management Program Assessment

5.6.1 Organization and Reporting

Management and Reporting

The following observations were made by the DSR engineer regarding dam safety management and reporting:

- The Greenwood OMS manual reflects the operating condition, and had not been updated for the current care and maintenance condition at the time of the DSR site visit. Huakan updated the OMS manual in November 2014.
- Site custodians did not have a copy of the OMS manual on site and were not aware of its contents at the time of the DSR site visit. Huakan indicates that the updated OMS was sent to the site on November 14, 2014.
- Site custodians were not aware of the potential dam failure modes and effects, or trained in dam safety monitoring, emergency preparedness and emergency response;
- Weekly inspections of the TSF were not being documented (in writing and photographically).

Huakan initiated an inspection check list in October 2014, which was updated in November 2014 (Appendix VIII) to include inspection of TSF diversion ditches for signs of erosion or sedimentation, and provided additional space for general comments or observations. Inspection reports must be filed at the mill site office with copies at the Huakan office.

Incident Reporting

Huakan have not reported any dam safety incidents since construction. KCB has not reviewed a system for reporting incidents should they occur. We recommend that a reporting system be developed if not already in place.

Dam Safety Inspections

Merit/Huakan and Gold Crown completed annual dam safety inspections by their own staff in 2009, 2011 and 2012, but these inspections have not been completed by a professional engineer. The Code (HSRC 10.5.3) states that inspections are to be completed by a professional engineer.

5.6.2 Operations, Maintenance and Surveillance (OMS) Manual

The Greenwood OMS manual was completed in 2008 and was developed for an operational TSF. KCB recommended that the OMS manual be updated to reflect the care and maintenance condition, outlining the maintenance and surveillance programs that should continue until either the mine resumes operation or the facility is closed and the site reclaimed.

A copy of the OMS must be available at the mill site.

Huakan updated the OMS manual in November 2014 and indicates that the updated OMS was sent to the on-site custodians on November 14, 2014.

5.6.3 Emergency Preparedness Plan

Huakan provided the DSR engineer with an updated Emergency Response Plan (ERP) for the care and maintenance stage (Appendix IX). This ERP provides emergency contact details, hazard identification and procedures, primary for personnel health and safety. We recommend that the ERP be augmented to include dam safety information, including but not limited to:

- Construction equipment and materials resource lists for responding to a potential dam breach scenario; and
- Response procedures, such as public notification protocols and contact information, in the event of a TSF emergency (e.g. imminent breach).

The Greenwood OMS manual provides a framework for emergency preparedness and response plans that address dam safety.

A copy of the Emergency Response Plan must be available at the mill office. The ERP must be checked and updated annually. A test of the ERP should be carried out and documented as requested by MEM in their "Report on Geotechnical Inspection" dated July 9, 2014.

6 RECOMMENDATIONS

This 2014 Dam Safety Review (DSR) report has been carried out using the guidelines provided by the Canadian Dam Association (2013) and the Association of Professional Engineers and Geoscientists of BC (2013). "Dam Safety Review Assurance Statement", sealed by the DSR Engineer, is provided in Appendix X in accordance with APEGBC guidelines (2013).

A preliminary dam breach analysis completed for the existing tailings starter dam for this Dam Safety Review. A review of dam failure consequences for the current care and maintenance conditions indicates that the original "High" consequence classification (based on the 1999 Canadian Dam Association "Dam Safety Guidelines for the ultimate design height and storage capacity of the TSF) should be reduced to "Significant", as defined by the 2013 Canadian Dam Association "Dam Safety Guidelines". The original Flood Discharge and Seismic design criteria for the tailings storage dam exceed the current CDA design criteria for both "Significant" and "High" consequence classifications.

The conclusion of this DST assessment is that the tailings facility dams are in good condition and reasonably safe with the installation of emergency spillways at the Emergency Water Pond and the Tailings Storage Facility following the dam safety inspection site visit. However, the dam safety review revealed some deficiencies and non-conformances, and opportunities for improvement. These are summarized in Table 6.1.

Table 6.1 DSR Non-Conformance and Deficiency Recommendations

Deficiency (D) or Non-Conformance (NC) - Description	No. (Report Section)	Recommended Action	Schedule
(D) Tailings Pond Surface Water Diversion System	4.2.1	Install gates or other barriers on inlet culverts at dam abutment to control in-flow of surface water from diversion ditches while under Care and Maintenance conditions.	Prior to 2015 Freshet
(NC) Training	5.6.1	Provide a training workshop for custodians, which includes potential failure modes and effects, dam safety monitoring, emergency preparedness and emergency response procedures and refresh annually.	2014
(NC) Annual Inspections	5.6.1	Annual inspections to be conducted by a professional engineer registered in British Columbia with experience in dam safety.	2015
(NC) Inspection Records	5.6.1	Document inspections of the tailings facility and maintain records at the mill office.	Implemented November 2014
(D) Incident Reporting	5.6.1	The document management system should include a system for incident reporting.	2014
(D) - OMS Document	5.6.2	Review the OMS annually and update as required.	2015

Recommended maintenance and surveillance items are summarized in Table 6.1.

Table 6.2 Maintenance and Surveillance Recommendations

Maintenance (M) or Surveillance (S) -Description	No. (Report Section)	Recommended Action	Schedule
(M) Drainage Ditches	4.2.1 5.4.3	Clean out remaining site drainage ditches and install erosion protection in ditches and at culvert outlets, as per design, to reduce maintenance frequency.	Prior to 2015 Dam Safety Inspection
(S) Tailings Storage	5.5.2	Survey the existing tailings beach surface to assess existing tailings volume.	Prior to 2015 Dam Safety Inspection
(S) Piezometric Levels	5.4.2	Monitor piezometric levels quarterly and document in annual inspection report.	Prior to 2015 Dam Safety Inspection
(S) Piezometer Identification	4.2.7	Piezometers should be clearly labelled in the field to facilitate collection of readings.	Prior to 2015 Dam Safety Inspection
(S) Water Quality	5.4.2	Monitor groundwater and tailings pond water quality annually.	Prior to 2015 Dam Safety Inspection
(S) Crest Monuments	4.2.7 5.4.2	Install 4 survey monuments on dam crest for monitoring settlement and lateral displacements. Monitor quarterly for one year and annually thereafter. Document results in the annual report.	Prior to 2015 Dam Safety Inspection
(M) Dam Clearing	4.1.1 4.2.2	Clear trees and small shrubs on emergency water pond embankment and tailings dam from upstream crests to downstream toes.	2015
(M) Seepage Recovery Clearing	4.2.3	Clear vegetation between downstream toe of tailings dam and seepage recovery ditch and pond to permit visual assessment of seepage in weekly inspections.	2015
(M) Pond Liner	4.2.4	Inspect pond liner and repair damaged areas using sealants or procedures approved by the LLDPE liner manufacturer.	2015
(S) Water Level Gauge	4.2.4	Install a water level gauge at the Emergency Water Pond and correct the water level marks on the geomembrane liner at the tailings pond.	Prior to 2015 Dam Safety Inspection
(M) Submergence of tailings	5.5.2	The OMS manual states that tailings will be submerged to reduce the risk of tailings acid generation. Although water quality is currently moderately affected, tailings oxidation has the potential to turn the tailings pond from neutral to acidic once the “lag” time is exceeded, if tailings composition is as predicted in the design phase of the project.	Following 2015 Spring freshet.

The recommended “Significant” consequence classification for the current “Care and Maintenance” conditions requires Dam Safety Reviews at 10 year intervals in accordance with the BC Mining Dam Requirements (2014). The consequence classification should be reviewed if mill operations recommence or closure is implemented.

7 CLOSING

This report is an instrument of service of Klohn Crippen Berger Ltd. The report has been prepared for the exclusive use of Huakan International Mining Inc. (Client) for the specific application to the Greenwood Gold Tailings Storage Facility – 2014 Dam Safety Review.

In the preparation of this DSR Report, KCB has endeavored to observe the degree of care and skill generally exercised by other consultants undertaking similar DSRs at the same time, under similar circumstances and conditions, and in the same geographical area. KCB makes no other warranty, expressed or implied.

Use of or reliance upon this instrument of service by the Client is subject to the following conditions:

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- The report is read as a whole, with sections or parts of the report read or relied upon in the context of and subject to the terms of the Contract Agreement between KCB and the Client.
- The executive summary is a selection of key elements of our instrument of service. It does not include crucial details needed for the proper application of our findings and recommendations, which are best evaluated with the active participation of the professionals who developed them.
- The observations, findings, and conclusions in this report are based on conditions that existed at the time of the work described herein and should not be relied upon to precisely represent conditions at any other time.

KLOHN CRIPPEN BERGER LTD.

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
11/25/2014
S. R. AHLFIELD

Steven R. Ahlfield, P.Eng.
Dam Safety Review Engineer

REFERENCES

Refer to Table 2.1 for a list of references reviewed for this report. The table also provides a brief summary description of main subjects covered by the reports. Additional references used are as follows:

Association of Professional Engineers and Geoscientists of British Columbia (2014). "Professional Practice Guidelines – Legislated Dam Safety Reviews in BC", July 2013, revised V2.0 March 2014.

Canadian Dam Association (2013). "Dam Safety Guidelines", originally published January 2007. Revised Section 6, published in 2013.

Canadian Dam Association (2014). "Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams", *not yet issued to public*.

Ministry of Energy, Mines and Petroleum Resources (2008). "Health, Safety and Reclamation Code for Mines in British Columbia", by Mining and Minerals Division, Victoria British Columbia, 2008.

Natural Resources Canada (2010). 2010 National Building Code of Canada seismic hazard calculator, http://www.earthquakescanada.nrcan.gc.ca/hazard/ (accessed on October 22, 2014).

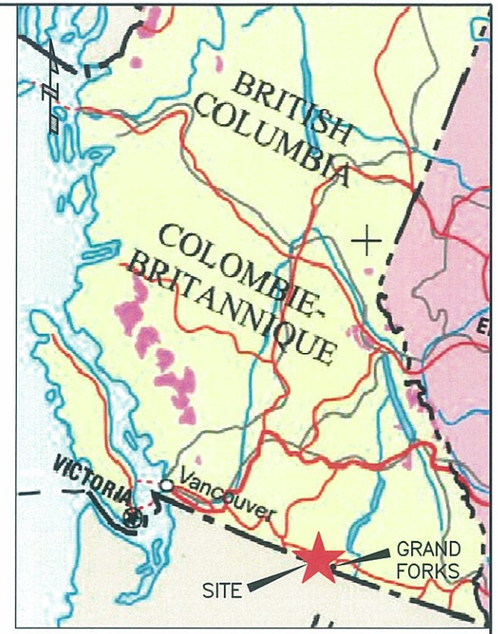
APPENDIX I

Construction Record Drawings

D-7001 (Rev.1)	Site Location Plan
D-7002 (Rev.1)	General Site Arrangement
D-7006 (Rev.1)	Site A Dam – Plan
D-7008 (Rev.1)	Site A – Station 2+00 & 2+50 – Sheet 1 of 3
D-7008 (Rev.1)	Site A – Station 3+00 & 3+50 – Sheet 2 of 3
D-7008 (Rev.1)	Site A – Station 4+00 to 5+00 – Sheet 3 of 3
D-7011 (Rev.0)	Site A Dam – Foundation Surface

PHOENIX MINE SITE
SNOWSHOE PIT
SNOWSHOE CREEK
CROWSNEST HIGHWAY
BAKER RIDGE
NEFF CREEK
MILL AND TAILINGS IMPOUNDMENT SITE
SNOWSHOE MAIN ROAD
GOLDEN CROWN MINE SITE
GOAT MOUNTAIN
HARDY MOUNTAIN
JULY CREEK
SKEFF CREEK
EAGLE MOUNTAIN
HARDY CREEK
SPENCER HILL
OBSERVATION MOUNTAIN
MAY CREEK
GRAND FORKS
CROWSNEST HIGHWAY
GIBBS CREEK
384 000E
386 000E
388 000E
390 000E
392 000E
394 000E
5 438 000N
5 436 000N
5 434 000N
5 432 000N
5 430 000N

TO LEXINGTON–GRENOBLE MINE SITE



LOCATION MAP
N.T.S.

LEGEND

- CREEKS AND RIVERS
- ROADS AND OTHER FEATURES
- RAILWAY
- HIGHWAY

NOTES:

1. FOR GENERAL NOTES SEE DWG D–7002.
2. SEE DWG D–7002 FOR SITE ACCESS ROADS.

CONSTRUCTION RECORD

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NO.	DATE	ISSUE / REVISION	DRAWN	CHK'D	DESIGN	APP'D
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0	JULY 13, 2007	ISSUED FOR CONSTRUCTION				

DRAWING NO. | REFERENCE DRAWING

CLIENT: MERIT MINING CORP.

Klohn Crippen Berger

PROJECT: GREENWOOD GOLD TAILINGS STORAGE FACILITY

TITLE: SITE LOCATION PLAN

SCALE	PROJECT No.	DWG. No.	REV.
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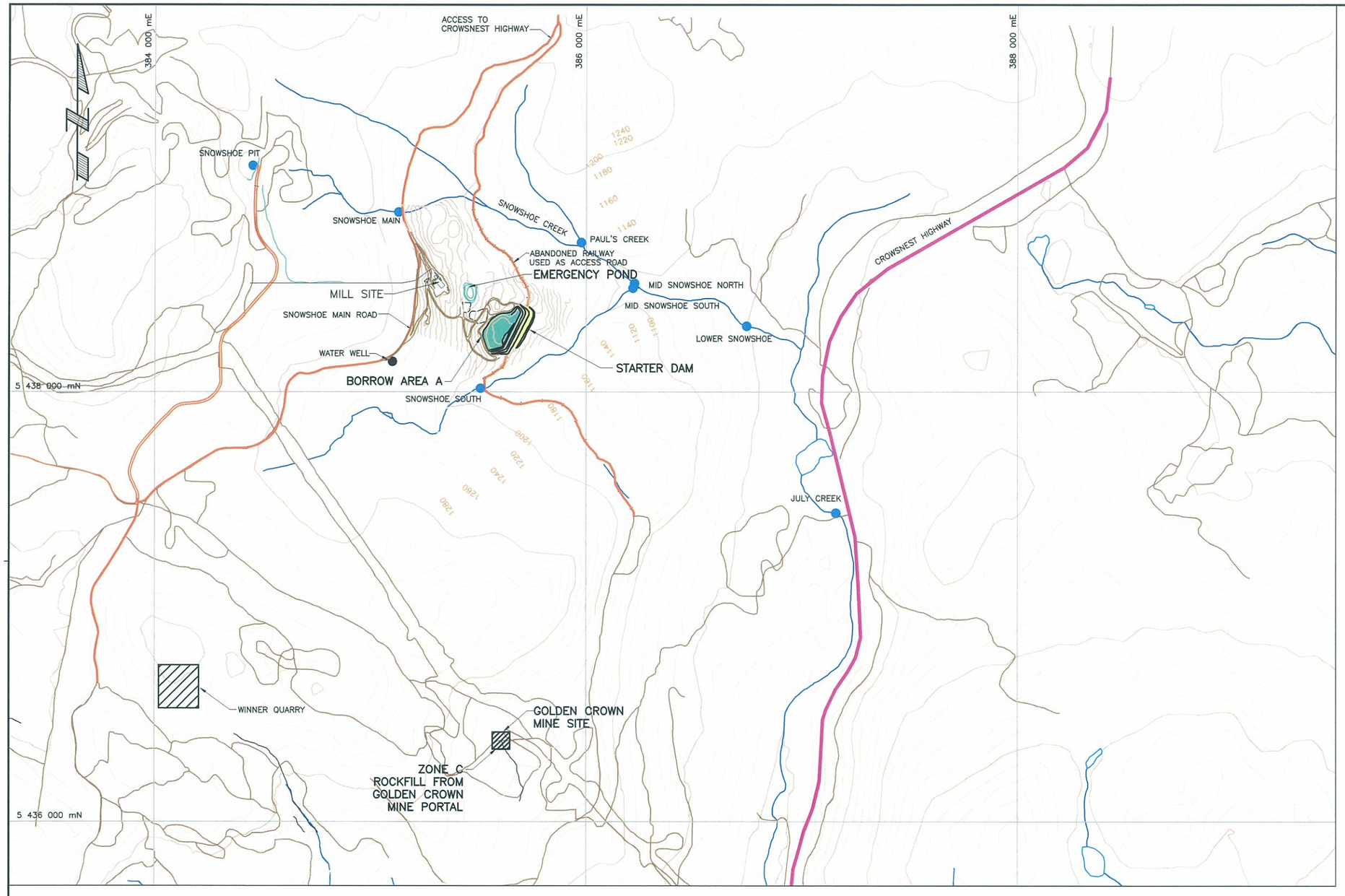

LEGEND

- SNOWSHOE MAIN
- WATER QUALITY SAMPLE LOCATIONS
- EXISTING PUBLIC ROADS FOR SITE ACCESS
- ROADS AND OTHER FEATURES
- RAILWAY
- HIGHWAY

GENERAL NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. REGIONAL TOPOGRAPHY DATA (DWG. D-7001) FROM TRIM MAP SERIES A721, MAP 82 E.2 EDITION 2 MCE.
3. SITE SURVEY CONTOUR INTERPRETATION FOR SITE A AND B PROVIDED BY MERIT APRIL 5, 2007.
4. AS-BUILT SITE A SURVEY PROVIDED BY MERIT MINING NOV. 28, 2007.

PLAN
SCALE A

CONSTRUCTION RECORD

SCALE A: 0 400 m

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		0	JULY 13, 2007	ISSUED FOR CONSTRUCTION				

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CLIENT: MERIT MINING CORP.

Klohn Crippen Berger

PROJECT: GREENWOOD GOLD TAILINGS STORAGE FACILITY

TITLE: GENERAL SITE ARRANGEMENT

SCALE	PROJECT No.	DWG. No.	REV.
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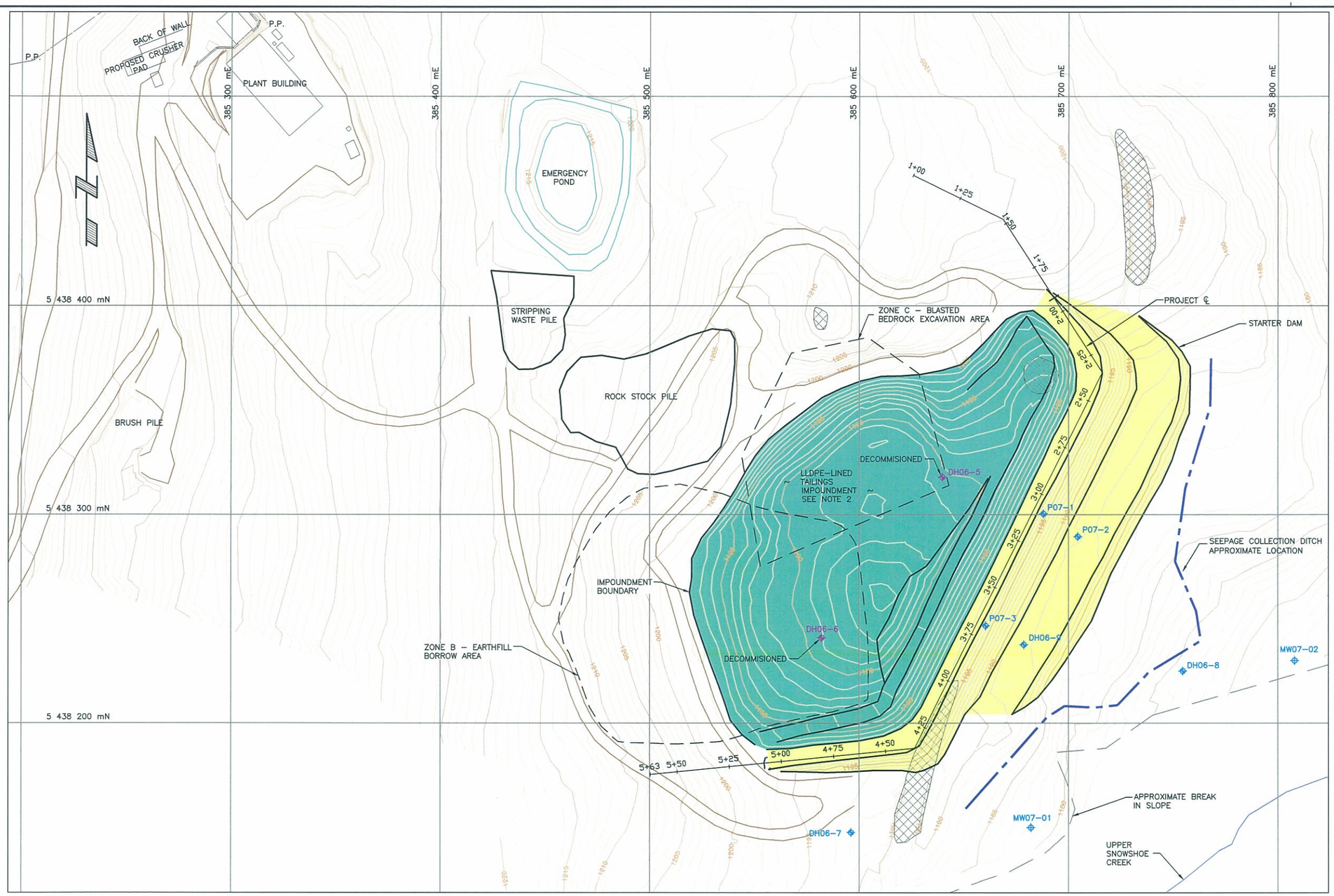

LEGEND

- DH06–7 — DRILL HOLE AND STANDPIE
- MW07–02 — MONITORING WELL
- P07–1 — STANDPIPE PIEZO METER
- ROAD
- BEDROCK OUTCROP

NOTES:

1. FOR GENERAL NOTES SEE DWG. D–7002.
2. IMPOUNDMENT LINED WITH ONE LAYER 40 MIL LLDPE OVER ONE LAYER 8 OZ. NON–WOVEN GEOTEXTILE.

PLAN
SCALE A

SCALE A: 0 50 m

CONSTRUCTION RECORD

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0	JULY 13, 2007	ISSUED FOR CONSTRUCTION				

DRAWING NO. | REFERENCE DRAWING

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CLIENT: MERIT MINING CORP.

Klohn Crippen Berger

PROJECT: GREENWOOD GOLD TAILINGS STORAGE FACILITY

TITLE: SITE A DAM PLAN

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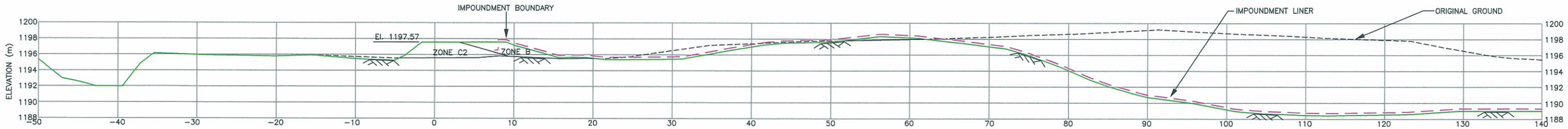

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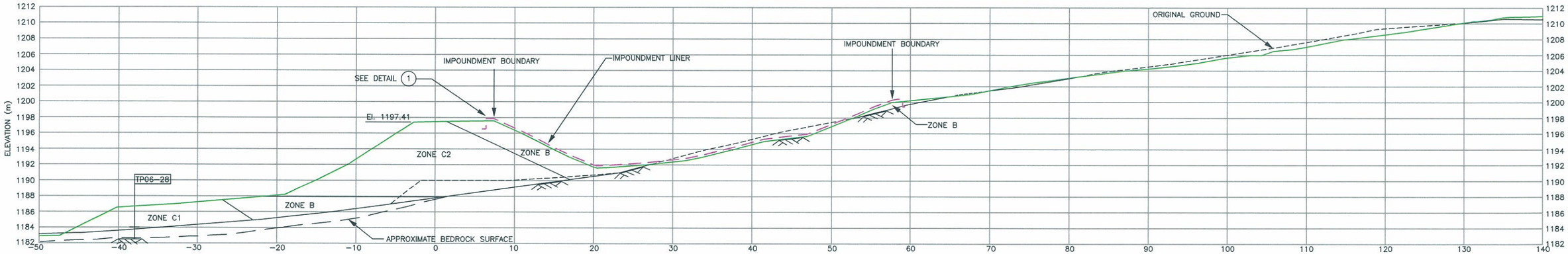

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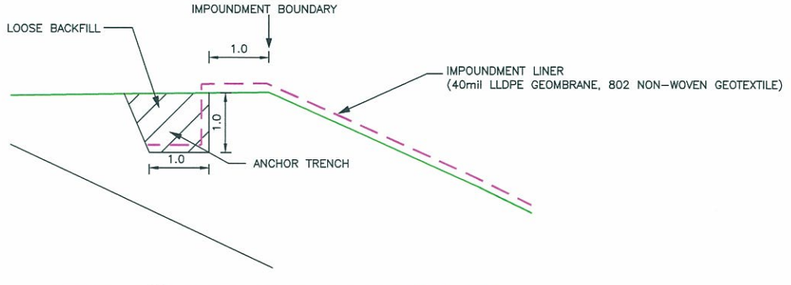

NOTE:

1. FOR GENERAL NOTES SEE D−7002.

DETAIL 1 LINER ANCHOR TRENCH (TYP.)
SCALE B

CONSTRUCTION RECORD

SCALE A 0 15 m

SCALE B 0 5 m

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0	JULY 13, 2007	ISSUED FOR CONSTRUCTION				

DRAWING NO. | REFERENCE DRAWING

CLIENT: MERIT MINING CORP.

Klohn Crippen Berger

PROJECT: GREENWOOD GOLD TAILINGS STORAGE FACILITY

TITLE: SITE A
STATION 2+00 & 2+50
SHEET 1 OF 3

SCALE	PROJECT No.	DWG. No.	REV.
AS SHOWN	M09200 A07	D−7008	1

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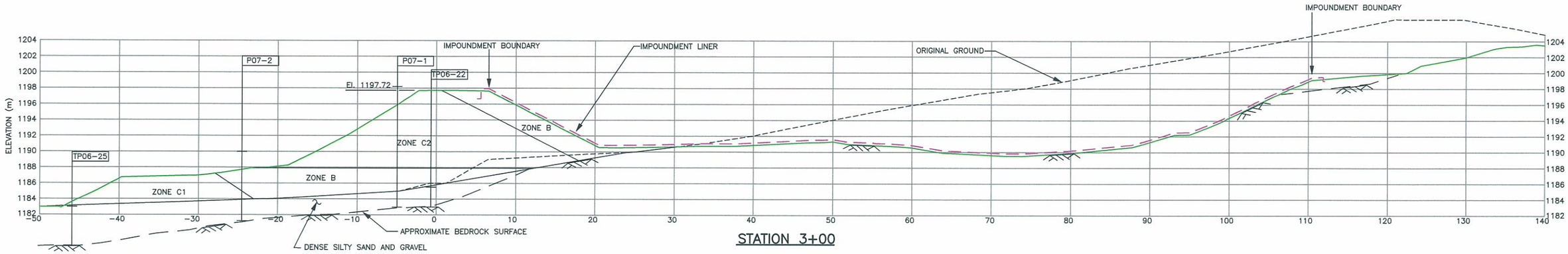

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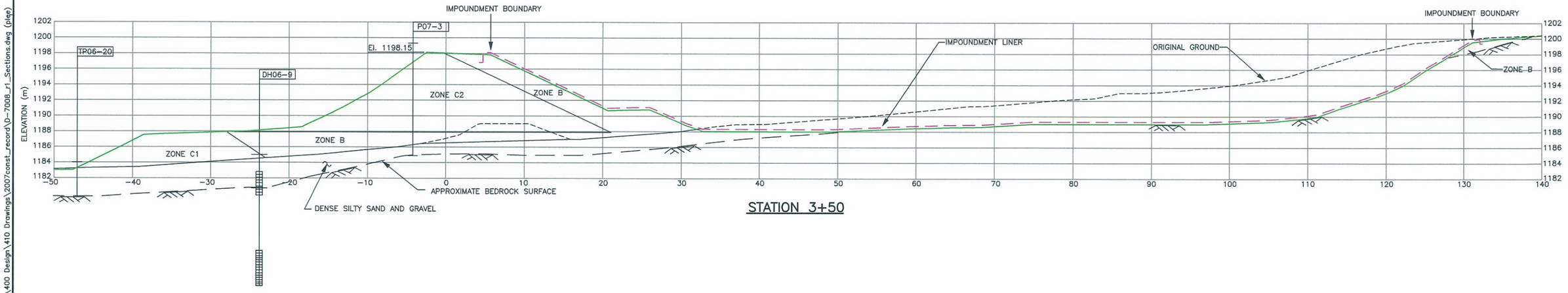

STATION 3+50

NOTE:

1. FOR GENERAL NOTES SEE D−7002.

CONSTRUCTION RECORD

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CLIENT: MERIT MINING CORP.

Klohn Crippen Berger

PROJECT: GREENWOOD GOLD TAILINGS STORAGE FACILITY

TITLE: SITE A
STATION 3+00 & 3+50
SHEET 2 OF 3

SCALE	PROJECT No.	DWG. No.	REV.
AS SHOWN	M09200 A07	D−7008	1

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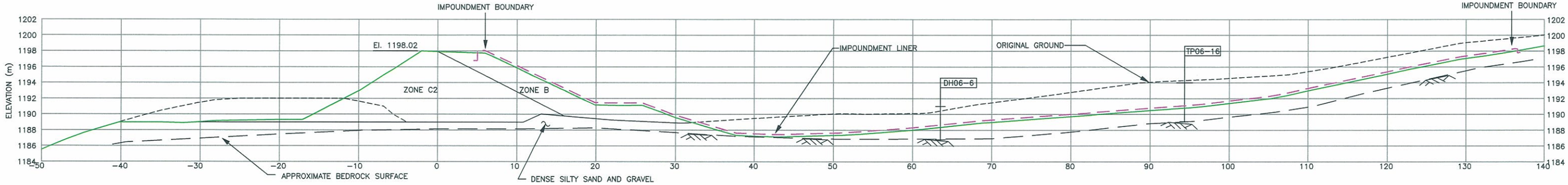

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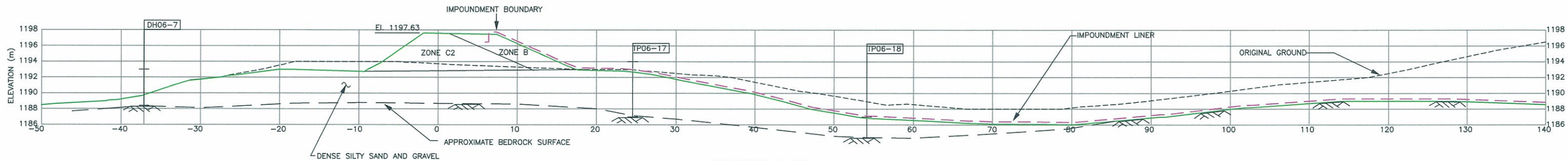

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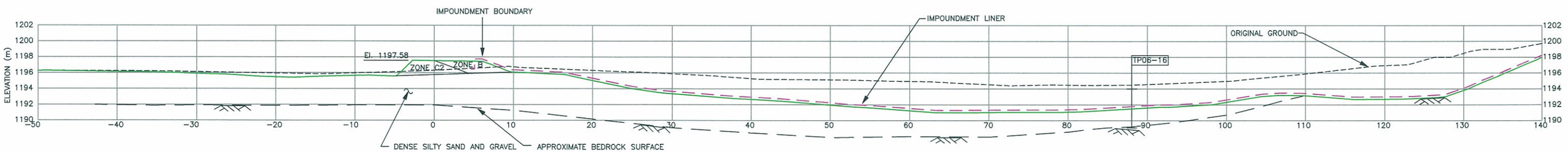

STATION 5+00

NOTE:

1. FOR GENERAL NOTES SEE D-7002.

CONSTRUCTION RECORD

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0	JULY 13, 2007	ISSUED FOR CONSTRUCTION				

DRAWING NO. | REFERENCE DRAWING

PROFESSIONAL ENGINEER — H.N. McLEOD — BRITISH COLUMBIA — ENGINEER

SCALE 0 15 m

CLIENT: MERIT MINING CORP.

Klohn Crippen Berger

PROJECT: GREENWOOD GOLD TAILINGS STORAGE FACILITY

TITLE: SITE A
STATION 4+00 TO 5+00
SHEET 3 OF 3

SCALE	PROJECT No.	DWG. No.	REV.
AS SHOWN	M09200 A07	D-7008	1

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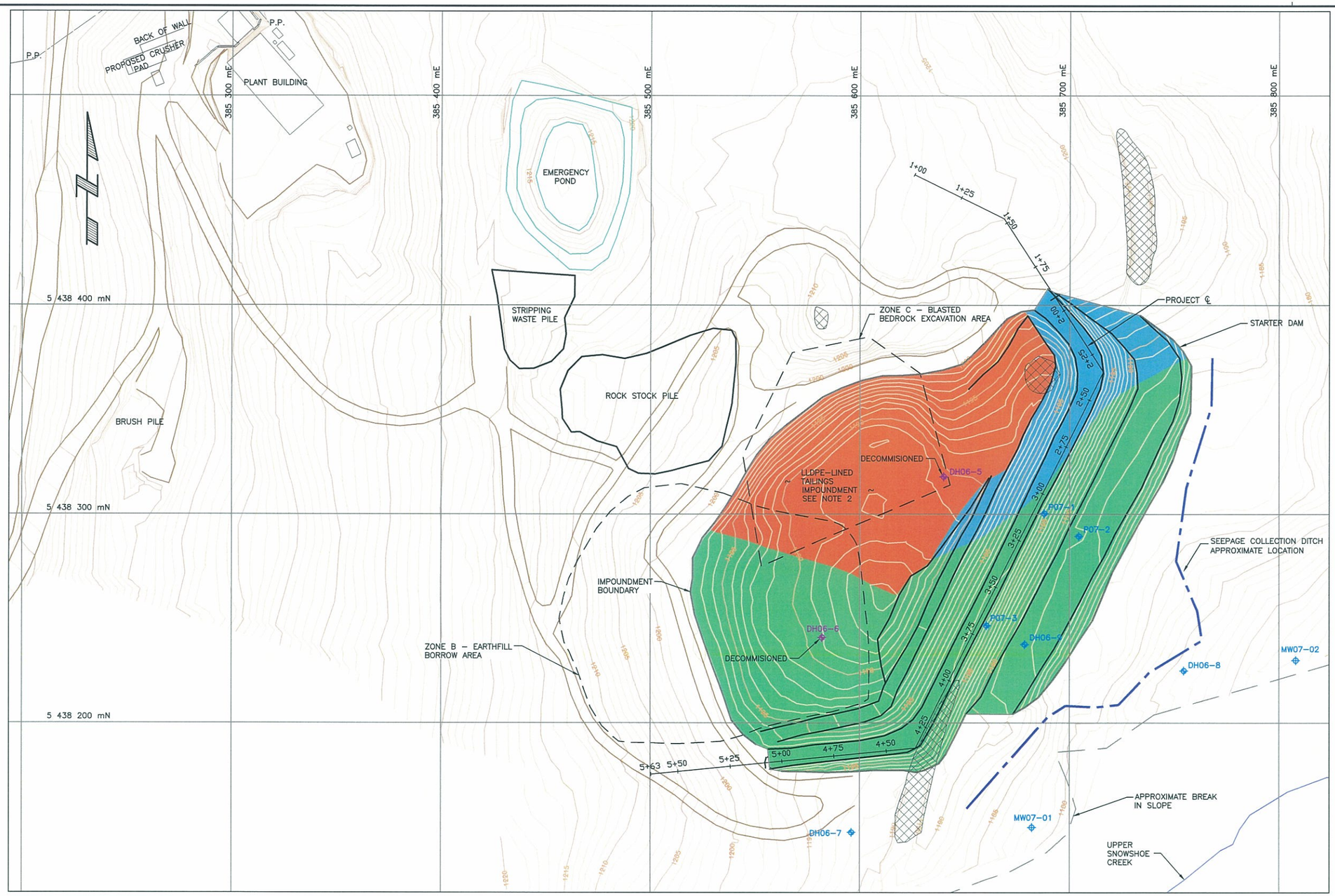


LEGEND

- DH06–7 — DRILL HOLE AND STANDPIE
- MW07–02 — MONITORING WELL
- P07–1 — STANDPIPE PIEZO METER
- ROAD
- BEDROCK OUTCROP
- DENSE SILTY SAND AND GRAVEL
- 0.1M TO 0.3M OF COMPACTED ZONE B OR SELECT BEDDING ON BEDROCK
- BEDROCK

NOTES:

1. FOR GENERAL NOTES SEE DWG. D–7002.

SCALE A: 0 50 m

PLAN
SCALE A

CONSTRUCTION RECORD

DRAWING NO.	REFERENCE DRAWING	NO.	DATE	ISSUE / REVISION	DRAWN	CHK'D	DESIGN	APP'D
		1	JAN. 21, 2008	CONSTRUCTION RECORD	RL			
		0	JULY 13, 2007	ISSUED FOR CONSTRUCTION				

PROFESSIONAL ENGINEER — H. N. McLEOD — BRITISH COLUMBIA — ENGINEER

CLIENT: MERIT MINING CORP.

Klohn Crippen Berger

PROJECT: GREENWOOD GOLD TAILINGS STORAGE FACILITY

TITLE: SITE A DAM FOUNDATION SURFACE

SCALE	PROJECT No.	DWG. No.	REV.
AS SHOWN	M09200 A07	D–7011	1

CANCEL PRINTS BEARING PREVIOUS REVISION

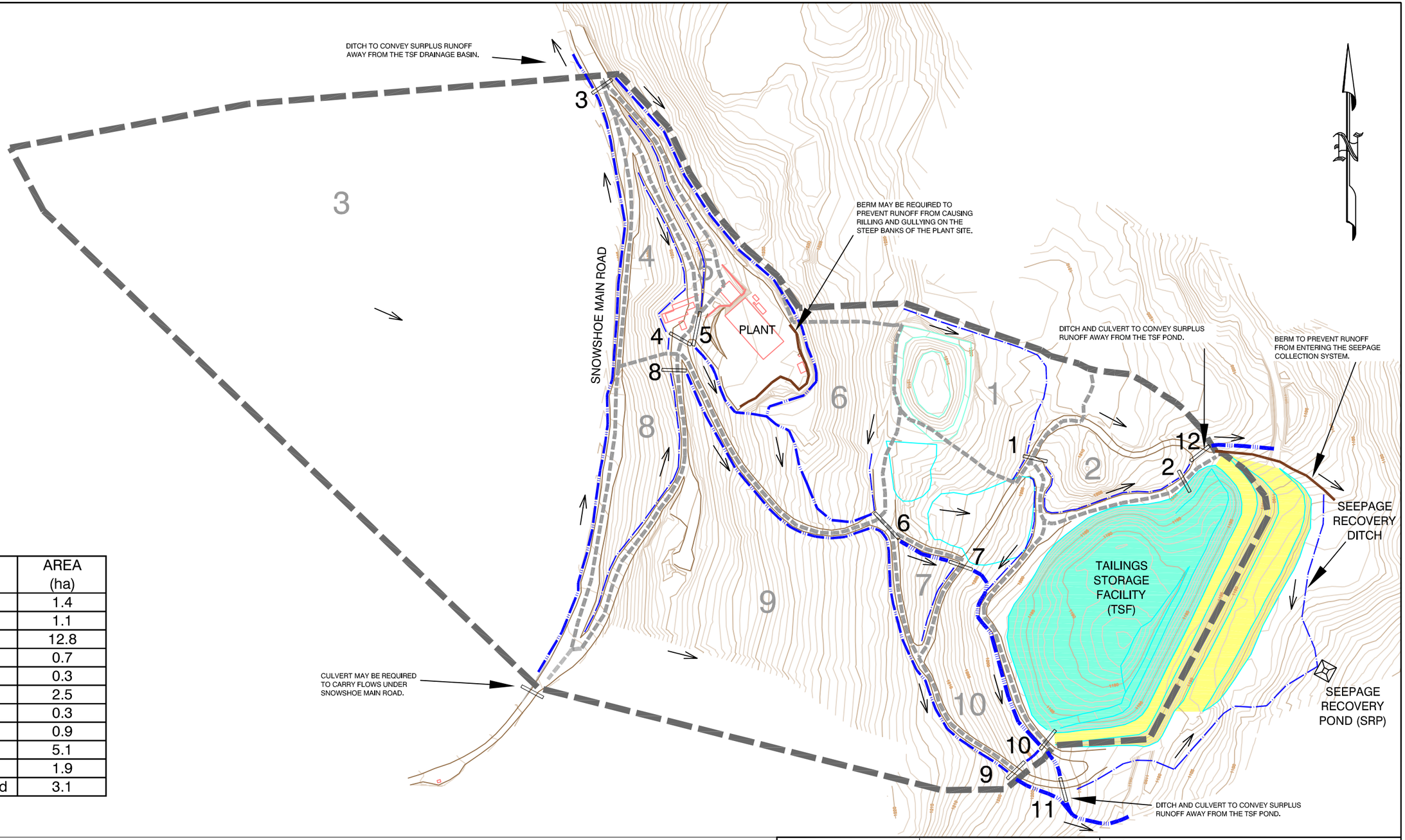
KGB-C-MED

Time: 15:01:43
Date: 1/31/2008
Scale: 1=1(PS)
Drawing File: M:\M09200A07 – Greenwood Detailed Design\400 Design\410 Drawings\2007const_record\D–7006_r1+7011_r1.dwg (plee)
Xrefs: BMGREENWOOD–DEC19–07

APPENDIX II

Site Drainage Plan

Figure 1.1 Site Drainage Plan



SUB BASIN	AREA (ha)
1	1.4
2	1.1
3	12.8
4	0.7
5	0.3
6	2.5
7	0.3
8	0.9
9	5.1
10	1.9
TSF Pond	3.1

LEGEND:

- 3 — PROPOSED CULVERT
- TOTAL TSF DRAINAGE BOUNDARY
- SUB-BASIN BOUNDARIES
- PROPOSED BERM
- DIRECTION OF FLOW
- TYPE I DITCH
- TYPE II DITCH
- TYPE III DITCH

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED APRIL 9, 2008

SCALE: 0 100 m

CLIENT: MERIT MINING CORP.

Klohn Crippen Berger

PROJECT: GREENWOOD GOLD TAILINGS STORAGE FACILITY

TITLE: SITE DRAINAGE PLAN

PROJECT No. M09200 A08 | Figure No. 1.1 | REV.

APPENDIX III

DSR Site Visit Photographs

September 11 – 12, 2014

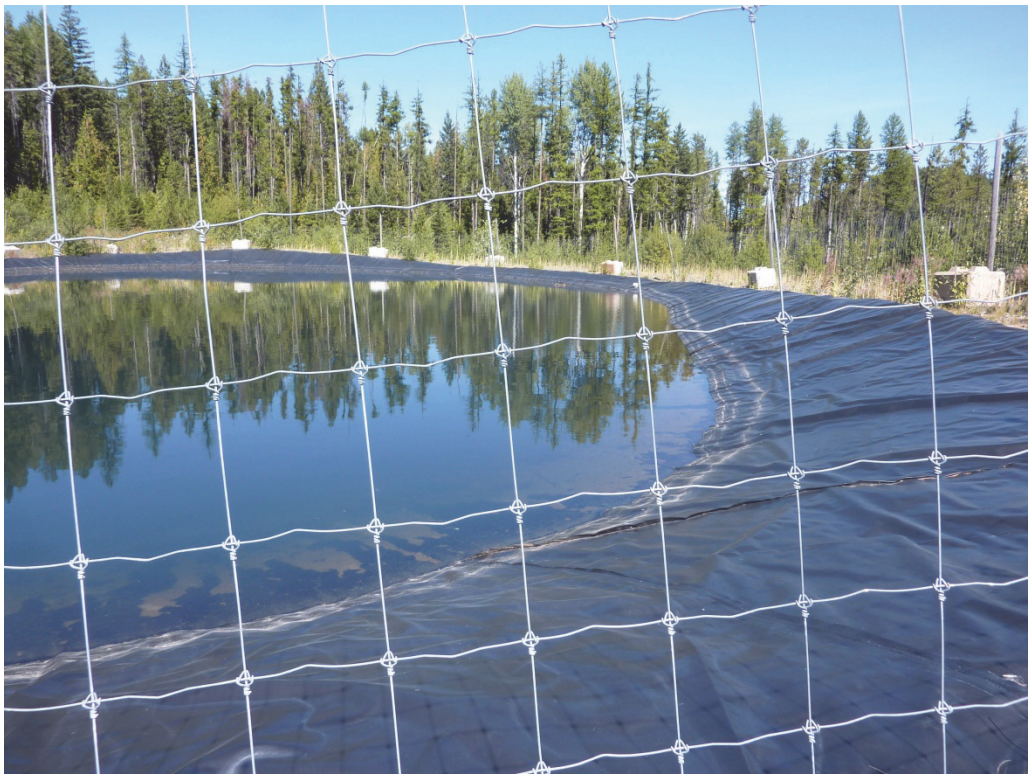


Photo III-1 – Emergency Water Storage Pond – Liner and Dam Crest

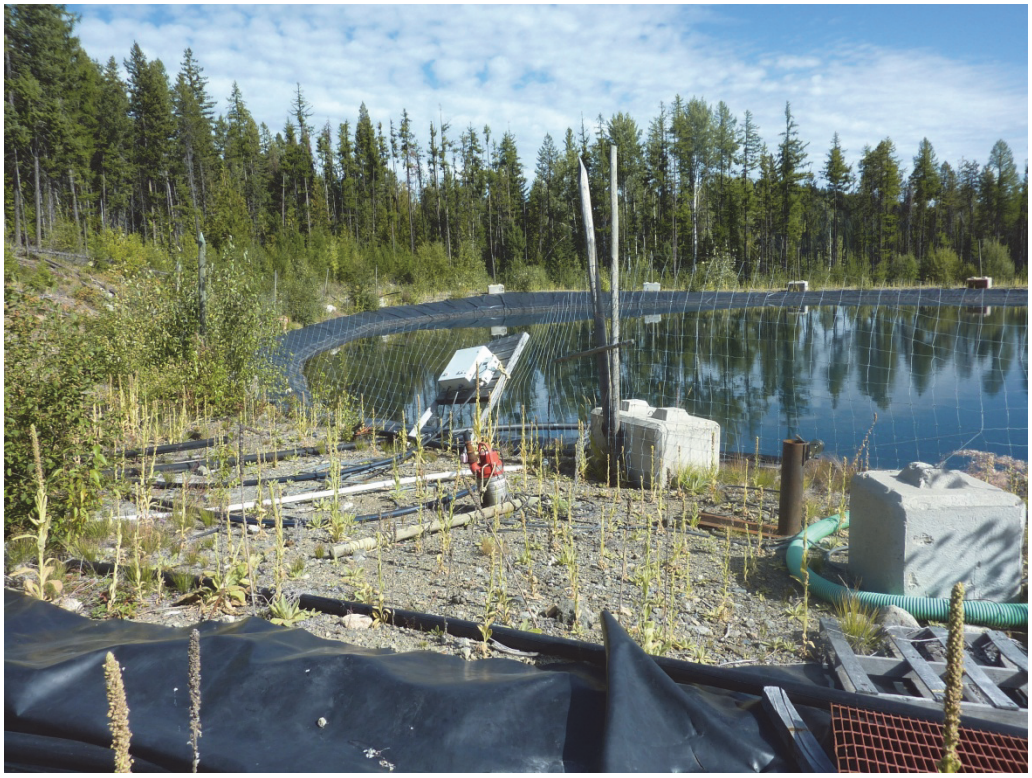


Photo III-2 – Emergency Water Pond – Power Panel Leaning Against Fence

Photo III-3 – Emergency Water Pond - PVC Outlet Pipe

Photo III-4 - Emergency Water Pond - PVC Outlet Pipe Discharge at Tailings Pond

Photo III-5 – Surface Water Diversion Ditch

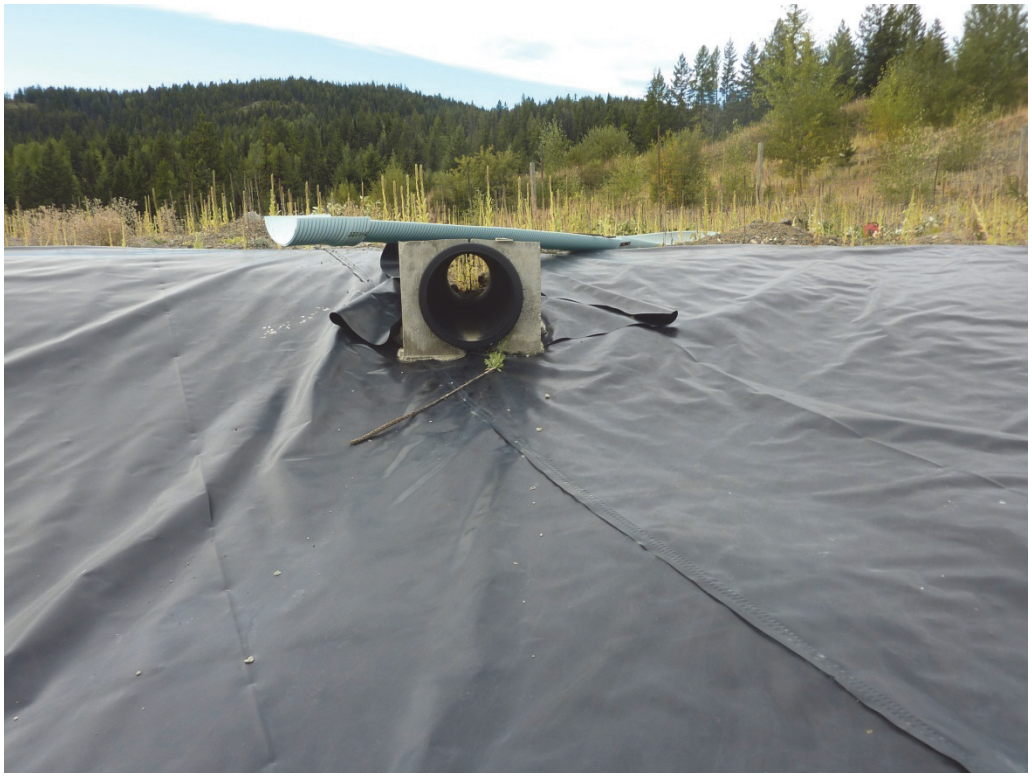


Photo III-6 – Tailings Pond – Surface Water Inlet Culvert at Southwest End of Dam Embankment

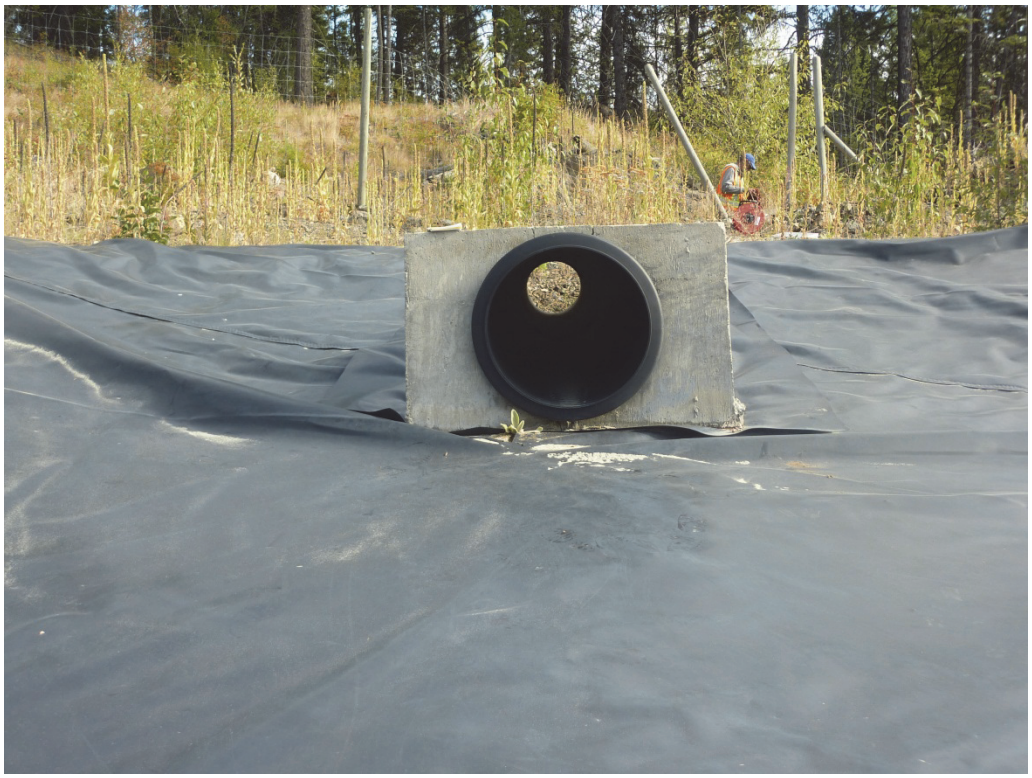


Photo III-7 – Tailings Pond – Surface Water Inlet Culvert at Northeast End of Dam Embankment

Photo III-8 – Tailings Pond – Bypass Channel and Culvert at Southwest End of Dam Embankment

Photo III-9 – Tailings Pond – Bypass Channel at Northeast End of Dam Embankment – Inlet Culvert at Bottom of Photo

Photo III-10 – Tailings Pond – Dam Crest and Downstream Slope

Photo III-11 – Tailings Pond – Geomembrane liner viewed from northeast corner looking southwest.

Photo III-12 – Tailings Pond – Small tears in geomembrane at SW corner. Note reclaim pump power cable and discharge hose are still present.

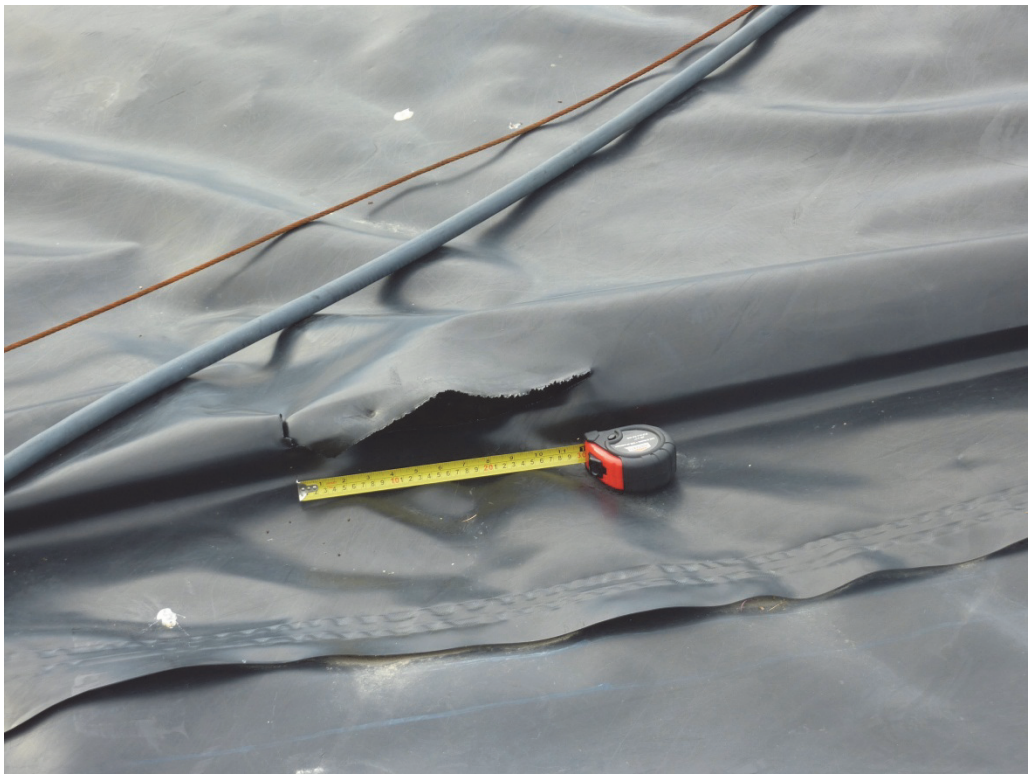


Photo III-13 - Tailings Pond – Close-up of small tear in geomembrane at SW corner.

Photo III-14 – Tailings Pond – Tear in geomembrane liner at culvert inlet in northeast corner

Photo III-15 – Tailings Pond – Reservoir Level Marks Spray Painted on Geomembrane Liner

Photo III-16 – Tailings Pond – Tailings Beach Spigot Point in Northeast Corner

APPENDIX IV

Dam Breach Analysis Technical Memorandum

MEMORANDUM

TO:	Harvey McLeod	**DATE:**	November 24, 2014
FROM:	Davood Hasanloo	**FILE NO:**	M09951A01
SUBJECT:	Greenwood Dam Break and Inundation Study		

1 INTRODUCTION

Klohn Crippen Berger Ltd. (KCB) was retained by Huakan International Mining Inc. to undertake a high level preliminary dam breach and inundation analyses for the Greenwood Tailings Storage Facility (TSF) Dam.

This study predicts potential impacts of the breach on areas along the receiving waters downstream of the dam relative to guidelines and criteria established for dam safety. The results of this study would not alter the design criteria for the dam and the primary goal of this study was to predict the potential inundation areas.

A hydraulic model was used to estimate outflow resulting from the breach of Greenwood TSF dam, and the outflow was routed along the streams downstream of the dam to estimate flood depths and the likely extent of flooding downstream of the dam. Two hydrologic scenarios (a rainy-day breach and a sunny-day breach) were considered. Typically the flooding levels are compared to natural water levels in the receiving streams commensurate with the assumed flow condition at the time of dam breach.

This report was prepared by Klohn Crippen Berger Ltd. for the account of Huakan International Mining Inc. The material in it reflects Klohn Crippen Berger's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Klohn Crippen Berger Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

2 SITE DESCRIPTION

The Greenwood TSF is located in Southern British Columbia 11 km northwest of Grand Forks. The Greenwood Gold Project consists of an underground "small mine" development for an initial capacity of 72,000 tonnes per year from the Lexington-Grenoble deposit.

Ore was transported from the Lexington-Grenoble underground mine, located approximately 9.5 km to the southwest, to the mill site located adjacent to the TSF. One tailings stream is produced: a pyrite bearing final tailings. The wastes have been stored within the geomembrane-lined tailings

impoundment. Geochemical testing of the tailings during the design phase indicated if a separate pyrite tailings was produced; it had the potential for developing acid rock drainage. Therefore, the facility was designed for tailings storage in a saturated impoundment with a saturated rockfill cover on closure and with zero-discharge of contact water.

The project was constructed between September 2007 and May 2008 by then owner Merit Mining Corp. of Vancouver, BC, which changed its name in 2010 to Huakan International Mining Inc... On May 8, 2008, the project received mine and mill operating permits from Province of BC to operate at 72,000 tonnes per year for the Lexington-Grenoble mineralization. The Greenwood mill operated for 8 months before suspending operations in late 2008
(source: www.Huakanmining.com/projects/greenwood-project/).

The entire tailings impoundment is lined with a 40-mil LLDPE geomembrane liner up to the starter dam crest at approximately El. 1197.5 m (minimum crest elevation).

The starter dam is a zoned embankment dam, constructed from earthfill and rockfill borrowed mainly from within the impoundment (see Figure).

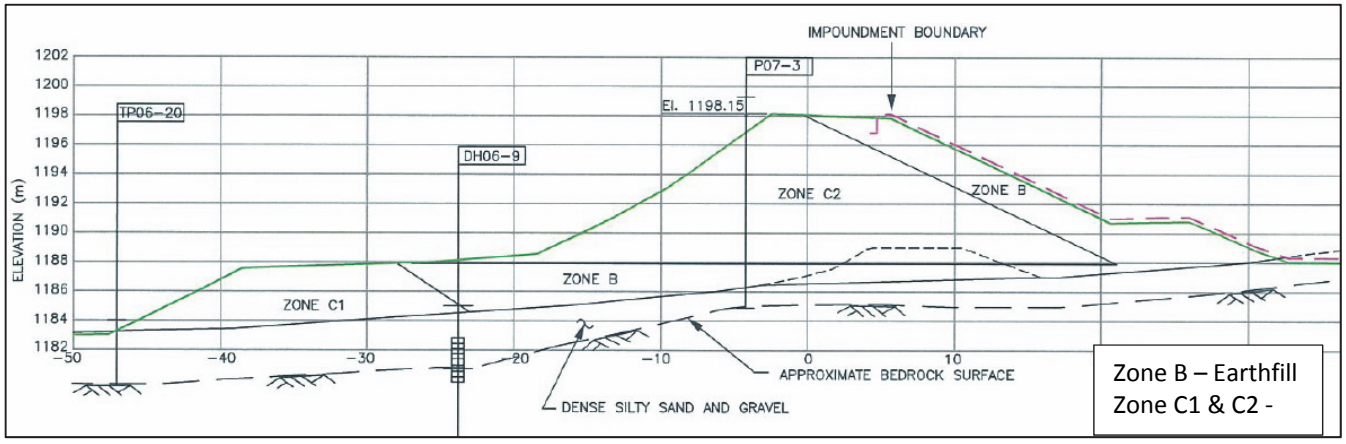


Figure 1 Typical Embankment Cross Section (Sta. 3+50)

The as-built impoundment stage-storage-area, assuming horizontal layers, is presented in Figure 2.

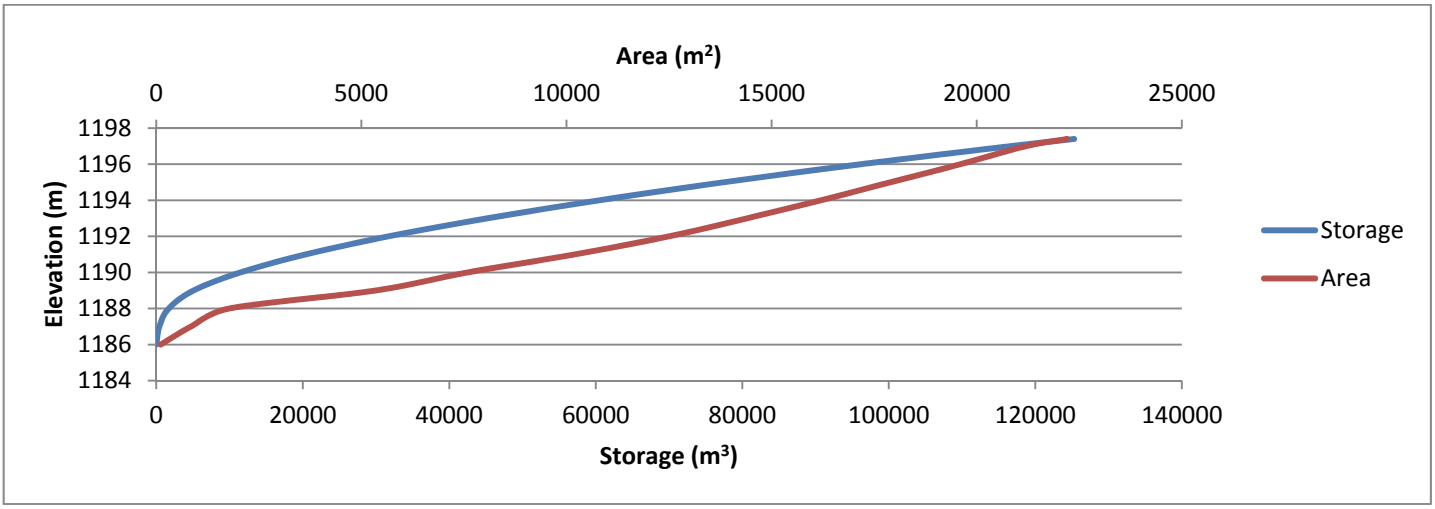


Figure 2 TSF Impoundment Stage Storage Area curves.

3 METHODS

3.1 Model

The FLO-2D PRO version was used to perform the flood routing and inundation mapping for the Greenwood dam failure scenarios. FLO-2D Pro is an industry standard depth averaged 2D model which has been widely used for dam breach assessment and flood routing.

The input topography data to the model was based on a 2 m resolution Digital Elevation Data extracted from Google Earth. A preliminary model run with TRIM contour maps (20 m resolution) showed that a large section of the highway and majority of the houses located in the downstream of the dam could be inundated. Therefore, it was decided to use more accurate elevation data to perform the main flood routing. About 22,000 grid elements were generated in the model which covered a distance about 5.5 km downstream of the dam location shown in Figure 3.

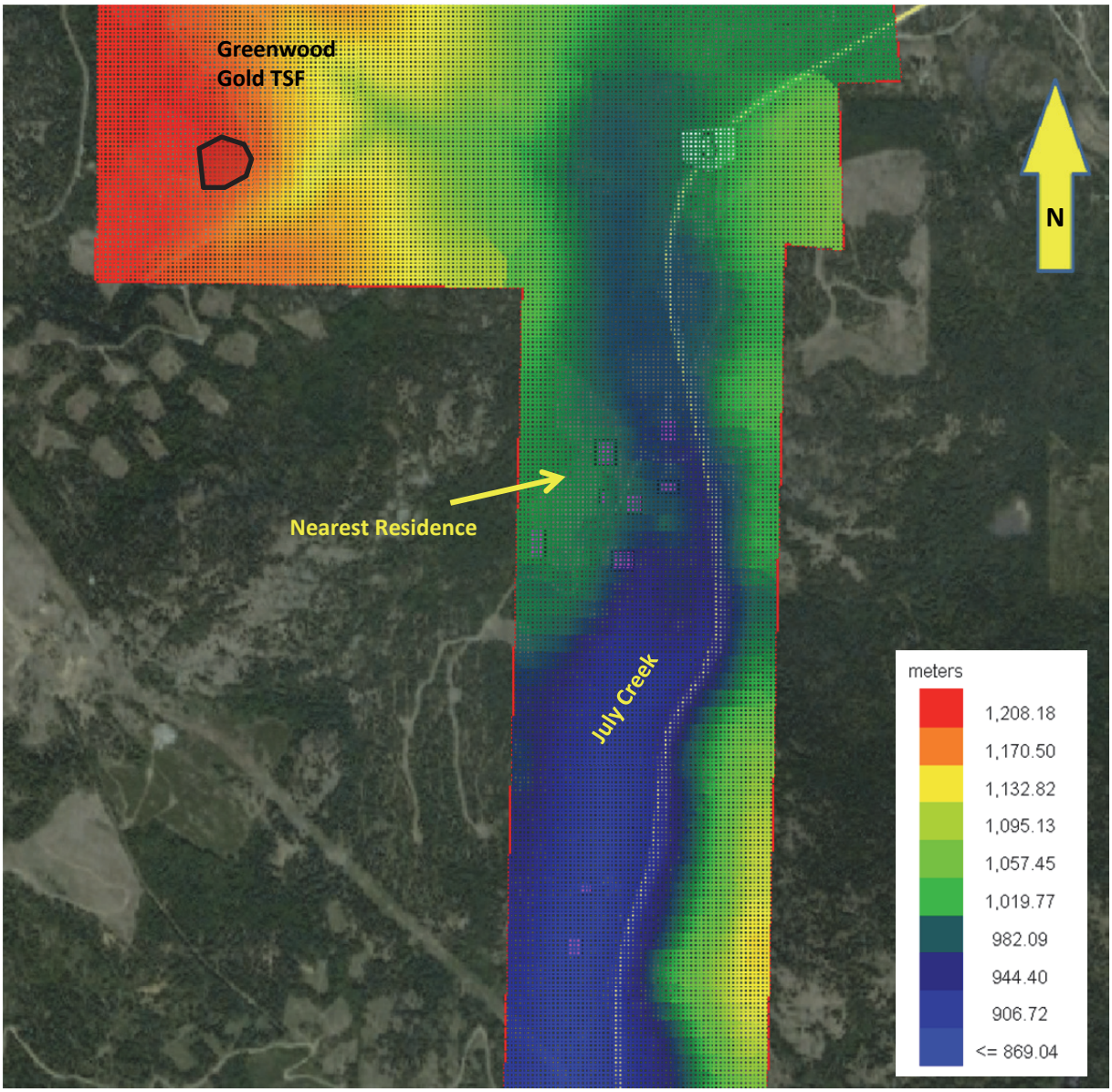


Figure 3 Inundation Flow Path – 5 km from base of TSF

3.2 Outflow Breach Hydrograph

Empirical equations and charts from MacDonald and Landridge-Monopilis (1984), Wahl (1998), Rico et al. (2008) and Fread (1981) were used to estimate the breach formation time and peak outflows from the hypothetical breach events. By assuming that the dam would breach up to El. 1188 m (Figure 1), it was conservatively estimated that a sum of 80,000 m^3 and 110,000 m^3 of tailings and water would be released in a piping and overtopping failure, respectively. The Breach formation Time (BFT) was initially estimated to be about 30 minutes assuming erodible material used for the embankments. However, considering the erosion resistance of the rockfill materials used in the

embankment fill, it was decided to increase the breach formation time to 2 hours. With the new assumption, the peak breach hydrograph was estimated to be 12.7 m^3/s.

3.3 Concurrent Flows and Hydrologic Condition

Two different flood scenarios, i.e. sunny day and rainy day failures, were considered for this study. Preliminary model runs showed that the dam consequence would be classified as "significant" to "high" (Table 1) and therefore the inflow design flood would place between 100 year and 1000 year floods. Also, since the inflow design criteria in British Columbia is based on 200 year flood, this analysis also conservatively used a 200 year flood as the concurrent flow for the case of the rainy day failure.

Table 1 2013 CDA Dam Safety Guidelines – Dam Classification Categories

Dam Class	Population at Risk (Note 1)	Incremental Losses		
		Potential for Loss of Life (Note 2)	Environmental and Cultural Values	Infrastructure and Economics
Extreme	Permanent	More than 100	Major loss of critical fish or wildlife habitat. Restoration or compensation in kind impossible.	Extreme losses affecting critical infrastructure or services (e.g., hospital, major industrial complex, major storage facilities for dangerous substances).
Very High	Permanent	100 or fewer	Significant loss or deterioration of critical fish or wildlife habitat. Restoration or compensation in kind possible but impractical.	Very high economic losses affecting important infrastructure or services (e.g., highway, industrial facility, storage facilities for dangerous substances).
High	Permanent	10 or fewer	Significant loss or deterioration of important fish or wildlife habitat. Restoration of compensation in kind highly possible.	High economic losses affecting infrastructure, public transportation, and commercial facilities.
Significant	Temporary only	Unspecified	No significant loss or deterioration of fish or wildlife habitat. Loss of marginal habitat only. Restoration or compensation in kind highly possible.	Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes.
Low	None	0	Minimal short-term loss No long-term loss.	Low economic losses; area contains limited infrastructure or services.

Note 1: Definition for population at risk:
None – There is no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure.
Temporary – People are only temporarily in the dam-breach inundation zone (e.g., seasonal cottage use, passing through on transportation routes, participating in recreational activities).
Permanent – The population at risk is ordinarily located in the dam-breach inundation zone (e.g., as permanent residents); three consequences classes (High, Very High, Extreme) are proposed to allow for more detailed estimated of potential loss of life (to assist in decision-making if the appropriate analysis is carried out).

Note 2: Implications for loss of life:
Unspecified – The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

To estimate the concurrent flows in July Creek (Station 08NN018), a preliminary frequency analysis was conducted based on the available historical flow data, and the results are shown in Table 2. Based on the assumption of the 200 year flood flow in a rainy day scenario and using the data from Table 2, it was assumed that a 10 m^3/s flow would occur concurrently in July Creek. For the sunny day failure, the Mean Annual Flow (MAF) is normally assumed to be the concurrent flow. MAF in July Creek is relatively small compared to the sunny day failure flows and therefore it was neglected in the analysis. This assumption is conservative because the incremental difference in the flood depth would be the entire flood depth.

Table 2 July Creek Flow for Different Return Periods

Return Period (yr)	Flow (m3/s)
2	2
5	3
10	4
20	6
25	6
50	7
100	9
200	10
500	13

4 RESULTS

For the case of the rainy day failure, the breach flood extent and depth should be compared with that of the 200 year flood. Figure 4 shows the maximum inundation extent originated by a 200 year flood in July Creek and compares that with the location of the dwellings and Highway #3 in the modelled area. The 200 year flood depth within the channel is estimated to be in a range of 1 m to 2 m, which has impacted some of the houses along the flood route (Figure 4).

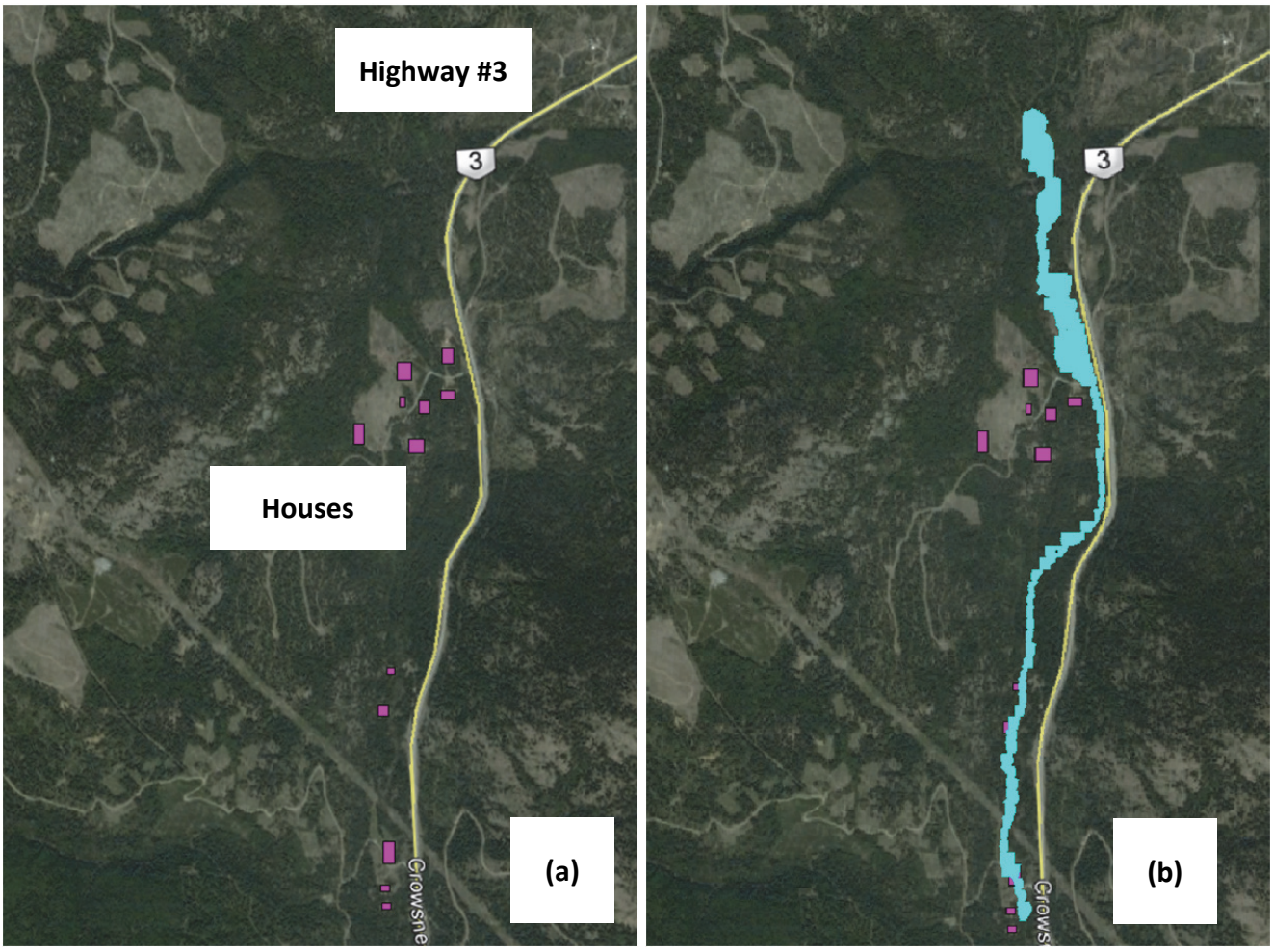


Figure 4 **a) Location of Dwellings and Highway #3 along the flood route.**
b) The maximum Flood Inundation extent for the 200 year flood.

Figure 5 shows the maximum inundation extent from a rainy day failure, which includes flow from a 200 year flood topped with the overtopping dam breach flow. As shown, the cumulative maximum inundation extent has relatively widened compared to that from the 200 year flow, and the total flow depth for the cumulative flood is within a range of 2.5 m and 3.5 m. However, the impacted residences have already been affected by the 200 year flood and the incremental difference of the flood depth is about 0.5 m to 1 m.

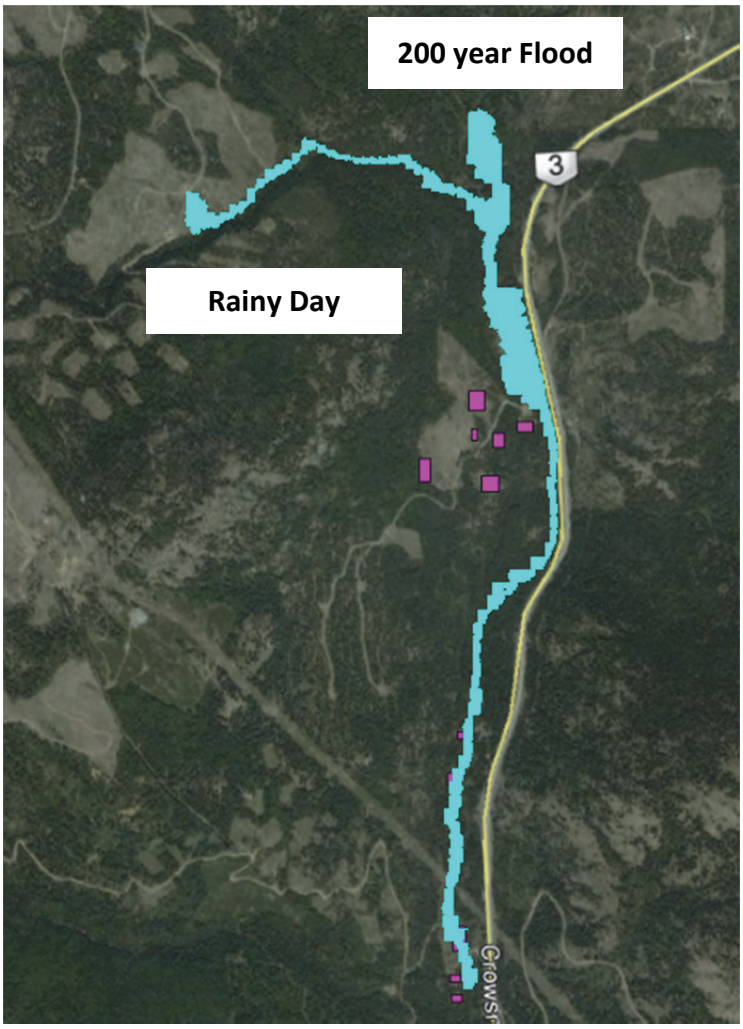


Figure 5 Maximum Inundation Extent for the Rainy Day Failure

The maximum inundation extent from the sunny day failure is shown in Figure 6. Since the mean annual flow within the July Creek is very small, the concurrent flow for the sunny day failure is neglected. The flood depth for the majority of the channel length ranges between 1 m to 3 m, which is comparable with flow depths of the 200 year flood.

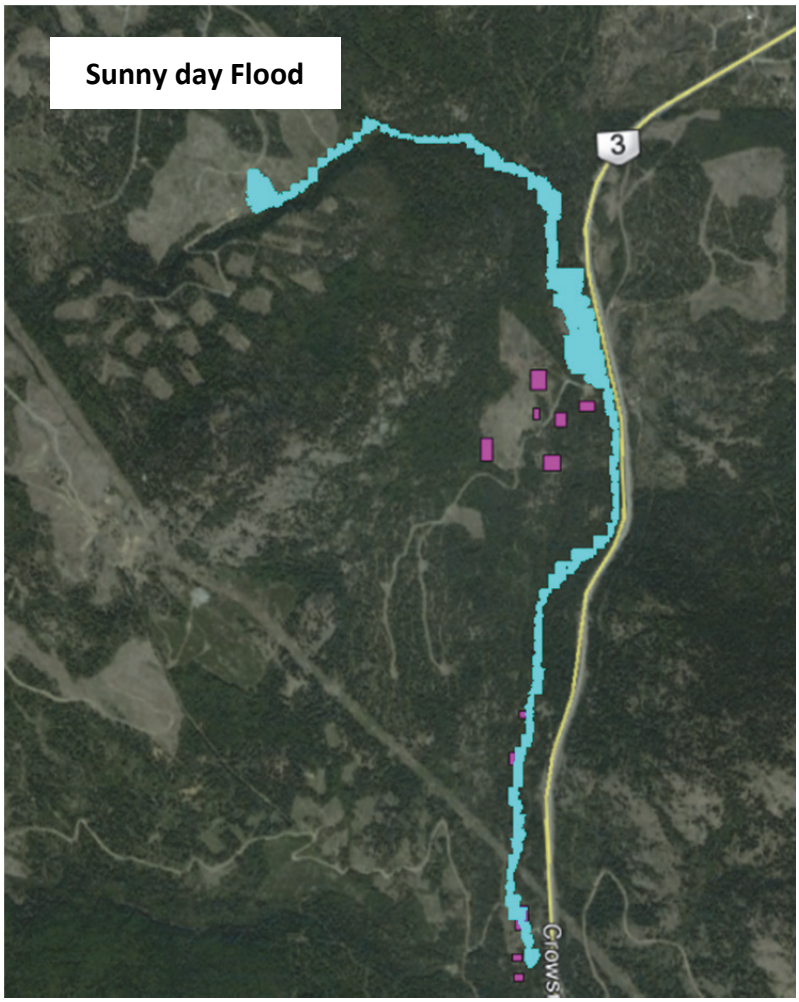


Figure 6 Maximum Inundation Extent for the sunny day failure.

5 SUMMARY

The results from the Greenwood dam breach and inundation mapping showed that some of the houses along the flood path might be impacted by the dam breach flood. The inundation extent also showed that a section of the highway may also be impacted by the flood; however, this is most likely due to the grid spacing (2 m x 2 m resolution) and resolution of the topography data used in the model. Huakan reports that the highway is located about 5 m higher than the invert of the channel, therefore, the highway most likely will not be impacted by the flood. The results also showed that the flood depths associated from a sunny day failure is comparable to that from the July Creek's 200 year flood event. The incremental impact from the rainy day failure is within 0.5 m to 1 m above the natural water elevation at the time of the breach. Therefore, the incremental impact from the sunny day failure is more significant than that of the rainy day failure. It should be noted that this study was performed as a simplified preliminary assessment of the inundation extents, and there are several uncertainties associated with the breach parameters and the topography data.

6 REFERENCES

Canadian Dam Association. CDA. 2007. Dam Safety Guidelines.

Fread, D. L. 2001. Some existing capabilities and future directions for Dam-Breach modeling/Flood routing, Proceeding FEMA workshop on “issues, Resolutions, and Research Needs Related to Embankment Dam failure Analysis. Oklahoma City, Oklahoma.

MacDonald, T. C. and Monopolis, J. L. 1984. Breaching Characteristics of Dam Failures, Journal of Hydraulic Engineering, Vol. 110, No. 5, May.

Wahl, T. L. 1998. Predicting Embankment Dam Breach Parameters – A Literature Review and Needs Assessment, Dam Safety Research Report DSO-98-004, US Bureau of Reclamation, Dam Safety Office, July.

APPENDIX V

2014 Water Quality Data (Huakan)

Process Water Pond Samples (File No. L593660 & L1528236-1)
Greenwood Project - Creek Water Quality Samples (File No. L1466241)

Mill Site - Zip Water Samples					
ALS File No				L593660	L1528236-1
				Process	
Location - Process Water Pond				Water Pond	
Received by ALS Date				January 14, 2008	October 6, 2014
Sampling Date				January 13, 2008	October 5, 2014
		BCWQ Criteria for Freshwater			
		Aquatic Life			Water
		H=165mg/LCaCO3	**H=250mg/LCaCO3**		
Physical Tests					
Conductivity	(uS/cm)			252	603
Hardness	CaCO3			126	280
Total Dissolved Solids				154	469
pH		6.5 to 9.0		7.73	7.34
Total Suspended Solids				44.5	<3.0
Turbidity					
Anions and Nutrients					
Alkalinity - Total	CaCo3			80	26.7
Ammonia Nitrogen	N			0.0761	0.218
Nitro NO3+NO2 D					
Nitrate Nitrogen	N			0.0203	0.0092
Nitrite Nitrogen	N			<0.0010	<0.0010
Sulphate	SO4	100		46.8	270
Bromide (Br)					<0.050
Chloride (Cl)					1.47
Fluoride (F)					0.148
Dissolved Metals					
Aluminum	Al	0.1 (D) 1		<0.0050	
Antimony	Sb	0.02(T)		<0.00050	
Arsenic	As	0.005(T)		0.00243	
Barium	Ba	5		0.037	
Beryllium	Be	.0053 6		<0.0010	
Bismuth	Bi				
Boron	B			<0.10	
Cadmium	Cd	0.00005 (T) 2		0.000021	
Calcium	Ca			42.4	
Chromium	Cr	0.009 (T)		<0.0010	
Cobalt	Co	0.0009 (T)		<0.00030	
Copper	Cu	0.018 (T)	0.026 (T)	<0.0010	
Iron	Fe	0.3 (T)		<0.030	
Lead	Pb	0.15 (T)	0.26 (T)	<0.00050	
Lithium	Li	5		<0.0050	
Magnesium	Mg			4.95	
Manganese	Mn	2.2 (T) 3		0.00747	
Mercury	Hg	0.00002 7		<0.000020	
Molybdenum	Mo	2 (T)		<0.0010	
Nickel	Ni	0.11 (T) 4		<0.0010	
Phosphorus	P				
Potassium	K			<2.0	
Selenium	Se	0.002 (T)		<0.0010	
Silicon	Si				
Silver	Ag	0.003 (T) 5		<0.000020	
Sodium	Na			2.9	
Strontium	Sr				
Sulphur	S				
Tellurium	Te				
Thallium	Tl	0.0003		<0.00020	
Tin	Sn			<0.00050	
Titanium	Ti	0.1		<0.010	
Uranium	U			<0.00020	
Vanadium	V			<0.0010	
Yttrium	Y			<0.0050	
Zinc	Zn	0.09 (T)	0.13 (T)		
Zirconium	Zr				
Total Metals					
Aluminum T-Al		0.1 (D) 1		1.44	0.0101
Antimony T-Sb		0.02(T)		<0.00050	<0.00050
Arsenic T-As		0.005(T)		0.00419	0.00189
Barium T-Ba		5		0.031	<0.020
Beryllium T-Be		.0053 6		<0.0010	<0.0010
Boron T-B				<0.10	<0.10
Cadmium T-Cd		0.00005 (T) 2		0.000021	<0.000010
Calcium T-Ca				42.8	91.8
Chromium T-Cr		0.009 (T)		0.0023	<0.0010
Cobalt T-Co		0.0009 (T)		0.00051	<0.00030
Copper T-Cu		0.018 (T)	0.026 (T)	0.0058	0.0097
Iron T-Fe		0.3 (T)		1.16	0.104
Lead T-Pb		0.15 (T)	0.26 (T)	0.00063	0.00050
Lithium T-Li		5		<0.0050	<0.0050
Magnesium T-Mg				5.35	12.3
Manganese T-Mn		2.2 (T) 3		0.0211	0.0203
Mercury T-Hg		0.00002 7		<0.000020	<0.000010
Molybdenum T-Mo		2 (T)		<0.0010	<0.0010
Nickel T-Ni		0.11 (T) 4		0.0021	0.0012
Potassium T-K				<2.0	20.1
Selenium T-Se		0.002 (T)		<0.0010	<0.00010
Silver T-Ag		0.003 (T) 5		0.000064	<0.000020
Sodium T-Na				3.2	7.1
Thallium T-Tl		0.0003		<0.00020	<0.00020
Tin T-Sn				<0.00050	<0.00050
Titanium T-Ti		0.1		0.063	0.015
Uranium T-U				0.00028	<0.00020
Vanadium T-V				0.0033	<0.0010
Zinc T-Zn		0.09 (T)	0.13 (T)	<0.0050	<0.0050

Results expressed in milligrams/litre unless otherwise noted (except pH)

Project GRRENWOOD
Report To Paul Cowley, HUAKAN INTERNATIONAL MINING INC.
ALS File No. L1466241
Date Received 05-Jun-14 09:23
Date 16-Jun-14

RESULTS OF ANALYSIS

	MID SNOWSHOE CR SOUTH	MID SNOWSHOE CR NORTH	SNOWSHOE CR.SOUTH	UPPER SNOWSHOE	SNOWSHOE CR MAIN NEAR JULY	LEXINGTON #2	GOOSMUS CR 100M DOWNSTREAM	GOOSMUS CR 750M DOWNSTREAM	GOOSMUS CR
Sample ID	E270307	E270306	E270308	NORTH E270305	CR E270309	PORTAL E266383	E266384	E266385	UPSTREAM#2
Date Sampled	03-JUN-14	03-JUN-14	02-JUN-14	02-JUN-14	03-JUN-14	03-JUN-14	03-JUN-14	03-JUN-14	03-JUN-14
Time Sampled	09:45	09:45	17:10	05:45	08:30	12:15	14:15	12:50	13:50
ALS Sample ID	L1466241-1	L1466241-2	L1466241-3	L1466241-4	L1466241-5	L1466241-6	L1466241-7	L1466241-8	L1466241-9
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water
Physical Tests									
Conductivity	232	481	188	670	342	432	428	424	406
Hardness (as CaCO3)	114	249	89.7	352	171	207	233	233	225
pH	8.09	8.22	8.04	8.10	8.20	8.20	8.22	8.26	8.31
Total Suspended Solids	<3.0	<3.0	<3.0	<3.0	<3.0	3.5	<3.0	<3.0	3.4
Total Dissolved Solids	167	324	139	499	239	302	265	265	241
Anions and Nutrients									
Alkalinity, Total (as CaCO3)	85.5	127	67.2	92.8	113	89.1	219	208	207
Ammonia, Total (as N)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050
Bromide (Br)	<0.050	<0.050	<0.050	<0.50	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	2.00	4.13	2.59	<5.0	2.82	0.54	0.54	0.57	<0.50
Fluoride (F)	0.047	0.075	0.043	<0.20	0.059	0.115	0.085	0.086	0.074
Nitrate (as N)	<0.0050	<0.0050	<0.0050	<0.050	<0.0050	0.532	0.0224	0.0855	<0.0050
Nitrite (as N)	<0.0010	<0.0010	<0.0010	<0.010	<0.0010	0.0052	<0.0010	<0.0010	<0.0010
Sulfate (SO4)	32.4	122	25.2	266	68.4	130	37.4	39.8	30.7
Total Metals									
Aluminum (Al)-Total	0.0313	0.0055	0.0132	0.0109	0.0096	0.130	0.0092	0.0216	0.152
Antimony (Sb)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00238	<0.00050	<0.00050	<0.00050
Arsenic (As)-Total	0.00130	0.00124	0.00072	0.00070	0.00171	0.00142	0.00075	0.00086	0.00078
Barium (Ba)-Total	<0.020	0.037	<0.020	0.035	0.023	0.045	0.039	0.041	0.038
Beryllium (Be)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron (B)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)-Total	<0.000010	<0.000010	<0.000010	0.000012	<0.000010	0.000074	0.000010	<0.000010	0.000021
Calcium (Ca)-Total	39.0	84.7	30.2	124	59.3	44.6	52.9	51.3	47.1
Chromium (Cr)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0014	<0.0010	0.0010	0.0013
Cobalt (Co)-Total	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.00034	<0.00030	<0.00030	0.00042
Copper (Cu)-Total	0.0023	0.0029	0.0028	0.0029	0.0029	0.0428	0.0022	0.0016	0.0082
Iron (Fe)-Total	0.037	<0.030	<0.030	<0.030	<0.030	0.418	<0.030	0.038	0.390
Lead (Pb)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Lithium (Li)-Total	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Total	3.88	7.57	2.93	10.0	5.62	23.5	24.9	24.7	26.4
Manganese (Mn)-Total	0.00113	0.00047	0.00070	0.00145	0.00049	0.0156	0.00052	0.00154	0.0277
Mercury (Hg)-Total	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Total	<0.0010	0.0021	<0.0010	0.0069	0.0012	0.0205	0.0057	0.0056	0.0058
Nickel (Ni)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0053	0.0029	0.0017	0.0069
Potassium (K)-Total	<2.0	<2.0	<2.0	<2.0	<2.0	2.8	2.6	2.4	2.1
Selenium (Se)-Total	0.00012	0.00062	0.00013	0.00181	0.00032	0.00190	0.00070	0.00077	0.00065
Silver (Ag)-Total	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	0.000021	<0.000020	<0.000020	<0.000020
Sodium (Na)-Total	2.5	2.9	2.2	2.7	2.8	5.1	2.2	2.4	2.1
Thallium (Tl)-Total	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin (Sn)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Total	<0.00020	0.00037	<0.00020	0.00049	<0.00020	0.00525	0.00050	0.00048	0.00032
Vanadium (V)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Total	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0451	<0.0050	<0.0050	<0.0050
Dissolved Metals									
Dissolved Mercury Filtration Location	LAB	LAB	LAB	LAB	LAB	LAB	LAB	LAB	LAB
Dissolved Metals Filtration Location	LAB	LAB	LAB	LAB	LAB	LAB	LAB	LAB	LAB
Aluminum (Al)-Dissolved	<0.0050	<0.0050	0.0066	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Antimony (Sb)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00241	<0.00050	<0.00050	<0.00050
Arsenic (As)-Dissolved	0.00120	0.00127	0.00062	0.00066	0.00165	0.00107	0.00073	0.00084	0.00059
Barium (Ba)-Dissolved	<0.020	0.038	<0.020	0.034	0.022	0.042	0.038	0.041	0.035
Beryllium (Be)-Dissolved	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron (B)-Dissolved	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)-Dissolved	<0.000010	<0.000010	<0.000010	0.000014	<0.000010	0.000048	0.000011	<0.000010	<0.000010
Calcium (Ca)-Dissolved	39.3	86.8	30.9	124	59.4	45.0	52.8	52.2	46.9
Chromium (Cr)-Dissolved	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt (Co)-Dissolved	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Copper (Cu)-Dissolved	0.0020	0.0025	0.0024	0.0025	0.0024	0.0201	0.0016	0.0011	0.0012
Iron (Fe)-Dissolved	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Lithium (Li)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Dissolved	3.88	7.75	3.05	9.92	5.53	23.0	24.6	24.9	26.2
Manganese (Mn)-Dissolved	<0.00030	<0.00030	<0.00030	0.00038	<0.00030	0.00651	<0.00030	<0.00030	0.00134
Mercury (Hg)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	<0.0010	0.0022	<0.0010	0.0069	0.0011	0.0209	0.0058	0.0055	0.0062
Nickel (Ni)-Dissolved	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0038	0.0028	0.0014	0.0041
Potassium (K)-Dissolved	<2.0	<2.0	<2.0	<2.0	<2.0	2.9	2.6	2.4	2.1
Selenium (Se)-Dissolved	0.00011	0.00059	0.00011	0.00175	0.00032	0.00190	0.00064	0.00073	0.00057
Silver (Ag)-Dissolved	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Sodium (Na)-Dissolved	2.5	3.0	2.3	2.7	2.7	5.2	2.2	2.5	2.0
Thallium (Tl)-Dissolved	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin (Sn)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Dissolved	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Dissolved	<0.00020	0.00039	<0.00020	0.00048	<0.00020	0.00508	0.00049	0.00048	0.00031
Vanadium (V)-Dissolved	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0211	<0.0050	<0.0050	<0.0050

APPENDIX VI

2010 NBCC Seismic Hazard Calculation

2010 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Requested by: , October 22, 2014

Site Coordinates: 49.09 North 118.57 West

User File Reference: Greenwood Gold TSF Site

National Building Code ground motions:
2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.2)	Sa(0.5)	Sa(1.0)	Sa(2.0)	PGA (g)
0.274	0.168	0.084	0.047	0.136

Notes. Spectral and peak hazard values are determined for firm ground (NBCC 2010 soil class C - average shear wave velocity 360-750 m/s). Median (50th percentile) values are given in units of g. 5% damped spectral acceleration (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are tabulated. Only 2 significant figures are to be used. ***These values have been interpolated from a 10 km spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the calculated values.***

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.2)	0.058	0.132	0.186
Sa(0.5)	0.038	0.083	0.115
Sa(1.0)	0.021	0.043	0.058
Sa(2.0)	0.013	0.026	0.034
PGA	0.033	0.071	0.096

References

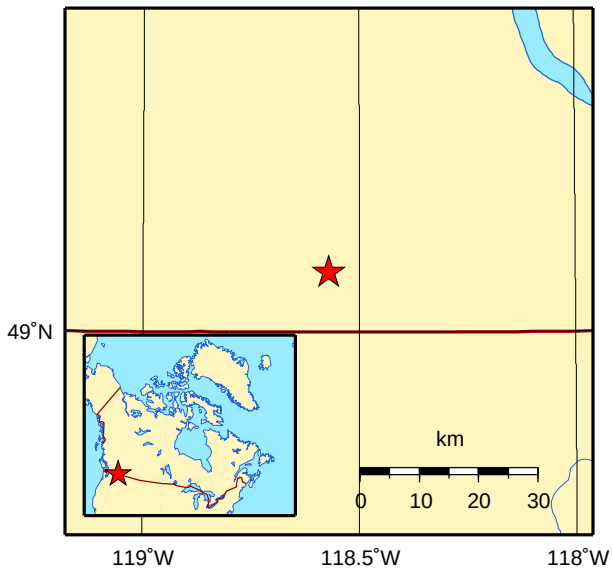
National Building Code of Canada 2010 NRCC no. 53301; sections 4.1.8, 9.20.1.2, 9.23.10.2, 9.31.6.2, and 6.2.1.3
Appendix C: Climatic Information for Building Design in Canada - table in Appendix C starting on page C-11 of Division B, volume 2

User's Guide - NBC 2010, Structural Commentaries NRCC no. 53543 (in preparation)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File xxxx
Fourth generation seismic hazard maps of Canada: Maps and grid values to be used with the 2010 National Building Code of Canada (in preparation)

See the websites *www.EarthquakesCanada.ca* and *www.nationalcodes.ca* for more information

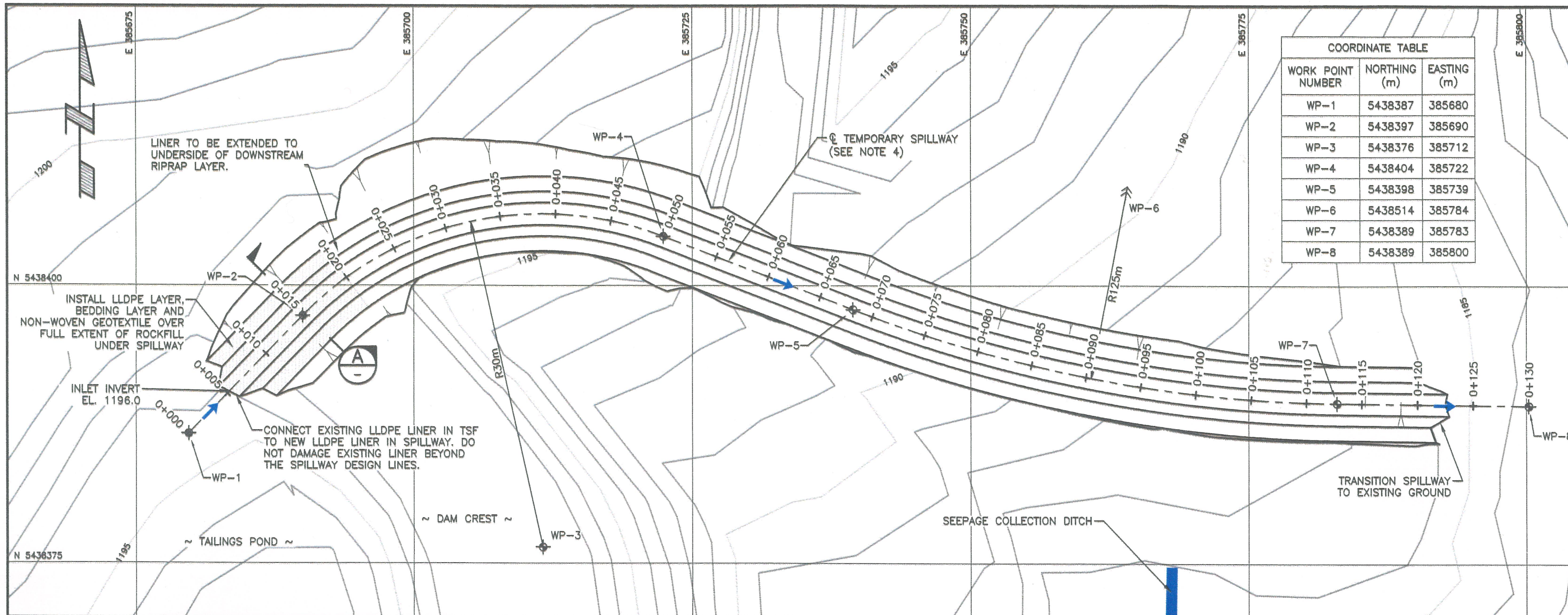
Aussi disponible en français



APPENDIX VII

Temporary Emergency Spillway

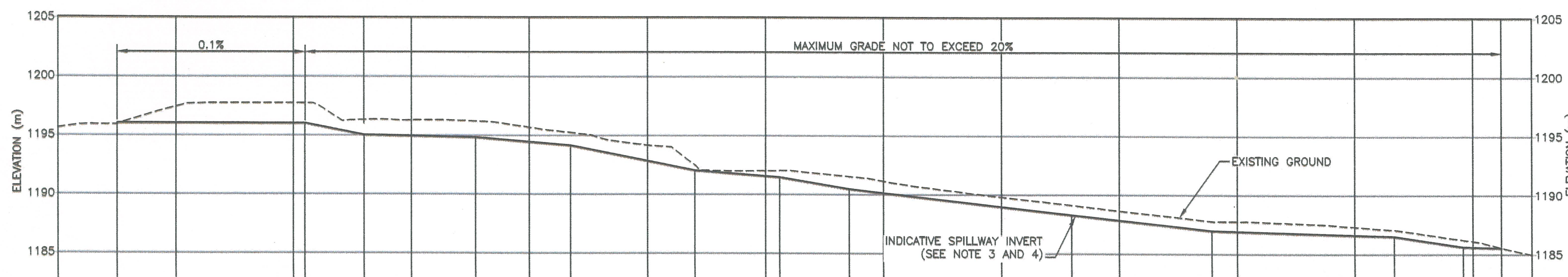
Drawing No. D-1001 (Rev.0) Temporary Spillway – Plan, Profile and Section
Construction Photographs (by Huakan)



COORDINATE TABLE		
WORK POINT NUMBER	NORTHING (m)	EASTING (m)
WP-1	5438387	385680
WP-2	5438397	385690
WP-3	5438376	385712
WP-4	5438404	385722
WP-5	5438398	385739
WP-6	5438514	385784
WP-7	5438389	385783
WP-8	5438389	385800

PLAN VIEW

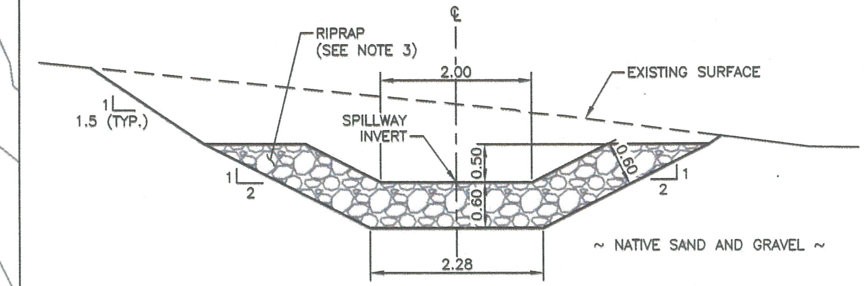
SCALE A



STATION (m)	SPILLWAY INVERT (m)	EXISTING GROUND (m)
0+005	1196.00	1195.92
0+010	1196.00	1197.40
0+020	1195.99	1197.69
0+021	1195.98	1197.69
0+026	1194.98	1196.28
0+030	1194.90	1196.25
0+035	1194.79	1196.17
0+040	1194.41	1195.64
0+043	1194.11	1195.20
0+050	1192.81	1194.15
0+054	1192.00	1192.45
0+060	1191.52	1191.98
0+061	1191.43	1191.99
0+067	1190.42	1191.51
0+070	1190.09	1191.11
0+080	1188.94	1189.77
0+086	1188.25	1189.10
0+090	1187.80	1188.62
0+098	1186.94	1187.75
0+100	1186.87	1187.74
0+110	1186.57	1187.28
0+113	1186.47	1187.03
0+119	1185.60	1186.19
0+120	1185.57	1186.08
0+122	1185.50	1185.52
0+125		

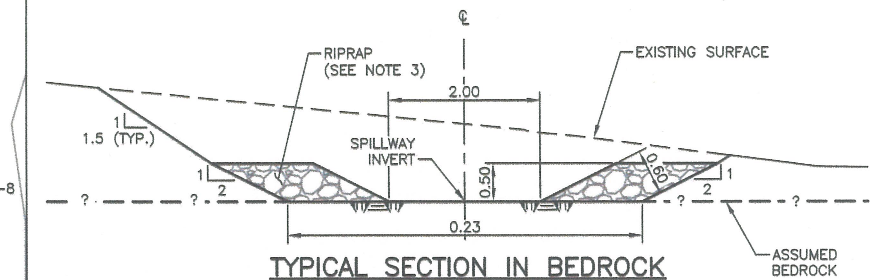
PROFILE – TEMPORARY SPILLWAY

SCALE A



TYPICAL SECTION IN OVERBURDEN

SCALE A

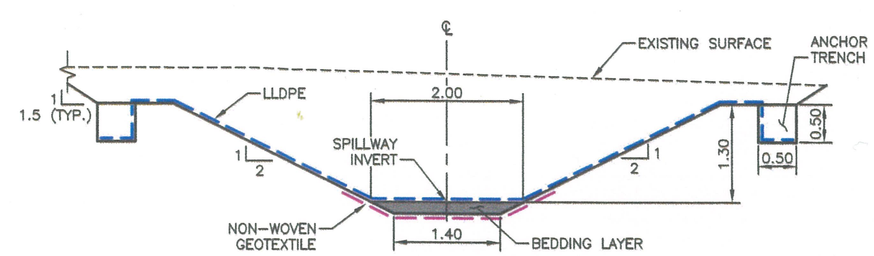


TYPICAL SECTION IN BEDROCK

SCALE A

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. AS-BUILT SITE SURVEY PROVIDED BY MERIT MINING NOVEMBER 28, 2007.
3. TEMPORARY SPILLWAY TO BE LINED WITH RIPRAP EXCEPT WHERE COMPETENT BEDROCK IS ENCOUNTERED.
4. TEMPORARY SPILLWAY ALIGNMENT AND PROFILE TO BE FIELD FIT TO SUIT GROUND CONDITIONS AND PROVIDE CONTINUOUS DOWNSLOPE GRADIENT. SPILLWAY CHANNEL TO BE FOUNDED IN NATURAL GROUND.



SECTION (A) TYPICAL

SCALE B

TECHNICAL SPECIFICATIONS

1. RIPRAP AND BEDDING GRADATION.

MATERIAL	D_{15}(mm)	D_{50}(mm)	D_{85}(mm)
RIPRAP	120	260	380
BEDDING	15	30	45

2. RIPRAP MATERIAL PROPERTIES:
   a. NON ACID GENERATING, HARD, DURABLE AND ANGULAR ROCK FRAGMENTS FREE FROM CRACKS, SEAMS AND OTHER DEFECTS.
   b. MINIMUM SPECIFIC GRAVITY OF 2.64.
   c. THE MAXIMUM DIMENSIONS SHALL NOT EXCEED 2.5 TIMES THE MINIMUM DIMENSION.
   d. LESS THAN 30% WEIGHT LOSS AFTER 1000 REVOLUTIONS IN A LOS ANGELES ABRASION TEST.
3. FOUNDATION PREPARATION AND FILL PLACEMENT:
   a. GRADE THE FOUNDATION TO UNIFORM, EVEN SURFACE.
   b. FILL DEPRESSIONS WITH APPROVED MATERIAL AND COMPACT AS DIRECTED.
   c. PLACE RIPRAP STARTING AT THE LOWER END OF CHANNEL AND PROCEED UPSLOPE.
   d. REWORK THE RIPRAP SURFACE AT LEAST ONCE TO PRODUCE A KEYED, DENSE AND UNIFORM SURFACE.
4. MINIMUM QUALITY CONTROL TESTING BY CONTRACTOR:
   a. CONDUCT GRADATION TESTS, IF REQUIRED, AT NO ADDITIONAL COST, ACCORDING TO CHAPTER 7 OF THE MINNESOTA TECHNICAL RELEASE 3 (LOOSE RIPRAP PROTECTION, SOIL CONSERVATION SERVICE, US DEPARTMENT OF AGRICULTURE, JULY 1989).
5. GEOSYNTHETICS SHALL BE INSTALLED BY A LICENSED CONTRACTOR AND IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.
6. WHERE APPROPRIATE, LAY THE GEOSYNTHETIC FROM THE DOWNSLOPE MOVING UPSLOPE, SUCH THAT THE OVERLAPS GO IN THE DIRECTION OF WATER FLOW.
7. LLDPE TO BE ENVIROFLEX 40 OR EQUIVALENT.

ISSUED FOR CONSTRUCTION

SCALE A 0 — 10 m SCALE B 0 — 2 m

REVISION	DESCRIPTION OF REVISION	DATE (YYYY-MM-DD)	DRAWN	DESIGNED	CHECKED	APPROVED
0	ISSUED FOR CONSTRUCTION	2014-10-23	PE	MMP	CMM	TJ

PROFESSIONAL ENGINEER – T. K. JIBIKI – # 31489 – BRITISH COLUMBIA – Oct. 24, 2014

AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.

CLIENT: HUAKAN INTERNATIONAL MINING INC.

Klohn Crippen Berger

PROJECT: GREENWOOD GOLD TAILINGS FACILITY

TITLE: TEMPORARY SPILLWAY PLAN, PROFILE AND SECTIONS

SCALE	PROJECT NO.	DWG. NO.	REV.
AS SHOWN	M09951A01	D-1001	0

CANCEL PRINTS BEARING PREVIOUS REVISION

KCB-DWG-D-L

Time: 15:18:10
Date: 10/23/2014
Scale: 1:2(PS)
Drawing File: Z:\M\VCR\M09951A01-HUA-Greenwood DSR\400 Drawings\CAD\D1001 - TemporarySpillway - Opt2.dwg (mmorgan)
Xrefs: BM-Tulsequah_Apr08

Appendix VI-B
Spillway Construction Photos (by Huakan)

Photo VI-1

Photo VI-2

Photo VI-3

Photo VI-4

Photo VI-5

APPENDIX VIII

Weekly TSF Inspection Checklist

GREENWOOD TAILING EMPOUNDMENT MONITORING

DATE	Sept 11/14									
OBSERVER	COWLEY									
INITIALS	TSC									
MAIN TAILINGS DAM										
FENCE WITHOUT BREAKS	X-fixed									
FENCE POSTS WITHOUT DAMAGE OR LEANING	✓									
LINER WITHOUT DAMAGE	X-minor									
LINEN FLEXIBILITY GOOD	✓									
WATER LEVEL	m									
NO CRACKS ON DAM CREST	✓									
NO CRACKS ON DOWNSLOPE OF DAM	✓									
NO SLUMPING ON DOWNSLOPE OF DAM	✓									
TOE TRENCH DRY	✓									
SPILLWAY CLEAR	N/A									
NO RELEASE FROM SPILLWAY	N/A									
NO TREE GROWTH ON CREST	X - cutting									
NO WILDLIFE INVASION	X - bear									
EMERGENCY POND DAM										
FENCE WITHOUT BREAKS	✓									
FENCE POSTS WITHOUT DAMAGE OR LEANING	✓									
LINER WITHOUT DAMAGE	✓									
LINEN FLEXIBILITY GOOD	✓									
WATER LEVEL	m									
NO CRACKS ON DAM CREST	✓									
NO CRACKS ON DOWNSLOPE OF DAM	✓									
NO SLUMPING ON DOWNSLOPE OF DAM	✓									
TOE TRENCH DRY	N/A									
SPILLWAY CLEAR	N/A									
NO RELEASE FROM SPILLWAY	N/A									
NO TREE GROWTH ON CREST	✓									
NO WILDLIFE INVASION	✓									

✓ = YES X = NO

APPENDIX IX

Emergency Response Plan

EMERGENCY RESPONSE PLAN

FOR CARE-AND-MAINTENANCE HUAKAN INTERNATIONAL MINING INC. LEXINGTON MINE AND GREENWOOD MILL PROPERTY

Site/Operation Information:

Lexington Mine Project of Huakan International Mining Inc., 890-580 Hornby St., Vancouver, BC, V6C 3B6
Phone: 604.694.2344; FAX: 604.642.6577;
e-mail: accountspayable@huakanmining.com

Mine Manager: Paul Cowley, 890 – 580 Hornby Street, Vancouver, BC V6C 3B6 (604) 694-2344 ext. 111; (604) 694-6536 (direct); (604) 340-7711 (cell); (604) 926-6440 (home); residential address: 5765 Westport Road, West Vancouver, BC V7W 2X7

Alternate designated Mine Manager: Jeffrey Ren, 2205-4808 Hazel Street, Burnaby, BC, V5H0A2; (604) 518-0136(cell); (604) 569-8350 (home).

Mine No.: 1630157

Permit No.: M-234 and M-233

Programme: Care-and-Maintenance at Lexington Mine Site. No work being conducted on site. Underground portals gated and locked.

No. of employees: Two caretakers at Greenwood Mill rotating two weeks in, two weeks out, with a one or two hour overlap at each changeover. No caretakers at Lexington Mine.

Hazard Analysis

Fire/explosion: Diesel fuel, cleaning fluids/solvents (if present); vehicles fuel – diesel and/or gasoline. All are properly stored.

Injury to Workers: Falls, slips in winter conditions.

Environmental: Possible small spills due to break of fuel line hose. Spill kits on hand to contain/clean up any potential spills.

Climate: (Onset of winter conditions), icing and freezing conditions.

Equipment Failure: Only equipment to be operated by the caretakers will be the Kubota tractor at the mine and Hyundai loader at the Mill and only on a limited basis.

There is rollover or rolling hazard. Grid power is provided at mill. No power at mine site.

Emergency Equipment

Fire/explosion: Fire extinguishers type ABC in shop and office as required.

Injury to Workers: Worksafe BC No. 2 equivalent 1st Aid kit; basket stretcher.

Trained Personnel

On-site First Aid: Level one1st Aid Certificates – Caretakers: Ken Mc Neil and John Demurs at mill. No one at mine.

Fire Department: (No rural coverage outside of Greenwood fire district.

Search and Rescue: Search & Rescue – Emergency Centre 1 800.663.3456, which will contact Greenwood/Grand Forks based Search and Rescue personnel.

Provincial Ambulance: via 911 or BC Ambulance phone or 1.800.461.9911

Communications Procedure: (attached) – Caretakers to report in twice daily by phone at 10:30am and 3:30pm and every 2.5 hours each day with SPOT
during hours of 8:00 am and 6:00 pm. After hours, caretakers are not to engage in any physical activity that may result in personal injury.

Implementation of Plan

The road from Highway 3 up to the Greenwood Mill will be kept open through the winter to ensure there is access to the site.

First calls: 911 via cell Phone from site (ask for Grand Forks crew as all crews in area have map of mine site location and driving directions).

Midway RCMP – emergency number 911

Implementation: Site Manager, Huakan Communication Contacts

Communication systems: Mill site satellite phone +8816234391

P.E.P. notification: phone 1.800.663.3456

M.E.M.P.R. notification: Cranbrook phone 250-426-1537 or 250-423-0944

Contact Lists

Mine Manager: Paul Cowley - (604) 694-2344 ext. 111; (604) 694-6536 (direct); (604) 340-7711 (cell); (604) 926-6440 (home)

Alternate Designated Manager: Jeffrey Ren- (604) 518-0136 (cell); (604) 569-8350 (home)

Huakan Contacts and Key Emergency and Service Contacts:

Name	Phone Number	email
Jeffrey Ren CEO of Huakan	(604) 694-6539 (direct office line) (604) 518-0136 (cell) (604) 569-8350 (home)	jeffreyrenyuandong@hotmail.com
Paul Cowley Mine Manager	(604) 694-6536 (direct office line) (604) 340-7711 (cell) (604) 926-6440 (home)	cowleypgeo@gmail.com
AMBULANCE	911 or 1 800 461-9911	
Search and Rescue	1 800.663.3456	
Glen Hendrickson Senior Inspector of Mines, Permitting	(250) 426-1705	

APPENDIX X

DSR Assurance Statement

APPENDIX D2: *DAM SAFETY REVIEW ASSURANCE STATEMENT – MINING DAMS*

Note: This Statement is to be read and completed in conjunction with the current "*APEGBC Guidelines for Legislated Dam Safety Reviews in British Columbia,* ("*APEGBC* Guidelines") and is to be provided for *dam safety review reports* in accordance with permit conditions and the *Health, Safety and Reclamation Code for Mines in British Columbia* or the *British Columbia Dam Safety Regulation*, B.C. Reg. 44/2000 as amended (refer to Table C-1 in Appendix C). Italicized words are defined in the *APEGBC* Guidelines. An assurance statement is required for each *dam* that is assessed.

To: The *Owner(s)*

Date: November 25, 2014

Huakan International Mining Inc.
Name

850 - 580 Hornby Street

Vancouver, BC V6C 3B6
Address

With reference to the permit conditions and the *Health, Safety and Reclamation Code for Mines in British Columbia* or the *British Columbia Dam Safety Regulation*, B.C. Reg. 44/2000 as amended (refer to Table C-1 in Appendix C).

For the *Dam*:

UTM (Location): 385 600m E; 5 438 300m N

Located at (Description): Grand Forks, B.C

Name of *dam* or description: Greenwood Tailings Storage Facility

Provincial *dam* number: N/A (Mine # 1630157, Permit No. M-233

Dam function: Tailings Storage Facility

Owned by: Huakan International Mining Inc.

(the "*Dam*")

Current *Dam classification* is:

Check one

- □ Low
- □ Significant
- X High
- □ Very High
- □ Extreme

The undersigned hereby gives assurance that he/she is a *Qualified Professional Engineer.*

I have signed, sealed and dated the attached *dam safety review report* for the *Dam* in accordance with the *APEGBC Guidelines*. That report must be read in conjunction with this Statement. In preparing that report I have:

Check to the left of applicable items (see Guideline Section 3.2):

X 1. Collected and reviewed available and relevant background information, documentation and data

_X_ 2. Reviewed the environmental objectives for the materials stored in the impoundment and related design requirements

_X_ 3. Understood the current *classification* for the *Dam*, including performance expectations

_X_ 4. Undertaken an initial facility review

_X_ 5. Reviewed and assessed the *Dam* safety management obligations and procedures

_X_ 6. Inspected the condition of the *Dam*, impoundment area and relevant areas upstream and downstream of the facility

_X_ 7. Interviewed operations and maintenance personnel

_X_ 8. Interviewed Engineer of Record

_X_ 9. Reviewed available maintenance and operating records, the Operations, Maintenance and Surveillance (OMS) Manual and the Emergency Preparedness Plan

_X_ 10. Confirmed proper functioning of mine waste and water management systems and environmental control systems

_X_ 11. After the above, reassessed the consequence *classification*, including the identification of required *dam* safety criteria

_X_ 12. Carried out a *dam safety analysis* based on the *classification* in Item 11

_X_ 13. Evaluated facility performance and conformance with design basis and operating criteria

_X_ 14. Identified, characterized and determined the magnitude of deficiencies in the safe operation of the *Dam* and non-conformances in the *dam* safety management system

_X_ 15. Recommended and prioritized actions to be taken in relation to deficiencies and non-conformances

_X_ 16. Prepared a *dam safety review report* for submittal to the *Regulatory Authority* by the *Owner* and reviewed the report with the *Owner*

_X_ 17. The *dam safety review report* has been reviewed in meeting the intent of *APEGBC* Bylaw 14(b)(2).

Based on my *dam safety review*, the *Dam classification* is:

Check one

- ☐ Appropriate
- ☒ Should be reviewed or amended

I undertook the following type of *Dam Safety Review*:

Check one

- ☐ Audit
- ☒ Comprehensive
- ☐ Detailed design-based multi-disciplinary
- ☐ Comprehensive, detailed design and performance

I hereby give my assurance that, based on the attached *Dam Safety Review report,* at this point in time:

Check one

- ☐ The *Dam* is reasonably safe in that the *dam safety review* did not reveal any unsafe or unacceptable conditions in relation to the design, construction, maintenance and operation of the *Dam* as set out in the attached *dam safety review report.*
- ☐ The *Dam* is reasonably safe but the *dam safety review* did reveal non-conformances with the regulatory requirements as set out in section(s) ____ of the attached *dam safety review report.*
- ☒ The *Dam* is reasonably safe but the *dam safety review* did reveal deficiencies and non-conformances as set out in section(s) 6 of the attached *dam safety review report.*
- ☐ The *Dam* is not safe in that the *dam* safety review did reveal deficiencies and/or non-conformances which require urgent action as set out in section(s) ____ of the attached *dam safety review report.*

Steven R. Ahlfield
Name

November 25, 2014
Date

Steven R. Ahlfield
Signature

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
4/25/2014
S. R. AHLFIELD

500 - 2955 Virtual Way
Address

Vancouver, BC V5M 4X6

604 - 669 - 3800
Telephone

(Affix Professional Seal here)

If the *Qualified Professional Engineer* is a member of a firm, complete the following:

I am a member of the firm Klohn Crippen Berger Ltd
and I sign this letter on behalf of the firm. (Print name of firm)