Klohn Crippen Berger

Teck Resources Limited

Bullmoose Mine

Bullmoose Tailings Storage Facility 2022

Annual Facility Performance Report

M09893A13.730

March 2023

March 16, 2023

Teck Resources Limited
Legacy Properties
601 Knighton Road
Kimberley, British Columbia
V1A 1C7

Mark Slater, P.Eng.
Manager, Geotechnical & Water
Dear Mr. Slater:

Bullmoose Mine
Bullmoose Tailings Storage Facility
2022 Annual Facility Performance Report

We are pleased to submit the 2022 Annual Facility Performance Report for the Bullmoose Tailings Storage Facility.

Please contact us if you have any questions regarding this report.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

M. Cronk

Max Cronk, P.Eng.
Project Manager
Civil Engineer, Associate

MC/HC/RWC:jc

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Teck Resources Limited

Bullmoose Mine

Bullmoose Tailings Dam

2022 Annual Facility Performance Report

EXECUTIVE SUMMARY

Klohn Crippen Berger Ltd. (KCB) was engaged by Teck Resources Limited (Teck) on behalf of the Bullmoose Operating Corporation to conduct the 2022 Annual Facility Performance Report (AFPR) for the Bullmoose Tailings Storage Facility (BTSF).

The site visit was conducted by KCB representatives, Mr. Bob Chambers, P.Eng., and Mr. Max Cronk, P.Eng., on July 28, 2022. Mr. Chambers is the Engineer of Record (EoR) for the BTSF. Mr. Mark Slater, P.Eng., of Teck attended the site visit, and is the Responsible Tailings Facility Engineer (RTFE) for the BTSF.

This report covers from September 2021 to August 2022, referred to as the "review period".

This summary section is provided in accordance with the Health, Safety and Reclamation Code (HSRC), and Teck's "Guideline for Tailings and Water Retaining Structures" (Teck 2019a). We also understand that Teck makes these annual reports available for public viewing prior to their full conformance with the Global Industry Standard on Tailings Management (GISTM) in 2023. This summary is provided solely for purposes of overview. Any party who relies on this report must read the full report. This summary omits a number of details, any one of which could be crucial to the proper application of this report.

Summary of Facility Description

Bullmoose Mine is a closed open-pit coal mine located in the Peace River District of northeastern British Columbia (Teck 2003). The mine site is about 45 km northwest of Tumbler Ridge. The mine was operated between 1983 and 2003 (Teck 2003). Reclamation activities were carried out in 2003, and the site has been inactive since that time.

The BTSF is a side-hill tailings storage facility that was used to store fine coal refuse tailings produced during operations. The BTSF was designed to store 4.6 Mm^3 of tailings. Approximately 4.4 million m^3 of tailings were deposited in the facility during operations from 1983 until 2003. Tailings are retained in the facility by the Bullmoose Tailings Dam (BTD), which is a downstream-raised zoned earthfill embankment constructed primarily of compacted coarse coal rejects (CCR). The embankment is 38 m high, and the downstream and upstream slopes are approximately 2.5H:1V and 2H:1V, respectively. The facility has an open channel spillway at the left abutment. Reclamation work conducted on the BTSF included re-sloping of the downstream slope, placement of growth medium in selected areas, and seeding of the tailings surface and dam slopes (upstream and downstream) (Teck 2003).

Summary of Key Potential Hazards and Failure Modes

KCB understands that Teck's long-term goal for all of their tailings facilities is to reach landform status with all potential failure modes that could result in catastrophic release of tailings and/or water being either not present or having been reduced to non-credible. Teck's long-term goal for the BTSF is for all potential failure modes to be non-credible based on extreme loading conditions, or to manage the risk to ALARP (i.e., as low as reasonably practicable) using appropriate loading conditions when it is not practicable to address extreme loading conditions.

Teck, with support from KCB, conducted a credible catastrophic failure mode assessment in April 2022. The assessment considered the three key failure modes for tailings facilities identified in the ICMM Good Practice Guide (ICMM 2021). Teck's definition of a "catastrophic" failure is one with a risk to life safety or irreversible impact to a rare or valued ecosystem, social, or cultural heritage element. The assessment concluded that, based on the available information and current understanding of the site, there are no credible "catastrophic" failure scenarios for the BTSF.

The risk assessment for the BTSF was reviewed by Teck and KCB representatives in November 2021. There have been no changes to the key hazards and the existing controls were adequate to manage potential failure modes within compliance and risk limits.

Potential Consequence of Failure

Teck provided the following statement regarding the consequence classification of the facility:

> *Teck are aligned with the most conservative interpretation of the Global Industry Standard on Tailings Management (GISTM) which, in turn, is consistent with their safety culture. Commensurately, Teck has advised that consequence classification is not a part of their tailings management governance and has asked that it not be reported in this AFPR. Instead, Teck will adopt the extreme consequence case design loading for any facility with a credible catastrophic flow failure mode. For facilities without a credible failure mode in terms of a life safety issue, Teck will reduce credible risks to As Low As Reasonably Practicable (ALARP). This consequence case applies for both earthquake and flood scenarios for all tailings facilities, consistent with the GISTM. Adopting this approach meets or exceeds any regulatory requirements, aligns with Teck's goal to eliminate risk for loss of life, and is consistent with the GISTM. This approach is consistent with industry-leading best practices and has an added benefit of providing accurate narratives to communities about the safety of tailings facilities that could impact them and who share Teck's approach of one life is one too many to be at risk.*

The BTSF meets HSRC requirements.

Instrumentation and/or Visual Monitoring

Piezometer readings are consistent with typical performance (post-operation), and there were no threshold exceedances during the review period. No changes are recommended to the instrument reading frequency or threshold levels.

The routine inspections and annual site visit observations indicate that the facility is performing in line with expectations. There were no concerns identified during the annual site visit.

Surface Water Management

There were no changes to surface water management during the review period. Estimated seepage rates based on a simplified water accounting calculation are consistent with estimates since 2013 (KCB 2014a).

OMS Manual and EPRP

The Operation, Maintenance and Surveillance (OMS) Manual was updated in 2022 and is considered appropriate for the facility (Teck 2022).

The most recent version of the Emergency Preparedness and Response Plan (EPRP) for the BTSF is in the Mine Emergency Response Plan (MERP), which was last updated in March 2022 (Teck 2019b).

Dam Safety Review

Teck engaged Thurber Engineering Ltd. to perform a Dam Safety Review (DSR) for the BTSF in 2020. The site visit was conducted in September 2020 and the report issued in June 2022. The HSRC requires that DSRs be performed at least once every 5 years. The next DSR should be scheduled to be initiated within 2025 to comply with the HSRC requirements.

Summary of Recommendations

The observed performance of the BTSF during the review period was consistent with past behavior and expected performance. There were no dam safety concerns related to facility performance noted during the review period.

There are no new recommendations for this AFPR, and recommendations from previous reviews have been addressed and closed.

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

List of Tables

List of Figures

List of Appendices

CLARIFICATIONS REGARDING THIS REPORT

This report is an instrument of service of Klohn Crippen Berger (KCB). The report has been prepared for the exclusive use of Teck Resources Limited. (Client) for the specific application to the 2022 Annual Facility Performance Report of the Bullmoose Tailings Storage Facility, and it may not be relied upon by any other party without KCB's written consent.

KCB has prepared this report in a manner consistent with the level of care, skill and diligence ordinarily provided by members of the same profession for projects of a similar nature at the time and place the services were rendered. KCB makes no warranty, express or implied.

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

1. The report is to be read in full, with sections or parts of the report relied upon in the context of the whole report.
2. The Executive Summary is a selection of key elements of the report. It does not include details needed for the proper application of the findings and recommendations in the report.
3. The observations, findings and conclusions in this report are based on observed factual data and conditions that existed at the time of the work and should not be relied upon to precisely represent conditions at any other time.
4. The report is based on information provided to KCB by the Client or by other parties on behalf of the client (Client-supplied information). KCB has not verified the correctness or accuracy of such information and makes no representations regarding its correctness or accuracy. KCB shall not be responsible to the Client for the consequences of any error or omission contained in Client-supplied information.
5. KCB should be consulted regarding the interpretation or application of the findings and recommendations in the report.

LIST OF ABBREVIATIONS

Abbreviation	Definition
AFPR	Annual Facility Performance Report
ALARP	As Low As Reasonably Practicable
BOC	Bullmoose Operating Corporation
BTD	Bullmoose Tailings Dam
BTSF	Bullmoose Tailings Storage Facility
CCR	Coarse Coal Rejects
CDA	Canadian Dam Association
DSR	Dam Safety Review
EDGM	Earthquake Design Ground Motion
EMLI	Ministry of Energy, Mines, and Low Carbon Innovation (BC)
ENV	Ministry of Environment and Climate Change Strategy (BC)
EoR	Engineer of Record
EPRP	Emergency Preparedness and Response Plan
FSO	Facility Surveillance Officer
FoS	Factor of Safety
GISTM	Global Industry Standard on Tailings Management
HSRC	Health, Safety and Reclamation Code for Mines in BC
ICMM	International Council on Mining and Metals
IDF	Inflow Design Flood
KL	Klohn Leonoff Ltd.
KC	Klohn Crippen Consultants Ltd.
KCB	Klohn Crippen Berger Ltd.
LiDAR	Light Detection and Ranging
MEM	Ministry of Energy and Mines (now EMLI) (BC)
MERP	Mine Emergency Response Plan
NOWL	Normal Operating Water Level
OMS	Operation, Maintenance and Surveillance
PGA	Peak Ground Acceleration
PMF	Probable Maximum Flood
RTFE	Responsible Tailings Facility Engineer
TSF	Tailings Storage Facility
TWRS	Tailings and Water Retaining Structures

1 INTRODUCTION

1.1 General

Klohn Crippen Berger Ltd. (KCB) was engaged by Teck Resources Limited (Teck) on behalf of the Bullmoose Operating Corporation to conduct the 2022 Annual Facility Performance Report for the Bullmoose Tailings Storage Facility (BTSF), also previously referred to as the South Fork Tailings Dam at the Bullmoose Mine.

This AFPR was prepared to comply with Section 10.5.3 of the Health, Safety and Reclamation Code (HSRC) for Mines in British Columbia (EMLI 2021). This report covers the period from September 2021 to August 2022, referred to as the "review period," and was prepared following:

- Section 4.2 "Annual Tailings Facility and Dam Safety Inspection Report" of the 2016 HSRC Guidance Document (MEM 2016); and
- Teck's Guideline for Tailings and Water Retaining Structures (TWRS) (Teck 2019a).

The site visit was conducted by the Engineer of Record (EoR), Mr. Bob Chambers, P.Eng., and Mr. Max Cronk, P.Eng., as representatives of KCB on July 28, 2022. Mr. Mark Slater, P.Eng., of Teck attended the site visit, and is the Responsible Tailings Facility Engineer (RTFE) for the BTSF.

1.2 Facility Description

Bullmoose Mine is a closed open-pit coal mine located in the Peace River District of northeastern British Columbia (Teck 2003). Infrastructure and pre-stripping development began in 1982, and the mine was operated between 1983 and 2003 (Teck 2003). Reclamation activities were carried out in 2003, and the site has been inactive since that time. The mine site is about 45 km northwest of Tumbler Ridge BC as shown in Figure 1.

The BTSF is a side-hill tailings storage facility that was designed to store fine coal refuse tailings produced during operations. The BTSF is situated on the south flank of the valley bottom, with South Bullmoose Creek to the west and Bullmoose Creek to the north (Figure 2). Tailings are retained in the facility by the Bullmoose Tailings Dam (BTD). There is an open channel spillway located at the west abutment of the BTSF which was constructed in 2002 (BOC 2004). Key facility information is summarized in Table 1.1. Typical cross-sections and design drawings are included in Appendix III.

Table 1.1 Key Facility Information

Item	Description
Embankment Type	Zoned earthfill (primarily coarse coal rejects) with a drainage blanket
Foundation	Silty sand and gravel, glacial till and alluvium
Construction Method	Staged construction, downstream raises
Operation	1983 to 2003
Maximum Embankment Height	38 m (crest to downstream toe)
Crest Elevation	1123 m
Crest Length	1050 m
Crest Width	10 m to 15 m
Slopes	Upstream 2H:1V; Downstream 2.5H:1V
Impoundment Area	20 ha (surface area of covered tailings plus 2 ha of pond)
Pond Volume	~26,000 m^3
Design Storage Capacity	4.6 million m^3
Volume of Tailings Stored	4.4 million m^3
Inflow Design Flood (IDF)	$^2/_3$ between 1,000-year return period and Probable Maximum Flood (PMF) – 24 hour
Earthquake Design Ground Motions (EDGM)	½ between 2,475-year and 10,000-year return period earthquake
Water Management Structures (Open Channel Spillway)	Invert Elevation: 1122 m Grade: 1% to 3% Base Width: 3 m Erosion Protection: Riprap (D_{50} of 200 mm) and bedrock
Minimum Required Freeboard	0.2 m based on CDA (2013) wave setup + wave runup methodologies
Catchment Area	36 ha (16 ha upslope; 20 ha impoundment)
Access to Facility	Vehicle access to the mine from Tumbler Ridge, BC, is 27 km northwest along BC Highway 29, and then 18 km southwest along Bullmoose Road.

1.3 Background Information and History

Coal production at Bullmoose Mine began in December 1983; the mine produced about 1.7 million tonnes of metallurgical coal and 0.6 million tonnes of thermal coal annually. Waste from the coal preparation process included Coarse Coal Rejects (CCR) and fine coal refuse (i.e., tailings). Tailings production varied considerably depending on the ratio of thermal coal to metallurgical coal. Tailings were transported as slurry, 35% solids by weight, and deposited from a single discharge point located at the southern ridge of the impoundment.

Construction of the BTD began in 1983. A starter embankment, about 10 m high, was constructed of alluvial borrow material to store tailings from the first year of operations (KL 1984). Crest raises were constructed using downstream methodology to a final crest elevation of El. 1122 m. A layer of glacial till was placed on the crest for erosion protection (BOC 2003), which raised the tailings dam to El. 1123 m (confirmed with the 2020 LiDAR). However, field observations suggest the glacial till placement was likely not consistent (in terms of thickness and coverage) across the full length and width of the crest.

During operations, a diversion ditch was constructed upslope of the impoundment to divert approximately 14 ha of upslope catchment away from the impoundment under normal conditions. The diversion channel was observed to be overgrown in 2015 (KCB 2016). KCB reviewed the water management of the facility in 2015 (KCB 2015b) and concluded that the diversion channel was no longer required to maintain an adequate water balance in the facility or to manage flood flows for dam safety.

Mine operations ceased in 2003, and the BTSF was reclaimed that same year. Reclamation work conducted on the BTSF included re-sloping of the downstream slope, placement of cover or growth medium in selected areas, and seeding of the tailings surface and dam slopes (upstream and downstream) (Teck 2003). There has been no construction since 2003.

The 2020 LiDAR indicates that the spillway invert and the crest elevations are 1 m higher than the post-construction as-built survey. This difference in survey does not impact this assessment as the difference in elevation between the crest and spillway invert (1 m) is the same for both surveys.

A summary of the available BTSF reference documents is included in Appendix I.

2 SUMMARY OF ACTIVITIES DURING THE REVIEW PERIOD

The BTSF is a closed facility and does not require operational intervention, except for routine surveillance and maintenance activities. There were no maintenance activities required or undertaken during the review period (September 2021 to August 2022).

3 CLIMATE WATER MANAGEMENT AND WATER ACCOUNTING

3.1 Climate

The climate of the region is dictated by a variety of factors including latitude, altitude, and location relative to the Rocky Mountains (Teck 2013b). The region encompassing the site is occasionally subject to intense low-pressure systems that draw warm, tropical air into the region from the Gulf of Mexico (Teck 2013b).

KCB reviewed precipitation and temperature data from the Chetwynd Airport Climate Station, the nearest active Environment Canada Climate Station to the site, for the review period. Details of the climate station are summarized in Table 3.1. Precipitation and temperature data are summarized in Table 3.2 and Figure 3.1 and compared to “Climate Normals” published by Environment Canada for the period of 1981 to 2010. Of note is that precipitation in April and May was more than double the average for those months, due to rainfall events of 21 mm, 28 mm, and 43 mm on April 27, May 27, and May 28, 2022, respectively.

In previous AFPRs (pre-2022), the climate summary presented data from the Chetwynd Airport Climate Station which had been adjusted to estimate the local weather at the Bullmoose Mine site using correlation factors based on historical normals. However, this report has been changed to show the original Chetwynd Airport Climate Station data to simplify the comparison to the “Climate Normals” published by Environment Canada. Correcting the precipitation data to estimate local weather is not a control for the key hazards and failure modes of the facility.

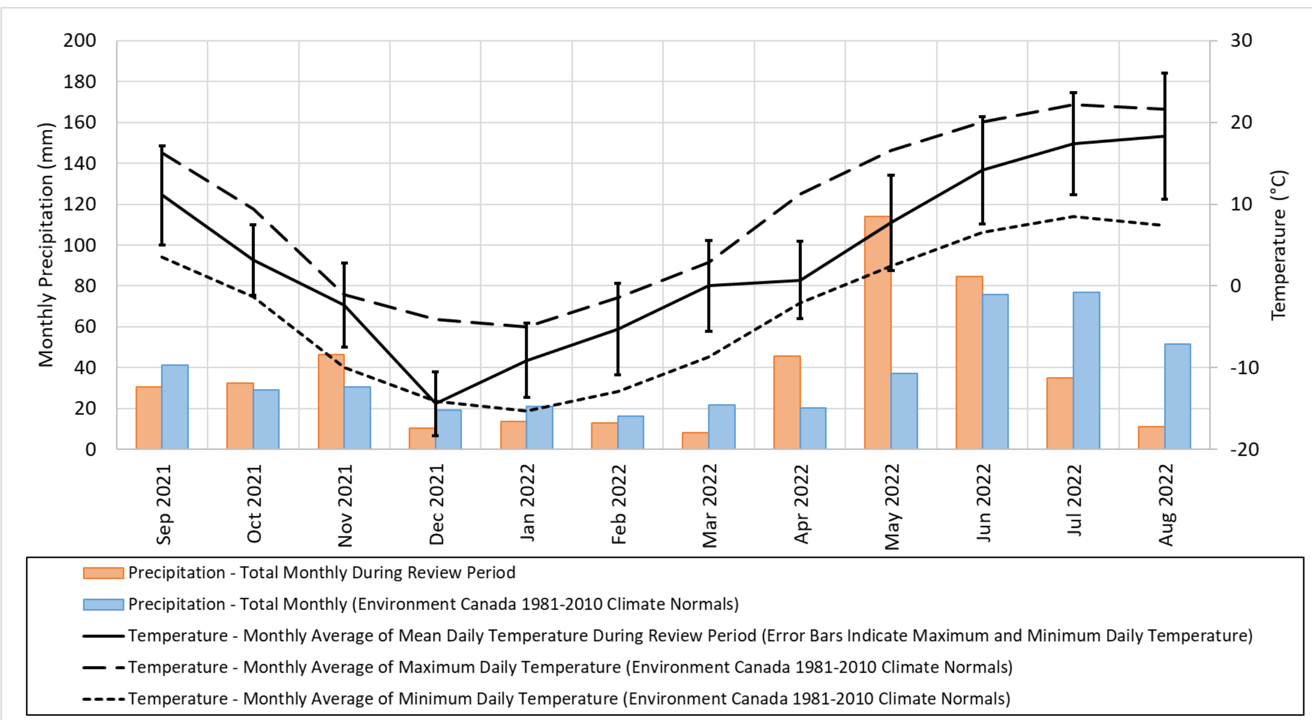
Table 3.1 Summary of Climate Stations

Climate Station	Alternate Name	Monitored By	Station No.	Location	Elevation (m)	Period of Record
Chetwynd Airport	n/a	Environment Canada	1181508	62 km north of Bullmoose Mine	610	1982 to present

Table 3.2 Climate Data for Chetwynd Airport During the Review Period

Month	Precipitation at Chetwynd Airport (mm)		Average Daily Temperature at Chetwynd Airport (ºC)	
	1981 to 2010 Mean	2021 to 2022	1981 to 2010 Mean	2021 to 2022
September 2021	41	30	9.9	11.1
October 2021	29	32	4.1	3.2
November 2021	31	46	-5.5	-2.3
December 2021	19	10	-9.1	-14.4
January 2022	21	14	-10.2	-9.1
February 2022	16	13	-7.2	-5.3
March 2022	22	8	-2.9	0.0
April 2022	20	46	4.6	0.7
May 2022	37	114	9.5	7.7
June 2022	76	85	13.4	14.2
July 2022	77	35	15.4	17.4
August 2022	51	11	14.5	18.4
Total	**440**	**444**		

Figure 3.1 Precipitation Data at Chetwynd Airport During the Review Period



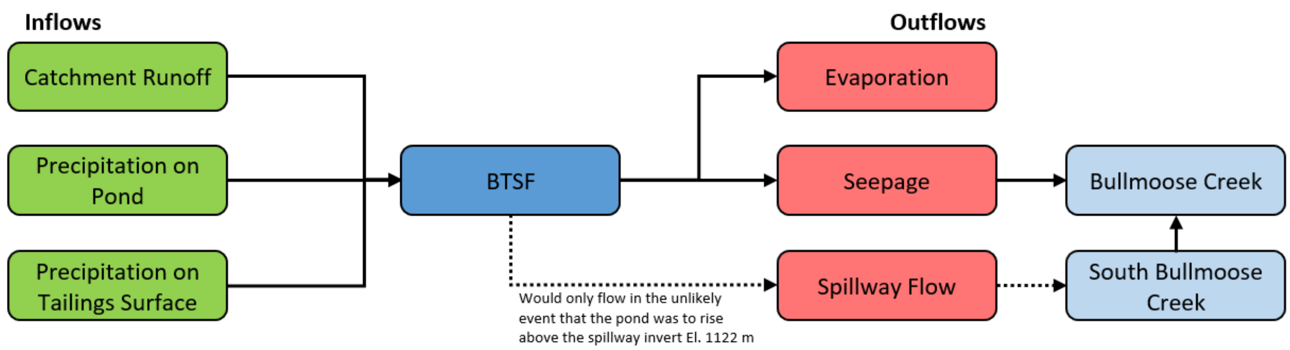
3.2 Water Management

Under normal conditions, water enters the facility precipitation on the tailings impoundment and pond, or as runoff from the catchment. Water accumulates in the low point of the tailings surface on the east side of the impoundment and exits as either seepage or evaporation with no surface discharge. The pond level typically fluctuates between El. 1115 m and El. 1117 m and has an estimated volume of about 26,000 m^3 under normal conditions. The total catchment that reports to the BTSF under normal conditions is 36 ha: 2 ha pond area; 18 ha covered tailings area; and 16 ha upslope natural catchment.

Under flood conditions, the gravel roads upslope of the impoundment are assumed to be overtopped which increases the upslope catchment by approximately 5 ha to 21 ha (KCB 2015b). Flood flows are stored within the impoundment and exit as either seepage or evaporation. In the unlikely event that the pond was to rise above El. 1122 m, water would discharge from the open channel spillway into South Bullmoose Creek. There is no record of the spillway operating since construction in 2003.

A flow schematic is shown in Figure 3.2. The catchment, spillway, and diversion channel are shown in Figure 3.

Figure 3.2 Flow Schematic for the BTSF



3.3 Water Accounting

A simplified water accounting calculation for the review period (values rounded to the nearest thousand) is summarized in Table 3.3. This simplified assessment omits a number of minor inputs and outputs but is considered adequate for the purpose of the annual review and for the current condition of the facility.

Table 3.3 Simplified Water Accounting for the Review Period

Inflow/Outflow		Value	Unit
Inflow	Runoff from Upstream Catchment (Notes 1 and 2)	56,000	m^3
	Precipitation on Tailings Beach (excluding Pond) (Notes 1 and 3)	155,000	m^3
	Precipitation on Pond (Notes 1 and 4)	18,000	m^3
Outflow	Evaporation from Pond Surface (Note 5)	10,000	m^3
	Seepage Losses (estimated as inflows minus evaporation)	**219,000**	**m^3**
		7	**L/s**
	Net Average Annual Flow Through the Spillway	-	m^3

Notes:

1. Precipitation from Chetwynd Airport climate station data is adjusted to the Bullmoose Mine site using correlation factors derived from historical normals, see Appendix IV.
2. Assumed a runoff coefficient of 0.4.
3. Assumed a runoff coefficient of 0.6 to account for water lost to evaporation from the pond and evapotranspiration from the beach.
4. Assumed the pond surface on average is at El. 1115.5 m.
5. Evaporation rate for this site is 502 mm/year adopted from the Baseline Hydrology Report for the Quintette site (Teck 2013b).

3.4 Freeboard and Flood Storage

3.4.1 Flood Storage

There is approximately 680,000 m^3 of flood storage in the facility between the Normal Operating Water Level (NOWL) (El. 1115 m) and the spillway invert (El. 1122 m) (KCB 2015b). The Inflow Design Flood (IDF) for the BTSF is the $^2/_3$ between the 1,000-year return period and PMF, 24-hour duration event; the volume of the IDF is approximately 114,370 m^3 (KCB 2015b), which is less that one fifth of the available storage within the BTSF under normal conditions. This indicates that a storm event significantly larger than the IDF would be required to raise the pond level to the spillway invert. For example, the 30-day PMF has a volume of approximately 446,000 m^3, which indicates that even under this scenario, the pond would not reach the spillway invert.

3.4.2 Freeboard

Minimum freeboard requirements for the BTSF were estimated using the CDA Dam Safety Guidelines Wave Runup methodology (CDA 2013), which is in line with expectations noted in the HSRC Guidance Document (MEM 2016). The CDA (2013) method defines freeboard under two scenarios:

- Normal Freeboard: the difference in elevation between the lowest elevation of the crest of the embankment and the maximum NOWL; and

- Minimum Freeboard: the difference in elevation between the lowest elevation of the crest of the embankment and the peak pond level during the IDF.

Based on the CDA (2013) method, the “Normal Freeboard” for the BTSF is 0.4 m, while the “Minimum Freeboard” is 0.2 m. The actual freeboard observed during the review period ranged from 7 m to 8 m, which exceeds the both the “Normal Freeboard” and “Minimum Freeboard” requirements.

The hydrotechnical assessment of the BTSF estimated that there would be at least 0.5 m of freeboard in the facility during the IDF assuming the pond level starts at the spillway invert (KCB 2015b); as noted in Section 3.4.1, a storm event significantly larger than the IDF would be required to reach the initial conditions assumed in the hydrotechnical assessment.

4 MONITORING PROGRAM AND SITE OBSERVATIONS

4.1 Overview

The BTSF monitoring program is summarized in Table 4.1, along with comments on activities during the review period. The monitoring program is appropriate for the BTSF under existing conditions given the long performance history of the facility, adequacy of instrumentation coverage, large flood storage capacity and provision of an open channel spillway.

Table 4.1 Summary of Monitoring Program

Surveillance Type/Task	Frequency	Responsible	OMS Manual Compliance Met?	Notes for Review Period
Water Quality	Three times per year(1)	Teck Facility Surveillance Officer (FSO)	Yes	Reported separately by Teck to the Ministry of Environment (ENV).
Routine Inspections	Monthly – March to November(2)	Teck FSO	No	No inspection conducted in March or November due to heavy snow cover. No inspection during August due to staff availability.
Event-Driven Inspections	As required(3)	Teck FSO or Professional Geotechnical Engineer	Yes	No event-driven inspections were triggered.
Piezometers	Annual	Teck	Yes	Read by KCB on behalf of Teck during the annual site visit.
Annual Facility Performance Report	Annual	EoR	Yes	This report
Dam Safety Review	Every 5 years	Third Party Consultant/ Qualified Registered Professional Engineer	Yes	Site visit conducted by Thurber Engineering Ltd. In September 2020, and the report was issued in June 2022.

Notes:

1. Three times per year – spring (freshet / high flow), summer, and fall (low flow).
2. Inspections are conducted monthly when the site is accessible and when snow cover does not obstruct the inspection.
3. Triggers for event-driven inspections are defined in the OMS Manual (Teck 2022).

4.2 Routine Inspections

There were no issues of concern noted during the routine inspections. Inspection forms were provided by the FSO to KCB and to the RTFE for review. The August routine inspection was not completed due to limited staff availability; however, informal site visits confirmed that the facility remains in good condition. This is not considered a concern given the long history of good performance of the facility, and Teck were able to resolve the issue in September 2022.

4.3 Annual Site Visit Observations

The following is a summary of the key observations from the annual site visit by the EoR. The weather was sunny, and the temperature was 23°C. No precipitation was recorded 24 hours prior to the site visit. Selected photographs from the site visit are included in Appendix II, and site visit waypoints are included in Figure 2.

- **Crest**: Good condition No signs of cracking, settlement, sinkholes, erosion, excessive vegetation, or animal activity. The crest is vegetated with grasses and small shrubs.
- **Downstream Slope and Toe**: Good condition. No signs of erosion, slope instability, or seepage. Vegetation (grasses and mosses) is well established.
  - No change to the small erosion gulley observed at the toe near the right abutment (Photo II-13). The gulley was first observed in 2017 and has not shown signs of change since that time. The gulley was presumably formed during a period of concentrated local flow during spring freshet. This feature continues to be monitored during annual site visits for signs of change.
  - There is typically a small wet area near the toe of the north arm of the BTSF (Photo II-18) which was first noted in 2019. There were no signs of seepage emerging from the downstream slope, and the wet area is believed to be due to ponding from snowmelt from the slopes. This area was dry during the site visit.
- **Upstream Slope**: Good condition. No signs of erosion or slope instability. Vegetation consists of grasses and small shrubs.
- **Left and Right Abutment**: Good condition. No signs of erosion or seepage. Vegetation is well established at the abutment and along the abutment/downstream slope contact.
- **Tailings Impoundment and Pond**: A pond (approximately 2 ha) is located on the east side of the impoundment; the pond is approximately 400 m from the spillway inlet and 6 m lower. Outside of the pond, the impoundment surface is vegetated with grasses, shrubs, and small trees. The exposed tailings surface appears well drained and supports human/animal traffic. The pond was below the pond level threshold stake at the time of the site visit.
- **Spillway:** Good condition. No signs of erosion or obstructions. There was some minor re-growth of vegetation, but it does not affect the performance of the spillway. Teck personnel noted that this vegetation is scheduled to be removed in the fall of 2022.

- **Historical Slope Failure on Natural Slope South of Impoundment:** A historical slope failure is present in the natural slope on the south side of the impoundment (Photo II-9). The area impacted is about 20 m by 60 m. The failure is also visible in photographs from previous annual reports (Teck 2013a, KCB 2011, KCB 2014a, and KCB 2020a) indicating this has been present since at least 2010. The slide mass is overgrown with vegetation including small trees. Comparison of photographs between 2010 and 2022 does not indicate any visually identifiable changes, and the feature is not a risk to the facility.

4.4 Piezometers

There are 13 functional piezometers at the BTSF (11 standpipe piezometers and 2 pneumatic piezometers) which are shown in Figure 2. The piezometers are measured annually during the site visit which was conducted on July 28, 2022. A summary of the piezometer details and latest readings are shown in Table 4.2.

A summary of the historical piezometer readings can be found in Figure 4, and selected cross-sections of the facility displaying the latest readings can be found in Figure 5. None of the measured piezometers exceed Threshold Level 1, and none of the piezometers indicate a trend of increasing pore pressures within the embankment or foundation. The piezometer data collected to date continues to show that the dam shell is well drained with a low gradient of approximately 0.04 to 0.05 (KCB 2018b).

Table 4.2 Summary of 2022 Piezometer Readings

Sec.	Piezo No.	Status	Unit	Tip El. (m)	Threshold Level 1 El. (m)	Standpipe Reading (m)	Pneumatic Reading (psi)	Piezometric El. (m)	Comments
A	PA-1	Standpipe	Downstream slope, foundation	1077.3	1100.0	34.4	-	1078.7	Stick up shortened to 0.55 m
	PA-2	Standpipe	Downstream slope, general fill	1083.4	1100.0	27.2	-	1086.0	Stick up shortened to 0.7 m
	PA-3N	Pneumatic	Crest, general fill	1094.8	1107.0	-	0.8	1095.3	
	PA-4	Standpipe	Downstream slope, foundation	1077.3	1088.0	11.8	-	Dry	
	PA-5	Standpipe	Downstream slope, general fill	1079.0	1088.0	12.9	-	1081.6	
B	PB-1	Standpipe	Crest, foundation	1081.9	1107.0	40.0	-	Dry	
	PB-3	Standpipe	Crest, general fill	1099.5	1107.0	24.2	-	Dry	
	PB-4	Standpipe	Downstream slope, foundation	1080.1	1095.0	20.2	-	1081.6	
	PB-5	Standpipe	Downstream slope, foundation	1081.6	1095.0	20.1	-	1081.8	
C	PC-1	Standpipe	Crest, foundation	1083.7	1110.0	36.1	-	1085.4	
	PC-2	Standpipe	Crest, general fill	1090.3	1110.0	30.6	-	Dry	
	PC-3	Standpipe	Crest, general fill	1101.8	1110.0	19.6	-	Dry	
	PC-4N	Pneumatic	Downstream slope, foundation	1093.5	1100.0	-	1.3	1094.4	

4.5 Pond Level

Teck installed a pond level stake approximately 1 m above the NOWL as Threshold Level 1 marker. The pond level stake is checked visually during routine and event-driven inspections and is considered appropriate for ongoing monitoring of the pond level.

There were no freeboard exceedances noted during the review period. As noted in Section 3.4.2, the minimum freeboard observed during the review period was 7 m to 8 m which exceeds the minimum required freeboard.

4.6 Discharge Water Quality

Groundwater wells are installed downstream of the facility for water quality monitoring. Teck have indicated that there have been no water quality exceedances and that the monitoring frequency meets their permit requirements. Teck reports the results to the BC Ministry of Environment and Climate Change Strategy (ENV) as specified in Permit No. PE-06757.

5 TAILINGS FACILITY SAFETY ASSESSMENT

5.1 Design Basis Review

KCB have performed engineering assessments of the existing facility (KC 1996, KCB 2015b, KCB 2017) which confirmed that the BTSF meets the key design criteria for flood and earthquake loading required under the HSRC. There were no changes to the design basis during the review period.

5.2 Dam Safety Review

The most recent DSR was performed in 2020 by Thurber Engineering Ltd. The site visit was conducted in September 2020 and the report was issued in June 2022. The HSRC requires that DSRs be performed at least once every 5 years; the next DSR should be scheduled to be initiated in 2025.

5.3 Failure Modes Review

KCB understands that Teck's long-term goal for all of their tailings facilities is to reach landform status, with all potential failure modes that could result in catastrophic release of tailings and/or water being either not present or having been reduced to non-credible. Teck's long-term goal for the BTSF is for all potential failure modes to be non-credible based on extreme loading conditions, or to manage the risk to ALARP (i.e., as low as reasonably practicable) using appropriate loading conditions when it is not practicable to address extreme loading conditions. Evaluation of failure modes with respect to this goal is ongoing.

Teck, with support from KCB, conducted a credible catastrophic failure mode assessment in April 2022. The assessment considered the three key failure modes for tailings facilities identified in the ICMM Good Practice Guide (ICMM 2021). Teck's definition of a "catastrophic" failure is one with a risk to life safety or irreversible impact to a rare or valued ecosystem, social, or cultural heritage element. The assessment concluded that, based on the available information and current understanding of the site, there are no credible "catastrophic" failure scenarios for the BTSF.

The most recent failure modes review was conducted in November 2021. There were no changes to the key hazards and the existing controls were adequate to manage potential failure modes. The following is a summary of the controls in place to manage the three key hazards / failure modes for tailings facilities identified in the ICMM Good Practice Guide (ICMM 2021):

- **Overtopping:** The pond level (visually estimated) is typically 6 m to 7 m below the spillway invert. At this level, the available flood storage before spilling is more than 5 times the IDF volume (KCB 2015b) (see Section 3.4.1 and Section 5.6.2 for more details). In addition, the spillway was designed to safely route the IDF, with freeboard, assuming the pond is at the spillway invert level at the start of the storm (KCB 2015b).
- **Internal Erosion and Piping:** The embankment is a semi-pervious design (i.e., no compacted core or seepage barrier), which allows seepage flow through the dam fill. The filter compatibility of the fill types and native materials was checked as part of the design process

(KCB 2014c). The dam is constructed with zones of CCR, which were compacted with varying efforts and lift thicknesses to produce the internal zones. This included a drainage blanket of lightly-compacted CCR in the downstream shell, which was designed to draw down the phreatic surface (BOC 1982). As-built gradations of the tailings and embankment fill materials were found to be filter compatible (KCB 2015a). Hydraulic gradients in the embankment adjacent to the pond have been consistent over the past several years (approximately 0.04) and are below the average critical gradient of 0.11 required to erode the dam fill (KCB 2018b). Hydraulic gradients in other portions of the embankment further from the pond are much lower than 0.04.

- **Slope Instability:**
  - The dam is composed of compacted fill with a free-draining downstream shell and drainage layers. The downstream slope of the dam is 2.5H:1V (BOC 2003). The FoS reported in design was greater than 1.7 (KC 1996), which exceeds the HSRC requirements. This analysis and the long performance history with no visible or documented signs of instability indicates that the current condition of the structure is stable under normal loading.
  - Seismic stability was evaluated using a pseudo-static analysis (KL 1982) and indicated that the facility has a FoS of 1.4 with a horizontal seismic coefficient of 0.1 g (corresponding to a PGA of 0.2 g). This exceeds the PGA for a 10,000-year earthquake (0.16 g) based on the site-specific seismic hazard assessment (KCB 2020b) which indicates that deformations would be limited to less than 1 m under these conditions. The BTSF has approximately 8 m of freeboard under normal conditions, which is much greater than the anticipated displacements.
  - The potential for toe erosion to affect embankment stability was evaluated (KCB 2018a); the study indicates that the maximum flood level in Bullmoose Creek near the BTSF during the IDF[1] event is approximately 2 m below Bullmoose Mine Road (see Figure 2 for Bullmoose Mine Road location) and 1 m below the toe of the BTSF (KCB 2018a). The flood inundation extent is at least 40 m (horizontal) from the BTSF toe (KCB 2018a).

Based on the above, the key hazards related to the BTSF and the three potential failure modes are being managed effectively, and the BTSF is not seen as having the potential for a catastrophic flow failure in its current configuration under design flood and earthquake loading. Teck have indicated that the BTSF is a candidate for long-term landform status and KCB will be working with Teck towards that goal.

[1] Two-thirds between 1,000-year and PMF event

5.4 Upstream and Downstream Conditions Review

There have been no significant changes in the upstream condition since mine closure in 2003. No infrastructure is located upstream of the BTSF, except for forest service and recreational roads.

The downstream conditions were assessed as part of a flood inundation study (KCB 2014b) and there have been no significant changes since that time.

5.5 Potential Consequence of Failure

Teck provided the following statement regarding the consequence classification of the facility:

> *Teck are aligned with the most conservative interpretation of the Global Industry Standard on Tailings Management (GISTM) which, in turn, is consistent with their safety culture. Commensurately, Teck has advised that consequence classification is not a part of their tailings management governance and has asked that it not be reported in this AFPR. Instead, Teck will adopt the extreme consequence case design loading for any facility with a credible catastrophic flow failure mode. For facilities without a credible failure mode in terms of a life safety issue, Teck will reduce credible risks to As Low As Reasonably Practicable (ALARP). This consequence case applies for both earthquake and flood scenarios for all tailings facilities, consistent with the GISTM. Adopting this approach meets or exceeds regulatory requirements, aligns with Teck's goal to eliminate risk for loss of life, and is consistent with the GISTM. This approach is consistent with industry-leading best practices and has an added benefit of providing accurate narratives to communities about the safety of tailings facilities that could impact them and who share Teck's approach of one life is one too many to be at risk.*

The BTSF meets HSRC requirements.

5.6 Physical Performance

5.6.1 Geotechnical

The facility has performed adequately for approximately 40 years and has shown no indications of geotechnical instability. As noted in Section 4, there were no threshold exceedances or unusual conditions observed during the review period, and instrumentation readings were consistent with historic trends and expected behaviour.

5.6.2 Hydrotechnical

The hydrotechnical performance of the facility during the review period was consistent with historic trends and expectations. As noted in Section 4, there were no pond level exceedances or unusual conditions observed during the review period.

5.7 Operational Performance

The BTSF has been closed since 2003 and there are no operational requirements.

5.8 Documentation Review

The OMS Manual was last revised in 2022 (Teck 2022) and is considered appropriate for the facility.

The most recent version of the Emergency Preparedness and Response Plan (EPRP) for the BTSF is in the Mine Emergency Response Plan (MERP), which was last updated in March 2022.

6 SUMMARY AND RECOMMENDATIONS

The observed performance of the BTSF during the review period was consistent with past behavior and expected performance. There were no dam safety concerns related to facility performance noted during the review period.

There are no new recommendations for this AFPR, and recommendations from previous reviews have been addressed and closed.

7 CLOSING

We thank you for the opportunity to work on this project. Should you have any questions, please do not hesitate to contact the undersigned.

Yours truly,
KLOHN CRIPPEN BERGER LTD.
B.C. Permit to Practice No. 1000171

Max Cronk, P.Eng.
Project Manager
Civil Engineer, Associate

PROFESSIONAL
PROVINCE OF
R. W. CHAMBERS
16 MAR 2023
BRITISH COLUMBIA
ENGINEER

Robert W. Chambers, P.Eng.
Senior Geotechnical Engineer, Principal

REFERENCES

Bullmoose Operating Corporation (BOC). 1982. “Tailings Dam Design Report – Bullmoose Coal Project”, October 22.

Bullmoose Operating Corporation (BOC). 2003. “Tailings Dam Annual Review of Operations”, November.

Bullmoose Operating Corporation (BOC). 2004. ““Tailings Dam Annual Review of Operations”, November.

Canadian Dam Association (CDA). 2013. “Dam Safety Guidelines 2007 – Revised 2013”.

International Council on Mining & Metals (ICMM). 2021. “Tailings Management Good Practice Guide”.

Klohn Crippen Consultants Ltd. (KC). 1996. “South Fork Tailings Dam - Seepage and Stability Review”, October.

Klohn Crippen Berger Ltd. (KCB). 2011. “Bullmoose 2010 Dam Safety Inspection and Consequence Classification”, March.

Klohn Crippen Berger Ltd. (KCB). 2014a. “Bullmoose Mine 2013 Dam Safety Inspection”, March.

Klohn Crippen Berger Ltd. (KCB). 2014b. “Bullmoose Mine Tailings Storage Facility – Dam Breach and Inundation Study”, June.

Klohn Crippen Berger Ltd. (KCB). 2014c. “Bullmoose Mine – Tailings Dam Design Review”, August 15.

Klohn Crippen Berger Ltd. (KCB). 2015a. “Bullmoose Mine Tailings Storage Facility Response to February 3, 2015 MEM Memorandum”, June.

Klohn Crippen Berger Ltd. (KCB). 2015b. “Bullmoose Mine 2015 Consulting – Tailings Storage Facility Hydrotechnical Review”, December.

Klohn Crippen Berger Ltd. (KCB). 2016. “Bullmoose Mine Tailings Storage Dam – 2015 Dam Safety Inspection”, March 22.

Klohn Crippen Berger Ltd. (KCB). 2017. “Bullmoose Mine Tailings Storage Facility – Review of Seismic Hazard Assessment”, October 13.

Klohn Crippen Berger Ltd. (KCB). 2018a. “Bullmoose Creek Flood Study”, June 22.

Klohn Crippen Berger Ltd. (KCB). 2018b. “Bullmoose Tailings Dam - Internal Stability Assessment”, December 3.

Klohn Crippen Berger Ltd. (KCB). 2019. “Bullmoose Tailings Dam – 2018 Dam Safety Inspection,” March 26.

Klohn Crippen Berger Ltd. (KCB). 2020a. “Bullmoose Tailings Dam – 2019 Dam Safety Inspection,” April 24.

Klohn Crippen Berger Ltd. (KCB). 2020b. “2019 Seismic Hazard Assessment – Bullmoose Coal Mine Tailings Storage Facilities – Final”. July 17.

Klohn Leonoff (KL). 1982. “Bullmoose Coal Project Tailings Dam Design Report”, October.

Klohn Leonoff (KL). 1984. “Bullmoose Tailings Disposal 1983 Starter Dam Construction”, March.

Ministry of Energy and Mines (MEM). 2016. “Health, Safety and Reclamation Code for Mines in British Columbia Guidance Document”, July.

Ministry of Energy, Mines, and Low Carbon Innovation (EMLI). 2021. “Health, Safety and Reclamation Code for Mines in British Columbia”, April.

Teck Cominco. (2003). “Bullmoose Mine – Closure Report Reclamation Permit No. C-158”, January.

Teck Resources Limited. (Teck). 2013a. “Bullmoose Tailings Impoundment 2012 Dam Safety Inspection”, August.

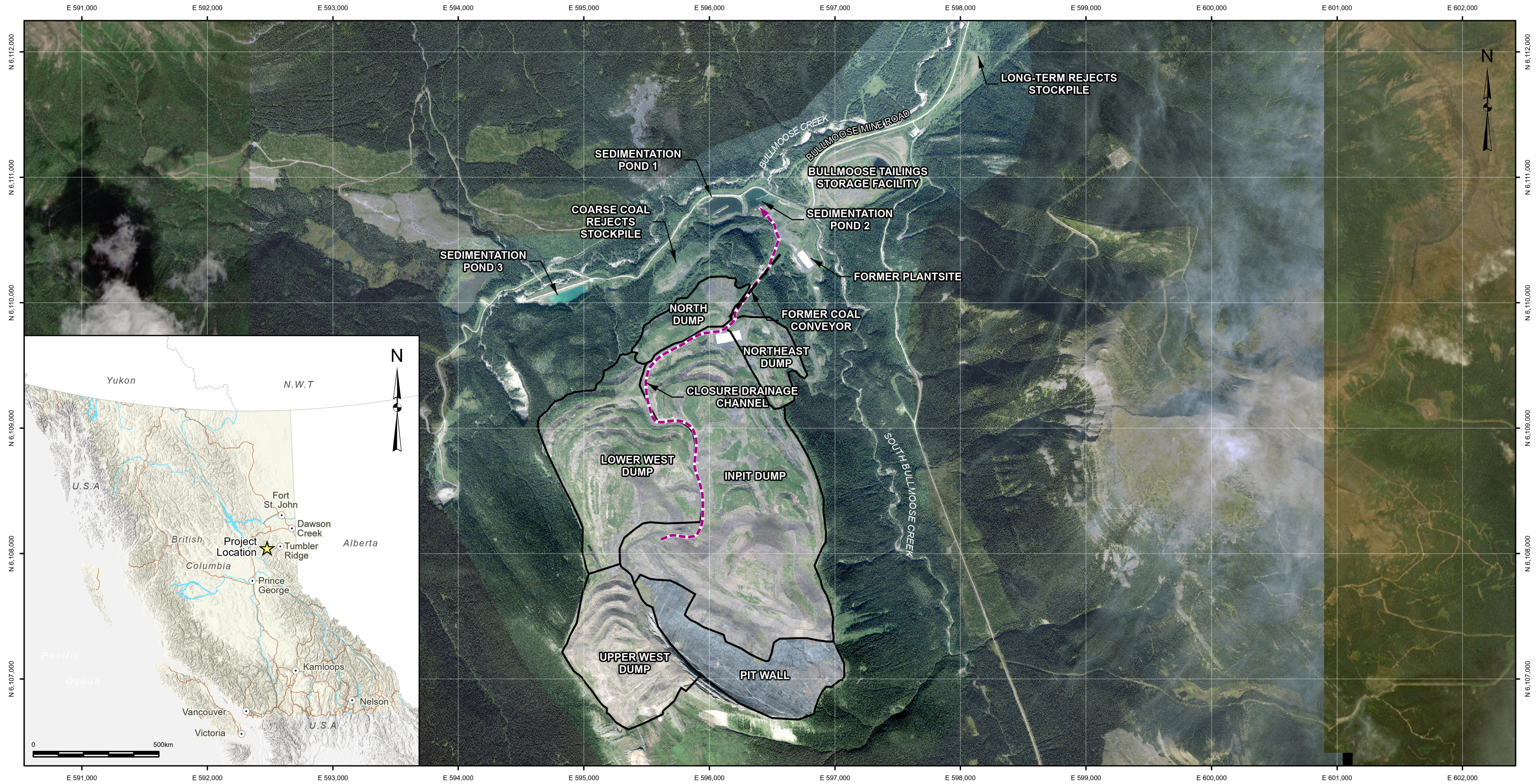
Teck Resources Limited. (Teck). 2013b. “Baseline Hydrology and Design Basis”, May.

Teck Resources Limited (Teck). 2019a. “Guideline for Tailings and Water Retaining Structures”, January.

Teck Resources Limited (Teck). 2019b. “Bullmoose Mine Emergency Response Plan”. March 27.

Teck Resources Limited. (Teck). 2022. “Bullmoose Mine Tailings Storage Facility Operations, Maintenance and Surveillance Manual”. February.

FIGURES



LEGEND

- CITY/TOWN
- HIGHWAY
- STRUCTURE BOUNDARY

NOTES:
1. DATUM, PROJECTION: NAD83, UTM ZONE 10N.
2. ORTHOPHOTO PROVIDED BY TECK.
   SOURCE: AIRBORNE IMAGING. 2020. "FINAL SURVEY REPORT: 15997 QUINTETTE/BULLMOOSE FOR TECK METALS". AUGUST 20.
   SUPPLEMENTAL IMAGERY FROM TECK DATED 2013.

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NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

SCALE 0 1,000m

CLIENT: Teck

Klohn Crippen Berger

PROJECT: BULLMOOSE MINE
2022 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: GENERAL SITE PLAN

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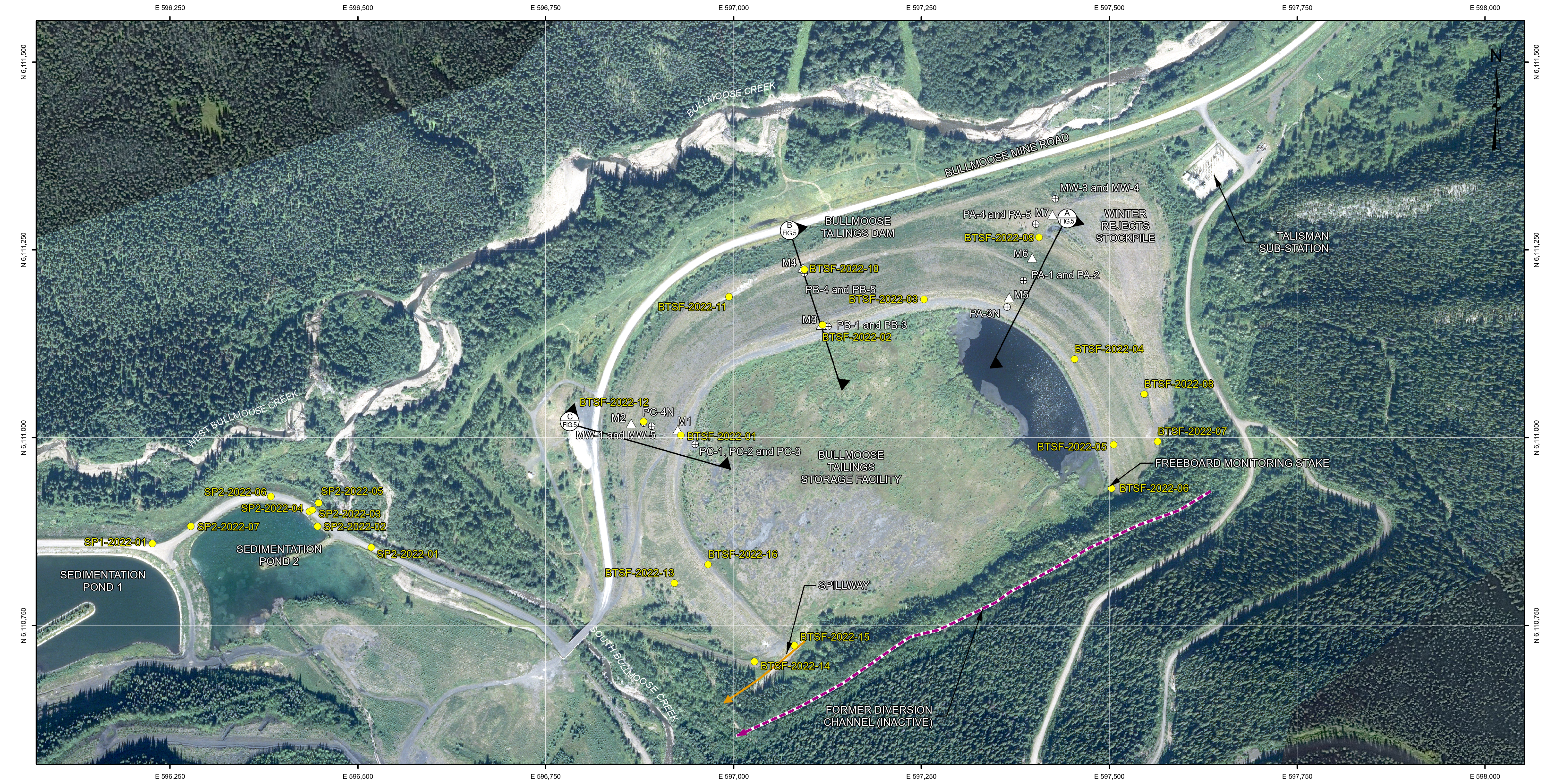

LEGEND

- SITE VISIT WAYPOINT
- SURVEY MONUMENT
- PIEZOMETER

NOTES:
1. DATUM, PROJECTION: NAD83, UTM ZONE 10N.
2. ORTHOPHOTO PROVIDED BY TECK.
   SOURCE: AIRBORNE IMAGING. 2020. "FINAL SURVEY REPORT: 15997 QUINTETTE/BULLMOOSE FOR TECK METALS". AUGUST 20.
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NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

SCALE 0 250m

CLIENT: Teck

Klohn Crippen Berger

PROJECT: BULLMOOSE MINE
2022 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: BULLMOOSE TAILINGS STORAGE FACILITY
GENERAL ARRANGEMENT

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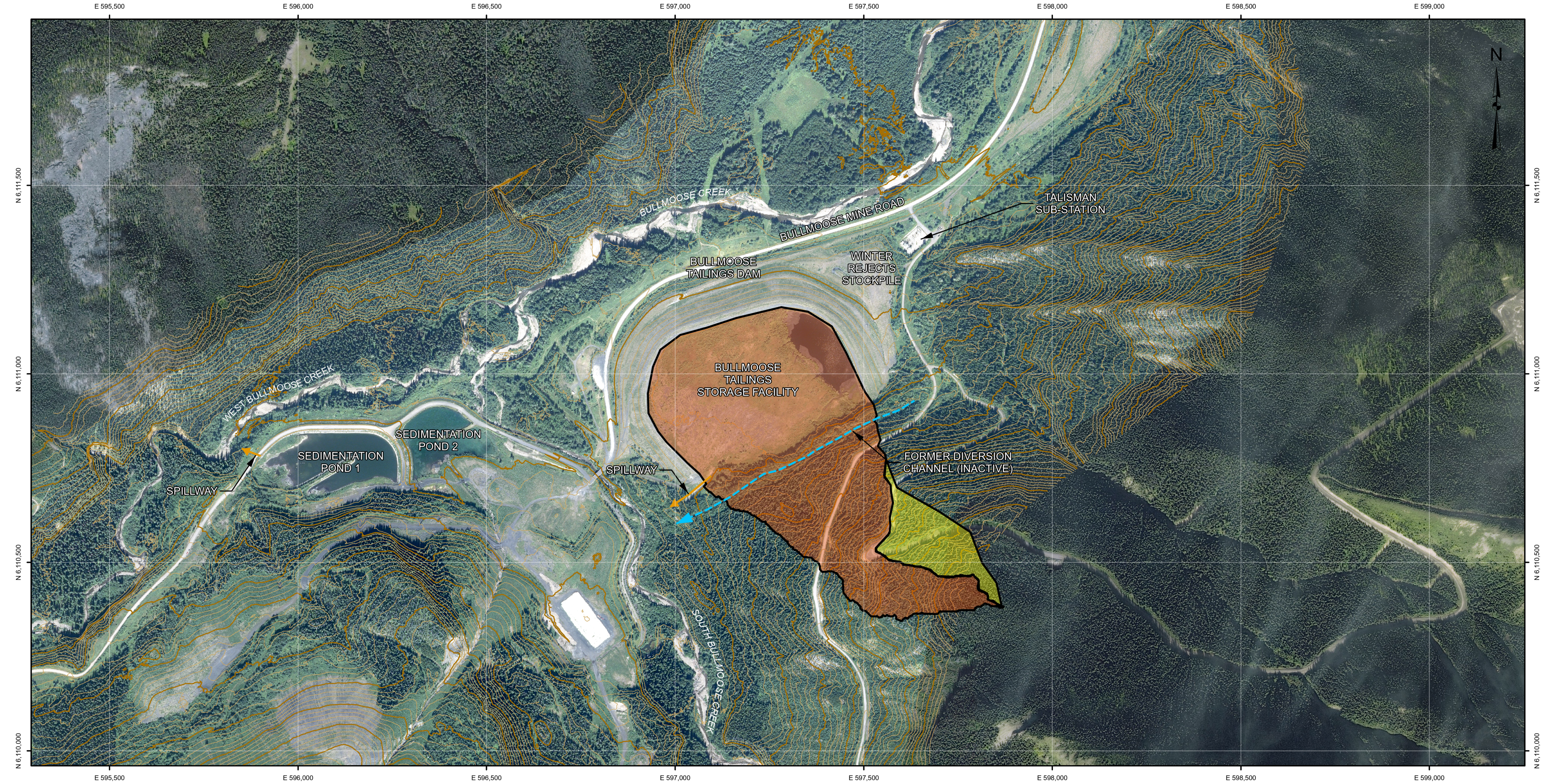

LEGEND

CATCHMENT AREA - NORMAL CONDITIONS
ADDITIONAL CATCHMENT AREA - FLOOD CONDITIONS
INDEX CONTOUR (25 m)
INTERMEDIATE CONTOUR (5 m)

NOTES:
1. DATUM, PROJECTION: NAD83, UTM ZONE 10N.
2. ORTHOPHOTO PROVIDED BY TECK.
SOURCE: AIRBORNE IMAGING. 2020. "FINAL SURVEY REPORT: 15997 QUINTETTE/BULLMOOSE FOR TECK METALS". AUGUST 20.
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NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

SCALE 0 500m

CLIENT

Teck

Klohn Crippen Berger

PROJECT

BULLMOOSE MINE
2022 ANNUAL FACILITY PERFORMANCE REPORT

TITLE

BULLMOOSE TAILINGS STORAGE FACILITY CATCHMENT

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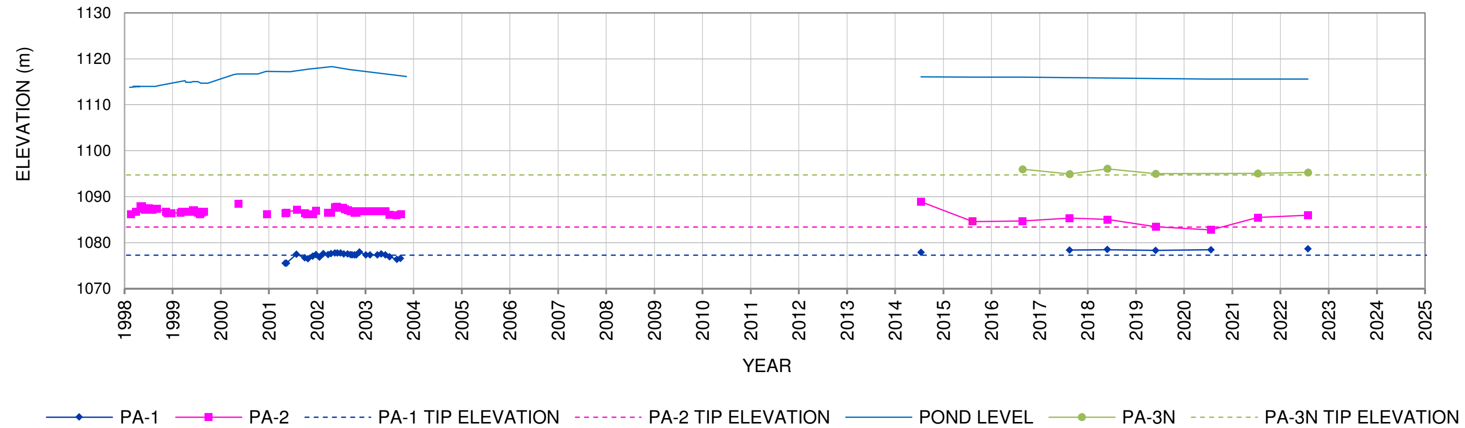
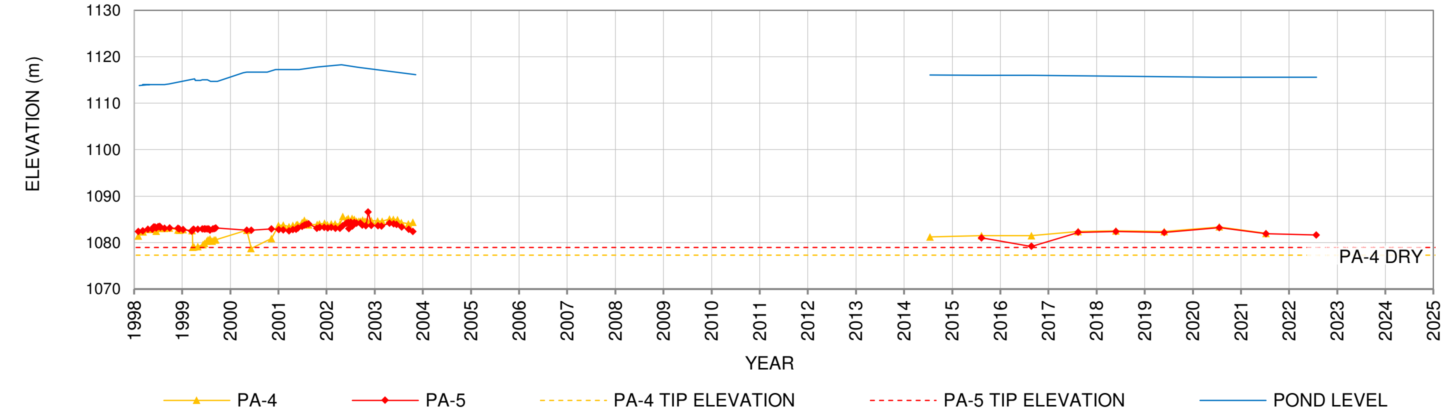
AS SHOWN	M09893A13	3

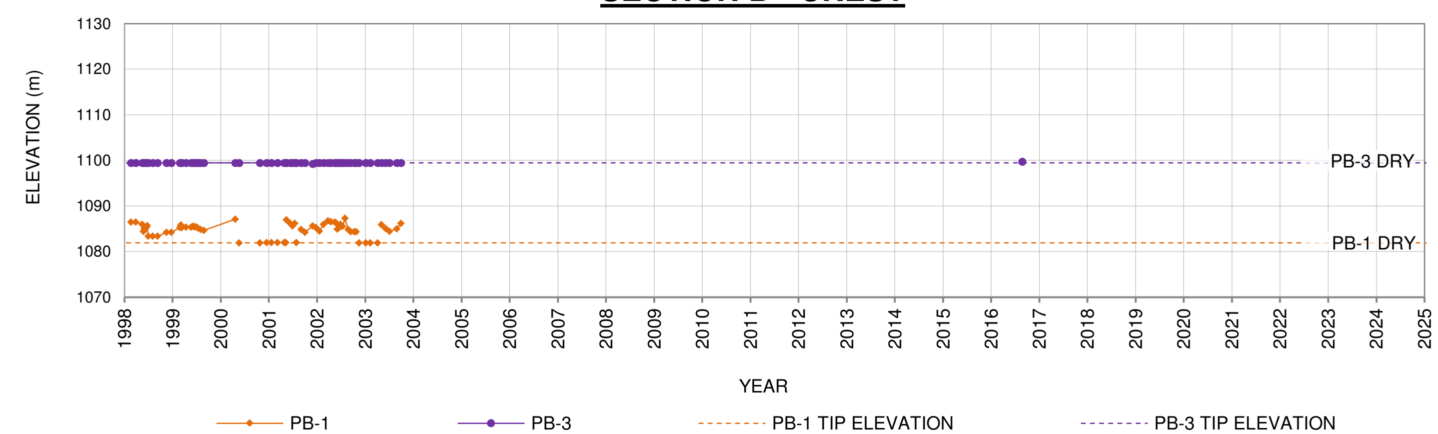
SECTION A - MID-SLOPE



SECTION A - TOE



SECTION B - CREST



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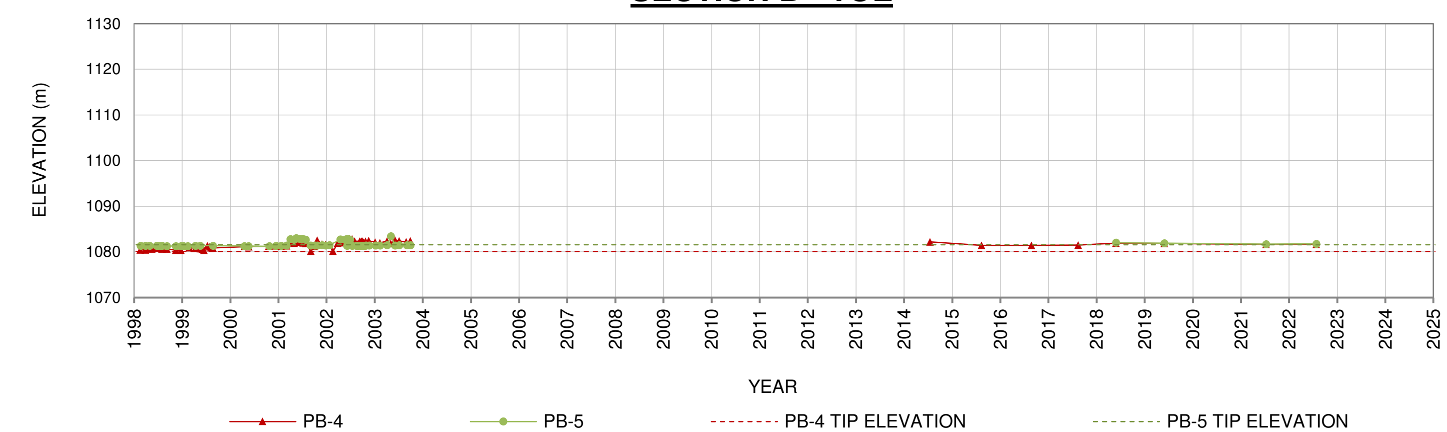
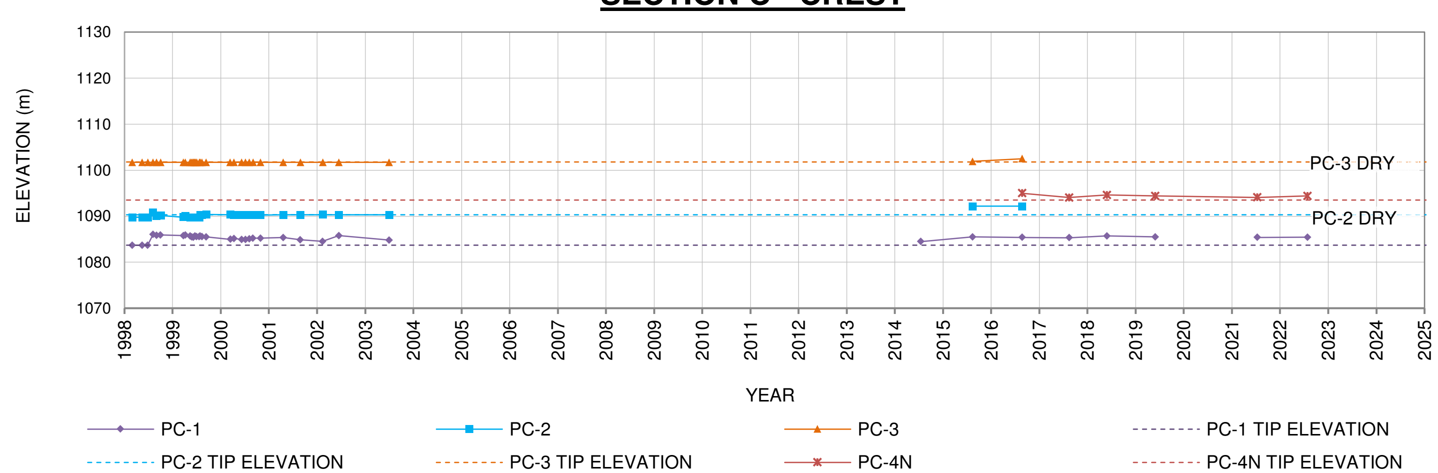


SECTION C - CREST



NOTES:
1. PIEZOMETER AND POND LEVEL READINGS NOT AVAILABLE FROM 2004 TO 2013.

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Teck

Klohn Crippen Berger

PROJECT: BULLMOOSE MINE
2022 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: BULLMOOSE TAILINGS STORAGE FACILITY
HISTORICAL PIEZOMETER READINGS

PROJECT No. M09893A13

FIG. No. 4

Date & Time: 2023-03-14 11:48
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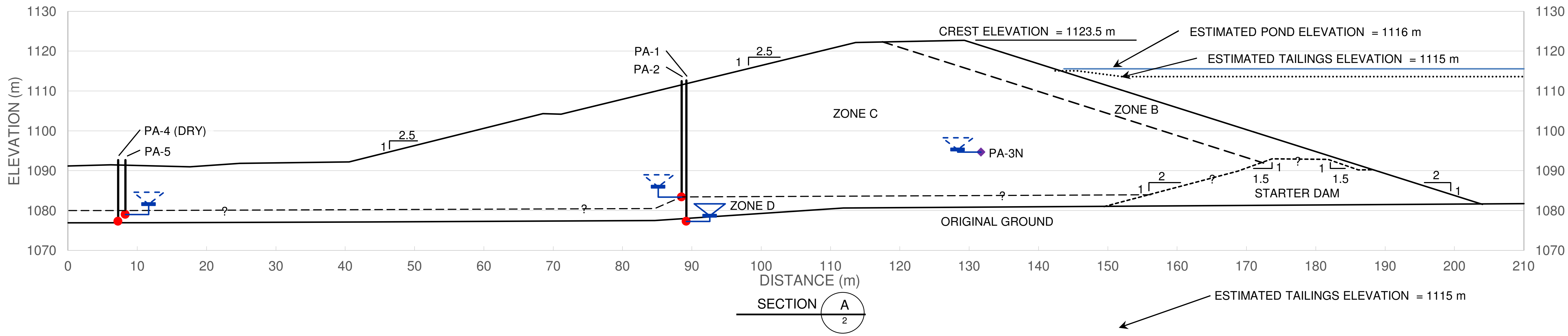

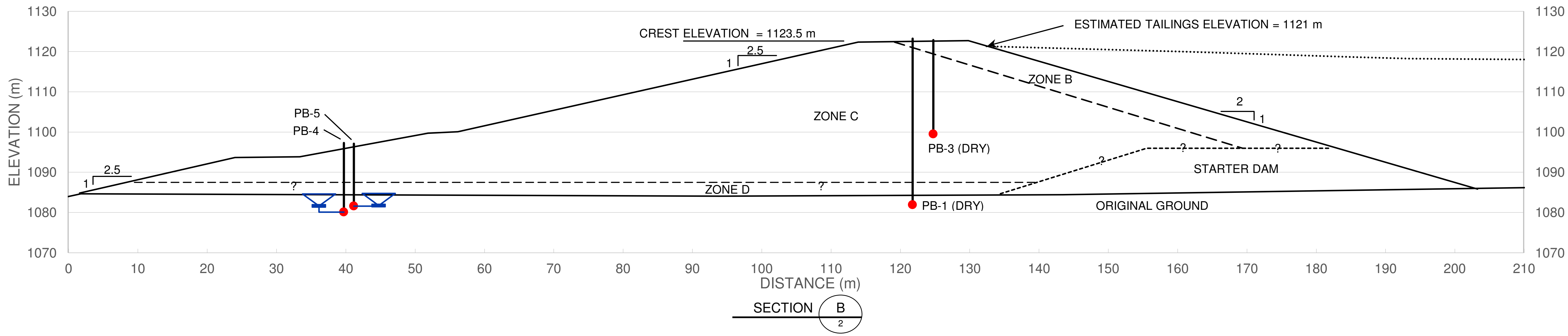

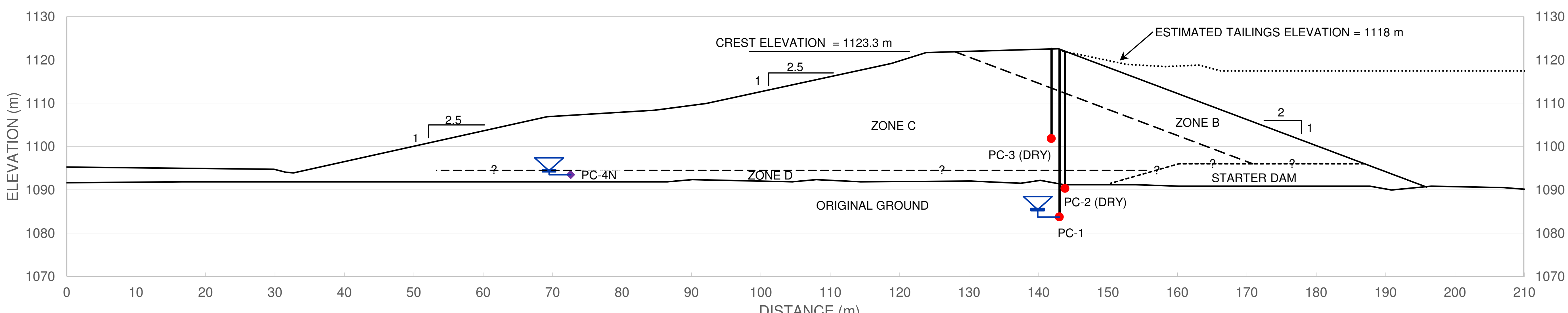

SECTION C 2

NOTES:
1. SECTION DRAWINGS PRODUCED BY TECK (2004)
2. STARTER DAM SECTION OBTAINED FROM KLOHN LEONOFF (1984)
3. ZONE B AS-BUILT PRODUCED BY TECK (2000).
4. KLOHN LEONOFF (KL). 1982. "BULLMOOSE COAL PROJECT TAILINGS DAM DESIGN REPORT", OCTOBER.

LEGEND:
- STANDPIPE PIEZOMETER TIP
- PNEUMATIC PIEZOMETER TIP
- EMBANKMENT PIEZOMETER WATER LEVEL
- FOUNDATION PIEZOMETER WATER LEVEL

Klohn Leonoff 1982 Design Report:

ZONE	MATERIAL	LIFT THICKNESS	COMPACTION* %Standard proctor
A Impervious	Silty sand & gravel (borrow)	0.3m	98 %
B Low permeability	Coarse refuse	0.15m	98 %
C General fill	Coarse refuse	0.5m	98 %
D Drainage	Coarse refuse	1.0m	95 %

* 98 % standard proctor should be achieved with 4 passes with a large vibratory roller and 95 % with about 2 passes

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Teck
Klohn Crippen Berger

PROJECT: BULLMOOSE MINE
2022 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: BULLMOOSE TAILINGS STORAGE FACILITY
INSTRUMENTATION SCHEMATIC
SECTIONS A, B AND C

PROJECT No. M09893A13
FIG. No. 5

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APPENDIX I

Register of Reference Documents

Appendix I
Register of Reference Documents

Document Title	Author	Date of Issue
Bullmoose Coal Project - Phase II - Geotechnical, Hydrogeological and Water Management Study - Report II - Project Description, Geologic Setting and Phase II Field Investigation	Hardy Associates Ltd.	January 8, 1982
Bullmoose Coal Project - Phase II - Geotechnical, Hydrogeological and Water Management Study - Report VI - Tailings Disposal Facility Geotechnical Study	Hardy Associates Ltd.	February 23, 1982
Bullmoose Coal Project - Phase II - Geotechnical, Hydrogeological and Water Management Study - Report X - Construction Materials	Hardy Associates Ltd.	March 30, 1982
Sedimentation Ponds No. 1 and No. 2 Bullmoose Coal Project - Geotechnical Design Report	Klohn Leonoff	June 25, 1982
Bullmoose Coal Project - Tailings Dam Design Report	Klohn Leonoff	October 22, 1982
Bullmoose Coal Project Hydrogeology Study	Klohn Leonoff	November 17, 1982
Bullmoose Coal Project - DESIGN: Sedimentation Pond No. 3	Klohn Leonoff	February 25, 1983
Bullmoose Tailings Disposal 1983 Starter Dam Construction	Klohn Leonoff	March 14, 1984
Annual Review of Tailings Dam - 1984/85	Bullmoose Operating Corporation	August, 1985
Annual Review of Tailings Dam 1986/87	Klohn Leonoff	August 11, 1987
Report on Site Visit July 24, 1987 and Annual Review of Tailings Dam 1986/87	Klohn Leonoff	August 11, 1987
Annual Review of Tailings Dams for 1987/88	Klohn Leonoff	September 9, 1988
Annual Review of Operations - 1987/88	Bullmoose Operating Corporation	August 17, 1988
Annual Review of Tailings Dams for 1988/1989	Klohn Leonoff	August 28, 1989
Annual Review of Operations - 1988/89	Bullmoose Operating Corporation	August, 1989
1989-90 Annual Review of Tailings Dam	Klohn Leonoff	August 30, 1990
Tailings Pond Annual Review of Operations - 1989/90	Bullmoose Operating Corporation	August, 1990
1990-91 Annual Review of Tailings Dam	Klohn Leonoff	August 29, 1991
Annual Review of Operations - 1990/91	Bullmoose Operating Corporation	July, 1991
1991-92 Annual Review of Tailings Dam	Klohn Leonoff	August 26, 1992
Annual Review of Operations 1991/92	Bullmoose Operating Corporation	July, 1992
1992-93 Annual Review of Tailings Dam	Klohn Crippen	August 30, 1993
Annual Review of Operations 1992/93	Bullmoose Operating Corporation	July, 1993
Annual Review of Operations 1993/94	Bullmoose Operating Corporation	July, 1994
May Site Visit: Tailings Dam Recommendations	Klohn Crippen	June, 1995
South Fork Tailings Dam - Seepage and Stability Review	Klohn Crippen	October 11, 1996
1996 Annual Review of Tailings Facility	Klohn Crippen	December 17, 1996
Density Comparison, Tailings Dam Construction - Bullmoose Mine, Tumbler Ridge, BC	Peace Country Materials Testing Ltd.	June 4, 1997
1997 Annual Review of Tailings Facility	Klohn Crippen	December 17, 1997
Annual Review of Operations 1997/98 Tailings Pond	Bullmoose Operating Corporation	December, 1998
1998 Annual Review of Tailings Facility	Klohn Crippen	January 13, 1999
Bullmoose Tailings Facility Establishment of Threshold Warning Levels of Piezometers	Klohn Crippen	October 8, 1999
Summary of Site Visit on September 23, 1999	Klohn Crippen	November 19, 1999
Annual Review of Operations 1998/99 Tailings Pond	Bullmoose Operating Corporation	November, 1999

Document Title	Author	Date of Issue
1999 Annual Review	Klohn Crippen	February 7, 2000
Annual Review of Operations	Bullmoose Operating Corporation	November, 2000
Review of 2000 Tailings Operations Report	Klohn Crippen	December 20, 2000
Annual Review of Operations	Bullmoose Operating Corporation	November, 2001
Tailings Impoundment Closure Spillway Design	Klohn Crippen	December 18, 2001
Review of 2001 Tailings Operations Report	Klohn Crippen	December 18, 2001
Tailings Impoundment Closure Spillway - Review of Proposed Layout	Klohn Crippen	October 15, 2002
Bullmoose Mine Review of 2002 Tailings Operations Report	Klohn Crippen	December 18, 2002
Annual Review of Operations	Bullmoose Operating Corporation	November, 2003
Bullmoose Mine Review of 2003 Tailings Operations Report	Klohn Crippen	December 18, 2003
Bullmoose Tailings Facility Closure Spillway Inspection on September 22, 2004	Klohn Crippen	October 6, 2004
Bullmoose Mine Review of 2004 Tailings Operations Report	Klohn Crippen	December 17, 2004
Tailings Dam Annual Review of Operations	Bullmoose Operating Corporation	December 20, 2004
Bullmoose 2010 Dam Safety Inspection and Consequence Classification	Klohn Crippen Berger	March 1, 2011
Bullmoose Tailings Impoundment 2012 Dam Safety Inspection	Teck	August, 2013
Bullmoose Mine 2013 Dam Safety Inspection	Klohn Crippen Berger	March 25, 2014
Bullmoose Mine Tailings Dam Design Review	Klohn Crippen Berger	August 15, 2014
Bullmoose Mine Tailings Storage Dam 2014 Dam Safety Inspection Revision 1	Klohn Crippen Berger	November 26, 2014
Bullmoose Mine Tailings Storage Facility - Dam Breach and Inundation Study	Klohn Crippen Berger	November 27, 2014
Bullmoose Mine Tailings Storage Facility - Response to February 3, 2015 MEM Memorandum	Klohn Crippen Berger	June 29, 2015
Bullmoose Mine 2015 Consulting - Tailings Storage Facility Hydrotechnical Review	Klohn Crippen Berger	December 22, 2015
Bullmoose Mine Tailings Storage Dam – 2015 Dam Safety Inspection	Klohn Crippen Berger	March 22, 2016
Bullmoose Tailings Storage Facility Engineer of Record	Klohn Crippen Berger	September 23, 2016
Bullmoose Mine Tailings Dam - Water Management, Water Balance and Quantifiable Performance Objectives	Klohn Crippen Berger	December 22, 2016
Bullmoose Mine Tailings Storage Dam – 2016 Dam Safety Inspection	Klohn Crippen Berger	March 1, 2017
Bullmoose Tailings Dam - Review of Monument Survey Data - May, 2017	Klohn Crippen Berger	June 9, 2017
Survey Monuments Quantifiable Performance Objectives	Klohn Crippen Berger	August 25, 2017
Review of Seismic Hazard Assessment	Klohn Crippen Berger	October 13, 2017
Bullmoose Mine Tailings Storage Dam – 2017 Dam Safety Inspection - Revision 1	Klohn Crippen Berger	March 16, 2018
Bullmoose Creek Flood Study	Klohn Crippen Berger	June 22, 2018
Bullmoose Tailings Dam - Internal Stability Assessment	Klohn Crippen Berger	December 3, 2018
Bullmoose Mine Bullmoose Tailings Dam 2018 Dam Safety Inspection	Thurber Engineering Ltd.	March 26, 2019
Hillside Terrain Stability Assessment	Klohn Crippen Berger	August 30, 2019
Bullmoose Mine Bullmoose Tailings Dam 2019 Dam Safety Inspection	Klohn Crippen Berger	April 24, 2020
Bullmoose Coal Mine Tailings Storage Facilities	Klohn Crippen Berger	July 17, 2020
Bullmoose Mine Bullmoose Tailings Dam 2020 Annual Summary of Tailings Facility Performance	Klohn Crippen Berger	March 26, 2021
Bullmoose Mine Bullmoose Tailings Storage Facility 2021 Annual Facility Performance Review	Klohn Crippen Berger	March 22, 2022
Bullmoose Tailings Facility 2020 Dam Safety Review	Thurber Engineering Ltd.	June 28, 2022

APPENDIX II

Site Visit Photographs

Appendix II
Site Visit Photographs

LEGEND:

- BTSF = Bullmoose Tailings Storage Facility
- BTSF-2022-## refers to the 2022 site visit photograph location, as shown in Figure 2

Photographs were taken during site visit on July 28, 2022.

Photo II-1 BTSF crest looking north (BTSF-2022-01)

Photo II-2 BTSF crest looking west (BTSF-2022-02)

Photo II-3 BTSF crest looking east (BTSF-2022-02)

Photo II-4 BTSF pond looking southeast (BTSF-2022-03)

Photo II-5 BTSF crest looking northwest (BTSF-2022-04)

Photo II-6 BTSF crest looking southeast (BTSF-2022-04)

Photo II-7 BTSF pond looking northwest (BTSF-2022-05)

Photo II-8 BTSF impoundment looking west (BTSF-2022-05)

Photo II-9 BTSF impoundment and historic slope failure looking southwest (BTSF-2022-05)

Photo II-10 Freeboard monitoring stake was dry at the time of the site visit (BTSF-2022-06)

Photo II-11 BTSF downstream slope looking southwest (BTSF-2022-07)

Photo II-12 BTSF downstream slope looking north (BTSF-2022-07)

Photo II-13 Erosion gully near the toe of BTSF. No visible change from previous site visits. (BTSF-2022-08)

Photo II-14 BTSF downstream slope looking southeast (BTSF-2022-09)

Photo II-15 BTSF downstream slope looking west (BTSF-2022-09)

Photo II-16 BTSF downstream slope looking east (BTSF-2022-10)

Photo II-17 BTSF downstream slope looking west (BTSF-2022-10)

Photo II-18 Known wet area near the toe of BTSF, dry at the time of visit (BTSF-2022-11)

Photo II-19 BTSF downstream slope looking northeast (BTSF-2022-12)

Photo II-20 BTSF downstream slope looking south (BTSF-2022-12)

Photo II-21 BTSF downstream slope looking north (BTSF-2022-13)

Photo II-22 BTSF downstream slope looking south (BTSF-2022-13)

Photo II-23 BTSF spillway looking downstream from end of spillway channel (BTSF-2022-14)

Photo II-24 BTSF spillway looking upstream at invert (BTSF-2022-15)

Photo II-25 BTSF spillway looking downstream from inlet to spillway (BTSF-2022-15)

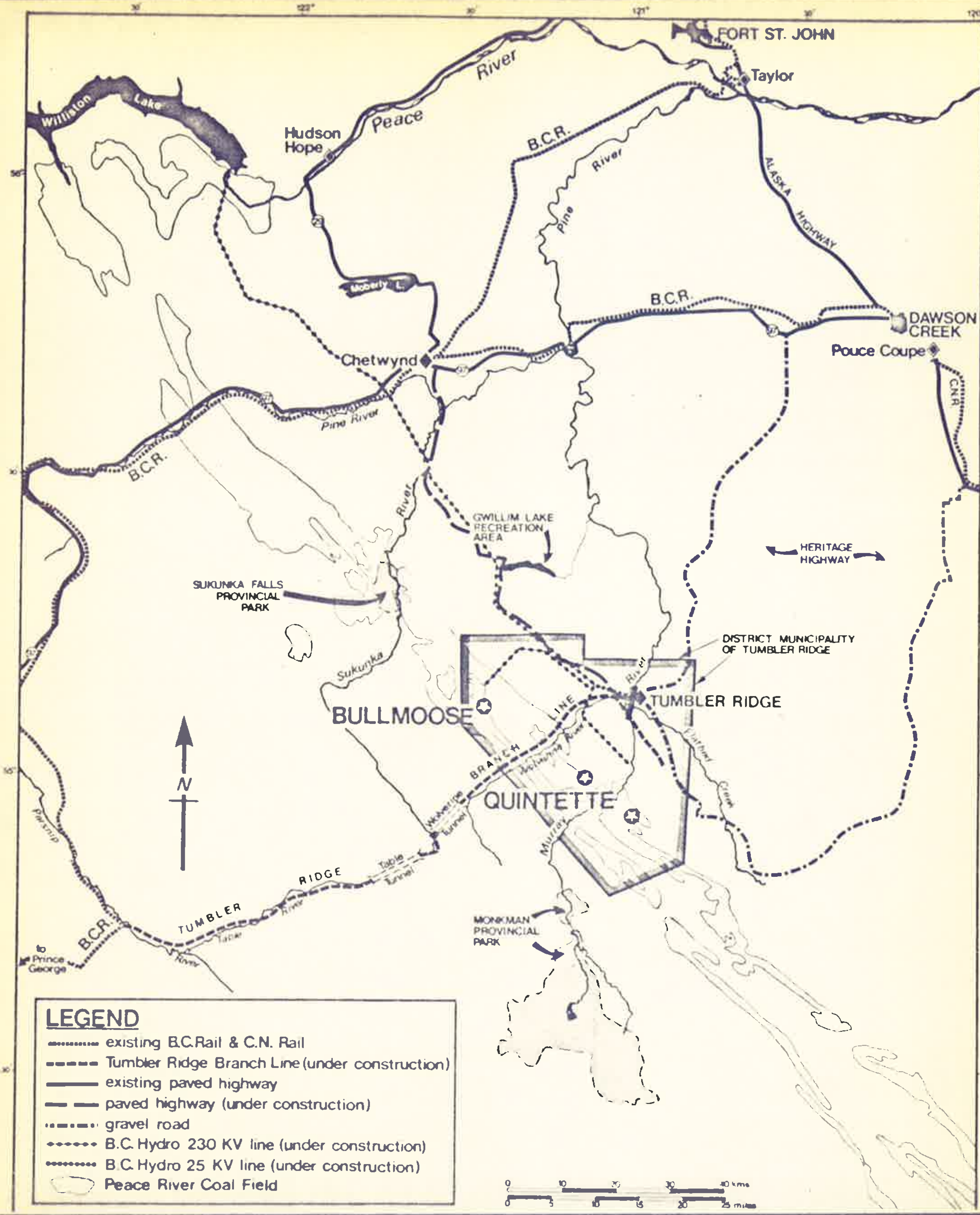
Photo II-26 BTSF spillway riprap (BTSF-2022-15)

Photo II-27 BTSF crest looking southeast towards spillway (BTSF-2022-16)

Photo II-28 BTSF crest looking northwest (BTSF-2022-16)

APPENDIX III

Dam Design Drawings



KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

PROJECT: BULLMOOSE COAL PROJECT

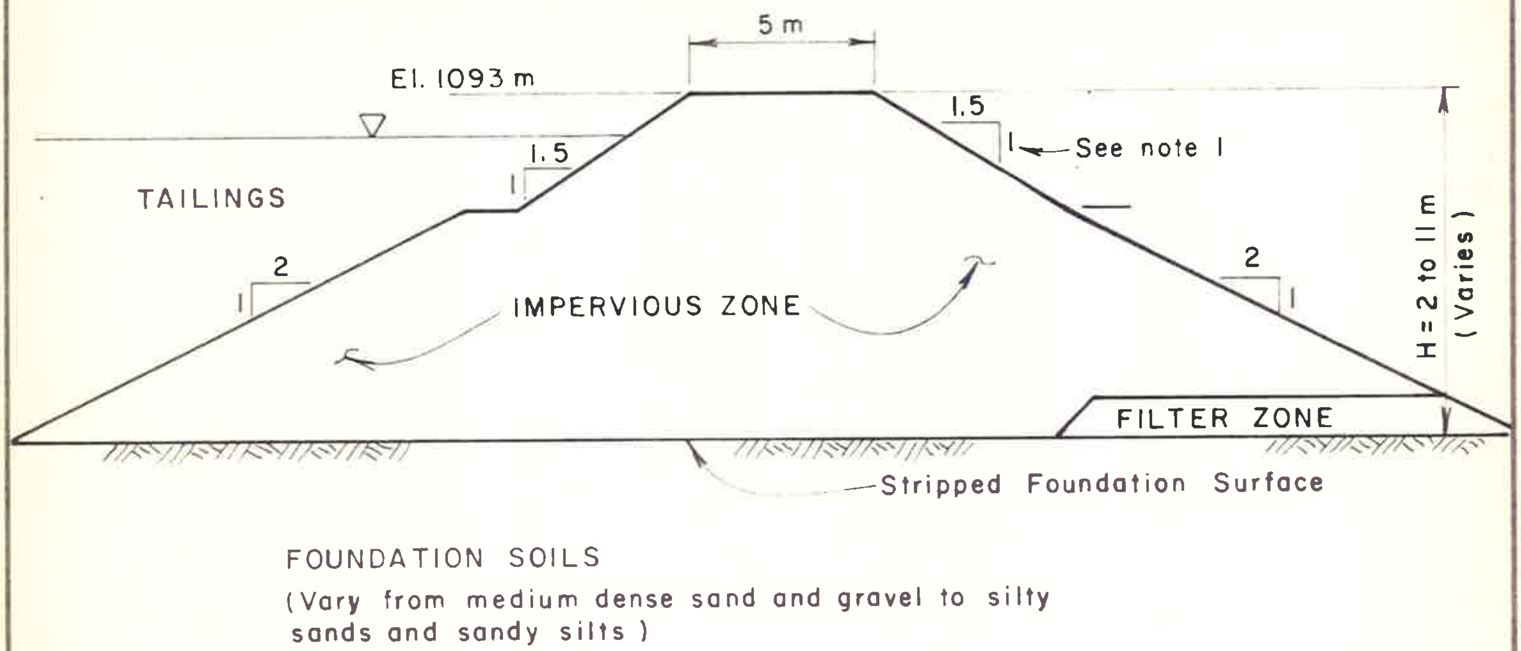
TITLE: LOCATION PLAN

CLIENT: BULLMOOSE OPERATING CORPORATION

DATE	PROJECT No	DWG No	REV
OCT. 22, 1982	PB2971-02	A-101	

APPROVED: H. N. McLEOD

PROFESSIONAL ENGINEER · BRITISH COLUMBIA



NOTES

1. Dam slope revised to 1.5 : 1 , H : V over maximum top 5.0 metres of dam in October, 1984.

2. Impervious zone consists of silty sand and gravel compacted to 98 % of the Standard Proctor Density.

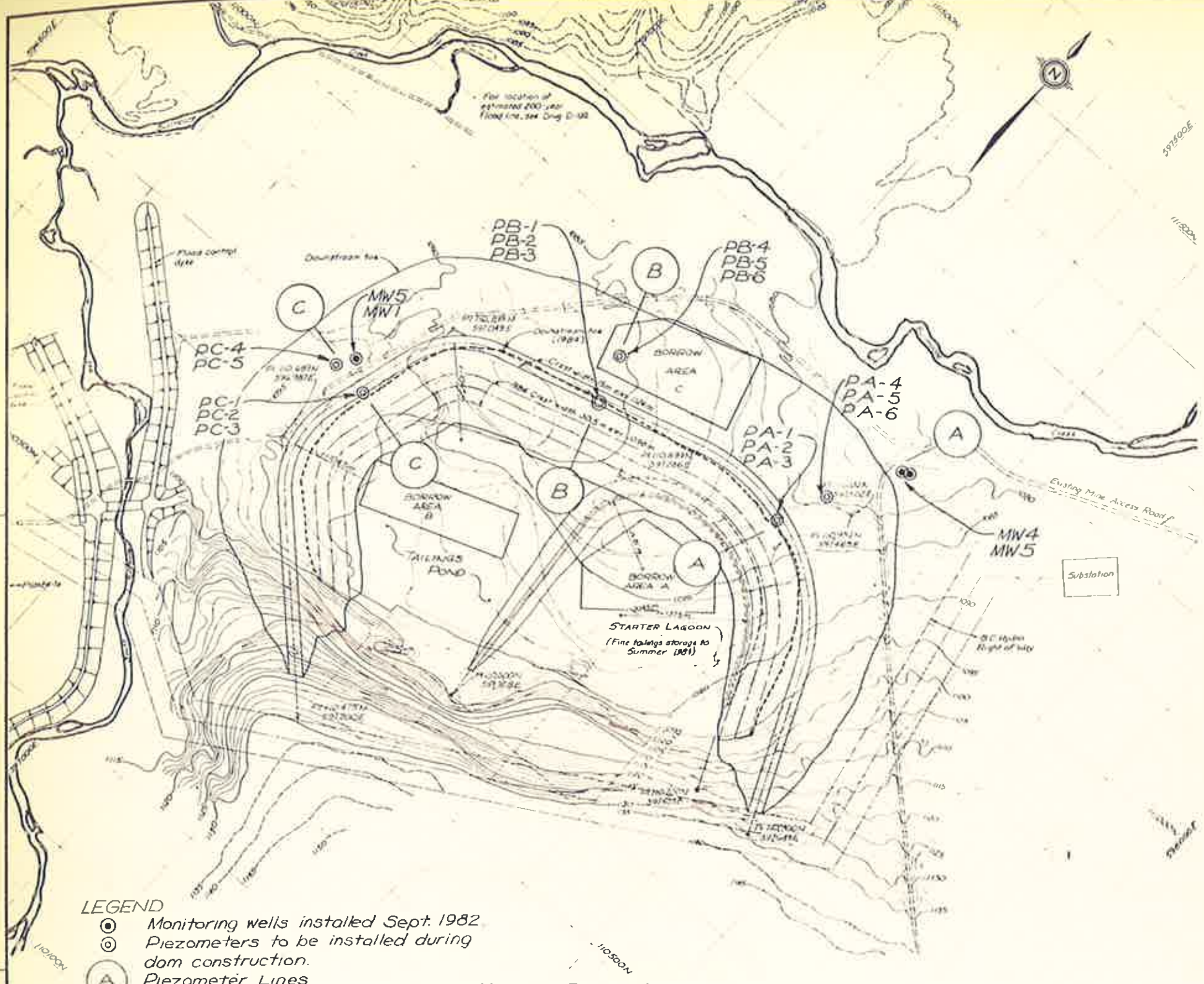
3. Filter zone consists of blasted mudstone and sandstone, moderately well graded; 15 percent greater than 150 mm.

SCALE 1:200

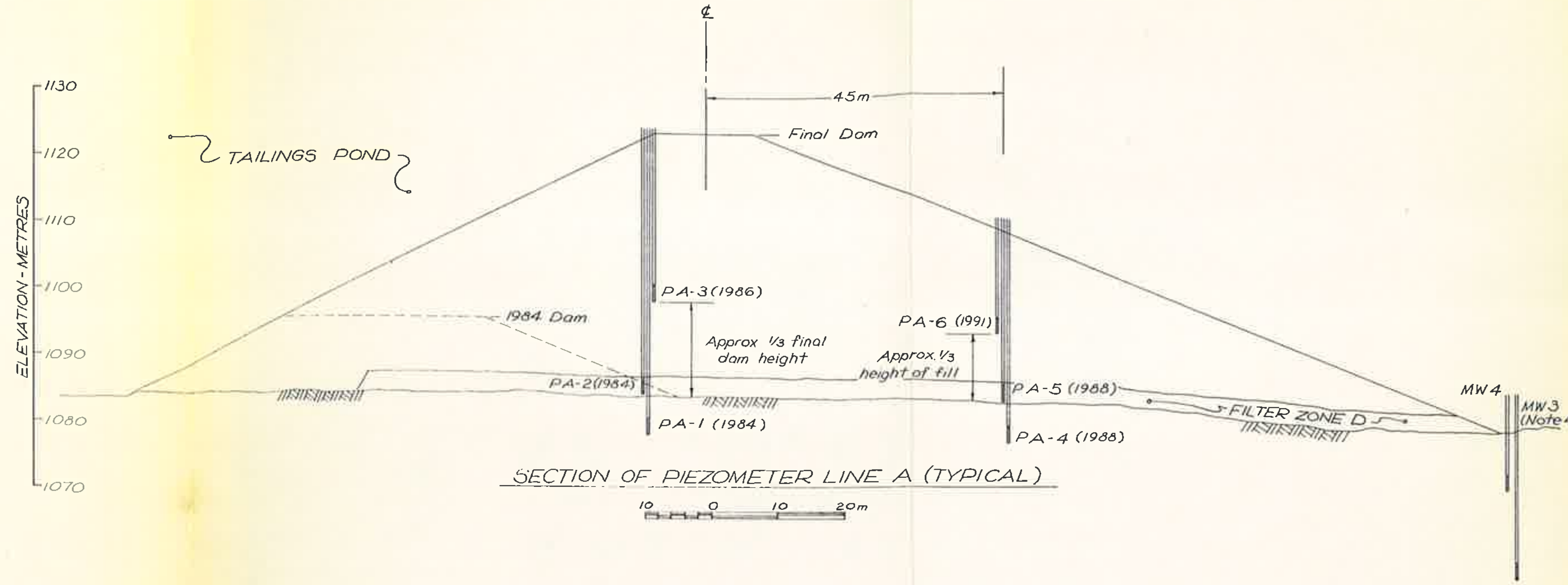
KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

PROJECT	BULLMOOSE COAL PROJECT
TITLE	TAILINGS STARTER DAM TYPICAL AS-BUILT SECTION

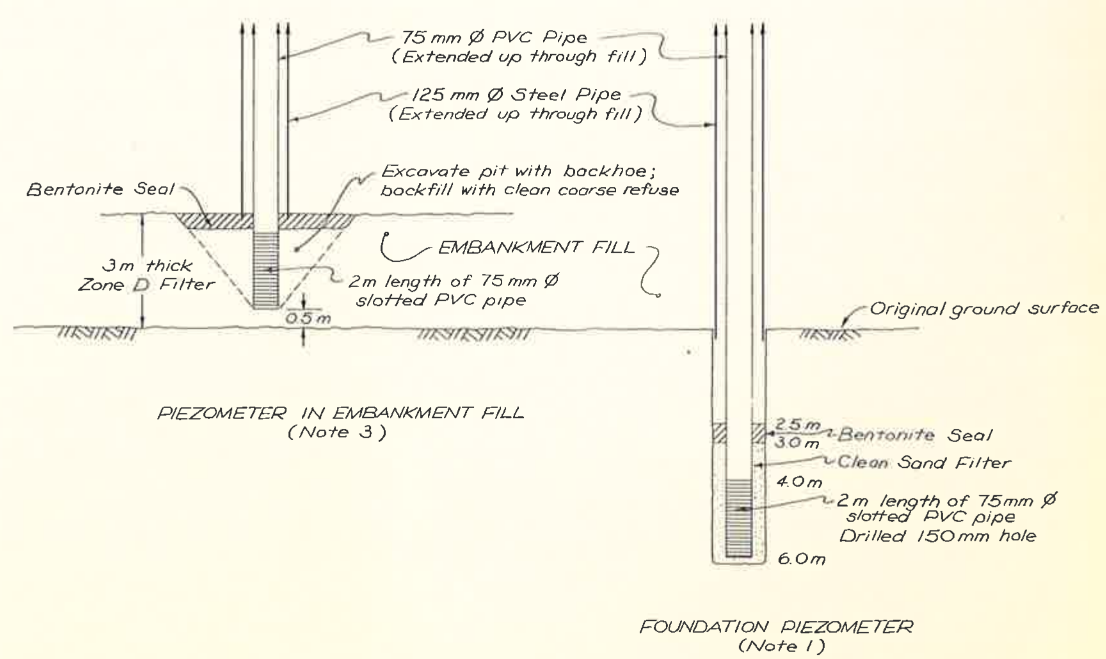
CLIENT:	DATE OF ISSUE	PROJECT No	DWG No	REV
BULLMOOSE OPERATING CORPORATION	MARCH 15, 1984	PB2971-02	A-117	
	APPROVED			



LOCATION PLAN



SECTION OF PIEZOMETER LINE A (TYPICAL)



TYPICAL PIEZOMETER INSTALLATION DETAILS

N.T.S.

NOTES:

1. Standpipe piezometers will be installed during construction of the dam and will be extended up through the embankment fill. PA-1, PA-2 and PB-1, PB-2 and PC-1, PC-2 to be installed in 1984. Additional piezometers to be installed as shown during later construction.
2. Foundation piezometers to be installed with a drilling rig.
3. Piezometers in embankment fill to be installed with a backhoe.
4. Monitoring wells installed by Klohn Leonoff Ltd. in Sept. 1982.

TO BE READ WITH KLOHN LEONOFF REPORT DATED OCT. 22, 1982

SCALE: AS SHOWN

KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

CLIENT: BULLMOOSE OPERATING CORPORATION

REV.	DATE	REVISION DETAILS

DESIGN	DRAWN	DATE	SCALES
H.M.	D.T.	OCT. 1982	AS SHOWN

PROJECT: BULLMOOSE COAL PROJECT

TITLE: PLAN, SECTION & DETAILS OF TAILINGS DAM PIEZOMETERS

DATE OF ISSUE	PROJECT No.	DWG. No.	REV.
OCT. 22, 1982	PB2971-02	D-112	

PROFESSIONAL ENGINEER — P. C. LIGHTHALL — PROVINCE OF BRITISH COLUMBIA

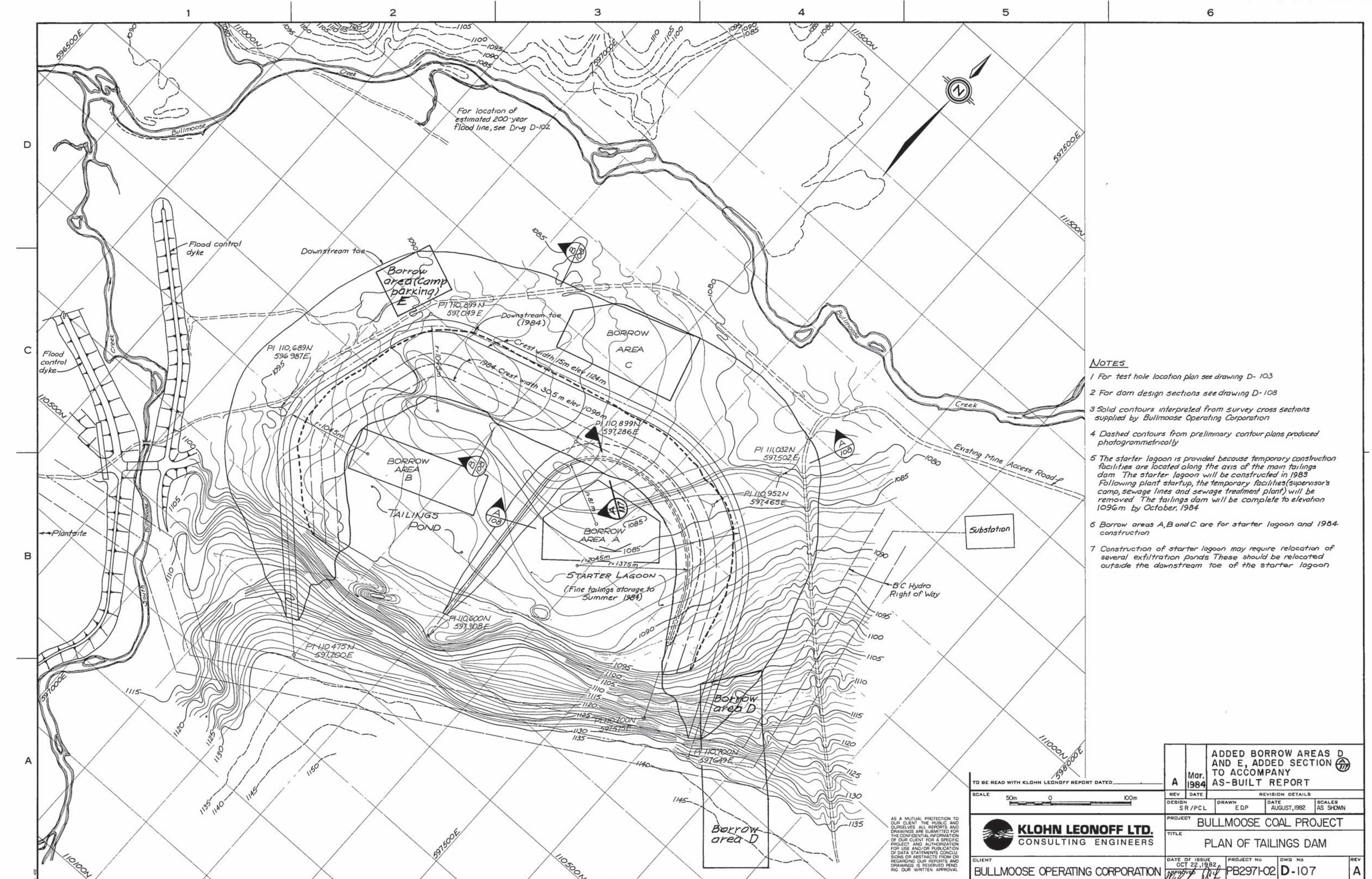
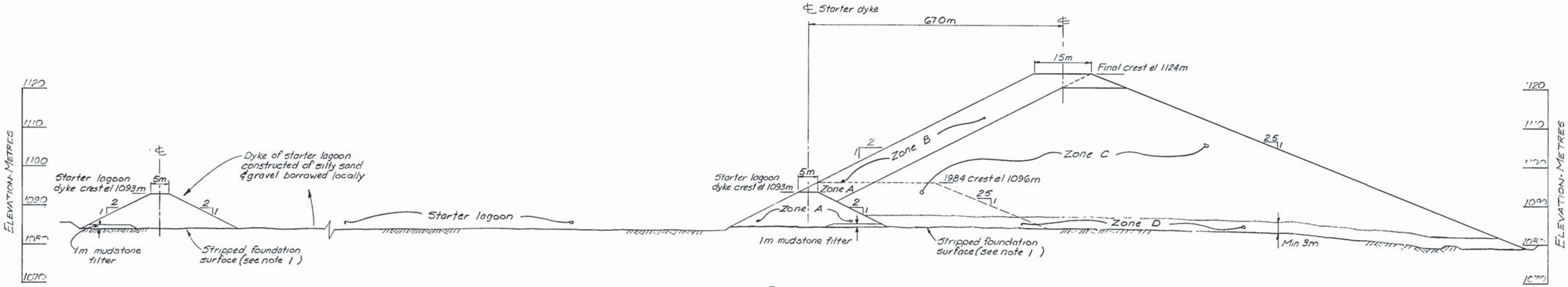
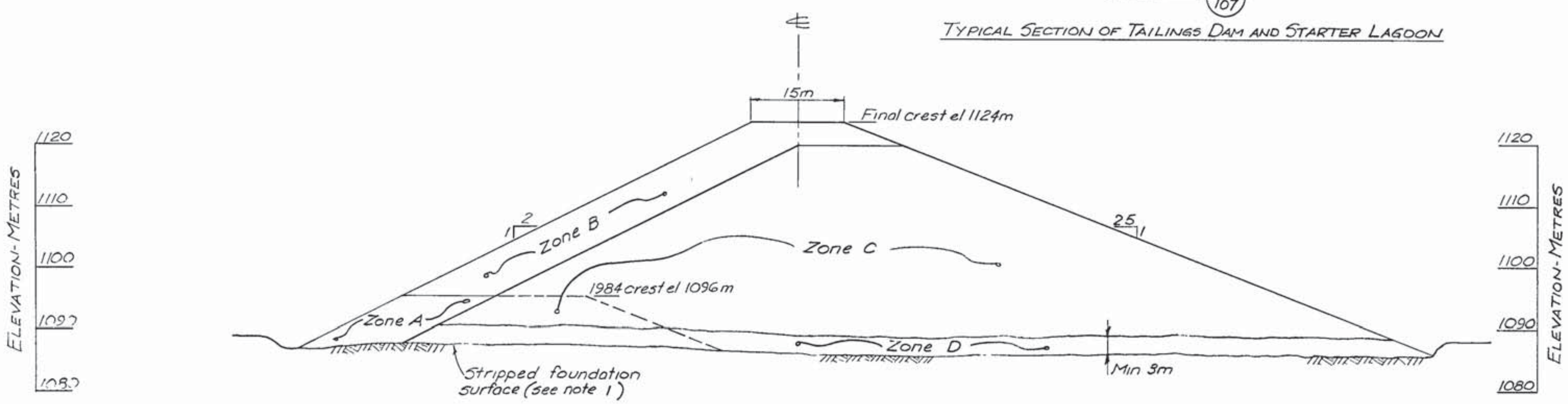


Figure 6 Bullmoose Tailings Dam - Plan View



SECTION A/107

TYPICAL SECTION OF TAILINGS DAM AND STARTER LAGOON



SECTION B/107

TYPICAL SECTION OF TAILINGS DAM

ZONE	MATERIAL	LIFT THICKNESS	COMPACTION* % Standard proctor
A Impervious	Silty sand & gravel (borrow)	0.3m	98 %
B Low permeability	Coarse refuse	0 15m	98 %
C General fill	Coarse refuse	0 5m	98 %
D Drainage	Coarse refuse	1 0m	95 %

* 98 % standard proctor should be achieved with 4 passes with a large vibratory roller and 95 % with about 2 passes

CONSTRUCTION NOTES

1 FOUNDATION PREPARATION

All vegetation, organics and soft material shall be removed from the dam foundation area to expose silty sand and gravel soils Loose materials include areas where waste from the plantsite and construction camp excavation were placed during the 1982 site development The foundation surface should be heavily compacted prior to fill placement

2 CONSTRUCTION MATERIALS, PLACEMENT COMPACTION

GENERAL

Fill placement should be carried out during warmer parts of the year so that no frozen materials or lenses of ice or snow are incorporated in the fill

Where a vibratory roller is specified for compaction in following sections, the compactor should have a minimum static weight of 8 tonnes

ZONE A

Zone A material will be used for the starter dyke and for the upstream zone of the tailings dam for 1984 construction The material should consist of silty sand and gravel borrowed from the alluvial deposits within the tailings dam reservoir Zone A is intended to be a zone of low permeability and should have a minimum of 15 percent by weight passing the 0 075 mm sieve size

Zone A material should be placed in maximum loose lift thicknesses of 0 3 m and compacted to a minimum density equivalent to 98 percent of the maximum Standard Proctor density (ASTM D-698 Method D) This density should be achieved by compacting with at least four passes of a vibratory roller, provided the water content of the fill material is near optimum

ZONE B

Zone B is a 15 m wide zone of coarse refuse on the upstream side of the tailings dam which will be heavily compacted to provide a zone of low permeability The coarse refuse should be placed in maximum loose lift thicknesses of 0 15 m and compacted with at least 4 complete passes of a vibratory roller

ZONE C

Zone C is the general fill portion of the dam, constructed of compacted coarse refuse The coarser refuse should be placed in maximum loose lift thicknesses of 0 5 m and compacted with a minimum of 4 complete passes of a vibratory roller The fill surface should be scarified between lifts

ZONE D

Zone D is a drainage zone, constructed of loosely compacted, select coarse refuse

The coarse refuse used in Zone D should be selected to have the minimum amount of fines There should be a maximum of 5 percent, by weight, passing the 0 075 mm sieve size Coarse refuse should be placed in lifts 1 m thick Compaction should consist of 2 complete passes of a vibratory roller The fill surface should be scarified between lifts

3 QUALITY CONTROL AND TESTING

COMPACTION CONTROL

Standard Proctor compaction tests conforming to ASTM D-698 Method D should be carried out a minimum of once per week during construction or at any time when the material quality changes Compaction control should consist of frequent inspection of placement and compaction procedures, augmented by field density tests One field density test for every 1500 m^3 of fill placed should be performed Zones A, B and C should be compacted to 98% Standard Proctor density and the filter Zone D to 95% Standard Proctor

GRAIN SIZE ANALYSES

For Zone A, grain size analyses of the fill material should be performed at a minimum frequency of twice weekly For the coarse refuse, grain size analyses should be performed weekly on samples from the stockpile and the fill after compaction

4 TAILINGS DISCHARGE

Tailings may be deposited to the pond by a single point discharge, with the discharge point located at intervals along the dam crest Discharge should be adjusted so as to form a beach adjacent to the dam and to maintain the ponded water at the back of the pond adjacent to the hillside During freezing weather, tailings should be discharged near or beneath the surface of the water pond so as to minimize ice formation on the beaches.

TO BE READ WITH KLOHN LEONOFF REPORT DATED OCT 22, 1982

SCALE 10m 0 30m

KLOHN LEONOFF LTD. CONSULTING ENGINEERS

CLIENT BULLMOOSE OPERATING CORPORATION

REV	DATE	REVISION DETAILS	
DESIGN SR/PCL	DRAWN EDP	DATE SEPT, 1982	SCALES AS SHOWN

PROJECT BULLMOOSE COAL PROJECT

TITLE TYPICAL SECTIONS OF TAILINGS DAM

DATE OF ISSUE	PROJECT No	DWG No	REV
OCT 22, 1982	PB2971-02	D-108	

APPROVED

Figure 7 Bullmoose Tailings Dam - Typical Sections

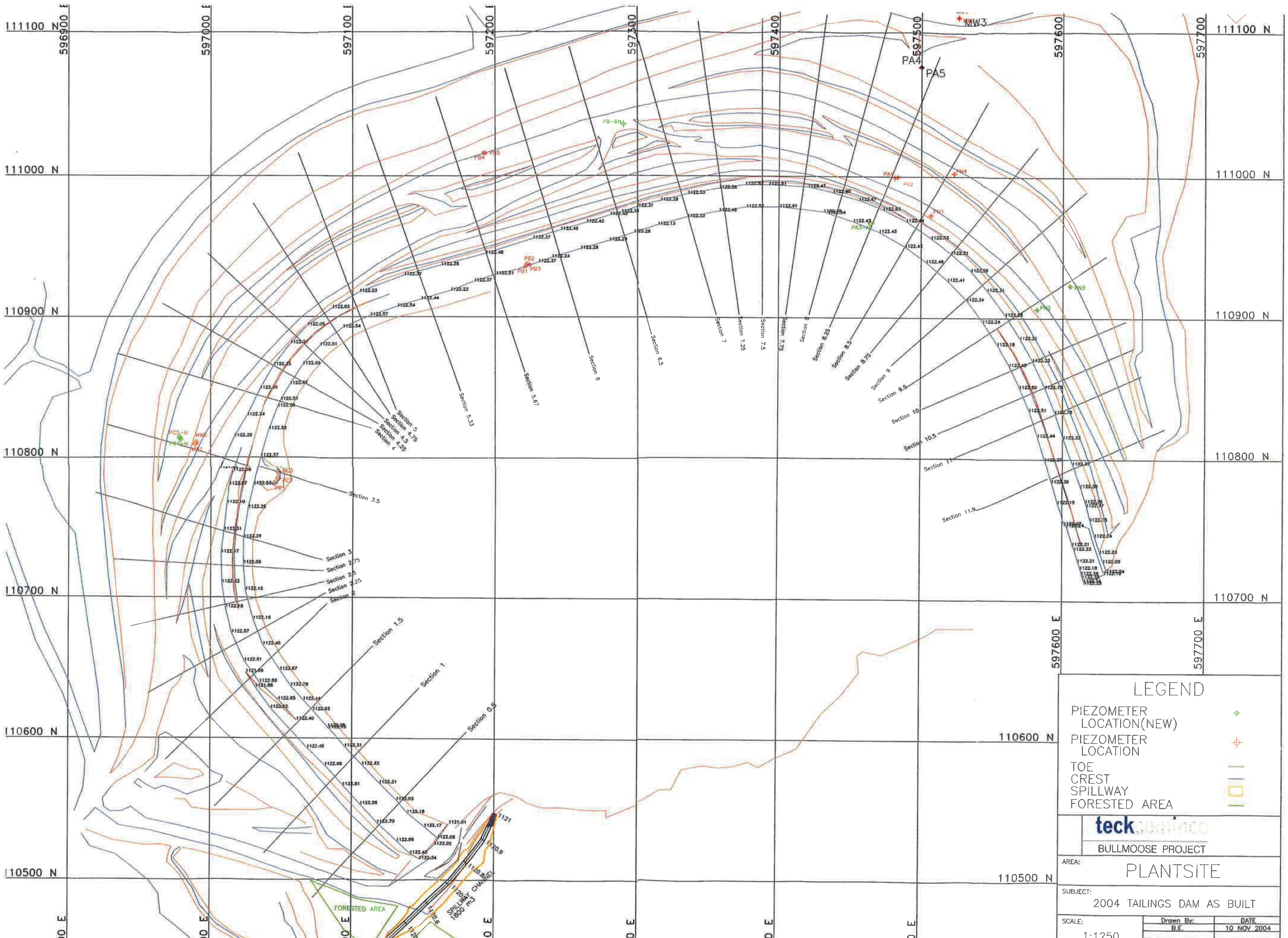
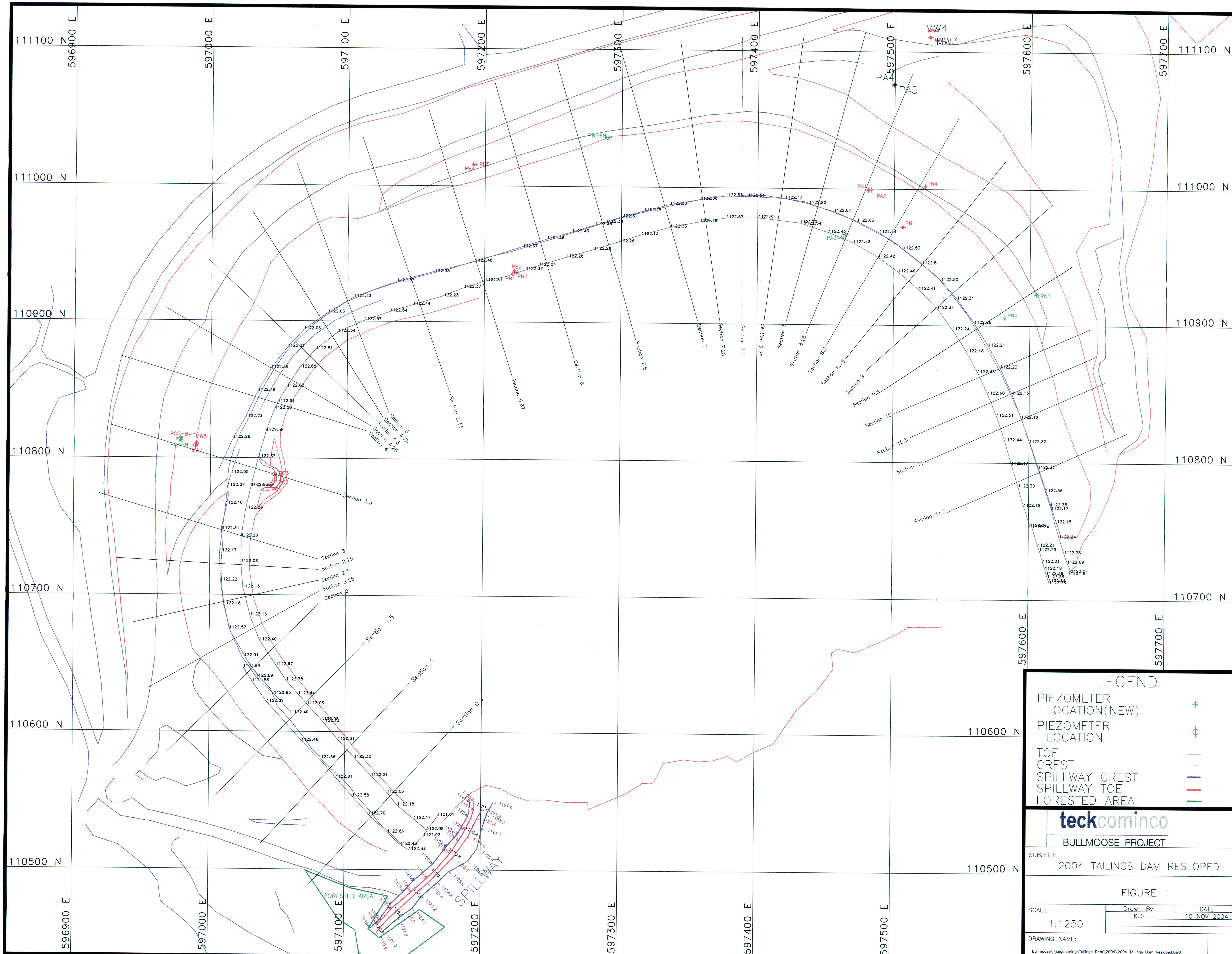
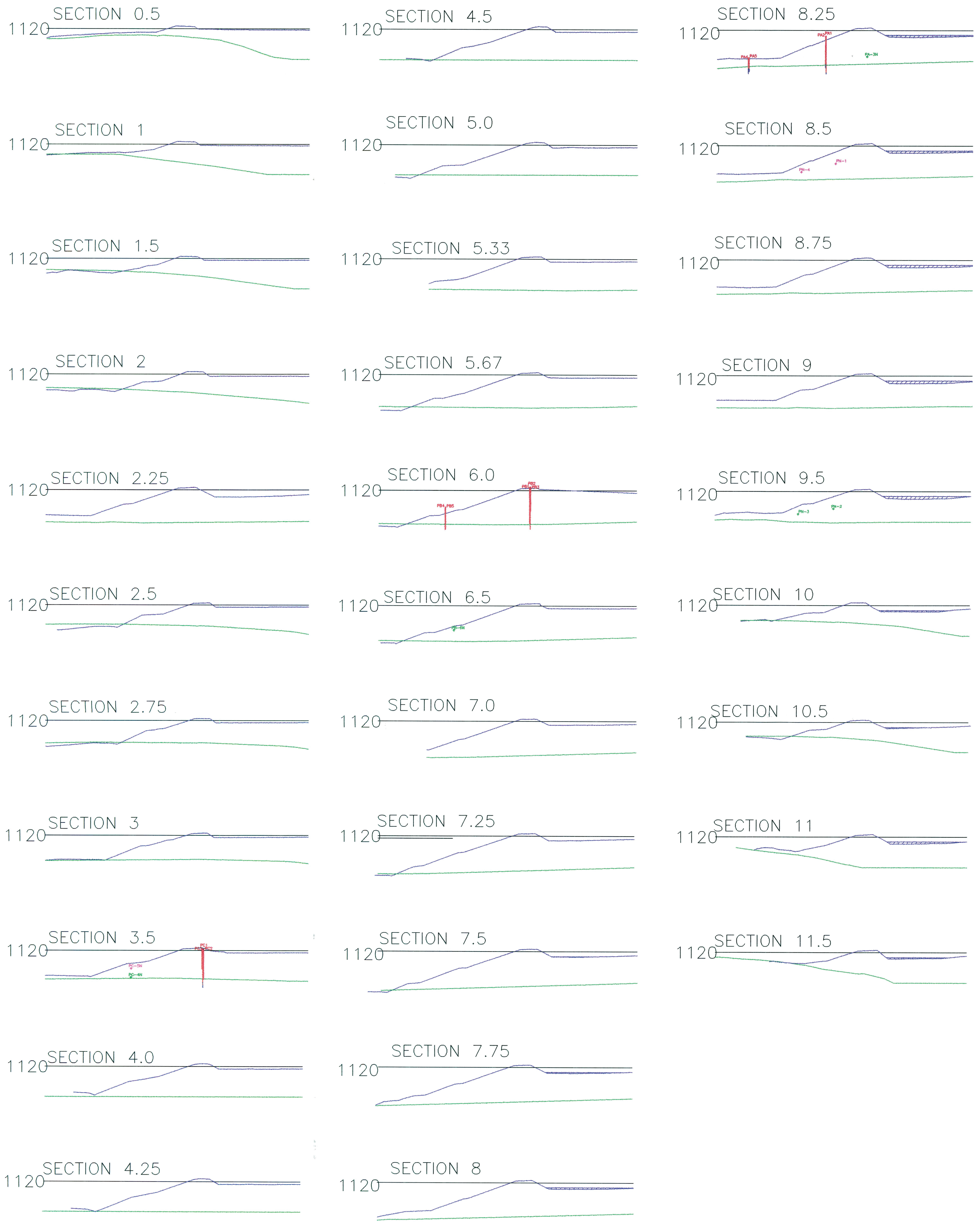


Figure 8 Bullmoose Tailings Dam and Instrumentation - As-Built Plan



LEGEND
PIEZOMETER LOCATION(NEW)
PIEZOMETER LOCATION
TOE
CREST
SPILLWAY CREST
SPILLWAY TOE
FORESTED AREA
teckcominco
BULLMOOSE PROJECT
SUBJECT:
2004 TAILINGS DAM RESLOPED
FIGURE 1
SCALE:
1:1250
Drawn By:
KJS
DATE
10 NOV 2004
DRAWING NAME:
Bullmoose\\Engineering\Tailings Dam\2004\2004 Tailings Dam Resloped.DWG
SPILLWAY
FORESTED AREA



LEGEND

Final Crest EOS 2003

Original Ground

PN−1 New Piezometer

PB−6N Piezometer Location

PB3 Standpipe

Water Elev. Sep. 2004
Elev. 1115.2 m

0 125 m
1:2,500

teckcominco

BULLMOOSE PROJECT

SECTIONS OF TAILINGS DAM

DATE: NOVEMBER 10, 2004

Bullmoose:\\Engineering\TailingsDam\2004\Sections 2004.DWG

APPENDIX IV

Climate

Appendix IV
Climate

There is currently no active climate station at the Bullmoose site. The nearest active climate station is the Environment Canada climate station at Chetwynd Airport (No. 1181508) which is located approximately 62 km north of the site at El. 610 m. There was a climate station on site during operations called the Bullmoose Climate Station (No. 1181120 at El. 1,102 m), which operated from 1982 to 2003.

To estimate the annual precipitation at site, KCB developed monthly correlation factors for precipitation between the Chetwynd Airport Climate Station and Bullmoose Climate Station by comparing data from the period of overlapping records. The correlation factors are summarized in Table IV-1.

KCB also estimated the difference in temperature between the two stations by comparing the daily average, maximum, and minimum temperatures. The temperature comparison is also summarized in Table IV-1.

Table IV-1 Chetwynd Airport/Bullmoose Precipitation and Temperature Correlation Factors

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly Precipitation Correlation Factors												
Bullmoose Climate Station / Chetwynd Airport Climate Station(1)	3.3	3.6	2.9	1.7	1.3	1.3	1.2	1.5	1.9	3.3	3.3	3.1
Daily Average Temperature (°C)												
Chetwynd Airport Climate Station (1981-2010)	-10.2	-7.2	-2.9	4.6	9.5	13.4	15.4	14.5	9.9	4.1	-5.5	-9.1
Bullmoose Climate Station (1981-2003)	-8.0	-6.6	-4.2	1.7	6.9	11.0	13.3	12.8	8.2	2.5	-4.7	-7.4
Temperature Difference (Bullmoose – Chetwynd)	2.2	0.6	-1.3	-2.9	-2.6	-2.4	-2.1	-1.7	-1.7	-1.6	0.8	1.7
Daily Maximum Temperature (°C)												
Chetwynd Airport Climate Station (1981-2010)	-5.0	-1.4	2.9	11.2	16.6	20.1	22.2	21.6	16.3	9.4	-1.1	-4.1
Bullmoose Climate Station (1981-2003)	-3.4	-2.0	0.3	6.7	12.4	16.3	18.9	18.3	12.9	6.3	-1.0	-3.1
Temperature Difference (Bullmoose – Chetwynd)	1.6	-0.6	-2.6	-4.5	-4.2	-3.8	-3.3	-3.3	-3.4	-3.1	0.1	1.0
Daily Minimum Temperature (°C)												
Chetwynd Airport Climate Station (1981-2010)	-15.3	-12.9	-8.7	-2.1	2.4	6.6	8.5	7.4	3.5	-1.3	-10.0	-14.1
Bullmoose Climate Station (1981-2003)	-12.6	-11.2	-8.7	-3.4	1.5	5.6	7.8	7.2	3.4	-1.2	-8.5	-11.6
Temperature Difference (Bullmoose – Chetwynd)	2.7	1.7	0.0	-1.3	-0.9	-1.0	-0.7	-0.2	-0.1	0.1	1.5	2.5

Notes:
1. Excludes outliers and months with incomplete or missing data.