Klohn Crippen Berger

Teck Coal Limited

Quintette Coal Operations

2018 Dam Safety Inspection

Plantsite Tailings Dam

CANADA'S BEST MANAGED COMPANIES Platinum member

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M09684A15.730

March 2019

March 25, 2019

Teck Coal Ltd.
P.O. Box 1500
23097 Murray Forest Service Road
Tumbler Ridge, British Columbia
V0C 2W0

Mr. Rob Muise
Site Lead, Care and Maintenance

Dear Mr. Muise:

Quintette Coal Operations
Plantsite Tailings Dam
2018 Dam Safety Inspection

We are pleased to submit the 2018 Dam Safety Inspection Report for the Plantsite Tailings Dam.

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

Yours truly,

KLOHN CRIPPEN BERGER LTD.

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

MC/NG:jc

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Teck Coal Limited

Quintette Coal Operations

2018 Dam Safety Inspection

Plantsite Tailings Dam

EXECUTIVE SUMMARY

Klohn Crippen Berger Ltd. (KCB) were engaged by Teck Coal Ltd. (Teck) to complete a Dam Safety Inspection (DSI) for the Plantsite Tailings Dam (PTD) at the Quintette Coal Operations (QCO) mine site. This DSI is intended to comply with both Section 10.5.3 of the Health, Safety and Reclamation Code (HSRC) for Mines in British Columbia (also referred to as the Code) (MEMPR 2017) and Teck's internal governance requirements. This report was prepared following:

- Ministry of Energy, Mines and Petroleum Resources (MEMPR), British Columbia (BC) Section 4.2 "Annual Tailings Facility and Dam Safety Inspection Report" of the 2016 HSRC Guidance Document;
- Teck's 2014 Guideline for Tailings and Water Retaining Structures (TWRS); and
- MEMPR Guidelines for Annual Dam Safety Inspection Report.

The 2018 inspection was completed by the Engineer of Record (EoR), KCB representative Mr. Bob Chambers, P.Eng., on May 29, 2018. Mr. Chambers has been the EoR since September, 2016. KCB have been involved as EoR since March, 2016, with KCB representative Mr. Rick Friedel, P.Eng., serving as EoR from March, 2016 to September, 2016. Golder, who designed the facility, were the EoR, prior to KCB involvement. Teck have designated Mr. Andrew Bidwell, P.Eng., as the Tailings Storage Facility (TSF) Qualified Person (QP), as defined by the Code, for the PTD.

The summary is provided solely for the purposes of overview. Any party who relies on this report must read the full report. The summary omits a number of details and context which are crucial to the proper application and interpretation of this report.

Summary of Facility Description

The QCO site is currently under care and maintenance status where Teck staff are onsite for environmental sampling, inspections and maintenance. The PTD is considered to be in the "Closure-Active Care" phase as defined by the Canadian Dam Association (CDA) Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams (CDA 2014). Key descriptions of the PTD are as follow:

- The PTD is approximately 2 km north of the QCO processing plant and approximately 16 km south of the Municipality of Tumbler Ridge in northeastern BC.
- The PTD is constructed of a compacted coarse coal rejects (CCR) downstream shell with an upstream low permeability zone of compacted glacial till. The glacial till and the CCR zones are separated by a chimney drain.
- The PTD is horseshoe shaped, approximately 2.6 km in length along the crest, and has a maximum downstream slope height (crest to toe) of 52 m and an average downstream slope of 2H:1V. The crest is typically 5 m wide and was constructed to El. 884 masl.
- The PTD impoundment is formed by the PTD and natural slope. Fine coal tailings were stored in the impoundment from the start of operations in 1984 to early 1997 (Golder 2003). The impoundment has been inactive with no construction since 1997 except for the closure spillway which was built between 2001 and 2002.

- The PTD closure spillway channel is approximately 630 m long with a base width ranging from 16 m to 27 m and includes a meandering low flow channel 2 m to 5 m wide. The spillway invert starts at the tailings surface and slopes down to original ground before discharging into M17 Creek which reports to the Murray River downstream.
- Seepage through the dam is collected in a perimeter ditch, where it flows into the Seepage Collection Pond before being discharged to the environment.

Summary of Key Hazards

Foundation Failure: Glaciolacustrine deposits (clayey silt and silty clay) are present in the southwest corner of the facility. Stability analysis (KCB 2016a) indicates the factors of safety (FoS) of slip surfaces through the glaciolacustrine meet current design standards. Based on the stability analysis and long performance history with no observed or documented significant displacements, the probability of dam failure through the glaciolacustrine layer under existing loading is very low.

Surface Erosion: As is common with earthfill structures in this climate, there is significant rilling on the downstream slope. The rills observed during the DSI site visit do not significantly reduce the structural integrity of the dam and do not extend through the crest towards the impoundment.

Earthquakes:

- Pseudo-static stability of the dam was reviewed by KCB (2016a). The two-dimensional FoSs meet the target values except for a stability section at Sta. 0+800 where the calculated FoS was 0.9. The result indicates the dam section at Sta. 0+800 may undergo some deformations under seismic loading. Pseudo-static analyses are not intended to simulate limit equilibrium conditions but, rather, are considered to provide a preliminary seismic deformation screening analysis. A pseudo-static FOS below criterion does not indicate that the dam will fail, but rather, that seismic deformations should be reviewed.
- The estimated horizontal and vertical seismic deformations would not be sufficient to cause a release of tailings from the facility (refer to the main text of this report for more details). Further, it is unlikely a purely two-dimensional movement event could occur. The likelihood of a slope failure due to deformation is considered to be very low.

Other Hazards: such as overtopping, internal erosion and piping, and static slope instability are not considered “key hazards” for this facility and are discussed in the main text of this report.

Summary – no present dam safety concern indicated.

Consequence Classification of Dam

The PTD was assigned a “High” consequence classification (KCB 2014), as defined by the CDA Dam Safety Guidelines (CDA 2013). There have been no changes to the downstream environment or operation of the structure that would require a revision to this classification.

Significant Changes in Instrumentation and/or Visual Monitoring Records

An event-driven inspection was triggered on July 23, 2018 following a significant rainfall (>57 mm within 24 hours). Teck's inspection observations indicate no dam safety issues or significant changes to the PTD following the event.

The piezometers indicate low pore pressures in the downstream shell of the dam. Survey monuments indicate no continuous movement of the dam crest in the downstream direction.

Instrumentation reading frequency was reduced to once per year in 2018 as per KCB recommendation (KCB 2018b) which was made based on no significant changes in available monitoring records over the past 10 years.

2018 DSI observations do not indicate any significant changes in the PTD or dam safety issues. Rills were monitored and compared to previous year observations and no significant changes were noted.

Significant Changes to Surface Water Control

There were no significant changes to surface water control in 2018. A simplified water balance for the facility estimated an average flow rate of 17 L/s through the dam spillway between September 1, 2017 and August 31, 2018; the water balance is within the expected performance range with the closure spillway in operation.

Operations, Maintenance, and Surveillance Manual

The Operating, Maintenance, and Surveillance (OMS) manual was updated in March 2018. The OMS manual identifies KCB representative, Mr. Bob Chambers, P.Eng., as the EoR for the PTD. Quantifiable Performance Objectives (QPOs) (i.e., thresholds) and trigger responses for piezometers, survey monuments and freeboard are included in the document.

Emergency Preparedness and Response Plan

The Emergency Preparedness and Response Plan (EPRP) (Teck 2014) was last updated in November, 2014. The EPRP should be updated to include the latest Teck contact information and verified that the community outreach contact, contingency plan and details on testing of response plan are current and accurate.

Dam Safety Review

The most recent Dam Safety Review (DSR) was completed in 2013 (KCB 2013). Teck have indicated that the next DSR should be completed by July 2021, which is 5 years from the effective date of the Code requirement for DSRs to be performed at least every 5 years.

2018 DSI Observations and Summary of Recommendations

The PTD appears in good condition with respect to stability and water management. Comparison of available annual inspection reports and 2018 monitoring records indicate there have been no significant changes to the condition of the dam over the past 10 years.

Recommendations from previous DSI inspections are summarized in Table 1. Recommendations resulting from the 2018 DSI are summarized in Table 2. Closed recommendations are shown in grey italics and will be removed from the table in the next DSI report.

Priority guidelines, specified in the 2016 HSRC Guidance Document, are assigned to each recommendation by KCB. Priority guidelines are as follows:

- Priority 1: A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant risk of regulatory enforcement.
- Priority 2: If not corrected could likely result in dam safety issues leading to injury, environmental impact or significant regulatory enforcement; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
- Priority 3: Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
- Priority 4: Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.

Table E-1 Previous Recommendations

ID Number	Deficiency or Non-Conformance	Applicable Regulation or OMS Manual Reference	Recommended Action	Priority	Recommended Deadline
PTD-2016-01	Monitoring Downstream Slope Rills	OMS Manual	Add physical indicators (e.g., stakes) to identify rill monitoring points (for photographs). Details regarding Rill monitoring program to be added to the OMS manual.	3	July 2019 (in-progress - pending review of 2018 LiDAR for baseline readings)
PTD-2016-04	Seepage Measurements	OMS Manual	Re-establish the collection of seepage measurements from the V-notch weir located at the outlet of the Seepage Collection Pond.	4	December 2019
PTD-2017-01	Emergency Preparedness and Response Plan (EPRP)	HSRC Code	The EPRP should be updated and verified that all Teck contacts, community outreach contacts, contingency plan and information on testing of response plan are current and accurate.	3	July 2019
PTD-2017-02	*Freeboard Thresholds and Responses*	*OMS Manual*	*Teck to install a physical indicator at ponding location at the northwest corner of the impoundment during 2018 spring inspection. The indicator should be placed at 1 m away from observed tailings/vegetation boundary.*	*4*	*CLOSED*

ID Number	Deficiency or Non-Conformance	Applicable Regulation or OMS Manual Reference	Recommended Action	Priority	Recommended Deadline
PTD-2017-03	Seismic Hazard Assessment for "Closure-Passive Care"	HSRC Code	Complete a site specific seismic hazard assessment for the PTD, using the Code recommended design event for a "High" consequence classification dam under "Closure-Passive Care" condition.	4	December 2019

Table E-2 2018 Recommendations

ID Number	Deficiency or Non-Conformance	Applicable Regulation or OMS Manual Reference	Recommended Action	Priority	Recommended Deadline
PTD-2018-01	Beaver Activity at Seepage Collection Pond	OMS Manual	Monitoring of beaver activities which can impact dam performance (spillway blockages) should be included as a maintenance parameter in the OMS manual.	4	December 2018
PTD-2018-02	Evaluate piezometer reliability before the next DSR	OMS Manual	In the event that Quintette is not re-activated prior to the next Dam Safety Review, the reliability and performance of the piezometers should be evaluated.	4	December 2020
PTD-2018-03	n/a	n/a	Review whether the Seepage Collection Pond is still required, or if the structure can be decommissioned.	4	n/a
PTD-2018-04	Upper and Lower Met rain gauges unreliable in winter	n/a	Repair or improve the Upper and Lower Met climate station rain gauges to improve reliability of precipitation measurements during the winter months	4	December 2019
PTD-2018-05	Spillway channel erosion protection	OMS Manuel	Add to the OMS that the spillway channel and level spreader should be inspected for erosion damage as part of event-driven inspections.	4	December, 2019

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LIST OF ACRONYMS

Acronym	Definition
BC	British Columbia
CCR	Coarse Coal Rejects
CDA	Canadian Dam Association
DSI	Dam Safety Inspection
DSR	Dam Safety Review
EDGM	Earthquake Design Ground Motion
EoR	Engineer of Record
EPRP	Emergency Preparedness and Response Plan
FoS	Factor of Safety
HSRC	Health, Safety and Recreation Code for Mines in BC
IDF	Inflow Design Flood
KL	Klohn Leonoff
KCB	Klohn Crippen Berger Ltd.
MAC	Mining Association of Canada
MEMPR	Ministry of Energy, Mines and Petroleum Resources (BC)
MoE	Ministry of Environment (BC)
OMS	Operational, Maintenance and Surveillance
PMF	Probable Maximum Flood
PTD	Plantsite Tailings Dam
QCO	Quintette Coal Operations
QOC	Quintette Operating Corporation
QPO	Quantifiable Performance Objectives
TSF	Tailings Storage Facility
UHRS	Uniform Hazard Response Spectra

1 INTRODUCTION

Klohn Crippen Berger Ltd. (KCB) were engaged by Teck Coal Ltd. (Teck) to complete a Dam Safety Inspection (DSI) for the Plantsite Tailings Dam (PTD) at the Quintette Coal Operations (QCO) mine site to comply with Section 10.5.3 of the Health, Safety and Reclamation Code (HSRC) for Mines in British Columbia (also referred to as the Code) (MEMPR 2017). This report was prepared following:

- Ministry of Energy, Mines and Petroleum Resources (MEMPR), British Columbia (BC) Section 4.2 "Annual Tailings Facility and Dam Safety Inspection Report" of the 2016 HSRC Guidance Document;
- Teck's 2014 Guideline for Tailings and Water Retaining Structures (TWRS); and
- MEMPR Guidelines for Annual Dam Safety Inspection Report.

The DSI site visit was completed on May 29, 2018 by the EoR, KCB representative Mr. Bob Chambers, P.Eng., along with Mr. Nat Gullayanon, P.Eng., of KCB. During the inspection, KCB engineers were accompanied by Mr. Andrew Bidwell, P.Eng., Mr. Rob Muise, and Ms. Morgan Lypka, E.I.T., of Teck. During the inspection, the weather was sunny and no precipitation was recorded 24 hours prior to the inspection. Refer to Figures 1 and 2 for a general site location and an overview of the structure with satellite imagery and photograph locations from the DSI site visit. Inspection observations are summarized in the following sections. Dam inspection photographs are provided in Appendix I.

Teck have designated Mr. Andrew Bidwell, P.Eng., as the Tailings Storage Facility (TSF) Qualified Person (QP), as defined by the Code, for the PTD. Mr. Rob Muise of Teck is the designated Dam Inspector for PTD (Teck 2018). KCB have been involved as EoR since March, 2016, with KCB representative Mr. Rick Friedel, P.Eng., serving as EoR from March, 2016 to September, 2016. Golder, who designed the facility, were the EoR prior to KCB involvement.

QCO has not been in operation since 2000. Portions of the site have been reclaimed, but otherwise the site has been under care and maintenance status since operations stopped. During care and maintenance, Teck staff are on site for environmental sampling, inspections and maintenance. Under this level of site presence, the PTD is considered to be in the "Closure-Active Care" phase as defined by the Canadian Dam Association (CDA) Mining Dam Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams (2014).

In 2013 and 2014, Teck received permits for a restart of mining operations at the QCO site:

- Ministry of Energy, Mines and Petroleum Resources (MEMPR), Permit No. C-156 (amended June 20, 2013); and
- Ministry of Environment (MoE), Permit No. PE-06739 (amended July 9, 2014).

Teck have deferred the restart of operations pending an improvement in market conditions. The PTD would not be utilized if operations are restarted at QCO, any future tailings will be stored at the existing Shikano TSF. However, the 2014 MoE permit amendment includes provisions for water quality monitoring of the PTD that apply to care and maintenance as well as to restart operations.

The PTD was classified as a “High” consequence dam (CDA 2013) based on the most recent Dam Safety Review (DSR) (KCB 2014). The factors considered in the classification of the PTD are listed in Table 1.1.

Table 1.1 PTD Consequence Classification (KCB 2014)

Population at Risk	Loss of Life	Economic and Social Loss	Environmental and Cultural Losses
No Permanent Population	Significant	Low	High

Teck have scheduled the next DSR for 2021.

2 BACKGROUND AND RECENT ACTIVITY

2.1 Background Information

The PTD was designed by Kilborn Engineering Ltd. and Golder Associates Ltd. (Golder) in 1982, with Golder continuing as the design engineer of the facility during operations.

The PTD is approximately 16 km southwest of the Municipality of Tumbler Ridge in northeastern BC and approximately 2 km north of the QCO processing plant and gatehouse. The Murray River flows from south to north approximately 2 km west (downstream) of the PTD. M17 Creek flows along the southwest boundary of the PTD toe at the closet location. There is an unnamed smaller creek that runs adjacent to the north boundary of the facility. Catchment of the PTD is described in Section 3.

Fine coal tailings slurry was first deposited in the impoundment when mine operations began in 1984 (Golder 2003). The impoundment has been inactive since 1997 when it reached capacity and tailings deposition shifted to the Shikano North Tailings Facility. The PTD closure spillway was constructed between 2001 and 2002. Since 2002, there has been no construction (raises, upgrades, or repairs) on the dam. A list of available PTD reference documents is included in Appendix V.

The PTD is a horseshoe shaped dam, approximately 2.6 km long and was constructed along a side hill to store coal tailings. The PTD starter dam was constructed to El. 864 masl, starting in 1983. The starter dam is primarily constructed of locally borrowed compacted glacial till (labelled as the impervious zone on design drawings in Appendix III) and weathered bedrock (siltstone/shale). A 1 m wide vertical chimney drain between the glacial till and weathered bedrock performed as a filter and drainage feature. The chimney drain was connected to a core drain which had a series of finger drains that extended to the downstream toe at 45 m intervals along the crest. The upstream glacial till zone was keyed into the in-situ till or bedrock with a cut-off trench.

The PTD was raised in a downstream configuration with compacted coarse coal rejects (CCR) to a final El. 884 masl between 1983 and 1995. The chimney drain was raised with each crest raise between the glacial till and CCR. The glacial till zone has a minimum thickness of 3.5 m, measured perpendicular to the upstream face (Golder 1988). The overall existing downstream slope is 2H:1V. The upstream slope was built at 2.5H:1V to El. 878 masl and 2H:1V to the ultimate crest El. 884 masl (KCB 2015). The final dam crest is typically 5 m wide. The maximum downstream slope height of the dam is 52 m.

A closure spillway was constructed between 2001 and 2002. Since 2002, there has been no construction activity on the dam. The spillway is approximately 650 m long and grades at 0.5% to 0.8%. The base of the channel is a minimum of 20 m wide and contained by 4 m to 6 m high banks with 2.2H:1V side slopes

Seepage is collected at the Seepage Collection Pond, approximately 200 m downstream of the PTD (Figure 2).

The general PTD foundation profile includes the following three main units:

- Glacial Till: either dense to very dense sandy silt glacial till or clayey silt glacial till. Cobbles and boulders, and seams of silts and sands were encountered throughout the sandy silt glacial till. Thickness of the glacial till unit varies with the depth to the bedrock.
- Glaciolacustrine: very stiff to hard overly conservative clayey silt and silty clay with occasional sand and gravel seams and numerous silt and fine sand layers and partings. The glaciolacustrine unit is below the glacial till in the southwest corner, with a thickness up to 18.3 m, and is present at surface to the northwest. Refer to Section 6 for further discussion on the glaciolacustrine material and dam stability.
- Bedrock: Bedrock underlying the PTD belongs to the Lower Cretaceous Shaftesbury Formation of the Fort St. John Group (Golder 1982b) and consists of weathered and friable interbedded shale and siltstone or mudstone dipping predominately towards the northeast between 20° and 30°. Bedrock is up to 28.5 m below ground surface beneath the PTD.

Muskeg and surficial silt and clay deposits (above the glacial till) were present over the PTD footprint with a maximum observed thickness of 3 m (Golder 1982a). However, construction specifications and record documents indicate that these deposits were removed during foundation preparation (KCB 2015).

At the request of Teck, KCB assumed the EoR role in 2015, with Mr. Rick Friedel, P.Eng., acting as the named KCB representative. Effective September 1, 2016, Mr. Bob Chambers, P.Eng., became the named KCB representative for the EoR role.

2.2 Recent Activity

Teck completed the following maintenance and surveillance activities in 2018:

- Installed pond level indicator at the northwest corner for Ponded Area 1 in July 2018 (refer to Figure 2 and Section 4.3.4 for more details);
- An event-driven inspection of the PTD following an exceedance in precipitation “Warning Level” trigger (see Section 4.3 for more details); and
- Cleared a beaver dam obstructing the flow in the outfall channel of the Seepage Collection Pond on October 27 and 28, 2018 (Photos I-53 and I-54).

The maintenance and surveillance activities were completed in compliance with the Operation, Maintenance, and Surveillance (OMS) requirements.

3 WATER MANAGEMENT, CLIMATE AND WATER BALANCE

3.1 Overview

The catchment for the PTD impoundment, assuming both roads upstream of the PTD act as diversions, is 134.8 ha including the 101.8 ha tailings beach and pond area. The upstream low permeability zone of the dam limits seepage losses. During operations, tailings were discharged from the northeastern edge of the impoundment which formed a tailings beach slope towards the horseshoe shaped PTD. Ponded water was pumped back to the plant by a reclaim barge.

At the end of tailings deposition, the tailings pond was in the southern area of the impoundment (QOC 2002); as a result, most of the tailings beach slopes towards this area which made it the preferred location for the closure spillway. The closure spillway was constructed in 2001 and 2002, and is founded on a mix of waste rock, tailings and glacial till (Golder 2001, KCB 2018c). The closure spillway channel is approximately 620 m long with a base width of 16 m to 27 m and includes a meandering low flow channel 2 m to 5 m wide (KC 2005). The spillway invert starts at the tailings surface and slopes down to original ground, typically at 0% to 1.2%, before discharging into M17 Creek. The vertical distance between the spillway invert at the inlet and the dam crest is approximately 5.8 m.

With the closure spillway in place, the PTD impoundment is no longer capable of storing a large pond. This reduces the likelihood and potential consequences of a dam failure. Approximately 25,000 m^3 of water can collect in local depressions on the tailings surface within the impoundment before flowing out the spillway (KCB 2018c). At the time of the 2018 DSI site visit, water was ponded at the northeast and northwest corners of the impoundment, and in local tailings depressions near the spillway inlet (see Photos I-31, I-35, I-45 and Figure 2). Ponded water is eventually lost as evaporation, seepage, or discharge through the spillway low flow channel. Low flow in the spillway was observed during the 2018 inspection but could not be reliably estimated due to vegetation in the spillway channel.

3.2 Climate

Site precipitation and temperature data from September 1, 2017 to August 31, 2018 are summarized in Table 3.1. Climate data were measured at the Plantsite climate station (also known as Lower Met station, elevation 914 masl).

The rain gauge at Lower Met station is not heated so winter precipitation measurements are not reliable. As a result, data from October 2017 to April 2018 from the Environment Canada Chetwynd Airport climate station (station No. 1181508; elevation 610 masl; and 86 km north of QCO) were used after being corrected for orographic effects using the mean annual precipitation and elevation relationship from baseline hydrology study (Teck 2013). KCB suggest that Teck repair the weather station for on-going, year-round monitoring of climate data; however, it is not a dam safety concern, and therefore, is not a time sensitive issue.

Average temperatures from 1991 to 2000, taken from baseline hydrology study (Teck 2013), are also summarized in Table 3.1 for comparison.

Seasonal snowpack depth is measured digitally at the Plantsite climate station; however, data conversion details are not available. Therefore, snowpack information is not available for review.

The following observations are made based on the data from September 1, 2017 to August 31, 2018:

- Total precipitation at the Plantsite (752 mm) was higher than the estimated Mean Annual Precipitation (561 mm).
- Summer months (May to August) were warmer than normal, and winter months (November to April) were colder than normal.
- An event-driven inspection was triggered on July 23, 2018 following a precipitation event of 57 mm, exceeding the “Warning Level” threshold (52 mm). Refer to Section 4.3.1 for more details on event-driven inspection.

Table 3.1 Precipitation and Temperature at Plantsite Tailings Dam

Month	Corrected PTD Mean Annual Precipitation[1] Distribution (mm)	Corrected PTD 2017-2018 Precipitation[2],[3] (mm)	Lower Met Station 1991-2000 Average Temperature[4] (ºC)	Lower Met Station 2017-2018 Daily Max. Temperature[5] (ºC)	Lower Met Station 2017-2018 Daily Min. Temperature[5] (ºC)	Lower Met Station 2017-2018 Daily Average Temperature[5] (ºC)
September	43	76	10.1	16.7	4.6	10.5
October	54	119	3.6	8.2	0.3	4.3
November	56	102	-3.7	-3.4	-11.6	-7.4
December	41	4	-6.8	-2.5	-9.2	-6.0
January	44	54	-10.7	-3.8	-11.6	-7.6
February	36	50	-5.4	-7.2	-15.9	-11.4
March	33	60	-2.1	0.9	-10.0	-4.6
April	27	25	3.5	5.6	-5.3	0.6
May	32	11	8.3	17.9	5.7	12.4
June	71	50	12.3	18.8	7.3	13.2
July	75	162	14.5	21.4	9.0	15.3
August	50	38	13.9	21.0	9.8	15.6
Total	**561**	**752**				

Notes:

1. Monthly precipitation values are based on the mean annual precipitation-elevation relationship and monthly distribution outlined in the 2013 Baseline Hydrology and Design Basis Report (Teck 2013).
2. October 2017 to April 2018 precipitation values were based on Chetwynd Airport climate station (station No. 1181508; elevation 610 masl; and 86 km north of QCO) data, with mean annual precipitation and elevation correction from Teck (2013).
3. September 2017, and May 2018 to August 2018 precipitation values were based on Plantsite climate station data with mean annual precipitation and elevation correction from Teck (2013).
4. Average monthly temperatures are from the Quintette Plantsite as outlined in the 2013 Baseline Hydrology and Design Basis Report (Teck 2013).
5. Daily maximum, minimum, and average temperatures are based on daily temperature readings that were taken at the Lower Met climate station.

3.3 Water Balance

Impoundment inflows are from direct precipitation and runoff. Outflows are predominantly flow through the spillway and evaporation losses with lesser volumes of seepage (via finger drains). Golder (2003) estimated a seepage rate of 0.6 L/s through the underdrains based on a measurement at the V-notch weir located at the outflow from the Seepage Collection Pond. Seepage during the 2018 DSI site visit was visually estimated to be approximately 0.2 L/s. A simplified annual water accounting calculation for the PTD for the period September 1, 2017 to August 31, 2018 is summarized below:

- Inflows:
  - Precipitation on ponds = 38,000 m^3 (assumed ponds occupy 5% of tailings beach based on observed localized ponds in the PTD impoundment and at the spillway inlet);
  - Runoff from the tailings beach (excluding pond area) = 437,000 m^3 (assumed average runoff coefficient of 0.6 assuming the remaining water is lost due to seepage, beach evaporation or evapotranspiration); and
  - Runoff from upstream catchment = 100,000 m^3 (assumed average runoff coefficient of 0.4 and both roads upstream of the PTD act as catchment divides under average conditions).
- Outflows:
  - Evaporation from pond surface = 27,000 m^3 (evaporation rate for this site is 536 mm/yr based on the evaporation-elevation relationship from Teck (2013));
  - Seepage losses from the impoundment = 20,000 m^3 (estimate as 0.6 L/s based on measured flows reported in Golder (2003)); and
  - Flow through spillway = 528,000 m^3 (the remainder of inflows minus evaporation and seepage losses).

The flow rate through the spillway during the time of the inspection couldn't be reliably estimated due to the riprap placed at the outlet and the vegetation in the channel (Photo I-4). Based on the simplified water accounting, the average flow rate through the spillway between September 2017 and August 2018 was 17 L/s. Construction of a flow station at the spillway outlet is not required to assess dam safety.

The water accounting flows are within the expected range with the spillway in operation. There are no planned changes to surface water management.

3.4 Flood Routing

The inflow design flood (IDF) for a "High" consequence dam in the "Closure-Active Care" phase such as the PTD is $^1/_3$ between the 1,000-year return period and probable maximum flood (PMF) (CDA 2014). KCB reviewed the PTD closure spillway (KCB 2018c) performance during the IDF and concluded that the spillway has sufficient capacity to route the IDF while maintaining a freeboard of 5 m along the south embankment. The assessment conservatively assumes both roads upslope of the PTD do not divert any inflow away from the impoundment during the IDF (KCB 2018c).

4 REVIEW OF MONITORING RECORDS AND DOCUMENTS

4.1 Operations, Maintenance and Surveillance Manual

The OMS manual was updated and issued by Teck in March 2018. The document includes instrumentation threshold levels, threshold responses, and monitoring frequencies (refer to Section 4.3 for more details). KCB understand that the Mining Association of Canada (MAC) are in the process of updating their guidelines for developing an OMS manual, and recommend that the OMS manual structure be reviewed, and revised if necessary to follow these updated guidelines after they are finalized.

4.2 Emergency Preparedness and Response Plan

The Emergency Preparedness and Response Plan (EPRP) (Teck 2014) was last updated in November, 2014. The EPRP should be updated to include the latest Teck contact information and verified that the community outreach contact, contingency plan and details on testing of response plan are current and accurate. The EPRP should also include KCB representative Mr. Bob Chambers, P.Eng., as the EoR for the PTD.

4.3 Monitoring Program

4.3.1 Visual Inspection

The PTD monitoring program includes the following visual inspections (Teck 2018):

- Annual DSI (this report) – completed by the EoR.
- Routine – completed by Teck's Dam Inspector three times per year, spring (after snowmelt), mid-summer, and fall (before first snowfall). Routine inspections were completed three times in 2018 (May 29, August 8 and September 21). The DSI inspection was counted as spring inspection. Teck's inspection checklists (Appendix IV) do not indicate any dam safety issues.
- Event-driven –completed by Teck staff following:
  - A 24-hour rainfall event either greater than the 10-year return period (52 mm – "Warning Level") or the 50-year return period (67 mm – "Alarming Level"). Follow up inspections are to occur within 36 hours for a 50-year return period event and 3 days for a 10-year return period event.
  - An earthquake magnitude M5 or greater within 100 km of the site, or a smaller event but significant enough to be felt on site and/or in Tumbler Ridge.
  - The event-driven inspection on July 23, 2018 was completed after a precipitation of 57 mm was recorded on site. Teck's inspection checklist (Appendix IV) does not indicate any dam safety issues.
  - No earthquakes with a magnitude of M5 or greater were recorded by the Geological Survey of Canada within 100 km of the site in 2018.

The inspection program is considered appropriate for the PTD given the long performance history of the PTD, no permanent pond and the provision of a closure spillway.

4.3.2 Downstream Slope Erosion

Based on comparison of photographs and previous DSI reports, rill erosion of the downstream slope has undergone minor, if any, changes since 2011. The 2013 DSR recommended repairs be undertaken to prevent rill erosion from extending through the crest into the impoundment. However, there has been no maintenance of the slope for more than 15 years and no rills are eroding the crest toward the impoundment. Therefore, slope remediation is not currently required but visual inspections of rill development should continue.

Rilling at the 16 monitoring locations are summarized in Table 4.1. Rill photographs are included in Appendix II. The most significant year-over-year change is the vegetation growth.

In 2016, KCB recommended a rill monitoring program be established, and suggested installing stakes or posts to establish photograph control points, or using aerial survey / LiDAR to track rill development.

In 2018, Teck retained UAViation of Coquitlam, BC, to complete a LiDAR topographic survey of PTD to monitor rill erosion. The topography survey was completed in October 2018 and the data was sent to KCB in December, 2018. KCB is currently in the process of verifying data suitability for repeat drone surveys to monitor rill development.

Table 4.1 Rill Monitoring Locations

Rill Monitoring Point (PTD-Rill-X)	Coordinates[1]	
	Northing (m)	Easting (m)
01	6097604	628135
02	6097600	628129
03	6097654	628065
04	6097706	628024
05	6097956	627977
05A	6098126	628035
05B	6098214	628067
06	6098278	628044
06A	6098534	628174
07	6098654	628204
07A	6098726	628228
07B	6098751	628228
08	6098945	628270
09	6099031	628395
10	6099029	628748
11	6099035	628820

Notes:
1. UTM Zone 10N, NAD83.

4.3.3 Instrumentation

Instrumentation at the PTD includes 19 functional pneumatic piezometers and 8 dam crest survey monuments. Locations of the piezometer readout locations and the survey monuments are shown in Figure 2.

4.3.3.1 Piezometers

Pneumatic piezometers in the dam fill (upstream and downstream of the chimney drain) and foundation are installed along instrumentation lines (KCB 2018a). Pneumatic piezometer cables are accessible in corrugated steel culvert risers at several locations along the downstream toe. Piezometers are read once per year, typically during the DSI site visit by the Dam Inspector.

Functional piezometers are summarized in Table 4.2. Based on the PTD performance to date and lack of reported dam safety issues, the current functional instruments are considered sufficient for on-going monitoring the dam under "Closure-Active Care" conditions.

Table 4.2 Piezometer Readout Locations and 2018 Monitoring Summary

Station (m)	Read Out Location Coordinates[1]		Functional Piezometers	2018 Reading Collected	
	Northing (m)	Easting (m)		May 31	Comments
0+188	6097529	628210	1A	Yes	
0+300	6097676	628052	P1, P2, P3 and P4	Yes	P2 - May 2018 reading did not stabilize and was discarded. To be reviewed during 2019 DSI.
0+475	6097914	627979	P5, P6 and P7	Yes	
0+575	6098050	628002	P8, P9, P10 and P11	Yes	
0+696	6098172	628045	P12, P13 and P14	Yes	
0+800	6098278	628094	P15, P16 and P17	Yes	Key section for pseudo-static stability
2+040	6099035	628875	P31	Yes	

Notes:
1. UTM Zone 10N, NAD83.

Threshold values (i.e., Quantifiable Performance Objectives (QPOs)) for the piezometers are summarized in Table 4.3. The threshold values were developed based on the following:

- Threshold Level 1 - "Warning Level":
  - If any piezometer reading is 0.5 m (approximately 0.7 psi) greater than the maximum reading since the re-initiation of the instrument in July 2014.
- Threshold Level 2 - "Alarming Level":
  - If there are Threshold level 1 exceedance of two or more instruments in the same instrumentation section; or

- If there are two or more instrumentation sections with observed exceedance of one or more piezometers.

Threshold Level 2 - “Alarming Level” was developed such that responses are based on a trend of instruments exceeding Threshold Level 1 - “Warning Level” rather than an individual piezometer exceeding a threshold on a single occurrence, which may have been caused by reading error or faulty instrument, leading to unnecessary increase in monitoring of the instrument.

Table 4.3 Recommended Piezometer Threshold Values

Station[1] (m)	Instrument ID	Installation Unit	Historical Maximum Since Instrumentation Re-Initiation in July 2014[2]		Threshold Level 1 “Warning Level”		2018 Readings	
0+188	1A	Below fill/foundation contact	2.2 psi	868.5 masl	2.9 psi	869.0 masl	0.2 psi	867.1 masl
0+300	P1	Below fill/foundation contact	5.3 psi	858.5 masl	6.0 psi	859.0 masl	2.9 psi	856.8 masl
	P2	Fill – compacted glacial till	10.2 psi	867.0 masl	10.9 psi	867.5 masl	n/a[3]	n/a masl
	P3	Fill/foundation contact	5.5 psi	858.5 masl	6.2 psi	859.0 masl	3.7 psi	857.2 masl
	P4	Below fill/foundation contact	7.9 psi	857.8 masl	8.6 psi	858.2 masl	5.7 psi	856.2 masl
0+475	P5	Fill/foundation contact	12.2 psi	862.0 masl	12.9 psi	862.5 masl	8.3 psi	859.2 masl
	P6	Fill – compacted glacial till	8.3 psi	864.4 masl	9.0 psi	864.9 masl	5.0 psi	862.1 masl
	P7	Below fill/foundation contact	3.9 psi	858.4 masl	4.6 psi	858.9 masl	0.3 psi	855.9 masl
0+575	P8	Below fill/foundation contact	3.6 psi	852.4 masl	4.3 psi	852.9 masl	0.6 psi	850.3 masl
	P9	Fill – compacted glacial till	17.8 psi	867.9 masl	18.5 psi	868.4 masl	0.2 psi	855.5 masl
	P10	Fill/foundation contact	0.7 psi	848.3 masl	1.4 psi	848.8 masl	0.3 psi	848.0 masl
	P11	Below fill/foundation contact	1.6 psi	846.6 masl	2.3 psi	847.1 masl	0 psi	845.5 masl
0+696	P12	Fill – compacted glacial till	10.9 psi	862.8 masl	11.6 psi	863.3 masl	0.4 psi	855.a masl
	P13	Fill/foundation contact	1.2 psi	843.8 masl	1.9 psi	844.3 masl	0.2 psi	843.1 masl
	P14	Below fill/foundation contact	0.8 psi	841.7 masl	1.5 psi	842.2 masl	0.1 psi	841.2 masl
0+800	P15	Below fill/foundation contact	10.3 psi	853.4 masl	11.0 psi	853.9 masl	0.9 psi	846.8 masl
	P16	Fill – compacted glacial till	7.4 psi	860.0 masl	8.1 psi	860.5 masl	4.2 psi	857.8 masl
	P17	Fill – CCR	3.0 psi	850.4 masl	3.7 psi	850.9 masl	0.3 psi	848.5 masl

Notes:
1. Locations as shown on Figure 2.
2. Suspiciously high piezometer readings, i.e., data outliers, or single occurrence "high readings", likely due to faulty instrument or human error, were discarded from the data set.
3. Piezometer did not stabilize. Piezometer reliability to be reviewed during 2019 DSI.

The recommended threshold responses are summarized in Table 4.4. The piezometer QPOs and responses are included in the 2018 OMS manual.

Table 4.4 Piezometers Threshold Responses

Thresholds	Threshold Exceedance	Action
Level 1 "Warning Level"	Exceedance of a threshold in an individual piezometer	▪ Notify Tailings QP and EoR within 24 hours upon verification of reading exceedance. ▪ EoR to evaluate data for reliability, and review piezometric data (and survey data if available) within the general vicinity of the individual piezometer in question. EoR may recommend repeat measurement and increased on-going monitoring frequency.
Level 2 "Alarming Level"	Trend of threshold exceedances in a group of piezometers	▪ Notify Tailings QP and EoR within 24 hours upon verification of reading exceedance. ▪ Repeat reading within 1 week. ▪ EoR to assess dam integrity and may recommend stability analysis, site visit, or other action.

2018 piezometer reading was completed after the DSI site visit on May 31, 2018. Pore pressure data were compared to historical readings and are summarized in Table 4.3 and shown in cross sections on Figures 3 through 9. The following observations are made:

- No threshold values were exceeded.
- The chimney drain appears to be performing as designed based on reduced pore pressures in the downstream shell of the dam compared to upstream of the chimney drain. "Low" pore pressures in the downstream shell of the dam indicate that dam drainage capacity exceeds flow requirements.
- P2 at Sta. 0+300 had been historically noted as plugged by Golder (2003) and there is a trend of post-closure readings fluctuating from approximately 30 psi to 3 psi between May and October. Readings exceeding 30 psi usually resulted from inability for pressure to stabilize (likely indicating a malfunction of the piezometer) and those unreliable readings were discarded. The nearby P1 at Sta. 0+300, installed upstream of the core below the dam fill/foundation contact, was recording values similar to historic trends (El. 856.8 masl).
- In general, despite the instrument were read during spring freshet with slightly elevated pond levels, all piezometers showed slightly lower water levels when compared to 2017 readings which was read in mid-summer.

4.3.3.2 Survey Monument Pins

Survey pins were installed along the PTD dam crest in 2014 for displacement monitoring. The instruments are surveyed once a year as per the OMS manual (Teck 2018). In 2018, survey monuments were read on June 21 by Teck's surveyor. Comparison of the October 2017 and June

2018 monitoring records is summarized in Figure 10. Threshold values (i.e., QPOs), defined in the OMS manual, are summarized below:

- Threshold Level 1 – "Warning Level":
  - If an individual survey reading shows ≥ 60 mm of horizontal movement from the initial reading;
  - If an individual survey reading shows ≥ 90 mm of vertical movement from the initial reading; and
  - If there is an incremental reading of ≥ 90 mm of vertical movement between readings.
- Threshold Level 2 – "Alarming Level":
  - If there is a trend of threshold exceedances in the monitoring pins.

The thresholds were developed based on the maximum observed survey measurement to date plus 20%. Threshold exceedance responses are summarized in Table 4.5.

Table 4.5 Survey Monument Threshold Responses

Thresholds	Threshold Exceedance	Action
Level 1 "Warning Level"	Exceedance of a threshold in an individual survey pin -	▪ Inspect the area around the pin. ▪ Measure again within 1 week and increase monitoring frequency to weekly. ▪ Notify EoR within 24 hours of second reading. ▪ EoR to evaluate data for reliability, and review survey data within the general vicinity of the individual survey pin in question.
Level 2 "Alarming Level"	Common trend of threshold exceedances in a group of pins	▪ Increase monitoring frequency of the survey pins as needed based on assessment of common trend. ▪ EoR to assess stability, stability analysis may be required.

No changes to the thresholds and responses included in the 2018 OMS manual are recommended.

From a review of the June 2018 survey data, there appears to be no general trend in the downstream direction or significant crest settlement. There was no exceedance of thresholds in 2018 (Figures 11 to 13). Historical (i.e., before 2014) displacement monitoring records are not available for comparison, but visual inspections made since 2003 indicate that no significant crest or slope movements (e.g. slumping, cracking, bulging at toe) have occurred.

4.3.4 Freeboard

Freeboard QPOs are defined in the OMS manual based on visual observations of the ponded areas (refer to Figure 2):

- Ponded Area 1 at northwest corner of the impoundment (see Photo I-36);

- Ponded Area 2 inside tailings depressions (see Photo I-45); and
- Ponded Area 3 at the northeast corner of the impoundment (see Photo I-31).

Ponded Area 3 was first observed in 2018 during the DSI site visit. Thus, KCB has updated the freeboard QPOs and thresholds responses to include Ponded Area 3 which are summarized as follows:

- Threshold Level 1 – "Warning Level" is exceeded if water in Ponded Area 1 is 1 m horizontally beyond the observed vegetation boundary, and/or if Ponded Area 3 starts to accumulate water. In July 2018, Teck installed a physical indicator at the northwest corner of Ponded Area 1 (Photo I-52) at 1 m offset from the tailings/vegetation boundary as recommended in the 2017 DSI Report (KCB 2018b).
- Threshold Level 2 – "Alarming Level" is exceeded if:
  - Water from Ponded Areas 1 and 3 flows over the tailings beach towards the spillway; or
  - Water level crests Ponded Area 2 on to the tailings beach.

The recommended responses for the freeboard Threshold Levels are summarized in Table 4.6.

Table 4.6 Response to Freeboard Threshold Exceedance

Response Level	Exceedance Threshold	Action
Level 1 "Warning Level"	Pond extent is 1 m beyond observed vegetation boundary at Ponded Area 1, and/or Ponded Area 3 starts to accumulate water.	▪ Notify Tailings QP and EoR within 24 hours upon pond level measurement and exceedance. ▪ EoR may recommend increased monitoring of pond level.
Level 2 "Alarming Level"	Water starts to flow from Ponded Areas 1 and 3 towards the spillway, or Water level crests Ponded Area 2 on to tailings beach.	▪ Notify Tailings QP and EoR immediately upon pond level measurement and exceedance. ▪ Increased monitoring frequency as directed by the EoR. ▪ EoR to investigate the increase in pond level and may recommend mitigation measure(s) as required.

KCB recommend Ponded Area 3 QPOs be included in the OMS manual. No changes to the thresholds and responses for Ponded Areas 1 and Ponded Area 2 are recommended.

2018 DSI observations indicate the water levels in Ponded Areas 1 and 3 are approximately 1.3 m below the dam crest. Pond level at Ponded Area 1 was well within the Threshold Level 1 limit. No exceedance in freeboard threshold was reported or observed in 2018.

4.4 Water Quality

Teck monitor water quality downstream of the PTD at monitoring points M17A and M17B as per the MoE Permit No. PE-06739. Seepage flows from the PTD are one of multiple inflows into M17A and M17B; therefore, the water quality at monitoring points M17A and M17B is not directly representative of PTD seepage water quality. Teck confirmed that there are no permit limits for these

sites, but that there are periodic exceedances above BC Water Quality Guidelines for certain parameters. Monitoring program at these locations includes:

- M17A:
  - April to October, weekly: flow rate; dissolved Oxygen; TSS and field turbidity;
  - November to March, monthly: flow rate; and
  - Quarterly: field turbidity; lab turbidity and total suspended solids; total extractable hydrocarbons (TEH); metal and non-metal parameters as defined by the permit.
- M17B:
  - Quarterly: flow, metal and non-metal parameters as defined by the permit.

2018 water quality monitoring data will be submitted to MoE in a Teck prepared report for compliance reporting in March 2019.

5 VISUAL OBSERVATIONS

No significant changes related to dam safety were observed between the 2018 and 2017 DSI observations. The following observations were made during the 2018 DSI site visit:

- **Dam Crest**: Good condition with minor rutting due to vehicle traffics. No signs of movement, significant differential settlement or cracking (Photos I-29, I-38, and I-41).
- **Downstream Slope**: Good condition (Photos I-6, I-8, I-25, I-27, I-30, I-33, I-39, I-40, and I-42). No signs of displacement or slumping. Minor depression in the slope, likely caused by animal activity, was observed on the east embankment (Photo I-28); however, this is not considered a dam safety concern. Refer to Section 4.3.2 for discussion regarding rill erosion and Appendix II for rill photographs.
- **Downstream Toe**: A small depression filled with water was observed at PTD-2018-08 and was suspected to have been originated by the collapse of an animal burrow. No unusual condition of the dam slope immediately upstream of PTD-2018-08 was observed and the feature is not considered a dam safety concern but should be revisited during annual DSI inspections.
- **Upstream Slope**: Good condition. No signs of significant erosion or displacement. Vegetation covers most of the slope, primarily grasses and bushes (Photos I-32, I-34, I-43, I-47, and I-48).
- **North Abutment**: Good condition. No signs of significant erosion or displacement along the fill/natural material interface.
- **South Abutment**: The PTD does not have a south abutment as the closure spillway excavation leaves a gap between the native abutment and dam fill (Photo I-1).
- **Tailings Impoundment**: Similar to previous DSI inspections, there was some locally ponded water (upstream of instrument lines at Sta. 0+300, Sta. 0+475, and Sta. 0+575) in low points on the tailings surface likely formed by differential settlement (Photos I-45 and I-46). The tailings surface is partially vegetated, well drained, except in pond areas. No signs of significant tailings erosion near the closure spillway inlet or other areas of the impoundment (Photo I-46). No sinkholes or depressions on tailings surface adjacent to the dam embankment were observed.
- **Closure Spillway Channel**: Good condition. The vegetation cover, primarily grasses and bushes, is well established. No signs of erosion or scouring were noted (Photos I-1 to I-3, and Photos I-46 to I-50). The riprap on the natural slope bank is showing signs of particle breakdown and should be monitored as part of the annual DSI inspection to document the rate of degradation (Photo I-51). KCB performed a hydrotechnical assessment in 2018 which found that the riprap may be more susceptible to erosion damage during significant flood events, but that additional erosion protection was not required at this time because the damage would not be expected to compromise dam safety. (KCB 2018c). A recommendation was made to inspect the spillway channel and level spreader for damage following a significant flood event, and to repair if necessary (KCB 2018c).
- **Closure Spillway Outlet to M17 Channel**: Good condition. Vegetation is well established. No signs of obstruction or debris blocking the outlet (Photo I-4).

- **Seepage**: Minor seepage was observed from the underdrains at several locations along the dam toe (Photos I-10, I-19, I-20, and I-23). Where seepage was notably flowing from the underdrain, the water was clear. Similar to previous year observations, finger drain at waypoint PTD-DRAIN-22 appears to have red (iron oxide) precipitate (Photo I-23). This observation is not a dam safety concern.

  Ponded water likely due to seepage was also observed at the toe area of the east embankment at PTD-2018-18 (see Figure 2 and Photo I-26). No apparent flow was noted. Ponded water has not been observed at this location during previous DSIs, which have typically been done later in the year and not this close to freshet. The local ponding is not considered unusual condition or dam safety concern.
- **Seepage Collection Pond**: Good condition, no signs of distress or dam safety issues (Photos I-11 through I-18). During the 2018 inspection, low flow from the pond into the outfall channel was observed despite a beaver dam obstructing the channel (Photo I-12). A beaver dam was removed by Teck in late 2017 indicating beavers are still active in the vicinity of the dam.

  Teck removed the beaver dam observed during the 2018 site visit on October 27 and 28, 2018 (Photos I-53 and I-54). Monitoring of beaver activities should be included as a maintenance parameter in the OMS manual.

  Although not related to dam safety, KCB suggest Teck review whether the Seepage Collection Pond is still required, or if can the structure be decommissioned.

6 ASSESSMENT OF DAM SAFETY

The potential failure modes included in the CDA Dam Safety Guidelines (2013) were reviewed based on the inspection observations and review of available documents. No significant changes to 2017 assessment were observed in 2018.

- **Overtopping:** The closure spillway is located in the lowest area of the tailings surface and carries flow out of the facility with no practical means of retaining a large pond. The minimum vertical distance between the invert channel and dam crest is 5.8 m and the channel width is more than 17 m. The probability of an overtopping failure is very low.
- **Internal Erosion and Piping:** The dam was constructed with a chimney drain filter between the low permeability glacial till upstream blanket and downstream CCR shell. The filter compatibility was reviewed and no deficiencies requiring follow up activities were identified (KCB 2015). The low piezometric levels in the dam, long performance record and clear seepage from the underdrains indicate the filter is performing adequately and the probability of an internal erosion and piping failure is very low.
- **Slope Instability:** A slope stability review of the PTD was completed in 2016 (KCB 2016a) and the calculated factors of safety (FoS) meet current design standards as defined in the Code (≥ 1.5 for static stability) and CDA (2013). Based on the stability analysis, long performance history with no visible or documented displacements, and consistent piezometric levels to those assumed in the stability models, the probability of a slope failure is very low.
- **Foundation Failure:** The field data from drilling and laboratory testing is sufficient to characterize the foundation (KCB 2015). A deposit of glaciolacustrine clayey silt and silty clay is present in the southwest corner of the facility. KCB characterized the material including undrained and residual shear strengths based on available field and laboratory tests. Where tests were not available, material properties were estimated based on empirical relationships and appropriately conservative assumptions. FoSs of slip surfaces through the glaciolacustrine material meet the current design standards (KCB 2016a). Based on stability analysis and long performance history with no visible or documented displacements, the probability of a foundation failure is very low.
- **Surface Erosion:** As is common with earthfill structures in this climate, there is significant rilling (erosion gullies) of the downstream slope; refer to discussion in Section 4.3.2. The rills observed during the DSI site visit do not significantly reduce the structural integrity of the dam and do not extend through the crest towards the impoundment. Recommendations for ongoing monitoring are discussed in Section 4.3.2.
- **Earthquakes:**
  - Stability of the dam under seismic loading was reviewed in 2016. The FoSs for pseudo-static stability analysis range between 1.1 and 1.2 for earthquake design ground motion (EDGM) corresponding to 50% of the Peak Ground Acceleration (PGA) during the 2,475-year return period event, as per the Code. However, one stability section (Section C near

Sta. 0+800) has a FoS of 0.9; therefore, the PTD may undergo some seismic deformations. Pseudo-static analyses are not intended to simulate limit equilibrium conditions but, rather, are considered to provide a preliminary seismic deformation screening analysis. A pseudo-static FOS below criterion does not indicate that the dam will fail, but rather, that seismic deformations should be reviewed.

- The estimated horizontal displacements are 240 mm to 500 mm and the estimated crest settlement is 80 mm (KCB 2016a). Due to large available freeboard (>5 m) and typical crest width of 5 m to 10 m, the seismic deformation would not be sufficient to cause a release of tailings from the facility (KCB 2016a). The probability of a failure due to seismic deformation is low.
- Before the PTD is transitioned into "Closure-Passive Care" phase, KCB recommend a site specific seismic hazard assessment be completed to obtain an EDGM and to derive a Uniform Hazard Response Spectra (UHRS) for appropriate return period.

The PTD appears in good condition with respect to stability and water management. The annual inspection reports and piezometer measurements indicate no significant changes to the condition of the dam.

Recommendations from previous DSI inspections are summarized in Table 6.1. Recommendations resulting from the 2018 inspection are summarized in Table 6.2. Recommendation on the OMS manual restructuring to follow the MAC Guidelines is not a dam safety related recommendation. Closed recommendations are shown in grey italics and will be removed from the table in the next DSI report.

Priority guidelines, specified in the 2016 HSRC Guidance Document, are assigned to each recommendation by KCB. Priority guidelines are as follow:

- Priority 1: A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant risk of regulatory enforcement.
- Priority 2: If not corrected could likely result in dam safety issues leading to injury, environmental impact or significant regulatory enforcement; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
- Priority 3: Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
- Priority 4: Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.

Table 6.1 Previous Recommendations

ID Number	Deficiency or Non-Conformance	Applicable Regulation or OMS Manual Reference	Recommended Action	Priority	Recommended Deadline
PTD-2016-01	Monitoring Downstream Slope Rills	OMS Manual	Add physical indicators (e.g., stakes) to identify rill monitoring points (for photographs). Details regarding Rill monitoring program to be added to the OMS manual.	3	July 2019
PTD-2016-04	Seepage Measurements	OMS Manual	Re-establish the collection of seepage measurements from the V-notch weir located at the outlet of the Seepage Collection Pond.	4	December 2019
PTD-2017-01	Emergency Preparedness and Response Plan (EPRP)	HSRC Code	The EPRP should be updated and verified that all Teck contacts, community outreach contacts, contingency plan and information on testing of response plan are current and accurate.	3	July 2019
PTD-2017-02	*Freeboard Thresholds and Responses*	*OMS Manual*	*Teck to install a physical indicator at ponding location at the northwest corner of the impoundment during 2018 spring inspection. The indicator should be placed at 1 m away from observed tailings/vegetation boundary.*	*4*	*CLOSED*
PTD-2017-03	Seismic Hazard Assessment for "Closure-Passive Care"	HSRC Code	Complete a site specific seismic hazard assessment for the PTD, using the Code recommended design event for a "High" consequence classification dam under "Closure-Passive Care" condition.	4	Complete prior to transitioning to "Closure – Passive Care" status

Table 6.2 2018 Recommendations

ID Number	Deficiency or Non-Conformance	Applicable Regulation or OMS Manual Reference	Recommended Action	Priority	Recommended Deadline
PTD-2018-01	Beaver Activity at Seepage Collection Pond	OMS Manual	Monitoring of beaver activities which can impact dam performance (spillway blockages) should be included as a maintenance parameter in the OMS manual.	4	December 2018
PTD-2018-02	Evaluate piezometer reliability before the next DSR	OMS Manual	In the event that Quintette is not re-activated prior to the next Dam Safety Review, the reliability and	4	December 2019

ID Number	Deficiency or Non-Conformance	Applicable Regulation or OMS Manual Reference	Recommended Action	Priority	Recommended Deadline
			performance of the piezometers should be evaluated.		
PTD-2018-03	n/a	n/a	Review whether the Seepage Collection Pond is still required, or if the structure can be decommissioned.	4	n/a
PTD-2018-04	Upper and Lower Met rain gauges unreliable in winter	n/a	Repair or improve the Upper and Lower Met climate station rain gauges to improve reliability of precipitation measurements during the winter months.	4	December 2019
PTD-2018-05	Spillway channel erosion protection	OMS Manual	Add to the OMS that the spillway channel and level spreader should be inspected for erosion damage as part of event-driven inspections.	4	December, 2019

7 CLOSING

This report is an instrument of service of Klohn Crippen Berger Ltd. The report has been prepared for the exclusive use of Teck Coal Ltd. (Client) for the specific application to the 2018 Dam Safety Inspections. The report's contents may not be relied upon by any other party without the express written permission of Klohn Crippen Berger. In this report, Klohn Crippen Berger has endeavoured to comply with generally-accepted professional practice common to the local area. Klohn Crippen Berger makes no warranty, express or implied.

Yours truly,

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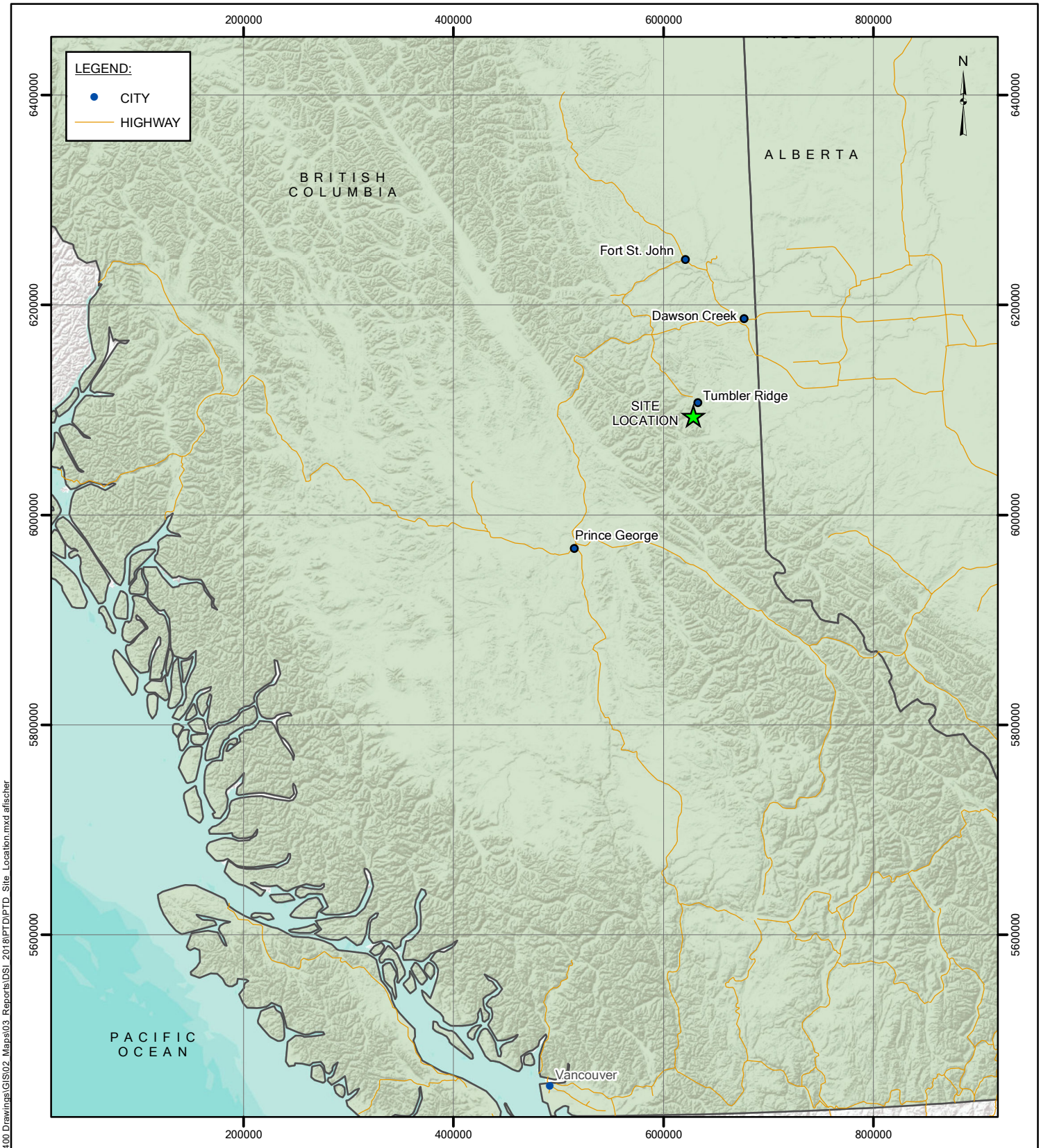
FIGURES



NOTES:
1. PROJECTION: NAD83 UTM ZONE 10N.
2. BASE DATA: ESRI.

SCALE 0 100,000 m

CLIENT: Teck

Klohn Crippen Berger

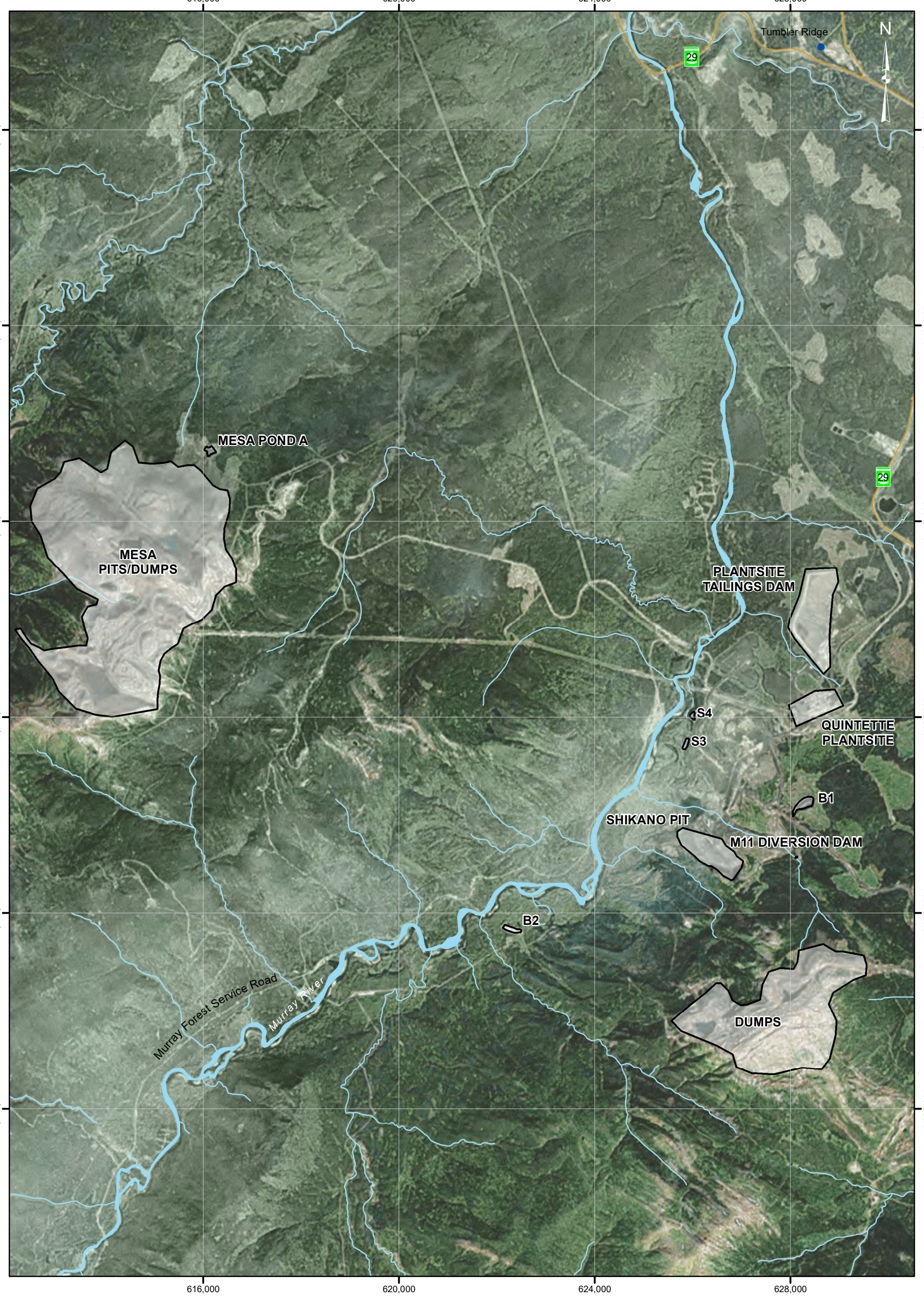
PROJECT: QUINTETTE COAL OPERATIONS
2018 DAM SAFETY INSPECTION

TITLE: SITE LOCATION

PROJECT No. M09684A15

FIG No. 1

Path: Z:\M\VCR\M09684A15 - TCL-Quintette 2018 Services\400 Drawings\GIS\02_Maps\03_Reports\DSI_2018\PTD\PTD_Site_Location.mxd afischer



NOTES:
1. PROJECTION: NAD83 UTM ZONE 10N.
2. BASE DATA: ESRI.

LEGEND:

STRUCTURE BOUNDARY

SCALE 0 2,500 m

CLIENT Teck

Klohn Crippen Berger

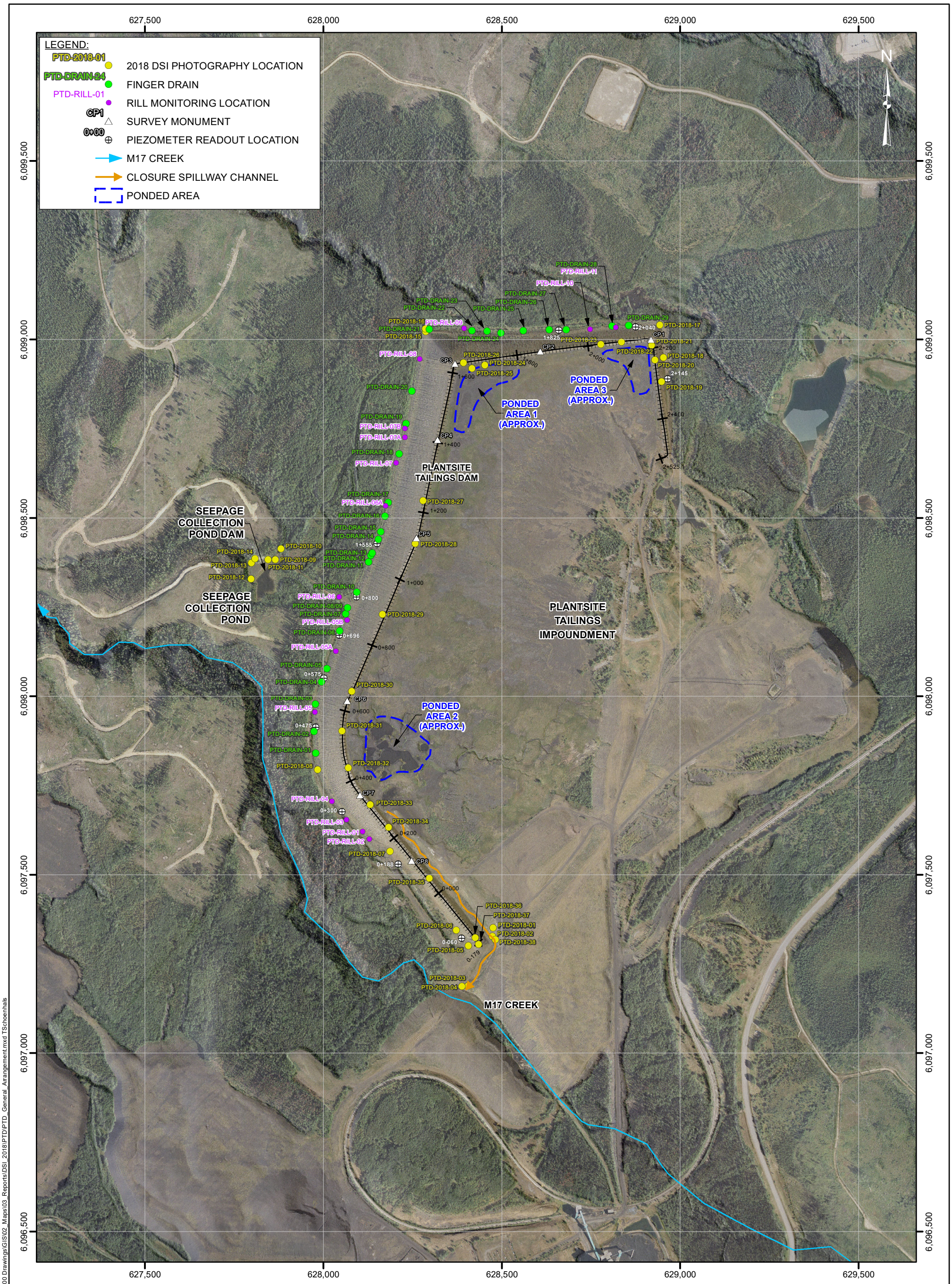
PROJECT
QUINTETTE COAL OPERATIONS
2018 DAM SAFETY INSPECTION

TITLE
GENERAL SITE PLAN

PROJECT No. M09684A15

FIG No. 2

Path: Z:\M\VCR\M09684A15 - TCL-Quintette 2018 Services\400 Drawings\GIS\02_Maps\03_Reports\DSI_2018\General_SitePlan.mxd TSchoenhals



NOTES:
1. PROJECTION: NAD83 UTM ZONE 10N.
2. 2010 ORTHOPHOTO PROVIDED BY TECK.

SCALE 0 500 m

CLIENT: Teck

Klohn Crippen Berger

PROJECT: QUINTETTE COAL OPERATIONS 2018 DAM SAFETY INSPECTION

TITLE: PLANTSITE TAILINGS DAM GENERAL ARRANGEMENT

PROJECT No. M09684A15

FIG No. 3

Path: Z:\M\VCR\M09684A15 - TCL-Quintette 2018 Services\400 Drawings\GIS\02_Maps\03_Reports\DSI_2018\PTD\PTD_General_Arrangement.mxd TSchoenhals

627,500 628,000 628,500 629,000 629,500

6,099,500 6,099,000 6,098,500 6,098,000 6,097,500 6,097,000 6,096,500

N

PLANTSITE TAILINGS DAM

SEEPAGE COLLECTION POND DAM

SEEPAGE COLLECTION POND

PLANTSITE TAILINGS IMPOUNDMENT

157.5 ha

NOTES:
1. PROJECTION: NAD83 UTM ZONE 10N.
2. 2010 ORTHOPHOTO PROVIDED BY TECK.

LEGEND:

CATCHMENT AREA

SCALE 0 500 m

CLIENT Teck

Klohn Crippen Berger

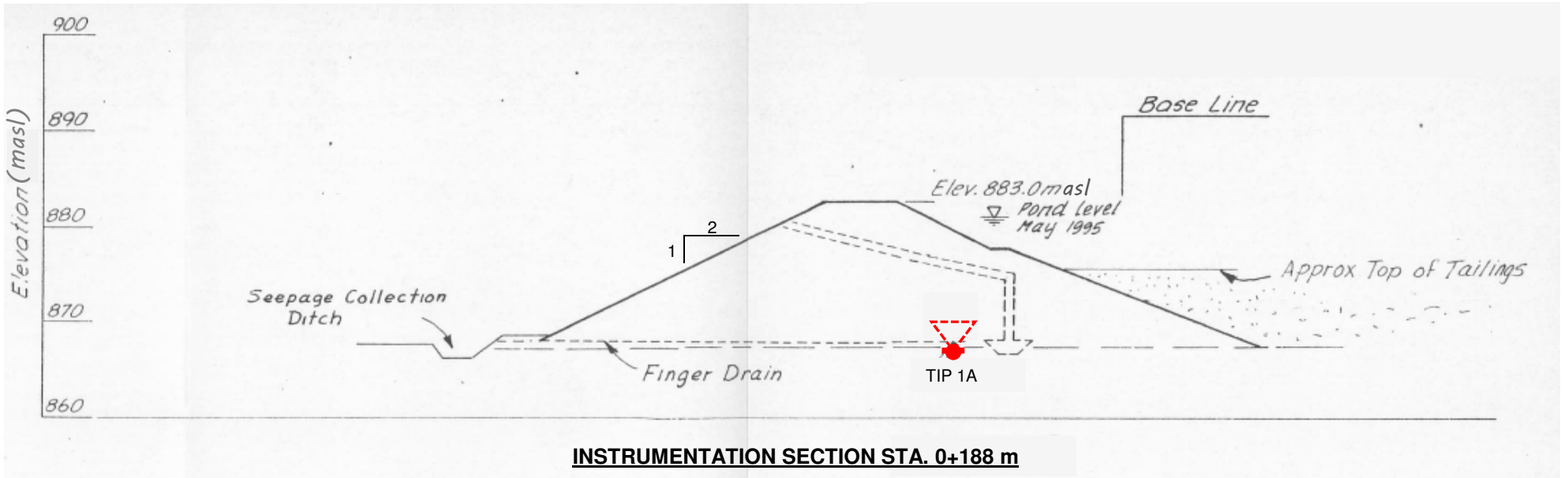
PROJECT QUINTETTE COAL OPERATIONS 2018 DAM SAFETY INSPECTION

TITLE PLANTSITE TAILINGS DAM CATCHMENT

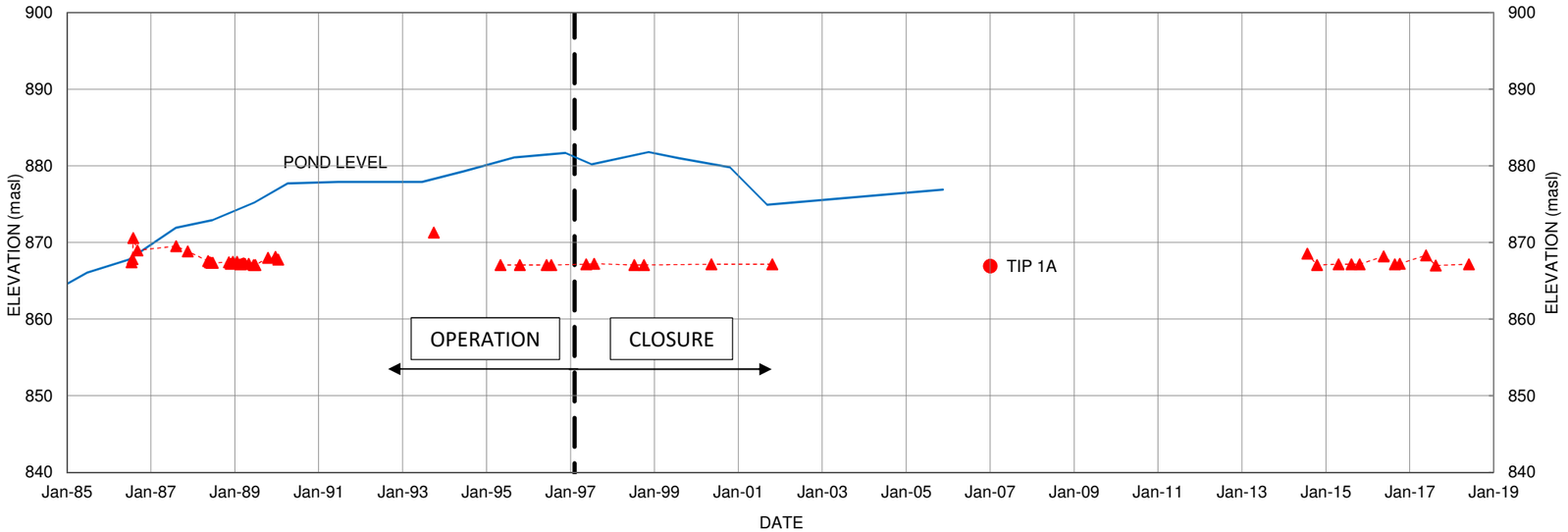
PROJECT No. M09684A15

FIG No. 4

Path: Z:\M\VCR\M09684A15 - TCL-Quintette 2018 Services\400 Drawings\GIS\02_Maps\03_Reports\DSI_2018\PTD\PTD_Catchment.mxd TSchoenhals



INSTRUMENTATION SECTION STA. 0+188 m



PIEZOMETER READINGS AND WATER ELEVATION

DATE	STATION	PIEZOMETER ID.	PIEZOMETER TYPE	TIP ELEVATION (masl)	PRESSURE READING (psi)	PIEZOMETRIC LEVELS	
						HEAD (m)	ELEVATION (masl)
2018-05-31	0+188	1A	PNEUMATIC	867.0	0.2	0.1	867.1

LEGEND:

- PIEZOMETER TIP ELEVATION
- TIP 1A WATER ELEVATION
- 31-MAY-2018 WATER LEVEL

NOTES:

1. INSTRUMENT SECTIONS TAKEN FROM GOLDER (1995).
2. INSTRUMENT CHART AND HISTORICAL RAW MONITORING DATA PROVIDED BY TECK IN 2015.
3. PIEZOMETER TIP ELEVATION INTERPRETED FROM GOLDER (1995).
4. UPSTREAM SLOPE AT 2.5H:1V TO EL. 878 masl AT WHICH UPSTREAM SLOPE BECOMES 2H:1V TO THE FINAL CREST EL. 884 masl.

CLIENT: Teck

Klohn Crippen Berger

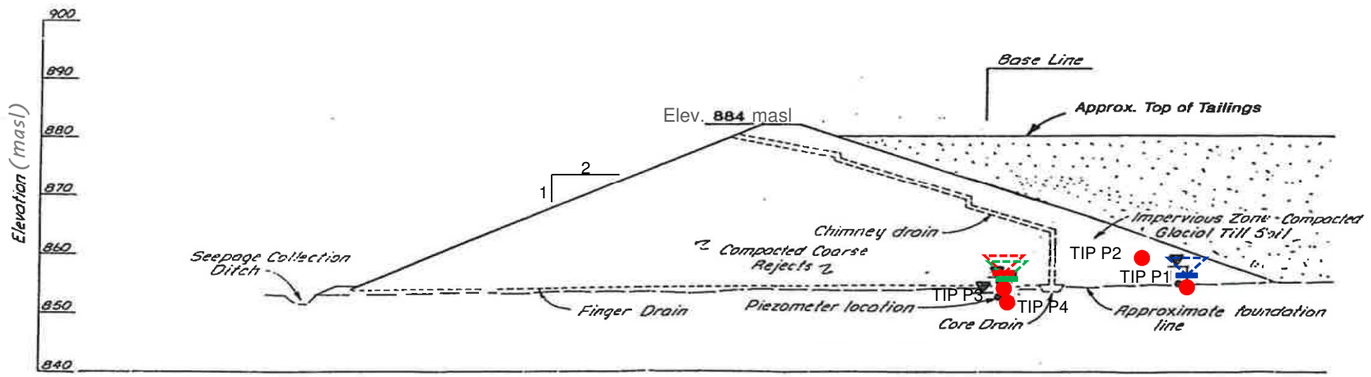
PROJECT: QUINTETTE COAL OPERATIONS
2018 DAM SAFETY INSPECTION

TITLE: PLANTSITE TAILINGS DAM
2018 PIEZOMETER READINGS
STA. 0+188 m

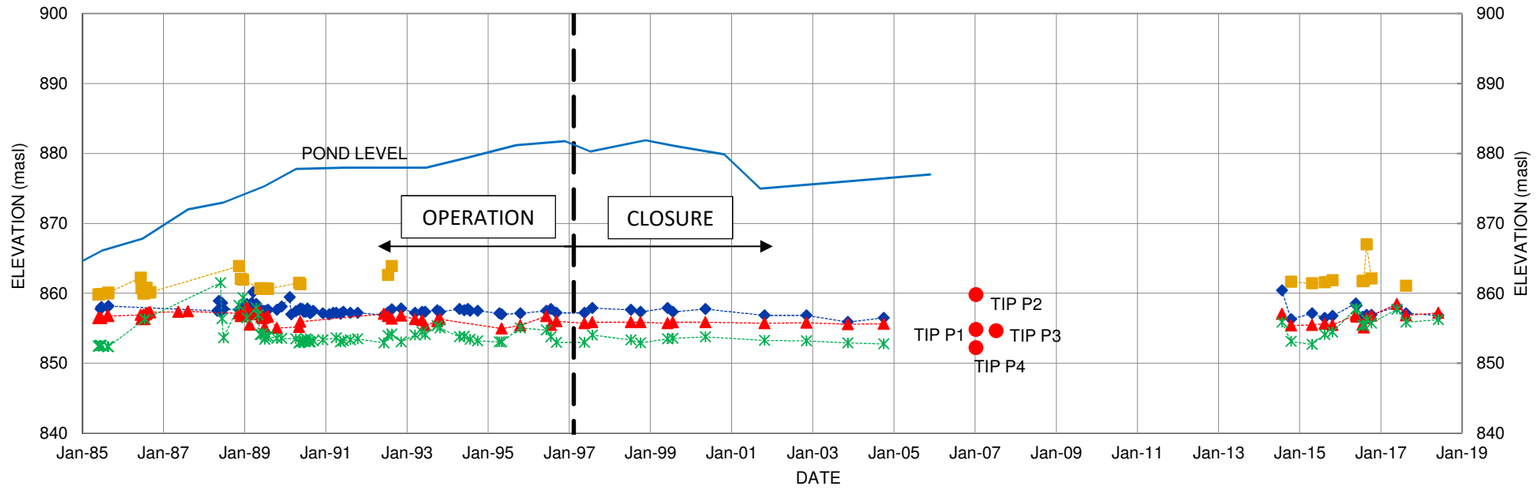
PROJECT No. M09684A15

FIG. No. 5

Date & Time: 2019-02-13 16:14
Figure File: Z:\MVCR\M09684A15 - TCL-Quintette 2018 Services\300 Design\301 Instrumentation\PTD\Piezometer\1180611 Plantsite Piezometer.xlsx]Project & Figure Info.



INSTRUMENTATION SECTION STA. 0+300 m



PIEZOMETER READINGS AND WATER ELEVATION

DATE	STATION	PIEZOMETER ID.	PIEZOMETER TYPE	TIP ELEVATION (masl)	PRESSURE READING (psi)	PIEZOMETRIC LEVELS	
						HEAD (m)	ELEVATION (masl)
2018-05-31	0+300	P1	PNEUMATIC	854.8	2.9	2.0	856.8
		P2	PNEUMATIC	859.8	30.0	21.1	880.9
		P3	PNEUMATIC	854.6	3.7	2.6	857.2
		P4	PNEUMATIC	852.2	5.7	4.0	856.2

LEGEND:

- PIEZOMETER TIP ELEVATION
- 31-MAY-2018 WATER LEVEL
- TIP P1 WATER ELEVATION
- TIP P2 WATER ELEVATION
- TIP P3 WATER ELEVATION
- TIP P4 WATER ELEVATION

NOTES:

1. INSTRUMENT SECTIONS TAKEN FROM GOLDER (2003).
2. INSTRUMENT CHART AND HISTORICAL RAW MONITORING DATA PROVIDED BY TECK IN 2015.
3. PIEZOMETER TIP ELEVATION INTERPRETED FROM GOLDER (1984).
4. UPSTREAM SLOPE AT 2.5H:1V TO EL. 878 masl AT WHICH UPSTREAM SLOPE BECOMES 2H:1V TO THE FINAL CREST EL. 884 masl.

CLIENT: Teck

Klohn Crippen Berger

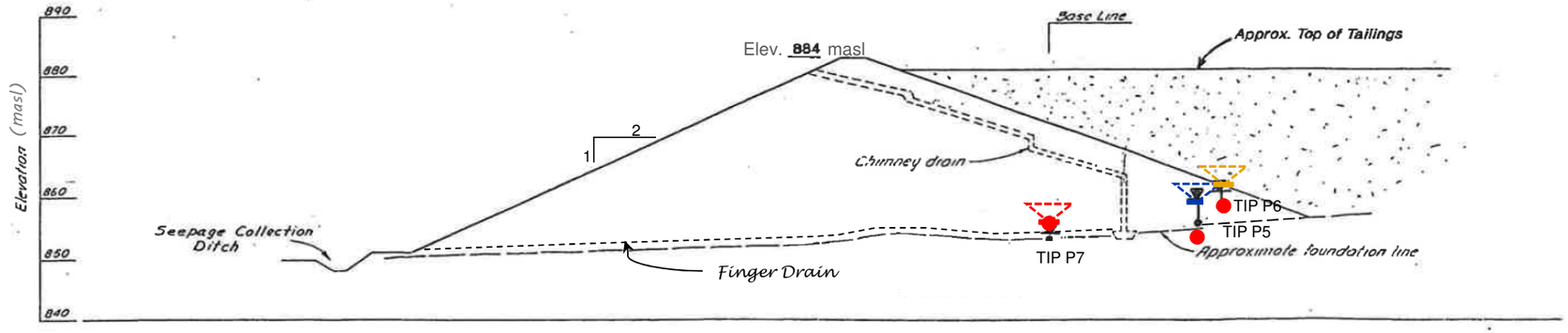
PROJECT: QUINTETTE COAL OPERATIONS
2018 DAM SAFETY INSPECTION

TITLE: PLANTSITE TAILINGS DAM
2018 PIEZOMETER READINGS
STA. 0+300 m

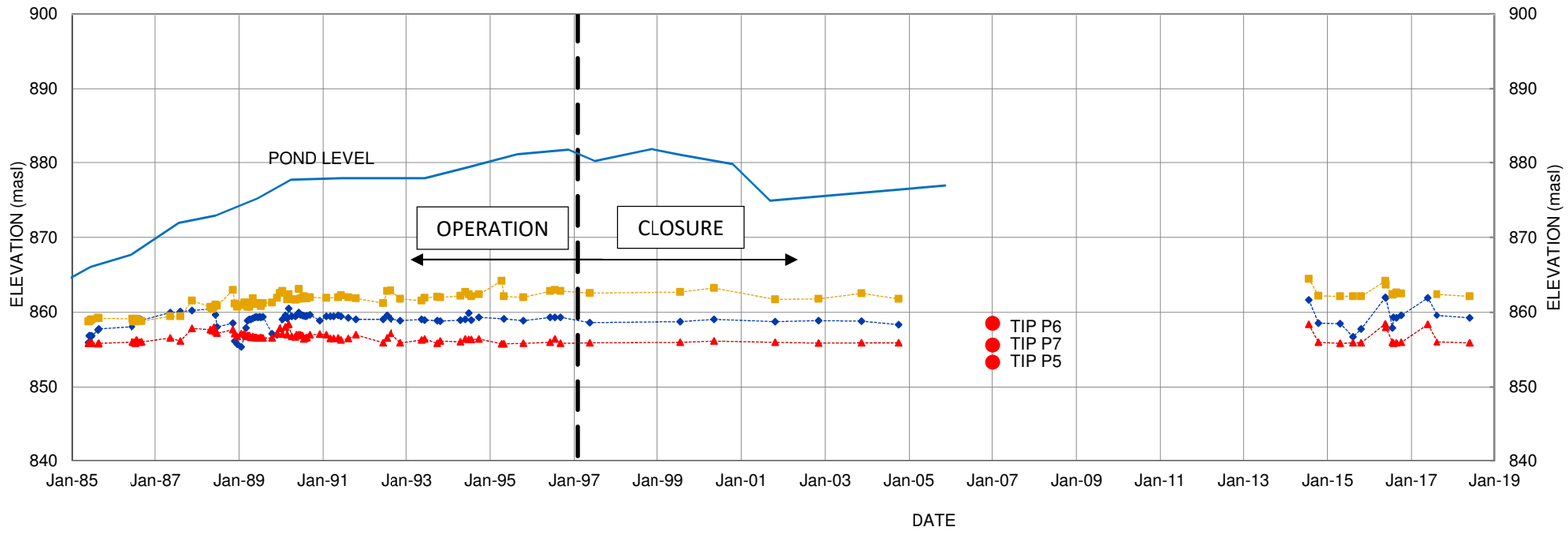
PROJECT No. M09684A15

FIG. No. 6

Date & Time: 2019-02-13 16:14
Figure File: Z:\M\VCR\M09684A15 - TCL-Quintette 2018 Services\300 Design\301 Instrumentation\PTD\Piezometer\[180611 Plantsite Piezometer.xlsx]Project & Figure Info.



INSTRUMENTATION SECTION STA. 0+475 m



PIEZOMETER READINGS AND WATER ELEVATION

DATE	STATION	PIEZOMETER ID.	PIEZOMETER TYPE	TIP ELEVATION (masl)	PRESSURE READING (psi)	PIEZOMETRIC LEVELS	
						HEAD (m)	ELEVATION (masl)
2018-05-31	0+475	P5	PNEUMATIC	853.4	8.3	5.8	859.2
		P6	PNEUMATIC	858.6	5.0	3.5	862.1
		P7	PNEUMATIC	855.7	0.3	0.2	855.9

LEGEND:

- PIEZOMETER TIP ELEVATION
- 31-MAY-2018 WATER LEVEL
- TIP P5 WATER ELEVATION
- TIP P6 WATER ELEVATION
- TIP P7 WATER ELEVATION

NOTES:

1. INSTRUMENT SECTIONS TAKEN FROM GOLDER (2003).
2. INSTRUMENT CHART AND HISTORICAL RAW MONITORING DATA PROVIDED BY TECK IN 2015.
3. PIEZOMETER TIP ELEVATION INTERPRETED FROM GOLDER (1984).
4. UPSTREAM SLOPE AT 2.5H:1V TO EL. 878 masl AT WHICH UPSTREAM SLOPE BECOMES 2H:1V TO THE FINAL CREST EL. 884 masl.

CLIENT: Teck

Klohn Crippen Berger

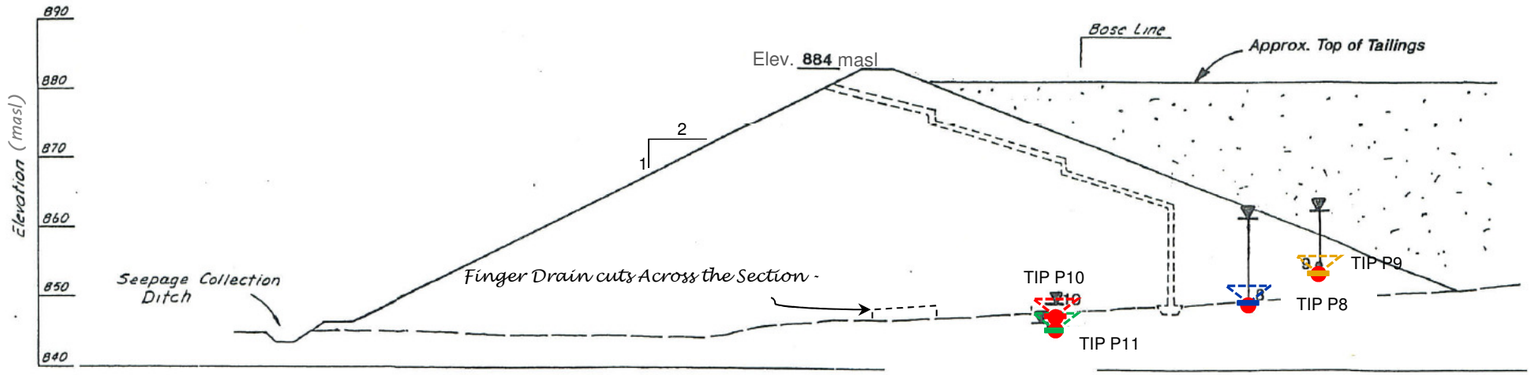
PROJECT: QUINTETTE COAL OPERATIONS
2018 DAM SAFETY INSPECTION

TITLE: PLANTSITE TAILINGS DAM
2018 PIEZOMETER READINGS
STA. 0+475 m

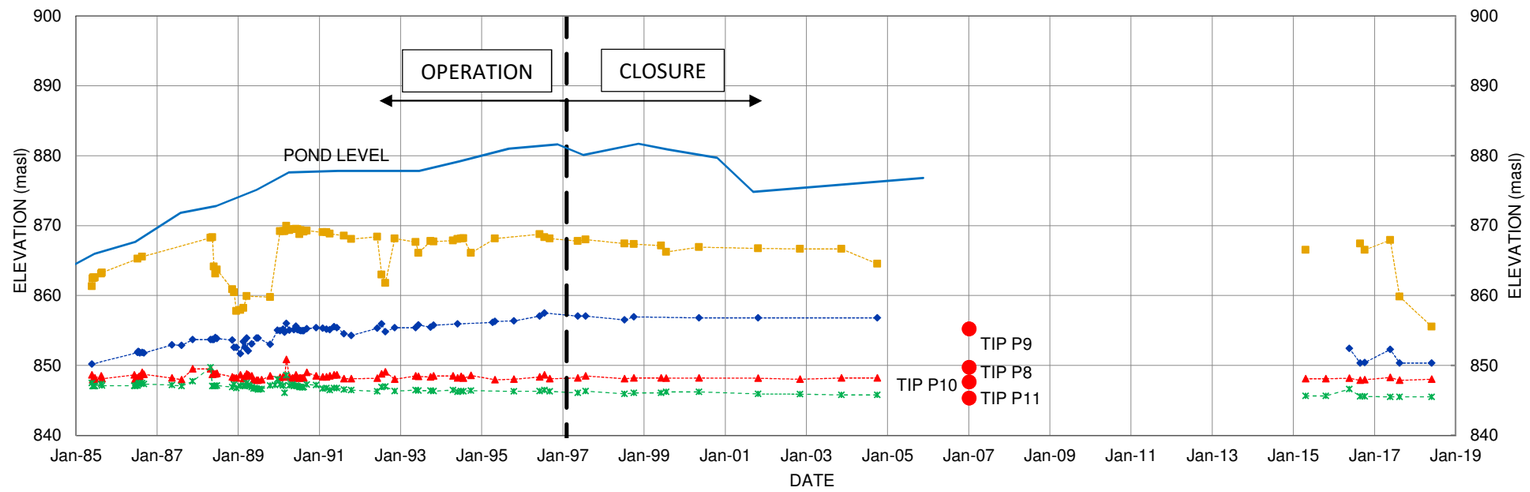
PROJECT No. M09684A15

FIG. No. 7

Date & Time: 2019-02-13 16:14
Figure File: Z:\M\VCR\M09684A15 - TCL-Quintette 2018 Services\300 Design\301 Instrumentation\PTD\Piezometer\[180611 Plantsite Piezometer.xlsx]Project & Figure Info.



INSTRUMENTATION SECTION STA. 0+575 m



PIEZOMETER READINGS AND WATER ELEVATION

DATE	STATION	PIEZOMETER ID.	PIEZOMETER TYPE	TIP ELEVATION (masl)	PRESSURE READING (psi)	PIEZOMETRIC LEVELS	
						HEAD (m)	ELEVATION (masl)
2018-05-31	0+575	P8	PNEUMATIC	849.9	0.6	0.4	850.3
		P9	PNEUMATIC	855.4	0.2	0.1	855.5
		P10	PNEUMATIC	847.8	0.3	0.2	848.0
		P11	PNEUMATIC	845.5	0.0	0.0	845.5

LEGEND:

- PIEZOMETER TIP ELEVATION
- 31-MAY-2018 WATER LEVEL
- TIP P8 WATER ELEVATION
- TIP P9 WATER ELEVATION
- TIP P10 WATER ELEVATION
- TIP P11 WATER ELEVATION

NOTES:

1. INSTRUMENT SECTIONS TAKEN FROM GOLDER (2003).
2. INSTRUMENT CHART AND HISTORICAL RAW MONITORING DATA PROVIDED BY TECK IN 2015.
3. PIEZOMETER TIP ELEVATION INTERPRETED FROM GOLDER (1984).
4. UPSTREAM SLOPE AT 2.5H:1V TO EL. 878 masl AT WHICH UPSTREAM SLOPE BECOMES 2H:1V TO THE FINAL CREST EL. 884 masl.

CLIENT: Teck

Klohn Crippen Berger

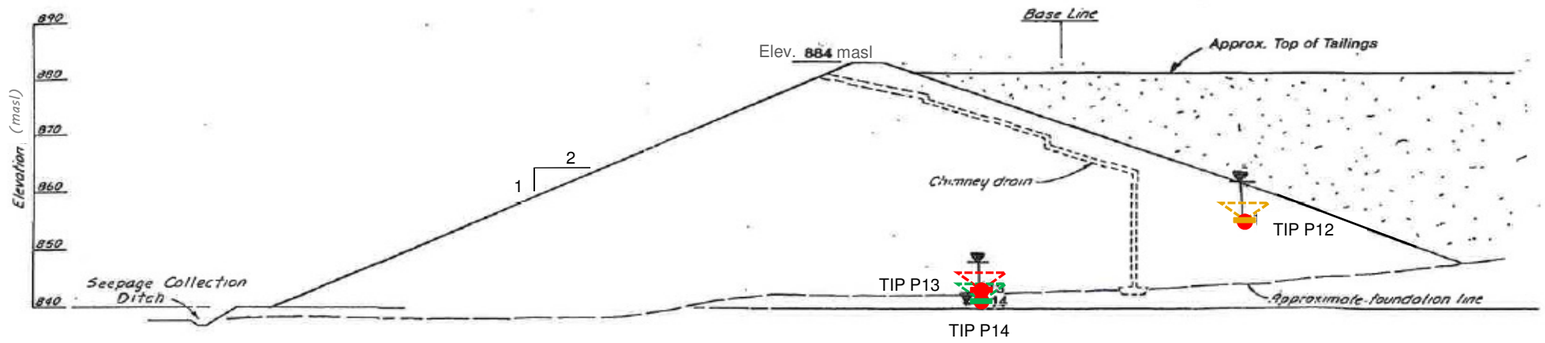
PROJECT: QUINTETTE COAL OPERATIONS
2018 DAM SAFETY INSPECTION

TITLE: PLANTSITE TAILINGS DAM
2018 PIEZOMETER READINGS
STA. 0+575 m

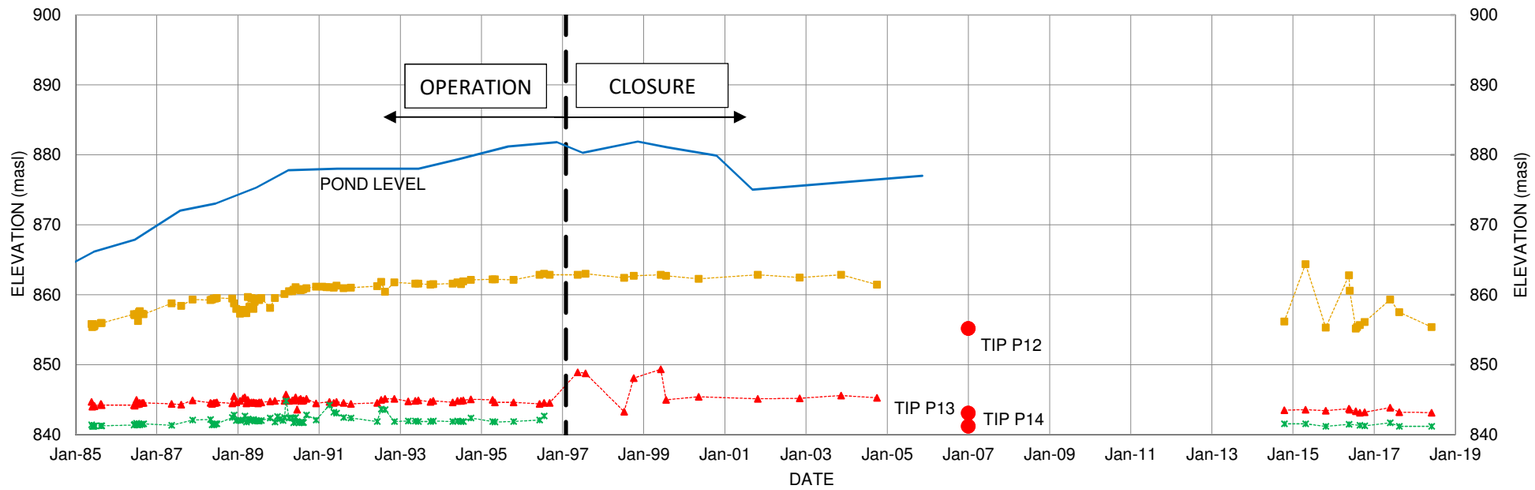
PROJECT No. M09684A15

FIG. No. 8

Date & Time: 2019-02-13 16:14
Figure File: Z:\M\VCR\M09684A15 - TCL-Quintette 2018 Services\300 Design\301 Instrumentation\PTD\Piezometer\[180611 Plantsite Piezometer.xlsx]Project & Figure Info.



INSTRUMENTATION SECTION STA. 0+696 m



PIEZOMETER READINGS AND WATER ELEVATIONS

DATE	STATION	PIEZOMETER ID.	PIEZOMETER TYPE	TIP ELEVATION (masl)	PRESSURE READING (psi)	PIEZOMETRIC LEVELS	
						HEAD (m)	ELEVATION (masl)
2018-05-31	0+696	P12	PNEUMATIC	855.1	0.4	0.3	855.4
		P13	PNEUMATIC	843.0	0.2	0.1	843.1
		P14	PNEUMATIC	841.1	0.1	0.1	841.2

LEGEND:

- PIEZOMETER TIP ELEVATION
- 31-MAY-2018 WATER LEVEL
- TIP P12 WATER ELEVATION
- TIP P13 WATER ELEVATION
- TIP P14 WATER ELEVATION

NOTES:

1. INSTRUMENT SECTIONS TAKEN FROM GOLDER (2003).
2. INSTRUMENT CHART AND HISTORICAL RAW MONITORING DATA PROVIDED BY TECK IN 2015.
3. PIEZOMETER TIP ELEVATION INTERPRETED FROM GOLDER (1984).
4. UPSTREAM SLOPE AT 2.5H:1V TO EL. 878 masl AT WHICH UPSTREAM SLOPE BECOMES 2H:1V TO THE FINAL CREST EL. 884 masl.

CLIENT: Teck

Klohn Crippen Berger

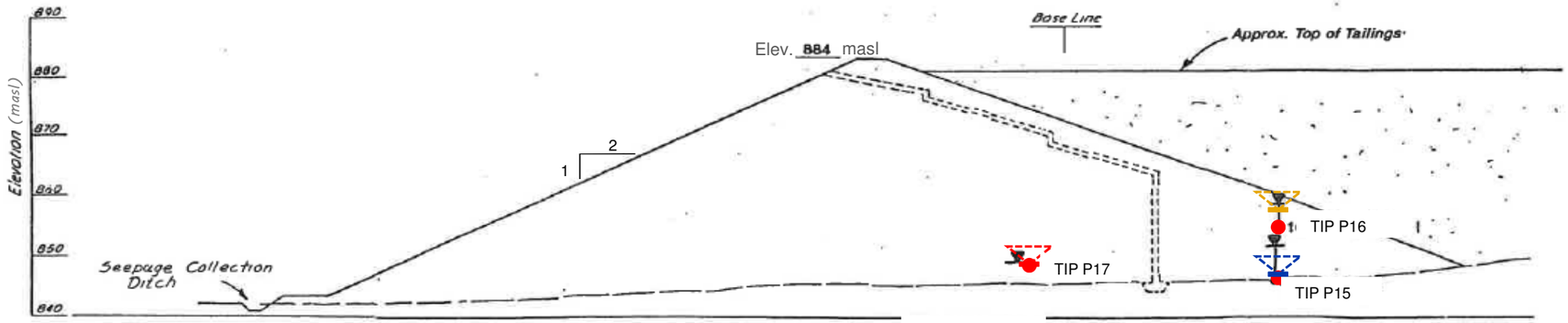
PROJECT: QUINTETTE COAL OPERATIONS
2018 DAM SAFETY INSPECTION

TITLE: PLANTSITE TAILINGS DAM
2018 PIEZOMETER READINGS
STA. 0+696 m

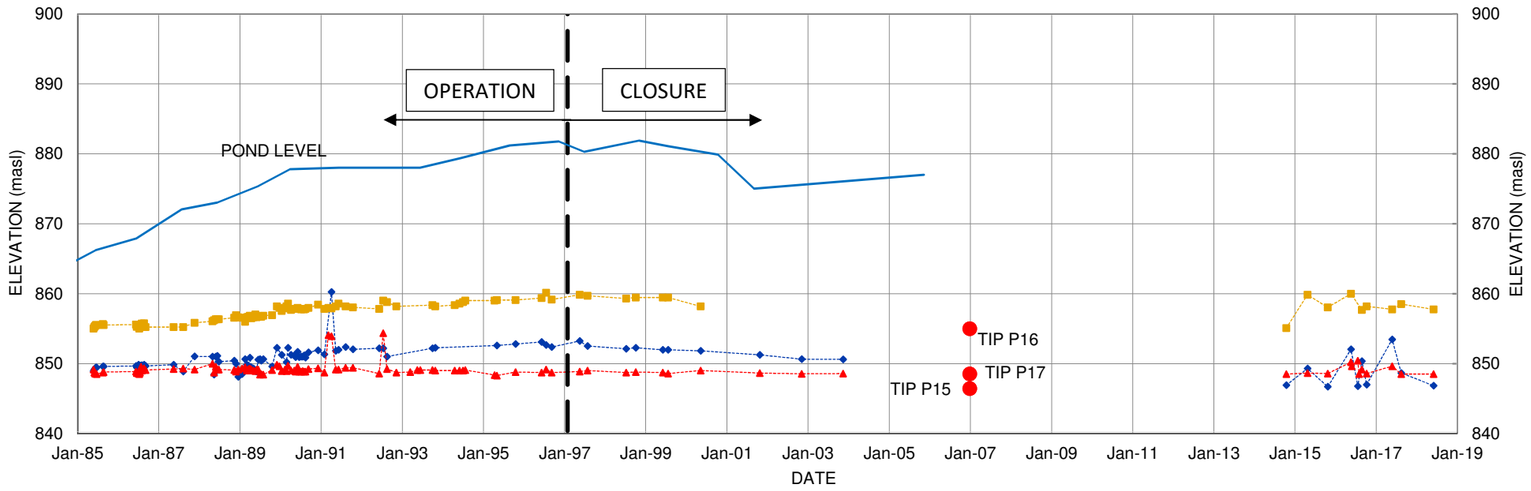
PROJECT No. M09684A15

FIG. No. 9

Date & Time: 2019-02-13 16:14
Figure File: Z:\M\VCR\M09684A15 - TCL-Quintette 2018 Services\300 Design\301 Instrumentation\PTD\Piezometer\[180611 Plantsite Piezometer.xlsx]Project & Figure Info.



INSTRUMENTATION SECTION STA. 0+800 m



PIEZOMETER READINGS AND WATER ELEVATIONS

DATE	STATION	PIEZOMETER ID.	PIEZOMETER TYPE	TIP ELEVATION (masl)	PRESSURE READING (psi)	PIEZOMETRIC LEVELS	
						HEAD (m)	ELEVATION (masl)
2018-05-31	0+800	P15	PNEUMATIC	846.2	0.9	0.6	846.8
		P16	PNEUMATIC	854.8	4.2	3.0	857.8
		P17	PNEUMATIC	848.3	0.3	0.2	848.5

LEGEND:

- PIEZOMETER TIP ELEVATION
- 31-MAY-2018 WATER LEVEL
- TIP P15 WATER ELEVATION
- TIP P16 WATER ELEVATION
- TIP P17 WATER ELEVATION

NOTES:

1. INSTRUMENT SECTIONS TAKEN FROM GOLDER (2003).
2. INSTRUMENT CHART AND HISTORICAL RAW MONITORING DATA PROVIDED BY TECK IN 2015.
3. PIEZOMETER TIP ELEVATION INTERPRETED FROM GOLDER (1984).
4. UPSTREAM SLOPE AT 2.5H:1V TO EL. 878 masl AT WHICH UPSTREAM SLOPE BECOMES 2H:1V TO THE FINAL CREST EL. 884 masl.

CLIENT: Teck

Klohn Crippen Berger

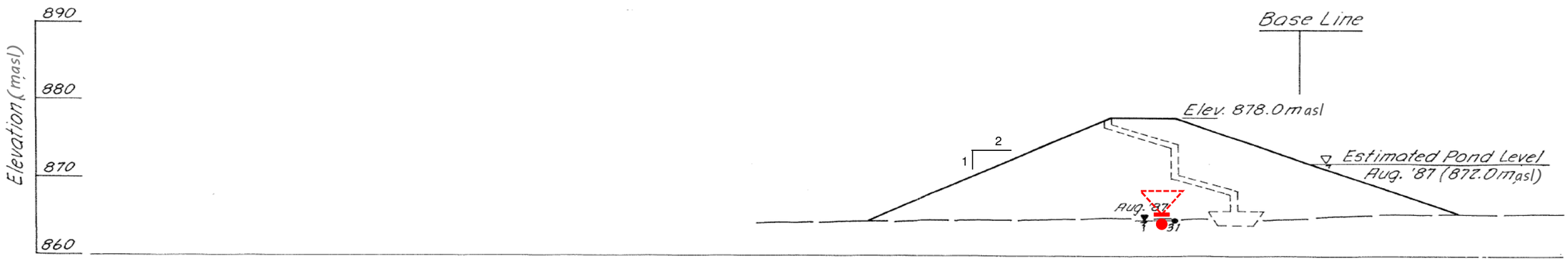
PROJECT: QUINTETTE COAL OPERATIONS
2018 DAM SAFETY INSPECTION

TITLE: PLANTSITE TAILINGS DAM
2018 PIEZOMETER READINGS
STA. 0+800 m

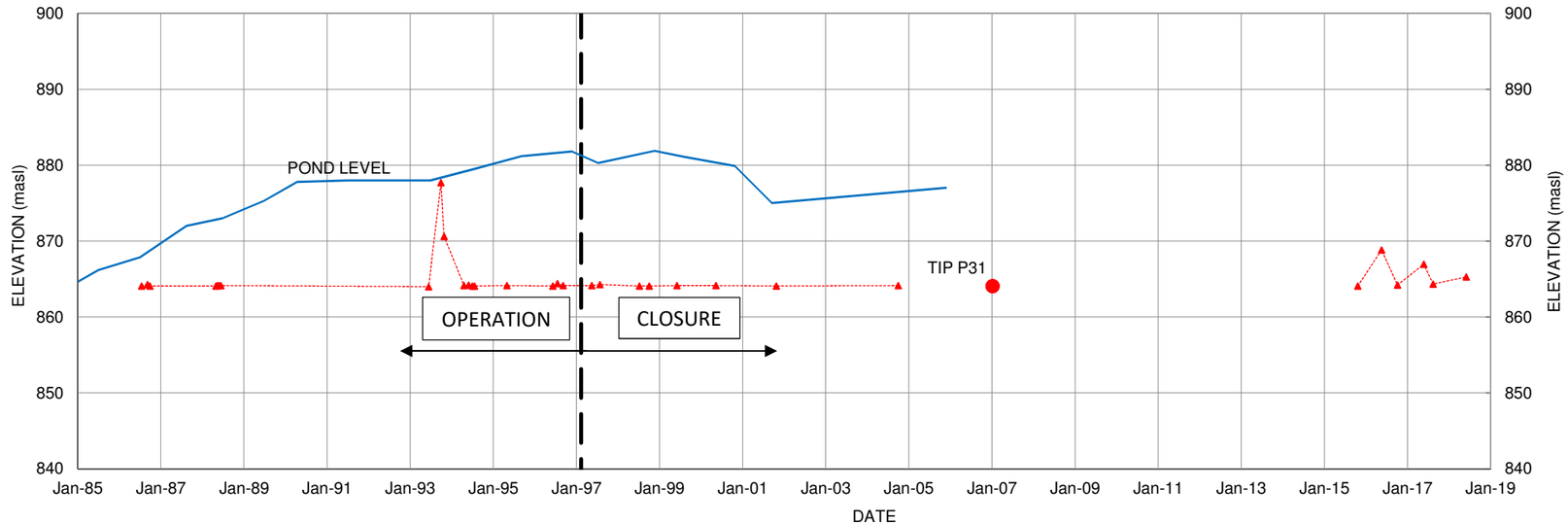
PROJECT No. M09684A15

FIG. No. 10

Date & Time: 2019-02-13 16:14
Figure File: Z:\M\VCR\M09684A15 - TCL-Quintette 2018 Services\300 Design\301 Instrumentation\PTD\Piezometer\[180611 Plantsite Piezometer.xlsx]Project & Figure Info.



INSTRUMENTATION SECTION STA. 2+040 m



PIEZOMETER READINGS AND WATER ELEVATION

DATE	STATION	PIEZOMETER ID.	PIEZOMETER TYPE	TIP ELEVATION (masl)	PRESSURE READING (psi)	PIEZOMETRIC LEVELS	
						HEAD (m)	ELEVATION (masl)
2018-05-31	2+040	P31 (NOTE 3)	PNEUMATIC	864.0	1.8	1.3	865.3

LEGEND:

- PIEZOMETER TIP ELEVATION
- TIP P31 WATER ELEVATION
- 31-MAY-2018 WATER LEVEL

NOTES:

1. INSTRUMENT SECTIONS TAKEN FROM GOLDER (1988).
2. INSTRUMENT CHART AND HISTORICAL RAW MONITORING DATA PROVIDED BY TECK IN 2015.
3. NO LABEL ON PIEZOMETER LEAD. LABELS SHOULD BE ADDED FOR ON-GOING COMPARISON PURPOSES.
4. UPSTREAM SLOPE AT 2.5H:1V TO EL. 878 masl AT WHICH UPSTREAM SLOPE BECOMES 2H:1V TO THE FINAL CREST EL. 884 masl.

CLIENT: Teck

Klohn Crippen Berger

PROJECT: QUINTETTE COAL OPERATIONS
2018 DAM SAFETY INSPECTION

TITLE: PLANTSITE TAILINGS DAM
2018 PIEZOMETER READINGS
STA. 2+040 m

PROJECT No. M09684A15

FIG. No. 11

Date & Time: 2019-02-13 16:14
Figure File: Z:\MVCR\M09684A15 - TCL-Quintette 2018 Services\300 Design\301 Instrumentation\PTD\Piezometer\[180611 Plantsite Piezometer.xlsx]Project & Figure Info.

MONUMENT	NORTHING (m)		CHANGES BETWEEN READINGS AND PREVIOUS YEAR (mm)
	October 4, 2017	June 21, 2018	June 21, 2018
CP1	6099000.227	6099000.203	-23
CP2	6098967.256	6098967.243	-13
CP3	6098932.293	6098932.259	-34
CP4	6098718.779	6098718.758	-21
CP5	6098443.870	6098443.866	-4
CP6	6097987.154	6097987.168	14
CP7	6097722.680	6097722.678	-2
CP8	6097539.400	6097539.406	7

MONUMENT	EASTING (m)		CHANGES BETWEEN READINGS AND PREVIOUS YEAR (mm)
	October 4, 2017	June 21, 2018	June 21, 2018
CP1	628918.362	628918.378	16
CP2	628607.723	628607.726	3
CP3	628369.020	628369.024	4
CP4	628319.738	628319.737	-1
CP5	628260.901	628260.891	-10
CP6	628067.095	628067.107	12
CP7	628102.210	628102.222	12
CP8	628246.908	628246.914	7

MONUMENT	ELEVATION (masl)		CHANGES BETWEEN READINGS AND PREVIOUS YEAR (mm)
	October 4, 2017	June 21, 2018	June 21, 2018
CP1	883.125	883.082	-43
CP2	882.839	882.818	-21
CP3	882.777	882.753	-23
CP4	882.781	882.748	-33
CP5	882.235	882.207	-28
CP6	882.589	882.579	-10
CP7	882.394	882.375	-19
CP8	882.519	882.538	19

NOTES:

1. LATEST SURVEY DATA PROVIDED BY QUINTETTE COAL OPERATIONS ON JUNE 21, 2018.

SURVEY ACCURACY:
HORIZONTAL: +/- 5 mm to 10 mm
VERTICAL: +/- 8 mm to 15 mm

CLIENT: Teck

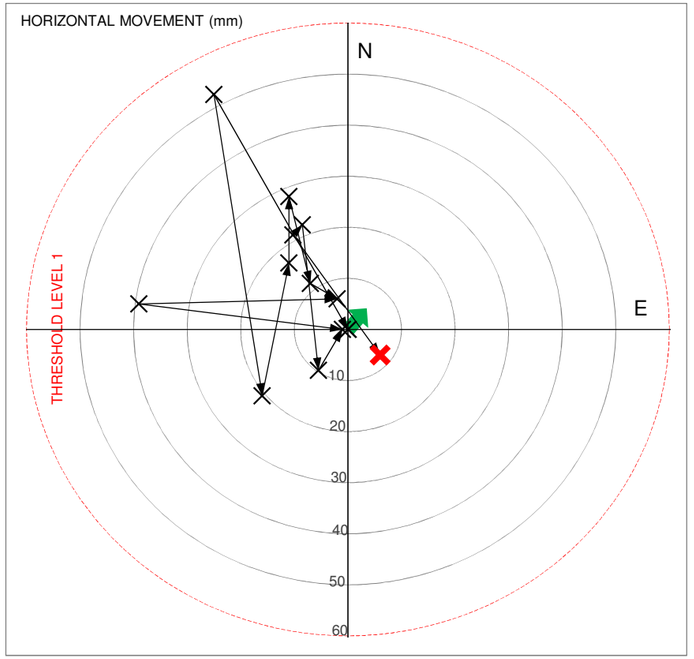
Klohn Crippen Berger

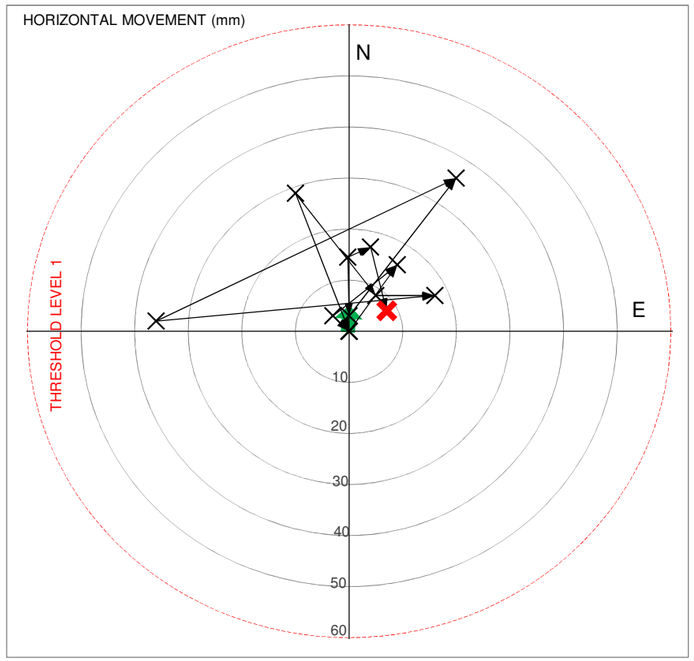
PROJECT: QUINTETTE COAL OPERATIONS
2018 DAM SAFETY INSPECTION

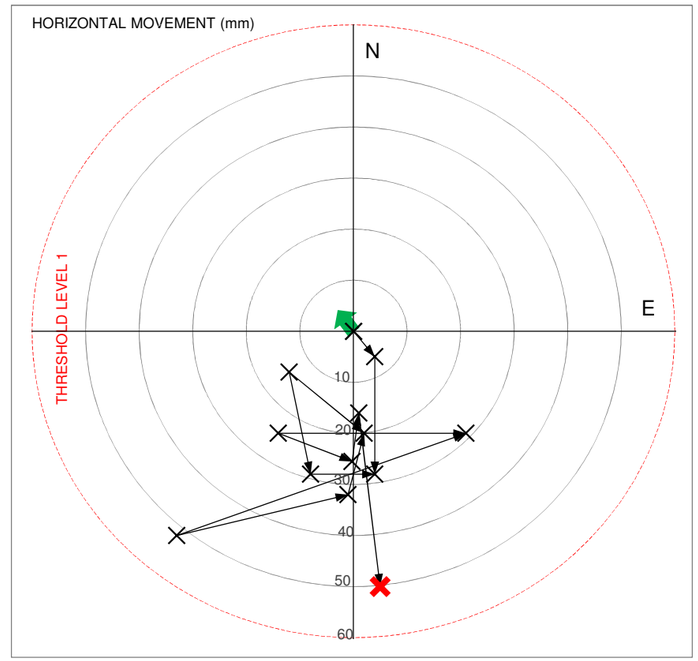
TITLE: PLANTSITE TAILINGS DAM
2018 SURVEY MONUMENT DATA

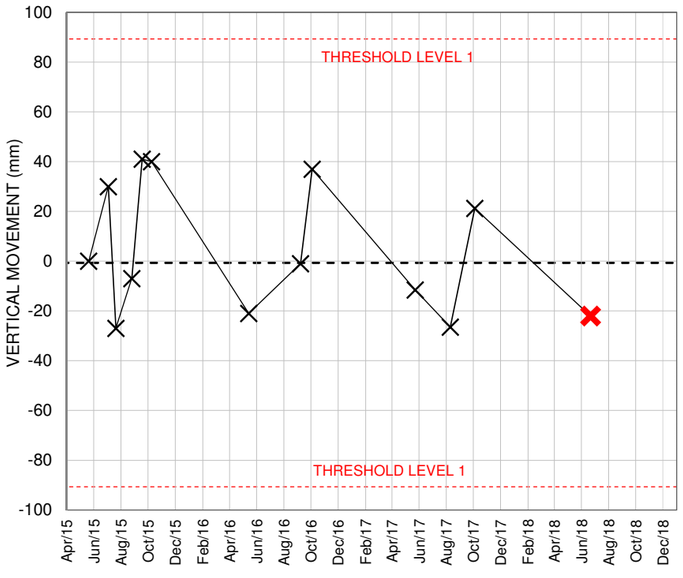
PROJECT No. M09684A15

FIG. No. 12

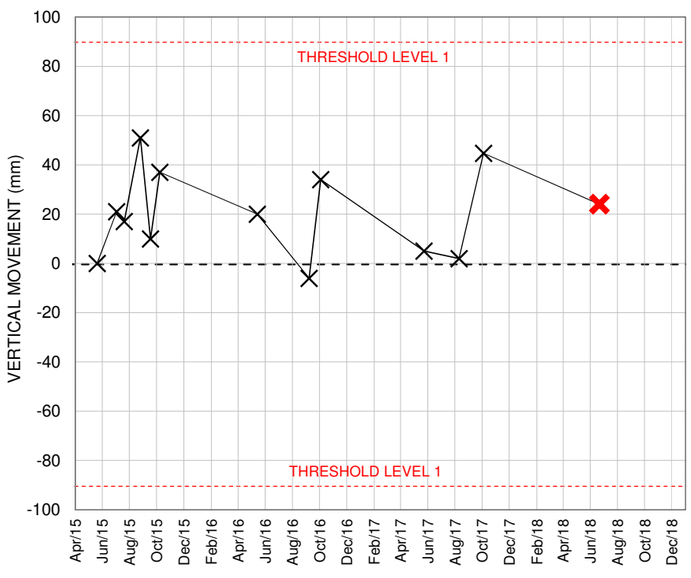




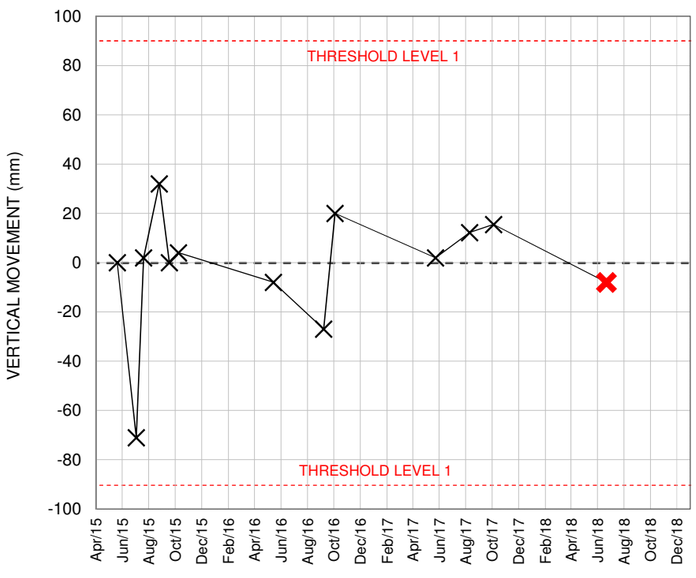




CP1 SURVEY RECORDS



CP2 SURVEY RECORDS



CP3 SURVEY RECORDS

NOTES:

1. LATEST SURVEY DATA PROVIDED BY QUINTETTE COAL OPERATIONS ON JUNE 21, 2018.

LEGEND:

- DOWNSTREAM DIRECTION
- LATEST SURVEY READING

SURVEY ACCURACY:
HORIZONTAL: +/- 5 mm to 10 mm
VERTICAL: +/- 8 mm to 15 mm

THRESHOLD VALUES:
THRESHOLD LEVEL 1: ≥ 60 mm OF HORIZONTAL MOVEMENT FROM INITIAL READING;
≥ 90 mm OF VERTICAL MOVEMENT FROM INITIAL READING; OR
IF VERTICAL MOVEMENT ≥ 90 mm BETWEEN SUCCESSIVE READINGS.
THRESHOLD LEVEL 2: IF THERE IS A TREND OF THRESHOLD EXEEDANCE IN THE MONITORING MONUMENTS.

CLIENT: Teck

Klohn Crippen Berger

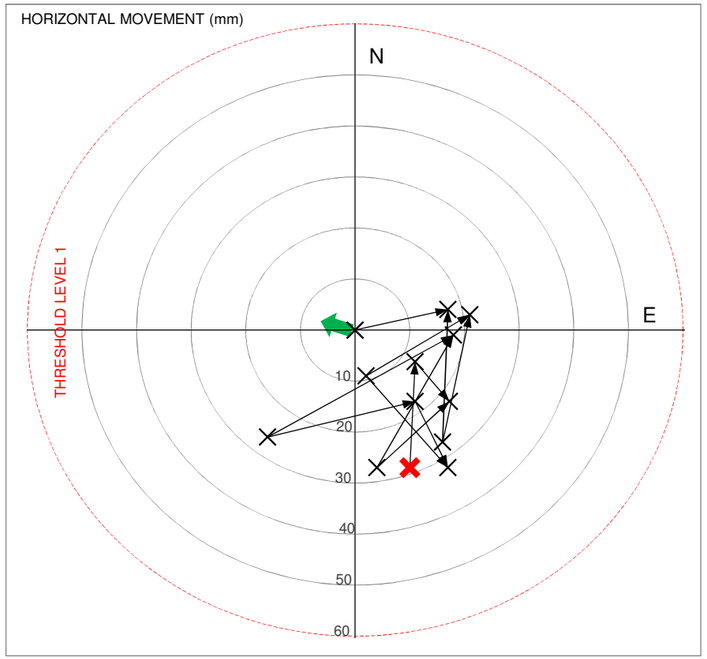
PROJECT: QUINTETTE COAL OPERATIONS
2018 DAM SAFETY INSPECTION

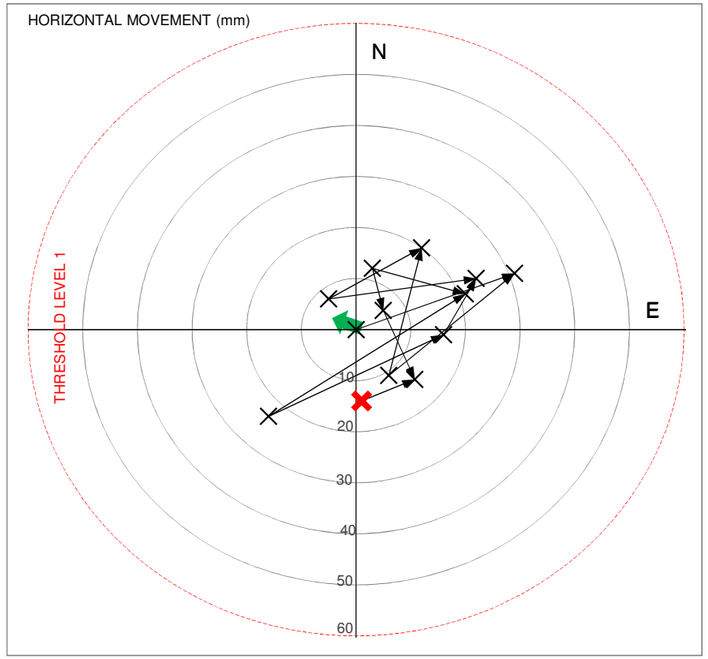
TITLE: PLANTSITE TAILINGS DAM
2018 SURVEY MONUMENT PLOTS
(CP1 TO CP3)

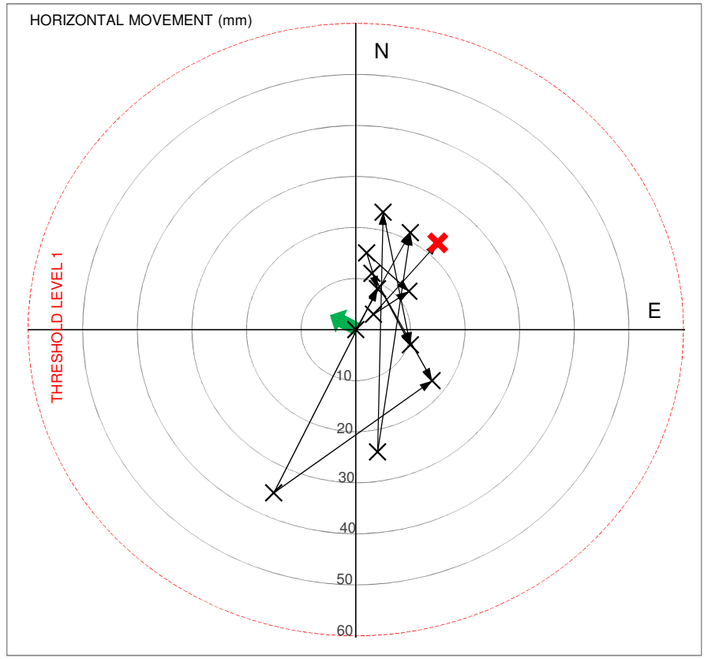
PROJECT No. M09684A15

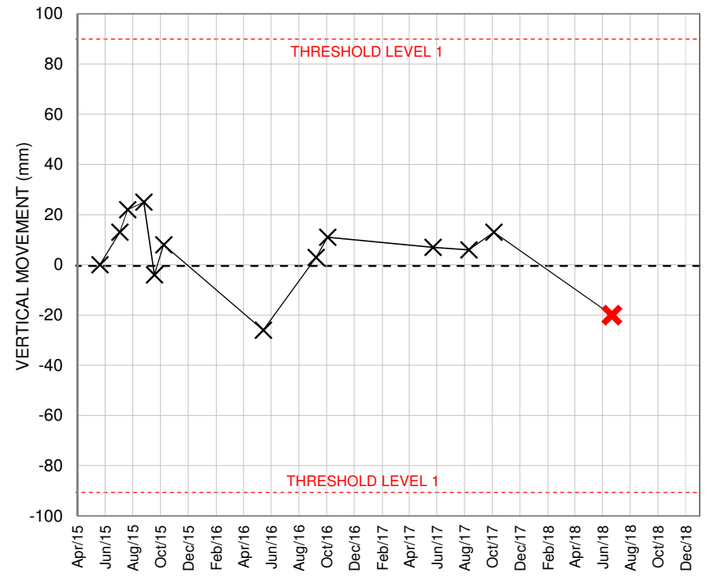
FIG. No. 13

Date & Time: 2019-02-13 16:19
Figure File: Z:\MV\CR\M09684A15 - TCL-Quintette 2018 Services\300 Design\301 Instrumentation\PTD\Survey Monument\[180626 Plantsite Survey.xlsx]Figure D

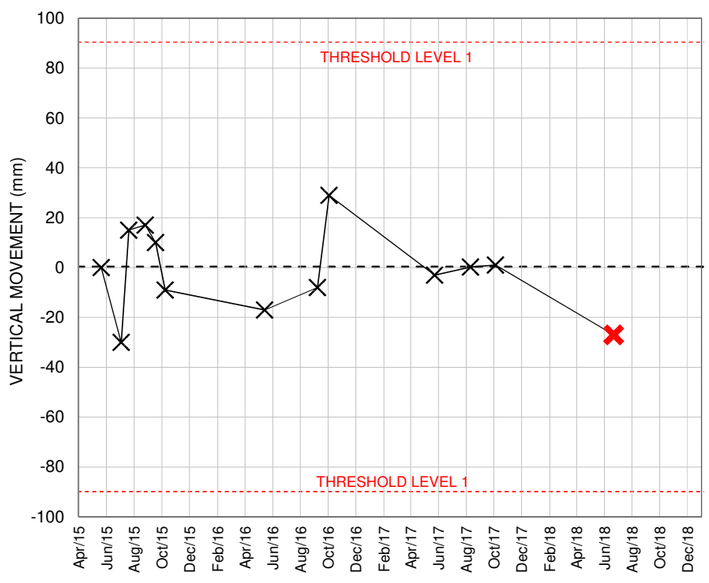




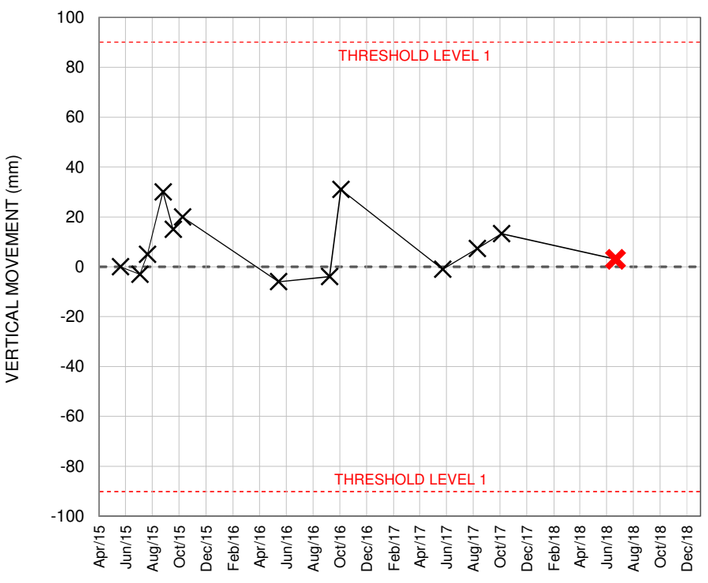




CP4 SURVEY RECORDS



CP5 SURVEY RECORDS



CP6 SURVEY RECORDS

NOTES:

1. LATEST SURVEY DATA PROVIDED BY QUINTETTE COAL OPERATIONS ON JUNE 21, 2018.

LEGEND:

- DOWNSTREAM DIRECTION
- LATEST SURVEY READING

SURVEY ACCURACY:
HORIZONTAL: +/- 5 mm to 10 mm
VERTICAL: +/- 8 mm to 15 mm

THRESHOLD VALUES:
THRESHOLD LEVEL 1: ≥ 60 mm OF HORIZONTAL MOVEMENT FROM INITIAL READING;
≥ 90 mm OF VERTICAL MOVEMENT FROM INITIAL READING; OR
IF VERTICAL MOVEMENT ≥ 90 mm BETWEEN SUCCESSIVE READINGS.
THRESHOLD LEVEL 2: IF THERE IS A TREND OF THRESHOLD EXEEDANCE IN THE MONITORING MONUMENTS.

CLIENT: Teck

Klohn Crippen Berger

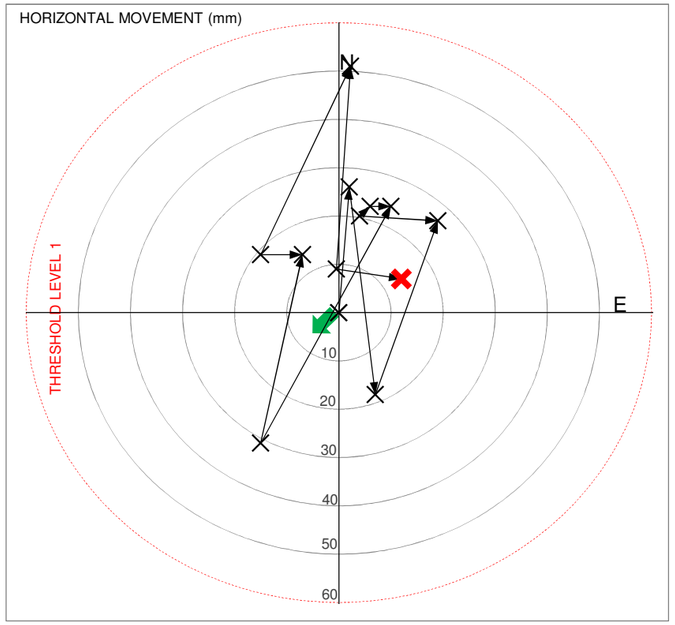
PROJECT: QUINTETTE COAL OPERATIONS
2018 DAM SAFETY INSPECTION

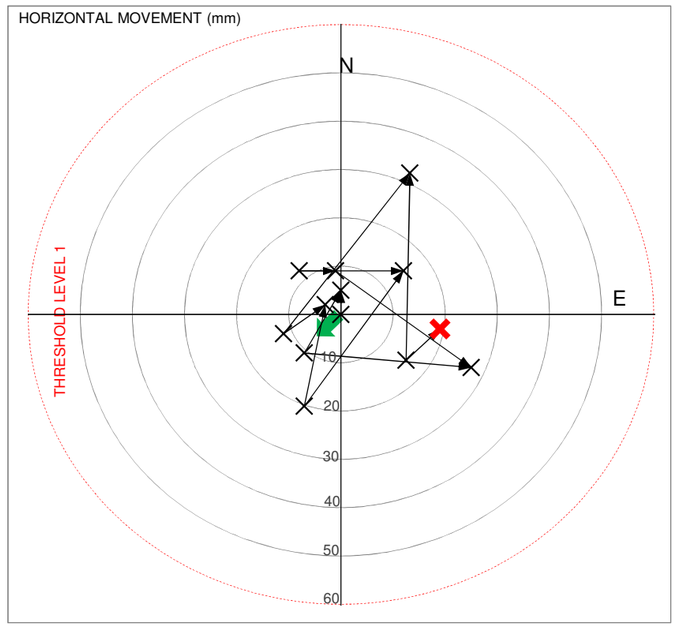
TITLE: PLANTSITE TAILINGS DAM
2018 SURVEY MONUMENT PLOTS
(CP4 TO CP6)

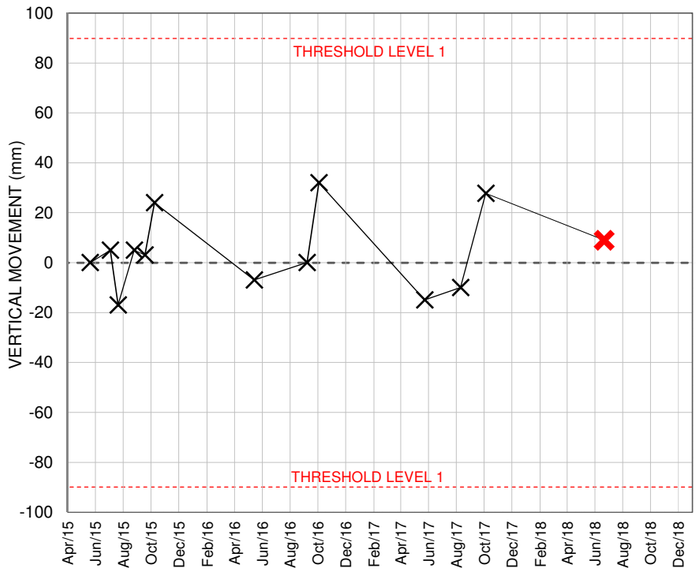
PROJECT No. M09684A15

FIG. No. 14

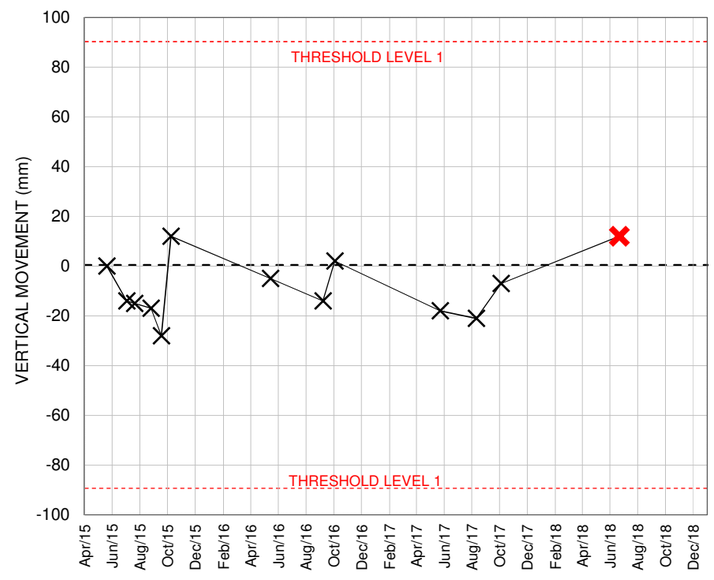
Date & Time: 2019-02-13 16:19
Figure File: Z:\M\VCR\M09684A15 - TCL-Quintette 2018 Services\300 Design\301 Instrumentation\PTD\Survey Monument\[180626 Plantsite Survey.xlsx]Figure D







CP7 SURVEY RECORDS



CP8 SURVEY RECORDS

NOTES:

1. LATEST SURVEY DATA PROVIDED BY QUINTETTE COAL OPERATIONS ON JUNE 21, 2018.

LEGEND:

DOWNSTREAM DIRECTION

LATEST SURVEY READING

SURVEY ACCURACY:
HORIZONTAL: +/- 5 mm to 10 mm
VERTICAL: +/- 8 mm to 15 mm

THRESHOLD VALUES:
THRESHOLD LEVEL 1: ≥ 60 mm OF HORIZONTAL MOVEMENT FROM INITIAL READING;
≥ 90 mm OF VERTICAL MOVEMENT FROM INITIAL READING; OR
IF VERTICAL MOVEMENT ≥ 90 mm BETWEEN SUCCESSIVE READINGS.
THRESHOLD LEVEL 2: IF THERE IS A TREND OF THRESHOLD EXEEDANCE IN THE MONITORING MONUMENTS.

CLIENT: Teck

Klohn Crippen Berger

PROJECT: QUINTETTE COAL OPERATIONS
2018 DAM SAFETY INSPECTION

TITLE: PLANTSITE TAILINGS DAM
2018 SURVEY MONUMENT PLOTS
(CP7 AND CP8)

PROJECT No. M09684A15

FIG. No. 15

Date & Time: 2019-02-13 16:19
Figure File: Z:\MVCR\M09684A15 - TCL-Quintette 2018 Services\300 Design\301 Instrumentation\PTD\Survey Monument\[180626 Plantsite Survey.xlsx]Figure D

APPENDIX I

Inspection Photographs

Appendix I
Inspection Photographs

LEGEND:

- PTD = Plantsite Tailings Dam
- PTD-2018-## refers to 2018 DSI photograph location, as shown on Figure 3

All photographs were taken during site inspection on May 29, 2018.

Photo I-1 Spillway outlet channel – viewed from spillway North Berm looking southwest toward discharge point into M17 Creek (PTD-2018-01)

Photo I-2 **Spillway channel – viewed from spillway North Berm looking northwest along the channel. Channel is well vegetated but no obstruction observed (PTD-2018-01)**

Photo I-3 **Closeup view of the outlet channel – looking southwest toward discharge point into M17 Creek. Flows in low flow channel was observed (PTD-2018-02)**

Photo I-4 Spillway discharge point into M17 Creek; estimated flow was 5 L/s to 6 L/s (PTD-2018-03)

Photo I-5 Looking south along the M17 Creek. Creek is well vegetated, but not a dam safety concern (PTD-2018-04)

Photo I-6 **Overview of PTD downstream slope looking northwest – the slope is in good condition (PTD-2018-05)**

Photo I-7 **Looking southwest at a wet area downstream of PTD toe – no apparent change in condition from previous year (PTD-2018-06)**

Photo I-8 PTD downstream slope - looking northwest. No signs of distress (PTD-2018-07)

Photo I-9 Small sinkhole located downstream of the dam's toe – suspected to be collapsed animal burrow (PTD-2018-08)

Photo I-10 **Finger drain at PTD toe; area downstream of the finger drain is boggy and well vegetated (PTD-DRAIN-08/09)**

Photo I-11 Seepage Collection Pond – located west of the PTD which discharges into M17B Creek. No signs of erosion, distress, or discernable discharge noted (PTD-2018-09)

Photo I-12 PTD Seepage Collection Pond – looking west. Beaver dam noted obstructing the outlet area of the pond (PTD-2018-09)

Photo I-13 Seepage Collection Pond Outfall Channel – looking north. Small flow was noted. Majority of the channel appears to be in good condition (PTD-2018-09)

Photo I-14 Outlet channel of the Seepage Collection Pond – looking northeast. Ponded area appears to be larger than previous year – not a dam safety issue (PTD-2018-10)

Photo I-15 Seepage Collection Pond crest – looking southwest. Medium trees noted, but no signs of distress (PTD-2018-11)

Photo I-16 Seepage Collection Pond downstream slope/south abutment contact – looking north. No signs of unusual conditions (PTD-2018-12)

Photo I-17 Seepage Collection Pond downstream slope – looking east. No signs of erosion or movement (PTD-2018-13)

Photo I-18 Seepage Collection Pond – looking east. Spillway channel appears to be dry (PTD-2018-14)

Photo I-19 Flow noted coming from downstream toe adjacent to a finger drain (Chanel 1) - flow was estimated 1 L/min (PTD-DRAIN-19)

Photo I-20 Flow noted coming from a finger drain (Chanel 2) – flow was estimated 1 L/min (PTD-DRAIN-19)

Photo I-21 Overview of PTD northwest corner's downstream slope - looking southeast. Similar amount of vegetation from previous years (PTD-2018-15)

Photo I-22 Overview of PTD northwest corner - steep scarp near downstream slope ramp – inactive due to the amount of vegetation growth on scarp (PTD-2018-16)

Photo I-23 Finger drain with geotextile – red (oxidized iron) precipitate observed (PTD-DRAIN-22)

Photo I-24 Typical dry finger drain along the north embankment (PTD-DRAIN-23)

Photo I-25 PTD northeast corner's downstream slope – no signs of distress (PTD-2018-17)

Photo I-26 PTD east embankment downstream toe area – looking south. Wet ground noted and likely due to seepage (PTD-2018-18)

Photo I-27 **Change in vegetation type observed at approximately Sta. 2+200 – looking west. Vegetation is thick lush green, likely indication of increased moisture in this part of the dam (PTD-2018-18)**

Photo I-28 **Small sloughed area on the dam's downstream slope – looking south. The feature is likely caused by animal activity (PTD-2018-19)**

Photo I-29 PTD crest – no signs of distress. Tailings surface is approximately 1.5 m lower than dam crest level (PTD-2018-20)

Photo I-30 Downstream slope of the PTD - looking north at approximately Sta. 2+230 (PTD-2018-20)

Photo I-31 PTD impoundment area - looking north at the northeast corner. Ponded water noted and was likely caused by snow melt (PTD-2018-21)

Photo I-32 Upstream slope and tailings beach – looking west. No sinkholes or signs of distress – looking west (PTD-2018-22)

Photo I-33 Downstream slope of the PTD - looking west at approximately Sta. 2+100. No signs of displacement or deformation (PTD-2018-22)

Photo I-34 Upstream slope and tailings beach – no sinkholes or signs of distress. Tailings surface is less than 1 m below the crest; not a dam safety concern (PTD-2018-23)

Photo I-35 **PTD northwest corner. Ponded Area 1 appears to be larger than previous year due to freshet; no dam safety concern (PTD-2018-24)**

Photo I-36 **Temporary stake installed at the ponded area at the northwest corner of the PTD for freeboard monitoring. A permanent staff gauge was installed in July 2018 (PTD-2018-25)**

Photo I-37 Looking south at the Ponded Area 1, water is approximately 30 m from the dam embankment – looking south (PTD-2018-26)

Photo I-38 Standing at the dam's crest at the northwest corner; no signs of distress – looking west (PTD-2018-26)

Photo I-39 **Overview of the downstream slope from the dam crest near Sta. 1+640 – looking east. No signs of distress, significant movement or erosion (PTD-2018-26)**

Photo I-40 **Overview of the downstream slope from the dam crest near Sta. 1+230 – looking south. No signs of distress, significant movement or erosion (PTD-2018-27)**

Photo I-41 Overview of dam crest looking south. No signs of erosion or cracking observed (PTD-2018-28)

Photo I-42 Overview of the downstream slope from the dam crest near Sta. 0+900 – looking north. No signs of distress, significant movement (PTD-2018-29)

Photo I-43 Dam upstream slope near Sta. 0+660; no signs of distress – looking south (PTD-2018-30)

Photo I-44 From dam crest near Sta. 0+540 looking at the ponded area and the tailings beach; no signs of sinkholes or distress – looking east (PTD-2018-31)

Photo I-45 **Pond within depressions (Ponded Area 2) along the tailings beach near Sta. 0+440 – looking east. Pond appears to be the higher than 2017 observation (PTD-2018-32)**

Photo I-46 **Low Flow Channel inlet – looking north. Water was noted to be cresting over the depression (Ponded Area 2) into the Low Flow Channel (PTD-2018-33)**

Photo I-47 **From dam crest looking east at the Low Flow Channel and upstream slope – no obstruction in the channel and no signs of distress on the slope (PTD-2018-34)**

Photo I-48 **Spillway channel - viewed from the embankment looking east along the channel – channel is well vegetated but no obstruction observed (PTD-2018-35)**

Photo I-49 Spillway channel - looking east towards the spillway channel's 90° bend – minor vegetation, but no obstruction (PTD-2018-36)

Photo I-50 Overview of outlet channel – looking south toward discharge point into M17 Creek (PTD-2018-37)

Photo I-51 Standing on the spillway channel slope looking south at deteriorating riprap and ponded area inside local depressions inside the channel (PTD-2018-38)

Photo I-52 Permanent Ponded Area 1 extent marker installed by Teck in July 2018 for pond level monitoring (near PTD-2018-25)

Photo I-53 **Seepage Collection Pond – looking north. Beaver dam was removed by Teck from the outlet channel. Clean up work was completed between October 27 and 28, 2018**

Photo I-54 **Seepage Collection Pond – looking west. Beaver dam was removed by Teck from the outlet channel. Clean up work was completed between October 27 and 28, 2018**

APPENDIX II

Rill Monitoring Photographs

Appendix II
Rill Monitoring Photos

LEGEND:

- PTD-RILL-## refers to proposed rill monitoring point, plan location is shown on Figure 3

Coordinates for monitoring points are summarized in Table II-1. All 2018 photographs were taken during inspection on May 29, 2018.

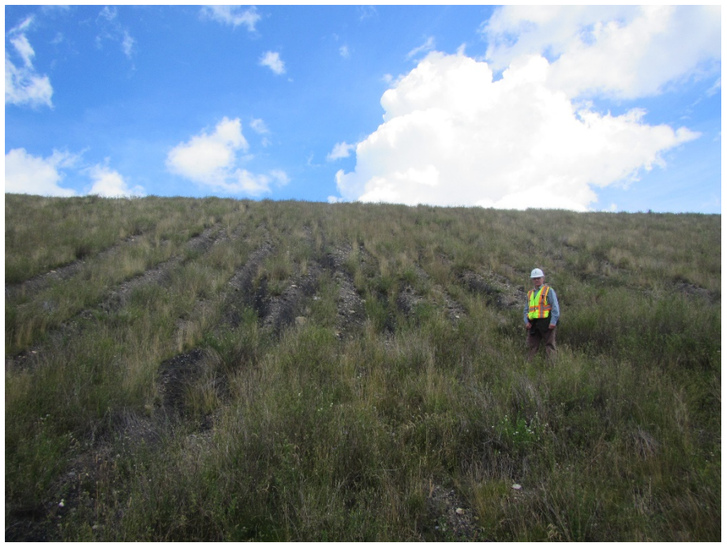
Table II-1 Rill Monitoring Point Locations

Rill Monitoring Point PTD-Rill-##	Northing (m)	Easting (m)
01	6097603.6	628135.4
02	6097599.6	628128.6
03	6097654.1	628064.7
04	6097706.1	628024.0
05	6097955.8	627976.7
05A	6098126.4	628034.7
05B	6098213.7	628067.3
06	6098278.2	628044.4
06A	6098533.6	628174.1
07	6098654.2	628204.4
07A	6098725.7	628219.6
07B	6098750.8	628228.3
08	6098945.2	628270.2
09	6099031.2	628394.9
10	6099029.1	628747.9
11	6099034.7	628820.0

II-1 PTD-RILL-01

2015

2016



2017

2018

II-2 PTD-RILL-02

2015

2016

2017

2018

II-3 PTD-RILL-03

2015

2016

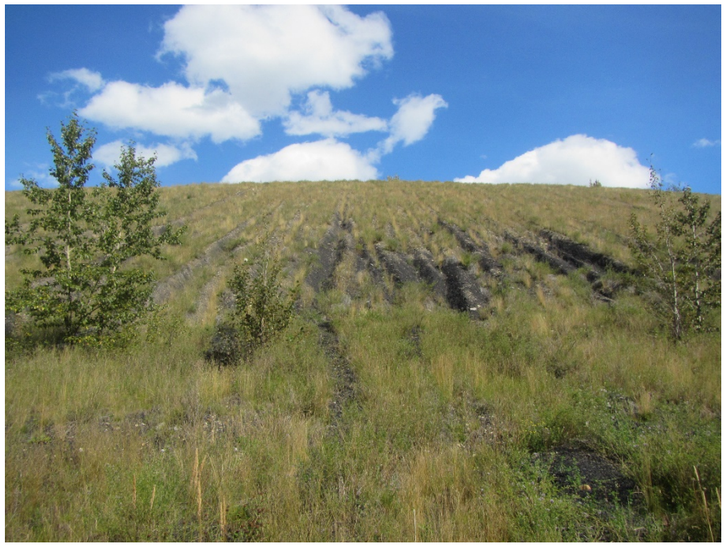
2017

2018

II-4 PTD-RILL-04

2015

2016



2017

2018

II-5 PTD-RILL-05

2015

2016

2017

2018

II-6 PTD-RILL-05A

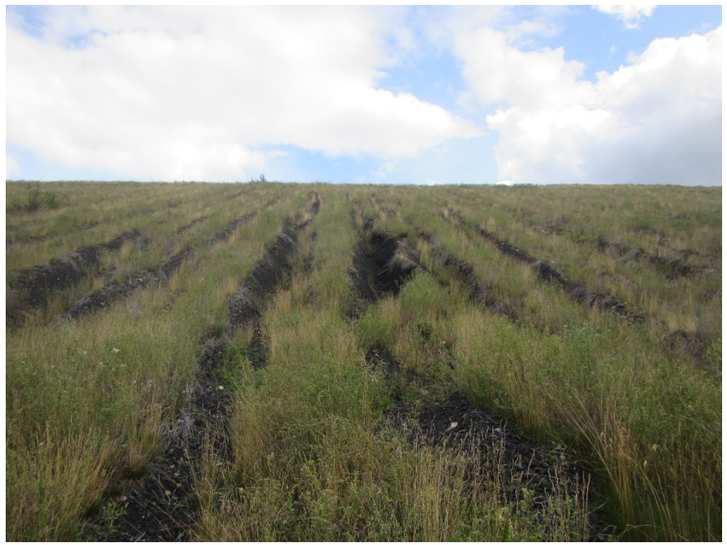
2016

2017

2018

II-7 PTD-RILL-05B

2016



2017

2018

II-8 PTD-RILL-06

2015

2016

2017

2018

II-9 PTD-RILL-06A

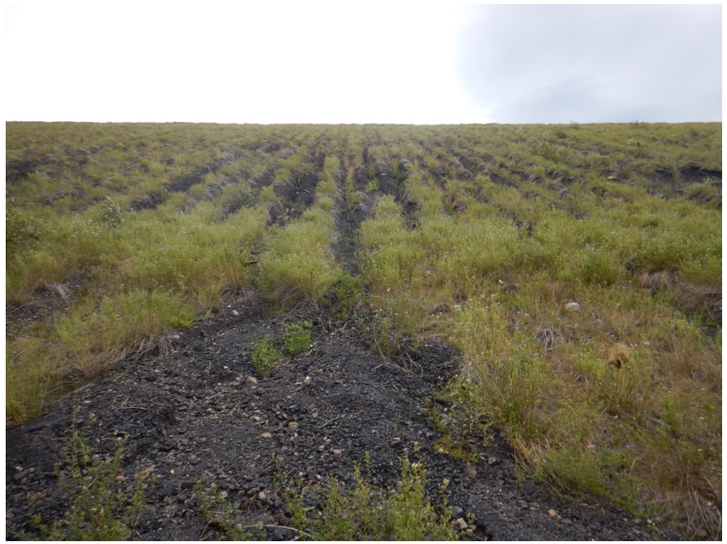
2016

2017

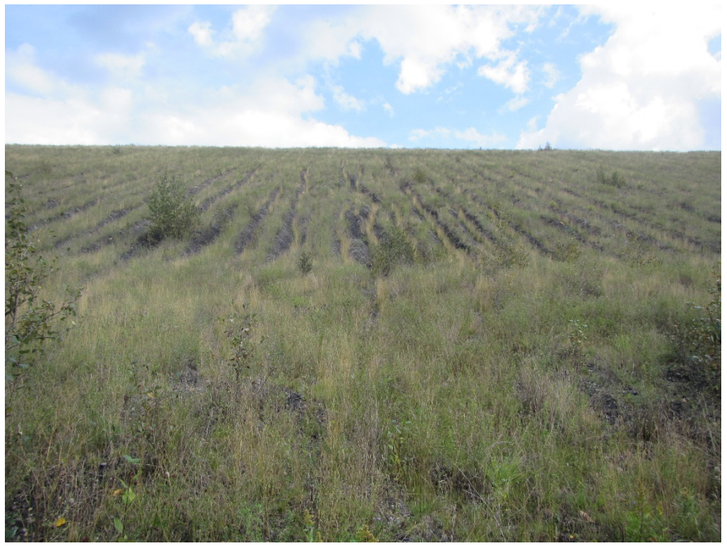
2018

II-10 PTD-RILL-07

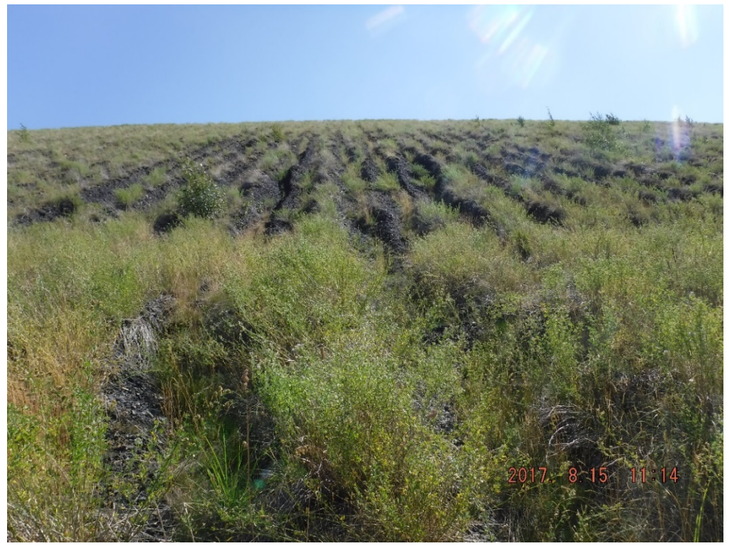
2015



2016



2017

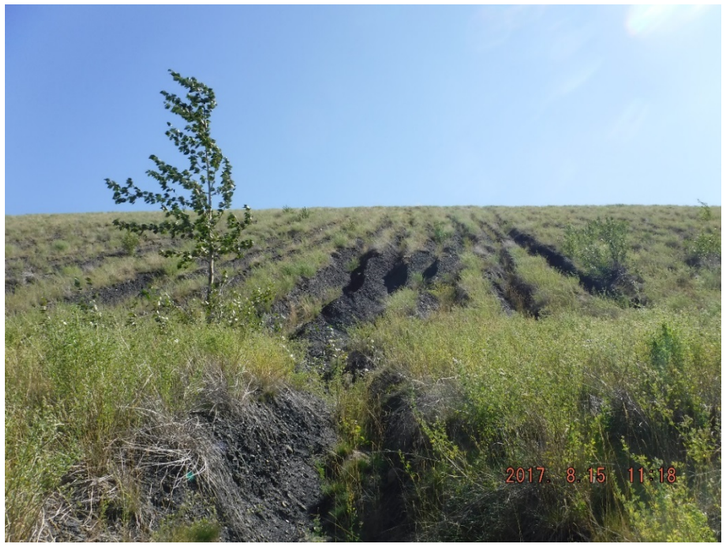


2018

II-11 PTD-RILL-07A

2016

2017

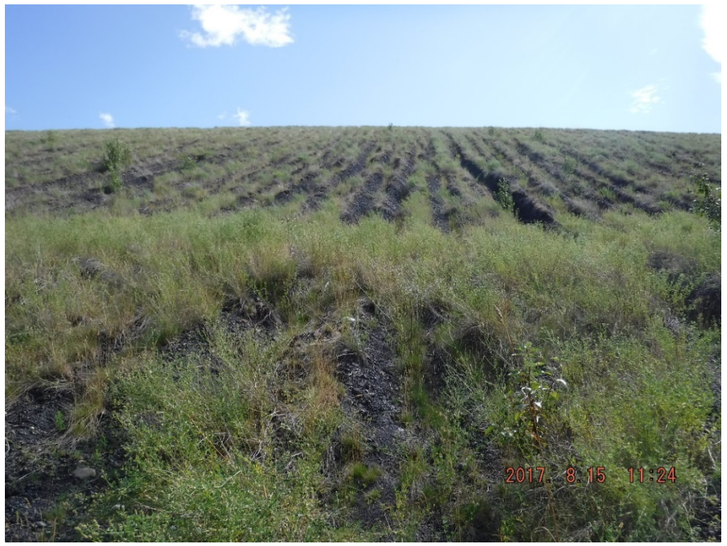


2018

II-12 PTD-RILL-07B

2016

2017



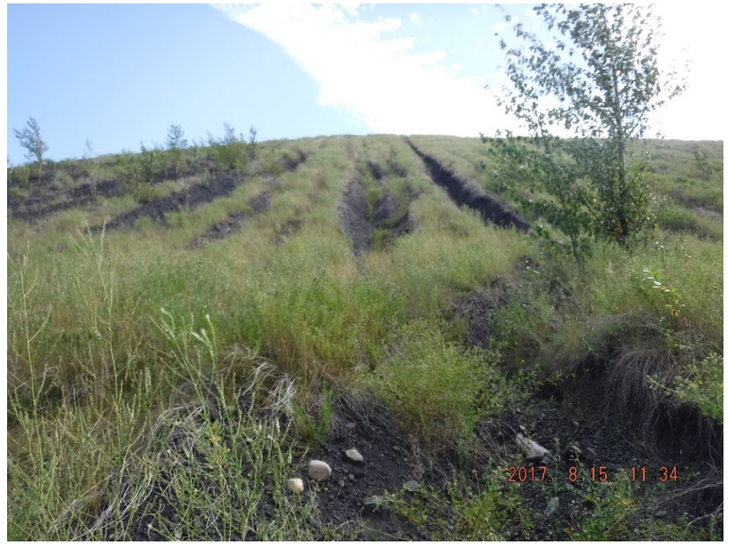
2018

II-13 PTD-RILL-08

2015

2016

2017



2018

II-14 PTD-RILL-09

2015

2016

2017

2018

II-15 PTD-RILL-10

2015

2016

2017

2018

II-16 PTD-RILL-11

2015

2016

2017

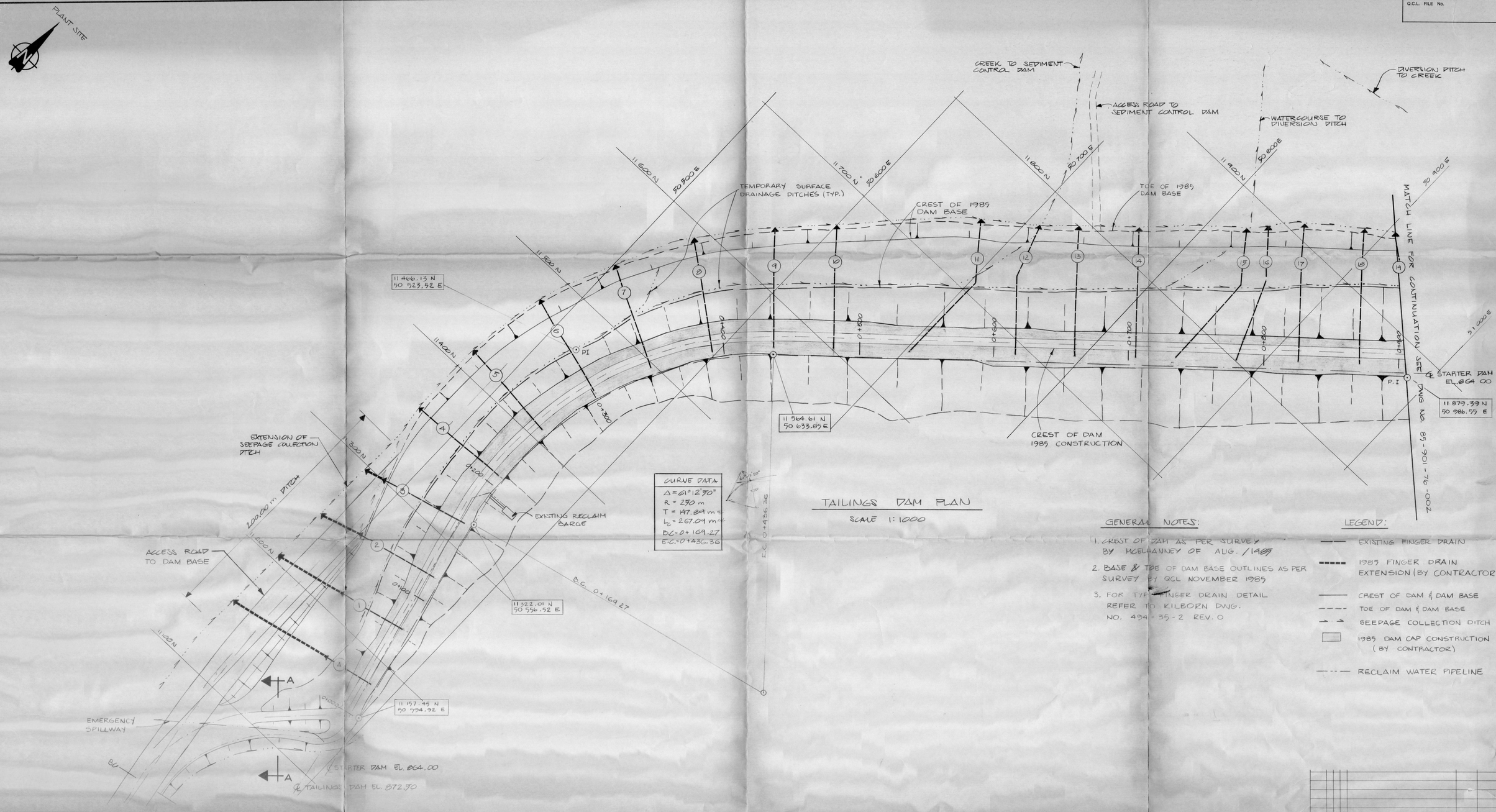
n/a

2018

APPENDIX III

Dam Design Drawings

Q.C.L. FILE No.



CURVE DATA
Δ = 61°12'30"
R = 250 m
T = 147.89 m
L_c = 267.09 m
BC = 0+169.27
EC = 0+436.36

TAILINGS DAM PLAN

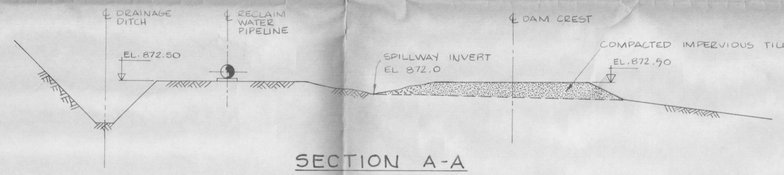
SCALE 1:1000

GENERAL NOTES:

1. CREST OF DAM AS PER SURVEY BY McELHANNEY OF AUG. /1985
2. BASE & TOE OF DAM BASE OUTLINES AS PER SURVEY BY QCL NOVEMBER 1985
3. FOR TYP. FINGER DRAIN DETAIL REFER TO KILBORN DWG. NO. 494-35-2 REV. 0

LEGEND:

- EXISTING FINGER DRAIN
- 1985 FINGER DRAIN EXTENSION (BY CONTRACTOR)
- CREST OF DAM & DAM BASE
- TOE OF DAM & DAM BASE
- SEEPAGE COLLECTION DITCH
- 1985 DAM CAP CONSTRUCTION (BY CONTRACTOR)
- RECLAIM WATER PIPELINE



SECTION A-A

THROUGH EMERGENCY SPILLWAY

SCALE HORIZ. 1:100
VERT. 1:1000

Rev.	D	M	Y	Revision Description	Drn.	Des.	App.
0	15	11	85	ORIGINAL DRAFT	KJV	WEM	WEM

QUINTETTE COAL LIMITED

Project Manager
DENISON MINES LIMITED
COAL DIVISION

Area TAILINGS POND | Category CIVIL

Drawing Title
1985 TAILINGS DAM CONSTRUCTION PROGRAM AS-BUILT DETAILS
(SHEET 1 of 2) FIG. 2.1

Scale	Drawing No.	Rev.
AS SHOWN	85-901-76-001	1

Q.C.L. FILE No.

PLANT SITE

DIVERSION DITCH TO CREEK

MATCH LINE - FOR CONTINUATION SEE DWG. NO. 85-901-76-001

50 900 E | 12 100 N | 51 000 E | 12 200 N | 51 100 E | 12 300 N | 51 200 E | 51 300 E | 51 400 E | 51 500 E | 51 600 E | 12 200 N | 12 100 N | 12 000 N | 11 900 N

1985 DAM BASE TOE

1985 DAM BASE CREST

SEEPAGE COLLECTION DITCH

TEMPORARY SURFACE DRAINAGE DITCH

20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 PI

0+000 | 0+100 | 0+200 | 0+300 | 0+400 | 0+500 | 0+600 | 0+700 | 0+800 | 0+900 | 1+000 | 1+100 | 1+200 | 1+300 | 1+400 | 1+500 | 1+600 | 1+700 | 1+800 | 1+900

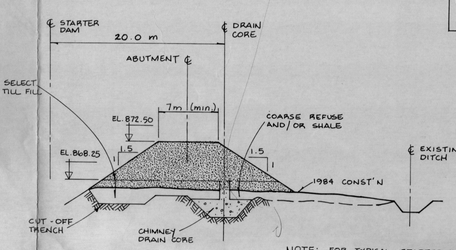
12663.26 N
51275.85 E

B

B

TAILINGS DAM PLAN

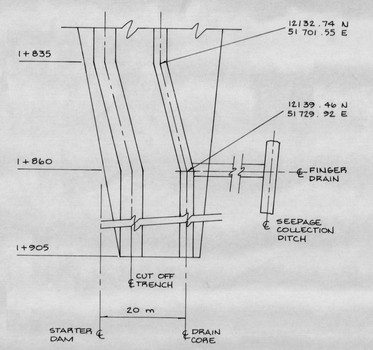
SCALE 1:1000



NOTE: FOR TYPICAL STARTER FILL ABUTMENT EXTENSION DETAIL REFER TO KILBORN DWG. NO. 494-35-1 REV. 2

TYPICAL ABUTMENT EXTENSION

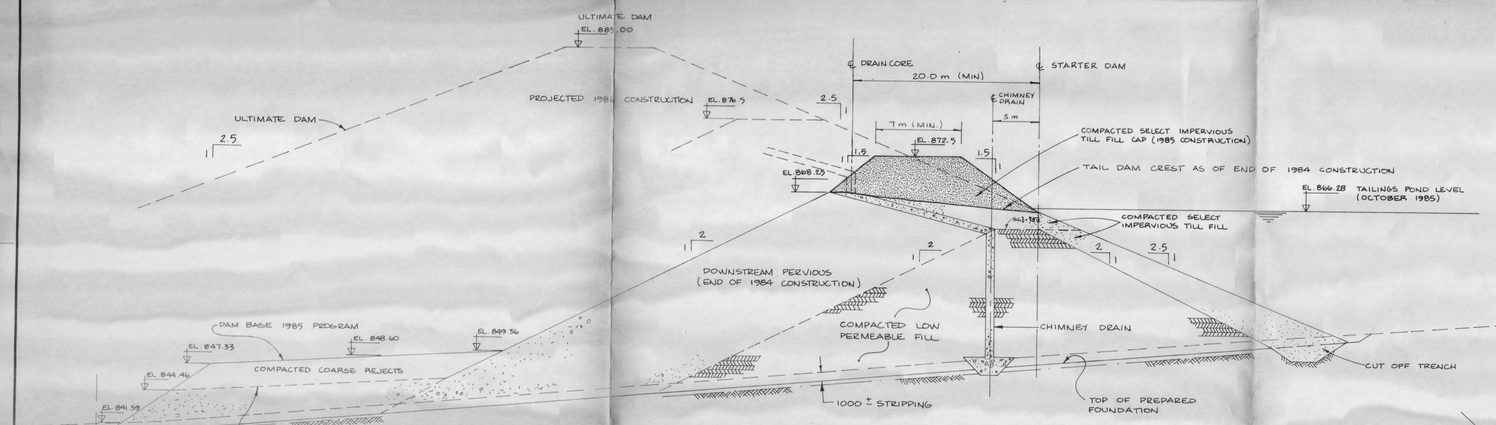
SCALE 1:250



NORTH ABUTMENT EXTENSION

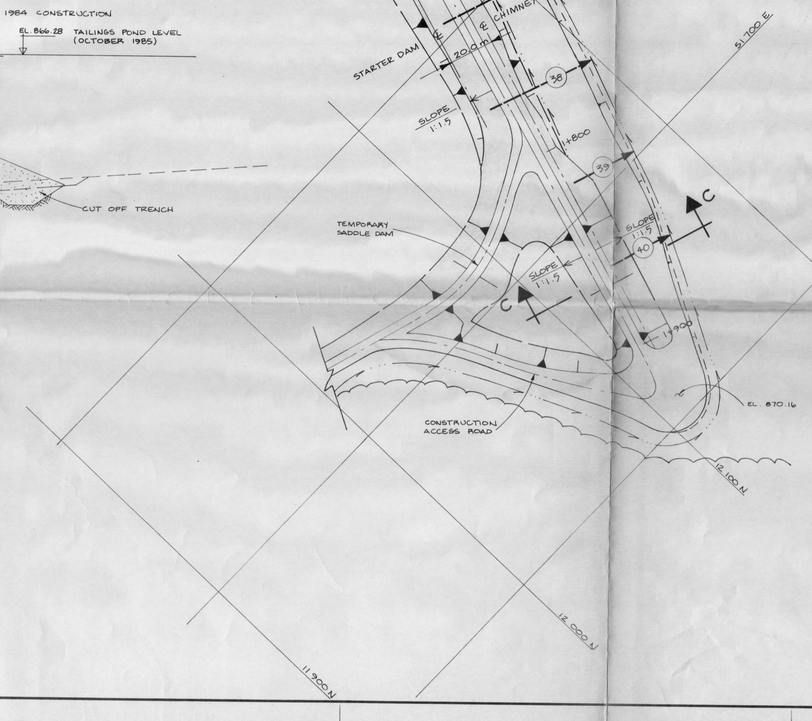
CUT-OFF TRENCH & DRAIN CORE RE-ALIGNMENT

(N.T.S.)



SECTION B-B (TYPICAL)

SCALE: HORIZ. 1:250
VERT. 1:250



Rev.	D	M	Y	Revision Description	Drn.	Des.	App.
0	18	11	85		KJV	WEM	WEM

QUINTETTE COAL LIMITED

Project Manager

DENISON MINES LIMITED

COAL DIVISION

Area	Category
TAILINGS POND	CIVIL

Drawing Title

1985 TAILINGS DAM CONSTRUCTION PROGRAM AS-BUILT DETAILS

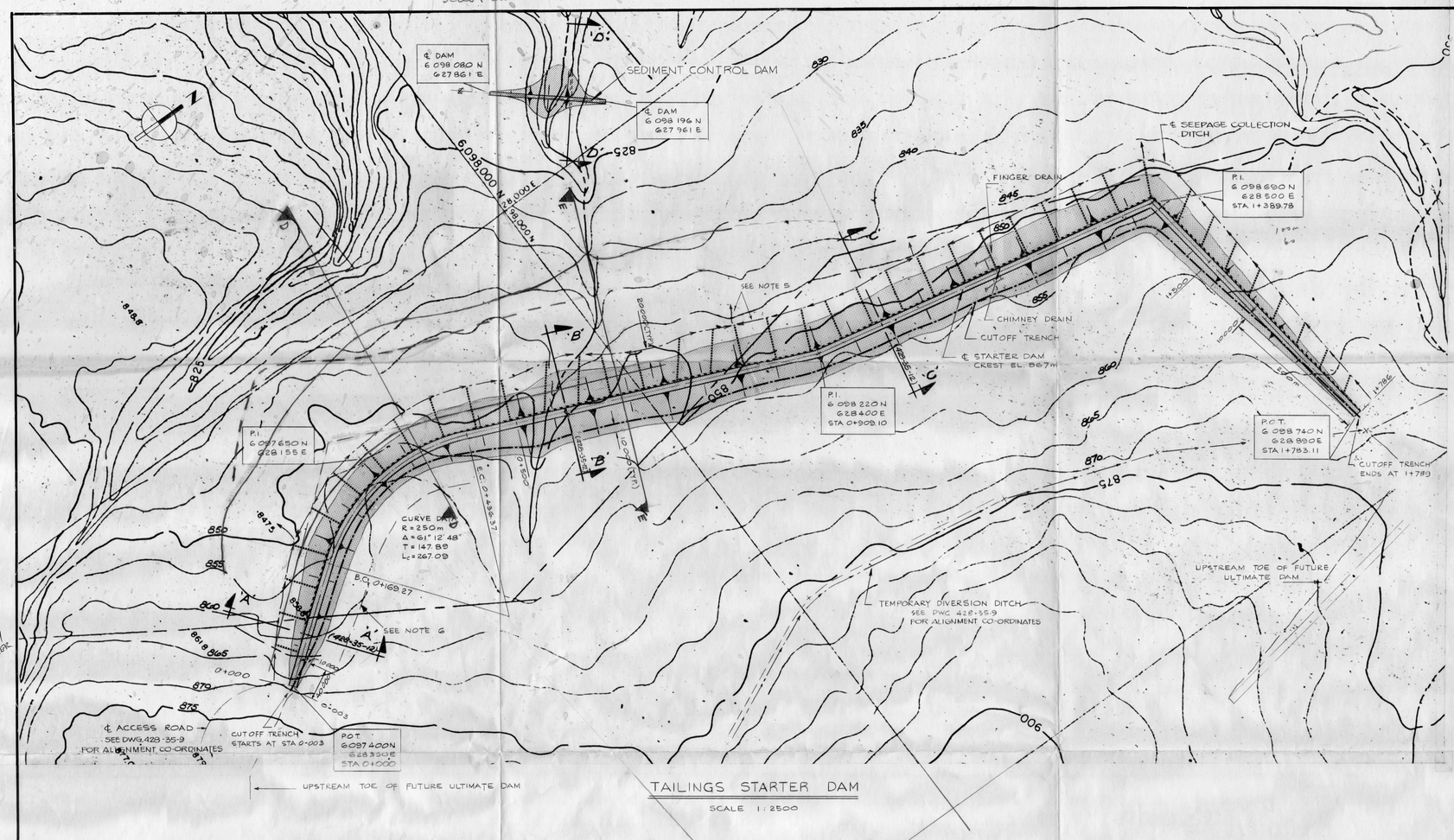
(SHEET 2 of 2)

FIG. 2.2

Scale	Drawing No.	Rev.
AS SHOWN	85-901-76-002	0

1:250
1" to 20.83'
1" to 6.35 metres

Scale 1:2500

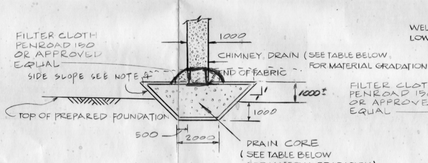


TAILINGS STARTER DAM

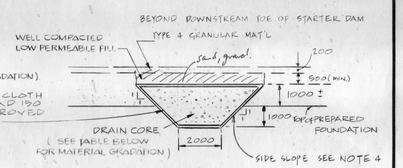
SCALE 1:2500

NOTES:

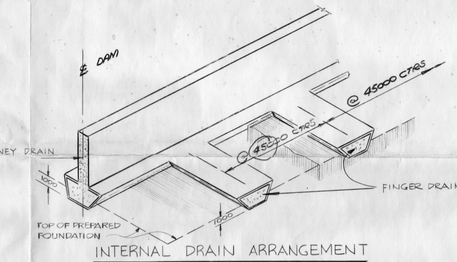
1. EXACT LOCATION AND INVERTS OF C.S.P. FOR SEDIMENT CONTROL DAM TO BE DETERMINED BY ENGINEER.
2. COMBINED U.T.M. FACTOR IS 0.99967
3. TYPICAL SECTIONS THROUGH TAILINGS STARTER DAM SEE DWG 428-35-12
4. SIDE SLOPE OF DRAIN CORE IS 1:1 OR AS DIRECTED BY ENGINEER.
5. SLOPE, INVERT ELEVATIONS AND DISCHARGE LOCATIONS FOR SEEPAGE COLLECTION DITCH TO BE PROVIDED BY THE ENGINEER. DIRECTION OF FLOW ARROWS ARE APPROXIMATE ONLY.
6. BORROW MATERIAL IS NOT TO BE EXCAVATED ANY CLOSER THAN 30m FROM THE UPSTREAM TOE OF THE TAILINGS DAM.



DETAIL 5
CHIMNEY DRAIN
SCALE 1:100



DETAIL 6
FINGER DRAIN
SCALE 1:100

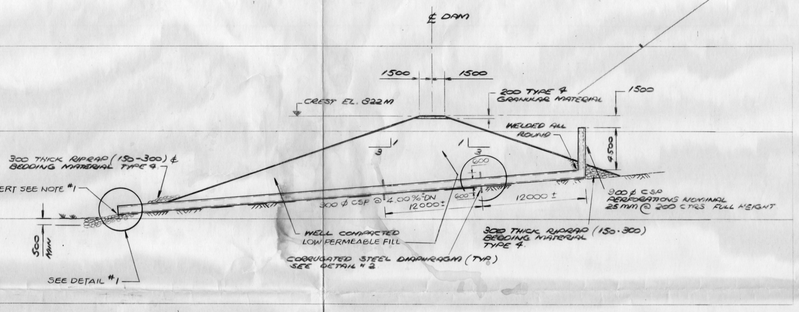


INTERNAL DRAIN ARRANGEMENT

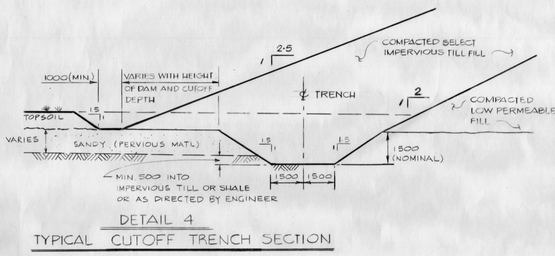
N.T.S.

MATERIAL GRADATION			
CHIMNEY DRAIN		DRAIN CORE & FINGER DRAINS	
PARTICLE SIZE mm	% FINER THAN	PARTICLE SIZE mm	% FINER THAN
10	100	40	100
4	80-95	20	80-100
1	45-60	10	30-60
0.4	25-42	4	0-20
0.1	0-15	2	0

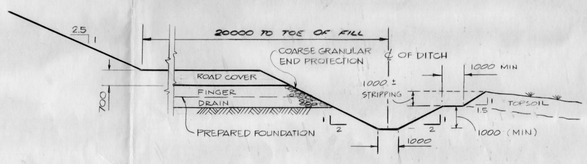
These conform to spec..



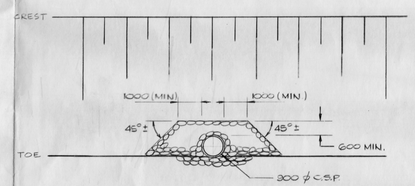
SECTION 'D-D'
SEDIMENT CONTROL DAM
SCALE - 1:250



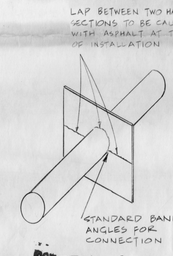
DETAIL 4
TYPICAL CUTOFF TRENCH SECTION
SCALE 1:100



DETAIL 3
SEEPAGE COLLECTION DITCH
SCALE 1:100



DETAIL 1
RIPRAP APRON CULVERT OUTLET
SCALE 1:100



OCT 4 1982 2

FOR TENDER

CONTRACT C433

DWG. NO.	REFERENCE DRAWINGS
428-35-3	TAILINGS AREA CLEARING PLAN
428-35-9	TAILINGS DISPOSAL IMPOUNDMENT AREA
400-35-1	SURFACE PLANT GEN. LOCATION PLAN

No.	DESCRIPTION	CLIENT	PROJ. ENG.	CHECK
	REVISIONS			

No.	DESCRIPTION
B	GENERAL REVISIONS FOR TENDER 1982 SEPT 20 WB
A	ISSUED FOR TENDER 1982 SEPT 12 P.L.

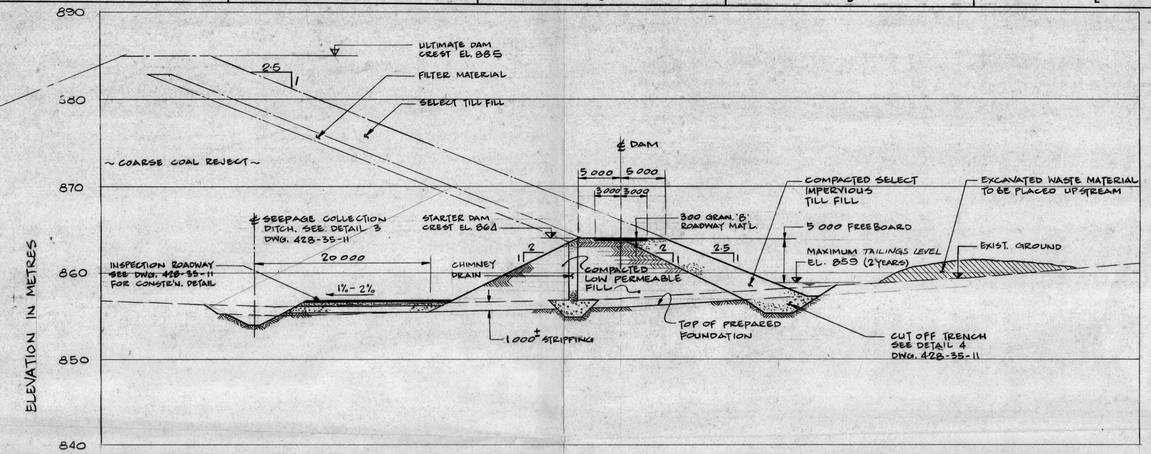
REVISIONS

SECTION:	CIVIL LAYOUT
SCALE:	AS NOTED DATE
DESIGNED BY:	S.J. 1982 SEPT 11
DRAWN BY:	P.L. 1982 SEPT 12
CHECKED BY:	
APPROVED BY:	

CLIENT: QUINTETTE COAL LIMITED
PROJECT MANAGER: DENISON MINES LIMITED VANCOUVER, B.C.
PROJECT LOCATION: DAWSON CREEK, B.C.

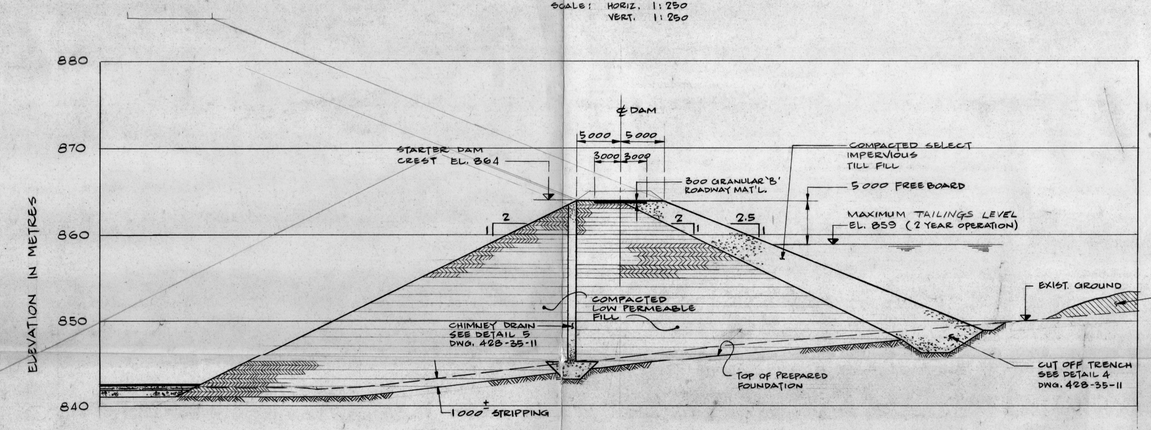
KILBORN

TITLE	B.O.M. No.	
QUINTETTE COAL PROJECT	PROJECT No. 7525	DIVISION No. 16
SURFACE PLANT TAILINGS DISPOSAL STARTER DAM, PLAN SECTIONS & DETAILS	DRAWING NUMBER 428-35-11	REV. B



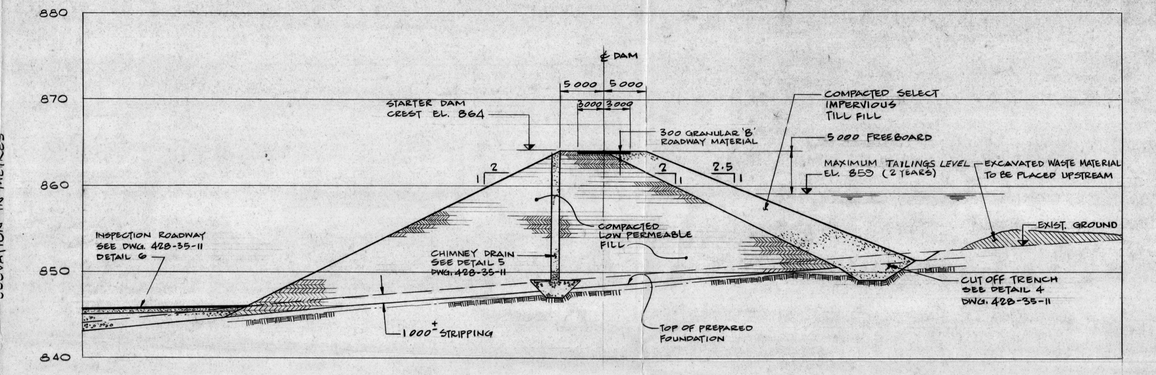
⚠ SECTION A-A (DWG. 428-35-11)

SCALE: HORIZ. 1:250
VERT. 1:250



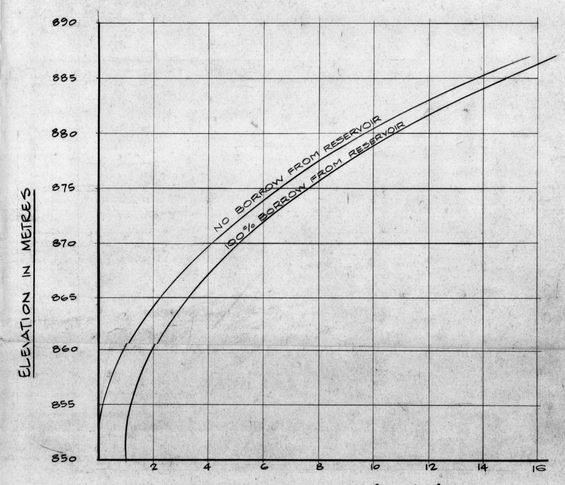
SECTION B-B (DWG. 428-35-11)

SCALE: HORIZ. 1:250
VERT. 1:250

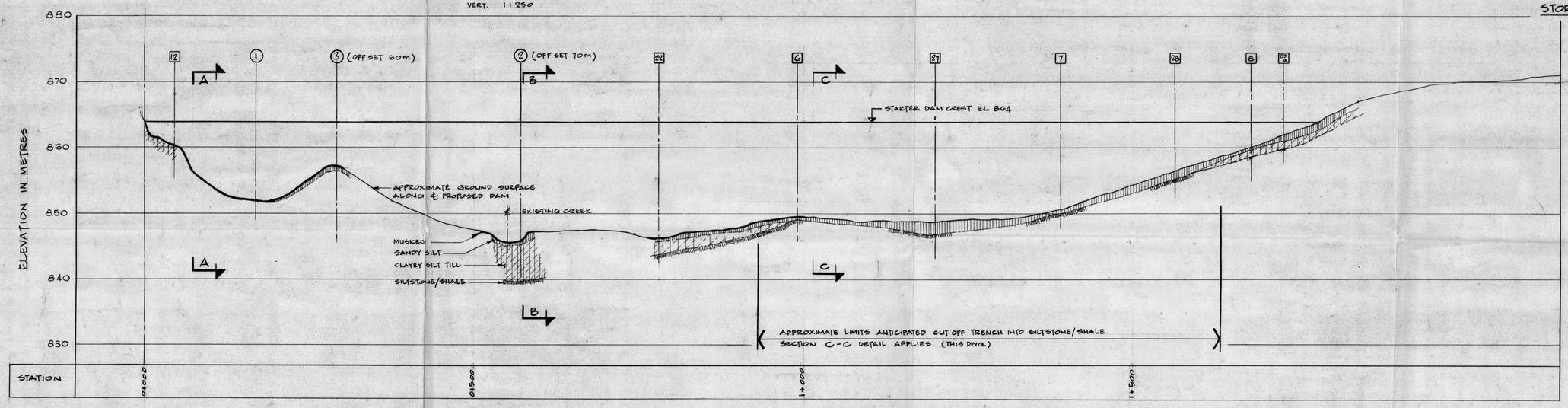


⚠ SECTION C-C (DWG. 428-35-11)

SCALE: HORIZ. 1:250
VERT. 1:250



STORAGE VOLUME $M^3 \times 10^6$ ⚠



⚠ PROFILE ON ℄ OF DAM (DWG. 428-35-11)

SCALE: HORIZONTAL: 1:2500
VERTICAL: 1:250

NOTES:
1. SOIL STRATIGRAPHY SHOWN ON SECTIONS AND PROFILE IS APPROXIMATE ONLY. REFER TO BOREHOLE LOGS FOR ACCURATE INFORMATION
2. ALL MUSKEG TO BE STRIPPED ACROSS FULL BASE WIDTH OF DAM. SANDY SILT / SILTY SAND MATERIAL TO BE COMPLETELY EXCAVATED AT CUT OFF TRENCH AND WHERE DISTURBED OVER BASE
3. CUT OFF TRENCH TO EXTEND MINIMUM OF 0.5 METRES INTO SILTSTONE/SHALE OR DENSE TILL WHICHEVER IS ENCOUNTERED FIRST OR AS DIRECTED BY THE ENGINEER
4. ⚠ STORAGE VOLUME CURVE CALCULATED FROM GROUND SURVEY INFORMATION (DEC. 82.)
5. ⚠ GROUND PROFILE FOR SECTIONS TAKEN FROM AERIAL SURVEY. ACCURACY IS NOT GUARANTEED.

LEGEND
(1) BOREHOLE
12 TEST PIT

REFERENCE DRAWINGS	
400-35-1	GENERAL - LOCATION PLAN
428-35-11	TAILS DISPOSAL - STARTER DAM - PLAN
428-35-9	TAILS DISPOSAL - IMPOUNDMENT AREA

NO.	DESCRIPTION	DATE	BY
1	ALL ELEVS REVISED, NOTES ADDED, ISSUED FOR CONSTRUCTION	JAN/83	PAM
0	ISSUED FOR CONSTRUCTION	DEC 1982	RG
A	RELEASED FOR TENDER		RG

(STORAGE CAPACITY CURVE REVISED)

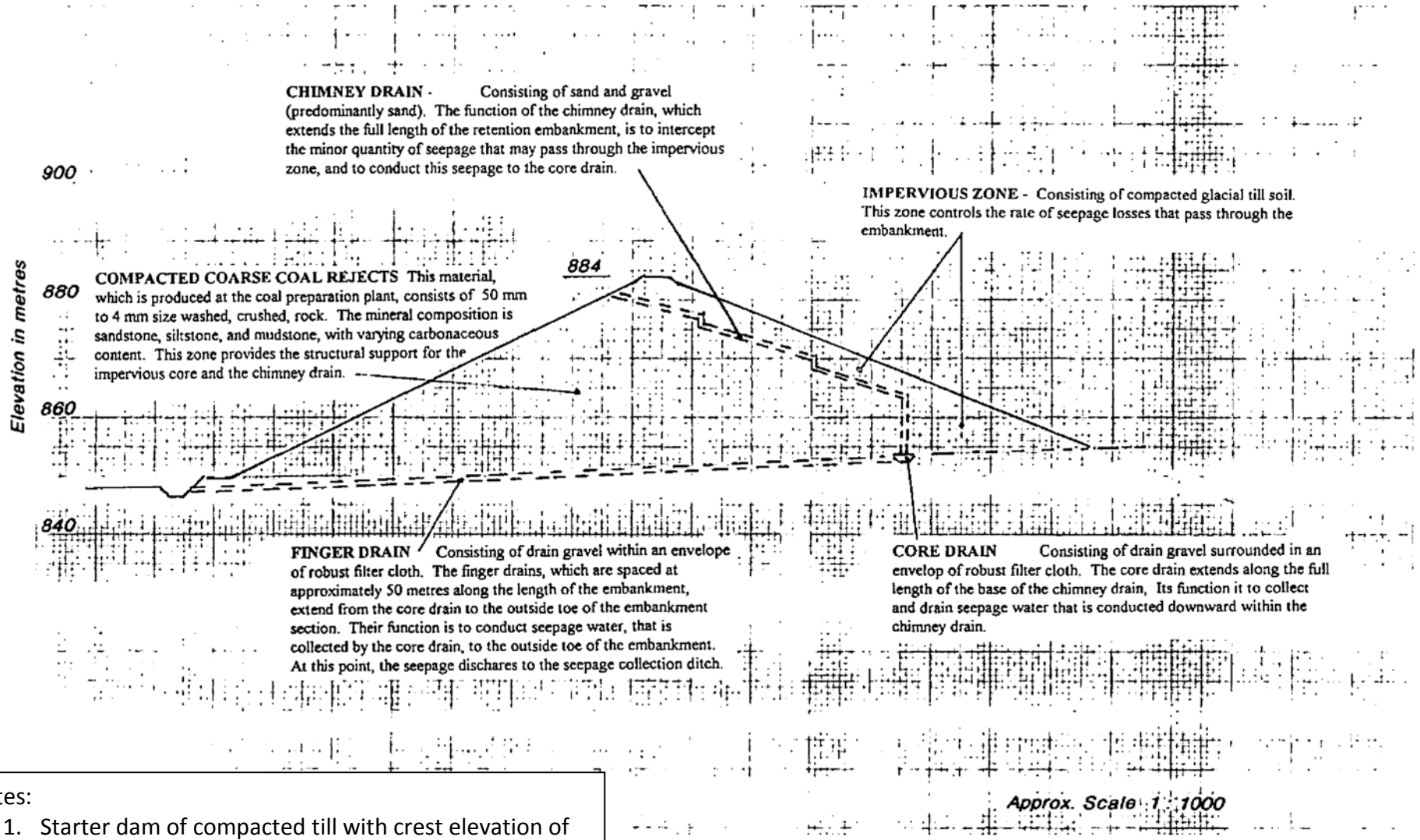
SECTION:	CIVIL LAYOUT
SCALE:	AS SHOWN
DESIGNED:	E.I. JURGENS SEPT. 82
DRAWN:	R. GRIGG SEPT. 23-82
CHECKED:	
APPROVED:	

CLIENT: QUINTETTE COAL LIMITED
PROJECT MANAGER: DENISON MINES LIMITED VANCOUVER, B.C.
PROJECT LOCATION: DAWSON CREEK, B.C.

KILBORN

TITLE	R.O.M. NO.	
QUINTETTE COAL PROJECT	PROJECT NO.	DIVISION NO.
SURFACE PLANT	7525	16
TAILINGS DISPOSAL	DRAWING NUMBER	
STARTER DAM	428-35-12	REV. 1
SECTIONS & PROFILE		

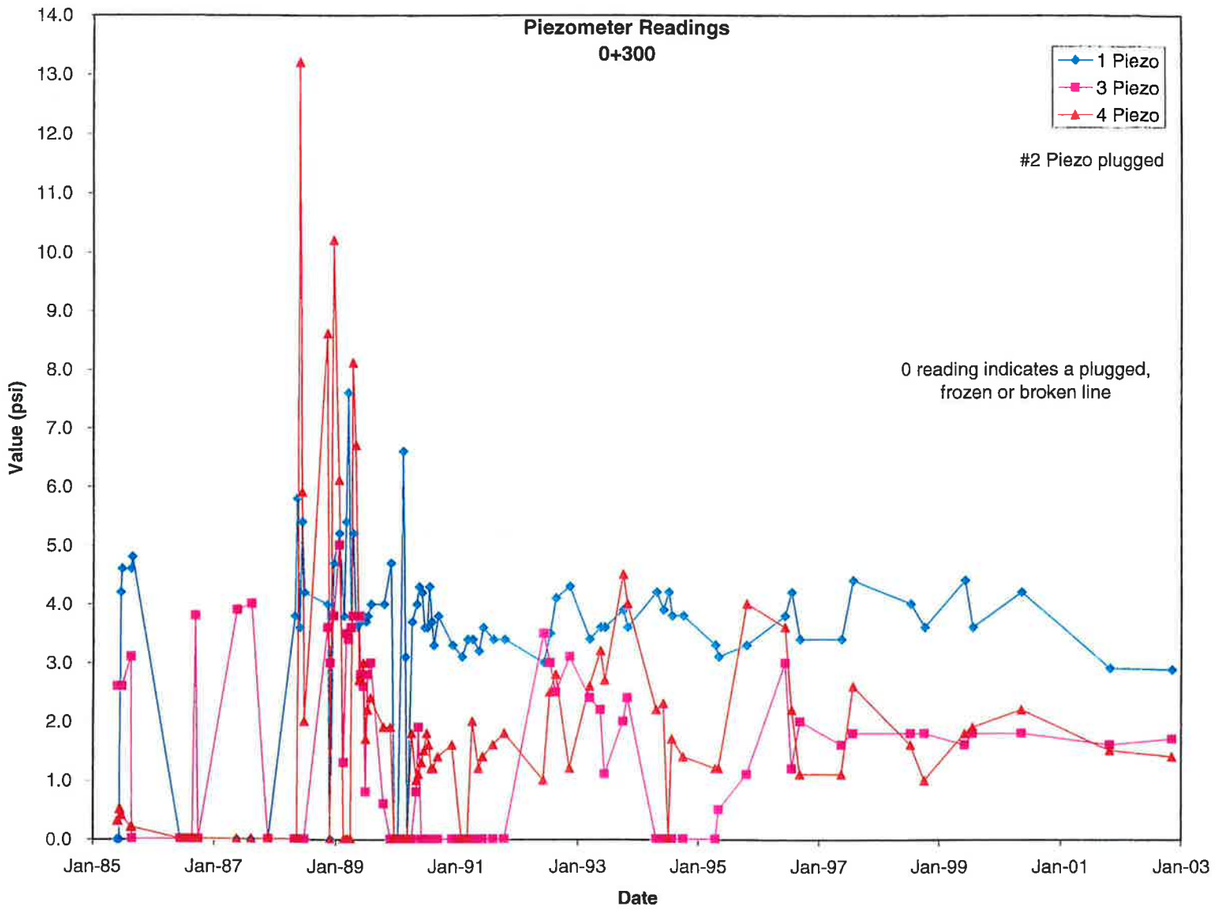
FORM KE-36 REV. 1 (AD)

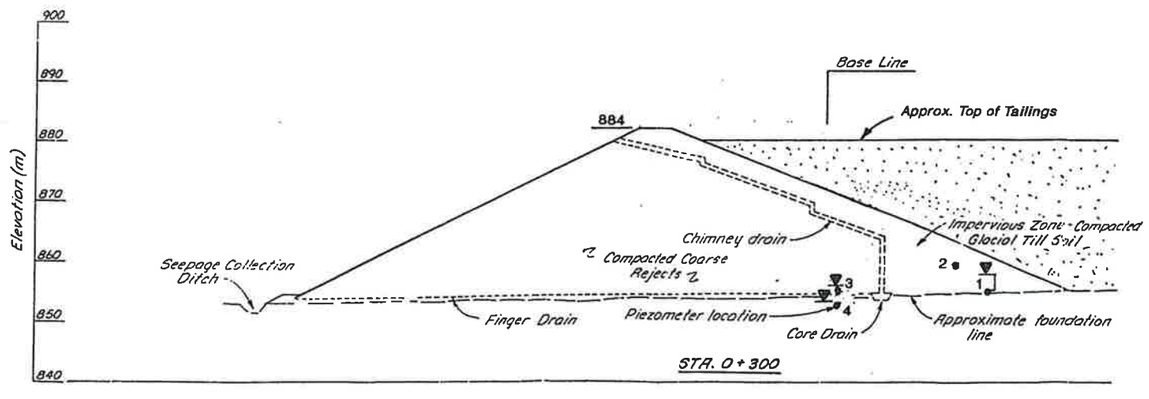


Notes:

1. Starter dam of compacted till with crest elevation of 864 m is not shown.

Project No. 962-1493 Drawn BAD Reviewed DBC Date Jan.'97	Golder Associates	QOC - TUMBLER RIDGE SECTION THROUGH CONFINING DYKE AT NORTH TAILINGS POND	Figure 3





Project No. 022-1520 Drawn BAD Reviewed Date Mar.'03

STATION 0+300

The piezometers at Station 0+300 are located within a vertical plane at horizontal distances of approximately 25 metres from the adjacent finger drains on either side of the plane.

Piezometer No. 1 is located on the upstream (pond) side of the Chimney/Core drain at shallow depth below the embankment fill/foundation surface of contact. Piezometer 2 within the compacted glacial till fill (impervious zone) on the upstream side of the chimney drain.

Piezometers 3 and 4 are located within the foundation soils on the downstream side of the core drain. Piezometer No. 4 is located at shallow depth below the fill/foundation contact, and Piezometer No. 3 is located at the fill/foundation surface of contact.

The piezometric pressures that have been recorded over the past decade indicate that significant head loss occurs as the seepage water passes through the settled tails and through the zone of compacted glacial till fill (the impervious zone) on the upstream side of the chimney drain. On the downstream side of the chimney drain, the piezometric head remains low.

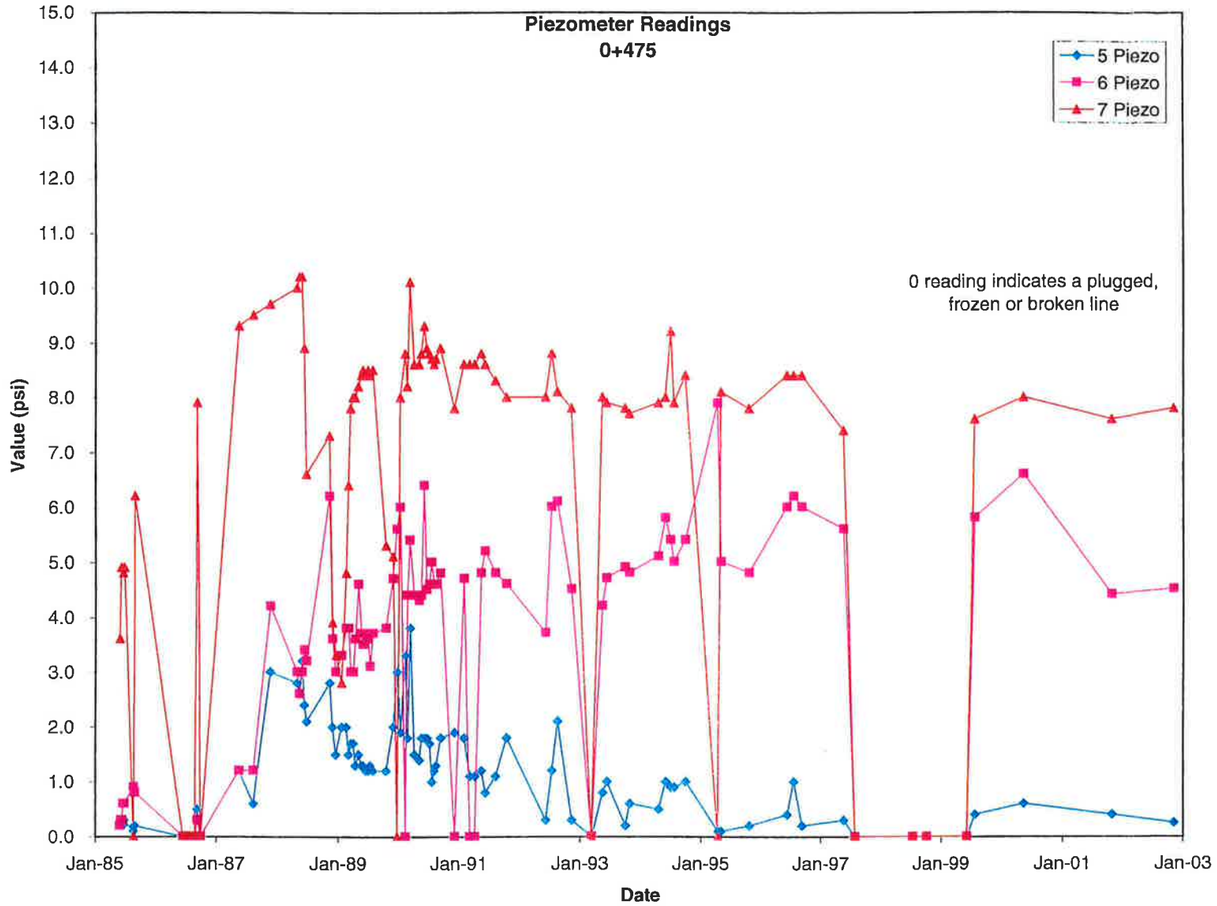
NOTES

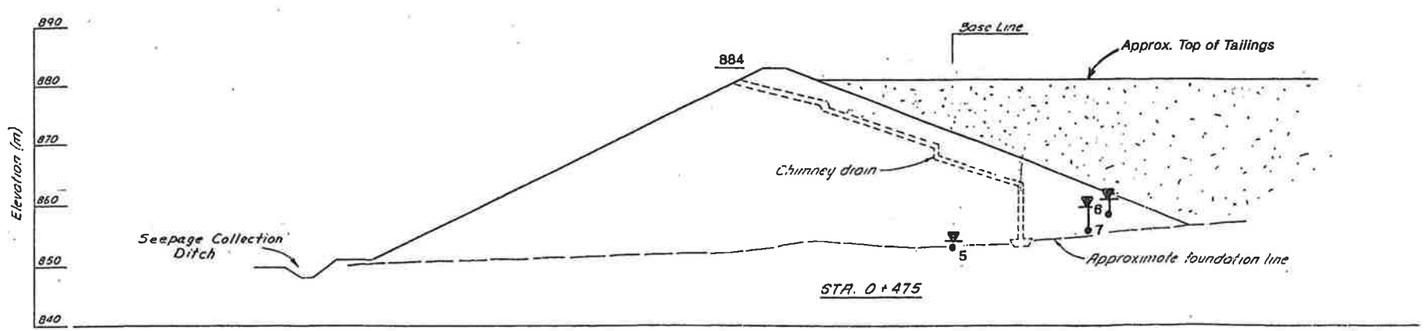
1 Location of section is shown on Figure B1 of this Appendix.
2 1 (one) psi of pressure is equivalent to a head of 0.704 metres of water. Plotted piezometric heights above piezometer tips are to scale.
3 Occasional zero readings at a piezometer are an indication that the piezometer leads were frozen or otherwise blocked at the time of the readings.

Golder Associates

QOC – NORTH TAILINGS DAM
PIEZOMETER DATA – STATION 0 + 300

Figure **B-2**





STATION 0+475

The piezometers at Station 0+475 are located within a vertical plane at horizontal distances of approximately 25 metres from the adjacent finger drains on either side of the plane.

Piezometers 6 and 7 are located on the upstream (pond) side of the Chimney/Core drain at shallow depth below the embankment fill/foundation surface of contact. Piezometer 6 is located within the compacted glacial till fill (impervious zone) on the upstream side of the chimney drain, and Piezometer 7 is located at the fill/foundation contact.

Piezometer No. 5 is located within the foundation soils on the downstream side of the core drain at a shallow depth below the fill/foundation contact.

The piezometric pressures that have been recorded over the past decade indicate that significant head loss occurs as the seepage water passes through the settled tails and through the zone of compacted glacial till fill (the impervious zone) on the upstream side of the chimney drain.

The piezometer data show that the bulk of the section remains well drained. These low piezometric levels contribute to the stability of the embankment section.

NOTES

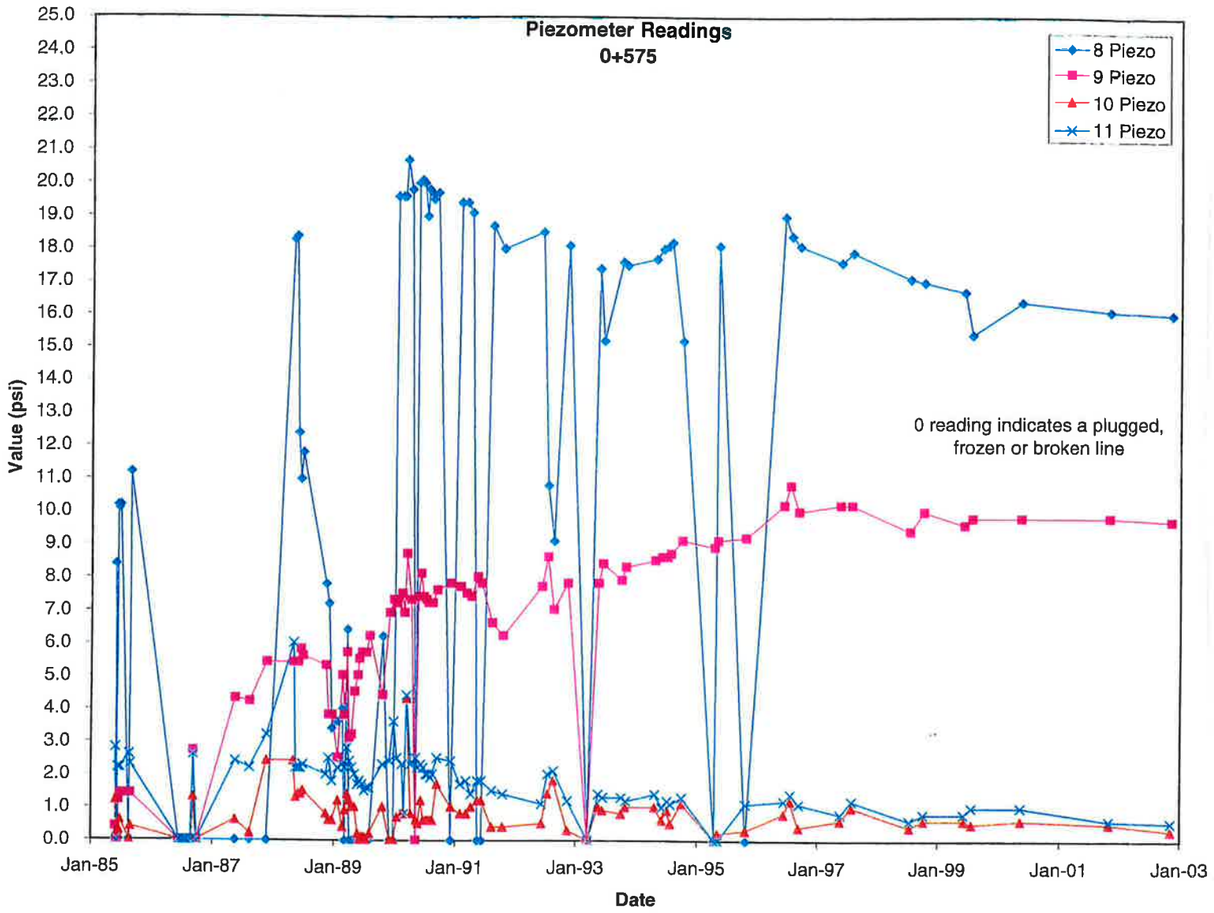
1. Location of section is shown on Figure B1 of this Appendix.
2. 1 (one) psi of pressure is equivalent to a head of 0.704 metres of water. Plotted piezometric heights above piezometer tips are to scale.
3. Occasional zero readings at a piezometer are an indication that the piezometer leads were frozen or otherwise blocked at the time of the readings.

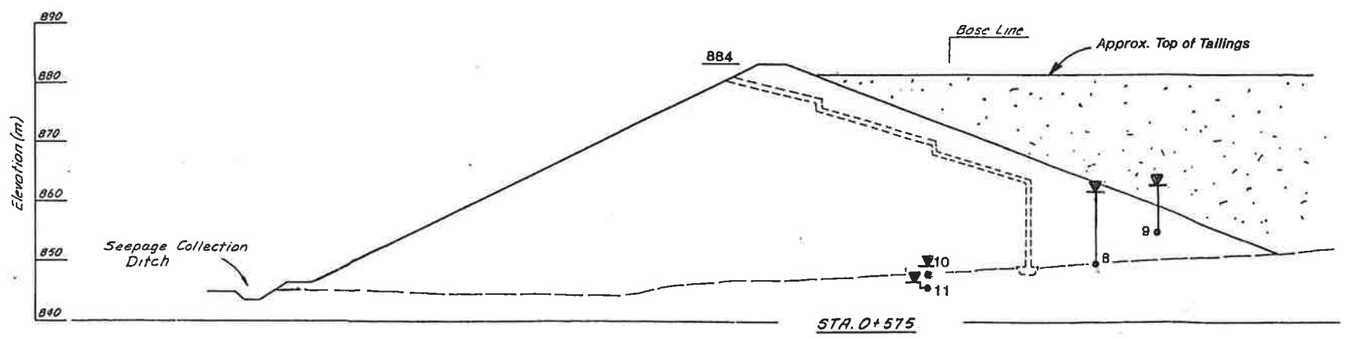
Project No. 022-1520 Drawn BAD Reviewed Date Mar.'03

Golder Associates

QOC – NORTH TAILINGS DAM
PIEZOMETER DATA – STATION 0 + 475

Figure **B–3**





STATION 0+575

The piezometers at Station 0+575 are located within a vertical plane at horizontal distances of approximately 25 metres from the adjacent finger drains on either side of the plane.

Piezometers 8 and 9 are located upstream (inside) of the Chimney/Core drain. Piezometer No. 8 is at shallow depth below the fill/foundation surface of contact, and Piezometer No. 9 is located within the compacted glacial till fill on the upstream (pond) side of the chimney/core drain.

Piezometers 10 and 11 are located within the foundation soils on the downstream side of the core drain. Piezometer No. 11 is located at shallow depth below the fill/foundation surface of contact, and Piezometer No. 10 is located at the fill/foundation interface.

The piezometric levels at Piezometers 8 and 9 indicate that a significant head loss occurs as seepage passes from the pond, and through the settled tails and the impervious glacial till fill.

The piezometric heads at Piezometers 10 and 11, downstream of the chimney drain, have remained at 1 metre or less over the past 7 years.

The piezometric pressures that have been recorded over the past decade indicate that significant head loss occurs as the seepage water passes through the settled tails and through the zone of compacted glacial till fill (the impervious zone) on the upstream side of the chimney drain. On the downstream side of the chimney drain, the piezometric pressures are insignificant, relative to the stresses imposed by the overlying fill and the settled tails.

The piezometer data show that the bulk of the section remains well drained. The low piezometric levels on the downstream (outside) of the chimney drain contribute to the stability of the embankment.

NOTES

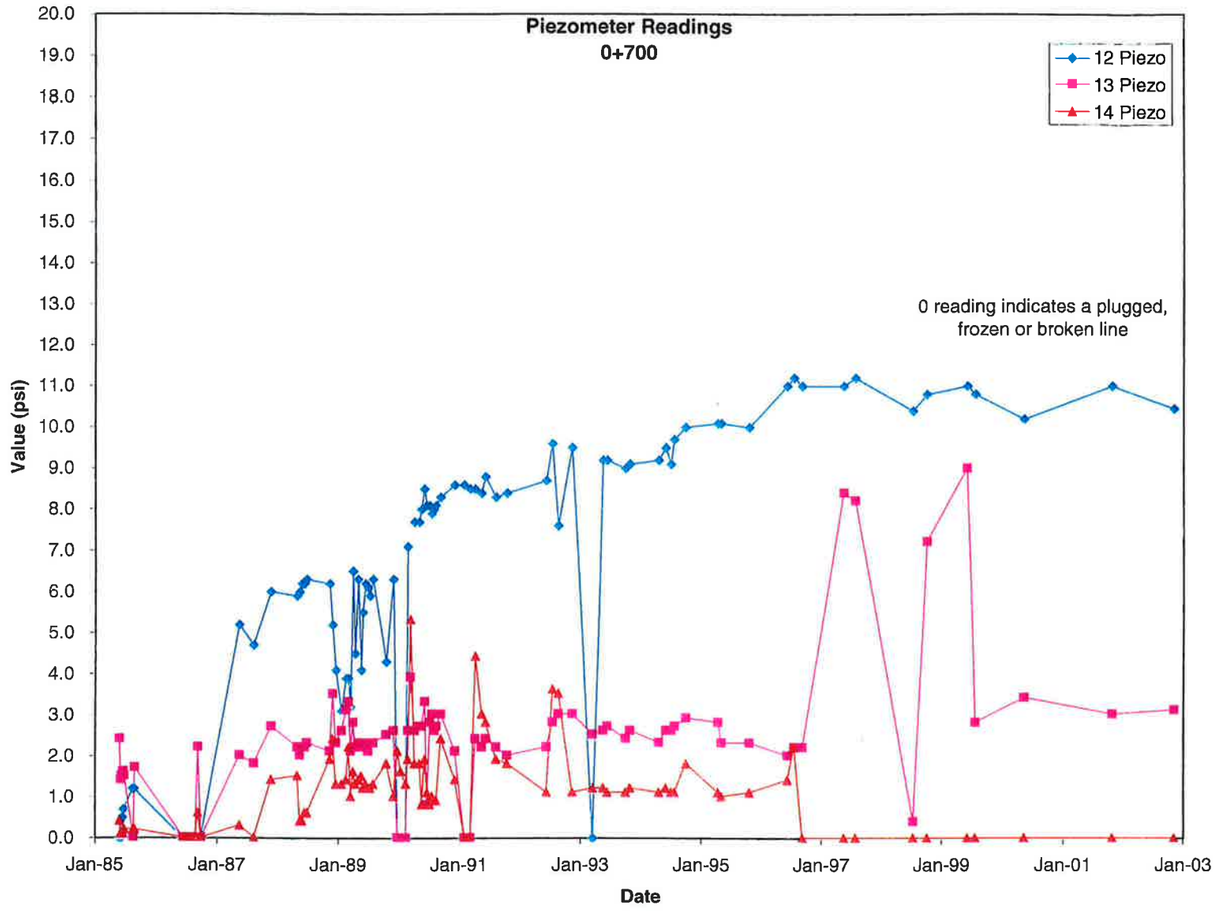
1. Location of section is shown on Figure B1 of this Appendix.
2. 1 (one) psi of pressure is equivalent to a head of 0.704 metres of water. Plotted piezometric heights above piezometer tips are to scale.
3. Occasional zero readings at a piezometer are an indication that the piezometer leads were frozen or otherwise blocked at the time of the readings.

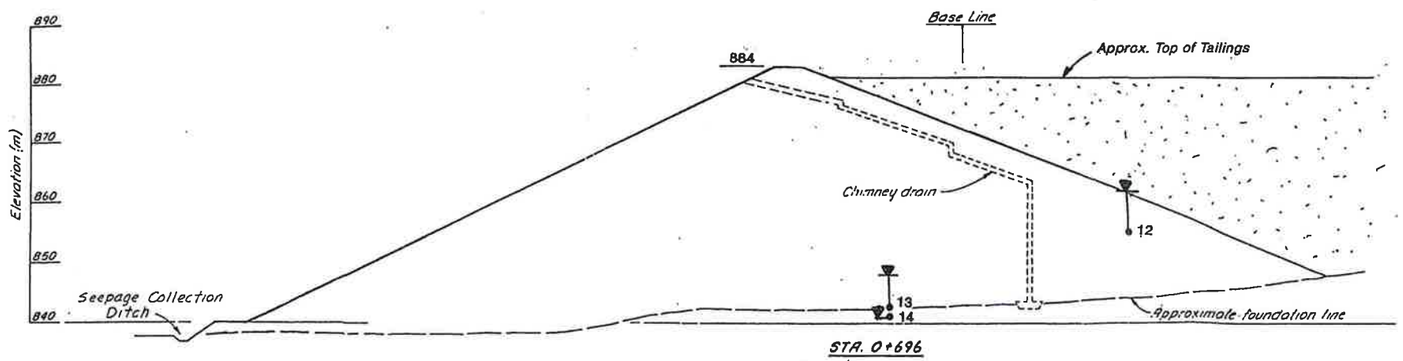
Project No. 022-1520 Drawn BAD Reviewed Date Mar.'03

Golder Associates

QOC – NORTH TAILINGS DAM
PIEZOMETER DATA – STATION 0 + 575

Figure **B-4**





STATION 0+700

The piezometers at Station 0+696 are located within a vertical plane at horizontal distances of approximately 25 metres from the adjacent finger drains on either side of the plane.

Piezometer 12 is located within the compacted glacial till fill on the upstream (pond) side of the Chimney/Core drain.

Piezometers 13 and 14 are located within the foundation soils on the downstream side of the core drain. Piezometer No. 14 is located at shallow depth below the fill/foundation contact, and Piezometer No. 13 is located at the fill/foundation interface.

The piezometric pressures that have been recorded over the past decade indicate that significant head loss occurs as the seepage water passes through the settled tails and through the zone of compacted glacial till fill (the impervious zone) on the upstream side of the chimney drain. Piezometer No. 12 within the compacted glacial till fill has been constant for the last 4 years.

The piezometer data show that the bulk of the section remains well drained. The low piezometric levels on the downstream (outside) of the chimney drain contribute to the stability of the embankment.

NOTES

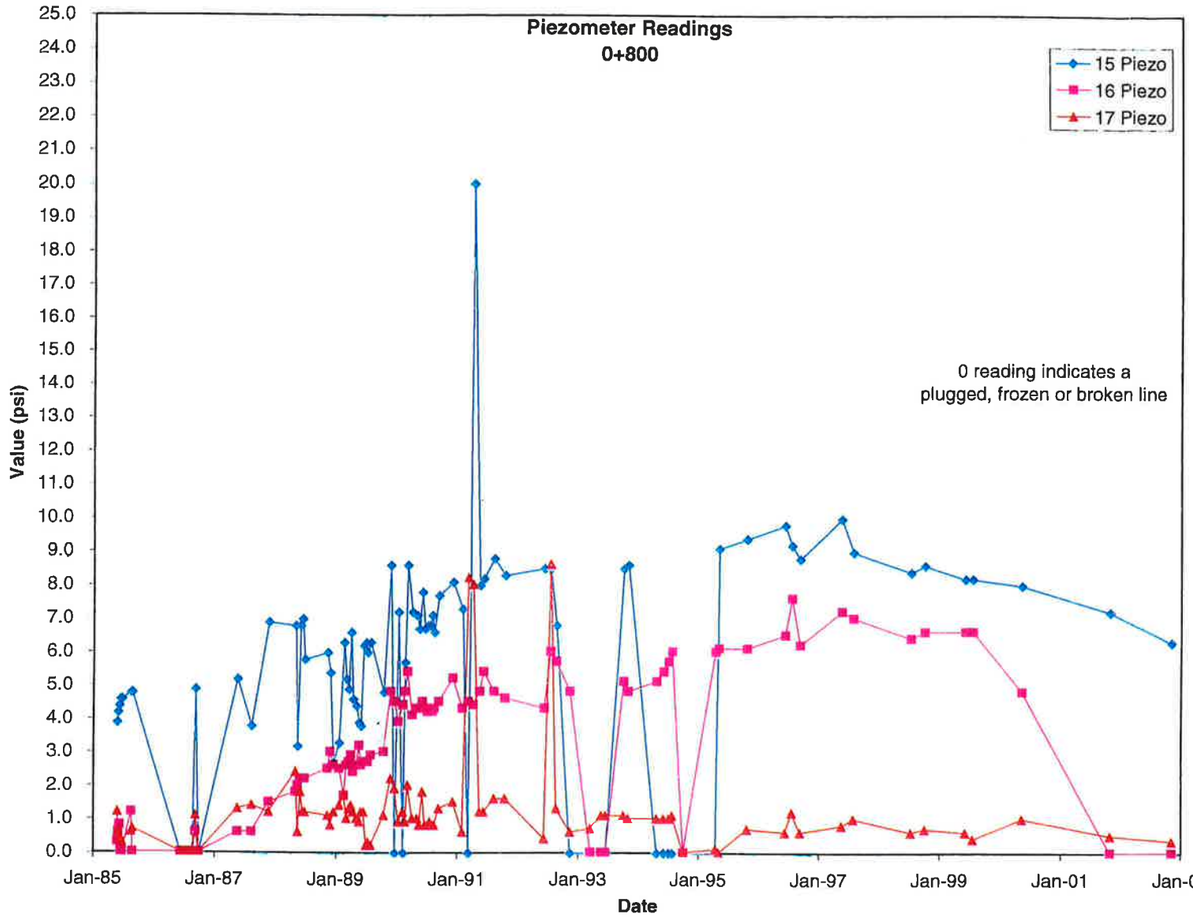
1. Location of section is shown on Figure B1 of this Appendix.
2. 1 (one) psi of pressure is equivalent to a head of 0.704 metres of water. Plotted piezometric heights above piezometer tips are to scale.
3. Occasional zero readings at a piezometer are an indication that the piezometer leads were frozen or otherwise blocked at the time of the readings.

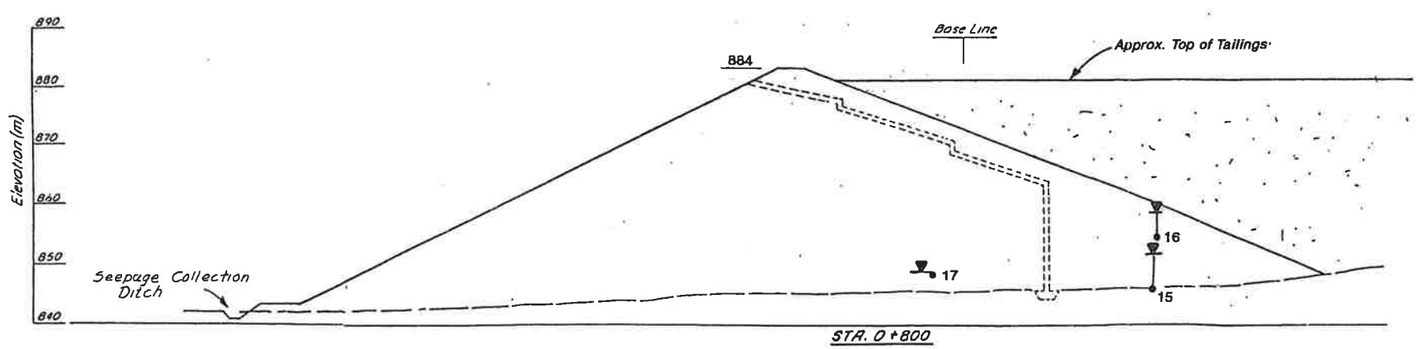
Project No. 022-1520 Drawn BAD Reviewed Date Mar.'03

Golder Associates

QOC – NORTH TAILINGS DAM
PIEZOMETER DATA – STATION 0 + 700

Figure **B-5**





STATION 0+800

The piezometers at Station 0+800 are located within a vertical plane at horizontal distances of approximately 25 metres from the adjacent finger drains on either side of the plane.

Piezometers 15 and 16 are located on the upstream (pond) side of the Chimney/Core drain. Piezometer 15 is located at shallow depth below the embankment fill/foundation interface. Piezometer 16 is located within the compacted glacial till fill (impervious zone) on the upstream side of the chimney drain.

Piezometer No. 17 is located within the compacted Coarse Reject fill, at a modest height about the foundation/fill surface of contact.

The piezometric pressures that have been recorded over the past decade indicate that significant head loss occurs as the seepage water passes through the settled tails and through the zone of compacted glacial till fill (the impervious zone) on the upstream side of the chimney drain.

The piezometer data show that the bulk of the section remains well drained. The low piezometric levels contribute to the stability of the embankment section.

NOTES

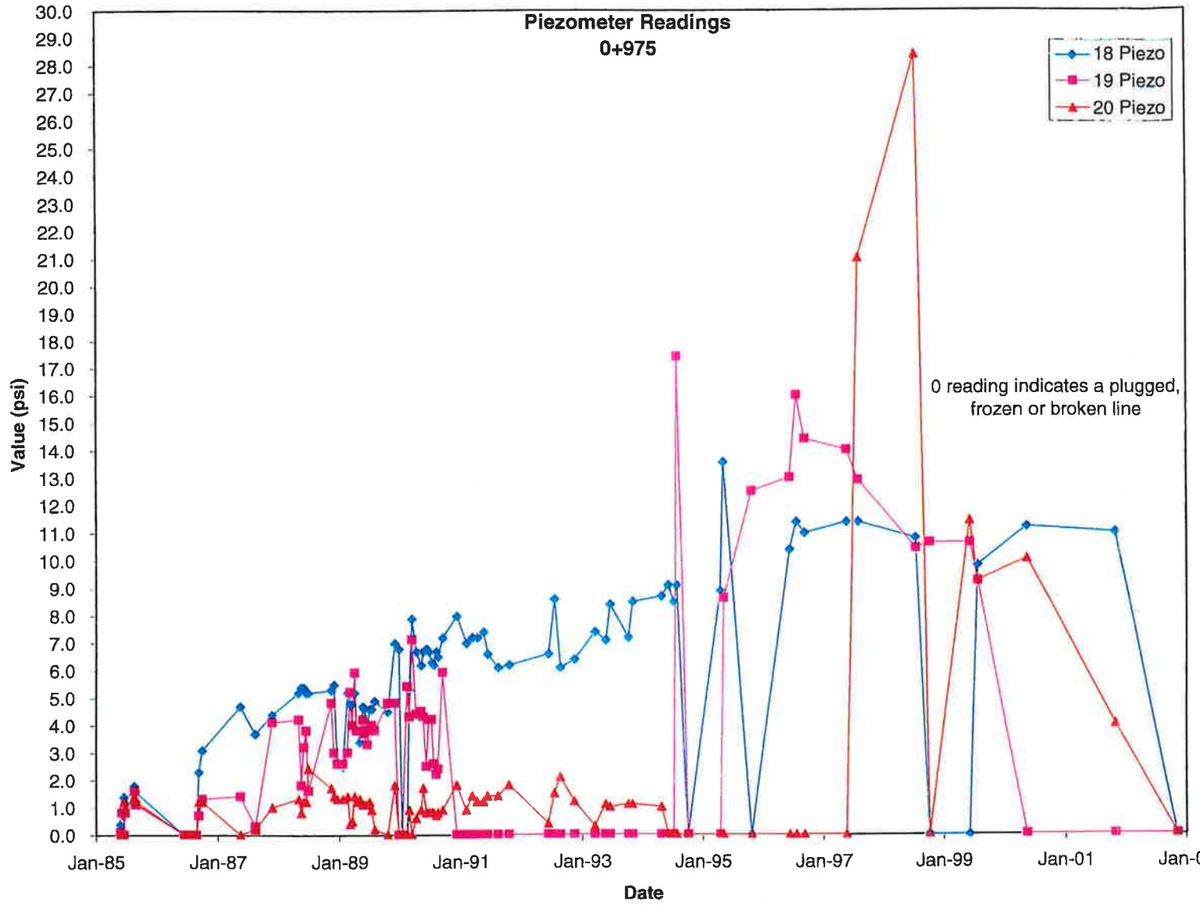
1. Location of section is shown on Figure B1 of this Appendix.
2. 1 (one) psi of pressure is equivalent to a head of 0.704 metres of water. Plotted piezometric heights above piezometer tips are to scale.
3. Occasional zero readings at a piezometer are an indication that the piezometer leads were frozen or otherwise blocked at the time of the readings.

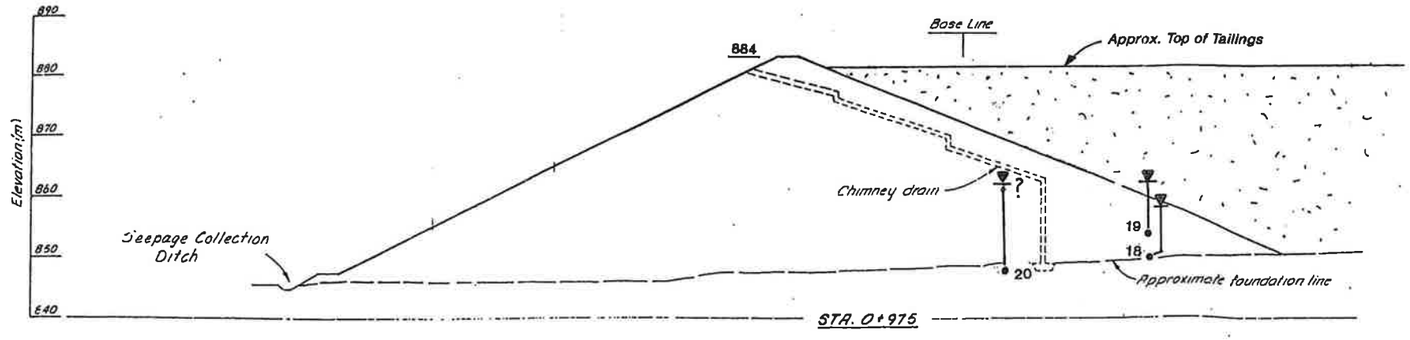
Project No. 022-1520 .... Drawn BAD .... Reviewed .... Date Mar.'03

Golder Associates

QOC – NORTH TAILINGS DAM
PIEZOMETER DATA – STATION 0 + 800

Figure **B-6**





STATION 0+975

The piezometers at Station 0+975 are located within a vertical plane which is approximately 25 metres horizontally from the adjacent finger drains on either side of the plane.

Piezometers 18 and 19 are located on the upstream (pond) side of the Chimney/Core drain. Piezometer 18 is located at shallow depth below the embankment fill/foundation interface, and piezometer No. 19 is located within the compacted glacial till fill (impervious zone) on the upstream side of the chimney drain.

Piezometer No. 20 is located within the in situ foundation soils, at shallow depth below the base of the compacted embankment fill.

The piezometer data show that the bulk of the section remains well drained. These low piezometric levels contribute to the stability of the embankment section.

NOTES

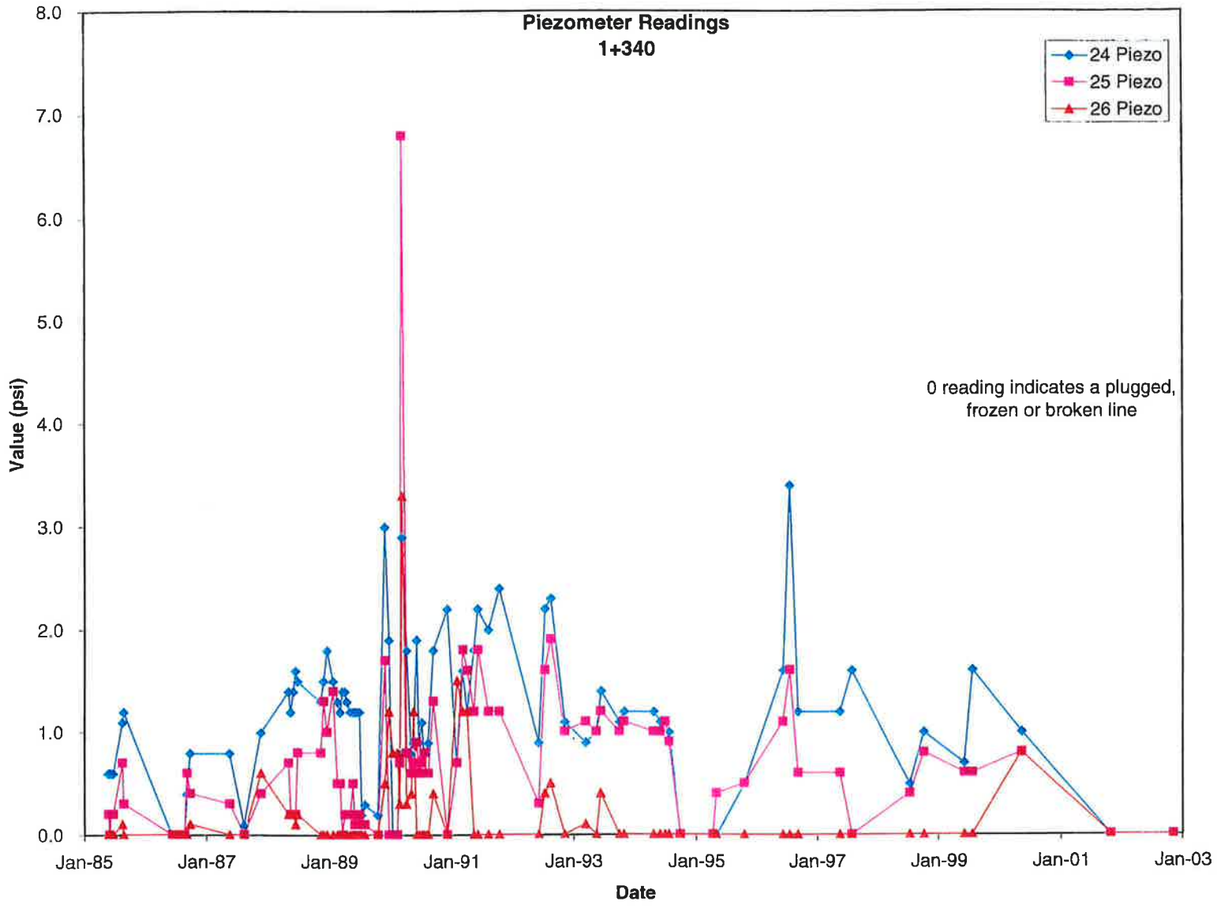
1. Location of section is shown on Figure B1 of this Appendix.
2. 1 (one) psi of pressure is equivalent to a head of 0.704 metres of water. Plotted piezometric heights above piezometer tips are to scale.
3. Occasional zero readings at a piezometer are an indication that the piezometer leads were frozen or otherwise blocked at the time of the readings.

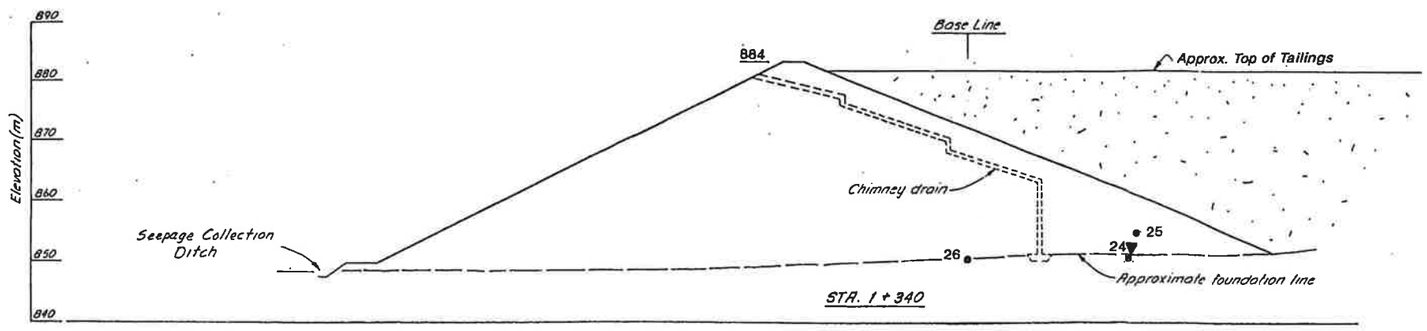
Project No. 022-1520 Drawn BAD Reviewed ..... Date Mar.'03

Golder Associates

QOC – NORTH TAILINGS DAM
PIEZOMETER DATA – STATION 0 + 975

Figure **B–7**





STATION 1+340

The piezometers at Station 1+340 are located within a vertical plane that is approximately 25 metres from the adjacent finger drains on either side of the plane.

Piezometers 24 and 25 are located on the upstream (pond) side of the Chimney/Core drain. Piezometer 24 communicates with the in situ foundation soils at shallow depth below the embankment fill/foundation interface. Piezometer 25 is located within the compacted glacial till fill (impervious zone) on the upstream side of the chimney drain.

Piezometer 26 is located shallow depth below the fill/foundation surface of contact, on the downstream side of the core drain. This piezometer has not been functional for several years.

NOTES

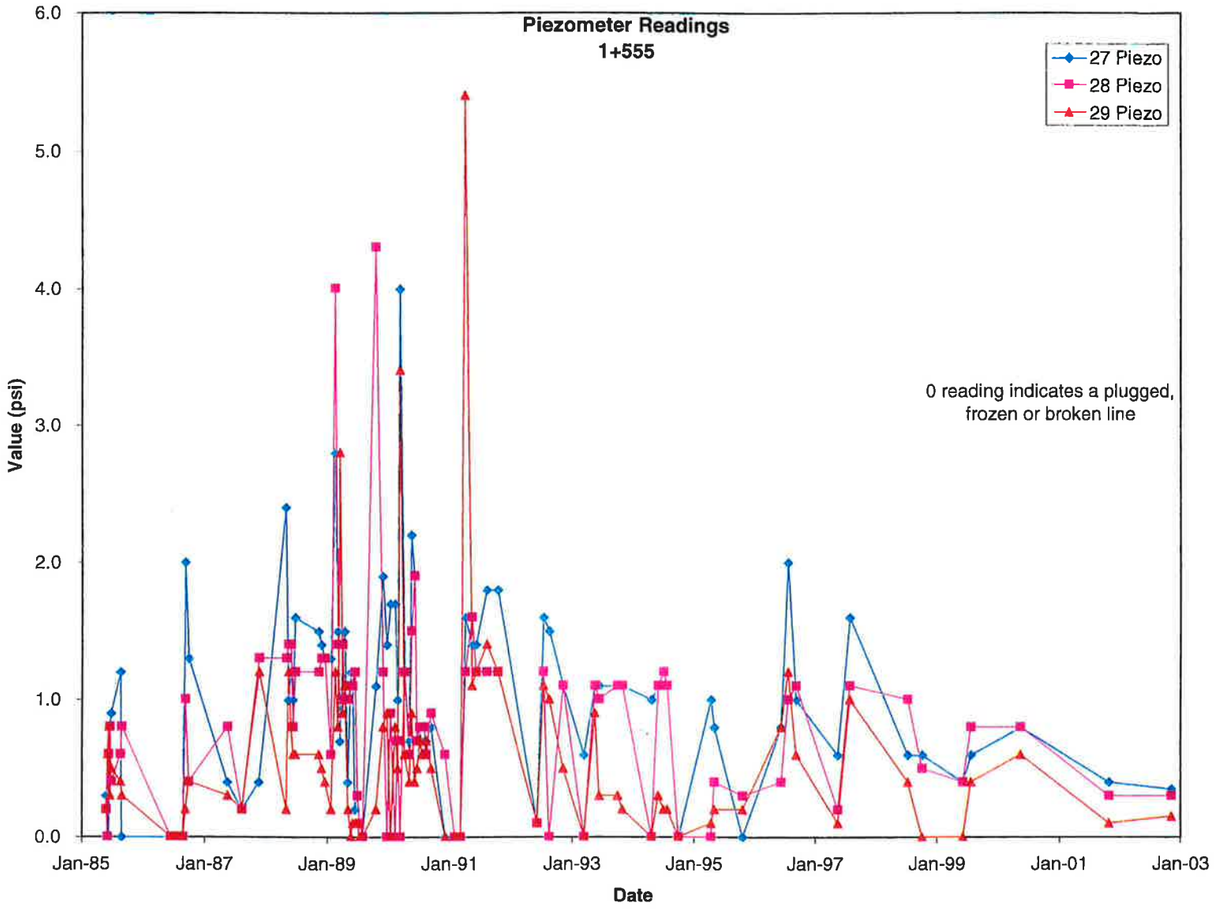
1. Location of section is shown on Figure B1 of this Appendix.
2. 1 (one) psi of pressure is equivalent to a head of 0.704 metres of water. Plotted piezometric heights above piezometer tips are to scale.
3. Occasional zero readings at a piezometer are an indication that the piezometer leads were frozen or otherwise blocked at the time of the readings.

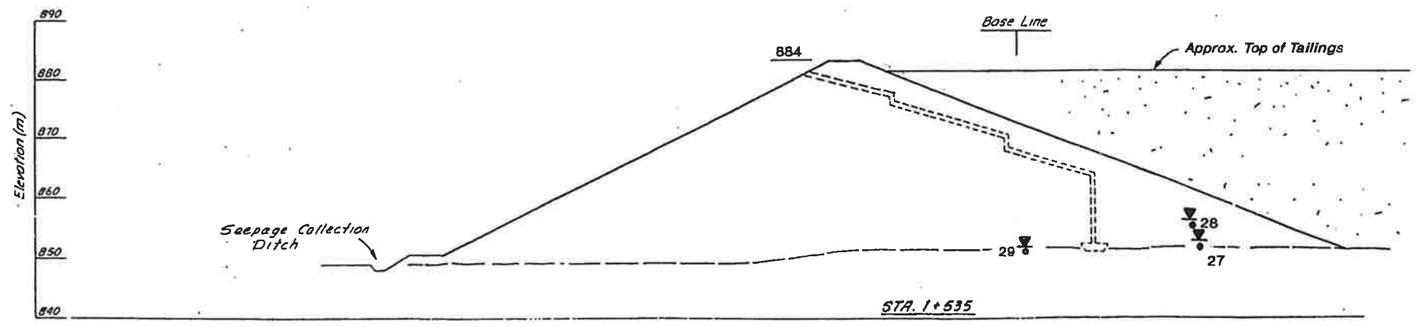
Project No. 022-1520 Drawn BAD Reviewed ..... Date Mar.'03

Golder Associates

QOC – NORTH TAILINGS DAM
PIEZOMETER DATA – STATION 1 + 340

Figure **B–9**





STATION 1+555

The piezometers at Station 1+535 are located within a vertical plane at horizontal distances of approximately 25 metres from the adjacent finger drains on either side of the plane.

Piezometers 27 and 28 are located on the upstream (pond) side of the Chimney/Core drain. Piezometer 27 communicates with the in situ foundation soils at shallow depth below the embankment fill/foundation interface. Piezometer 28 is located within the compacted glacial till fill (impervious zone) on the upstream side of the chimney drain. Piezometer 29 is lcoated within the foundation soils, on the downstream side of the core drain.

The piezometer data show that the bulk of the section remains well drained. The low piezometric levels contribute to the stability of the embankment section.

NOTES

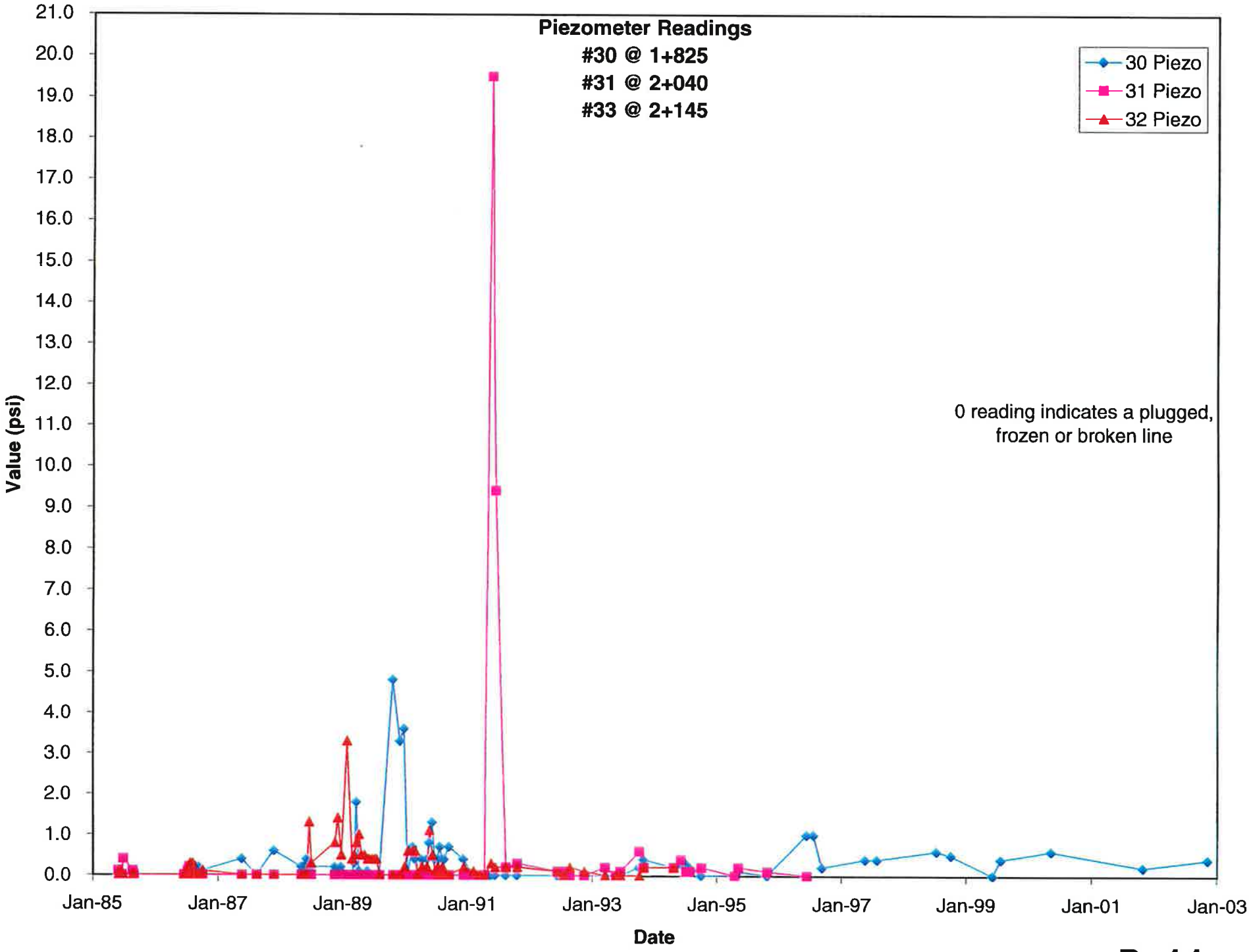
1. Location of section is shown on Figure B1 of this Appendix.
2. 1 (one) psi of pressure is equivalent to a head of 0.704 metres of water. Plotted piezometric heights above piezometer tips are to scale.
3. Occasional zero readings at a piezometer are an indication that the piezometer leads were frozen or otherwise blocked at the time of the readings.

Project No. 022-1520 Drawn BAD Reviewed Date Mar.'03

Golder Associates

QOC – NORTH TAILINGS DAM
PIEZOMETER DATA – STATION 1 + 555

Figure **B–10**


Piezometer Readings
#30 @ 1+825
#31 @ 2+040
#33 @ 2+145
30 Piezo
31 Piezo
32 Piezo
0 reading indicates a plugged, frozen or broken line
Value (psi)
21.0
20.0
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Jan-85
Jan-87
Jan-89
Jan-91
Jan-93
Jan-95
Jan-97
Jan-99
Jan-01
Jan-03
Date

APPENDIX IV

Teck's Plantsite Tailings Dam
2018 Event-Driven and Routine Inspection Checklists

Plantsite Tailings Dam – Visual Inspection

Date:	July 23/18
Property:	Quintette Coal Operations (QCO)
Structure:	Plantsite Tailings Dam
Inspection Performed By:	Rob Meise
Inspection Type (circle one):	Routine Event-Driven (Rainfall) Event-Driven (Earthquake)

57mm on July 20/18

Conditions at Time of Inspection		
Conditions	☒Sunny ☐Scattered Clouds ☐Overcast ☐Raining ☐Snowing Comments:	
Temperature	20°c	
Winds	☐None ☒Light ☐Moderate ☐High	From:
Snow Cover	☒None ☐Slight ☐Drifts ☐Melting Comments:	
Pond	☐None ☒Open Water ☐Partially Frozen ☐Frozen ☐High Turbidity Comments:	
Wave Action:	☒None ☐Light ☐Moderate ☐High ☐Causing Erosion Comments:	

Plantsite Tailings Dam – Visual Inspection

DAM STRUCTURE	Visible for Inspection	Cracks	Settlement	Sloughing, Slides or Sinkholes	Surficial Erosion or Rutting	Seepage Breakout, Turbidity or Discoloration	Excessive Vegetation	Excessive Debris	Animal Activity
Crest	Yes ☑ No ☐	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑		Yes ☐ No ☑		Yes ☐ No ☑
	Comments or Unusual Conditions:								
Upstream Slope	Yes ☑ No ☐	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑		Yes ☐ No ☑		Yes ☐ No ☑
	Comments or Unusual Conditions:								
Downstream Slope	Yes ☑ No ☐	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑		Yes ☐ No ☑
	Comments or Unusual Conditions:								
Right Abutment	Yes ☑ No ☐	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑
	Comments or Unusual Conditions:								
Left Abutment	Yes ☑ No ☐	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑
	Comments or Unusual Conditions:								
Downstream Toe & Area	Yes ☑ No ☐	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑
	Comments or Unusual Conditions:								
Drains	Yes ☑ No ☐	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑
	Comments or Unusual Conditions:								
Other	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions:								

Note: Shaded cells indicate highly improbable conditions under normal/natural circumstances.

Plantsite Tailings Dam – Visual Inspection

APPERTENANT STRUCTURES	Visible for Inspection	Cracks	Settlement	Sloughing, Slides or Sinkholes	Surficial Erosion or Rutting	Seepage Breakout, Turbidity or Discoloration	Excessive Vegetation	Excessive Debris	Animal Activity
Reservoir *(includes upstream slopes)*	Yes ☑ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑
	Reservoir Level: Below Water Marker					**Freeboard:**			
	Comments or Unusual Conditions:								
Tailings Beach	Yes ☑ No ☐	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☐	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑
	Width of Beach:								
	Comments or Unusual Conditions:								
Spillway	Yes ☑ No ☐	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑
	Comments or Unusual Conditions:								
Decant Structure	Yes ☐ No ☐	Yes ☑ No ☐ N/A	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions:								
Pipelines	Yes ☐ No ☐	Yes ☐ No ☐ N/A	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions:								
Weirs	Yes ☐ No ☐	Yes ☐ No ☐ N/A	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions:								
Signage	Yes ☐ No ☐	Yes ☐ No ☐ N/A	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions:								
Other	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions:								

Comment [BAC18]: Need to update this inspection sheet to include the new freeboard monitoring/reference stakes plan. Set up a separate section for this.

Plantsite Tailings Dam – Visual Inspection

Date:	Aug 8/2018
Property:	Quintette Coal Operations (QCO)
Structure:	Plantsite Tailings Dam
Inspection Performed By:	Rob Muise
Inspection Type (circle one):	(Routine) Event-Driven (Rainfall) Event-Driven (Earthquake)

Conditions at Time of Inspection		
Conditions	☐Sunny ☐Scattered Clouds ☒Overcast ☐Raining ☐Snowing Comments: Smokey	
Temperature	8°C	
Winds	☒None ☐Light ☐Moderate ☐High	From:
Snow Cover	☒None ☐Slight ☐Drifts ☐Melting Comments:	
Pond	☐None ☒Open Water ☐Partially Frozen ☐Frozen ☐High Turbidity Comments:	
Wave Action:	☒None ☐Light ☐Moderate ☐High ☐Causing Erosion Comments:	

Plantsite Tailings Dam – Visual Inspection

DAM STRUCTURE	Visible for Inspection	Cracks	Settlement	Sloughing, Slides or Sinkholes	Surficial Erosion or Rutting	Seepage Breakout, Turbidity or Discoloration	Excessive Vegetation	Excessive Debris	Animal Activity
Crest	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒		Yes ☐ No ☒		Yes ☐ No ☒
	Comments or Unusual Conditions:								
Upstream Slope	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒		Yes ☐ No ☒		Yes ☐ No ☒
	Comments or Unusual Conditions:								
Downstream Slope	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒		Yes ☐ No ☒
	Comments or Unusual Conditions:								
Right Abutment	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒
	Comments or Unusual Conditions:								
Left Abutment	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒
	Comments or Unusual Conditions:								
Downstream Toe & Area	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒
	Comments or Unusual Conditions: Rilling								
Drains	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒
	Comments or Unusual Conditions:								
Other	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions:								

Note: Shaded cells indicate highly improbable conditions under normal/natural circumstances.

Plantsite Tailings Dam – Visual Inspection

APPERTENANT STRUCTURES

	Visible for Inspection	Cracks	Settlement	Sloughing, Slides or Sinkholes	Surficial Erosion or Rutting	Seepage Breakout, Turbidity or Discoloration	Excessive Vegetation	Excessive Debris	Animal Activity
Reservoir *(includes upstream slopes)*	Yes ☒ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☒ No ☐
	Reservoir Level: Normal - Marker is Pk					**Freeboard:** ~7 metres			
	Comments or Unusual Conditions: Birds + Elk Stakes in Place								
Tailings Beach	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒
	Width of Beach: N/A								
	Comments or Unusual Conditions:								
Spillway	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒
	Comments or Unusual Conditions:								
Decant Structure	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions: N/A								
Pipelines	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions: N/A								
Weirs	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions: N/A								
Signage	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions: N/A								
Other	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions:								

Comment [BAC18]: Need to update this inspection sheet to include the new freeboard monitoring/reference stakes plan. Set up a separate section for this.

Plantsite Tailings Dam – Visual Inspection

	Date:	Sept 21/2018	
Property:	Quintette Coal Operations (QCO)		
Structure:	Plantsite Tailings Dam		
Inspection Performed By:	Rob Muise		
Inspection Type (circle one):	(Routine)	Event-Driven (Rainfall)	Event-Driven (Earthquake)

Conditions at Time of Inspection						
Conditions	☐Sunny	☐Scattered Clouds	☒Overcast	☐Raining	☐Snowing	Comments:
Temperature	-1 °C					
Winds	☒None	☐Light	☐Moderate	☐High	From:	
Snow Cover	☒None	☐Slight	☐Drifts	☐Melting	Comments:	
Pond	☐None	☒Open Water	☐Partially Frozen	☐Frozen	☐High Turbidity	Comments:
Wave Action:	☒None	☐Light	☐Moderate	☐High	☐Causing Erosion	Comments:

Plantsite Tailings Dam – Visual Inspection

DAM STRUCTURE	Visible for Inspection	Cracks	Settlement	Sloughing, Slides or Sinkholes	Surficial Erosion or Rutting	Seepage Breakout, Turbidity or Discoloration	Excessive Vegetation	Excessive Debris	Animal Activity
Crest	Yes ☒ No ☐	Yes ☒ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☒ No ☐		Yes ☐ No ☒		Yes ☐ No ☒
	Comments or Unusual Conditions:								
Upstream Slope	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒		Yes ☐ No ☒		Yes ☐ No ☒
	Comments or Unusual Conditions:								
Downstream Slope	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒		Yes ☐ No ☒
	Comments or Unusual Conditions:								
Right Abutment	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒
	Comments or Unusual Conditions:								
Left Abutment	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions: N/A								
Downstream Toe & Area	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒
	Comments or Unusual Conditions:								
Drains	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒
	Comments or Unusual Conditions: NO Turbidity / Regular seepage								

Note: Shaded cells indicate highly improbable conditions under normal/natural circumstances.

Plantsite Tailings Dam – Visual Inspection

APPERTENANT STRUCTURES	Visible for Inspection	Cracks	Settlement	Sloughing, Slides or Sinkholes	Surficial Erosion or Rutting	Seepage Breakout, Turbidity or Discoloration	Excessive Vegetation	Excessive Debris	Animal Activity
Tailings Beach	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☒ No ☐
	Width of Beach:								
	Comments or Unusual Conditions: EIK								
Spillway	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒
	Comments or Unusual Conditions:								

Note: Shaded cells indicate highly improbable conditions under normal/natural circumstances.

Freeboard Monitoring

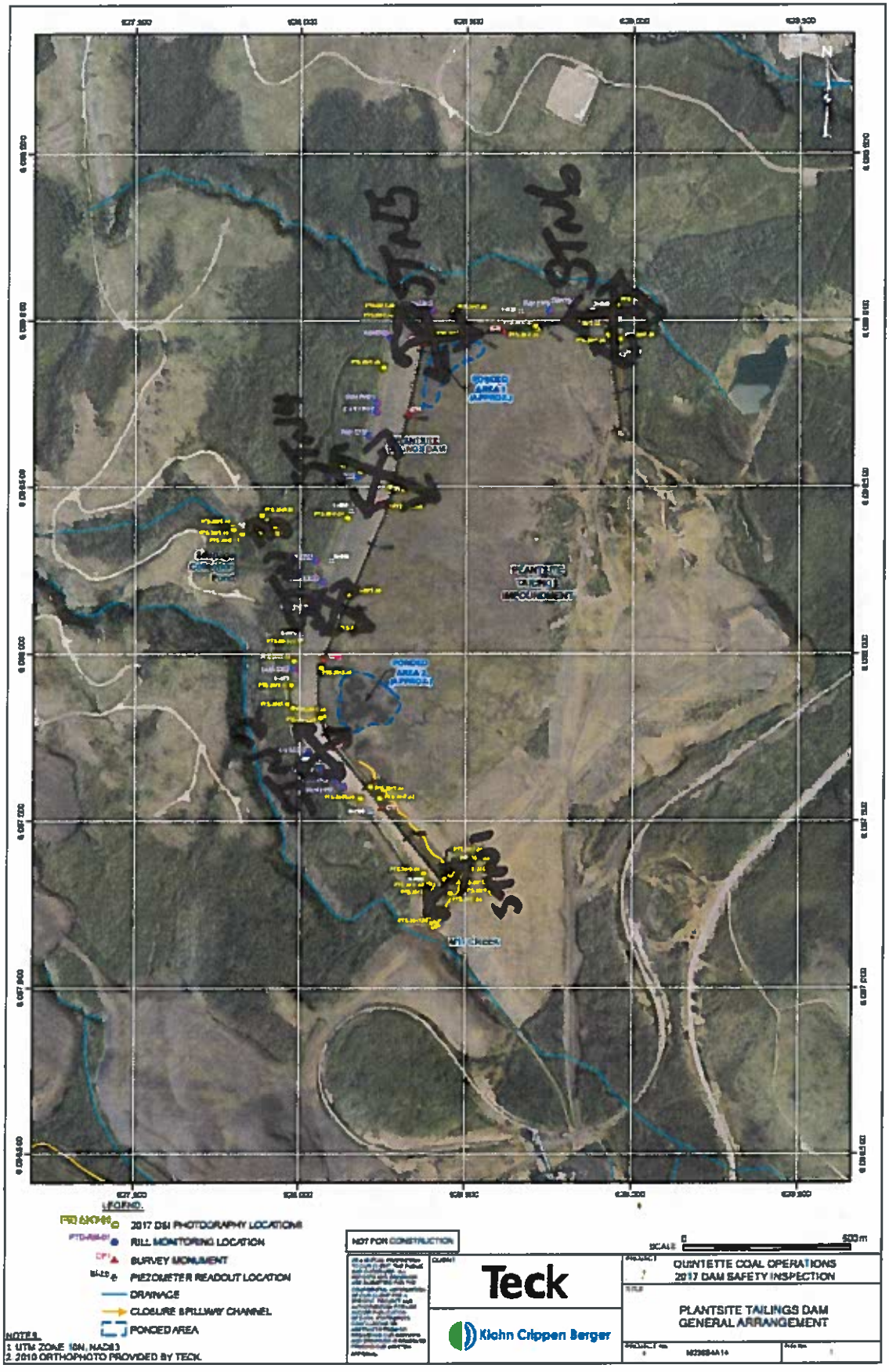
Ponded Area 1 (adjacent to northwest corner of dam, between survey monuments CP2 and CP4)

- What is the water level relative to the base of the reference stake? (Circle one) (Below) Above
- If the water level is above the base of the reference stake, is water flowing towards the spillway? (Circle one) [illegible] (No) Yes

Ponded Area 2 (adjacent to west corner of dam, between survey monuments CP6 and CP7)

- Has the water level in Ponded Area 2 risen above the typical extent, with water flooding onto the surrounding vegetated area on the tailings surface? (Circle one) (No) Yes

Photo's


LEGEND
2017 DSI PHOTOGRAPHY LOCATIONS
RLL MONITORING LOCATION
SURVEY MONUMENT
PIEZOMETER READOUT LOCATION
DRAINAGE
CLOSURE SPILLWAY CHANNEL
PONDED AREA
NOTES
1. UTM ZONE 10N, NAD83
2. 2010 ORTHOPHOTO PROVIDED BY TECK
NOT FOR CONSTRUCTION
Teck
Klohn Crippen Berger
QUINTETTE COAL OPERATIONS
2017 DAM SAFETY INSPECTION
PLANTSITE TAILINGS DAM
GENERAL ARRANGEMENT

APPENDIX V

Register of Reference Documents

Appendix V
Register of Reference Documents

Document Title	Author	Date of Issue
Geotechnical Conditions at the Proposed Quintette Coal Development Site Near Chetwynd B.C.	Golder Associates Ltd.	Jan-78
Hydrology Design Memorandum for Quintette Coal Limited	Ker, Priestman & Associates Ltd.	May-81
Proposed Tailings Retention Area Quintette Coal Project	Golder Associates Ltd.	Jan-82
Quintette Coal Project Physical Properties of Coal Tails	Golder Associates Ltd.	11-May-82
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