Klohn Crippen Berger

Teck Coal Limited

Quintette Coal Operations

2017 Dam Safety Inspection

Plantsite Tailings Dam

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March 2018

Klohn Crippen Berger

March 16, 2018

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

Mr. Rob Muise
Site Lead, Care and Maintenance

Dear Mr. Muise:

Quintette Coal Operations
2017 Tailings Dam Safety Inspection
Plantsite Tailings Dam

We are pleased to submit the 2017 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.
Engineer of Record
Senior Geotechnical Engineer, Principal

OL/NG:jcp/dl

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Teck Coal Limited

Quintette Coal Operations

2017 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, to comply with Section 10.5.3 of the Health, Safety and Reclamation Code (HSRC) for Mines in British Columbia (the Code), revised in 2017. This report was prepared following:

- Ministry of Energy and Mines[1] (MEM), British Columbia (BC) Section 4.2 "Annual Tailings Facility and Dam Safety Inspection Report" of the 2016 HSRC Guidance Document; and
- MEM Guidelines for Annual Dam Safety Inspection Report.

The 2017 inspection was completed by the Engineer of Record, (EoR), Mr. Bob Chambers, P.Eng., as a representative of KCB, on August 15th, 2017. Mr. Andrew Bidwell, P.Eng., of Teck is the Tailings Storage Facility (TSF) Qualified Person, as defined by the Code, for the PTD.

Summary of Facility Description

The QCO site is currently on "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 (2014). Key description of the PTD is as follow:

- The PTD is approximately 2 km north of the QCO processing plant and site gatehouse and is approximately 16 km south of the Municipality of Tumbler Ridge in northeastern BC.
- The PTD is constructed of compacted coarse coal rejects (CCR) downstream shell with an upstream low permeability, compacted Glacial Till zone. The Glacial Till and CCR zones are separated by a chimney drain.
- The PTD is horseshoe shaped, approximately 2.6 km long crest, a maximum downstream slope height (crest to toe) of 52 m, and an average downstream slope of 2H:1V. The crest is approximately 5 m wide and was constructed to elevation 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 with 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.

[1] Ministry of Energy and Mines (MEM) is now Ministry of Energy, Mines and Petroleum Resources (MEMPR).

Summary of Key Hazards

Foundation Failure: A deposit of Glaciolacustrine clayey silt and silty clay is present in the southwest corner of the facility. Stability analysis (2016b) indicates the factors of safety (FoS) of slip surfaces through the Glaciolacustrine material meet current design standards. Based on the stability analysis result and long performance history with no observed or documented significant displacements, the probability of dam failure due to Glaciolacustrine layer is very low.

Surface Erosion: There is significant rilling (erosion gullies) of 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: Stability of the dam under Earthquake Design Ground Motion (EDGM) corresponding to the 2475-year return period, as recommended by the Code, was reviewed by KCB (2016b). The FoS for pseudo-static stability analysis is greater than 1 except for a stability section at Sta. 0+800 (refer to the main text of this report for details), which had a FoS of 0.9. As a result, this section might undergo some seismic deformations. The estimated horizontal displacements are 240 mm to 500 mm and the estimated crest settlement is 80 mm (KCB 2016b); however, due to large available freeboard and crest width of 5 m to 10 m, the seismic deformation would not be sufficient to cause a release of tailings from the facility.

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

Consequence Classification of Dam

The PTD was assigned a “High” consequence classification, as defined by the CDA Dam Safety Guidelines (CDA 2013) (KCB 2014a). 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

There are 19 functional piezometers and 8 survey monuments at the PTD. No exceedance in instrument thresholds was recorded and no event-driven inspection was triggered in 2017. The monitoring program is sufficient for assessing the performance of the PTD during care and maintenance. The instrumentation reading frequency can now be reduced to once per year since there has been no significant change to the condition of the dam indicated in available monitoring records over the past 10 years.

The piezometers indicate the chimney drain appears to be performing as designed based on low pore pressures in the downstream shell of the dam. Monument surveys indicate there is no continuous movement in the downstream direction and there was no exceedance of survey monument thresholds in 2017.

Routine inspections of the dam were completed by Teck’s Dam Inspector in May 2017 and October 2017. Inspection details were documented using a standard checklist. The routine inspections and 2017 DSI observations do not indicate any significant change in the PTD or dam safety issues.

Downstream slope rill erosion monitoring locations were monitored and compared to previous years. A more regimented and repeatable rill monitoring program should be implemented for on-going monitoring of the rills.

Significant Changes to Dam Stability and/or Surface Water Control

There has been no significant change in piezometric level, pond level or loading condition and therefore no change in dam stability. There has been no significant change in surface water control since closure.

The catchment for the PTD impoundment is 134.8 ha which includes tailings beach and pond area (101.8 ha) and upstream catchment (33 ha). With the passive closure spillway, the PTD impoundment cannot store as much water as during operations, which reduces the likelihood of a slope failure.

Total precipitation from September 1st, 2016 to August 31st, 2017 was 436 mm, which is less than the precipitation normals (1991 to 2000) of 561 mm. A simplified water balance for the facility estimated an average flow rate of 9 L/s through the dam spillway between September 1st, 2016 and August 31st, 2017; the water balance is within the expected performance range with the closure spillway in operation.

The closure spillway was designed for an Inflow Design Flood (IDF) based on design standards at the time (CDA 1999), which was the 1000-year 24-hour flood (Golder 2001). The current IDF for the PTD specified by the Code is ⅓ between the 1000-year and the Probable Maximum Flood (PMF). The spillway has sufficient capacity to pass the larger IDF (KCB 2015b). Some erosion of the channel is likely to occur during a large flood but would not cause failure of the dam.

Operations, Maintenance, and Surveillance Manual

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

Emergency Preparedness and Response Plan

The Emergency Preparedness an Response Plan (EPRP) was first issued in November 2014. It 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 Mr. Bob Chambers, P.Eng., of KCB as the EoR of the PTD.

Dam Safety Review

The most recent Dam Safety Review (DSR) was completed in 2013 by KCB. Teck has 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.

2017 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 2017 monitoring records indicate there has been no significant change to the condition of the dam over the past 10 years.

Recommendations for future work or items of concern for the dam are summarized in Table 1. Recommendations for future work or items of concern for the dam resulting from the 2017 DSI are summarized in Table 2. Closed recommendations are shown in italics and will be removed from the table in the following year's DSI.

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 1 Previous Deficiencies and Recommendations

ID Number	Deficiency or Non-Conformance	Applicable Regulation or OMS Manual Reference	Recommended Action	Priority	Recommended Deadline
PTD-2015-01 (DSI-PS-11)	*Survey Monitoring Requirements*	*n/a*	*After 2016 survey monument readings, review available data and define appropriate threshold values which should then be added to the OMS manual.*	*3*	*CLOSED*
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	October 2017
PTD-2016-02	*Review of Piezometer Thresholds*	*OMS Manual*	*Review existing piezometer threshold values and revise to suit existing conditions, if appropriate.*	*3*	*CLOSED*
PTD-2016-03	*Seepage Collection Pond*	*HSRC Code*	*Assess whether the Plantsite Seepage Collection Pond meets the criteria of a dam. If so it is to be classified as a dam and added to Teck's dam register.*	*3*	*CLOSED*
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	October 2017
PTD-2016-05	*Engineer of Record (EoR)*	*OMS Manual*	*Update the EoR currently listed in the OMS manual.*	*3*	*CLOSED*

Table 2 2017 Deficiencies and Recommendations

ID Number	Deficiency or Non-Conformance	Applicable Regulation or OMS Manual Reference	Recommended Action	Priority	Recommended Deadline
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	March 2018
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	April 2018
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

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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 (the Code), revised in 2017. This report was prepared following:

- Ministry of Energy and Mines[1] (MEM), British Columbia (BC) Section 4.2 "Annual Tailings Facility and Dam Safety Inspection Report" of the 2016 HSRC Guidance Document; and
- MEM Guidelines for Annual Dam Safety Inspection Report.

QCO has not been in operation since 2000. Portions of the site have been reclaimed, but otherwise the site has been on care and maintenance 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).

The DSI site visit was completed on August 15th, 2017 between 8:40 am and 2:00 pm by the EoR, Mr. Bob Chambers, P.Eng., as a representative of KCB, along with Mr. Nat Gullayanon, P.Eng., of KCB, and Mr. Rob Muise and Mr. Ray Proulx of Teck. During the inspection, the weather was sunny with cloudy periods and no precipitation 24 hours prior to the 2017 inspection. Refer to Figure 1 for an overview of the structure with satellite imagery and photograph locations from the DSI site visit.

Mr. Andrew Bidwell, P.Eng., of Teck is the Tailings Storage Facility (TSF) Qualified Person (as defined by the Code) for the PTD. Mr. Rob Muise of Teck is the designated Dam Inspector for PTD (Teck 2016).

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

- Ministry of Energy and Mines (MEM), 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 changed if operations were to restart. 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 2013 Dam Safety Review (DSR) (KCB 2014a). The factors considered in the classification of the PTD are listed in Table 1.1.

The next DSR is planned to be completed by May 2021, according to Teck. This is 5 years from the effective date of the Code requirement for DSRs to be performed at least every 5 years.

[1] Ministry of Energy and Mines (MEM) is now Ministry of Energy, Mines and Petroleum Resources (MEMPR).

Table 1.1 PTD Consequence Classification (KCB, 2014a)

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

Inspection observations are summarized in the following sections. Dam inspection photographs are provided in Appendix I.

2 BACKGROUND AND RECENT ACTIVITY

2.1 Background Information

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

The PTD is approximately 16 km southwest of the Municipality of Tumbler Ridge in northeastern BC, and is 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 was 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 horseshoe shaped, approximately 2.6 km long, and is a compacted, zoned earthfill structure constructed by the downstream method. The crest elevation is approximately 884 masl and is approximately 5 m wide. The maximum downstream slope height of the structure is 52 m (crest to toe). The downstream slope is approximately 2H:1V. The dam comprises an upstream compacted Glacial Till zone supported by an embankment of compacted coarse coal rejects (CCR), with a granular chimney filter drain separating the two zones. A system of internal finger drains convey seepage to the downstream toe of the dam. Seepage is collected at the Seepage Collection Pond, approximately 200 k downstream of the PTD (Figure 1). Typical design and as-built cross sections of the PTD are included in Appendix III.

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.
- Glaciolacustrine: very stiff to hard 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 20° and 30° predominately towards the northeast. Bedrock is up to 28.5 m below ground surface.

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 2015a).

At the request of Teck, KCB assumed the EoR role in 2015, with Mr. Rick Friedel, P.Eng., acting as a representative of KCB, following the issuing of the 2015 DSI report. Effective September 1st, 2016, Mr. Bob Chambers, P.Eng., assumed the role of EoR for the PTD.

2.2 Recent Activity

The Operation, Maintenance, and Surveillance (OMS) manual specifies maintenance activities that includes clearing of vegetation on the dam crest and slopes, maintenance of pneumatic piezometer cables and fittings, maintenance of dam access roads, and quarterly check of weather stations on site. Teck completed the following maintenance activities in 2017:

- Replaced 4 pneumatic piezometer fittings on August 14th (refer to Section 4.3.3.1 for more details); and
- Cleared beaver dam obstructing the flow in the outfall channel of the Seepage Collection Pond on October 3rd (Photos I-57 and I-58).

3 WATER MANAGEMENT, CLIMATE AND WATER BALANCE

3.1 Overview

The PTD is an inactive facility. The catchment for the PTD impoundment, assuming both roads upstream of the PTD act as catchment diversions during average conditions, is 134.8 ha including the 101.8 ha tailings beach and pond area. The Glacial Till blanket along the upstream slope 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.

Based on Quintette (2002), at the end of tailings deposition the tailings pond was in the southern area of the impoundment; 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 this area in 2001 and 2002, and is founded on a mix of waste rock, tailings and Glacial Till (KCB 2015b). 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 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, similar to what was present during operations. This reduces the likelihood of a dam failure. Approximately 25,000 m^3 of water can collect in local depressions over the impoundment before flowing out the spillway (KCB 2015b). At the time of the August 2017 inspection, water was ponded at the northwest corner of the impoundment local depressions in the tailings surface near the spillway inlet (see Photos I-41 and I-48 and Figure 1). Ponded water is eventually lost as evaporation, seepage, and discharge through the spillway. Low flow in the spillway was observed during the 2017 inspection (i.e., ponded water from local depressions and low points in the spillway channel was draining towards the outlet) but the flow rate could not be reliably estimated due to vegetation in the spillway channel.

3.2 Climate

Precipitation and temperature data at the site from September 1st, 2016 to August 31st, 2017 is summarized in Table 3.1. The climate data was measured by a Teck maintained climate station by the PTD (also known as Lower Met station, elevation 914 masl). However, the rain gauge is not heated so winter precipitation measurements are not reliable. KCB suggests that Teck install a heated rain gauge to collect the winter climate data, however it is not a dam safety concern and therefore no immediate action is required. As a result, data from October 2016 to April 2017 from the Environment Canada Chetwynd Airport climate station (station No. 1181508; elevation 610 masl; and 86 km north of QCO) was obtained and corrected for orographic effects using the elevation-rainfall relationship developed for the restart permit application (KCB 2012a).

Climate normals (1991 to 2000), taken from 2013 Baseline Hydrology and Design Basis report (Teck 2013), are also summarized in Table 3.1 for comparison.

Seasonal snowpack depth is measured at the Plantsite station, but no conversion information of the data is available; therefore, snowpack data is not available for review. KCB suggests that Teck resolve this issue for on-going climate data recording; however, it is not a dam safety concern that requires immediate action.

The following observations are made based on the data from September 1st, 2016 to August 31st, 2017:

- Total precipitation during this period was 436 mm, which is well below the precipitation normals of 561 mm, and is approximately 85% of the precipitation measured in 2016 (512 mm).
- Average temperatures in September 2016, and between April and August 2017 were similar to the normals. Temperatures between October 2016 and March 2017 were lower than normals, by 2 ^{o}C to 6 ^{o}C, except for November 2016 and January 2017 when temperatures were higher than normals by approximately 3 ^{o}C to 5 ^{o}C.
- No event-driven inspections were triggered between September 2016 and August 2017. Event-driven inspections are required after 10-year and 50-year rainfall events (52 mm and 67 mm, respectively, in 24-hour duration (Teck 2016)).

Table 3.1 Precipitation and Temperature at Plantsite Tailings Dam

Month	1991–2000 Normals Precipitation[1] (mm)	2016-2017 Precipitation[2],[3] (mm)	1991-2000 Normals Average Temperature[4] (°C)	2016-2017 Daily Max. Temperature[5] (°C)	2016-2017 Daily Min. Temperature[5] (°C)	2016-2017 Daily Average Temperature[5] (°C)
September	42.5	34.8	10.1	14.0	4.3	9.3
October	54.0	81.9	3.6	2.5	-2.8	-0.2
November	55.7	42.4	-3.7	3.1	-3.9	-0.2
December	41.0	11.6	-6.8	-9.3	-16.5	-12.8
January	43.6	14.7	-10.7	-2.8	-8.9	-5.7
February	36.1	23.9	-5.4	-3.2	-11.9	-7.2
March	33.3	29.8	-2.1	-0.1	-10.2	-5.0
April	27.4	45.9	3.5	6.8	-1.6	2.6
May	31.6	48.8	8.3	16.0	4.1	10.4
June	71.2	49.4	12.3	18.6	6.6	13.0
July	74.8	27.6	14.5	21.3	9.1	15.3
August	49.9	24.9	13.9	22.0	9.1	15.6
Total	**561.1**	**435.7**				

Notes:

1. Monthly normal precipitation is 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 2016 to April 2017 precipitation values were based on Chetwynd Airport climate station (station No. 1181508; elevation 610 masl; and 86 km north of QCO) data, with elevation correction from KCB (2012a).
3. September 2016, and May 2017 to August 2017 precipitation values were based on Plantsite climate station data with elevation correction from KCB (2012a).
4. Average monthly temperatures for the Quintette Site are 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 Plantsite climate station.

3.3 Water Balance

Inflows to the impoundment are from direct precipitation and runoff. Outflows are predominantly flow through the spillway with lesser volumes of seepage (via finger drains) and evaporation losses. 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. However, 2017 site visit observation estimated seepage to be close to 0.2 L/s. A simplified annual water balance calculation for the PTD for the period September 1st, 2016 to August 31st, 2017 is summarized below:

- Inflows:
  - Precipitation on ponds = 21,690 m^3 (assumed ponds occupy 5% of tailings beach based on observed localized ponds in the northwest corner of the PTD and at the spillway inlet);
  - Runoff from the tailings beach (excluding pond area) = 253,190 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 = 57,477 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 = 26,686 m^3 (evaporation rate for this site is 536 mm/yr (KCB 2016c));
  - Seepage losses from the impoundment = 19,868 m^3 (estimate as 0.6 L/s based on measured flows reported in Golder (2003)); and
  - Flow through spillway = 285,803 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 (Photos I-8, I-53 and I-55). Based on the simplified water balance, the average flow rate through the spillway between September 2016 and August 2017 was 9 L/s. Construction of a flow station at the spillway outlet is not required to assess dam safety.

The water balance 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 1000-year return period and probable maximum flood (PMF) events (CDA 2014). KCB reviewed the PTD closure spillway (KCB 2015b) relative to the IDF; the review concluded that the spillway has sufficient capacity to route the updated IDF while maintaining a freeboard of 5 m, conservatively assuming both roads upslope of the PTD do not divert flow away from the impoundment during storm events (KCB 2015b).

4 REVIEW OF MONITORING RECORDS AND DOCUMENTS

4.1 Operations, Maintenance and Surveillance Manual

The OMS manual was updated in February 2018 as draft. The OMS manual identifies Mr. Bob Chambers, P.Eng., of KCB as the EoR of PTD (Teck 2018).

The OMS manual includes recommended instrumentation threshold levels and responses, and recommended monitoring frequencies described in Section 4.3 of this report.

4.2 Emergency Preparedness and Response Plan

The Emergency Preparedness and Response Plan (EPRP) was first issued 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 Mr. Bob Chambers, P.Eng., as the EoR for the PTD.

4.3 Monitoring Program

Monitoring of the dam includes visual observations (DSI, routine and event driven) and review of instrumentation readings (i.e., piezometers and survey monuments).

4.3.1 Visual Inspection

The PTD monitoring program includes the following inspections:

- 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 2017 (May 31st, August 15th and October 3rd). The DSI inspection was counted as the mid-summer inspection. Teck's routine inspection checklists (Appendix IV) do not indicate any significant change in the PTD or observed dam safety issues; and
- Event-driven – completed by Teck staff following a 24-hour rainfall event either greater than the 10-year return period (52 mm) or the 50-year return period (67 mm) or an earthquake magnitude 5 or greater within 100 km of the site. The magnitude of the precipitation event determines the response time for the inspection of the facility. 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. In 2017, no event-driven inspection was triggered and no earthquakes were recorded by the Geological Survey of Canada within 100 km of the site.

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

4.3.2 Downstream Slope Erosion

Based on comparison of photographs and DSI reports, rill erosion of the downstream slope has undergone minor, if any, change 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 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 (Table 4.1) shows no significant change in the rills over the past year. Rill photographs are shown in Appendix II. The most significant year-over-year change is the vegetation growth.

Table 4.1 Rill Monitoring Locations

Rill Monitoring Point (PTD-Rill-X)	Northing[1] (m)	Easting[1] (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 PTD includes 32 pneumatic piezometers and 8 dam crest survey monuments to monitor dam movement and settlement. Locations of the piezometer readout locations and the survey monuments are shown in Figure 1.

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 2018). After operation ceased in 1997, the piezometer labels were not maintained and they were unreadable in 2014. The instruments were re-labeled by Teck in 2015.

Pneumatic piezometer cables are accessible in corrugated steel culvert risers at several locations along the downstream toe. Some of the instrument risers could not be found or the cables have been buried. Refer to Table 4.2 for a summary of the functional piezometers located at the PTD.

Several piezometer fittings were replaced prior to measurements on August 14th, 2017 (refer to Table 4.2) by Mr. Rob Muise of Teck. Of 32 piezometers, 19 piezometers are considered functional. Significant numbers of piezometers are no longer functioning due to aging of the instrument. However, based on the PTD performance to date and lack of reported dam safety issues, the remaining functional instruments are considered sufficient for on-going monitoring the dam under "Closure-Active Care" conditions.

Table 4.2 Piezometer Readout Locations and 2017 Monitoring Summary

Station (m)	Northing(1) (m)	Easting(1) (m)	Functional Piezometers	2017 Reading Collected		
				May 23	August 14	Comments
-0+179	n/a	n/a	n/a	No	No	
-0+060	6097322	628388	n/a	No	No	
0+188	6097529	628210	1A	Yes	Yes	
0+300	6097676	628052	P1, P2, P3 and P4	Yes	Yes	P2 - May 23 reading was unable to stabilize and was discarded.
0+475	6097914	627979	P5, P6 and P7	Yes	Yes	P6 - May 23 reading was suspiciously high; suspected reading error.
0+575	6098050	628002	P8, P9, P10 and P11	Yes	Yes	P8 and P11 fittings were replaced on August 14, 2017
0+696	6098172	628045	P12, P13 and P14	Yes	Yes	P13 and P14 fittings were replaced on August 14, 2017
0+800	6098278	628094	P15, P16 and P17	Yes	Yes	
0+975	n/a	n/a	n/a	No	No	
1+150	n/a	n/a	n/a	No	No	
1+340	n/a	n/a	n/a	No	No	
1+555	6098428.	628151	n/a	No	No	
1+825	6099026	628661	n/a	No	No	
2+040	6099035	628875	P31	Yes	Yes	
2+145	6098890	628965	n/a	No	No	

Notes:
1. UTM Zone 10N, NAD83.

Detailed review of piezometer data was conducted by KCB in 2017, as part of the threshold values (i.e., Quantifiable Performance Objectives (QPOs)) review, and the following observations and revisions are made:

- **Sta. 0+475:** Piezometers P5 and P7 may have been mislabeled (or switched) in Golder (2003) historical piezometric data figures (Appendix III), based on piezometer naming convention and KCB (2018). The "smallest" labels are given to the instruments installed at the fill/foundation

interface, upstream of the chimney drain. As a result, labels for P5 and P7 have been revised in Figure 4.

- **Sta. 0+575:** P8 and P9 instrument labels may have been switched in the field during relabeling of the instrument in 2015 (see KCB (2016c) Figure 6 instrumentation plot for reference). The observation was based on lower water level recorded in piezometers installed at the fill/foundation relative to water level measured in piezometers installed in the dam fill. Revised data and piezometer plots for P8 and P9 are shown in Figure 5.
- **Sta. 0+696:** P12 and P13 labels and measurements may have been switched in May 2016 (refer to KCB (2016c) Figure 7 instrumentation plot for reference). P13 is expected to read relatively constant piezometric level as the water table is likely controlled by the upstream chimney drain and by a nearby finger drain at Sta. 0+705 (approximate). Instead, P13 data between May 2016 and May 2017 indicate seasonal fluctuation. Conversely, P12, located upstream of the chimney drain, showed no seasonal fluctuation in 2016, contradicting data from other piezometers installed upstream of the chimney drain. This indicates the labels of the two piezometers may have been switched. Revised P12 and P13 plots are shown in Figure 6.

The updated threshold values (QPOs) for the piezometers are summarized in Table 4.3. The thresholds 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.

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

Table 4.3 Recommended Piezometer Threshold Values

Station[1] (m)	Instrument ID	Historical Maximum Since Instrumentation Re-Initiation in July 2014[2] (psi)	Threshold Level 1 "Warning Level" (psi)
0+188	1A	2.2	2.9
0+300	P1	5.3	6
	P2	10.2	10.9
	P3	5.5	6.2
	P4	7.9	8.6
0+475	P5	12.2	12.9
	P6	8.3	9
	P7	3.9	4.6
0+575	P8	3.6	4.3
	P9	17.8	18.5
	P10	0.7	1.4
	P11	1.6	2.3
0+696	P12	10.9	11.6
	P13	1.2	1.9
	P14	0.8	1.5
0+800	P15	10.3	11
	P16	7.4	8.1
	P17	3.0	3.7

Notes:
1. Locations as shown on Figure 1.
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.

Table 4.4 Piezometers Threshold Responses

Thresholds	Threshold Exceedance	Action
Level 1 "Warning Level"	Exceedance of a threshold in an individual piezometer	▪ Notify 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 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.

After the completion of 2017 piezometer reading during the DSI site visit, pore pressure measurements are compared to historical readings and are shown in cross sections on Figures 2 to 8. The following observations are made:

- 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.
- No Threshold Level 1 was triggered based on the revised threshold values. May 2017 readings generally show higher piezometric levels compared to August 2017, likely due to spring freshet.
- 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. However, even with readings of 30 psi, P2 water level was still consistent with the assumed water table level in the recently conducted stability analysis (KCB 2016b). In addition, the nearby P1 at Sta. 0+300, which is also installed upstream of the core within the dam fill, was recording values similar to historic trends.
- The reading from instrument P6 at Sta. 0+475 in May 2017 was nearly triple historical readings. This reading is most likely the result of instrument/human error.
- Sta. 0+300, Sta. 0+475 and Sta. 0+575 are situated near ponded water (Figure 1), which would likely influence the readings and show elevated pore pressures in the warmer wetter months (May to September).

4.3.3.2 Survey Monument Pins

Survey pins were installed along the PTD dam crest in 2014 for monitoring displacement and were surveyed 3 times during 2017. A comparison of the October 2016 and 2017 monitoring records are summarized in Figure 9. Threshold values (i.e., QPOs) and threshold responses were established and have been recommended in the 2016 DSI report (KCB 2016c) and 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%. The responses for each of the threshold levels 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.

The recommended thresholds and responses are included in the 2018 OMS manual.

Teck completed each survey using the same equipment (GPS base station with portable rod mounted survey device). The horizontal (HMRS) accuracy of the GPS is approximately 0.005 m to 0.010 m and the vertical (VMRS) accuracy is 0.008 m to 0.015 m, as provided by Teck. Real Time Kinematic (RTK) GPS averaging of continuous measurements (typically greater than 180 measurements) was used over a period of 10 to 30 minutes to achieve this accuracy.

From a review of the 2017 survey data, there appears to be no general trend. None of the monuments indicate a general trend in the downstream direction or significant crest settlement. There was no exceedance of thresholds in 2017 (Figures 10 to 12). Threshold Levels are also plotted in Figures 10 to 12 for comparison. Historical displacement monitoring records are not available for comparison but visual inspections made since 2003 indicate that no significant crest or slope movements have occurred (e.g. slumping, cracking, bulging at toe). Therefore, KCB recommends that Teck to reduce the reading frequency of the survey monuments from 3 times per year to once per year.

4.3.4 Freeboard

The followings are the recommended freeboard QPOs based on ponded areas at the northwest corner of the impoundment (Ponded Area 1) (see Photo I-41 and Figure 1) and inside tailings depressions (Ponded Area 2) (see Photo I-48 and Figure 1):

- Threshold Level 1 – "Warning Level" is exceeded if water in Ponded Area 1 is 1 m horizontally beyond the observed vegetation boundary. KCB recommend Teck to install a physical indicator (e.g., a staff gauge) at the northwest corner of Ponded Area 1, 1 m from the tailings/vegetation boundary during routine visual inspection at the PTD in spring of 2018. The physical indicator should have a minimum of 1 m stickup such that they can be easily located.
- Threshold Level 2 – "Alarming Level" is exceeded if:
  - Water from Ponded Area 1 starts to flow over the tailings beach towards the spillway; or
  - Water level crests Ponded Area 2 on to the tailings beach.

The recommended responses for the 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	▪ Notify 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 Area 1 towards the spillway, or Water level crests Ponded Area 2 on to tailings beach	▪ Notify 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.

The recommended QPOs and the exceedance responses are included in the 2018 OMS manual.

4.4 Water Quality

Teck monitors water quality downstream of the PTD at monitoring points M17A and M17B. M17A and M17B are included in MOE Permit No. PE-06739. Monitoring 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.

Water quality monitoring data is submitted to MOE for compliance reporting and will be summarized in a Teck prepared annual report in March 2018. 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 there have been no non-conformances and that monitoring frequency meets the permit requirements.

5 VISUAL OBSERVATIONS

The following observations were made during the inspection:

- **Dam Crest**: Good condition. No sign of movement, significant differential settlement or cracking of the dam crest (Photo I-40).
- **Downstream Slope**: Good condition (Photos I-9, I-12, 31, I-35, I-36, I-42, I-44, and I-47). No sign of displacement. Ongoing rill erosion with some rills up to 1.5 m deep. Refer to Section 4.3.2 for discussion regarding rill erosion and Appendix II for rill photographs.
- **Upstream Slope**: Good condition. No sign of significant erosion or displacement. Vegetation covers most of the slope, primarily grasses and bushes (Photos I-39, I-50, I-51, and I-52).
- **North Abutment**: Good condition. No sign 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 (Photos I-1 and I-4).
- **Tailings Impoundment**: Similar to previous DSI inspections, there is some locally ponded water (upstream of instrument lines at Sta. 0+300, Sta. 0+475, and Sta. 0+575) on the tailings surface likely formed by settling of the tailings (Photos I-41 and I-48). The tailings surface is partially vegetated, well drained, except in pond areas, and can easily support human traffic. There were no signs of significant tailings erosion near the closure spillway inlet or other areas of the impoundment (Photo I-3).
- **Closure Spillway Channel**: Good condition. The vegetation cover, primarily grasses and bushes, is well established and there is no sign of erosion damage (Photos I-3 to I-5). The riprap on the natural slope bank is in adequate condition, however, the riprap is observed to be showing signs of breaking down and should be included as part of the annual monitoring for the DSI to document the rate of degradation (Photos I-53 to I-56).
- **Closure Spillway Outlet to M17 Channel**: Good condition. Vegetation is well established and there is no obstruction or debris blocking the outlet (Photo I-7). Near the outlet, the M17 channel riprap also appears to be in good condition.
- **Seepage**: Minor seepage was observed from the underdrains at several locations along the dam toe (Photos I-13, I-15 to I-17, I-26 to I-30, and I-33 to I-34). Where seepage was notably flowing from the underdrain, the water was clear. Most of the seepage areas or underdrains had no discernible flow but were identified based on wet ground or ponded water. Finger drain at waypoint PTD-2017-26 appears to have red (iron oxide) precipitate (Photos I-33 and I-34), but this is not a dam safety concern.
- **Seepage Collection Pond**: Good condition, no sign of erosion or distress (Photos I-18 to I-25). During the 2017 inspection, no water was flowing from the seepage collection pond to the outfall channel due to a beaver dam obstructing the flow (Photo I-19). The beaver dam was removed in 2017 as described in Section 2.2. A recommendation to re-establish V-notch weir flow monitoring and measurement during each inspection at the PTD has been made by KCB in 2016 (recommendation PTD-2016-04).

6 ASSESSMENT OF DAM SAFETY

The potential failure modes included in the CDA Dam Safety Guidelines (2013) were reviewed based on the inspection and review of available documents:

- **Overtopping:** The closure spillway is constructed 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 coarse coal rejects. The filter compatibility was reviewed and no deficiencies requiring follow up activities were identified (KCB 2015a). 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 failure due to piping is very low.
- **Slope Instability:** A slope stability review of the PTD was completed (KCB 2016b) and the calculated factors of safety (FoS) meet current design standards as defined in the Code (≥ 1.5) and CDA (2013). Based on the stability analysis, long performance history with no visible or documented displacements, and stable piezometric levels consistent with stability assumptions (KCB 2016b), 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 2015a). 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 2016b). Based on stability analysis and long performance history with no visible or documented displacements, the probability of dam failure due to a foundation failure is very low.
- **Surface Erosion:** 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. FoS for pseudo-static stability analysis range between 1.1 and 1.2 for Earthquake Design Ground Motion (EDGM) corresponding to 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 might undergo some seismic deformations. The estimated horizontal displacements are 240 mm to 500 mm and the estimated crest settlement is 80 mm (KCB 2016b). However, due to large available freeboard and 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 2016b). 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 change to the condition of the dam.

Previous recommendations regarding the dam that are still outstanding are summarized in Table 6.1. Recommendations resulting from the 2017 inspection are summarized in Table 6.2. Closed recommendations are shown in italic and will be removed from the table in the following year's DSI.

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 Deficiencies and Recommendations

ID Number	Deficiency or Non-Conformance	Applicable Regulation or OMS Manual Reference	Recommended Action	Priority	Recommended Deadline
PTD-2015-01 (DSI-PS-11)	*Survey Monitoring Requirements*	*n/a*	*After 2016 survey monument readings, review available data and define appropriate threshold values which should then be added to the OMS manual.*	*3*	*CLOSED*
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	October 2017
PTD-2016-02	*Review of Piezometer Thresholds*	*OMS Manual*	*Review existing piezometer threshold values and revise to suit existing conditions, if appropriate.*	*3*	*CLOSED*
PTD-2016-03	*Seepage Collection Pond*	*HSRC Code*	*Assess whether the Plantsite Seepage Collection Pond meets the criteria of a dam. If so it is to be classified as a dam and added to Teck's dam register.*	*3*	*CLOSED*
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	October 2017
PTD-2016-05	*Engineer of Record (EoR)*	*OMS Manual*	*Update the EoR currently listed in the OMS manual.*	*3*	*CLOSED*

Table 6.2 2017 Deficiencies and Recommendations

ID Number	Deficiency or Non-Conformance	Application Regulation or OMS Manual Reference	Recommended Action	Priority	Recommended Deadline
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	March 2018
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	April 2018
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

6 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 2017 Dam Safety Inspection. 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.

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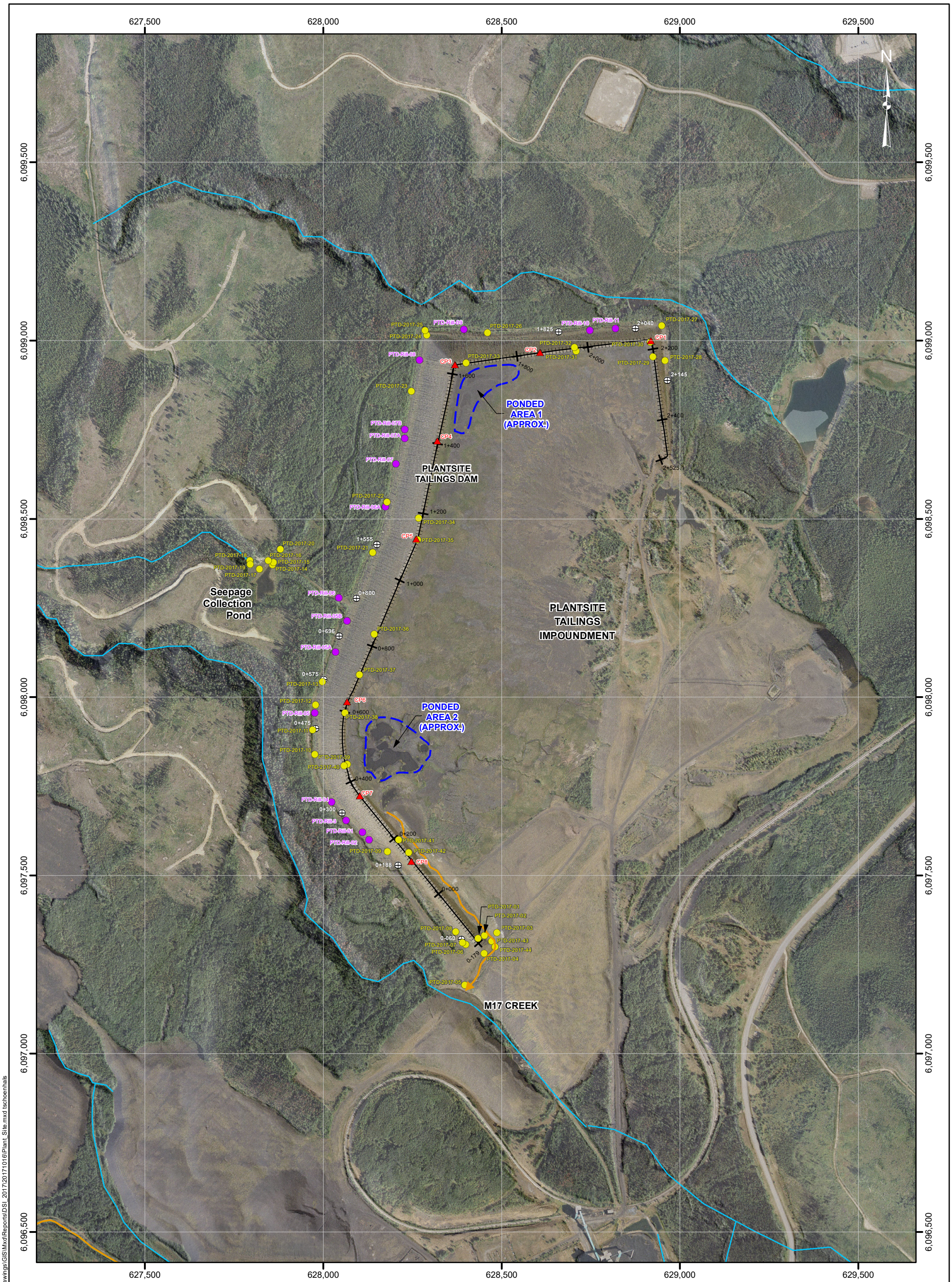
FIGURES



LEGEND:

- PTD-2017-01 — 2017 DSI PHOTOGRAPHY LOCATIONS
- PTD-Rill-01 — RILL MONITORING LOCATION
- CP1 — SURVEY MONUMENT
- 0+00 — PIEZOMETER READOUT LOCATION
- DRAINAGE
- CLOSURE SPILLWAY CHANNEL
- PONDED AREA

NOTES:

1. UTM ZONE 10N, NAD83
2. 2010 ORTHOPHOTO PROVIDED BY TECK.

NOT FOR CONSTRUCTION

SCALE 0 500 m

CLIENT: Teck

Klohn Crippen Berger

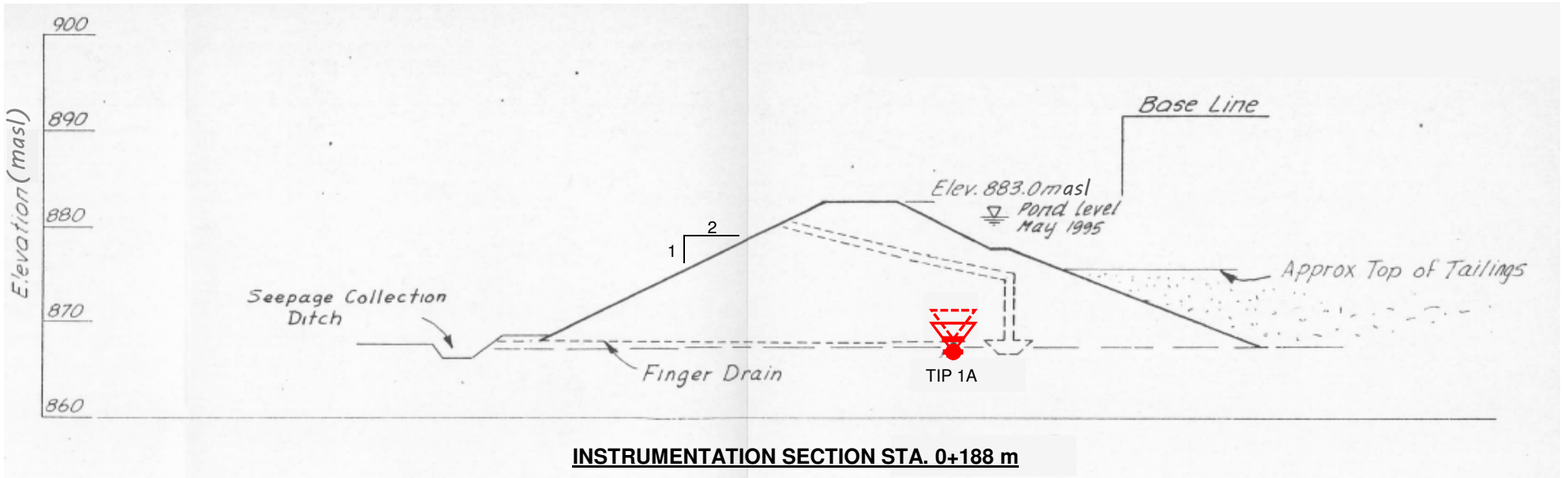
PROJECT: QUINTETTE COAL OPERATIONS
2017 DAM SAFETY INSPECTION

TITLE: PLANTSITE TAILINGS DAM
GENERAL ARRANGEMENT

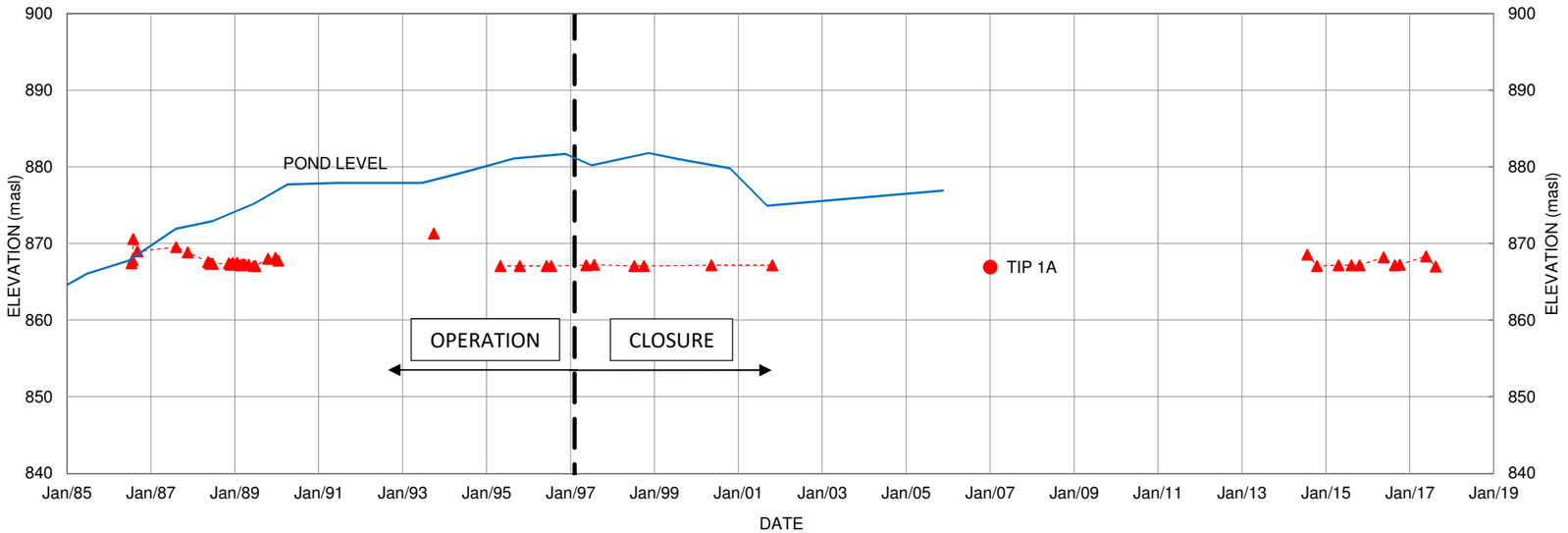
PROJECT No. M09684A14

FIG No. 1

Path: Z:\M\VCR\M09684A14 - TCL-Quintette 2017 DSI\400 Drawings\GIS\Mxd\Reports\DSI_2017\20171016\Plant_Site.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)
2017-05-23	0+188	1A	PNEUMATIC	867.0	1.9	1.3	868.3
2017-08-14	0+188	1A	PNEUMATIC	867.0	0.0	0.0	867.0

LEGEND:

- PIEZOMETER TIP ELEVATION
- TIP 1A WATER ELEVATION
- 23-MAY-2017 WATER LEVEL
- 14-AUGUST-2017 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

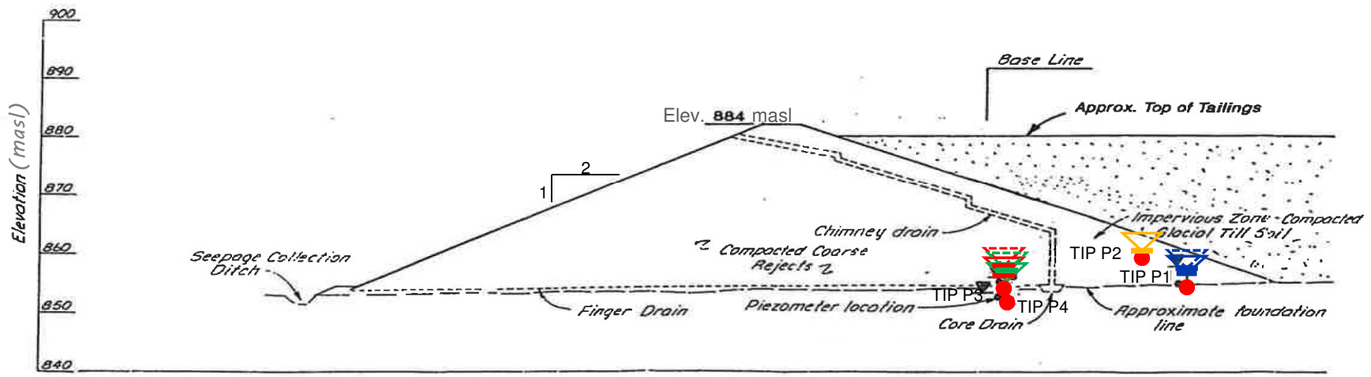
PROJECT: QUINTETTE COAL OPERATIONS
2017 DAM SAFETY INSPECTION

TITLE: PLANTSITE TAILINGS DAM
2017 PIEZOMETER READINGS
STA. 0+188 m

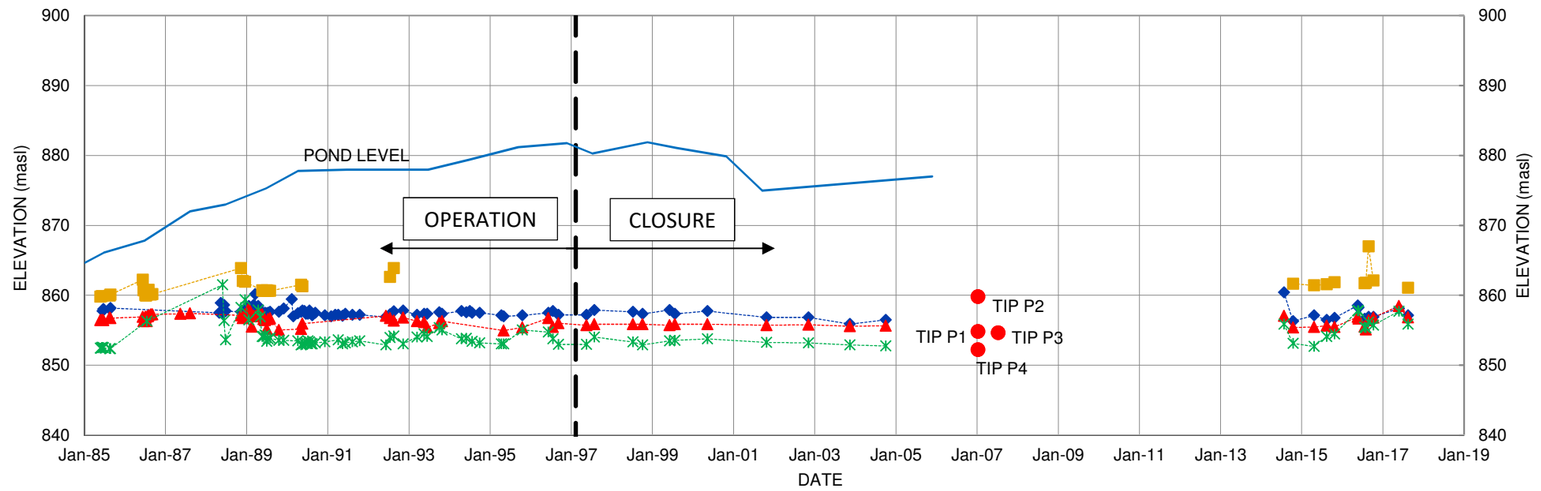
PROJECT No. M09684A14

FIG. No. 2

Date & Time: 2018-03-15 15:56
Figure File: Z:\MVCR\M09684A14 - TCL-Quintette 2017 DSI\300 Design\340 Ph04-EngSupport\341 Instrumentation\PTD Piezometer\[171207 Plantsite Piezometer.xlsx]Figure G



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)
2017-05-23	0+300	P1	PNEUMATIC	854.8	4.7	3.3	858.1
		P2	PNEUMATIC	859.8	30.1	21.2	881.0
		P3	PNEUMATIC	854.6	5.5	3.9	858.5
		P4	PNEUMATIC	852.2	7.8	5.5	857.7
2017-08-14	0+300	P1	PNEUMATIC	854.8	3.3	2.3	857.1
		P2	PNEUMATIC	859.8	1.8	1.3	861.1
		P3	PNEUMATIC	854.6	3.2	2.3	856.9
		P4	PNEUMATIC	852.2	5.2	3.7	855.9

LEGEND:

- PIEZOMETER TIP ELEVATION
- 23-MAY-2017 WATER LEVEL
- 14-AUGUST-2017 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

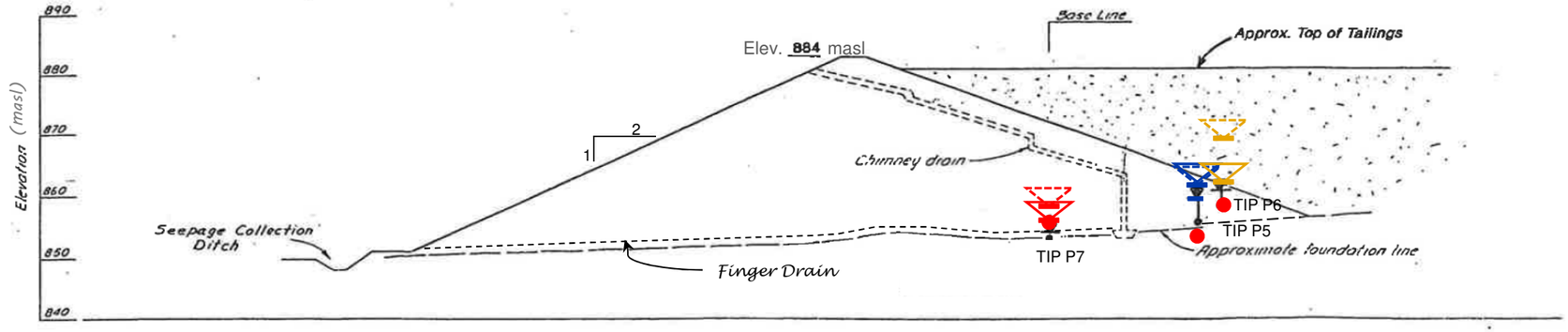
PROJECT: QUINTETTE COAL OPERATIONS
2017 DAM SAFETY INSPECTION

TITLE: PLANTSITE TAILINGS DAM
2017 PIEZOMETER READINGS
STA. 0+300 m

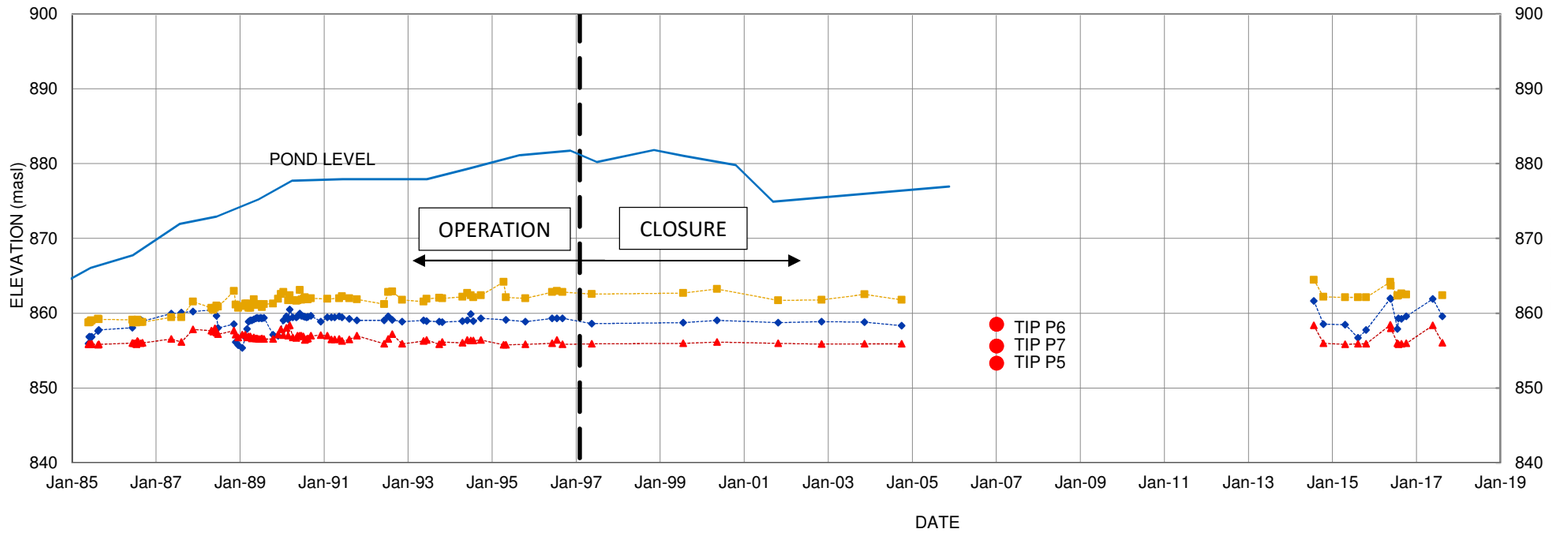
PROJECT No. M09684A14

FIG. No. 3

Date & Time: 2018-03-15 16:06
Figure File: Z:\MVCR\M09684A14 - TCL-Quintette 2017 DSI\300 Design\340 Ph04-EngSupport\341 Instrumentation\PTD Piezometer\[171207 Plantsite Piezometer.xlsx]Figure B



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)
2017-05-23	0+475	P5	PNEUMATIC	853.4	12.1	8.5	861.9
		P6	PNEUMATIC	858.6	15.7	11.0	869.6
		P7	PNEUMATIC	855.7	3.8	2.7	858.4
2017-08-14	0+475	P5	PNEUMATIC	853.4	8.8	6.2	859.6
		P6	PNEUMATIC	858.6	5.4	3.8	862.4
		P7	PNEUMATIC	855.7	0.5	0.4	856.1

LEGEND:

- PIEZOMETER TIP ELEVATION
- 23-MAY-2017 WATER LEVEL
- 14-AUGUST-2017 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

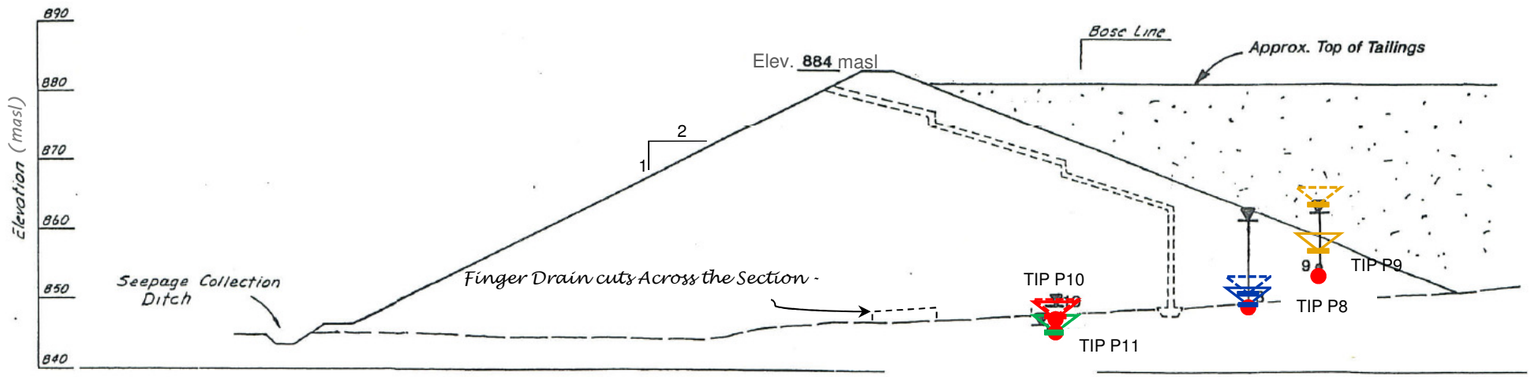
PROJECT: QUINTETTE COAL OPERATIONS
2017 DAM SAFETY INSPECTION

TITLE: PLANTSITE TAILINGS DAM
2017 PIEZOMETER READINGS
STA. 0+475 m

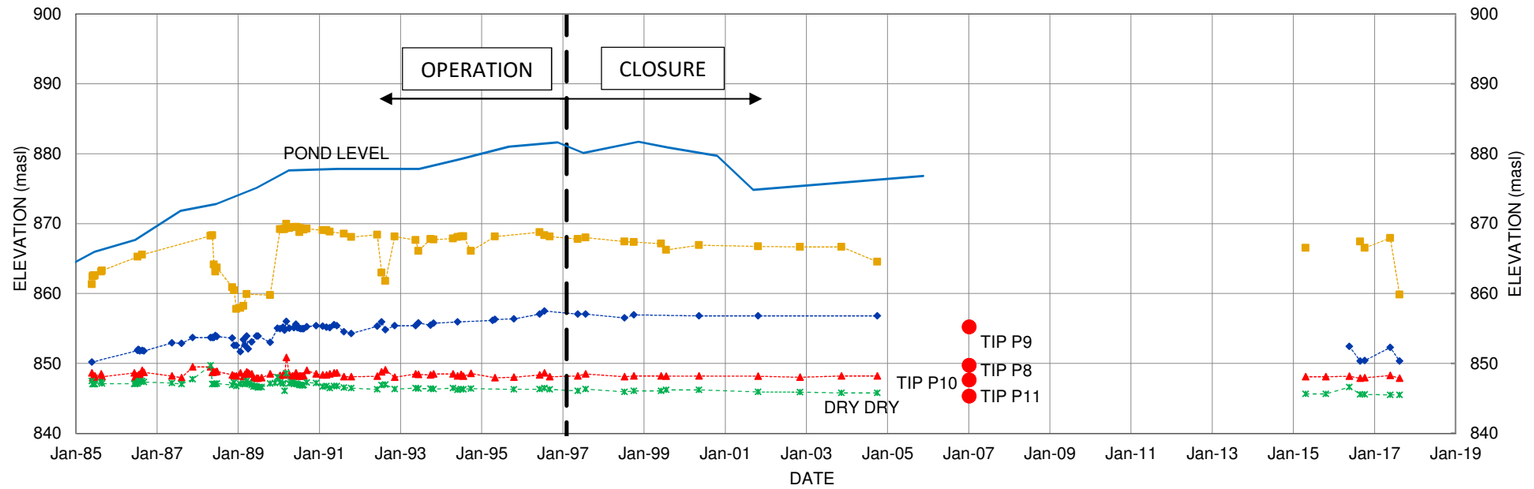
PROJECT No. M09684A14

FIG. No. 4

Date & Time: 2018-03-15 15:56
Figure File: Z:\M\VCR\M09684A14 - TCL-Quintette 2017 DSI\300 Design\340 Ph04-EngSupport\341 Instrumentation\PTD Piezometer\[171207 Plantsite Piezometer.xlsx]Figure G



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)
2017-05-23	0+575	P8	PNEUMATIC	849.9	3.4	2.4	852.3
		P9	PNEUMATIC	855.4	17.8	12.5	867.9
		P10	PNEUMATIC	847.8	0.7	0.5	848.3
		P11	PNEUMATIC	845.5	0.0	0.0	<845.5
2017-08-14	0+575	P8	PNEUMATIC	849.9	0.6	0.4	850.3
		P9	PNEUMATIC	855.4	6.3	4.4	859.8
		P10	PNEUMATIC	847.8	0.1	0.1	847.9
		P11	PNEUMATIC	845.5	0.0	0.0	<845.5

LEGEND:

- PIEZOMETER TIP ELEVATION
- 23-MAY-2017 WATER LEVEL
- 14-AUGUST-2017 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

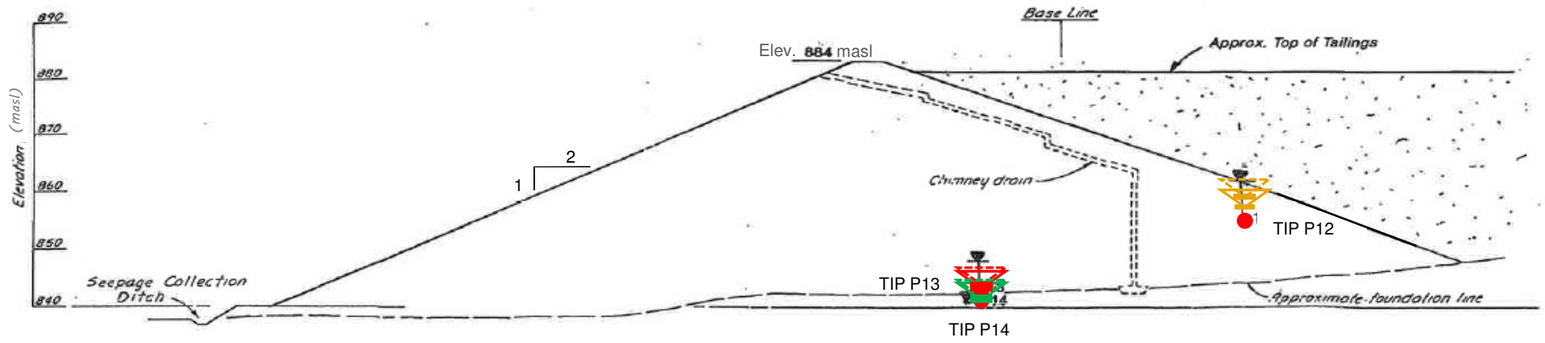
PROJECT: QUINTETTE COAL OPERATIONS
2017 DAM SAFETY INSPECTION

TITLE: PLANTSITE TAILINGS DAM
2017 PIEZOMETER READINGS
STA. 0+575 m

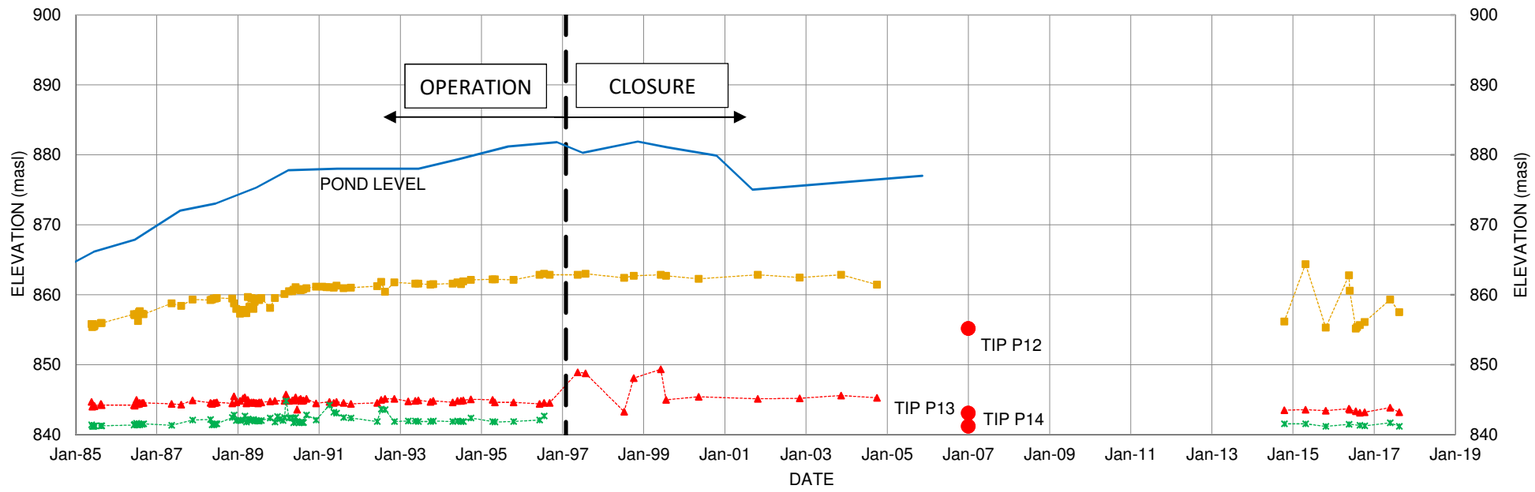
PROJECT No. M09684A14

FIG. No. 5

Date & Time: 2018-03-15 15:56
Figure File: Z:\MVCR\M09684A14 - TCL-Quintette 2017 DSI\300 Design\340 Ph04-EngSupport\341 Instrumentation\PTD Piezometer\[171207 Plantsite Piezometer.xlsx]Figure G



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)
2017-05-23	0+696	P12	PNEUMATIC	855.1	6.0	4.2	859.3
		P13	PNEUMATIC	843.0	1.2	0.8	843.8
		P14	PNEUMATIC	841.1	0.8	0.6	841.7
2017-08-14	0+696	P12	PNEUMATIC	855.1	3.4	2.4	857.5
		P13	PNEUMATIC	843.0	0.3	0.2	843.2
		P14	PNEUMATIC	841.1	0.1	0.1	841.2

LEGEND:

- PIEZOMETER TIP ELEVATION
- 23-MAY-2017 WATER LEVEL
- 14-AUGUST-2017 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

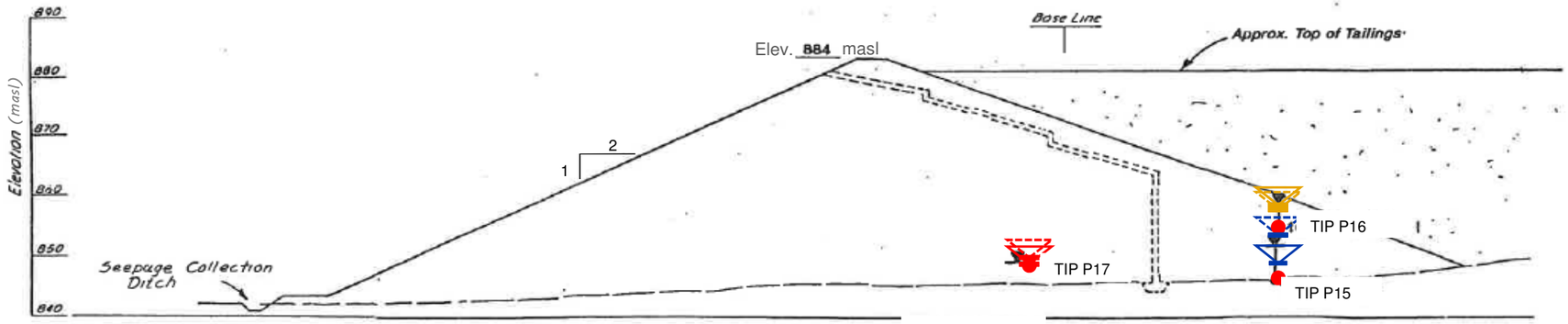
PROJECT: QUINTETTE COAL OPERATIONS
2017 DAM SAFETY INSPECTION

TITLE: PLANTSITE TAILINGS DAM
2017 PIEZOMETER READINGS
STA. 0+696 m

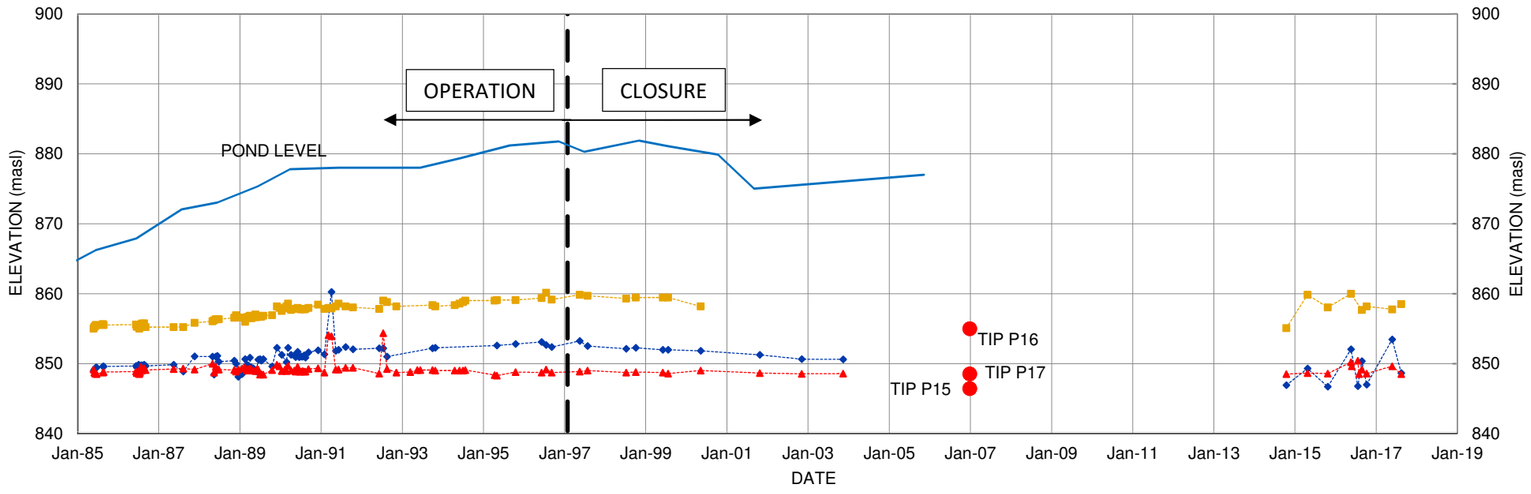
PROJECT No. M09684A14

FIG. No. 6

Date & Time: 2018-03-15 15:56
Figure File: Z:\M\VCR\M09684A14 - TCL-Quintette 2017 DSI\300 Design\340 Ph04-EngSupport\341 Instrumentation\PTD Piezometer\[171207 Plantsite Piezometer.xlsx]Figure G



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)
2017-05-23	0+800	P15	PNEUMATIC	846.2	10.3	7.2	853.4
		P16	PNEUMATIC	854.8	4.2	3.0	857.8
		P17	PNEUMATIC	848.3	1.9	1.3	849.6
2017-08-14	0+800	P15	PNEUMATIC	846.2	3.5	2.5	848.7
		P16	PNEUMATIC	854.8	5.3	3.7	858.5
		P17	PNEUMATIC	848.3	0.3	0.2	848.5

LEGEND:

- PIEZOMETER TIP ELEVATION
- 23-MAY-2017 WATER LEVEL
- 14-AUGUST-2017 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

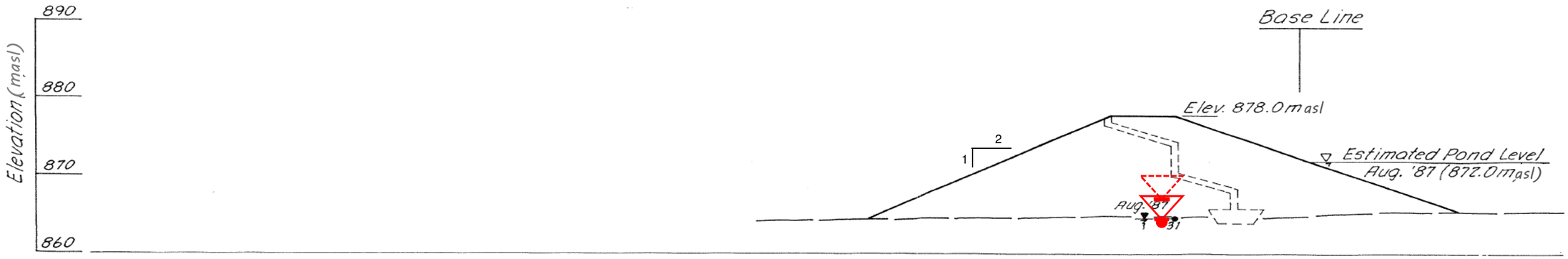
PROJECT: QUINTETTE COAL OPERATIONS
2017 DAM SAFETY INSPECTION

TITLE: PLANTSITE TAILINGS DAM
2017 PIEZOMETER READINGS
STA. 0+800 m

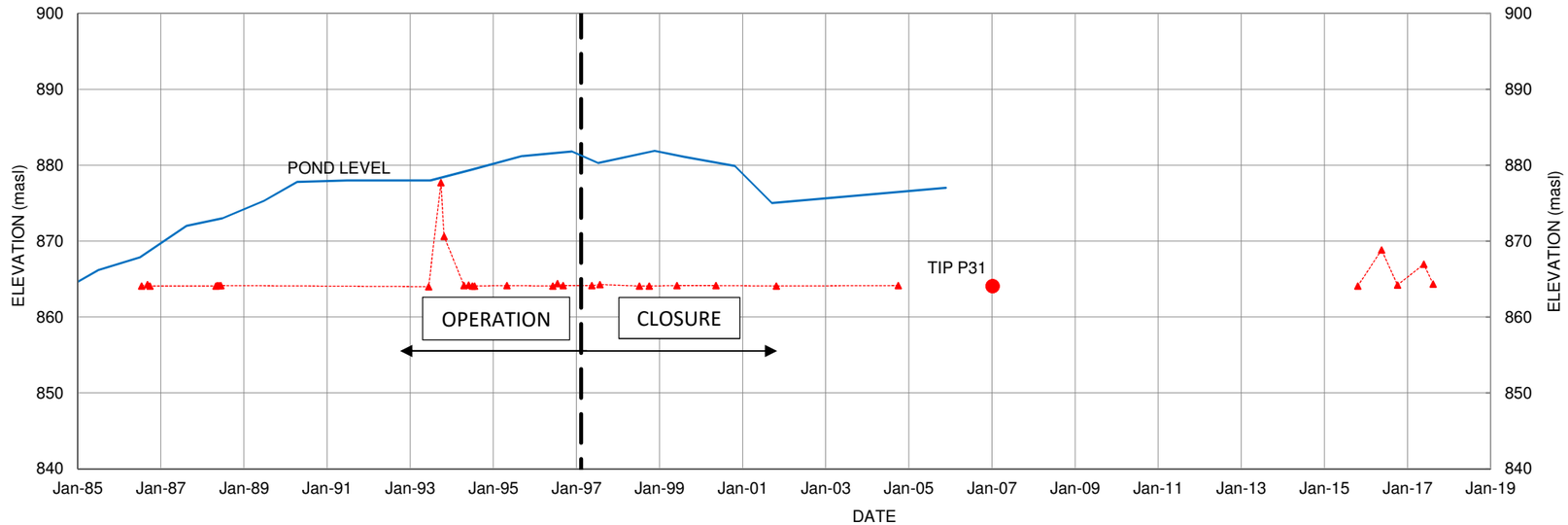
PROJECT No. M09684A14

FIG. No. 7

Date & Time: 2018-03-15 15:56
Figure File: Z:\MVCR\M09684A14 - TCL-Quintette 2017 DSI\300 Design\340 Ph04-EngSupport\341 Instrumentation\PTD Piezometer\[171207 Plantsite Piezometer.xlsx]Figure G



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)
2017-05-23	2+040	P31 (NOTE 3)	PNEUMATIC	864.0	4.2	3.0	867.0
2017-08-14	2+040	P31 (NOTE 3)	PNEUMATIC	864.0	0.5	0.4	864.4

LEGEND:

- PIEZOMETER TIP ELEVATION
- TIP P31 WATER ELEVATION
- 23-MAY-2017 WATER LEVEL
- 14-AUGUST-2017 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
2017 DAM SAFETY INSPECTION

TITLE: PLANTSITE TAILINGS DAM
2017 PIEZOMETER READINGS
STA. 2+040 m

PROJECT No. M09684A14

FIG. No. 8

Date & Time: 2018-03-15 15:56
Figure File: Z:\MVCR\M09684A14 - TCL-Quintette 2017 DSI\300 Design\340 Ph04-EngSupport\341 Instrumentation\PTD Piezometer\[171207 Plantsite Piezometer.xlsx]Figure G

MONUMENT	OCTOBER 2016 READINGS	NORTHING (m)			CHANGES BETWEEN READINGS FROM OCTOBER 2016 (mm)		
	NORTHING (m)	May 23, 2017	August 10, 2017	October 4, 2017	May 23, 2017	August 10, 2017	October 4, 2017
CP1	6099000.208	6099000.200	6099000.229	6099000.227	-8	20	18
CP2	6098967.269	6098967.242	6098967.254	6098967.256	-27	-15	-14
CP3	6098932.289	6098932.289	6098932.284	6098932.293	0	-5	4
CP4	6098718.784	6098718.758	6098718.771	6098718.779	-26	-13	-5
CP5	6098443.887	6098443.892	6098443.884	6098443.870	5	-3	-17
CP6	6097987.159	6097987.166	6097987.159	6097987.154	7	-1	-5
CP7	6097722.683	6097722.683	6097722.722	6097722.680	0	39	-3
CP8	6097539.411	6097539.405	6097539.438	6097539.400	-6	27	-12

MONUMENT	OCTOBER 2016 READINGS	EASTING (m)			CHANGES BETWEEN READINGS FROM OCTOBER 2016 (mm)		
	EASTING (m)	May 23, 2017	August 10, 2017	October 4, 2017	May 23, 2017	August 10, 2017	October 4, 2017
CP1	628918.371	628918.367	628918.364	628918.362	-5	-8	-9
CP2	628607.739	628607.719	628607.719	628607.723	-20	-20	-16
CP3	628369.040	628369.005	628369.019	628369.020	-35	-21	-20
CP4	628319.745	628319.731	628319.744	628319.738	-14	-1	-7
CP5	628260.910	628260.893	628260.895	628260.901	-17	-15	-9
CP6	628067.096	628067.094	628067.102	628067.095	-2	6	-1
CP7	628102.203	628102.195	628102.212	628102.210	-8	9	7
CP8	628246.892	628246.884	628246.908	628246.908	-8	16	15

MONUMENT	OCTOBER 2016 READINGS	ELEVATION (masl)			CHANGES BETWEEN READINGS FROM OCTOBER 2016 (mm)		
	ELEVATION (masl)	May 23, 2017	August 10, 2017	October 4, 2017	May 23, 2017	August 10, 2017	October 4, 2017
CP1	883.141	883.093	883.078	883.125	-48	-63	-16
CP2	882.828	882.799	882.796	882.839	-29	-32	11
CP3	882.781	882.763	882.773	882.777	-18	-8	-5
CP4	882.779	882.775	882.774	882.781	-4	-5	2
CP5	882.263	882.231	882.234	882.235	-32	-29	-28
CP6	882.607	882.575	882.583	882.589	-32	-24	-18
CP7	882.398	882.351	882.356	882.394	-47	-42	-4
CP8	882.528	882.508	882.505	882.519	-20	-23	-9

NOTES:

1. LATEST SURVEY DATA PROVIDED BY QUINTETTE COAL OPERATIONS ON OCTOBER 4, 2017.

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

CLIENT: Teck

Klohn Crippen Berger

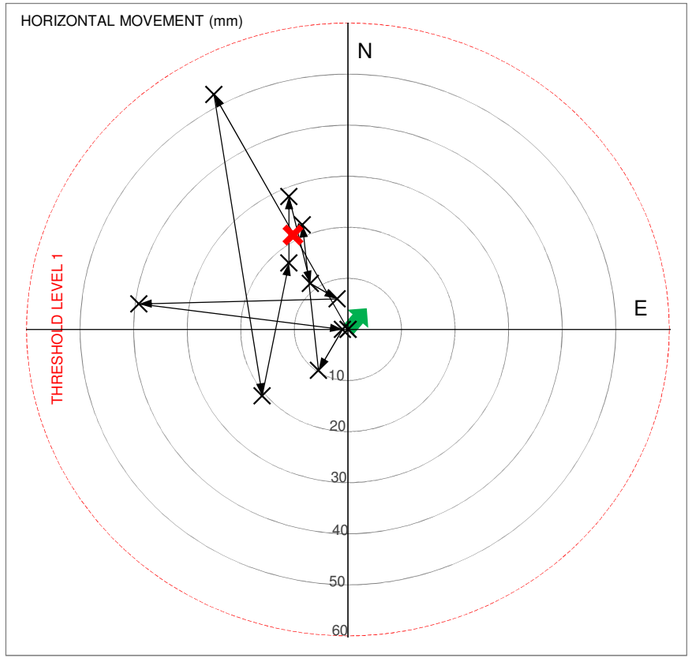
PROJECT: QUINTETTE COAL OPERATIONS
2017 DAM SAFETY INSPECTION

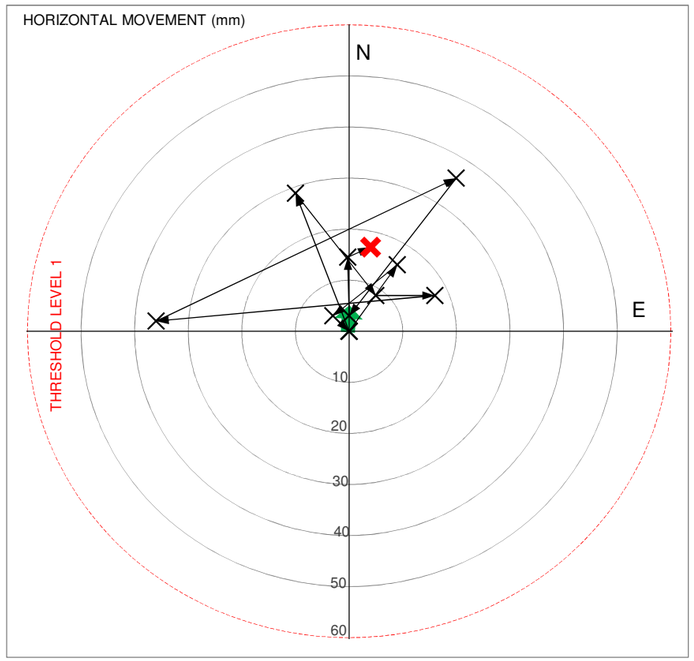
TITLE: PLANTSITE TAILINGS DAM
2017 SURVEY MONUMENT DATA

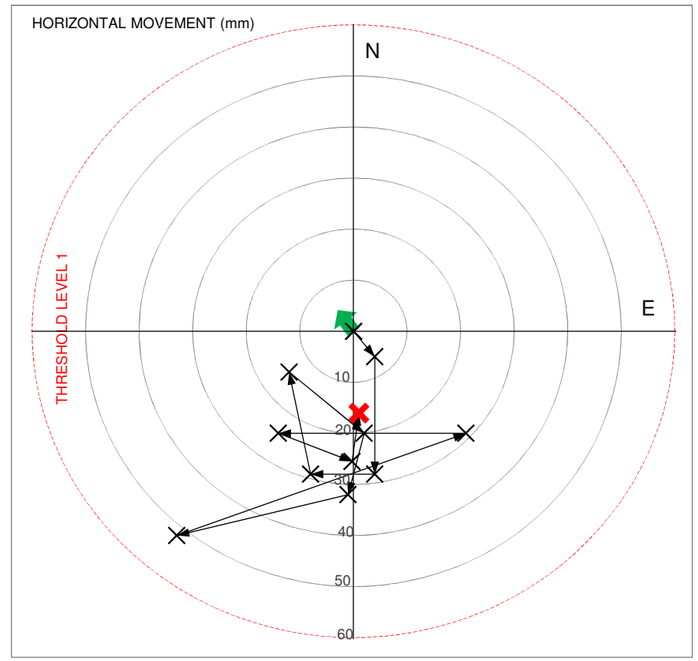
PROJECT No. M09684A14

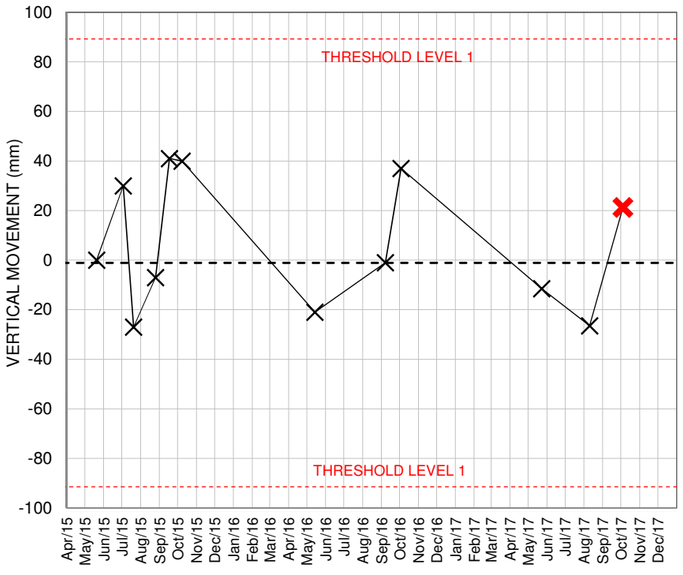
FIG. No. 9

Date & Time: 2018-02-24 0:48
Figure File: C:\Users\ngullayanon\Desktop\PTD\[180223 Plantsite Survey.xlsx]Figure A

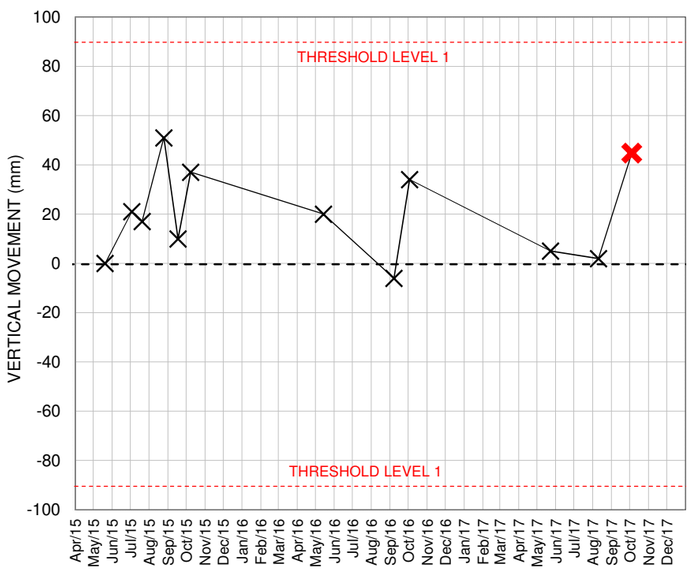




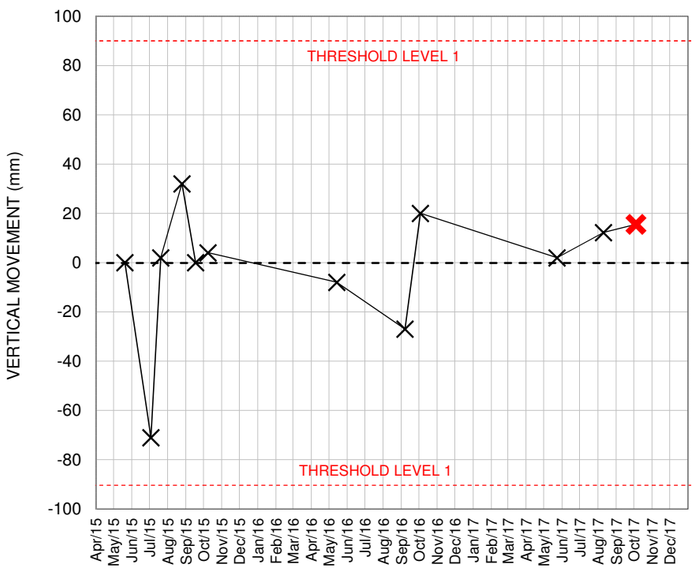




CP1 SURVEY RECORDS



CP2 SURVEY RECORDS



CP3 SURVEY RECORDS

NOTES:

1. LATEST SURVEY DATA PROVIDED BY QUINTETTE COAL OPERATIONS ON OCTOBER 4, 2017.

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

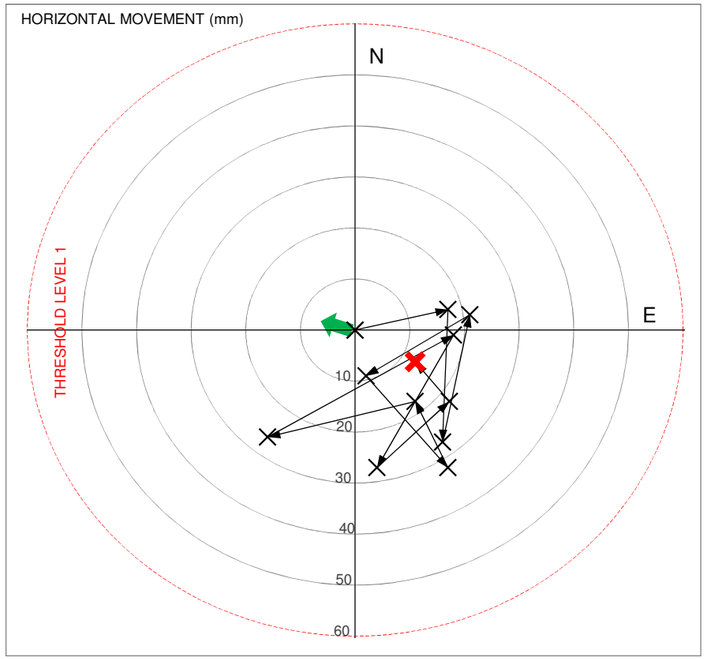
PROJECT: QUINTETTE COAL OPERATIONS
2017 DAM SAFETY INSPECTION

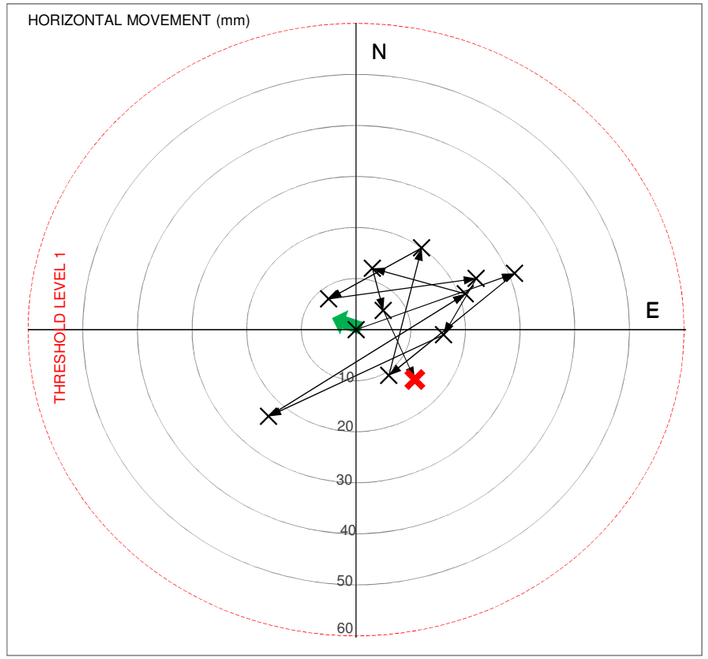
TITLE: PLANTSITE TAILINGS DAM
2017 SURVEY MONUMENT PLOTS
(CP1 TO CP3)

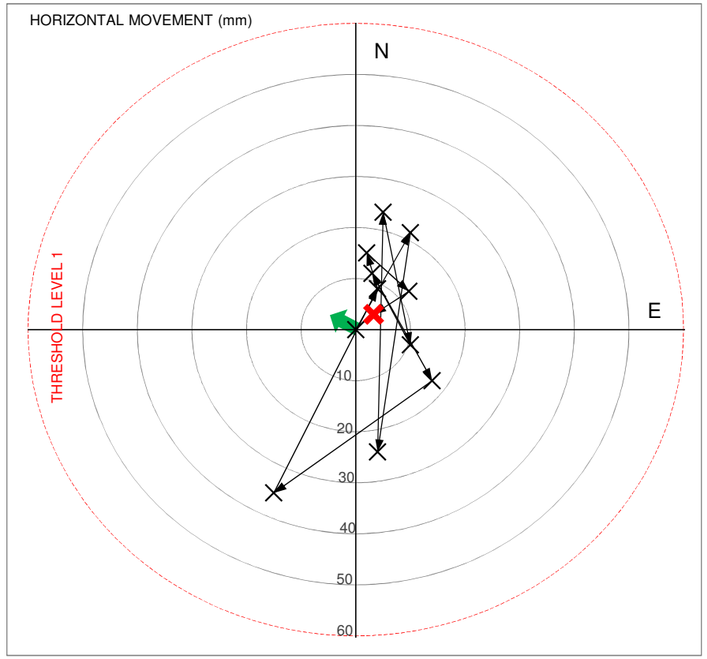
PROJECT No. M09684A14

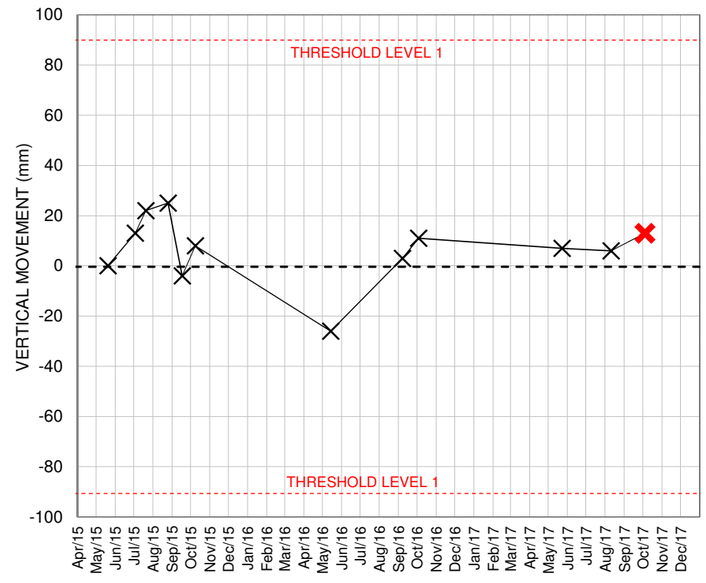
FIG. No. 10

Date & Time: 2018-02-24 0:48
Figure File: C:\Users\ngullayaron\Desktop\PTD\[180223 Plantsite Survey.xlsx]Figure A

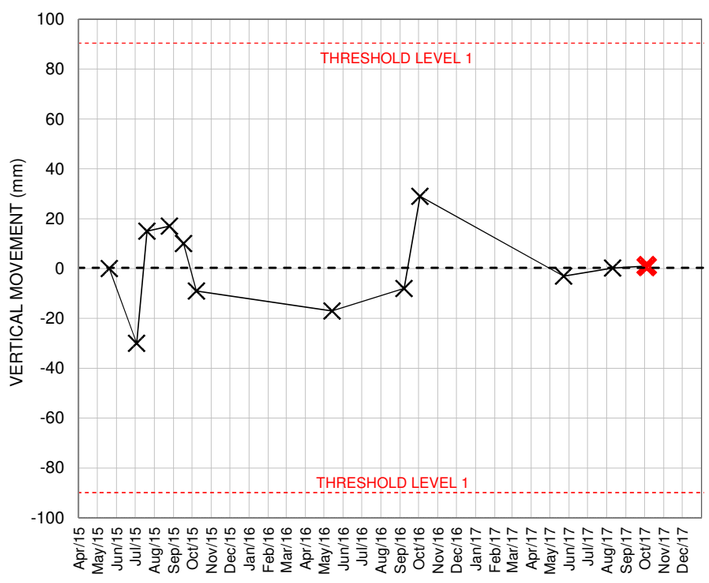




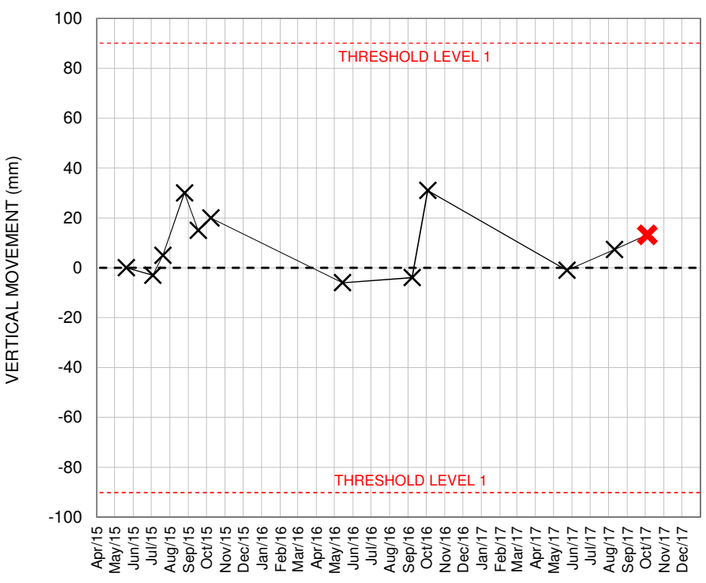




CP4 SURVEY RECORDS



CP5 SURVEY RECORDS



CP6 SURVEY RECORDS

NOTES:

1. LATEST SURVEY DATA PROVIDED BY QUINTETTE COAL OPERATIONS ON OCTOBER 4, 2017.

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

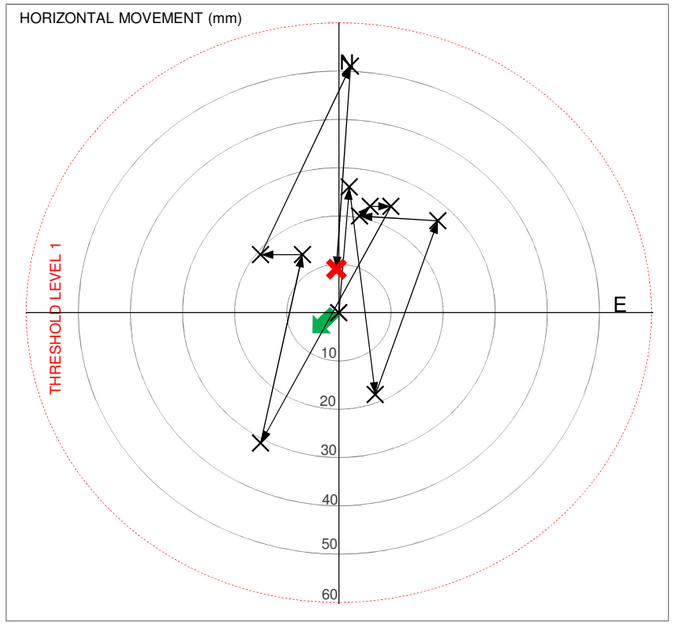
PROJECT: QUINTETTE COAL OPERATIONS
2017 DAM SAFETY INSPECTION

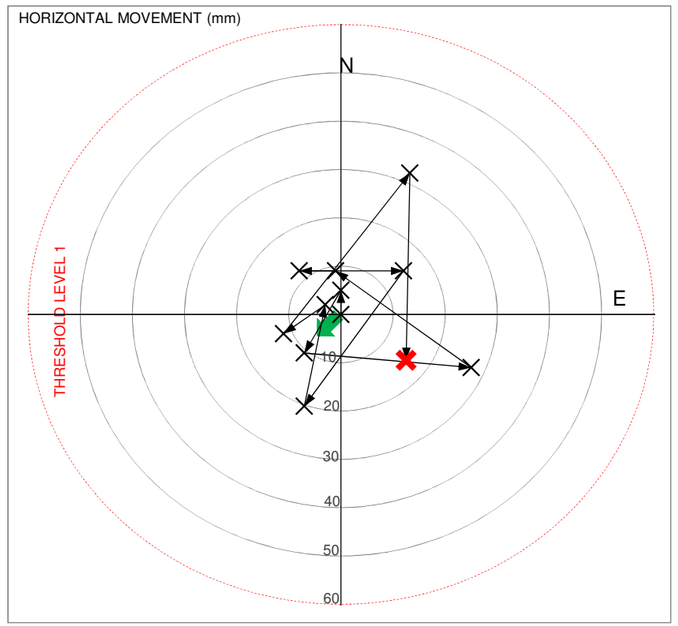
TITLE: PLANTSITE TAILINGS DAM
2017 SURVEY MONUMENT PLOTS
(CP4 TO CP6)

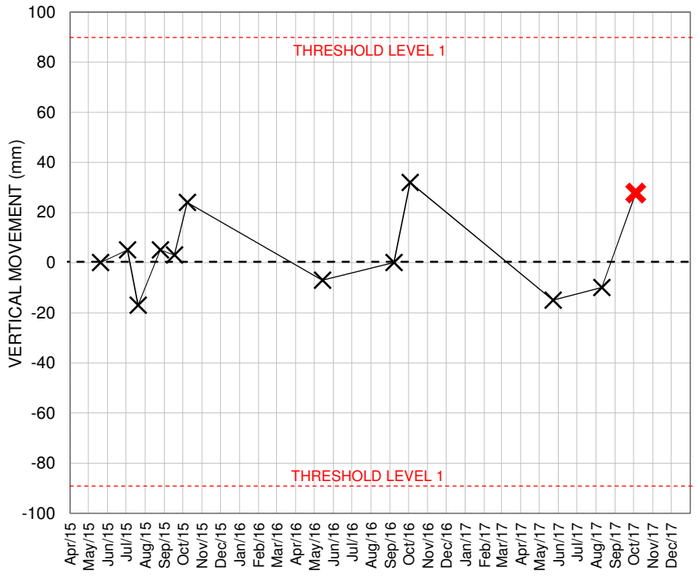
PROJECT No. M09684A14

FIG. No. 11

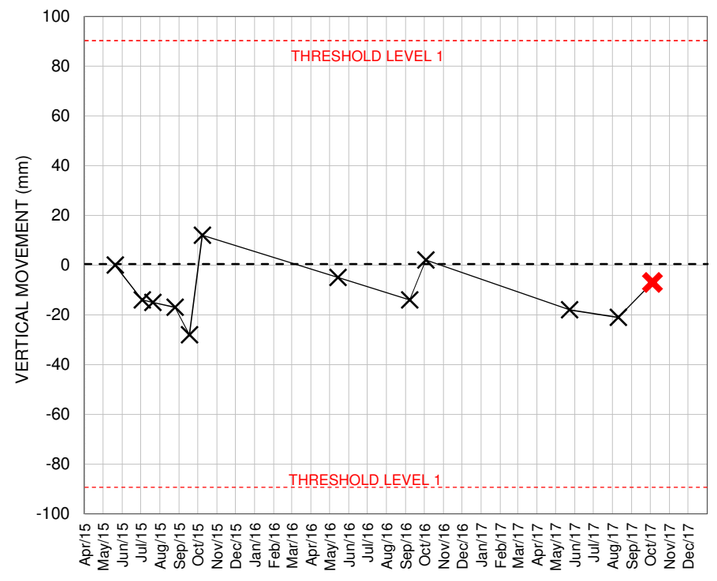
Date & Time: 2018-02-24 0:48
Figure File: C:\Users\ngullayanon\Desktop\PTD\1180223 Plantsite Survey.xlsx]Figure A







CP7 SURVEY RECORDS



CP8 SURVEY RECORDS

NOTES:

1. LATEST SURVEY DATA PROVIDED BY QUINTETTE COAL OPERATIONS ON OCTOBER 4, 2017.

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
2017 DAM SAFETY INSPECTION

TITLE: PLANTSITE TAILINGS DAM
2017 SURVEY MONUMENT PLOTS
(CP7 AND CP8)

PROJECT No. M09684A14

FIG. No. 12

Date & Time: 2018-02-24 0:48
Figure File: C:\Users\ngullayanon\Desktop\PTD\[180223 Plantsite Survey.xlsx]Figure A

APPENDIX I

Inspection Photographs

Appendix I
Inspection Photographs

LEGEND:

- PTD = Plantsite Tailings Dam.
- PTD-2017-## refers to 2017 DSI photograph location, as shown on Figure 1.
- All photographs were taken during site inspection on August 15th, 2017.

Photo I-1 Spillway channel - looking east towards the spillway channel's 90° bend – minor vegetation, but no obstruction (PTD-2017-01)

Photo I-2 **Spillway channel - viewed from the embankment looking north along the channel – channel is well vegetated but no obstruction observed (PTD-2017-01)**

Photo I-3 **Looking northwest toward the inlet (PTD-2017-02)**

Photo I-4 **Spillway channel – viewed from inside the PTD impoundment looking southwest toward discharge point into M17 Creek (PTD-2017-03)**

Photo I-5 **Spillway channel – viewed from inside the PTD impoundment looking northwest along the channel. Channel is well vegetated but no obstruction observed; (PTD-2017-03)**

Photo I-6 Overview of outlet channel – looking southwest toward discharge point into M17 Creek. (PTD-2017-04)

Photo I-7 Spillway discharge point into M17 Creek (PTD-2017-05)

Photo I-8 **Spillway discharge point into M17 Creek – minor flow observed but could not be estimated due to the vegetation (PTD-2017-05)**

Photo I-9 **Overview of PTD downstream slope looking northeast – the slope is in good condition (PTD-2017-06)**

Photo I-10 Looking northwest at a wet area downstream of PTD toe – no apparent change in condition from previous year (PTD-2017-07)

Photo I-11 Closeup view of the wet area downstream of PTD toe. Algae buildup in pond (PTD-2017-08)

Photo I-12 PTD downstream slope - looking northeast. No sign of distress (PTD-2017-09)

Photo I-13 Finger drain at PTD toe; area downstream of the finger drain is boggy and well vegetated (PTD-2017-10)

Photo I-14 Closeup of the boggy area at the finger drain outlet – water observed on the surface (PTD-2017-10)

Photo I-15 Finger drain at the PTD toe – little to no flow observed (PTD-2017-11)

Photo I-16 Finger drain at the PTD toe – <1 L/min flow (PTD-2017-12)

Photo I-17 Finger drain at the PTD toe – <1 L/min flow (PTD-2017-13)

Photo I-18 **Seepage Collection Pond – located west of the PTD which discharges into M17B Creek. No sign of erosion, distress, or discernable discharge noted (PTD-2017-14)**

Photo I-19 **PTD Seepage Collection Pond – Beaver Dam noted obstructing the outlet area of the pond (PTD-2017-15)**

Photo I-20 Seepage Collection Pond – no sign of distress (PTD-2017-16)

Photo I-21 Seepage Collection Pond – downstream slope; no sign of erosion or movement. (PTD-2017-17)

Photo I-22 Seepage Collection Pond – spillway channel appears to be dry; channel is heavily vegetated (PTD-2017-18)

Photo I-23 Seepage Collection Pond – looking west at the toe; area appears to be dry (PTD-2017-19)

Photo I-24 Seepage Collection Pond – looking south at the toe; area appears to be dry (PTD-2017-19)

Photo I-25 Outlet channel of the Sedimentation Pond – ponded area appears to be smaller than previous year; no discharge noted (PTD-2017-20)

Photo I-26 Typical finger drain wrapped with geotextile – wet ground downstream of the drain outlet noted (<1 L/min flow) (PTD-2017-21)

Photo I-27 Closeup of small flow (<1 L/min) downstream of the finger drain outlet (PTD-2017-21)

Photo I-28 Finger drain with flow <1 L/min (PTD-2017-22)

Photo I-29 Flow noted coming from downstream toe adjacent to a finger drain - flow was estimated 1 L/min (PTD-2017-23)

Photo I-30 Flow noted coming from finger drain – flow was estimated 3 to 5 L/min (PTD-2017-23)

Photo I-31 **Overview of PTD northwest corner's downstream slope - looking southeast. More vegetation than previous years (PTD-2017-24)**

Photo I-32 **Overview of PTD northwest corner - steep scarp near downstream slope ramp – inactive due to the amount of vegetation growth on scarp (PTD-2017-25)**

Photo I-33 Finger drain with geotextile – red (oxidized iron) precipitate observed (PTD-2017-26)

Photo I-34 Finger drain with geotextile – flow was estimated 0.5 L/min (PTD-2017-26)

Photo I-35 **PTD northeast corner's downstream slope – no sign of distress (PTD-2017-27)**

Photo I-36 **Change in vegetation type observed at approximately Sta. 2+200. Vegetation is thick lush green, likely indication of increased moisture in this part of the dam (PTD-2017-28)**

Photo I-37 **PTD impoundment area - looking northeast at the northwest corner. No pond noted in the area. Tailing surface appears to be desiccated (PTD-2017-29)**

Photo I-38 **Standing at the PTD's northwest corner looking southwest into the impoundment – no sign of distress (PTD-2017-30)**

Photo I-39 Upstream Slope and Tailings beach – no sinkholes or sign of distress (PTD-2017-31)

Photo I-40 PTD crest – no sign of distress. Tailings surface is approximately 2 m lower than dam crest level (PTD-2017-32)

Photo I-41 Pond estimated as 70 m from dam crest near Sta. 1+550 (PTD-2017-33)

Photo I-42 Overview of the downstream slope from the dam crest near Sta. 1+200 – looking southwest. No sign of distress, significant movement or erosion (PTD-2017-34)

Photo I-43 **Distance between tailings surface and dam crest is 0.8 m – not a freeboard or dam safety concern (PTD-2017-35)**

Photo I-44 **Portion of downstream slope appears to be tiered - no change from previous year (PTD-2017-36)**

Photo I-45 **Whaleback feature – no change from previous year (PTD-2017-37). See Figure I for location of PTD-2017-37.**

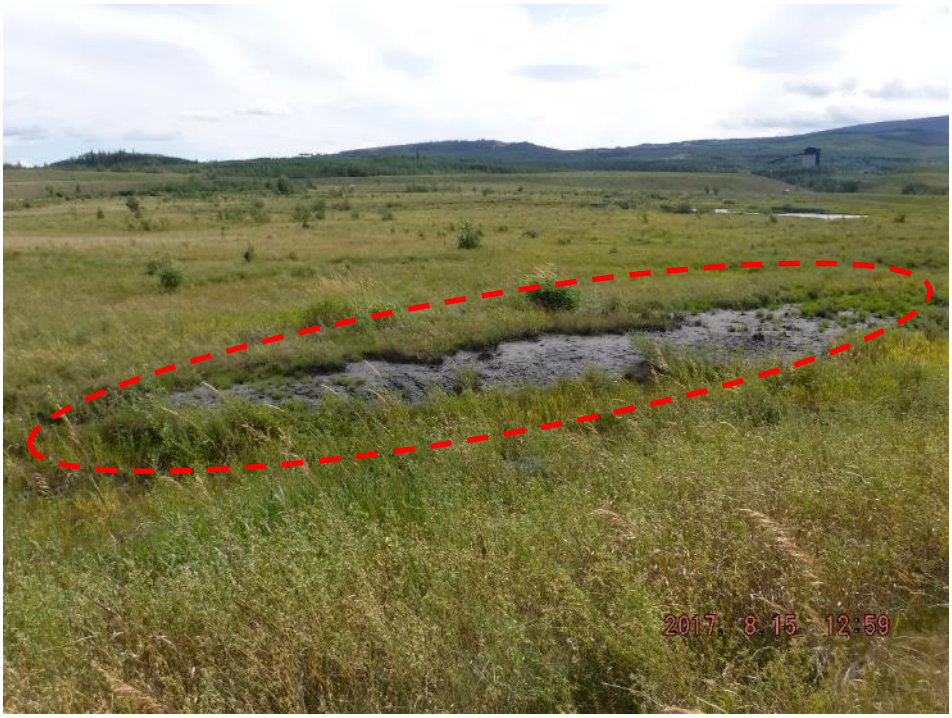


Photo I-46 **From dam crest near Sta. 0+600 looking at the ponded area and the tailings beach; no sign of sinkholes or distress (PTD-2017-38)**

Photo I-47 Downstream slope at the southwest corner – no sign of erosion or distress (PTD-2017-39)

Photo I-48 Pond within depressions along the tailings beach near Sta. 0+400 – pond appears to be the same as in 2016 (PTD-2017-40)

Photo I-49 Low level channel inlet – unlike 2015 and 2016 observations, there was no ponded water in the depression beside the channel (PTD-2017-41)

Photo I-50 Large trees on the upstream slope of the PTD (PTD-2017-41)

Photo I-51 **From dam crest looking southeast at the spillway low flow channel – no obstruction or sign of distress (PTD-2017-42)**

Photo I-52 **From dam crest looking northwest at the spillway low flow channel and downstream slope – no obstruction or sign of distress (PTD-2017-42)**

Photo I-53 **Standing inside the spillway channel looking north at deteriorating riprap and ponded area inside local depressions inside the channel (PTD-2017-43)**

Photo I-54 Closeup of the slaking riprap (PTD-2017-43)

Photo I-55 Standing inside the spillway channel looking east at deteriorating riprap and a small channel behind the riprap with flow of <2 L/min (PTD-2017-44)

Photo I-56 Closeup of the deteriorating riprap (PTD-2017-44)

Photo I-57 Teck removed beaver dam at the Seepage Collection Pond in October 2017 – looking southwest (near waypoint PTD-2017-15)

Photo I-58 Teck removed beaver dam and vegetation at the Seepage Collection Pond in October 2017 – looking northeast (near waypoint PTD-2017-15)

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 1.
- Coordinates for monitoring points are summarized in Table III-1.
- All 2017 photographs were taken during inspection on August 15th, 2017.

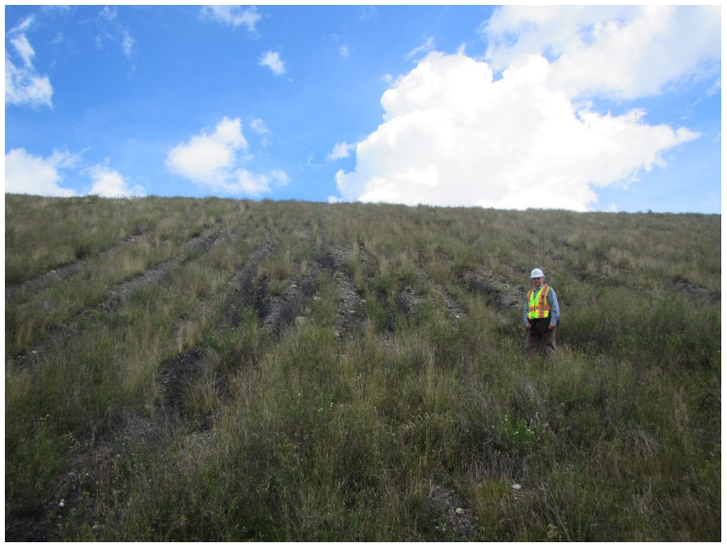
Table III-1 Rill Monitoring Point Locations

Rill Monitoring Point PTD-Rill-x	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

II-2 PTD-RILL-02

2015

2016

2017

II-3 PTD-RILL-03

2015

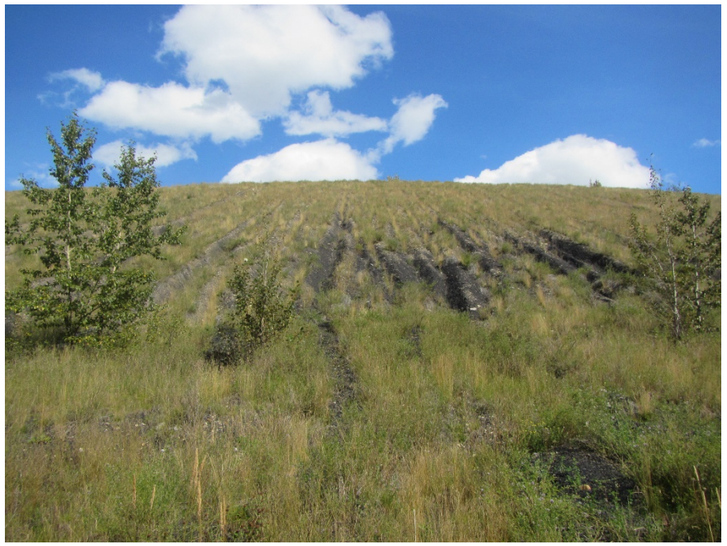
2016

2017

II-4 PTD-RILL-04

2015

2016



2017

II-5 PTD-RILL-05

2015

2016

2017

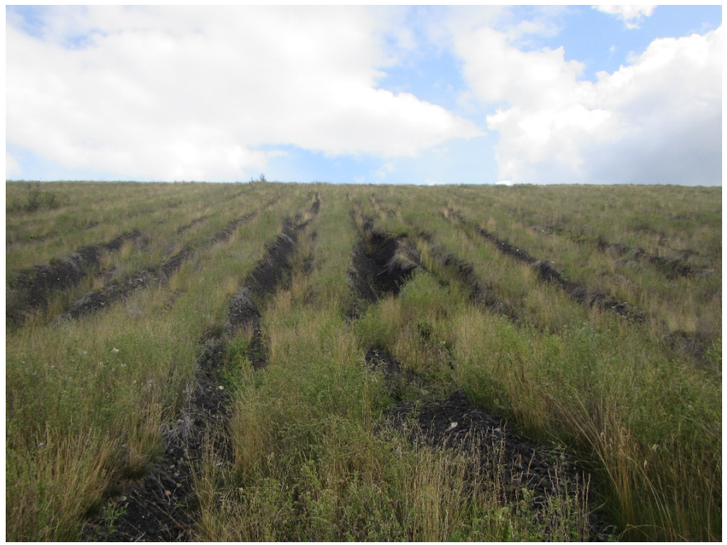
II-6 PTD-RILL-05A

2016

2017

II-7 PTD-RILL-05B

2016



2017

II-8 PTD-RILL-06

2015

2016

2017

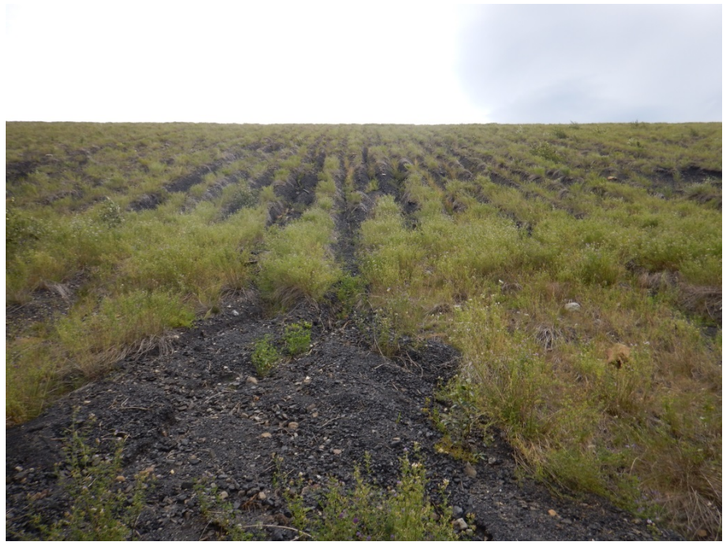
II-9 PTD-RILL-06A

2016

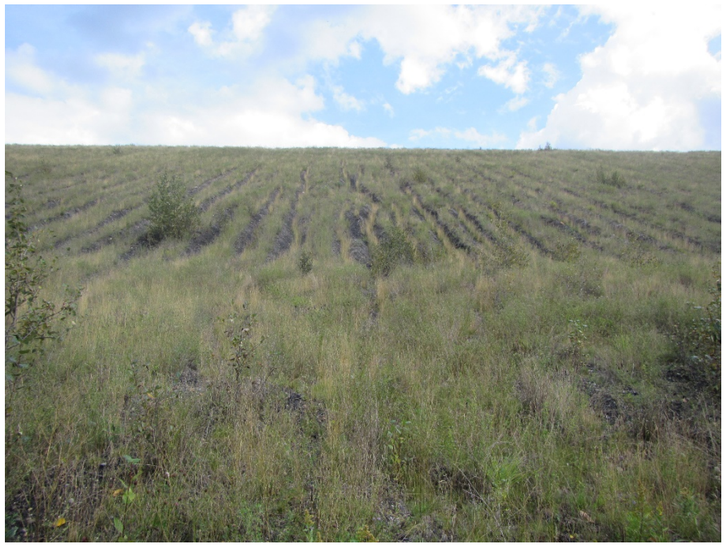
2017

II-10 PTD-RILL-07

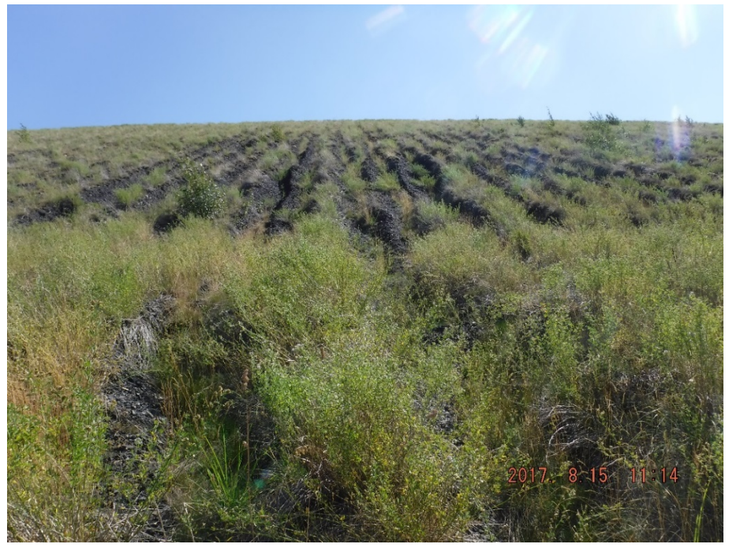
2015



2016



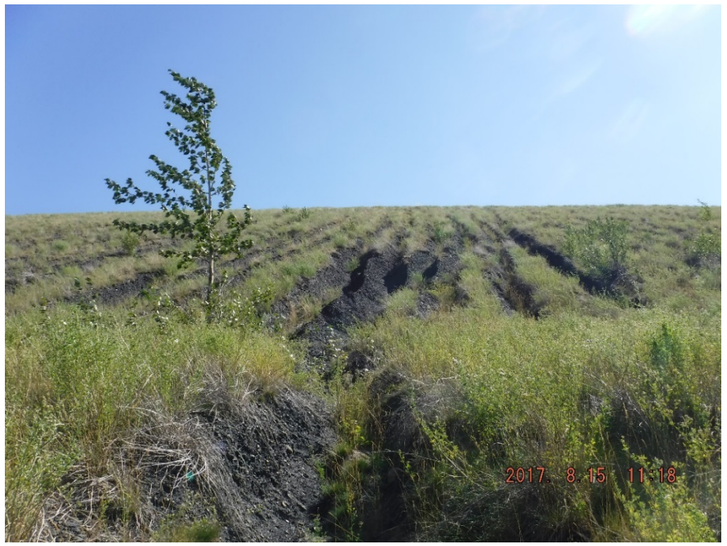
2017



II-11 PTD-RILL-07A

2016

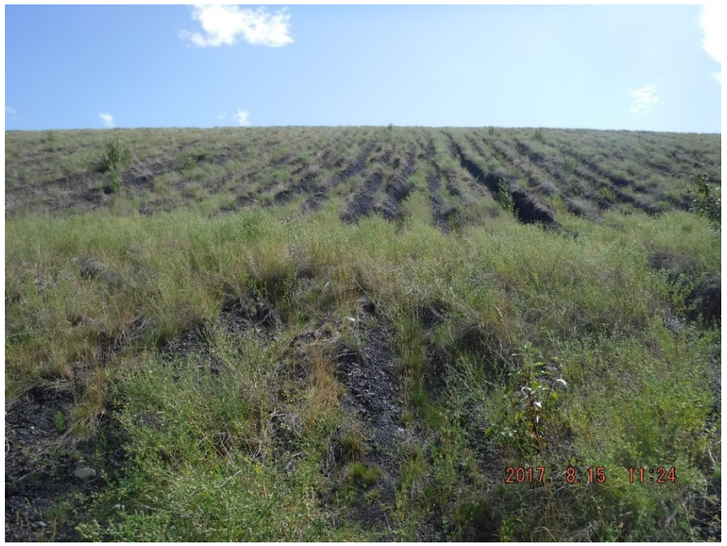
2017



II-12 PTD-RILL-07B

2016

2017

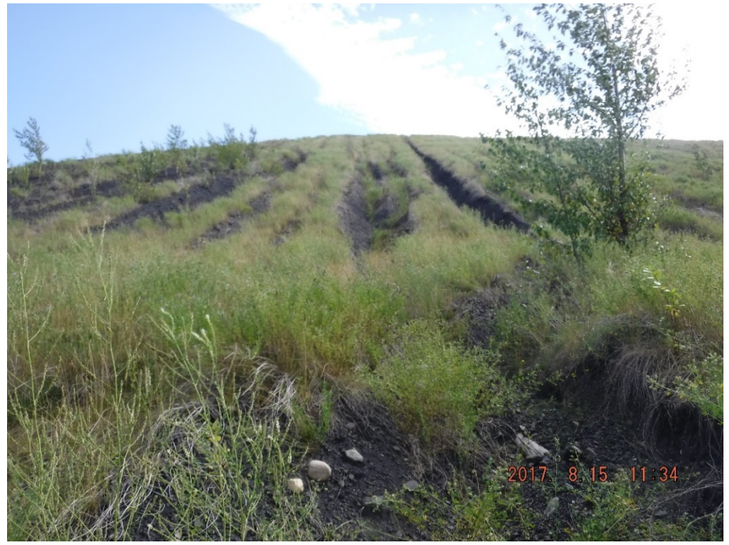


II-13 PTD-RILL-08

2015

2016

2017



II-14 PTD-RILL-09

2015

2016

2017

II-15 PTD-RILL-10

2015

2016

2017

II-16 PTD-RILL-11

2015

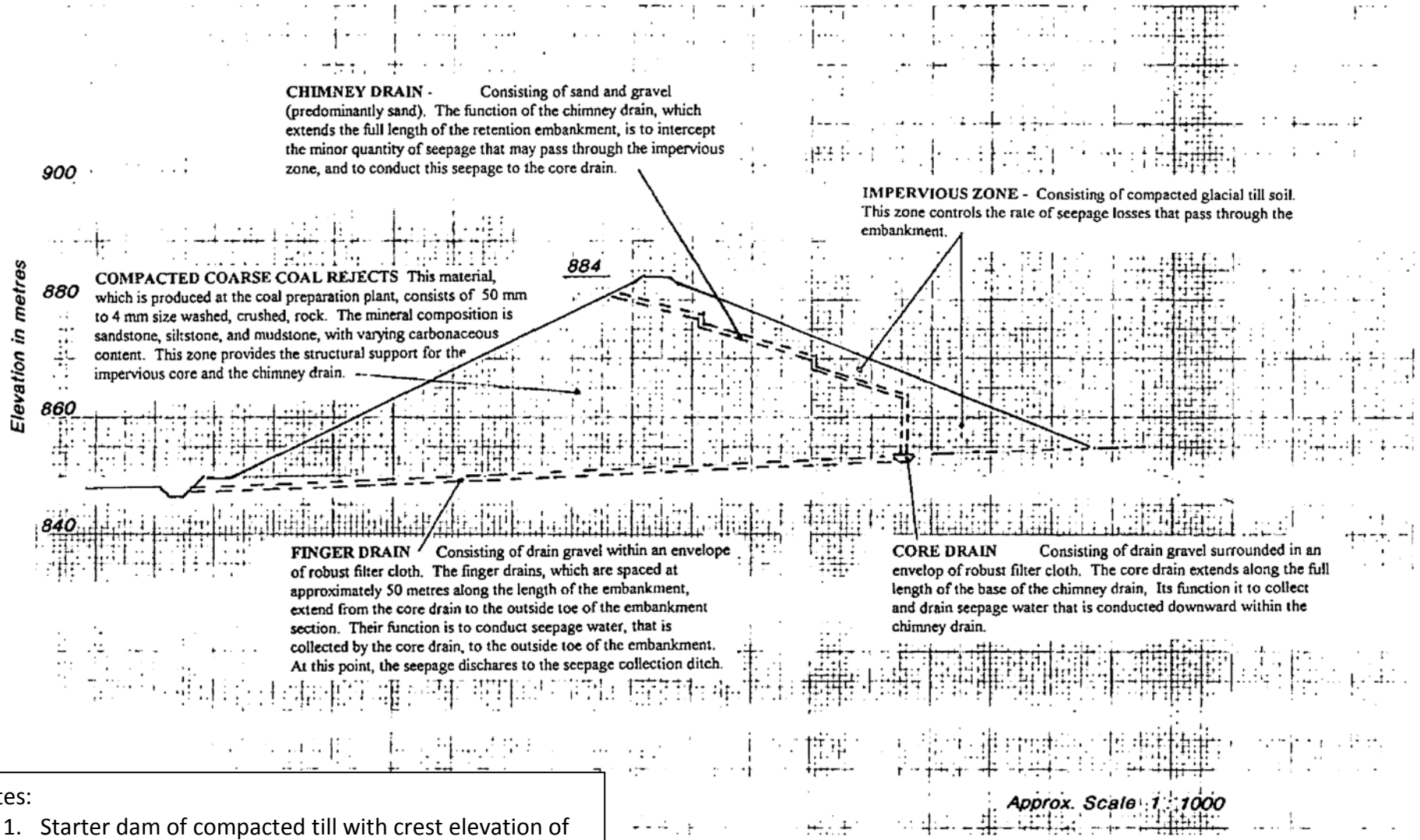
2016

2017

n/a

APPENDIX III

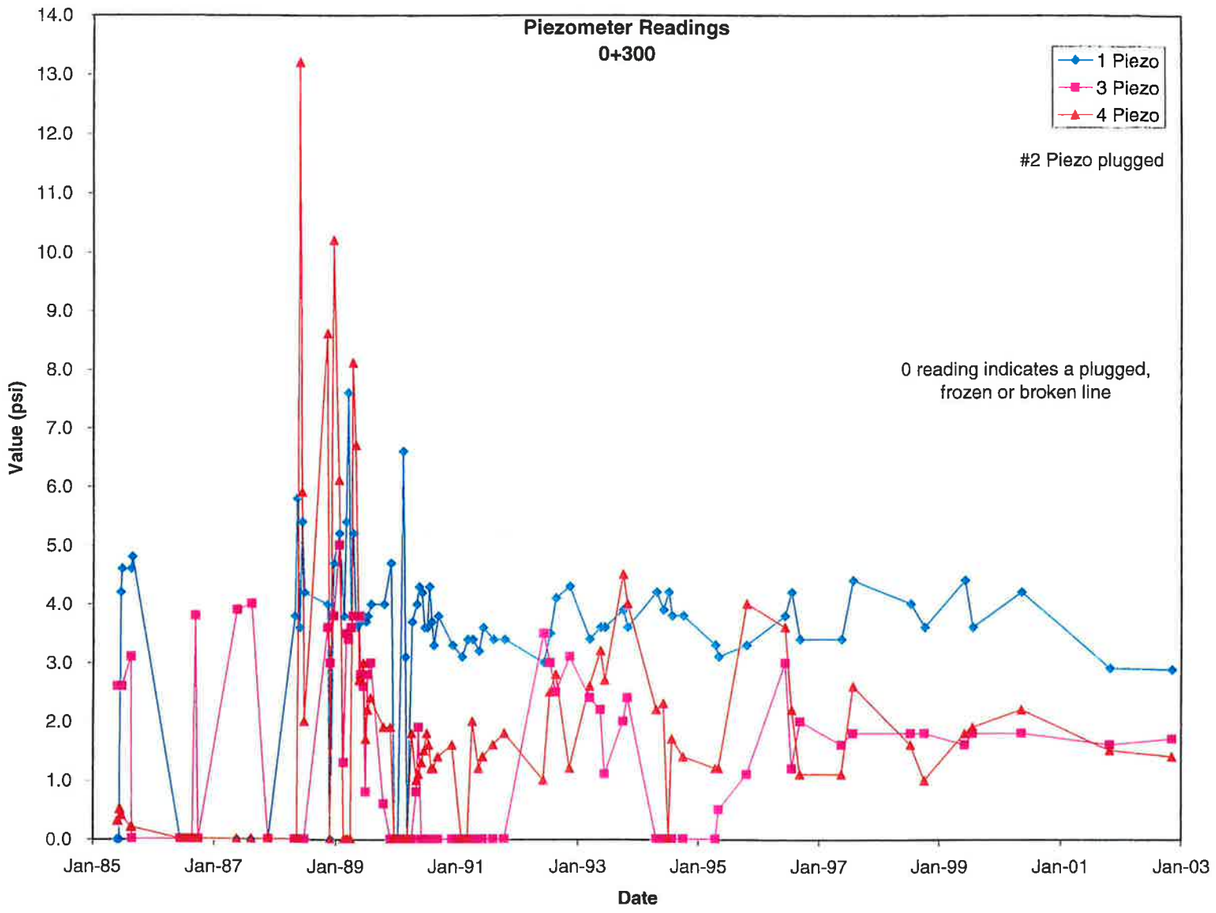
Dam Design Drawings

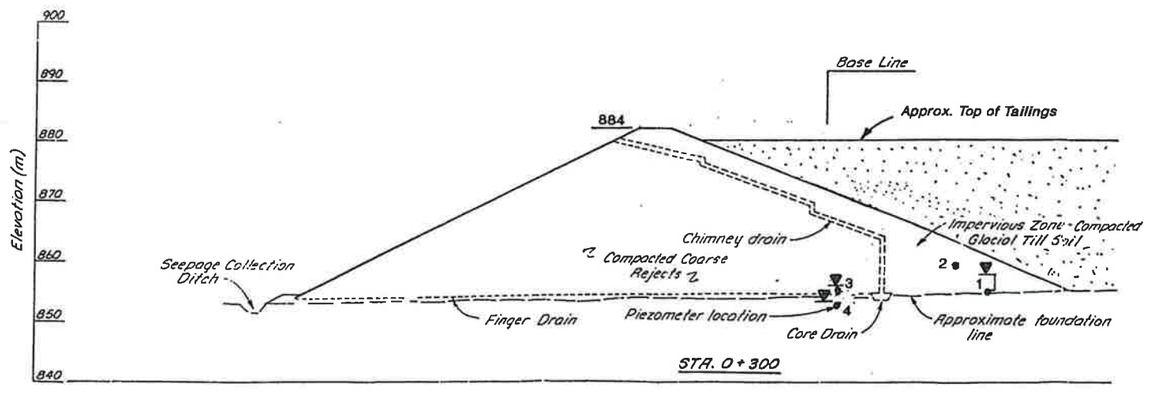


Notes:

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.

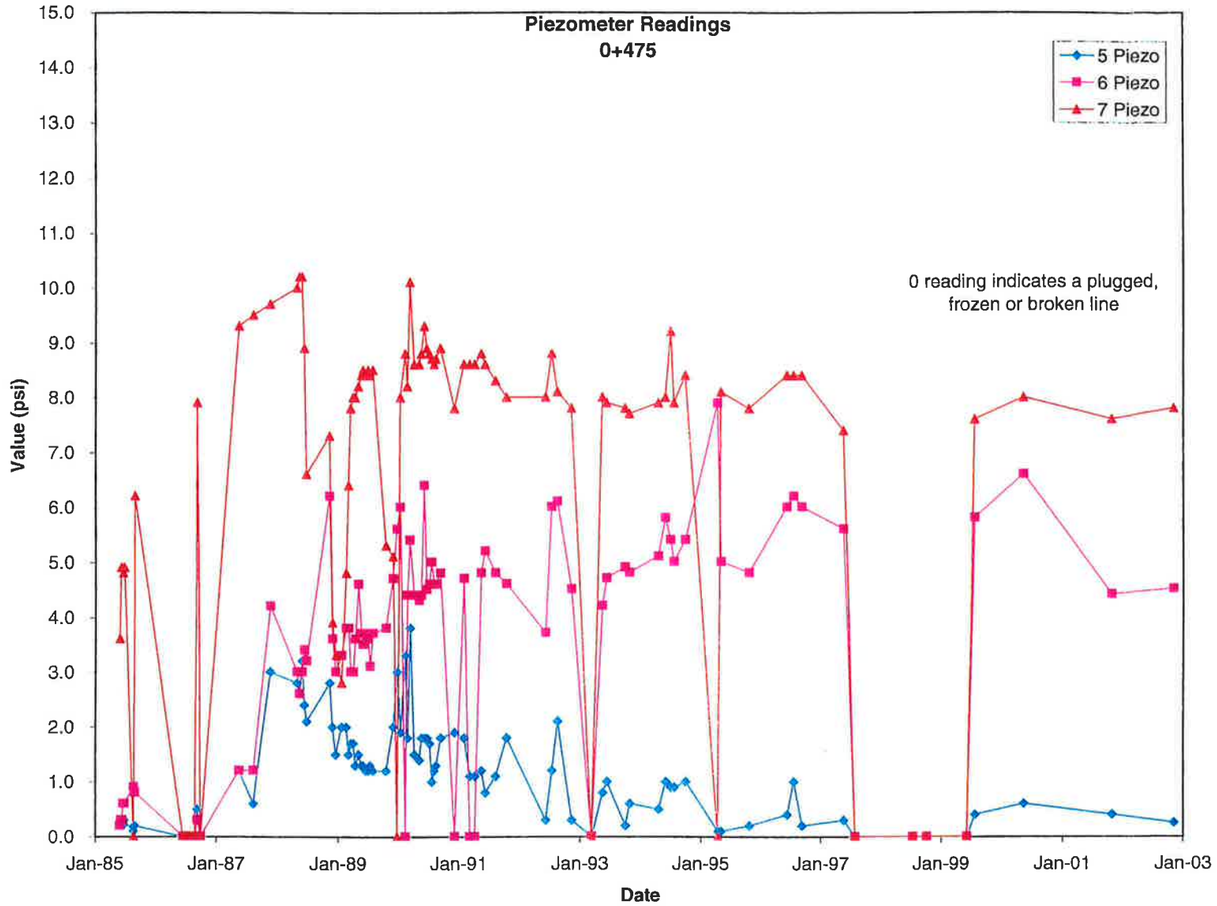
NOTES

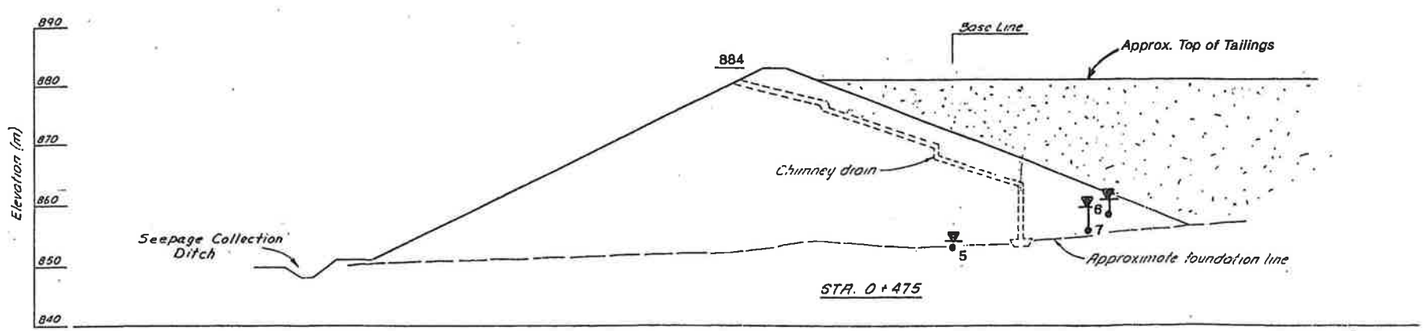
1 Location of section is shown on Figure B1 of this Appendix.
2 1 (one) psi of pressure is equivalent to a head of 0.704 metres of water. Plotted piezometric heights above piezometer tips are to scale.
3 Occasional zero readings at a piezometer are an indication that the piezometer leads were frozen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

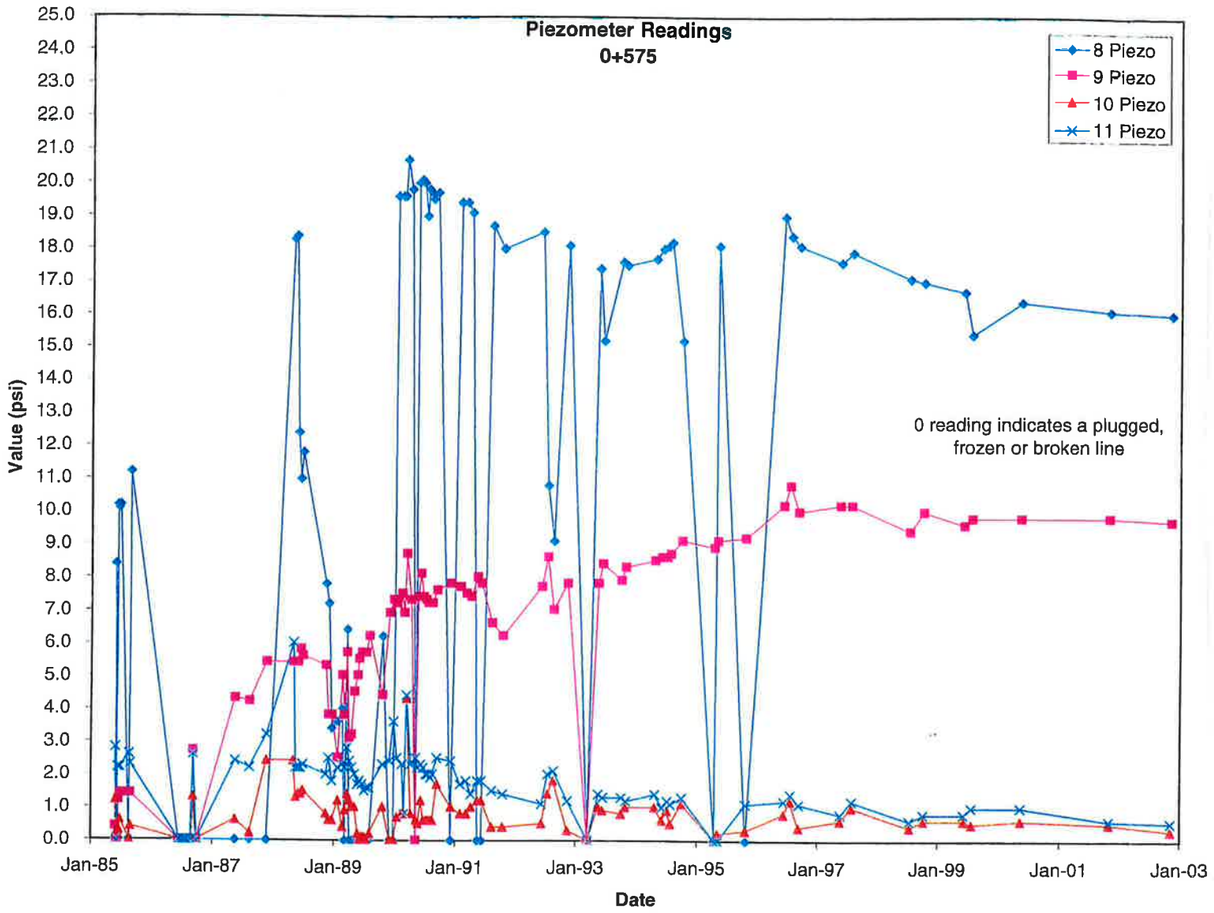
1. Location of section is shown on Figure B1 of this Appendix.
2. 1 (one) psi of pressure is equivalent to a head of 0.704 metres of water. Plotted piezometric heights above piezometer tips are to scale.
3. Occasional zero readings at a piezometer are an indication that the piezometer leads were frozen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

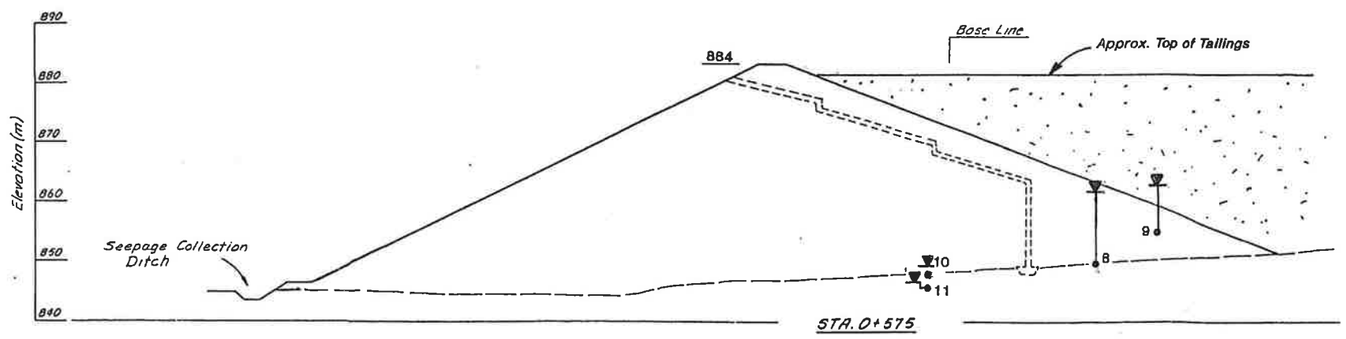
Project No. 022-1520 Drawn BAD Reviewed Date Mar.'03

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

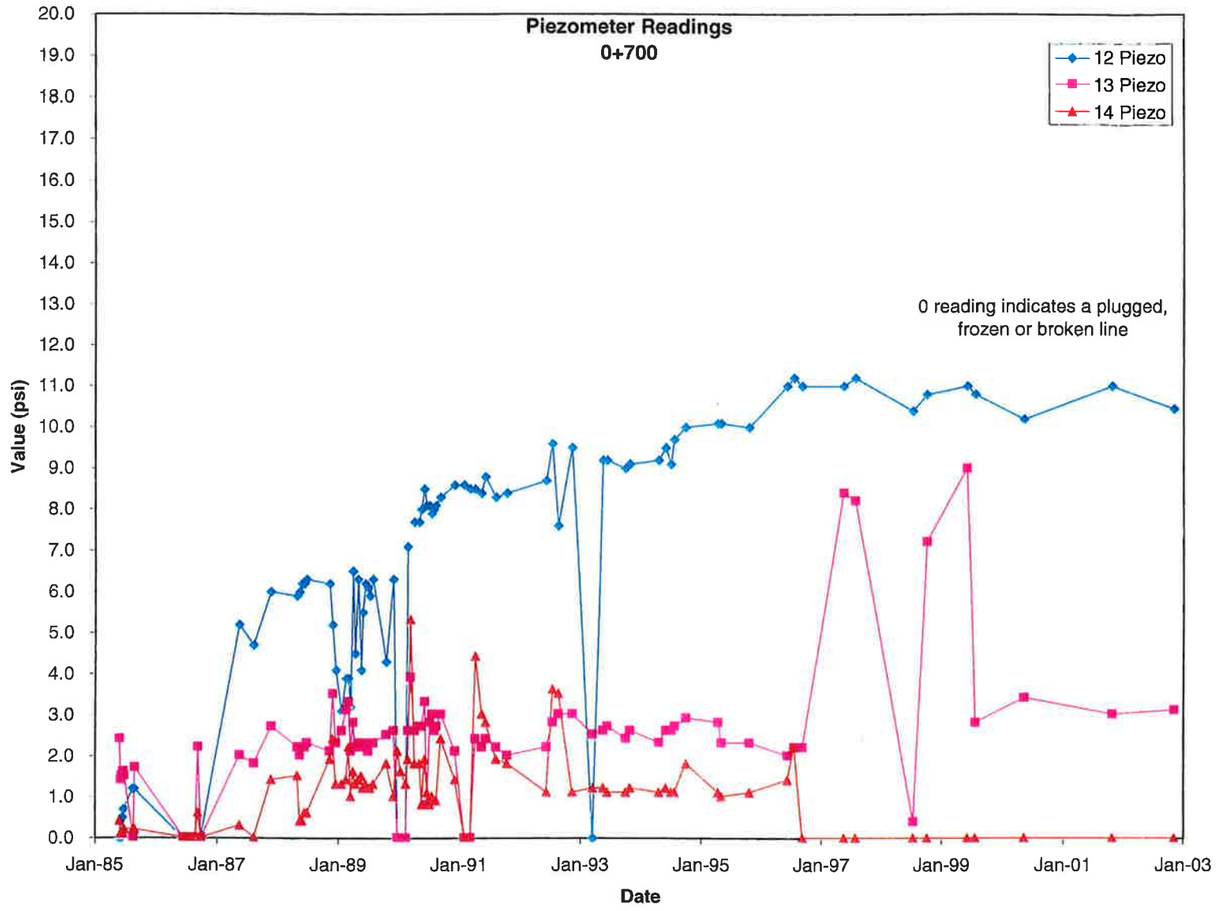
1. Location of section is shown on Figure B1 of this Appendix.
2. 1 (one) psi of pressure is equivalent to a head of 0.704 metres of water. Plotted piezometric heights above piezometer tips are to scale.
3. Occasional zero readings at a piezometer are an indication that the piezometer leads were frozen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

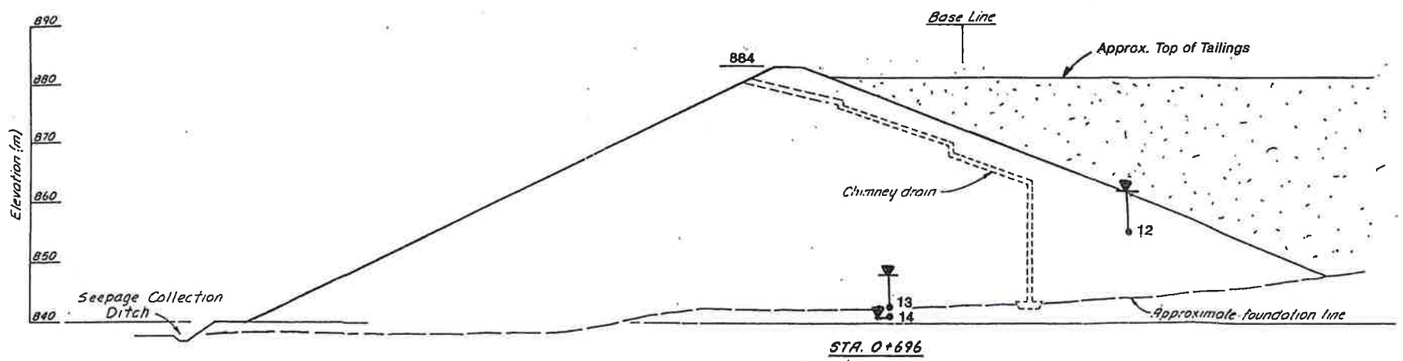
Project No. 022-1520 Drawn BAD Reviewed Date Mar.'03

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

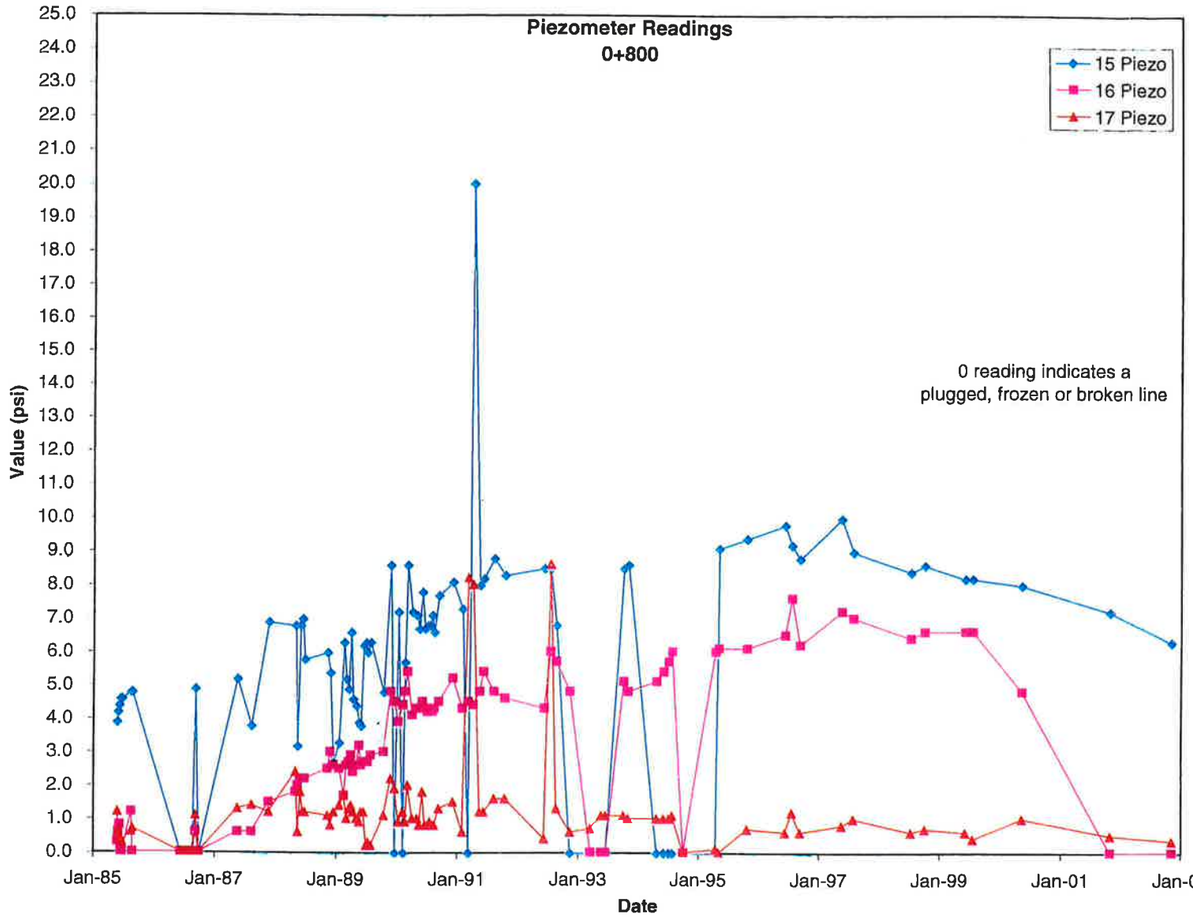
1. Location of section is shown on Figure B1 of this Appendix.
2. 1 (one) psi of pressure is equivalent to a head of 0.704 metres of water. Plotted piezometric heights above piezometer tips are to scale.
3. Occasional zero readings at a piezometer are an indication that the piezometer leads were frozen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

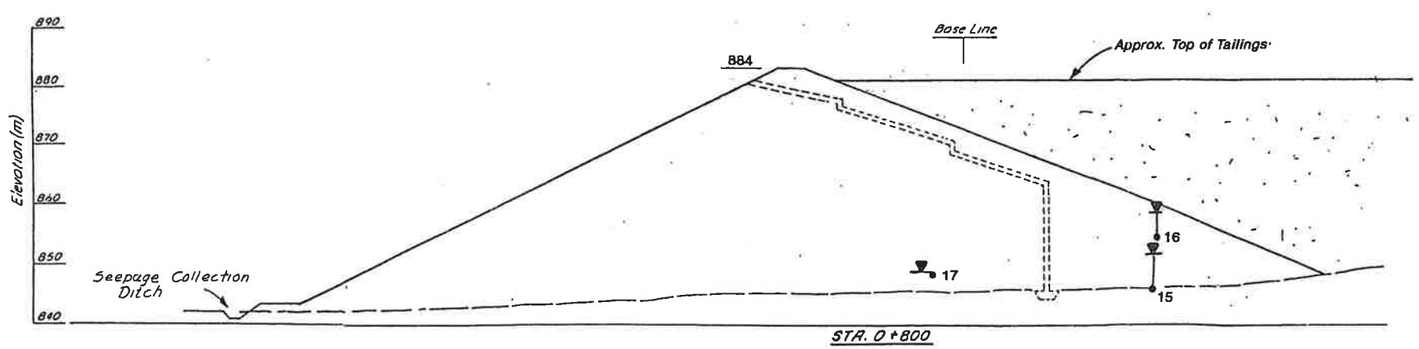
Project No. 022-1520 Drawn BAD Reviewed Date Mar.'03

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

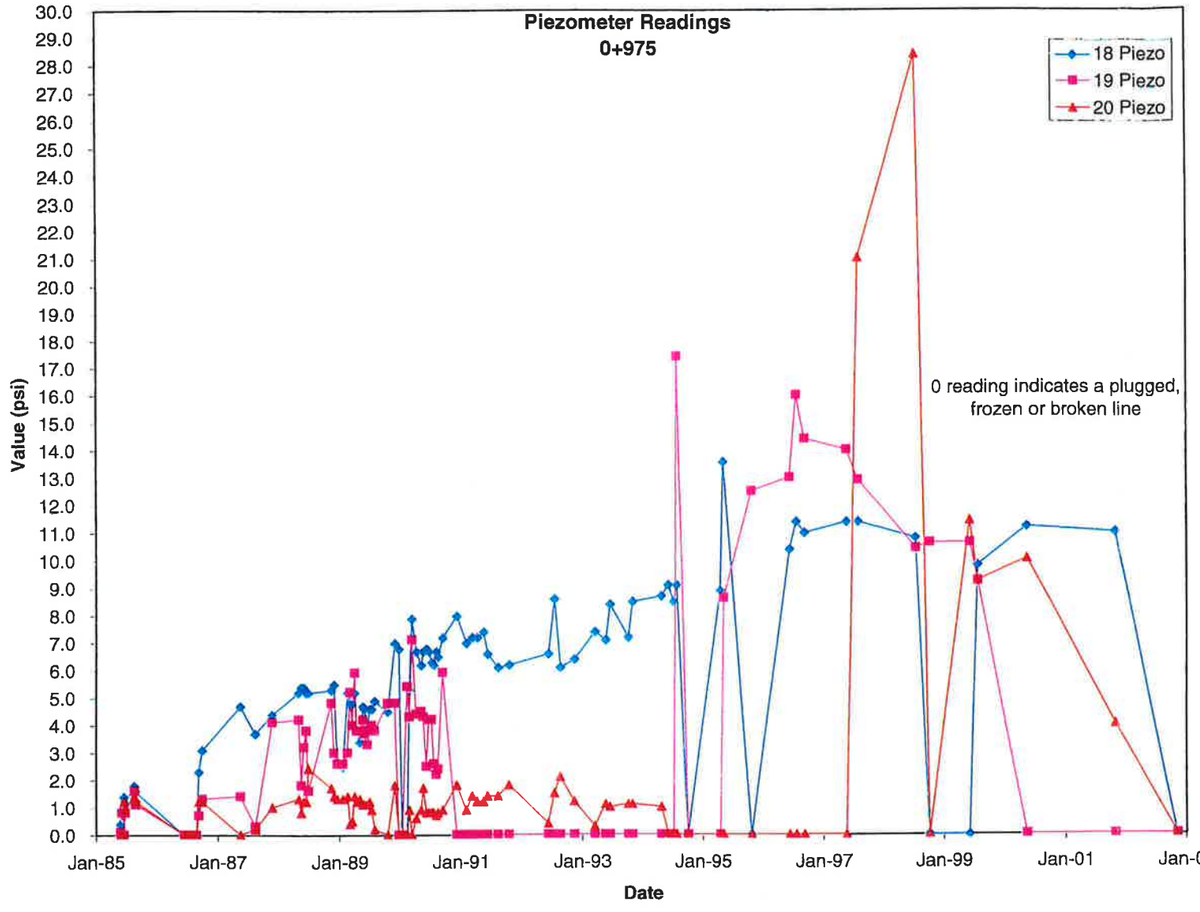
1. Location of section is shown on Figure B1 of this Appendix.
2. 1 (one) psi of pressure is equivalent to a head of 0.704 metres of water. Plotted piezometric heights above piezometer tips are to scale.
3. Occasional zero readings at a piezometer are an indication that the piezometer leads were frozen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

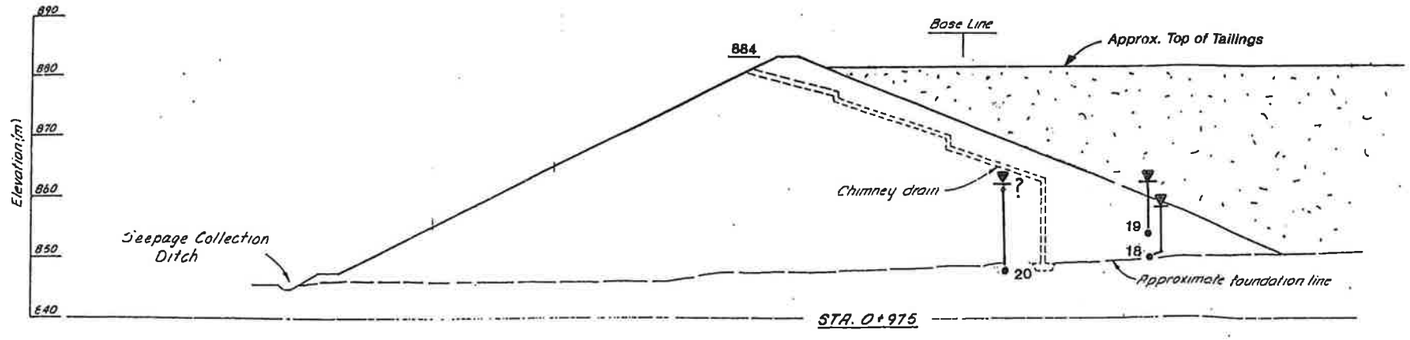
Project No. 022-1520 .... Drawn BAD .... Reviewed .... Date Mar.'03

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

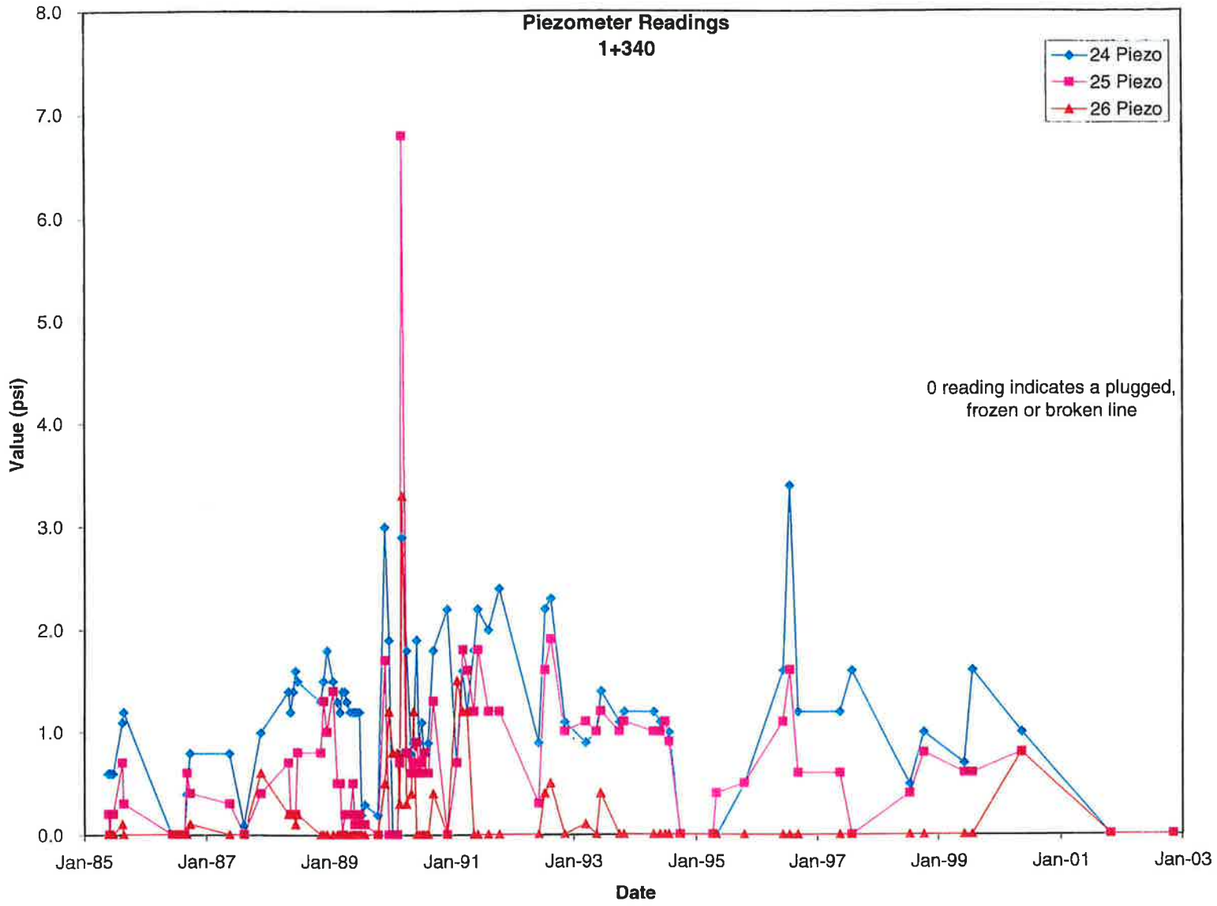
1. Location of section is shown on Figure B1 of this Appendix.
2. 1 (one) psi of pressure is equivalent to a head of 0.704 metres of water. Plotted piezometric heights above piezometer tips are to scale.
3. Occasional zero readings at a piezometer are an indication that the piezometer leads were frozen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

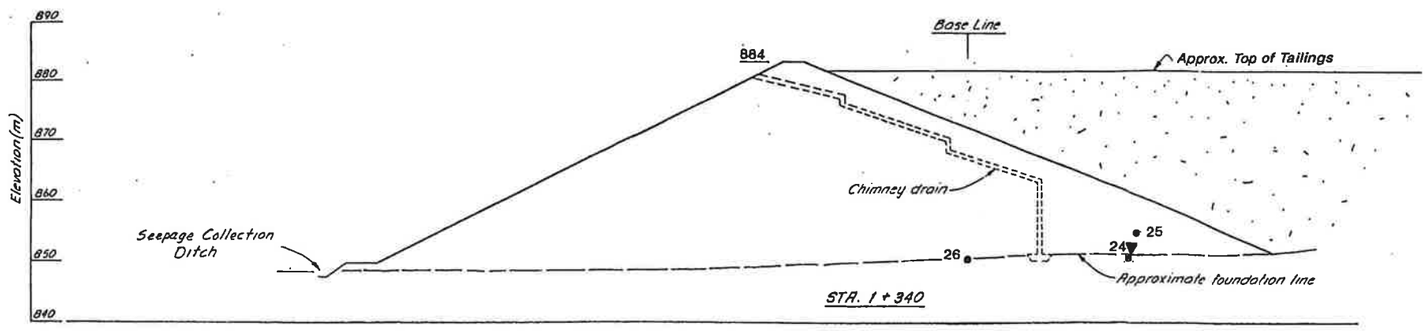
Project No. 022-1520 Drawn BAD Reviewed ..... Date Mar.'03

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

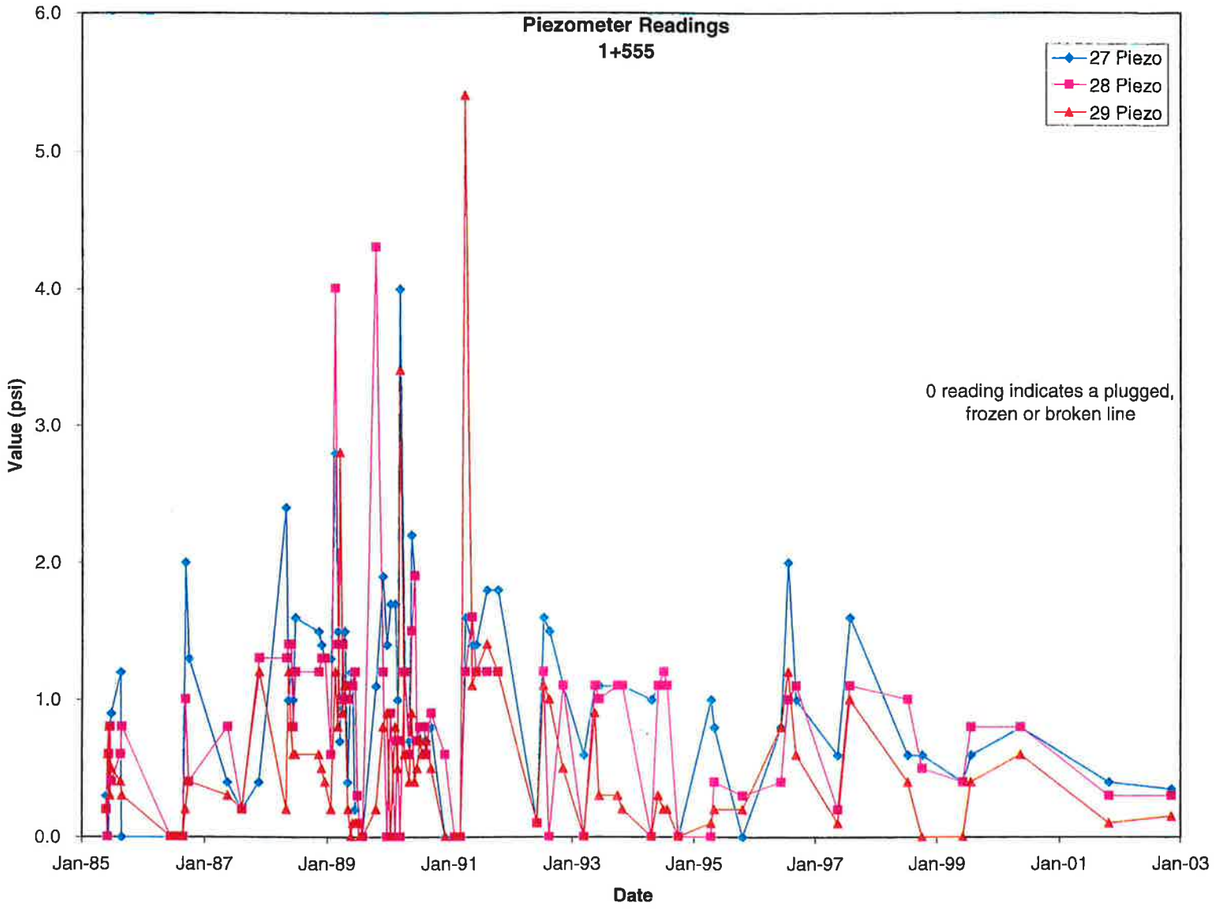
1. Location of section is shown on Figure B1 of this Appendix.
2. 1 (one) psi of pressure is equivalent to a head of 0.704 metres of water. Plotted piezometric heights above piezometer tips are to scale.
3. Occasional zero readings at a piezometer are an indication that the piezometer leads were frozen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

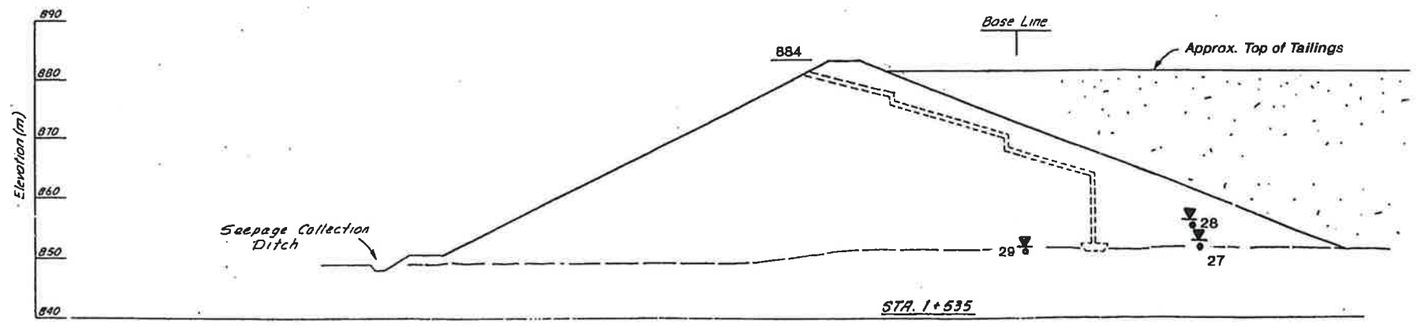
Project No. 022-1520 Drawn BAD Reviewed ..... Date Mar.'03

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

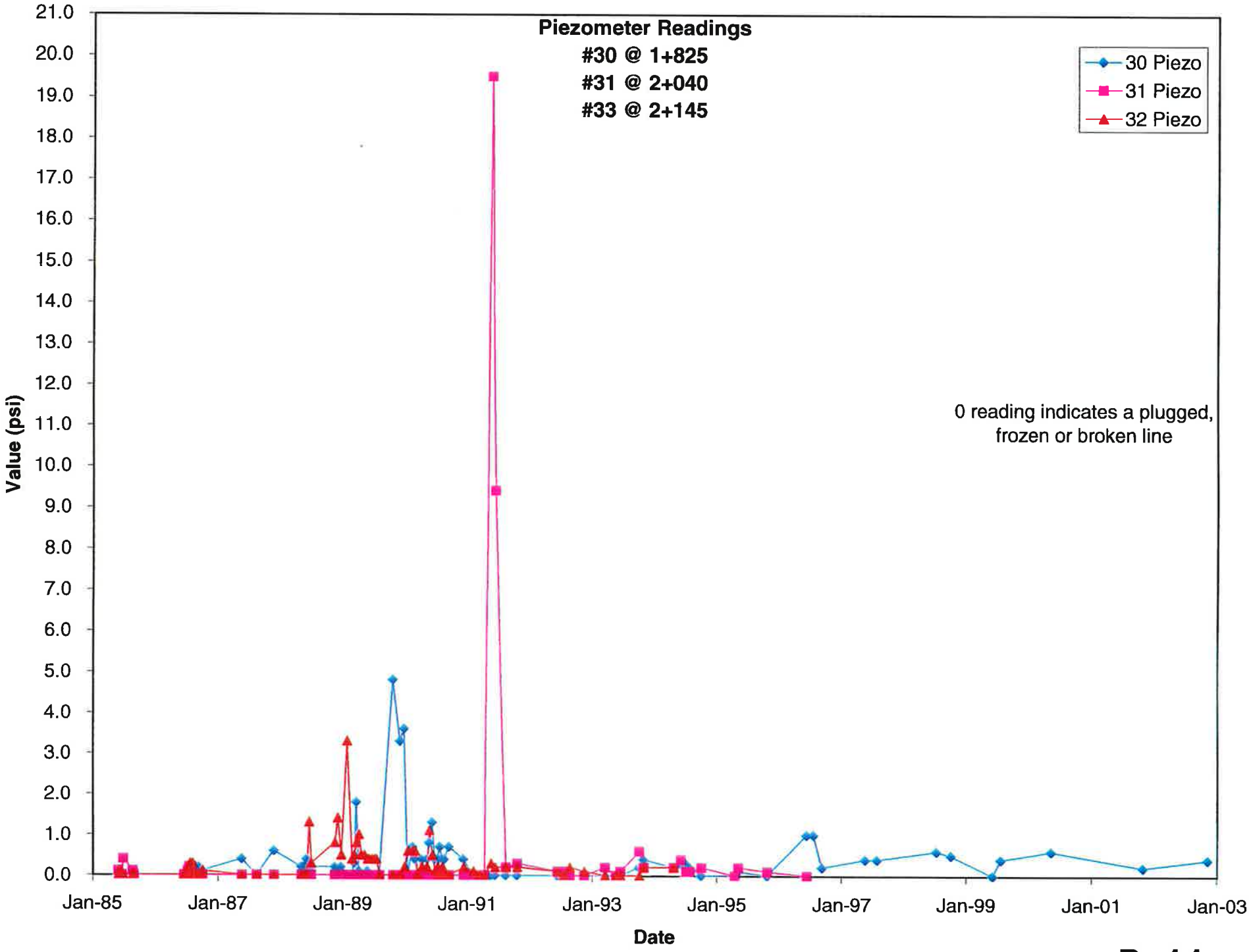
1. Location of section is shown on Figure B1 of this Appendix.
2. 1 (one) psi of pressure is equivalent to a head of 0.704 metres of water. Plotted piezometric heights above piezometer tips are to scale.
3. Occasional zero readings at a piezometer are an indication that the piezometer leads were frozen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

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

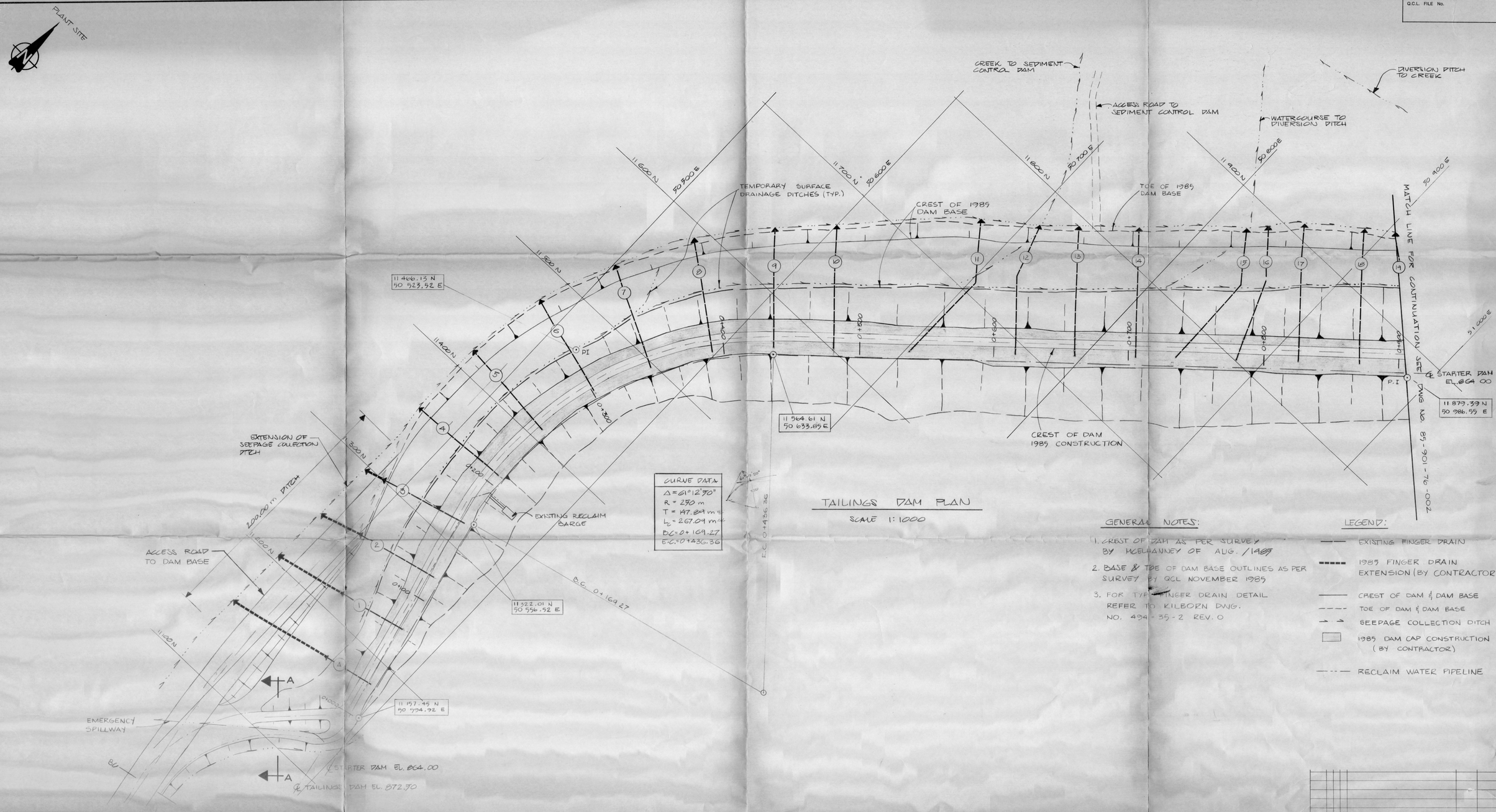
Golder Associates

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

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

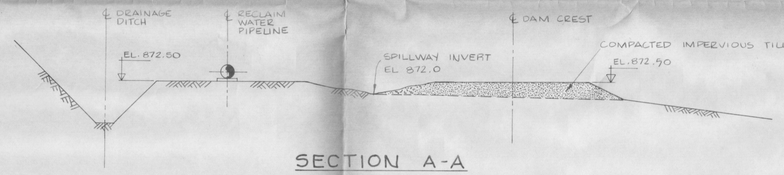
SCALE 1:1000

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

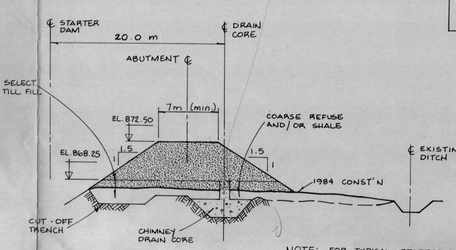
12663.26 N
51275.85 E

B

B

TAILINGS DAM PLAN

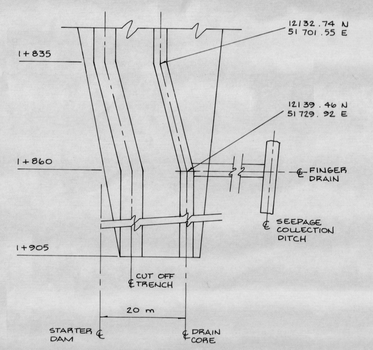
SCALE 1:1000



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

TYPICAL ABUTMENT EXTENSION

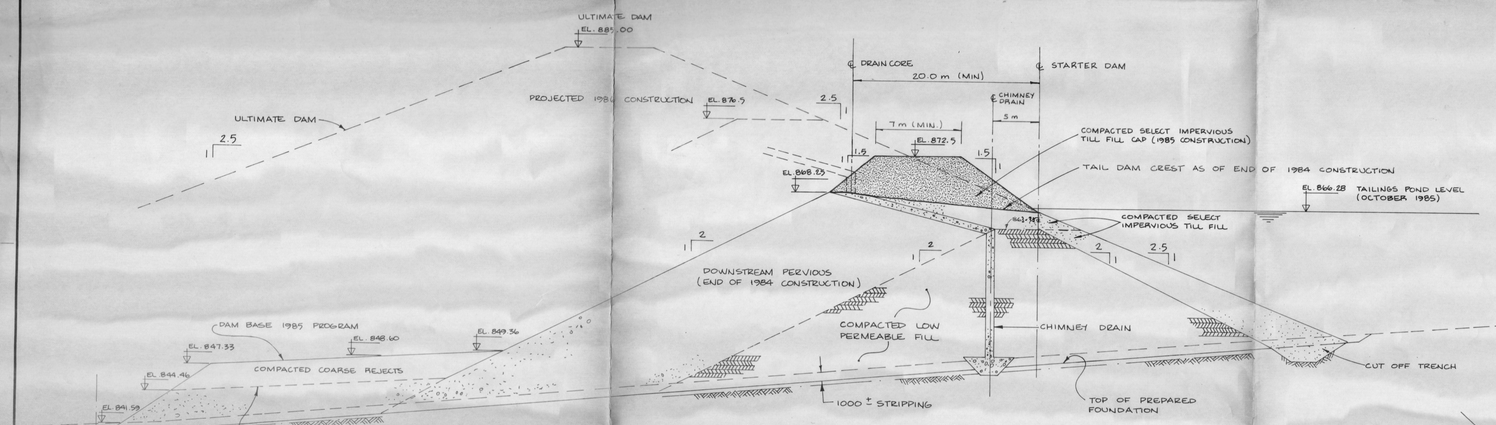
SCALE 1:250



NORTH ABUTMENT EXTENSION

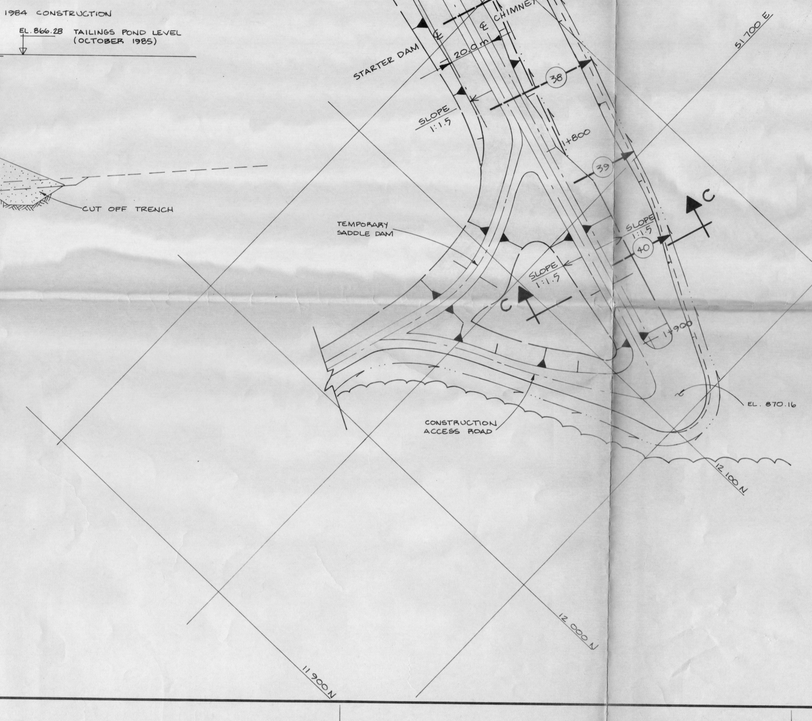
CUT-OFF TRENCH & DRAIN CORE RE-ALIGNMENT

(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

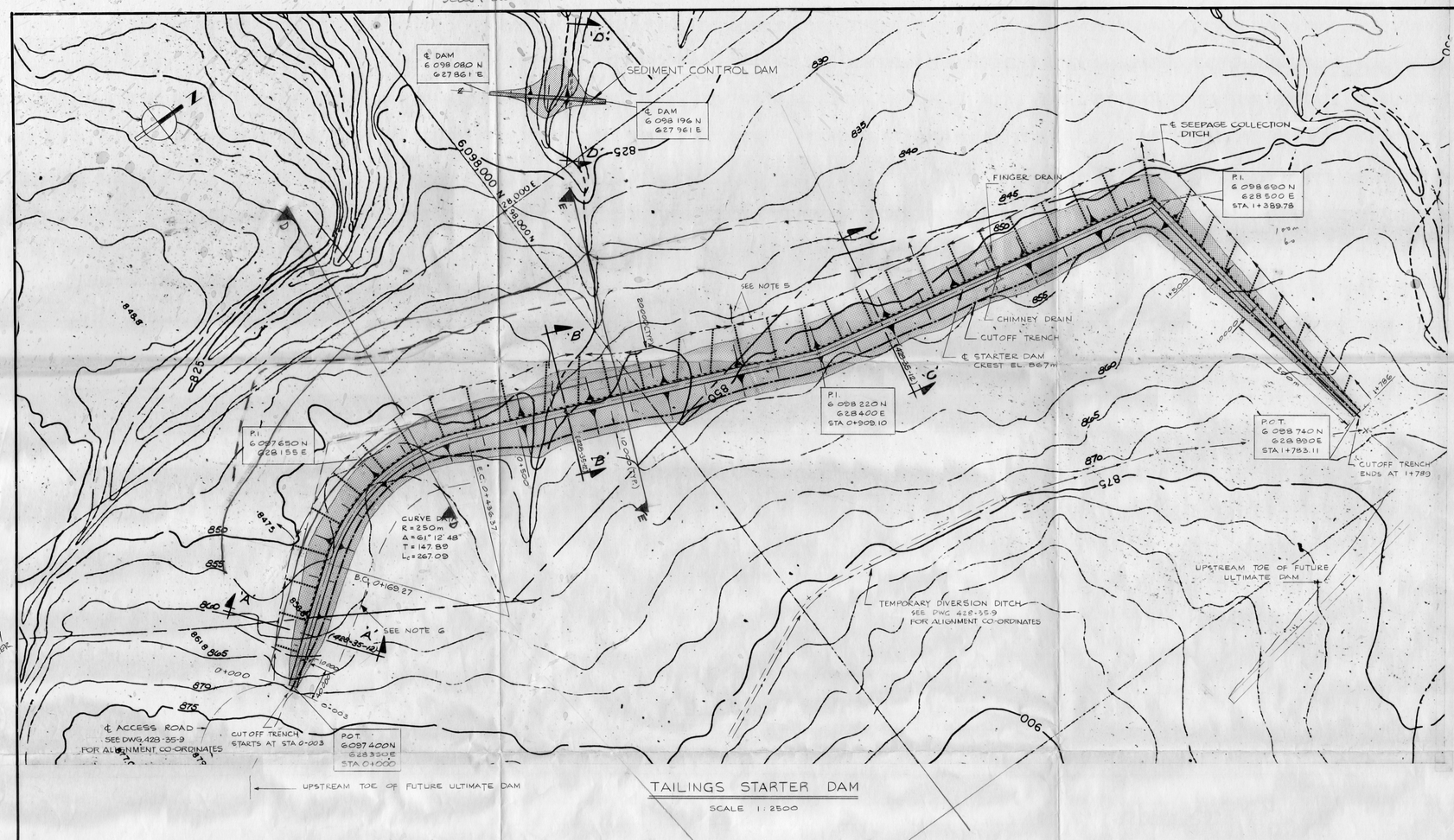
(SHEET 2 of 2)

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

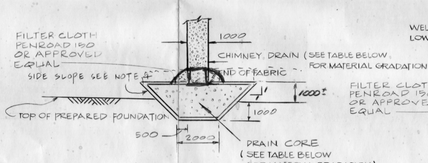


TAILINGS STARTER DAM

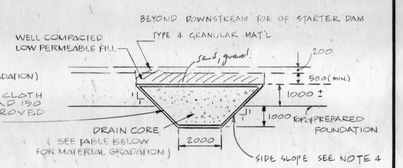
SCALE 1:2500

NOTES:

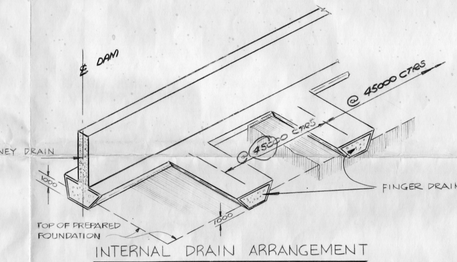
1. EXACT LOCATION AND INVERTS OF C.S.P. FOR SEDIMENT CONTROL DAM TO BE DETERMINED BY ENGINEER.
2. COMBINED U.T.M. FACTOR IS 0.99967
3. TYPICAL SECTIONS THROUGH TAILINGS STARTER DAM SEE DWG 428-35-12
4. SIDE SLOPE OF DRAIN CORE IS 1:1 OR AS DIRECTED BY ENGINEER.
5. SLOPE, INVERT ELEVATIONS AND DISCHARGE 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

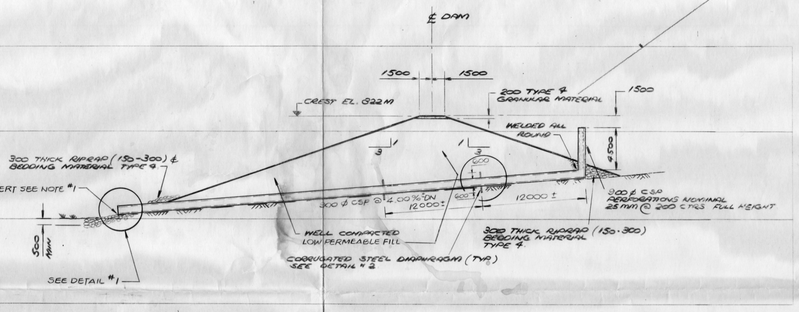


INTERNAL DRAIN ARRANGEMENT

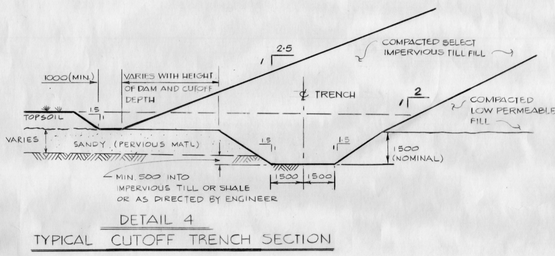
N.T.S.

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

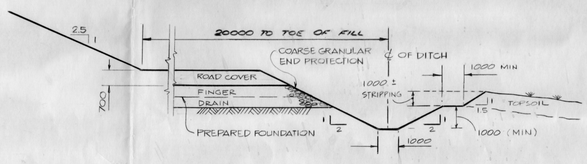
These conform to spec..



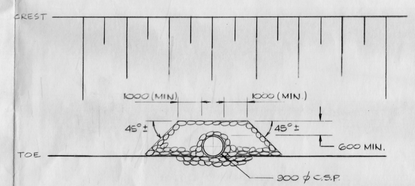
SECTION 'D-D'
SEDIMENT CONTROL DAM
SCALE - 1:250



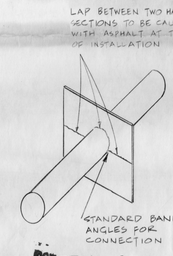
DETAIL 4
TYPICAL CUTOFF TRENCH SECTION
SCALE 1:100



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.

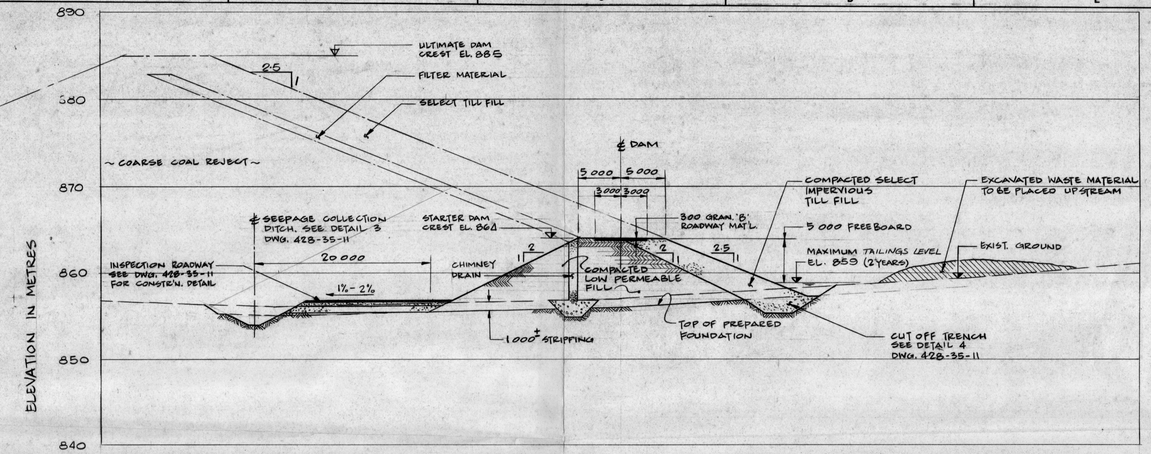
REVISIONS

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.

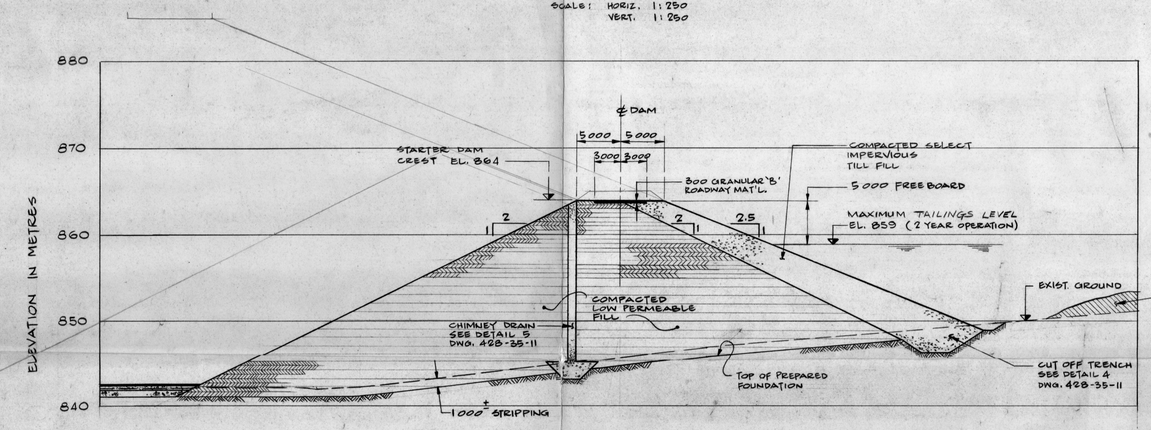
KILBORN

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



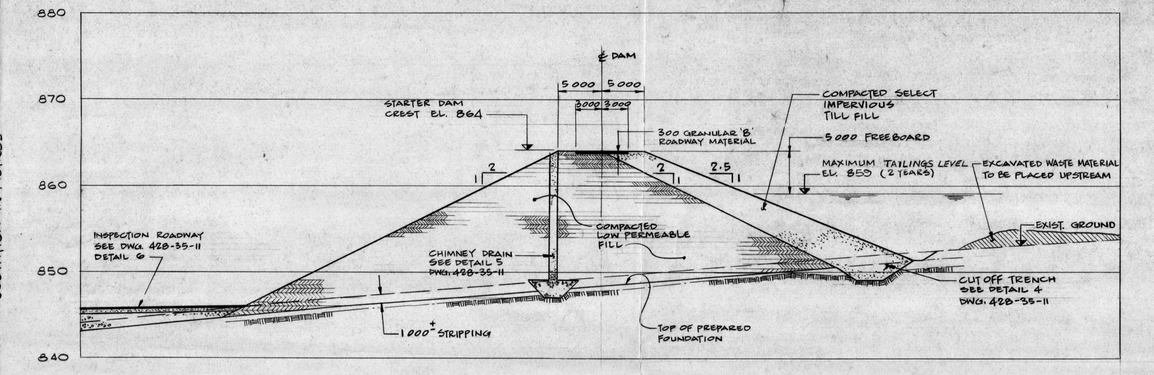
⚠ SECTION A-A (DWG. 428-35-11)

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



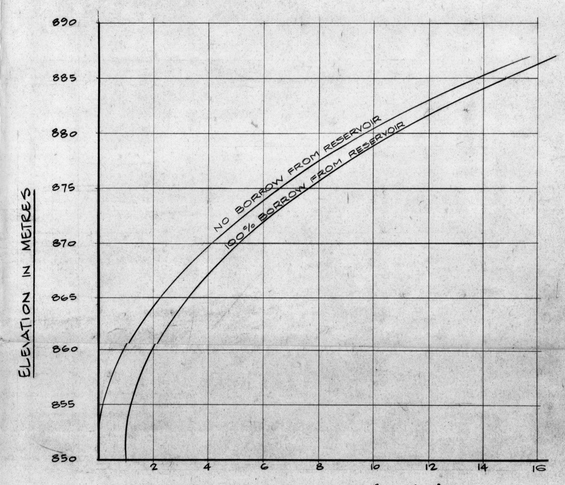
SECTION B-B (DWG. 428-35-11)

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

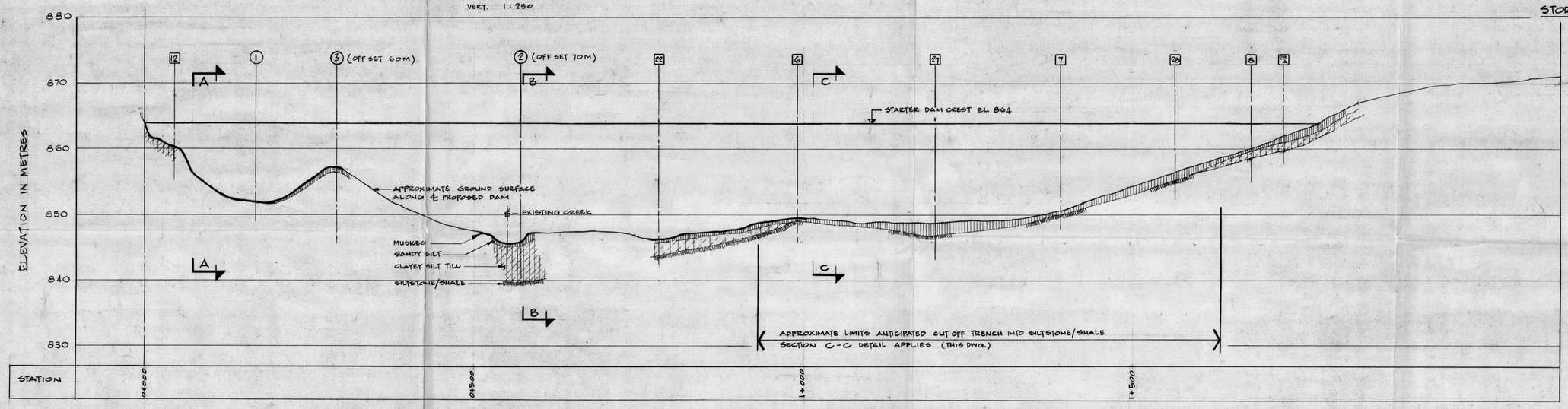


⚠ SECTION C-C (DWG. 428-35-11)

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

REVISIONS				
NO.	DESCRIPTION	DATE	BY	CLIENT / PROJ. ENG. / CHECK
1	ALL ELEVS REVISED, NOTES ADDED, ISSUED FOR CONSTRUCTION	JAN/83	PAM	
0	ISSUED FOR CONSTRUCTION	DEC 1982	RG	
A	RELEASED FOR TENDER	SEPT. 82	RGB	

(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	REV.
STARTER DAM SECTIONS & PROFILE	428-35-12	1

FORM KE-36 REV. 1 (AS)

APPENDIX IV

Teck's Plantsite Tailings Dam
2017 Routine Inspection Checklists

Plantsite Tailings Dam – Visual Inspection

	Date:	May 31/2017	
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	14° 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: Vehicle ruts								
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: Normal Rills, Same as last year								
Right Abutment N/A	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions:								
Left Abutment N/A	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: Normal Rilling								
Drains	Yes ☑ No ☐	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☑ No ☐	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑
	Comments or Unusual Conditions: Normal Seepage								
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:					**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: Some Minor Settling								
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 N/A	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions:								
Pipelines N/A	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions:								
Weirs N/A	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions:								
Signage	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions: NONE								
Other	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions:								

Plantsite Tailings Dam – Visual Inspection

Date:	Oct 3/2017
Property:	Quintette Coal Operations (QCO)
Structure:	Plantsite Tailings Dam
Inspection Performed By:	
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	6° 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: Rutting from tire Tracks								
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: Rutting or Rilling → has NOT Provocated from DSI								
Right 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								
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: Some Erosion at Toe around Some of the Piezo stations/Minor Seeping								
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:					**Freeboard:** 1 meter			
	Comments or Unusual Conditions: Standing water @ N/W corner								
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: Some Minor settlement / Some animal activity								
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: NONE								
Other	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	Comments or Unusual Conditions:								

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. (Golder)	Jan-78
Hydrology Design Memorandum for Quintette Coal Limited	Ker, Priestman & Associates Ltd.	May-81
Proposed Tailings Retention Area Quintette Coal Project	Golder	Jan-82
Quintette Coal Project Physical Properties of Coal Tails	Golder	11-May-82
Hydrogeology of the Quintette Project British Columbia Volume I - Main Text	Golder	May-82
Hydrogeology of the Quintette Project British Columbia Volume II - Appendices A to E	Golder	May-82
Design, Construction, Operation and Abandonment of the Tailings Impoundment	Kilborn Engineering (B.C.) Ltd. (Kilborn) and Golder Associates	09-Jun-82
Drawing No. 428-35-2 - Surface Plant Tailings Disposal General Arrangement	Kilborn	Sep-82
Drawing No. 428-35-8 - Surface Plant Tailings Disposal Clearing Plan	Kilborn	Sep-82
Drawing No. 428-35-9 - Surface Plant Tailings Disposal Impoundment Area & Access Road Details	Kilborn	Sep-82
Tailings Dam Design Review Quintette Coal Project	Golder	Oct-82
Drawing No. 428-35-11 - Surface Plant Tailings Disposal Starter Dam, Plan Sections and Details	Kilborn	Jan-83
Drawing No. 428-35-12 - Surface Plant Tailings Disposal Starter Dam Sections and Profile	Kilborn	Jan-83
Stability of Sediment Control Dam and Tailings Starter Dam at Quintette Coal Project	Golder	Feb-84
Assorted Daily Construction Inspection Reports	Golder	May to Sep-84
Letter Report to Quintette Coal Ltd. On Retention Dam	Golder	Jun-84
Tailings Retention Dam Placement of Coarse Rejects During Winter Weather	Golder	Oct-84
Stability Assessment of Settling Pond Dykes and Tailing Retention Structure	Golder	Oct-84
Performance of Tailings Dam and Other Impoundment Structures Quintette Coal Operations	Golder	May-85
Volumes Operations and Material Properties at the Tailings Retention Structure	Golder	Jul-85
Stability of Impoundment Structures at Quintette Coal Property	Golder	Sep-85
Drawing No. 85-901-76-002 - 1985 Tailings Dam Construction Program As-Built Details	Quintette Operating Corporation (QOC)	Nov-85
Dawing No. 85-901-76-001 - 1985 Tailings Dam Construction Program As-Built Details	QOC	Nov-85
Application of Polymeric Liner in Tailings Dam Construction	Golder	Nov-85
Inspection of Tailings Dam	Golder	Dec-85
Drawing No. 86-901-76-1 - 1986 Tailings Dam Construction Program General Layout (Rev. 3)	Golder	18-Jun-86
Drawing No. 86-901-76-2 - 1986 Tailings Dam Construction Program Plan (Rev. 1)	Golder	12-Jun-86
Drawing No. 86-901-76-3 - 1986 Tailings Dam Construction Program Plan (Rev. 2)	Golder	12-Jun-86
Drawing No. 86-901-76-4 - 1986 Tailings Dam Construction Program Cross-Sections (Rev. 1)	Golder	12-Jun-86
Drawing No. 86-901-76-5 - 1986 Tailings Dam Construction Program Cross-Sections (Rev. 1)	Golder	12-Jun-86
Stability of Impoundment Structures at Quintette Coal Property	Golder	Oct-86
Drawing No. 86-901-76-001 - 1987 Tailings Dam Construction Program General Layout (Rev. A)	Golder	09-Jul-87
Drawing No. 86-901-76-002 - 1987 Tailings Dam Construction Program Plan Sheet 1 of 2 (Rev. A)	Golder	09-Jul-87
Drawing No. 86-901-76-003 - 1987 Tailings Dam Construction Program Plan Sheet 2 of 2 (Rev. A)	Golder	08-Jul-87
Drawing No. 86-901-76-004 - 1987 Tailings Dam Construction Program Cross-Sections (Rev. A)	Golder	08-Jul-87
Drawing No. 86-901-76-005 - 1987 Tailings Dam Construction Program Cross-Sections (Rev. O)	Golder	08-Jul-87
Construction and Performance of Tailings Dam	Golder	Feb-88
Geotechnical Investigation for a Porposed Borrow Source	Peace Country Materials Testing Ltd. (Peace)	23-Mar-88
Stability of Outside Fill Slope Tailings Retention Embankment	Golder	Dec-88
1989 Tailings Dam Construction Production of Chimney Drain Material	Golder	10-Apr-89
Tailings Dam As At End of 1988 Construction Season	Golder	Jul-89
1989 Tailings Dam Construction Program Excerpt from QOC July 1990 Report to EMPR on Tailings Dam	QOC	Jul-90
Tailings Retention Embankment As At The End of 1989	Golder	Jan-91
Geotechnical Assessment of Shikano North Alternative Dump	Golder	Mar-91
Tailings Retention Embankment As At The End of 1990	Golder	Apr-91
Synopsis Excerpt from QCO May 1991 Report to EMPR on 1990 Construction.	QOC	May-91
Tailings Dam Repair	Golder	07-Aug-92
Tailings Dam Instrumentation	Golder	10-Sep-92
1991/1992 Tailings Dam Performance	Golder	Oct-92
1992/1993 Tailings Dam Performance	Golder	Nov-93
1994 Inspection of the Tailings Retention Dam	Golder	Sep-94
1995 Inspection of the Tailings Retention Dam	Golder	Aug-95
1995 Tailings Dam Raising	Peace	Sep-95
Operation and Upkeep of the Tailings Impoundment - August 1994 to July 1995	QOC	May-96
Operation and Upkeep of the Tailings Impoundment - August 1995 to July 1996	QOC	Mar-97
Annual Inspection of the North Tailings Pond	Golder	Aug-97
Annual Inspection of the North Tailings Pond	Golder	Oct-98
Annual Inspection of the North Tailings Pond	Golder	Sep-99
Closure Drainage for North Tailings Pond	Golder	30-Sep-00
Permanent Spillway for Closure of the North Tailings Pond	Golder	07-Mar-01
Stability Assessment for The North Tailings Pond	Golder	Feb-02
Operation and Upkeep of the Plantsite Tailings Impoundment - August 1999 to October 2001	Golder	Mar-02
Stability Assessment for The North Tailings Pond	Golder	Mar-03
North Tailings Pond Spillway Review of As-Built Channel	Klohn Crippen (KC)	14-Jan-05
Annual Dam Safety Inspection Report Plantsite North Tailings Impoundment - 2005	QOC	Mar-06
Quintette 2010 Dam Safety Inspection and Consequence Classification	Klohn Crippen Berger (KCB)	01-Mar-11
Quintette Project - Baseline Climate & Hydrology Conditions	Clearwater Consultants Ltd.	17-Aug-11
2012 Dam Inspections: Plantsite Tailings Dam, M11 Diversion Dam, Shikano North Tailings Dam	KCB	19-Dec-12
Plantsite Tailings Dam - 2013 Dam Safety Inspection Report	KCB	12-Dec-13
Quintette Dam Safety Review - Plantsite Tailings Storage Facility	KCB	27-May-14
Quintette Coal Operations - Plantsite Tailings Dam - 2014 Dam Safety Inspection - Revision 1	KCB	26-Nov-14
Plantsite Tailings Dam - Response to February 3, 2015 MEM Memorandum	KCB	29-Jun-15
Quintette Coal Operations - Plantsite Tailings Dam - 2016 Stability Assessment Report	KCB	17-May-16
Quintette Coal Operations - Plantsite Tailings Dam - Water Management, Water Balance, and Quantified Performance Objectives	KCB	22-Dec-16
Quintette Coal Operations - Plantsite Tailings Dam - Consolidated Facility Report	KCB	18-Jan-18