



Klohn Crippen Berger

Teck Highland Valley Copper Partnership

2017 Dam Safety Inspection Report

Highland Tailings Storage Facility



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Teck Highland Valley Copper Partnership
PO Box 1500
Logan Lake, British Columbia
V0K 1W0

Mr. Chris Anderson
Superintendent, Tailings and Water Management

Dear Mr. Anderson:

2017 Dam Safety Inspection
Highland Tailings Storage Facility

We are pleased to submit the 2017 Dam Safety Inspection report for the Highland Tailings Storage Facility. The inspection and this report were prepared to comply with Section 10.5.3 of the Health, Safety and Reclamation Code for Mines in British Columbia (the Code), Section 4.2 “Annual Tailings Facility and Dam Safety Inspection Report” of the Code Guidance Document.

Yours truly,

KLOHN CRIPPEN BERGER LTD.



Bill Chin, P.Eng.
Engineer of Record
Senior Geotechnical Engineer, Principal

CW/EH:cd

Teck Highland Valley Copper Partnership

2017 Dam Safety Inspection Report

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EXECUTIVE SUMMARY

Klohn Crippen Berger Ltd. (KCB) were engaged by Teck Highland Valley Copper Partnership (THVCP) to complete the 2017 Dam Safety Inspection (DSI) of the Highland Tailings Storage Facility (TSF) on the Highland Valley Copper (HVC) mine site in accordance with requirement of the Health, Safety and Reclamation Code for Mines in British Columbia (the Code). The visual inspection was completed by the Engineer of Record (EoR), Mr. Bill Chin, P.Eng., as a representative of KCB on September 27, 2017. Mr. Chris Anderson, P. Eng., THVCP Tailings and Water Superintendent, is the TSF Qualified Person (as defined by the Code) for the Highland TSF.

The DSI includes the L-L Dam and H-H Dam, three seepage collection ponds at the toe of the L-L Dam (Seepage Pond 1, Seepage Pond 2, Seepage Water Reclaim Pond), two active slimes ponds at the toe of the L-L Dam (Slimes Pond 1 and Slimes Pond 2), and 24 Mile Lake.

The HVC site is located near Logan Lake, approximately 45 km south of Kamloops, in the interior of British Columbia. The Highland TSF is located approximately 6.5 km northwest of the operating mill, refer to Figure 1. Tailings from ongoing mining operations are discharged into the Highland TSF. Tailings are retained in the impoundment by two containment dams (L-L Dam and H-H Dam) which are incrementally raised to meet tailings storage requirements, typically on an annual basis. 24 Mile Lake is an active containment facility which receives emergency discharge of water and tailings from the H-H Pumphouse during tailings line maintenance and operational upsets.

The L-L Dam comprises an earthfill starter dam raised via the centerline method with a low permeability vertical glacial till core supported by a downstream zone of hydraulically placed, compacted cycloned sand and an upstream cycloned sand berm/tailings beach. A sand and gravel drainage blanket extends beneath the downstream shell of the dam, with granular finger drains at selected locations which convey flow into a series of seepage recovery ponds at the toe of the dam.

The H-H Dam comprises an earthfill starter dam raised via the centerline method with a low permeability centreline vertical glacial till core, supported by random fill and tailings beach on the upstream side and variable mine waste fill on the downstream side.

24 Mile Lake is a former natural lake surrounded by waste dumps that have been placed over the life of the mine.

The L-L Dam has been assigned an “Extreme” consequence category and the H-H Dam a “Very High” consequence category, as defined by CDA (2013). The downstream seepage dams at the toe of the L-L Dam have been assigned a “Significant” consequence category. 24 Mile Lake has been assigned a “Low” consequence category, as defined by CDA (2013). There were no significant changes to the key geotechnical or hydrotechnical hazards during 2017. The most recent dam safety review (DSR) of the Highland TSF was completed by Stantec in 2017 (Stantec 2018). The Code requires a DSR be conducted at a minimum every five years for TSFs, irrespective of dam consequence classification (MEM 2016). Therefore, the next DSR is scheduled for 2022.

The Highland TSF free water pond is maintained at the western end of the impoundment. The water level in the pond varied by 6.6 m in 2017, which is greater than historical trends over the past seven

years, largely due to more inflow from a wetter freshet. THVCP manages and tracks the annual water balance for the Highland TSF. In 2017, a net gain in the TSF pond volume was estimated based on the water balance. The Highland TSF has no spillway and is designed to store the environmental design flood (EDF) and inflow design flood (IDF), which for this facility is the probable maximum flood (PMF). 24 Mile Lake can also store the IDF (100-year return period event). All of the L-L Dam seepage and slimes ponds, except the Seepage Water Reclaim Pond and Seepage Pond 2, are designed to safely route or store, with appropriate freeboard, storm events greater than or equal to the IDF required by the Code (MEM 2016). Agreed actions to bring the Seepage Water Reclaim Pond and Seepage Pond 2 back into compliance are underway and are listed in Table 2.

The Operation, Maintenance and Surveillance (OMS) manual was updated in 2018. The manual meets the intent of the Mining Association of Canada (MAC 2011) and CDA (2014) guidelines, is current and provides adequate coverage for existing conditions. An update for the Emergency Preparedness and Response Plan (EPRP) is ongoing.

Visual inspections and instrument measurements were completed by THVCP in general accordance with the prescribed frequencies during periods of the year when instrument sites are accessible. There were two event-driven inspections of the L-L Dam in 2017 in response to a pipe rupture at the cyclone house and to flooding during freshet. There were four piezometers and no inclinometer threshold exceedances noted at the L-L Dam during 2017. None of the piezometer threshold exceedances were considered a dam safety concern. There were three piezometers and two inclinometer threshold exceedances noted at the H-H Dam in 2017. These exceedances led to increased reading frequencies and review of the instrumentation data in relation to further fill placement but were not considered a dam safety concern. Further details of the actions taken are presented in Sections 5.4 and 5.5 of the report. Revised piezometric and movement thresholds have been set for 2018 to monitor deviation from the established trend. During 2017, an additional 60 vibrating wire piezometers, 15 standpipe piezometers and 11 inclinometers were installed at the L-L Dam. At the H-H Dam, an additional 26 vibrating wire piezometers, 2 standpipe piezometers, 6 Sondex settlement systems and 6 inclinometers were installed. Ten survey monuments were installed at the lock-block retaining wall upslope of the H-H Pumphouse.

Water quality downstream of the Highland TSF is monitored by HVC monthly to assess the effectiveness of the tailings facility in protecting the downstream receiving environment (ERM 2018). All permit sampling requirements and frequency were met in 2017. THVCP have implemented the Sulphate Adaptive Management Plan to mitigate influence of seepage from the Highland TSF on downstream water quality and increase water available to downstream users in Pukaist creek. This is a multi-year program which includes installation of interception wells downstream of the dam, lining of seepage collection ponds and diversion of non-contact water around the TSF and into Pukaist Creek.

The Highland TSF appeared to be in good physical condition and the observed performance during the 2017 site inspections was consistent with the expected design conditions and past performance. The status of recommendations to address deficiencies and non-conformances identified during past

DSIs are summarized in Table 1. Closed recommendations are shown in *italics*. Recommendations to address deficiencies and non-conformances identified during the 2017 DSI are summarized in Table 2.

As shown, most of the recommendations have either been completed or are included in the planned 2018 dam construction activities. For the purposes of the DSI, these recommendations are considered closed. The only outstanding recommendations are associated with upgrading the Seepage Water Reclaim Pond and the Seepage Pond 2 to bring them back into compliance with management of the IDF and freeboard, as listed in Table 2.

Table 1 Previous DSI Recommendations – Status Update

ID No.	Recommended Action	Priority ⁽¹⁾	Recommended Deadline (Status)
L-L Dam			
LL-2015-01	Downstream sand should be placed in over-steepened upper sections of the downstream dam slopes (between Sta. 1+050 m and Sta. 3+650 m) to the design (2.5H:1V) during the next construction season. Some re-work of the existing loose sand on these slopes will be required as the downstream sand is raised, to ensure these slopes meet compaction/density requirements.	3	End of next construction season (Outstanding. Included in construction sequence for next dam raise (2017 to 2018). EoR has reviewed stability and found acceptable factor of safety and no interim dam safety concern.)
LL-2015-02	The overflow lines from the secondary cyclones were buried with un-compacted cyclone sand across the upstream S2 zone during 2015. This sand will require re-working following completion of downstream sand placement during the next construction season.	3	End of next construction season (Outstanding. Some of the lines were removed and trenches re-filled with S2 fill during 2017 (refer to section 3.2.2 for details). Remaining will be done as part of ongoing construction)
LL-2015-04	<i>It was noted in the Q4 dam inspection that the north side of the NBB El. 1202 m bench is over-steepened to 1V:1H. This should be re-graded to the design slope gradient to prevent instability.</i>	4	<i>During next construction season (CLOSED. This over steepened area is related to an access road cut in one of the benches and potential instability relates to local area and is not a dam safety issue. Area will be remediated during future construction works. EoR has reviewed stability and found acceptable factor of safety and no interim dam safety concern.)</i>
LL-2015-06	We recommend that key design criteria for the Highland TSF, including the probable maximum flood (PMF), freeboard requirements and seismic ground motions be reviewed during 2016.	4	December 2016 (Outstanding. Deferred to 2018. There is no interim dam safety concern.)
LL-2016-01	<i>Repair P10-4 to prevent inflow of surface water (suspected cause of elevated groundwater readings). Remove metal cover and investigate possible location where surface water could be entering the standpipe. If the original grout backfill to the hole has sunk, then top up with bentonite or cement to seal the standpipe. Ensure ground is sloped away from the piezo to prevent any ponding water.</i>	4	<i>May 1 2017 (CLOSED)</i>
LL-2016-02	Install seepage measurement weirs at the outflow points of the North Dam (Sta. 3+600) and South Dam (Sta. 1+100) major drains to monitor seepage rates.	3	December 2017 (Outstanding. Deferred until 2018 when proposed North Dam drain construction is completed)

ID No.	Recommended Action	Priority ⁽¹⁾	Recommended Deadline (Status)
H-H Dam			
HH-2015-01	H-H lock-block wall - during operations routine monitoring of the retaining wall condition should be conducted. This includes an annual survey at selected points along the crest and toe of the wall, and monthly photographs taken from the same location to monitor for signs of changes to the wall alignment.	3	Ongoing throughout 2016 (CLOSED)
HH-2015-02	H-H lock-block wall - a piezometer should be installed behind or at the toe of the retaining wall to monitor water levels behind the retaining wall as this can affect the stability of the dam near the retaining wall	3	December 2016 (CLOSED, VWP installed in 2017)
HH-2016-01	H-H lock-block wall - during operations routine monitoring of the retaining wall condition should be conducted. This includes an annual survey at selected points along the crest and toe of the wall.	3	May 2017 (CLOSED, duplicate of HH-2015-01)
24 Mile Lake			
None.			
L-L Dam Seepage Collection and Slimes Ponds			
SP-2016-01	In order to meet the design freeboard requirement at Seepage Pond 2, the following is recommended: <ul style="list-style-type: none"> ▪ lower the existing inlet invert elevation by 0.4 m (from El. 1114.4 m to El. 1114.0 m); ▪ re-align the pipe such that the bend after the first 12 m (currently graded upwards) is removed; and maintain or lower the existing outlet invert elevation to achieve a minimum grade of 1%.	2	July 2017 (CLOSED, superseded by SP-2017-02)
SP-2016-02	To meet the design freeboard requirement at the Seepage Water Reclaim Pond, review the following items as part of planning and prior to construction activities in 2017: <ul style="list-style-type: none"> ▪ the water quality and discharge requirements to determine an appropriate environmental design flood (EDF) and explore options for discharge during flood events, if permissible; ▪ the anticipated timeline for construction and operation of the proposed Slimes Pond 3 which was modeled, as designed, to discharge to Seepage Water Reclaim Pond under flood conditions; ▪ review the current and proposed operational requirements for pumping (in relation to capacity and operational elevations); and update, if necessary, the 2015 flood routing assessment based on revised assumptions.	2	July 2017 (CLOSED)
SP-2016-03	If required, upgrade the water management plan for the Seepage Water Reclaim Pond, based on the updated flood routing assessment (action item SP-2016-02).	2	December 2017 (CLOSED, superseded by SP-2017-01)
SP-2016-04	Repair the small tear in the liner of Seepage Pond 2 (Photo II-C-12, Appendix II).	3	May 2017 (CLOSED)

Notes:

1. Recommendation priority guidelines, specified by Teck and assigned by KCB:
 - 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 2 2017 Recommendations for Deficiencies and Non-Conformances

ID No.	Deficiency or Non-Conformance	Applicable Regulation or OMS Reference	Recommended Action	Priority ⁽¹⁾	Recommended Deadline (Status)
L-L Dam					
No new recommendations from 2017					
H-H Dam					
No new recommendations from 2017					
24 Mile Lake					
No new recommendations from 2017					
L-L Dam Seepage Collection and Slimes Ponds					
SP-2017-01	Water Management	Flood Routing	The Seepage Water Reclaim Pond has insufficient capacity to store the IDF and should be brought into compliance. Note: THVCP to include an interim plan involving pumping to manage the IDF without off-lease discharge until upgrade works are complete. Suggested interim milestones: Design in 2018, Permit and IFC in 2019 and Construction in 2020. .	2	Q4 2020
SP-2017-02	Water Management	Flood Routing	Regrade pipe to a consistent downward grade	2	Q4 2018

Notes:

- Recommendation priority guidelines, specified by Teck and assigned by KCB:
 - 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.

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1 INTRODUCTION

Klohn Crippen Berger Ltd. (KCB) was engaged by Teck Highland Valley Copper Partnership (THVCP) to complete the 2017 dam safety inspection (DSI) of the Highland Tailings Storage Facility (TSF) on the Highland Valley Copper (HVC) mine site, as shown in Figure 1. Tailings from ongoing mining operations are discharged into the Highland TSF. Tailings are retained in the impoundment by two containment dams (L-L Dam and H-H Dam) which are incrementally raised to meet tailings storage requirements, typically on an annual basis.

The scope of this report includes: L-L Dam and the Seepage Collection and Slimes Ponds at the downstream toe; H-H Dam and 24 Mile Lake at the downstream toe of the H-H Dam.

The scope of work consisted of:

- a visual inspection of the physical conditions of the various containment facilities;
- a review of updated piezometer, inclinometer and seepage monitoring data provided by THVCP;
- a review of climate and water balance data for the site;
- a review of other relevant dam safety management documents (e.g. Operations, Maintenance & Surveillance (OMS) manual); and
- a review of the past year's construction records.

The inspection and this report were prepared to comply with Section 10.5.3 of the Health, Safety and Reclamation Code for Mines in British Columbia (the Code), Section 4.2 "Annual Tailings Facility and Dam Safety Inspection Report" of the Code Guidance Document (MEM 2016).

The visual inspection was completed by the Engineer of Record (EoR), Mr. Bill Chin, P.Eng., as a representative of KCB on September 27, 2017. The weather during the DSI was clear and sunny and did not impact the visual inspection. Mr. Chris Anderson, P. Eng., THVCP Tailings and Water Superintendent, is the TSF Qualified Person (as defined by the Code) for the Highland TSF.

The Highland TSF is operated under the following permits:

- British Columbia Ministry of Energy, Mines and Petroleum Resources (MEM) Geotechnical Permit M11 – the permit covers the entire mine life, property and the surrounding area and communities. This permit was last amended in 2011, approving the Lornex Pit expansion, the new South Side Tailings Distribution System and raised ultimate crest elevations of H-H Dam and L-L Dam. Section B 2 of the permit lists the conditions concerning dam safety at Highland TSF.
- British Columbia Ministry of Environment (MOE) Water Licenses 46527 and 46528 – these licenses allow diversion and storage of water from Pukaist Creek on Crown Land.

- British Columbia MOE Effluent Permit PE-376 – this permit allows the storage of tailings and effluent in the Highland TSF.

The L-L Dam and H-H Dam have been assigned an “Extreme” consequence classification and a “Very High” consequence classification, respectively, in accordance with the Code which refers to the Canadian Dam Association (CDA) Dam Safety Guidelines (CDA 2013). These classifications are based on the latest dam consequence review hosted by THVCP on January 16, 2018, which the EoR’s designate (Mr. Rick Friedel, P.Eng. of KCB) participated in via teleconference. The classifications were subsequently reviewed and agreed by the EoR (Mr. Bill Chin, P.Eng. of KCB). A summary list of the consequence classifications assigned to each of the supplementary dams downstream of the main dams is provided in Section 2.

The Code recommends a dam safety review (DSR) be undertaken every 5 years based on the “Extreme” consequence classification of L-L Dam and “Very High” consequence classification for the H-H Dam. The other dams at the facility with lower consequence classifications have previously been included in the Highland TSF DSR. The most recent DSR for the Highland TSF dams was carried out by Stantec in 2017 and is in process of documentation. The next DSR is scheduled for 2022.

2 FACILITY DESCRIPTION

2.1 General

The Highland Valley Copper Mine, owned and operated by THVCP, is located near Logan Lake, approximately 45 km southwest of Kamloops, in the interior of British Columbia, as shown in Figure 1. The Highland TSF is located approximately 6.5 km northwest of the operating mill.

The tailings are retained in the Highland TSF by the L-L Dam (west end) and H-H Dam (east end) which were constructed across either end of the Highland Valley. The free water pond is maintained at the western end of the TSF, separated from the core of the L-L Dam by a combined 126 m width of compacted sand zone and a tailings beach. Three seepage collection ponds (Seepage Pond 1, Seepage Pond 2, Seepage Water Reclaim Pond) are located at the downstream toe of the L-L Dam. Two active slimes ponds (Slimes Pond 1 and Slimes Pond 2) are also located at the downstream toe of the L-L Dam and are used to collect construction water and slimes (i.e. suspended sediment) from hydraulic sand placement on the downstream side of L-L Dam. Two inactive slimes ponds (Slimes Pond 3 and Slimes Pond 4) are also located at the downstream toe of the L-L Dam. All seepage and construction water reports to Seepage Water Reclaim Pond, where it is subsequently pumped back to the TSF pond via the seepage water reclaim pipeline. The accumulated slimes in the slimes ponds are excavated during winter months when the slimes are frozen, and hauled to the impoundment for disposal on an as needed basis. The layout of the L-L Dam structures is shown in Figure 2.

The 24 Mile Lake facility area was formally a natural lake that is now surrounded by waste dumps with no clearly defined dam structure. The facility is downstream of the H-H Dam, physically separate from the Highland TSF, and collects seepage from the H-H Dam as well as emergency tailings disposal from the H-H Pumphouse during periods of tailings line maintenance and/or operational upsets. The layout of the H-H Dam and 24 Mile Lake are shown in Figure 4. In 2017, KCB completed an assessment was initiated to review the potential for declassifying 24 Mile Lake facility as a “dam” under the Code (KCB 2018c). This work was still in progress at the time of this DSI.

Pertinent information on the dam structures at the Highland TSF are included in Table 2.1. Further descriptions for the L-L Dam, H-H Dam and 24 Mile Lake are provided in the subsequent sections of the report. A schematic of the tailings and water management system is shown on Figure 2.1.

Table 2.1 Containment Facilities at the Highland TSF

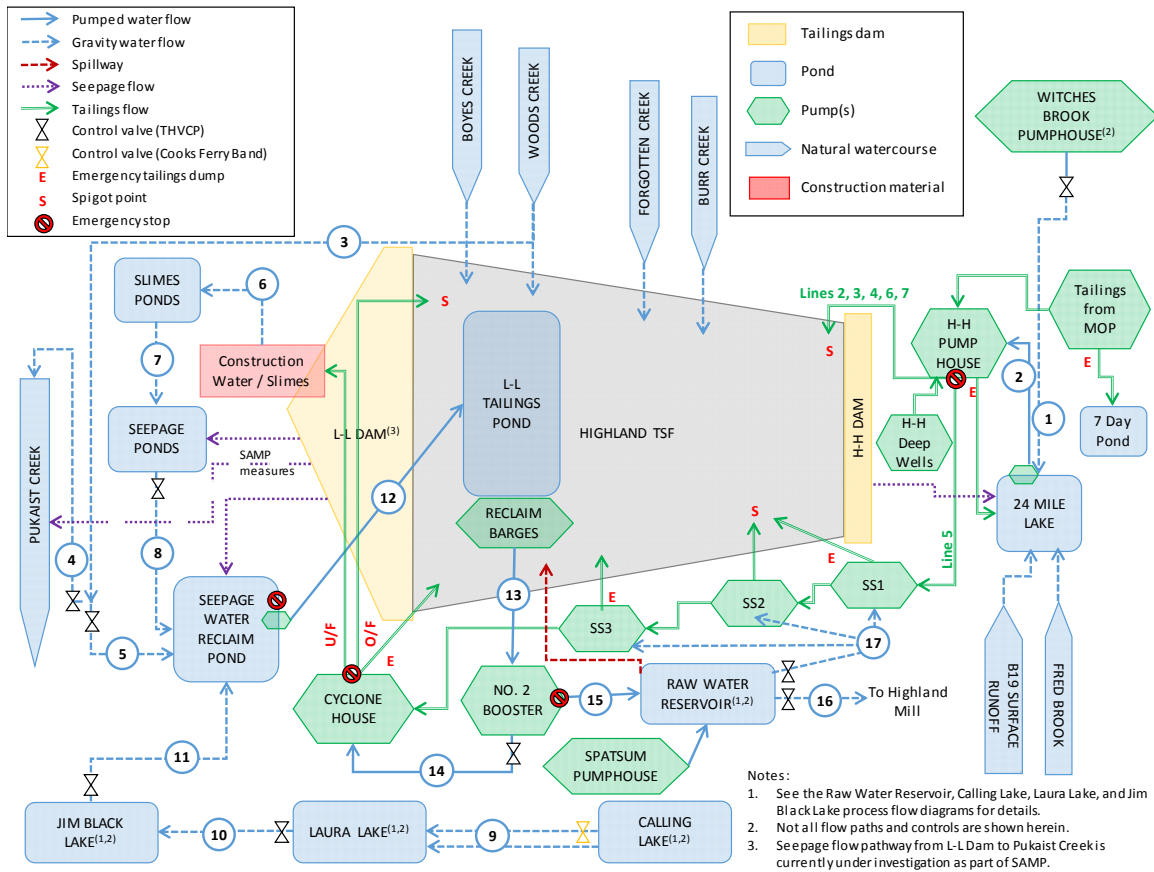
Dam / Facility	Consequence Classification ⁽¹⁾	Purpose	Construction	Current Approximate Dam Crest Length (m)	Current Dam Crest Elevation (m)	Current Approximate Maximum Dam Height (m)
L-L Dam	Extreme	Contains the Highland TSF at its downstream (western) limit.	Earthfill starter dam that has been raised using centreline method of construction with a downstream zone of compacted cycloned sand, a centreline vertical till core, and a sand and gravel drainage blanket beneath the downstream shell of the dam.	3,000	1260.5	161
H-H Dam	Very High	Contains the Highland TSF at the upstream (eastern) limit.	Earthfill starter dam that has been raised using the centreline method of construction, with a downstream zone of variable mine waste and a centreline vertical core.	1,755	1271 to 1277	97
24 Mile Lake	Low ^(1,2)	Receives seepage from the H-H Dam and emergency tailings disposal from the H-H Pumphouse during maintenance of the tailings lines and/or operational upsets.	A former natural lake surrounded by waste dumps.	n/a	Min. 1220 (waste dumps)	40 to 50 (waste dumps)
Seepage Water Reclaim Pond	Significant	Part of the reclaim system, which pumps water back to the TSF. Receives water from surface runoff, the slimes ponds and the seepage collection ponds.	Original embankment on the west side of pond is homogeneous glacial till with downstream sand and gravel filter. Pond is unlined.	95	1103.2	5
Seepage Pond 1	n/a (decommissioned) ⁽³⁾	Collects seepage from the toe of the VBB at the L-L Dam. Pond is unlined.	Excavated into natural ground with an embankment constructed of silty sand (possible Glacial Till) fill on the southwest side. The northeast side of the pond is formed by the sand and gravel drainage blanket to the VBB. Pond is unlined.	500	1104	3

Dam / Facility	Consequence Classification ⁽¹⁾	Purpose	Construction	Current Approximate Dam Crest Length (m)	Current Dam Crest Elevation (m)	Current Approximate Maximum Dam Height (m)
Seepage Pond 2	Significant	Collects seepage primarily from finger drains under the NBB at the L-L Dam.	Excavated into natural ground on three sides, with a homogenous glacial till embankment on the north side of the pond. Pond is lined with geomembrane.	80	1116.6	1.8
Slimes Pond 1	Significant	Was used to collect construction water and fines from hydraulic sand placement on the downstream side of L-L Dam prior to the construction of Slimes Pond 2.	Excavated into natural ground with homogeneous glacial till embankment on the northeast (NE) and southwest (SW) sides. Pond is unlined.	NE = 500 SW = 700	1103.2	2.5 to 3.75 m
Slimes Pond 2	Significant ⁽¹⁾	Collects construction water and fines from hydraulic sand placement on the downstream side of L-L Dam.	Excavated into natural ground on three sides, with a homogeneous glacial till embankment on the south side. Pond is lined with geomembrane.	100	1126.9	10
Slimes Pond 3	n/a (under construction)	Once completed will collect construction water and fines from hydraulic sand placement on the downstream side of L-L Dam.	Under construction.			
Slimes Pond 4	n/a (inactive)	Was used to collect construction water and fines from hydraulic sand placement on the downstream side of L-L Dam prior to the construction of Slimes Pond 2.	Not in use – THVCP plan to decommission. Not included in DSI.			

Notes:

- As assigned during the Dam Classification Workshop held in January 2018.
- Assessed in late 2017 for potential to be declassified as a dam under the Code (KCB 2018c).
- During the 2014 review of the consequence classification, THVCP and KCB's EOR at the time concluded that Seepage Pond 1 was "decommissioned". However, annual inspection of this pond is maintained as part of the annual DSI for the Highland TSF.

Figure 2.1 Process Flow Diagram for Highland TSF



Notes:
 1. See the Raw Water Reservoir, Calling Lake, Laura Lake, and Jim Black Lake process flow diagrams for details.
 2. Not all flow paths and controls are shown herein.
 3. See seepage flow pathway from L-L Dam to Pukaist Creek is currently under investigation as part of SAM.P.

No.	Name	Description	Status
1	Roman Road Pipeline	1x 20" HDPE pipeline	Operational
2	Dewatering to H-H Pumphouse	1x 12" HDPE pipeline	Operational
3	Woods Creek Diversion	System consists of: i) riprap-lined collection pond below Highway 97c; ii) Pumphouse and motor control center buildings; iii) 7 km HDPE pipeline (dia. varies) to Pukaist Creek; and iv) 2x 500 mm dia. HDPE pipes with knife gate valves for discharge to either SWRP or Pukaist Creek.	Operational
4	Woods Creek Diversion to Pukaist Creek	1x 500 mm dia. HDPE pipeline with knife gate valve	Operational
5	Woods Creek Diversion to SWRP	1x 500 mm dia. HDPE pipeline with knife gate valve	Operational
6	Construction Water / Slimes to Slimes Ponds	Gravity flow of water and slimes from one or more hydraulic cyclone sand cells during construction.	Operational during construction
7	Slimes Ponds to Seepage Ponds	Slimes Pond 1 drains to SWRP, and Slimes Pond 2 drains to Seepage Pond 2.	Operational
8	Seepage Pond 2 Outlet	1x 36" dia. HDPE pipe graded upward for the first 12.1 m, then downward for the next 44 m to the SWRP with control valve	Operational
9	Low-Level Outlet and Spillway (Calling Lake)	Low-level outlet: 12" dia. HDPE pipe with control valve and submerged intake trash rack. Spillway: 12' wide channel.	Operational
10	Diversion Outlet (Laura Lake)	12" dia. HDPE pipe with control valve and intake trash rack	Operational
11	Jim Black Diversion to SWRP	Open channel with U/S y-valve	Operational
12	SWRP to TSF	2x permanent pumps in the Seepage Water Reclaim Pond pumphouse feeding 2x 18" dia. HDPE pipelines to the L-L Pond	Operational
13	Reclaim Barges	#1 and #2 Reclaim Barges on the south side of the L-L Pond	Operational
14	Bypass via Reclaim Isolation Valve	Bypass line controlled by hydraulic valve	Operational
15	Reclaim to Raw Water	2x 36" dia. HDPE pipelines from No. 2 Booster to Raw Water Reservoir	Operational
16	Raw Water to Mill	Consists of Low-Level Outlet at East Dam (2x HDPE pipelines with control valves) and #3, #4 Reclaim (2x HDPE pipelines with control valves)	Operational
17	South Side Tailings Gland Water System	1x 10" HDPE pipeline	Operational

2.2 L-L Dam

The layout of the L-L Dam and associated structures is shown in Figure 2. For context and reference, selected design drawings and typical cross sections are included in Appendix III. Since there was no construction in 2017 other than the start of foundation preparation for the 2018 dam raise, the construction record drawings issued in the 2015 construction summary report (KCB 2015) remain applicable for the purposes of this report. General information regarding the dam is as follows:

- As of the end of 2017, the crest elevation of L-L Dam is 1260.5 m, corresponding to a maximum height (crest to toe of Valley Buttress Berm at El. 1107 m) of about 155 m. The currently permitted ultimate crest of the L-L Dam is El. 1279 m, which corresponds to a maximum height of 172 m at the same location.
- The starter dam construction records were reported by Bechtel (1977). Construction records of subsequent raises are contained in various construction summary reports (1978 to 2015).
- The L-L Dam foundation characterization is documented in the KCB report entitled “L-L Dam Geological and Geotechnical Site Characterization Report” (KCB 2016o), which should be referenced for details. The typical stratigraphic sequence beneath the L-L Dam, starting from surface, is as follows:
 - ◆ Upper Sand and Gravel;
 - ◆ Lacustrine Unit:
 - Unit has been excavated from the dam footprint downstream of the starter dam.
 - ◆ Upper Glaciolacustrine Unit;
 - ◆ Glacial Till;
 - ◆ Lower Glaciolacustrine Unit;
 - ◆ Lower Sand and Gravel;
 - ◆ Lower Glacial Till / Gravel; and
 - ◆ Bedrock (Kamloops Group volcanic and sedimentary units, and Guichon Creek granodiorite).
- The dam comprises the following main elements (KCB 2010):
 - ◆ An initial earthfill starter dam, raised via the centerline method with a 15.2 m wide low permeability vertical glacial till core supported by a downstream zone of hydraulically placed, compacted cycloned sand and an upstream compacted cycloned sand berm and tailings beach.
 - ◆ A sand and gravel drainage blanket beneath the downstream shell of the dam, with granular finger drains at selected locations.
 - ◆ Downstream slopes ranging from 2H:1V to 3H:1V, with three buttress berms constructed of hydraulically placed, compacted cycloned sand, designated as the South Buttress Berm (SBB), the Valley Buttress Berm (VBB) and the North Buttress Berm (NBB). With these buttress berms in place, the current overall equivalent slopes at these locations are approximately 3H:1V, 3.5H:1V, and 7H:1V respectively.

- The foundation blanket and foundation drains direct seepage to Seepage Pond 1, Seepage Pond 2 and the Seepage Water Reclaim Pond.
- Construction water and fines are collected in Slimes Pond 1 and Slimes Pond 2, with the water being decanted into the Seepage Water Reclaim Pond.
- Seepage and construction water from the toe of the dam is pumped back into the impoundment from the Seepage Water Reclaim Pond via a 460 mm (18 inch) pipeline which crosses the dam crest at the south abutment.

2.3 H-H Dam

The layout of the H-H Dam is shown in Figure 4. Refer to Appendix III for selected design drawings and typical cross sections. The dam was raised late 2017, to be documented in the construction record drawings in the 2017 construction summary report (in progress). General information regarding the dam is as follows:

- As of December 2017, the crest elevation of H-H Dam varies from 1271 m (west abutment) to 1277 m (east abutment), with a maximum downstream slope height of 97 m. The current permitted ultimate crest of the H-H Dam is El. 1292.7 m, which corresponds to a maximum height of 113 m.
- The starter dam construction records were reported by Bechtel (1972). Construction records of subsequent raises are contained in various construction summary reports (1978 to 2015).
- The foundation conditions at the H-H Dam are documented in the KCB report entitled “H-H Dam Performance Review Report” (KCB 2016b), which should be referenced for details. The typical stratigraphic sequence beneath the H-H Dam, starting at surface, is as follows:
 - ◆ Upper Sand and Gravel;
 - ◆ Glacial Till;
 - ◆ Sand and gravel with interlayered silt and clay; and
 - ◆ Bedrock (Guichon Creek granodiorite).
- The dam comprises the following main elements (KCB 2010):
 - ◆ An earthfill starter dam, raised via the centerline method with a low permeability centreline vertical glacial till core, supported by random fill and tailings beach on the upstream side and variable mine waste fill on the downstream side.
 - ◆ Downstream slope of approximately 2H:1V, with a buttress of varying heights along the dam alignment, constructed of mine waste.
 - ◆ An approximately 6.8 m high lock-block retaining wall constructed at the east of the dam immediately adjacent to the H-H Pumphouse.
- Seepage from the H-H Dam reports to 24 Mile Lake.

2.4 24 Mile Lake

The layout of 24 Mile Lake is shown in Figure 4. There are no design drawings available. General information regarding 24 Mile Lake is as follows:

- The facility is a former natural lake surrounded by waste dumps that have been placed over the life of the mine. There are no construction records for the facility.
- AMEC (2014a) indicated that the two dumps formed on the valley side slopes downstream of the lake consist of overburden stockpiled from pit stripping operations. AMEC (2014a) also indicated that some of these dumps contain free dumped high plastic clay which may be in excess of 40 m thick above the outlet haul road level, and that a portion of these dumps are capped with waste rock for armouring purposes.
- AMEC (2014b) indicated that the foundation conditions include waste fills (as described above), glaciofluvial sand and gravels, glacial till, and interglacial silts and sands. The latter deposits contain glaciolacustrine units, including those designated as 10A, 10B, and 10C, which are prevalent in the valley mine pit and contain slickensided shear surfaces. No information is provided by AMEC as to the depth and extent of the glaciolacustrine units at the facility.
- 24 Mile Lake is an active containment facility which receives emergency discharge of water and tailings from the H-H Pumphouse during tailings line maintenance and operational upsets via an inlet located in the northeast corner of the facility.
- The water in 24 Mile Lake is pumped back to the H-H Pumphouse, via a pump located on the east side of the facility, maintaining a relatively constant pond volume throughout the year.
- The current depth of tailings is unknown, but is estimated to be at least 30 m based on a 1970 survey of the original lake edge.

2.5 Seepage Collection and Slimes Ponds

Slimes, seepage collection and water reclaim ponds were constructed and modified as required to accommodate the expanding footprint of the L-L Dam and meet construction requirements. The design and construction records for most of these ponds are not available.

- Seepage Pond 2 was designed by THVCP.
- Slimes Pond 2 and Slimes Pond 3 were designed by KCB (KCB 2014d, KCB 2015d):
 - ◆ Slimes Pond 2 was constructed in 2014 and commissioned in 2015.
 - ◆ Slimes Pond 3 construction began in 2015 and has not been completed.

3 HISTORY AND RECENT ACTIVITY

3.1 General

Construction of the Highland TSF began in 1971 with the J-J Starter Dam, which was located approximately half-way between the H-H Dam and the L-L Dam. In 1972 the H-H Starter Dam was constructed, followed by the L-L Starter Dam between 1976 and 1979. By 1991 the J-J Dam was buried by tailings.

Over the 45-year life of the facility, there has been five major design updates, along with some minor design revisions, to reflect changes in the mine plan. The current design for the facility is documented in the KCB report entitled “Highland Valley Tailings Storage Facility, Design Update for L-L Dam Crest Elevation 1279 m” (KCB 2010).

3.2 L-L Dam

3.2.1 Historical Overview

A brief history of the construction and operations at the L-L Dam is summarized below. This information was based on the construction summary reports prepared from 1978 to 2015. No construction took place at the L-L Dam in 2015 and 2016.

- The starter dam was constructed to El. 1155 m between 1976 and 1979 (Bechtel 1977, KL 1988). Since then, the dam has been raised on a regular basis (typically annually).
- The first major redesign occurred with the excavation and replacement of the downstream lacustrine deposits followed by the extension of the VBB during construction of the starter dam in 1978 (KL 1988).
- The Seepage Water Reclaim Pond was constructed in the 1980’s.
- In the 1990s, the NBB was added to the section of the dam between about Sta. 2+300 and 2+800 where potentially weaker sedimentary layers were noted in the underlying bedrock (KL 1992, KCB 1999).
- Slimes Pond 1 and Seepage Pond 1 were constructed in the early 1990’s.
- The SBB, was also added in the 1990’s to support an upstream bend in the dam alignment (KC 1995).
- In 2001, a Low-Level Outlet (LLO) was constructed at the south abutment of the dam (KCB 2014a). In addition, an upstream compacted cycloned sand zone was incorporated into the design to provide additional support to the glacial till core in the event of earthquake induced liquefaction of the tailings beach. This upstream cycloned sand zone extends 126 m upstream and the centreline and is raised concurrently with the till core.
- Seepage Pond 2 was constructed in 2012 (KCB 2013).

- In 2013 the LLO was decommissioned by backfilling with concrete (KCB 2014a), and in 2015 an inverted filter drain was constructed at the outlet of the decommissioned LLO to mitigate piping risks (KCB 2015c).
- Also in 2013, the pumps in Seepage Pond 1, which controlled outflow to the Seepage Water Reclaim Pond, were removed and replaced by the installation of a gravity outlet pipe at the south end of the pond (KCB 2014b).
- In 2014, construction of the Valley Buttress Berm Extension (VBBE) commenced, which connects the NBB to the VBB.
- Slimes Pond 2 was constructed in 2014 (KCB 2015).
- In 2015, Slimes Pond 3 construction commenced but is not yet complete (KCB 2016c).

3.2.2 2017 Construction Activities

During 2017, THVCP entered into a new construction contract (Highland TSF 2017-2019 Construction) for the planned three-year sequence of annual raises at the L-L Dam and H-H Dam. Delays in construction startup limited the amount of work completed at the L-L Dam in 2017, as described below. However, upstream beach construction continued as in previous years. The next scheduled milestone is to raise the crest to El. 1262.5 m by November 30, 2018 which is an additional 2 m above the current crest at El. 1260.5 m.

The construction activities listed below were completed in 2017 and will be reported in greater detail in the 2017 construction summary report.

Upstream S2 Fill Zone – Underflow Pipe Grade and Excavation/Removal of Secondary Cyclone Pipelines at South Dam

In preparation for hydraulic cycloned sand placement as part of 2018 construction activities, THVCP engaged a Contractor to remove existing secondary cyclone pipelines from their location (per end of 2015 construction season) and construct a new underflow pipe grade within the upstream S2 fill zone. From June 28, 2017 to July 8, 2017, the following dam construction works to support pipe placement took place:

- Widen the pipe grade downstream of the existing overflow pipeline by excavating part of the S2 fill between the South Abutment (Sta. 0+800) and Sta. 2+000;
- Place excavated fill within the S2 zone (between Sta. 0+800 and Sta. 2+000);
- Excavate and remove four of the eight pipes within the S2 zone between Sta. 1+400 and Sta. 2+000 from the secondary cyclones to the tailings beach; and
- Backfill the excavated pipe trenches (2 m to 3 m deep), using the S2 fill from the excavations.

Fill placement was carried out per the mechanical placement specifications from the 2017 construction package, summarized as:

- Fill placed in horizontal lifts (with dozer or excavator);
- Maximum 0.3 m loose lift thickness; and
- Compacted to minimum 97% of standard Proctor maximum dry density.

THVCP dam inspectors provided quality control (QC) during construction which included initial full time / later part time monitoring, completing daily checklists to document compliance with specifications, taking daily photographs, and conducting pre-/post-construction as-built surveys. KCB provided intermittent quality assurance (QA) coverage including two (minimum) nuclear densometer tests per day and daily photographs of the work area.

Based on available QA/QC records, the completed works are in compliance with specifications.

Foundation Preparation at North and South Dam

From November 19, 2017 to December 20, 2017, the Contractor undertook foundation preparation activities at two segments of L-L Dam: North Dam (Sta. 2+800 to Sta. 3+600) and South Dam (Sta. 1+100 to Sta. 1+200). The work consisted of:

- removal of unsuitable material down to competent foundation where the GLU is absent, or just above the top of GLU where present (in these areas, excavation of the GLU will be carried out at a later date in 2018 in close coordination with progressive backfill as the excavation progresses); and
- placement of approximately 7,700 m³ of SG1 drainage blanket fill at the North Dam (Sta. 3+000 to Sta. 3+200).

The construction activities were carried out in general accordance with the specifications in the 2017 construction documents. Temporary works and temporary excavations are the responsibility of the contractor, but are reviewed by KCB from a dam safety related perspective.

Beach Construction

Beach construction via open ended discharge of Primary cyclone underflow and overflow tailings from the crest of the L-L Dam was carried out between April and September 2017, between Sta. 1+600 and Sta. 2+900.

3.3 H-H Dam

3.3.1 Historical Overview

A brief history of the construction and operations at the H-H Dam is summarized below. This information was based on the construction summary reports prepared from 1978 to 2015. In general, up to 1993, the H-H Dam was constructed by Contractors using local borrow materials. From 1993

onwards, the portion of dam downstream of the core and downstream filter zone (SG2 fill zone) is constructed by THVCP, employing its own equipment and workforce, using select waste material from the Valley Pit. This was carried out in 2016 with intermittent placement of downstream RF2 fill out to the ultimate dam profile (between Sta. 0+540 and Sta. 1+600, up to approximately El. 1271 m).

- The starter dam was constructed in 1972 to El. 1193.6 m (Bechtel 1972). Following completion of the starter dam, the dam has been raised on a regular basis (typically annually).
- After about 1992, the downstream shell was raised by end-dumping sand and gravel (random fill) material in up to 10 m thick lifts with only traffic compaction by construction equipment (i.e., haul trucks). A 10 m wide “transition zone” immediately downstream of the glacial till core was typically compacted in thinner (2 m) lifts (KCB 2016b).
- From about 2003 to 2007, a waste dump was constructed downstream of the dam which raised the original ground at the toe from El. 1195 m to about El. 1224 m to El. 1227 m (KCB 2016b). The waste dump was constructed in about 10 m thick lifts with the top of each lift compacted by construction equipment traffic.
- Between about 2008 and 2009, the downstream side of the dam was further raised to about El. 1255.5 m across most of the dam length using Bethsaida sand (sand and gravel fill) with similar construction procedures as per the random fill:
 - ◆ Over approximately the same period, a portion of the waste dump along the western end of H-H Dam (i.e. from about Sta. 0+600 to Sta. 1+200) was raised as high as El. 1290 m.
 - ◆ Along the eastern end of H-H Dam (i.e. from about Sta. 1+500 to Sta. 1+950), and immediately upstream of 24 Mile Lake, the waste dump was maintained at about El. 1224 m.
- In 2010, a filter zone was added between the glacial till core and the downstream fill zones (KCB 2010).
- A 6.8 m high lock block retaining wall was designed by Sadé Engineering Associates (SEA) and constructed by THVCP during 2012 at the toe of the dam at Sta. 2+020.
- In 2014, a rockfill buffer zone was added along the upstream edge of the dam to mitigate erosion by tailings slurry (KCB 2014).

3.3.2 2017 Construction Activities

During 2017, THVCP entered into a new construction contract (Highland TSF 2017-2019 Construction) for a planned three-year sequence of annual raises at the L-L Dam and H-H Dam. Delays in 2017 meant not all work was carried out to design lines and specifications (deviations summarized below). However, the minimum 2017 Till Core raise was reviewed based on updated depositional modelling, and the horizontal crest milestone at El. 1273 m was revised from to a sloping crest from El. 1271 m (West Abutment) to El. 1277 m (East Abutment). The next milestone crest raise is planned to El. 1276 m by November 30, 2018 which will be reviewed in 2018.

The construction activities listed below were completed in 2017 and will be reported in greater detail in the construction record report for the ongoing raise.

Annual Dam Raise

A brief summary of the construction activities at the H-H Dam is provided below:

- The downstream RF2 Zone (downstream of the glacial till core and transition/filter zone) was raised on two separate occasions to El. 1277 m (between Sta. 0+540 and Sta. 1+600) and El. 1271 m (between Sta. 1+500 and Sta. 1+700).
- The upstream RF1/RF2 Zone was raised 2 m from West to East Abutment, 1 m higher than the adjacent Till Core Zone to facilitate construction of a pipe grade which was planned to be used to discharge tailings onto the beach and also act as a safety berm to maintain minimum 1 m buffer height (in compliance with the OMS).
- The SG2 Zone was raised between 2 m (east abutment, to El. 1277 m) and 1 m (west abutment, to El. 1271 m) while maintaining the 0.6% grade from Sta. 1+400 to the east abutment, consistent with the Till Core Zone raise.
- The Till Core Zone was raised between 2 m (East Abutment, to El. 1277 m) and 1 m (West Abutment, to El. 1271 m) while maintaining the 0.6% grade from Sta. 1+400 to the east abutment. Due to inclement weather late in the year, till was placed per temporary requirements (i.e. not to full IFC specification) as agreed upon between KCB and THVCP. This material is part of the Till Core Zone buffer (1 m) and will be removed and replaced with fill placed to specifications during the next Till Core raise in 2018.

Relocation of Tailings Pipelines

Prior to November 2017, tailings deposition at the H-H Dam consisted of discharge through six lines at three locations: SS1 (Line 5 by West Abutment), Sta. 2+200 (Lines 2, 3, 4), and East Abutment (Lines 6, 7 which are ~100 m northwest of the dam abutment). Lines 6, 7 are preferentially used because discharge at SS1 and Sta. 2+200 have been known to cause erosion and sudden rises of the tailings beach against the upstream slope of H-H Dam. However, in early 2017, Lines 6, 7 were briefly inundated by build-up of tailings at the pipeline outfalls, and THVCP began to develop plans to raise the two lines and explore alternative deposition strategies from the crest of the H-H Dam.

A summary of construction activities related to the relocation of tailings pipelines is given in Table 3.1.

Table 3.1 Construction Activities for Relocation of Tailings Pipelines at H-H Dam

Plan Component	Construction Activity	Completed in 2017?
Pipe grade for Lines 3, 4 across the upstream edge of the H-H Dam	Construct an RF2 bench on top (where needed for grade) of the 2017 as-built upstream RF1/RF2 zone: <ul style="list-style-type: none"> ▪ Sta. 2+200 to Sta. 1+300: 8 m wide ▪ Sta. 1+300 to ~Sta. 1+000: <8 m wide to avoid placing within the Till Core Zone 	Y
Relocation of Lines 3, 4 across the upstream edge of the H-H Dam crest	Move discharge points from Sta. 2+200 to Sta. 1+600 and Sta. 1+300.	N (pending review of deposition strategy)
Raise and extension of Lines 6, 7	Construct new right of way for pipelines from East Abutment to ~150 m northwest of the dam abutment. Relocate Lines 6, 7 to new right of way.	Y

THVCP plan to review the tailings deposition strategy for the Highland TSF as a whole, and work with KCB to determine long-term sequencing.

The new right of way for Lines 6,7 was constructed across the H-H dam at the east abutment. The fill placed for this right of way is considered temporary and will be removed during future raises of the dam crest.

4 WATER MANAGEMENT

4.1 Overview

Water management at each structure and how they interact with each other is summarized below. Figure or drawing references for key operating water management structures, where available, are summarized in Table 4.1.

Table 4.1 References for Operational Water Management Structures for Highland Facility

Facility	Structure Name	Drawing or Figure Reference (Appendix III)
L-L Dam / H-H Dam	Reclaim barges 1 and 2	Figure 17
Seepage Pond 2	Outflow pipe	No design drawing available
	Temporary pump	No design drawing available
Slimes Pond 1	Pumping pipeline	No design drawing available
Slimes Pond 2	Outflow pipe	D-74001
	Underdrain pump	D-74001
Seepage Water Reclaim Pond	Seepage water reclaim pipeline	111-803-140
24 Mile Lake	Portable pump	No design drawing available

Highland TSF

- Inflows include water from tailings slurry (discharged either upstream of the H-H Dam or upstream of the L-L Dam), precipitation on the pond, seepage return water pumped from the Seepage Water Reclaim Pond, seepage return water pumped from 24 Mile Lake, surface runoff from surrounding catchments, and inflows from Boyes Creek, Burr Creek, and Forgotten Creek all located on the northern side of the TSF:
 - ◆ Flows from Woods Creek, which previously reported to the TSF, are now diverted into Pukiast Creek downstream of the TSF via the Woods Creek Diversion Scheme, which is part of the Pukiast Creek Sulphate Adaptive Management Plan (THVCP 2017a).
- The free water pond is maintained at the western end of the impoundment. The water level in the pond varied by 6.6 m in 2017, which is greater than historical trends over the past six years (~3.7 m). This is largely attributed to the runoff resulting from rapid melt of a larger than average snowpack during freshet, discussed further in Section 4.2.
- Outflows include seepage from both dams, reclaim water from two reclaim barges located on the south side of the impoundment near the L-L Dam which is pumped to the Raw Water Reservoir for reclaim to the Highland Mill and evaporation. The Highland TSF has no spillway and is designed to store the environmental design flood (EDF) and inflow design flood (IDF); refer to Section 4.4.

Seepage Pond 2

- Inflows include seepage from northern sections of the L-L Dam (via Finger Drain #1 which channels seepage from beneath the North Dam and North Buttress Berm), precipitation on the pond, runoff from upstream catchments, and decant water from Slimes Pond 2.

- The water level is not regularly surveyed by THVCP. Based on a visual estimate, the pond level was visually estimated to be 1.5 m below the dam crest during the 2017 DSI site visit.
- Outflows include gravity flow through a 900 mm (36") outflow pipe located in the southeast corner of the pond and evaporation. The outflow pipe is graded upward at 4.2% for the first 9.5 m and 0.6% for the next 2.6 m, then downward at 3.5% for the next 44 m to the outlet. A flow control valve is located along the upward 0.6% segment of pipe. A temporary pump can also be used to increase outflow capacity during active hydraulic sand placement when decant water was flowing from Slimes Pond 2. Outflows from the pond report to the Seepage Water Reclaim Pond. There is no spillway for this pond.

Slimes Pond 1

- Inflows include seepage from the L-L Dam, seepage from Seepage Pond 1, precipitation on the pond, and runoff from upstream catchments.
- The water level is not regularly surveyed by THVCP. Based on a visual estimate, the pond level was 5 m below the dam crest during the 2017 DSI site visit.
- Outflows include seepage, which flows into the adjacent Seepage Water Reclaim Pond, and sporadic pumping by THVCP to drawdown water levels in advance of slimes excavation. There is no spillway for this pond.

Slimes Pond 2

- Inflows include construction water from hydraulic sand placement on the downstream side of L-L Dam, precipitation on the pond, and runoff from upstream catchments.
- The water level is not regularly surveyed by THVCP; and the pond was dry during the 2017 site inspection.
- Outflows include gravity flow through a 900 mm (36") outflow pipe which is directed into Seepage Pond 2, evaporation and discharge via an underdrain pump which can be used to manually draw down the water level in the pond prior to slimes excavation. There is no spillway for this pond.

Seepage Water Reclaim Pond

- Inflows include seepage from the L-L Dam (via the UVD/LVD drain), seepage from Slimes Pond 1, outflow from Seepage Pond 2, outflow from Seepage Pond 1, outflow from Jim Black Lake, precipitation on the pond, diverted flows from Woods Creek, and runoff from upstream catchments.
- The water level is regularly surveyed by THVCP. The water level varied seasonally up to 1.2 m in 2017 and the minimum freeboard measured was 2.3 m.
- Outflows include seepage, reclaim pumping back to the impoundment via the seepage water reclaim pipeline which crosses the L-L Dam crest at the south abutment. The pumpback system is comprised of two Peerless 6-Stage 16HXB vertical turbine pumps, each with a rated discharge of 3,000 USGPM (0.19 m³/s) for a total capacity of 0.38 m³/s. There is no spillway for this pond which relies on pumping to manage the IDF, as discussed in Section 4.4.

24 Mile Lake

- Inflows include water from tailings slurry from the H-H Pumphouse, seepage from the H-H Dam, precipitation on the pond, and runoff from upstream catchments.
- The water level is regularly surveyed by THVCP. The water level varies seasonally, up to 3.4 m in 2017. The minimum freeboard measured during 2017 was 20 m.
- Outflows include seepage that discharges to the Valley Pit, and reclaim water pumped to the H-H Pumphouse via a portable pump located on the east side of the facility. There is no spillway for this facility.

4.2 Climate

Climate data was collected throughout the year from the L-L Dam weather station (El. 1122 m) and summarised on Table 4.2 and

Figure 4.1. Climate normals (1981 to 2010) from the Highland Valley Lornex Station (Environment Canada Station No. 1123469) are shown on the same figure for comparison. This climate station was located near the Highland Mill, and had the longest running record for the mine site from 1971 until being decommissioned in November 2011.

Seasonal snowpack depth is not measured at the L-L Dam weather station. Instead, monthly measurements at the Highland Valley snow survey station (Station No. 1C09A) near the Trojan TSF are used to track the changes in snowpack. The measurements are sorted by survey period (the first of January through May) to compare snowpack depths (in snow-water equivalent (SWE) around the same time each year. Historical average and 2017 snowpack depths based on available records are summarized in Table 4.3.

The following observations were noted for 2017:

- May through August appear noticeably drier than average. No data was missing during this time.
- On an annual basis, precipitation at the L-L Dam weather station was 28% lower than normal (at Lornex).
- Snowpack depths were not measured for the January 1st or February 1st survey periods. The March 1st, April 1st, and May 1st snowpack depths (in SWE) were 30%, 50%, and 271% greater than average, respectively.

During freshet, a period of rainfall followed by a sudden increase in temperature (Figure 4.2) triggered greater than normal surface runoff on site and in the region starting May 5, 2017. Available records also show the snowpack depth (in SWE) near the Trojan TSF was 3.7 times greater (relative percent difference = +271%) than average for that time of year. The combination of available snowpack and rapid melt-inducing changes led to a more severe freshet in 2017 than normal. Observations and actions in response are discussed in the relevant sections of this report.

Table 4.2 Monthly Precipitation in 2017

Month	Precipitation (mm)	
	L-L Dam – Unadjusted	Lornex Normals
January	13.5	27.5
February	37.1	21.0
March	21.2	16.7
April	34.6	21.3
May	15.6	41.3
June	5.9	47.9
July	2.8	43.5
August	10.8	31.7
September	28.8	31.2
October	33.5	30.0
November	46.2	40.4
December	34.8	40.8
Annual Total	284.7	393.3

Figure 4.1 Monthly Precipitation in 2017 and Climate Normals

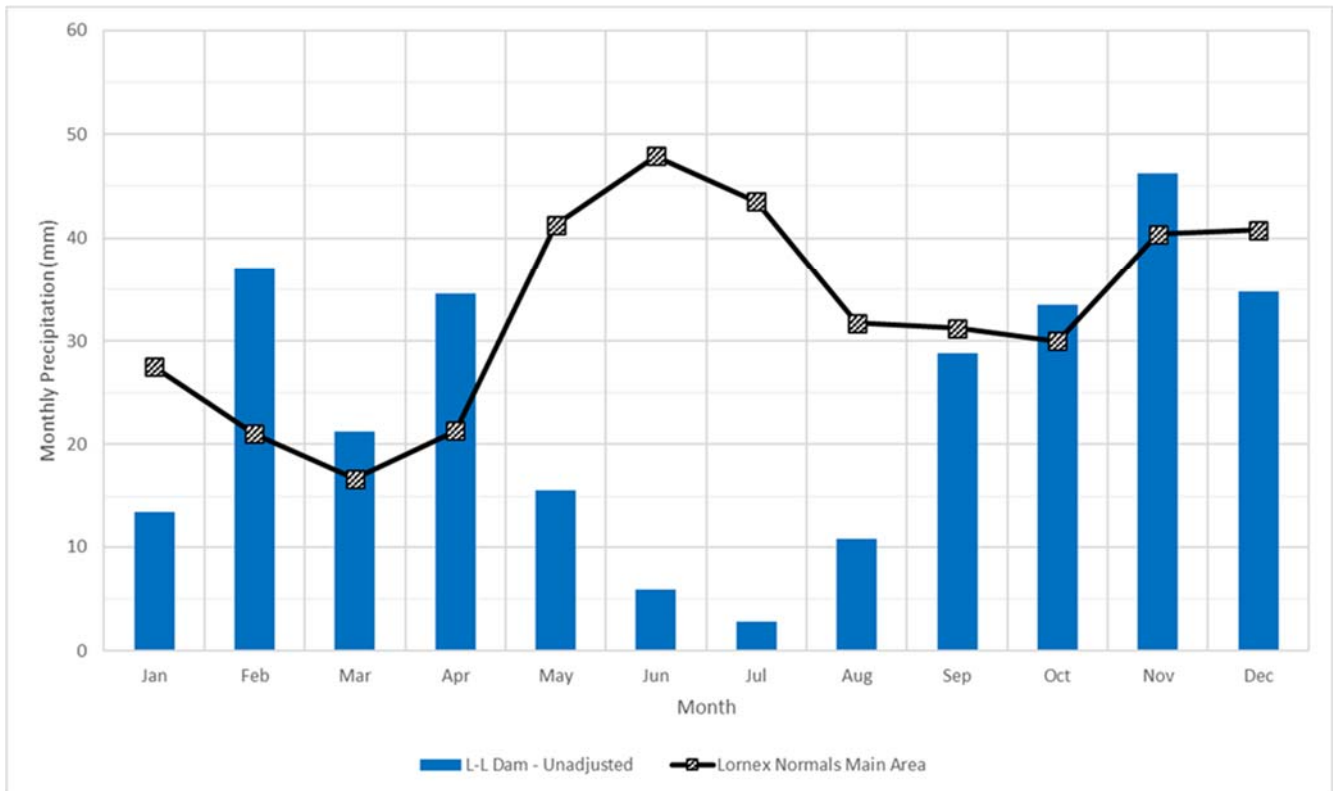


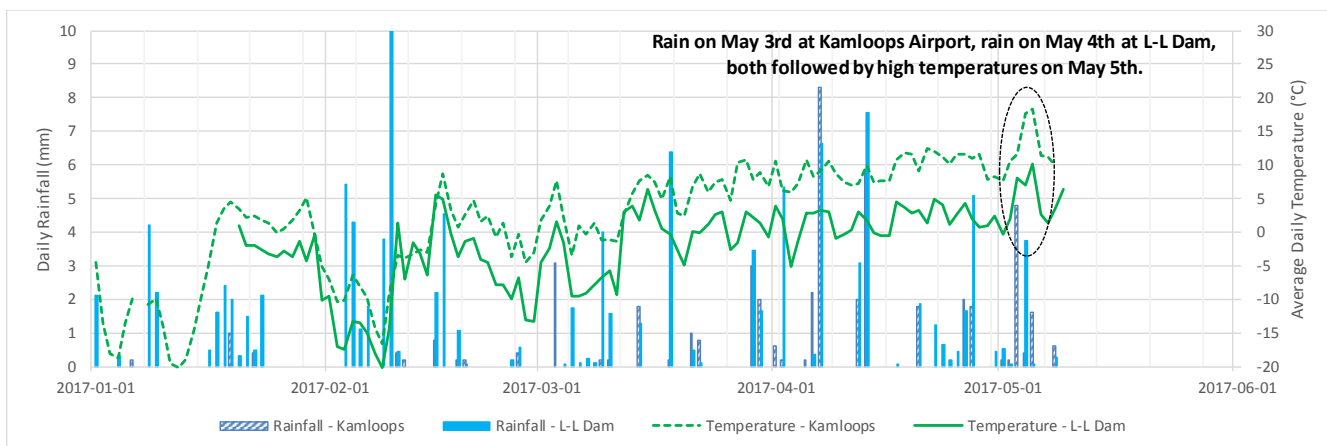
Table 4.3 Historical Average and 2017 Snowpack Depths

Survey Period	Years of Record ⁽¹⁾	Historic Average Snowpack Depth ⁽²⁾ (mm SWE ⁽³⁾)	2017 Snowpack Depth (mm SWE ⁽³⁾)	Relative Percent Difference (%)
January 1 st	11	50.2	Not surveyed	N/A
February 1 st	25	83.5	Not surveyed	N/A
March 1 st	51	89.5	116 ⁽⁴⁾	+30%
April 1 st	51	96.3	144 ⁽⁴⁾	+50%
May 1 st	48	27.3	101 ⁽⁴⁾	+271%

Notes:

1. At the Highland Valley snow survey station (Station No. 1C09A) near the Bethlehem TSF. Data prior to 1966 was not included as the station was moved to its current location in 1965.
2. Calculated based on available period on record.
3. SWE = snow water equivalent.
4. The March 1st survey was conducted on March 4, 2017. The April 1st survey was conducted on April 3, 2017. The May 1st survey was conducted on May 3, 2017.

Figure 4.2 Daily Rainfall and Average Temperature at Kamloops Airport and L-L Dam Climate Stations Leading up to Freshet



4.3 Water Balance

THVCP manages and tracks the annual water balance for the Highland TSF. Table 4.4 is a summary of annual inflows and outflows, provided by THVCP. The water balance is based on simplified modelling results and therefore the values should be treated as indicative only. As a check, THVCP also calculated the difference in pond volume at the end of 2017 and 2016 using weekly pond elevations combined with a stage-storage curve (Table 4.5). Both modelled and measured values indicate the Highland TSF was operated with a net gain for the 2017 calendar year; however, there is a 0.2 Mm³ (approximate) difference between the two values. This discrepancy can be partially attributed to the challenges of capturing seasonal trends which are dependent on climatic conditions from previous months (e.g. highs and lows of temperature or precipitation in a year) when modelling over a calendar versus a hydrologic year. This effect can be exacerbated during “extreme” climatic periods such as the more severe, melt-induced freshet in 2017.

Table 4.4 Annual Water Balance for Highland TSF

Item	Volume in 2017 (Mm ³)
Inflows	
Runoff ⁽¹⁾	5.67
Consolidation water	2.87
Water in tailings through H-H	94.30
Outflow from Jim Black Lake	0.82
Groundwater	0.64
Spatsum	0.58
<i>Total inflow:</i>	<i>104.88</i>
Outflows	
Evaporation ⁽²⁾	7.40
Seepage to Pukaist Creek	0.77
Entrainment	17.24
Reclaim to Highland Mill	78.32
<i>Total outflow:</i>	<i>103.73</i>
Balance	
Water gained from impoundment (inflow minus outflow) from end of 2016 to end of 2017	1.15

Notes:

- Adjusted precipitation values from Shula Flats weather station used in water balance model.2. Evaporation was assumed to be 570 mm/year.

Table 4.5 Change in Pond Volume in 2017 for Highland TSF

	Volume (m ³)
Pond volume on Dec 27, 2016	13,586,069
Pond volume on Dec 21, 2017	13,041,160
Change in pond volume (2017 minus 2016)	-544,909
Volume correction ⁽¹⁾	1,916,813
<i>Change in pond volume (with correction)</i>	<i>1,371,904</i>

Notes:

- The bathymetry used to generate the stage-storage curve for the Highland TSF was updated in September which resulted in a 1,916,813 m³ difference compared to the previous stage-storage curve. This difference was added to the change in pond volume.
- The discrepancy between modeled and observed volume changes (i.e. between Table 4.4 and 4.5) can be partially attributed to the challenges of modeling over the calendar year rather than the hydrological year.

4.4 Flood Management

The summary of flood management structures and the applicable design criteria and details for the seven facilities are given in Table 4.6 below with the following discussion points noted:

- The Highland TSF is designed to contain the required return period storm volume with a storm duration (5-day) greater than the minimum required (72-hour) by the Code.
- The remaining water containment structures, except the Seepage Water Reclaim Pond and Seepage Pond 2, are designed to safely route or store, with appropriate freeboard, storm

events greater than or equal to the IDF required by the Code and recommended by CDA (2013).

- Slimes Pond 1 design event return period is equal to the IDF recommended under the Code; however, the duration (24-hour) is less than the minimum recommended if the IDF is to be stored rather than routed (72-hour). Slimes removal and backfilling of the pond is ongoing as part of construction and the pond will be decommissioned in 2018; therefore, no further action is required.
- The Seepage Water Reclaim Pond relies on pumping to maintain water levels year-round, and in its current state, has insufficient capacity to store the IDF (KCB 2018b). If the Seepage Water Reclaim Pond capacity is exceeded it would initially flood the nearby area potentially impacting THVCP operations but not initially result in an off-lease discharge. KCB had recommended that THVCP should advance the design of preferred options described in the 2018 flood routing assessment (KCB 2018b), or suitable alternative. KCB understands that this work is ongoing. Measures would include:
 - ◆ Maximizing diversion of surface runoff from undisturbed catchments as part of normal operating protocol by:
 - Closing the Jim Black Lake outlets that report to SWRP during freshet and periods of sustained or extreme rainfall.
 - Diverting flow within the Woods Creek Diversion system from the SWRP during freshet and periods of sustained or extreme rainfall.
 - ◆ Increasing the pumpback capacity from 0.38 m³/s to sufficient capacity to manage the IDF (~0.8 m³/s), and provide redundancy.
 - ◆ As part of future L-L Dam seepage collection and slimes ponds expansion for ultimate conditions, consider:
 - Increasing the storage capacity of the SWRP through construction of larger seepage ponds (in-place or upstream) – to be operated as surge ponds with low-level outlets and low operating pond levels, as recommended in KCB (2018c).
 - Opportunities to divert non-contact runoff from undisturbed catchments north of Highway 97C and Slimes Pond 3.

Given the scope of work required, THVCP and KCB set a timeline and milestones for undertaking the upgrade works: design in 2018; permit and IFC Drawings in 2019 and construction in 2020. In the interim, THVCP should develop and implement an interim plan involving pumping to manage the IDF without off-lease discharge until upgrade works are complete. This plan will be incorporated into the OMS manual.

- In its current state, Seepage Pond 2 does not meet the minimum freeboard requirement (0.5 m) during the IDF (KCB 2018b). In 2016, KCB recommended THVCP commission works to lower the outlet pipe intake and re-grade the pipe to achieve a consistent downward grade from inlet to outlet. KCB understands this work was not completed in 2017. Per the 2018 flood

routing assessment (KCB 2018b), by maintaining the existing inlet invert elevation (1114.4 m), the system has capacity to route the IDF with sufficient freeboard provided the water level is not “perched” at the top of the existing bend (El. 1114.8 m), and the hydraulic capacity of the pipe is not compromised by the initial upward segment. KCB recommends this work be carried out as part of 2018 construction activities at the L-L Dam.

Table 4.6 Inflow Design Flood Requirements for Highland Facility

	Outfall Type	Consequence Classification	Inflow Design Flood	Design Event (Precipitation Depth, Design Flow/Volume)	IDF stored or routed?	Reference
L-L Dam	None	Extreme	PMF ⁽¹⁾	5-day PMF (423 mm ⁽²⁾ , 49.4 Mm ³)	Stored	(KCB 2010)
H-H Dam	None	Very high	2/3 between 1000-year and PMF ⁽¹⁾	5-day PMF (423 mm ⁽²⁾ , 49.4 Mm ³)	Stored	(KCB 2010)
Seepage Pond 2	Pipe	Significant	Between 100-year and 1000-year ⁽³⁾	100-year 24-hour (75.5 mm ⁽⁸⁾ , 1.9 m ³ /s)	Routed (Note 9)	(KCB 2018b)
Slimes Pond 1	None	Significant	Between 100-year and 1000-year ⁽³⁾	100-year 24-hour (59 mm ⁽⁴⁾ , 14,300 m ³)	Stored	(KCB 2015a)
Slimes Pond 2	Pipe	Significant ⁽⁵⁾	Between 100-year and 1000-year ⁽³⁾	100-year 24-hour (75.5 mm ⁽⁸⁾ , 0.2 m ³ /s)	Routed	(KCB 2018b)
Seepage Water Reclaim Pond	Pump	Significant	Between 100-year and 1000-year ⁽³⁾	100-year 24-hour (75.5 mm ⁽⁸⁾ , Note 7)	Routed (Pumped)	(KCB 2018b)
24 Mile Lake	None	Low	100-year ⁽³⁾	24-hour PMF (210 mm ⁽⁶⁾ , 2.2 Mm ³)	Stored	(AMEC 2014a)

Notes:

1. Per the Code (MEM 2016) for tailings dams.
2. Includes 367 mm of probable maximum precipitation (PMP) from the Environment Canada Highland Valley Lornex climate station (Station No. 1123469), and 56 mm of average annual snowmelt runoff estimated using average annual runoff from nearby streamflow stations.
3. Per the Code (MEM 2016) for water dams.
4. Based on data from the Environment Canada Highland Valley Lornex climate station (Station No. 1123469) with adjustment factor applied (KCB 2015a).
5. As assigned during the Dam Classification Workshop held in February 2015.
6. Based on data from the Environment Canada Highland Valley Lornex climate station (Station No. 1123469) (AMEC 2014b).
7. Refer to discussion in Section 4.4 above.
8. Based on Golder (2016).
9. Seepage Pond 2 does not have sufficient capacity to route the IDF in its current state. See discussion above for recommendations to meet minimum freeboard requirements.

4.5 Freeboard

Where available, the minimum freeboard¹ measured during 2017 based on either the DSI site visit observations and/or the latest survey, are estimated in Table 4.7. The Code specifies that an evaluation of available freeboard in excess of the peak design flood level is required but defers to CDA (2013) for freeboard design standards. The following items are of note:

- There is no permanent pond at the H-H Dam and the crest is more than 10 m higher than L-L Dam; therefore, overtopping is not a credible failure mode. The minimum freeboard, or

¹ The vertical distance between the pond level and the low point of the dam crest.

“buffer” for the H-H Dam reported in Table 4.7 refers to the vertical distance between the top of the tailings and the dam crest (KCB 2017b).

- No minimum freeboard assessment has been completed for 24 Mile Lake based on CDA (2013). However, the available freeboard is expected to exceed the minimum requirement because the available storage (11.8 Mm³ based on the May 2017 bathymetric survey) is far in excess of the estimated 24-hour PMF volume of 2.2 Mm³ (AMEC 2014a) and, therefore, is also far in excess of the IDF volume corresponding to the 100-year.
- Seepage Water Reclaim Pond is projected to be overtopped during the IDF and therefore does not meet minimum freeboard requirements (KCB 2018b). Seepage Pond 2 is projected to not meet minimum freeboard requirements. Refer to Section 4.4 for KCB recommendations.
- All other facilities meet freeboard requirements during the IDF.

Table 4.7 Minimum Available Freeboard in 2017

Dam	Required Minimum Freeboard ⁽¹⁾	Minimum Available Freeboard in 2017	Freeboard Surveyed/Visually Estimated
L-L Dam	2 m	12.5 m	Annual minimum from surveys
H-H Dam	1 m ⁽²⁾	1 m ⁽²⁾	Annual minimum from surveys at Sta. 0+600
Seepage Pond 2	0.5 m	1.5 m	At time of site inspection
Slimes Pond 1	0.5 m	5 m	At time of site inspection
Slimes Pond 2	0.5 m	Pond was empty	At time of site inspection
Seepage Water Reclaim Pond	0.5 m	2.3 m	Annual minimum from surveys
24 Mile Lake	Note 3	20 m	Annual minimum from surveys

Notes:

1. The vertical distance between the peak pond level during a flood event and the low point of the dam crest to accommodate wave runoff and setup per CDA (2013).
2. “Buffer” measured between top of tailings surface and effective H-H Dam crest.
3. No minimum freeboard assessment completed; see discussion above for details.

5 REVIEW OF MONITORING RECORDS AND DOCUMENTS

5.1 Monitoring Plan

The Operation, Maintenance and Surveillance (OMS) manual, including the Emergency Preparedness and Response Plan (EPRP), was updated in 2018 (THVCP 2018) and will be issued by THVCP to MEM. The 2018 update will supersede the versions submitted to MEM in December 2016 (THVCP 2016) and included the recommended items from the 2016 DSI.

- Review structure of report and include any data which is updated on an annual basis as an appendix which can easily be updated, rather than text in the body of the report (e.g. tailings production schedule, threshold levels, groundwater chemistry);
- Include a list of named individuals for each of the main roles of responsibility as an appendix to the OMS instead of in the main body of the text, to make it easier to update on a yearly basis;
- Include a plan(s) showing the location of all the facilities associated with the Highland TSF (seepage ponds, slimes ponds, inflows, outflows etc.);
- Review and update recommendations on minimum beach widths;
- Review and update the failure mode assessment;
- Update definition of event-driven dam inspections to include the following:
 - ◆ Exceedance of piezometric and/or dam movement instrumentation thresholds as discussed in Sections 5.4 to Section 5.6;
 - ◆ Earthquake greater than magnitude 5, within 100 km of the site; and
 - ◆ Rainfall event greater than the 10-year, 24-hour duration storm.

The 2018 manual meets the intent of the Mining Association of Canada (MAC 2011) and CDA (2014) guidelines, is current and provides adequate coverage for existing conditions.

5.2 Inspections

The Highland TSF monitoring program includes the following visual inspections:

- Annual DSI (this report) – completed by the EoR to comply with Section 10.5.3 of the Code and submitted to MEM.
- Routine – routine monitoring frequencies are summarized in Table 5.1. Summaries of dam inspection observations are provided to the EoR typically on a monthly basis and have been reviewed as part of this DSI. Inspections by THVCP staff have been completed at the prescribed frequencies during periods of the year when dams are accessible. KCB carried out quarterly dam inspections of the L-L Dam and H-H Dam on March 30th, May 28th and

December 20th/21st (checklists from these quarterly inspections are included in Appendix I-E). The annual dam safety inspection in September constitutes one of the quarterly inspections.

- Event-driven – completed by THVCP staff in response to unusual conditions and the threshold exceedances listed below (included in the 2018 OMS manual). EoR participation is determined on a case-by-case basis. Details of exceedances and/or unusual conditions, including trigger, response, and remediation / actions taken, are documented in event-driven monitoring review memorandums (MRMs) for record:
 - ◆ Exceedance of piezometric and/or dam movement instrumentation thresholds as discussed in Sections 5.4 to Section 5.6;
 - ◆ Earthquake greater than magnitude 5, within 100 km of the site; and
 - ◆ Rainfall event greater than the 10-year, 24-hour duration storm.

Threshold exceedances are summarized in the appropriate sections (5.3 to 5.5). In 2017, the following event-driven inspections were triggered:

- April 2017:
 - ◆ On April 8 around 4:30 PM, a leak developed in one of the L-L Cyclone House gland water lines, resulting in localized ponding on the till core and erosion of the downstream fill. The affected area was limited to the south abutment, from approximately Sta. 1+000 to Sta. 1+030. The incident was identified by a THVCP dam inspector during a routine inspection who notified appropriate departments. Mill Operations mobilized to repair the leak by evening of the same day, and a THVCP dam inspector monitored the ponding/erosion.
 - ◆ On April 9, the THVCP dam inspector visually estimated the single erosion gully to be 4 m at the widest and 2 m at the deepest. KCB reviewed the erosion and determined there was no significant impact to dam safety, and the area was repaired.
 - ◆ In response to this incident, THVCP upgraded surface drainage to divert similar flows into the impoundment rather than to the dam.
- May 2017:
 - ◆ On May 4 and 5, severe freshet conditions (water levels approaching discharge / Level 1 thresholds, localized flooding) triggered increased site-wide monitoring efforts.
 - ◆ On May 5, Mr. Darryl Pongracz of KCB inspected an area of ponding against the north side of the NBB. Historically, ponding has been observed in the same area due to blockage of a culvert connecting the toe seepage collection ditch to a major finger drain under the NBB. Inflows that exceed the capacity of the major finger drain also tend to pond and draw down over time, which is likely the case during this inspection during freshet. No erosion damage was noted on the slopes of the NBB immediately following freshet, nor during the DSI.

- ◆ On May 6, Mr. Rick Friedel (EoR designate) of KCB accompanied THVCP to inspect the Highland TSF, amongst other structures, via helicopter fly-over. No immediate dam safety concerns were noted during this fly-over.

Table 5.1 Routine Monitoring Frequency

Dam	Inspection by THVCP	Inspection by KCB (EoR or designate)
L-L Dam	Weekly	Quarterly
H-H Dam	Weekly	Quarterly
24 Mile Lake	Quarterly	Quarterly
L-L Dam Seepage Pond 2	Monthly	Quarterly
L-L Dam Slimes Pond 1	Monthly	Quarterly
L-L Dam Slimes Pond 2	Monthly	Quarterly
L-L Dam Seepage Water Reclaim Pond	Monthly	Quarterly

5.3 Reservoir Levels / Tailings Buffer

5.3.1 Tailings Pond at L-L Dam

The Highland TSF pond elevation was measured weekly (minimum) during 2017 in compliance with the OMS manual. Pond elevations are shown in the piezometric figures included in Appendix V.

During 2017, the pond elevation varied from a minimum of El. 1241.4 m in March to a maximum of El. 1248.0 m in June. The seasonal changes in the pond elevation in 2017 are approximately 78% greater than previous years which can be attributed to wetter than normal conditions during freshet. Since 2011, the typical pond elevation throughout the year has increased by around 1 m per year. Typically, pond levels remain relatively constant from June to November, decrease from December to February, and rises during freshet from mid-February to June. In 2017, the same general trend was observed but with a much higher rise in pond level during the freshet period due to excessive snowmelt observed that year. There were no required changes to the water management plan in 2017.

5.3.2 Tailings Beach at H-H Dam

There is no permanent free water pond against H-H Dam during normal operating conditions and hence, there are no specific freeboard reporting requirements defined in the M-11 and PE-376 permits. However, the 2018 OMS update specifies that the tailings beach at the H-H Dam needs to be maintained a minimum of 1 m below the effective dam crest to prevent erosion and overrunning of tailings onto the dam crest during active tailings deposition. This “1 m buffer zone” applies to a situation that can be controlled by operational changes (e.g. relocating discharge points) and is not the same as conventional freeboard requirements associated with a free water pond for protection against wave run-up and flood surcharge. The “effective dam crest” is measured to the top of confinement for tailings, whether that is provided by the top of the Glacial Till core, rockfill or any berms that are along the upstream edge of the crest.

In 2017, the tailings beach was surveyed weekly, per the OMS manual. In June 2017, the tailings beach at Lines 6, 7 (discharge points ~450 m northwest of the East Abutment) inundated the tailings pipelines, which required re-routing the discharge to the lines at Sta. 2+200 m. This resulted in a relatively rapid rise of the tailings surface at that location to within ~1.1 m of the dam crest at this East Abutment. The EoR was notified and a decision was made in conjunction with THVCP to construct an approximately 1 m high berm of Zone RF1 fill on the upstream edge of the crest to increase the available buffer until the planned 2017 raise of the dam could be completed.

At the same time, KCB recommended that THVCP commission studies to increase the flexibility and capability of the tailings deposition system to accommodate similar operational upsets in the future. These studies are ongoing.

5.3.3 24 Mile Lake

The current available storage volume is far in excess of the estimated IDF volume (see Section 4.5). In 2017, the lake level was surveyed weekly which meets the minimum required per the 2018 OMS update.

5.3.4 L-L Dam Seepage Collection and Slimes Ponds

Of the five seepage collection and slimes ponds at the toe of the L-L Dam, only Seepage Water Reclaim Pond is routinely surveyed to track pond levels. In 2017, surveys were conducted weekly which meets the minimum frequency required in the OMS manual. The remaining seepage collection and slimes ponds are visually inspected monthly at which time the dam inspector estimates the available freeboard.

The 2018 OMS update specifies minimum freeboard required for each pond under flood conditions, as summarized in Table 4.7. KCB recommends expanding the routine pond level survey activities to include Seepage Pond 2, Slimes Pond 2, and Slimes Pond 3 (when its construction is expected to be completed) on a monthly basis, per the 2018 OMS update.

5.4 Piezometers

5.4.1 Overview

THVCP's Tailings and Water team are responsible for collecting, processing, documenting and distributing instrumentation readings. Piezometric readings are compared to threshold values included in the OMS manual. Information is provided to KCB for routine monthly reviews, or as required (e.g. threshold exceedances).

All piezometers at the L-L and H-H Dams are required to be monitored by THVCP on a monthly basis, when accessible. This requirement was generally met during 2017. Several instruments located on the slope of the dam are unsafe to access during winter conditions, therefore monthly reading frequency is not required and these instruments were read when safely accessible. In 2016, THVCP began to implement a program of automated reading collection and remote monitoring of vibrating wire piezometers at the L-L and H-H Dams using the Navstar GeoExplorer.

KCB reviews the piezometer data provided by THVCP on a monthly basis and summarizes the observations in a Routine Monitoring Review (RMR) memo. The primary objective of these RMRs is to provide a succinct summary of the surveillance results for the period under consideration. Nine RMR's were issued in 2017 (two of the issued RMR's included review of multiple months of data).

In addition to RMRs, any piezometer threshold exceedances are reviewed by KCB and reported in Monitoring Review Memos (MRMs) which document the occurrence, response and recommendations associated with specific threshold exceedances in instrument readings. During 2017, KCB issued 11 MRM's which covered piezometer threshold exceedances (discussed further in section 5.4.2 and 5.4.3 below).

5.4.2 L-L Dam

There are currently 215 piezometers (combination of standpipes and vibrating wire piezometers) at the L-L Dam (as shown on Figure V-1 in Appendix V), of which:

- 26 of the standpipe piezometers are currently plugged;
- 28 of the standpipe piezometers are dry;
- 13 are located in the vicinity of the seepage ponds and slimes ponds at the toe of the L-L Dam; and
- 60 vibrating wire piezometers and 15 standpipe piezometers were recently installed during two separate drilling programs throughout 2017. The first program (Highland TSF Phase 1) was completed in 2017. The second program (Highland TSF Phase 2/3) began in 2017 and will be completed in 2018.

Figures of piezometric levels are included in Appendix V. The figures are grouped by dam segment and stratigraphy, as shown in Figure V-1. Each figure is further subdivided into 'a' and 'b', whereby 'a' illustrates the long term piezometric trends for the dam segment, and 'b' illustrates the piezometric trend over the past five years.

Cross sections through the dam, showing geology, pond elevations, piezometric readings and cumulative displacement profiles from inclinometers are included in Appendix VI.

For the purposes of this 2017 DSI, the 2017 threshold levels have been applied for review of the data. Updated threshold levels have been issued for use during the upcoming 2018 construction season (KCB 2017c).

Pore pressure trends in relation to threshold levels for piezometers within each dam segment are discussed below. In 2017, there were six Level 1 exceedances (documented in MRMs). Typical actions following Level 1 exceedances included increasing reading frequency, visual inspection by THVCP dam inspectors, review of data by the EoR or designate, and updating the threshold values as deemed appropriate.

North Abutment (North of Sta. 3+400 m)

- Figure V-2 to Figure V-4 in Appendix V show piezometric levels at the North Abutment over time.
- Figure VI-2 in Appendix VI shows a cross section of piezometric levels through the dam at Sta. 3+630.
- In general, the piezometers both upstream and downstream at the North Abutment show a historic trend of fluctuating elevations with changes in pond elevation, with occasional spikes which are generally attributed to hydraulic cyclone sand placement. Levels recorded in 2017 are consistent with this historic trend; with some of the downstream and upstream piezometers showing a response to beach construction at the end of 2017.

North Dam (Sta. 2+800 m to 3+400 m)

- Figure V-5 to Figure V-6 in Appendix V show piezometric levels at the North Flank over time.
- Figure VI-3 in Appendix VI shows a cross section of piezometric levels through the dam at Sta. 3+300.
- In general, upstream piezometers at the North Dam show a historic muted trend of fluctuating elevations with changes in pond elevation, whereas downstream piezometers have shown minimal change in elevation since 2012, with occasional spikes which are generally attributed to hydraulic cyclone sand placement. Levels recorded in 2017 are consistent with this historic trend, with the exception of the following:
 - ◆ One Level 1 exceedance was triggered in P04-2 during freshet in early May. KCB reviewed the exceedance and concluded that it was related to ponding due to freshet runoff. The threshold exceedance was not considered a dam safety concern and details on the response and KCB's recommendations were recorded in an MRM.

North Buttress Berm (Sta. 2+400 m to 2+800 m)

- Figure V-7 to Figure V-10 in Appendix V show piezometric levels at the NBB over time.
- Figure VI-4 in Appendix VI shows a cross section of piezometric levels through the dam at Sta. 2+564.
- In general, piezometers upstream at the North Buttress show a historic muted trend of fluctuating elevations with changes in pond elevation, whereas downstream piezometers have shown minimal change in elevation since the 1990's, with occasional spikes which are generally attributed to hydraulic cyclone sand placement. Levels recorded in 2017 are consistent with this historic trend.
- There were no threshold exceedances in piezometers at the NBB during 2017.

Valley Buttress Berm Extension (Sta. 2+100 m to 2+400 m)

- Figure V-8 to Figure V-12 in Appendix V show piezometric levels at the VBBE over time.
- Figure VI-5 in Appendix VI shows a cross section of piezometric levels through the dam at Sta. 2+250.
- In general, downstream piezometers at the VBBE have shows minimal change in elevation since the mid 1990's, with occasional spikes which are generally attributed to hydraulic cyclone sand placement. Levels recorded in 2017 are consistent with this historic trend, with the exception of the following:
 - ◆ One Level 1 exceedance was triggered in standpipe piezometer P92-1B. A review of the data indicated a large discrepancy between the readings in P92-1B and readings in two other piezometers (P92-1A and P92-1C) which are located within the same sedimentary bed in the same drillhole. Therefore, KCB concluded there was no dam safety concern and recommended that this piezometer be abandoned. KCB's recommendations were recorded in an MRM.

Valley Buttress Berm (Sta. 1+500 m to 2+100 m)

- Figure V-13 to Figure V-16 in Appendix V show piezometric levels at the VBB over time.
- Figure VI-6 in Appendix VI shows a cross section of piezometric levels through the dam at Sta. 1+850.
- In general, upstream piezometers at the VBB show a historic trend of fluctuating elevations with changes in pond elevation, while downstream instruments have historically remained constant since the late 1980's. Levels recorded in 2017 are consistent with this historic trend, with the exception of the following:
 - ◆ One Level 1 exceedance was triggered in P10-4. Following a review of available monitoring data, KCB concluded that the falling head test carried out in August 2016 cleaned out the piezometer screen and it is now responding to piezometric levels in the Glacial Till, as levels are consistent with other nearby piezometers installed in the Glacial Till. The threshold exceedance was not considered a dam safety concern and details on the response and KCB's recommendations were recorded in an MRM.
 - ◆ A number of new instruments have been installed in the VBB since 2016, and as such, long-term trends in these instruments are not yet developed.

South Dam (Sta. 0+800 m to 1+500 m)

- Figure V-14 to Figure V-18 in Appendix V show piezometric levels at the South Dam over time.
- Figure VI-7 in Appendix VI shows a cross section of piezometric levels through the dam at Sta. 1+200.
- In general, upstream piezometers at South Dam show a historic trend of fluctuating elevations with changes in pond elevation, while downstream instruments have historically remained

constant since the late 1980's. Levels recorded in 2017 are consistent with this historic trend, with the exception of the following:

- ◆ P02-1 P02-2 and P02-3, all installed in Glacial Till fill within a trench cut into the granodiorite bedrock, have shown a consistent rise in piezometric elevation since 2009. The quality of these instrument installations was considered questionable, and therefore a new piezometer, VWP17-03A, was installed in 2017 at this location for validation.

5.4.3 H-H Dam

There are currently 38 piezometers at the H-H Dam (as shown in Figure V-19), of which:

- 5 standpipe piezometers are currently plugged;
- 3 standpipe piezometers are dry; and
- 2 standpipes and 26 vibrating wire piezometers were recently installed throughout 2017 at the H-H Dam (KCB 2018). Fourteen of the 28 new instruments have not been read since installation late in the year, and therefore are not shown in Appendix V.

Figures of piezometric levels are included in Appendix V. Cross sections through the dam, showing geology, pond elevations, piezometric readings and cumulative displacement profiles from inclinometers are included in Appendix VI.

Updated threshold levels for 2017 were issued for the piezometers at the H-H Dam in 2016 (KCB 2016j), based on a review of the performance history of the dam (KCB 2016k). These levels, with the exception of VWP15-23B, will be reviewed and updated, where necessary, during the H-H Dam Design Review, scheduled for completion mid-2018. The threshold for VWP15-23B was revised in November 2017 to reflect the historical trend based on the increased period of record and three exceedances during fill placement over the year. For the purposes of this 2017 review and moving forward for 2018 monitoring, the 2016 threshold levels (defined for 2017) are considered appropriate given the lack of noted exceedances, and have been applied.

In 2017, there were three Level 1 exceedances, all at VWP15-23B in relation to fill placement and/or upstream tailings deposition activities, as summarized below:

- January to 2017 March 2017:
 - ◆ Between November 2016 and March 11, 2017, THVCP placed fill on the H-H Dam to raise the RF2 fill zone (located downstream of the core) to elevation 1277 m between the right (southwest) abutment and Sta. 1+600. In early December 2016, readings in piezometer VWP15-23 B, installed in a glaciolacustrine unit in the foundation exceeded the Level 1 thresholds.
 - ◆ Based on KCB's review of the available data, KCB and THVCP agreed on December 6, 2016 to suspend fill placement until the instrument readings indicated stabilizing and/or attenuating trends. Regular reviews of the instrument readings collected by THVCP following cessation of fill placement, were carried out by KCB.

- ◆ Fill placement re-started on January 18, 2017 and continued throughout February and March under close stewardship through frequent communications between THVCP and KCB as well as regular instrumentation data reviews.
- ◆ Placement of the final 3 m lift of fill to EL. 1277 m was completed on March 11, 2017.
- ◆ By March 25, 2017, piezometric levels in VWP15-23B had dropped below the Level 1 threshold.
- ◆ KCB concluded that the threshold exceedances were in response to RF2 fill placement, and were not considered an immediate dam safety concern. However due to the lack of performance history data available for the H-H Dam, a precautionary approach was taken to ongoing fill placement.
- July to October 2017:
 - ◆ From late May 2017, the piezometric level in VWP15-23 B began to steadily increase again and exceeded the Level 1 threshold on July 3rd, 2017.
 - ◆ VWP15-22, which is installed upstream of HHVWP15-23B within the dam fill sand and gravel recorded a rise in piezometric level of almost 5 m over the same time period as the response seen in VWP15-23 B.
 - ◆ KCB reviewed the data and concluded that the response in both instruments most likely reflected active tailings beach deposition.
- October to November 2017:
 - ◆ During October 2017, the piezometric level in VWP15-23 B began to steadily increase again and exceeded the Level 1 threshold.
 - ◆ The timing of the piezometric level rise coincided with the start of dam crest raise works at the H-H Dam in mid October 2017.
 - ◆ Following this latest threshold exceedance, and based on a review of its response to the past year's fill placement activities, KCB updated the Level 1 threshold from El. 1205 m to El. 1207 m.

The threshold exceedances at VWP15-23 B were not considered a dam safety concern and details on the response and KCB's recommendations were recorded in a series of MRM's.

5.4.4 24 Mile Lake

There are no piezometers installed at 24 Mile Lake.

5.5 Inclinerometers

5.5.1 Overview

THVCP's Tailings and Water team are responsible for collecting, processing, documenting and distributing instrumentation readings. Inclinerometer readings are compared to threshold values

included in the OMS manual. Information is provided to KCB for routine monthly reviews, or as required (e.g. threshold exceedances).

All inclinometers at the L-L Dam and H-H Dam are required to be monitored by THVCP on a monthly basis, weather permitting. This was generally completed during 2017. Several instruments located on the slope of the dam are unsafe to access during winter conditions, therefore monthly reading frequency is not required and these instruments were read when safely accessible.

KCB reviews the inclinometer data provided by THVCP on a monthly basis and summarizes the main observations a Routine Monitoring Review (RMR) memo. The primary objective of these RMRs is to provide a succinct summary of the surveillance results for the period under consideration. During 2017, KCB issued nine RMR's (two of the issued RMR's included review of multiple months of data).

In addition to RMRs, any inclinometer threshold exceedances are reviewed by KCB and reported in monitoring review memos (MRMs) which document the occurrence, response and recommendations associated with specific threshold exceedances in instrument readings. During 2017, KCB issued three MRM's which covered inclinometer threshold exceedances (discussed further in section 5.5.3 below).

5.5.2 L-L Dam

There are currently 30 inclinometers at the L-L Dam, as shown in Figure IV-1 in Appendix IV. During 2017, 11 inclinometers were installed during two separate drilling programs. The first program (Highland TSF Phase 1) was completed in 2017. The second program (Highland TSF Phase 2/3) began in 2017 and will be completed in 2018. Of the 11 new inclinometers, three have not been read since installation late in the year, and therefore are not shown in Appendix IV.

Figures of cumulative displacement for each inclinometer are included in Appendix IV (Figure IV-1 to Figure IV-20). In addition, Figure IV-21 and Figure IV-22 show rates of displacement in selected key geological units.

Cross sections through the dam, showing geology, pond elevations, piezometric readings and cumulative displacement profiles from inclinometers are included in Appendix VI.

For the purposes of the current DSI review, the 2017 threshold levels have been applied. Updated threshold levels have been issued for use during the upcoming 2018 construction season (KCB 2017c).

In 2017, there were no threshold exceedances recorded in the inclinometers at the L-L Dam. Readings are consistent with historical trends.

5.5.3 H-H Dam

There are currently eight inclinometers and six Sondex settlement systems installed at the H-H Dam, as shown in Figure IV-23. Of these, six inclinometers and six Sondex settlement systems were recently installed during two separate drilling programs. The first program (Highland TSF Phase 1) was completed in 2017. The second program (Highland TSF Phase 2/3) began in 2017 and will be completed in 2018. Three inclinometers and three Sondex settlement systems have not been read since installation late in the year, and therefore are not shown in Appendix IV.

Figures of cumulative displacement for each inclinometer are included in Appendix IV (Figure IV-24 to Figure IV-26). In addition, Figure IV-27 and Figure IV-28 show rates of displacement in key geological units. Cross sections through the dam, showing geology, pond elevations, piezometric readings and cumulative displacement profiles from inclinometers are included in Appendix VI.

Updated threshold levels for 2017 were issued for the piezometers at the H-H Dam in 2016 (KCB 2016j), based on a review of the performance history of the dam (KCB 2016k). These levels will be reviewed and updated, where necessary, during the H-H Dam Design Review, scheduled for completion mid-2018. For the purposes of this 2017 review, the 2016 threshold levels have been applied.

Between January and March 2017, Level 1 exceedances were recorded at HHSAA12-1 and HHI12-1 in response to RF2 fill placement, as follows:

- Between November 2016 and March 11, 2017, THVCP placed fill on the H-H Dam to raise the RF2 fill zone (located downstream of the core) to elevation 1277 m between the right (southwest) abutment and Sta. 1+600. In early December 2016, readings in inclinometers HHSAA12-1 and HHI12-1, exceeded their respective Level 1 thresholds. All of the movements measured in the inclinometers were within the dam fill.
- Based on KCB's review of the available data, KCB and THVCP agreed on December 6, 2016 to suspend fill placement until the instrument readings indicated stabilizing and/or attenuating trends. Regular reviews of the instrument readings collected by THVCP following cessation of fill placement, were carried out by KCB.
- Fill placement re-started on January 18, 2017 and continued throughout February and March under close stewardship through frequent communications between THVCP and KCB as well as regular instrumentation data reviews.
- Placement of the final 3 m lift of fill to EL. 1277 m was completed on March 11, 2017.
- By March 25, 2017, horizontal displacement rates in HHSAA12-1 and HHI15-23 were below the Level 1 threshold.
- KCB concluded that the threshold exceedances in HHSAA12-1 and HHI15-23 were in response to RF2 fill placement, and were not considered an immediate dam safety concern. However due to the lack of performance history data available for the H-H Dam, a precautionary approach was taken to ongoing fill placement.
- Details on the response and KCB's recommendations were recorded in a series of MRM's.

5.5.4 24 Mile Lake, L-L Dam Seepage Collection and Slimes Ponds

There are no inclinometers located at 24 Mile Lake, Seepage Ponds or the Slimes Ponds.

5.6 Seepage

5.6.1 L-L Dam

Seepage is recorded, when accessible, on a weekly basis from four weirs at the toe of the L-L Dam:

- LL—FS-01 – records seepage flows from Finger Drain 1 which collects seepage from the west side of the NBB and seepage from the North Abutment. It is recommended that a new weir be installed at the North Flank to enable separate measurement of seepage flow rates from the North Abutment.
- LL—FS-02 – records seepage flows from the UVD/LVD drains which collects seepage from the volcanic units beneath the eastern side of the NBB.
- LL—FS-03 – records combined flows from seepage at the toe of the VBB (outflowing from the south end of Seepage Pond 1) as well as outflows from Jim Black Lake. Flows from Jim Black Lake can be subtracted, based on measurements at LL-JB-FS-01.
- KCB3 – records seepage flows from the VBB. This weir was choked throughout 2017, and no readings were taken by THVCP.

In addition, THVCP measures flows in Pukaist Creek, approximately 3 km southwest of the Seepage Water Reclaim Pond. Flow measurement locations are shown in Figure VII-1, and flow rates are shown in Figure VII-2, in Appendix VII. Seepage rates in 2017 were generally comparable to 2016 rates which are lower than previous years, likely due to the lack of downstream hydraulic cycloned sand construction at the dam in both 2016 and 2017. The sudden increases in May 2017 are attributed to surface runoff during freshet flood conditions.

There is currently no seepage measurement weir at the North Dam, or South Dam major drains. We recommend that weirs be installed at these locations to monitor seepage rates.

5.6.2 H-H Dam

There are no seepage measurement points at the H-H Dam.

5.6.3 24 Mile Lake, L-L Dam Seepage Collection and Slimes Ponds

There are no seepage measurement points at 24 Mile Lake, or at the L-L Dam Seepage Ponds or Slimes Ponds.

5.7 Survey Monuments

Based on a 2016 DSI recommendation, THVCP installed ten survey prisms within the lock-block retaining wall located behind the H-H Pumphouse at the H-H Dam, during 2017. Monitoring of the prisms began on October 4, 2017.

Required monitoring frequency for the prisms is monthly during periods of no construction, increasing to weekly when construction is active between Sta. 1+800 and Sta. 2+200. This was completed between October and November 21, 2017.

KCB understands that since November 21, 2017, the pedestal at the toe of the retaining wall has moved, which has compromised the subsequent readings, but that THVCP plans to modify the method of survey during 2018 to mitigate this issue going forward.

The location of the prisms and displacement plots for 2017 are included in Appendix V-III. The data indicates no clear trend of movement within the wall over the monitoring period. Vertical and horizontal displacement rates were generally < 0.2 mm per day.

5.8 Water Quality

Water quality downstream of the Highland TSF is monitored by HVC monthly to assess the effectiveness of the tailings facility in protecting the downstream receiving environment. A copy of the HVC 2017 Annual Water Quality Monitoring Report (ERM 2018) was provided to KCB for review as part of the DSI. Select observations and findings from the monitoring report are summarized as follows:

- There are six permitted surface water quality monitoring sites in the L-L Dam/Thompson Valley area, as shown on the site monitoring plan in Appendix IX. There are no surface monitoring points in the immediate area downstream of H-H Dam however there are two ground water wells sampled quarterly
- All permit sampling requirements and frequency were met in 2017.
- The 2017 monitoring results were screened against applicable BC Water Quality Guidelines (WQG). However, it should be noted that the WQG are not prescribed performance targets in permit PE-376.
- The receiving environment downstream of the dam indicated some WQG exceedances in 2017 which may be attributed in part to the following factors:
 - ◆ Influence from naturally occurring high background levels
 - ◆ Particulate transport during the unusually high freshet
 - ◆ Seepage from LL Dam and unlined seepage collection ponds
- Longer term trends in the receiving environment downstream of the dam indicate that Sulphate, Fe, Mn, and Mo have been increasing over time, which may be attributed to seepage from the LL Dam and unlined seepage collection ponds.

Further discussion on specific WQG exceedances and water quality trends observed during 2017 can be found in the 2017 Annual Water Quality Monitoring Report (ERM 2018).

THVCP have implemented the Sulphate Adaptive Management Plan to mitigate influence of seepage from the Highland TSF on downstream water quality and increase water available to downstream users in Pukaist creek. This is a multi-year program which includes installation of interception wells downstream of the dam, lining of seepage collection ponds and diversion of non-contact water around the TSF and into Pukaist Creek.

6 VISUAL OBSERVATIONS AND PHOTOGRAPHS

The visual observations made during the DSI site visit are summarized below. Copies of the inspection forms are included in Appendix I. The referenced site inspection photos are included in Appendix II.

L-L Dam

- **Crest:** Good physical condition. (Photo II-A-11 and Photo II-A-12)
- **South Abutment:** Good physical condition. (Photo II-A-2, Photo II-A-2 and Photo II-A-22)
- **North Abutment:** Good physical condition. (Photo II-A-1)
- **Upstream Slope:** Overall good physical condition. Tailings discharge during beach construction has undercut the upstream slope in a few locations (e.g. Sta. 2+000). The undercutting was observed not to have encroached on the 126 m wide compacted S2 sand berm, therefore it is not a dam safety concern. These occurrences were noted and monitored as part of weekly inspections. (Photo II-A-3 to Photo II-A-7).
- **Downstream Slope:** Overall good physical condition. In 2014, KCB recommended that the locally steepened (upper ~20 m) part of the slope between Sta. 1+050 m and Sta. 3+650 m be re-graded to design (2.5H:1V) during the next (2018) construction season. In most areas, the overall slope angle (from crest to toe) is shallower than 2.5H:1V, and the resultant factor of safety for slope stability is > 1.5 , therefore this is not considered a dam safety concern. (Photo II-A-8)
- **North Dam:** Good physical condition. The North Dam Major Drain was flowing clear at the time of inspection. (Photo II-A-13 to Photo II-A-15)
- **NBB:** Good physical condition. The area of ponding against the north side of the NBB during freshet was dry at the time of inspection. No significant scour or erosion was observed. (Photo II-A-16 to Photo II-A-17)
- **VBB/VBBE:** Good physical condition. (Photo II-A-23)
- **SBB:** Good physical condition.
- **South Dam:** Overall good physical condition. In April, a ruptured water pipe at the L-L cyclone house led to flow over the downstream slope at the south abutment contact. The resultant erosional features in the downstream slope will be addressed as part of downstream fill placement in 2018. (Photo II-A-9). The Major Drain was flowing clear at less than 1 L/min at the time of inspection, which is consistent with past inspections.
- **Tailings Beach:** Good physical condition. Some erosion gullies are evident from overflow discharge pipes. These features do not compromise freeboard.
- **Pond:** At the time of inspection, the pond was 13 m below the crest of the dam (El. 1247.3 m). (Photo II-A-2)
- **Toe Collection Ditches:** Good physical condition, with no obstructions. In 2016, the ditch upstream of LL—FS-03 which was choked with sediment from erosion of the soft lacustrine

soils which line the ditch and had filled the base of the weir. This was not cleared during 2017 and will be impacting flow readings in the weir.

- **Seepage:** All toe seepage water was clear and free of sediment. Point A weir (KCB3) was overgrown by vegetation and is no longer functional. THVCP have no plans to re-instate this weir as the area will be cleared as part of foundation preparation in 2018. (Photo II-A-24 to Photo II-A-28).

H-H Dam

- **Crest:** Overall good physical condition (Photo II-B-1 and Photo II-B-3 to Photo II-B-6):
 - ◆ Minor vegetation (grasses) was noted on the crest of the dam in the RF1 and Till Core zones (Photo II-B-3). Vegetation removal should be carried out as part of regular dam maintenance works. This is not considered to be a dam safety issue.
 - ◆ Longitudinal cracking up to 20 cm deep was observed in the Till Core Zone along the centerline from Sta. 1+200 to Sta. 1+400 (not continuous). This is not considered to be a dam safety issue at this time, but should continue to be monitored as part of routine inspections, in accordance with the OMS manual. The area of cracking was flagged and unsuitable material stripped off prior to fill placement during 2017 construction activities. (Photo II-B-5).
 - ◆ A pre-existing longitudinal crack (originally observed by THVCP and reported to KCB on April 5, 2017) was observed at the downstream edge of the SG2 zone between ~Sta. 1+500 and Sta. 1+550. No signs of fresh movement or vertical displacement were observed across the crack. Crack is >30 cm deep and up to 20 cm wide with another hairline crack ~ 1 m upstream of the main crack. Details of the history, surveillance and ongoing monitoring of the cracking were previously reported in MRM-2017-004. The cracking was repaired (by digging down and re-compacting the SG2 fill) later in the year during the annual crest raise at the H-H Dam.
- **West Abutment:** Good physical condition. (Photo II-B-1)
- **East Abutment:** Good physical condition. The foundation at the abutment has been exposed since the end of 2015 when fill placement was halted at the end of the year. (Photo II-B-2)
- **Upstream Slope:** Good physical condition. (Photo II-B-7 and Photo II-B-8)
- **Downstream Slope:** Good physical condition. (Photo II-B-9 to Photo II-B-12 and Photo II-B-14)
- **Tailings Beach:** At the time of inspection, the available buffer was approximately 1.2 m at its lowest point (Sta. 2+100).
- **Seepage:** No seepage was observed at the toe of the H-H Dam.
- **Lock-Block Retaining Wall:** Generally good physical condition. In 2017, survey prisms were installed at the wall. In addition, 1x VWP, 1x inclinometer and 1x Sondex settlement system were installed immediately above the wall. These instruments were installed to monitor potential movements and pore pressures, the data from which will be used in ongoing reviews

of global dam stability by KCB. Local stability of the wall, similar to the original design, is by Others. (Photo II-B-13 and Photo II-B-15)

24 Mile Lake

- **Upstream Slopes:** Overall good physical condition. Multiple erosion gullies were observed on the west slopes, which should be repaired as part of routine maintenance per the OMS manual. (Photo II-D-1 and Photo II-D-2)
- **Outlet Pump:** Present but not operational at time of inspection. Pump was not inspected or tested. (Photo II-D-3)
- **Inlet:** Good condition. Neither water nor tailings inflows were active during the inspection. (Photo II-D-6 and Photo II-D-7)

L-L Dam Seepage Collection and Slimes Ponds

- **Seepage Pond 1:** Good physical condition. (Photo II-C-4 and Photo II-C-5)
- **Seepage Pond 2:** Good physical condition. The tear in the pond liner on the east slope was repaired in 2017. It is understood that the outlet pipe re-alignment recommended in 2016 is on hold pending completion of the SWRP flood routing review. (Photo II-C-9 to Photo II-C-12)
- **Slimes Pond 1:** Good physical condition. (Photo II-C-2 and Photo II-C-3)
- **Slimes Pond 2:** Good physical condition. Slimes were removed/excavated down to pond bottom in 2017. The protective gravel layer on top of the liner was not observed to have been compromised. (Photo II-C-6 to Photo II-C-8)
- **Seepage Water Reclaim Pond:** Good physical condition. Algae continues to collect on the surface of the pond and on the screen to the outlet pumps. The Woods Creek Diversion was not flowing into SWRP at the time of inspection. (Photo II-C-13 and Photo II-C-14)

7 ASSESSMENT OF DAM SAFETY

7.1 Dam Classification Review

The consequence classification of each of the dams included in the Highland TSF (as summarised in Table 2.1) is reviewed annually by THVCP and KCB's EoR or designate representative at the time. The 2017 review was performed on January 16, 2018. No change in consequence classification was recommended.

As previously indicated, an assessment was initiated in 2017 to review the potential for declassifying the 24 Mile Lake facility as a "dam" under the Code (KCB 2018c). This work is in progress at the time of this DSI.

7.2 Failure Mode Review

7.2.1 Overview

Based on the DSI and review of available documents regarding the L-L Dam and the H-H Dam, the potential failure modes included in the CDA Dam Safety Guidelines (CDA 2013) were reviewed and discussed below. KCB is aware, and participated in, a more recent Failure Modes and Effects Analysis (FMEA) which is underway by the Wood Group, the results of which will be reviewed as part of the 2018 DSI.

It should be noted that the design, construction and operations of the L-L Dam and the H-H Dam are an ongoing process, and are closely integrated through the application of the Observational Method.

7.2.2 L-L Dam

Overtopping

The Highland TSF is designed to contain the flood volume from the PMF (49.4 Mm³) resulting from the average annual snowmelt runoff plus the 5-day PMP, which is a duration greater than required by the Code. For reference, the minimum measured freeboard during 2017 was 12.5 m, which is greater than the operating freeboard limit of approximately 6.1 m determined for 2017. Crest elevation milestones in the construction schedule are designed to maintain storage capacity for a minimum of one full year in advance. Therefore, under current construction and operating conditions, the likelihood of overtopping is considered negligible.

Internal Erosion and Piping

Based on a 2015 review of filter adequacy (KCB 2015b), the risk of piping related failure through the dam developing at this stage is very low. The dam design incorporates a large upstream cycloned sand berm and a long tailings beach, and a vertical glacial till core supported by a downstream cyclone sand zone that is filter compatible with the core fill. Piezometric levels indicate low hydraulic gradients across the dam filter zones.

At the North Abutment, the glacial till core zone only provides a partial cutoff to seepage flow, due to the deep elevation of impermeable Glacial Till. A review of the risks of internal erosion and piping at the North Abutment was carried out in 2016 (KCB 2017). A review of particle size distributions against measured and predicted hydraulic gradients for existing and ultimate conditions indicated that internal erosion based mechanisms in the North Abutment foundation should not be a concern (KCB 2017, KCB 2017c).

A decommissioned Low-Level Outlet (LLO) remains close to the South Abutment of the dam. The downstream outlet of the LLO was surrounded with filter compatible fills in 2015, in order to mitigate the risks of piping. Therefore, the likelihood of a piping related failure developing around the LLO is very low.

Contaminated Seepage

Release of contaminated seepage may occur if the seepage collection system downstream of the L-L Dam were to fail. This is dependent on the operation and design of the seepage and slimes collection ponds, and is not amenable to the Observational Method. Currently, the system is a closed loop with all outflows from the individual ponds directed to the Seepage Water Reclaim Pond (SWRP) where it is then pumped back to the TSF. To date, this system has performed satisfactorily to meet the range of expected seepage rates through the L-L Dam. The Seepage Water Reclaim Pond relies on pumping to maintain water levels year-round, and in its current state, has insufficient capacity to store the IDF (KCB 2018b). KCB recommend THVCP advance design of preferred options described in the 2018 flood routing assessment, and implement measures during the 2018 construction season to provide sufficient flood management capacity within the system. It is understood that this work is ongoing.

A second pathway for contaminated seepage to leave the TSF is via groundwater flowpaths bypassing the seepage collection system. This failure mode is being assessed separately for the design of seepage mitigation options in support of THVCP's Sulphate Adaptive Management Plan (SAMP).

Stability

The dam is founded on a mix of Lacustrine clays (beneath the Starter Dam in the centre of the valley only), Glacial Till with interbedded Glaciolacustrine deposits, and a mix of granodiorite, volcanic and sedimentary bedrock units. The design of the L-L Dam accounts for the variability of the foundation conditions along its alignment, including buttresses where required by the localized foundation conditions.

As previously indicated, stability analyses are carried out on a regular basis, and especially during planning of each construction raise. In 2017, the influence of the Lower Glaciolacustrine Unit (L-GLU) on the design and performance of the VBB were reviewed considering Most Likely Case (MLC) and Reasonably Worst Case (RWC) conditions (KCB 2017c). The analysis using the MLC parameters represent the Design Case and indicate that the minimum static safety factors are acceptable. The analysis using the RWC parameters represent the contingency case, which is used to size the stabilizing buttress required in the event performance monitoring indicates that there is a potential for RWC conditions to be mobilized in the field. The results have been formerly incorporated into the Observational Method and therefore the likelihood of a dam instability is considered low.

Surface Erosion

The downstream slope of the dam ranges from 1.5H:1V (in localised areas such as access roads) to 3H:1V. Where the slopes are steeper than 2.5H:1V, there is a risk of surface erosion, particularly during snow melt conditions, and erosion features are not uncommon during freshet. Progressive erosion that develops over time or multiple events are managed through routine and event-driven monitoring and ongoing maintenance. The likelihood of surface erosion over the downstream slope resulting in a failure from a single event is negligible.

Earthquakes

Slope stability and deformation of the dam under seismic loading and post-earthquake conditions were assessed in 2010 stability analyses (KCB 2010). The design earthquake assumed for the analysis was a magnitude M6.5 with a peak ground acceleration of 0.32 g corresponding to a 10,000-year return period event. This seismic event is in accordance with the minimum earthquake design ground motion (EDGM) required (10,000-year or maximum credible earthquake (MCE)) under the Code. The likelihood of a seismic-related failure is considered low.

7.2.3 H-H Dam

Overtopping

Overtopping of the H-H Dam is not a plausible failure mode in the current configuration because the crest is 10.5 m higher than the L-L Dam crest on the far side of the impoundment. Therefore, the L-L Dam would be overtopped before the pond reached the H-H Dam crest.

Internal Erosion and Piping

Based on a 2015 review of filter adequacy (KCB 2015b), the likelihood of piping related failure through the dam developing at this stage is low. Of particular relevance, there is no free water pond adjacent to H-H Dam.

Stability

The dam is founded on a mix of Sand and Gravel, Glacial Till with interbedded Glaciolacustrine deposits, and granodiorite bedrock. KCB (2016n) indicated that, although Glaciolacustrine lenses have been identified within the Glacial Till, they are not a concern to stability because of their depth and deep confining overburden layers.

Stability analyses were carried out in 2015 as part of construction staging for the 2016 dam crest of El. 1270 m and calculated static safety factors met the Code requirements (KCB 2015c). This process was repeated in 2017 for the 2017-2019 construction milestones. In November 2017, the impact of the planned 2 m raise on local stability at the lock-block wall (previously not assessed) was reviewed. The stability analysis found the static safety factors to meet minimum Code requirements. Moreover, to date, the instrumentation data has indicated generally satisfactory performance. Therefore, the likelihood of a dam instability is considered low.

Surface Erosion

The downstream slope of the dam is approximately 2H:1V. The majority of the downstream face of the dam comprises rockfill, therefore it is not at risk of erosion. Some rilling of the surface is visible in the lower slopes where sand and gravel fills are exposed in the face. Progressive erosion that develops over time or multiple events are managed through routine and event-driven monitoring and ongoing maintenance. The likelihood of surface erosion over the downstream slope resulting in a failure from a single event is low.

Earthquakes

Slope stability and deformation of the dam under seismic loading and post-earthquake conditions were assessed in 2010 stability analyses (KCB 2010). The design earthquake assumed for the analysis was a magnitude M6.5 with a peak ground acceleration of 0.24 g corresponding to the 5,000-year return period event. The minimum EDGM required ($2/3^{\text{rd}}$ between 2,475-year and 10,000 year or MCE) under the Code is 0.26 g, which is not significantly higher than the design earthquake. The likelihood of a seismic-related failure is low.

7.3 Emergency Preparedness and Response

The emergency preparedness and response plan (EPRP) for the Highland TSF forms a part of the OMS manual. KCB understands the 2018 update is in progress and as such, the following discussion will be in reference to the 2016 EPRP.

Training of THVCP staff and contractors who work near the dams is provided by a video presentation which outlines dam safety warning signs that all staff should be aware of and report if any are observed during their work.

In the case of an emergency an incident command center would be established on site to coordinate with regional emergency response organizations and local authorities. The roles and responsibilities of key team members are well defined, along with reporting structures and who is responsible for declaring an emergency and starting the incident response. The EPRP also outlines strategies that could be implemented in the event of several types of dam emergencies.

Training and testing of the EPRP currently is done using desktop scenarios. Along with testing of the system, offsite emergency response resources are contacted regularly to ensure that contact information is still up to date. The emergency reporting contact list is also reviewed and updated as required. A table top exercise to review and update the Emergency Preparedness Response Plan for the HVC site was hosted by THVCP and attended by the EoR on November 20, 2017. The main findings and recommendations have been incorporated into the latest version attached to the 2018 OMS update.

8 SUMMARY

The Highland TSF appears in good physical condition and the observed performance during the 2017 site inspections is consistent with the expected design conditions and past performance. The status of recommendations to address deficiencies and non-conformances identified during past DSIs are summarized in Table 8.1. Closed recommendations are shown in *italics*. Recommendations to address deficiencies and non-conformances identified during the 2017 DSI are summarized in Table 8.2.

As shown, most of the recommendations have either been completed or are included in the planned 2018 dam construction activities. For the purposes of the DSI, these recommendations are considered closed. The only outstanding recommendations are associated with upgrading the Seepage Water Reclaim Pond and the Seepage Pond 2 to bring them back into compliance with management of the IDF and freeboard, as listed in Table 8.2.

Table 8.1 Status of 2016 Recommendations for Deficiencies and Non-Conformances

ID No.	Recommended Action	Priority ⁽¹⁾	Recommended Deadline (Status)
L-L Dam			
LL-2015-01	Downstream sand should be placed in over-steepened upper sections of the downstream dam slopes (between Sta. 1+050 m and Sta. 3+650 m) to the design (2.5H:1V) during the next construction season. Some re-work of the existing loose sand on these slopes will be required as the downstream sand is raised, to ensure these slopes meet compaction/density requirements.	3	End of next construction season (Outstanding. Included in construction sequence for next dam raise (2017 to 2018). EoR has reviewed stability and found acceptable factor of safety and no interim dam safety concern.)
LL-2015-02	The overflow lines from the secondary cyclones were buried with un-compacted cyclone sand across the upstream S2 zone during 2015. This sand will require re-working following completion of downstream sand placement during the next construction season.	3	End of next construction season (Outstanding. Some of the lines were removed and trenches re-filled with S2 fill during 2017 (refer to section 3.2.2 for details). Remaining will be done as part of ongoing construction)
LL-2015-04	<i>It was noted in the Q4 dam inspection that the north side of the NBB El. 1202 m bench is over-steepened to 1V:1H. This should be re-graded to the design slope gradient to prevent instability.</i>	4	<i>During next construction season (CLOSED. This over steepened area is related to an access road cut in one of the benches and potential instability relates to local area and is not a dam safety issue. Area will be remediated during future construction works. EoR has reviewed stability and found acceptable factor of safety and no interim dam safety concern.)</i>
LL-2015-06	We recommend that key design criteria for the Highland TSF, including the probable maximum flood (PMF), freeboard requirements and seismic ground motions be reviewed during 2016.	4	December 2016 (Outstanding. Deferred to 2018. There is no interim dam safety concern.)

ID No.	Recommended Action	Priority ⁽¹⁾	Recommended Deadline (Status)
LL-2016-01	<i>Repair P10-4 to prevent inflow of surface water (suspected cause of elevated groundwater readings). Remove metal cover and investigate possible location where surface water could be entering the standpipe. If the original grout backfill to the hole has sunk, then top up with bentonite or cement to seal the standpipe. Ensure ground is sloped away from the piezo to prevent any ponding water.</i>	4	May 1, 2017 (CLOSED)
LL-2016-02	Install seepage measurement weirs at the outflow points of the North Dam (Sta. 3+600) and South Dam (Sta. 1+100) major drains to monitor seepage rates.	3	December 2017 (Outstanding. Deferred until 2018 when proposed North Dam drain construction is completed)
H-H Dam			
HH-2015-01	<i>H-H lock-block wall - during operations routine monitoring of the retaining wall condition should be conducted. This includes an annual survey at selected points along the crest and toe of the wall, and monthly photographs taken from the same location to monitor for signs of changes to the wall alignment.</i>	3	Ongoing throughout 2016 (CLOSED)
HH-2015-02	<i>H-H lock-block wall - a piezometer should be installed behind or at the toe of the retaining wall to monitor water levels behind the retaining wall as this can affect the stability of the dam near the retaining wall</i>	3	December 2016 (CLOSED, VWP installed in 2017)
HH-2016-01	<i>H-H lock-block wall - during operations routine monitoring of the retaining wall condition should be conducted. This includes an annual survey at selected points along the crest and toe of the wall.</i>	3	May 2017 (CLOSED, duplicate of HH-2015-01)
24 Mile Lake			
None.			
L-L Dam Seepage Collection and Slimes Ponds			
SP-2016-01	<i>In order to meet the design freeboard requirement at Seepage Pond 2, the following is recommended:</i> <ul style="list-style-type: none"> ▪ lower the existing inlet invert elevation by 0.4 m (from El. 1114.4 m to El. 1114.0 m); ▪ re-align the pipe such that the bend after the first 12 m (currently graded upwards) is removed; and ▪ maintain or lower the existing outlet invert elevation to achieve a minimum grade of 1%. 	2	July 2017 (CLOSED, superseded by SP-2017-02)
SP-2016-02	<i>To meet the design freeboard requirement at the Seepage Water Reclaim Pond, review the following items as part of planning and prior to construction activities in 2017:</i> <ul style="list-style-type: none"> ▪ the water quality and discharge requirements to determine an appropriate environmental design flood (EDF) and explore options for discharge during flood events, if permissible; ▪ the anticipated timeline for construction and operation of the proposed Slimes Pond 3 which was modeled, as designed, to discharge to Seepage Water Reclaim Pond under flood conditions; 	2	July 2017 (CLOSED)

ID No.	Recommended Action	Priority ⁽¹⁾	Recommended Deadline (Status)
	<ul style="list-style-type: none"> ▪ review the current and proposed operational requirements for pumping (in relation to capacity and operational elevations); and ▪ update, if necessary, the 2015 flood routing assessment based on revised assumptions.. 		
SP-2016-03	If required, upgrade the water management plan for the Seepage Water Reclaim Pond, based on the updated flood routing assessment (action item SP-2016-02).	2	December 2017 (CLOSED, superseded by SP-2017-01)
SP-2016-04	Repair the small tear in the liner of Seepage Pond 2 (Photo II-C-12, Appendix II).	3	May 2017 (CLOSED)

Notes:

- Recommendation priority guidelines, specified by Teck and assigned by KCB:
 - 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 8.2 2017 Recommendations for Deficiencies and Non-Conformances

ID No.	Deficiency or Non-Conformance	Applicable Regulation or OMS Reference	Recommended Action	Priority ⁽¹⁾	Recommended Deadline (Status)
L-L Dam					
No new recommendations from 2017					
H-H Dam					
No new recommendations from 2017					
24 Mile Lake					
No new recommendations from 2017					
L-L Dam Seepage Collection and Slimes Ponds					
SP-2017-01	Water Management	Flood Routing	The Seepage Water Reclaim Pond has insufficient capacity to store the IDF and should be brought into compliance. Note: THVCP to include an interim plan involving pumping to manage the IDF without off-lease discharge until upgrade works are complete. Suggested interim milestones: Design in 2018, Permit and IFC in 2019 and Construction in 2020. .	2	Q4 2020
SP-2017-02	Water Management	Flood Routing	Regrade pipe to a consistent downward grade	2	Q4 2018

Notes:

- Recommendation priority guidelines, specified by Teck and assigned by KCB:
 - 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.

9 CLOSING

This report is an instrument of service of Klohn Crippen Berger Ltd. The report has been prepared for the exclusive use of Teck Highland Valley Copper Partnership (Client) for the specific application to the Highland Valley Copper Project. 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.

KLOHN CRIPPEN BERGER LTD.



Bill Chin, P.Eng.
Engineer of Record
Senior Geotechnical Engineer, Principal

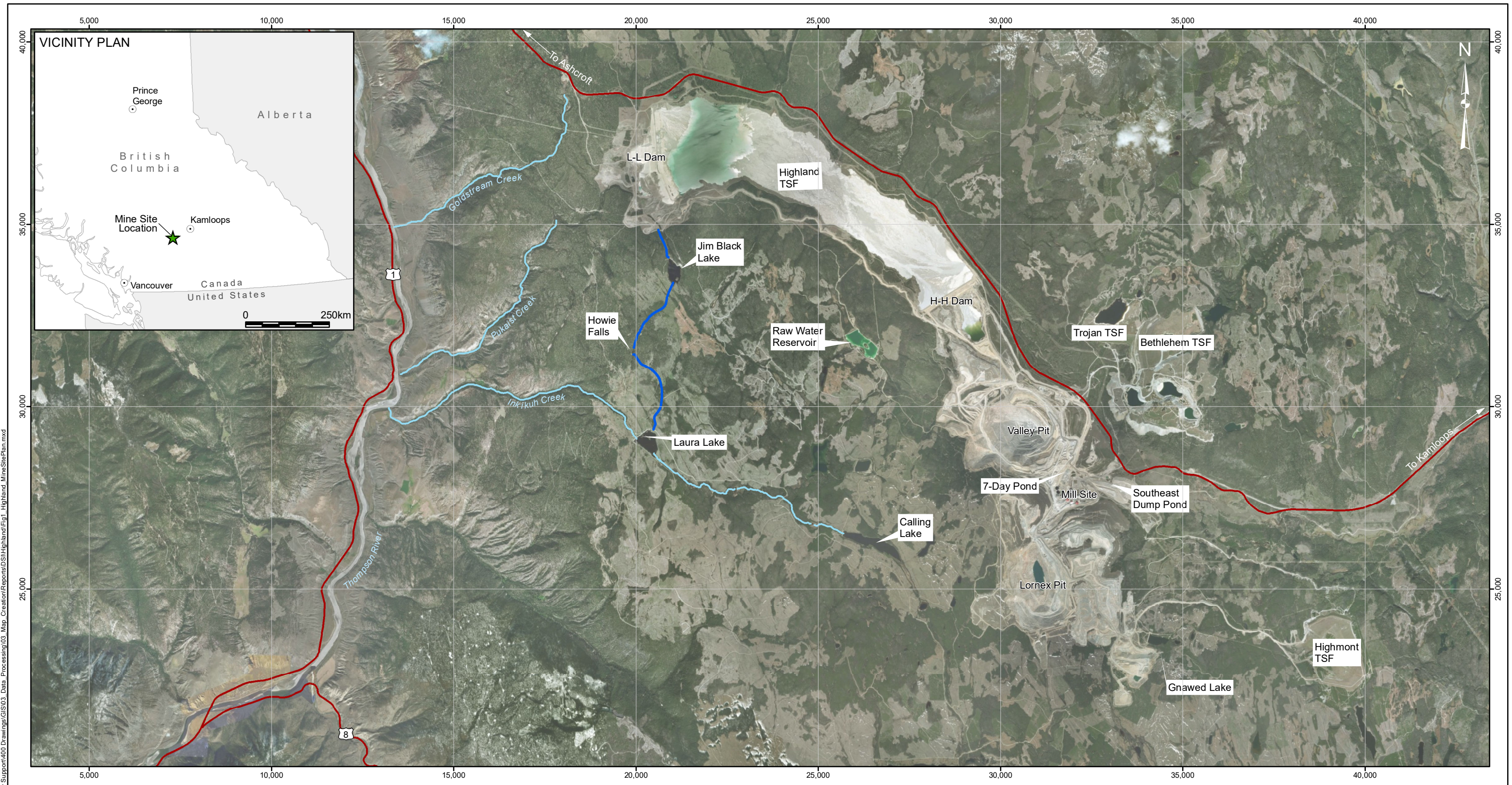
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FIGURES



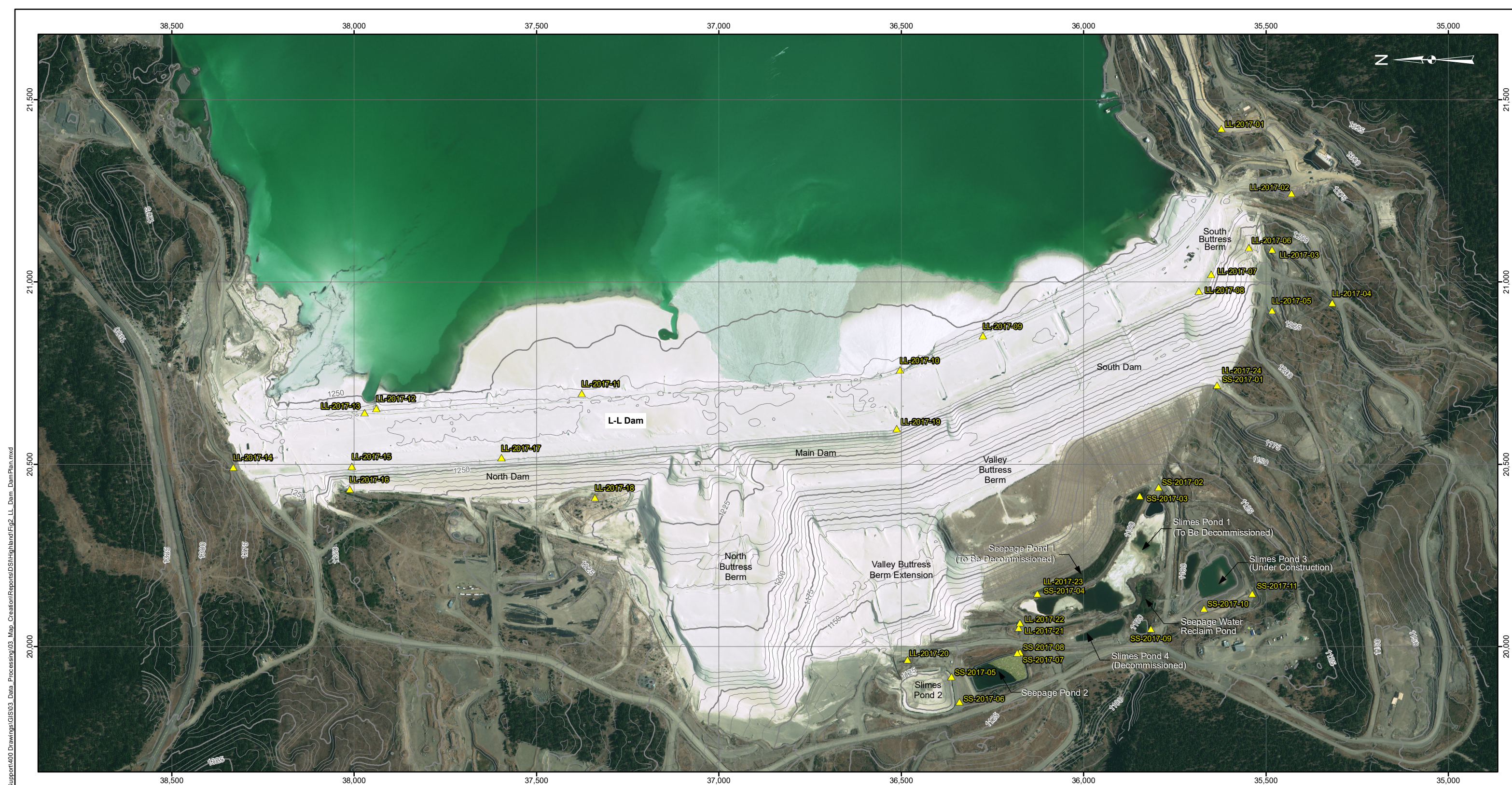
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- Creek / River
 - Highway
 - Ditch



CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION	
	TITLE MINE SITE PLAN	
	SCALE 1:100,000	PROJECT No. M02341B26
	FIG No. 1	


Notes:
 1. Projection: HVC Mine Grid.
 2. TSF = Tailings Storage Facility.
 3. Base data provided by the Government.
 4. Imagery provided by ESRI.

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- Legend**
- ▲ Waypoint (LL/SS-2017-xx)
 - Index Contour (25 m)
 - Intermediate Contour (5 m)

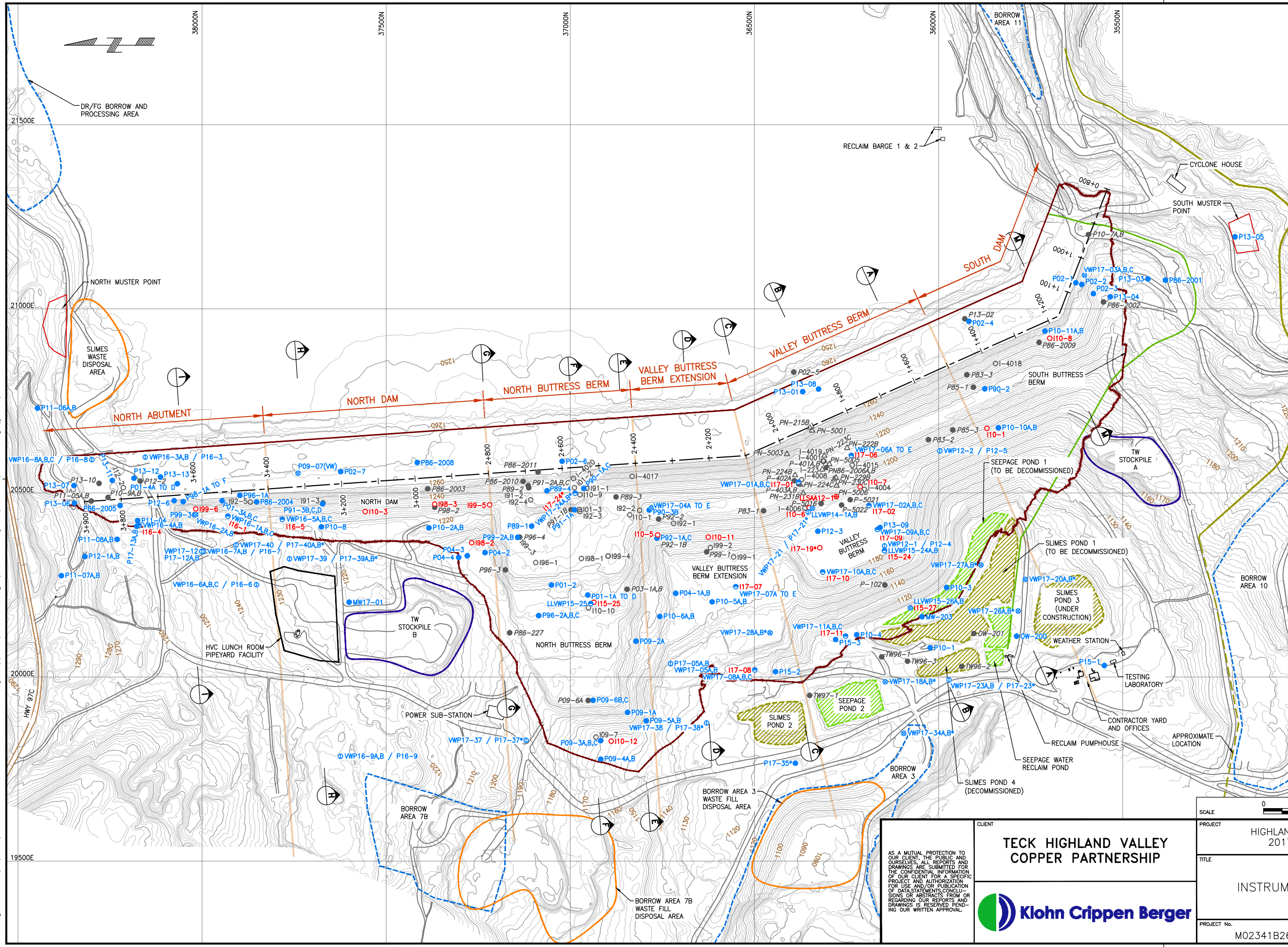


CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION	
	TITLE L-L DAM SAFETY INSPECTION WAYPOINTS	
	SCALE 1:10,000	PROJECT No. M02341B26
	FIG No. 2	

Notes:
 1. Projection: HVC Mine Grid.
 2. Imagery and Topography from Satellite Surveys Conducted on Sept. 15th and Sept. 24th, 2017.

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- LEGEND:**
- BORROW AREA
 - WASTE FILL DISPOSAL AREA
 - SEEPAGE POND
 - SLIMES POND
 - EL. 1279 m ULTIMATE DAM FOOTPRINT
 - SURFACE WATER RECLAIM PIPELINE
 - SPATSUM WATER PIPELINE
 - HAUL ROAD
 - PUBLIC ROAD
 - L-L DAM CENTERLINE
 - GEOLOGICAL CROSS SECTION

- ACTIVE INSTRUMENTS (SEE NOTE 2):**
- STANDPIPE PIEZOMETER AND OBSERVATION WELL
 - ⊗ VIBRATING-WIRE PIEZOMETER
 - ⊕ COMBINED STANDPIPE PIEZOMETER AND VIBRATING-WIRE PIEZOMETER
 - ⊙ COMBINED INCLINOMETER AND VIBRATING-WIRE PIEZOMETER
 - STANDARD INCLINOMETER
 - ⊙ IN-PLACE SAA INCLINOMETER

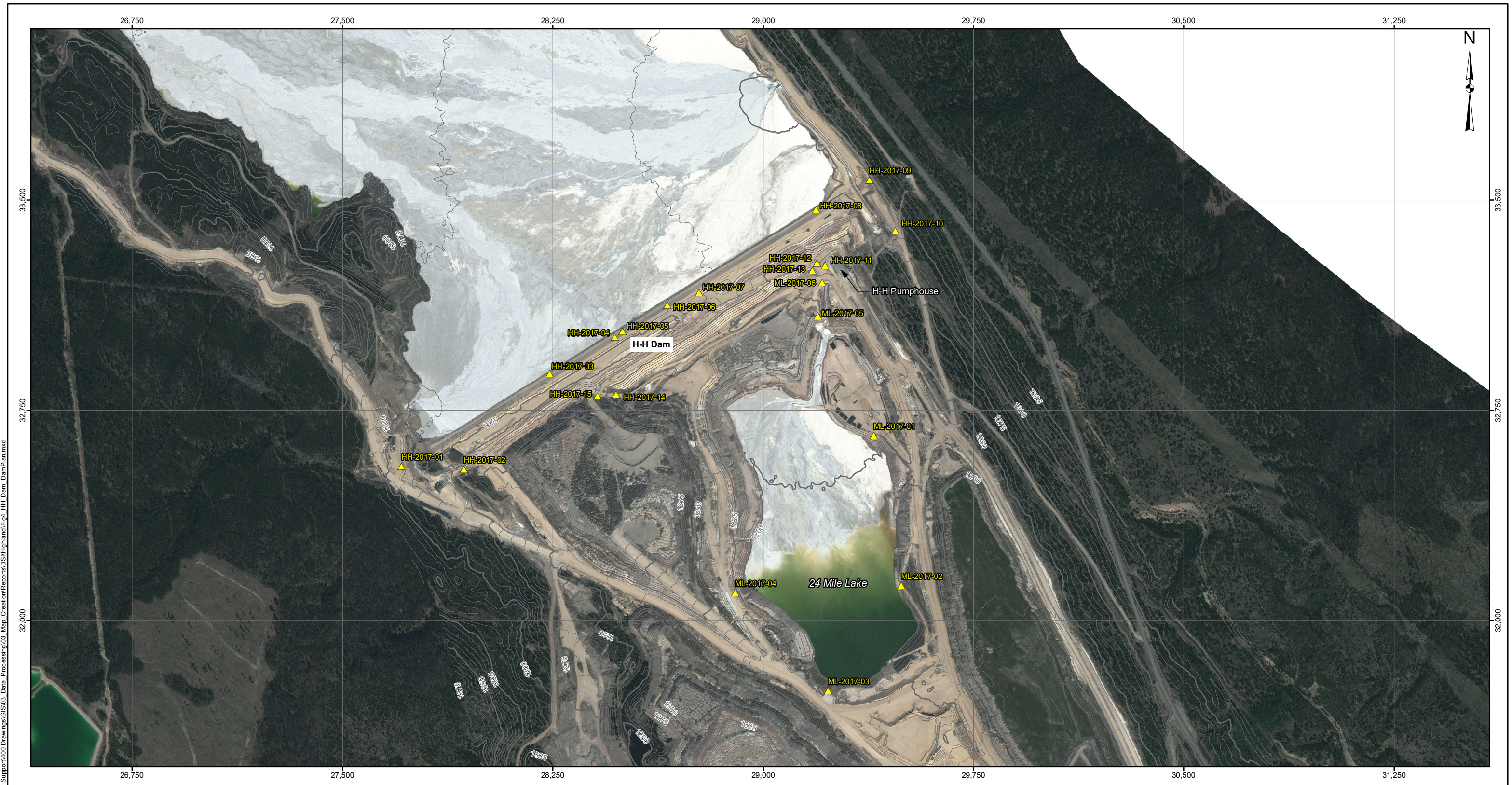
- DEFUNCT INSTRUMENTS (SEE NOTE 3):**
- △ DEFUNCT PNEUMATIC PIEZOMETER
 - DEFUNCT STANDPIPE PIEZOMETER
 - DEFUNCT INCLINOMETER

- NOTES:**
1. TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER PARTNERSHIP AND WAS DERIVED FROM SATELLITE IMAGERY TAKEN ON 2017-07-01.
 2. ACTIVE INSTRUMENTS ARE DEFINED AS ANY INSTRUMENTS SATISFYING ONE OF THE FOLLOWING CRITERIA: CURRENTLY READING AN ACTIVE WATER LEVEL, DRY OR PLUGGED <20 m ABOVE TIP ELEVATION AS THIS COULD SHOW A RESPONSE IN THE FUTURE.
 3. DEFUNCT INSTRUMENTS ARE DEFINED AS ANY INSTRUMENTS SATISFYING ONE OF THE FOLLOWING CRITERIA: DESTROYED, DAMAGED OR PLUGGED >20 m ABOVE TIP ELEVATION.
 4. ASTERISK (*) DENOTES PROPOSED INSTRUMENT LOCATION TO BE UPDATED WITH AS-CONSTRUCTED LOCATION WHEN SURVEY IS COMPLETED.



AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.	TECK HIGHLAND VALLEY COPPER PARTNERSHIP	CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP
PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION		TITLE L-L DAM INSTRUMENTATION LOCATION PLAN
PROJECT No. M02341B26	FIG. No. 3	

KCB-R-MD



- Legend**
- ▲ Waypoint (HH/ML-2017-xx)
 - Index Contour (25 m)
 - Intermediate Contour (5 m)

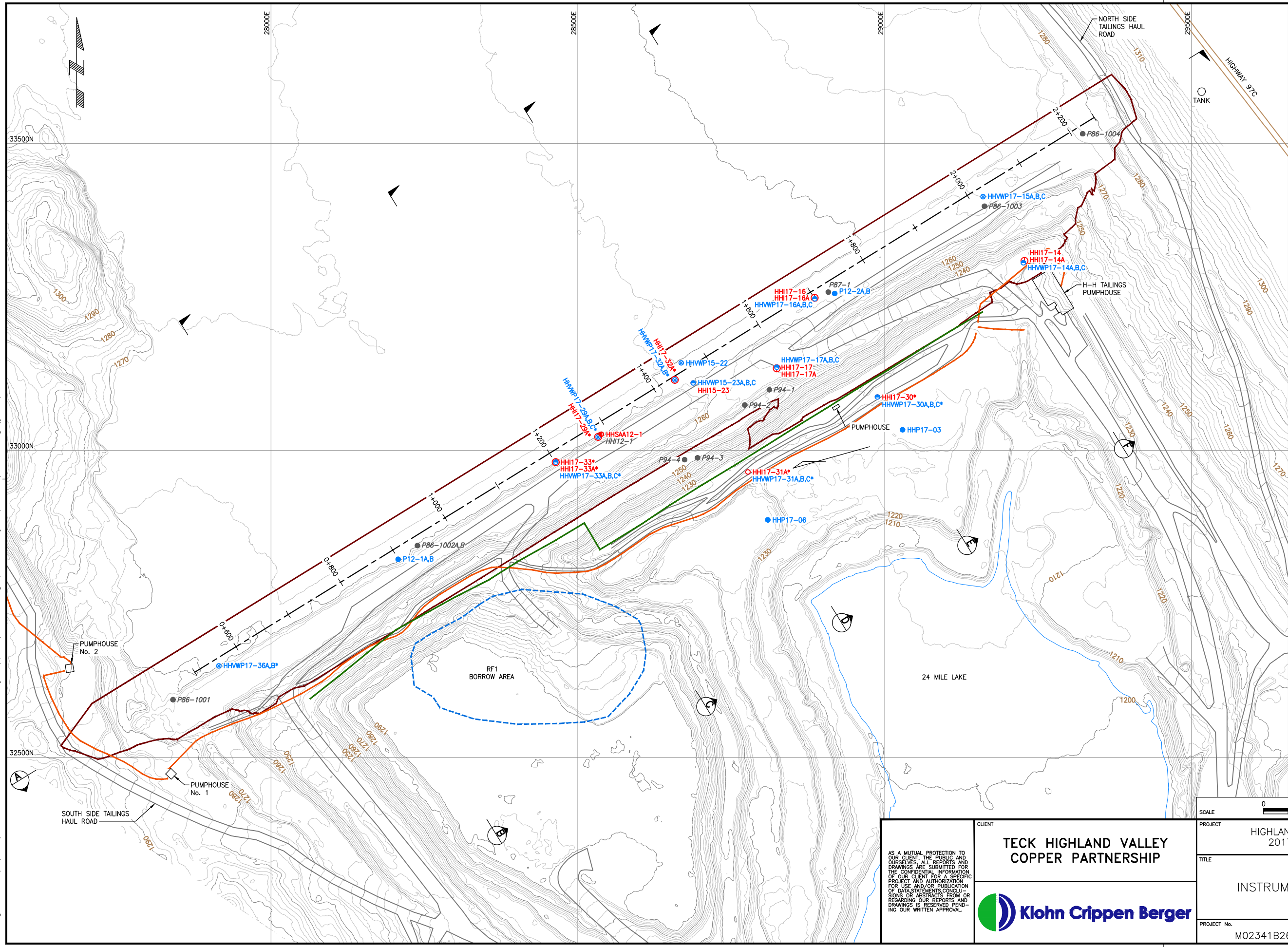


Notes:
 1. Projection: HVC Mine Grid.
 2. Imagery and Topography from Satellite Surveys Conducted on Sept. 15th and Sept. 24th, 2017.

CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION	
	TITLE H-H DAM AND 24 MILE LAKE DAM SAFETY INSPECTION WAYPOINTS	
	SCALE 1:13,000	PROJECT No. M02341B26
	FIG No. 4	

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LEGEND:

- BORROW AREA
- ULTIMATE DAM FOOTPRINT
- TAILINGS PIPELINE
- POWERLINE
- HAUL ROAD
- PUBLIC ROAD
- H-H DAM CENTERLINE
- TANK
- GEOLOGICAL CROSS SECTION

- ACTIVE INSTRUMENTS (SEE NOTE 2):**
- STANDPIPE PIEZOMETER AND OBSERVATION WELL
 - ⊗ VIBRATING-WIRE PIEZOMETER
 - ⊕ COMBINED STANDPIPE PIEZOMETER AND VIBRATING-WIRE PIEZOMETER
 - ⊙ COMBINED INCLINOMETER AND VIBRATING-WIRE PIEZOMETER
 - STANDARD INCLINOMETER
 - ⊙ COMBINED STANDARD INCLINOMETER AND IN-PLACE SAA INCLINOMETER
 - ⊕ COMBINED STANDARD INCLINOMETER AND PAIRED SONDEX SETTLEMENT SYSTEM

- DEFUNCT INSTRUMENTS (SEE NOTE 3):**
- DEFUNCT STANDPIPE PIEZOMETER
 - ⊙ DEFUNCT COMBINED STANDARD INCLINOMETER AND IN-PLACE SAA INCLINOMETER

- NOTES:**
1. TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER PARTNERSHIP AND WAS DERIVED FROM SATELLITE IMAGERY TAKEN ON 2017-07-01.
 2. ACTIVE INSTRUMENTS ARE DEFINED AS ANY INSTRUMENTS SATISFYING ONE OF THE FOLLOWING CRITERIA: CURRENTLY READING AN ACTIVE WATER LEVEL, DRY OR PLUGGED <20 m ABOVE TIP ELEVATION AS THIS COULD SHOW A RESPONSE IN THE FUTURE.
 3. DEFUNCT INSTRUMENTS ARE DEFINED AS ANY INSTRUMENTS SATISFYING ONE OF THE FOLLOWING CRITERIA: DESTROYED, DAMAGED OR PLUGGED >20 m ABOVE TIP ELEVATION.
 4. ASTERISK (*) DENOTES PROPOSED INSTRUMENT LOCATION TO BE UPDATED WITH AS-CONSTRUCTED LOCATION WHEN SURVEY IS COMPLETED.

SCALE 0 200 m

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PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION		TITLE H-H DAM INSTRUMENTATION LOCATION PLAN
PROJECT No. M02341B26		FIG. No. 5

KCB-R-MID

APPENDIX I

Dam Safety Inspection Checklist

APPENDIX I-A

L-L Dam Safety Inspection Checklist

2017 DAM SAFETY INSPECTION CHECKLIST



Facility:	L-L Dam	Inspection Date:	September 27, 2017
Consequence Classification	Extreme		
Weather:	Clear, sunny, 24°C	Inspector(s):	E. Hill, B. Chin

Tailings Pond (m)	
Pond El. (Survey data)	1247.61 (THVCP survey completed on Sept. 28, 2017)
Current Min. Dam Crest El. (Survey data)	1260.2 m
Freeboard	12.89 m (based on HVC pond survey completed on Sept. 28, 2017)
Required 2017 Crest El. (PMF + 2 m)	1259.9 m

Are the following in SATISFACTORY CONDITION?

North Dam	Yes/No	North Buttress Berm	Yes/No
U/S (S2 zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	U/S (S2 zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Crest (Till zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Crest (Till zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Slope (Sand zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	D/S Slope (Sand zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Drains	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Drains	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Main Dam	Yes/No	Valley Buttress Berm	Yes/No
U/S (S2 zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	U/S (S2 zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Crest (Till zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Crest (Till zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Slope (Sand zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	D/S Slope (Sand zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Drains	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Drains	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

South Dam	Yes/No
U/S (S2 zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Crest (Till zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Slope (Sand zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Were any POTENTIAL PROBLEM INDICATORS found?

INDICATOR	North Dam	North Buttress Berm	Main Dam	Valley Buttress Berm	South Dam
Piping	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sinkholes	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Seepage	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
External Erosion	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Cracks	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Settlement	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sloughing/Slides	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Animal Activity	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Excessive Growth	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Excessive Debris	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Over-steepened Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

Deficiencies:

- The downstream upper 20 m is over-steepened to ~ 1H:1V. These areas are monitored for signs of instability on a regular basis. No immediate dam safety concern (FoS > 1.5).

Comments:

- Point A weir (KCB3) overgrown by vegetation. Plans to decommission as part of 2018 foundation preparation activities.
- Point B weir (LL—FS-03) full of sediment which is affecting flow readings.

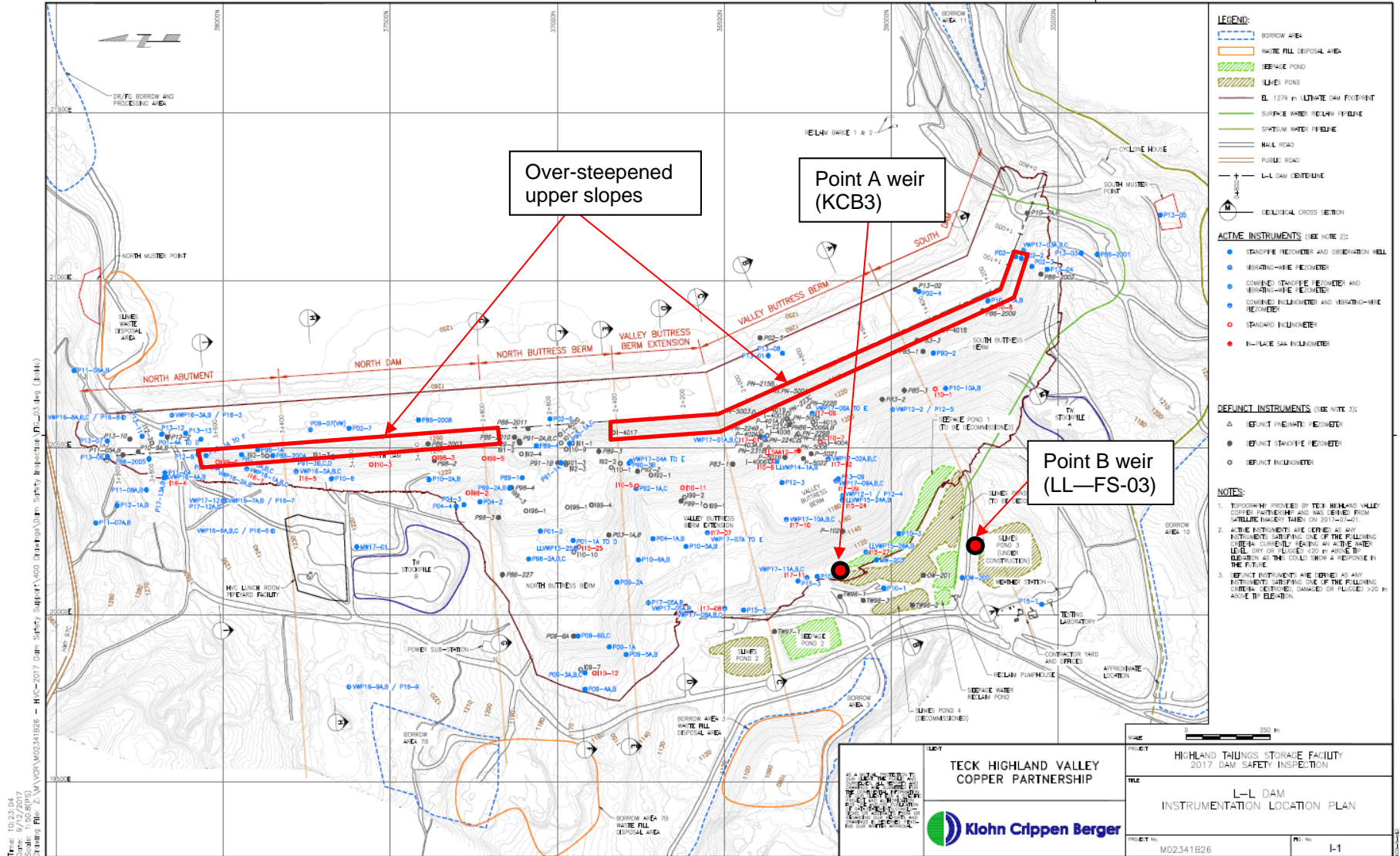
Dam Classification:

- Classification:** Extreme
- Date of latest dam classification:** January 2017
- By:** Teck/AMEC/KCB

Does the Dam meet design requirements?

- Stability:** Yes
- Flood Storage:** Yes

SITE PLAN



APPENDIX I-B

H-H Dam Safety Inspection Checklist

2017 DAM SAFETY INSPECTION CHECKLIST



Facility:	H-H Dam	Inspection Date:	September 27, 2017
Weather:	Clear, sunny, 15°C	Inspector(s):	E. Hill, B.Chin
Minimum buffer (top of tailings to crest)	1.2 m @ Sta. 2+100		

Are the following in SATISFACTORY CONDITION?

DAM	Yes/No
U/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Crest	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Were any POTENTIAL PROBLEM INDICATORS found?

INDICATOR	DAM
Piping	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sinkholes	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Seepage	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
External Erosion	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Cracks	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Settlement	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sloughing/Slides	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Animal Activity	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Excessive Growth	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Excessive Debris	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

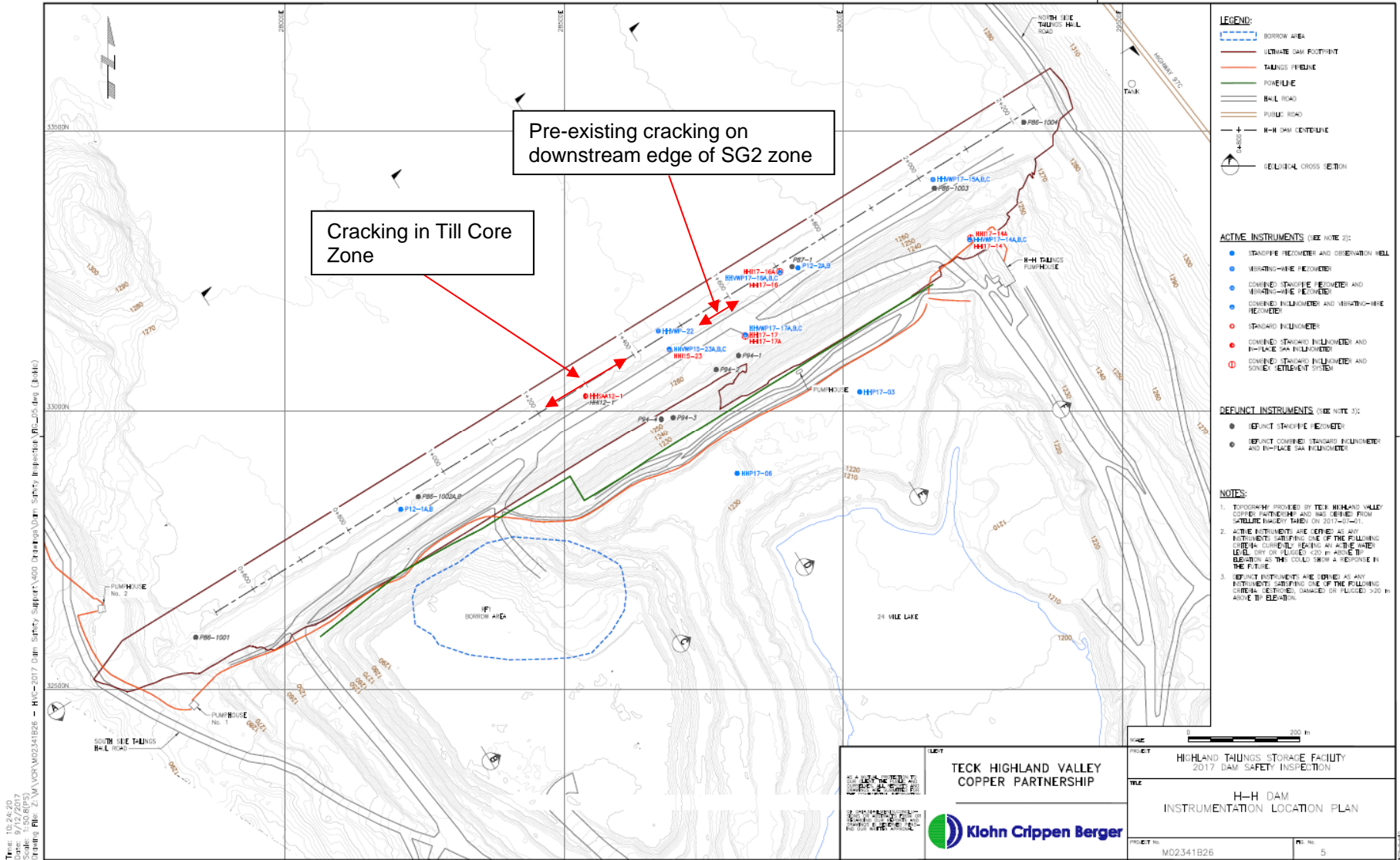
Deficiencies:

- None noted.

Comments:

- Vegetation noted on the crest of the dam (Till Core and RF1 Zones) which should be removed as part of regular dam maintenance works.
- Longitudinal cracking noted in Till Core Zone from Sta. 1+200 to Sta. 1+400 (non-continuous). Material will be stripped as part of subgrade preparation during 2017 fill placement.
- Pre-existing longitudinal crack noted at the downstream edge of the SG2 zone at WP1608. No signs of fresh movement or vertical displacement across crack. Crack is >30 cm deep and up to 20 cm wide with another hairline crack approx. 1 m upstream of the main crack. HVC is monitoring the extent (depth / width / length) of the cracking during regular site inspections. Continue to monitor. Plan to repair with dozer blade, scarify and re-compact.
- Upstream RF2 material placed on Till Core Zone near HHVWP15-22 to be pushed back during 2017 dam raise.
- RF2 material overbuilt onto SG2 zone from Sta. 0+540 to Sta. 1+600 to be scaled back during 2017 dam raise.

Site Plan



APPENDIX I-C

Highland TSF Safety Inspection Checklist

APPENDIX I-C-1

L-L Seepage Pond 1 Safety Inspection Checklist

2017 DAM SAFETY INSPECTION CHECKLIST



Facility:	L-L Dam Seepage Pond 1	Inspection Date:	September 27, 2017
Weather:	Clear, sunny, 24°C	Inspector(s):	E. Hill, B. Chin

Condition	Outlet
Was outlet flowing?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Flow rate at Point A Weir (KCB3):	No flow, overgrown by vegetation and no longer functional
Flow rate at Point B Weir (LL—FS-03):	Not recorded

Are the following in **SATISFACTORY CONDITION**?

WEST EMBANKMENT	Yes/No
U/S slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Crest	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Were **POTENTIAL PROBLEM INDICATORS** found?

INDICATOR	WEST EMBANKMENT
Piping	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sinkholes	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Seepage	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
External Erosion	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Cracks	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Settlement	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sloughing/Slides	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Animal Activity	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Excessive Growth	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Excessive Debris	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

Deficiencies:

- None noted.

Comments:

- Outlet flow is combined with flows from Jim Black Lake prior to measurement at Point B weir (LL—FS-03)— flow should be measured separately.
- Point B weir (LL—FS-03) is checked with sediment and should be cleaned out to ensure accurate measurements

SITE PLAN



● = measuring weir

APPENDIX I-C-2

L-L Seepage Pond 2 Safety Inspection Checklist

2017 DAM SAFETY INSPECTION CHECKLIST



Facility:	L-L Dam Seepage Pond 2	Inspection Date:	September 27, 2017
Weather:	Clear, sunny, 24°C	Inspector(s):	E. Hill, B.Chin
Freeboard:	~1.5 m		

Condition	Outlet
Was outlet flowing?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Inflow rate at Finger Drain 1 weir (LL—FS-01):	475 L/min
Outflow rate at Seepage Pond 2 Weir (LL—FS-04):	490 L/min

Are the following in **SATISFACTORY CONDITION?**

EMBANKMENT	Yes/No	OUTLET	Yes/No
U/S slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Outlet Pipe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Crest	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Outlet Channel	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Outlet Controls	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		

Were **POTENTIAL PROBLEM INDICATORS** found?

INDICATOR	EMBANKMENT	OUTLET CHANNEL
Piping	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Sinkholes	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Seepage	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
External Erosion	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Cracks	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Settlement	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Sloughing/Slides	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Animal Activity	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Excessive Growth	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Excessive Debris	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

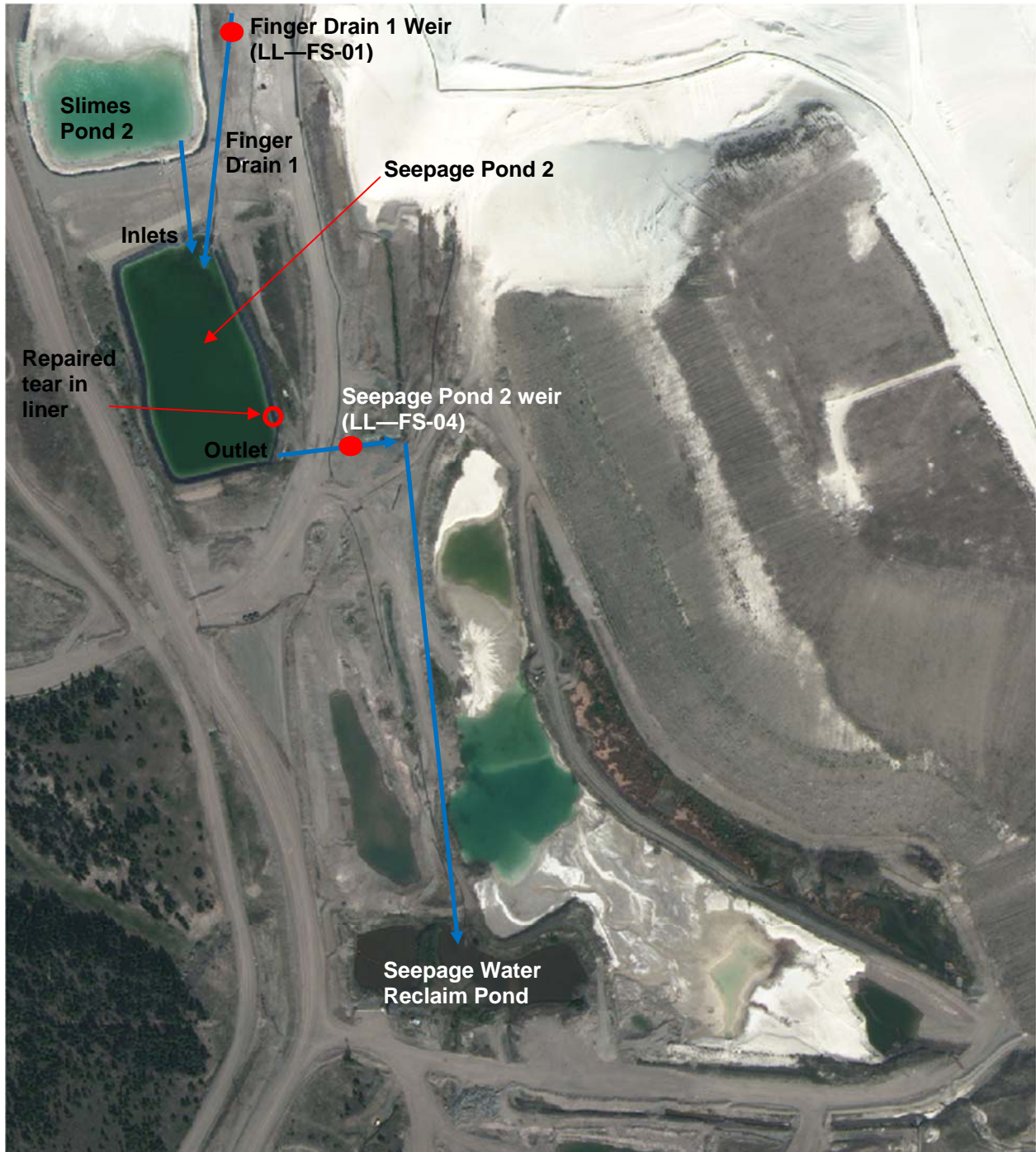
Deficiencies:

None.

Comments:

- Capacity of outlet pipe under review to determine available freeboard during the IDF.
- No inflow from Slimes Pond 2 at time of inspection.
- Small tear in pond liner (~30 cm wide) close to outlet pipe (approx. 1m above water level) has been repaired.

SITE PLAN



● = measuring weir

APPENDIX I-C-3

L-L Slimes Pond 1 Safety Inspection Checklist

2017 DAM SAFETY INSPECTION CHECKLIST



Facility:	L-L Dam Slimes Pond 1	Inspection Date:	September 27, 2017
Weather:	Clear, sunny, 24°C	Inspector(s):	E. Hill, B.Chin

Are the following in **SATISFACTORY CONDITION?**

AREA	EAST EMBANKMENT	WEST EMBANKMENT
U/S slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Crest	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Were **POTENTIAL PROBLEM INDICATORS** found?

INDICATOR	EAST EMBANKMENT	WEST EMBANKMENT
Piping	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sinkholes	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Seepage	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
External Erosion	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Cracks	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Settlement	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sloughing/Slides	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Animal Activity	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Excessive Growth	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Excessive Debris	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

* the dam is breached

Deficiencies:

- None noted.

Comments:

- None noted.

SITE PLAN



● = measuring weir

APPENDIX I-C-4

L-L Slimes Pond 2 Safety Inspection Checklist

2017 DAM SAFETY INSPECTION CHECKLIST



Facility:	L-L Dam Slimes Pond 2	Inspection Date:	September 27, 2017
Weather:	Clear, sunny, 24°C	Inspector(s):	E. Hill, B.Chin
Freeboard:	n/a – pond was dry and empty		

Condition	Outlet
Was outlet flowing?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
Inflow rate:	0 L/min
Outflow rate:	0 L/min

Are the following in **SATISFACTORY CONDITION?**

AREA	EMBANKMENT
U/S slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Crest	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Were **POTENTIAL PROBLEM INDICATORS** found?

INDICATOR	EMBANKMENT
Piping	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sinkholes	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Seepage	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
External Erosion	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Cracks	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Settlement	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sloughing/Slides	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Animal Activity	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Excessive Growth	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Excessive Debris	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

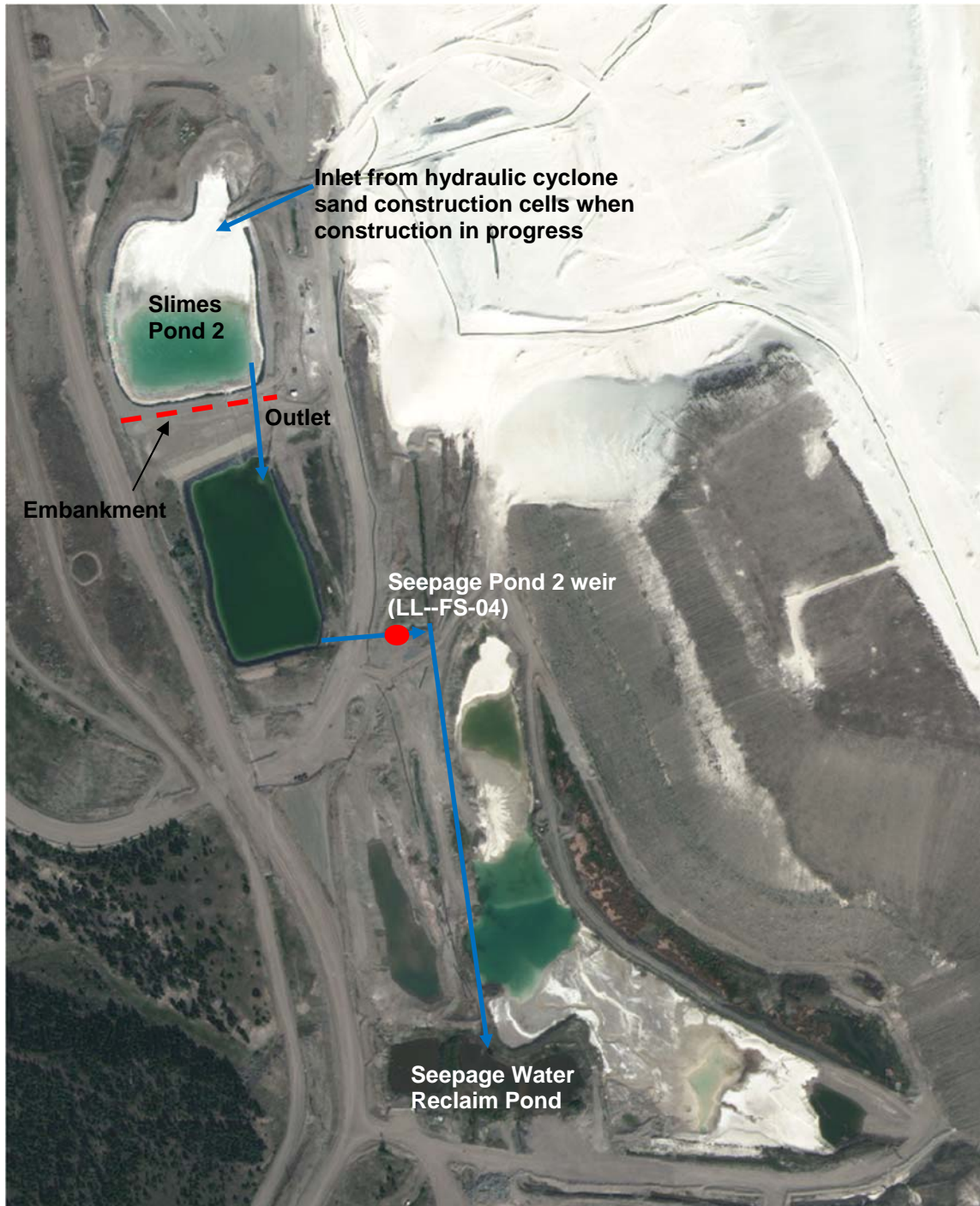
Deficiencies:

- None.

Comments:

- Slimes were removed/excavated to pond bottom in 2017. The protective gravel layer above the liner was not compromised.

SITE PLAN



● = measuring weir

APPENDIX I-C-5

Highland Seepage Water Pond Safety Inspection Checklist

2017 DAM SAFETY INSPECTION CHECKLIST



Facility:	L-L Dam Seepage Water Reclaim Pond	Inspection Date:	September 27, 2017
Weather:	Sunny, clear, 24°C	Inspector(s):	E. Hill, B.Chin
Freeboard:	3.25 m (based on HVC pond survey 28-Sep-17)		

Condition	Outlet pumps	Inlet #1	Inlet #2
Was it flowing?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Flow rate:	Not recorded	Not recorded	Not recorded

Inlet#1=from Jim Black Lake / Seepage Pond 1, Inlet #2=from Seepage Pond II / UVD/LVD weir

Are the following in **SATISFACTORY CONDITION**?

EAST EMBANKMENT*	Yes/No
U/S slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Crest	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

* This refers to the embankment separating the Surface Water Reclaim Pond and Slimes Pond 1

WEST DAM	Yes/No	OUTLET	Yes/No
U/S slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Outlet Pump	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Crest	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Outlet Controls	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

INLETS	Inlet #1	Inlet #2
Inlet pipe / ditch	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Inlet#1=from Jim Black Lake / Seepage Pond 1, Inlet #2=from Seepage Pond II / UVD/LVD weir,

Were **POTENTIAL PROBLEM INDICATORS** found?

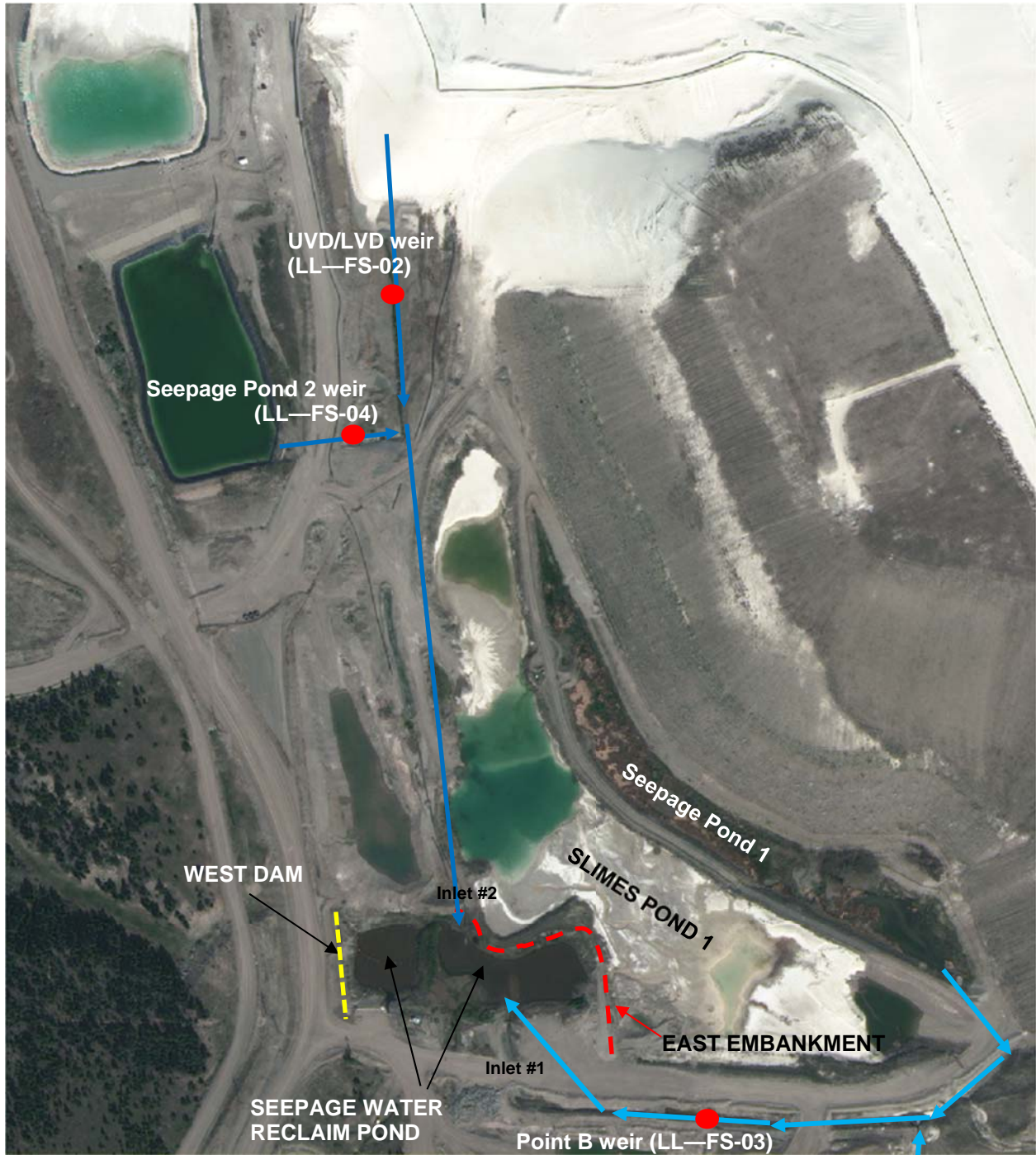
INDICATOR	EAST EMBANKMENT	WEST DAM
Piping	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sinkholes	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Seepage	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
External Erosion	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Cracks	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Settlement	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sloughing/Slides	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Animal Activity	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Excessive Growth	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Excessive Debris	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

Deficiencies:

None

Comments:

SITE PLAN



● = measuring weir

Flow from Jim Black Lake

APPENDIX I-D

24 Mile Lake Dam Safety Inspection Checklist

2017 DAM SAFETY INSPECTION CHECKLIST



Facility:	24 Mile Lake	Inspection Date:	September 27, 2017
Weather:	Clear, sunny, 14°C	Inspector(s):	E. Hill, B.Chin
Crest Elevation:	1220 m		
Current Pond Elevation:	1196.8 m (THVCP survey completed on Sept. 28, 2017)	Freeboard:	> 10 m (field measurement on 27-Sep-17) 14.2 m (based on THVCP pond survey completed on Sept. 28, 2017)

Are the following in **SATISFACTORY CONDITION?**

WASTE DUMP WALLS	Yes/No
U/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Crest	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Were **POTENTIAL PROBLEM INDICATORS** found?

INDICATOR	EMBANKMENT
Piping	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sinkholes	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Seepage	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
External Erosion	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Cracks	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Settlement	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sloughing/Slides	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Animal Activity	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Excessive Growth	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Excessive Debris	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

Deficiencies:

- None noted.

Comments:

- Some erosion gullies evident on west side of pond in waste dump walls. No dam safety concern at this time.
- Evidence of recent erosion at southeast corner of pond on reclaimed slope. Haul road could be impacted if erosion progresses.

APPENDIX I-E

Quarterly Dam Safety Inspection Checklist

APPENDIX I-E-1

Quarter 2 H-H Dam Safety Inspection Checklist

Q2 QUARTERLY DAM INSPECTION CHECKLIST



Facility:	H-H Dam	Inspection Date:	2017-05-28
Weather:	Clear / sunny	Inspector(s):	E.Hill
Minimum observed buffer height (delta level to dam crest):	1.5 m at Sta. 0+490		

Are the following components of your dam in **SATISFACTORY CONDITION?**
(check one if applicable)

EMBANKMENT	Yes/No
U/S slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Crest	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Were any of the following **POTENTIAL PROBLEM INDICATORS** found?

INDICATOR	EMBANKMENT	INDICATOR	EMBANKMENT
Piping	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Settlement	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sinkholes	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Sloughing/Slides	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Seepage	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Animal Activity	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
External Erosion	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Excessive Growth	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Cracks	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Excessive Debris	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

List and describe any deficiencies (all deficiencies require assessment and/or repair):

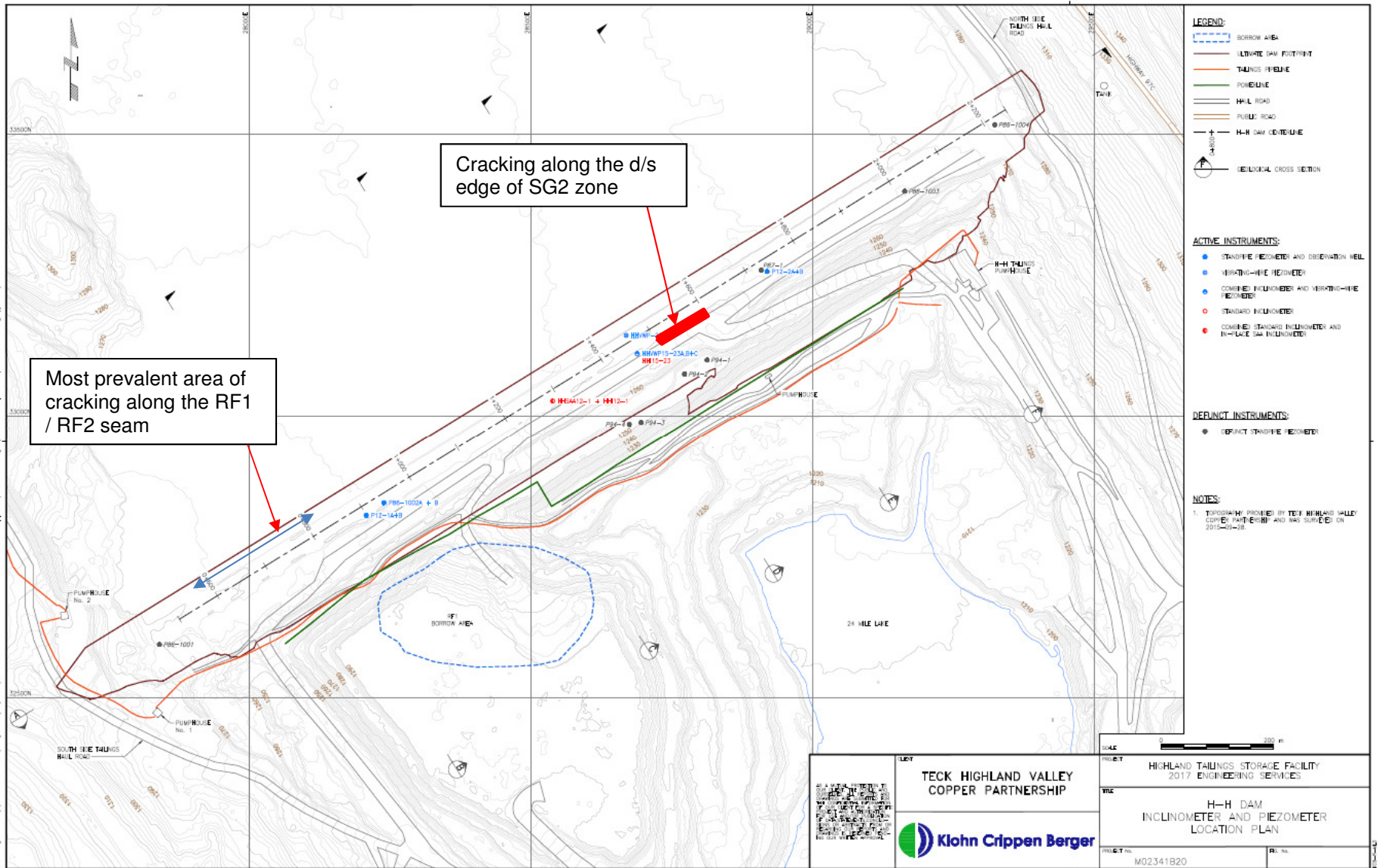
New and Outstanding deficiencies:

None

Comments / Notes:

1. Current discharge at west abutment spigot point.
2. Some cracking at the seam between RF1 zone and the upstream (u/s) RF2 zone along the length of the dam due to settlement of the u/s RF2, most prevalent west of Sta.0+800. The cracking was not characterized as a significant dam safety concern as similar cracks have been recorded historically during fill placement, and have been attributed to settlement of the RF1 fill which is placed directly on the tailings. (Photo 1 and 2)
3. Observed cracking on the downstream (d/s) edge of SG2 zone between Sta. 1+497 and Sta. 1+562 (based on HVC survey April 5, 2017), as shown on attached Figure 1. Crack dimensions are being monitored by THVCP on a weekly basis. Cracking is located in an area where the d/s RF2 zone is approximately 4m below the elevation of the SG2 zone. Therefore the source of cracking is likely settlement of the loose safety berm material. Refer to KCB MRM-2017-004 for further details.

Figure 1 - SITE PLAN



Relevant photos –



Photo 1 – Cracking at the seam between RF1 and U/S RF2 at approx. Sta. 0+800



Photo 2 - Cracking at the seam between RF1 and U/S RF2 at approx. Sta. 0+800



Photo 3 – Cracking on the u/s edge of SG2 zone at approx. Sta. 1+550 (facing west)



Photo 4 – Cracking on the u/s edge of SG2 zone at approx. Sta. 1+550



Photo 5 – Overview of cracking area on the u/s edge of SG2 zone showing height of loose safety berm (~ 4m)

APPENDIX I-E-2

Quarter 2 L-L Dam Safety Inspection Checklist

Q2 QUARTERLY DAM INSPECTION CHECKLIST



Facility:	L-L Dam	Inspection Date:	2017-05-28
Weather:	Clear / sunny	Inspector(s):	E.Hill

Tailings Pond		Seepage Flows	L / min	Comments
Pond El. (m)	1247.51	Finger Drain 1	372	Clear
Min. Dam Crest El. (m)	1260.5	UVD/LVD	830	Clear
Freeboard (m)	13	Point B weir	6,662	Weir and channel are silted-up. Readings are not accurate.
Required 2017 Crest El (PMF + 2m) (m)	1260.5			

Are the following components in **SATISFACTORY CONDITION?**

South Dam		Valley Buttress Berm	
U/S slope of Zone D	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	U/S slope of Zone D	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Crest (Zone B)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Crest (Zone B)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	D/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
		Drains	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Main Dam		North Buttress Berm	
U/S slope of Zone D	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	U/S slope of Zone D	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Crest (Zone B)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Crest (Zone B)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	D/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Drains	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Drains	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

North Dam			
U/S slope of Zone D	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
Crest (Zone B)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
D/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
Drains	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		

Were any of the following *POTENTIAL PROBLEM INDICATORS* found?

INDICATOR	South Dam	Valley Buttress Berm	Main Dam	North Buttress Berm	North Dam
Seepage	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
External Erosion	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Cracks	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Settlement	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sloughing/Slides	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Over-steepened Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

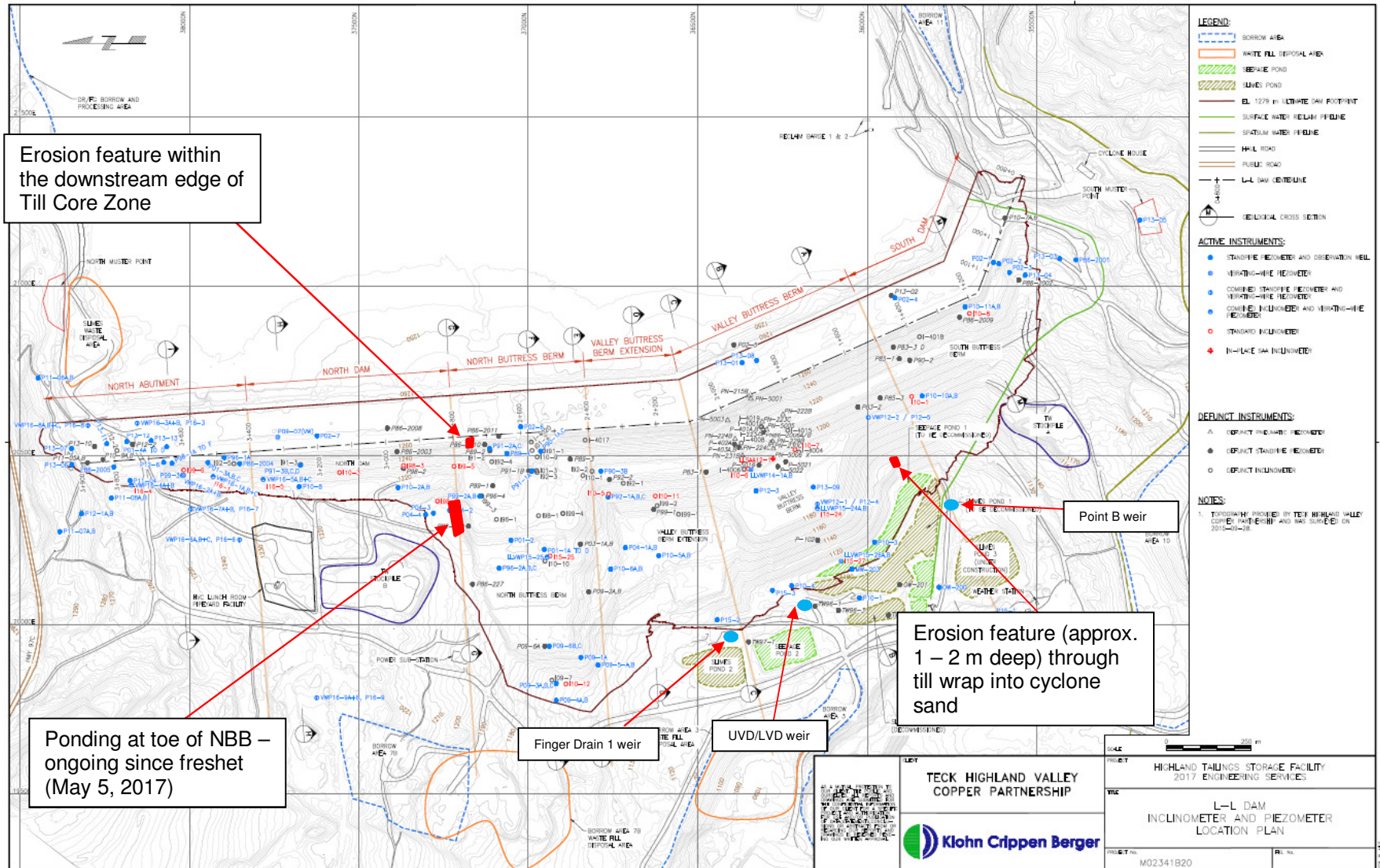
List and describe any deficiencies:

- Over-steepened upper sections of the downstream dam slopes still evident. These locally over-steepened slopes were due to raising of the glacial till core in 2013 and 2015 without concurrently constructing the downstream sand support, and have been noted in 2016 DSI report. EoR has reviewed stability and found acceptable factor of safety and no interim dam safety concern. No signs of instability during inspection.
- These locally over-steepened slopes will be flattened during the upcoming 2017/2018 construction

Notes and Comments:

- Water associated with snowmelt freshet continues to flow from the North Dam and accumulate at the northern toe of the North Buttress Berm (location shown in Figure 1). It appears that the upstream end of an existing culvert which used to feed water from the North Dam drain into the major finger drain beneath the NBB (Finger Drain 1) is buried/blocked. This is likely contributing to the ongoing ponding. This is not considered a dam safety issue, at this time. (Photo 1)
- An erosion feature was noted below the VBB at Sta. 1+600 (approx. El. 1125), (location shown in Figure 1). Runoff has eroded through the till wrap into the cyclone sand and is approximately 1 – 2 m deep. Erosion feature should be backfilled to prevent further erosion of cyclone sand. (Photo 2)
- Erosion feature (approx. 0.5 m deep) at ~ Sta. 2+750 has eroded the downstream edge of the Till Core Zone (location shown in Figure 1). Will require repair during the next construction raise. Erosion feature should be surveyed for record purposes. (Photo 3)
- Higher than normal water level in Slimes Pond 1 due to recent freshet. Freeboard > 5m. (Photo 4)
- Till Core Zone is covered by wind-blown sand making inspection of its condition impossible. (Photo 5)

Figure 1 – Site Plan



Relevant Photos:



Photo 1- Poned Water At North Toe of North Buttress Berm (facing west)

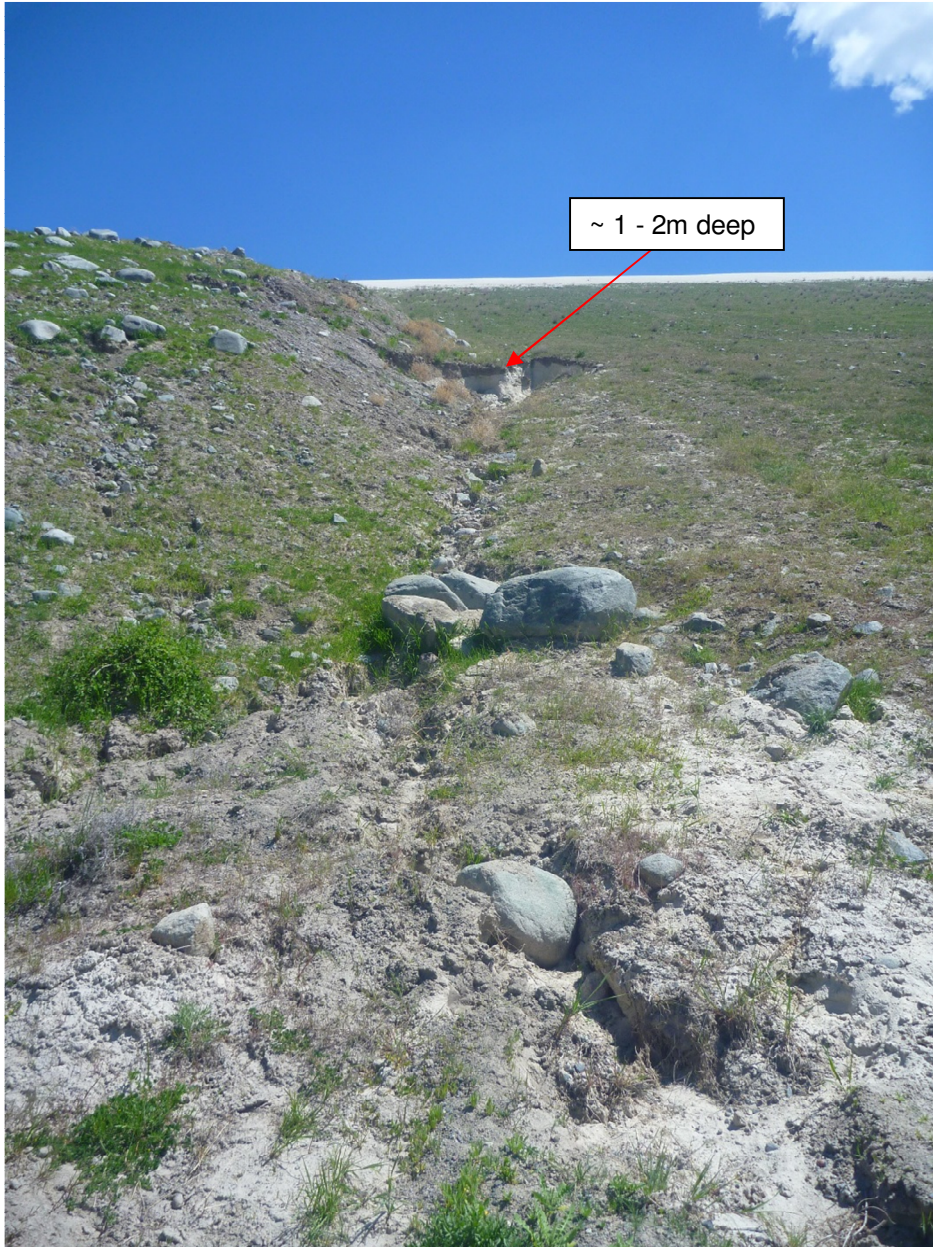


Photo 2 – Erosion Feature at Sta. 1+600



Photo 3 – Erosion feature in downstream edge of Till Core Zone at ~ Sta. 2+750



Photo 4 – Slimes Pond 1



Photo 5 – Windblown sand cover on Till Core Zone

APPENDIX I-E-3

Quarter 4 H-H Dam Safety Inspection Checklist

Q4 QUARTERLY DAM INSPECTION CHECKLIST



Facility:	H-H Dam	Inspection Date:	2017-12-21
Weather:	Cloudy to snow, -7°C	Inspector(s):	D.Pongracz
Minimum observed buffer (delta level to top of buffer zone):	1.8 m at Sta. 2+200 3.2 m at Sta. 1+400 2.3 m at Sta. 0+490 (THVCP delta survey from 2017-12-19)		

Are the following components of your dam in **SATISFACTORY CONDITION?**
(check one if applicable)

EMBANKMENT	Yes/No
U/S slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Crest	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Were any of the following **POTENTIAL PROBLEM INDICATORS** found?

INDICATOR	EMBANKMENT	INDICATOR	EMBANKMENT
Piping	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Settlement	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sinkholes	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Sloughing/Slides	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Seepage	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Animal Activity	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
External Erosion	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Excessive Growth	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Cracks	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Excessive Debris	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

List and describe any deficiencies (all deficiencies require assessment and/or repair):

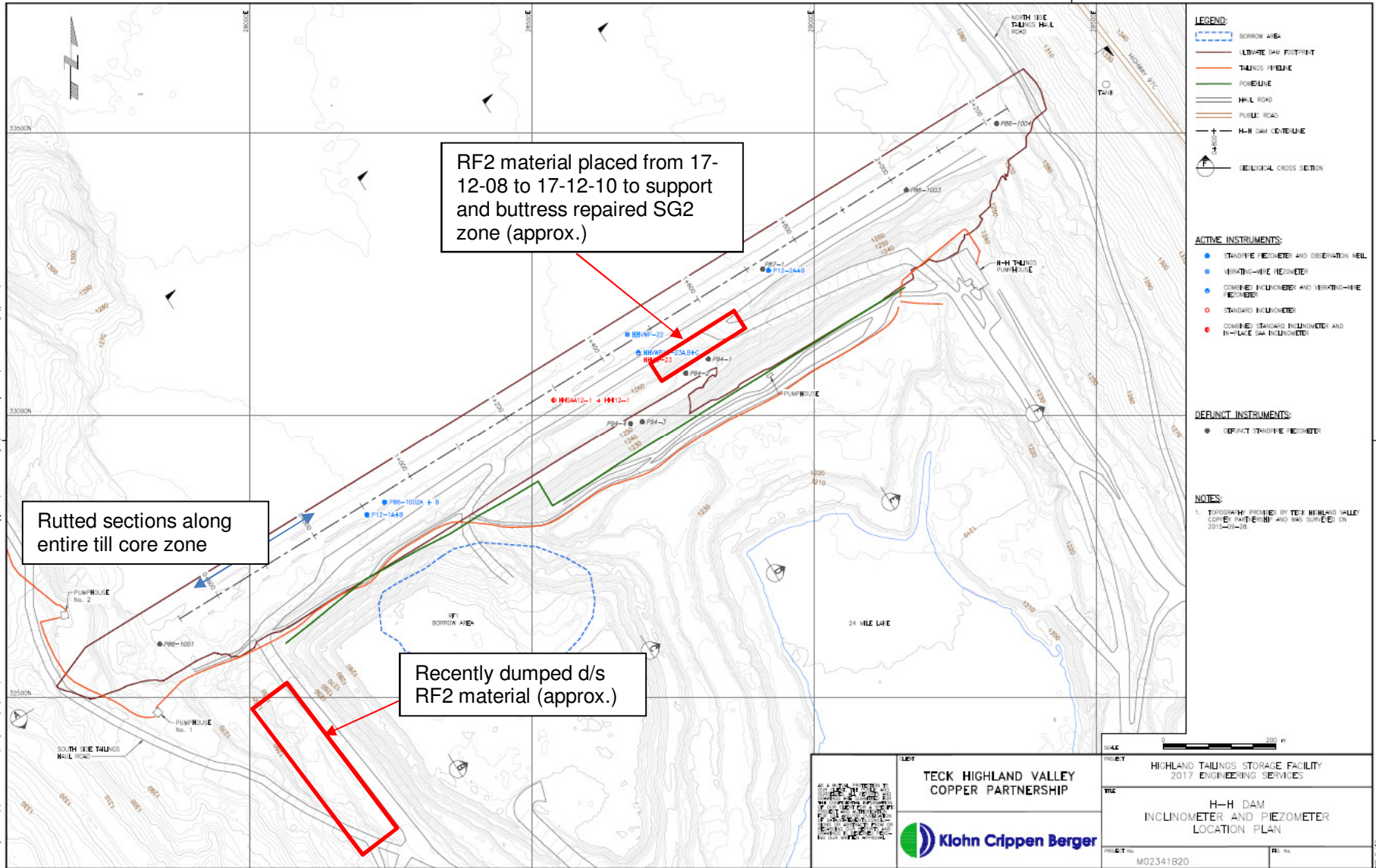
New and Outstanding deficiencies:

None

Comments / Notes:

1. Most of the H-H Dam was covered in snow and observations were made to the best of their ability during the current conditions (Photo 1). Evidence of previous discharge from SS1/SS2 along/near the u/s RF2 face approximately between Sta. 0+600 to 0+750 (Photo 2 and 3).
2. Recently dumped d/s RF2 material observed between west side of I-9 waste dump and the west access road onto the dam (Photo 4).
3. Sections of the till core zone were heavily rutted across the dam (Photo 5).
4. Observed area where HVC Mine Ops hauled, dumped and wheel packed d/s RF2 material from December 8 to 10, 2017. The material was placed between ~Sta. 1+475 to ~Sta. 1+625 to ~El. 1268 m to support and buttress the SG2 where cracking had previously occurred (refer to MRM-2017-004) (Photo 6).
5. Current tailings discharge northwest of the east abutment (Photo 7).

Figure 1 - SITE PLAN



Relevant Photos:



Photo 1 – Most of the H-H Dam was snow covered at the time of the inspection (looking northeast).



Photo 2 - Evidence of recent discharge from SS1/SS2 along/near the u/s RF2 face approximately between Sta. 0+600 to 0+750 (looking northeast).



Photo 3 - Evidence of recent discharge from SS1/SS2 along/near the u/s RF2 face approximately between Sta. 0+600 to 0+750 (looking east).



Photo 4 – Recently dumped d/s RF2 material observed between west side of I-9 waste dump and the west access road on the dam (looking southeast).



Photo 5 – Sections of the till core zone were heavily rutted (looking northeast).



Photo 6 – Area where THVCP Mine Ops hauled, dumped and wheel packed d/s RF2 material from December 8 to 10, 2017. The material was placed between ~Sta. 1+475 to ~Sta. 1+625 to ~El. 1268 m to support and buttress the SG2 where cracking had previously occurred (refer to MRM-2017-004) (looking north).



Photo 7 – Tailings discharging northwest of the east abutment (looking northeast).

APPENDIX I-E-4

Quarter 4 L-L Dam Safety Inspection Checklist

Q4 QUARTERLY DAM INSPECTION CHECKLIST



Facility:	L-L Dam	Inspection Date:	2017-12-20 / 2017-12-21
Weather:	17-12-20: Clear, -10°C 17-12-21: Snow, -11°C	Inspector(s):	E.Hill / D. Pongracz

Tailings Pond		Seepage Flows	L / min	Comments
Pond El. (m)	1247.19	Finger Drain 1 (LL—FS-01)	491 (16 cm)	Clear (17-12-20)
Min. Dam Crest El. (m)	1260.5	UVD/LVD (LL—FS-02)	966 (21 cm)	Mainly clear
Freeboard (m)	13.3	Point B weir (LL—FS-03)	965 (21 cm)	Accumulated sediment in weir box and outfall – measurement likely not accurate
Required 2017 Crest El (PMF + 2m) (m)	1260.5			

Are the following components in SATISFACTORY CONDITION?

South Dam		Valley Buttress Berm	
U/S slope of U/S S2 zone	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	U/S slope of U/S S2 zone	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Crest (Till Core zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Crest (Till Core zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	D/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
		Drains	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Main Dam		North Buttress Berm	
U/S slope of U/S S2 zone	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	U/S slope of U/S S2 zone	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Crest (Till Core zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Crest (Till Core zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
D/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	D/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Drains	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Drains	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

North Dam			
U/S slope of U/S S2 zone	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
Crest (Till Core zone)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
D/S Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
Toe	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
Drains	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		

Were any of the following *POTENTIAL PROBLEM INDICATORS* found?

INDICATOR	South Dam	Valley Buttress Berm	Main Dam	North Buttress Berm	North Dam
Seepage	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
External Erosion	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Cracks	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Settlement	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Sloughing/Slides	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Over-steepened Slope	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

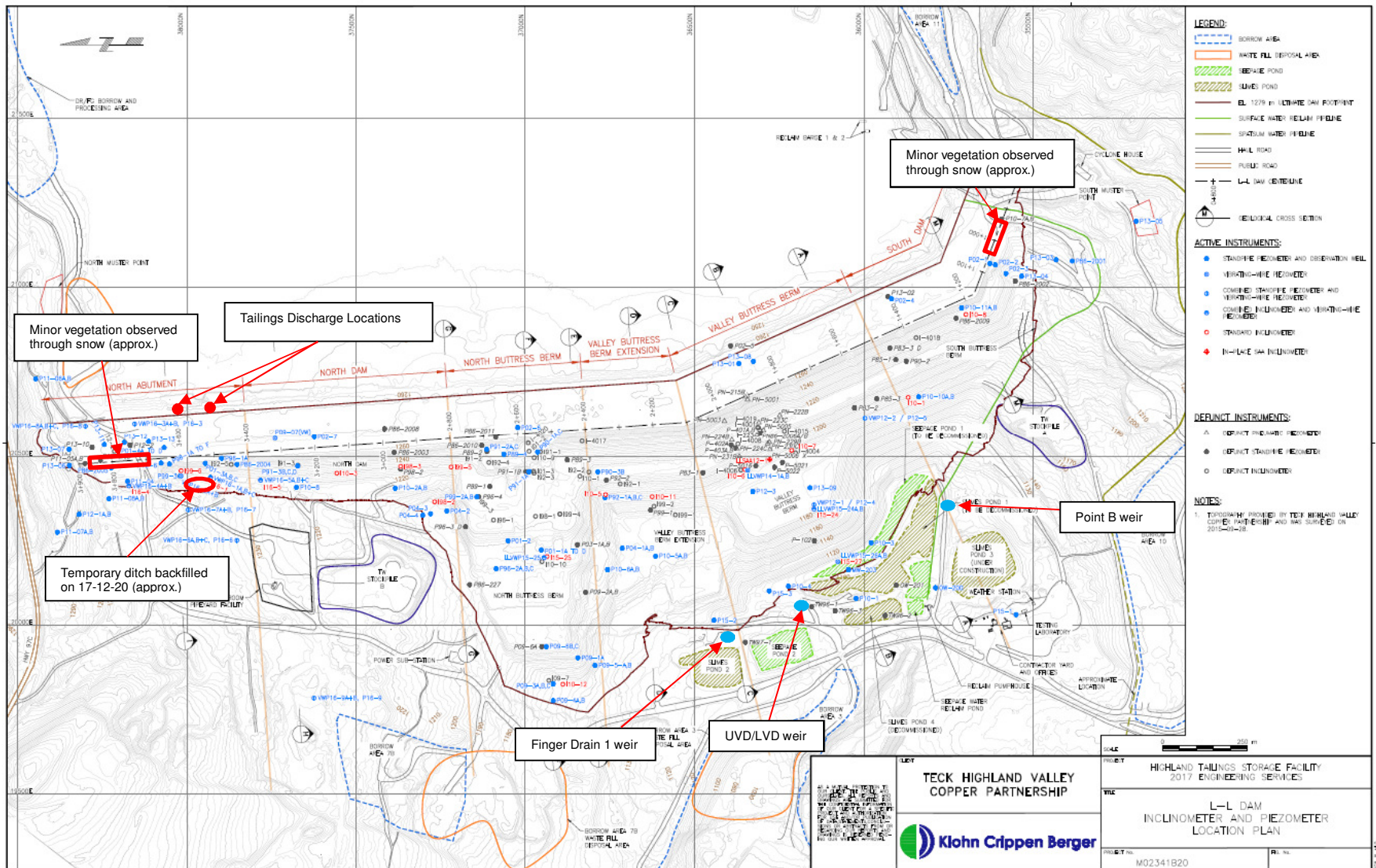
List and describe any deficiencies:

- Over-steepened upper sections of the downstream dam slopes still evident. These locally over-steepened slopes were due to raising of the glacial till core zone in 2013 and 2015 without concurrently constructing the downstream sand support, and have been noted in previous DSI reports and quarterly dam inspections. EoR has reviewed stability and found acceptable factor of safety and no interim dam safety concern. No signs of instability during inspection.
- These locally over-steepened slopes will be addressed during the upcoming 2018/2019 construction.

Notes and Comments:

- The entire L-L Dam was covered in snow and observations were made to the best of their ability during the current conditions (Photo 1).
- Minor vegetation observed through the snow on the till core zone at the North Abutment and South Dam (Photo 2).
- A temporary ditch dug during foundation preparation works at the North Abutment (from Sta. 3+500 to ~3+570) was backfilled on 17-12-20 (Photo 3).
 - d/s flow was clear.
 - u/s flow was partially backed up but approximately similar to the 17-12-20 observations.
- No flow from Jim Black Lake reporting to Point B weir (Photo 4).
- No flow from Woods Creek Diversion into Reclaim Pond (Photo 5).
- Tailings discharge locations at Sta. 3+500 and Sta. 3+600 (Photo 6).

Figure 1 – Site Plan



Relevant Photos:



Photo 1- Entire L-L Dam was snow covered at the time of the inspection; two drill rigs seen on the North Buttress Berm (looking North).



Photo 2 – Minor vegetation observed through the snow on the till core zone at the South Dam (looking northwest).



Photo 3 – Temporary ditch dug during foundation preparation works at the North Abutment (from Sta. 3+500 to ~3+570) backfilled on 17-12-20 (looking south).



Photo 4 – No flow from Jim Black Lake reporting to Point B weir (Photo 4).



Photo 5 – No flow from Woods Creek Diversion into the Reclaim Pond (looking north).



Photo 6 – Tailings discharge locations at Sta. 3+500 and 3+600 (photo taken on 17-12-20).



Photo 7 – Point B weir with accumulated sediment in weir box and outfall.

APPENDIX II

Inspection Photographs

APPENDIX II-A

L-L Dam Inspection Photographs

Appendix II-A Inspection Photographs - L-L Dam

LEGEND:

- LL = L-L Dam.
- LL-2017-## refers to 2017 DSI waypoint shown on Figure 2.
- All photographs taken during inspection on September 26 and 27, 2017.

Photo II-A-1 North Abutment Overview (LL-2017-14)



Photo II-A-2 South Abutment Overview (LL-2017-01)



Photo II-A-3 Upstream Dam Face – Facing South (overall 3.5H to 1V) (LL-2017-12)



Photo II-A-4 Upstream Dam Face with Undercutting and Overhanging at Old Overflow Discharge Location – Facing East (LL-2017-13)



Photo II-A-5 Upstream Dam Face – Beach was Constructed using Hydraulic Sand Panels in 2015 – Facing North (LL-2017-11)



Photo II-A-6 Upstream Dam Face – Undercutting at Beaching Location – Facing North (LL-2017-10)



Photo II-A-7 Pond at the Toe of the Upstream Dam Slope – Facing South (LL-2017-09)



Photo II-A-8 Downstream face at South Abutment - Facing North (LL-2017-02)



Photo II-A-9 South Dam – Erosion from Cyclone House Spill (LL-2017-06)



Photo II-A-10 South Dam – Major Drain Outlet with <1 L/min Flow Rate (LL-2017-05)



Photo II-A-11 South Dam Till Core Zone – Facing Northwest (LL-2017-08)



Photo II-A-12 North Dam Till Core Zone – Facing South (LL-2017-15)



Photo II-A-13 North Dam Downstream Toe – Facing South (LL-2017-16)



Photo II-A-14 North Dam Drain – Facing North (LL-2017-16)



Photo II-A-15 North Dam Downstream Slope – Facing North (LL-2017-17)



Photo II-A-16 North Buttress Berm North Slope – Facing West (LL-2017-18)

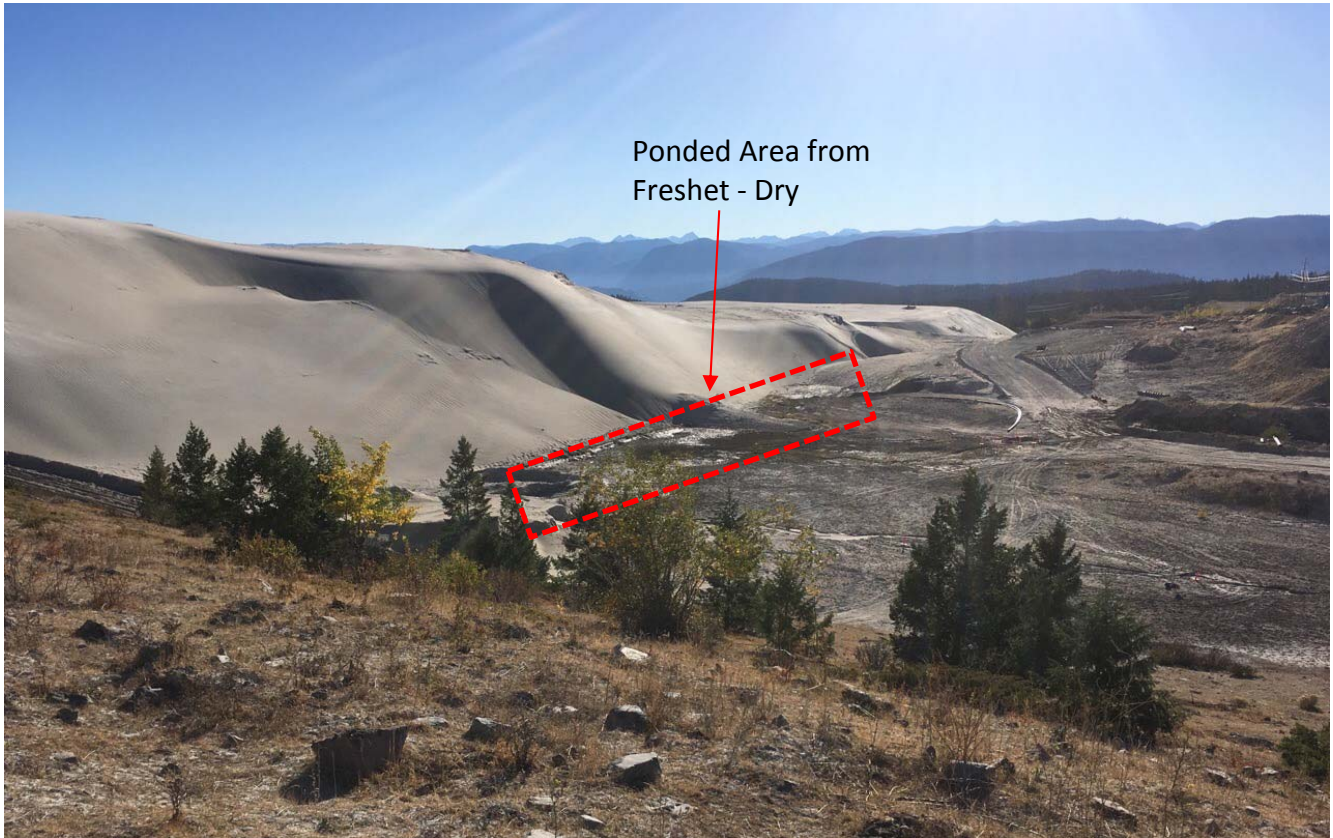


Photo II-A-17 North Buttress Berm South Slope – Facing Northwest (LL-2017-19)



Photo II-A-18 Toe and Downstream Face of South Dam - Facing Northwest (LL-2017-24)



Photo II-A-19 Downstream Slope of South Dam - Facing North (LL-2017-04)



Photo II-A-20 Downstream Toe at South Abutment - Facing East (LL-2017-07)



Photo II-A-21 Downstream Slope at South Abutment - Facing Northwest (LL-2017-03)



Photo II-A-22 Valley Buttress and Valley Buttress Berm Extension - Facing West (LL-2017-19)



Photo II-A-23 Finger Drain No.1 Measuring Weir (LL—FS-01) (LL-2017-20)



Photo II-A-24 UVD/LVD Drain Measuring Weir (LL—FS-02) (LL-2017-22)



Photo II-A-25 Seepage Pond 2 Weir (LL—FS-04) (LL-2017-21)



**Photo II-A-26 Point A Weir – No Flow, Overgrown by Vegetation and No Longer Functional (KCB3)
(LL-2017-23)**



APPENDIX II-B

H-H Dam Inspection Photographs

Appendix II-B Inspection Photographs - H-H Dam

LEGEND:

- HH = H-H Dam.
- LL-2017-## refers to 2017 DSI waypoint shown on Figure 4.
- All photographs taken during inspection on September 26 and 27, 2017.

Photo II-B-1 Overview of Dam from West Abutment; RF2 fill overbuilt onto SG2 fill zone, requires cutting back during next crest raise (HH-2017-01)



Photo II-B-2 Overview of Dam from East Abutment and Exposed Bedrock from 2015 Abutment Foundation Preparation Works (HH-2017-09)



Photo II-B-3 Till Core Zone and RF1 Zone - Facing Southwest; sporadic vegetation growth (HH-2017-05)



Photo II-B-4 Till Core Zone - Facing Northeast; upstream buffer at HHVWP15-22; RF2 material has been placed on Till Core Zone (HH-2017-06)



Photo II-B-5 Longitudinal cracking in Till Core Zone from Sta. 1+200 to Sta. 1+400 (not continuous) along centerline of Dam, up to 20 cm deep (HH-2017-04)



Photo II-B-6 Existing longitudinal crack on downstream edge of SG2 fill zone, with no signs of fresh movement or vertical displacement across crack; crack is >30 cm deep and up to 20 cm wide; hairline crack approx. 1 m upstream of the main crack (HH-2017-07)

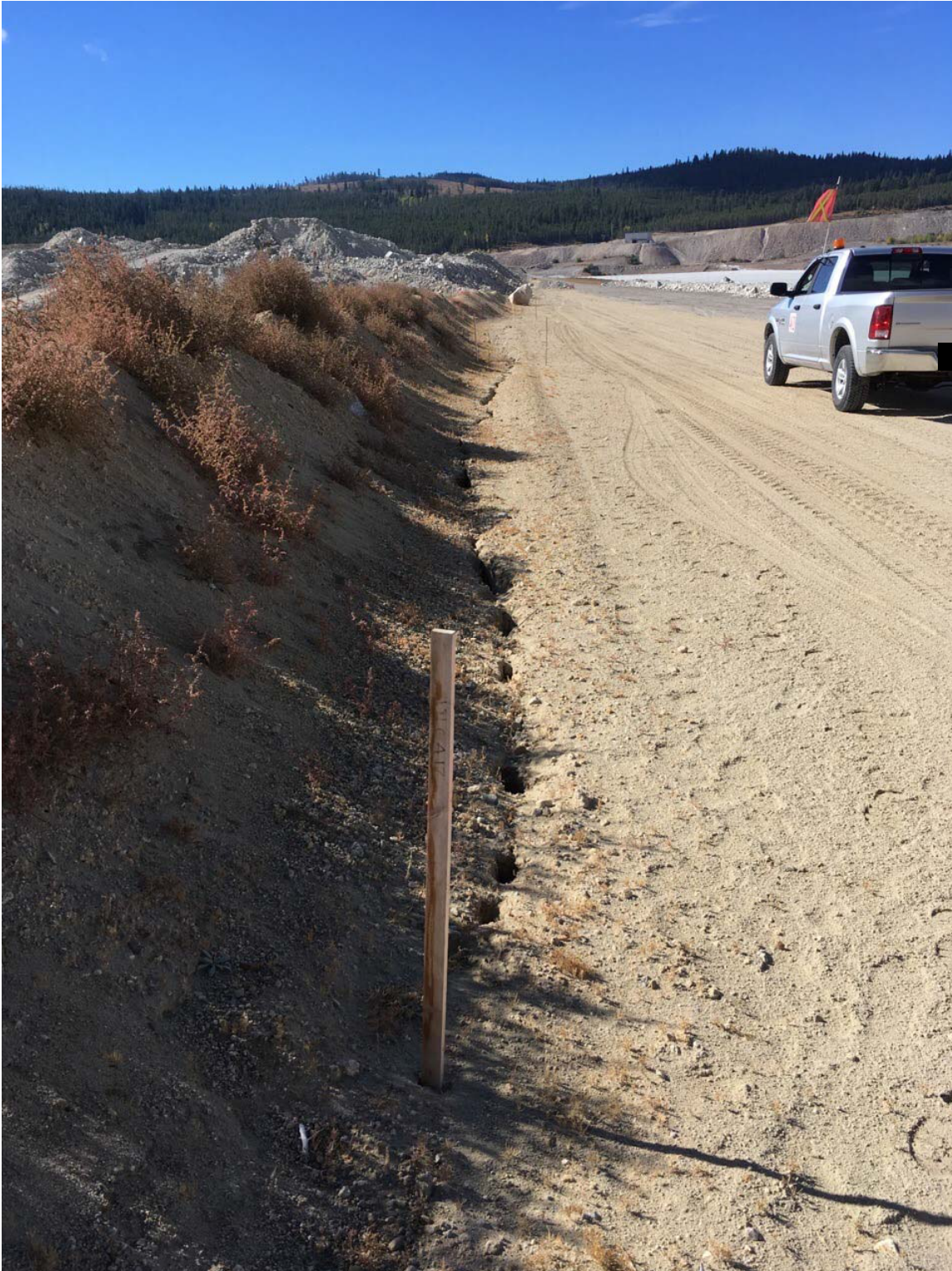


Photo II-B-7 Existing longitudinal crack on downstream edge of SG2 fill zone, with no signs of fresh movement or vertical displacement across crack; crack is >30 cm deep and up to 20 cm wide; hairline crack approx. 1 m upstream of the main crack (HH-2017-07)



Photo II-B-8 Upstream Face of Dam - Facing Northeast; RF2/RF1 buffer zone on the upstream edge of dam crest, approx. 1 m high; available buffer is approx. 0.5 m (HH-2017-08)



Photo II-B-9 Downstream Face of Dam - Facing Northeast (HH-2017-02)



Photo II-B-10 Downstream Face of Dam - Facing Northeast (HH-2017-15)



Photo II-B-11 Downstream Toe of Dam - Facing Northeast (HH-2017-14)



Photo II-B-12 Downstream Toe of Dam - Facing West (HH-2017-13)



Photo II-B-13 East Abutment - Facing Northeast; new VWP, inclinometer and settlement system installed in 2017 behind the H-H Pumphouse lock-block retaining wall (HH-2017-12)



Photo II-B-14 Downstream Face of Dam - Facing West (HH-2017-10)



Photo II-B-15 Lock-block Retaining Wall at Toe of Dam; new survey prisms (HH-2017-11)



APPENDIX II-C

L-L Dam Seepage Slimes Ponds Inspection Photographs

Appendix II-C Inspection Photographs - L-L Dam Seepage and Slimes Pond

LEGEND:

- SS = L-L Dam seepage and slimes ponds.
- SS-2017-## refers to 2017 DSI waypoint shown on Figure 2.
- All photographs taken during inspection on September 26 and 27, 2017.

Photo II-C-1 Overview of Seepage and Slimes Collection Ponds – Facing Northwest (SS-2017-01)

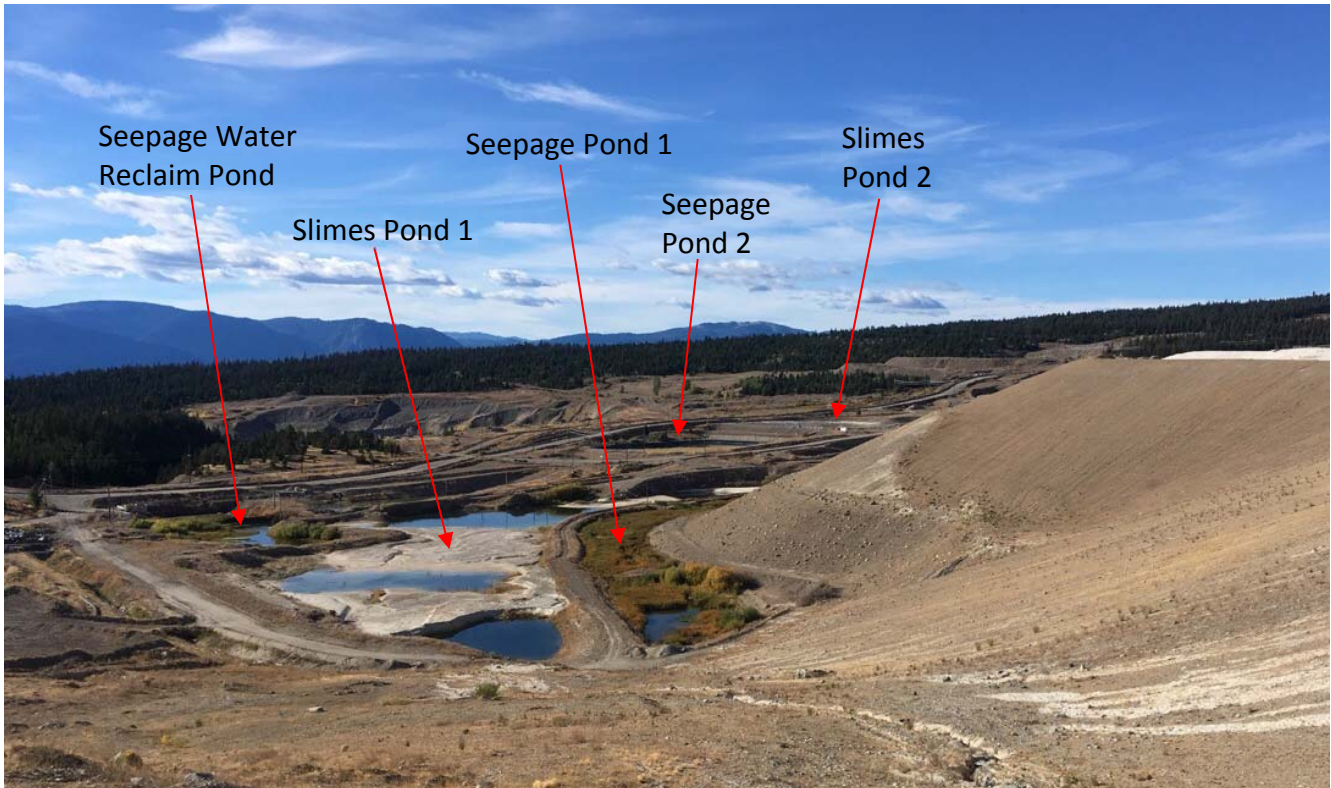


Photo II-C-2 Slimes Pond 1 – Facing South (SS-2017-04)



Photo II-C-3 Slimes Pond 1 – Facing Northwest (SS-2017-02)



Photo II-C-4 South End of Seepage Pond 1 – Facing Northwest (SS-2017-03)



Photo II-C-5 Seepage Pond 1 Outlet (SS-2017-03)



Photo II-C-6 Slimes Pond 2 – Slimes excavate/removed in 2017 – Facing North (SS-2017-05)



Photo II-C-7 Slimes Pond 2 Crest – Facing East (SS-2017-06)

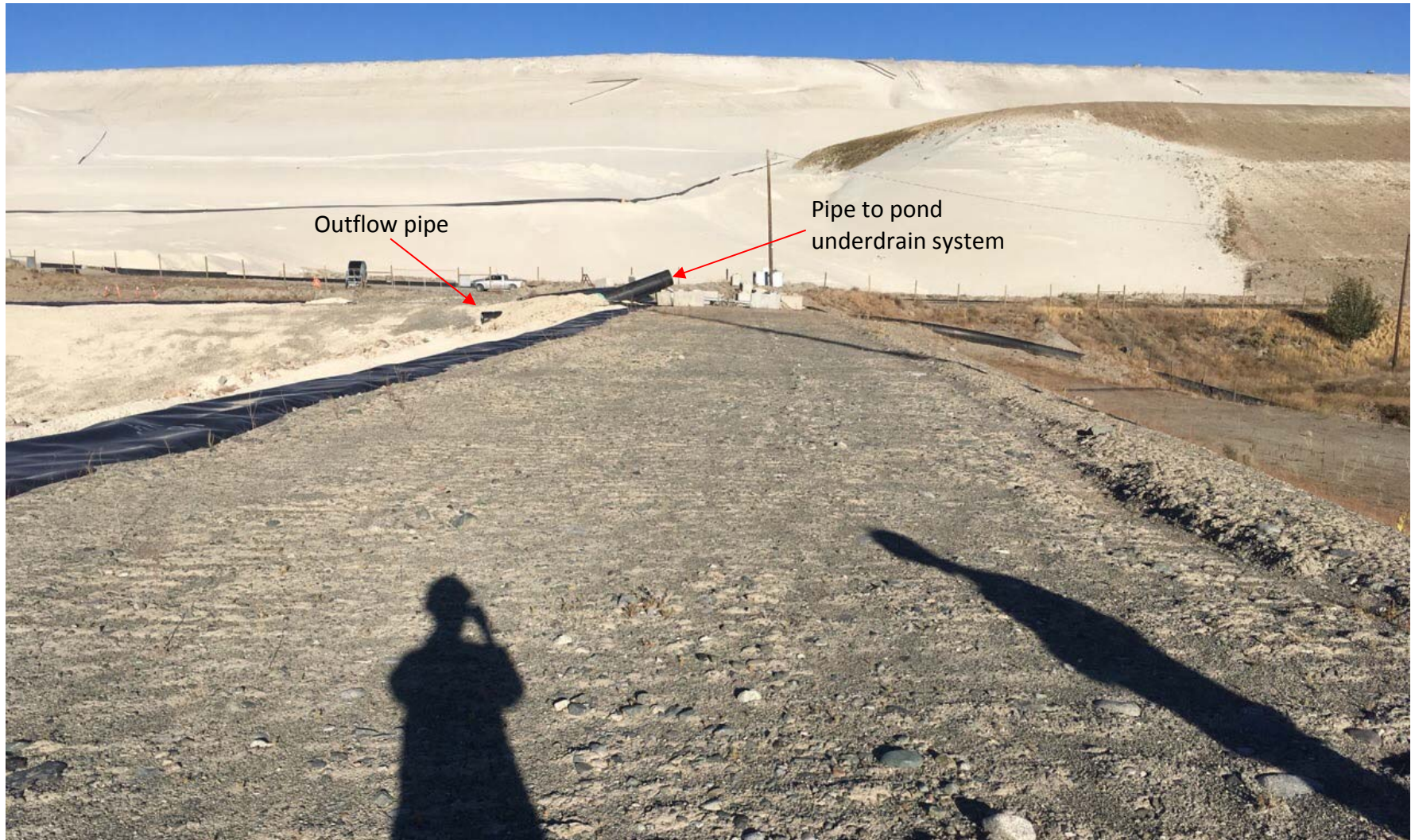


Photo II-C-8 Slimes Pond 2 Downstream Face – Facing East (SS-2017-06)



Photo II-C-9 Seepage Pond 2 Overview – Facing Southeast (SS-2017-06)



Photo II-C-10 Seepage Pond 2 Outflow Pipe – Facing West; Outlet not yet repaired (SS-2017-08)



Photo II-C-11 Seepage Pond 2 Tear in Liner Repaired in 2017 – On east side of pond (SS-2017-08)



Photo II-C-12 Seepage Pond 2 Outlet Pipe and Lock-block Wall (SS-2017-07)



Photo II-C-13 Seepage Water Reclaim Pond – Facing North (SS-2017-09)



Photo II-C-14 Seepage Water Reclaim Pond – Outfall from Woods Creek Diversion – Facing Northwest (SS-2017-09)



Outfall from Woods Creek
Diversion

Photo II-C-15 Slimes Pond 3 (partially constructed) – Facing West (SS-2017-01)



Photo II-C-16 Slimes Pond 3 (partially constructed) – Facing South (SS-2017-10)

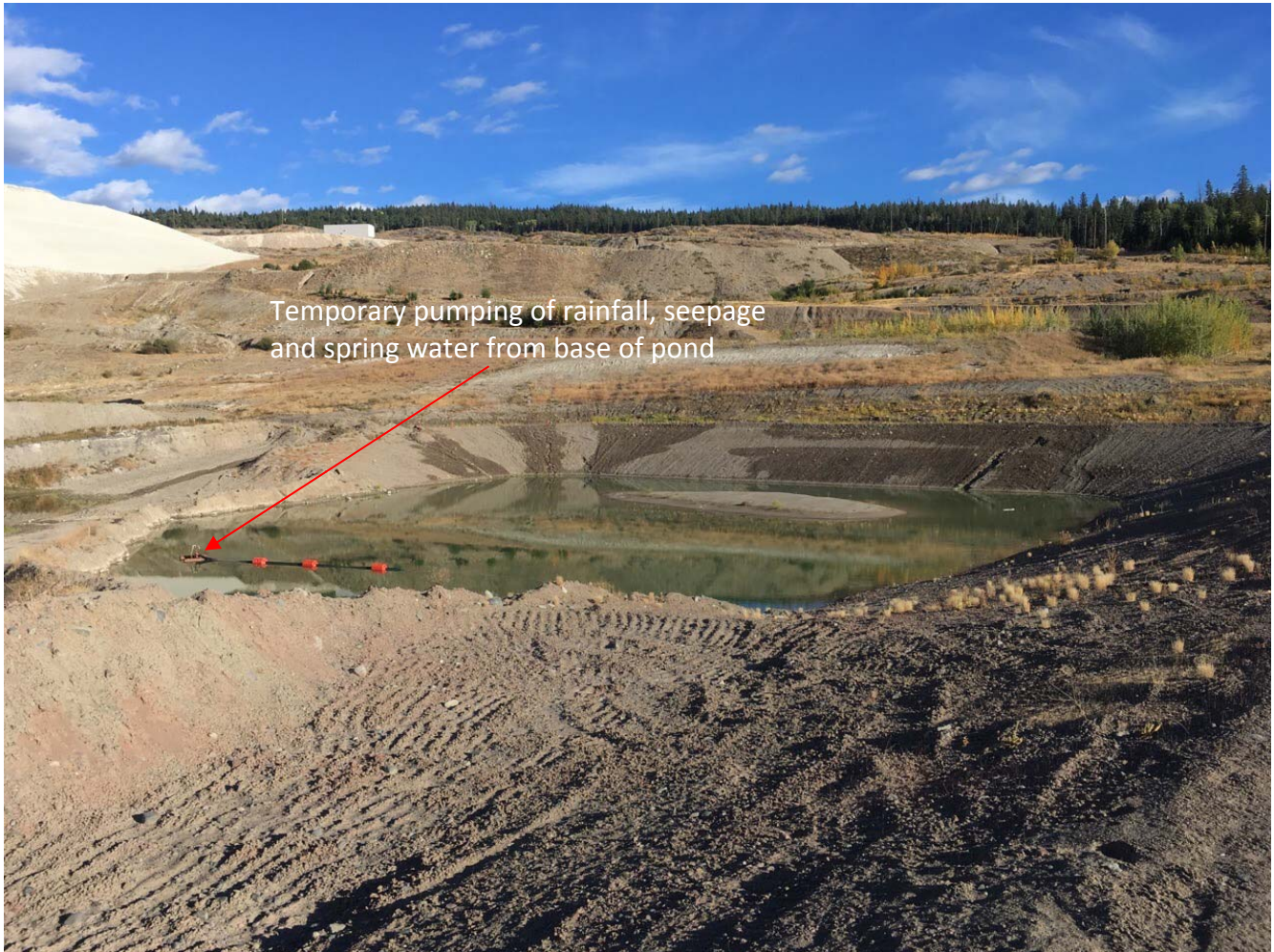


Photo II-C-17 Slimes Pond 3 (partially constructed) – Ponded Water on Crest from Spring Lines in Slope – Facing East (SS-2017-11)



APPENDIX II-D

24 Mile Lake Inspection Photographs

Appendix II-D Inspection Photographs - 24 Mile Lake

LEGEND:

- ML = 24 Mile Lake.
- ML-2017-## refers to 2017 DSI waypoint shown on Figure 4.
- All photographs taken during inspection on September 26 and 27, 2017.

Photo II-D-1 Overview of 24 Mile Lake, facing H-H Dam (north); >10 m freeboard observed (ML-2017-03)



Photo II-D-2 West side of Lake; multiple erosion gullies observed (ML-2017-01)

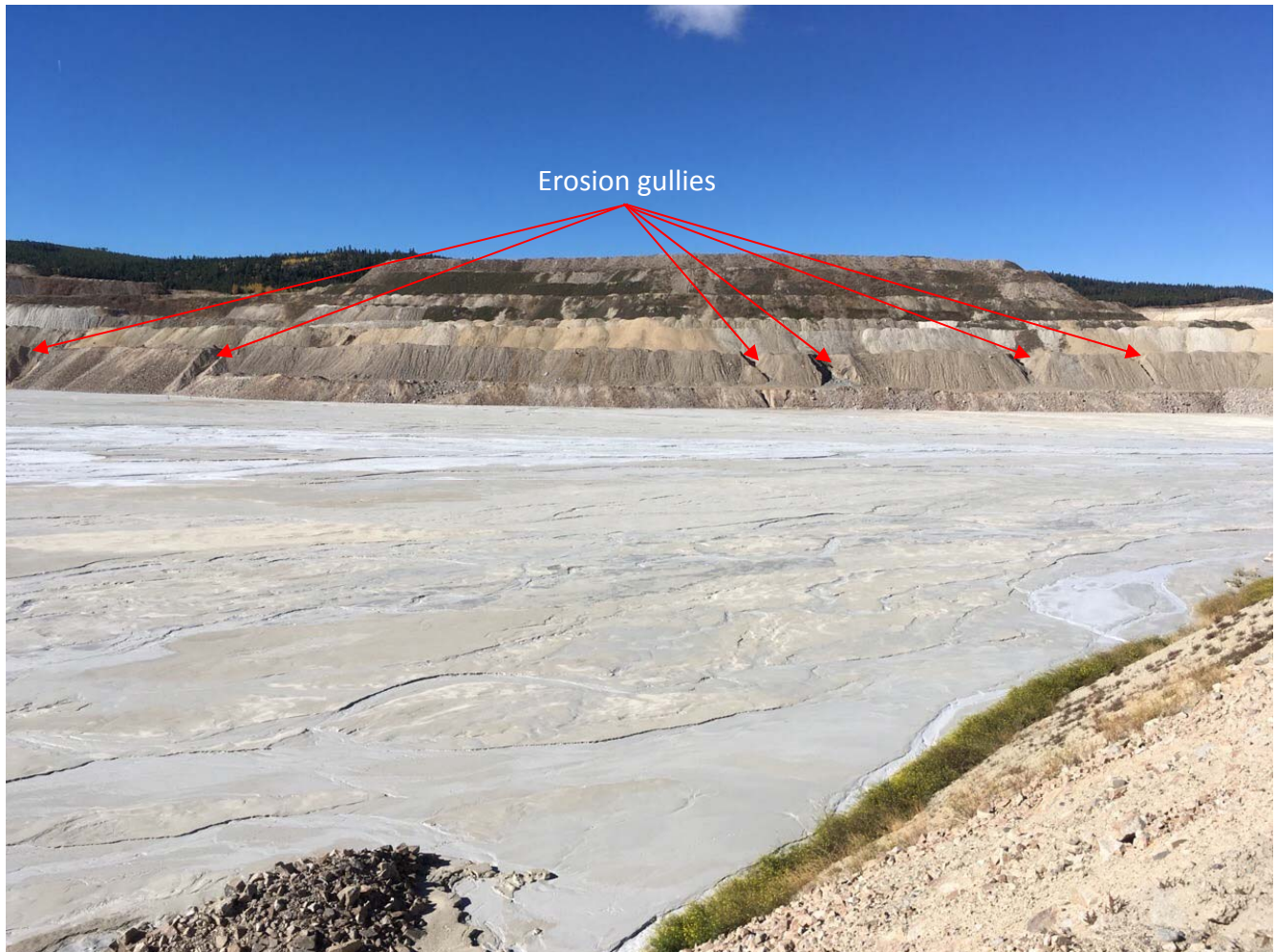


Photo II-D-3 Outflow pump location, facing H-H Dam (northwest) (ML-2017-02)



Photo II-D-4 East side of Lake (ML-2017-04)



Photo II-D-5 Southeast Side of Lake (ML-2017-01)



Photo II-D-6 H-H Pumphouse outflow channel, facing south (ML-2017-05)



Photo II-D-7 H-H Pumphouse emergency dump outflow pipes, facing southwest (ML-2017-06)



APPENDIX III

Reference Dam Design Drawings

Appendix III Design Drawings

III-A – L-L Dam

Design drawings are taken from the following report:

- Klohn Crippen Berger. 2010. “Tailings Storage Facility - Ultimate Dam Crest Elevation for 2028 Mine Plan”, August 20.

List of drawings -

- Figure 4 L-L Dam General Arrangement Ultimate Dam
- Figure 9 L-L Ultimate Dam Station 1+160
- Figure 10 L-L Ultimate Dam Station 1+600
- Figure 11 L-L Ultimate Dam Station 2+000
- Figure 12 L-L Ultimate Dam Station 2+200
- Figure 13 L-L Ultimate Dam Station 2+550
- Figure 14 L-L Ultimate Dam Station 2+900
- Figure 15 L-L Ultimate Dam Station 3+200
- Figure 17 Ultimate Dam Spillway, LLO and Drainage Ditches Preliminary Arrangement – Plan
- Figure 18 Ultimate Dam Spillway and LLO Preliminary Profiles & Typ. Sections

III-B – H-H Dam

Design drawings are taken from the following report:

- Klohn Crippen Berger. 2010. “Tailings Storage Facility - Ultimate Dam Crest Elevation for 2028 Mine Plan”, August 20.

List of drawings -

- Figure 5 H-H Dam General Arrangement Ultimate Dam
- Figure 16 H-H Ultimate Dam Station 1+500

III-C – L-L Dam Seepage and Slimes Ponds

C-1 – Seepage Pond 1

No design drawings available

C-2 - Seepage Pond 2

- THVCP Drawing 1011-021-SlimePond-ASB.dwg “Slimes Pond Plan and Sections”, September 2012 (as-built)
- THVCP Drawing “Seepage Pond #2 Ditch Design”, February 2014

C-3 – Slimes Pond 1

No design drawings available

C-4 – Slimes Pond 2

- Drawing No. D-74001 “Slimes Pond 2 Earthworks Plan”, Oct 2014.
- Drawing No. D-74002 “Slimes Pond 2 Cross Sections and Liner Details”, Oct 2014.
- Drawing No. D-74003 “Slimes Pond 2 Outflow Pipe and Underdrain Sump Details”, Oct 2014.
- Drawing No. D-74004 “Slimes Pond 2 Fill and Placement Specifications”, Oct 2014.

C-5 – Seepage Water Reclaim Pond

- Drawing 111-803-140 Rev 1 “Water Collection Dam L-L Axis Plan and Sections” 1977

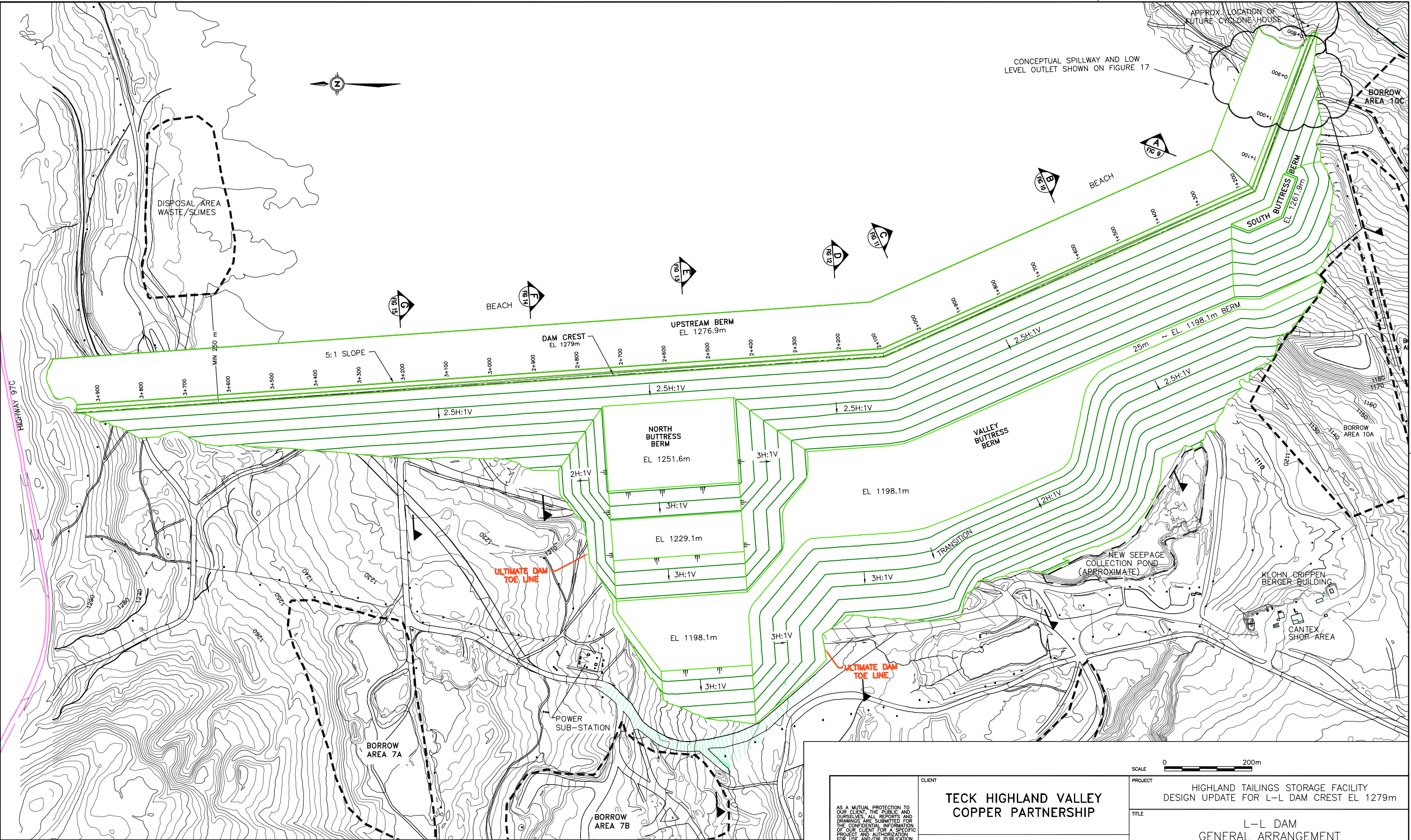
III-C – 24 Mile Lake

No design drawings available

APPENDIX III-A

L-L Dam

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NOTES
 1. LOCATION OF SLIME POND TO BE DETERMINED.

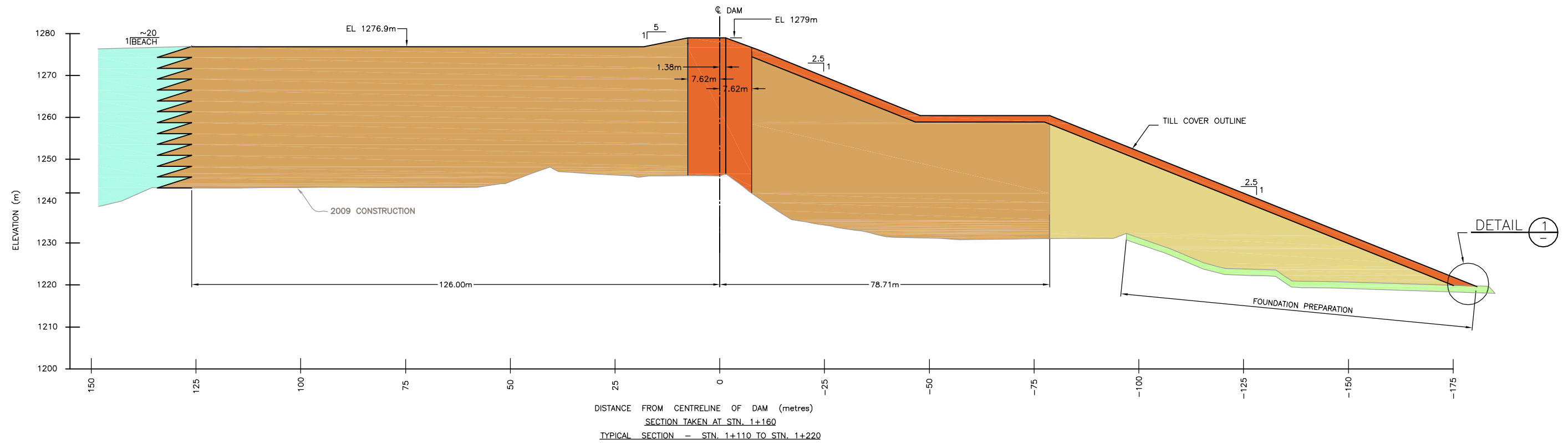
AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS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

CLIENT
**TECK HIGHLAND VALLEY
 COPPER PARTNERSHIP**

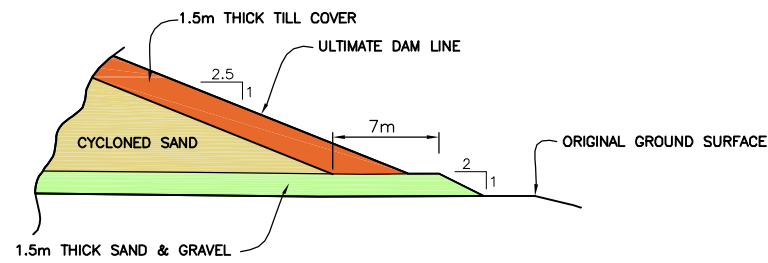
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PROJECT No.	M02341A50	FIG. No.
		4

KCB-R-MD

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 Drawing File: M:\02341A46 - HVC 2009 Tailings Facility\400 Design\410 Drawings\working-cy\2028-el1279\design-update\figure 7.dwg (swong)



SECTION A
 FIG 4



DETAIL 1
 SCALE 1:500

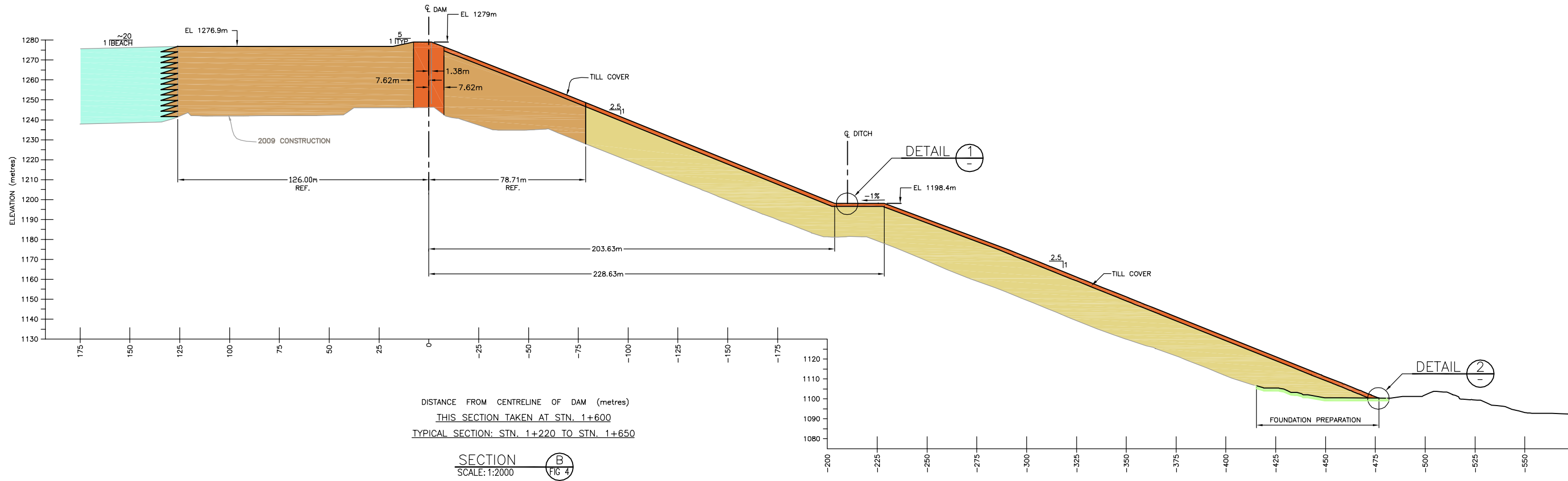
LEGEND

- BEACH TAILINGS
- COMPACTED CYCLONED SANDFILL WITH FINES CONTENT < 20%
- COMPACTED CYCLONED SANDFILL WITH FINES CONTENT < 10%
- COMPACTED GLACIAL TILL
- SAND AND GRAVEL



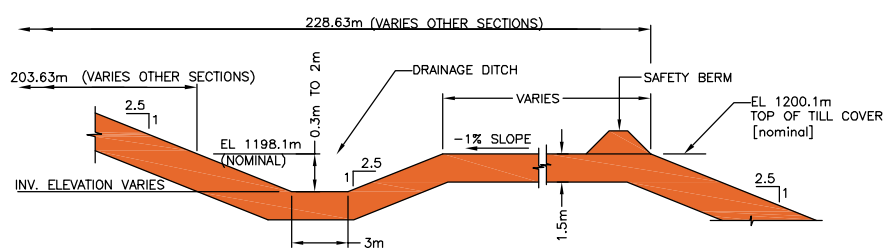
AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.	CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY DESIGN UPDATE FOR L-L DAM CREST EL 1279m
		TITLE L-L ULTIMATE DAM STATION 1+160
	PROJECT No. M02341A50	FIG. No. 9

Time: 15:13:15
 Date: 8/11/2010
 Scale: 1=500
 Drawing File: M:\02341A46 - HVC_2008 Tailings Facility\400 Design\410 Drawings\working-cy\2028-el1279\design-update\figure_8.dwg (cwong)

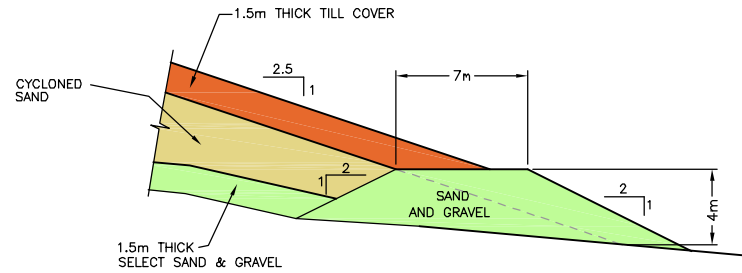


DISTANCE FROM CENTRELINE OF DAM (metres)
 THIS SECTION TAKEN AT STN. 1+600
 TYPICAL SECTION: STN. 1+220 TO STN. 1+650

SECTION (B) FIG 4
 SCALE: 1:2000



DETAIL 1
 SCALE: 1:400



DETAIL 2
 SCALE: 1:400

LEGEND

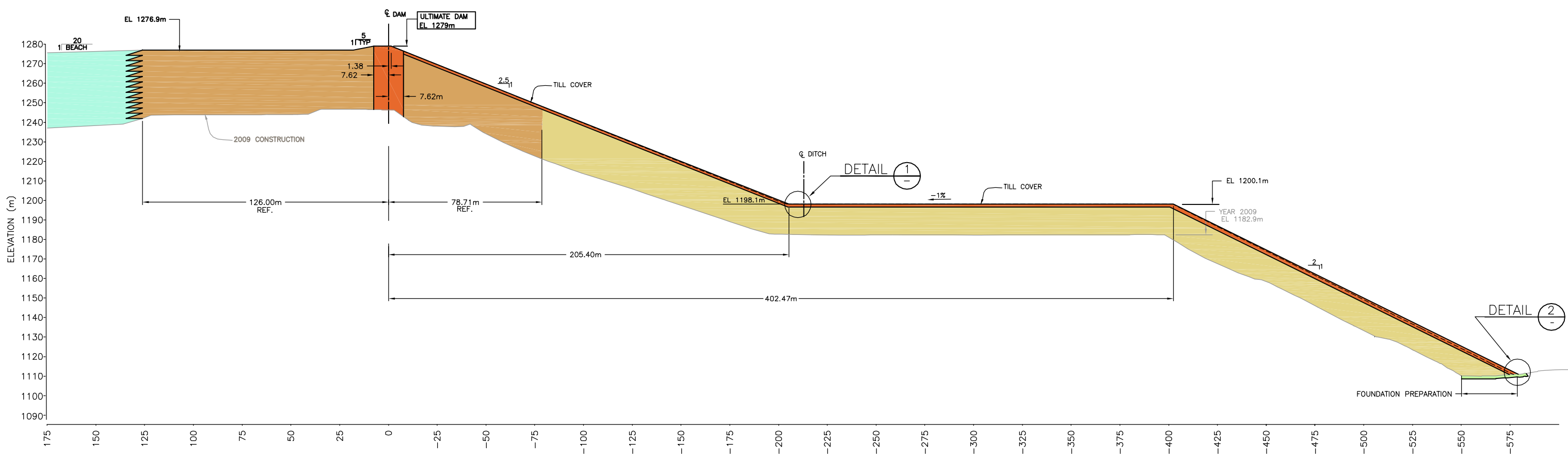
- BEACH TAILINGS
- COMPACTED CYCLONED SANDFILL WITH FINES CONTENT < 20%
- COMPACTED CYCLONED SANDFILL WITH FINES CONTENT < 10%
- COMPACTED GLACIAL TILL
- SAND AND GRAVEL



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		L-L ULTIMATE DAM STATION 1+600
	PROJECT No. M02341A50	FIG. No. 10

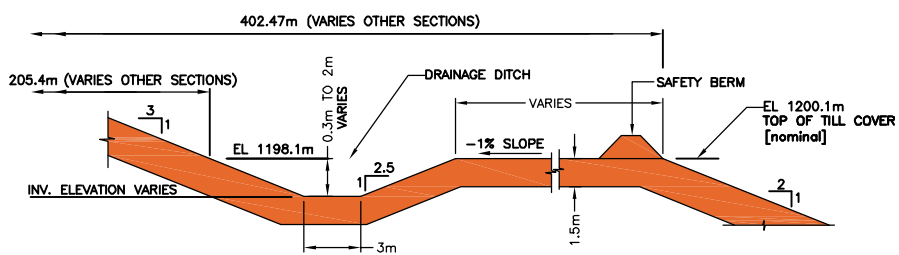
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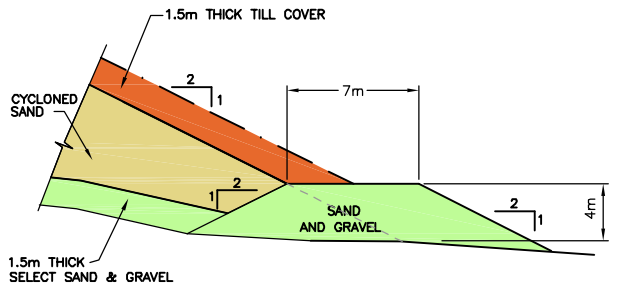


DISTANCE FROM CENTRELINE OF DAM (m)
 THIS SECTION TAKEN AT STN. 2+000
 TYPICAL SECTION: STN. 1+650 TO 2+100
SECTION C
 SCALE 1:2000 **FIG 4**

- LEGEND**
- BEACH TAILINGS
 - COMPACTED CYCLONED SANDFILL WITH FINES CONTENT < 20%
 - COMPACTED CYCLONED SANDFILL WITH FINES CONTENT < 10%
 - COMPACTED GLACIAL TILL
 - SAND AND GRAVEL



DETAIL 1
SCALE 1:400

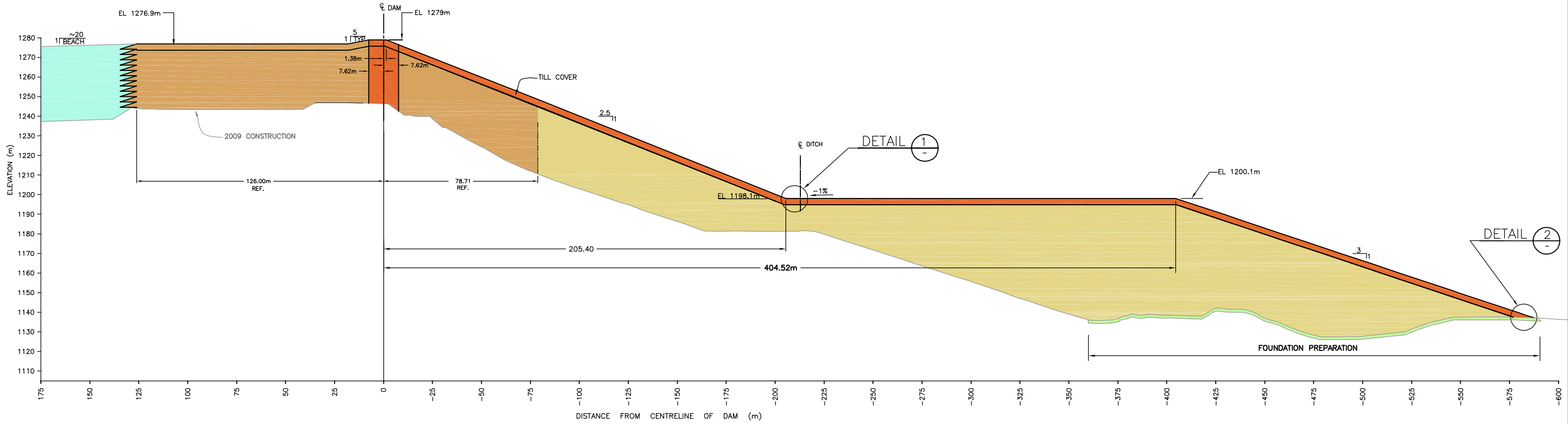


DETAIL 2
SCALE 1:400



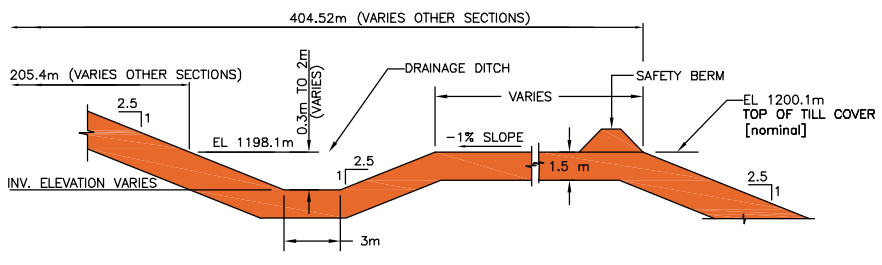
AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR REPRODUCTION OF DATA STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.	CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY DESIGN UPDATE FOR L-L DAM CREST EL 1279m
		TITLE L-L ULTIMATE DAM STATION 2+000
	PROJECT No. M02341A50	FIG. No. 11

KCB-21-210

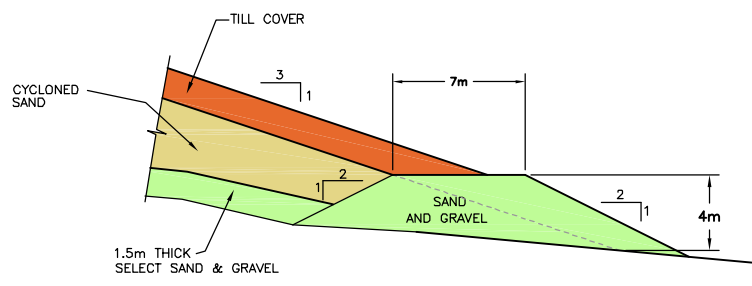


DISTANCE FROM CENTRELINE OF DAM (m)
 THIS SECTION TAKEN @ STN. 2+200
 TYPICAL SECTION : STN. 2+100 TO STN. 2+450

SECTION **D**
 SCALE: 1:2000



DETAIL **1**
 SCALE: 1:400



DETAIL **2**
 SCALE: 1:400

- LEGEND**
- BEACH TAILINGS
 - COMPACTED CYCLONED SANDFILL WITH FINES CONTENT < 20%
 - COMPACTED CYCLONED SANDFILL WITH FINES CONTENT < 10%
 - COMPACTED GLACIAL TILL
 - SAND AND GRAVEL

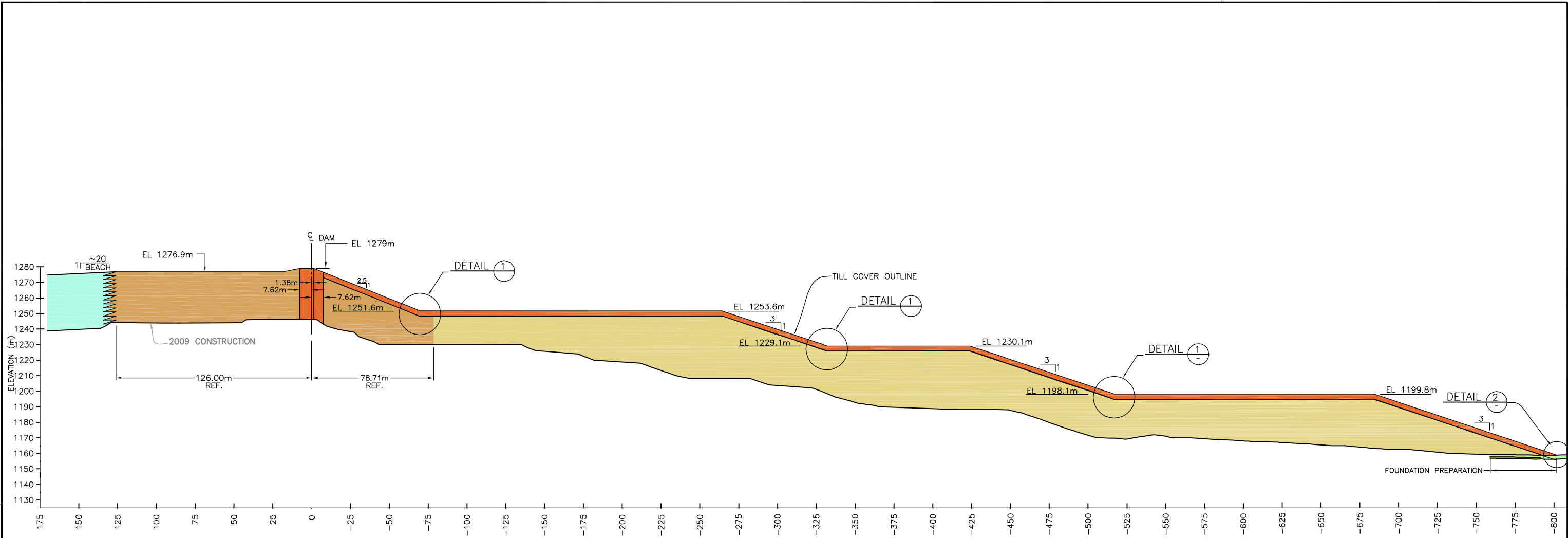


AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.	CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY DESIGN UPDATE FOR L-L DAM CREST EL 1279m
		TITLE L-L ULTIMATE DAM STATION 2+200
	PROJECT No. M02341A50	FIG. No. 12

Time: 15:9:22
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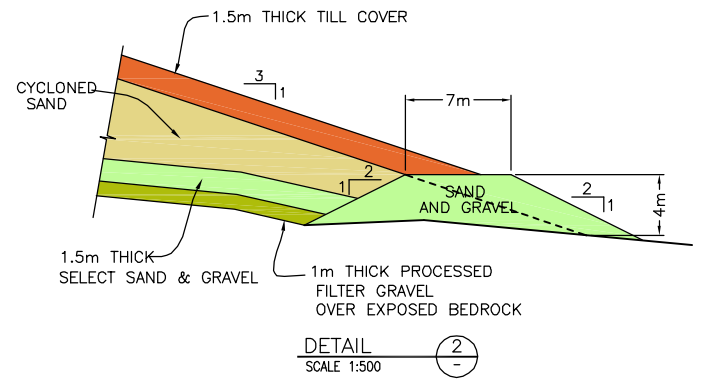
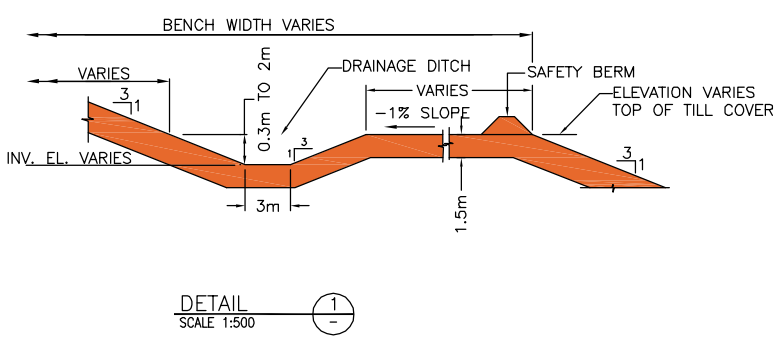
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THIS SECTION TAKEN AT STN. 2+550
 TYPICAL SECTION: STN. 2+450 TO STN. 2+750

SECTION E
 SCALE 1:2500



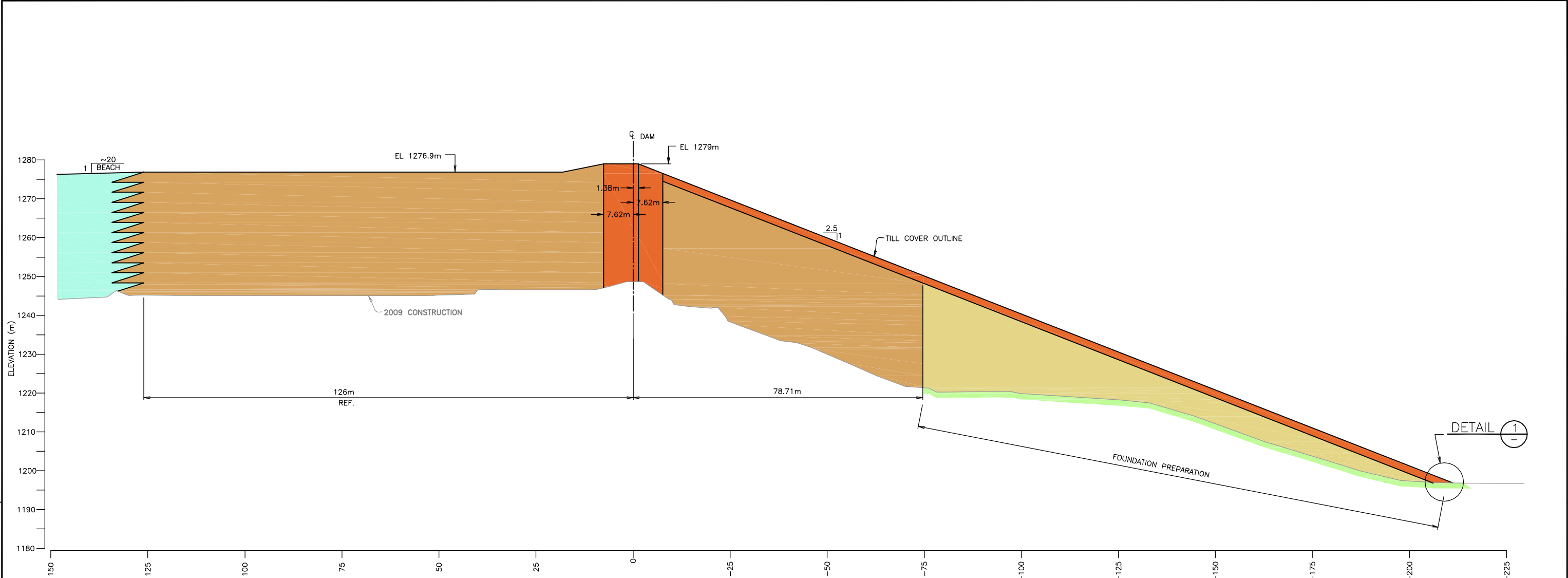
- LEGEND**
- BEACH TAILINGS
 - COMPACTED CYCLONED SANDFILL WITH FINES CONTENT < 20%
 - COMPACTED CYCLONED SANDFILL WITH FINES CONTENT < 10%
 - COMPACTED GLACIAL TILL
 - SAND AND GRAVEL
 - PROCESSED FILTER GRAVEL



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		TITLE L-L ULTIMATE DAM STATION 2+550
	PROJECT No. M02341A50	FIG. No. 13

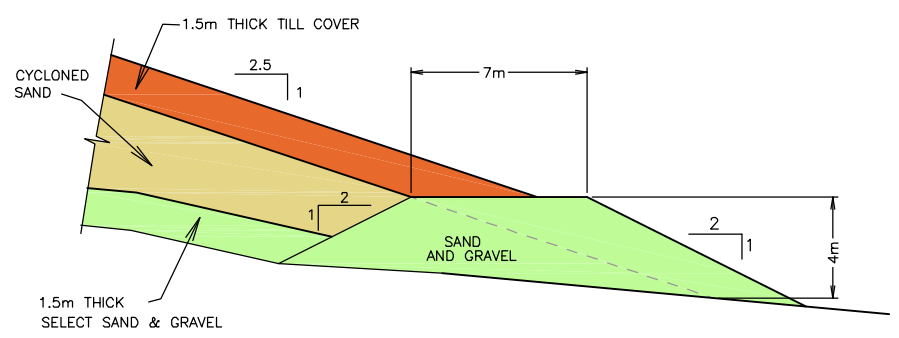
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DISTANCE FROM CENTRELINE OF DAM (m)
 SECTION TAKEN AT STN. 2+900
 TYPICAL SECTION : STN. 2+750 TO STN. 3+000

SECTION **F**
 SCALE 1:1000 **FIG 4**



DETAIL **1**
 SCALE 1:300

LEGEND

- BEACH TAILINGS
- COMPACTED CYCLOPED SANDFILL WITH FINES CONTENT < 20%
- COMPACTED CYCLOPED SANDFILL WITH FINES CONTENT < 10%
- COMPACTED GLACIAL TILL
- SAND AND GRAVEL

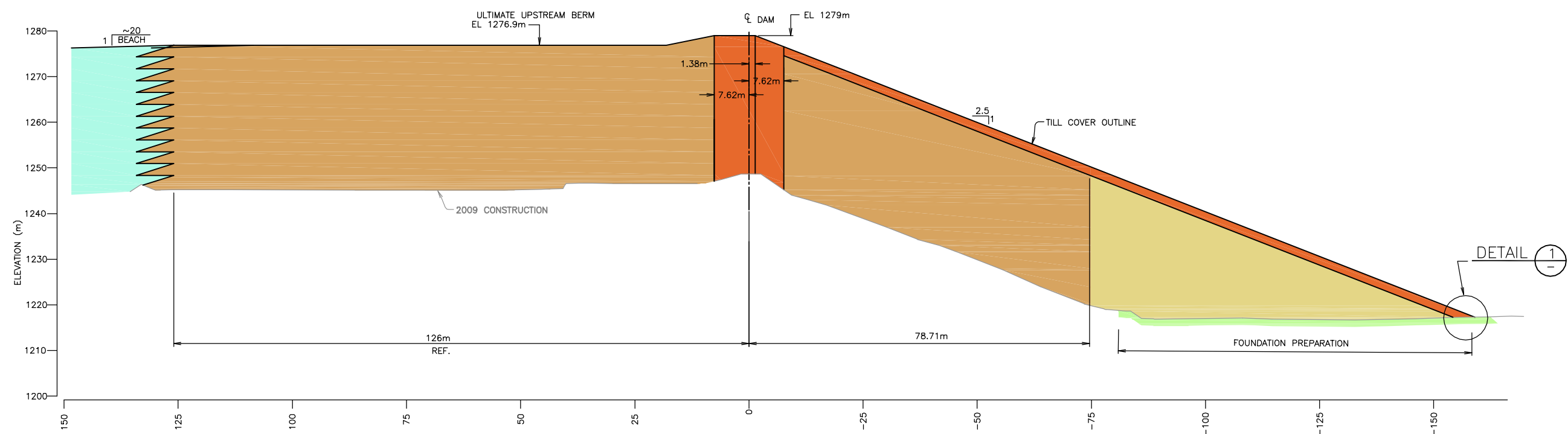


AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.	CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY DESIGN UPDATE FOR L-L DAM CREST EL 1279m
	TITLE L-L ULTIMATE DAM STATION 2+900	
PROJECT No. M02341A50		FIG. No. 14

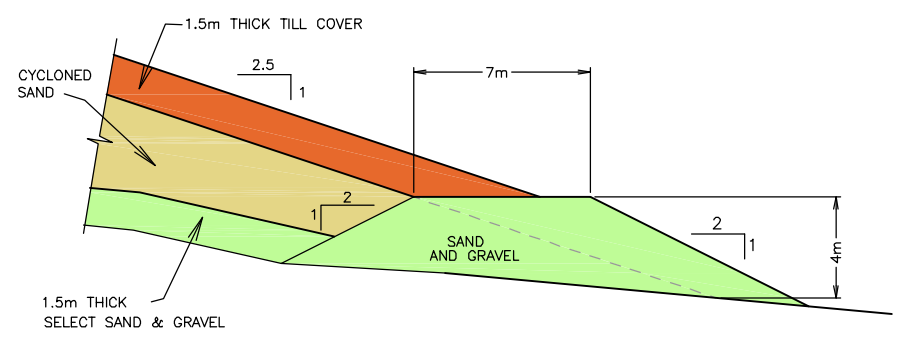


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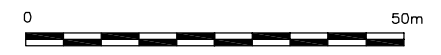


DISTANCE FROM CENTRELINE OF DAM (m)
 SECTION TAKEN AT STN. 3+200
 TYPICAL SECTION : STN. 3+000 TO STN. 3+670
SECTION G
 SCALE 1:1000 FIG 4



DETAIL 1
 SCALE 1:300

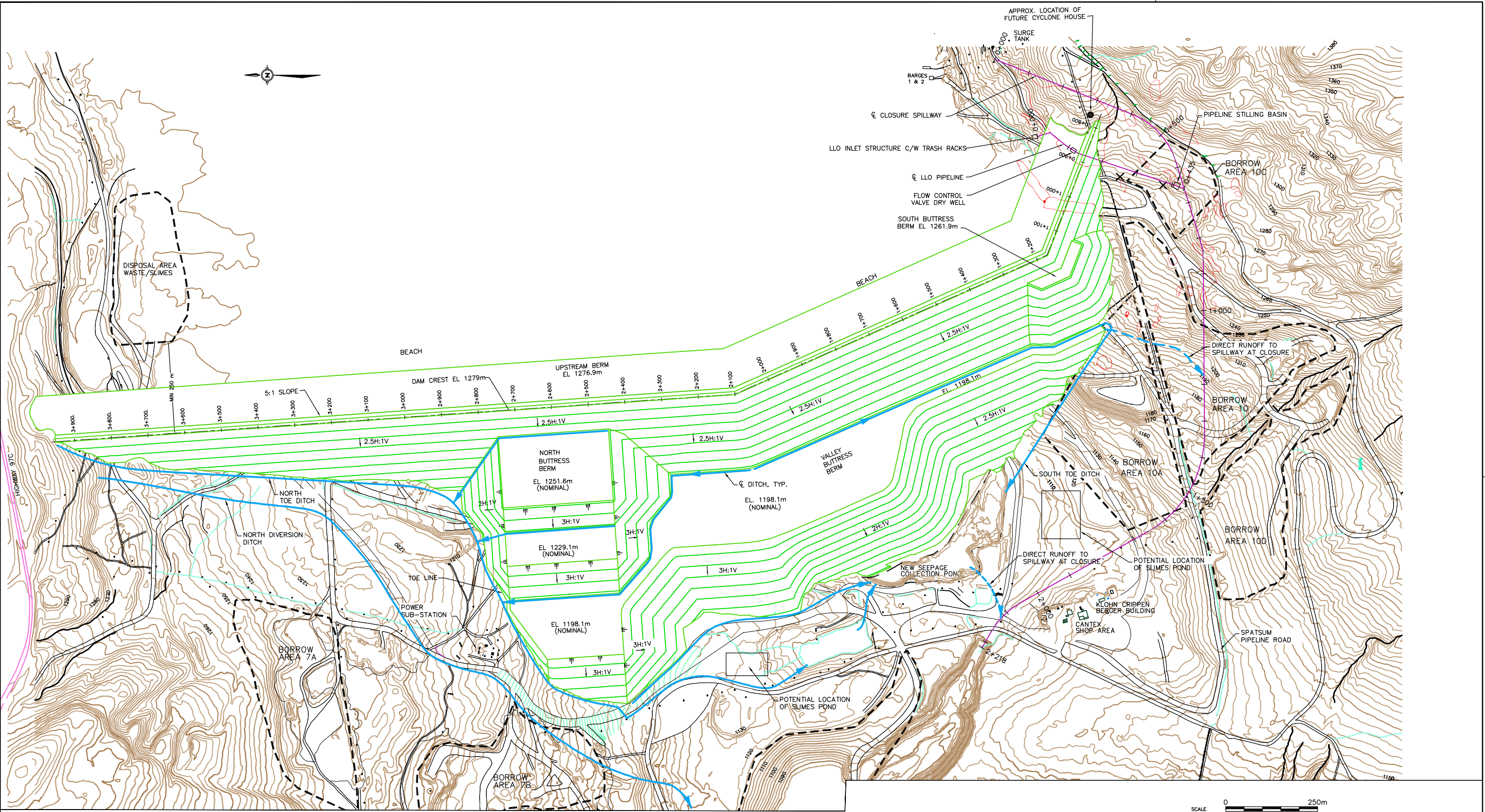
- LEGEND**
- BEACH TAILINGS
 - COMPACTED CYCLONED SANDFILL WITH FINES CONTENT < 20%
 - COMPACTED CYCLONED SANDFILL WITH FINES CONTENT < 10%
 - COMPACTED GLACIAL TILL
 - SAND AND GRAVEL



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			TITLE L-L ULTIMATE DAM STATION 3+200
		PROJECT No. M02341A50	FIG. No. 15

KCB-R-MLD

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LEGEND	
x	ROCK OUTCROP LOCATION
[Red outline]	ROCK OUTCROP OUTLINE (NOTE 2)
[Dashed line]	BORROW AREAS
LLO	LOW LEVEL OUTLET

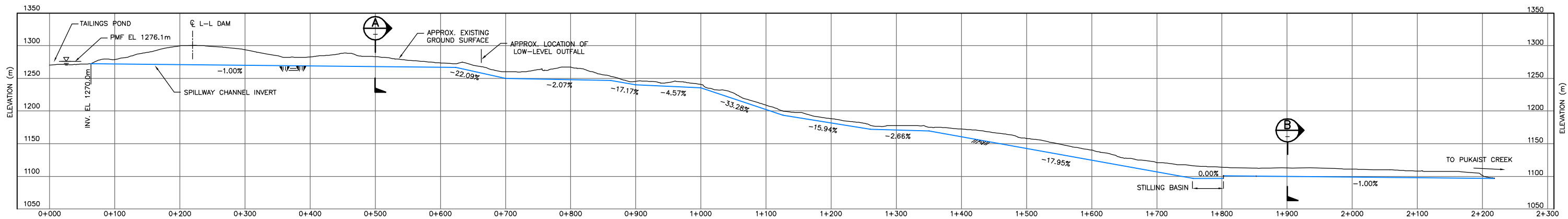
- NOTES:**
1. TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER, JAN 27, 2010.
 2. ROCK OUTCROP OUTLINES WERE MAPPED IN 1990.
 3. DETAILS OF UPSTREAM DAM FILL TO SUIT LOW LEVEL OUTLET ARE TO BE DETERMINED.
 4. FOR PROFILE OF SPILLWAY AND LOW LEVEL OUTLET SEE FIG. 18

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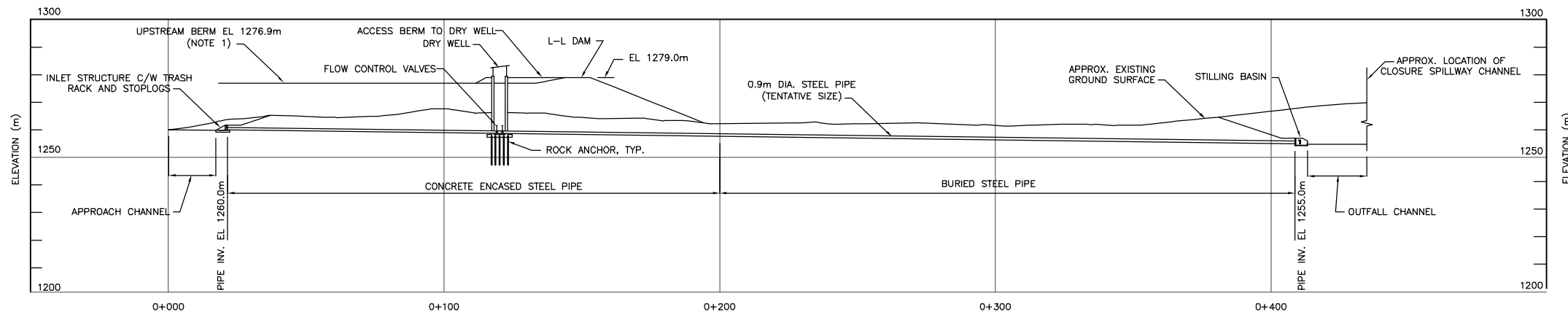
CLIENT
TECK HIGHLAND VALLEY COPPER PARTNERSHIP

SCALE 0 250m	PROJECT HIGHLAND TAILINGS STORAGE FACILITY DESIGN UPDATE FOR L-L DAM CREST EL 1279m
TITLE ULTIMATE DAM SPILLWAY, LLO AND DRAINAGE DITCHES PRELIMINARY ARRANGEMENT-PLAN	PROJECT No. M02341A50
FIG. No. 17	

KCB-R-MD

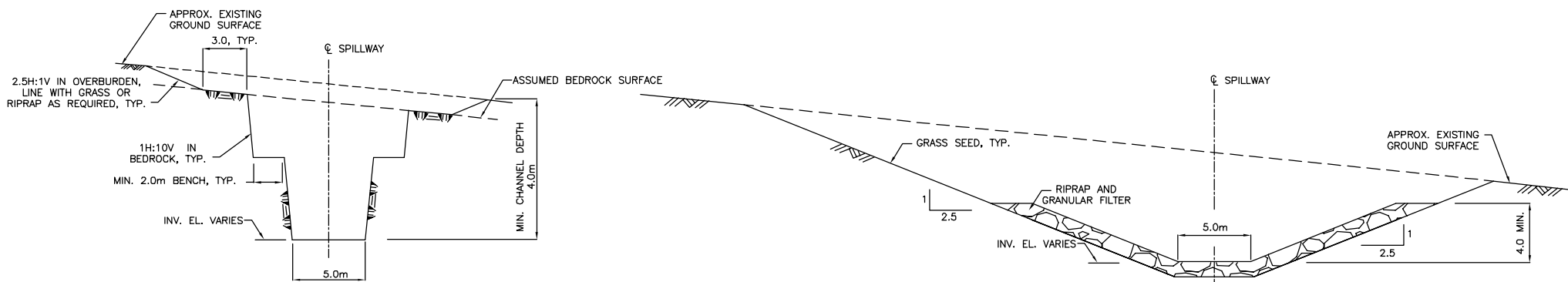


CLOSURE SPILLWAY PROFILE
(EXISTING AND PROPOSED ROADS NOT SHOWN)
SCALE A



LOW LEVEL OUTLET PROFILE
SCALE B

- NOTES:**
1. DETAILS OF UPSTREAM BERM (EL 1276.9m) AND TAILING BEACH TO SUIT LOW-LEVEL OUTLET ARE TO BE DETERMINED.



SECTION A
SCALE C

TYP. SPILLWAY SECTION IN BEDROCK

SECTION B
SCALE C

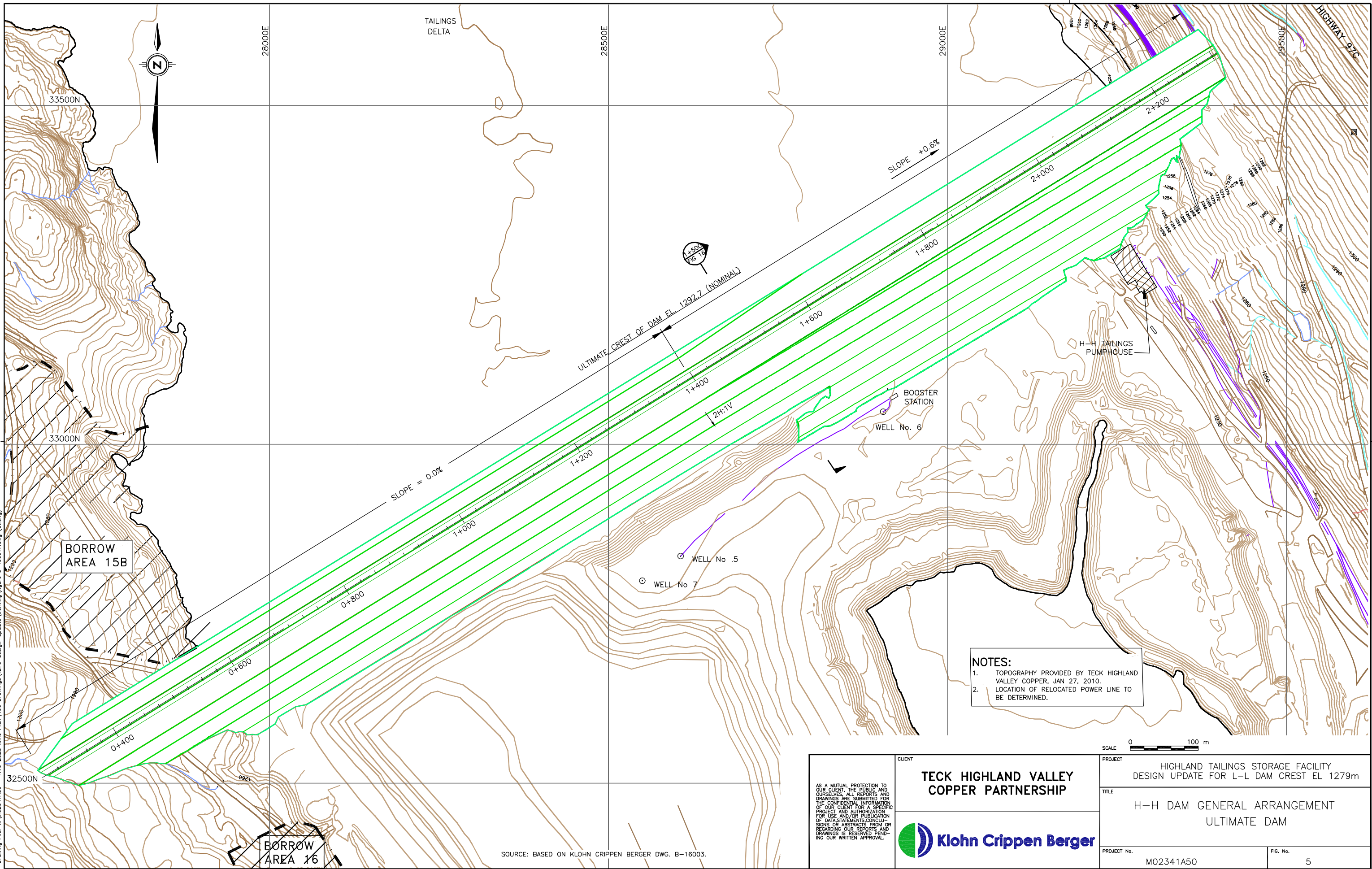
TYP. SPILLWAY SECTION IN OVERBURDEN



<p>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</p>	<p>CLIENT</p> <p>TECK HIGHLAND VALLEY COPPER PARTNERSHIP</p>	<p>PROJECT</p> <p>HIGHLAND TAILINGS STORAGE FACILITY DESIGN UPDATE FOR L-L DAM CREST EL 1279m</p>
	<p>Klohn Crippen Berger</p>	<p>TITLE</p> <p>ULTIMATE DAM SPILLWAY AND LLO PRELIMINARY PROFILES & TYP. SECTIONS</p>
<p>PROJECT No.</p> <p>M02341A50</p>		<p>FIG. No.</p> <p>18</p>

APPENDIX III-B

H-H Dam



NOTES:
 1. TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER, JAN 27, 2010.
 2. LOCATION OF RELOCATED POWER LINE TO BE DETERMINED.



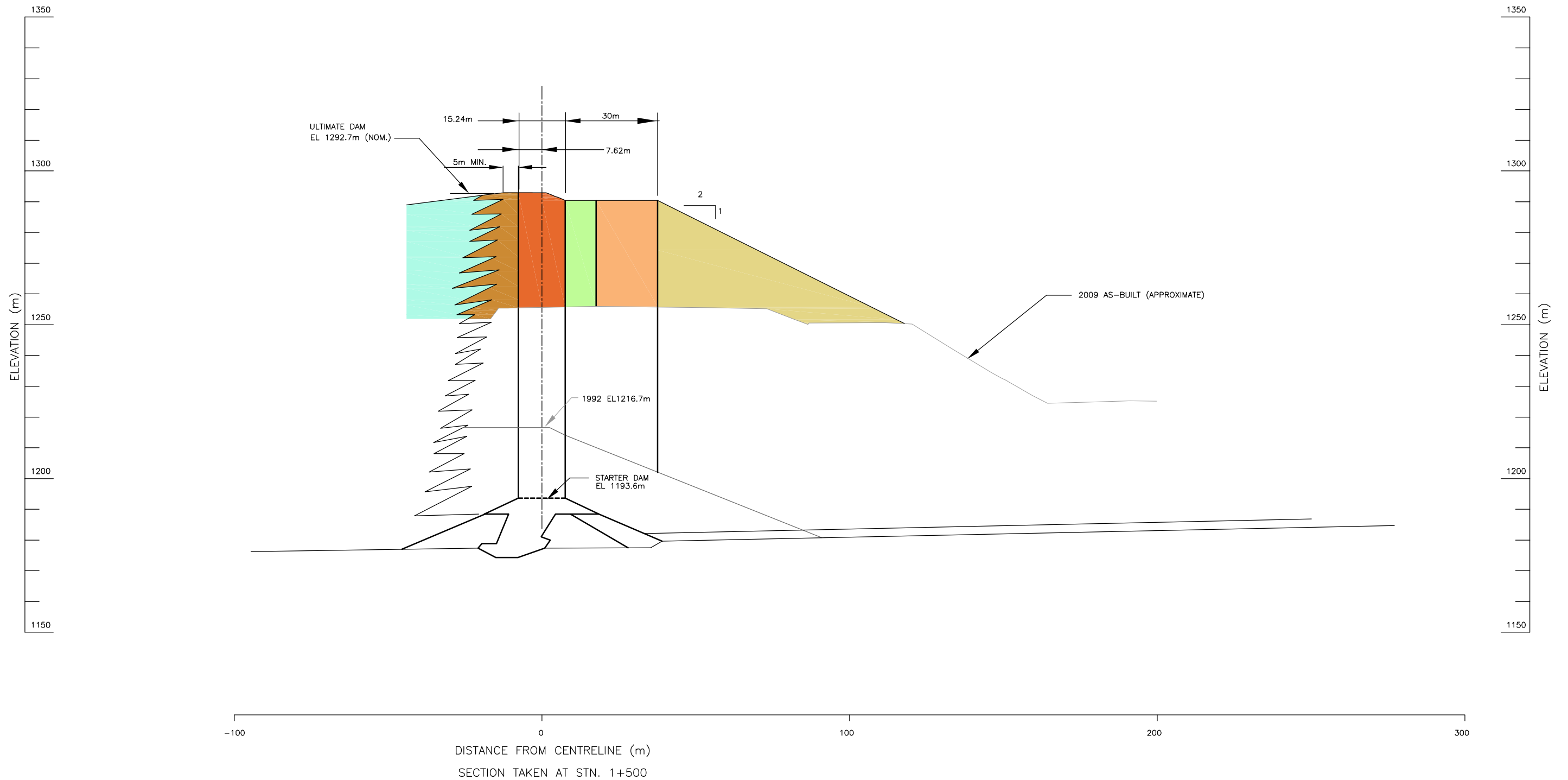
<small>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</small>	CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY DESIGN UPDATE FOR L-L DAM CREST EL 1279m
		TITLE H-H DAM GENERAL ARRANGEMENT ULTIMATE DAM
PROJECT No. M02341A50		FIG. No. 5

SOURCE: BASED ON KLOHN CRIPPEN BERGER DWG. B-16003.

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KCB-R-MD

Time: 14:40:56
 Date: 9/16/2010
 Scale: 1:4 (P5)
 Drawing File: M:\M02341A50 - HVC 2028 Mine Plan\400 Drawings\1279 design-update\working\figure 8-100916.dwg (swong)



- LEGEND**
- BEACH TAILINGS
 - UPSTREAM RANDOM FILL
 - DOWNSTREAM TRANSITION STRUCTURAL FILL
 - DOWNSTREAM RANDOM ROCKFILL OR EARTH FILL
 - COMPACTED GLACIAL TILL
 - SAND AND GRAVEL

TO BE READ WITH KLOHN CRIPPEN REPORT DATED _____		SCALE 0 50m
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		TITLE H-H ULTIMATE DAM STATION 1+500
PROJECT No.	M02341A50	FIG. No.
	16	

KCB-11M

APPENDIX III-C

L-L Dam Seepage and Slimes Ponds

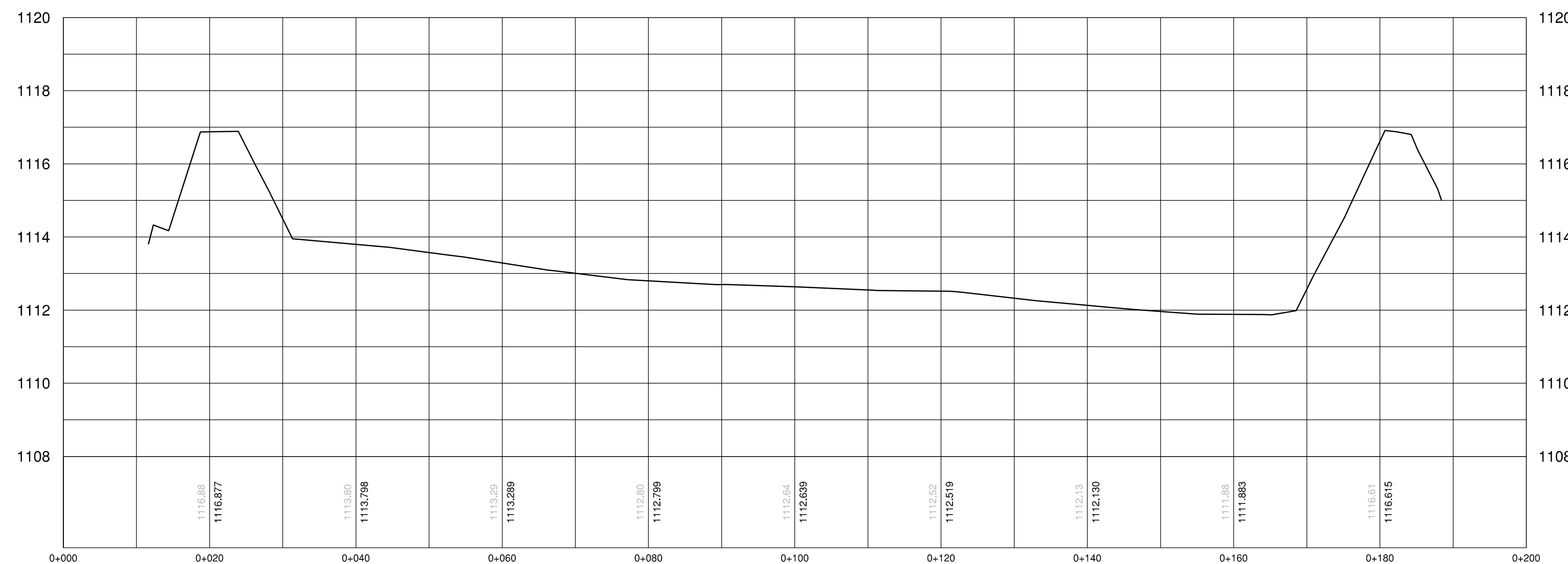
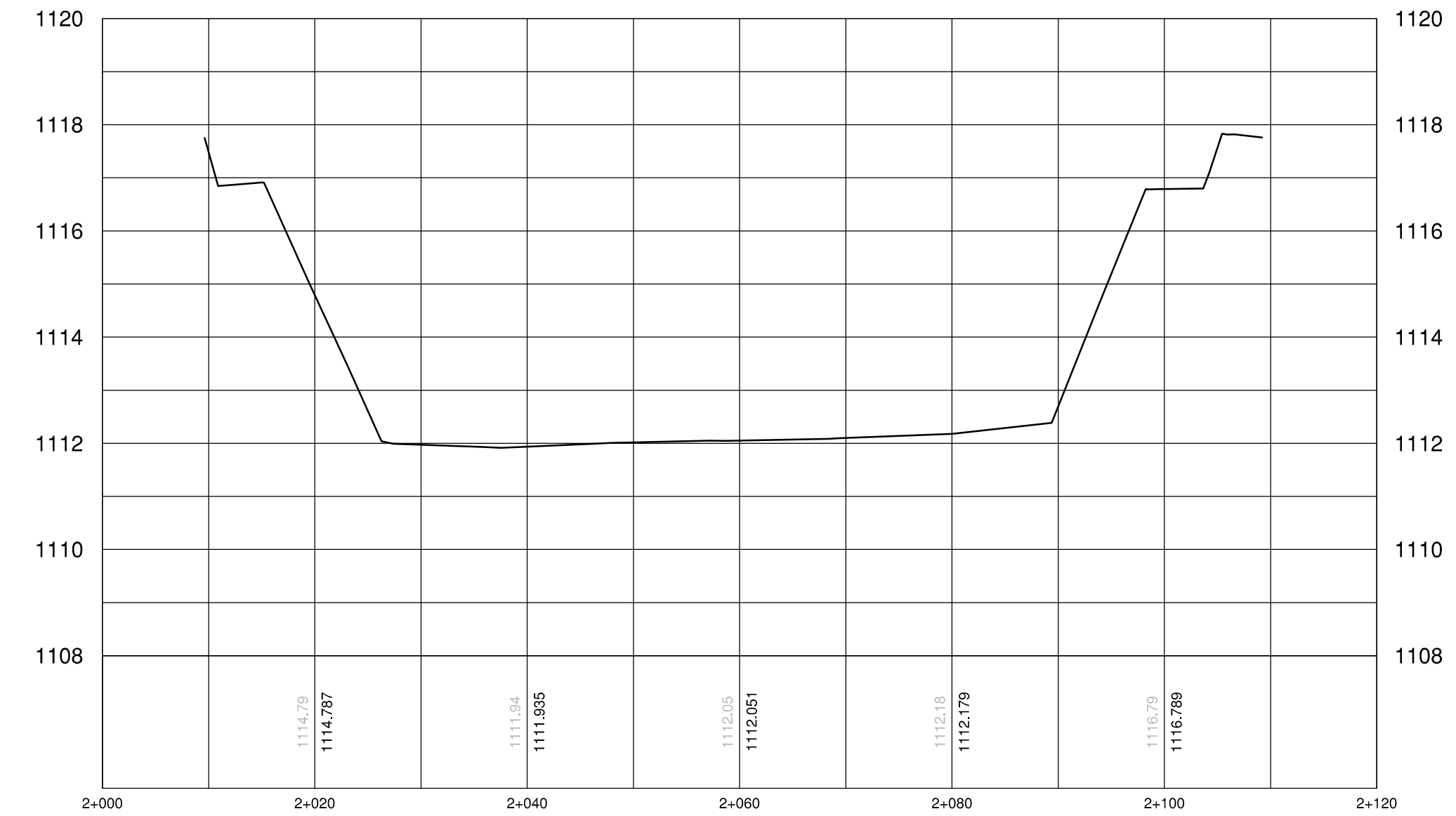
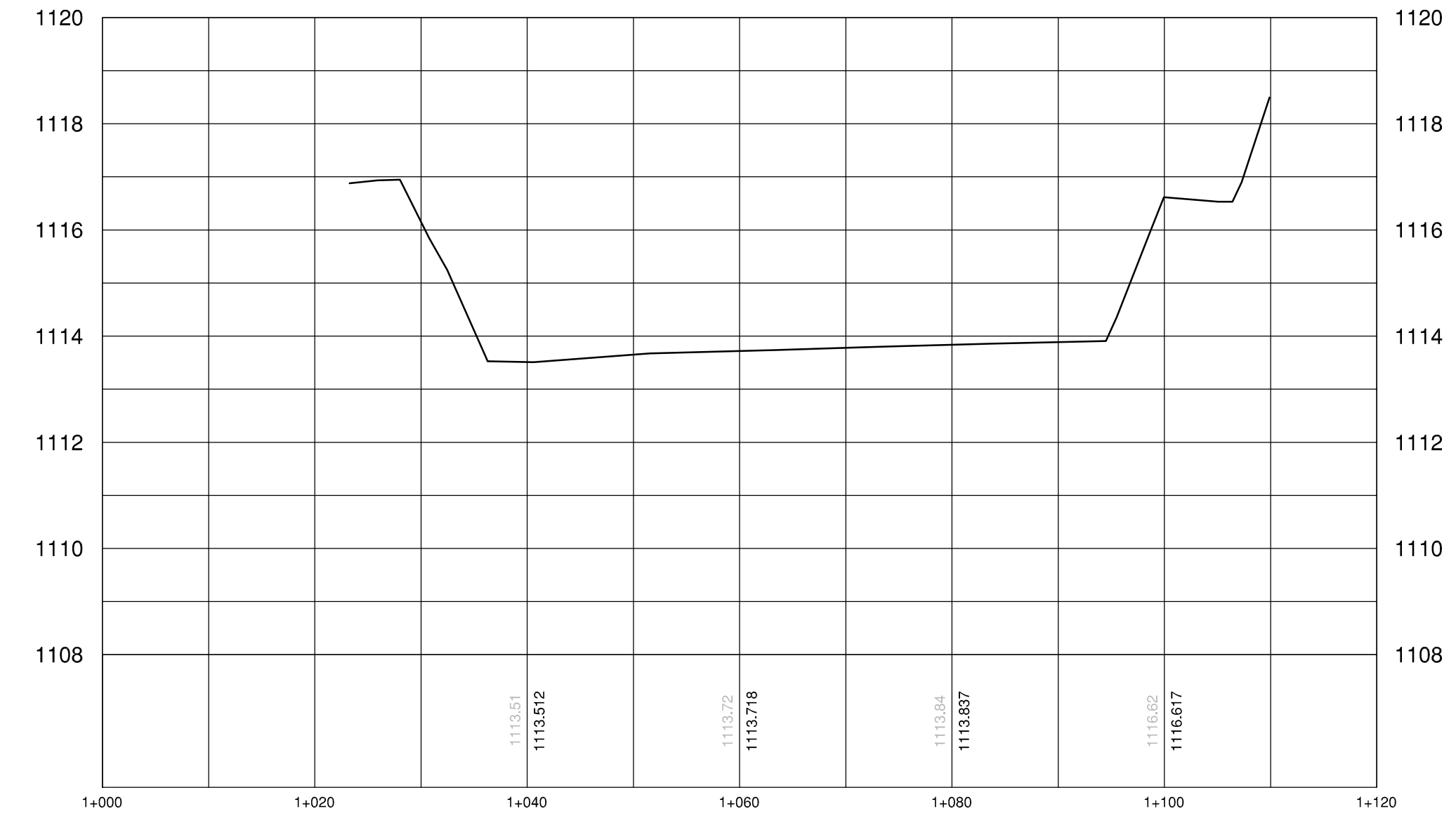
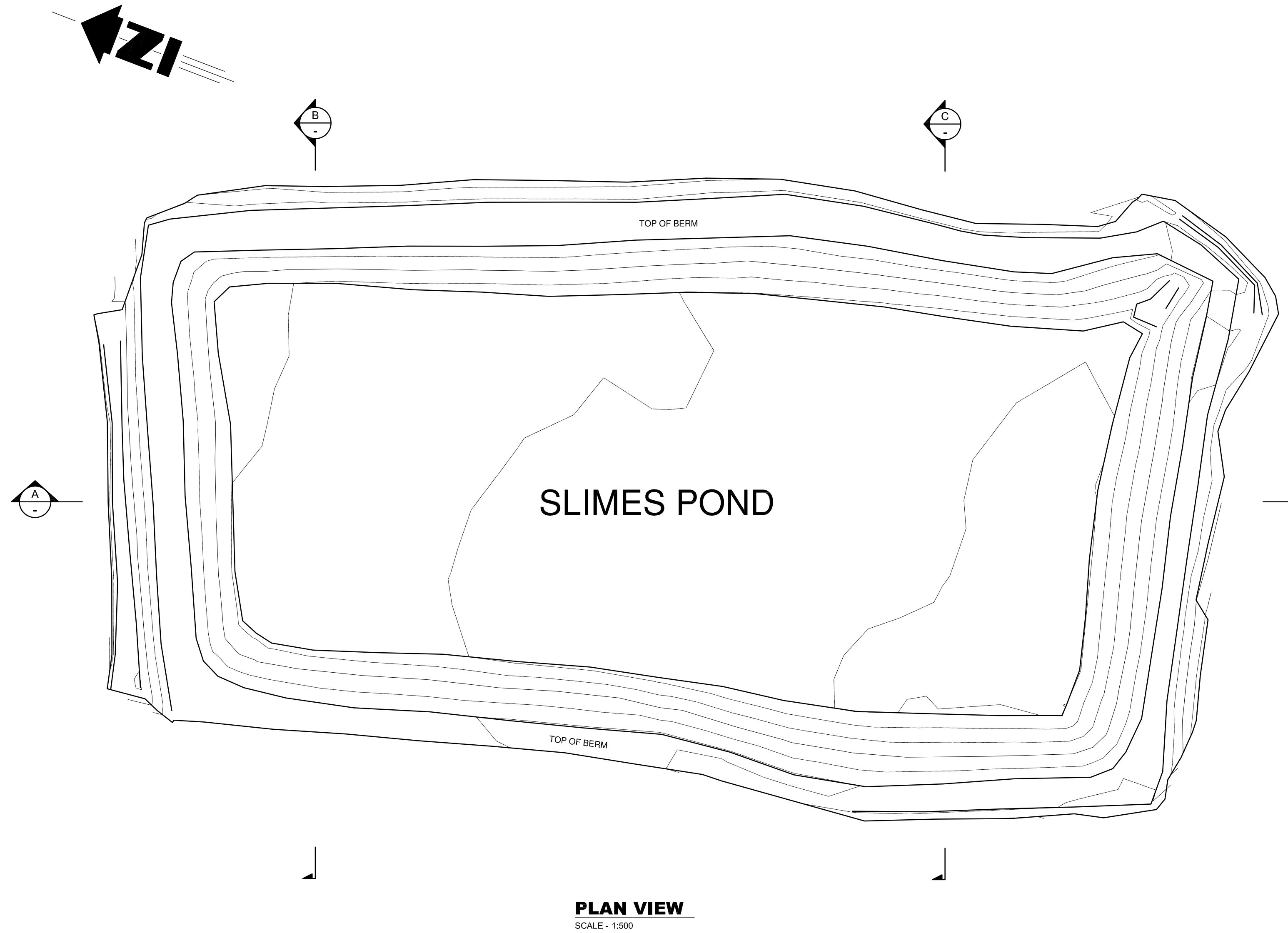
APPENDIX III-C-1

Seepage Pond 1

Drawings Not Available

APPENDIX III-C-2

Seepage Pond 2



NO.	ISSUE	DATE	BY	CHKD	APPD

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REF.	DWG. NO.	REFERENCE DRAWING DESCRIPTION

ISSUED FOR: **REVIEW**

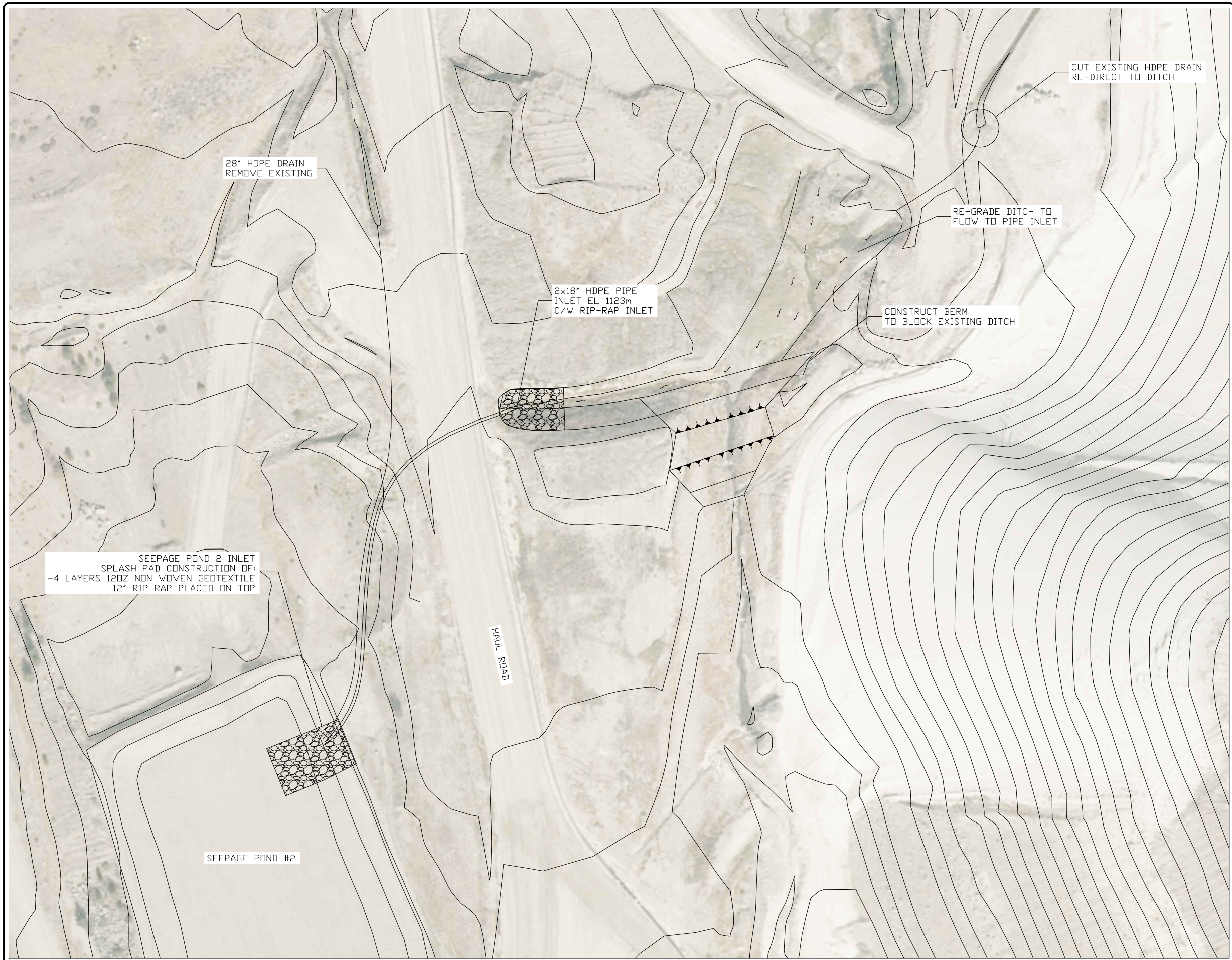
TRUE CONSULTING
201 - 2079 Falcon Road
Kamloops BC V2C 4J2
tel 250.828.0881
fax 250.828.0717
info@TRUE.bc.ca

DESIGNED:	CHECKED:
DRAWN:	DATE:
SCALE:	CAD FILE:
DWG NO:	REV.

**SLIMES POND
PLAN AND
SECTIONS**

**Highland Valley Copper
Teck**

HVC DESIGN:	HVC CHECKED:
HVC DRAWN: SC	DATE: SEPTEMBER 2012
SCALE: 1:500	HVC CAD FILE: 1011-021-SlimePond-ASB.dwg
HVC DWG NO:	REV.



28" HDPE DRAIN
REMOVE EXISTING

CUT EXISTING HDPE DRAIN
RE-DIRECT TO DITCH

RE-GRADE DITCH TO
FLOW TO PIPE INLET

2x18" HDPE PIPE
INLET EL 1123m
C/W RIP-RAP INLET

CONSTRUCT BERM
TO BLOCK EXISTING DITCH

SEEPAGE POND 2 INLET
SPLASH PAD CONSTRUCTION OF:
-4 LAYERS 120Z NON WOVEN GEOTEXTILE
-12' RIP RAP PLACED ON TOP

HAUL ROAD

SEEPAGE POND #2

NO.	ISSUE	DATE	BY	CHKD	APPD

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REF.	DWG. NO.	REFERENCE DRAWING DESCRIPTION

ISSUED FOR:

DESIGNED:	CHECKED:
DRAWN:	DATE:
SCALE:	CAD FILE:

DWG NO:	REV.
	△

SEEPAGE POND #2
DITCH DESIGN

Highland Valley Copper
Teck

HVC DESIGN:	HVC CHECKED:
HVC DRAWN: B STEANE	DATE: FEBRUARY 2013
SCALE: As Shown	HVC CAD FILE:

HVC DWG NO:	REV.
	△

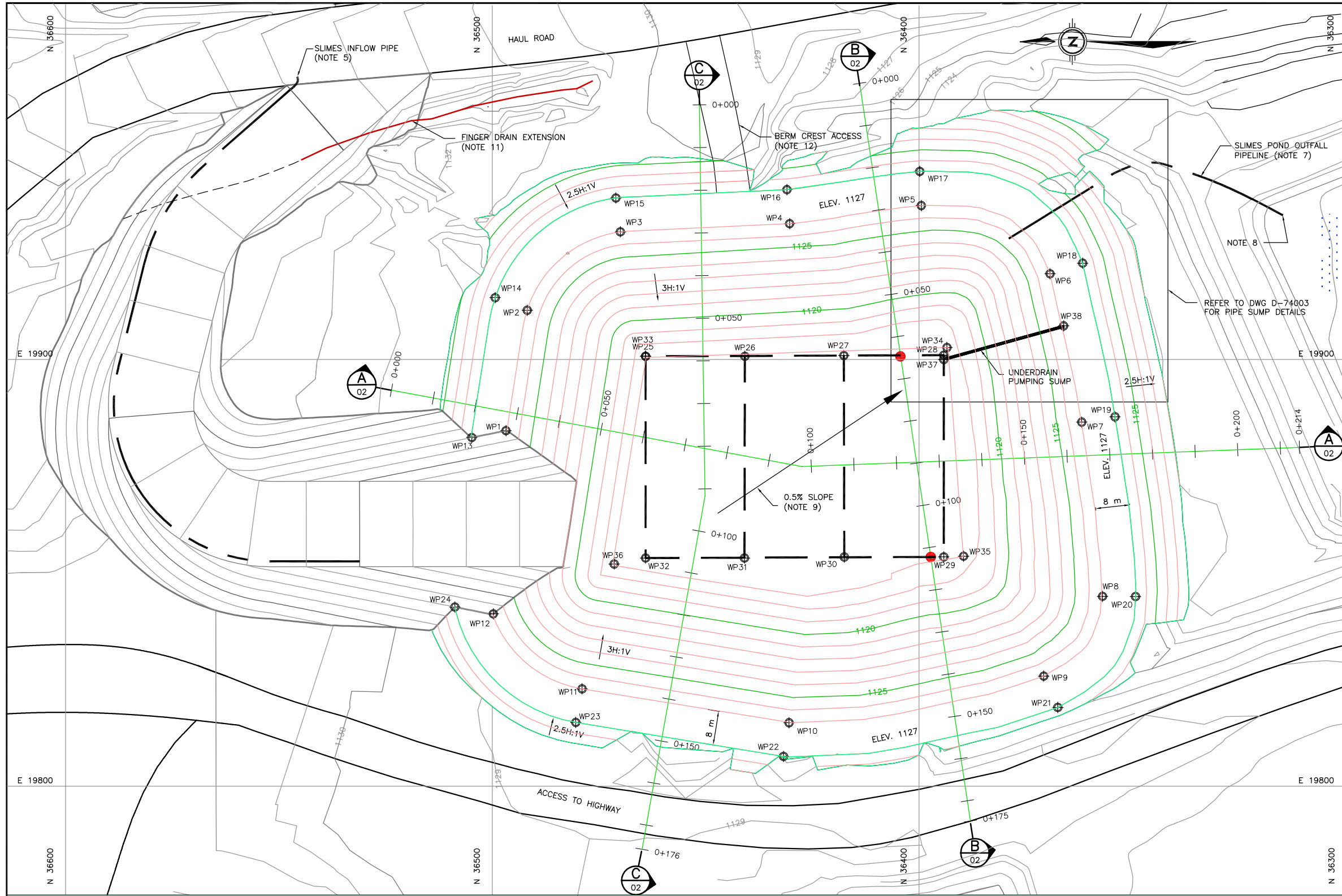
APPENDIX III-C-3

Slimes Pond 1

Drawings Not Available

APPENDIX III-C-4

Slimes Pond 2



WORK POINT	EASTING (m)	NORTHING (m)	ELEVATION (m)	LOCATION
WP1	19883.3	36496.8	1127.0	8m BERM CREST
WP2	19911.5	36491.8	1127.0	
WP3	19929.9	36470.0	1127.0	
WP4	19931.8	36430.3	1127.0	
WP5	19936.1	36399.5	1127.0	
WP6	19920.1	36369.3	1127.0	
WP7	19885.3	36361.9	1127.0	
WP8	19844.5	36357.0	1127.0	
WP9	19825.8	36370.8	1127.0	
WP10	19814.9	36430.5	1127.0	
WP11	19822.8	36479.0	1127.0	
WP12	19840.4	36499.8	1127.0	
WP13	19881.7	36504.8	1127.0	
WP14	19914.5	36499.3	1127.0	
WP15	19937.8	36471.0	1127.0	
WP16	19939.8	36431.0	1127.0	
WP17	19944.1	36399.8	1127.0	
WP18	19922.6	36361.7	1127.0	
WP19	19886.5	36354.1	1127.0	
WP20	19844.4	36349.3	1127.0	
WP21	19818.4	36367.5	1127.0	
WP22	19807.0	36431.8	1127.0	
WP23	19814.9	36480.5	1127.0	
WP24	19842.0	36508.8	1127.0	
WP25	19900.7	36464.1	—	UNDERDRAIN PIPE (NOTE 9)
WP26	19900.7	36440.8	—	
WP27	19900.7	36417.6	—	
WP28	19901.0	36394.2	—	
WP29	19853.5	36394.2	—	
WP30	19853.5	36417.5	—	EXCAVATION BASE
WP31	19853.5	36440.9	—	
WP32	19853.5	36464.1	—	
WP33	19900.7	36464.1	1117.0	
WP34	19902.8	36393.5	1117.0	UNDERDRAIN PUMPING SUMP
WP35	19853.9	36389.6	1117.0	
WP36	19852.1	36471.4	1117.0	
WP37	19900.0	36394.2	1117.1	
WP38	19907.9	36366.1	1127.0	

BILL OF QUANTITIES (NOTE 3)

EXCAVATION	46745 m ³
FILL	8356 m ³
AVAILABLE SLIMES STORAGE	53120 m ³
GEOMEMBRANE SURFACE AREA INCLUDING ANCHOR TRENCH	20080 m ²

- NOTES**
- BASE MAP FROM HVC 2013 CONTRACT DRAWING AND SLIMES POND EXISTING CONDITION SURVEY RECEIVED FROM HVC AUGUST 15, 2014.
 - ALL DIMENSIONS ARE IN METRES UNLESS NOTED.
 - VOLUMES ARE NEAT-LINE COMPACTED OR IN SITU WITH NO BULKING FACTOR OR CONTINGENCY. GEOMEMBRANE AREA INCLUDES 10% CONTINGENCY FOR OVERLAP AND WASTAGE.
 - UNDERDRAIN PIPE DETAILS PROVIDED ON DWG. D-74002.
 - SLIMES INFLOW PIPE DETAILS TO BE DETERMINED BY HVC BUT NOT TO EXCEED SINGLE 24" DIA PIPE PLACED ALONG FIELD FIT ACCESS/MAINTENANCE RAMP.
 - SLIMES INFLOW PIPE DISCHARGE TO BE SET BELOW ELEV. 1125.5 m. LOCALLY PLACE RIPRAP (D₅₀ = 0.3 m) IMMEDIATELY DOWNSTREAM OF THE DISCHARGE LOCATION (2 m WIDTH, 4 m LENGTH).
 - SLIMES POND OUTFALL PIPELINE, MINIMUM GRADE OF 2% REQUIRED ALONG ENTIRE ALIGNMENT. HVC SPECIFIED 36-INCH DR26 HDPE PIPE.
 - DETAILS OF DISCHARGE INTO SEEPAGE POND 2 TO BE DIRECTED BY QC ENGINEER IN THE FIELD.
 - UNDERDRAINS TO BE GRADED AT 0.5% (OVERALL) SLOPE TOWARDS SOUTHEAST CORNER, FIELD FIT DURING INSTALLATION.
 - REFER TO D-74002 FOR PIEZOMETER DETAILS. LOCATIONS TO BE SELECTED BY QC ENGINEER IN THE FIELD.
 - FIELD FIT EXTENSION TO FINGER DRAIN BELOW ACCESS RAMP AS DIRECTED BY QC ENGINEER, USING PROCESSED FILTER GRAVEL SURROUNDED BY AT LEAST 0.3 m THICKNESS OF SELECT SAND AND GRAVEL.
 - FIELD FIT BERM CREST ACCESS RAMP TO MAINTAIN MINIMUM 0.9 m COVER DEPTH OVER EXISTING BURIED PIPE.
 - ACCESS/MAINTENANCE RAMP WILL BE FIELD FIT BY HVC AND QC ENGINEER WITH MAXIMUM SLOPE 8%. LAYOUT ON THIS DRAWING SHOWN AS REFERENCE EXAMPLE.

- LEGEND**
- UNDERDRAIN (NOTE 4)
 - VIBRATING WIRE PIEZOMETER (NOTE 10)

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CLIENT
TECK HIGHLAND VALLEY COPPER PARTNERSHIP
Klohn Crippen Berger

PROJECT
HIGHLAND TAILINGS STORAGE FACILITY
TITLE
SLIMES POND 2 EARTHWORKS PLAN
SCALE AS SHOWN PROJECT NO. M02341A74 DWG. NO. D-74001 REV. 1

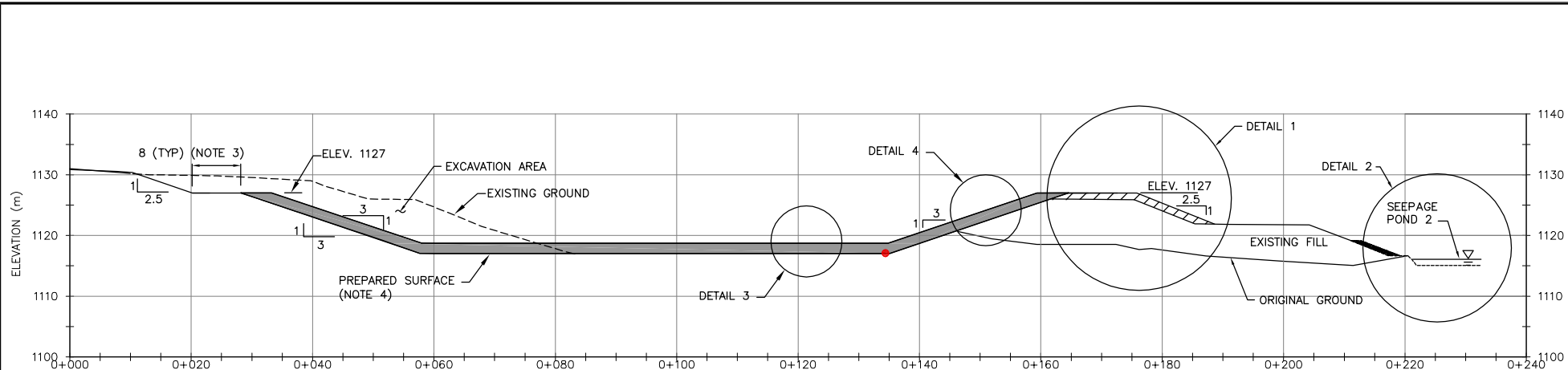
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0	ISSUED FOR CONSTRUCTION	2014-08-26	CYW	RF	AM	NS

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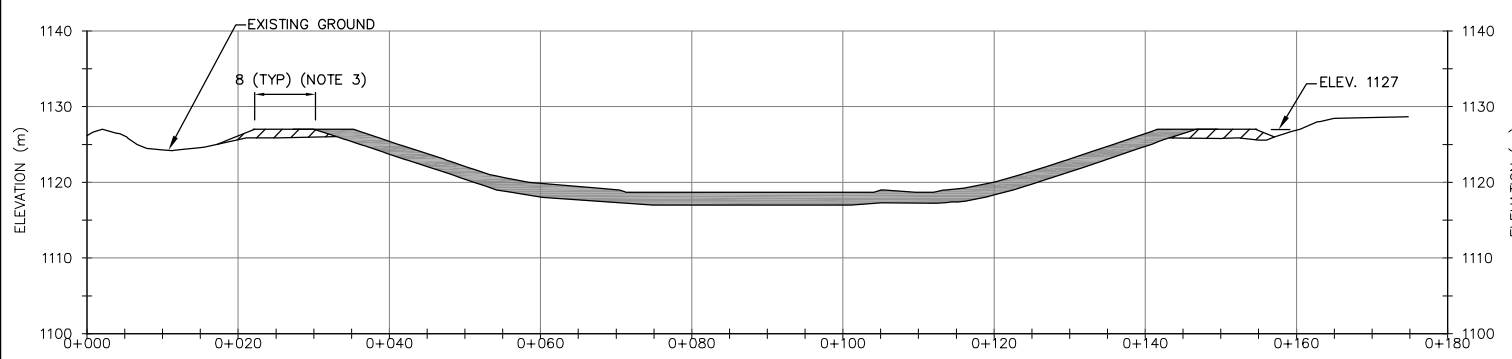
CANCEL PRINTS BEARING PREVIOUS REVISION

KCB-DWG-D-1

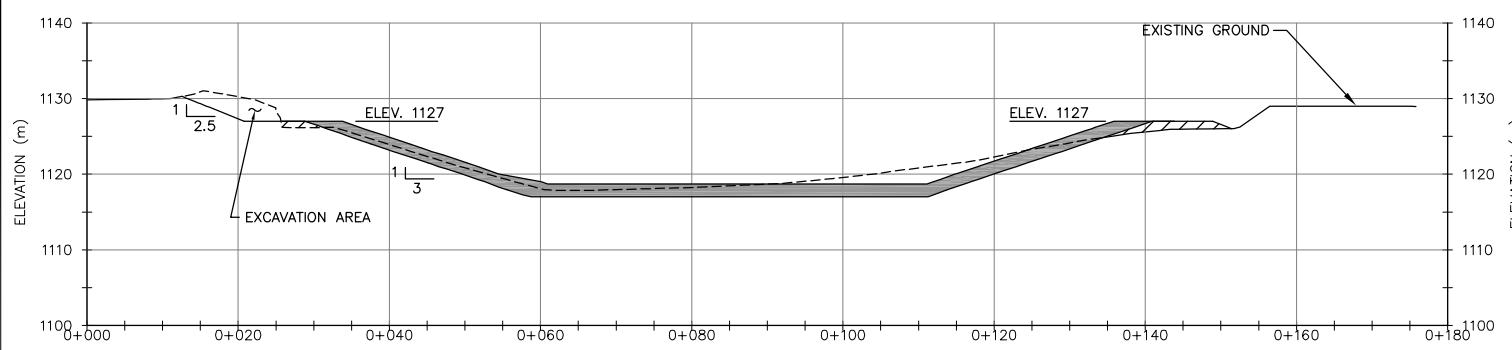
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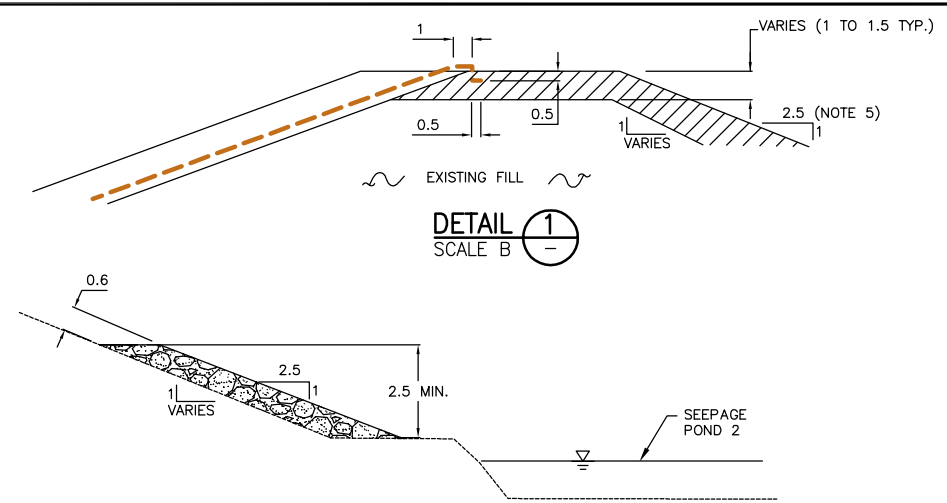
SECTION A
SCALE A



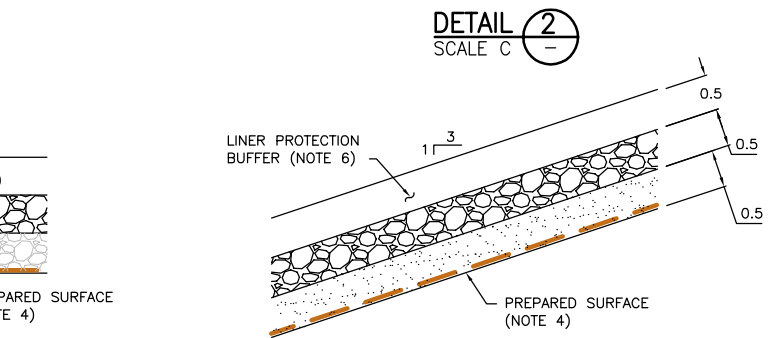
SECTION B
SCALE A



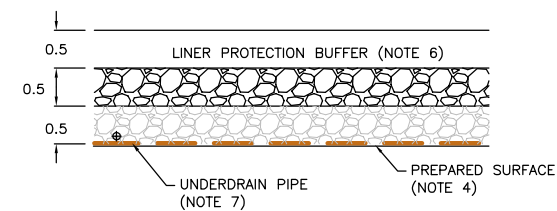
SECTION C
SCALE A



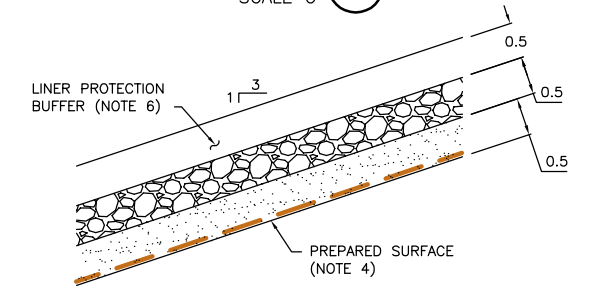
DETAIL 1
SCALE B



DETAIL 2
SCALE C



DETAIL 3
SCALE D



DETAIL 4
SCALE D

NOTES

1. BASE MAP FROM HVC 2013 CONTRACT DRAWING AND SLIMES POND EXISTING CONDITION SURVEY RECEIVED FROM HVC AUGUST 15, 2014.
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED.
3. FILL CREST AND EXCAVATION BENCH WIDTHS HAVE BEEN SET FOR SINGLE LANE TRAFFIC (LIGHT VEHICLE AND 30 TONNE HAUL TRUCKS) WITH AN ALLOWANCE FOR SAFETY BERMS TO BE SIZED AND PLACED BY HVC.
4. GRADE AND COMPACT THE TILL SURFACE TO THE DESIGN LINES. RE-GRADE EXISTING SLOPES AS REQUIRED TO ACHIEVE MAXIMUM 3H:1V SLOPE FOR GEOMEMBRANE. FLATTEN SMALL RIDGELINES LEFT BY THE PACKER AND INFILL LOCAL DEPRESSIONS. REMOVE PEBBLES LARGER THAN 1 INCH NOMINAL SIZE OR, IF FEASIBLE, FORCE THEM INTO THE UNDERLYING TILL WITH THE VIBRATORY COMPACTOR. COVER ANY LOCAL GRAVEL/COBBLE ZONE (IF PRESENT) WITH FINE GRAINED TILL AND COMPACT. ALTERNATIVELY, 12.5 mm MINUS SAND AND GRAVEL MAY BE PLACED LOCALLY AS REQUIRED AND COMPACTED TO ACHIEVE A SMOOTH SURFACE.
5. FILL SLOPE TO EXTEND DOWN TO EXISTING GROUND OR FILL LEVEL.
6. FOR CALCULATION OF AVAILABLE SLIMES STORAGE, A 0.5 m BUFFER OF UNREMOVED SLIMES WAS ASSUMED ABOVE GEOMEMBRANE PROTECTION FILL.
7. UNDERDRAIN LAYOUT AS ON DWG. D-74001, 150 mm Ø ARMTEC BOSS-2000 DUAL WALL CORRUGATED HDPE PERFORATED DRAINAGE PIPE WITH FILTER SOCK. 4-90° ELBOWS AND 4-TEE JUNCTIONS.

PIPE DIAMETER	SLOT WIDTH	SLOT LENGTH	SLOT TYPE
150 mm	1.5 mm	17 mm	PATTERN #1

8. SOLMAX 480T-2000 HDPE TEXTURED GEOMEMBRANE (HVC SPECIFIED)
9. FILL GRADATION AND PLACEMENT SPECIFICATIONS SHOWN ON DWG. D-74004.
10. RST VW2100-HD HEAVY DUTY VIBRATING WIRE PIEZOMETER, 0.35 MPa PRESSURE RANGE, 60 m CABLE LENGTH. SATURATE TIP WITH WATER BEFORE INSTALLATION. DIG A HOLE IN THE PREPARED SURFACE, INSTALL PIEZOMETER WITH TIP POINTING UP, AND BACKFILL WITH 20-40 FILTER SAND. INSTRUMENT CABLE TO RUN INSIDE A 2-INCH Ø DR11 HDPE PIPE, RUNNING UP THE SLOPE IN A TRENCH BACKFILLED WITH TILL, AND ACROSS THE CREST BELOW THE LEVEL OF THE LINER ANCHOR TRENCH TO A READOUT LOCATION ON THE DOWNSTREAM SLOPE. INSTRUMENTS ARE TO BE READ BI-WEEKLY AS GEOMEMBRANE LEAK DETECTION.

LEGEND

	GLACIAL TILL (NOTE 9)		LINER SYSTEM
	UNDERFLOW SAND (NOTE 9)		GEOMEMBRANE (NOTE 8)
	SAND AND GRAVEL FILTER (NOTE 9)		VIBRATING WIRE PIEZOMETER (NOTE 10)
	PROCESSED BLAST ROCK (NOTE 9)		UNDERDRAIN PIPE (NOTE 7)
	SAND AND GRAVEL DRAINAGE LAYER (NOTE 9)		

REVISION	DESCRIPTION OF REVISION	DATE (YYYY-MM-DD)	DRAWN	DESIGNED	CHECKED	APPROVED
1	REVISED UNDERDRAIN SPECIFICATIONS	2014-10-14	CYW	FS	AM	NS
0	ISSUED FOR CONSTRUCTION	2014-08-28	CYW	RF	AM	NS

ISSUED FOR CONSTRUCTION

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R.J. FRIEDEL
 P. ENG.,
 PROVINCE OF BRITISH COLUMBIA
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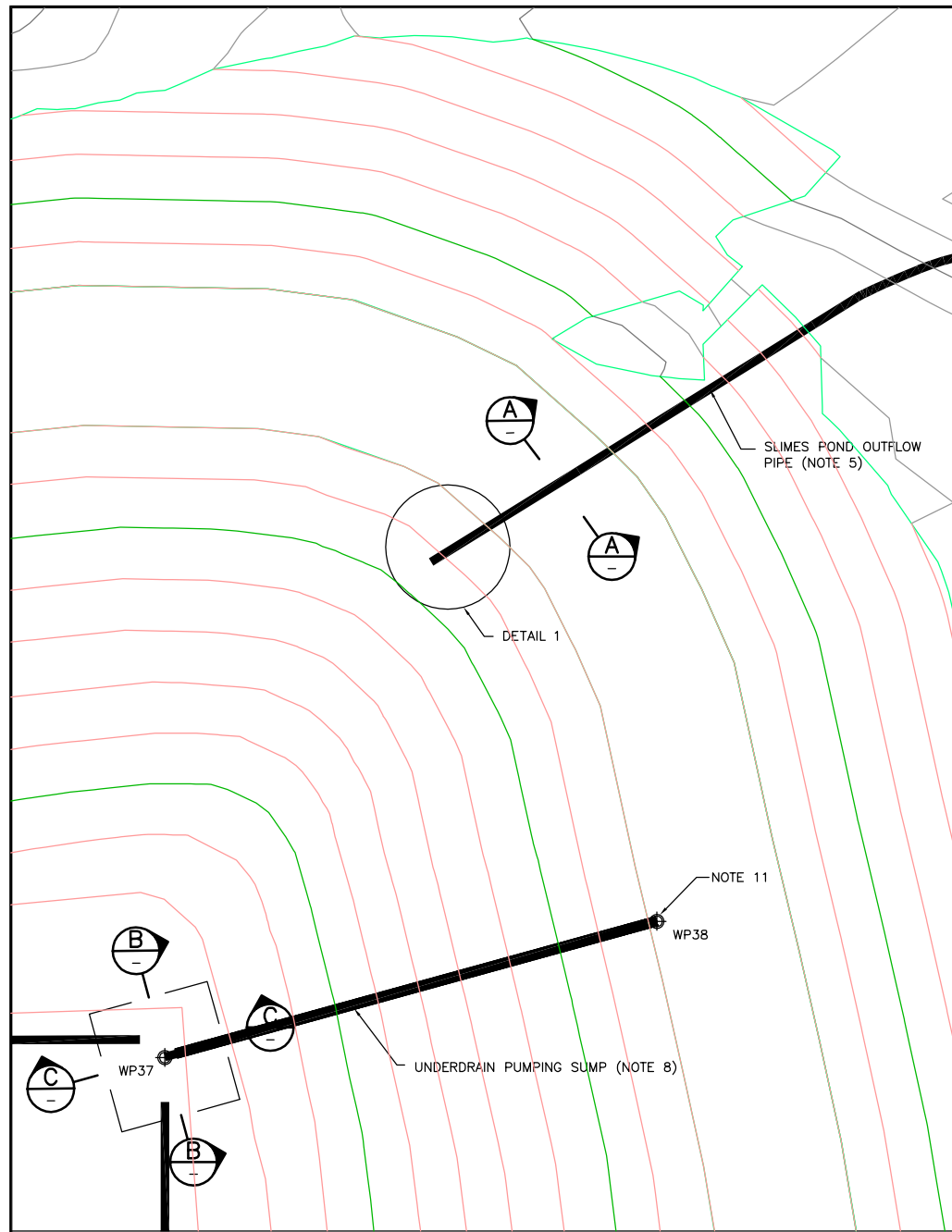
CLIENT
TECK HIGHLAND VALLEY COPPER PARTNERSHIP

PROJECT	HIGHLAND TAILINGS STORAGE FACILITY		
TITLE	SLIMES POND 2 CROSS SECTIONS AND LINER DETAILS		
SCALE	PROJECT NO.	DWG. NO.	REV.
AS SHOWN	M02341A74	D-74002	1

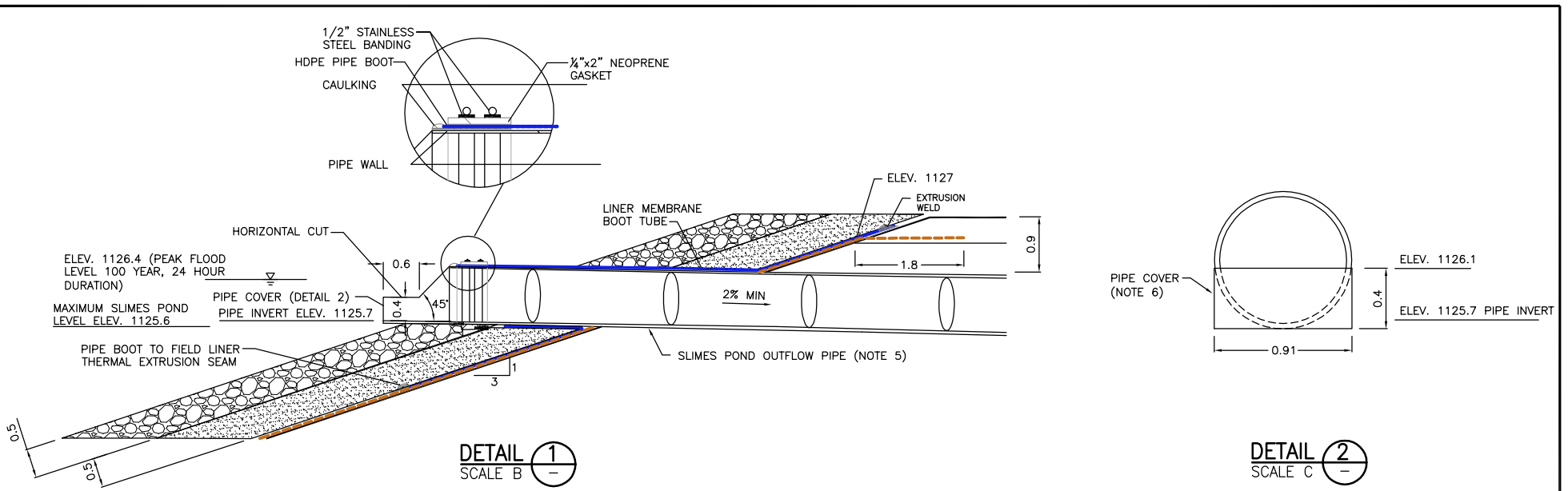
CANCEL PRINTS BEARING PREVIOUS REVISION

KCB-DWG-D-1

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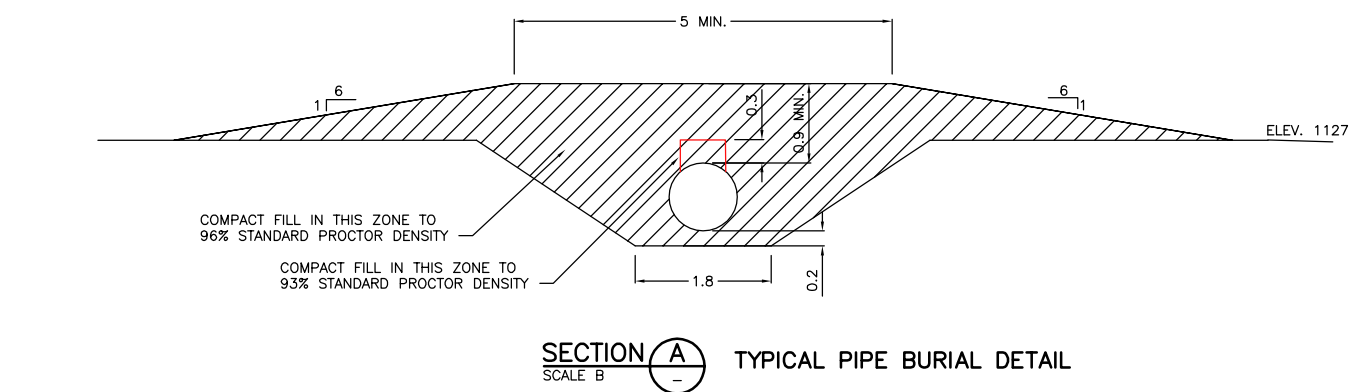


PIPE DETAIL
SCALE A

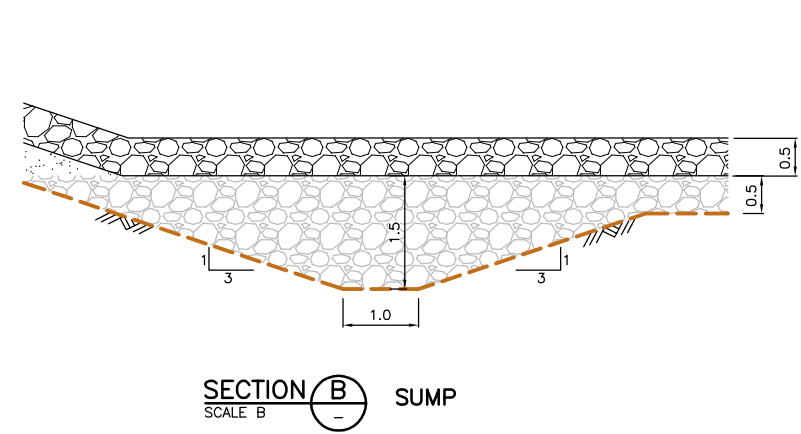


DETAIL 1
SCALE B

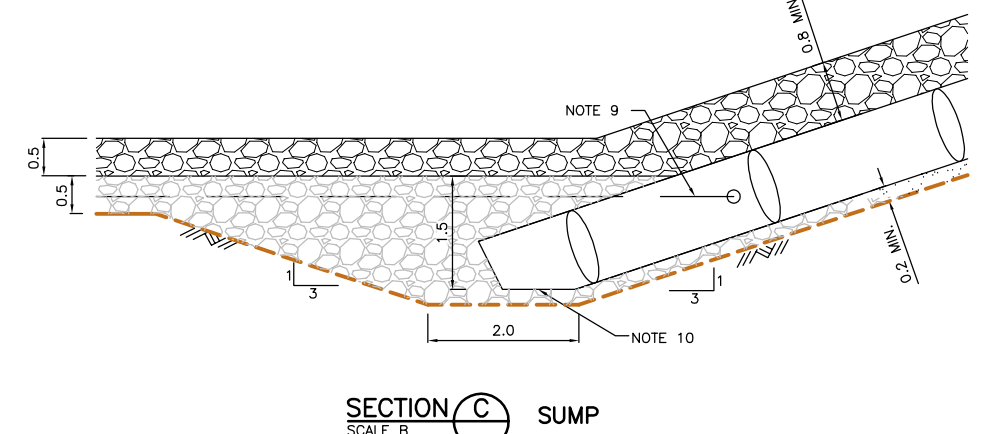
DETAIL 2
SCALE C



SECTION A
SCALE B
TYPICAL PIPE BURIAL DETAIL



SECTION B
SCALE B
SUMP



SECTION C
SCALE B
SUMP

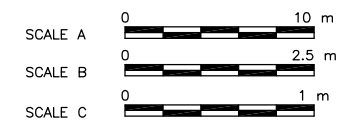
LEGEND

	GLACIAL TILL (NOTE 3)
	UNDERFLOW SAND (NOTE 3)
	SAND AND GRAVEL DRAINAGE LAYER (NOTE 3)
	PROCESSED BLAST ROCK
	GEOMEMBRANE (NOTE 4)
	GEOMEMBRANE PIPE BOOT (NOTE 7)
	PIPELINE IN SECTION

- NOTES**
1. BASE MAP FROM HVC 2013 CONTRACT DRAWING AND SLIMES POND EXISTING CONDITION SURVEY RECEIVED FROM HVC AUGUST 15, 2014.
 2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED.
 3. FILL GRADATION AND PLACEMENT SPECIFICATIONS SHOWN ON DWG D-74004
 4. SOLMAX 480T-2000 HDPE TEXTURED GEOMEMBRANE (HVC SPECIFIED)
 5. HVC SPECIFIED 36-INCH DR26 HDPE PIPE.
 6. PIPE COVER TO BE STEEL, HDPE OR EQUIVALENT MATERIAL, APPROVED BY QC ENGINEER, TO BE SECURED TO PIPE OPENING USING STAINLESS STEEL BOLTS WITH SEALANT PLACED AROUND CONTACT POINTS AND BOLTS BETWEEN PIPE COVER AND OUTFLOW PIPE. ARRANGEMENT CAN BE FIELD FIT WITH QC ENGINEER APPROVAL.
 7. GEOMEMBRANE PIPE BOOT TO BE INSTALLED ACCORDING TO MANUFACTURER'S SPECIFICATIONS.
 8. 36-INCH DR26 HDPE PIPE.
 9. UNDERDRAIN PIPES TO DISCHARGE INTO UNDERDRAIN PUMPING SUMP. IF CONNECTIONS CANNOT BE WELDED, CUT HOLES IN SIDES OF SUMP PIPE, INSERT UNDERDRAIN PIPES AND STUFF AND SECURE GEOTEXTILE IN GAPS.
 10. END OF PIPE TO BE CUT SO IT IS PLACED HORIZONTAL AND CAPPED WITH WELDED HDPE.
 11. REMOVABLE TOP CAP TO PREVENT ANIMAL ACCESS AND FOR FROST PROTECTION.

REVISION	DESCRIPTION OF REVISION	DATE (YYYY-MM-DD)	DRAWN	DESIGNED	CHECKED	APPROVED
1	ADDED SUMP DETAILS	2014-10-14	CYW	RF	AM	NS
0	ISSUED FOR CONSTRUCTION	2014-10-14	CYW	RF	AM	NS

NOT FOR CONSTRUCTION DRAFT



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			TITLE SLIMES POND 2 OUTFLOW PIPE AND UNDERDRAIN SUMP DETAILS
SCALE AS SHOWN		PROJECT NO. M02341A74	DWG. NO. D-74003
		REV. 1	CANCEL PRINTS BEARING PREVIOUS REVISION

KCB-DWG-D-1

Material	Source	Gradation	Placement Method/Specification
Glacial Till	Pond Excavation	> 30% passing No. 200 Sieve	Minimum 96% Standard Proctor. Above outflow pipe: refer to DWG D-74003.
Underflow Sand	Cyclones on Dam Crest	Maximum of 10% passing the No. 200 sieve	Liner Bedding: Single lift, 2 passes with 10t vibratory smooth drum roller. Above Liner: 0.5 m lift, 4 overlapping passes with 10t smooth drum roller (no vibration).
Sand and Gravel Drainage Layer	From Stockpile	Clean 25 mm minus with less than 5% passing the No. 200 sieve	0.5 m lift, 4 overlapping passes with 10t smooth drum roller (no vibration).
Sand and Gravel Filter	Borrow Area 3	Clean 150 mm minus with less than 5% passing the No. 200 sieve	Placed with excavator bucket and tamped in place with bucket (heavy tamping as directed by QC Engineer).
Processed Blast Rock	Blast Rock	300 mm minus	0.5 m lift, 6 overlapping passes with D8 (or equivalent sized dozer) or 10t vibratory smooth drum roller.
Riprap	Blast Rock	See Table 2	Placed with excavator in an interlocking pattern as directed by QC Engineer.

	MINIMUM	MAXIMUM
D ₁₀₀	450	510
D ₈₅	360	420
D ₅₀	300	345
D ₁₅	120	180

ISSUED FOR CONSTRUCTION


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1	REVISED DESCRIPTION	2014-10-14	CYW	RF	AM	NS
0	ISSUED FOR CONSTRUCTION	2014-08-28	CYW	RF	AM	NS

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CLIENT
**TECK HIGHLAND VALLEY
 COPPER PARTNERSHIP**



PROJECT	HIGHLAND TAILINGS STORAGE FACILITY		
TITLE	SLIMES POND 2 FILL AND PLACEMENT SPECIFICATIONS		
SCALE	PROJECT NO.	DWG. NO.	REV.
AS SHOWN	M02341A74	D-74004	1

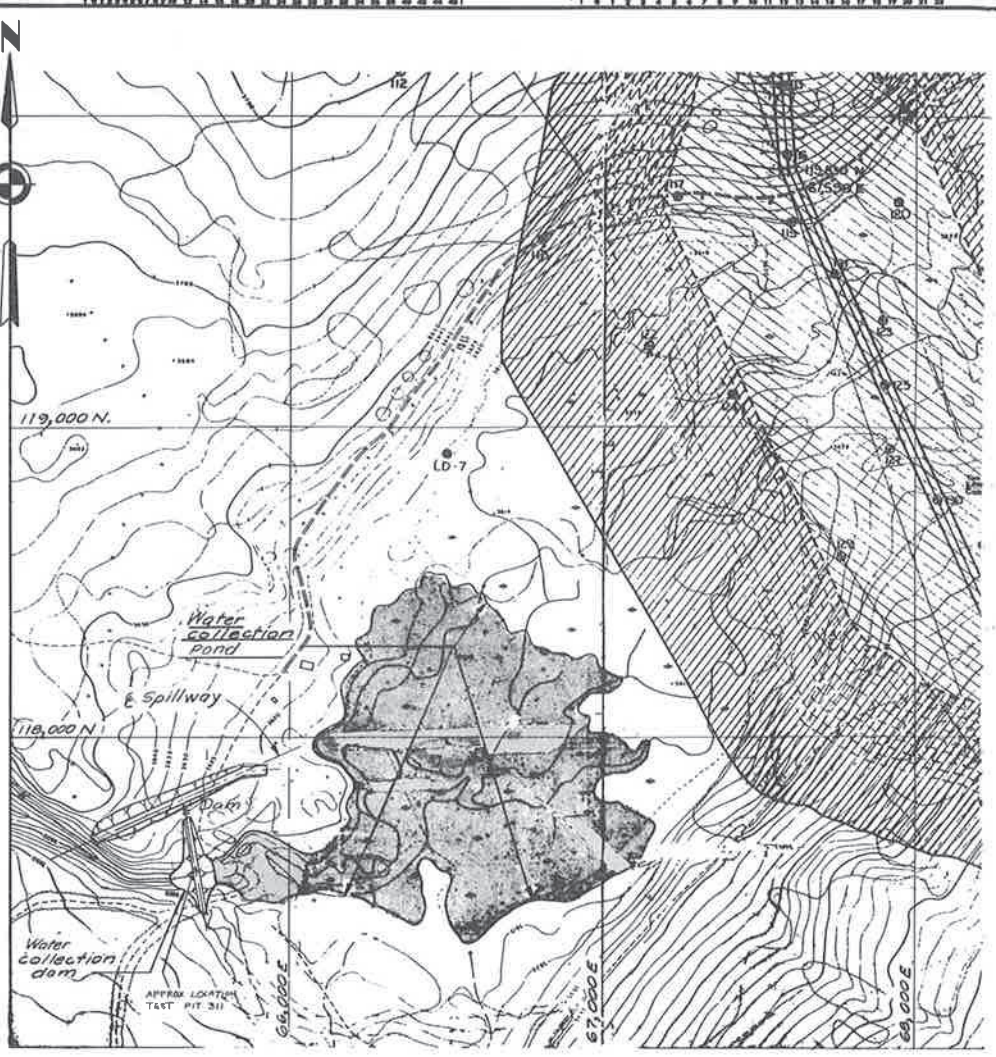
CANCEL PRINTS BEARING PREVIOUS REVISION

KCB-DWG-D-L

APPENDIX III-C-5

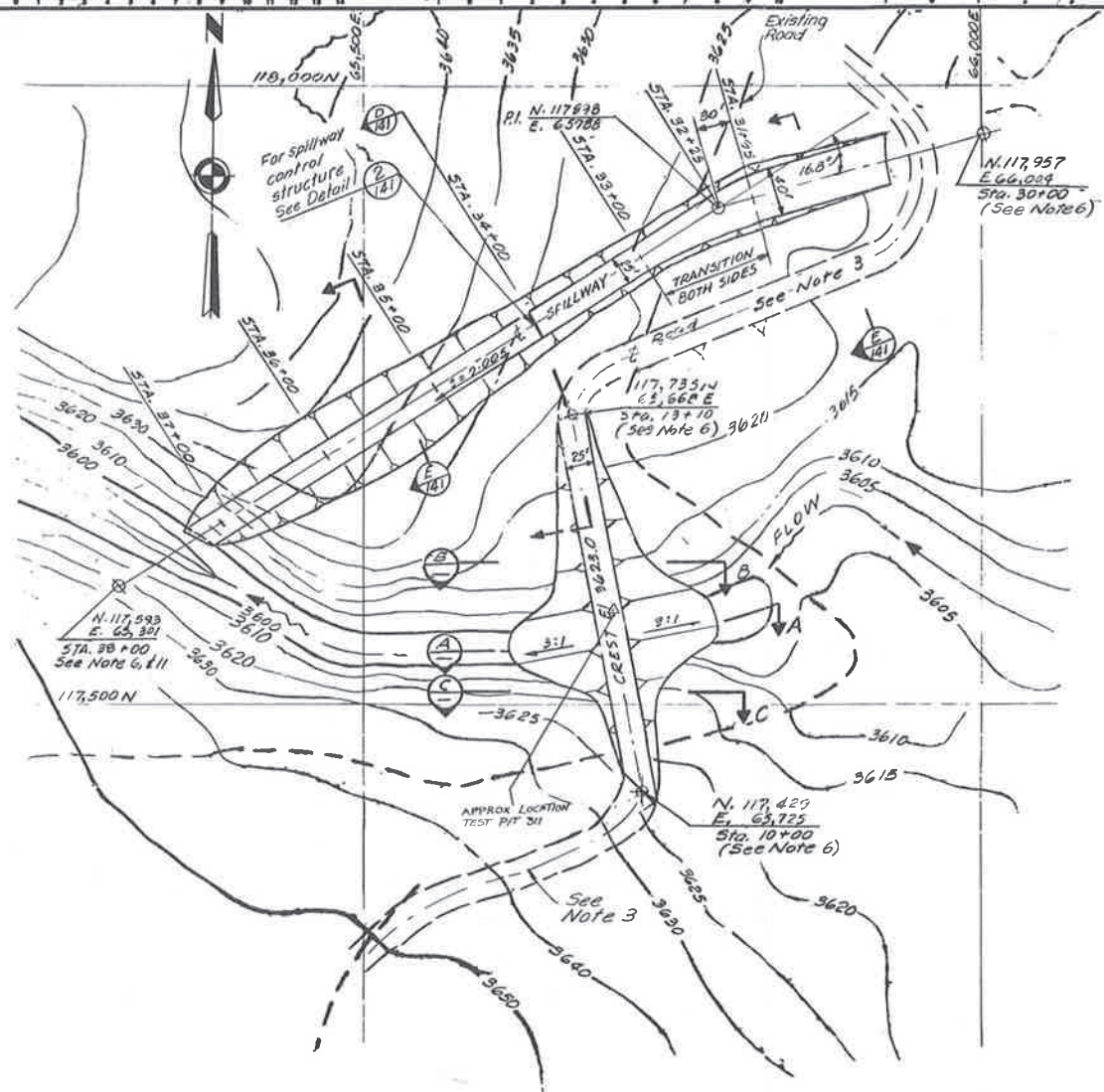
Seepage Water Reclaim Pond

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LOCATION OF WATER COLLECTION POND

Scale: 1" = 200'



PLAN

Scale: 1" = 50'

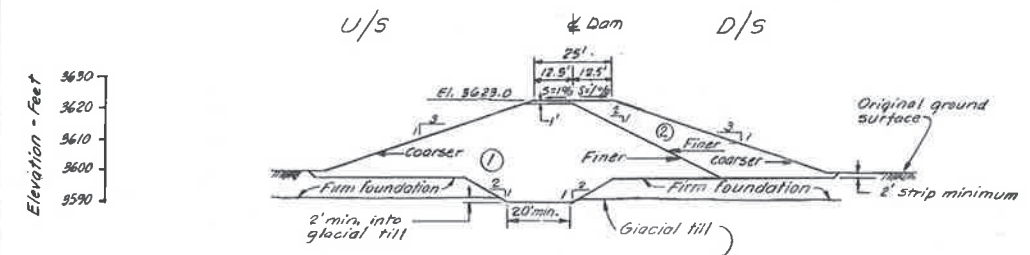
- NOTES:**
- Original ground lines idealized for simplification.
 - Topography furnished by Lernex Mining Corporation Ltd. (Dwg. No. 111-803-180 Dated May 19, 1976).
 - Connection of existing road to Dam to be determined in the field based upon actual ground contours.
 - Suitable borrow material for Zone 1 shall be obtained from spillway excavation as approved by the Manager. After using all suitable Zone 1 material from spillway excavation Zone 1 shall be obtained from borrow areas shown on Dwg. 111-803-106.
 - Borrow material for Zone 2 shall be obtained from Borrow Area 3 as indicated on Dwg. 111-803-106.
 - These coordinates and stations are approximate and are to be verified in field by the Manager.
 - Stations of channel entrance and outlet to be determined in field based upon actual ground contours.
 - Limits of clearing and grubbing are areas to be covered by the dam and spillway plus a strip 10 ft. wide measured horizontally around them in all directions. Clearing shall consist of felling and removing all standing trees, brush, down trees, logs and debris. Grubbing shall include removal of all stumps, roots larger than 1-1/2" diameter and matted roots.
 - Waste material shall be disposed of in any borrow area shown on drawing 111-803-106 or as approved by the Manager.
 - If there is a surplus of suitable Zone 1 material from the spillway excavation this material should be used as Zone 1 material in the L-L Dam as approved by the Manager.
 - Spillway excavation line and end are based upon Lernex survey January, 1977.

LEGEND

- ① Glacial till
- ② Sand and Gravel

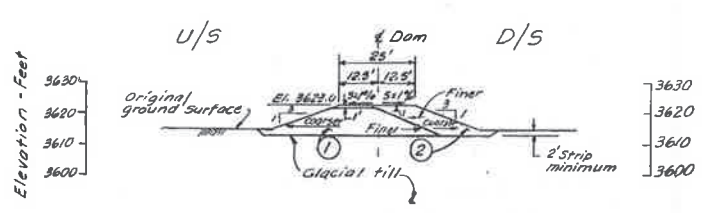
REFERENCE DRAWINGS:

- 111-803-106 Investigation Borrow Plan
- 111-803-141 Excavation Profile, and Spillway Details.



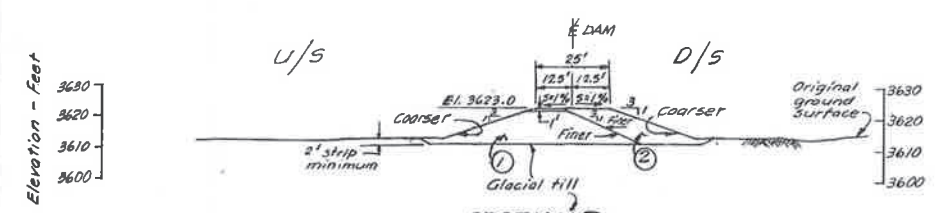
SECTION A
TYPICAL SECTION ALONG CREEK BED

Scale: 1" = 20'



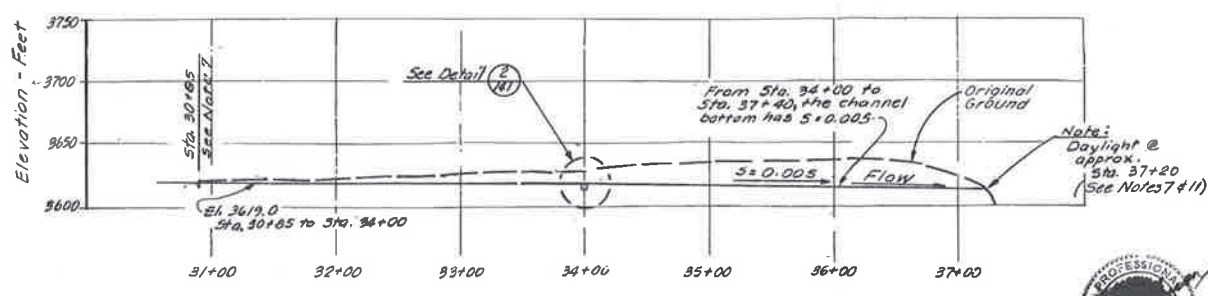
SECTION B
TYPICAL LEFT ABUTMENT SECTION

Scale: 1" = 20'



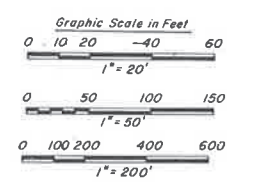
SECTION C
TYPICAL RIGHT ABUTMENT SECTION

Scale: 1" = 20'



SPILLWAY CHANNEL PROFILE

Scale: 1" = 50'



NO.	DATE	BY	CHKD.	APP'D.
1-77	ISSUED FOR REVIEW	YN	SS	AB
3-87	ISSUED FOR CONSTRUCTION	SS	AB	

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RIO ALGOM MINES LTD.
LORNE HIGHLAND VALLEY PROJECT

WATER COLLECTION DAM U-L AXIS
PLAN AND SECTIONS

JOB No.	DRAWING No.	REV.
9039	111-803-140	1



APPENDIX III-D

24 Mile Lake

Drawings Not Available

APPENDIX IV

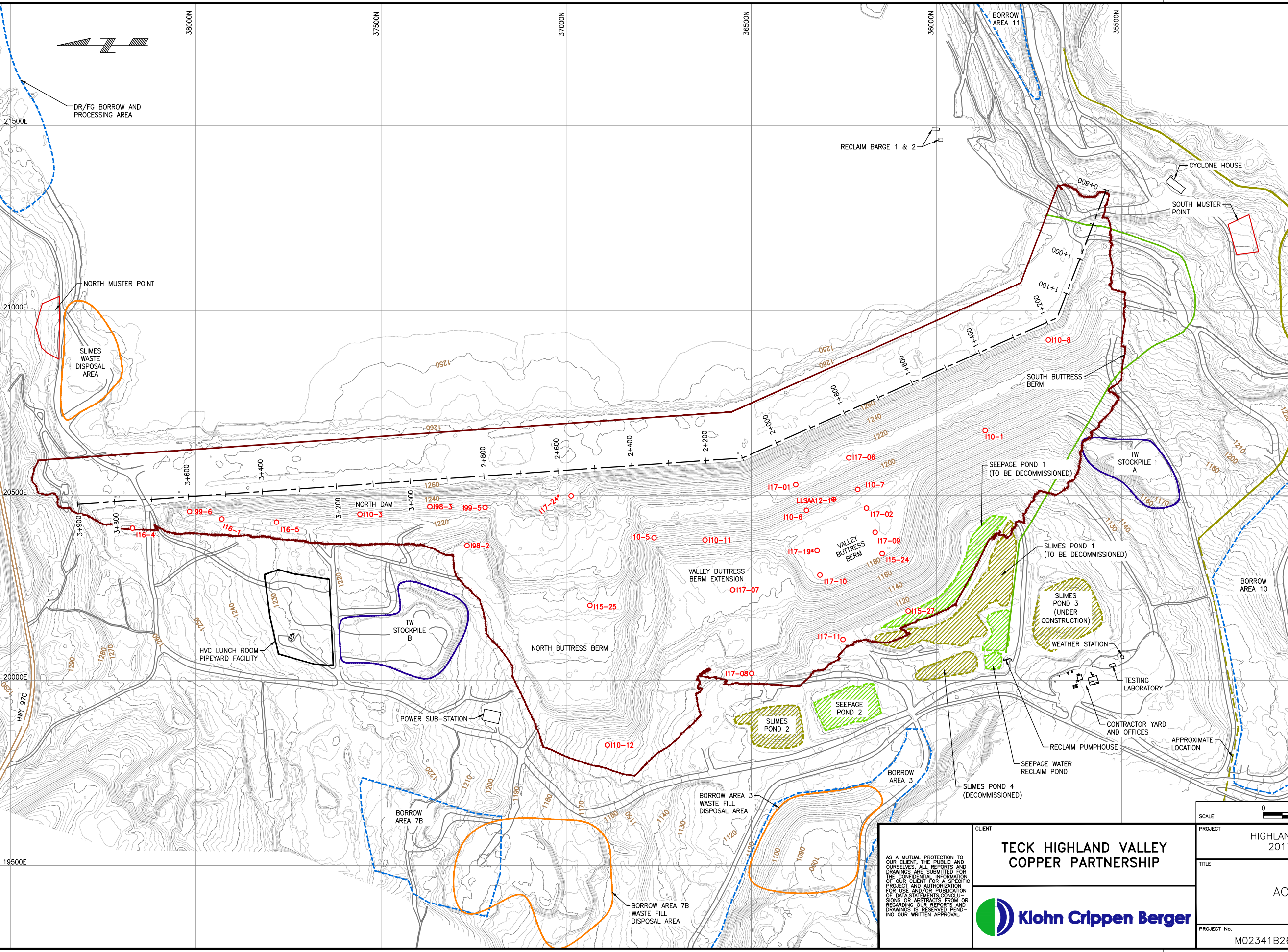
Inclinometer Plots

Appendix IV Inclinometer Plots

Figure IV-1	L-L Dam Active Inclinometers Location Plan
Figure IV-2	Inclinometer Cumulative Displacement Profile – I16-4
Figure IV-3	Inclinometer Cumulative Displacement Profile – I99-6
Figure IV-4	Inclinometer Cumulative Displacement Profile – I16-1
Figure IV-5	Inclinometer Cumulative Displacement Profile – I16-5
Figure IV-6	Inclinometer Cumulative Displacement Profile – I10-3
Figure IV-7	Inclinometer Cumulative Displacement Profile – I98-3
Figure IV-8	Inclinometer Cumulative Displacement Profile – I98-2
Figure IV-9	Inclinometer Cumulative Displacement Profile – I99-5
Figure IV-10	Inclinometer Cumulative Displacement Profile – I15-25
Figure IV-11	Inclinometer Cumulative Displacement Profile – I10-12
Figure IV-12	Inclinometer Cumulative Displacement Profile – I10-5
Figure IV-13	Inclinometer Cumulative Displacement Profile – I10-11
Figure IV-14	Inclinometer Cumulative Displacement Profile – I17-7
Figure IV-15	Inclinometer Cumulative Displacement Profile – I17-8
Figure IV-16	Inclinometer Cumulative Displacement Profile – I17-1
Figure IV-17	Inclinometer Cumulative Displacement Profile – I10-6
Figure IV-18	Inclinometer Cumulative Displacement Profile – I17-10
Figure IV-19	Inclinometer Cumulative Displacement Profile – I17-11
Figure IV-20	Inclinometer Cumulative Displacement Profile – LLSAA12-1
Figure IV-21	Inclinometer Cumulative Displacement Profile – I17-06
Figure IV-22	Inclinometer Cumulative Displacement Profile – I10-7
Figure IV-23	Inclinometer Cumulative Displacement Profile – I17-02
Figure IV-24	Inclinometer Cumulative Displacement Profile – I17-09
Figure IV-25	Inclinometer Cumulative Displacement Profile – I15-24
Figure IV-26	Inclinometer Cumulative Displacement Profile – I15-27
Figure IV-27	Inclinometer Cumulative Displacement Profile – I10-1
Figure IV-28	Inclinometer Cumulative Displacement Profile – I10-8
Figure IV-29	L-L Dam Horizontal Displacements - Top of Lacustrine Unit 2014-2017
Figure IV-30	L-L Dam Horizontal Displacements Across Lacustrine Unit 2014-2017
Figure IV-31	H-H Dam Active Inclinometers Location Plan
Figure IV-32	Inclinometer Cumulative Displacement Profile – HHSAA12-1
Figure IV-33	Inclinometer Cumulative Displacement Profile – HHI15-23

- Figure IV-34 Inclinometer Cumulative Displacement Profile – HHI17-17
- Figure IV-35 Inclinometer Cumulative Displacement Profile – HHI17-16
- Figure IV-36 Inclinometer Cumulative Displacement Profile – HHI17-14
- Figure IV-37 H-H Dam Horizontal Displacements – Dam Fill 2016-2018
- Figure IV-38 H-H Dam Vertical Displacements – HHI17-14A (Sondex)
- Figure IV-39 H-H Dam Vertical Displacements – HHI17-16A (Sondex)
- Figure IV-40 H-H Dam Vertical Displacements – HHI17-17A (Sondex)

Time: 10:34:27
 Date: 3/13/2018
 Scale: 1:50.8(P/S)
 Drawing File: Z:\M\CR\M02341B26 - HVC-2017 Dam Safety Support\400 Drawings\Dam Safety Inspection\FIG_IV-1.dwg (skuan)



LEGEND:

- BORROW AREA
- WASTE FILL DISPOSAL AREA
- SEEPAGE POND
- SLIMES POND
- EL. 1279 m ULTIMATE DAM FOOTPRINT
- SURFACE WATER RECLAIM PIPELINE
- SPATSUM WATER PIPELINE
- HAUL ROAD
- PUBLIC ROAD
- L-L DAM CENTERLINE

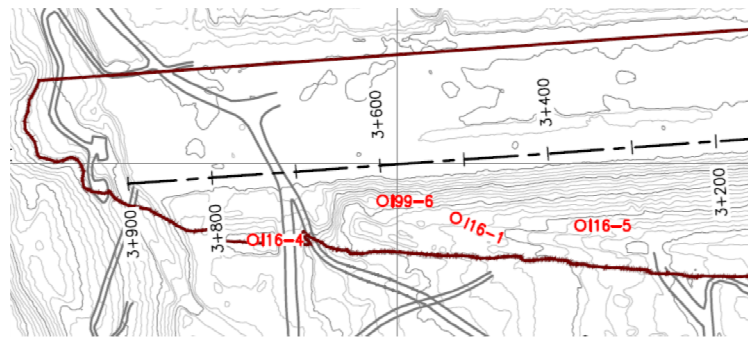
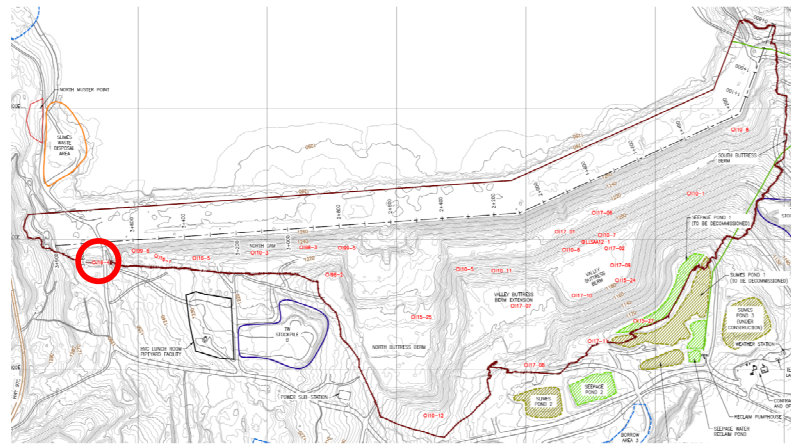
ACTIVE INSTRUMENTS (SEE NOTE 2):

- STANDARD INCLINOMETER
- IN-PLACE SAA INCLINOMETER

- NOTES:**
1. TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER PARTNERSHIP AND WAS DERIVED FROM SATELLITE IMAGERY TAKEN ON 2017-07-01.
 2. ACTIVE INSTRUMENTS ARE DEFINED AS ANY INSTRUMENTS SATISFYING ONE OF THE FOLLOWING CRITERIA: CURRENTLY READING AN ACTIVE WATER LEVEL, DRY OR PLUGGED <20 m ABOVE TIP ELEVATION AS THIS COULD SHOW A RESPONSE IN THE FUTURE.
 3. ASTERISK (*) DENOTES PROPOSED INSTRUMENT LOCATION TO BE UPDATED WITH AS-CONSTRUCTED LOCATION WHEN SURVEY IS COMPLETED.



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	Klohn Crippen Berger	TITLE L-L DAM ACTIVE INCLINOMETERS LOCATION PLAN
PROJECT No. M02341B26	FIG. No. IV-1	

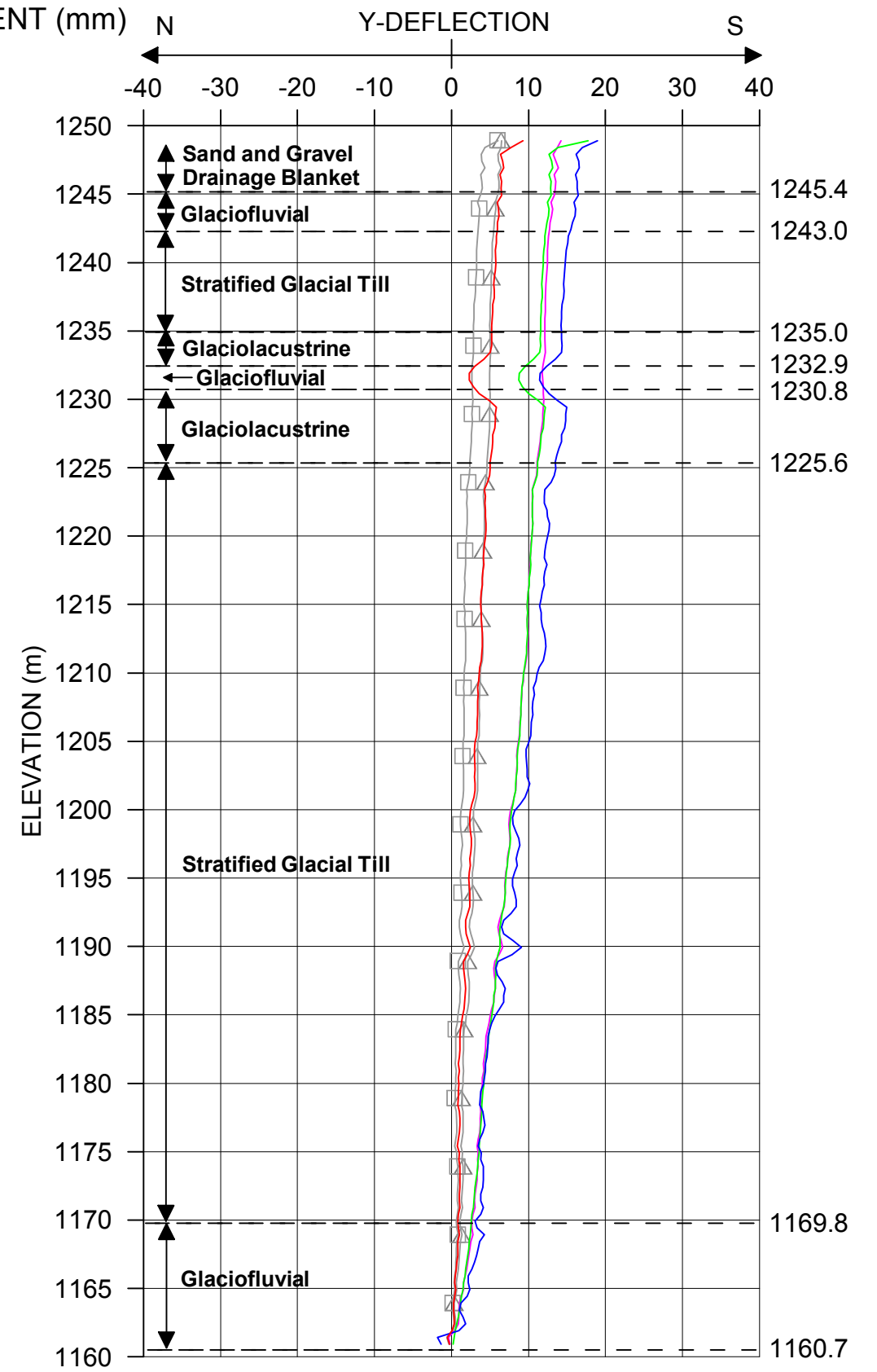
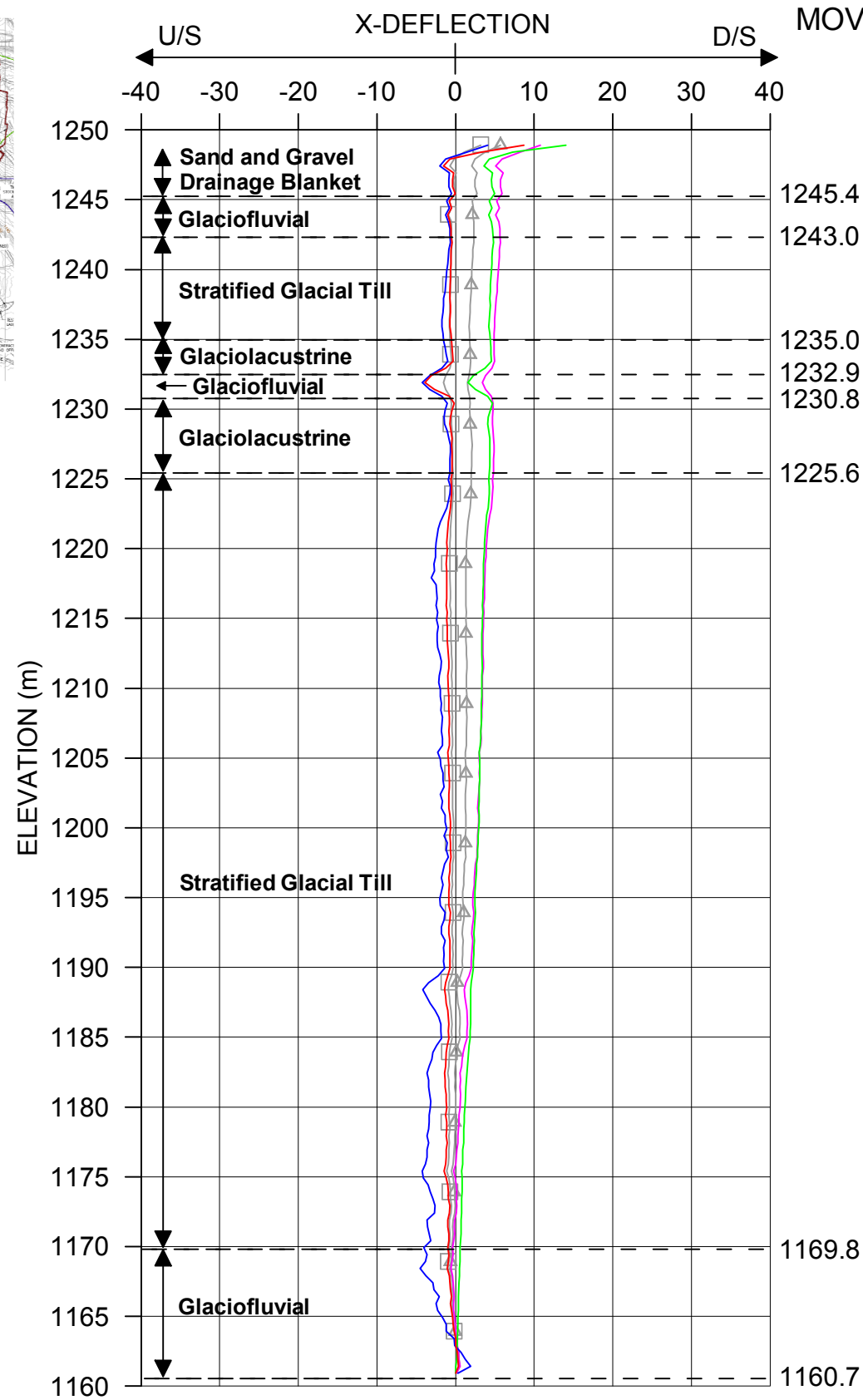


LEGEND

- ▲ —▲—▲ Dec 3, 2016
- —□—□ Jan 29, 2017
- Mar 31, 2017
- July 25, 2017
- Sep 23, 2017
- Dec 20, 2017

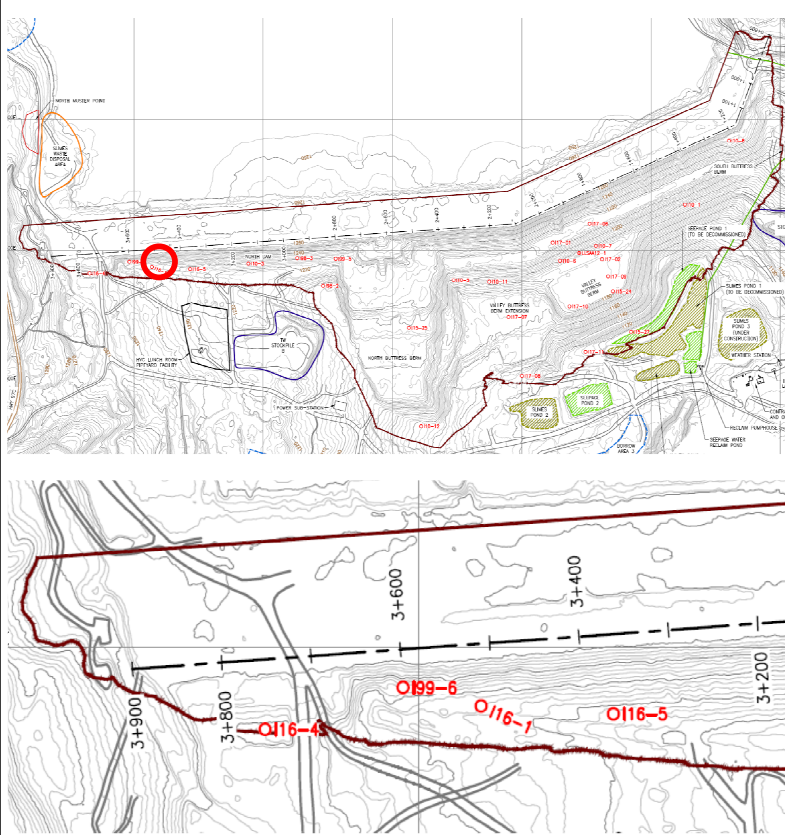
NOTES:

- 1) Initial reading = October 25, 2016.
- 2) 6" casing abandoned downhole from 111.7 m to 99.5 m.
- 3) Hole backfilled with pea gravel from 111.7 m to 88.0 m and sealed with bentonite to 87.0 m.
- 4) An In-Place Inclinometer (IPI) was installed in April 2017 from El. 1236.0 m to El. 1222.5 m.



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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 116-4
		PROJECT No. M02341B26

Date: February 27, 2018
Z:\MVC\R\2017\2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-L_Dam\199-6\Grapher files\199-6 2017 (For DSI only).grf



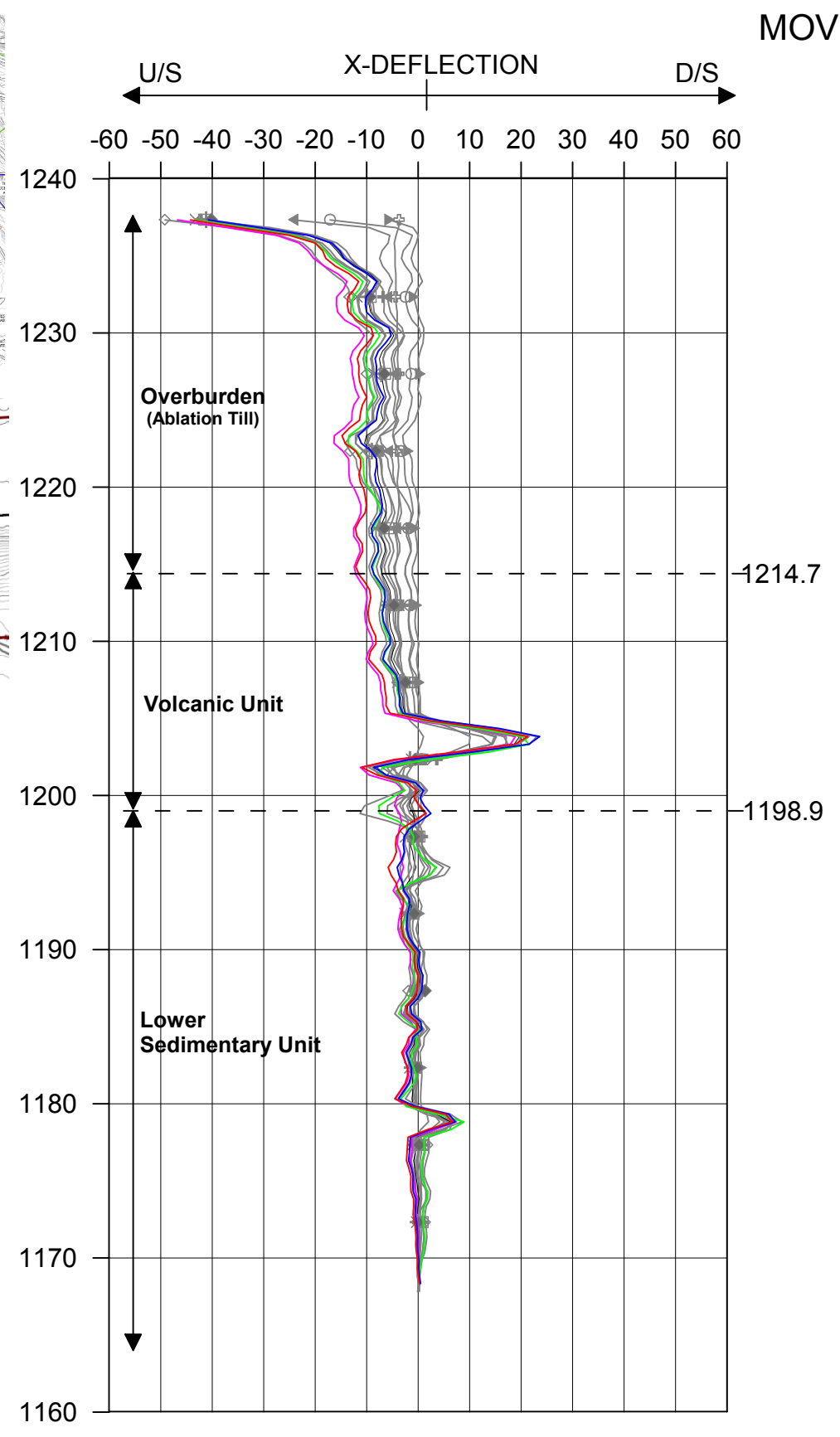
LEGEND

- ⊕ — ⊕ — ⊕ Aug 26, 2000
- ▶ — ▶ — ▶ Oct 21, 2001
- — ○ — ○ May 11, 2005
- ◀ — ◀ — ◀ Apr 24, 2007
- ⊕ — ⊕ — ⊕ Sept 1, 2009
- ◇ — ◇ — ◇ July 9, 2011
- — □ — □ June 1, 2013
- ⊕ — ⊕ — ⊕ July 15, 2014
- × — × — × Aug 17, 2015
- ◆ — ◆ — ◆ July 22, 2016
- — — — — Jan 6, 2017
- — — — — Apr 22, 2017
- — — — — Aug 25, 2017
- — — — — Dec 20, 2017
- — — — — Jan 03, 2018

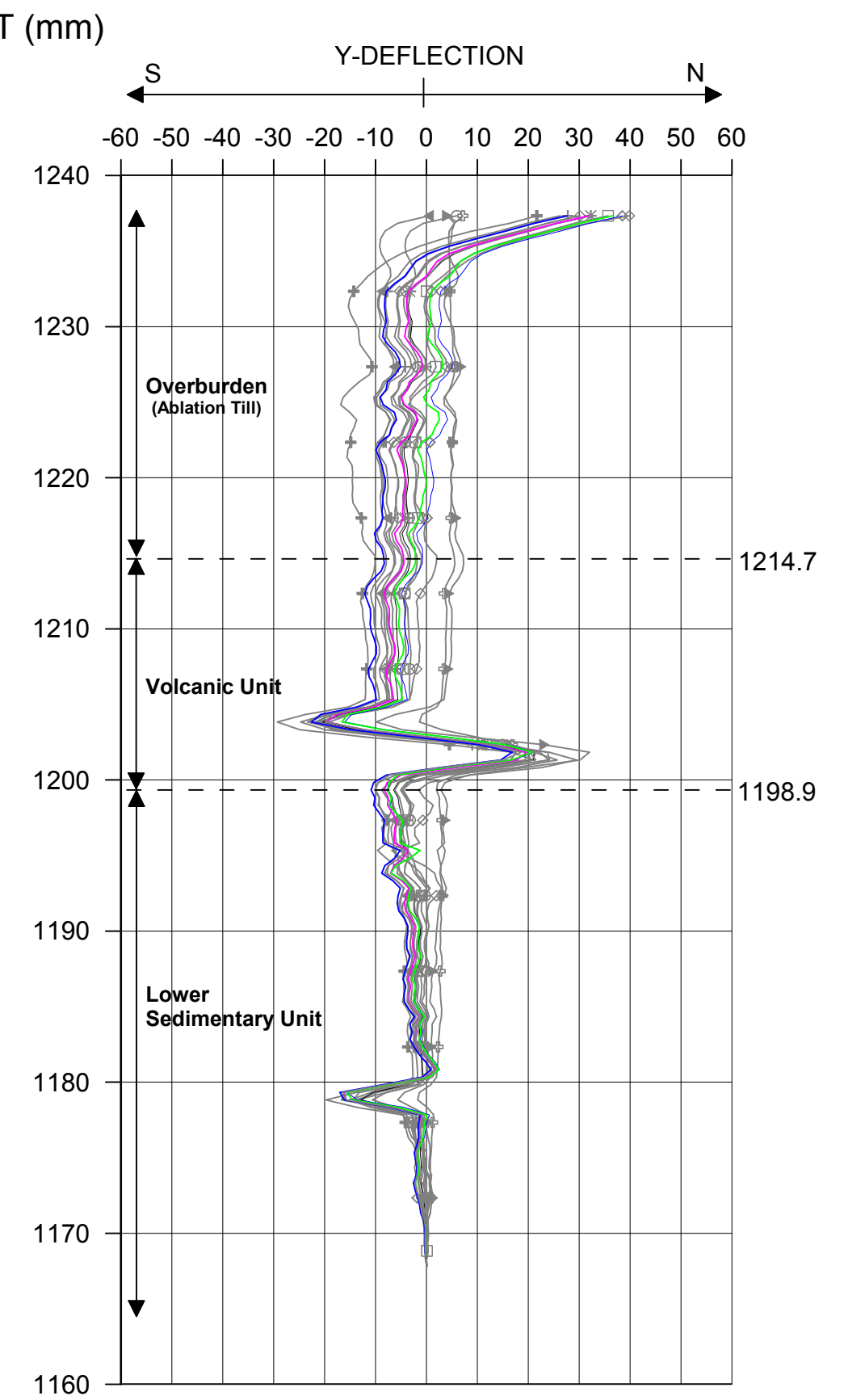
NOTES:

- 1) Initial reading = October 7, 1999.
- 2) Not all readings are plotted.

ELEVATION (m)



ELEVATION (m)

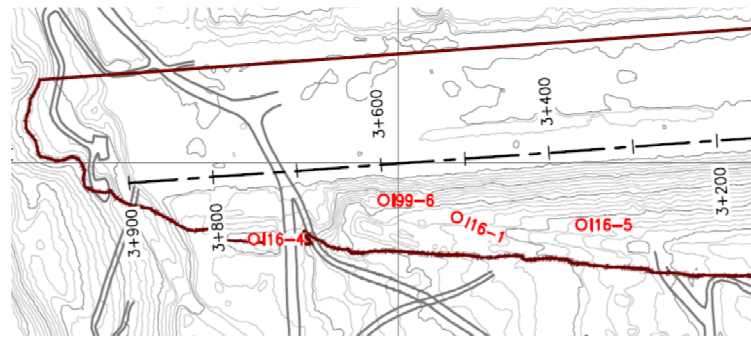
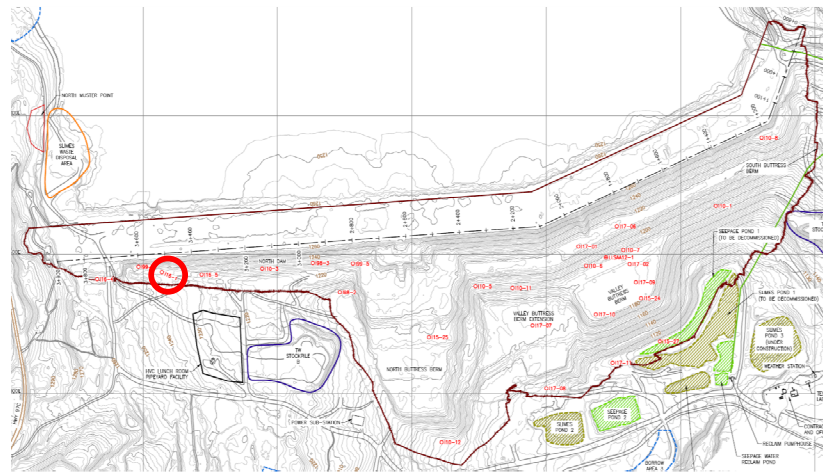


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CLIENT
TECK HIGHLAND VALLEY COPPER PARTNERSHIP

PROJECT	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
TITLE	INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 199-6
PROJECT No.	M02341B26
FIG No.	IV-3

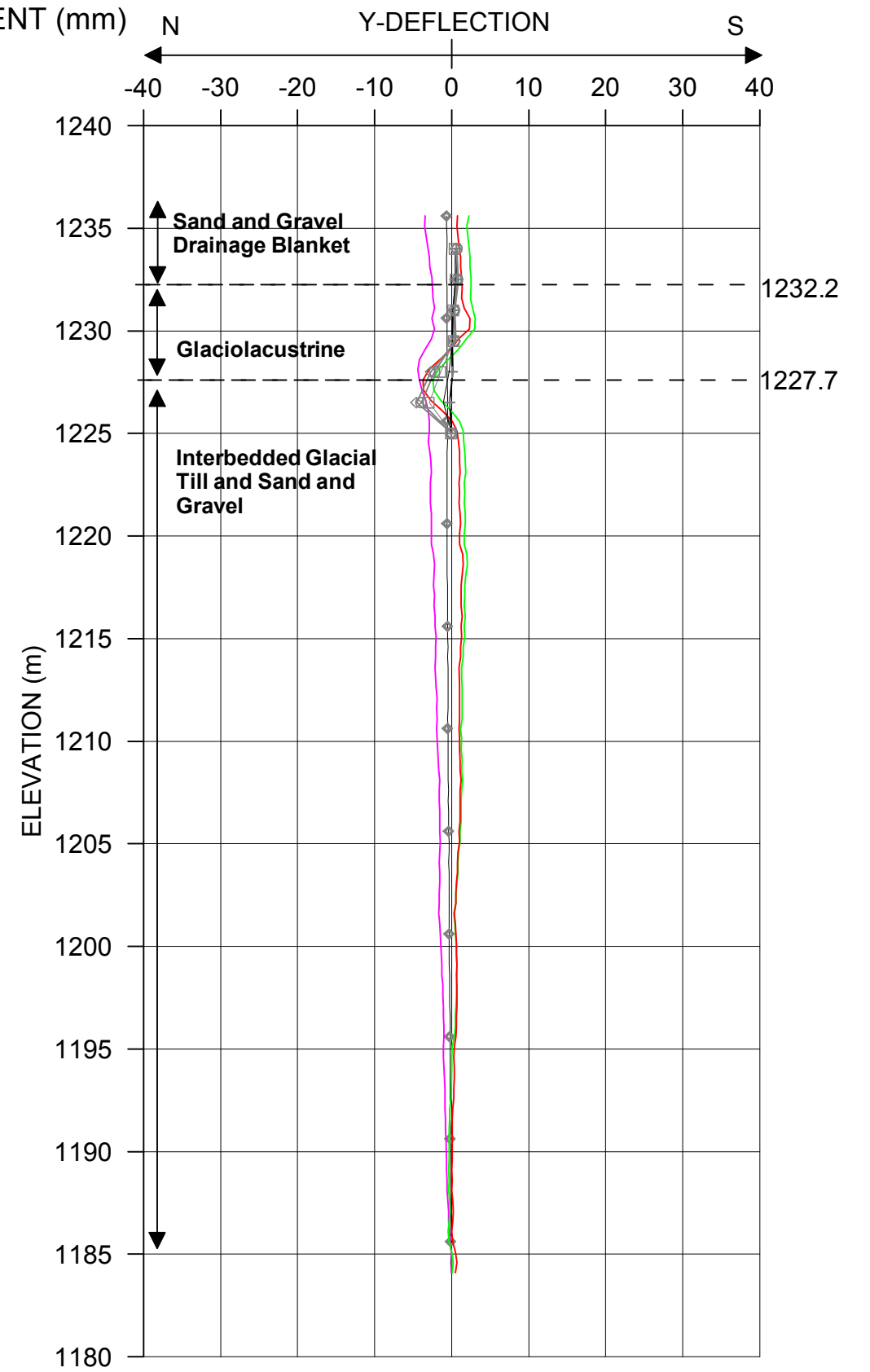
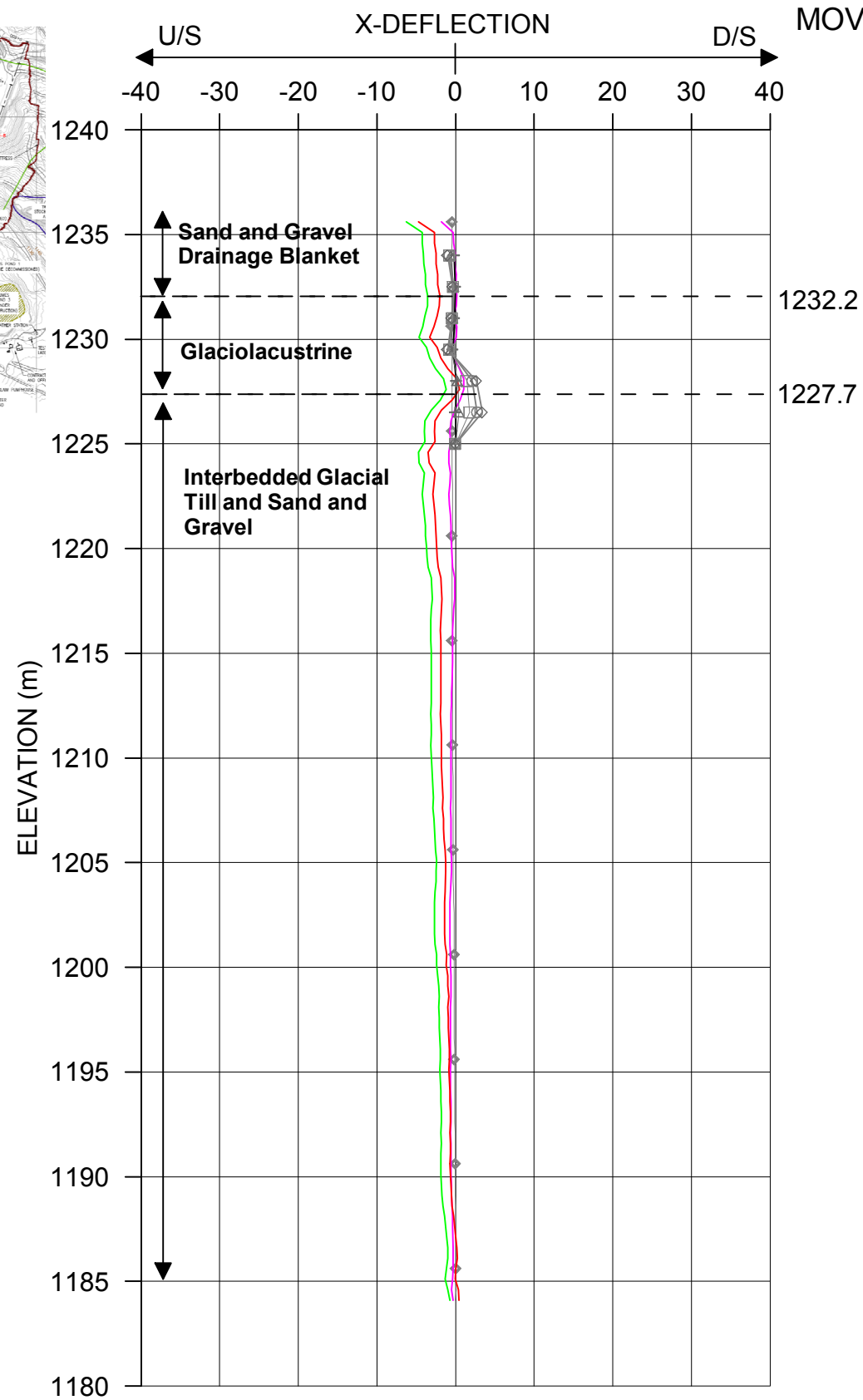
Date: February 27, 2018
 Z:\M\CR\M02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-Dam\116-1\Grapher files\116-1 2017 (for DSI only).grf



- LEGEND**
- ◆ Jun 12, 2016
 - Aug 20, 2016
 - Apr 20, 2017
 - June 27, 2017
 - + IPI Aug 29, 2017
 - △ IPI Oct 15, 2017
 - IPI Nov 29, 2017
 - IPI Dec 21, 2017
 - ◇ IPI Jan 11, 2018

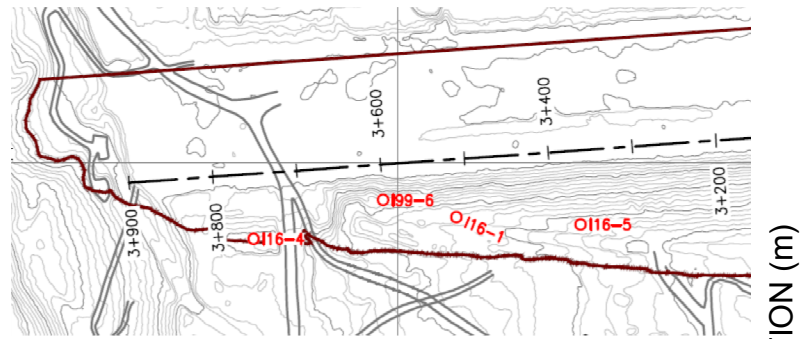
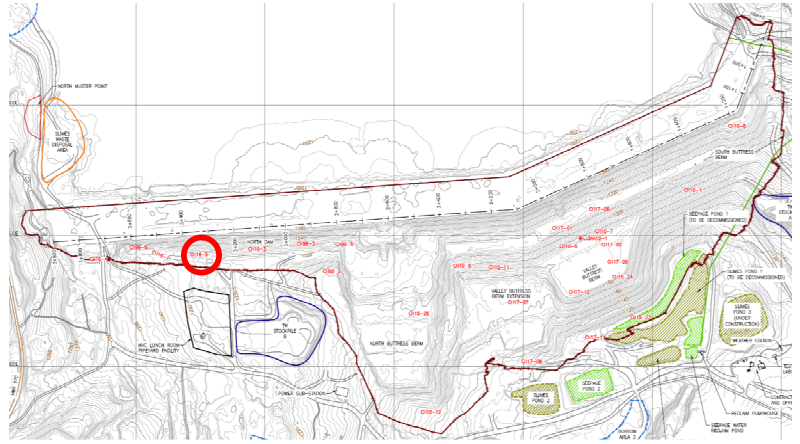
NOTES:

- 1) Initial reading = June 12, 2016.
- 2) No readings between Aug. 20, 2016 and April 20, 2017 due to frozen groundwater within casing.
- 3) An In-Place Inclinometer (IPI) was installed in July 2017 from El. 1225 m to El. 1234 m.



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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 116-1
	PROJECT No. M02341B26	FIG No. IV-4

Date: February 27, 2018
 Z:\MVC\RM234-1B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L_Dam\116-5\Grapher Files\116-5 2017 (for DSI only).grf

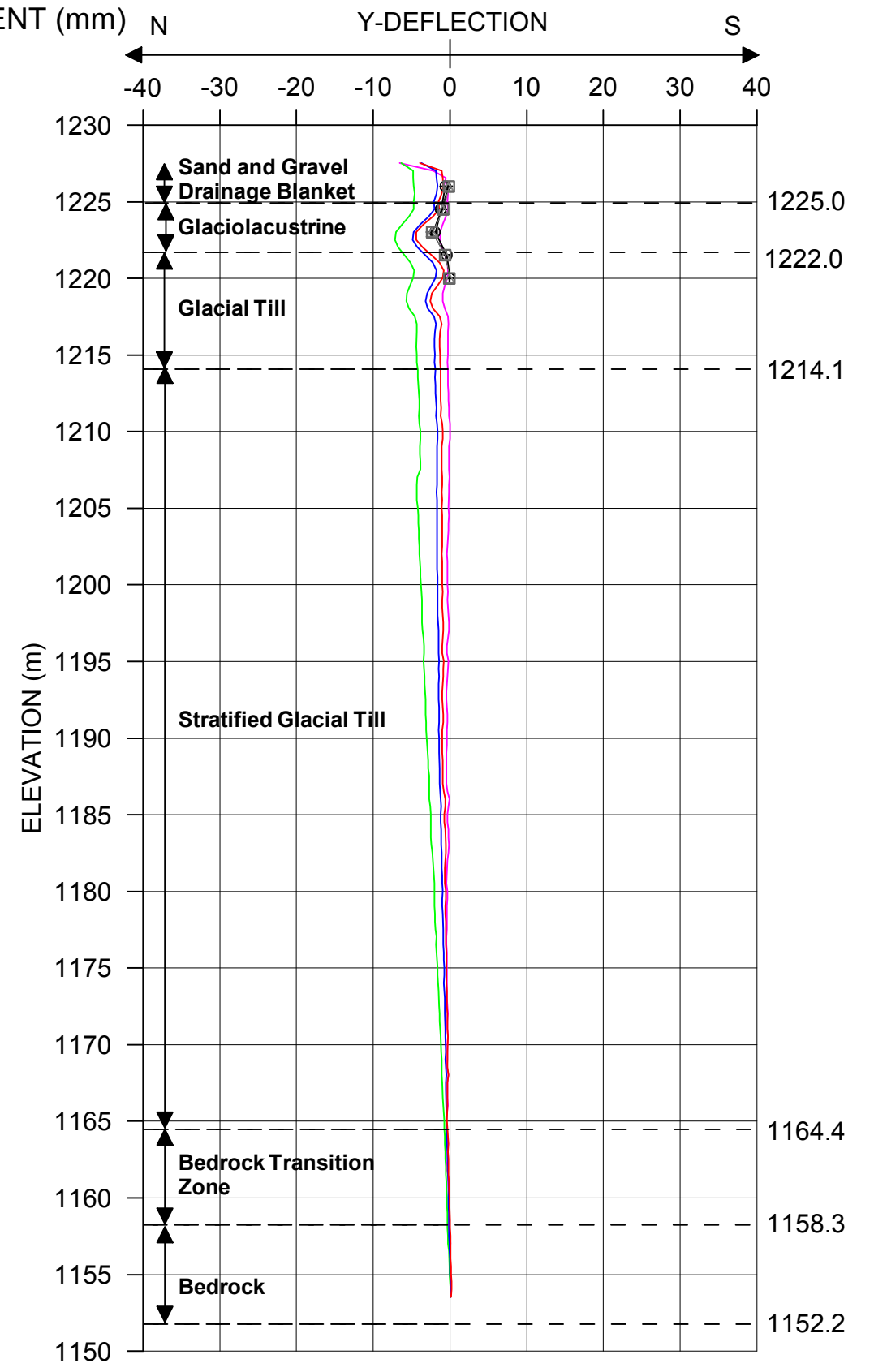
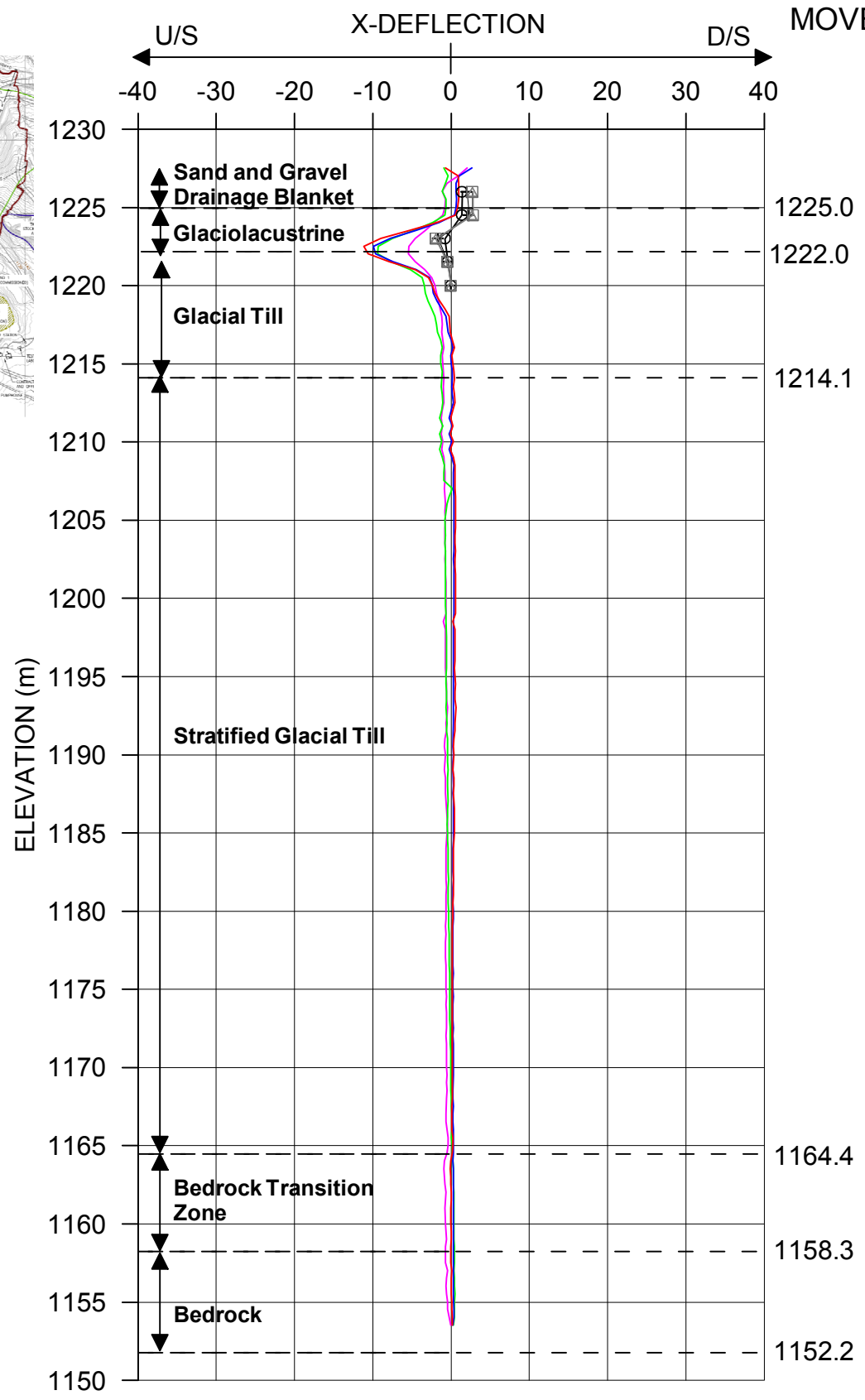


LEGEND

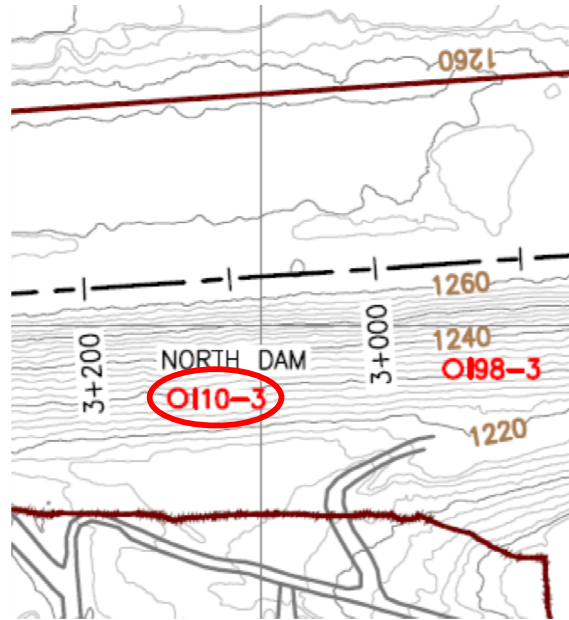
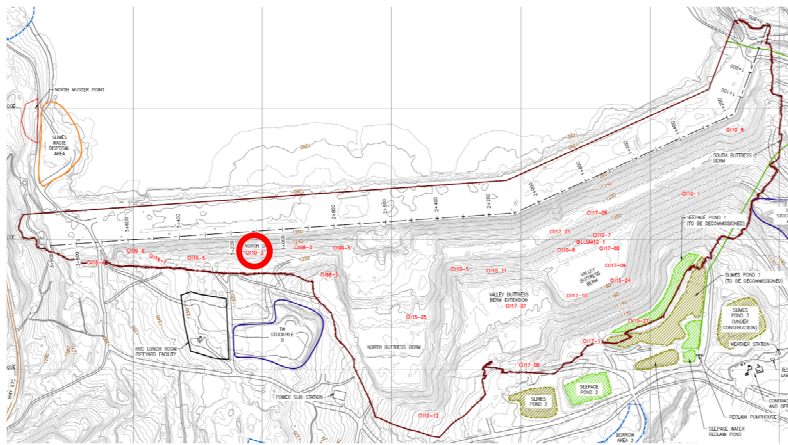
- Feb 4, 2017
- April 20, 2017
- May 20, 2017
- June 11, 2017
- — ○ IPI - Aug 29, 2017
- + — + IPI - Oct 29, 2017
- △ — △ IPI - Dec 21, 2017
- — □ IPI - Jan 11, 2018

NOTES:

- 1) Initial reading = December 4, 2016.
- 2) An In-Place Inclinometer (IPI) was installed in July 2017 from El. 1220 m to El. 1226 m



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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE I16-5
		PROJECT No. M02341B26



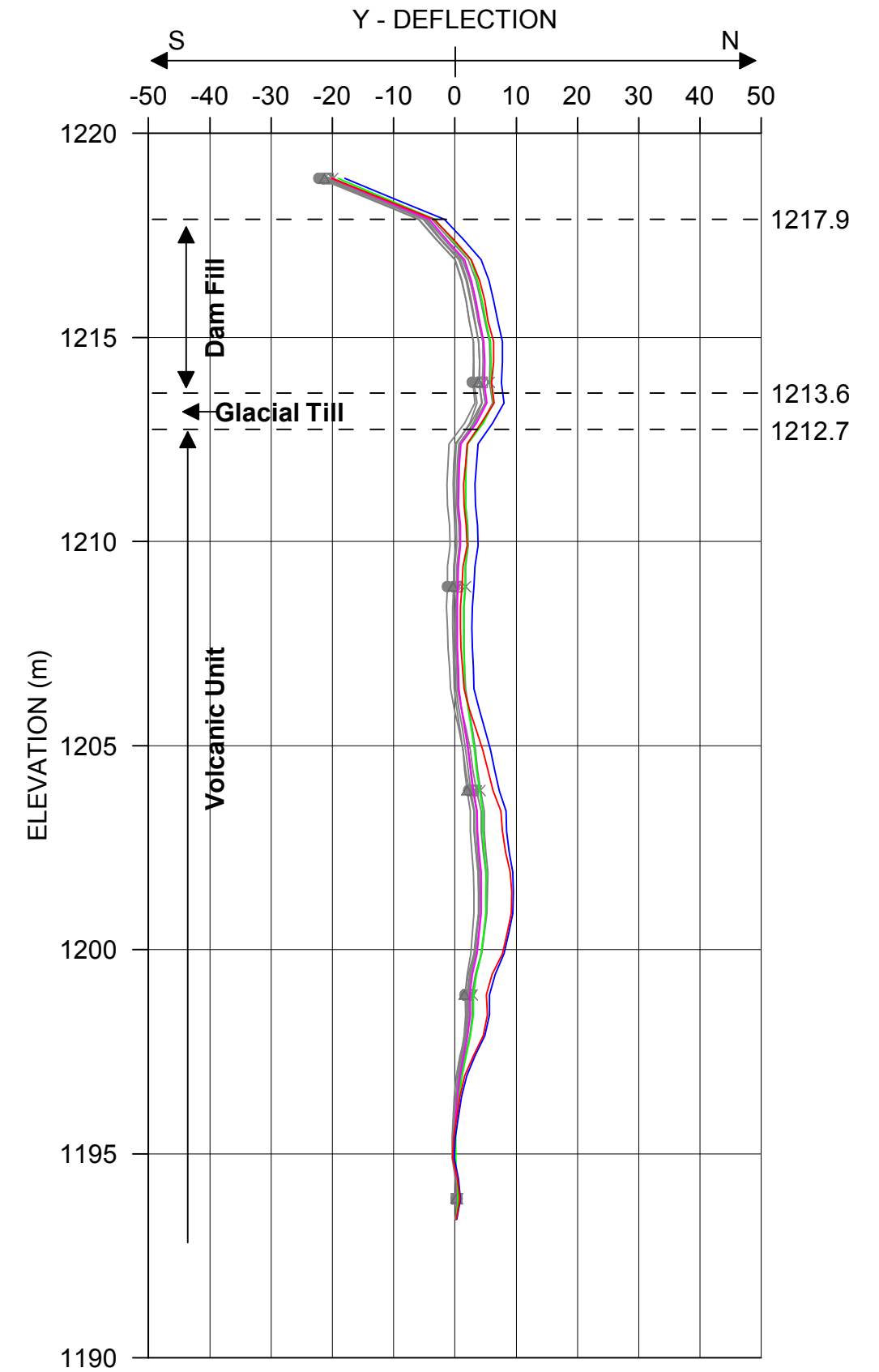
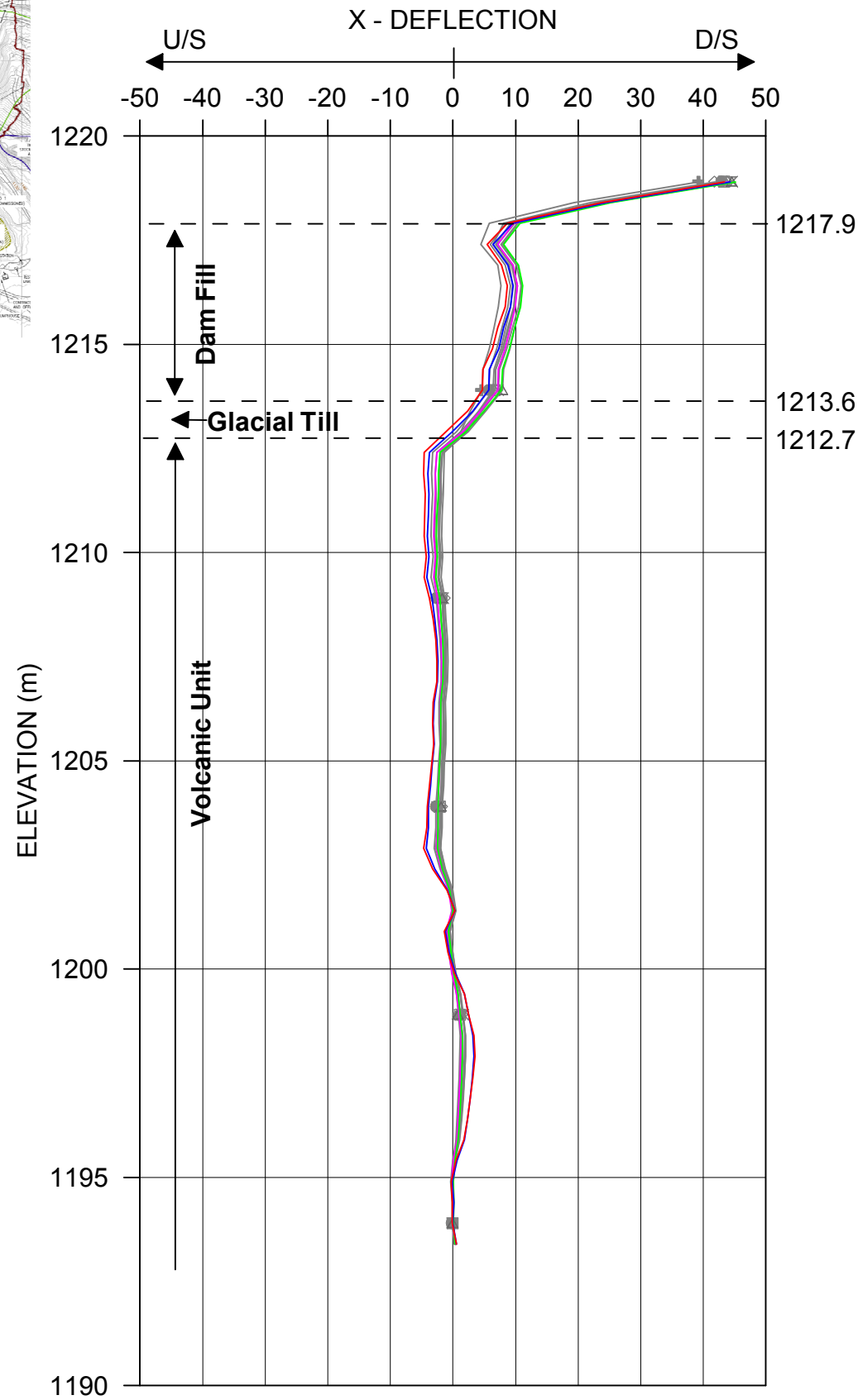
LEGEND

- ✦ — ✦ — ✦ Mar 16, 2012
- ◇ — ◇ — ◇ Mar 23, 2013
- — □ — □ June 11, 2014
- ✕ — ✕ — ✕ June 17, 2015
- — ● — ● Jan 25, 2016
- ▽ — ▽ — ▽ June 13, 2016
- △ — △ — △ Nov 7, 2016
- May 28, 2017
- July 22, 2017
- Sept 23, 2017
- Oct 28, 2017

NOTES:

- 1) 110-3 was installed on October 24, 2010.
- 2) 110-3 was initialized on July 04, 2011.
- 3) Reel/Probe Serial Number for the initial reading: Not Available.
- 4) Not all readings are plotted.

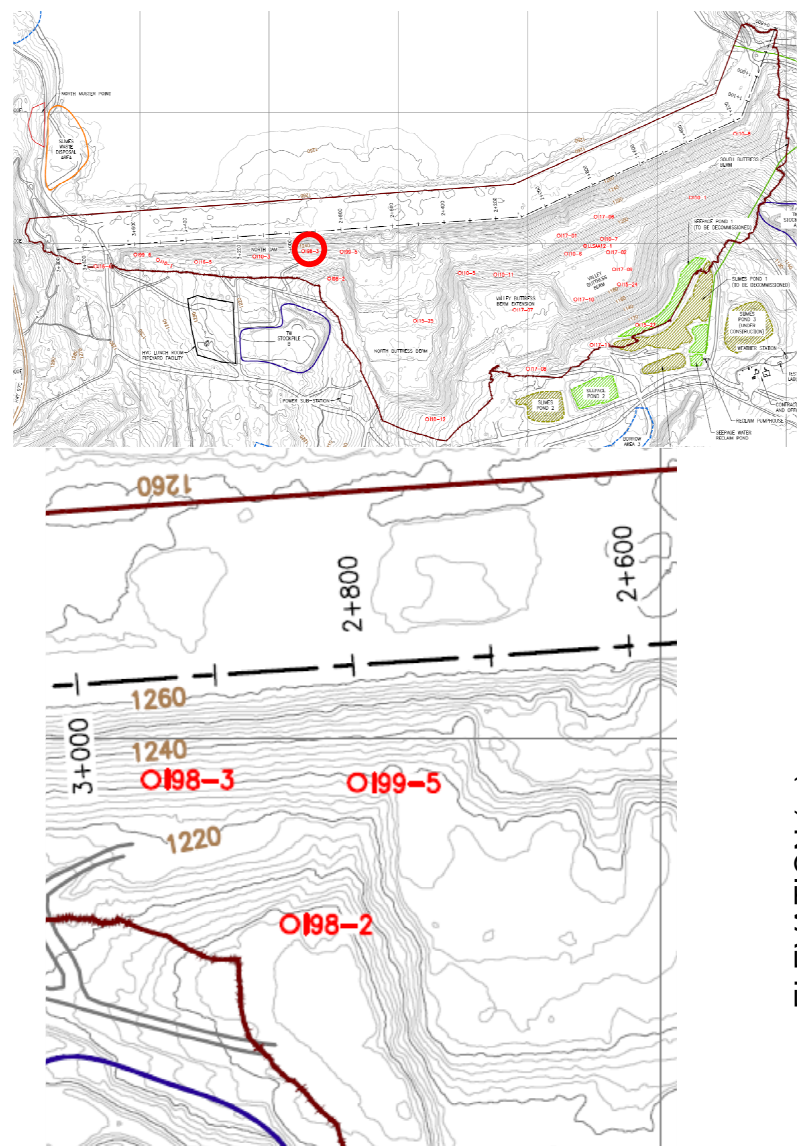
MOVEMENT (mm)



Date: February 27, 2018
File: Z:\MVCR\M02341A58 - HVC - 2011 Services\300 Design\Inclinometers 2011\110-3\2011 Files\FIG_110-3_2011.grffiles

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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 110-3
		PROJECT No. M02341B26 FIG No. IV-6

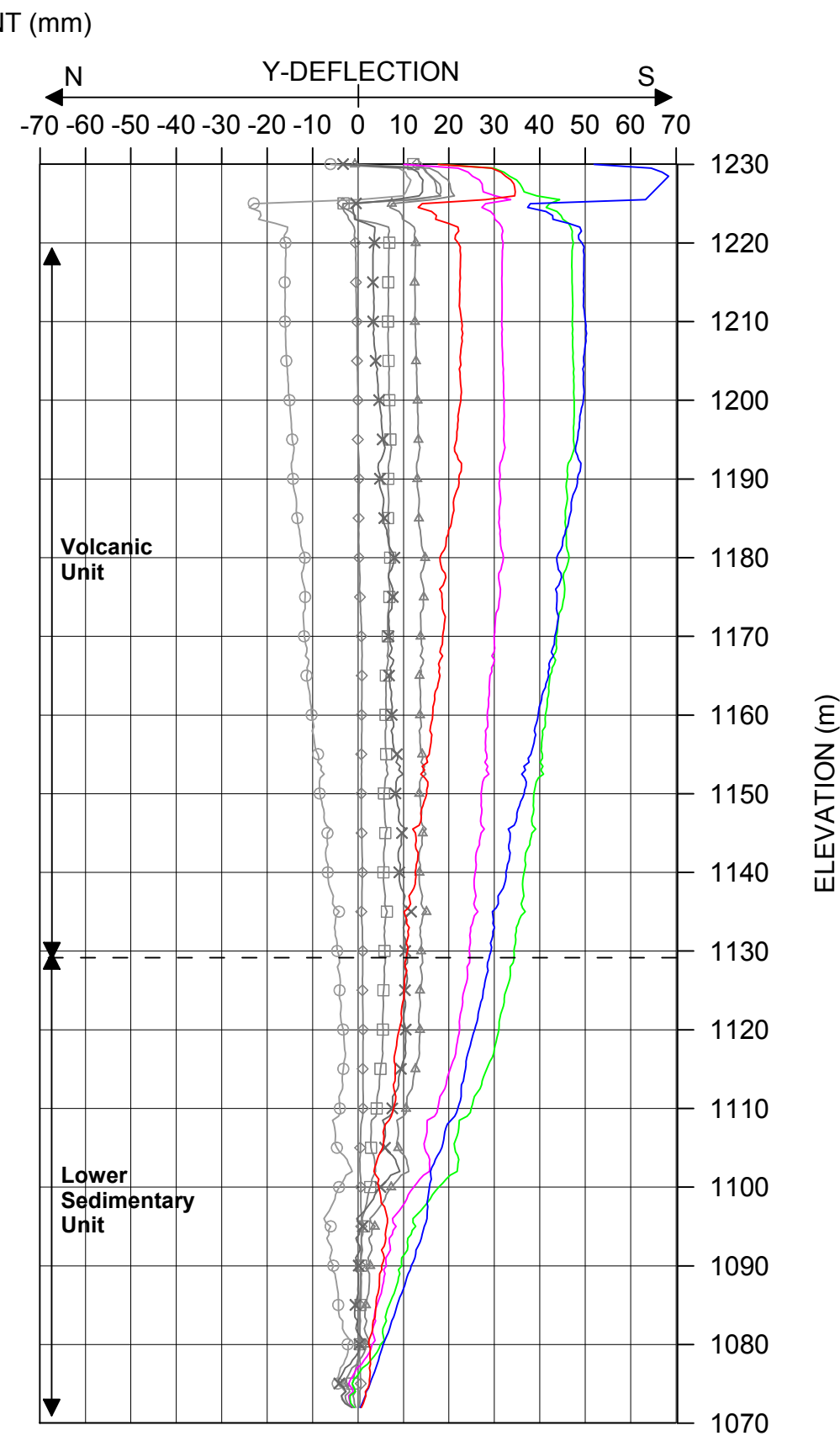
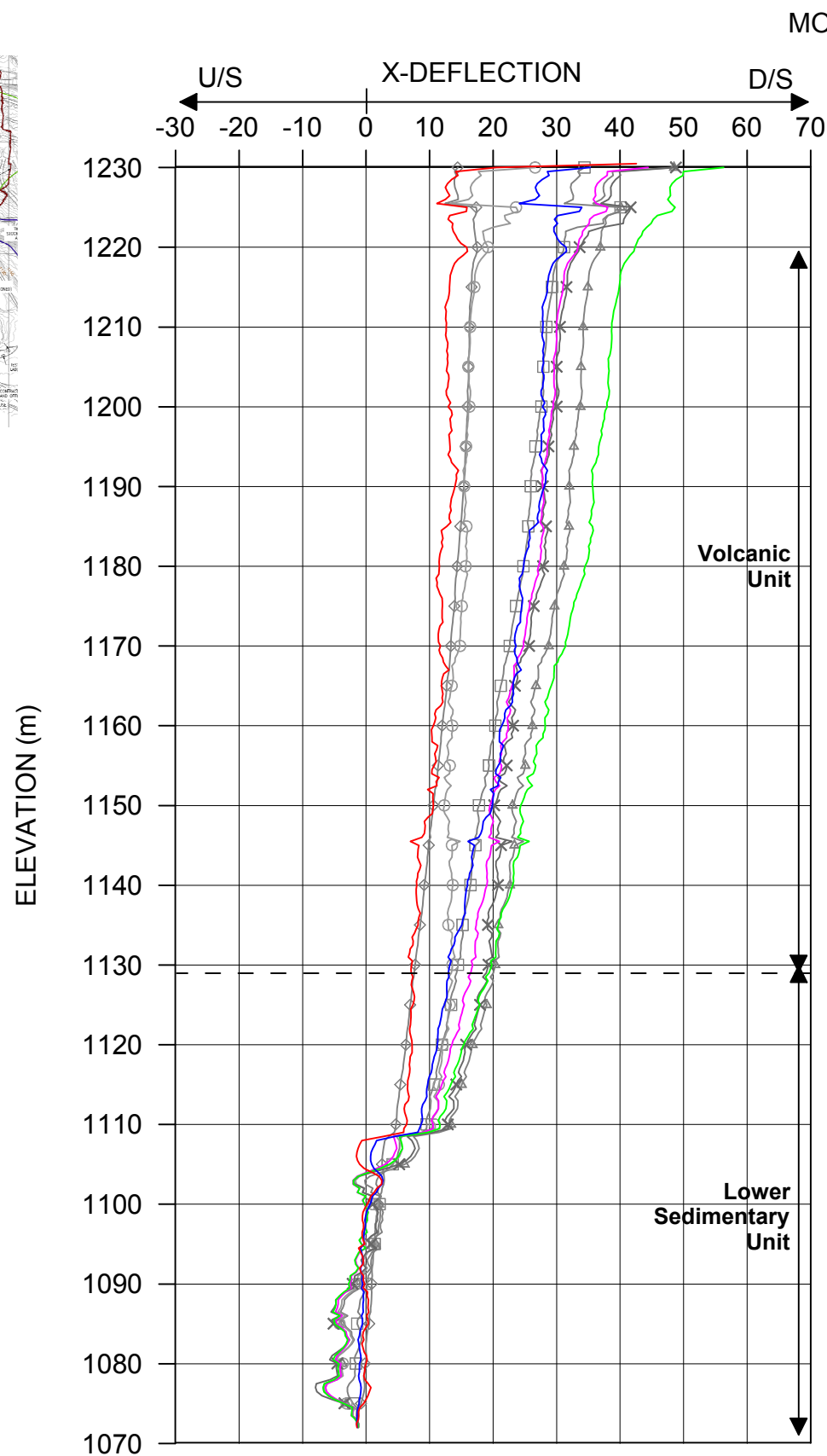
Date: February 27, 2018
 File: Z:\MIVCR\M02341A74 - HVC 2014 Eng Services\300 Design\320 Site Data\Inclinometers 2014\198-3\2013 files\198-3 2013.grf



LEGEND

◇	◇	◇	Apr 6, 2013
□	□	□	July 14, 2014
△	△	△	Aug 18, 2015
○	○	○	Aug 22, 2016
×	×	×	Nov 7, 2016
—	—	—	Apr 1, 2017
—	—	—	June 18, 2017
—	—	—	Sept 17, 2017
—	—	—	Oct 21, 2017

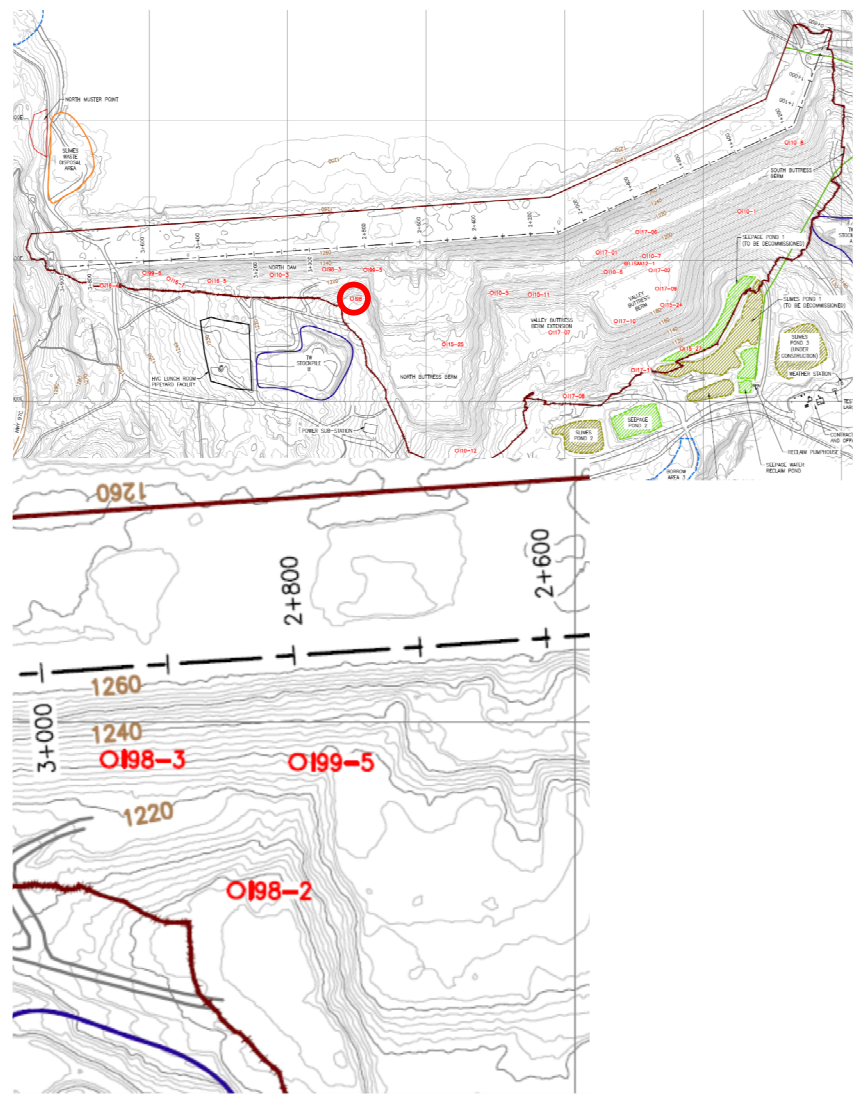
- NOTES:**
- 1) Inclinometer installed on March 29, 1998.
 - 2) Inclinometer cumulative displacement was re-initialized on May 13, 2012.
 - 3) Not all readings are plotted.
 - 4) Plots are clipped at El. 1230 m.



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CLIENT
**TECK HIGHLAND VALLEY
 COPPER PARTNERSHIP**

PROJECT	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
TITLE	INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 198-3
PROJECT No.	M02341B26
FIG No.	IV-7

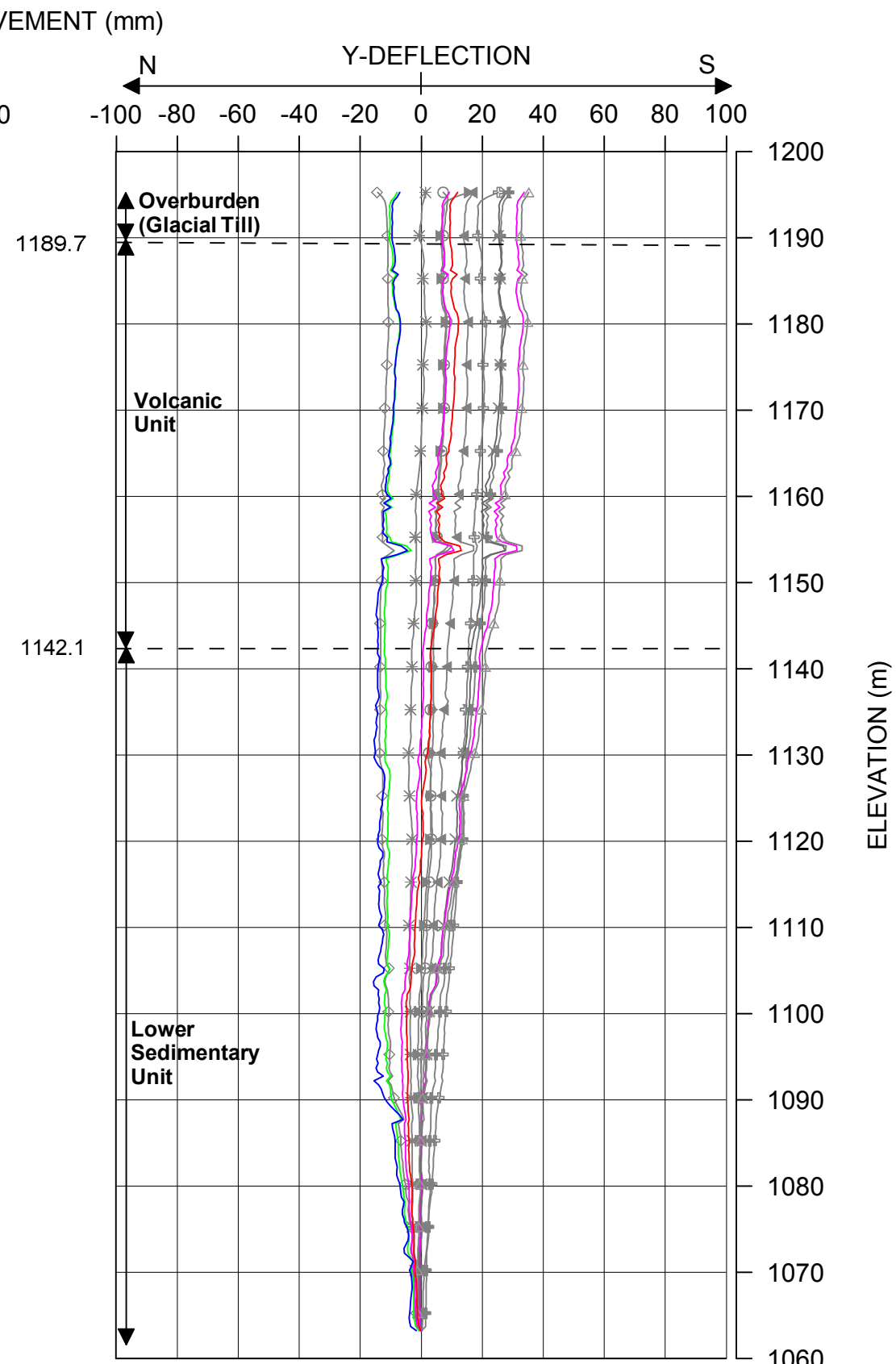
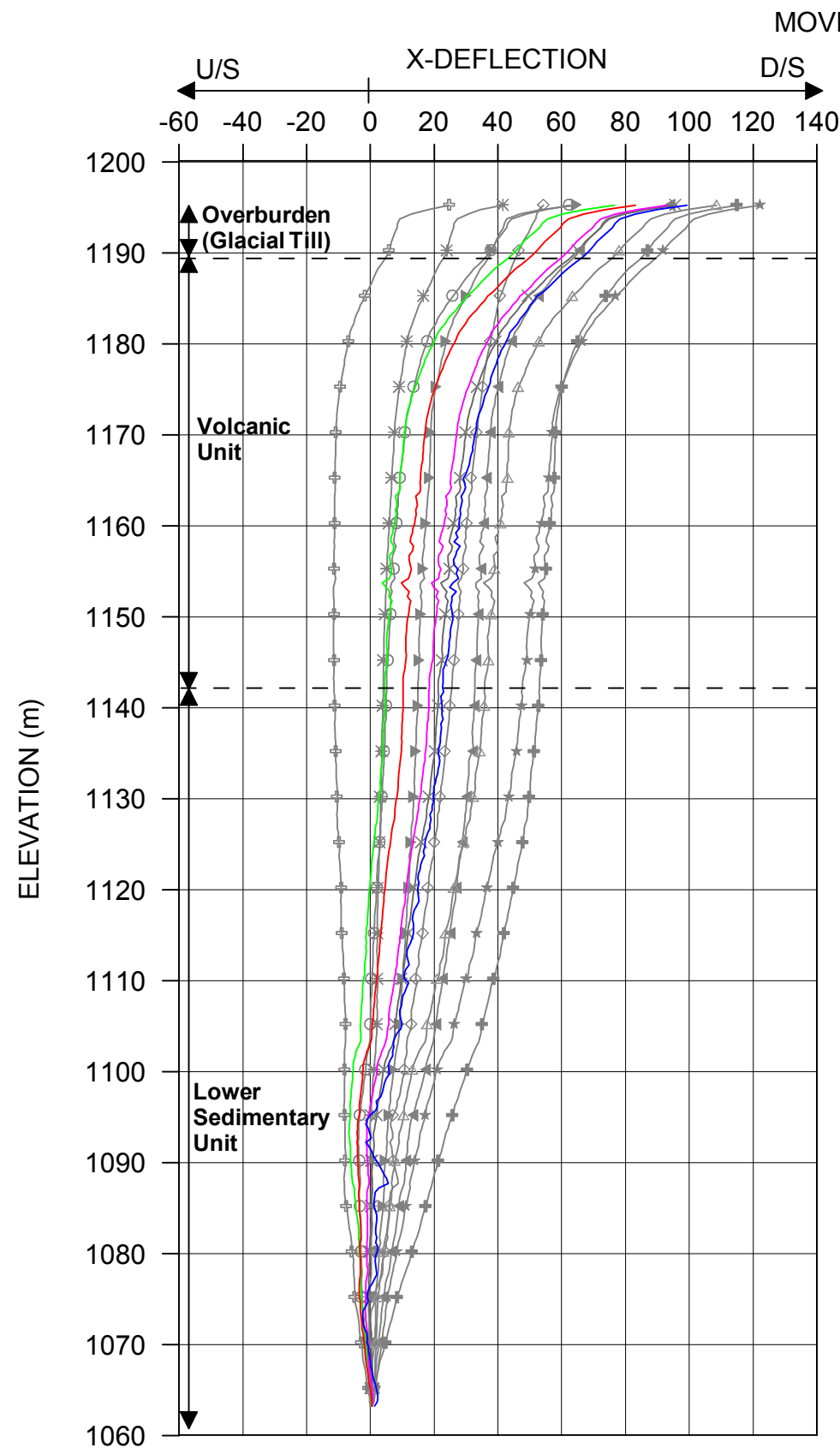


LEGEND

- * * * Mar 20, 1999
- ⊕ ⊕ ⊕ Oct 5, 2001
- ▶ ▶ ▶ June 15, 2003
- ○ ○ Mar 25, 2005
- ◀ ◀ ◀ Aug 14, 2007
- + + + July 9, 2009
- ◇ ◇ ◇ July 9, 2011
- □ □ June 4, 2013
- × × × July 9, 2015
- ★ ★ ★ Aug 5, 2016
- △ △ △ Jan 27, 2017
- Apr 17, 2017
- July 14, 2017
- Oct 16, 2017
- Dec 20, 2017

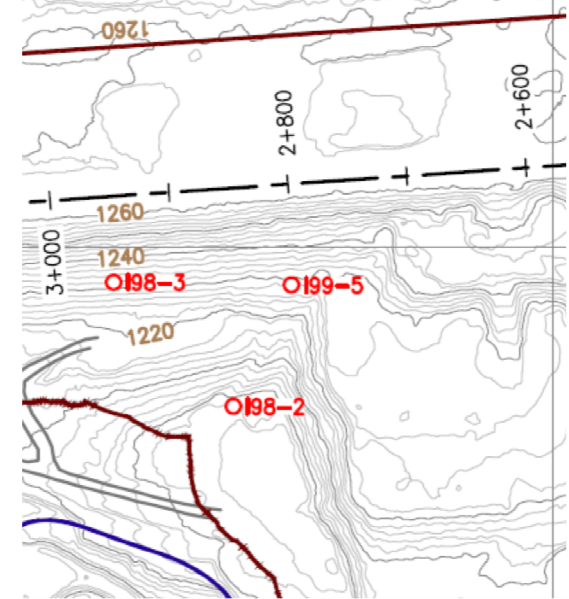
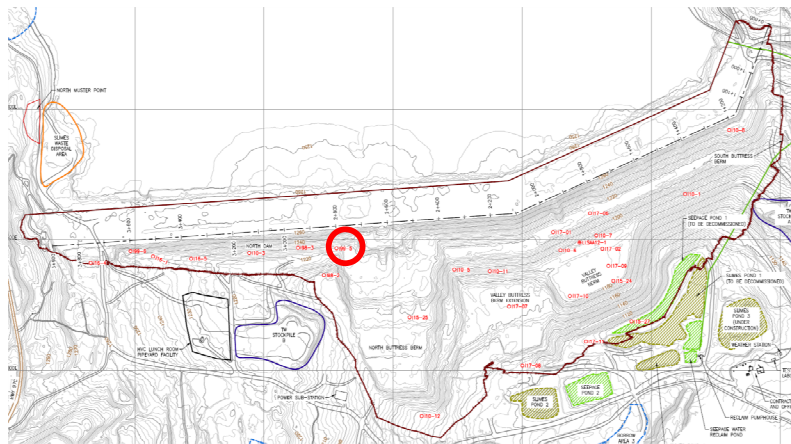
NOTES:

- 1) Initial reading = June 12, 1998.
- 2) Not all readings are plotted.



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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 198-2
	PROJECT No. M02341B26	FIG No. IV-8

Date: February 27, 2018
Z:\MVC\RM02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-L Dam\199-5\Grapher plots\199-5 2017 (For DSI only).grf

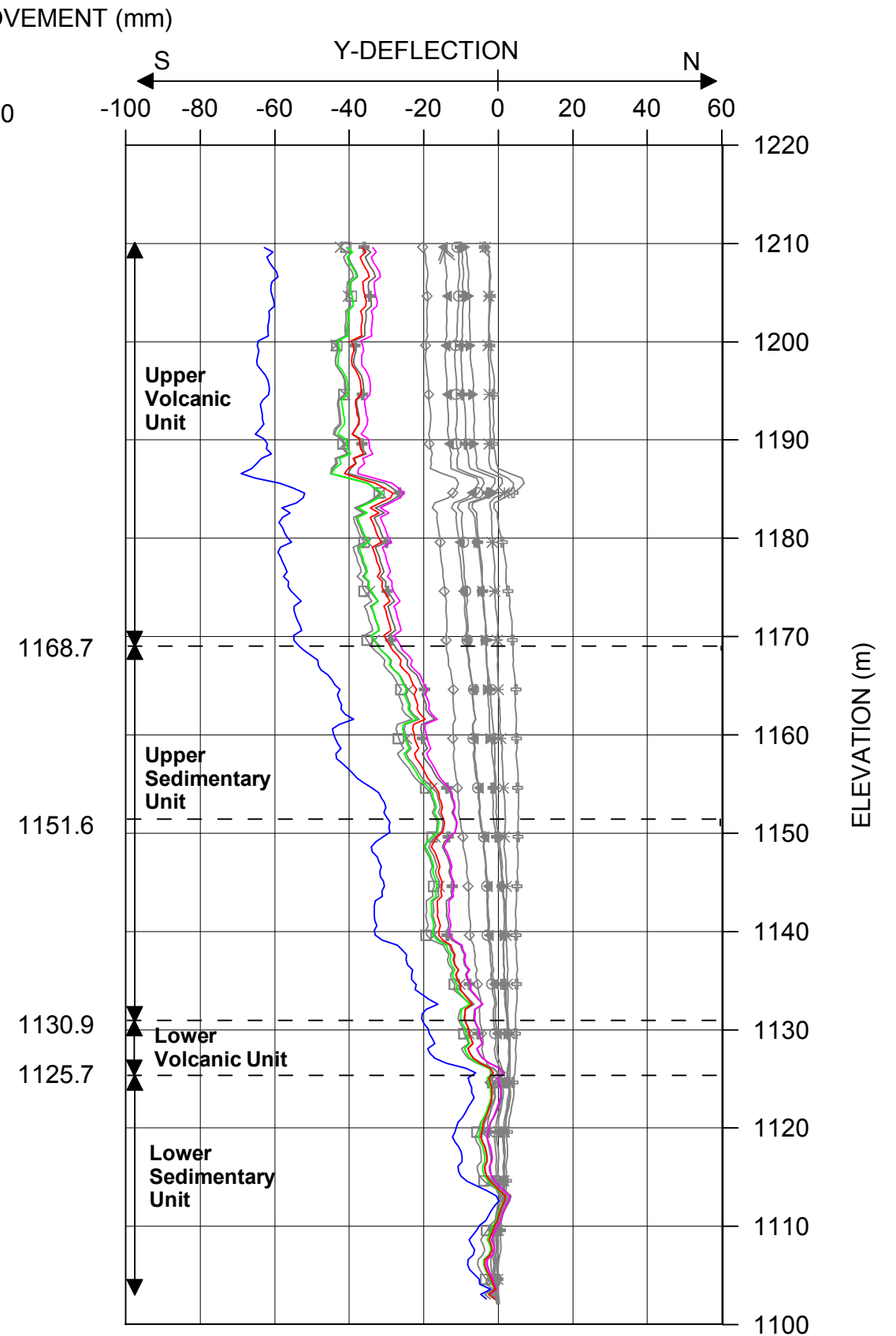
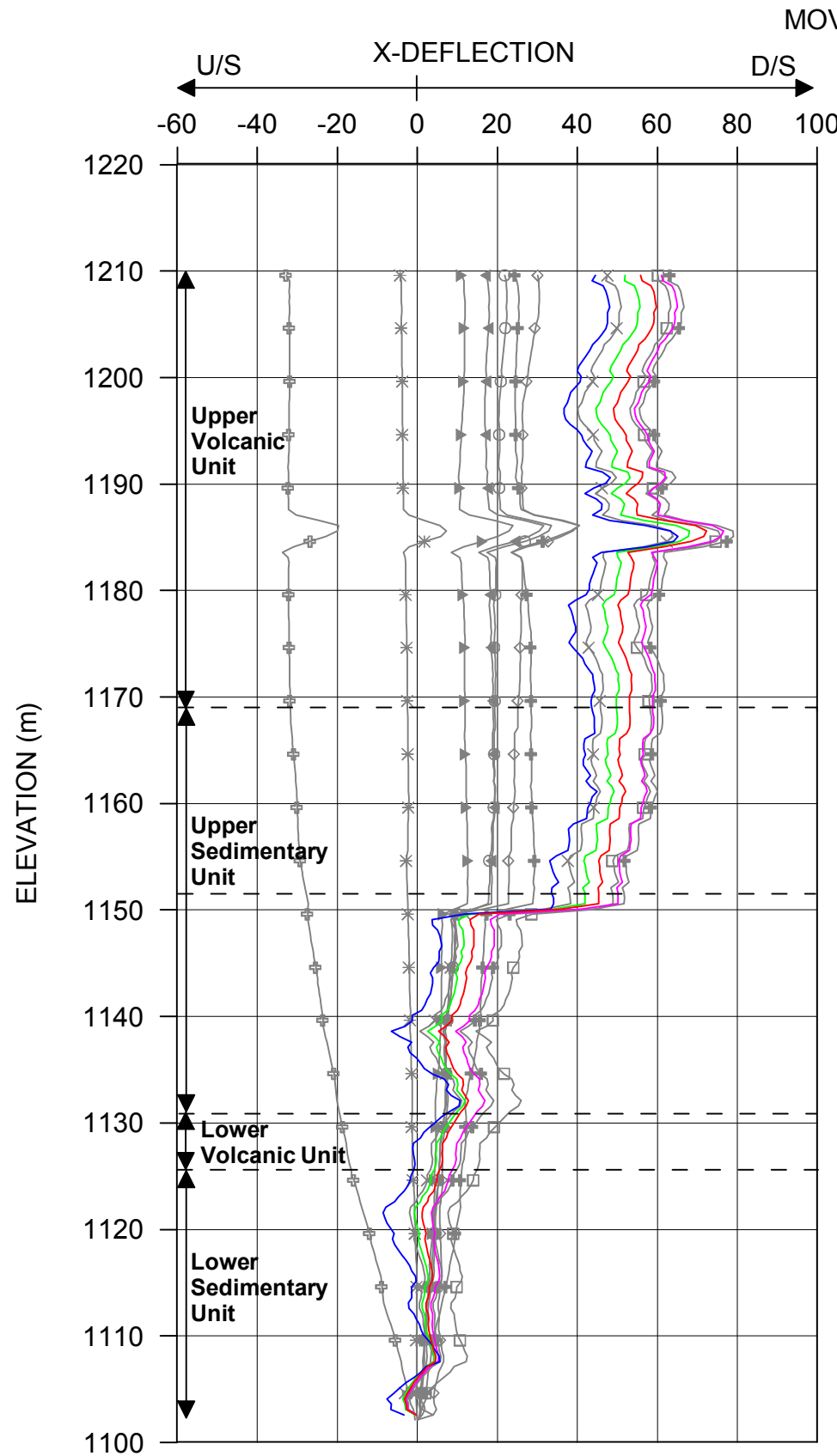


LEGEND

- * * * * * Oct 8, 1999
- ⊕ ⊕ ⊕ ⊕ ⊕ July 8, 2001
- ▶ ▶ ▶ ▶ ▶ June 25, 2003
- ○ ○ ○ ○ May 4, 2005
- ◀ ◀ ◀ ◀ ◀ Aug 11, 2007
- + + + + + July 14, 2009
- ◇ ◇ ◇ ◇ ◇ May 9, 2011
- □ □ □ □ Jun 6, 2013
- × × × × × July 30, 2015
- ⊕ ⊕ ⊕ ⊕ ⊕ July 11, 2016
- — — — — Jan 20, 2017
- — — — — May 17, 2017
- — — — — Sept 17, 2017
- — — — — Dec 18, 2017

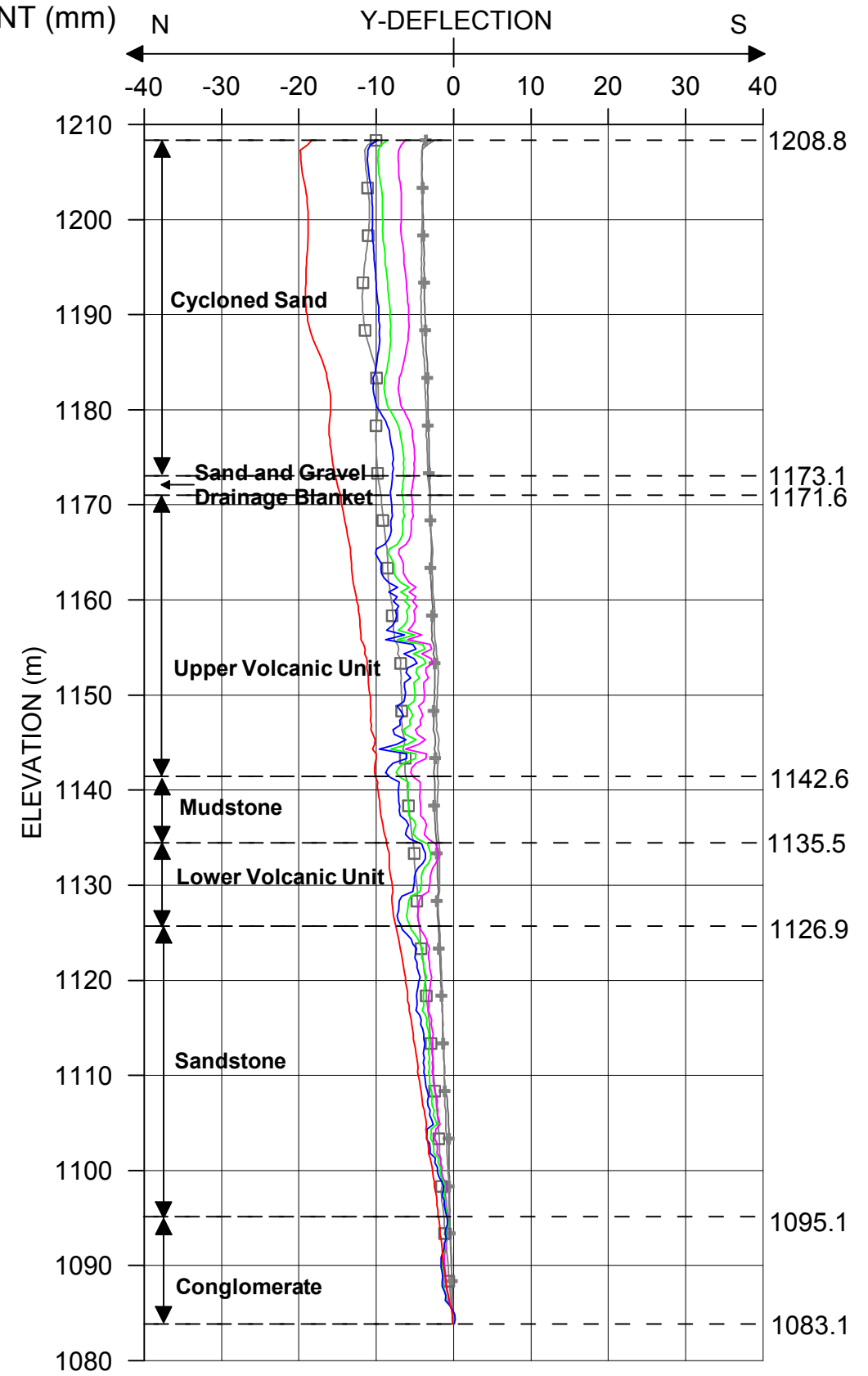
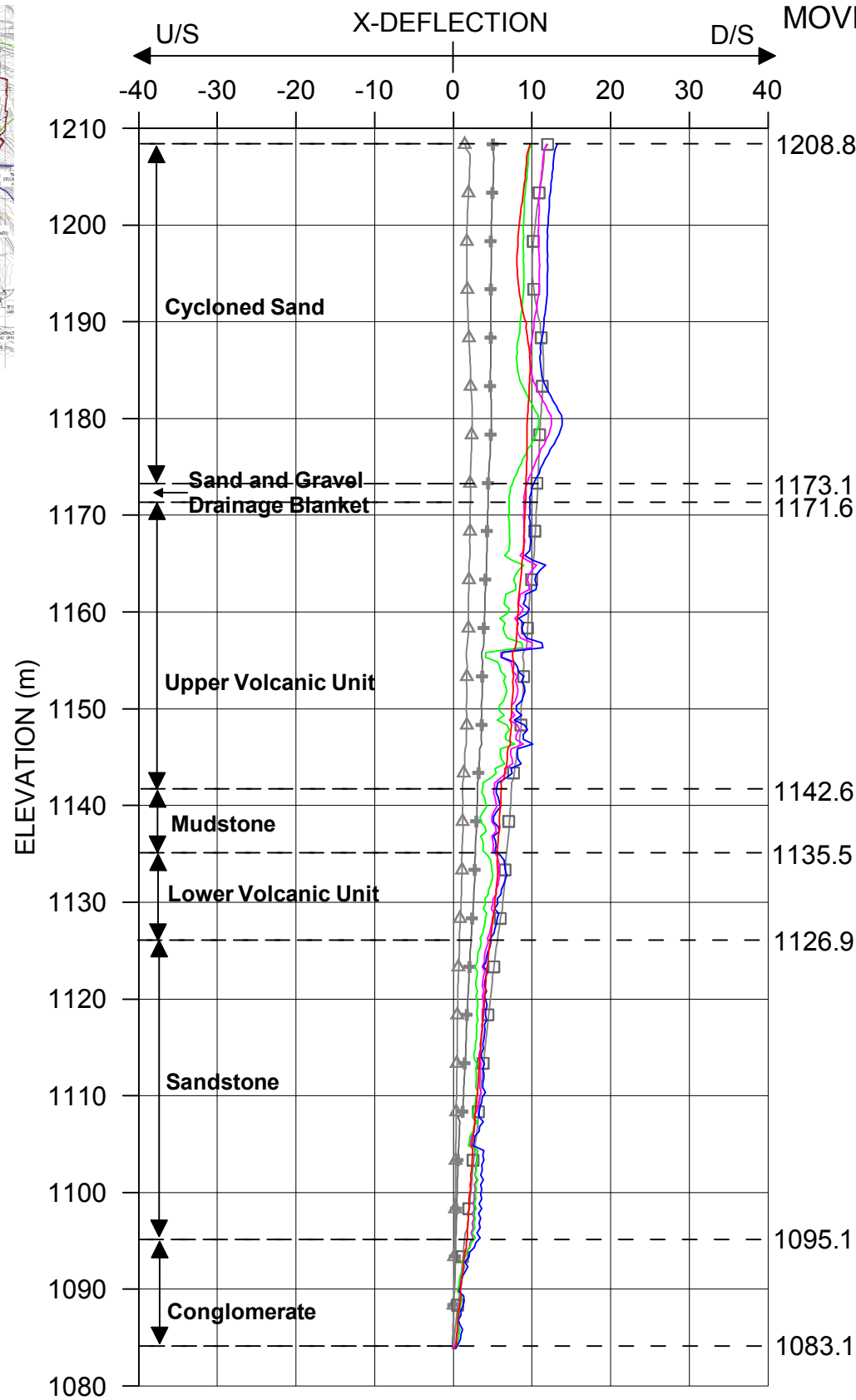
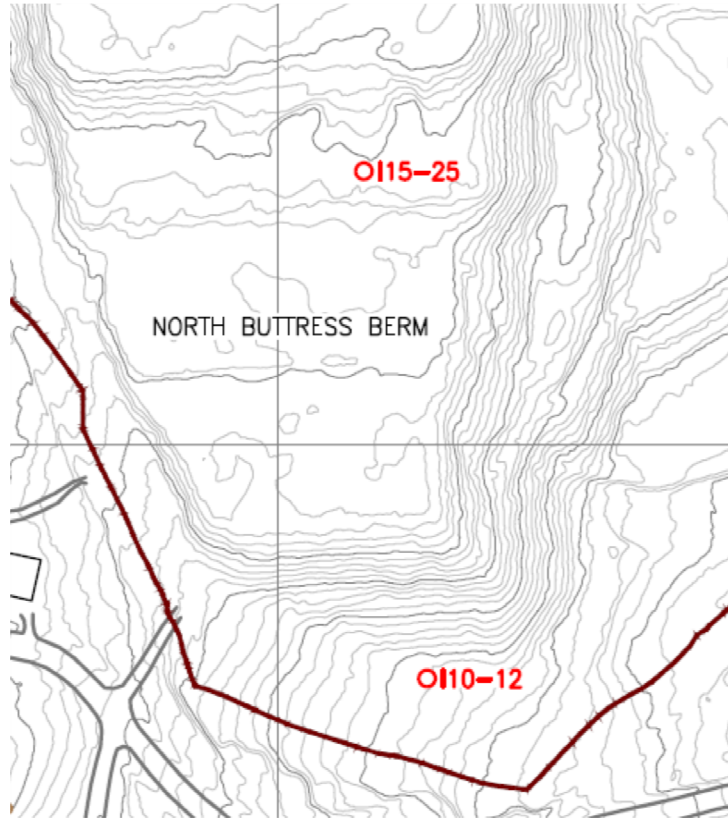
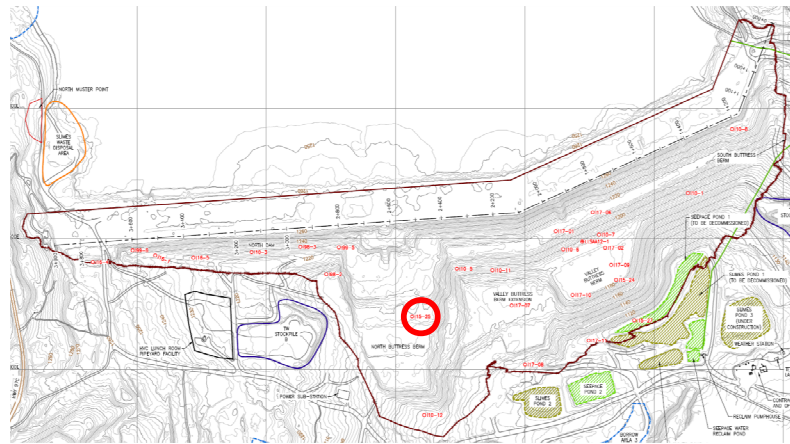
NOTES:

- 1) Initial reading = August 24, 1999.
- 2) Not all readings are plotted.
- 3) Plots are clipped at El. 1210 m.



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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 199-5
PROJECT No. M02341B26		FIG No. IV-9

Date: February 27, 2018
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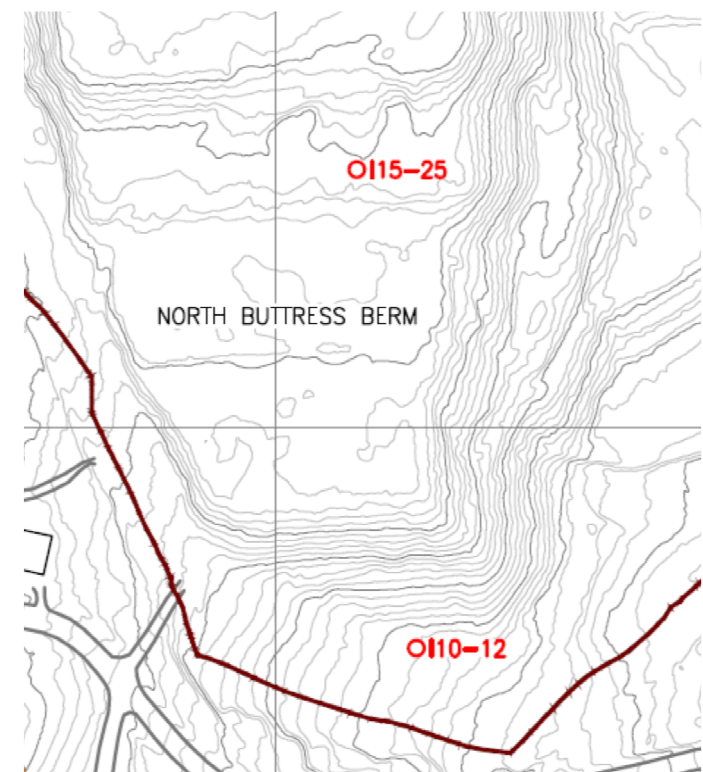
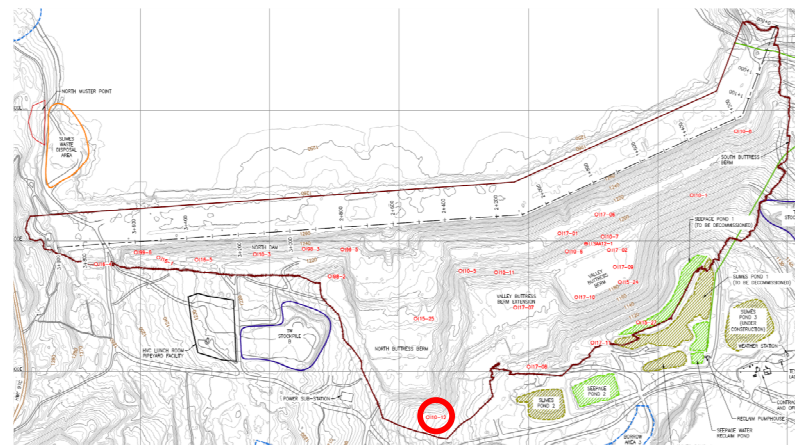
LEGEND

- ✦ July 1, 2016
- △ Jan 27, 2017
- May 13, 2017
- July 28, 2017
- Oct 7, 2017
- Nov 4, 2017
- Dec 20, 2017

NOTES:
 1) Initial reading = April 8, 2016.
 2) Not all readings are plotted.

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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 115-25
	PROJECT No. M02341B26	FIG No. IV-10

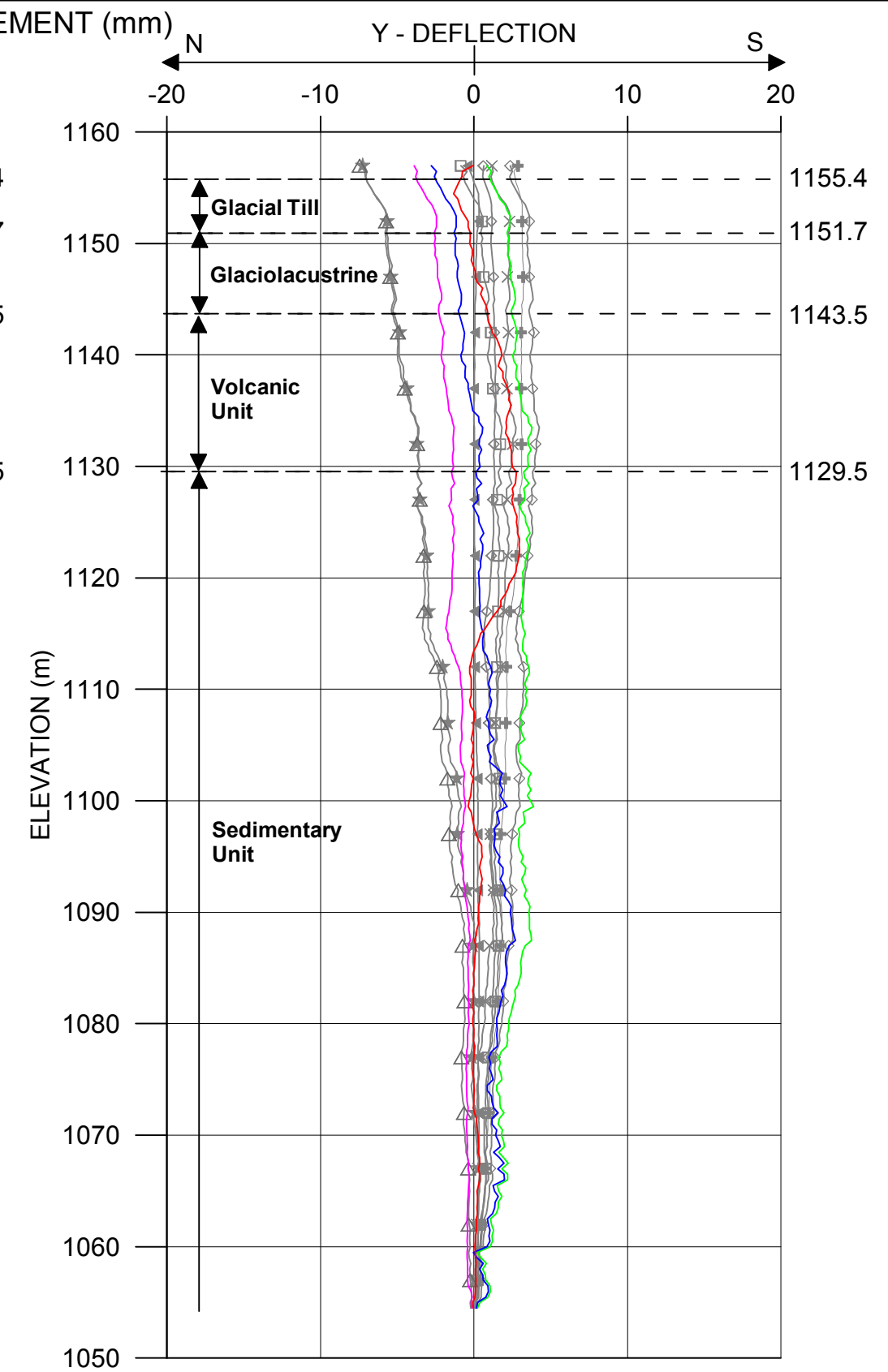
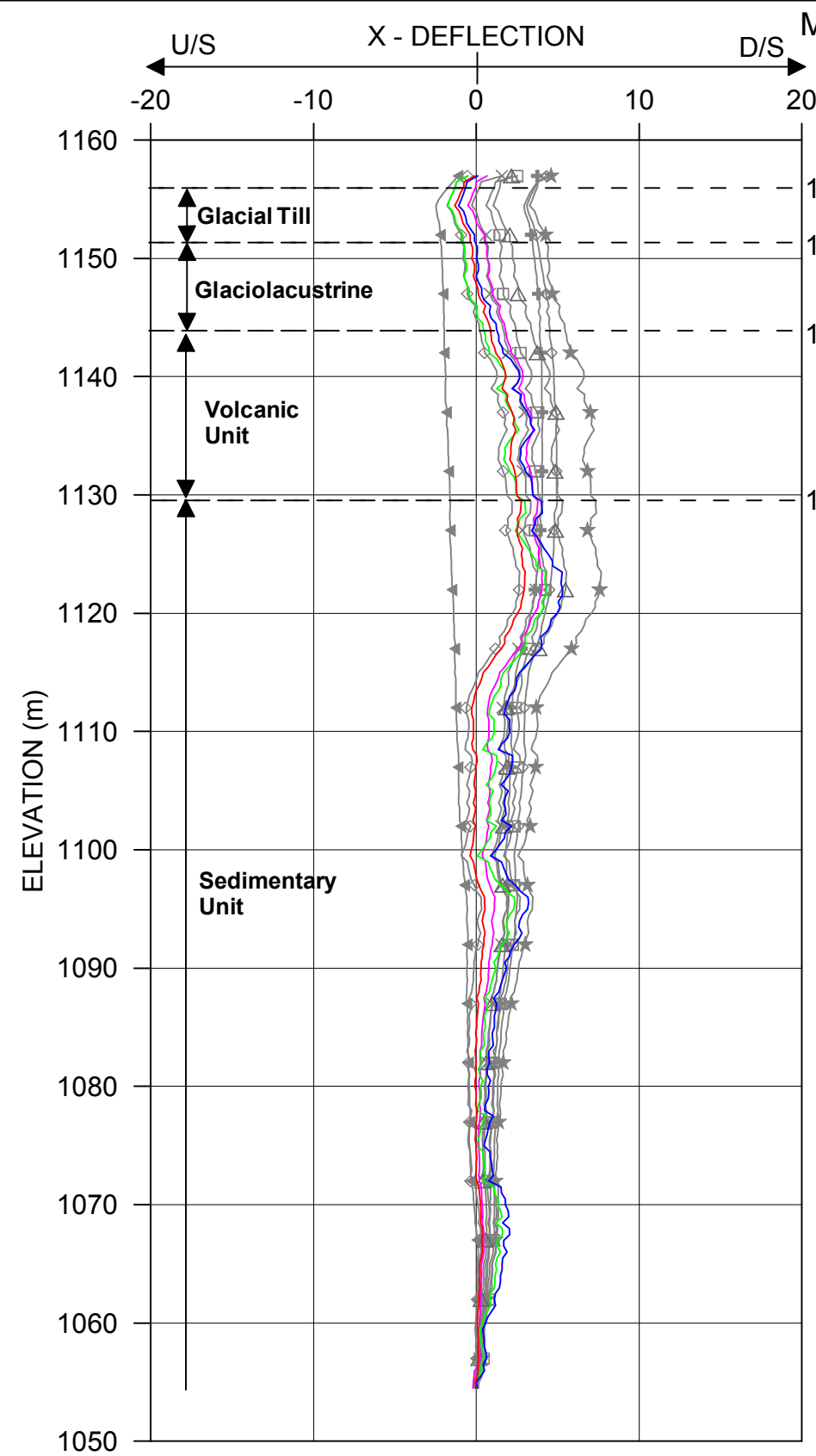
Date: February 27, 2018
Z:\MVC\R\M02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-L Dam\110-12\Grapher files\110-12 2017 (for DS) only.grf



LEGEND

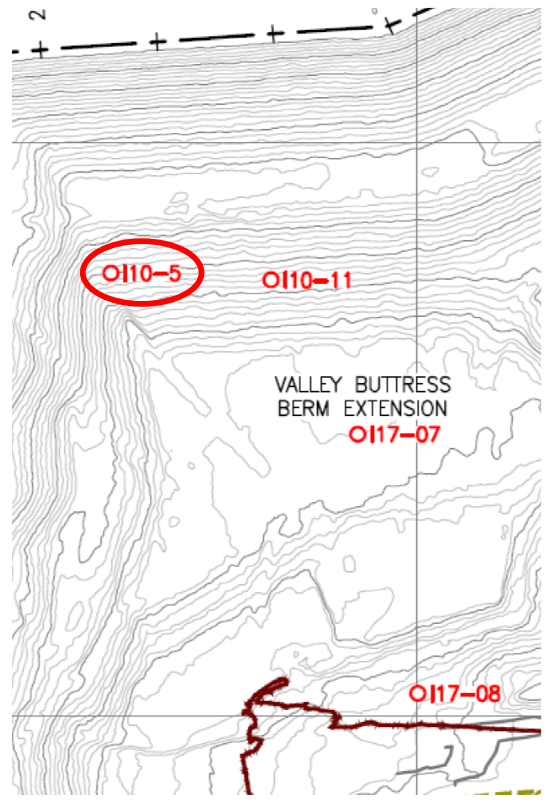
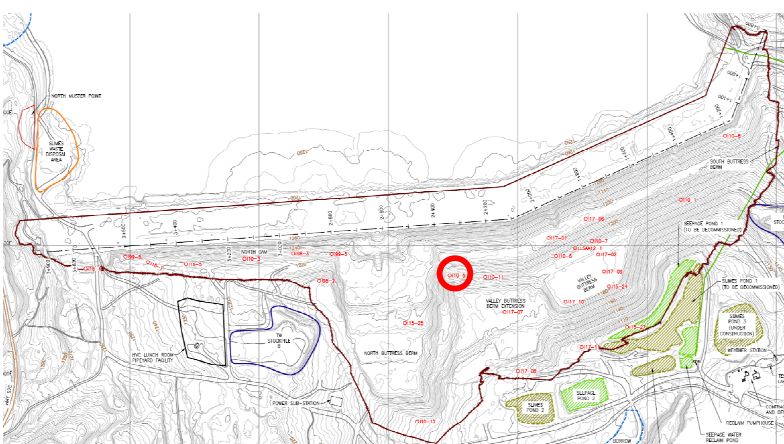
- ← ← ← July 3, 2011
- + + + Aug 9, 2012
- ◇ ◇ ◇ May 20, 2013
- □ □ July 15, 2014
- × × × Aug 5, 2015
- ★ ★ ★ Jul 8, 2016
- △ △ △ Jan 27, 2017
- ◇ ◇ ◇ Mar 26, 2017
- Jun 02, 2017
- Sep 3, 2017
- Nov 4, 2017
- Dec 19, 2017

NOTES:
 1) Initial reading = April 16, 2011.
 2) Not all readings are plotted.



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	 Klohn Crippen Berger	TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 110-12
		PROJECT No. M02341B26 FIG No. IV-11

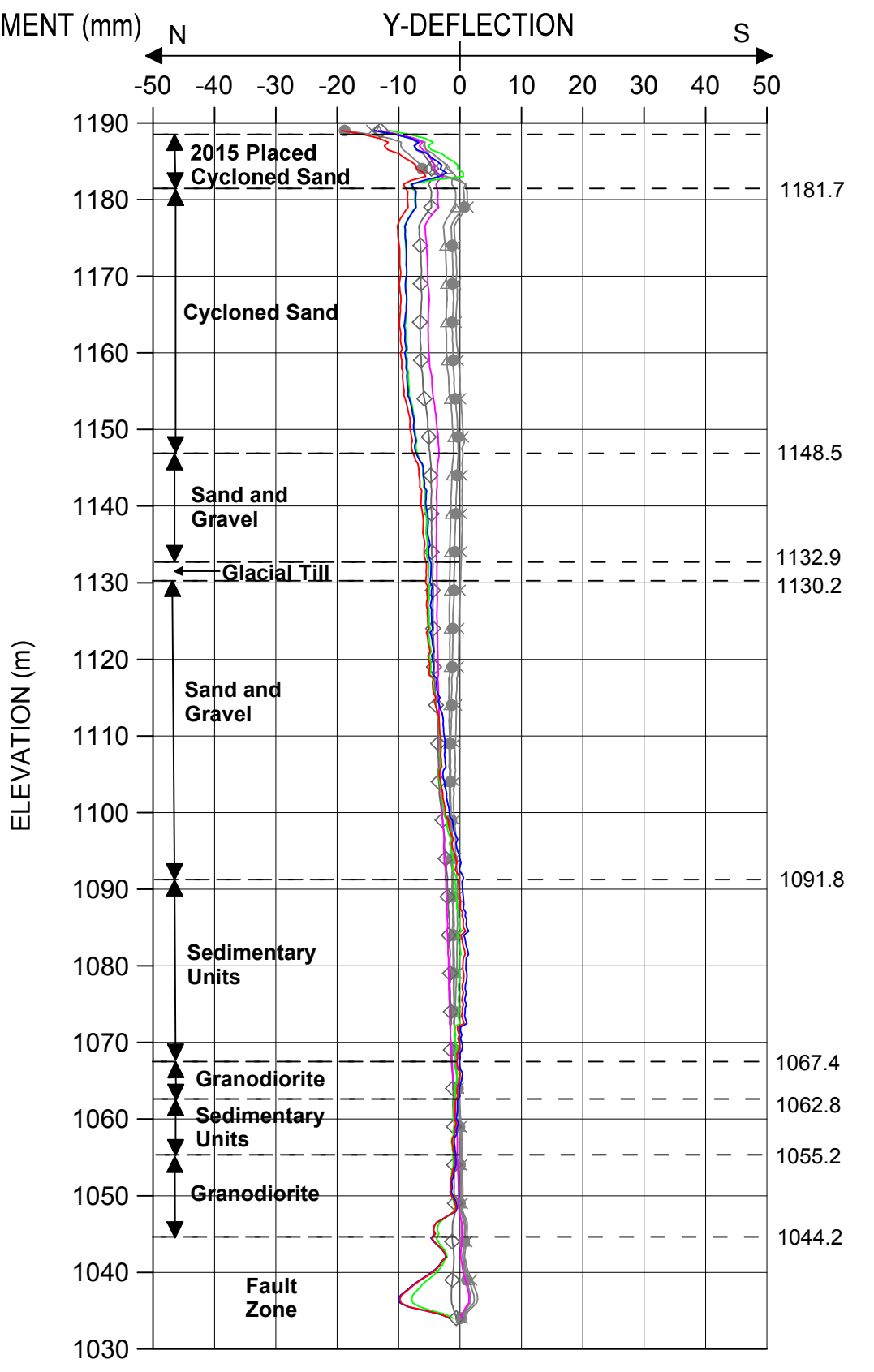
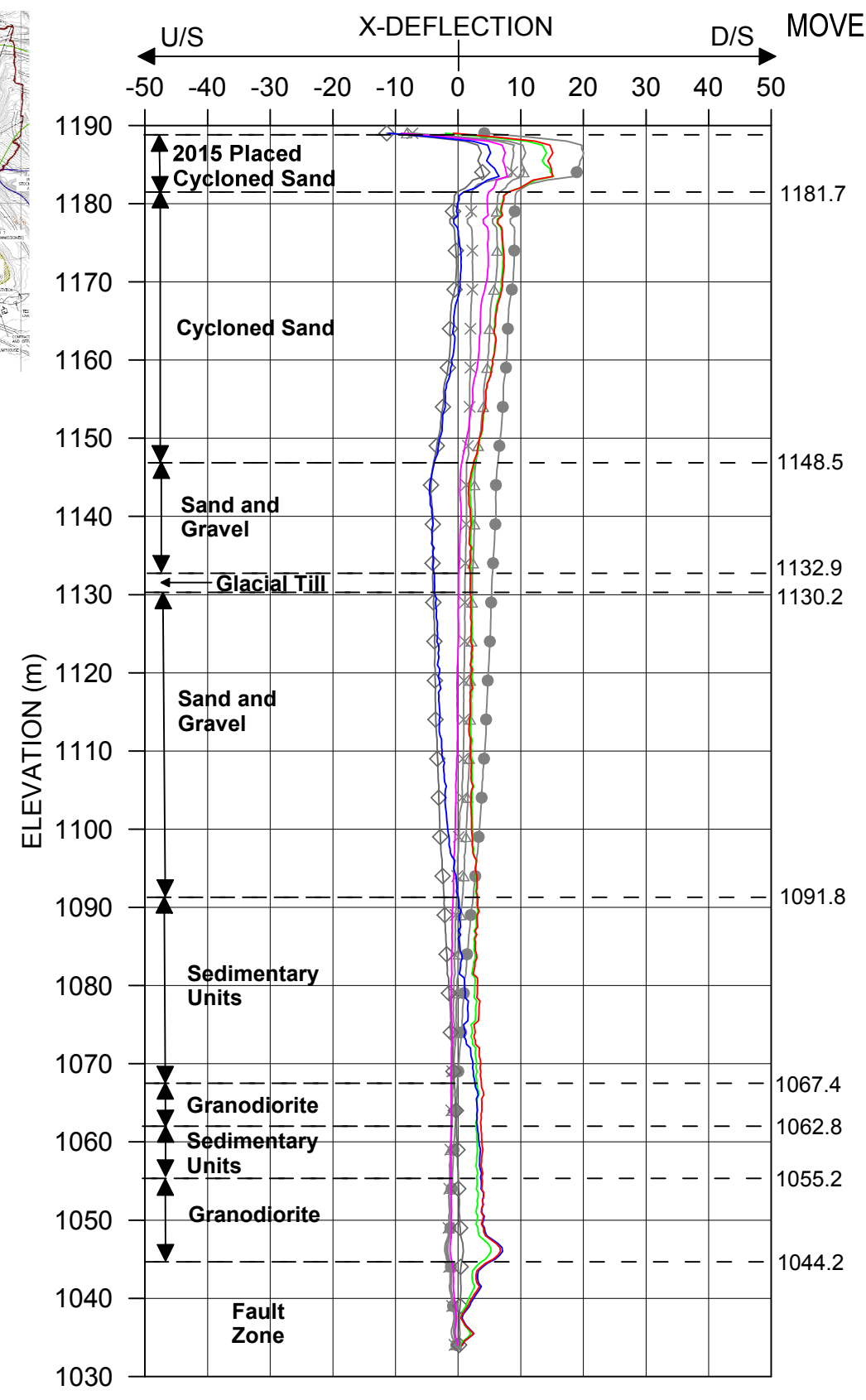
Date: February 27, 2018
Z:\M\CRM\2017\2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer_processing\L-Dam\10-5\Grapher\files\10-5-2017 (DSI only).grf



LEGEND

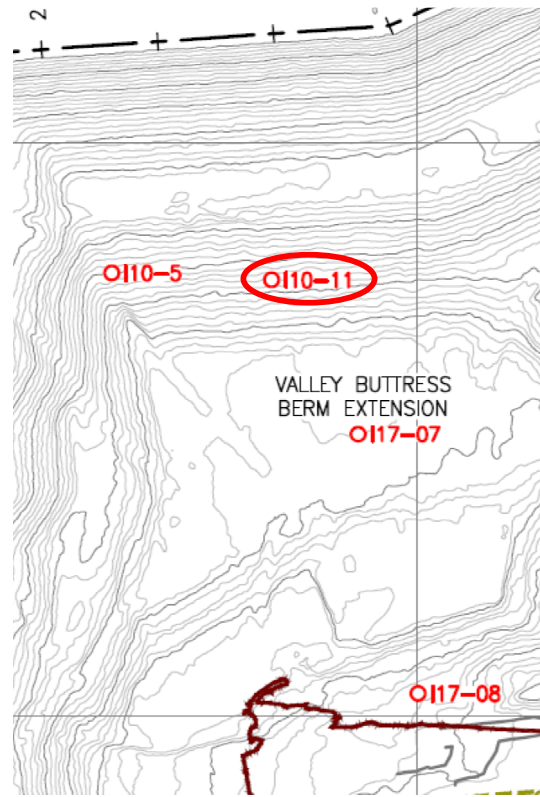
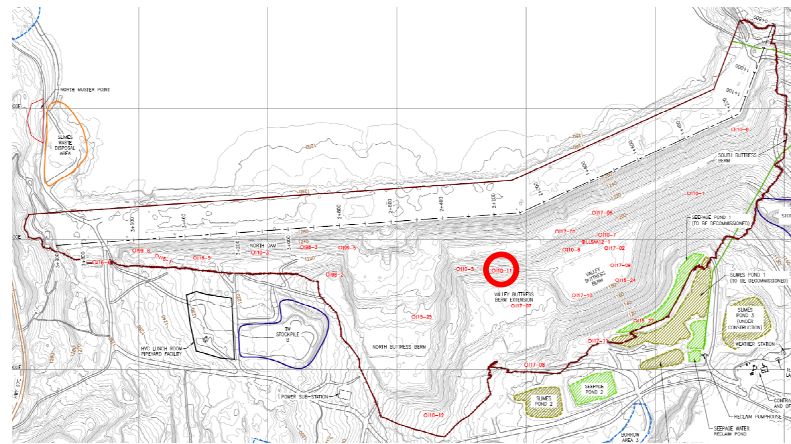
- × — × — × Nov 18, 2015
- — ● — ● Apr 4, 2016
- △ — △ — △ Sept 11, 2016
- ◇ — ◇ — ◇ Apr 13, 2017
- June 11, 2017
- Aug 15, 2017
- Sept 9, 2017
- Oct 9, 2017

NOTES:
 1) I10-5 was installed on November 18, 2010.
 2) I10-5 was damaged during 2015 construction and was repaired on September 24, 2015.
 3) I10-5 was re-initialized on October 13, 2015.
 4) Reel/Probe Serial Number for the initial reading: DR1943000/DP06580000.
 5) Not all readings are plotted.
 6) 2017 readings for August, September and October are inconsistent with historical trends, and are under review by KCB/THVCP (likely due to surveillance error).
 Readings are shown on this figure as the deviation from historical trend are minor and do not indicate an immediate dam safety issue.



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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE I10-5
		PROJECT No. M02341B26

Date: February 27, 2018
Z:\MVC\RM02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-L Dam\10-11\Grapher Files\10-11 2017 (DSI only).grf

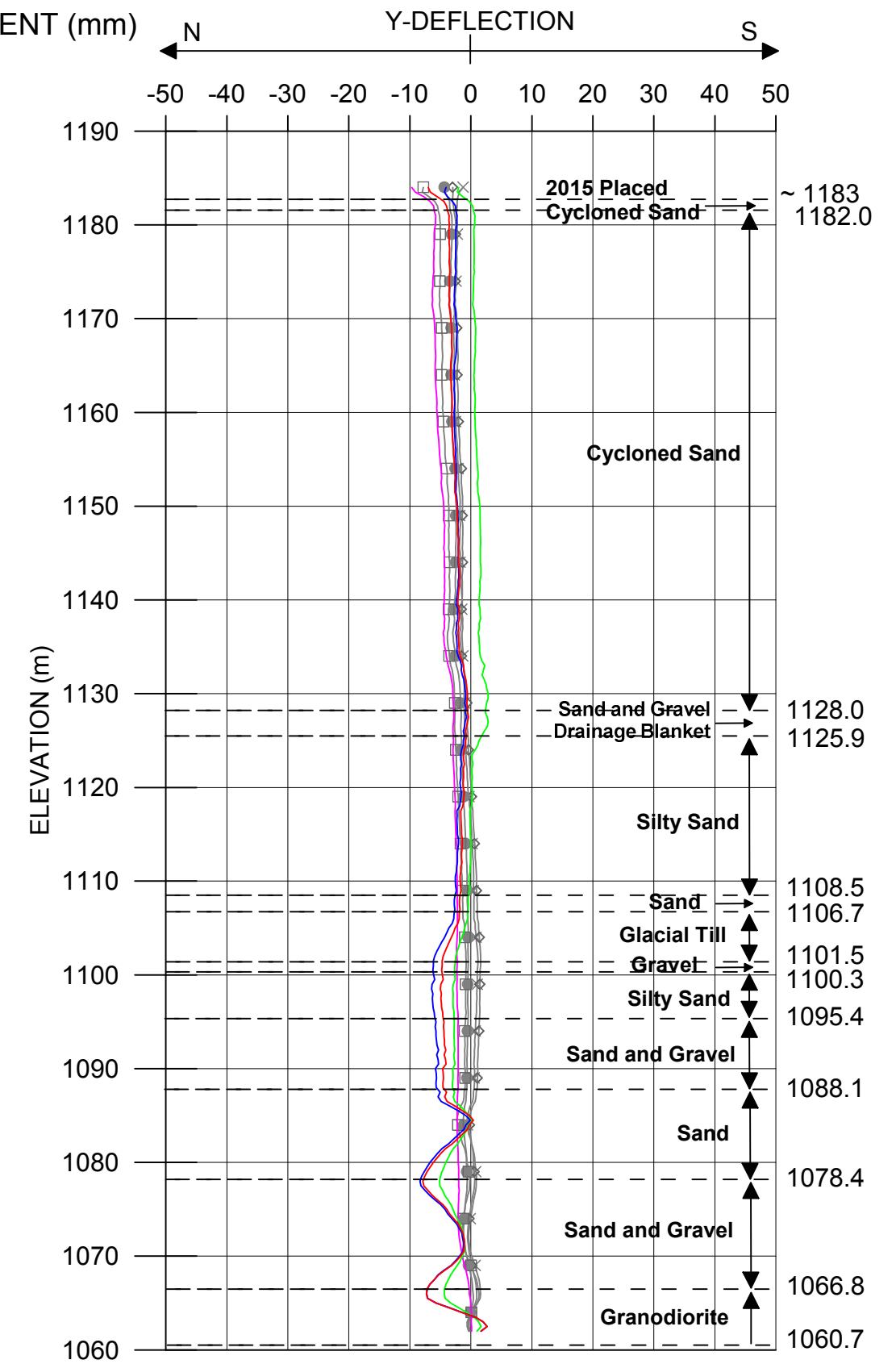
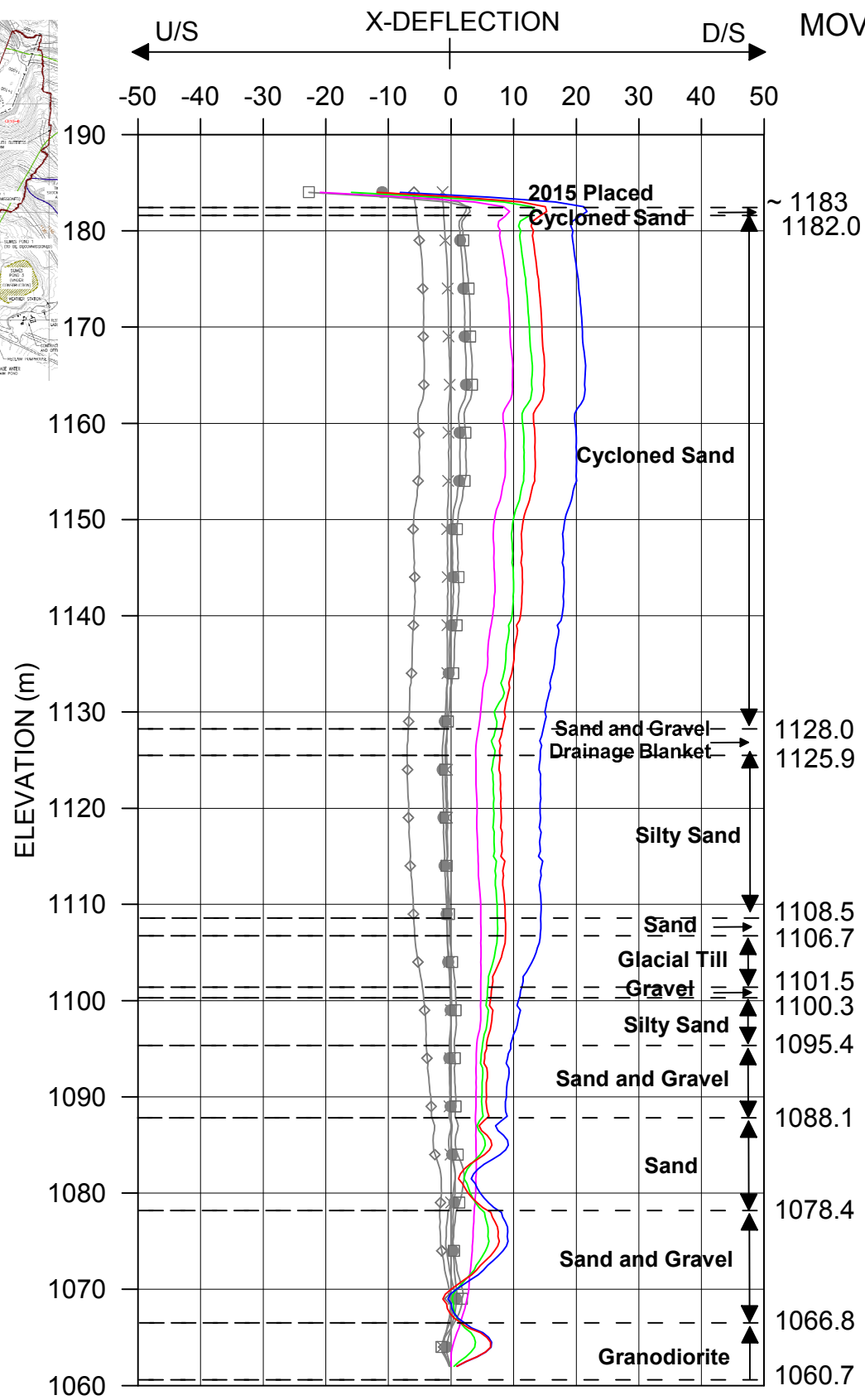


LEGEND

- × × × Nov 16, 2015
- ◇ ◇ ◇ Apr 15, 2016
- ● ● July 3, 2016
- □ □ Oct 11, 2016
- June 16, 2017
- August 11, 2017
- Sept 8, 2017
- Oct 9, 2017

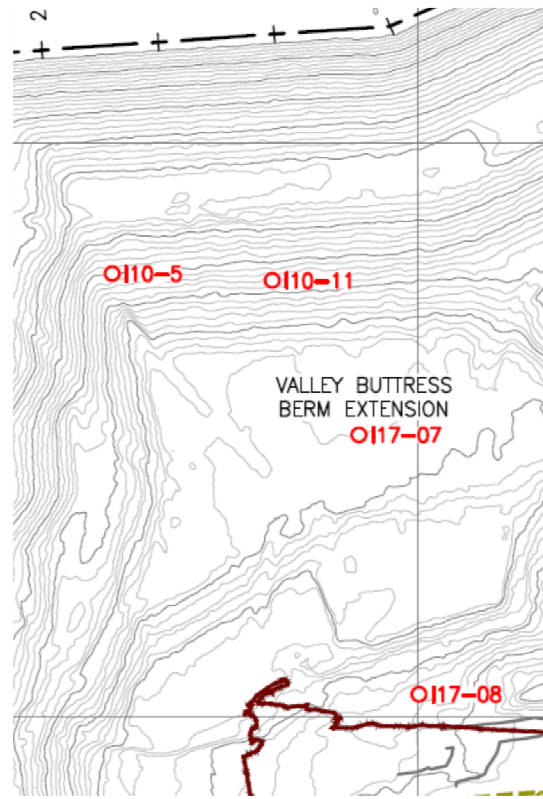
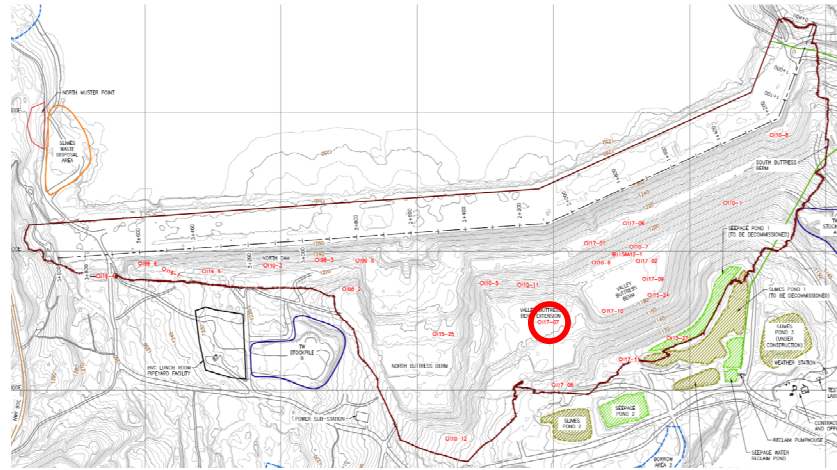
NOTES:

- 1) I10-11 was installed on December 06, 2010.
- 2) I10-11 was damaged during 2015 construction and was repaired on September 29, 2015.
- 3) I10-11 was re-initialized on October 26, 2015.
- 4) Reel/Probe Serial Number for the initial reading: DR19430000/DP06580000.
- 5) Not all readings are plotted.
- 6) 2017 readings for August, September and October are inconsistent with historical trends, and are under review by KCB/THVCP (likely due to surveillance error). Readings are shown on this figure as the deviation from historical trend are minor and do not indicate an immediate dam safety issue.



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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE I10-11
PROJECT No. M02341B26		FIG No. IV-13

Date: February 27, 2018 Z:\MVC\CR\M02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-Dam\17-07\Grapher Files\17-07 2017 (for DSI only).grf

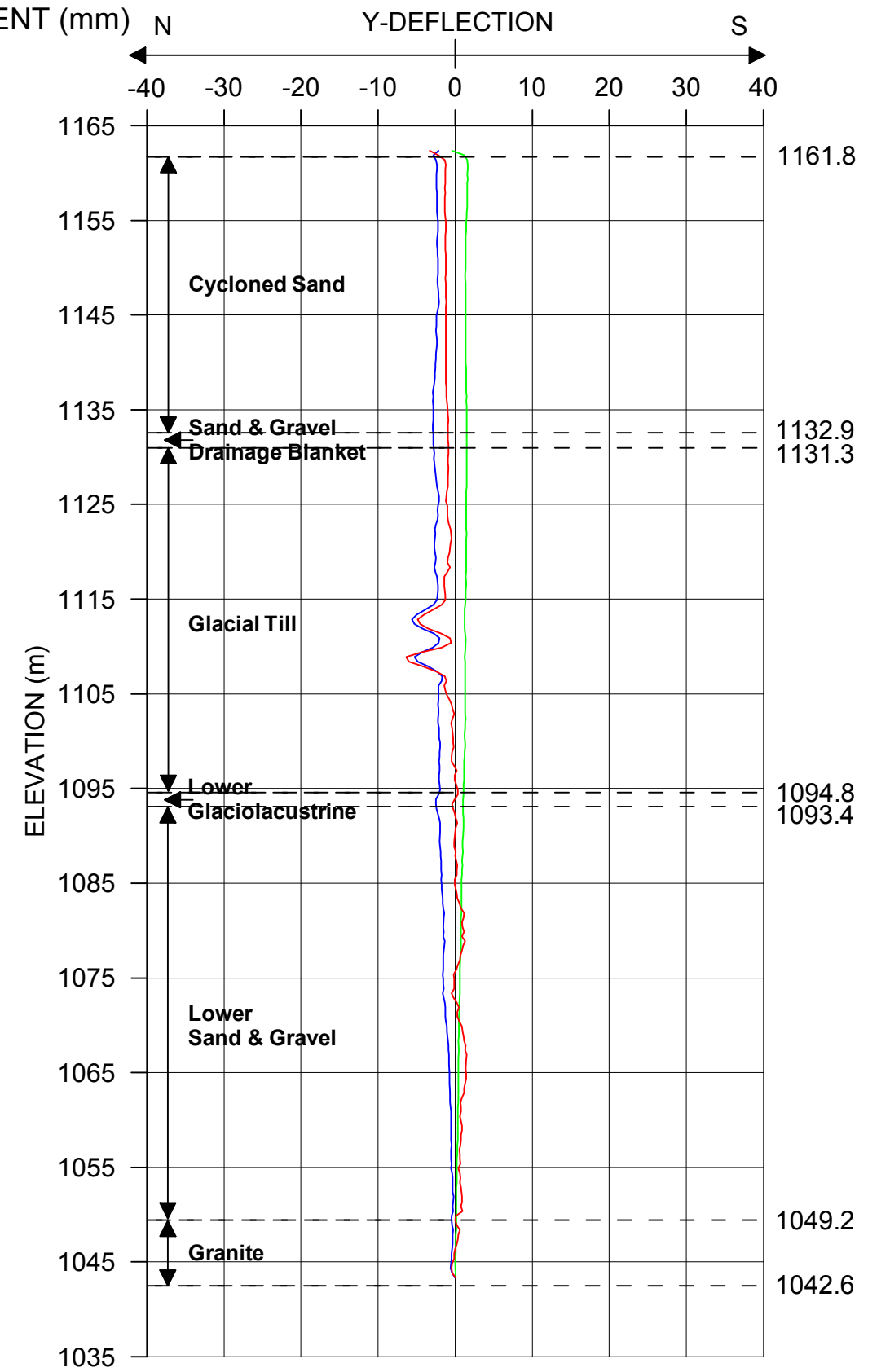
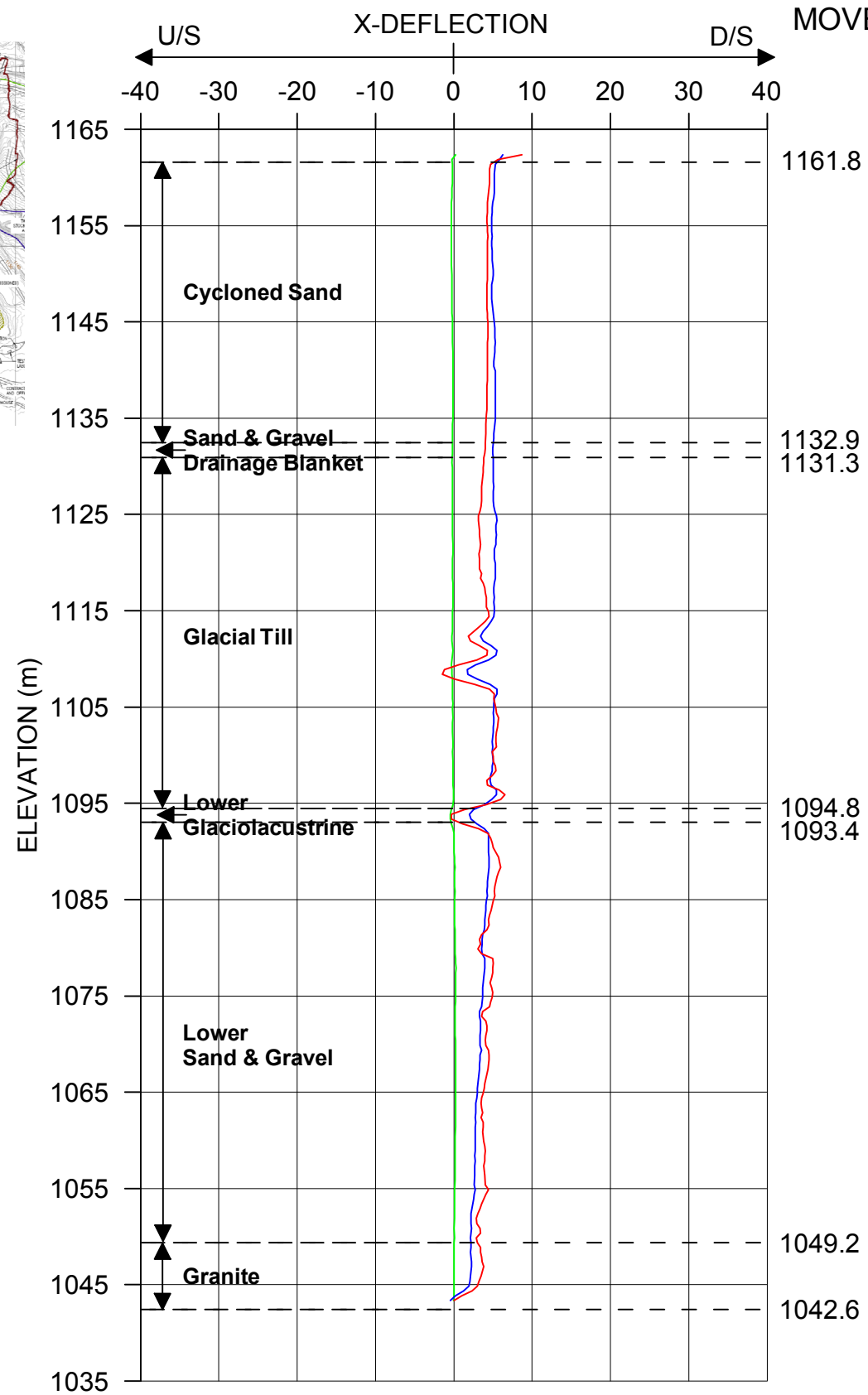


LEGEND

- July 10, 2017
- Sept 28, 2017
- Oct 22, 2017

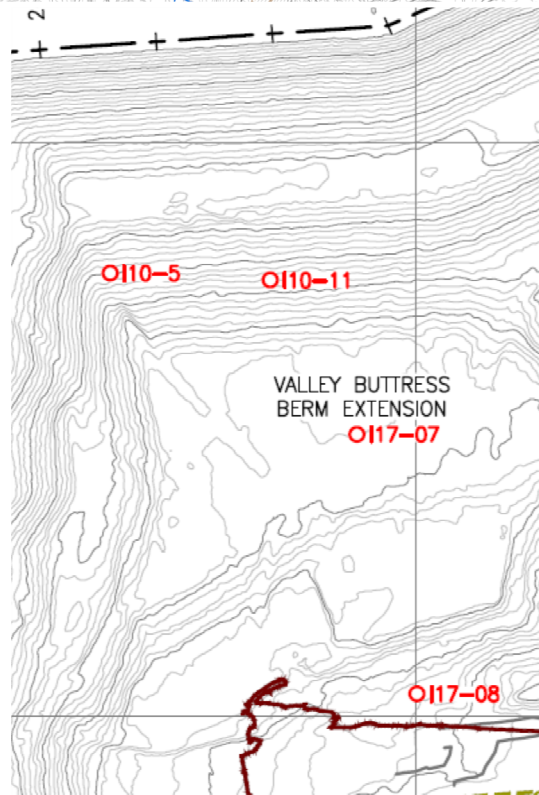
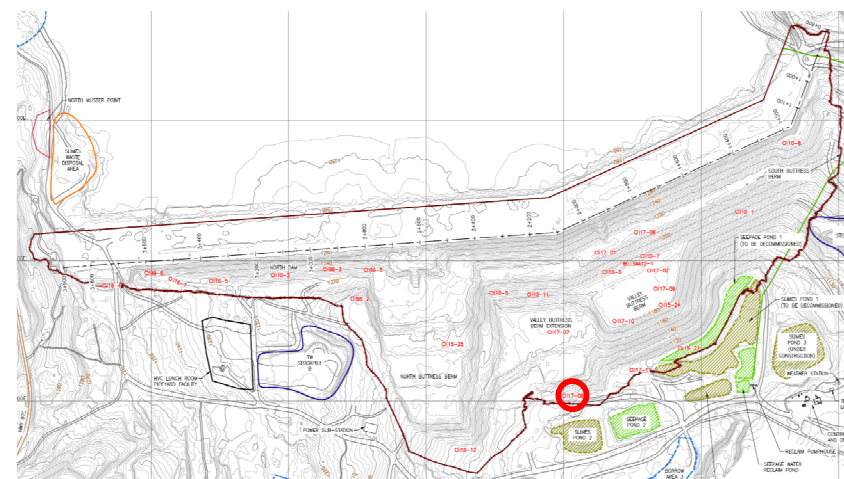
NOTES:

- 1) Initial reading = July 10, 2017.
- 2) Not all readings are plotted.
- 3) 2017 readings for November and December are inconsistent with historical trends, and are under review by KCB/THVCP (likely due to surveillance error). As such, the readings are not shown on this figure.



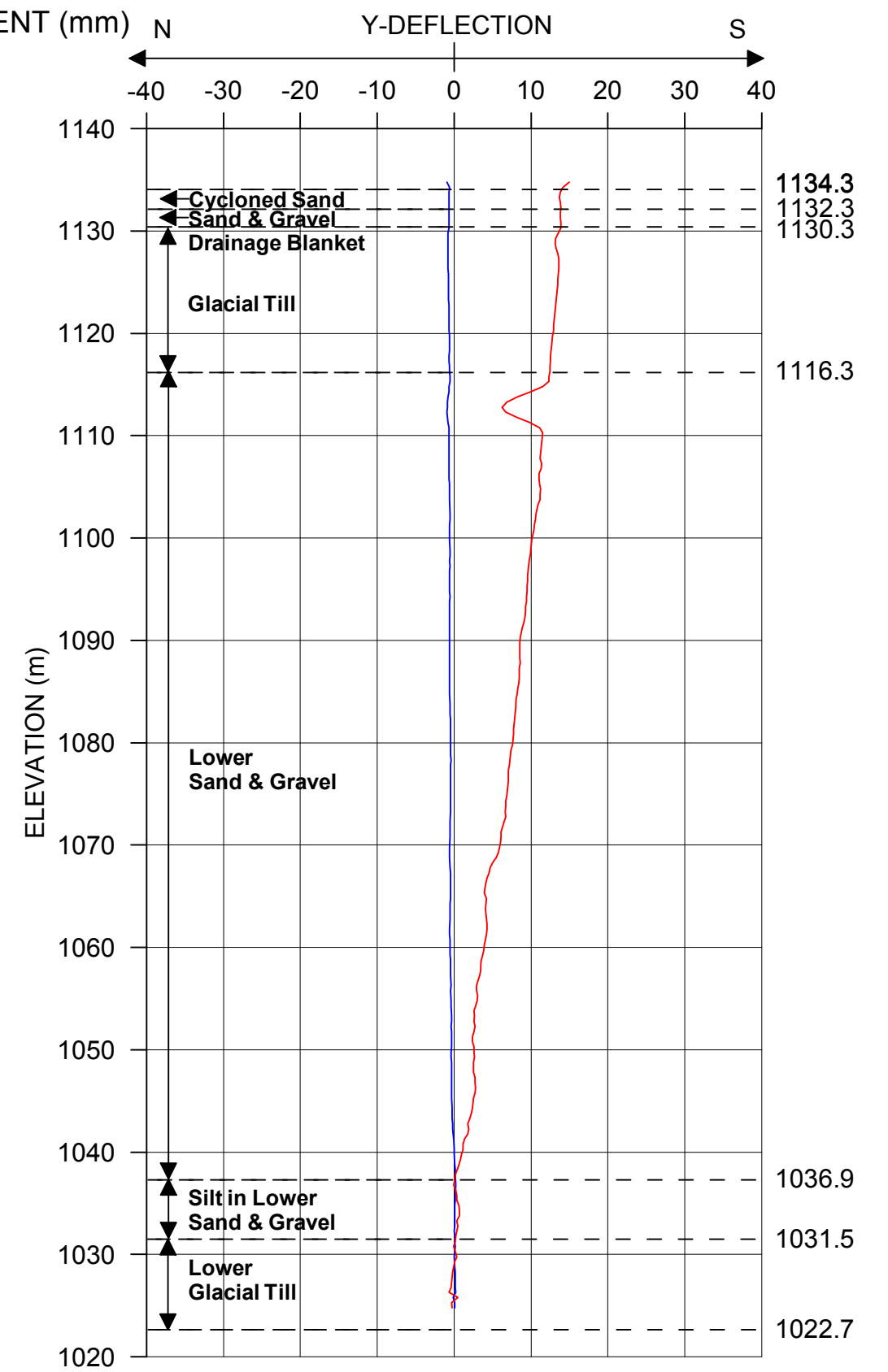
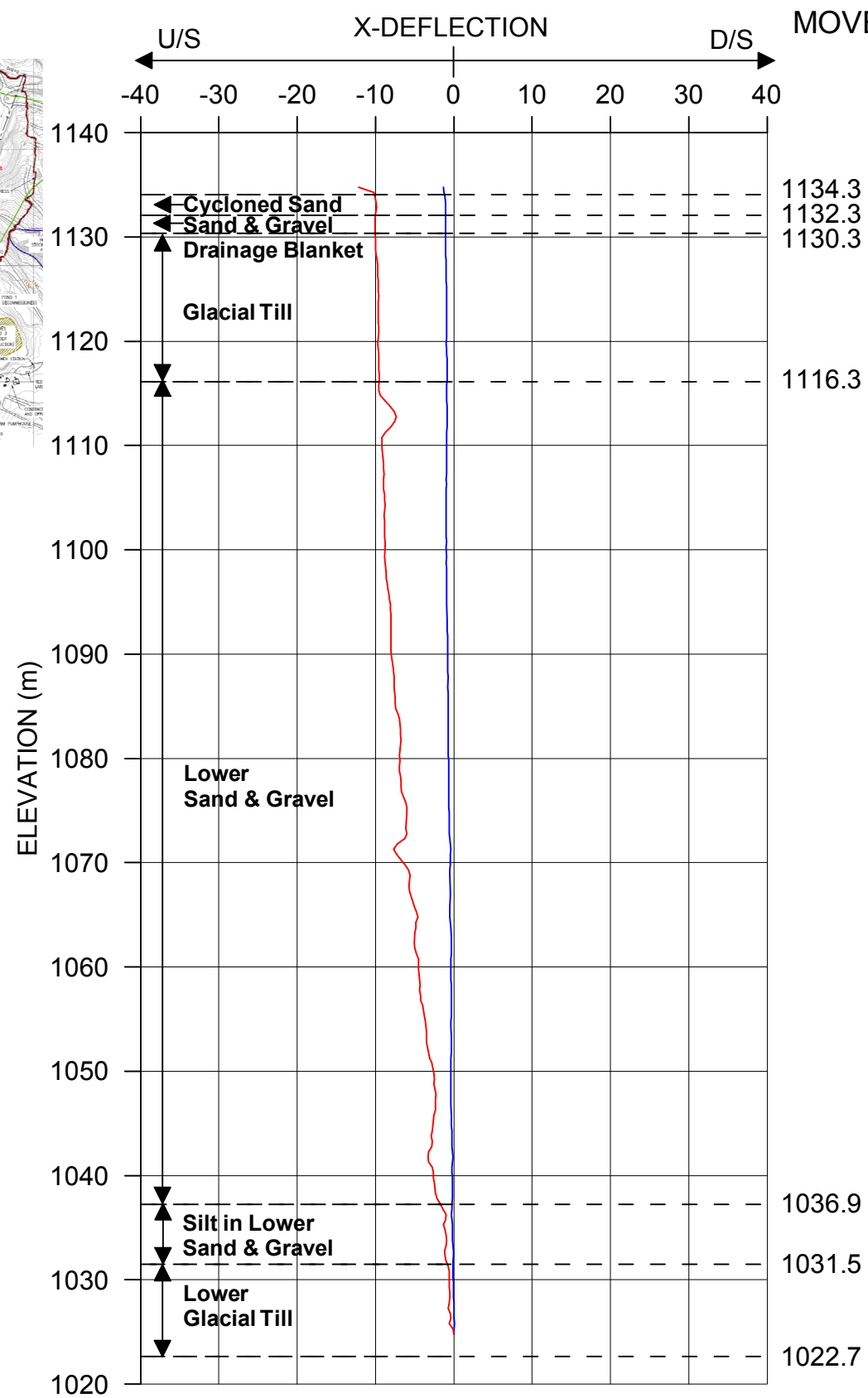
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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 117-07
		PROJECT No. M02341B26 FIG No. IV-14

Date: February 27, 2018 Z:\MVC\RM02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-Dam\17-08\Grapher Files\17-08 2017 (for DSI only).grf



LEGEND

- Aug 4, 2017
- Oct 3, 2017

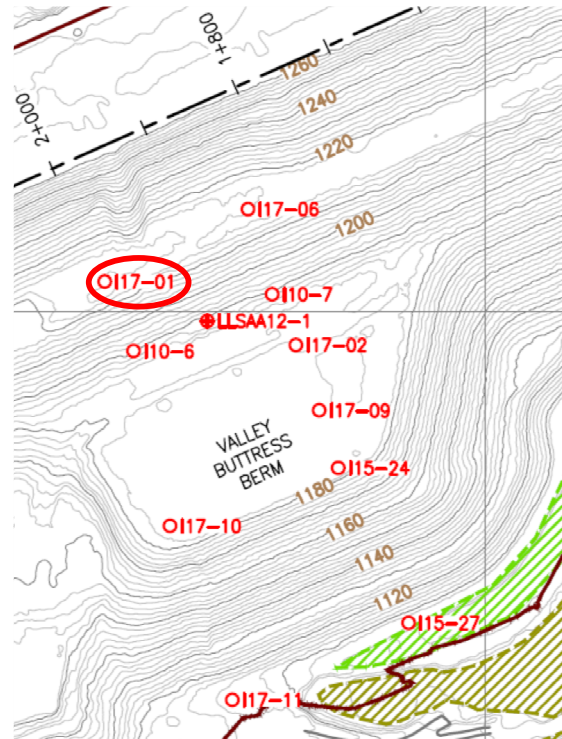
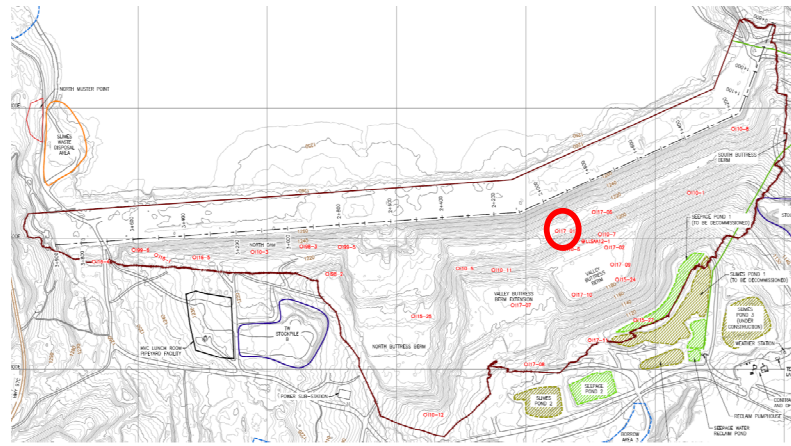


NOTES:

- 1) Initial reading = August 4, 2017.
- 2) Not all readings are plotted.
- 3) 2017 readings for November and December are inconsistent with historical trends, and are under review by KCB/THVCP (likely due to surveillance error). As such, the readings are not shown on this figure.

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			TITLE	INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 117-08
	PROJECT No.	M02341B26	FIG No.	IV-15

Date: February 27, 2018 Z:\MVC\RM02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-L Dam\17-01\Grapher Files\17-01 2017 (DSI only).grf

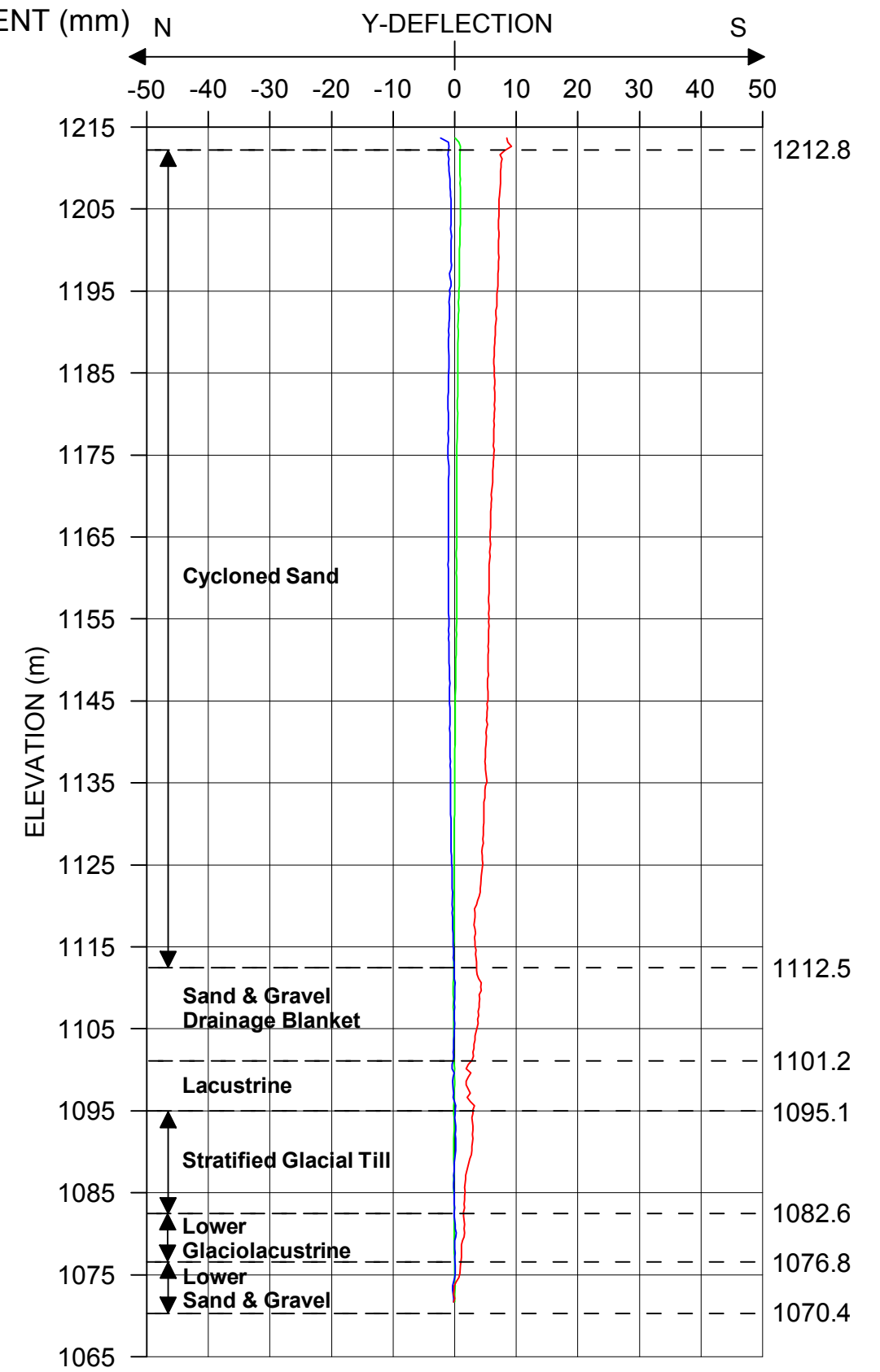
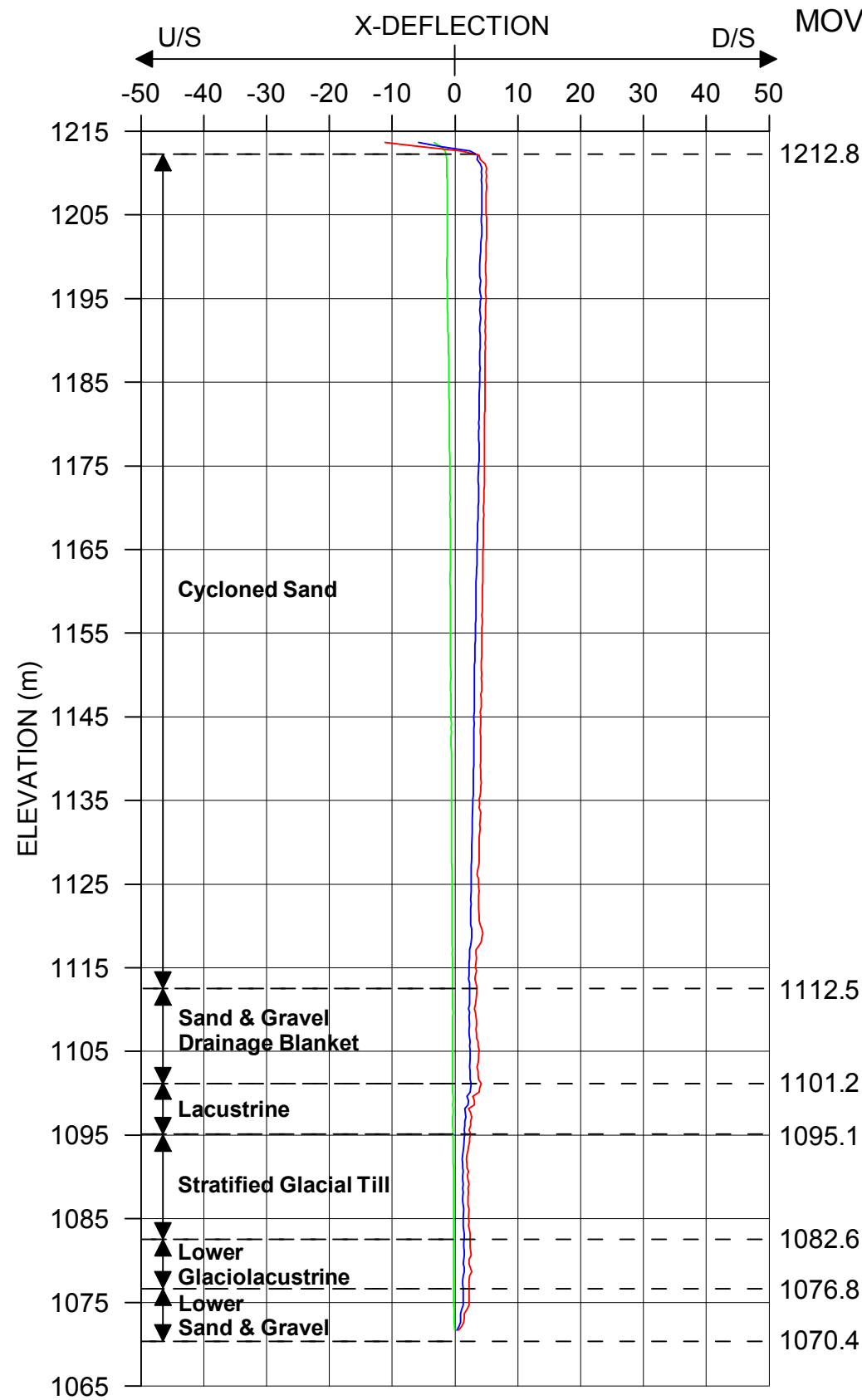


LEGEND

- July 10, 2017
- Oct 4, 2017
- Oct 31, 2017

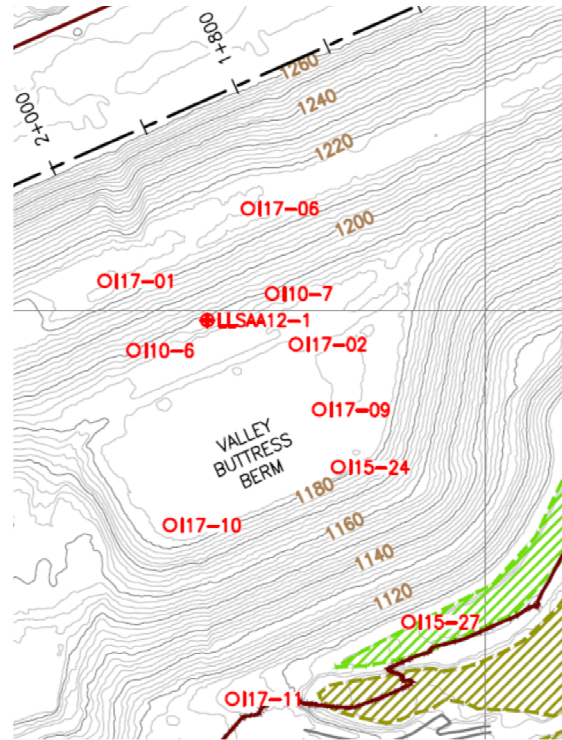
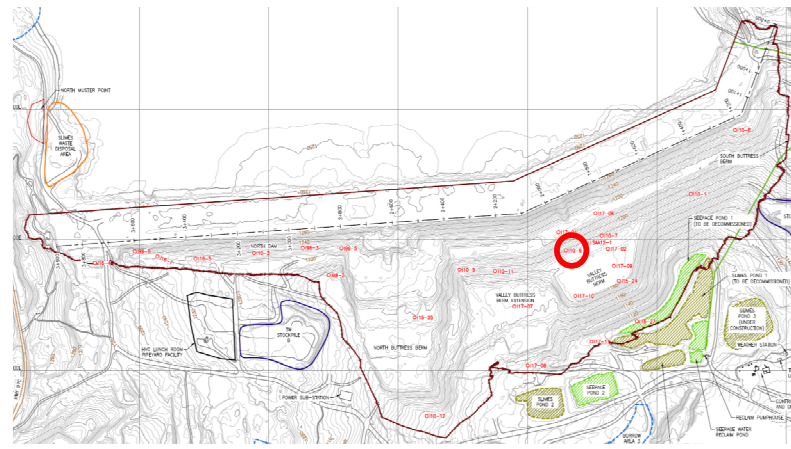
NOTES:

- 1) I17-01 was installed on May 16, 2017.
- 2) I17-01 was initialized on July 10, 2017.
- 3) Reel/Probe Serial Number for the initial reading: DR25880000/DP17520000.
- 4) Not all readings are plotted.
- 5) 2017 reading for December is inconsistent with historical trends, and is under review by KCB/THVCP (likely due to surveillance error). As such, the reading is not shown on this figure.



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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 17-01
		PROJECT No. M02341B26
		FIG No. IV-16

Date: February 27, 2018 Z:\MV\CRM\02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-L Dam\10-6\Grapher\Files\10-6 2017 (for DSI only).grf

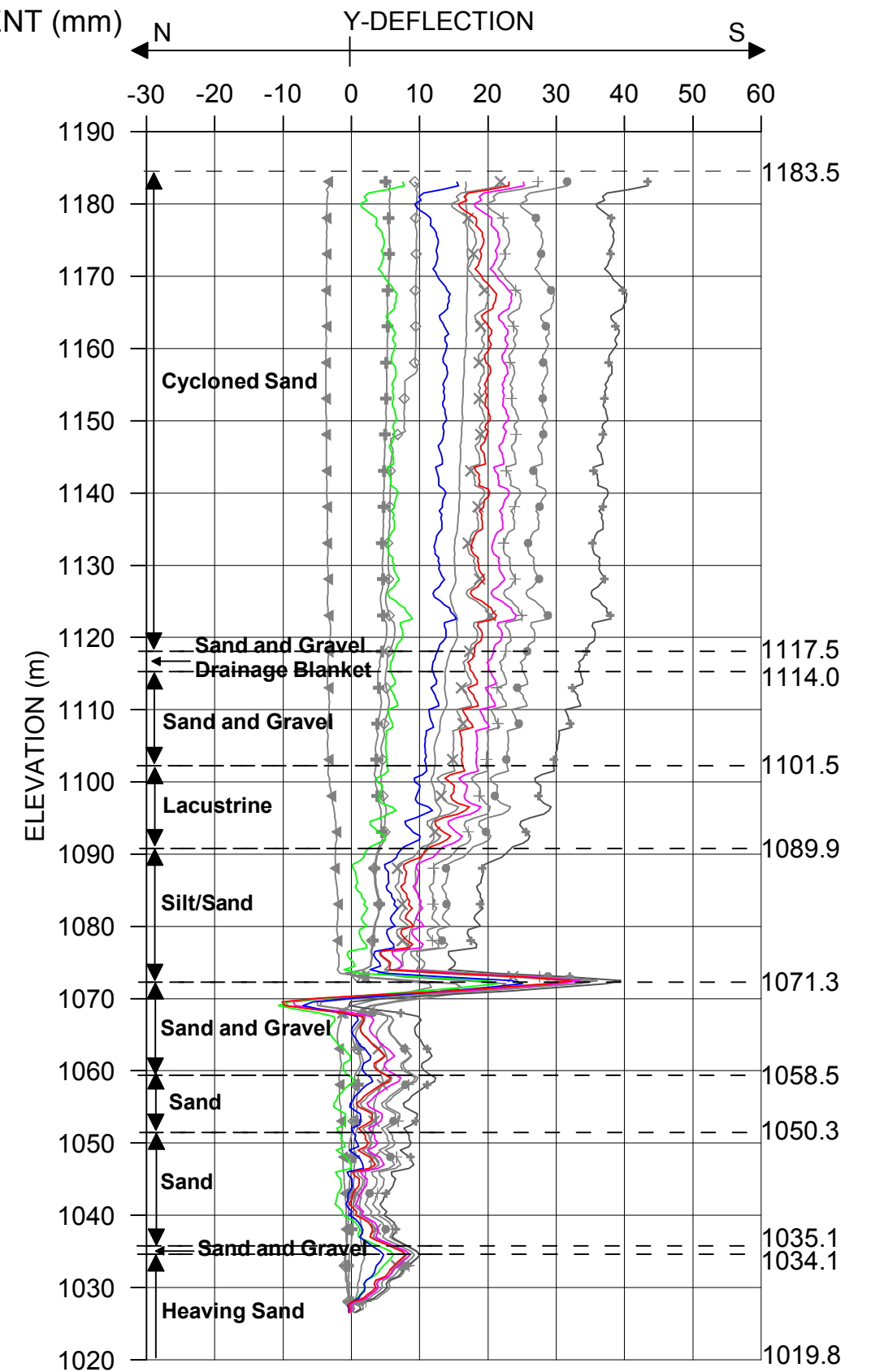
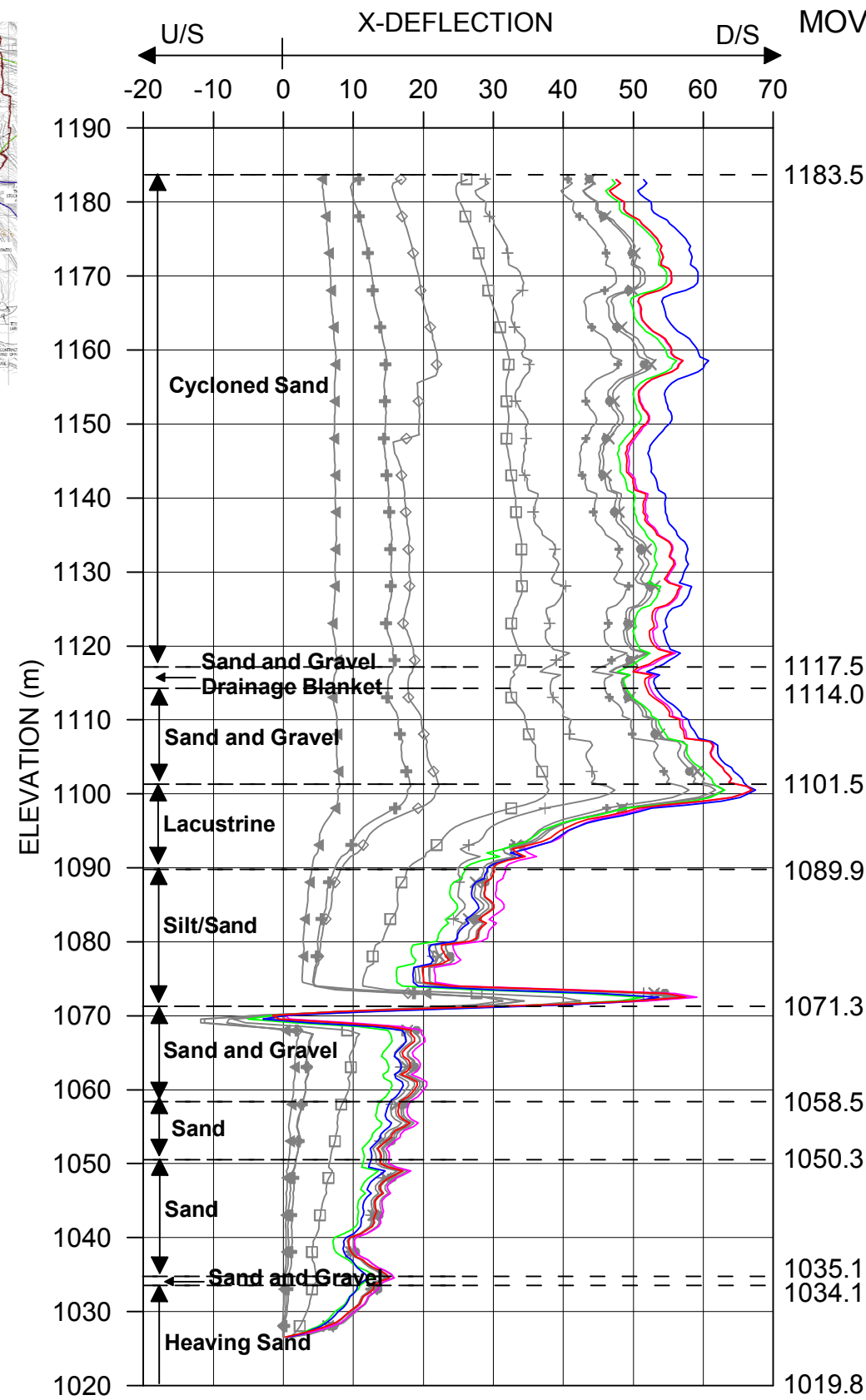


LEGEND

- ← ← ← ← July 3, 2011
- + + + + Aug 5, 2012
- ◇ ◇ ◇ ◇ Mar 21, 2013
- □ □ □ July 15, 2014
- + + + + July 8, 2015
- + + + + Dec 29, 2015
- ● ● ● July 10, 2016
- x x x x Mar 8, 2017
- June 13, 2017
- Sept 11, 2017
- Nov 28, 2017
- Dec 13, 2017

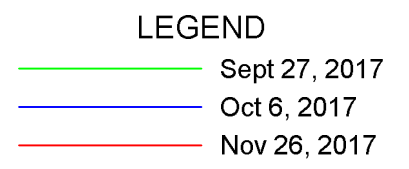
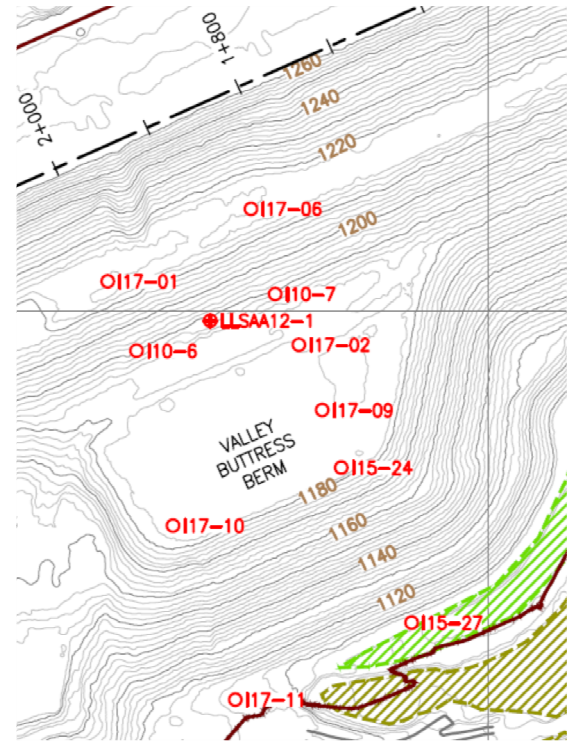
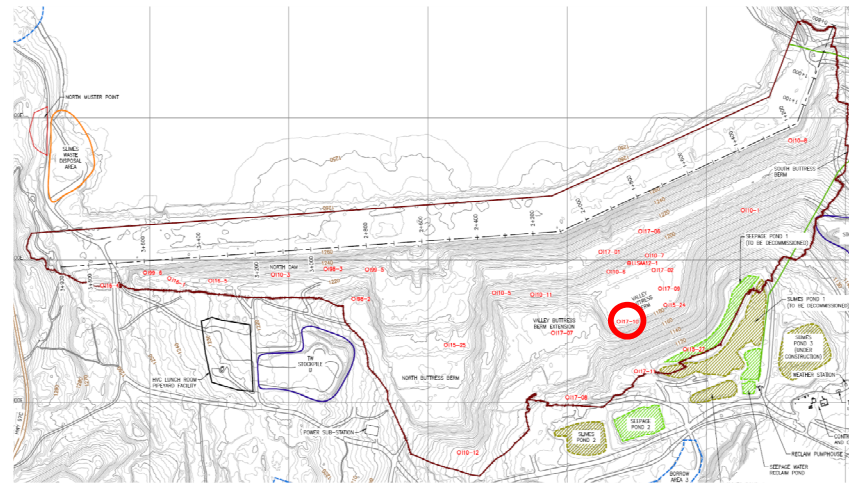
NOTES:

- 1) Initial reading = January 15, 2011.
- 2) Not all readings are plotted.

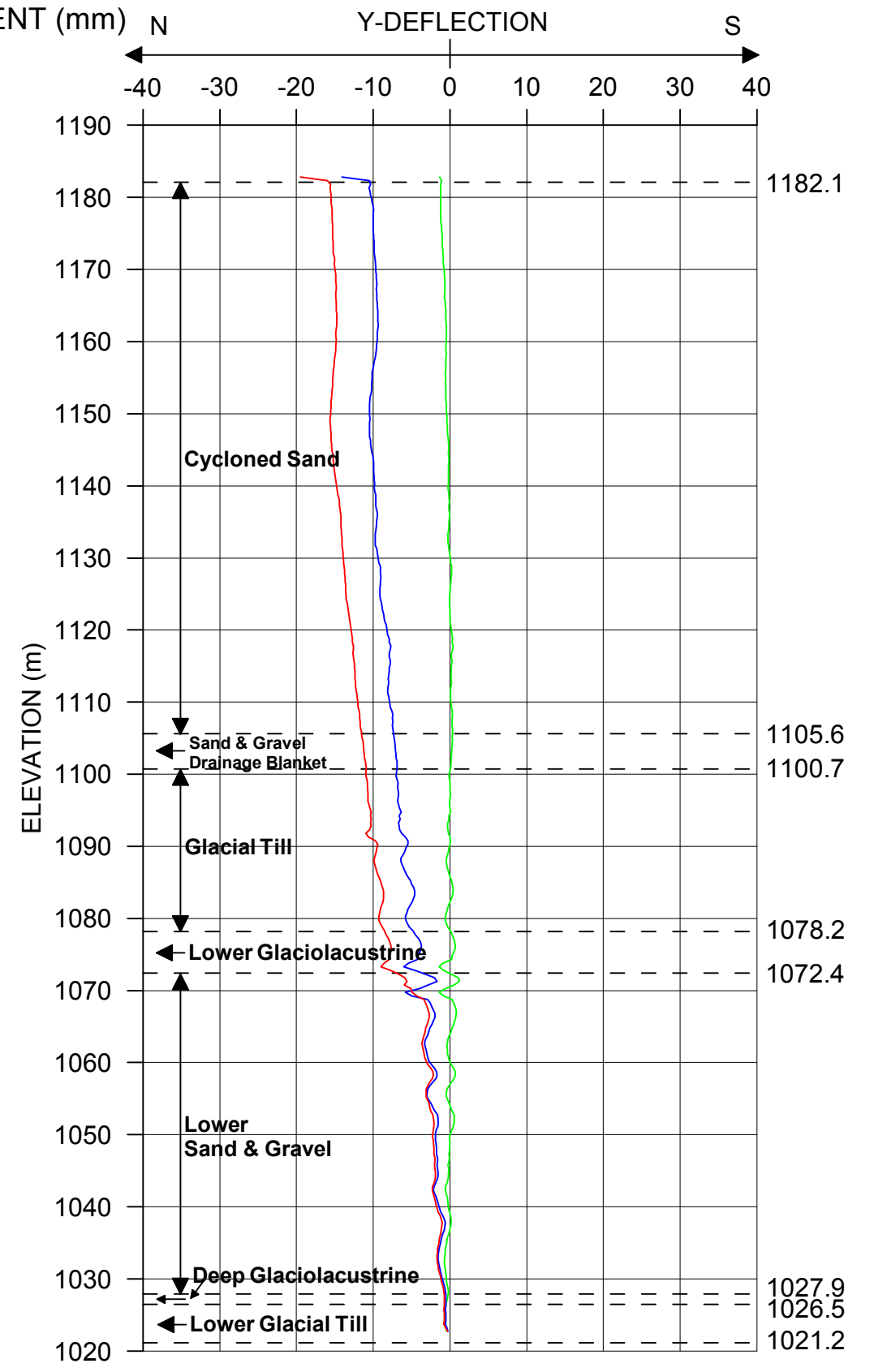
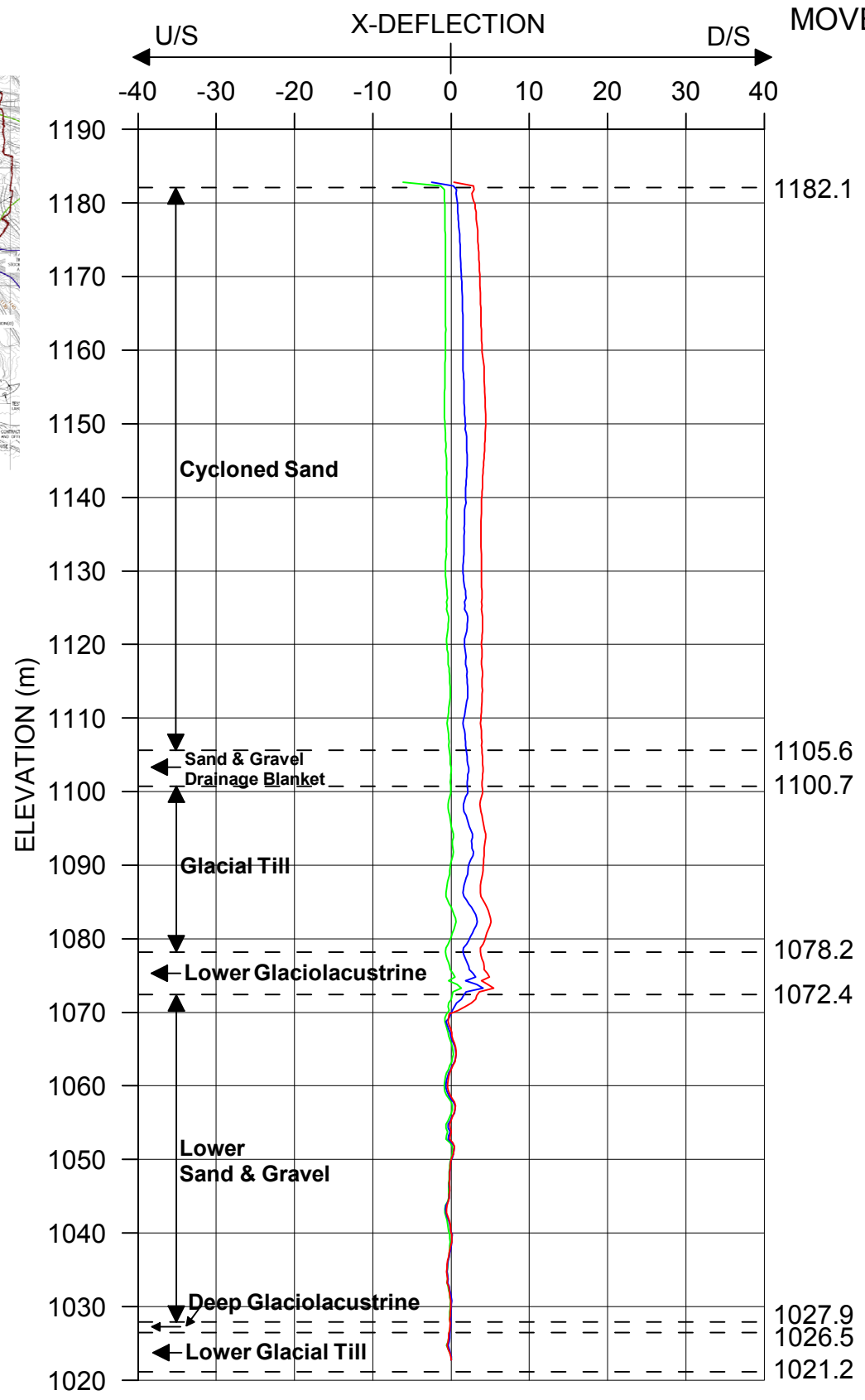


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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 110-6
		PROJECT No. M02341B26 FIG No. IV-17

Date: February 27, 2018 Z:\MVC\CRM02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-Dam\17-10\Grapher Files\17-10 2017 (for DSI only).grf

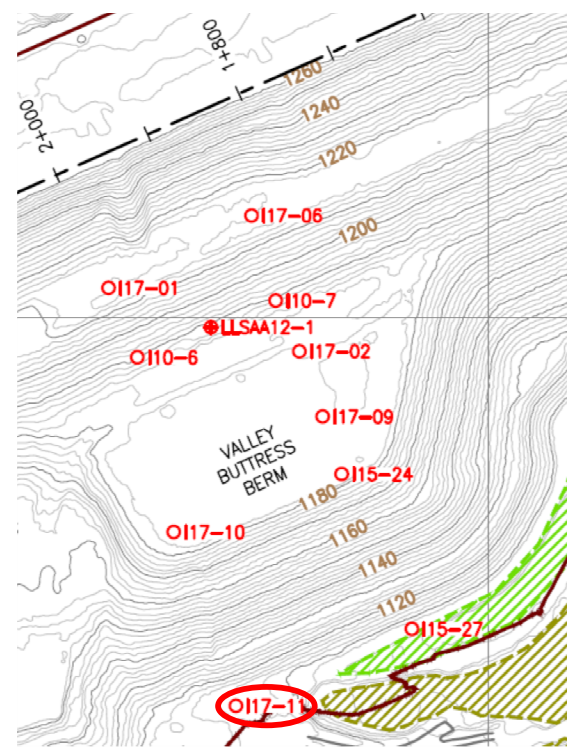
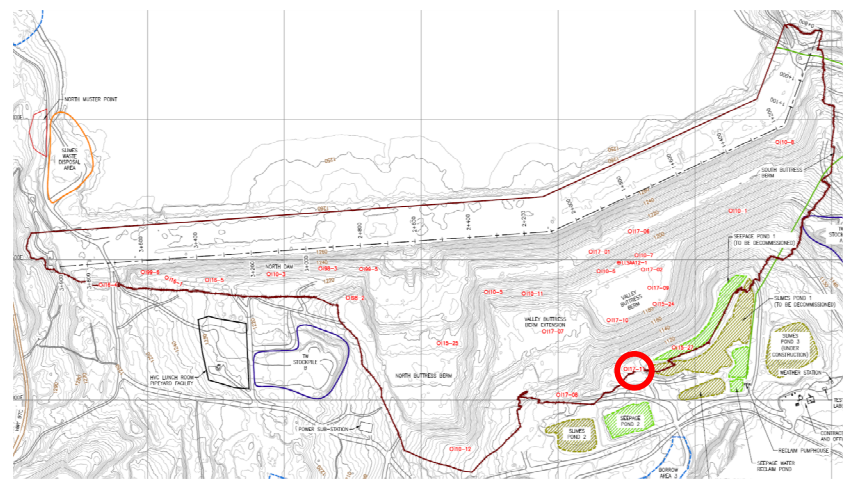


NOTES:
 1) Initial reading = September 27, 2017.
 2) Not all readings are shown.
 3) 2017 reading for December is inconsistent with historical trends, and is under review by KCB/THVCP (likely due to surveillance error). As such, the reading is not shown on this figure.



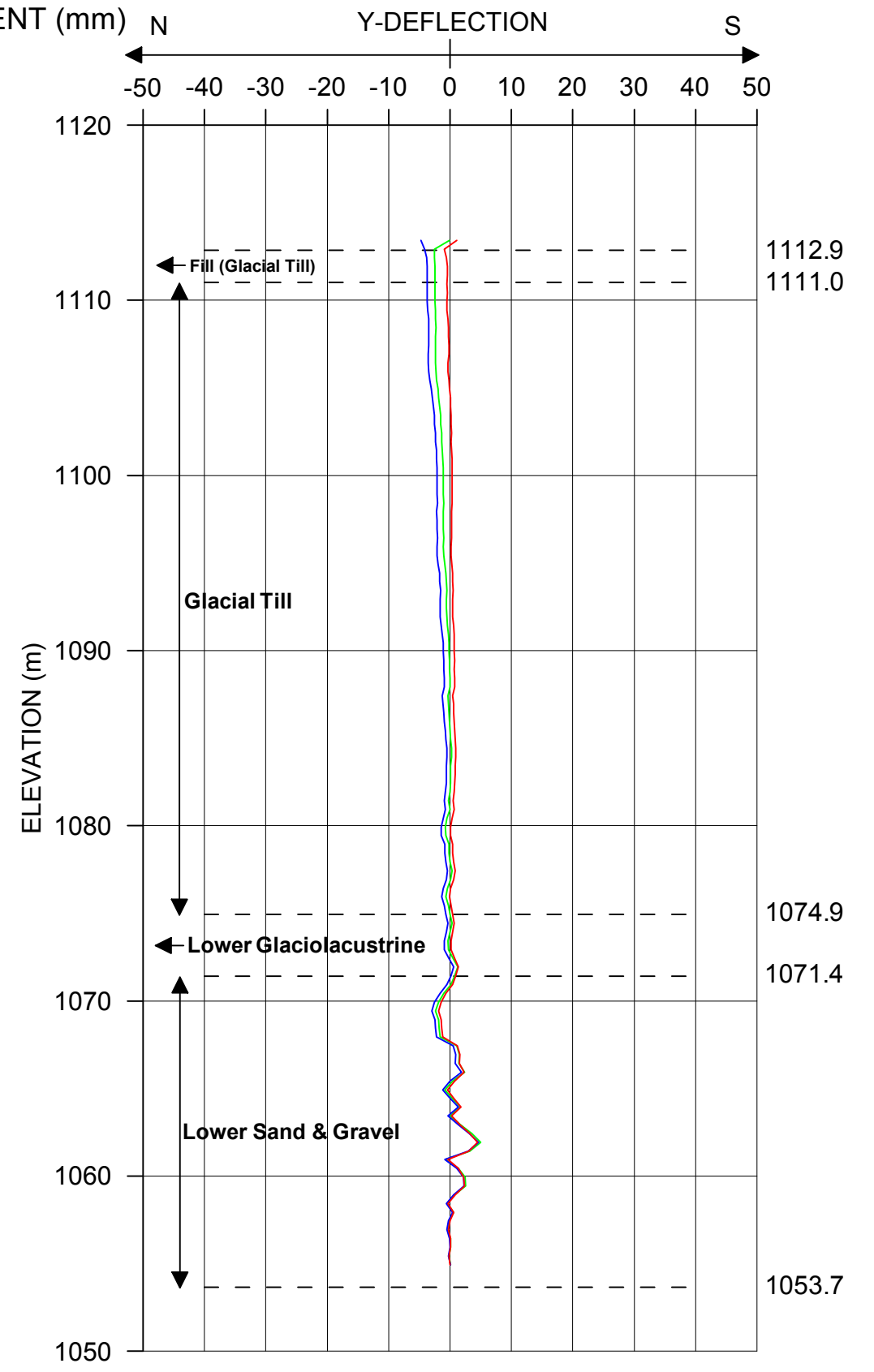
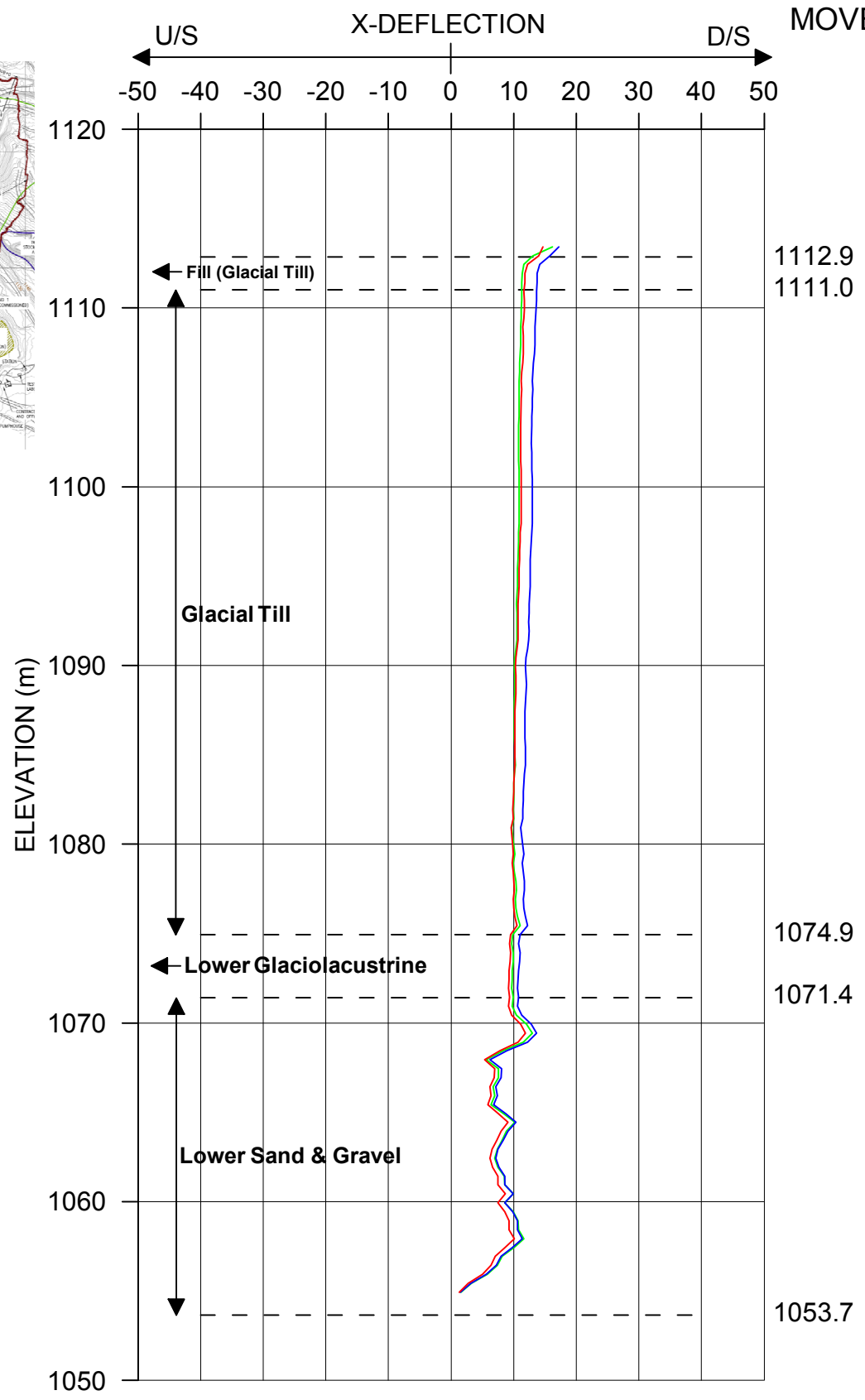
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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 117-10
	PROJECT No. M02341B26	FIG No. IV-18

Date: February 27, 2018 Z:\MVC\RM02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-Dam\17-11\Grapher Files\17-11 2017 - DSI only.grf



LEGEND

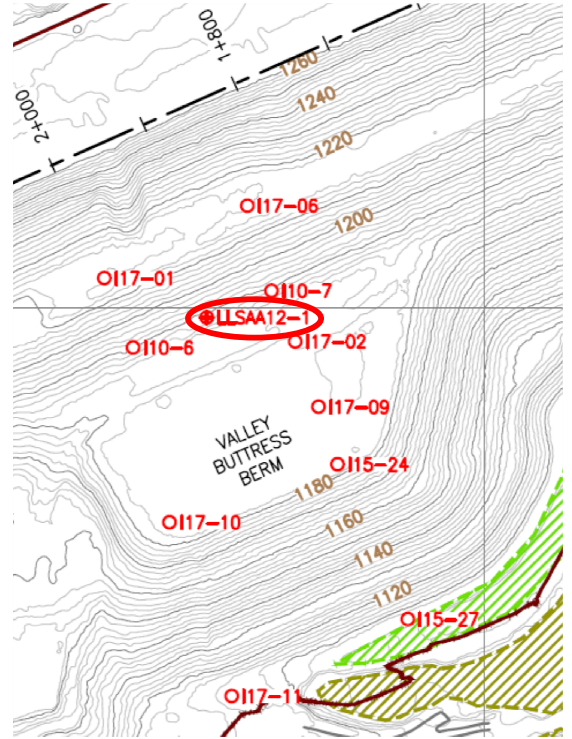
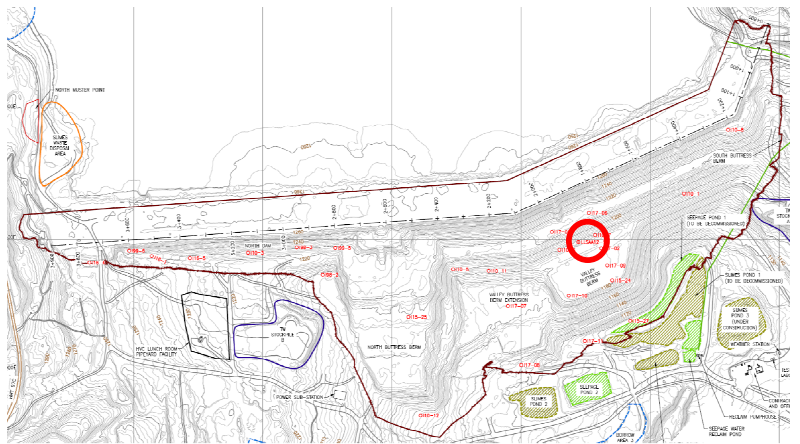
- Sept 27, 2017
- Oct 18, 2017
- Dec 8, 2017



NOTES:

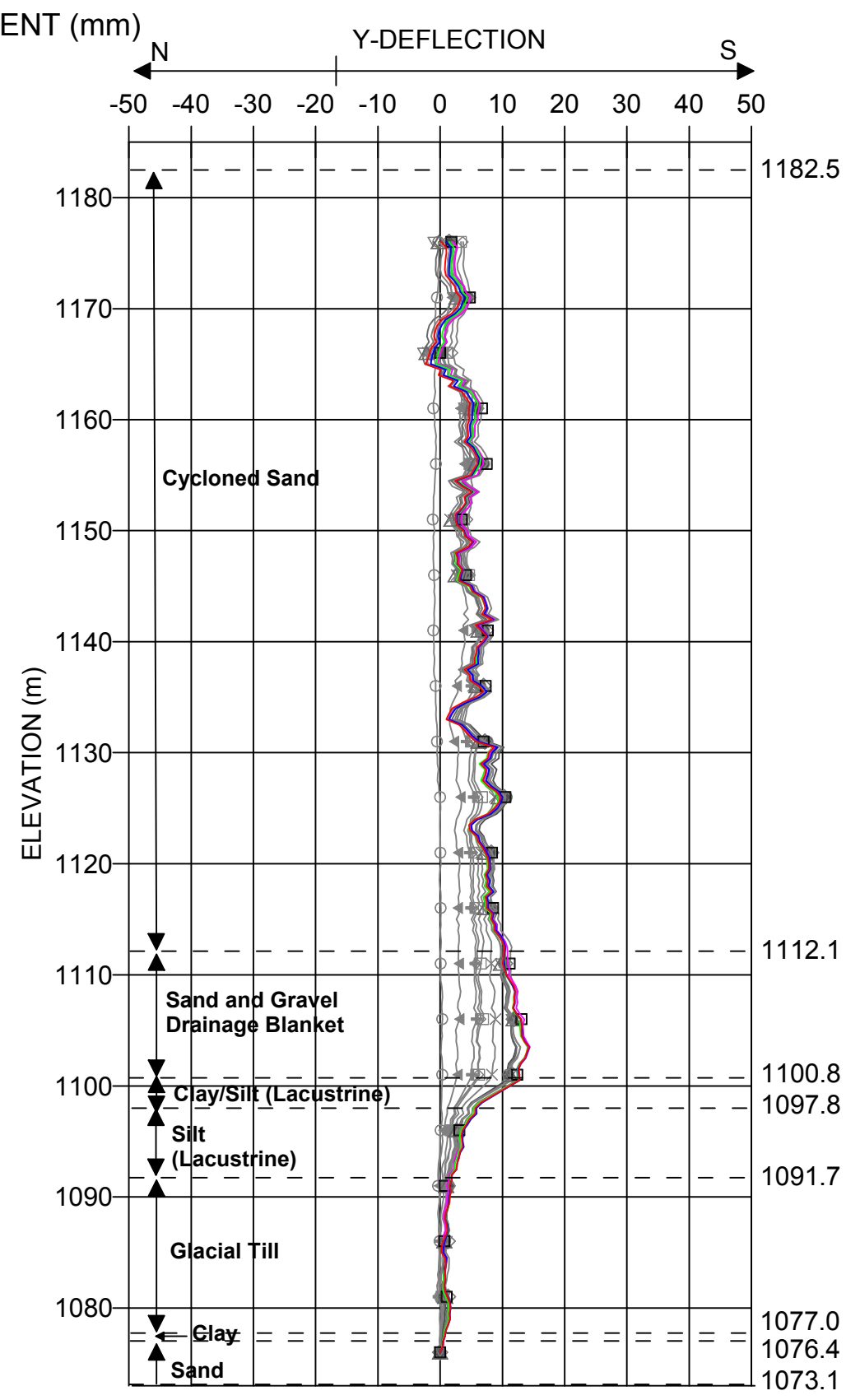
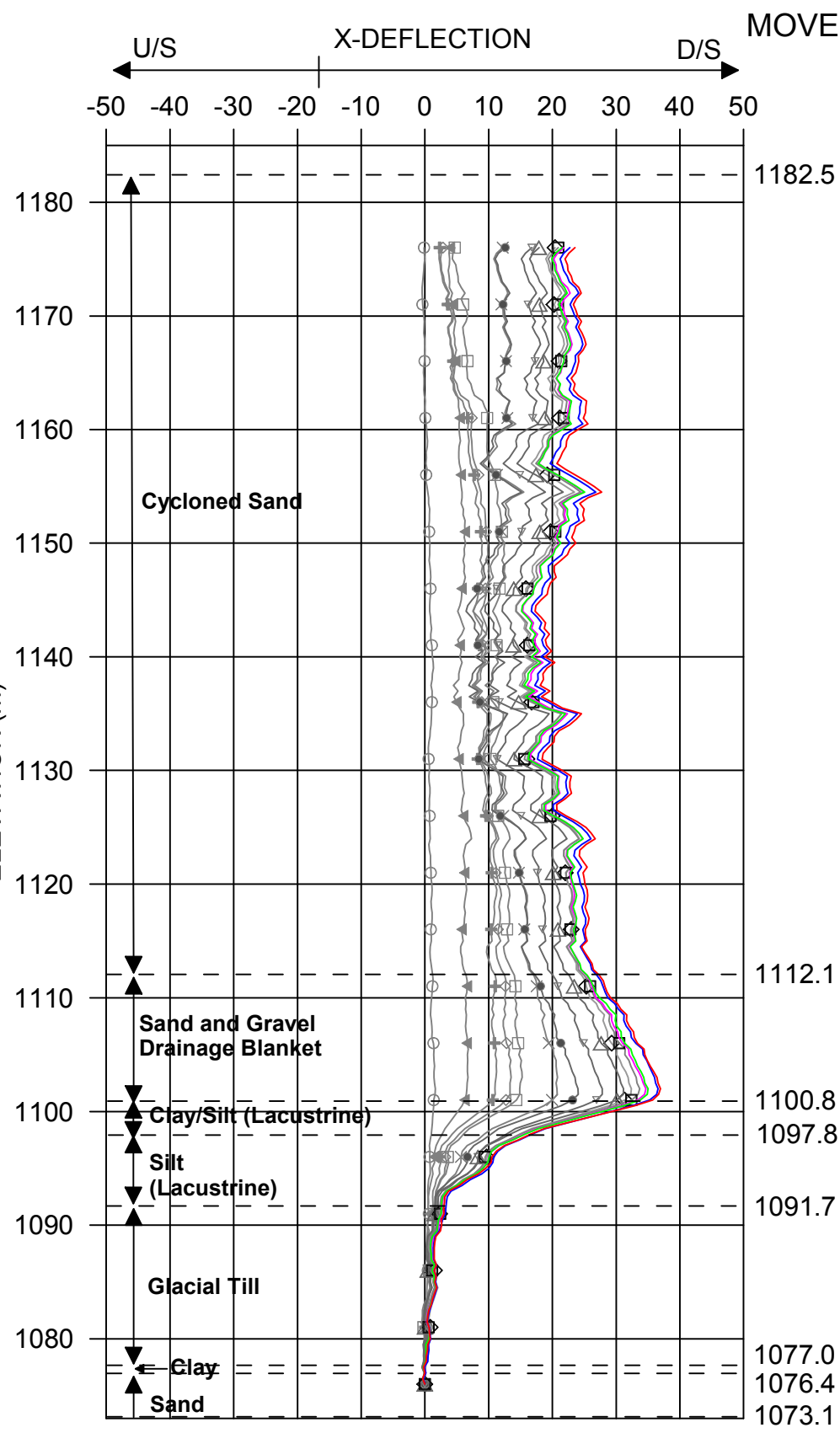
- 1) I17-11 was installed on July 10, 2017.
- 2) I17-11 was initialized on September 17, 2017.
- 3) Reel/Probe Serial Number for the initial reading: DR25880000/DP17520000.
- 4) Not all readings are plotted.
- 5) 2017 reading for November is inconsistent with historical trends, and is under review by KCB/THVCP (likely due to surveillance error). As such, the reading is not shown on this figure.

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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 117-11
	PROJECT No. M02341B26	FIG No. IV-19



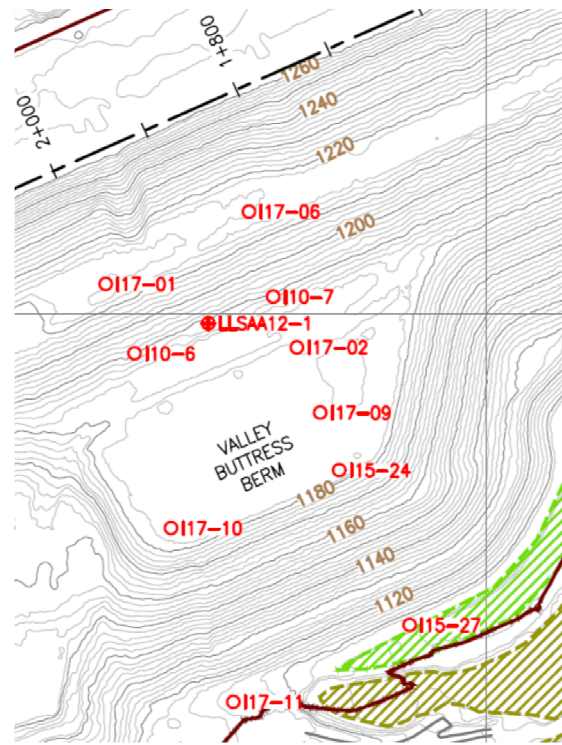
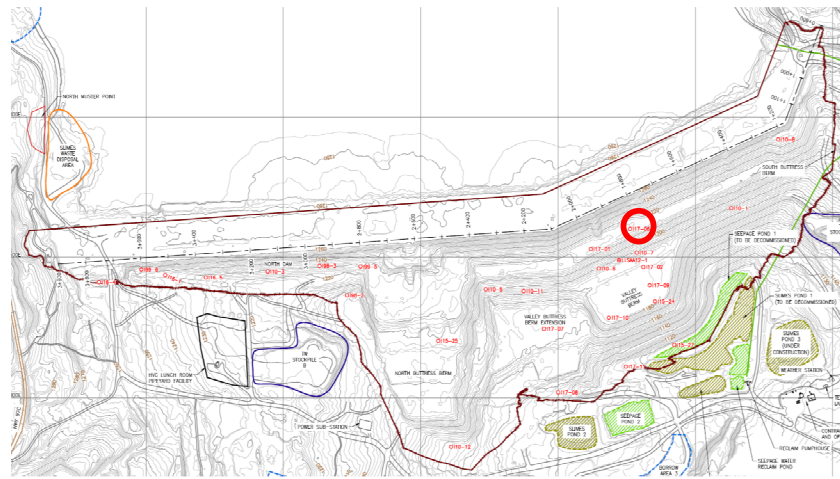
- — ○ — ○ Oct 30, 2012
- ← — ← — ← Aug 31, 2013
- + — + — + Aug 21, 2014
- ◇ — ◇ — ◇ Jan 21, 2015
- — □ — □ June 5, 2015
- × — × — × Oct 9, 2015
- — ● — ● Jan 21, 2016
- ▽ — ▽ — ▽ June 16, 2016
- ◇ — ◇ — ◇ Jan 17, 2017
- △ — △ — △ April 17, 2017
- — □ — □ July 7, 2017
- (magenta) — Aug 27, 2017
- (green) — Oct 4, 2017
- (blue) — Dec 4, 2017
- (red) — Jan 4, 2018

NOTES:
 1) SAA installed on May 23, 2012.
 2) SAA re-initialized on September 12, 2012 to eliminate early erroneous data.
 3) Not all readings are plotted.



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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE LLSAA12-1
PROJECT No. M02341B26		FIG No. IV-20

Date: February 27, 2018
Z:\MVC\CRM02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-Dam\17-06\Grapher Files\17-06 2017 (for DSI only).grf

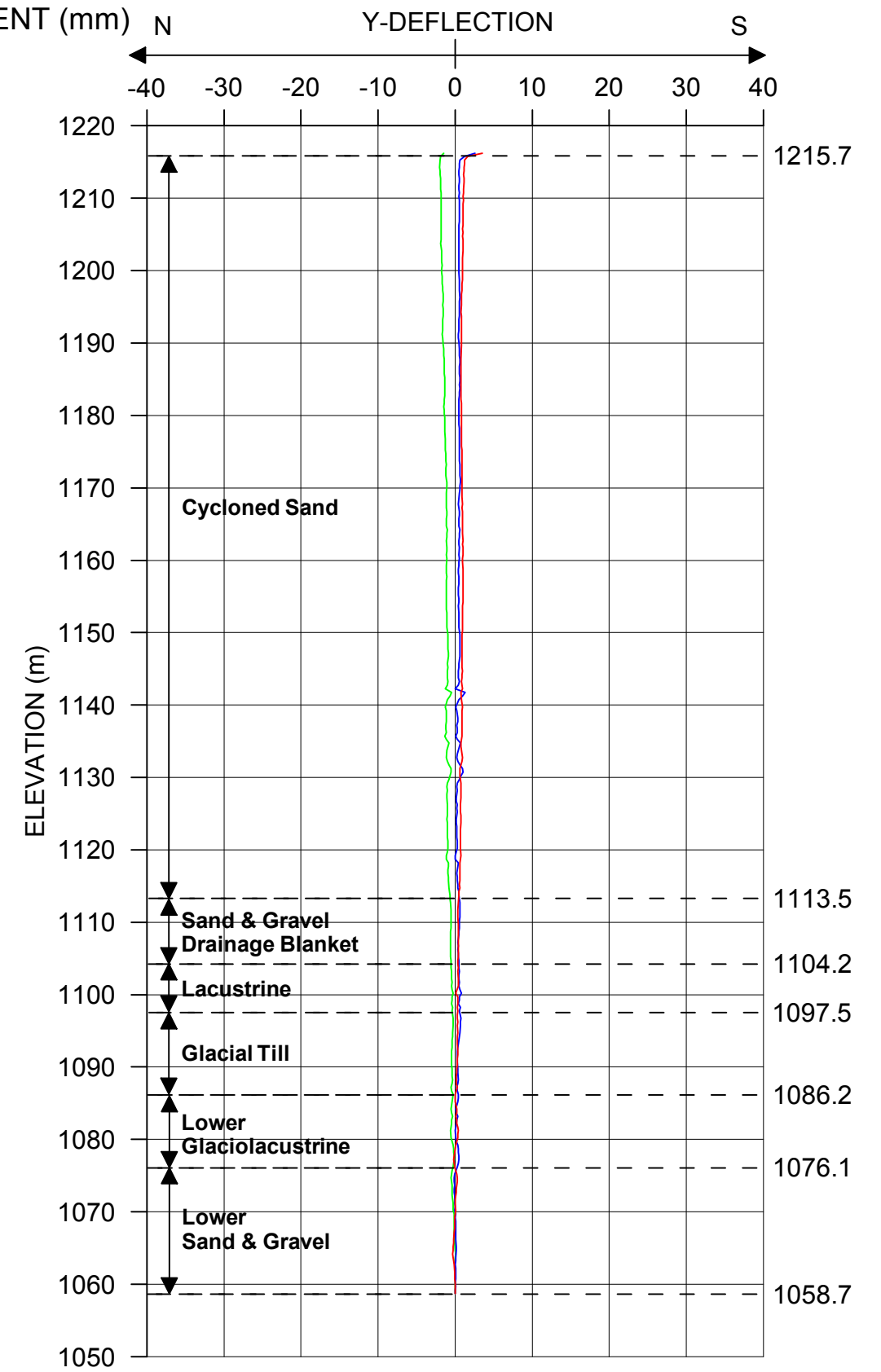
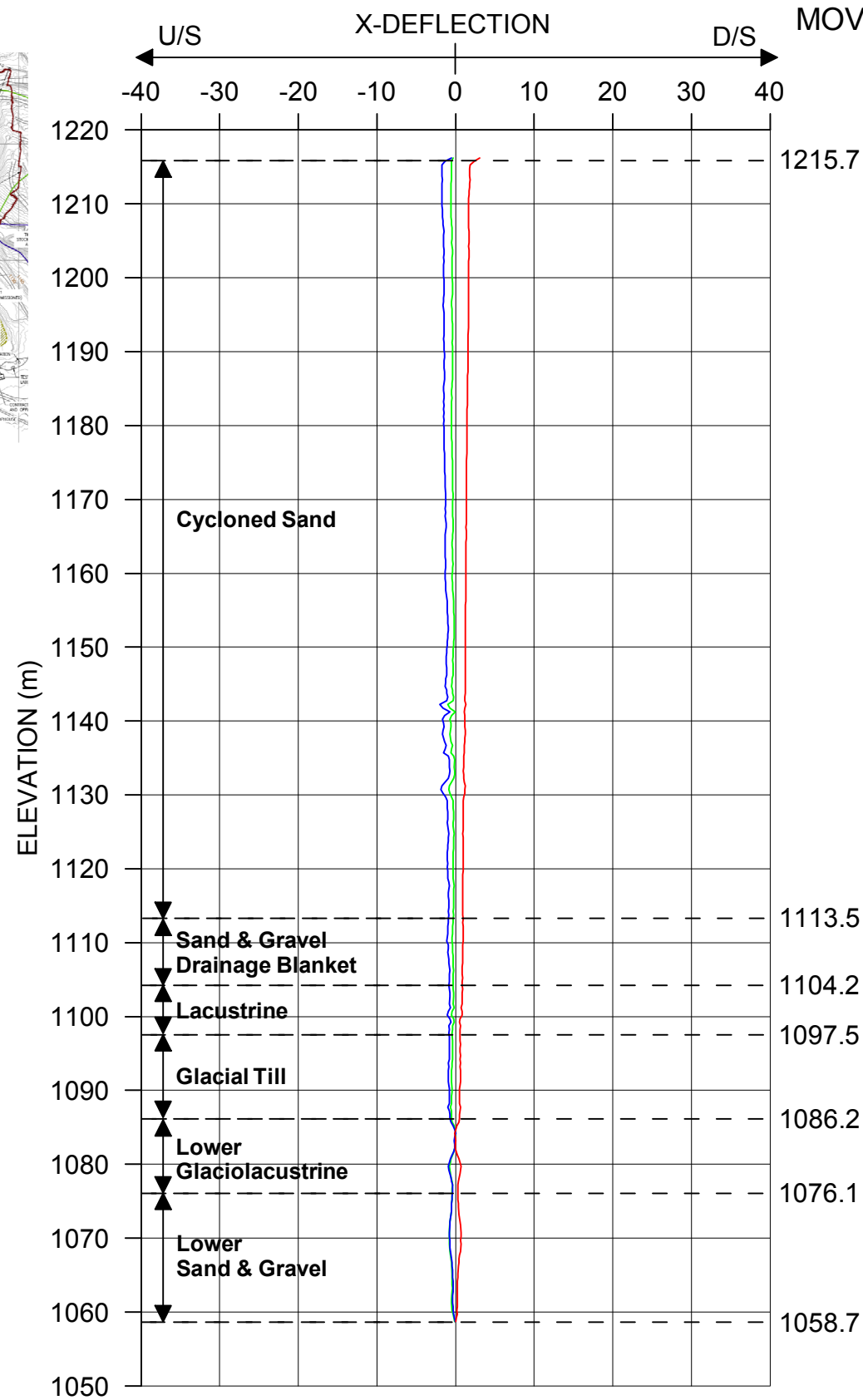


LEGEND

- Sept 30, 2017
- Oct 7, 2017
- Nov 5, 2017

NOTES:

- 1) Initial reading = September 30, 2017.
- 2) Not all readings are plotted.
- 3) 2017 readings for November and December are inconsistent with historical trends, and are under review by KCB/THVCP (likely due to surveillance error). As such, the readings are not shown on this figure.

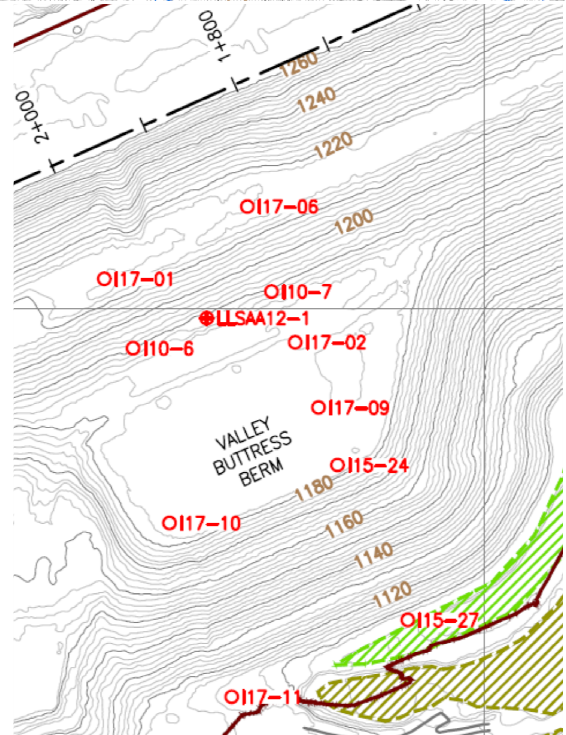
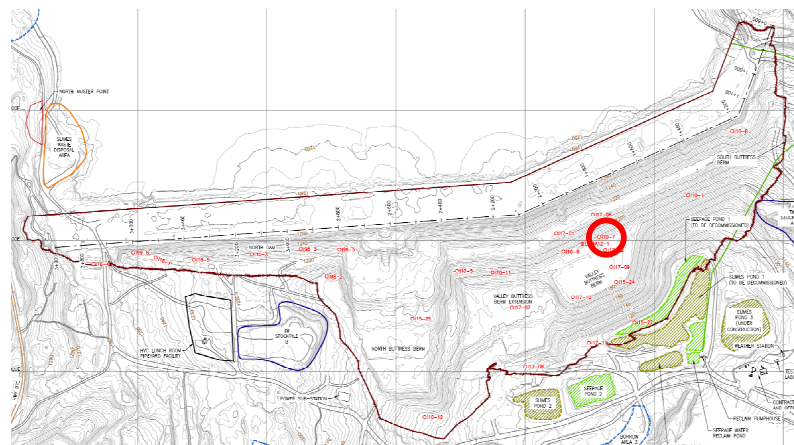


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CLIENT
TECK HIGHLAND VALLEY COPPER PARTNERSHIP

PROJECT	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
TITLE	INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 117-06
PROJECT No.	M02341B26
FIG No.	IV-21

Date: February 27, 2018
Z:\MVC\RM2341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-Dam\10-7\Grapher Files\10-7 2017 (for DSI only).grf

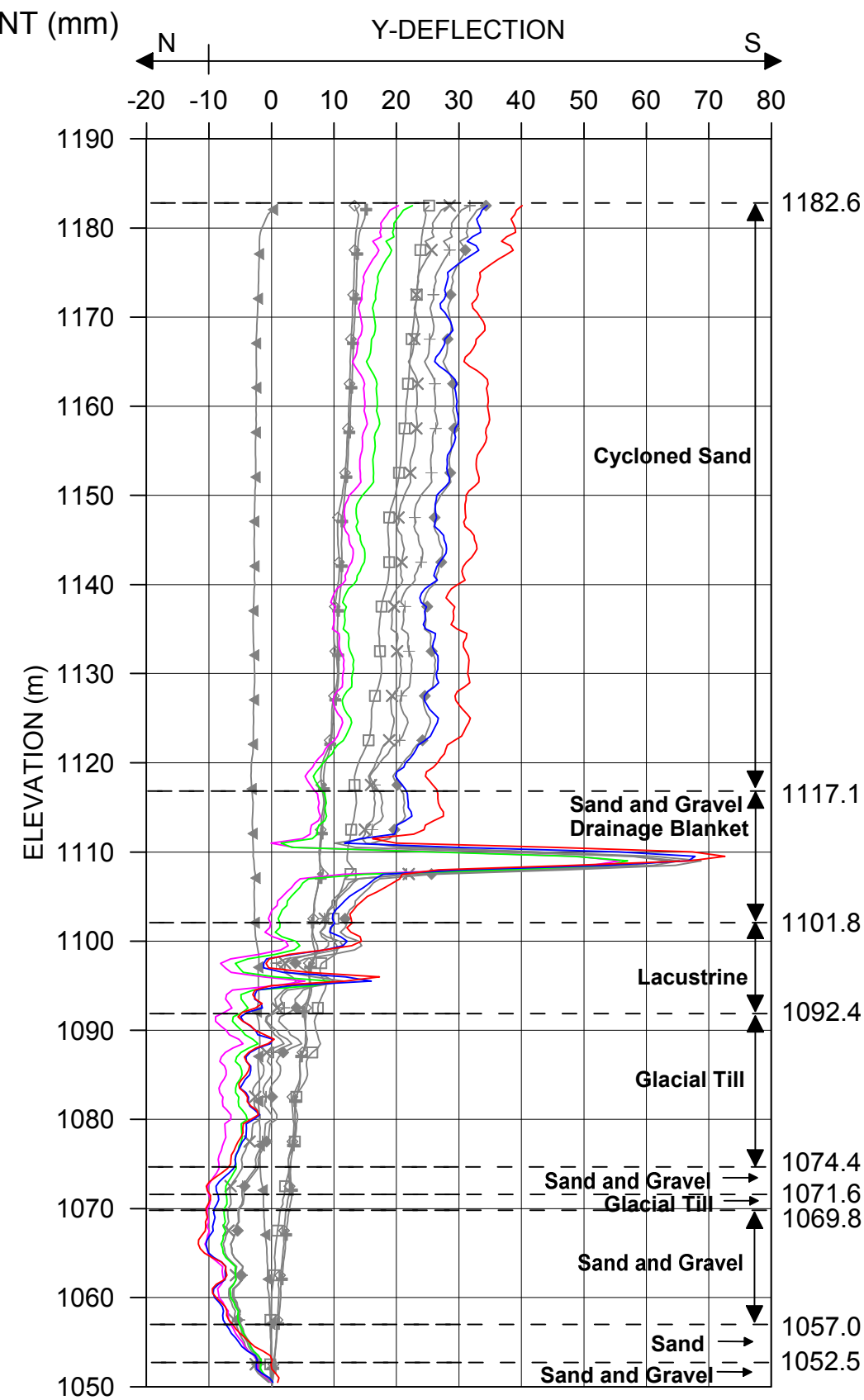
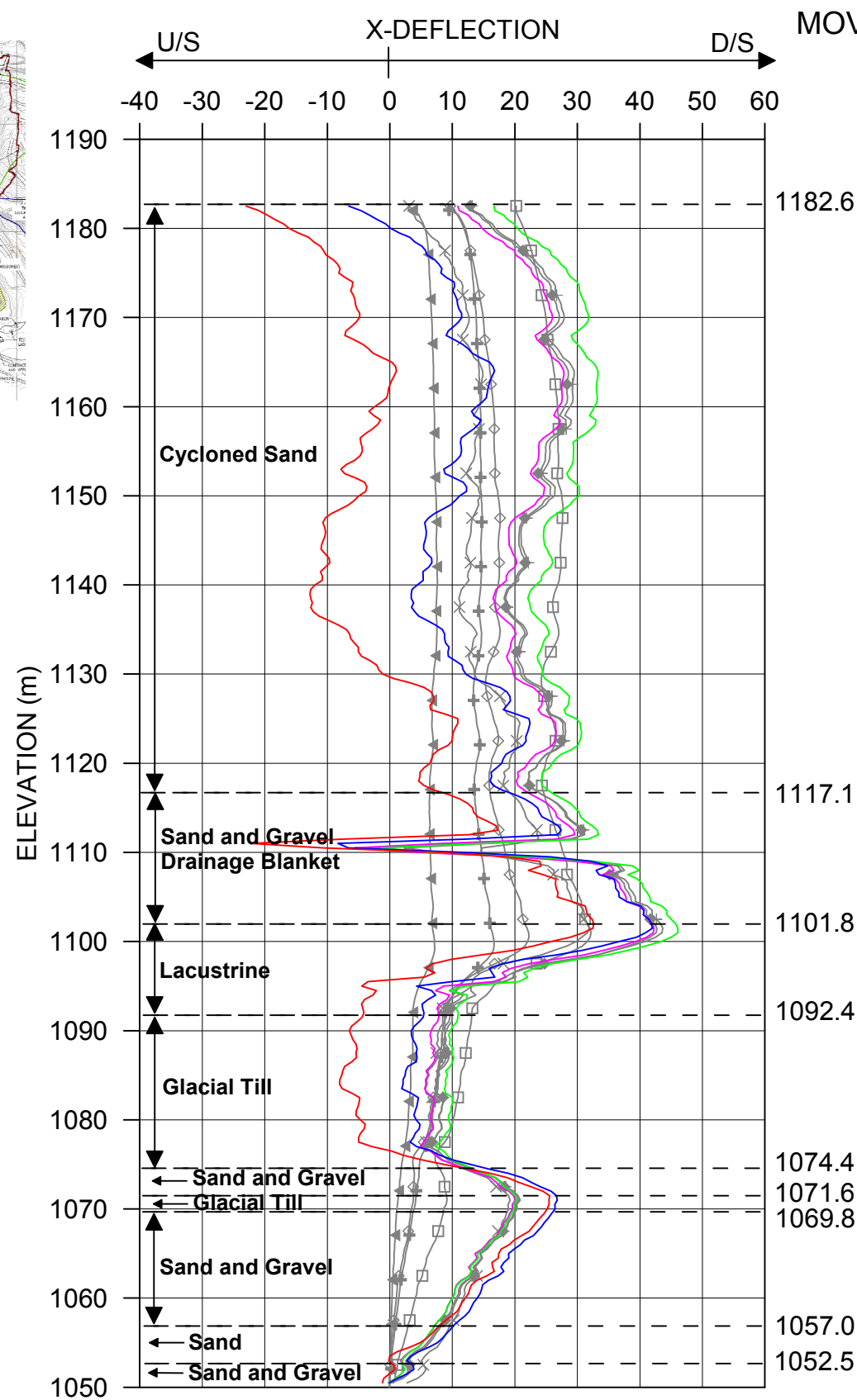


LEGEND

- ← ← ← ← ← Jul 2, 2011
- + + + + + Mar 27, 2012
- ◇ ◇ ◇ ◇ ◇ May 20, 2013
- □ □ □ □ July 11, 2014
- × × × × × July 8, 2015
- ◆ ◆ ◆ ◆ ◆ July 10, 2016
- + + + + + Jan 13, 2017
- Apr 6, 2017
- July 6, 2017
- Oct 11, 2017
- Dec 13, 2017

NOTES:

- 1) Initial reading = January 17, 2011.
- 2) Not all readings are plotted.

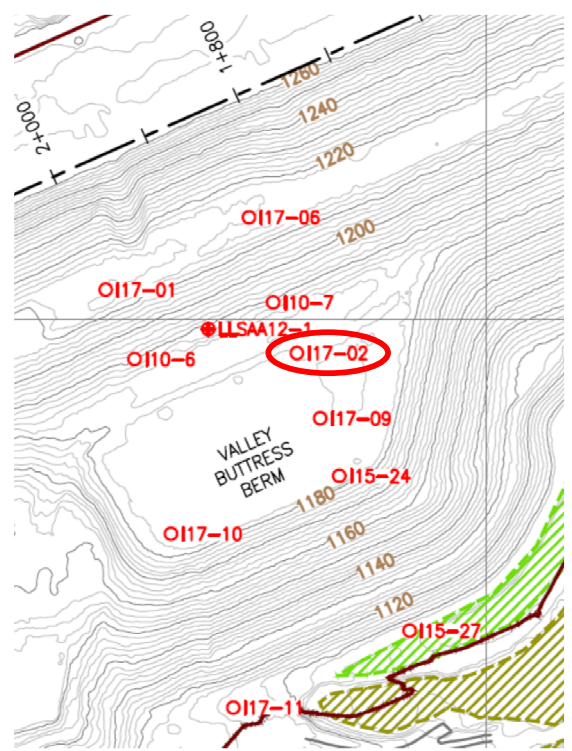
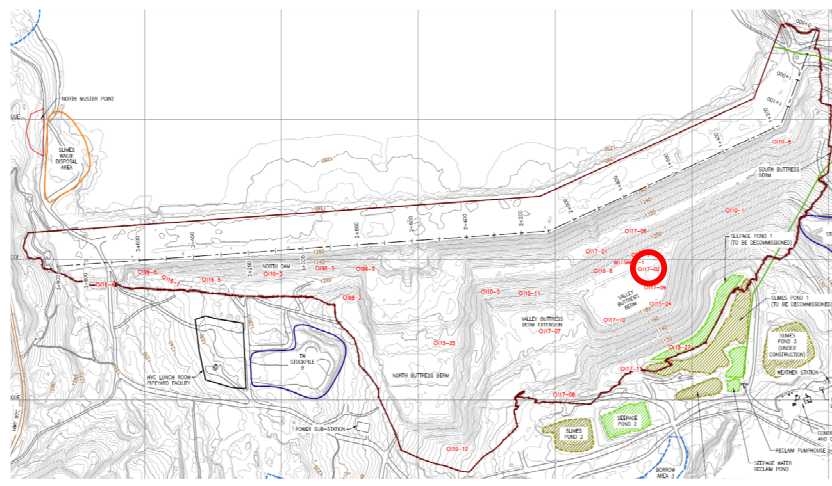


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CLIENT
TECK HIGHLAND VALLEY COPPER PARTNERSHIP

PROJECT	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
TITLE	INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 110-7
PROJECT No.	M02341B26
FIG No.	IV-22

Date: March 13, 2018
Z:\M\CRM\02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-Dam\17-02\Grapher Files\17-02 2017 - DSI only.grf

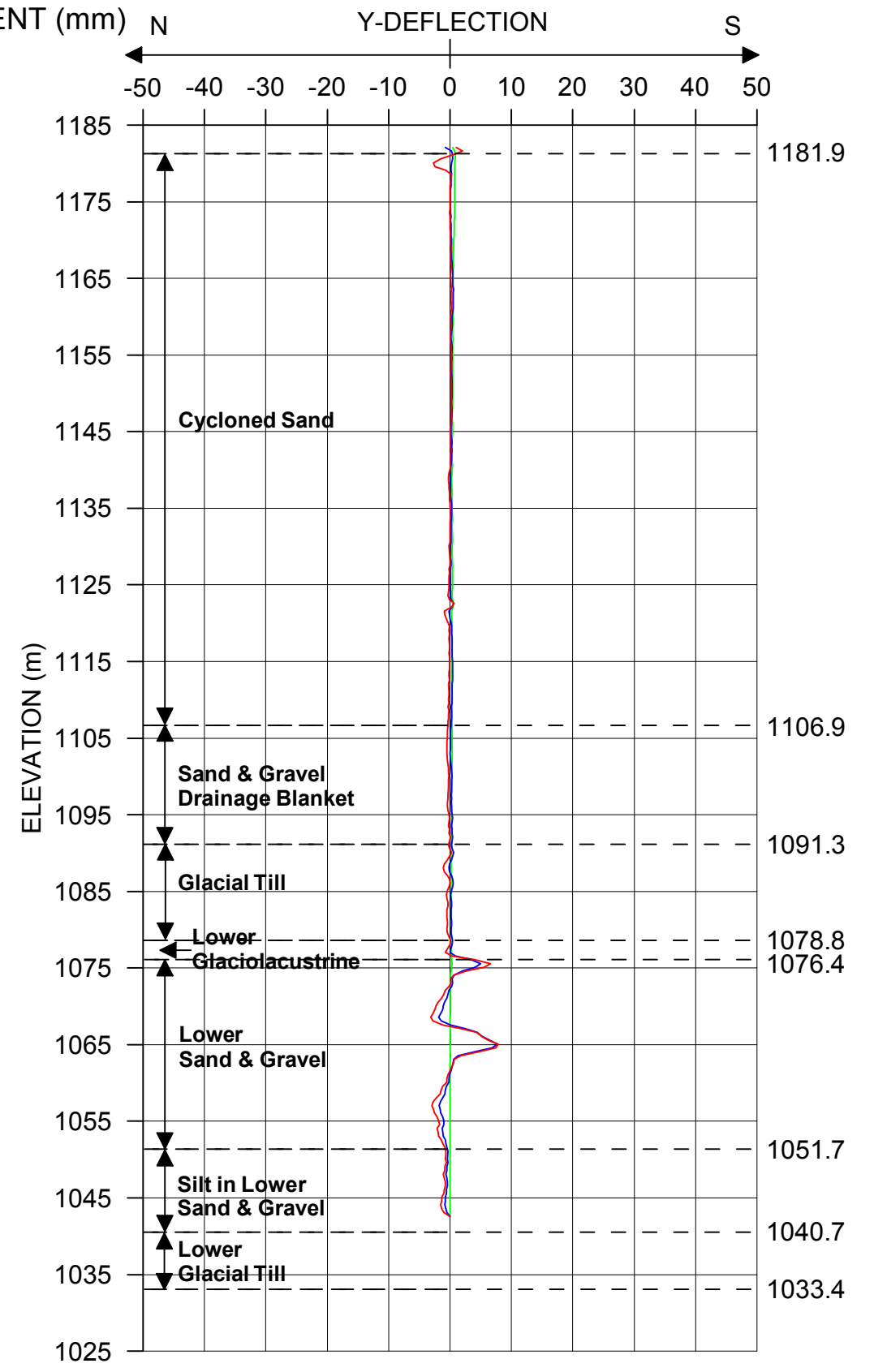
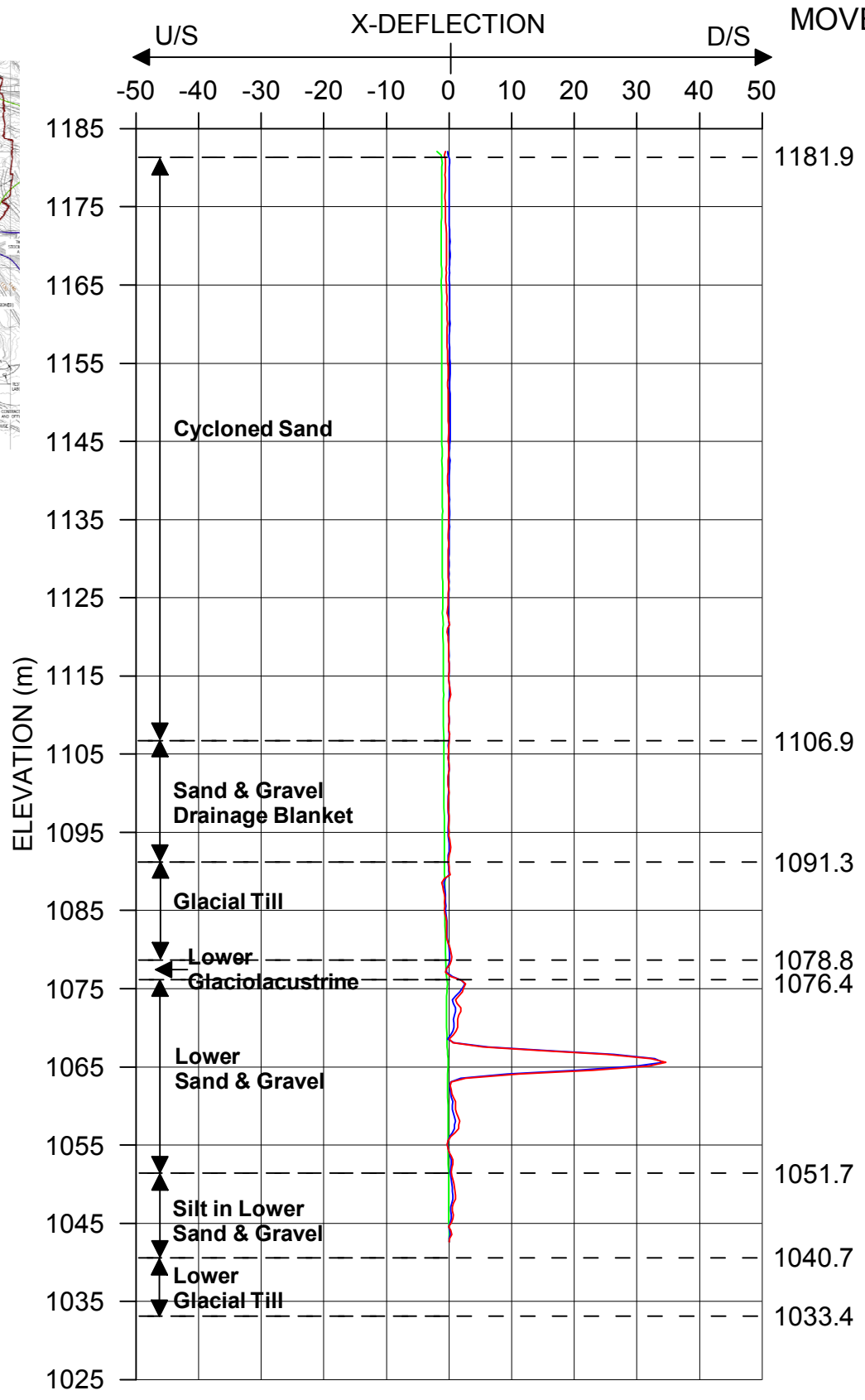


LEGEND

- July 9, 2017
- Sept 29, 2017
- Nov 4, 2017

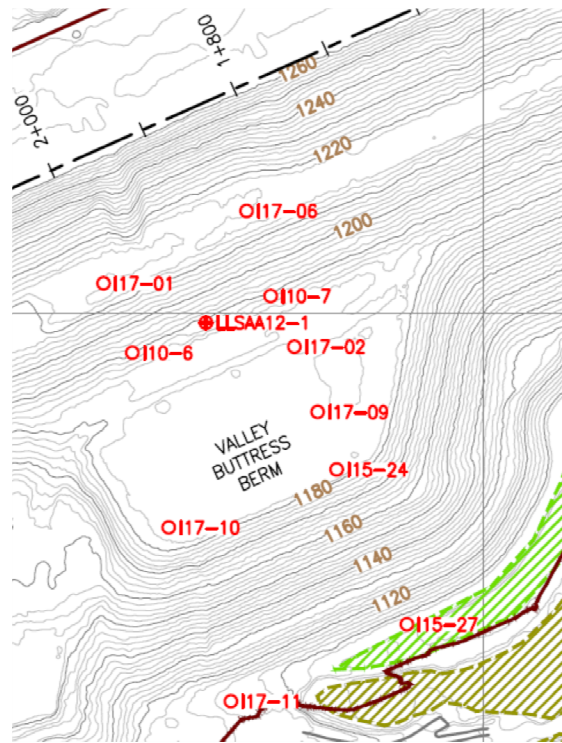
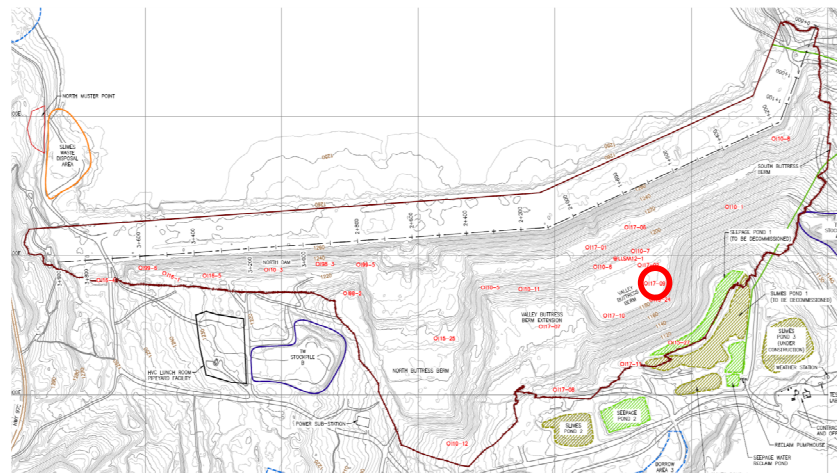
NOTES:

- 1) I17-02 was installed on May 12, 2017.
- 2) I17-02 was initialized on July 09, 2017.
- 3) Reel/Probe Serial Number for the initial reading: DR25880000/DP17520000.
- 4) Not all readings are plotted.
- 5) 5) 2017 reading for December is inconsistent with historical trends, and is under review by KCB/THVCP (likely due to surveillance error). As such, the reading is not shown on this figure.



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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 117-02
	PROJECT No. M02341B26	FIG No. IV-23

Date: February 27, 2018 Z:\MVC\RM02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-Dam\17-09\Grapher Files\17-09 2017 (for DSI only).grf

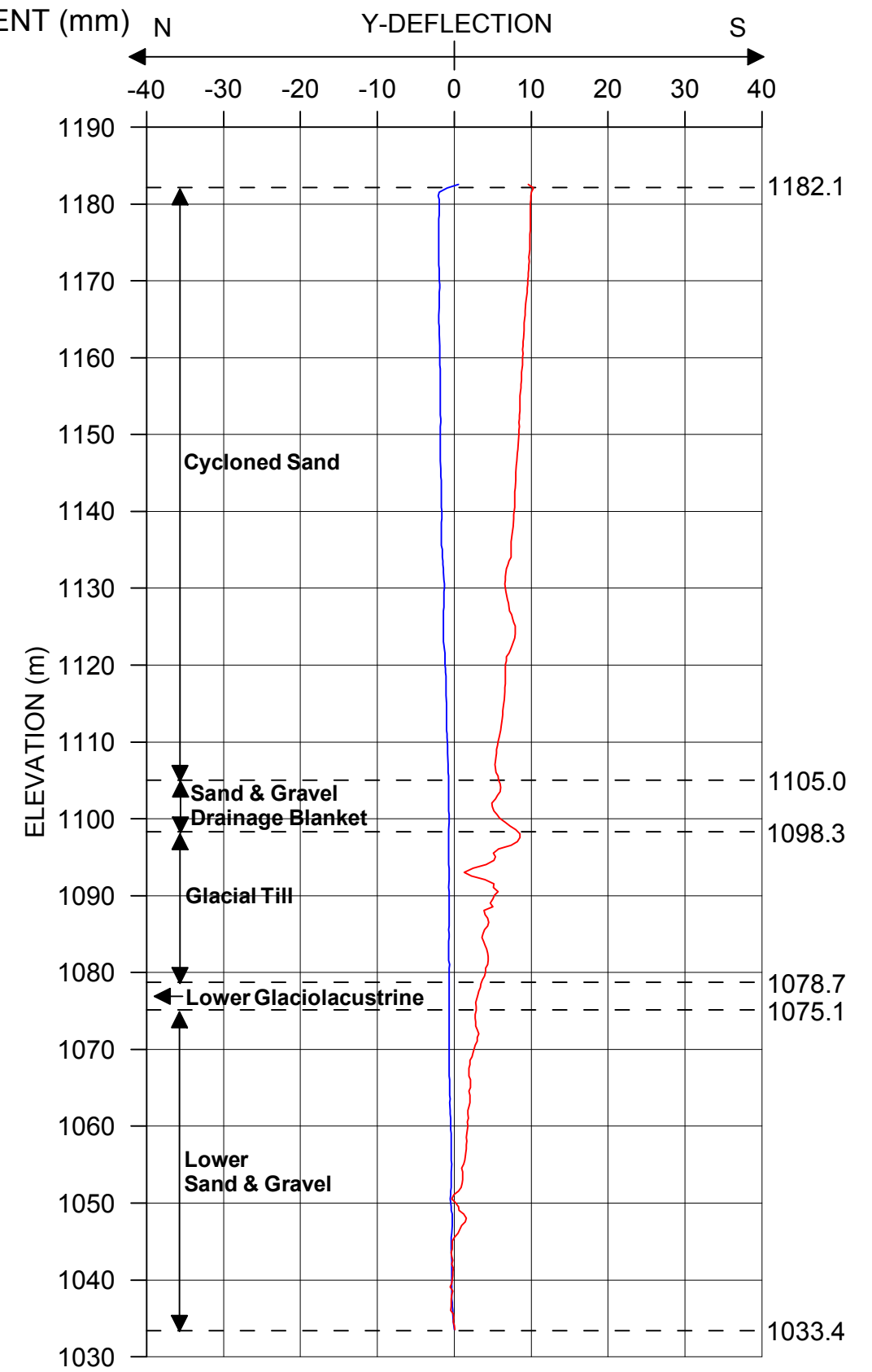
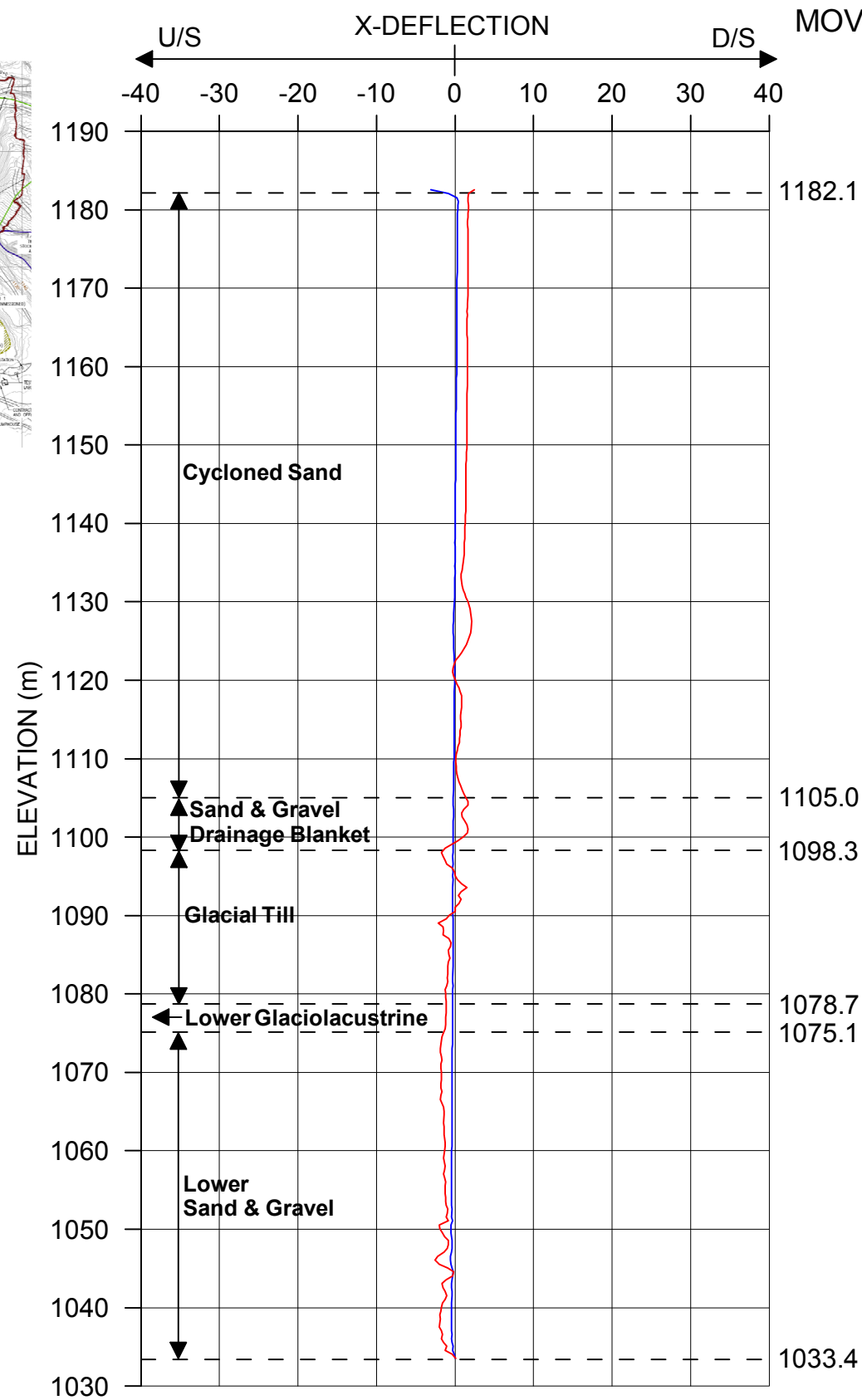


LEGEND

- Aug 5, 2017
- Sept 29, 2017

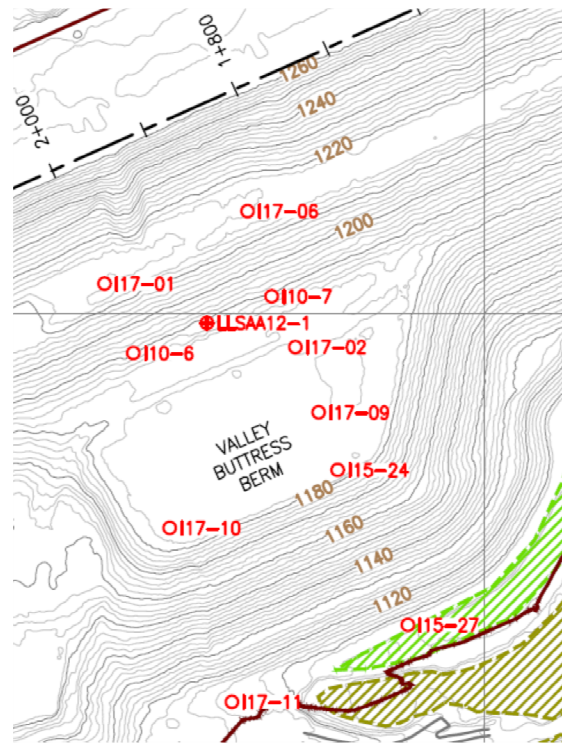
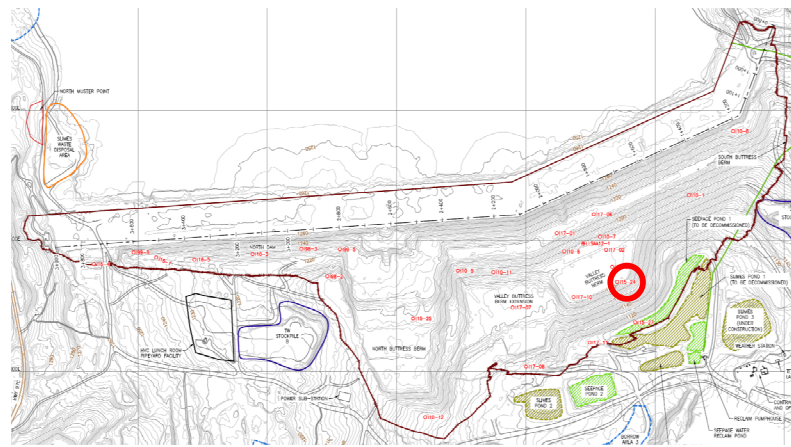
NOTES:

- 1) Initial reading = August 5, 2017.
- 2) Not all readings are plotted.
- 3) 2017 readings for November and December are inconsistent with historical trends, and are under review by KCB/THVCP (likely due to surveillance error). As such, the readings are not shown on this figure.



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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 117-09
	PROJECT No. M02341B26	FIG No. IV-24

Date: February 27, 2018
Z:\MIV\CRM\2017\2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-Dam\115-24\Grapher files\115-24-2017 (for DS) only.grf

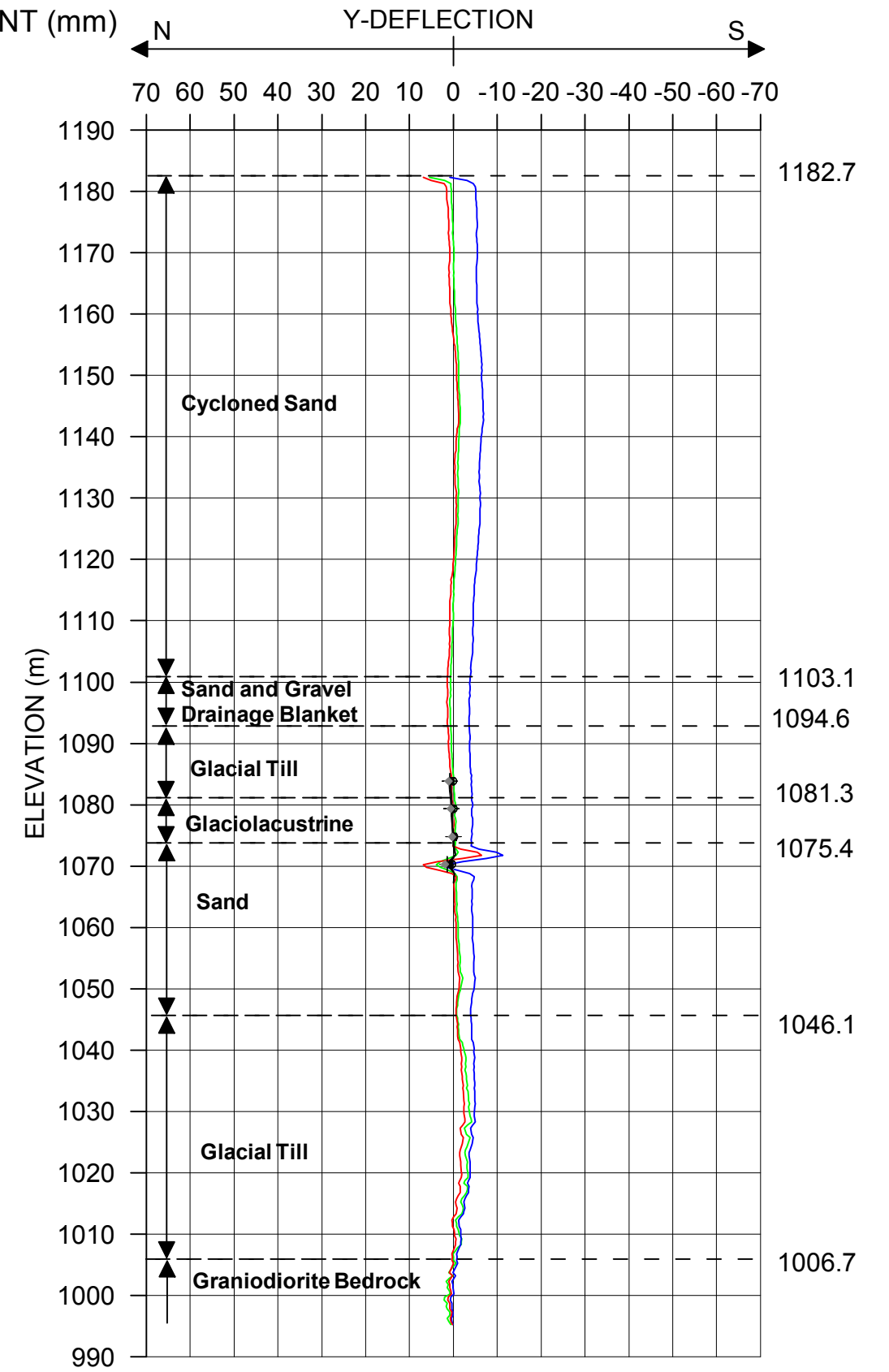
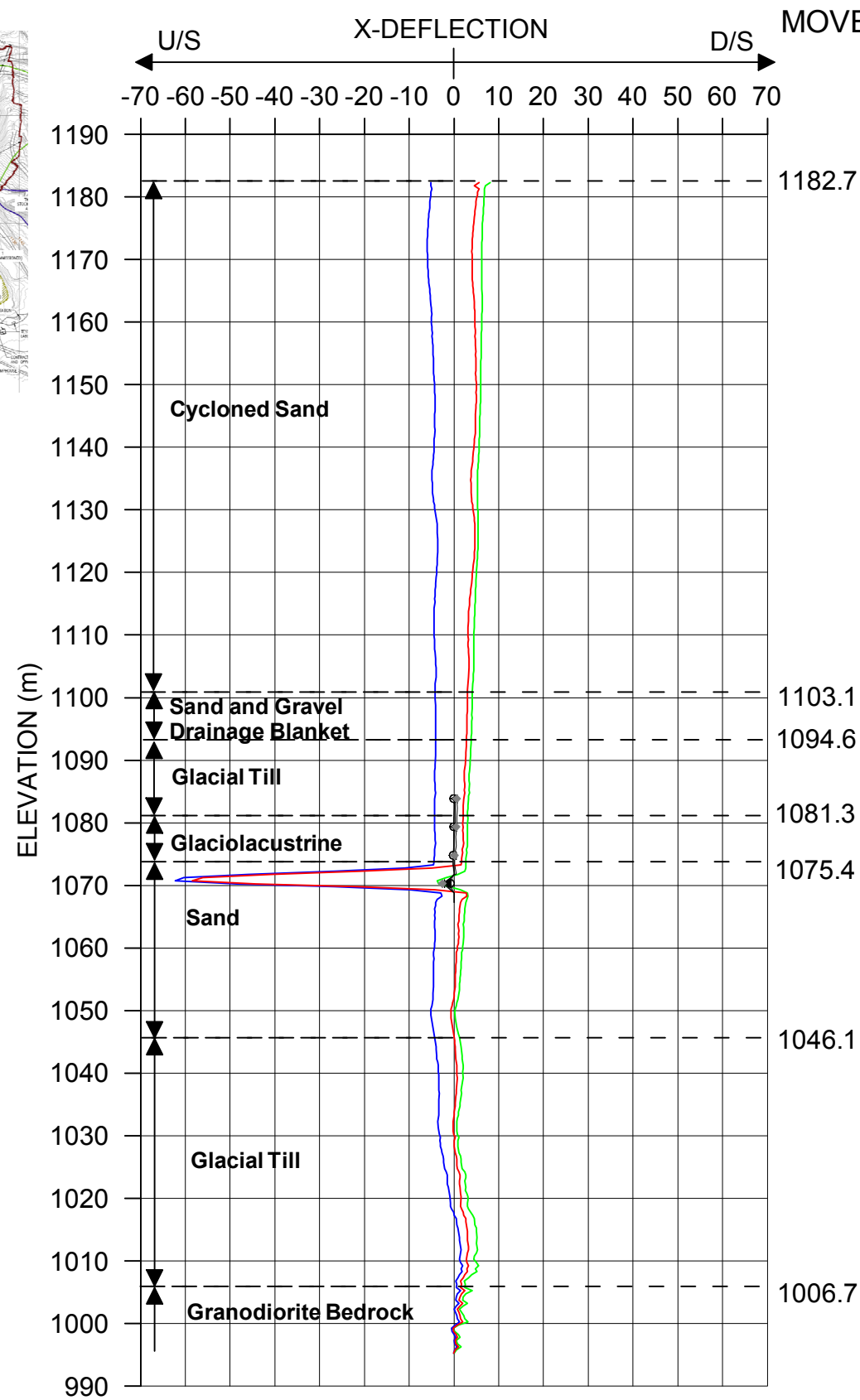


LEGEND

- July 2, 2016
- Jan 11, 2017
- Feb 12, 2017
- ○ ○ IPI - May 15, 2017
- ◀ ◀ ◀ IPI - July 24, 2017
- + + + IPI - Oct 14, 2017
- ◆ ◆ ◆ IPI - Dec 21, 2017

NOTES:

- 1) Initial reading = February 2, 2016.
- 2) Not all readings are plotted.
- 3) An In-Place Inclinometer (IPI) was installed in March 2017 from El. 1083.8 m to El. 1067.3 m

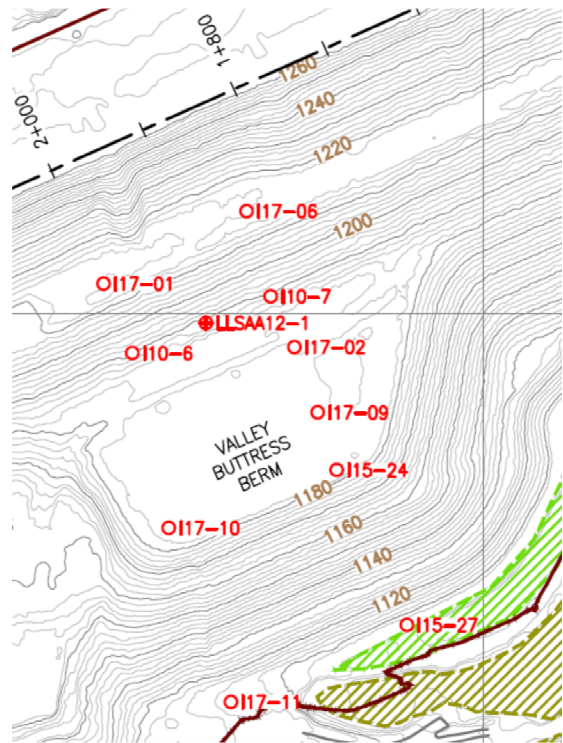
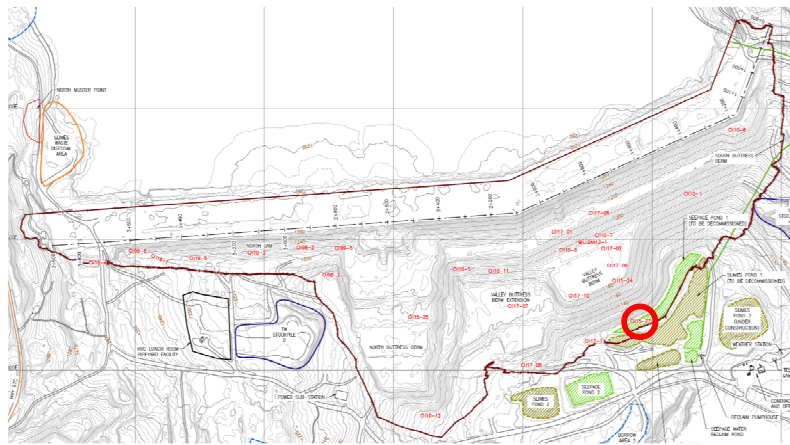


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CLIENT
TECK HIGHLAND VALLEY COPPER PARTNERSHIP

PROJECT	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
TITLE	INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 115-24
PROJECT No.	M02341B26
FIG No.	IV-25

Date: February 27, 2018
Z:\MIV\CR\M02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-Dam\115-27\Grapher files\115-27 2017 (for DS\only).grf

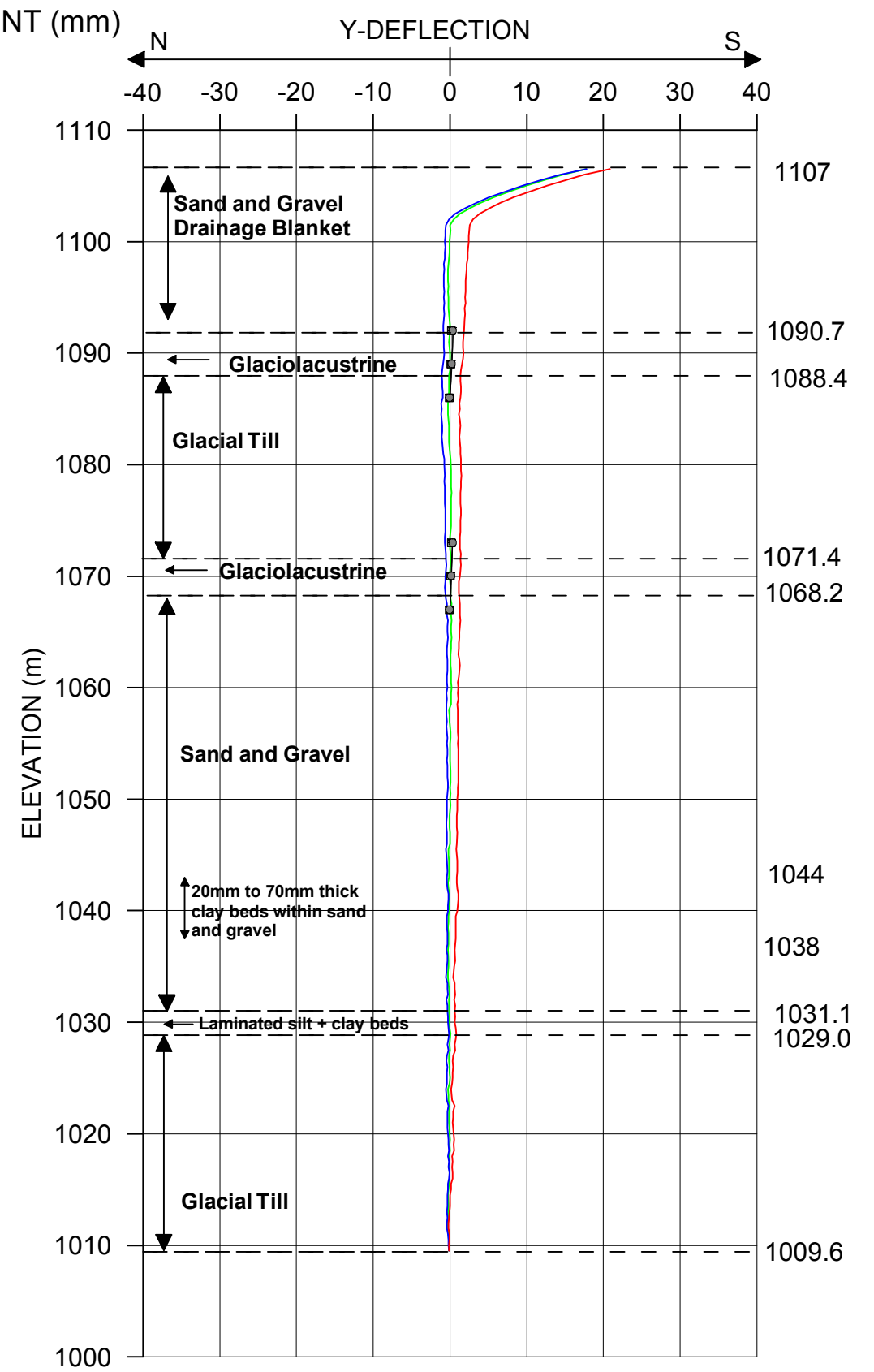
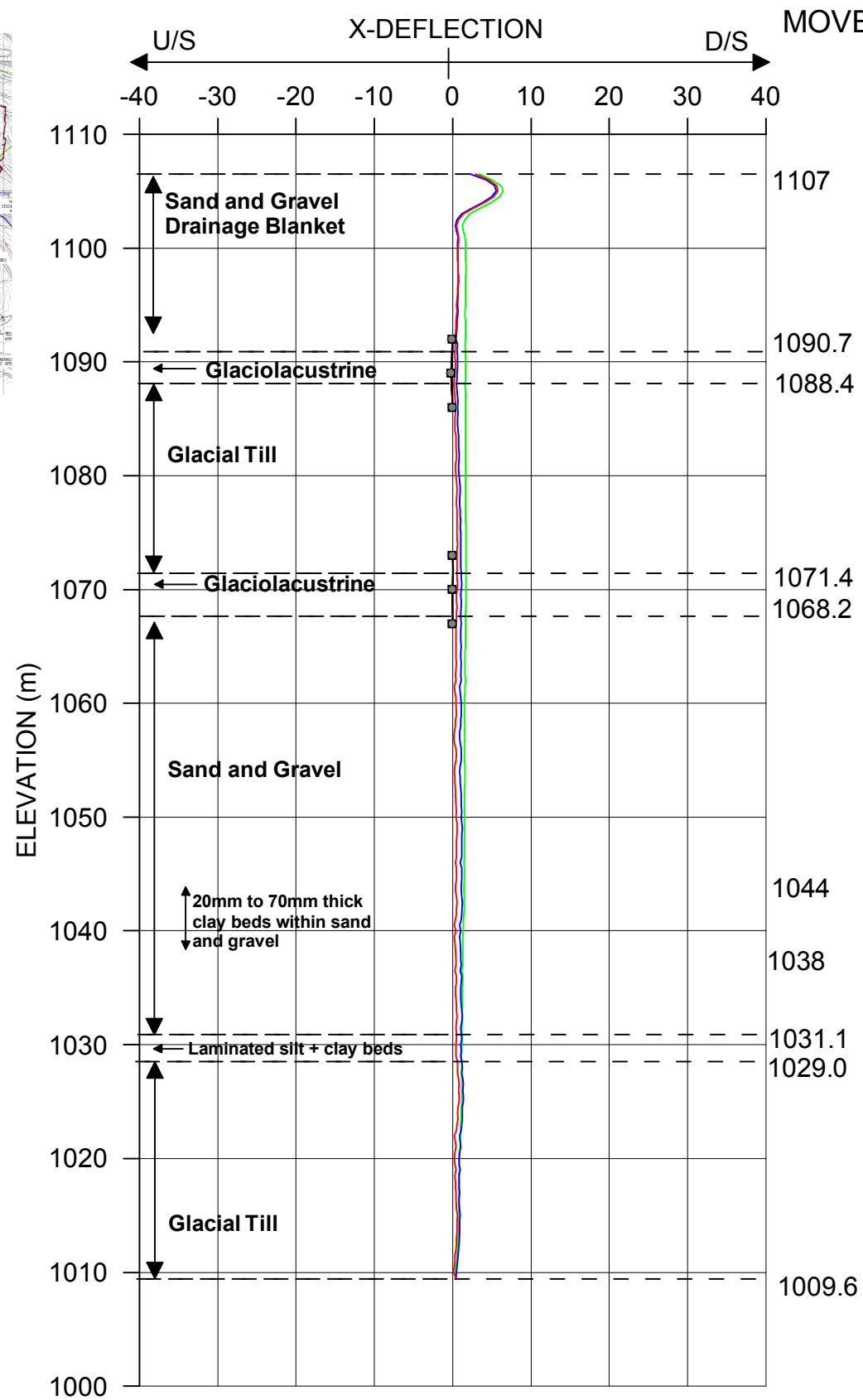


LEGEND

- July 1, 2016
- Feb 12, 2017
- Mar 16, 2017
- IPI - June 29, 2017
- IPI - Sep 29, 2017
- IPI - Dec 21, 2017

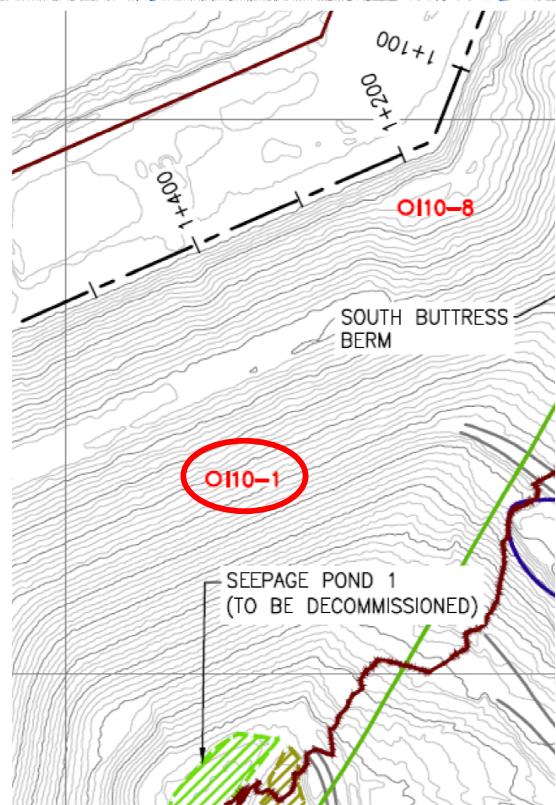
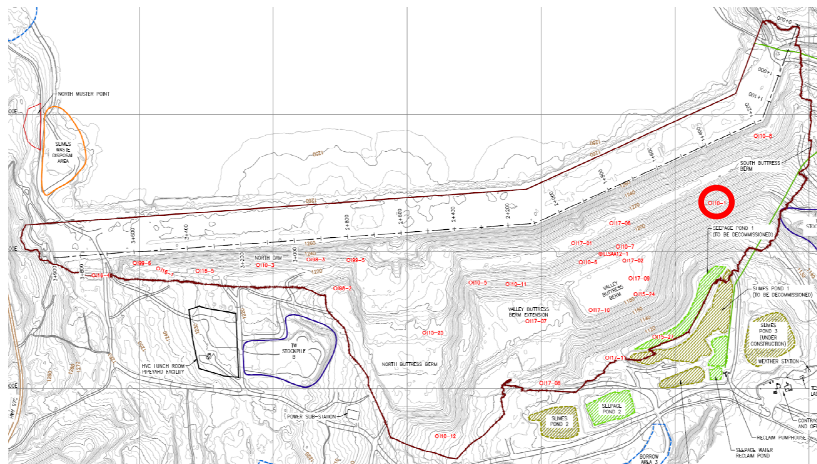
NOTES:

- 1) Initial reading = February 4, 2016.
- 2) Not all readings are plotted.
- 3) In-Place Inclinometers (IPI) were installed in April 2017 from El. 1092 m to El. 1086 m and from El. 1073 m to El. 1067 m.



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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 115-27
		PROJECT No. M02341B26 FIG. No. IV-26

Date: February 27, 2018
Z:\MVC\RM02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-1_Dam\10-1\Grapher Files\10-1 2017 (DSI only).grf

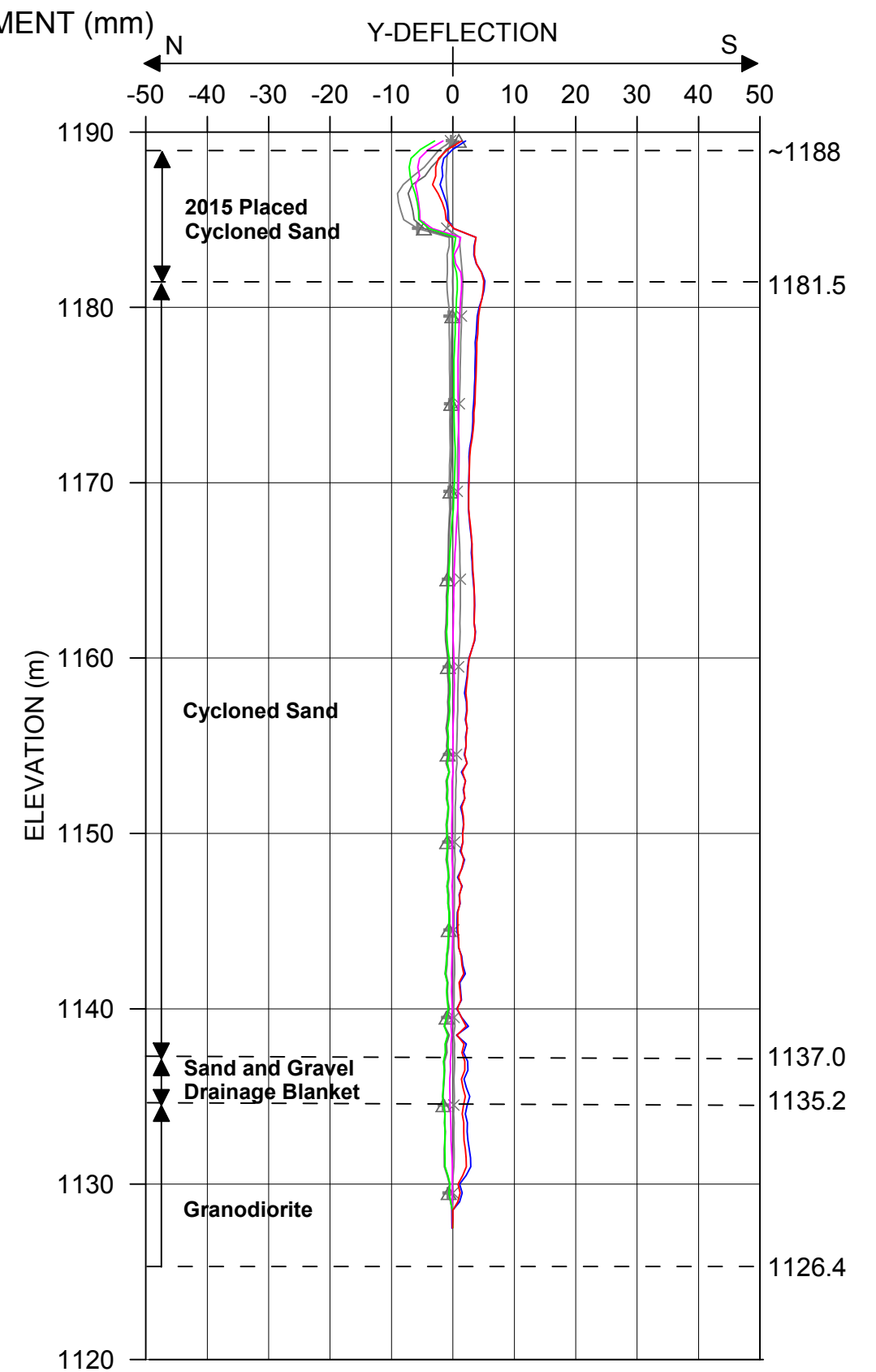
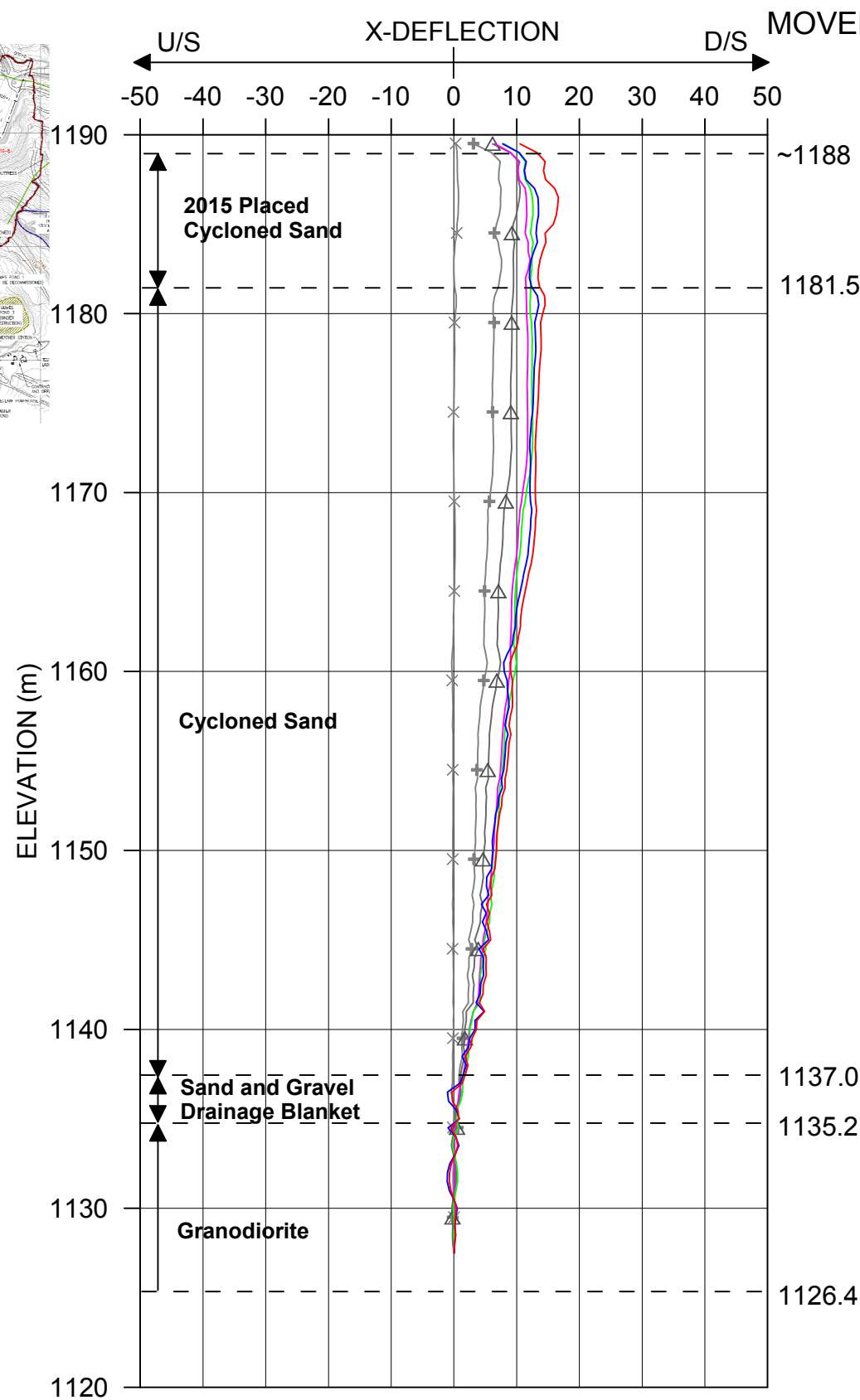


LEGEND

- × — × — × Oct 22, 2015
- + — + — + Mar 30, 2016
- △ — △ — △ Oct 16, 2016
- Apr 25, 2017
- July 2, 2017
- Sep 2, 2017
- Oct 8, 2017

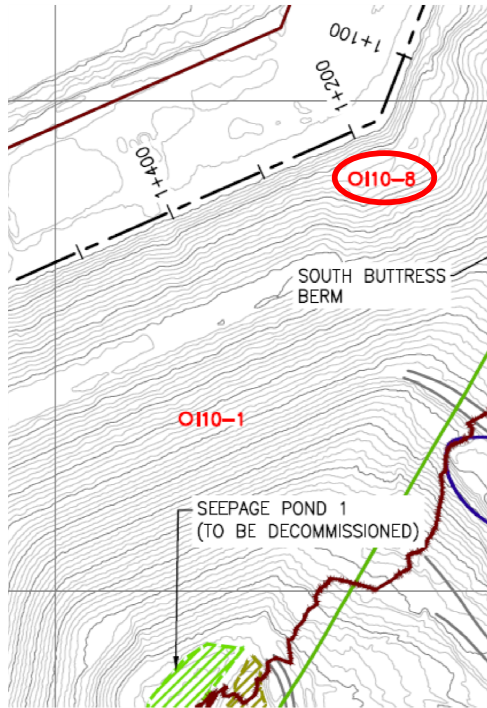
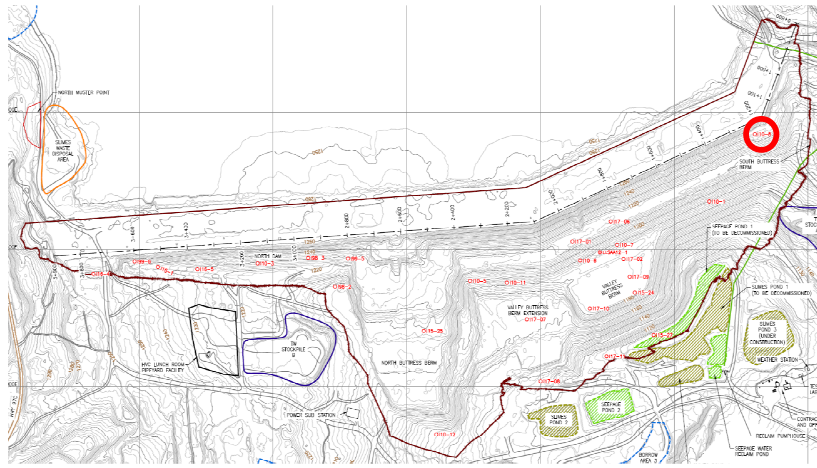
NOTES:

- 1) I10-1 was installed on October 17, 2010.
- 2) I10-1 was damaged during 2015 construction and was repaired June 23, 2015.
- 3) I10-1 was re-initialized on October 8, 2015.
- 4) Reel/Probe Serial Number for the initial reading: DR19430000/DP06580000.
- 5) Not all readings are plotted.



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	Klohn Crippen Berger	TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE I10-1
	PROJECT No. M02341B26	FIG No. IV-27

Date: February 27, 2018
 Z:\MVC\RM02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\L-Dam\110-8\Grapher Files\110-8 2017 (DSI only).grf

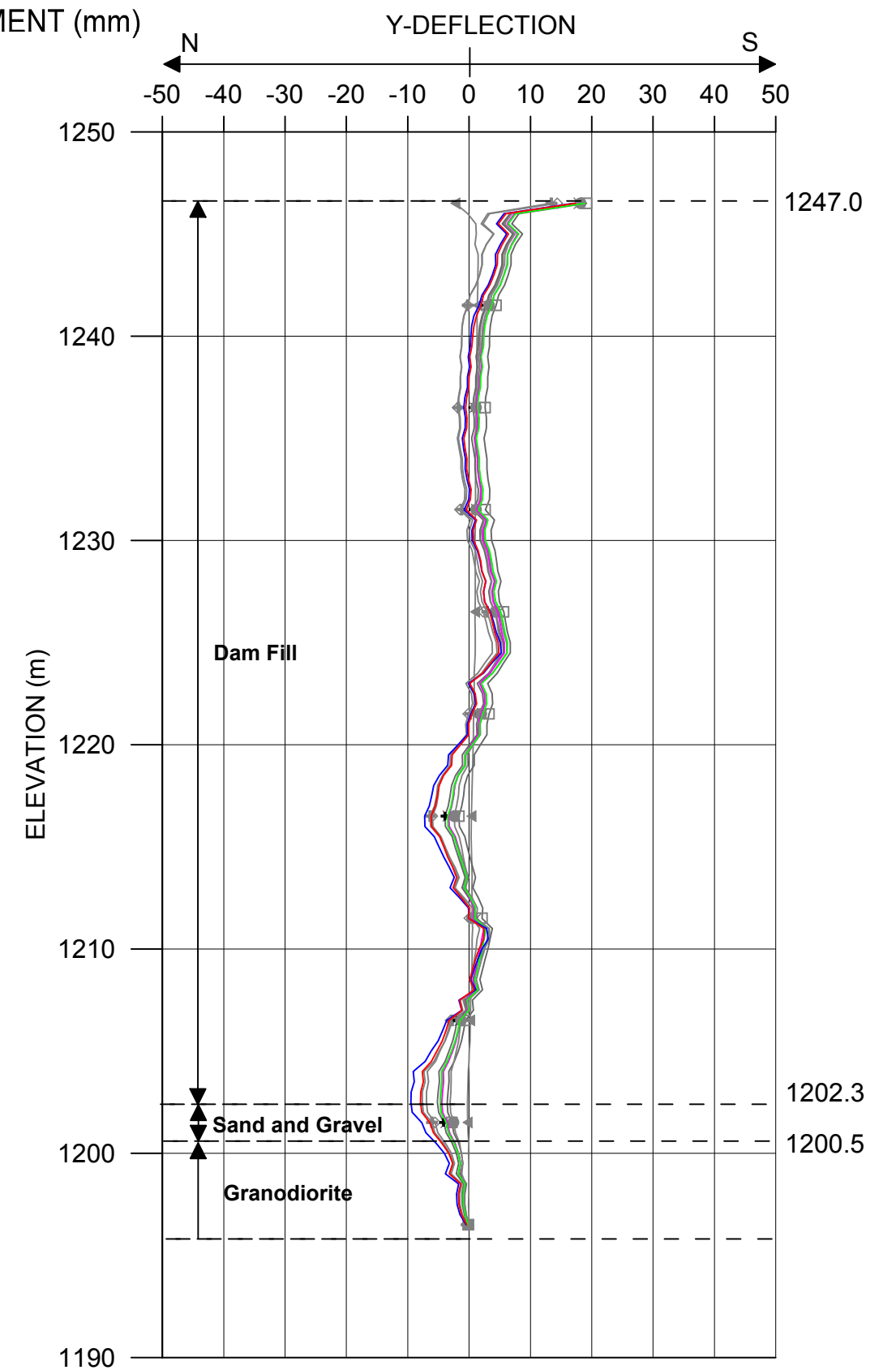
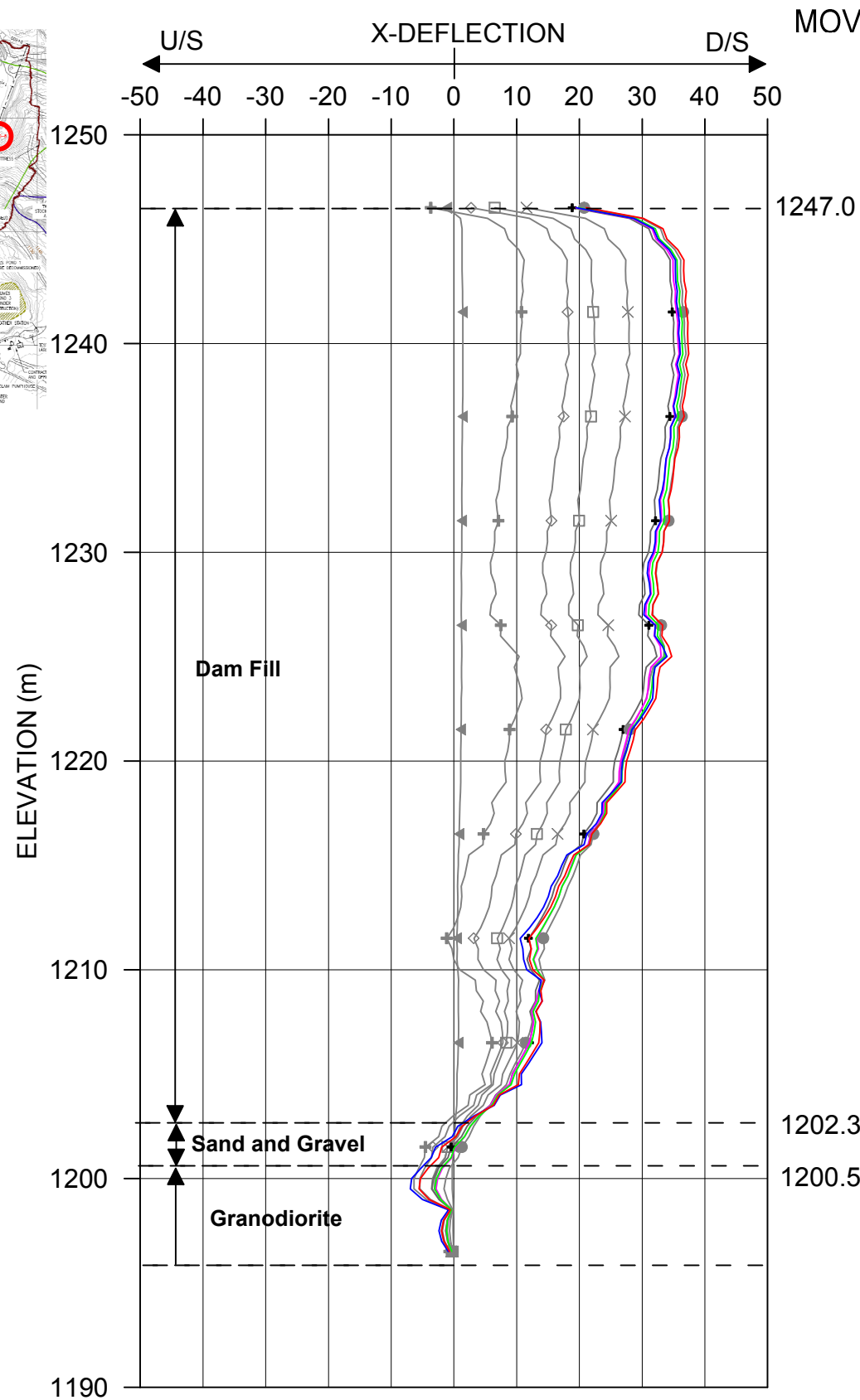


LEGEND

- ← ← ← July 6, 2011
- + + + July 29, 2012
- ◇ ◇ ◇ Aug 10, 2013
- □ □ July 14, 2014
- × × × July 13, 2015
- + + + June 27, 2016
- ● ● Jan 20, 2017
- Apr 25, 2017
- July 1, 2017
- Sep 1, 2017
- Oct 8, 2017

NOTES:

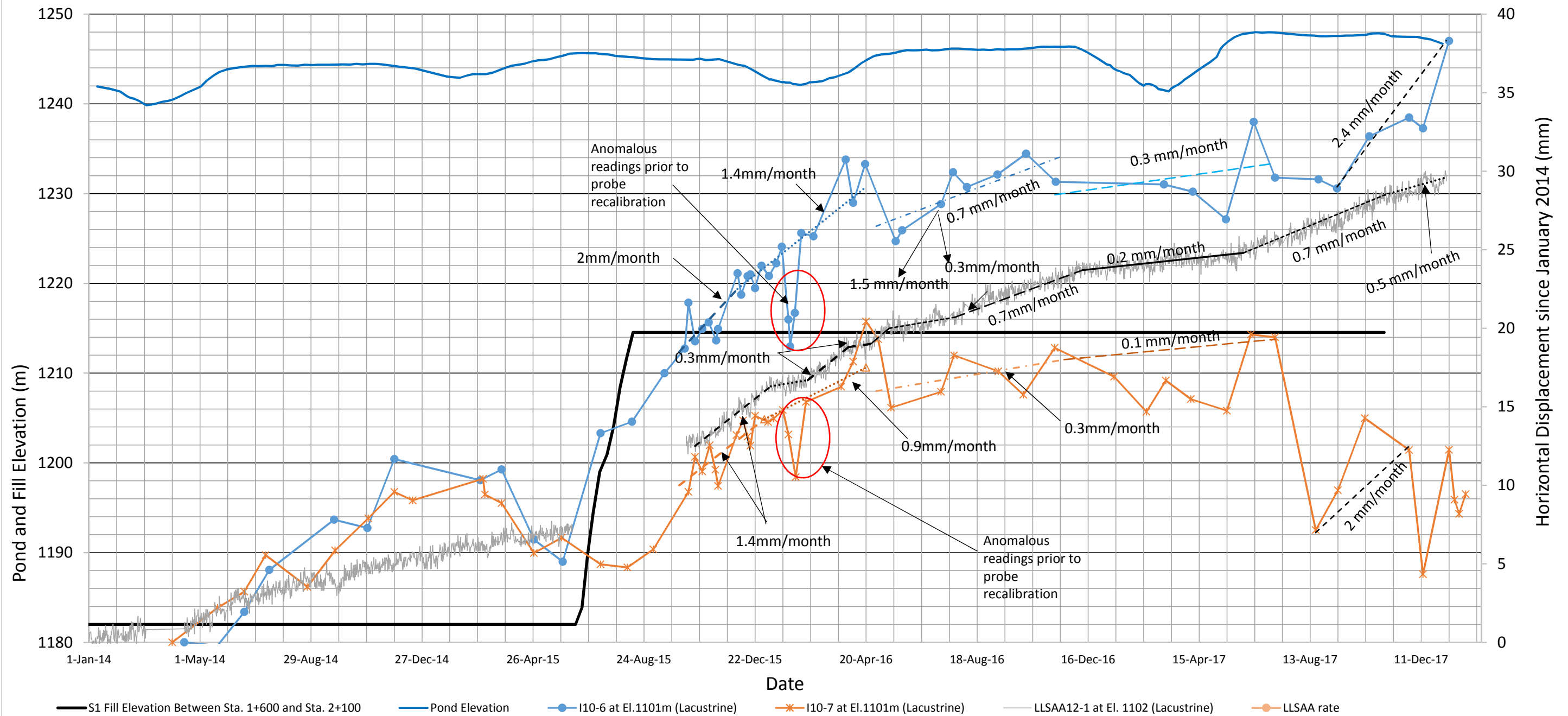
- 1) I110-8 was installed on November 30, 2010.
- 2) I110-8 was initialized on January 14, 2011.
- 3) Reel/Probe Serial Number for the initial reading: DR00820000/DP06580000.
- 4) Not all readings are plotted.



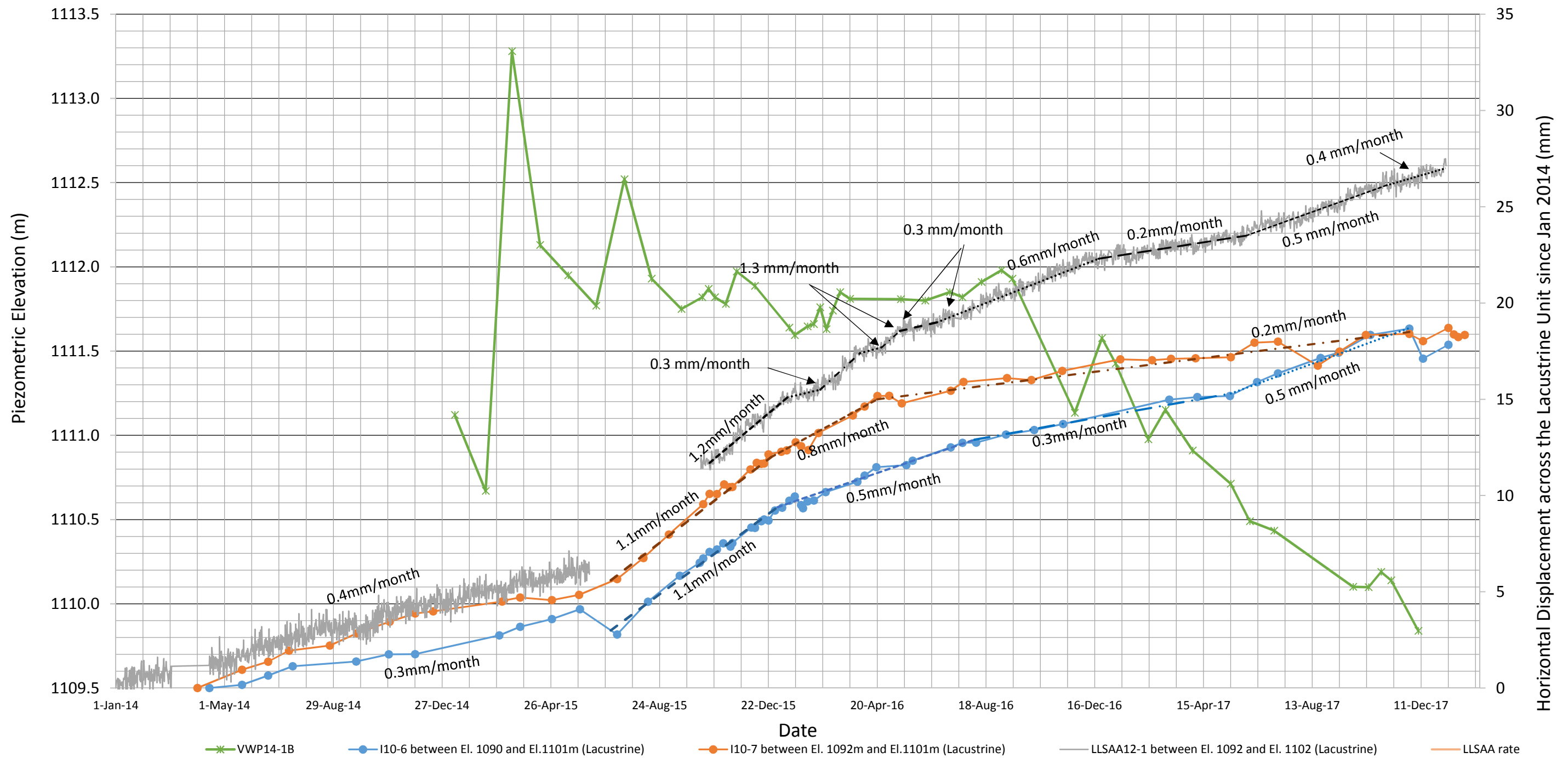
AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS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

CLIENT
**TECK HIGHLAND VALLEY
 COPPER PARTNERSHIP**

PROJECT	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
TITLE	INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE 110-8
PROJECT No.	M02341B26
FIG No.	IV-28



<p>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</p>	<p>TECK HIGHLAND VALLEY COPPER PARTNERSHIP</p>		<p>HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION</p>	
			<p>L-L Dam Horizontal Displacements - Top of Lacustrine Unit 2014 - 2017</p>	
			<p>M02341B26</p>	<p>IV-29</p>



VWP14-1B is a vibrating wire piezometer installed within the Lacustrine Clay at El. 1098.1m in December 2014.

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**TECK HIGHLAND VALLEY
COPPER PARTNERSHIP**



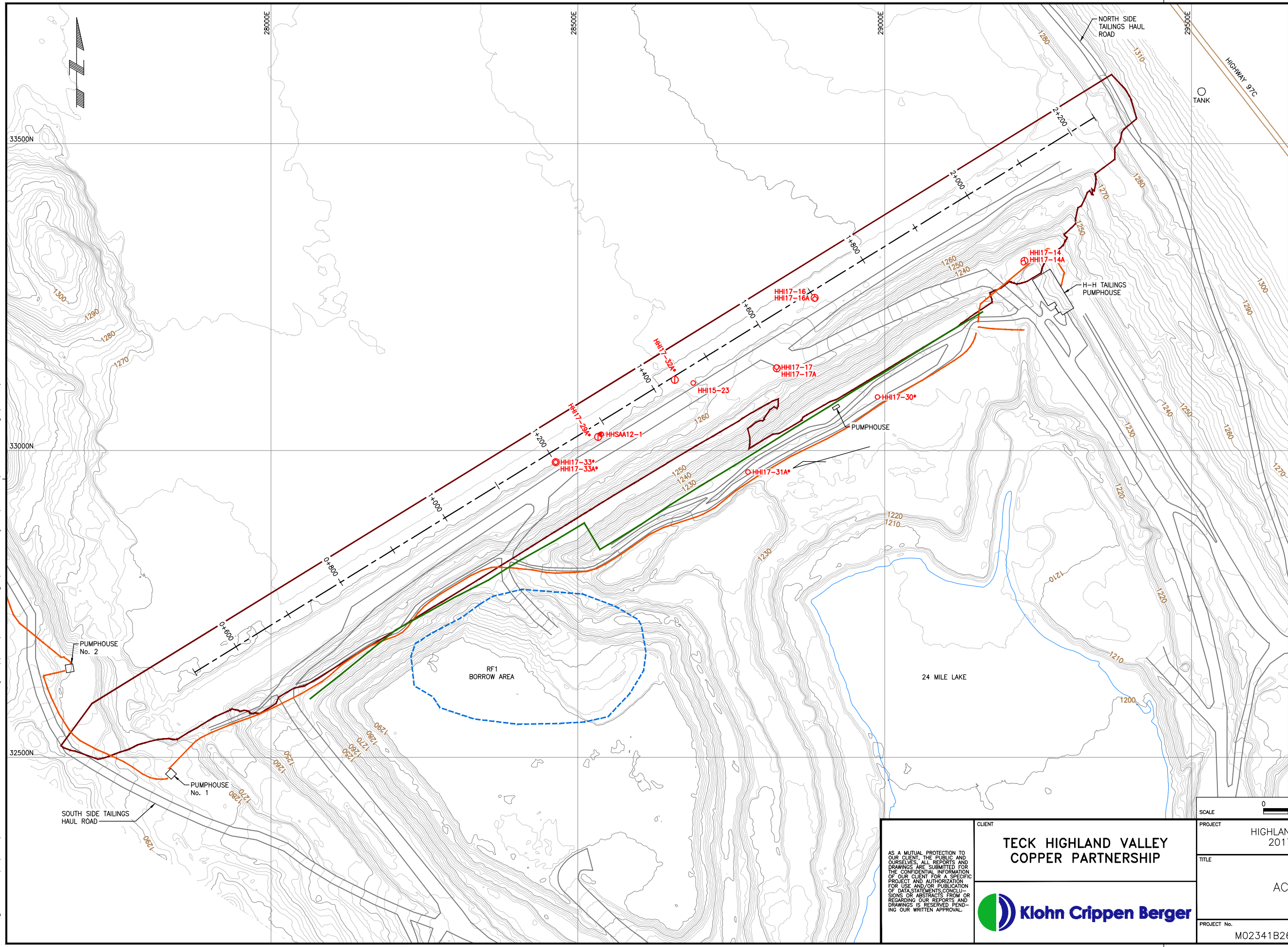
HIGHLAND TAILINGS STORAGE FACILITY
2017 DAM SAFETY INSPECTION

L-L Dam Horizontal Displacements
Across Lacustrine Unit
2014 - 2018

M02341B26

IV-30

Time: 11:27:02
 Date: 3/13/2018
 Scale: 1:50.8(P/S)
 Drawing File: Z:\M\CR\M02341B26 - HVC-2017 Dam Safety Support\400 Drawings\Dam Safety Inspection\FIG_IV-31.dwg (skuan)



LEGEND:

- BORROW AREA
- ULTIMATE DAM FOOTPRINT
- TAILINGS PIPELINE
- POWERLINE
- HAUL ROAD
- PUBLIC ROAD
- H-H DAM CENTERLINE

ACTIVE INSTRUMENTS (SEE NOTE 2):

- STANDARD INCLINOMETER
- COMBINED STANDARD INCLINOMETER AND IN-PLACE SAA INCLINOMETER
- ⊕ COMBINED STANDARD INCLINOMETER AND PAIRED SONDEX SETTLEMENT SYSTEM

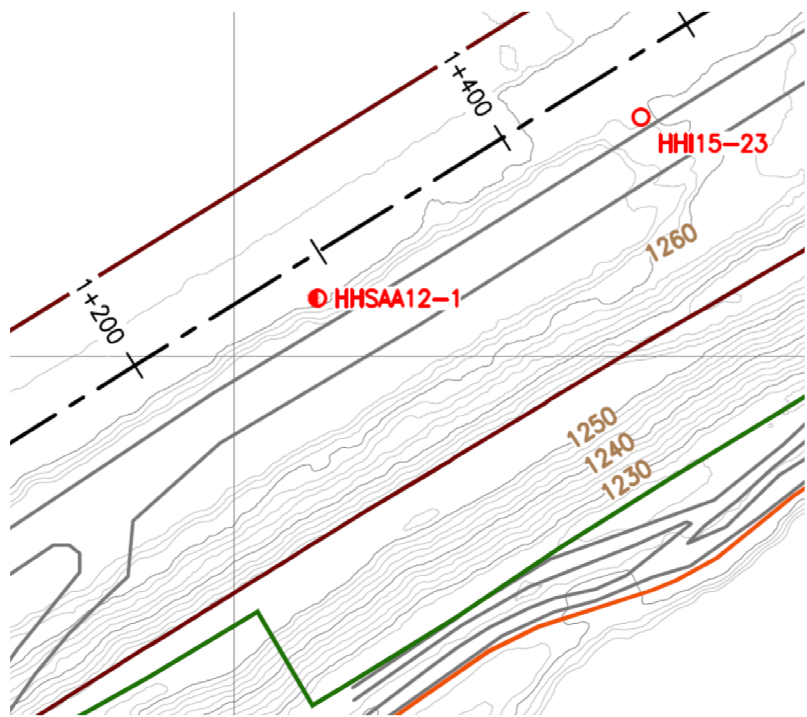
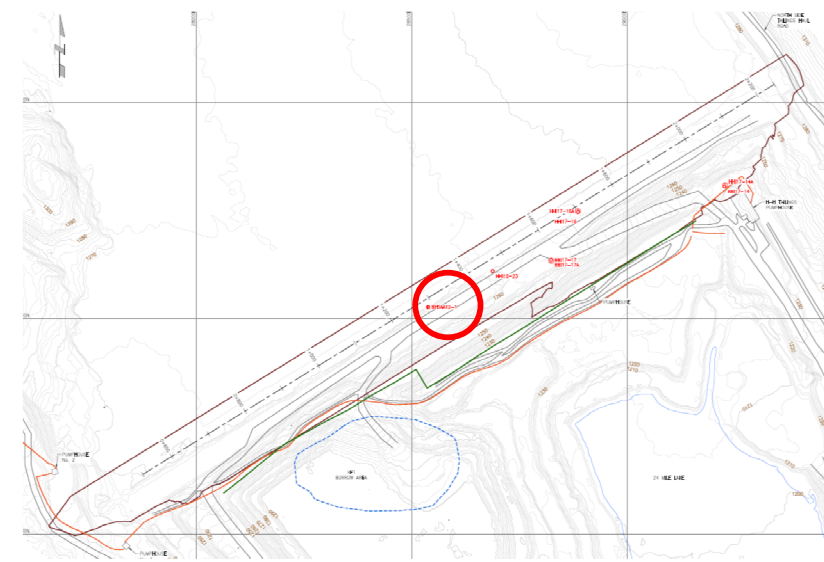
- NOTES:**
1. TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER PARTNERSHIP AND WAS DERIVED FROM SATELLITE IMAGERY TAKEN ON 2017-07-01.
 2. ACTIVE INSTRUMENTS ARE DEFINED AS ANY INSTRUMENTS SATISFYING ONE OF THE FOLLOWING CRITERIA: CURRENTLY READING AN ACTIVE WATER LEVEL, DRY OR PLUGGED <20 m ABOVE TIP ELEVATION AS THIS COULD SHOW A RESPONSE IN THE FUTURE.
 3. ASTERISK (*) DENOTES PROPOSED INSTRUMENT LOCATION TO BE UPDATED WITH AS-CONSTRUCTED LOCATION WHEN SURVEY IS COMPLETED.



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	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION	
TITLE H-H DAM ACTIVE INCLINOMETERS LOCATION PLAN		PROJECT No. M02341B26
		FIG. No. IV-31

KCB-R-MID

Date: February 27, 2018
 Z:\MVCRI\02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\H-H Dam\HHSAA12-1\HHSAA12-1 (for DSI only).grf

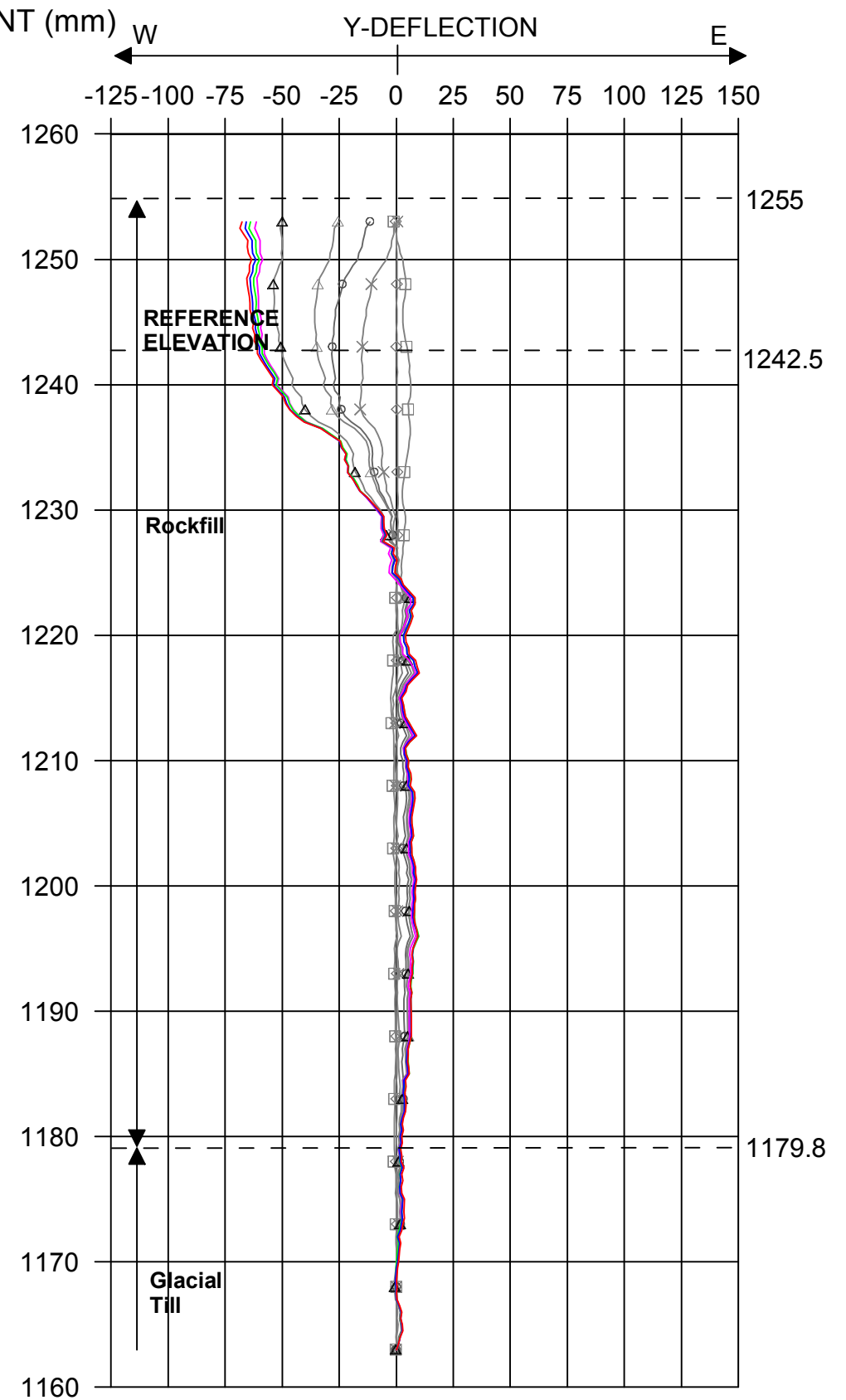
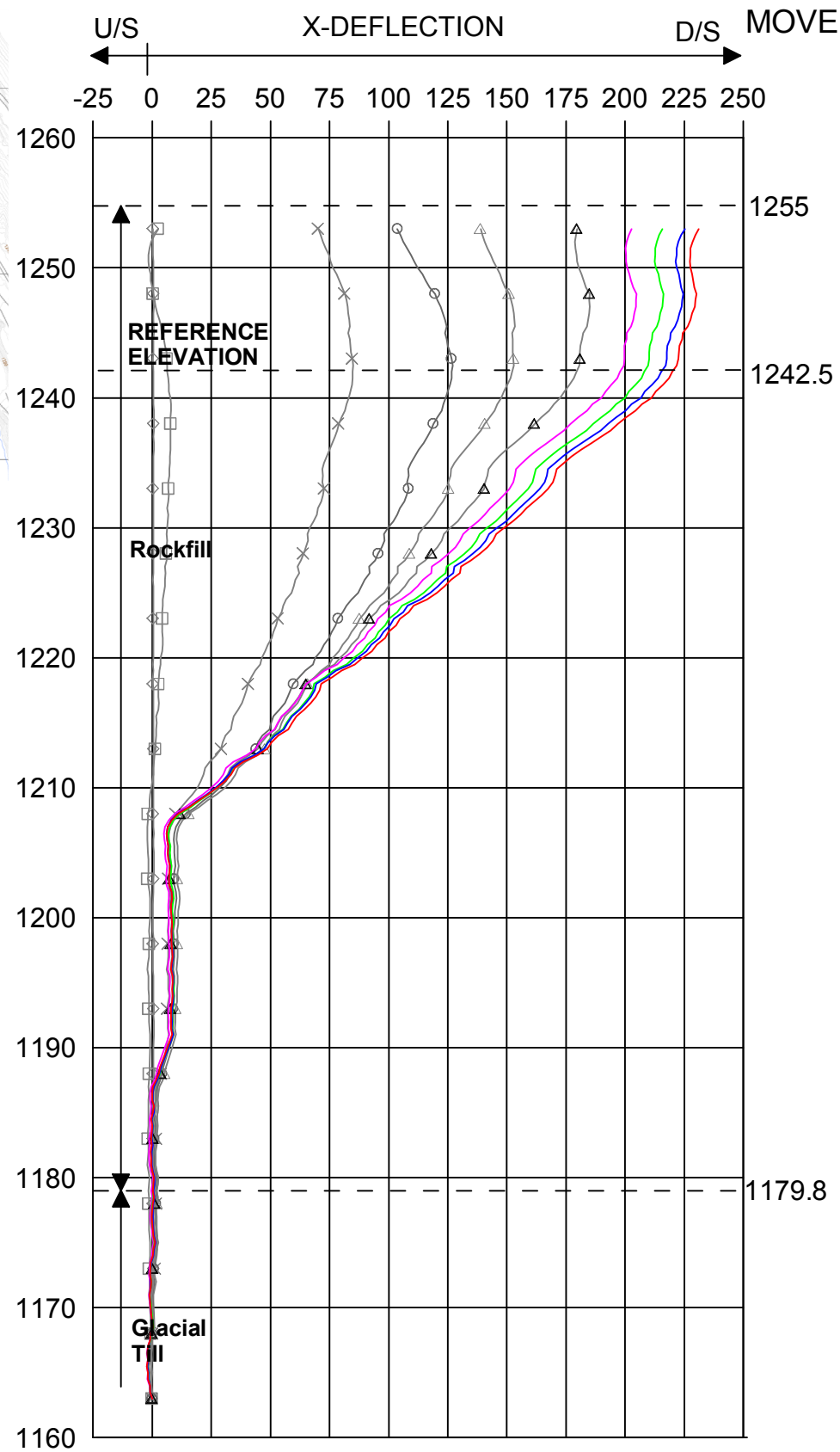


LEGEND

- ◇ July 15, 2013
- April 15, 2014
- × June 4, 2015
- July 2, 2016
- △ Dec 31, 2016
- ▲ March 27, 2017
- June 26, 2017
- August 26, 2017
- October 26, 2017
- November 26, 2017

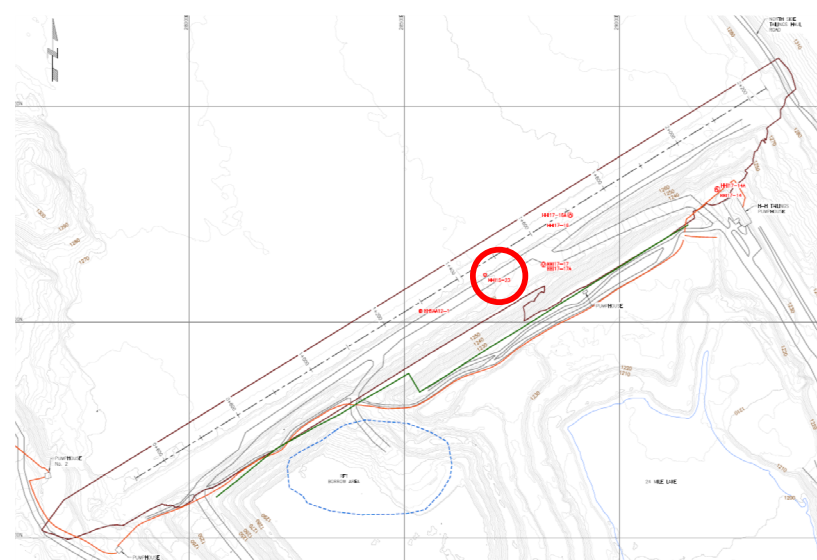
NOTES:

- 1) SAA installed in October 2012.
- 2) SAA re-initialized on July 8, 2013; instrument pulled up 2 m.
- 3) Not all readings are plotted.
- 4) Malfunctioning segments 125-128 and 165-168 (rather than previously identified 107-110 and 147-150) were removed from the data processing in July 2017, based on recommendations from Measurand. This correction was applied to all historical data.



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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE HHSAA12-1
		PROJECT No. M02341B26 FIG No. IV-32

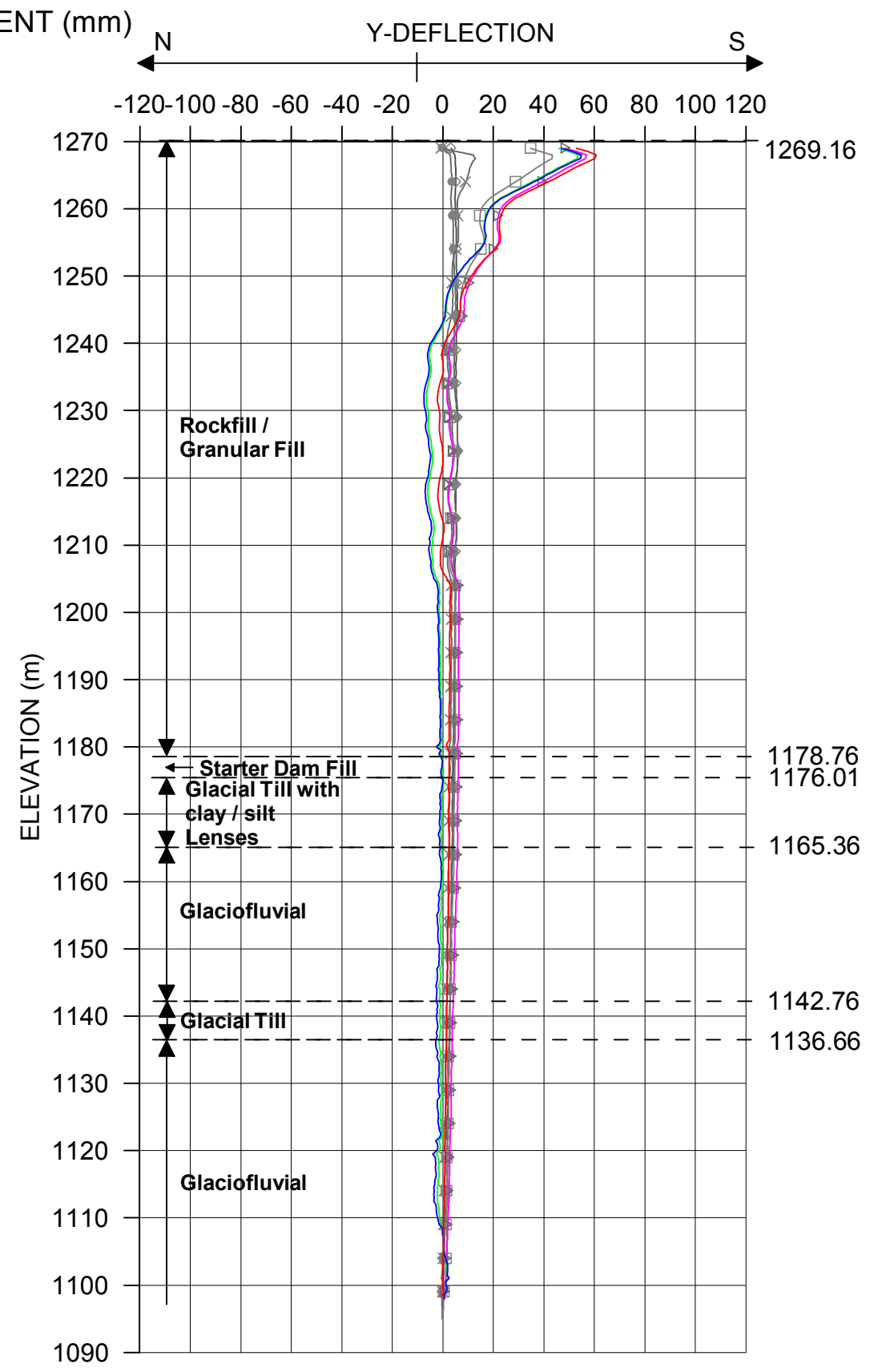
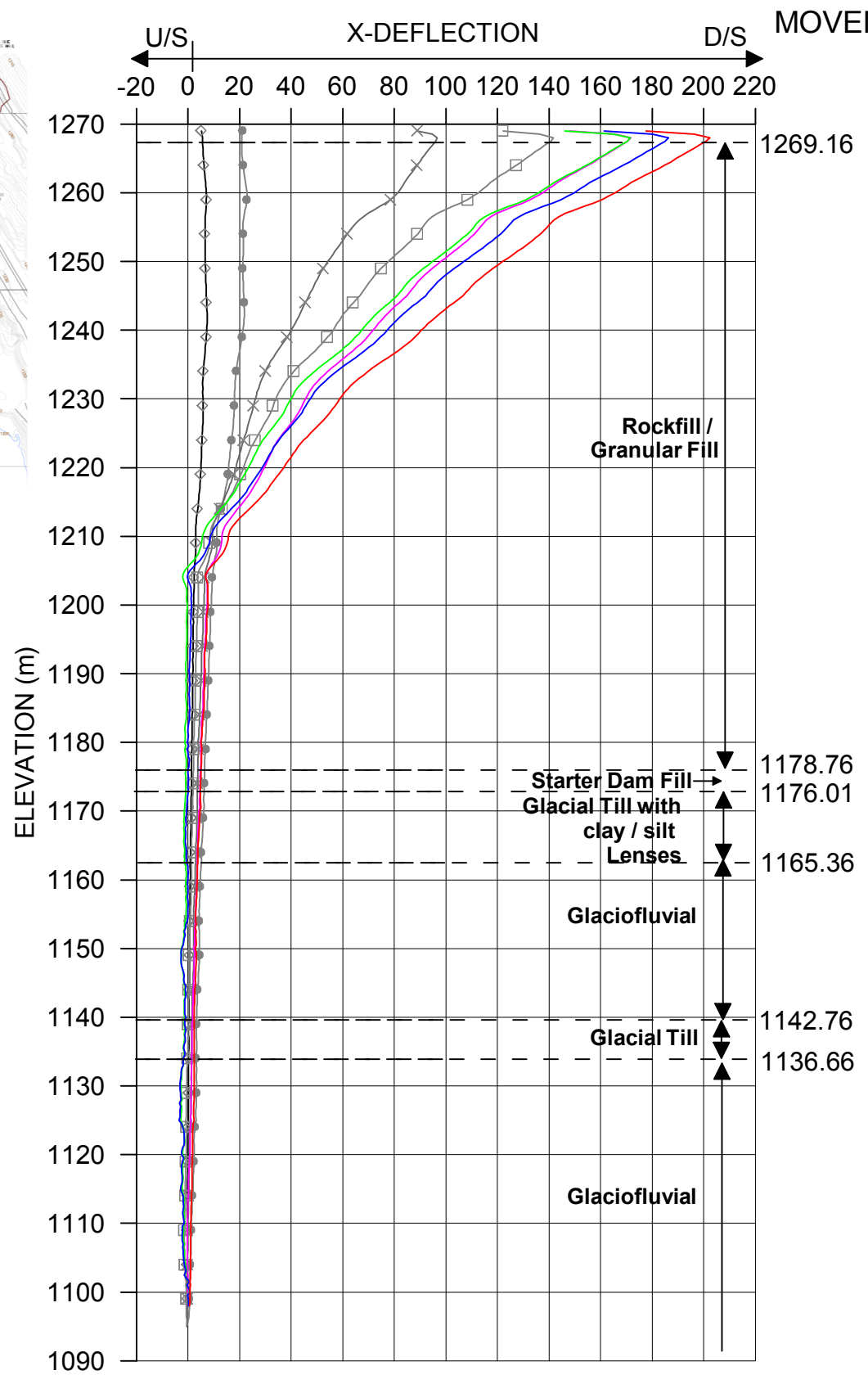
Date: February 27, 2018
Z:\MVC\RM02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\H-H Dam\HH15-23\Grapher Files\2017 HH15-23 (DSI only).grf



LEGEND

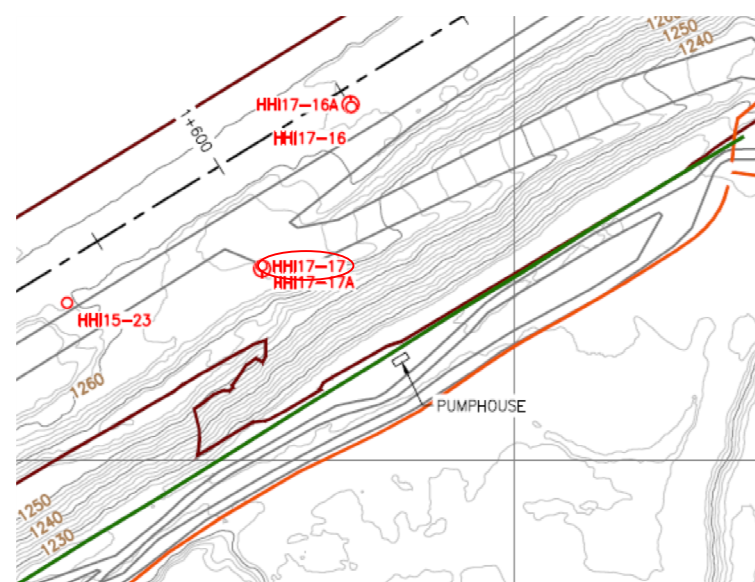
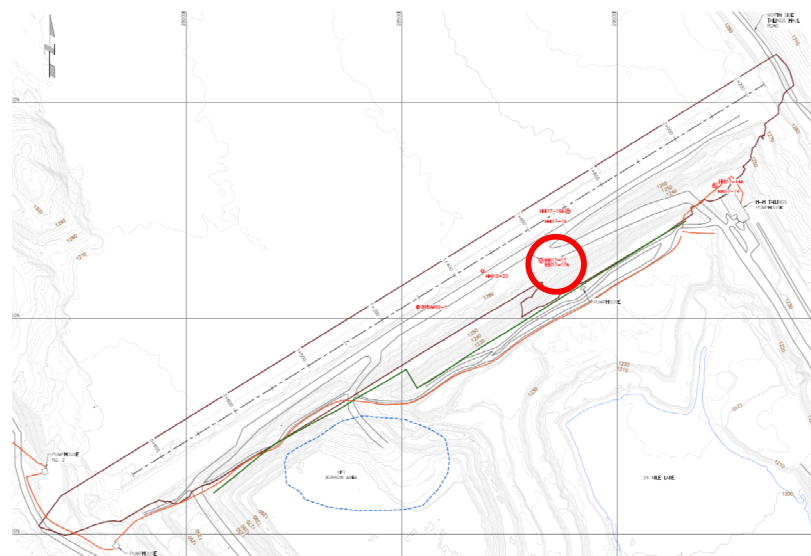
◇	◇	◇	Jul 4, 2016
●	●	●	Oct 15, 2016
×	×	×	Jan 4, 2017
□	□	□	Mar 30, 2017
—	—	—	Jun 18, 2017
—	—	—	Aug 14, 2017
—	—	—	Oct 2, 2017
—	—	—	Dec 4, 2017

- NOTES:**
- 1) HHI15-23 was installed on February 02, 2016.
 - 2) HHI15-23 was initialized on April 11, 2016.
 - 3) Reel/Probe Serial Number for the initial reading: DR19430000/DP06580000.
 - 4) Not all readings are plotted.



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		<small>TITLE</small> INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE HHI15-23
		<small>PROJECT No.</small> M02341B26 <small>FIG No.</small> IV-33

Date: February 27, 2018 Z:\MVC\RM02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\HH Dam\HH17-17\Grapher Files\HH17-17 2017 (DS only).grf

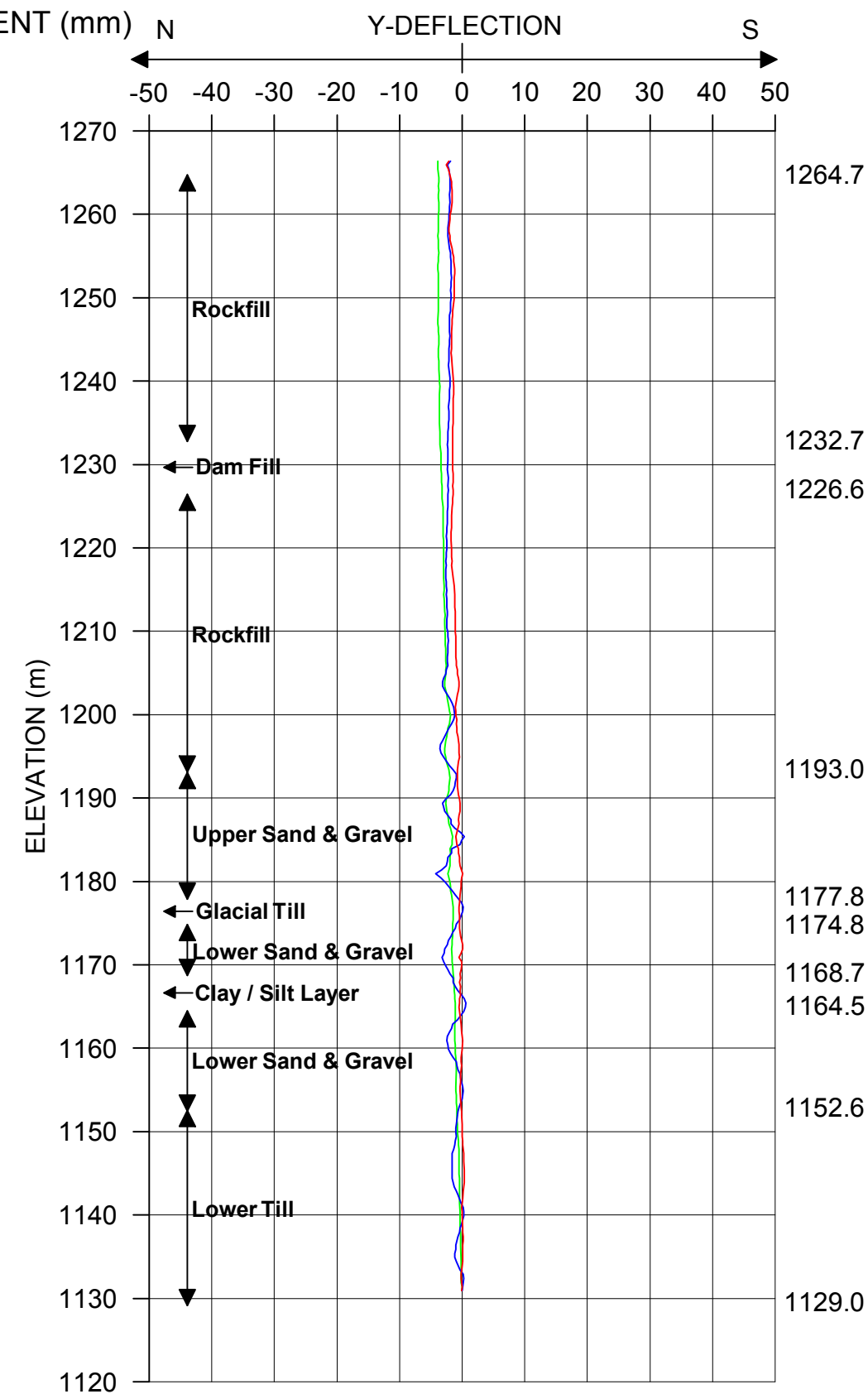
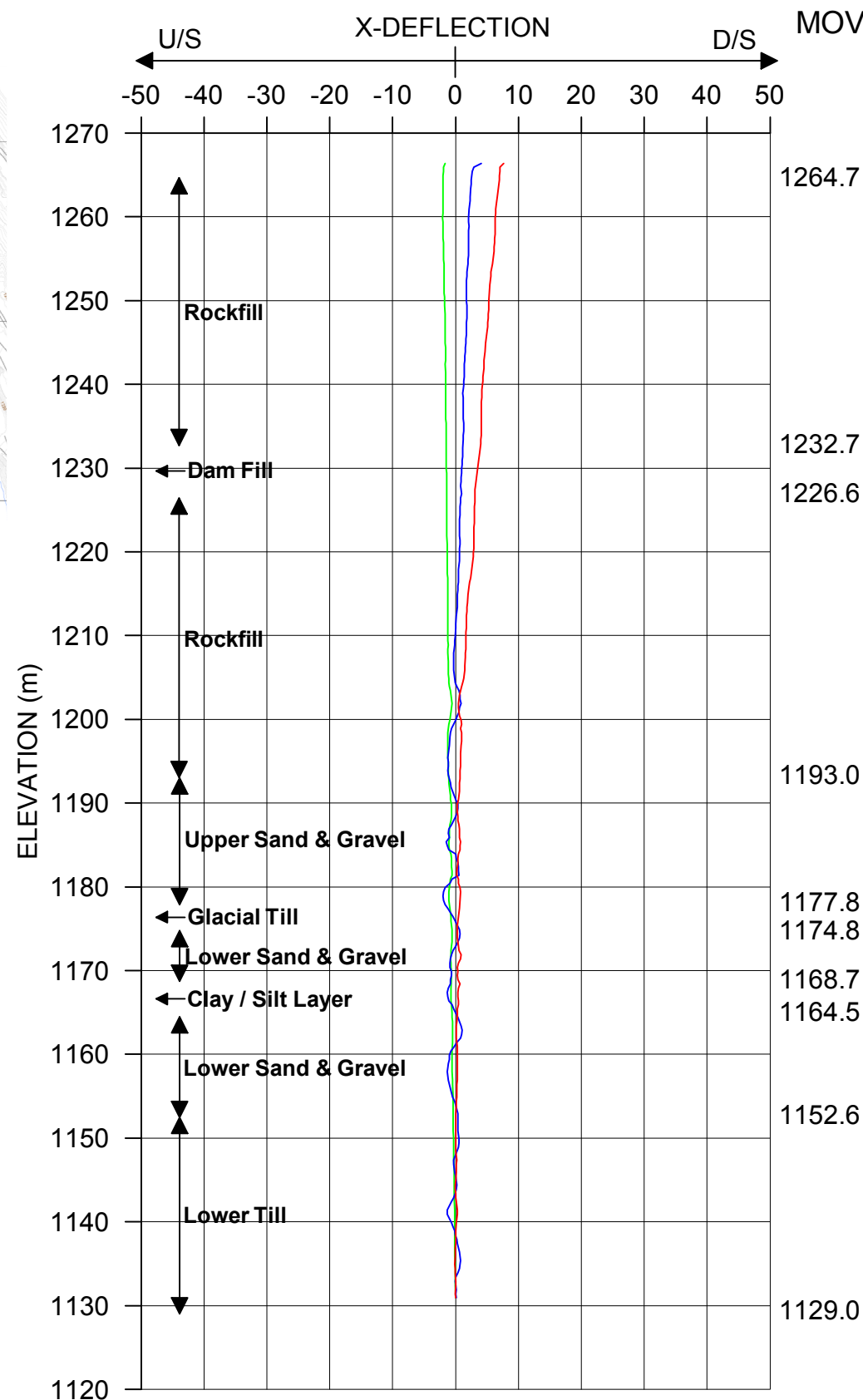


LEGEND

- Sept 26, 2017
- Oct 27, 2017
- Nov 13, 2017

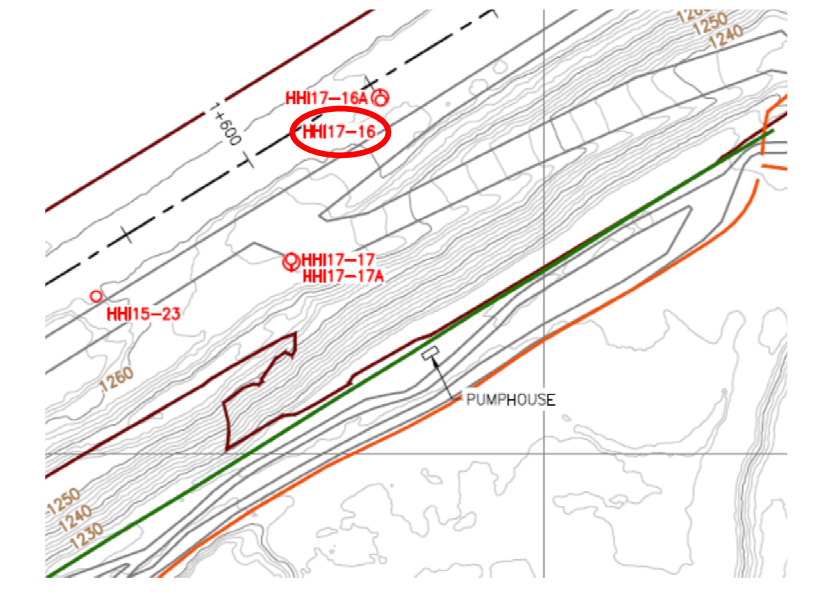
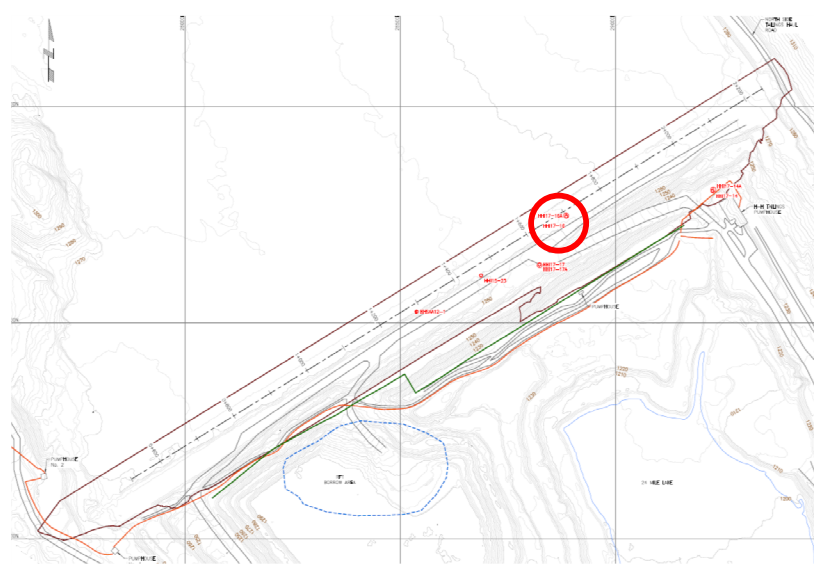
NOTES:

- 1) HHI17-16 was installed on August 07, 2017.
- 2) HHI17-16 was initialized on September 26, 2017.
- 3) Reel/Probe Serial Number for the initial reading: DR25880000/DP06580000.
- 4) Not all readings are plotted.
- 5) 2017 reading for December is inconsistent with historical trends, and is under review by KCB/THVCP (likely due to surveillance error). As such, the reading is not shown on this figure.



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	Klohn Crippen Berger	TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE HHI17-17
		PROJECT No. M02341B26 FIG No. IV-34

Date: February 27, 2018 Z:\MVC\RM02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\H-H Dam\HH17-16\Grapher Files\HH17-16 2017 (DSI only).grf

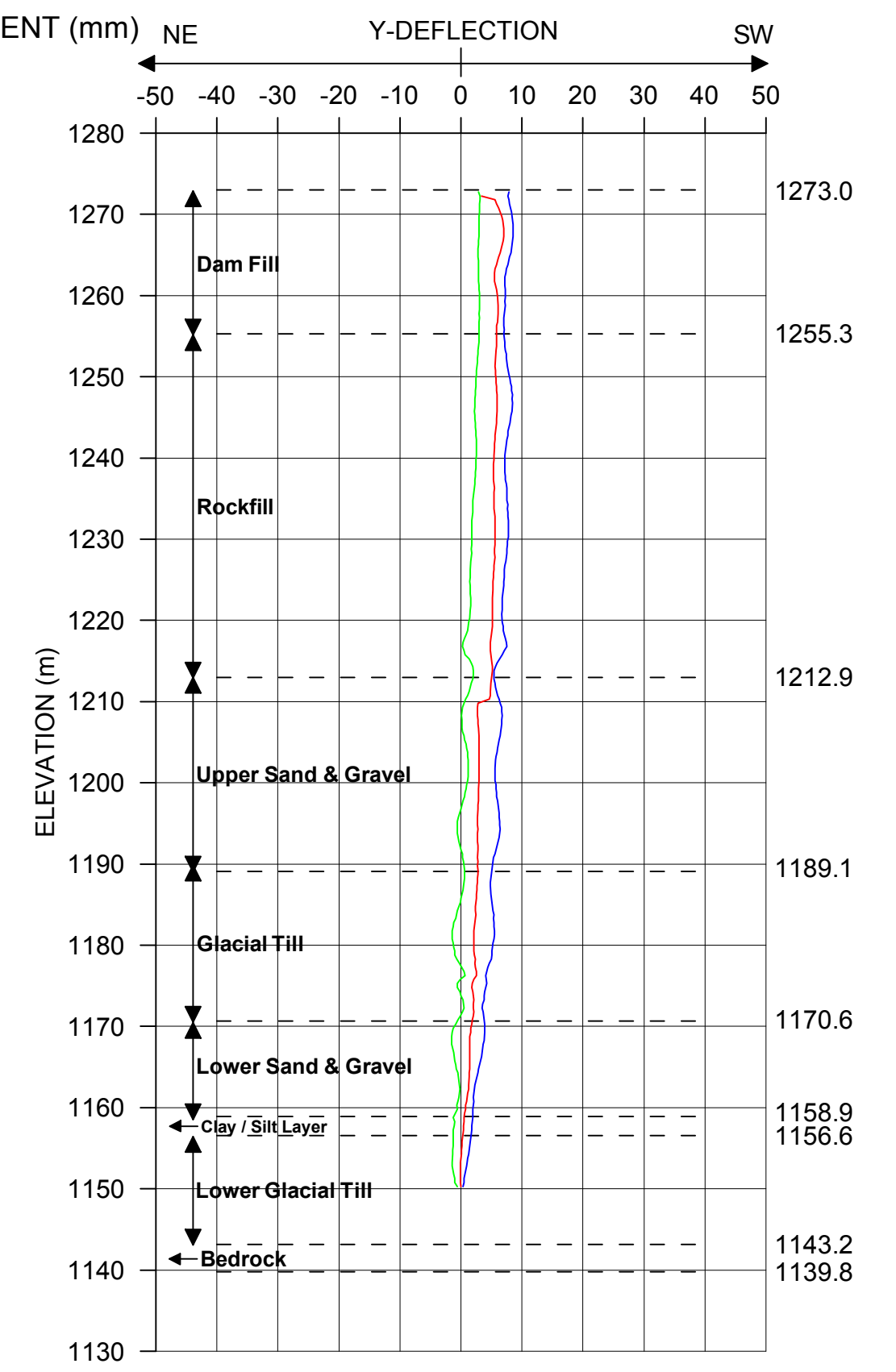
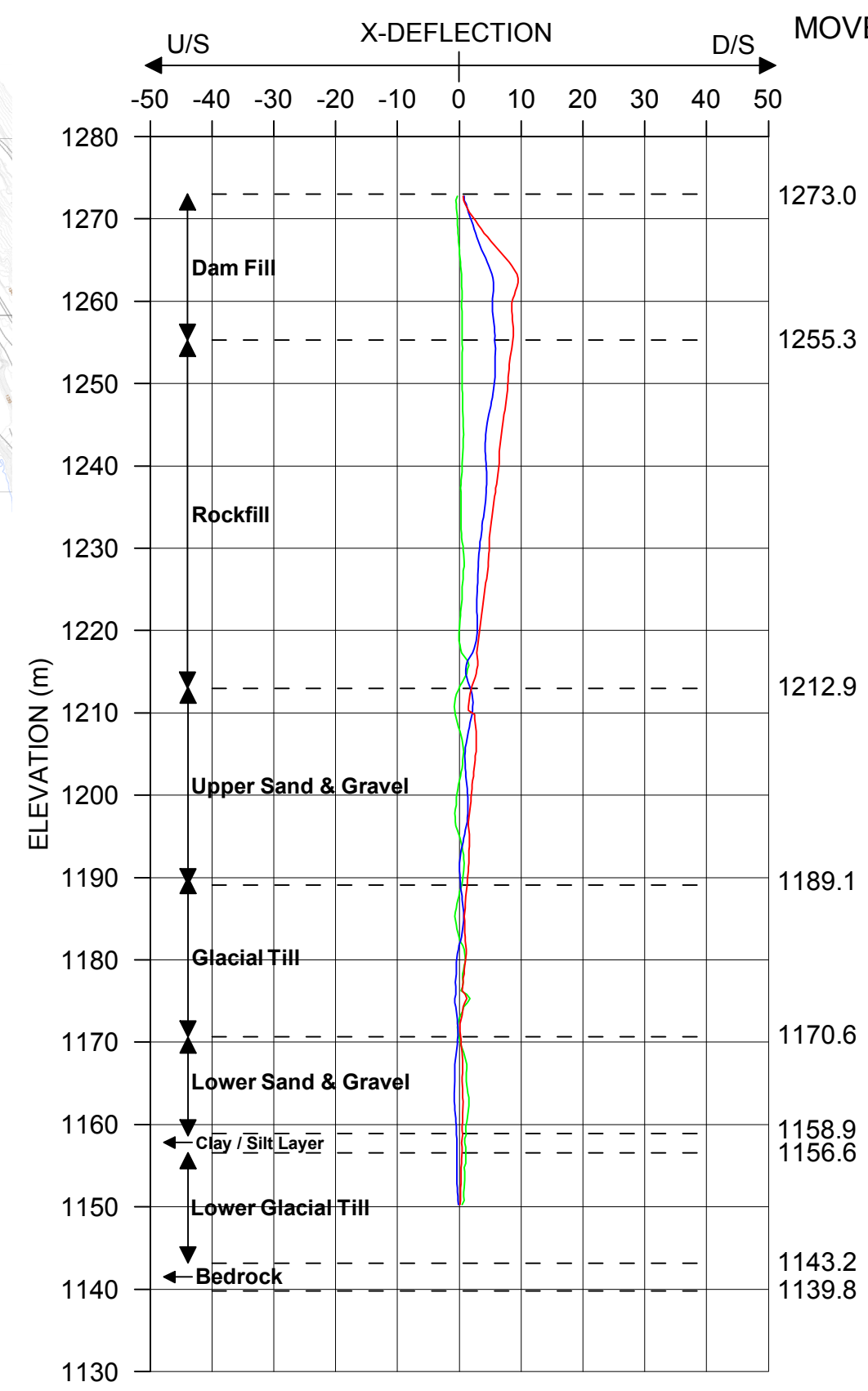


LEGEND

- Sept 28, 2017
- Oct 21, 2017
- Nov 7, 2017

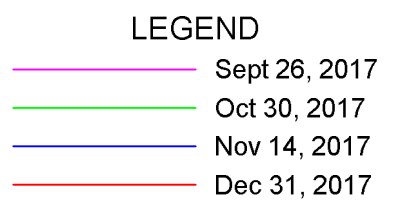
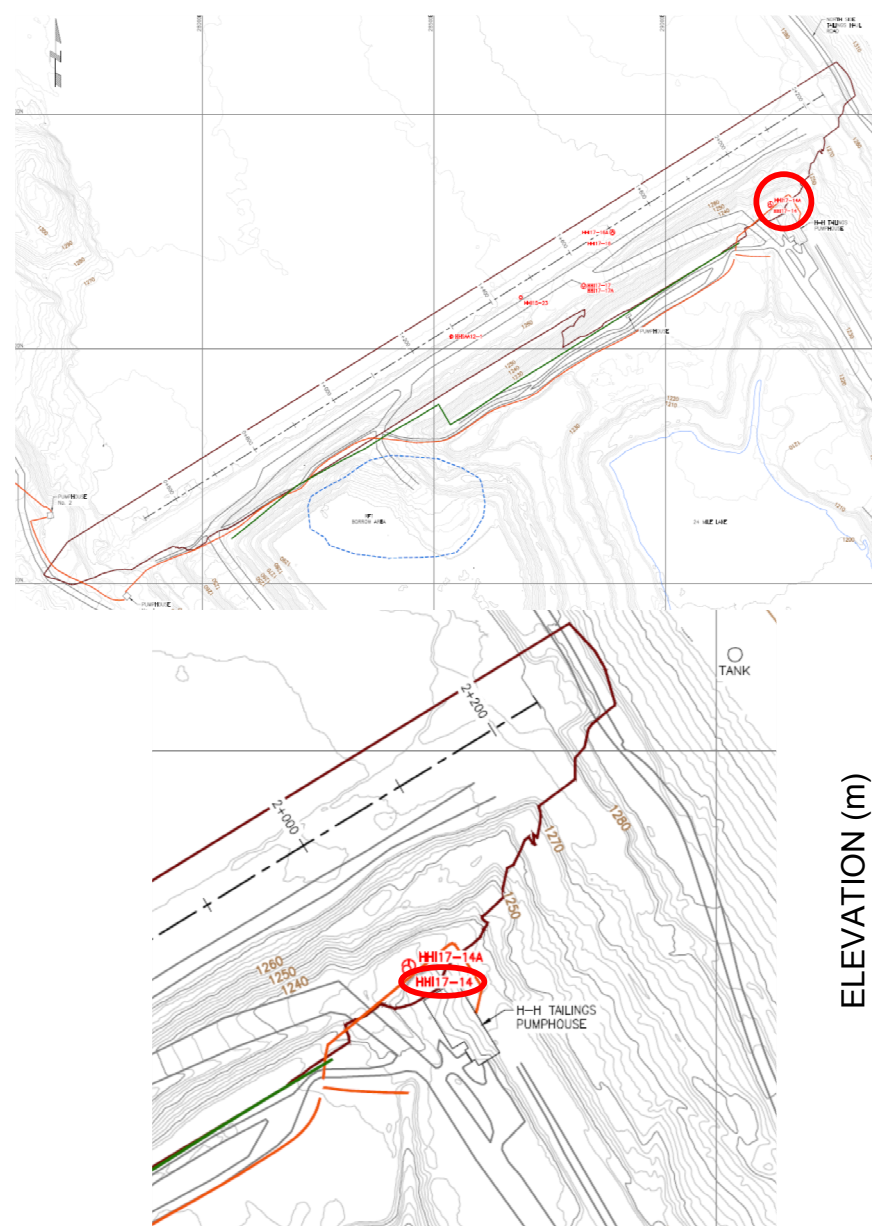
NOTES:

- 1) HHI17-16 was installed on July 28, 2017.
- 2) HHI17-16 was initialized on September 18, 2017.
- 3) Reel/Probe Serial Number for the initial reading: DR25880000/DP17520000.
- 4) Not all readings are plotted.
- 5) 2017 reading for December is inconsistent with historical trends, and is under review by KCB/THVCP (likely due to surveillance error). As such, the reading is not shown on this figure.

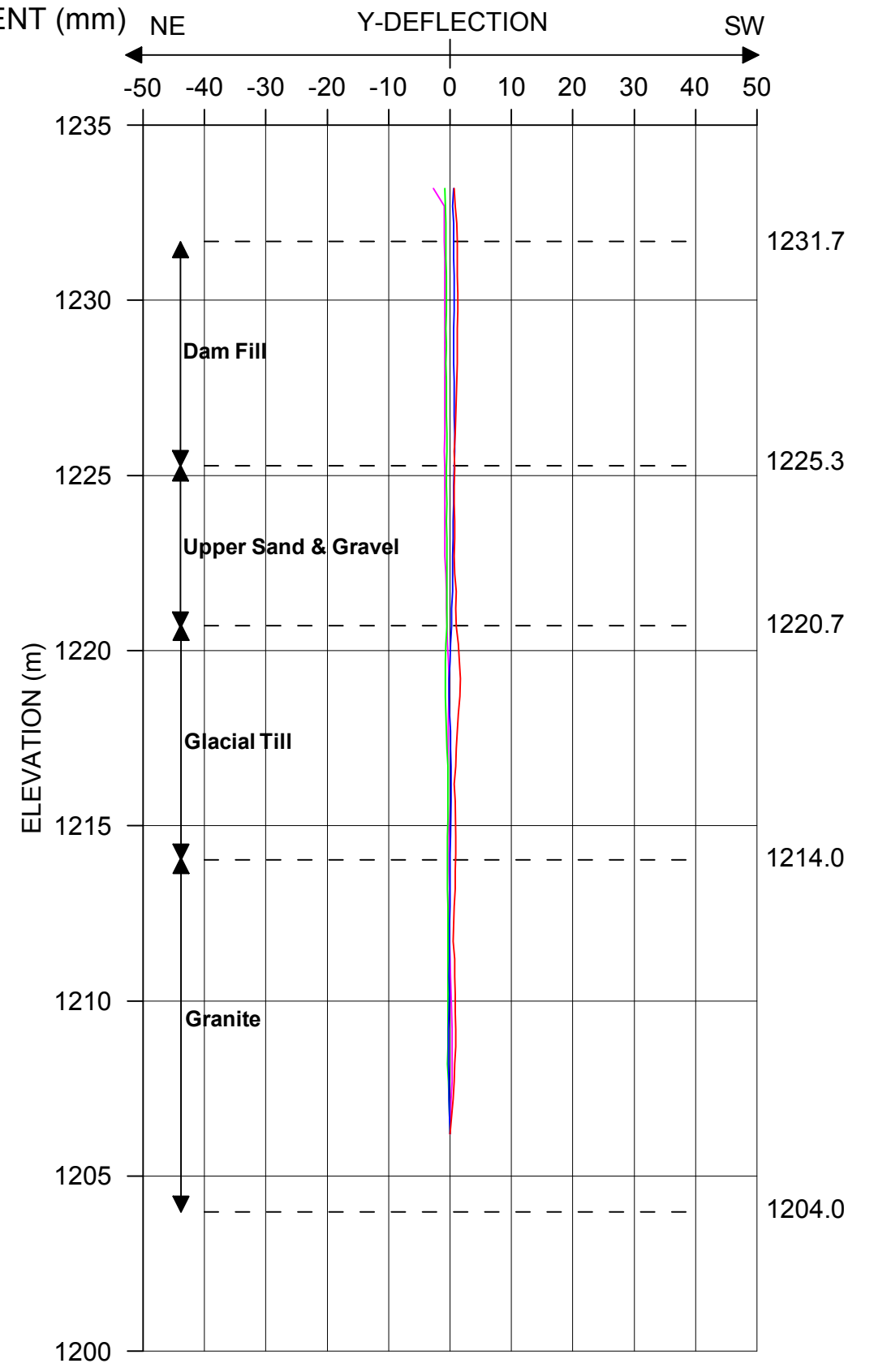
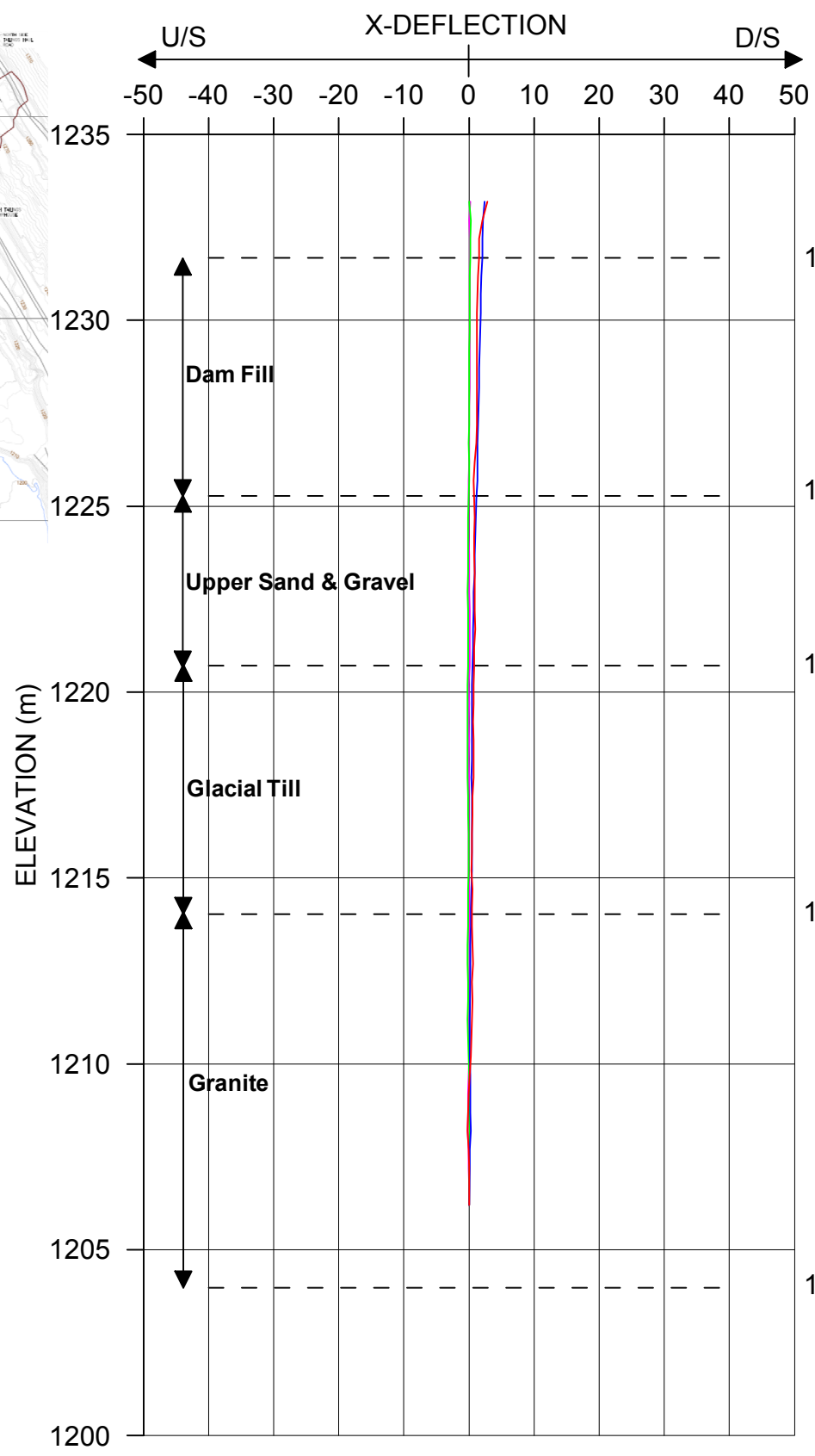


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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE HHI17-16
		PROJECT No. M02341B26 FIG No. IV-35

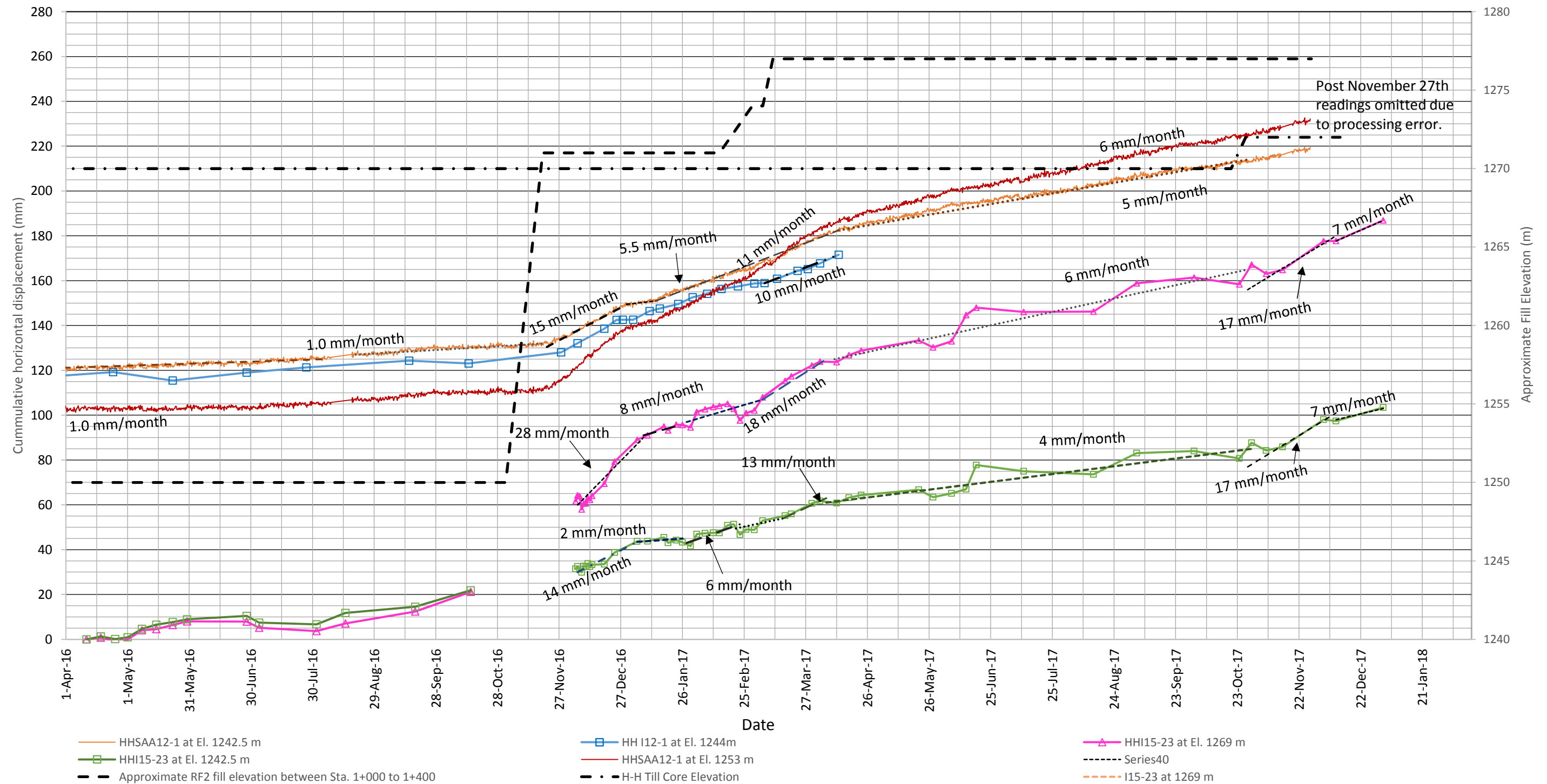
Date: February 27, 2018
Z:\MVC\CRM\2341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\H-H Dam\HH17-14\Grapher Files\HH17-14 2017 (DS only).grf



- NOTES:**
- 1) HHI17-14 was installed on July 13, 2017.
 - 2) HHI17-14 was initialized on September 18, 2017.
 - 3) Reel/Probe Serial Number for the initial reading: DR25880000/DP17520000.
 - 4) Not all readings are plotted.



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		TITLE INCLINOMETER CUMULATIVE DISPLACEMENT PROFILE HHI17-14
		PROJECT No. M02341B26 FIG No. IV-36



Notes:

Dates of RF2 fill placement based on QC checklist information provided by HVC
 Inclinator I12-1 damaged during April 2017

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**TECK HIGHLAND VALLEY
 COPPER PARTNERSHIP**

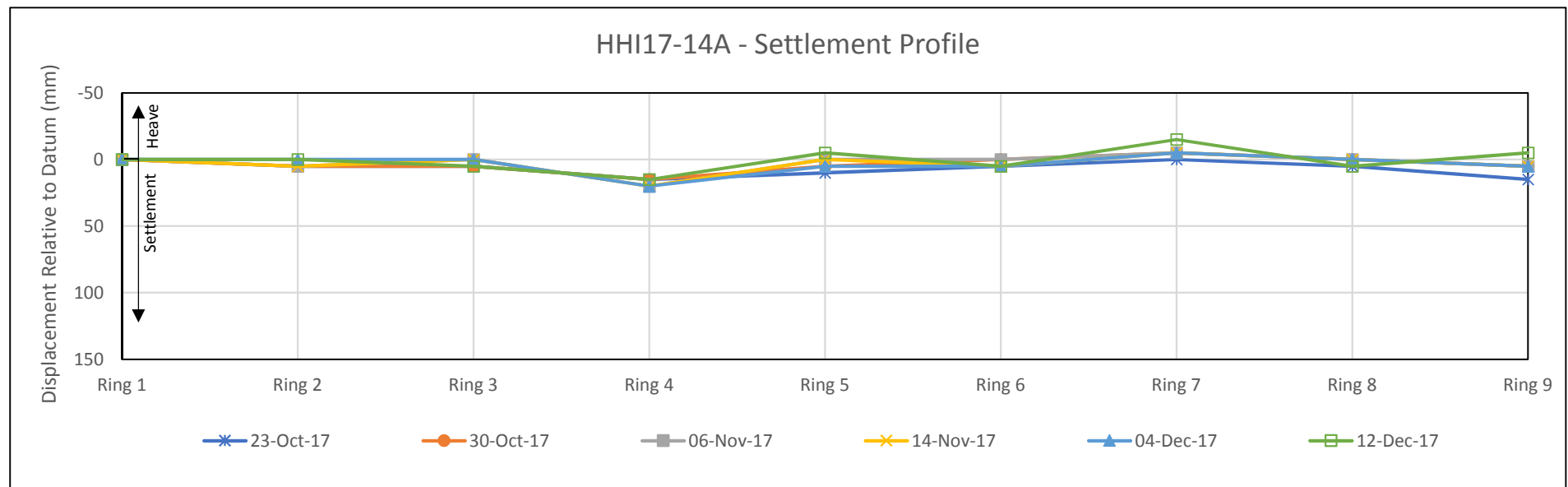
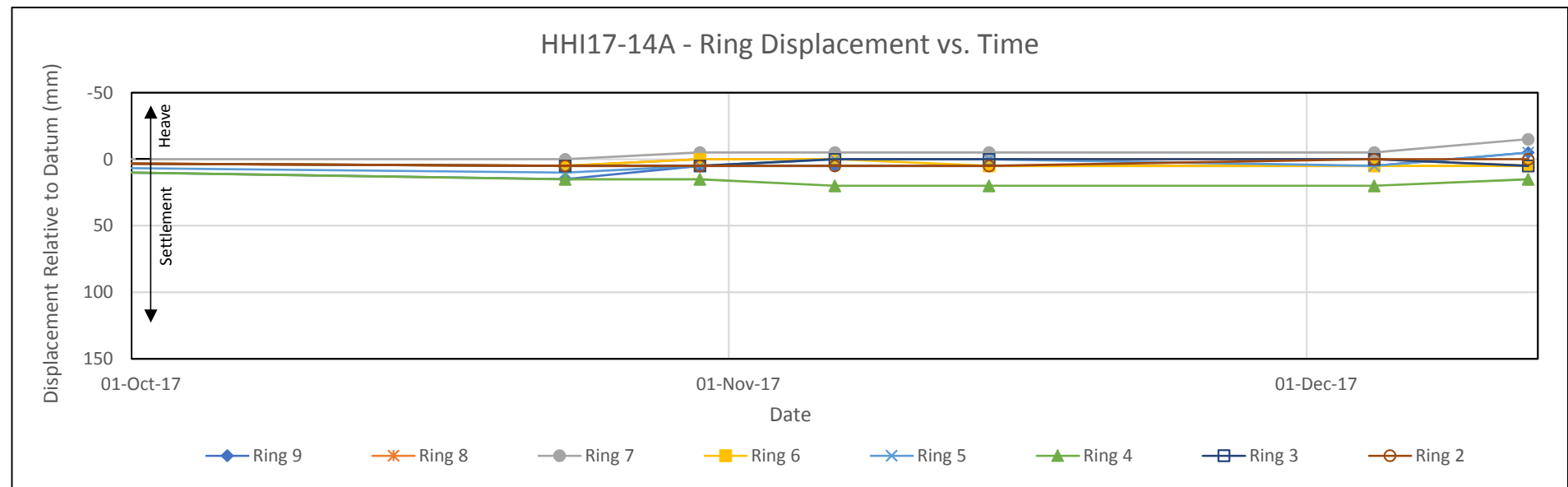
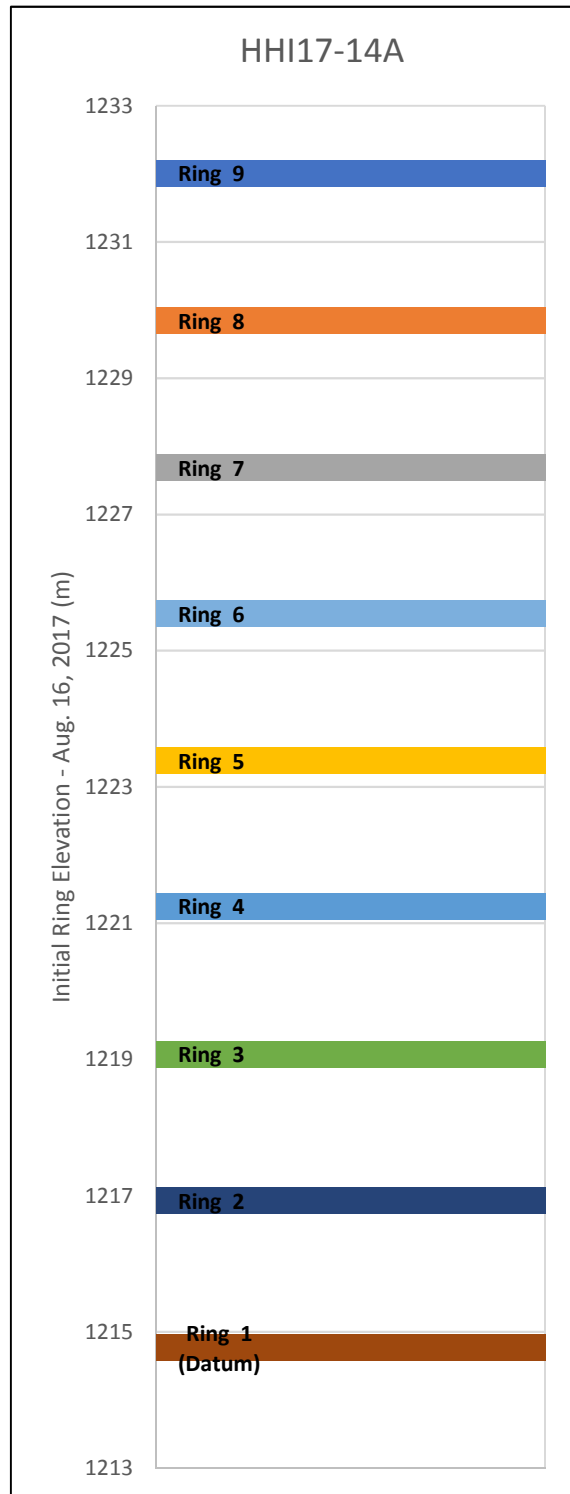


HIGHLAND TAILINGS STORAGE FACILITY
 2017 DAM SAFETY INSPECTION

H-H Dam Horizontal Displacements -
 Dam Fill
 2016 - 2018

M02341B26

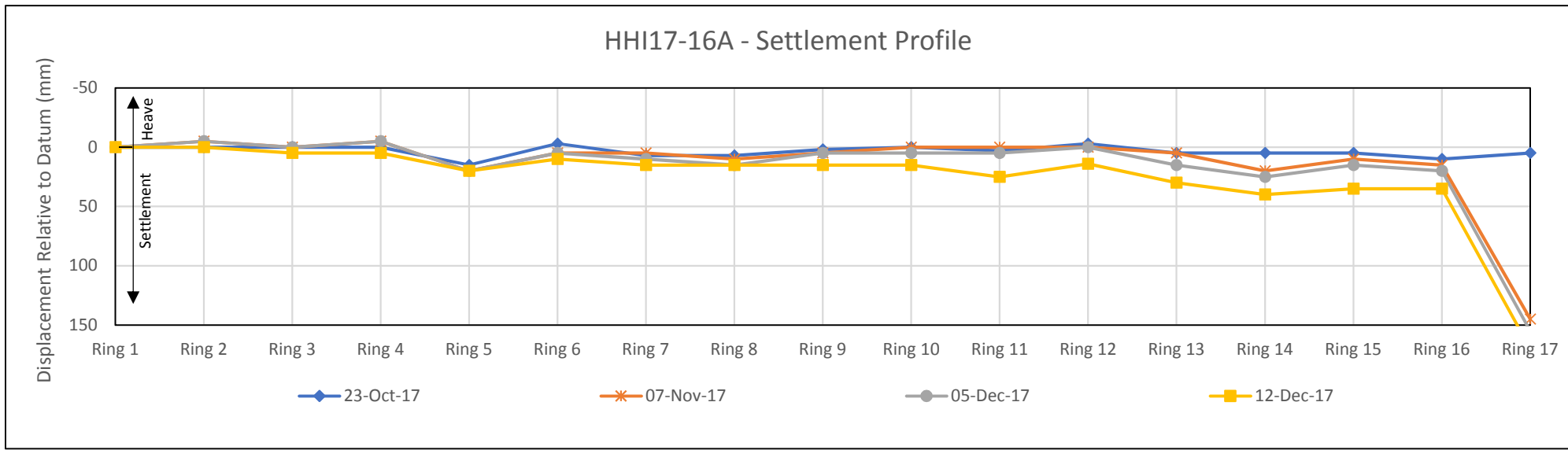
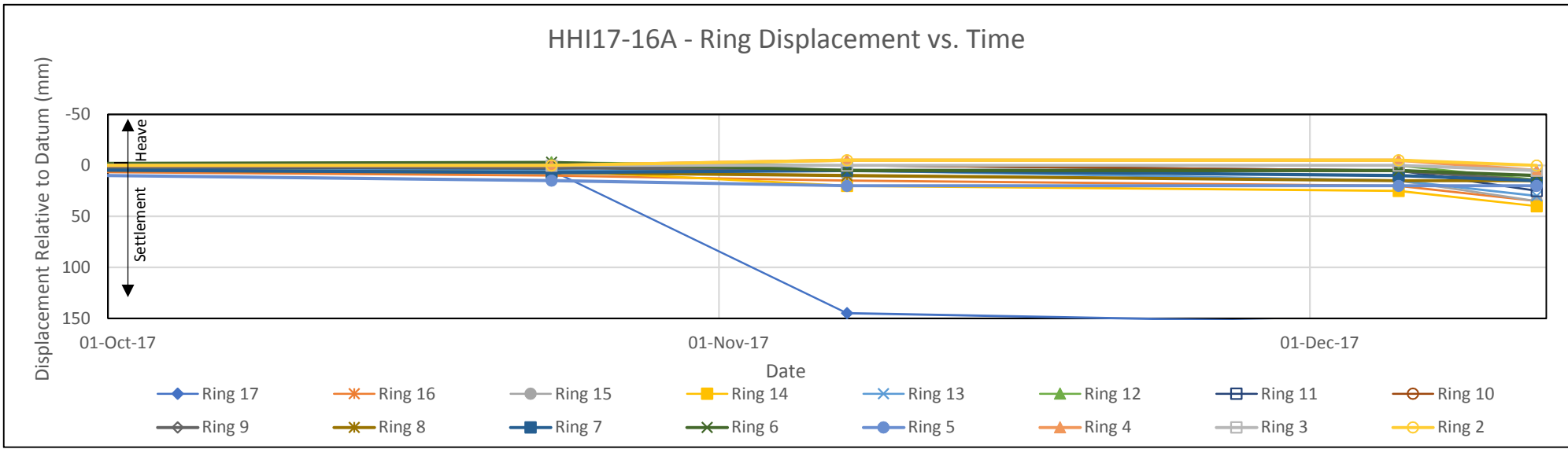
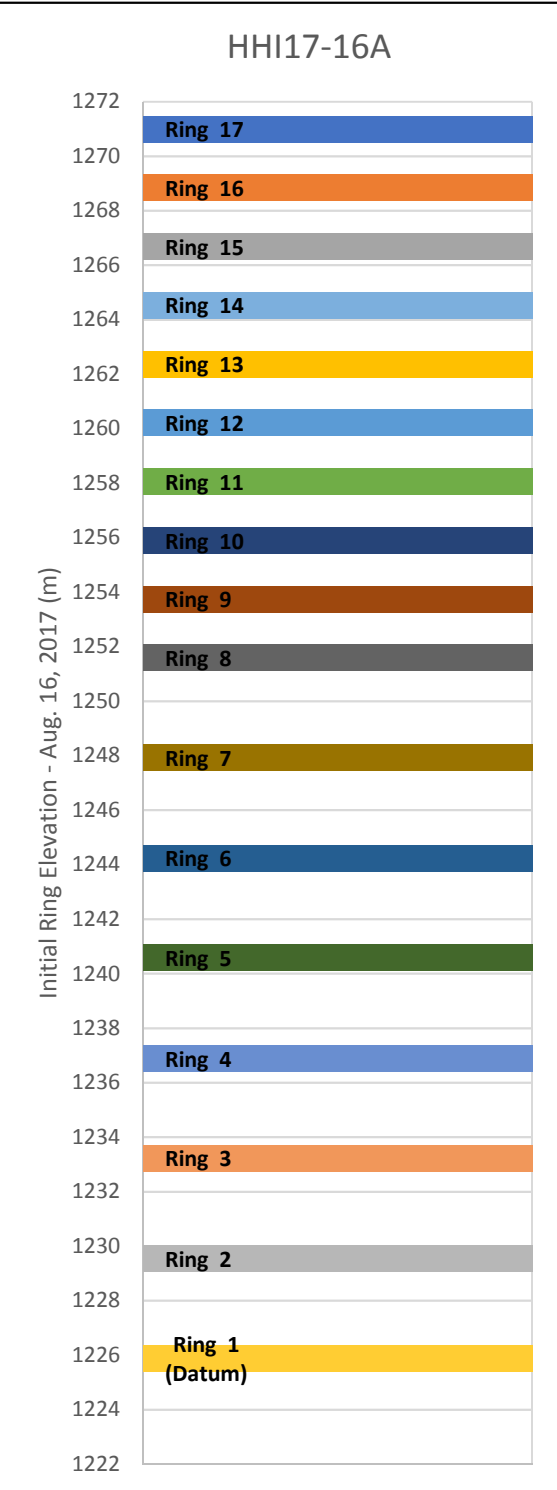
IV-37



Notes:

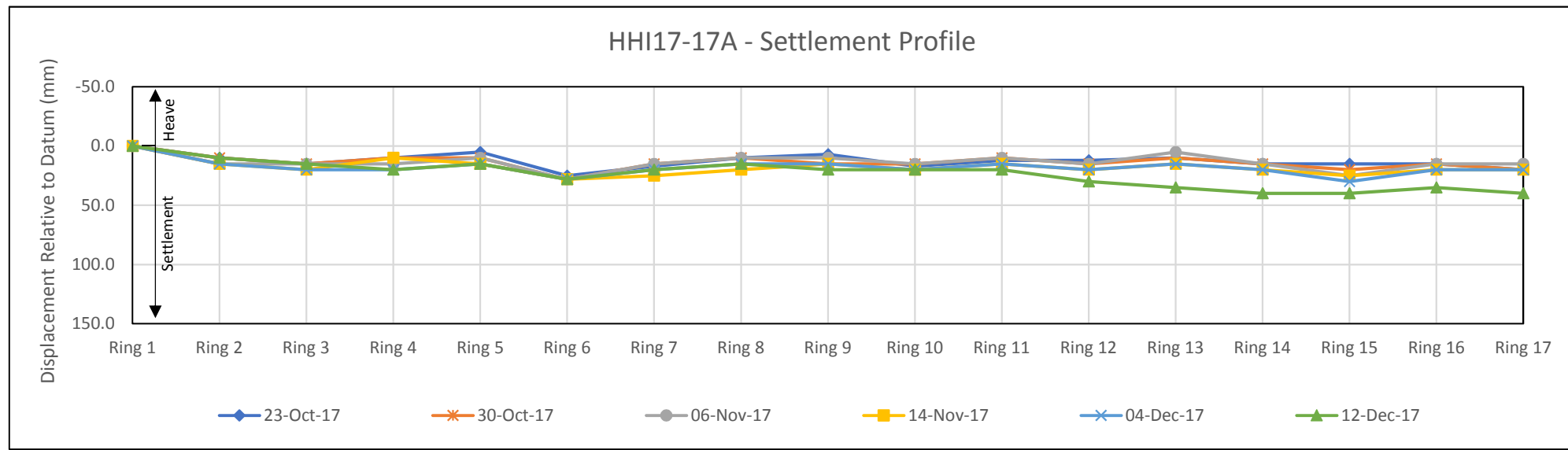
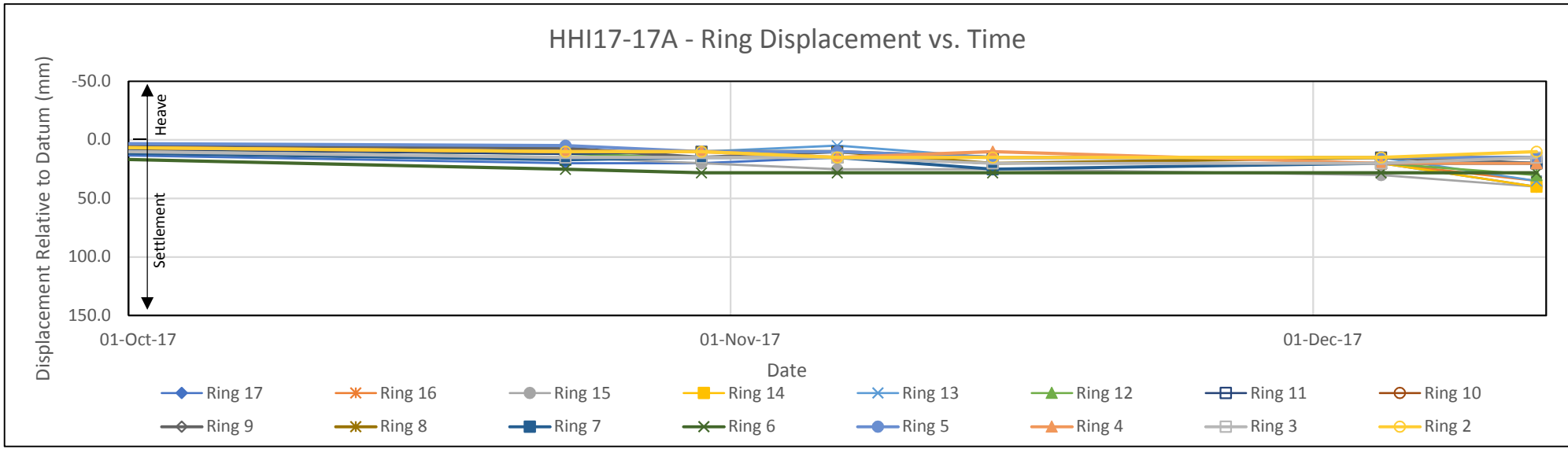
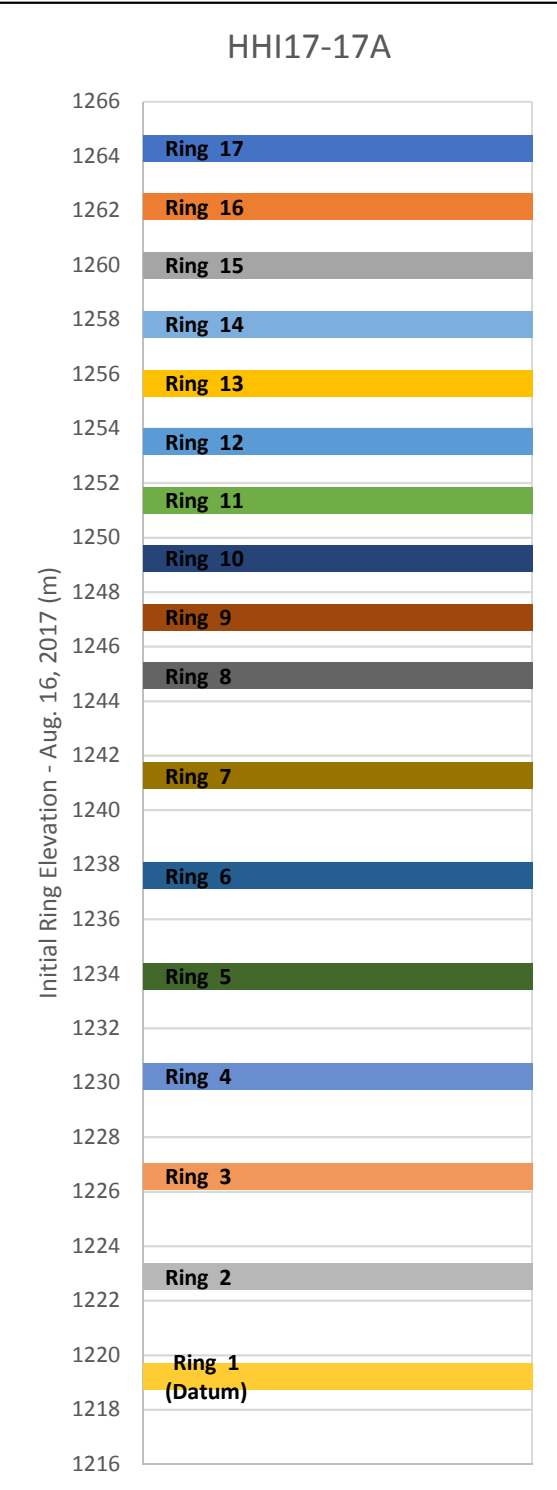
1. Ring displacements are calculated relative to the initial elevations for each ring. The datum is the bottom ring (Ring 1).
2. Positive displacements represent settlement. Negative displacements represent heave.

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	Klohn Crippen Berger	H-H Dam Vertical Displacements - HHI17-14A (Sondex)	
		M02341B26	IV-38



- Notes:
1. Ring displacements are calculated relative to the initial elevations for each ring. The datum is the bottom ring (Ring 1).
 2. Positive displacements represent settlement. Negative displacements represent heave.
 3. The Ring 12 reading from December 11, 2017 was not consistent with readings in the rings above and below, due to a suspected data entry error. The reading was adjusted to match the trends of Ring 11 and Ring 13.

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		H-H Dam Vertical Displacements - HHI17-16A (Sondex)	
		M02341B26	IV-39



- Notes:
1. Ring displacements are calculated relative to the initial elevations for each ring. The datum is the bottom ring (Ring 1).
 2. Positive displacements represent settlement. Negative displacements represent heave.
 3. The Ring 5 reading from December 11, 2017 was not consistent with readings in the rings above and below, due to a suspected data entry error. The reading was adjusted to match the trends of Ring 4 and Ring 6.

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		H-H Dam Vertical Displacements - HHI17-17A (Sondex)	
		M02341B26	IV-40

APPENDIX V

Piezometer Plots

Appendix V Piezometer Plots

L-L Dam

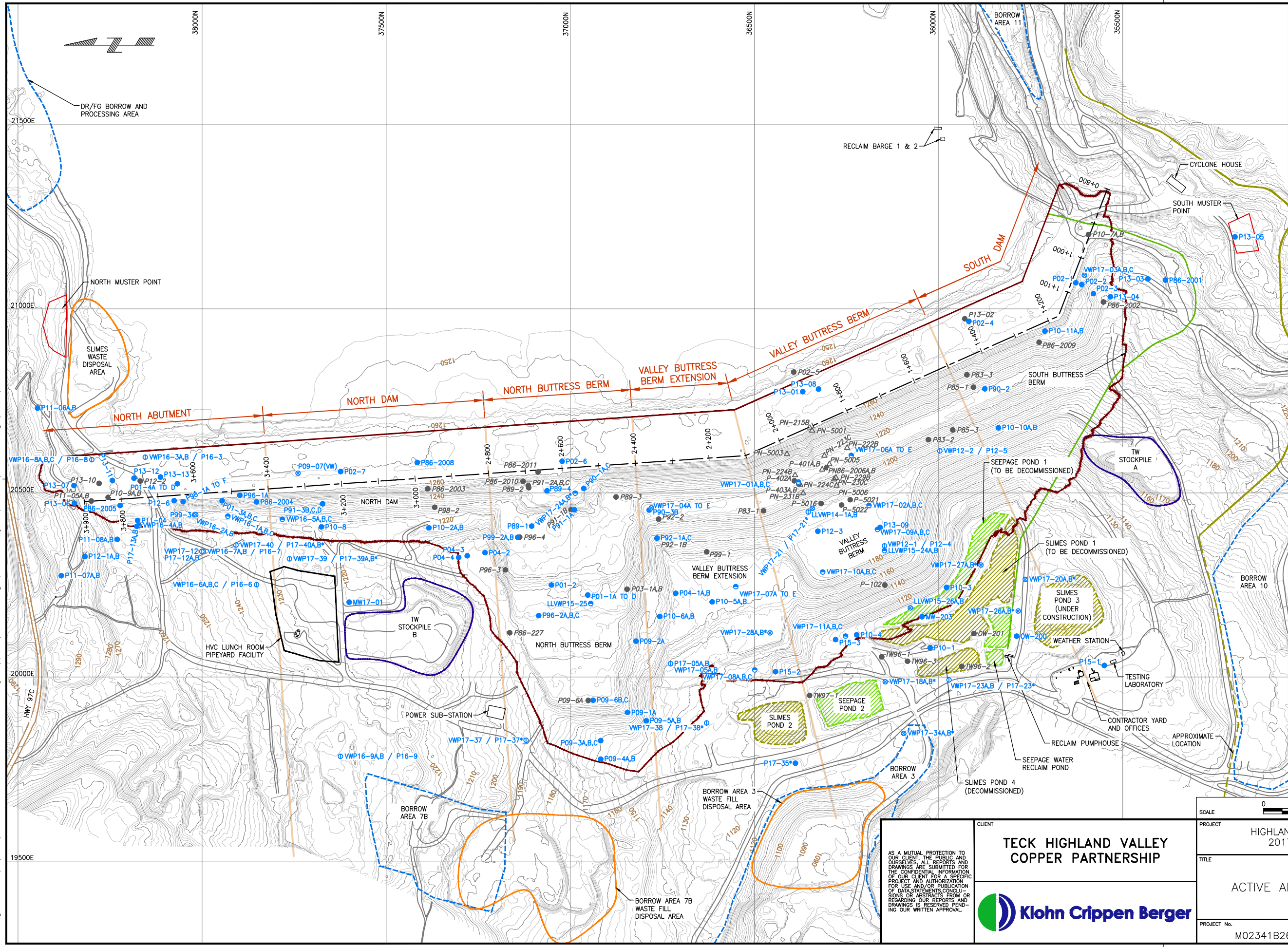
- Figure V-1 L-L Dam Active and Defunct Piezometers Location Plan
- Figure V-2a L-L Dam Piezometric Data U/S Overburden and Bedrock - 2001-2017 - North Abutment (North of STN 3+400 m)
- Figure V-2b L-L Dam Piezometric Data U/S Overburden and Bedrock - 2012-2017 - North Abutment (North of STN 3+400 m)
- Figure V-3a L-L Dam Piezometric Data D/S Overburden - 1994-2017 - North Abutment (North of STN 3+400 m)
- Figure V-3b L-L Dam Piezometric Data D/S Overburden - 2012-2017 - North Abutment (North of STN 3+400 m)
- Figure V-4a L-L Dam Piezometric Data D/S Bedrock - 1994-2017 - North Abutment (North of STN 3+400 m)
- Figure V-4b L-L Dam Piezometric Data D/S Bedrock - 2012-2017 - North Abutment (North of STN 3+400 m)
- Figure V-5a L-L Dam Piezometric Data U/S Damfill and Overburden - 1994-2017 - North Dam (STNS 2+800 m to 3+400 m)
- Figure V-5b L-L Dam Piezometric Data U/S Damfill and Overburden - 2012-2017 - North Dam (STNS 2+800 m to 3+400 m)
- Figure V-6a L-L Dam Piezometric Data Bedrock - 1994-2017 - North Dam (STNS 2+800 m to 3+400 m)
- Figure V-6b L-L Dam Piezometric Data Bedrock - 2012-2017 - North Dam (STNS 2+800 m to 3+400 m)
- Figure V-7a L-L Dam Piezometric Data U/S Dam Fill - 1994-2017 - North Buttress Berm (STNS 2+400 m to 2+800 m)
- Figure V-7b L-L Dam Piezometric Data U/S Dam Fill - 2012-2017 - North Buttress Berm (STNS 2+400 m to 2+800 m)
- Figure V-8a L-L Dam Piezometric Data Overburden - 1994-2017 - North Buttress Berm (STNS 2+400 m to 2+800 m)
- Figure V-8b L-L Dam Piezometric Data Overburden - 2012-2017 - North Buttress Berm (STNS 2+400 m to 2+800 m)
- Figure V-9a L-L Dam Piezometric Data Volcanic Bedrock - 1994-2017 - North Buttress Berm (STNS 2+400 m to 2+800 m)
- Figure V-9b L-L Dam Piezometric Data Volcanic Bedrock - 2012-2017 - North Buttress Berm (STNS 2+400 m to 2+800 m)
- Figure V-10a L-L Dam Piezometric Data Sedimentary Bedrock - 1994-2017 - North Buttress Berm (STNS 2+400 m to 2+800 m)

- Figure V-10b L-L Dam Piezometric Data Sedimentary Bedrock - 2012-2017 - North Buttress Berm (STNS 2+400 m to 2+800 m)
- Figure V-11a L-L Dam Piezometric Data Overburden - 1994-2017 - Valley Buttress Berm Extension (STNS 2+100 m to 2+400 m)
- Figure V-11b L-L Dam Piezometric Data Overburden - 2012-2017 - Valley Buttress Berm Extension (STNS 2+100 m to 2+400 m)
- Figure V-12a L-L Dam Piezometric Data Bedrock - 1994-2017 - Valley Buttress Berm Extension (STNS 2+100 m to 2+400 m)
- Figure V-12b L-L Dam Piezometric Data Bedrock - 2012-2017 - Valley Buttress Berm Extension (STNS 2+100 m to 2+400 m)
- Figure V-13a L-L Dam Piezometric Data Dam Fill - 1989-2017 - Valley Buttress Berm (STNS 1+500 m to 2+100 m)
- Figure V-13b L-L Dam Piezometric Data Dam Fill - 2012-2017 - Valley Buttress Berm (STNS 1+500 m to 2+100 m)
- Figure V-14a L-L Dam Piezometric Data Lacustrine - 1976-2017 - Valley Buttress Berm (STNS 1+500 m to 2+100 m)
- Figure V-14b L-L Dam Piezometric Data Lacustrine - 2012-2017 - Valley Buttress Berm (STNS 1+500 m to 2+100 m)
- Figure V-15 L-L Dam Piezometric Data Glaciolacustrine - 2017 - Valley Buttress Berm (STNS 1+500 m to 2+100 m)
- Figure V-16a L-L Dam Piezometric Data Glacial Till - 1976-2017 - Valley Buttress Berm (STNS 1+500 m to 2+100 m)
- Figure V-16b L-L Dam Piezometric Data Glacial Till - 2012-2017 - Valley Buttress Berm (STNS 1+500 m to 2+100 m)
- Figure V-17a L-L Dam Piezometric Data Dam Fill - 2002-2017 – South Dam (STNS 0+800 m to 1+500 m)
- Figure V-17b L-L Dam Piezometric Data Dam Fill - 2012-2017 – South Dam (STNS 0+800 m to 1+500 m)
- Figure V-18a L-L Dam Piezometric Data Granodiorite Bedrock and Glacial Till - 1994-2017 – South Dam (STNS 0+800 m to 1+500 m)
- Figure V-18b L-L Dam Piezometric Data Granodiorite Bedrock and Glacial Till - 2012-2017 – South Dam (STNS 0+800 m to 1+500 m)

H-H Dam

- Figure V-19 H-H Dam Active and Defunct Piezometers Location Plan
- Figure V-20a H-H Dam Piezometric Data Upstream and Abutments - 1987-2017
- Figure V-20b H-H Dam Piezometric Data Upstream and Abutments - 2013-2017
- Figure V-21a H-H Dam Piezometric Data - 1994-2017 – Sand and Gravel and Dam Fill
- Figure V-21b H-H Dam Piezometric Data - 2013-2017 – Sand and Gravel and Dam Fill
- Figure V-22a H-H Dam Piezometric Data - 1987-2017 – Glacial Till and Glaciolacustrine
- Figure V-22b H-H Dam Piezometric Data - 2013-2017 – Glacial Till and Glaciolacustrine
- Figure V-23 H-H Dam Piezometric Data - 2013-2017 – Bedrock

Time: 10:38:09
 Date: 3/13/2018
 Scale: 1:50.8(P.S)
 Drawing File: Z:\M\CR\M02341B26 - HVC-2017 Dam Safety Support\400 Drawings\Dam Safety Inspection\FIG_V-1.dwg (skuan)



LEGEND:

- BORROW AREA
- WASTE FILL DISPOSAL AREA
- SEEPAGE POND
- SLIMES POND
- EL. 1279 m ULTIMATE DAM FOOTPRINT
- SURFACE WATER RECLAIM PIPELINE
- SPATSUM WATER PIPELINE
- HAUL ROAD
- PUBLIC ROAD
- L-L DAM CENTERLINE

ACTIVE INSTRUMENTS (SEE NOTE 2):

- STANDPIPE PIEZOMETER AND OBSERVATION WELL
- ⊗ VIBRATING-WIRE PIEZOMETER
- ⊕ COMBINED STANDPIPE PIEZOMETER AND VIBRATING-WIRE PIEZOMETER
- ⊙ COMBINED INCLINOMETER AND VIBRATING-WIRE PIEZOMETER

DEFUNCT INSTRUMENTS (SEE NOTE 3):

- △ DEFUNCT PNEUMATIC PIEZOMETER
- DEFUNCT STANDPIPE PIEZOMETER

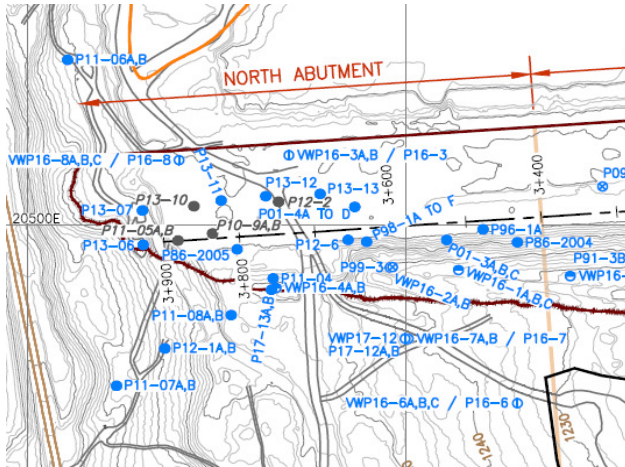
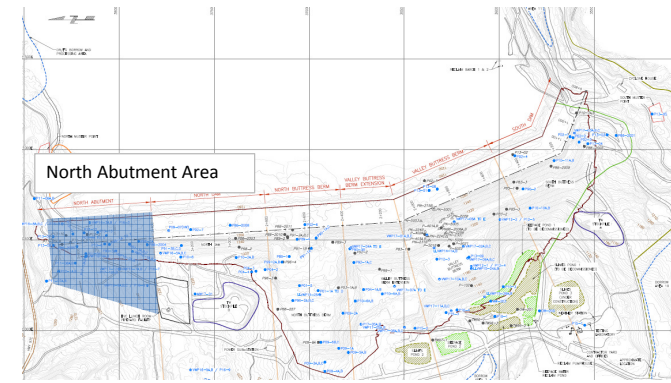
- NOTES:**
- TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER PARTNERSHIP AND WAS DERIVED FROM SATELLITE IMAGERY TAKEN ON 2017-07-01.
 - ACTIVE INSTRUMENTS ARE DEFINED AS ANY INSTRUMENTS SATISFYING ONE OF THE FOLLOWING CRITERIA: CURRENTLY READING AN ACTIVE WATER LEVEL, DRY OR PLUGGED <20 m ABOVE TIP ELEVATION AS THIS COULD SHOW A RESPONSE IN THE FUTURE.
 - DEFUNCT INSTRUMENTS ARE DEFINED AS ANY INSTRUMENTS SATISFYING ONE OF THE FOLLOWING CRITERIA: DESTROYED, DAMAGED OR PLUGGED >20 m ABOVE TIP ELEVATION.
 - ASTERISK (*) DENOTES PROPOSED INSTRUMENT LOCATION TO BE UPDATED WITH AS-CONSTRUCTED LOCATION WHEN SURVEY IS COMPLETED.

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CLIENT
**TECK HIGHLAND VALLEY
 COPPER PARTNERSHIP**

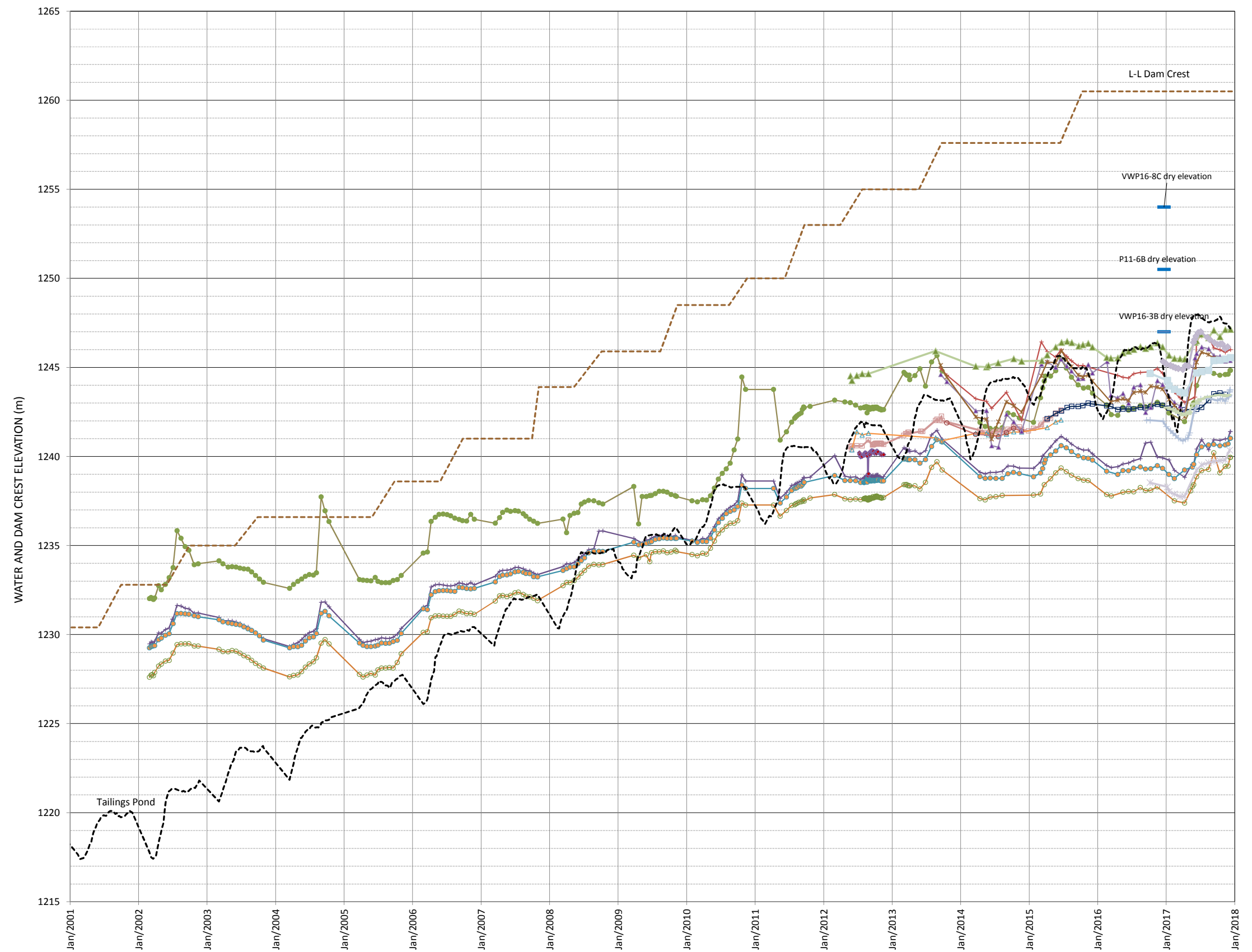
PROJECT	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
TITLE	L-L DAM ACTIVE AND DEFUNCT PIEZOMETERS LOCATION PLAN
PROJECT No.	M02341B26
FIG. No.	V-1

KCB-R-MD



LEGEND:

- P01-4A (Tip El. 1230.70 m, Glacial Till) - U/S
- P01-4B (Tip El. 1214.50 m, Sedimentary) - U/S
- P01-4C (Tip El. 1212.00 m, Sedimentary) - U/S
- P01-4D (Tip El. 1177.70 m, Sedimentary) - U/S
- P11-5A (Tip El. 1225.00 m, Glacial Till with Interbedded Sand) - U/S
- P11-5B (Tip El. 1241.40 m, Sand/Glacial Till) - U/S
- P12-2 (Tip El. 1220.40 m, Glacial Till) - U/S
- P13-7 (Tip El. 1242.00 m, Glacial Till) - U/S
- P13-10 (Tip El. 1224.40 m, Glacial Till) - U/S
- P13-11 (Tip El. 1241.80 m, Sand and Gravel) - U/S
- P13-12 (Tip El. 1229.50 m, Glaciolacustrine/Glacial Till) - U/S
- P13-13 (Tip El. 1232.30 m, Sand and Gravel) - U/S
- P11-6A (Tip El. 1232.5 m, Glacial Till) - U/S
- P11-6B (Tip El. 1251.7 m, Glacial Till) - U/S
- LLVWP16-3A (Tip El. 1205.60 m, Glaciolacustrine) - U/S
- LLVWP16-8A (Tip El. 1171.10 m, Stratified Glacial Till) - U/S
- LLVWP16-8B (Tip El. 1244.70 m, Glaciolacustrine) - U/S
- P16-03 (Tip El. 1158.94 m, Glaciofluvial) - U/S
- P16-08 (Tip El. 1200.04 m, Glaciofluvial) - U/S

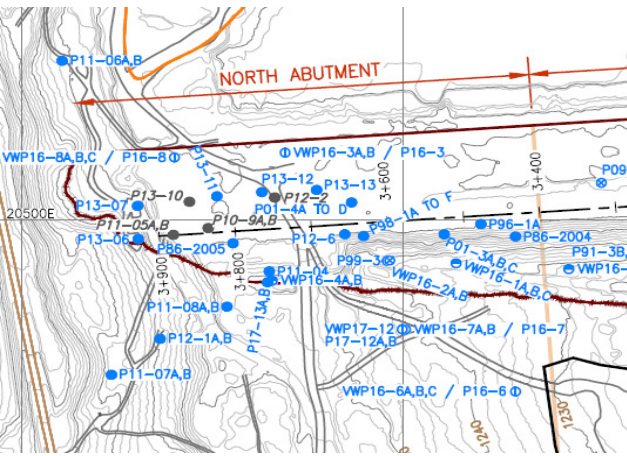
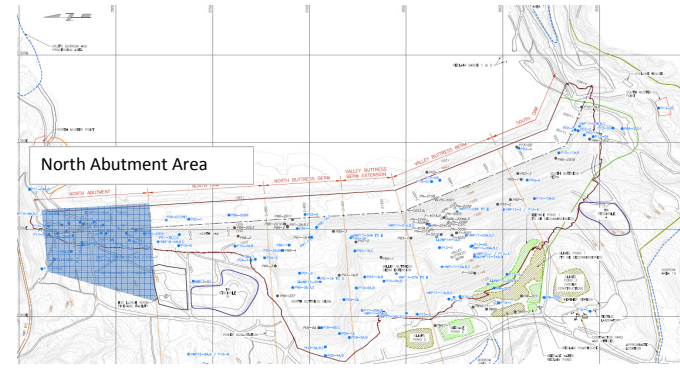


NOTES:
 U/S = Upstream of the dam centerline
 D/S = Downstream of the dam centerline
 P12-2 was grouted up in 2013
 VWP16-3B has been dry since 2016 installation

P11-6B predominantly dry since 2012
 P11-5A,B decommissioned on July 20, 2015
 VWP16-8C has been dry since 2016 installation

March 13, 2018 2:00 PM C:\Users\jrb\Documents\2017\2017 Dam Safety Support\300_Design\Phase 2\Highland\Final\2017 version\160109 Master L-L Piezo Plots - 2017.xdms\Abut V-2a

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		TITLE L-L DAM PIEZOMETRIC DATA U/S OVERBURDEN AND BEDROCK 2001-2017 NORTH ABUTMENT (NORTH OF STN 3+400 m)
PROJECT No. M02341B26		FIG No. V-2a



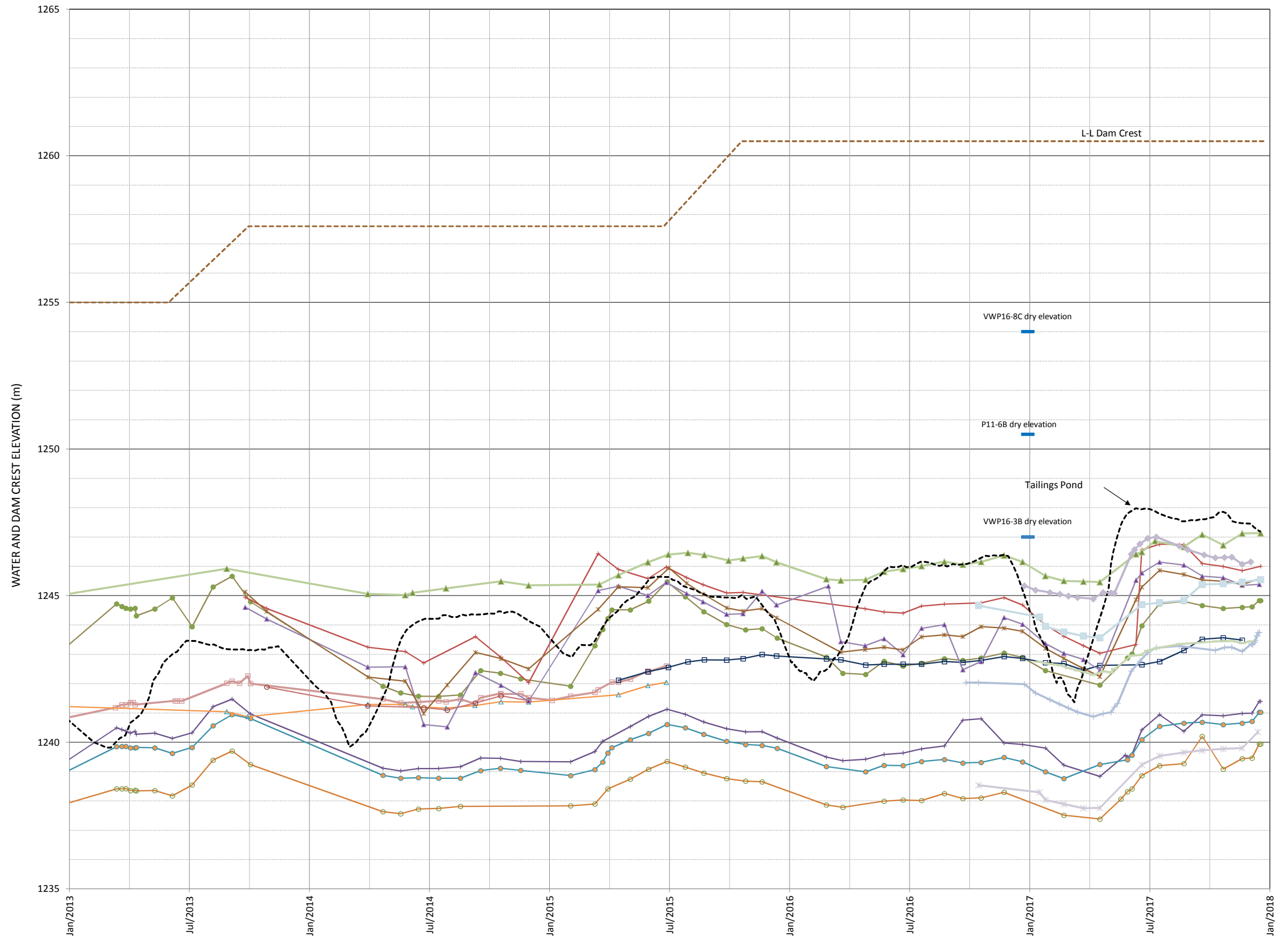
LEGEND:

- P01-4A
(Tip El. 1230.70 m, Glacial Till) - U/S
- P01-4B
(Tip El. 1214.50 m, Sedimentary) - U/S
- P01-4C
(Tip El. 1212.00 m, Sedimentary) - U/S
- P01-4D
(Tip El. 1177.70 m, Sedimentary) - U/S
- P11-5A
(Tip El. 1225.00 m, Glacial Till with Interbedded Sand) - U/S
- P11-5B
(Tip El. 1241.40 m, Sand/Glacial Till) - U/S
- P12-2
(Tip El. 1220.40 m, Glacial Till) - U/S
- P13-7
(Tip El. 1242.00 m, Glacial Till) - U/S
- P13-10
(Tip El. 1224.40 m, Glacial Till) - U/S
- P13-11
(Tip El. 1241.80 m, Sand and Gravel) - U/S
- P13-12
(Tip El. 1229.50 m, Glaciolacustrine/Glacial Till) - U/S
- P13-13
(Tip El. 1232.30 m, Sand and Gravel) - U/S
- P11-6A
(Tip El. 1232.5 m, Glacial Till) - U/S
- P11-6B
(Tip El. 1251.7 m, Glacial Till) - U/S
- LLVWP16-3A
(Tip El. 1205.60 m, Glaciolacustrine) - U/S
- LLVWP16-8A
(Tip El. 1171.10 m, Stratified Glacial Till) - U/S
- LLVWP16-8B
(Tip El. 1244.70 m, Glaciolacustrine) - U/S
- P16-03
(Tip El. 1158.94 m, Glaciofluvial) - U/S
- P16-08
(Tip El. 1200.04 m, Glaciofluvial) - U/S

NOTES:

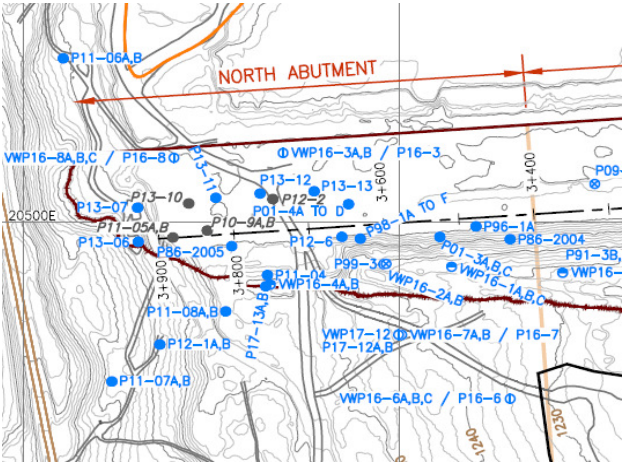
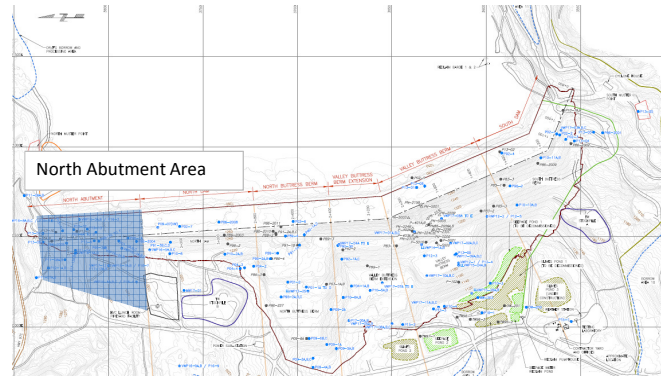
U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 P11-6B predominantly dry since 2012
 VWP16-3B has been dry since 2016 installation

P12-2 was grouted up in 2013
 P11-5A,B decommissioned on July 20, 2015
 VWP16-8C has been dry since 2016 installation



March 13, 2018
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AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF SAID STATEMENTS, CONCLUSIONS, RECOMMENDATIONS, AND DRAWINGS IS RESERVED FOR OUR WRITTEN APPROVAL.	CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP 	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION TYPE L-L DAM PIEZOMETRIC DATA U/S OVERBURDEN AND BEDROCK 2013-2017 NORTH ABUTMENT (NORTH OF STN 3+400 m) PROJECT No. M02341B26 FIG. No. V-2b
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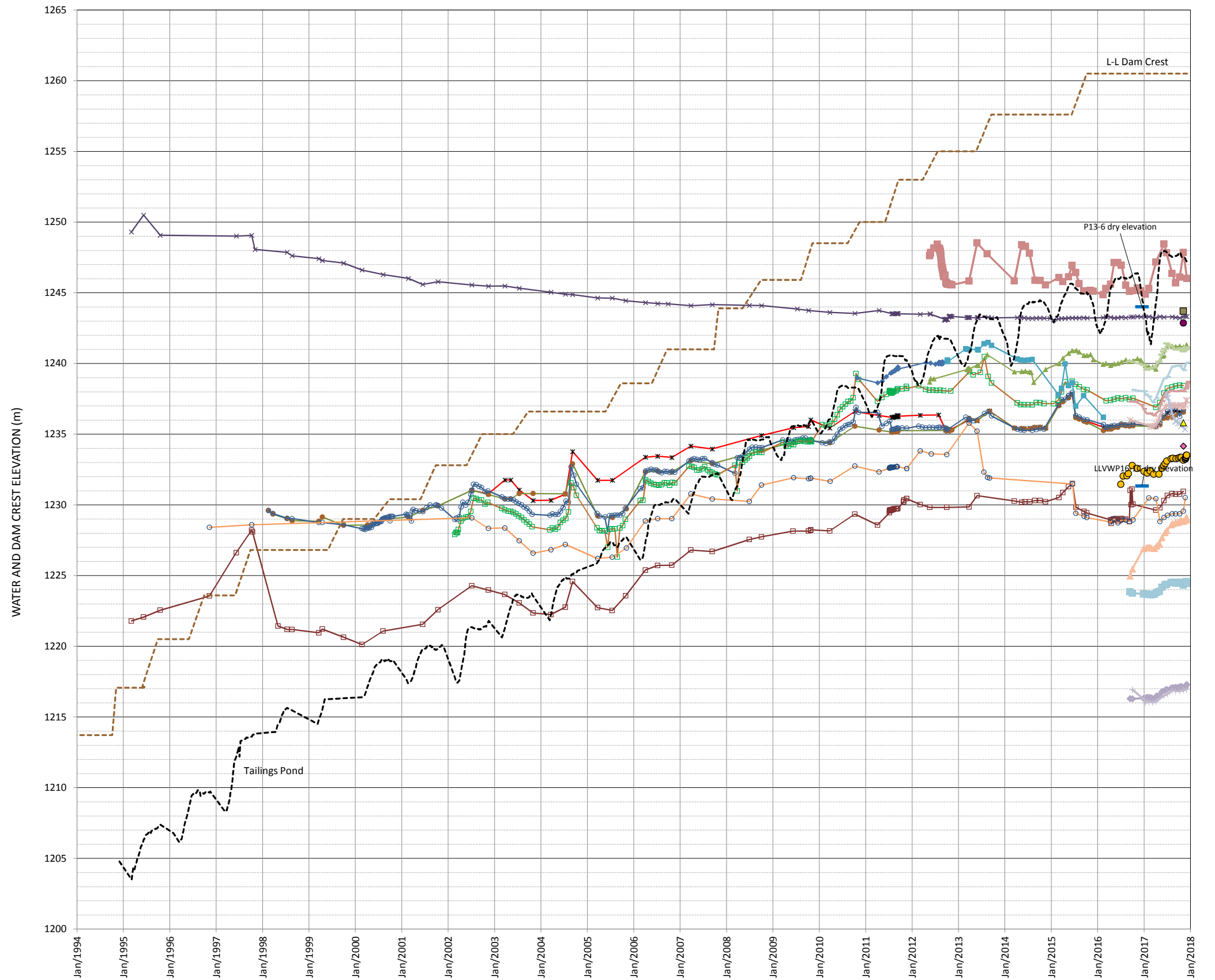


LEGEND:

- P86-2004 (Tip El. 1205.40 m, Silt/Some Sand - possible sedimentary)
- ✕ P98-1A (Tip El. 1230.40 m, Glacial Till)
- P98-1C (Tip El. 1218.40 m, Glacial Till)
- P10-9A (Tip El. 1209.20 m, Glacial Till)
- P11-7A (Tip El. 1268.10 m, Glacial Till with Interbedded Sand)
- P12-6 (Tip El. 1233.40 m, Sand and Gravel)
- P11-8B (Tip El. 1239.60 m, Glacial Till)
- LLVWP16-1B (Tip El. 1215.84 m, Glacial Till)
- ✕ LLVWP16-2B (Tip El. 1225.8 m, Glaciofluvial)
- LLVWP16-4B (Tip El. 1227.4 m, Upper Glaciolacustrine)
- LLVWP16-6B (Tip El. 1209.3 m, Stratified Glacial Till)
- ✕ LLVWP16-7B (Tip El. 1207.9 m, Glaciofluvial)
- P16-06 (Tip El. 1140.2 m, Glaciofluvial)
- LLVWP16-1C (Tip El. 1231.34 m, Upper Glaciolacustrine)
- P17-12B (Tip El. 1233.6 m, Glacial Till)
- P17-13B (Tip El. 1240.2 m, Glacial Till)
- ✕ P86-2005 (Tip El. 1239.50 m, Sand and Gravel)
- P98-1B (Tip El. 1224.40 m, Glacial Till)
- P01-3A (Tip El. 1224.40 m, Glacial Till)
- P11-4 (Tip El. 1207.50 m, Glacial Till)
- P11-7B (Tip El. 1281.20 m, Glacial Till with Interbedded Sand)
- P96-1A (Tip El. 1227.8 m, Glacial Till)
- ▲ LLVWP16-1A (Tip El. 1203.84 m, Glaciofluvial)
- LLVWP16-2A (Tip El. 1205.8 m, Glacial Till)
- LLVWP16-4A (Tip El. 1164.0 m, Glaciofluvial)
- LLVWP16-6A (Tip El. 1185.5 m, Glaciofluvial)
- LLVWP16-6C (Tip El. 1224.6 m, Glaciofluvial)
- P16-07 (Tip El. 1194.2 m, Glaciofluvial)
- LLVWP17-12 (Tip El. 1230.6, Glacial Till (Silt))
- P17-12A (Tip El. 1221.1 m, Glacial Till)
- P17-13A (Tip El. 1232.3 m, Sand and Gravel)

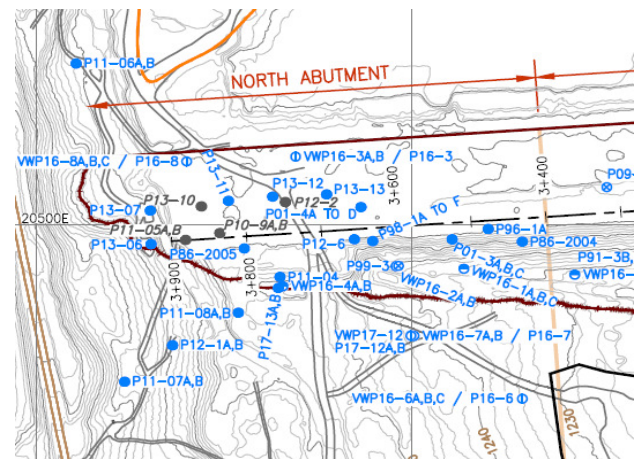
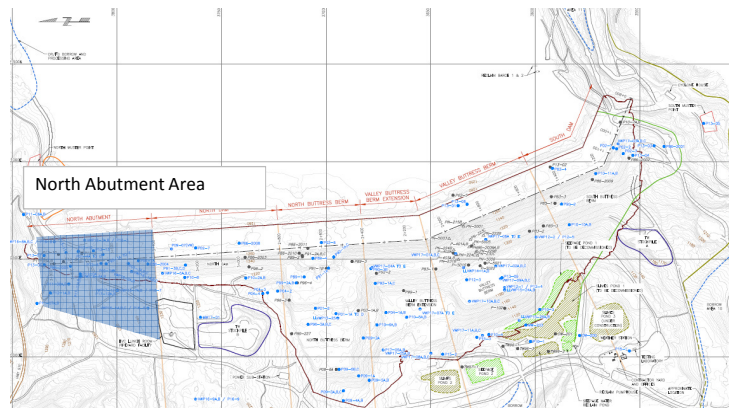
NOTES:

- U/S = Upstream of dam centerline
- D/S = Downstream of dam centerline
- P11-7A,B dry since 2011 installation
- P13-6 dry since 2013 installation
- VWP16-1C dry since 2016 installation



March 13, 2018
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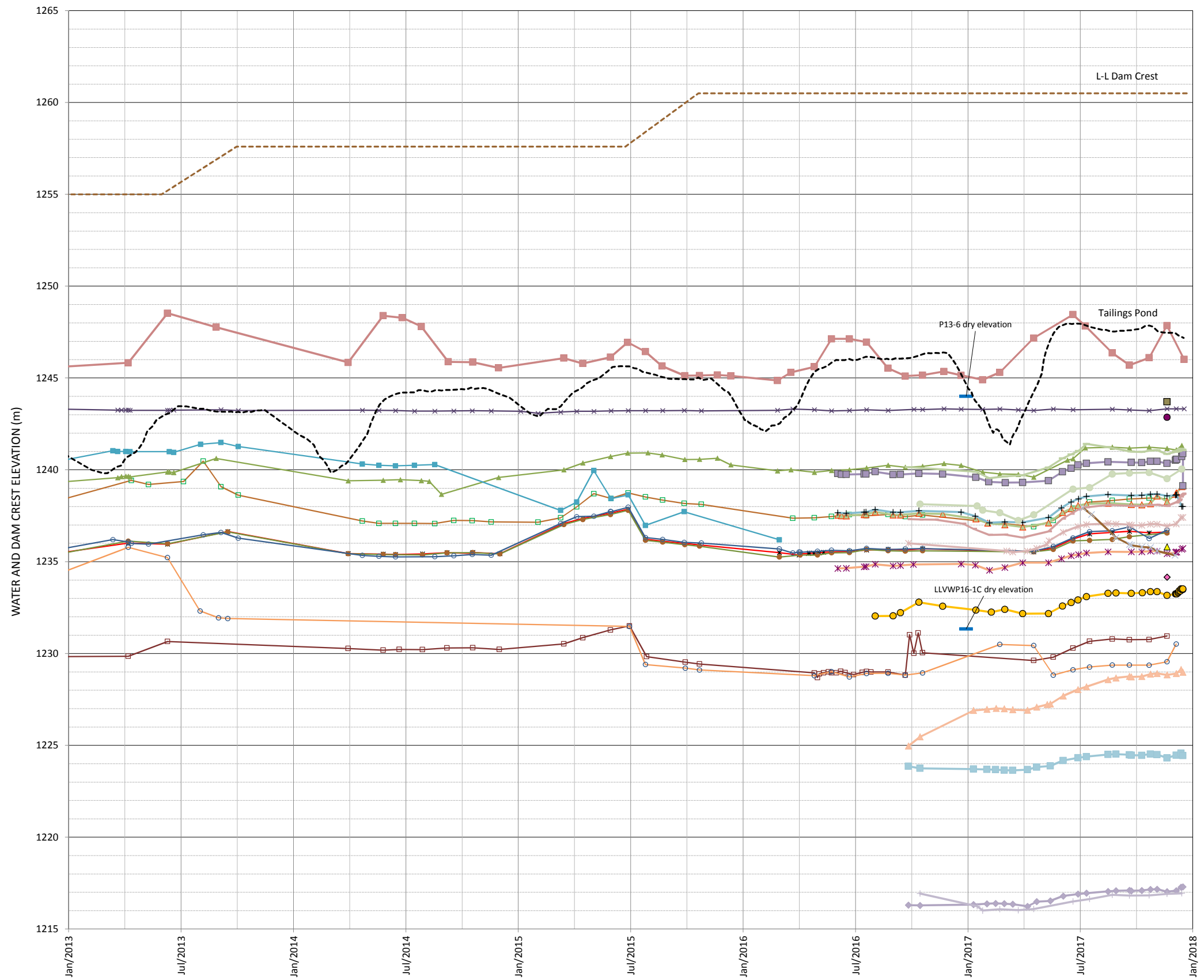
<p>ALL A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES. ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR REUSE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS, RECOMMENDATIONS, DESIGN AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</p>	<p>TECK HIGHLAND VALLEY COPPER PARTNERSHIP</p>	<p>PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION</p> <p>TITLE: L-L DAM PIEZOMETRIC DATA D/S OVERBURDEN 1994-2017</p> <p>LOCATION: NORTH ABUTMENT (NORTH OF STN 3+400 m)</p> <p>PROJECT No.: M02341B26 FIG No.: V-3a</p>
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LEGEND:

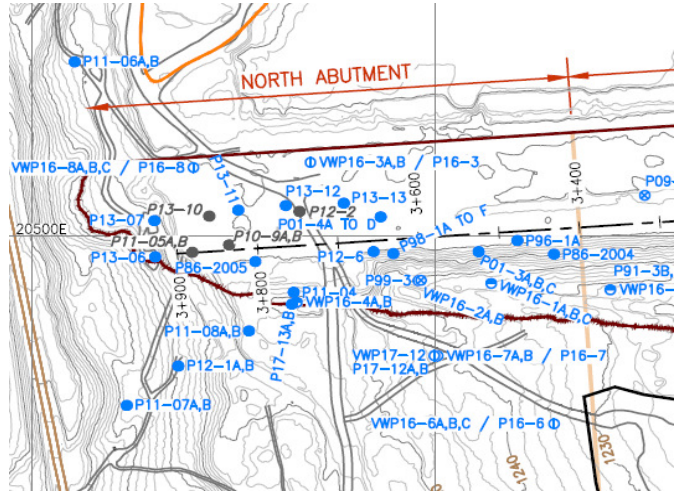
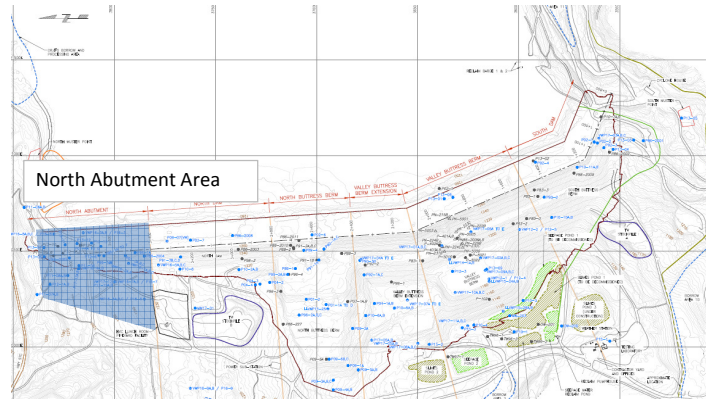
<ul style="list-style-type: none"> — P86-2004 (Tip El. 1205.40 m, Silt/Some Sand possible sedimentary) — P88-1A (Tip El. 1230.40 m, Glacial Till) — P98-1C (Tip El. 1218.40 m, Glacial Till) — P10-9A (Tip El. 1209.20 m, Glacial Till) — P11-7A (Tip El. 1268.10 m, Glacial Till with Interbedded Sand) — P12-6 (Tip El. 1233.40 m, Sand and Gravel) — P11-88 (Tip El. 1239.60 m, Glacial Till) — LLVWP16-1B (Tip El. 1215.84 m, Glacial Till) — LLVWP16-2B (Tip El. 1225.8 m, Glaciofluvial) — LLVWP16-4B (Tip El. 1227.4 m, Upper Glaciolacustrine) — LLVWP16-6B (Tip El. 1209.3 m, Stratified Glacial Till) — LLVWP16-7B (Tip El. 1207.9 m, Glaciofluvial) — P16-06 (Tip El. 1140.2 m, Glaciofluvial) — LLVWP16-1C (Tip El. 1231.34 m, Upper Glaciolacustrine) — P17-12B (Tip El. 1233.7, Upper Sand and Gravel) — P17-13B (Tip El. 1240.3, Upper Sand and Gravel) 	<ul style="list-style-type: none"> — P86-2005 (Tip El. 1239.50 m, Sand and Gravel) — P98-1B (Tip El. 1224.40 m, Glacial Till) — P01-3A (Tip El. 1224.40 m, Glacial Till) — P11-4 (Tip El. 1207.50 m, Glacial Till) — P11-7B (Tip El. 1281.20 m, Glacial Till with Interbedded Sand) — P96-1A (Tip El. 1227.8 m, Glacial Till) — LLVWP16-1A (Tip El. 1203.84 m, Glaciofluvial) — LLVWP16-2A (Tip El. 1205.8 m, Glacial Till) — LLVWP16-4A (Tip El. 1164.0 m, Glaciofluvial) — LLVWP16-6A (Tip El. 1185.5 m, Glaciofluvial) — LLVWP16-6C (Tip El. 1224.6 m, Glaciofluvial) — P16-07 (Tip El. 1194.2 m, Glaciofluvial) — LLVWP17-12 (Tip El. 1230.6, Glacial Till (Silt)) — P17-12A (Tip El. 1221.2, Glacial Till) — P17-13A (Tip El. 1232.7, Upper Sand and Gravel)
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NOTES:
 U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 P11-7A,B dry since 2011 installation
 P13-6 dry since 2013 installation
 VWP16-1C dry since 2016 installation



March 13, 2018
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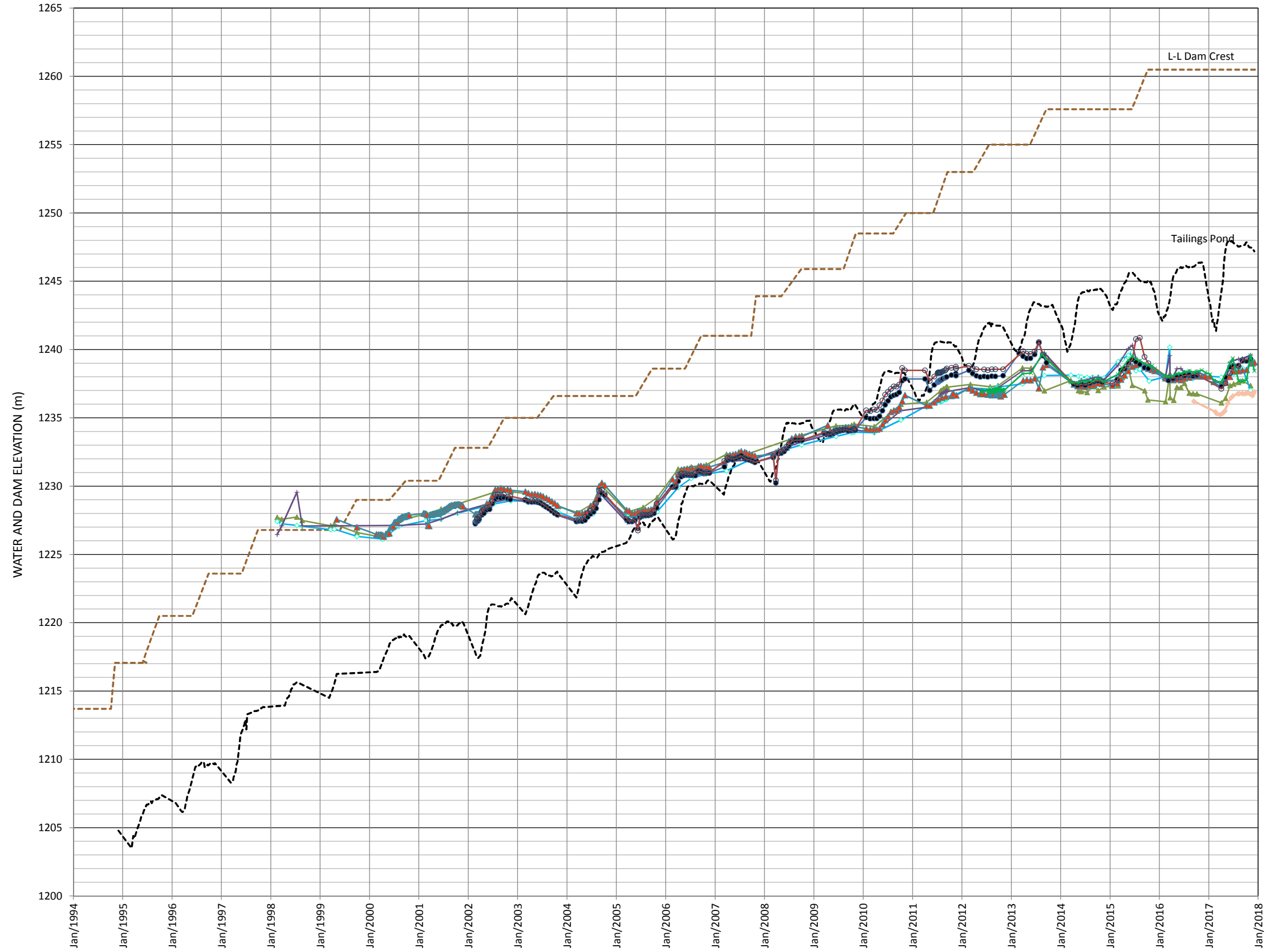
<p>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND COMMUNITY, ALL REPORTS AND DRAWINGS ARE SUBMITTED TO THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR THE PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OUR REPORTS, CONCLUSIONS OR DRAWINGS IS RESERVED. PERSONAL OUR WRITTEN APPROVAL.</p>	<p>CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP </p>	<p>PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION</p>
		<p>DATE L-L DAM PIEZOMETRIC DATA D/S OVERBURDEN 2013-2017 NORTH ABUTMENT (NORTH OF STN 3+400 m)</p>
<p>PROJECT No. M02341B26</p>		<p>FIG No. V-3b</p>



LEGEND:

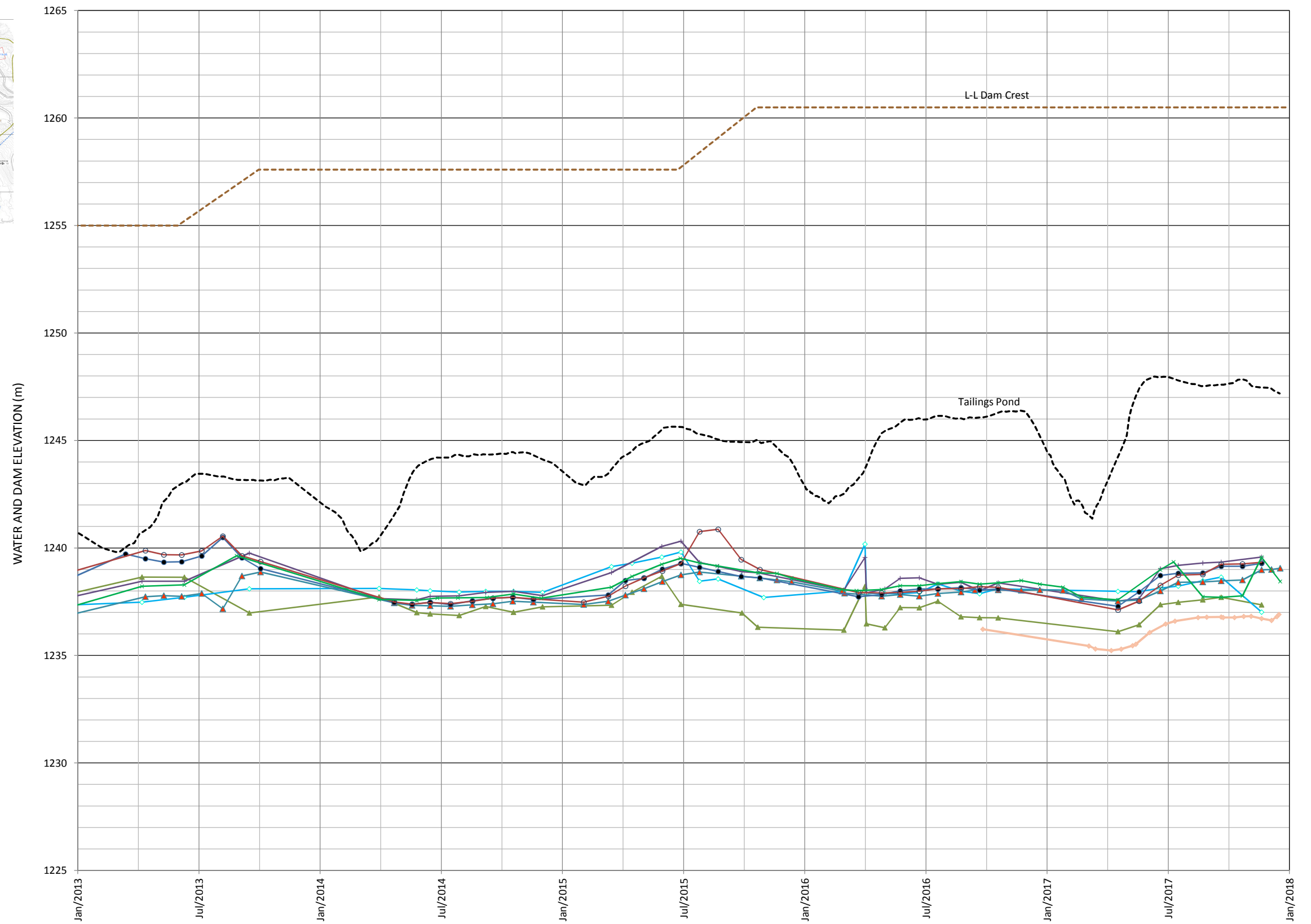
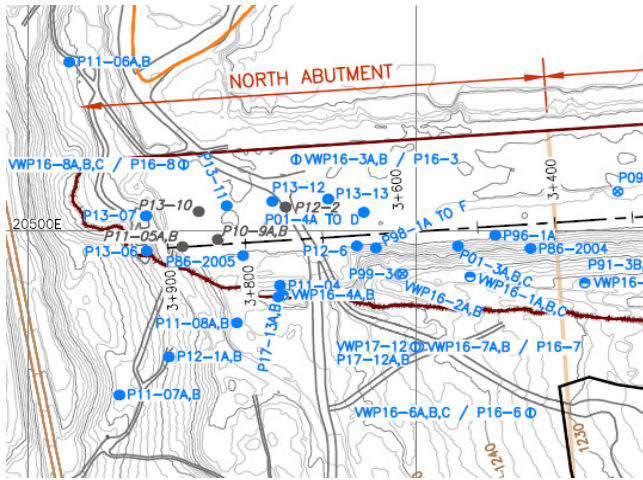
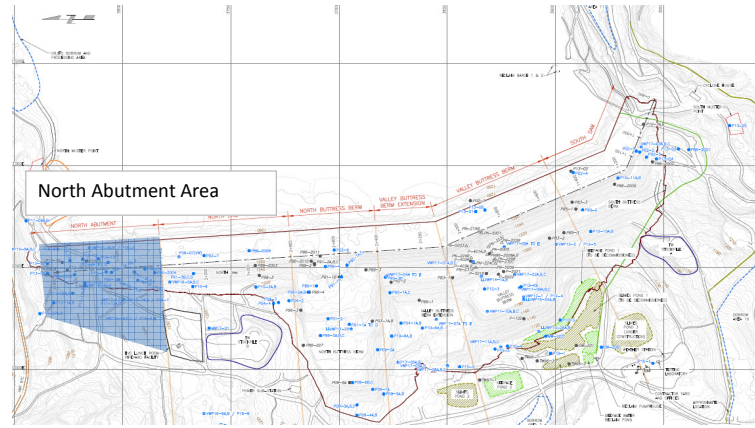
- ▲— P98-1D
(Tip El. 1199.40 m, Volcanics)
- ◇— P98-1E
(Tip El. 1178.40 m, Sedimentary)
- ▲— P98-1F
(Tip El. 1146.40 m, Sedimentary)
- ▲— P99-3
(Tip El. 1203.00 m, Volcanics)
- P01-3B
(Tip El. 1205.80 m, Sedimentary)
- P01-3C
(Tip El. 1188.80 m, Sedimentary)
- ▲— P11-8A
(Tip El. 1193.80 m, Volcanics)
- ▲— LLVWP16-7A
(Tip El. 1145.5 m, Weathered Sedimentary)

NOTES:
 U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline



March 13, 2018
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CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION	
	TITLE L-L DAM PIEZOMETRIC DATA D/S BEDROCK 1994-2017 NORTH ABUTMENT (NORTH OF STN 3+400 m)	
PROJECT No. M02341B26	FIG No. V-4a	



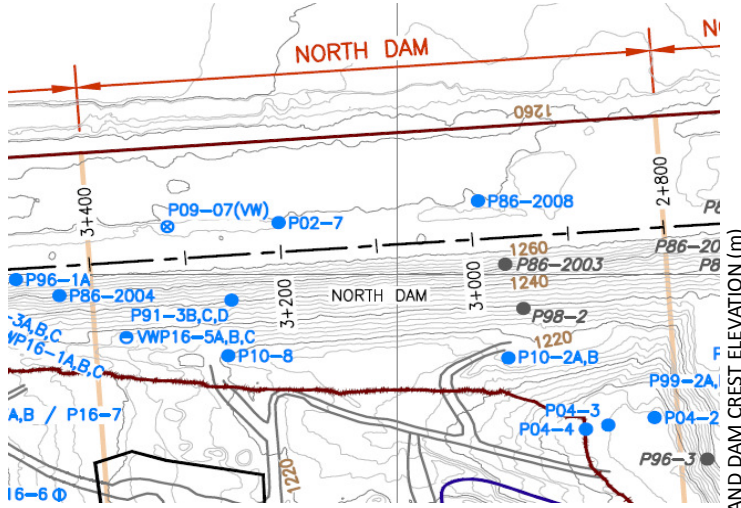
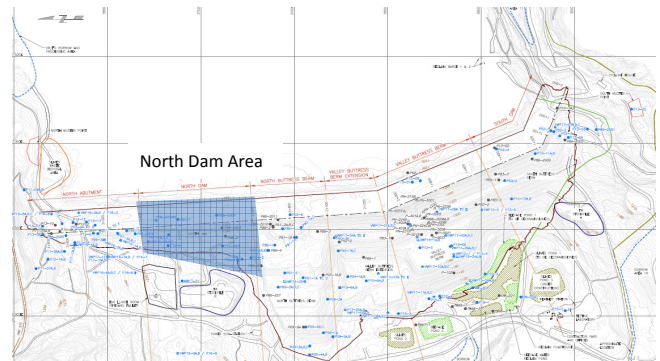
LEGEND:

- ▲— P98-1D
(Tip El. 1199.40 m, Volcanics)
- ◇— P98-1E
(Tip El. 1178.40 m, Sedimentary)
- ▲— P98-1F
(Tip El. 1146.40 m, Sedimentary)
- ▲— P99-3
(Tip El. 1203.00 m, Volcanics)
- P01-3B
(Tip El. 1205.80 m, Sedimentary)
- P01-3C
(Tip El. 1188.80 m, Sedimentary)
- ×— P11-8A
(Tip El. 1193.80 m, Volcanics)
- LLVWP16-7A
(Tip El. 1145.5 m, Weathered Sedimentary)

NOTES:
 U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline

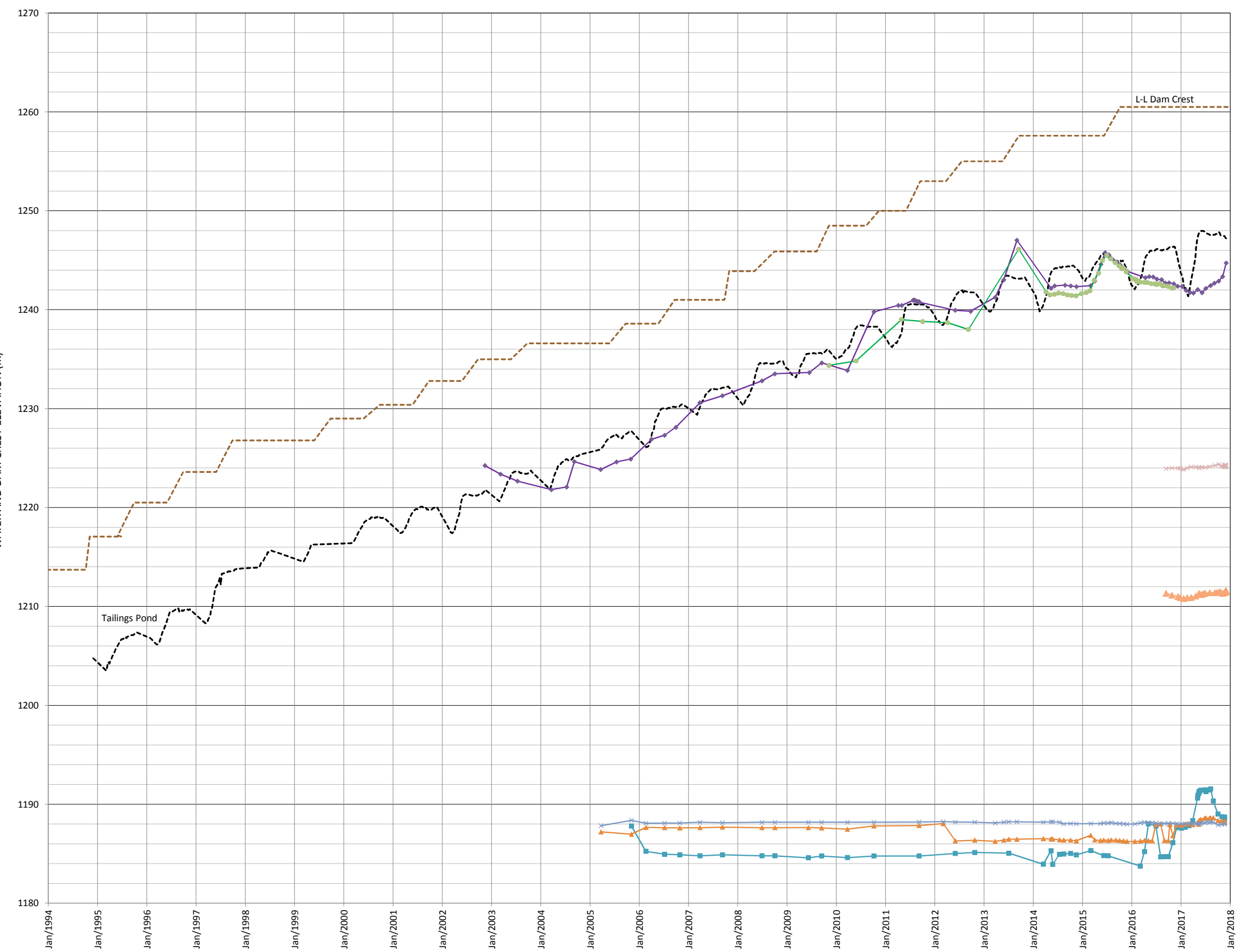
AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.	TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		TITLE L-L DAM PIEZOMETRIC DATA D/S BEDROCK 2013-2017 NORTH ABUTMENT (NORTH OF STN 3+400 m)
PROJECT NO: M02341B26		FIG. NO: V-4b

March 13, 2018
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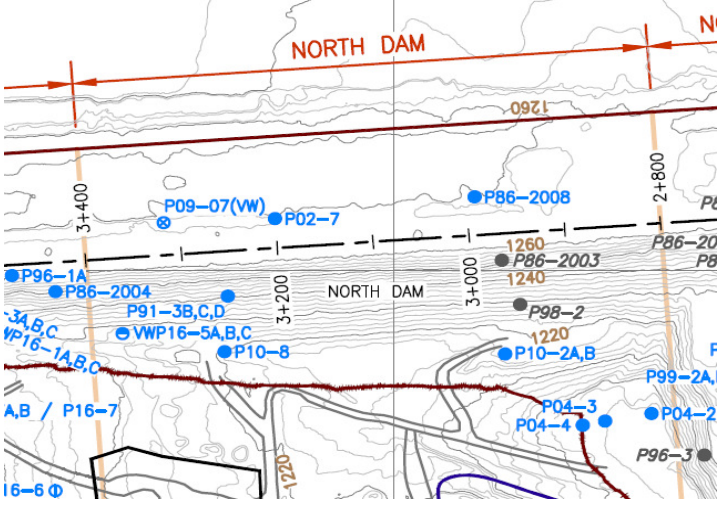
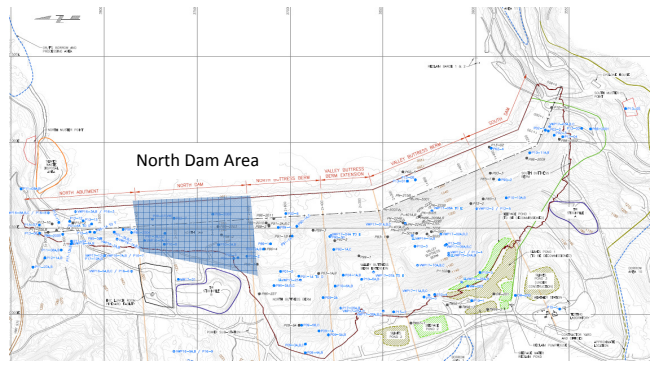


- LEGEND:**
- ◆ P02-7
(Tip El. 1216.8 m, U/S Dam Fill (Cycloned Sand))
 - P04-2
(Tip El. 1182.8, Glacial Till)
 - ▲ P04-3
(Tip El. 1186.2, Glacial Till)
 - ✕ P04-4
(Tip El. 1186.4 m, Glacial Till)
 - ◆ P09-07(VWP)
(Tip El. 1228.8 m, U/S Dam Fill (Cycloned Sand))
 - ▲ LLVWP16-5A
(Tip El. 1172.1 m, Stratified Glacial Till)
 - ✕ LLVWP16-5B
(Tip El. 1223.5 m, Upper Glaciolacustrine)

NOTES:
 U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline



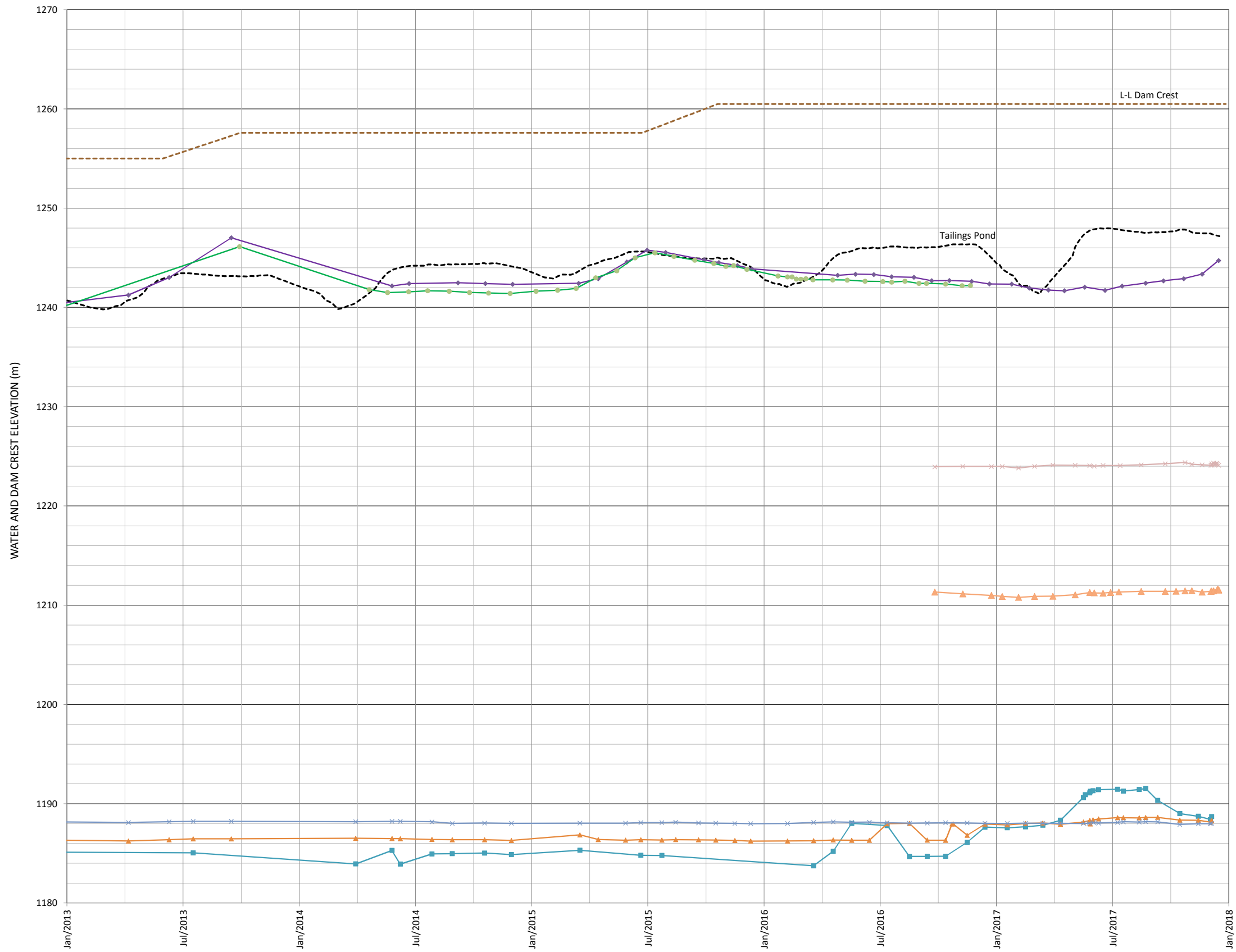
<small>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATISTICS, CONCLUSIONS OR ABSTRACTS FROM OR REISSUING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</small>	CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		TITLE L-L DAM PIEZOMETRIC DATA U/S DAM FILL AND D/S OVERBURDEN 1994-2017 NORTH DAM (STNS 2+800 m to 3+400 m)
PROJECT NO. M02341B26		FIG. NO. V-5a



LEGEND:

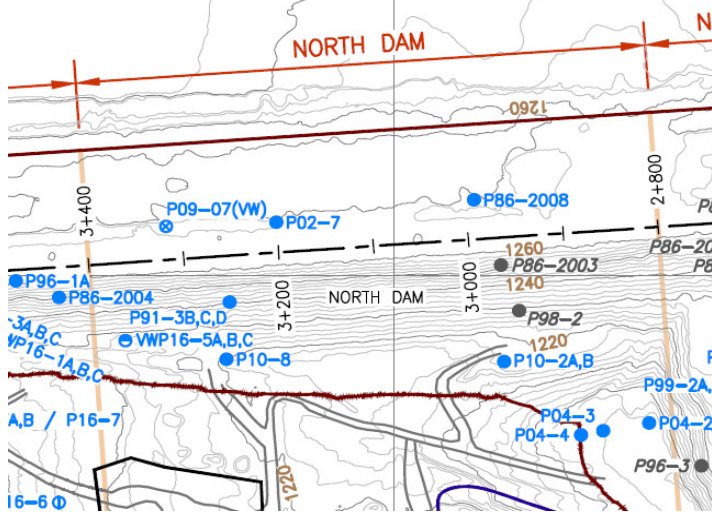
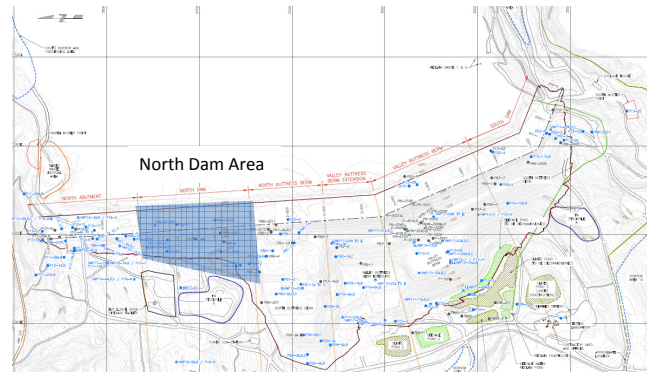
- P02-7
 (Tip El. 1216.8 m, U/S Dam Fill (Cycloned Sand))
- P04-2
 (Tip El. 1182.8, Glacial Till)
- P04-3
 (Tip El. 1186.2, Glacial Till)
- P04-4
 (Tip El. 1186.4 m, Glacial Till)
- P09-07(VWP)
 (Tip El. 1228.8 m, U/S Dam Fill (Cycloned Sand))
- LLVWP16-5A
 (Tip El. 1172.1 m, Stratified Glacial Till)
- LLVWP16-5B
 (Tip El. 1223.5 m, Upper Glaciolacustrine)

NOTES:
 U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline



March 13, 2018
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AS A MUTUAL PROTECTION TO OUR CLIENT THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND APPLICATION. THE USER AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR WITHIN THESE REPORTS AND DRAWINGS IS RESERVED WITHOUT OUR WRITTEN APPROVAL.	CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		TITLE L-L DAM PIEZOMETRIC DATA U/S DAM FILL AND D/S OVERBURDEN 2013 - 2017 NORTH DAM (STNS 2+800 m to 3+400 m)
	PROJECT NO. M02341B26	FIG. NO. V-5b

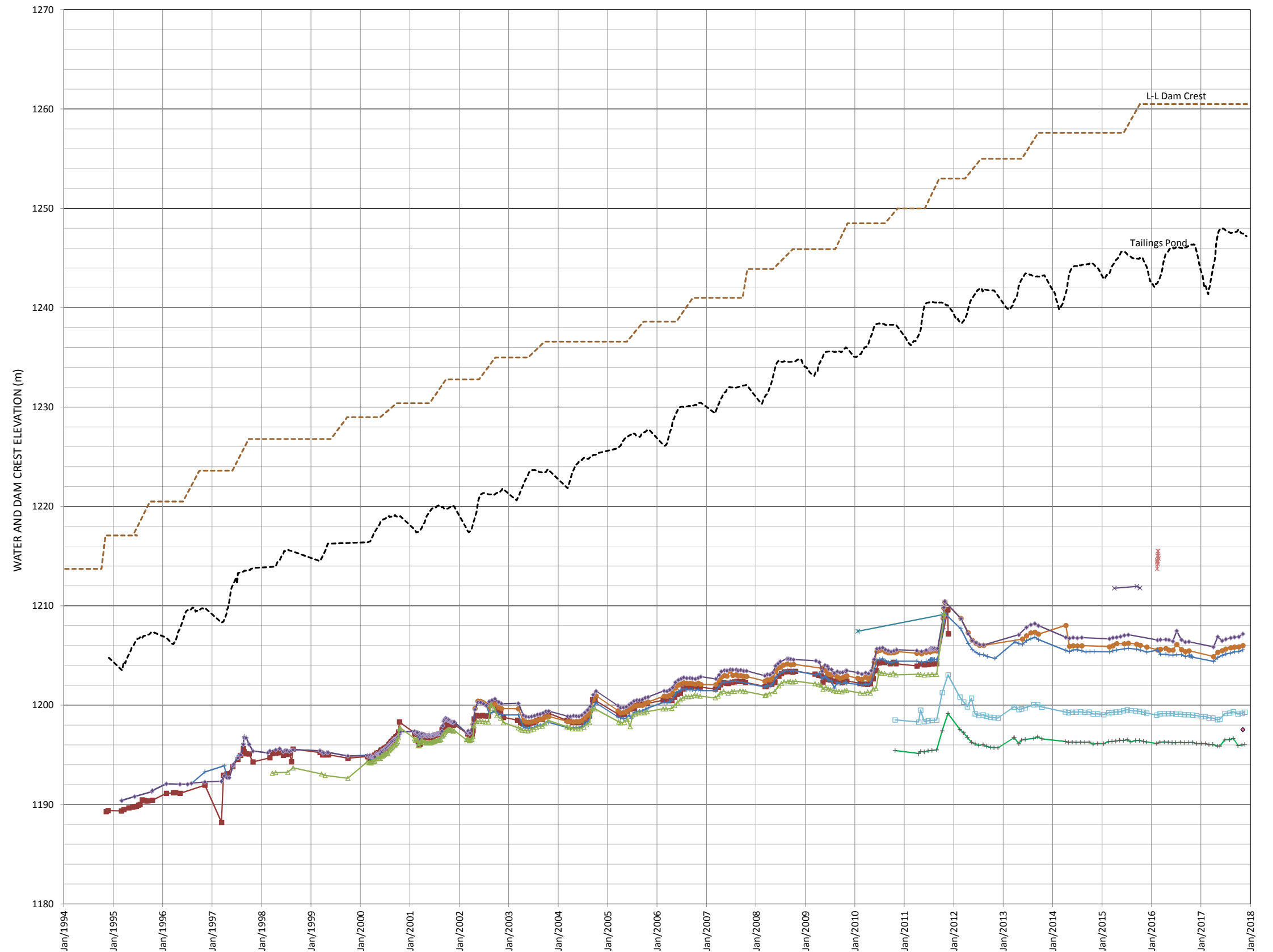


LEGEND:

- P86-2003 (Tip El. 1164.9 m, Volcanics)
- ✕ P86-2008 (Tip El. 1212.6m, Volcanics)
- ✕ P91-3A (Tip El. 1205.7 m, Volcanics)
- P91-3B (Tip El. 1197 m, Volcanics)
- P91-3C (Tip El. 1182.4 m, Volcanics)
- P91-3D (Tip El. 1169.5 m, Volcanics)
- P98-2 (Tip El. 1183.2m, Volcanics)
- ✕ P10-8 (Tip El. 1210.2 m, Upper Volcanics)
- P10-2A (Tip El. 1146.7 m, Upper Volcanics)
- P10-2B (Tip El. 1173 m, Upper Volcanics)
- ◆ MW17-01 (Tip El. 1120.8 m, Sandstone)

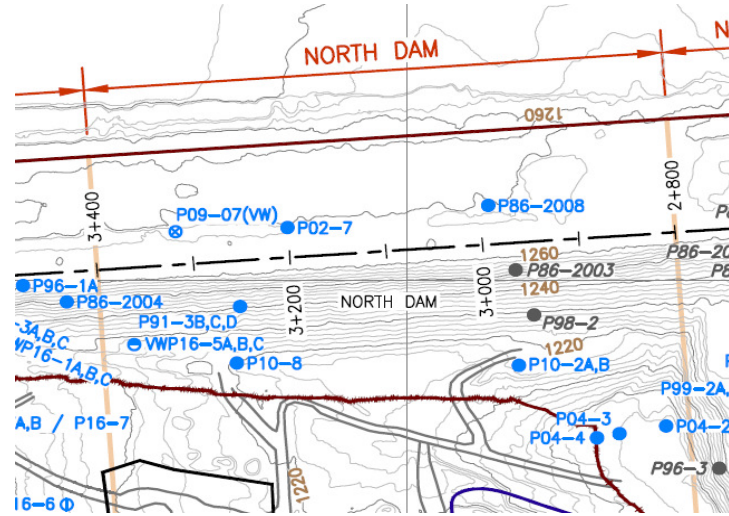
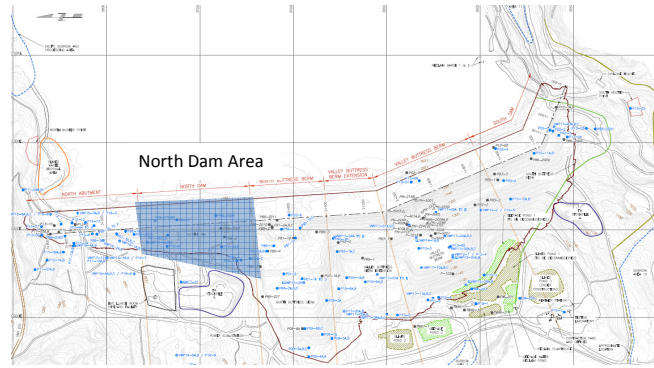
NOTES:

- U/S = Upstream of dam centerline
- D/S = Downstream of dam centerline
- P98-2 was grouted/decommissioned in 2012
- P10-8 was dry at El. 1210.5 m between 2010 and 2015
- P86-2008 was plugged at El. 1230 m between 2008 and 2014, plugged in 2016
- P91-3A dry at El. 1205.7 m from installation to 2007, dry/plugged between 2007 and 2012 and plugged thereafter at ~El. 1217 m
- P86-2003 became plugged end of 2011/2012, currently plugged at ~El.1219 m



March 13, 2018 Z:\MVC\H24\1826 - HVC-2017 Dam Safety Support\300 Design\Piezo Data\Highland\Final 2017 vens\1810109 Master L-L Piezo Plots - 2017.dwg\NAbut (V-2a)

<small>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE, AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR RECOMMENDATIONS REGARDING OUR REPORTS AND DRAWINGS IS REQUIRED PENDING OUR WRITTEN APPROVAL.</small>	CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		TITLE L-L DAM PIEZOMETRIC DATA 1994-2017 NORTH DAM (STNS 2+800 m to 3+400 m)
<small>PROJECT NO.</small> M02341B26		<small>FIGURE NO.</small> V-6a

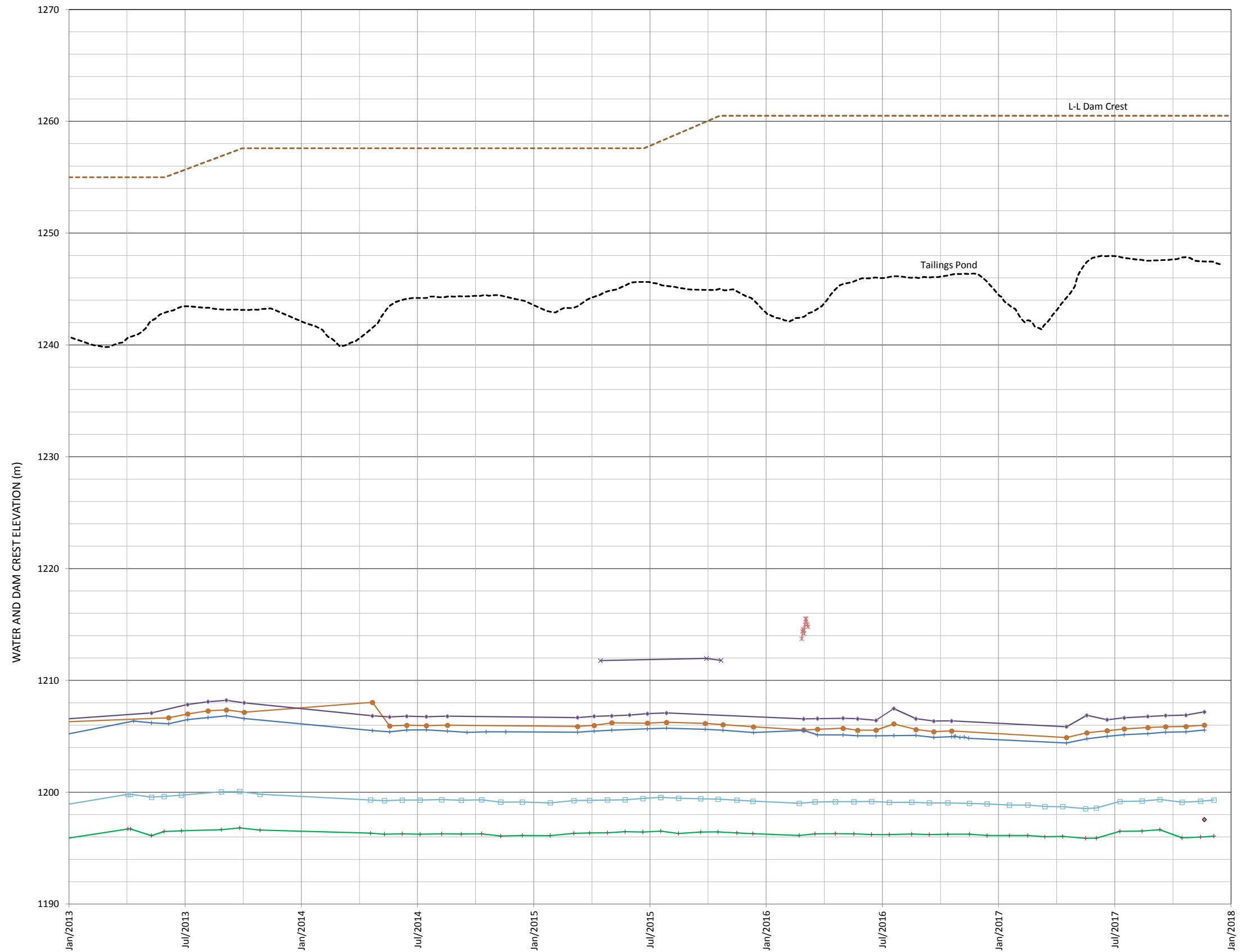


LEGEND:

- ✕ P86-2008
(Tip El. 1212.6m, Volcanics)
- P91-3B
(Tip El. 1197 m, Volcanics)
- P91-3C
(Tip El. 1182.4 m, Volcanics)
- ▲ P91-3D
(Tip El. 1169.5 m, Volcanics)
- ✶ P10-8
(Tip El. 1210.2 m, Upper Volcanics)
- ◆ P10-2A
(Tip El. 1146.7 m, Upper Volcanics)
- P10-2B
(Tip El. 1173 m, Upper Volcanics)
- ◇ MW17-01
(Tip El. 1120.8 m, Sandstone)

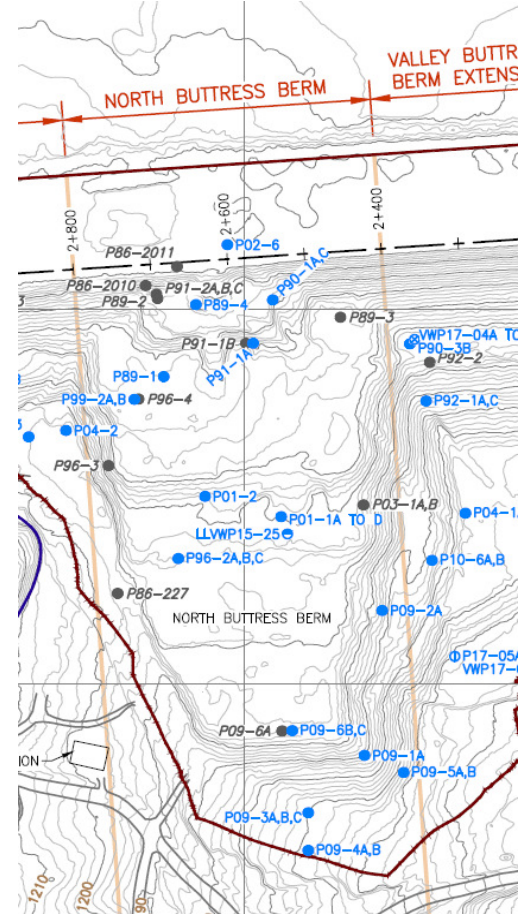
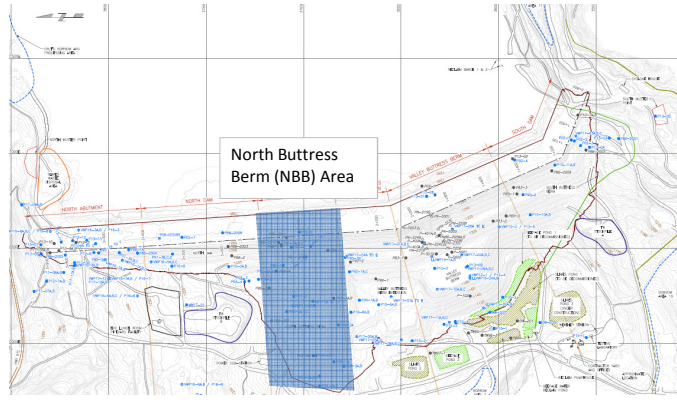
NOTES:

- U/S = Upstream of dam centerline
- D/S = Downstream of dam centerline
- P98-2 was grouted/decommissioned in 2012
- P10-8 was dry at El. 1210.5m between 2010 and 2015
- P86-2008 was plugged at El. 1230 m between 2008 and 2014, plugged in 2016



March 13, 2018
Z:\MCH\2017\2017 Dam Safety\Supp300 Design\Phase Data\Highland\Final 2017 version\180109 Master L-L Phase Plots - 2017.dwg\About (V-2a)

<small>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR INFORMATION IS RESERVED. PENDING OUR WRITTEN APPROVAL.</small>	TECK HIGHLAND VALLEY COPPER PARTNERSHIP	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		L-L DAM PIEZOMETRIC DATA BEDROCK 2013-2017 NORTH DAM (STNS 2+800 m to 3+400 m)
<small>PROJECT NO. M02341B26</small>		<small>FIG. NO. V-6b</small>



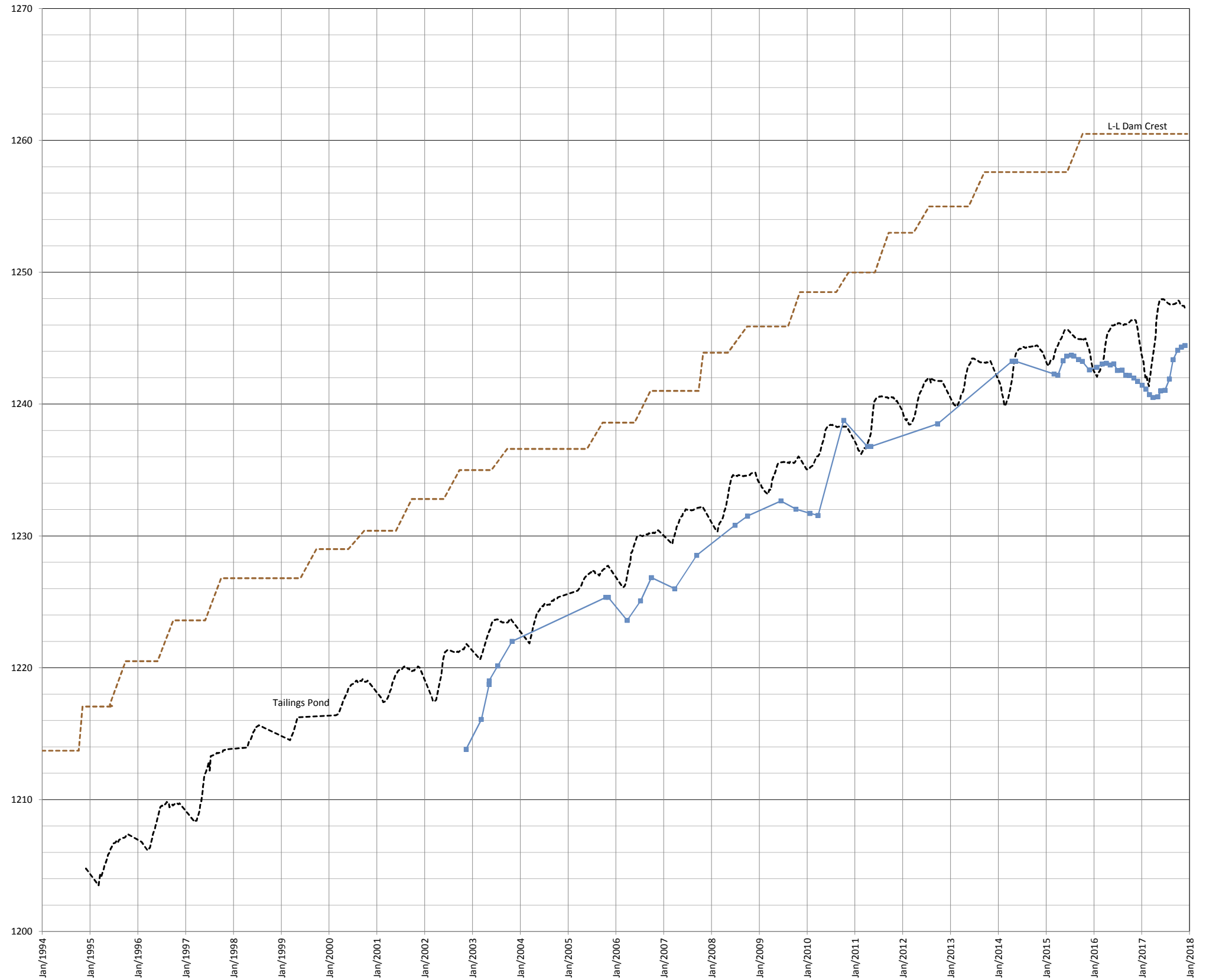
LEGEND:

- P02-6
(Tip El. 1188.40 m, U/S Dam Fill (Cycloned Sand))

NOTES:

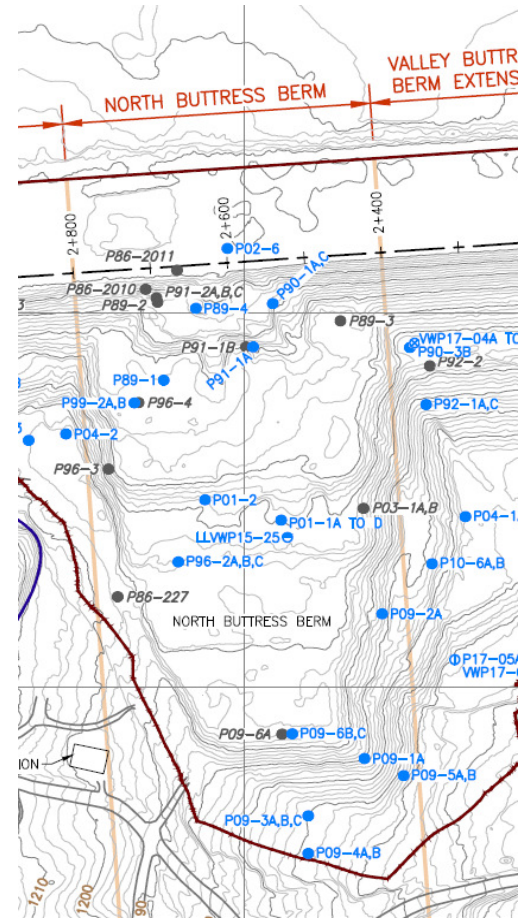
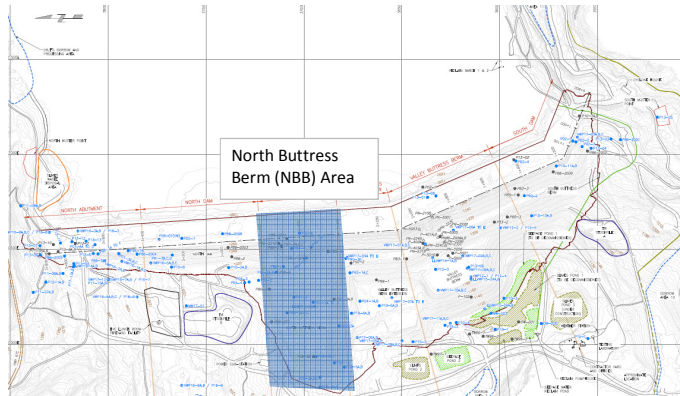
U/S = Upstream of dam centerline
D/S = Downstream of dam centerline

WATER AND DAM CREST ELEVATION (m)



March 13, 2018
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<p>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</p>	<p>CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP</p> <p></p>	<p>PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION</p>
		<p>TITLE L-L DAM PIEZOMETRIC DATA U/S DAM FILL 1994-2017 NORTH BUTTRESS BERM (STNS 2+400 m to 2+800 m)</p>
		<p>PROJECT# M02341B26</p>

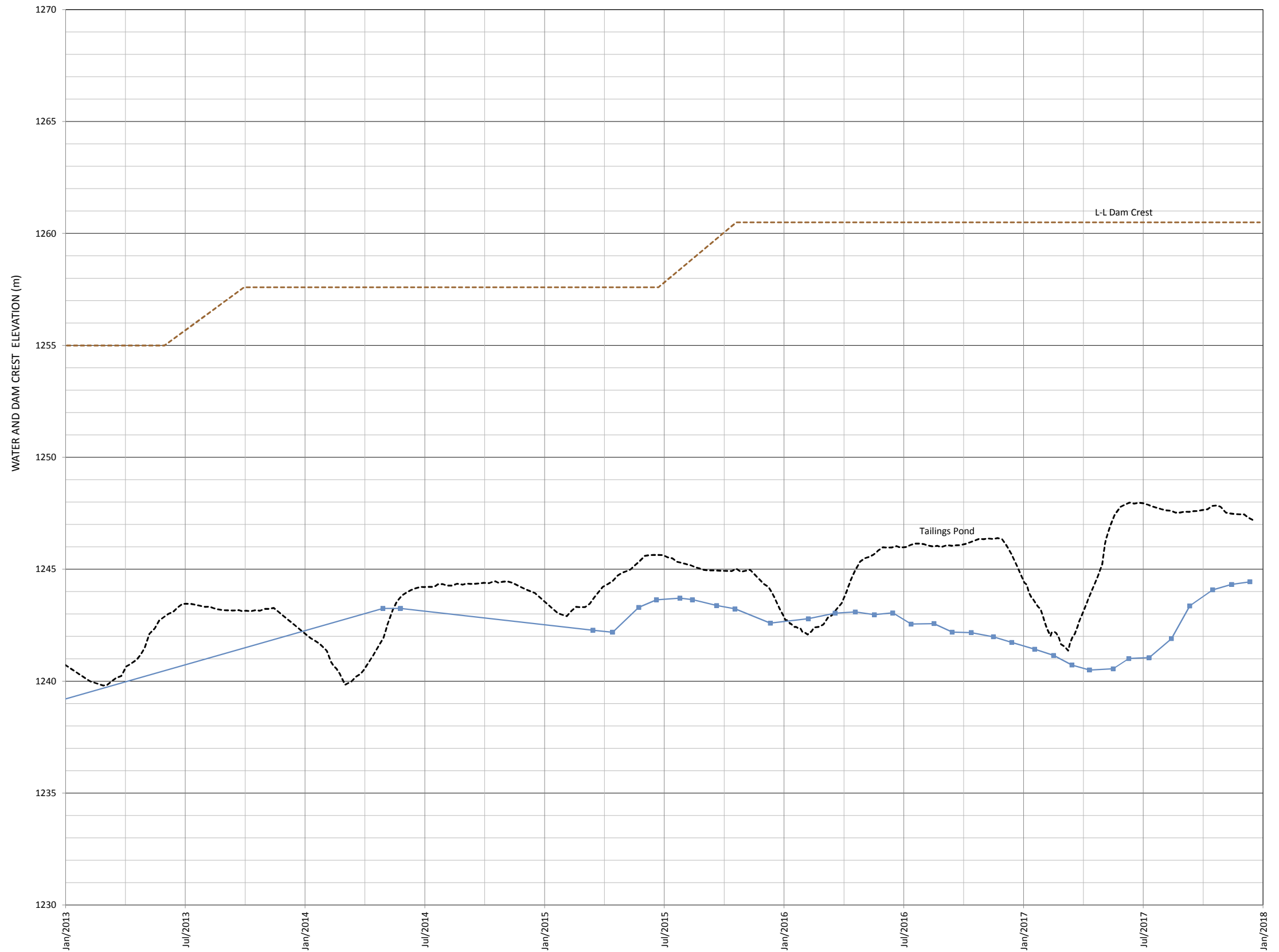


LEGEND:

- P02-6
(Tip El. 1188.40 m, U/S Dam Fill (Cycloned Sand))

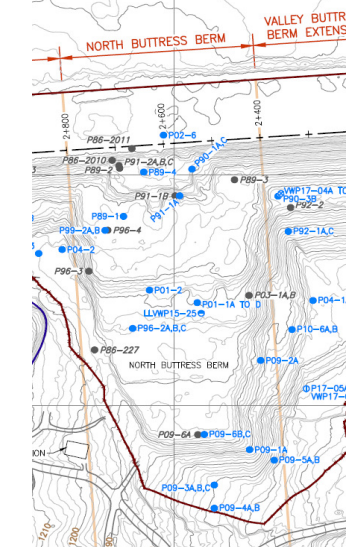
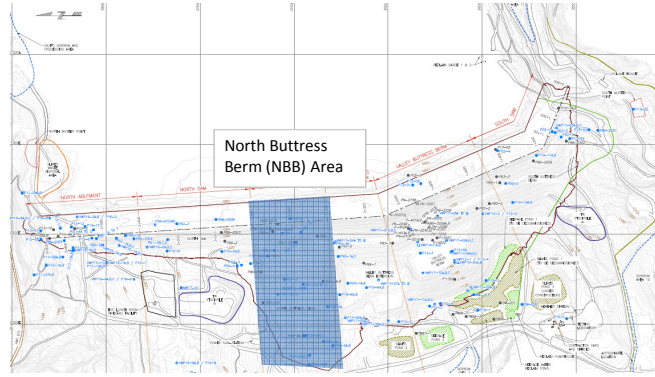
NOTES:

- U/S = Upstream of dam centerline
- D/S = Downstream of dam centerline



March 19, 2018
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AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.	CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		TITLE L-L DAM PIEZOMETRIC DATA U/S DAM FILL 2013-2017 NORTH BUTTRESS BERM (STNS 2+400 m to 2+800 m)
PROJECT NO. M02341B26		FIG. V-7b

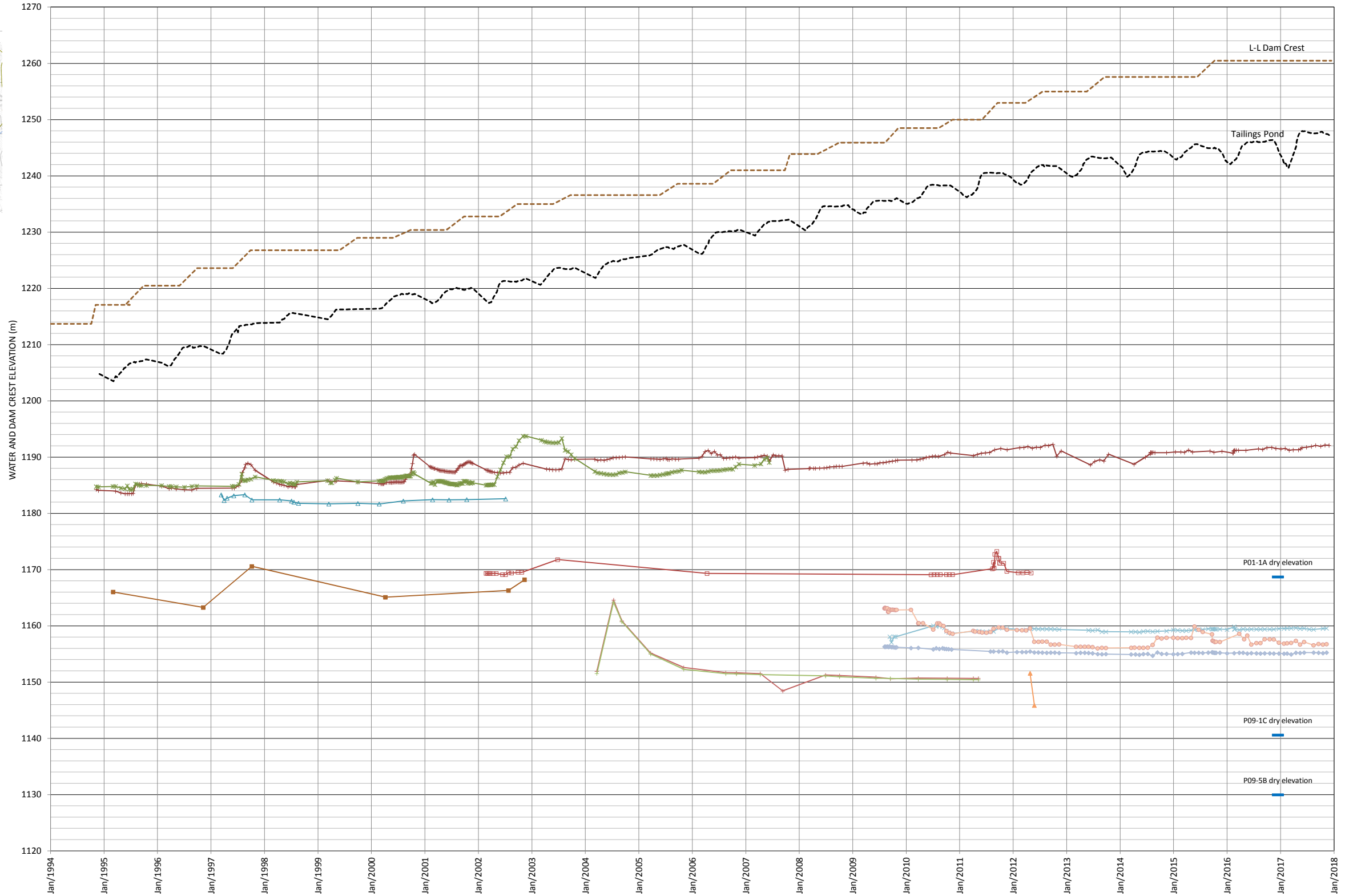


LEGEND:

- P89-3 (Tip El. 1166.30 m, Assumed Glacial Till)
- P90-1A (Tip El. 1168.50 m, Glacial Till)
- P90-1B (Tip El. 1155.30 m, Sand and Gravel)
- P96-4 (Tip El. 1171.50 m, Glacial Till)
- P01-1A (Tip El. 1168.72 m, Glacial Till)
- P03-1A (Tip El. 1149.59 m, Assumed Glacial Till)
- P03-1B (Tip El. 1149.67 m, Assumed Glacial Till)
- P09-1C (Tip El. 1140.60 m, Glacial Till)
- P09-3C (Tip El. 1142.40 m, Glaciolacustrine)
- P09-4B (Tip El. 1124.20 m, Glaciolacustrine)
- P09-5B (Tip El. 1129.40 m, Glaciofluvial (Sand/Gravel))
- P09-6C (Tip El. 1158.30 m, Glacial Till)

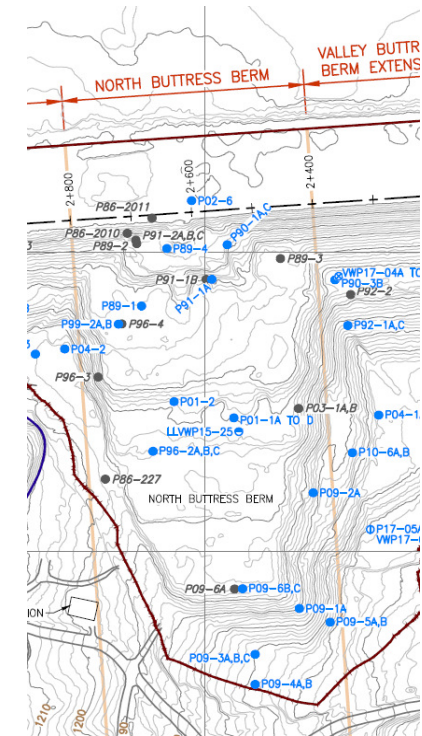
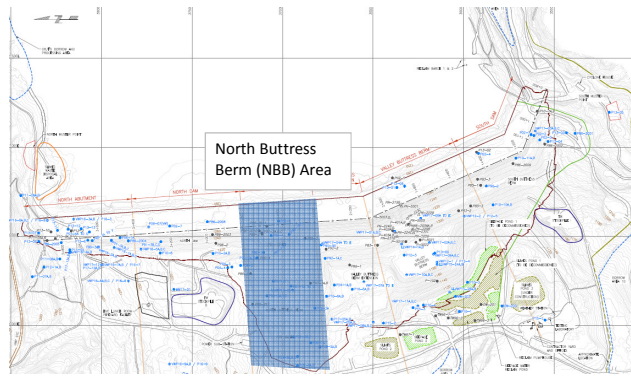
NOTES:

U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 P09-5B has been dry since 2009
 P09-1C has been dry since 2009 with the exception of construction spikes in 2012
 P01-1A has been dry since 2012



March 13, 2018 Z:\MVC\RM\02341B26 - HMC\2017 Dam Safety Support\300 Design\Piezo Data\Highland\Final 2017\revised\180109 Master L-L Piezo Files - 2017_xm\Mapout (V.26)

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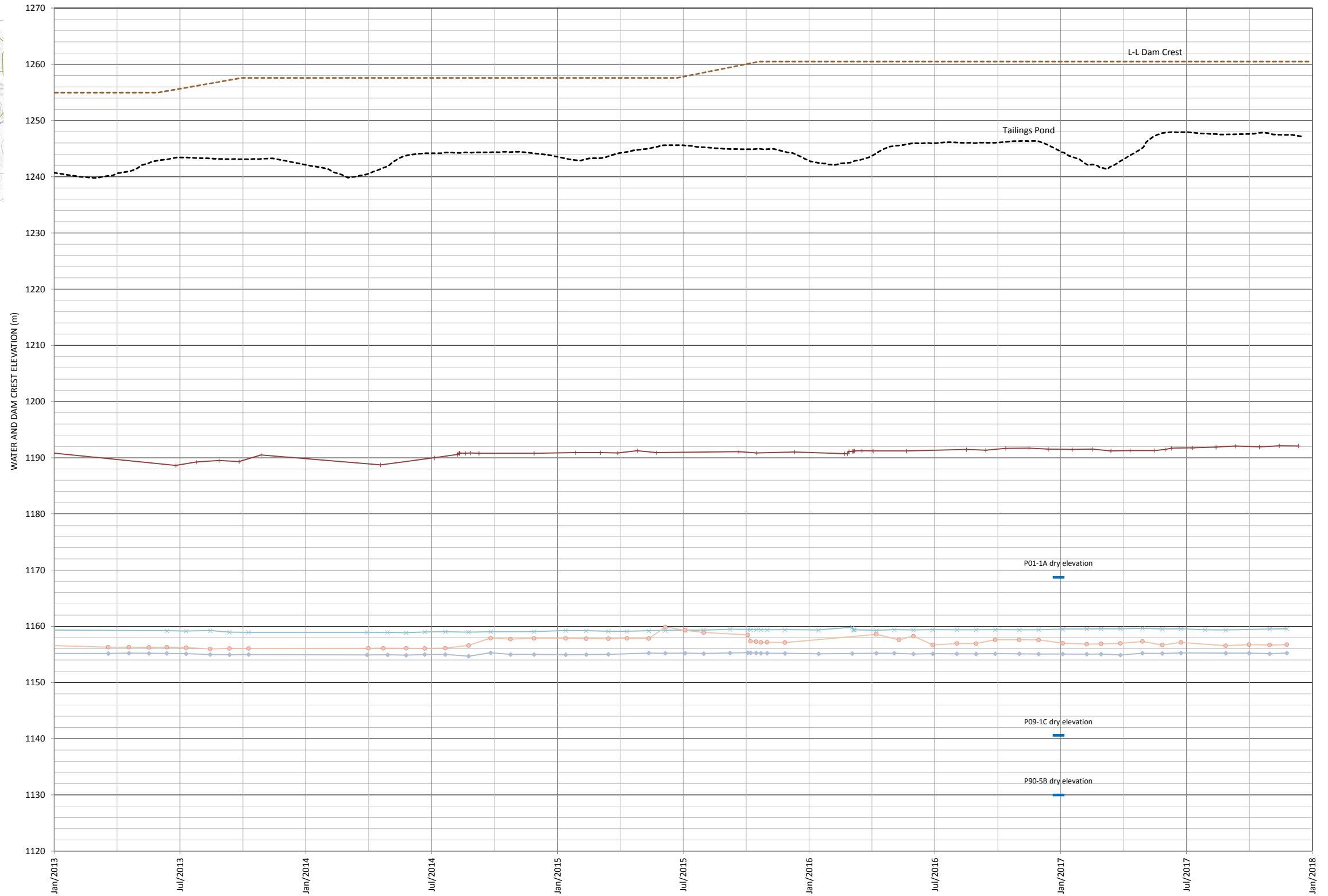


LEGEND:

- +— P90-1A (Tip El. 1168.50 m, Glacial Till)
- P01-1A (Tip El. 1168.72 m, Glacial Till)
- ▲— P09-1C (Tip El. 1140.60 m, Glacial Till)
- ×— P09-3C (Tip El. 1142.40 m, Glaciolacustrine)
- ◇— P09-4B (Tip El. 1124.20 m, Glaciolacustrine)
- △— P09-5B (Tip El. 1129.40 m, Glaciofluvial (Sand/Gravel))
- P09-6C (Tip El. 1158.30 m, Glacial Till)

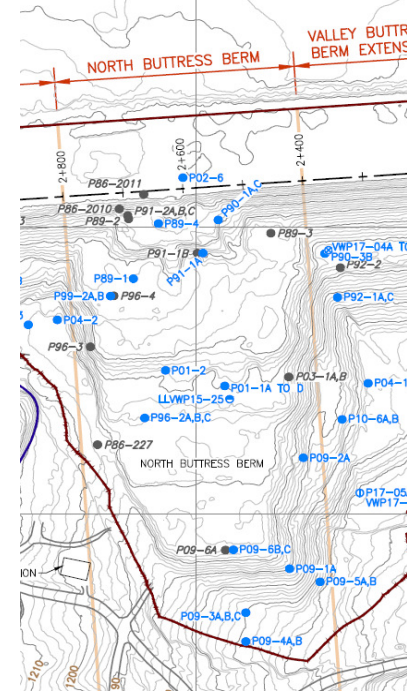
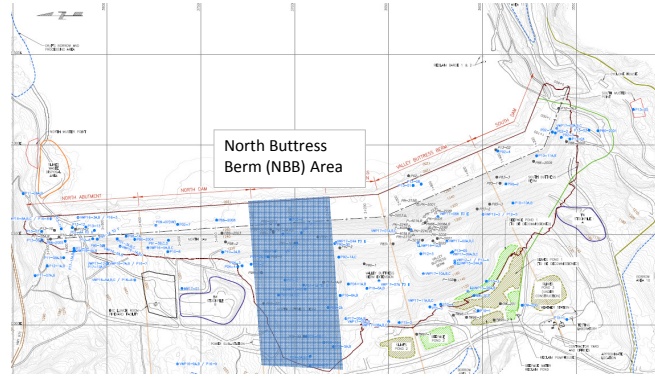
NOTES:

- U/S = Upstream of dam centerline
- D/S = Downstream of dam centerline
- P09-5B has been dry since 2009
- P09-1C has been dry since 2009 with the exception of construction spikes in 2012
- P01-1A has been dry since 2012



March 13, 2018 Z:\MCH\20241826 - HVC-2017 Dam Safety Support\030 Designer\Prado Data\Highland\Final 2017 version\180709 Master L-L Piezo Plot - 2017.dwg\Plot (V.2a)

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	<p>Klohn Crippen Berger</p>	<p>TITLE</p> <p>L-L DAM PIEZOMETRIC DATA OVERBURDEN 2013-2017</p> <p>NORTH BUTTRESS BERM (STNS 2+400 m to 2+800 m)</p>
<p>PROJECT No. M02341B26</p>		<p>FIG. No. V-8b</p>

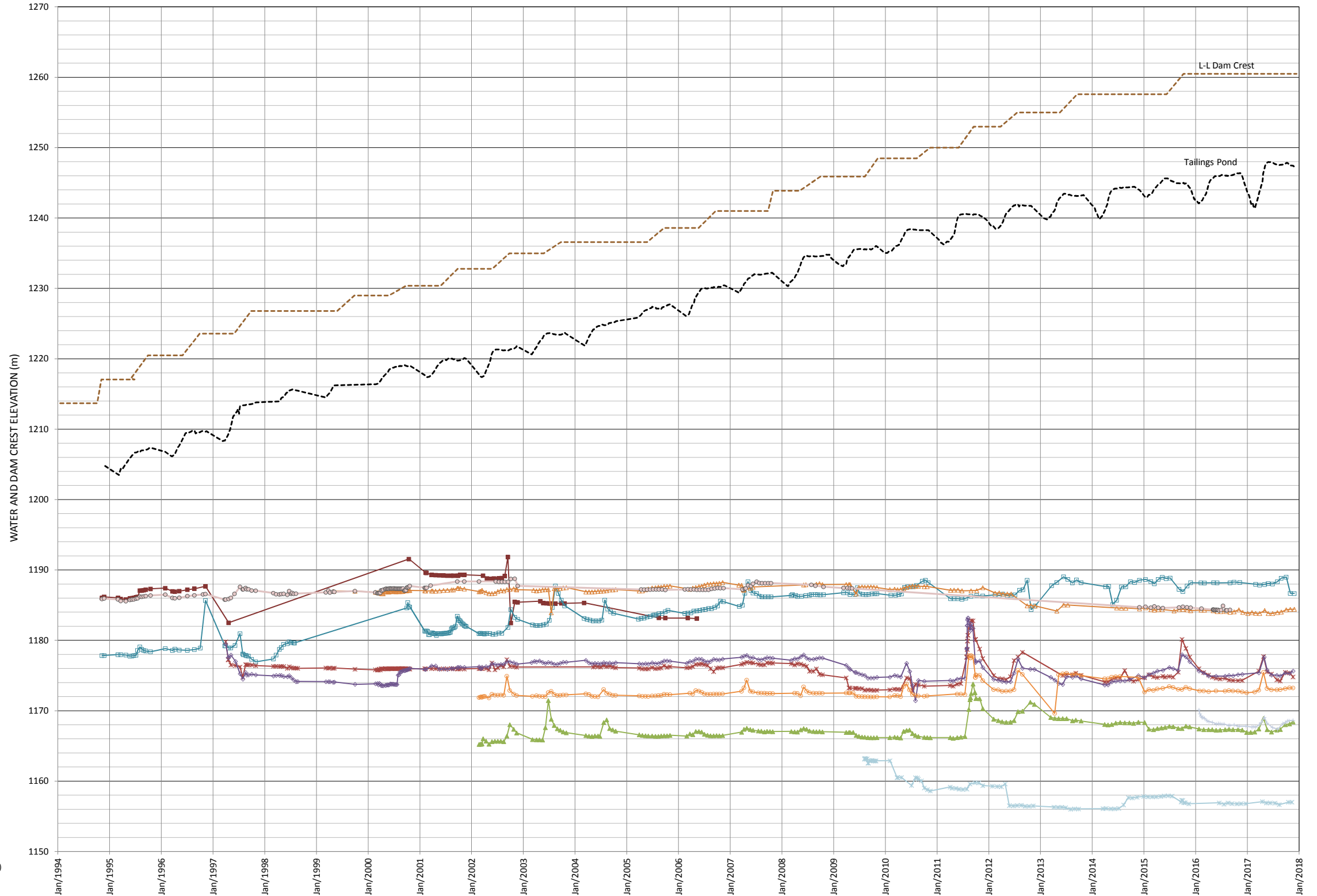


LEGEND:

- P86-2010 (Tip El. 1152.80 m, Volcanics)
- P96-2A (Tip El. 1172.10 m, Volcanics)
- P99-2A (Tip El. 1149.90 m, Volcanics)
- P91-2C (Tip El. 1166.3 m, Lower Volcanics)
- P09-6B (Tip El. 1143.80 m, Volcanics)
- P91-1A (Tip El. 1159.50 m, Volcanics)
- P96-2C (Tip El. 1120.90 m, Volcanics)
- P01-1B (Tip El. 1161.20 m, Volcanics)
- P01-2 (Tip El. 1167.10 m, Volcanics)
- LLVWP15-25 (Tip El. 1135.15 m, Upper Volcanics)

NOTES:

U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 P86-2010 plugged from 2006 onwards, currently plugged at ~1203 m to 1207 m

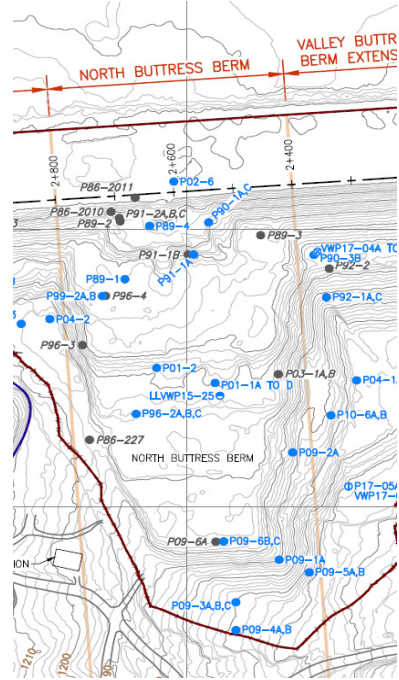
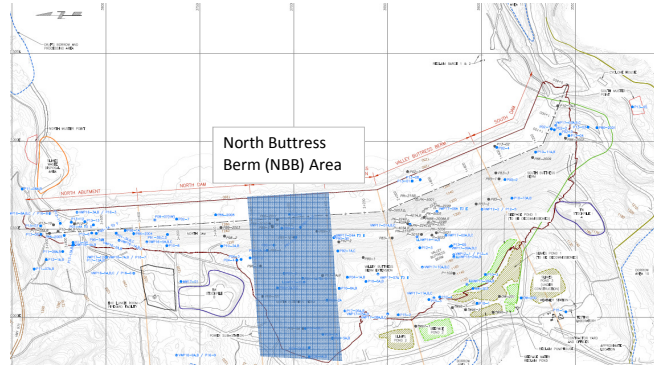


March 13, 2018 Z:\MVC\CR\202341B26 - HVCC-2017 Dam Safety Support\300 Design\Drawings\Highland Final 2017 version\180109 Master L-L Piezo Plot - 2017 Asm\N\About V.9a

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CLIENT
**TECK HIGHLAND VALLEY
 COPPER PARTNERSHIP**

PROJECT	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
TITLE	L-L DAM PIEZOMETRIC DATA VOLCANIC BEDROCK 1994-2017 NORTH BUTTRESS BERM (STNS 2+400 m to 2+800 m)
PROJECT No.	M02341B26
FIG. No.	V-9a

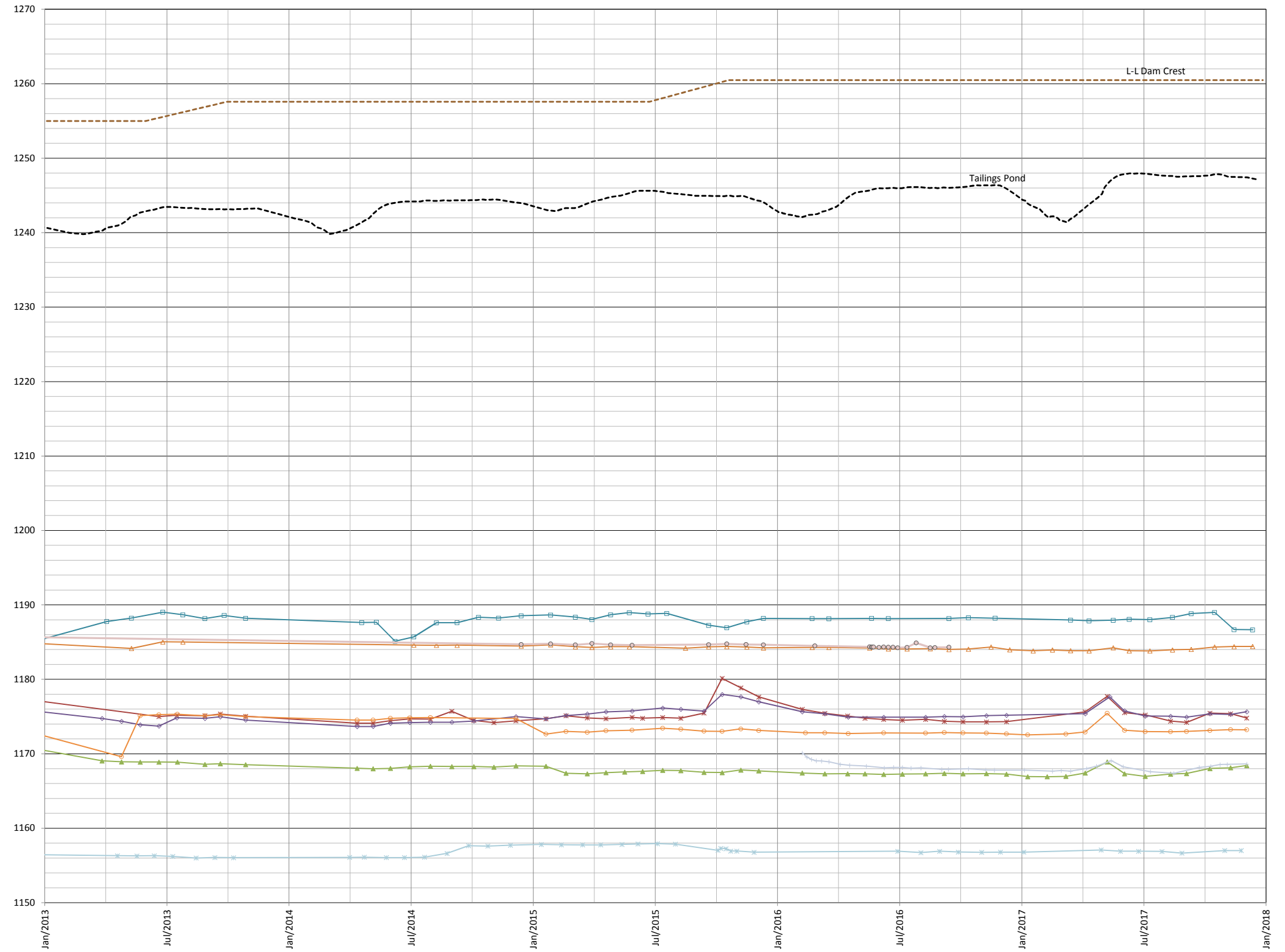


LEGEND:

- P91-1A (Tip El. 1159.50 m, Volcanics)
- P99-2A (Tip El. 1149.90 m, Volcanics)
- P01-2 (Tip El. 1167.10 m, Volcanics)
- P96-2A (Tip El. 1172.10 m, Volcanics)
- P01-1B (Tip El. 1161.20 m, Volcanics)
- P09-6B (Tip El. 1143.80 m, Volcanics)
- P96-2C (Tip El. 1120.90 m, Volcanics)
- P91-2C (Tip El. 1166.3 m, Lower Volcanics)
- LLVWP15-25 (Tip El. 1135.15 m, Upper Volcanics)

NOTES:
 U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline

WATER AND DAM CREST ELEVATION (m)

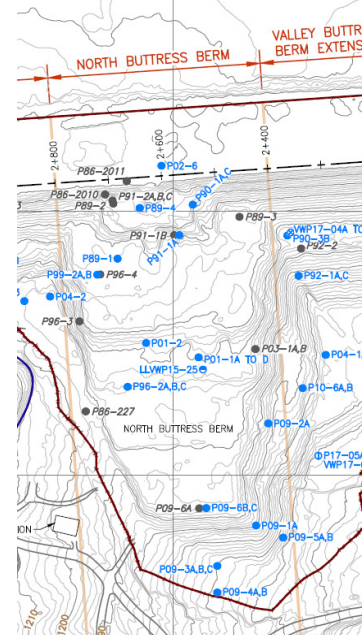
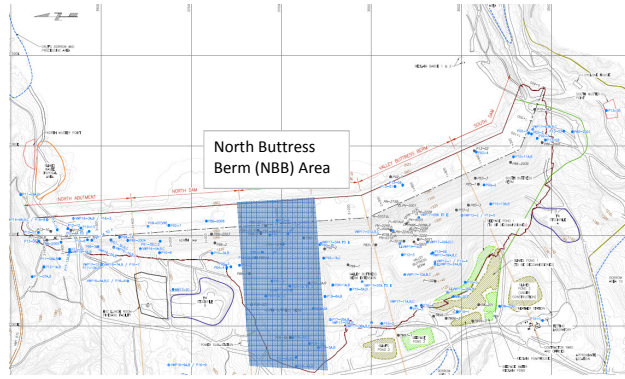


March 13, 2018
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CLIENT
**TECK HIGHLAND VALLEY
 COPPER PARTNERSHIP**

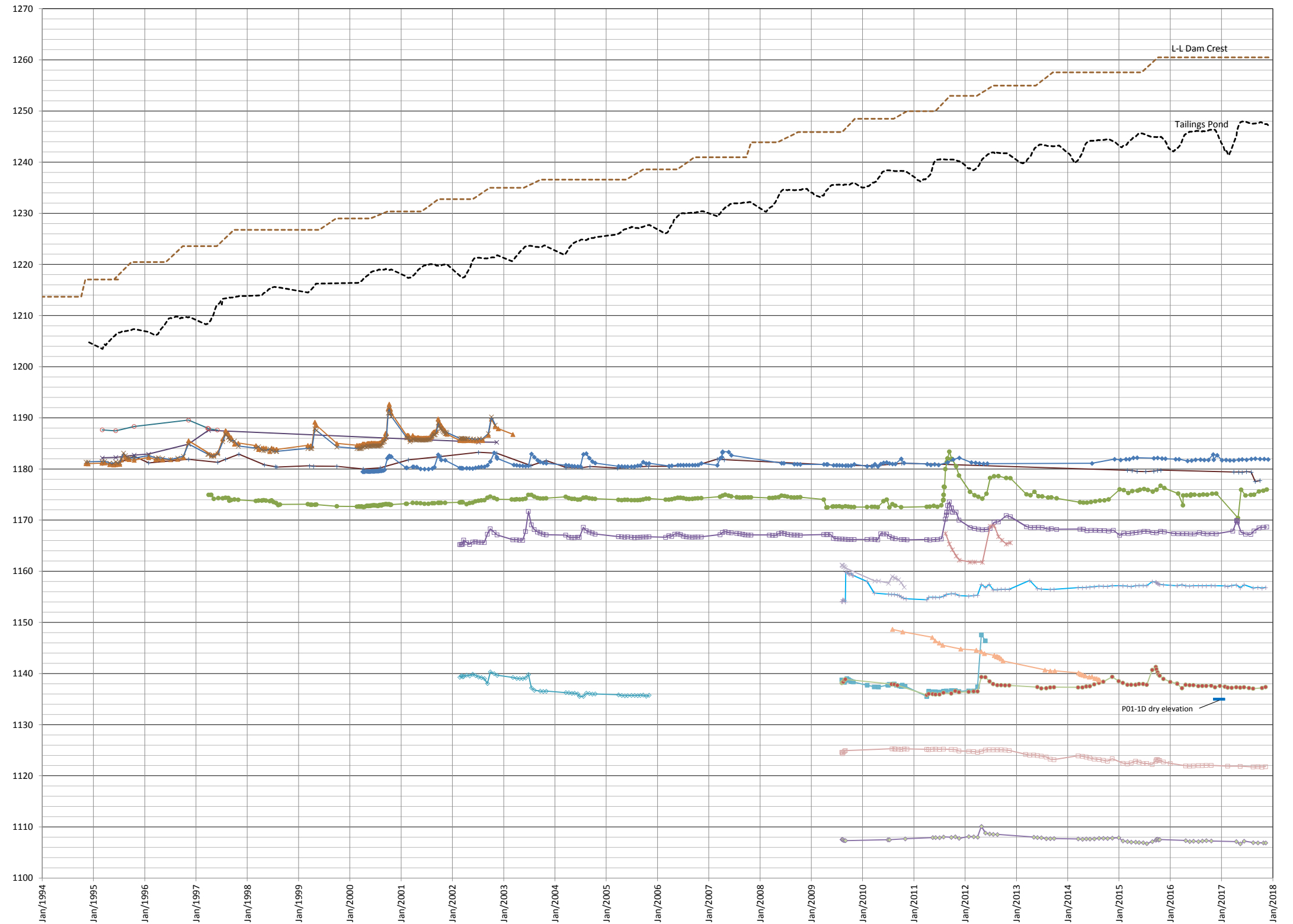
PROJECT	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
TITLE	L-L DAM PIEZOMETRIC DATA VOLCANIC BEDROCK 2013-2017 NORTH BUTTRESS BERM (STNS 2+400 m to 2+800 m)
PROJECT NO.	M02341B26
FIG. NO.	V-9b



LEGEND:

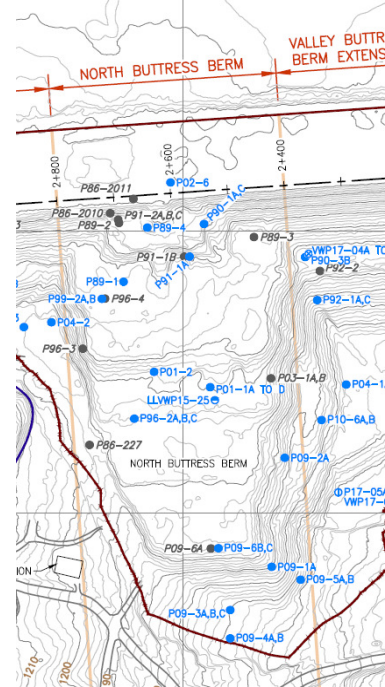
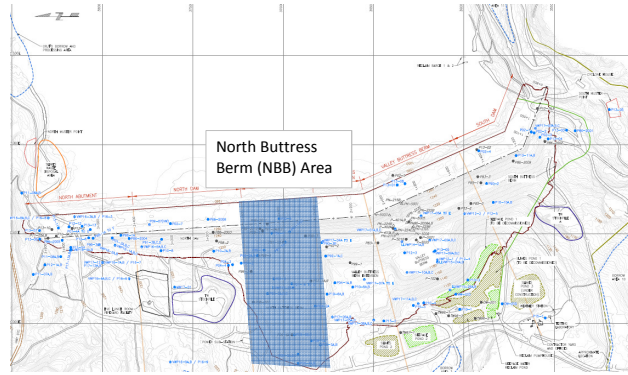
- ✕ P89-1 (Tip El. 1171.70 m, Sedimentary)
- ✕ P89-4 (Tip El. 1180.30 m, Assumed Sedimentary)
- ✕ P91-1C (Tip El. 1146.10 m, Sedimentary)
- ◆ P99-2B (Tip El. 1133.50 m, Lower Sedimentary)
- ◆ P01-1D (Tip El. 1134.80 m, Lower Sedimentary)
- ◆ P09-1B (Tip El. 1125.80 m, Sedimentary)
- ◆ P09-2B (Tip El. 1131.70 m, Sedimentary)
- ◆ P09-3B (Tip El. 1129.50 m, Sedimentary)
- ◆ P09-5A (Tip El. 1121.20 m, Sedimentary)
- ◆ P89-2 (Tip El. 1183.40 m, Assumed Sedimentary)
- ◆ P91-1B (Tip El. 1151.50 m, Sedimentary)
- ◆ P96-2B (Tip El. 1145.60 m, Sedimentary)
- ◆ P01-1C (Tip El. 1148.70 m, Lower Sedimentary)
- ◆ P09-1A (Tip El. 1103.60 m, Sedimentary)
- ◆ P09-2A (Tip El. 1124.70 m, Sedimentary)
- ◆ P09-3A (Tip El. 1113.30 m, Sedimentary)
- ◆ P09-4A (Tip El. 1109.80 m, Sedimentary)
- ◆ P09-6A (Tip El. 1124.80 m, Sedimentary)

NOTES:
 U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 P89-2 was plugged from 1997 to 2012, destroyed in 2012
 P89-4 plugged in 2016 at El. 1240 m
 P01-1D has been dry since 2006
 P09-4A was plugged from 2013 to mid 2014
 P09-6A became plugged in 2011 and was decommissioned in 2012



March 18, 2018
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	<p>Klohn Crippen Berger</p>	<p>TITLE L-L DAM PIEZOMETRIC DATA SEDIMENTARY BEDROCK 1994-2017</p> <p>NORTH BUTTRISS BERM (STNS 2+400 m to 2+800 m)</p>
	<p>PROJECT No. M02341B26</p>	<p>REV No. V-10a</p>

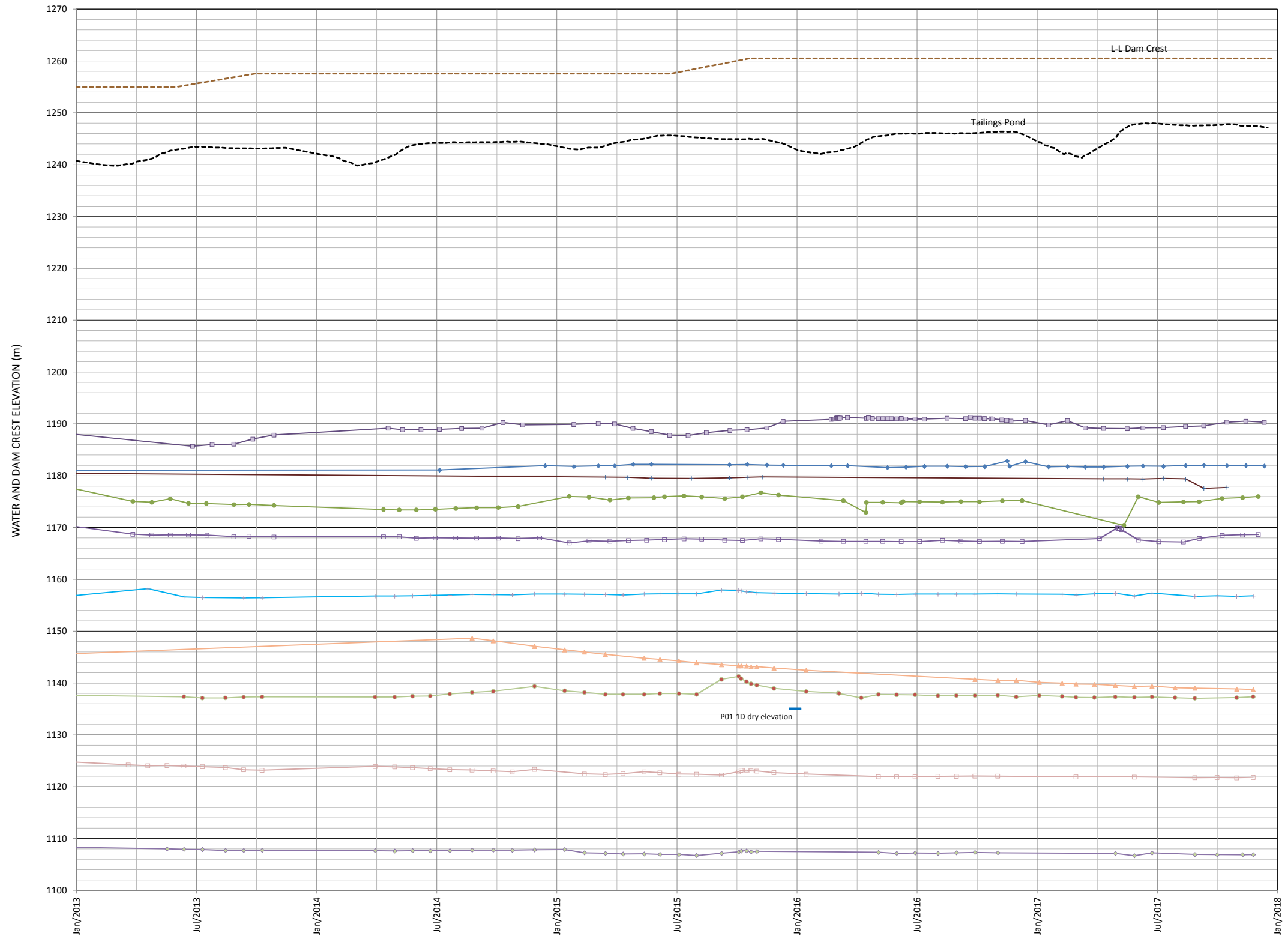


LEGEND:

- P89-4 (Tip El. 1180.30 m, Assumed Sedimentary)
- P96-2B (Tip El. 1145.60 m, Sedimentary)
- P01-1C (Tip El. 1148.70 m, Lower Sedimentary)
- P09-1A (Tip El. 1103.60 m, Sedimentary)
- P09-2A (Tip El. 1124.70 m, Sedimentary)
- P09-3B (Tip El. 1129.50 m, Sedimentary)
- P09-5A (Tip El. 1121.20 m, Sedimentary)
- P90-1C (Tip El. 1145.00 m, Sedimentary)
- P99-2B (Tip El. 1133.50 m, Lower Sedimentary)
- P01-1D (Tip El. 1134.80 m, Lower Sedimentary)
- P09-1B (Tip El. 1125.80 m, Sedimentary)
- P09-3A (Tip El. 1113.30 m, Sedimentary)
- P09-4A (Tip El. 1109.80 m, Sedimentary)

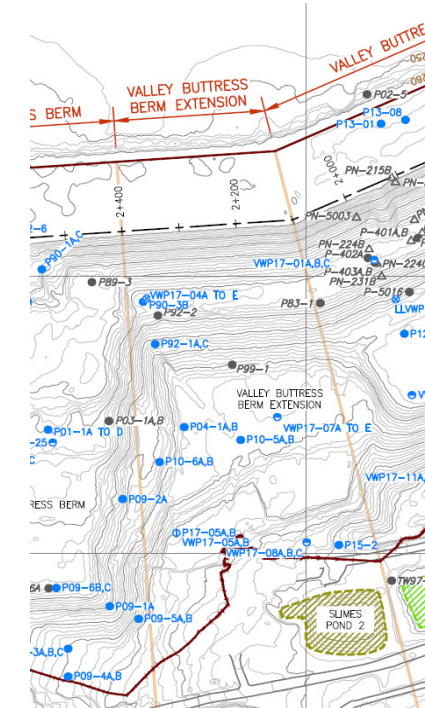
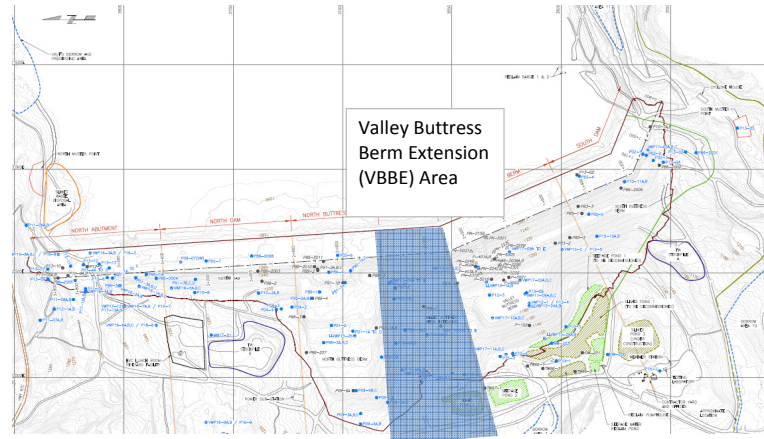
NOTES:

U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 P89-4 plugged in 2016 at El. 1240 m
 P01-1D has been dry since 2006
 P09-4A was plugged from 2013 to mid 2014



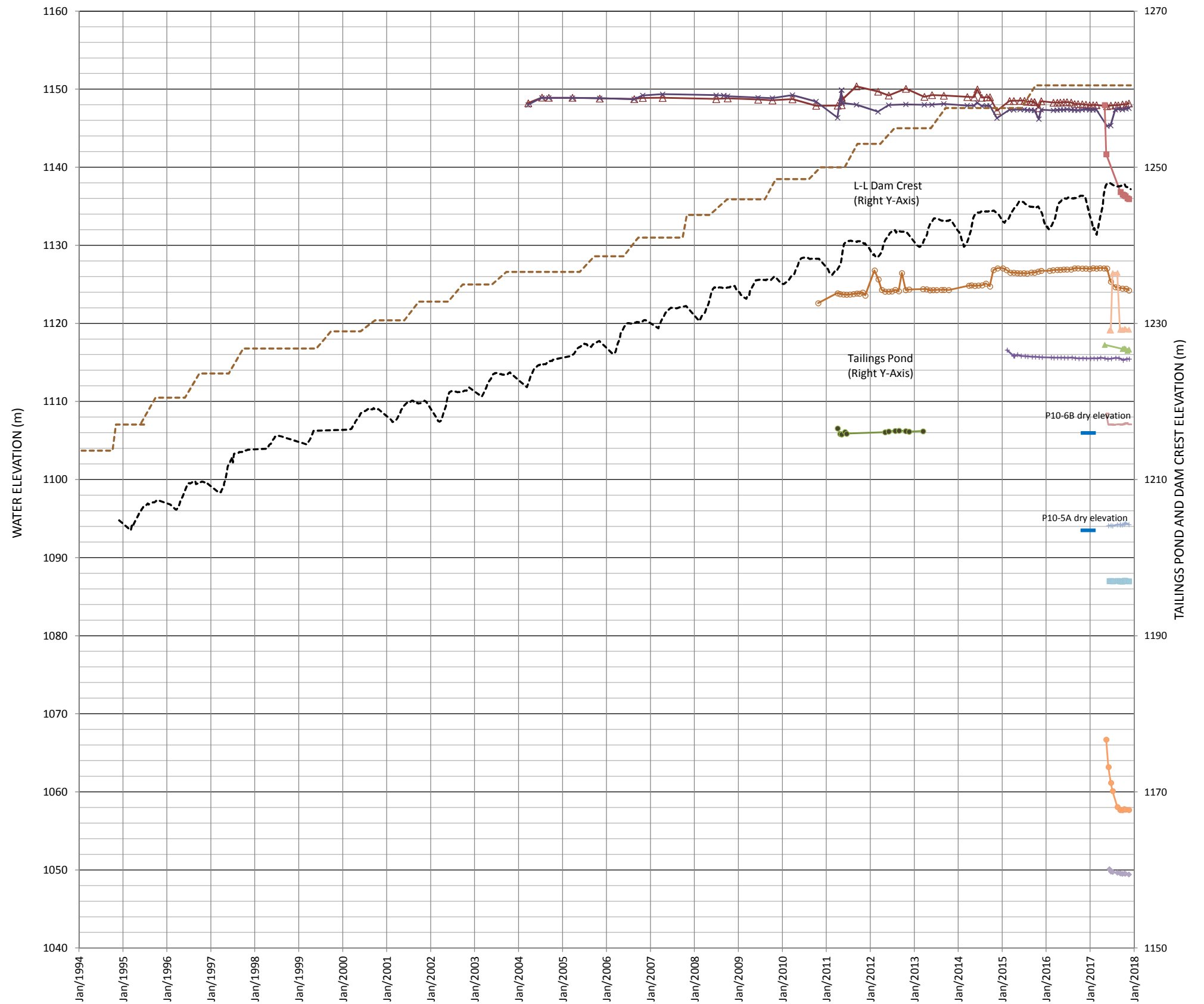
March 15, 2018
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		FILE: L-L DAM PIEZOMETRIC DATA SEDIMENTARY BEDROCK 2013-2017 NORTH BUTTRESS BERM (STNS 2+400 m to 2+800 m)
PROJECT NO: MO2341B26		SHEET: V-10b



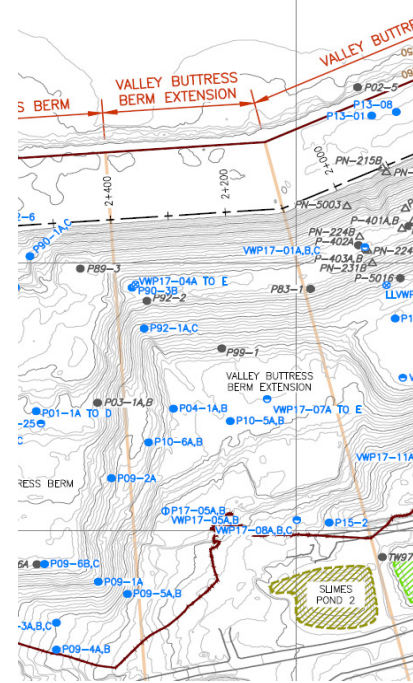
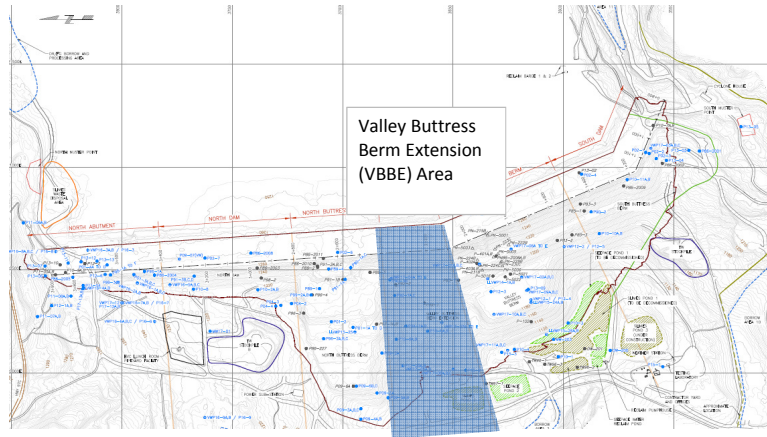
- LEGEND:**
- ▲ P04-1A (Tip El. 1145.93, Glacial Till)
 - P10-5B (Tip El. 1120.3, Glacial Till / Glaciolacustrine)
 - ◆ P15-2 (Tip El. 1111.65, Glacial Till)
 - LLVWP 17-04 E (Tip El. 1133.9 m, Glacial Till)
 - ◆ LLVWP 17-05B (Tip El. 1139.1 m, Sand and Gravel Drainage Blanket)
 - ◆ LLVWP 17-07 C (Tip El. 1094.1 m, Glaciofluvial)
 - ◆ LLVWP 17-07 E (Tip El. 1132.1 m, Sand and Gravel Drainage Blanket)
 - ◆ LLVWP 17-08 A (Tip El. 1036.4 m, Sand and Gravel (Silt Layer))
 - ◆ P17-05B (Tip El. 1086.89 (Lower Sand and Gravel))
 - ◆ P04-1B (Tip El. 1146.63, Sand and Gravel)
 - ◆ P10-6B (Tip El. 1106.0, Glaciofluvial)
 - ◆ LLVWP 17-04 D (Tip El. 1116.9 m, Glaciofluvial)
 - ◆ LLVWP 17-05A (Tip El. 1133.4 m, Glacial Till)
 - ◆ LLVWP 17-07 B (Tip El. 1057.3 m, Glaciofluvial)
 - ◆ LLVWP 17-07 D (Tip El. 1106.9 m, Glacial Till)
 - ◆ LLVWP 17-08 C (Tip El. 1119.0 m, Glacial Till)
 - ◆ LLVWP 17-08 B (Tip El. 1087.0 m, Glaciofluvial)

NOTES:
 U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 P10-5A has been dry since 2010 installation
 P90-3A was dry from 1995 records to 2005 and then plugged thereafter, currently plugged at ~El. 1148 m
 P10-6B has been dry since 2013 at tip El. 1106 m
 Log is missing for P04-1 drillhole. Tip is likely within the Glacial Till, based on interpolation of geology from adjacent drillholes



March 13, 2018 Z:\MVC\RM0234\B26 - HVC-2017 Dam Safety Support\300 Design\Piezo Data\Highland\Final 2017 version\180109 Master\L-L Piezo Plots - 2017.xem\NAbut (V-2a)

AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND NOTIFICATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR HEREINAFTER, OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.	CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		TITLE L-L DAM PIEZOMETRIC DATA OVERBURDEN 1994-2017 VALLEY BUTTRESS BERM EXTENSION (STNS 2+100 m to 2+400 m)
	PROJECT NO. M02341B26	FIG NO. V-11a

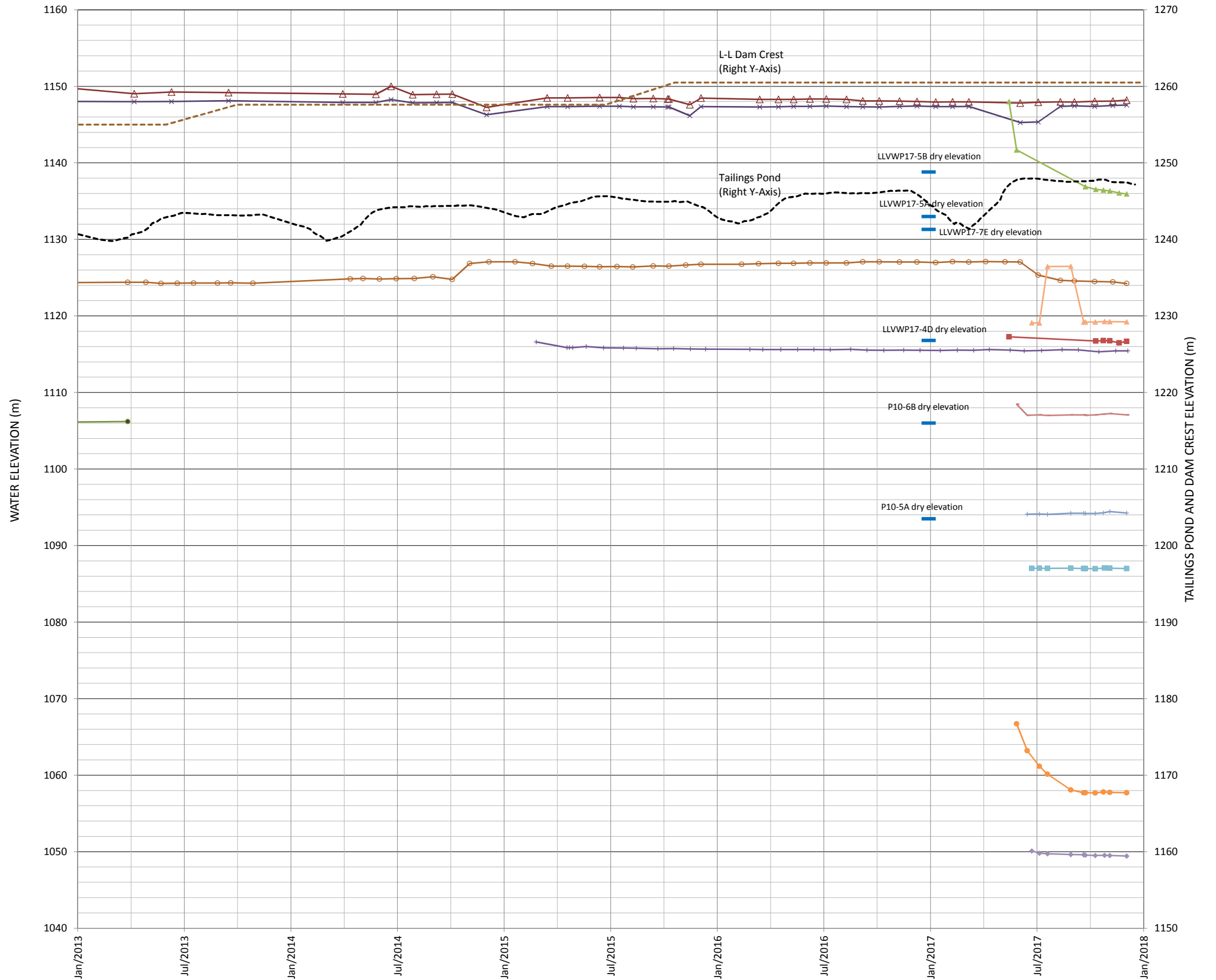


LEGEND:

- ▲ P04-1A (Tip El. 1145-93, Glacial Till)
- P10-5B (Tip El. 1120.3, Glacial Till / Glaciolacustrine)
- P15-2 (Tip El. 1111.65, Glacial Till)
- LLVWP 17-04 E (Tip El. 1133.9 m, Glacial Till)
- LLVWP 17-05B (Tip El. 1139.1 m, Sand and Gravel Drainage Blanket)
- LLVWP 17-07 C (Tip El. 1094.1 m, Glaciofluvial)
- LLVWP 17-07 E (Tip El. 1132.1 m, Sand and Gravel Drainage Blanket)
- LLVWP 17-08 B (Tip El. 1087.0 m, Glaciofluvial)
- P17-05B (Tip El. 1086.89 (Lower Sand and Gravel))
- ✕ P04-1B (Tip El. 1146.63, Sand and Gravel)
- P10-6B (Tip El. 1106.0, Glaciofluvial)
- LLVWP 17-04 D (Tip El. 1116.9 m, Glaciofluvial)
- ✕ LLVWP 17-05A (Tip El. 1133.4 m, Glacial Till)
- LLVWP 17-07 B (Tip El. 1057.3 m, Glaciofluvial)
- LLVWP 17-07 D (Tip El. 1106.9 m, Glacial Till)
- LLVWP 17-08 A (Tip El. 1036.4 m, Sand and Gravel (Silt Layer))
- LLVWP 17-08 C (Tip El. 1119.0 m, Glacial Till)

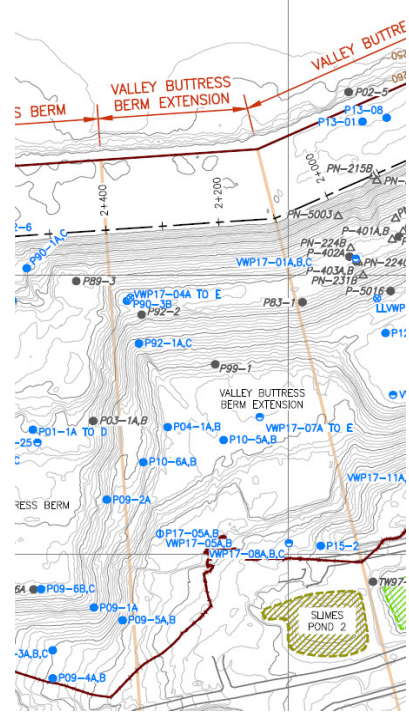
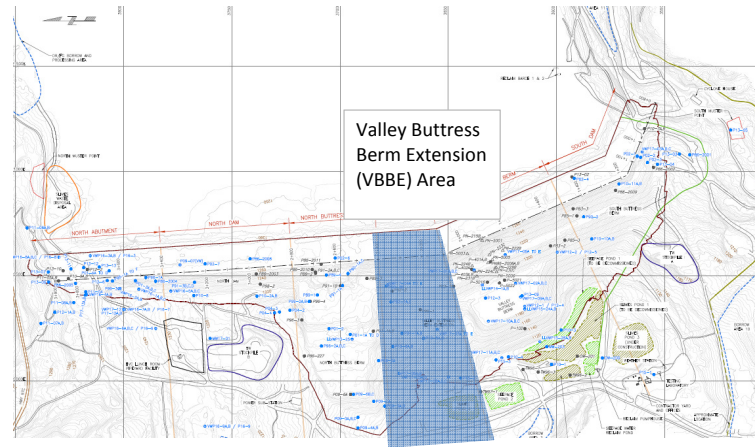
NOTES:

U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 P10-5A has been dry since 2010 installation
 P10-6B has been dry since 2013 at tip El. 1106 m.
 Log is missing for P04-1 drillhole. Tip is likely within the Glacial Till, based on interpolation of geology from adjacent drillholes.
 LLVWP 17-4D, 17-5A a17-55B and 17-7E have been dry since installation



March 15, 2018
 Z:\M\CDM\0241826 - HV\2017 Dam Safety Support\00 Design\Drawings\2017 version\180109 Master L-L Piezo Plot - 2017.xdml\A04b (V2a)

<p>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND REGULATORS, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND INTENDED FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR RELATIONS OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</p>	<p>TECK HIGHLAND VALLEY COPPER PARTNERSHIP</p>	<p>PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION</p> <p>TITLE: L-L DAM PIEZOMETRIC DATA OVERBURDEN AND DAM FILL 2013-2017</p> <p>VALLEY BUTRESS BERM EXTENSION (STNS 2+100 m to 2+400 m)</p> <p>PROJECT NO.: M02341B26 FIG. NO.: V-11b</p>
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LEGEND:

- ◆ P92-1A
(Tip El. 1076.7 m, Sedimentary)
- ▲ P92-1C
(Tip El. 1032.7 m, Sedimentary)
- LLVWP 17-04 A
(Tip El. 1007.8 m, Sedimentary)
- LLVWP 17-04 C
(Tip El. 1074.9 m, Sedimentary)
- ◆ P17-05A
(Tip El. 1076.64, Sedimentary)
- P92-1B
(Tip El. 1047.5 m, Sedimentary)
- ✕ P10-6A
(Tip El. 1044.70 m, Sedimentary)
- LLVWP 17-04 B
(Tip El. 1038.9 m, Sedimentary)
- LLVWP 17-07 A
(Tip El. 1046.3 m, Granodiorite)

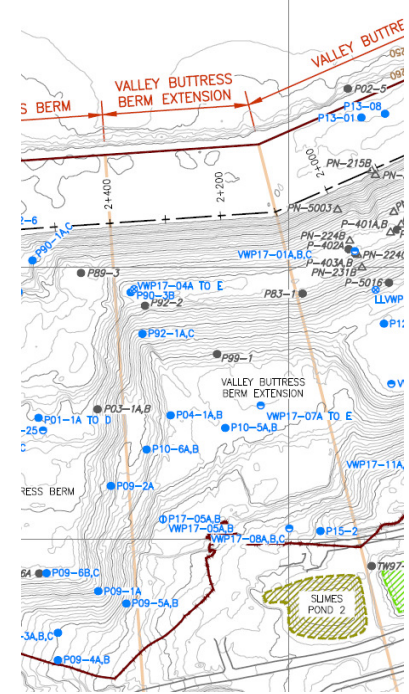
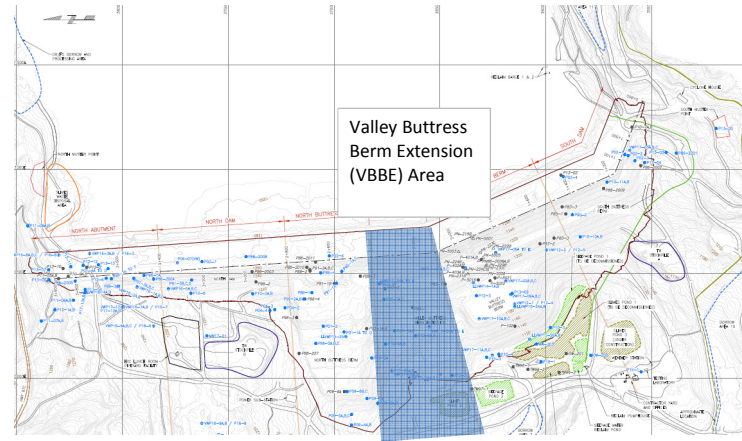
NOTES:

- U/S = Upstream of dam centerline
- D/S = Downstream of dam centerline
- P90-3B has been dry since 1995 records
- P92-2 has been plugged since 2007, currently plugged at ~El. 1151 m
- P99-1 has been plugged since end of 2007, currently plugged at ~El. 1134 m



March 13, 2018
Z:\MVC\CFM02341B26 - HVC-2017 Dam Safety\Support\300 Design\Highland\Final\2017 version\180109 Master L-L Piezo Plots - 2017.xlsm\About (V.2a)

AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC, AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT. FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR REUSE AND/OR PUBLICATION OF DATA, STATISTICS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.	CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		TITLE L-L DAM PIEZOMETRIC DATA BEDROCK 1994-2017 VALLEY BUTTRESS BERM EXTENSION (STNS 2+100 m to 2+400 m)
	PROJECT NO. M02341B26	FIG NO. V-12a

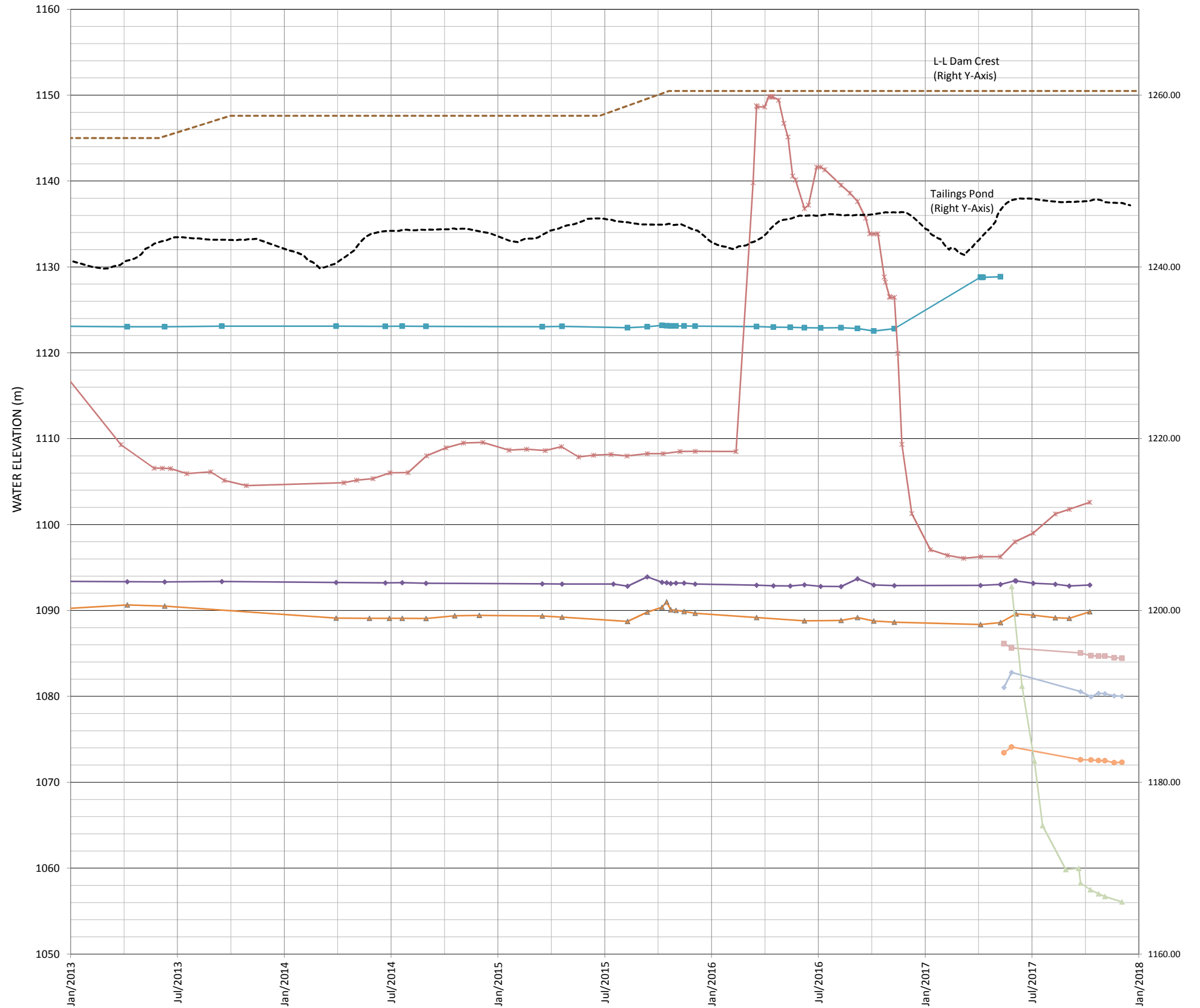


LEGEND:

- ◆ P92-1A (Tip El. 1076.7 m, Sedimentary)
- ▲ P92-1C (Tip El. 1032.7 m, Sedimentary)
- ◆ LLVWP 17-04 A (Tip El. 1007.8 m, Sedimentary)
- LLVWP 17-04 C (Tip El. 1074.9 m, Sedimentary)
- ◆ P17-05A (Tip El. 1076.64, Sedimentary)
- P92-1B (Tip El. 1047.5 m, Sedimentary)
- ✱ P10-6A (Tip El. 1044.70 m, Sedimentary)
- ◆ LLVWP 17-04 B (Tip El. 1038.9 m, Sedimentary)
- ▲ LLVWP 17-07 A (Tip El. 1046.3 m, Granodiorite)

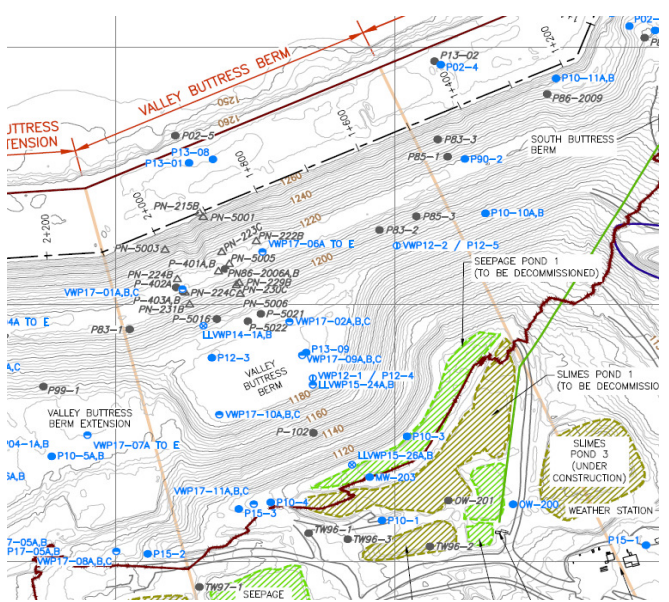
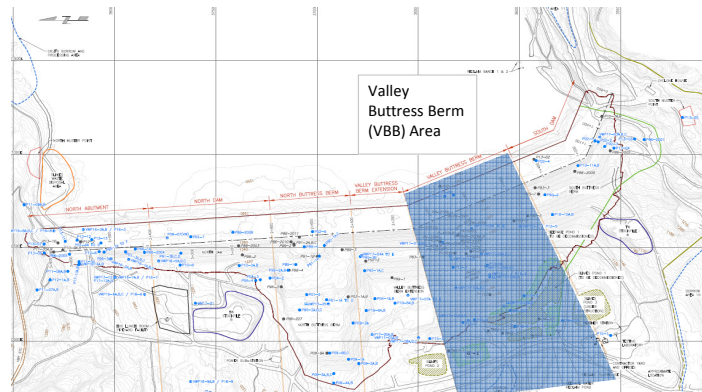
NOTES:

U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 P90-3B has been dry since 1995 records
 P92-1B defunct as of May 2017



March 13, 2018
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<small>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE, INVOICE, PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REPRODUCING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</small>	TECK HIGHLAND VALLEY COPPER PARTNERSHIP	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		L-L DAM PIEZOMETRIC DATA BEDROCK 2013-2017
	PROJECT NO: M02341B26	FIG NO: V-12b

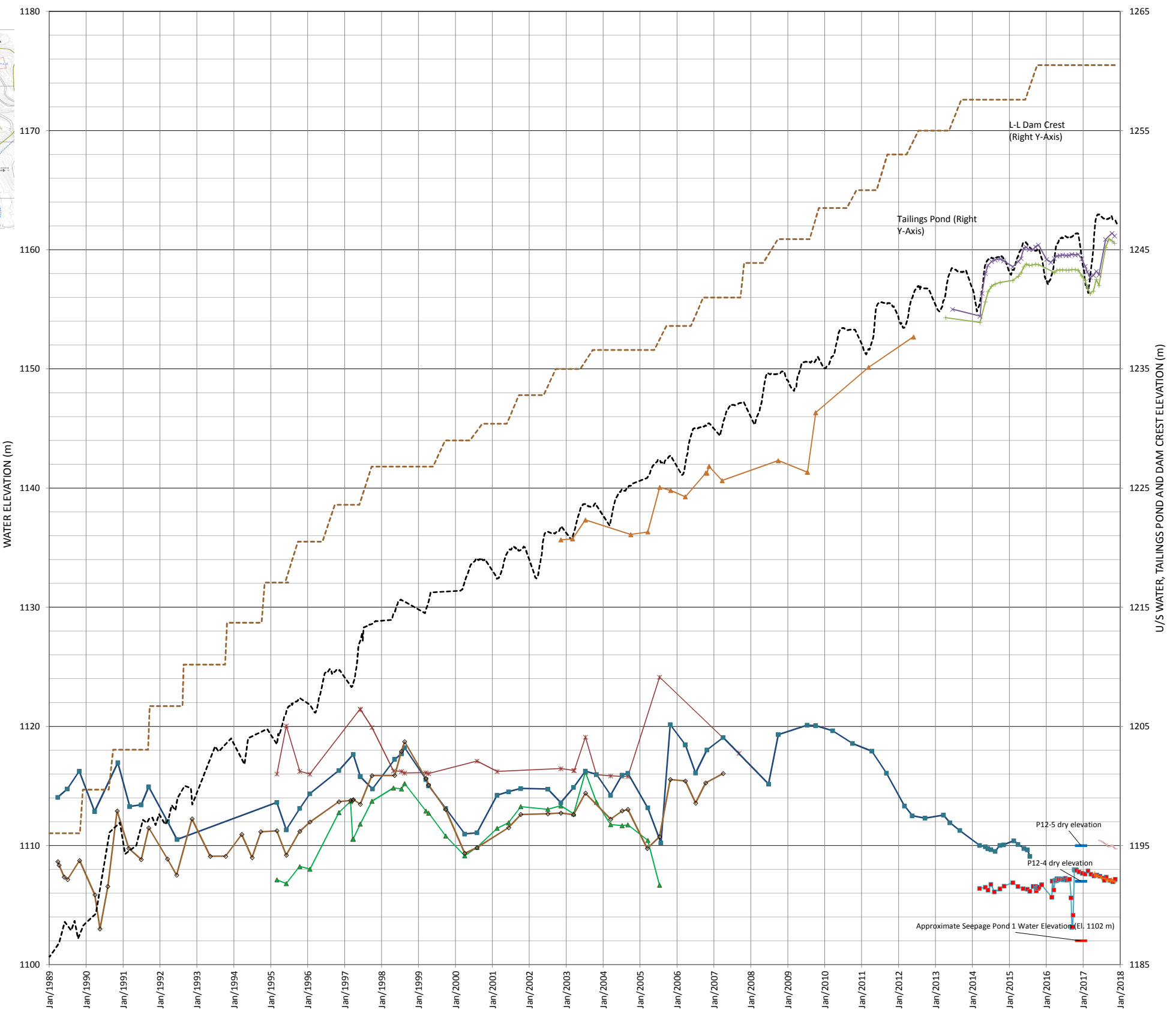


LEGEND:

- P83-2 (Tip El. 1108.30 m, Assumed D/S Dam Fill)
- P85-3 (Tip El. 1114.60 m, Assumed D/S Dam Fill)
- P12-4 (Tip El. 1108.80 m, D/S Dam Fill)
- P12-5 (Tip El. 1111.30 m, D/S Dam Fill (Cycloned Sand))
- P13-9 (Tip El. 1091.30 m, S&G Drainage Blanket)
- LLVWP 17-02 C (Tip El. 1092.9 m, Sand and Gravel Drainage Blanket)
- P83-1 (Tip El. 1109.9 m, D/S Dam Fill)
- P-5016 (Tip El. unknown, D/S Dam Fill)
- LLVWP 17-06 E (Tip El. 1107.7 m, Sand and Gravel Drainage Blanket)
- P02-5 (Tip El. 1173.50 m, U/S Dam Fill (Cycloned Sand)) - Right Y-Axis
- P13-1 (Tip El. 1176.00 m, U/S Dam Fill (Cycloned Sand)) - Right Y-Axis
- P13-8 (Tip El. 1228.50 m, U/S Dam Fill (Cycloned Sand)) - Right Y-Axis

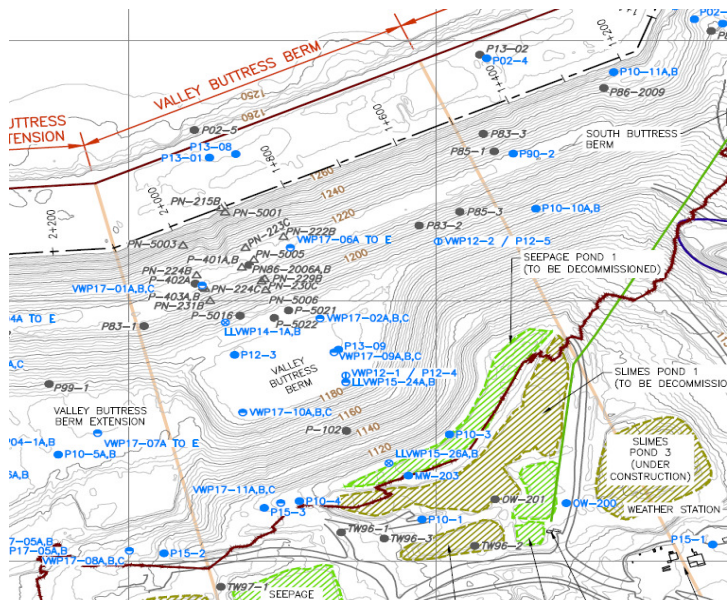
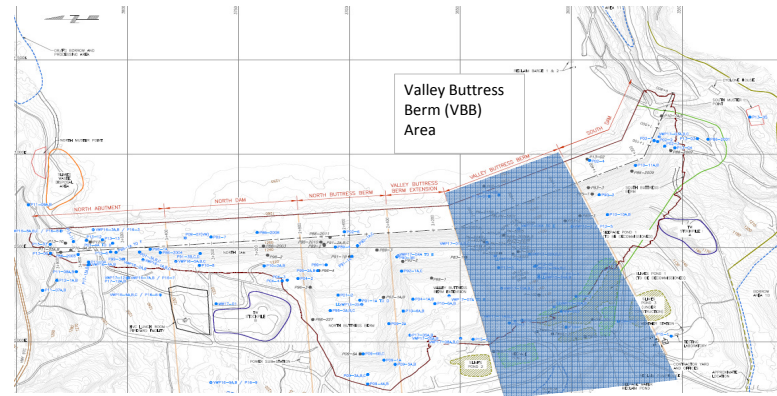
NOTES:

- U/S = Upstream of dam centerline
- D/S = Downstream of dam centerline
- P12-4 dry since 2012 installation
- P12-5 dry since 2012 installation
- P83-1 has been plugged at ~El. 1196 m since 2015



March 19, 2018
 Z:\N\CB\202341B26 - HVC-2017 Dam Safety Support\300 Design\Piezo Data\Highland\Final 2017 version\180109 Master L-L Piezo Plots - 2017 (am) (M\A\B\U\238)

	AS A MATERIAL PROTECTION TO OUR CLIENT, THE PUBLIC AND ENVIRONMENT, ALL REVISED AND CHANGED AND SUBMITTED FOR THE CONSTRUCTION, IMPROVEMENT, MAINTENANCE, OPERATION AND PROJECT AND ALLOCATION FOR THE USE AND INSTALLATION OF DATA, INSTRUMENTS, CONCLUSIONS AND RECOMMENDATIONS. ALL CHANGES IS RESERVED PROVIDED FOR WRITTEN APPROVAL.	PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION TITLE: L-L DAM PIEZOMETRIC DATA DAM FILL 1989-2017 VALLEY BUTTRESS BERM (STNS 1+500 m to 2+100 m)
		PROJECT No. M02341B26 FIG No. V-13a

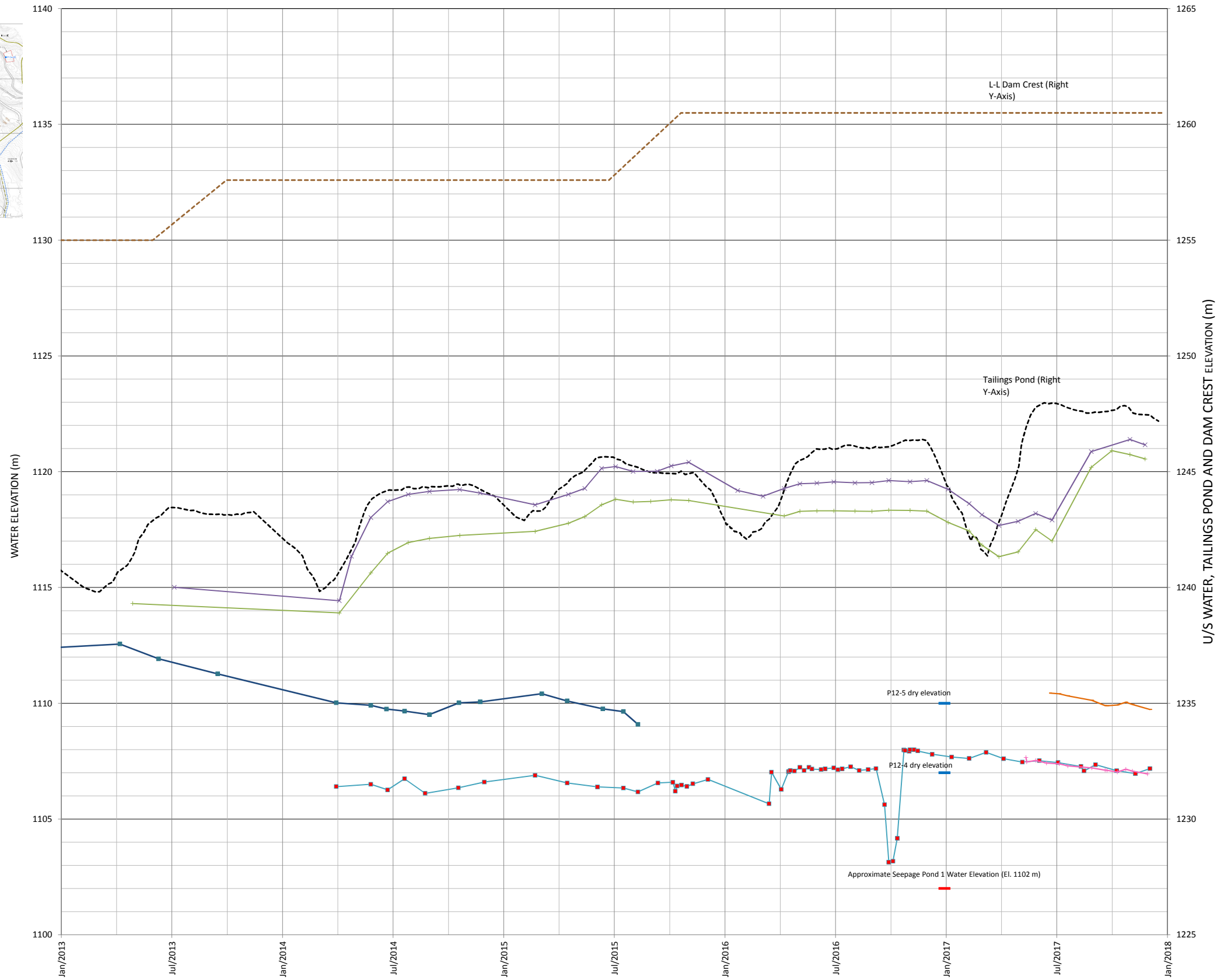


LEGEND:

- P12-4 (Tip El. 1108.80 m, D/S Dam Fill)
- P12-5 (Tip El. 1111.30 m, D/S Dam Fill (Cycloned Sand))
- P13-9 (Tip El. 1091.30 m, S&G Drainage Blanket)
- P83-1 (Tip El. 1109.9 m, D/S Dam Fill)
- LLVWP 17-02 C (Tip El. 1092.9 m, Sand and Gravel Drainage Blanket)
- LLVWP 17-06 E (Tip El. 1107.7 m, Sand and Gravel Drainage Blanket)
- P13-1 (Tip El. 1176.00 m, U/S Dam Fill (Cycloned Sand)) - Right Y-Axis
- P13-8 (Tip El. 1228.50 m, U/S Dam Fill (Cycloned Sand)) - Right Y-Axis

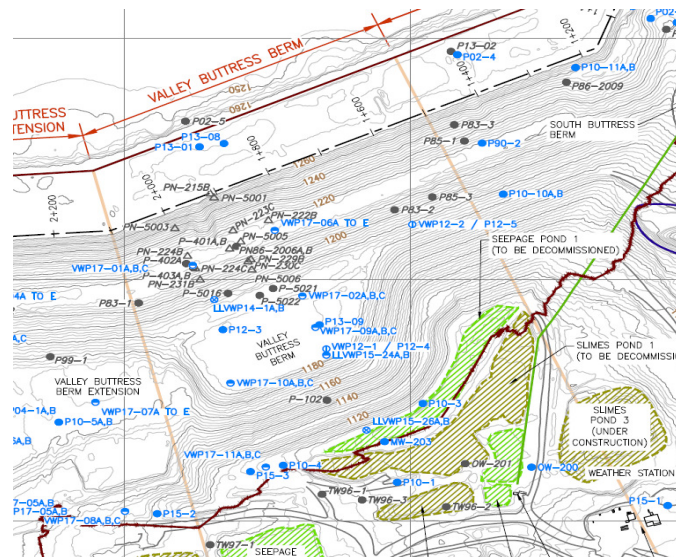
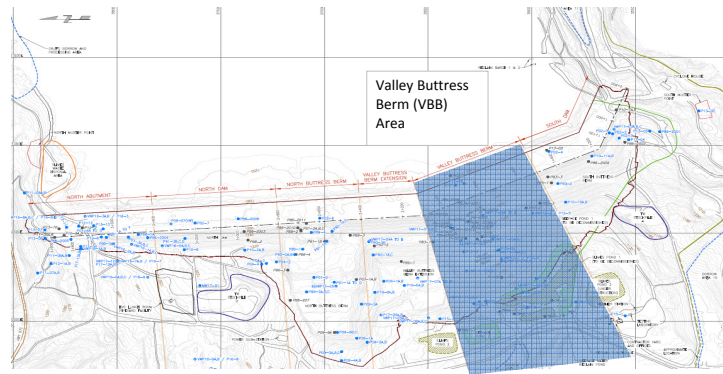
NOTES:

- U/S = Upstream of dam centerline
- D/S = Downstream of dam centerline
- P12-4 dry since 2012 installation
- P12-5 dry since 2012 installation
- P83-1 has been plugged at ~El. 1196 m since 2015



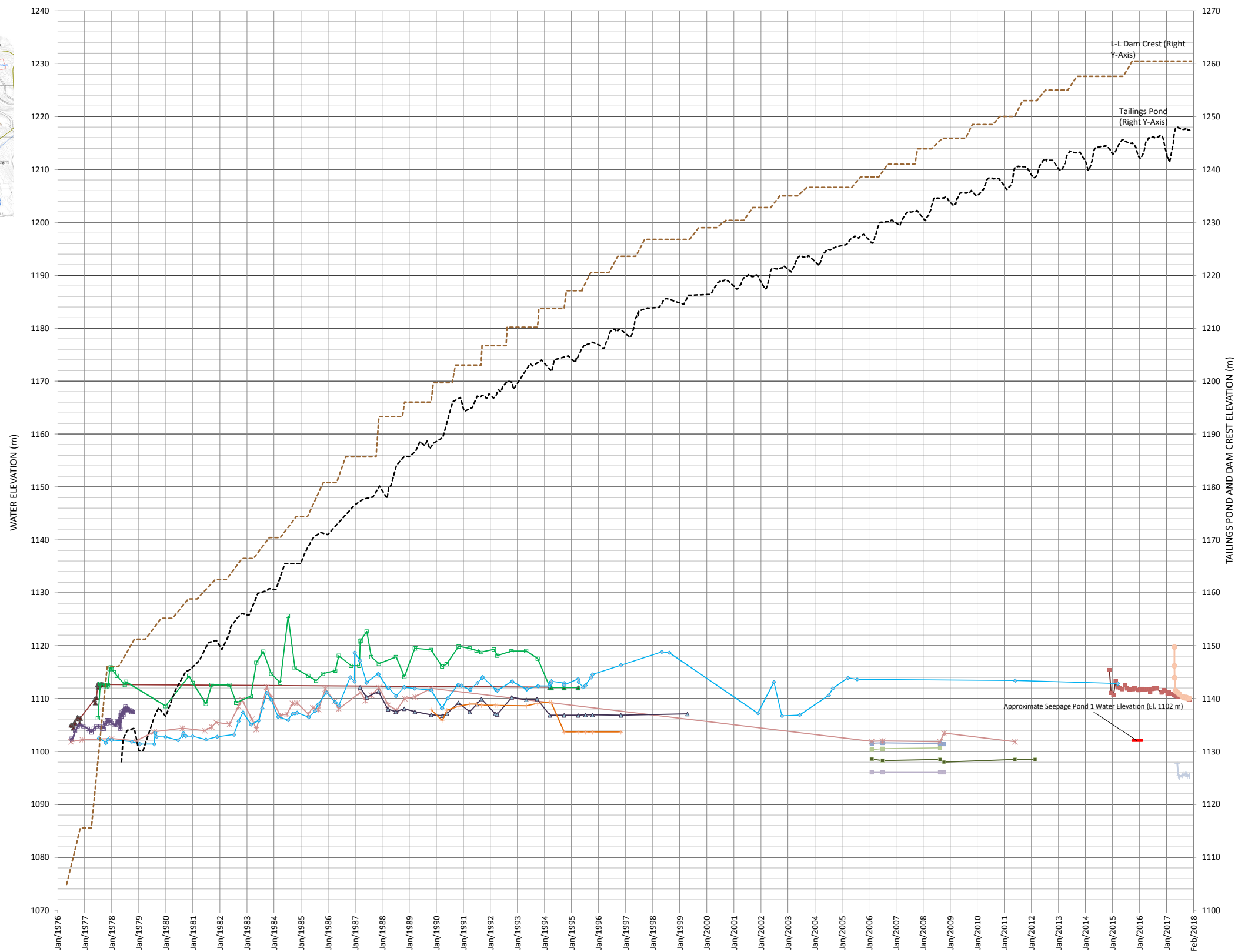
March 13, 2018
Z:\MVR\2018\1826 - HVC-2017 Dam Safety Support\300 Design\Piezo Data\Highland\Final\2017 version\180109 Master L-L Piezo Plot - 2017.dam\Map (V28)

<p>TECK HIGHLAND VALLEY COPPER PARTNERSHIP</p>	<p>HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION</p>
	<p>L-L DAM PIEZOMETRIC DATA DAM FILL 2013-2017 VALLEY BUTTRESS BERM (STNS 1+500 m to 2+100 m)</p>
<p>PROJECT No. M02341B26</p>	<p>FIG. No. V-13b</p>



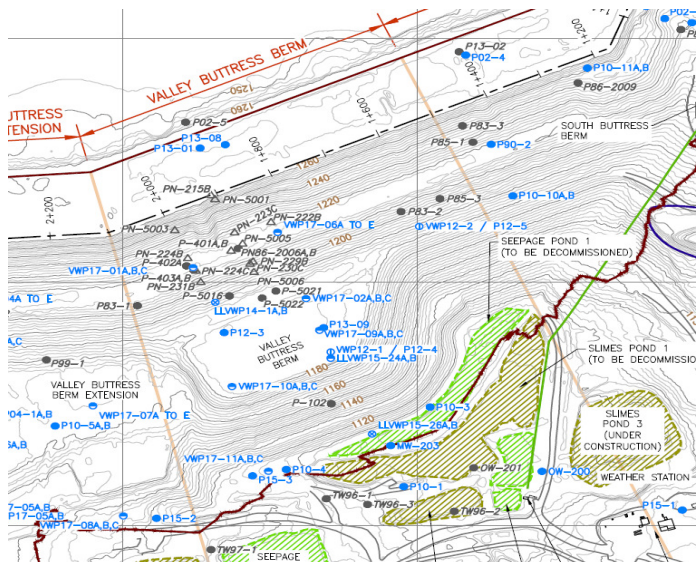
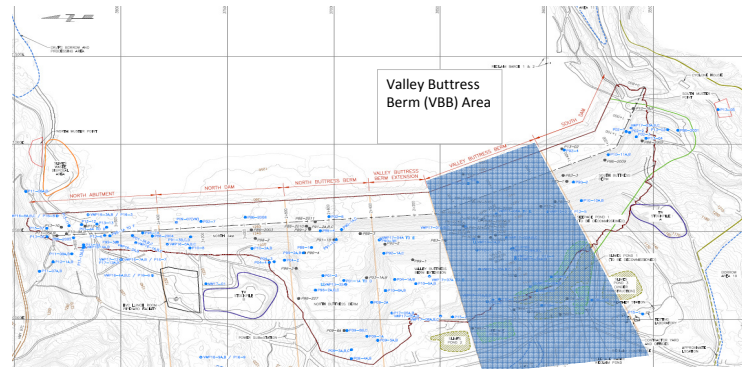
- LEGEND:**
- LLVWP14-1B (Tip El. 1098.10 m, Lacustrine)
 - PN-215B (Tip El. 1103.4 m, Peat Silt (Lacustrine))
 - PN-222B (Tip El. 1101.55 m, Sandy-silt (Lacustrine))
 - PN-230A (Tip El. 1098.5 m, Clay (Lacustrine))
 - PN-230C (Tip El. 1101.85 m, Clayey silt (Lacustrine))
 - PN-231B (Tip El. 1100.33 m, Peat-silt (Lacustrine))
 - P-401A (Tip El. 1112.00 m, Clay (Lacustrine))
 - P-401B (Tip El. 1106.85 m, Silt Clay (Lacustrine))
 - P-402A (Tip El. 1103.68 m, Silt (Lacustrine))
 - P-403A (Tip El. 1106.73 m, Silt (Lacustrine))
 - PN-5005 (Tip El. 1097.74 m, Clay-silt (Lacustrine))
 - PN-5006 (Tip El. 1096.06 m, Peat-silt (Lacustrine))
 - LLVWP 17-01 C (Tip El. 1098.5 m, Lacustrine)
 - LLVWP 17-06 D (Tip El. 1100.2 m, Lacustrine)

NOTES:
 U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 P-403A gives suspect readings after 1999
 P-401A, P-401B and P-402A gives suspect readings after 1994



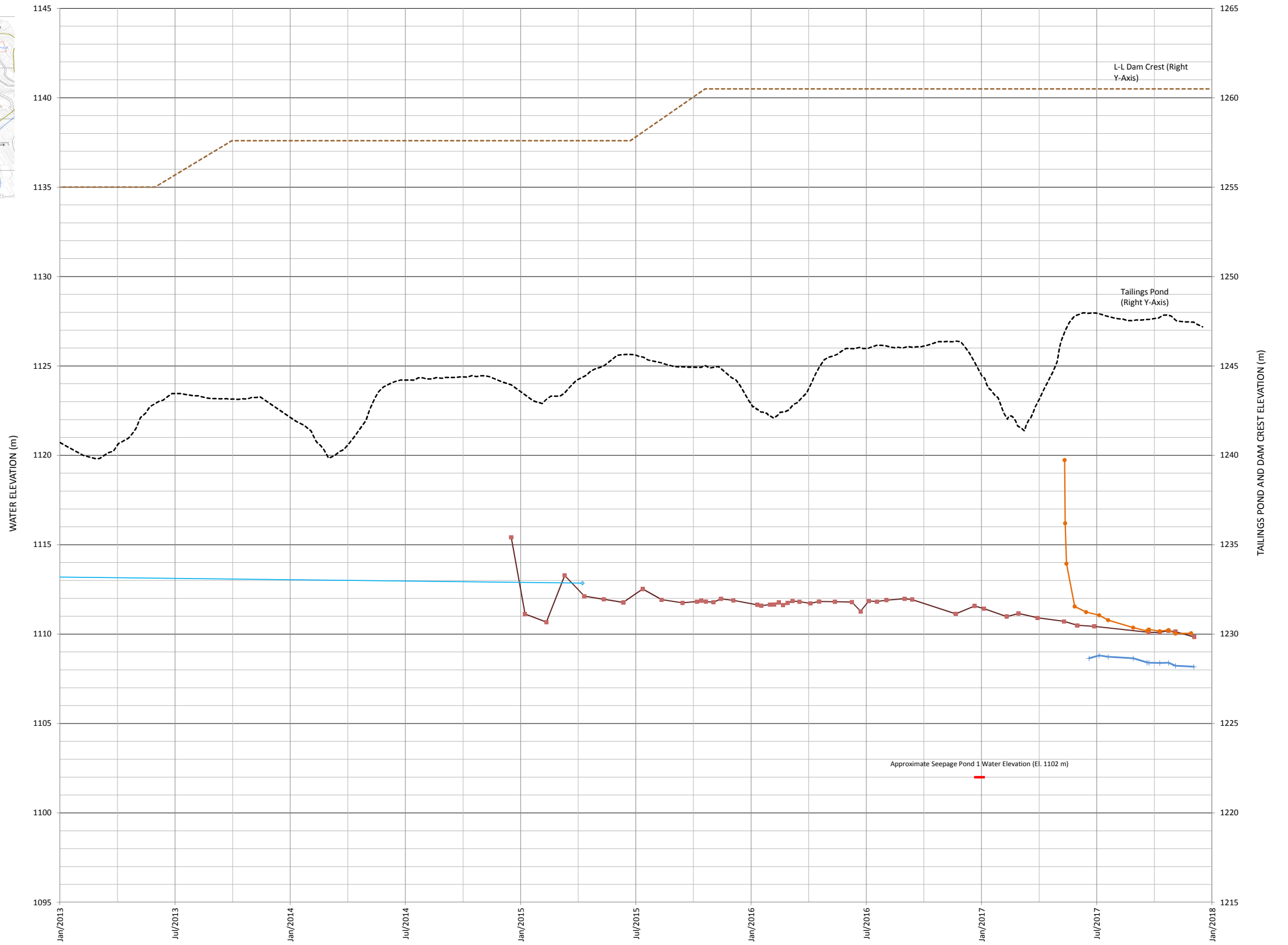
March 13, 2018
 Z:\MVC\18\0234\1826 - HGC-2017 Dam Safety Support\000 Design\Phase Data\High\final 2017 version\180109 Main\1.L. Piezo Data - 2017.dwg\Main\1.V.29

AS A NEUTRAL PROVIDER TO OUR CLIENTS, THE PUBLIC, AND OURSELVES, ALL REPORTS AND CONCLUSIONS ARE BASED ON THE DATA AND INFORMATION PROVIDED TO US BY OUR CLIENTS. WE DO NOT GUARANTEE THE ACCURACY, COMPLETENESS, OR TIMELINESS OF THE DATA, INFORMATION, OR CONCLUSIONS. WE ACCEPT NO LIABILITY FOR ANY DAMAGE, INCLUDING CONSEQUENTIAL DAMAGES, ARISING FROM THE USE OF THIS REPORT.	TECK HIGHLAND VALLEY COPPER PARTNERSHIP 	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION L-L DAM PIEZOMETRIC DATA LACUSTRINE 1976-2017 VALLEY BUTTRESS BERM (STNS 1+500 m to 2+100 m)
	PROJECT NO. M02341826	SHEET NO. V-14a



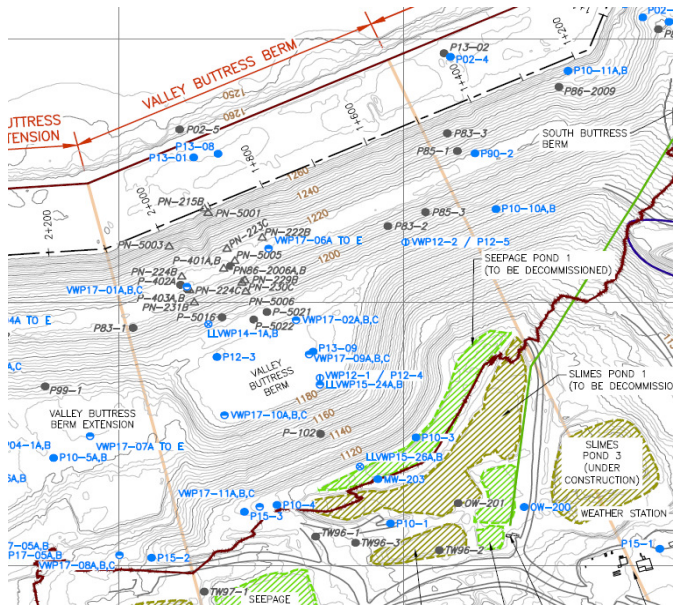
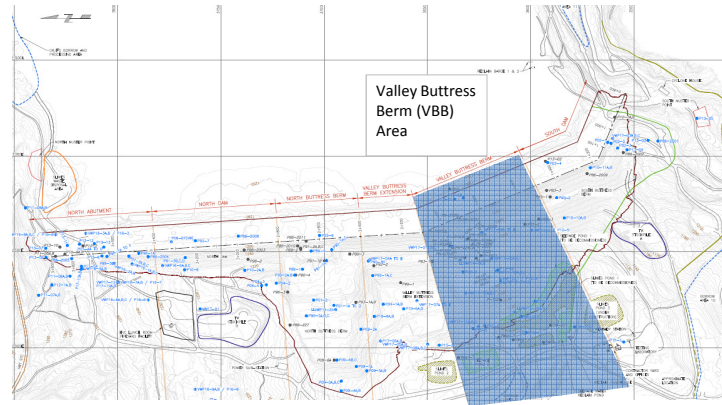
- LEGEND:**
- LLVWP14-1B (Tip El. 1098.10 m, Lacustrine)
 - P-403A (Tip El. 1106.73 m, Silt (Lacustrine))
 - LLVWP 17-01 C (Tip El. 1098.5 m, Lacustrine)
 - LLVWP 17-06 D (Tip El. 1100.2 m, Lacustrine)

NOTES:
 U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 P-403A gives suspect readings after 1999
 LLVWP 17-01 C appears to be in the process of reaching equilibrium.



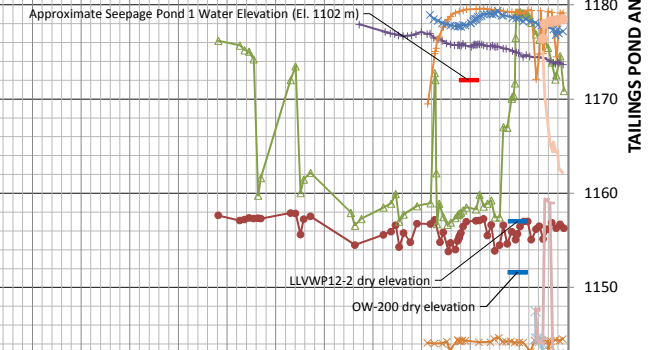
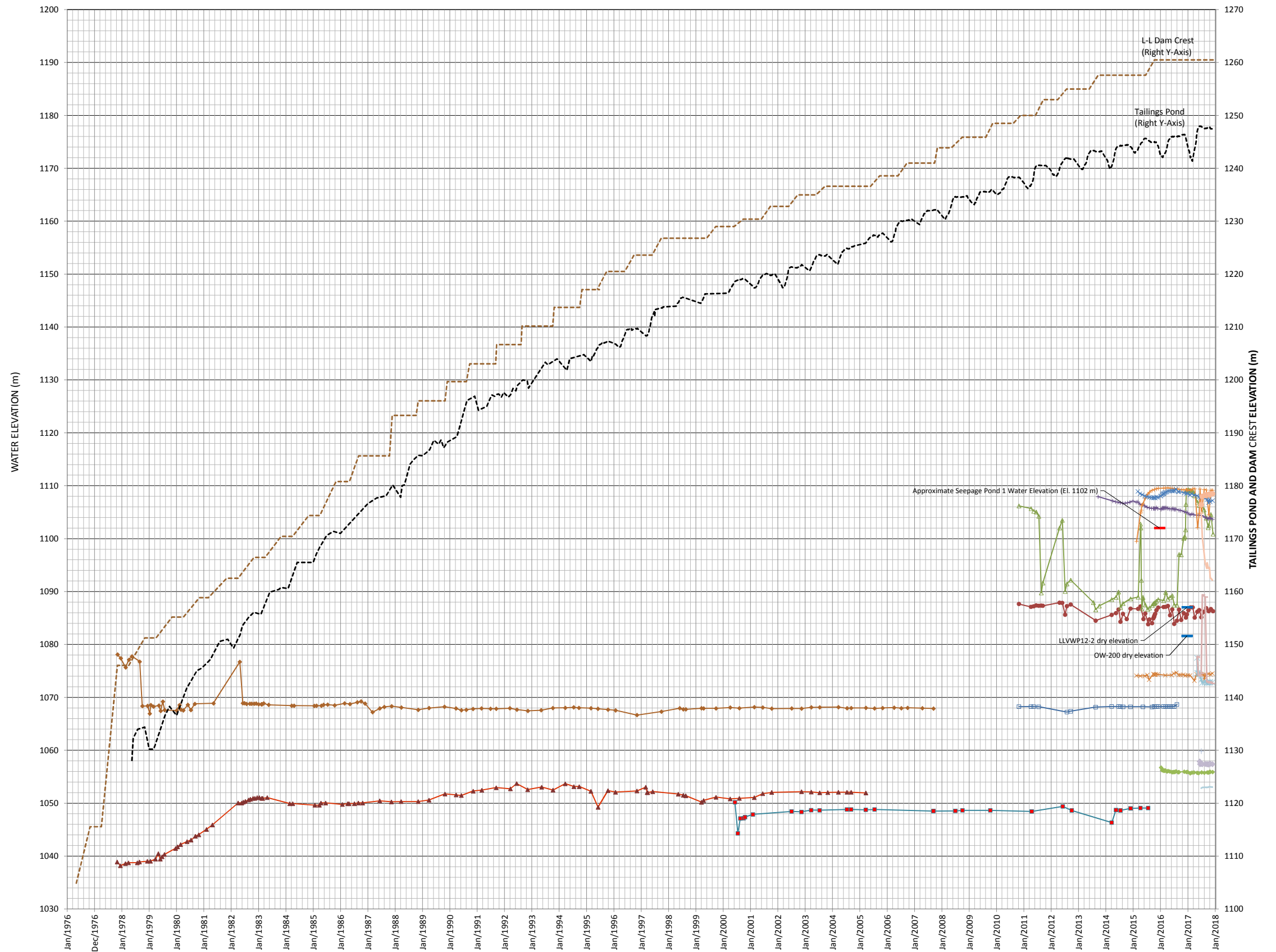
March 13, 2018
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CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
	TITLE L-L DAM PIEZOMETRIC DATA LACUSTRINE 2013-2017 VALLEY BUTRESS BERM (STNS 1+500 m to 2+100 m)
CONSULTANT 	PROJECT NO. M02341B26



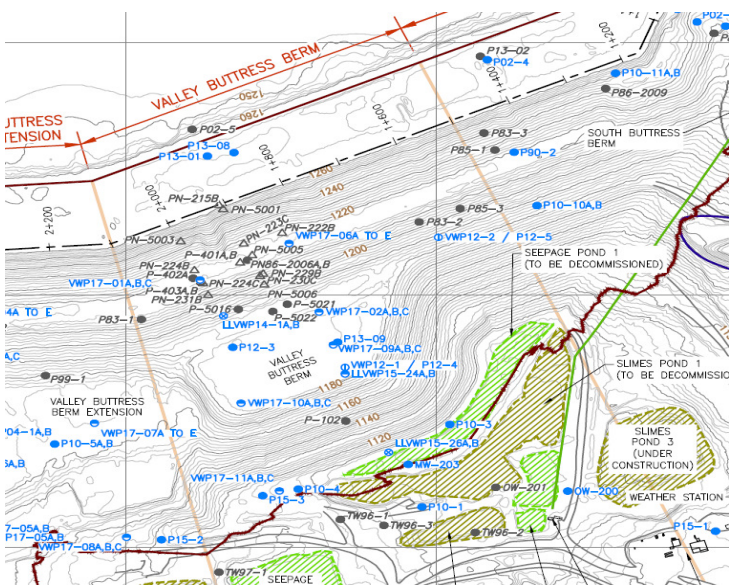
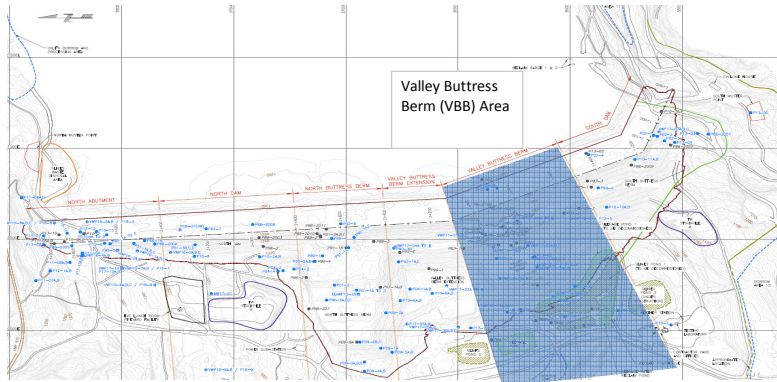
- LEGEND:**
- OW-201 (Tip El. 1067.1, Assumed Glacial Till)
 - MW-203 (Tip El. 1026.60 m, Glacial Till/Bedrock Transition Zone)
 - P10-1 (Tip El. 1068.40 m, Glacial Till)
 - P10-3 (Tip El. 1082.20 m, Glacial Till)
 - P10-4 (Tip El. 1086.40 m, Glacial Till)
 - LLVWP12-1 (Tip El. 1084.50 m, Glacial Till)
 - P12-3 (Tip El. 1073.00 m, Glacial Till)
 - P15-3 (Tip El. 1093.09 m, Glacial Till)
 - LLVWP14-1A (Tip El. 1084.57 m, Glacial Till)
 - LLVWP15-24A (Tip El. 1025.00 m, Glacial Till/Bedrock Transition Zone)
 - LLVWP 17-01 A (Tip El. 1072.6 m, Lower Sand and Gravel)
 - LLVWP 17-11 C (Tip El. 1087.2 m, Glacial Till)
 - LLVWP 17-11 A (Tip El. 1057.8 m, Glaciofluvial)
 - LLVWP 17-02 A (Tip El. 1071.9 m, Glaciofluvial)
 - LLVWP 17-09 C (Tip El. 1087.2 m, Glacial Till)
 - LLVWP 17-09 A (Tip El. 1044.6 m, Glaciofluvial)
 - LLVWP 17-10 A (Tip El. 1027.4 m, Glacial Till)
 - LLVWP 17-10 C (Tip El. 1079.3 m, Glaciofluvial)

NOTES:
 U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 OW-200 dry since 1994 (source file starts in 1994)
 OW-201 destroyed in 2008
 LLVWP12-2 dry since 2012 installation



March 13, 2018
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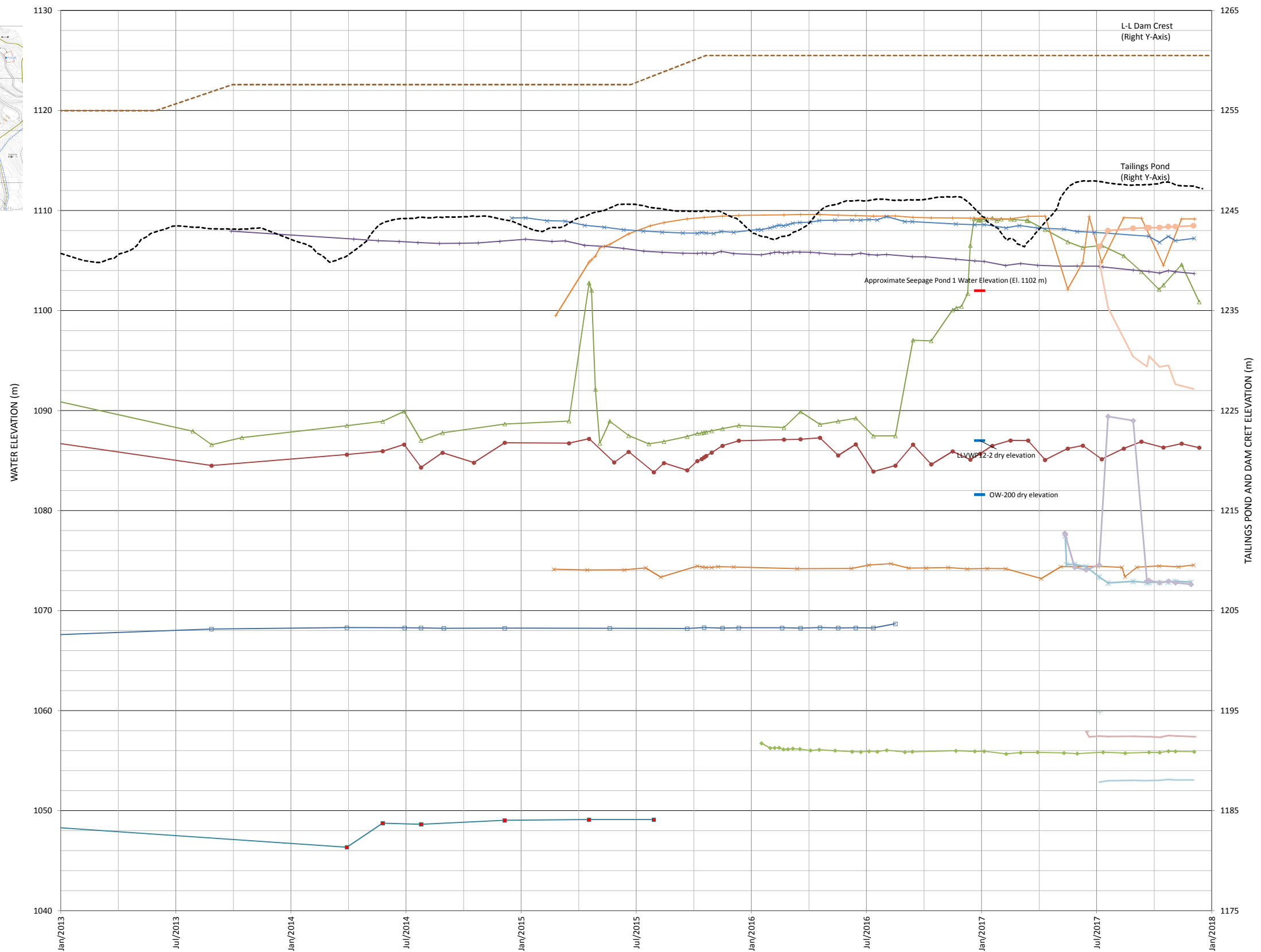
	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
	L-L DAM PIEZOMETRIC DATA GLACIAL TILL 1976-2017 VALLEY BUTTRESS BERM (STNS 1+500 m to 2+100 m)
	PROJECT No. M02341B26



LEGEND:

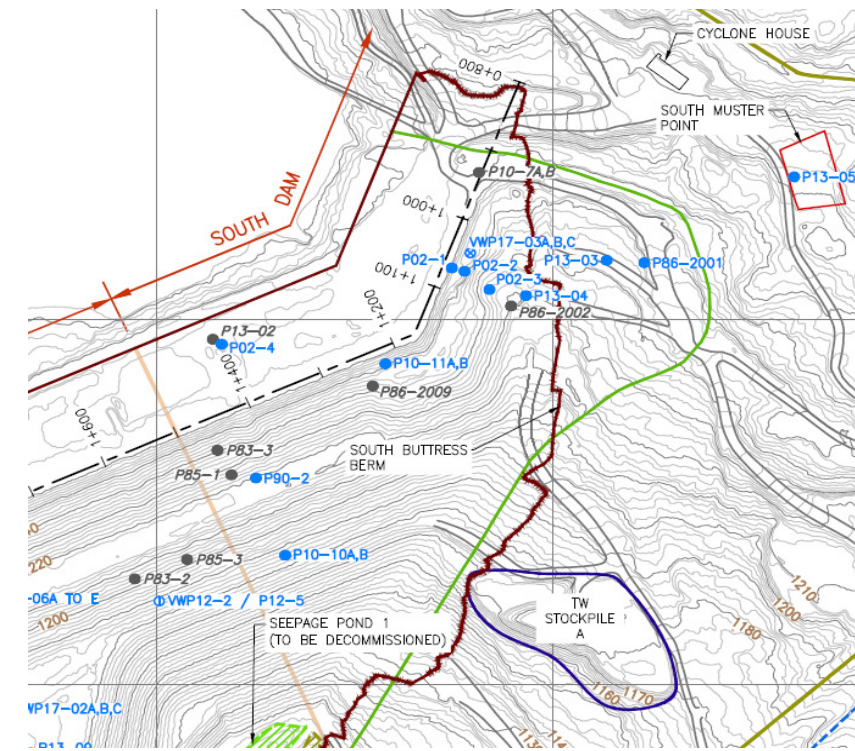
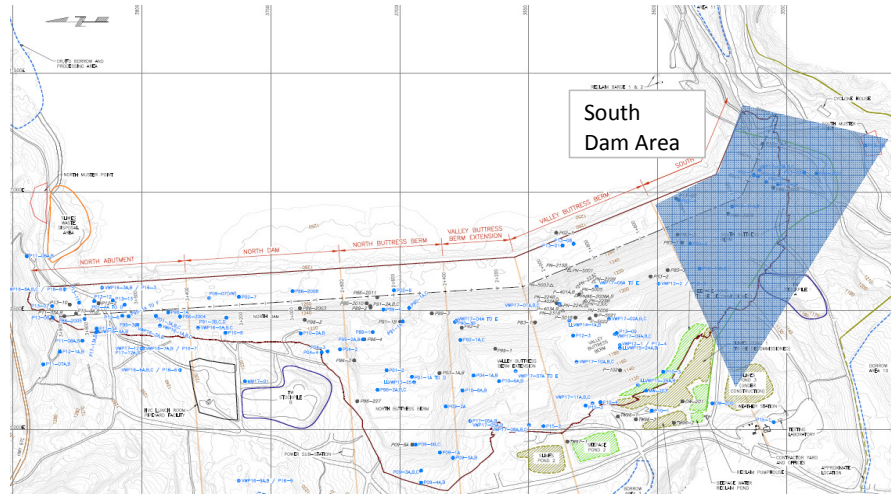
- MW-203 (Tip El. 1026.60 m, Glacial Till/Bedrock Transition Zone)
- P10-1 (Tip El. 1068.40 m, Glacial Till)
- P10-3 (Tip El. 1082.20 m, Glacial Till)
- ▲ P10-4 (Tip El. 1086.40 m, Glacial Till)
- ◆ LLVWP12-1 (Tip El. 1084.50 m, Glacial Till)
- ◇ LLVWP12-2 (Tip El. 1087.00 m, Glacial Till)
- × P12-3 (Tip El. 1073.00 m, Glacial Till)
- P15-3 (Tip El. 1093.09 m, Glacial Till)
- ✕ LLVWP14-1A (Tip El. 1084.57 m, Glacial Till)
- ◇ LLVWP15-24A (Tip El. 1025.00 m, Glacial Till/Bedrock Transition Zone)
- ◇ LLVWP 17-01 A (Tip El. 1072.6 m, Lower Sand and Gravel)
- LLVWP 17-11 C (Tip El. 1087.2 m, Glacial Till)
- ◇ LLVWP 17-11 A (Tip El. 1057.8 m, Glaciofluvial)
- ◇ LLVWP 17-02 A (Tip El. 1071.9 m, Glaciofluvial)
- ◇ LLVWP 17-09 A (Tip El. 1044.6 m, Glaciofluvial)
- ◇ LLVWP 17-09 C (Tip El. 1087.2 m, Glacial Till)
- ◇ LLVWP 17-10 A (Tip El. 1027.4 m, Glacial Till)
- ◇ LLVWP 17-10 C (Tip El. 1079.3 m, Glaciofluvial)

NOTES:
 U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 OW-200 dry since 1994 (source file starts in 1994)
 LLVWP12-2 dry since 2012 installation
 LLVWP 17-9C dry since 2017 installation



March 13, 2018
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	TECK HIGHLAND VALLEY COPPER PARTNERSHIP	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
	PROJECT: L-L DAM PIEZOMETRIC DATA GLACIAL TILL AND GLACIOFLUVIAL 2013-2017 VALLEY BUTTRESS BERM (STNS 1+500 m to 2+100 m)	PROJECT NO: M02341B26

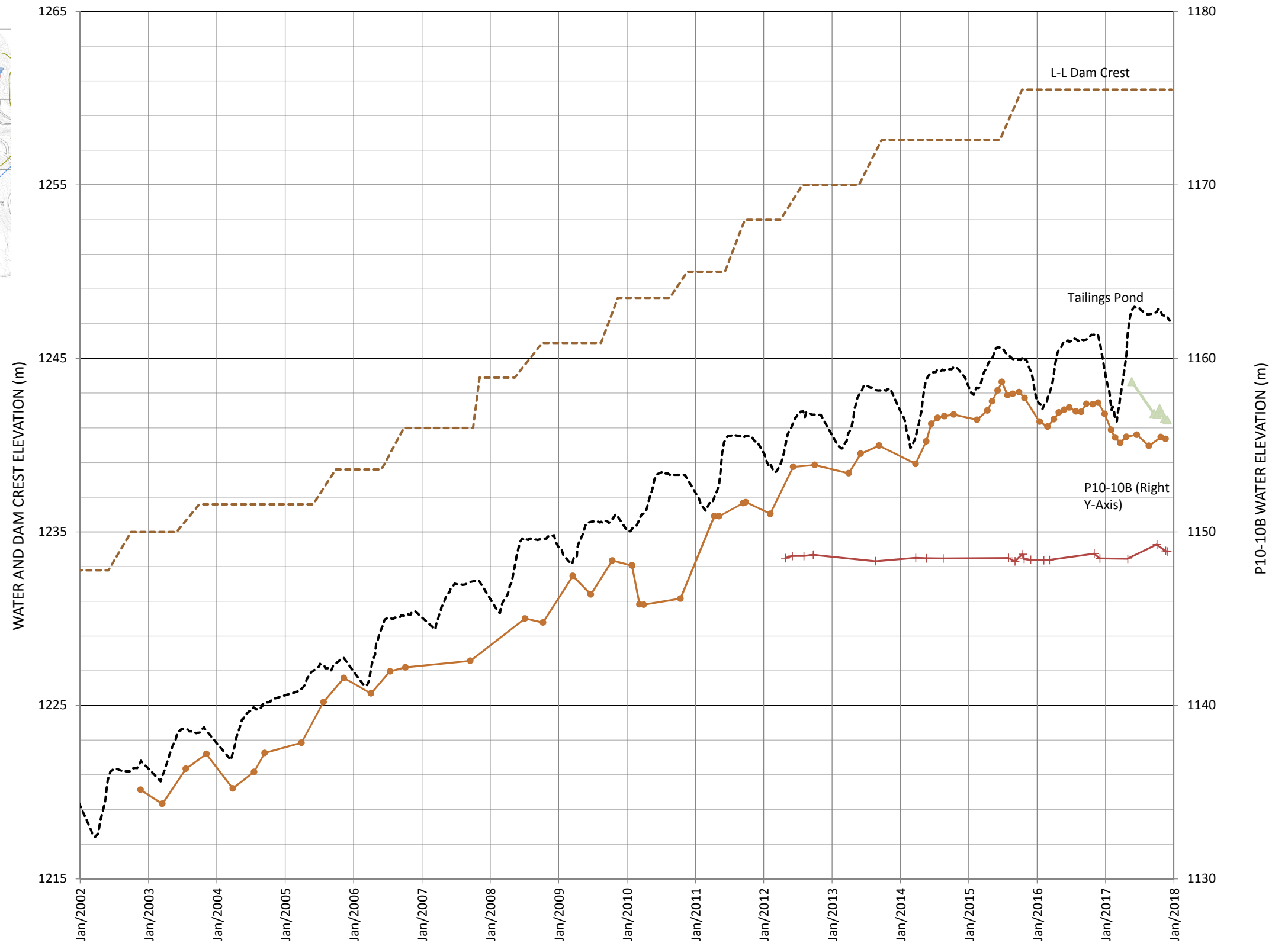


LEGEND:

- P02-4
(Tip El. 1178.6 m, U/S Dam Fill (Cycloned Sand))
- ▲ LLVWP 17-03 C
(Tip El. 1239.4 m, Till Dam Fill)
- + P10-10B - Right Y-Axis
(Tip El. 1146.9 m, Gravel Drain)

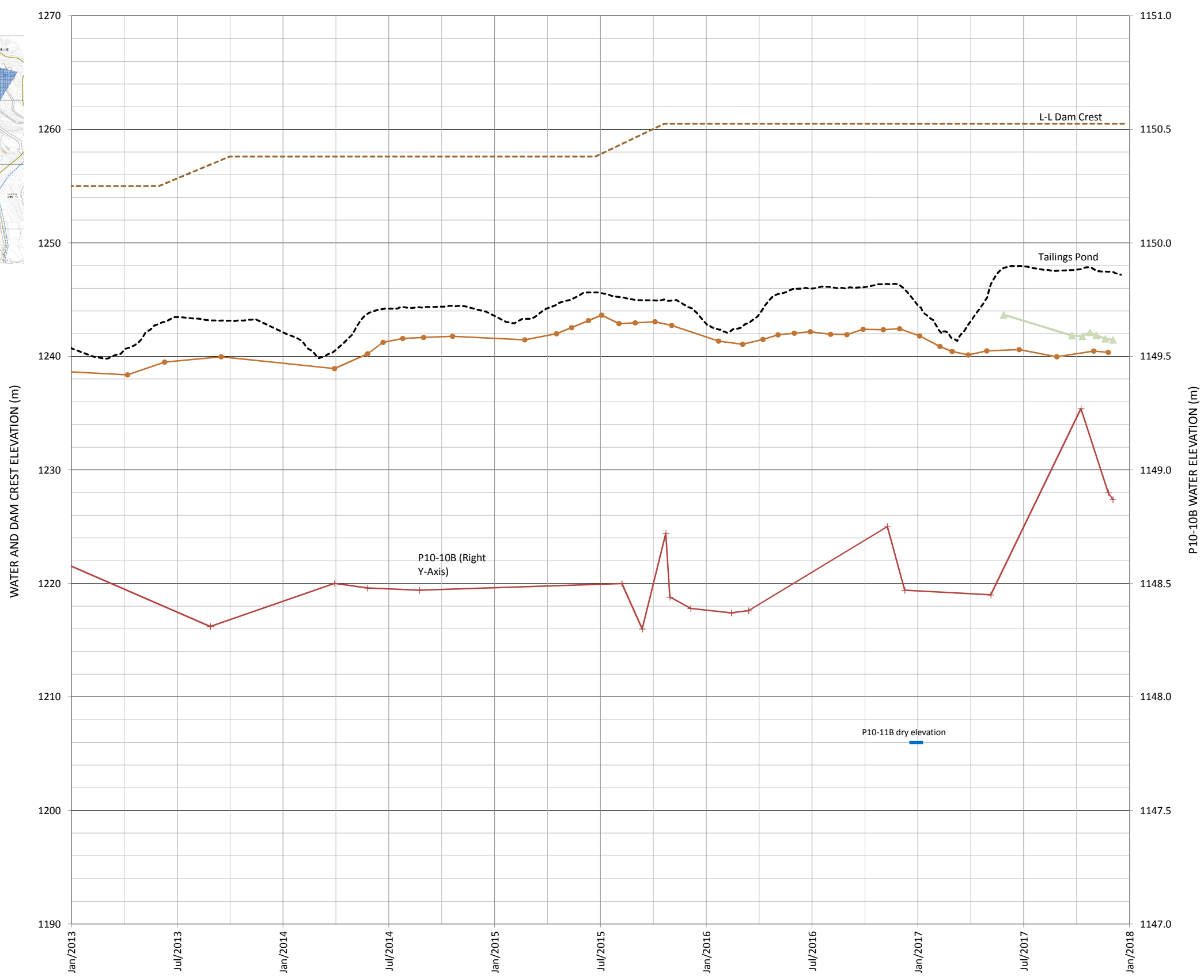
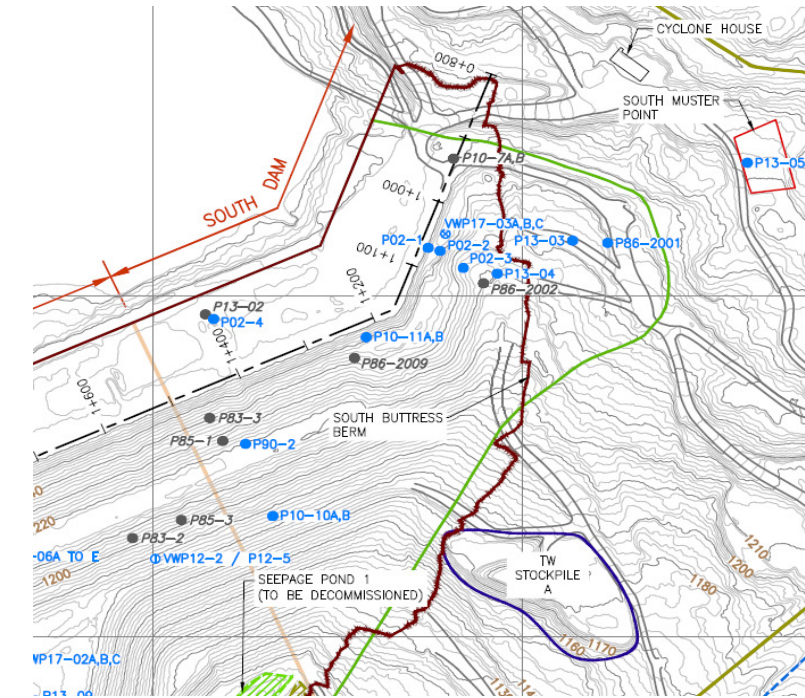
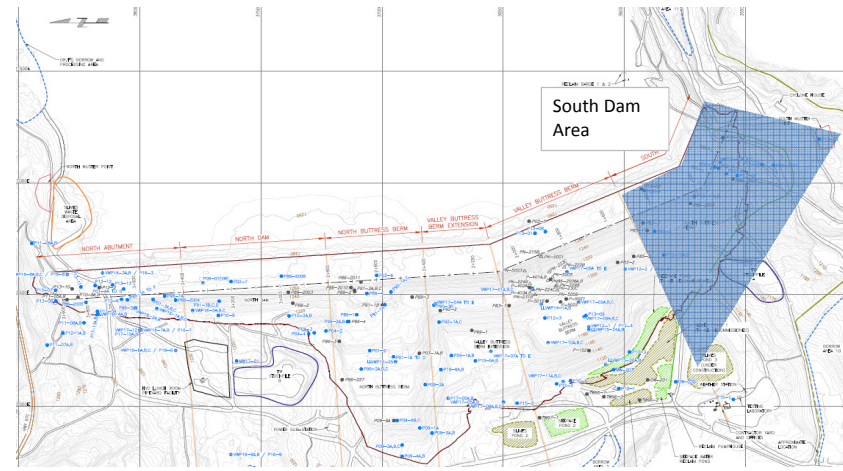
NOTES:

- U/S = Upstream of dam centerline
- D/S = Downstream of dam centerline
- P13-02 was destroyed before any readings were taken, tip El. 1215.4 m (cycloned sand)
- P10-11B has been dry since 2010 installation
- P10-10B periodically dry/wet since 2010 installation, dry/wet in 2016 between March and November



March 13, 2018 Z:\MVC\RM02341B26 - HVC-2017 Dam Safety Support\300 Design\Highland\Final\180109 Master L-L Piezo Plots - 2017.xlsm\About (V-2a)

<small>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</small>	TECK HIGHLAND VALLEY COPPER PARTNERSHIP	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		L-L DAM PIEZOMETRIC DATA DAM FILL 2002-2017
SOUTH DAM (STNS 0+800 m to 1+500 m)		<small>PROJECT No. M02341B26 FIG No. V-17a</small>



LEGEND:

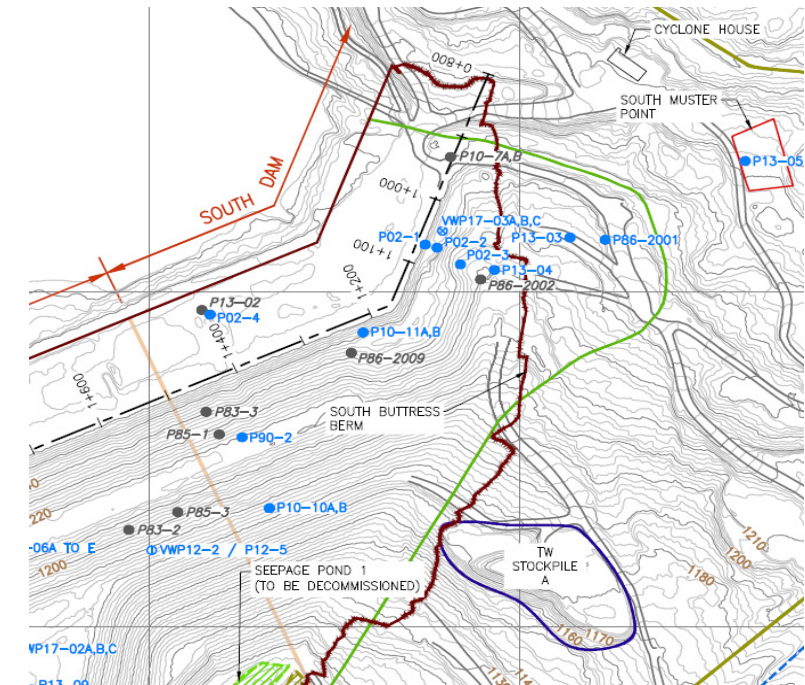
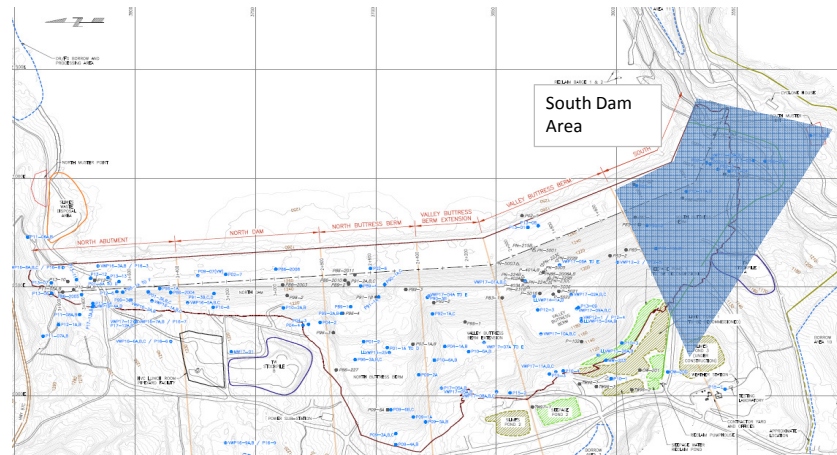
- P02-4
(Tip El. 1178.6 m, U/S Dam Fill (Cyclone Sand))
- ▲— LLVWP 17-03 C
(Tip El. 1239.4 m, Till Dam Fill)
- +— P10-10B - Right Y-Axis
(Tip El. 1146.9 m, Gravel Drain)

NOTES:

U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 P13-02 was destroyed before any readings were taken, tip El. 1215.4 m (cycloned sand)
 P10-11B has been dry since 2010 installation
 P10-10B periodically dry/wet since 2010 installation, dry/wet in 2016 between March and November

March 13, 2018
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		TITLE: L-L DAM PIEZOMETRIC DATA DAM FILL 2013-2017 SOUTH DAM (STNS 0+800 m to 1+500 m)
		PROJECT NO: M02341B26 FIG NO: V-17b

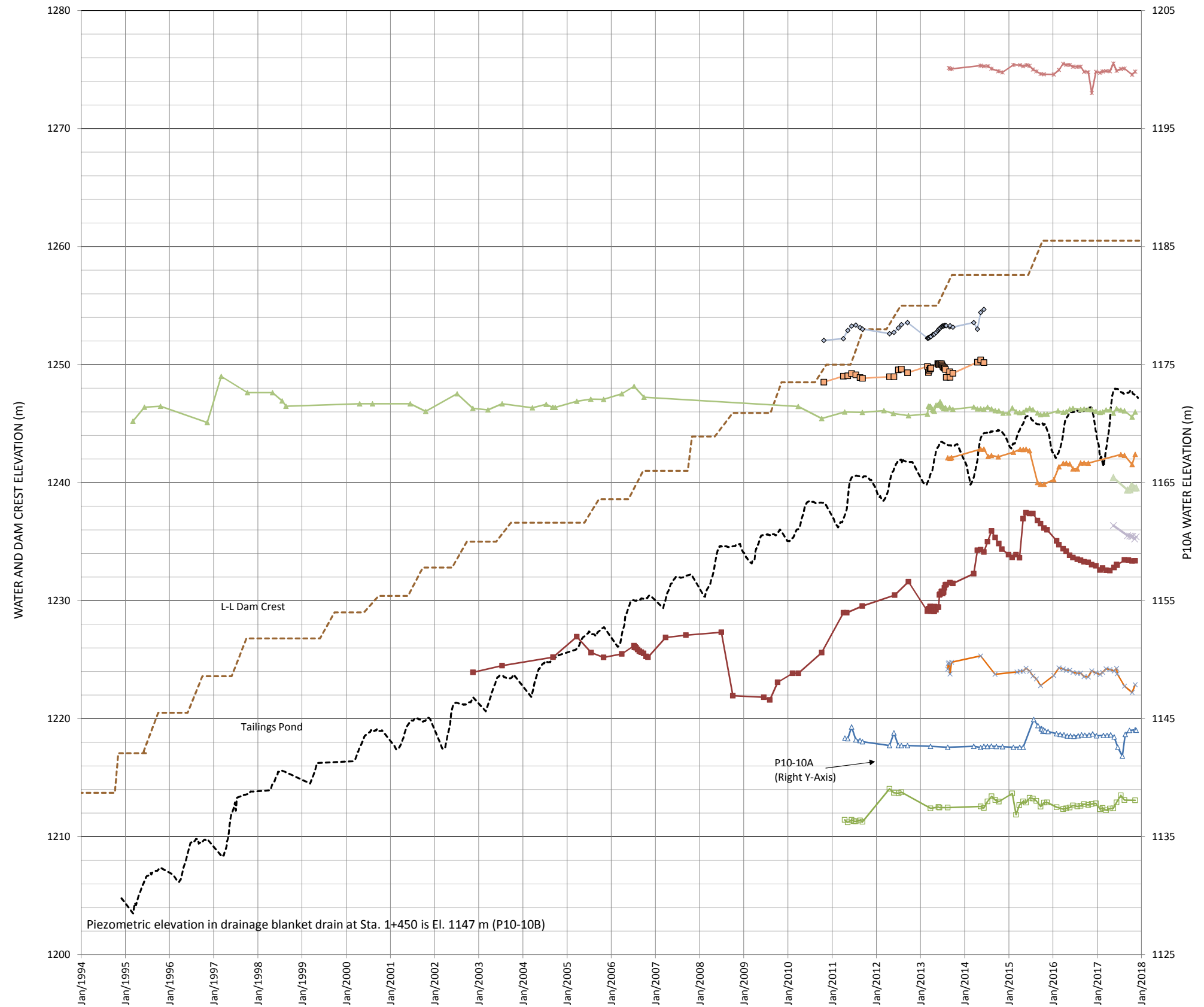


LEGEND:

- P02-1 (Tip El. 1223.92 m, Till Fill in Granodiorite Trench)
- P02-2 (Tip El. 1222.52 m, Till Fill in Granodiorite Trench)
- P02-3 (Tip El. 1222.44 m, Till Fill in Granodiorite Trench)
- P13-03 (Tip El. 1218.8 m, Granodiorite)
- P13-05 (Tip El. 1265.8 m, Granodiorite)
- P86-2009 (Tip El. 1190.8 m, Granodiorite)
- P10-7B (Tip El. 1249.6 m, Glacial Till)
- LLVWP 17-03 B (Tip El. 1234.9 m, Sand and Gravel)
- P10-11A (Tip El. 1196.5 m, Granodiorite)
- P13-04 (Tip El. 1207 m, Granodiorite)
- P86-2001 (Tip El. 1237.3 m, Granodiorite)
- P10-7A (Tip El. 1235.9 m, Granodiorite)
- LLVWP 17-03 A (Tip El. 1227.0 m, Granodiorite)
- P10-10A - Right Y-Axis (Tip El. 1142.3 m, Granodiorite)

NOTES:

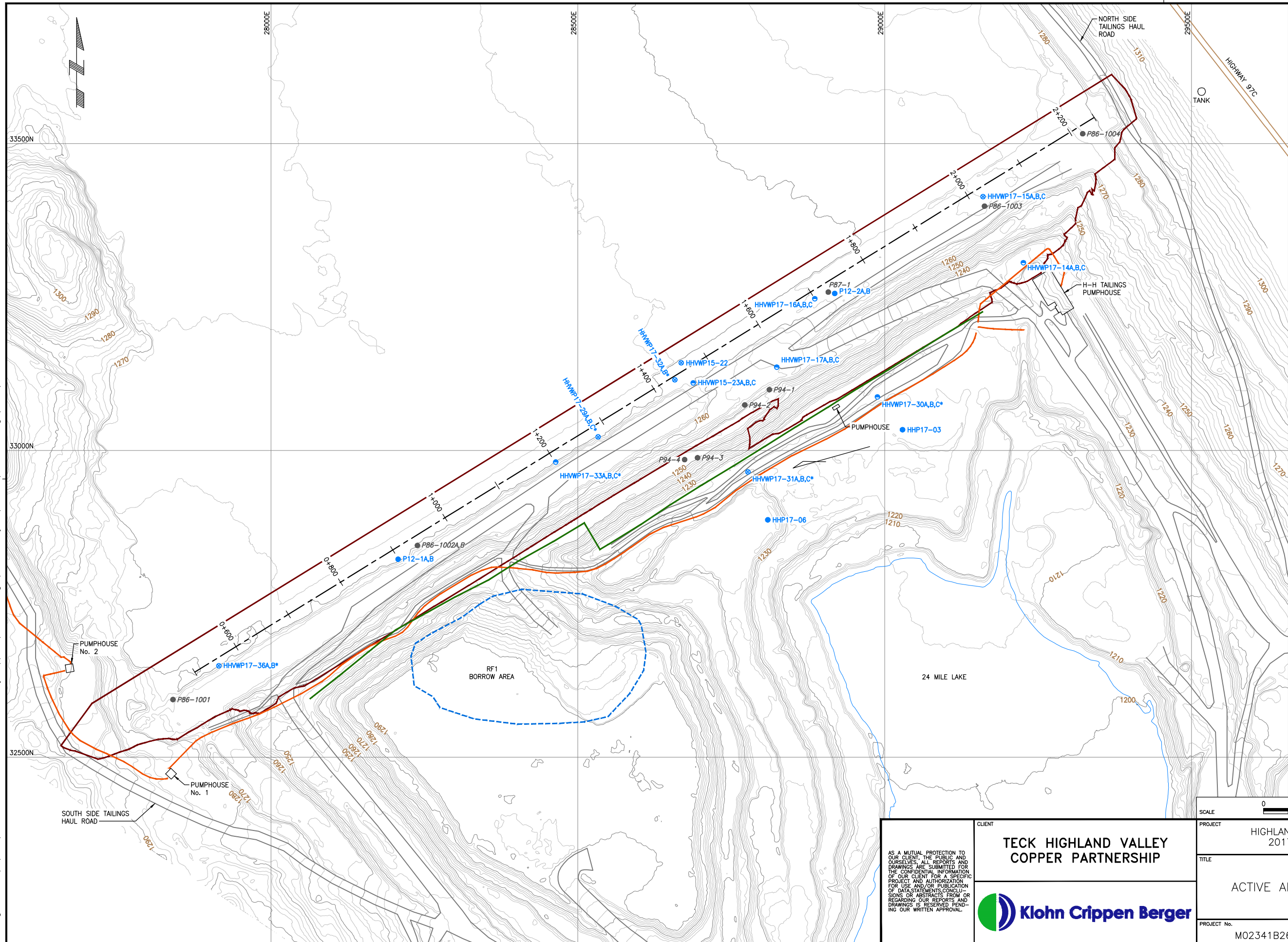
- U/S = Upstream of dam centerline
- D/S = Downstream of dam centerline
- Survey error has been identified in TOC elevations for P02-1, P02-2 and P02-3 between 2008 and 2012, therefore water elevations are not correct during this period
- P83-3D was destroyed prior to 1994
- P10-7A and B were decommissioned in 2014
- P86-2009 was damaged in 2013 - no subsequent readings



March 13, 2018
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<p>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC, AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND NOT FOR GENERAL USE AND/OR PUBLICATION OF DATA. STATEMENTS, CONCLUSIONS, ABSTRACTS FROM OR REVISIONS OF OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</p>	<p>CLIENT</p> <p>TECK HIGHLAND VALLEY COPPER PARTNERSHIP</p>	<p>PROJECT</p> <p>HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION</p>
	<p>Klohn Crippen Berger</p>	<p>TITLE</p> <p>L-L DAM PIEZOMETRIC DATA GRANODIORITE BEDROCK AND GLACIAL TILL 1994-2017</p> <p>SOUTH DAM (STNS 0+800 m to 1+500 m)</p>
<p>PROJECT NO.</p> <p>M02341B26</p>		<p>FIG. NO.</p> <p>V-18a</p>

Time: 10:39:24
 Date: 3/13/2018
 Scale: 1:50.8(P/S)
 Drawing File: Z:\M\CR\M02341B26 - HVC-2017 Dam Safety Support\400 Drawings\Dam Safety Inspection\FIG_V-19.dwg (skuan)



LEGEND:

- BORROW AREA
- ULTIMATE DAM FOOTPRINT
- TAILINGS PIPELINE
- POWERLINE
- HAUL ROAD
- PUBLIC ROAD
- H-H DAM CENTERLINE
- TANK

- ACTIVE INSTRUMENTS** (SEE NOTE 2):
- STANDPIPE PIEZOMETER AND OBSERVATION WELL
 - ⊗ VIBRATING-WIRE PIEZOMETER
 - ⊕ COMBINED STANDPIPE PIEZOMETER AND VIBRATING-WIRE PIEZOMETER
 - ⊙ COMBINED INCLINOMETER AND VIBRATING-WIRE PIEZOMETER

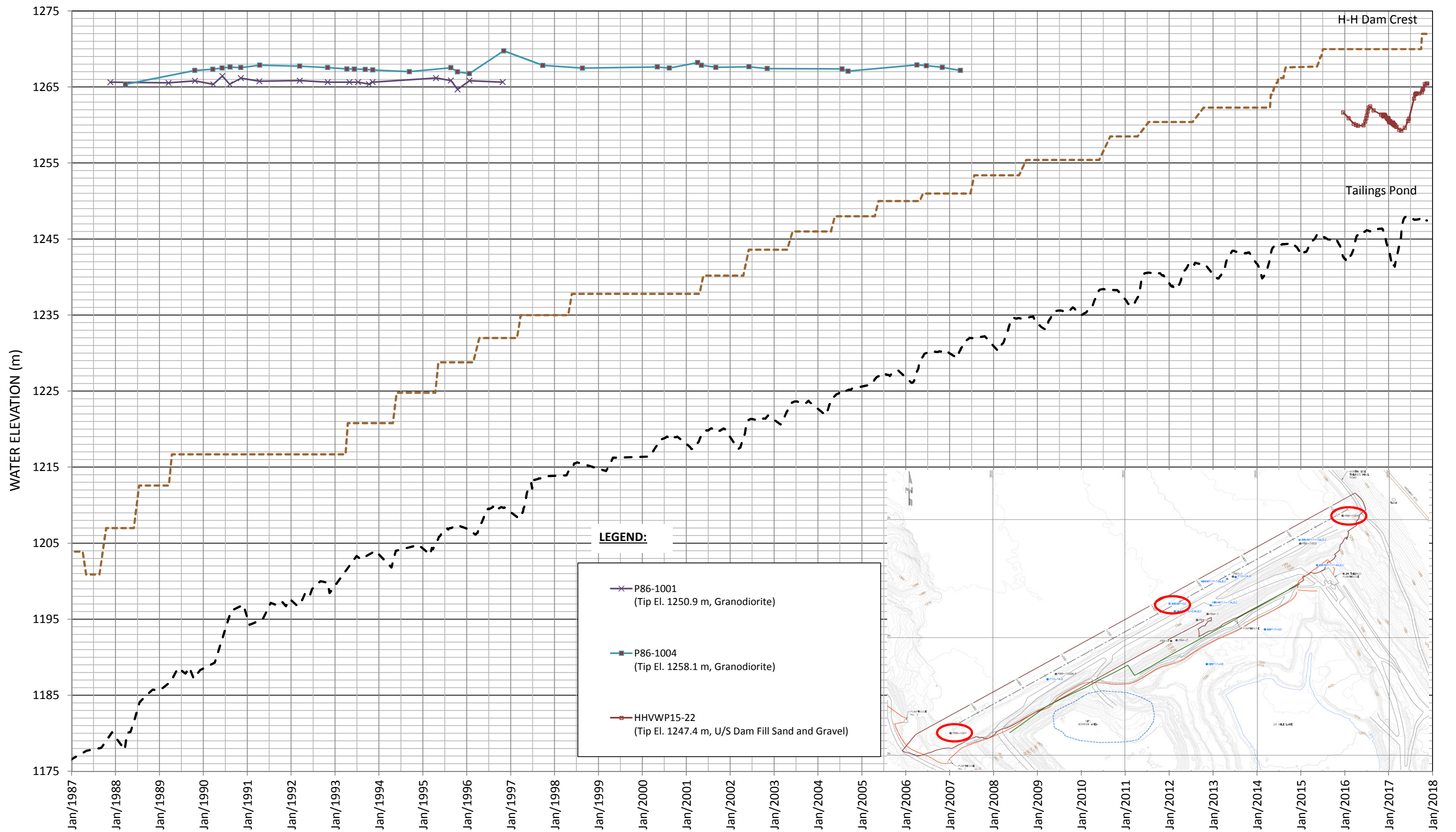
- DEFUNCT INSTRUMENTS** (SEE NOTE 3):
- DEFUNCT STANDPIPE PIEZOMETER

- NOTES:**
1. TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER PARTNERSHIP AND WAS DERIVED FROM SATELLITE IMAGERY TAKEN ON 2017-07-01.
 2. ACTIVE INSTRUMENTS ARE DEFINED AS ANY INSTRUMENTS SATISFYING ONE OF THE FOLLOWING CRITERIA: CURRENTLY READING AN ACTIVE WATER LEVEL, DRY OR PLUGGED <20 m ABOVE TIP ELEVATION AS THIS COULD SHOW A RESPONSE IN THE FUTURE.
 3. DEFUNCT INSTRUMENTS ARE DEFINED AS ANY INSTRUMENTS SATISFYING ONE OF THE FOLLOWING CRITERIA: DESTROYED, DAMAGED OR PLUGGED >20 m ABOVE TIP ELEVATION.
 4. ASTERISK (*) DENOTES PROPOSED INSTRUMENT LOCATION TO BE UPDATED WITH AS-CONSTRUCTED LOCATION WHEN SURVEY IS COMPLETED.



AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.	TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		TITLE H-H DAM ACTIVE AND DEFUNCT PIEZOMETERS LOCATION PLAN
	PROJECT No. M02341B26	FIG. No. V-19

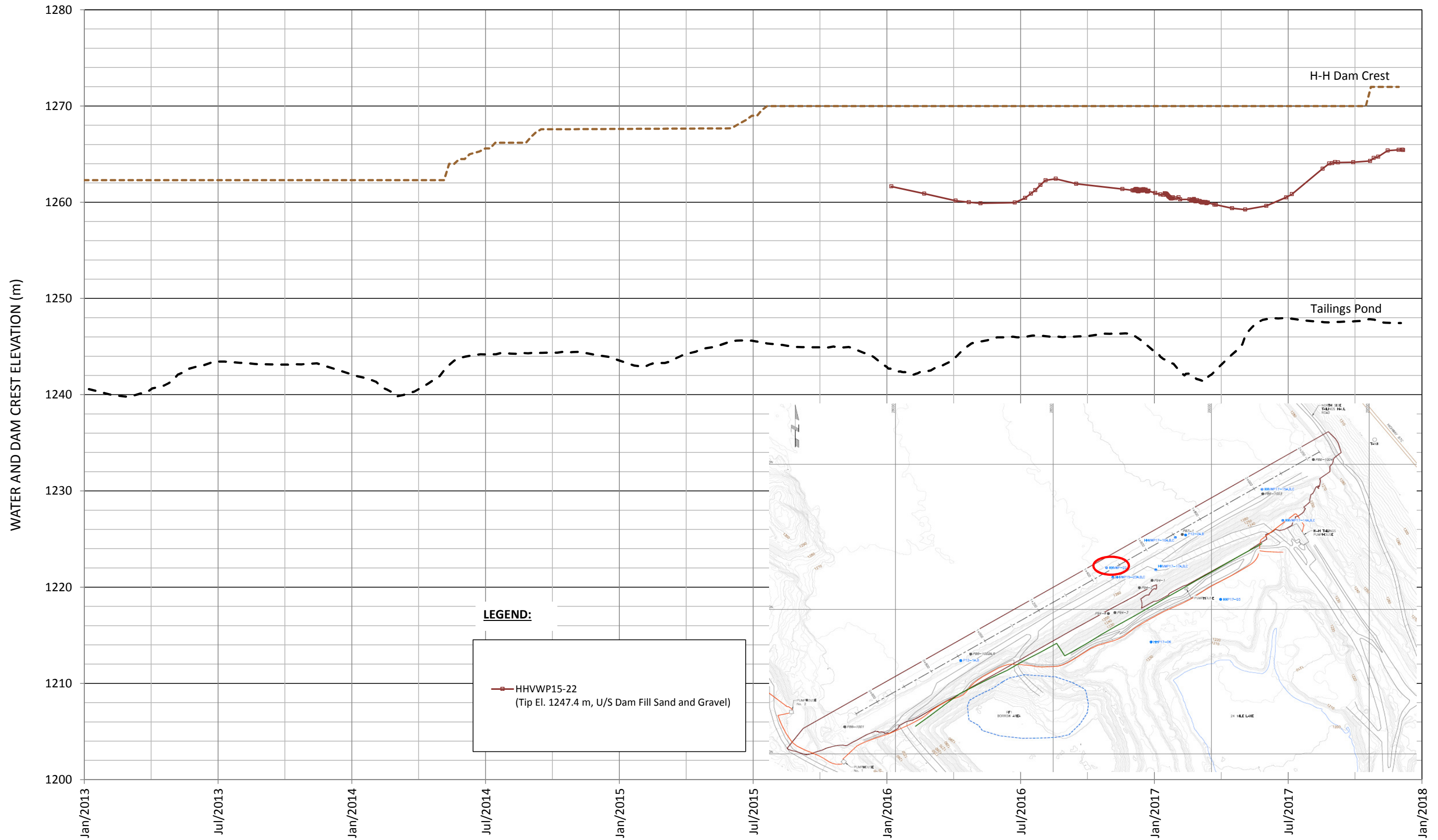
KCB-R-MID



NOTES:

U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 P86-1004 was destroyed in 2000
 P86-1001 was destroyed in 1997

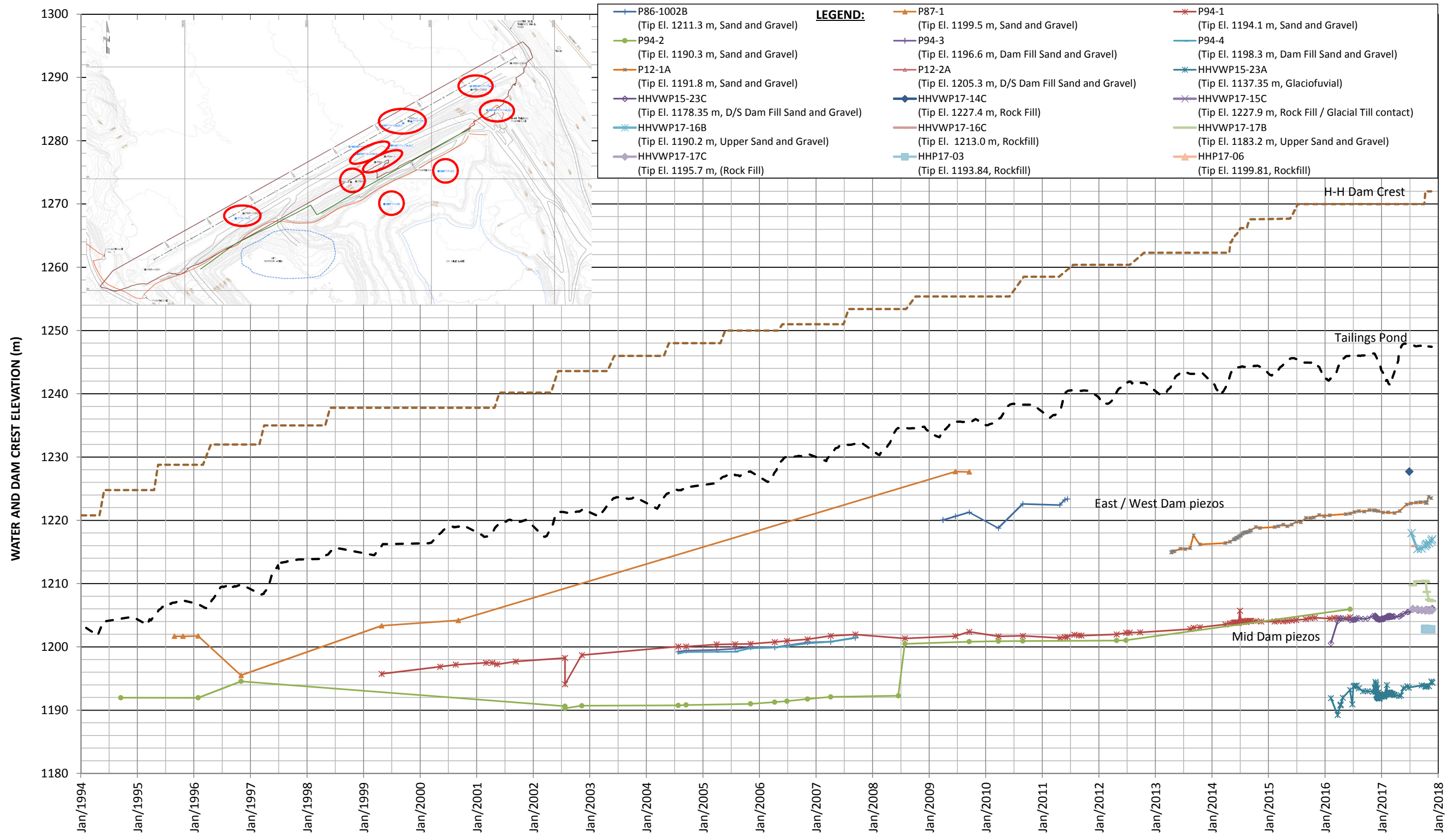
AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.	TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION	
		H-H DAM PIEZOMETRIC DATA UPSTREAM AND ABUTMENTS	
		1987-2017	
		PROJECT No.	M02341B26
		FIG No.	V-20a



NOTES:
 U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline

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		H-H DAM PIEZOMETRIC DATA UPSTREAM AND ABUTMENTS 2013-2017
	PROJECT No.	M02341B26
	FIG No.	V-20b

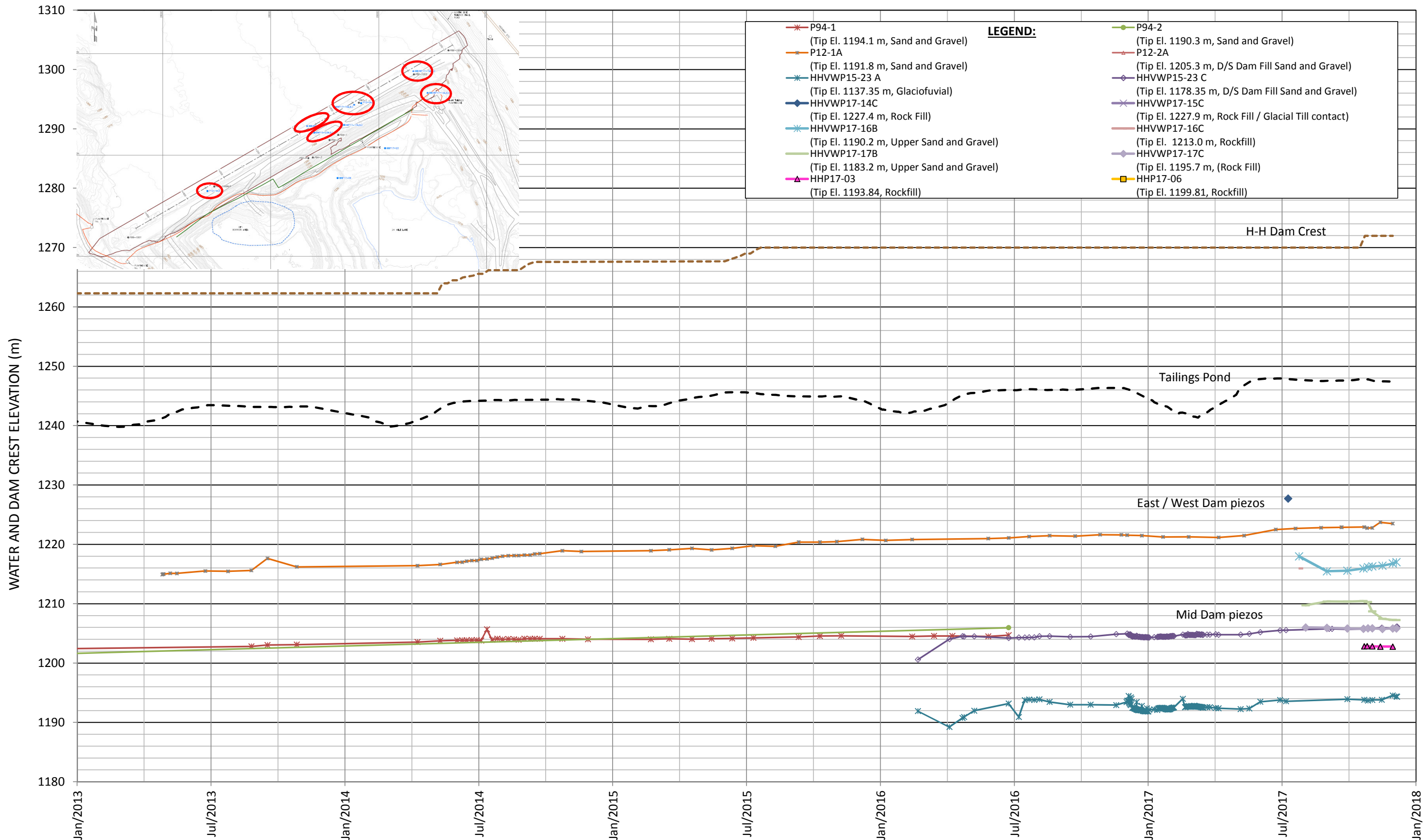
February 20, 2018
 Z:\M\VC\RM\02341B26 - HVC-2017 Dam Safety Support\300 Design\Piezo Data\Highland\Final 2017 version\171204 Master H-H Piezo Plots - 2017.xlsx\Dam Fill & S+G (VI-21a)



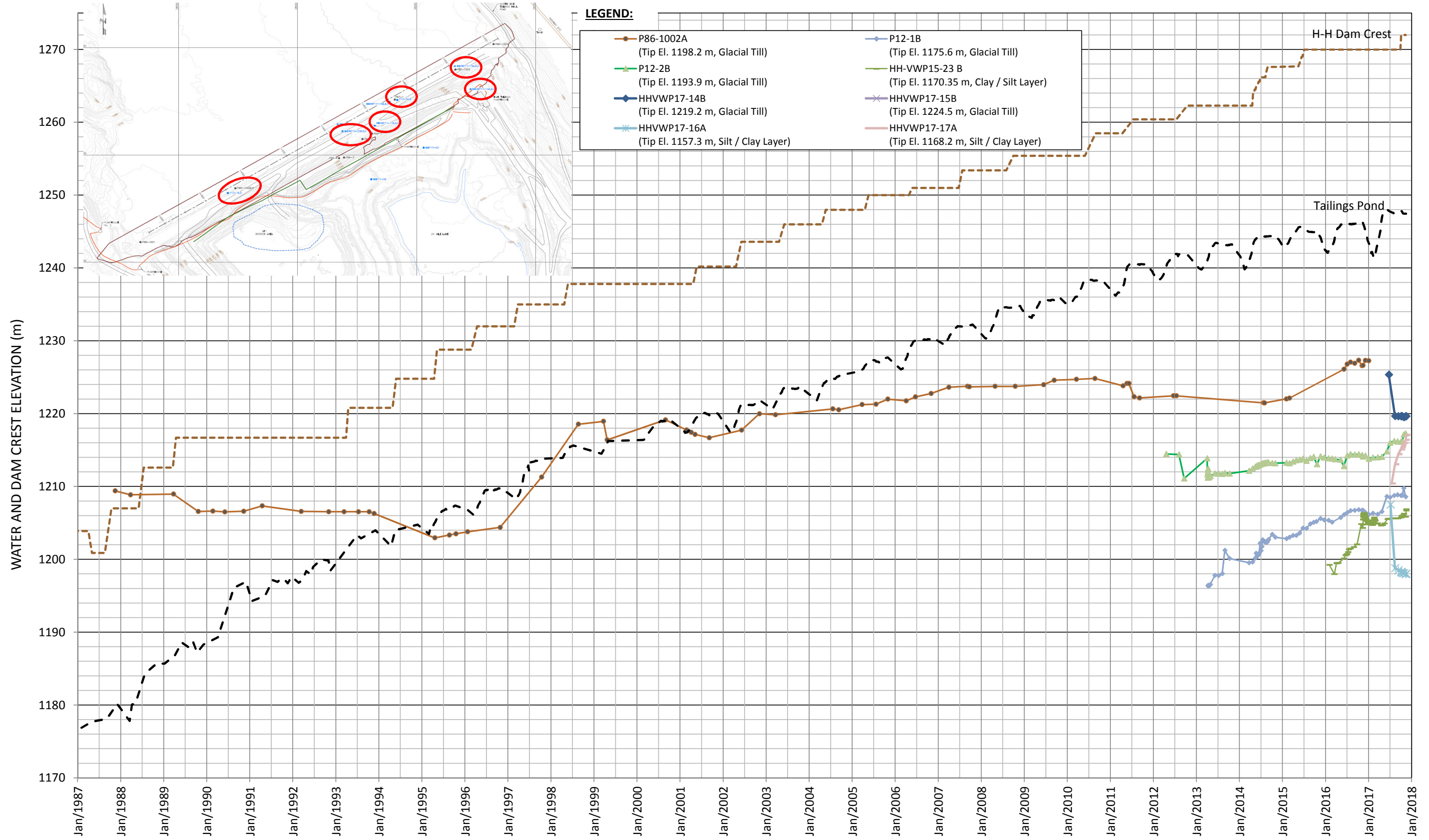
NOTES:
 U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 P87-1 has been plugged since 2009
 P86-1002B has been plugged since 2011
 P94-1 decommissioned Oct. 30, 2016
 P94-2 - possible survey error prior to 2008, decommissioned Oct. 30, 2016
 P94-3 and P94-4 both destroyed in 2008
 P12-2A has been plugged since 2012 construction at El. 1224 m

<small>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE, AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</small>	CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		TITLE H-H DAM PIEZOMETRIC DATA SAND AND GRAVEL AND DAM FILL 1994-2017
	PROJECT No. M02341B26	FIG No. V-21a

February 20, 2018 Z:\MVCRA\M02341B26 - HVC-2017 Dam Safety Support\300 Design\Piezo Data\Highland\Final 2017 version\171204 Master H-H Piezo Plots - 2017.xlsx\Dam Fill & S+G (V1-21a)

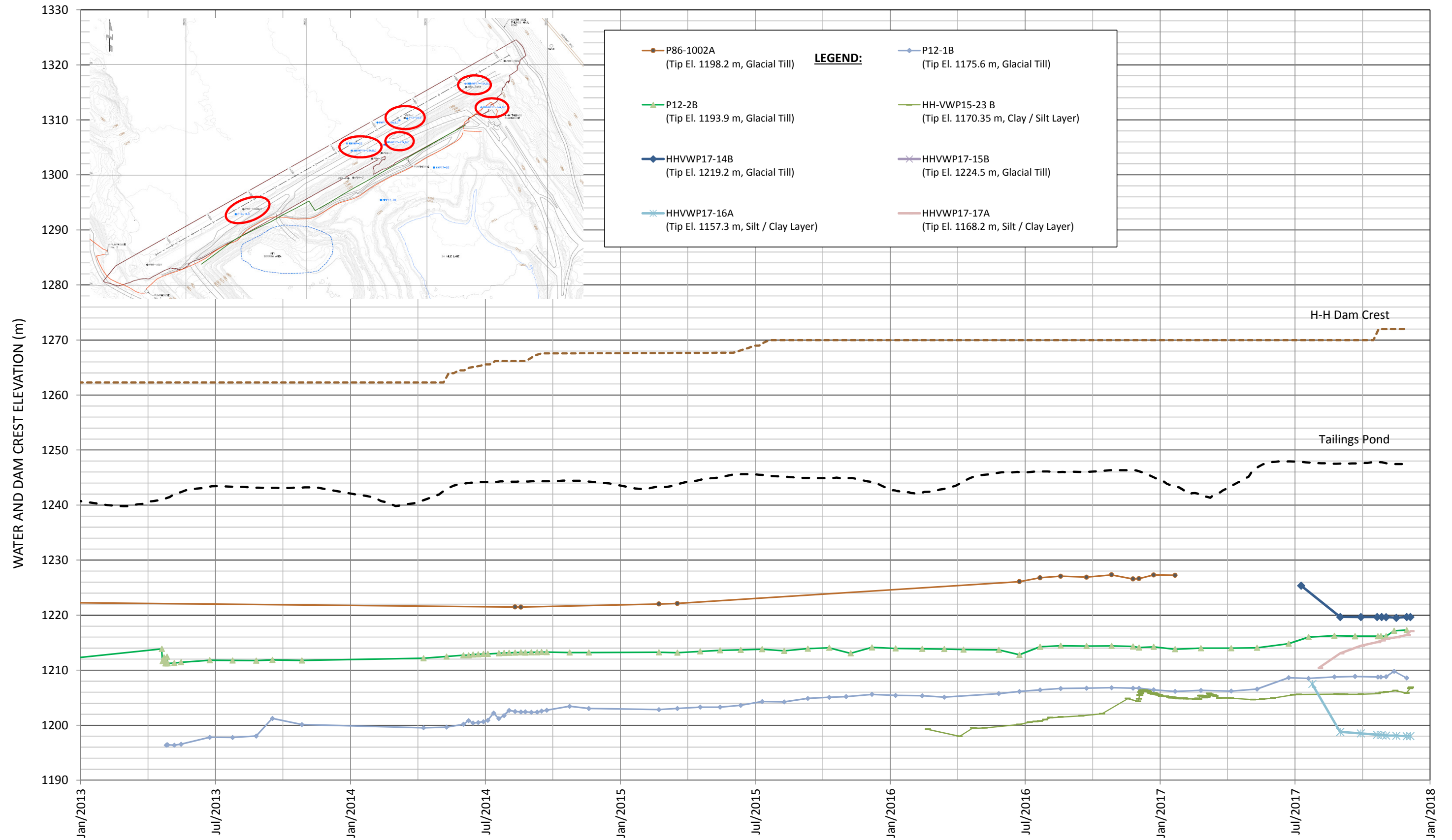


<p>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</p>	<p>CLIENT</p> <p>TECK HIGHLAND VALLEY COPPER PARTNERSHIP</p>	<p>PROJECT</p> <p>HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION</p>
	<p>Klohn Crippen Berger</p>	<p>TITLE</p> <p>H-H DAM PIEZOMETRIC DATA SAND AND GRAVEL AND DAM FILL</p>
	<p>PROJECT No.</p> <p>M02341B26</p>	<p>FIG No.</p> <p>V-21b</p>



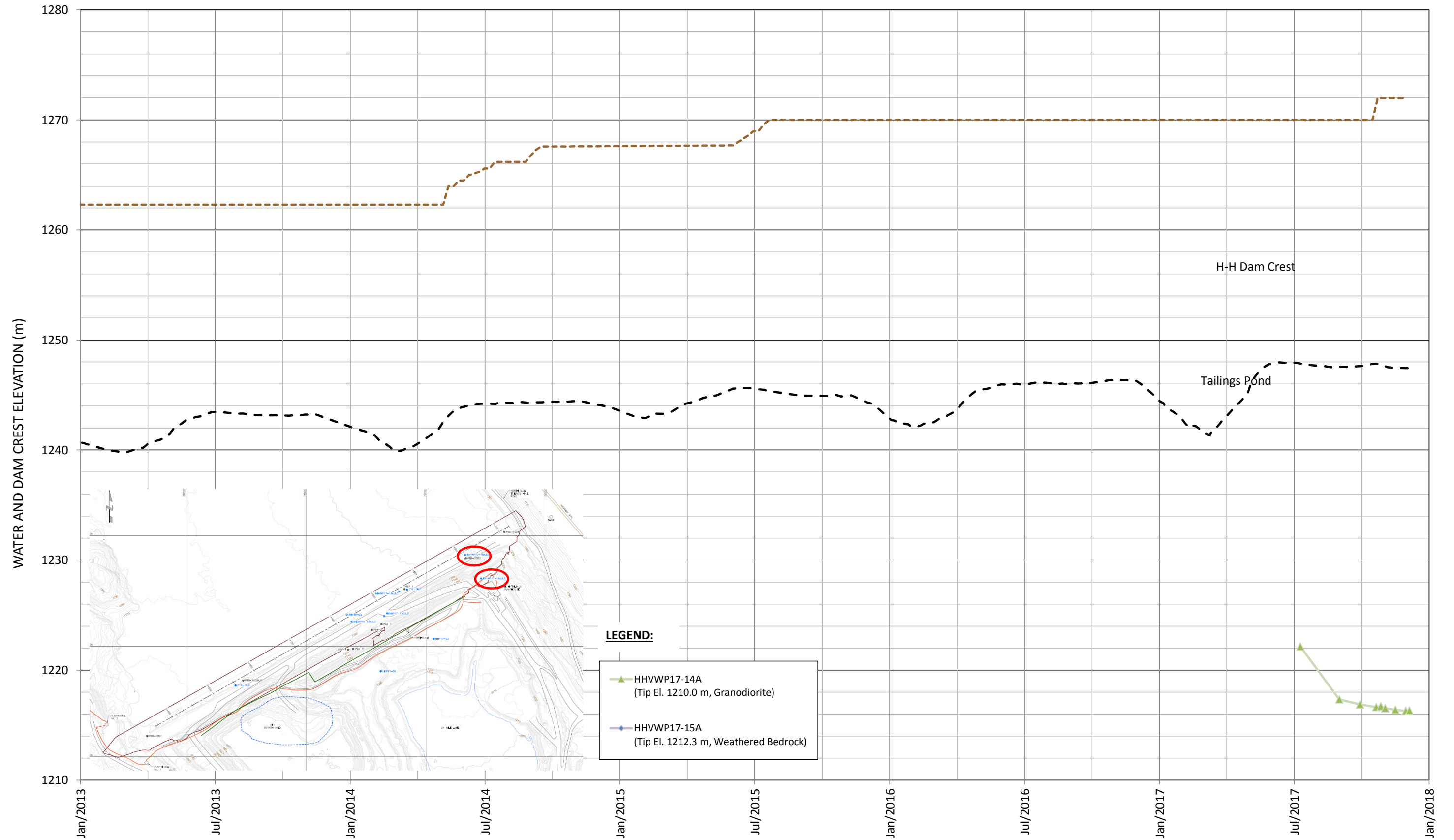
NOTES:
 U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 P86 - 1002A has been plugged since February 2017

<p>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</p>	<p>CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP</p>	<p>PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2016 DAM SAFETY INSPECTION</p>
	<p>Klohn Crippen Berger</p>	<p>TITLE H-H DAM PIEZOMETRIC DATA GLACIAL TILL AND CLAY / SILT LAYER</p>
	<p>PROJECT No. M02341B17</p>	<p>FIG No. V-22a</p>



NOTES:
 U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 P86 - 1002A has been plugged since February 2017

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		TITLE H-H DAM PIEZOMETRIC DATA GLACIAL TILL AND CLAY / SILT LAYER 2013-2017
PROJECT No. M02341B26		FIG No. V-22b

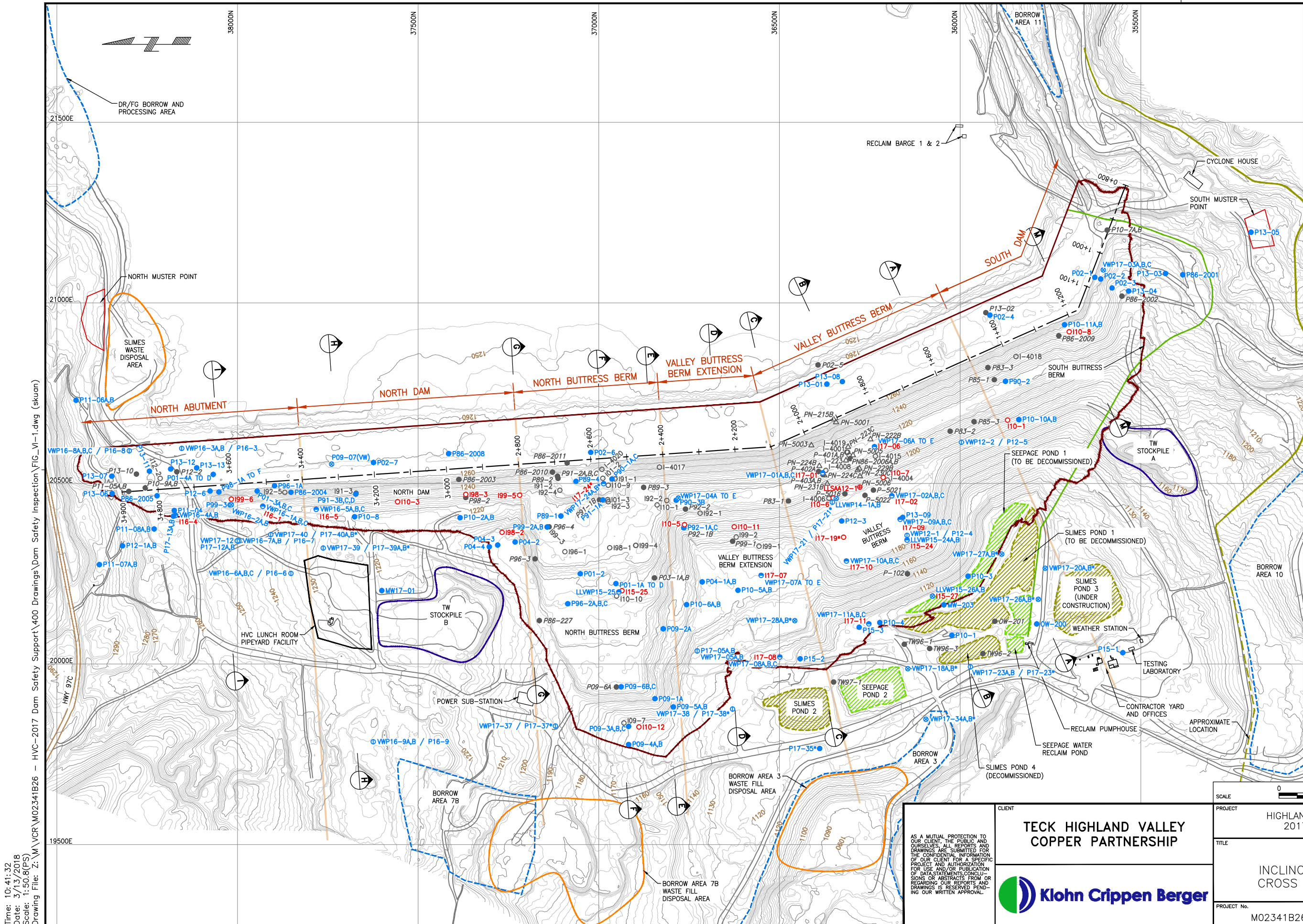


NOTES:
 U/S = Upstream of dam centerline
 D/S = Downstream of dam centerline
 P86 - 1002A has been plugged since February 2017
 HHVWP17-15A has been dry since installation

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		H-H DAM PIEZOMETRIC DATA BEDROCK 2013-2017
PROJECT No. M02341B26		FIG No. V-23

APPENDIX VI

Inclinometer and Piezometer Cross Sections



LEGEND:

- BORROW AREA
- WASTE FILL DISPOSAL AREA
- SEEPAGE POND
- SLIMES POND
- EL. 1279 m ULTIMATE DAM FOOTPRINT
- SURFACE WATER RECLAIM PIPELINE
- SPATSUM WATER PIPELINE
- HAUL ROAD
- PUBLIC ROAD
- L-L DAM CENTERLINE
- GEOLOGICAL CROSS SECTION

ACTIVE INSTRUMENTS (SEE NOTE 2):

- STANDPIPE PIEZOMETER AND OBSERVATION WELL
- ⊗ VIBRATING-WIRE PIEZOMETER
- ⊕ COMBINED STANDPIPE PIEZOMETER AND VIBRATING-WIRE PIEZOMETER
- ⊙ COMBINED INCLINOMETER AND VIBRATING-WIRE PIEZOMETER
- STANDARD INCLINOMETER
- ⊙ IN-PLACE SAA INCLINOMETER

DEFUNCT INSTRUMENTS (SEE NOTE 3):

- △ DEFUNCT PNEUMATIC PIEZOMETER
- DEFUNCT STANDPIPE PIEZOMETER
- DEFUNCT INCLINOMETER

- NOTES:**
1. TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER PARTNERSHIP AND WAS DERIVED FROM SATELLITE IMAGERY TAKEN ON 2017-07-01.
 2. ACTIVE INSTRUMENTS ARE DEFINED AS ANY INSTRUMENTS SATISFYING ONE OF THE FOLLOWING CRITERIA: CURRENTLY READING AN ACTIVE WATER LEVEL, DRY OR PLUGGED <20 m ABOVE TIP ELEVATION AS THIS COULD SHOW A RESPONSE IN THE FUTURE.
 3. DEFUNCT INSTRUMENTS ARE DEFINED AS ANY INSTRUMENTS SATISFYING ONE OF THE FOLLOWING CRITERIA: DESTROYED, DAMAGED OR PLUGGED >20 m ABOVE TIP ELEVATION.
 4. ASTERISK (*) DENOTES PROPOSED INSTRUMENT LOCATION TO BE UPDATED WITH AS-CONSTRUCTED LOCATION WHEN SURVEY IS COMPLETED.

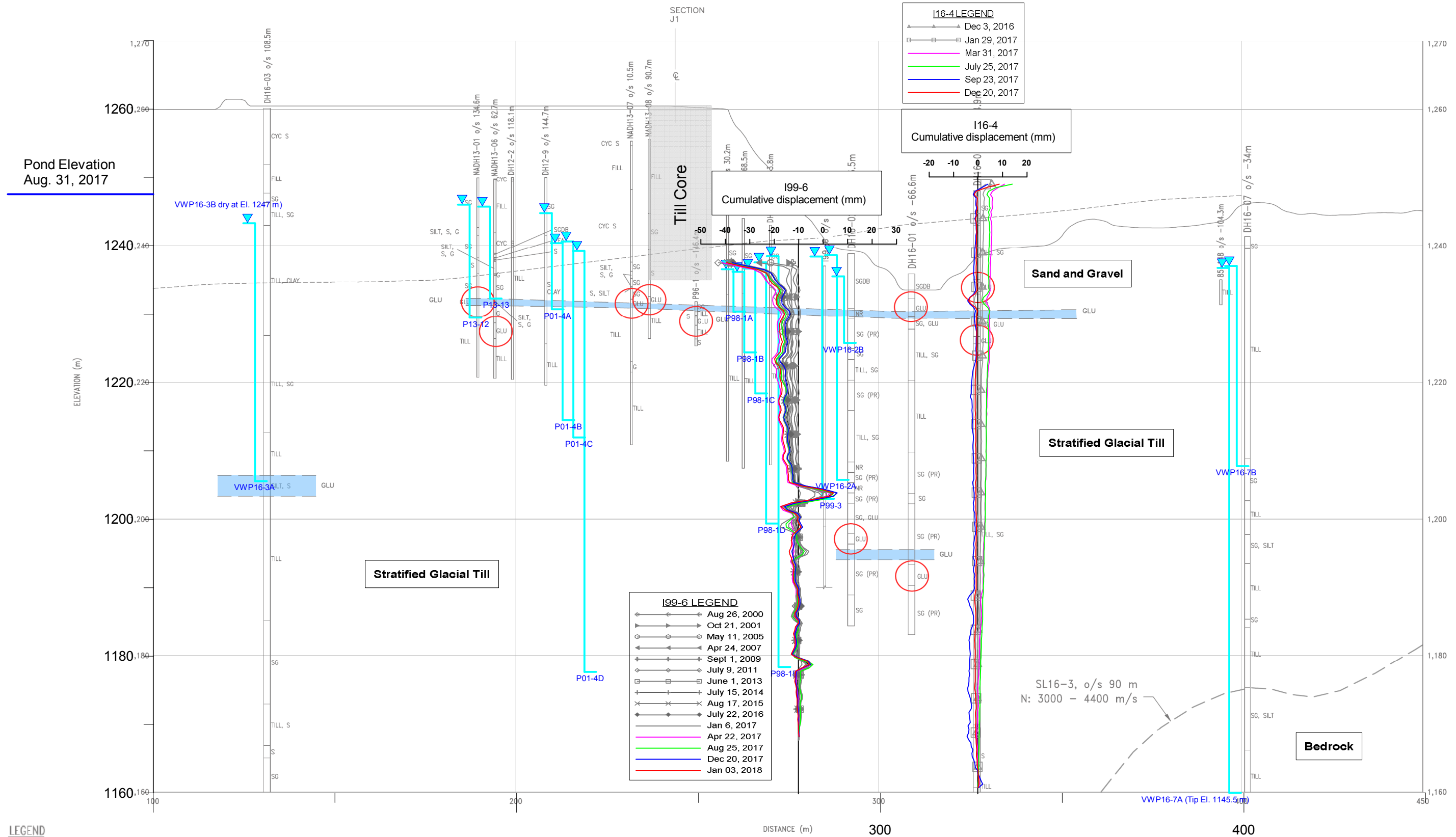


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		L-L DAM INCLINOMETER AND PIEZOMETER CROSS SECTION LOCATION PLAN
PROJECT No.	M02341B26	FIG. No.
		VI-1

KCB-R-MD

Date: February 22, 2018
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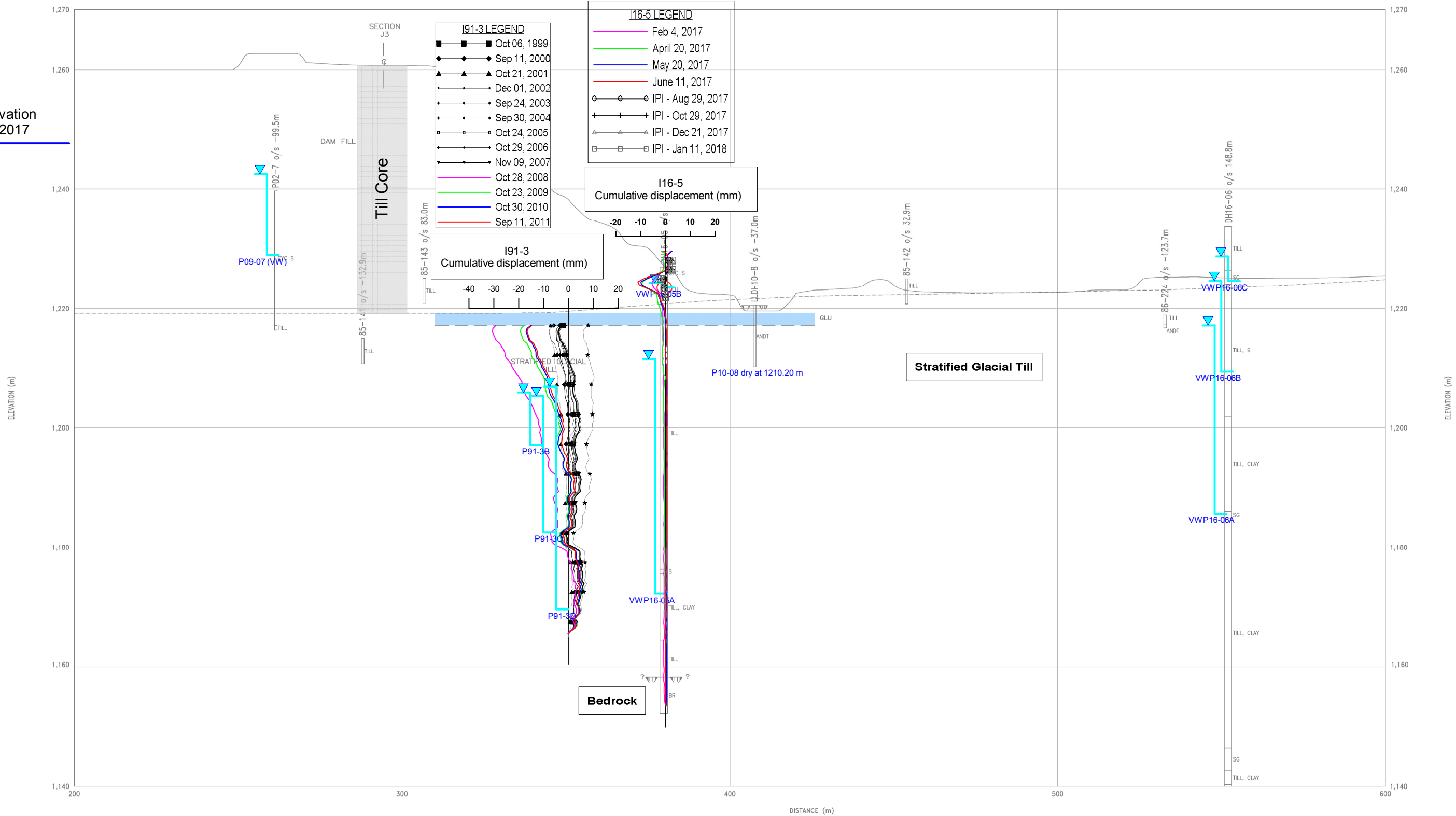
LEGEND	
OVERBURDEN	BEDROCK
CYC S Cycloned Sand	AGLM Agglomerate
SGDB Sand & Gravel Drainage Blanket	ANDT Andesite
CLAY Clay	BR Bedrock
G Gravel	BRCA Breccia
GLU Glaciolacustrine	CGLM Conglomerate
LU Lacustrine	GRDT Granodiorite
S Sand	MDST Mudstone
SG Sand & Gravel	SLST Siltstone
SG (PR) Sand & Gravel (Poor Recovery)	SST Sandstone
SILT Silt	NR No Recovery
TILL Till	
	Inferred Bedrock Surface
	Original Ground
	Glaciolacustrine (GLU)
	GLU seen in core
	Interpreted Velocity Boundaries from 2016 Seismic Refraction Program
	Piezometric elevation (2017)
	Piezometer name and tip elevation

NOTES:
 1) Section is exaggerated 2 times vertically
 2) Positive offset is North, negative offset is South
 3) Surface topography is 2015 lidar survey
 4) Geological sections are taken from KCB report "L-L Dam Geological and Geotechnical Site Characterization, Rev 1", Dec 2016.

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		TITLE INCLINOMETER AND PIEZOMETER CROSS SECTION I Sta. 3+630
	PROJECT No. M02341B26	FIG No. VI-2

Date: February 22, 2018
Z:\M\CR\2017\2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\Cross Section Figures DS\Section H - Sta. 3+300.grf

Pond Elevation
Aug. 31, 2017



LEGEND

OVERBURDEN		BEDROCK	
CYC S	Cycloned Sand	AGLM	Agglomerate
SGDB	Sand & Gravel Drainage Blanket	ANDT	Andesite
CLAY	Clay	BR	Bedrock
G	Gravel	BRCA	Breccia
GLU	Glaciolacustrine	CGLM	Conglomerate
LU	Lacustrine	GRDT	Granodiorite
S	Sand	MDST	Mudstone
SG	Sand & Gravel	SLST	Siltstone
SG (PR)	Sand & Gravel (Poor Recovery)	SST	Sandstone
SILT	Silt	NR	No Recovery
TILL	Till		

- Inferred Bedrock Surface
- Original Ground
- Glaciolacustrine (GLU)
- GLU seen in core
- Interpreted Velocity Boundaries from 2016 Seismic Refraction Program
- Piezometer elevation (2017)
- Piezometer name and tip elevation

NOTES:

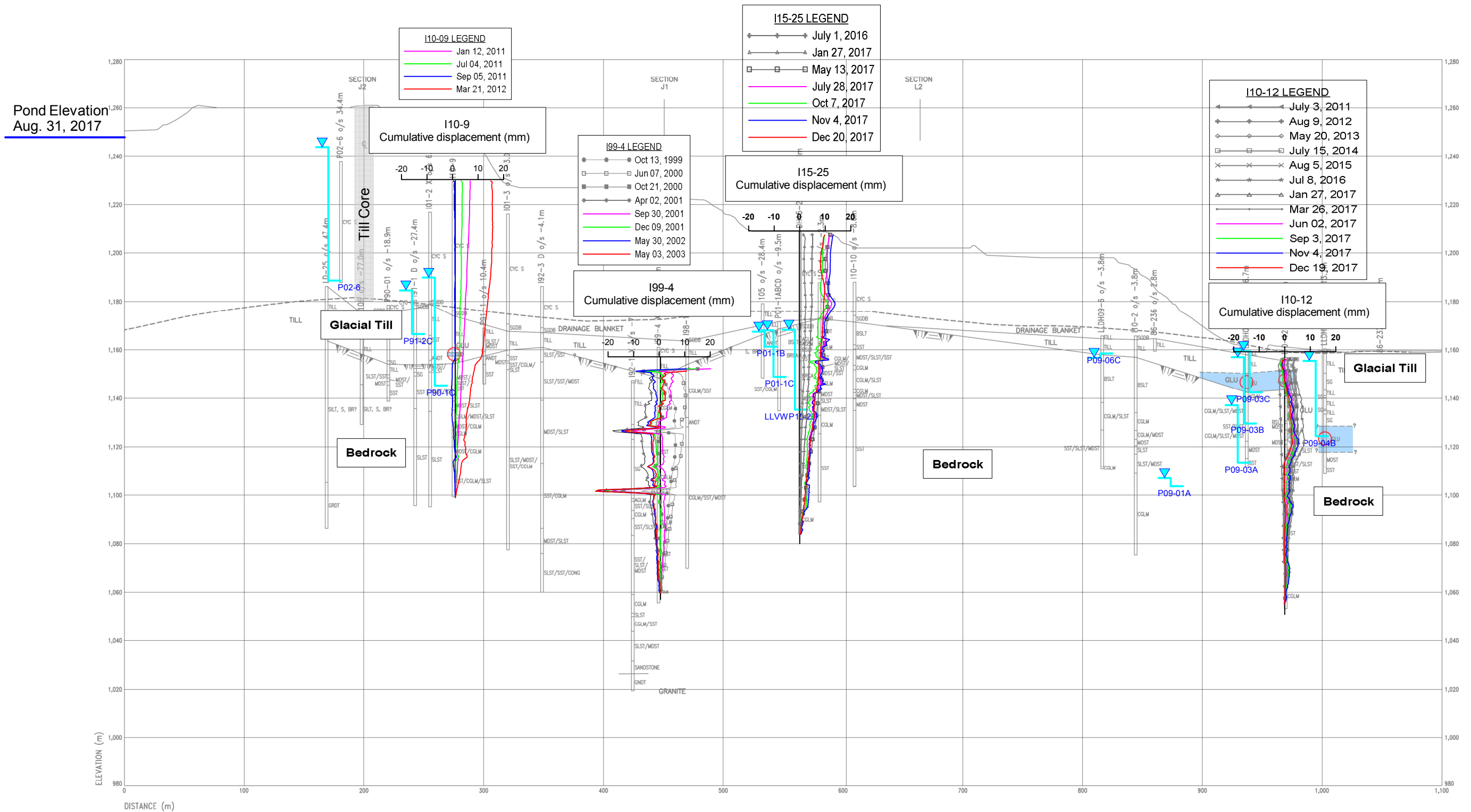
- 1) Section is exaggerated 2 times vertically
- 2) Positive offset is North, negative offset is South
- 3) Surface topography is 2015 lidar survey
- 4) Geological sections are taken from KCB report "L-L Dam Geological and Geotechnical Site Characterization, Rev 1", Dec 2016.

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CLIENT
**TECK HIGHLAND VALLEY
COPPER PARTNERSHIP**

PROJECT	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION	
TITLE	INCLINOMETER AND PIEZOMETER CROSS SECTION H Sta. 3+300	
PROJECT No.	M02341B26	FIG No. VI-3

Date: March 13, 2018
Z:\MVC\RM02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\Cross Section Figures DS\Section F - Sta. 2+564.grf



LEGEND

OVERBURDEN	BEDROCK	Inferred Bedrock Surface
CYC S Cycloned Sand	AGLM Agglomerate	Original Ground
SGDB Sand & Gravel Drainage Blanket	ANDT Andesite	Glaciolacustrine
CLAY Clay	BR Bedrock	GLU seen in core
G Gravel	BRCA Breccia	
GLU Glaciolacustrine	CGLM Conglomerate	
LU Lacustrine	GRDT Granodiorite	
S Sand	MDST Mudstone	
SG Sand & Gravel	SLST Siltstone	
SILT Silt	SST Sandstone	
TILL Till		

NOTES:

- 1) Section is exaggerated 2 times vertically
- 2) Positive offset is North, negative offset is South
- 3) Surface topography is 2015 lidar survey
- 4) Geological sections are taken from KCB report "L-L Dam Geological and Geotechnical Site Characterization, Rev 1", Dec 2016.

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

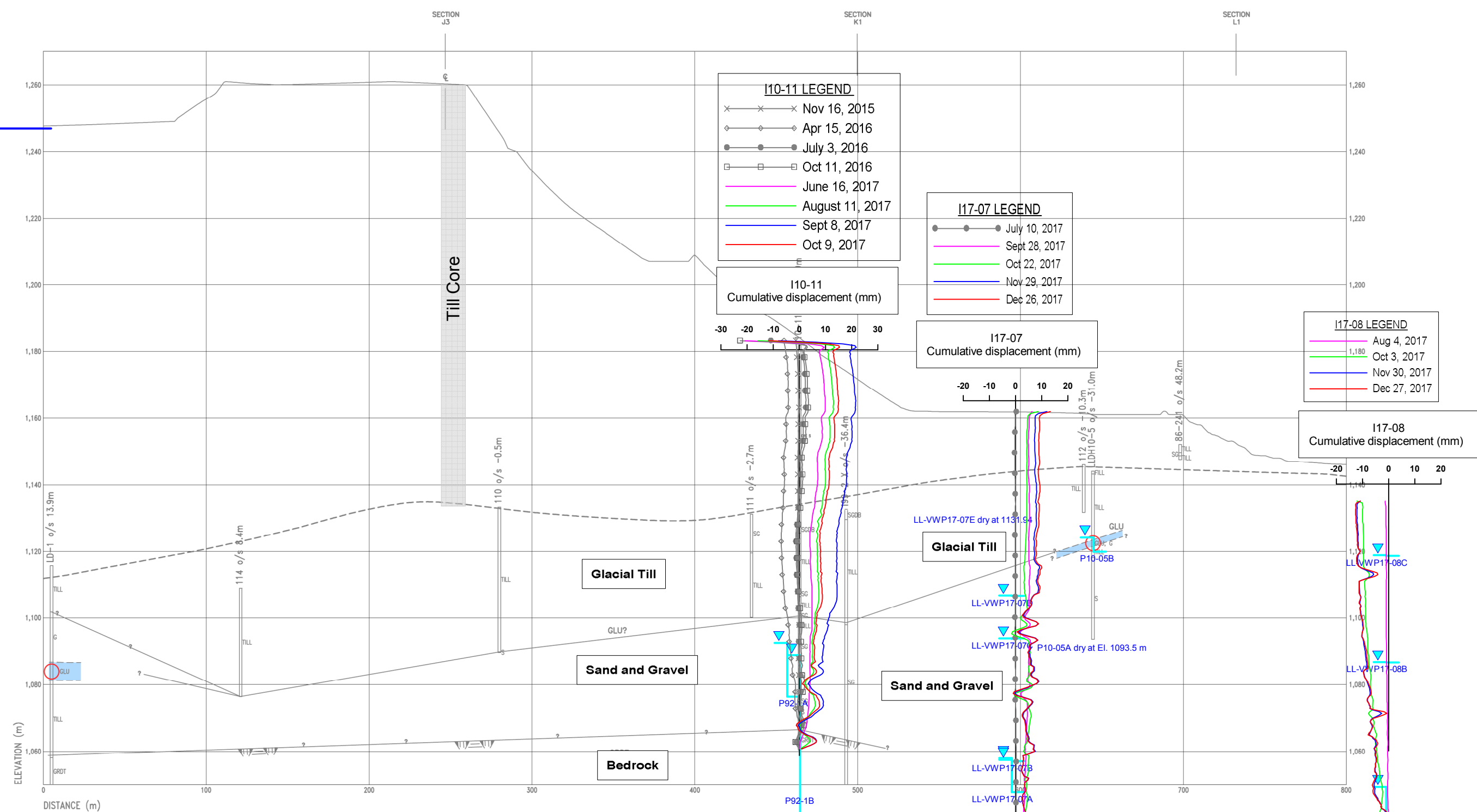
CLIENT
TECK HIGHLAND VALLEY COPPER PARTNERSHIP

Klohn Crippen Berger

PROJECT	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
TITLE	INCLINOMETER AND PIEZOMETER CROSS SECTION F Sta. 2+564
PROJECT No.	M02341B26
FIG No.	VI-4

Date: March 13, 2018
Z:\MIV\CRM\0234\B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\Cross Section Figures DSI\Section D - Sta. 2+250.grf

Pond Elevation
Aug. 31, 2017



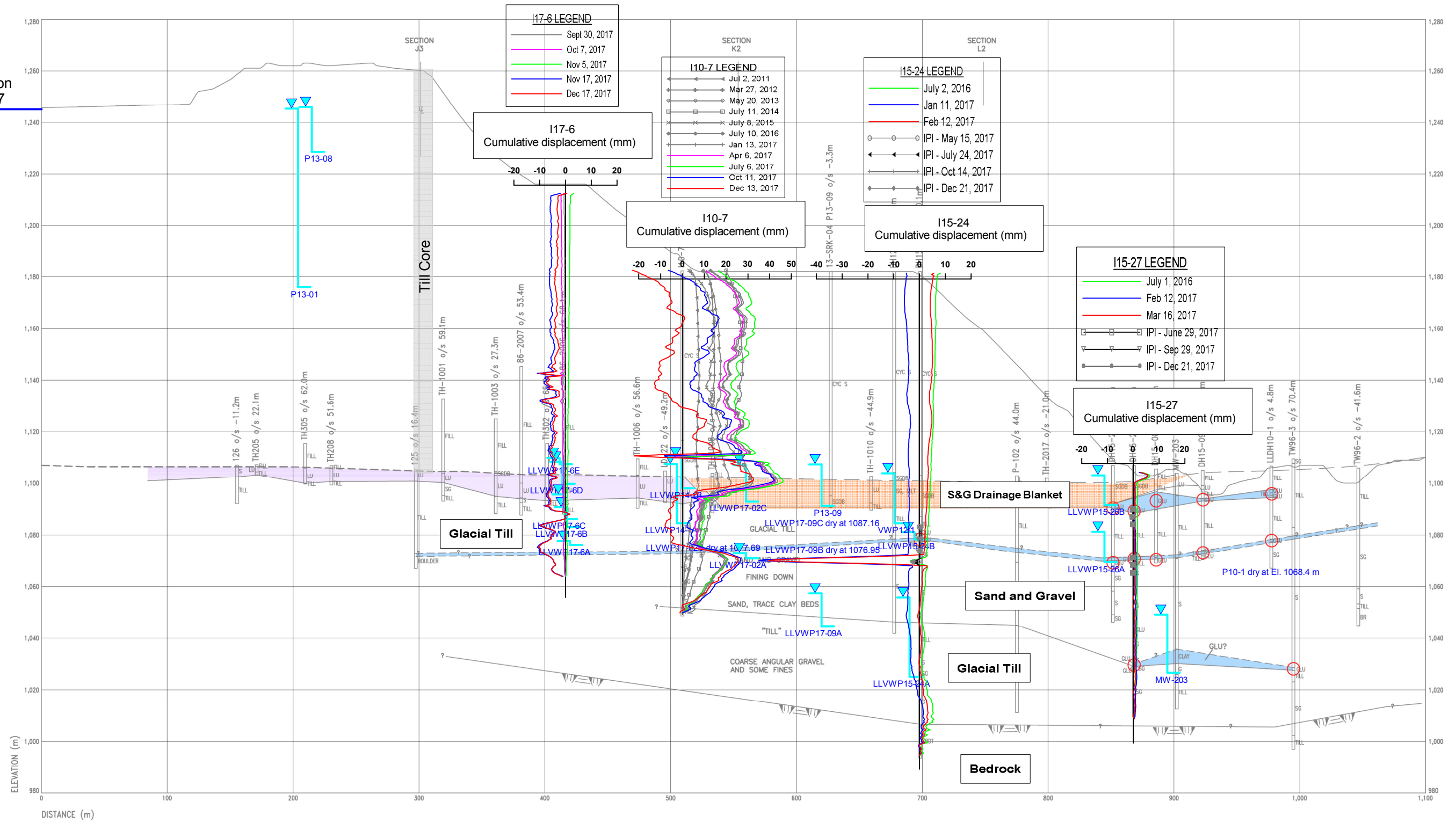
LEGEND	
OVERBURDEN	
CYC S	Cycloned Sand
SGDB	Sand & Gravel Drainage Blanket
CLAY	Clay
G	Gravel
GLU	Glaciolacustrine
LU	Lacustrine
S	Sand
SG	Sand & Gravel
SILT	Silt
TILL	Till
BEDROCK	
AGLM	Agglomerate
ANDT	Andesite
BR	Bedrock
BRCA	Breccia
CGLM	Conglomerate
GRDT	Granodiorite
MDST	Mudstone
SLST	Siltstone
SST	Sandstone
	Inferred Bedrock Surface
	Original Ground
	Glaciolacustrine (GLU)
	GLU seen in core
	Piezometric elevation (2017)
	Piezometer name and tip elevation

NOTES:
 1) Section is exaggerated 2 times vertically
 2) Positive offset is North, negative offset is South
 3) Surface topography is 2015 lidar survey
 4) Geological sections are taken from KCB report "L-L Dam Geological and Geotechnical Site Characterization, Rev 1", Dec 2016.

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		TITLE INCLINOMETER AND PIEZOMETER CROSS SECTION D Sta. 2+250
	PROJECT No. M02341B26	FIG No. VI-5

Date: March 13, 2018
Z:\MVC\RM0234\B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\Cross Section Figures DSI\Section B - Sta. 1+850.grf

Pond Elevation
Aug. 31, 2017



LEGEND

OVERBURDEN
 CYC S Cycloned Sand
 SGDB Sand & Gravel Drainage Blanket
 CLAY Clay
 G Gravel
 GLU Glaciolacustrine
 LU Lacustrine
 S Sand
 SILT Silt
 TILL Till

BEDROCK
 AGLM Agglomerate
 ANDT Andesite
 BR Bedrock
 BRCA Breccia
 CGLM Conglomerate
 GRDT Granodiorite
 MDST Mudstone
 SLST Siltstone
 SST Sandstone

— Inferred Bedrock Surface
 - - - Original Ground
 - - - Original Ground - Excavated
 [Blue Box] Glaciolacustrine (GLU)
 [Purple Box] Lacustrine (LU)
 ○ GLU seen in core

— Piezometric elevation (2017)
 [Blue Triangle] Piezometer name and tip elevation

NOTES:

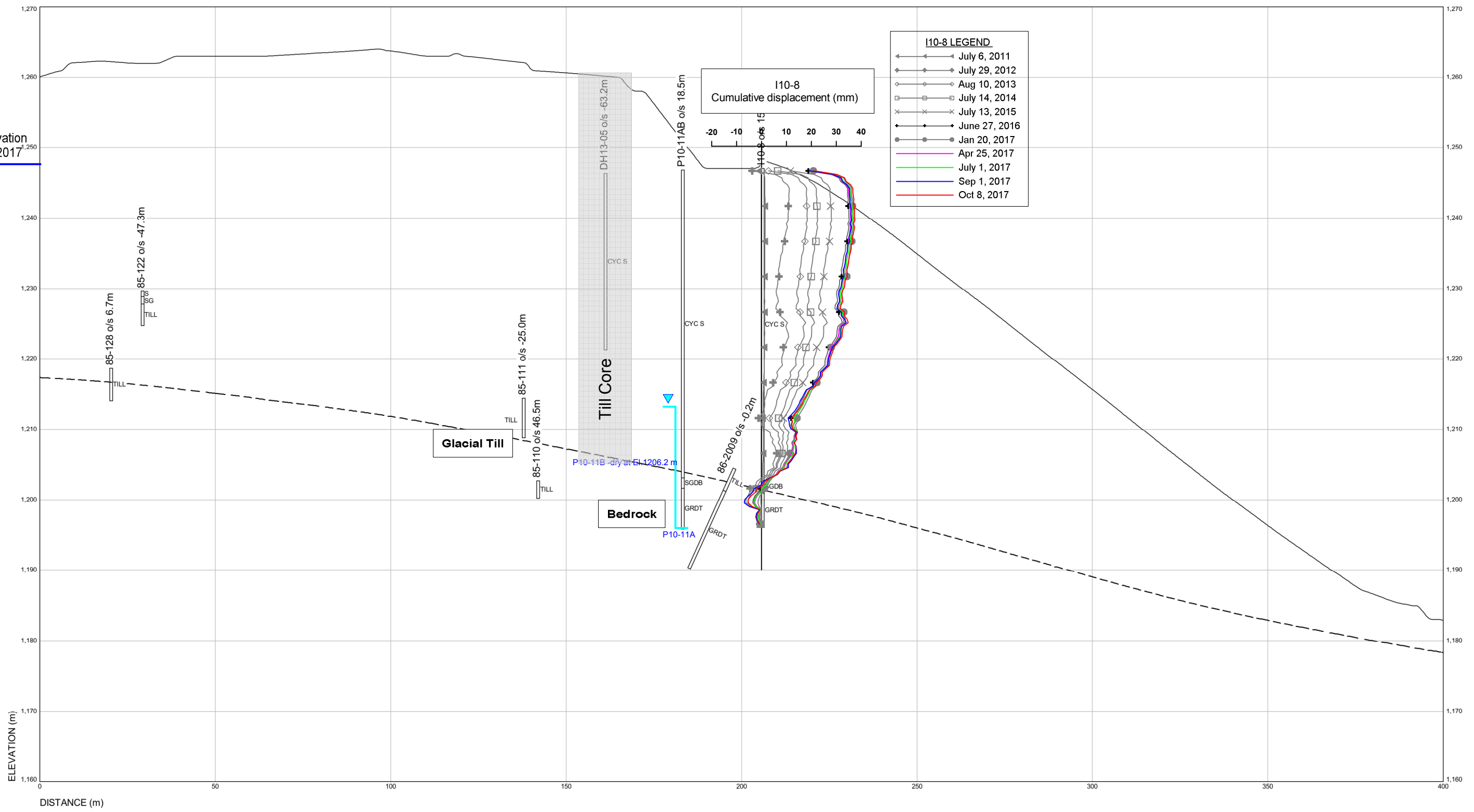
- 1) Section is exaggerated 2 times vertically
- 2) Positive offset is North, negative offset is South
- 3) Surface topography is 2015 lidar survey
- 4) Geological sections are taken from KCB report "L-L Dam Geological and Geotechnical Site Characterization, Rev 1", Dec 2016.

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CLIENT
TECK HIGHLAND VALLEY COPPER PARTNERSHIP

PROJECT	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
TITLE	INCLINOMETER AND PIEZOMETER CROSS SECTION B Sta. 1+850
PROJECT No.	M02341B26
FIG No.	VI-6

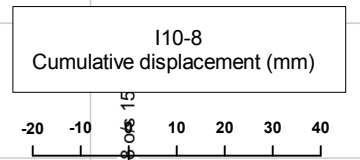
Date: February 23, 2018
Z:\MVC\RM02341B26 - HVC-2017 Dam Safety Support\300 Design\Inclinometer Data\Inclinometer processing\Cross Section Figures DSI\Section M - Sta. 1+200 rev.gif



Pond Elevation
Aug. 31, 2017
1,250

I10-8 LEGEND

- ← July 6, 2011
- ♦ July 29, 2012
- ◇ Aug 10, 2013
- July 14, 2014
- × July 13, 2015
- ▲ June 27, 2016
- Jan 20, 2017
- Apr 25, 2017
- July 1, 2017
- Sep 1, 2017
- Oct 8, 2017



LEGEND

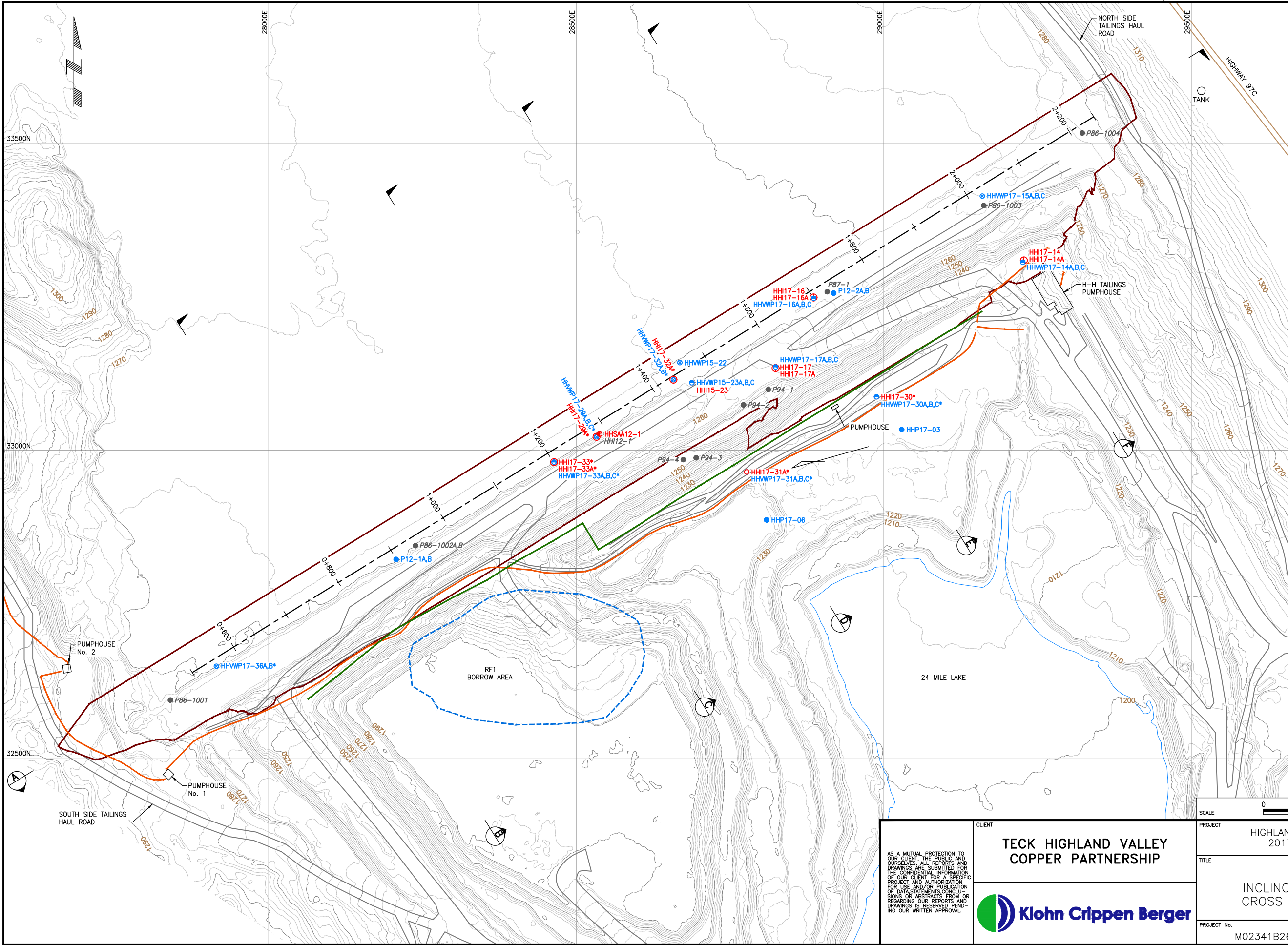
OVERBURDEN	BEDROCK	— 2015 Surface
CYC S Cycloned Sand	AGLM Agglomerate	--- Original Ground
SGDB Sand & Gravel Drainage Blanket	ANDT Andesite	
CLAY Clay	BR Bedrock	
G Gravel	BRCA Breccia	
GLU Glaciolacustrine	CGLM Conglomerate	
LU Lacustrine	GRDT Granodiorite	
S Sand	MDST Mudstone	
SG Sand & Gravel	SLST Siltstone	
SILT Silt	SST Sandstone	
TILL Till		

Piezometric elevation (2017) Piezometer name and tip elevation

NOTES:
 1) Section is exaggerated 2 times vertically
 2) Positive offset is North, negative offset is South
 3) Geological sections are taken from KCB report "L-L Dam Geological and Geotechnical Site Characterization, Rev 1", Dec 2016.

AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.	CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		TITLE INCLINOMETER AND PIEZOMETER CROSS SECTION M Sta. 1+200
	PROJECT No. M02341B26	FIG No. VI-7

Time: 10:43:00
 Date: 3/13/2018
 Scale: 1:50.8(P/S)
 Drawing File: Z:\M\CR\M02341B26 - HVC-2017 Dam Safety Support\400 Drawings\Dam Safety Inspection\FIG_VI-8.dwg (skuan)



LEGEND:

- BORROW AREA
- ULTIMATE DAM FOOTPRINT
- TAILINGS PIPELINE
- POWERLINE
- HAUL ROAD
- PUBLIC ROAD
- H-H DAM CENTERLINE
- TANK
- GEOLOGICAL CROSS SECTION

ACTIVE INSTRUMENTS (SEE NOTE 2):

- STANDPIPE PIEZOMETER AND OBSERVATION WELL
- ⊗ VIBRATING-WIRE PIEZOMETER
- ⊕ COMBINED STANDPIPE PIEZOMETER AND VIBRATING-WIRE PIEZOMETER
- ⊙ COMBINED INCLINOMETER AND VIBRATING-WIRE PIEZOMETER
- STANDARD INCLINOMETER
- ⊙ COMBINED STANDARD INCLINOMETER AND IN-PLACE SAA INCLINOMETER
- ⊕ COMBINED STANDARD INCLINOMETER AND PAIRED SONDEX SETTLEMENT SYSTEM

DEFUNCT INSTRUMENTS (SEE NOTE 3):

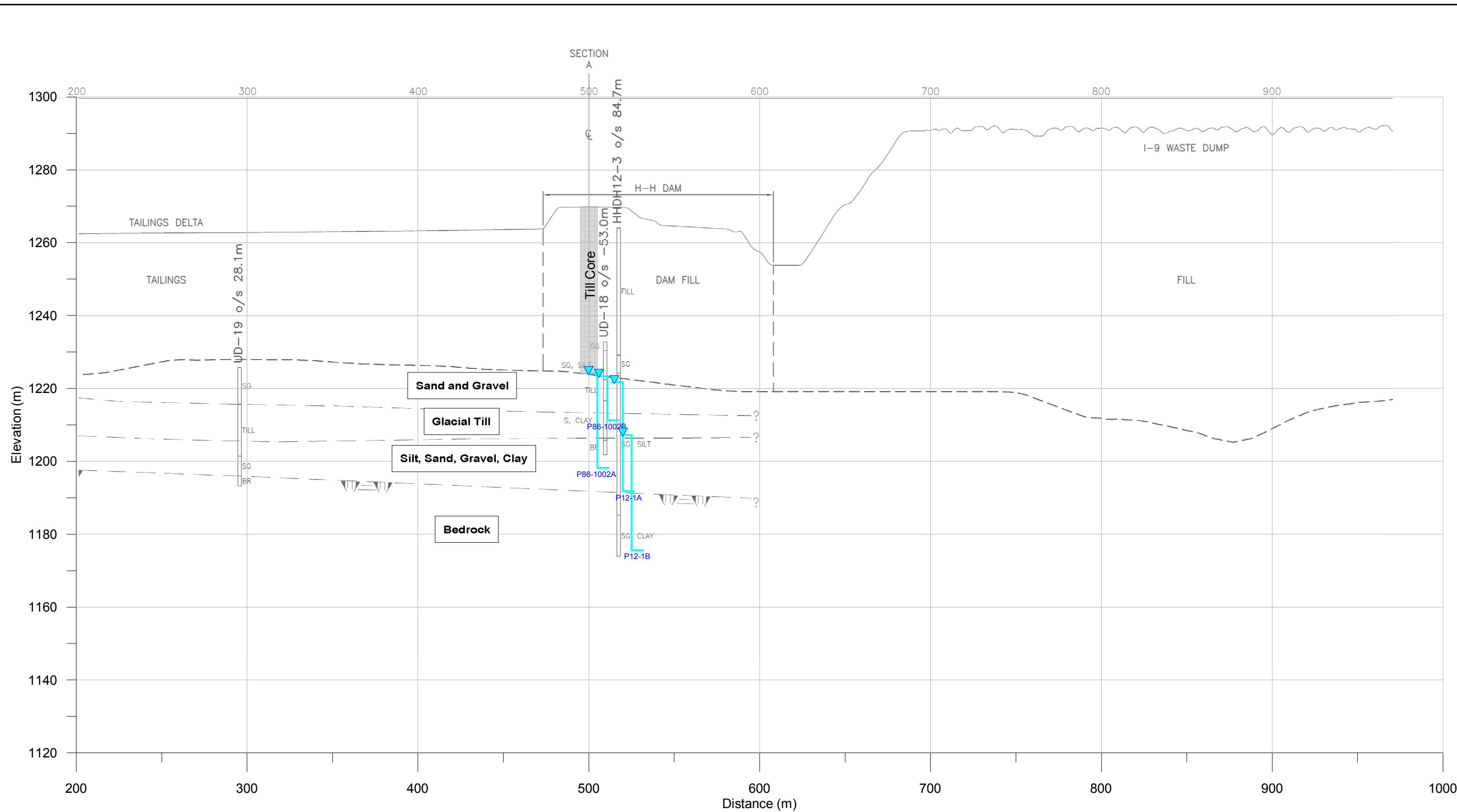
- DEFUNCT STANDPIPE PIEZOMETER
- ⊙ DEFUNCT COMBINED STANDARD INCLINOMETER AND IN-PLACE SAA INCLINOMETER

- NOTES:**
1. TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER PARTNERSHIP AND WAS DERIVED FROM SATELLITE IMAGERY TAKEN ON 2017-07-01.
 2. ACTIVE INSTRUMENTS ARE DEFINED AS ANY INSTRUMENTS SATISFYING ONE OF THE FOLLOWING CRITERIA: CURRENTLY READING AN ACTIVE WATER LEVEL, DRY OR PLUGGED <20 m ABOVE TIP ELEVATION AS THIS COULD SHOW A RESPONSE IN THE FUTURE.
 3. DEFUNCT INSTRUMENTS ARE DEFINED AS ANY INSTRUMENTS SATISFYING ONE OF THE FOLLOWING CRITERIA: DESTROYED, DAMAGED OR PLUGGED >20 m ABOVE TIP ELEVATION.
 4. ASTERISK (*) DENOTES PROPOSED INSTRUMENT LOCATION TO BE UPDATED WITH AS-CONSTRUCTED LOCATION WHEN SURVEY IS COMPLETED.

SCALE 0 200 m

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PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION		TITLE H-H DAM INCLINOMETER AND PIEZOMETER CROSS SECTION LOCATION PLAN
PROJECT No. M02341B26		FIG. No. VI-8

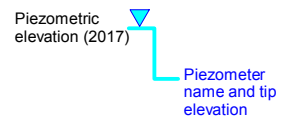
KCB-R-MID



NOTES:

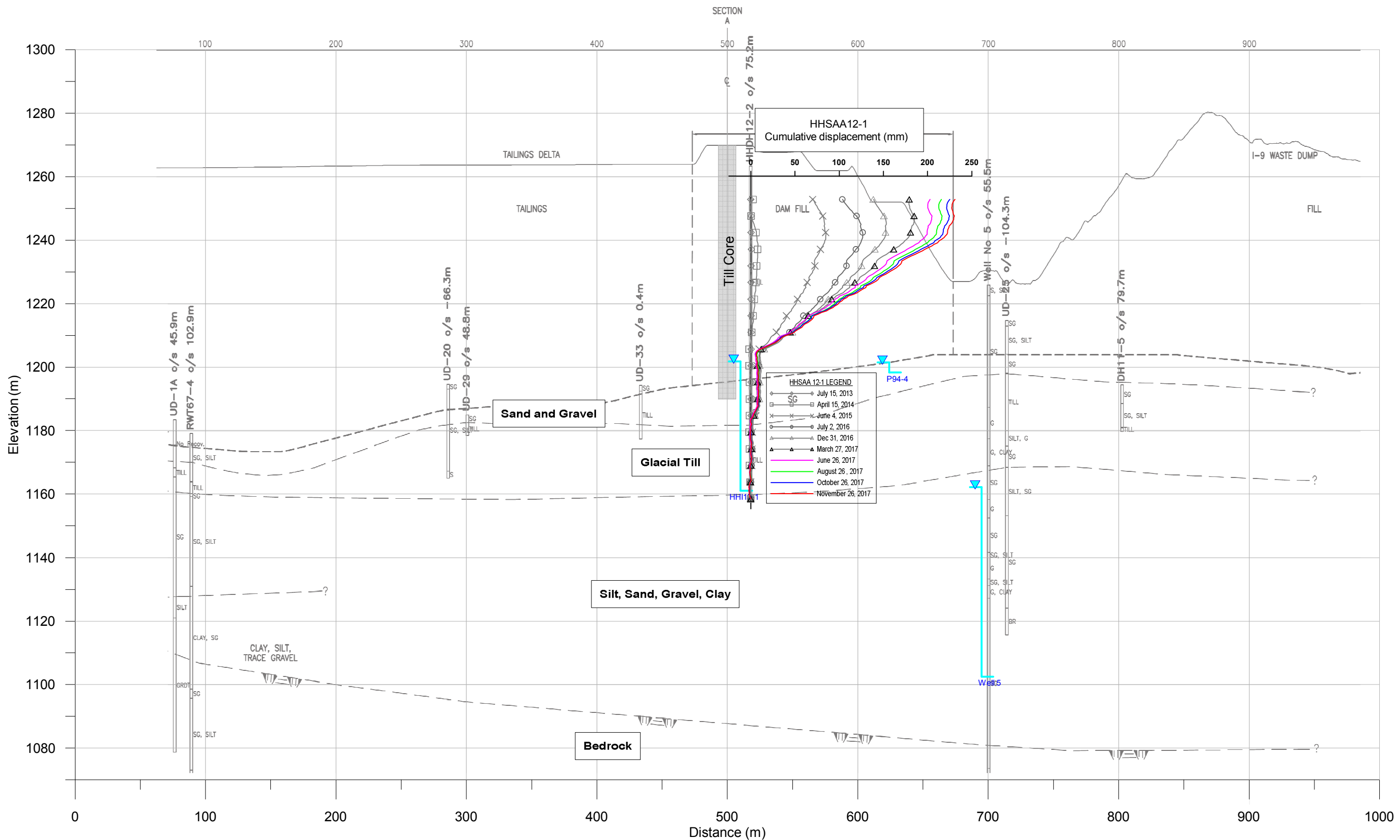
- 1) Section is exaggerated 2 times vertically
- 2) Positive offset is East, negative offset is West
- 3) Surface topography is 2015 lidar survey
- 4) Geological sections are taken from KCB report "H-H Dam Performance Review", Nov 2016.
- 5) P86-1002B piezometer reading taken in 2011 (instrument plugged thereafter)

LEGEND

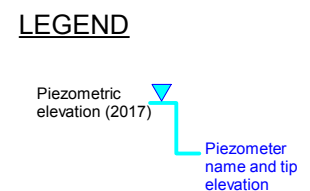


Date: March 13, 2018

AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.	TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		TITLE INCLINOMETER AND PIEZOMETER CROSS SECTION B Sta. 0+800
PROJECT No. M02341B26		FIG No. VI-9

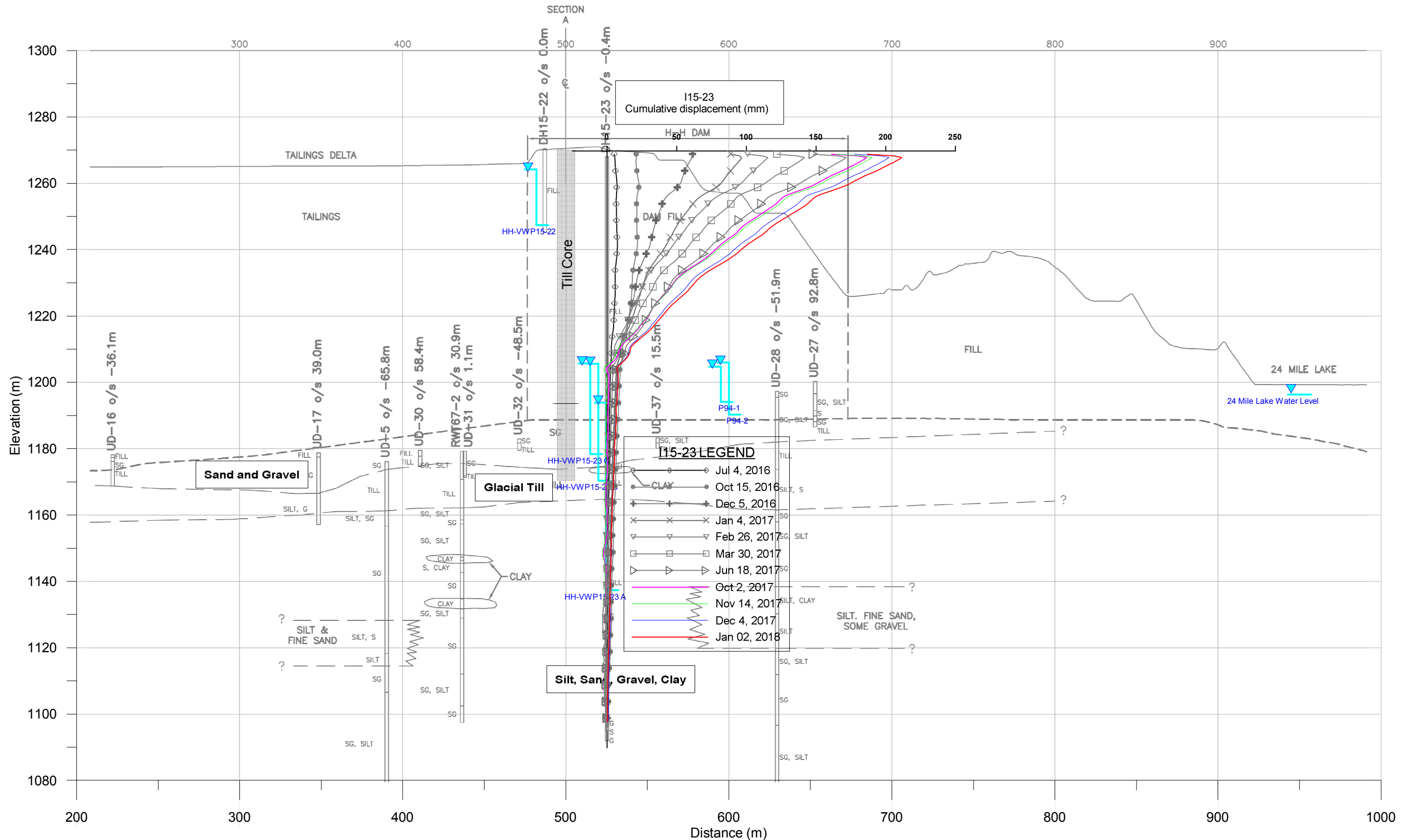


- NOTES:**
- 1) Section is exaggerated 2 times vertically
 - 2) Positive offset is East, negative offset is West
 - 3) Surface topography is 2015 lidar survey
 - 4) Geological sections are taken from KCB report "H-H Dam Performance Review", Nov 2016.
 - 5) Well 5 piezometer reading taken in 2002
 - 6) P94-4 piezometer reading taken in 2007 (instrument damaged thereafter)



AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.	CLIENT TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		TITLE INCLINOMETER AND PIEZOMETER CROSS SECTION C Sta. 1+200
	PROJECT No. M02341B26	FIG No. VI-10

Date: March 13, 2018



NOTES:

- 1) Section is exaggerated 2 times vertically
- 2) Positive offset is East, negative offset is West
- 3) Surface topography is 2015 lidar survey
- 4) Geological sections are taken from KCB report "H-H Dam Performance Review", Nov 2016.
- 5) Starter Dam Crest Elevation = 1193.6 m
- 6) P94-1 and P94-2 were decommissioned during late 2016 (readings shown are from June 2016)

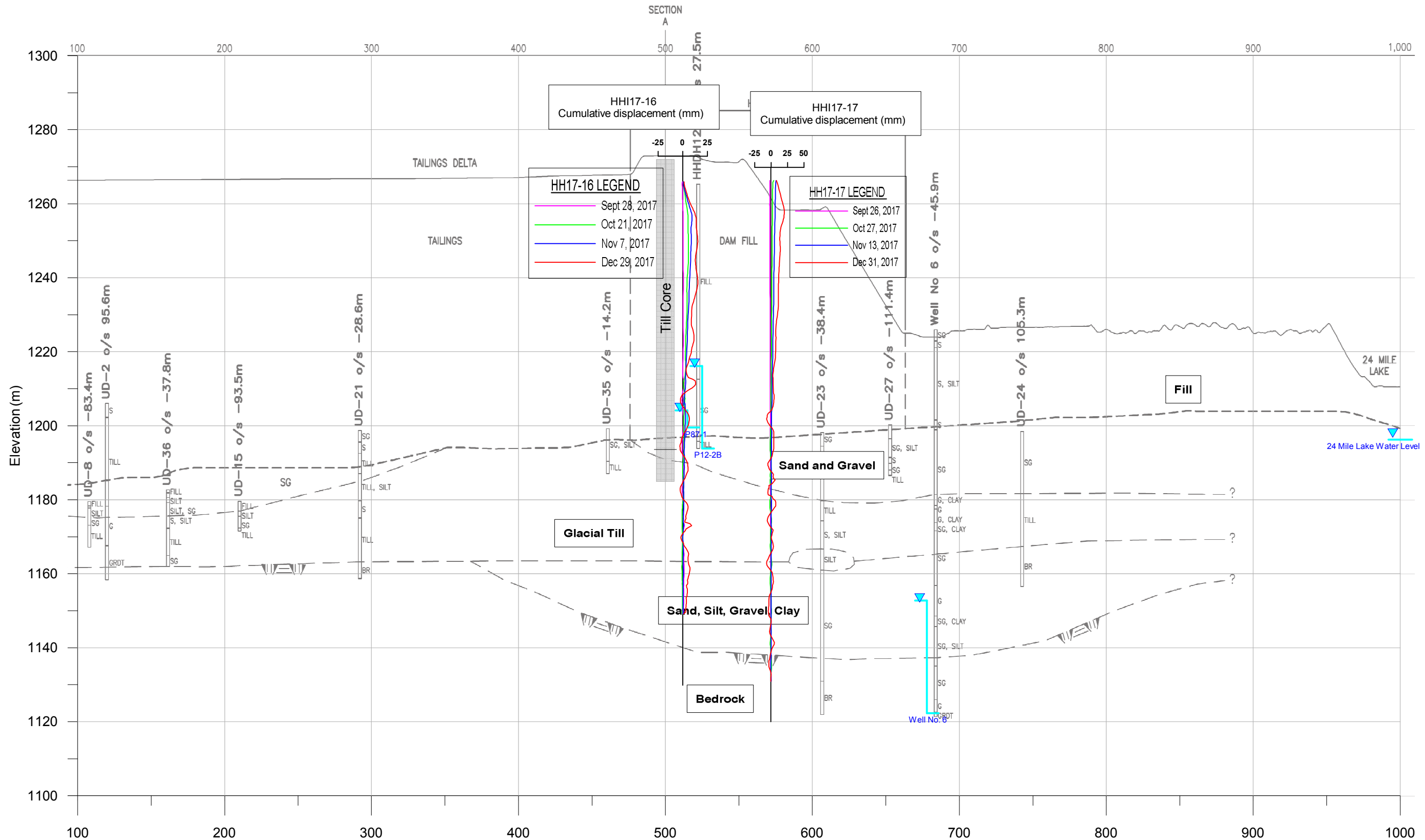
LEGEND

- Piezometric elevation (2017)
- Piezometer name and tip elevation

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

CLIENT **TECK HIGHLAND VALLEY COPPER PARTNERSHIP**

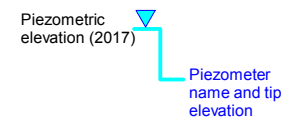
PROJECT	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
TITLE	INCLINOMETER AND PIEZOMETER CROSS SECTION D Sta. 1+460
PROJECT No.	M02341B26
FIG No.	VI-11



NOTES:

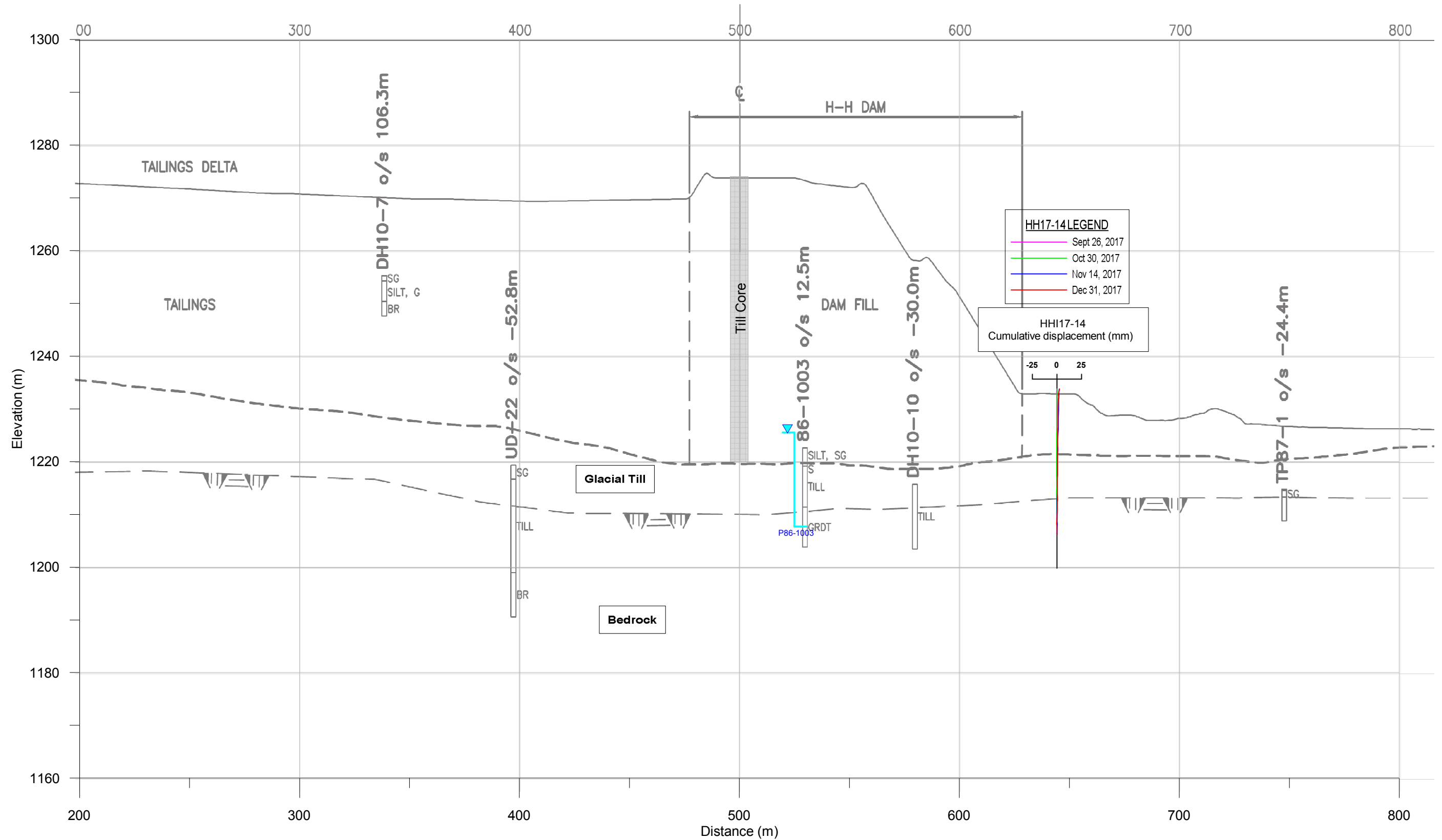
- 1) Section is exaggerated 2 times vertically
- 2) Positive offset is East, negative offset is West
- 3) Surface topography is 2015 lidar survey
- 4) Geological sections are taken from KCB report "H-H Dam Performance Review", Nov 2016.
- 5) P87-1 piezometer reading taken in 2000 (instrument destroyed thereafter)
- 6) Well No. 6 reading taken in 2002

LEGEND



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	<p>Klohn Crippen Berger</p>	<p>TITLE</p> <p>INCLINOMETER AND PIEZOMETER CROSS SECTION E Sta. 1+700</p>
		<p>PROJECT No.</p> <p>M02341B26</p>
		<p>FIG No.</p> <p>VI-12</p>

Date: March 13, 2018



NOTES:

- 1) Section is exaggerated 2 times vertically
- 2) Positive offset is East, negative offset is West
- 3) Surface topography is 2015 lidar survey
- 4) Geological sections are taken from KCB report "H-H Dam Performance Review", Nov 2016.
- 5) P86-1003 piezometer reading taken in 2009 (instrument plugged thereafter)

LEGEND

- Piezometric elevation (2017)
- Piezometer name and tip elevation

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CLIENT

TECK HIGHLAND VALLEY COPPER PARTNERSHIP



PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION

TITLE INCLINOMETER AND PIEZOMETER CROSS SECTION F Sta. 2+000

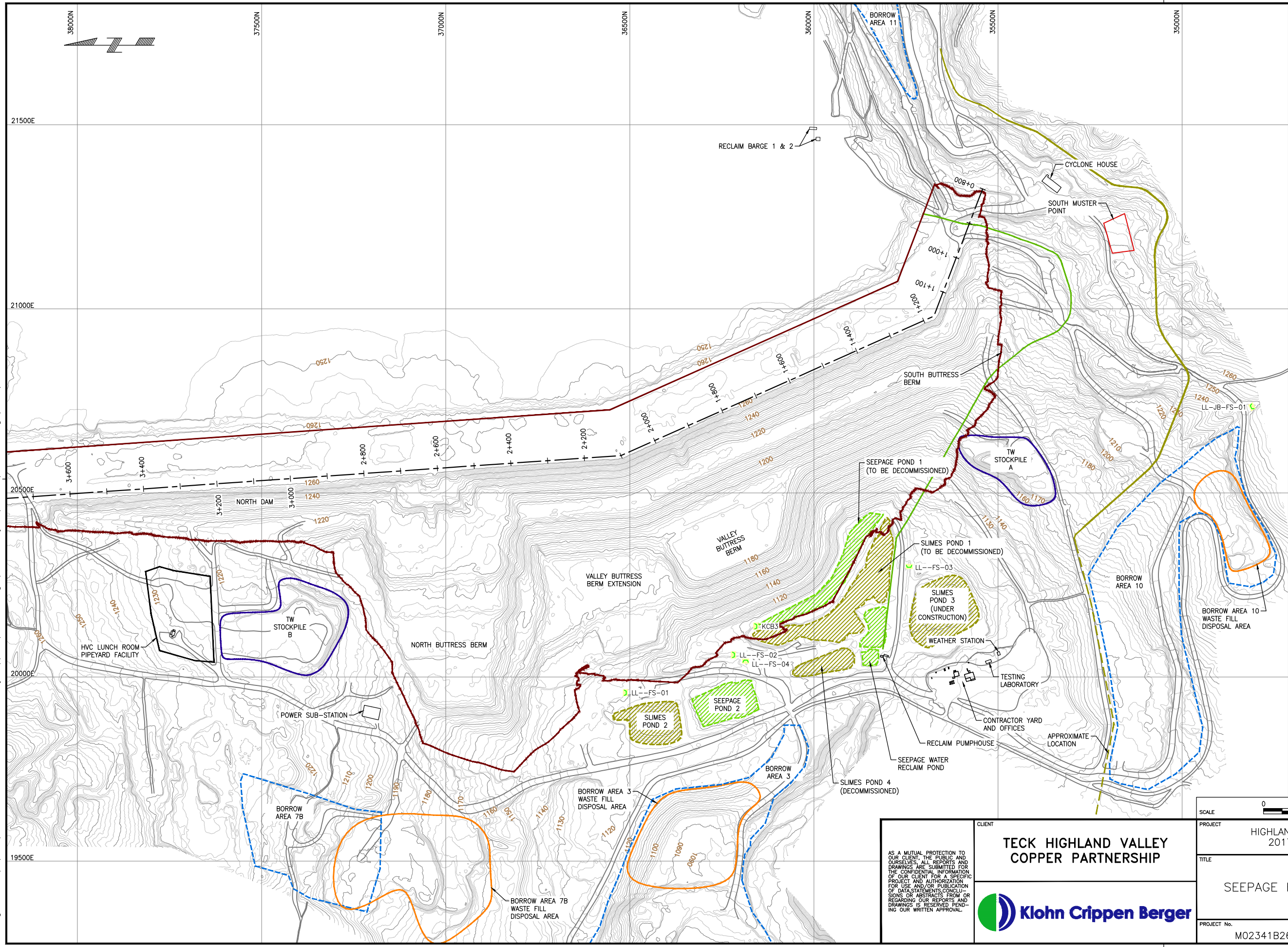
PROJECT No. M02341B26

FIG No. VI-13

APPENDIX VII

Seepage Flow Data Plots

Time: 10:44:39
 Date: 3/13/2018
 Scale: 1:50.8(P/S)
 Drawing File: Z:\M\CR\M02341B26 - HVC-2017 Dam Safety Support\400 Drawings\Dam Safety Inspection\FIG_VII-1.dwg (skuan)



LEGEND:

- BORROW AREA
- WASTE FILL DISPOSAL AREA
- SEEPAGE POND
- SLIMES POND
- EL. 1279 m ULTIMATE DAM FOOTPRINT
- SURFACE WATER RECLAIM PIPELINE
- SPATSUM WATER PIPELINE
- HAUL ROAD
- PUBLIC ROAD
- L-L DAM CENTERLINE

ACTIVE INSTRUMENTS (SEE NOTE 2):

- SEEPAGE FLOW MONITORING WEIR

- NOTES:**
- TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER PARTNERSHIP AND WAS DERIVED FROM SATELLITE IMAGERY TAKEN ON 2017-07-01.
 - ACTIVE INSTRUMENTS ARE DEFINED AS ANY INSTRUMENTS SATISFYING ONE OF THE FOLLOWING CRITERIA: CURRENTLY READING AN ACTIVE WATER LEVEL, DRY OR PLUGGED <20 m ABOVE TIP ELEVATION AS THIS COULD SHOW A RESPONSE IN THE FUTURE.
 - PUKAIST CREEK WEIR IS NOT SHOWN AND IS LOCATED AT E 17448 N 34452.

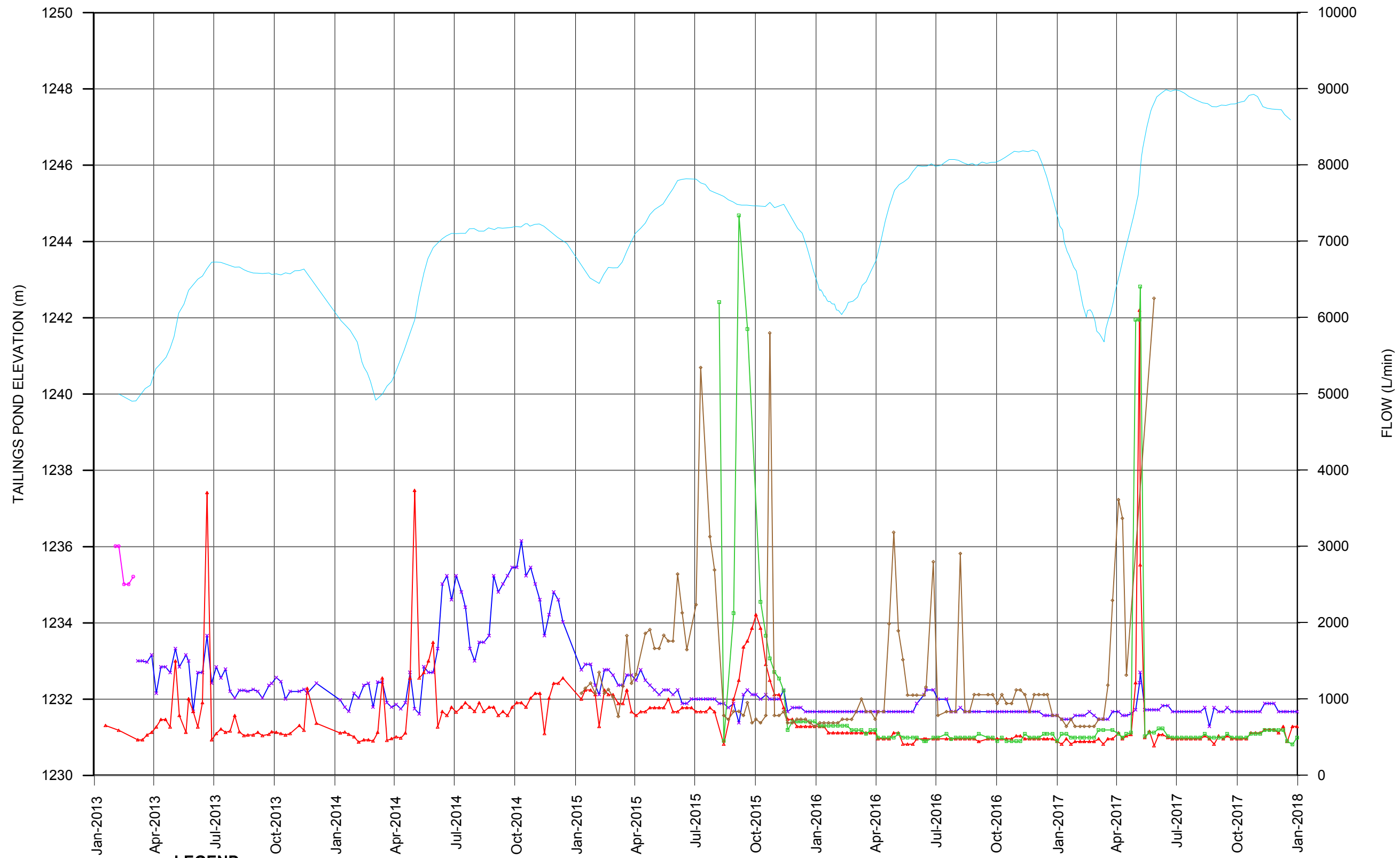
THVCP WEIR NAME	KCB WEIR NAME
LL--FS-01	FINGER DRAIN #1
LL--FS-02	UVD/LVD
LL--FS-03	POINT B
LL--FS-04	SEEPAGE POND 2
KCB3	POINT A
LL-JB-FS-01	POINT D



<p>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</p>	<p>CLIENT</p> <p>TECK HIGHLAND VALLEY COPPER PARTNERSHIP</p>	<p>PROJECT</p> <p>HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION</p>
		<p>TITLE</p> <p>L-L DAM SEEPAGE FLOW MONITORING STATIONS</p>
<p>PROJECT No.</p> <p>M02341B26</p>	<p>FIG. No.</p> <p>VII-1</p>	

KCB-R-MD

Date: February 20, 2018
Z:\M\CR\M02341B26 - HVC-2017 Dam Safety Support\300 Design\Seepage Data\170727 Seepage (DSI only).gjr



LEGEND

- LL--FS-01
- LL--FS-02
- LL--FS-04
- LL--FS-02 plus LL--FS-01 Combined Flows (2012 to Mar-2013)
- Seepage from VBB Toe (LL--FS-03 minus LL-JB-FS-01)
- Tailings Pond

Notes:
In 2016, OS-PC-FS-02 was measured using a datalogger. One manual reading of the weir by THVCP suggested that the datalogger was reading lower than actual flow rates.

KCB Weir Name	THVCP Weir Name
Finger Drain #1	LL--FS-01
UVD/LVD	LL--FS-02
Point B	LL--FS-03
Seepage Pond 2 Weir	LL--FS-04
Point D	LL-JB-FS-01
Pukaist Weir	OS-PC-FS-02

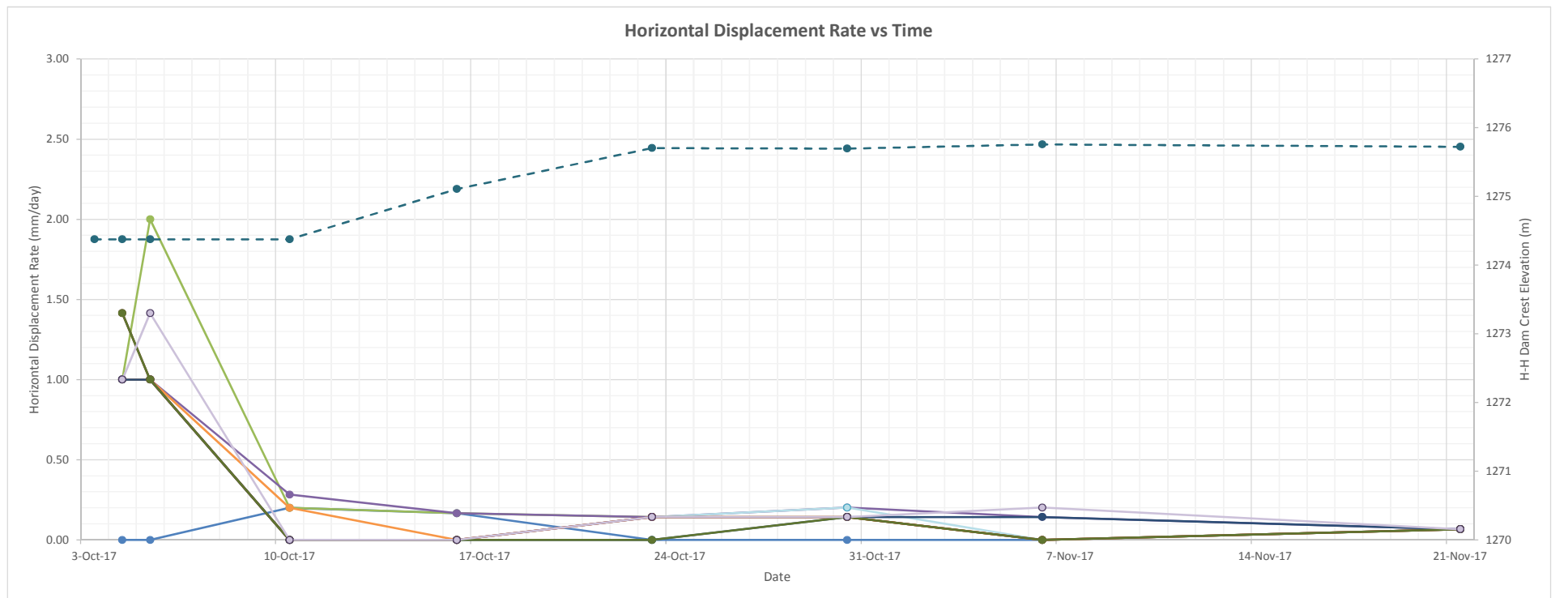
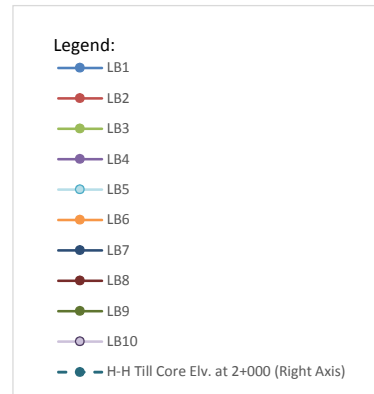
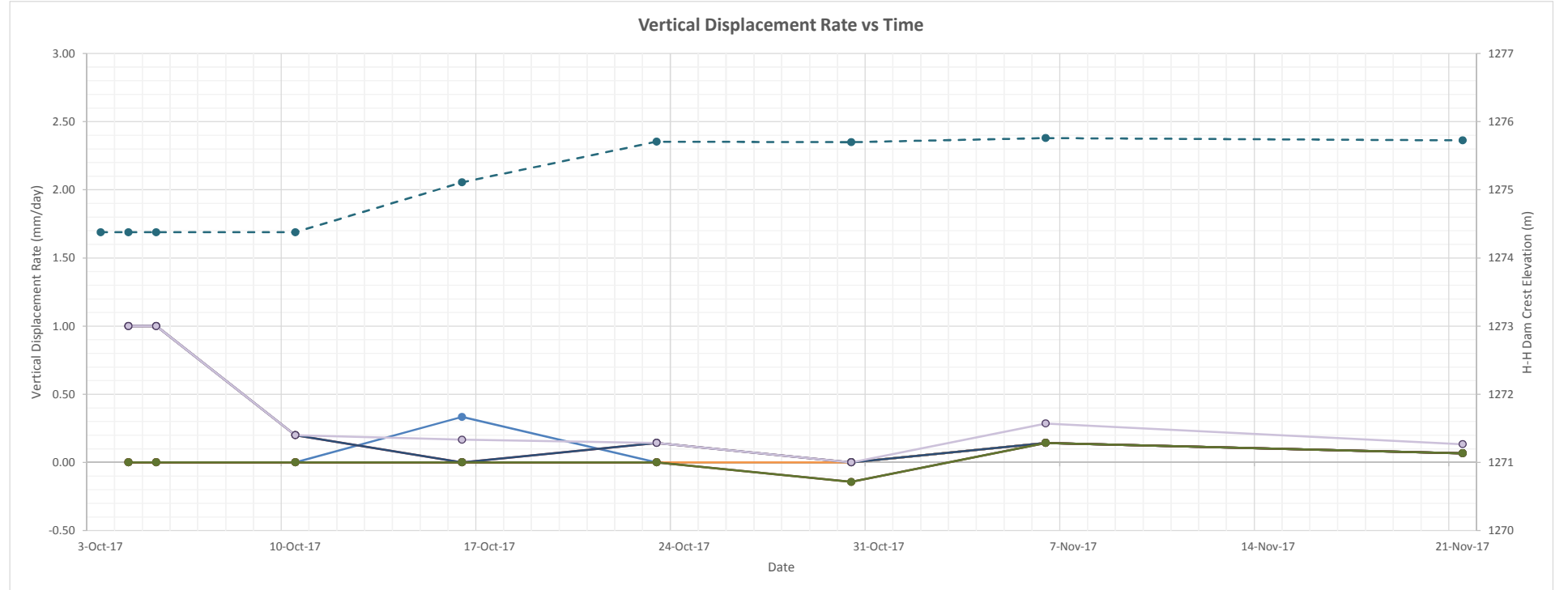
AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS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

CLIENT
TECK HIGHLAND VALLEY COPPER PARTNERSHIP

PROJECT	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION	
TITLE	L-L DAM POND LEVEL AND SEEPAGE FLOW 2013-2017	
PROJECT No.	M02341B26	FIG No. VII-2

APPENDIX VIII

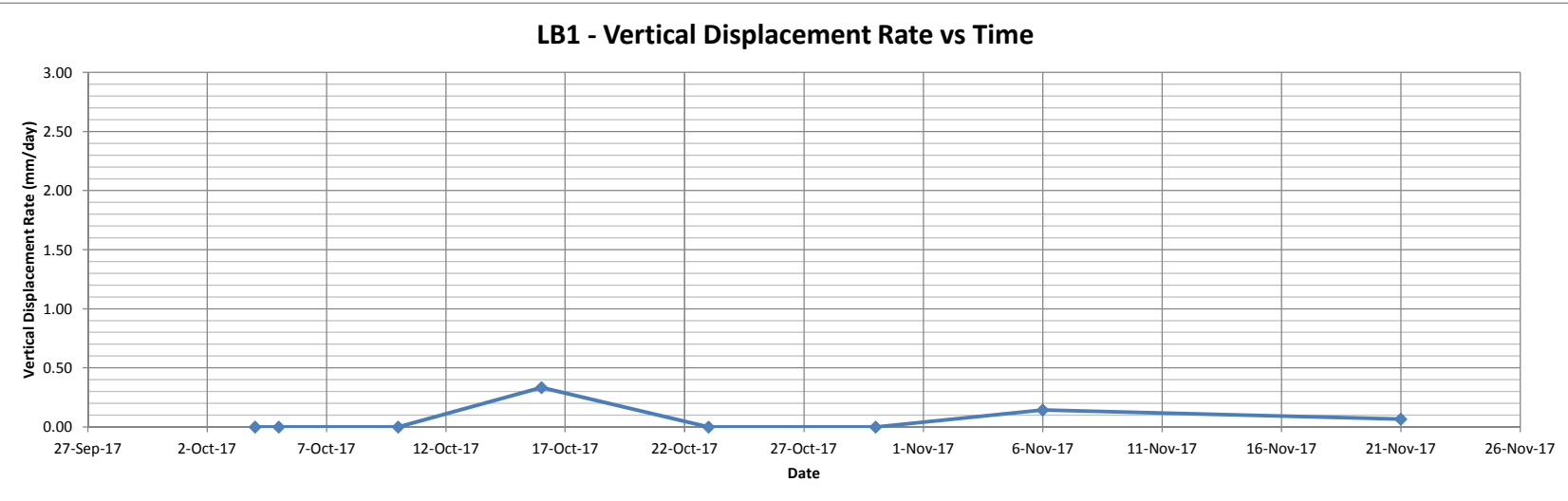
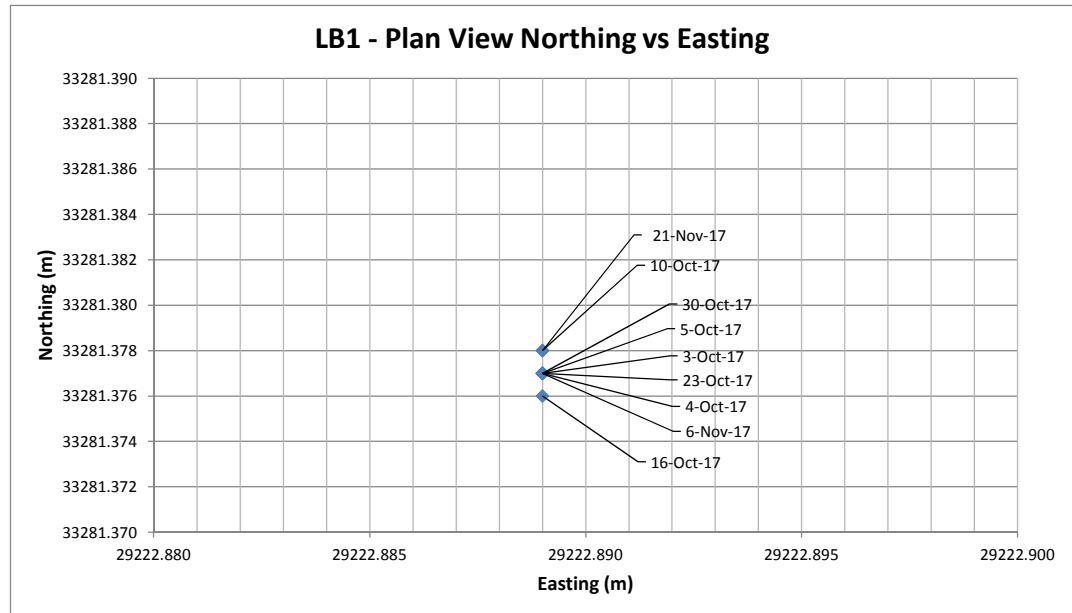
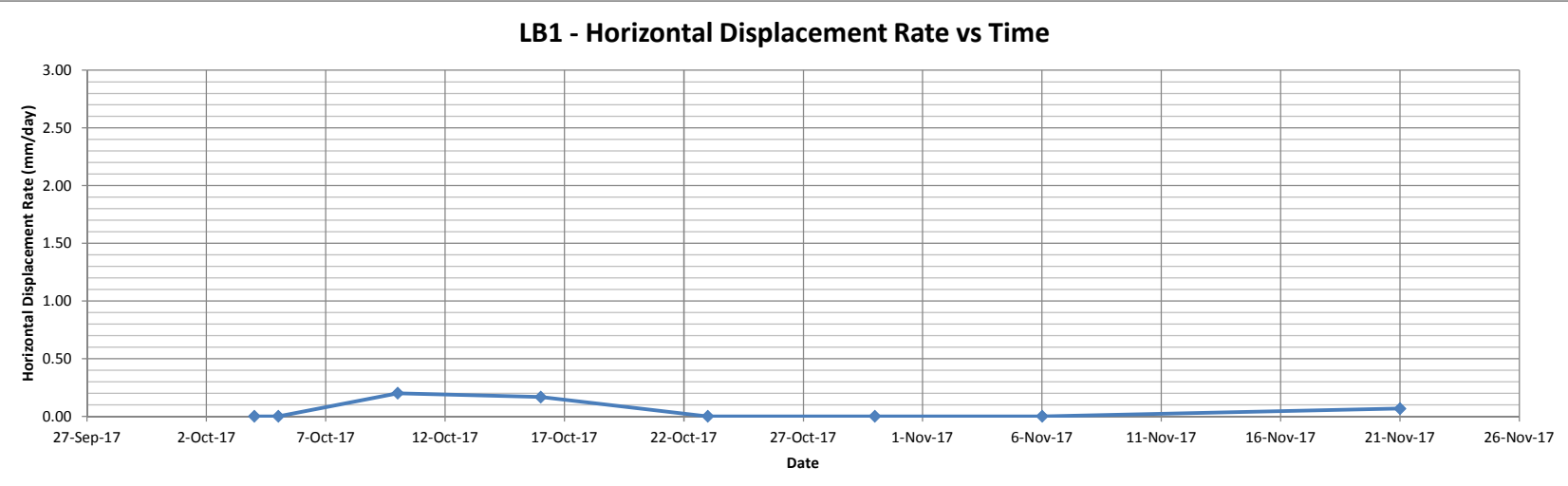
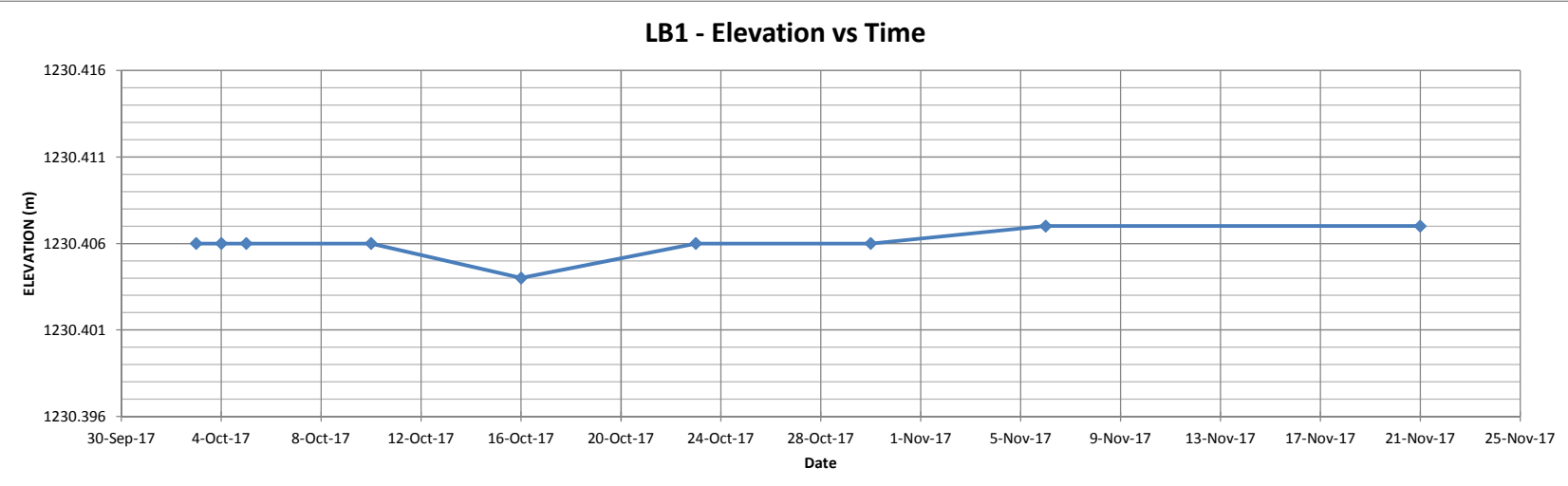
H-H Lock-Block Wall Monument Data Plots



NOTES:

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		TITLE: H-H DAM LOCK-BLOCK RETAINING WALL SURVEY MONUMENT READINGS SUMMARY
		PROJECT No.: M02341B26 FIG No.: VIII-1

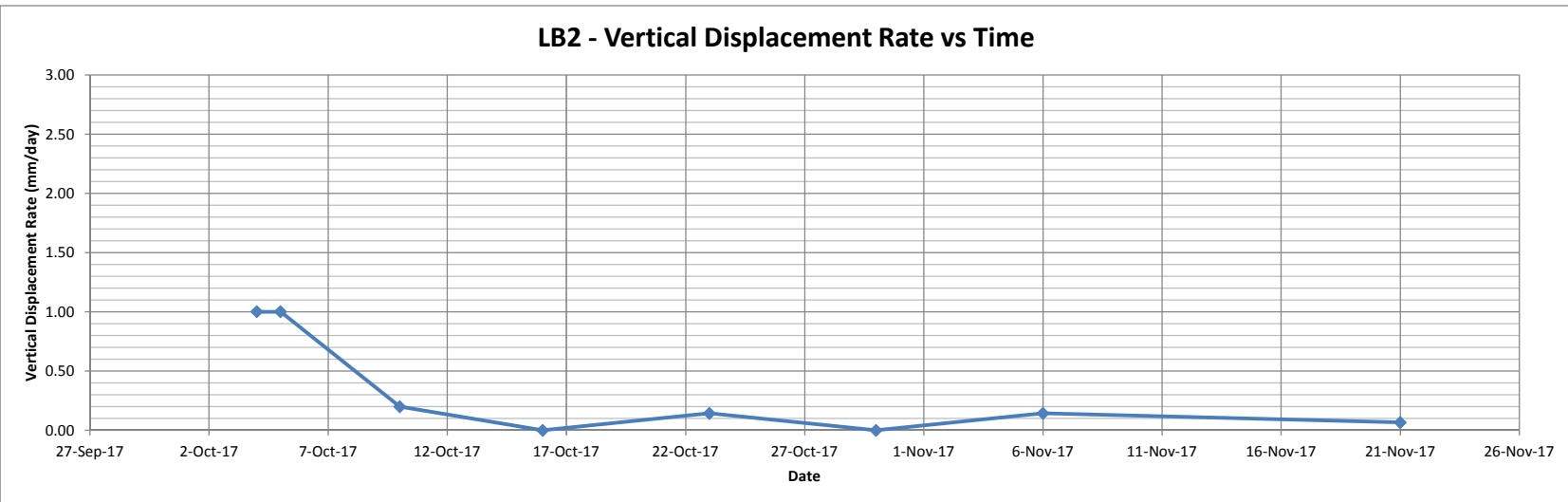
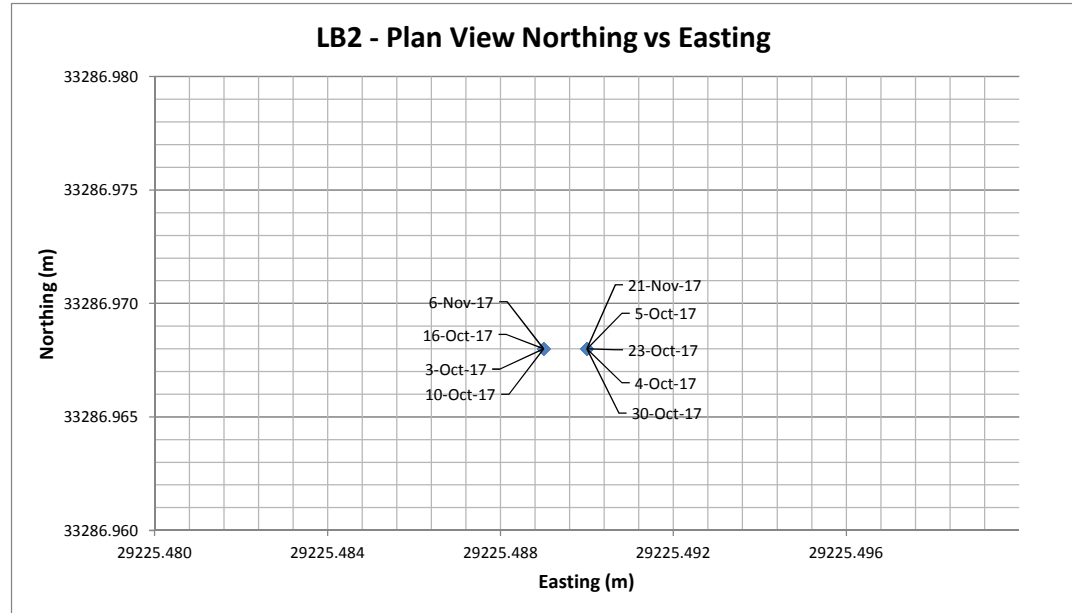
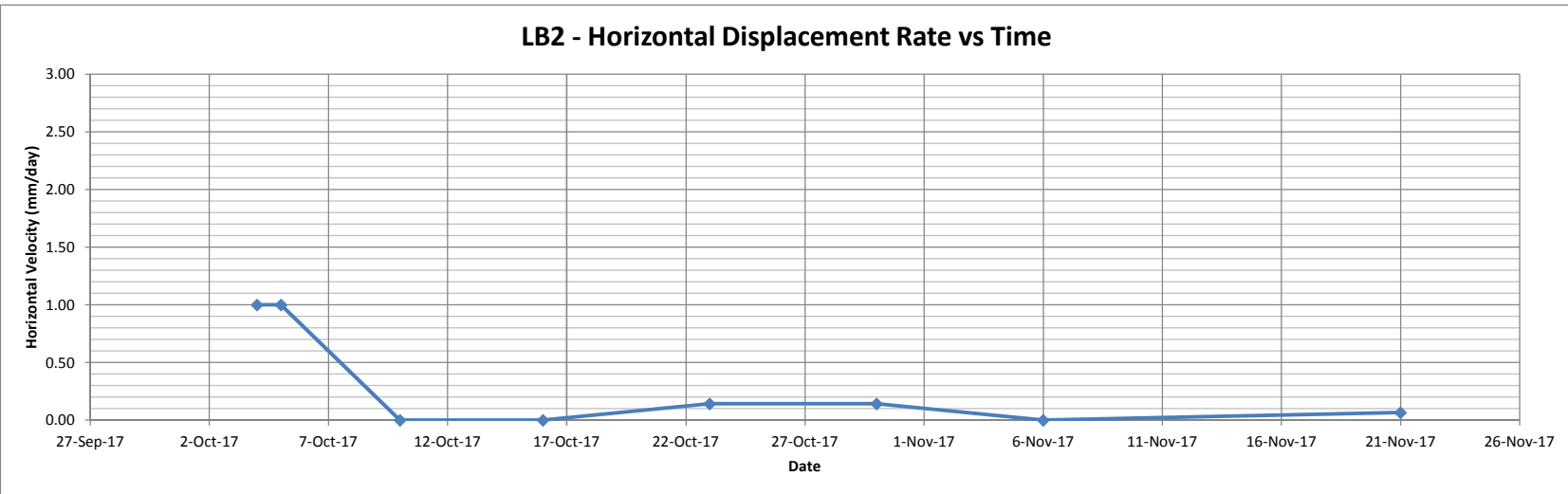
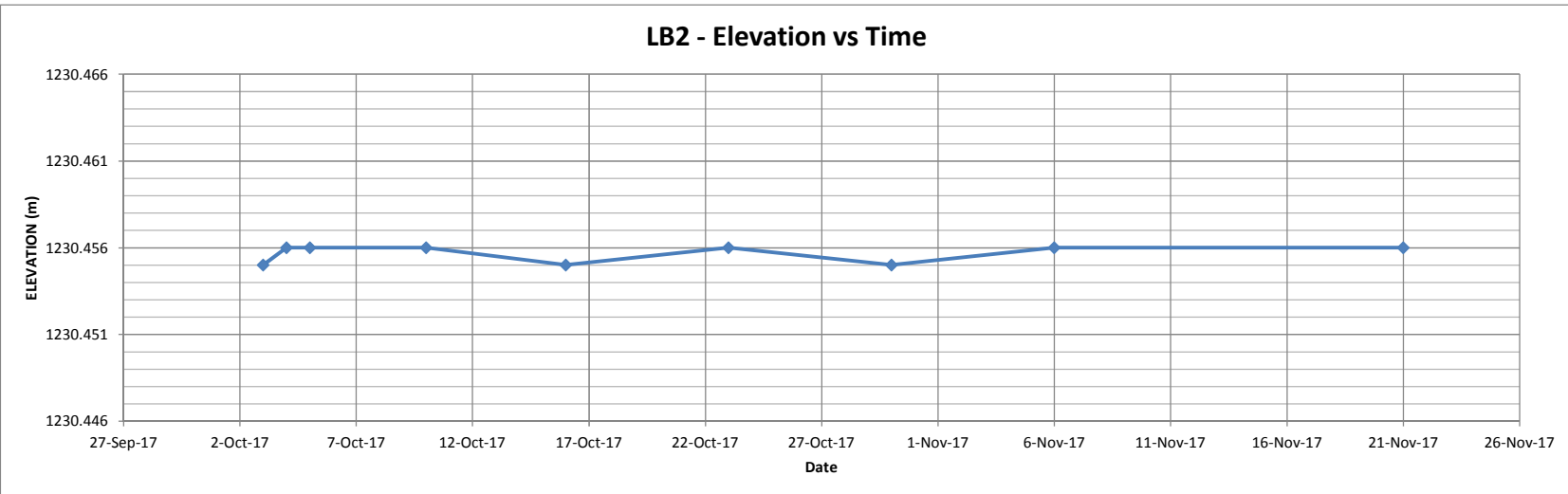


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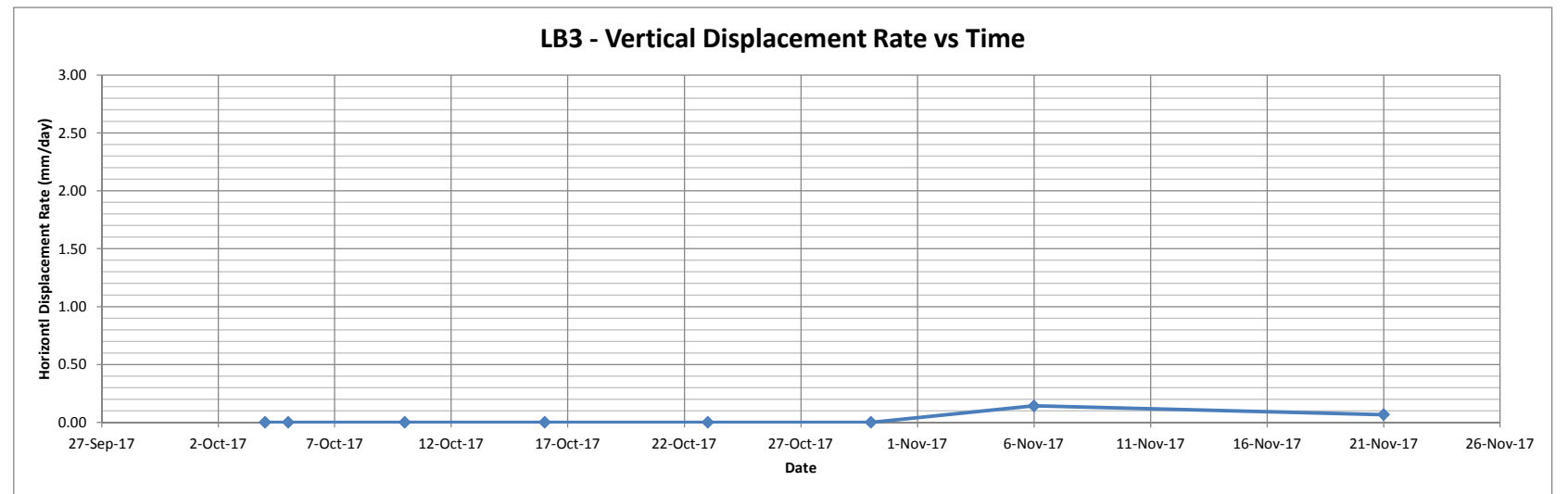
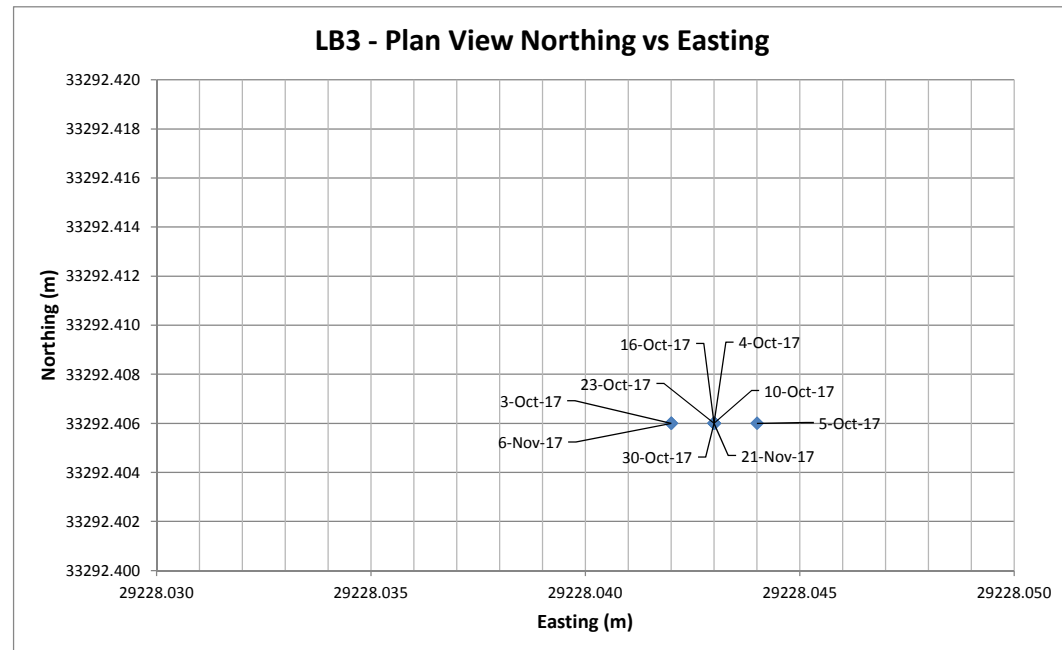
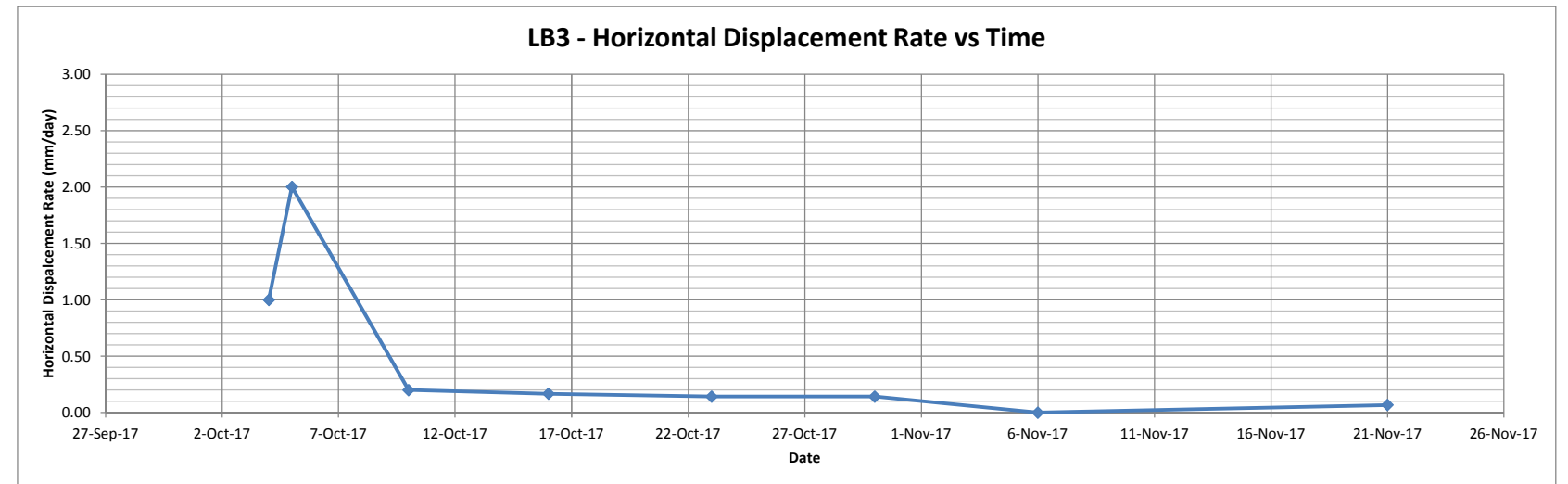
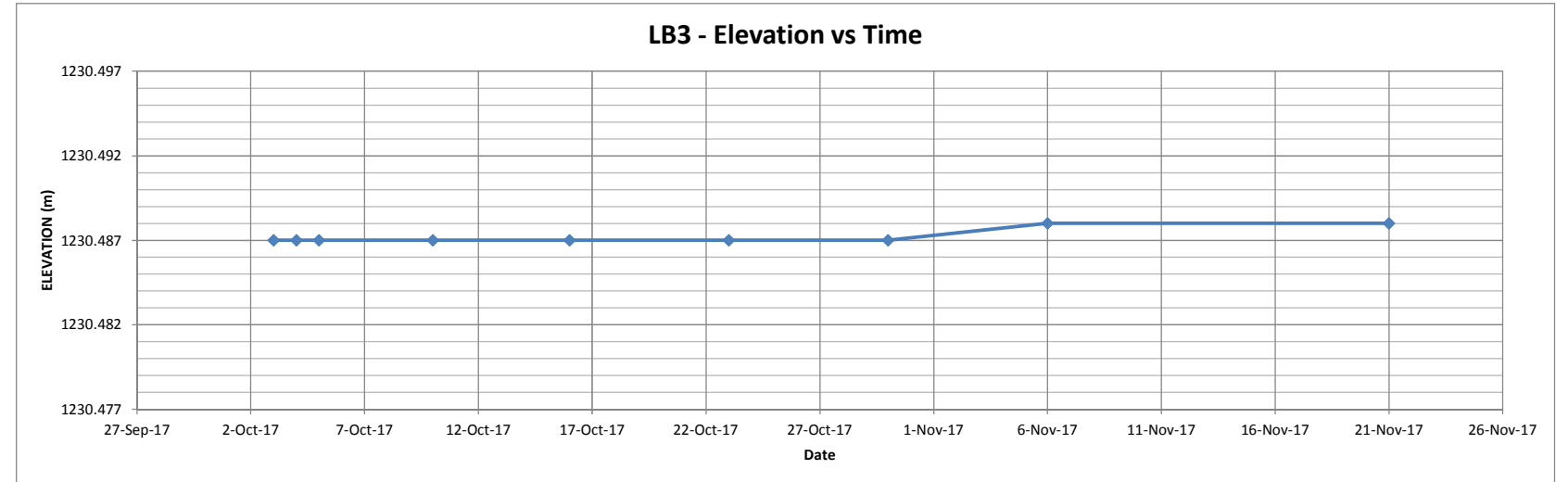
<small>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND NOT FOR PUBLICATION OR ABSTRACTS FROM OUR DATA STATEMENTS, CONCLUSIONS OR RESEARCH. OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</small>	TECK HIGHLAND VALLEY COPPER PARTNERSHIP	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		H-H DAM LOCK-BLOCK RETAINING WALL SURVEY MONUMENT READINGS LB1
	PROJECT No: M02341B26	FIG No: VIII-2



NOTES:

1. All data provided by THVCP.

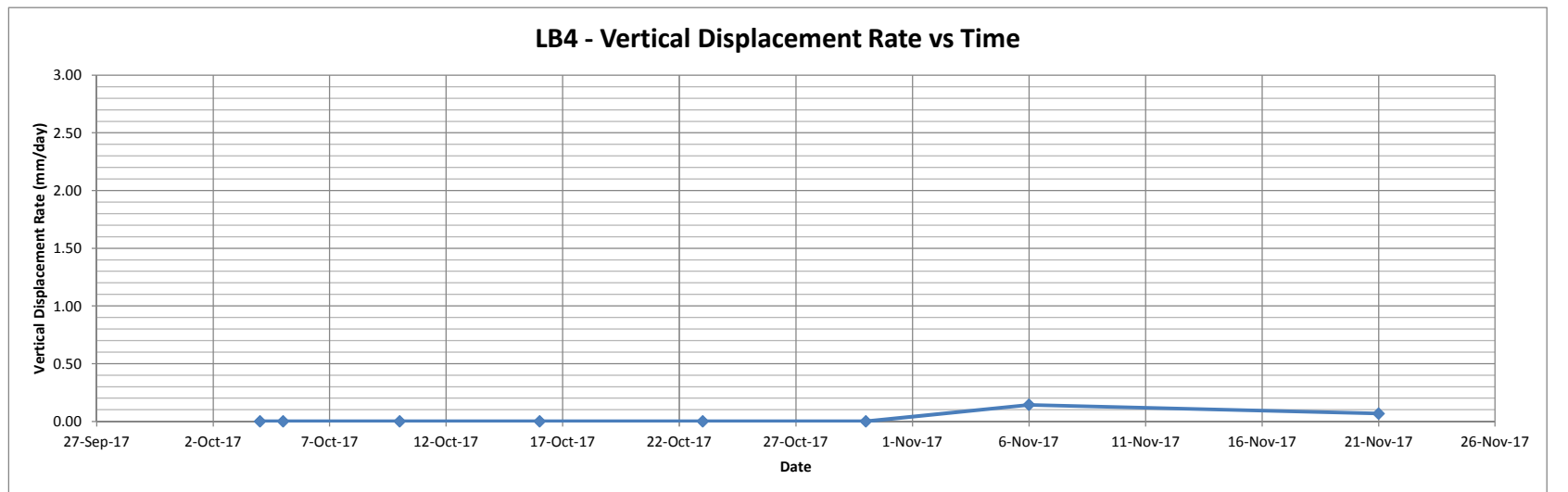
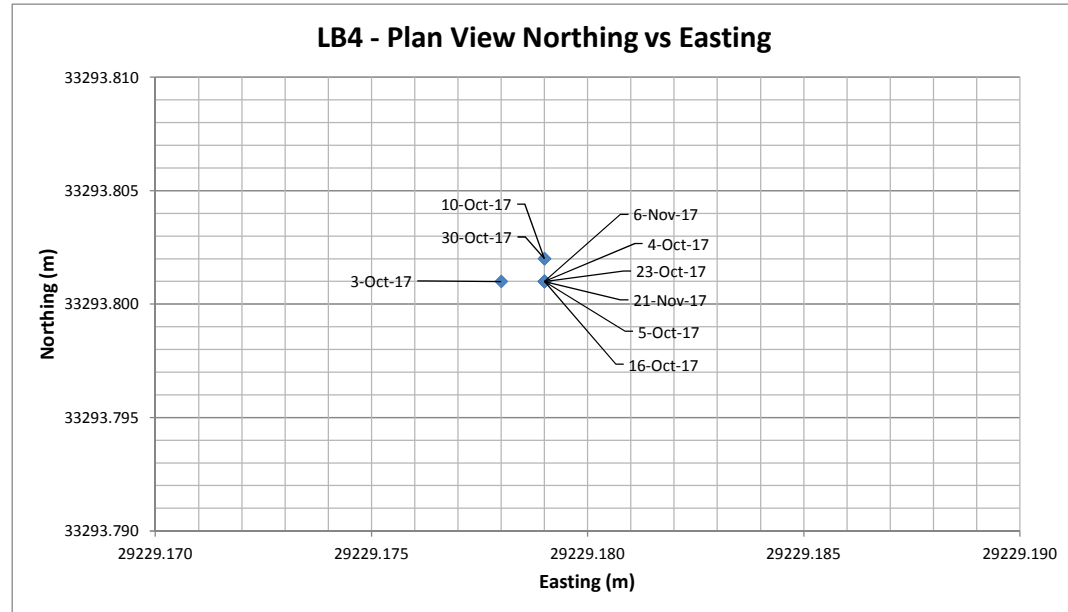
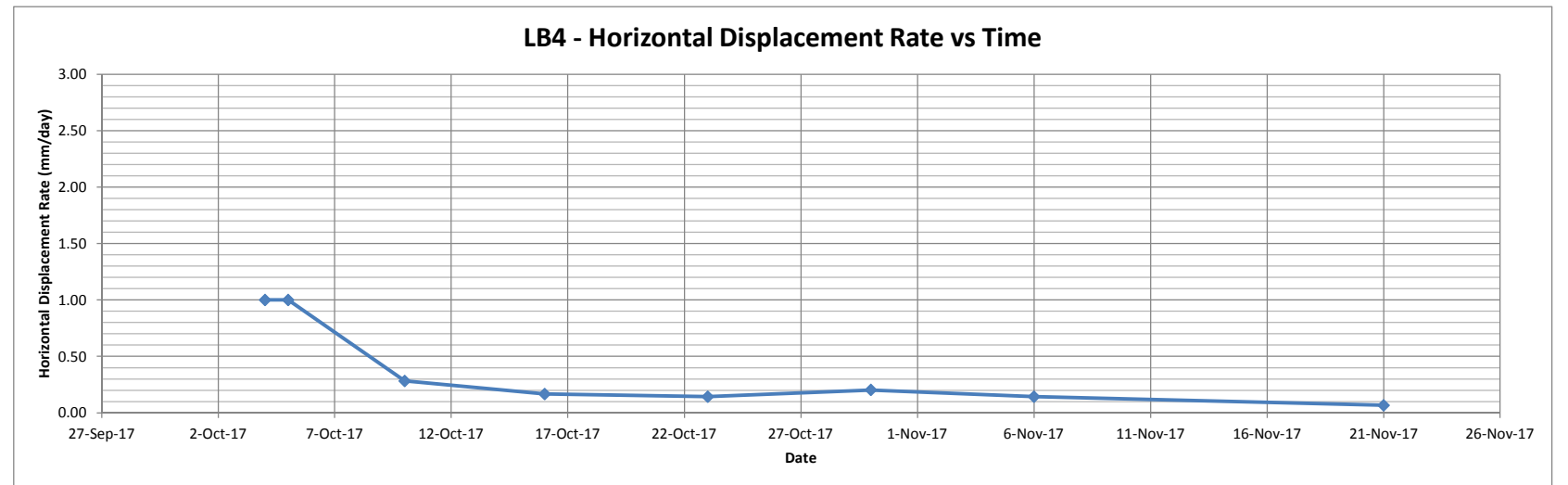
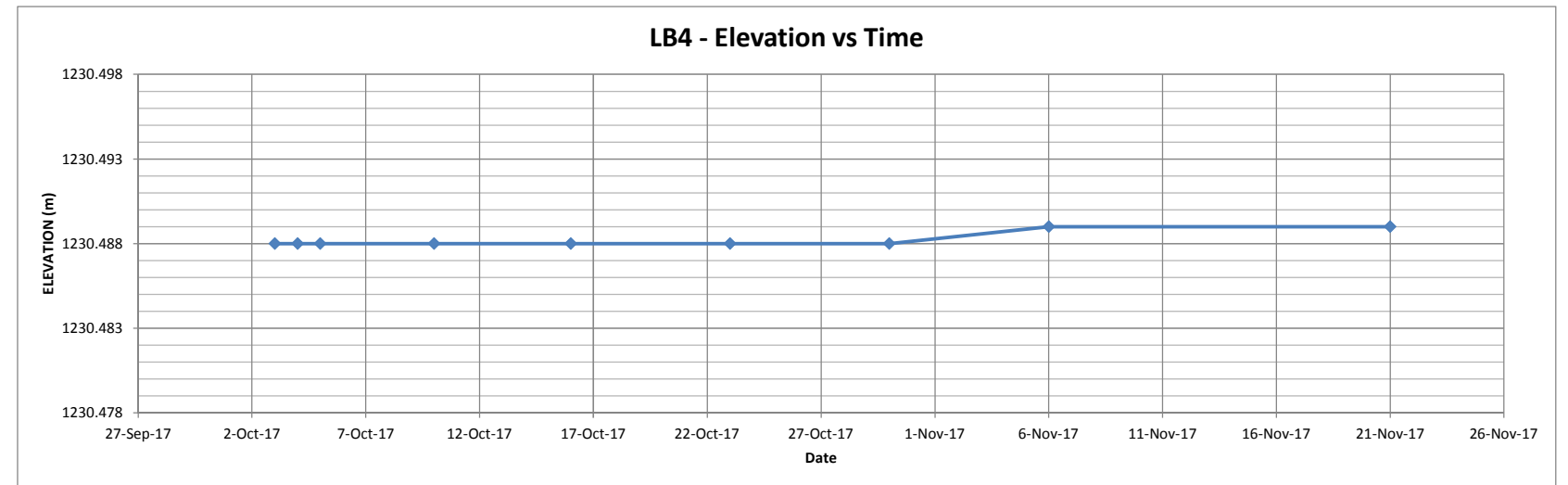
<small>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND NOT FOR PUBLICATION OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</small>	TECK HIGHLAND VALLEY COPPER PARTNERSHIP	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		H-H DAM LOCK-BLOCK RETAINING WALL SURVEY MONUMENT READINGS LB2
	PROJECT No: M02341B26	FIG No: VIII-3



NOTES:

1. All data provided by THVCP.

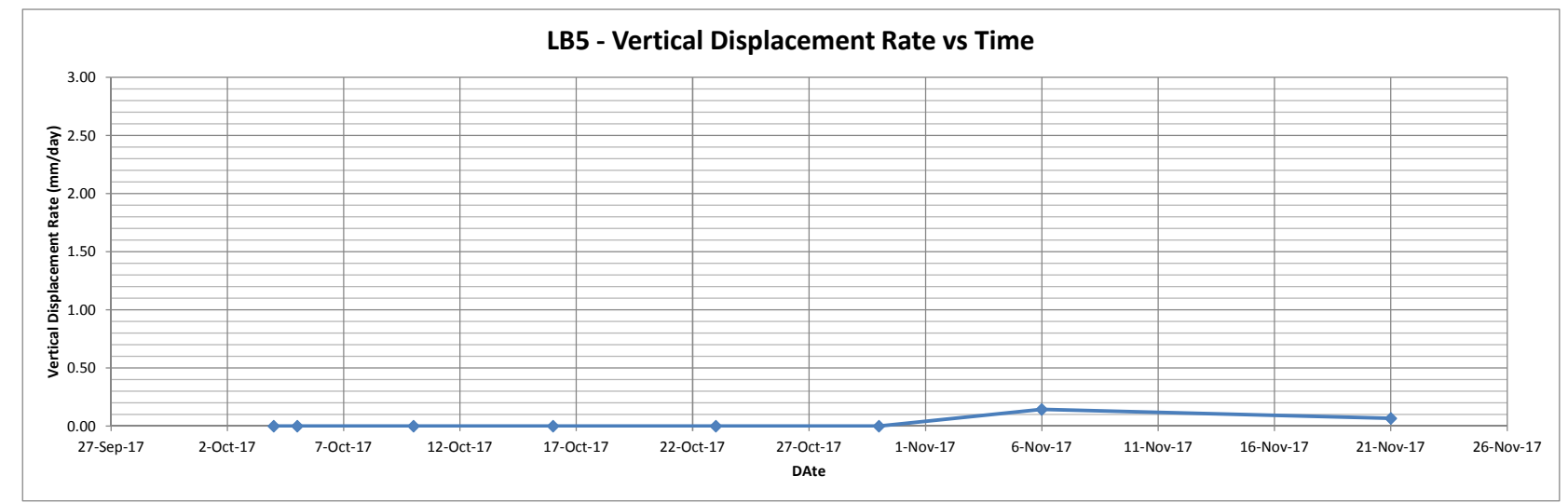
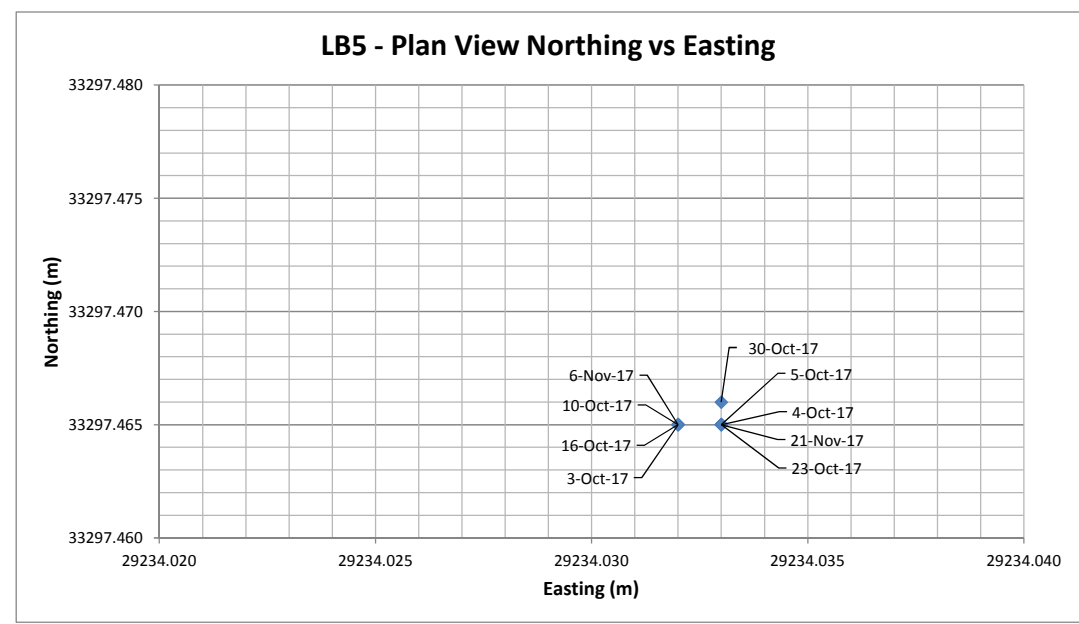
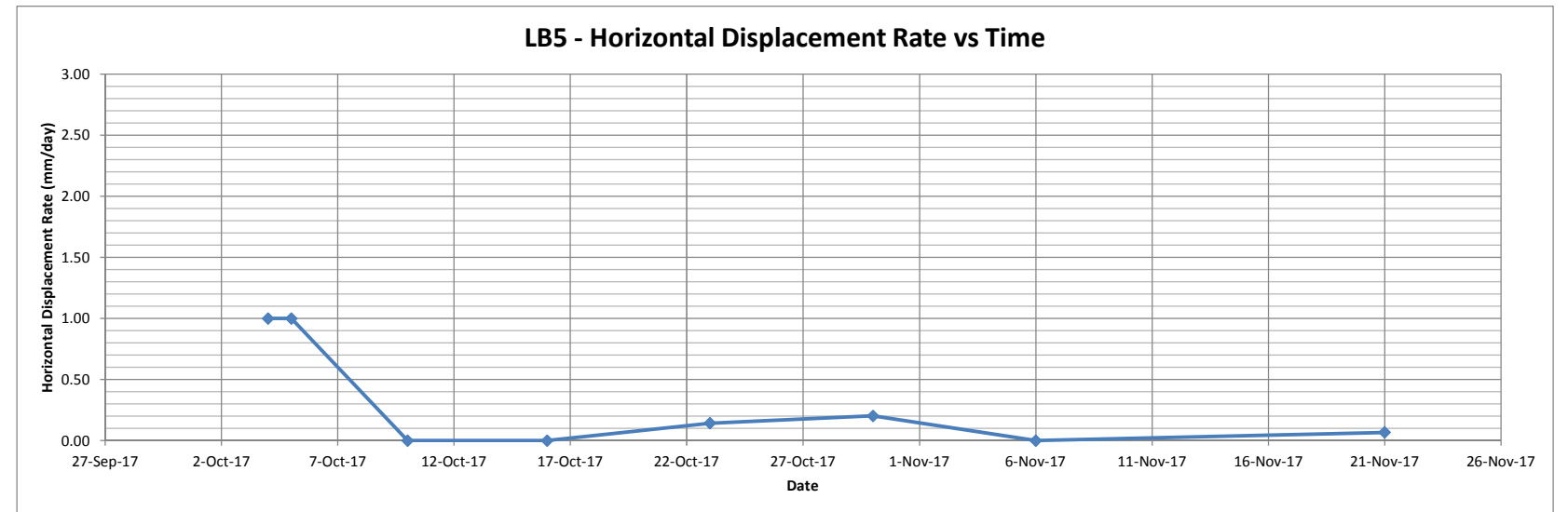
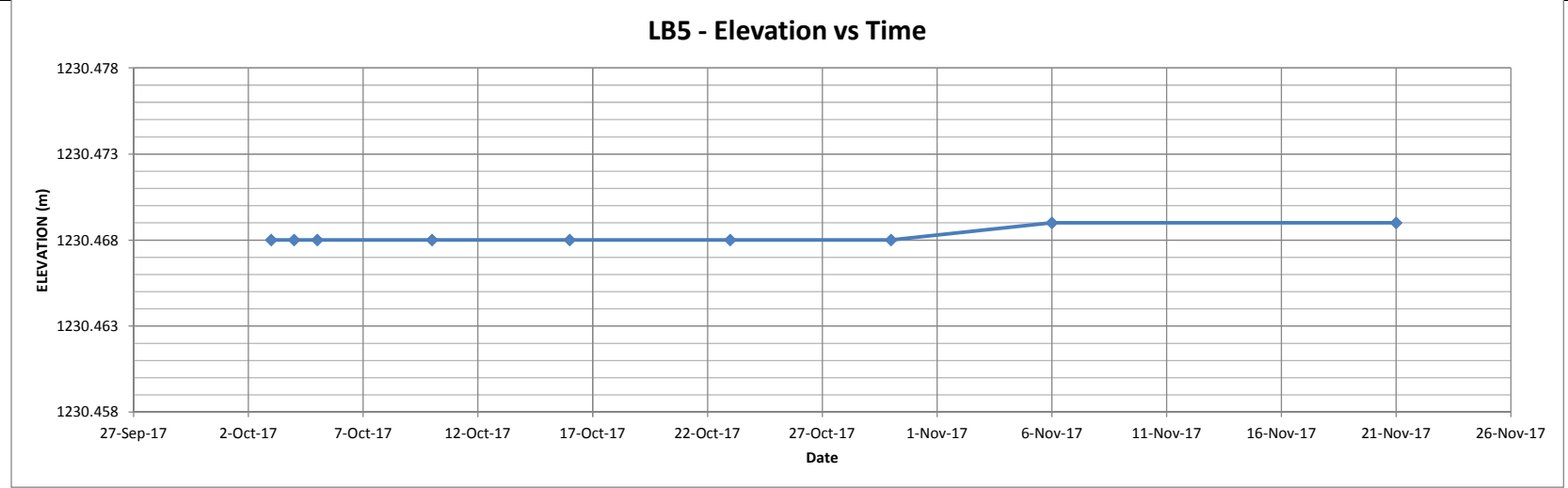
<small>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND NOT FOR PUBLICATION OR ABSTRACTS FROM OUR DATA STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</small>	TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		TITLE H-H DAM LOCK-BLOCK RETAINING WALL SURVEY MONUMENT READINGS LB3
PROJECT No. M02341B26		FIG No. VIII-4



NOTES:

- 1. All data provided by THVCP.

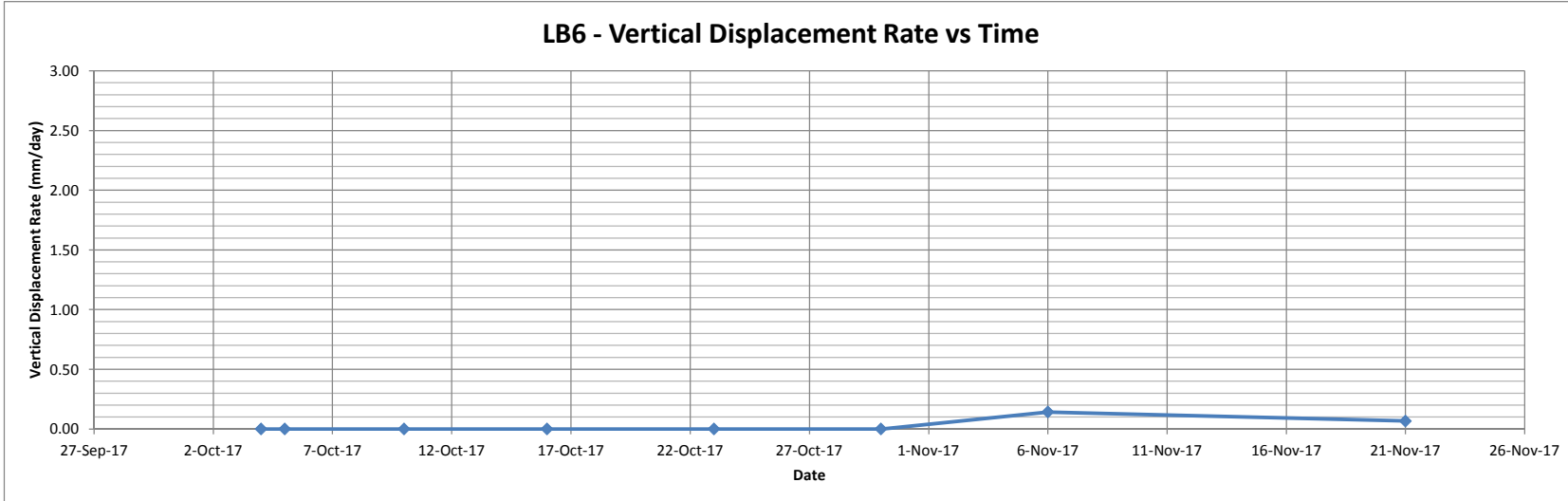
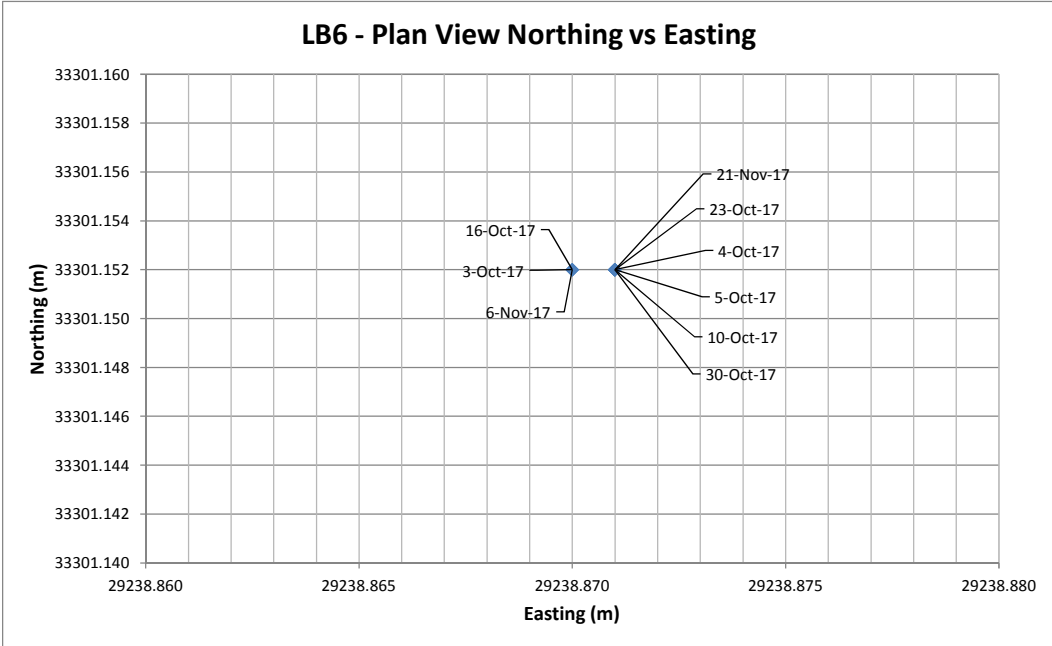
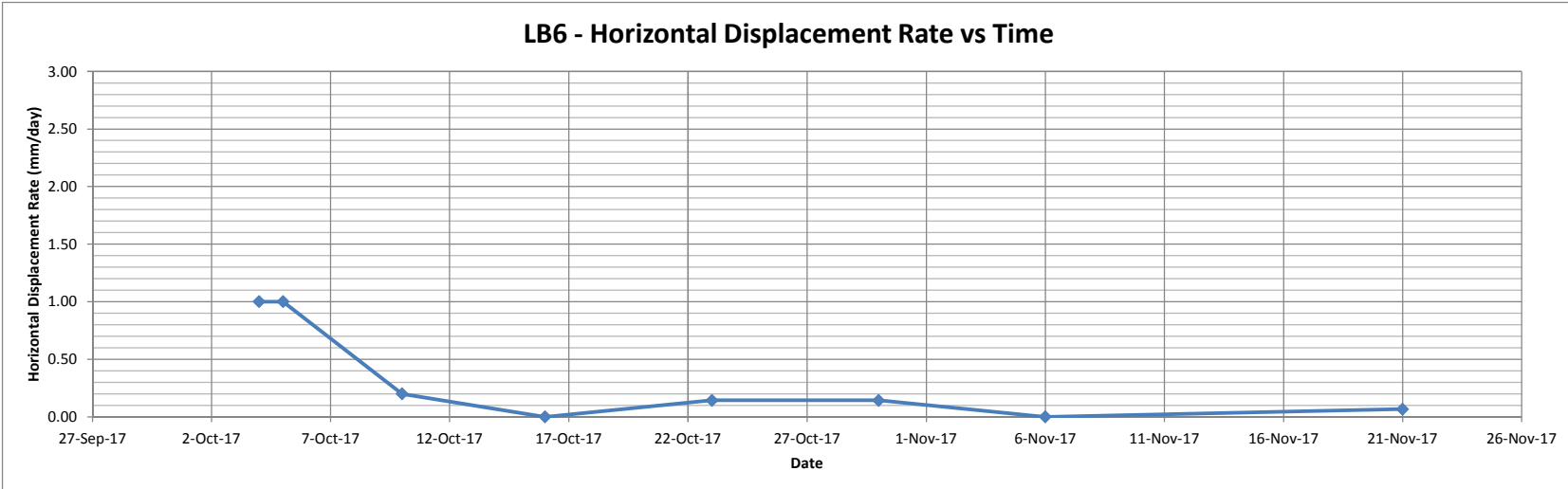
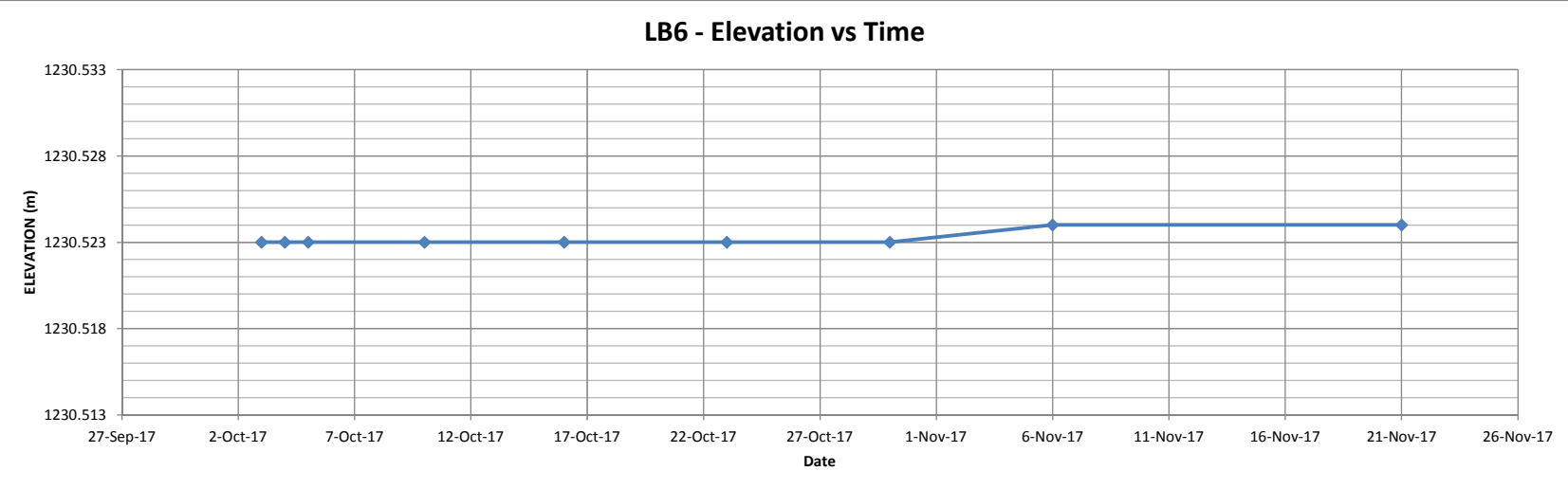
<small>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND NOT FOR PUBLICATION OR ABSTRACTS FROM DATA STATEMENTS, CONCLUSIONS OR RESEARCH. OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</small>	TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		TITLE H-H DAM LOCK-BLOCK RETAINING WALL SURVEY MONUMENT READINGS LB4
	PROJECT No: M02341B26	FIG No: VIII-5



NOTES:

- 1. All data provided by THVCP.

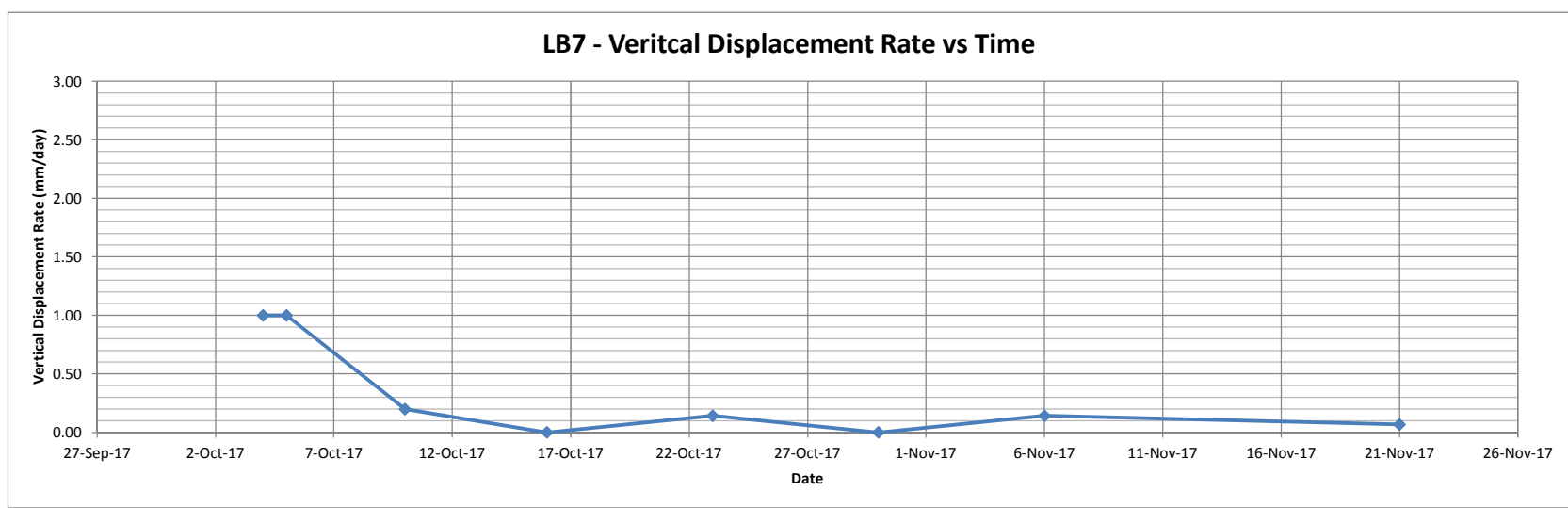
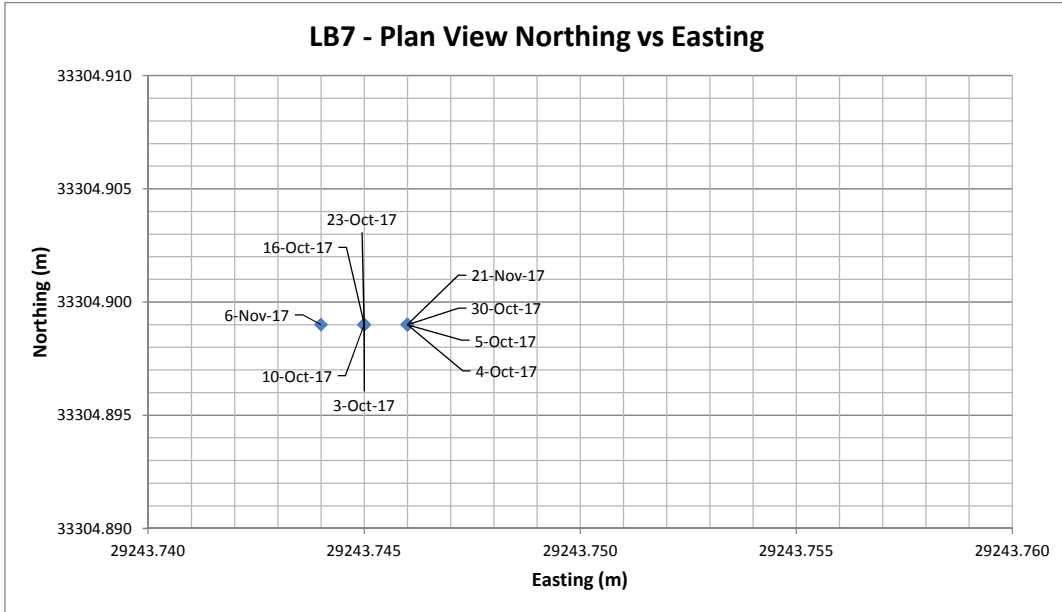
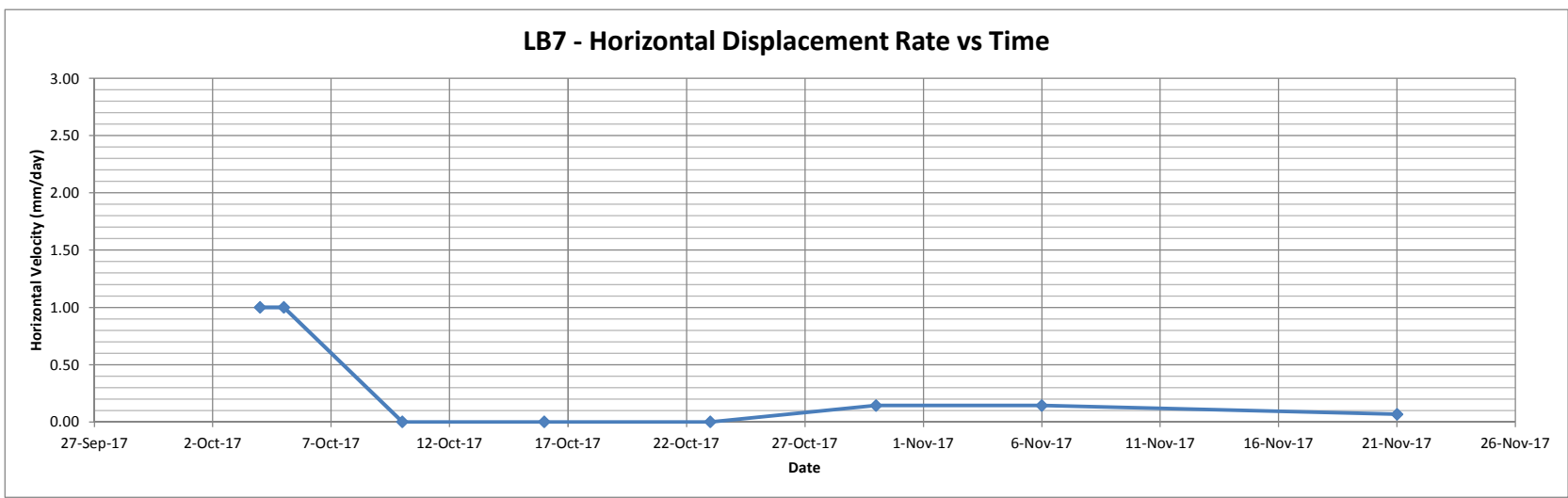
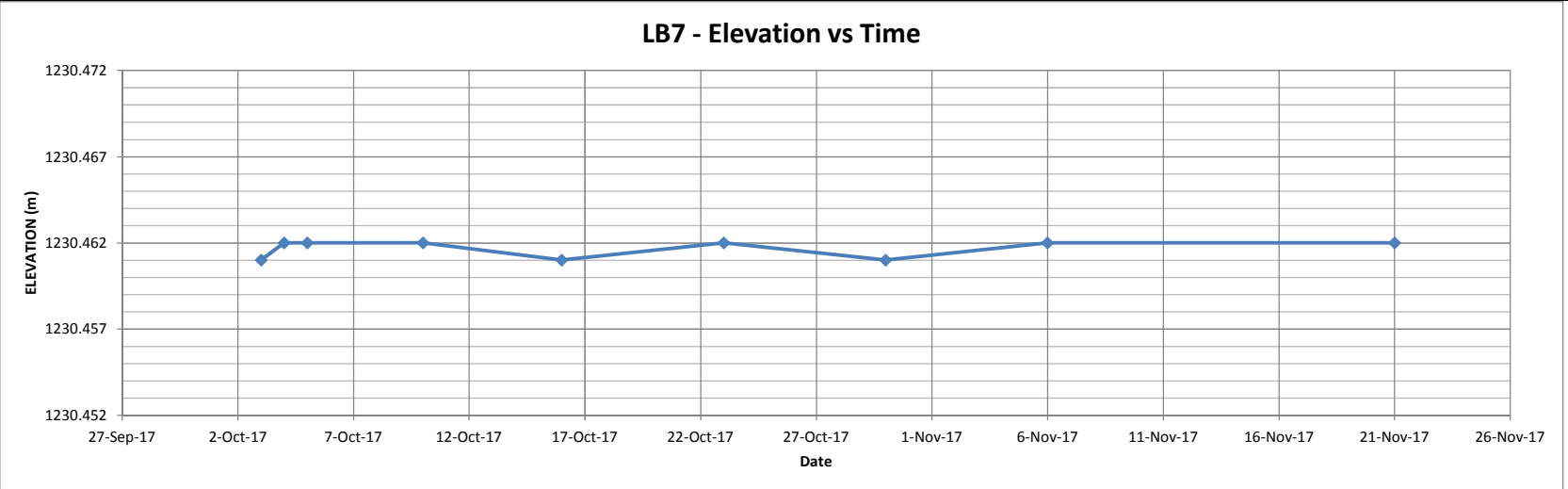
<small>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND NOT FOR PUBLICATION OR ABSTRACTS FROM OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</small>	TECK HIGHLAND VALLEY COPPER PARTNERSHIP	HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		H-H DAM LOCK-BLOCK RETAINING WALL SURVEY MONUMENT READINGS LB5
	PROJECT No: M02341B26	FIG No: VIII-6



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		TITLE H-H DAM LOCK-BLOCK RETAINING WALL SURVEY MONUMENT READINGS LB6
	PROJECT No. M02341B26	FIG No. VIII-7

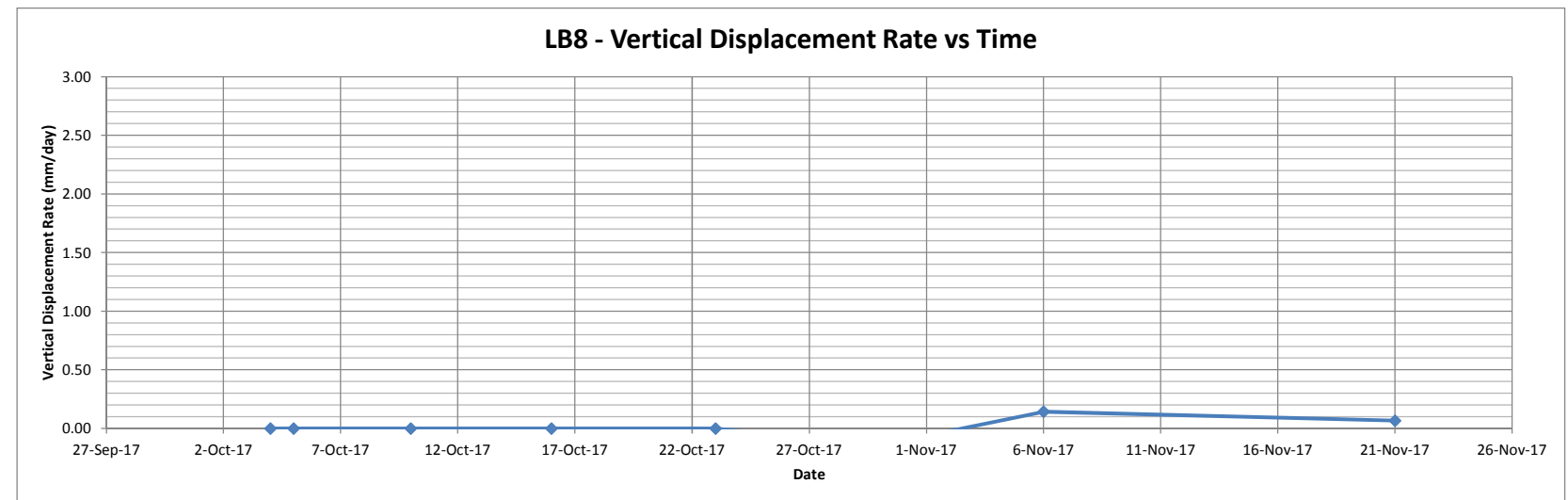
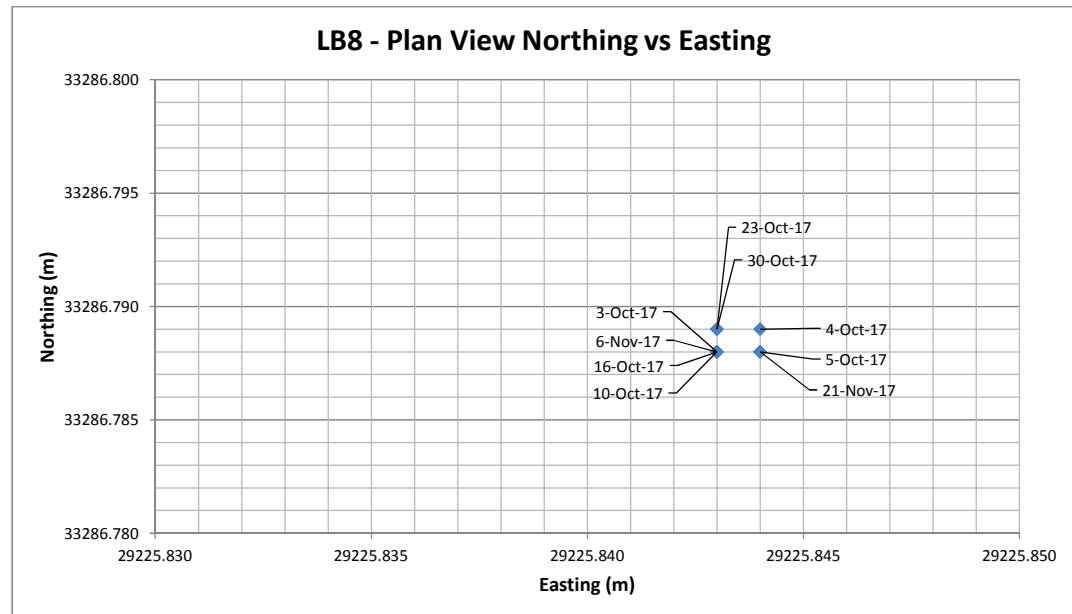
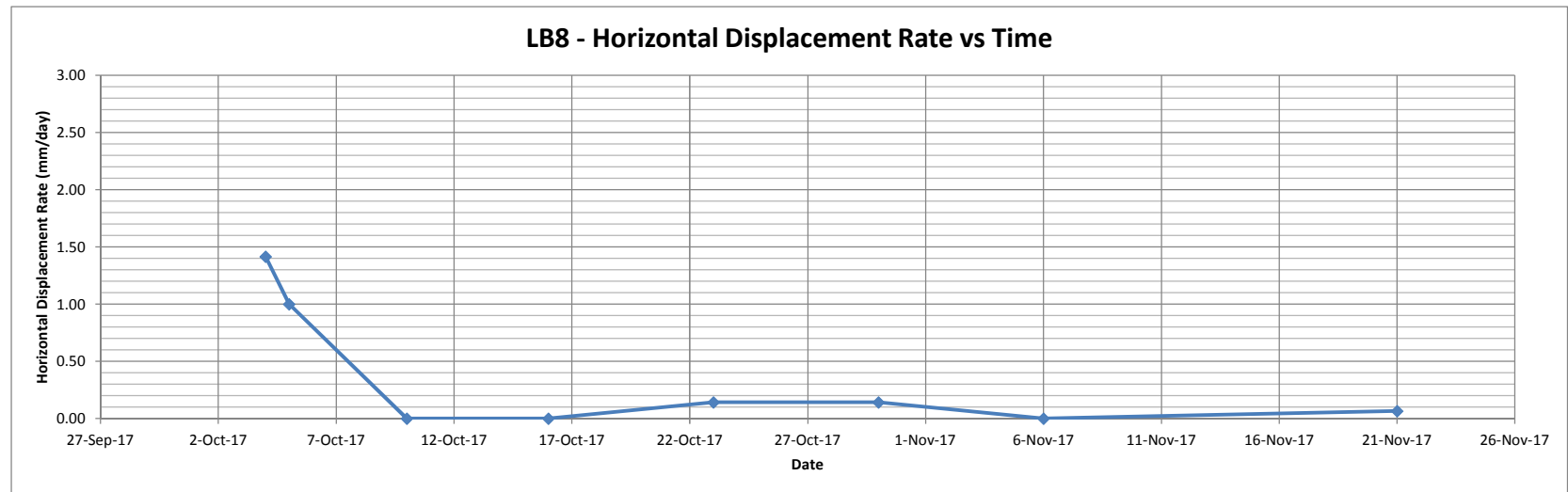
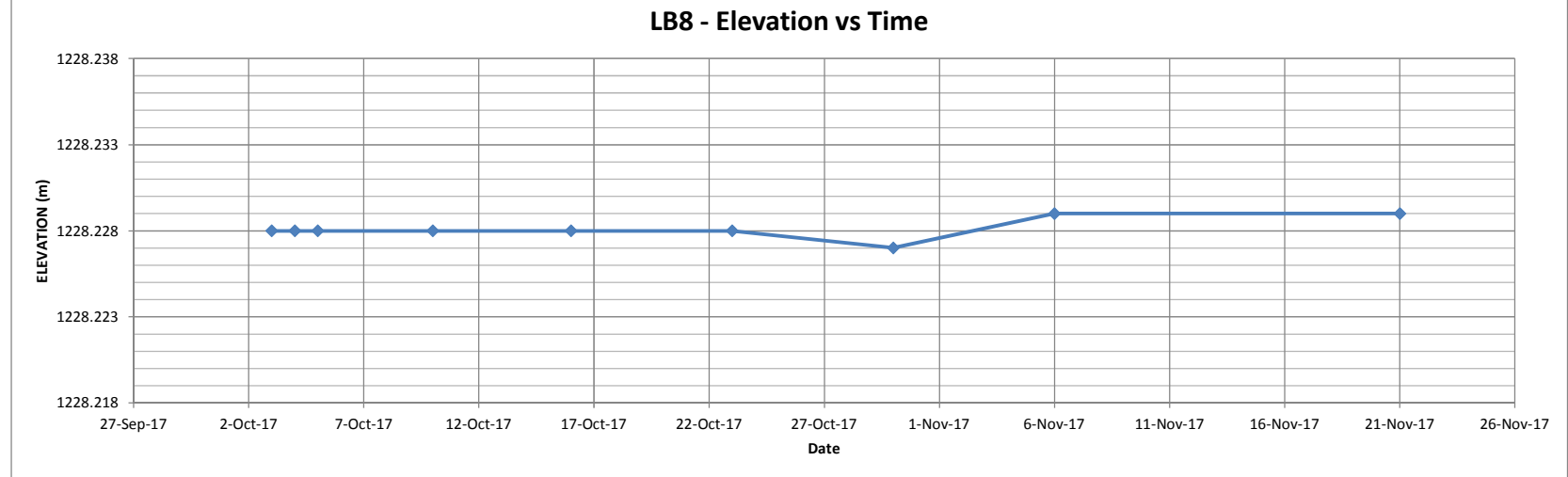


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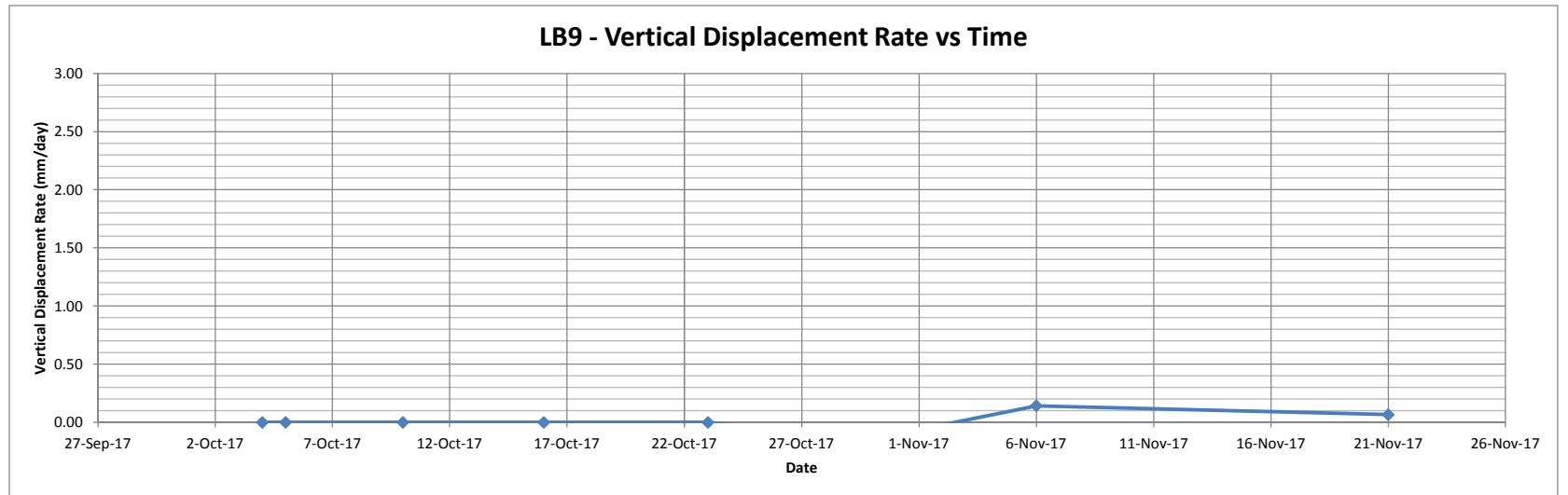
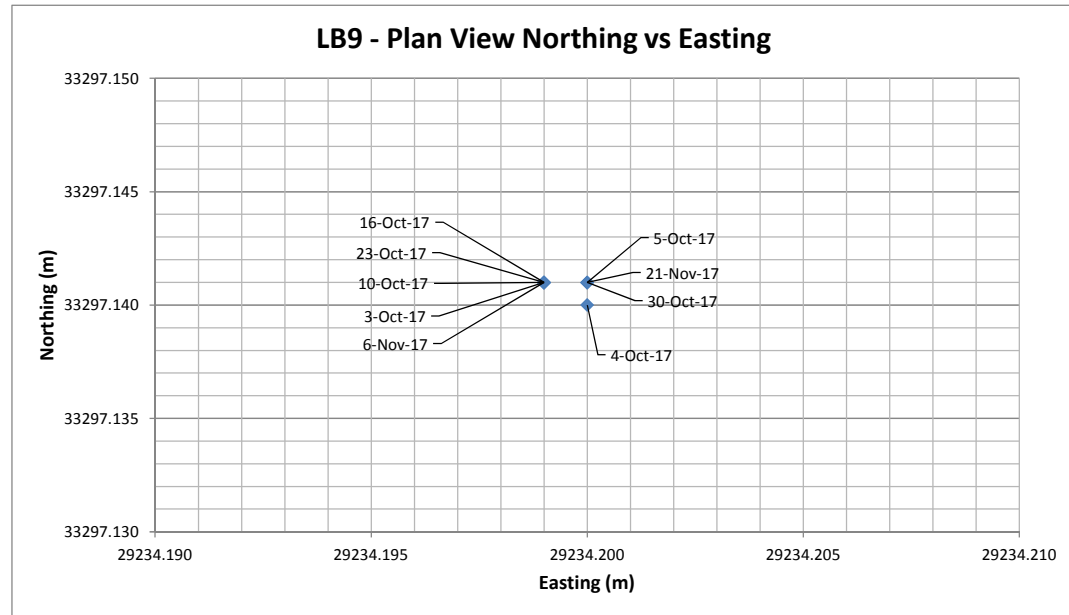
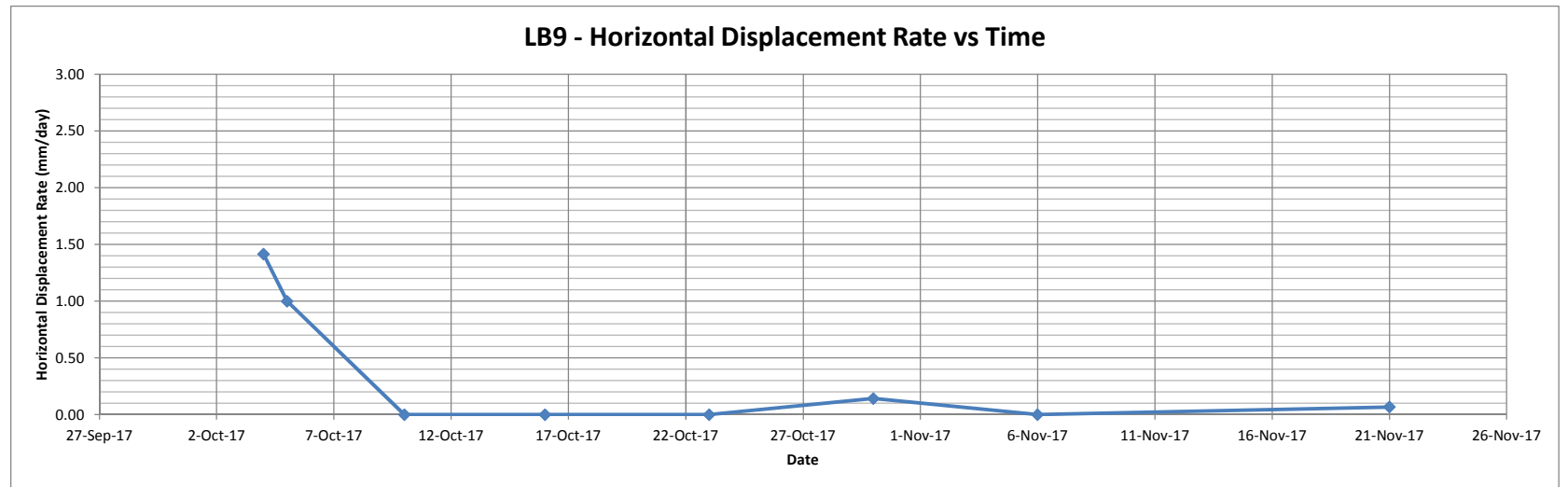
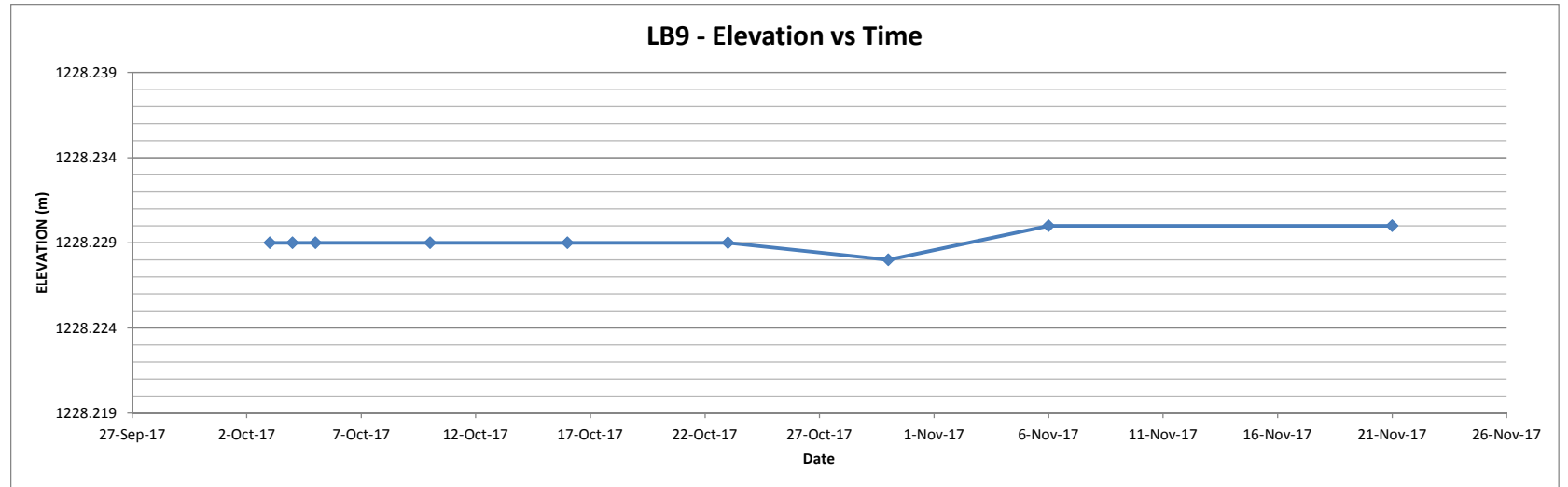
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		TITLE H-H DAM LOCK-BLOCK RETAINING WALL SURVEY MONUMENT READINGS LB7
PROJECT No. M02341B26		FIG No. VIII-8



NOTES:

1. All data provided by THVCP.

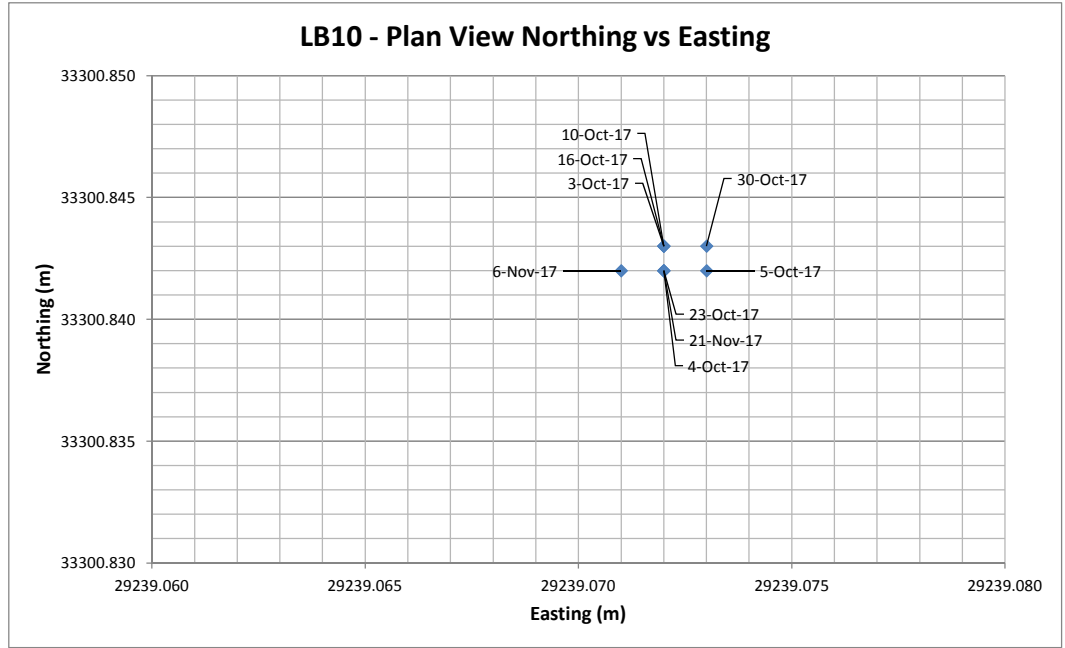
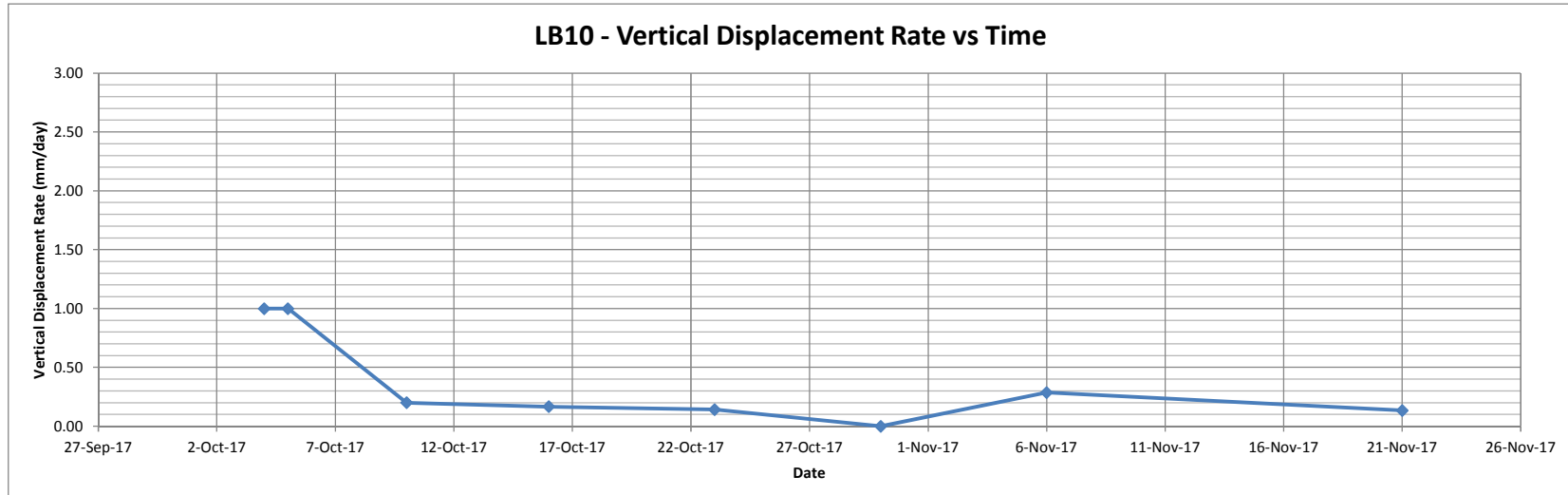
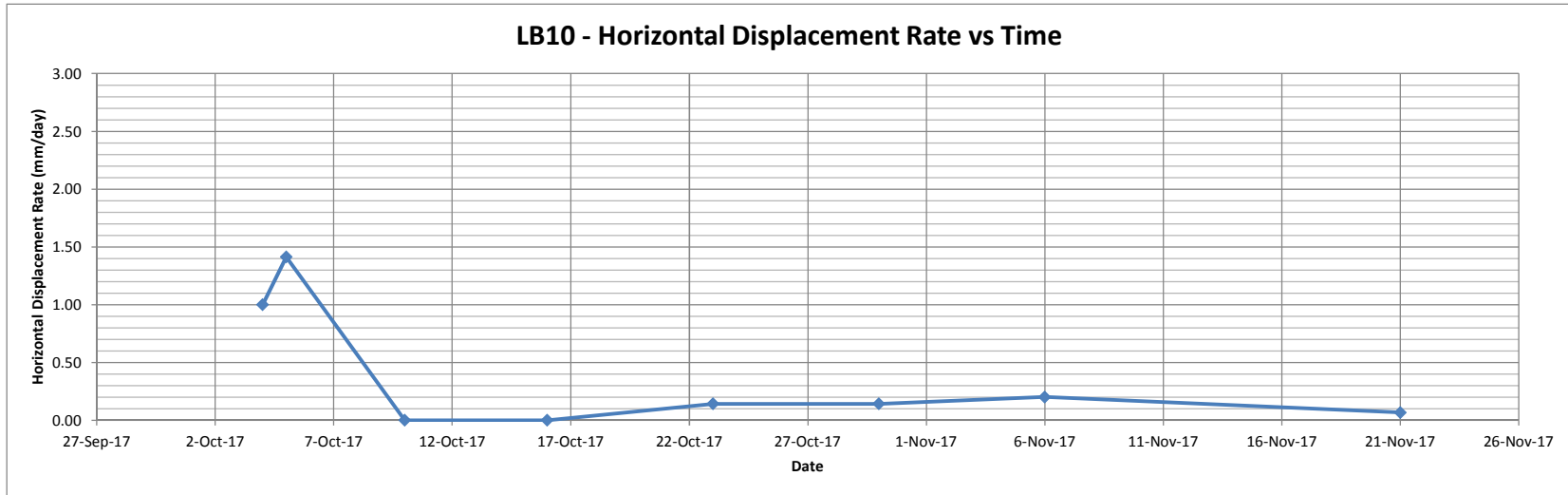
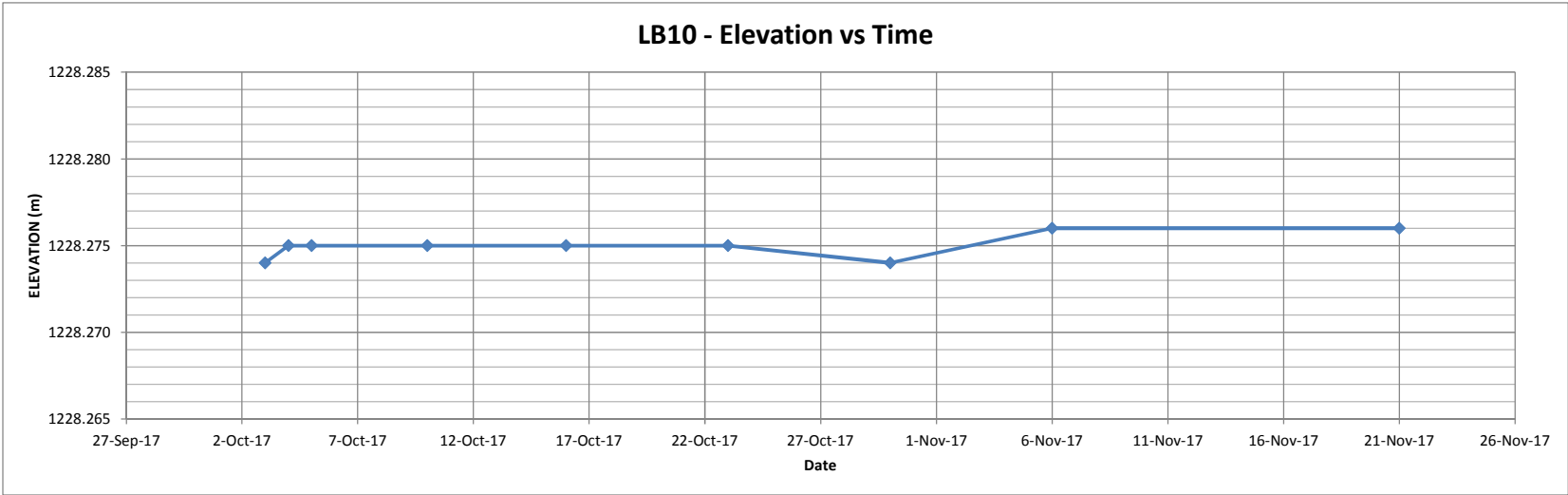
<small>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND NOT FOR PUBLICATION OR ABSTRACTS FROM DATA STATEMENTS, CONCLUSIONS OR RECOMMENDATIONS REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</small>	TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2017 DAM SAFETY INSPECTION
		TITLE H-H DAM LOCK-BLOCK RETAINING WALL SURVEY MONUMENT READINGS LB8
PROJECT No. M02341B26		FIG No. VIII-9



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		TITLE H-H DAM LOCK-BLOCK RETAINING WALL SURVEY MONUMENT READINGS LB9
PROJECT No. M02341B26		FIG No. VIII-10



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		H-H DAM LOCK-BLOCK RETAINING WALL SURVEY MONUMENT READINGS LB10
	PROJECT No: M02341B26	FIG No: VIII-11

APPENDIX IX

Map of Water Quality Monitoring Points

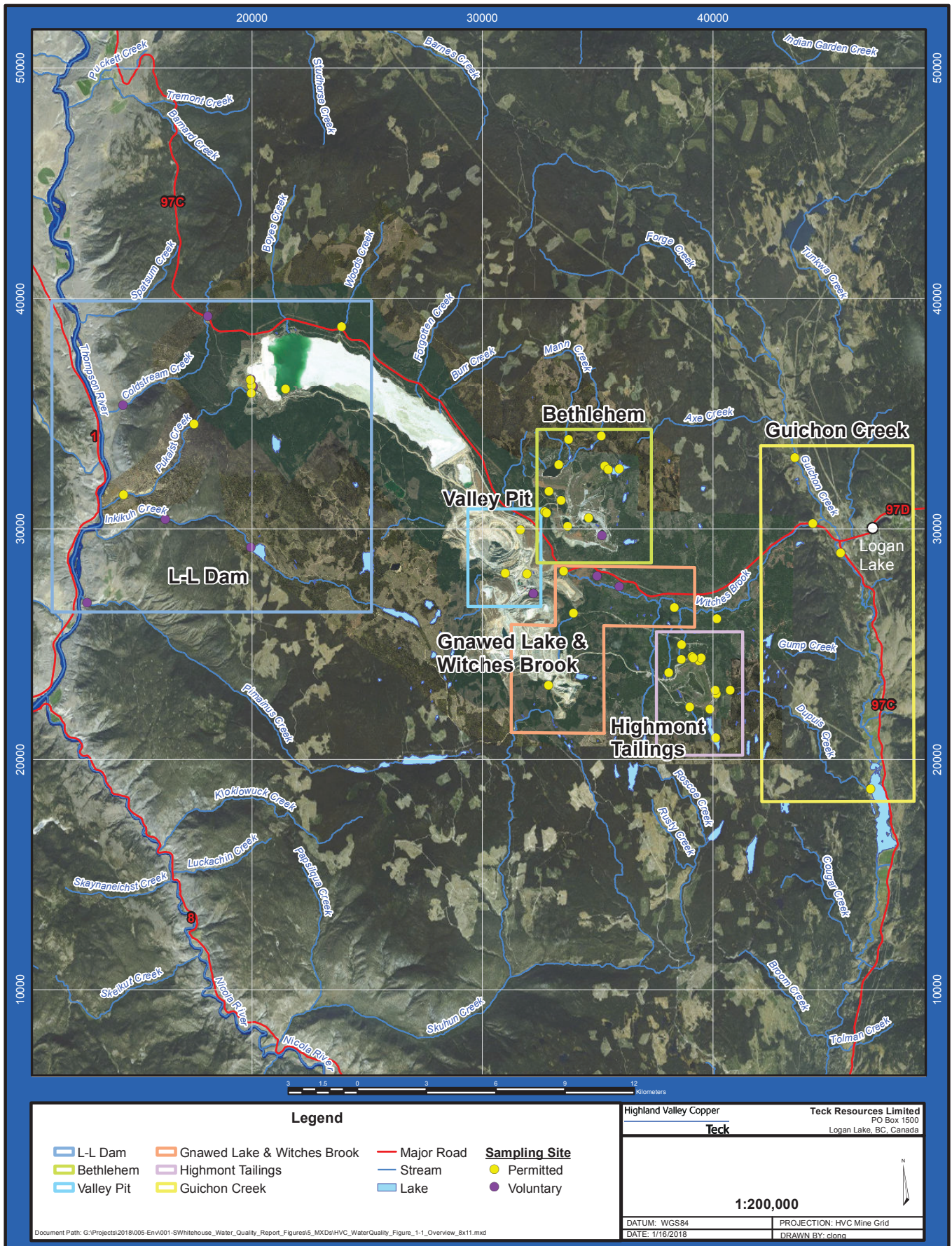


Figure 1-1 Water Quality Monitoring Sites Highland Valley Copper, 2017

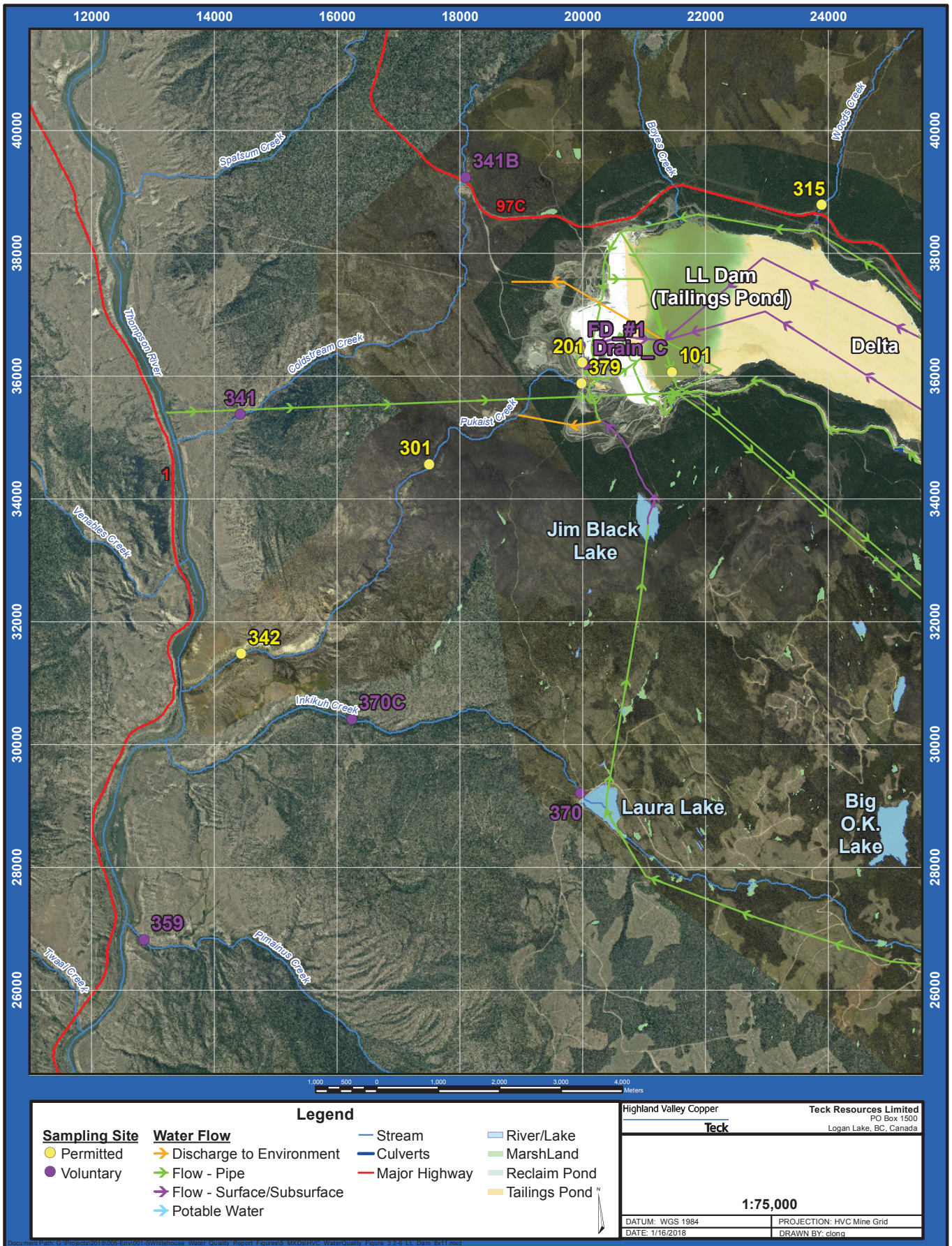


Figure 3.2-5 Water Quality Monitoring Sites in the in the LL Dam/Thompson Valley Area, Highland Valley Copper, 2017