Klohn Crippen Berger

Teck Highland Valley Copper Partnership

2020 Annual Facility Performance Report

Highland Tailings Storage Facility

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March 2021

Klohn Crippen Berger

March 19, 2021

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

Mr. Bryan Bale
Chief Tailings Engineer

Dear Mr. Bale:

2020 Annual Facility Performance Report
Highland Tailings Storage Facility

We are pleased to submit the 2020 Annual Facility Performance 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), and Section 4.2 "Annual Tailings Facility and Dam Safety Inspection Report" of the Code Guidance Document.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

Rick Friedel, P.Eng.
Engineer of Record (Highland TSF)
Principal

RF:cd

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Teck Highland Valley Copper Partnership

2020 Annual Facility Performance Report

Highland Tailings Storage Facility

EXECUTIVE SUMMARY

Klohn Crippen Berger Ltd. (KCB) was engaged by Teck Highland Valley Copper Partnership (THVCP) to complete the 2020 Annual Facility Performance Report[1] (AFPR) of the Highland Tailings Storage Facility (TSF) for the period of November 2019 through November 2020. The Highland TSF is the primary active storage facility for the Highland Valley Copper (HVC) mine, which is owned and operated by THVCP.

The review covers the following structures which comprise the Highland TSF:

- L-L Dam is a cycloned sand dam with a vertically raised central glacial till core. At the end of 2020, the crest of L-L Dam is at El. 1267 m, corresponding to a maximum downstream slope height of about 162 m. Consequence classification, as defined by CDA (2019), of "Extreme."
- H-H Dam is an earthfill dam constructed of local borrow and pit waste materials. Similar to the L-L Dam, a glacial till core that has been raised vertically from the crest of the H-H Starter Dam. At the end of 2020, the crest of H-H Dam is between El. 1278.0 m and El. 1283.0 m, with a maximum downstream slope height of about 55 m. Consequence classification, as defined by CDA (2019), of "Very High."
- 24 Mile Emergency TSF stores overflow tailings from the H-H Pumphouse. The facility is surrounded by waste dumps and a portion of the tailings area is being covered by the 24 Mile Waste Dump.
- Seepage and sediment ponds downstream of the L-L Dam which collect mine affected surface water and seepage for reclaim back to the impoundment with no off-site discharge.

The performance of the L-L Dam and H-H Dam is assessed based on the following:

- compliance with design criteria;
- comparison of actual conditions to design assumptions;
- consistency between measured response[2] and expected behaviour[3]; and
- presence or absence of potential dam safety concern indicators.

On this basis, the performance of both dams during the review period was acceptable.

During 2020, approximately 46.2 Mt of tailings were discharged into the Highland TSF and the facility was operated with adequate flood storage, freeboard capacity and tailings storage. The pond level rose 2.6 m during the year which was consistent with the forecast. To offset pond and tailings rise, the planned crest raises at L-L Dam (2.5 m) and H-H Dam (1.5 m to 2.5 m) were completed. The 2020 construction at each dam met engineering requirements to support the raised crests. However, due to construction delays related to COVID-19 and cycloned sand production the 2020 target fill volumes

[1] Past Annual Facility Performance Reports were referred to as Dam Safety Inspections (DSI).
[2] "Measured response" refers to instrumentation readings and visual observations during inspections.
[3] "Expected behaviour" is a forecast of how the dam will respond under future loading conditions based on interpretation of the historic measured response, coupled with numerical analysis where appropriate.

were not placed. The life-of-mine construction sequence was therefore updated to accommodate the additional material not placed in 2020. In addition to the dam crest raises, the THVCP mining fleet continued the campaign to develop the 24 Mile Waste Dump over the area previously referred to as the 24 Mile Emergency TSF.

During 2020, key tailings management roles for the Highland TSF transitioned, as planned:

- Mr. Rick Friedel, P.Eng. (representative of KCB), transitioned into the Engineer of Record (EoR) role, replacing Mr. Bill Chin, P.Eng. Mr. Friedel has been involved in the design and performance assessment of the Highland TSF since 2016 and Mr. Chin remains involved in the project to support the transition.
- Mr. Bryan Bale, P.Eng. (THVCP Chief Engineer - Tailings), transitioned into the TSF Qualified Person, replacing Mr. Chris Anderson, P.Eng.

THVCP submitted, for regulatory approval, modifications to the L-L Dam and H-H Dam design based on the review which was completed in 2020 (KCB 2020b). The design modifications were based on additional information collected since the previously approved design (KCB 2010). Also in 2020, THVCP received a revision to the M-11 Permit which included design modifications to the LL Dam to account for loading conditions under future dam raises (KCB 2018c).

The current Operation, Maintenance and Surveillance (OMS) Manual and the Emergency Preparedness and Response Plan (EPRP) (THVCP 2019) are suitable for the facility. As part of the routine update cycle both documents are being revised to align with the most recent industry guidance documents. A trial exercise of the EPRP was completed on December 9, 2020 in which THVCP and KCB representatives participated.

Due to the COVID 19 pandemic and to meet provincial health regulations THVCP implemented protocols limiting site resources. To support this change, the EoR and THVCP agreed to modify the frequency of some routine surveillance activities which did not compromise the overall surveillance and management controls at the Highland TSF but helped ensure priority activities were maintained.

The Highland TSF surveillance program is extensive and includes visual inspections, measured behaviour from 300 instruments installed at the dams, routine performance reviews and a Trigger-Action-Response-Plan (TARP). The TARP includes four levels which represent conditions of potentially increasing concern ranging from a routine engineering review, design assumption deviation up to initiation of the ERP.

The instrumentation program includes appropriate redundancy so that appropriate level of surveillance is maintained, even during temporary loss of service for some instruments. The adequacy of the instrumentation is reviewed during routine performance reviews. During 2020, 3 new inclinometers were installed at the L-L Dam: one at the VBBE to replace a damaged inclinometer; and two at the NBB to increase redundancy and coverage area. In addition, THVCP continued their program to increase automation of instrument readings and data collection.

Both dams are expected to respond to increased loading from construction, and rising tailings and pond levels. The performance of each dam was reviewed by the EoR monthly based on measured behaviour and other surveillance observations. In addition, routine engineering reviews were triggered, by the first level of the Trigger-Action-Response-Plan (TARP), in response to a localized deviation from historic or expected behaviour. Key observations from those reviews in 2020 are:

- None of the reviews identified an issue of dam safety concern or unacceptable performance.
- The tailings pond rate of rise was within the limits assumed in the dam crest rate of rise forecast and minimum freeboard at the L-L Dam during 2020 was 9.6 m. If the design PMF (5-day duration) had occurred at peak water level, the minimum freeboard would have been 4.5 m which exceeds the design minimum (2 m) required to account for wave run-up and crest settlement.
- The M-11 permit requires that the vertical distance between the tailings surface and crest of the H-H Dam be 1 m or more. This was achieved through the year and following completion of the 2020 crest raise the buffer was approximately 5 m along the crest.
- Visual inspections by the dam inspector, the EoR or others working in the area did not identify any indications of unacceptable behaviour at the dam. In compliance with standard procedure, items in the OMS Manual which required routine maintenance (e.g. localized slope erosion) were communicated to and actioned by the THVCP tailings team.
- Measured movement patterns and magnitude across each dam were consistent with expected behaviour for 2020 construction activities and once loading was completed the rate of movements attenuated back to the expected range for non-loading periods.
- Piezometric levels within the dam fill and foundation continued to respond to the dominant influences identified for that unit (e.g. rising pond level, construction loading, beaching) consistent with historic trends and patterns.
- However, at the H-H Dam, the second level of the TARP was triggered by increasing piezometric levels in the foundation following suspension of groundwater pumping, related to mechanical failure. This situation had not been considered in the forecasted behaviour for 2020. A review by the EoR concluded the dam, under the elevated piezometric levels, remained in compliance with relevant design criteria and therefore performance remained acceptable. Pumping has resumed and potential for a similar response, if pumping is suspended in the future, has been incorporated into 2021 forecast.

Water quality downstream of the Highland TSF is monitored but no water quality limits have been defined for this area in the permit (PE-376). Water quality monitoring data for the area is summarized and reported in 2020 Annual Water Quality Monitoring Report. There were no significant water quality non-compliances noted although the monthly sample from one site was not collected in October, although two had been collected in September. A significant observation during 2020 was a reversal of the previously rising Sulphate concentrations in Pukaist Creek. The average annual Sulphate concentration during 2020 was ~23% less than the 2019 annual average, based on values reported in the 2019 and 2020 SAMP Annual Reports. The change in trend is associated with mitigations implemented over the past several years by THVCP as part of SAMP.

The status of dam safety recommendations identified during past AFPRs and the outstanding items from the most recent DSR (Stantec 2018) are summarized in Table 1, as of the issue date of this report. Closed recommendations are shown in *italics*. During 2020, three of the five recommendations from previous AFPRs were closed and the portion of LL-2019-01 scheduled for 2020 was completed as planned. The remaining recommendation (LL-2019-02) is scheduled for completion in 2022, following construction of the Seepage Water Reclaim Pond (SWRP) replacement pond. This project was scheduled for 2021 but delayed due to land disturbance constraints encountered during construction. Dam safety recommendations identified during the 2020 AFRP, two, are summarized in Table 2.

Table 1 Previous Recommendations Related to Facility Performance – Status Update

ID No.	Performance Area	Recommended Action	Priority[1]	Recommended Deadline (Status)
L-L Dam				
LL-2019-01	Surveillance	Install 4 additional inclinometers at NBB (north of I17-24, I17-22, I15-25 and I19-08) to increase monitoring coverage to capture 3D behaviour and provide redundancy.	3	Q3 2021 (Open, 2 of 4 installed)
LL-2019-02	Surveillance	Install new seepage weirs along downstream toe after SWRP has been replaced and L-L Dam constructed to ultimate toe. (DSR recommendation LL-2017-06) *Update: Deadline changed to align with delay to construction of new SWPR.*	3	Q4 2021 (Open, completion target to be confirmed based on cultural heritage approval for SWRP)
LL-2019-03	*Surveillance*	*Include potential impacts on dam surveillance for a scenario where the site is not accessible due to fire. (To resolve DSR recommendation TSF-2017-11)*	*3*	*CLOSED (included in revised OMS Manual)*
H-H Dam and 24 Mile Emergency TSF				
No Outstanding Previous Recommendations				
L-L Dam Seepage Collection and Sediment Ponds				
SP-2017-01	*Flood Management*	*SWRP has insufficient capacity to store the IDF and should be brought into compliance. 2020 Update: This recommendation is closed on the basis that, under existing condition, the SWRP would flood adjacent area but not result in an offsite discharge.*	*2*	*CLOSED*
SP-2017-02	*Flood Management*	*Regrade Seepage Pond 2 outlet pipe to a consistent downward grade. 2020 Update: overflow to manage flood installed rather than regrading pipe.*	*2*	*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 2020 Recommendations Related to Facility Performance

ID No.	Performance Area	Recommended Action	Priority(1)	Recommended Deadline (Status)
L-L Dam				
LL-2020-01	Surveillance	To implement the Observational Method, restore function of one of the existing inclinometers at the VBB (near I10-7) or install a replacement.	3	Q2 2021
H-H Dam				
HH-2020-01	As-built Condition	Reconcile and confirm the design of interim and ultimate buttress configurations at the H-H Dam based on actual extent of tailings placed in channel from H-H Pumphouse to 24 Mile Emergency TSF.	3	Q1 2022
24 Mile Emergency TSF & L-L Dam Seepage Collection and Sediment Ponds				
No New Recommendations				

Notes:
Refer to Table 1 notes.

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1 INTRODUCTION

Klohn Crippen Berger Ltd. (KCB) was engaged by Teck Highland Valley Copper Partnership (THVCP) to complete the 2020 Annual Facility Performance Report (AFPR) for the Highland Tailings Storage Facility (TSF) for the period of November 2019 to November 2020 (herein referred to as the "review period"). The Highland TSF is the primary active storage facility for the Highland Valley Copper (HVC) mine, which is owned and operated by THVCP, and includes the facilities listed in Table 1.1 and shown on Figure 1 and Figure 2 (end of report).

Table 1.1 Highland TSF Structures

Structure	Function	Consequence Classification(1)
L-L Dam	Cross-valley retaining dam at northwest end of Highland TSF.	Extreme
H-H Dam	Cross-valley retaining dam at southeast end of Highland TSF.	Very High
24 Mile Emergency TSF	Receives seepage from the H-H Dam and acts as storage for tailings spoils for the H-H Pumphouse.	Low (2)
Seepage Water Reclaim Pond (SWRP)	Primary collection pond downstream of L-L Dam, which collects and pumps water back into the impoundment. Receives water from surface runoff, sediment ponds, and seepage collection ponds.	Significant
Seepage Pond 2	Collects local runoff and dam seepage primarily from finger drains under the northern portions of the L-L Dam.	Significant
Sediment Pond 1 (3)	Temporarily store overflow and sediments from L-L Dam downstream hydraulic cell construction. Routes inflow and local runoff to SWRP.	Significant
Sediment Pond 2 (3)		Significant
Sediment Pond 4 (3)	Contingency storage for overflow and sediments from L-L Dam downstream hydraulic cell construction. Routes inflow to SWRP.	n/a (4)

Note:
1. Consequence classification as defined by CDA (2019) which is not a risk classification. Refer to Section 7.1 for further discussion.
2. There are no credible failure modes for the 24 Mile Emergency TSF, in its current configuration, that could lead to a breach release of tailings or water off site (KCB 2018a). However, there are regulatory requirements and operational risks related to overtopping of the perimeter crest.
3. Sediment ponds were referred to as "slimes" ponds in previous review and design documents.
4. The crest of the divider dykes are below the surrounding natural ground. Failure of any of the divider dykes would be internal to the pond only with no downstream impacts.

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 (MEM 2017), herein referred to as the Code, and Section 4.2 of the Code Guidance Document (MEM 2016). The AFPR scope of work consisted of:

- visual inspection of the physical conditions of the various containment facilities;
- review of surveillance data for the review period provided by THVCP;
- review of climate and water balance data for the site;
- review of the Operations, Maintenance & Surveillance (OMS) manual to confirm it is appropriate for the existing facility; and
- review of additional activities completed at the site during the review period, if any.

The visual inspection was completed by KCB representatives Mr. Rick Friedel, P.Eng., P.E. and Ms. Narges Solgi, EIT on July 16, 2020. During the inspection, the weather was sunny and did not impede the inspection. Designated roles related to tailings management, required under Part 10 of the Code, for the Highland TSF at the end of the review period were filled by:

- Engineer or Record (EoR) - Mr. Friedel, P.Eng. (representative of KCB):
  - Mr. Friedel has been involved in the project since 2016 and transitioned into the EoR role in December 2020, replacing Mr. Bill Chin, P.Eng.
- TSF Qualified Person (QP) - Mr. Bryan Bale, P.Eng. (THVCP Tailings Chief Engineer):
  - Mr. Bale transitioned into the TSF Qualified Person role in September 2020, replacing Mr. Chris Anderson, P.Eng.

The Highland TSF is operated under the following permits:

- British Columbia Ministry of Energy, Mines and Petroleum Resources[4] (EMPR) Geotechnical Permit M-11 (EMPR 2020) – the permit covers the entire mine life, property and the surrounding area and communities.
- 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.

[4] Currently known as the Ministry of Energy, Mines and Low Carbon Innovation.

2 FACILITY DESCRIPTION

2.1 Highland TSF

The HVC mine 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 and is approximately 10 km long.

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 H-H Dam is constructed of local borrow and waste materials from the Valley Pit, while the L-L Dam is constructed of local borrow materials, processed filter materials, and cycloned tailings sand. Construction of the Highland TSF began in 1971 with the J-J Starter Dam, which was located approximately halfway 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.

The majority of tailings have been discharged from spigots near the east and west abutments of the H-H Dam. As a result, the tailings beach slopes away from the H-H Dam towards the pond, which is over 7 km away, near the L-L Dam. No significant ponding occurs at the H-H Dam. Water from the tailings pond is recirculated, via floating barges, back to the mill for use in processing.

In addition to L-L Dam and H-H Dam, there are several other supplementary retaining structures related to water and sediment management. General information regarding each retaining structure at the Highland TSF is summarized in Table 2.1. The tailings retaining dams, L-L Dam and H-H Dam, are discussed further in Sections 2.2 and 2.3. More detailed discussion of the facility history and overview is included in the revised OMS Manual which will be issued prior to March 31, 2021.

Table 2.1 Containment Facilities at the Highland TSF (as of November 2020)

Structure	Containment or Design Type	Est. Crest Length (m)	Est. Crest El. (m)	Est. Max Downstream Slope Height (m)
L-L Dam	Refer to Section 2.2.	2,980	1267	162
H-H Dam	Refer to Section 2.3.	1,800	1278 m to 1283 m	~53[1]
24 Mile Emergency TSF	The area was previously a natural lake. Tailings have been raised above the natural lake level and are encapsulated on all sides by waste rock dumps.	n/a	Min. 1220 (waste dumps)	n/a (Note 2)
Seepage Water Reclaim Pond	Portion of pond formed by excavation into natural ground with embankment on the west side. Embankment is homogeneous glacial till with downstream sand and gravel filter. Pond is unlined.	95	1103.2	5
Seepage Pond 2	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
Sediment Pond 1[3]	Excavated into natural ground. In 2018, remaining sediment and accessible lacustrine/glaciolacustrine deposits over the base of the pond were removed and the pond backfilled with sand and gravel.	NE = 500 SW = 700	1103.2	2.5 m
Sediment Pond 2[3]	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
Sediment Pond 4[3]	Contained by natural ground with small compacted till embankments to provide containment at the south and southeast ends.	n/a	1103 to 1104	<2 m

Notes:
1. The maximum downstream slope height is ~53 m to existing ground which has been raised ~40 m above natural ground by waste dumps.
2. The crest of the waste dump providing containment is more than a kilometer-wide and there are no credible failure modes for the dump which could result in an uncontrolled release of tailings downstream (KCB 2018b).
3. Sediment ponds were referred to as "slimes" ponds in previous review and design documents.

2.2 L-L Dam

Figure 2.1 is a typical design section of the L-L Dam, through the Valley Buttress Berm (VBB) at Sta. 1+850 along the crest. The dam includes a glacial till core for seepage control which extends from the existing crest, through the starter dam and is keyed into the foundation. The dam crest has been raised using the centreline method with the core supported by compacted cycloned sand on the upstream and downstream sides. The majority of the cycloned sand fill in the dam has been placed and densified hydraulically, rather than by conventional construction equipment.

General construction staging of the VBB through 2020 is shown on Figure 2.2. Select design and construction record drawings as well as further discussion of the design and construction timeline for the L-L Dam is included in the OMS Manual. The 2020 layout of the L-L Dam and associated structures is shown on Figure 2 (at end of report).

The L-L Dam is divided into five design segments based on foundation conditions (Figure 3): South Dam; Valley Buttress Berm (VBB); Valley Buttress Berm Extension (VBBE); North Buttress Berm (NBB); and North Dam. The North Dam is further subdivided into two zones: North Dam Bedrock; and North Dam Upper-Glaciolacustrine (U-GLU). The geologic and geotechnical characterization of the L-L Dam foundation is summarized in KCB (2020c) which is consistent with the requirements recommended by APEGBC (2016). The overall downstream slope, measured from the downstream edge of the crest and the downstream toe, is 2.5H:1V except where foundation conditions govern the need for additional buttressing (i.e., VBB, VBBE, NBB).

The approved design for the L-L Dam is based on KCB (2018c) which proposed modifications to the previously approved design (KCB 2010), specifically at the VBB and North Dam, and downstream ponds. The current configuration of the dam meets design and regulatory criteria (KCB 2020b).

Additional modifications to the L-L Dam design have been recommended by KCB (2020b) which were submitted to the Ministry of Energy, Mines and Low Carbon Innovation[5] (EMPR) for approval by THVCP during in November 2020. The proposed modifications are all related to improving tailings management and maintaining compliance under future loading conditions, based on information collected since the previously approved design was completed in 2010 (KCB 2010).

The downstream cycloned sand shell is underlain by a sand and gravel blanket drain which includes minor and major underdrains to increase drainage capacity. The purpose of the underdrainage system is to maintain low piezometric pressures in the downstream shell, intercept upward seepage from the natural ground, and promote downward drainage through the dam shell during hydraulic placement of cycloned sand dam fill. Seepage intercepted by the blanket drain flows towards the VBB, which is the low point of the natural valley, unless intercepted by an underdrain.

Seepage through the foundation that is not intercepted by the dam fill or drains is managed by THVCP as part of the Sulphate Adaptive Management Plan (SAMP), which includes a diversion of Woods Creek flow around the Highland TSF to Pukaist Creek and a network of interception wells

[5] Previously known as Ministry of Energy, Mines and Petroleum Resources (EMPR).

downstream of L-L Dam. The SAMP system is not considered a design feature of the L-L Dam but is a requirement of THVCP under the conditions of the M-11 permit (EMPR 2020). Water quality monitoring is reported by THVCP in a separate report as discussed in Section 5.4.

The purpose of the downstream collection ponds is to collect mine affected surface water and seepage with no off-site discharge. The SWRP, located downstream of the VBB toe, is the primary collection pond where all water reports and is then pumped into the Highland TSF impoundment via a pipeline.

Figure 2.1 Schematic L-L Dam Typical Base Case Design Section at VBB (Sta. 1+850)

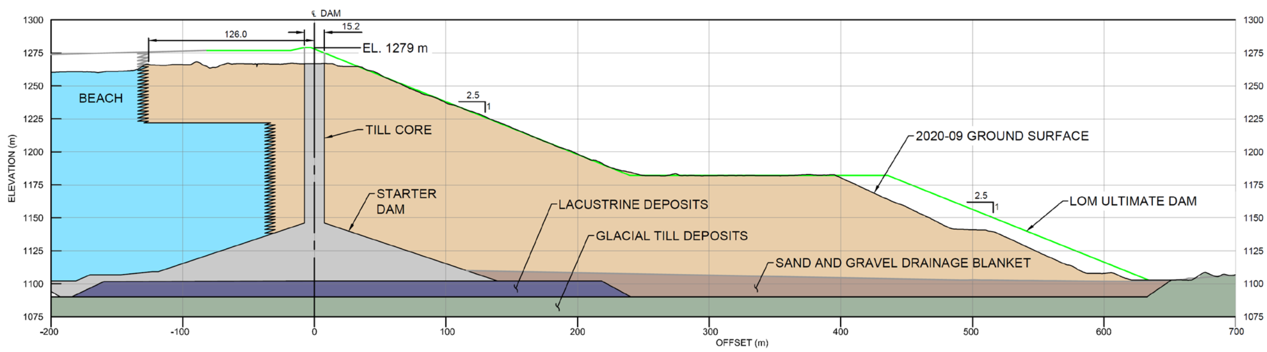
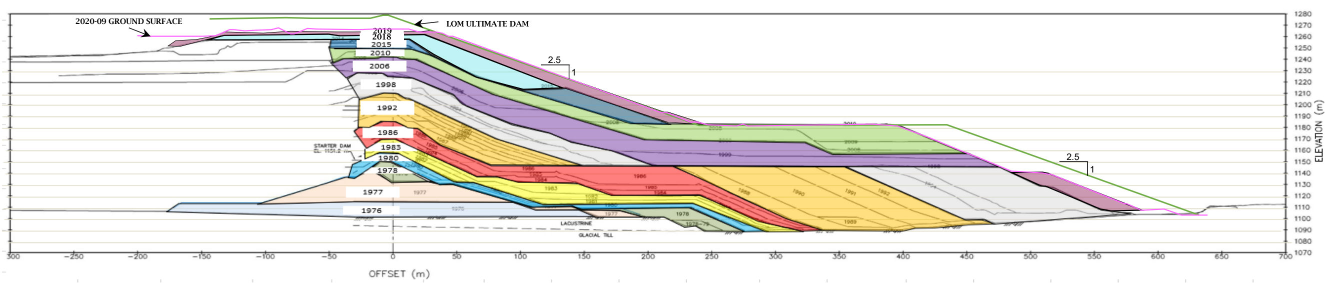


Figure 2.2 Schematic L-L Dam Construction Sequence at VBB through 2020 (Sta. 1+850)



2.3 H-H Dam

Figure 2.3 is a typical design section, with construction staging, of the H-H Dam at Sta. 1+400 along the crest. The dam includes a glacial till core for seepage control which extends from the existing crest, through the starter dam and is keyed into the foundation. The dam crest has been raised using the centreline method with the core supported by granular fills on the upstream and downstream sides. The majority of the downstream shell has been placed by the THVCP mining fleet.

Select design and construction record drawings as well as further discussion of the design and construction timeline for the H-H Dam is included in the OMS Manual. The 2020 layout of the H-H Dam and associated structures is shown on Figure 4.

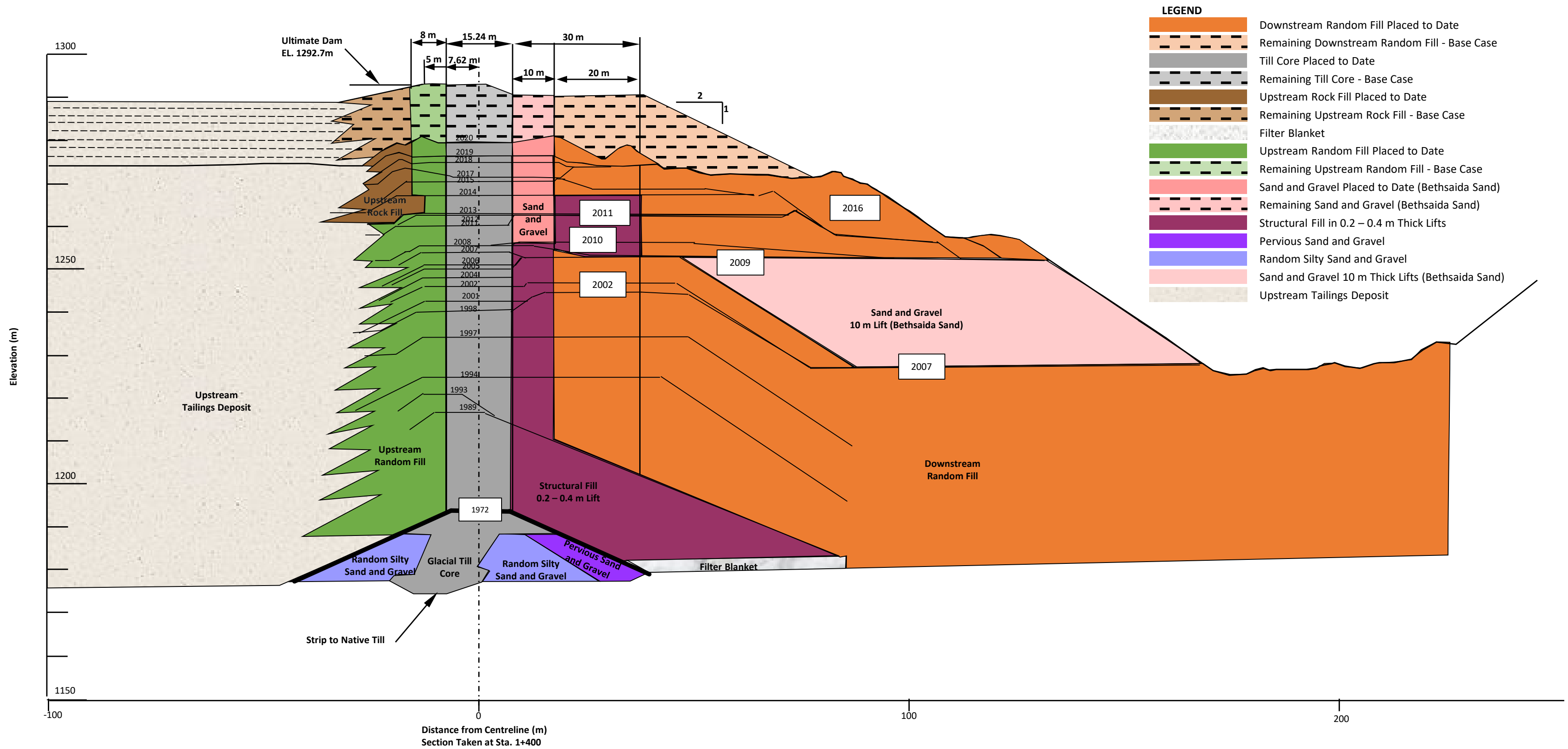
The approved design for the H-H Dam is based on KCB (2010) and the current configuration of the H-H Dam meets design and regulatory criteria (KCB 2020b).

Similar to the L-L Dam, modifications to the H-H Dam design have been recommended by KCB (2020b) related to improving tailings management and maintaining compliance under future loading conditions, based on information collected since the previously approved design was completed in 2010 (KCB 2010). These were submitted by THVCP to the Ministry of Energy, Mines and Low Carbon Innovation for approval in November 2020.

No overtopping concern is present at the H-H Dam because the crest is higher than the L-L Dam crest (typically ~14 m) and the tailings beach slopes away from the dam. Therefore, rather than constructing a horizontal crest to match rise of a pond surface, the H-H Dam crest is sloped to match the forecasted beach profile immediately upstream of the dam.

The 24 Mile Waste Dump and 24 Mile Emergency TSF (Section 2.4) is located approximately 110 m downstream of the H-H Dam fill toe but is physically connected by downstream waste dumps. Seepage from the H-H Dam reports to the 24 Mile Emergency TSF or is intercepted by the pumping wells downstream of the dam toe which supply water to the H-H Pumphouse.

Figure 2.3 Schematic H-H Dam Base Case Design and Construction Sequence through 2020 (Sta. 1+400)



Note: Structural fill below ~El. 1216.7 m is a transition zone between Glacial Till core and downstream Random Fill.

2.4 24 Mile Emergency TSF

The 24 Mile Lake was a natural lake that has been encompassed by waste dumps and used to store tailings from the H-H Pumphouse during upset or emergency conditions. The impoundment where tailings are stored is referred to as the 24 Mile Emergency TSF. Starting in 2019, THVCP began capping the northern end of 24 Mile Emergency TSF with waste rock which has segregated the surface of the 24 Mile Emergency TSF into two areas (Figure 2.4):

- 24 Mile Waste Dump – northern portion of the 24 Mile Emergency TSF which is being capped with waste rock. This dump is physically connected to and provides stabilization to the H-H Dam.
- 24 Mile TSF – southern portion of the 24 Mile Emergency TSF is uncapped during operations and used to store overflow tailings from the H-H Pumphouse and surface runoff. This area must be capped at the end of operations (KCB 2020b).

Figure 2.4 Plan View of 24 Mile Emergency (Planned Ultimate Configuration)

3 2020 OPERATIONS

3.1 Tailings Deposition and Available Storage

The maximum permitted ore throughput, and subsequently tailings production, allowed by the M-11 Permit (EMPR 2020) is 200,000 tonnes per day (tpd) calculated on an annual average basis. During 2020, THVCP generated approximately 46.2 million tonnes (Mt) which corresponds to an average daily production of ~127,000 tpd. All of the tailings were discharged into the Highland TSF, except for cycloned sand placed in the L-L Dam and small quantities of tailings discharged into 7-Day Pond or 24 Mile Emergency TSF during upset conditions at the Mill or H-H Pumphouse, refer to Table 3.1.

2020 tailings spigot points at the Highland TSF are shown on Figure 3.1 and the estimated volumes of tailings discharged at each location (as provided by THVCP) are summarized in Table 3.1.

THVCP sequences dam construction such that at the end of each calendar year, the Highland TSF has capacity to store the forecasted tailings production for the next year. This is in addition to flood storage and freeboard requirements. THVCP plans to produce 44 Mt of tailings in 2021. Based on forecasted pond volume and elevation, the dam crests at end of 2020 are sufficient to store forecasted 2021 tailings and maintain flood storage and freeboard.

Tailings deposition modelling completed in 2020 (KCB 2020e) shows that the approved ultimate crests of both dams are sufficient to store the forecasted tailings production for the remaining mine life; ~376 Mt (2021 to 2027).

Figure 3.1 2020 Highland TSF Spigot Locations

Dam	Spigot Details			Tailings Type Discharged During 2020
	ID	Location/Station Range	No of Points	
L-L Dam	A	3+750	2 (1)	Primary Cyclone Overflow
	B	1+800 to 3+600	10 (2)	Primary Cyclone Underflow, Secondary Cyclone Overflow
	C	0+850 to 1+650	5 (3)	Secondary Cyclone Overflow
H-H Dam	D	West Abut	1	Whole Tailings
	E	East Abut - North	4 (4)	Whole Tailings

Notes:

1. Located at approximately Sta. 3+750.
2. Located at stations 1+800, 2+000, 2+200, 2+400, 2+600, 2+800, 3+000, 3+200, 3+400 and 3+600.
3. Located at stations 0+950, 1+200, 1+350, 1+500 and 1+650.
4. Spigot was located at 350 m (January to July), and 420 m (since August) Northwest (i.e. upstream) of East abutment during 2020.

Table 3.1 2020 Tailings Deposition

Discharge Area	Spigot Location(s)[1]	Notes	Tailings Discharged (dry weight - Mt)[4]
		HIGHLAND TSF	
H-H Dam: East Abutment[1]	E	Discharge shifted from 350 m upstream of dam crest to 420 m in August 2020	32,777,373
H-H Dam: West Abutment (SS2)	D	Typically discharged during maintenance or inactivity at the L-L Cyclone House	2,802,540
Mid-Impoundment (SS3)	SS3	Typically discharged during maintenance or inactivity at the L-L Cyclone House	2,006,250
L-L Dam Crest	A, B, and C	Tailings are discharged as cyclone overflow or underflow via the L-L Cyclone House or secondary cyclones on dam crest	5,002,023
L-L Dam Cycloned Sand Fill	n/a	Cyclone underflow placed in the dam	3,650,084
		HH PUMPHOUSE SPOILS	
24 Mile Lake	n/a		Note 2
		MILL SPOILS	
7-Day Pond	n/a		Note 3
		Total 2020 Tailings:	**46,238,270**

Notes:
1. Refer to Figure 3.1 for spigot locations.
2. Volume estimate from aerial survey not reliable due to placement of initial capping layer and changes in drainage channel; however, volume is not significant relative to overall production.
3. Very small volume relative to overall production (~7,000 dry tonnes).
4. Some tailings discharge quantities are measured, while others are estimated based on process-flow-diagram.

3.2 2020 Dam Construction Activities

The crest raises in 2020 at both L-L Dam and H-H Dam were completed within the review period of this report, as planned. Fill placement at the L-L Dam continued into December 2020. General activities completed at each dam are summarized in Table 3.2 and Table 3.3 with the main work areas shown on Figure 6 and Figure 7.

2020 construction activities are documented in a separate construction summary report, which includes discussion of quality control/quality assurance activities and compliance with design intent. Overall, the 2020 construction activities complied with the design intent, Issued for Construction (IFC) specifications and drawings. There are no outstanding non-conformances which require further action.

In addition to activities summarized in Table 3.2 and Table 3.3, the following supporting activities were undertaken during 2020:

- Fill was placed (~3 m high and 5 m wide) on the downstream side of the lock-block wall at the toe of H-H Dam, near the H-H Pumphouse (Sta. 2+050), to provide additional support to the wall while fill was being placed upstream of the area (Section 5.3.3).
- Excavation of accumulated sediments from downstream sediment ponds or temporary on-dam storage cells.

- The temporary sediment storage cell within Sediment Pond 1 was re-established and used during 2020 construction. The temporary storage is required until Sediment Pond 3, which was delayed further due to archeological constraints, is commissioned.
- THVCP mine fleet placed a second lift of waste over the portion of the 24 Mile Waste Dump that is built over tailings. This included backfilling of the old channel where tailings flowed from H-H Pumphouse to 24 Mile Emergency TSF which was recommended by KCB, refer to Section 5.3.2.
- Development and management of borrow areas.
- Production (i.e. crushing and screening) of granular drainage and filter materials for dam construction.
- Repair of localized erosion of the downstream slope caused by overflow of the hydraulic cycloned sand or concentrated flow from snowmelt. Each case is assessed and repaired in accordance with requirements identified in CM-2018-008-01 (KCB 2018d).
- THVCP constructed an overflow channel that increases the flood routing capacity of Seepage Pond 2 (Section 4.2) to address an outstanding recommendation (SP-2017-01, Table 8.1). This was done instead of regrading the outlet pipe which required a larger excavation (i.e. disturbance area) and temporary water management works (e.g. pumping) while the work was being undertaken. The channel was excavated along the same alignment as the existing outlet (east side) through an access road away from the dam.

Table 3.2 Summary of 2020 Construction Activities at L-L Dam

Construction Activity	Dam Area				
	North Dam	NBB	VBBE	VBB	South Dam
Glacial Till Core Raise	✓	✓	✓	✓	✓
Upstream Fill (Cycloned Sand - Hydraulic)	✓	✓	✓	✓	✓
Upstream Fill (Cycloned Sand - Mechanical)	✓	✓	✓	✓	✓
Downstream Fill (Cycloned Sand - Hydraulic)	-	-	-	-	✓
Downstream Fill (Cycloned Sand - Mechanical)	-	✓	-	-	✓
Abutment Preparation (incl. key-in of core zone)	Note 2	-	-	-	Note 2
Foundation Preparation	✓	✓	-	✓	✓
Blanket Drain	-	✓	-	✓	✓
Finger Drains	-	✓	-	-	✓

Notes:
1. Refer to Figure 6.
2. North and South abutments were prepared to the 2021 crest raise elevation.

Table 3.3 Summary of 2020 Construction Activities at H-H Dam Area

Construction Activity	Dam Area			24 Mile Lake
	West Segment	Mid Segment	East Segment	
Glacial Till Core Raise	✓	✓	✓	-
Upstream Fill (Pit Waste)	✓	✓	✓	-
Downstream Fill (Sand and Gravel Filter)	Note 2	✓	✓	-
Downstream Fill (Random Fill) – by Contractor	✓	✓	-	-
Downstream Fill (Random Fill) – by THVCP Mining Fleet	-	-	✓	-
Abutment Preparation (incl. key-in of core zone)	Note 2	-	Note 2	-
Foundation Preparation	✓	-	-	-
Random Fill Capping Layer – by THVCP Mining Fleet	-	-	-	✓

Notes:

1. Refer to Figure 7.
2. As per the IFC drawing, a temporary fill key-in was completed at the East and West Abutment, final key-in is part of 2021 construction.

3.3 Incidents

During 2020, there were no incidents observed by KCB, reported by THVCP or initiated through the trigger-action-response-plan (Section 5.1) which could have compromised the integrity of either dam or required remedial actions be taken.

4 2020 WATER MANAGEMENT

4.1 Water Balance

There is no surface discharge from the facility; mill water reclaim, evaporation, and entrainment are the major sources of water loss. Annual climate fluctuations have the greatest influence on pond volume changes. THVCP manages the Highland TSF pond to balance mill water supply requirements, storing water to reduce downstream flooding events from natural events (e.g. freshet, storms) and not storing or accumulating excessive water in the impoundment which could impact dam safety.

THVCP maintains a predictive water balance, based on the process-flow-diagram shown on Figure 20, to forecast changes in pond volume which is used in tailings deposition and crest rate of rise estimates. Table 4.1 is a summary of Highland TSF inflows and outflows during 2020 based on the water balance, provided by THVCP.

THVCP also tracks pond volume based on estimates from bathymetric survey and pond level. Figure 4.1 plots Highland TSF estimated pond volumes over the past six years including 2020. Pond volumes are typically decreasing except during freshet. The magnitude of freshet typically has the greatest impact on annual pond volume change.

Table 4.2 compares the annual change in pond volume estimate based on bathymetry and water balance. Both methods indicate an increase in pond volume during the year between 4.7 Mm^3 and 5 Mm^3. This is consistent with the above average pond level rise during the same period (Section 5.2.1). Both pond volume and rate of rise were less than was observed in 2018. As discussed in Section 5.2.1, 2020 pond level rise and pond volumes were consistent with rate of rise forecasts and did not impact or encroach on flood or contingency storage.

Figure 4.1 Highland TSF Pond Volume: 2015 to 2020

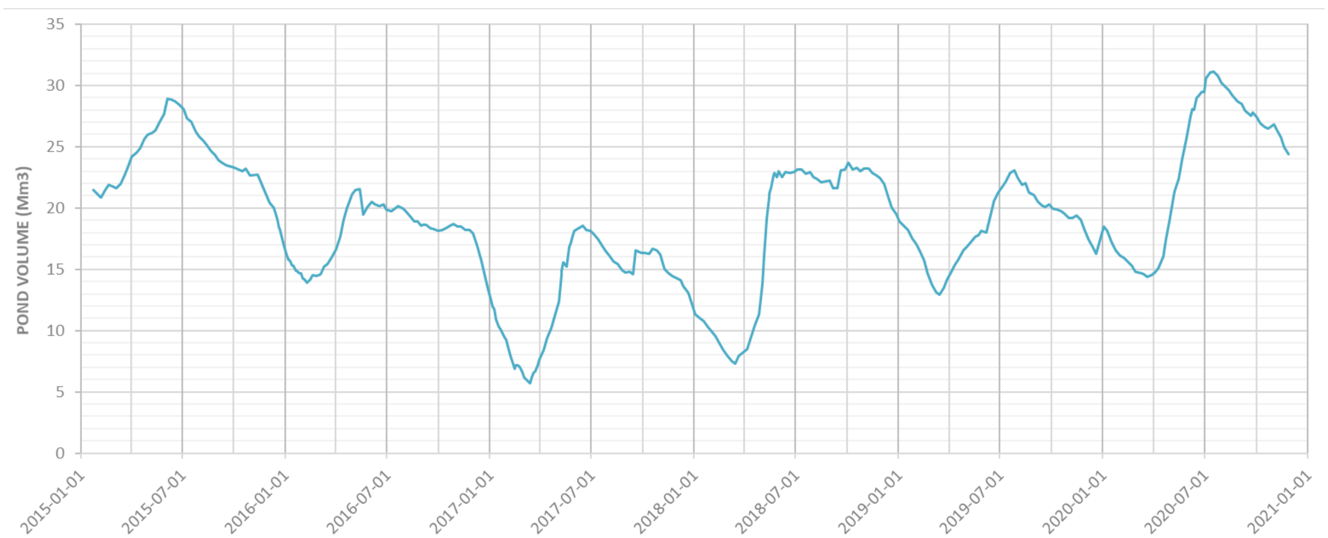


Table 4.1 Annual Water Balance for Highland TSF – Model Estimates

Item	2020 Volume (Mm^3)
Inflows	
Runoff[1]	11.1
Consolidation water	2.4
Water in tailings slurry discharged into impoundment	86.1
Groundwater	0.1
Seepage Pond Collection	4.7
Spatsum	0.0
Total inflow:	104.4
Outflows	
Evaporation[2]	5.6
Seepage to Pukaist Creek	0.3
Seepage to Surface Water Reclaim	2.4
Entrainment	15.9
Construction Losses	2.7
Reclaim to Highland Mill	72.8
Total outflow:	99.7
Balance	
Water gained in impoundment over the calendar year (inflows - outflows)	4.7

Notes:
1. Adjusted precipitation values from Shula Flats weather station used in water balance model.
2. Evaporation at the Highland TSF was assumed to be 645 mm/year.

Table 4.2 Change in Pond Volume During 2020 for Highland TSF

Metric		Volume
Pond Volume Calculated Based on Bathymetry	Pond volume on Dec. 19, 2019	18.8 Mm^3
	Pond volume on Dec. 4, 2020	23.8 Mm^3
	Est. Change in Pond Volume	+5 Mm^3
Est. Change in Pond Volume based on Water Balance		+4.7 Mm^3

4.2 Flood Management

The summary of flood management structures and the applicable design criteria for the Highland TSF facilities are given in Table 4.3 below. As discussed in Section 2.3, overtopping of H-H Dam by the Highland TSF pond is not possible; therefore, flood routing is measured relative to L-L Dam only. Each of the structures can safely manage or store the IDF, without offsite discharge, required under the Code.

The SWRP relies on pumping to maintain water levels year-round, and in its current state, has insufficient capacity to store or route the IDF (KCB 2018c). During the IDF, water from the SWRP would flood the adjacent area, mainly Sediment Pond 1, potentially impacting THVCP operations but the downstream Laura Lake public road (~El. 1108 m) would prevent an offsite discharge.

An overflow channel was excavated at Seepage Pond 2 (Section 3.2) to increase flood routing capacity sufficiently to route the IDF (100-year return period) with freeboard (0.5 m). The overflow channel follows the same alignment as the buried outlet pipe. The channel invert is set at El. 1115.5 m (i.e. 1.1 m above the outlet pipe inlet) and only engaged during large flood events. The overflow outlet discharge at the same location of the existing buried pipe as well so the channel does not change flow routing during normal or flood conditions.

Table 4.3 Inflow Design Flood Requirements for Highland Facility

Facility	Routed or Stored (Outflow)	Consequence Classification	Inflow Design Flood		Design Outflow/ Stored Volume
			Required(1)	Design	
L-L Dam	Stored	Extreme	PMF	PMF 120-hour(4)	50.3 Mm^3
Seepage Pond 2	Routed (Pipe)(2)	Significant	Between 100-year and 1000-year	100-year 24-hour(5)	3.2 m^3/s
Sediment Pond 2	Routed (Pipe)(2)	Significant	Between 100-year and 1000-year	100-year 24-hour(5)	0.2 m^3/s
Seepage Water Reclaim Pond	Routed / Stored(3)	Significant	Between 100-year and 1000-year	100-year 72-hour(6)	0.26 Mm^3
24 Mile TSF	Stored	Low	1/3rd between 1000-year and PMF	1/3rd between 1000-year and PMF 72-hour(7)	3.2 Mm^3

Notes:
1. Per the Code (MEM 2017) for tailings and water retaining facilities.
2. Seepage Pond 2 and Slimes Pond 2 IDFs are routed to the SWRP.
3. During the IDF, some water would be reclaimed back to the impoundment but the majority of flow stored.
4. Based on KCB (2020b).
5. Existing flood routing for Seepage Pond 2 and Sediment Pond 2 is based on the 200-year return period event to support SWRP design. A letter documenting flood routing for IDF of each structure is in preparation by KCB.
6. Based on KCB (2018b).
7. Based on KCB (2020a).

4.3 Freeboard

The minimum freeboard[6] measured during 2020 are summarized in Table 4.4. At the end of 2020, all facilities are designed to meet flood freeboard requirements under the Code, and minimum freeboards during 2020 were below criteria.

THVCP has defined alert levels which, if exceeded, trigger escalating action to mitigate flooding related risks (e.g., increased monitoring, active measures to drawdown pond level) and are integrated with the site wide emergency response plan, where appropriate. Pond alert levels for the Highland TSF and 24 Mile Emergency were reviewed and updated based on current conditions. Alert levels were also developed for the downstream sediment and seepage ponds in Table 4.4. All alert levels are defined in the revised OMS Manual (Section 5.1).

[6] The vertical distance between the pond level and the low point of the dam crest.

Table 4.4 Summary of Freeboard Requirements and Minimum During Review Period

Facility	Freeboard		
	Required During IDF(1)	Predicted During Peak Design Flood Level	Minimum Observed During the Review Period(7)
L-L Dam	2 m	4.5 m(2)	9.55 m(3)
Sediment Pond 1	0.5 m	0.5 m	1.3 m(4)
Seepage Pond 2	0.5 m	0.5 m	1.5 m
Sediment Pond 2	0.5 m	0.5 m	1.4 m
Seepage Water Reclaim Pond	0.5 m	Note 6	1.1 m(5)
24 Mile TSF	0.5 m	4 m(2)	19.9 m

Notes:

1. As per the Code, refers to the minimum vertical distance between peak pond level during the IDF and low point of crest.
2. The minimum freeboard that would have been present, if the IDF had occurred at peak 2020 pond level.
3. Based on peak pond level during review period (El. 1254.95 m, July 2020) and L-L Dam crest elevation at the time (El. 1264.5 m).
4. Measured relative to overflow point into SWRP.
5. SWRP freeboard during 2020 is measured relative to the spill point where water would start to flood the surrounding mine area (El. 1103.2 m). The freeboard relative to an offsite spill is 4.8 m higher than the value reported in the table.
6. During the IDF, water from the SWRP would flood the adjacent area, mainly Sediment Pond 1, potentially impacting THVCP operations but result in no offsite discharge. The peak flood level during the IDF (El. 1105.3 m) is 2.7 m below the elevation required to discharge offsite (El. 1108 m, crest of downstream Laura Lake public road).
7. Based on maximum recorded pond elevation during the review period.

5 2020 DAM SURVEILLANCE SUMMARY

5.1 Surveillance Program

The Operation, Maintenance and Surveillance (OMS) Manual was reviewed and issued by THVCP in December 2019 (THVCP 2019). As part of the routine update cycle the OMS Manual is being revised to align with the most recent industry guidance documents. The updates to the OMS Manual will reflect the updated life-of-mine tailings deposition and construction plans, incorporate updates to the quantitative performance objectives (QPO) based on the most recent design review (KCB 2020b) and comply with revised requirements from the Mining Association of Canada guidance document (MAC 2019).

The main activities of the dam surveillance program defined in the OMS Manual and related activities completed during 2020 are summarized in Table 5.1.

Starting in March 2020, THVCP was required to implement protocols to meet provincial health regulations related to reducing the spread of the COVID 19 pandemic. This included reducing the number of people on site to essential personnel only. Prior to reducing site personnel at the dams, THVCP requested KCB review the Highland TSF surveillance program to identify site activities which could be completed at a reduced frequency, that would allow THVCP to reduce site personnel, but not compromise the overall surveillance controls at the facility. The modified frequency recommended by KCB is summarized in Table 5.1 and remain appropriate during 2021 while site personnel restrictions remain in place.

The current suite of geotechnical instruments at the L-L Dam (241) and H-H Dam (59), locations shown on Figure 3 and 5, is sufficient to demonstrate the dams are performing within acceptable limits and consistent with design. Appendix III-A and IV-A include further breakdown of the instruments installed at each dam as of November 2020. In 2019, KCB recommended four additional inclinometers be installed to add redundancy and increase the monitoring area at the NBB (LL-2019-01, Table 8.1). Two of the inclinometers were installed at the NBB, as planned, and the remaining two are scheduled for installation in 2021.

In 2020, KCB recommended an inclinometer be installed at the VBB (near I10-7) to replace the instruments along this portion of the downstream slope which became non-functional during 2020. The existing inclinometers upstream and downstream of this area provide adequate coverage to demonstrate this segment of the dam is performing within acceptable limits. However, an inclinometer is required at this location to implement the Observational Method as described in KCB (2018c) which is referenced under the current M-11 Permit (EMPR 2020).

There were disruptions to the remotely monitored instruments throughout the year due to software and hardware issues. In each instance THVCP took action to address the situation. Due to the redundancy built into the program, these did not significantly impact the effectiveness of the Highland TSF surveillance controls.

The Highland TSF surveillance program includes a trigger-action-response-plan (TARP) with four levels which represent conditions of potentially increasing concern ranging from a routine engineering review, design assumption deviation, up to initiation of the ERP. The TARP defines what actions must be taken, within what timeframe and who is responsible if a defined level is exceeded. Threshold values and triggers which notify THVCP if a TARP level has been exceeded were reviewed and updated by the EoR prior for implementation during 2020 construction.

Throughout the year, the performance of the Highland TSF is routinely reviewed and documented to confirm the facility is performing and being operated in compliance with expected limits. The performance of the L-L Dam and H-H Dam is assessed based on the following:

- compliance with design criteria;
- comparison of actual conditions to design assumptions;
- consistency between measured response[7] and expected behaviour[8]; and
- presence or absence of potential dam safety concern indicators.

The following reviews of measured behaviour and performance are included as routine activities in the surveillance program:

- <u>THVCP Weekly Surveillance Review Meeting</u> - summary of routine inspections, surveillance data and activities at the Highland TSF are reviewed by the THVCP Tailings Group, including the QP, during a weekly intra-departmental meeting. Following the meeting, the presentation slides are provided to the EoR, or Alternate, for review. Observations or recommendations from the EoR based on the review are submitted back to THVCP.
- <u>Monthly EoR Surveillance Reviews</u> - EoR, or Alternate, monthly review of L-L Dam and H-H Dam surveillance information is documented in a Routine Monitoring Review (RMR) memo. The RMR summarizes: interpretation of instrument exceedances; construction and beaching activity; comments on general trends observed and forecasted behaviour; changes to instrumentation (e.g. repairs/replacement, operational status); and register of recommendations related to instrumentation and monitoring.
- <u>Routine EoR Reviews (triggered by TARP)</u> – a localized deviation from historic or expected behaviour at an instrument will trigger the first level of the TARP, referred to as "Notification Level," which requires an engineering review by the EoR. An exceedance of the Notification Level does not represent a dam safety concern or unacceptable performance. The EoR review focuses on the following:
    - cause for the measured response (e.g. change in soil behaviour, faulty instrument, change in loading or operational activity such as beaching);
    - review the measured response in nearby instruments to identify whether the response is localized or regional;

[7] "Measured response" refers to instrumentation readings and visual observations during inspections.
[8] "Expected behaviour" is a forecast of how the dam will respond under future loading conditions based on interpretation of the historic measured response, coupled with numerical analysis where appropriate.

- confirm the behaviour does not indicate unacceptable behaviour and/or if a higher TARP level should be triggered;
- recommend appropriate actions, if any, as follow up (e.g. repeat reading, confirm recent activity in area, revised thresholds or triggers based on new interpretation); and
- document the review for the facility record.

Triggering of the TARP, above Notification Level, based on instrument readings requires an exceedance at multiple instruments, indicative of a regional rather than a localized response, and in some cases other indicators of unacceptable performance (e.g. visual observation). No TARP levels, other than Notification Level, were triggered by instruments or EoR review during the review period.

Notification Level exceedances at each dam during the review period are summarized in Sections 5.2.3.1 and 5.3.2.1. These exceedances should not be mistaken as an indicator of unacceptable performance or dam safety concern. The goal of the Notification Level is to utilize information from the extensive instrumentation systems to inform how the facility is designed and managed rather than just to indicate a potential concern. At the Highland TSF the most common benefits from these reviews are:

- identify outlier readings related to instrumentation issues (e.g. serviceability or data processing);
- allow time to modify operations or construction plans, if appropriate, to better suit behaviour (e.g. deformations, piezometric levels);
- improve confidence in the predicted response under future conditions (e.g. construct loading or beaching) to support design assumptions and TARP triggers; and
- establish a thorough record of dam behaviour which can be used in future design activities and/or performance assessments.

Table 5.1 2020 Highland TSF Surveillance Activities

Monitoring Activity	Facility	Minimum Frequency[1]	Documentation	2020 Frequency Compliance[1]	Notes for the Review Period
Inspections					
Routine Visual Inspections[2]	L-L Dam / H-H Dam	Weekly	THVCP Inspection Reports	Yes	-
	24 Mile Emergency TSF / Waste Dump	Quarterly			
	Sediment and Water Ponds	Every 2 Months (except for SWRP: Monthly)			
Event-driven Visual Inspections	L-L Dam / H-H Dam / 24 Mile Emergency TSF / Sediment and Water Ponds	When Triggered[3]	THVCP Inspection Reports	N/A	No event-driven inspections were triggered during 2020.
Annual Facility Performance Report	Highland TSF	Annual	THVCP Inspection Reports	Yes	This report
Dam Safety Review (DSR)	Highland TSF	Every 5 years	DSR Report	N/A	Next DSR is due in 2022.
Visual Inspection of Beach length	L-L Dam	Weekly (Visual)	THVCP Inspection Reports	Yes	-
Instrumentation Monitoring					
Pond Level	Highland TSF / 24 Mile Emergency TSF	Weekly	Pond Level Tracking Register	Yes	-
	SWRP	Monthly			
	Sediment and Water Ponds	Every 2 Months			
Instrumentation – Piezometers	L-L Dam / H-H Dam	Varies (Note 4)	GeoExplorer Database	Yes	-
Instrumentation – Inclinometers	L-L Dam / H-H Dam	Varies (Note 4)	GeoExplorer Database	Yes	-
Instrumentation – Sondex (Settlement)	H-H Dam	Monthly	Sondex Tracking Register	Yes	-
Survey Monuments	H-H Dam Lock-block Wall	Quarterly (No Const) / Weekly (Const)	Survey Tracking Register	Yes	-
Instrumentation – Seepage Weirs	L-L Dam	Monthly	THVCP Inspection Reports	Yes	-
Surveys					
Construction Record Surveys	L-L Dam / H-H Dam / 24 Mile Emergency TSF	Annually	Construction Record Report & Drawings	Yes	-
Tailings Pond Bathymetric Surveys	Highland TSF	Twice per Year	Facility Performance Report	Yes	-
Tailings Level (Buffer)	H-H Dam	Weekly	THVCP Inspection Reports	Yes	-
Survey of Beach Length	L-L Dam	Twice per Year	THVCP Inspection Reports	Yes	-

Notes:
1. Frequency of routine surveillance activities were modified in 2020 related to site resources restrictions required to meet COVID 19 provincial health regulations, as discussed in Section 5.1.
2. Visual inspections include pond level measurements and observations for any evidence of unusual conditions and/or dam safety concerns (e.g. settlement, sinkholes, slope sloughing, erosion, seepage, piping, etc.)
3. THVCP staff are to complete an event-driven inspection in response to one of the following events:
   - Earthquake greater than magnitude 5, within 100 km of the site or any earthquake felt at site.
   - Rainfall event greater than the 10-year, 24-hour duration storm; 39.9 mm (Golder 2019).
4. The monitoring frequency of instruments is defined by the EoR and varies based several factors such as monitoring purpose, location and instrument type. Frequency is documented in the OMS Manual.

5.2 L-L Dam Performance Summary

5.2.1 Pond Level

Figure 5.1 plots surveyed Highland TSF pond elevation and L-L Dam crest over the past 5 years including 2020. Figure 5.2 plots 2020 pond elevations and volumes, estimated based on the most recent bathymetry survey. The annual pond rise during 2020, based on peak and end of year levels, was above the average over the previous 4 years (Table 5.2). However, the rate of rise was consistent with tailings rate of rise forecast (KCB 2020c) used to set 2020 crest raise elevation. At the end of 2020, including the completed crest raise, the capacity of the impoundment is sufficient to store 2021 forecasted tailings production while maintaining adequate flood storage and freeboard.

Pond volumes increased during 2020, relative to 2019, as discussed in Section 4.1 which is consistent with an above average rise in pond level (Table 5.2). However, based on pond levels this did not encroach on flood criteria or require a change to the planned crest rise.

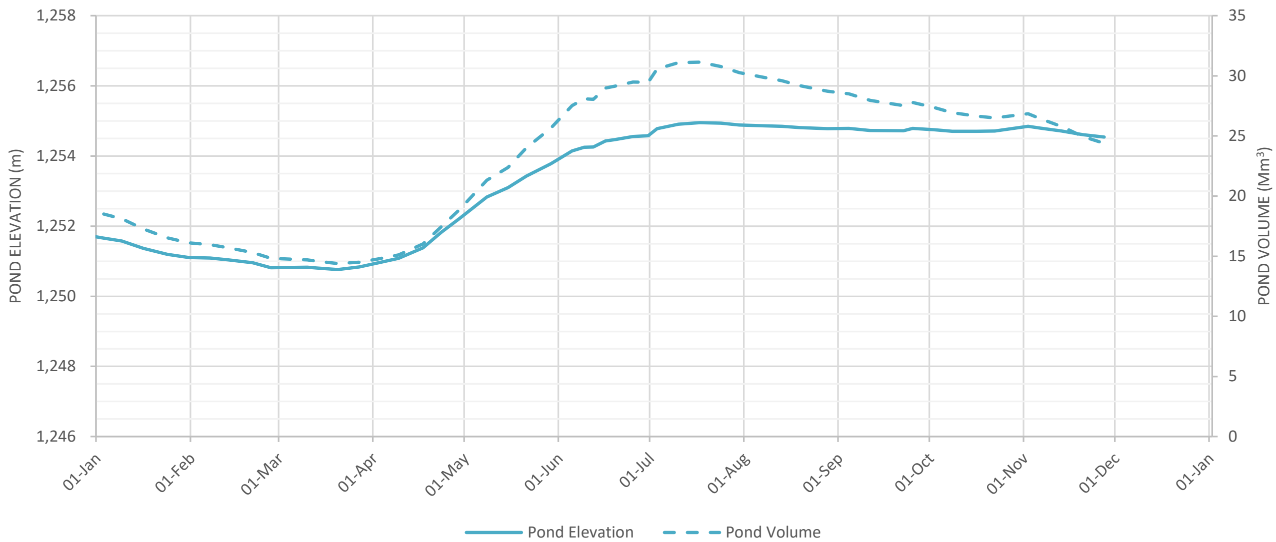
Table 5.2 Highland TSF Change in Pond Elevation

Annual Change	Change in Pond Level 2019 to 2020	Range of Annual Pond Level Change 2016 to 2019
Peak Pond	2.4 m	0.8 m to 3.4 m (avg. 1.8 m)
Pond at End of Year	2.6 m	0.9 m to 3.8 m (avg. 2.2 m)

Figure 5.1 Highland TSF Pond and Crest Elevations: 2016 to 2020

Note: there was no crest raise of L-L Dam during 2016 or 2017.

Figure 5.2 2020 Highland TSF Tailings Pond Elevations and Estimated Pond Volumes

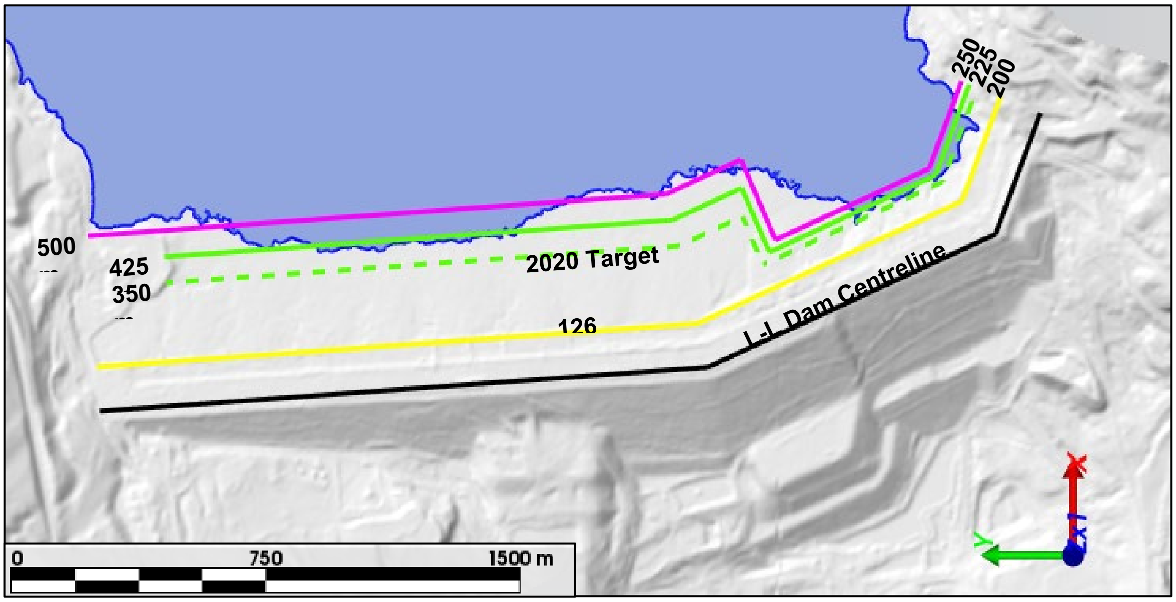


5.2.2 Beach Width

A minimum beach width of 500 m at the North Abutment is required to reduce seepage flows and gradients through the foundation in this area (Section 7.4.2). During 2020, the 500 m beach width was maintained by a combination of spigotted tailings, foundation preparation spoils and overflow sediments from hydraulic placement, as shown on Figure 5.3.

In addition, THVCP has initiated a multi-year project to increase beach width along the length of the dam crest as a risk reduction activity. As part of this project, THVCP has set interim beach width targets which were met for 2020 (dashed green line, Figure 5.3).

Figure 5.3 Status of L-L Dam Beach as of September 2020



5.2.3 Instrumentation Trends

5.2.3.1 Overview and Notification Level Exceedances

General piezometric and displacement behaviour, based on instrumentation readings from November 2019 to November 2020 at each segment of the L-L Dam is summarized herein. November 2020 instrumentation readings are shown on select design cross sections, through each dam segment, of the L-L Dam (Figure 8 to Figure 14). The L-L Dam instrumentation system is summarized in Appendix III-A. Summary plots of instrumentation readings are included in Appendix III-B (piezometers) and Appendix III-C (inclinometers).

The accuracy of inclinometers provided by the manufacturer is +/-2 mm over a 25 m length. This can be significant when interpreting typical movement rates measured at the L-L Dam (<1 mm/month). To accommodate this and filter out deflection of the inclinometer casing down the hole which is not related to shear, interpretation of inclinometer plots are based on cumulative, incremental and change over time. This is completed by both THVCP and KCB teams as part of routine instrument reviews.

During the review period, 19 potential Notification Level exceedances were triggered and reviewed by the EoR. After the EoR review, 16 of them were determined to be related to some factor other than a localized change from expected response, such as:

- Instrument failure – THVCP would action assessment of the instrument and schedule repairs or take the instrument offline.
- Data processing – follow up actions included review of calibration and corrections being applied to resolve the issue.

- Movement rate was influenced by a deflection feature along the inclinometer casing (e.g. compression zone) unrelated to foundation or dam fill movements – These were closed out by modifying elevation range used to monitor movement rates in target units.
- Incorrect threshold value – During the transition period as 2020 threshold values were being updated and input to the instrument tracking tools, some exceedances were triggered based on the superseded 2019 threshold value.

Identifying these types of issues is another intended function of the Notification Level trigger and help maintain health and performance of the instrumentation system. Notification Level triggers that were associated with a localized change from expected response are summarized as follows:

- VBBE - two piezometers which had previously been recording a piezometric level below the tip elevation started to record a positive pressure. The levels were in the Glacial Till which does not govern design and well below limits which may start to influence dam performance. The thresholds were revised to detect any further rise in these levels in the future.
- North Dam – The movement rate at an inclinometer near the crest of the dam (I99-05) exceeded the Notification Level while the dam crest was being raised in the area. The movement was along a known mudstone layer where movements have been shown to increase during previous construction loading. The peak rate measured was still within the range of those measured during previous construction periods and there were no Notification exceedances triggered at the inclinometer further down the slope or at the dam toe. Following construction loading the rate attenuated back down to typical levels for non-loading periods. Refer to Section 5.2.3.6 for more discussion on general trends and response in this segment of the dam.

5.2.3.2 South Dam

November 2020 instrumentation readings from South Abutment through Sta. 1+500 are projected along Sta. 1+200, shown on Figure 8. As shown on Figure 6, construction activity in the South Dam area during 2020 included crest raise, downstream foundation preparation and fill placement.

Piezometers

Measured behaviour during the review period was consistent with the design assumption that the dominant influence on piezometric levels in the foundation and glacial till fill in the dam near the south abutment, under existing crest height, is pond level. Over the past three years, including the review period, piezometric levels downstream of the dam have started to rise ~3 months after pond level rise. No hydraulic fill placement was completed in the South Dam during 2020 construction, which can also influence the piezometer response in the South Dam as was observed in 2018.

Inclinometers

Inclinometers were also consistent with typical behaviour through the review period with no defined shear or movement zones of concern.

5.2.3.3 Valley Buttress Berm

November 2020 instrumentation readings from Sta. 1+500 through Sta. 2+100 are projected along Sta. 1+850, shown on Figure 9. As shown on Figure 6, construction activity in the VBB area during 2020 included a crest raise, and hydraulic fill placement at the downstream toe and upper slope.

Piezometers

Overall piezometric levels in the dam fill and foundation were relatively steady with no significant response to pond level rise which is consistent with typical behaviour in the Lower Sand and Gravel and Glacial Till foundation units. This response was a change from the trends measured over recent years in Lower-Glaciolacustrine (L-GLU) and VBB blanket drain.

Piezometric levels in the downstream shell of the dam are primarily governed by hydraulic placement which temporarily increases the volume of water infiltrating into the dam fill. The largest response in piezometric levels to hydraulic sand is observed in the VBB blanket drain, regardless of whether fill is placed at the VBB or in some other segment of the dam. This is because VBB is the low point of the drainage system and is the primary collection and discharge area for seepage through the dam. Regardless, the stability of the VBB is not sensitive to piezometric level fluctuations in the VBB drainage blanket and shallow foundation units, as the design is governed by the underlying L-GLU foundation unit.

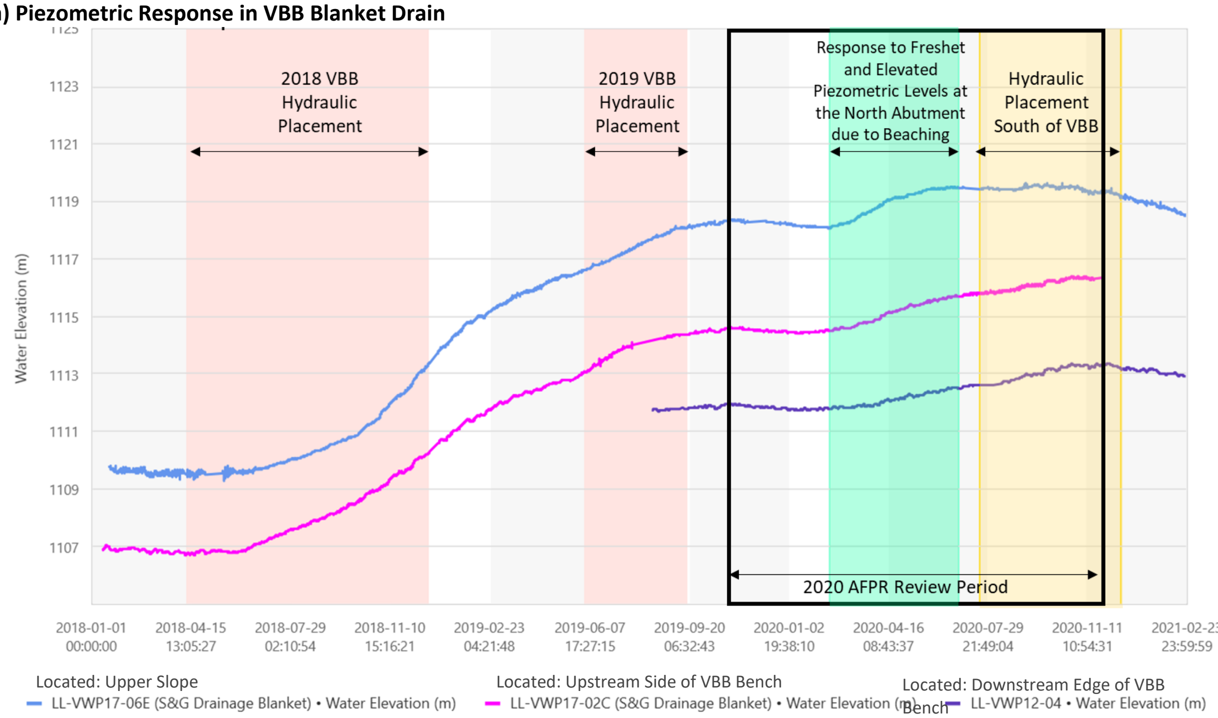
During 2018 and 2019 the piezometric levels in the VBB blanket drain rose at an average rate of ~3 m/year. This rise was a response to resumption of hydraulic sand placement in the downstream shell which had been suspended since August 2015. To discharge the seepage flow from hydraulic placement, piezometric levels in the drainage blanket rose to increase the seepage gradient through the dam fill. Starting in late 2019 and continuing through 2020, the rate of piezometric rise in the VBB blanket drain during hydraulic placement decreased indicating the seepage gradient was approaching the level required to manage the elevated seepage flows (Figure 5.4).

KCB did a review of piezometric response in the VBB blanket drain since 1989 and this same response to changes in hydraulic placement can be observed throughout the life of the structure (KCB 2020f).

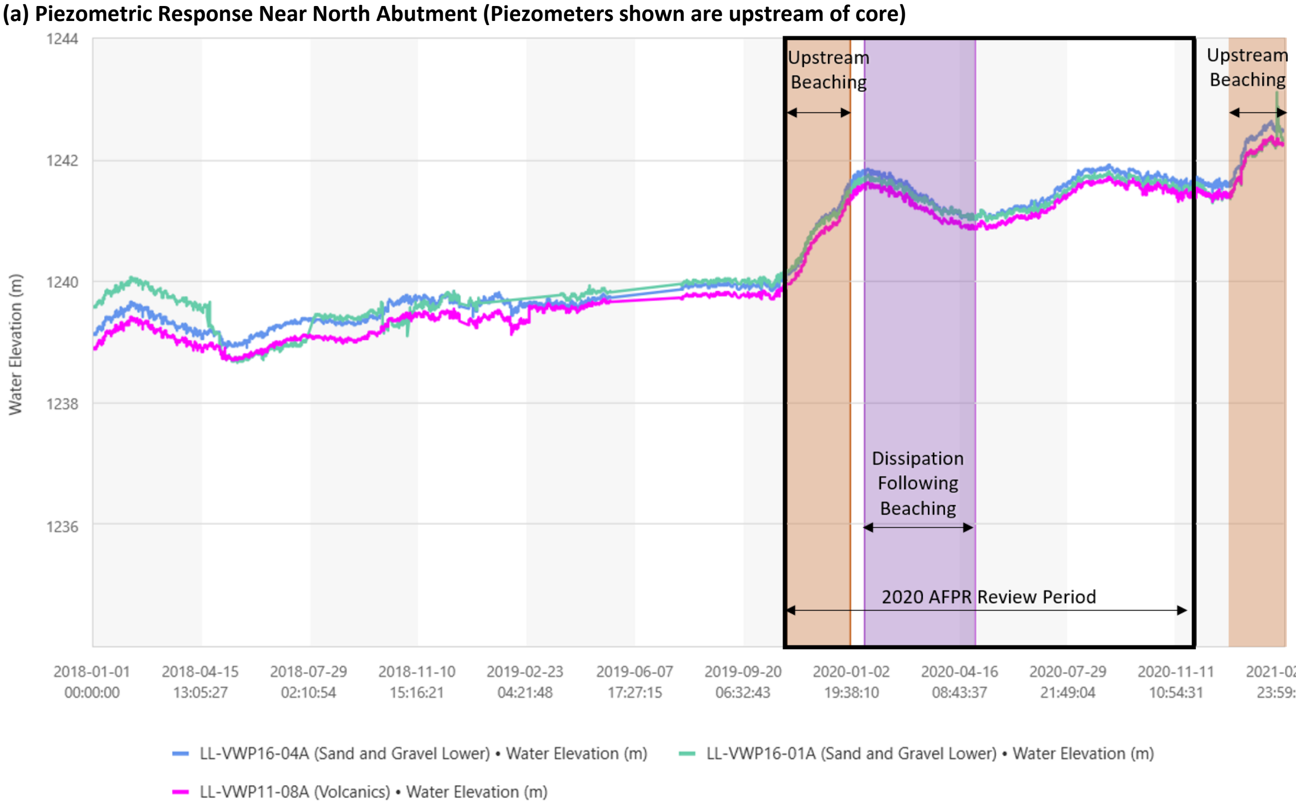
From mid-February to end of June, there was a rise in piezometric levels in the VBB drain (Figure 5.4). The measured rise was largest beneath the upper slope, reducing towards the toe. There was no downstream hydraulic placement during this period and the response was attributed to increased infiltration related to snowmelt/freshet and draining of elevated piezometric levels at the north abutment, related to upstream beaching, which dissipated from mid-January to early May (Figure 5.4). Piezometric levels below the VBB bench (Figure 5.4) continued to rise through the review period which is associated with hydraulic placement that was ongoing directly south of the VBB from late July to mid-December.

Figure 5.4 Piezometric Response In VBB Blanket Drain

(a) Piezometric Response in VBB Blanket Drain

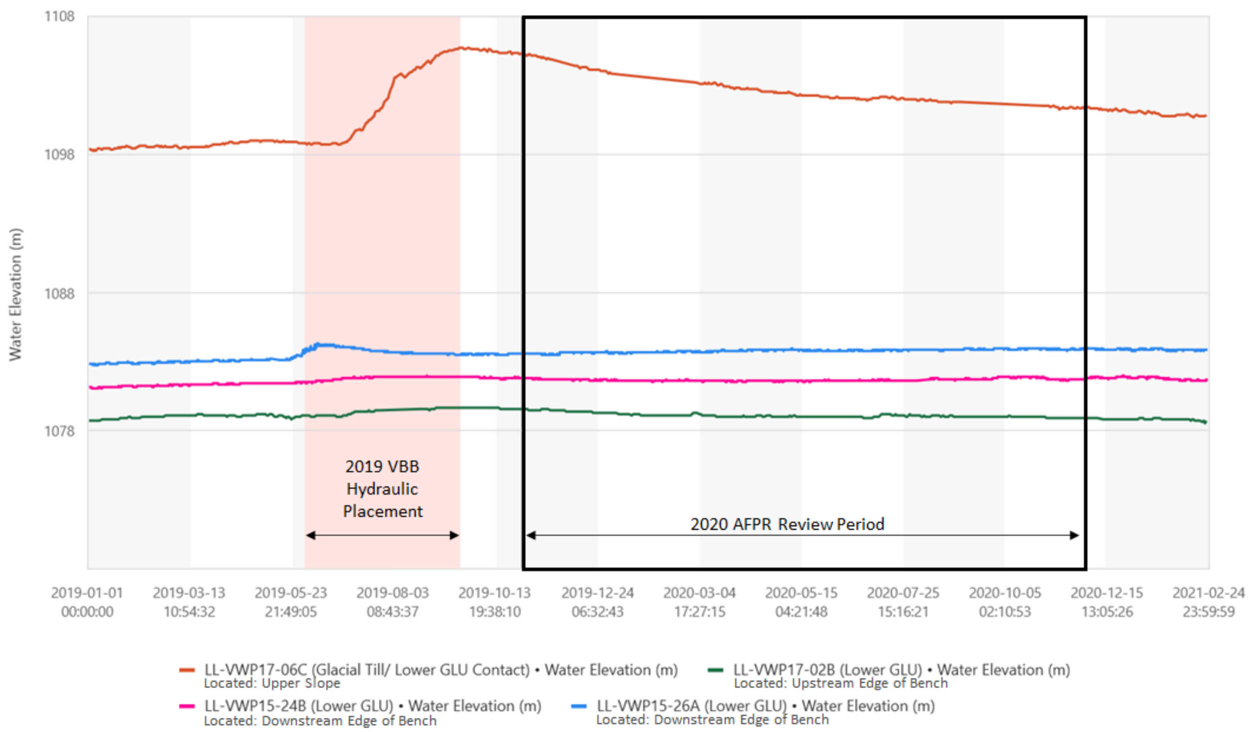


(a) Piezometric Response Near North Abutment (Piezometers shown are upstream of core)



Typical pore pressure response in the L-GLU is to increase in response to construction loading at the VBB, followed by a period of dissipation. As there was no downstream fill placement at the VBB during 2020 piezometric levels in the L-GLU continued to dissipate pore pressures from 2019 fill loading (below upper slope) or were steady throughout the review period (Figure 5.5).

Figure 5.5 Piezometric Response In Lower-Glaciolacustrine Beneath VBB



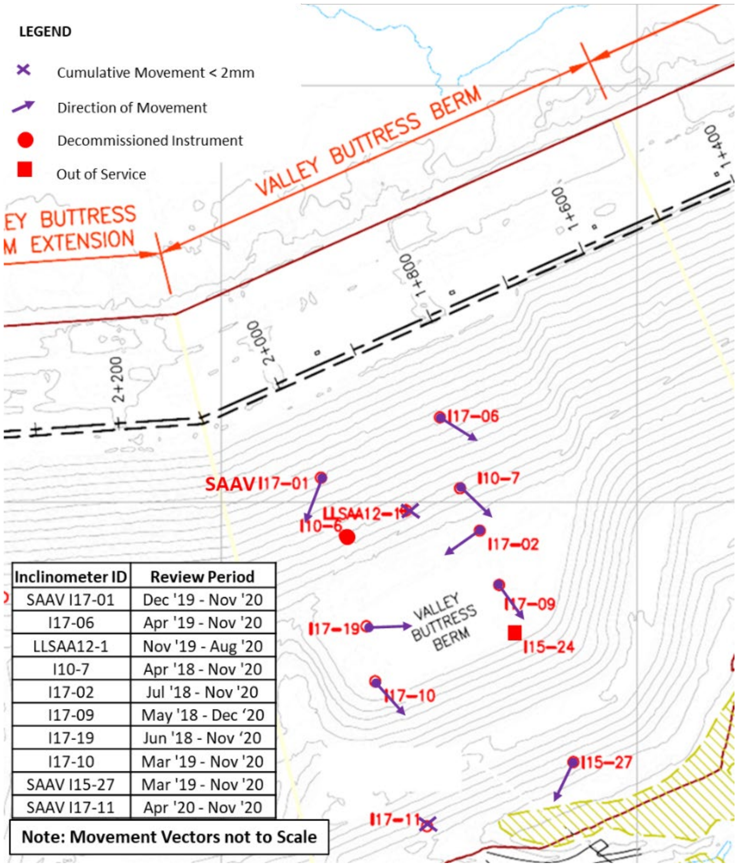
Inclinometers

The design of the VBB is governed by L-GLU which is continuous beneath the VBB. The primary function of the inclinometers at the VBB is to monitor deformation within the L-GLU to support implementation of the Observational Method, as described in KCB (2018c), and to measure actual behaviour for comparison to expected behaviour based on design.

Average movement rates L-GLU during the review period ranged from <0.1 mm/month to 0.3 mm/month which is consistent with previously measured response and expected response based on design when there is no active downstream fill placement in the area. This also agrees with the measured piezometric response which showed no response to the adjacent fill placement. Average movement rates measured at each instrument in select units are summarized in Appendix III-A.

Figure 5.6 shows the inferred direction of movement from the inclinometer readings, note that the arrows are not scaled to magnitude of movement. The movement trend is generally downstream but variable. Both are consistent with the expected response based on design analysis, natural variability within the L-GLU deposits and given the small magnitude of movement can also be influence by the reading accuracy of the inclinometer.

Figure 5.6 Direction of Measured Movements Within the Lower-Glaciolacustrine Unit



Inclinometer ID	Review Period
SAAV I17-01	Dec '19 - Nov '20
I17-06	Apr '19 - Nov '20
LLSAA12-1	Nov '19 - Aug '20
I10-7	Apr '18 - Nov '20
I17-02	Jul '18 - Nov '20
I17-09	May '18 - Dec '20
I17-19	Jun '18 - Nov '20
I17-10	Mar '19 - Nov '20
SAAV I15-27	Mar '19 - Nov '20
SAAV I17-11	Apr '20 - Nov '20

No horizontal shear zones were interpreted within the other foundation units or dam fill other than the normally consolidated Lacustrine unit. Horizontal movements are expected within the Lacustrine but has a negligible impact on stability as the unit has been removed from the majority of the downstream slope and replaced with compacted fill (Figure 2.1). Therefore, movement within the unit is constrained and cannot extend to the downstream toe.

As discussed in Section 5.1, three inclinometers in the same area of the downstream slope (I10-6, I10-7 and LLSAA12-01, shown on Figure 5.6) went out of service during 2019 and 2020. A replacement instrument in this area is recommended to continue use of the Observational Method as per design. When each inclinometer went out of service THVCP completed an investigation to confirm the cause. KCB reviewed this and recent dam performance in the area to confirm the cause was not related to adverse behaviour of the dam.

5.2.3.4 Valley Buttress Berm Extension

November 2020 instrumentation readings from Sta. 2+100 through Sta. 2+400 are projected along Sta. 2+250, shown on Figure 10. As shown on Figure 6, construction activity in the VBBE area during 2020 included a crest raise only.

Piezometers

The piezometric levels in the foundation and drainage blanket remained steady throughout the review period which is consistent with typical behaviour during periods with no downstream hydraulic placement in the area. Piezometric levels at VWP10-06A/B, which had been falling in 2019, leveled off in the mid-part of the 2020 at similar elevation to levels measured at nearby piezometers (VWP04-1A/B).

Inclinometers

Inclinometers were also consistent with typical behaviour through the review period with no defined shear or movement zones of concern. Based on drill hole information and the geologic characterization of the L-L Dam foundation (KCB 2020c), the mudstone layers, which govern the design of the NBB, are not continuous or, where present, are too deep to govern design of the VBBE (KCB 2020b). The measured response at the inclinometers continue to support this interpretation (i.e. no discrete shear zones similar to those measured at NBB are present).

5.2.3.5 North Buttress Berm

November 2020 instrumentation readings from Sta. 2+400 through Sta. 2+700 are projected along Sta. 2+564, shown on Figure 11. As shown on Figure 6, construction activity in the NBB area during 2020 included a crest raise only.

Piezometers

The piezometric levels in the foundation remained steady throughout the review period except for temporary rises in some shallow bedrock piezometers. Both patterns are consistent with typical behaviour during periods when there is no downstream hydraulic placement in the area. The response in some shallow bedrock piezometers is related to temporary ponding of runoff in the low point on the north side of the NBB. Water ponds in the area and drains through the major drain which runs underneath the NBB.

Inclinometers

Movement along mudstone layers near the crest and upper bench (e.g. I17-24) have been measured along discrete shear planes within mudstone layers since the early 1990's and are expected to continue with increased movement rates in response to loading. This pattern continued during the review period with movement rates at I17-24 (nearest inclinometer to crest) increasing in response to upstream cycloned sand placement and crest raise. Following loading, movement rates attenuated as expected.

Movement rates measured at I17-24 for both construction (peak) and no construction (average) loading periods are summarized in Table 5.3. The expected magnitude of movement at I17-24 is proportional to the degree of loading applied (i.e. more movement is expected under more incremental load). KCB compared the measured movement rates at I17-24 during the review period to those measured during 2018 which had a higher incremental construction load (Table 5.3). In line with expectations, the movements during 2020 were less than those measured during 2018.

Table 5.3 Summary of Typical Measured Movement Rates at NBB Inclinometer I17-24

Inclino.	Station	Location	Construction Influenced Peak Movement Rate (mm/month)		No Construction Averaged Movement Rate (mm/month)	
			2018	2020	2018	2020
I17-24	2+575	Upper Slope	2.1	0.9	1.2	0.2

Also consistent with previous and expected behaviour, shear movements measured at I17-24 were not measured at downstream inclinometers (e.g. I17-22, I15-25). Deformation models indicate that shear movements may start to be measured downstream of I17-24; however, this did not occur during 2020.

5.2.3.6 North Dam Bedrock

November 2020 instrumentation readings from Sta. 2+700 through Sta. 3+100 are projected along Sta. 2+800, shown on Figure 12. As shown on Figure 6, construction activity in the North Dam Bedrock area during 2020 included a crest raise, downstream foundation preparation and fill placement.

Piezometers

The piezometric levels in the foundation and drainage blanket remained steady throughout the review period which is consistent with typical behaviour during periods when there is no downstream hydraulic placement in the area.

Inclinometers

Similar to the NBB, there are mudstone layers where shear movements have been measured in the foundation of this segment of the dam. In comparison to the mudstone layers beneath the NBB, the mudstone in this segment of the dam is overlain by a thicker zone of volcanic bedrock and glacial overburden which provides adequate stabilization to meet design criteria without additional buttressing. Throughout the year, there were no measured shear zones within the volcanic bedrock passive wedge which is consistent with design.

During the initial part of 2020, movement rates measured along the mudstone shear zones were typical for a non-loading period. Movement rates are expected to increase in response to construction and then attenuate back to typical rates after the activity is completed. This is consistent with the movement rate fluctuations observed in 2020:

- Starting in June, coincident with upstream cycloned sand placement, an increase in movement rate was measured at I99-05, which is the inclinometer nearest to the crest in this area.
- At the beginning of September 2020, coincident with the upstream crest raise, an increase in movement rate was measured at I98-02, in the lower portion of the downstream slope.

Movement rates at both inclinometers were less than peak rates measured during 2018 or 2019 construction and the most recent readings indicate that the rates are attenuating back to typical non-loading rates.

Further north, at I10-03 and I19-02, no shear movements were measured in the foundation. Average movement rates measured at each instrument in select units are summarized in Appendix III-A.

5.2.3.7 North Dam U-GLU

November 2020 instrumentation readings from Sta. 3+100 to the North Abutment are projected along Sta. 3+300 and 3+630, shown on Figure 13 and Figure 14. As shown on Figure 6, construction activity in the North Dam U-GLU area during 2020 included crest raise only.

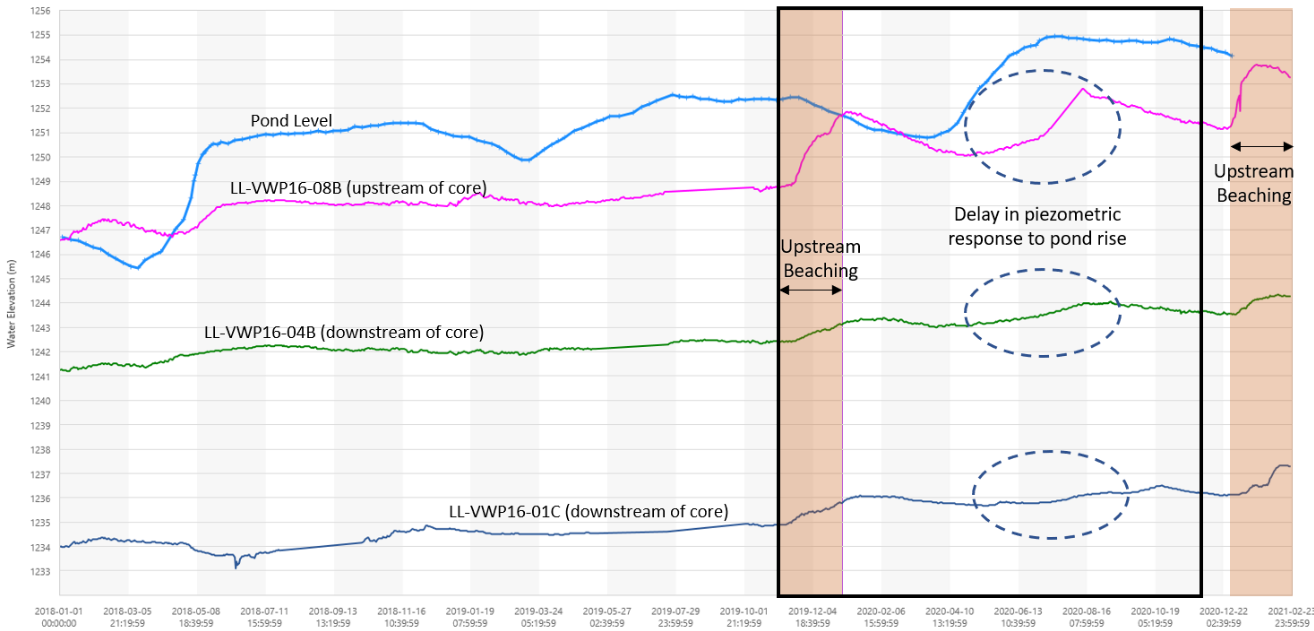
Piezometers

Unlike other segments of the dam, piezometric levels downstream of the core zone near the north abutment show a response to pond rise. This is because it is not practical to key the core zone into Glacial Till or bedrock due to the depth of excavation required. A minimum tailings beach width is specified in design to mitigate the effects (Section 7.4.2).

During 2020, piezometric response and trends were consistent with historic trends and rate of rise assumed in design (refer to Figure 5.7):

- Piezometric levels in the foundation near the north abutment, upstream and downstream of the core, vary with changes in pond level:
    - Piezometric response was measured between one to two months after pond rise started. This delay is the influence of the tailings beach.
    - Magnitude of piezometric rise upstream of the core is greater than downstream, and similar to pond rise.
    - Downstream of the core the typical rate of rise during the review period was 2 m/year or less and generally decrease further downstream of the core and to the south. This is consistent with forecasts assumed in design.
- Piezometric levels also respond to upstream beaching near the north abutment. Piezometric rise related to beaching is temporary and dissipates once complete.
    - Piezometric levels response quicker to beaching than pond level rise. This is because during beaching, the beach surface is wetted and the flow path length to the piezometers is much shorter than during pond rise when the beach keeps the pond 500 m (minimum) away from the core.

Figure 5.7 Piezometric Response in Foundation Deposits Near North Abutment



Inclinometers

Some horizontal movement, in response to changes in loading conditions, is expected within the U-GLU foundation unit which governs the dam design in this area. The U-GLU has been excavated from some areas of the dam foundation and is not present at all inclinometer locations. Where present, measured movement rates in the U-GLU during the review period were small (<0.2 mm/month even under construction loading). No defined shear zones were identified at inclinometers where the U-GLU was not logged at the drill hole or removed during foundation preparation (i.e. I99-06, I19-03 and I19-04). Average movement rates in the U-GLU measured at each instrument are summarized in Appendix III-A.

Post-installation deflection of the inclinometer casing, unrelated to foundation or dam fill movements, is more common in this segment of the dam because of challenging drilling and installation conditions in the glacial overburden. These features can make interpretation of data more challenging. Starting in 2020, THVCP and KCB took action to filter out these features to better facilitate the interpretation process (e.g. rebaseline, modify monitoring zones to filter out compression zones, installed down-hole automated SAAVs). This work continues into 2021.

5.2.4 Seepage

Seepage measurements from weirs installed downstream of the L-L Dam, since 2017 are shown on Figure 5.8. Measured flows showing data to January 2013 is included in Appendix III-D. Overall seepage rates have not shown and increasing trend to rising pond level. Key observations from the seepage measurements at each weir during the review period are:

LL—FS-01

- Measures seepage flow from a major drain which discharges on the south side of the NBB and surface water which from the dam slopes and local catchment which is routed to the SWRP.
- Seepage flows for the majority of the review period were between 9 L/s and 11 L/s (500 L/min and 650 L/min) with period of higher flow from May through July where flows got up to 24 L/s. High flow periods are caused by some spring runoff reporting to the weir and increased seepage through the major drain while there is ponding in the low area of the north side of the NBB. This pattern of behaviour is consistent with recent years.

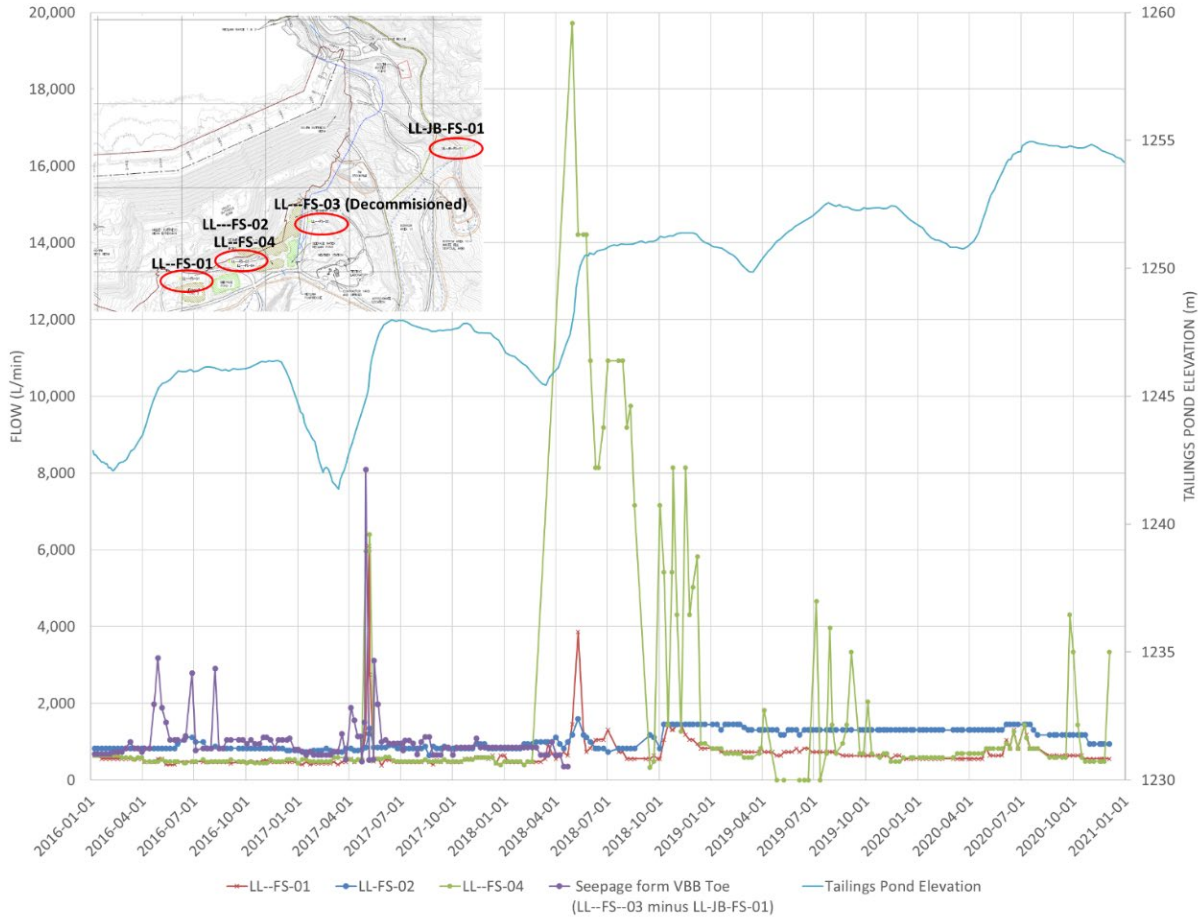
LL—FS-02

- Measures seepage flow from a major drain which discharges at the toe of the VBBE and extends under a portion of the NBB. There is a relatively small surface runoff catchment upstream of this weir.
- Measured flows during 2020 have been relatively steady since late 2018 ranging between 15 L/s to 24 L/s (950 L/min to 1450 L/min) and does not show significant response to climate which flow readings at this weir are not significantly influence by surface runoff.

LL—FS-04

- Measures discharge from Seepage Pond 2 which is routed to the SWRP.
- Flow rates showed the same pattern and magnitude of flow as LL—FS-01. The peak flow rates (up to 70 L/s) were measured between September and October when overflow from hydraulic placement cells were reporting to Seepage Pond 2 (via Sediment Pond 2). Similar flow rates were measured during 2019 under the same circumstances.

Figure 5.8 Seepage Flow Measurements Downstream of L-L Dam (2016 through 2020)



5.3 H-H Dam Performance Summary

5.3.1 Vertical Buffer Above Tailings Surface

There is no risk of overtopping or ponded water at the H-H Dam (Section 2.3). Therefore, freeboard is not an applicable metric at the H-H Dam. The M-11 Permit (EMPR 2020) requires that a minimum 1 m buffer[9] be maintained through operations. Buffer values from the November 5, 2020 survey, after the 2020 dam crest raise was completed, are shown on Figure 5.9. THVCP plans H-H Dam crest raises to maintain a 2 m buffer.

Figure 5.10 shows tailings beach profile since 2016 at various stations along the H-H Dam crest. The tailings beach near H-H Dam was relatively constant along the majority of the dam throughout 2020 which is the result of tailings being discharged on the far side (relative to H-H Dam) of the existing tailings cone and therefore the bulk of the tailings slurry flows towards L-L Dam and not near the H-H Dam.

[9] Vertical distance between the tailings surface at the upstream dam face and the dam crest in that area

Figure 5.9 H-H Dam Tailings Buffer – November 5, 2020 (after crest raise)

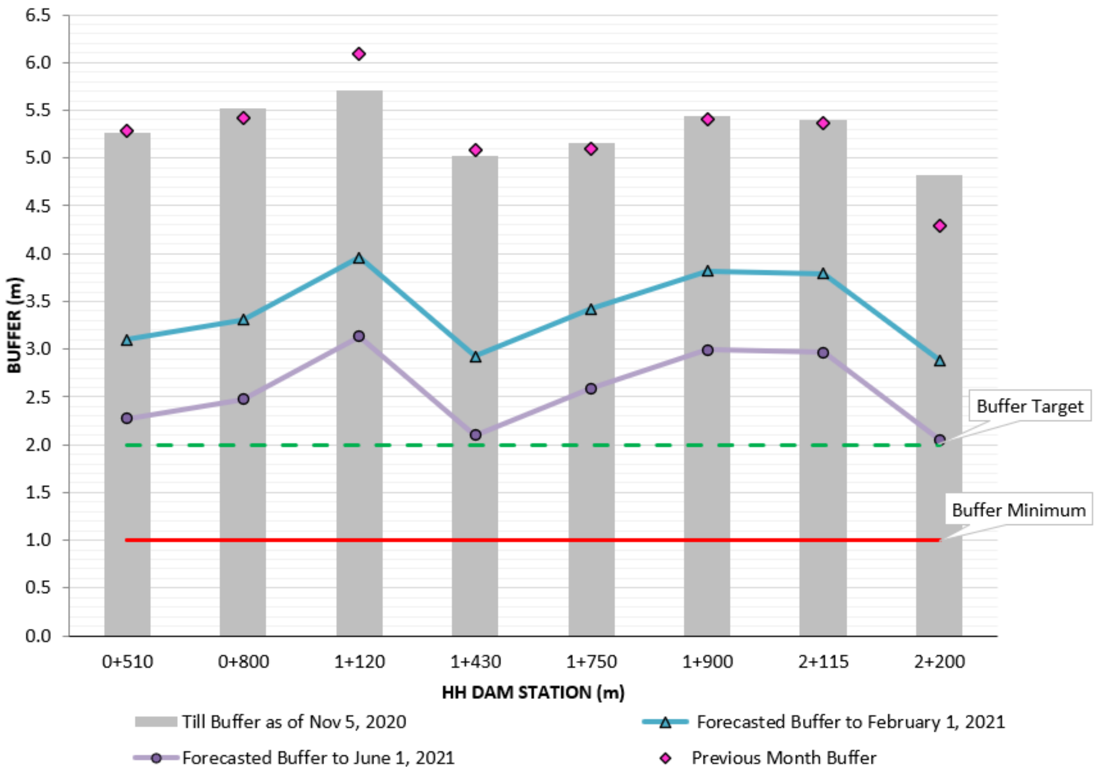
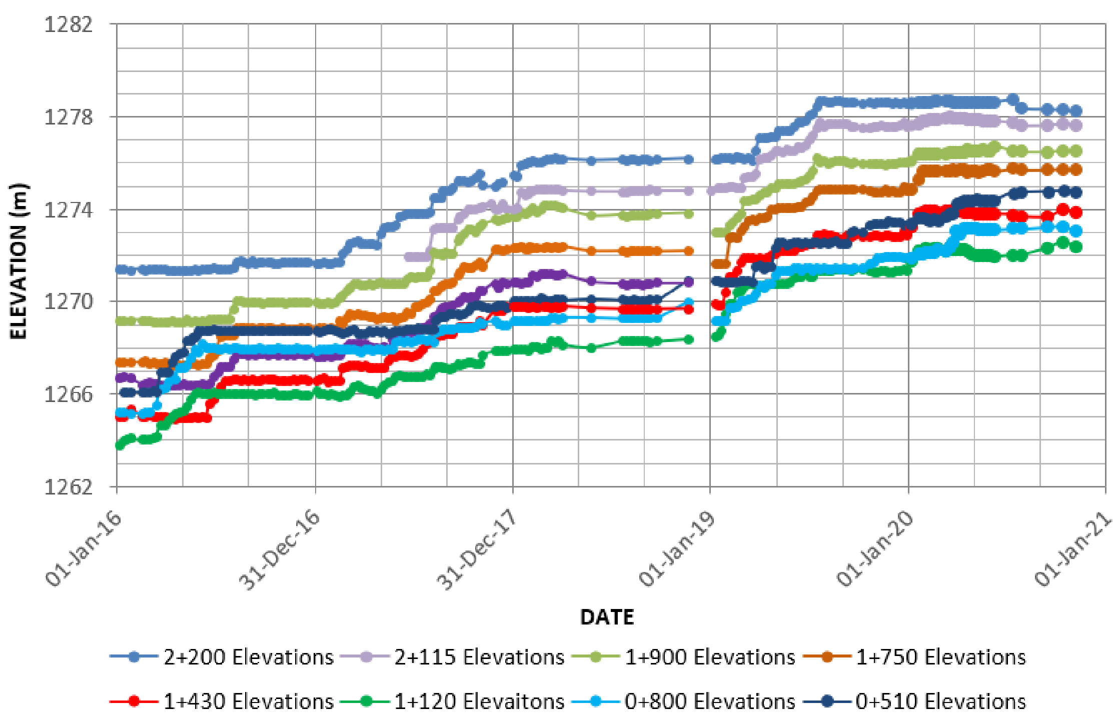


Figure 5.10 H-H Dam Tailings Beach Elevations Along Crest: 2016 to 2020



5.3.2 Instrumentation Trends

5.3.2.1 Overview and Notification Level Exceedances

General piezometric and displacement behaviour, or unexpected responses, based on instrumentation readings from November 2019 to November 2020 at the H-H Dam is summarized herein. November 2020 instrumentation readings are shown on select design cross sections, through each dam segment, of the H-H Dam (Figure 15 to Figure 19). The H-H Dam instrumentation system is summarized in Appendix IV-A. Summary plots of instrumentation readings are included in Appendix IV-B (piezometers) and Appendix IV-C (inclinometers).

During the review period, 10 Notification Level exceedances were triggered and reviewed by the EoR. All were associated with a localized change from expected response as summarized below but none were elevated to a higher level of the TARP:

- East-Segment – horizontal movement rate at I17-14 exceeded Notification Level threshold as a response to upslope fill placement. These movements were related to deflection of the lock-block wall immediately downstream of the inclinometer at the toe of the dam. The lock-block wall is not relied upon to maintain stability of H-H Dam and the corresponding movements at I17-14 did not represent unacceptable performance of the dam. Refer to Section 5.3.3 for further discussion.
- Mid-Segment –horizontal movement rate in the rockfill downstream of the core, measured at I17-16, exceeded the Notification Level as a response to downstream fill placement by the mining fleet. Horizontal movement in the downstream shell is related to settlement of the fill and not dam instability. EoR review concluded that the performance of the dam remained acceptable and no follow up actions were taken. Refer to Section 5.3.2.3 for further discussion.
- Mid-Segment – piezometric levels in the foundation rose after groundwater pumping, downstream of the H-H Dam, was stopped due to mechanical failure of the pumps. In total, Notification Level reviews were triggered at eight piezometers. EoR review concluded the dam remained in compliance and dam performance was acceptable under these elevated levels. Refer to Section 5.3.2.2 for further discussion of the measured response and EoR review.

5.3.2.2 Piezometers

Prior to June 2020, the piezometric response in the H-H Dam foundation units was similar to established trends that had been observed over the past 3 years. During this period THVCP operated a pumping well (Pump No. 7, Figure 5.11) which supplies water to the H-H Pumphouse and is screened in the basal overburden unit below the Glacial Till. In late June, Pump No. 7 became non-functional. In response, THVCP turned on the nearby Pump No. 5 which also pumps from the same basal unit but at a lower capacity. In October 2020, Pump No. 5 also became non-functional.

Following each disruption to pumping, the rate of rise of piezometric levels in the H-H Dam foundation increased significantly (Figure 5.11). This response was restricted to the Mid-Segment of the H-H Dam and was not measured closer to either abutment. KCB and THVCP reviewed other potential cause for the response (e.g. response to construction, change in 24 Mile TSF level) but none explained both responses and the piezometric response is consistent with what would be expected in response to reduced pumping from Pump No. 7 and No. 5.

The piezometric rise measured in the foundation was up to 16.5 m; however, this did not represent a dam safety concern or affect compliance with design criteria. The stability and design of the H-H Dam in this area is governed by the assumed piezometric levels in the fill and waste dump downstream of the dam, not the foundation. The peak foundation piezometric levels measured during 2020 would have to rise significantly (>10 m) before they start to govern design.

The old tailings channel from H-H Pumphouse to 24 Mile Emergency TSF (Figure 5.12) was to be backfilled with waste rock before the end of 2020. In August, while piezometric levels in the foundation were rising, KCB recommended THVCP prioritize this activity because it would increase the magnitude of piezometric rise which could be accommodated by the structure and remain in compliance with design criteria. THVCP adopted the recommendation and the area was backfilled by mid-September.

Piezometric levels in the dam shell, downstream of the core, have historically responded to change in 24 Mile Emergency TSF pond level. Changes in the configuration of the 24 Mile Emergency TSF, including temporary ponding over the old pipe laydown area, are interpreted as having the greatest influence on piezometric level in the dam fill during 2020, not changes in groundwater pumping. Piezometric response in the fill, following changes in pumping was much more moderate compared to the foundation piezometers and no distinct response to the shutdown of Pump No. 5 was measured.

Figure 5.11 Piezometric Response Measured in H-H Dam Foundation

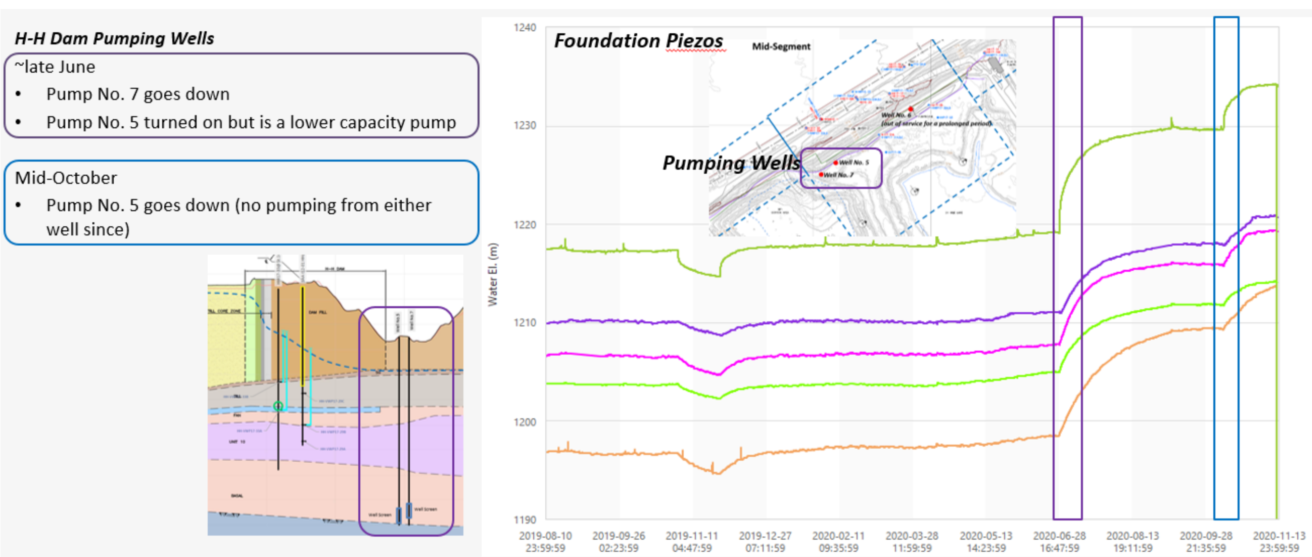
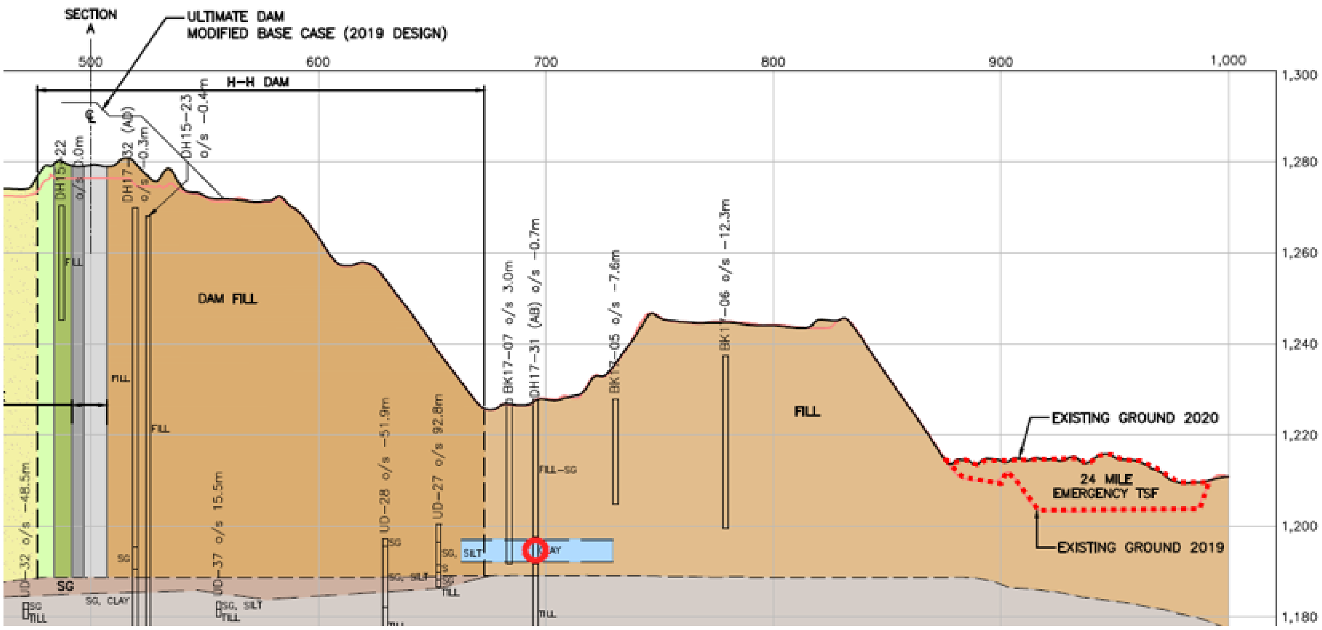


Figure 5.12 Old Tailings Channel Backfilled Area



5.3.2.3 Inclinometers and Settlement

During 2020, the measured horizontal movements and settlement in the fill were similar to those observed since the instruments were installed. Horizontal movements are interpreted as a response to settlement in the downstream fill, which was placed by the mining fleet in thick lifts (up to 10 m). Consistent with this interpretation, the locations where the largest settlement is measured (near the core and crest) correspond to the areas where horizontal movements are also largest.

No shear movement zones within the natural foundation were measured during 2020 along the dam which is consistent with historic and expected future behaviour.

Measured movements at I17-14 were not consistent with recent behaviour. This inclinometer is installed upstream of the lock-block wall at the toe of the H-H Dam, near the HH Pumphouse (~Sta. 2+025). The horizontal movements were measured at this location while fill was being placed upstream of the instrument. The response measured at the inclinometer was a local occurrence related to the behaviour of the lock-block wall and not representative of the overall dam slope, refer to Section 5.3.3 for further discussion.

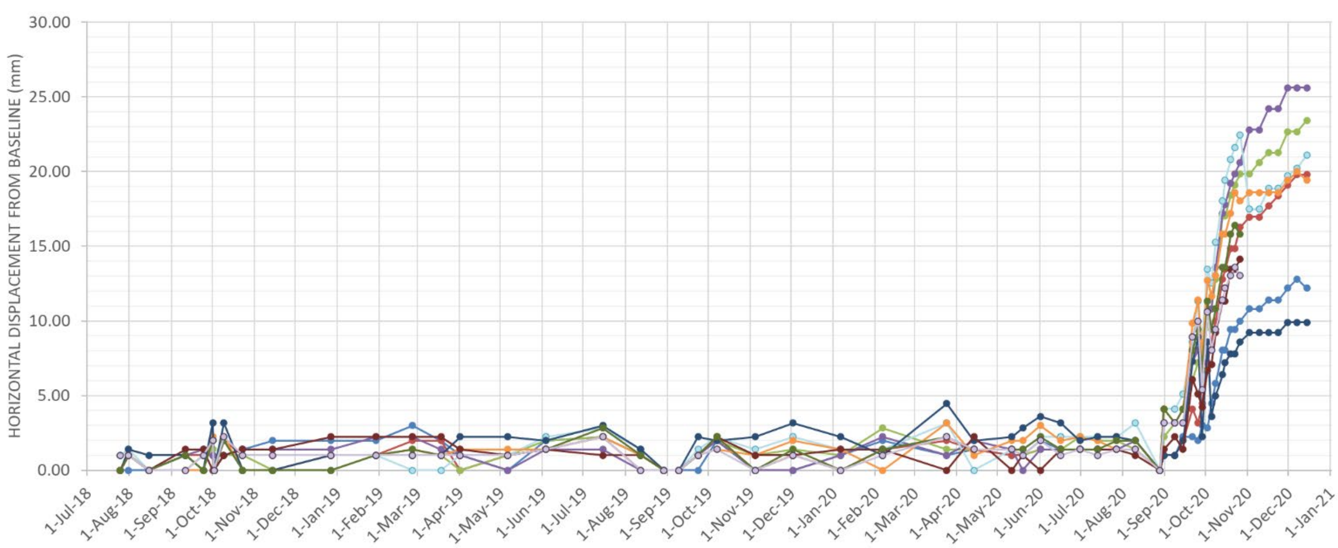
5.3.3 Lock-Block Wall Survey Monuments

The purpose of the lock-block wall at the toe of the H-H Dam, near the HH Pumphouse (~Sta. 2+025), is to increase the setback of the dam toe to the H-H Pumphouse. The lock-block wall is not a structural component of the overall H-H Dam fill and if it were to fail would pose no risk to the overall integrity of the dam. However, failure of the wall could pose a risk to workers or equipment in the area. Therefore, monitoring of the wall is part of the H-H Dam surveillance program which includes: survey of ten monuments on the lock-block wall; and visual inspections.

During 2020, the THVCP mining fleet placed dam fill immediately upstream of the wall. As part of the safe work plan, access to the upstream and downstream of the wall during fill placement was restricted. The fill placement increased the lateral load against the wall and in response to that load, horizontal movement of the wall was measured (Figure 5.13). This response was also measured at the inclinometer immediately upstream of the wall (I17-14). Visual observations throughout this work did not indicate any signs of distress in the wall (e.g. shifting blocks, rotation) and survey indicated that movement was greatest in the mid section of the wall but did not show signs of significant rotation or differential movement.

As the upstream fill placement progressed and the fill was placed higher up on the slope (and therefore further away from the wall), the movement rate started to attenuate. At the end of October, THVCP placed fill downstream to support the lower portion of the wall (Section 3.2), which had an immediate impact on further reducing the movement rates. Fill was continuing to be placed at the end of the review period but the movement at some instruments has almost stopped. Figures of monument surveys, and their locations, are included in Appendix IV-D.

Figure 5.13 Lock Block Wall Monuments: Horizontal Displacement From Baseline (2018 to 2020)



Note: Lower row of monuments were buried by fill placed downstream of wall in October.

5.4 Water Quality

Water quality downstream of the Highland TSF is monitored by THVCP. However, as per Permit PE-376, no water quality limits have been defined for this area. A summary of data to be included in the 2020 Annual Water Quality Monitoring Report was provided to KCB by THVCP for review as part of this review. Select observations and findings from the monitoring data 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 V. There are no surface monitoring points in the immediate area downstream of H-H Dam as water ultimately drains to the Valley Pit and is captured in the HVC water system; nevertheless, there are two ground water wells sampled quarterly.

- All sampling sites were in compliance with the required sampling frequencies and parameters except for Sample Site #201, which missed one sampling event in October (however, two samples were taken during September).
- Longer term trends in the receiving environment downstream of the L-L Dam indicate that some water quality concentrations (e.g., Sulphate, Fe, Mn and Mo) have been increasing over time. The timing of this trend and concentrations that are increasing indicate this is related to seepage from the L-L Dam and unlined seepage collection ponds. In 2012, THVCP developed the Sulphate Adaptive Management Plan (SAMP) to address sulphate impacts to the downstream receiving environment, and implementation has continued to current day.
- Starting in 2020, the trend of rising Sulphate concentrations in Pukaist Creek reversed. The average annual Sulphate concentration during 2020 was ~23% less than the 2019 annual average, based on values reported in the 2019 and 2020 SAMP Annual Reports. The change in trend is associated with mitigations implemented over the past several years by THVCP as part of SAMP: interception pumping reduces the volume of Highland TSF seepage that reaches Pukaist Creek; and non-contact water is being diverted around the impoundment and into Pukaist Creek via the Woods Creek Diversion. SAMP activities during 2020 are summarized in the annual report prepared by THVCP, the final of which was not reviewed by KCB in preparation of this AFPR.

The 2020 monitoring results were screened against applicable BC Water Quality Guidelines (WQG). Further discussion on 2020 water quality monitoring results trends reported in the 2020 Annual Water Quality Monitoring Report which is submitted by THVCP to the Ministry of Environment and the Ministry of Energy, Mines and Low Carbon Innovation.

6 2020 SITE VISIT VISUAL OBSERVATIONS

Visual observations made during the site visit to support this review, together with copies of the field inspection forms and select photographs, are included in Appendix I. Select observations are as follows:

L-L Dam

- No visual indications of a dam safety concern were observed. The dam was visually in good physical condition which agrees with other surveillance observations and data at the time.
- Active construction areas during the site visit included: hydraulic placement of cycloned sand and cell preparation upstream of the dam core; mechanical sand placement along crest to support core raise; downstream foundation preparation at the South Dam.
- THVCP is in the process of a multi-year plan to maintain a wider beach between upstream cycloned sand fill and pond along the length of the dam crest. Evidence of these efforts are visible and the beach width is noticeably wider than during 2019 site visit. Beach is widest at the north end of the dam and the required minimum 500 m width at the north abutment is met.

H-H Dam

- No visual indications of a dam safety concern were observed.
- Active construction areas during the site visit included: crest raise, including placement of core and upstream / downstream fill zones; and starting preparation of the west abutment.
- Tailings were being spigotted from the east abutment, approximately 450 m upstream of dam crest. Tailings slurry was flowing towards L-L Dam and not near H-H Dam.
- A new drainage channel to convey tailings from the H-H Pumphouse to 24 Mile Emergency TSF had been established along the east side of the 24 Mile Waste Dump. Flow along the previous channel had been blocked off but the channel had not yet been backfilled.
- The changes to the drainage channel were consistent with design but the area being covered by tailings visually appeared larger area than expected. KCB discussed with THVCP and the area was surveyed for comparison with tailings area assumed in design in 2021. If the tailings do cover a wider area, there is no influence on short term construction milestones or sequencing but should be incorporated into life-of-mine construction planning.

7 2020 DAM SAFETY ASSESSMENT

7.1 Consequence Classification

The consequence classification of each water or tailings storage facility at the Highland TSF (refer to Table 1.1) is reviewed annually by THVCP and the EoR, or approved designate, at the time. The 2020 review was completed on February 12, 2020 and concluded that there had been no significant changes to the downstream conditions or failure modes which justify any change to the existing consequence classifications.

7.2 Design Basis

An updated consolidated design basis memorandum for the L-L Dam and H-H Dam was prepared for and included in the most recent design review (KCB 2020b). No changes were made to the design basis of either L-L Dam or H-H Dam during 2020.

7.3 Status of 2017 Dam Safety Review Recommendations

The most recent DSR was conducted in 2017 by representatives of Stantec Consulting Ltd. (Stantec) and issued in 2018 (Stantec 2018). No unsafe or unacceptable conditions were identified in relation to design, construction, surveillance, maintenance, and operation of the dams. Stantec concluded that the dams at the Highland TSF comply with the 19 dam safety principles from CDA (2013).

All DSR recommendations have been addressed except for one which is scheduled for completion in 2022, following construction of the Seepage Water Reclaim Pond (SWRP) replacement pond. This project was scheduled for 2021 but delayed due to to land disturbance constraints encountered during construction. This item has been added to the AFPR recommendations (LL-2019-02, Table 8.1) for tracking.

The work plan documenting the action taken to address each recommendation is included in Appendix VI for the record. The Highland TSF Tailings Review Board (TRB) was given periodic updates with an opportunity to comment on the actions taken to address each recommendation. As the recommendations are now resolved the status of them will not be included in future AFPR reports.

7.4 Failure Modes

7.4.1 2020 Failure Mode Review

The recent L-L Dam and H-H Dam design review (KCB 2020b) included a review of potential dam failure modes applicable to each structure, an assessment of the controls (design and operational) in place to manage each and qualitative performance objectives which measure the effectiveness of those controls. There were no changes during the review period which would alter this assessment.

Management and status of failure modes, and related controls, which have the greatest influence on design and performance are summarized herein.

7.4.2 L-L Dam

Overtopping

To manage overtopping risks, the Highland TSF is designed to store the 120-hour duration PMF (Table 4.3), which is a longer duration than required by the Code (72-hour), with an additional 2 m of freeboard to account for wave run-up, settlement and added contingency. Even under extreme flood conditions the pond is separated from the downstream slope by a wide crest (>130 m).

Under the existing operating conditions there are additional controls and factors which significantly reduce the potential for overtopping:

- The pond is operated with excess capacity to store ~1 year of tailings production as contingency for construction delays. Even at peak pond level during the review period, the Highland TSF had an additional 30.5 Mm^3 of storage over and above flood and freeboard requirements.
- In the case of an unexpected mine shutdown, the current contingency storage is sufficient to accommodate 4 years or more of inflows (based on Table 4.1), without active dewatering, before encroaching on the PMF flood storage or freeboard criteria.
- The Highland TSF is monitored by a thorough surveillance program as described in the OMS Manual. There are preventative action plans, with TARP triggers established, which can be implemented to avoid overtopping. In addition, the Highland TSF is a heavily trafficked area with THVCP personnel and/or Contractors visiting the area multiple times a day. In order for overtopping to occur all surveillance controls would have to be failed and the situation ignored by everyone working in the area.

With such robust and redundant controls and level of supervision the potential for overtopping to occur under existing condition is negligible.

Internal Erosion and Piping

The L-L Dam includes controls which restrict the required conditions for internal erosion to develop. The fill interfaces within the dam were designed to be filter compatible so that fine particles cannot be washed through coarse dam fills and comprehensive quality control/quality assurance programs are in place to confirm fills placed in the dam to meet design intent. The low permeability core, upstream tailings beach and downstream underdrainage system maintain low seepage gradients in the downstream shell of the dam which reduces the seepage flow and gradient in the downstream shell. With these controls in place, the potential for internal erosion through the dam which develops into an overall breach and release of tailings is negligible.

At the North Dam U-GLU, seepage pressures at gradients in the foundation are elevated relative to other dam segments because the core could not be keyed into low permeability formations (i.e. bedrock or Glacial Till) due to their excessive depth. To offset this and manage foundation seepage flows and gradients in this area, the L-L Dam design (KCB 2020b) specifies a minimum 500 m wide beach be maintained at the north abutment and the blanket drain is filter compatible with the Glacial Till to prevent washing of the particles from the foundation through the dam fill if upwelling occurs.

During the review period, the minimum beach was maintained and the seepage gradients in the foundation, upstream to downstream direction, were <0.1 which is insufficient to support progression of internal erosion, even if susceptible zones are locally present.

A decommissioned Low-Level Outlet (LLO) close to the South Abutment remains in the dam. No observations or indicators of internal erosion around the LLO were observed while it was in operation and since decommissioning. To prevent fills from being washed through the dam along the LLO in the future, decommissioning included surrounding the downstream outlet with filter compatible fills (KCB 2014).

Slope Stability – Static and Seismic Loading

Compliance with slope stability design and regulatory criteria is checked by KCB prior to construction of each incremental crest raise, with consideration for material behaviour under changing load (e.g. strain softening, compression) and construction related response (e.g. increased seepage through dam fill, pore pressure generation). Stability analyses give consideration for material behaviour under changing load (e.g. strain softening, compression), construction related response (e.g. increased seepage through dam fill, pore pressure generation) and performance under the design earthquake (10,000-year return period event).

Characterization of dam fill and foundation soil behaviour is informed by a geologic/ geotechnical characterization (KCB 2020c) which has been developed to meet requirements of the Engineers and Geoscientists of BC (EGBC) professional practice document (APEGBC 2016) and supplemented with knowledge of the dam's historical performance over the +40 year life.

Routine reviews of surveillance observations and measured performance by the EoR during the review period concluded dam performance during the review period was acceptable[10] and the response to changing load conditions was consistent with forecasted behaviour as discussed in Section 5.2.3.

7.4.3 H-H Dam

Internal Erosion and Piping

The H-H Dam includes similar controls to the L-L Dam which restrict the required conditions for internal erosion to develop, with the exception of the lower portion of the dam between El. 1216.7 m and El. 1255.5 m where there is no sand and gravel filter separating the Glacial Till in the dam core from the coarse Random Fill.

Indicators of internal erosion (e.g. sinkholes in dam core, upstream fills or tailings beach) have not been recorded throughout the life of the structure. Regardless, the risk of internal erosion leading to a structural failure was reviewed in the design update (KCB 2020b), based on the method defined by

[10] Refer to discussion in Section 5.1 for the basis which performance is measured.

ICOLD (2017), which concluded the existing controls (e.g. upstream tailings beach, >7 km setback from the free water pond, low seepage gradient) would be effective in restricting the progression of any internal erosion along the interface in question. As a result, the risk of internal erosion leading to a failure that would result in uncontrolled release of the tailings is considered negligible for the existing structure.

Slope Stability – Static and Seismic Loading

Similar to the L-L Dam, the compliance with slope stability design and regulatory criteria is checked by KCB, under static and earthquake loading (5,000-year return period), prior to construction of each incremental crest raise, with consideration for planned downstream activity in the 24 Mile Emergency TSF. Geological and geotechnical characterization, which informs stability analyses, are equivalent to those methods for the L-L Dam.

The existing condition of the H-H Dam and downstream waste dumps is adequate to maintain compliance with slope stability criteria up to crest El. 1285 m (at Sta. 1+460) which is ~6 m above the November 2020 crest level. Additional downstream buttressing is required to meet post-earthquake criteria (i.e. assuming liquefaction of the liquefiable materials) before raising the dam crest above El. 1285 m (at Sta. 1+460). The earliest crest raise forecast predicts this will be required in 2023 but the raise is currently scheduled for 2022. Regulatory approval of the design changes included in the November 2020 permit amendment to the Ministry of Energy, Mines and Low Carbon Innovation is required during 2021 so the H-H Dam construction plan can proceed as currently sequenced. THVCP submitted a permit amendment to the Ministry of Energy, Mines and Low Carbon Innovation in November 2020 to obtain approval for the downstream buttress.

7.4.4 24 Mile Emergency TSF

There are no credible failure modes for the 24 Mile Emergency TSF, in its current configuration, that could lead to a breach release of tailings or water off site (KCB 2018a). However, there are regulatory requirements and operational risks related to ponded water overtopping of the perimeter crest and flowing along Roman Road into the pit. During closure the area will be capped as part of the plan to eliminate the remaining credible failure modes.

Overtopping

To manage overtopping risks, the 24 Mile Emergency TSF is operated with at least sufficient capacity to store the 72-hour duration IDF (Table 4.3), with an additional 0.5 m of freeboard, which meets the Code requirements. During the 2020 peak pond level, the facility was operated with sufficient capacity, in addition to the minimum flood storage requirement, to store the equivalent of 1.6 IDF volumes or greater (i.e. an additional 5.1 Mm^3 of storage).

The flood storage in 24 Mile Emergency TSF changes over mine-life as additional waste is placed in the surrounding area and the stored tailings and pond level rises. A life-of-mine forecast of flood storage is prepared and reviewed annually by the THVCP QP and EoR to confirm whether the perimeter area will be required, as required under the OMS Manual.

7.5 Emergency Preparedness and Response

The emergency preparedness and response plan (EPRP) for the Highland TSF was also reviewed and updated by THVCP, including the list of preventative measures which could be taken in response to potential unusual or emergency conditions, as part of the OMS Manual update. The EPRP is appropriate for the existing structure and is linked to the site wide emergency response plan.

Training and testing of the EPRP was completed on December 9, 2020. The training consisted of a trial of the EPRP using hypothetical scenario at the L-L Dam. Participants included members of THVCP's operation team (including site management), THVCP QP and EoR. Along with testing of the system, THVCP contacts offsite emergency response resources to ensure that contact information is current.

8 SUMMARY

The observed performance of the Highland TSF is consistent with expected performance and within design requirements.

The status of dam safety recommendations identified during past AFPRs are summarized in Table 8.1. Closed recommendations are shown in *italics*. During 2020, three of the five recommendations from previous AFPRs were closed and the portion of LL-2019-01 scheduled for 2020 was completed as planned. The remaining recommendation is scheduled for completion in 2022, following construction of the SWRP replacement pond. Dam safety recommendations identified during the 2020 AFRP, two, are summarized in Table 8.2.

Table 8.1 Previous Recommendations Related to Facility Performance – Status Update

ID No.	Performance Area	Recommended Action	Priority(1)	Recommended Deadline (Status)
L-L Dam				
LL-2019-01	Surveillance	Install 4 additional inclinometers at NBB (north of I17-24, I17-22, I15-25 and I19-08) to increase monitoring coverage to capture 3D behaviour and provide redundancy.	3	Q3 2021 (Open, 2 of 4 installed)
LL-2019-02	Surveillance	Install new seepage weirs along downstream toe after SWRP has been replaced and L-L Dam constructed to ultimate toe. (DSR recommendation LL-2017-06) *Update: Deadline changed to align with delay to construction of new SWPR.*	3	Q4 2021 (Open, completion target to be confirmed based on cultural heritage approval for SWRP)
LL-2019-03	*Surveillance*	*Include potential impacts on dam surveillance for a scenario where the site is not accessible due to fire. (To resolve DSR recommendation TSF-2017-11)*	*3*	*CLOSED (included in revised OMS Manual)*
H-H Dam and 24 Mile Emergency TSF				
No Outstanding Previous Recommendations				
L-L Dam Seepage Collection and Sediment Ponds				
SP-2017-01	*Flood Management*	*SWRP has insufficient capacity to store the IDF and should be brought into compliance. 2020 Update: This recommendation is closed on the basis that, under existing condition, the SWRP would flood adjacent area but not result in an offsite discharge.*	*2*	*CLOSED*
SP-2017-02	*Flood Management*	*Regrade Seepage Pond 2 outlet pipe to a consistent downward grade. 2020 Update: overflow to manage flood installed rather than regrading pipe.*	*2*	*CLOSED*

Notes:
2. 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 2020 Recommendations Related to Facility Performance

ID No.	Performance Area	Recommended Action	Priority(1)	Recommended Deadline (Status)
L-L Dam				
LL-2020-01	Surveillance	To implement the Observational Method, restore function of one of the existing inclinometers at the VBB (near I10-7) or install a replacement.	3	Q2 2021
H-H Dam				
HH-2020-01	As-built Condition	Reconcile and confirm the design of interim and ultimate buttress configurations at the H-H Dam based on actual extent of tailings placed in channel from H-H Pumphouse to 24 Mile Emergency TSF.	3	Q1 2022
24 Mile Emergency TSF & L-L Dam Seepage Collection and Sediment Ponds				
No New Recommendations				

Notes:
Refer to Table 8.1 notes.

9 CLOSING

This is a draft report only and we solicit your review and comments within four weeks of submission. Upon issue of the final report, we request that all draft reports are destroyed or returned to Klohn Crippen Berger. This draft report must not be relied upon for design, implementation and/or construction.

This report is an instrument of service of Klohn Crippen Berger (KCB). The report has been prepared for the exclusive use of Teck Highland Valley Copper Partnership (Client) for the specific application to the 2019 Dam Safety Support Project, and it may not be relied upon by any other party without KCB's written consent.

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

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

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

KLOHN CRIPPEN BERGER LTD.

PROFESSIONAL PROVINCE OF R. J. FRIEDEL # 33293 BRITISH COLUMBIA ENGINEER 2021/03/19

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Engineer of Record, Alternate
Principal

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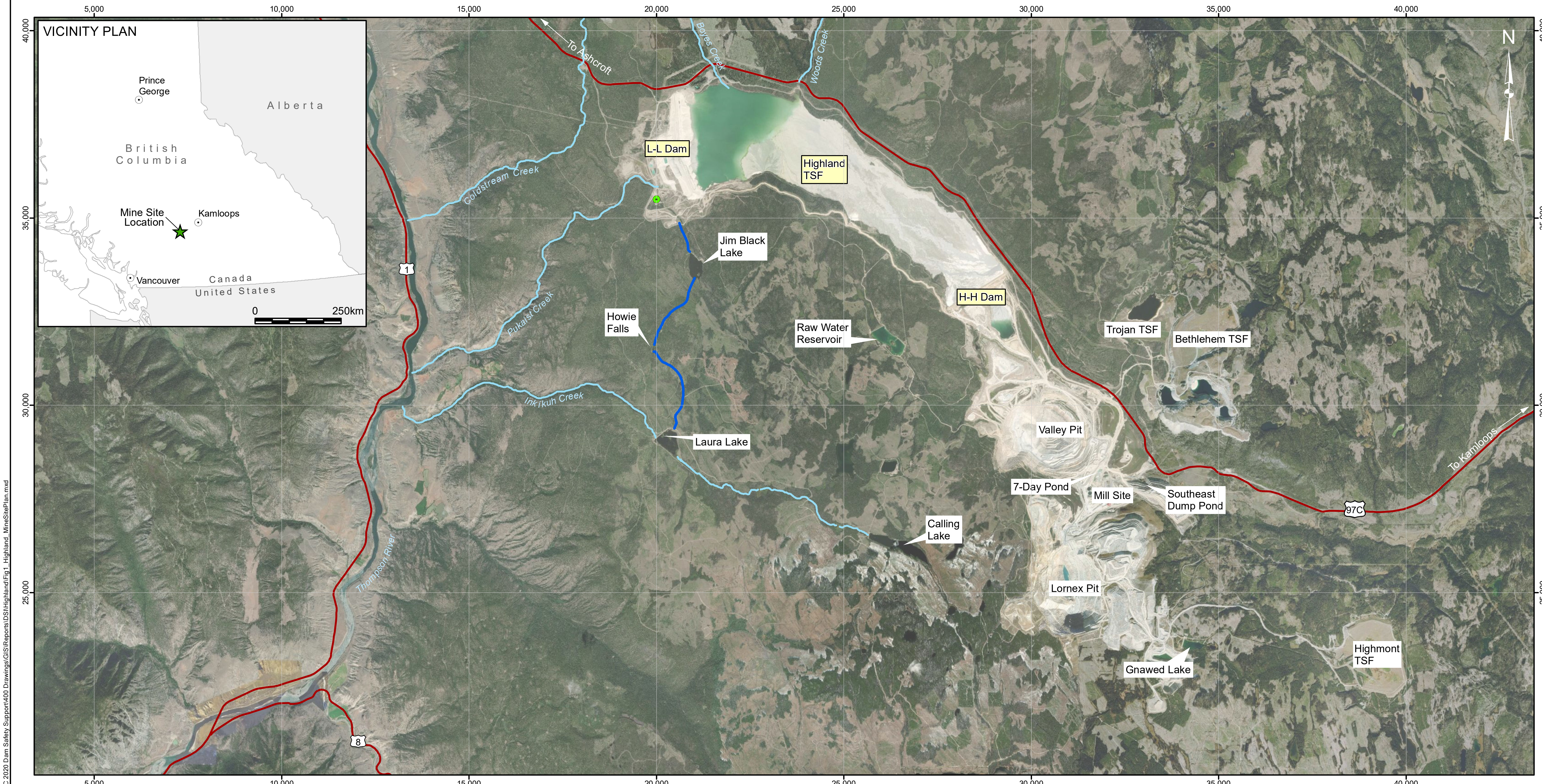
FIGURES



Legend

- L-L Dam Climate Station
- Creek / River
- Highway
- Ditch

0 5km

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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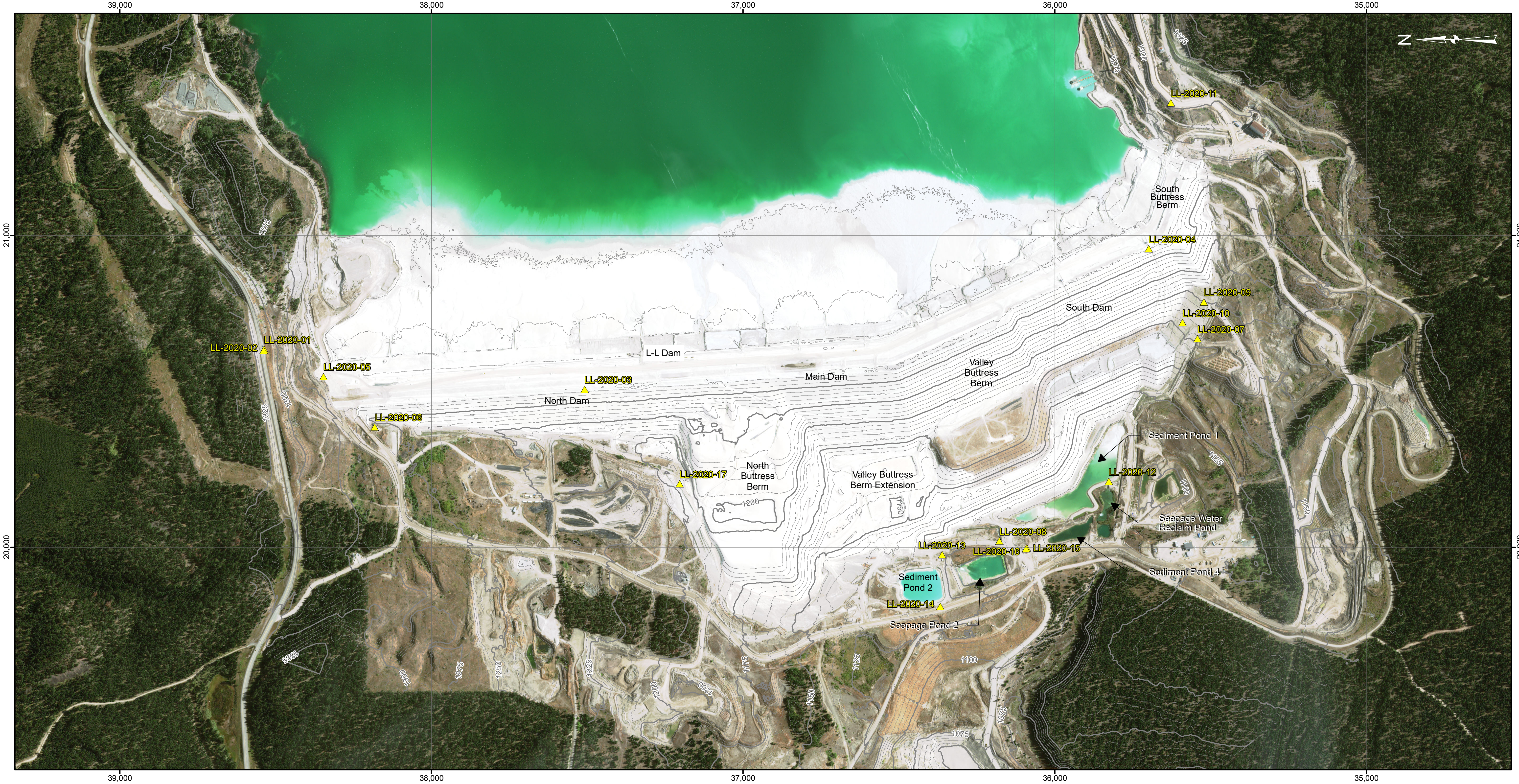
CLIENT Highland Valley Copper / Teck	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2020 ANNUAL FACILITY PERFORMANCE REPORT
Klohn Crippen Berger	TITLE MINE SITE PLAN
	SCALE 1:100,000 / PROJECT No. M02341B83 / FIG No. 1



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- Waypoint (LL-2020-xx)
- Index Contour (25 m)
- Intermediate Contour (5 m)

0 500m

CLIENT	PROJECT
Highland Valley Copper / Teck	HIGHLAND TAILINGS STORAGE FACILITY 2020 ANNUAL FACILITY PERFORMANCE REPORT
Klohn Crippen Berger	TITLE: L-L DAM PLAN
	SCALE 1:12,000 / PROJECT No. M02341B83 / FIG No. 2

Notes:
1. Projection: HVC Mine Grid.
2. Topography from satellite photogrammetry survey conducted in September, 2020.
3. Imagery from September, 2020.
4. Waypoint LL-2020-18 is 2000 m east of the figure extents and is not shown.

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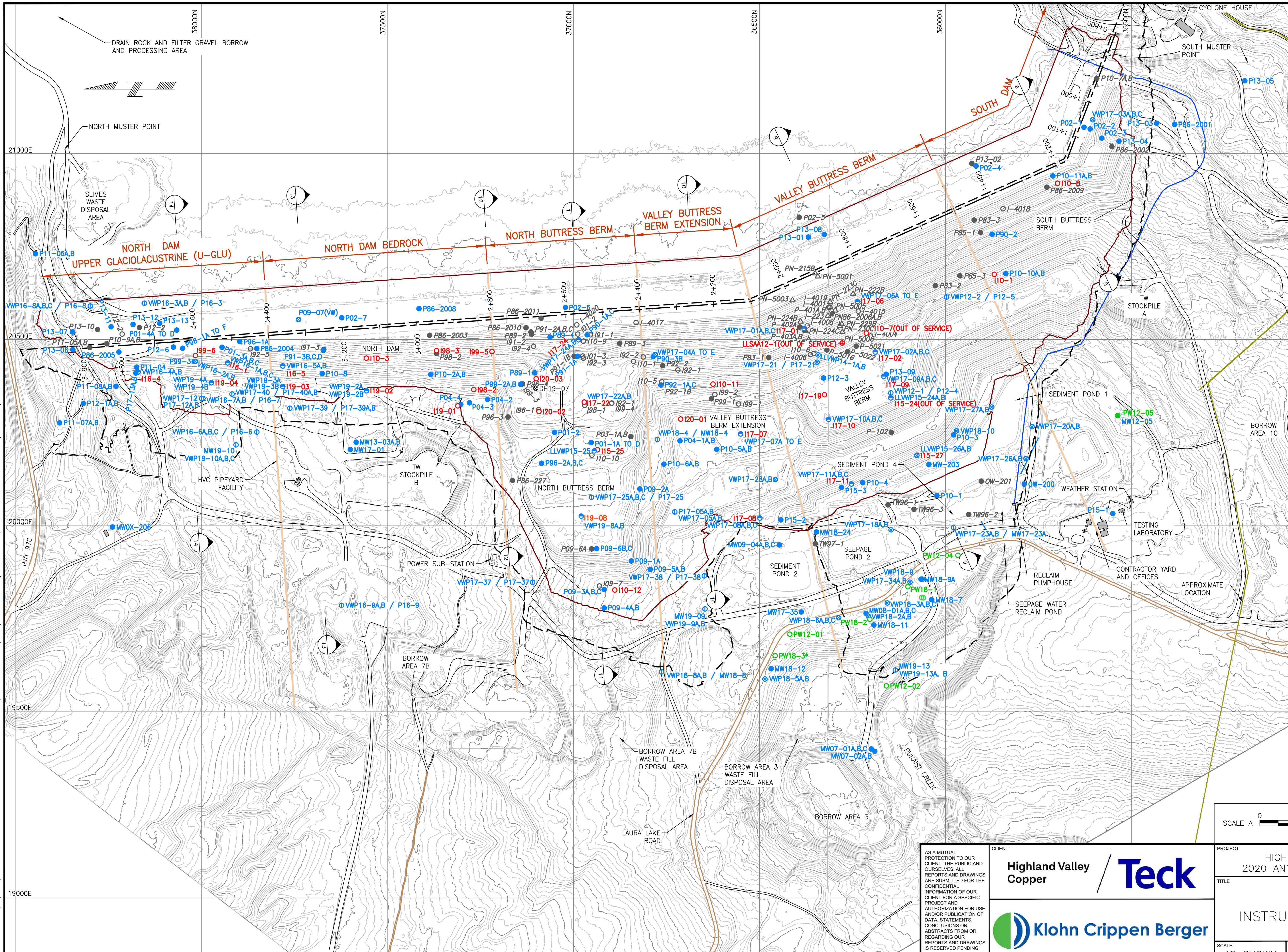

LEGEND:

- BORROW AREA
- WASTE FILL DISPOSAL AREA
- SEEPAGE POND
- SEDIMENT POND
- EL. 1279 m ULTIMATE DAM FOOTPRINT
- SURFACE WATER RECLAIM PIPELINE
- SPATSUM WATER PIPELINE
- HAUL ROAD
- PUBLIC ROAD
- 2040 PFS DAM FOOTPRINT
- L-L DAM CENTERLINE
- INSTRUMENTATION 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
- PUMPING WELL
- PUMPING WELL WITH STANDPIPE PIEZOMETER AND OBSERVATION WELL

DEFUNCT INSTRUMENTS AND BACKFILLED DRILLHOLES (SEE NOTE 3):

- DEFUNCT PNEUMATIC PIEZOMETER
- DEFUNCT STANDPIPE PIEZOMETER
- DEFUNCT INCLINOMETER
- BACKFILLED DRILLHOLE

NOTES:

1. TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER PARTNERSHIP AND WAS DERIVED FROM PHOTOSAT SURVEY DATED 2020-10-08 (L-L DAM) AND 2017-09-15 & 24 AND 2016-09-25 & 29 (OUTSIDE OF 2020 SURVEY EXTENT).
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. FOR LOCATION OF SEEPAGE FLOW MONITORING WEIRS, SEE APPENDIX III-D.

SCALE A 0 250 m

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: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: L-L DAM INSTRUMENTATION LOCATION PLAN

SCALE	PROJECT No.	FIG. No.
AS SHOWN	M02341B83	3

KCB-FIG-D-L

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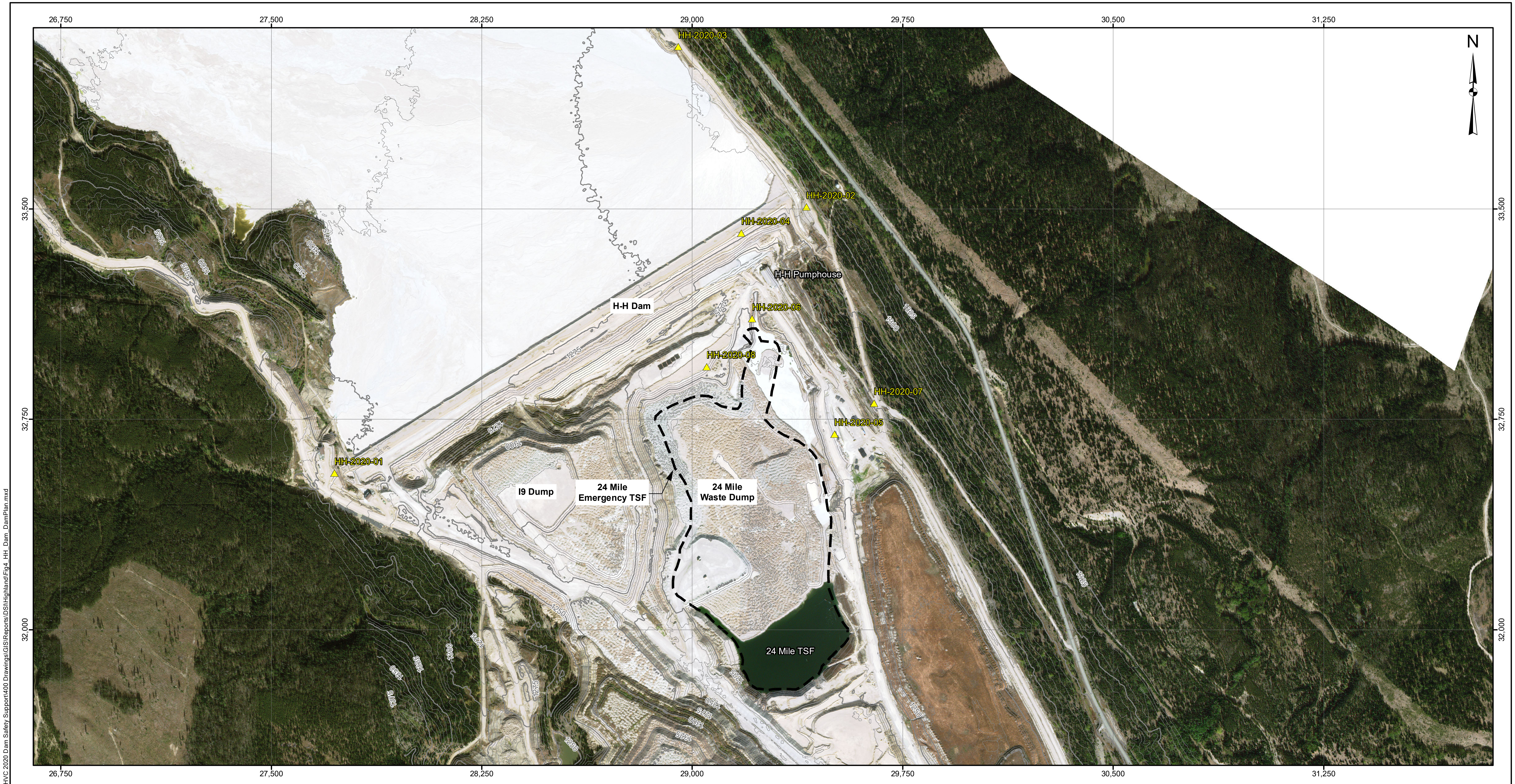

Legend

- Waypoint (HH-2020-xx)
- 24 Mile Emergency TSF
- Index Contour (25 m)
- Intermediate Contour (5 m)

Notes:
1. Projection: HVC Mine Grid.
2. Topography from satellite photogrammetry survey conducted in September, 2020.
3. Imagery from September, 2020.

Date: 2021-03-17
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CLIENT
Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT
HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE
H-H DAM AND 24 MILE EMERGENCY TSF PLAN

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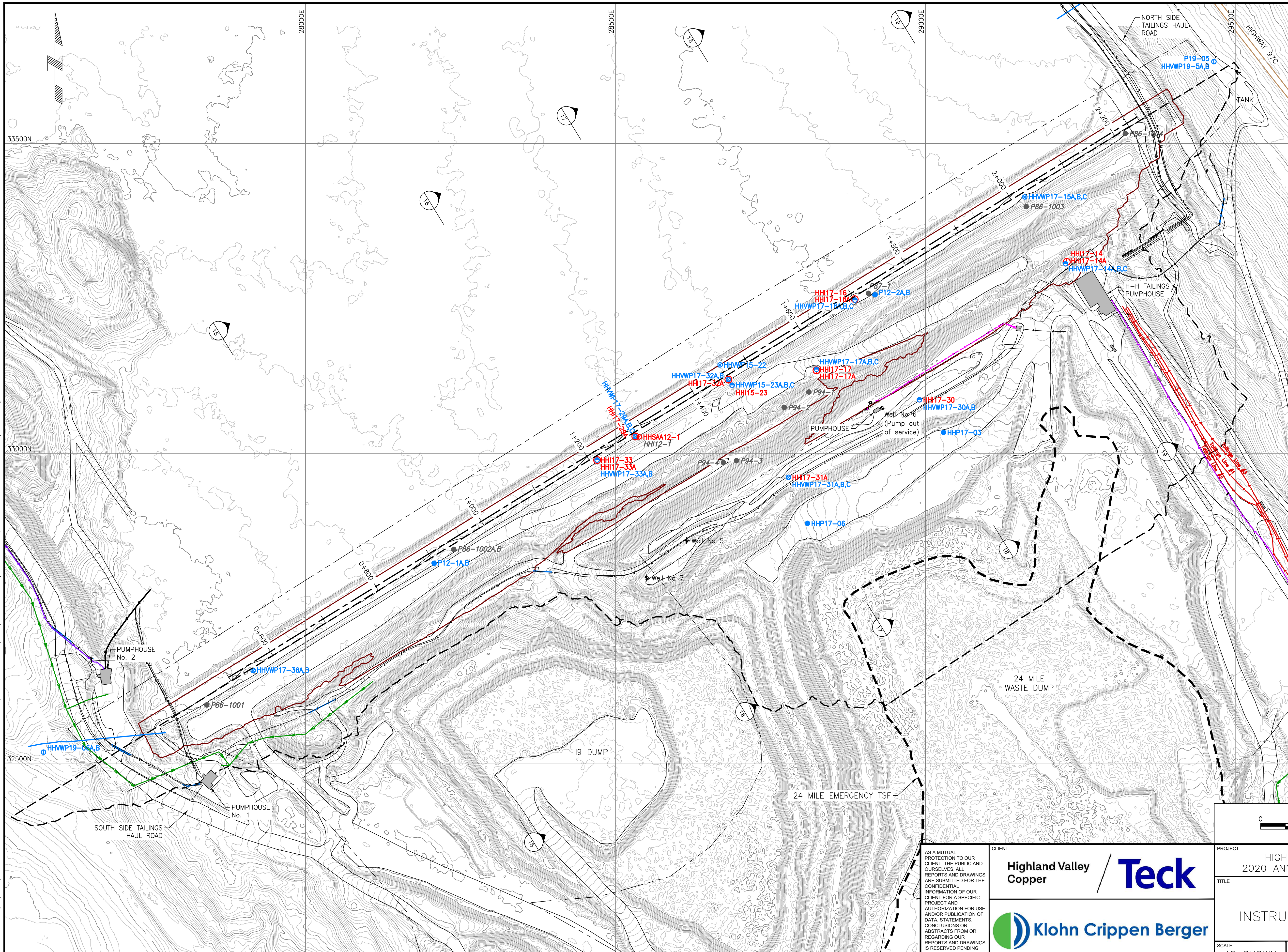


LEGEND:

ULTIMATE DAM FOOTPRINT
TAILINGS PIPELINE
POWERLINE
HAUL ROAD
PUBLIC ROAD
2040 PFS DAM FOOTPRINT
H-H DAM CENTERLINE
INSTRUMENTATION 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:

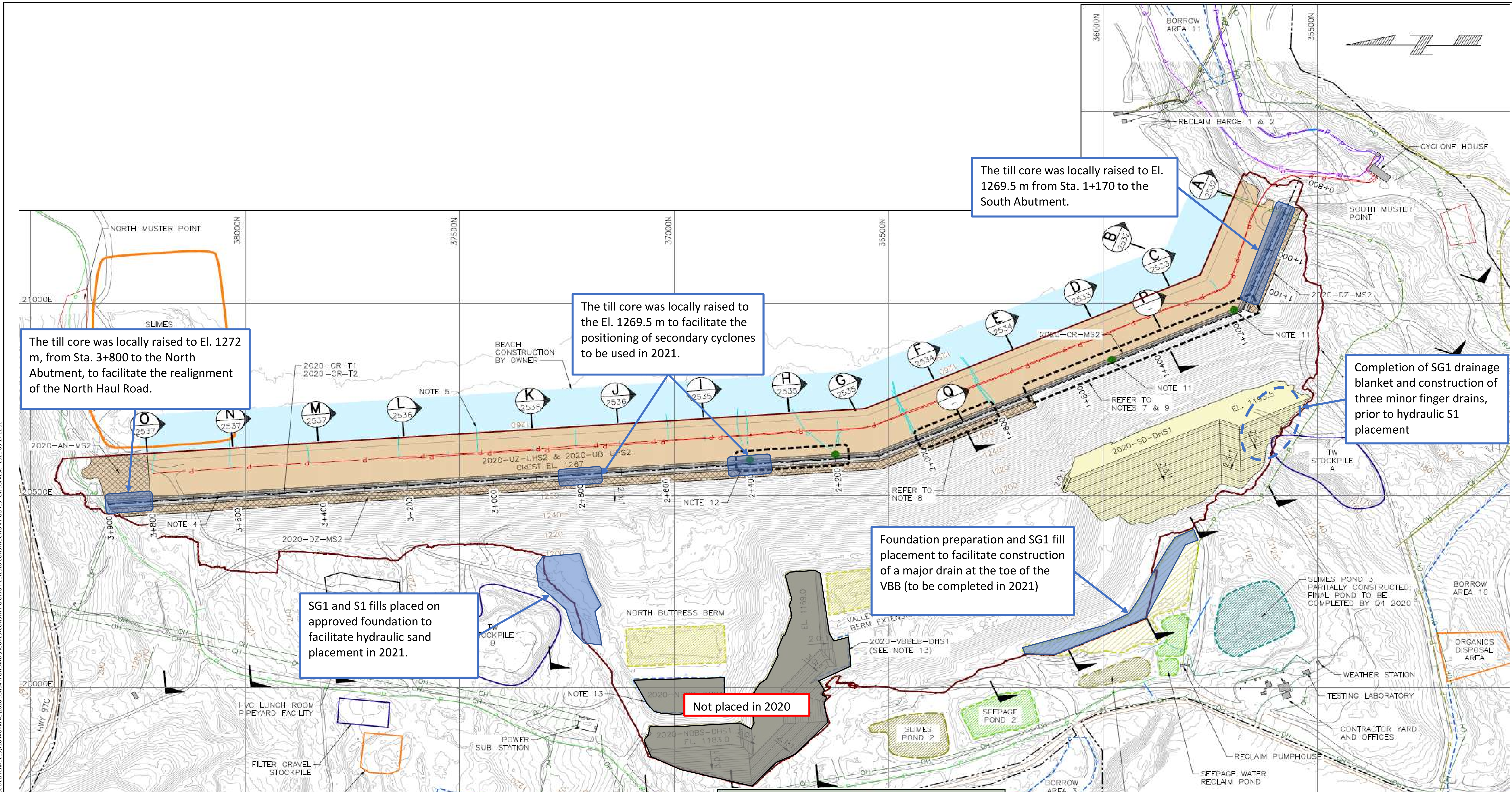
1. TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER PARTNERSHIP AND WAS DERIVED FROM PHOTOSAT SURVEY DATED 2020-10-08 (H-H DAM) AND 2017-09-15 & 24 AND 2016-09-25 & 29 (OUTSIDE OF 2020 SURVEY EXTENT).
2. ACTIVE INSTRUMENTS ARE DEFINED AS ANY INSTRUMENTS SATISFYING ONE OF THE FOLLOWING CRITERIA: CURRENTLY 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.

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	Highland Valley Copper / Teck
	Klohn Crippen Berger
PROJECT	HIGHLAND TAILINGS STORAGE FACILITY 2020 ANNUAL FACILITY PERFORMANCE REPORT
TITLE	H-H DAM INSTRUMENTATION LOCATION PLAN
SCALE	AS SHOWN
PROJECT No.	M02341B83
FIG. No.	5

KCB-FIG-D-L

SAVE DATE: 2021-02-08 (2:08 PM)
FILE PATH: Z:\M\VCR\M02341B53 - HVC-2019 DAM SAFETY SUPPORT\400 DRAWINGS\CAD\05-FIGURES\2020 AFPR\FIG 05 - H-H DAM.DWG (THAWKER)



LEGEND

- APPROX. PROPOSED LOCATION OF SECONDARY CYCLONE
- SITE BOUNDARY
- BORROW AREA (NOTE 12)
- WASTE FILL DISPOSAL AREA
- SEEPAGE POND
- SLIMES POND (PERMANENT)
- SLIMES POND (ON-DAM TEMPORARY)
- SLIMES POND (PERMANENT – PLANNED)
- STOCKPILE AREA
- WOODS CREEK PIPELINE
- EL 1279 m ULTIMATE DAM FOOTPRINT
- SEEPAGE WATER RECLAIM PIPELINE
- SPATSUM WATER PIPELINE
- PRIMARY CYCLONE OVERFLOW PIPELINE
- PRIMARY CYCLONE FEED LINE FROM H-H PUMPHOUSE
- PRIMARY CYCLONE UNDERFLOW LINE
- PRIMARY CYCLONE UNDERFLOW LINE LATERAL PIPES
- HAUL ROAD
- PUBLIC ROAD
- L-L DAM CENTERLINE
- SECTION NAME / DRAWING NUMBER WHERE SECTION IS SHOWN
- 2020-SD: FOUNDATION PREPARATION AREA I.D.

FILL TYPE (SEE NOTE 2)
T 1: SANDY TILL
T 2: CLAY TILL
S 1: TAILINGS SAND (HYDRAULICALLY PLACED)
S 1: TAILINGS SAND (MECHANICALLY PLACED)
S 2: TAILINGS SAND (HYDRAULICALLY PLACED)
S 2: TAILINGS SAND (MECHANICALLY PLACED)
SG 1: SAND AND GRAVEL
BEACH

SCALE A 0 250 m

NOT FOR CONSTRUCTION

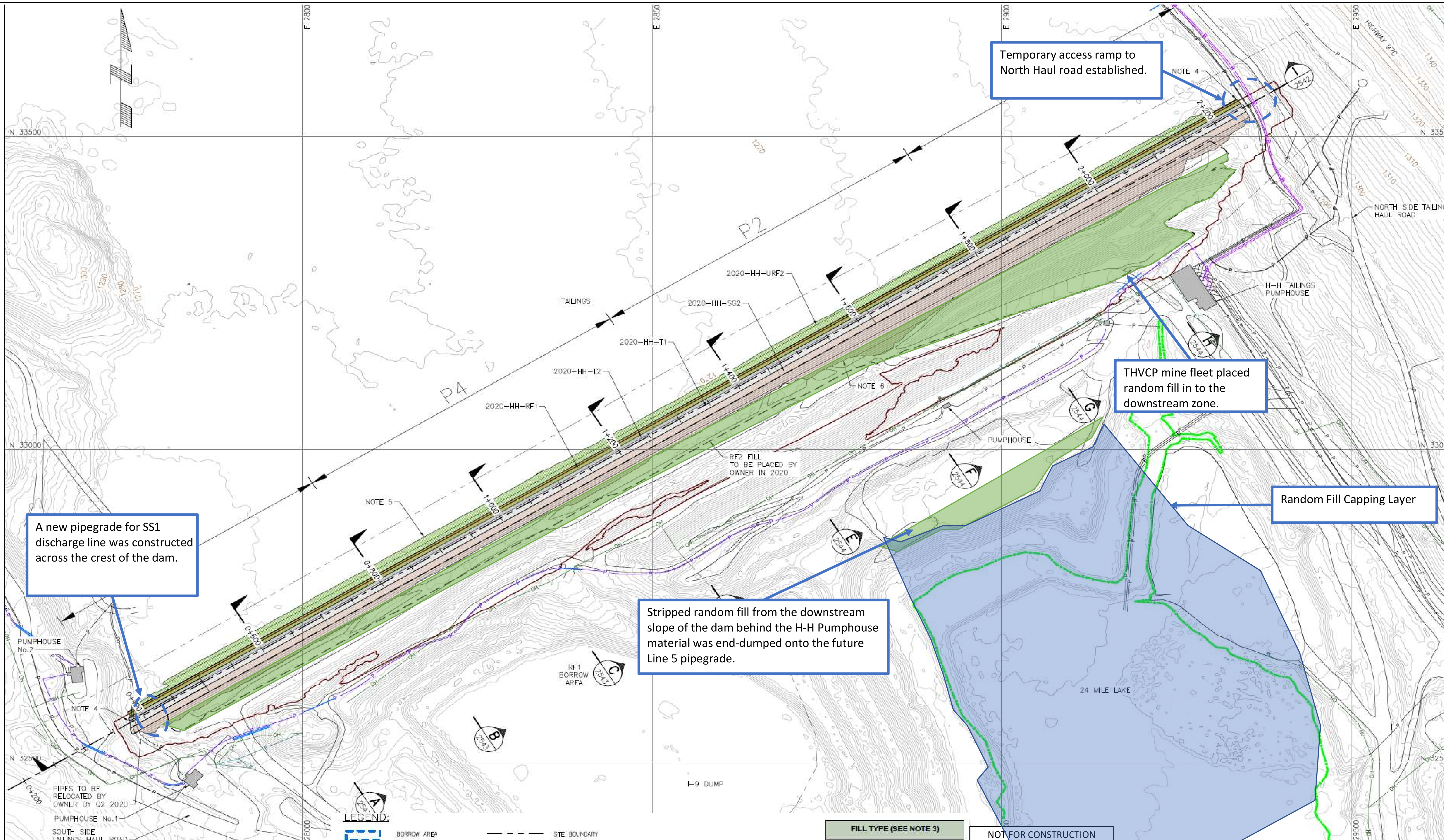
CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: L-L DAM 2020 CONSTRUCTION WORK AREAS

SCALE	PROJECT No.	FIG. No.
NTS	M02341B83	6



LEGEND:

BORROW AREA	SITE BOUNDARY
ULTIMATE DAM FOOTPRINT	H-H DAM CENTRELINE
TAILINGS PIPELINE	0+800
TAILINGS OVERFLOW PIPELINE	A / 2485 SECTION NAME / DRAWING NUMBER WHERE SECTION IS SHOWN
PIPELINE	
ELECTRICAL LINE	
POWER LINE	P3 PRIORITY SEQUENCE FOR 2020 FILL PLACEMENT ALL ZONES (NOTE 7)
HAUL ROAD	
PUBLIC ROAD	2020-HH-T2 FILL PLACEMENT AREA I.D.

FILL TYPE (SEE NOTE 3)	
T1:	SANDY TILL
T2:	CLAY TILL
SG2:	SAND AND GRAVEL
RF1:	RANDOM FILL
RF2:	RANDOM FILL

NOT FOR CONSTRUCTION

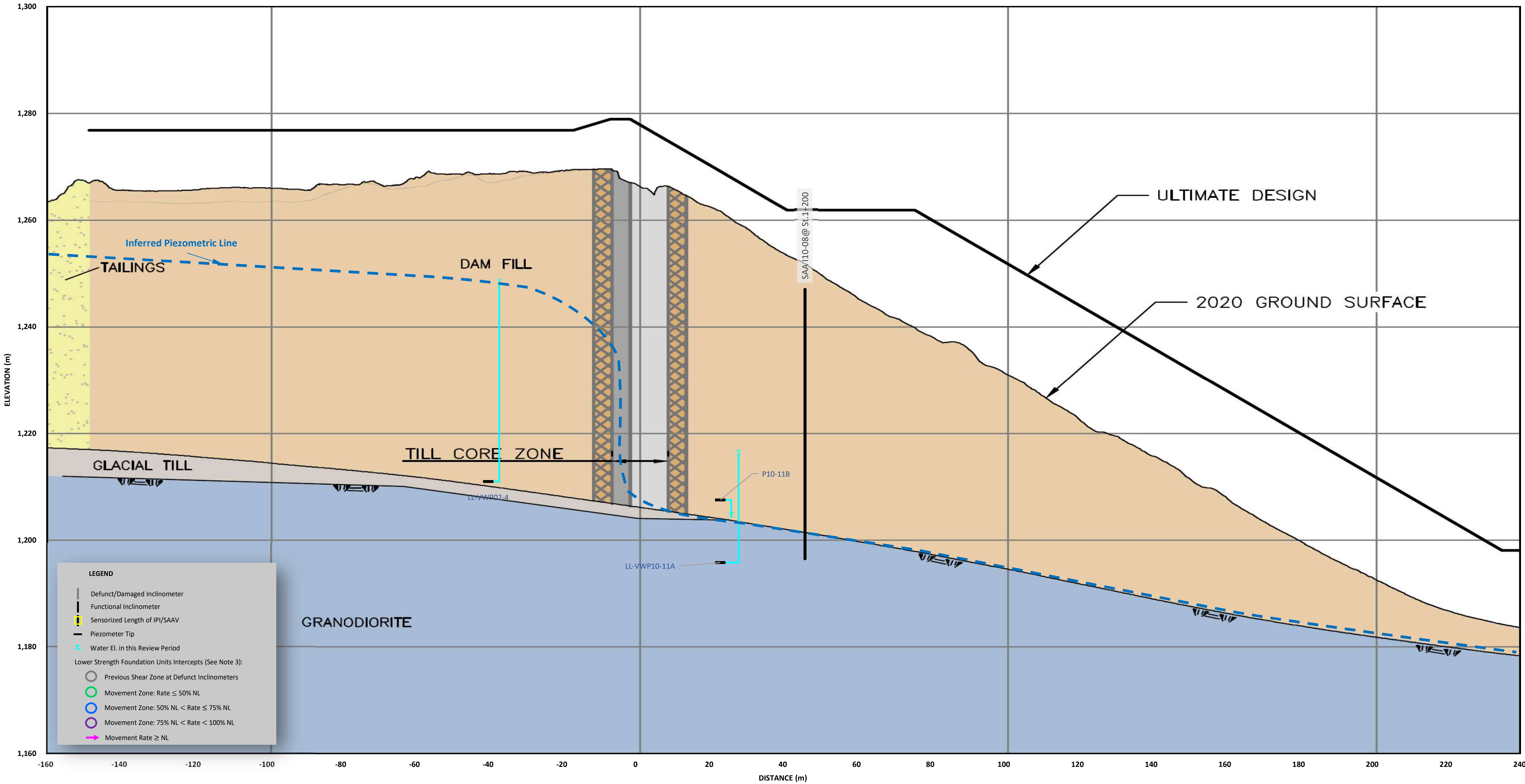
CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: H-H DAM 2020 CONSTRUCTION WORK AREAS

SCALE	PROJECT No.	FIG. No.
NTS	M02341B83	7



NOTES

1. The plotted positions of instruments that are located off of the section line are approximate.
2. Collar elevations of inclinometers are approximate.
3. Lower strength units (glaciolacustrine deposits and mudstone) are present in the L-L Dam foundation which govern design and are typically where the most movement has been measured to date. Limited movements have been measured in the other foundation units (glacial overburden and bedrock).

NOT FOR CONSTRUCTION

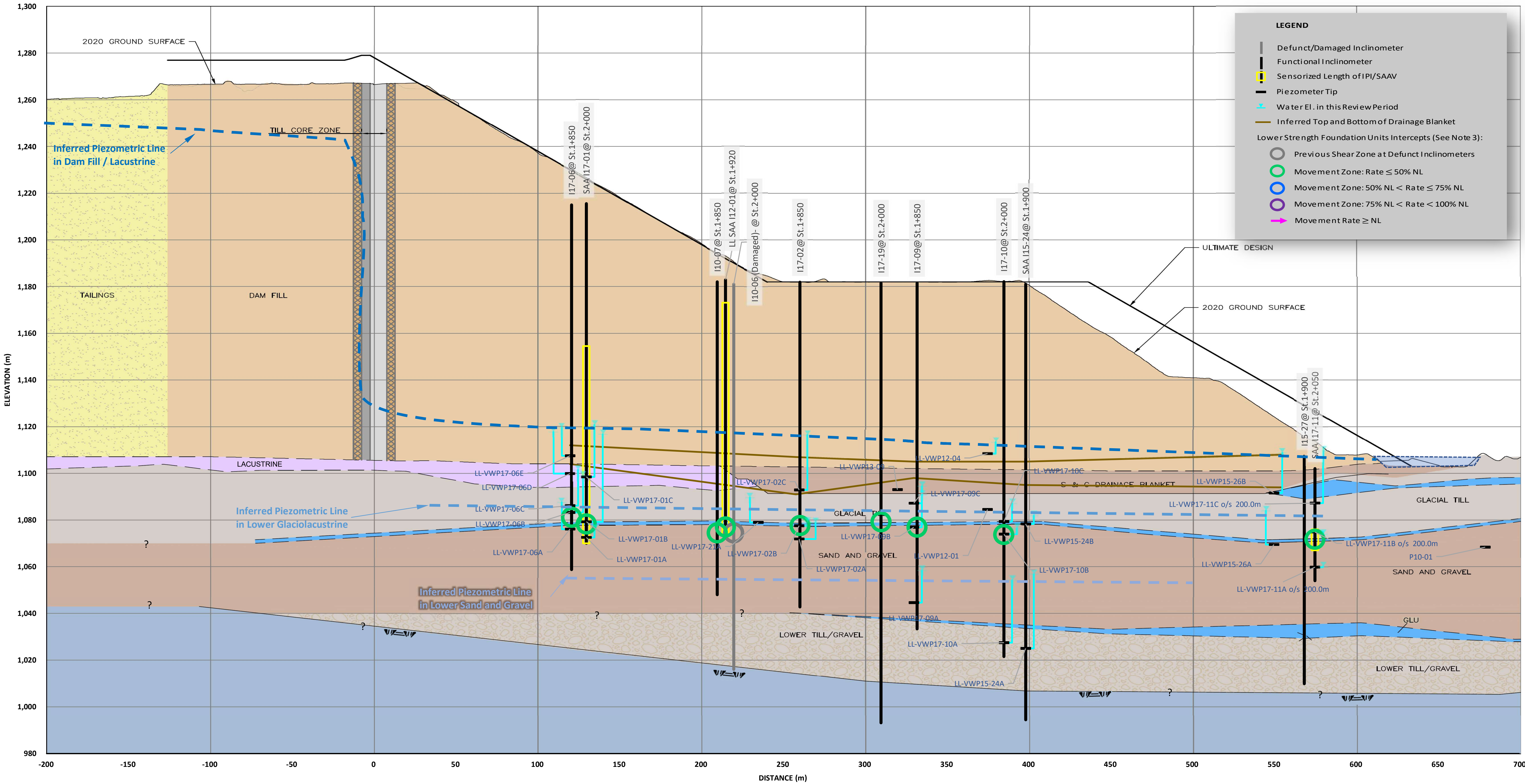
CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: L-L DAM SECTION
Sta. 1+200 - SOUTH DAM
INSTRUMENT STATUS AS OF END OF NOVEMBER 2020

SCALE	PROJECT No.	FIG. No.
NTS	M02341B83	8



NOT FOR CONSTRUCTION

NOTES

1. The plotted positions of instruments that are located off of the section line are approximate.
2. Collar elevations of inclinometers are approximate.
3. Lower strength units (glaciolacustrine deposits and mudstone) are present in the L-L Dam foundation which govern design and are typically where the most movement has been measured to date. Limited movements have been measured in the other foundation units (glacial overburden and bedrock).
4. There are some issues with processing of SAA I12-01 readings. The issue is with offsite supplier. THVCP and KCB are following-up.

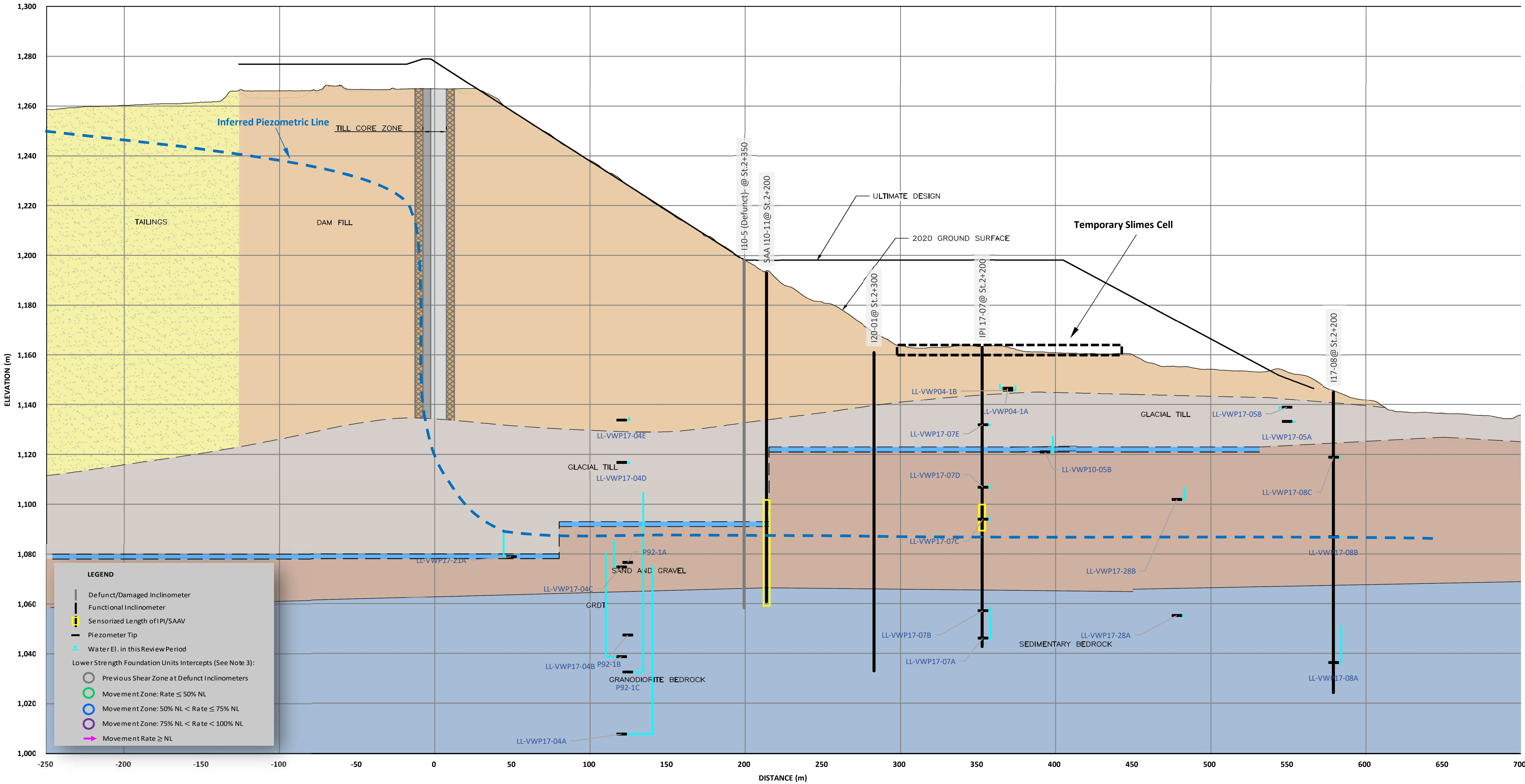
CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: L-L DAM SECTION
Sta. 1+850 - VALLEY BUTTRESS BERM
INSTRUMENT STATUS AS OF END OF NOVEMBER 2020

SCALE	PROJECT No.	FIG. No.
NTS	M02341B83	9



NOTES

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2. Collar elevations of inclinometers are approximate.
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NOT FOR CONSTRUCTION

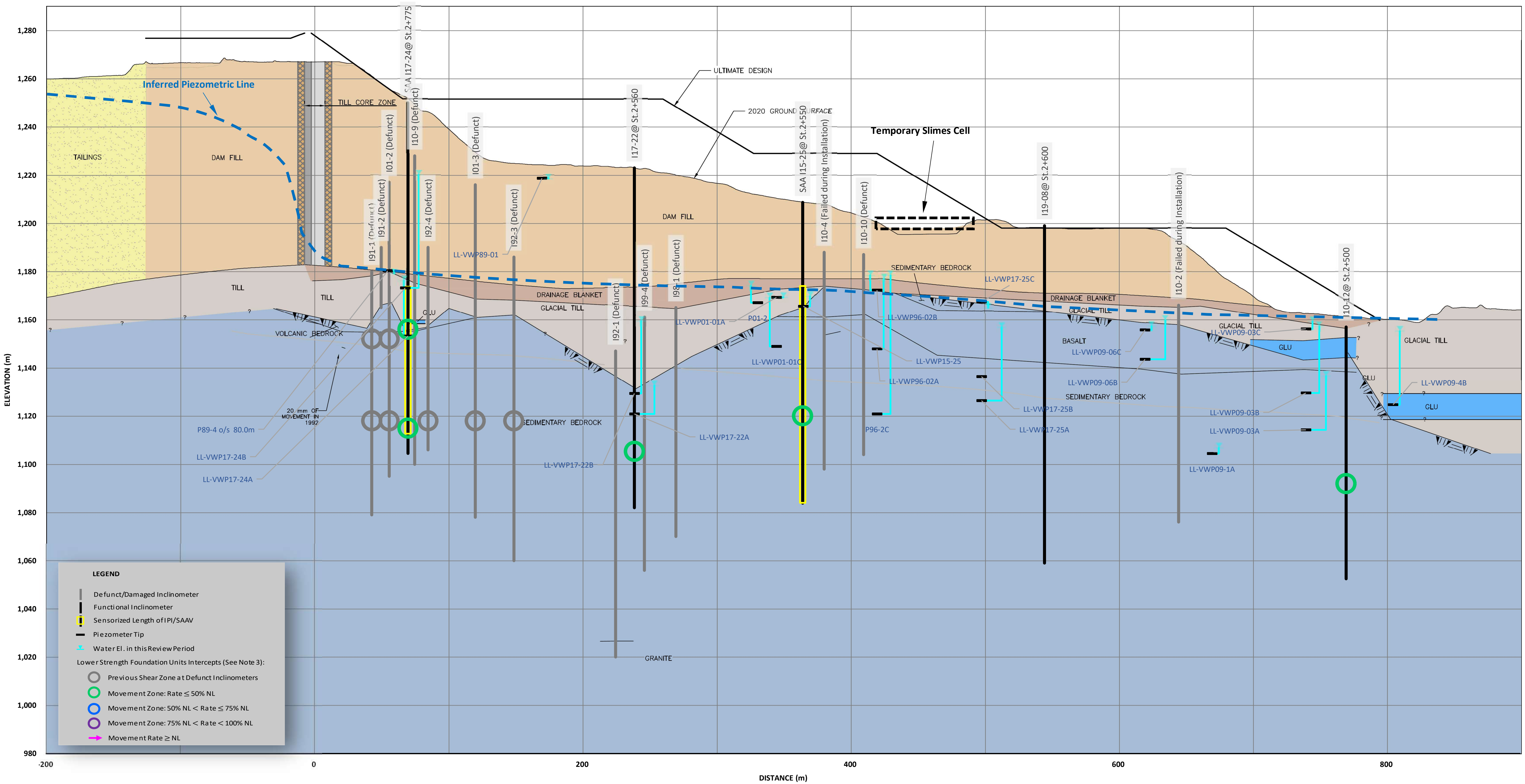
CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: L-L DAM SECTION
Sta. 2+250 - VALLEY BUTTRESS BERM EXTENSION
INSTRUMENT STATUS AS OF END OF NOVEMBER 2020

SCALE	PROJECT No.	FIG. No.
NTS	M02341B83	10



NOTES

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2. Collar elevations of inclinometers are approximate.
3. Lower strength units (glaciolacustrine deposits and mudstone) are present in the L-L Dam foundation which govern design and are typically where the most movement has been measured to date. Limited movements have been measured in the other foundation units (glacial overburden and bedrock).

NOT FOR CONSTRUCTION

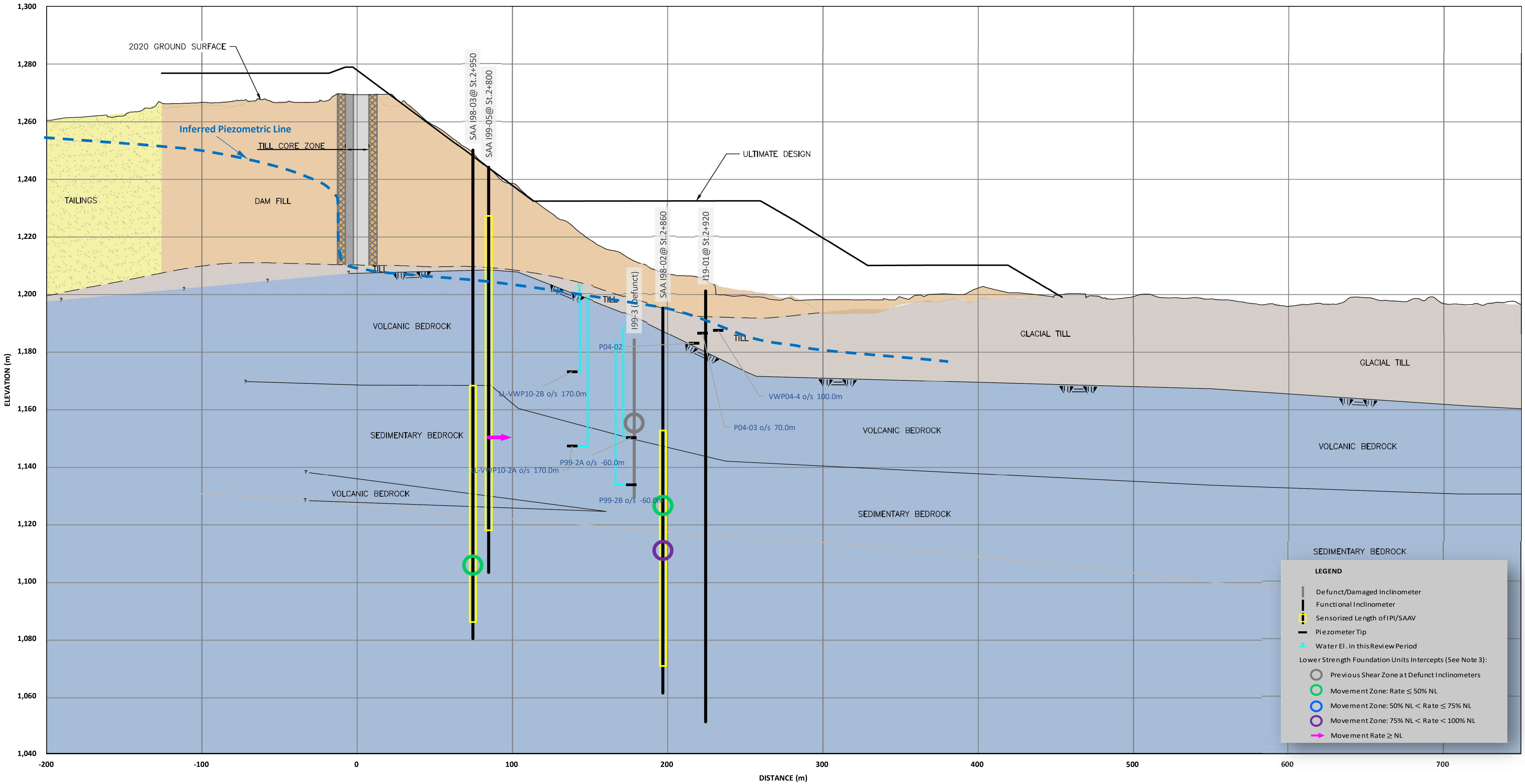
CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: L-L DAM SECTION Sta. 2+564 - NORTH BUTTRESS BERM INSTRUMENT STATUS AS OF END OF NOVEMBER 2020

SCALE	PROJECT No.	FIG. No.
NTS	M02341B83	11



NOTES

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2. Collar elevations of inclinometers are approximate.
3. Lower strength units (glaciolacustrine deposits and mudstone) are present in the L-L Dam foundation which govern design and are typically where the most movement has been measured to date. Limited movements have been measured in the other foundation units (glacial overburden and bedrock).

NOT FOR CONSTRUCTION

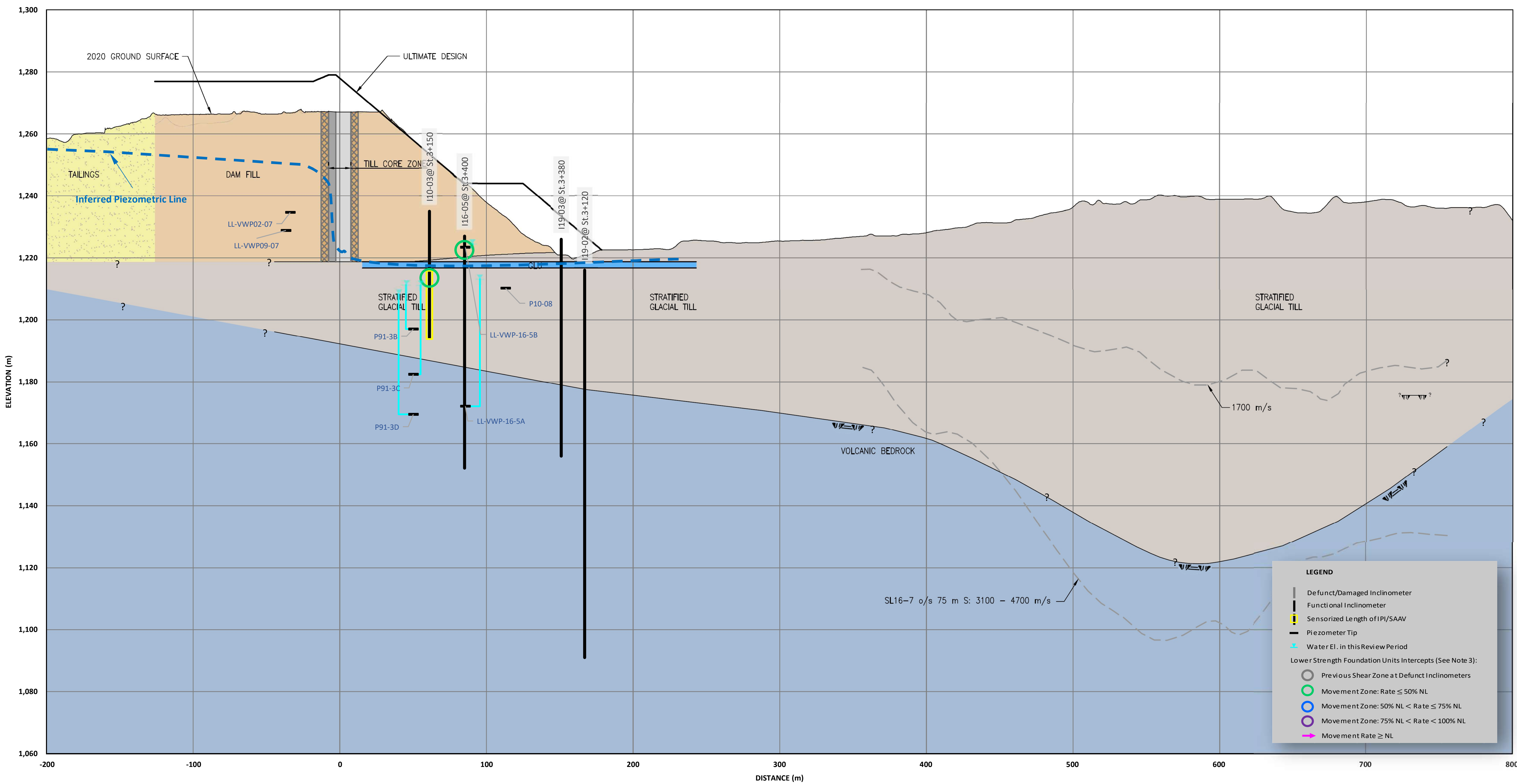
CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: L-L DAM SECTION
Sta. 2+800 - NORTH DAM BEDROCK
INSTRUMENT STATUS AS OF END OF NOVEMBER 2020

SCALE	PROJECT No.	FIG. No.
NTS	M02341B83	12



NOTES

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2. Collar elevations of inclinometers are approximate.
3. Lower strength units (glaciolacustrine deposits and mudstone) are present in the L-L Dam foundation which govern design and are typically where the most movement has been measured to date. Limited movements have been measured in the other foundation units (glacial overburden and bedrock).

NOT FOR CONSTRUCTION

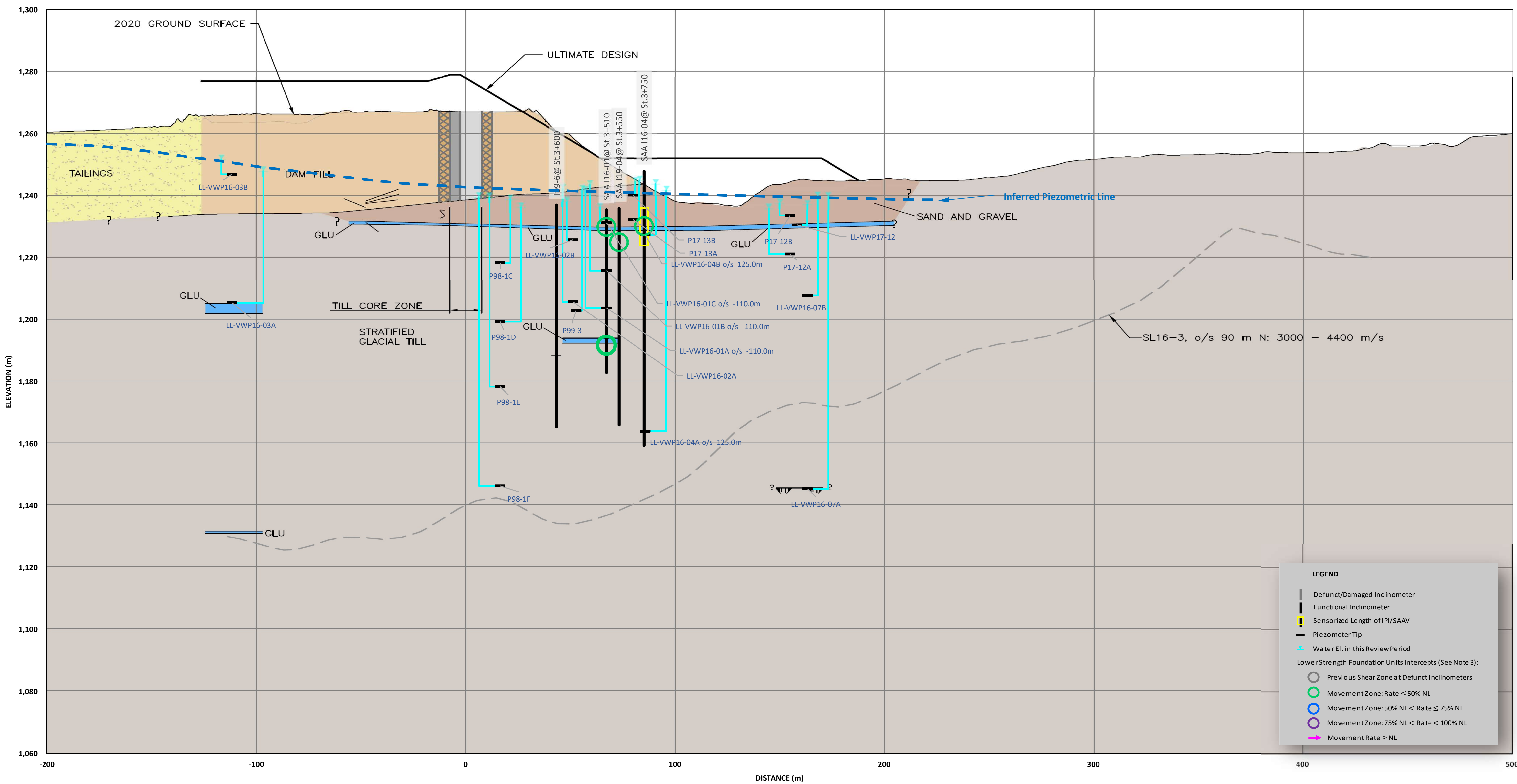
CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: L-L DAM SECTION Sta. 3+300 - NORTH DAM BEDROCK INSTRUMENT STATUS AS OF END OF NOVEMBER 2020

SCALE	PROJECT No.	FIG. No.
NTS	M02341B83	13



NOTES

1. The plotted positions of instruments that are located off of the section line are approximate.
2. Collar elevations of inclinometers are approximate.
3. Lower strength units (glaciolacustrine deposits and mudstone) are present in the L-L Dam foundation which govern design and are typically where the most movement has been measured to date. Limited movements have been measured in the other foundation units (glacial overburden and bedrock).

NOT FOR CONSTRUCTION

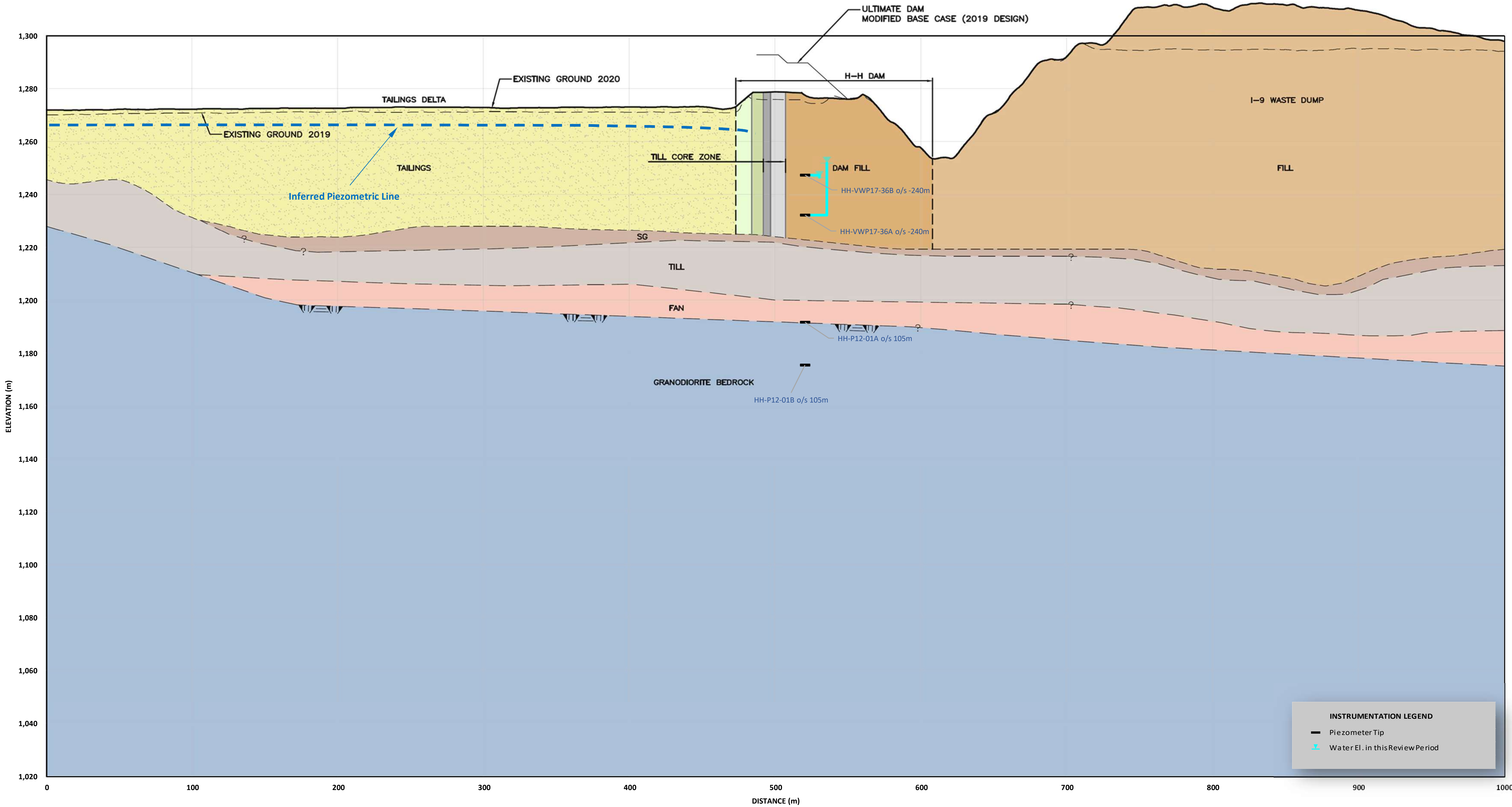
CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: L-L DAM SECTION
Sta. 3+630 - NORTH DAM U-GLU
INSTRUMENT STATUS AS OF END OF NOVEMBER 2020

SCALE	PROJECT No.	FIG. No.
NTS	M02341B83	14



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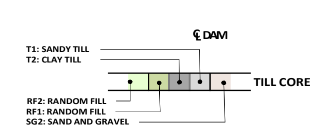
NOTES

1. The plotted positions of instruments that are located off of the section line are approximate.
2. Collar elevations of inclinometers are approximate.



SIMPLIFIED GEOLOGY UNITS

- GLACIOLACUSTRINE (GLU)
- LACUSTRINE (LU)
- DAM FILL
- TAILINGS
- TILL
- SAND AND GRAVEL
- FAN / BASAL
- UNIT 10
- BEDROCK

NOT FOR CONSTRUCTION

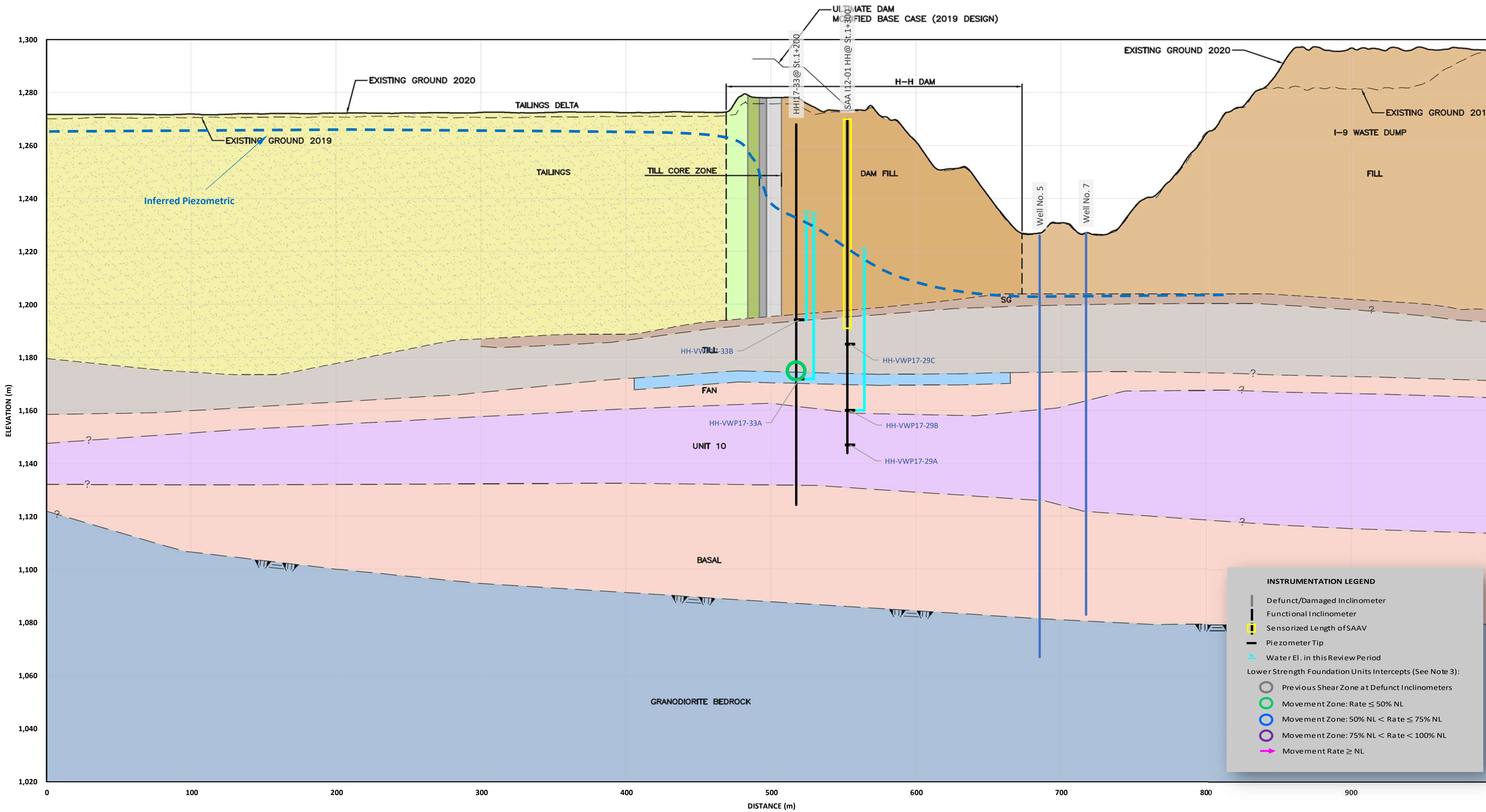
CLIENT
Highland Valley Copper / Teck

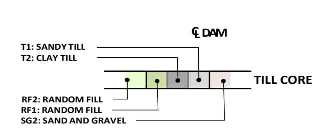
Klohn Crippen Berger

PROJECT
HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE
H-H DAM
INSTRUMENTATION SECTION - Sta. 0+800
INSTRUMENT STATUS AS OF END OF NOVEMBER 2020

SCALE	PROJECT No.	FIG. No.
NTS	M02341B83	15





SIMPLIFIED GEOLOGY UNITS

- GLACIOLACUSTRINE (GLU)
- LACUSTRINE (LU)
- DAM FILL
- TAILINGS
- TILL
- SAND AND GRAVEL
- FAN / BASAL
- UNIT 10
- BEDROCK

NOTES

1. The plotted positions of instruments that are located off of the section line are approximate.
2. Collar elevations of inclinometers are approximate.
3. Lower strength units (Clay Layer 1 and Clay Layer 2) are present in the H-H Dam foundation which govern design and are typically where the most movement has been measured to date. Limited movements have been measured in the other foundation units (glacial overburden and bedrock).
4. No defined movement zone was identified at SAA I12-01 HH.

NOT FOR CONSTRUCTION

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: H-H DAM
INSTRUMENTATION SECTION - Sta. 1+200
INSTRUMENT STATUS AS OF END OF NOVEMBER 2020

SCALE	PROJECT No.	FIG. No.
NTS	M02341B83	16

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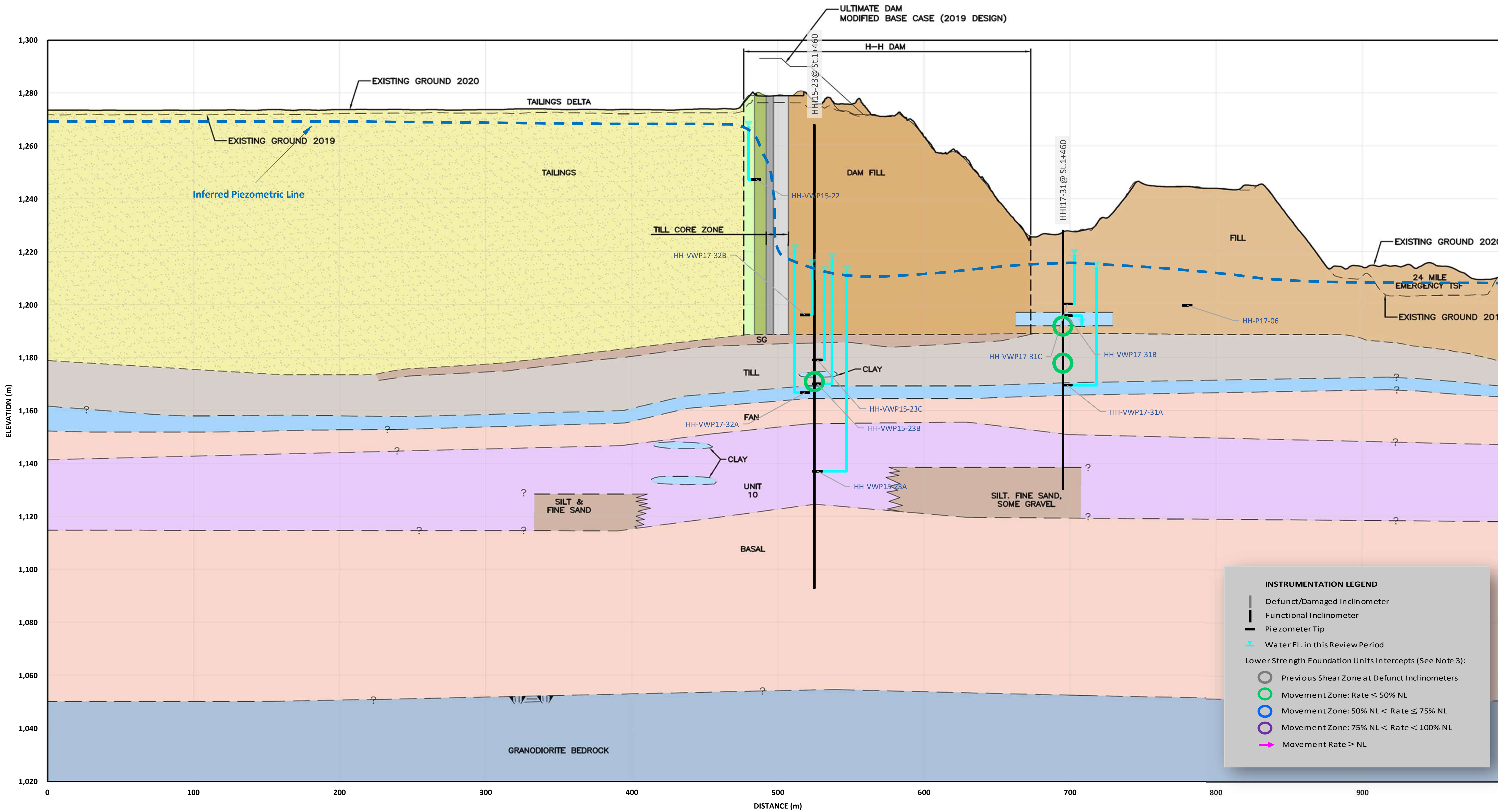

NOTES

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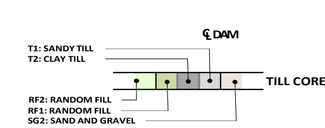
3. Lower strength units (Clay Layer 1 and Clay Layer 2) are present in the H-H Dam foundation which govern design and are typically where the most movement has been measured to date. Limited movements have been measured in the other foundation units (glacial overburden and bedrock).



SIMPLIFIED GEOLOGY UNITS

- GLACIOLACUSTRINE (GLU)
- LACUSTRINE (LU)
- DAM FILL
- TAILINGS
- TILL
- SAND AND GRAVEL
- FAN / BASAL
- UNIT 10
- BEDROCK

NOT FOR CONSTRUCTION

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: H-H DAM
INSTRUMENTATION SECTION - Sta. 1+460
INSTRUMENT STATUS AS OF END OF NOVEMBER 2020

SCALE	PROJECT No.	FIG. No.
NTS	M02341B83	17

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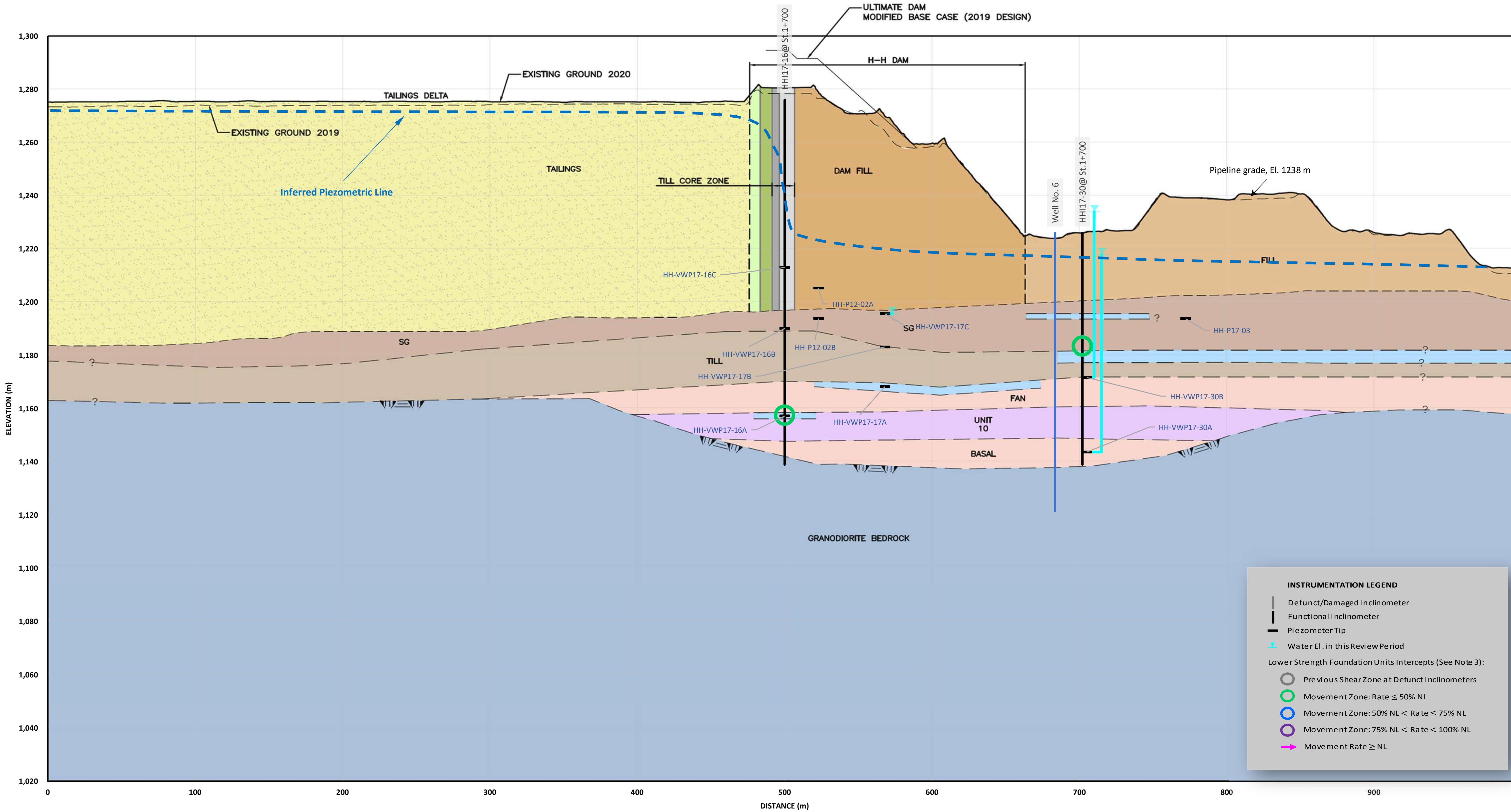
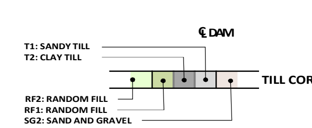


SIMPLIFIED GEOLOGY UNITS

- GLACIOLACUSTRINE (GLU)
- LACUSTRINE (LU)
- DAM FILL
- TAILINGS
- TILL
- SAND AND GRAVEL
- FAN / BASAL
- UNIT 10
- BEDROCK



NOT FOR CONSTRUCTION

NOTES

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2. Collar elevations of inclinometers are approximate.
3. Lower strength units (Clay Layer 1 and Clay Layer 2) are present in the H-H Dam foundation which govern design and are typically where the most movement has been measured to date. Limited movements have been measured in the other foundation units (glacial overburden and bedrock).

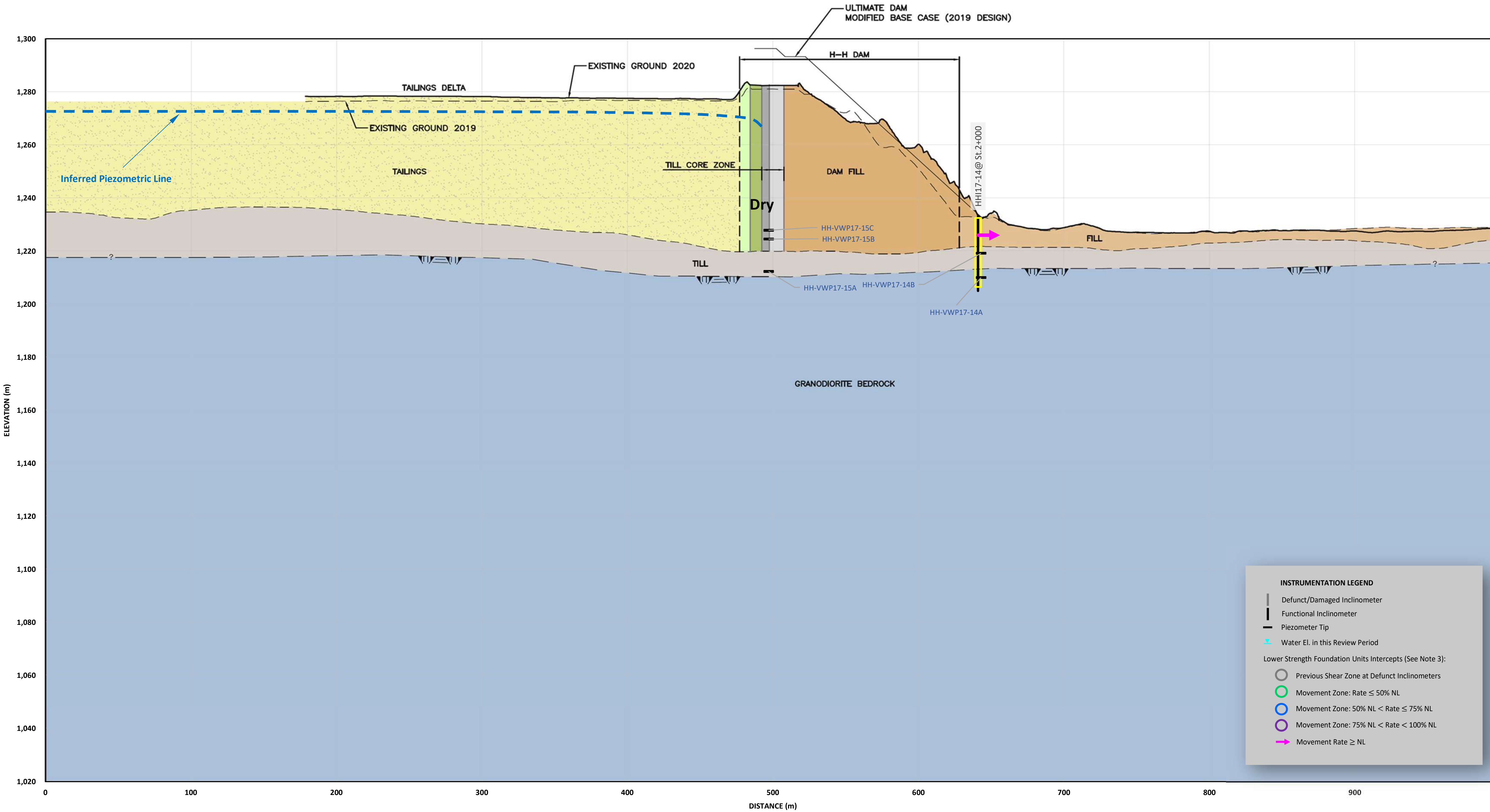
CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

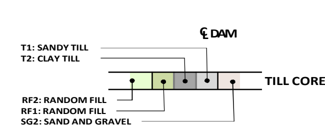
TITLE: H-H DAM
INSTRUMENTATION SECTION - Sta. 1+700
INSTRUMENT STATUS AS OF END OF NOVEMBER 2020

SCALE	PROJECT No.	FIG. No.
NTS	M02341B83	18



NOTES

1. The plotted positions of instruments that are located off of the section line are approximate.
2. Collar elevations of inclinometers are approximate.
3. Lower strength units (Clay Layer 1 and Clay Layer 2) are present in the H-H Dam foundation which govern design and are typically where the most movement has been measured to date. Limited movements have been measured in the other foundation units (glacial overburden and bedrock).
4. No defined movement zone was identified at HHI17-14.



SIMPLIFIED GEOLOGY UNITS

- GLACIOLACUSTRINE (GLU)
- LACUSTRINE (LU)
- DAM FILL
- TAILINGS
- TILL
- SAND AND GRAVEL
- FAN / BASAL
- UNIT 10
- BEDROCK

NOT FOR CONSTRUCTION

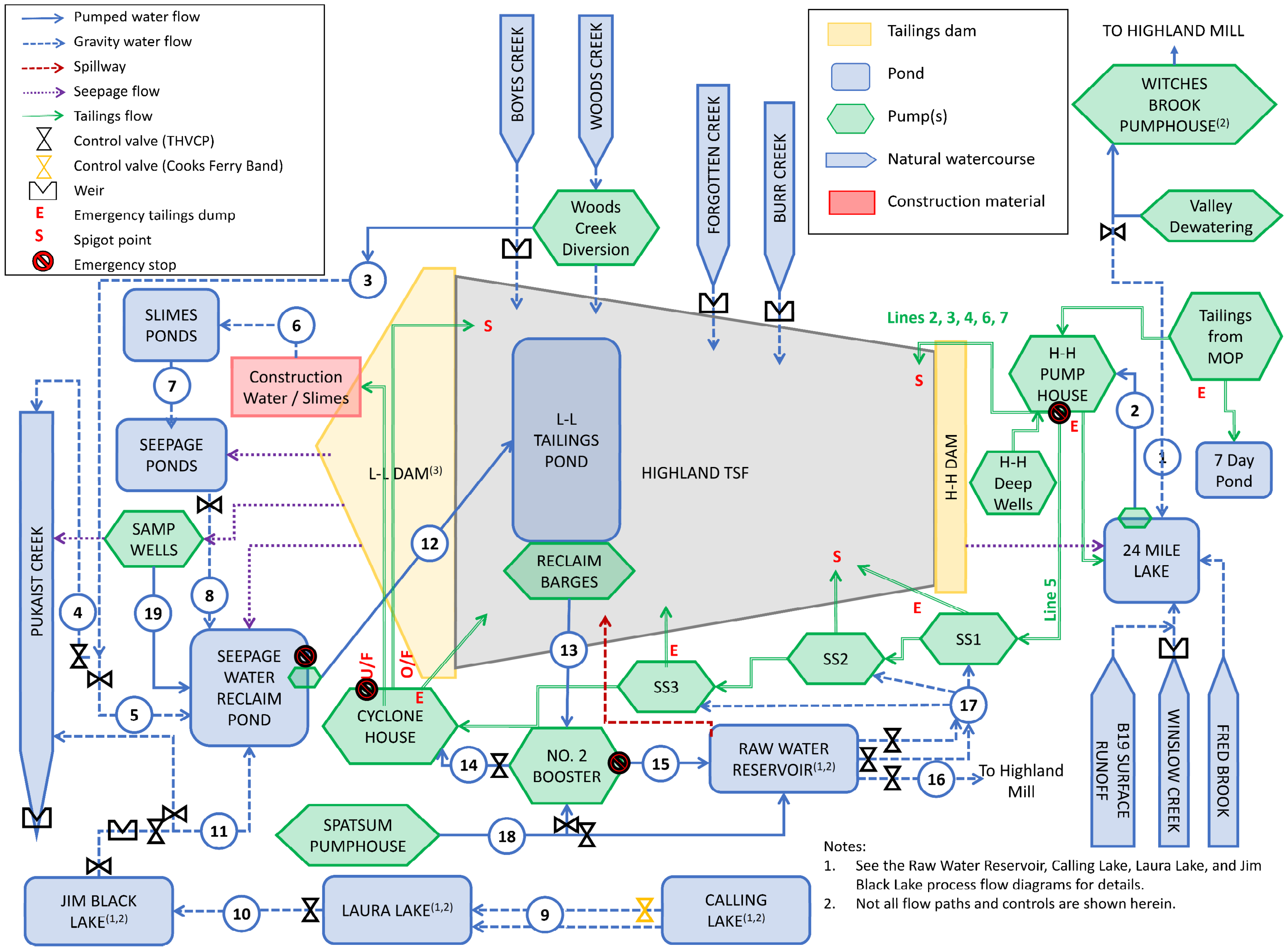
CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: H-H DAM
INSTRUMENTATION SECTION - Sta. 2+000
INSTRUMENT STATUS AS OF END OF NOVEMBER 2020

SCALE	PROJECT No.	FIG. No.
NTS	M02341B83	19



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.

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	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/Pukaist	Open channel with U/S y-valve to SWRP, 12" dia. HDPE pipe and open channel to Pukaist Creek	Operational
12	SWRP to TSF	2x permanent pumps in the SWRP 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. Section of 20" Spatsum Line from No. 2 Booster to Raw Water Reservoir also used.	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	Buried pipeline from LLO, backup 10" HDPE pipeline running from reclaim line	Operational
18	Spatsum Water Line	1 x 20" buried steel pipeline	Operational
19	SAMP Wells	4 x deep wells from 5HP to 60HP pumping to a 12" discharge line, draining into the SWRP	Operational

NOT FOR CONSTRUCTION

CLIENT
Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT
HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE
FLOW SCHEMATIC FOR HIGHLAND TSF

SCALE	PROJECT No.	FIG. No.
NTS	M02341B83	20

APPENDIX I

Inspection Checklist, Observations and Photographs

APPENDIX I-A

L-L Dam

Inspection Checklist, Observations and Photographs

Appendix I-A
Annual Facility Performance Report Inspection Checklist, Observations and Photographs – L-L Dam

INSPECTION CHECKLIST

Facility:	L-L Dam	**Inspection Date:**	July 16, 2020
Consequence Classification:	Main Embankment (Extreme)		
Weather:	Mostly cloudy	**Inspector(s):**	Rick Friedel, P.Eng. Narges Solgi, EIT.
Freeboard (pond level to dam crest):	Freeboard ~9.5 m based on July 17th survey		

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

EMBANKMENT	Yes/No
U/S slope	☒ Yes ☐ No
Crest	☒ Yes ☐ No
D/S Slope	☒ Yes ☐ No
D/S Toe	☒ Yes ☐ No

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

INDICATOR	EMBANKMENT	INDICATOR	EMBANKMENT
Piping	☐ Yes ☒ No	Settlement	☐ Yes ☒ No
Sinkholes	☐ Yes ☒ No	Sloughing/Slides	☐ Yes ☒ No
Seepage	☐ Yes ☒ No	Animal Activity	☐ Yes ☒ No
External Erosion	☐ Yes ☒ No	Excessive Growth	☐ Yes ☒ No
Cracks	☐ Yes ☒ No	Excessive Debris	☐ Yes ☒ No

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

- No dam safety deficiencies observed

Comments / Notes:

- Refer to Inspection Observations Section.

INSPECTION OBSERVATIONS

Crest and Upstream Slope

Good physical condition; no visual indicators of concern (Photo I-A-1 to Photo I-A-4).

Downstream Slope - North Abutment

Good physical condition; no observations of significant erosion or excessive seepage (Photo I-A-7).

Downstream Slope - North Dam

No observed dam safety issues of concern. At time of inspection, active construction included cell preparation for upstream cycloned sand to support the 2020 crest raise (Photo I-A-7 to Photo I-A-9).

Downstream Slope - North Buttress Berm (NBB)

No observed dam safety issues of concern. At time of inspection, there was no active construction. The temporary on-dam slimes cell storage was not in operation.

Some ponded water was observed at NBB low point on north side which is typical at this location and reoccurs after freshet due to runoff. The pond water drains through the major drain that daylights on the north side of the NBB and drains to the Seepage Water Reclaim Pond (SWRP). Area is planned to be raised with mechanical placement in 2020 (Photo I-A-29).

Downstream Slope - Valley Buttress Berm Extension (VBBE)

No observed dam safety issues of concern. At time of inspection, there was no active construction. The temporary on-dam slimes cell storage was not in operation.

Downstream Slope - Valley Buttress Berm (VBB)

No observed dam safety issues of concern. There was no active construction at the time of inspection. There was no seepage from the cycloned sand fill slope. No seepage face from the sand and gravel drainage blanket was visible either (Photo I-A-10 and Photo I-A-11). An erosion channel from the runoff was visible and marked. The erosion is a surficial feature and has a negligible impact on dam performance. Repair had been delayed due to habitat concerns from birds which had nested there (Photo I-A-12). Following the site visit, repairs were completed after the birds' migration.

Downstream Slope - South Dam

No observed dam safety issues of concern. Foundation preparation for fill placement and underdrain installation was ongoing at the time of inspection. Seepage was observed from areas where underdrains daylight from dam toe (Photo I-A-13 to Photo I-A-18).

Downstream Slope - South Abutment

Good physical condition; no observations of significant erosion or excessive seepage (Photo I-A-5).

Tailings Beach and Pond

Minimum beach requirements at North Abutment (>500 m) was met based on visual markers. THVCP is in the process of a multi-year plan to maintain a wider beach between upstream cycloned sand fill and pond along the length of the dam crest. Evidence of these efforts are visible as the tailings beach was wider relative to 2019 Annual Facility Performance Report (AFPR) site inspection. (Photo I-A-1 and Photo I-A-19)

At the time of AFPR site inspection, the pond was at El. 1255.0 m which is 9.5 m below the minimum dam crest (Photo I-A-19).

Seepage from Dam Toe

Where present, primarily from the underdrains, seepage emanating from the dam fill was clear with no turbidity. All water reports to a downstream collection pond and is reclaimed back to the impoundment via the SWRP. One seepage point (FS-03) downstream of the VBB toe was decommissioned in 2018 as part of Seepage Pond 1 backfilling. Seepage flow from VBB toe now reports directly to Sediment Pond 1 before flowing into SWRP.

Seepage and Sediment Ponds

All seepage and sediment ponds were in good condition. At the time of inspection, Sediment Pond 1 was in preparation phase for 2020 downstream sand placement, which would include replacing the drainage channel into SWRP with an outlet pipe (Photo I-A-20 to Photo I-A-22). Seepage visible on exposed divider dyke slope. Seepage is from the crest of the berm with no seepage faces or saturation of the blanket drain or cycloned sand (as expected) (Photo I-A-22).

Small, ponded water was observed in Sediment Pond 4 (Photo I-A-27 and Photo I-A-28). THVCP confirmed that water had not been routed into the basin so the source of flow is likely combination of groundwater and runoff from local catchment.

INSPECTION PHOTOGRAPHS

LEGEND:

- LL = L-L Dam.
- LL-2020-## refers to 2020 Annual Facility Performance Report way points shown on Figure 2.
- All photographs taken during inspection on June 30 and July 16, 2020.

Photo I-A-1 Overview of North Dam tailings beach (>500 m wide) and crest from North Abutment (LL-2020-01)

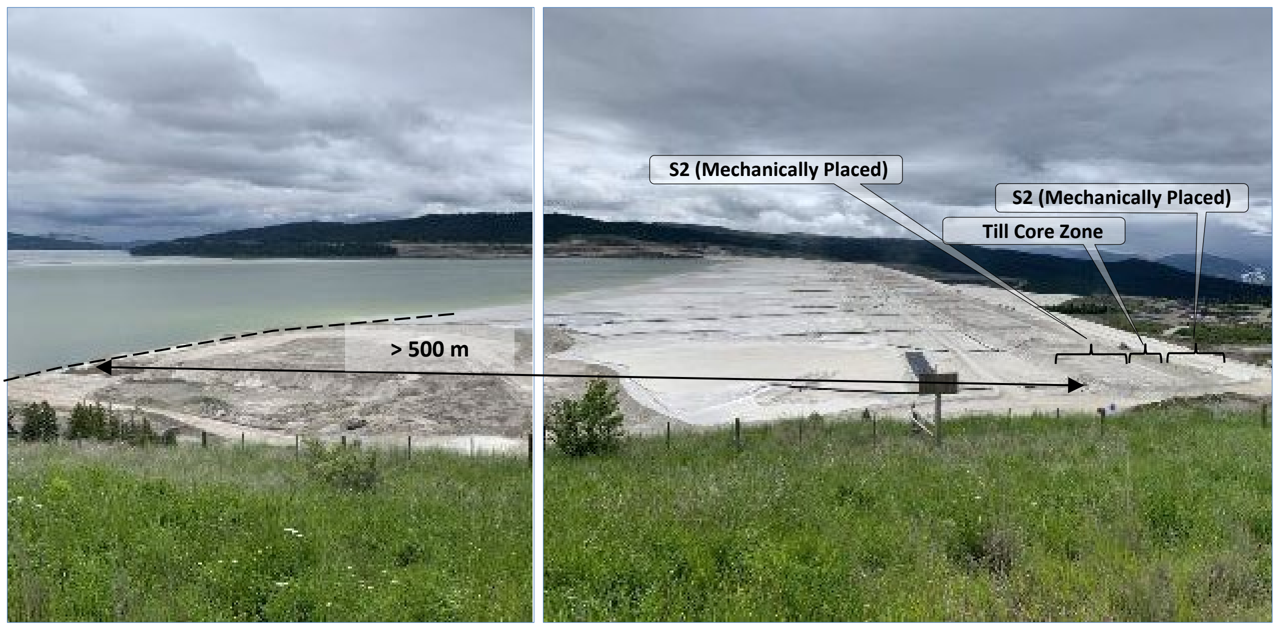


Photo I-A-2 Hydraulic sand placement was ongoing on upstream sand zone on July 16, 2020. Overview of beach development (LL-2020-02)

Photo I-A-3 View of North Dam crest and downstream slope, looking north (LL-2020-03)

Photo I-A-4 View of L-L Dam crest – looking south (LL-2020-03)

Photo I-A-5 View of raised Till Core Zone at South Dam. Oversized were pushed to edge of lift (LL-2020-04)

Photo I-A-6 View of an upstream hydraulic placement cell (LL-2020-05)

Photo I-A-7 View of key-in of Core Zone at North Abutment (LL-2020-05)

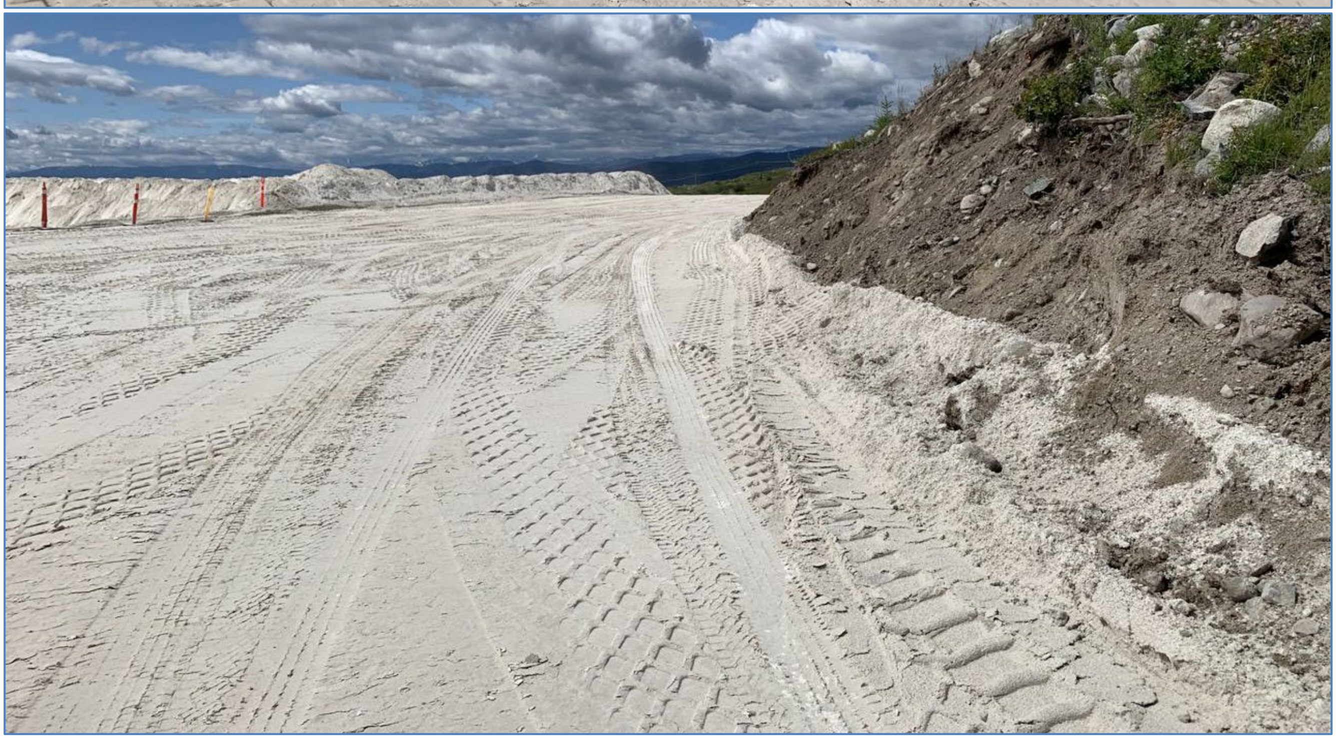


Photo I-A-8 Overview of the downstream slope of North Dam near I19-04. Wet area in low point of toe road but no seepage faces or wet areas on dam slope (LL-2020-06)

P0hoto I-A-9 Overview of the downstream slope of North Dam and North Buttress Berm segment, looking southwest (LL-2020-03)

Photo I-A-10 View of Valley Buttress Berm downstream slope and south of Sediment Pond 1. Prepping for downstream sand placement (LL-2020-07)

Photo I-A-11 View of Valley Buttress Berm and South Dam downstream slope and toe area. Ponded water is in Sediment Pond 1 (LL-2020-08)

Photo I-A-12 View of Valley Buttress Berm Extension downstream slope. Erosion visible and marked in the photo. Repair was delayed due to habitat concerns from birds which have nested there. Following the site visit, repairs were completed after the birds' migration (LL-2020-08)

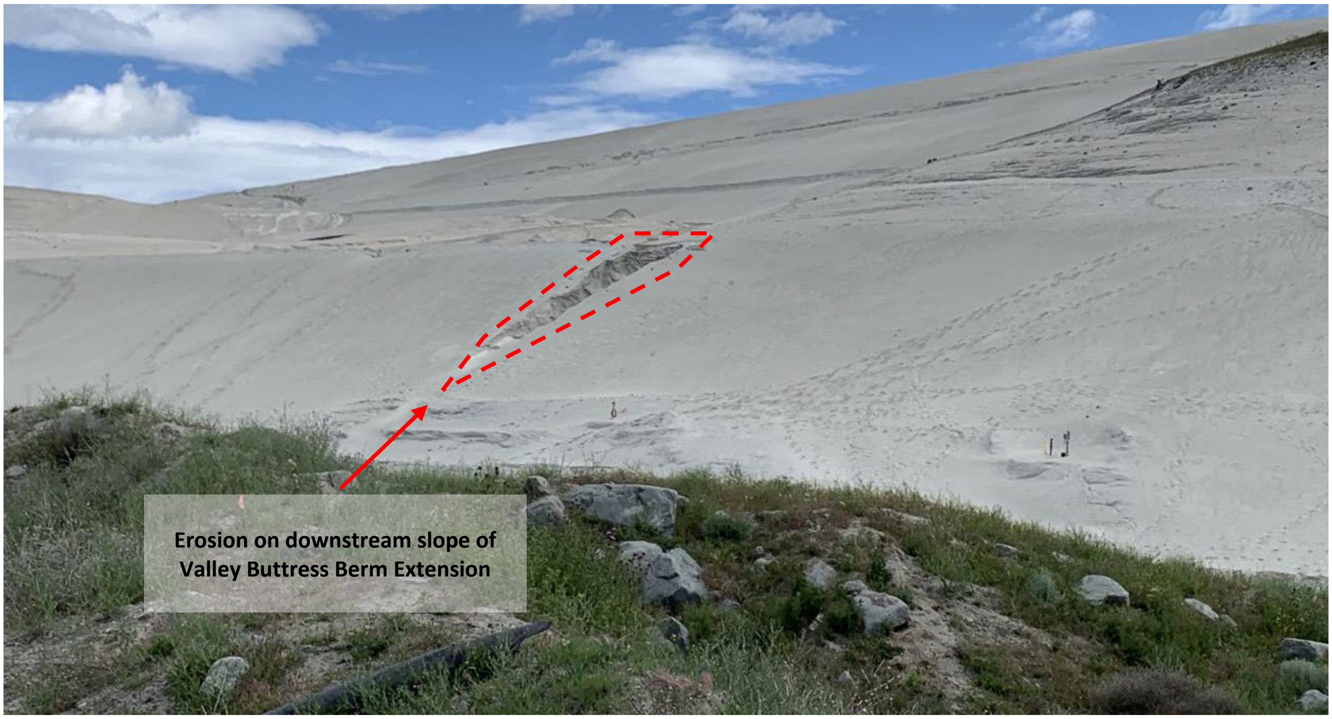


Photo I-A-13 Overview of South Dam downstream slope from crest – looking west (LL-2020-04)

Photo I-A-14 View of South Buttress Berm downstream toe, slope, and foundation area. Seepage was observed at the toe, from area of underdrain, no seepage face observed within cycloned sand. All seepage flows are collected (LL-2020-09)

Photo I-A-15 Overview of South Dam downstream foundation area for 2020 fill placement (LL-2020-09)

Photo I-A-16 View of Minor Drain being constructed at South Dam (LL-2020-10)

Photo I-A-17 View of Secondary Cyclones at South Dam crest – looking upstream (LL-2020-04)

Photo I-A-18 Overview of South Dam foundation area prepared for fill placement, looking south (LL-2020-04)

Photo I-A-19 Overview of L-L Dam beach and pond from South Abutment (top). Comparison with photo from 2019 AFPR site visit (bottom) shows beach width increase. (LL-2020-11)

Photo I-A-20 View of Sediment Pond 1 and downstream toe of the Valley Buttress Berm (VBB) (LL-2020-12)

Photo I-A-21 View of Sediment Pond 1 draining to Seepage Water Reclaim Pond (SWRP) via a channel which will be backfilled and replaced with a pipe as part of prep activities to get Sediment Pond 1 to receive hydraulic placement overflow (LL-2020-12)

Photo I-A-22 Sediment Pond 1 downstream berm. No ponding water was observed downstream side of berm – looking toward South Abutment (LL-2020-12)

Photo I-A-23 Overview of Sediment Pond 1. Seepage visible on exposed divider dyke slope at the expected location. No seepage or wetted face was observed within the dam fill or drainage blanket (LL-2020-12)

Photo I-A-24 Overview of Seepage Pond 2 (LL-2020-13)

Photo I-A-25 View of Seepage Pond 2 outflow and weir (LL-2020-08)

Photo I-A-26 View of Sediment Pond 2 (LL-2020-14)

Photo I-A-27 View of Sediment Pond 4 (LL-2020-15)

Photo I-A-28 View of channel into Sediment Pond 4 (LL-2020-16)

Photo I-A-29 North Buttress Berm low point on north side. Some ponded water was observed which is typical at this location and reoccurs after freshet due to runoff. The ponded water drains draining through the major drain which daylights on north side of NBB. Area is planned to be raised with mechanical placement in 2020 (LL-2020-17)

Photo I-A-30 View of Woods Creek Diversion. Pumps were working and there was no overflow into impoundment (LL-2020-18)

APPENDIX I-B

H-H Dam

Inspection Checklist, Observations and Photographs

Appendix I-B
Annual Facility Performance Report Inspection Checklist, Observations and Photographs – H-H Dam

INSPECTION CHECKLIST

Facility:	H-H Dam	**Inspection Date:**	July 16, 2020
Consequence Classification:	Main Embankment (Very High)		
Weather:	Mostly cloudy	**Inspector(s):**	Rick Friedel, P.Eng. Narges Solgi, EIT.
Minimum observed buffer height (delta level to dam crest):	Variable along dam crest (>3.3 m), the buffer is greatest at Sta. 1+120 based on July 13th survey		

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

EMBANKMENT	Yes/No
U/S slope	☒ Yes ☐ No
Crest	☒ Yes ☐ No
D/S Slope	☒ Yes ☐ No
D/S Toe	☒ Yes ☐ No

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

INDICATOR	EMBANKMENT	INDICATOR	EMBANKMENT
Piping	☐ Yes ☒ No	Settlement	☐ Yes ☒ No
Sinkholes	☐ Yes ☒ No	Sloughing/Slides	☐ Yes ☒ No
Seepage	☐ Yes ☒ No	Animal Activity	☐ Yes ☒ No
External Erosion	☐ Yes ☒ No	Excessive Growth	☐ Yes ☒ No
Cracks	☐ Yes ☒ No	Excessive Debris	☐ Yes ☒ No

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

- no dam safety concerns observed

Comments / Notes:

- Refer to Inspection Observations and photos for further notes.
- Tailings being deposited from HH Pumphouse to 24 Mile Spill Pond visually appeared to cover a wider area than expected. KCB discussed with THVCP and area was surveyed for comparison with tailings area assumed in design.

INSPECTION OBSERVATIONS

Crest

Good physical condition; no visual indicators of concern. There was ongoing crest raise activity at West and Mid Segments of H-H Dam during the inspection. Wet area in low point of tailings beach near H-H Dam was observed during the inspection which was related to surface runoff (Photo I-B-1).

West Abutment

Good physical condition; significant erosion or excessive seepage not observed. THVCP was preparing to relocate SS1 pipes over till core (temporarily) to allow West Abutment foundation preparation and crest raise to be completed (Photo I-B-2 and Photo I-B-3).

East Abutment

Good physical condition; significant erosion or excessive seepage not observed (Photo I-B-4).

Upstream Slope / Tailings Beach

Good physical condition; no erosion of the fill or indicators or concern (e.g. sinkholes) were observed on the beach surface. Beach dry in front of dam fill except for a wet area in the low point on Photo I-B-1 which is typical and related to local runoff. East Abutment deposition point is upstream of the main tailings cone so tailings were flowing away from H-H Dam, towards L-L Dam, with no tailings deposition near H-H Dam face (Photo I-B-5).

Downstream Slope

No observed dam safety issues of concern (e.g. slumping, cracking or large scour) (Photo I-B-6).

Lock-Block Retaining Wall

Generally good physical condition (i.e. no sign of deflection or shifting of blocks). Instrumentation installed (survey prisms, 1x VWP, 1x inclinometer and 1x Sondex settlement system) to monitor local stability of the wall in this area remain operational.

Seepage

No seepage was observed at the toe of the H-H Dam. Seepage typically flows through downstream waste rock towards 24 Mile Area.

24 Mile Waste Dump

No observed issues of concern with potential to impact H-H Dam were observed. Second lift of waste fill had been placed over most of capping area. The old tailings channel (from HH Pumphouse to 24 Mile Spill Pond) was recently blocked with waste to divert flow along new channel. The old channel was backfilled with waste subsequent to the site visit as per KCB recommendation (Photo I-B-6, Photo I-B-7 and Photo I-B-10).

KCB requested confirmation whether light brown area observed in 24 Mile Waste Dump is the relocated tailings from 7-Day Pond (Photo I-B-10). THVCP confirmed that this was actually an area that had not yet been covered by most recent dump lift. No tailings were stored in that area.

24 Mile Spill Pond

Tailings being deposited from HH Pumphouse to 24 Mile Spill Pond had been diverted along the new flow channel which passed over the old pipe laydown area. The tailings visually appeared to cover a wider area than expected. KCB discussed with THVCP and area was surveyed for comparison with tailings area assumed in design (Photo I-B-7, Photo I-B-8 and Photo I-B-10)

INSPECTION PHOTOGRAPHS

LEGEND:

- HH = H-H Dam.
- HH-2020-## refers to Annual Facility Performance Report way points shown on Figure 4.
- All photographs taken during inspections on June 30, 2020, and July 16, 2020.

Photo I-B-1 Overview of H-H Dam crest and tailings beach – View from West Abutment (HH-2020-01)

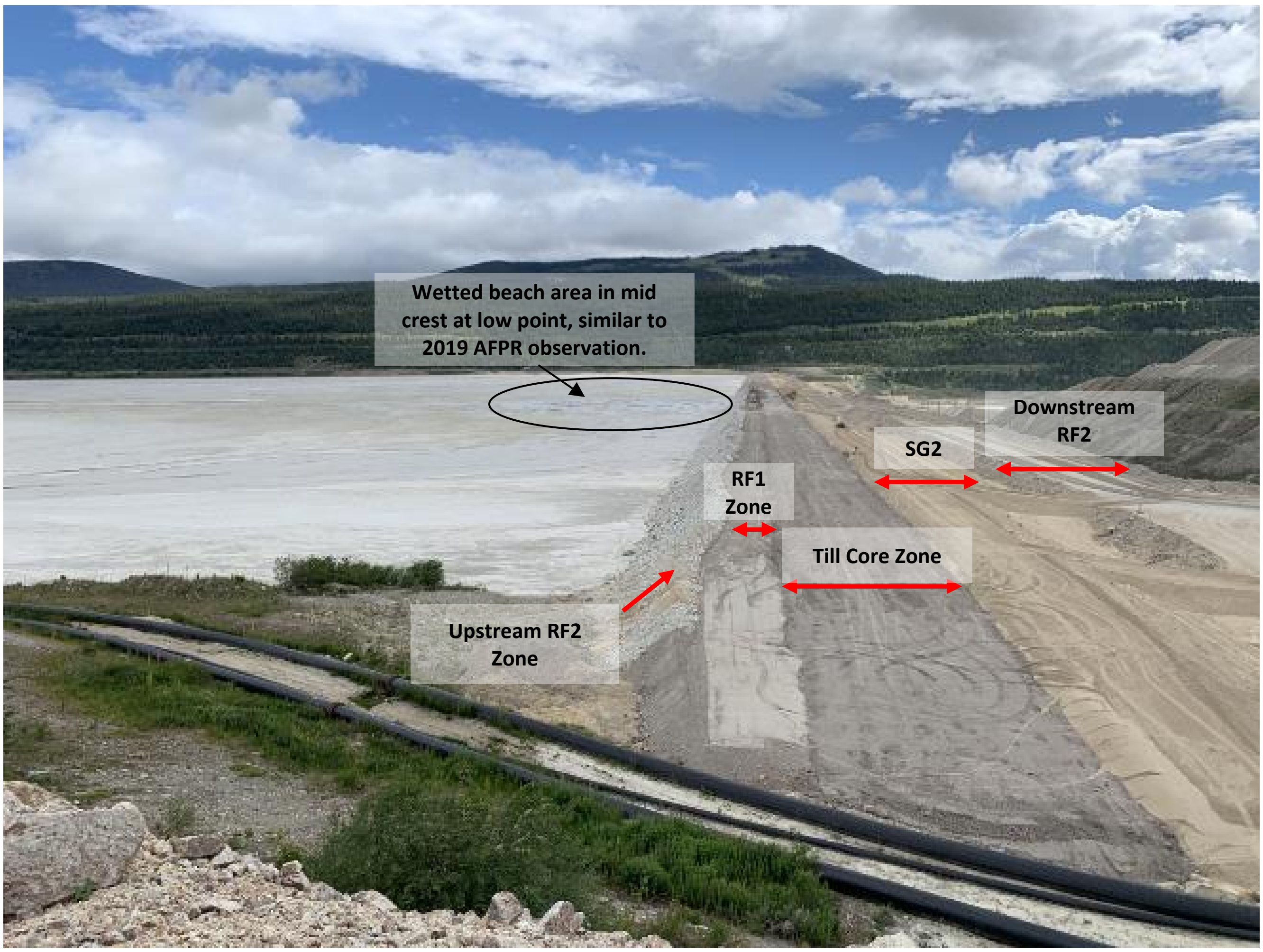


Photo I-B-2 Overview of West Abutment and H-H Dam Pumphouse No.1. SS1 pipes to be relocated over till core (temporarily) to allow West abutment construction to be completed, looking southeast (HH-2020-01)

Photo I-B-3 Overview of West Abutment dam raise. SG2 fill was pulled back near abutment to avoid culvert (ponded area). This area will be prepared for 2021 raise, looking southeast (HH-2020-01)

Photo I-B-4 Overview of East Abutment and upstream tailings beach (HH-2020-02)

Photo I-B-5 Active spigot point (>500 m) upstream of H-H Dam. No flow towards HH Dam. Wetted beach near the dam is from local runoff (HH-2020-03)

Photo I-B-6 View of downstream slope and 24 Mile Waste Dump area (HH-2020-02)

Photo I-B-7 Overview of 24 Mile Waste Dump, 24 Mile Spill Pond and HH Pumphouse. Tailings deposition area of flow from HH Pumphouse to 24 Mile Spill Pond, visually appeared greater than expected (HH-2020-04 and HH-2020-05)

Photo I-B-8 View of tailings overflow, discharging from HH Pumphouse, flowing along new tailings channel, over pipe laydown area, to 24 Mile Spill Pond (HH-2020-06)

Photo I-B-9 View of 24 Mile Spill Pond and 24 Mile Waste Dump with relocated pipe laydown in foreground (HH-2020-07)

Photo I-B-10 View of 24 Mile Waste Dump, second lift of waste has been placed (HH-2020-08)

APPENDIX II

Climate Data

Appendix II
Climate Data

THVCP provided weather data from the L-L Dam climate station (El. 1186 m) which is the nearest climate station to the site. To support key precipitation trends and impacts on observed dam performance, data from Kamloops Pratt Road (Environment Canada Station No. 116C8P0, El. 729.0 m) was reviewed for comparison. Previous Annual Facility Performance Reports (AFPRs) compared the Highland TSF data with Kamloops Airport (Environment Canada Station No. 1163781, El. 345 m) data, but this station was missing too much data in 2020. Precipitation records from L-L Dam and Kamloops Pratt Road between November 2019 and November 2020 are tabulated and plotted in Table II-1 and Figure II-1, respectively. Precipitation normals, reported in Table II-1, are based on the Highland Valley Lornex Synthetic Record using Golder (2019).

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 by THVCP to monitor snowpack. The measurements are sorted by survey period (the first of January through May) to compare snowpack depths, in snow-water equivalent (SWE), for the same period each year. Historical average and 2020 snowpack depths based on available records are summarized in Table II-2.

The following observations were noted for the reporting period (refer to Figure II-1):

- More than 10% of the L-L Dam weather station precipitation data were missing in March, June, and July. Due to these data gaps, the 2020 climate data from site was augmented with data from a regional weather station to support a comparison with historic normals.
- All storm events during 2020 were less than the 10-year return period rainfall event (40 mm in 24 hours). The largest 24-hour rainfall events measured at the L-L Dam Weather Station, during the review period, were: 23.3 mm on October 23; 23.1 mm on May 30; 18.2 mm on May 17; and 12.9 mm on September 19.
- January through April precipitation was significantly less than historic normals except the precipitation in February which was higher than average.
- May precipitation was almost twice as much as the historic normals. October precipitation was also more than 60% greater than historic normals.
- Figure II-1 indicates low precipitation at site during June and July; however, this is due to L-L Dam Weather Station data gaps during this period. THVCP inspection reports and regional climate station data indicate precipitation during this period was above historic normals.
- Snowpack depth measurements, from the Highland Valley station, indicate the snow had been melted by May 1, 2020.

Table II-1 Monthly Precipitation

Month [1]	Availability of Data (%)	Precipitation (mm)		
	L-L Dam Weather Station	L-L Dam Weather Station Data	Average Lornex Synthetic Record Adjusted to Highland Tailings Storage Facility (TSF) [2]	Kamloops Pratt Road Weather Station
Nov 2019	100	21.6	38.2	49.2
Dec 2019	97	22.5	41.4	36.6
Jan 2020	100	21.4	36.9	64.8
Feb 2020	100	29.8	23.3	45.4
Mar 2020	89	4.0 [3]	21.1	3.4
Apr 2020	100	14.8	22.0	16.4
May 2020	100	83.5	40.9	98.8
Jun 2020	32	9.6 [3]	45.7	78.0
Jul 2020	11	6.2 [3]	35.6	44.2
Aug 2020	100	26.2	33.8	15.2
Sep 2020	100	24.7	32.0	17.6
Oct 2020	99	54.6	32.7	69.6
Nov 2020	100	27.6	38.2	34.2

Notes:
1. Review period for Highland Annual Facility Performance Report is from November 2019 through November 2020.
2. Estimated by Golder (2019) using appropriate adjustment factors and average precipitation measured at Highland Valley Lornex climate station (Environment Canada ID No. 1123469 at El. 1268 m from 1976 to 2011). Golder (2019) infilled the data gaps prior to November 2011 and created a long-term synthetic precipitation record. Monthly average of the synthetic record adjusted to Highland Tailings Storage Facility (TSF) by a Lornex-to-TSF adjustment factor of 1.1 are shown herein, refer to Golder (2019) for detailed information.
3. Monthly precipitation with more than 10% missing data.

Figure II-1 Monthly Precipitation

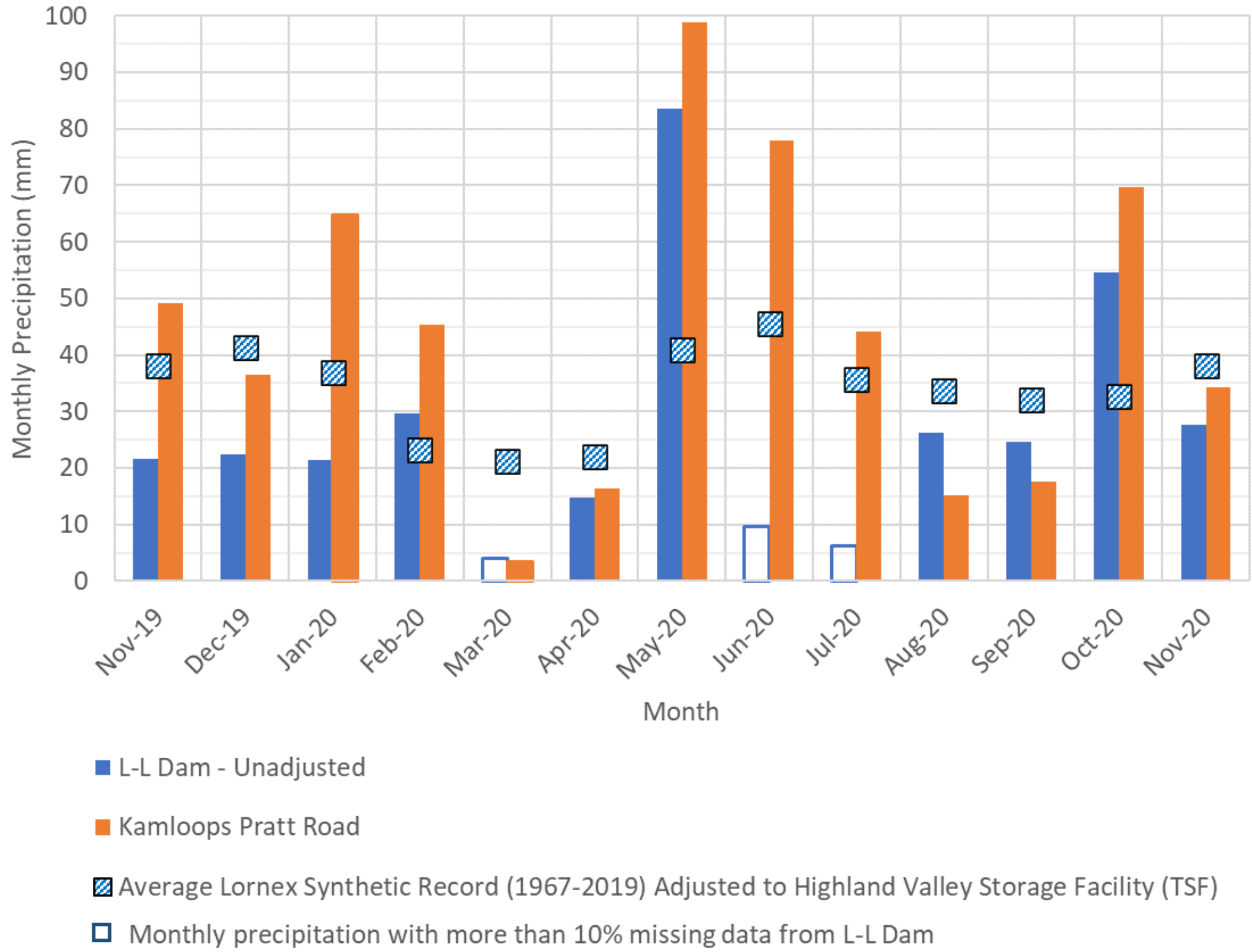


Table II-2 Historical Average and 2020 Snowpack Depths

Survey Period	Years of Record[1]	Historic Average Snowpack Depth[2] (mm SWE[3])	2020 Snowpack Depth (mm SWE[3])	Percent Change Relative to Historic Average
January 1st	11	50.2	Not surveyed	N/A
February 1st	25	83.5	Not surveyed	N/A
March 1st	54	91.2	100	10%
April 1st	52	100.8	Not surveyed	N/A
May 1st	53	28.1	0	-100%
May 15th	25	2.4	Not surveyed	N/A
June 1st	8	0	Not surveyed	N/A

Notes:
1. At the Highland Valley snow survey station (Station No. 1C09A) near the Bethlehem TSF. Data prior to 1966 were 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.

APPENDIX III

L-L Dam Instrumentation Summary

APPENDIX III-A

L-L Dam Response Summary

Appendix III-A
L-L Dam 2020 Instrumentation Summary

III-A-1 INSTRUMENTATION SYSTEM

Table III-A-1 summarizes instruments installed within or near the L-L Dam as of November 2020. Location of instruments are shown on Figure 3 of the main text. November 2020 instrumentation readings are shown on select design cross sections, through each dam segment, of the L-L Dam (Figure 8 to Figure 14). Instrumentation summary plots are included in Appendix III-B (piezometers) and III-C (inclinometers).

The instrumentation at L-L Dam is adequate to monitor dam performance and includes redundancy in key areas to account for disruptions in data collection at some instruments (e.g. software or hardware issues with automated instruments or physical damage).

The number of instruments varies throughout the life of the structure as some are damaged or new ones are added and the current status of the instrumentation system is recorded in the Master Instrument Register which is maintained by both THVCP and KCB. Readings for the majority of instruments are automated through the GeoExplorer software package.

Reading frequency for instruments vary depending on the location and control requirements. Reading frequency for manual piezometers and all inclinometers were reviewed in 2020 and the new requirements defined in MRM-2020-005[1] which was incorporated into the OMS Manual update. Readings from automated piezometers are typically collected more frequently.

Table III-A-1 Summary of Functional Instrumentation Installed at L-L Dam (November 2020)

Instrument	Type	Reading (1)	No.	Total
Piezometers	Standpipe	Manual	45	202
	Converted Standpipe to Vibrating Wire	Automated	60	
	Vibrating Wire	Automated	97	
Inclinometers	Down-hole Casing	Manual	17	36
	In-Place Inclinometer (IPI) (2)	Automated	1	
	ShapeArray (SAA or SAAV) (2)	Automated	15	
Seepage Weir	-	Manual	3	3

Notes:
1. Automated readings are transmitted through the remote monitoring system to increase data capture and summarize instrumentation.
2. IPI and SAA/SAAV are installed in down-hole casing inclinometers over a discrete elevation range which is defined by the EoR to target critical units.

[1] Klohn Crippen Berger Ltd. 2020. "L-L and H-H Dam Instrumentation Monitoring Frequency – Draft". November 5.

III-A-2 INCLINOMETER MOVEMENT SUMMARY

III-A-2-1 Valley Buttress Berm

At the end of 2020, 8 of the 12 inclinometers installed at the VBB are functional, refer to Figure III-A-1. A primary function of the instruments is to monitor deformation within the L-GLU to support implementation of the Observational Method as described in KCB (2018)[2]. For redundancy, the instruments are roughly split along two parallel instrumentation lines perpendicular to the crest. General IDs were assigned to identify the location along the downstream slope each inclinometer is installed (Figure III-A-1).

The non-functioning inclinometers at the VBB are:

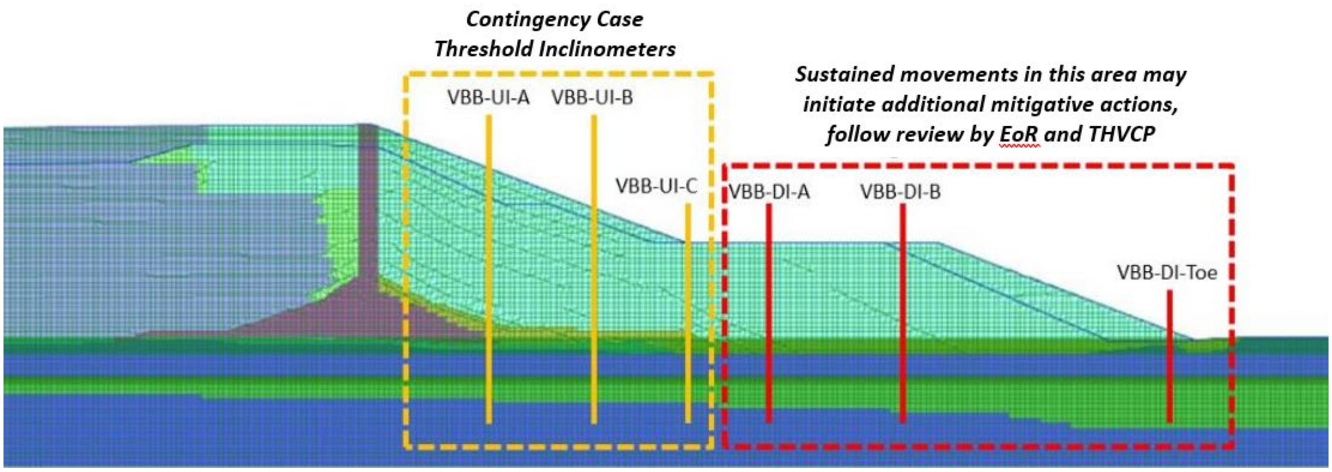
- I15-24 – IPI is stuck in the hole (I15-24), THVCP has a plan to reinstate in 2021;
- LLSAA12-1 – is an SAA which went in and out of service throughout the year related to software/hardware issues;
- I10-6 – the casing broke down the hole, in the cycloned sand fill and can no longer be measured; and
- I10-7 – the inner grooves that the measurement probe travels along is misaligned which impacts the ability to collect reliable readings.

At the end of 2020, the inclinometers at location VBB-UI-B (Figure III-A-1) along VBB downstream slope are out of service. The functional inclinometers are adequate to monitor dam performance of the existing structure. However, inclinometer coverage at VBB-UI-B is required to implement the Observational Method as described in KCB (2018)[2]. On that basis, KCB has recommended that a replacement inclinometer be installed near VBB-UI-B if one cannot be reinstated in early 2021.

KCB reviewed the cause of the casing damage at I10-6 and I10-7 and concluded they were not related to shear movements in the dam. The breakage at I10-6 occurred within cycloned sand dam fill where the casing had been raised and the segment of the casing which broke was exposed to atmosphere for an extended period which has been shown to weaken the casing and make it more brittle. The inclinometers upstream and downstream of I10-7 do not show movement zones within the cycloned sand fill and there was no indication of shear movement developing at the inclinometer before going out of service.

[2] KCB. 2018. "L-L Dam Permit Amendment – Modified Base Case and Valley Buttress Berm Contingency Case – 2018 Update." December 19.

Figure III-A-1 VBB Inclinometer Location ID



Location ID	Inclinometers North of ~Sta. 2+000	Inclinometers ~Sta. 1+910	Inclinometers ~Sta. 1+850
VBB-UI-A	SAAV I17-01	-	I17-06
VBB-UI-B	I10-6 (not functional)	LLSAA12-1 (not functional)	I10-7 (not functional)
VBB-UI-C	-	-	I17-02
VBB-DI-A	I17-19	-	I17-09
VBB-DI-B	I17-10	-	I15-24 (not functional)
VBB-DI-Toe	SAAV I17-11	-	SAAV I15-27

Typical movement rates measured with the L-GLU, which governs design, at the VBB inclinometers during 2020 are summarized in Table III-A-2 for both construction and no construction loading. Construction loading movement rates were below threshold values and those measured during 2018 and 2019 which both had downstream fill placement at the VBB which was not done during 2020. The direction of movement inferred from the inclinometer readings are summarized on Figure III-A-2 which show a movement direction which is generally downstream but variable. Both are consistent with expected behaviour based on design analysis, natural variability within the L-GLU deposits and accuracy of the inclinometers at this scale of movement (i.e. mm).

Figure III-A-2 VBB Inclinometers Movement Directions at L-GLU unit

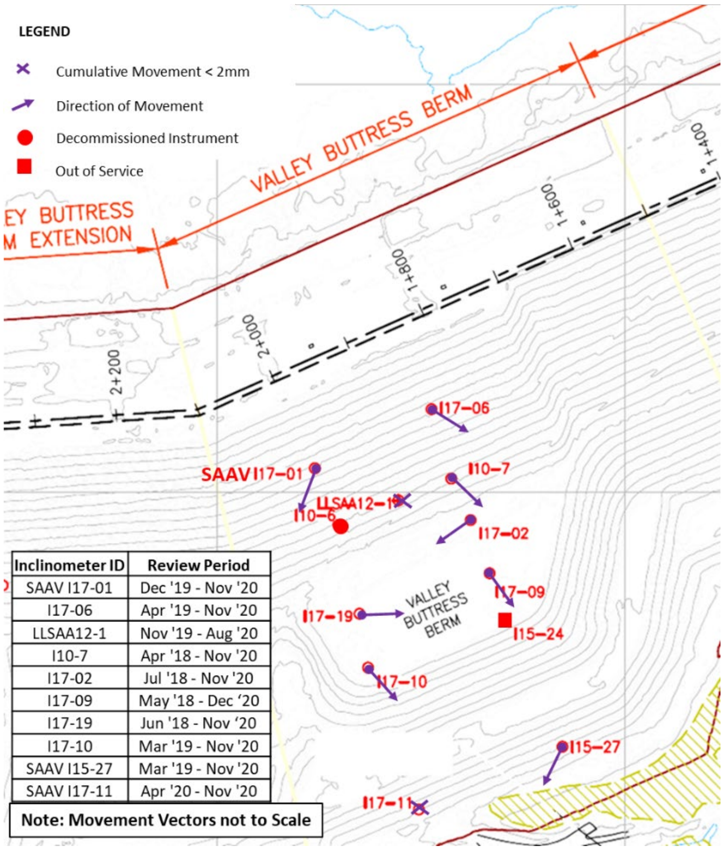


Table III-A-2 Measured Movement Rates at VBB Inclinometers During Review Period

Inclinometer	Location ID	L-GLU Elevation Range (est.) (m)	No Construction Average Movement Rates (mm/month)	Construction Peak Movement Rates (mm/month)
I17-01	VBB-UI-A	1073.6 – 1082.6	0.3	0.3
I17-06	VBB-UI-A	1076.2 – 1086.2	<0.1	0.3
LLSAA12-1	VBB-UI-B	1076.0 – 1077.0	Note 1	Note 1
I10-06	VBB-UI-B	1075-1080	Note 2	Note 2
I10-07	VBB-UI-B	1070.0 – 1079.0	<0.1 (3)	0.2 (3)
I17-02	VBB-UI-C	1076.1 – 1079.1	0.2	<0.1
I17-09	VBB-DI-A	1075.1 – 1079.1	<0.1	<0.1
I17-19	VBB-DI-A	1078.0 – 1080.4	<0.1	<0.1
I15-24	VBB-DI-B	1076.3 – 1081.3	Note 2	Note 2
I17-10	VBB-DI-B	1072.3 – 1078.3	0.2 (4)	<0.1
I15-27(3)	VBB-DI-Toe	1067.0 – 1071.5	<0.1 (5)	<0.1 (5)
I17-11	VBB-DI-Toe	1071.4 – 1075.4	<0.1	<0.1

Notes:
1. Anomalous readings related to software and hardware issues.
2. Instrument was damaged and data was not available since August 2019.
3. Instrument was damaged and data was not available after October 2020.
4. Peak movement rate measured was 0.7 mm/month from January to February 2020 which was related to 2019 construction. Movement rate had fully attenuated to 0.2 by May 2020.
5. Instrument was automated to an SAAV in April 2020; data between January 2020 and April 2020 was not available.

III-A-2-2 North Buttress Berm

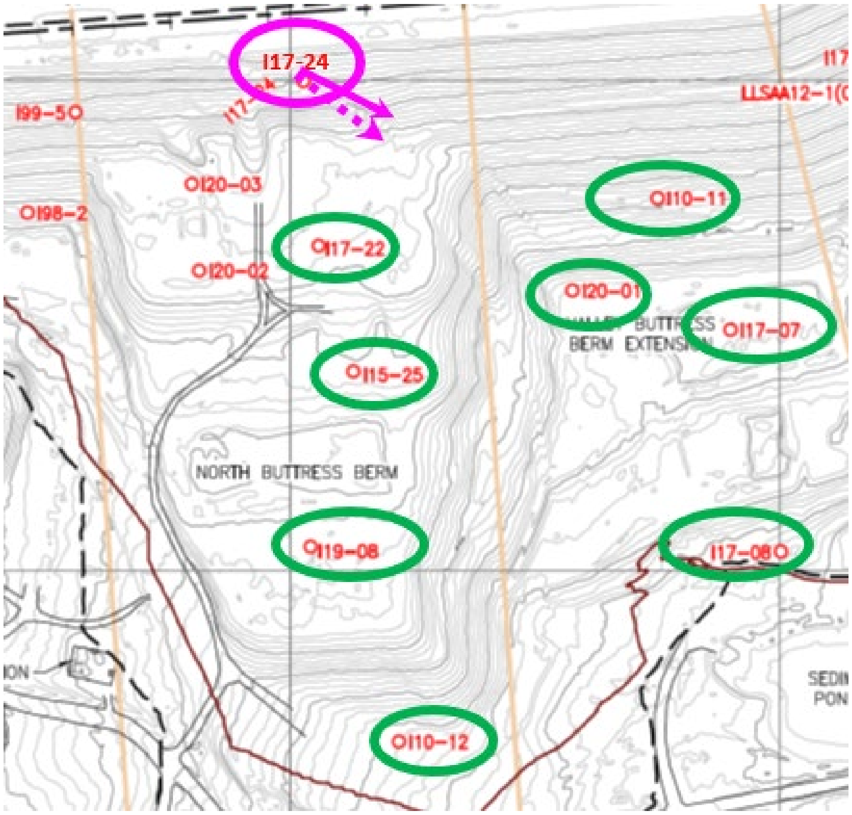
At the end of 2020, all five of the inclinometers installed at the NBB are functional, refer to Figure 3 of the main report. During November 2020, two additional inclinometers were installed at the NBB which will be commissioned and add to the surveillance program in 2021. A primary function of the instruments is to monitor ongoing shear along mudstone layers within the foundation, near the crest, and whether those movements propagate towards the toe. To date, shear movements have only been measured by the inclinometer nearest to the crest (I17-24) and not at any of the downstream inclinometers which was also the case for 2020.

Typical movement rates measured along the mudstone layers at I17-24 during 2020 are summarized in Table III-A-3 for both construction and no construction loading. Construction loading movement rates were below threshold values and consistent with the expected behaviour based on design. The direction of movement inferred from manual inclinometer readings are shown on Figure III-A-3 which is consistent with the historic movement direction. Inclinometers confirm the movement is not propagating downstream beneath the VBBE either.

Table III-A-3 Summary of Typical Measured Movement Rates at NBB Inclinometer I17-24

Inclino.	Station	Location	Construction Influenced Peak Movement Rate (mm/month)		No Construction Average Movement Rate (mm/month)	
			2018	2020	2018	2020
I17-24	2+575	Upper Slope	2.1	0.9	1.2	0.2

Figure III-A-3 Direction of Movement Along Mudstone Layers Measured at I17-24



III-A-2-3 North Dam

At the end of 2020, all twelve of the inclinometers installed at the North Dam Bedrock and U-GLU segments are functional, refer to Figure 3 of the main report. A primary function of the instruments is to monitor ongoing shear along mudstone layers (North Dam Bedrock) or U-GLU (North Dam U-GLU) within the foundation and potential movements which may indicate yielding within the passive wedge which is relied upon for stability in design.

Typical movement rates measured during 2020 at inclinometers which have intercepted either mudstone or U-GLU layers are summarized in Table III-A-4**.** for both construction and no construction loading with 2018 rates shown for comparison. Construction loading movement rates were below threshold values and there was no propagation measured in the downstream passive wedge. Both observations are consistent with the expected behaviour based on design.

Multiple inclinometers in the North Dam segments were converted from manual to SAAV inclinometers. THVCP and KCB are completing checks to confirm the interpreted movement directions are reliable. However, movements were measured at the previously observed elevations and a reason for established movement directions to have changed has not been identified.

Table III-A-4 Summary of Typical Measured Movement Rates at North Dam Inclinometers

Inclino.	Station	Location	Foundation Unit Governing Design (Mudstone or U-GLU)	Construction Influenced Peak Movement Rate (mm/month)		No Construction Movement Average Rate (mm/month)	
				2018	2020	2018	2020
I99-5	2+800	Upper slope	Mudstone	1.2	0.7	<0.2	<0.1
I98-2	2+860	Lower slope	Mudstone	1.2	0.4	<0.2	<0.1
I19-01	2+900	Toe	Mudstone	-	0.1 (Note 2)	<0.2	<0.1
I98-3	2+950	Upper slope	Mudstone	1.0	0.3	<0.2	<0.1
I19-02	3+150	Toe	No	-	-	-	-
I10-3	3+150	Mid slope	U-GLU	5	<0.1	<0.2	<0.1
I19-03	2+900	Toe	No	-	-	-	-
I16-5	3+400	Mid slope	U-GLU	Note 1	<0.1	<0.2	<0.1
I16-1	3+510	Mid slope	U-GLU	Note 1	<0.1	<0.2	<0.1
I19-04	3+150	Toe	No	-	-	-	-
I99-6	3+600	Upper slope	No	-	-	-	-
I16-4	3+750	Toe	U-GLU	<0.2	<0.1	<0.2	<0.1

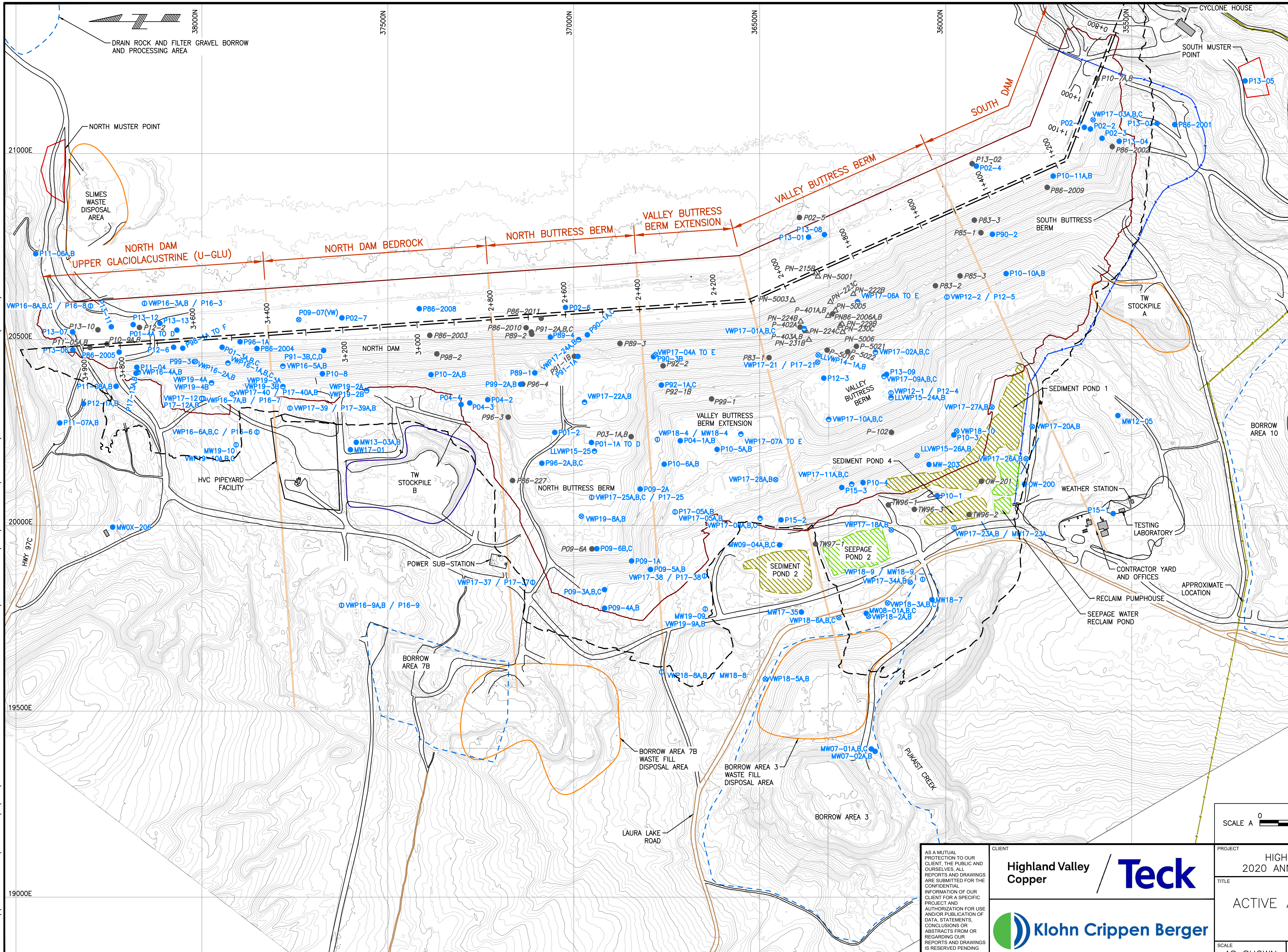
Notes:

1. In-place Inclinometers were reinitialized, and measurements were not reliable
2. Movement rate calculated excluding influence of compression feature in inclinometer casing. KCB reviewed and concluded movements are not related to shear or yielding of passive wedge.

APPENDIX III-B

L-L Dam Piezometer Plots

L-L Dam Piezometer Location Map



LEGEND:

- BORROW AREA
- WASTE FILL DISPOSAL AREA
- SEEPAGE POND
- SEDIMENT POND
- EL. 1279 m ULTIMATE DAM FOOTPRINT
- SURFACE WATER RECLAIM PIPELINE
- SPATSUM WATER PIPELINE
- HAUL ROAD
- PUBLIC ROAD
- 2040 PFS DAM FOOTPRINT
- 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 AND BACKFILLED DRILLHOLES (SEE NOTE 3):

- DEFUNCT PNEUMATIC PIEZOMETER
- DEFUNCT STANDPIPE PIEZOMETER

NOTES:

1. TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER PARTNERSHIP AND WAS DERIVED FROM PHOTOSAT SURVEY DATED 2020-10-08 (L-L DAM) AND 2017-09-15 & 24 AND 2016-09-25 & 29 (OUTSIDE OF 2020 SURVEY EXTENT).
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.

SCALE A 0 250 m

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: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: L-L DAM ACTIVE AND DEFUNCT PIEZOMETERS LOCATION PLAN

SCALE	PROJECT No.	FIG. No.
AS SHOWN	M02341B83	

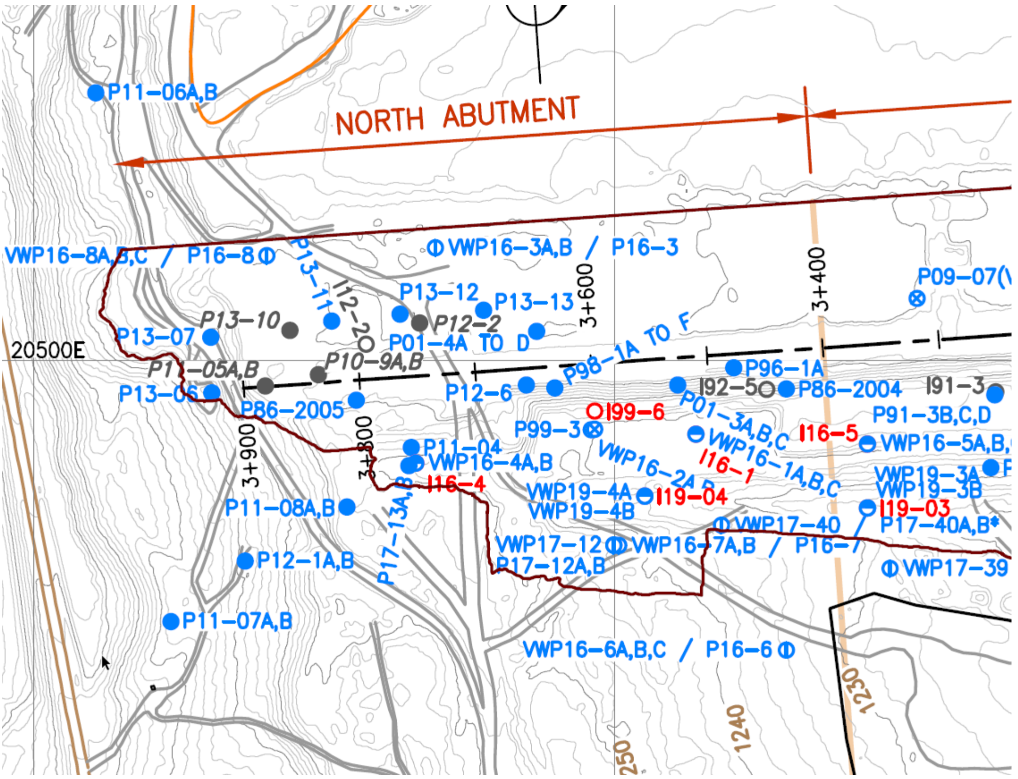
KCB-FIG-D-L

SAVE DATE: 2020-12-15 (9:01 AM) FILE PATH: \\INT.KLOHN.COM\PROJDATA\M\VCR\M02341B53 - HVC-2019 DAM SAFETY SUPPORT\400 DRAWINGS\CAD\05-FIGURES\2020 AFPR\L-L DAM-PIEZOMETERS.DWG (THAWKER)

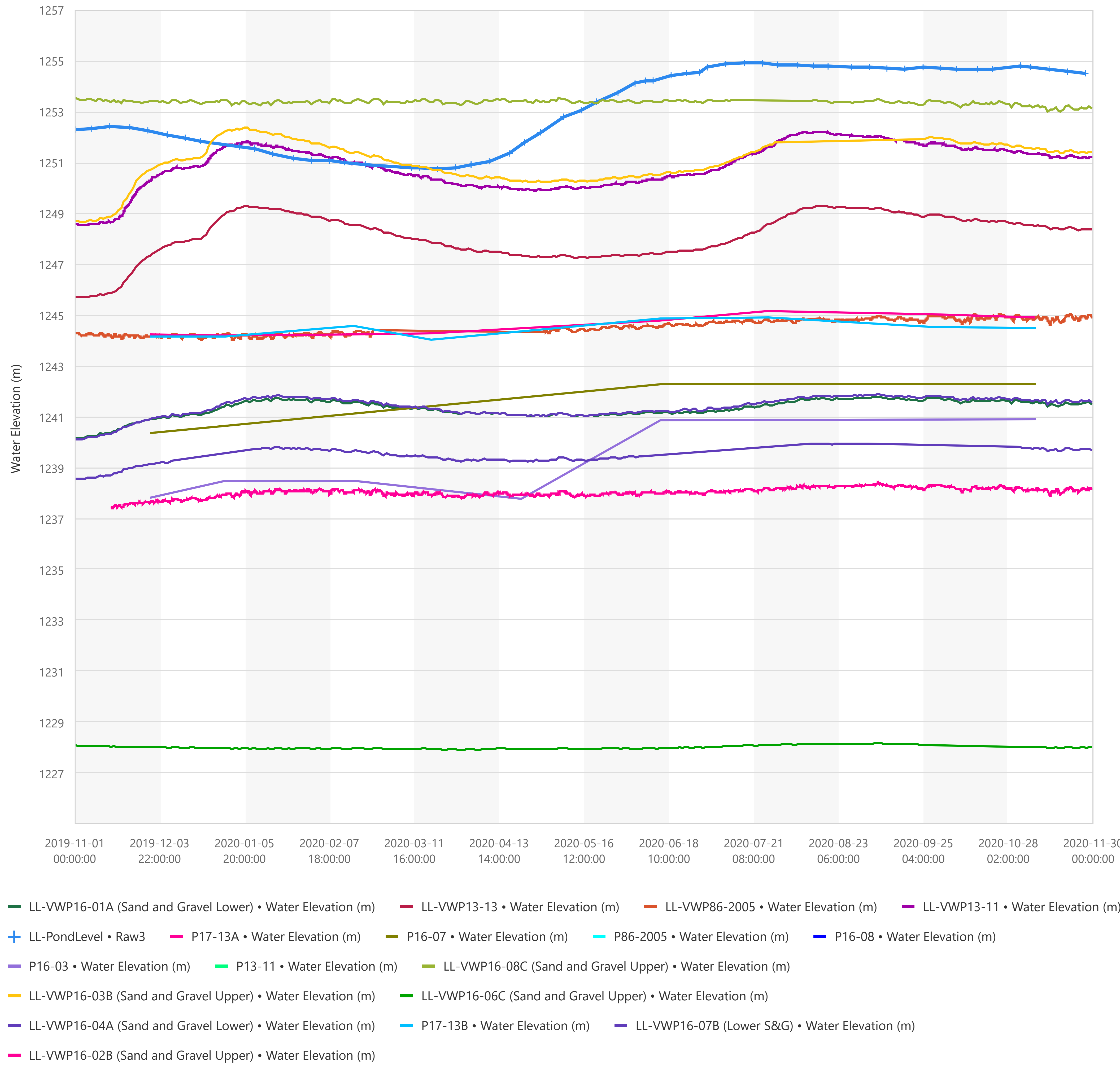
Appendix III-B-1

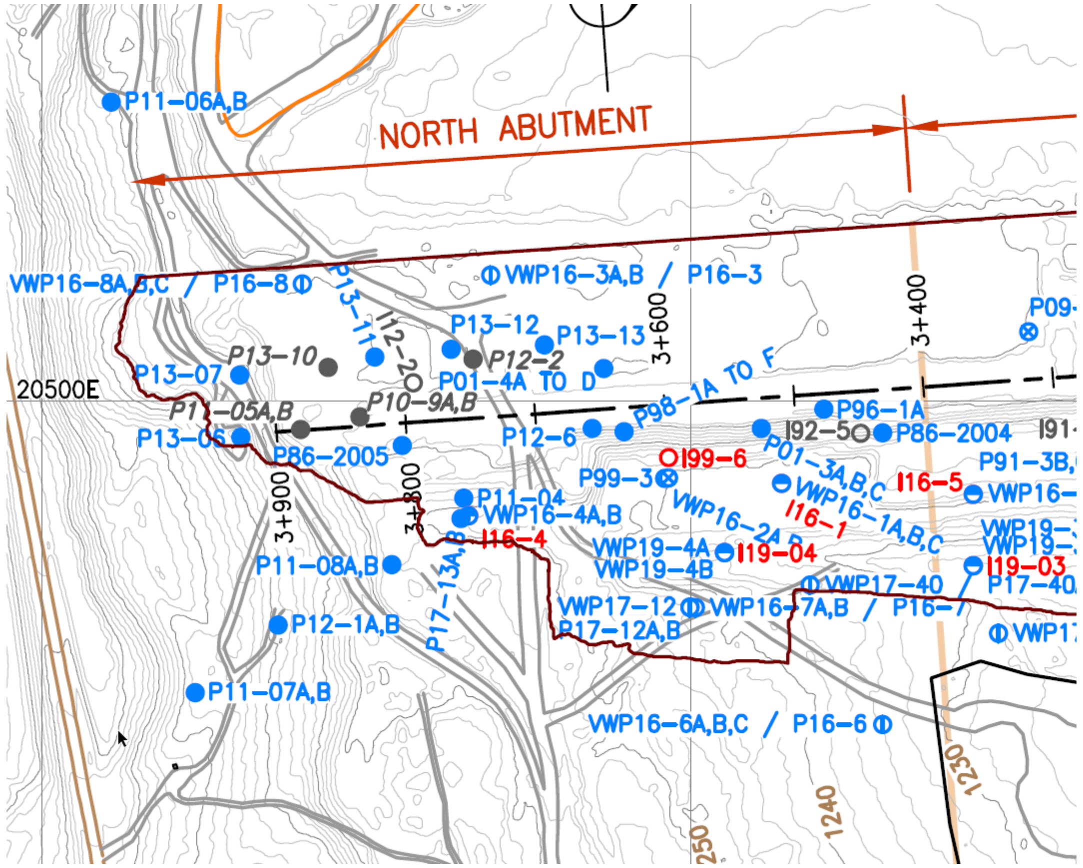
L-L Dam Piezometers: 2020 Water Elevations

North Dam Upper Glaciolacustrine (North Abutment) 2020 Water Elevations

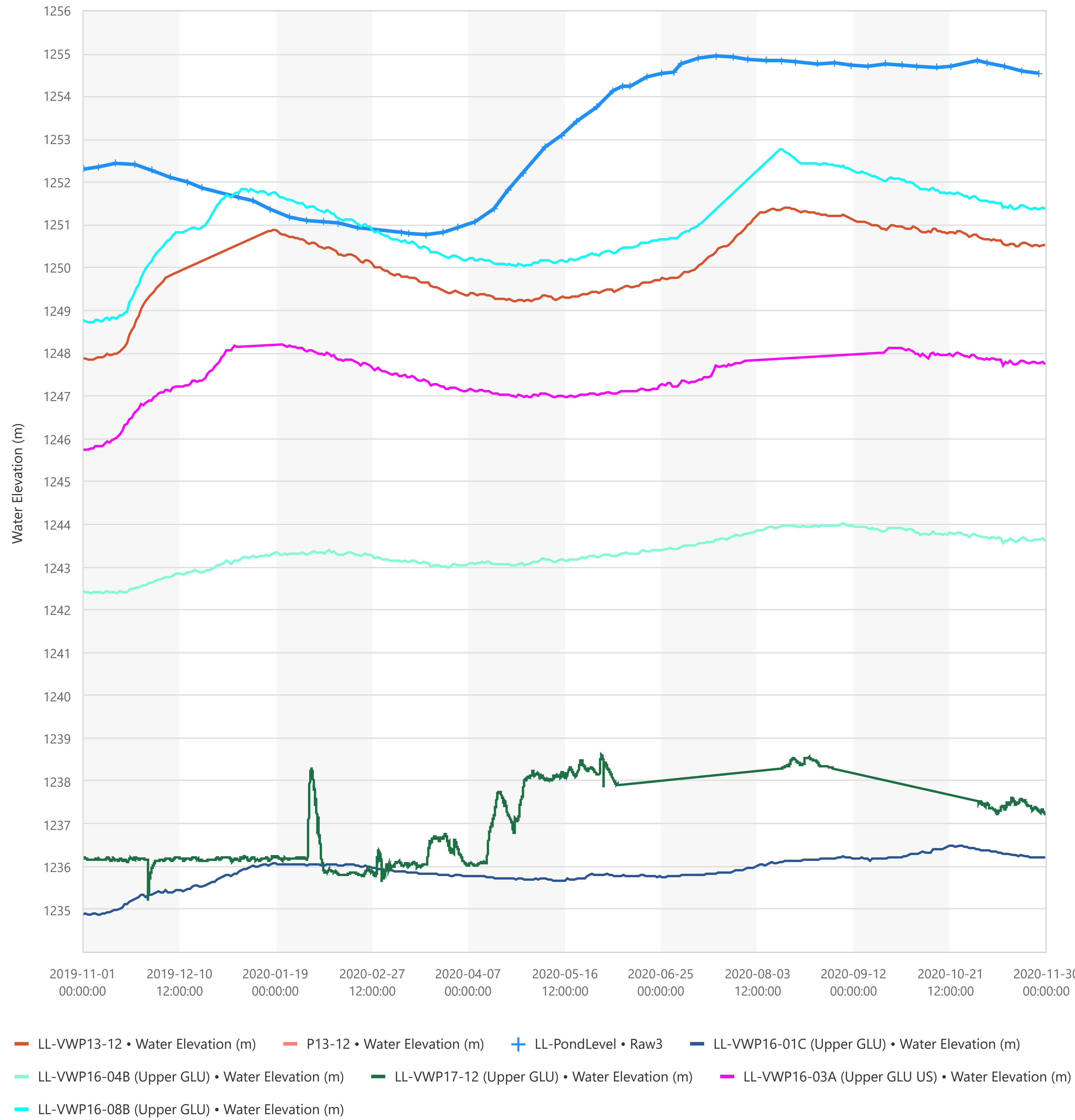


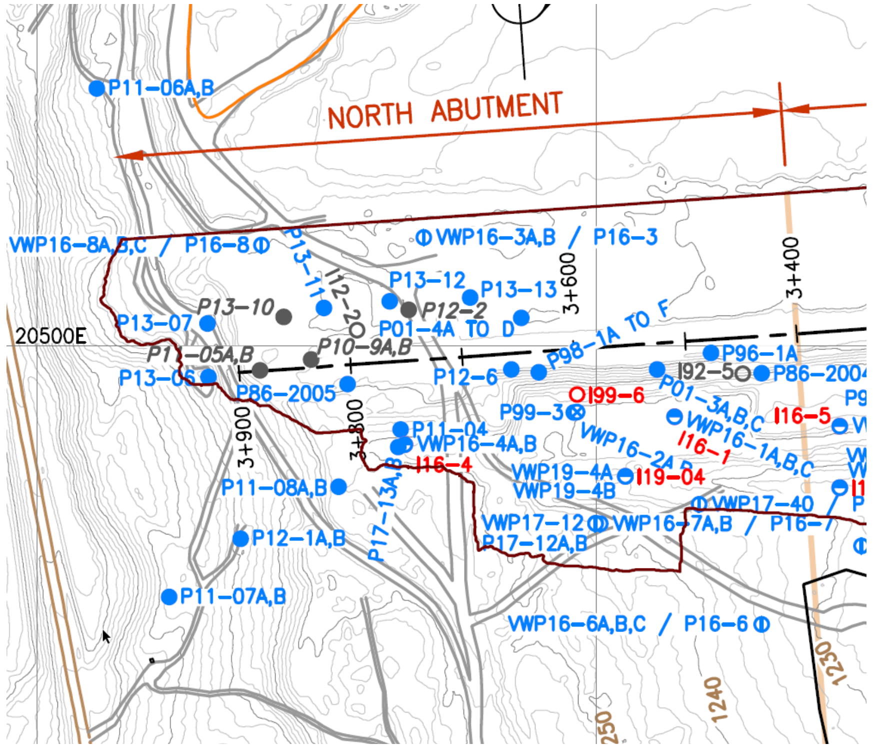
North Dam U-GLU - Sand and Gravel



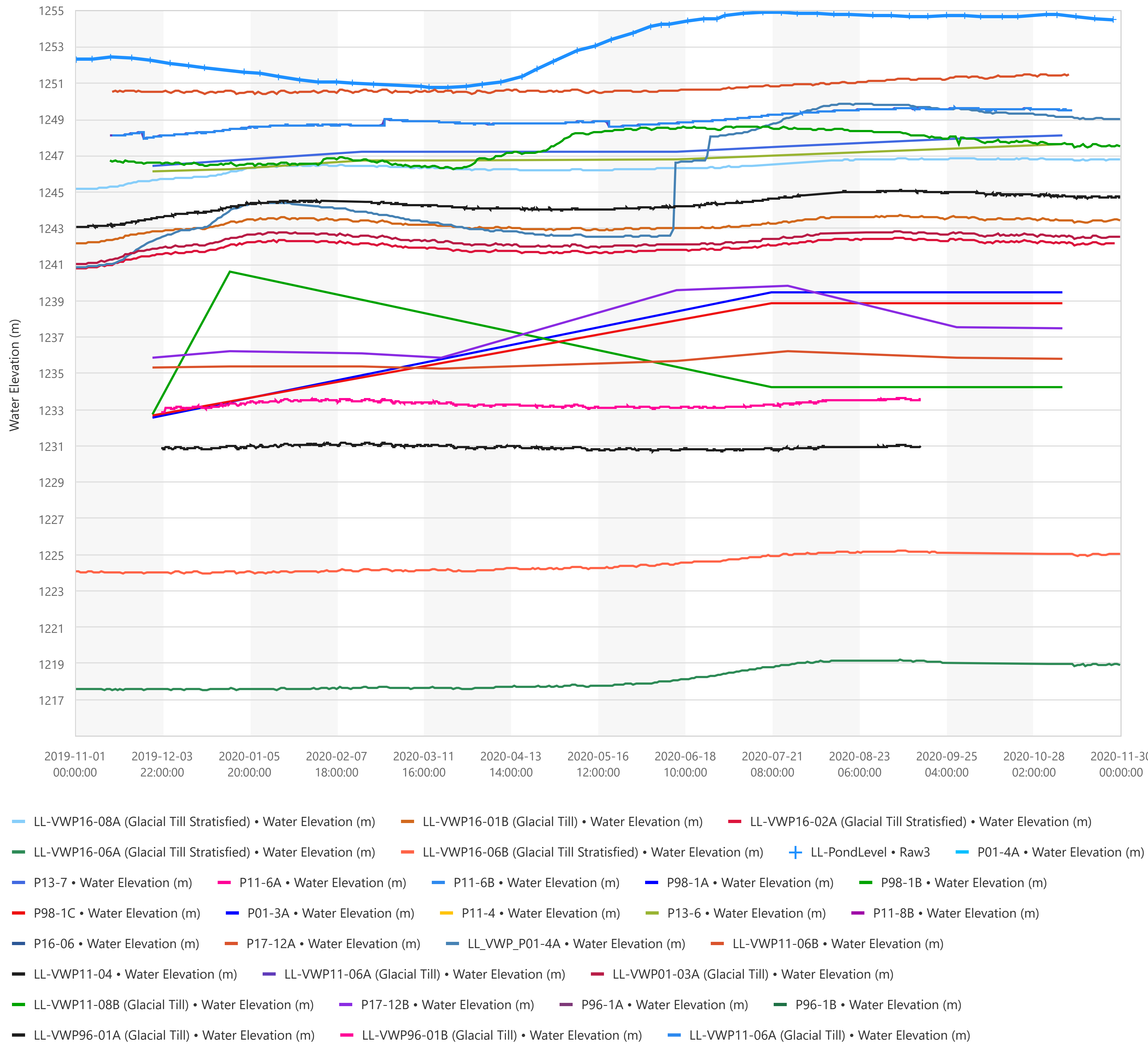


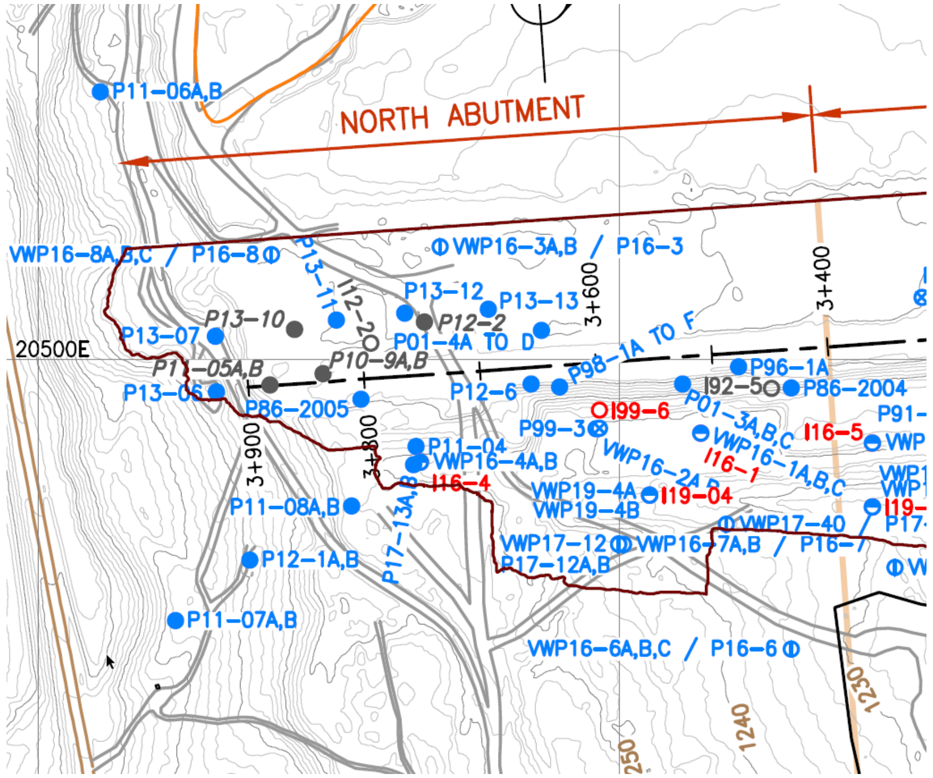
North Dam U-GLU - Glaciolacustrine



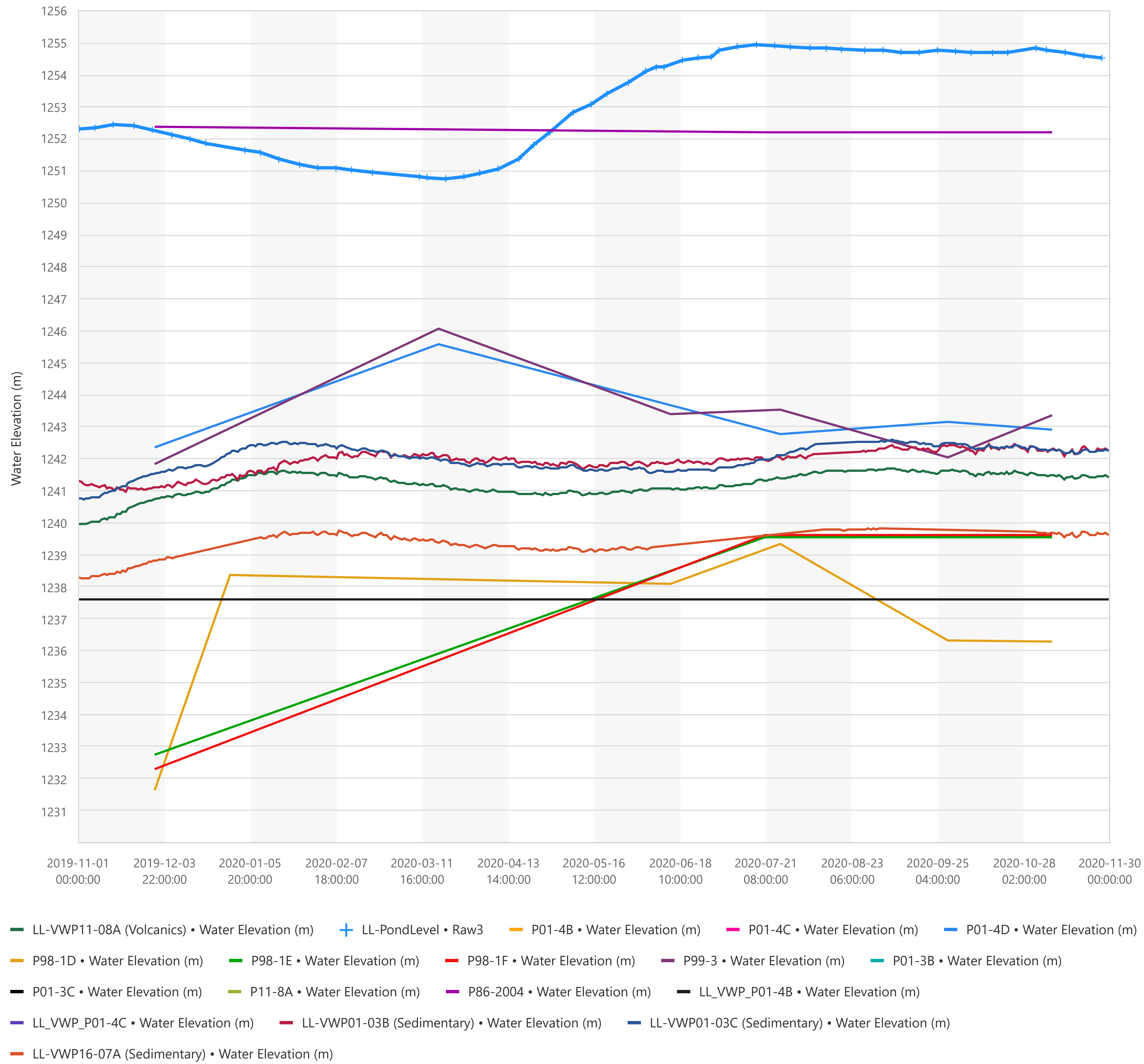


North Dam U-GLU - Glacial Till

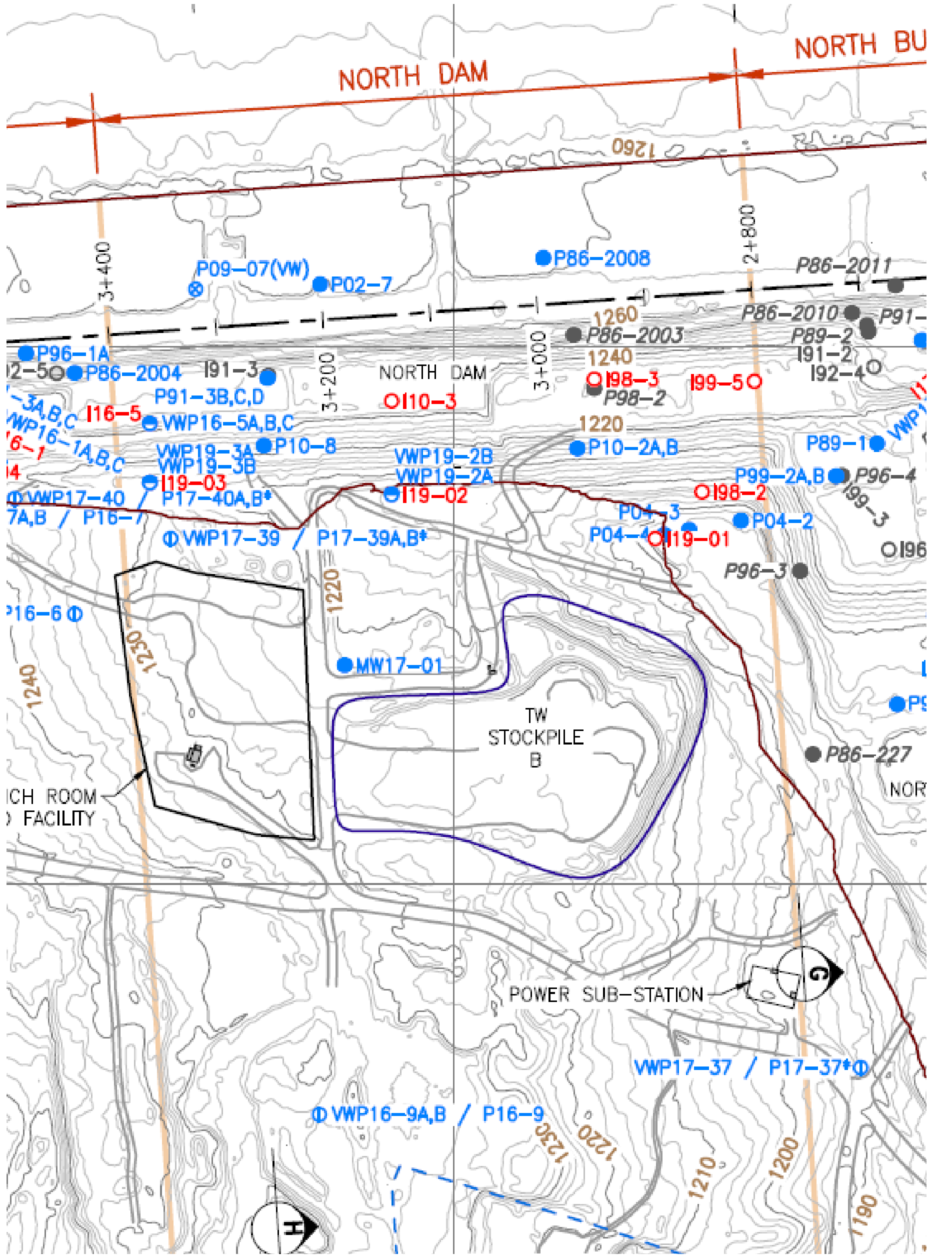




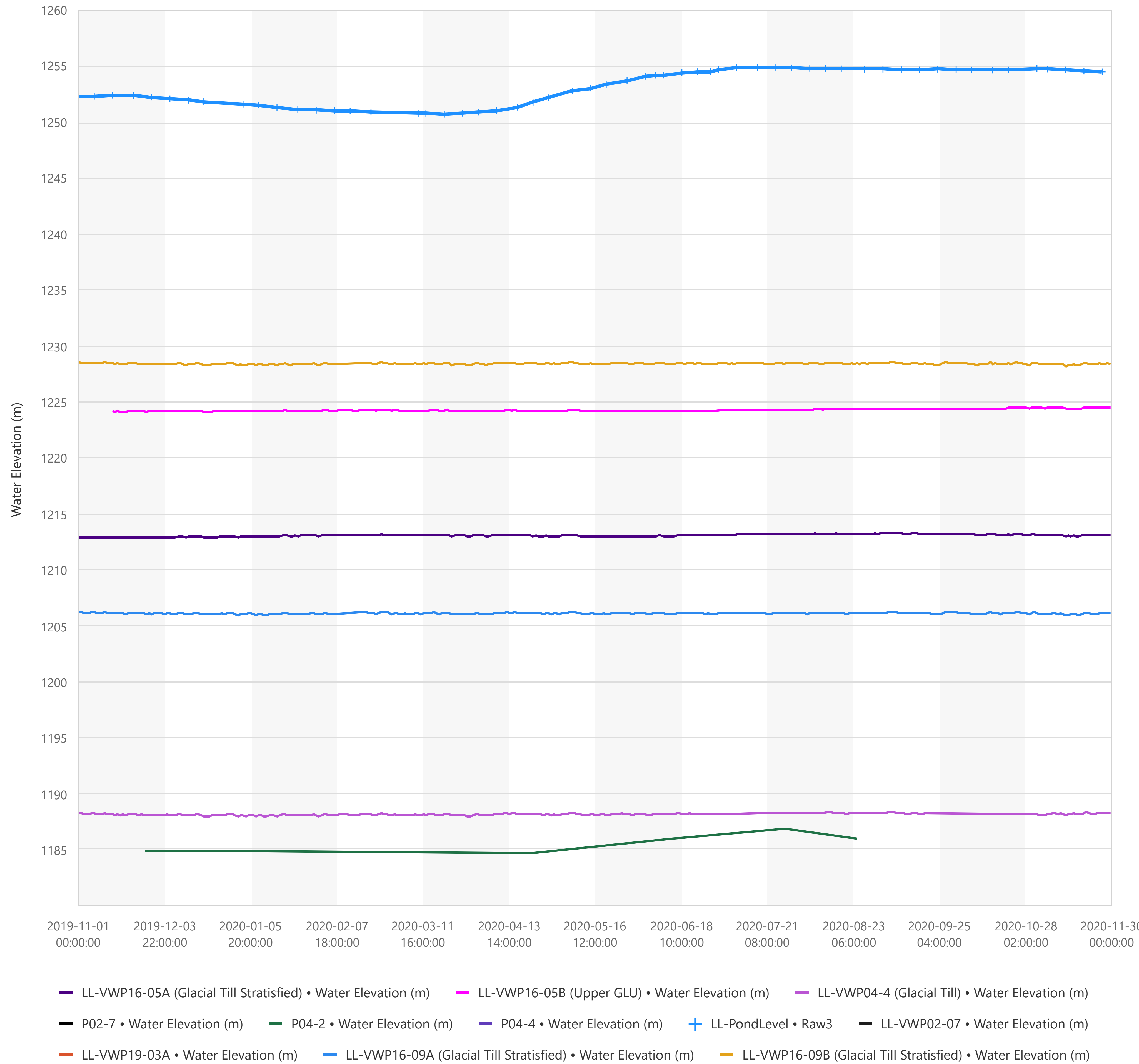
North Dam U-GLU - Foundation Rock

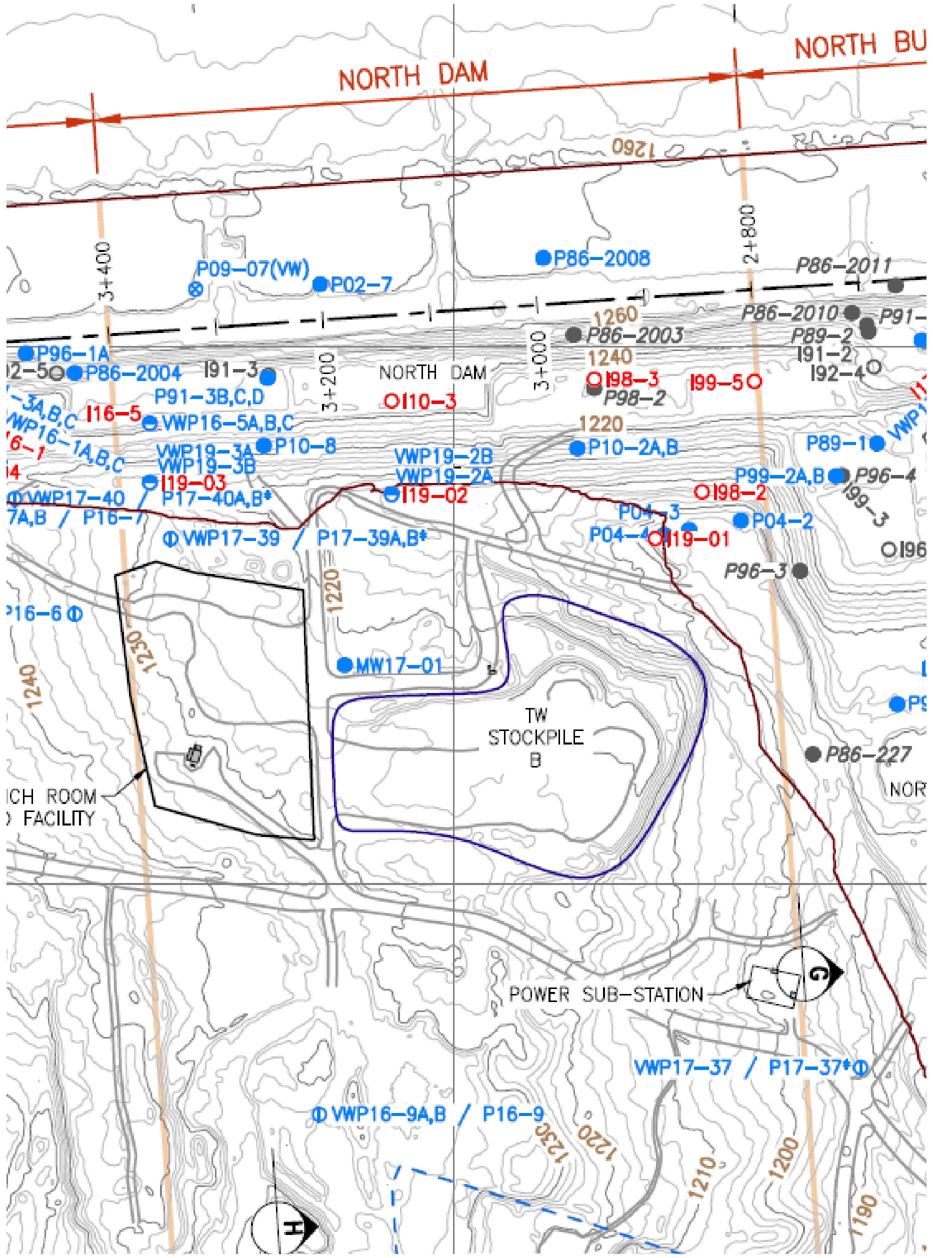


North Dam Bedrock
2020 Water Elevations

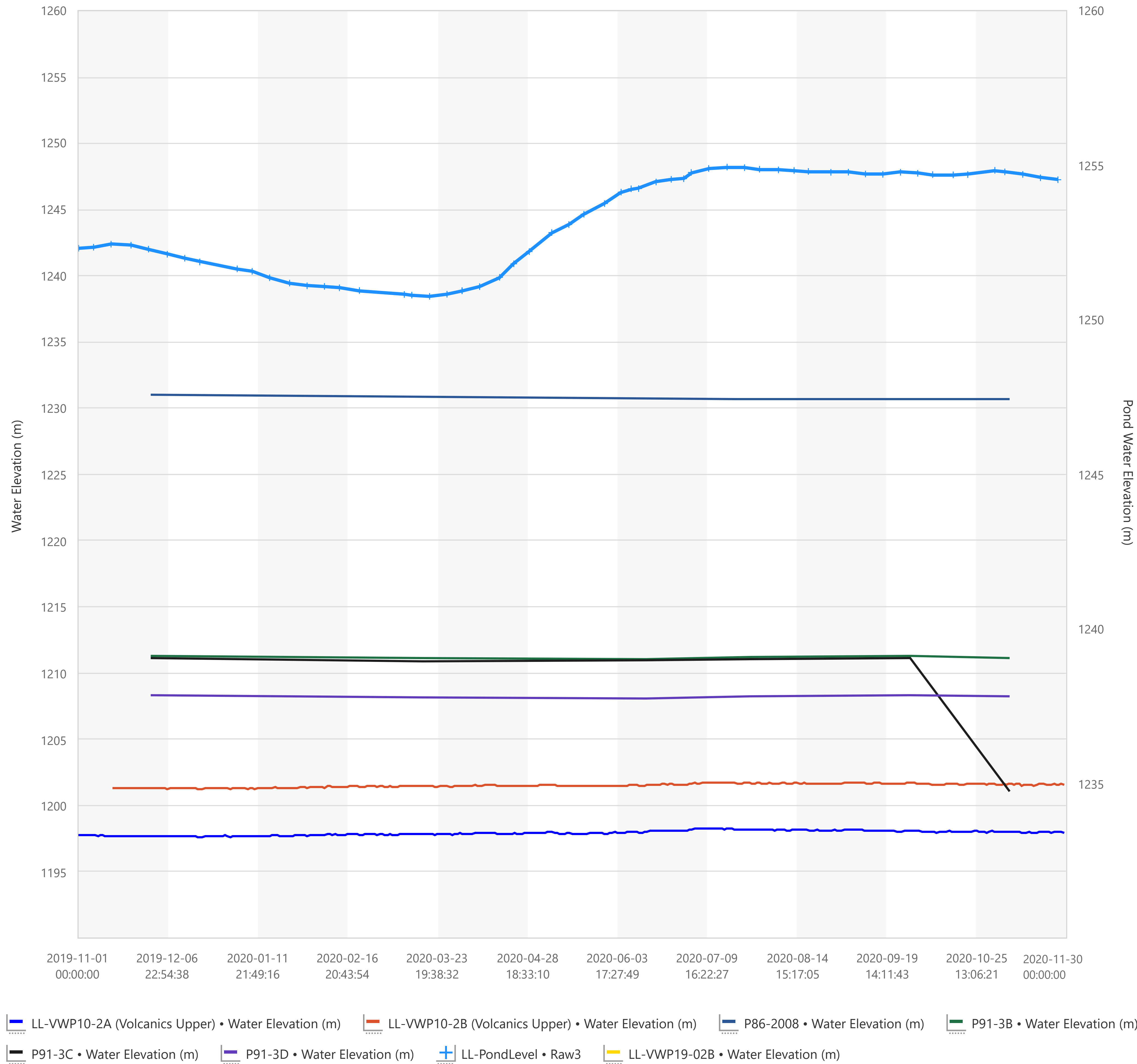


North Dam Bedrock
Glacial Till, Sand, Upper GLU

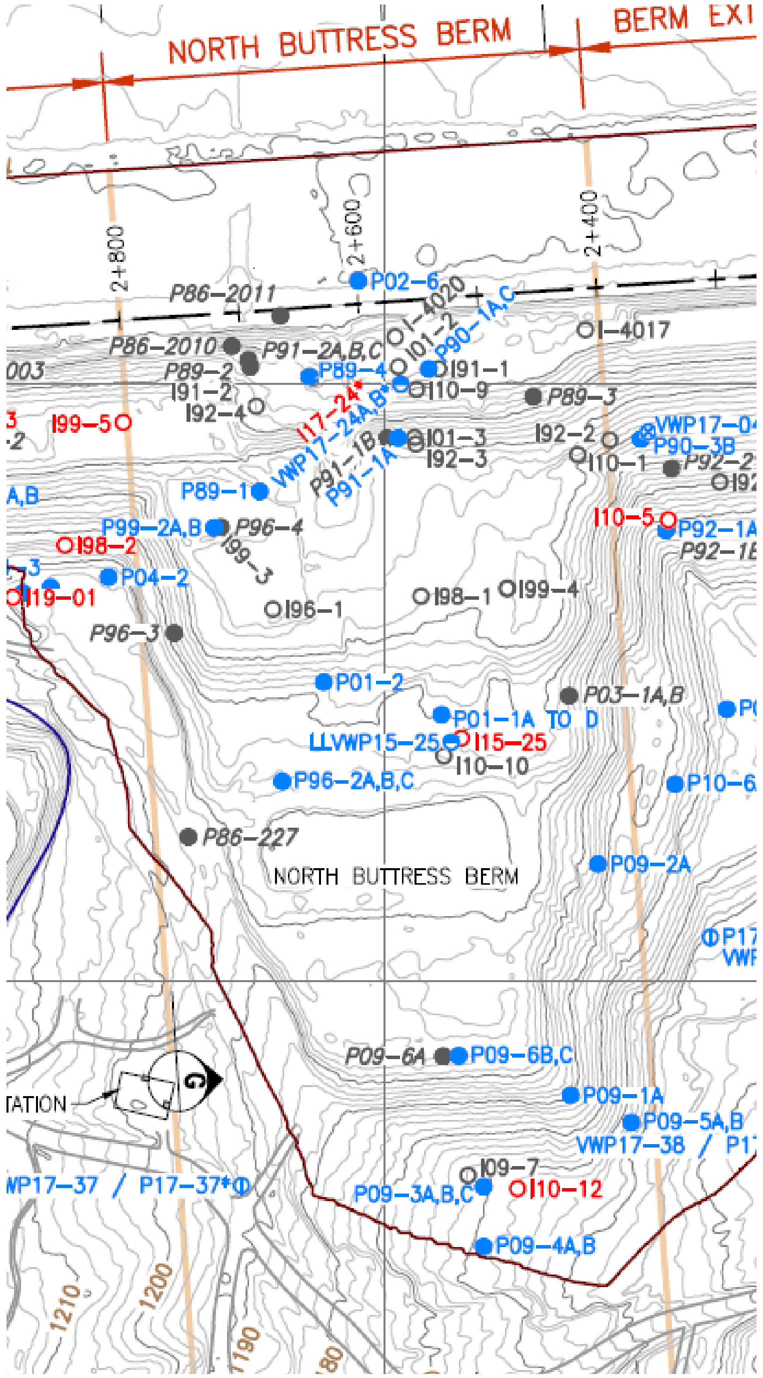




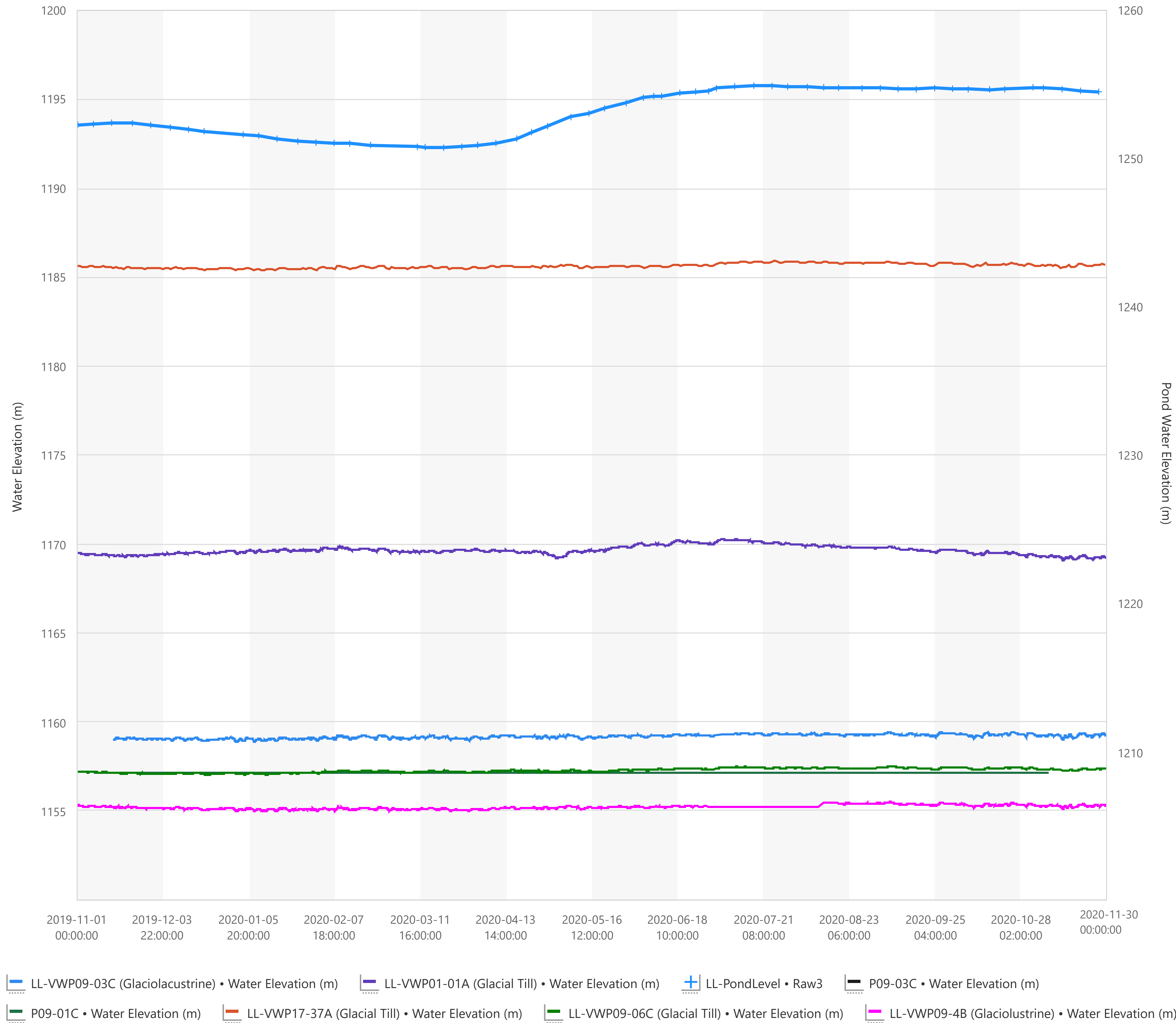
North Dam Bedrock - Volcanics

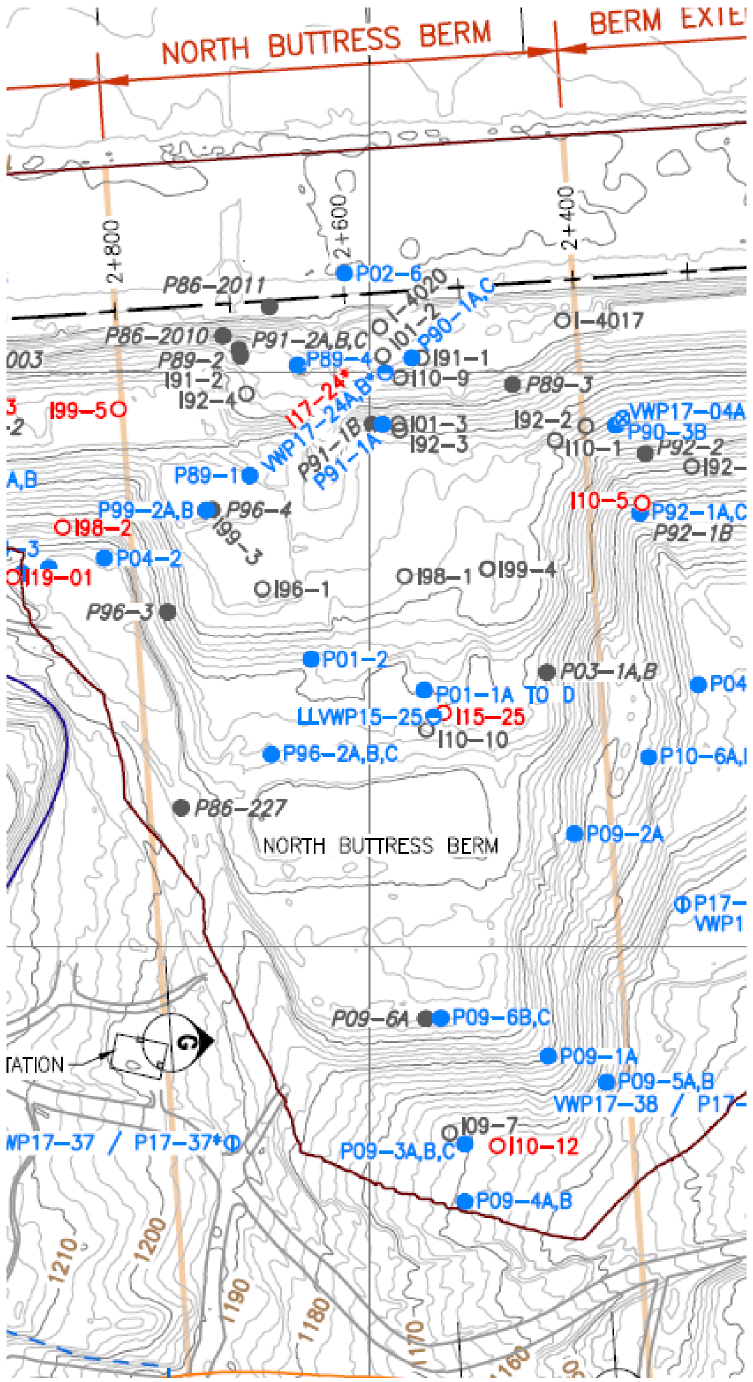


North Buttress Berm
2020 Water Elevations

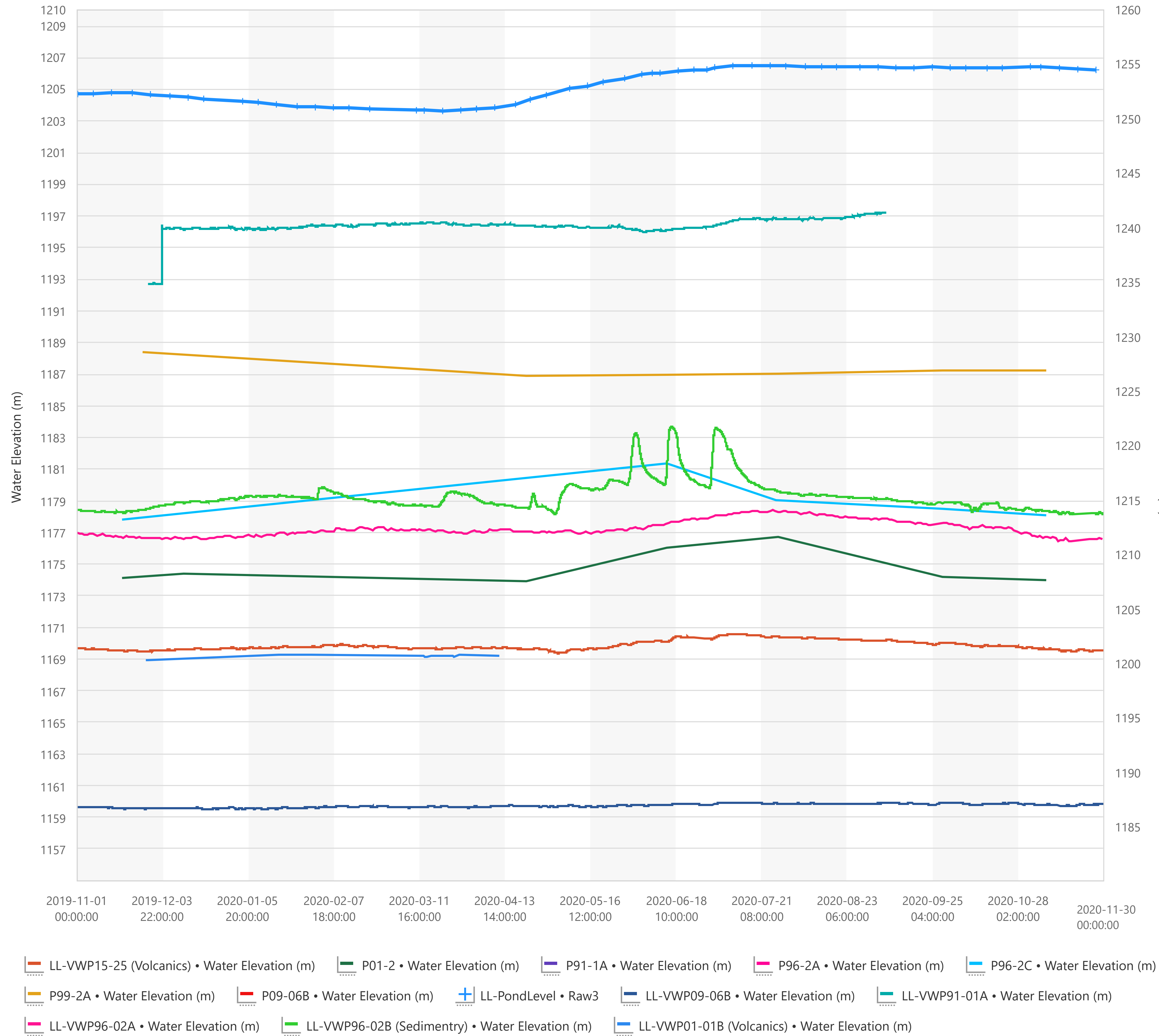


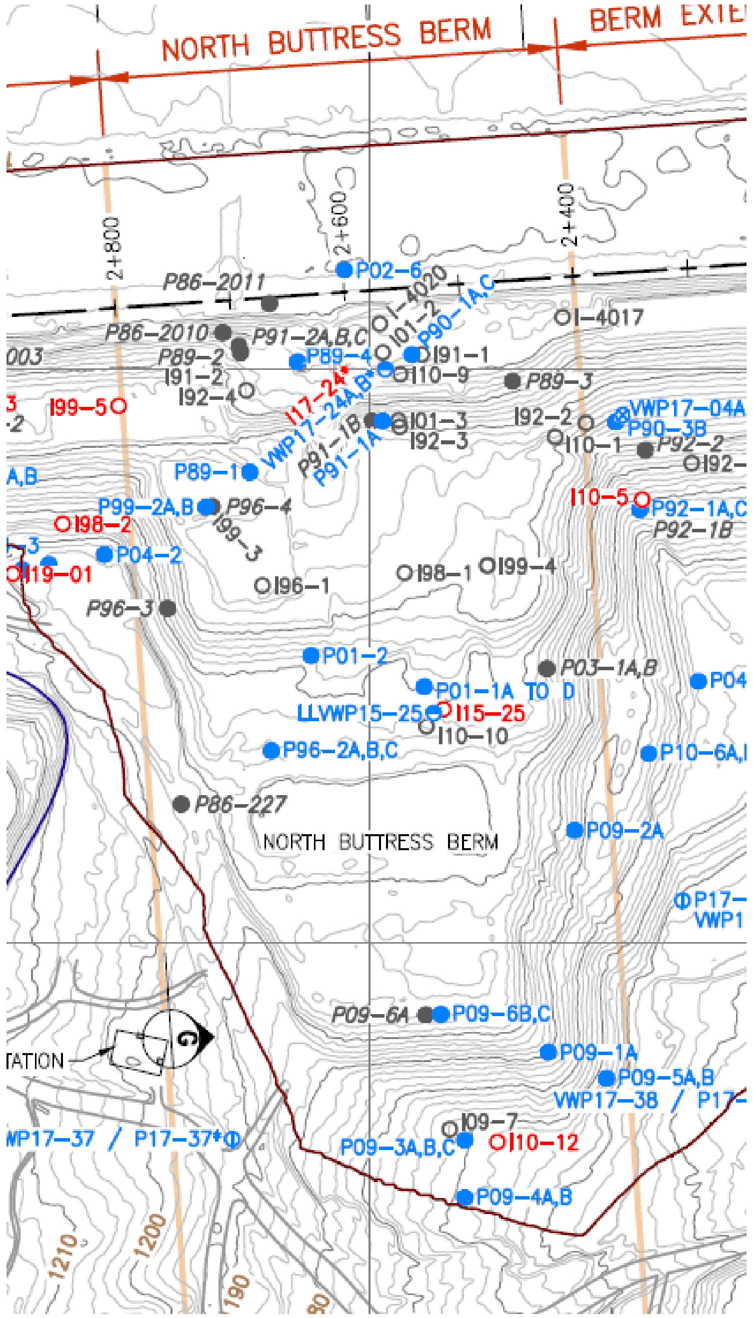
NBB - Overburden



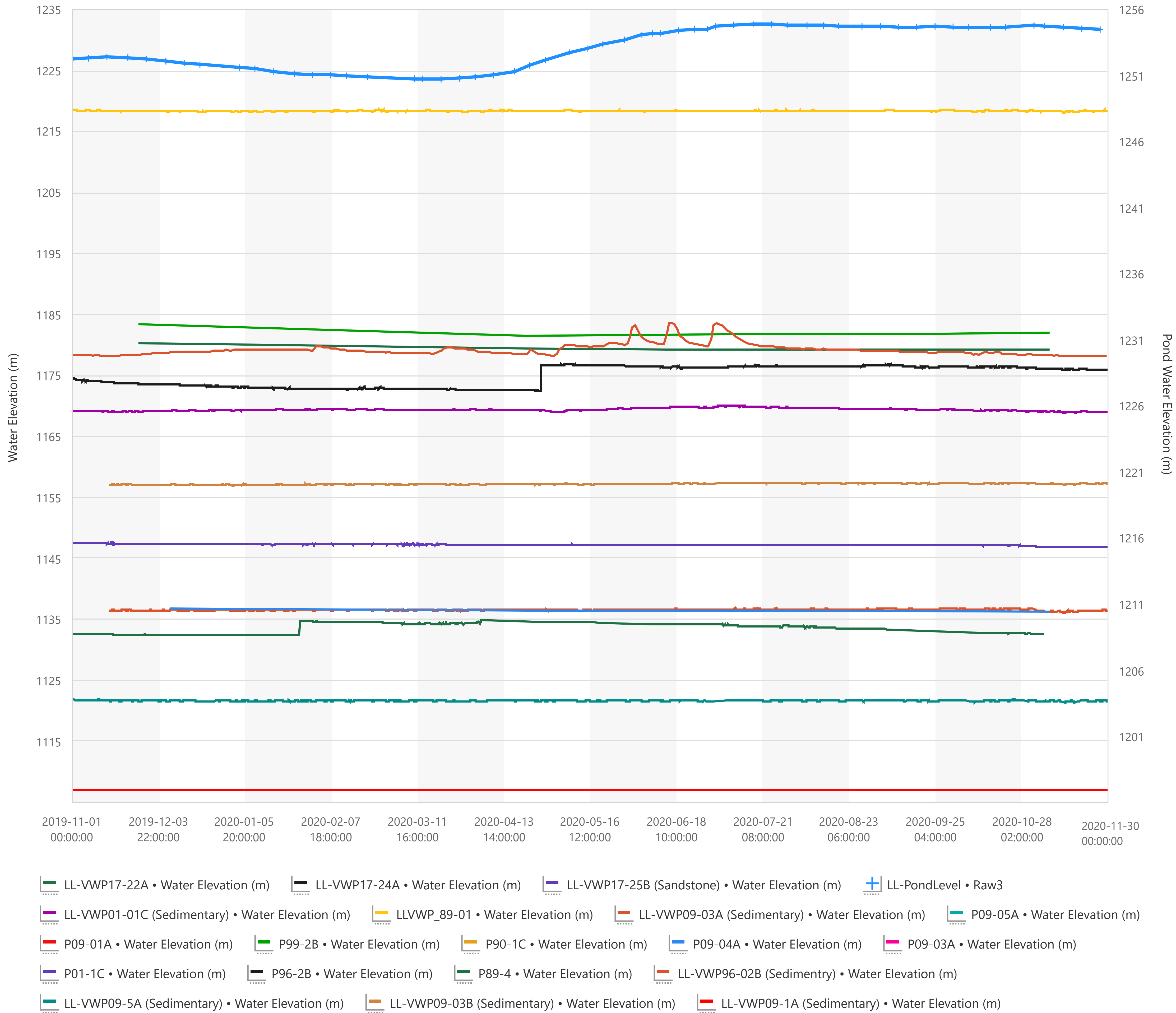


NBB - Volcanics

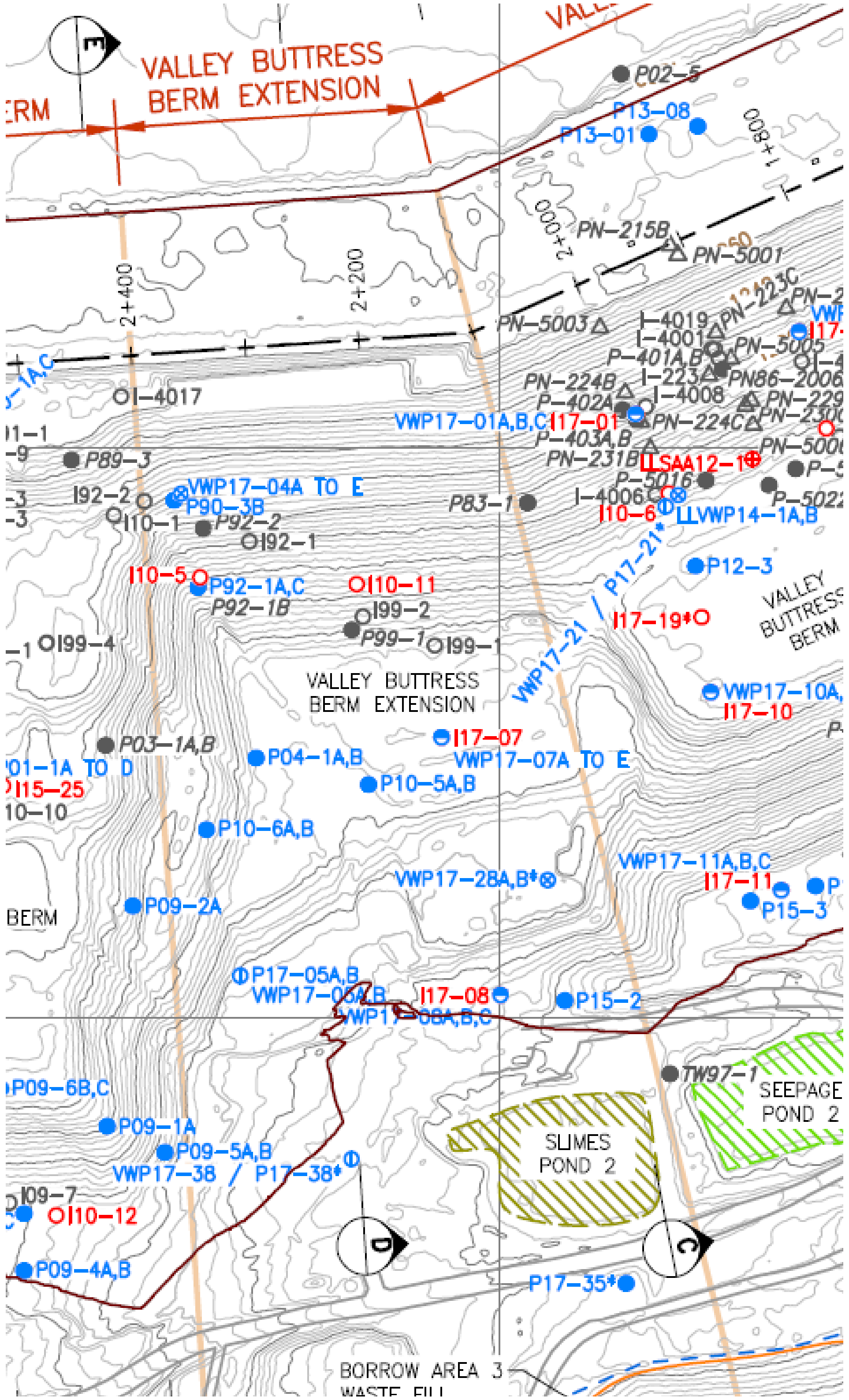




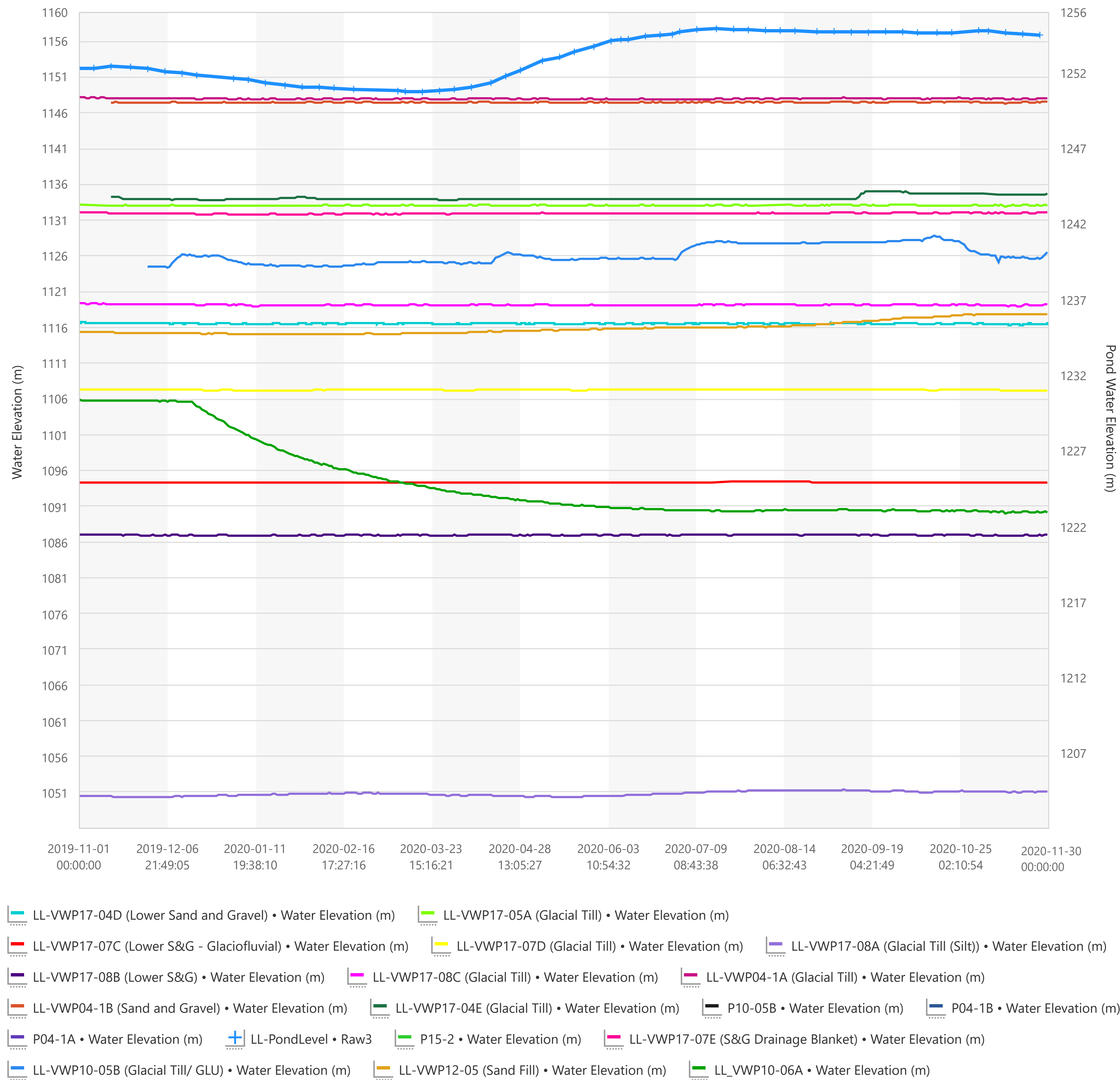
NBB - Sedimentary

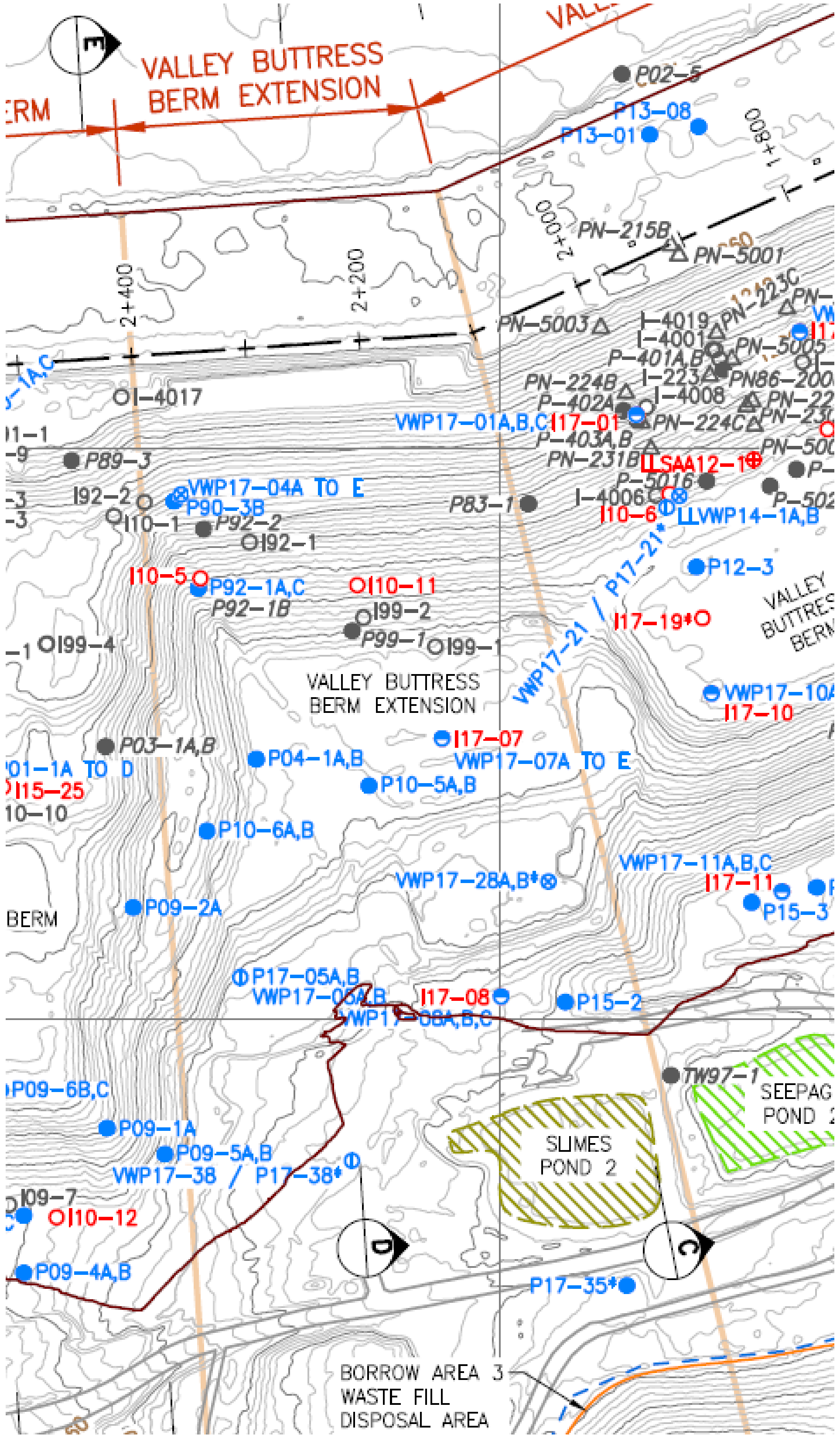


Valley Buttress Berm Extension
2020 Water Elevations

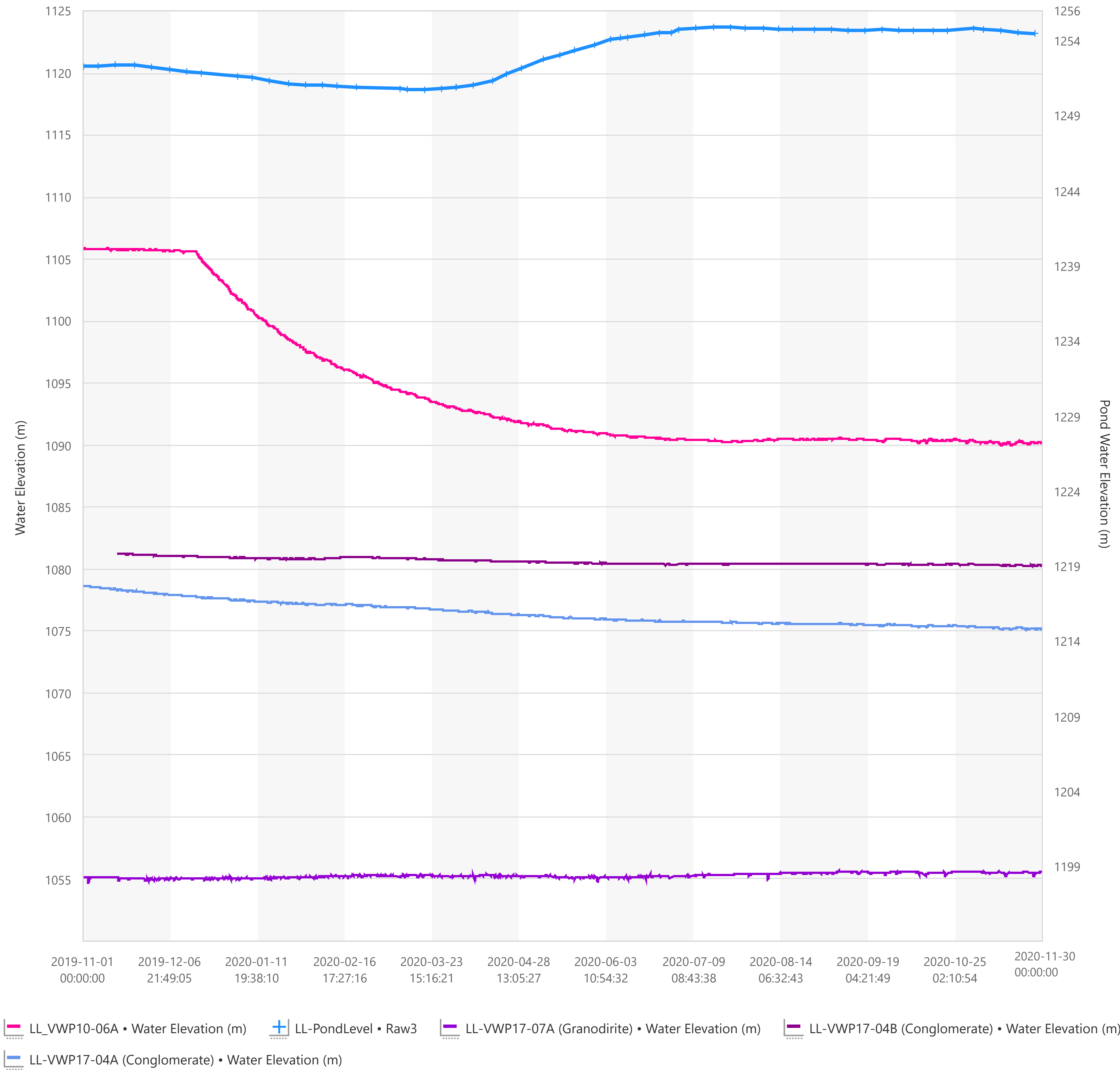


VBBE - Overburden and Dam Fill

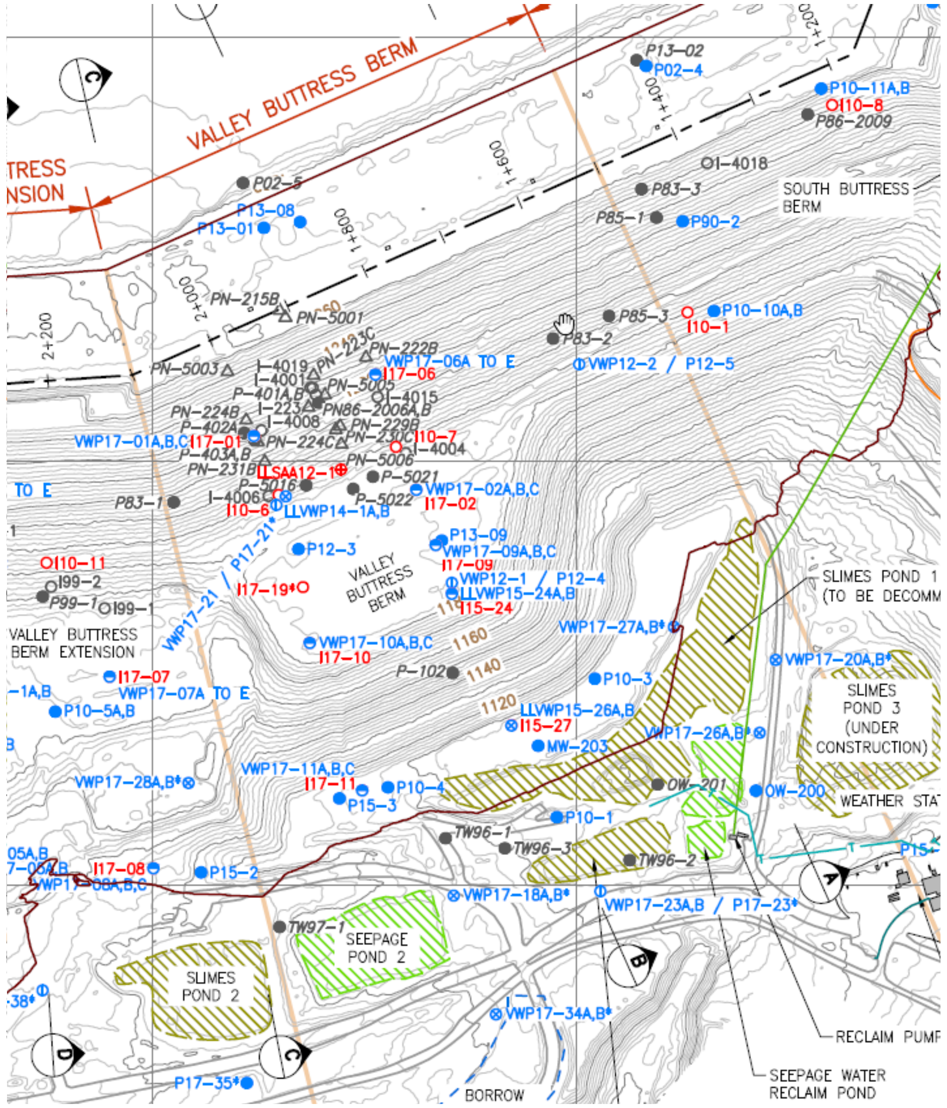




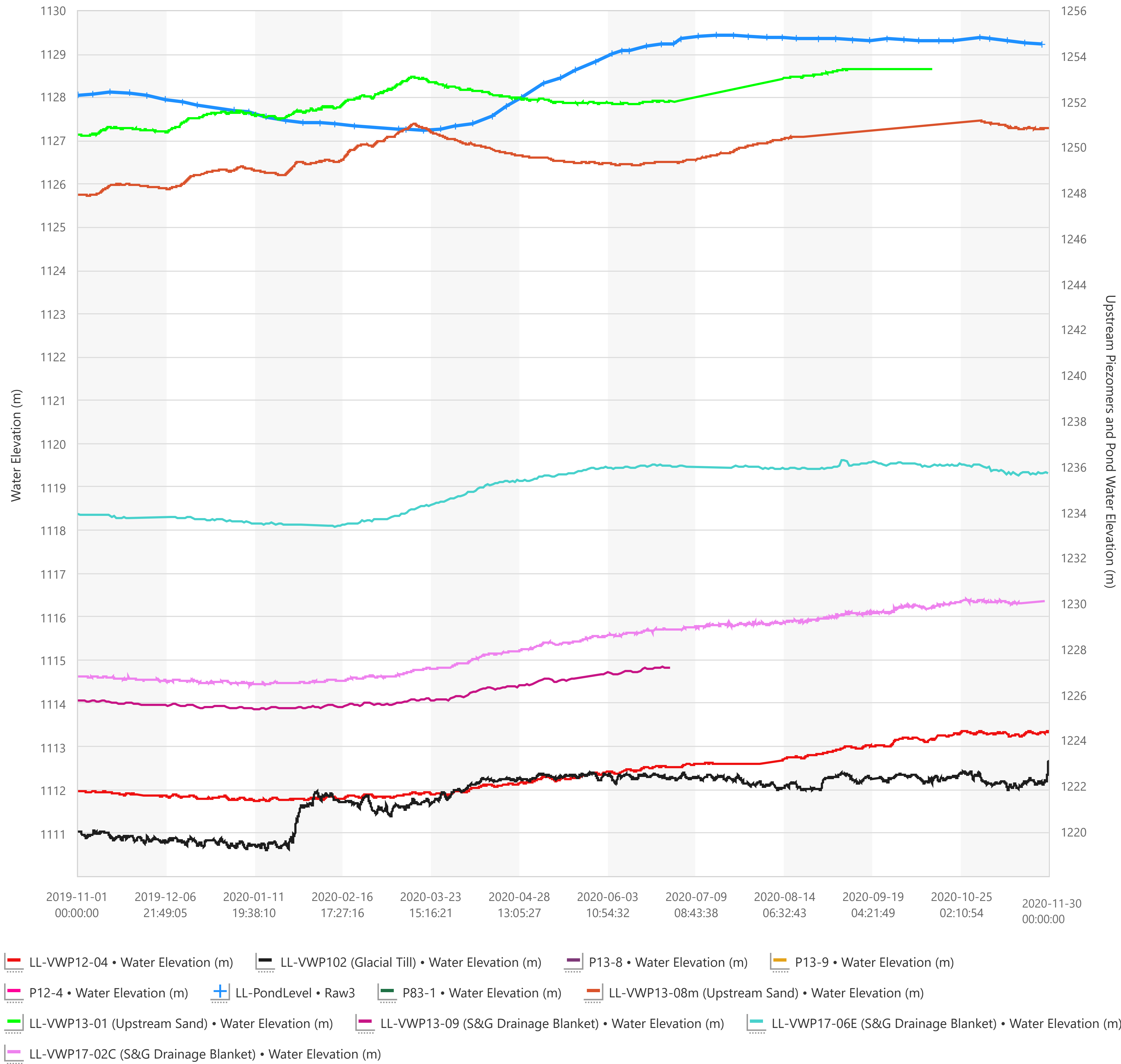
VBBE - Foundation Rock

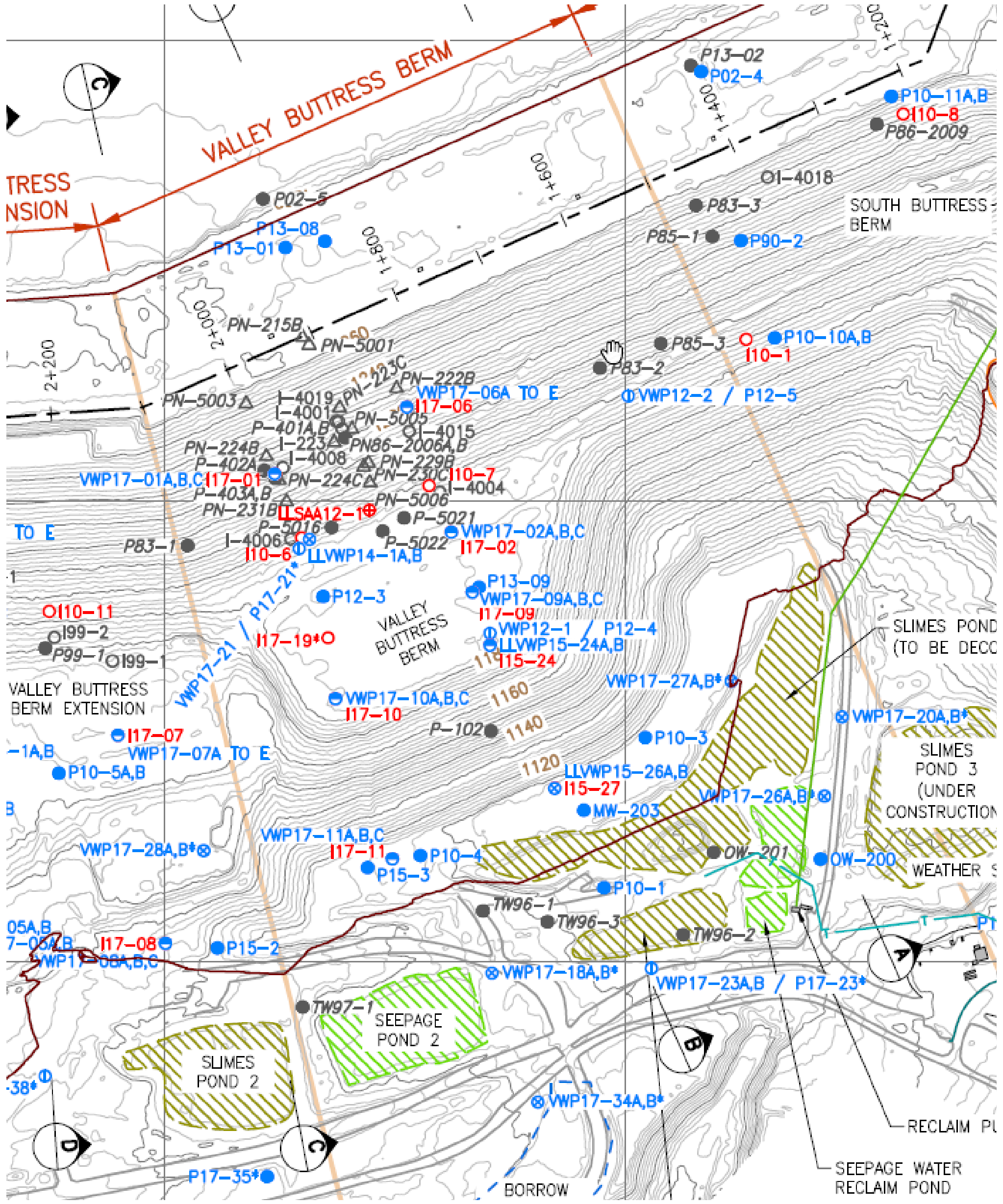


Valley Buttress Berm
2020 Water Elevations

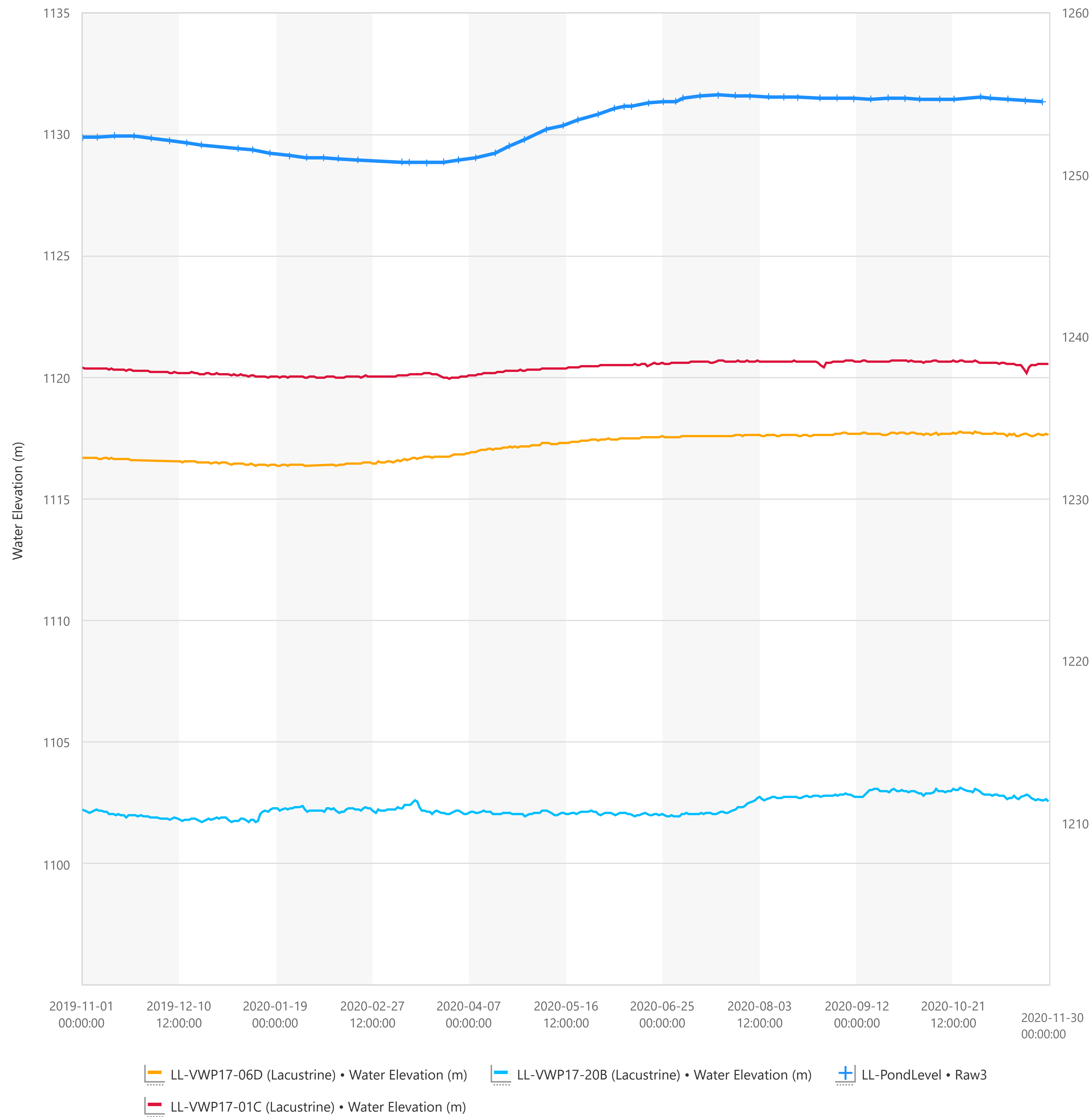

VALLEY BUTTRESS BERM
VALLEY BUTTRESS BERM EXTENSION
SOUTH BUTTRESS BERM
SLIMES POND 1 (TO BE DECOMM
SLIMES POND 3 (UNDER CONSTRUCTION)
SLIMES POND 2
SEEPAGE POND 2
WEATHER STA
RECLAIM PUMP
SEEPAGE WATER RECLAIM POND
BORROW

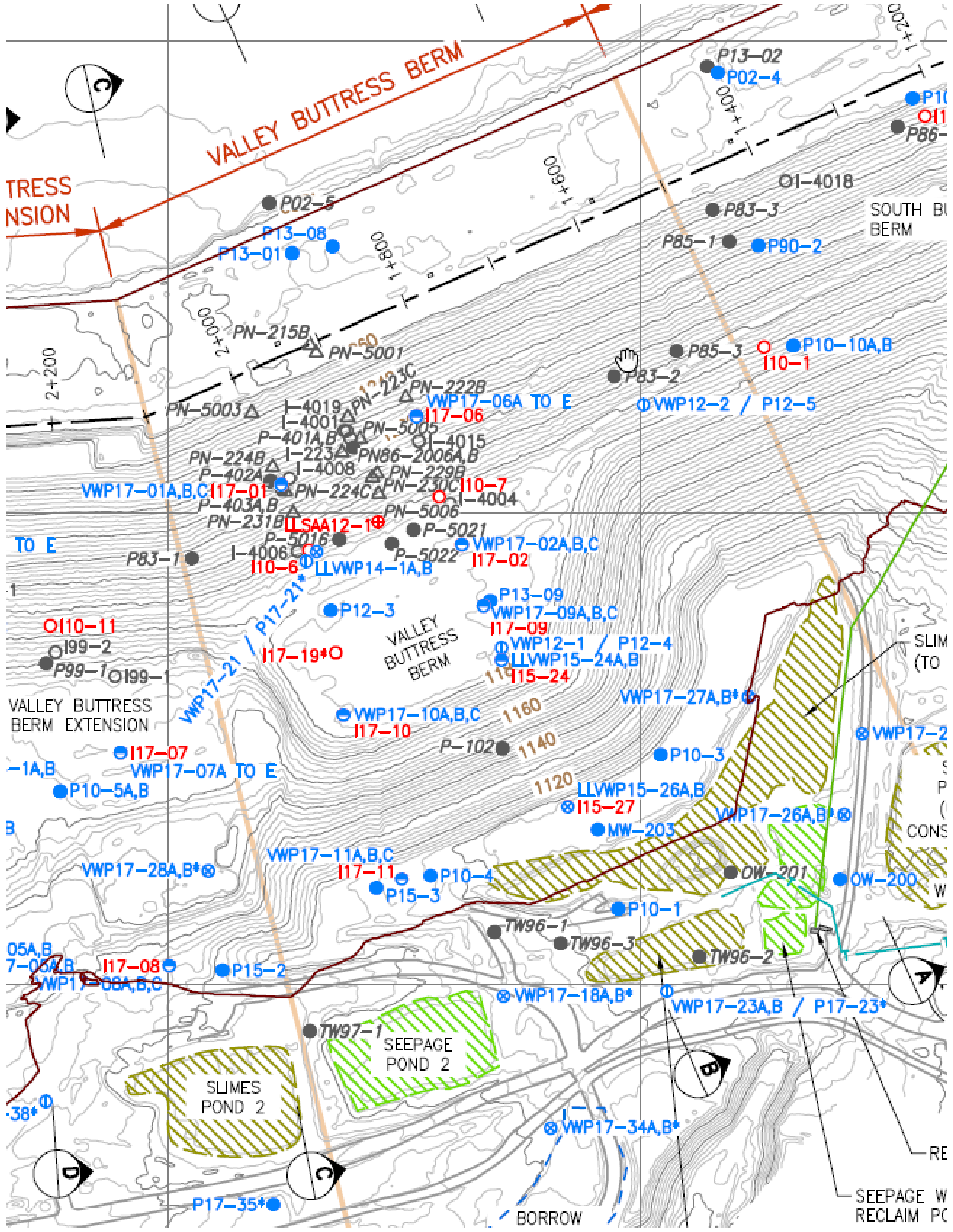
VBB - Dam Fill


Water Elevation (m)
Upstream Piezomers and Pond Water Elevation (m)
1130
1129
1128
1127
1126
1125
1124
1123
1122
1121
1120
1119
1118
1117
1116
1115
1114
1113
1112
1111
1256
1254
1252
1250
1248
1246
1244
1242
1240
1238
1236
1234
1232
1230
1228
1226
1224
1222
1220
2019-11-01 00:00:00
2019-12-06 21:49:05
2020-01-11 19:38:10
2020-02-16 17:27:16
2020-03-23 15:16:21
2020-04-28 13:05:27
2020-06-03 10:54:32
2020-07-09 08:43:38
2020-08-14 06:32:43
2020-09-19 04:21:49
2020-10-25 02:10:54
2020-11-30 00:00:00
LL-VWP12-04 • Water Elevation (m)
LL-VWP102 (Glacial Till) • Water Elevation (m)
P13-8 • Water Elevation (m)
P13-9 • Water Elevation (m)
P12-4 • Water Elevation (m)
LL-PondLevel • Raw3
P83-1 • Water Elevation (m)
LL-VWP13-08m (Upstream Sand) • Water Elevation (m)
LL-VWP13-01 (Upstream Sand) • Water Elevation (m)
LL-VWP13-09 (S&G Drainage Blanket) • Water Elevation (m)
LL-VWP17-06E (S&G Drainage Blanket) • Water Elevation (m)
LL-VWP17-02C (S&G Drainage Blanket) • Water Elevation (m)

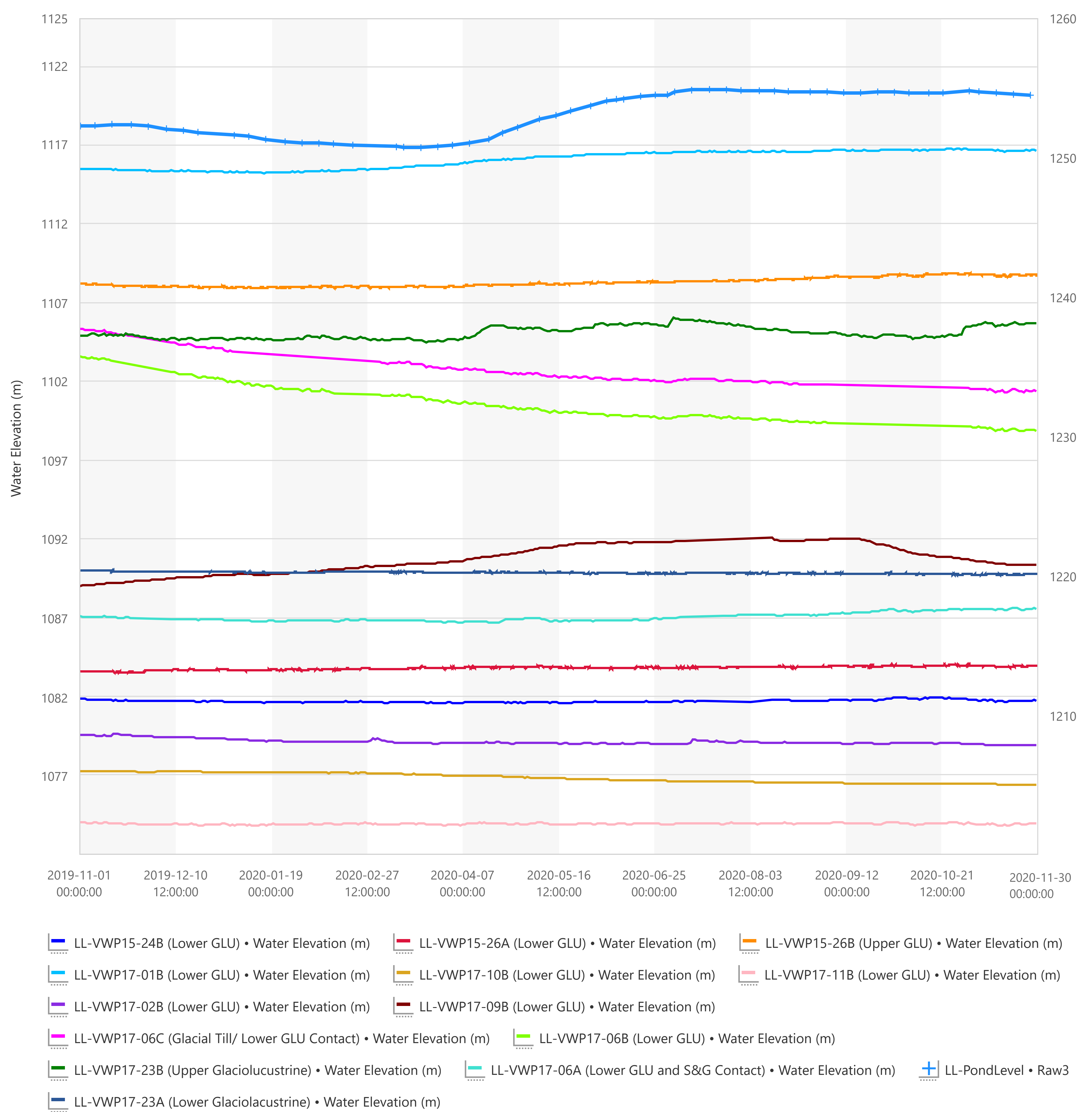


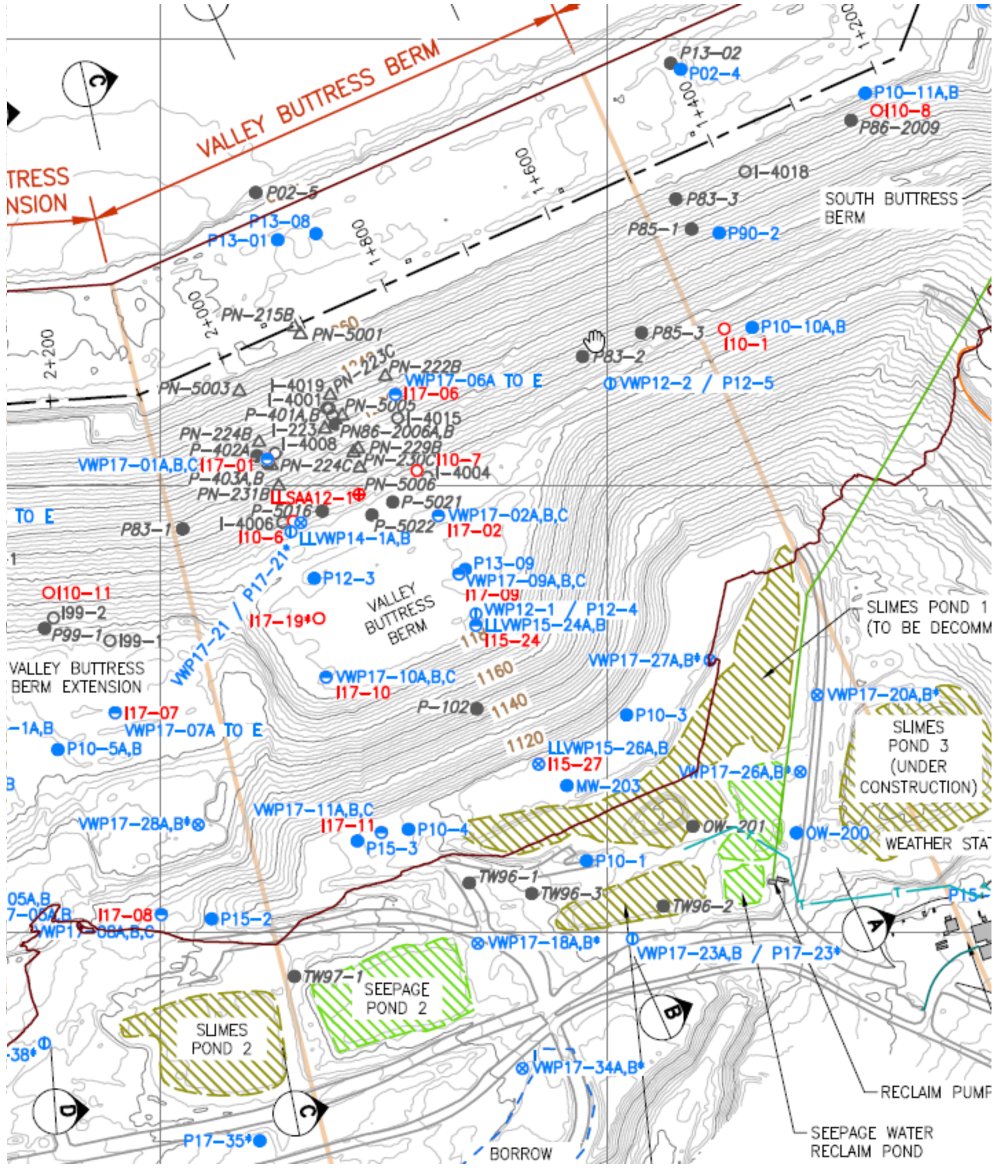
VBB - Lacustrine



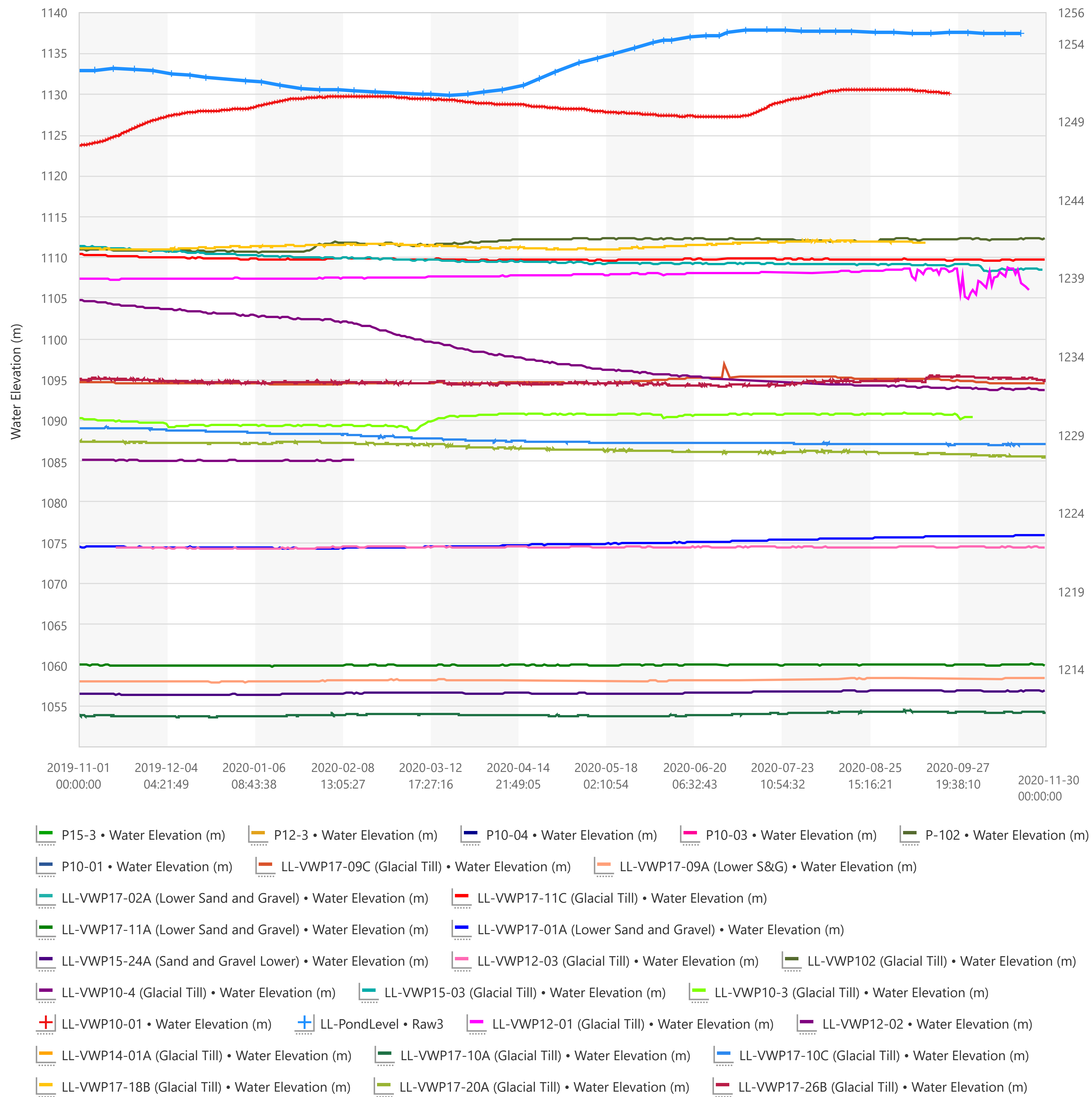


VBB - Glaciolacustrine

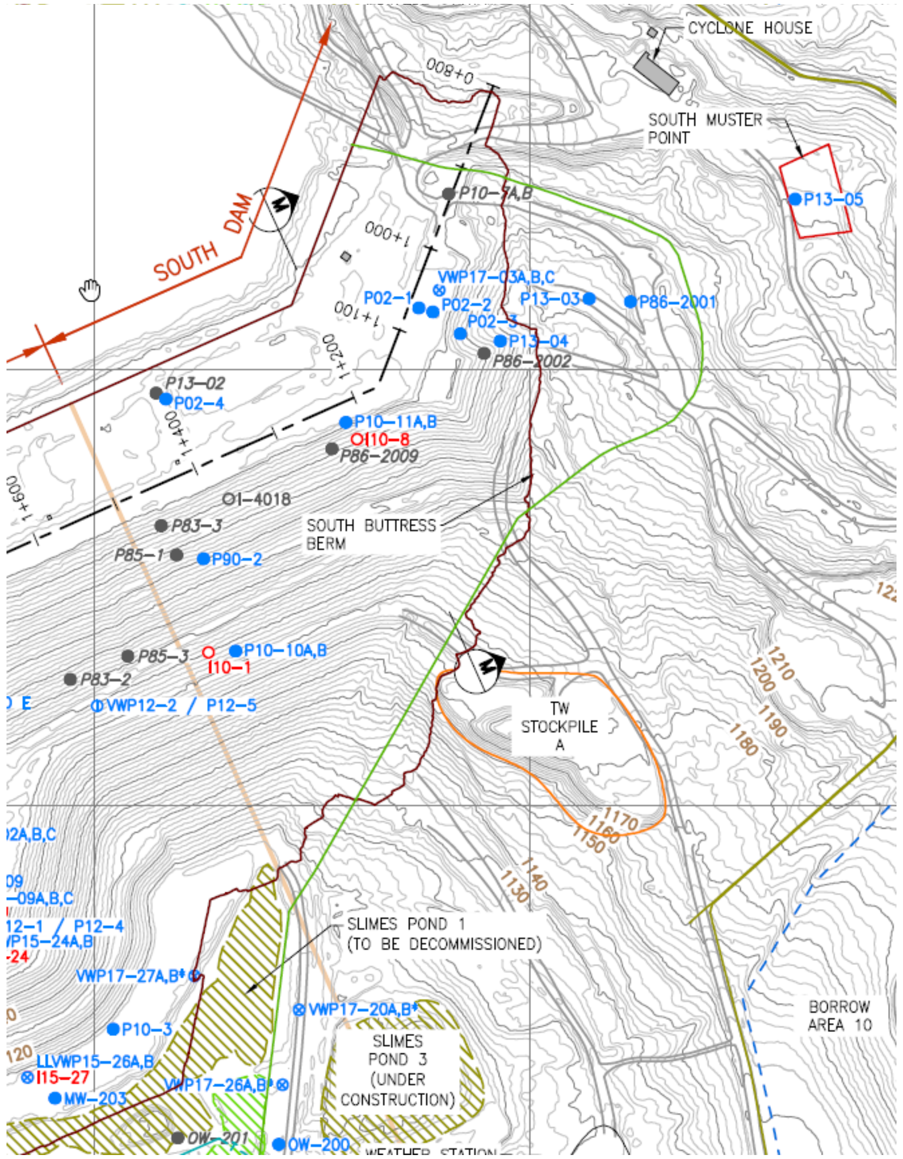




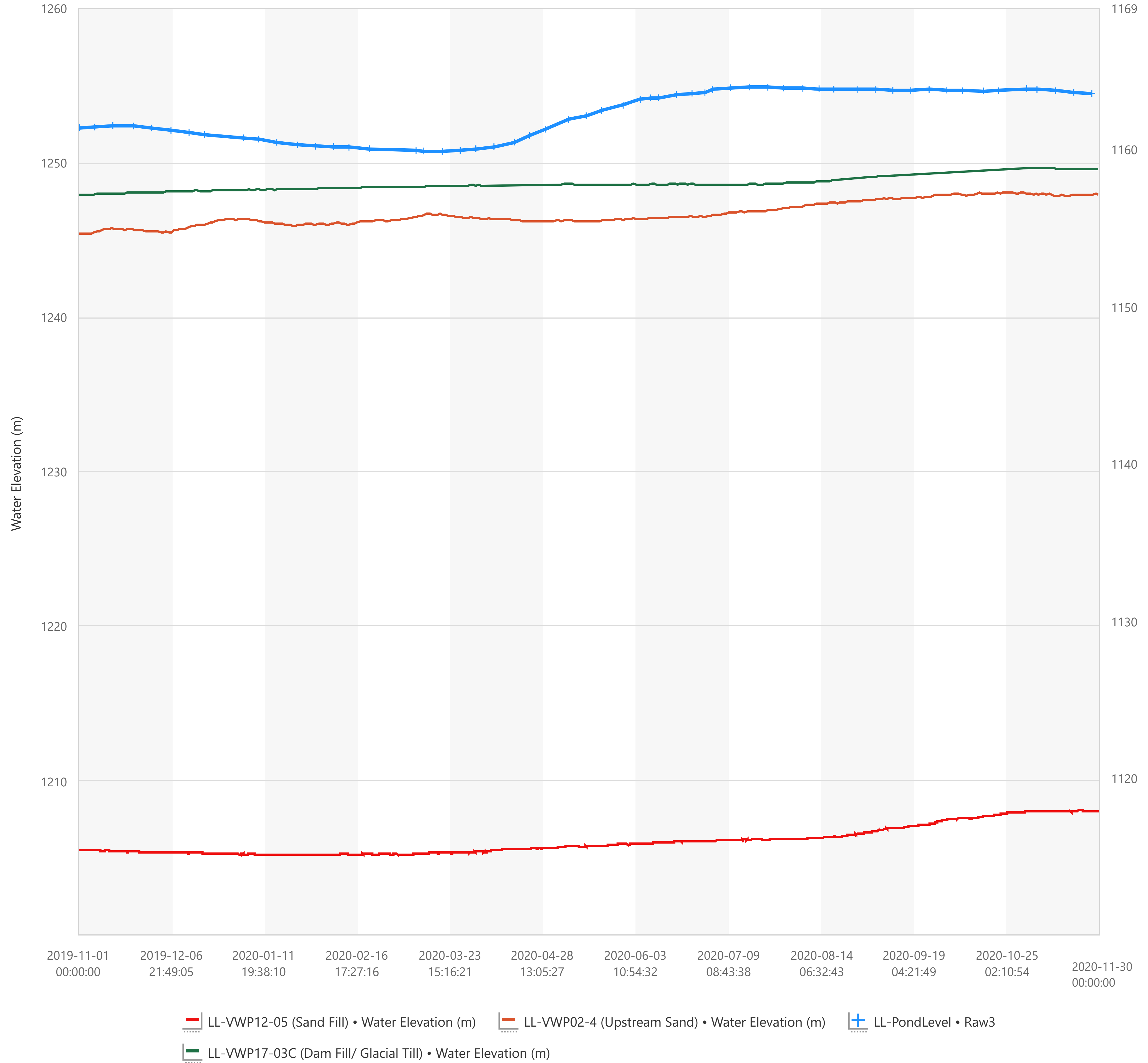
VBB - Glacial Till, Sand and Gravel

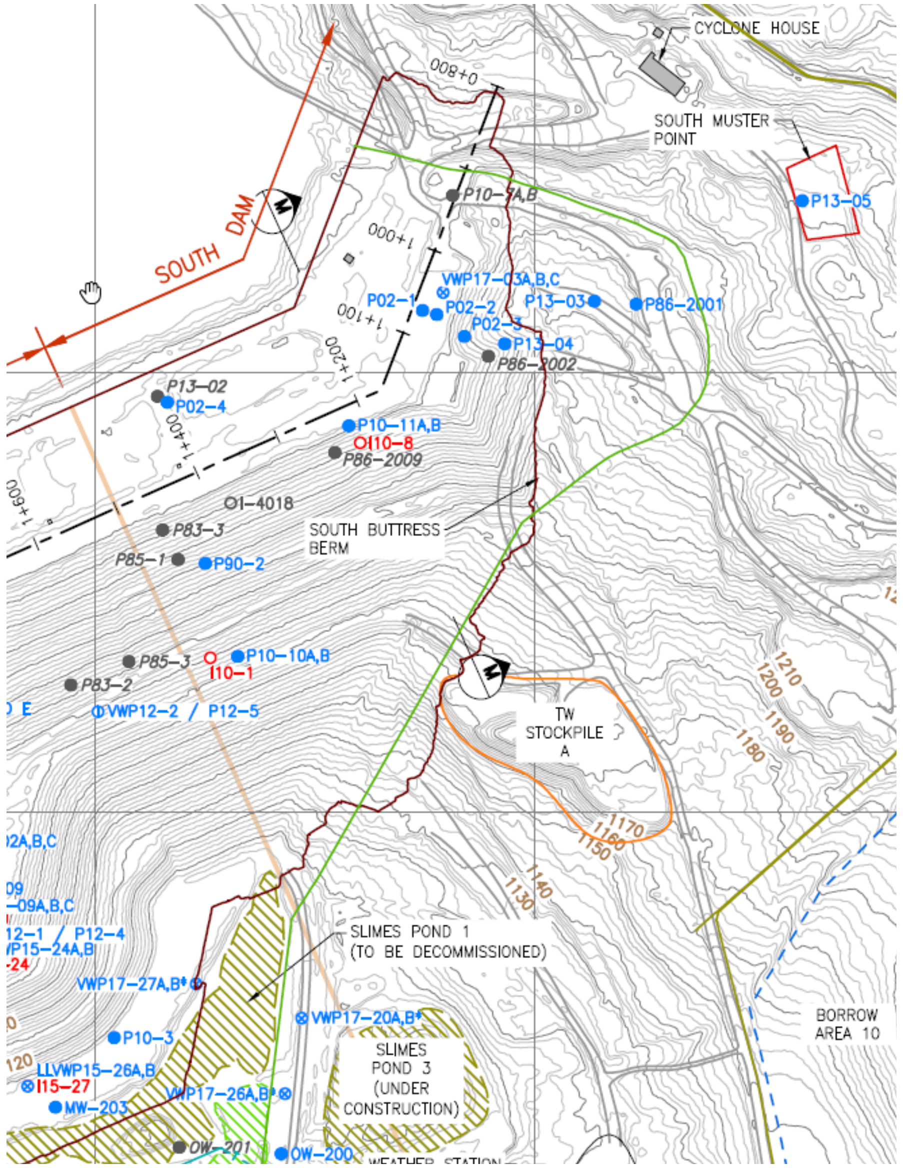


South Dam
2020 Water Elevations

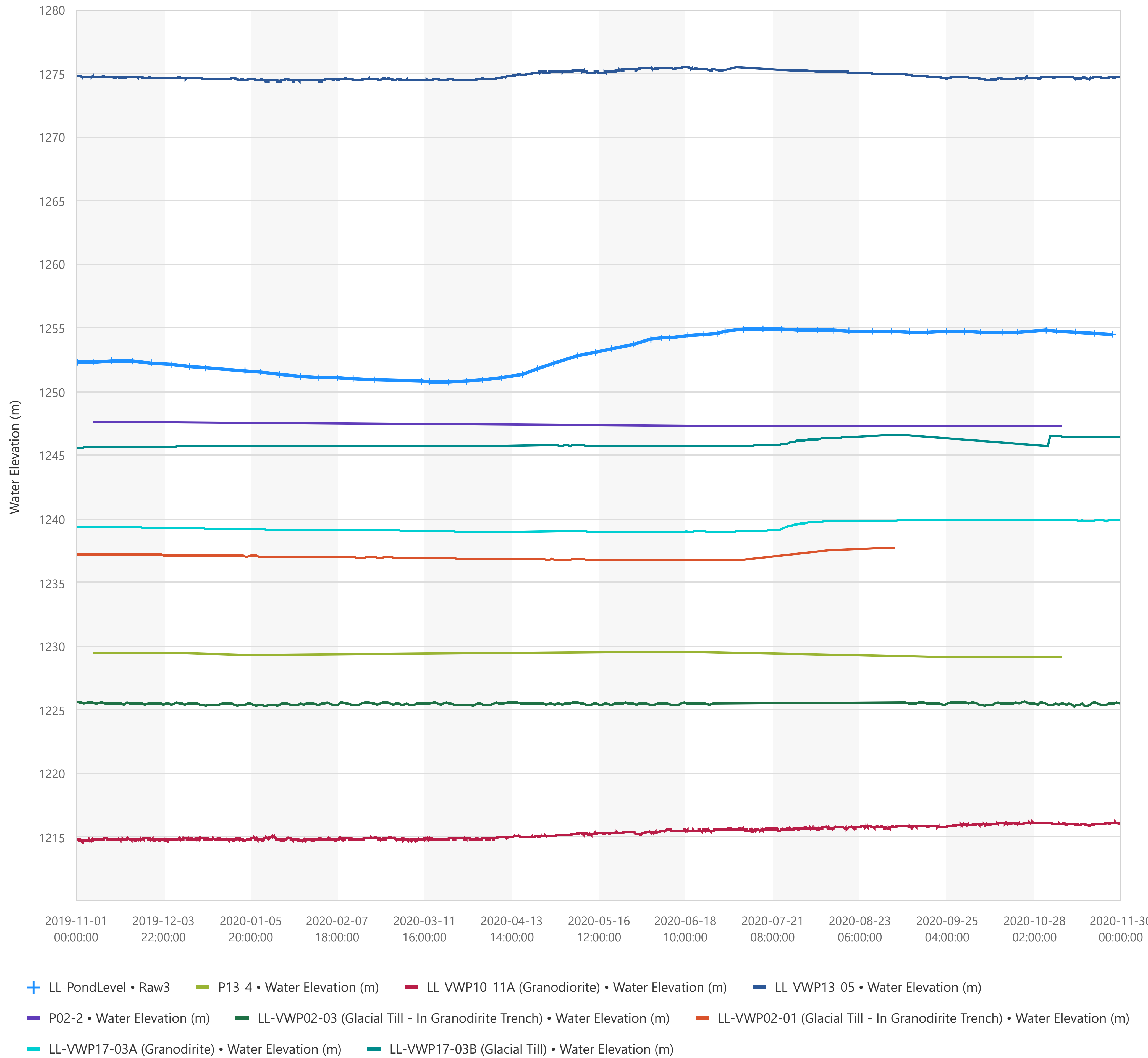


South Dam - Dam Fill



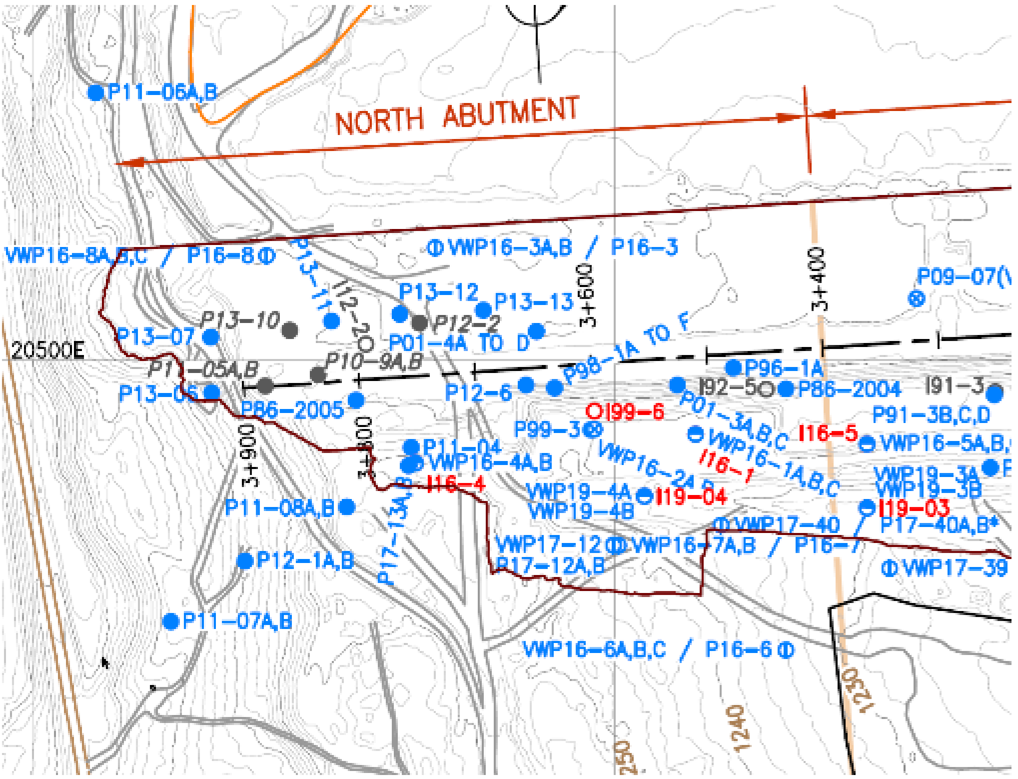


South Dam - Granodiorite Foundation Rock and Glacial Till

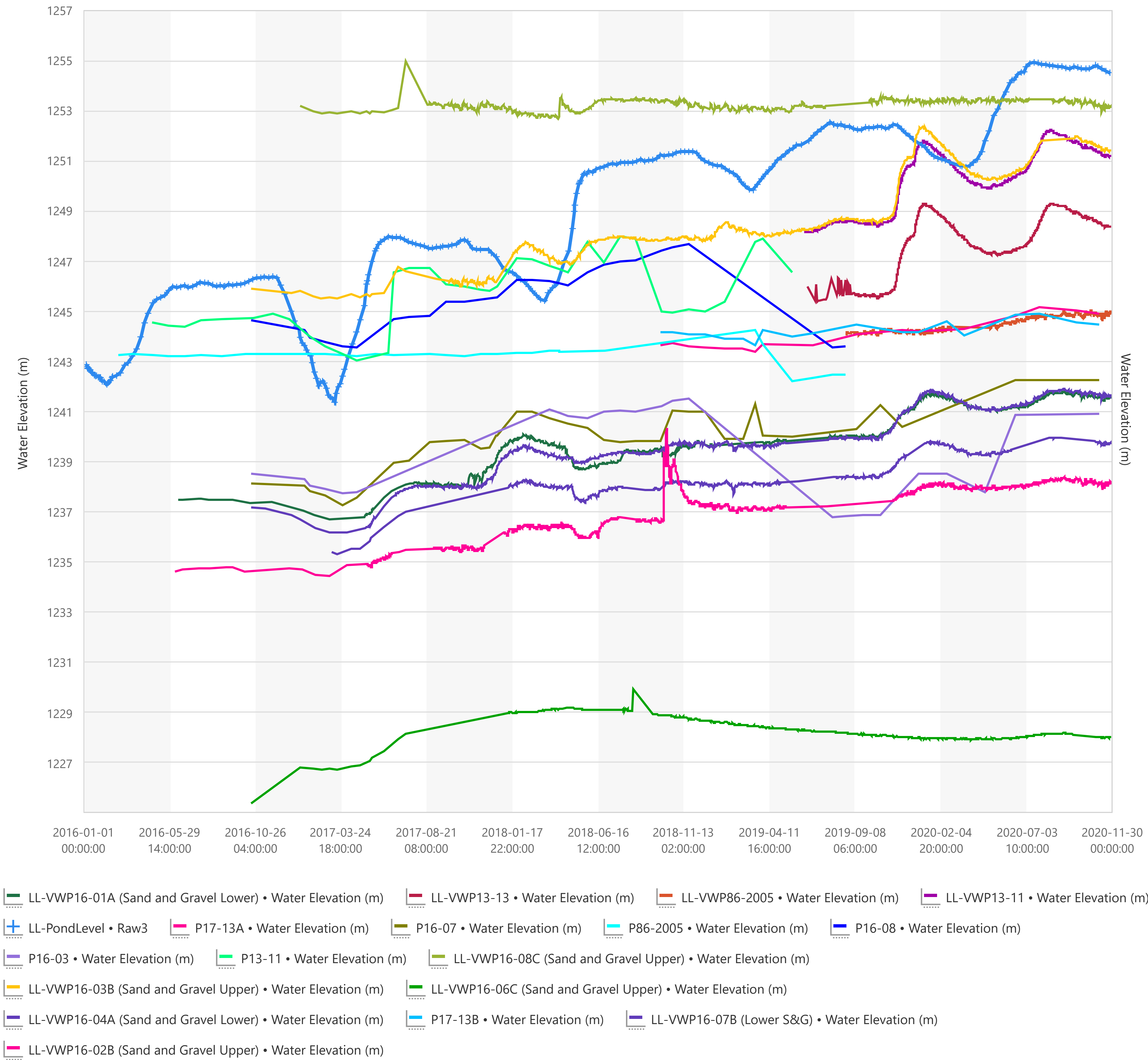


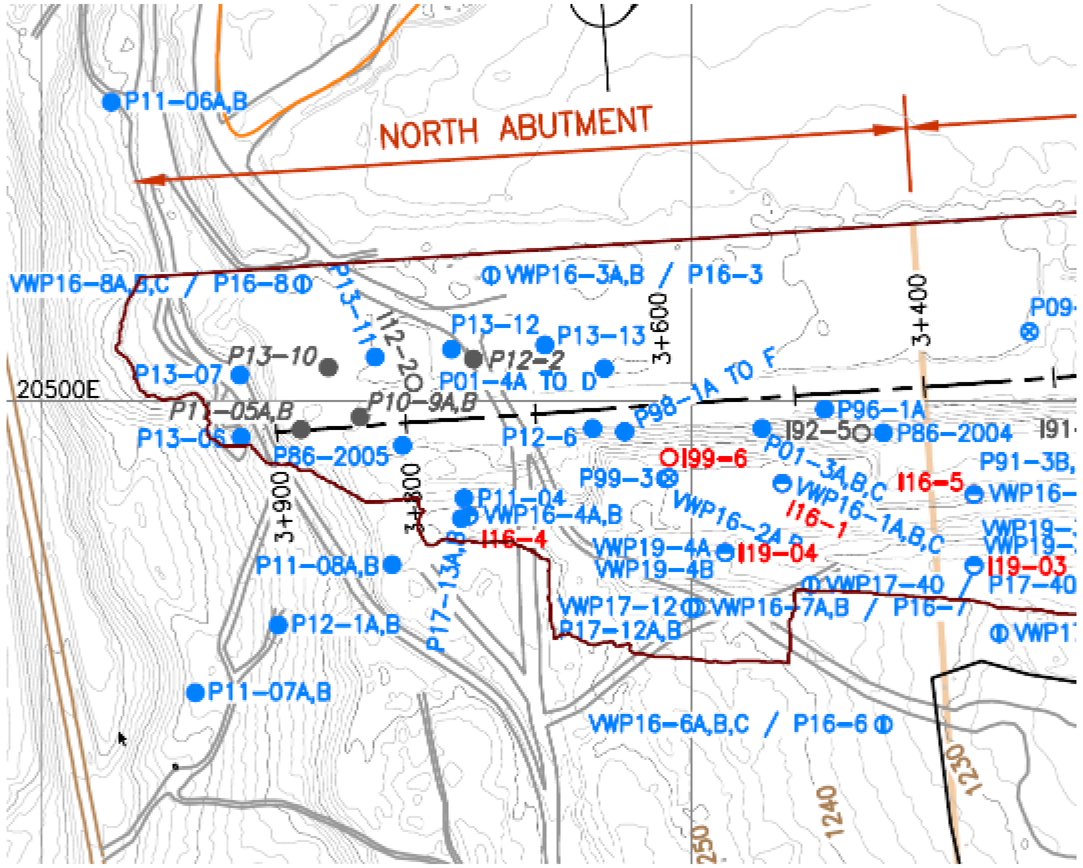
Appendix III-B-2
L-L Dam Piezometers: Water Elevations Since 2016

North Dam Upper Glaciolacustrine (North Abutment) Water Elevations Since 2016

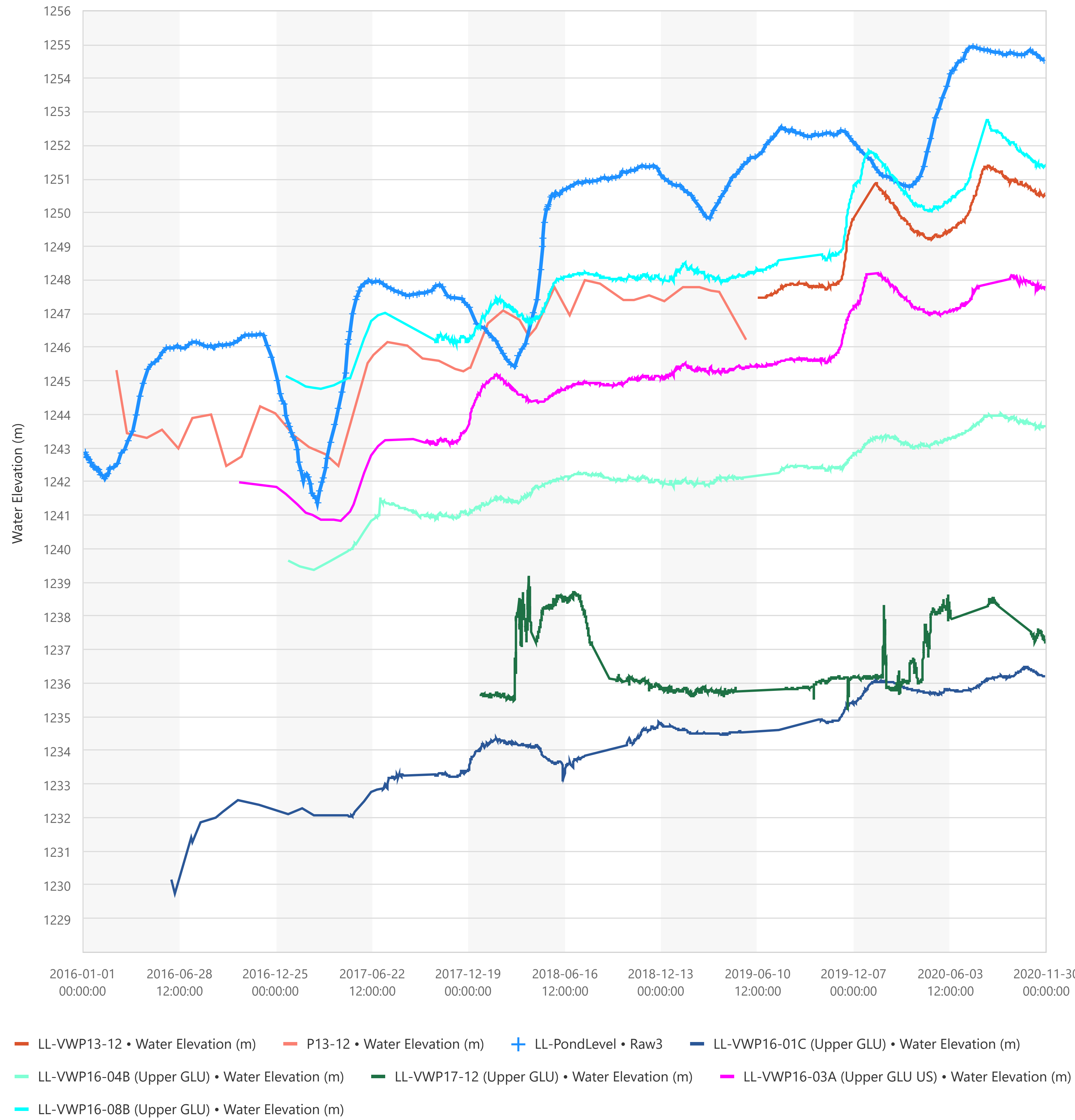


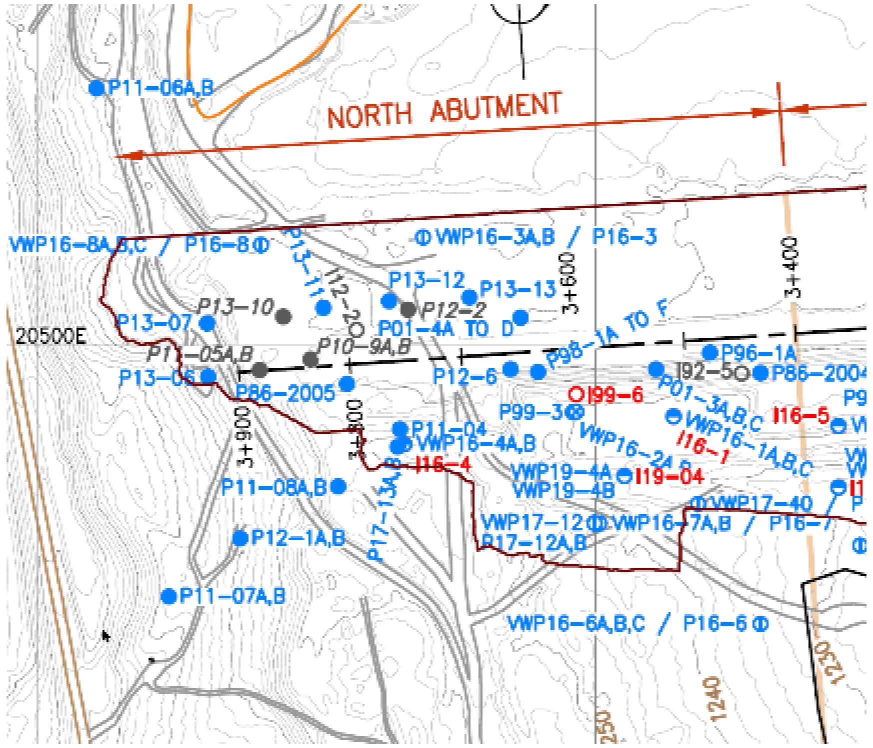
North Dam U-GLU - Sand and Gravel



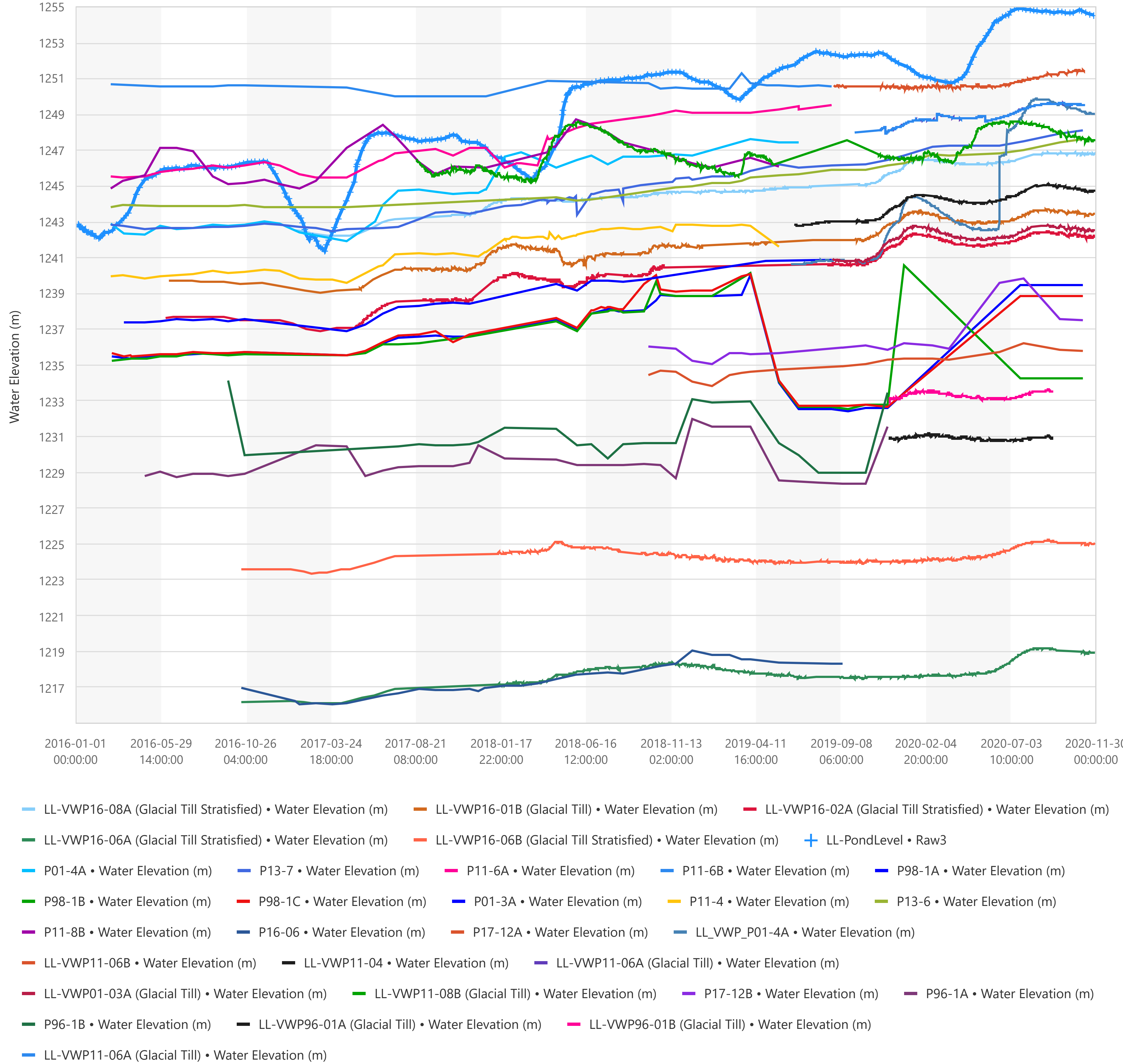


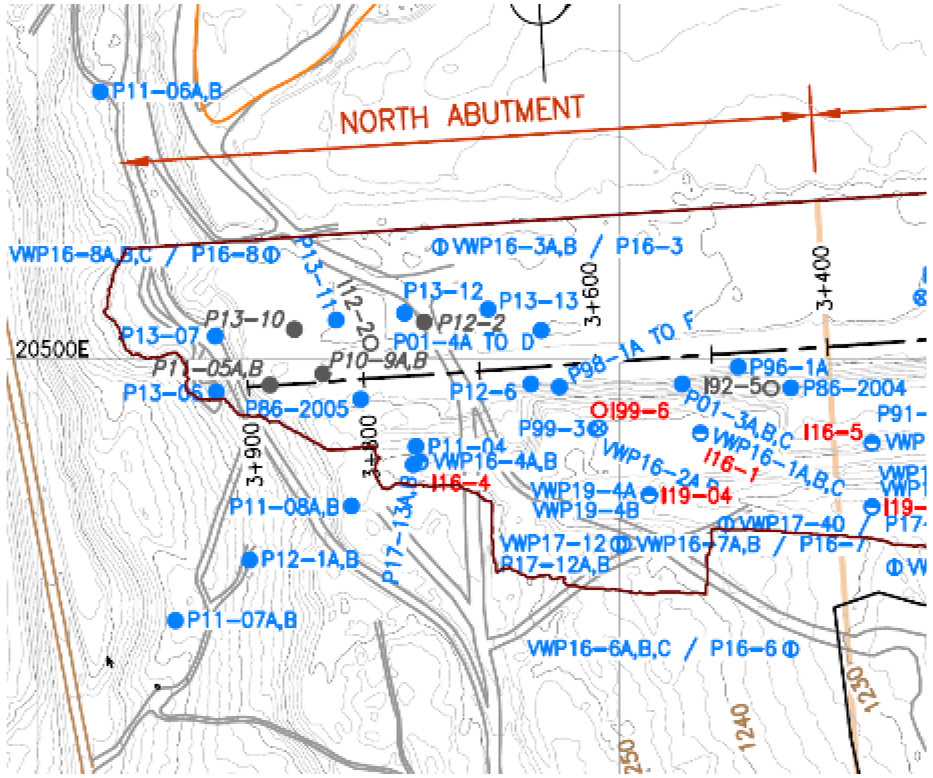
North Dam U-GLU - Glaciolacustrine



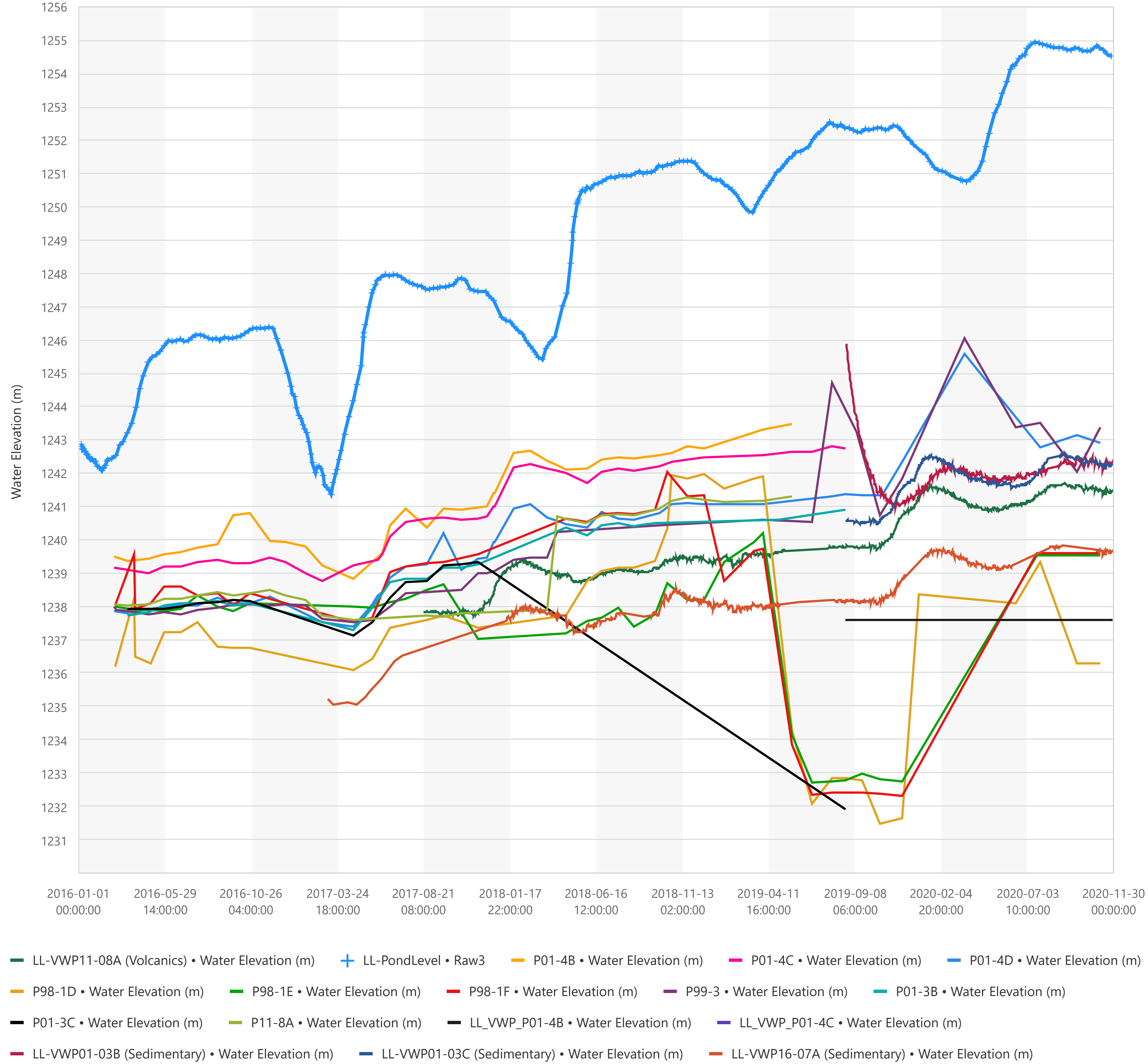


North Dam U-GLU - Glacial Till

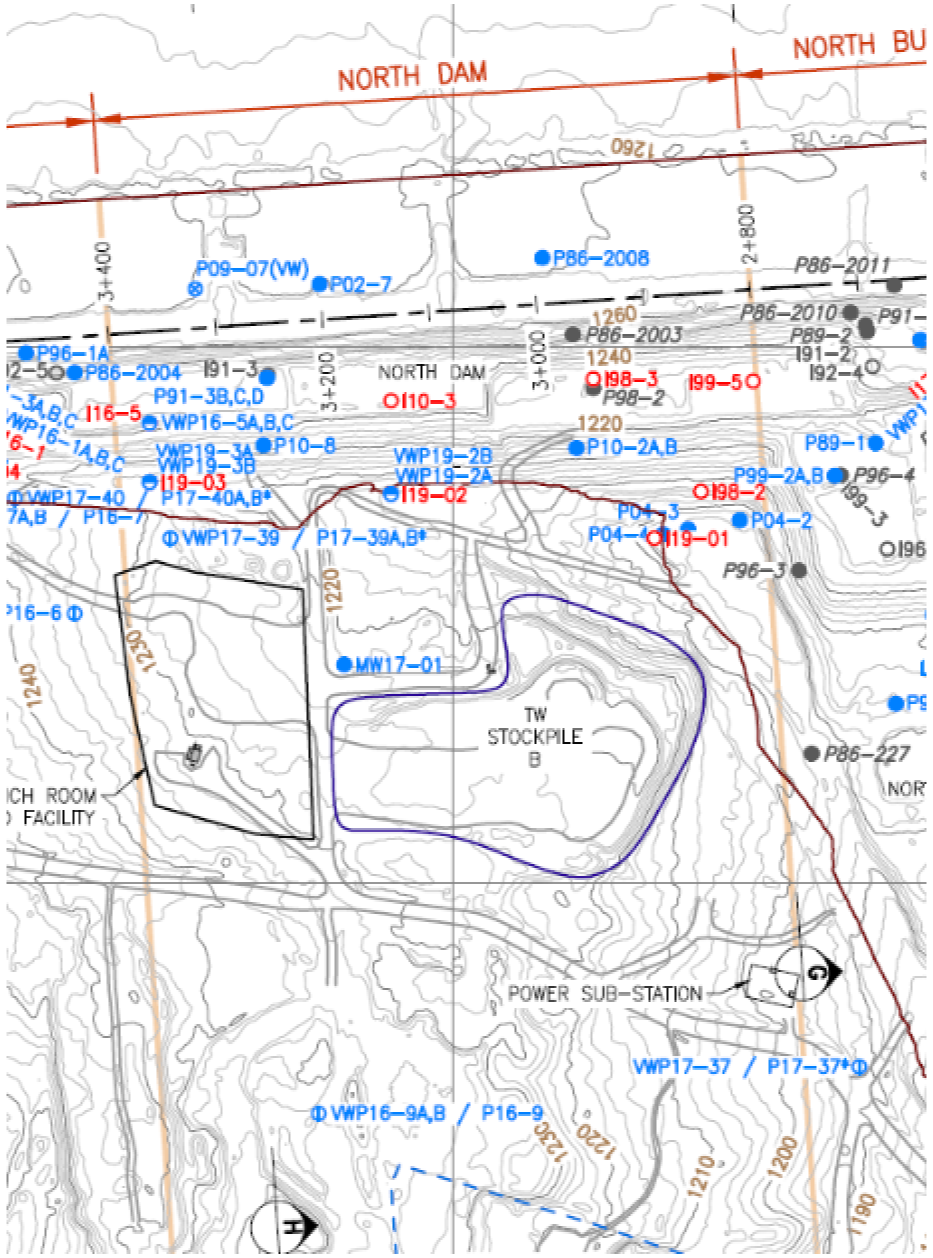




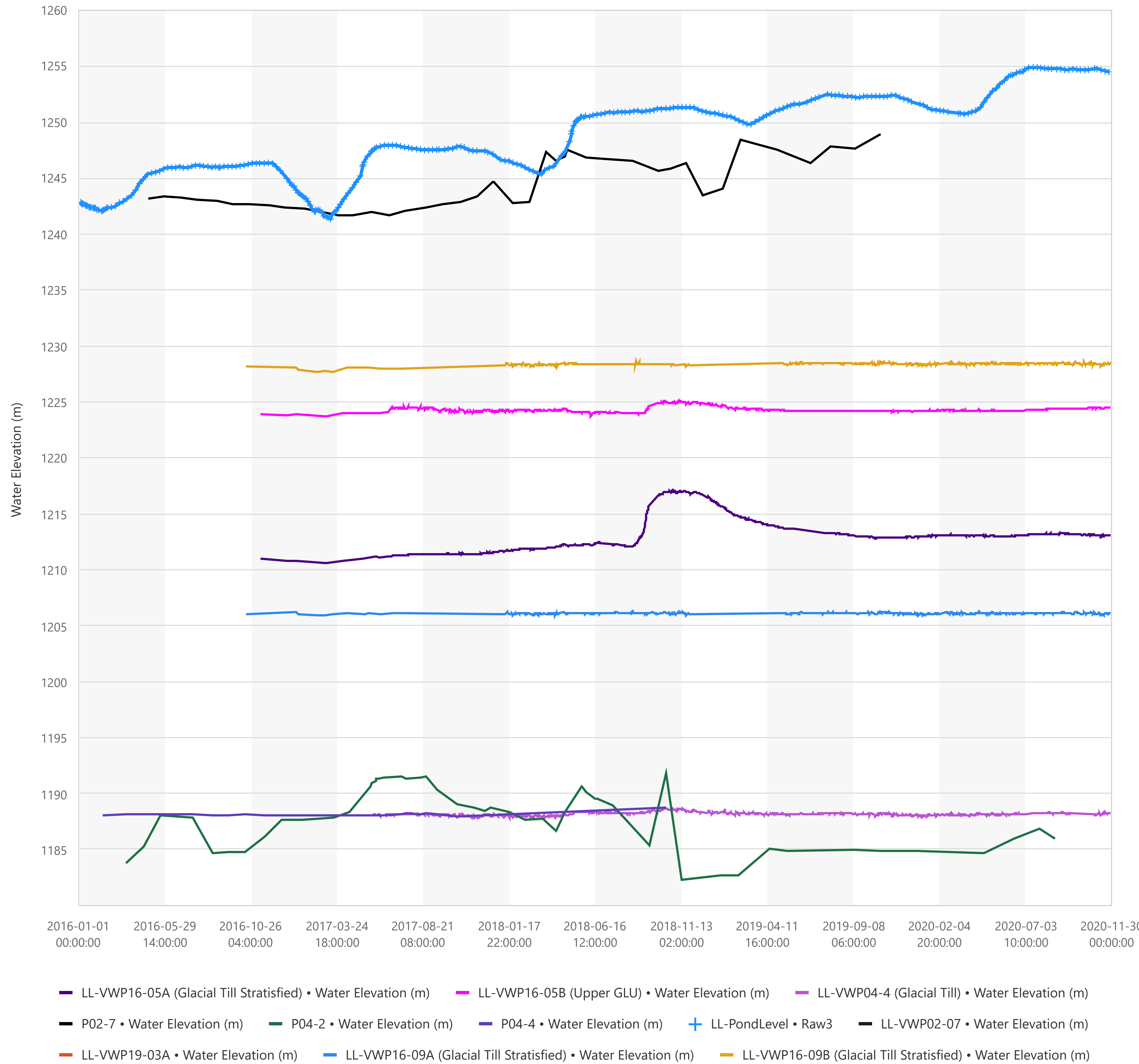
North DAM U-GLU - Foundation Rock

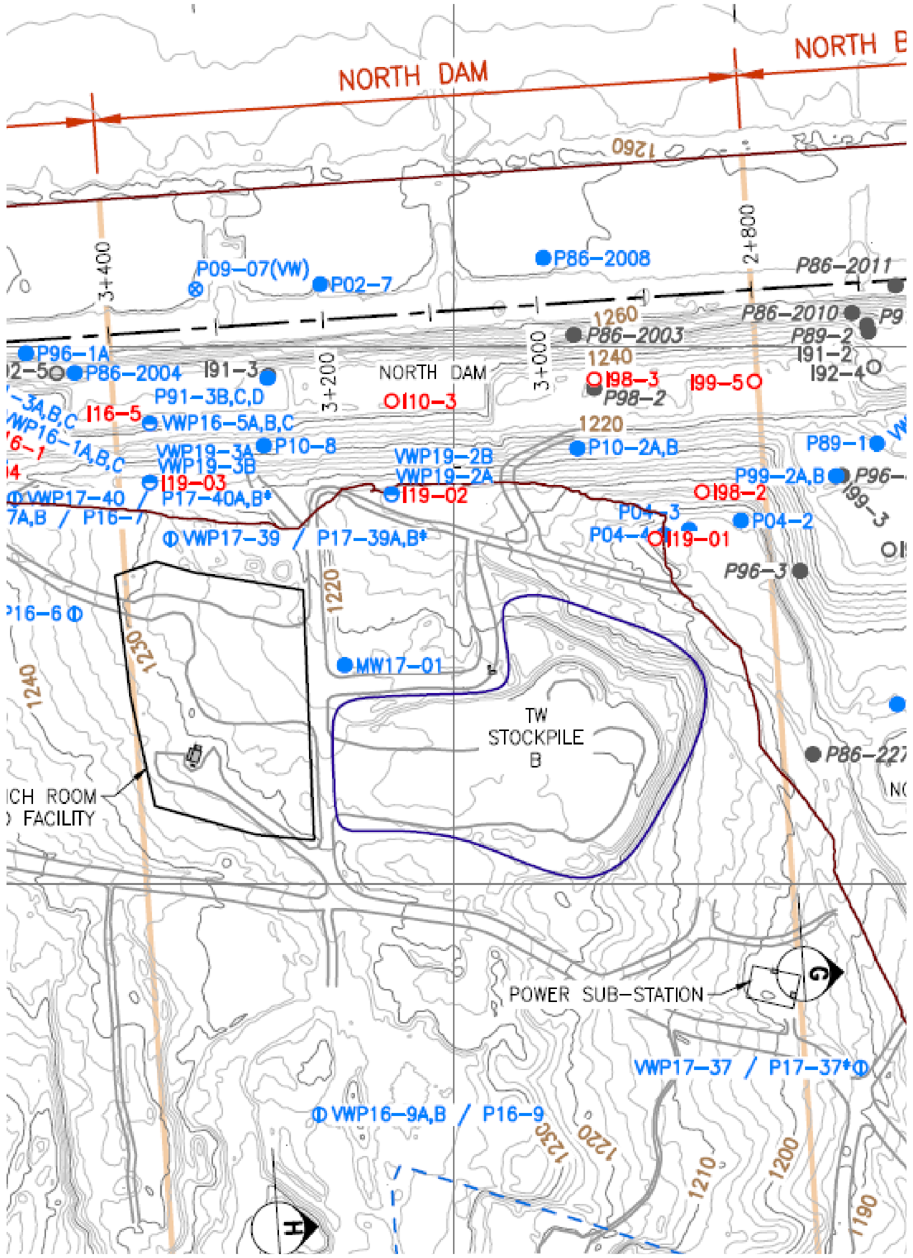


North Dam Bedrock
Water Elevations Since 2016

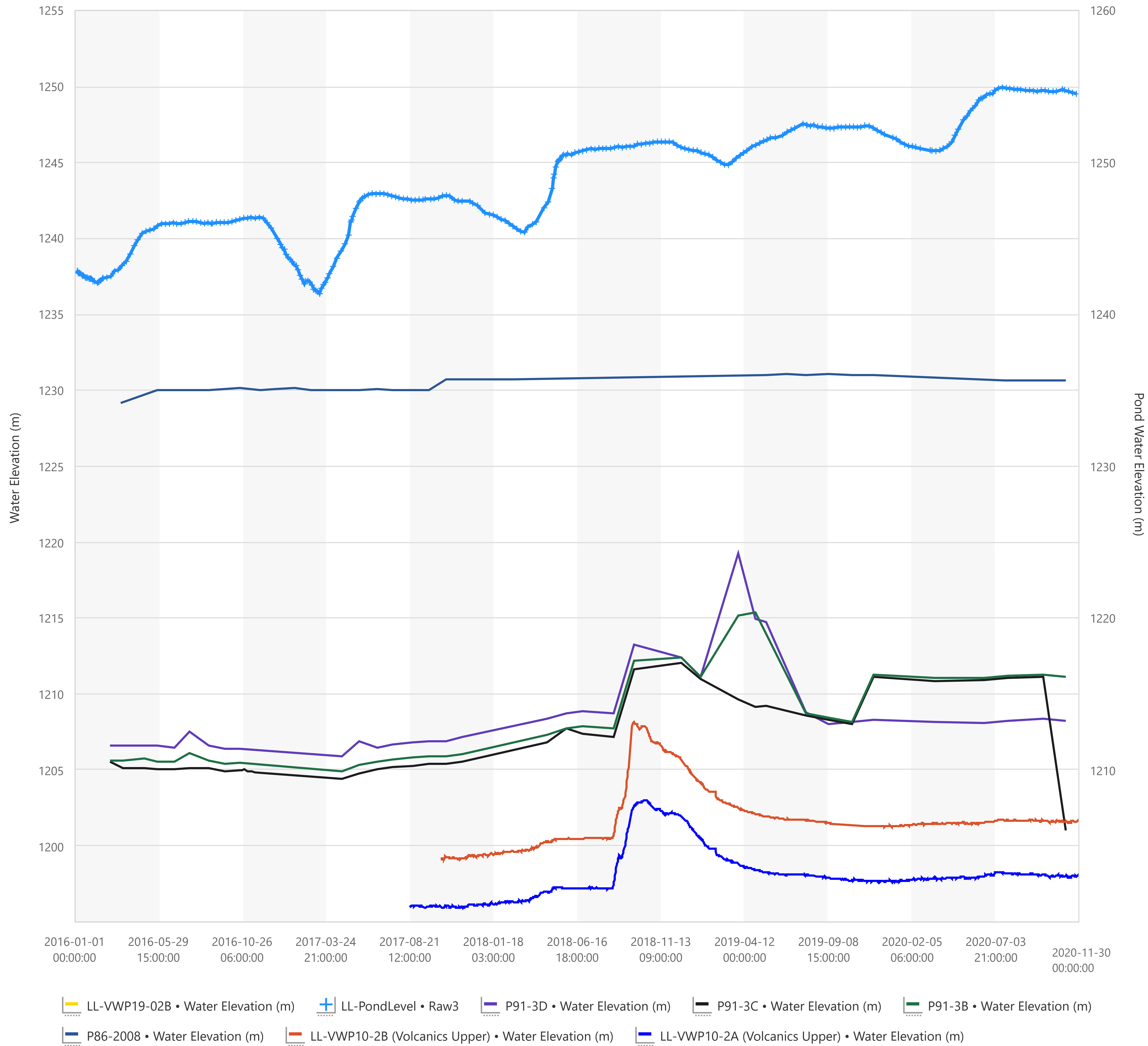


North Dam Bedrock
Glacial Till, Sand, Upper GLU

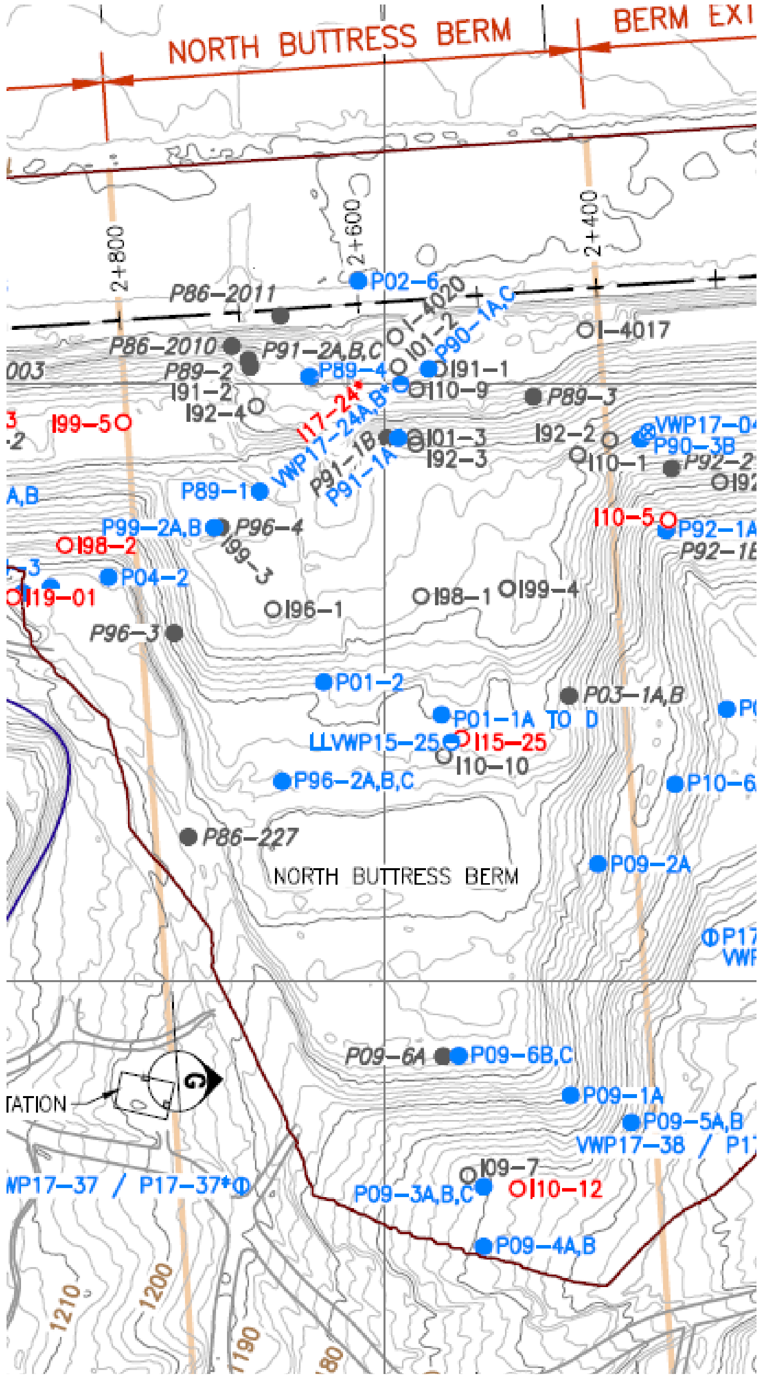




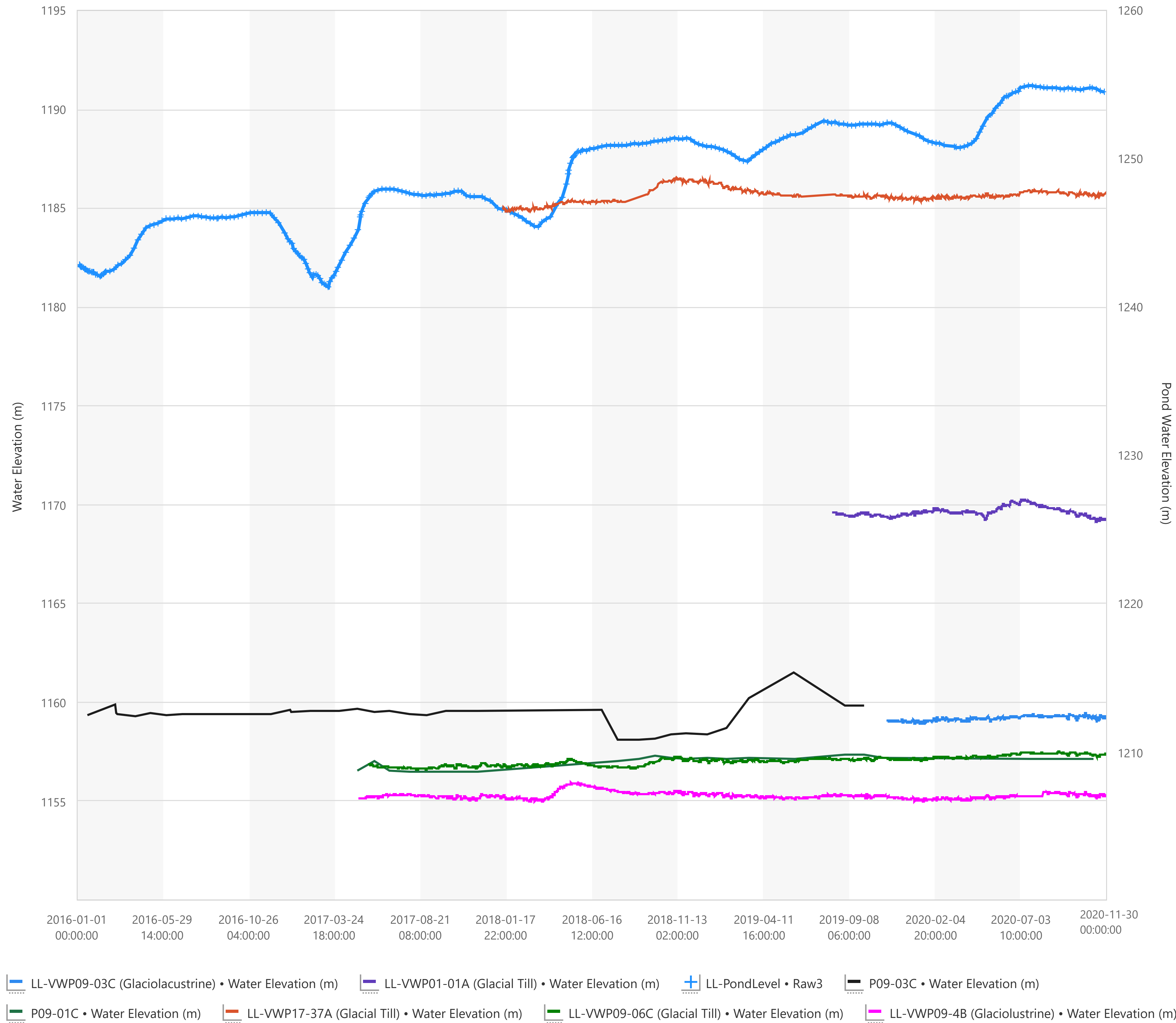
North Dam Bedrock - Volcanics

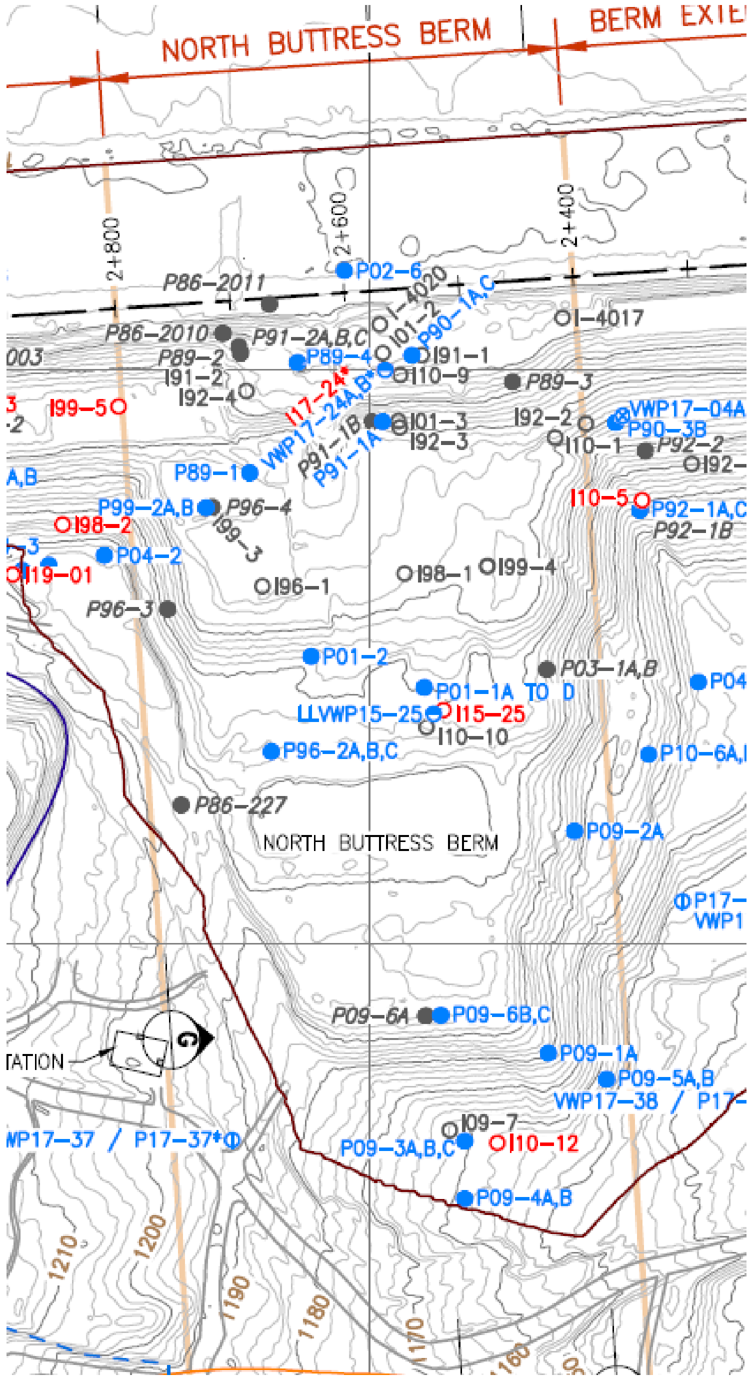


North Buttress Berm
Water Elevations Since 2016

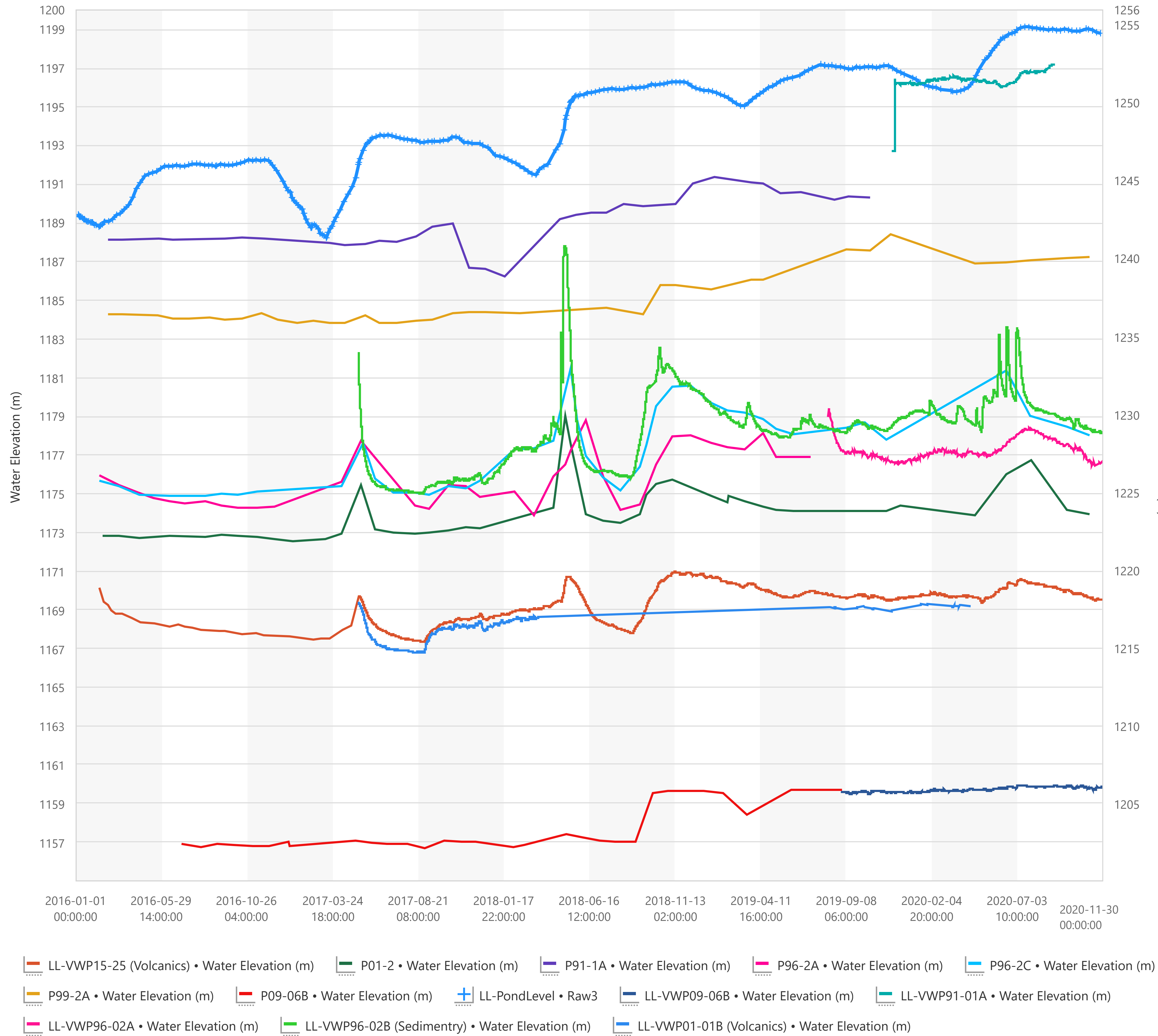


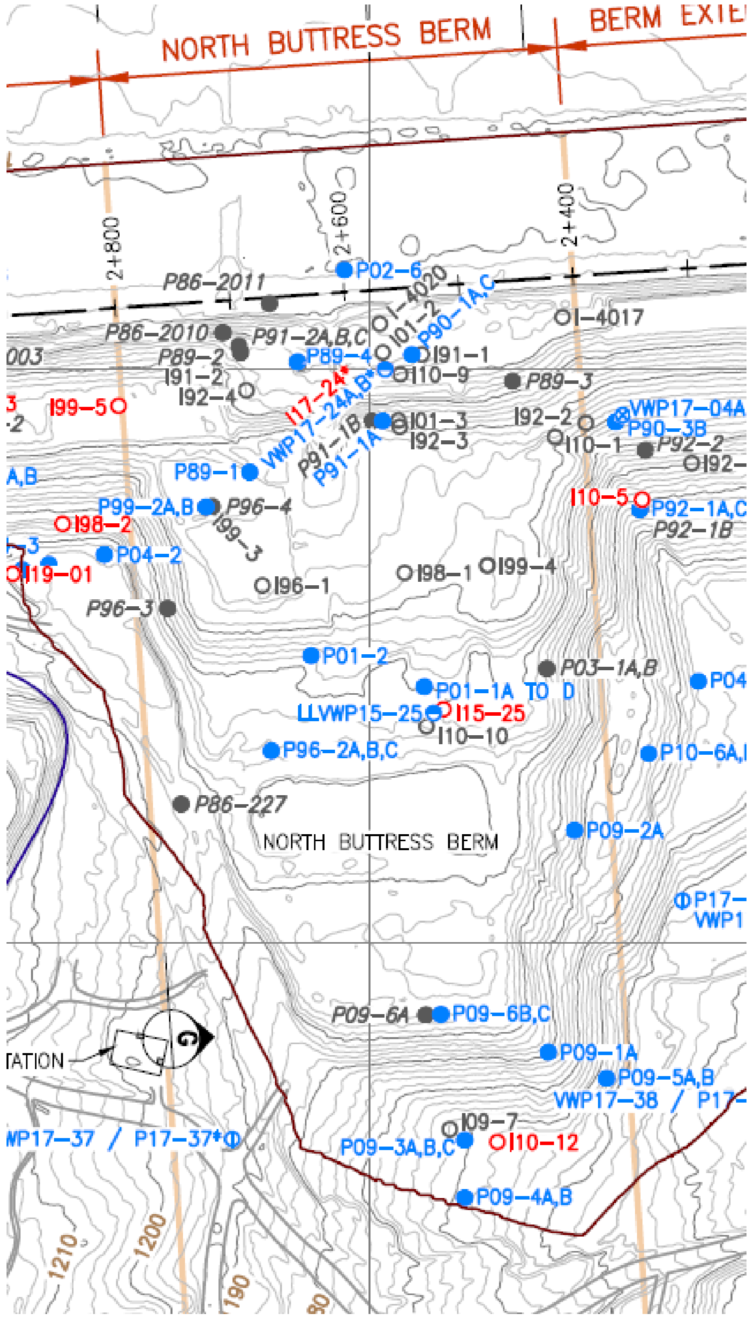
NBB - Overburden



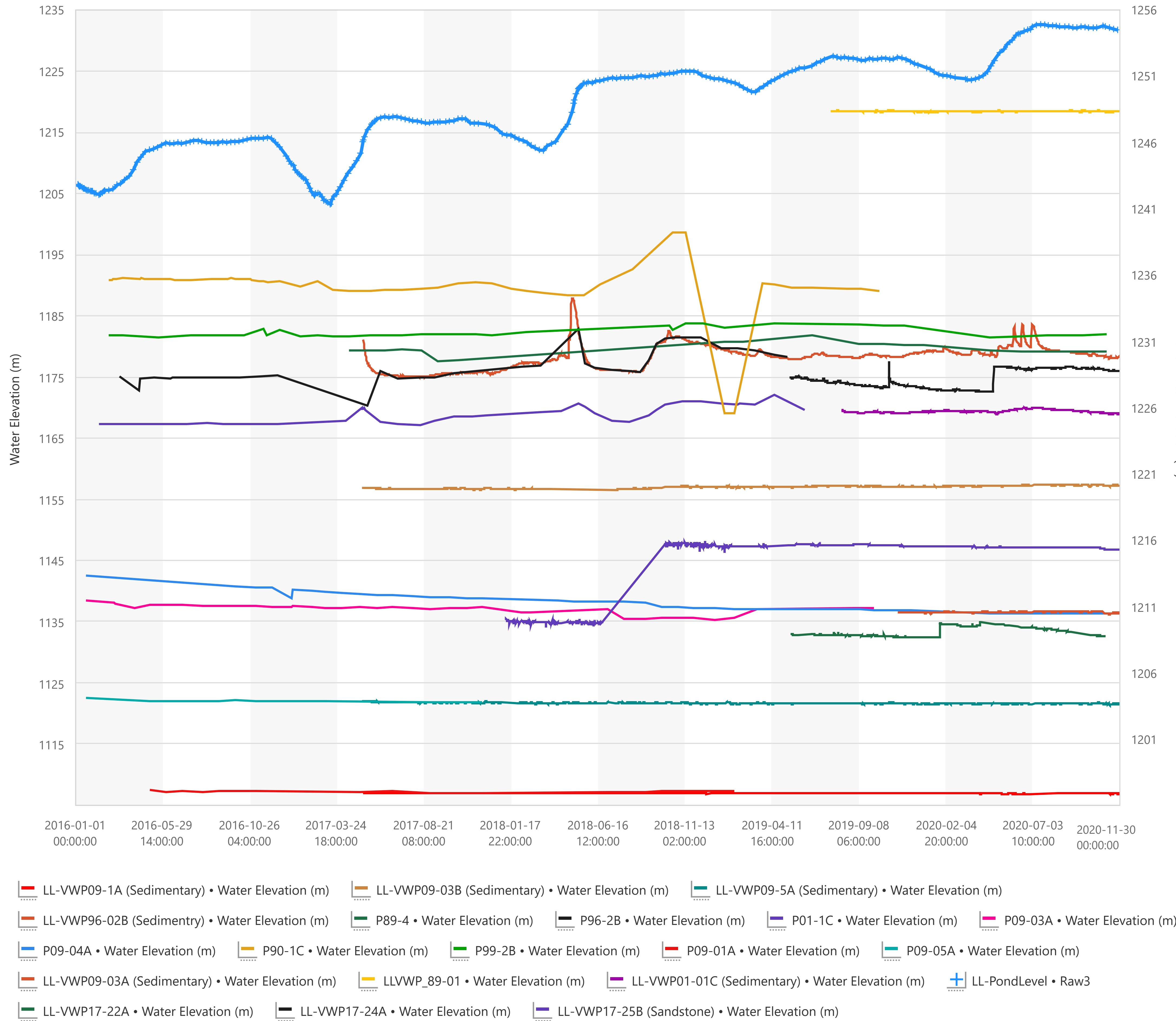


NBB - Volcanics

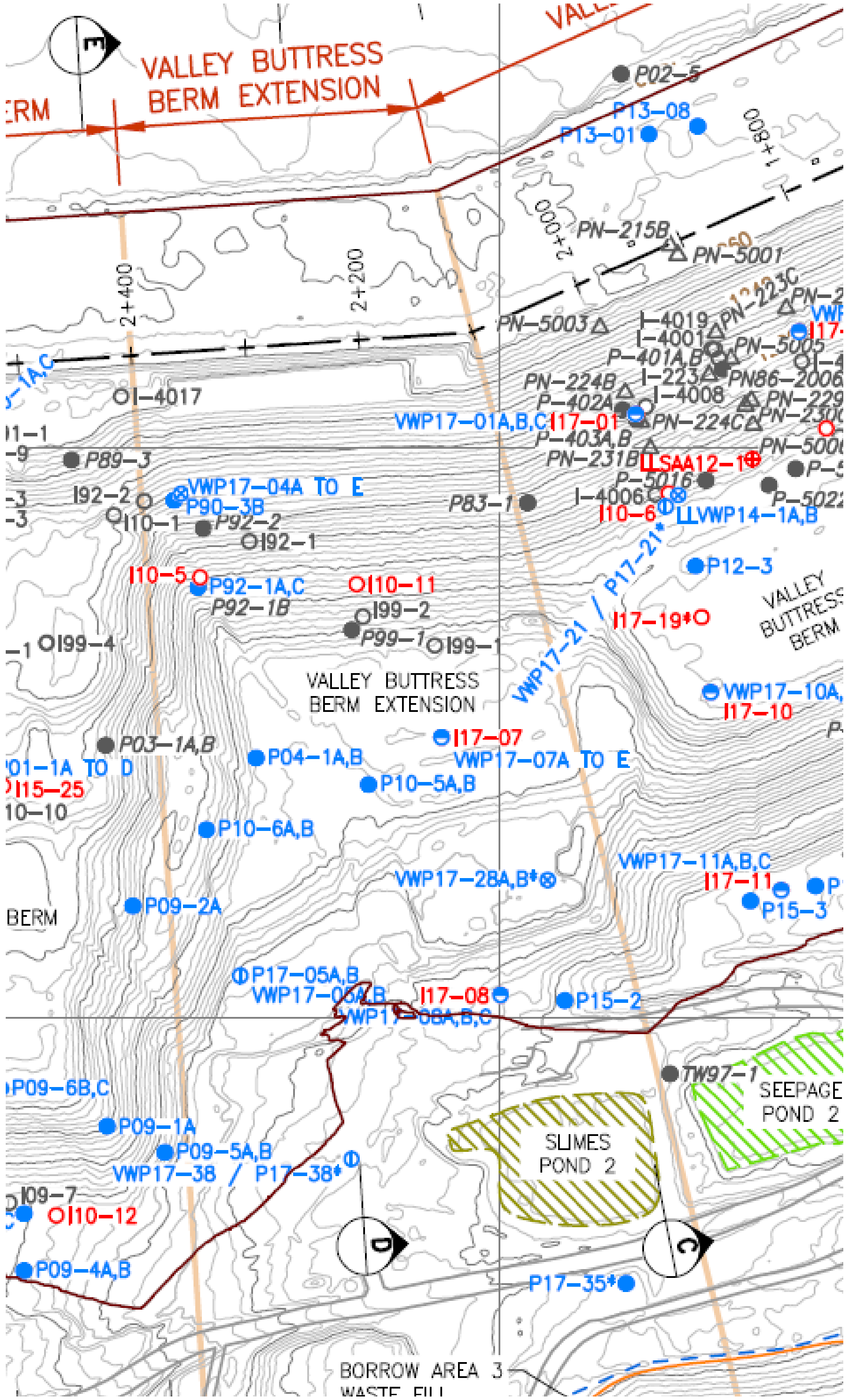




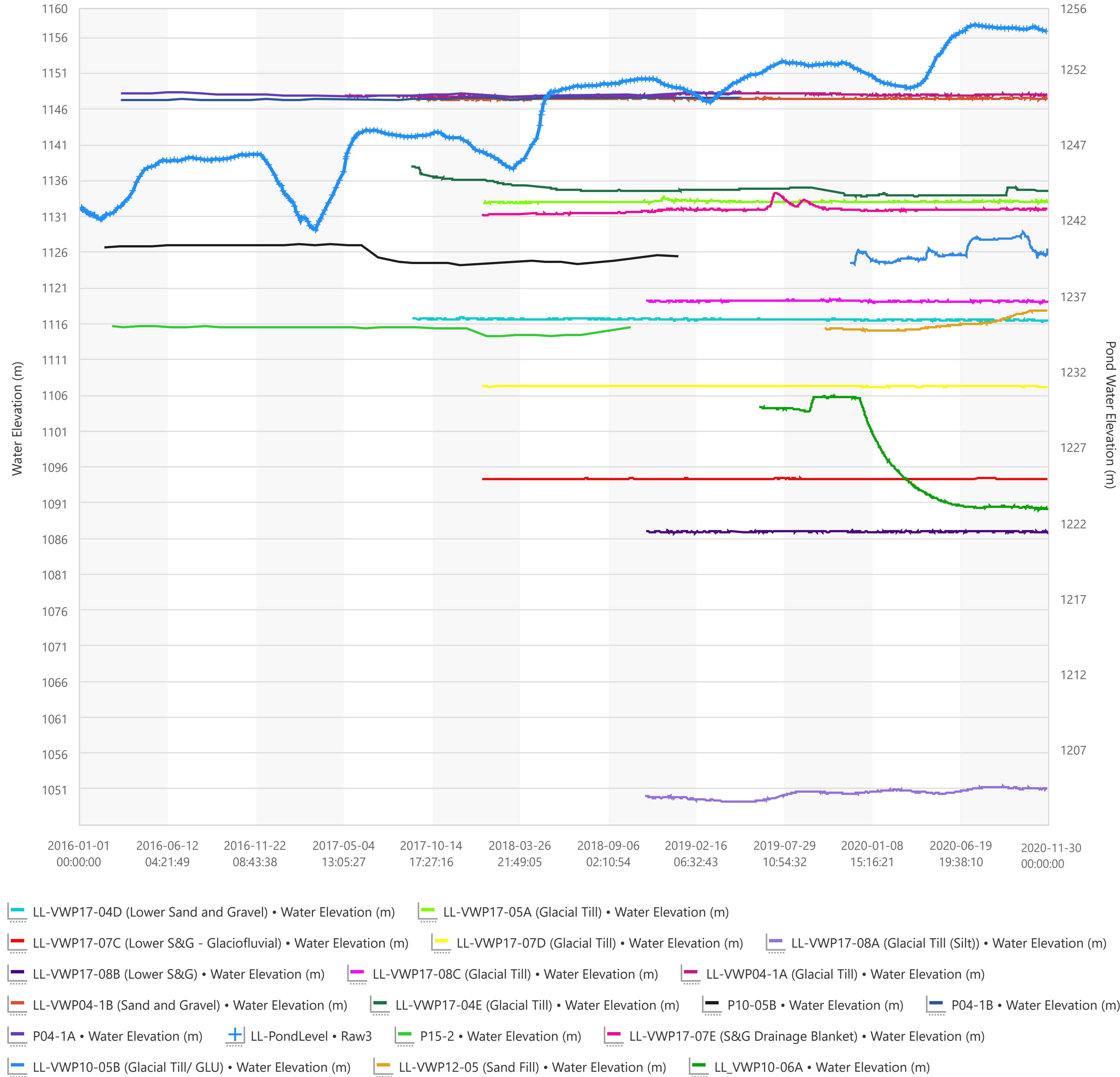
NBB - Sedimentary

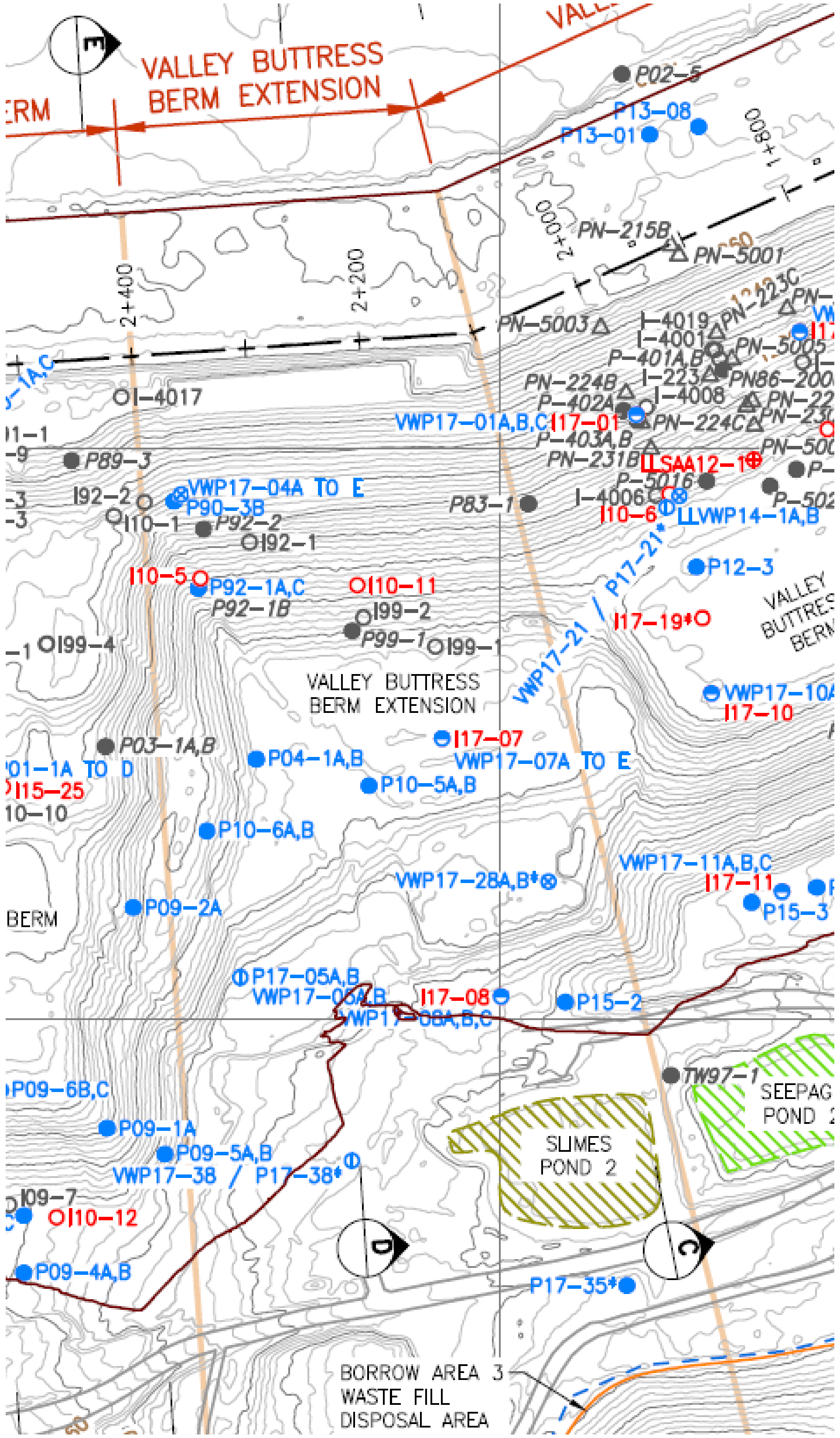


Valley Buttress Berm Extension
Water Elevations Since 2016

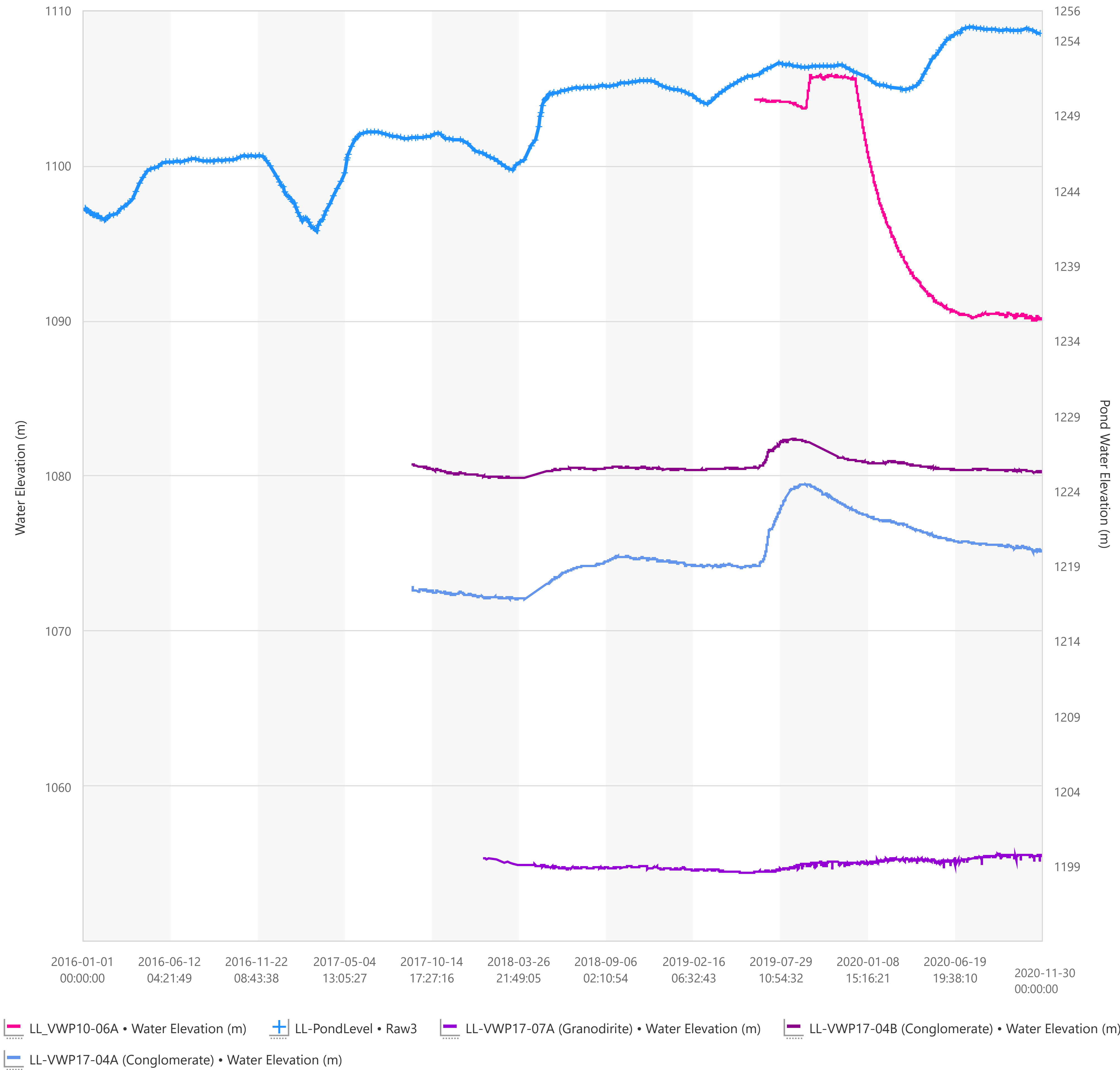


VBBE - Overburden and Dam Fill

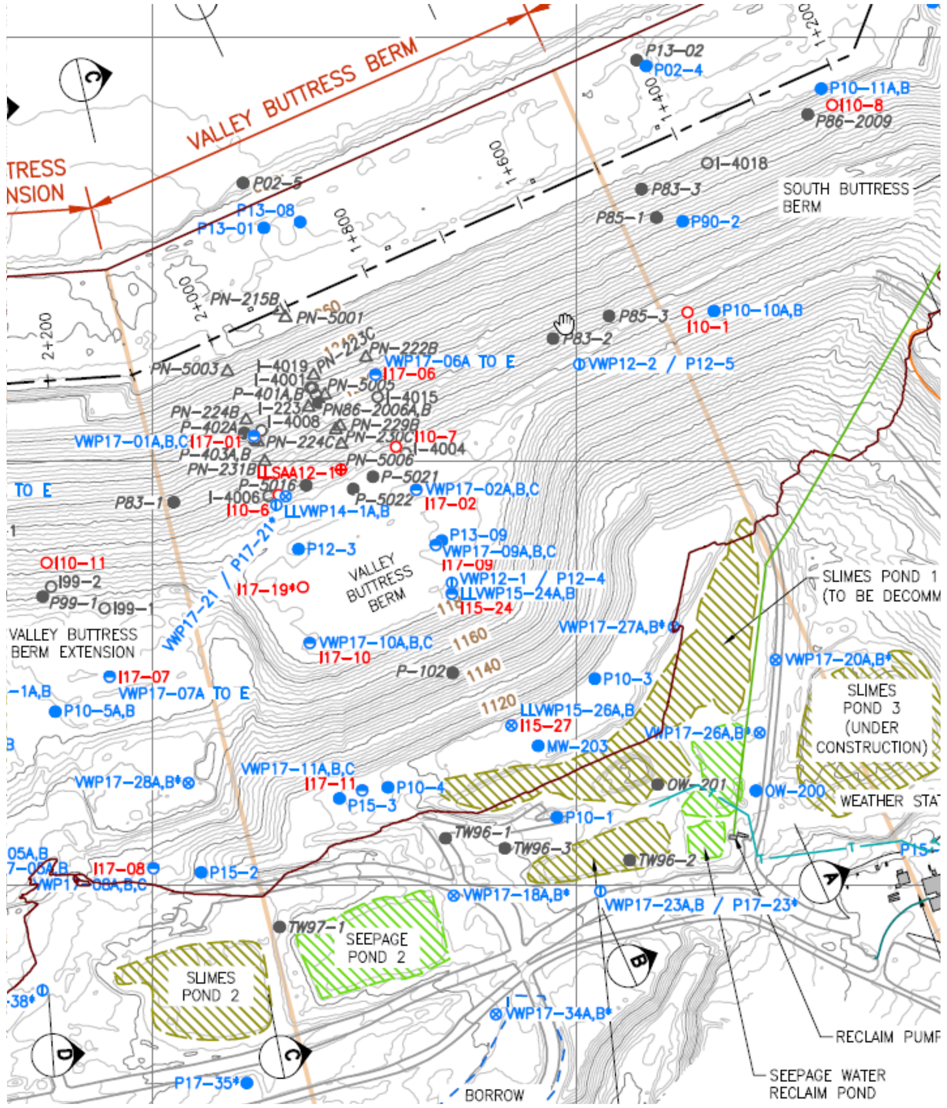




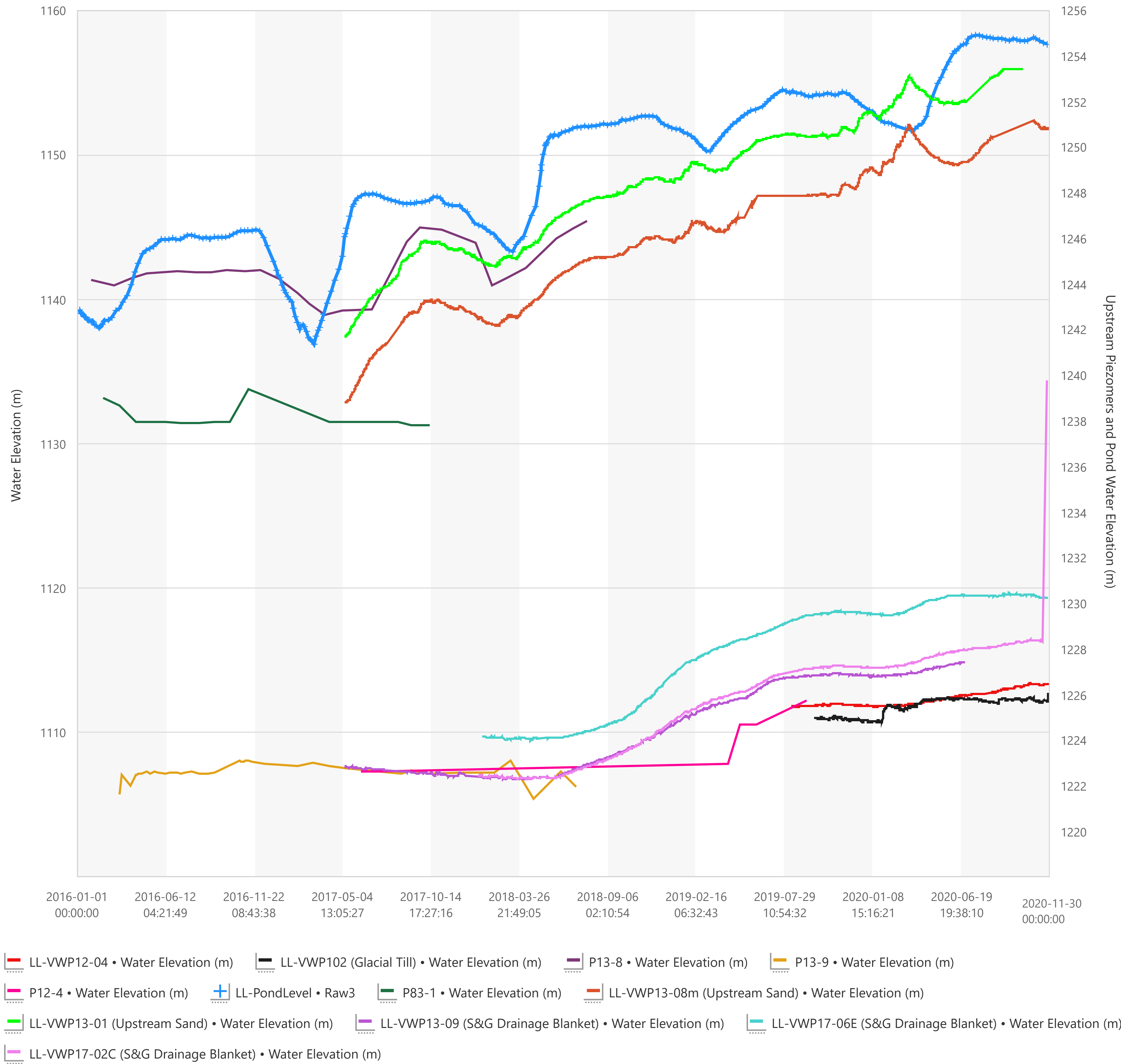
VBBE - Foundation Rock

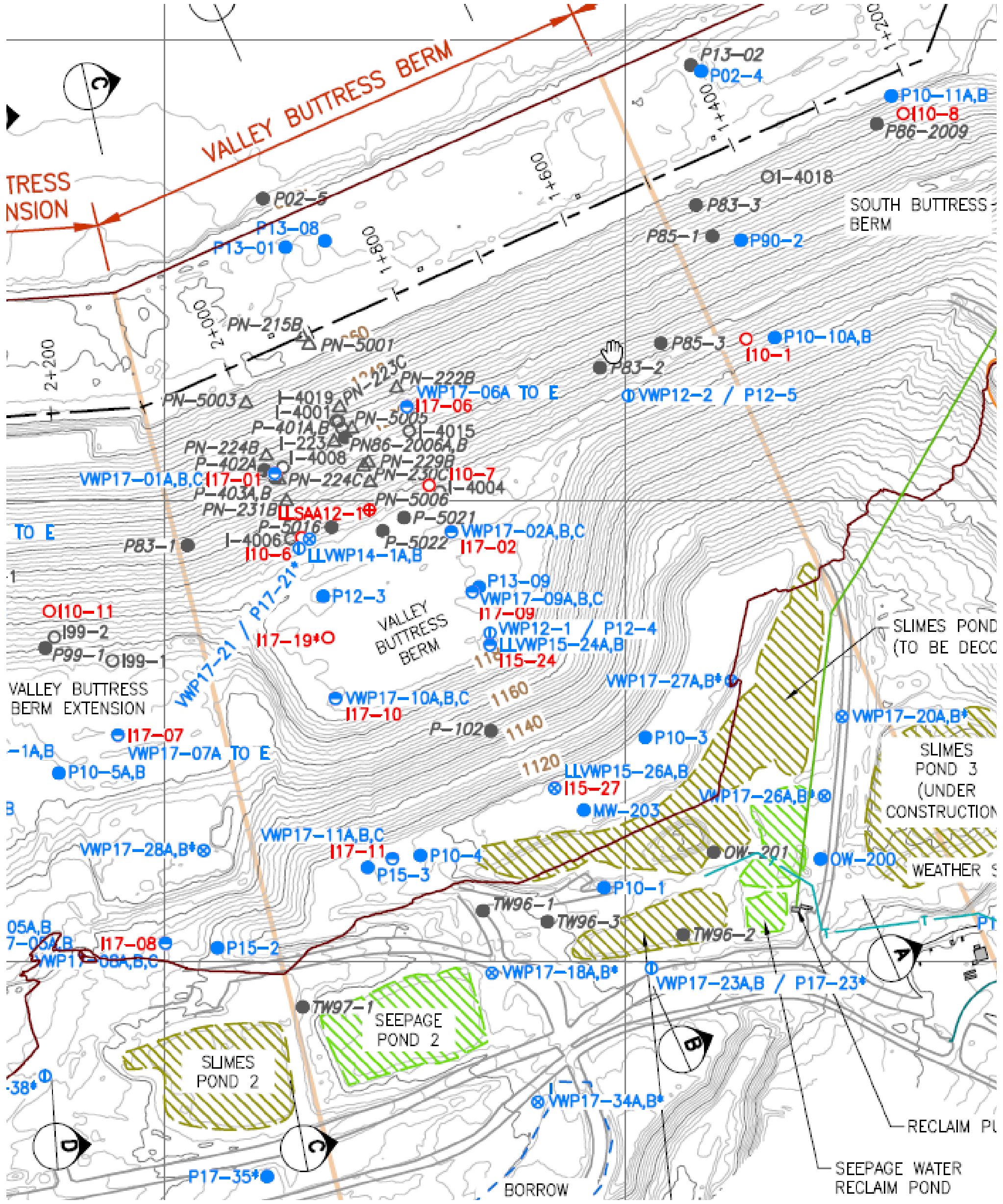


Valley Buttress Berm
Water Elevations Since 2016

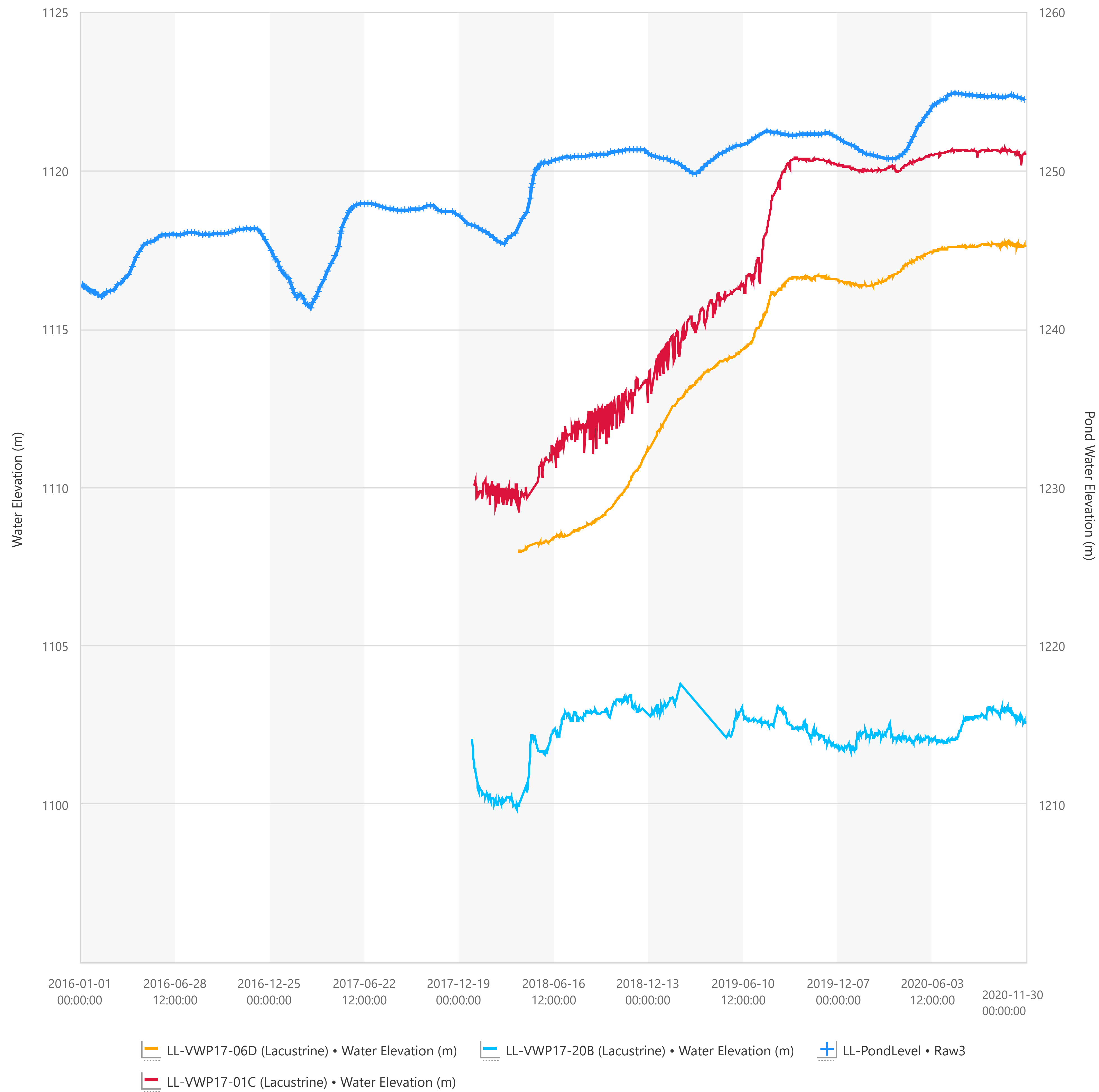

VALLEY BUTTRESS BERM
SOUTH BUTTRESS BERM
VALLEY BUTTRESS BERM EXTENSION
SLIMES POND 3 (UNDER CONSTRUCTION)
SLIMES POND 2
SEEPAGE POND 2
WEATHER STA
RECLAIM PUMP
SEEPAGE WATER RECLAIM POND
BORROW

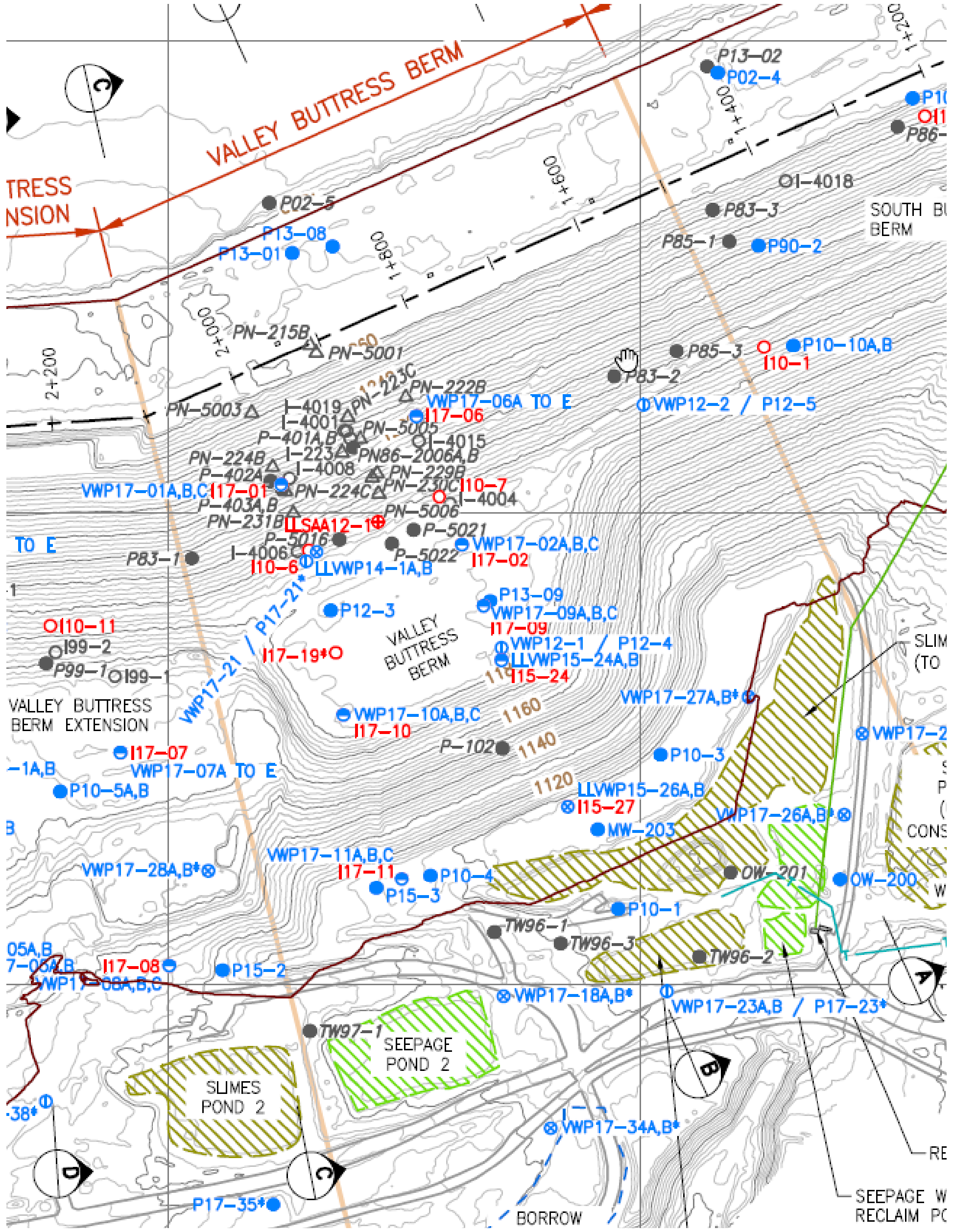
VBB - Dam Fill


Water Elevation (m)
Upstream Piezomers and Pond Water Elevation (m)
1160
1150
1140
1130
1120
1110
1256
1254
1252
1250
1248
1246
1244
1242
1240
1238
1236
1234
1232
1230
1228
1226
1224
1222
1220
2016-01-01 00:00:00
2016-06-12 04:21:49
2016-11-22 08:43:38
2017-05-04 13:05:27
2017-10-14 17:27:16
2018-03-26 21:49:05
2018-09-06 02:10:54
2019-02-16 06:32:43
2019-07-29 10:54:32
2020-01-08 15:16:21
2020-06-19 19:38:10
2020-11-30 00:00:00
LL-VWP12-04 • Water Elevation (m)
LL-VWP102 (Glacial Till) • Water Elevation (m)
P13-8 • Water Elevation (m)
P13-9 • Water Elevation (m)
P12-4 • Water Elevation (m)
LL-PondLevel • Raw3
P83-1 • Water Elevation (m)
LL-VWP13-08m (Upstream Sand) • Water Elevation (m)
LL-VWP13-01 (Upstream Sand) • Water Elevation (m)
LL-VWP13-09 (S&G Drainage Blanket) • Water Elevation (m)
LL-VWP17-06E (S&G Drainage Blanket) • Water Elevation (m)
LL-VWP17-02C (S&G Drainage Blanket) • Water Elevation (m)

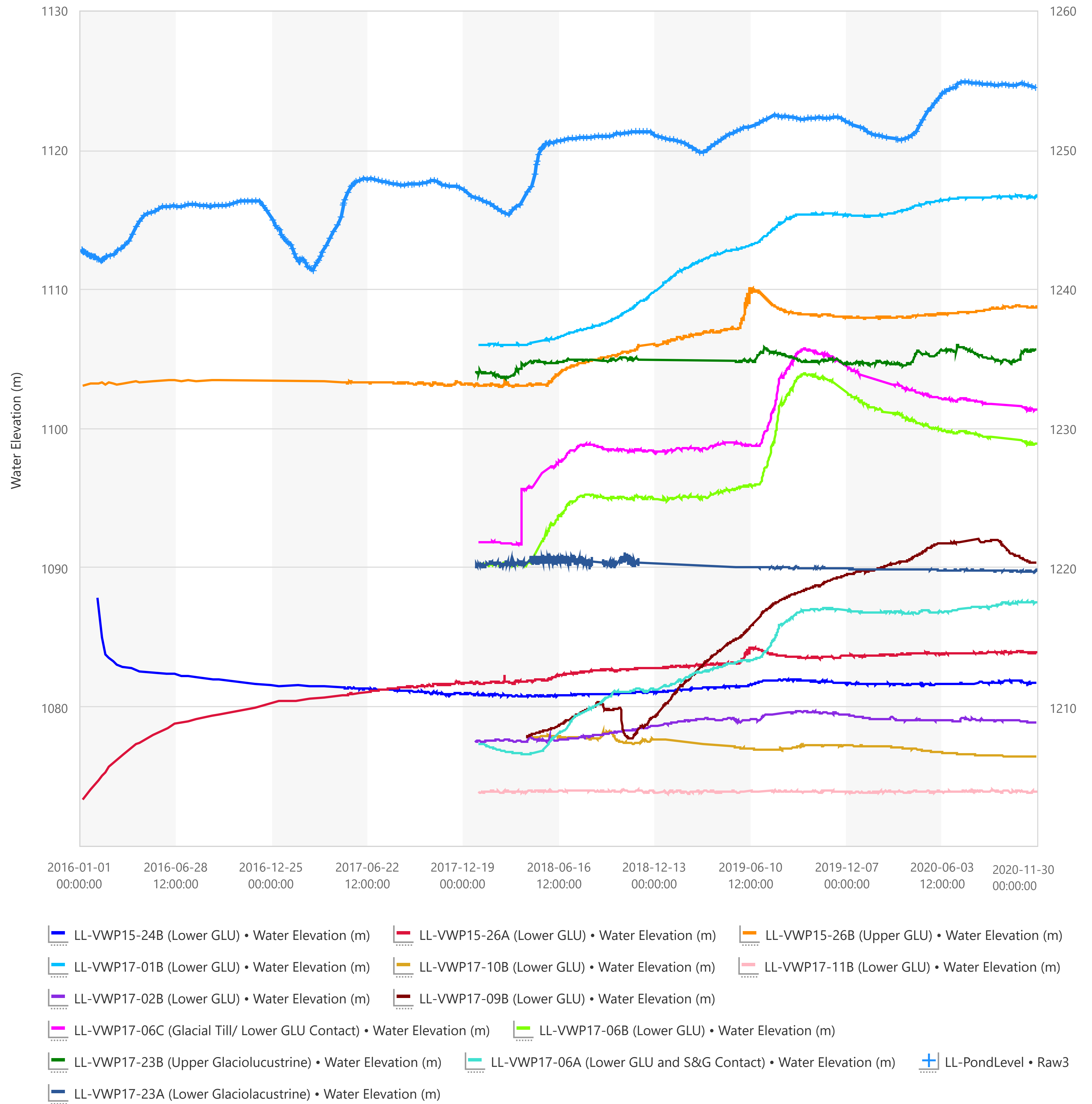


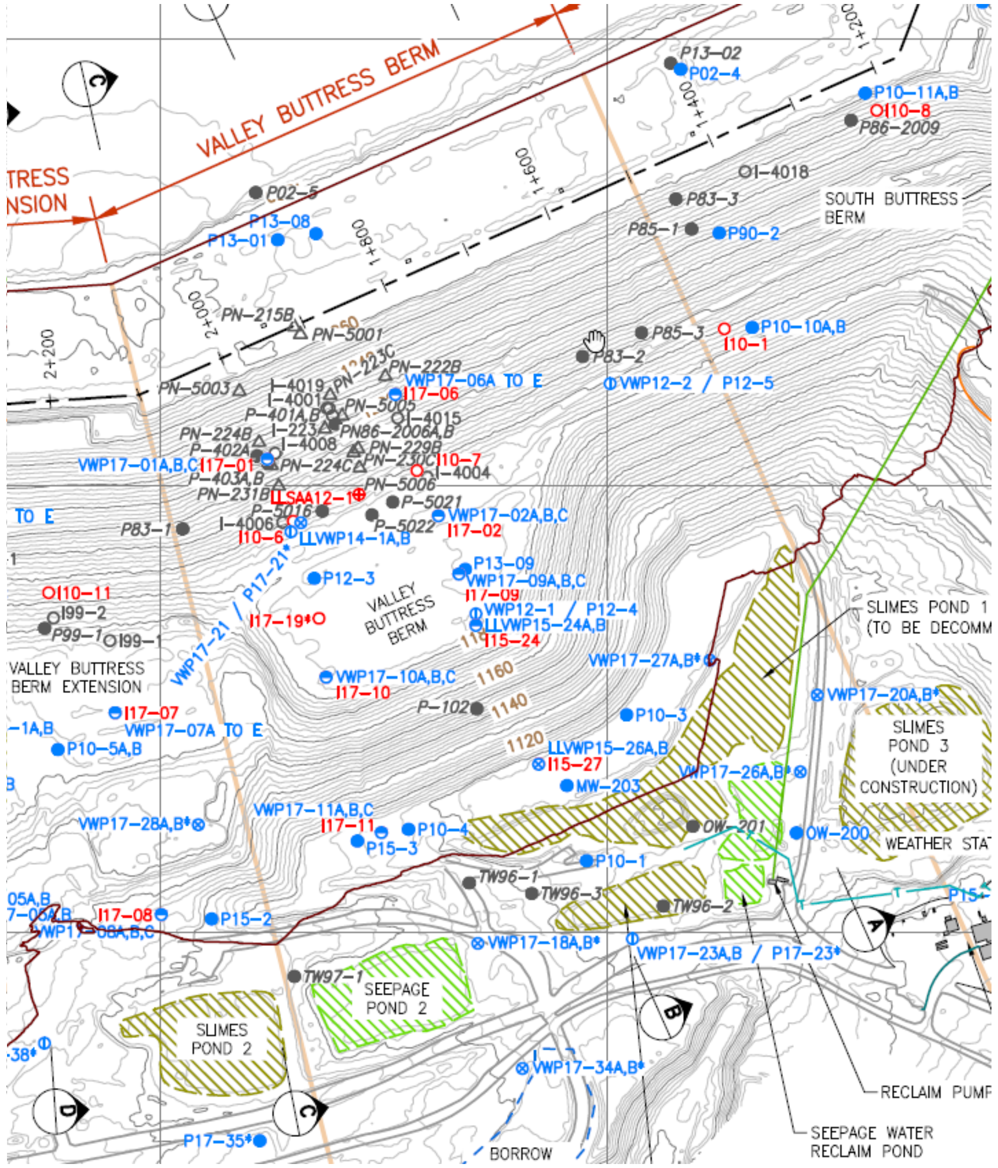
VBB - Lacustrine



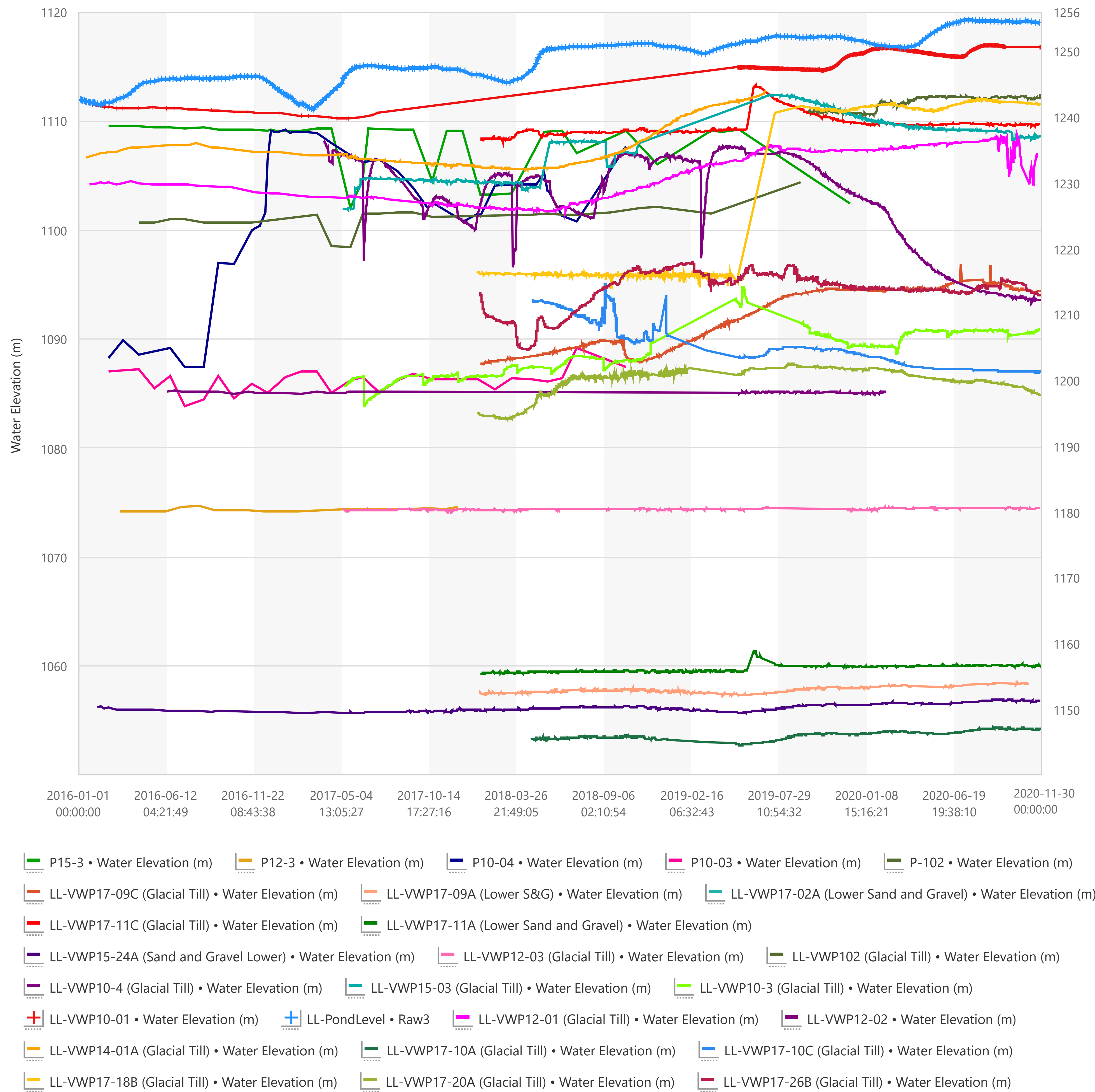


VBB - Glaciolacustrine

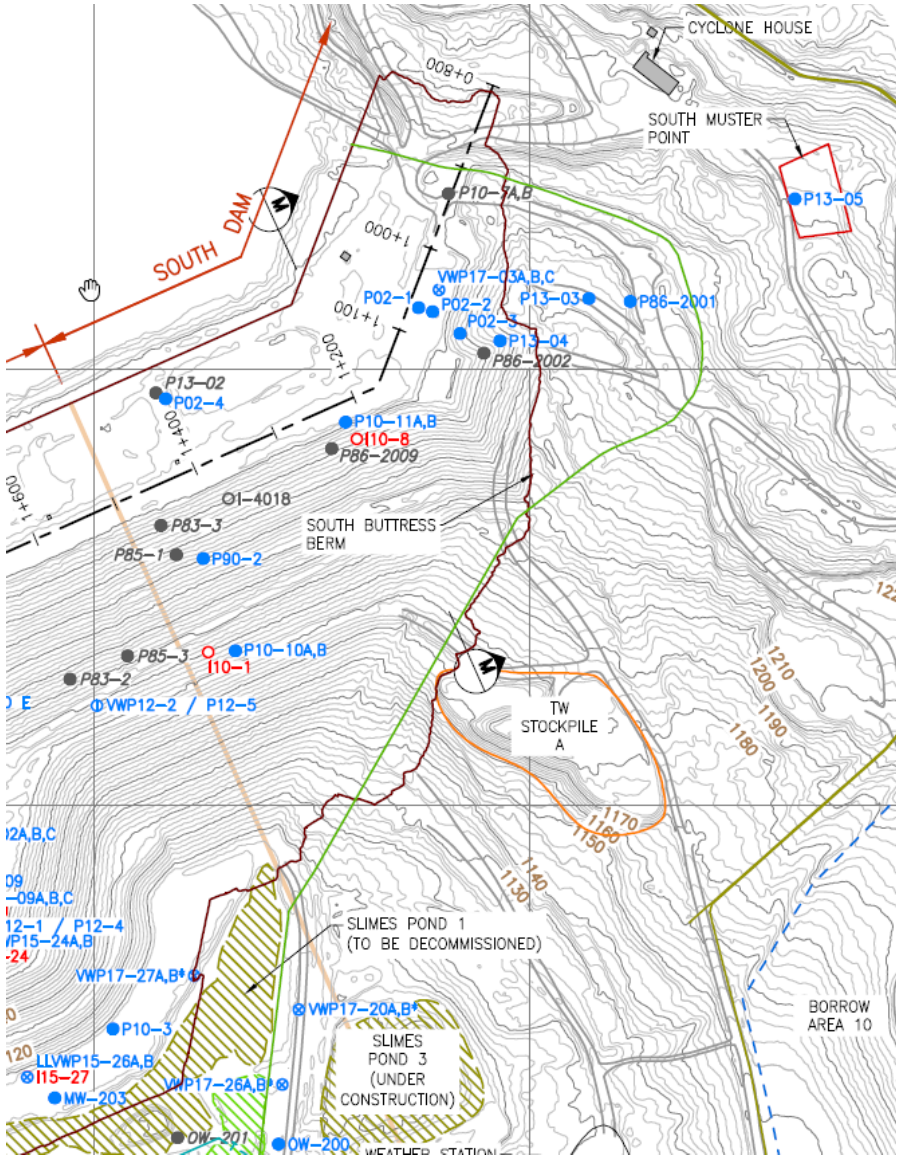




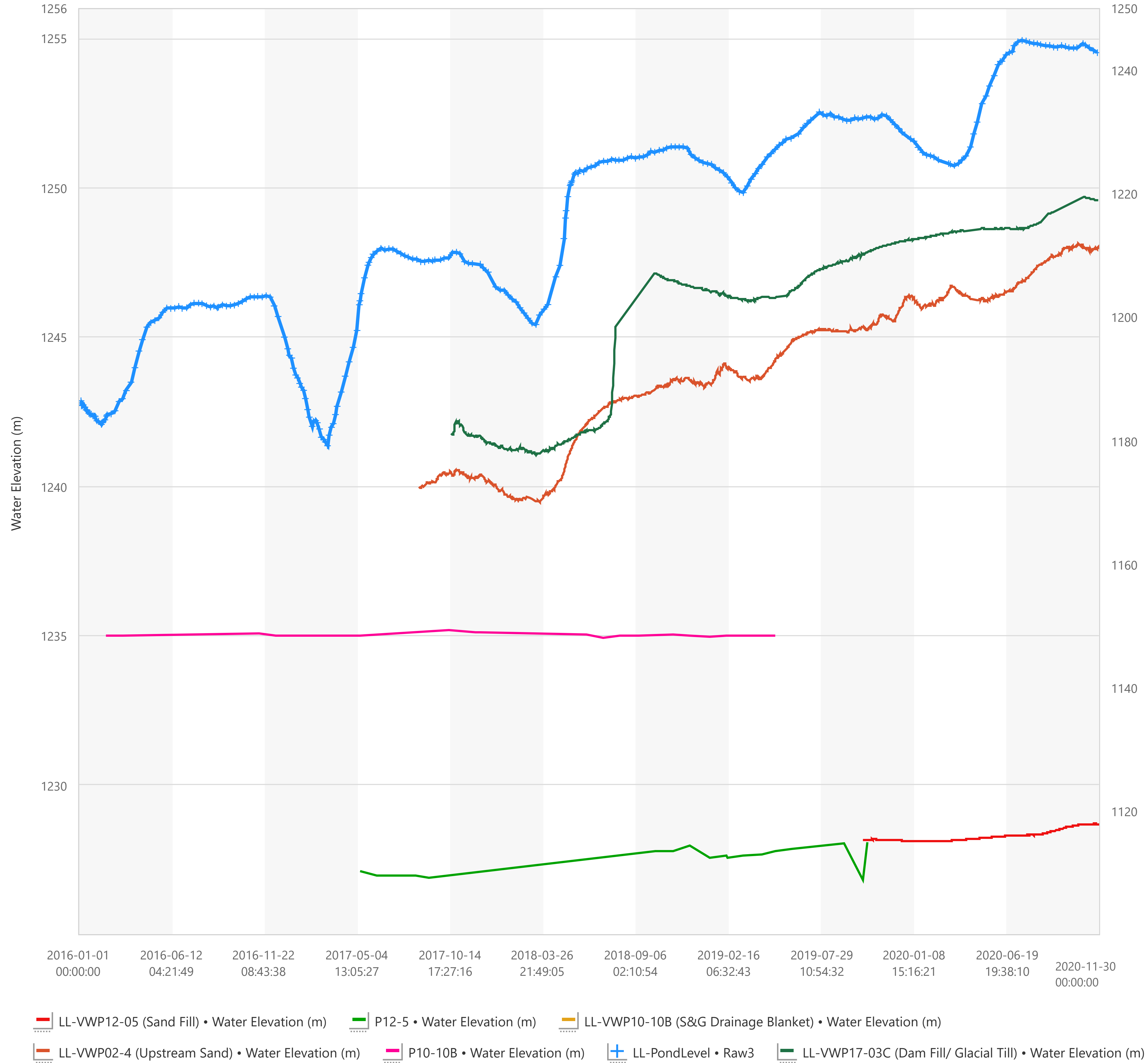
VBB - Glacial Till, Sand and Gravel

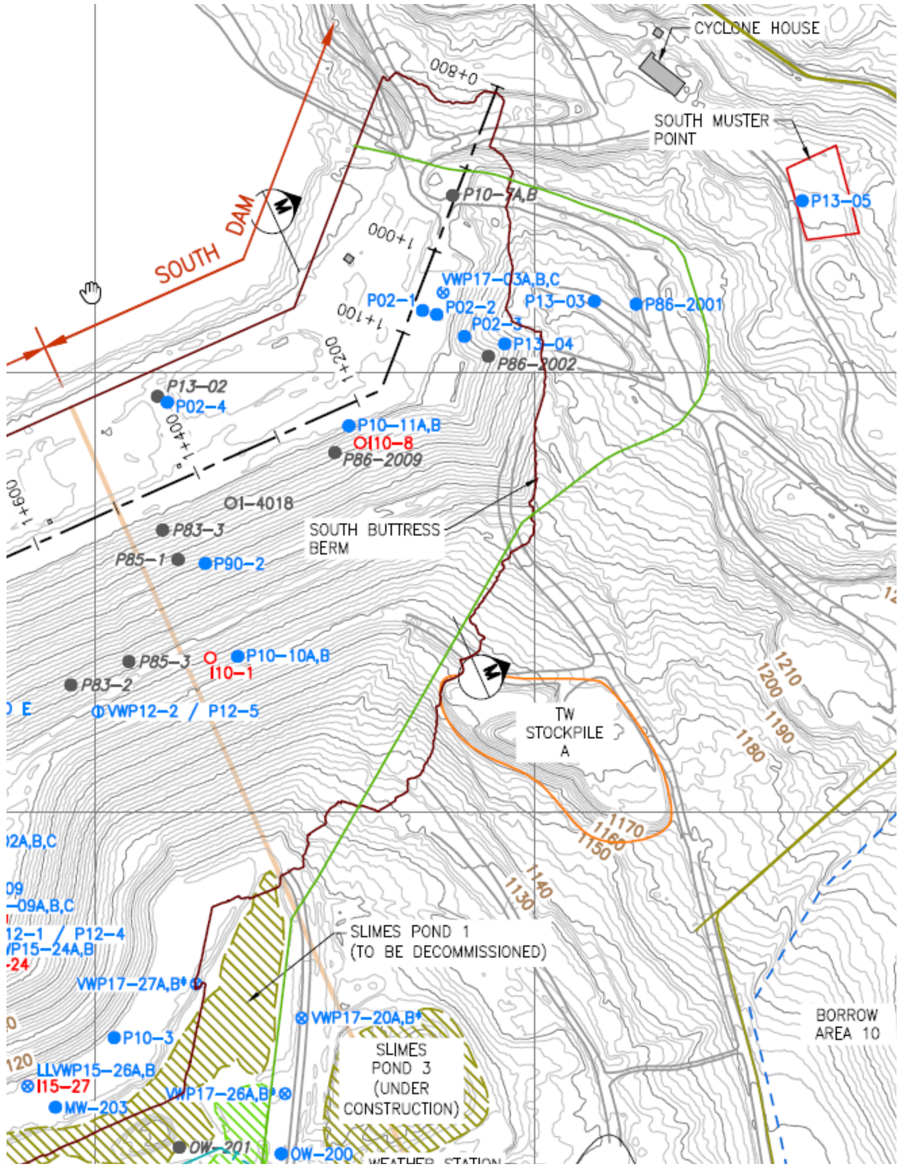


South Dam
Water Elevations Since 2016

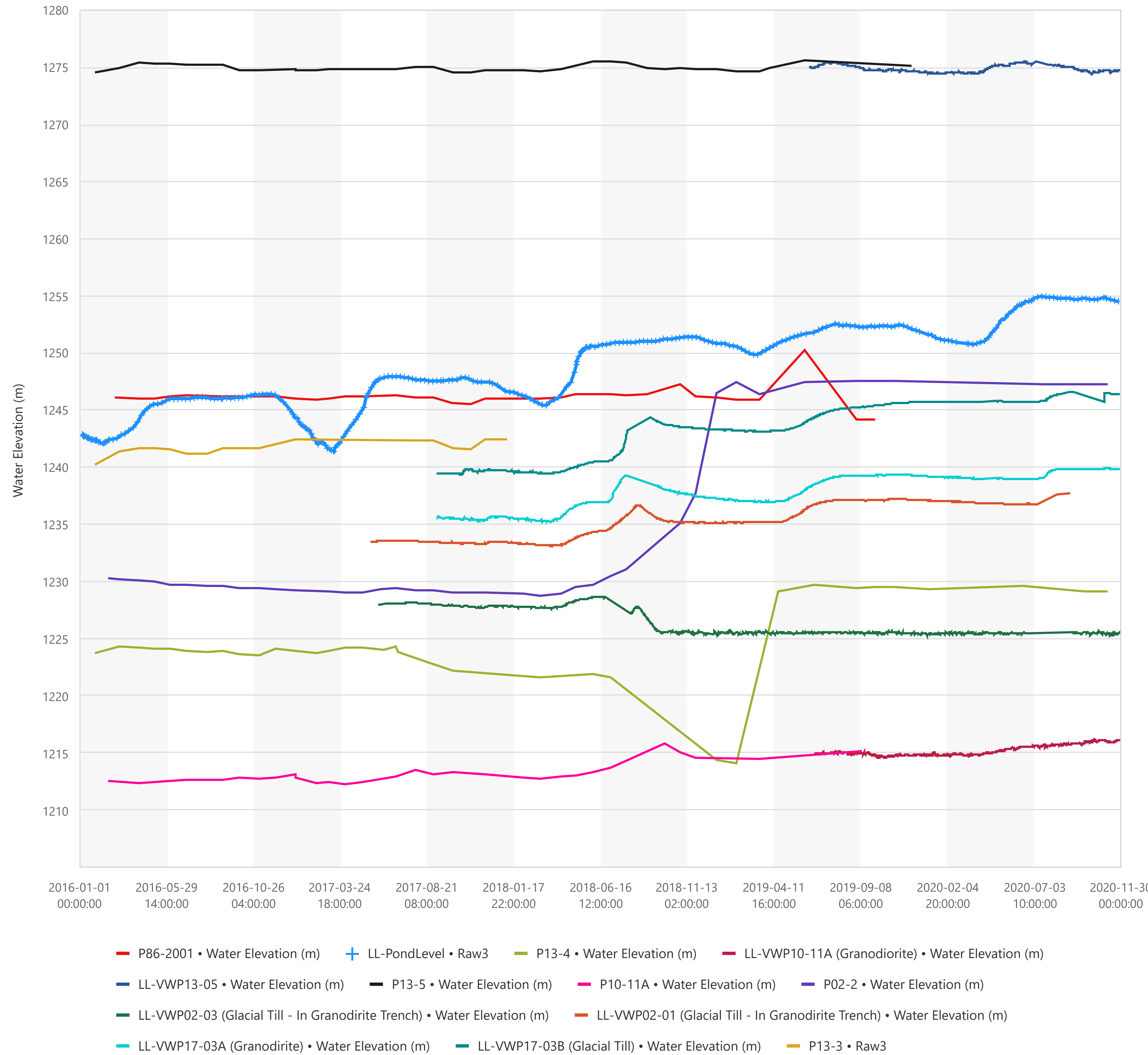


South Dam - Dam Fill





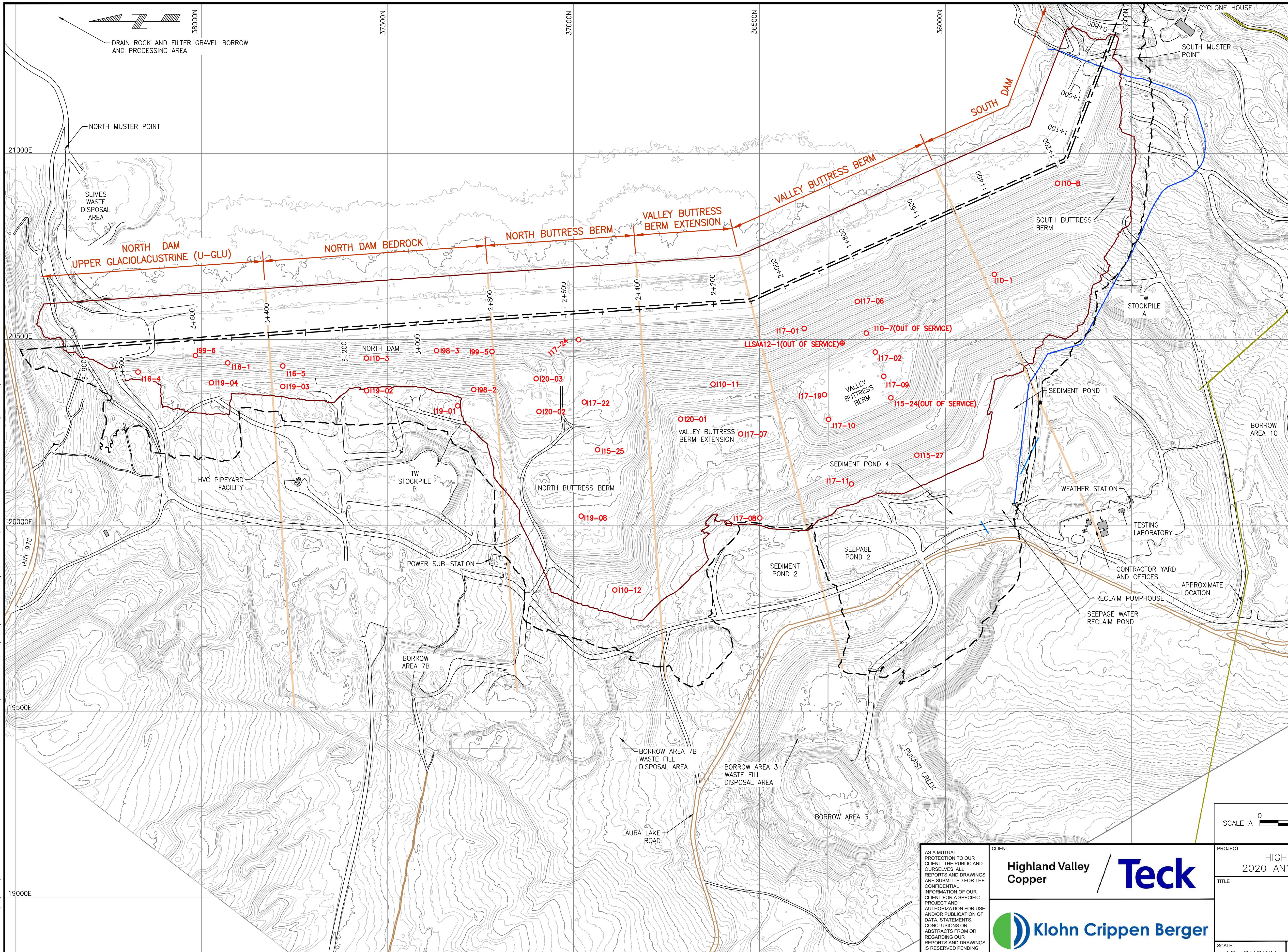
South Dam - Granodiorite Foundation Rock and Glacial Till



APPENDIX III-C

L-L Dam Inclinometer Plots

L-L Dam Inclinometer location plan



LEGEND:

- BORROW AREA
- WASTE FILL DISPOSAL AREA
- SEEPAGE POND
- SEDIMENT POND
- EL. 1279 m ULTIMATE DAM FOOTPRINT
- SURFACE WATER RECLAIM PIPELINE
- SPATSUM WATER PIPELINE
- HAUL ROAD
- PUBLIC ROAD
- 2040 PFS DAM FOOTPRINT
- 0+800 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 PHOTOSAT SURVEY DATED 2020-10-08 (L-L DAM) AND 2017-09-15 & 24 AND 2016-09-25 & 29, (OUTSIDE OF 2020 SURVEY EXTENT).
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.

SCALE A 0 250 m

SAVE DATE: 2020-12-15 (8:59 AM)
FILE PATH: Z:\M\VCR\M02341B53 - HVC-2019 DAM SAFETY SUPPORT\400 DRAWINGS\CAD\05-FIGURES\2020 AFPR\L-L DAM-INCLINOMETERS.DWG (THAWKER)

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2020 ANNUAL FACILITY PERFORMANCE REPORT

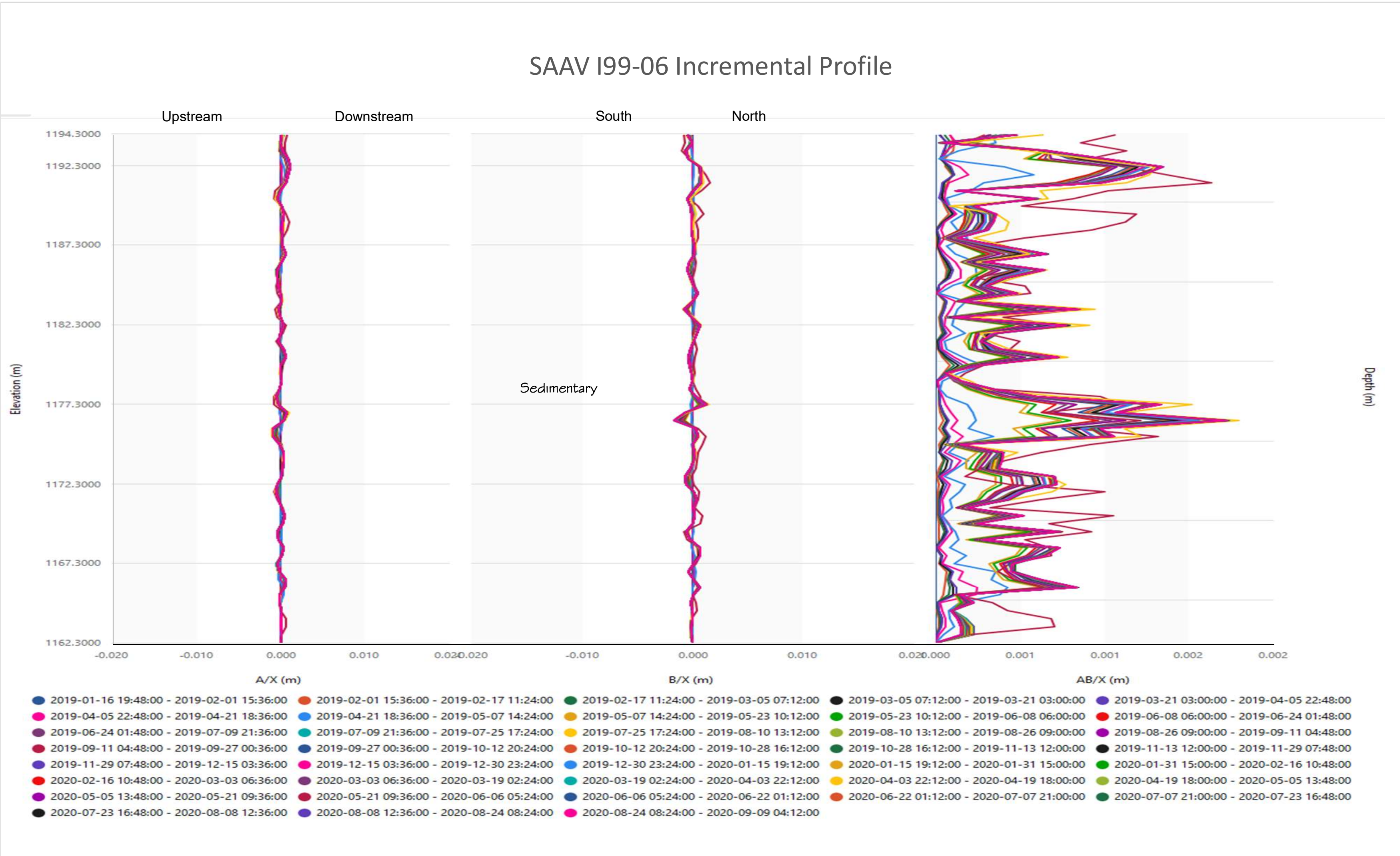
TITLE: L-L DAM INCLINOMETERS LOCATION PLAN

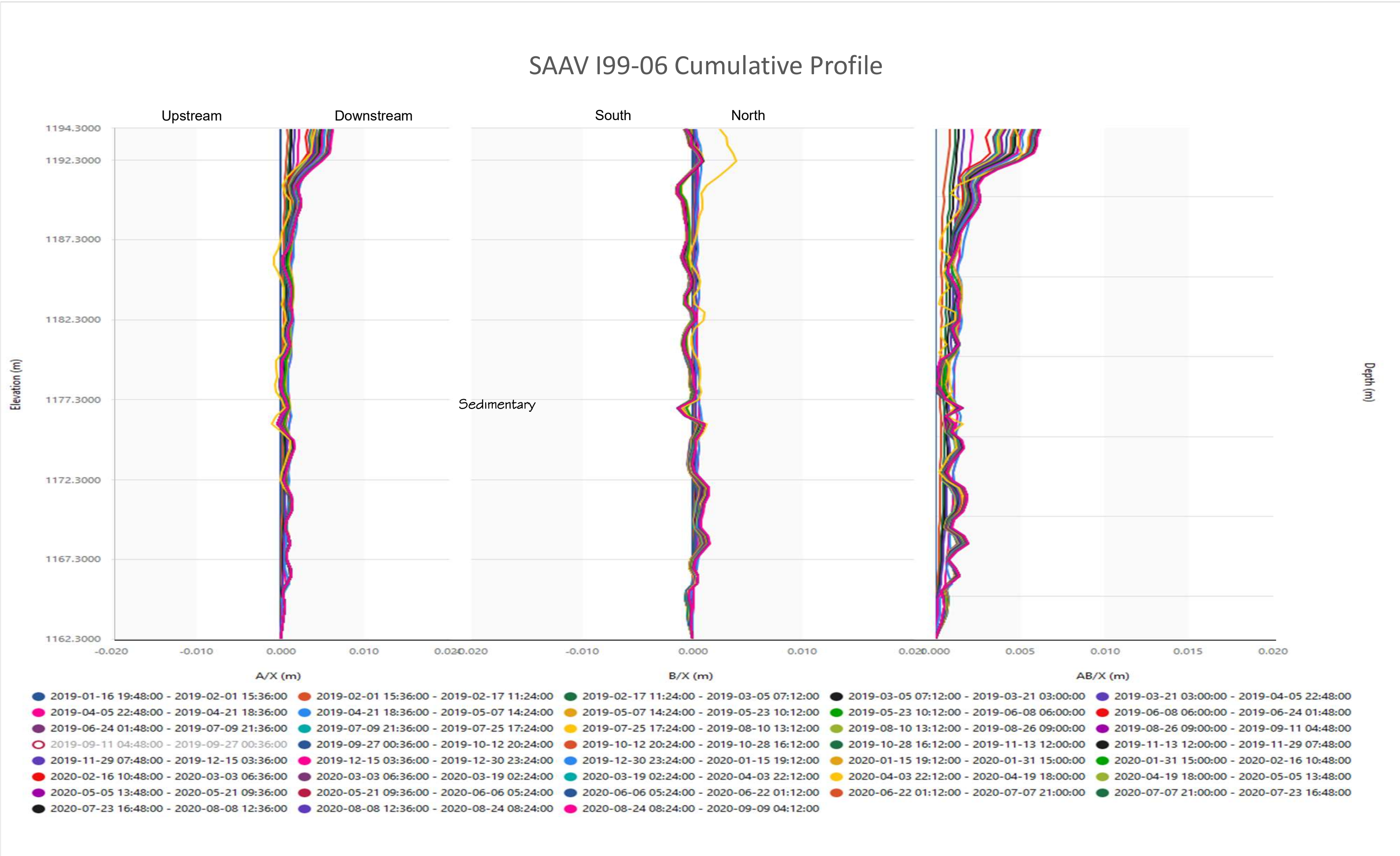
SCALE	PROJECT No.	FIG. No.
AS SHOWN	M02341B83	

KCB-FIG-D-L

North Dam Upper Glaciolacustrine (North Abutment)

I99-06


SAAV I99-06 Incremental Profile
Upstream
Downstream
South
North
Sedimentary
Elevation (m)
Depth (m)
1194.3000
1192.3000
1187.3000
1182.3000
1177.3000
1172.3000
1167.3000
1162.3000
-0.020
-0.010
0.000
0.010
0.020
0.000
0.001
0.001
0.002
0.002
A/X (m)
B/X (m)
AB/X (m)
2019-01-16 19:48:00 - 2019-02-01 15:36:00
2019-02-01 15:36:00 - 2019-02-17 11:24:00
2019-02-17 11:24:00 - 2019-03-05 07:12:00
2019-03-05 07:12:00 - 2019-03-21 03:00:00
2019-03-21 03:00:00 - 2019-04-05 22:48:00
2019-04-05 22:48:00 - 2019-04-21 18:36:00
2019-04-21 18:36:00 - 2019-05-07 14:24:00
2019-05-07 14:24:00 - 2019-05-23 10:12:00
2019-05-23 10:12:00 - 2019-06-08 06:00:00
2019-06-08 06:00:00 - 2019-06-24 01:48:00
2019-06-24 01:48:00 - 2019-07-09 21:36:00
2019-07-09 21:36:00 - 2019-07-25 17:24:00
2019-07-25 17:24:00 - 2019-08-10 13:12:00
2019-08-10 13:12:00 - 2019-08-26 09:00:00
2019-08-26 09:00:00 - 2019-09-11 04:48:00
2019-09-11 04:48:00 - 2019-09-27 00:36:00
2019-09-27 00:36:00 - 2019-10-12 20:24:00
2019-10-12 20:24:00 - 2019-10-28 16:12:00
2019-10-28 16:12:00 - 2019-11-13 12:00:00
2019-11-13 12:00:00 - 2019-11-29 07:48:00
2019-11-29 07:48:00 - 2019-12-15 03:36:00
2019-12-15 03:36:00 - 2019-12-30 23:24:00
2019-12-30 23:24:00 - 2020-01-15 19:12:00
2020-01-15 19:12:00 - 2020-01-31 15:00:00
2020-01-31 15:00:00 - 2020-02-16 10:48:00
2020-02-16 10:48:00 - 2020-03-03 06:36:00
2020-03-03 06:36:00 - 2020-03-19 02:24:00
2020-03-19 02:24:00 - 2020-04-03 22:12:00
2020-04-03 22:12:00 - 2020-04-19 18:00:00
2020-04-19 18:00:00 - 2020-05-05 13:48:00
2020-05-05 13:48:00 - 2020-05-21 09:36:00
2020-05-21 09:36:00 - 2020-06-06 05:24:00
2020-06-06 05:24:00 - 2020-06-22 01:12:00
2020-06-22 01:12:00 - 2020-07-07 21:00:00
2020-07-07 21:00:00 - 2020-07-23 16:48:00
2020-07-23 16:48:00 - 2020-08-08 12:36:00
2020-08-08 12:36:00 - 2020-08-24 08:24:00
2020-08-24 08:24:00 - 2020-09-09 04:12:00

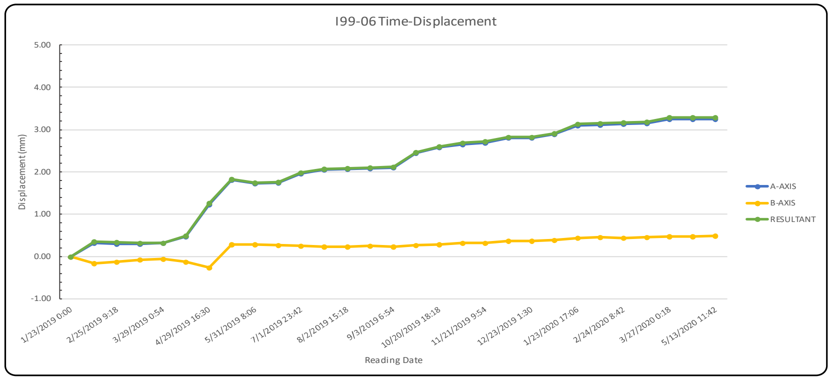

SAAV I99-06 Cumulative Profile
Upstream
Downstream
South
North
Sedimentary
Elevation (m)
Depth (m)
1194.3000
1192.3000
1187.3000
1182.3000
1177.3000
1172.3000
1167.3000
1162.3000
-0.020
-0.010
0.000
0.010
0.020
A/X (m)
B/X (m)
0.005
0.015
AB/X (m)
2019-01-16 19:48:00 - 2019-02-01 15:36:00
2019-02-01 15:36:00 - 2019-02-17 11:24:00
2019-02-17 11:24:00 - 2019-03-05 07:12:00
2019-03-05 07:12:00 - 2019-03-21 03:00:00
2019-03-21 03:00:00 - 2019-04-05 22:48:00
2019-04-05 22:48:00 - 2019-04-21 18:36:00
2019-04-21 18:36:00 - 2019-05-07 14:24:00
2019-05-07 14:24:00 - 2019-05-23 10:12:00
2019-05-23 10:12:00 - 2019-06-08 06:00:00
2019-06-08 06:00:00 - 2019-06-24 01:48:00
2019-06-24 01:48:00 - 2019-07-09 21:36:00
2019-07-09 21:36:00 - 2019-07-25 17:24:00
2019-07-25 17:24:00 - 2019-08-10 13:12:00
2019-08-10 13:12:00 - 2019-08-26 09:00:00
2019-08-26 09:00:00 - 2019-09-11 04:48:00
2019-09-11 04:48:00 - 2019-09-27 00:36:00
2019-09-27 00:36:00 - 2019-10-12 20:24:00
2019-10-12 20:24:00 - 2019-10-28 16:12:00
2019-10-28 16:12:00 - 2019-11-13 12:00:00
2019-11-13 12:00:00 - 2019-11-29 07:48:00
2019-11-29 07:48:00 - 2019-12-15 03:36:00
2019-12-15 03:36:00 - 2019-12-30 23:24:00
2019-12-30 23:24:00 - 2020-01-15 19:12:00
2020-01-15 19:12:00 - 2020-01-31 15:00:00
2020-01-31 15:00:00 - 2020-02-16 10:48:00
2020-02-16 10:48:00 - 2020-03-03 06:36:00
2020-03-03 06:36:00 - 2020-03-19 02:24:00
2020-03-19 02:24:00 - 2020-04-03 22:12:00
2020-04-03 22:12:00 - 2020-04-19 18:00:00
2020-04-19 18:00:00 - 2020-05-05 13:48:00
2020-05-05 13:48:00 - 2020-05-21 09:36:00
2020-05-21 09:36:00 - 2020-06-06 05:24:00
2020-06-06 05:24:00 - 2020-06-22 01:12:00
2020-06-22 01:12:00 - 2020-07-07 21:00:00
2020-07-07 21:00:00 - 2020-07-23 16:48:00
2020-07-23 16:48:00 - 2020-08-08 12:36:00
2020-08-08 12:36:00 - 2020-08-24 08:24:00
2020-08-24 08:24:00 - 2020-09-09 04:12:00

SAAV I99-06

Displacement Plot - Volcanics

Unit	Upper El. (m)	Lower El. (m)
Volcanic	1193.8	1191.3
Sedimentary	1191.3	1164.3

Upper El. (m)	1193.8
Lower El. (m)	1191.3

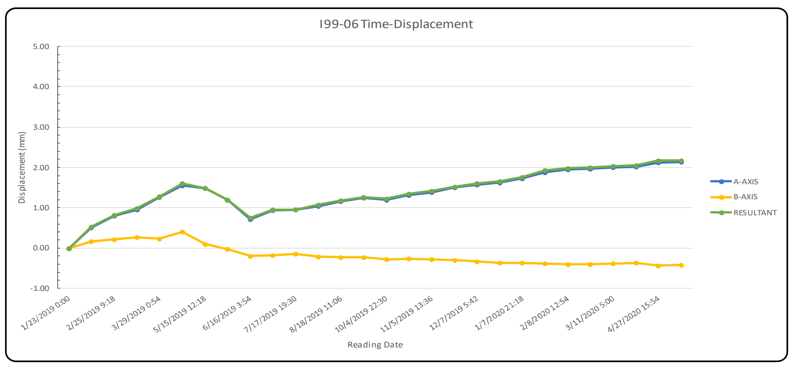


SAAV I99-06

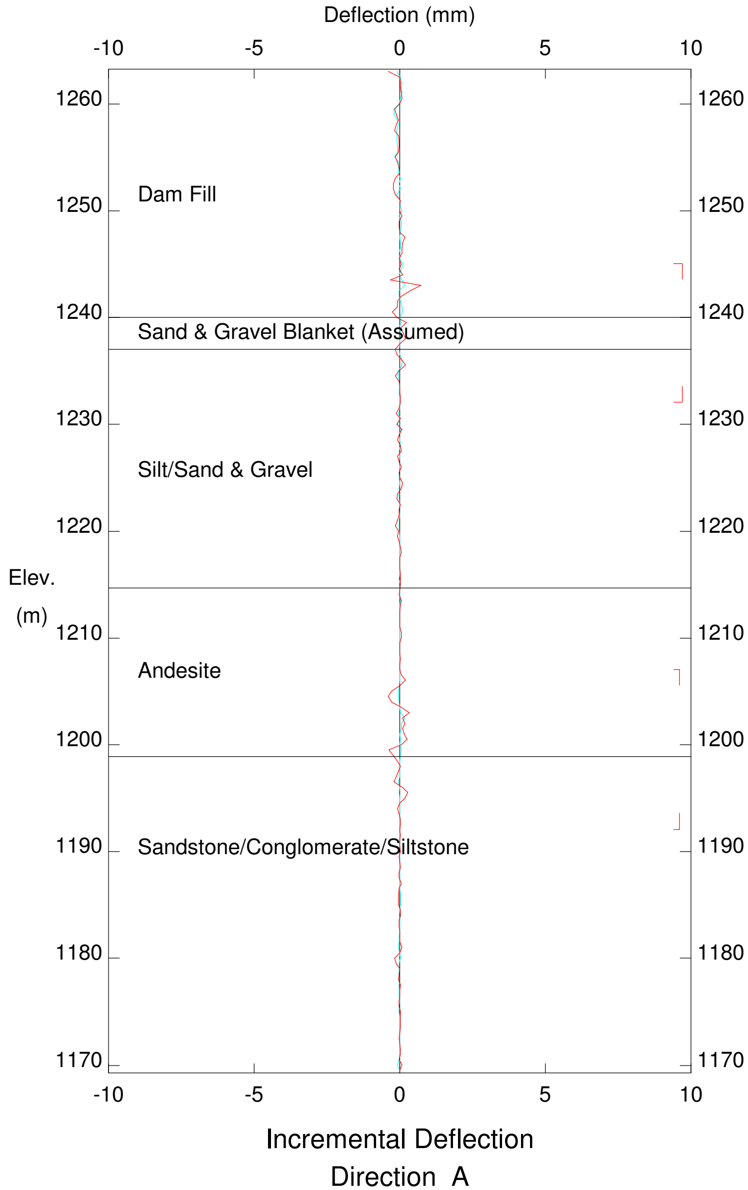
Displacement Plot - Sedimentary

Unit	Upper El. (m)	Lower El. (m)
Volcanic	1193.8	1191.3
Sedimentary	1191.3	1164.3

Upper El. (m)	1191.3
Lower El. (m)	1164.3



Highland Valley Copper - Logan Lake, BC



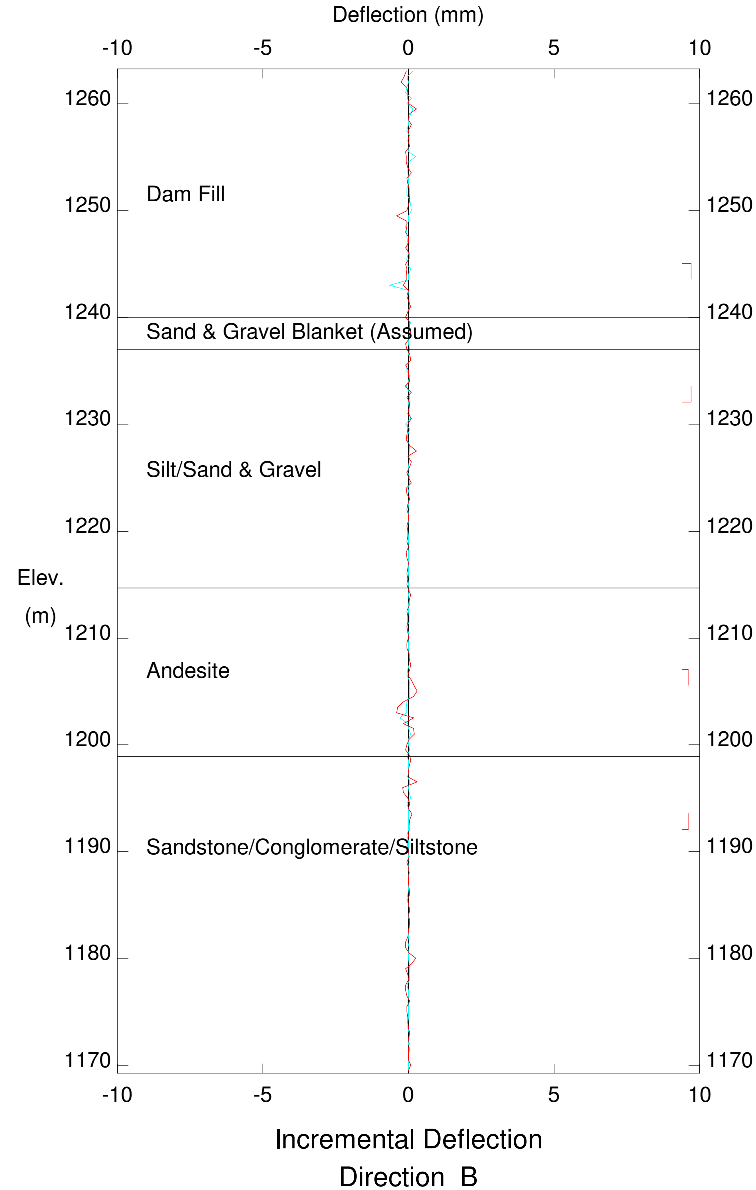
LEGEND

Initial 8 Nov 2020

8 Nov 2020*

21 Nov 2020*

Ref. Elevation 1263.272

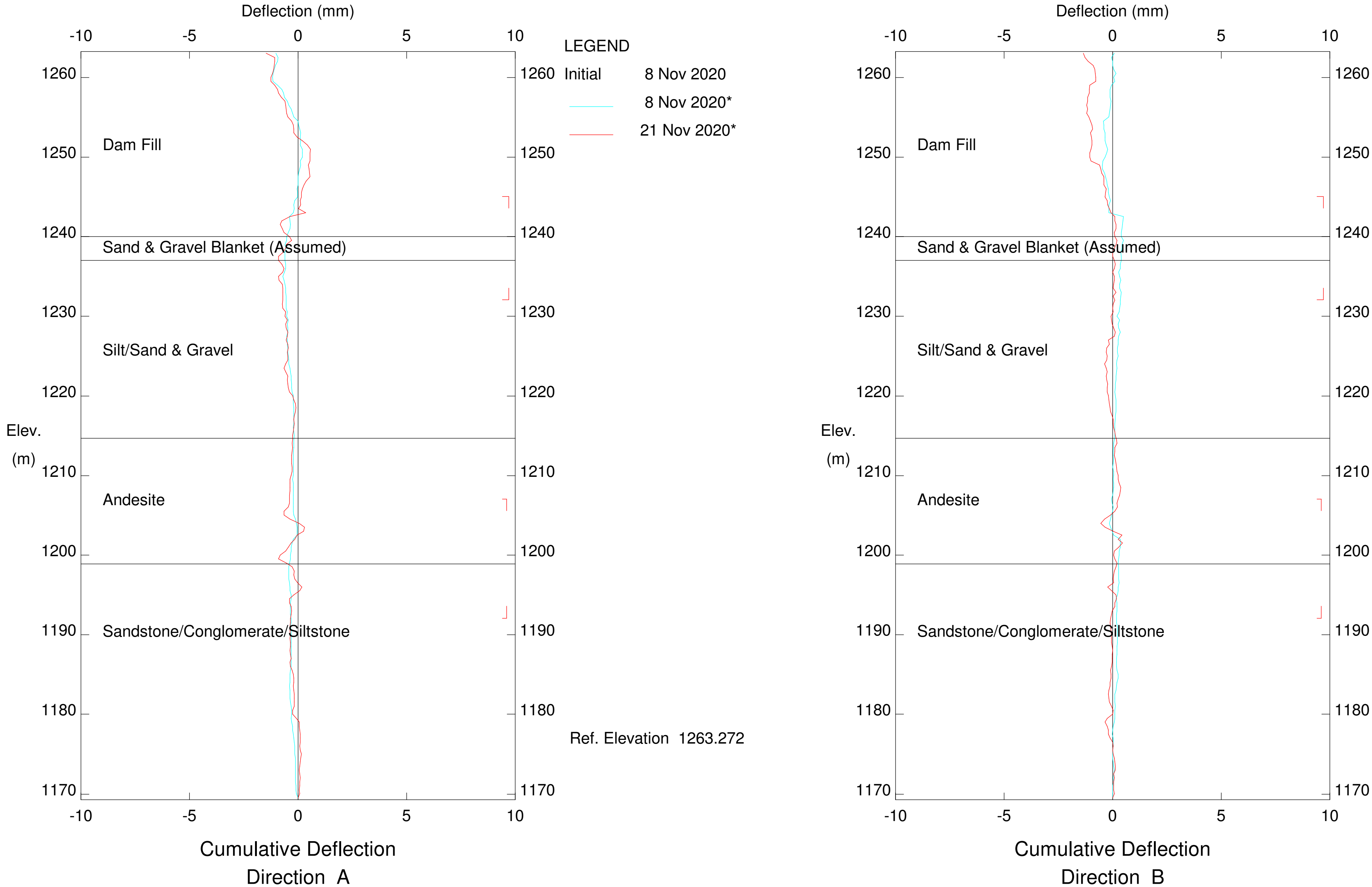


LL Dam - Dam fill excluded,,,, Inclinometer I99-06,,

Sets marked * include zero shift and/or rotation corrections.

I99-06,,,.gtl

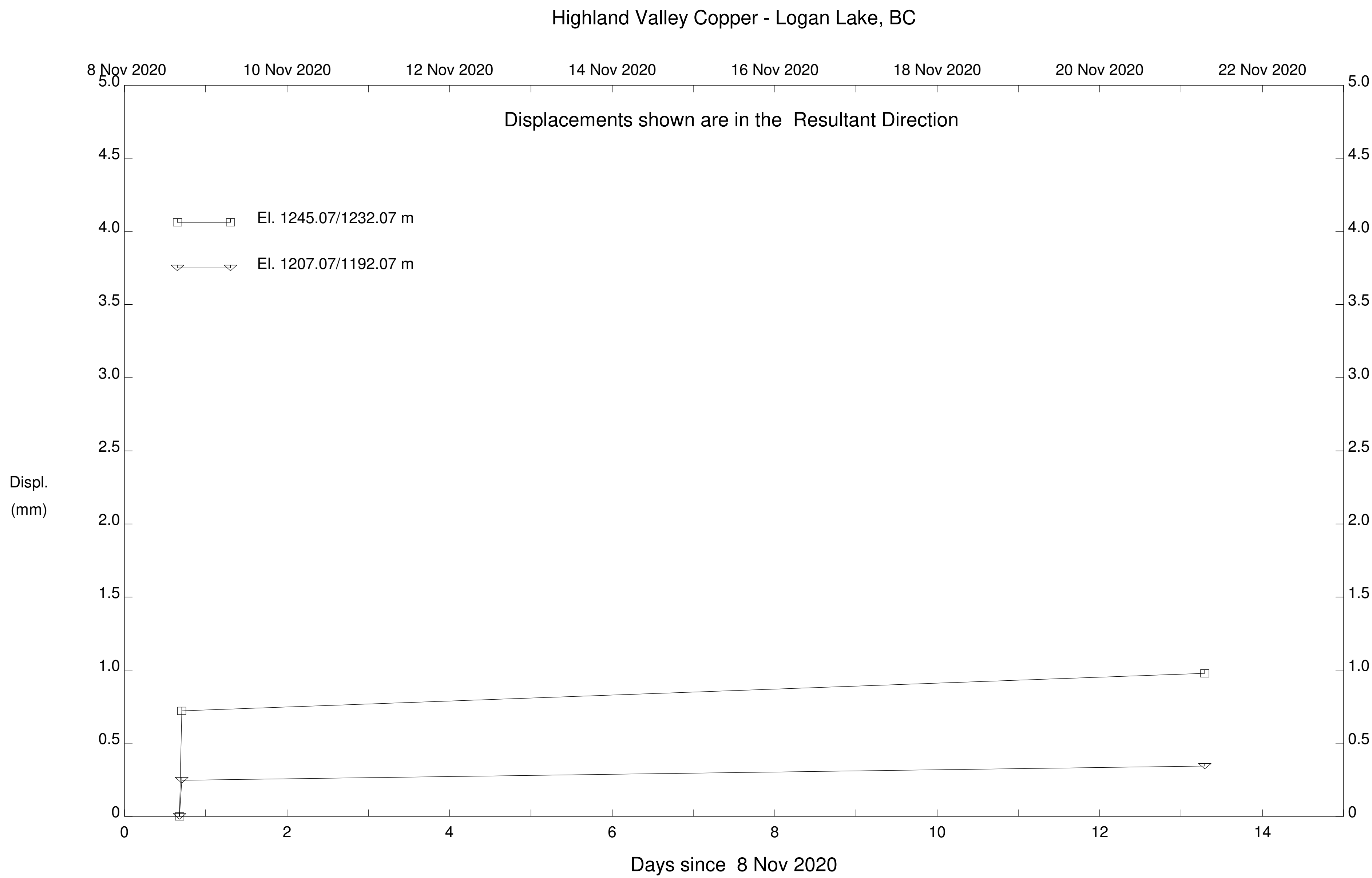
Highland Valley Copper - Logan Lake, BC



LL Dam - Dam fill excluded,,,, Inclinometer I99-06,,,

Sets marked * include zero shift and/or rotation corrections.

I99-06,,,.gtl

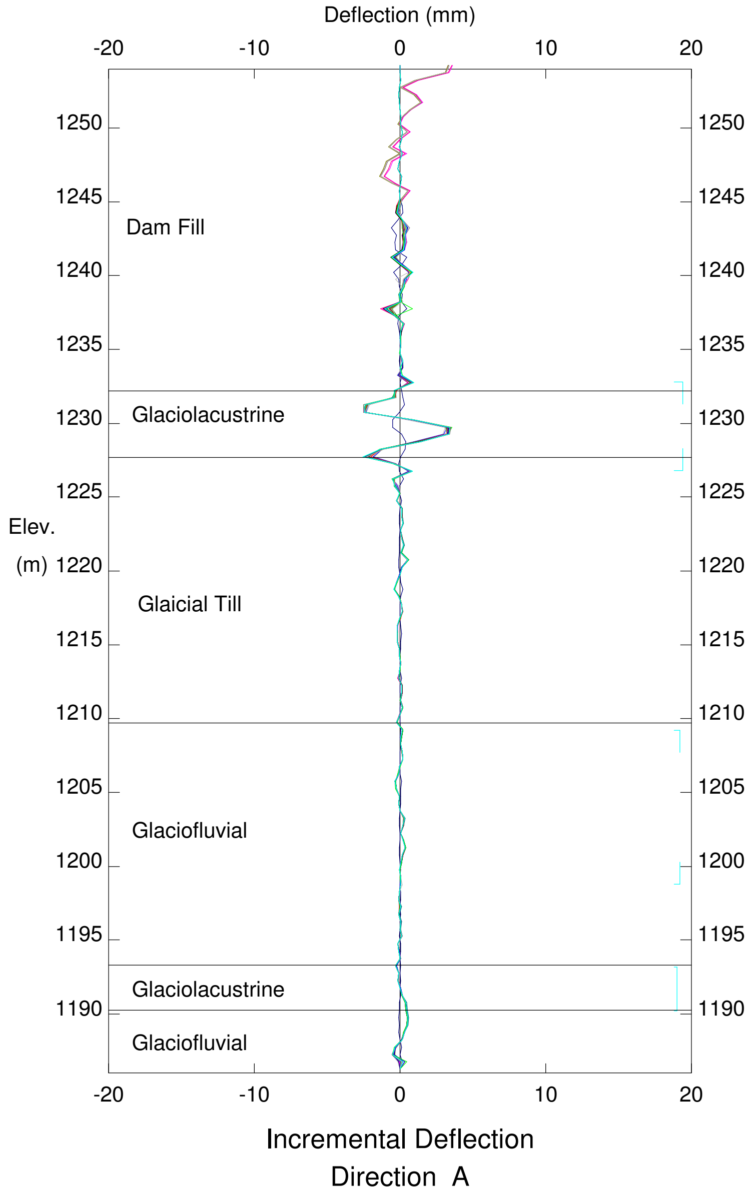


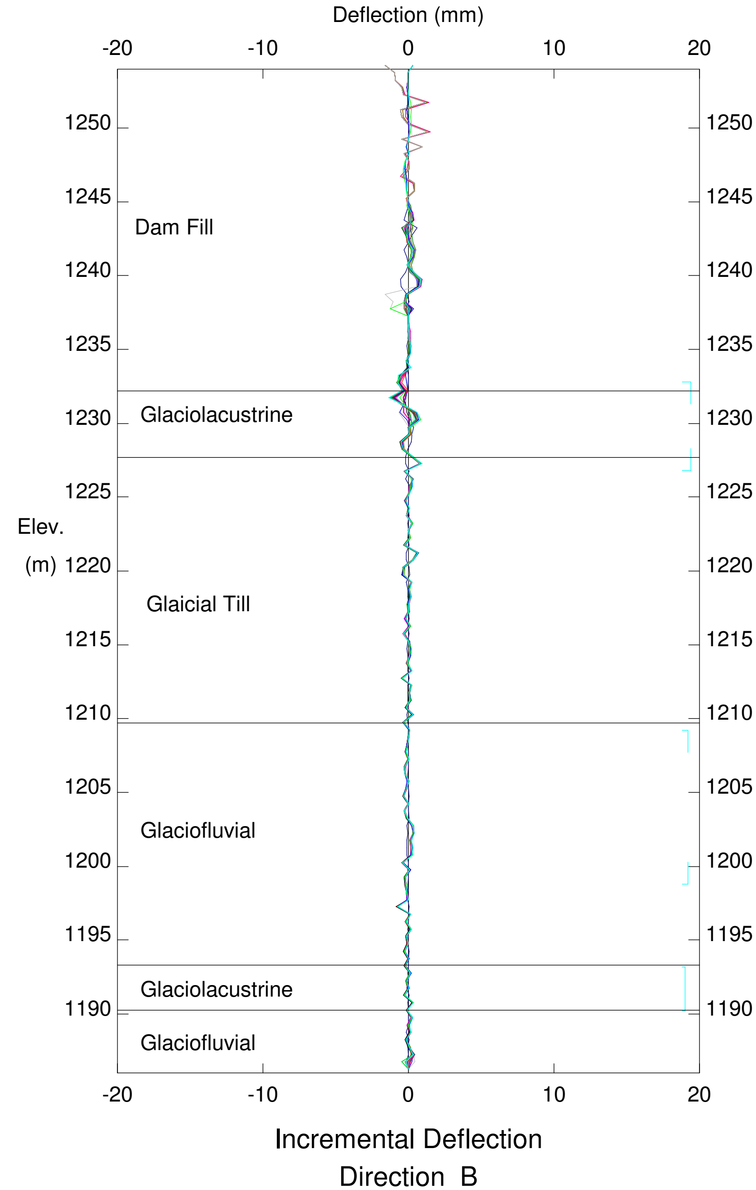
LL Dam - Dam fill excluded,,,, Inclinometer I99-06,,,

North Dam Upper Glaciolacustrine (North Abutment)

I16-01

Highland Valley Copper - Logan Lake, BC



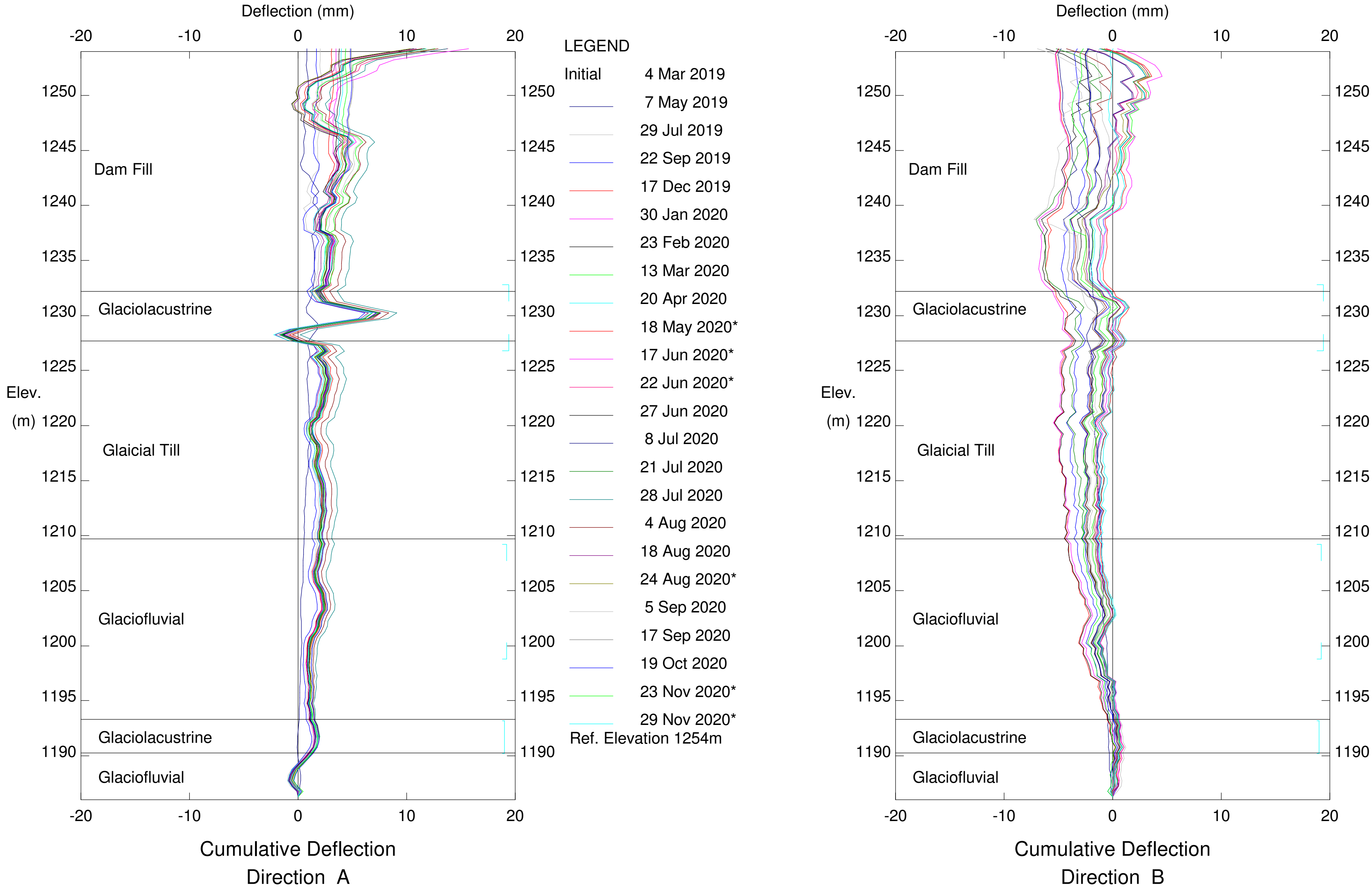


LL Dam, Inclinometer 16-01

Sets marked * include zero shift and/or rotation corrections.

I16-01.gtl

Highland Valley Copper - Logan Lake, BC

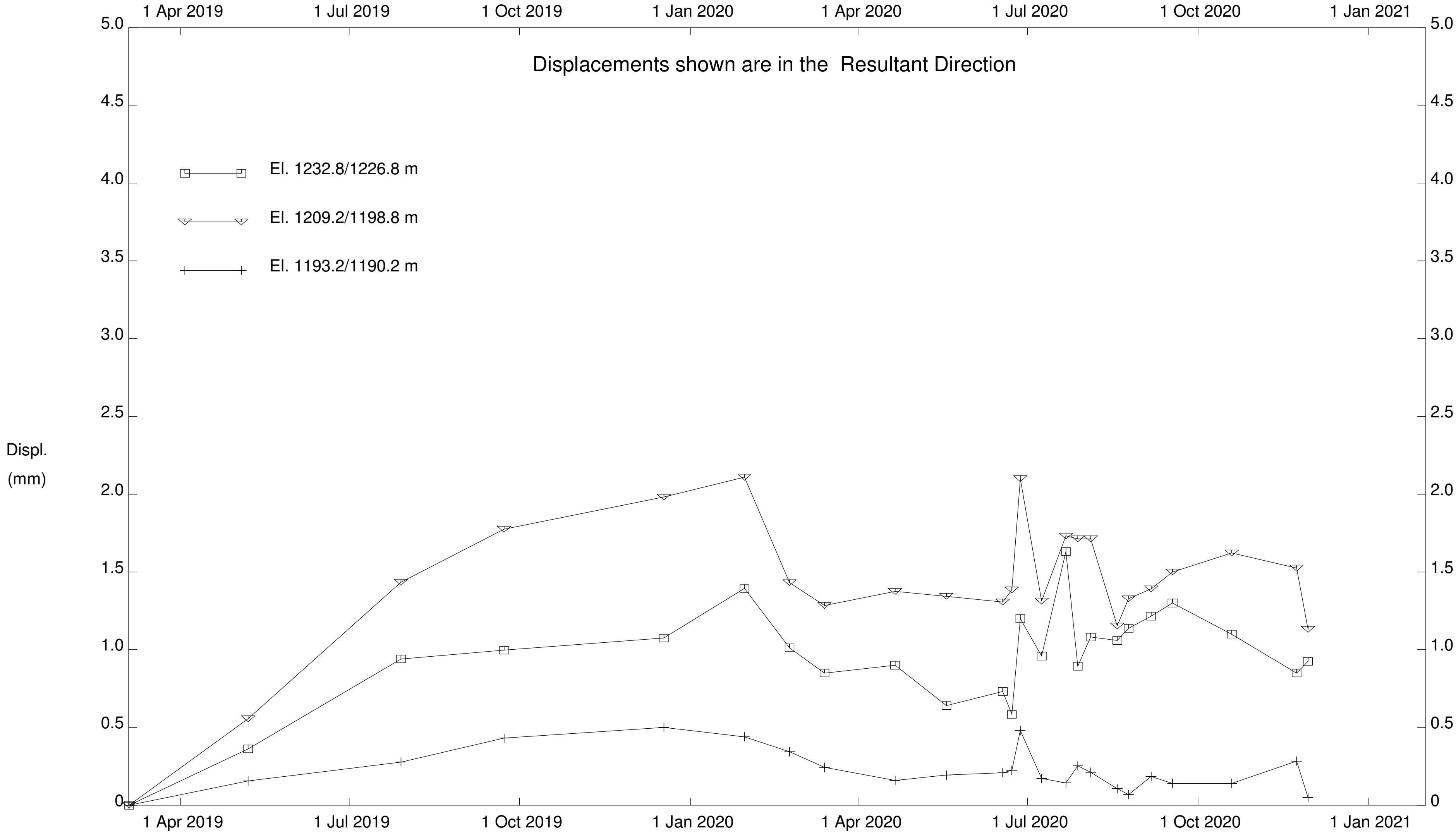


LL Dam, Inclinometer 16-01

Sets marked * include zero shift and/or rotation corrections.

I16-01.gtl

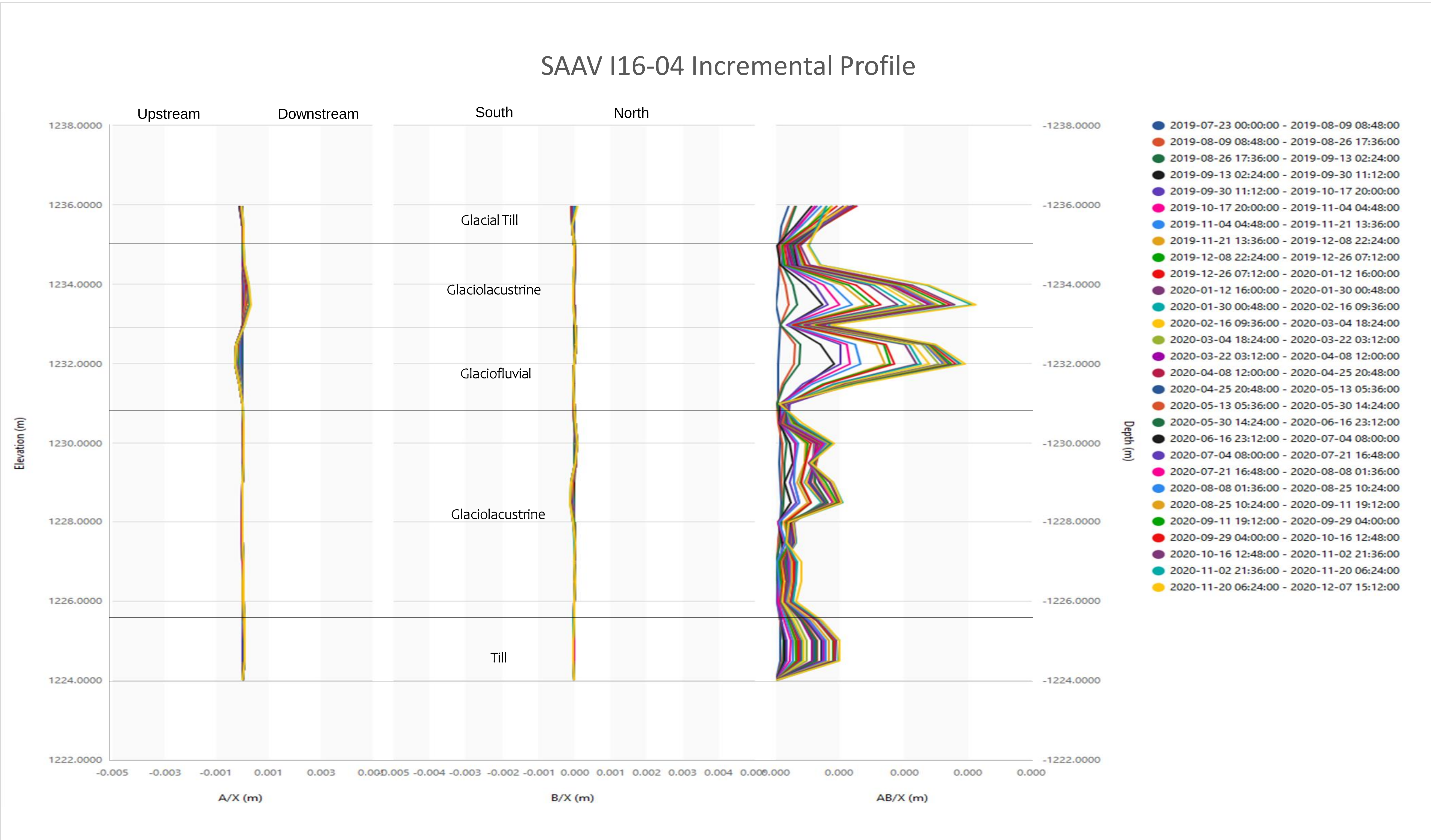
Highland Valley Copper - Logan Lake, BC

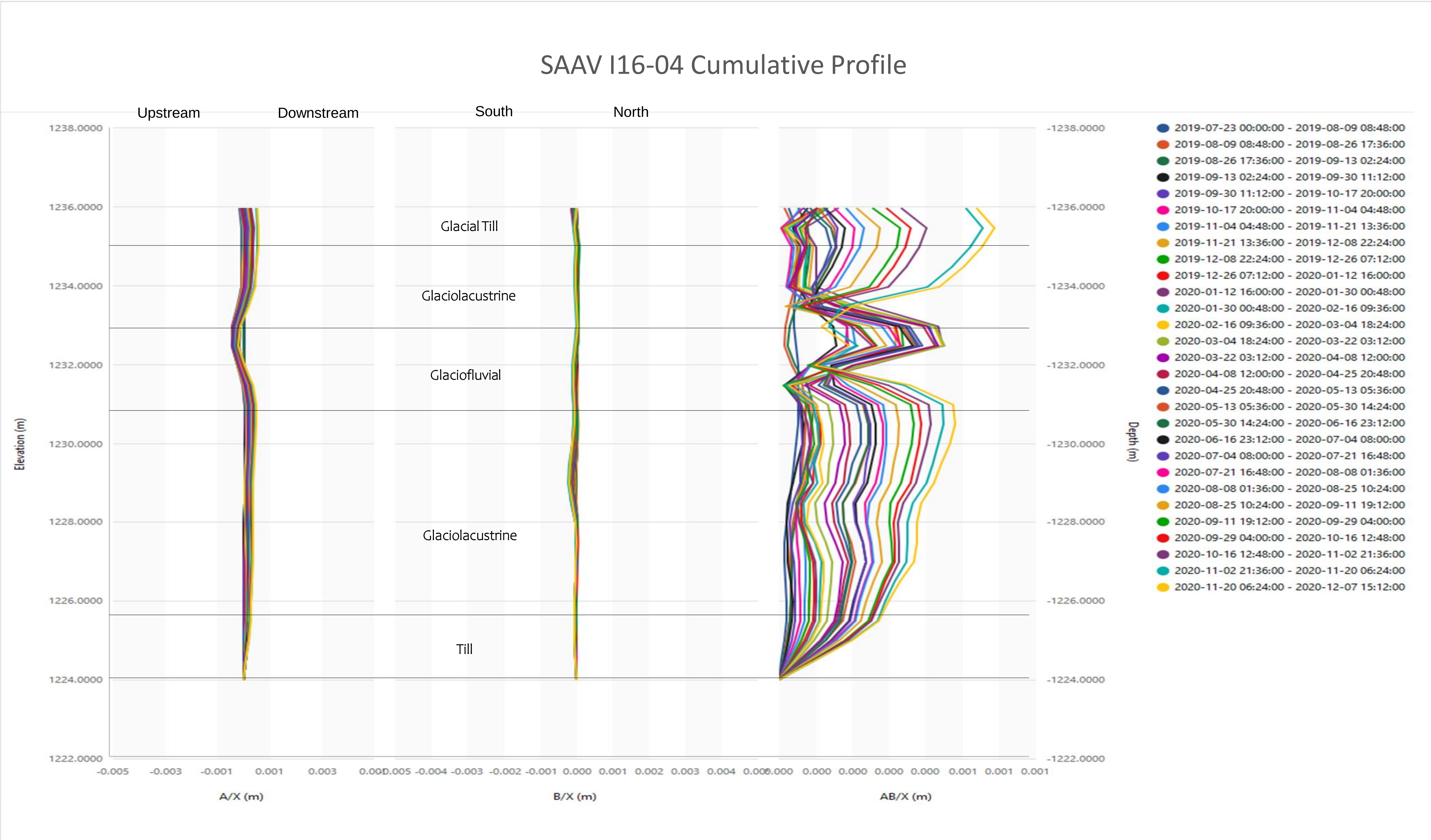


LL Dam, Inclinometer 16-01

North Dam Upper Glaciolacustrine (North Abutment)

SAAV I16-04


SAAV I16-04 Incremental Profile
Upstream
Downstream
South
North
Glacial Till
Glaciolacustrine
Glaciofluvial
Glaciolacustrine
Till
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
1238.0000
1236.0000
1234.0000
1232.0000
1230.0000
1228.0000
1226.0000
1224.0000
1222.0000
-1238.0000
-1236.0000
-1234.0000
-1232.0000
-1230.0000
-1228.0000
-1226.0000
-1224.0000
-1222.0000
-0.005 -0.003 -0.001 0.001 0.003 0.005
-0.005 -0.004 -0.003 -0.002 -0.001 0.000 0.001 0.002 0.003 0.004 0.005
0.000 0.000 0.000 0.000 0.000
2019-07-23 00:00:00 - 2019-08-09 08:48:00
2019-08-09 08:48:00 - 2019-08-26 17:36:00
2019-08-26 17:36:00 - 2019-09-13 02:24:00
2019-09-13 02:24:00 - 2019-09-30 11:12:00
2019-09-30 11:12:00 - 2019-10-17 20:00:00
2019-10-17 20:00:00 - 2019-11-04 04:48:00
2019-11-04 04:48:00 - 2019-11-21 13:36:00
2019-11-21 13:36:00 - 2019-12-08 22:24:00
2019-12-08 22:24:00 - 2019-12-26 07:12:00
2019-12-26 07:12:00 - 2020-01-12 16:00:00
2020-01-12 16:00:00 - 2020-01-30 00:48:00
2020-01-30 00:48:00 - 2020-02-16 09:36:00
2020-02-16 09:36:00 - 2020-03-04 18:24:00
2020-03-04 18:24:00 - 2020-03-22 03:12:00
2020-03-22 03:12:00 - 2020-04-08 12:00:00
2020-04-08 12:00:00 - 2020-04-25 20:48:00
2020-04-25 20:48:00 - 2020-05-13 05:36:00
2020-05-13 05:36:00 - 2020-05-30 14:24:00
2020-05-30 14:24:00 - 2020-06-16 23:12:00
2020-06-16 23:12:00 - 2020-07-04 08:00:00
2020-07-04 08:00:00 - 2020-07-21 16:48:00
2020-07-21 16:48:00 - 2020-08-08 01:36:00
2020-08-08 01:36:00 - 2020-08-25 10:24:00
2020-08-25 10:24:00 - 2020-09-11 19:12:00
2020-09-11 19:12:00 - 2020-09-29 04:00:00
2020-09-29 04:00:00 - 2020-10-16 12:48:00
2020-10-16 12:48:00 - 2020-11-02 21:36:00
2020-11-02 21:36:00 - 2020-11-20 06:24:00
2020-11-20 06:24:00 - 2020-12-07 15:12:00

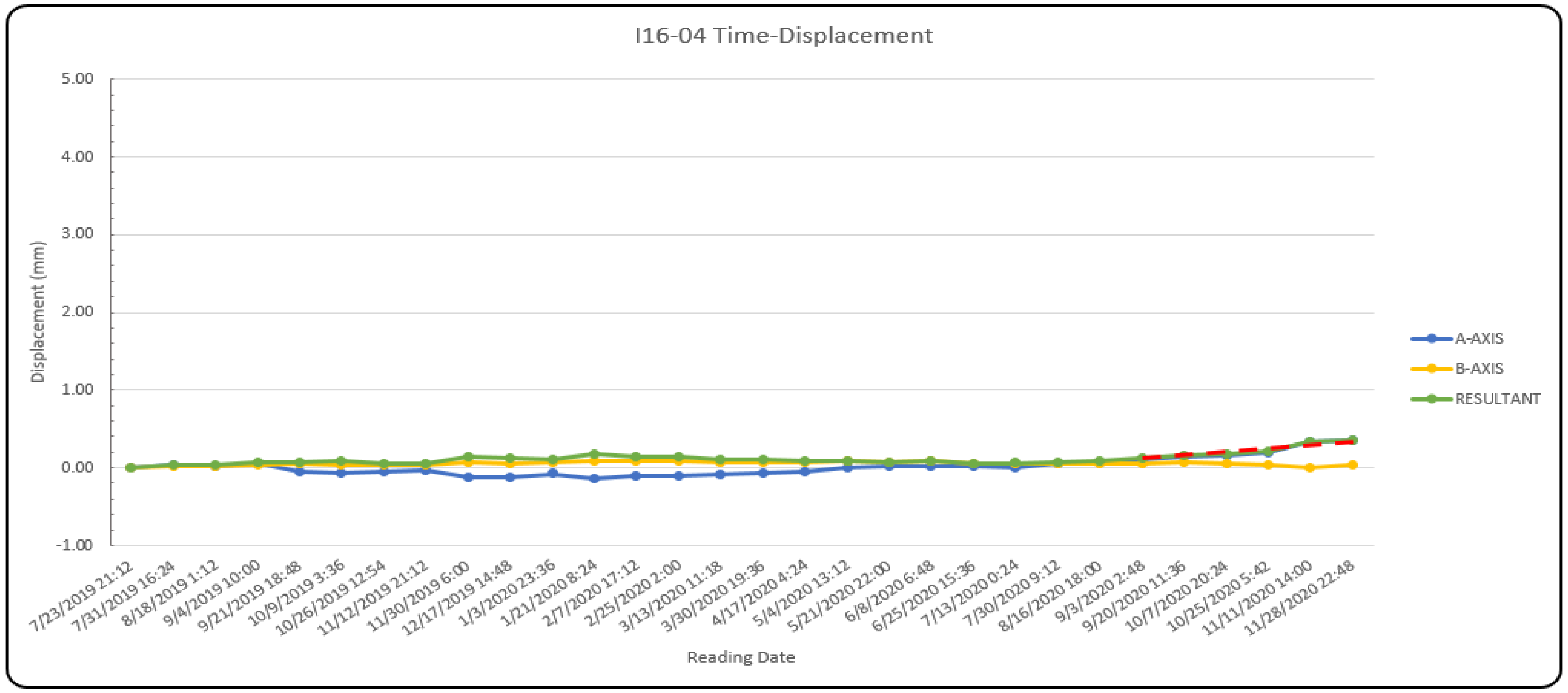

SAAV I16-04 Cumulative Profile
Upstream
Downstream
South
North
Glacial Till
Glaciolacustrine
Glaciofluvial
Glaciolacustrine
Till
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2019-07-23 00:00:00 - 2019-08-09 08:48:00
2019-08-09 08:48:00 - 2019-08-26 17:36:00
2019-08-26 17:36:00 - 2019-09-13 02:24:00
2019-09-13 02:24:00 - 2019-09-30 11:12:00
2019-09-30 11:12:00 - 2019-10-17 20:00:00
2019-10-17 20:00:00 - 2019-11-04 04:48:00
2019-11-04 04:48:00 - 2019-11-21 13:36:00
2019-11-21 13:36:00 - 2019-12-08 22:24:00
2019-12-08 22:24:00 - 2019-12-26 07:12:00
2019-12-26 07:12:00 - 2020-01-12 16:00:00
2020-01-12 16:00:00 - 2020-01-30 00:48:00
2020-01-30 00:48:00 - 2020-02-16 09:36:00
2020-02-16 09:36:00 - 2020-03-04 18:24:00
2020-03-04 18:24:00 - 2020-03-22 03:12:00
2020-03-22 03:12:00 - 2020-04-08 12:00:00
2020-04-08 12:00:00 - 2020-04-25 20:48:00
2020-04-25 20:48:00 - 2020-05-13 05:36:00
2020-05-13 05:36:00 - 2020-05-30 14:24:00
2020-05-30 14:24:00 - 2020-06-16 23:12:00
2020-06-16 23:12:00 - 2020-07-04 08:00:00
2020-07-04 08:00:00 - 2020-07-21 16:48:00
2020-07-21 16:48:00 - 2020-08-08 01:36:00
2020-08-08 01:36:00 - 2020-08-25 10:24:00
2020-08-25 10:24:00 - 2020-09-11 19:12:00
2020-09-11 19:12:00 - 2020-09-29 04:00:00
2020-09-29 04:00:00 - 2020-10-16 12:48:00
2020-10-16 12:48:00 - 2020-11-02 21:36:00
2020-11-02 21:36:00 - 2020-11-20 06:24:00
2020-11-20 06:24:00 - 2020-12-07 15:12:00

SAAV I16-04

Displacement Plot - Glaciolacustrine

Unit	Upper Depth	Lower Depth
Glaciolacustrine	1235	1225

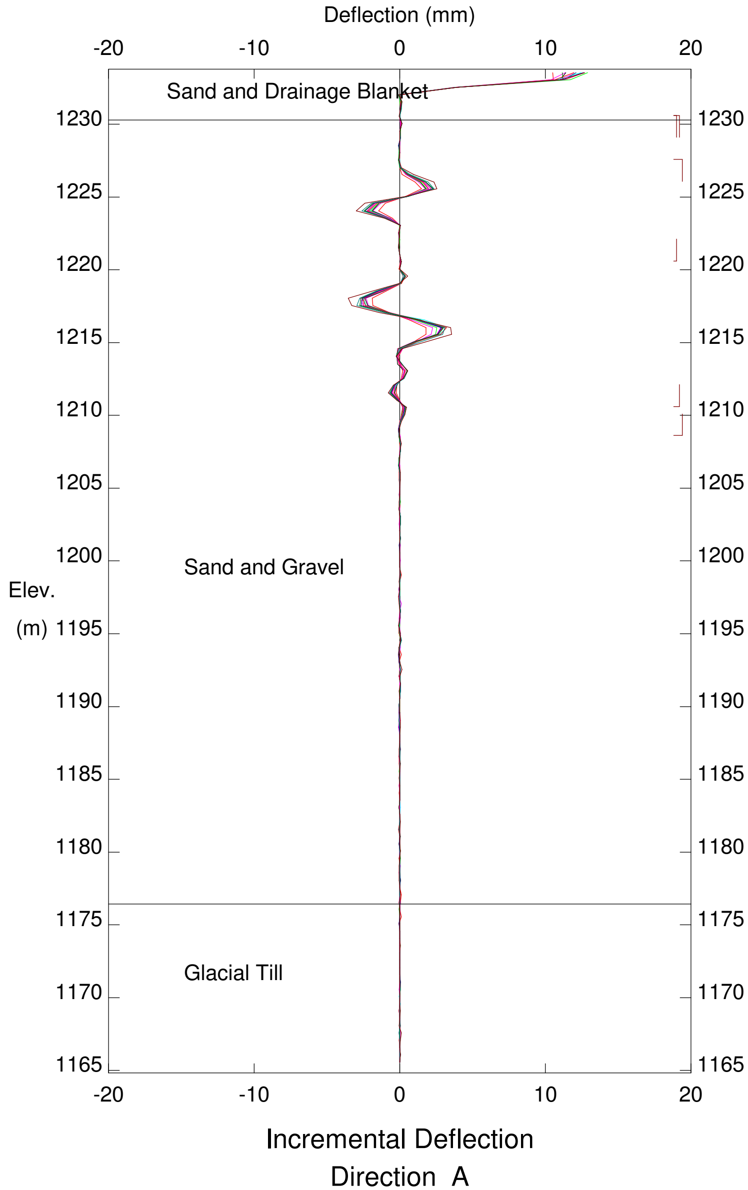
Upper El. (m)	1235.0
Lower El. (m)	1225.0



North Dam Upper Glaciolacustrine (North Abutment)

SAAV I19-04

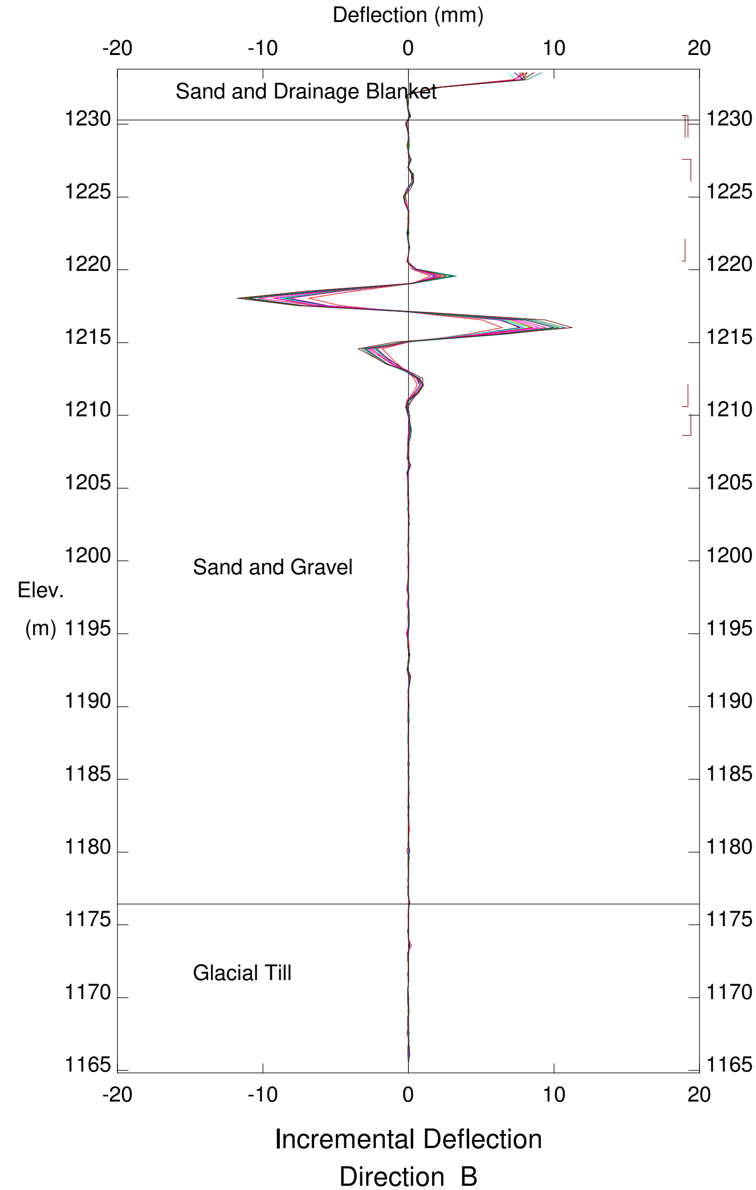
Highland Valley Copper - Logan Lake, BC



LEGEND

Initial 28 Jan 2020*
14 May 2020*
20 Jun 2020*
27 Jun 2020*
7 Jul 2020*
13 Jul 2020*
20 Jul 2020*
26 Jul 2020*
2 Aug 2020*
15 Aug 2020*
25 Aug 2020*
10 Sep 2020*
17 Oct 2020*

Ref. Elevation 1233.807m

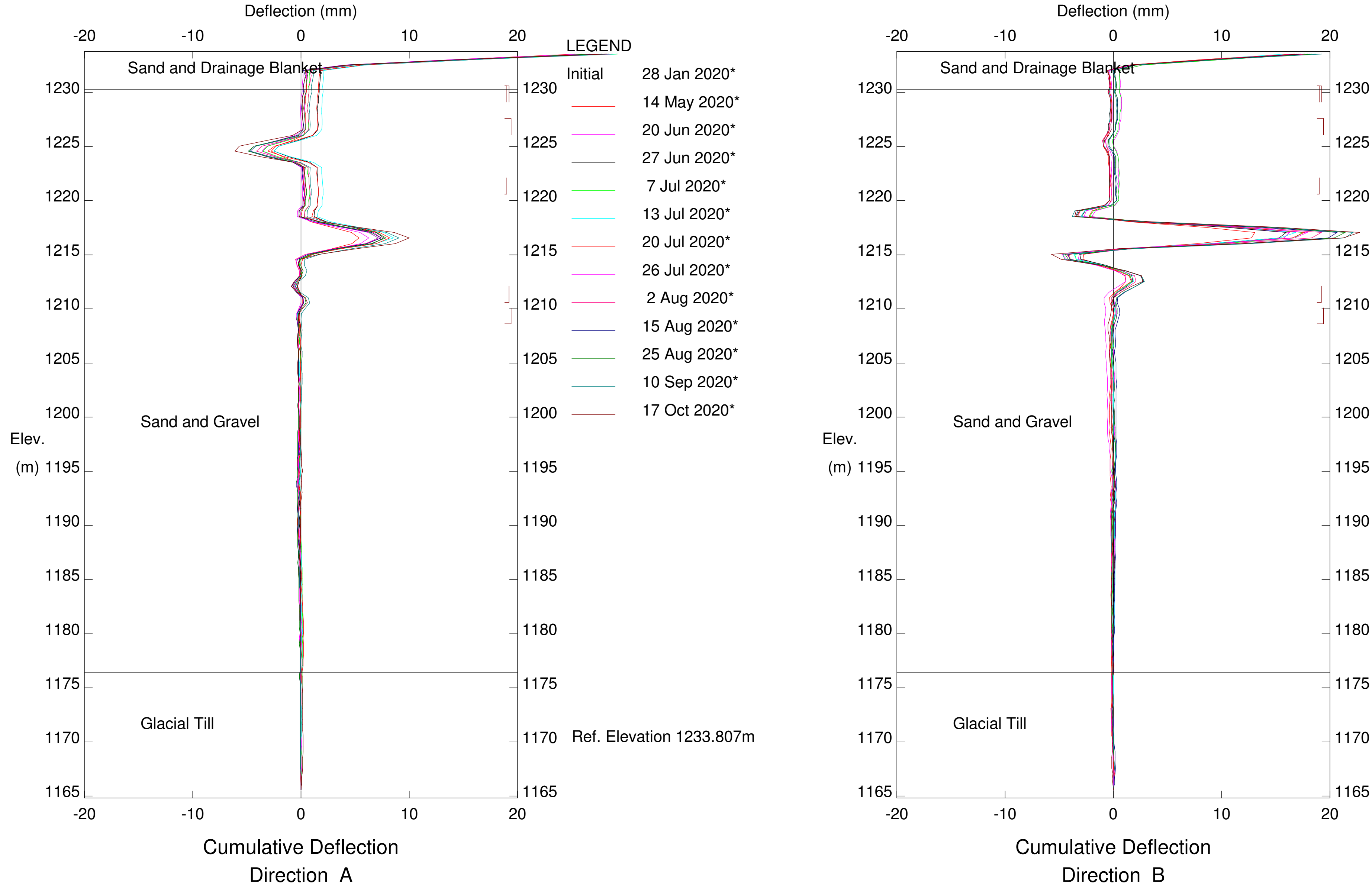


Dam Fill Excluded, Inclinometer 19-4

Sets marked * include zero shift and/or rotation corrections.

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\09 Geotechnical\Instrumentation\03 - Dam Movement Monitoring_L-L Dam\SI Monitoring\GTPLUS32 Files\I19-04.gtl

Highland Valley Copper - Logan Lake, BC

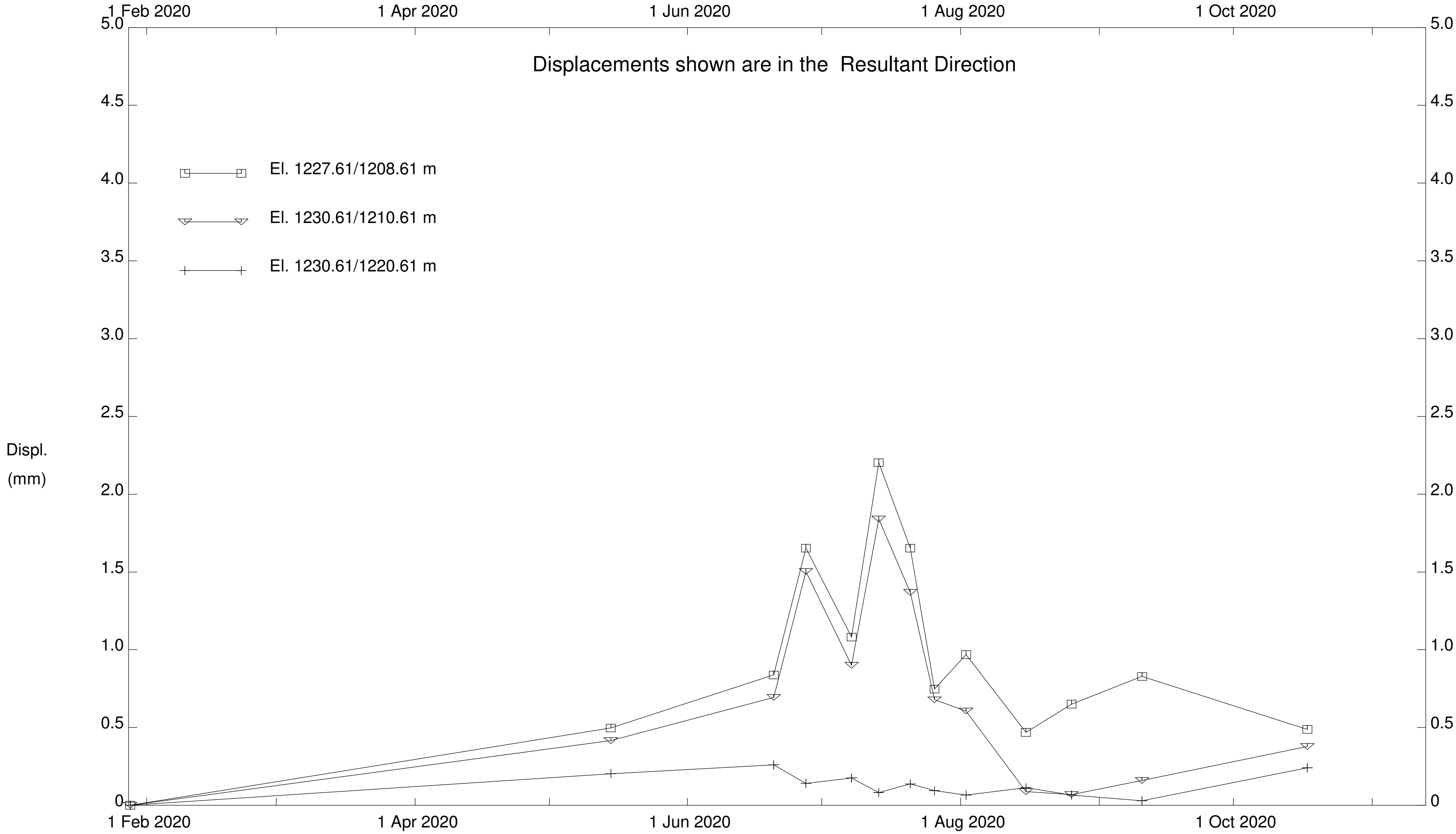


Dam Fill Excluded, Inclinometer 19-4

Sets marked * include zero shift and/or rotation corrections.

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\09 Geotechnical\Instrumentation\03 - Dam Movement Monitoring_L-L Dam\SI Monitoring\GTPLUS32 Files\I19-04.gtl

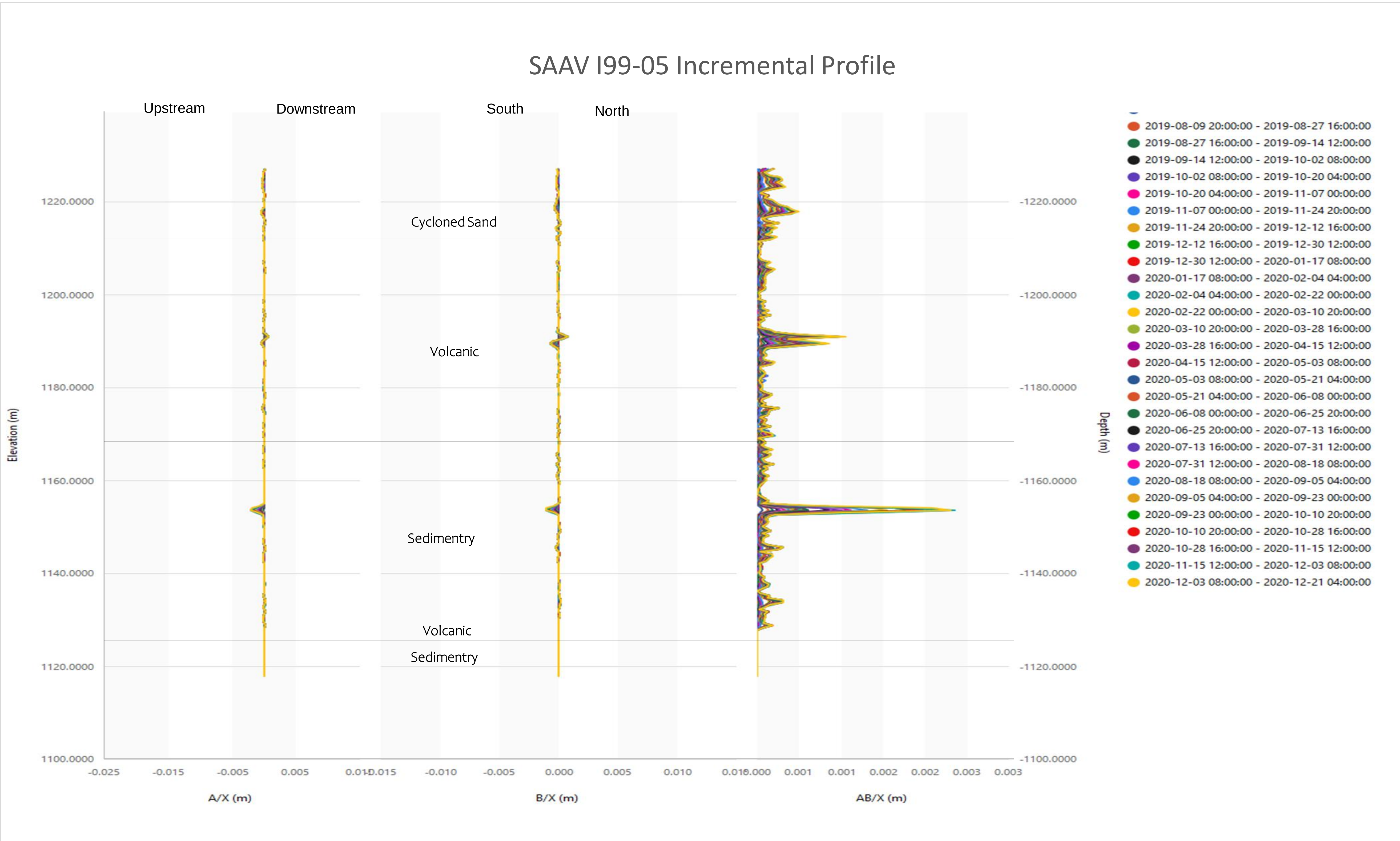
Highland Valley Copper - Logan Lake, BC



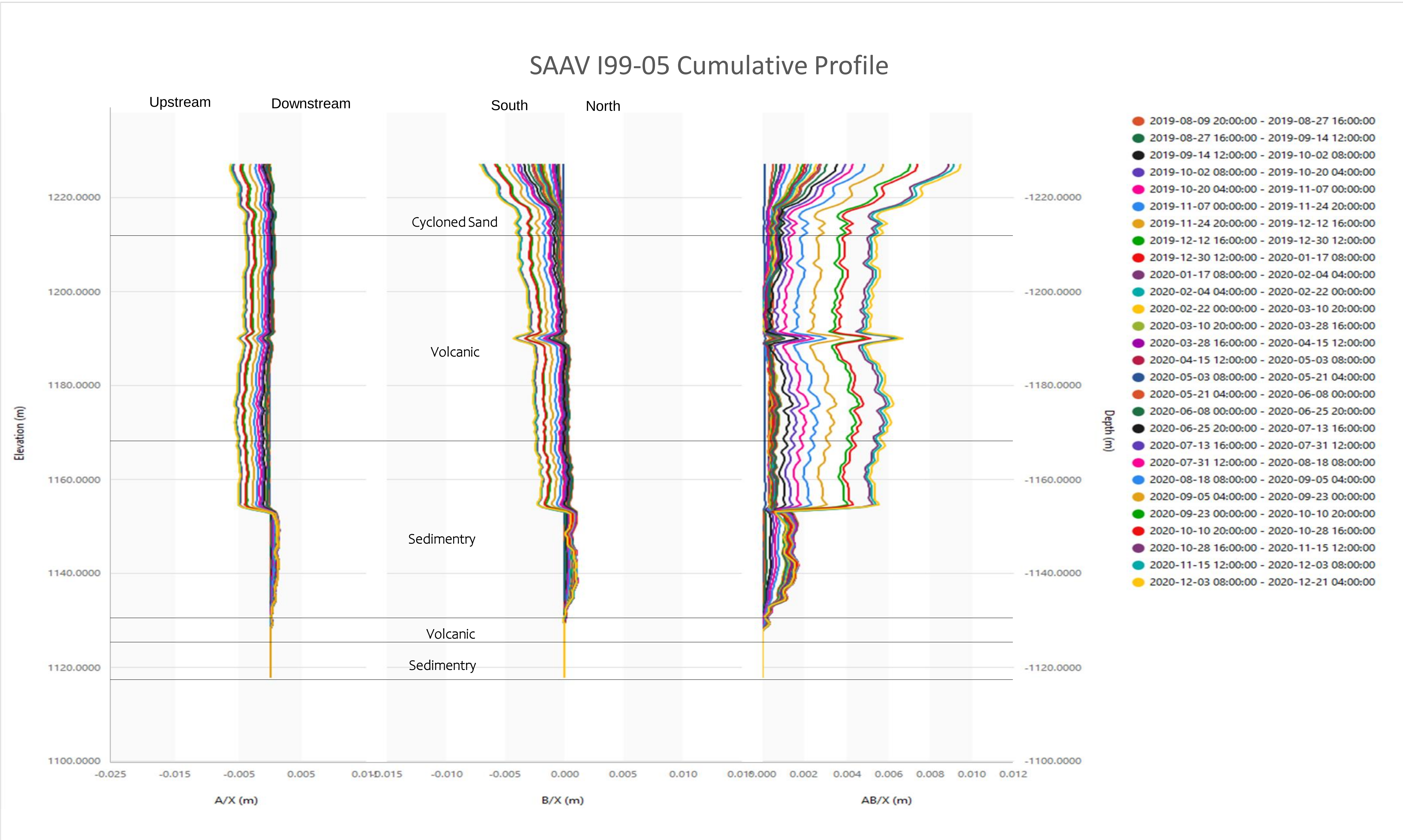
Dam Fill Excluded, Inclinometer 19-4

North Dam Bedrock

SAAV I99-05



SAAV I99-05 Incremental Profile
Upstream
Downstream
South
North
Cycloned Sand
Volcanic
Sedimentry
Volcanic
Sedimentry
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2019-08-09 20:00:00 - 2019-08-27 16:00:00
2019-08-27 16:00:00 - 2019-09-14 12:00:00
2019-09-14 12:00:00 - 2019-10-02 08:00:00
2019-10-02 08:00:00 - 2019-10-20 04:00:00
2019-10-20 04:00:00 - 2019-11-07 00:00:00
2019-11-07 00:00:00 - 2019-11-24 20:00:00
2019-11-24 20:00:00 - 2019-12-12 16:00:00
2019-12-12 16:00:00 - 2019-12-30 12:00:00
2019-12-30 12:00:00 - 2020-01-17 08:00:00
2020-01-17 08:00:00 - 2020-02-04 04:00:00
2020-02-04 04:00:00 - 2020-02-22 00:00:00
2020-02-22 00:00:00 - 2020-03-10 20:00:00
2020-03-10 20:00:00 - 2020-03-28 16:00:00
2020-03-28 16:00:00 - 2020-04-15 12:00:00
2020-04-15 12:00:00 - 2020-05-03 08:00:00
2020-05-03 08:00:00 - 2020-05-21 04:00:00
2020-05-21 04:00:00 - 2020-06-08 00:00:00
2020-06-08 00:00:00 - 2020-06-25 20:00:00
2020-06-25 20:00:00 - 2020-07-13 16:00:00
2020-07-13 16:00:00 - 2020-07-31 12:00:00
2020-07-31 12:00:00 - 2020-08-18 08:00:00
2020-08-18 08:00:00 - 2020-09-05 04:00:00
2020-09-05 04:00:00 - 2020-09-23 00:00:00
2020-09-23 00:00:00 - 2020-10-10 20:00:00
2020-10-10 20:00:00 - 2020-10-28 16:00:00
2020-10-28 16:00:00 - 2020-11-15 12:00:00
2020-11-15 12:00:00 - 2020-12-03 08:00:00
2020-12-03 08:00:00 - 2020-12-21 04:00:00

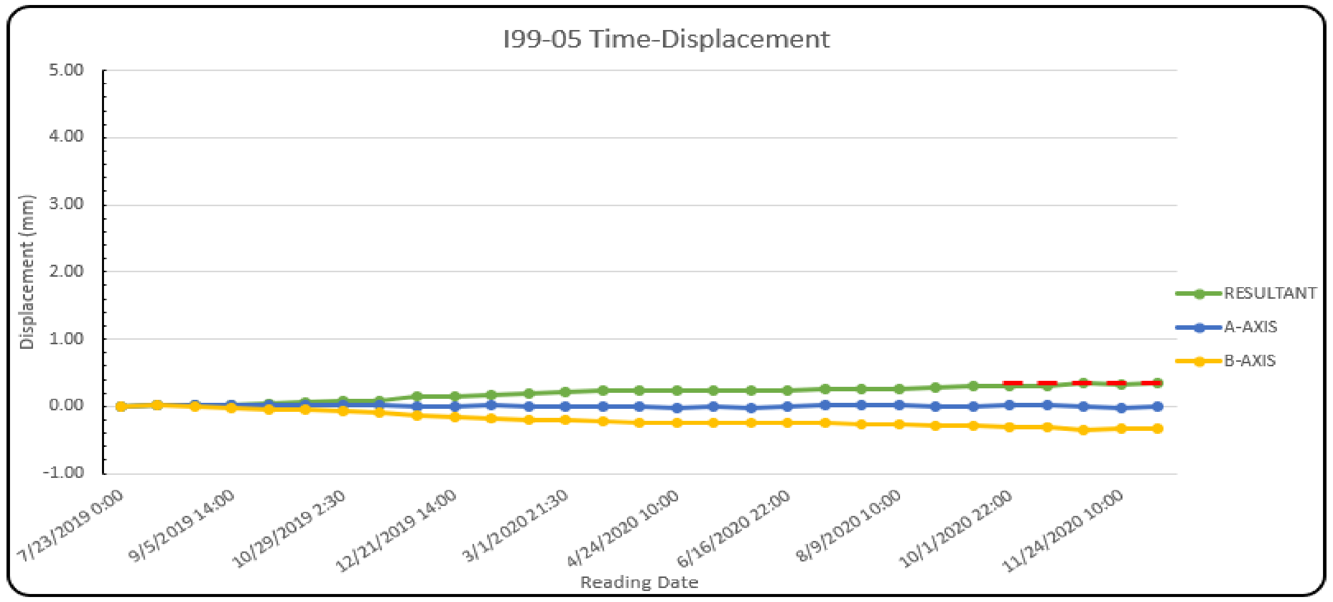

SAAV I99-05 Cumulative Profile
Upstream
Downstream
South
North
Cycloned Sand
Volcanic
Sedimentry
Volcanic
Sedimentry
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2019-08-09 20:00:00 - 2019-08-27 16:00:00
2019-08-27 16:00:00 - 2019-09-14 12:00:00
2019-09-14 12:00:00 - 2019-10-02 08:00:00
2019-10-02 08:00:00 - 2019-10-20 04:00:00
2019-10-20 04:00:00 - 2019-11-07 00:00:00
2019-11-07 00:00:00 - 2019-11-24 20:00:00
2019-11-24 20:00:00 - 2019-12-12 16:00:00
2019-12-12 16:00:00 - 2019-12-30 12:00:00
2019-12-30 12:00:00 - 2020-01-17 08:00:00
2020-01-17 08:00:00 - 2020-02-04 04:00:00
2020-02-04 04:00:00 - 2020-02-22 00:00:00
2020-02-22 00:00:00 - 2020-03-10 20:00:00
2020-03-10 20:00:00 - 2020-03-28 16:00:00
2020-03-28 16:00:00 - 2020-04-15 12:00:00
2020-04-15 12:00:00 - 2020-05-03 08:00:00
2020-05-03 08:00:00 - 2020-05-21 04:00:00
2020-05-21 04:00:00 - 2020-06-08 00:00:00
2020-06-08 00:00:00 - 2020-06-25 20:00:00
2020-06-25 20:00:00 - 2020-07-13 16:00:00
2020-07-13 16:00:00 - 2020-07-31 12:00:00
2020-07-31 12:00:00 - 2020-08-18 08:00:00
2020-08-18 08:00:00 - 2020-09-05 04:00:00
2020-09-05 04:00:00 - 2020-09-23 00:00:00
2020-09-23 00:00:00 - 2020-10-10 20:00:00
2020-10-10 20:00:00 - 2020-10-28 16:00:00
2020-10-28 16:00:00 - 2020-11-15 12:00:00
2020-11-15 12:00:00 - 2020-12-03 08:00:00
2020-12-03 08:00:00 - 2020-12-21 04:00:00

SAAV I99-05

Displacement Plot - Andesite

Unit	Upper El. (m)	Lower El. (m)
Andesite	1203.1	1201.1
Sedimentary (Upper)	1166.1	1152.1
Sedimentary (Lower)	1151.1	1149.1

Upper El. (m)	1203.1
Lower El. (m)	1201.1

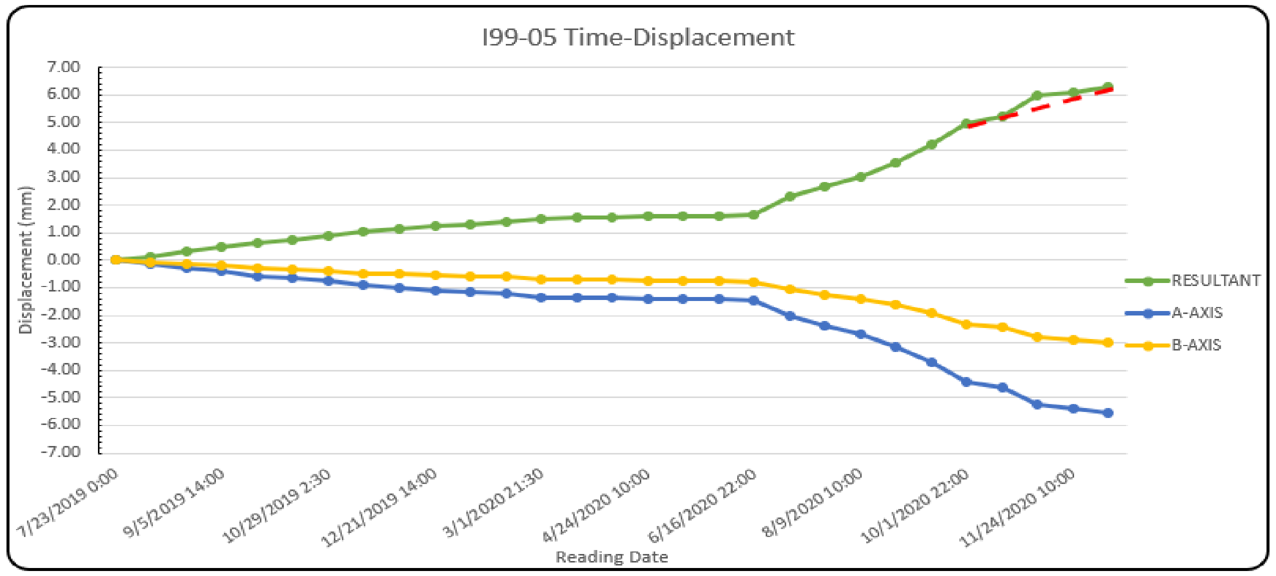


SAAV I99-05

Displacement Plot - Sedimentary

Unit	Upper El. (m)	Lower El. (m)
Andesite	1203.1	1201.1
Sedimentary (Upper)	1166.1	1152.1
Sedimentary (Lower)	1151.1	1149.1

Upper El. (m)	1166.1
Lower El. (m)	1152.1

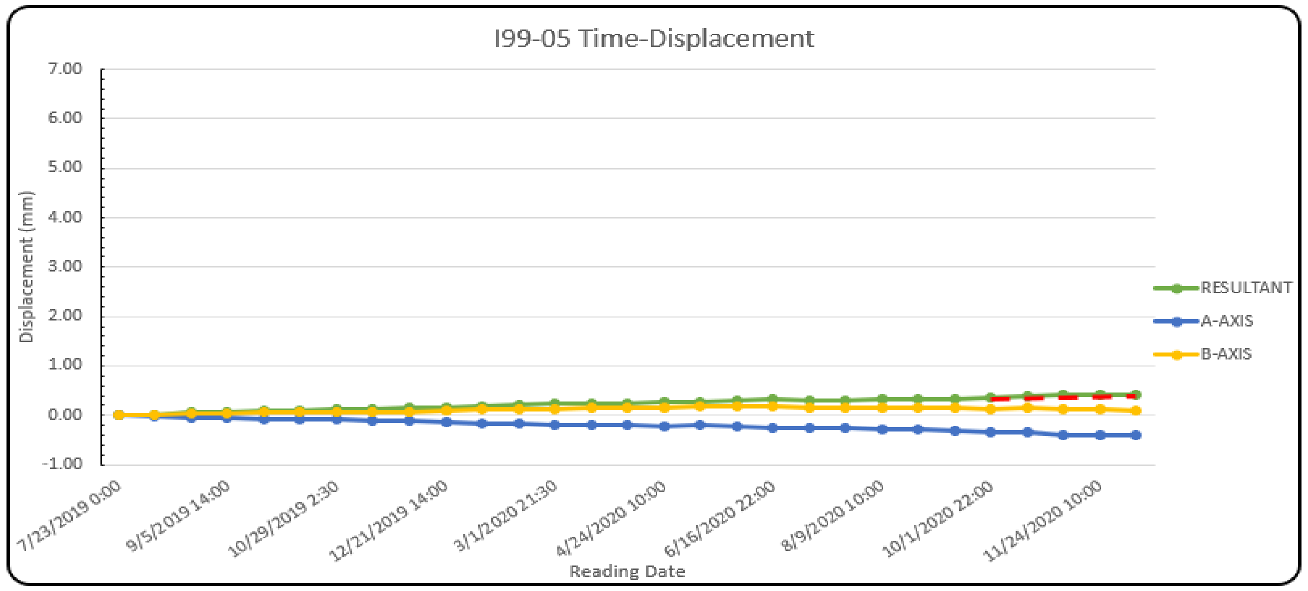


SAAV I99-05

Displacement Plot - Sedimentary

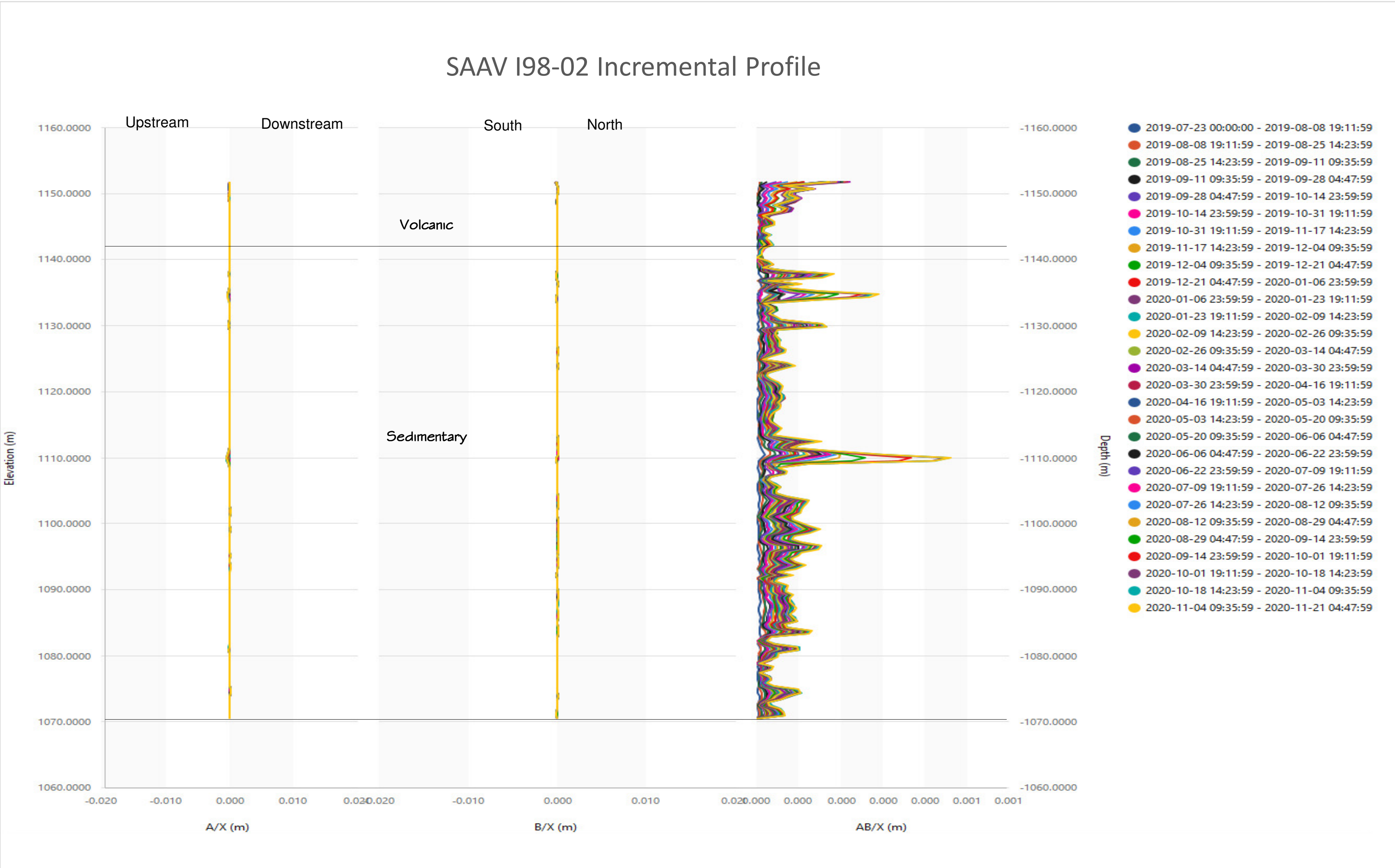
Unit	Upper El. (m)	Lower El. (m)
Andesite	1203.1	1201.1
Sedimentary (Upper)	1166.1	1152.1
Sedimentary (Lower)	1151.1	1149.1

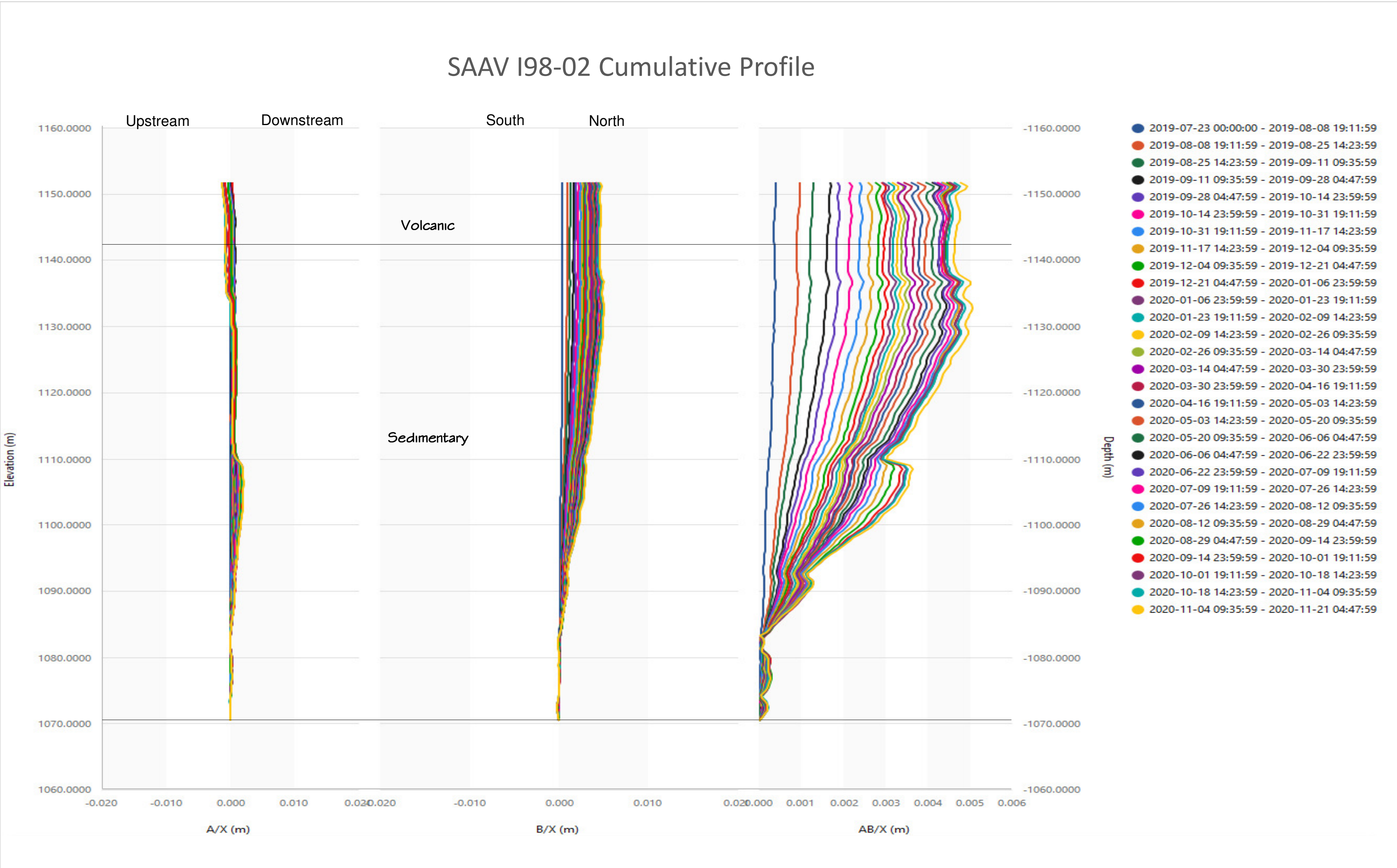
Upper El. (m)	1151.1
Lower El. (m)	1149.1



North Dam Bedrock

SAAV I98-02


SAAV I98-02 Incremental Profile
Upstream
Downstream
South
North
Volcanic
Sedimentary
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
1160.0000
1150.0000
1140.0000
1130.0000
1120.0000
1110.0000
1100.0000
1090.0000
1080.0000
1070.0000
1060.0000
-1160.0000
-1150.0000
-1140.0000
-1130.0000
-1120.0000
-1110.0000
-1100.0000
-1090.0000
-1080.0000
-1070.0000
-1060.0000
2019-07-23 00:00:00 - 2019-08-08 19:11:59
2019-08-08 19:11:59 - 2019-08-25 14:23:59
2019-08-25 14:23:59 - 2019-09-11 09:35:59
2019-09-11 09:35:59 - 2019-09-28 04:47:59
2019-09-28 04:47:59 - 2019-10-14 23:59:59
2019-10-14 23:59:59 - 2019-10-31 19:11:59
2019-10-31 19:11:59 - 2019-11-17 14:23:59
2019-11-17 14:23:59 - 2019-12-04 09:35:59
2019-12-04 09:35:59 - 2019-12-21 04:47:59
2019-12-21 04:47:59 - 2020-01-06 23:59:59
2020-01-06 23:59:59 - 2020-01-23 19:11:59
2020-01-23 19:11:59 - 2020-02-09 14:23:59
2020-02-09 14:23:59 - 2020-02-26 09:35:59
2020-02-26 09:35:59 - 2020-03-14 04:47:59
2020-03-14 04:47:59 - 2020-03-30 23:59:59
2020-03-30 23:59:59 - 2020-04-16 19:11:59
2020-04-16 19:11:59 - 2020-05-03 14:23:59
2020-05-03 14:23:59 - 2020-05-20 09:35:59
2020-05-20 09:35:59 - 2020-06-06 04:47:59
2020-06-06 04:47:59 - 2020-06-22 23:59:59
2020-06-22 23:59:59 - 2020-07-09 19:11:59
2020-07-09 19:11:59 - 2020-07-26 14:23:59
2020-07-26 14:23:59 - 2020-08-12 09:35:59
2020-08-12 09:35:59 - 2020-08-29 04:47:59
2020-08-29 04:47:59 - 2020-09-14 23:59:59
2020-09-14 23:59:59 - 2020-10-01 19:11:59
2020-10-01 19:11:59 - 2020-10-18 14:23:59
2020-10-18 14:23:59 - 2020-11-04 09:35:59
2020-11-04 09:35:59 - 2020-11-21 04:47:59

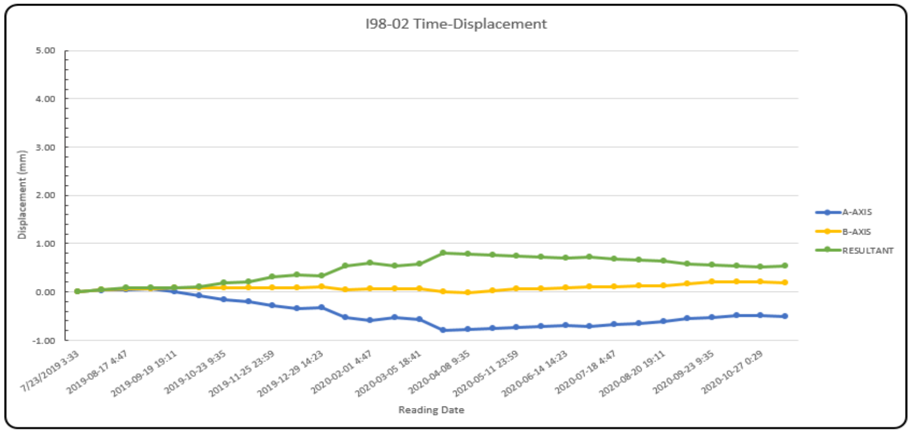

SAAV I98-02 Cumulative Profile
Upstream
Downstream
South
North
Volcanic
Sedimentary
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2019-07-23 00:00:00 - 2019-08-08 19:11:59
2019-08-08 19:11:59 - 2019-08-25 14:23:59
2019-08-25 14:23:59 - 2019-09-11 09:35:59
2019-09-11 09:35:59 - 2019-09-28 04:47:59
2019-09-28 04:47:59 - 2019-10-14 23:59:59
2019-10-14 23:59:59 - 2019-10-31 19:11:59
2019-10-31 19:11:59 - 2019-11-17 14:23:59
2019-11-17 14:23:59 - 2019-12-04 09:35:59
2019-12-04 09:35:59 - 2019-12-21 04:47:59
2019-12-21 04:47:59 - 2020-01-06 23:59:59
2020-01-06 23:59:59 - 2020-01-23 19:11:59
2020-01-23 19:11:59 - 2020-02-09 14:23:59
2020-02-09 14:23:59 - 2020-02-26 09:35:59
2020-02-26 09:35:59 - 2020-03-14 04:47:59
2020-03-14 04:47:59 - 2020-03-30 23:59:59
2020-03-30 23:59:59 - 2020-04-16 19:11:59
2020-04-16 19:11:59 - 2020-05-03 14:23:59
2020-05-03 14:23:59 - 2020-05-20 09:35:59
2020-05-20 09:35:59 - 2020-06-06 04:47:59
2020-06-06 04:47:59 - 2020-06-22 23:59:59
2020-06-22 23:59:59 - 2020-07-09 19:11:59
2020-07-09 19:11:59 - 2020-07-26 14:23:59
2020-07-26 14:23:59 - 2020-08-12 09:35:59
2020-08-12 09:35:59 - 2020-08-29 04:47:59
2020-08-29 04:47:59 - 2020-09-14 23:59:59
2020-09-14 23:59:59 - 2020-10-01 19:11:59
2020-10-01 19:11:59 - 2020-10-18 14:23:59
2020-10-18 14:23:59 - 2020-11-04 09:35:59
2020-11-04 09:35:59 - 2020-11-21 04:47:59

SAAV I98-02

Displacement Plot – Volcanic Unit

Unit	Upper Depth (m)	Lower Depth (m)
Andesite	0.5	10
Upper Sedimentary	24.5	27
Lower Sedimentary	50	52

Upper Depth	1151.9 m
Lower Depth	1142.4 m

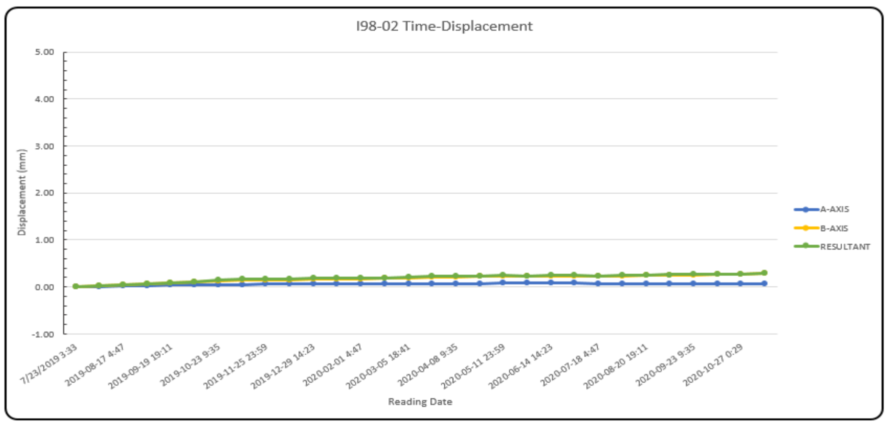


SAAV I98-02

Displacement Plot - Sedimentary

Unit	Upper Depth (m)	Lower Depth (m)
Andesite	0.5	10
Upper Sedimentary	24.5	27
Lower Sedimentary	50	52

Upper Depth	1127.9 m
Lower Depth	1125.4 m

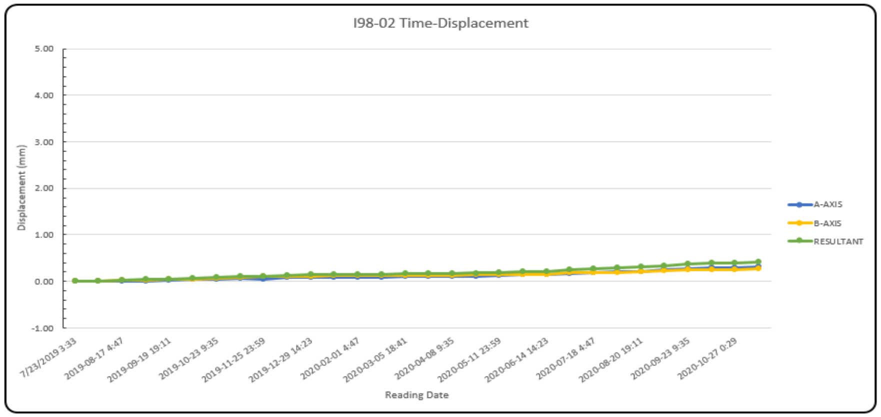


SAAV I98-02

Displacement Plot - Sedimentary

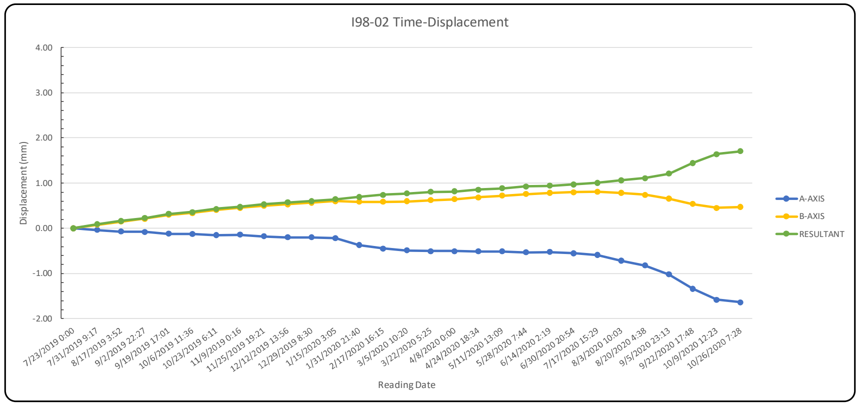
Unit	Upper Depth (m)	Lower Depth (m)
Andesite	0.5	10
Upper Sedimentary	24.5	27
Lower Sedimentary	50	52

Upper Depth	1102.4 m
Lower Depth	1100.4 m



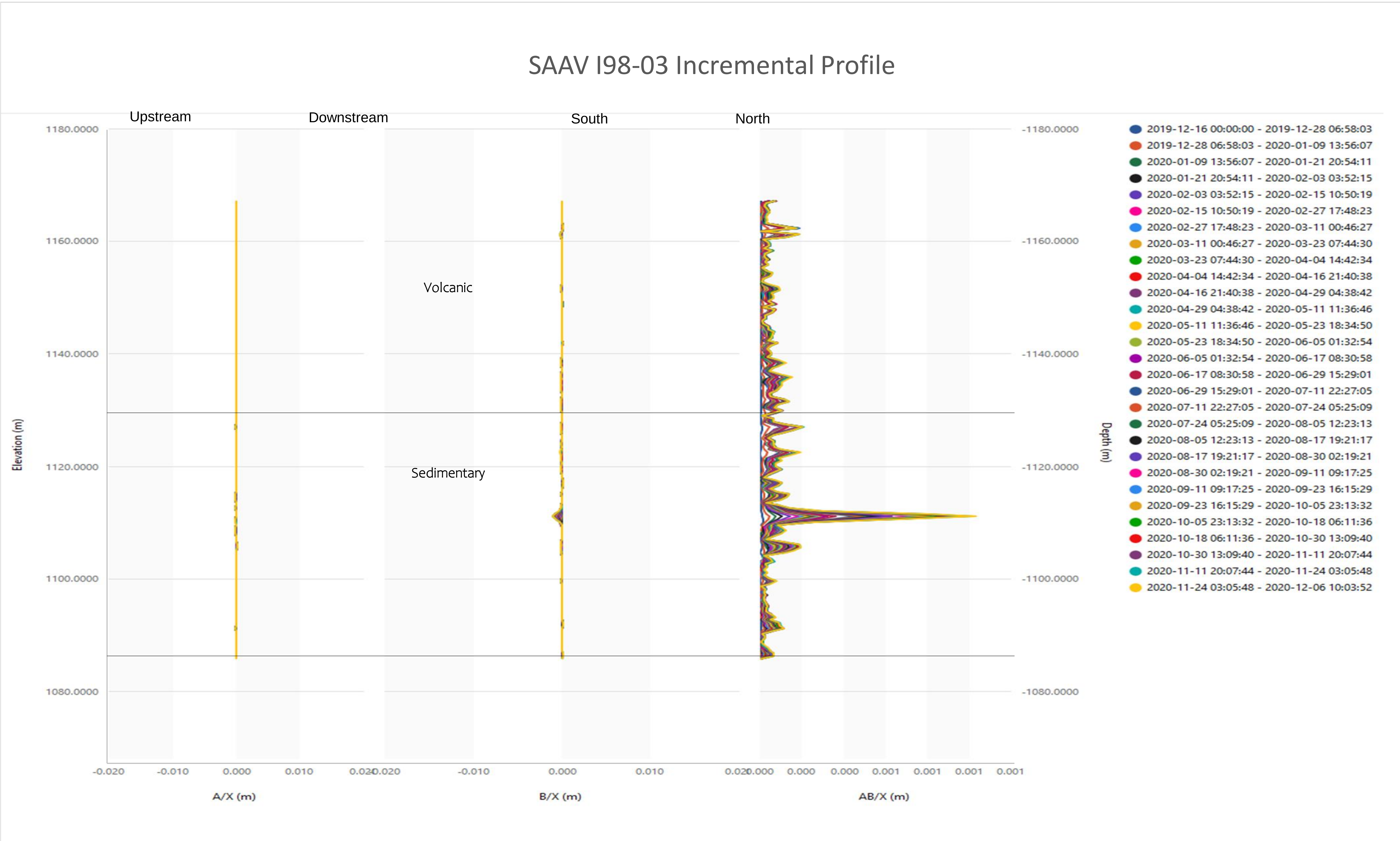
Unit	Upper El. (m)	Lower El. (m)
Andesite	1151.9	1142.4
Upper Sedimentary	1127.9	1125.4
Lower Sedimentary	1102.4	1100.4
Mudstone/Siltstone	1113.4	1107.9

Upper El. (m)	1113.4
Lower El. (m)	1107.9

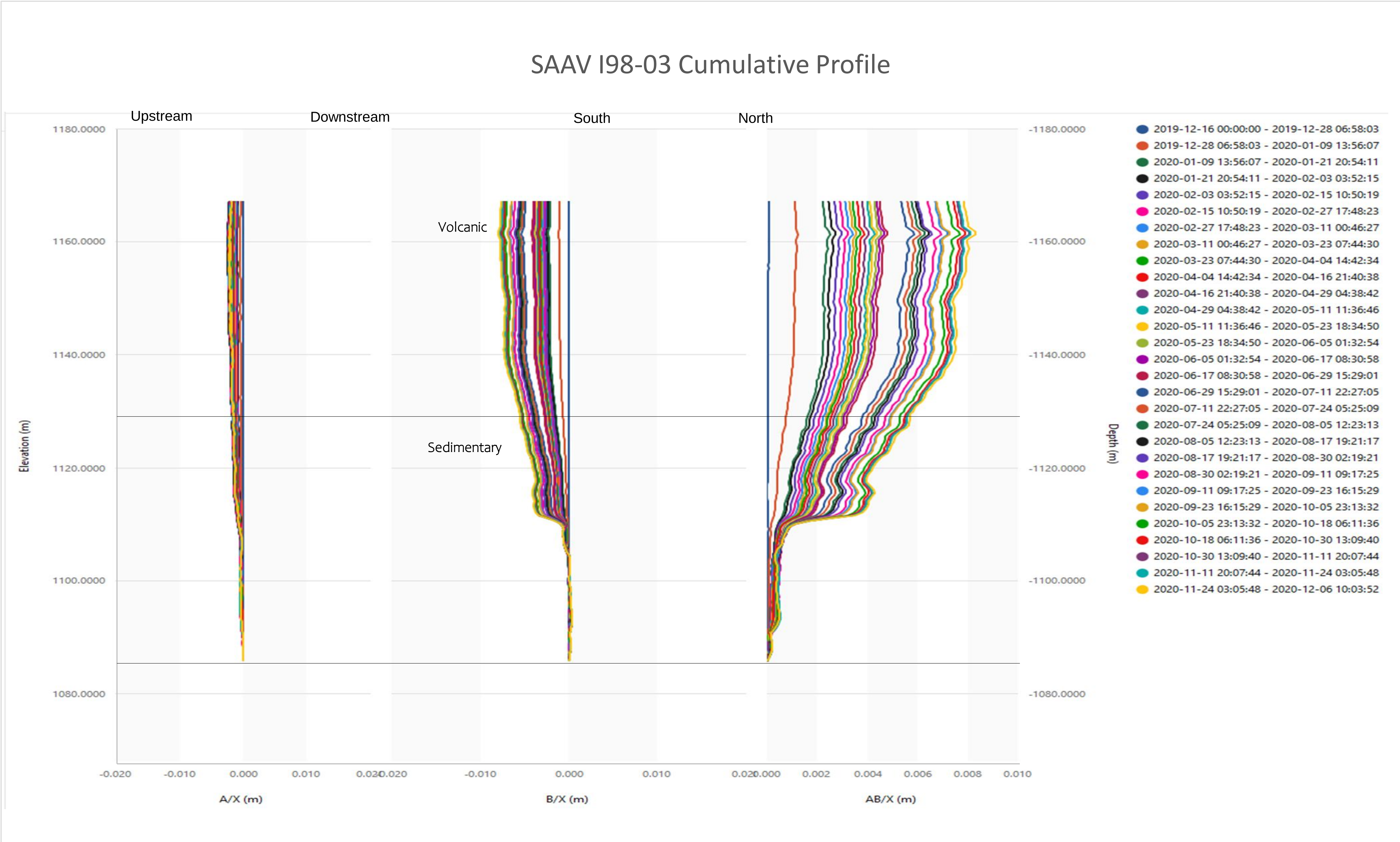


North Dam Bedrock

SAAV I98-03



SAAV I98-03 Incremental Profile
Upstream
Downstream
South
North
Volcanic
Sedimentary
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2019-12-16 00:00:00 - 2019-12-28 06:58:03
2019-12-28 06:58:03 - 2020-01-09 13:56:07
2020-01-09 13:56:07 - 2020-01-21 20:54:11
2020-01-21 20:54:11 - 2020-02-03 03:52:15
2020-02-03 03:52:15 - 2020-02-15 10:50:19
2020-02-15 10:50:19 - 2020-02-27 17:48:23
2020-02-27 17:48:23 - 2020-03-11 00:46:27
2020-03-11 00:46:27 - 2020-03-23 07:44:30
2020-03-23 07:44:30 - 2020-04-04 14:42:34
2020-04-04 14:42:34 - 2020-04-16 21:40:38
2020-04-16 21:40:38 - 2020-04-29 04:38:42
2020-04-29 04:38:42 - 2020-05-11 11:36:46
2020-05-11 11:36:46 - 2020-05-23 18:34:50
2020-05-23 18:34:50 - 2020-06-05 01:32:54
2020-06-05 01:32:54 - 2020-06-17 08:30:58
2020-06-17 08:30:58 - 2020-06-29 15:29:01
2020-06-29 15:29:01 - 2020-07-11 22:27:05
2020-07-11 22:27:05 - 2020-07-24 05:25:09
2020-07-24 05:25:09 - 2020-08-05 12:23:13
2020-08-05 12:23:13 - 2020-08-17 19:21:17
2020-08-17 19:21:17 - 2020-08-30 02:19:21
2020-08-30 02:19:21 - 2020-09-11 09:17:25
2020-09-11 09:17:25 - 2020-09-23 16:15:29
2020-09-23 16:15:29 - 2020-10-05 23:13:32
2020-10-05 23:13:32 - 2020-10-18 06:11:36
2020-10-18 06:11:36 - 2020-10-30 13:09:40
2020-10-30 13:09:40 - 2020-11-11 20:07:44
2020-11-11 20:07:44 - 2020-11-24 03:05:48
2020-11-24 03:05:48 - 2020-12-06 10:03:52



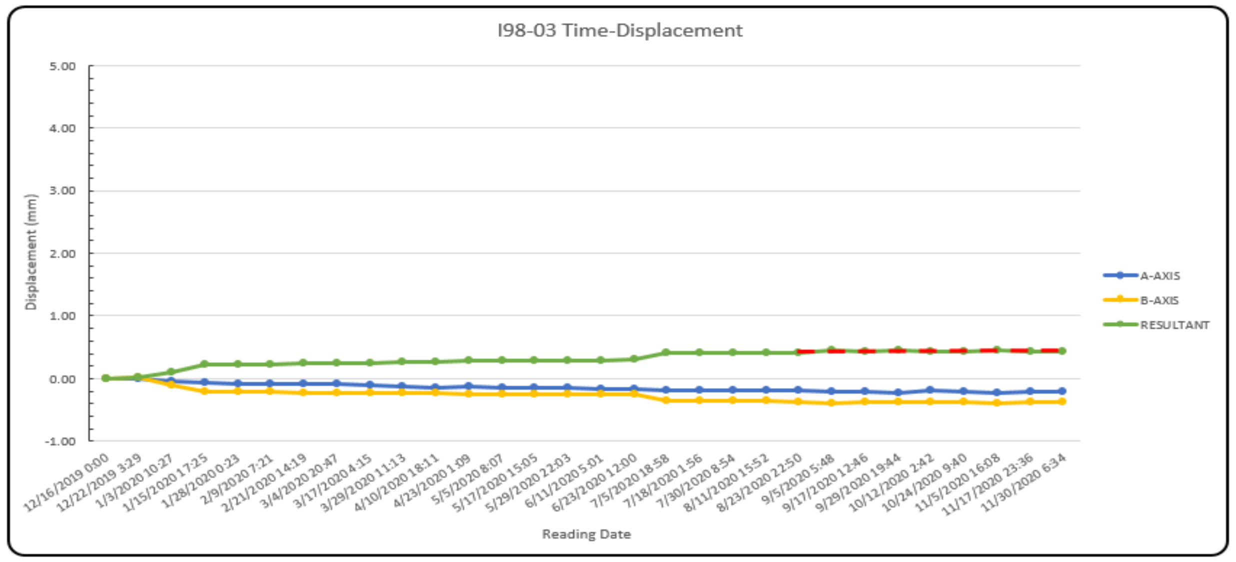
SAAV I98-03 Cumulative Profile
Upstream
Downstream
South
North
Volcanic
Sedimentary
Elevation (m)
Depth (m)
1180.0000
1160.0000
1140.0000
1120.0000
1100.0000
1080.0000
-1180.0000
-1160.0000
-1140.0000
-1120.0000
-1100.0000
-1080.0000
-0.020 -0.010 0.000 0.010 0.020
A/X (m)
-0.020 -0.010 0.000 0.010 0.020
B/X (m)
0.000 0.002 0.004 0.006 0.008 0.010
AB/X (m)
2019-12-16 00:00:00 - 2019-12-28 06:58:03
2019-12-28 06:58:03 - 2020-01-09 13:56:07
2020-01-09 13:56:07 - 2020-01-21 20:54:11
2020-01-21 20:54:11 - 2020-02-03 03:52:15
2020-02-03 03:52:15 - 2020-02-15 10:50:19
2020-02-15 10:50:19 - 2020-02-27 17:48:23
2020-02-27 17:48:23 - 2020-03-11 00:46:27
2020-03-11 00:46:27 - 2020-03-23 07:44:30
2020-03-23 07:44:30 - 2020-04-04 14:42:34
2020-04-04 14:42:34 - 2020-04-16 21:40:38
2020-04-16 21:40:38 - 2020-04-29 04:38:42
2020-04-29 04:38:42 - 2020-05-11 11:36:46
2020-05-11 11:36:46 - 2020-05-23 18:34:50
2020-05-23 18:34:50 - 2020-06-05 01:32:54
2020-06-05 01:32:54 - 2020-06-17 08:30:58
2020-06-17 08:30:58 - 2020-06-29 15:29:01
2020-06-29 15:29:01 - 2020-07-11 22:27:05
2020-07-11 22:27:05 - 2020-07-24 05:25:09
2020-07-24 05:25:09 - 2020-08-05 12:23:13
2020-08-05 12:23:13 - 2020-08-17 19:21:17
2020-08-17 19:21:17 - 2020-08-30 02:19:21
2020-08-30 02:19:21 - 2020-09-11 09:17:25
2020-09-11 09:17:25 - 2020-09-23 16:15:29
2020-09-23 16:15:29 - 2020-10-05 23:13:32
2020-10-05 23:13:32 - 2020-10-18 06:11:36
2020-10-18 06:11:36 - 2020-10-30 13:09:40
2020-10-30 13:09:40 - 2020-11-11 20:07:44
2020-11-11 20:07:44 - 2020-11-24 03:05:48
2020-11-24 03:05:48 - 2020-12-06 10:03:52

SAAV I98-03

Displacement Plot – Volcanic Unit

Unit	Upper El. (m)	Lower El. (m)
Volcanic	1132	1129
Sedimentary	1106	1103

Upper El. (m)	1132.0
Lower El. (m)	1129.0

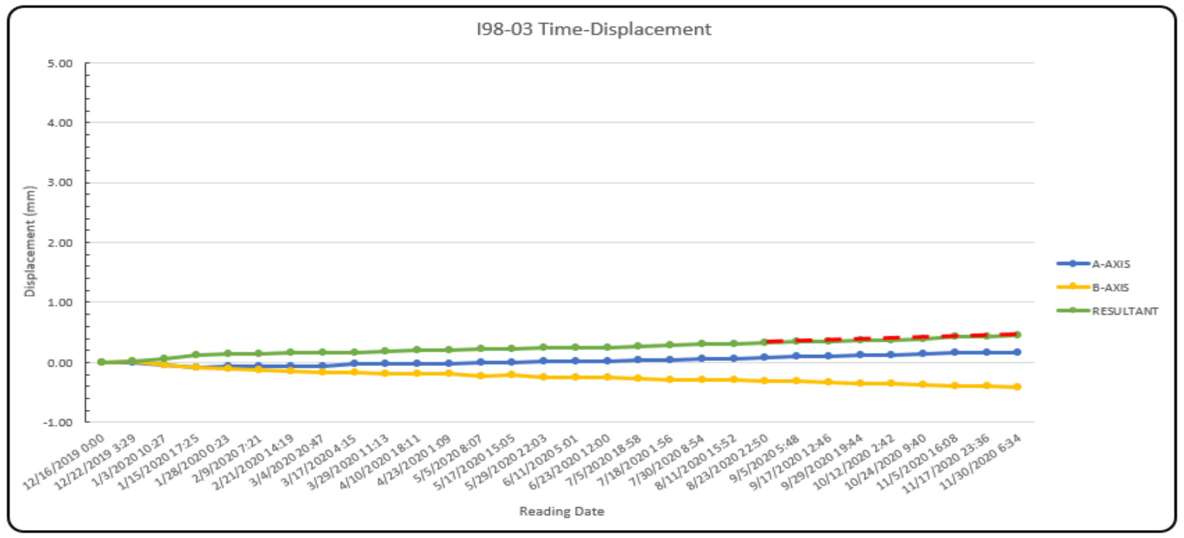


SAAV I98-03

Displacement Plot - Sedimentary

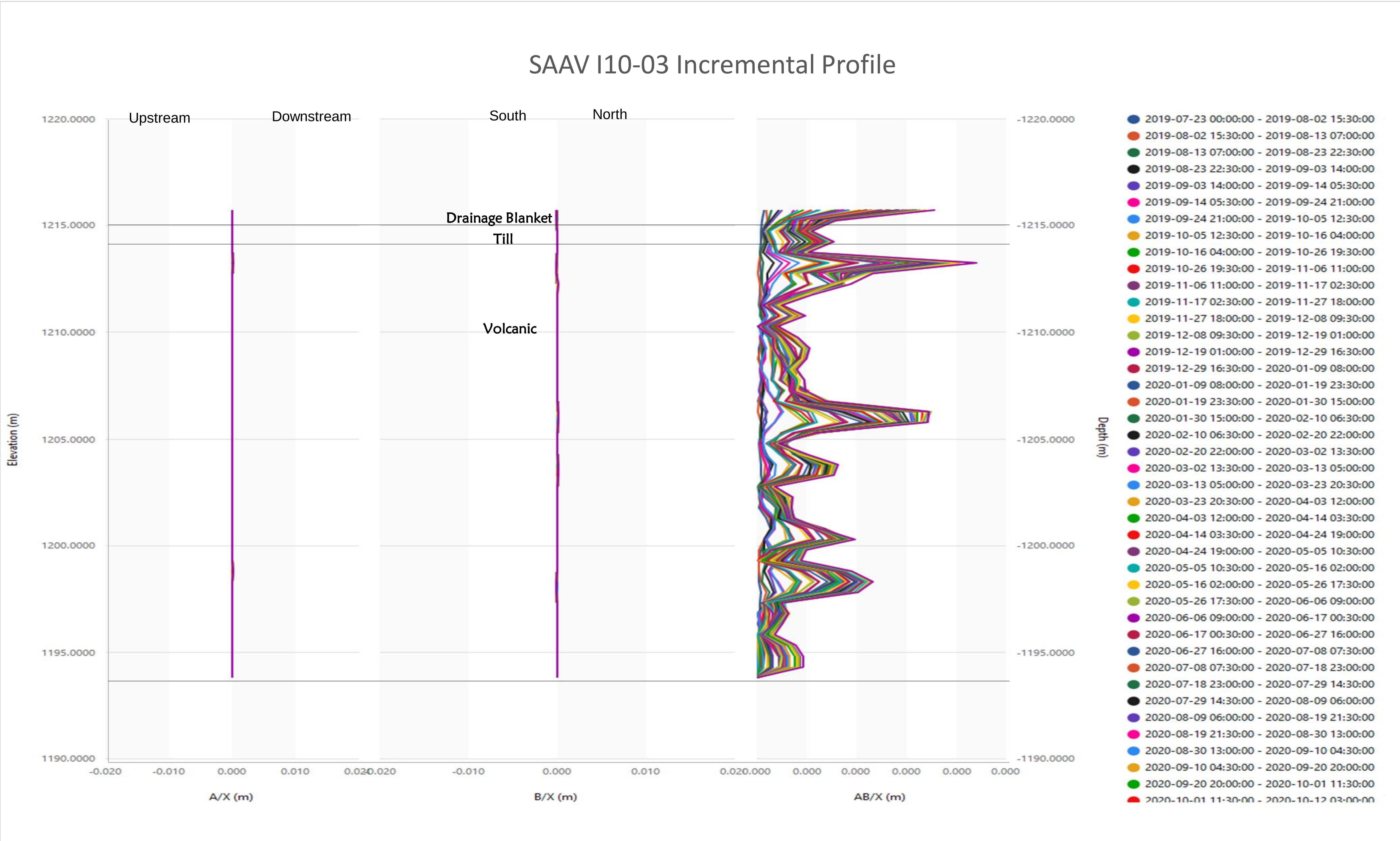
Unit	Upper El. (m)	Lower El. (m)
Volcanic	1132	1129
Sedimentary	1106	1103

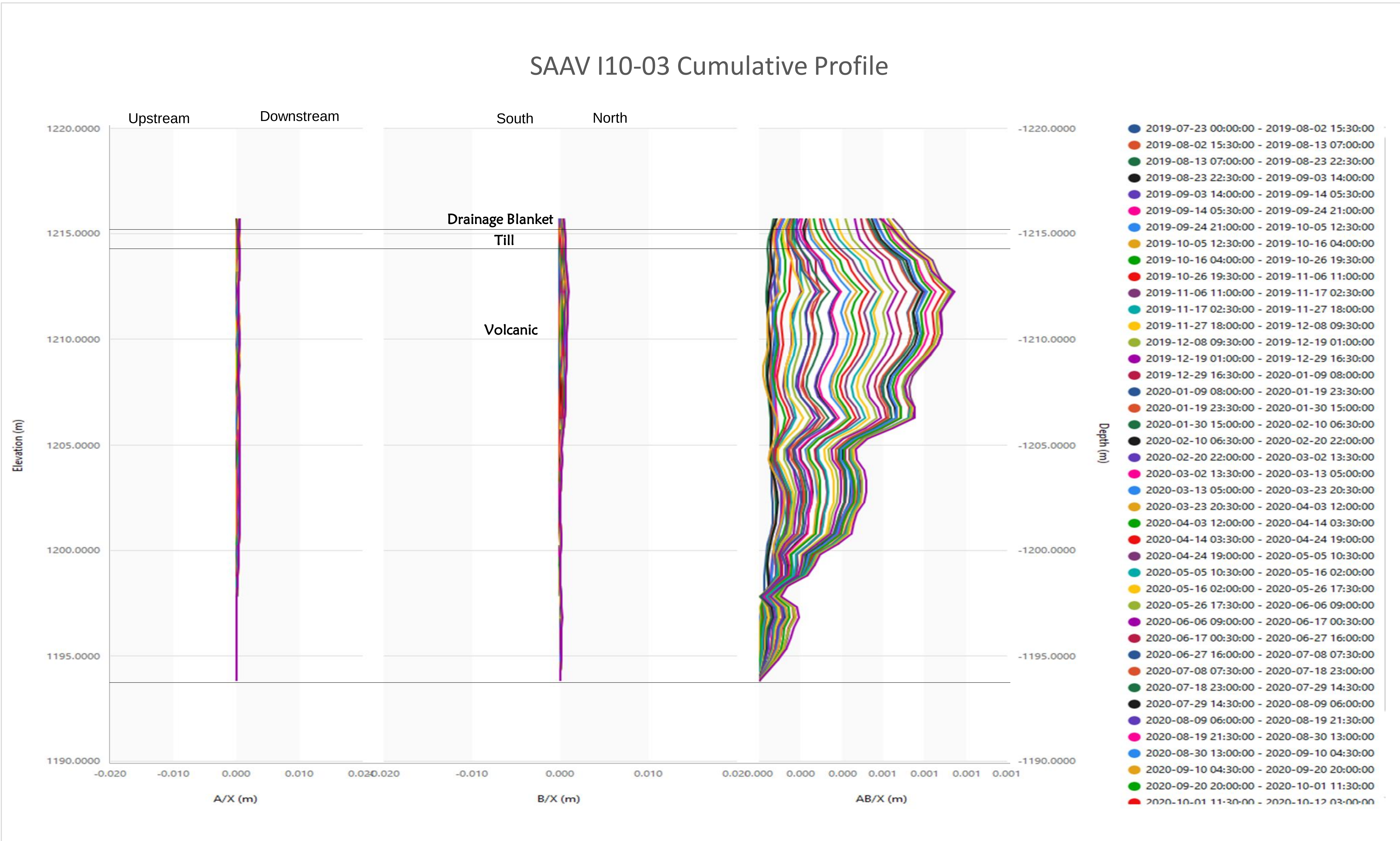
Upper El. (m)	1106.0
Lower El. (m)	1103.0



North Dam Bedrock

SAAV I10-03


SAAV I10-03 Incremental Profile
Upstream
Downstream
South
North
Drainage Blanket
Till
Volcanic
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
1220.0000
1215.0000
1210.0000
1205.0000
1200.0000
1195.0000
1190.0000
-1220.0000
-1215.0000
-1210.0000
-1205.0000
-1200.0000
-1195.0000
-1190.0000
-0.020
-0.010
0.000
0.010
0.020
2019-07-23 00:00:00 - 2019-08-02 15:30:00
2019-08-02 15:30:00 - 2019-08-13 07:00:00
2019-08-13 07:00:00 - 2019-08-23 22:30:00
2019-08-23 22:30:00 - 2019-09-03 14:00:00
2019-09-03 14:00:00 - 2019-09-14 05:30:00
2019-09-14 05:30:00 - 2019-09-24 21:00:00
2019-09-24 21:00:00 - 2019-10-05 12:30:00
2019-10-05 12:30:00 - 2019-10-16 04:00:00
2019-10-16 04:00:00 - 2019-10-26 19:30:00
2019-10-26 19:30:00 - 2019-11-06 11:00:00
2019-11-06 11:00:00 - 2019-11-17 02:30:00
2019-11-17 02:30:00 - 2019-11-27 18:00:00
2019-11-27 18:00:00 - 2019-12-08 09:30:00
2019-12-08 09:30:00 - 2019-12-19 01:00:00
2019-12-19 01:00:00 - 2019-12-29 16:30:00
2019-12-29 16:30:00 - 2020-01-09 08:00:00
2020-01-09 08:00:00 - 2020-01-19 23:30:00
2020-01-19 23:30:00 - 2020-01-30 15:00:00
2020-01-30 15:00:00 - 2020-02-10 06:30:00
2020-02-10 06:30:00 - 2020-02-20 22:00:00
2020-02-20 22:00:00 - 2020-03-02 13:30:00
2020-03-02 13:30:00 - 2020-03-13 05:00:00
2020-03-13 05:00:00 - 2020-03-23 20:30:00
2020-03-23 20:30:00 - 2020-04-03 12:00:00
2020-04-03 12:00:00 - 2020-04-14 03:30:00
2020-04-14 03:30:00 - 2020-04-24 19:00:00
2020-04-24 19:00:00 - 2020-05-05 10:30:00
2020-05-05 10:30:00 - 2020-05-16 02:00:00
2020-05-16 02:00:00 - 2020-05-26 17:30:00
2020-05-26 17:30:00 - 2020-06-06 09:00:00
2020-06-06 09:00:00 - 2020-06-17 00:30:00
2020-06-17 00:30:00 - 2020-06-27 16:00:00
2020-06-27 16:00:00 - 2020-07-08 07:30:00
2020-07-08 07:30:00 - 2020-07-18 23:00:00
2020-07-18 23:00:00 - 2020-07-29 14:30:00
2020-07-29 14:30:00 - 2020-08-09 06:00:00
2020-08-09 06:00:00 - 2020-08-19 21:30:00
2020-08-19 21:30:00 - 2020-08-30 13:00:00
2020-08-30 13:00:00 - 2020-09-10 04:30:00
2020-09-10 04:30:00 - 2020-09-20 20:00:00
2020-09-20 20:00:00 - 2020-10-01 11:30:00

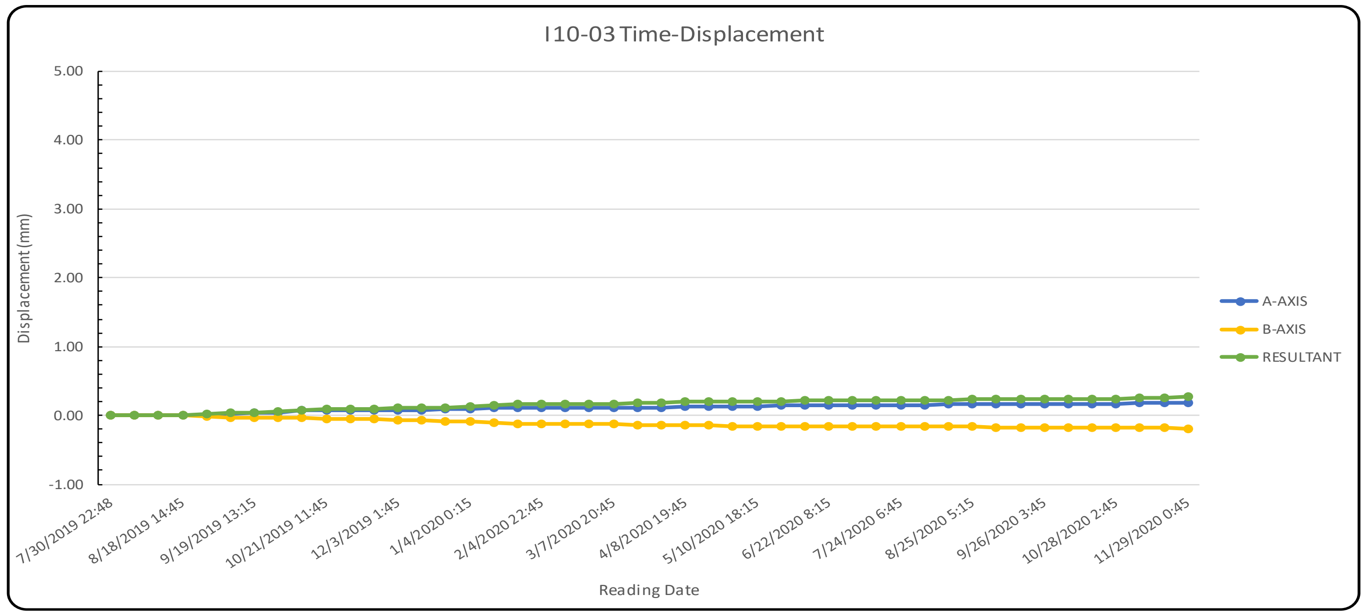

SAAV I10-03 Cumulative Profile
Upstream
Downstream
South
North
Drainage Blanket
Till
Volcanic
Elevation (m)
Depth (m)
1220.0000
1215.0000
1210.0000
1205.0000
1200.0000
1195.0000
1190.0000
-1220.0000
-1215.0000
-1210.0000
-1205.0000
-1200.0000
-1195.0000
-1190.0000
A/X (m)
B/X (m)
AB/X (m)
2019-07-23 00:00:00 - 2019-08-02 15:30:00
2019-08-02 15:30:00 - 2019-08-13 07:00:00
2019-08-13 07:00:00 - 2019-08-23 22:30:00
2019-08-23 22:30:00 - 2019-09-03 14:00:00
2019-09-03 14:00:00 - 2019-09-14 05:30:00
2019-09-14 05:30:00 - 2019-09-24 21:00:00
2019-09-24 21:00:00 - 2019-10-05 12:30:00
2019-10-05 12:30:00 - 2019-10-16 04:00:00
2019-10-16 04:00:00 - 2019-10-26 19:30:00
2019-10-26 19:30:00 - 2019-11-06 11:00:00
2019-11-06 11:00:00 - 2019-11-17 02:30:00
2019-11-17 02:30:00 - 2019-11-27 18:00:00
2019-11-27 18:00:00 - 2019-12-08 09:30:00
2019-12-08 09:30:00 - 2019-12-19 01:00:00
2019-12-19 01:00:00 - 2019-12-29 16:30:00
2019-12-29 16:30:00 - 2020-01-09 08:00:00
2020-01-09 08:00:00 - 2020-01-19 23:30:00
2020-01-19 23:30:00 - 2020-01-30 15:00:00
2020-01-30 15:00:00 - 2020-02-10 06:30:00
2020-02-10 06:30:00 - 2020-02-20 22:00:00
2020-02-20 22:00:00 - 2020-03-02 13:30:00
2020-03-02 13:30:00 - 2020-03-13 05:00:00
2020-03-13 05:00:00 - 2020-03-23 20:30:00
2020-03-23 20:30:00 - 2020-04-03 12:00:00
2020-04-03 12:00:00 - 2020-04-14 03:30:00
2020-04-14 03:30:00 - 2020-04-24 19:00:00
2020-04-24 19:00:00 - 2020-05-05 10:30:00
2020-05-05 10:30:00 - 2020-05-16 02:00:00
2020-05-16 02:00:00 - 2020-05-26 17:30:00
2020-05-26 17:30:00 - 2020-06-06 09:00:00
2020-06-06 09:00:00 - 2020-06-17 00:30:00
2020-06-17 00:30:00 - 2020-06-27 16:00:00
2020-06-27 16:00:00 - 2020-07-08 07:30:00
2020-07-08 07:30:00 - 2020-07-18 23:00:00
2020-07-18 23:00:00 - 2020-07-29 14:30:00
2020-07-29 14:30:00 - 2020-08-09 06:00:00
2020-08-09 06:00:00 - 2020-08-19 21:30:00
2020-08-19 21:30:00 - 2020-08-30 13:00:00
2020-08-30 13:00:00 - 2020-09-10 04:30:00
2020-09-10 04:30:00 - 2020-09-20 20:00:00
2020-09-20 20:00:00 - 2020-10-01 11:30:00

SAAV I10-03

Displacement Plot – Inferred GLU

Unit	Upper El. (m)	Lower El. (m)
Inferred GLU	1213.8	1212.8
Volcanic	1212.8	1193.8

Upper El. (m)	1213.8
Lower El. (m)	1212.8

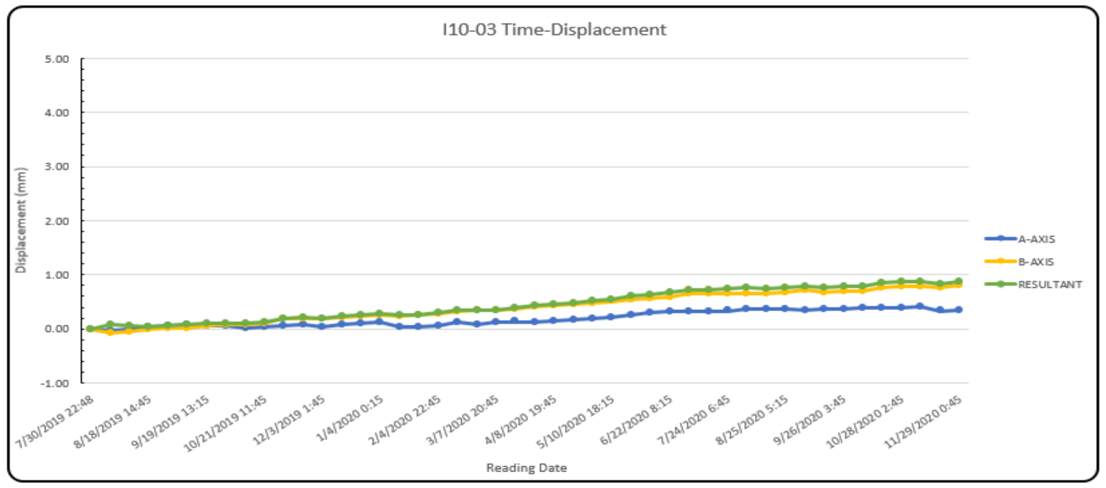


SAAV I10-03

Displacement Plot – Volcanic

Unit	Upper El. (m)	Lower El. (m)
Inferred GLU	1213.8	1212.8
Volcanic	1212.8	1193.8

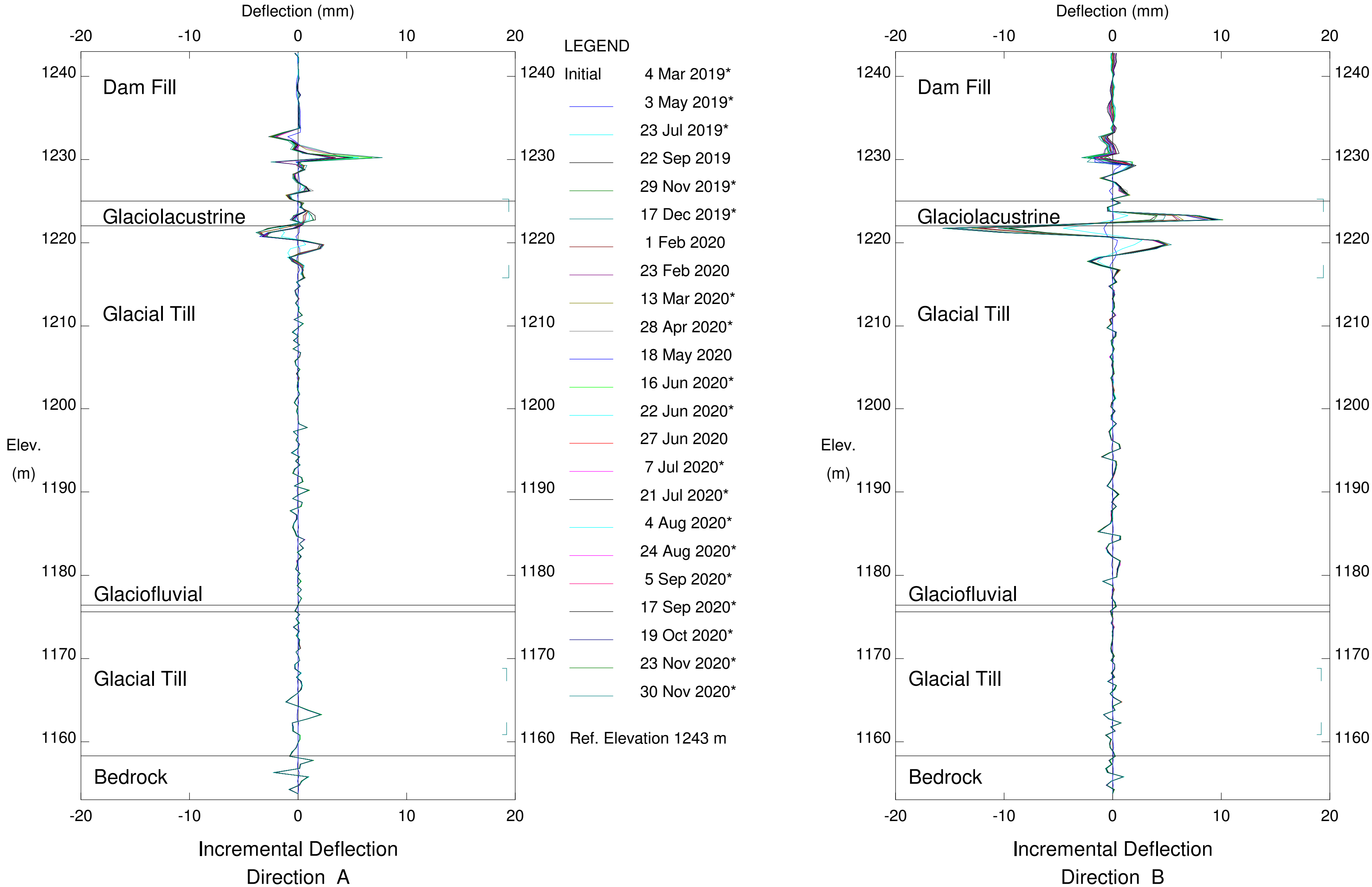
Upper El. (m)	1212.8
Lower El. (m)	1193.8



North Dam Bedrock

I16-05

Highland Valley Copper - Logan Lake, BC

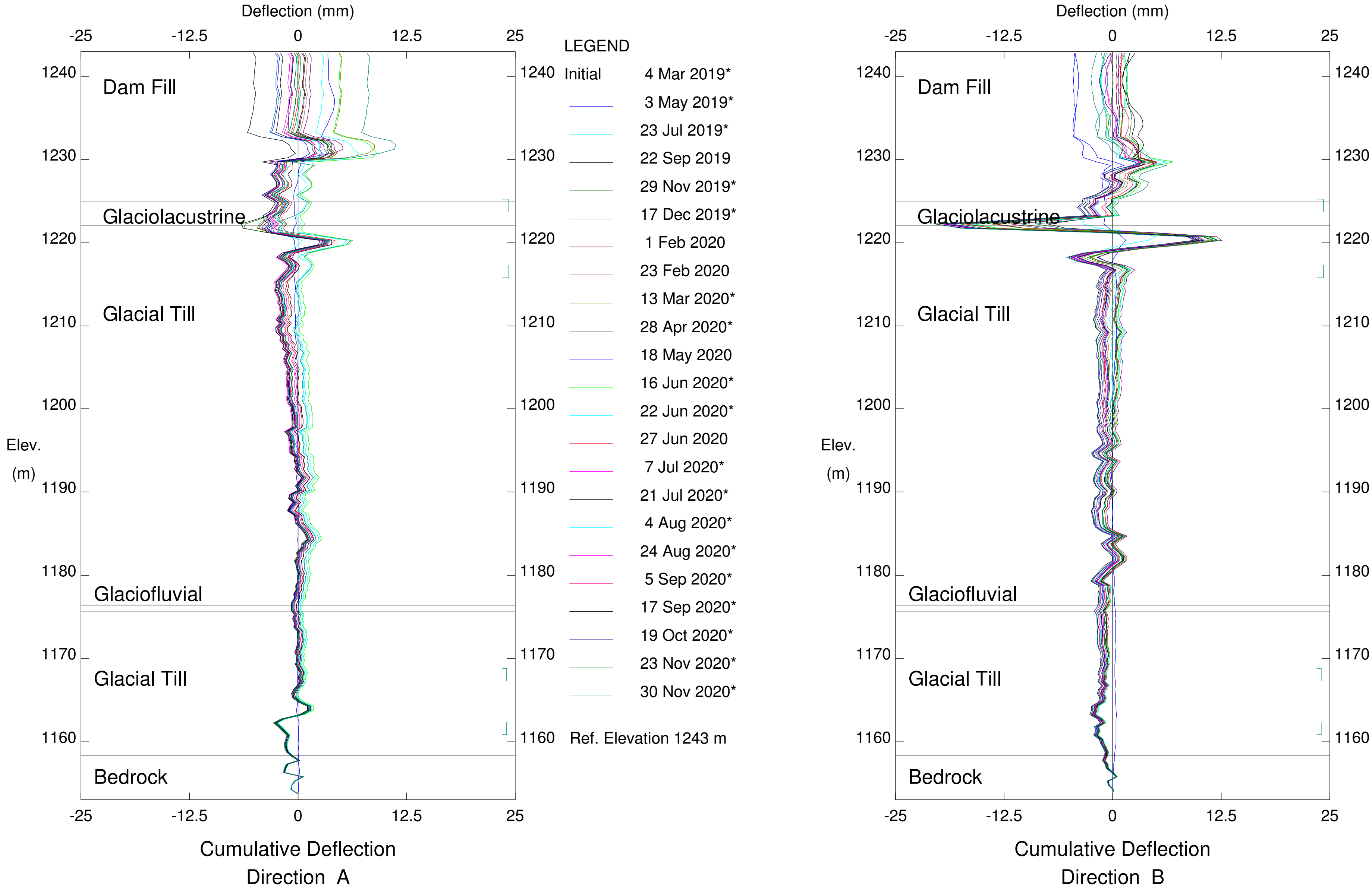


LL Dam, Inclinometer I16-5

Sets marked * include zero shift and/or rotation corrections.

I16-05.gtl

Highland Valley Copper - Logan Lake, BC

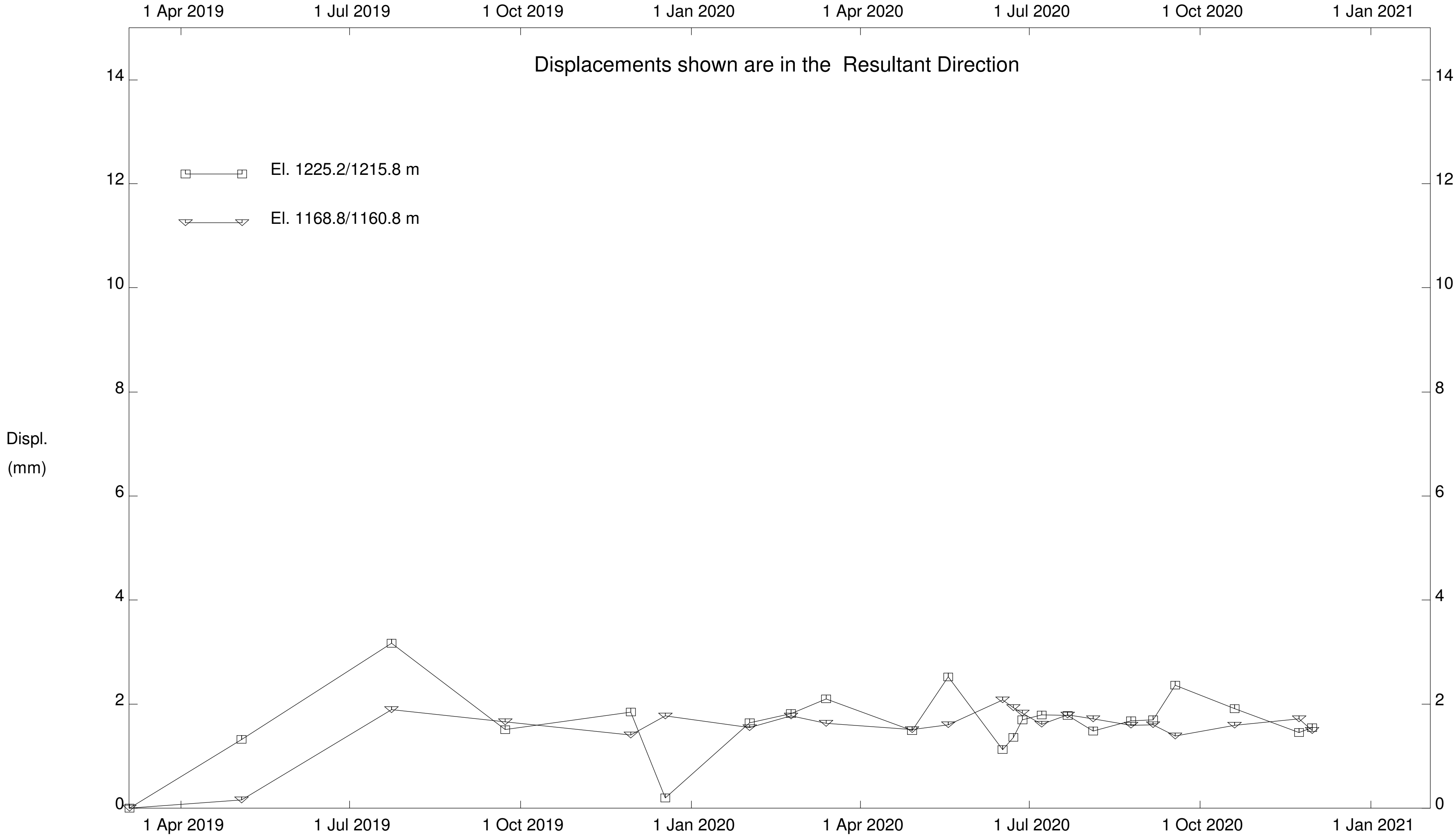


LL Dam, Inclinometer I16-5

Sets marked * include zero shift and/or rotation corrections.

I16-05.gtl

Highland Valley Copper - Logan Lake, BC

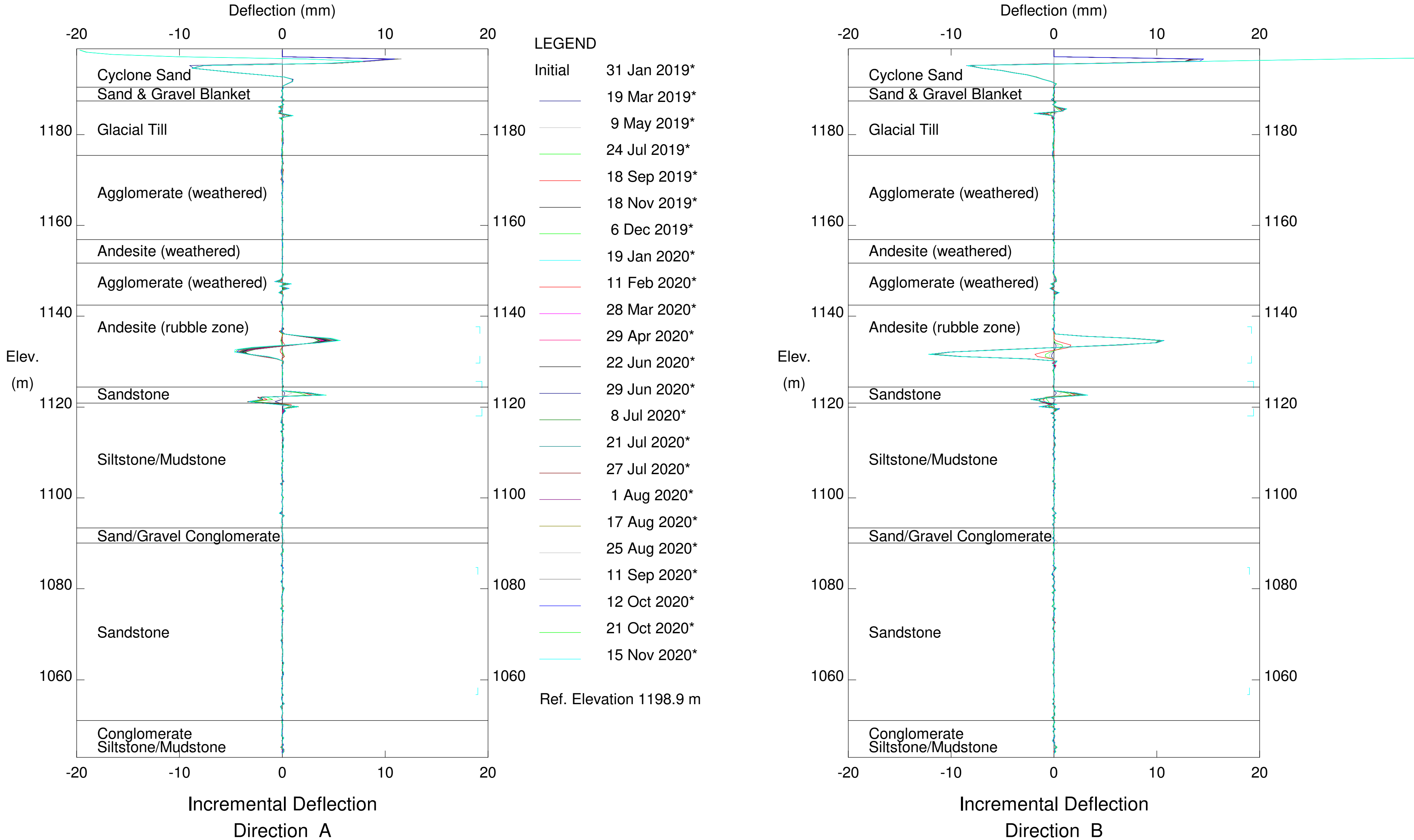


LL Dam, Inclinometer I16-5

North Dam Bedrock

I19-01

Highland Valley Copper - Logan Lake, BC

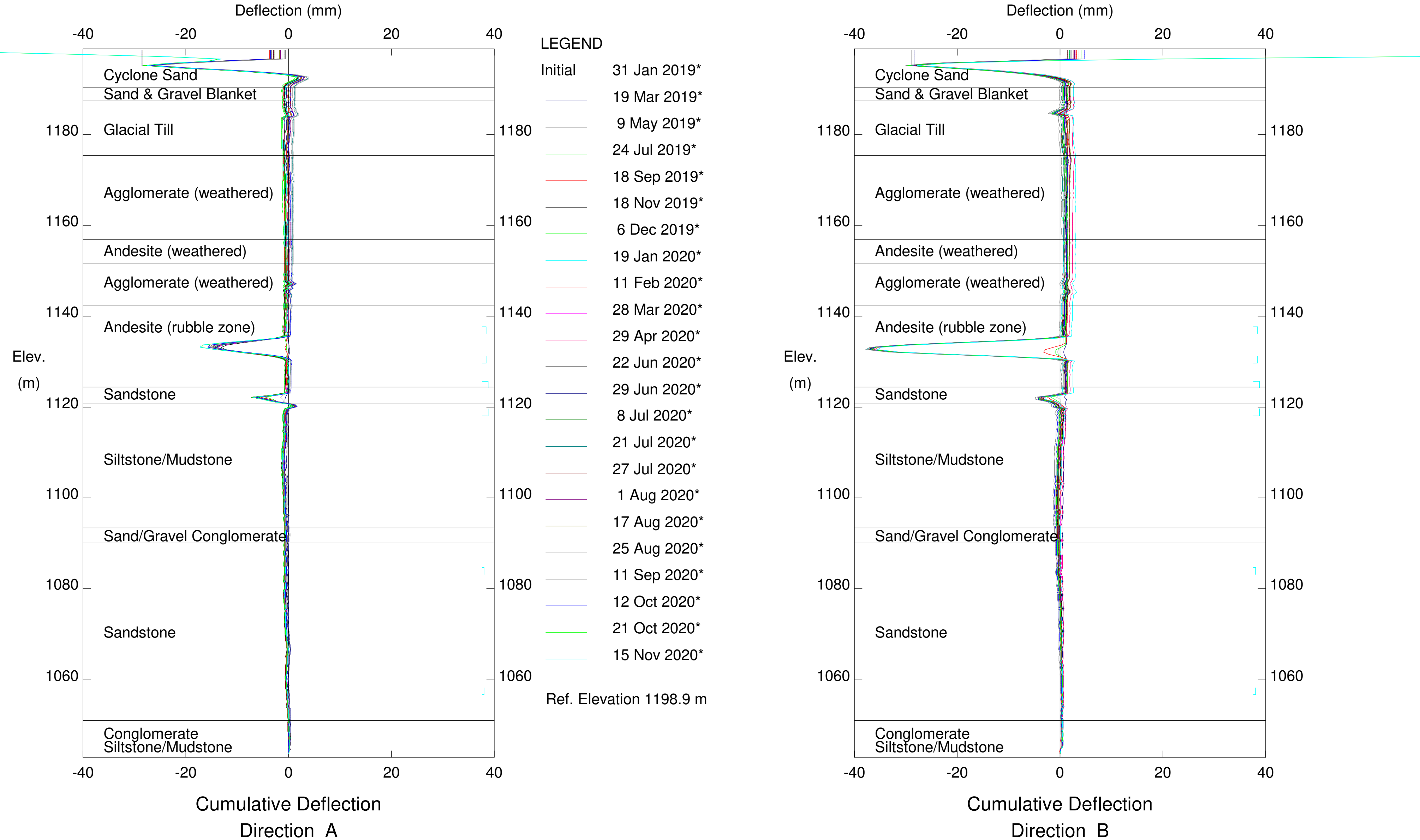


LL Dam, Inclinometer I19-1

Sets marked * include zero shift and/or rotation corrections.

I19-01.gtl

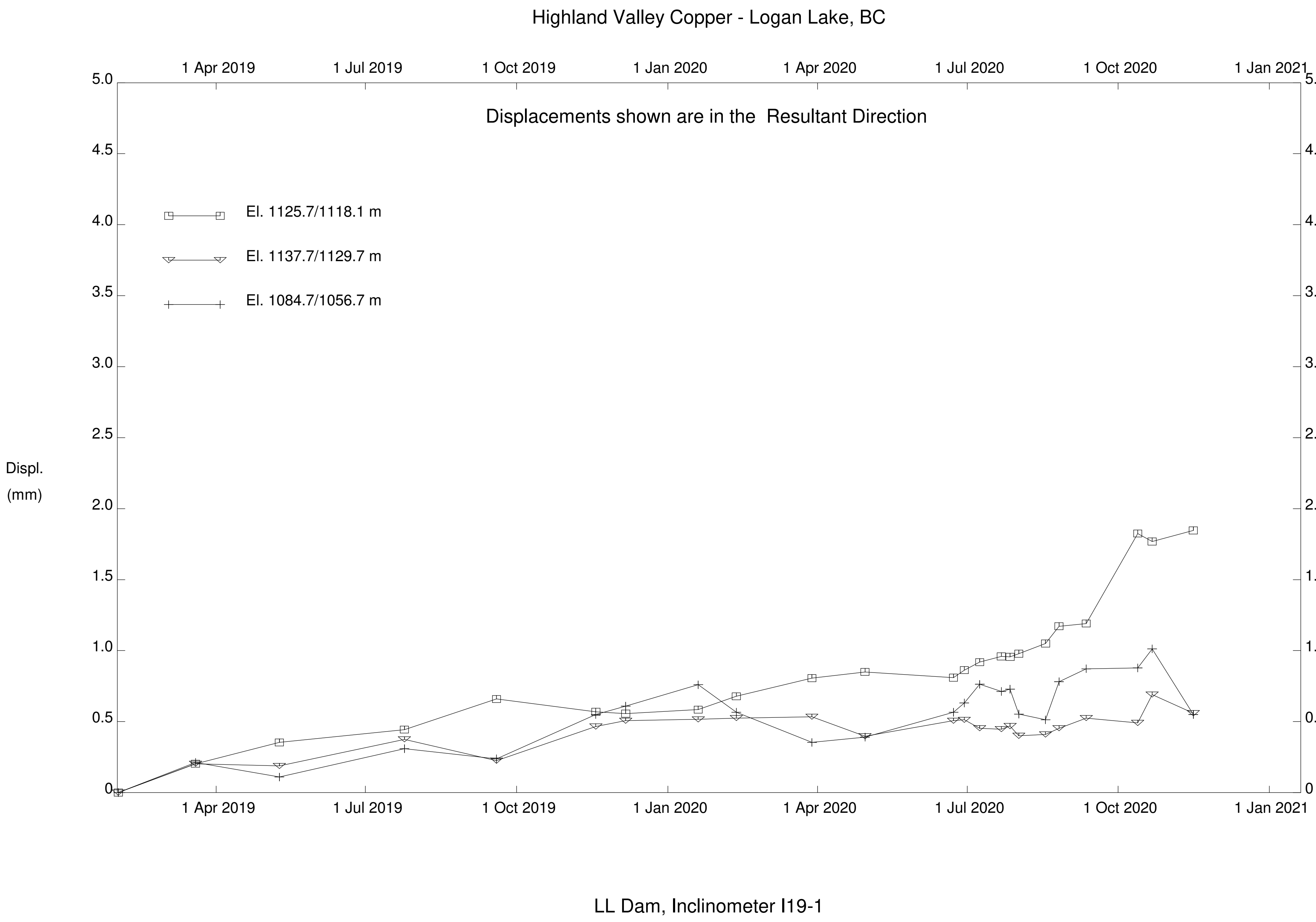
Highland Valley Copper - Logan Lake, BC



LL Dam, Inclinometer I19-1

Sets marked * include zero shift and/or rotation corrections.

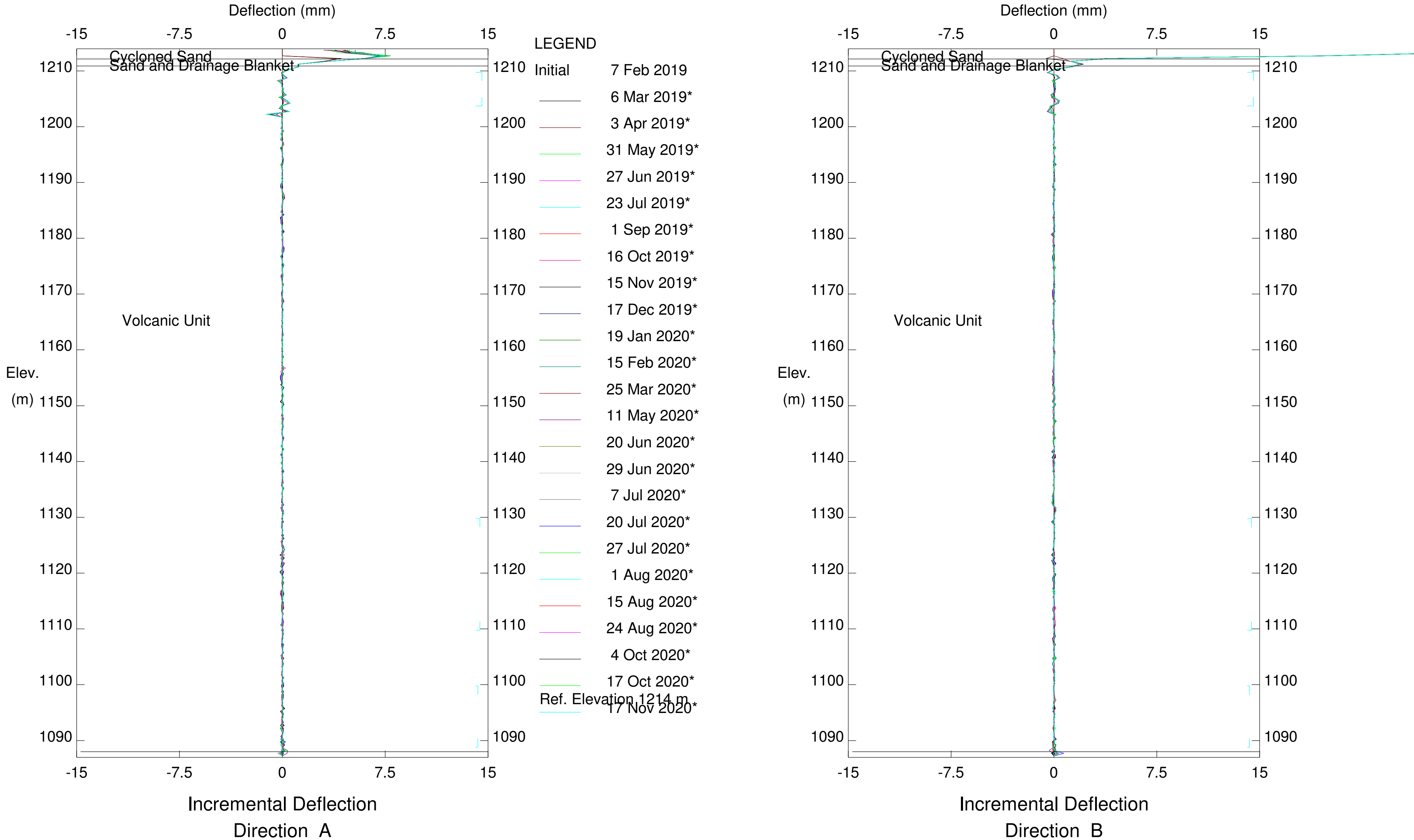
I19-01.gtl


Highland Valley Copper - Logan Lake, BC
Displacements shown are in the Resultant Direction
El. 1125.7/1118.1 m
El. 1137.7/1129.7 m
El. 1084.7/1056.7 m
Displ.
(mm)
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
1 Apr 2019
1 Jul 2019
1 Oct 2019
1 Jan 2020
1 Apr 2020
1 Jul 2020
1 Oct 2020
1 Jan 2021
LL Dam, Inclinometer I19-1

North Dam Bedrock

I19-02

Highland Valley Copper - Logan Lake, BC

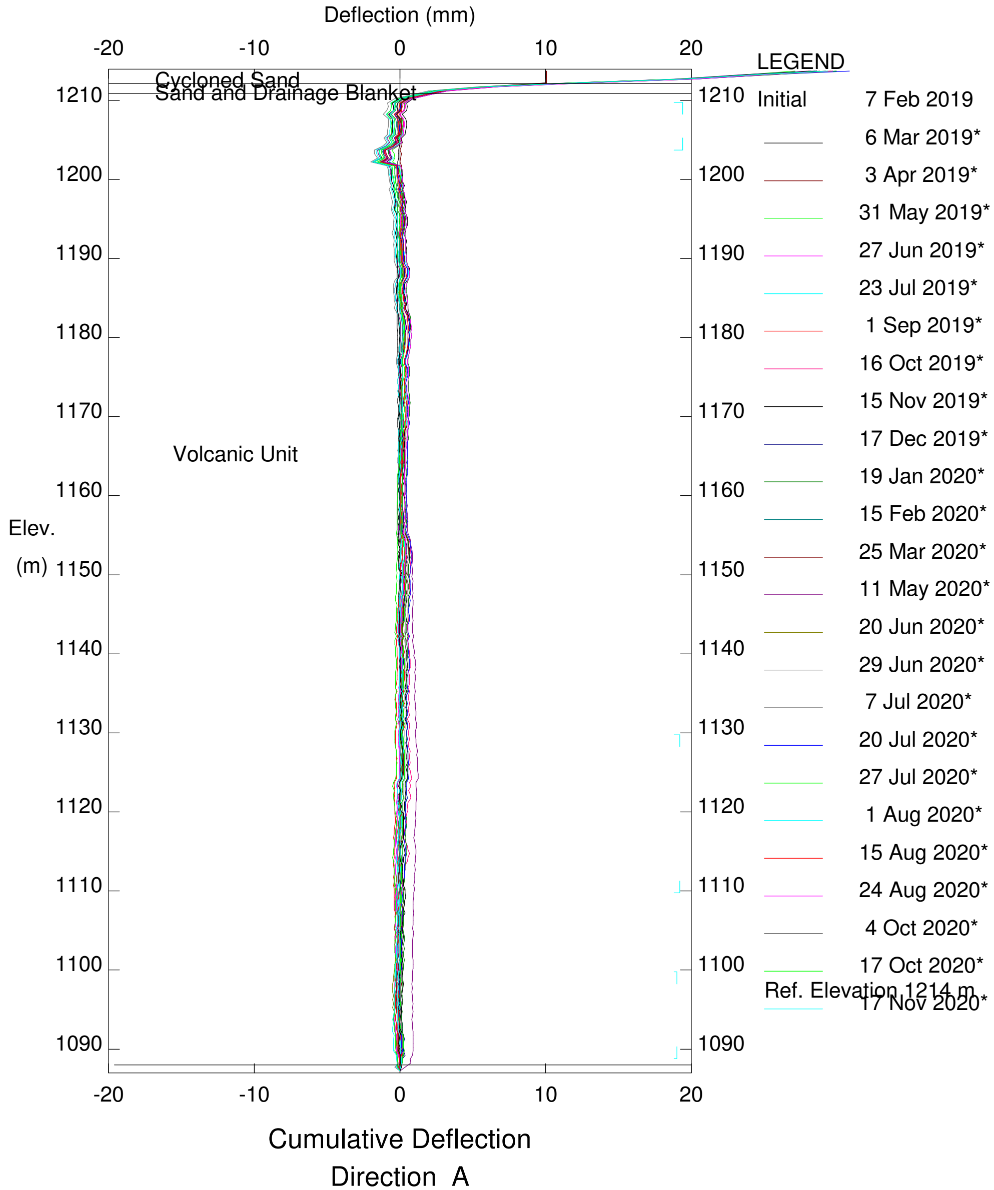


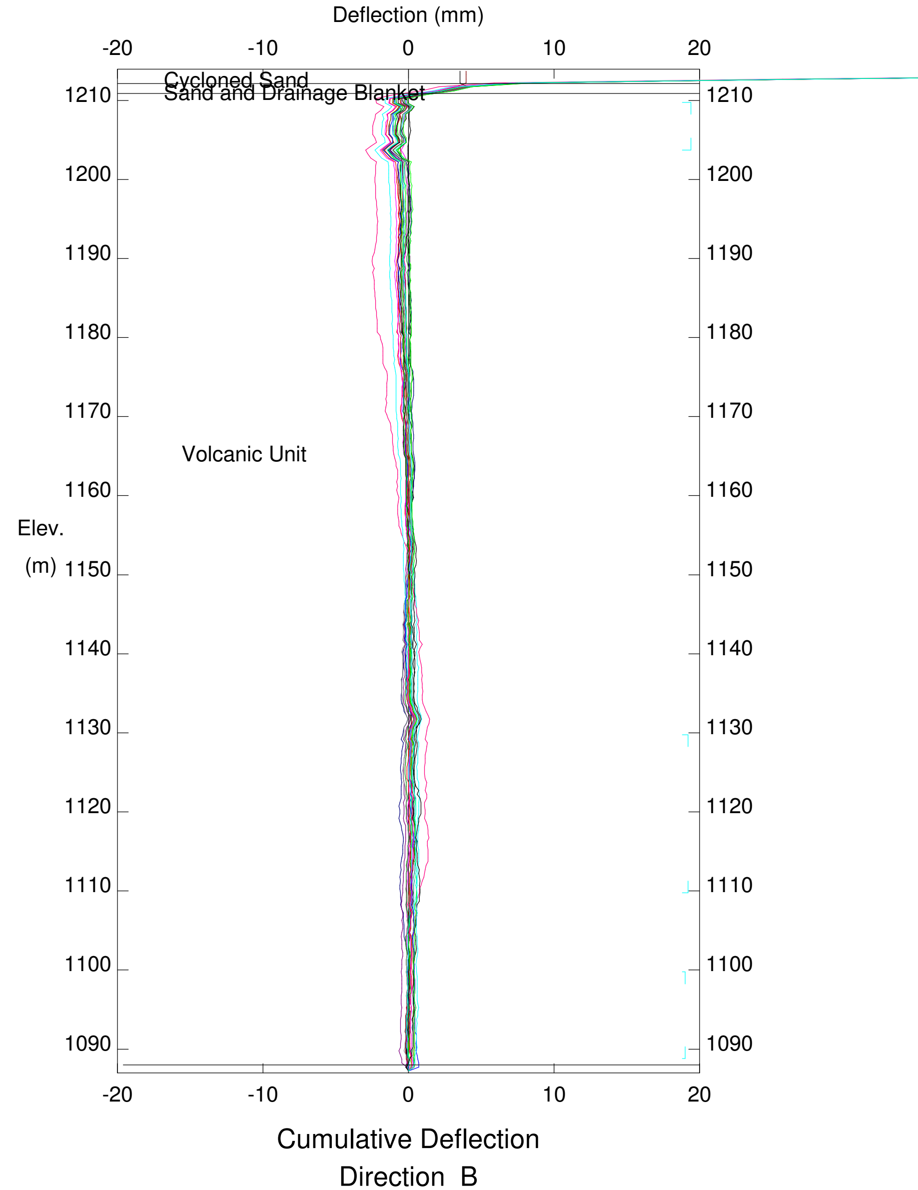
Dam Fill Excluded, Inclinometer 19-02

Sets marked * include zero shift and/or rotation corrections.

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\09 Geotechnical\Instrumentation\03 - Dam Movement Monitoring_L-L Dam\SI Monitoring\GTPLUS32 Files\I19-02.gtl

Highland Valley Copper - Logan Lake, BC

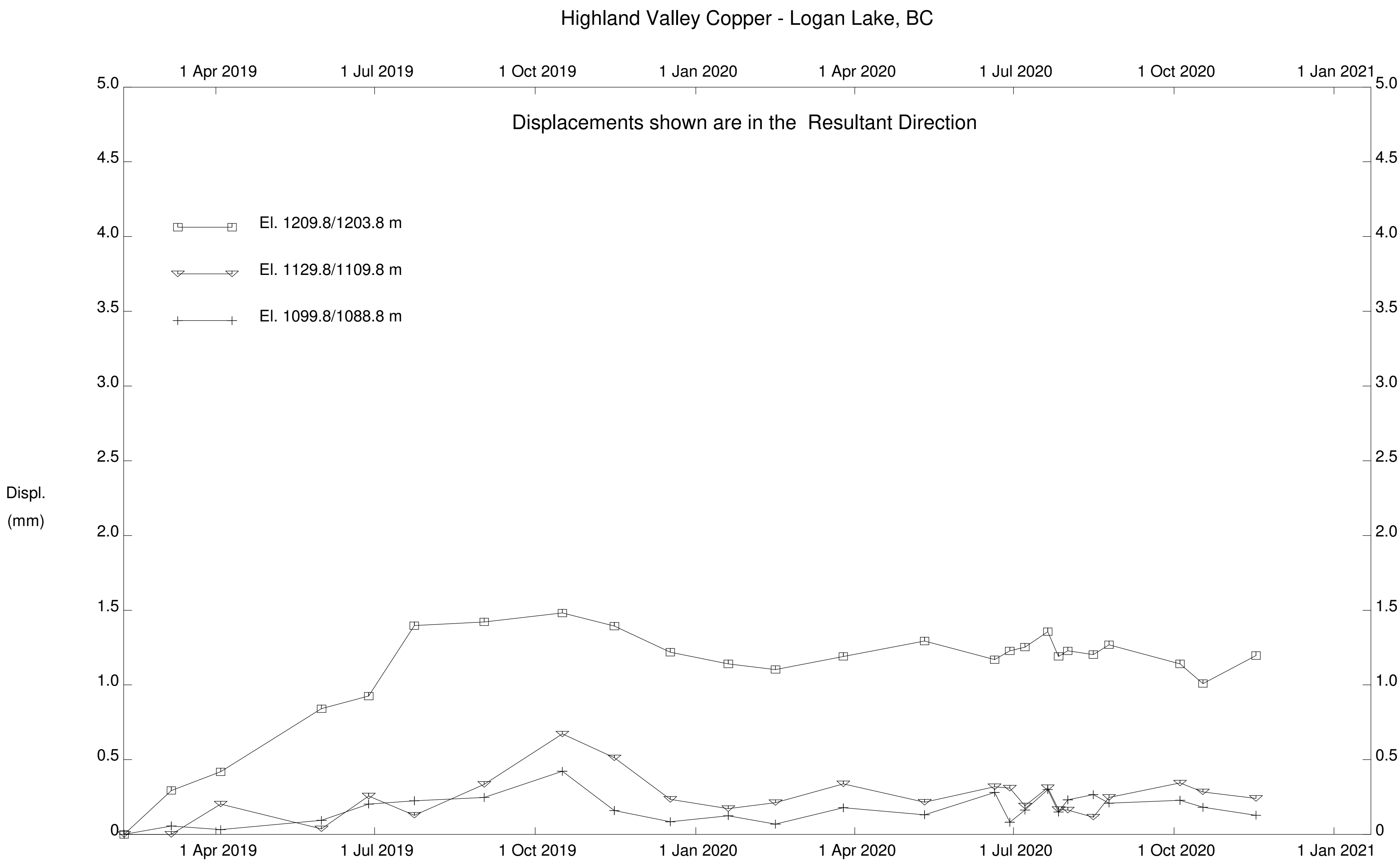




Dam Fill Excluded, Inclinometer 19-02

Sets marked * include zero shift and/or rotation corrections.

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\09 Geotechnical\Instrumentation\03 - Dam Movement Monitoring_L-L Dam\SI Monitoring\GTPLUS32 Files\I19-02.gtl

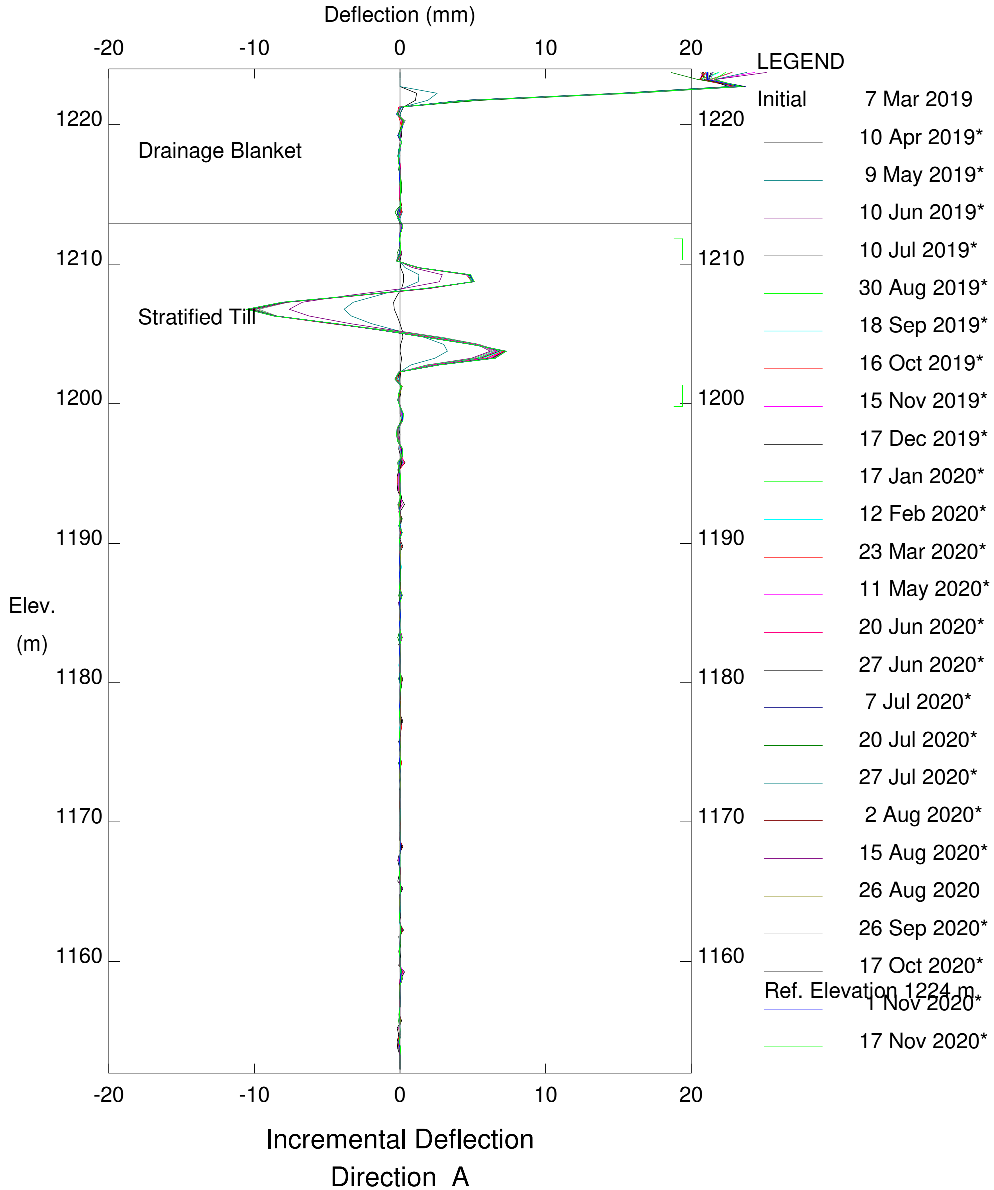


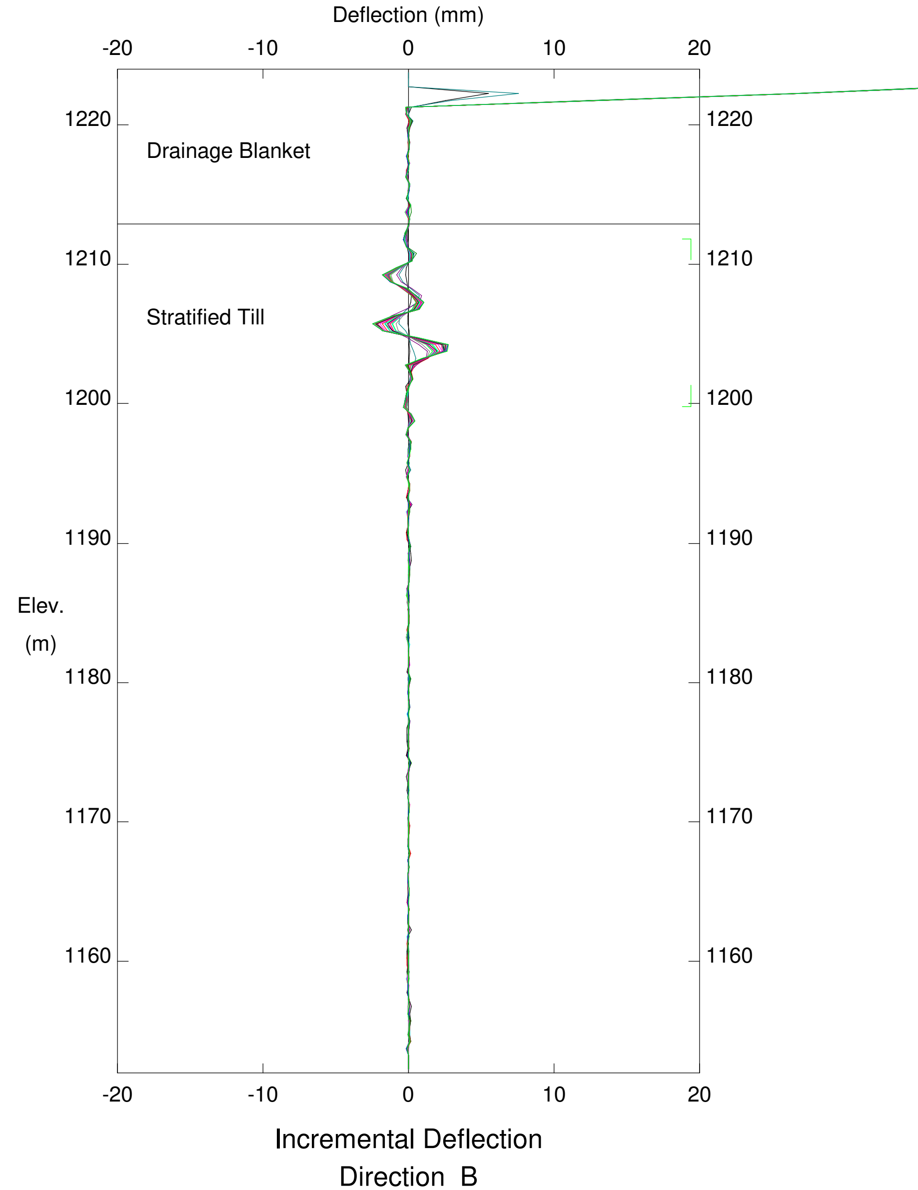
Dam Fill Excluded, Inclinometer 19-02

North Dam Bedrock

I19-03

Highland Valley Copper - Logan Lake, BC



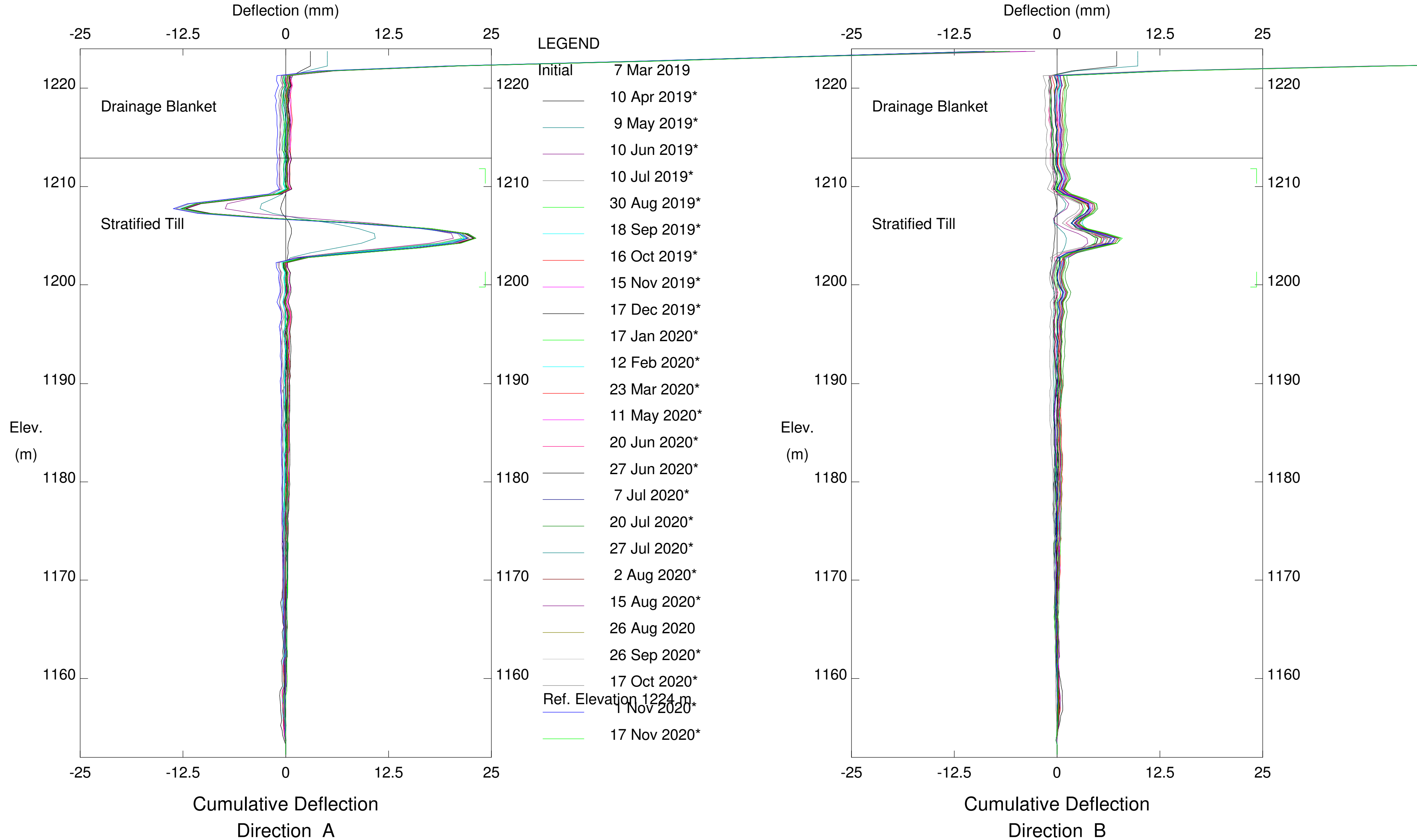


Dam Fill Excluded, Inclinometer 19-3

Sets marked * include zero shift and/or rotation corrections.

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\09 Geotechnical\Instrumentation\03 - Dam Movement Monitoring_L-L Dam\SI Monitoring\GTPLUS32 Files\I19-03.gtl

Highland Valley Copper - Logan Lake, BC

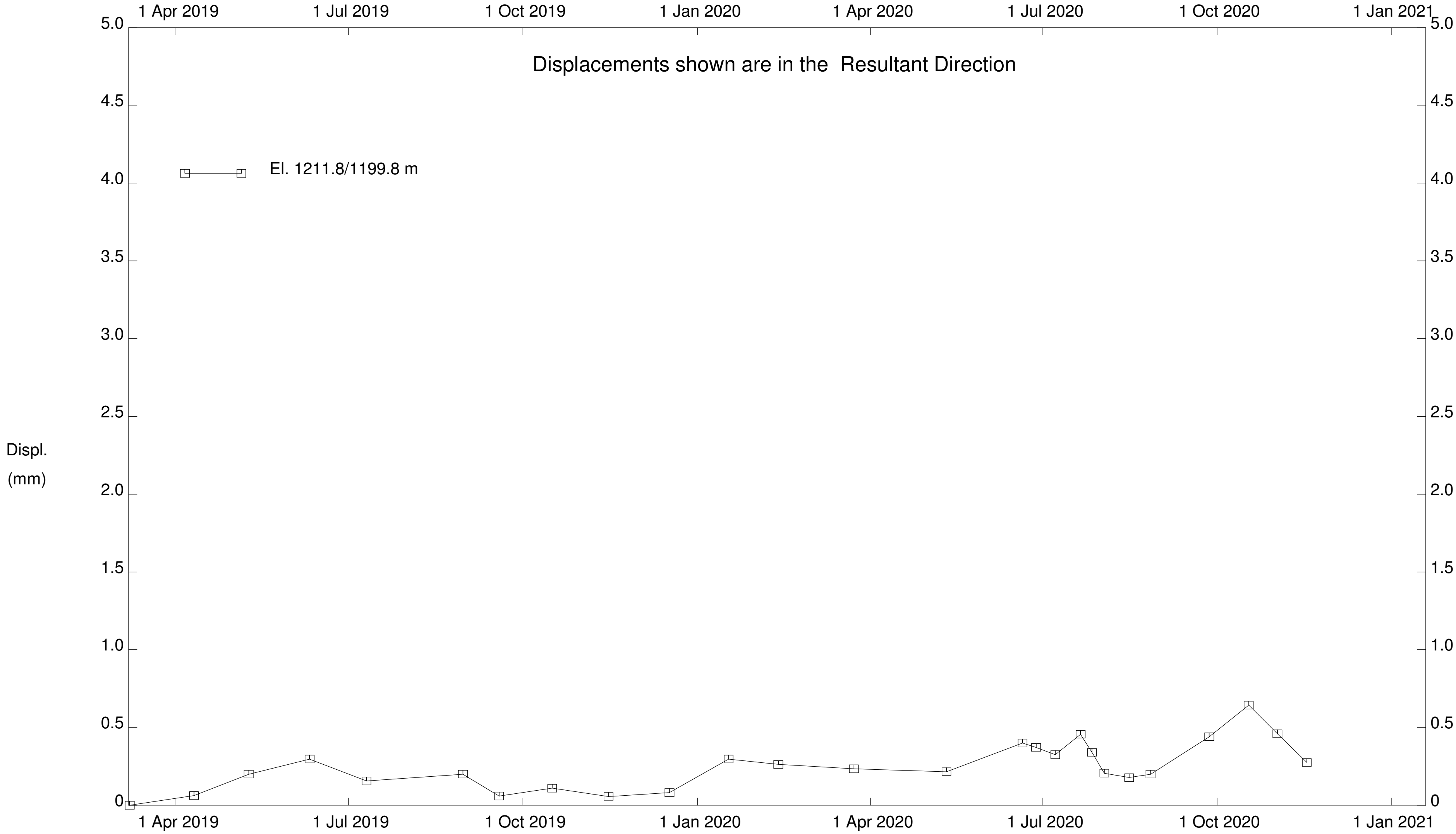


Dam Fill Excluded, Inclinometer 19-3

Sets marked * include zero shift and/or rotation corrections.

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\09 Geotechnical\Instrumentation\03 - Dam Movement Monitoring_L-L Dam\SI Monitoring\GTPLUS32 Files\I19-03.gtl

Highland Valley Copper - Logan Lake, BC

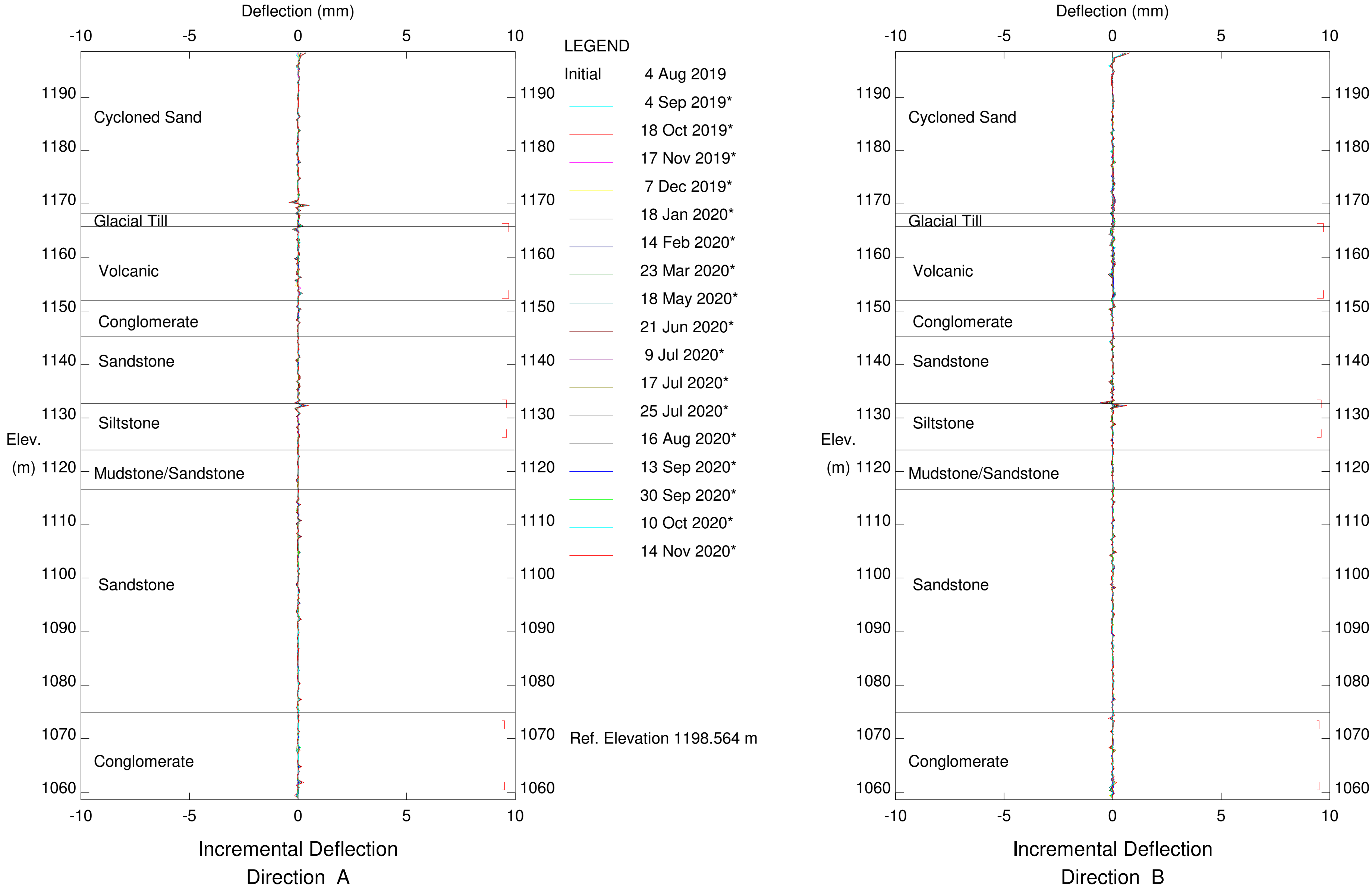


Dam Fill Excluded, Inclinometer 19-3

North Dam Bedrock

I19-08

Highland Valley Copper - Logan Lake, BC

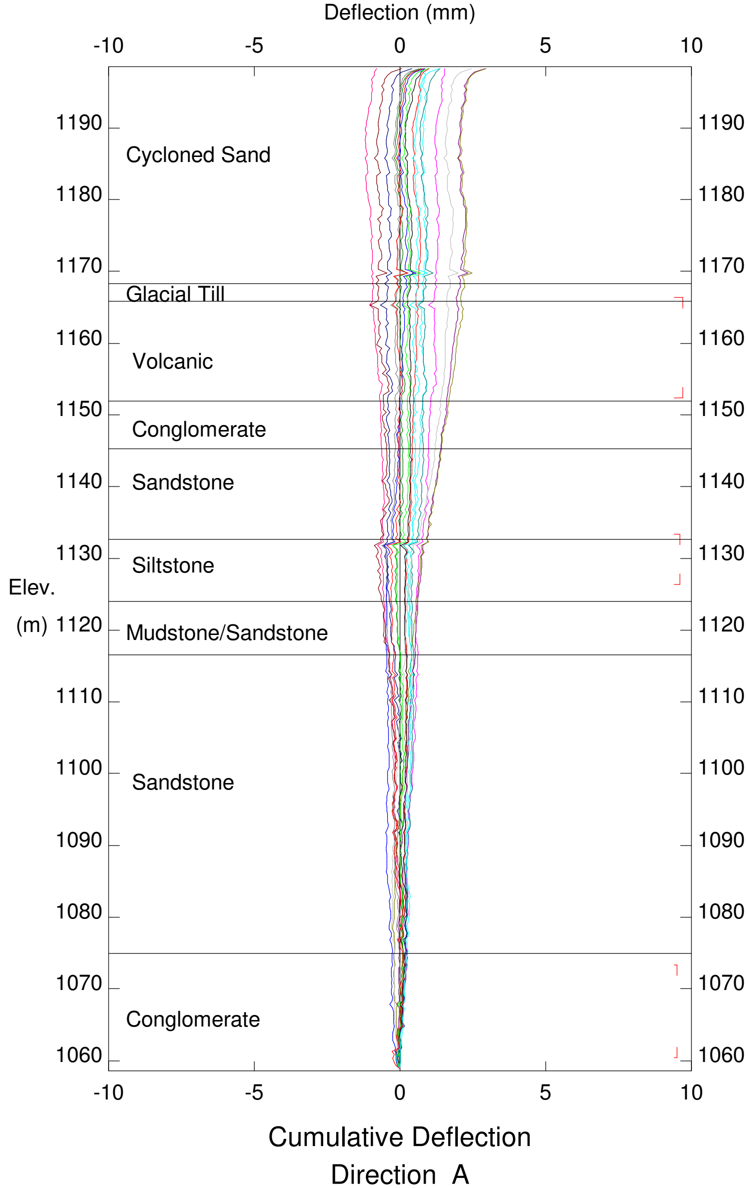


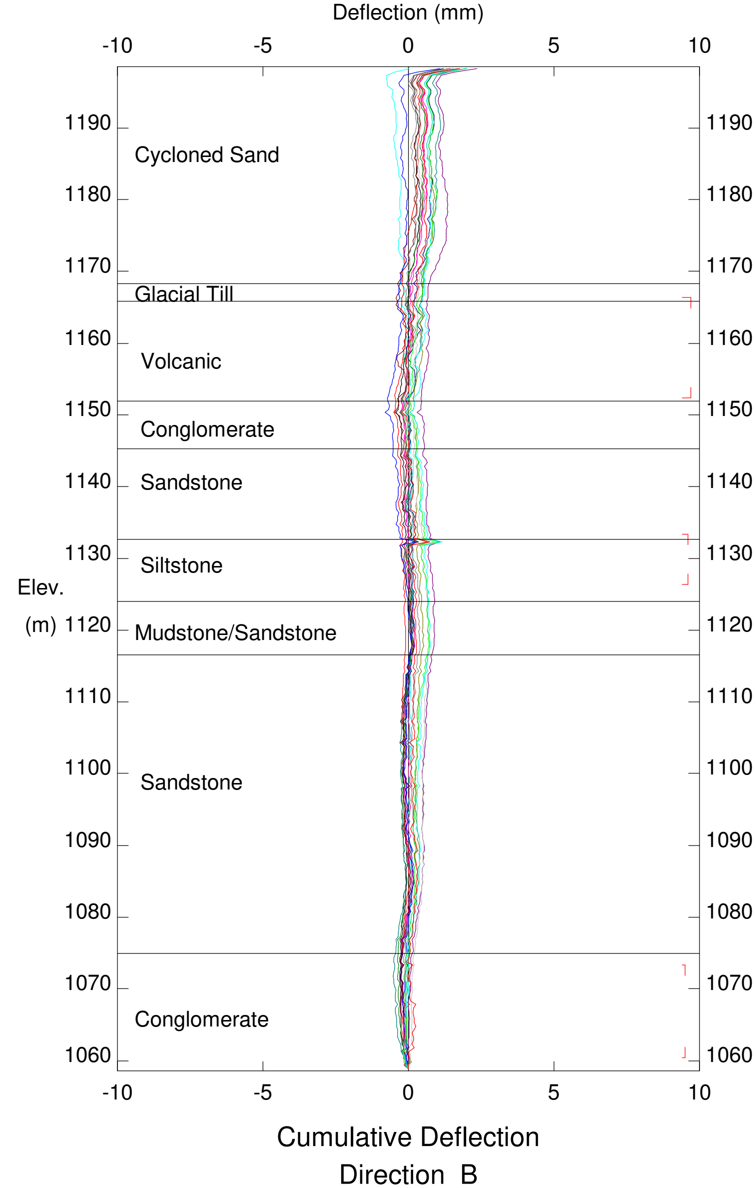
Dam Fill Excluded, Inclinometer I19-08

Sets marked * include zero shift and/or rotation corrections.

I19-08.gtl

Highland Valley Copper - Logan Lake, BC



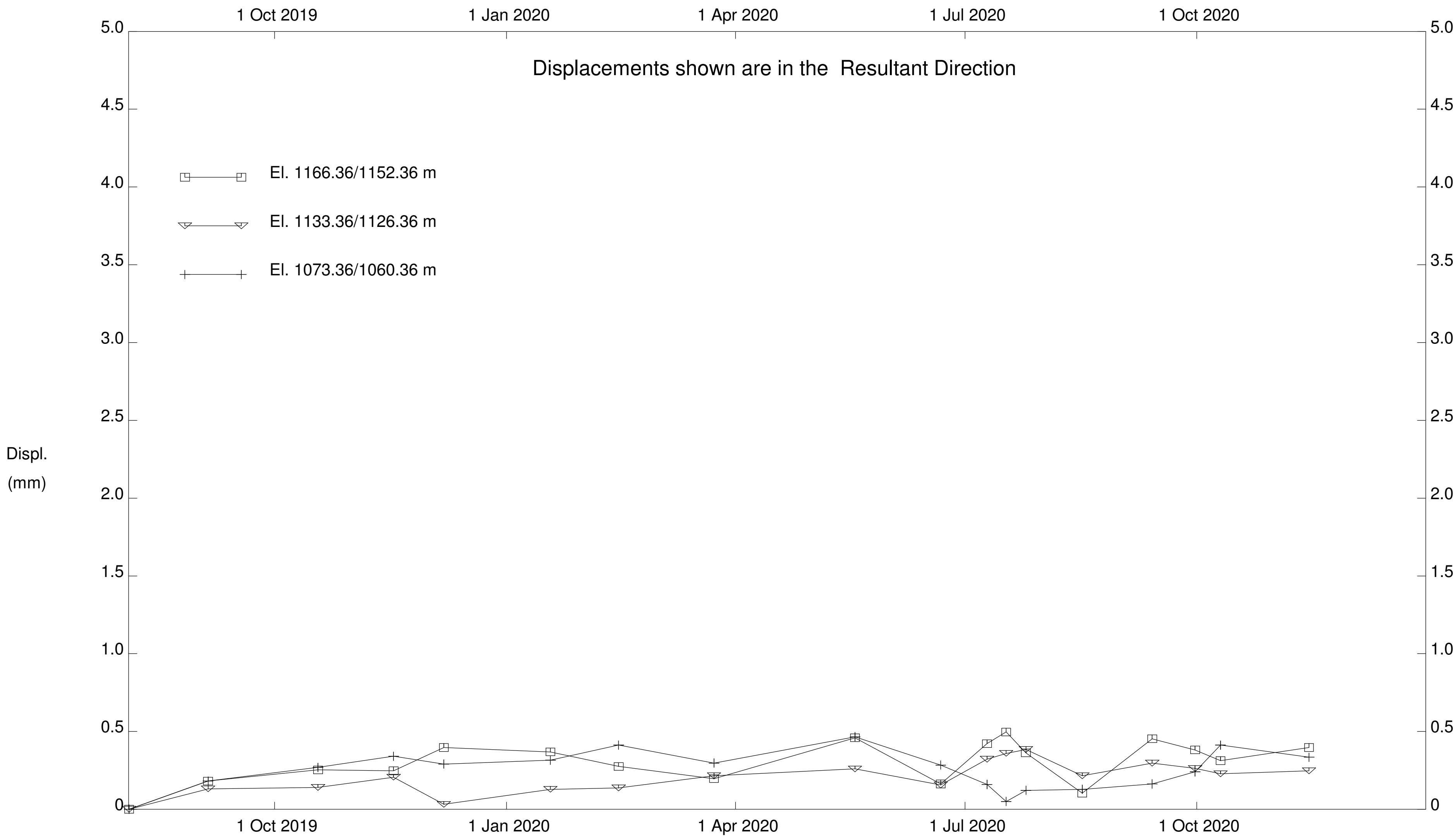


Dam Fill Excluded, Inclinometer I19-08

Sets marked * include zero shift and/or rotation corrections.

I19-08.gtl

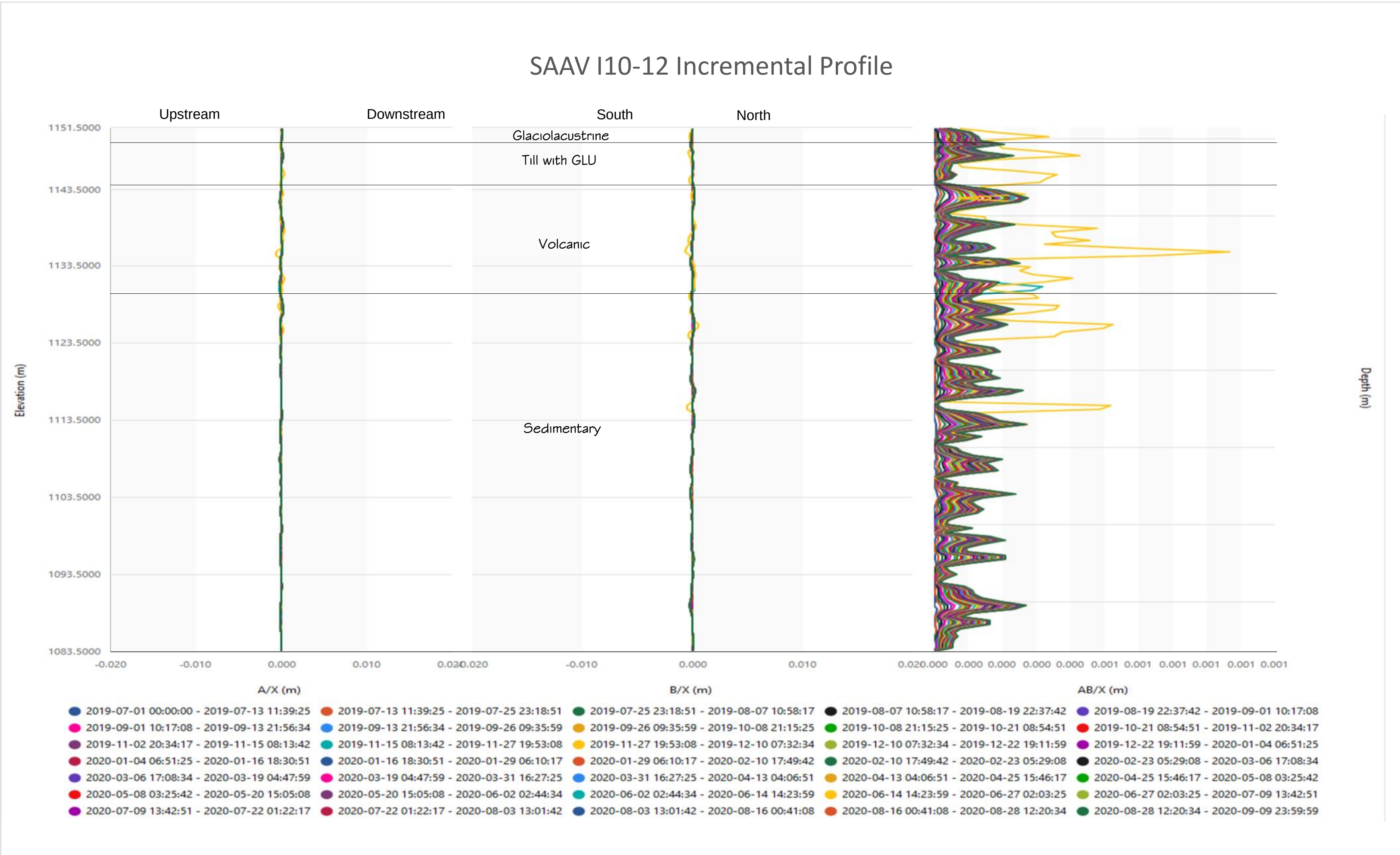
Highland Valley Copper - Logan Lake, BC

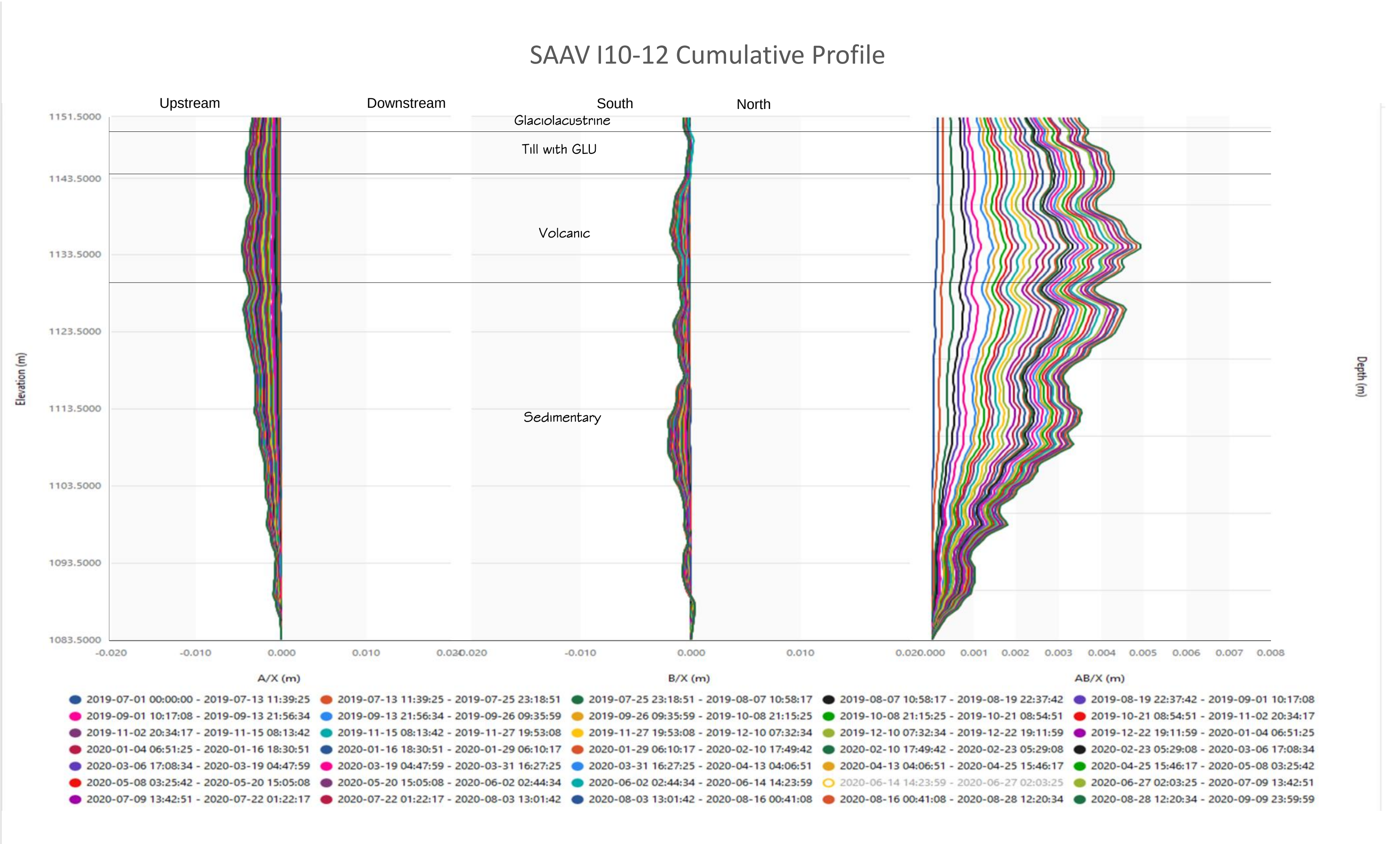


Dam Fill Excluded, Inclinometer I19-08

North Buttress Berm

I10-12


SAAV I10-12 Incremental Profile
Upstream
Downstream
South
North
Glaciolacustrine
Till with GLU
Volcanic
Sedimentary
Elevation (m)
Depth (m)
1151.5000
1143.5000
1133.5000
1123.5000
1113.5000
1103.5000
1093.5000
1083.5000
-0.020
-0.010
0.000
0.010
0.020
A/X (m)
B/X (m)
AB/X (m)
2019-07-01 00:00:00 - 2019-07-13 11:39:25
2019-07-13 11:39:25 - 2019-07-25 23:18:51
2019-07-25 23:18:51 - 2019-08-07 10:58:17
2019-08-07 10:58:17 - 2019-08-19 22:37:42
2019-08-19 22:37:42 - 2019-09-01 10:17:08
2019-09-01 10:17:08 - 2019-09-13 21:56:34
2019-09-13 21:56:34 - 2019-09-26 09:35:59
2019-09-26 09:35:59 - 2019-10-08 21:15:25
2019-10-08 21:15:25 - 2019-10-21 08:54:51
2019-10-21 08:54:51 - 2019-11-02 20:34:17
2019-11-02 20:34:17 - 2019-11-15 08:13:42
2019-11-15 08:13:42 - 2019-11-27 19:53:08
2019-11-27 19:53:08 - 2019-12-10 07:32:34
2019-12-10 07:32:34 - 2019-12-22 19:11:59
2019-12-22 19:11:59 - 2020-01-04 06:51:25
2020-01-04 06:51:25 - 2020-01-16 18:30:51
2020-01-16 18:30:51 - 2020-01-29 06:10:17
2020-01-29 06:10:17 - 2020-02-10 17:49:42
2020-02-10 17:49:42 - 2020-02-23 05:29:08
2020-02-23 05:29:08 - 2020-03-06 17:08:34
2020-03-06 17:08:34 - 2020-03-19 04:47:59
2020-03-19 04:47:59 - 2020-03-31 16:27:25
2020-03-31 16:27:25 - 2020-04-13 04:06:51
2020-04-13 04:06:51 - 2020-04-25 15:46:17
2020-04-25 15:46:17 - 2020-05-08 03:25:42
2020-05-08 03:25:42 - 2020-05-20 15:05:08
2020-05-20 15:05:08 - 2020-06-02 02:44:34
2020-06-02 02:44:34 - 2020-06-14 14:23:59
2020-06-14 14:23:59 - 2020-06-27 02:03:25
2020-06-27 02:03:25 - 2020-07-09 13:42:51
2020-07-09 13:42:51 - 2020-07-22 01:22:17
2020-07-22 01:22:17 - 2020-08-03 13:01:42
2020-08-03 13:01:42 - 2020-08-16 00:41:08
2020-08-16 00:41:08 - 2020-08-28 12:20:34
2020-08-28 12:20:34 - 2020-09-09 23:59:59

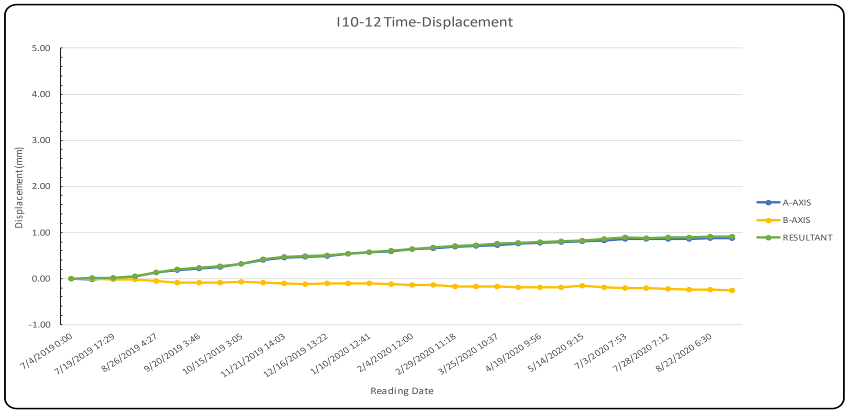

SAAV I10-12 Cumulative Profile
Upstream
Downstream
South
North
Glaciolacustrine
Till with GLU
Volcanic
Sedimentary
Elevation (m)
Depth (m)
1151.5000
1143.5000
1133.5000
1123.5000
1113.5000
1103.5000
1093.5000
1083.5000
-0.020
-0.010
0.000
0.010
0.020
0.001
0.002
0.003
0.004
0.005
0.006
0.007
0.008
A/X (m)
B/X (m)
AB/X (m)
2019-07-01 00:00:00 - 2019-07-13 11:39:25
2019-07-13 11:39:25 - 2019-07-25 23:18:51
2019-07-25 23:18:51 - 2019-08-07 10:58:17
2019-08-07 10:58:17 - 2019-08-19 22:37:42
2019-08-19 22:37:42 - 2019-09-01 10:17:08
2019-09-01 10:17:08 - 2019-09-13 21:56:34
2019-09-13 21:56:34 - 2019-09-26 09:35:59
2019-09-26 09:35:59 - 2019-10-08 21:15:25
2019-10-08 21:15:25 - 2019-10-21 08:54:51
2019-10-21 08:54:51 - 2019-11-02 20:34:17
2019-11-02 20:34:17 - 2019-11-15 08:13:42
2019-11-15 08:13:42 - 2019-11-27 19:53:08
2019-11-27 19:53:08 - 2019-12-10 07:32:34
2019-12-10 07:32:34 - 2019-12-22 19:11:59
2019-12-22 19:11:59 - 2020-01-04 06:51:25
2020-01-04 06:51:25 - 2020-01-16 18:30:51
2020-01-16 18:30:51 - 2020-01-29 06:10:17
2020-01-29 06:10:17 - 2020-02-10 17:49:42
2020-02-10 17:49:42 - 2020-02-23 05:29:08
2020-02-23 05:29:08 - 2020-03-06 17:08:34
2020-03-06 17:08:34 - 2020-03-19 04:47:59
2020-03-19 04:47:59 - 2020-03-31 16:27:25
2020-03-31 16:27:25 - 2020-04-13 04:06:51
2020-04-13 04:06:51 - 2020-04-25 15:46:17
2020-04-25 15:46:17 - 2020-05-08 03:25:42
2020-05-08 03:25:42 - 2020-05-20 15:05:08
2020-05-20 15:05:08 - 2020-06-02 02:44:34
2020-06-02 02:44:34 - 2020-06-14 14:23:59
2020-06-14 14:23:59 - 2020-06-27 02:03:25
2020-06-27 02:03:25 - 2020-07-09 13:42:51
2020-07-09 13:42:51 - 2020-07-22 01:22:17
2020-07-22 01:22:17 - 2020-08-03 13:01:42
2020-08-03 13:01:42 - 2020-08-16 00:41:08
2020-08-16 00:41:08 - 2020-08-28 12:20:34
2020-08-28 12:20:34 - 2020-09-09 23:59:59

SAAV I10-12

Displacement Plot – Lacustrine

Unit	Upper El. (m)	Lower El. (m)
Lacustrine	1151.5	1144.5
Volcanic	1143.5	1130.5
Sedimentary	1130	1083.5

Upper El. (m)	1151.5
Lower El. (m)	1144.5

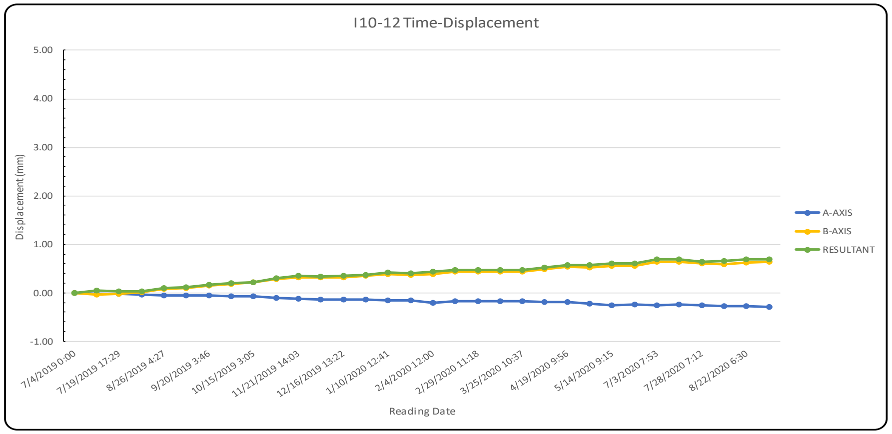


SAAV I10-12

Displacement Plot – Volcanic

Unit	Upper El. (m)	Lower El. (m)
Lacustrine	1151.5	1144.5
Volcanic	1143.5	1130.5
Sedimentary	1130	1083.5

Upper El. (m)	1143.5
Lower El. (m)	1130.5

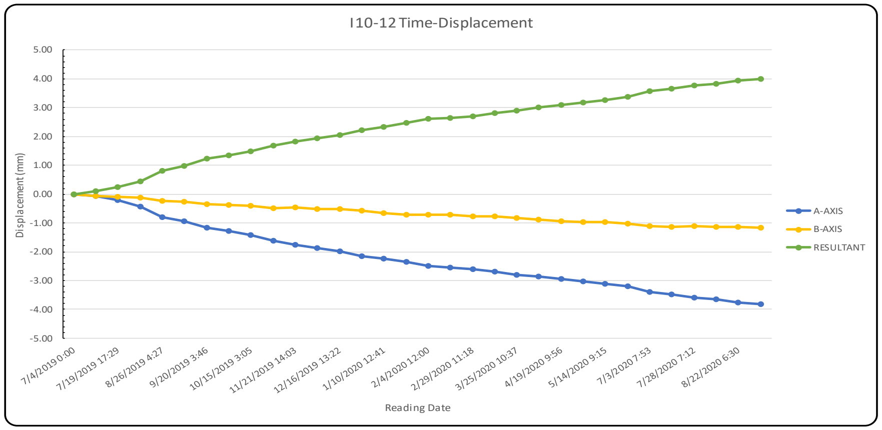


SAAV I10-12

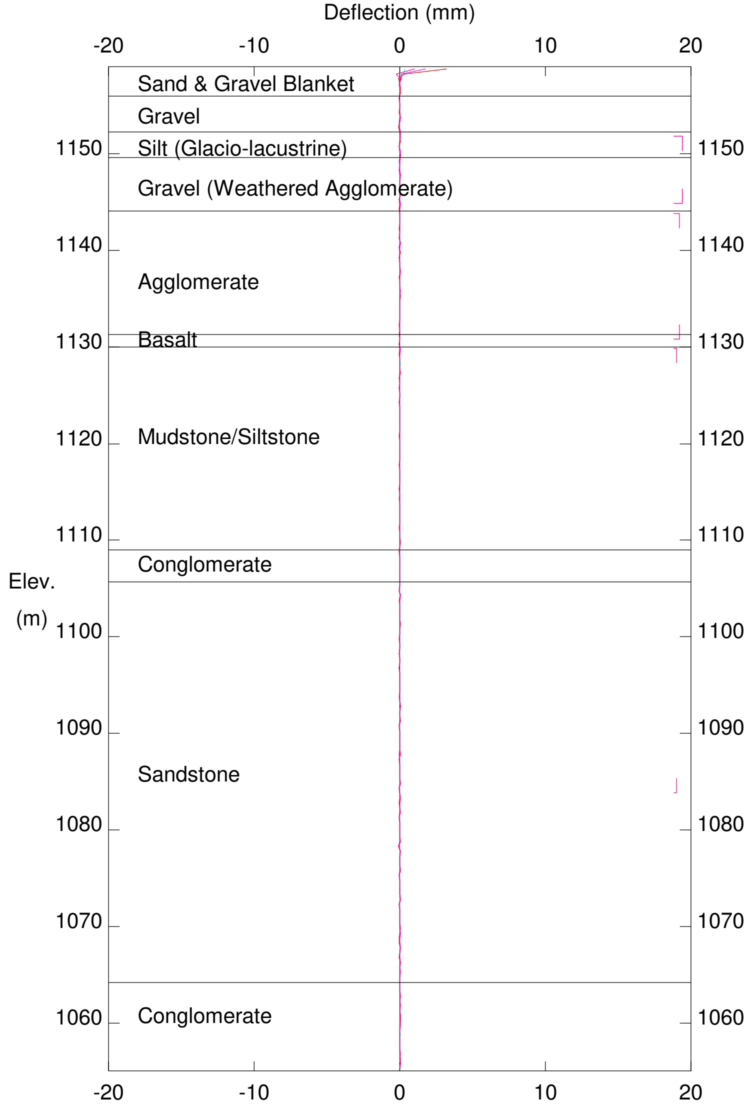
Displacement Plot – Sedimentary

Unit	Upper El. (m)	Lower El. (m)
Lacustrine	1151.5	1144.5
Volcanic	1143.5	1130.5
Sedimentary	1130	1083.5

Upper El. (m)	1130.0
Lower El. (m)	1083.5



Highland Valley Copper - Logan Lake, BC

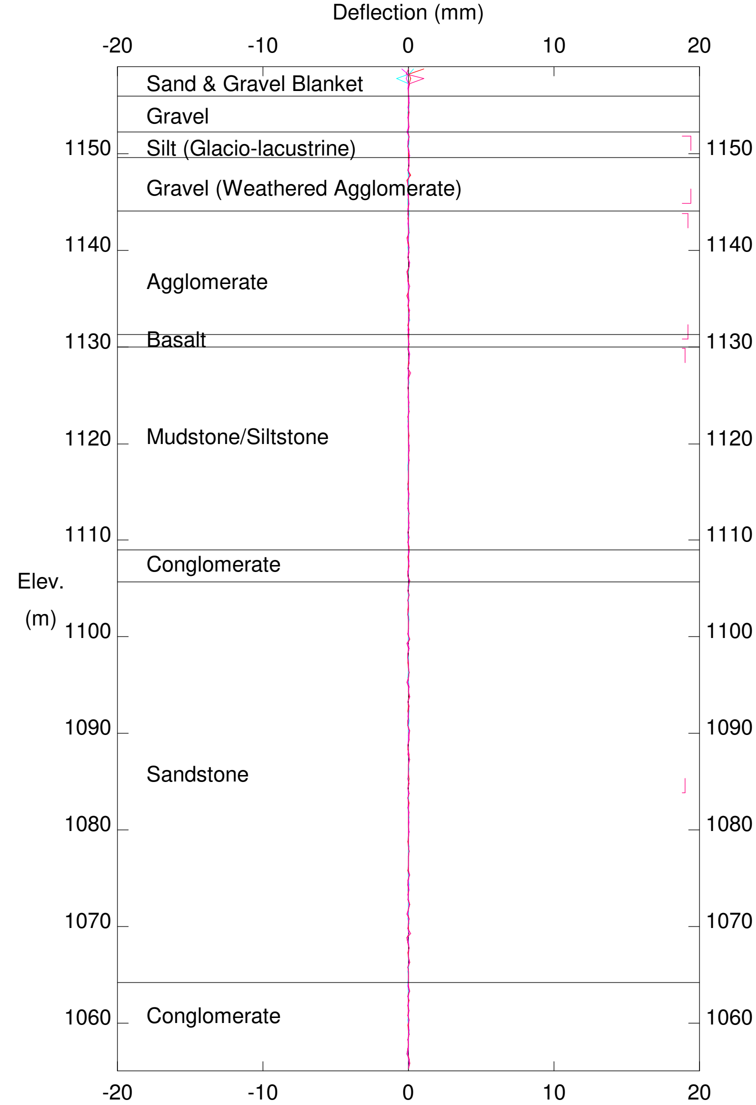


Incremental Deflection
Direction A

LEGEND

Initial	13 Oct 2020
	13 Oct 2020*
	25 Oct 2020*
	9 Nov 2020*
	25 Nov 2020*

Ref. Elevation 1159.04m



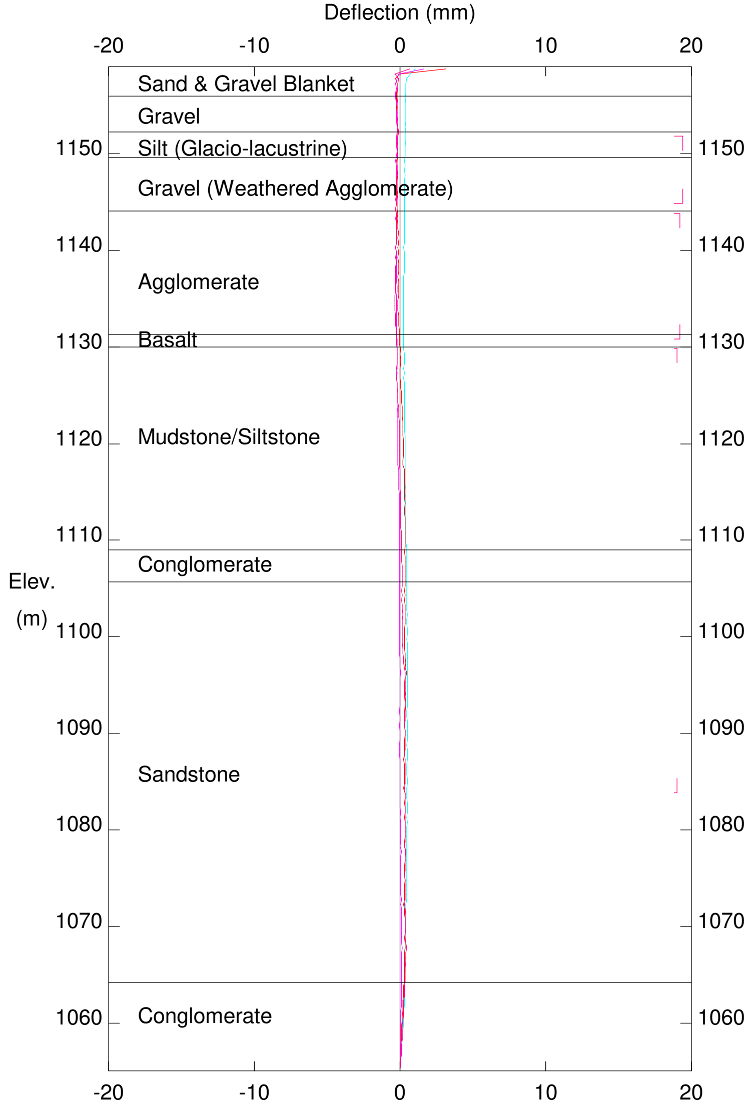
Incremental Deflection
Direction B

LL Dam - Dam fill excluded,,,, Inclinometer I10-12,,,

Sets marked * include zero shift and/or rotation corrections.

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\09 Geotechnical\Instrumentation\03 - Dam Movement Monitoring_L-L Dam\SI Monitoring\GTPLUS32 Files\I10-12.gtl

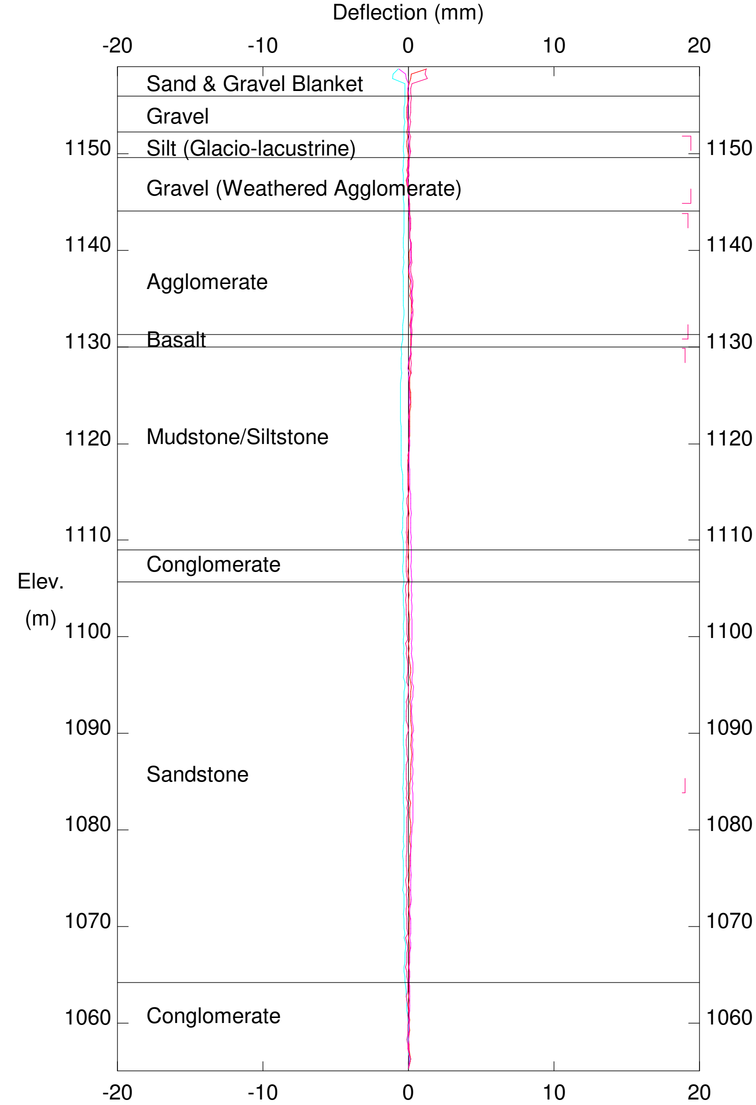
Highland Valley Copper - Logan Lake, BC



LEGEND

Initial	13 Oct 2020
	13 Oct 2020*
	25 Oct 2020*
	9 Nov 2020*
	25 Nov 2020*

Ref. Elevation 1159.04m

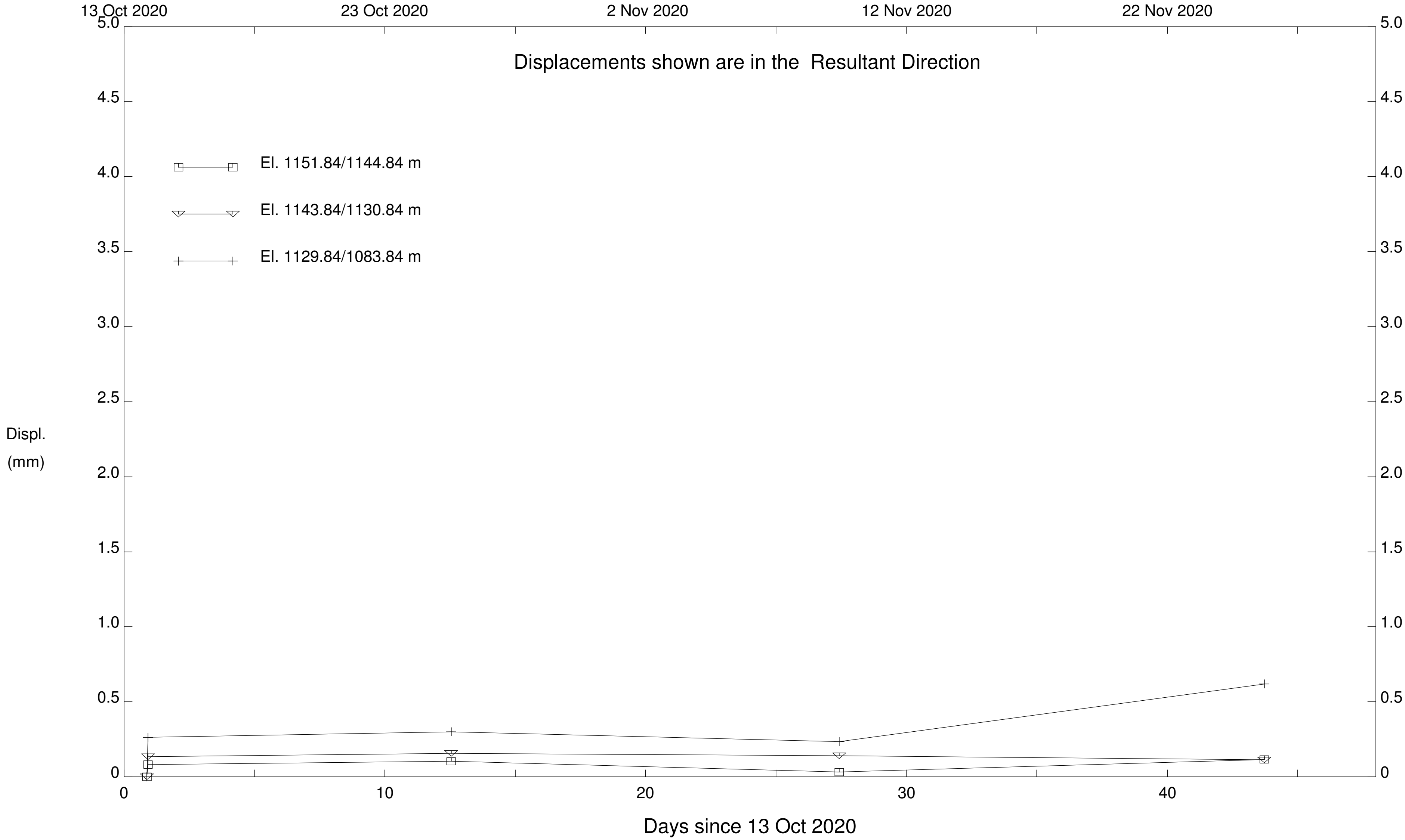


LL Dam - Dam fill excluded,,,, Inclinometer I10-12,,,

Sets marked * include zero shift and/or rotation corrections.

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\09 Geotechnical\Instrumentation\03 - Dam Movement Monitoring_L-L Dam\SI Monitoring\GTPLUS32 Files\I10-12.gtl

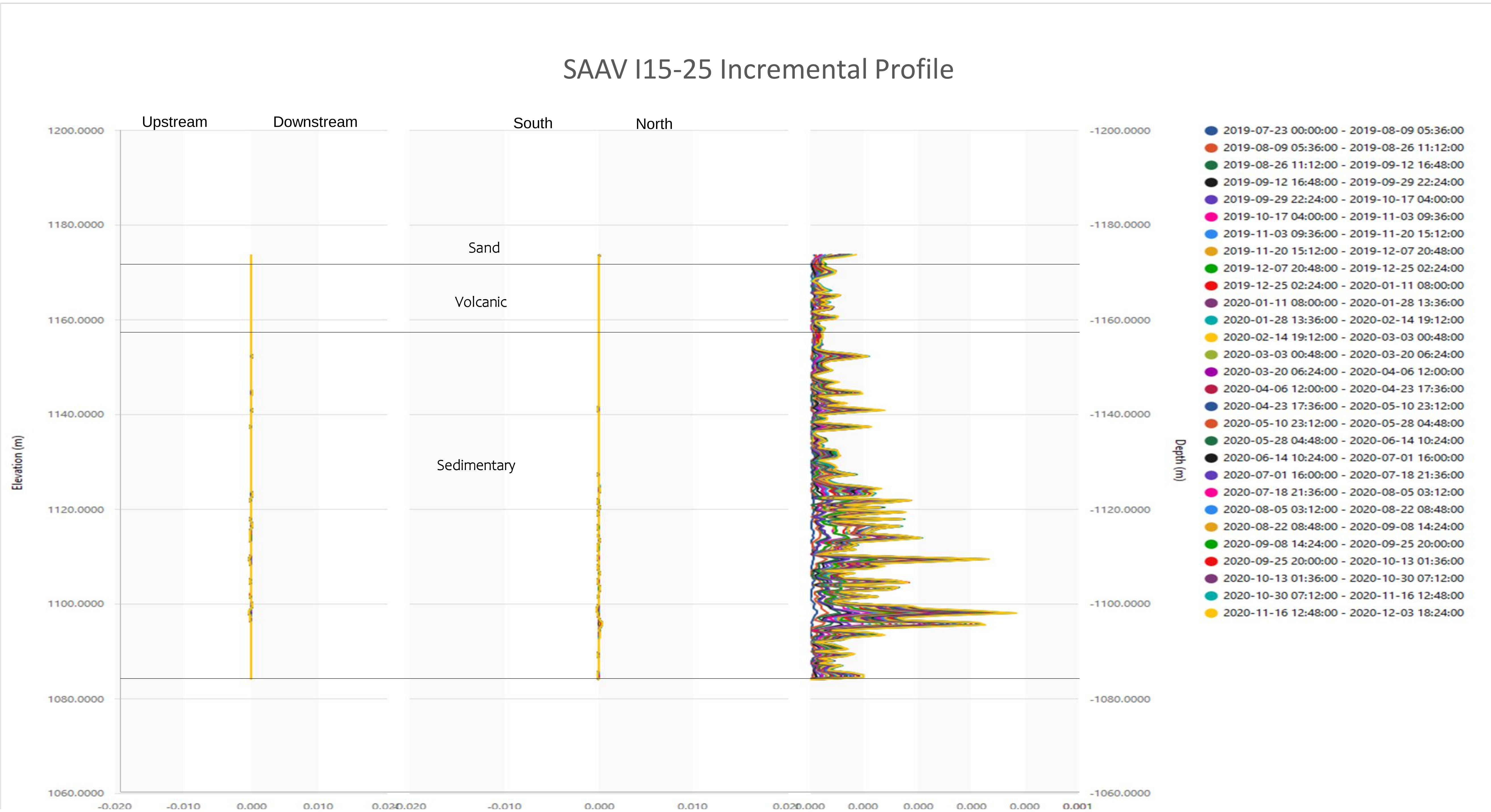
Highland Valley Copper - Logan Lake, BC

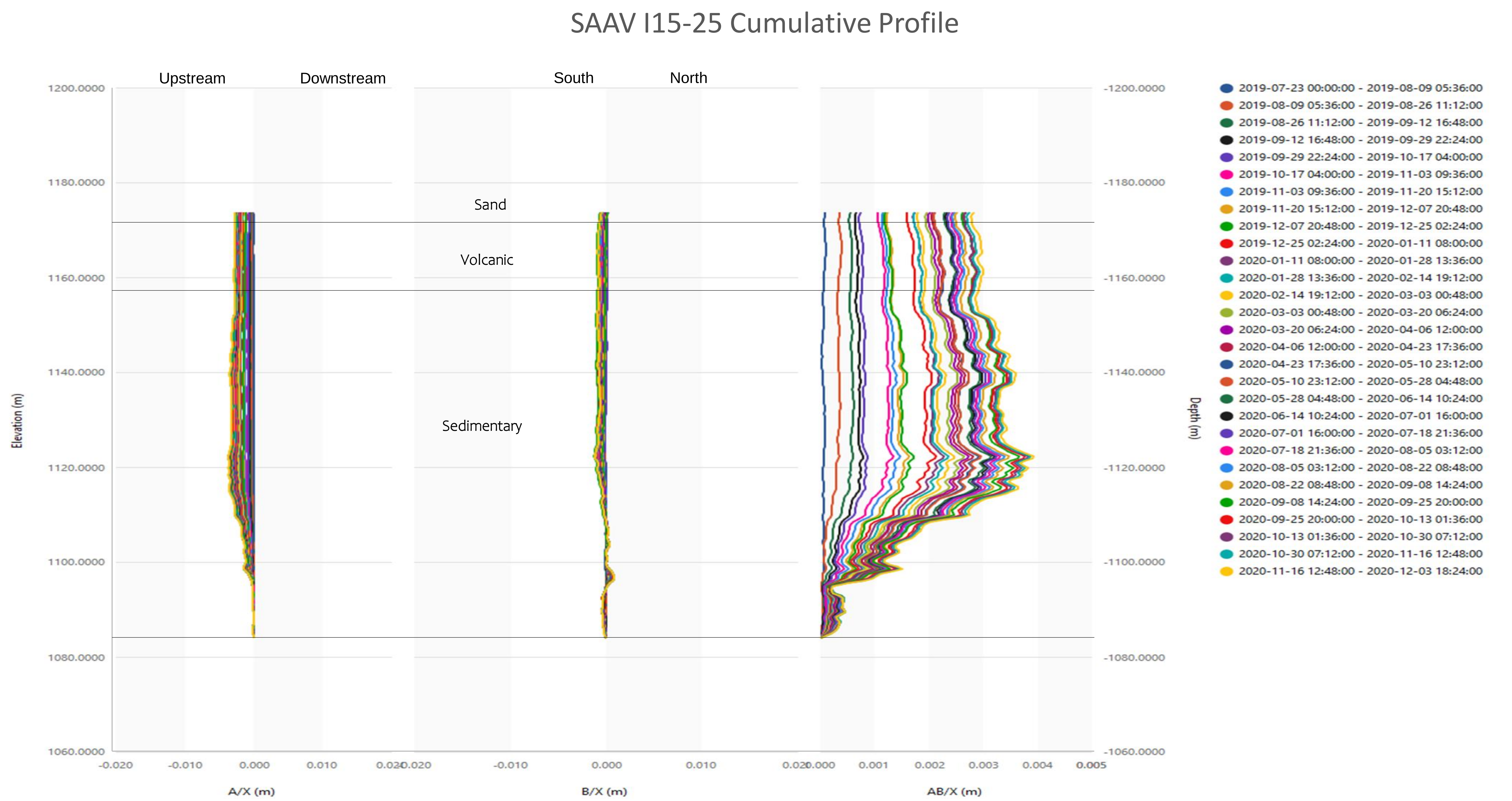


LL Dam - Dam fill excluded,,,, Inclinometer I10-12,,,

North Buttress Berm

I15-25


SAAV I15-25 Incremental Profile
Upstream
Downstream
South
North
Sand
Volcanic
Sedimentary
Elevation (m)
Depth (m)
2019-07-23 00:00:00 - 2019-08-09 05:36:00
2019-08-09 05:36:00 - 2019-08-26 11:12:00
2019-08-26 11:12:00 - 2019-09-12 16:48:00
2019-09-12 16:48:00 - 2019-09-29 22:24:00
2019-09-29 22:24:00 - 2019-10-17 04:00:00
2019-10-17 04:00:00 - 2019-11-03 09:36:00
2019-11-03 09:36:00 - 2019-11-20 15:12:00
2019-11-20 15:12:00 - 2019-12-07 20:48:00
2019-12-07 20:48:00 - 2019-12-25 02:24:00
2019-12-25 02:24:00 - 2020-01-11 08:00:00
2020-01-11 08:00:00 - 2020-01-28 13:36:00
2020-01-28 13:36:00 - 2020-02-14 19:12:00
2020-02-14 19:12:00 - 2020-03-03 00:48:00
2020-03-03 00:48:00 - 2020-03-20 06:24:00
2020-03-20 06:24:00 - 2020-04-06 12:00:00
2020-04-06 12:00:00 - 2020-04-23 17:36:00
2020-04-23 17:36:00 - 2020-05-10 23:12:00
2020-05-10 23:12:00 - 2020-05-28 04:48:00
2020-05-28 04:48:00 - 2020-06-14 10:24:00
2020-06-14 10:24:00 - 2020-07-01 16:00:00
2020-07-01 16:00:00 - 2020-07-18 21:36:00
2020-07-18 21:36:00 - 2020-08-05 03:12:00
2020-08-05 03:12:00 - 2020-08-22 08:48:00
2020-08-22 08:48:00 - 2020-09-08 14:24:00
2020-09-08 14:24:00 - 2020-09-25 20:00:00
2020-09-25 20:00:00 - 2020-10-13 01:36:00
2020-10-13 01:36:00 - 2020-10-30 07:12:00
2020-10-30 07:12:00 - 2020-11-16 12:48:00
2020-11-16 12:48:00 - 2020-12-03 18:24:00



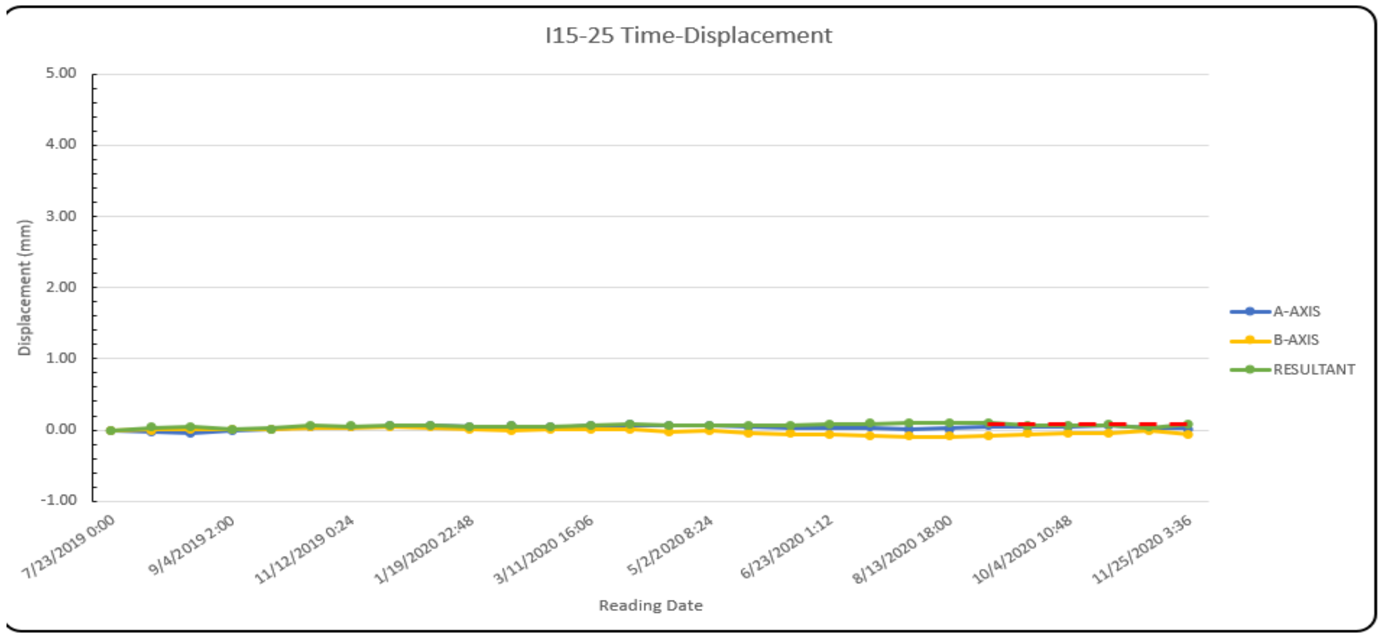
SAAV I15-25 Cumulative Profile
Upstream
Downstream
South
North
Sand
Volcanic
Sedimentary
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2019-07-23 00:00:00 - 2019-08-09 05:36:00
2019-08-09 05:36:00 - 2019-08-26 11:12:00
2019-08-26 11:12:00 - 2019-09-12 16:48:00
2019-09-12 16:48:00 - 2019-09-29 22:24:00
2019-09-29 22:24:00 - 2019-10-17 04:00:00
2019-10-17 04:00:00 - 2019-11-03 09:36:00
2019-11-03 09:36:00 - 2019-11-20 15:12:00
2019-11-20 15:12:00 - 2019-12-07 20:48:00
2019-12-07 20:48:00 - 2019-12-25 02:24:00
2019-12-25 02:24:00 - 2020-01-11 08:00:00
2020-01-11 08:00:00 - 2020-01-28 13:36:00
2020-01-28 13:36:00 - 2020-02-14 19:12:00
2020-02-14 19:12:00 - 2020-03-03 00:48:00
2020-03-03 00:48:00 - 2020-03-20 06:24:00
2020-03-20 06:24:00 - 2020-04-06 12:00:00
2020-04-06 12:00:00 - 2020-04-23 17:36:00
2020-04-23 17:36:00 - 2020-05-10 23:12:00
2020-05-10 23:12:00 - 2020-05-28 04:48:00
2020-05-28 04:48:00 - 2020-06-14 10:24:00
2020-06-14 10:24:00 - 2020-07-01 16:00:00
2020-07-01 16:00:00 - 2020-07-18 21:36:00
2020-07-18 21:36:00 - 2020-08-05 03:12:00
2020-08-05 03:12:00 - 2020-08-22 08:48:00
2020-08-22 08:48:00 - 2020-09-08 14:24:00
2020-09-08 14:24:00 - 2020-09-25 20:00:00
2020-09-25 20:00:00 - 2020-10-13 01:36:00
2020-10-13 01:36:00 - 2020-10-30 07:12:00
2020-10-30 07:12:00 - 2020-11-16 12:48:00
2020-11-16 12:48:00 - 2020-12-03 18:24:00

SAAV I15-25

Displacement Plot – Volcanic

Unit	Upper El.(m)	Lower El. (m)
Volcanic	1169	1159
Upper Sedimentary	1159	1154
Sedimentary	1149	1139

Upper El.(m)	1169.0
Lower El. (m)	1159.0

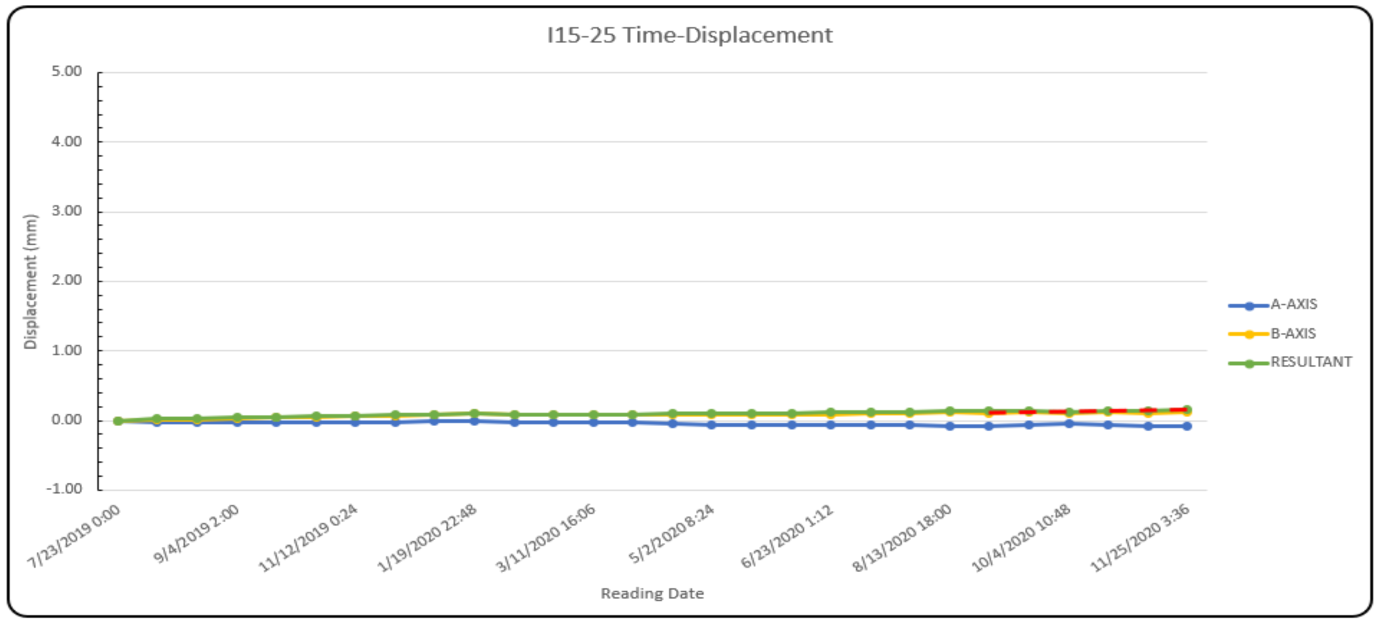


SAAV I15-25

Displacement Plot – Upper Sedimentary

Unit	Upper El.(m)	Lower El. (m)
Volcanic	1169	1159
Upper Sedimentary	1159	1154
Sedimentary	1149	1139

Upper El.(m)	1159.0
Lower El. (m)	1154.0

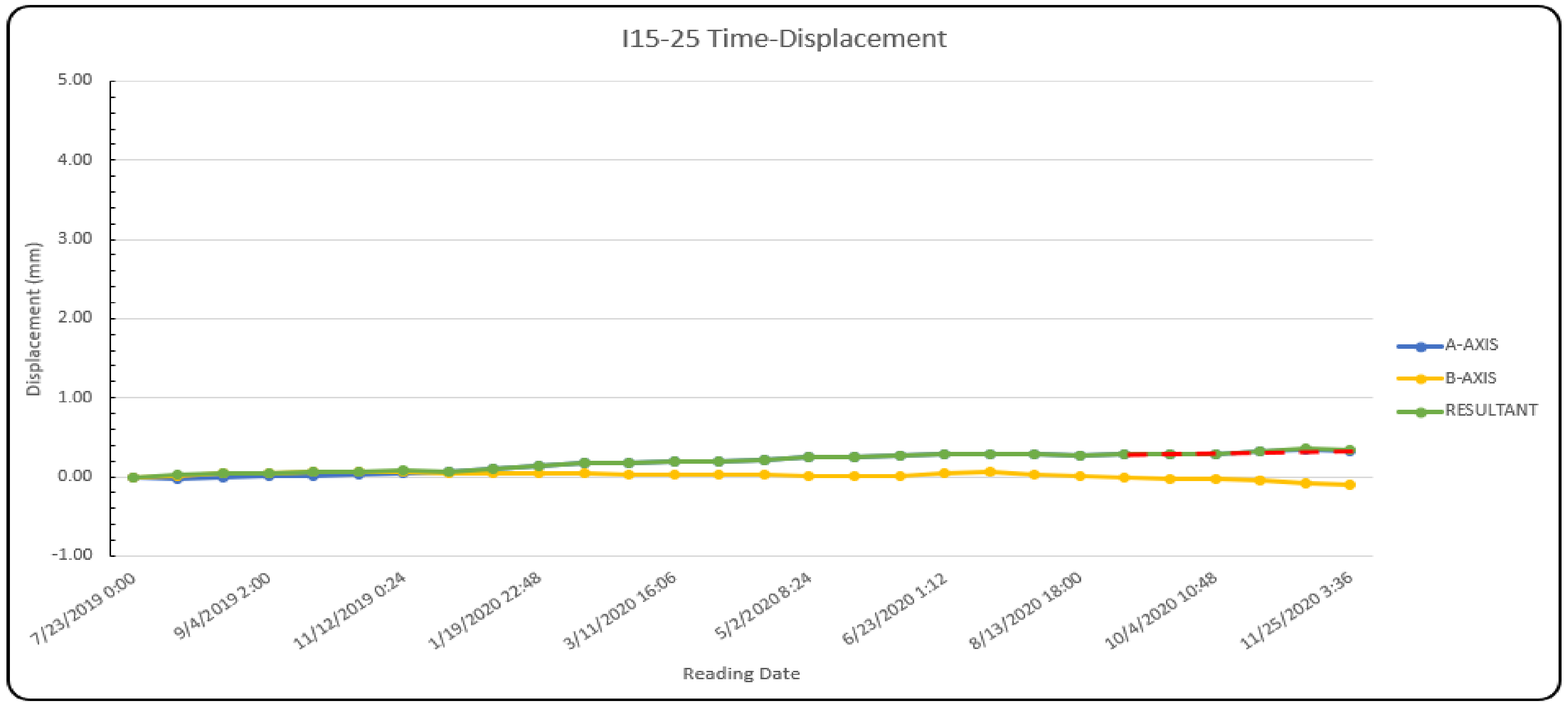


SAAV I15-25

Displacement Plot – Sedimentary

Unit	Upper El.(m)	Lower El. (m)
Volcanic	1169	1159
Upper Sedimentary	1159	1154
Sedimentary	1149	1139

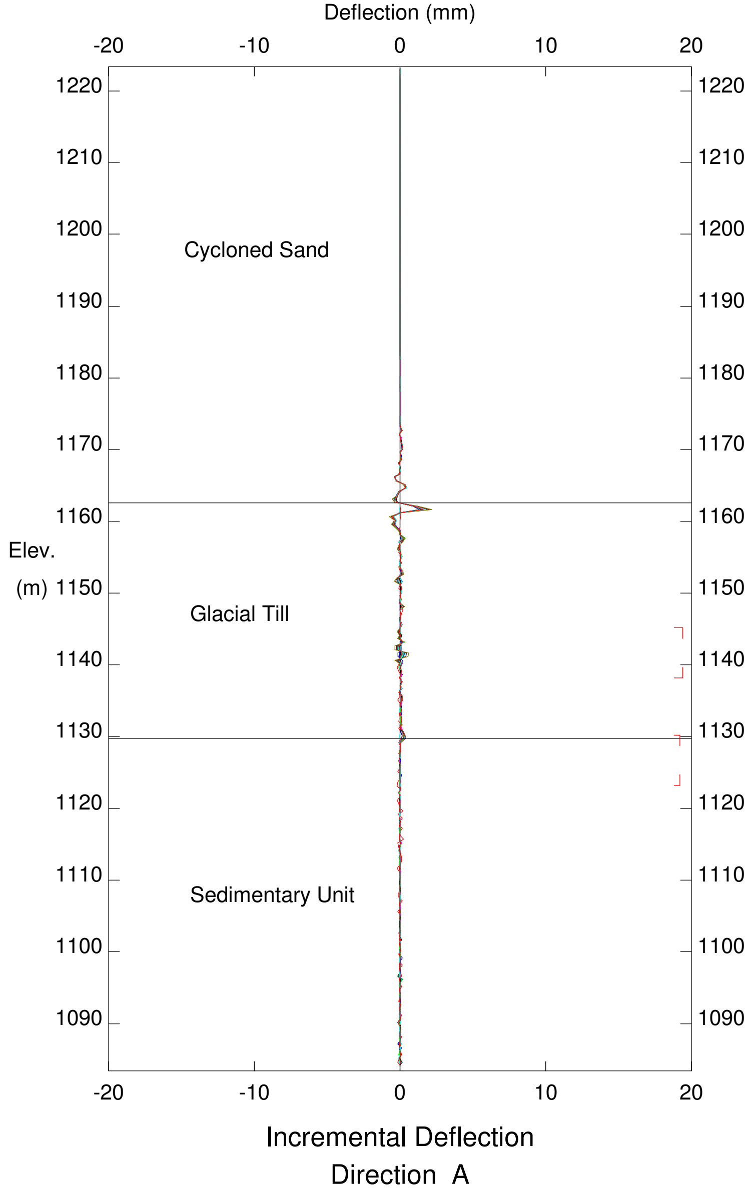
Upper El.(m)	1149.0
Lower El. (m)	1139.0



North Buttress Berm

I17-22

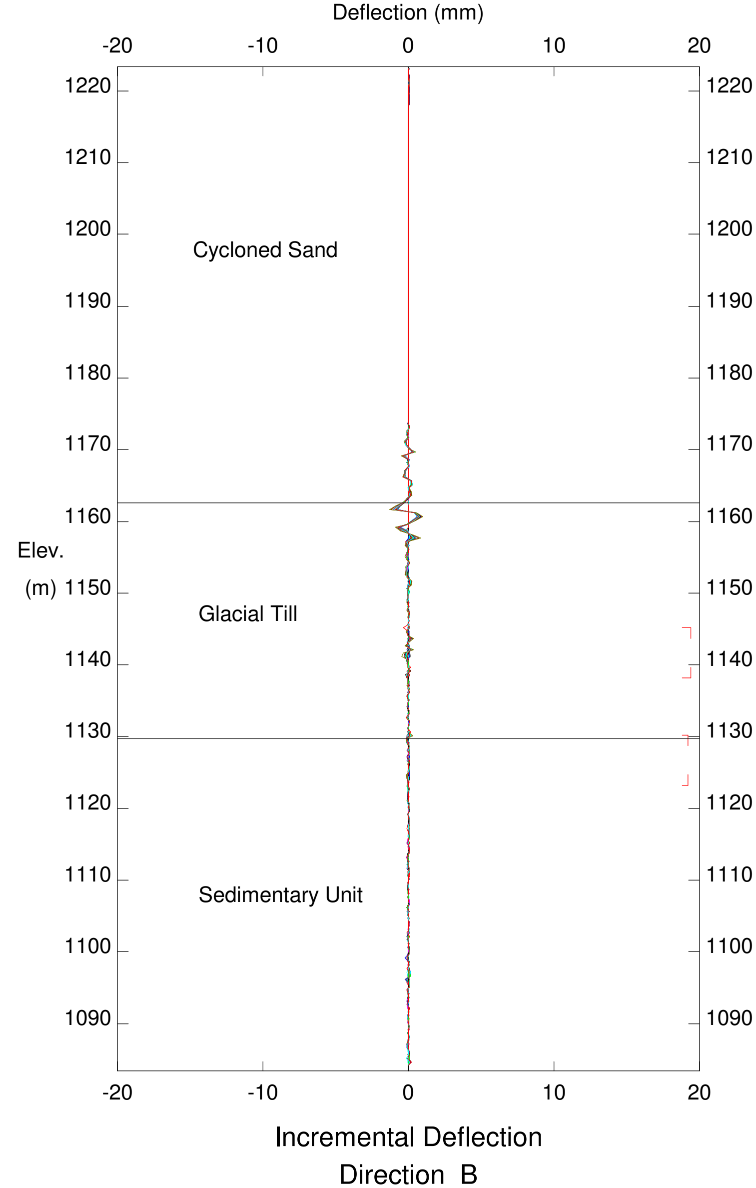
Highland Valley Copper - Logan Lake, BC



LEGEND

Initial 24 Oct 2018*
18 Dec 2018*
20 Feb 2019*
9 Apr 2019*
8 Jun 2019*
8 Aug 2019*
26 Sep 2019*
22 Oct 2019*
28 Nov 2019*
19 Dec 2019*
30 Jan 2020*
23 Feb 2020*
22 Mar 2020*
15 Apr 2020*
10 May 2020*
7 Jun 2020*
9 Jul 2020*
16 Jul 2020*
25 Jul 2020*
10 Aug 2020*
6 Sep 2020*
13 Sep 2020*
9 Oct 2020*
26 Oct 2020*
11 Nov 2020*
3 Dec 2020*

Ref. Elevation 1223.4m

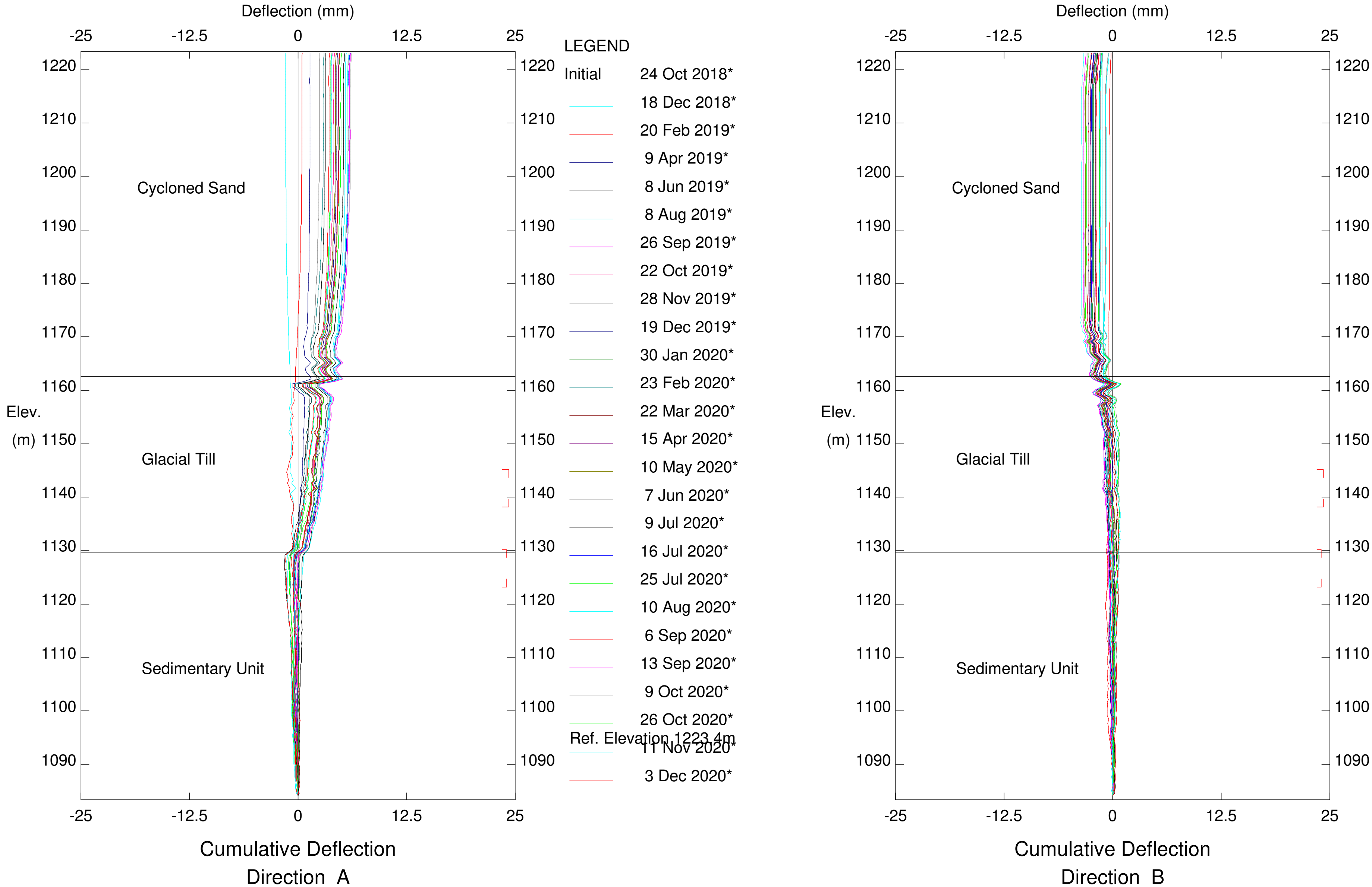


LL Dam - Dam fill excluded,,,, Inclinometer I17-22,,,

Sets marked * include zero shift and/or rotation corrections.

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\09 Geotechnical\Instrumentation\03 - Dam Movement Monitoring_L-L Dam\SI Monitoring\GTPLUS32 Files\I17-22.gtl

Highland Valley Copper - Logan Lake, BC

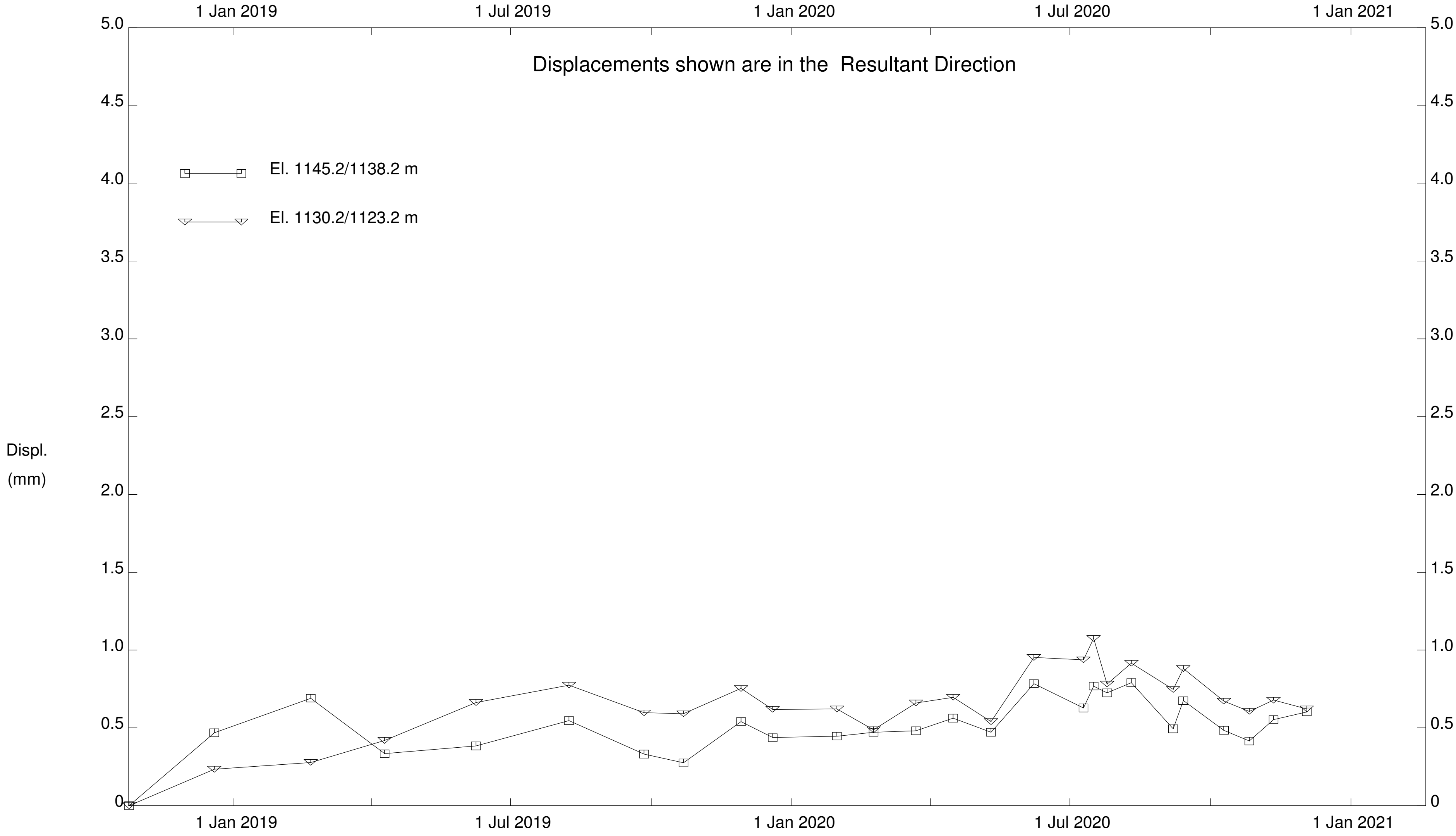


LL Dam - Dam fill excluded,,,, Inclinometer I17-22,,,

Sets marked * include zero shift and/or rotation corrections.

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\09 Geotechnical\Instrumentation\03 - Dam Movement Monitoring_L-L Dam\SI Monitoring\GTPLUS32 Files\I17-22.gtl

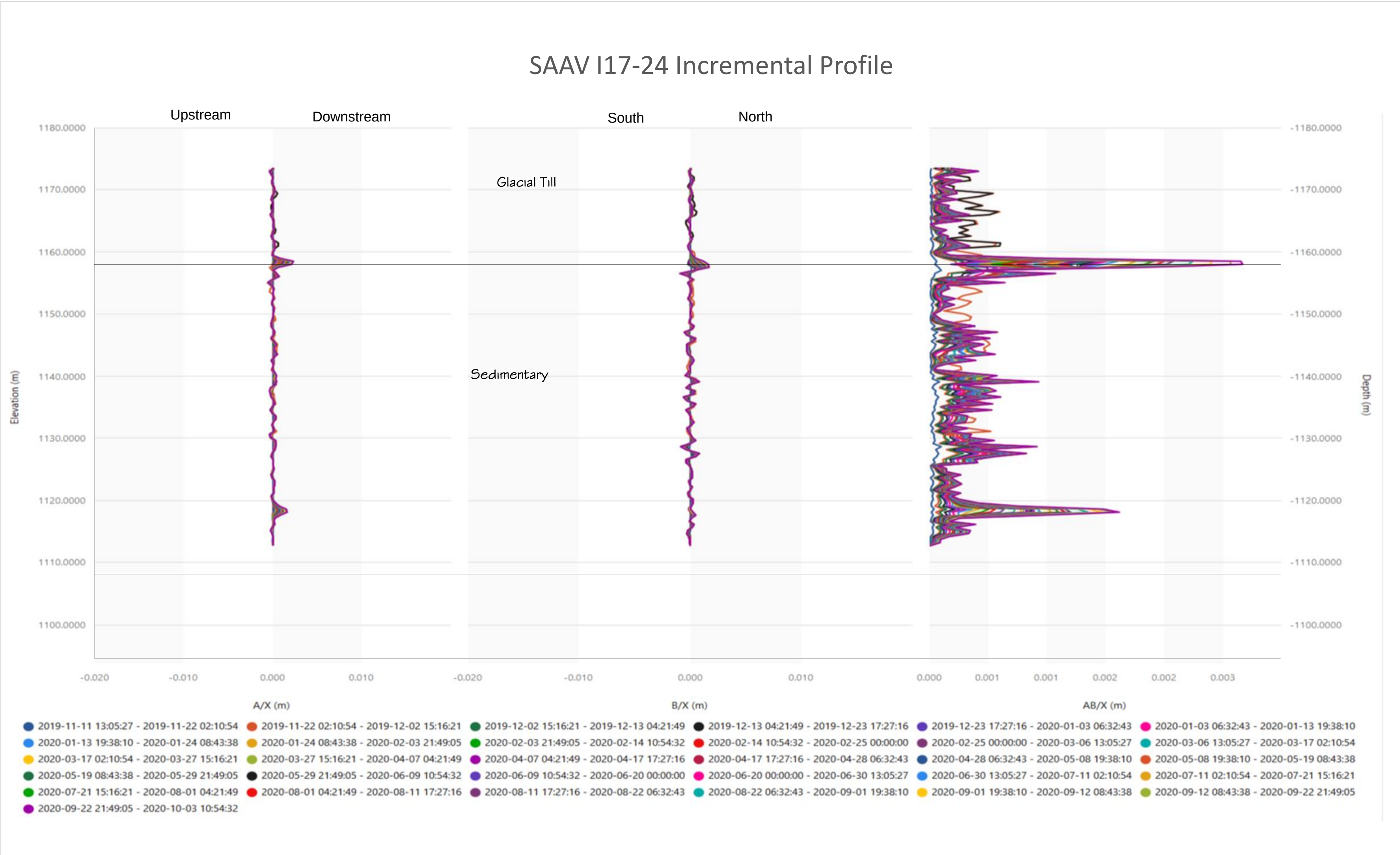
Highland Valley Copper - Logan Lake, BC

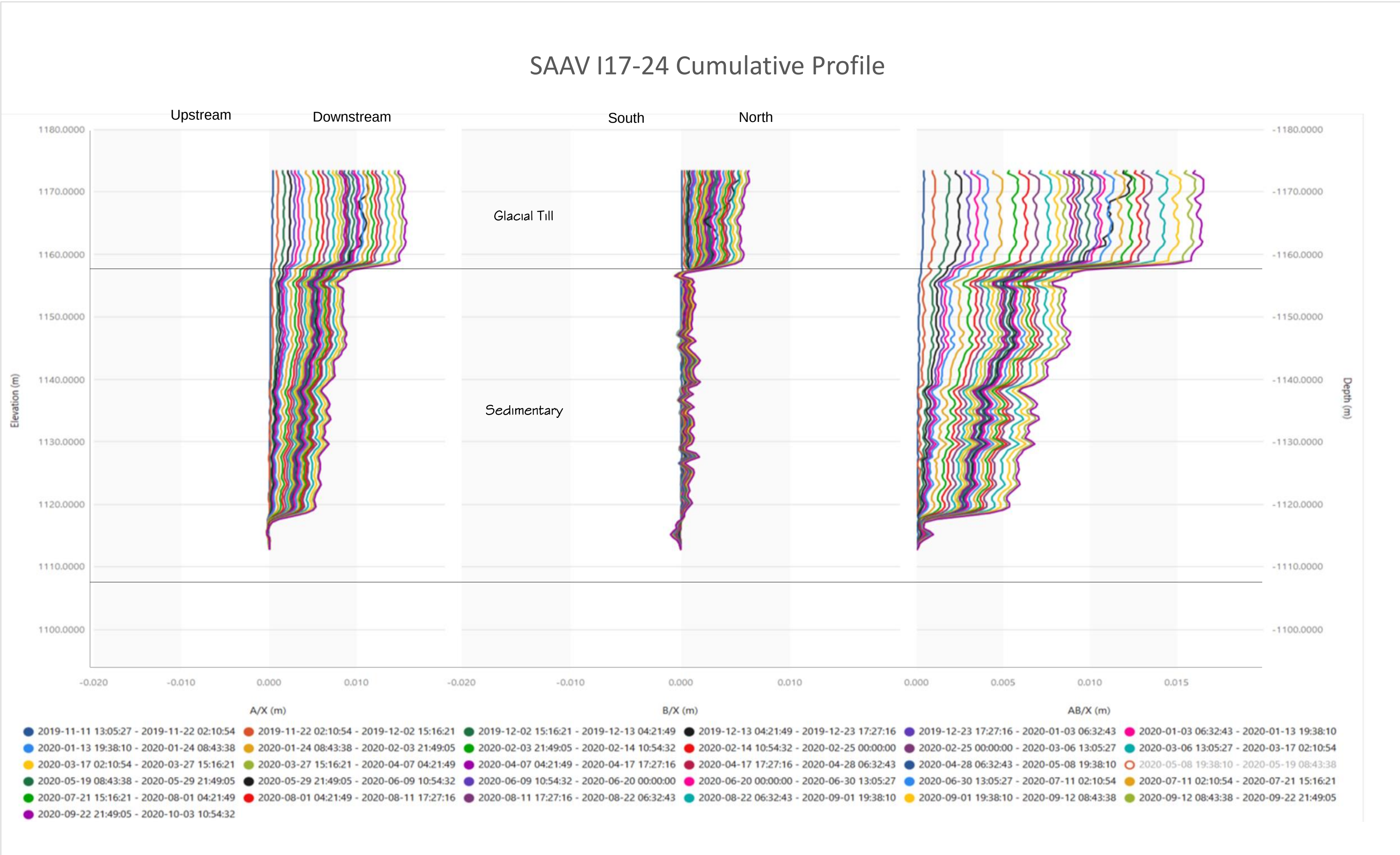


LL Dam - Dam fill excluded,,,, Inclinometer I17-22,,,

North Buttress Berm

SAAV I17-24


SAAV I17-24 Incremental Profile
Upstream
Downstream
South
North
Glacial Till
Sedimentary
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2019-11-11 13:05:27 - 2019-11-22 02:10:54
2019-11-22 02:10:54 - 2019-12-02 15:16:21
2019-12-02 15:16:21 - 2019-12-13 04:21:49
2019-12-13 04:21:49 - 2019-12-23 17:27:16
2019-12-23 17:27:16 - 2020-01-03 06:32:43
2020-01-03 06:32:43 - 2020-01-13 19:38:10
2020-01-13 19:38:10 - 2020-01-24 08:43:38
2020-01-24 08:43:38 - 2020-02-03 21:49:05
2020-02-03 21:49:05 - 2020-02-14 10:54:32
2020-02-14 10:54:32 - 2020-02-25 00:00:00
2020-02-25 00:00:00 - 2020-03-06 13:05:27
2020-03-06 13:05:27 - 2020-03-17 02:10:54
2020-03-17 02:10:54 - 2020-03-27 15:16:21
2020-03-27 15:16:21 - 2020-04-07 04:21:49
2020-04-07 04:21:49 - 2020-04-17 17:27:16
2020-04-17 17:27:16 - 2020-04-28 06:32:43
2020-04-28 06:32:43 - 2020-05-08 19:38:10
2020-05-08 19:38:10 - 2020-05-19 08:43:38
2020-05-19 08:43:38 - 2020-05-29 21:49:05
2020-05-29 21:49:05 - 2020-06-09 10:54:32
2020-06-09 10:54:32 - 2020-06-20 00:00:00
2020-06-20 00:00:00 - 2020-06-30 13:05:27
2020-06-30 13:05:27 - 2020-07-11 02:10:54
2020-07-11 02:10:54 - 2020-07-21 15:16:21
2020-07-21 15:16:21 - 2020-08-01 04:21:49
2020-08-01 04:21:49 - 2020-08-11 17:27:16
2020-08-11 17:27:16 - 2020-08-22 06:32:43
2020-08-22 06:32:43 - 2020-09-01 19:38:10
2020-09-01 19:38:10 - 2020-09-12 08:43:38
2020-09-12 08:43:38 - 2020-09-22 21:49:05
2020-09-22 21:49:05 - 2020-10-03 10:54:32

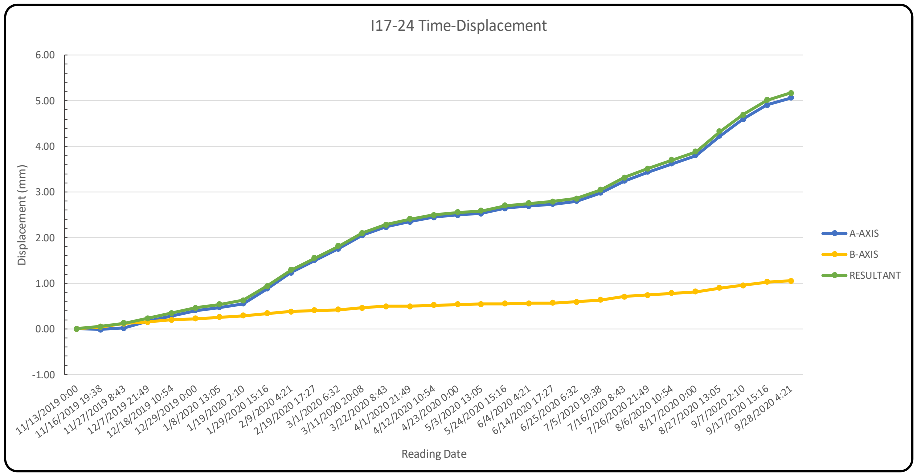

SAAV I17-24 Cumulative Profile
Upstream
Downstream
South
North
Glacial Till
Sedimentary
Elevation (m)
Depth (m)
1180.0000
1170.0000
1160.0000
1150.0000
1140.0000
1130.0000
1120.0000
1110.0000
1100.0000
-1180.0000
-1170.0000
-1160.0000
-1150.0000
-1140.0000
-1130.0000
-1120.0000
-1110.0000
-1100.0000
-0.020 -0.010 0.000 0.010
A/X (m)
-0.020 -0.010 0.000 0.010
B/X (m)
0.000 0.005 0.010 0.015
AB/X (m)
2019-11-11 13:05:27 - 2019-11-22 02:10:54
2019-11-22 02:10:54 - 2019-12-02 15:16:21
2019-12-02 15:16:21 - 2019-12-13 04:21:49
2019-12-13 04:21:49 - 2019-12-23 17:27:16
2019-12-23 17:27:16 - 2020-01-03 06:32:43
2020-01-03 06:32:43 - 2020-01-13 19:38:10
2020-01-13 19:38:10 - 2020-01-24 08:43:38
2020-01-24 08:43:38 - 2020-02-03 21:49:05
2020-02-03 21:49:05 - 2020-02-14 10:54:32
2020-02-14 10:54:32 - 2020-02-25 00:00:00
2020-02-25 00:00:00 - 2020-03-06 13:05:27
2020-03-06 13:05:27 - 2020-03-17 02:10:54
2020-03-17 02:10:54 - 2020-03-27 15:16:21
2020-03-27 15:16:21 - 2020-04-07 04:21:49
2020-04-07 04:21:49 - 2020-04-17 17:27:16
2020-04-17 17:27:16 - 2020-04-28 06:32:43
2020-04-28 06:32:43 - 2020-05-08 19:38:10
2020-05-08 19:38:10 - 2020-05-19 08:43:38
2020-05-19 08:43:38 - 2020-05-29 21:49:05
2020-05-29 21:49:05 - 2020-06-09 10:54:32
2020-06-09 10:54:32 - 2020-06-20 00:00:00
2020-06-20 00:00:00 - 2020-06-30 13:05:27
2020-06-30 13:05:27 - 2020-07-11 02:10:54
2020-07-11 02:10:54 - 2020-07-21 15:16:21
2020-07-21 15:16:21 - 2020-08-01 04:21:49
2020-08-01 04:21:49 - 2020-08-11 17:27:16
2020-08-11 17:27:16 - 2020-08-22 06:32:43
2020-08-22 06:32:43 - 2020-09-01 19:38:10
2020-09-01 19:38:10 - 2020-09-12 08:43:38
2020-09-12 08:43:38 - 2020-09-22 21:49:05
2020-09-22 21:49:05 - 2020-10-03 10:54:32

SAAV I17-24

Displacement Plot – Lower Sedimentary

Unit	Upper El. (m)	Lower El. (m)
Upper Sedimentary	1159.7	1151.7
Lower Sedimentary	1120.7	1112.7

Upper El. (m)	1120.7
Lower El. (m)	1113.7

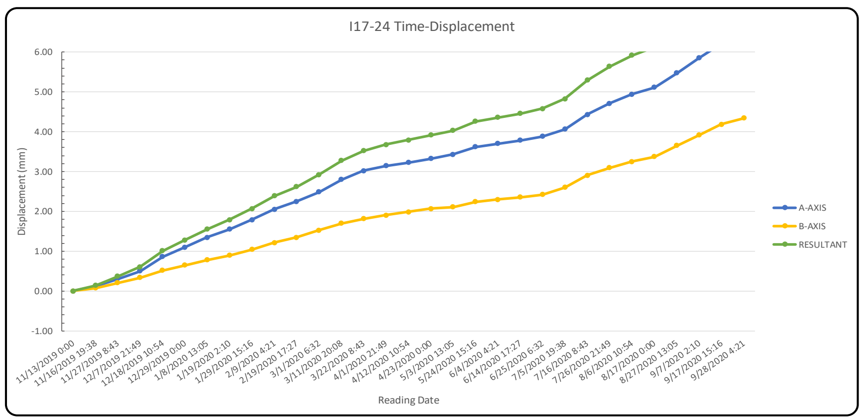


SAAV I17-24

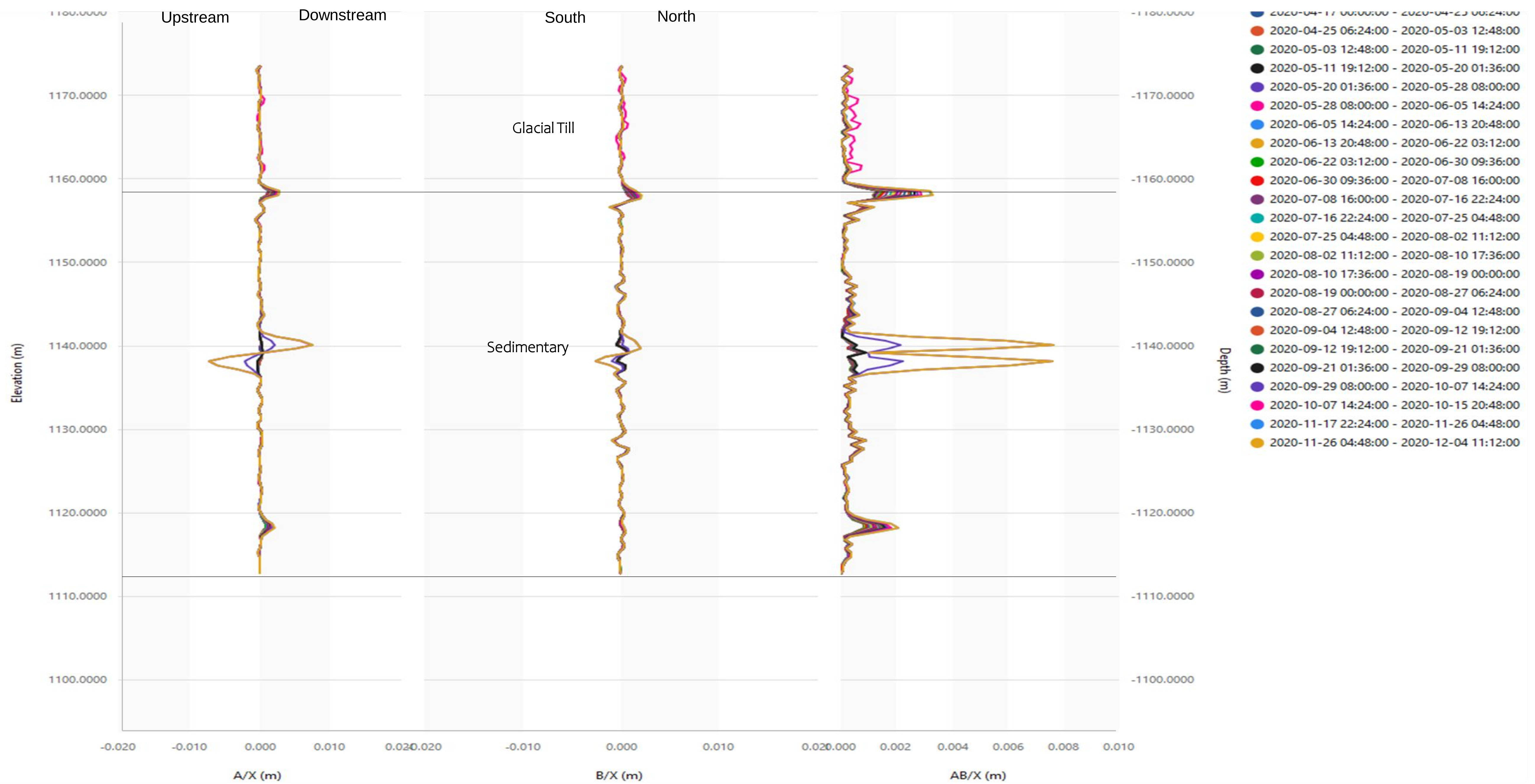
Displacement Plot – Upper Sedimentary

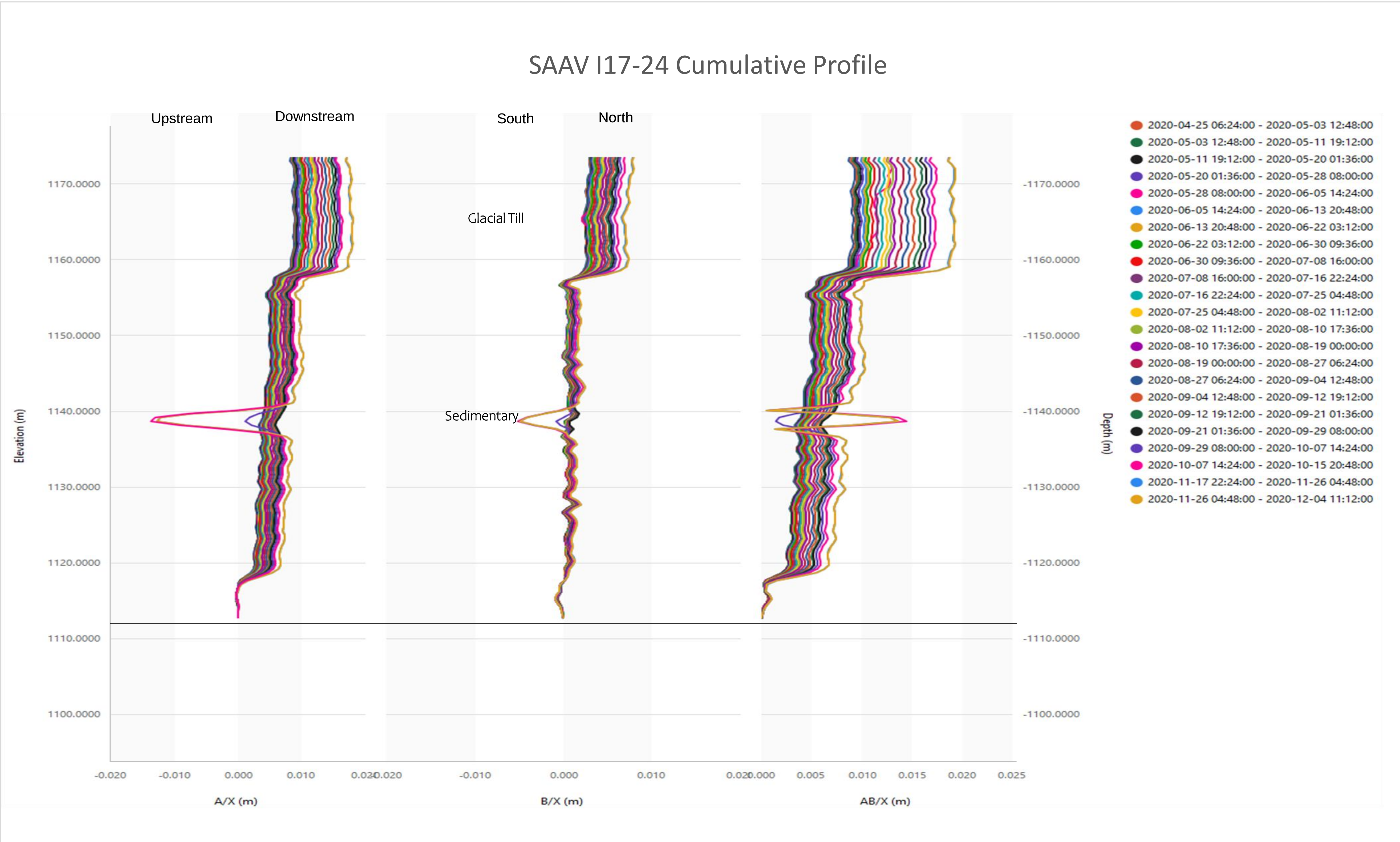
Unit	Upper El. (m)	Lower El. (m)
Upper Sedimentary	1159.7	1151.7
Lower Sedimentary	1120.7	1112.7

Upper El. (m)	1159.7
Lower El. (m)	1151.7



SAAV I17-24 Incremental Profile





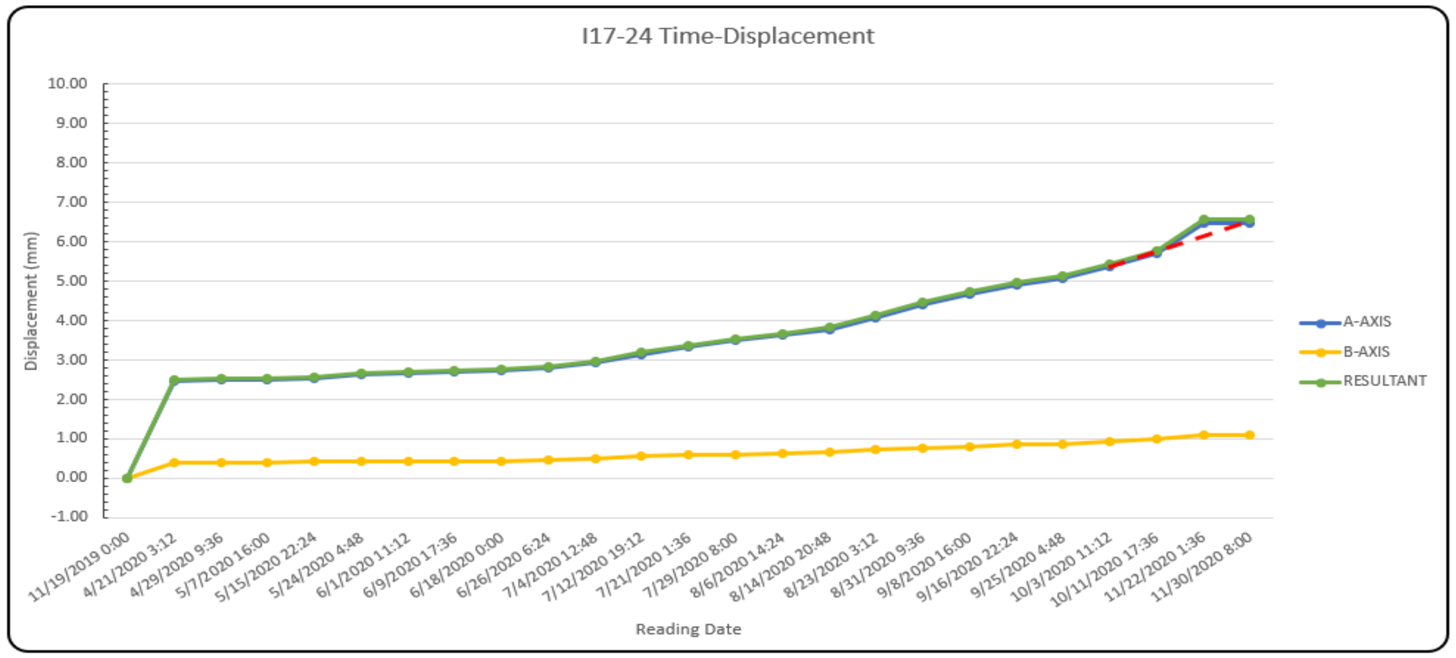
SAAV I17-24 Cumulative Profile
Upstream
Downstream
South
North
Glacial Till
Sedimentary
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2020-04-25 06:24:00 - 2020-05-03 12:48:00
2020-05-03 12:48:00 - 2020-05-11 19:12:00
2020-05-11 19:12:00 - 2020-05-20 01:36:00
2020-05-20 01:36:00 - 2020-05-28 08:00:00
2020-05-28 08:00:00 - 2020-06-05 14:24:00
2020-06-05 14:24:00 - 2020-06-13 20:48:00
2020-06-13 20:48:00 - 2020-06-22 03:12:00
2020-06-22 03:12:00 - 2020-06-30 09:36:00
2020-06-30 09:36:00 - 2020-07-08 16:00:00
2020-07-08 16:00:00 - 2020-07-16 22:24:00
2020-07-16 22:24:00 - 2020-07-25 04:48:00
2020-07-25 04:48:00 - 2020-08-02 11:12:00
2020-08-02 11:12:00 - 2020-08-10 17:36:00
2020-08-10 17:36:00 - 2020-08-19 00:00:00
2020-08-19 00:00:00 - 2020-08-27 06:24:00
2020-08-27 06:24:00 - 2020-09-04 12:48:00
2020-09-04 12:48:00 - 2020-09-12 19:12:00
2020-09-12 19:12:00 - 2020-09-21 01:36:00
2020-09-21 01:36:00 - 2020-09-29 08:00:00
2020-09-29 08:00:00 - 2020-10-07 14:24:00
2020-10-07 14:24:00 - 2020-10-15 20:48:00
2020-11-17 22:24:00 - 2020-11-26 04:48:00
2020-11-26 04:48:00 - 2020-12-04 11:12:00

SAAV I17-24

Displacement Plot – Lower Sedimentary

Unit	Upper El. (m)	Lower El. (m)
Upper Sedimentary	1159.7	1151.7
Lower Sedimentary	1120.7	1112.7

Upper El. (m)	1120.7
Lower El. (m)	1112.7

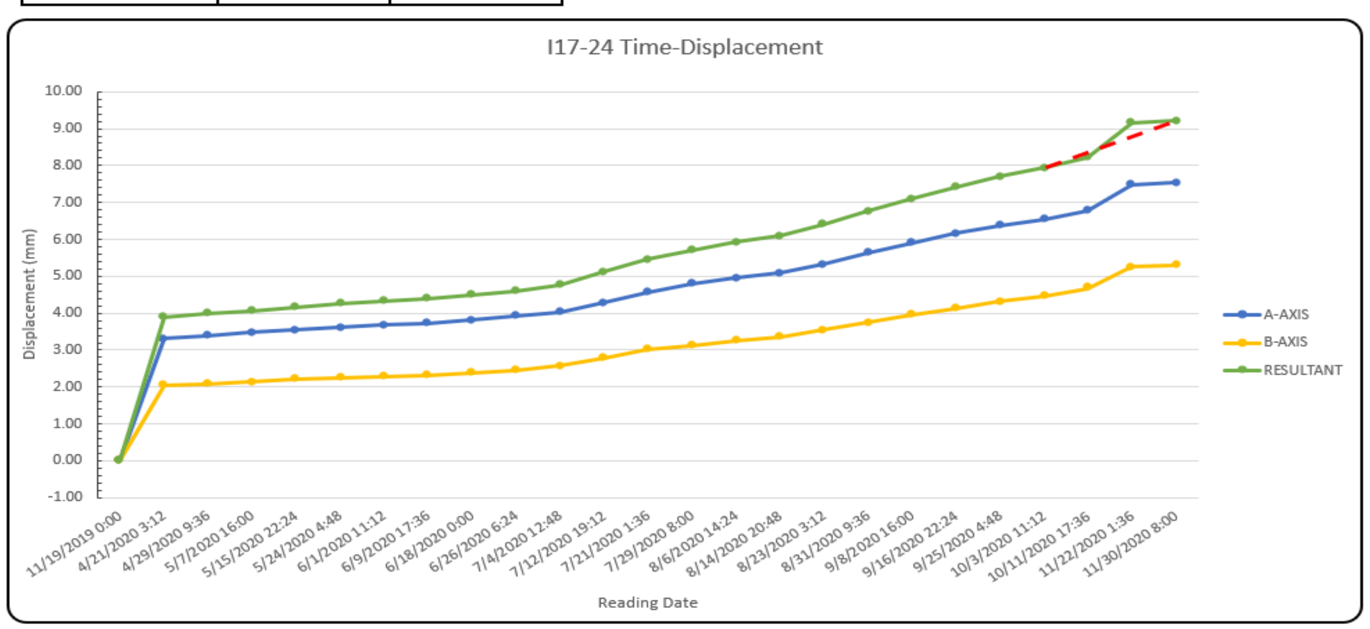


SAAV I17-24

Displacement Plot – Upper Sedimentary

Unit	Upper El. (m)	Lower El. (m)
Upper Sedimentary	1159.7	1151.7
Lower Sedimentary	1120.7	1112.7

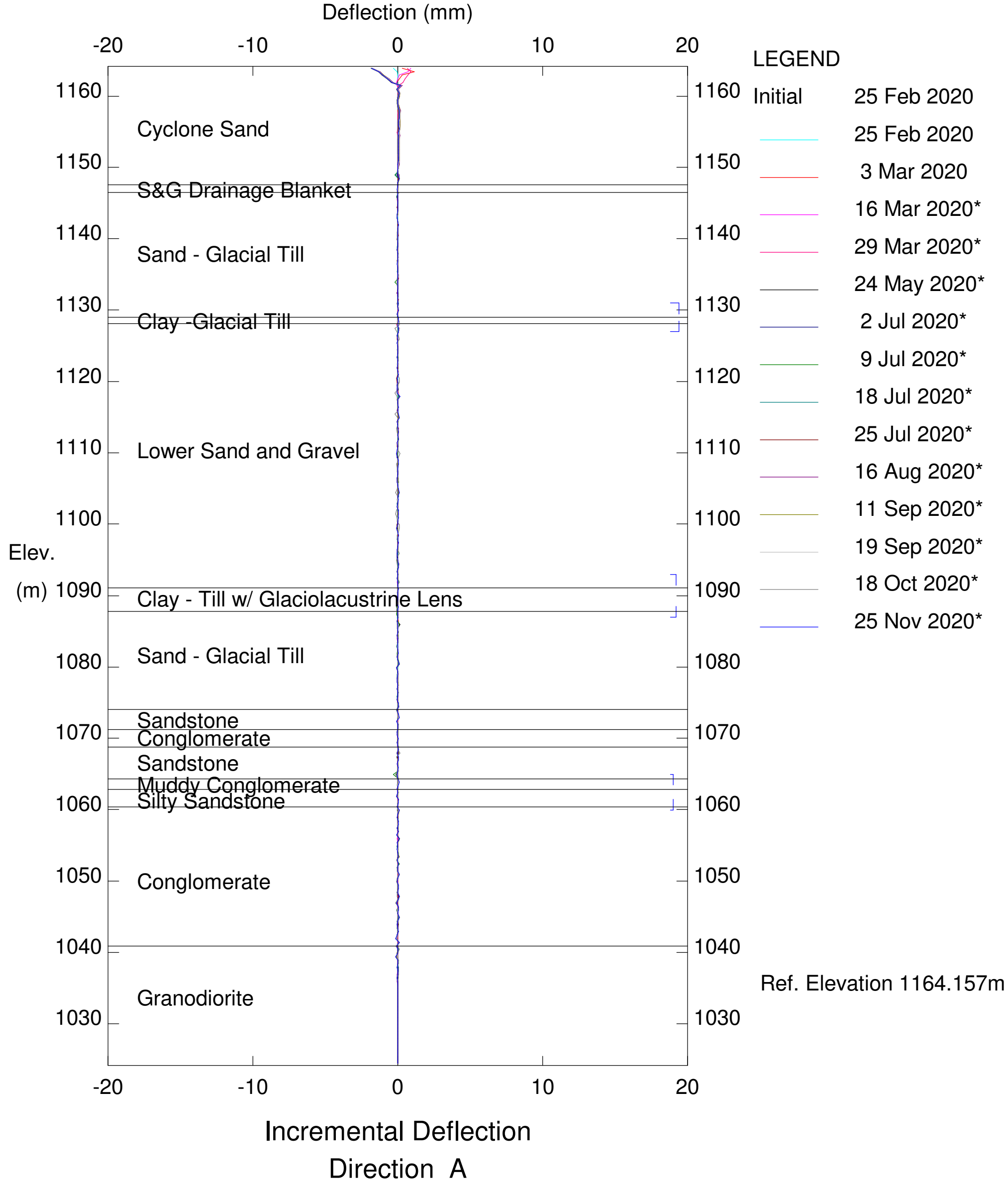
Upper El. (m)	1159.7
Lower El. (m)	1151.7

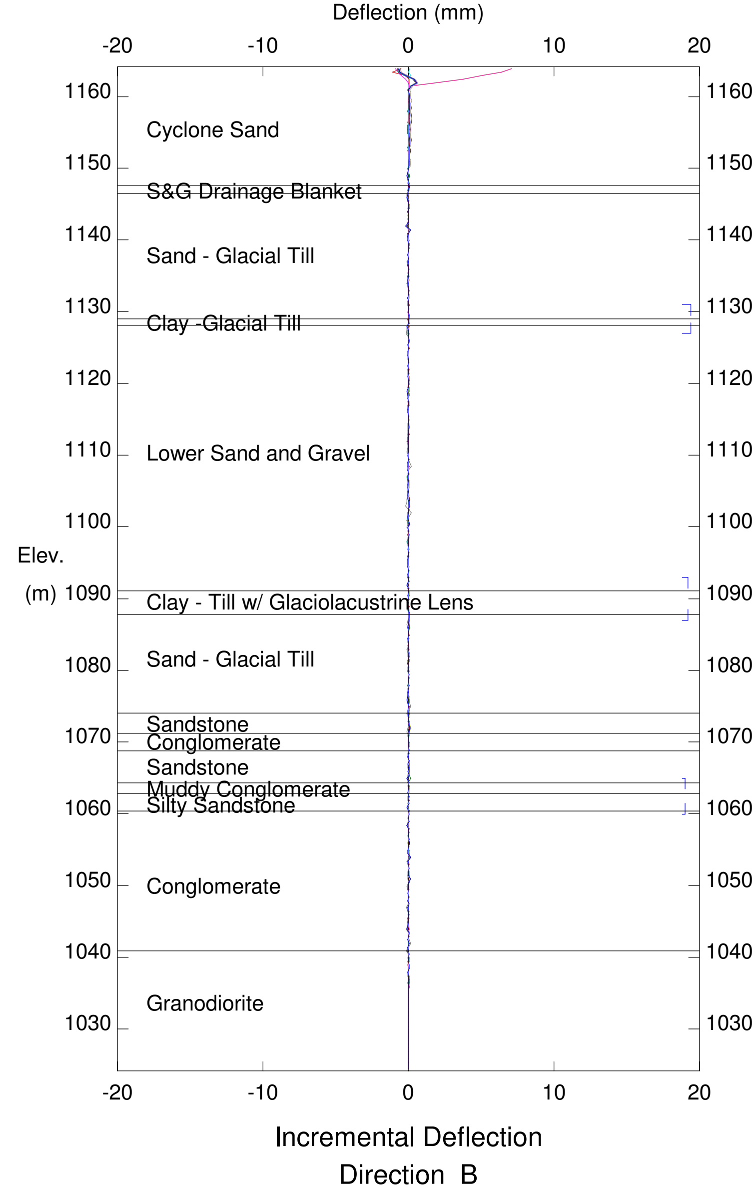


Valley Buttress Berm Extension

I20-01

Highland Valley Copper - Logan Lake, BC



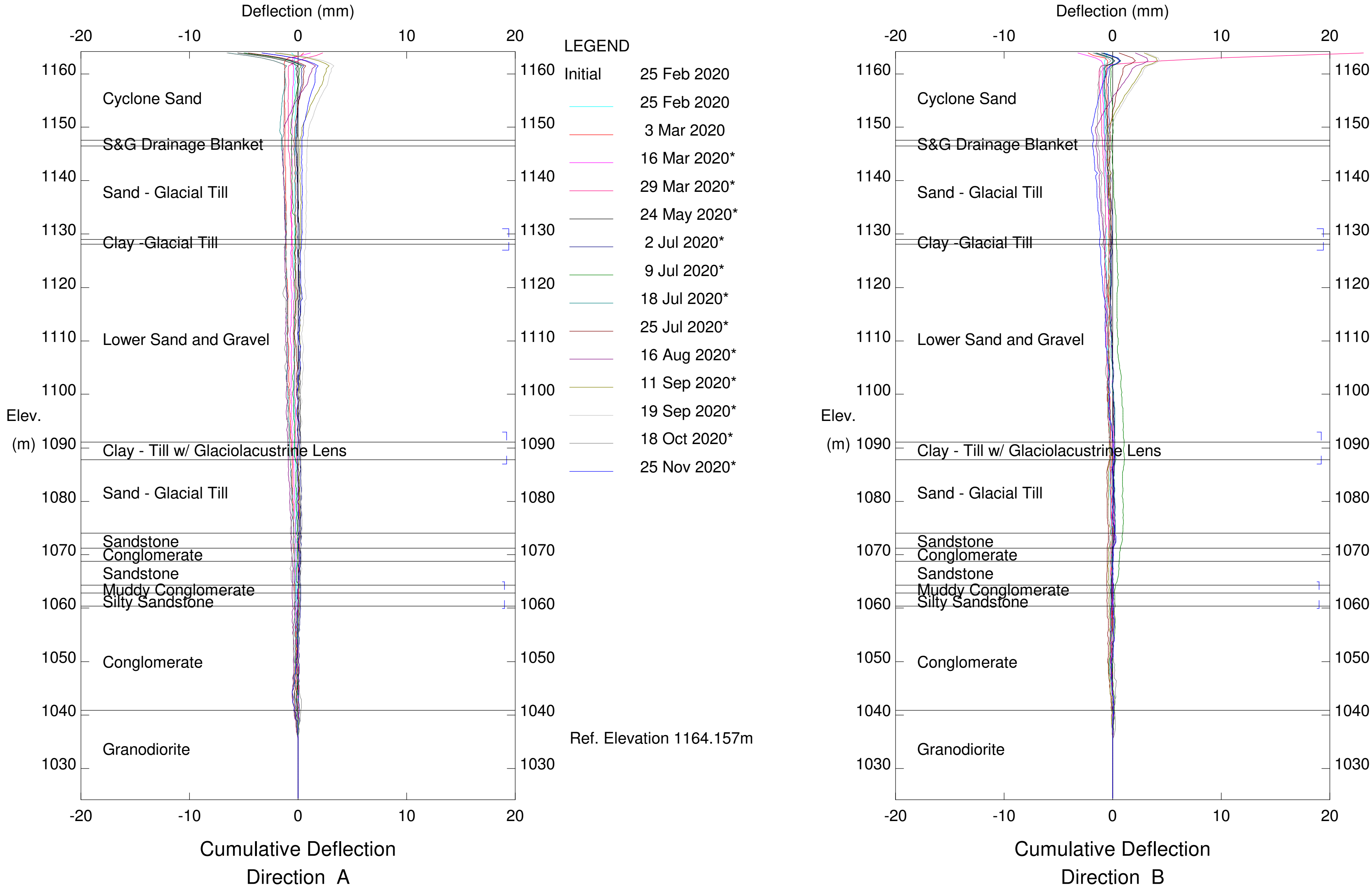


Valley Buttress Berm Extension,,,, Inclinometer I20-01,,,

Sets marked * include zero shift and/or rotation corrections.

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\09 Geotechnical\Instrumentation\03 - Dam Movement Monitoring_L-L Dam\SI Monitoring\GTPLUS32 Files\I20-01,,,.gtl

Highland Valley Copper - Logan Lake, BC

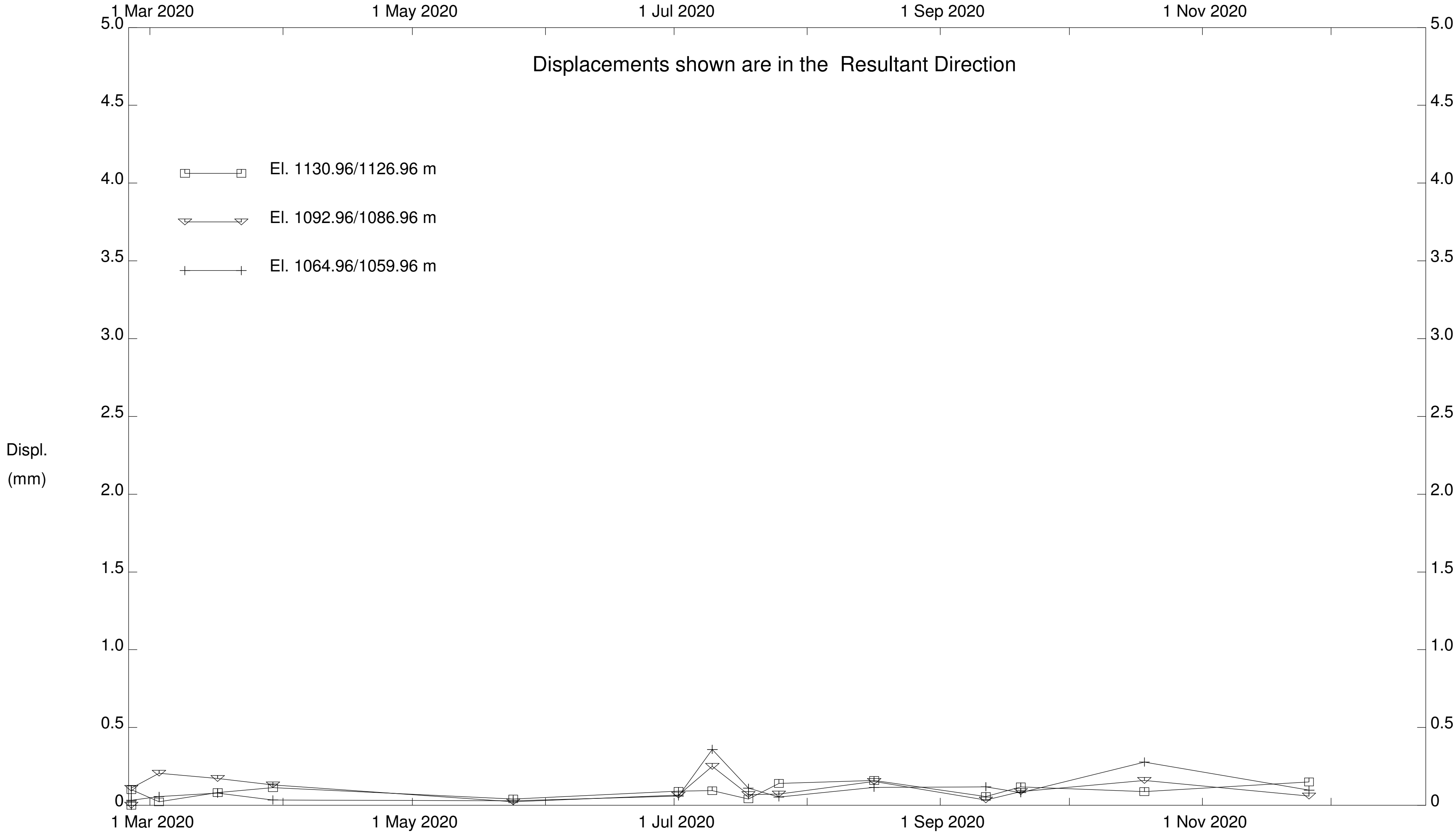


Valley Buttress Berm Extension,,,, Inclinometer I20-01,,,

Sets marked * include zero shift and/or rotation corrections.

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\09 Geotechnical\Instrumentation\03 - Dam Movement Monitoring_L-L Dam\SI Monitoring\GTPLUS32 Files\I20-01,,,.gtl

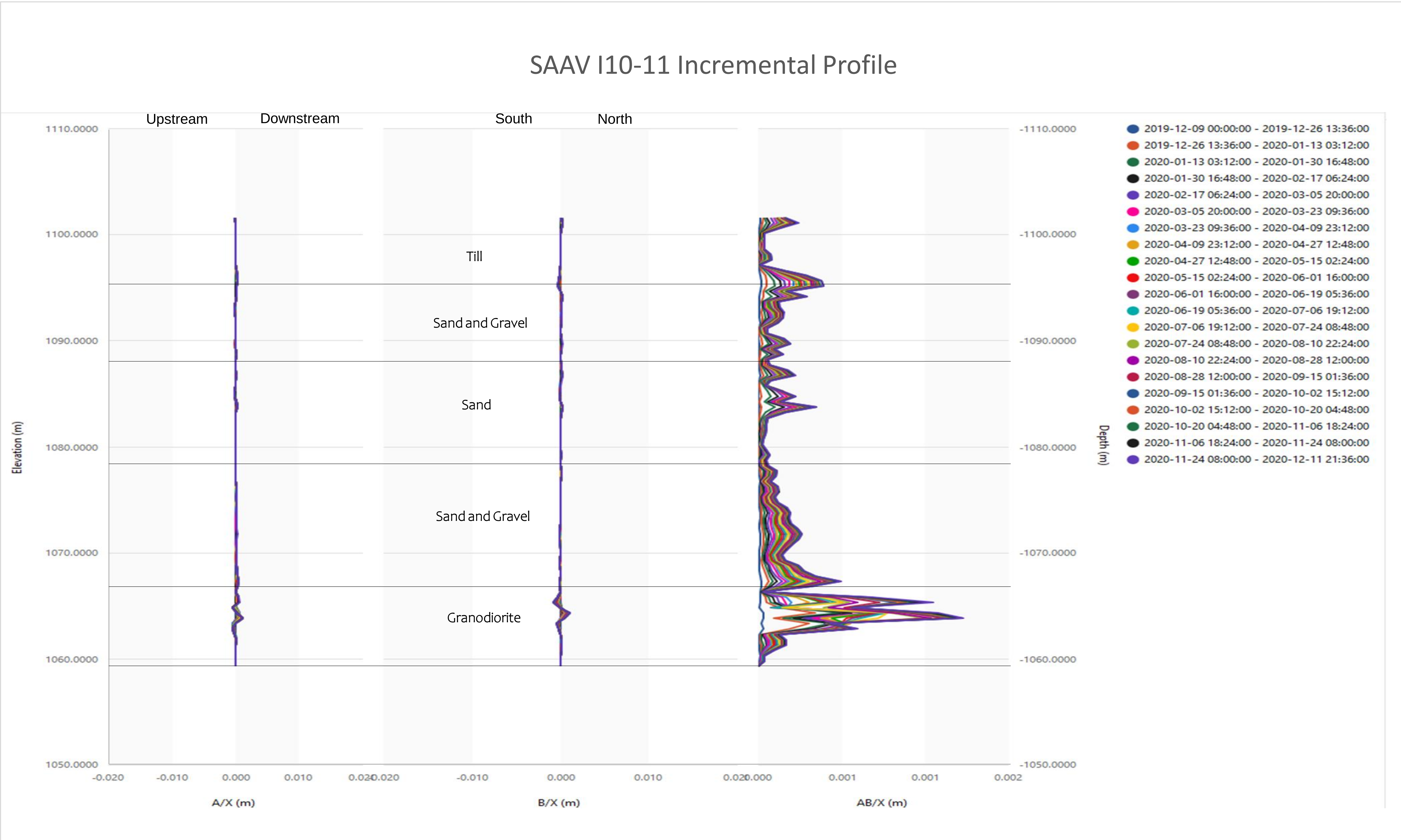
Highland Valley Copper - Logan Lake, BC

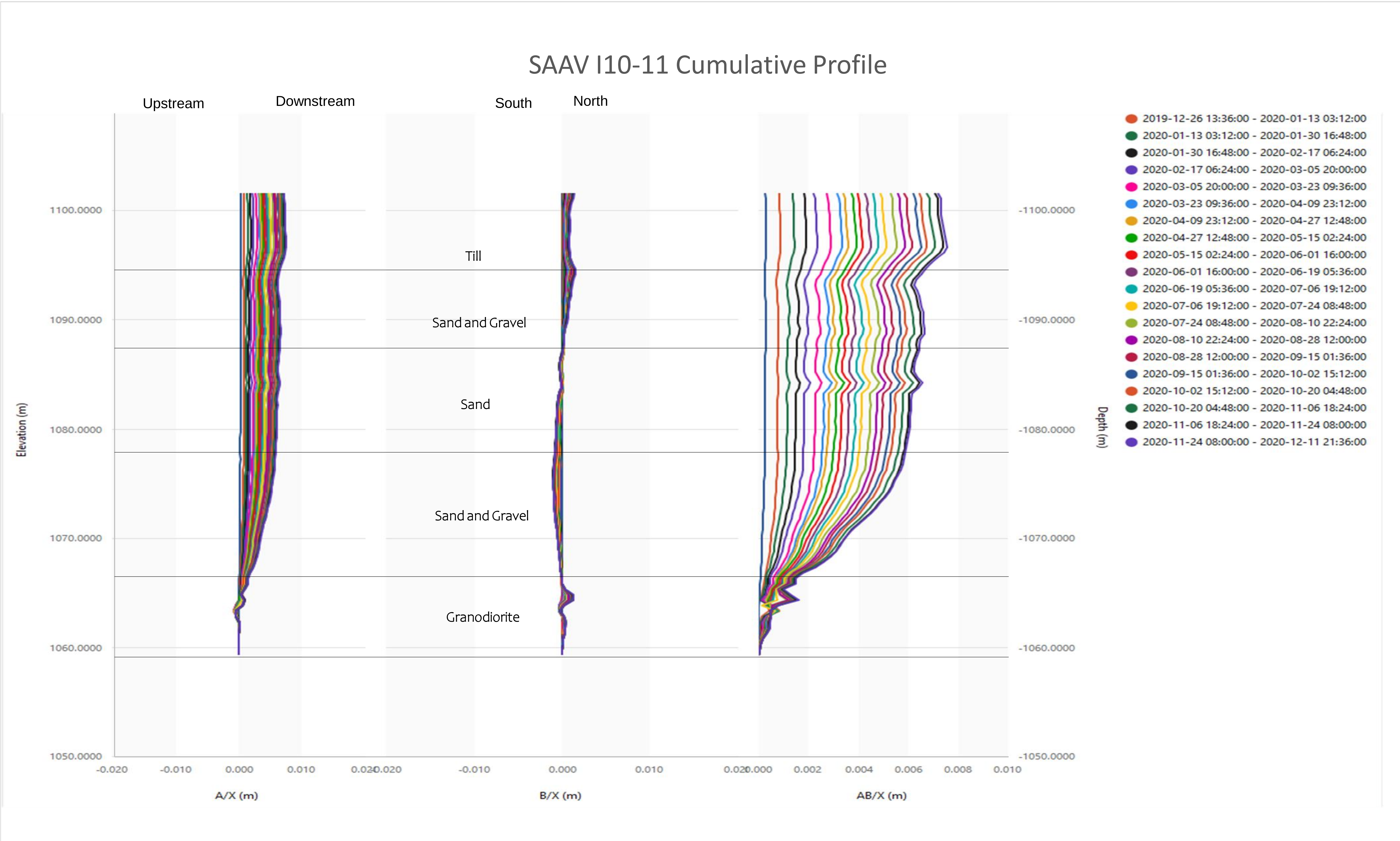


Valley Buttress Berm Extension,,,, Inclinometer I20-01,,,

Valley Buttress Berm Extension

SAAV I10-11


SAAV I10-11 Incremental Profile
Upstream
Downstream
South
North
Till
Sand and Gravel
Sand
Sand and Gravel
Granodiorite
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2019-12-09 00:00:00 - 2019-12-26 13:36:00
2019-12-26 13:36:00 - 2020-01-13 03:12:00
2020-01-13 03:12:00 - 2020-01-30 16:48:00
2020-01-30 16:48:00 - 2020-02-17 06:24:00
2020-02-17 06:24:00 - 2020-03-05 20:00:00
2020-03-05 20:00:00 - 2020-03-23 09:36:00
2020-03-23 09:36:00 - 2020-04-09 23:12:00
2020-04-09 23:12:00 - 2020-04-27 12:48:00
2020-04-27 12:48:00 - 2020-05-15 02:24:00
2020-05-15 02:24:00 - 2020-06-01 16:00:00
2020-06-01 16:00:00 - 2020-06-19 05:36:00
2020-06-19 05:36:00 - 2020-07-06 19:12:00
2020-07-06 19:12:00 - 2020-07-24 08:48:00
2020-07-24 08:48:00 - 2020-08-10 22:24:00
2020-08-10 22:24:00 - 2020-08-28 12:00:00
2020-08-28 12:00:00 - 2020-09-15 01:36:00
2020-09-15 01:36:00 - 2020-10-02 15:12:00
2020-10-02 15:12:00 - 2020-10-20 04:48:00
2020-10-20 04:48:00 - 2020-11-06 18:24:00
2020-11-06 18:24:00 - 2020-11-24 08:00:00
2020-11-24 08:00:00 - 2020-12-11 21:36:00



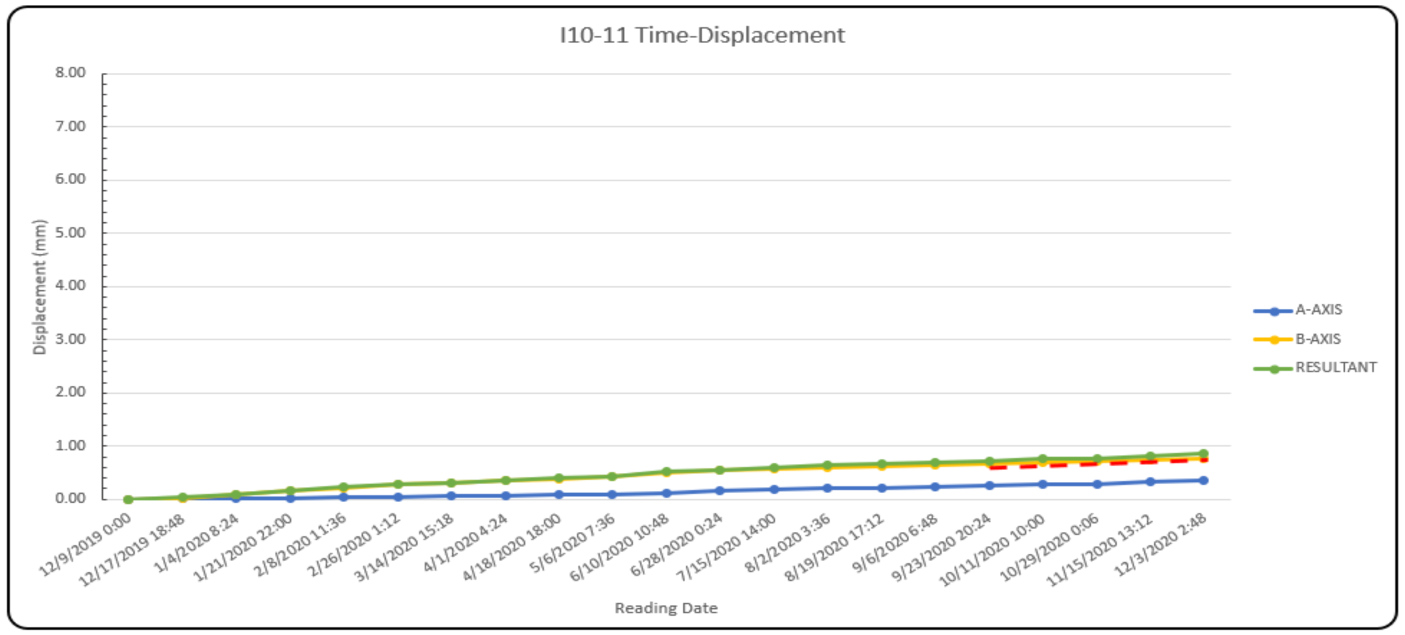
SAAV I10-11 Cumulative Profile
Upstream
Downstream
South
North
Till
Sand and Gravel
Sand
Sand and Gravel
Granodiorite
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2019-12-26 13:36:00 - 2020-01-13 03:12:00
2020-01-13 03:12:00 - 2020-01-30 16:48:00
2020-01-30 16:48:00 - 2020-02-17 06:24:00
2020-02-17 06:24:00 - 2020-03-05 20:00:00
2020-03-05 20:00:00 - 2020-03-23 09:36:00
2020-03-23 09:36:00 - 2020-04-09 23:12:00
2020-04-09 23:12:00 - 2020-04-27 12:48:00
2020-04-27 12:48:00 - 2020-05-15 02:24:00
2020-05-15 02:24:00 - 2020-06-01 16:00:00
2020-06-01 16:00:00 - 2020-06-19 05:36:00
2020-06-19 05:36:00 - 2020-07-06 19:12:00
2020-07-06 19:12:00 - 2020-07-24 08:48:00
2020-07-24 08:48:00 - 2020-08-10 22:24:00
2020-08-10 22:24:00 - 2020-08-28 12:00:00
2020-08-28 12:00:00 - 2020-09-15 01:36:00
2020-09-15 01:36:00 - 2020-10-02 15:12:00
2020-10-02 15:12:00 - 2020-10-20 04:48:00
2020-10-20 04:48:00 - 2020-11-06 18:24:00
2020-11-06 18:24:00 - 2020-11-24 08:00:00
2020-11-24 08:00:00 - 2020-12-11 21:36:00

SAAV I10-11

Displacement Plot – Sand & Gravel

Unit	Upper El. (m)	Lower El. (m)
Sand and Gravel	1087.8	1081.8
Granodiorite	1068.8	1059.3

Upper El. (m)	1087.8
Lower El. (m)	1081.8

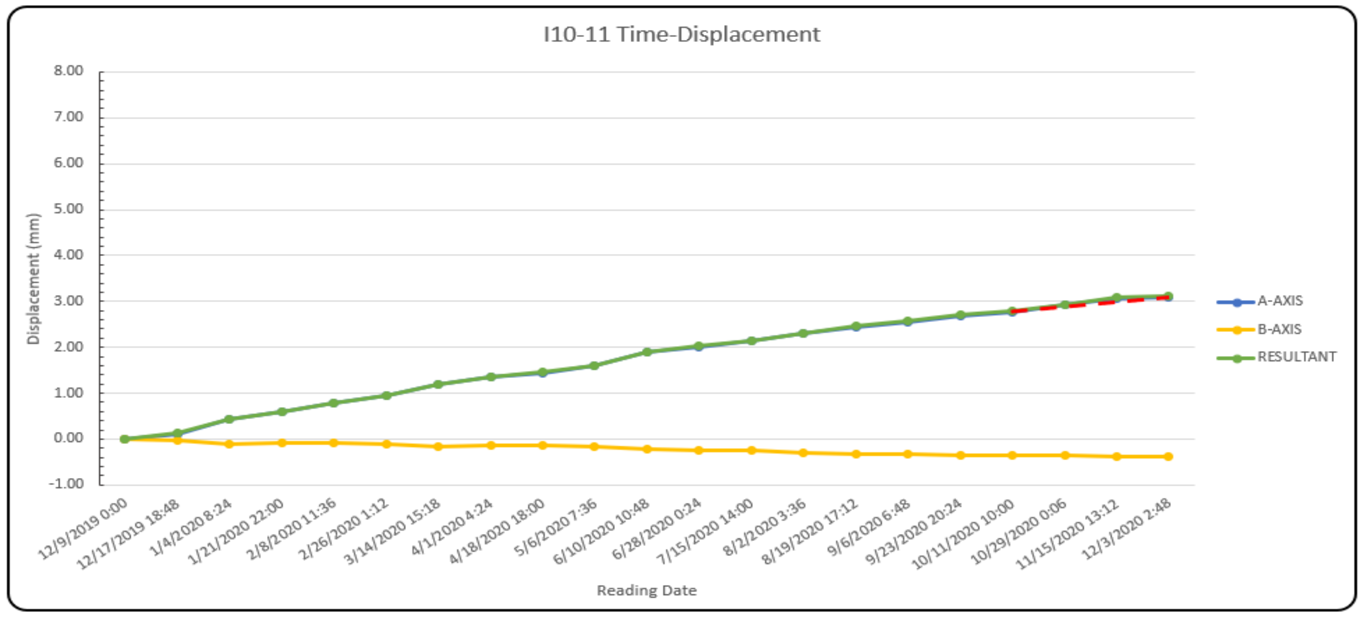


SAAV I10-11

Displacement Plot – Volcanic

Unit	Upper El. (m)	Lower El. (m)
Sand and Gravel	1087.8	1081.8
Granodiorite	1068.8	1059.3

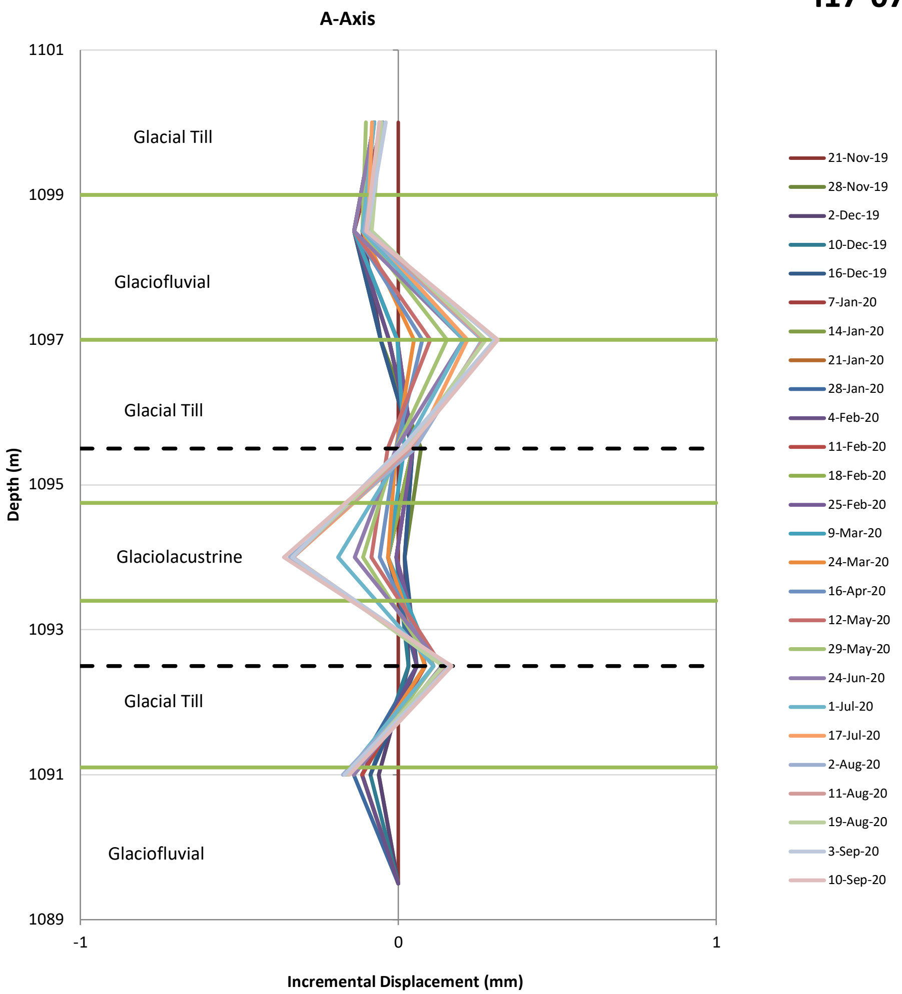
Upper El. (m)	1068.8
Lower El. (m)	1059.3

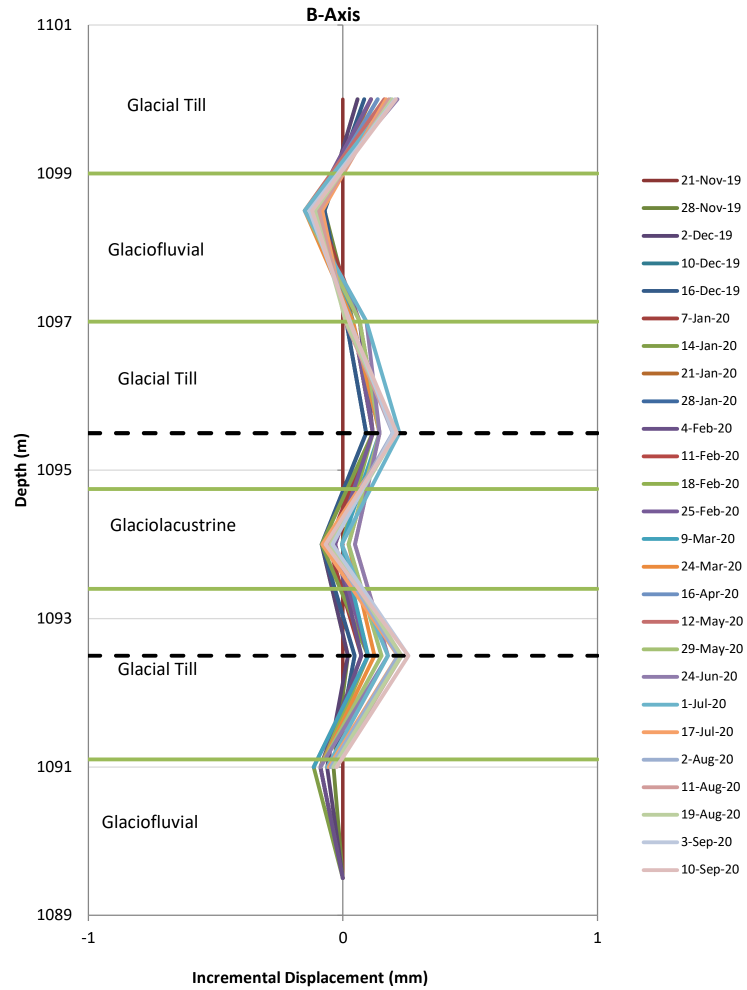


Valley Buttress Berm Extension

SAAV I17-07

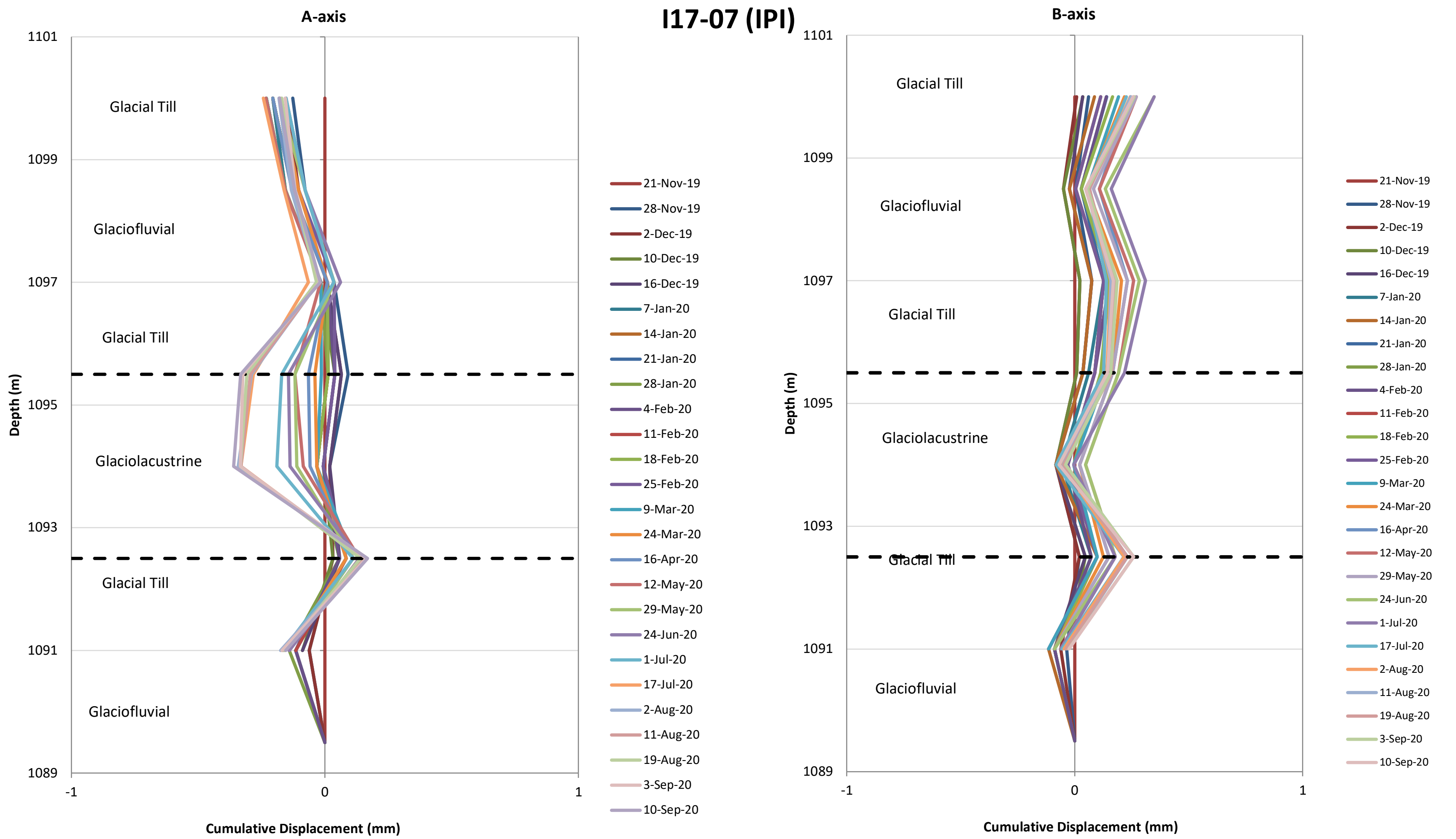
I17-07 (IPI)





Note: Manual readings were taken from July 17 to August 19

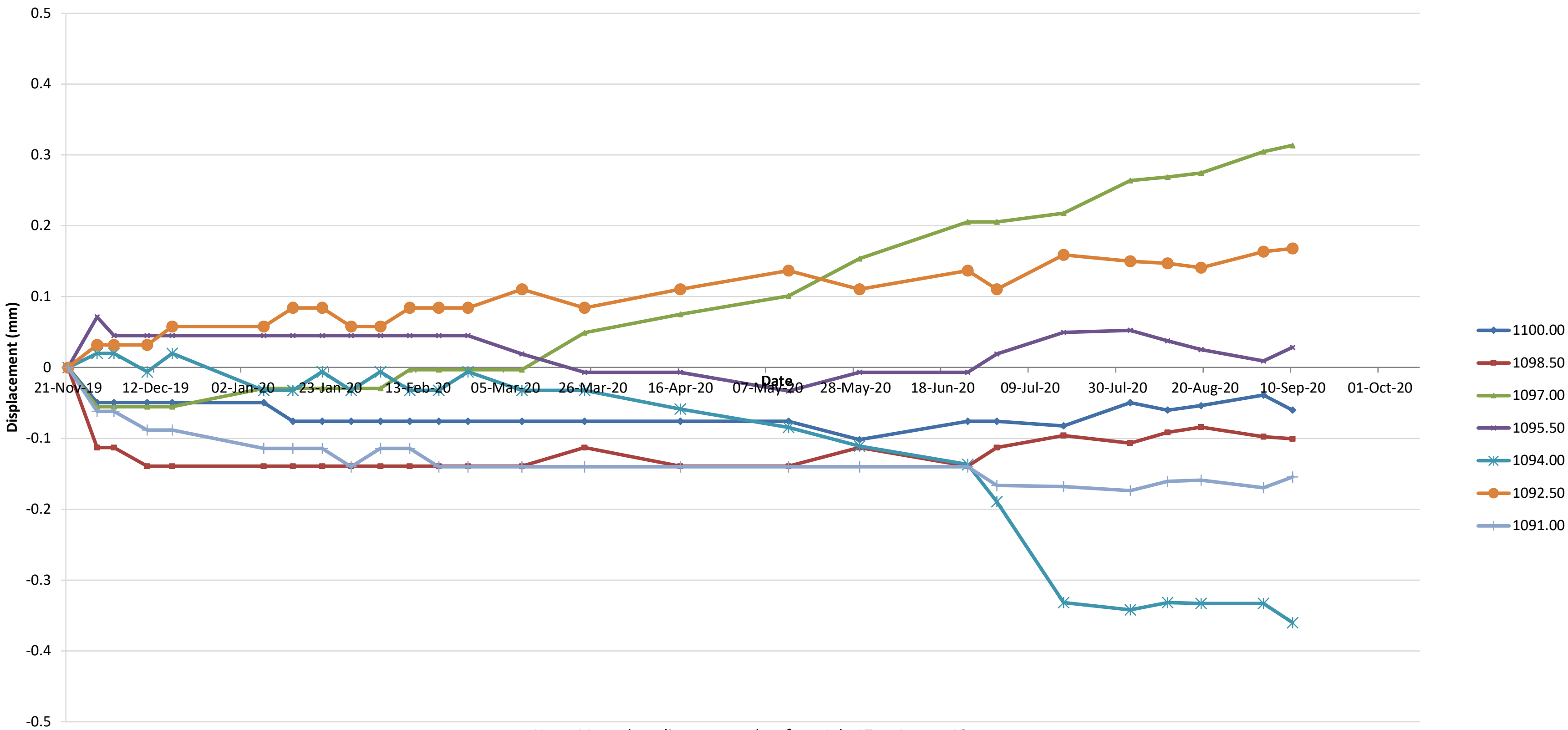
I17-07 (IPI)



Note: Manual readings were taken from July 17 to August 19

I17-07 (IPI)

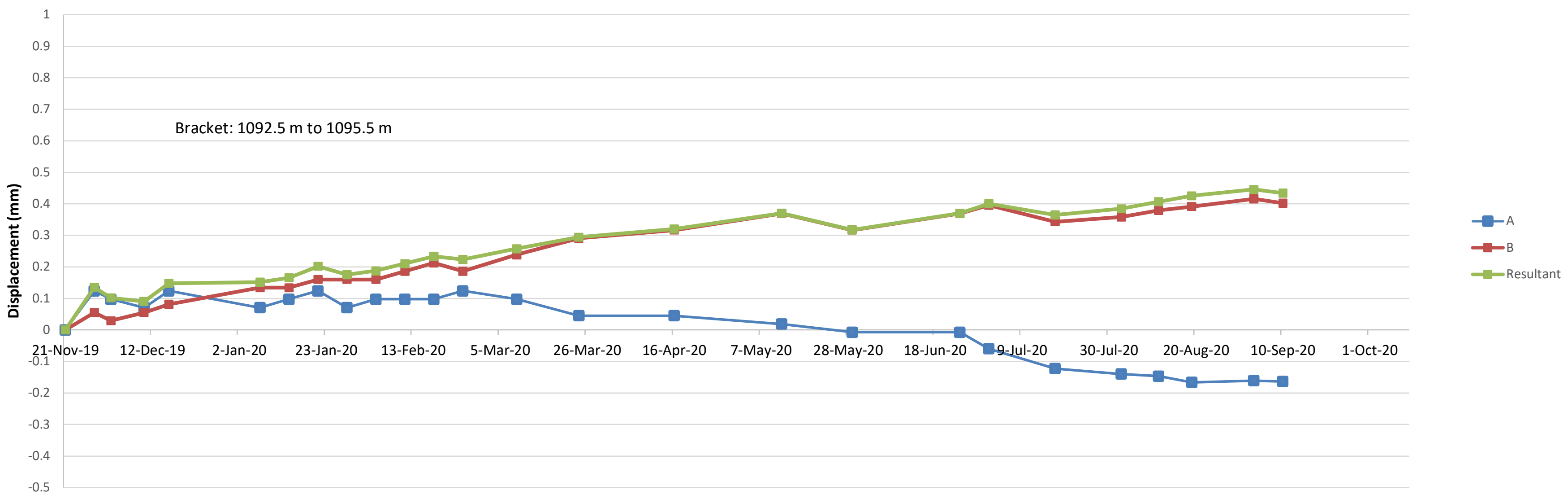
Displacement vs Time



Note: Manual readings were taken from July 17 to August 19

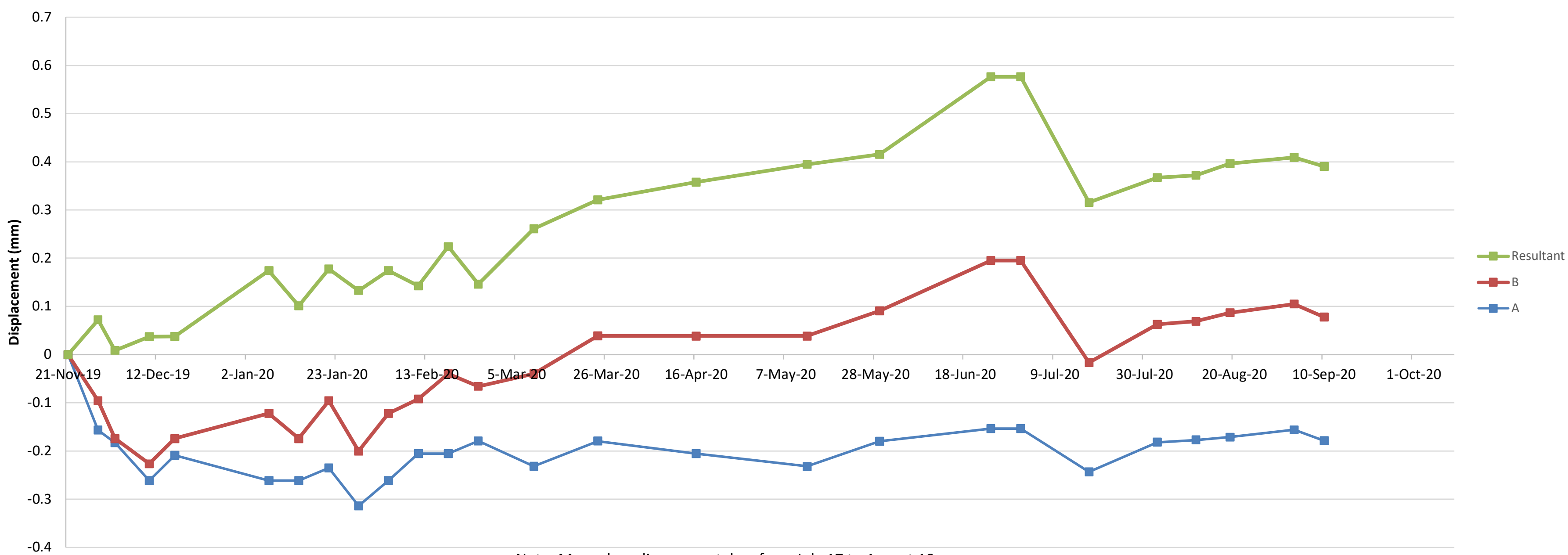
I17-07 (IPI)

Displacement vs Time (Glaciolacustrine)



Note: Manual readings were taken from July 17 to August 19

I17-07 (IPI)
Displacement vs Time (Borehole)

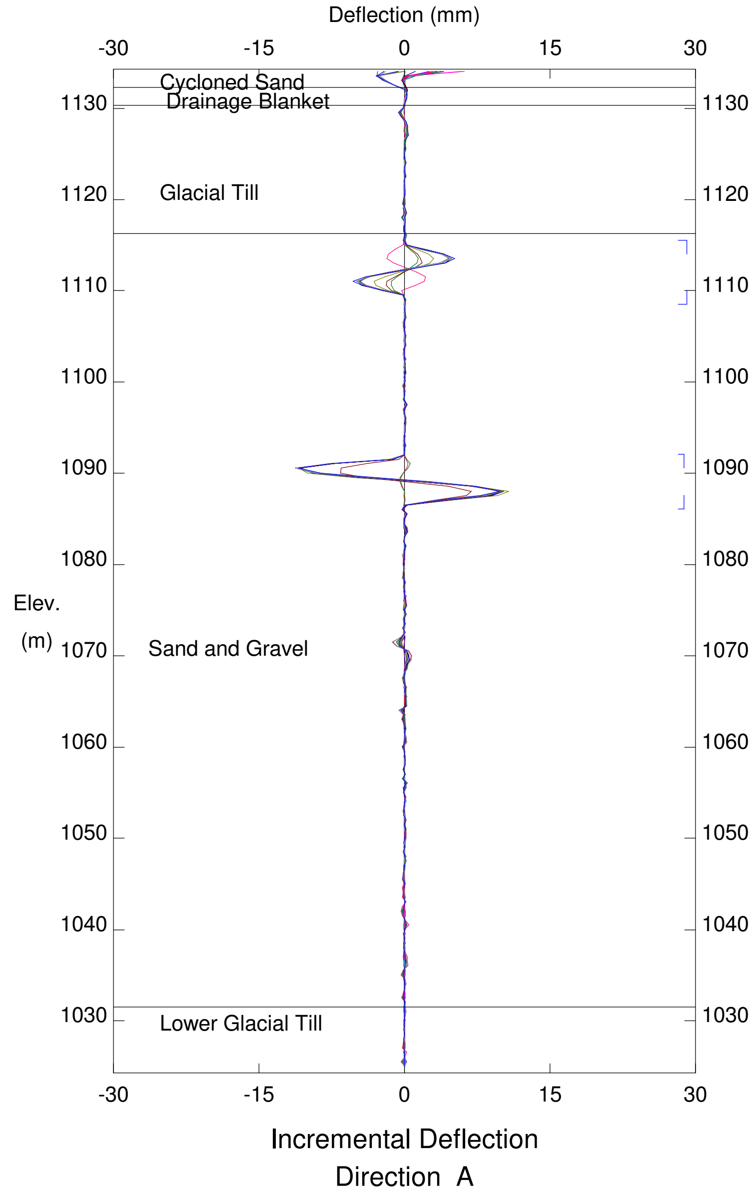


Note: Manual readings were taken from July 17 to August 19

Valley Buttress Berm Extension

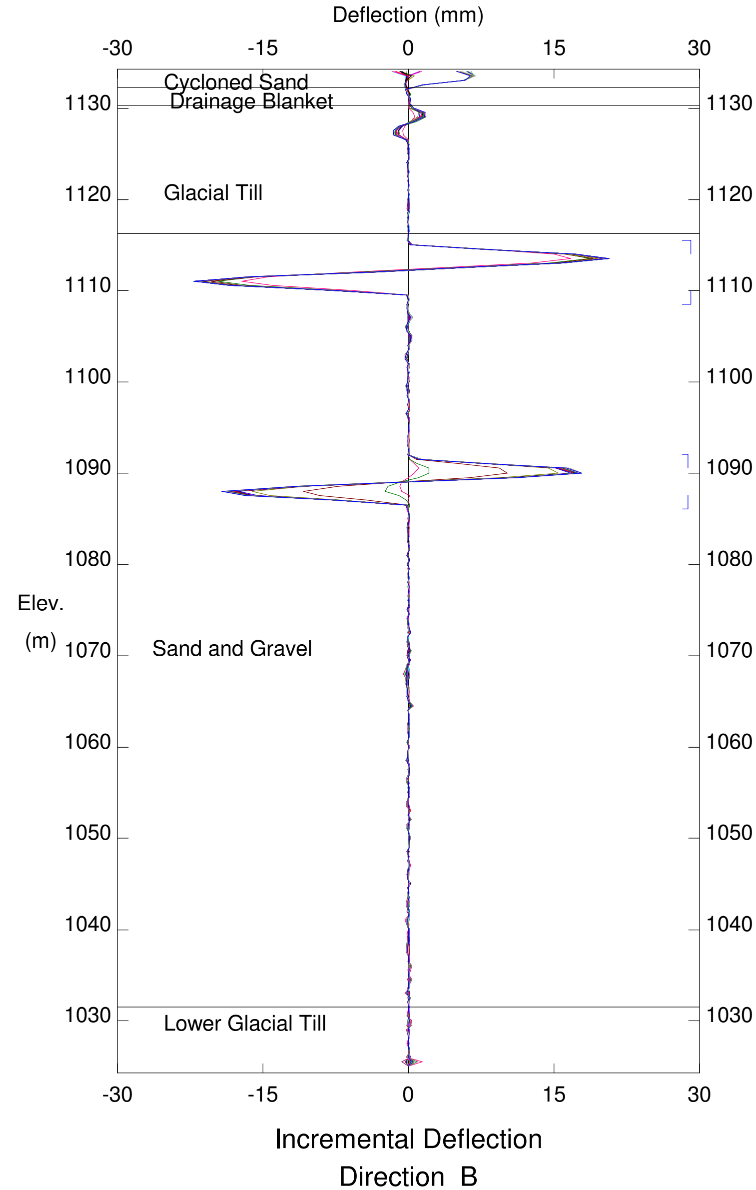
I17-08

Highland Valley Copper - Logan Lake, BC



LEGEND

Initial 3 Oct 2017*
7 May 2018*
21 Aug 2018*
20 Nov 2018*
19 Feb 2019*
24 Apr 2019
21 Jun 2019*
19 Jul 2019*
16 Aug 2019*
13 Sep 2019*
16 Nov 2019*
10 Jan 2020*
4 Mar 2020*
1 Jun 2020*
1 Jul 2020*
19 Jul 2020*
1 Aug 2020*
7 Aug 2020*
19 Aug 2020*
11 Sep 2020*
18 Sep 2020*
26 Sep 2020*
16 Oct 2020
29 Nov 2020*
Ref. Elevation 1134.3m

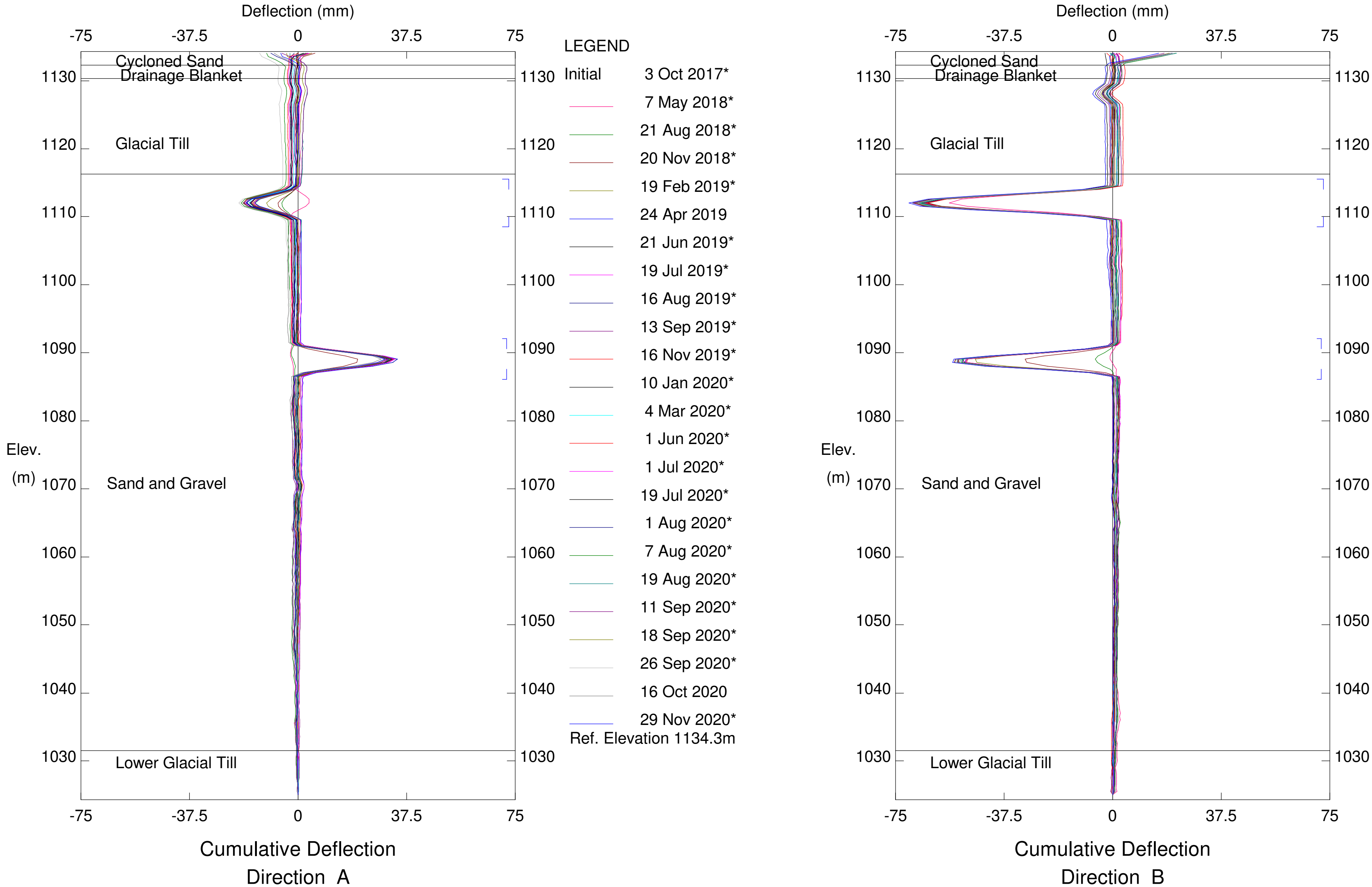


Valley Buttress Berm Extension, Inclinometer I17-08

Sets marked * include zero shift and/or rotation corrections.

I17-08.gtl

Highland Valley Copper - Logan Lake, BC

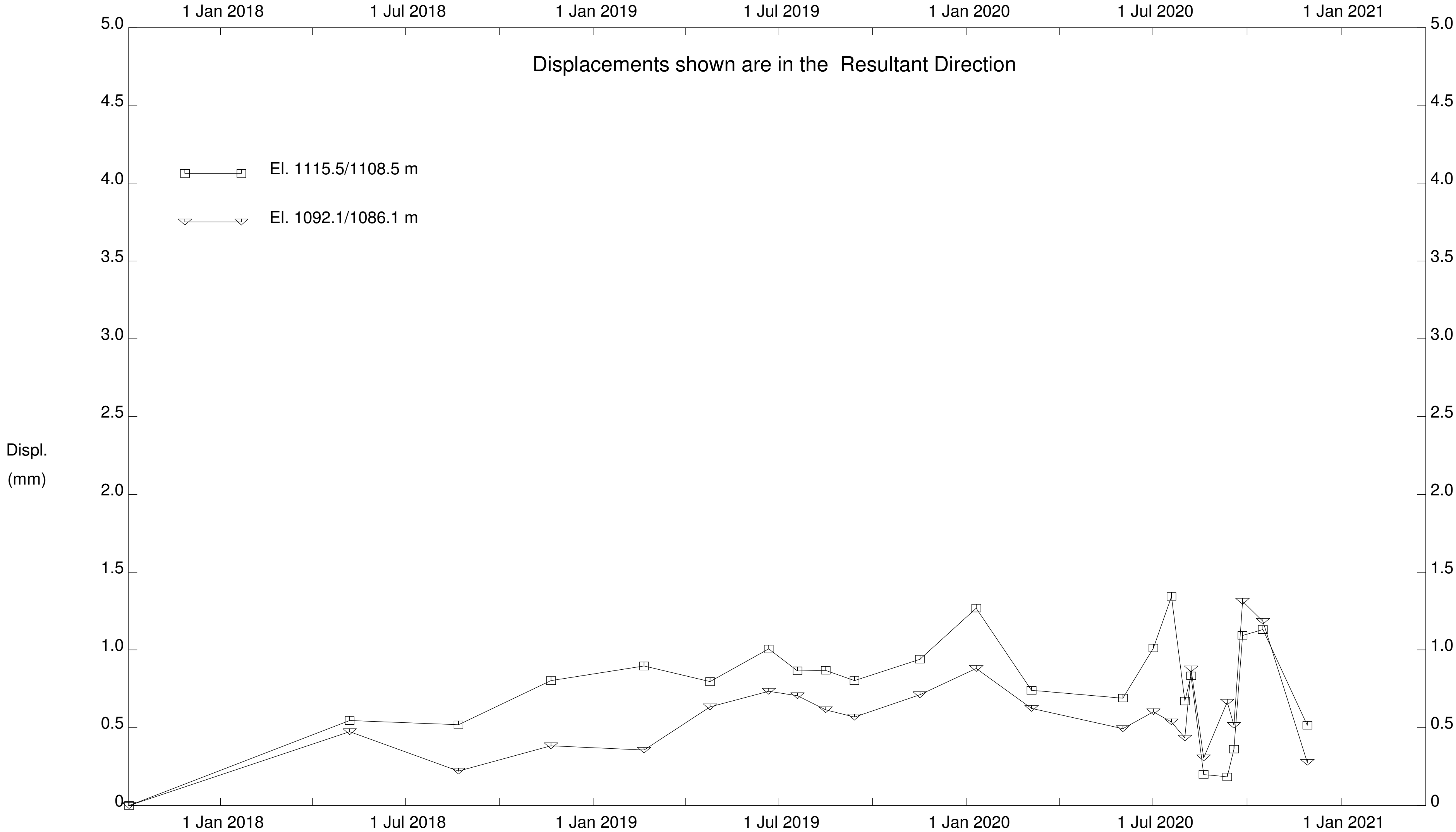


Valley Buttress Berm Extension, Inclinometer I17-08

Sets marked * include zero shift and/or rotation corrections.

I17-08.gtl

Highland Valley Copper - Logan Lake, BC

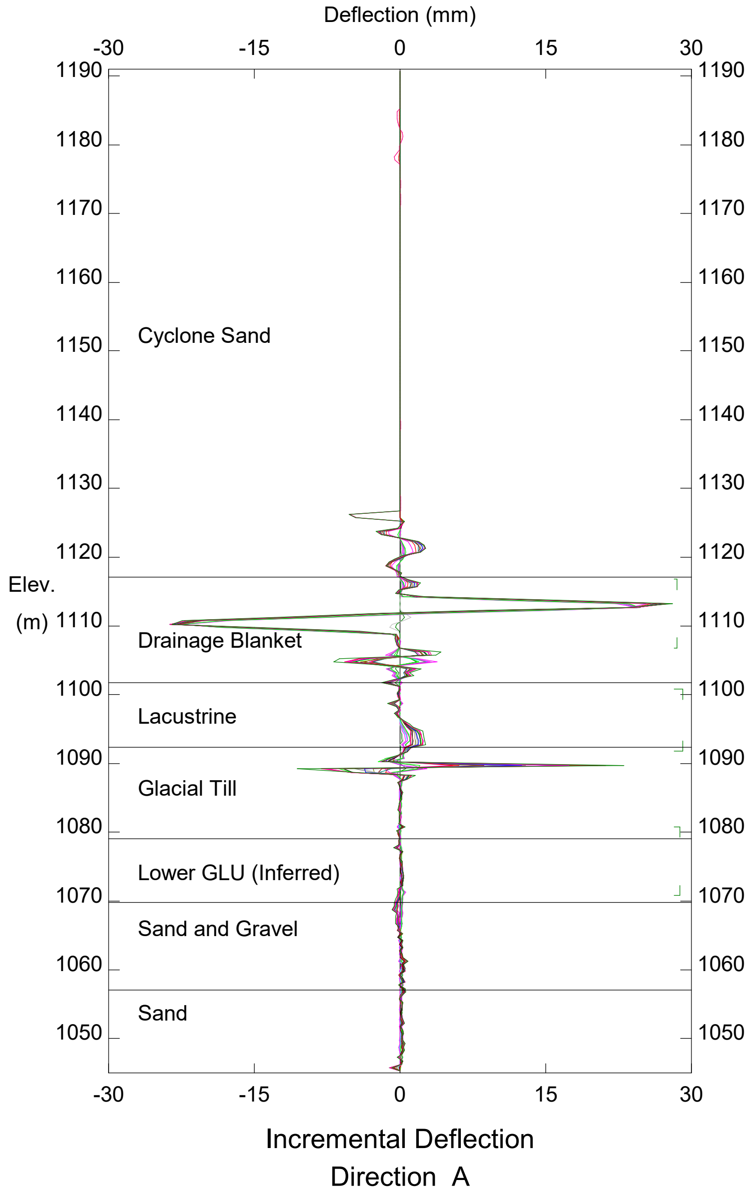


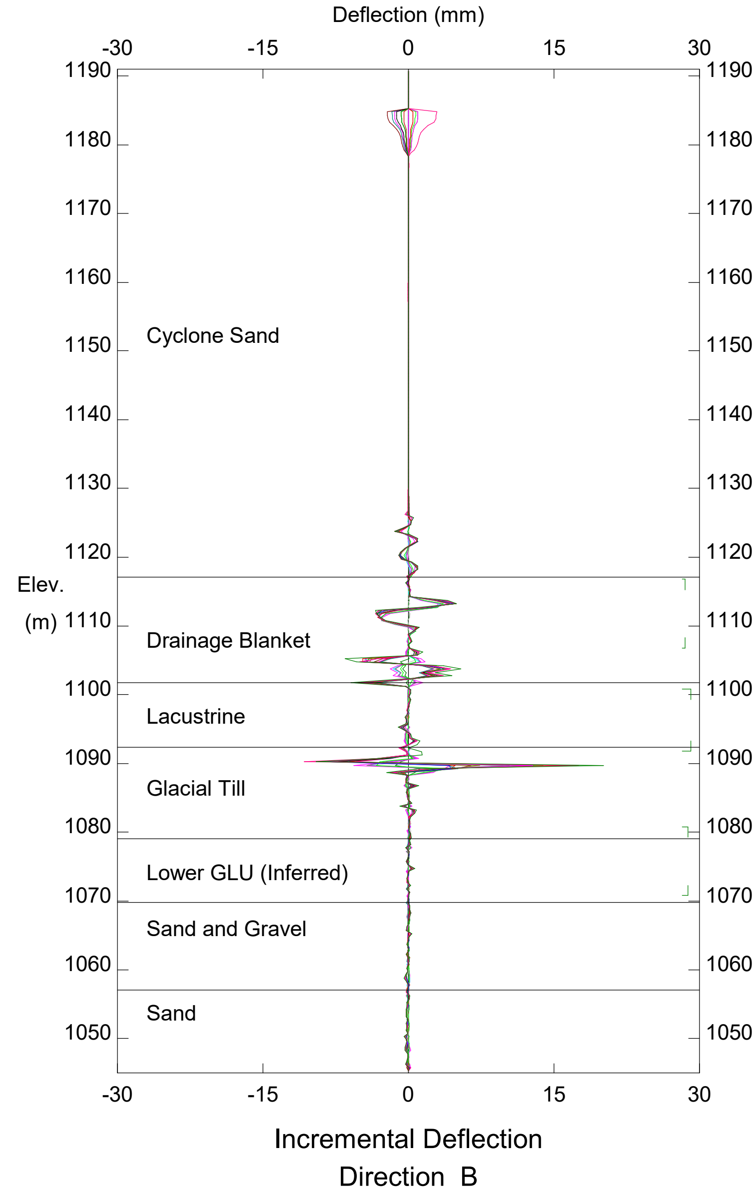
Valley Buttress Berm Extension, Inclinometer I17-08

Valley Buttress Berm

I10-07

Highland Valley Copper - Logan Lake, BC



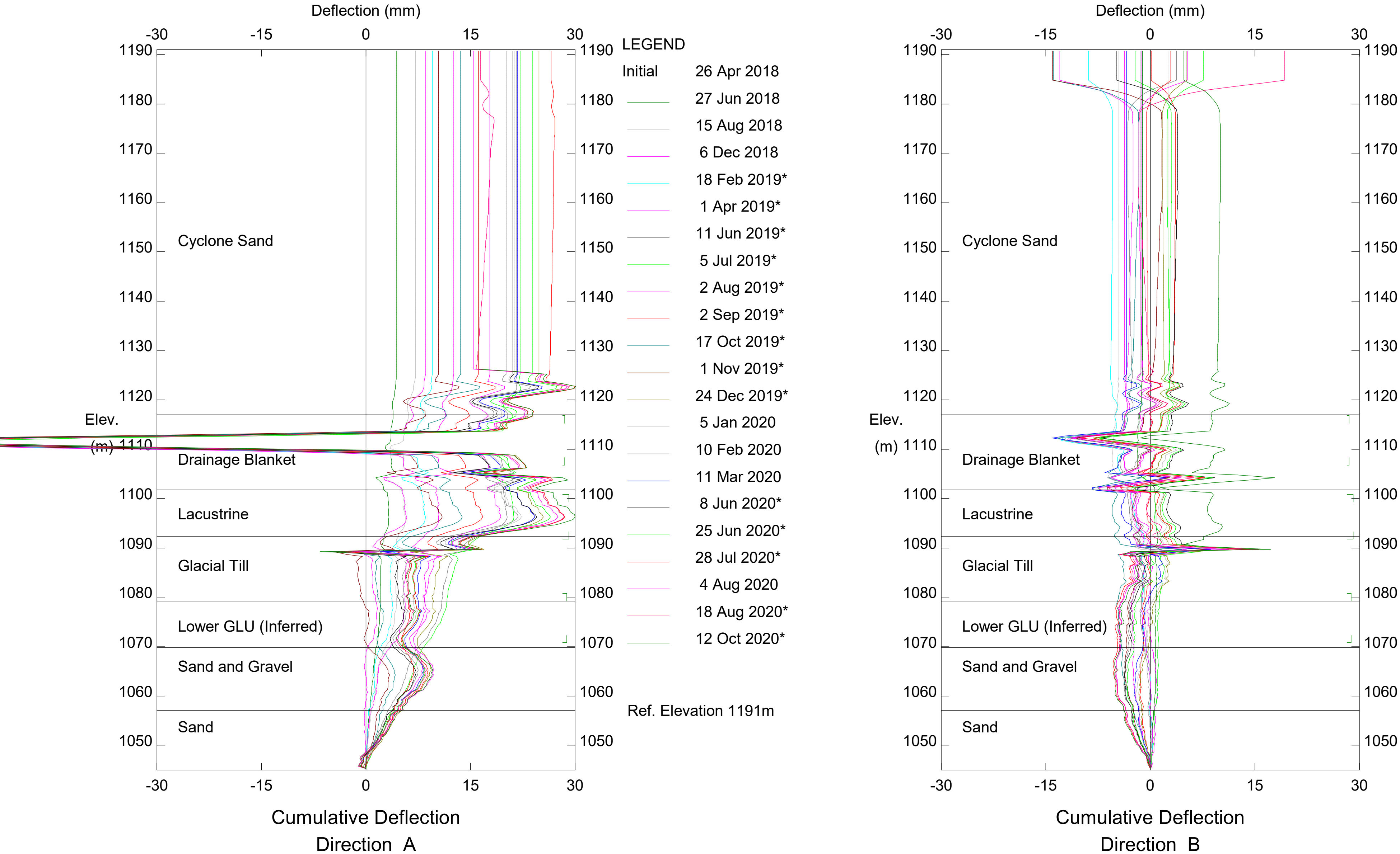


Dam Fill Excluded,,,, Inclinometer I10-7,,,

Sets marked * include zero shift and/or rotation corrections.

C:\Users\snarges\Desktop\AFPR\I10-07.gtl

Highland Valley Copper - Logan Lake, BC

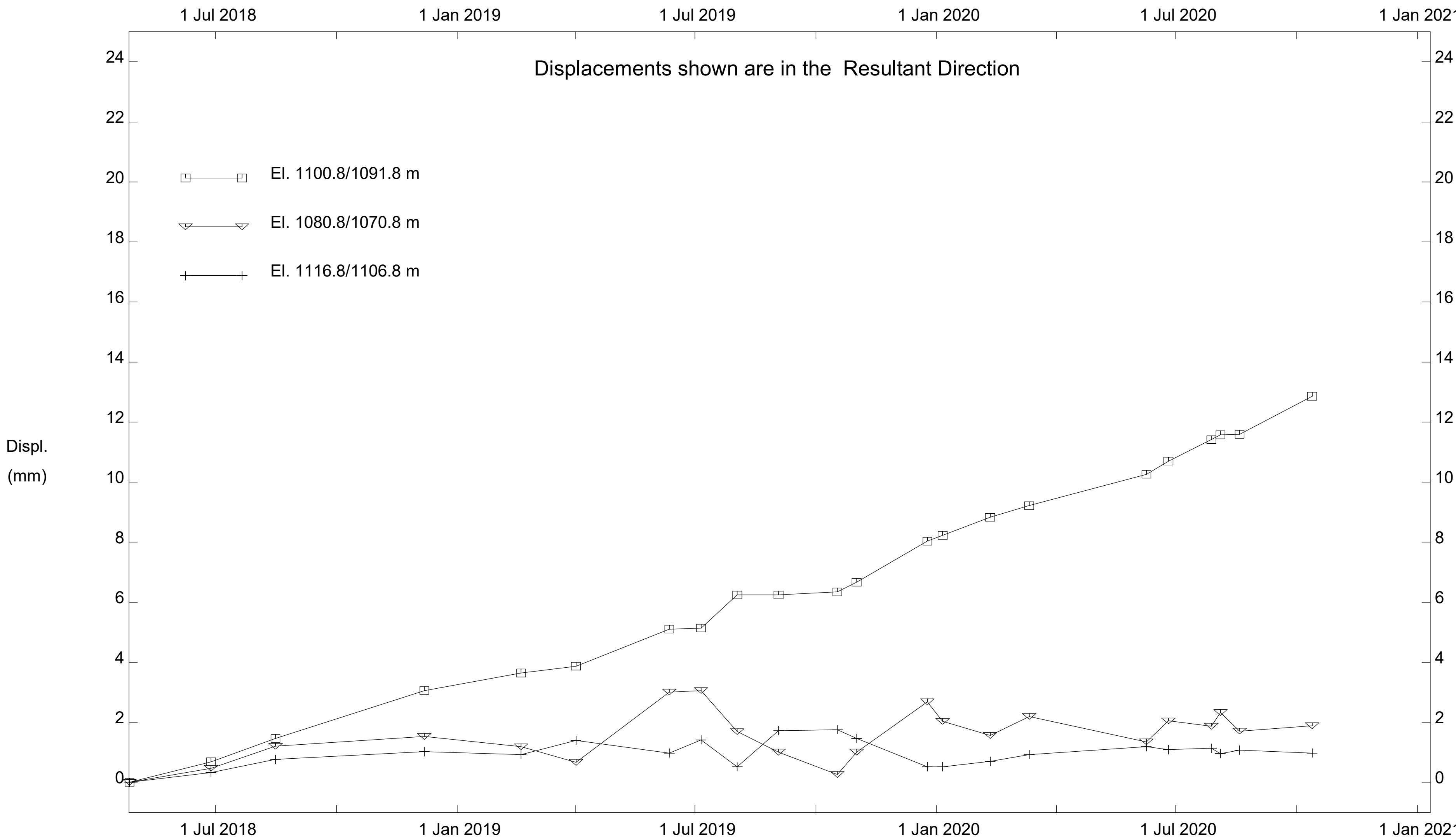


Dam Fill Excluded,,,, Inclinometer I10-7,,,

Sets marked * include zero shift and/or rotation corrections.

C:\Users\snarges\Desktop\AFPR\I10-07.gtl

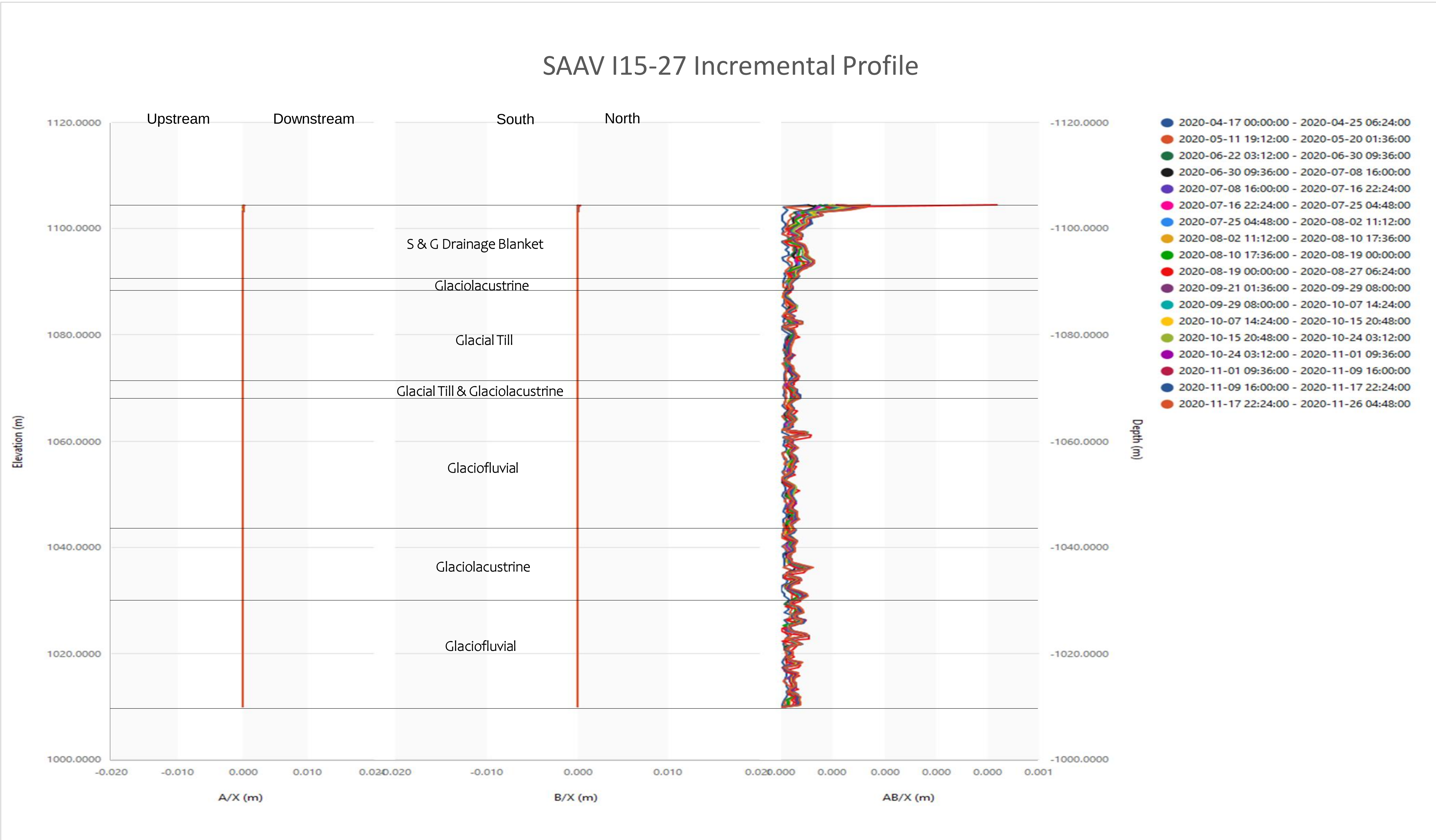
Highland Valley Copper - Logan Lake, BC

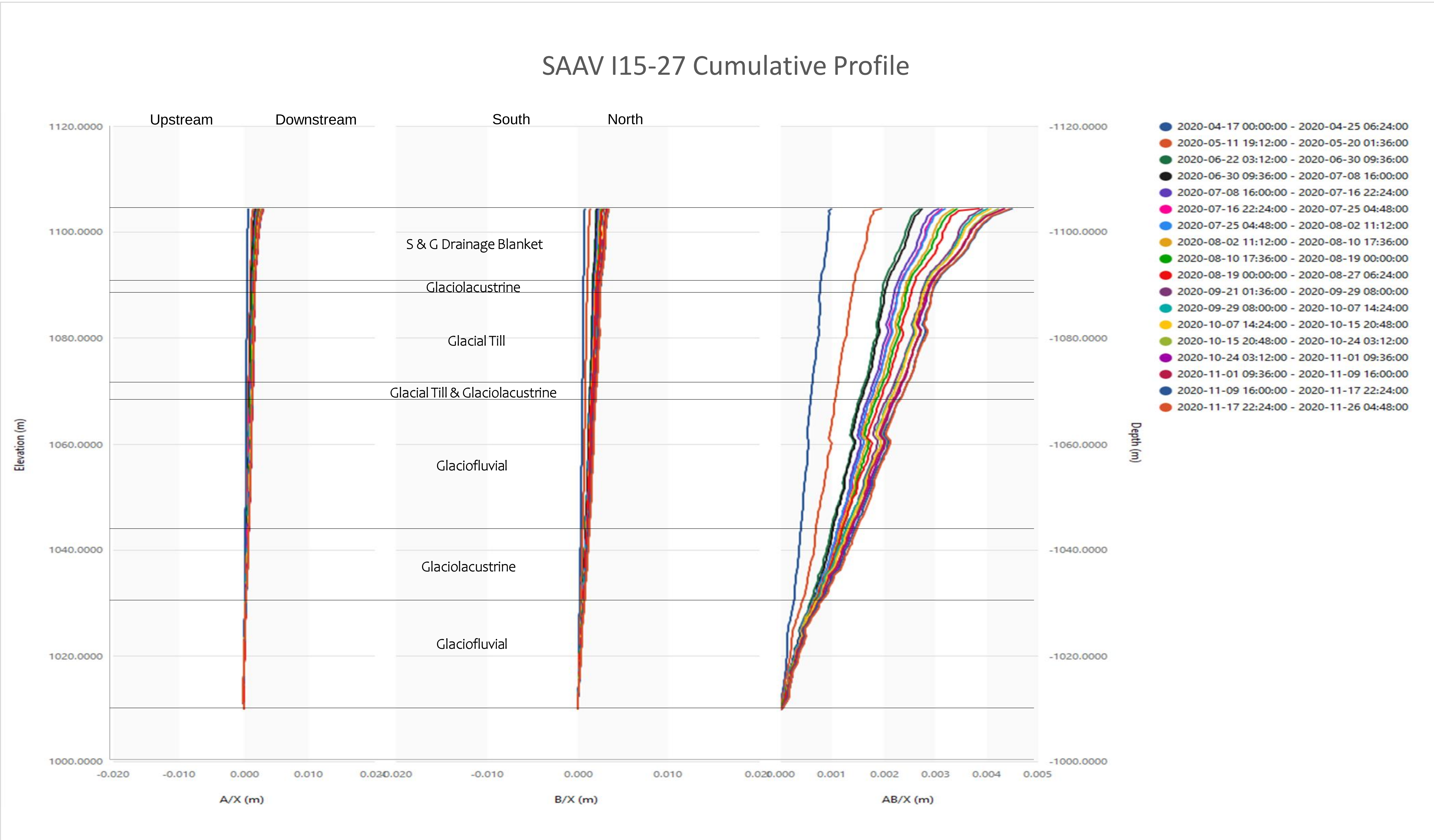


Dam Fill Excluded,,,, Inclinometer I10-7,,,

Valley Buttress Berm

IPI15-27


SAAV I15-27 Incremental Profile
Upstream
Downstream
South
North
S & G Drainage Blanket
Glaciolacustrine
Glacial Till
Glacial Till & Glaciolacustrine
Glaciofluvial
Glaciolacustrine
Glaciofluvial
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2020-04-17 00:00:00 - 2020-04-25 06:24:00
2020-05-11 19:12:00 - 2020-05-20 01:36:00
2020-06-22 03:12:00 - 2020-06-30 09:36:00
2020-06-30 09:36:00 - 2020-07-08 16:00:00
2020-07-08 16:00:00 - 2020-07-16 22:24:00
2020-07-16 22:24:00 - 2020-07-25 04:48:00
2020-07-25 04:48:00 - 2020-08-02 11:12:00
2020-08-02 11:12:00 - 2020-08-10 17:36:00
2020-08-10 17:36:00 - 2020-08-19 00:00:00
2020-08-19 00:00:00 - 2020-08-27 06:24:00
2020-09-21 01:36:00 - 2020-09-29 08:00:00
2020-09-29 08:00:00 - 2020-10-07 14:24:00
2020-10-07 14:24:00 - 2020-10-15 20:48:00
2020-10-15 20:48:00 - 2020-10-24 03:12:00
2020-10-24 03:12:00 - 2020-11-01 09:36:00
2020-11-01 09:36:00 - 2020-11-09 16:00:00
2020-11-09 16:00:00 - 2020-11-17 22:24:00
2020-11-17 22:24:00 - 2020-11-26 04:48:00



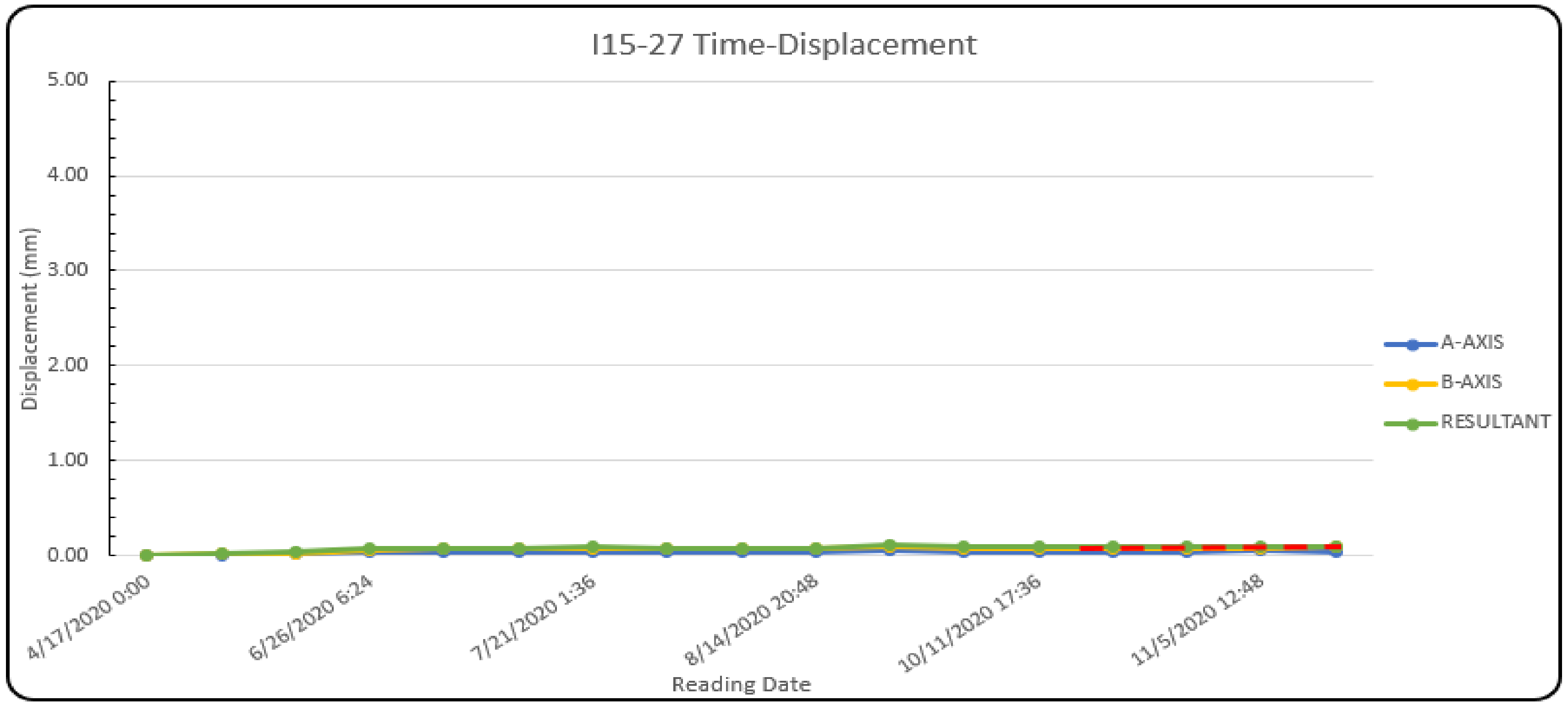
SAAV I15-27 Cumulative Profile
Upstream
Downstream
South
North
S & G Drainage Blanket
Glaciolacustrine
Glacial Till
Glacial Till & Glaciolacustrine
Glaciofluvial
Glaciolacustrine
Glaciofluvial
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2020-04-17 00:00:00 - 2020-04-25 06:24:00
2020-05-11 19:12:00 - 2020-05-20 01:36:00
2020-06-22 03:12:00 - 2020-06-30 09:36:00
2020-06-30 09:36:00 - 2020-07-08 16:00:00
2020-07-08 16:00:00 - 2020-07-16 22:24:00
2020-07-16 22:24:00 - 2020-07-25 04:48:00
2020-07-25 04:48:00 - 2020-08-02 11:12:00
2020-08-02 11:12:00 - 2020-08-10 17:36:00
2020-08-10 17:36:00 - 2020-08-19 00:00:00
2020-08-19 00:00:00 - 2020-08-27 06:24:00
2020-09-21 01:36:00 - 2020-09-29 08:00:00
2020-09-29 08:00:00 - 2020-10-07 14:24:00
2020-10-07 14:24:00 - 2020-10-15 20:48:00
2020-10-15 20:48:00 - 2020-10-24 03:12:00
2020-10-24 03:12:00 - 2020-11-01 09:36:00
2020-11-01 09:36:00 - 2020-11-09 16:00:00
2020-11-09 16:00:00 - 2020-11-17 22:24:00
2020-11-17 22:24:00 - 2020-11-26 04:48:00

SAAV I15-27

Displacement Plot – Middle Glaciolacustrine

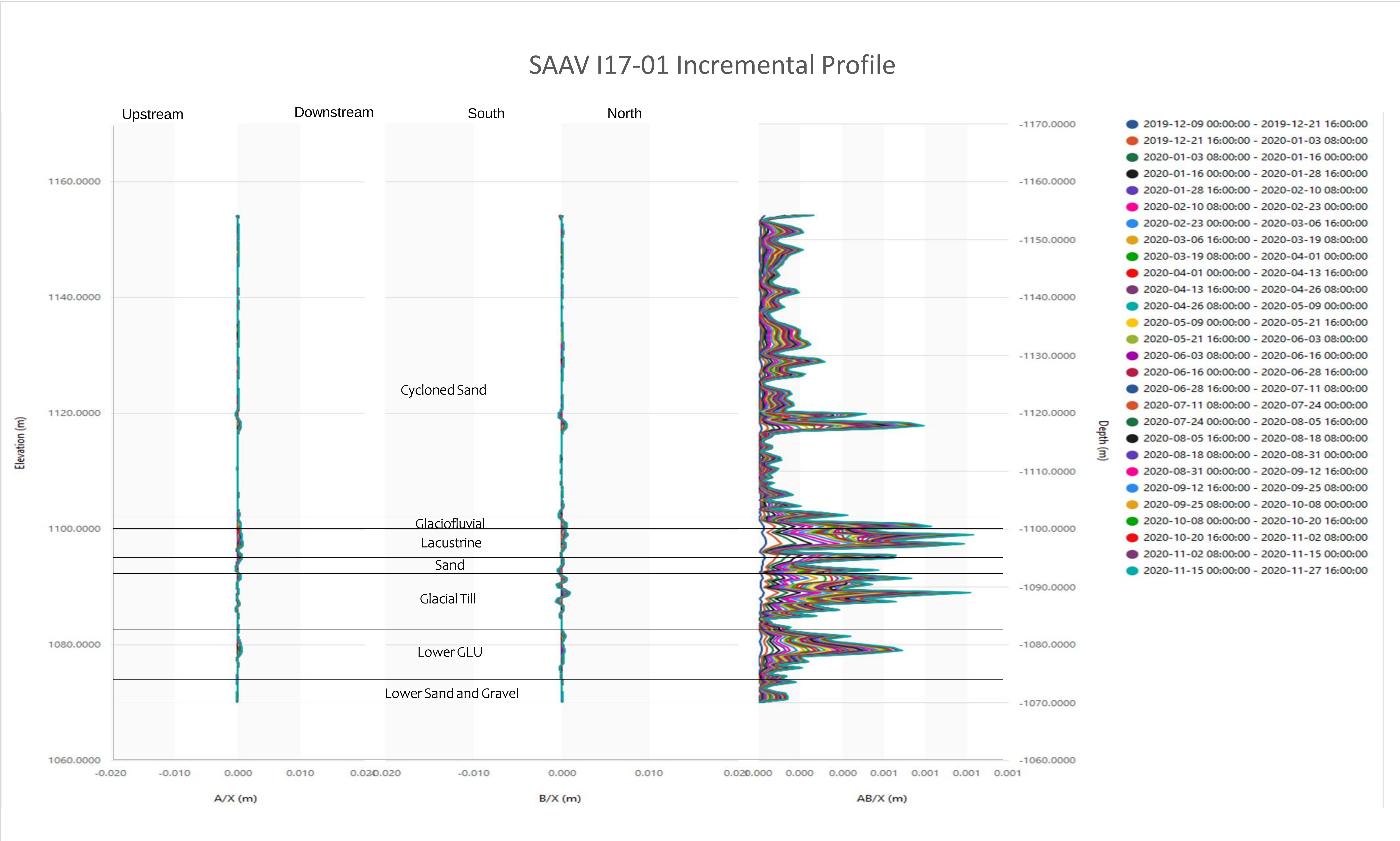
Unit	Upper El. (m)	Lower El. (m)
Upper Glaciolacustrine	1092.8	1088.8
Middle Glaciolacustrine	1071.8	1069.8
Lower Glaciolacustrine	1033.1	1025.6

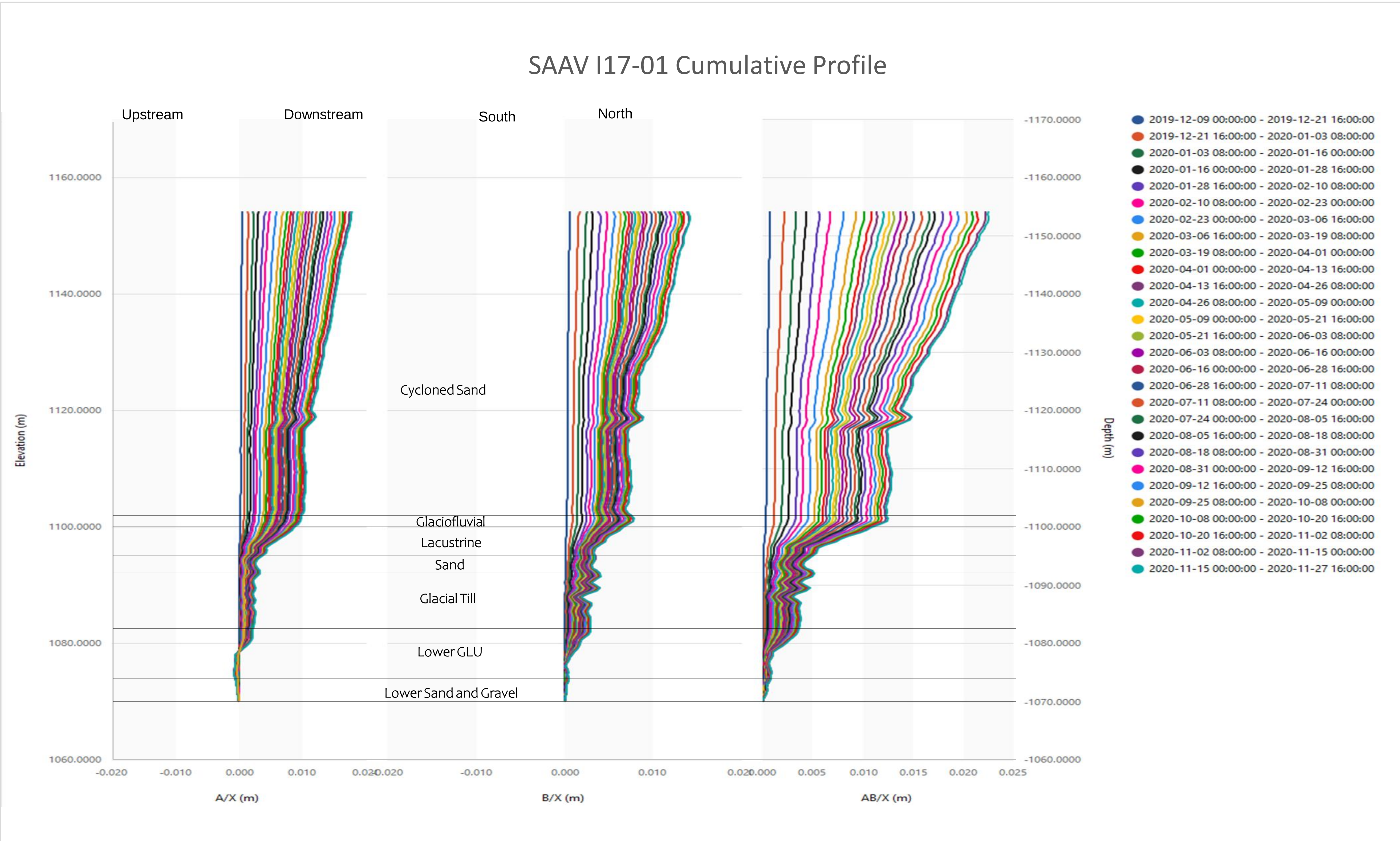
Upper El. (m)	1071.8
Lower El. (m)	1069.8



Valley Buttress Berm

I17-01


SAAV I17-01 Incremental Profile
Upstream
Downstream
South
North
Elevation (m)
Depth (m)
Cycloned Sand
Glaciofluvial
Lacustrine
Sand
Glacial Till
Lower GLU
Lower Sand and Gravel
A/X (m)
B/X (m)
AB/X (m)
2019-12-09 00:00:00 - 2019-12-21 16:00:00
2019-12-21 16:00:00 - 2020-01-03 08:00:00
2020-01-03 08:00:00 - 2020-01-16 00:00:00
2020-01-16 00:00:00 - 2020-01-28 16:00:00
2020-01-28 16:00:00 - 2020-02-10 08:00:00
2020-02-10 08:00:00 - 2020-02-23 00:00:00
2020-02-23 00:00:00 - 2020-03-06 16:00:00
2020-03-06 16:00:00 - 2020-03-19 08:00:00
2020-03-19 08:00:00 - 2020-04-01 00:00:00
2020-04-01 00:00:00 - 2020-04-13 16:00:00
2020-04-13 16:00:00 - 2020-04-26 08:00:00
2020-04-26 08:00:00 - 2020-05-09 00:00:00
2020-05-09 00:00:00 - 2020-05-21 16:00:00
2020-05-21 16:00:00 - 2020-06-03 08:00:00
2020-06-03 08:00:00 - 2020-06-16 00:00:00
2020-06-16 00:00:00 - 2020-06-28 16:00:00
2020-06-28 16:00:00 - 2020-07-11 08:00:00
2020-07-11 08:00:00 - 2020-07-24 00:00:00
2020-07-24 00:00:00 - 2020-08-05 16:00:00
2020-08-05 16:00:00 - 2020-08-18 08:00:00
2020-08-18 08:00:00 - 2020-08-31 00:00:00
2020-08-31 00:00:00 - 2020-09-12 16:00:00
2020-09-12 16:00:00 - 2020-09-25 08:00:00
2020-09-25 08:00:00 - 2020-10-08 00:00:00
2020-10-08 00:00:00 - 2020-10-20 16:00:00
2020-10-20 16:00:00 - 2020-11-02 08:00:00
2020-11-02 08:00:00 - 2020-11-15 00:00:00
2020-11-15 00:00:00 - 2020-11-27 16:00:00

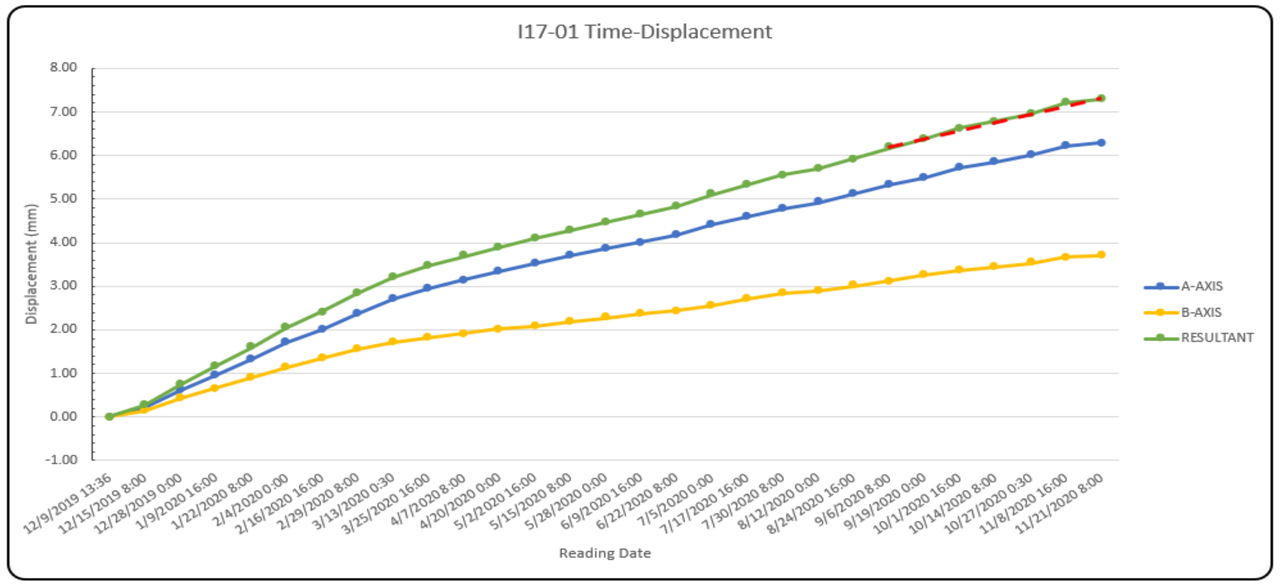

SAAV I17-01 Cumulative Profile
Upstream
Downstream
South
North
Cycloned Sand
Glaciofluvial
Lacustrine
Sand
Glacial Till
Lower GLU
Lower Sand and Gravel
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2019-12-09 00:00:00 - 2019-12-21 16:00:00
2019-12-21 16:00:00 - 2020-01-03 08:00:00
2020-01-03 08:00:00 - 2020-01-16 00:00:00
2020-01-16 00:00:00 - 2020-01-28 16:00:00
2020-01-28 16:00:00 - 2020-02-10 08:00:00
2020-02-10 08:00:00 - 2020-02-23 00:00:00
2020-02-23 00:00:00 - 2020-03-06 16:00:00
2020-03-06 16:00:00 - 2020-03-19 08:00:00
2020-03-19 08:00:00 - 2020-04-01 00:00:00
2020-04-01 00:00:00 - 2020-04-13 16:00:00
2020-04-13 16:00:00 - 2020-04-26 08:00:00
2020-04-26 08:00:00 - 2020-05-09 00:00:00
2020-05-09 00:00:00 - 2020-05-21 16:00:00
2020-05-21 16:00:00 - 2020-06-03 08:00:00
2020-06-03 08:00:00 - 2020-06-16 00:00:00
2020-06-16 00:00:00 - 2020-06-28 16:00:00
2020-06-28 16:00:00 - 2020-07-11 08:00:00
2020-07-11 08:00:00 - 2020-07-24 00:00:00
2020-07-24 00:00:00 - 2020-08-05 16:00:00
2020-08-05 16:00:00 - 2020-08-18 08:00:00
2020-08-18 08:00:00 - 2020-08-31 00:00:00
2020-08-31 00:00:00 - 2020-09-12 16:00:00
2020-09-12 16:00:00 - 2020-09-25 08:00:00
2020-09-25 08:00:00 - 2020-10-08 00:00:00
2020-10-08 00:00:00 - 2020-10-20 16:00:00
2020-10-20 16:00:00 - 2020-11-02 08:00:00
2020-11-02 08:00:00 - 2020-11-15 00:00:00
2020-11-15 00:00:00 - 2020-11-27 16:00:00

SAAV I17-01

Displacement Plot - Lacustrine

Unit	Upper El. (m)	Lower El. (m)
Lacustrine	1100.5	1094.5
Lower GLU	1082.5	1073.5

Upper El. (m)	1100.5
Lower El. (m)	1094.5

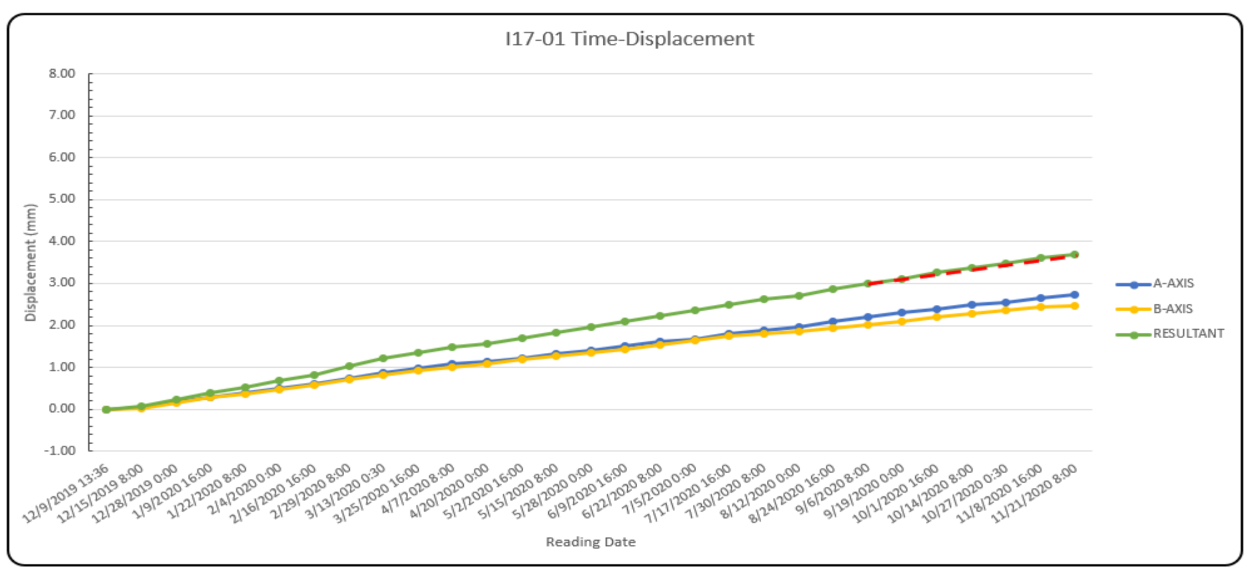


SAAV I17-01

Displacement Plot - Lower GLU

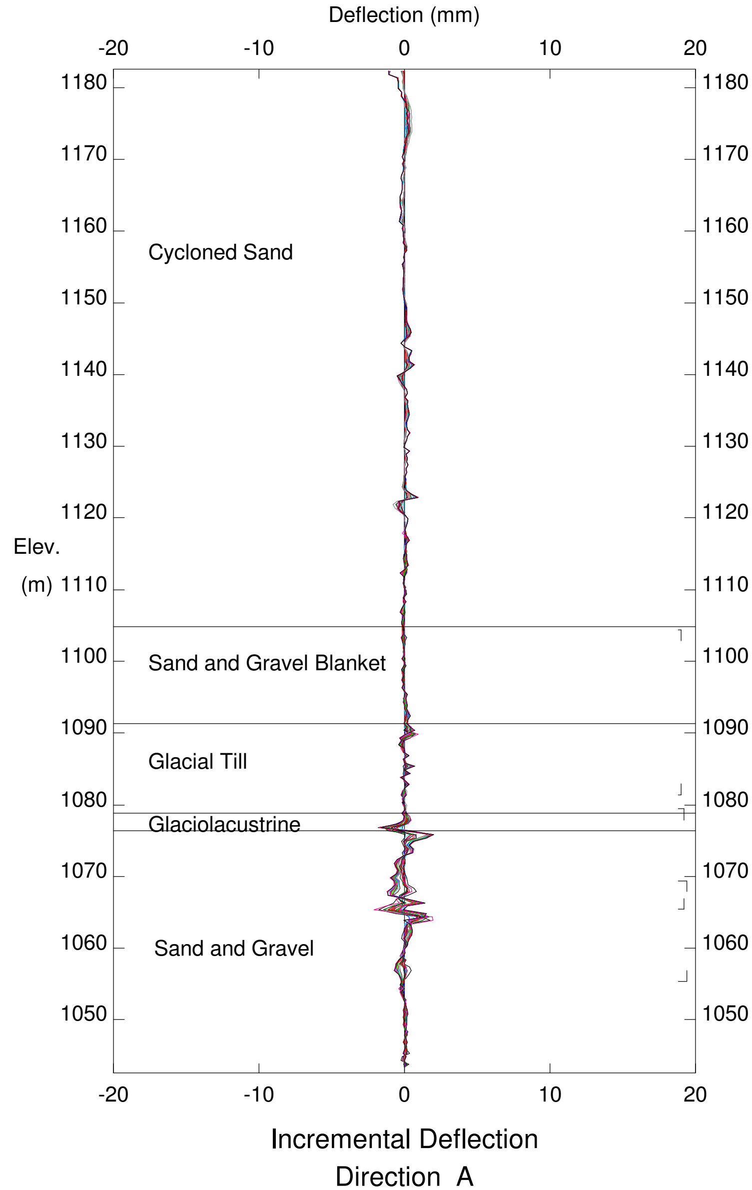
Unit	Upper El. (m)	Lower El. (m)
Lacustrine	1100.5	1094.5
Lower GLU	1082.5	1073.5

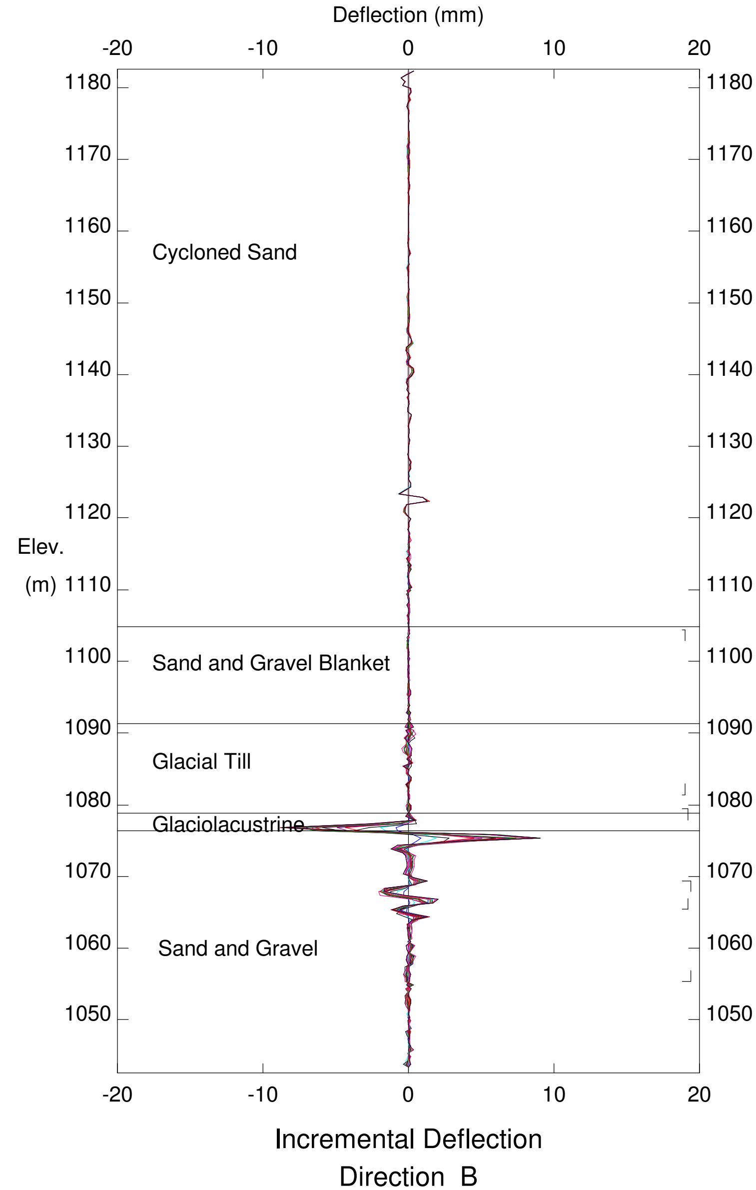
Upper El. (m)	1082.5
Lower El. (m)	1073.5



Valley Buttress Berm
I17-02

Highland Valley Copper - Logan Lake, BC



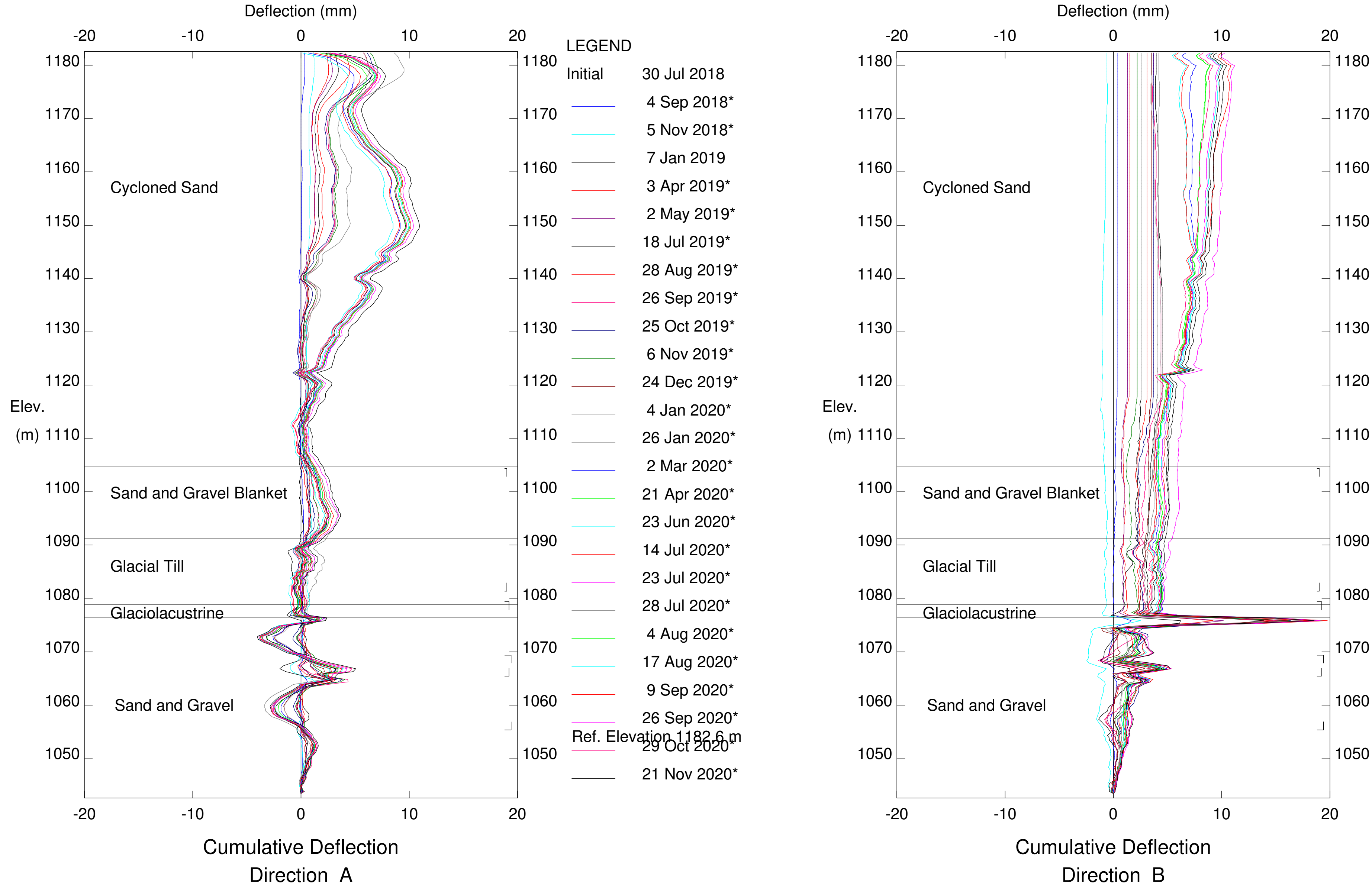


Dam Fill Excluded,,,, Inclinometer I17-02,,

Sets marked * include zero shift and/or rotation corrections.

I17-02.gtl

Highland Valley Copper - Logan Lake, BC

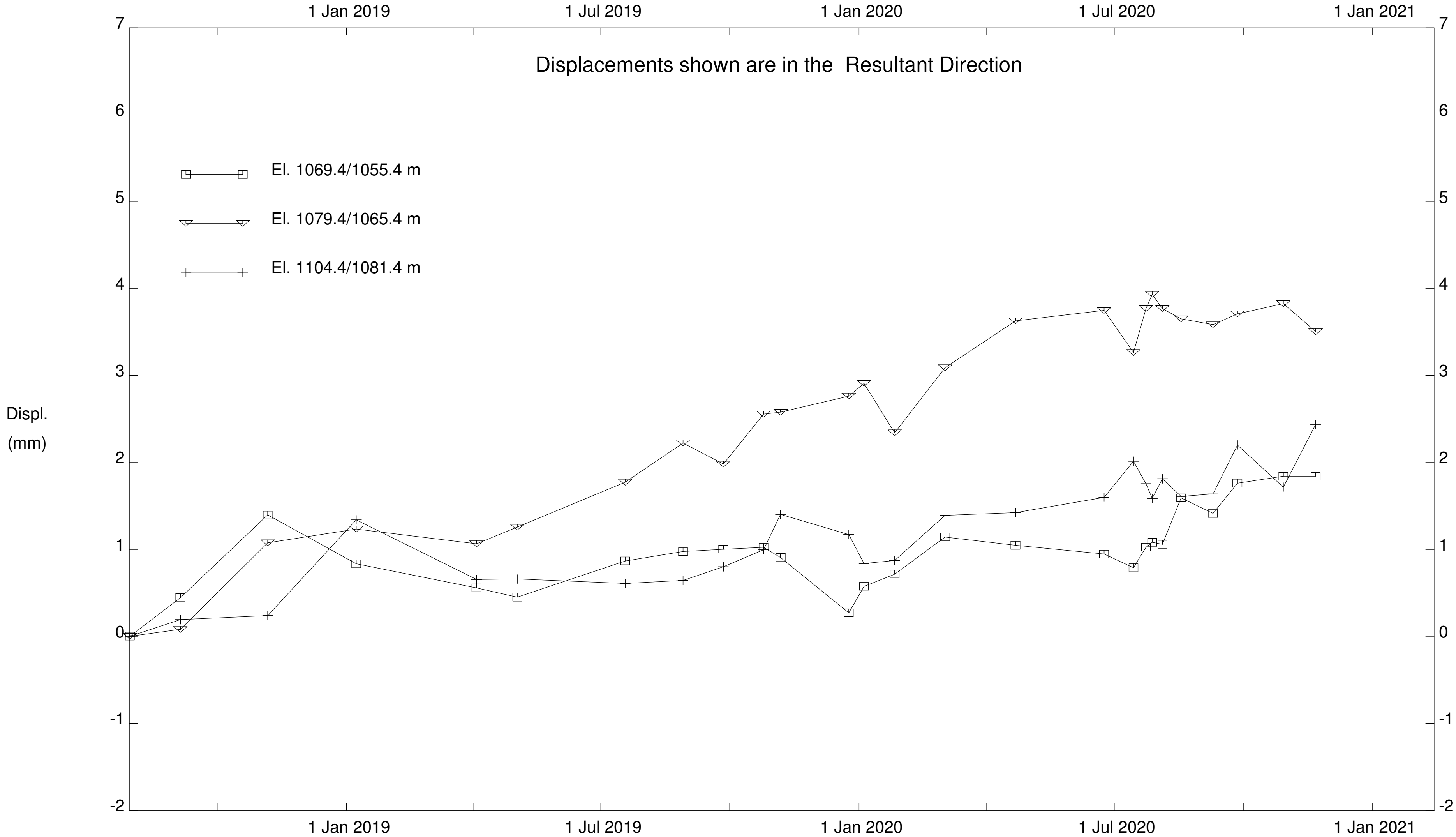


Dam Fill Excluded,,,, Inclinometer I17-02,,

Sets marked * include zero shift and/or rotation corrections.

I17-02.gtl

Highland Valley Copper - Logan Lake, BC

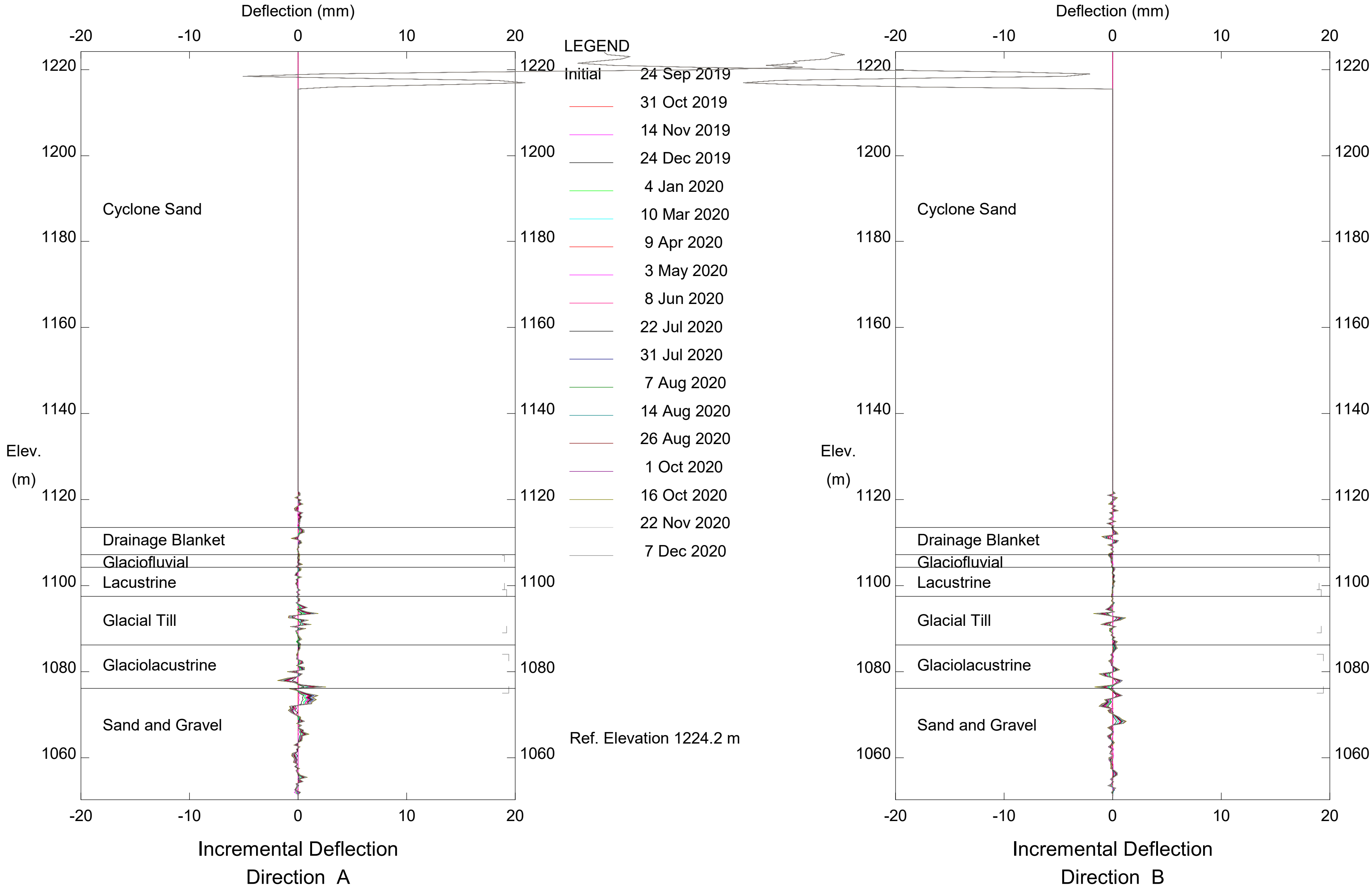


Dam Fill Excluded,,,, Inclinometer I17-02,,,

Valley Buttress Berm

I17-06

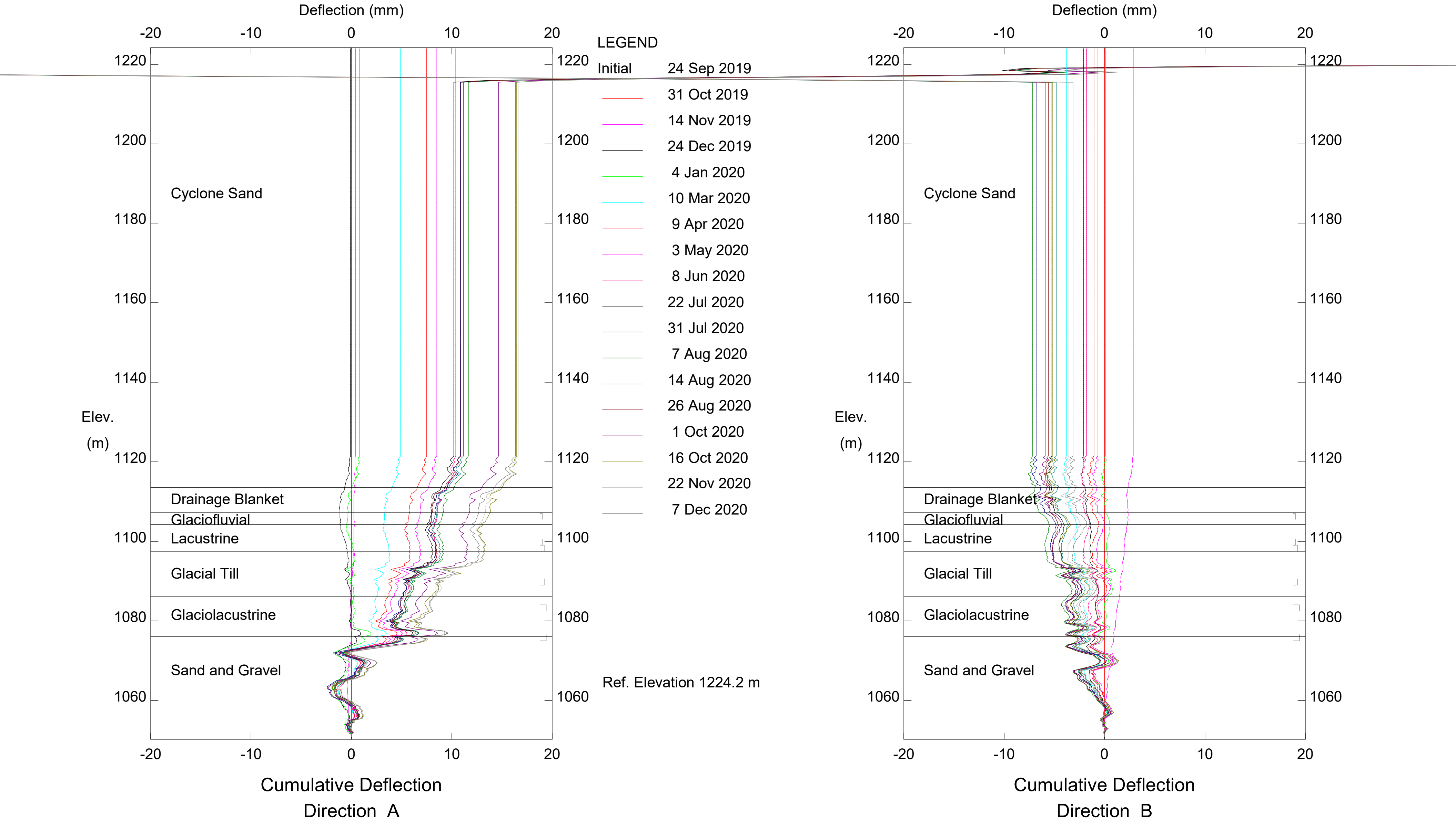
Highland Valley Copper - Logan Lake, BC



Dam Fill Excluded,,,, Inclinometer I17-06,,

C:\Users\snarges\Desktop\AFPR\I17-06 - No RC.gtl

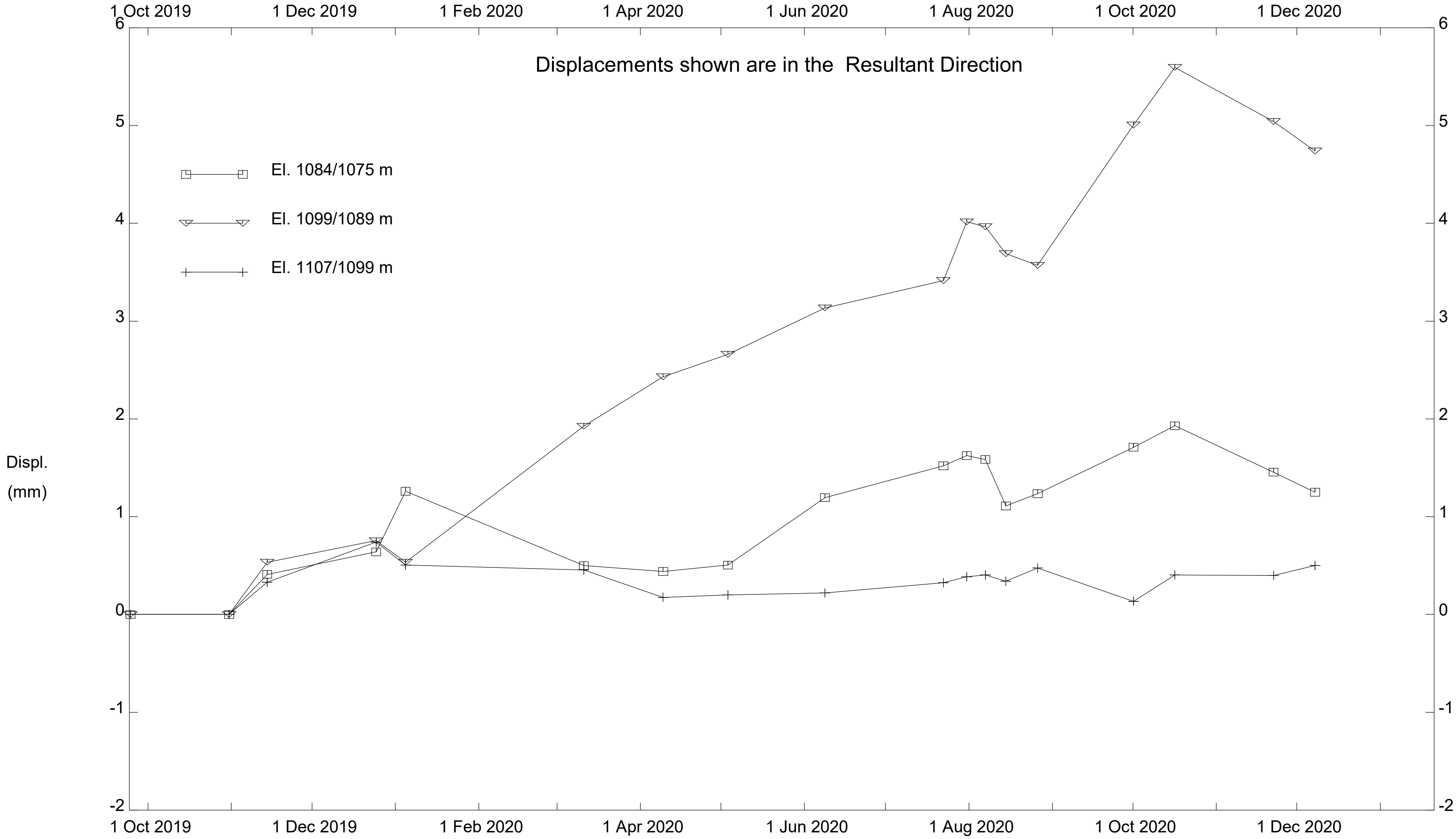
Highland Valley Copper - Logan Lake, BC



Dam Fill Excluded,,,, Inclinometer I17-06,,,

C:\Users\snarges\Desktop\AFPR\I17-06 - No RC.gtl

Highland Valley Copper - Logan Lake, BC

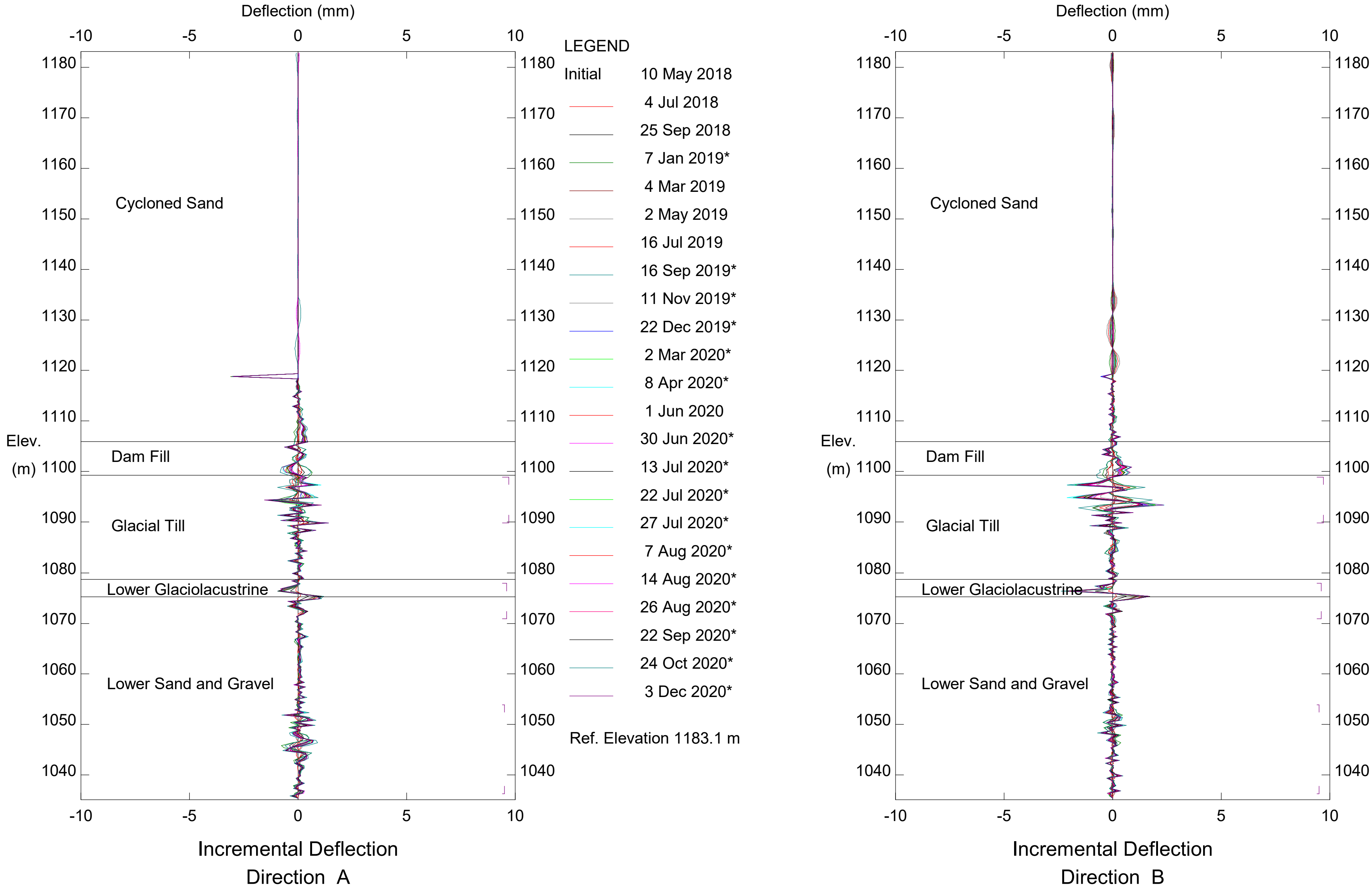


Dam Fill Excluded,,,, Inclinometer I17-06,,,

Valley Buttress Berm

I17-09

Highland Valley Copper - Logan Lake, BC

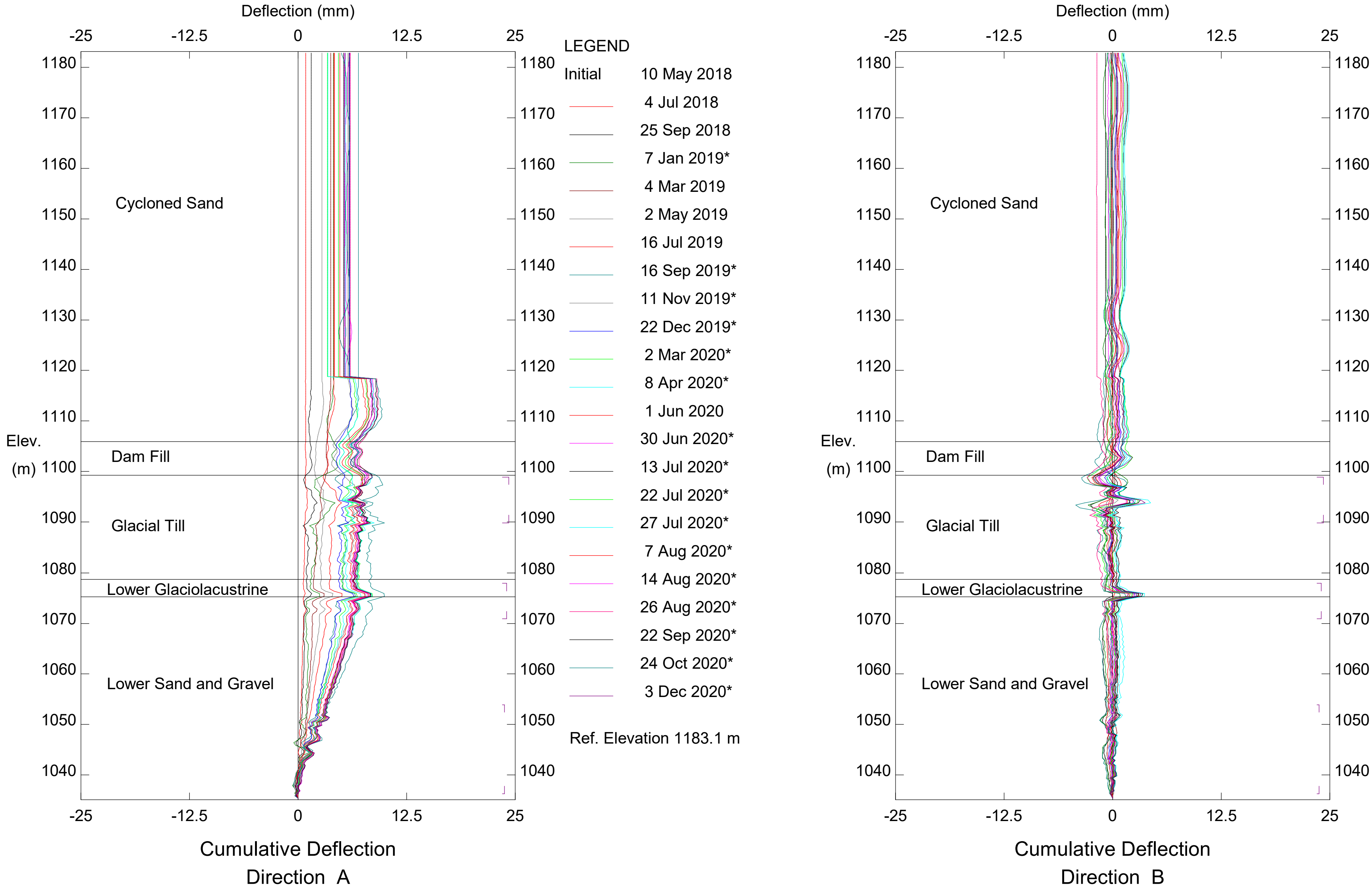


LL Dam, Inclinometer I17-9

Sets marked * include zero shift and/or rotation corrections.

C:\Users\snarges\Desktop\AFPR\I17-09.gtl

Highland Valley Copper - Logan Lake, BC

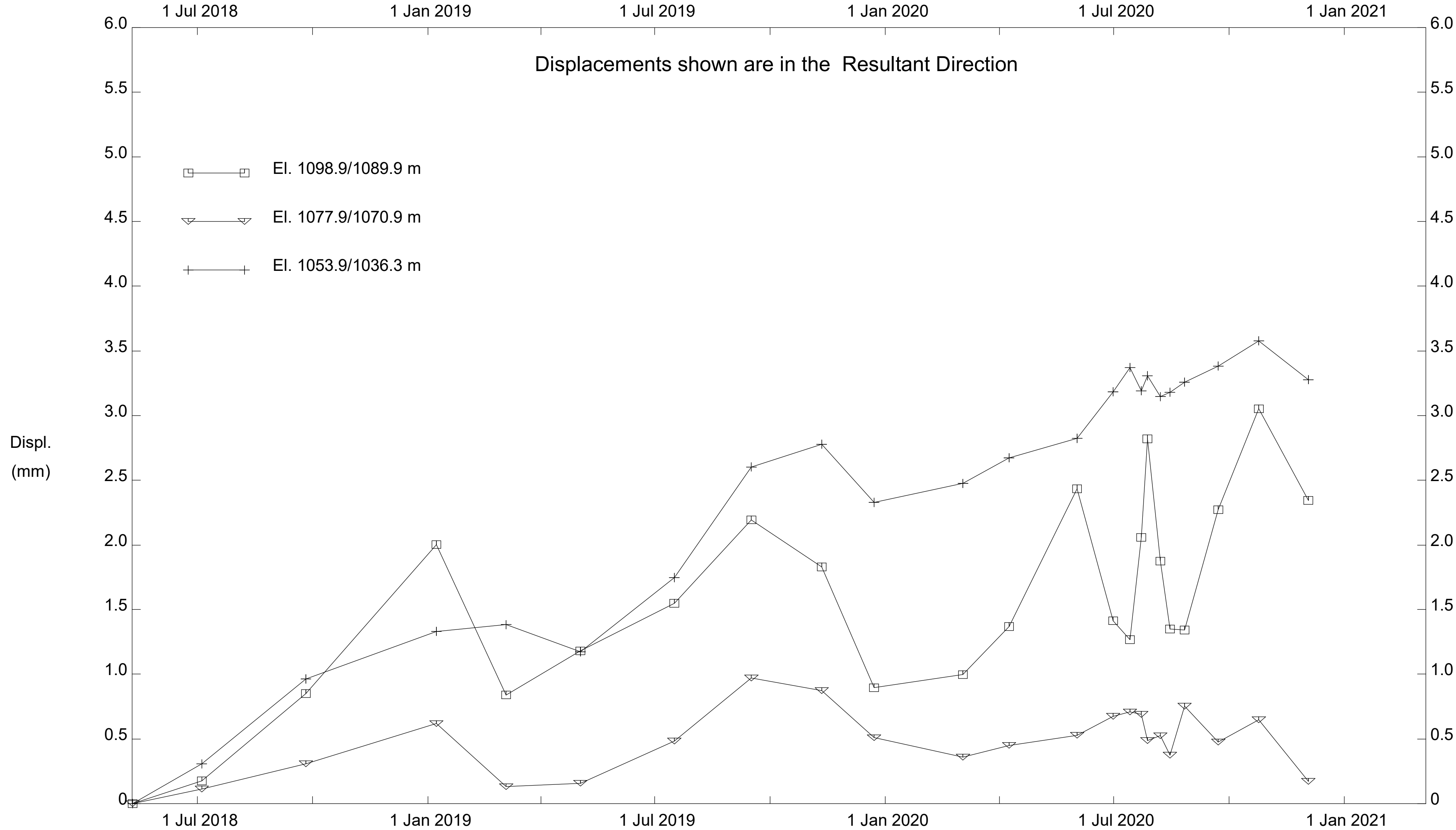


LL Dam, Inclinometer I17-9

Sets marked * include zero shift and/or rotation corrections.

C:\Users\snarges\Desktop\AFPR\I17-09.gtl

Highland Valley Copper - Logan Lake, BC

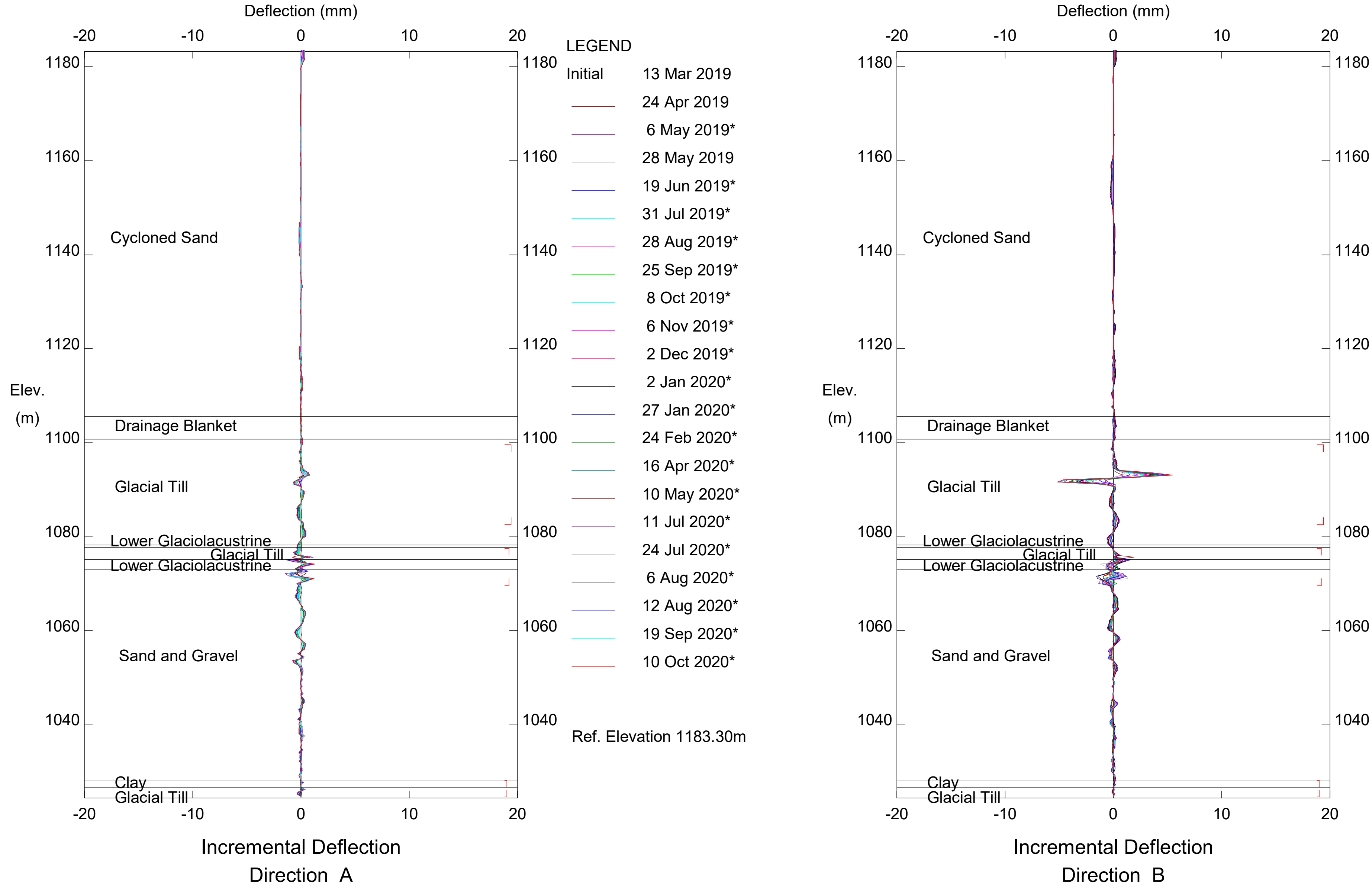


LL Dam, Inclinometer I17-9

Valley Buttress Berm

SAAV I17-10

Highland Valley Copper - Logan Lake, BC

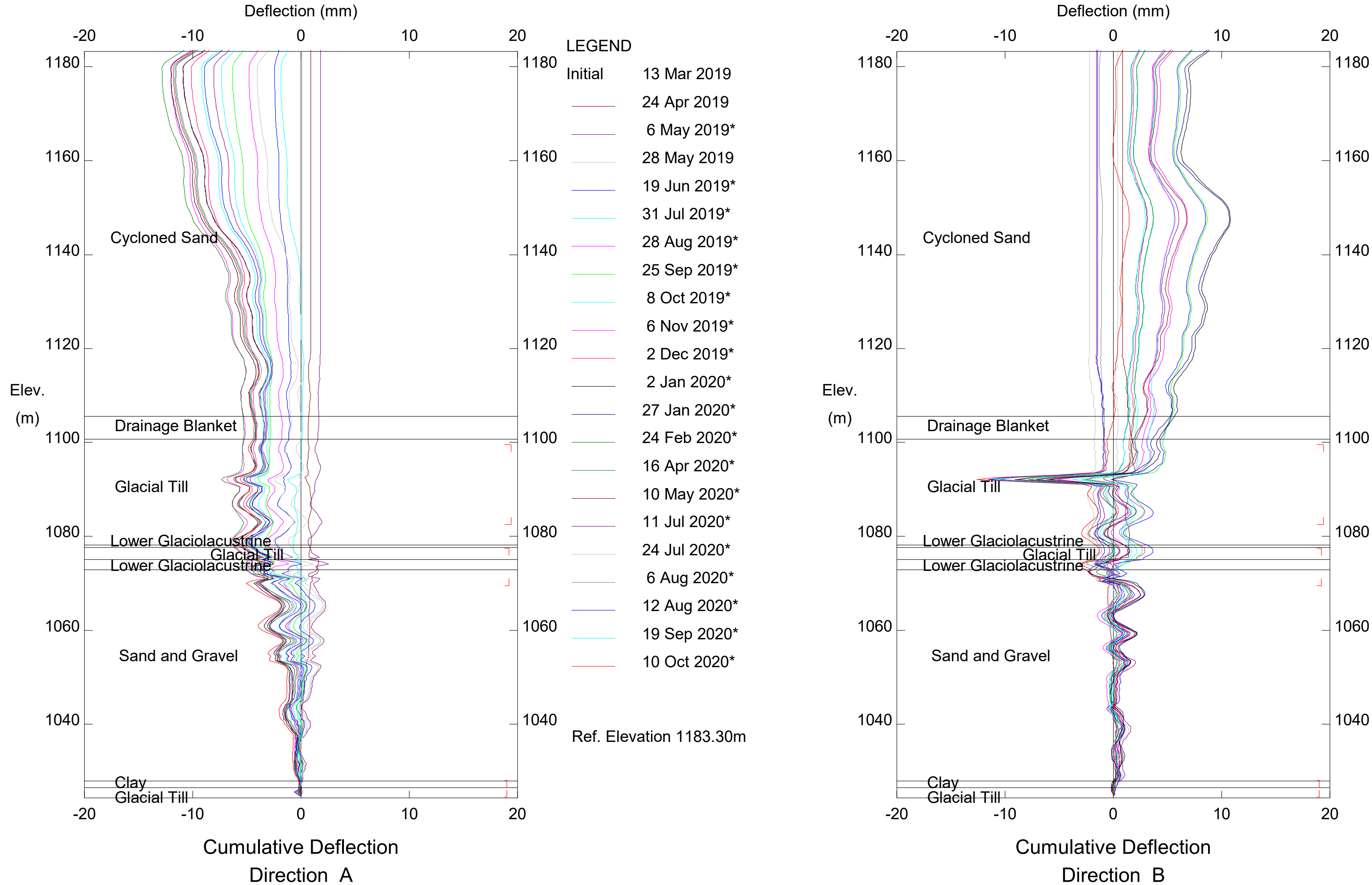


Valley Buttress Berm, Inclinometer I17-10

Sets marked * include zero shift and/or rotation corrections.

C:\Users\snarges\Desktop\AFPR\I17-10.gtl

Highland Valley Copper - Logan Lake, BC

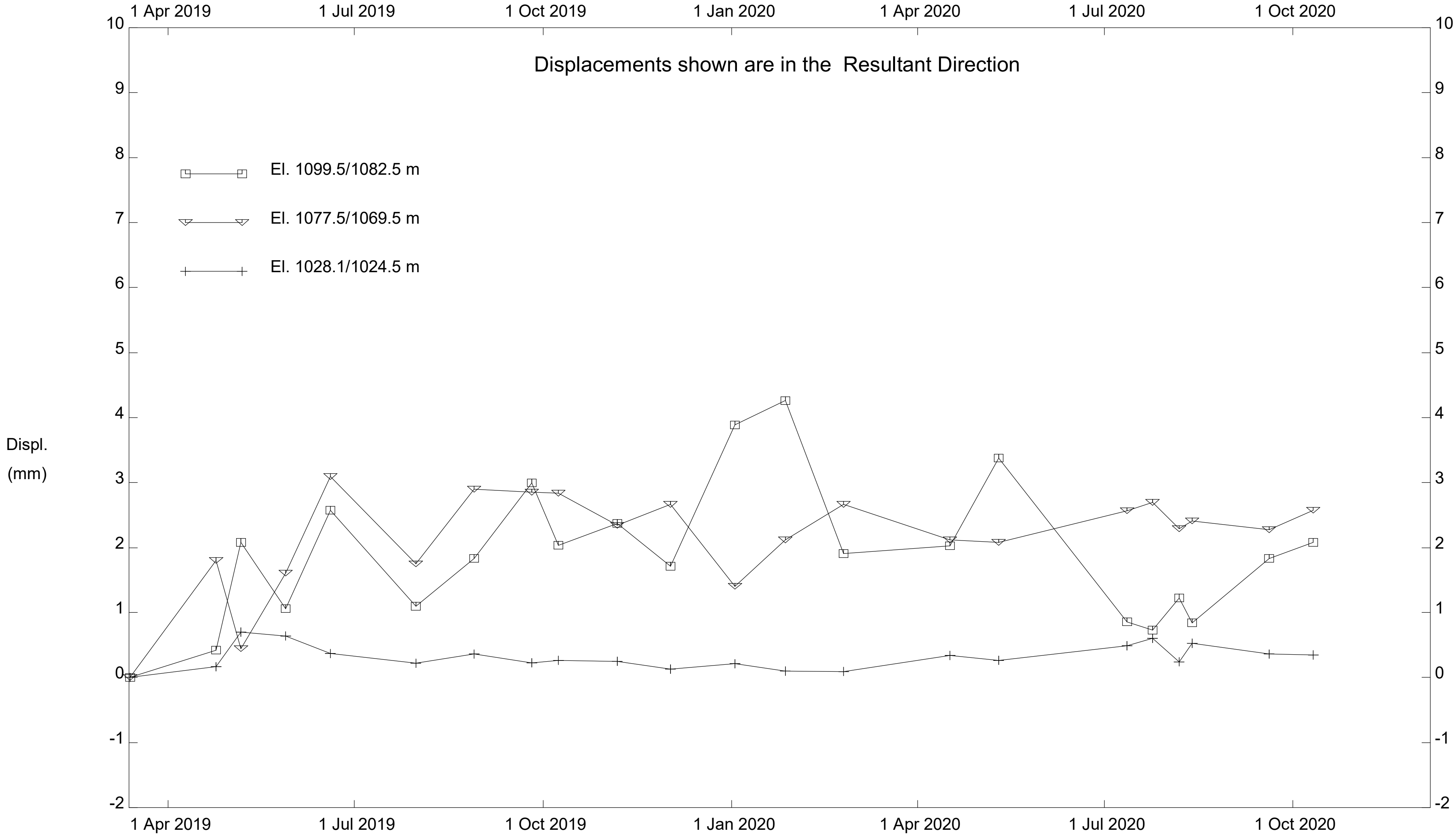


Valley Buttress Berm, Inclinometer I17-10

Sets marked * include zero shift and/or rotation corrections.

C:\Users\snarges\Desktop\AFPR\I17-10.gtl

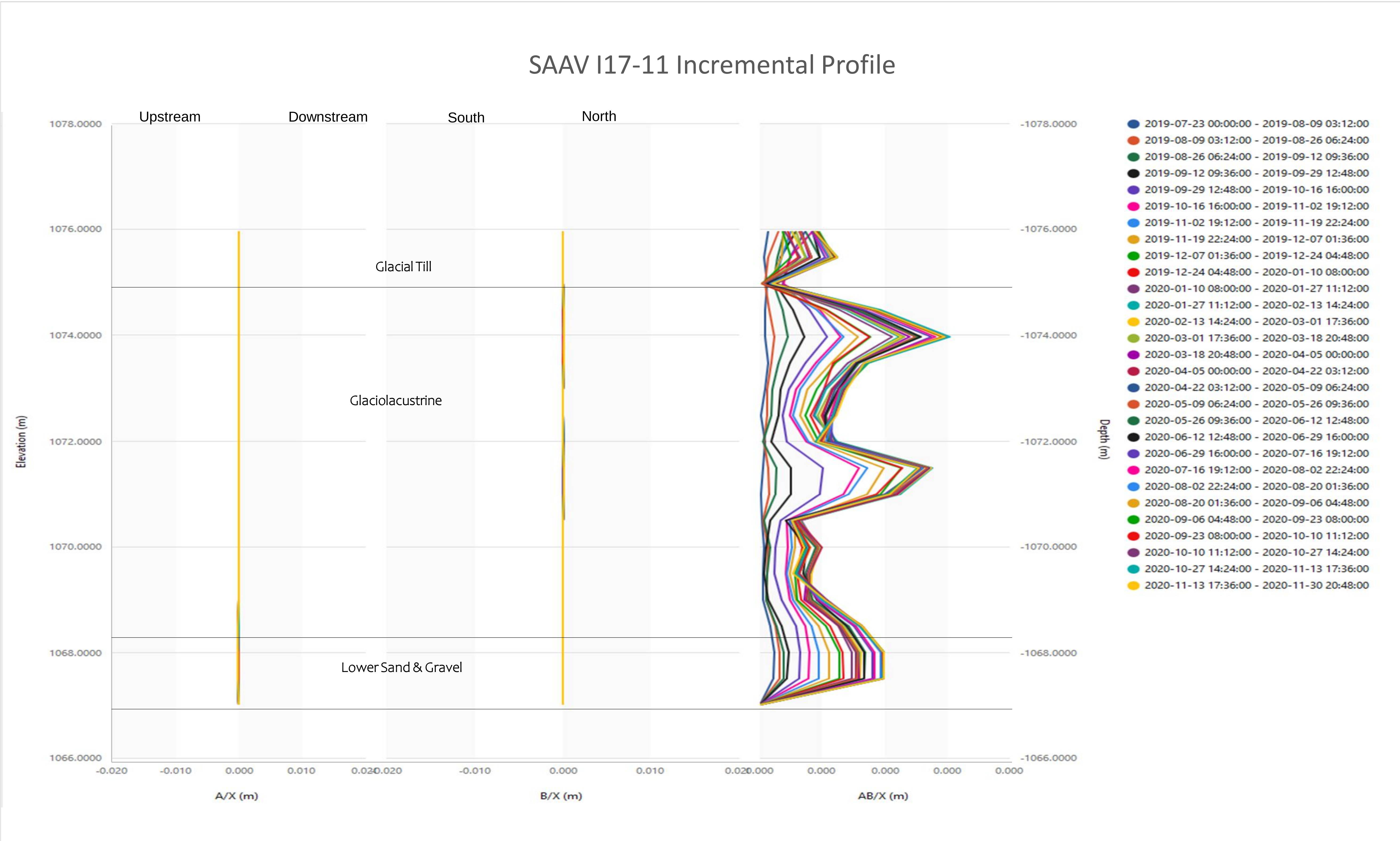
Highland Valley Copper - Logan Lake, BC

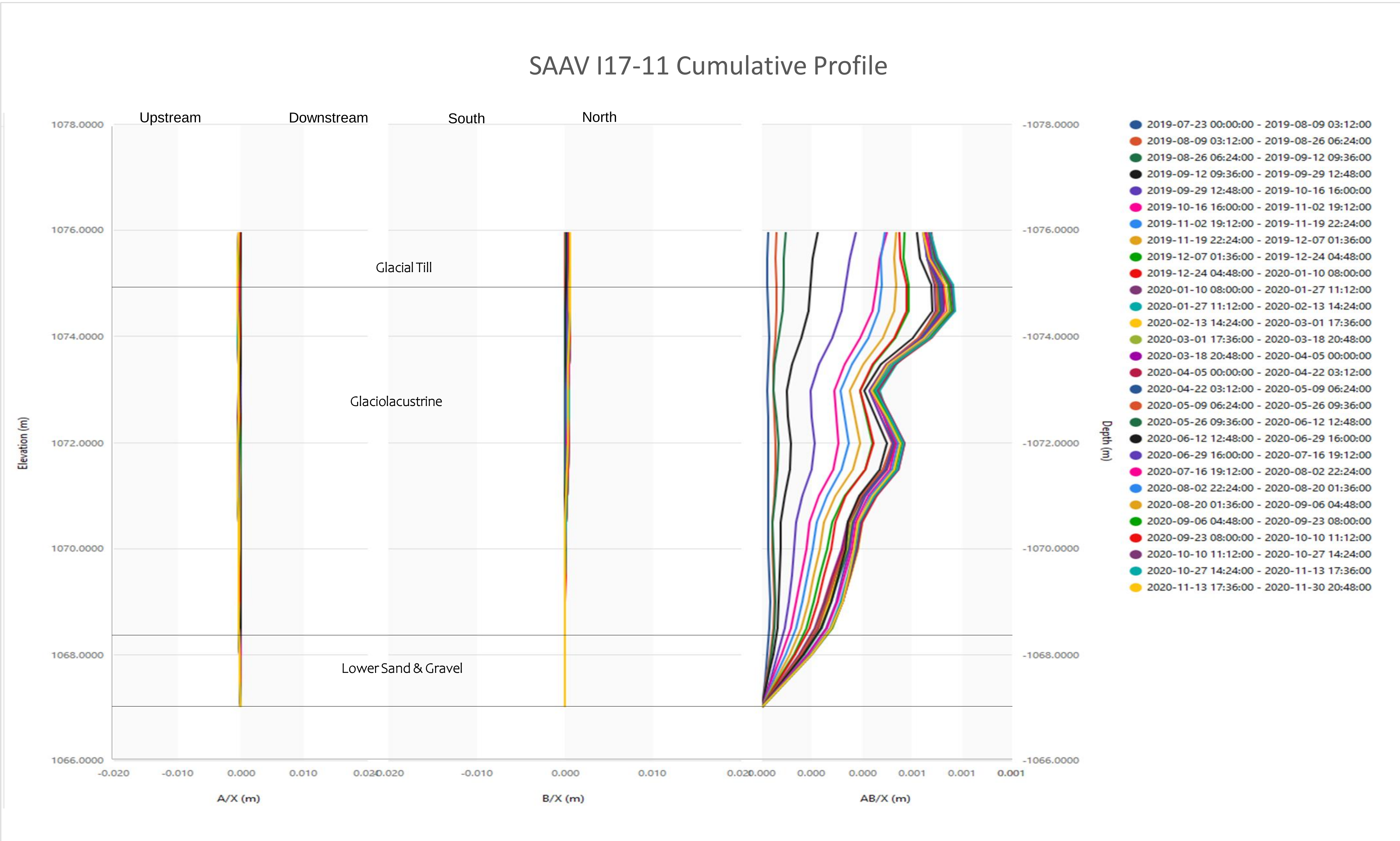


Valley Buttress Berm, Inclinometer I17-10

Valley Buttress Berm

SAAV I17-11


SAAV I17-11 Incremental Profile
Upstream
Downstream
South
North
Glacial Till
Glaciolacustrine
Lower Sand & Gravel
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
1078.0000
1076.0000
1074.0000
1072.0000
1070.0000
1068.0000
1066.0000
-1078.0000
-1076.0000
-1074.0000
-1072.0000
-1070.0000
-1068.0000
-1066.0000
-0.020
-0.010
0.000
0.010
0.020
2019-07-23 00:00:00 - 2019-08-09 03:12:00
2019-08-09 03:12:00 - 2019-08-26 06:24:00
2019-08-26 06:24:00 - 2019-09-12 09:36:00
2019-09-12 09:36:00 - 2019-09-29 12:48:00
2019-09-29 12:48:00 - 2019-10-16 16:00:00
2019-10-16 16:00:00 - 2019-11-02 19:12:00
2019-11-02 19:12:00 - 2019-11-19 22:24:00
2019-11-19 22:24:00 - 2019-12-07 01:36:00
2019-12-07 01:36:00 - 2019-12-24 04:48:00
2019-12-24 04:48:00 - 2020-01-10 08:00:00
2020-01-10 08:00:00 - 2020-01-27 11:12:00
2020-01-27 11:12:00 - 2020-02-13 14:24:00
2020-02-13 14:24:00 - 2020-03-01 17:36:00
2020-03-01 17:36:00 - 2020-03-18 20:48:00
2020-03-18 20:48:00 - 2020-04-05 00:00:00
2020-04-05 00:00:00 - 2020-04-22 03:12:00
2020-04-22 03:12:00 - 2020-05-09 06:24:00
2020-05-09 06:24:00 - 2020-05-26 09:36:00
2020-05-26 09:36:00 - 2020-06-12 12:48:00
2020-06-12 12:48:00 - 2020-06-29 16:00:00
2020-06-29 16:00:00 - 2020-07-16 19:12:00
2020-07-16 19:12:00 - 2020-08-02 22:24:00
2020-08-02 22:24:00 - 2020-08-20 01:36:00
2020-08-20 01:36:00 - 2020-09-06 04:48:00
2020-09-06 04:48:00 - 2020-09-23 08:00:00
2020-09-23 08:00:00 - 2020-10-10 11:12:00
2020-10-10 11:12:00 - 2020-10-27 14:24:00
2020-10-27 14:24:00 - 2020-11-13 17:36:00
2020-11-13 17:36:00 - 2020-11-30 20:48:00

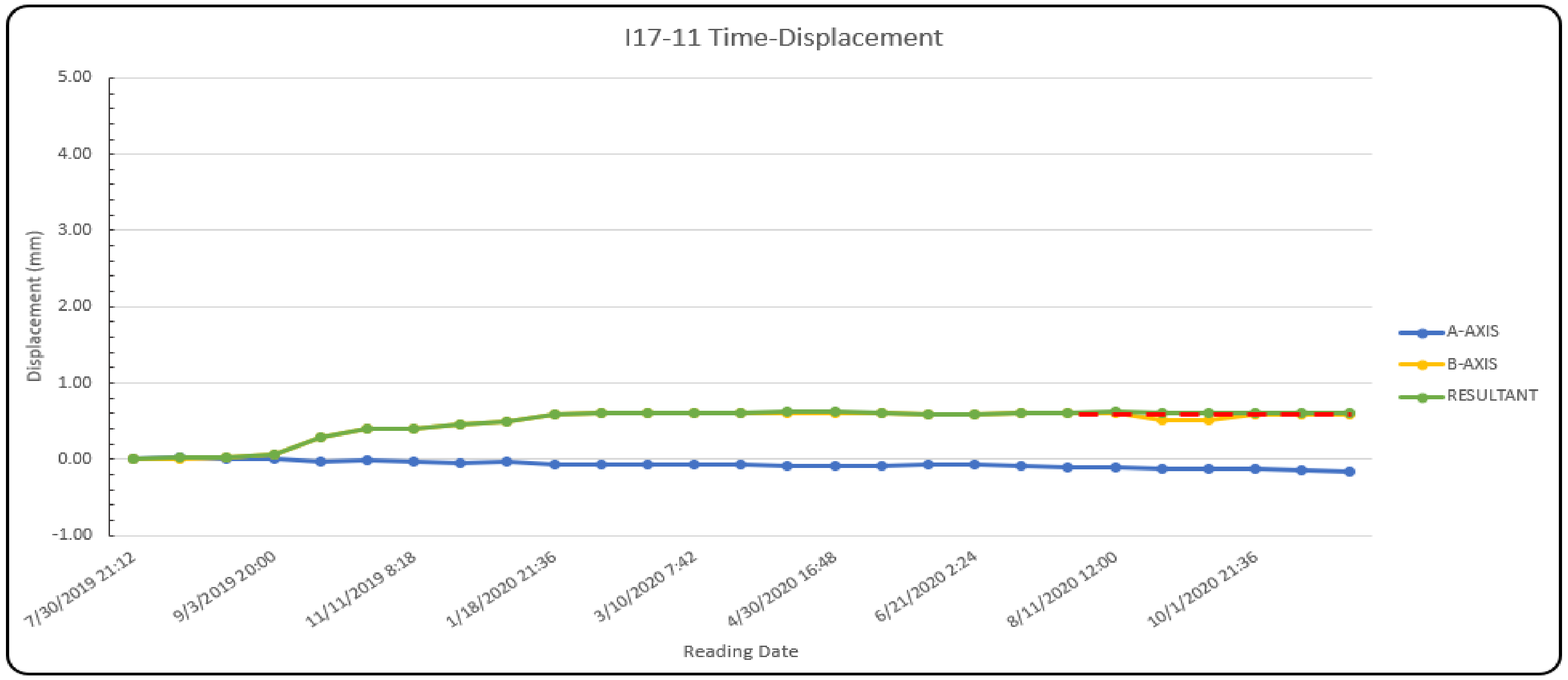

SAAV I17-11 Cumulative Profile
Upstream
Downstream
South
North
Glacial Till
Glaciolacustrine
Lower Sand & Gravel
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2019-07-23 00:00:00 - 2019-08-09 03:12:00
2019-08-09 03:12:00 - 2019-08-26 06:24:00
2019-08-26 06:24:00 - 2019-09-12 09:36:00
2019-09-12 09:36:00 - 2019-09-29 12:48:00
2019-09-29 12:48:00 - 2019-10-16 16:00:00
2019-10-16 16:00:00 - 2019-11-02 19:12:00
2019-11-02 19:12:00 - 2019-11-19 22:24:00
2019-11-19 22:24:00 - 2019-12-07 01:36:00
2019-12-07 01:36:00 - 2019-12-24 04:48:00
2019-12-24 04:48:00 - 2020-01-10 08:00:00
2020-01-10 08:00:00 - 2020-01-27 11:12:00
2020-01-27 11:12:00 - 2020-02-13 14:24:00
2020-02-13 14:24:00 - 2020-03-01 17:36:00
2020-03-01 17:36:00 - 2020-03-18 20:48:00
2020-03-18 20:48:00 - 2020-04-05 00:00:00
2020-04-05 00:00:00 - 2020-04-22 03:12:00
2020-04-22 03:12:00 - 2020-05-09 06:24:00
2020-05-09 06:24:00 - 2020-05-26 09:36:00
2020-05-26 09:36:00 - 2020-06-12 12:48:00
2020-06-12 12:48:00 - 2020-06-29 16:00:00
2020-06-29 16:00:00 - 2020-07-16 19:12:00
2020-07-16 19:12:00 - 2020-08-02 22:24:00
2020-08-02 22:24:00 - 2020-08-20 01:36:00
2020-08-20 01:36:00 - 2020-09-06 04:48:00
2020-09-06 04:48:00 - 2020-09-23 08:00:00
2020-09-23 08:00:00 - 2020-10-10 11:12:00
2020-10-10 11:12:00 - 2020-10-27 14:24:00
2020-10-27 14:24:00 - 2020-11-13 17:36:00
2020-11-13 17:36:00 - 2020-11-30 20:48:00

SAAV 17-11

Displacement Plot - Glaciolacustrine

Unit	Upper El. (m)	Lower El. (m)
Glaciolacustrine	1075	1068

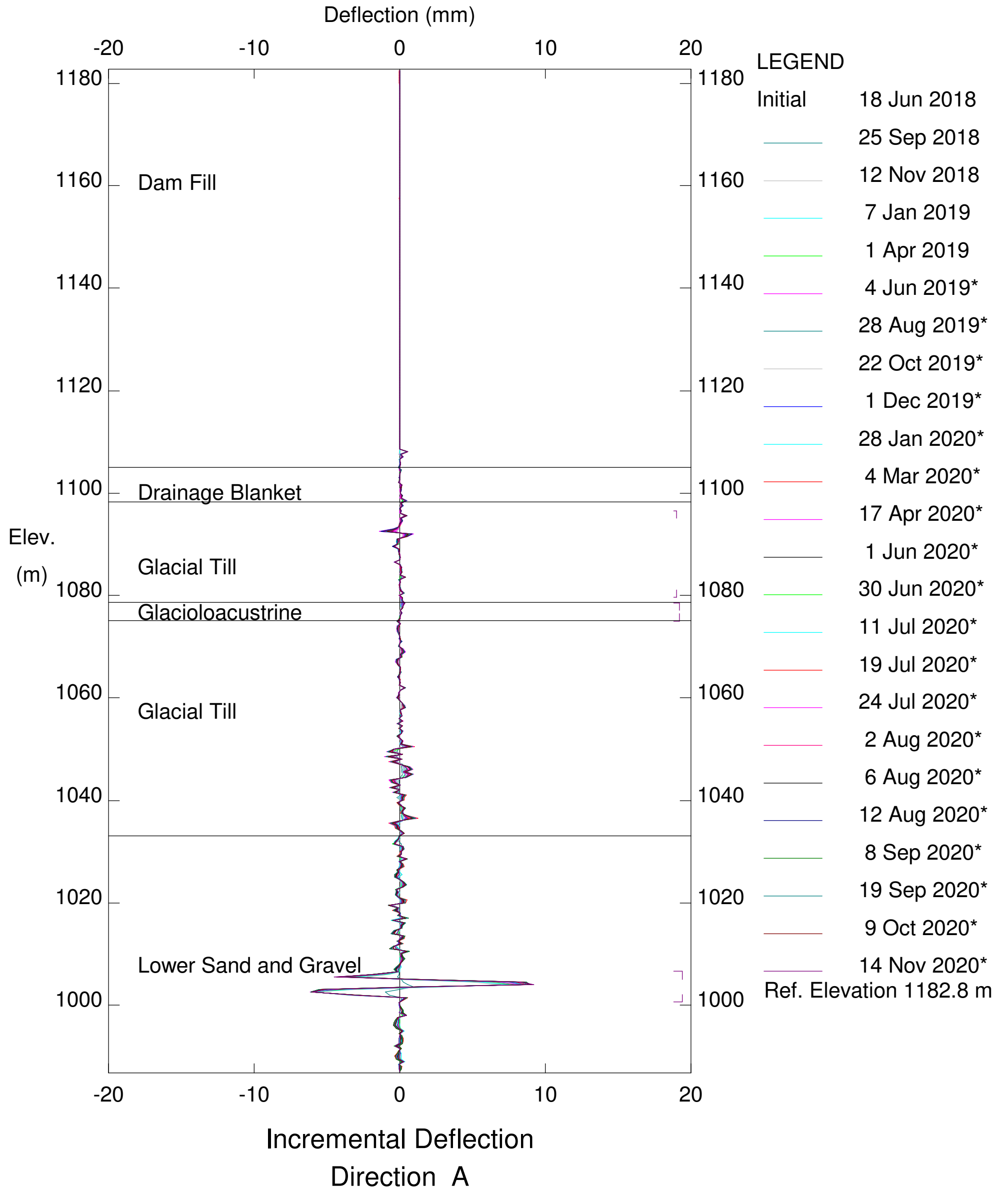
Upper El. (m)	1075.0
Lower El. (m)	1069.0

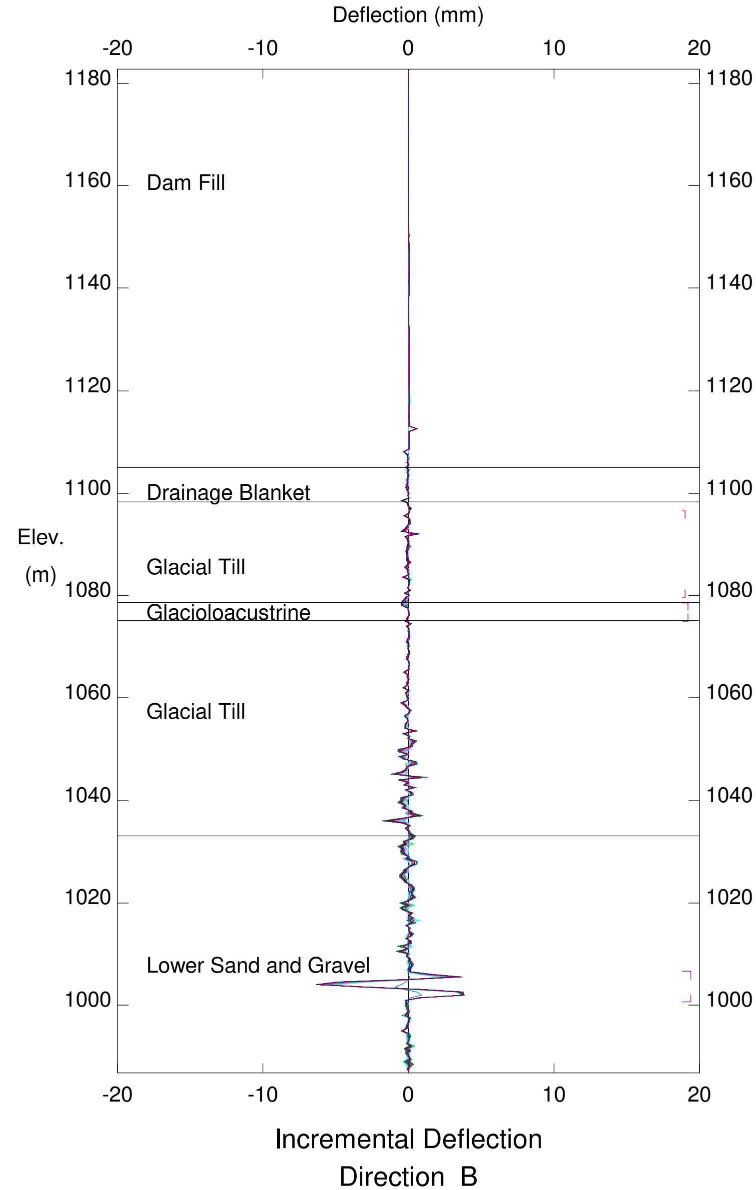


Valley Buttress Berm

I17-19

Highland Valley Copper - Logan Lake, BC



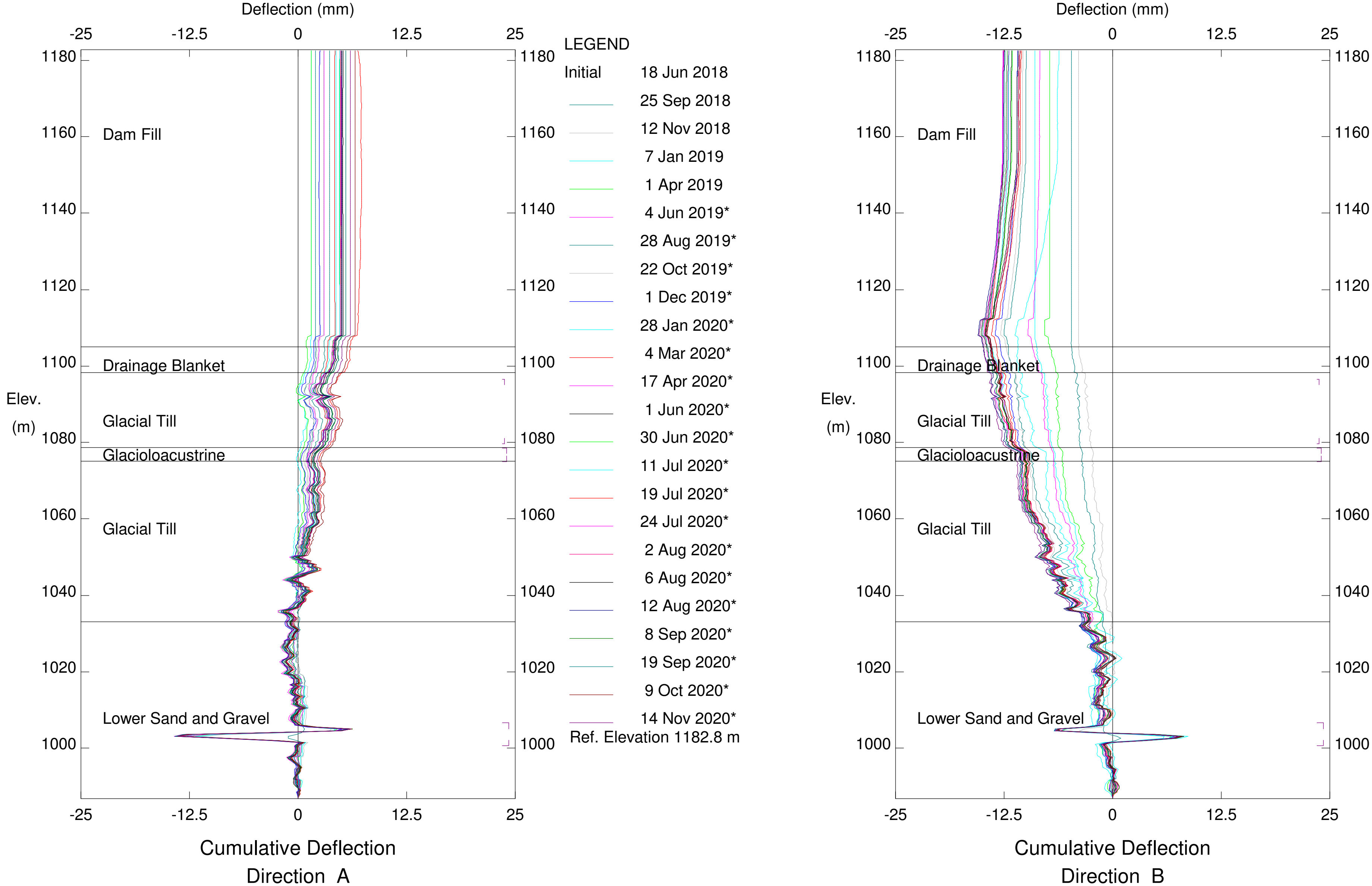


Valley Buttress Berm, Inclinometer I17-19

Sets marked * include zero shift and/or rotation corrections.

I17-19.gtl

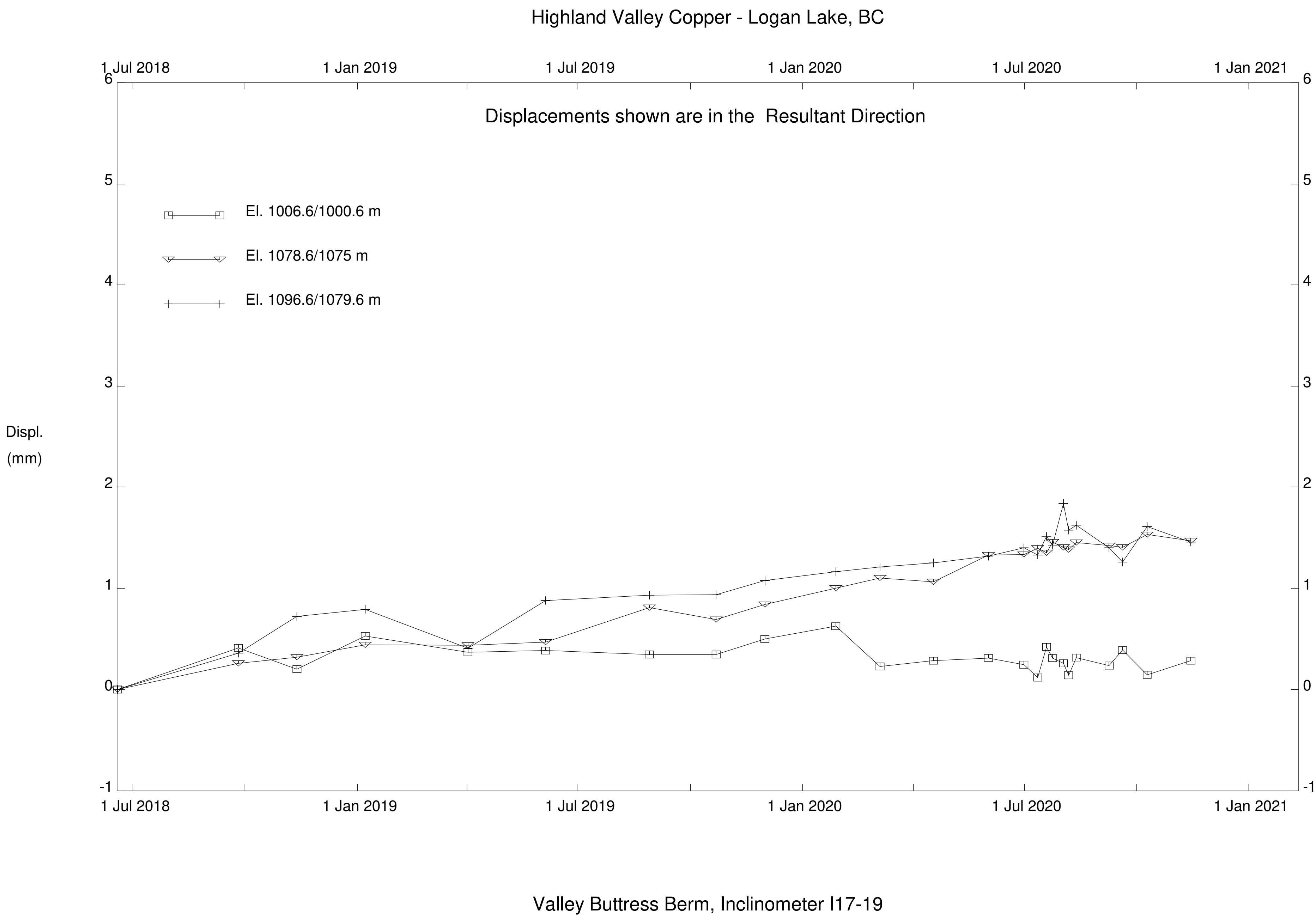
Highland Valley Copper - Logan Lake, BC



Valley Buttress Berm, Inclinometer I17-19

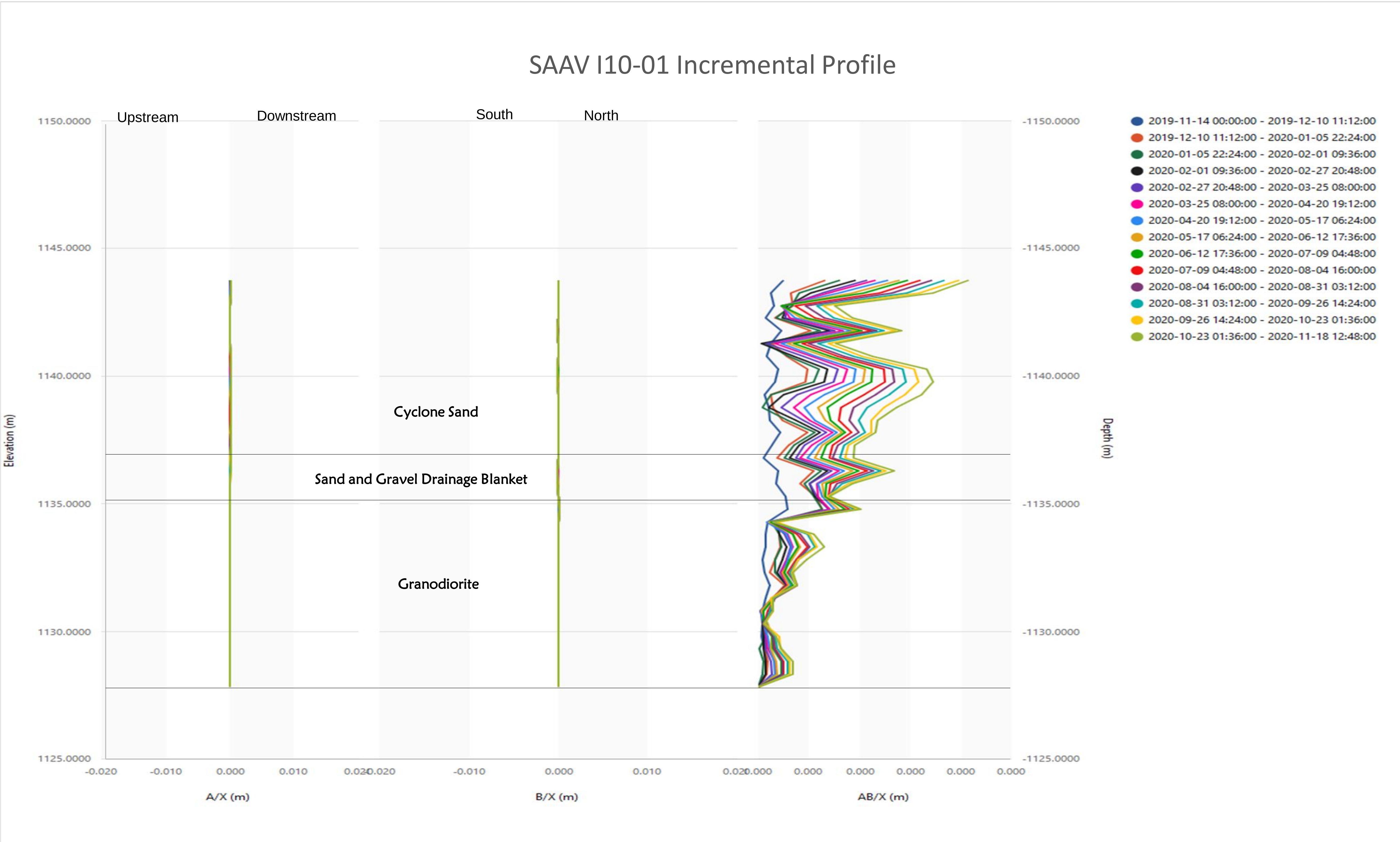
Sets marked * include zero shift and/or rotation corrections.

I17-19.gtl

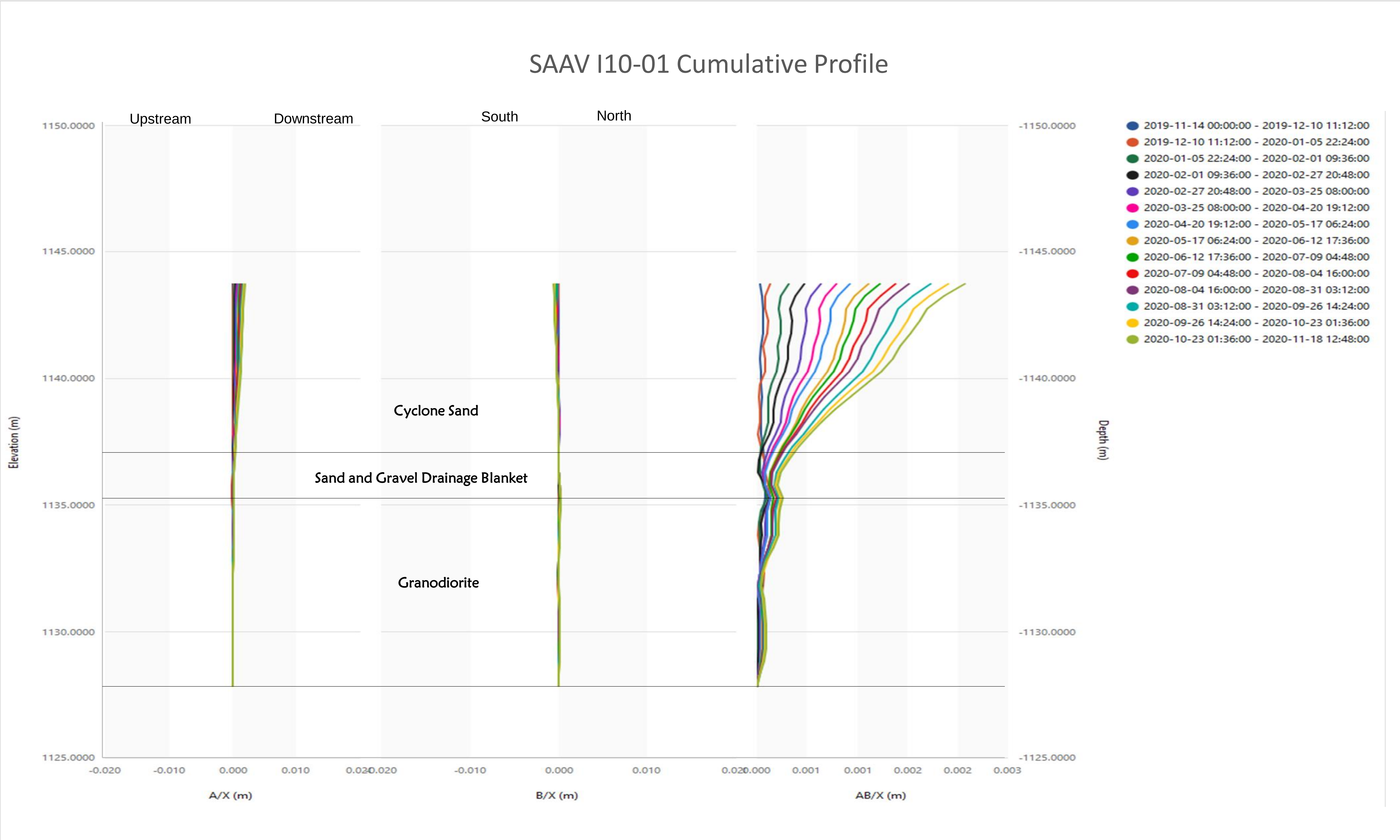

Highland Valley Copper - Logan Lake, BC
Displacements shown are in the Resultant Direction
El. 1006.6/1000.6 m
El. 1078.6/1075 m
El. 1096.6/1079.6 m
Displ.
(mm)
1 Jul 2018
1 Jan 2019
1 Jul 2019
1 Jan 2020
1 Jul 2020
1 Jan 2021
-1
0
1
2
3
4
5
6
Valley Buttress Berm, Inclinometer I17-19

South Dam

SAAV I10-01



SAAV I10-01 Incremental Profile
Upstream
Downstream
South
North
Cyclone Sand
Sand and Gravel Drainage Blanket
Granodiorite
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2019-11-14 00:00:00 - 2019-12-10 11:12:00
2019-12-10 11:12:00 - 2020-01-05 22:24:00
2020-01-05 22:24:00 - 2020-02-01 09:36:00
2020-02-01 09:36:00 - 2020-02-27 20:48:00
2020-02-27 20:48:00 - 2020-03-25 08:00:00
2020-03-25 08:00:00 - 2020-04-20 19:12:00
2020-04-20 19:12:00 - 2020-05-17 06:24:00
2020-05-17 06:24:00 - 2020-06-12 17:36:00
2020-06-12 17:36:00 - 2020-07-09 04:48:00
2020-07-09 04:48:00 - 2020-08-04 16:00:00
2020-08-04 16:00:00 - 2020-08-31 03:12:00
2020-08-31 03:12:00 - 2020-09-26 14:24:00
2020-09-26 14:24:00 - 2020-10-23 01:36:00
2020-10-23 01:36:00 - 2020-11-18 12:48:00



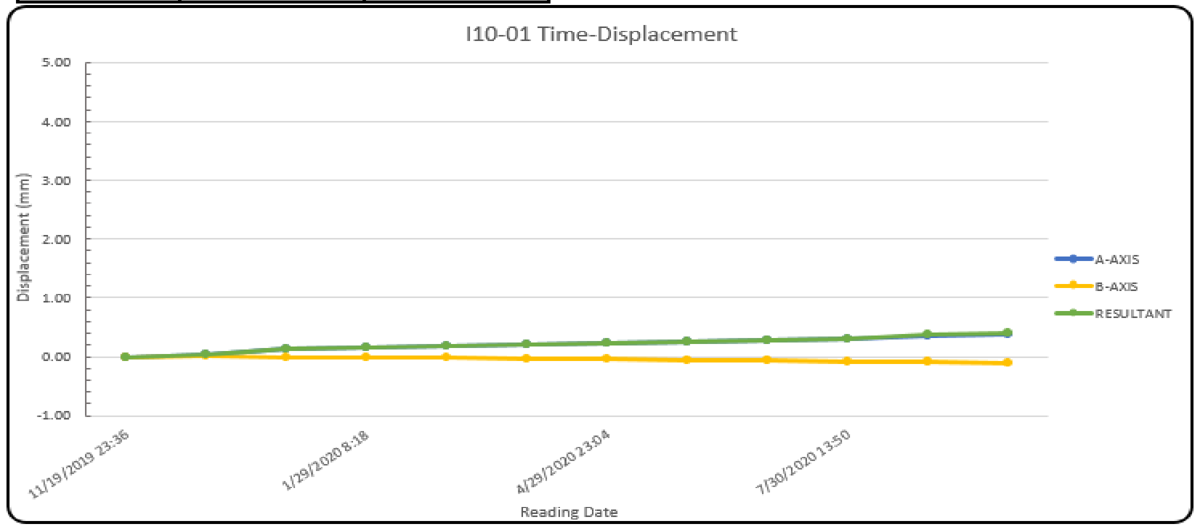
SAAV I10-01 Cumulative Profile
Upstream
Downstream
South
North
Cyclone Sand
Sand and Gravel Drainage Blanket
Granodiorite
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
1150.0000
1145.0000
1140.0000
1135.0000
1130.0000
1125.0000
-1150.0000
-1145.0000
-1140.0000
-1135.0000
-1130.0000
-1125.0000
-0.020
-0.010
0.000
0.010
0.020
0.001
0.002
0.003
2019-11-14 00:00:00 - 2019-12-10 11:12:00
2019-12-10 11:12:00 - 2020-01-05 22:24:00
2020-01-05 22:24:00 - 2020-02-01 09:36:00
2020-02-01 09:36:00 - 2020-02-27 20:48:00
2020-02-27 20:48:00 - 2020-03-25 08:00:00
2020-03-25 08:00:00 - 2020-04-20 19:12:00
2020-04-20 19:12:00 - 2020-05-17 06:24:00
2020-05-17 06:24:00 - 2020-06-12 17:36:00
2020-06-12 17:36:00 - 2020-07-09 04:48:00
2020-07-09 04:48:00 - 2020-08-04 16:00:00
2020-08-04 16:00:00 - 2020-08-31 03:12:00
2020-08-31 03:12:00 - 2020-09-26 14:24:00
2020-09-26 14:24:00 - 2020-10-23 01:36:00
2020-10-23 01:36:00 - 2020-11-18 12:48:00

SAA I10-01

Displacement Plot - Drainage Blanket

Unit	Upper El. (m)	Lower El. (m)
Drainage Blanket	1137.8	1135.8
Volcanic	1135.8	1127.8

Upper El. (m)	1137.8
Lower El. (m)	1135.8

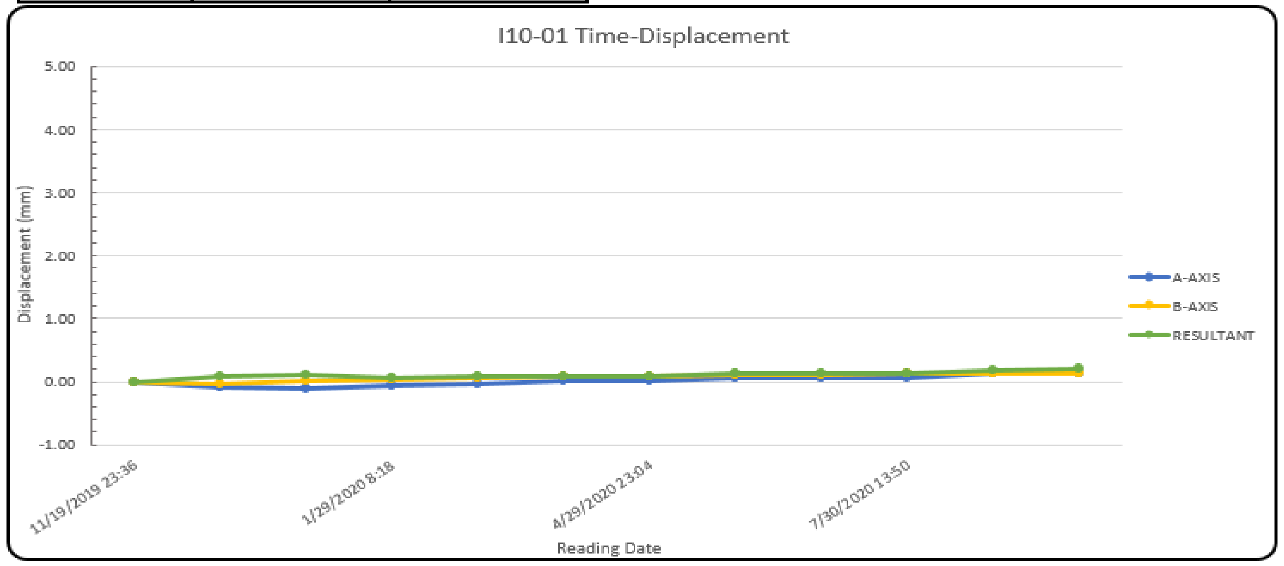


SAA I10-01

Displacement Plot - Volcanics

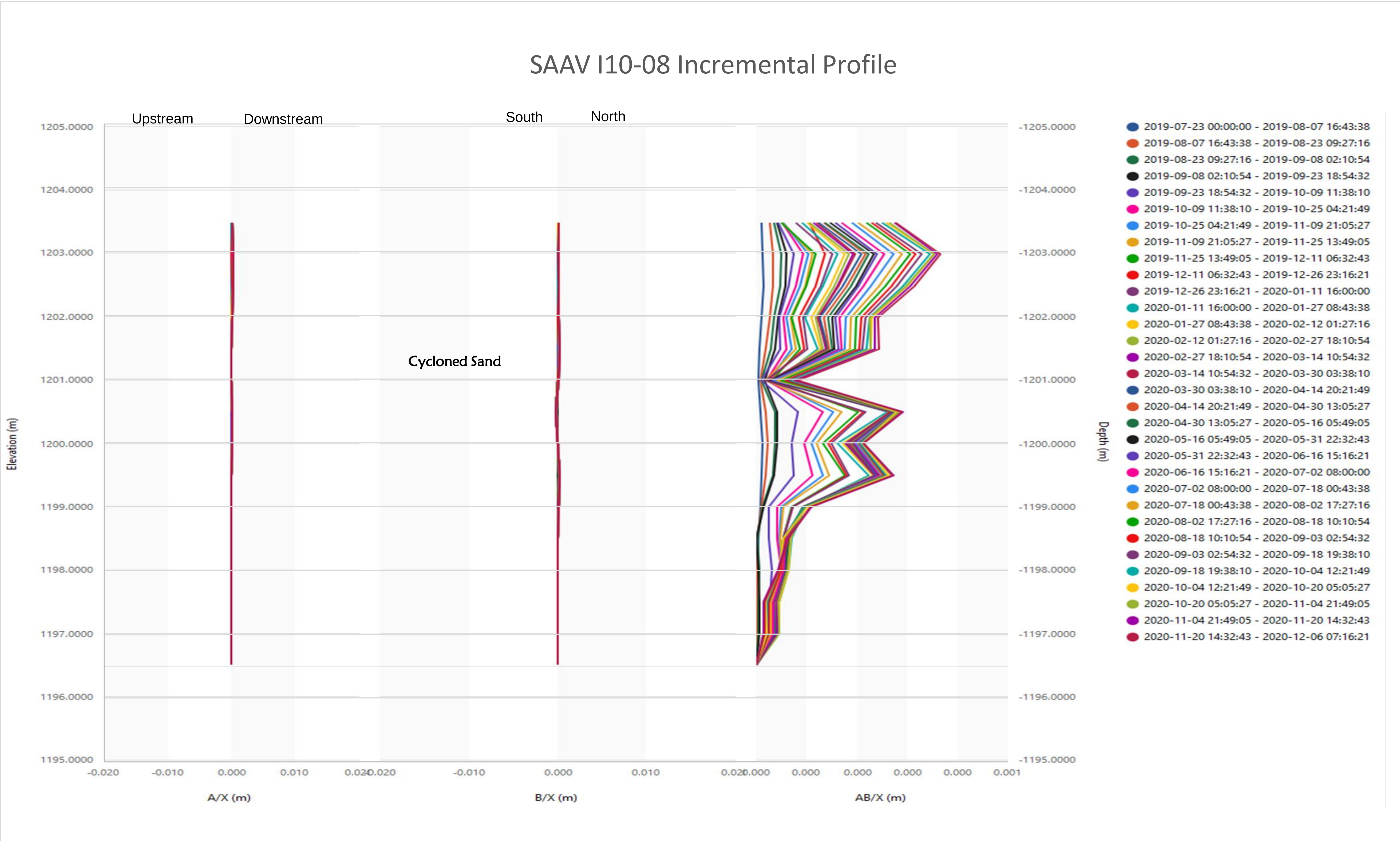
Unit	Upper El. (m)	Lower El. (m)
Drainage Blanket	1137.8	1135.8
Volcanic	1135.8	1127.8

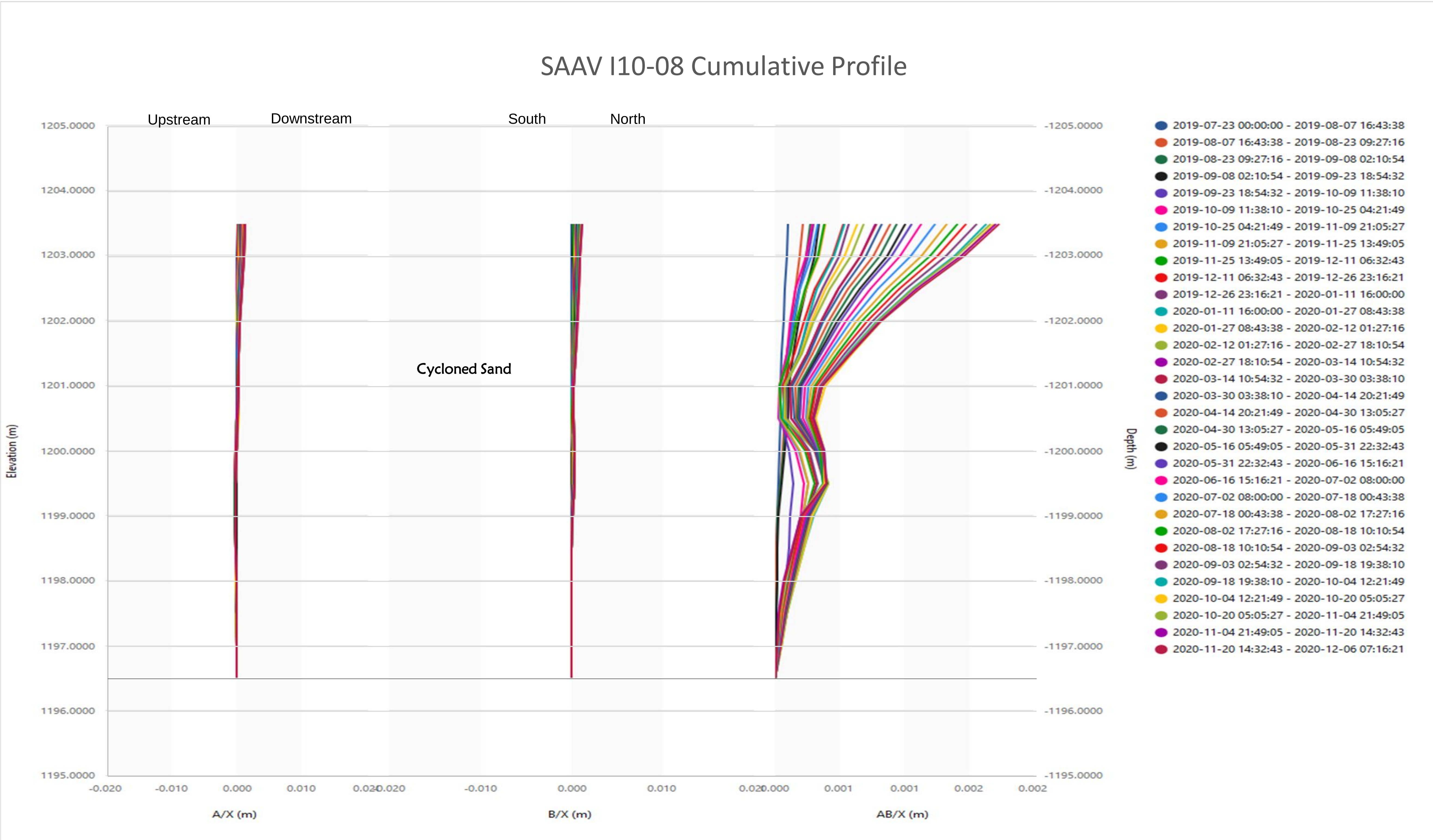
Upper El. (m)	1135.8
Lower El. (m)	1127.8



South Dam

SAAV I10-08


SAAV I10-08 Incremental Profile
Upstream
Downstream
South
North
Cycloned Sand
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2019-07-23 00:00:00 - 2019-08-07 16:43:38
2019-08-07 16:43:38 - 2019-08-23 09:27:16
2019-08-23 09:27:16 - 2019-09-08 02:10:54
2019-09-08 02:10:54 - 2019-09-23 18:54:32
2019-09-23 18:54:32 - 2019-10-09 11:38:10
2019-10-09 11:38:10 - 2019-10-25 04:21:49
2019-10-25 04:21:49 - 2019-11-09 21:05:27
2019-11-09 21:05:27 - 2019-11-25 13:49:05
2019-11-25 13:49:05 - 2019-12-11 06:32:43
2019-12-11 06:32:43 - 2019-12-26 23:16:21
2019-12-26 23:16:21 - 2020-01-11 16:00:00
2020-01-11 16:00:00 - 2020-01-27 08:43:38
2020-01-27 08:43:38 - 2020-02-12 01:27:16
2020-02-12 01:27:16 - 2020-02-27 18:10:54
2020-02-27 18:10:54 - 2020-03-14 10:54:32
2020-03-14 10:54:32 - 2020-03-30 03:38:10
2020-03-30 03:38:10 - 2020-04-14 20:21:49
2020-04-14 20:21:49 - 2020-04-30 13:05:27
2020-04-30 13:05:27 - 2020-05-16 05:49:05
2020-05-16 05:49:05 - 2020-05-31 22:32:43
2020-05-31 22:32:43 - 2020-06-16 15:16:21
2020-06-16 15:16:21 - 2020-07-02 08:00:00
2020-07-02 08:00:00 - 2020-07-18 00:43:38
2020-07-18 00:43:38 - 2020-08-02 17:27:16
2020-08-02 17:27:16 - 2020-08-18 10:10:54
2020-08-18 10:10:54 - 2020-09-03 02:54:32
2020-09-03 02:54:32 - 2020-09-18 19:38:10
2020-09-18 19:38:10 - 2020-10-04 12:21:49
2020-10-04 12:21:49 - 2020-10-20 05:05:27
2020-10-20 05:05:27 - 2020-11-04 21:49:05
2020-11-04 21:49:05 - 2020-11-20 14:32:43
2020-11-20 14:32:43 - 2020-12-06 07:16:21



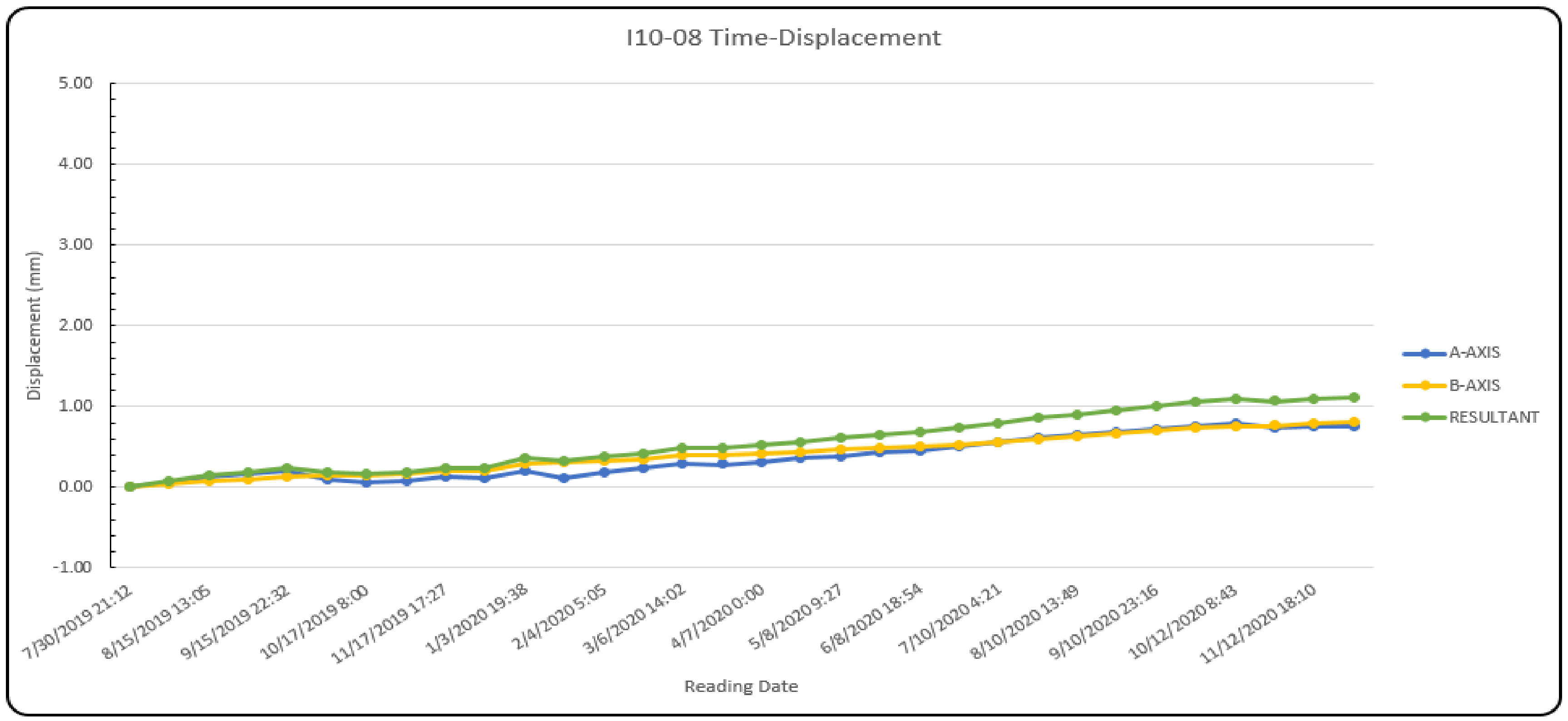
SAAV I10-08 Cumulative Profile
Upstream
Downstream
South
North
Cycloned Sand
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2019-07-23 00:00:00 - 2019-08-07 16:43:38
2019-08-07 16:43:38 - 2019-08-23 09:27:16
2019-08-23 09:27:16 - 2019-09-08 02:10:54
2019-09-08 02:10:54 - 2019-09-23 18:54:32
2019-09-23 18:54:32 - 2019-10-09 11:38:10
2019-10-09 11:38:10 - 2019-10-25 04:21:49
2019-10-25 04:21:49 - 2019-11-09 21:05:27
2019-11-09 21:05:27 - 2019-11-25 13:49:05
2019-11-25 13:49:05 - 2019-12-11 06:32:43
2019-12-11 06:32:43 - 2019-12-26 23:16:21
2019-12-26 23:16:21 - 2020-01-11 16:00:00
2020-01-11 16:00:00 - 2020-01-27 08:43:38
2020-01-27 08:43:38 - 2020-02-12 01:27:16
2020-02-12 01:27:16 - 2020-02-27 18:10:54
2020-02-27 18:10:54 - 2020-03-14 10:54:32
2020-03-14 10:54:32 - 2020-03-30 03:38:10
2020-03-30 03:38:10 - 2020-04-14 20:21:49
2020-04-14 20:21:49 - 2020-04-30 13:05:27
2020-04-30 13:05:27 - 2020-05-16 05:49:05
2020-05-16 05:49:05 - 2020-05-31 22:32:43
2020-05-31 22:32:43 - 2020-06-16 15:16:21
2020-06-16 15:16:21 - 2020-07-02 08:00:00
2020-07-02 08:00:00 - 2020-07-18 00:43:38
2020-07-18 00:43:38 - 2020-08-02 17:27:16
2020-08-02 17:27:16 - 2020-08-18 10:10:54
2020-08-18 10:10:54 - 2020-09-03 02:54:32
2020-09-03 02:54:32 - 2020-09-18 19:38:10
2020-09-18 19:38:10 - 2020-10-04 12:21:49
2020-10-04 12:21:49 - 2020-10-20 05:05:27
2020-10-20 05:05:27 - 2020-11-04 21:49:05
2020-11-04 21:49:05 - 2020-11-20 14:32:43
2020-11-20 14:32:43 - 2020-12-06 07:16:21

SAAV I10-08

Displacement Plot – Cycloned Sand

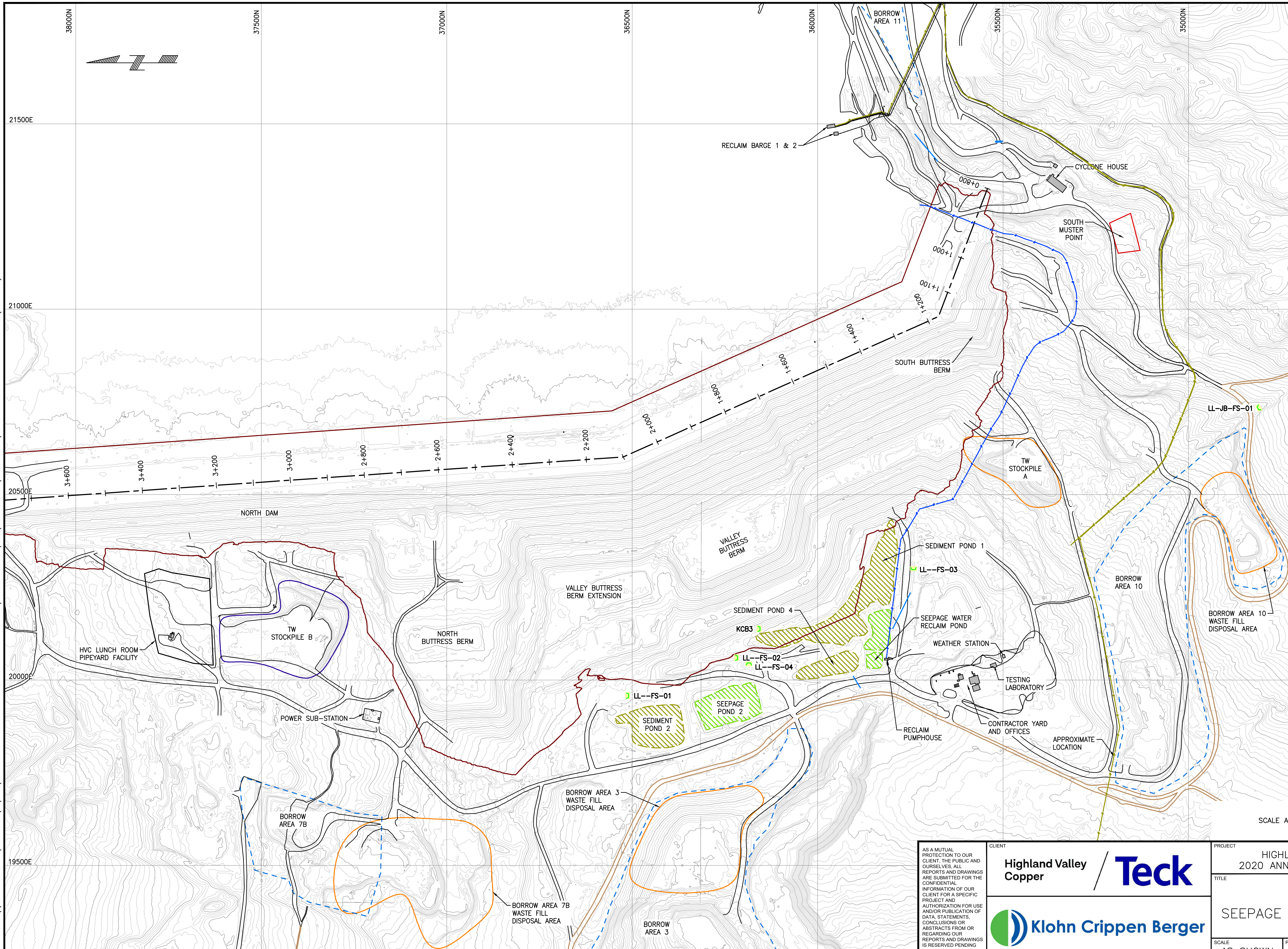
Unit	Upper El. (m)	Lower El. (m)
Cycloned Sand	1202.5	1196.5

Upper El. (m)	1202.5
Lower El. (m)	1196.5



APPENDIX III-D

L-L Dam Seepage Flow Data Plots



LEGEND:

- BORROW AREA
- WASTE FILL DISPOSAL AREA
- SEEPAGE POND
- SEDIMENT POND
- EL. 1279 m ULTIMATE DAM FOOTPRINT
- SURFACE WATER RECLAIM PIPELINE
- SPATSUM WATER PIPELINE
- HAUL ROAD
- PUBLIC ROAD
- L-L DAM CENTERLINE (0+800)

ACTIVE INSTRUMENTS (SEE NOTE 2):

- SEEPAGE FLOW MONITORING WEIR

NOTES:

1. TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER PARTNERSHIP AND WAS DERIVED FROM PHOTOSAT SURVEY IMAGERY DATED 2020-09-27 (L-L DAM) AND 2016-09-25 & 28 (OUTSIDE OF 2020 SURVEY EXTENT).
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. PUKAIST CREEK WEIR IS NOT SHOWN AND IS LOCATED AT E 17448 N 34452.
4. AS OF JUNE 2018, SEEPAGE POND 1 WAS BACKFILLED AND THERE WAS NO SEEPAGE REPORTING TO LL--FS-03.

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

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

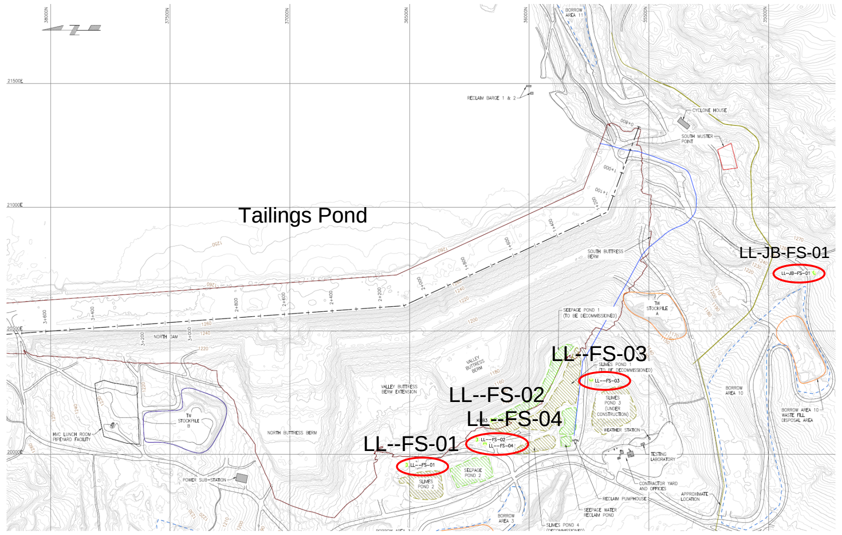
PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2020 ANNUAL FACILITY PERFORMANCE REPORT

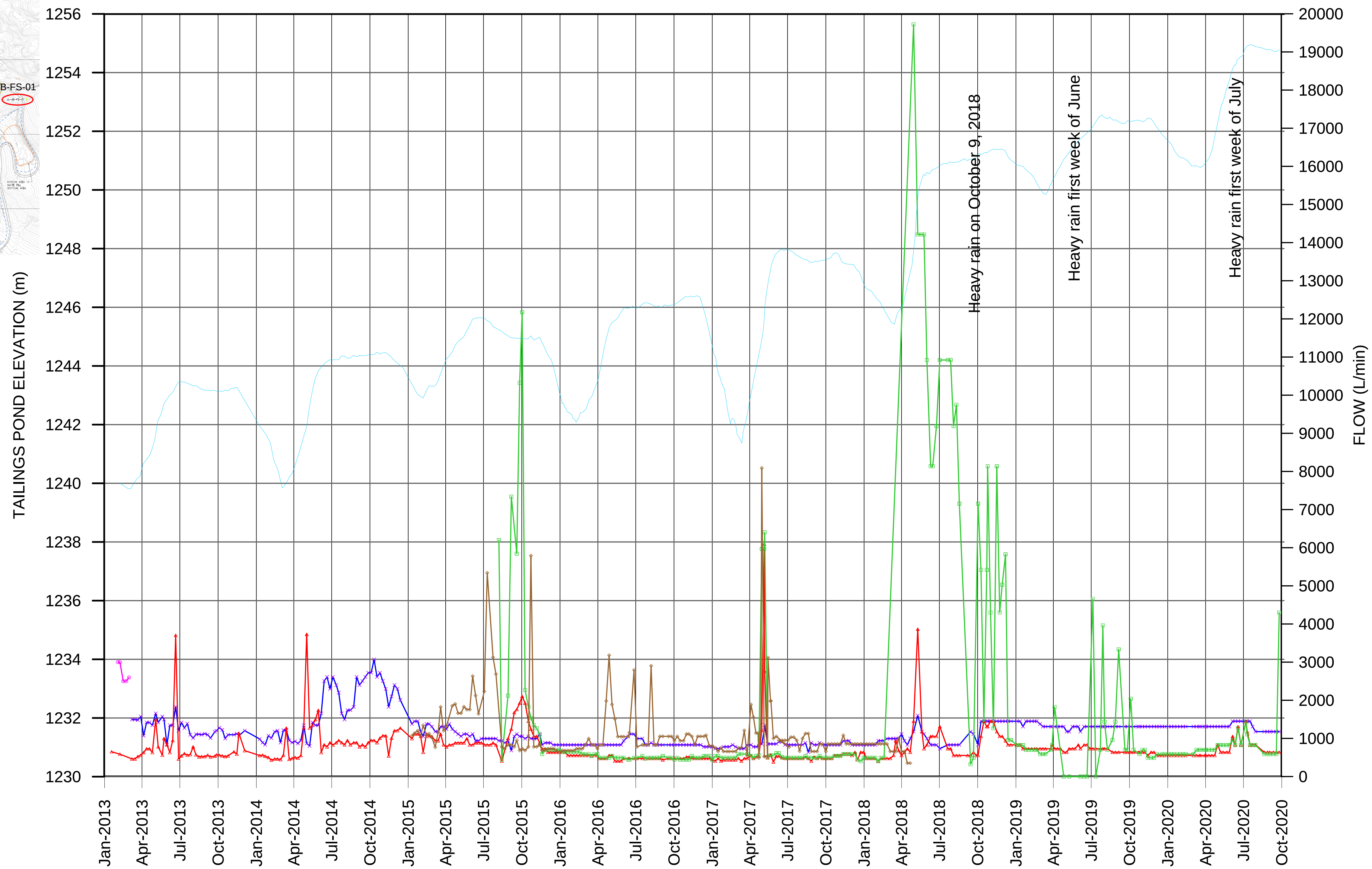
TITLE: L–L DAM SEEPAGE FLOW MONITORING STATIONS

SCALE	PROJECT No.	FIG. No.
AS SHOWN	M02341B53	

KCB-FIG-D-L

SAVE DATE: 2020-12-15 (9:24 AM)
FILE PATH: \\INT.KLOHN.COM\PROJDATA\M\VCR\M02341B53 - HVC-2019 DAM SAFETY SUPPORT\400 DRAWINGS\CAD\05-FIGURES\2020 AFPR\SEEPAGE-FLOW-MONITORING.DWG (THAWKER)





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.
As of June 2018, the seepage pond was backfilled and there was no seepage reporting to LL--FS-03.
Valve of LL-FS-04 was reported closed from April 26, 2019 to May 31, 2019 to aid in dredging.
Runoff was observed on March 29, 2019 at LL--FS-01.

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

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2020 ANNUAL REVIEW

TITLE: L-L DAM POND LEVEL AND SEEPAGE FLOW 2013-2020

PROJECT No. M02341B83

FIG No.

Date: December 08, 2020
\\int.klohn.com\Proj\Data\MVCR\M02341B83 - HVC 2020 Dam Safety Support\300 Design\350 Seepage Data\Highland\Seepage_For Narges.grf

APPENDIX IV

H-H Dam Instrumentation Summary

APPENDIX IV-A

H-H Dam 2020 Instrumentation Summary

Appendix IV-A
H-H Dam 2020 Instrumentation Summary

IV-A-1 INSTRUMENTATION SYSTEM

Table IV-A-1 summarizes instruments installed within or near the H-H Dam as of November 2020. Location of instruments are shown on Figure 3 of the main text. November 2020 instrumentation readings are shown on select design cross sections, through each dam segment, of the L-L Dam (Figure 15 to Figure 19). Instrumentation summary plots are included in Appendix IV-B (piezometers) and Appendix IV-C (inclinometers).

The instrumentation at H-H Dam is adequate to monitor dam performance and includes redundancy in key areas to account for disruptions in data collection at some instruments (e.g. software or hardware issues with automated instruments or physical damage).

The number of instruments varies throughout the life of the structure as some are damaged or new ones added and the current status of the instrumentation system is recorded in the Master Instrument Register which is maintained by both THVCP and KCB. Readings for the majority of instruments are automated through the GeoExplorer software package.

Reading frequency for instruments vary depending on the location and control requirements. Reading frequency for manual piezometers and all inclinometers were reviewed in 2020 and the new requirements defined in MRM-2020-005[1] which was incorporated into the OMS Manual update. Readings from automated piezometers are typically collected more frequently.

Table IV-A-1 Summary of Functional Instrumentation Installed at H-H Dam (November 2020)

Instrument	Type	Reading (1)	No.	Total
Piezometers	Standpipe	Manual	15	47
	Vibrating Wire	Automated	29	
	Converted Standpipe to Vibrating Wire	Automated	3	
Inclinometers	Down-hole Casing	Manual	6	8
	ShapeArray (SAA / SAAV) (2)	Automated	2	
Settlement	Sondex (3)	Manual	4	4

Notes:
1. Automated readings are transmitted through the remote monitoring system to increase data capture and summarize instrumentation.
2. SAA/SAAV are installed in down-hole casing inclinometers over elevation range defined by the EoR to target monitoring zone.
3. Sondex settlement monitoring systems were installed at the HH17 series inclinometers.

[1] Klohn Crippen Berger Ltd. 2020. "L-L and H-H Dam Instrumentation Monitoring Frequency – Draft". November 5.

There are 8 inclinometers and 4 Sondex settlement monitoring systems installed at the H-H Dam, refer to Table IV-A-2. During 2020, the Sondex installed near HHI17-14A (~Sta. 2+020) was damaged and could not be salvaged. The primary function of the Sondex was to monitor settlement in the downstream fill placed by the THVCP mining fleet to support the interpretation that horizontal movements in the fill is related to settlement of the fill. The instruments have achieved this function and ongoing monitoring of functional instruments remain part of routine surveillance. However, the loss of a Sondex does not compromise the surveillance program or controls of the H-H Dam.

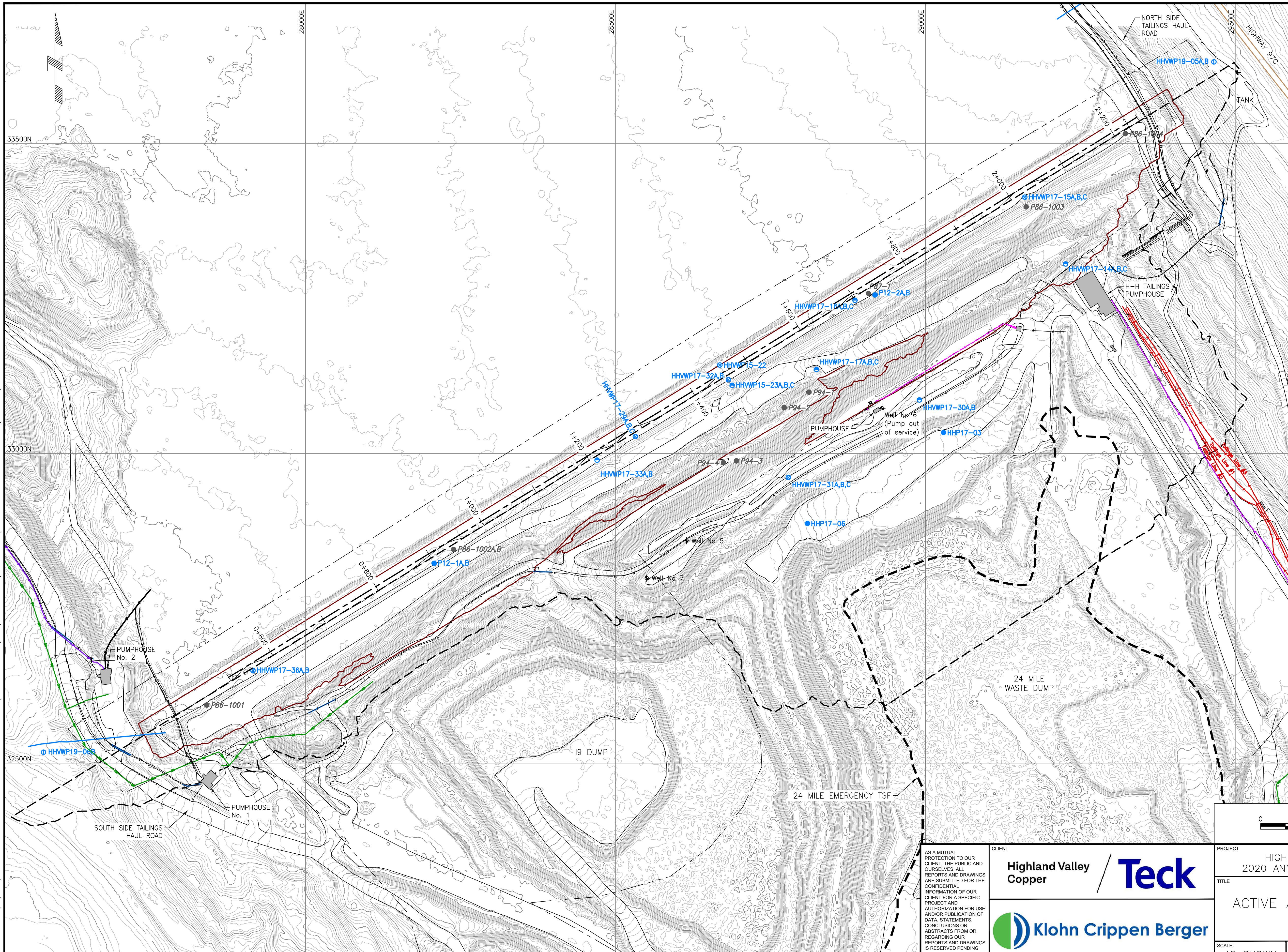
Table IV-A-2 Summary of Inclinometer / Sondex Installations at H-H Dam

Location	Inclinometer / Sondex					
	Sta. 1+200	Sta. 1+280	Sta. 1+460	Sta. 1+600	Sta. 1+700	Sta. 2+020
Near Core Zone	HHI17-33 / HHI17-33A	HHSAA12-01 / *damaged (2019)*	HHI15-23 / HHI17-33A	-	HHI17-16 / HHI17-16A	-
Crest of Fill Slope	-	-	-	HHI17-17 / HHI17-17A	-	-
Toe of Fill Slope	-	-	HHI17-31A / -	-	HHI17-30 / -	HHSAAVI17-14 / *damaged (2020)*

APPENDIX IV-B

H-H Dam Piezometer Plots

H-H Dam Piezometer Location Map



LEGEND:

- ULTIMATE DAM FOOTPRINT
- TAILINGS PIPELINE
- POWERLINE
- HAUL ROAD
- PUBLIC ROAD
- 2040 PFS DAM FOOTPRINT
- H-H DAM CENTERLINE (0+800)

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 PHOTOSAT SURVEY DATED 2020-10-08 (H-H DAM) AND 2017-09-15 & 24, AND 2016-09-25 & 29 (OUTSIDE OF 2020 SURVEY EXTENT).
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.

0 200 m

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: H-H DAM ACTIVE AND DEFUNCT PIEZOMETERS LOCATION PLAN

SCALE	PROJECT No.	FIG. No.
AS SHOWN	M02341B83	

SAVE DATE: 2021-02-08 (2:08 PM)
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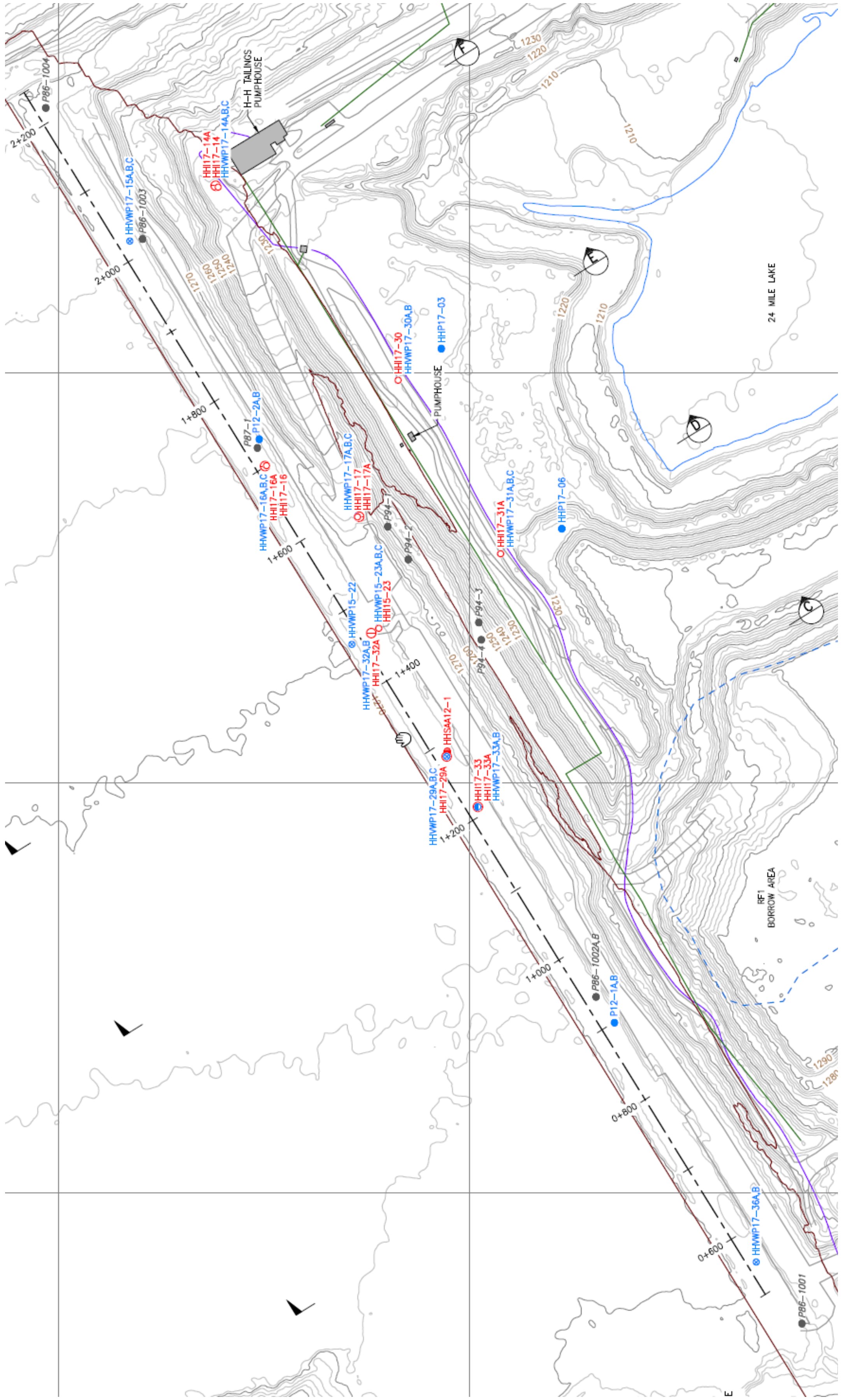
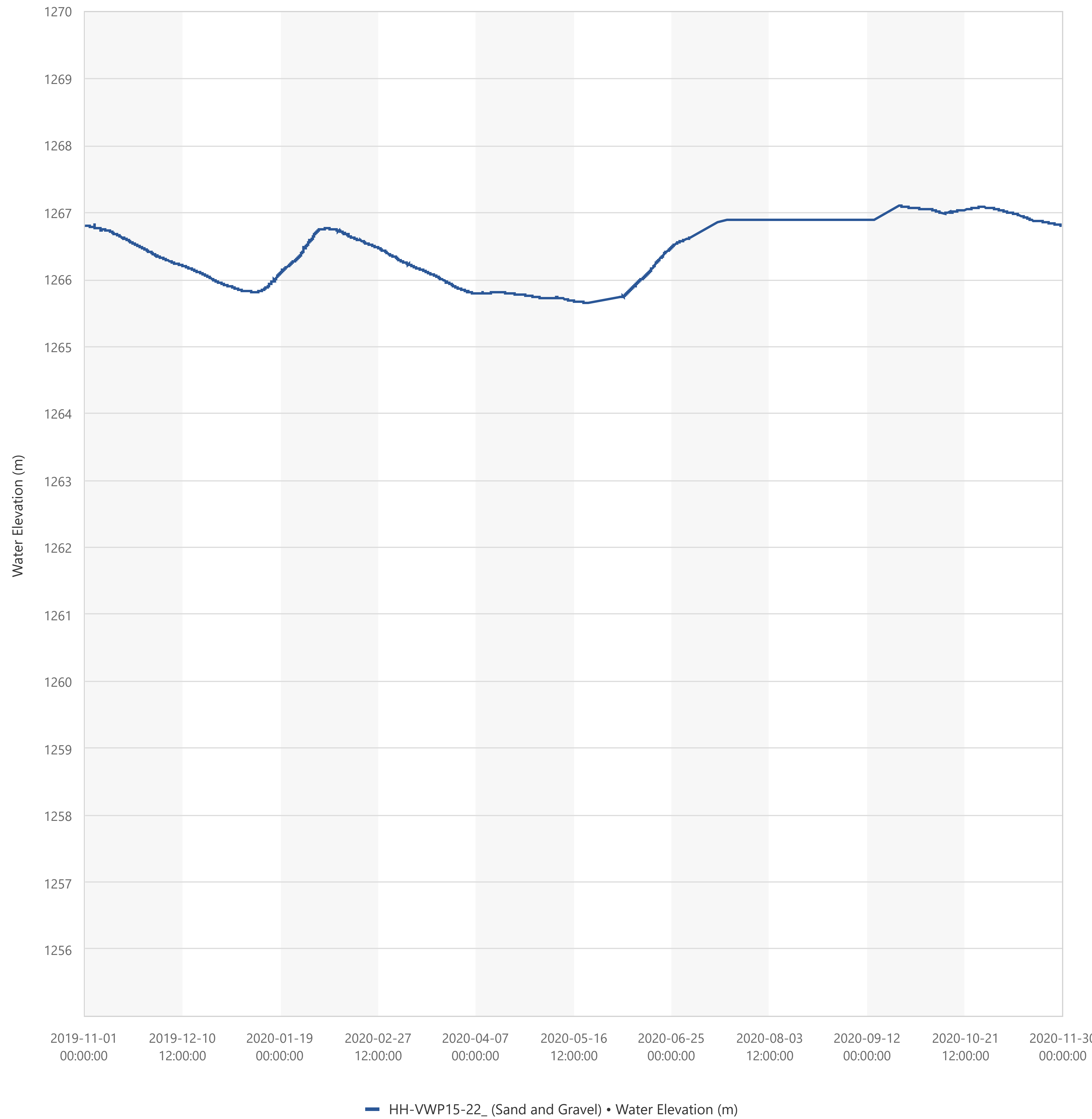
KCB-FIG-D-L

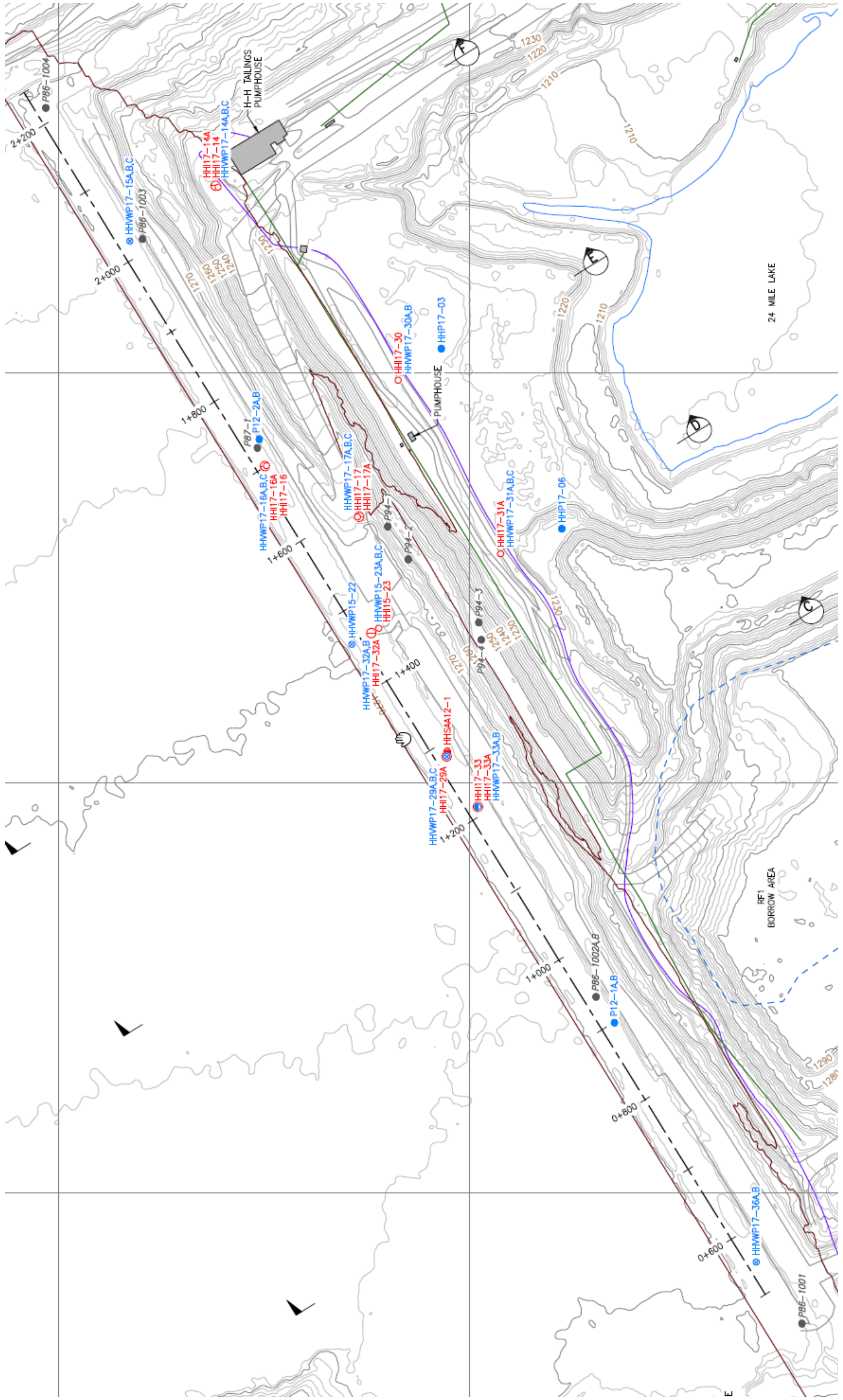
Appendix IV-B-1

H-H Dam Piezometers: 2020 Water Elevations

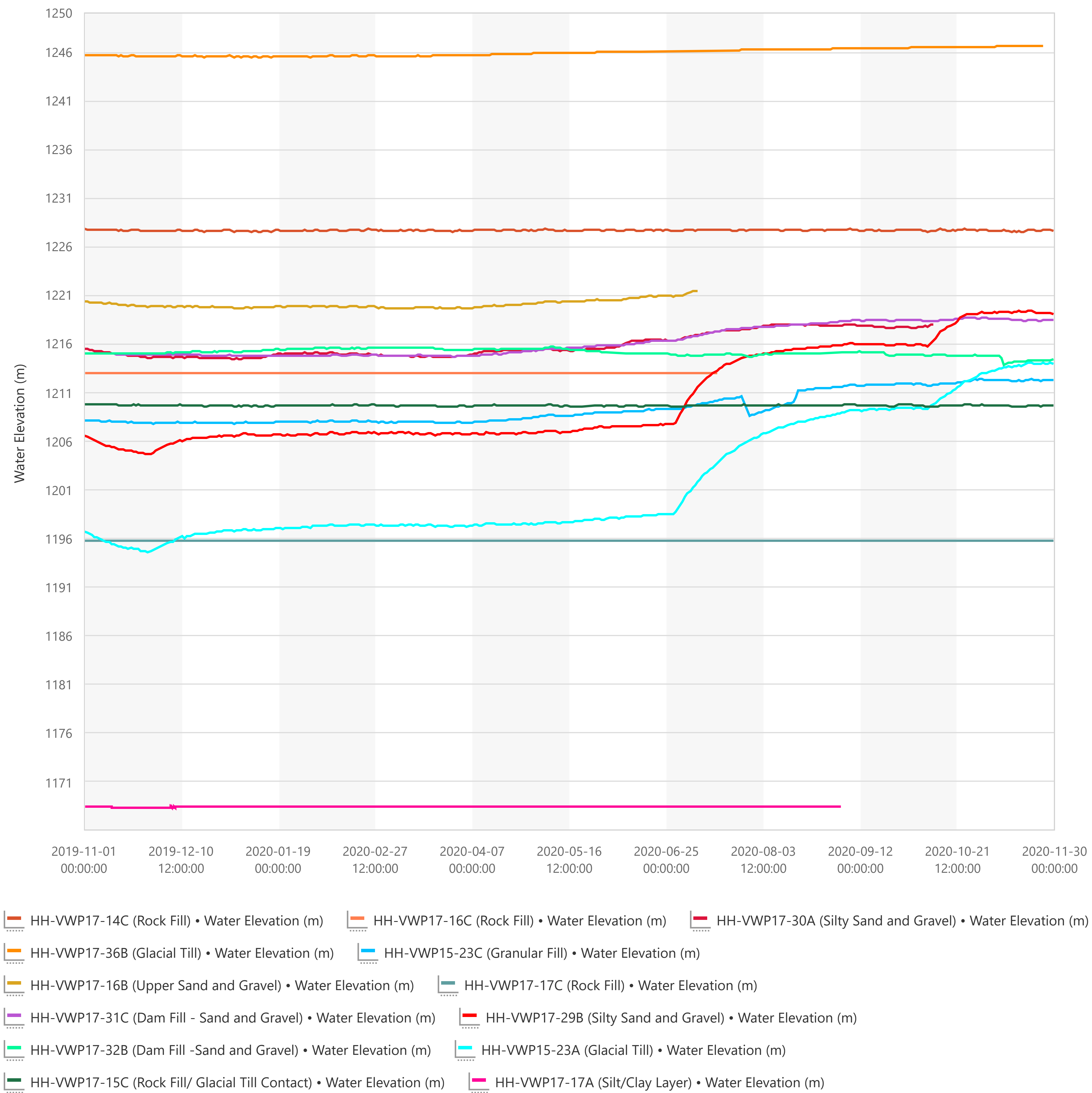


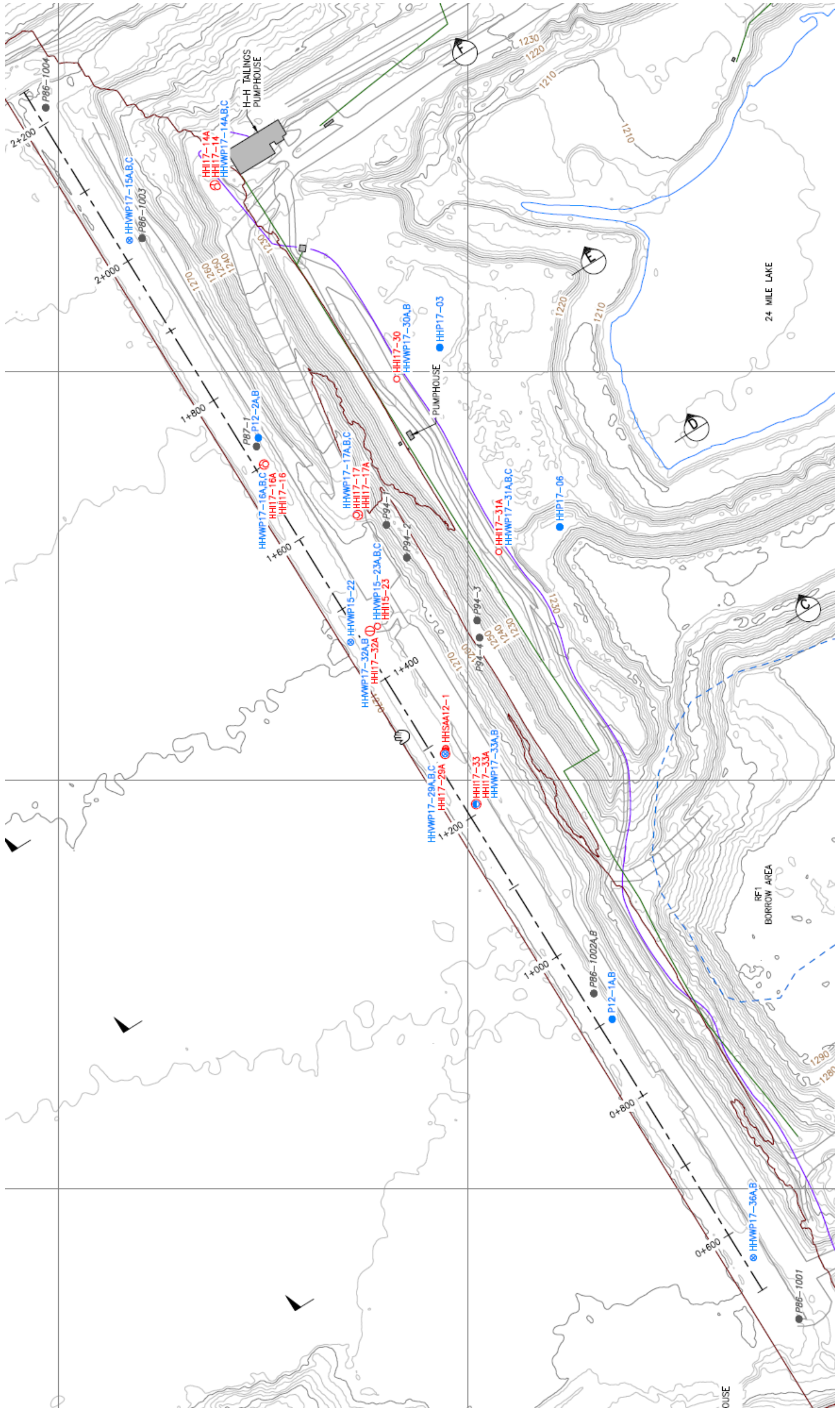
HH - Upstream of Core



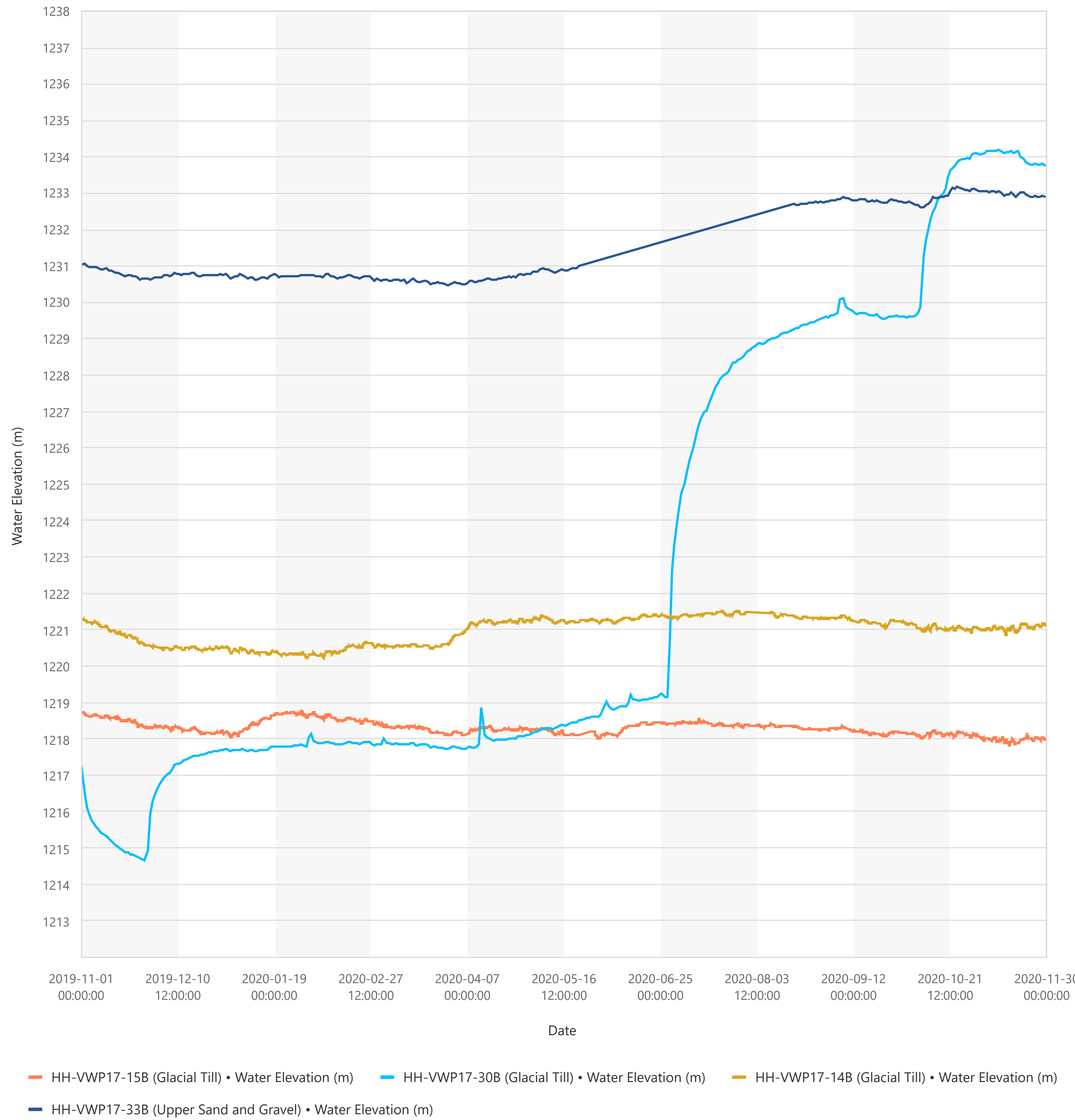


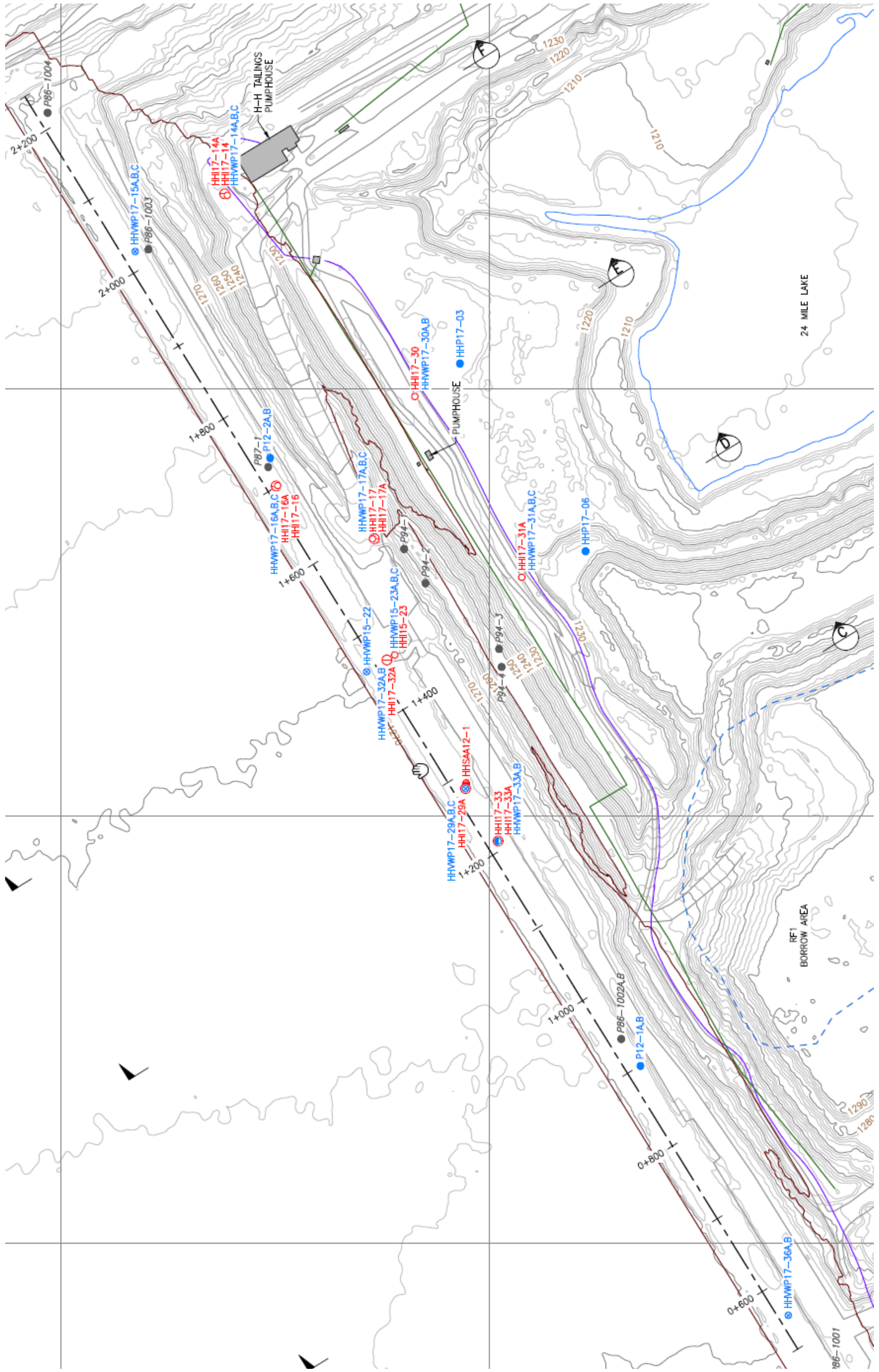
HH - Dam Fill, Sand and Gravel



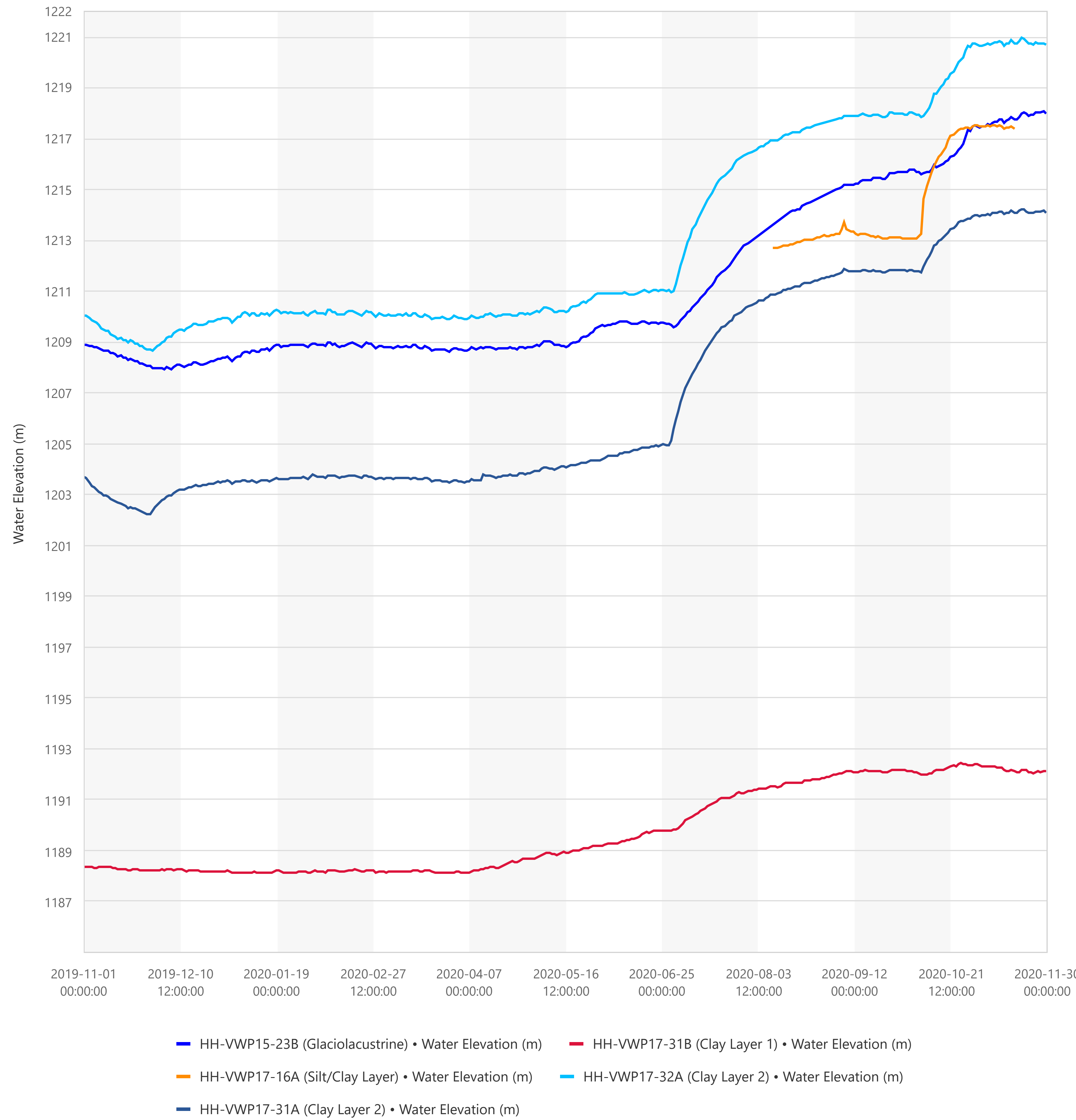


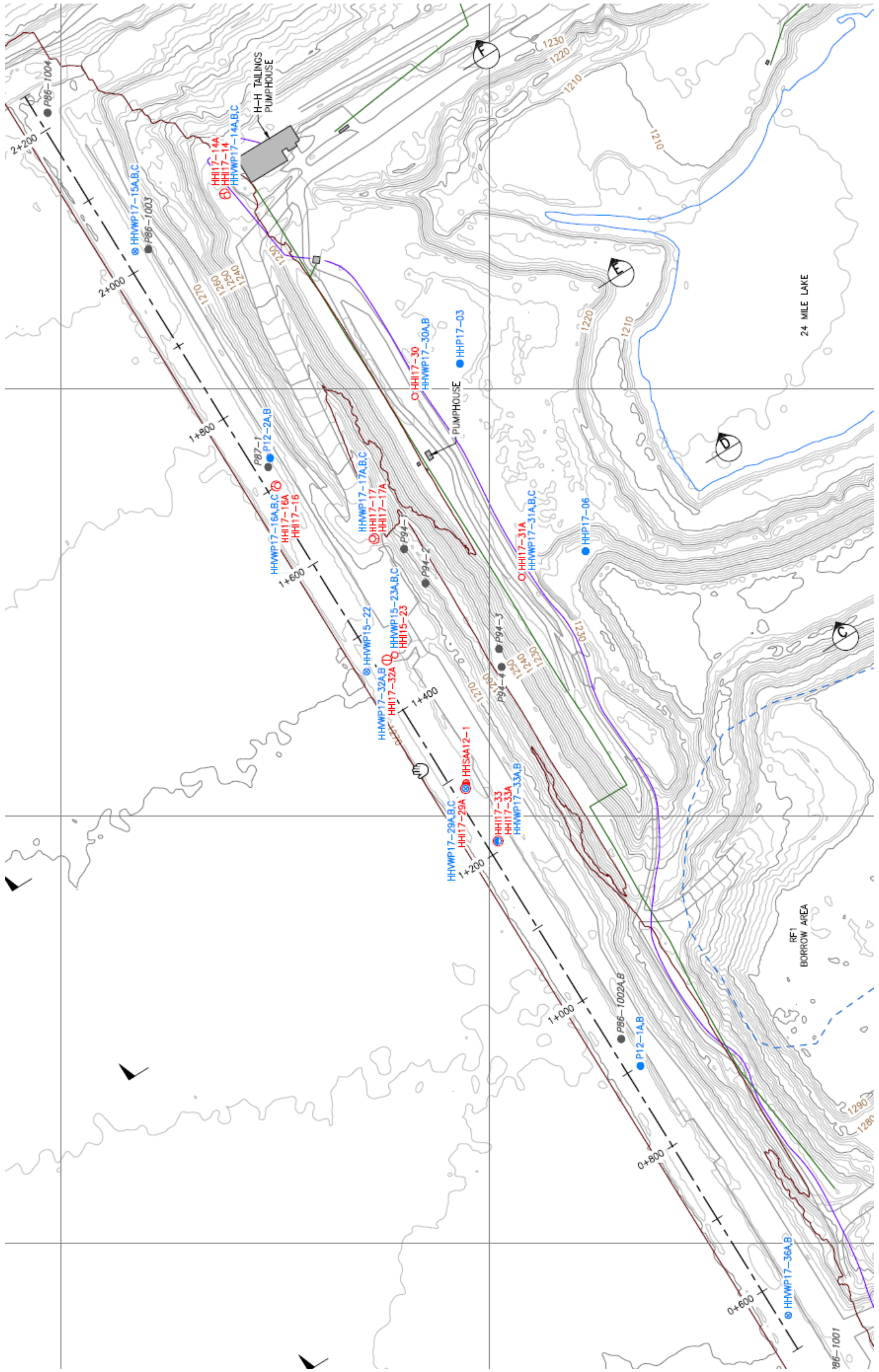
HH - Glacial Till and Clay, Silt



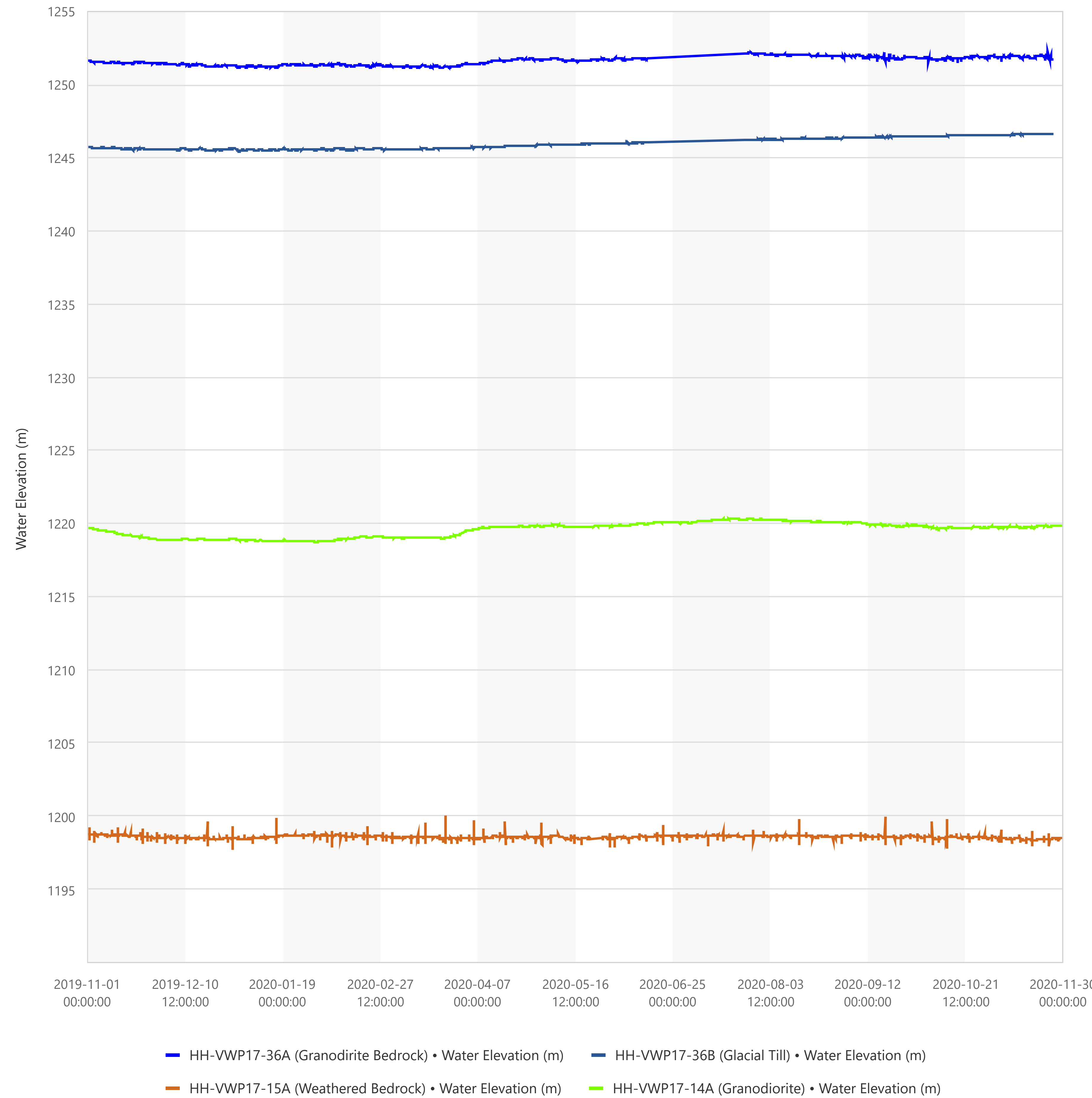


HH - Glaciolacustrine



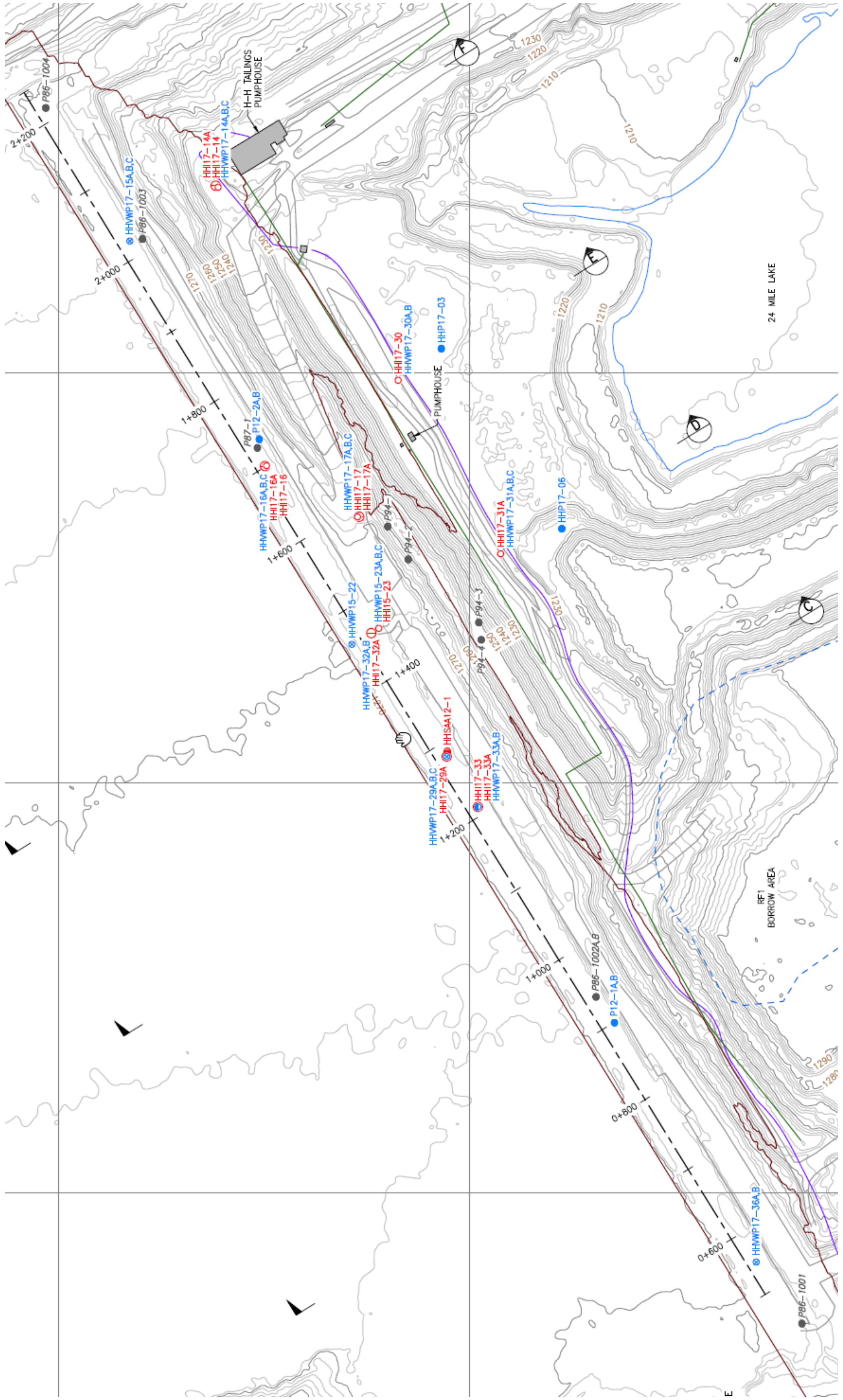


HH - Foundation Rock

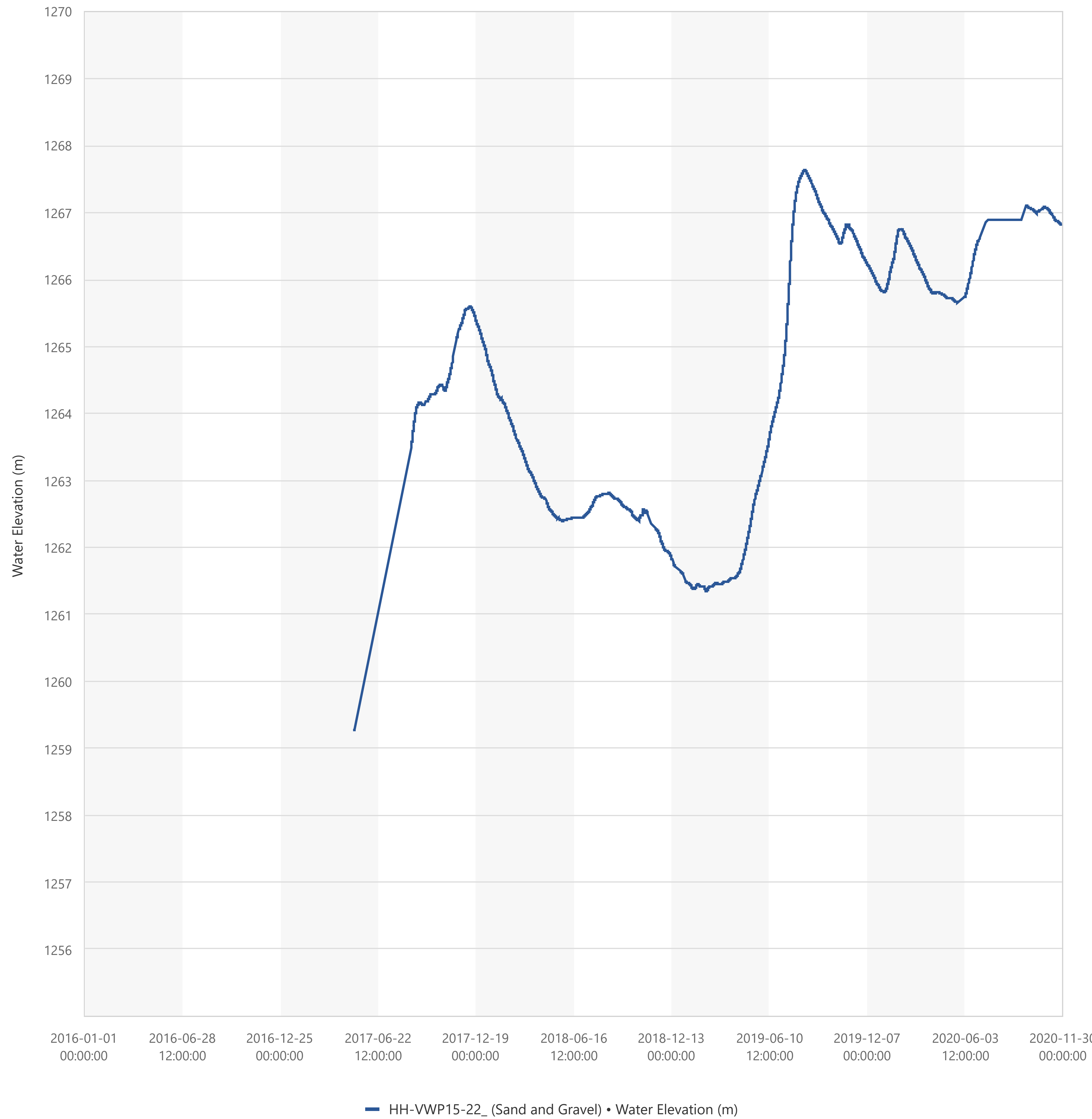


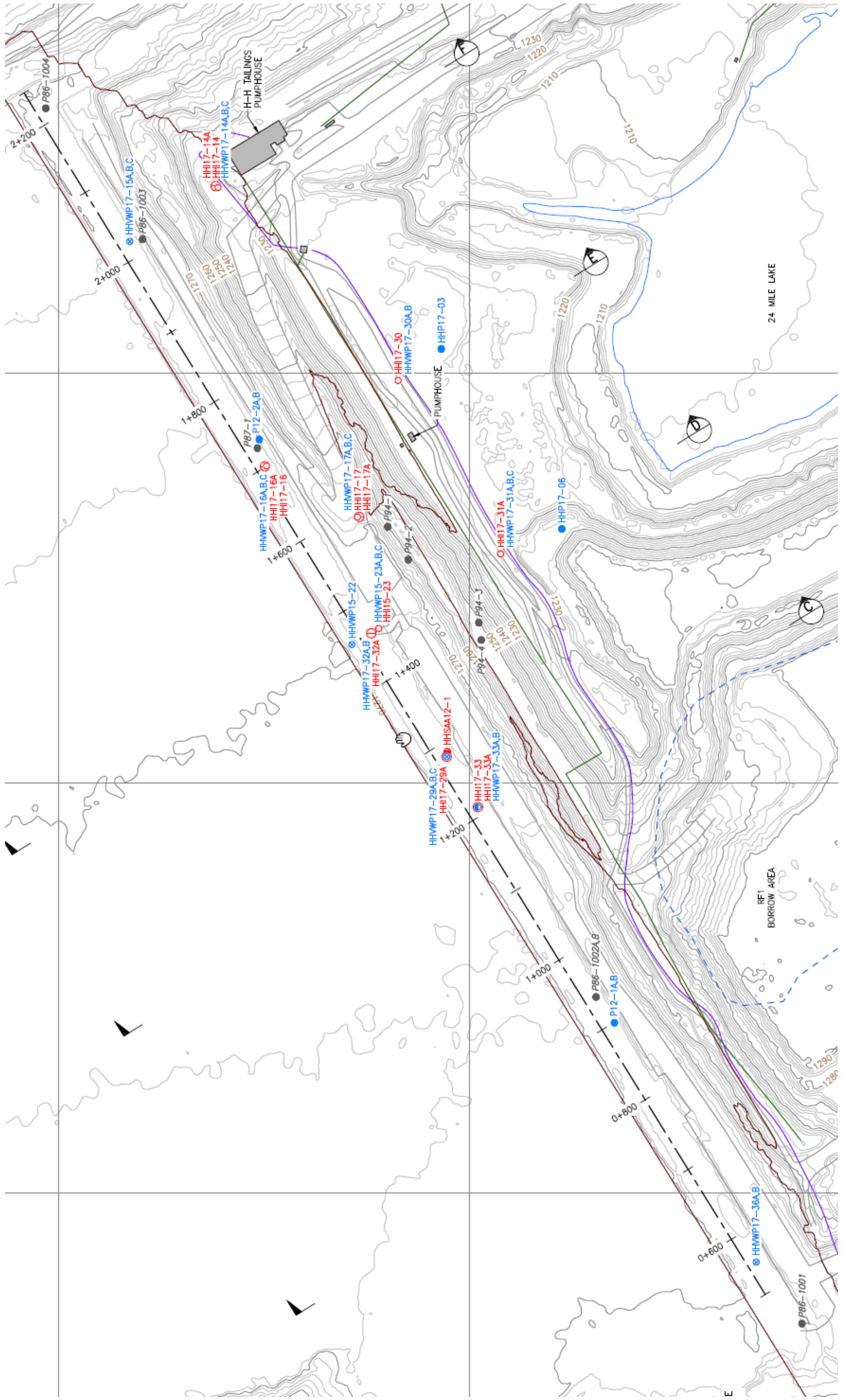
Appendix IV-B-2

H-H Dam Piezometers: Water Elevations Since 2016

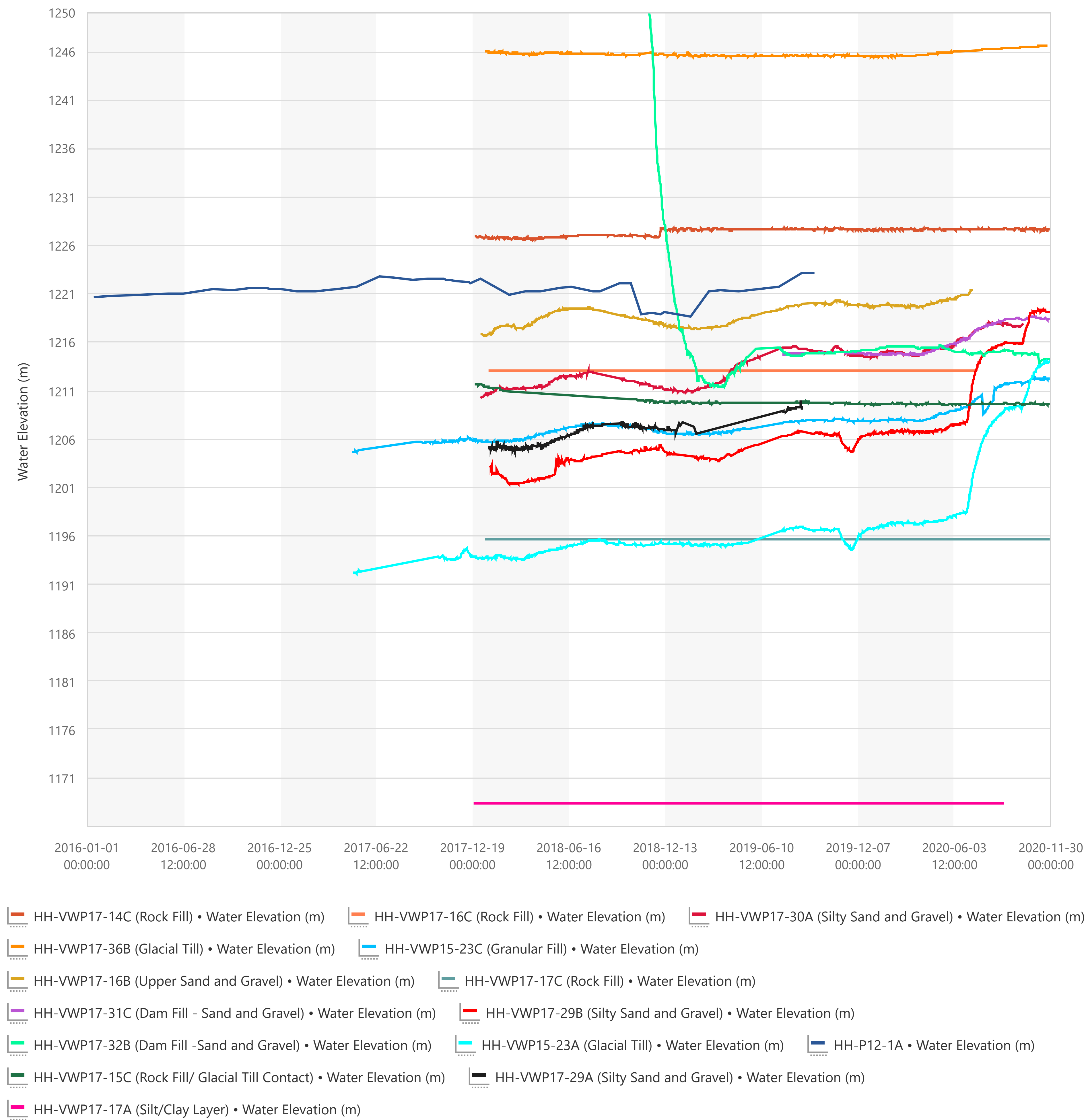


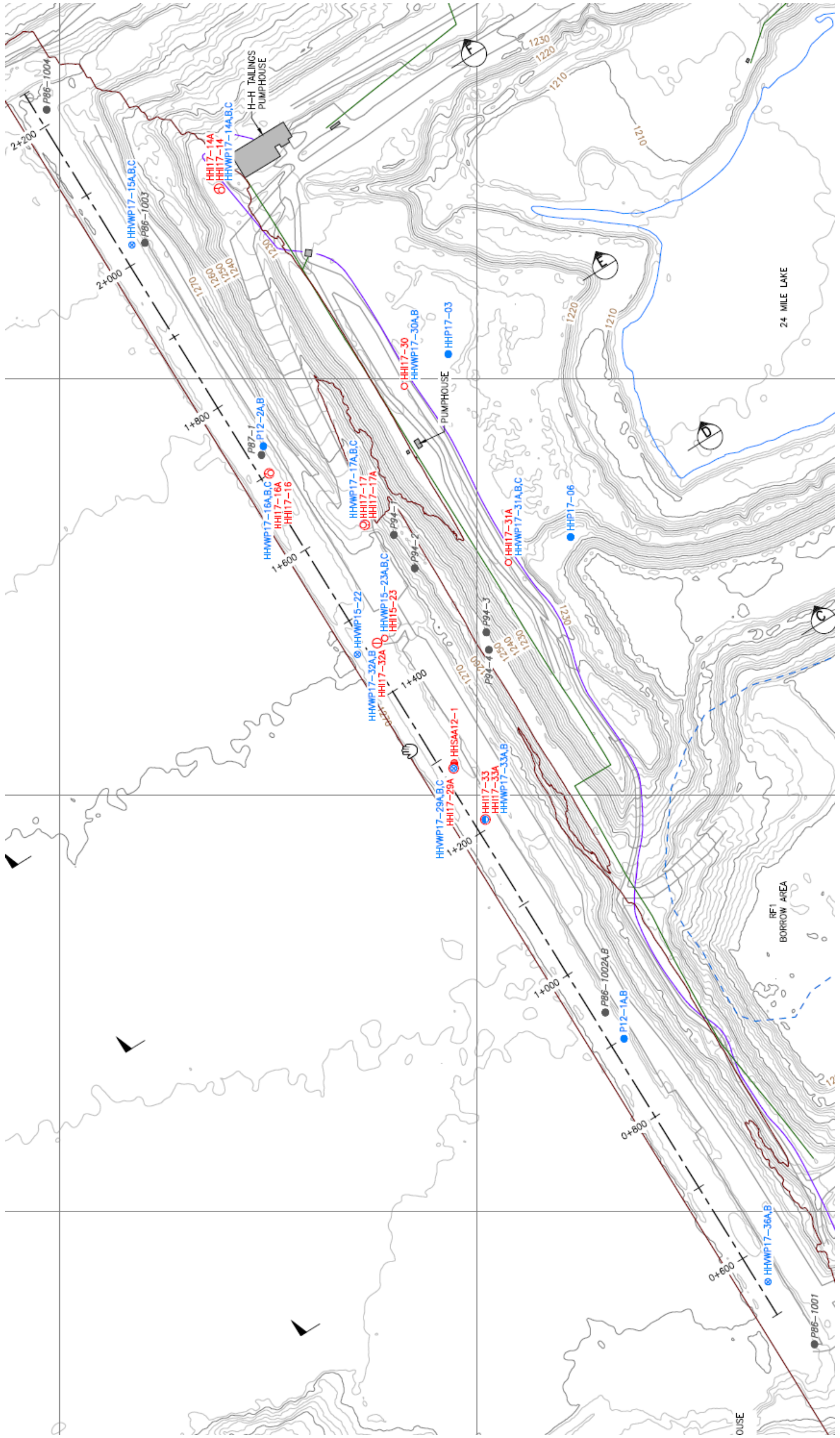
HH - Upstream of Core



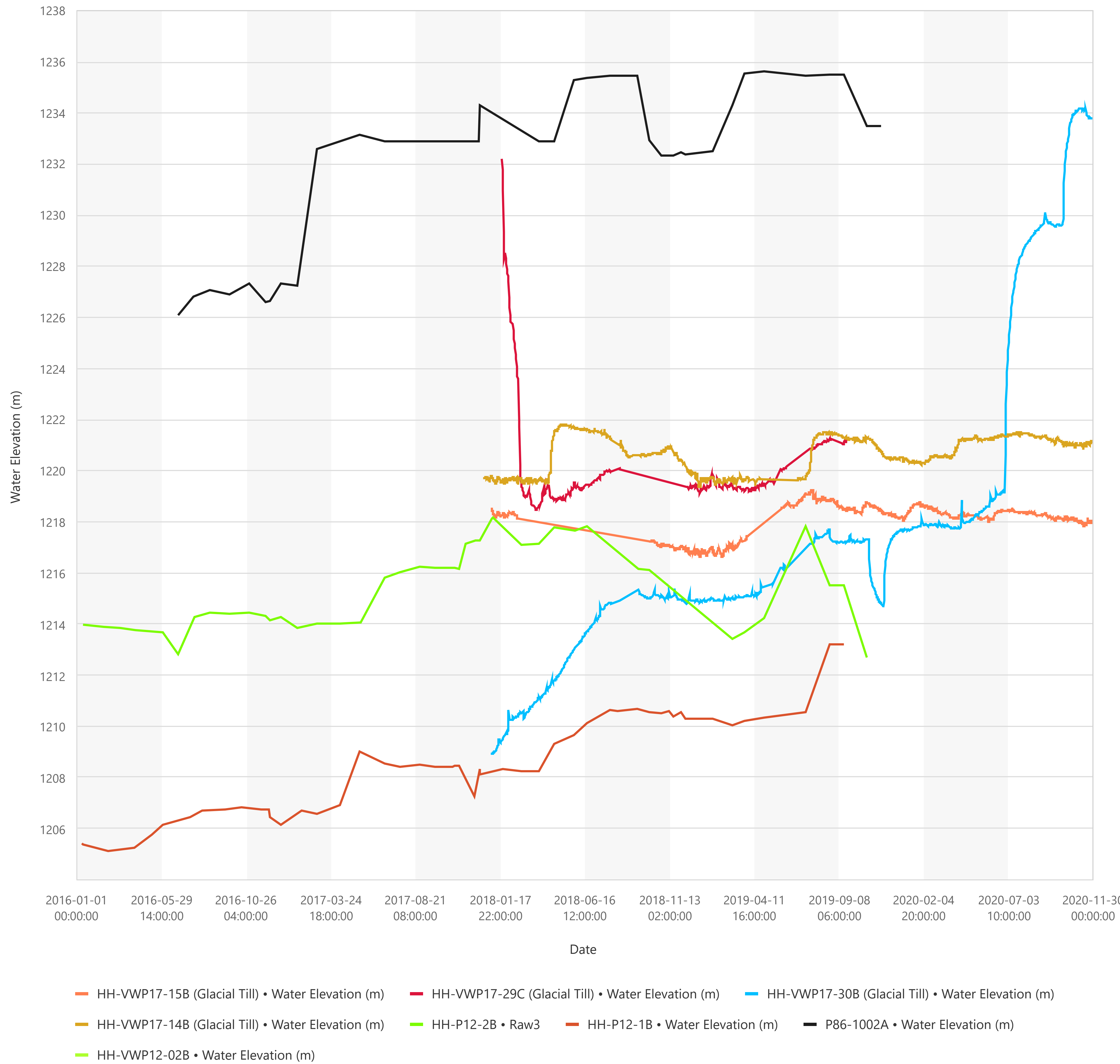


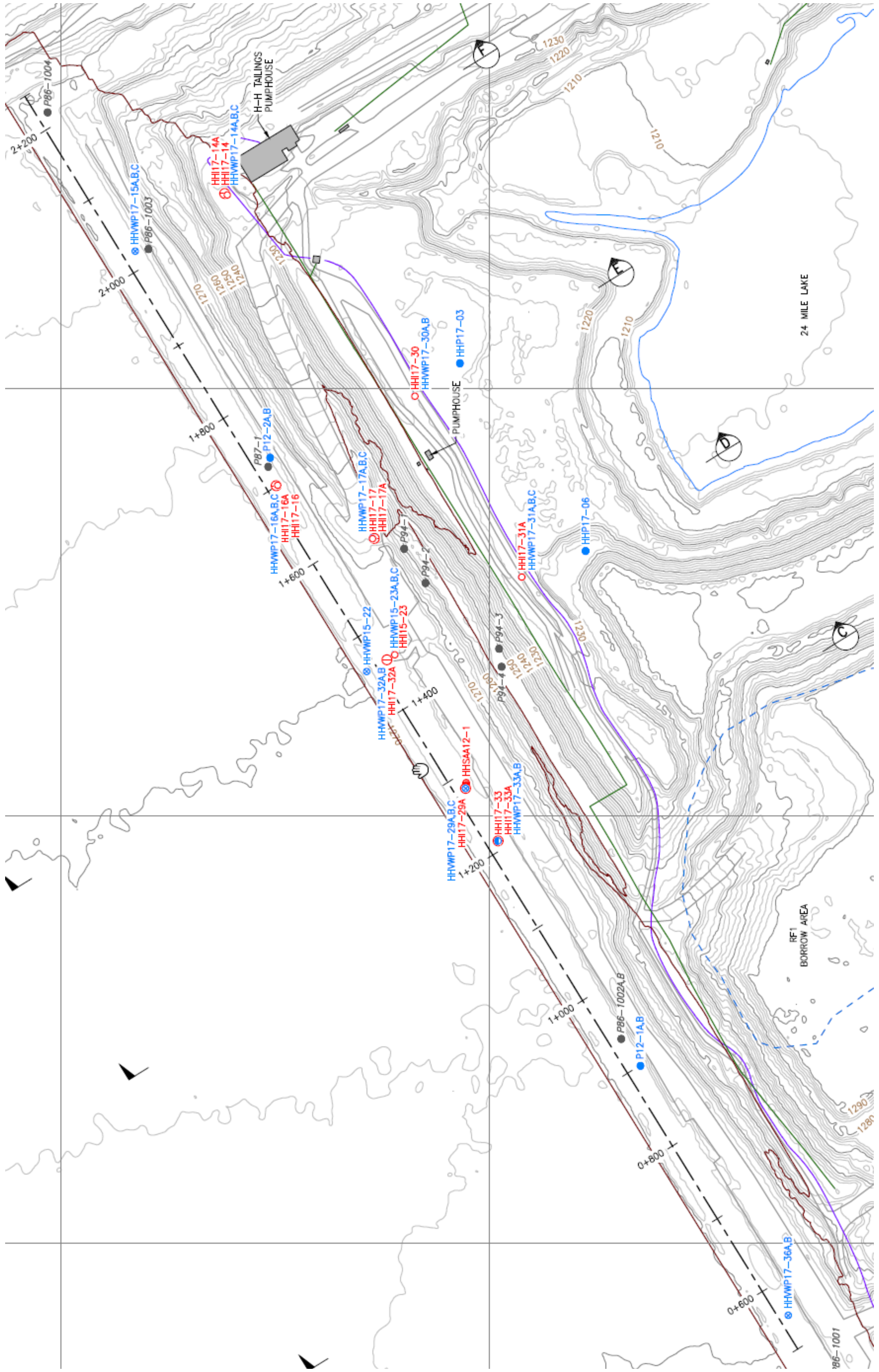
HH - Dam Fill, Sand and Gravel



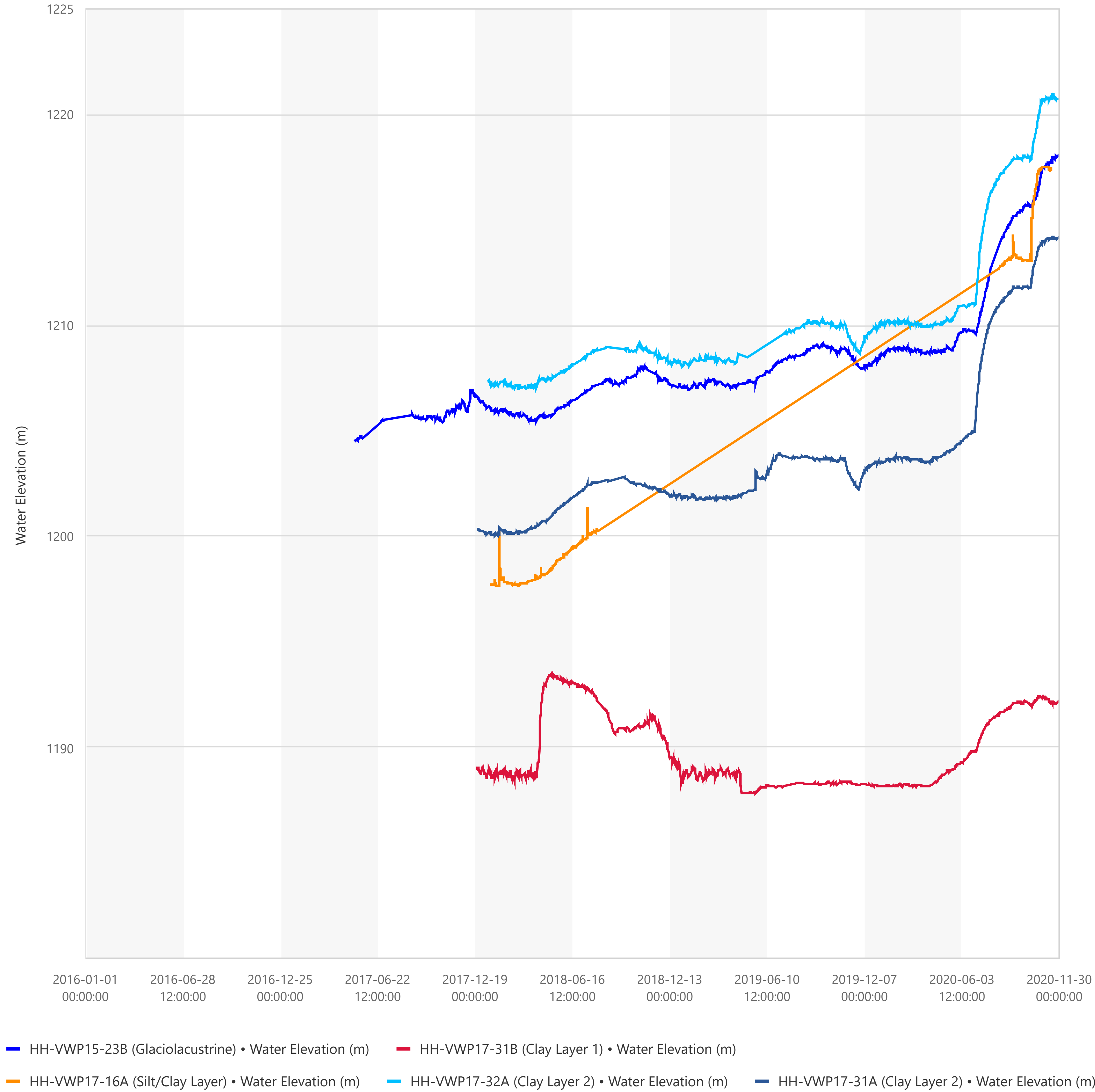


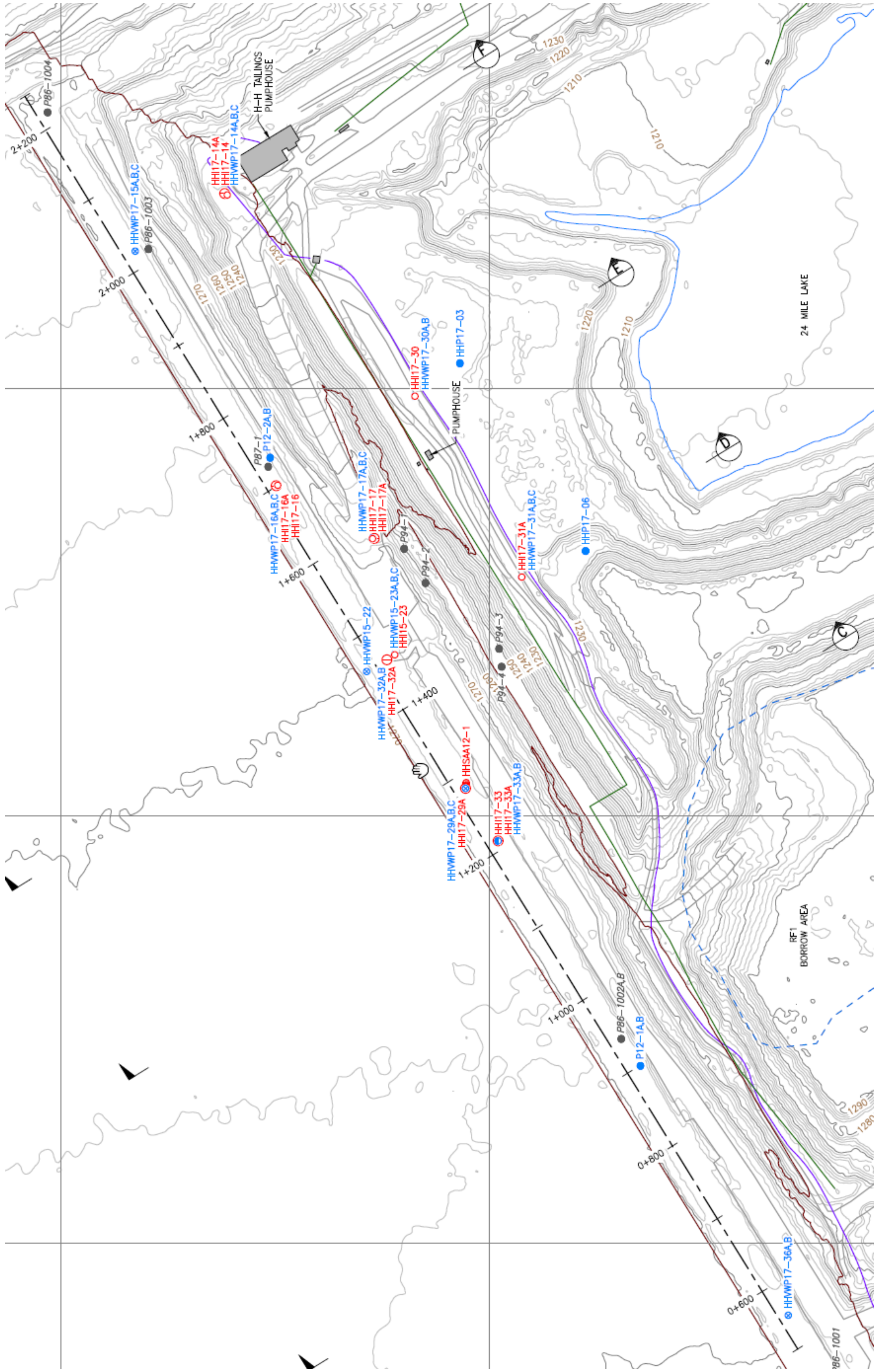
HH - Glacial Till and Clay, Silt



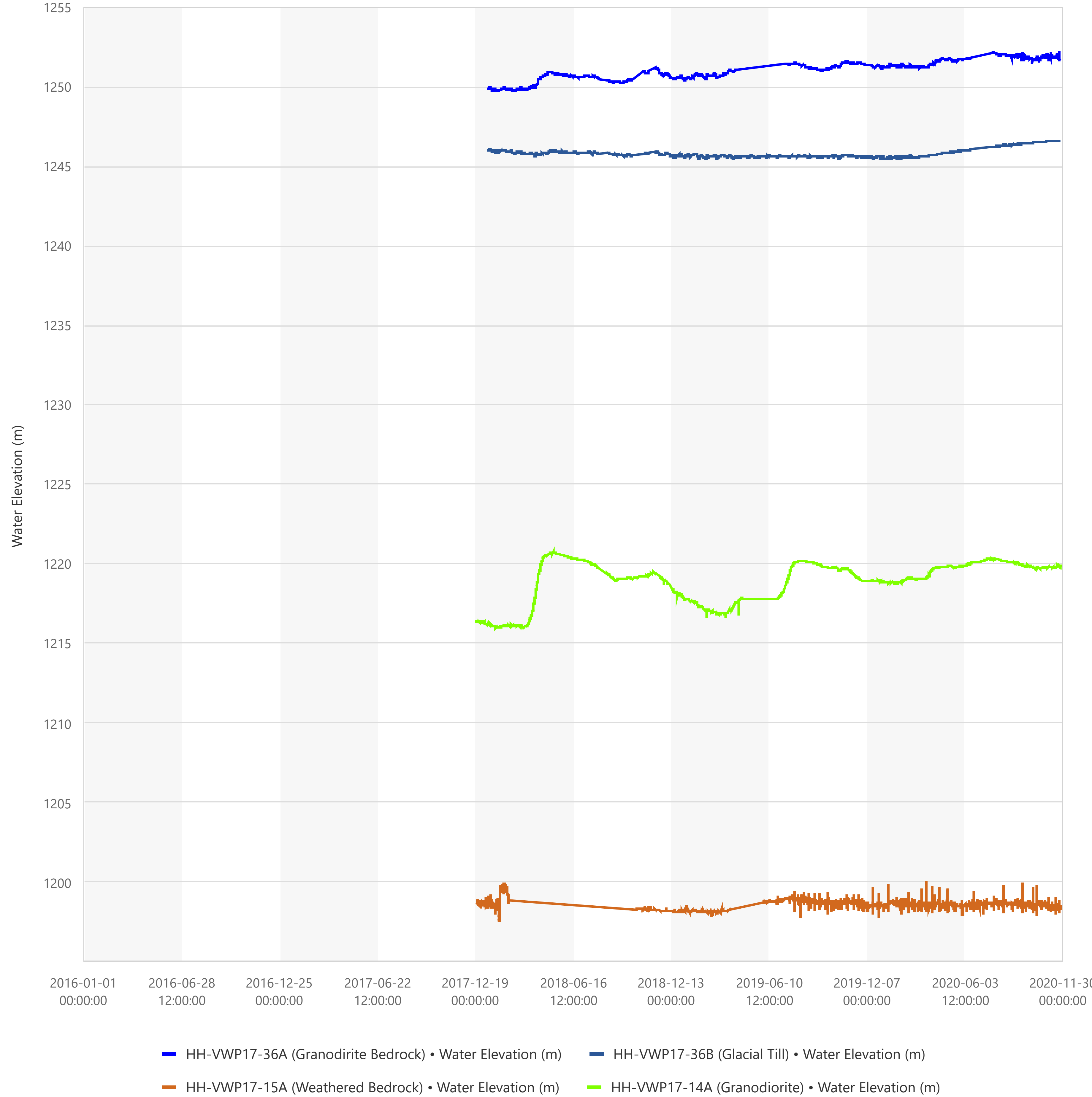


HH - Glaciolacustrine





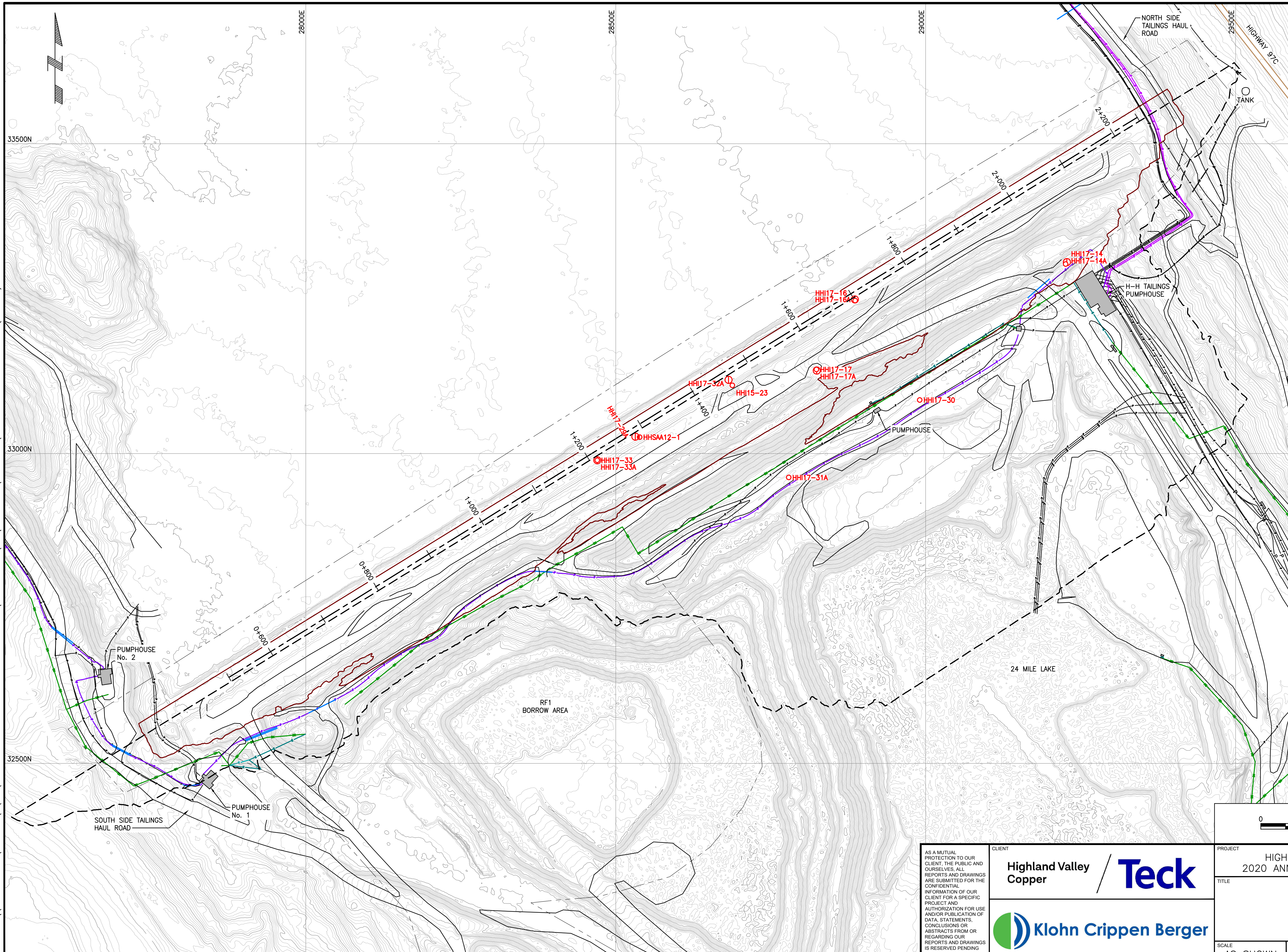
HH - Foundation Rock



APPENDIX IV-C

H-H Dam Inclinometer Plots

H-H DAM INCLINOMETER LOCATION PLAN



LEGEND:

- ULTIMATE DAM FOOTPRINT
- TAILINGS PIPELINE
- POWERLINE
- HAUL ROAD
- PUBLIC ROAD
- 2040 PFS DAM FOOTPRINT
- H-H DAM CENTERLINE (0+800)

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 PHOTOSAT SURVEY DATED 2020-10-08 (H-H DAM) AND 2017-09-15 & 24 AND 2016-09-25 & 29 (OUTSIDE OF 2020 SURVEY EXTENT).
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. SONDEX SYSTEM HHI17-29A REPORTED TO BE DEFUNCT SINCE OCTOBER 2018.
4. SONDEX SYSTEM HHI17-14A REPORTED TO BE DEFUNCT SINCE JULY 2020.

0 200 m

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: H-H DAM INCLINOMETERS LOCATION PLAN

SCALE	PROJECT No.	FIG. No.
AS SHOWN	M02341B83	

SAVE DATE: 2020-12-15 (9:31 AM)
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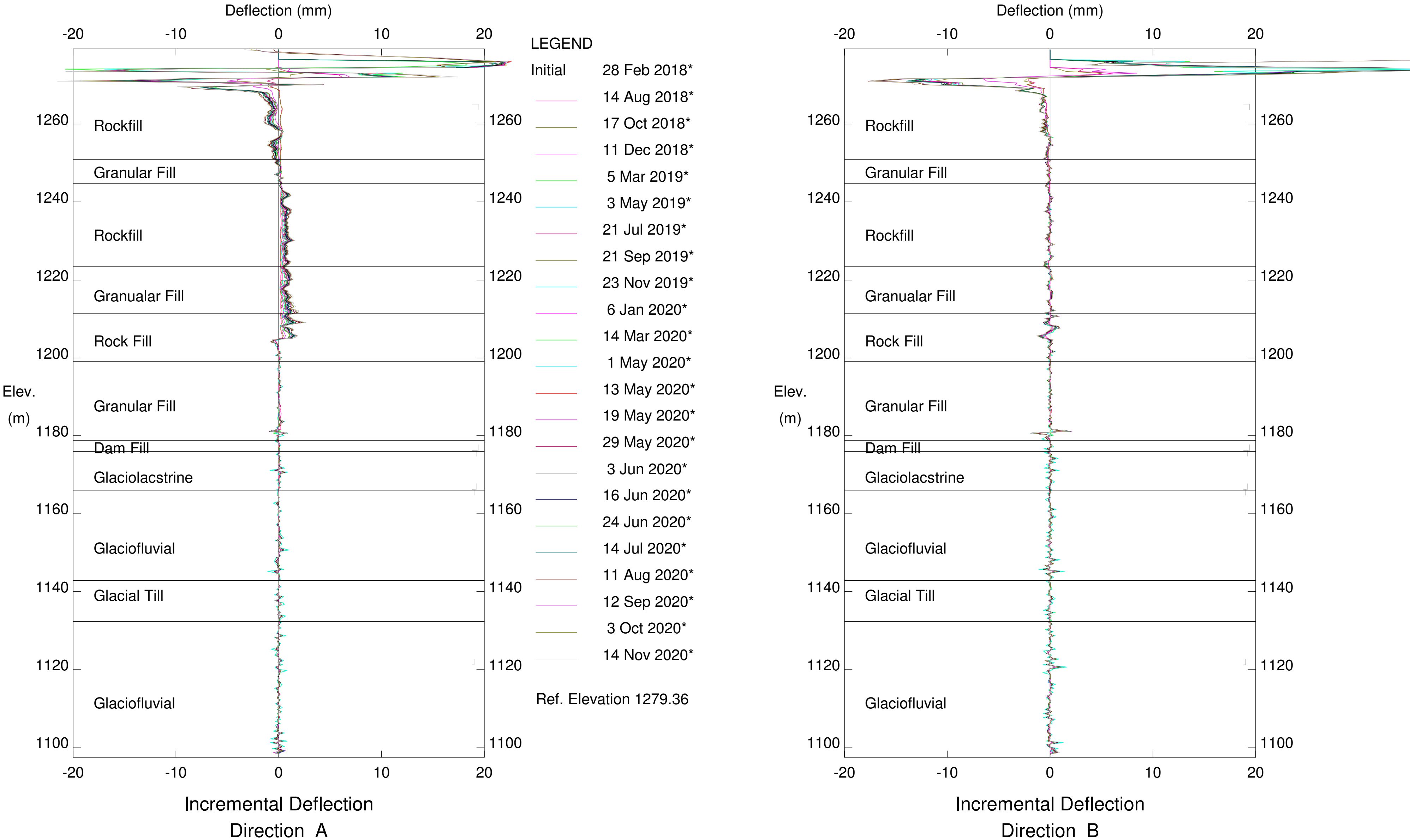
KCB-FIG-D-L

H-H DAM

I15-23

Highland Valley Copper - Logan Lake, BC

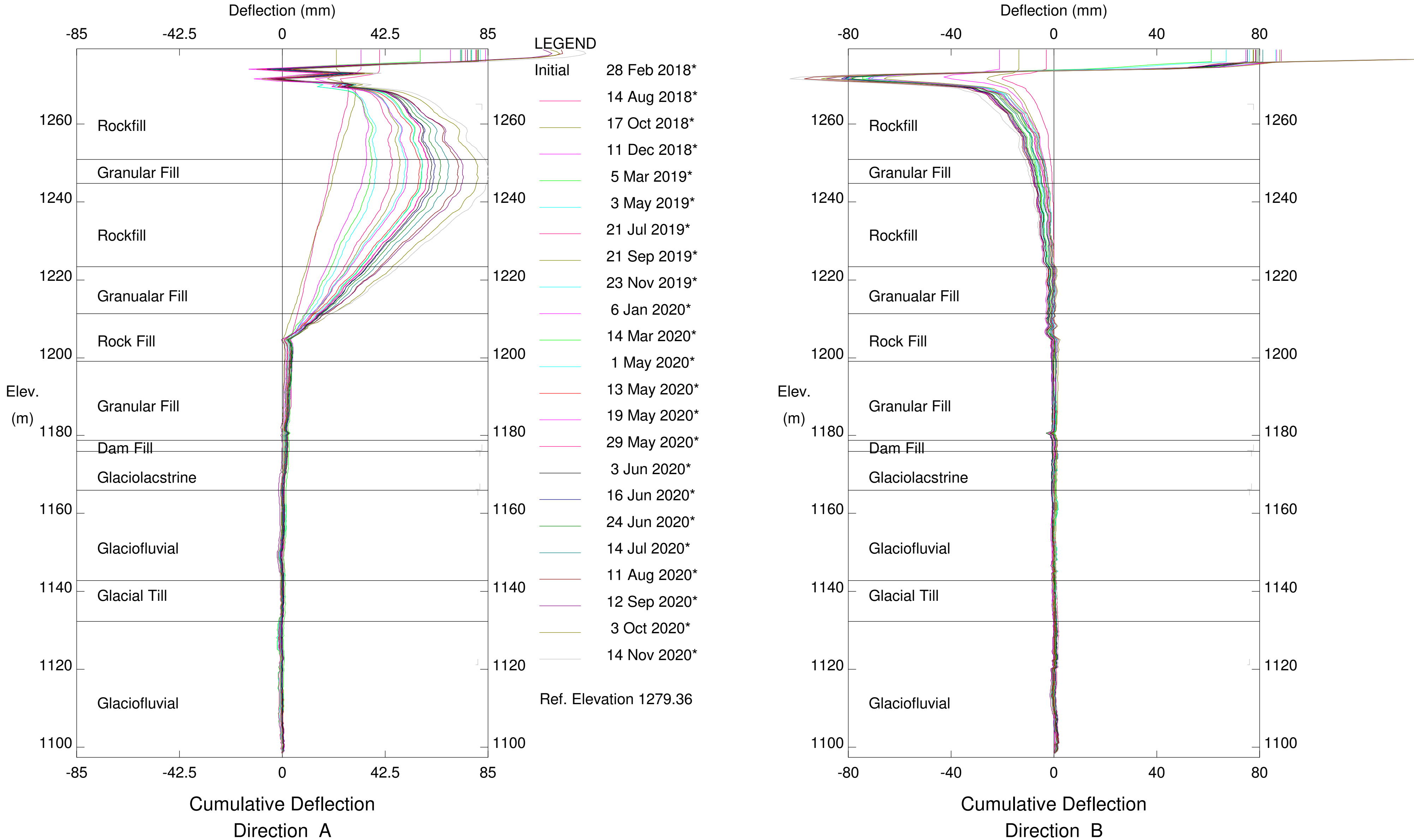


H-H Dam, Inclinometer I15-23

Sets marked * include zero shift and/or rotation corrections.

I15-23.gtl

Highland Valley Copper - Logan Lake, BC

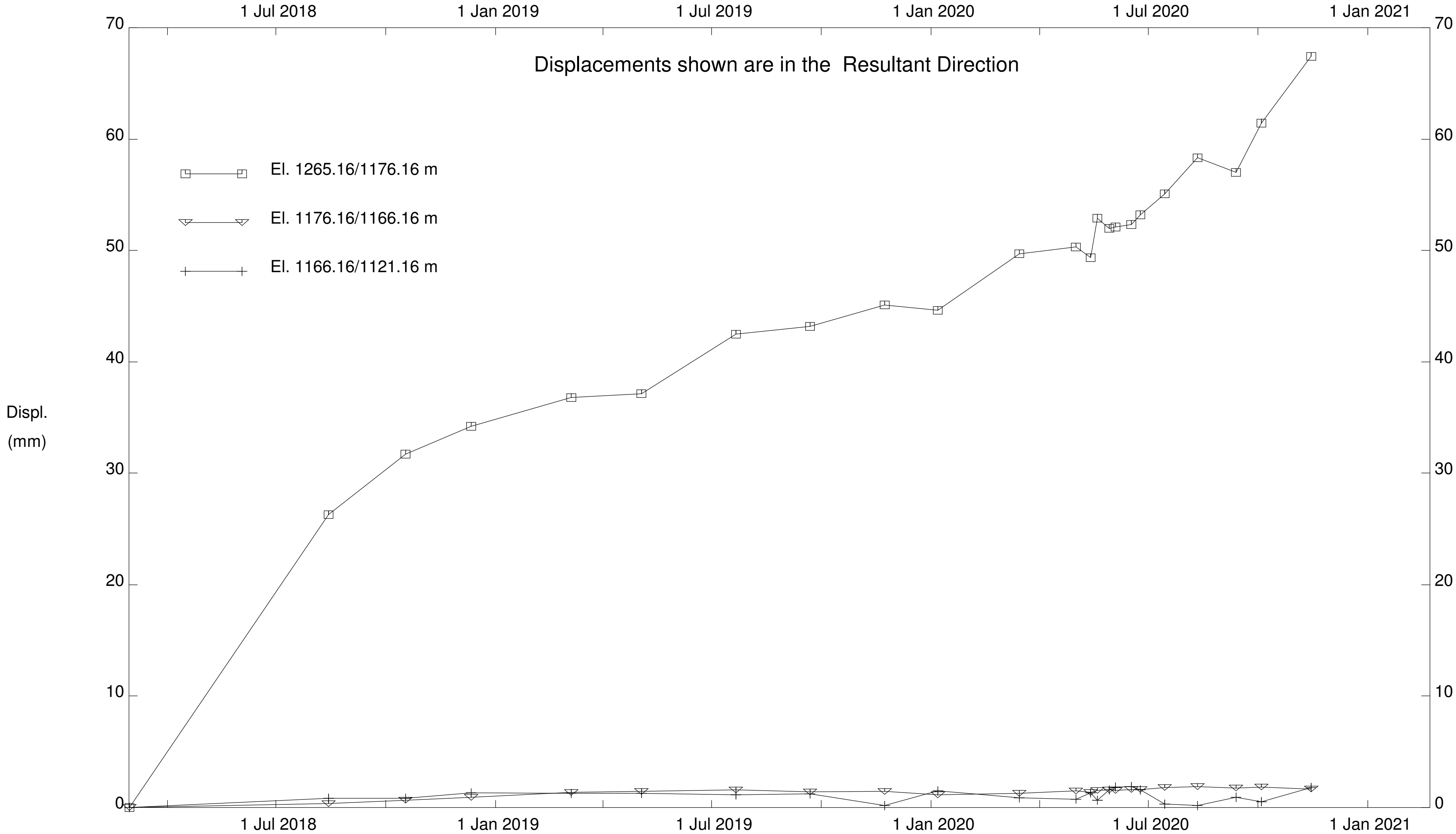


H-H Dam, Inclinometer I15-23

Sets marked * include zero shift and/or rotation corrections.

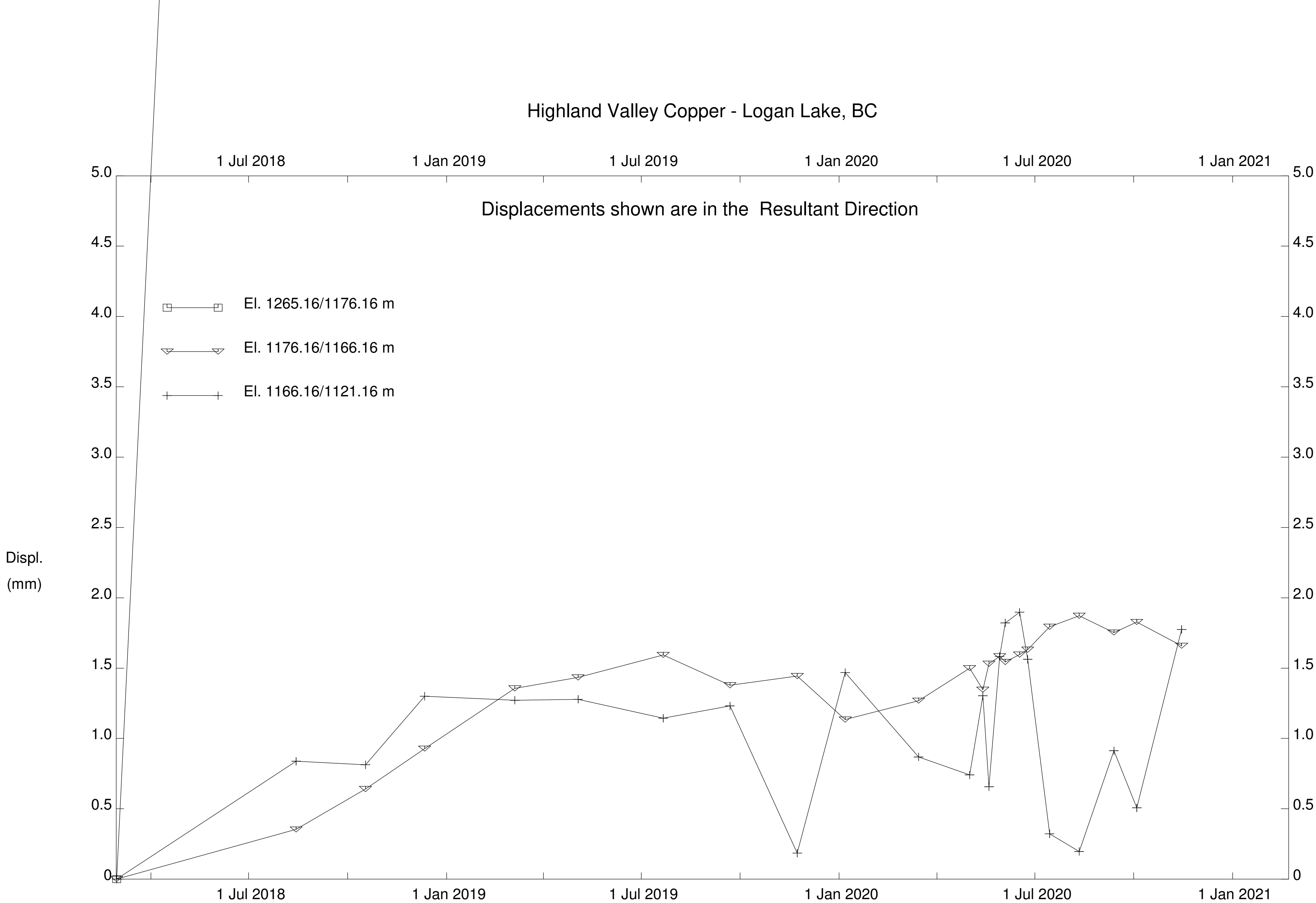
I15-23.gtl

Highland Valley Copper - Logan Lake, BC



H-H Dam, Inclinometer I15-23

Highland Valley Copper - Logan Lake, BC

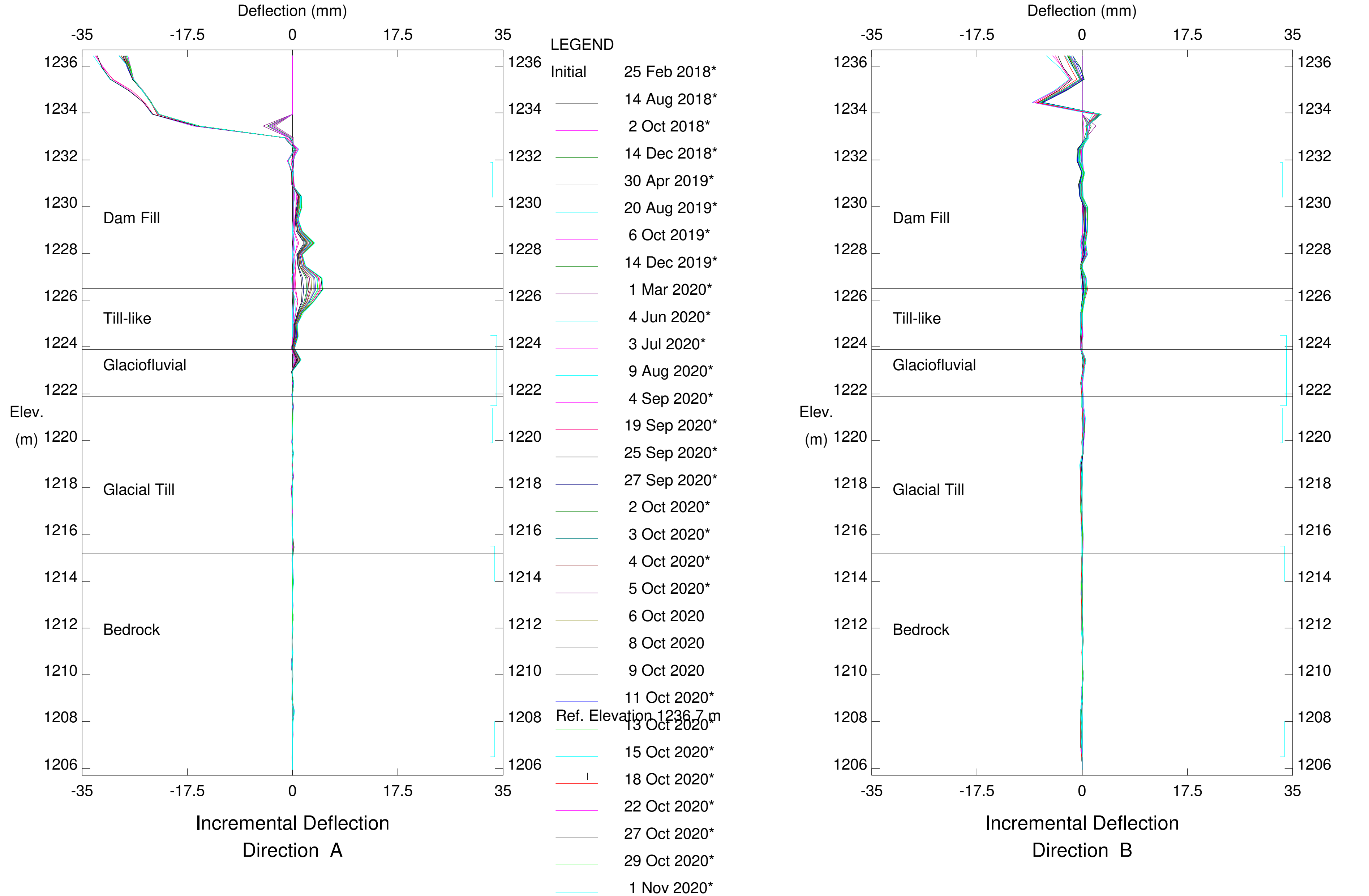


H-H Dam, Inclinometer I15-23

H-H DAM

I17-14

Highland Valley Copper - Logan Lake, BC

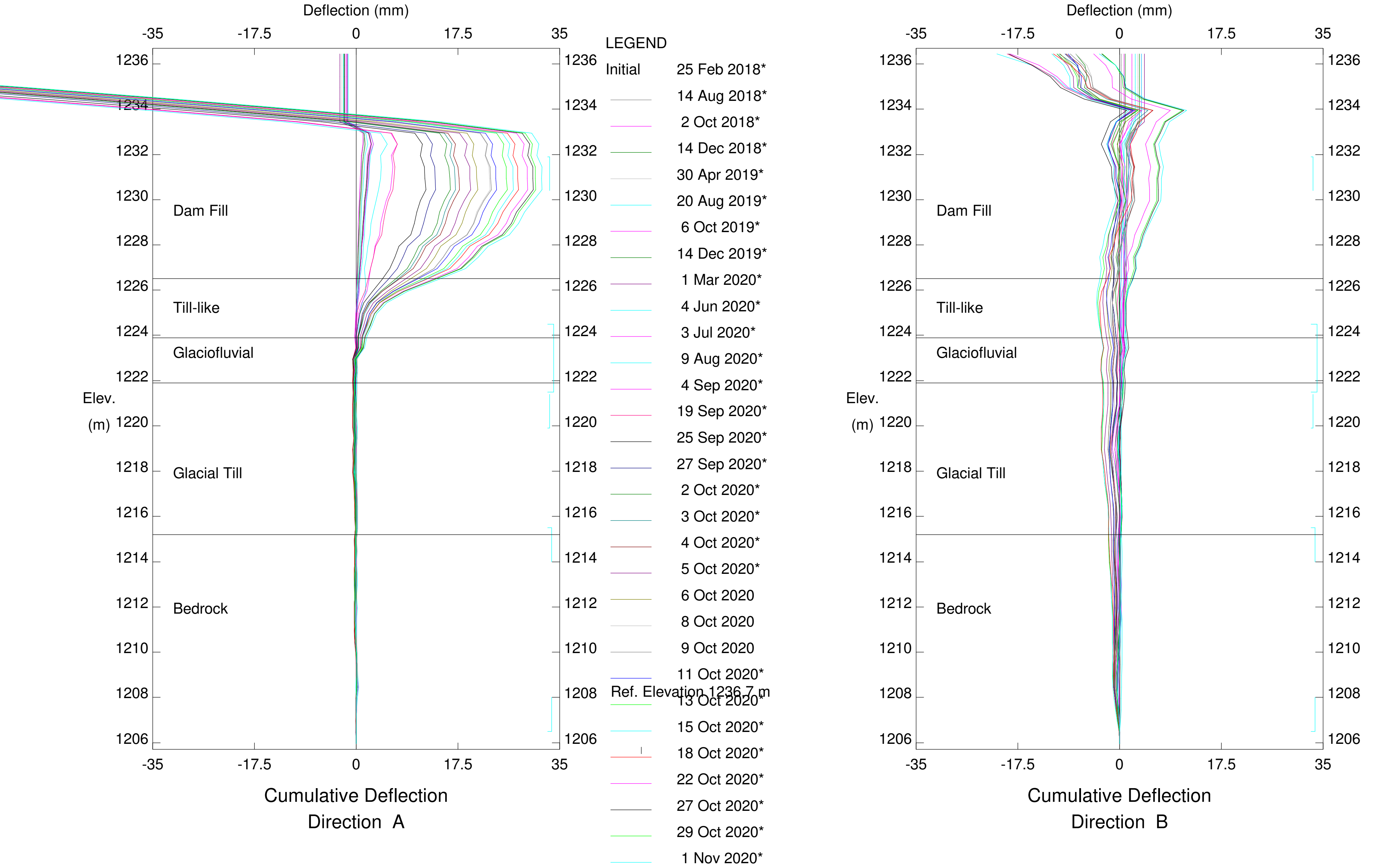


H-H Dam, Inclinometer I17-14

Sets marked * include zero shift and/or rotation corrections.

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\09 Geotechnical\Instrumentation\03 - Dam Movement Monitoring_H-H Dam\SI Monitoring\GTPLUS32 Files\I17-14.gtl

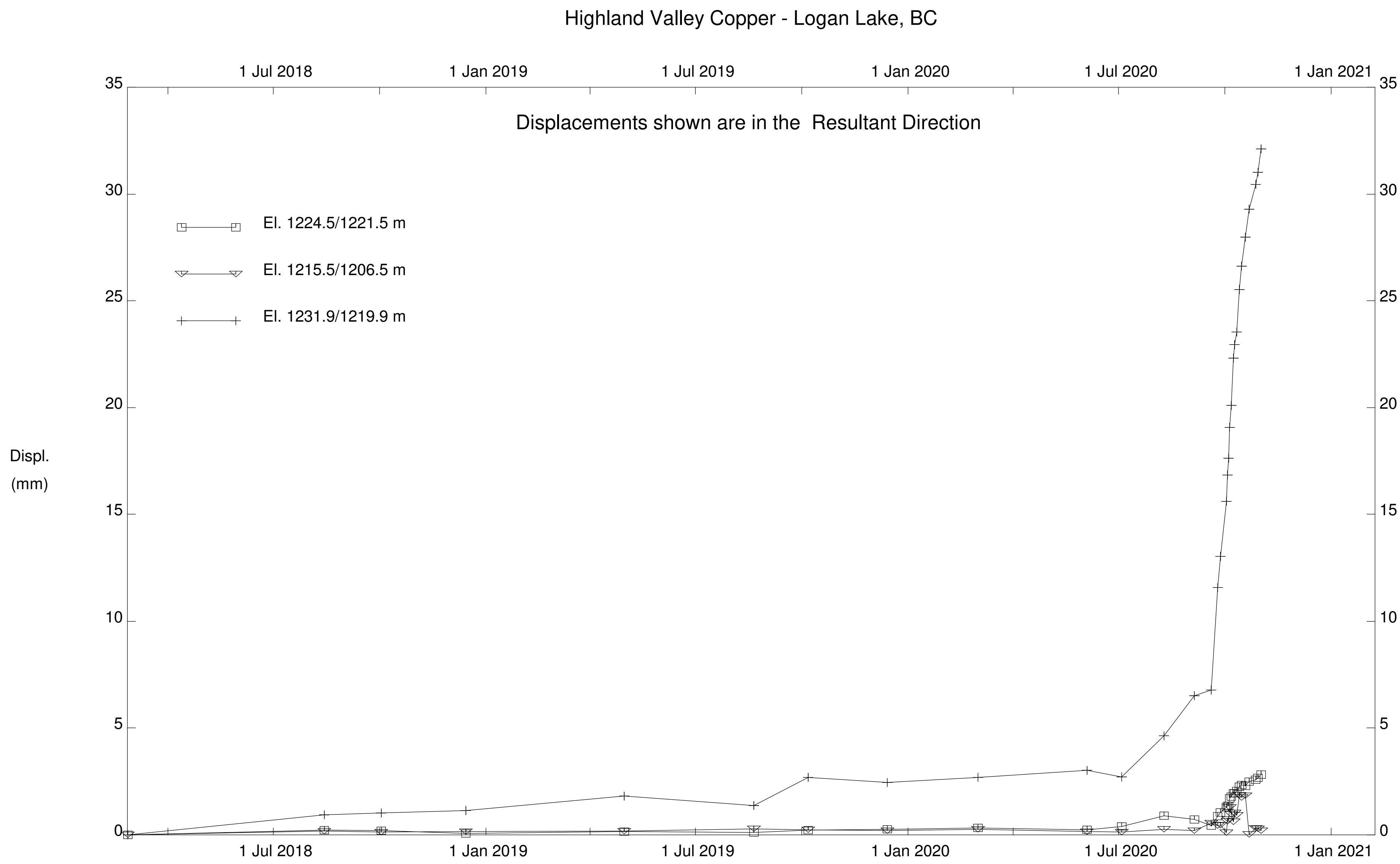
Highland Valley Copper - Logan Lake, BC



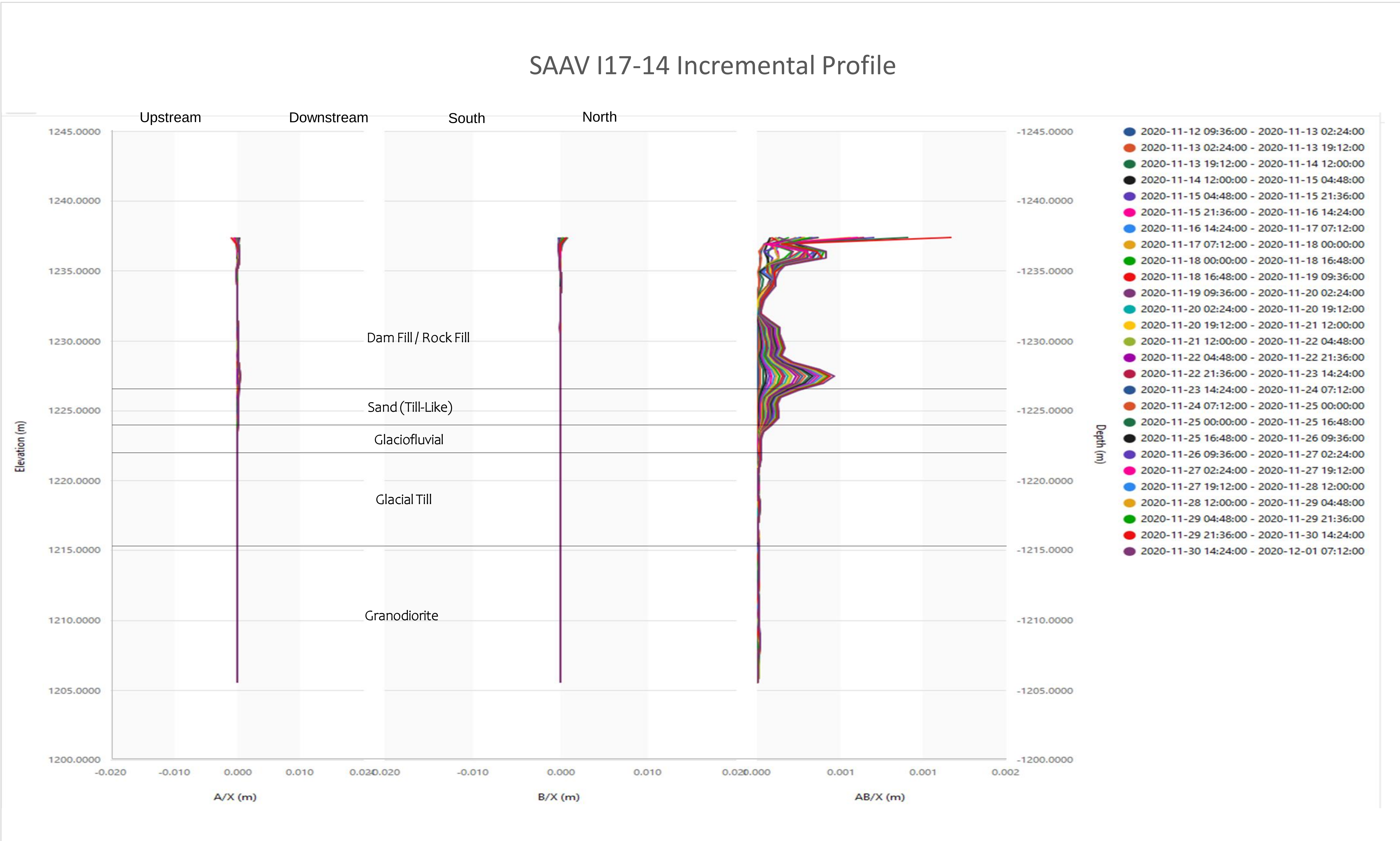
H-H Dam, Inclinometer I17-14

Sets marked * include zero shift and/or rotation corrections.

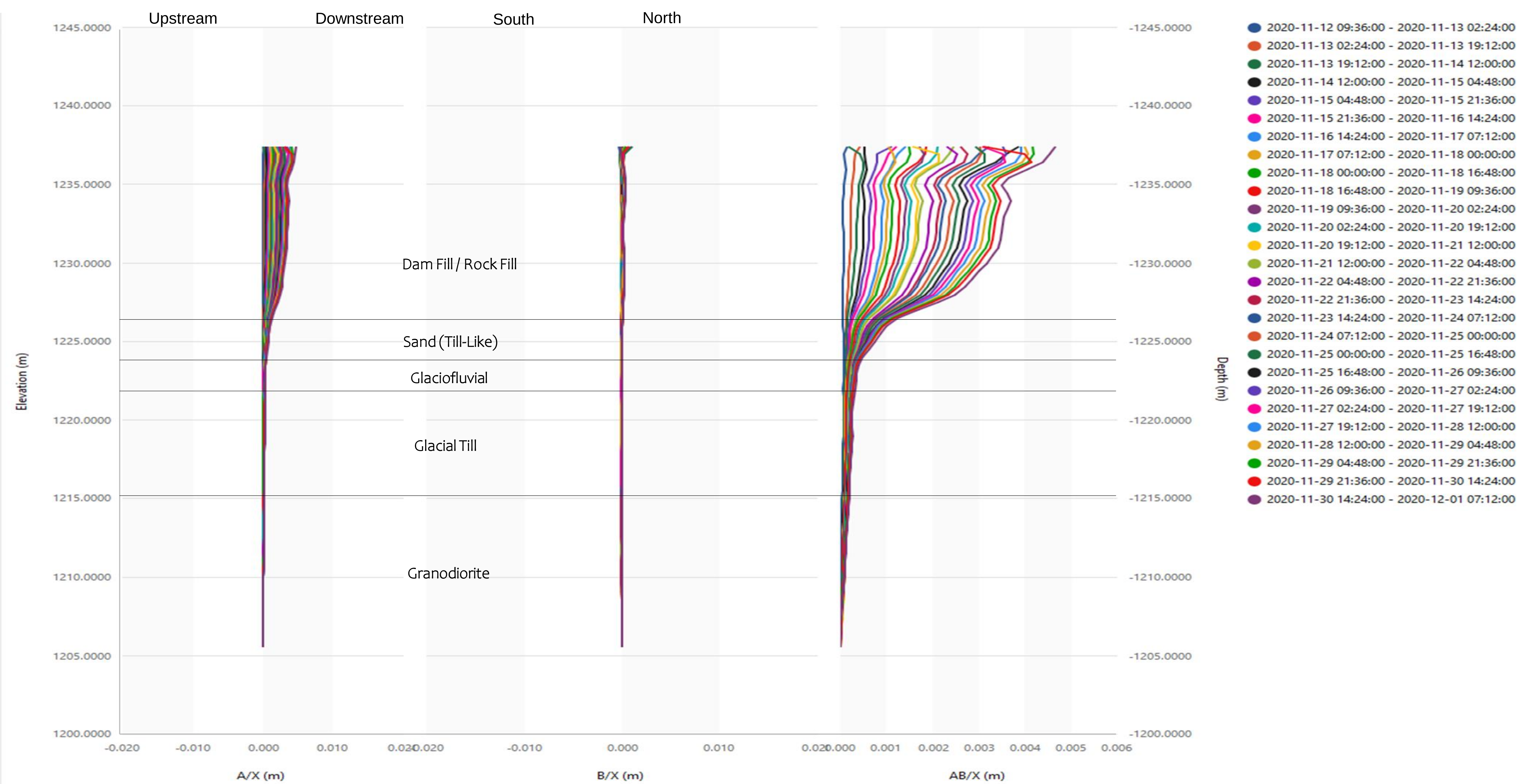
T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\09 Geotechnical\Instrumentation\03 - Dam Movement Monitoring_H-H Dam\SI Monitoring\GTPLUS32 Files\I17-14.gtl



H-H Dam, Inclinometer I17-14


SAAV I17-14 Incremental Profile
Upstream
Downstream
South
North
Dam Fill / Rock Fill
Sand (Till-Like)
Glaciofluvial
Glacial Till
Granodiorite
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2020-11-12 09:36:00 - 2020-11-13 02:24:00
2020-11-13 02:24:00 - 2020-11-13 19:12:00
2020-11-13 19:12:00 - 2020-11-14 12:00:00
2020-11-14 12:00:00 - 2020-11-15 04:48:00
2020-11-15 04:48:00 - 2020-11-15 21:36:00
2020-11-15 21:36:00 - 2020-11-16 14:24:00
2020-11-16 14:24:00 - 2020-11-17 07:12:00
2020-11-17 07:12:00 - 2020-11-18 00:00:00
2020-11-18 00:00:00 - 2020-11-18 16:48:00
2020-11-18 16:48:00 - 2020-11-19 09:36:00
2020-11-19 09:36:00 - 2020-11-20 02:24:00
2020-11-20 02:24:00 - 2020-11-20 19:12:00
2020-11-20 19:12:00 - 2020-11-21 12:00:00
2020-11-21 12:00:00 - 2020-11-22 04:48:00
2020-11-22 04:48:00 - 2020-11-22 21:36:00
2020-11-22 21:36:00 - 2020-11-23 14:24:00
2020-11-23 14:24:00 - 2020-11-24 07:12:00
2020-11-24 07:12:00 - 2020-11-25 00:00:00
2020-11-25 00:00:00 - 2020-11-25 16:48:00
2020-11-25 16:48:00 - 2020-11-26 09:36:00
2020-11-26 09:36:00 - 2020-11-27 02:24:00
2020-11-27 02:24:00 - 2020-11-27 19:12:00
2020-11-27 19:12:00 - 2020-11-28 12:00:00
2020-11-28 12:00:00 - 2020-11-29 04:48:00
2020-11-29 04:48:00 - 2020-11-29 21:36:00
2020-11-29 21:36:00 - 2020-11-30 14:24:00
2020-11-30 14:24:00 - 2020-12-01 07:12:00

SAAV I17-14 Cumulative Profile

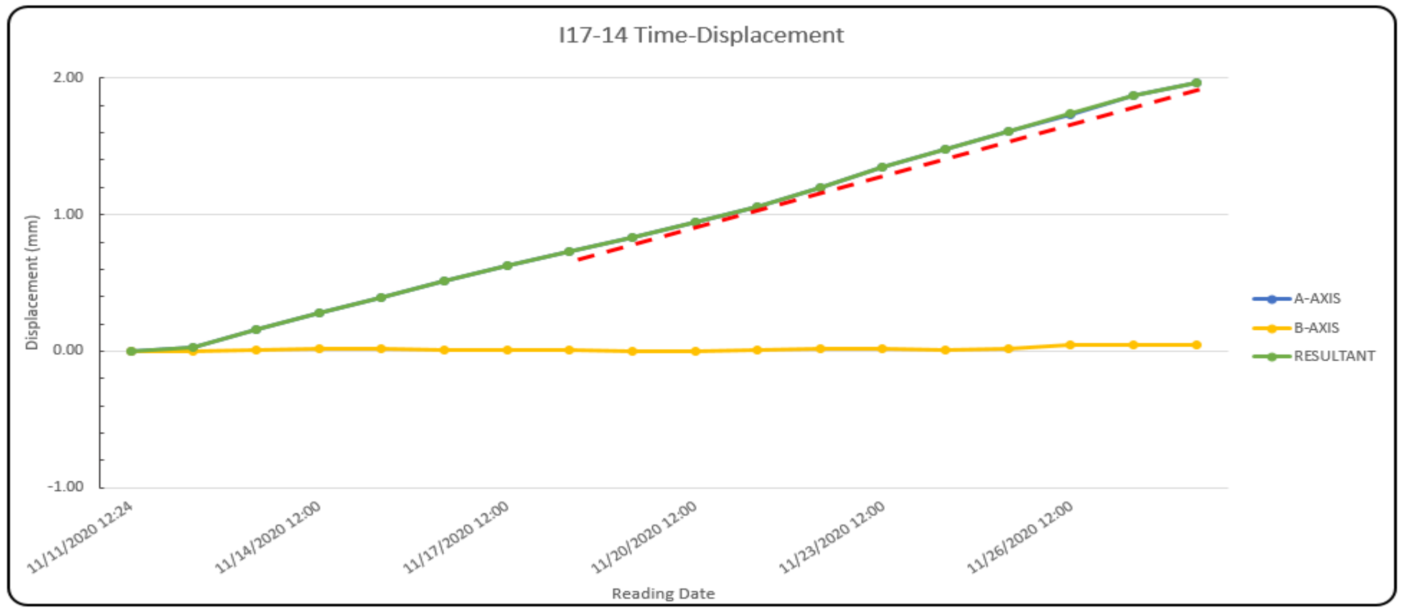


SAAV 17-14

Displacement Plot - Dam Fill / Rock Fill

Unit	Upper El. (m)	Lower El. (m)
Dam Fill / Rock Fill	1232.5	1226.5
Glaciofluvial	1224.5	1221.5
Bedrock	1215.5	1206.5

Upper El. (m)	1232.5
Lower El. (m)	1226.5

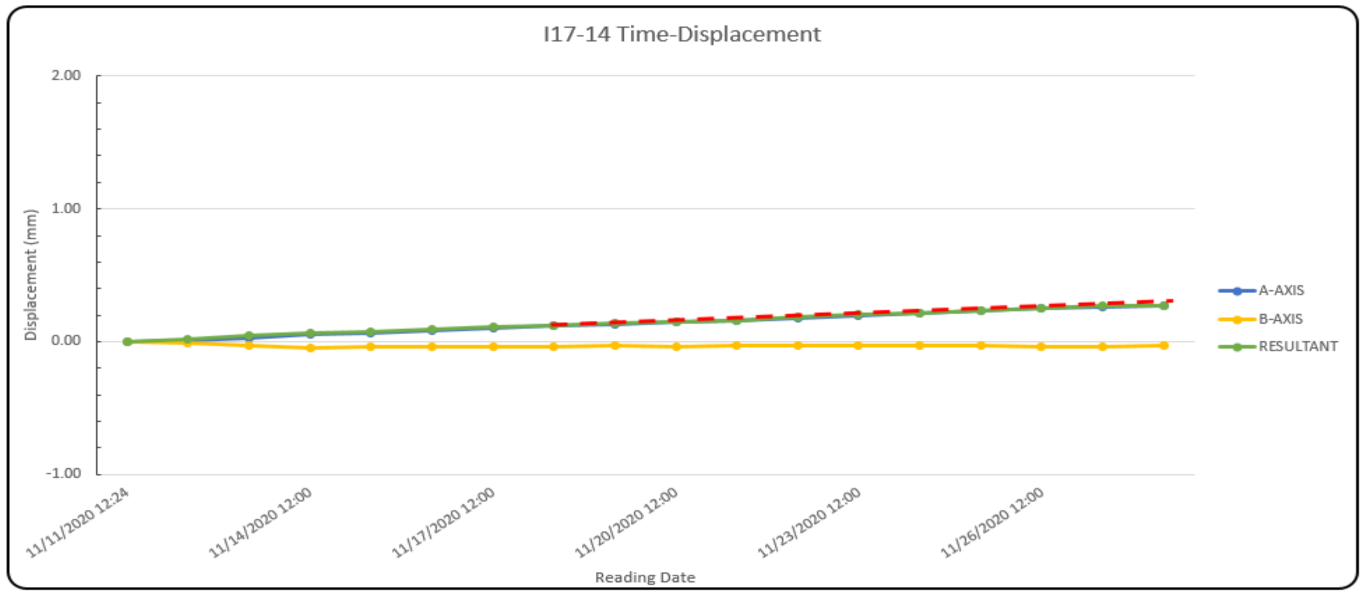


SAAV 17-14

Displacement Plot - Glaciofluvial

Unit	Upper El. (m)	Lower El. (m)
Dam Fill / Rock Fill	1232.5	1226.5
Glaciofluvial	1224.5	1221.5
Bedrock	1215.5	1206.5

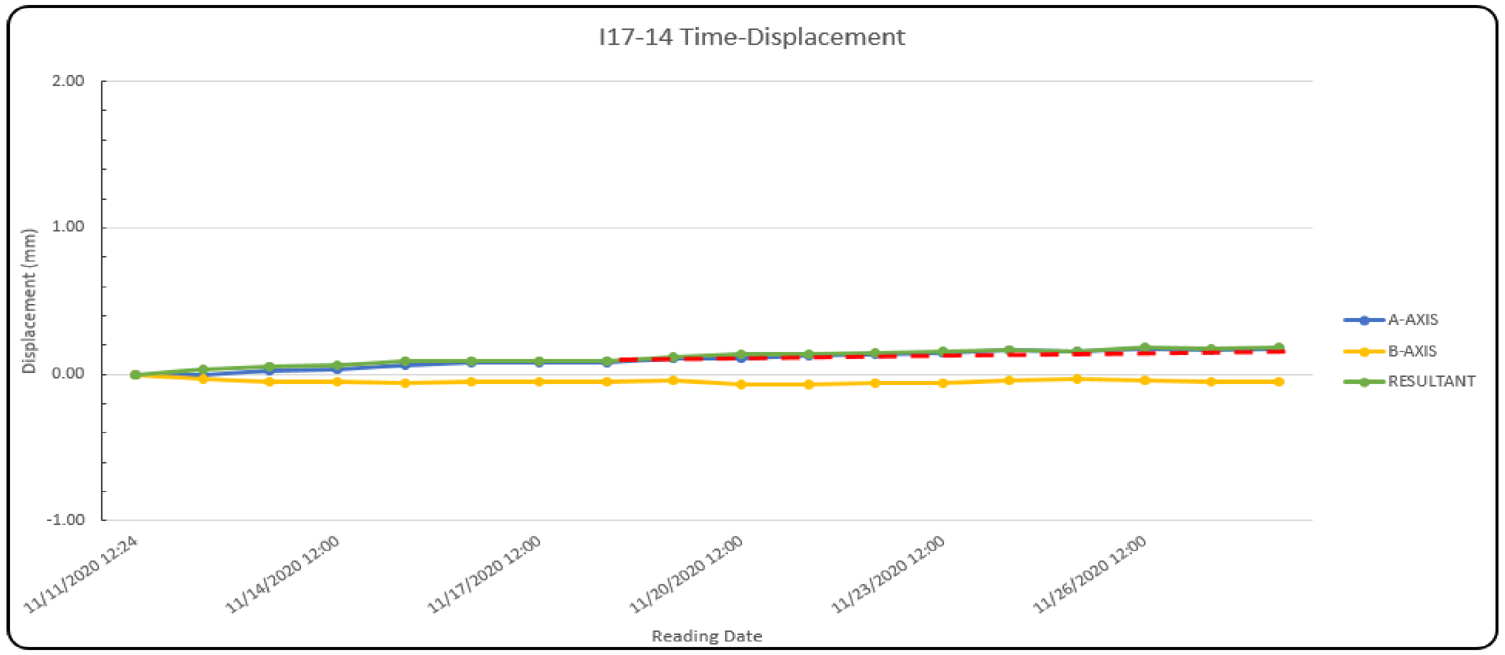
Upper El. (m)	1224.5
Lower El. (m)	1221.5



SAAV 17-14
Displacement Plot - Bedrock

Unit	Upper El. (m)	Lower El. (m)
Dam Fill / Rock Fill	1232.5	1226.5
Glaciofluvial	1224.5	1221.5
Bedrock	1215.5	1206.5

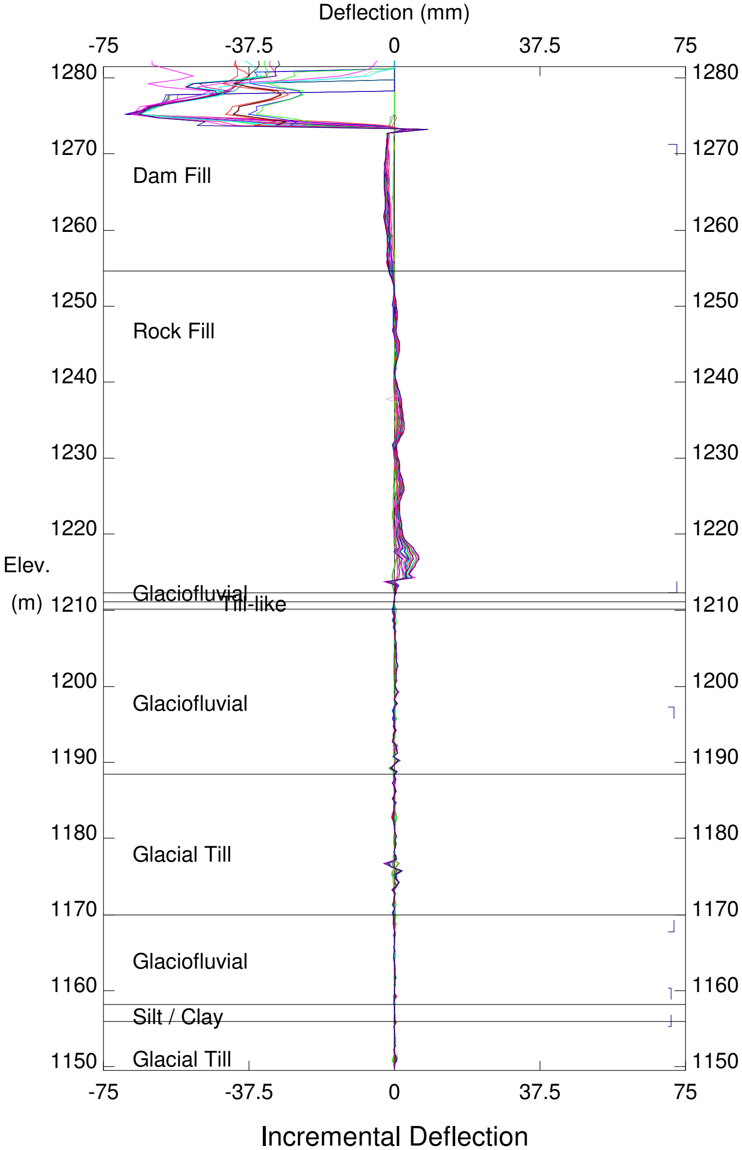
Upper El. (m)	1215.5
Lower El. (m)	1206.5

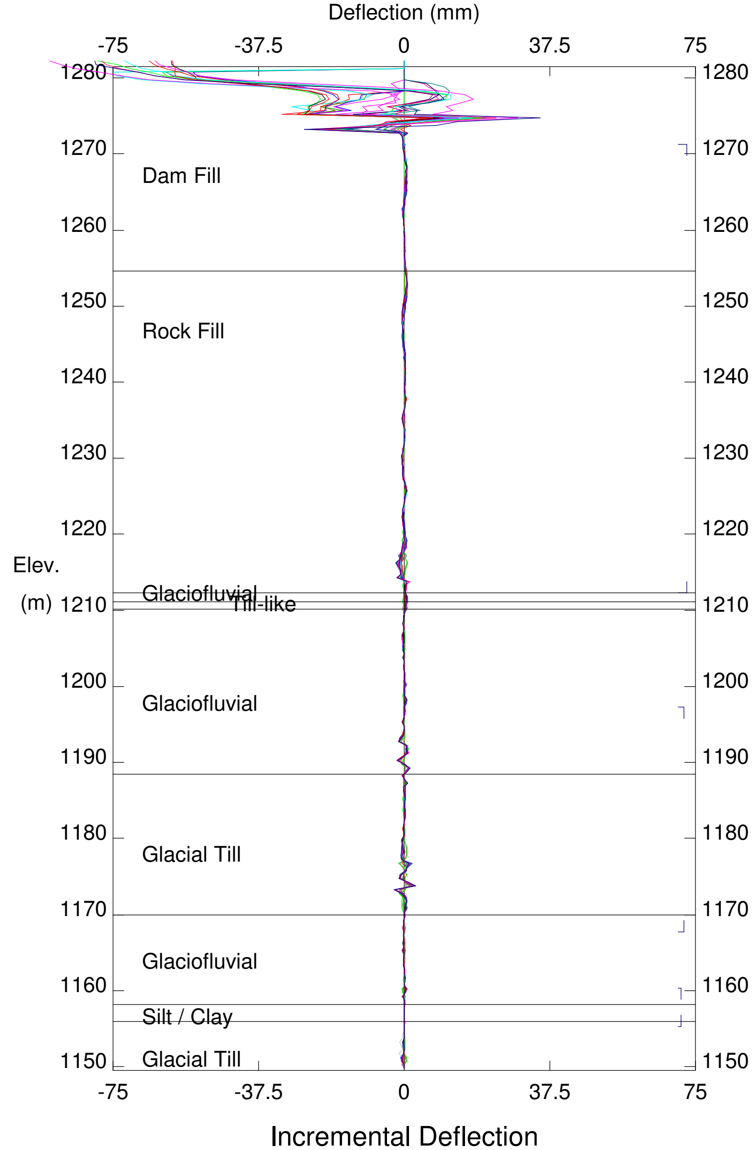


H-H DAM

I17-16

Highland Valley Copper - Logan Lake, BC



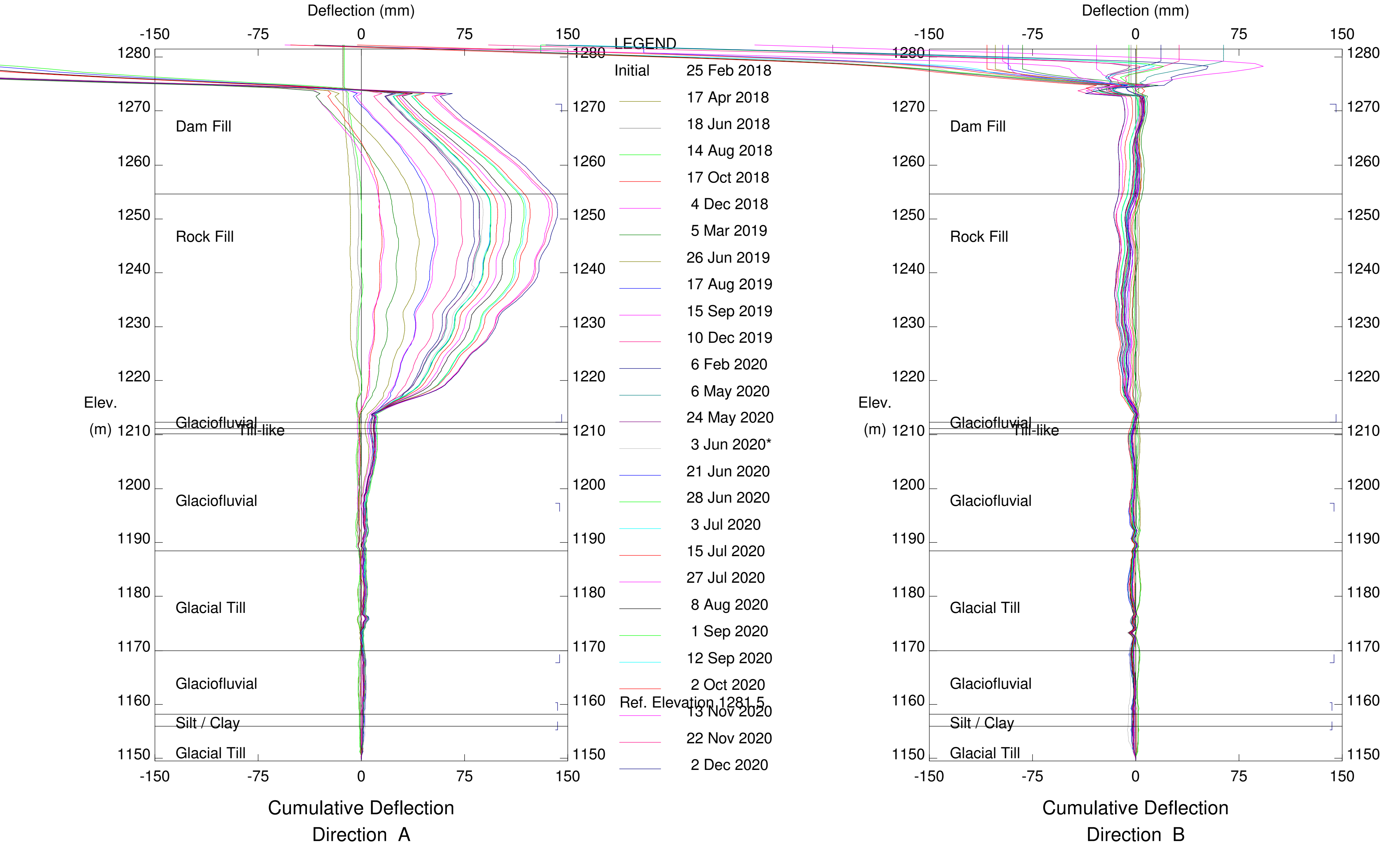


H-H Dam, Inclinometer I17-16

Sets marked * include zero shift and/or rotation corrections.

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\09 Geotechnical\Instrumentation\03 - Dam Movement Monitoring_H-H Dam\SI Monitoring\GTPLUS32 Files\I17-16.gtl

Highland Valley Copper - Logan Lake, BC

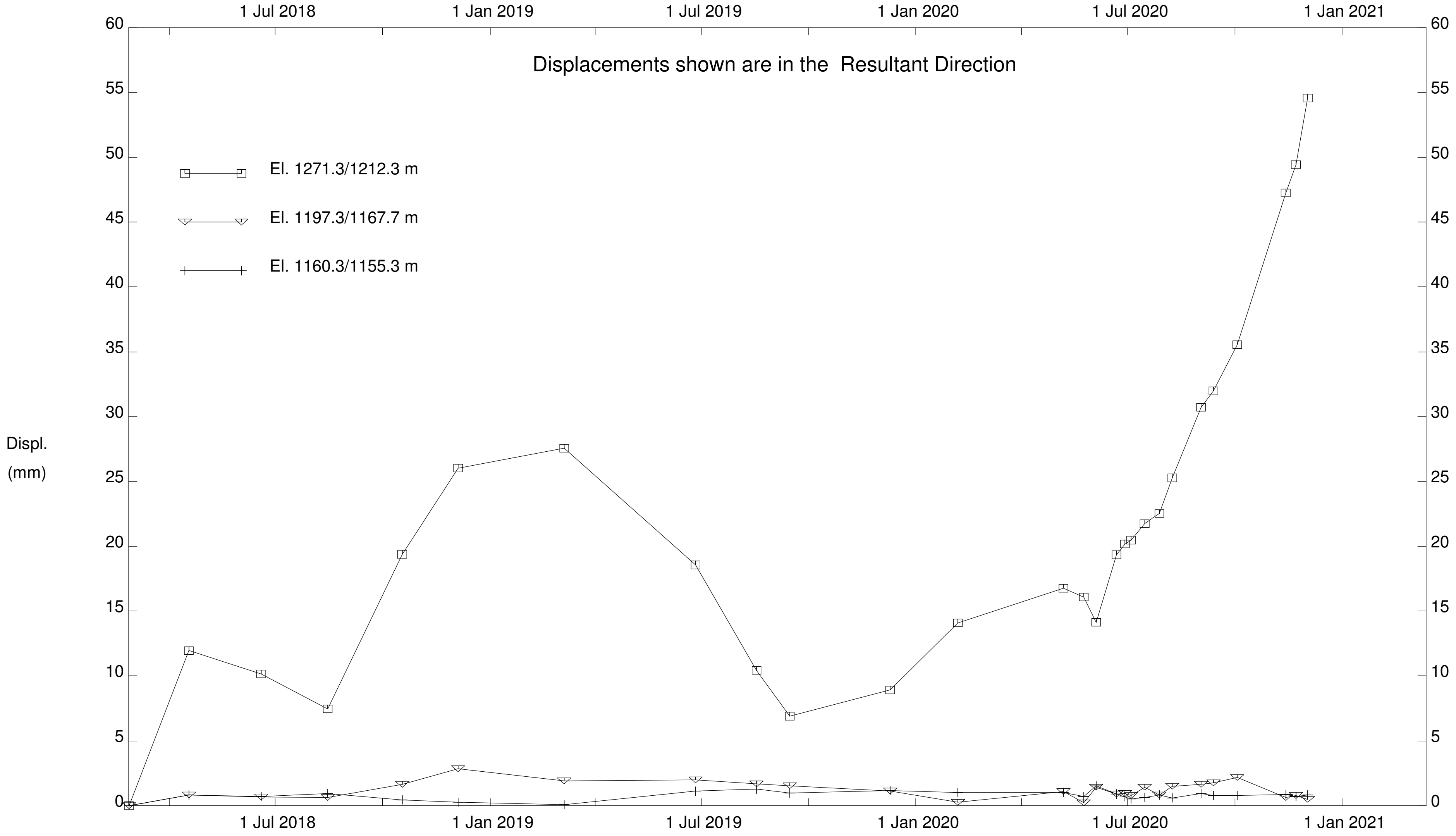


H-H Dam, Inclinometer I17-16

Sets marked * include zero shift and/or rotation corrections.

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\09 Geotechnical\Instrumentation\03 - Dam Movement Monitoring_H-H Dam\SI Monitoring\GTPLUS32 Files\I17-16.gtl

Highland Valley Copper - Logan Lake, BC

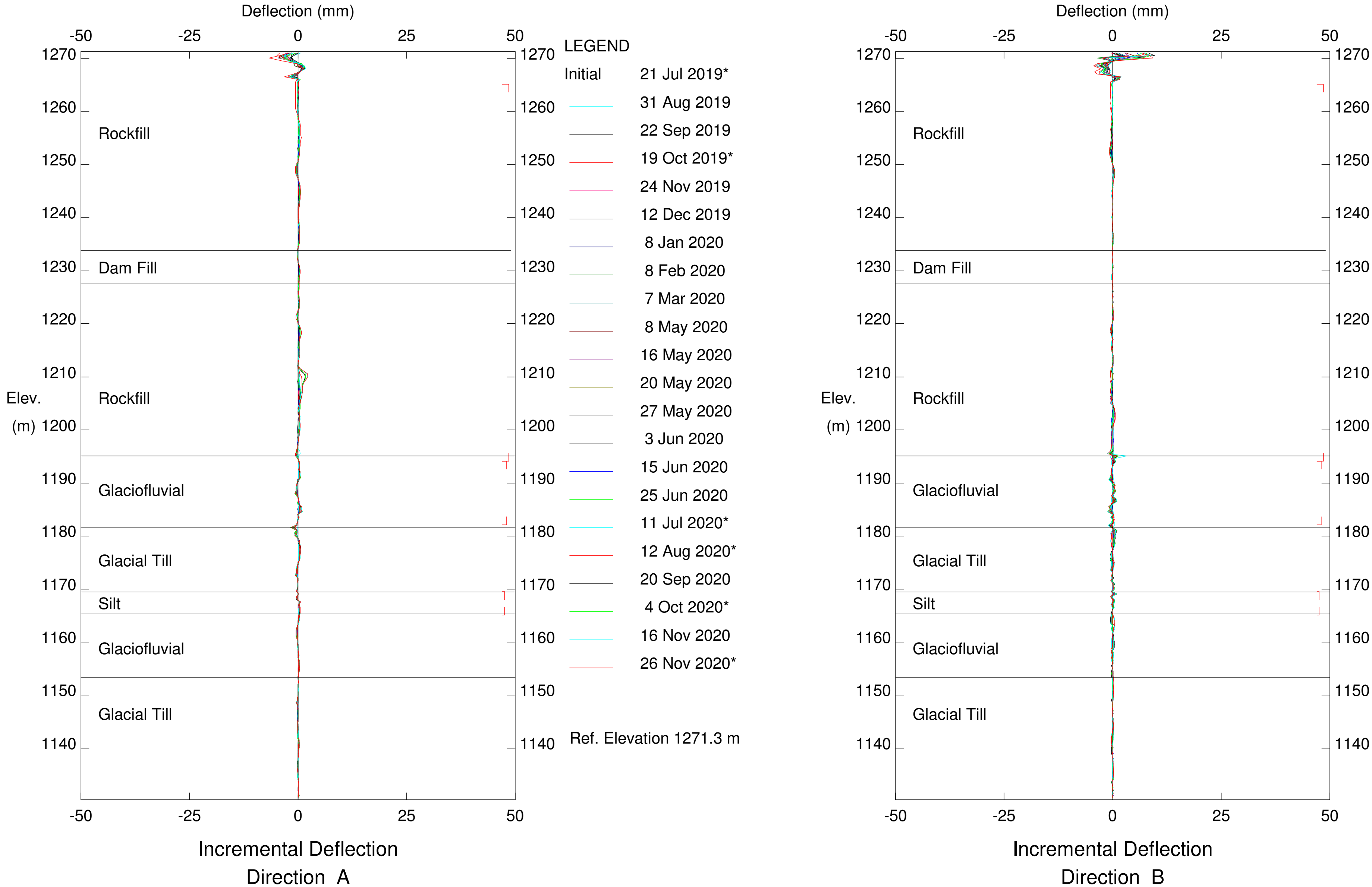


H-H Dam, Inclinometer I17-16

H-H DAM

I17-17

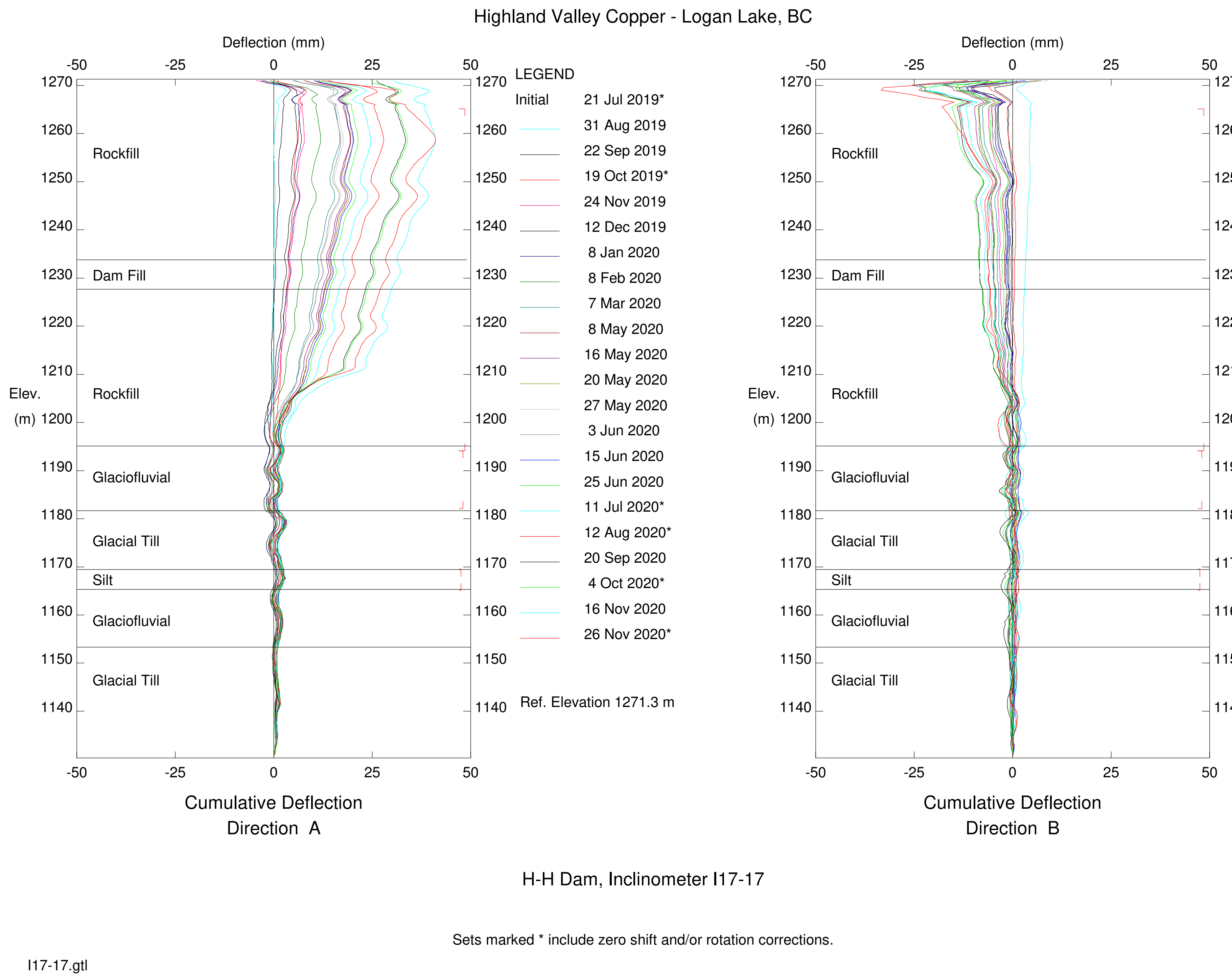
Highland Valley Copper - Logan Lake, BC



H-H Dam, Inclinometer I17-17

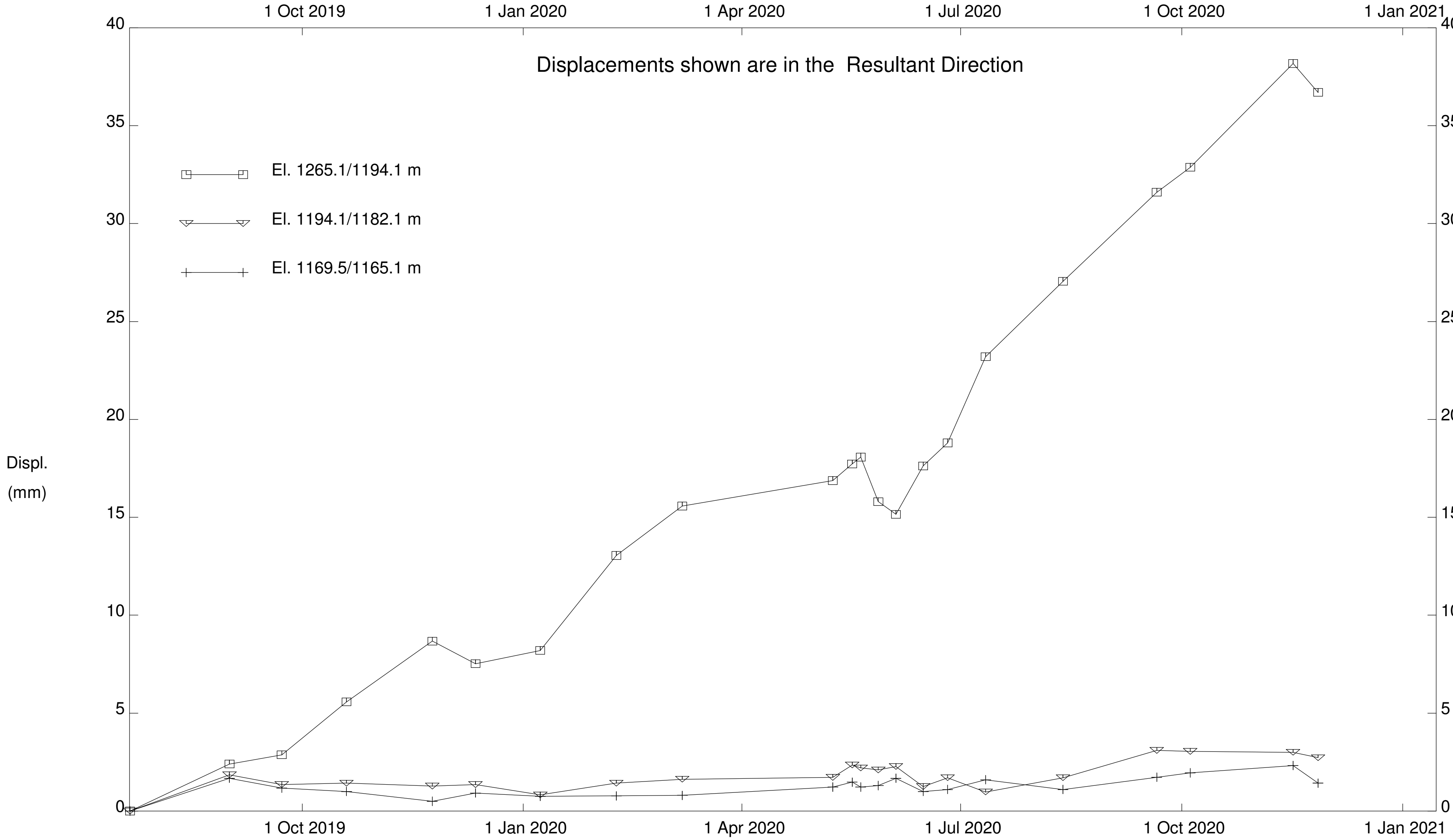
Sets marked * include zero shift and/or rotation corrections.

I17-17.gtl



Highland Valley Copper - Logan Lake, BC
Deflection (mm)
-50 -25 0 25 50
Elev. (m)
1270 1260 1250 1240 1230 1220 1210 1200 1190 1180 1170 1160 1150 1140
Rockfill
Dam Fill
Rockfill
Glaciofluvial
Glacial Till
Silt
Glaciofluvial
Glacial Till
Cumulative Deflection
Direction A
LEGEND
Initial 21 Jul 2019*
31 Aug 2019
22 Sep 2019
19 Oct 2019*
24 Nov 2019
12 Dec 2019
8 Jan 2020
8 Feb 2020
7 Mar 2020
8 May 2020
16 May 2020
20 May 2020
27 May 2020
3 Jun 2020
15 Jun 2020
25 Jun 2020
11 Jul 2020*
12 Aug 2020*
20 Sep 2020
4 Oct 2020*
16 Nov 2020
26 Nov 2020*
Ref. Elevation 1271.3 m
Deflection (mm)
Cumulative Deflection
Direction B
H-H Dam, Inclinometer I17-17
Sets marked * include zero shift and/or rotation corrections.
I17-17.gtl

Highland Valley Copper - Logan Lake, BC

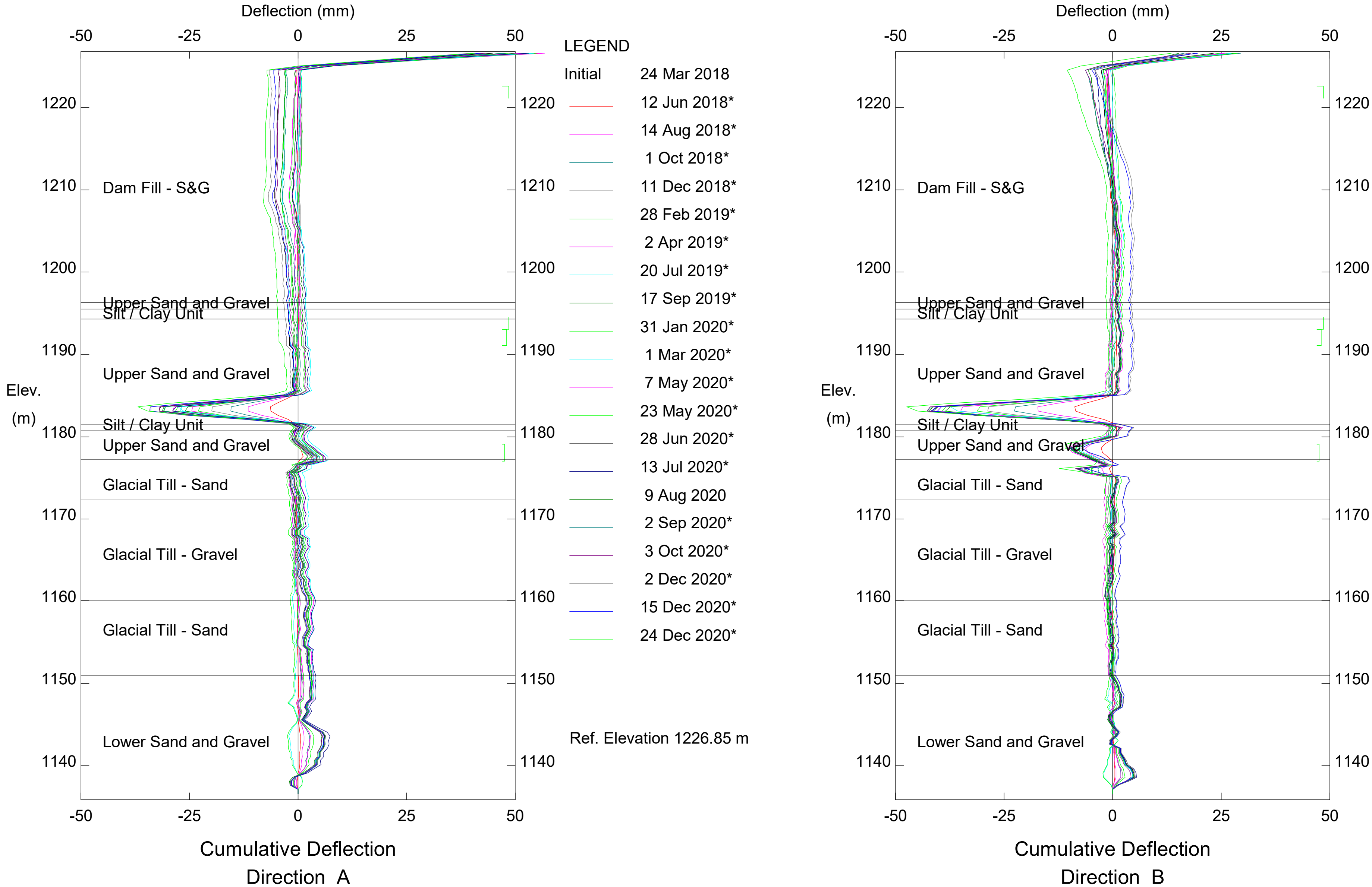


H-H Dam, Inclinometer I17-17

H-H DAM

I17-30

Highland Valley Copper - Logan Lake, BC

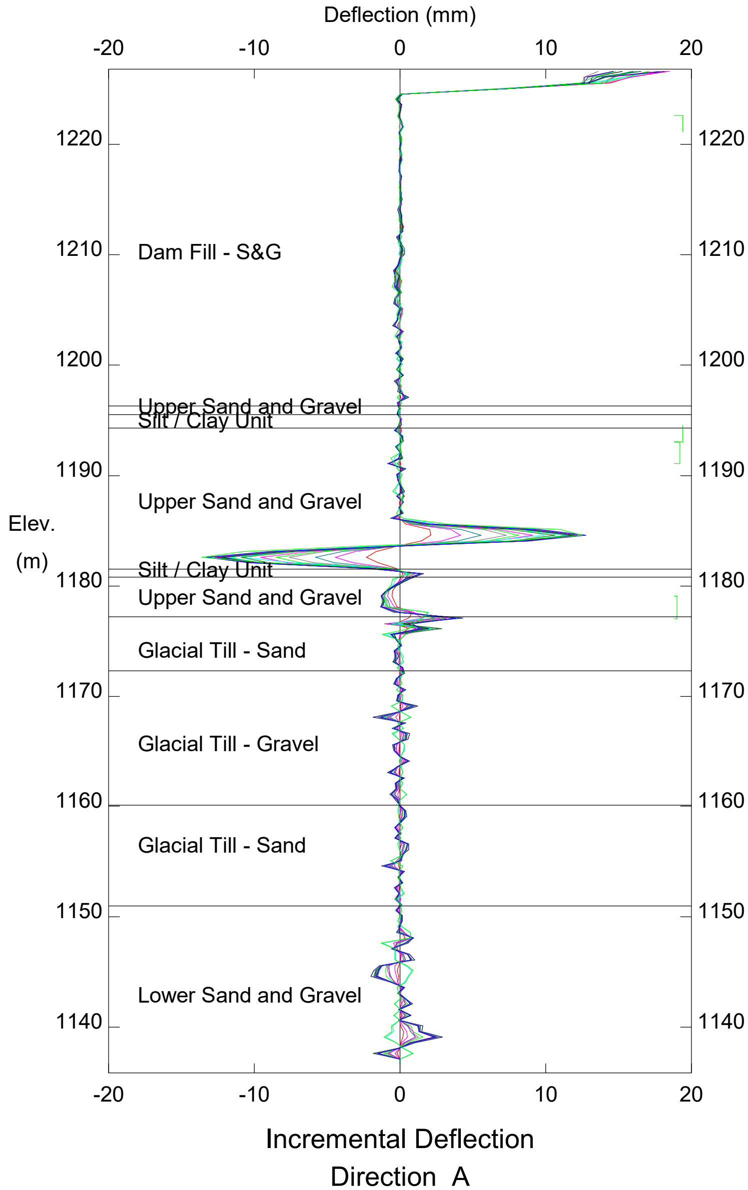


HH Dam,,,,,,,,,,,,,,,, Inclinometer I17-30,,,,,,

Sets marked * include zero shift and/or rotation corrections.

C:\Users\snarges\Desktop\17-30 and 17-31\I17-30.gtl

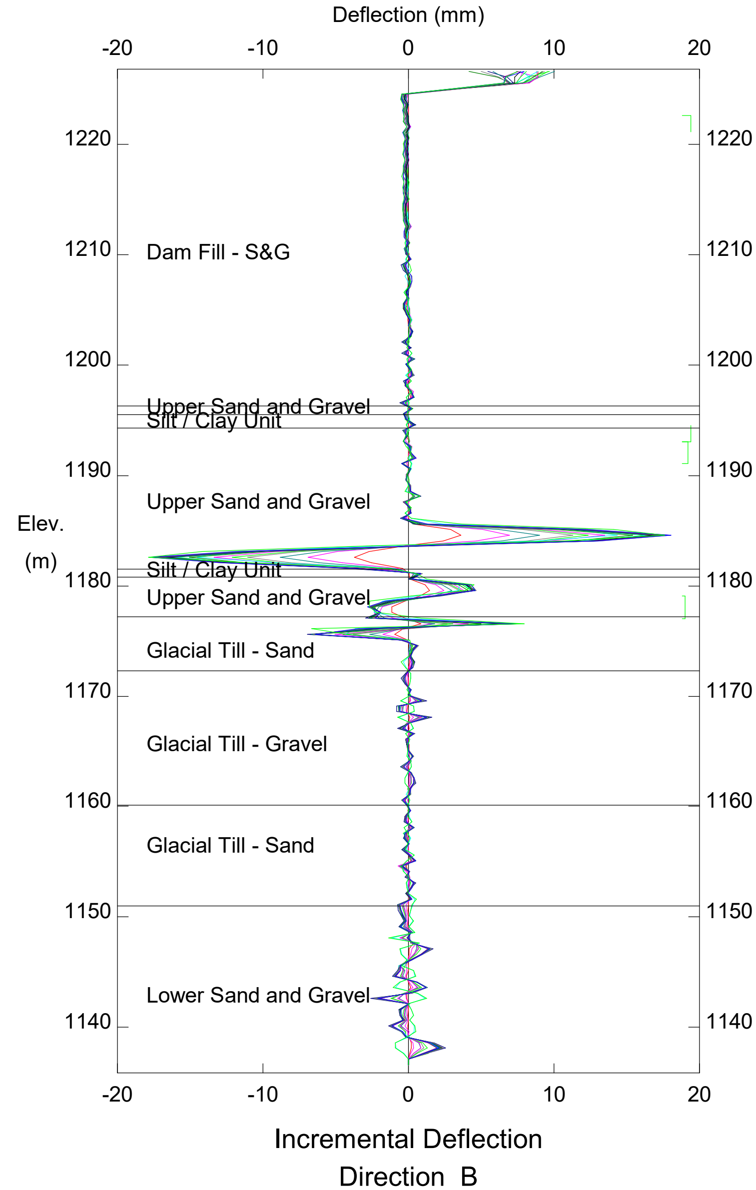
Highland Valley Copper - Logan Lake, BC



LEGEND

Initial	24 Mar 2018
	12 Jun 2018*
	14 Aug 2018*
	1 Oct 2018*
	11 Dec 2018*
	28 Feb 2019*
	2 Apr 2019*
	20 Jul 2019*
	17 Sep 2019*
	31 Jan 2020*
	1 Mar 2020*
	7 May 2020*
	23 May 2020*
	28 Jun 2020*
	13 Jul 2020*
	9 Aug 2020
	2 Sep 2020*
	3 Oct 2020*
	2 Dec 2020*
	15 Dec 2020*
	24 Dec 2020*

Ref. Elevation 1226.85 m

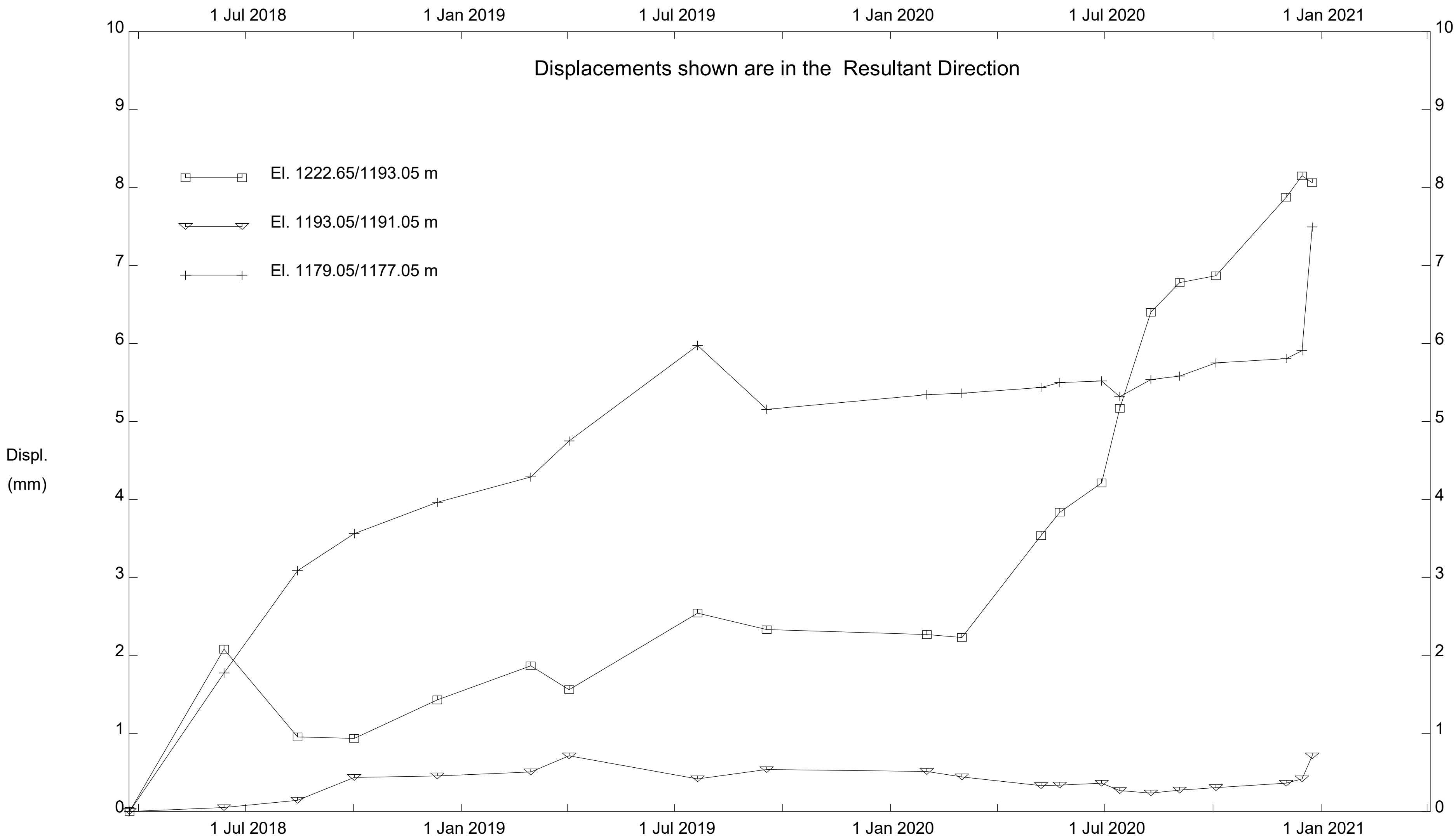


HH Dam,,,,,,,,,,,,,,,, Inclinometer I17-30,,,,,,

Sets marked * include zero shift and/or rotation corrections.

C:\Users\snarges\Desktop\17-30 and 17-31\I17-30.gtl

Highland Valley Copper - Logan Lake, BC

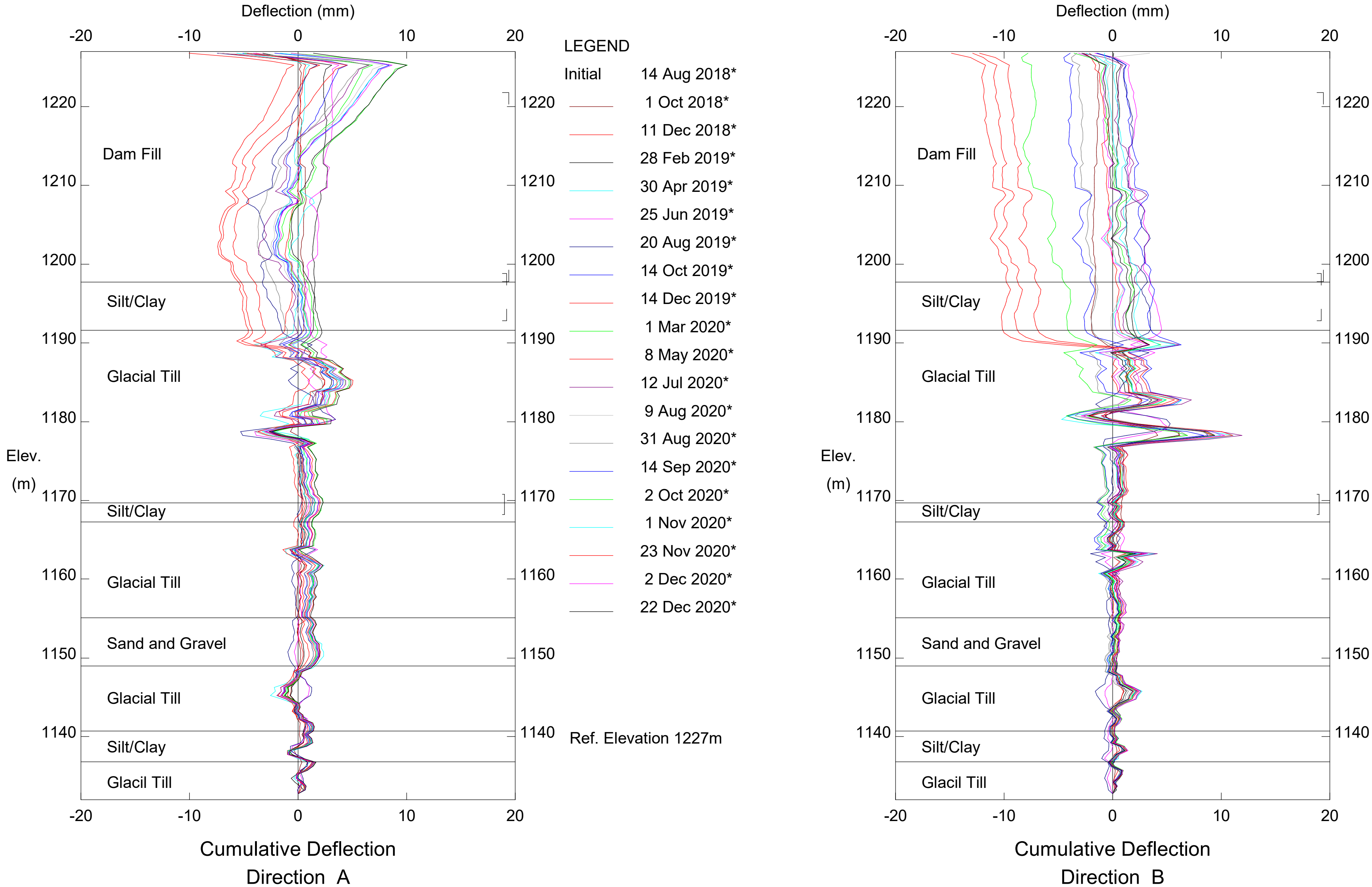


HH Dam,,,,,,,,,,,,,,,, Inclinometer I17-30,,,,,,

H-H DAM

I17-31

Highland Valley Copper - Logan Lake, BC

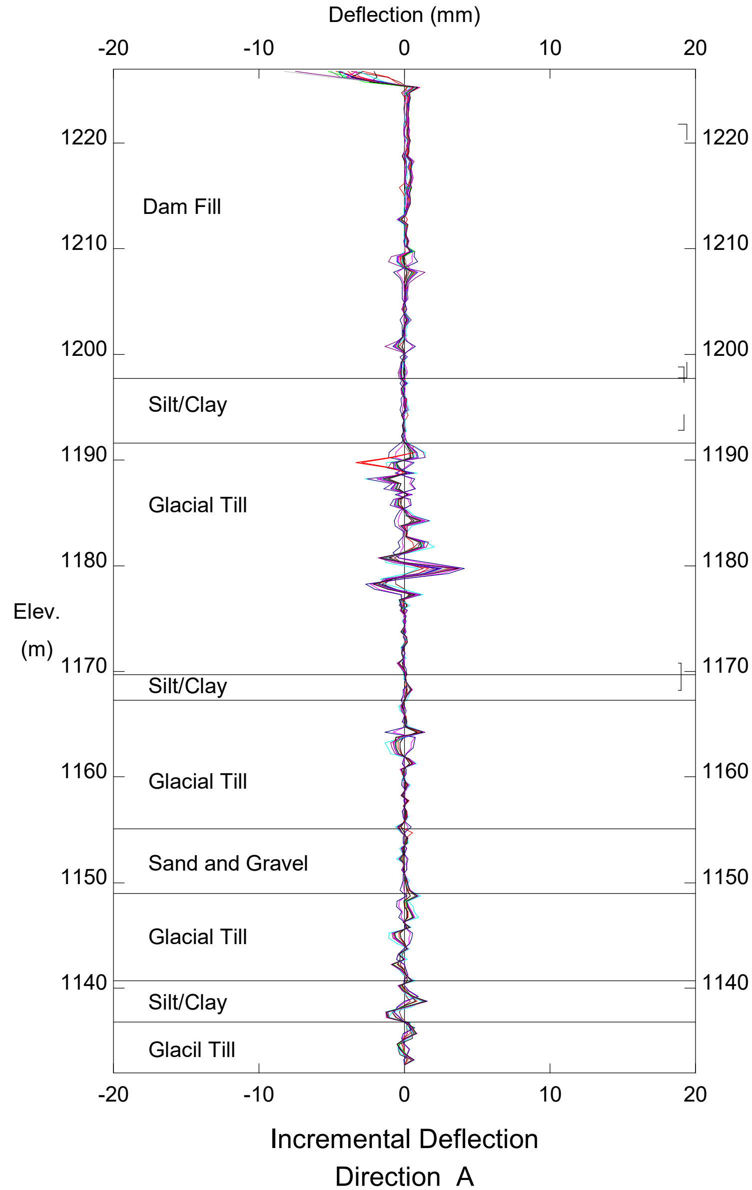


H-H Dam, Inclinometer I17-31

Sets marked * include zero shift and/or rotation corrections.

C:\Users\snarges\Desktop\17-30 and 17-31\I17-31.gtl

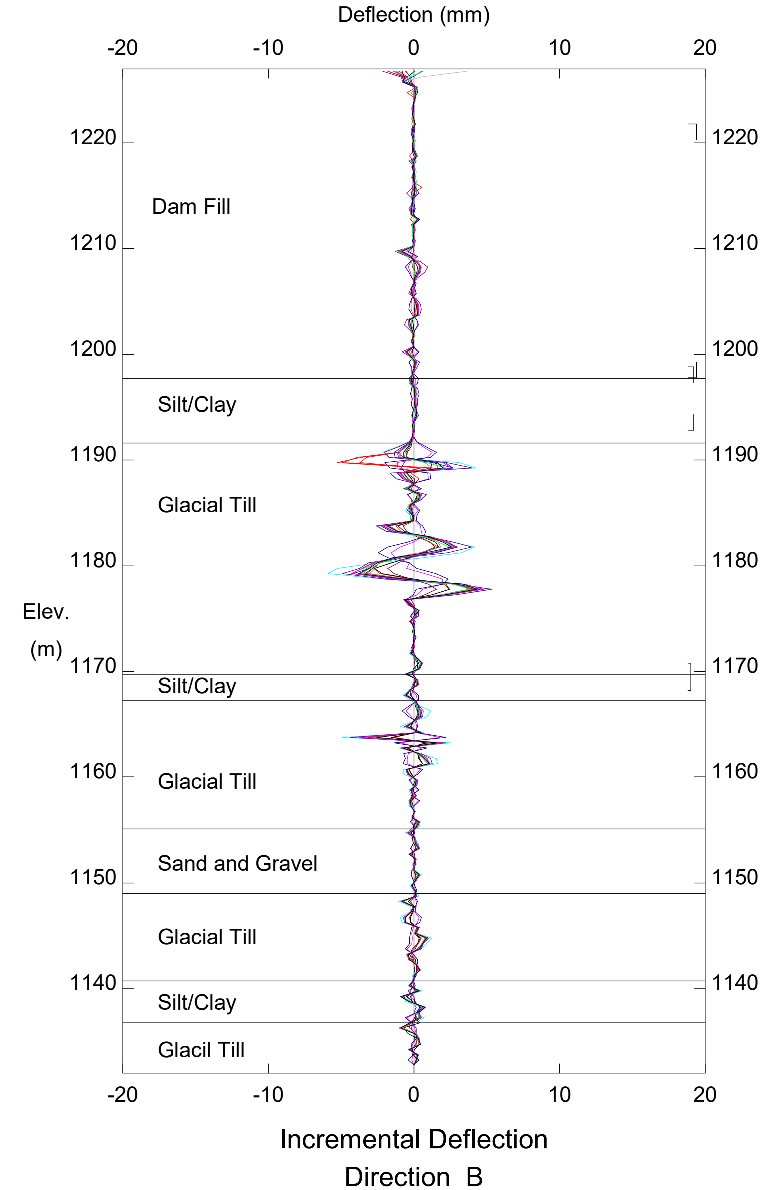
Highland Valley Copper - Logan Lake, BC



LEGEND

Initial	14 Aug 2018*
	1 Oct 2018*
	11 Dec 2018*
	28 Feb 2019*
	30 Apr 2019*
	25 Jun 2019*
	20 Aug 2019*
	14 Oct 2019*
	14 Dec 2019*
	1 Mar 2020*
	8 May 2020*
	12 Jul 2020*
	9 Aug 2020*
	31 Aug 2020*
	14 Sep 2020*
	2 Oct 2020*
	1 Nov 2020*
	23 Nov 2020*
	2 Dec 2020*
	22 Dec 2020*

Ref. Elevation 1227m

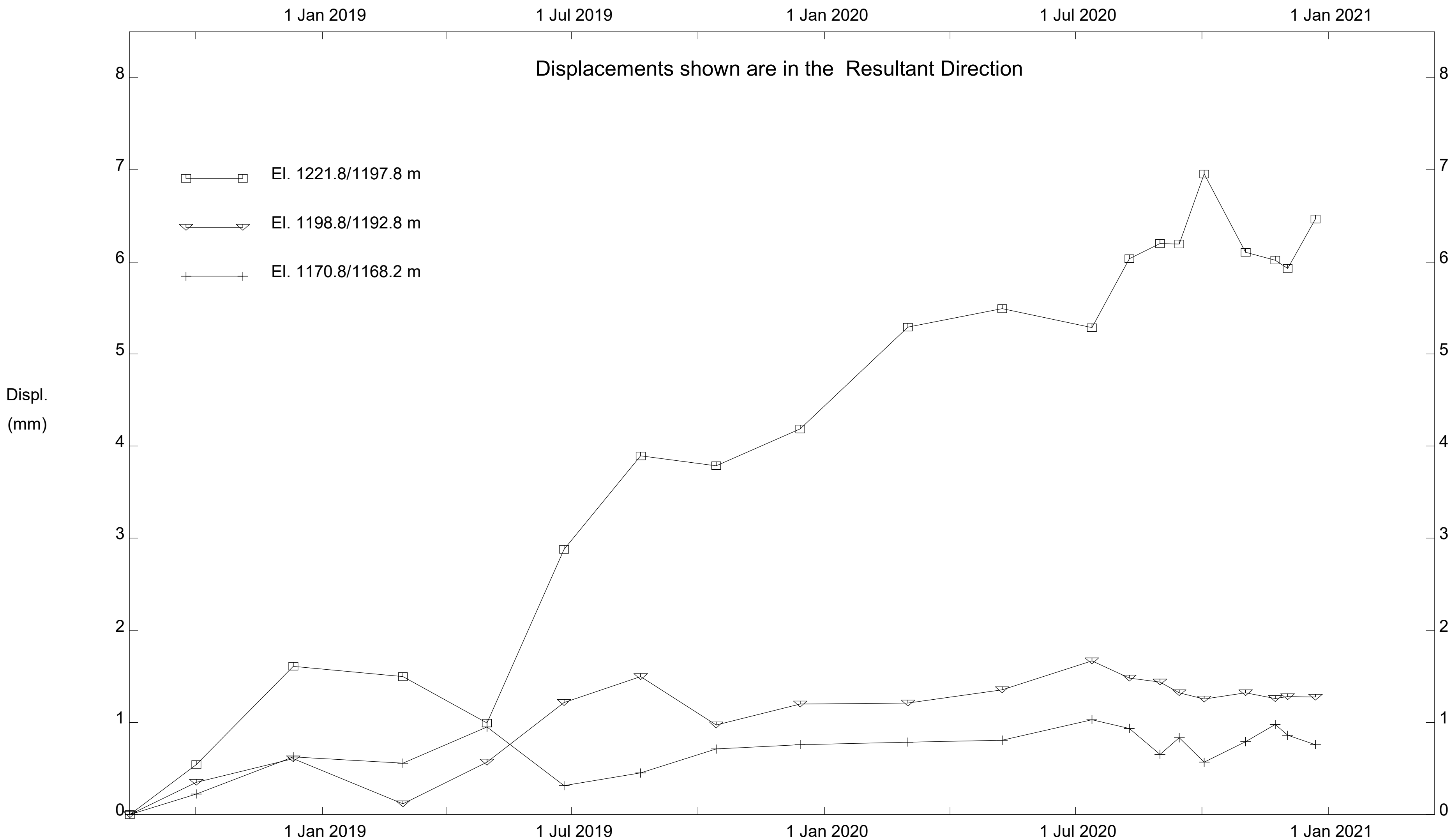


H-H Dam, Inclinometer I17-31

Sets marked * include zero shift and/or rotation corrections.

C:\Users\snarges\Desktop\17-30 and 17-31\I17-31.gtl

Highland Valley Copper - Logan Lake, BC

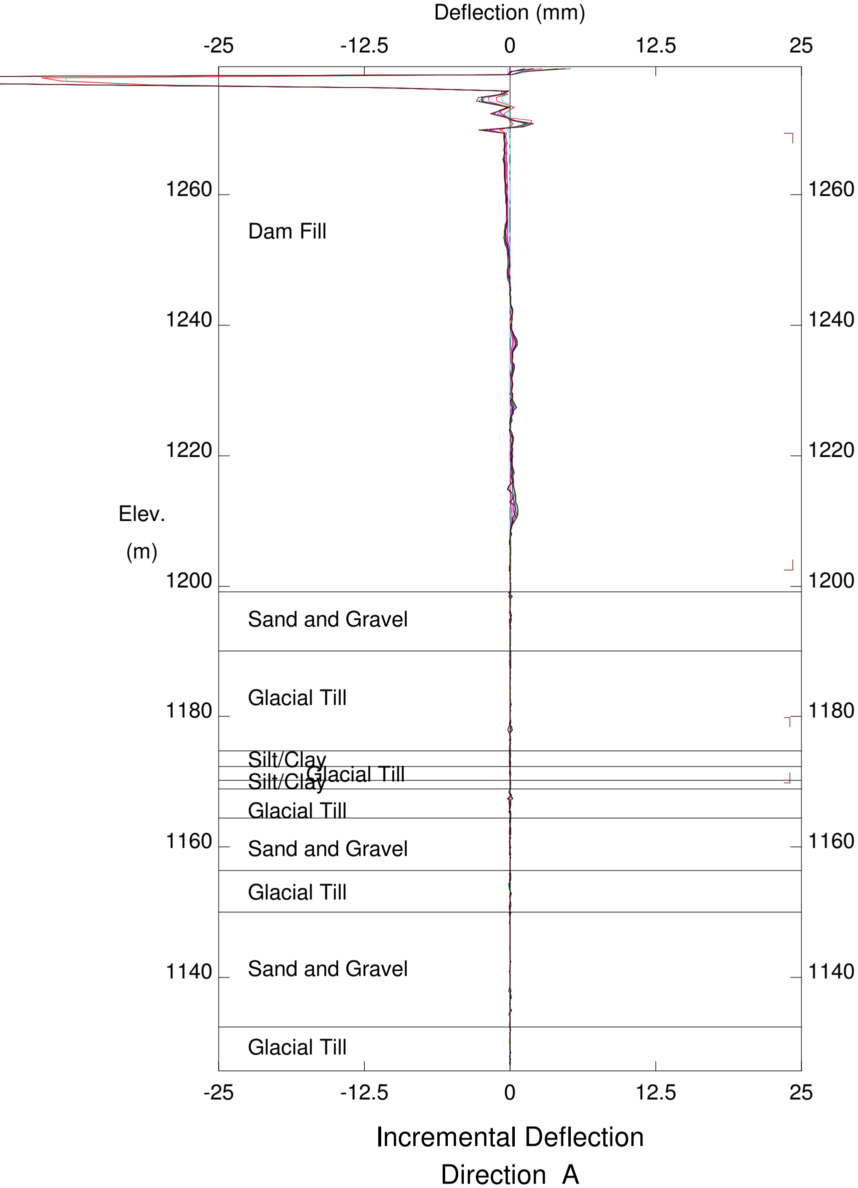


H-H Dam, Inclinometer I17-31

H-H DAM

I17-33

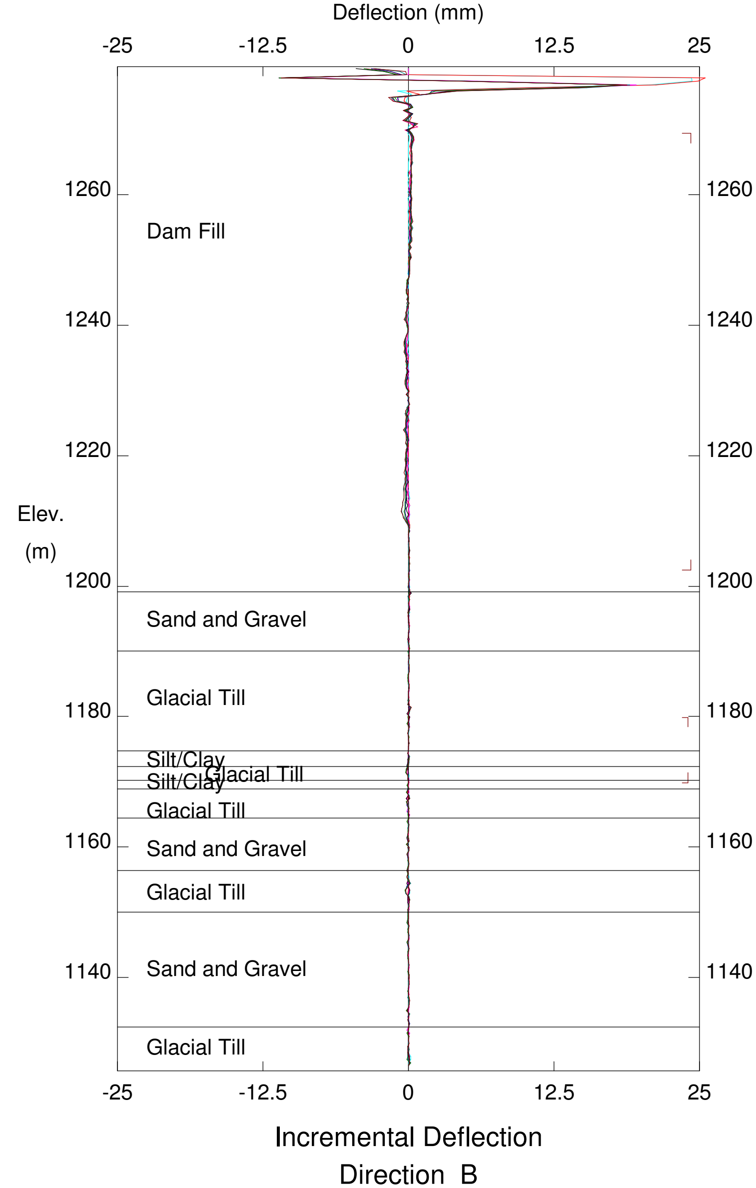
Highland Valley Copper - Logan Lake, BC



LEGEND

Initial	23 Jun 2020
	3 Jul 2020*
	18 Jul 2020
	27 Jul 2020*
	11 Aug 2020*
	4 Sep 2020*
	20 Sep 2020*
	8 Oct 2020*
	13 Nov 2020*
	30 Nov 2020*

Ref. Elevation 1279.65m

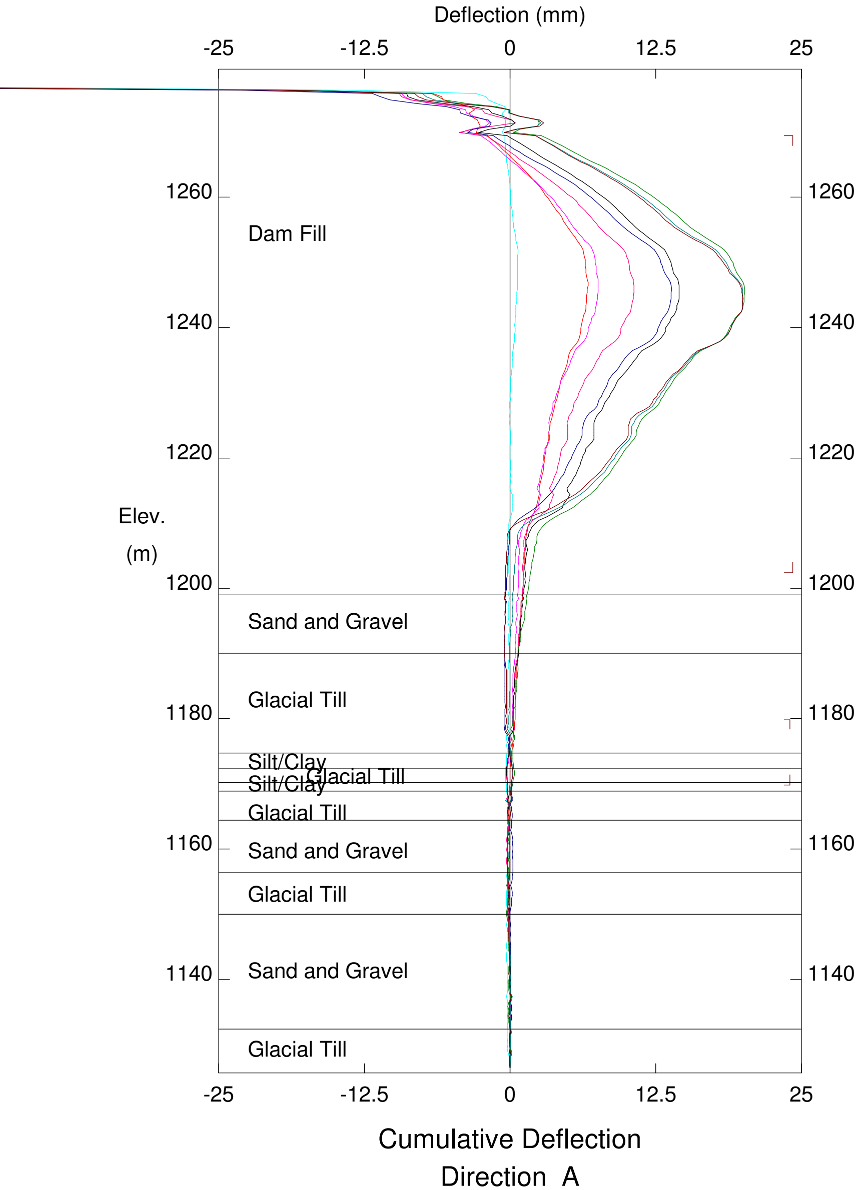


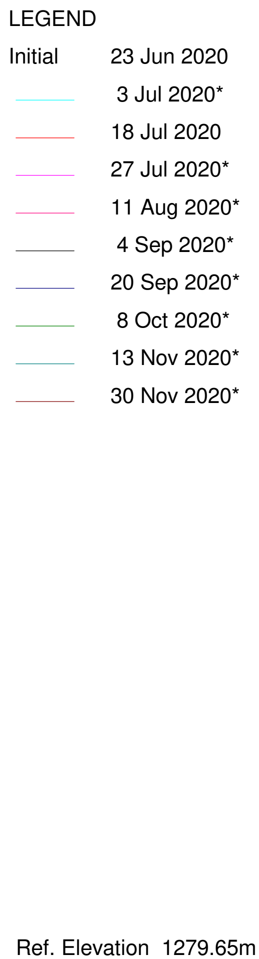
H-H Dam,,,, Inclinometer I17-33,,,

Sets marked * include zero shift and/or rotation corrections.

I17-33 New File.gtl

Highland Valley Copper - Logan Lake, BC

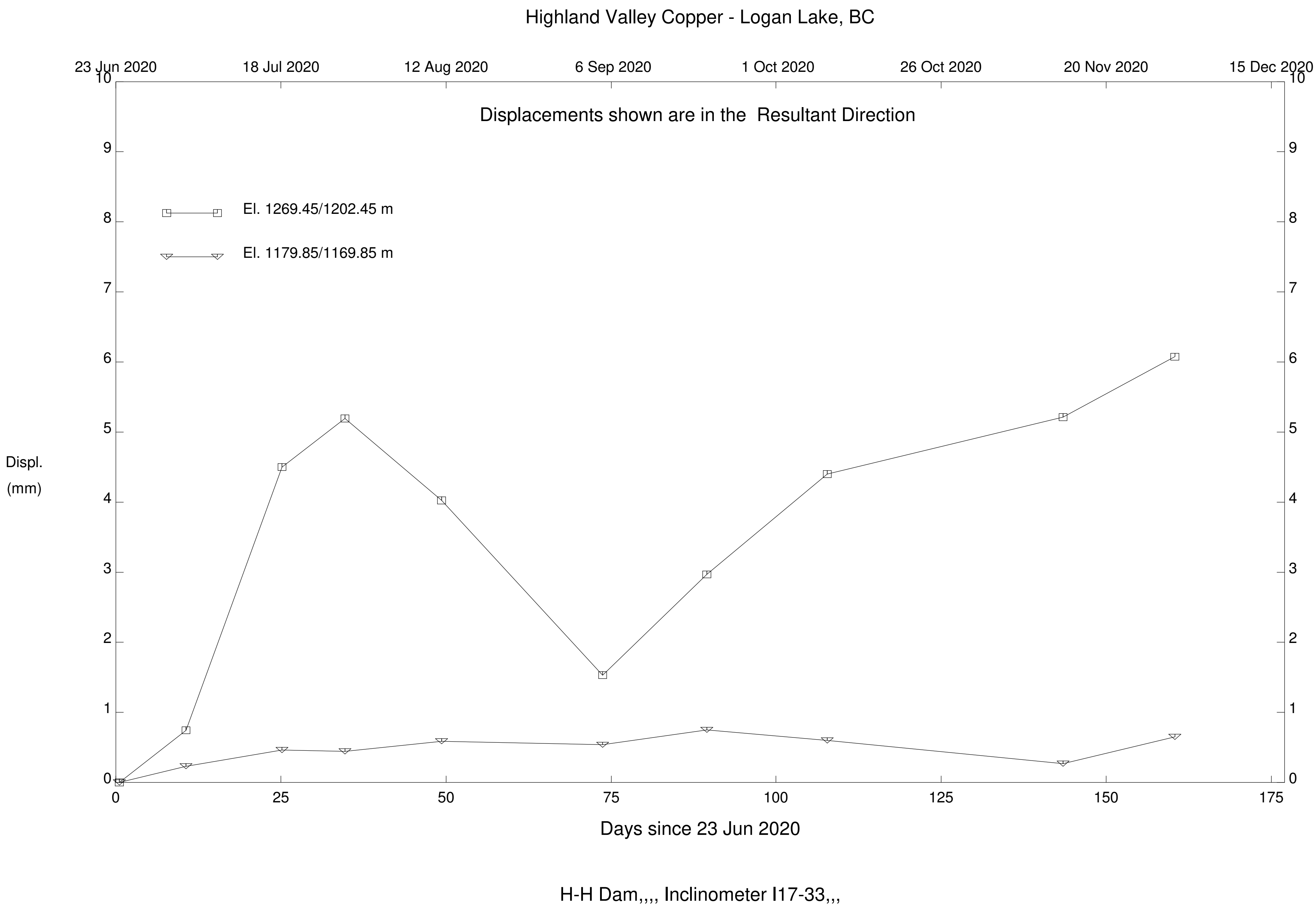




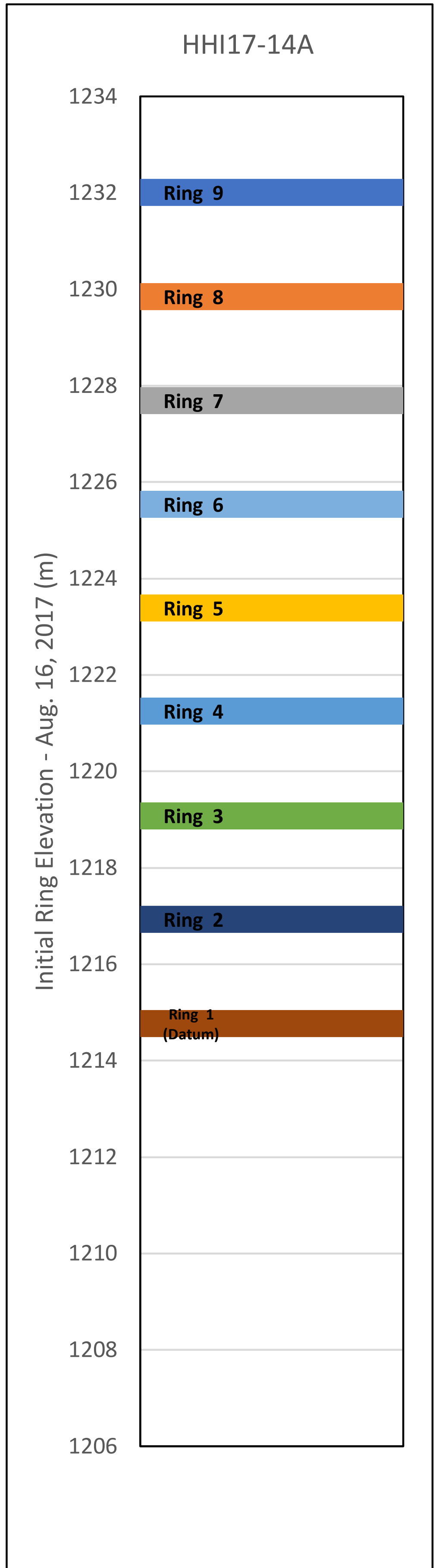
H-H Dam,,,, Inclinometer I17-33,,,

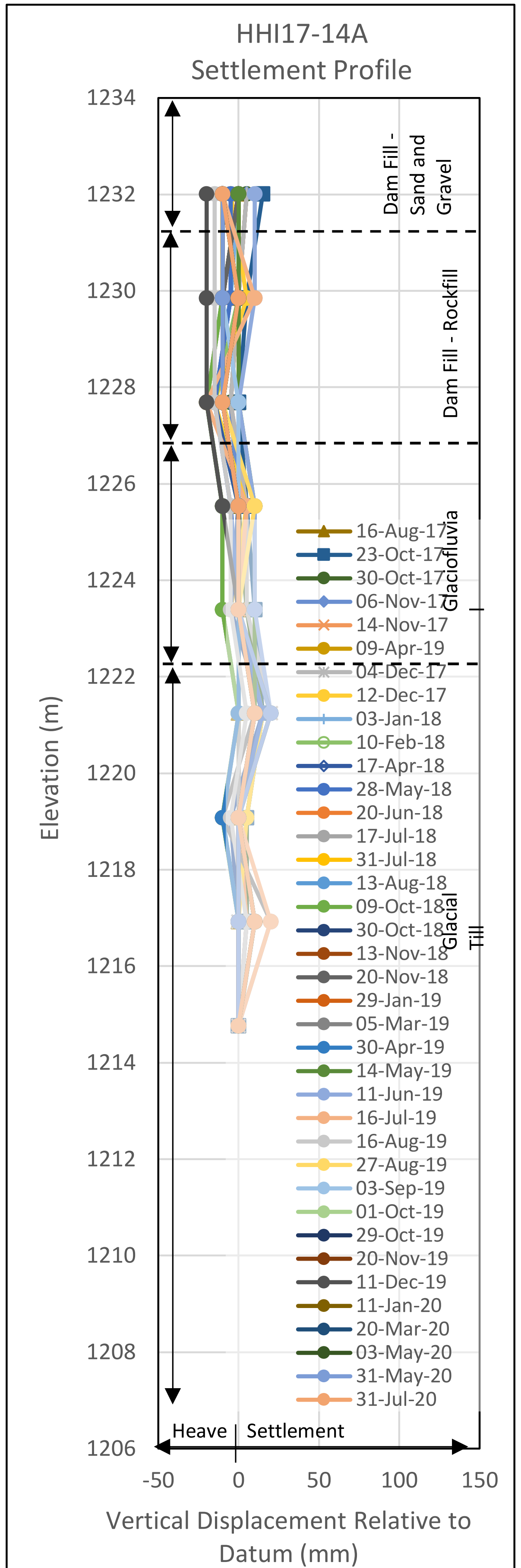
Sets marked * include zero shift and/or rotation corrections.

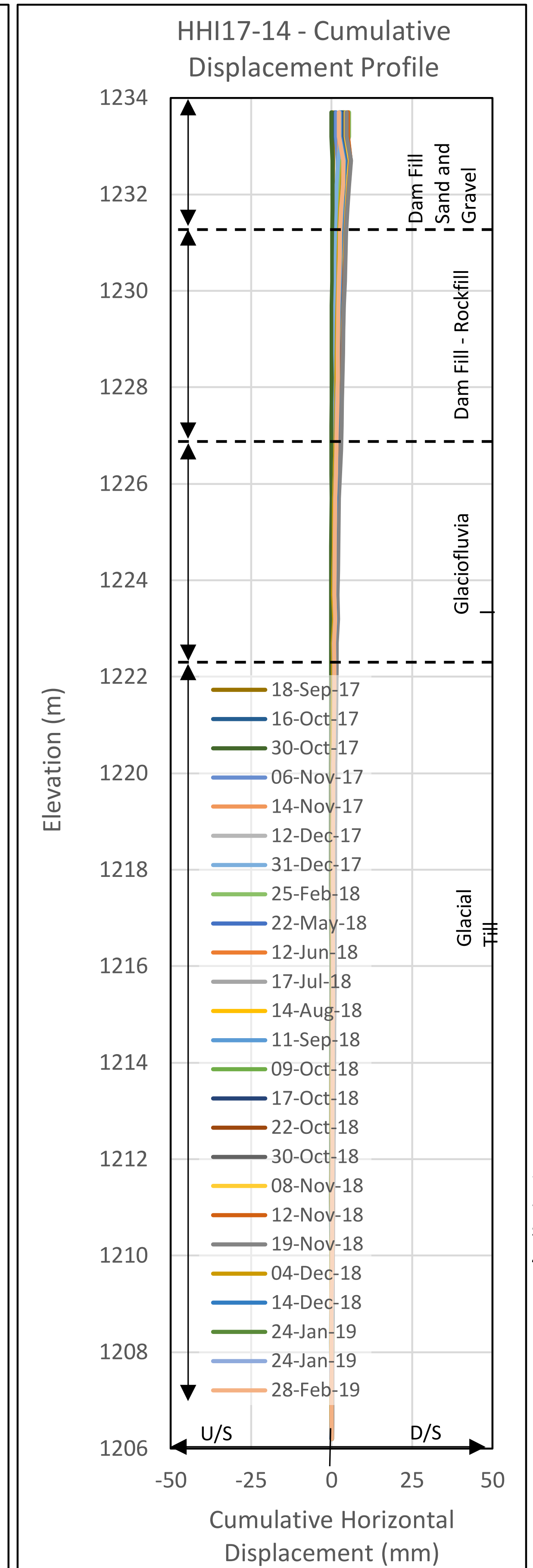
I17-33 New File.gtl


Highland Valley Copper - Logan Lake, BC
23 Jun 2020
18 Jul 2020
12 Aug 2020
6 Sep 2020
1 Oct 2020
26 Oct 2020
20 Nov 2020
15 Dec 2020
Displacements shown are in the Resultant Direction
El. 1269.45/1202.45 m
El. 1179.85/1169.85 m
Displ.
(mm)
0
1
2
3
4
5
6
7
8
9
10
0
25
50
75
100
125
150
175
Days since 23 Jun 2020
H-H Dam,,,, Inclinometer I17-33,,,

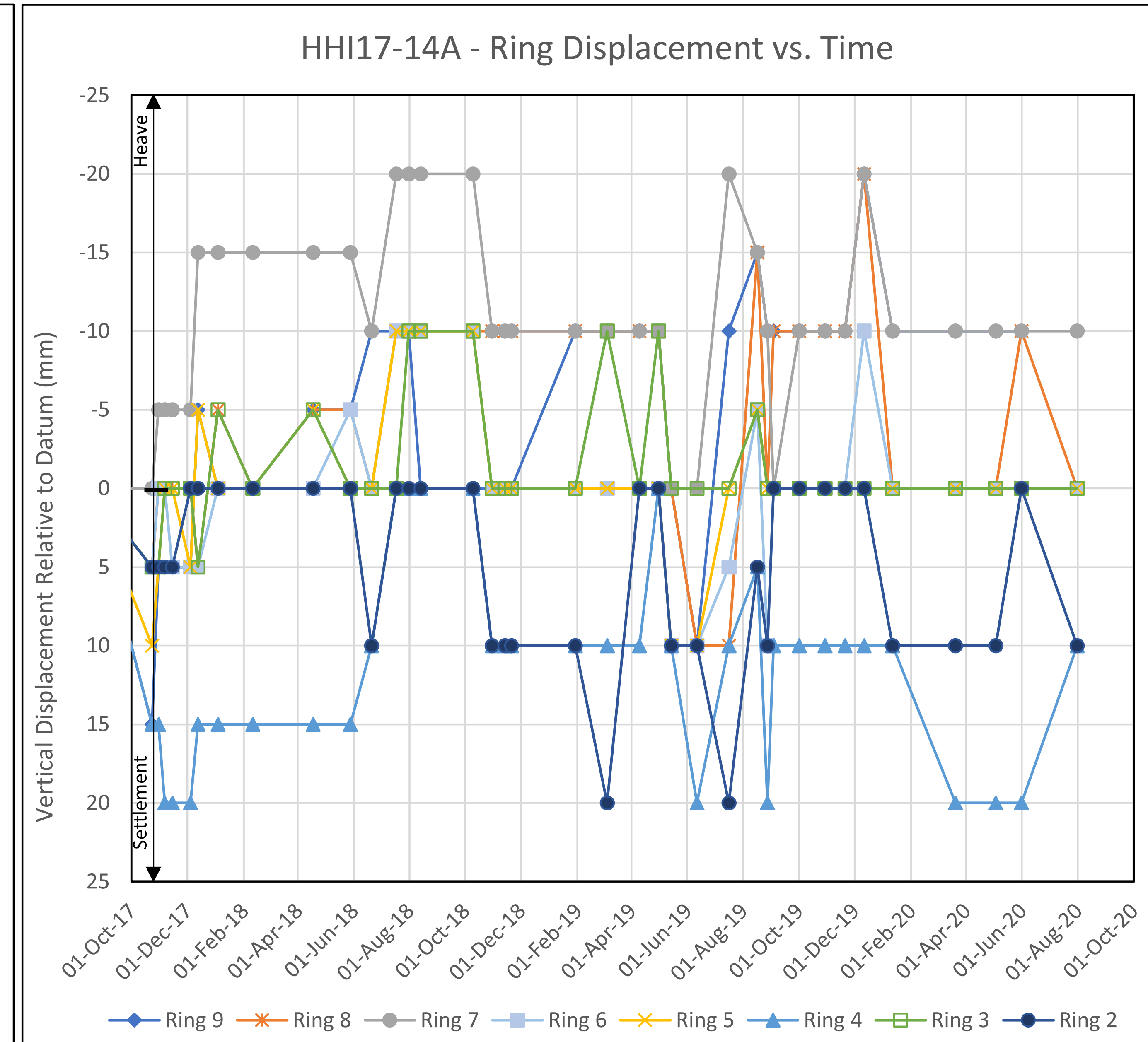
H-H DAM
SONDEX PLOTS







Note: Baseline reading is September 18, 2017



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 4 reading from February 10, 2018 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 3 and Ring 5.
4. No readings after July 31, 2020. Casing is broken at approximately 3 m downhole.

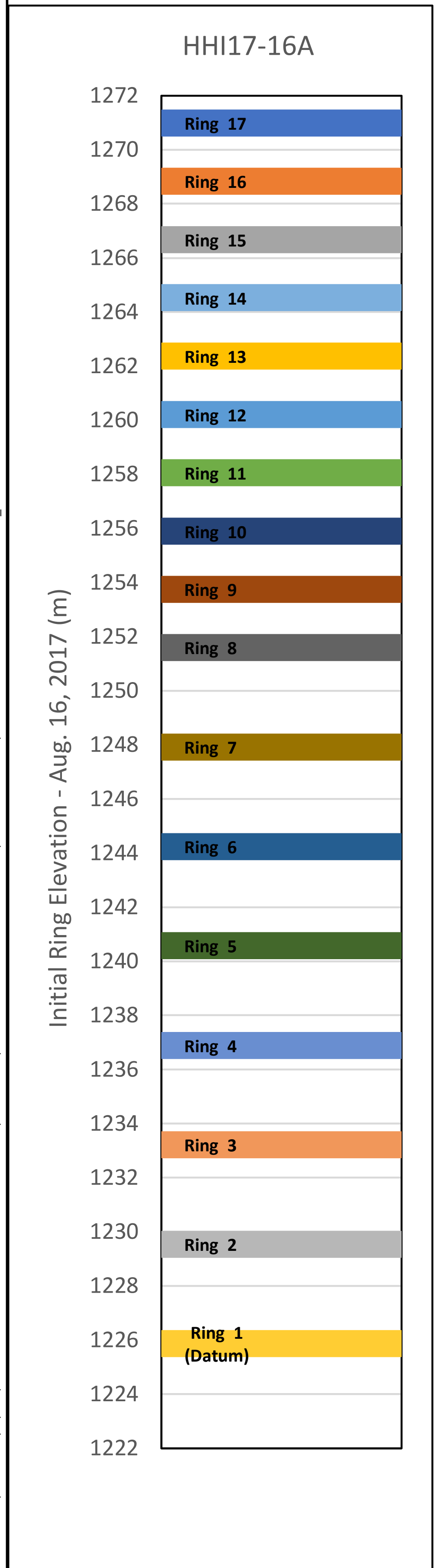
Highland Valley Copper / Teck

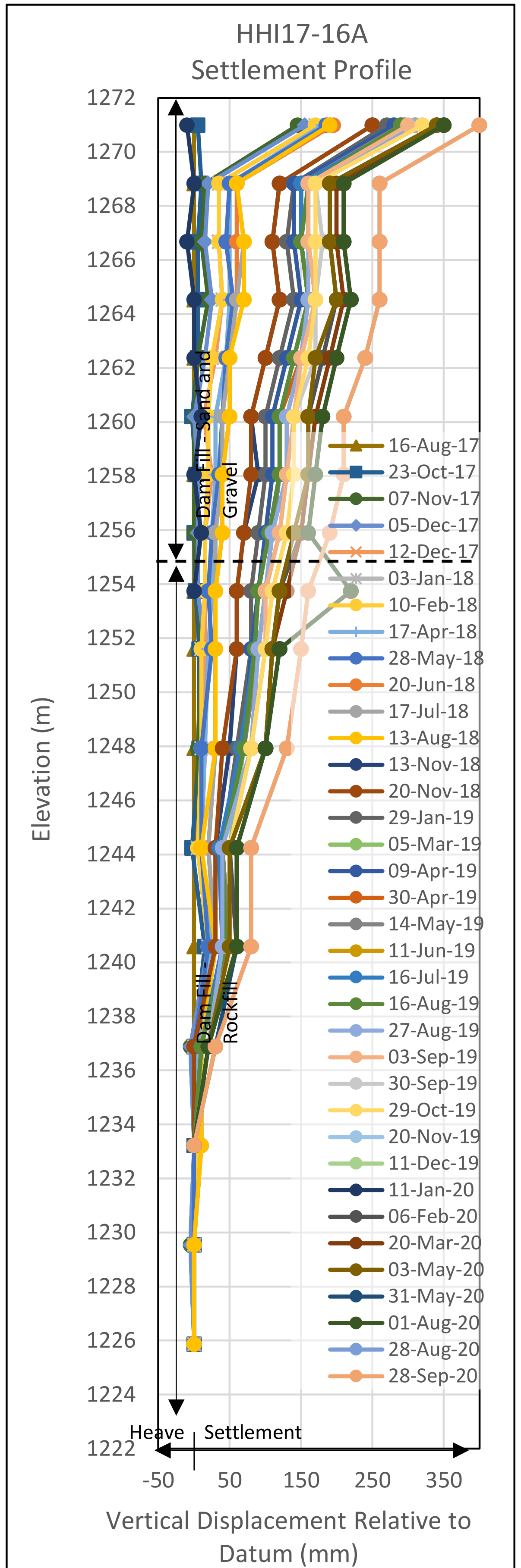
Klohn Crippen Berger

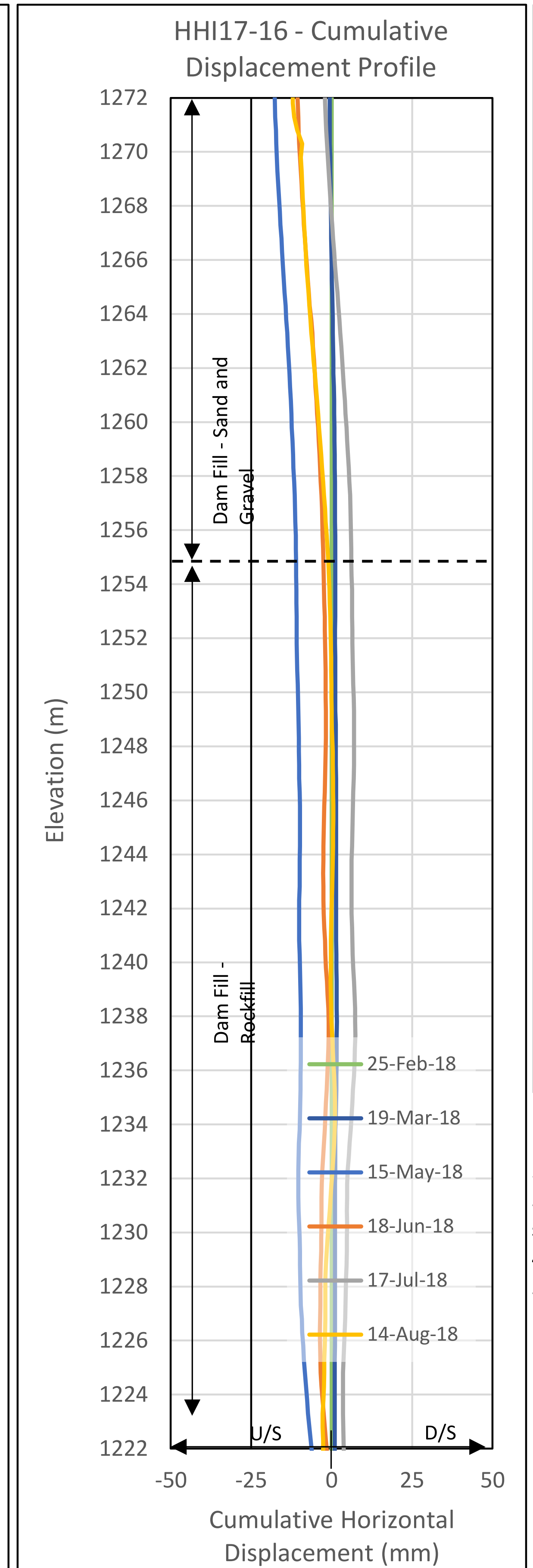
HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL REVIEW

H-H Dam Vertical Displacements - HHI17-14A (Sondex)

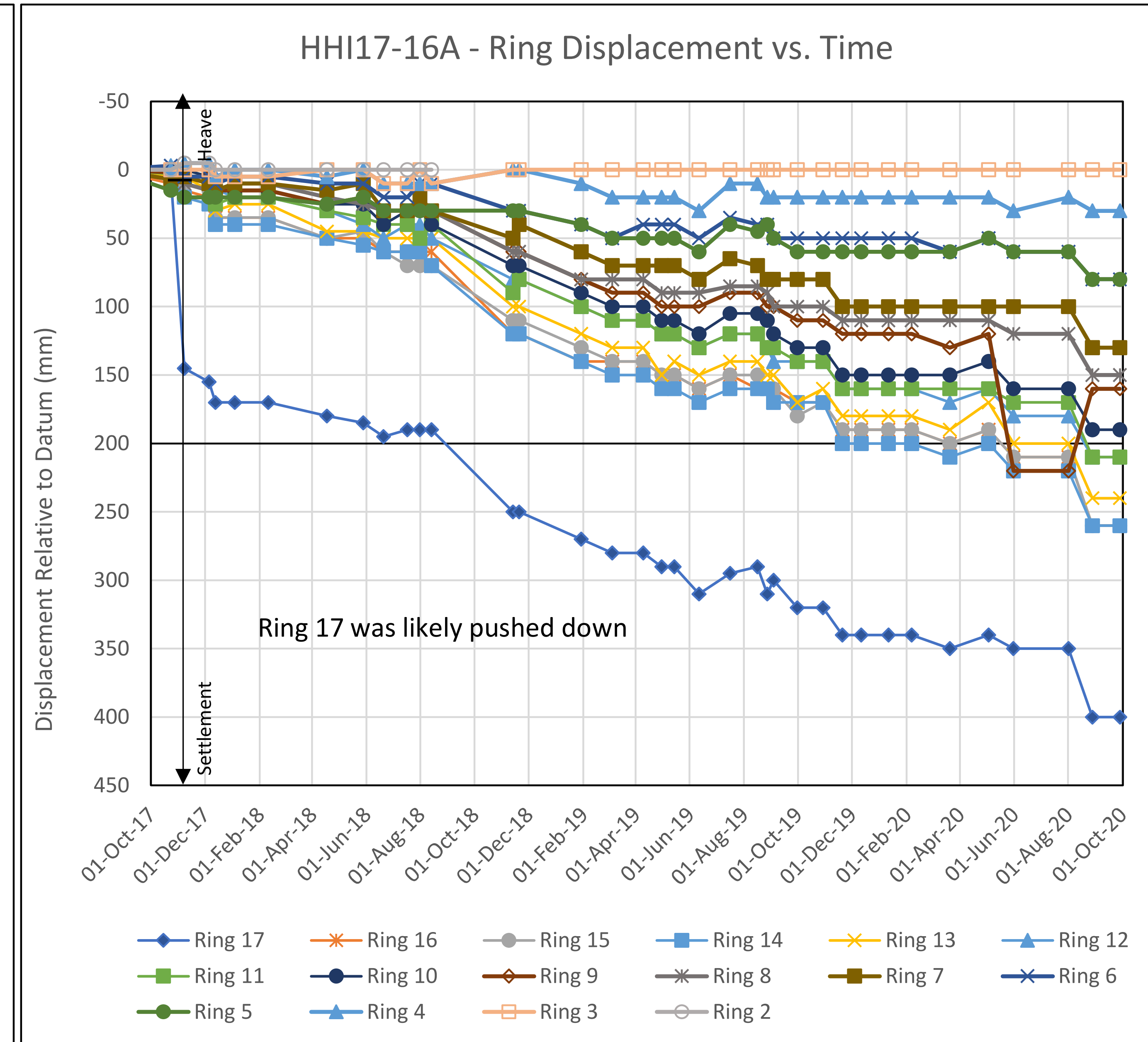
M02341B83







Note: Baseline reading is February 25, 2018



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.
4. Data from October 09, and 30, 2018 were not consistent with other readings and not showed here.
5. No readings recorded for Ring 1 and 2 after October 09, 2018

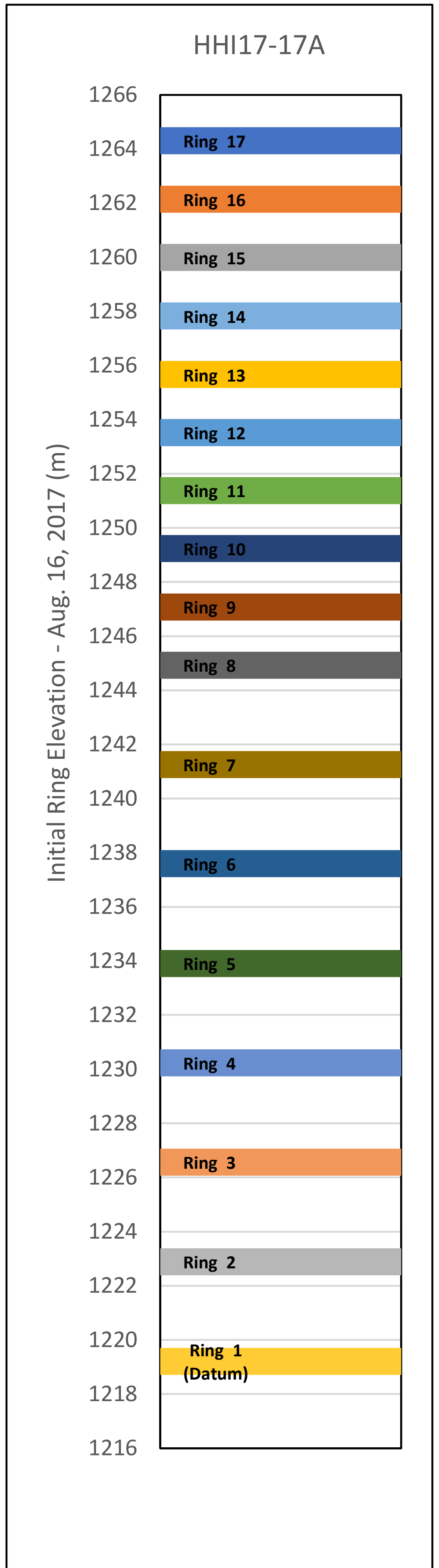
Highland Valley Copper / Teck

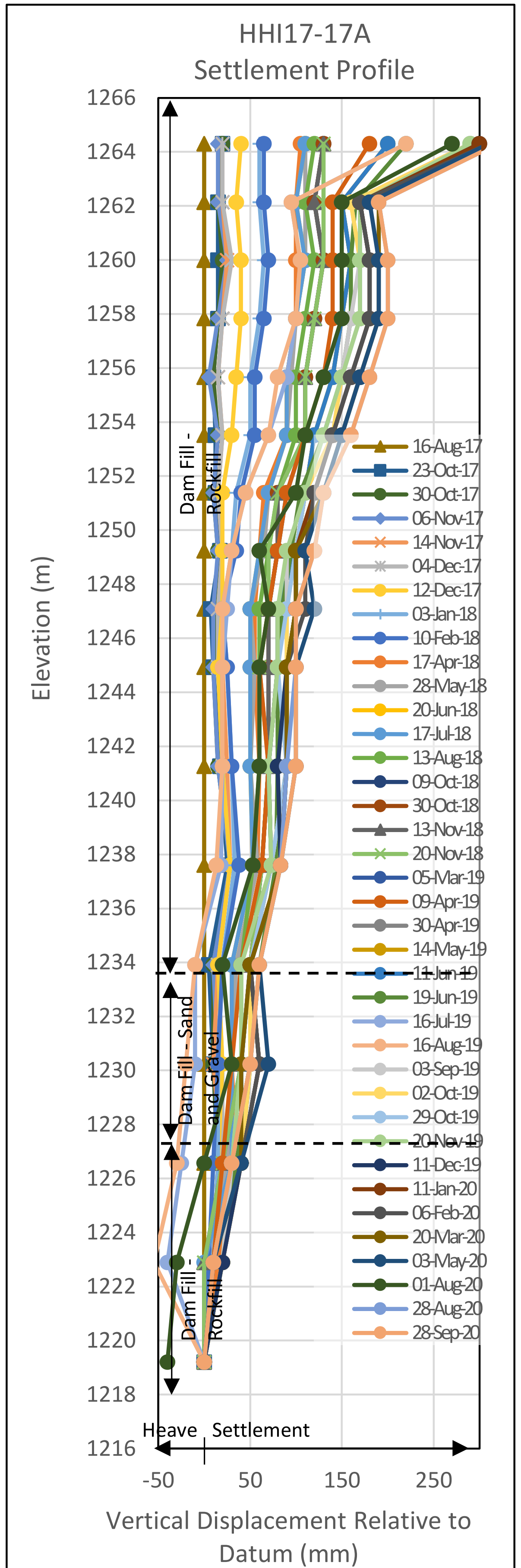
Klohn Crippen Berger

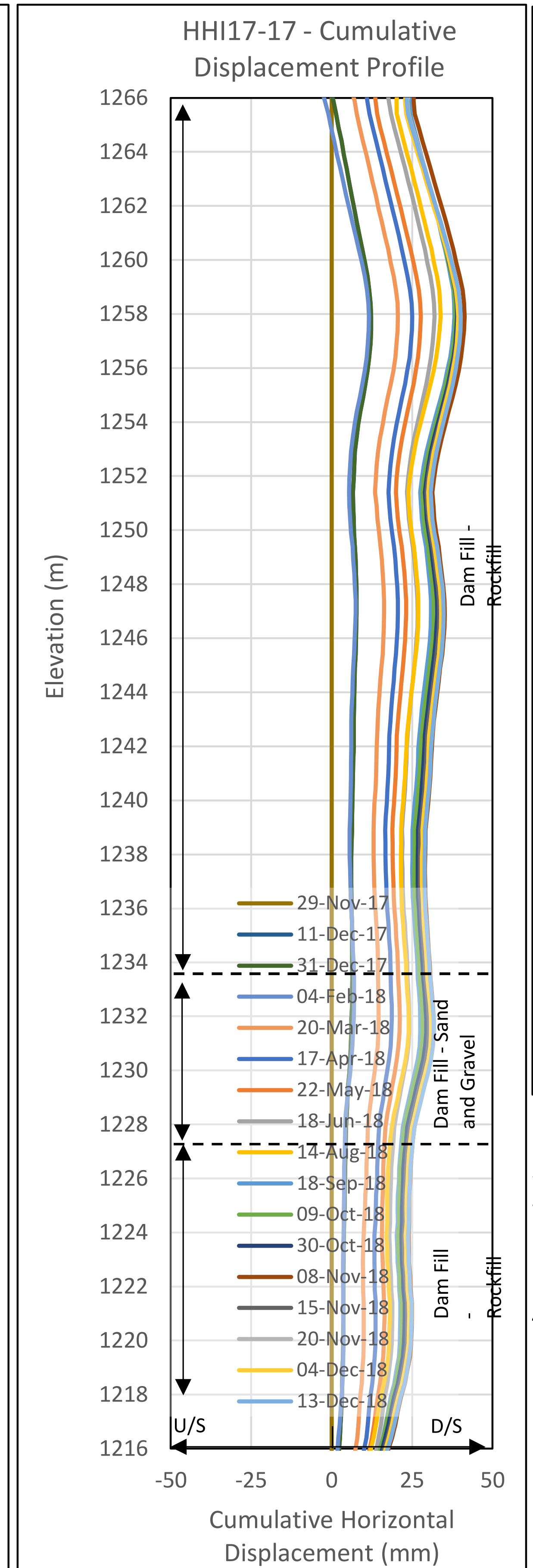
HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL REVIEW

H-H Dam Vertical Displacements - HHI17-16A (Sondex)

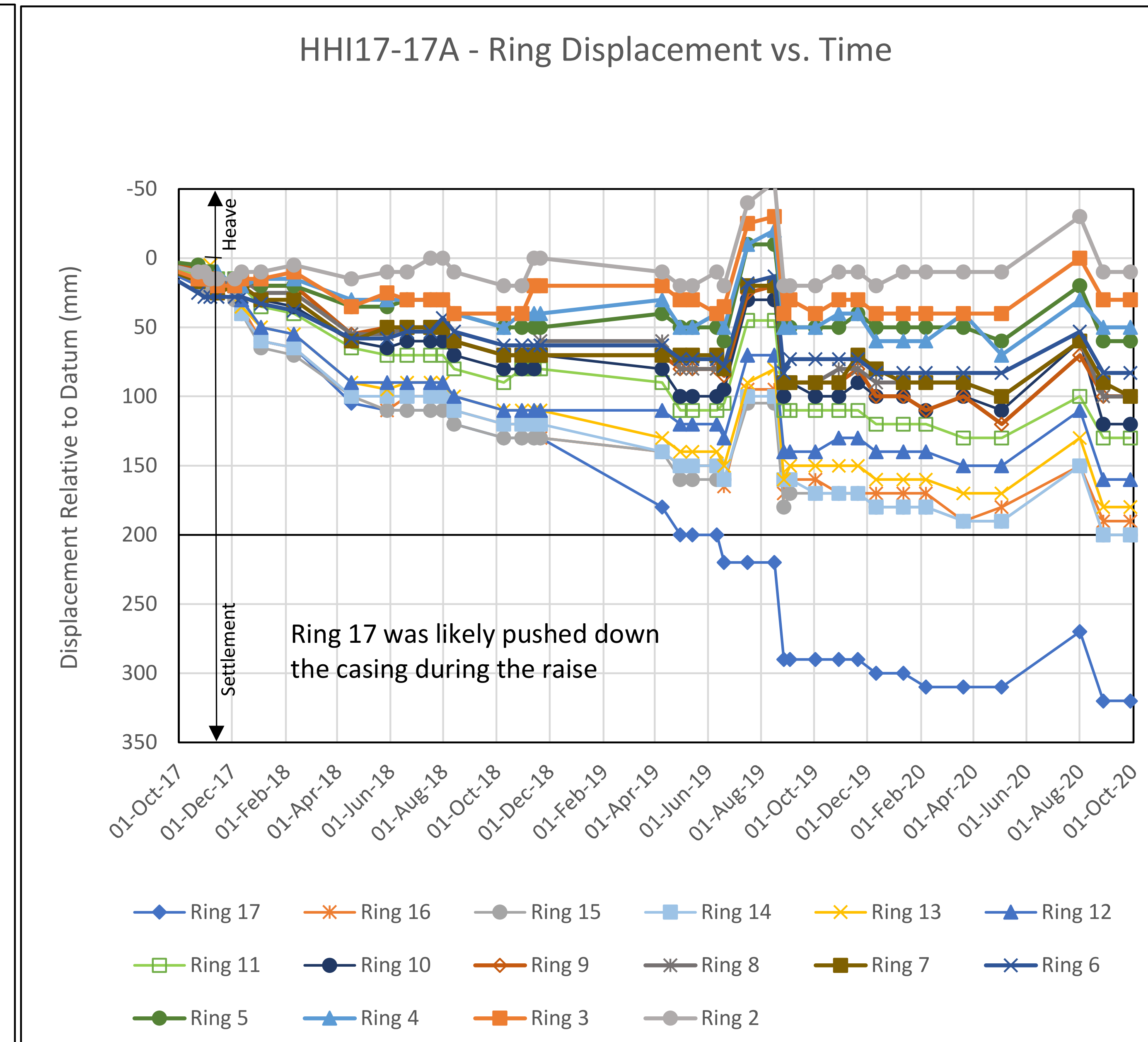
M02341B83







Note: Baseline reading is November 29, 2017



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 following readings were not consistent with readings in the rings above and below, due to suspected data entry errors. The readings were adjusted to match the trends of adjacent rings:
   - Ring 5 (December 11, 2017, January 3, 2018, February 10, 2018)
   - Ring 6 (January 3, 2018)
4. April readings were suspect to error and not shown here.

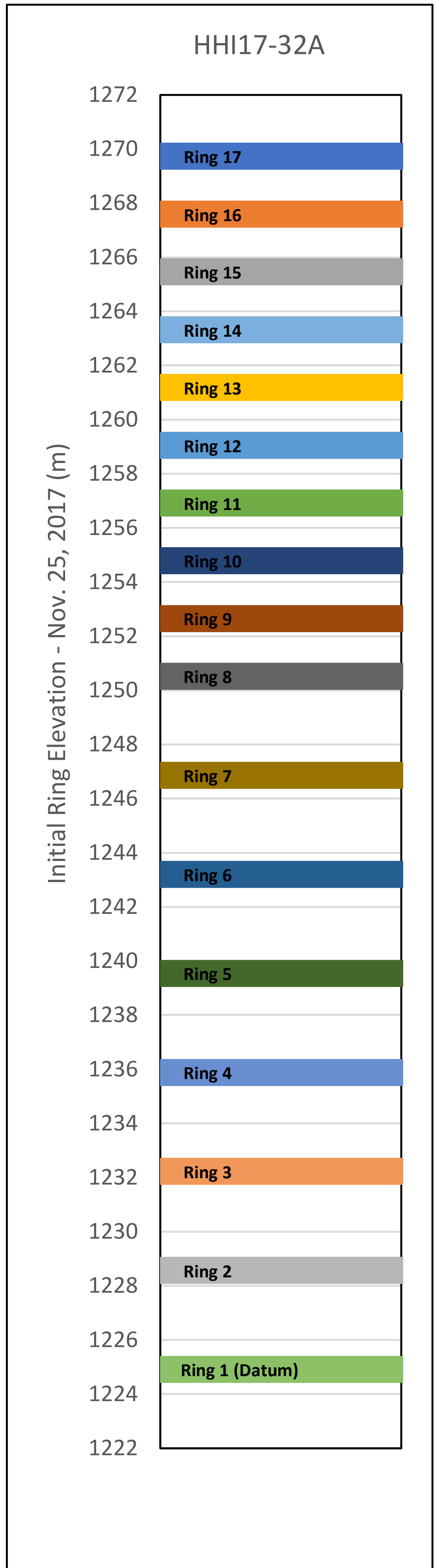
Highland Valley Copper / Teck

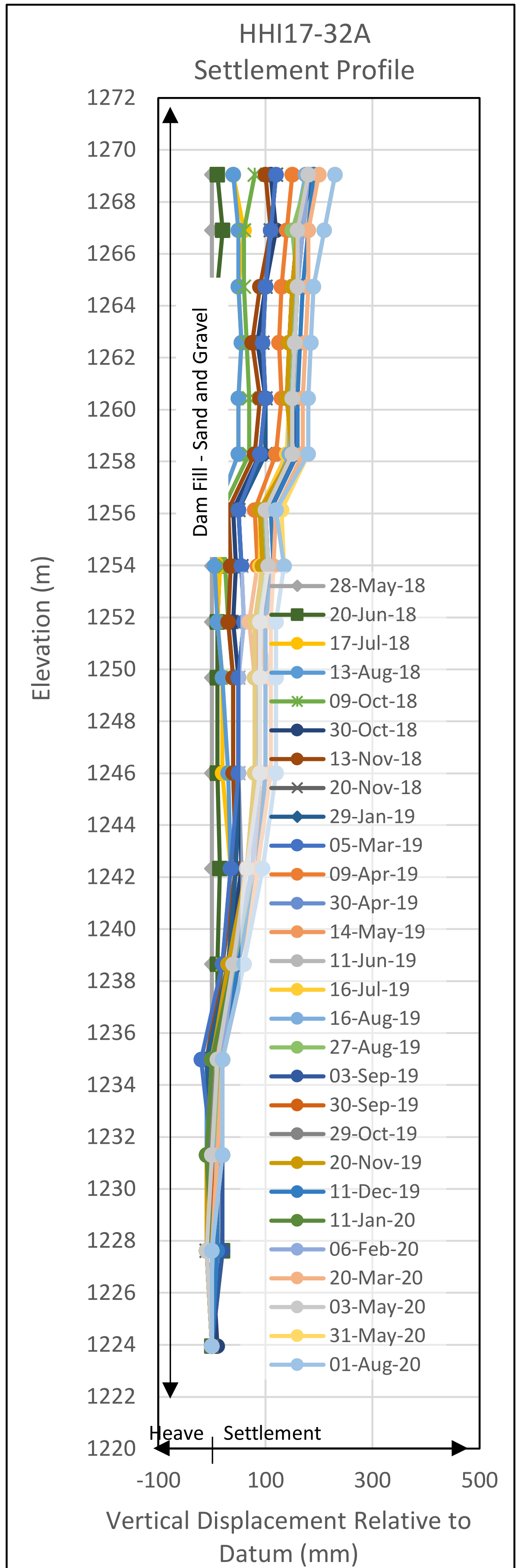
Klohn Crippen Berger

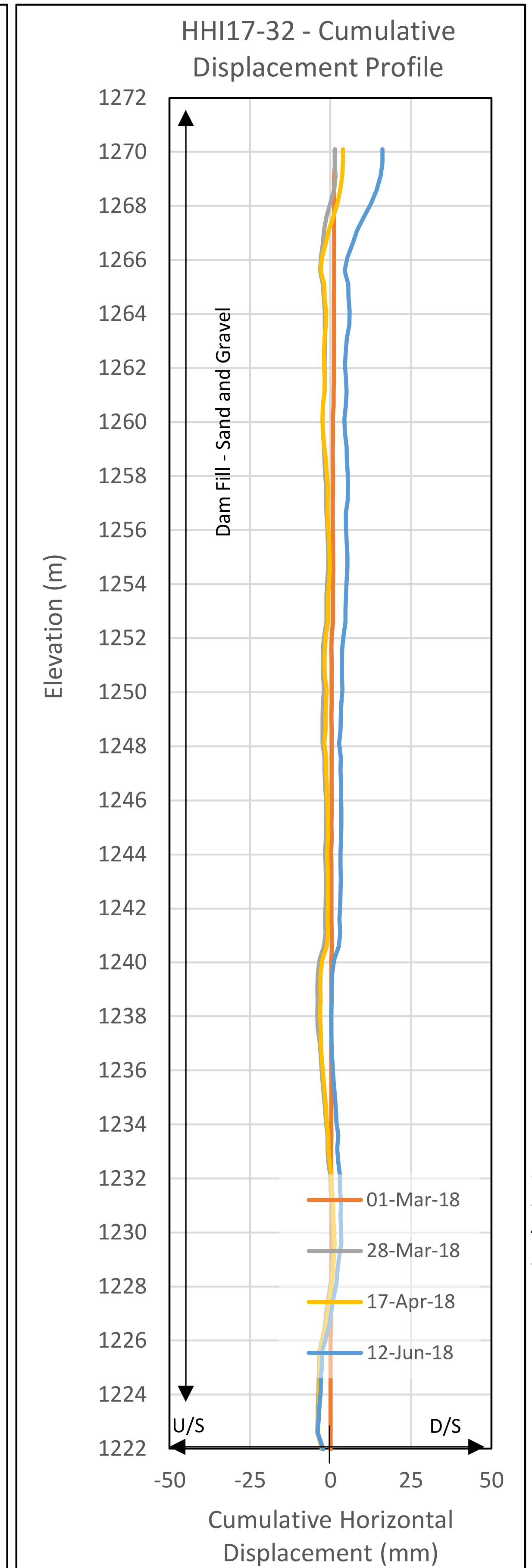
HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL REVIEW

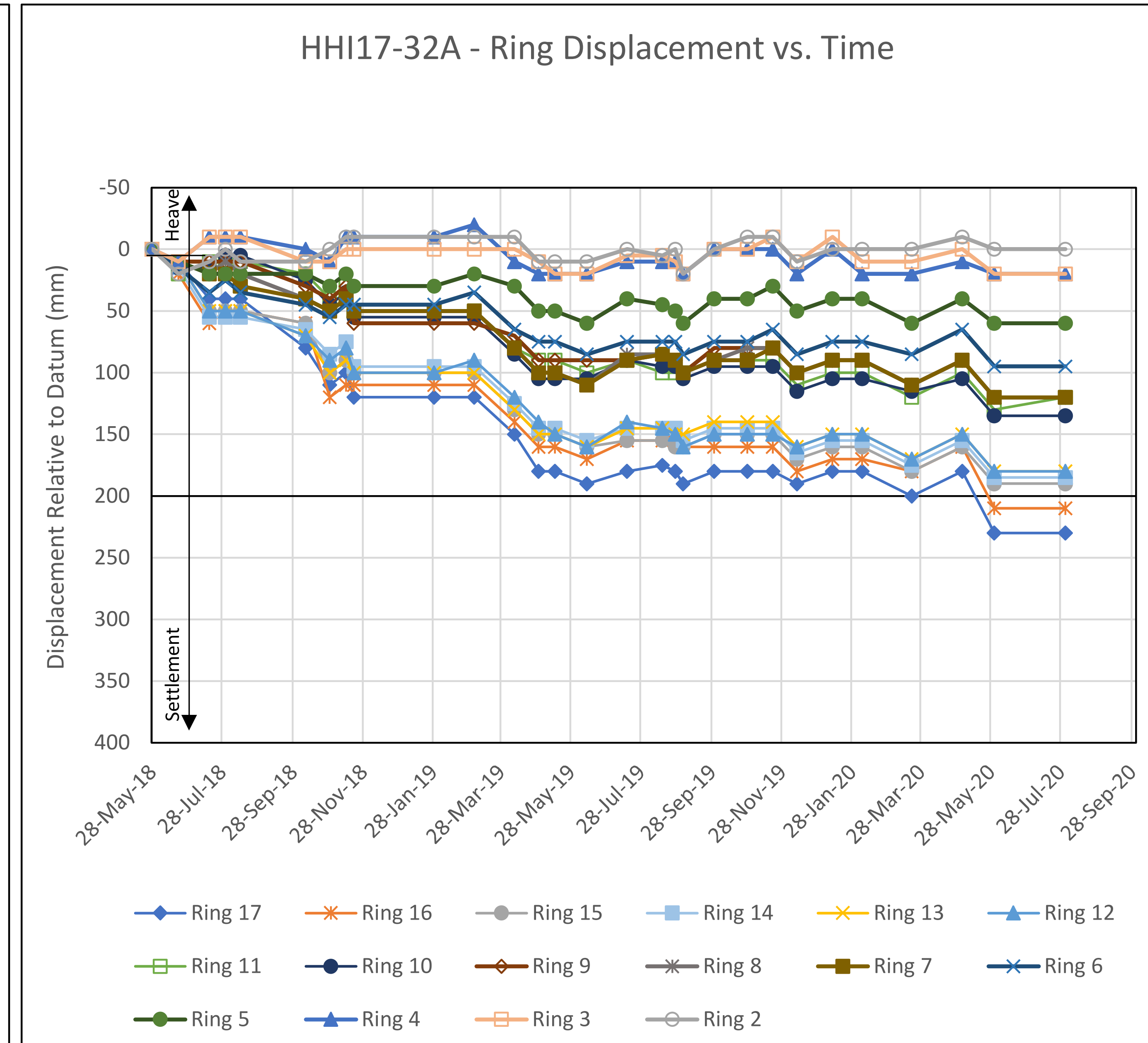
H-H Dam Vertical Displacements - HHI17-17A (Sondex)

M02341B83









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. Readings of October 30, and November 13, 2018 were not consistent and are adjusted.
4. The baseline reading of vertical displacemnet plot is May 28, 2018.
5. Data from August 28, 2020 and September 28, 2020 appeared to be outliers and are not shown here.

Highland Valley Copper / Teck

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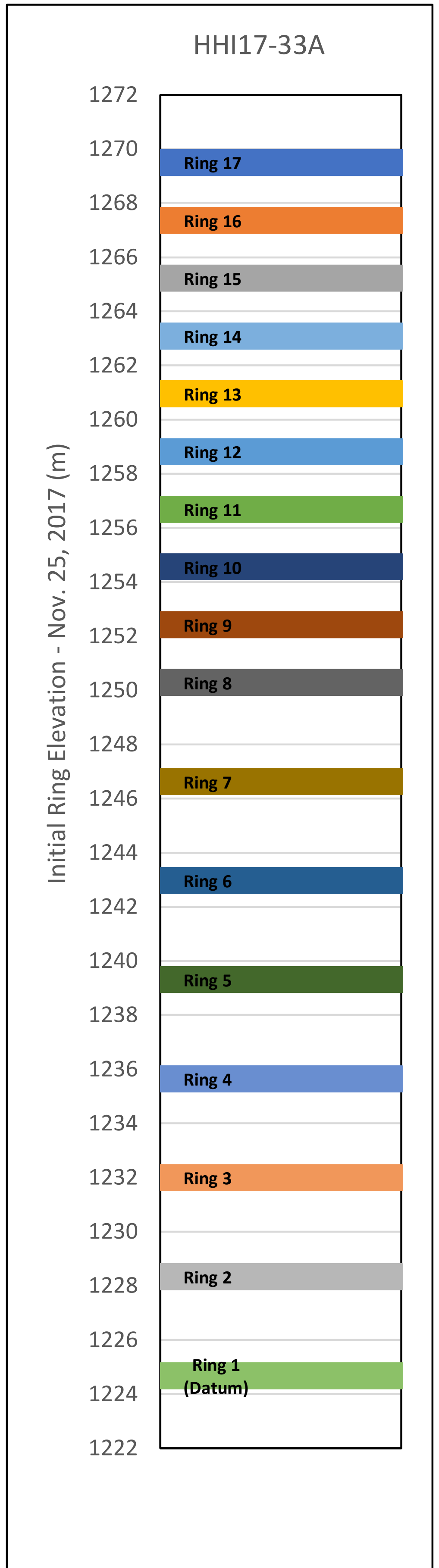
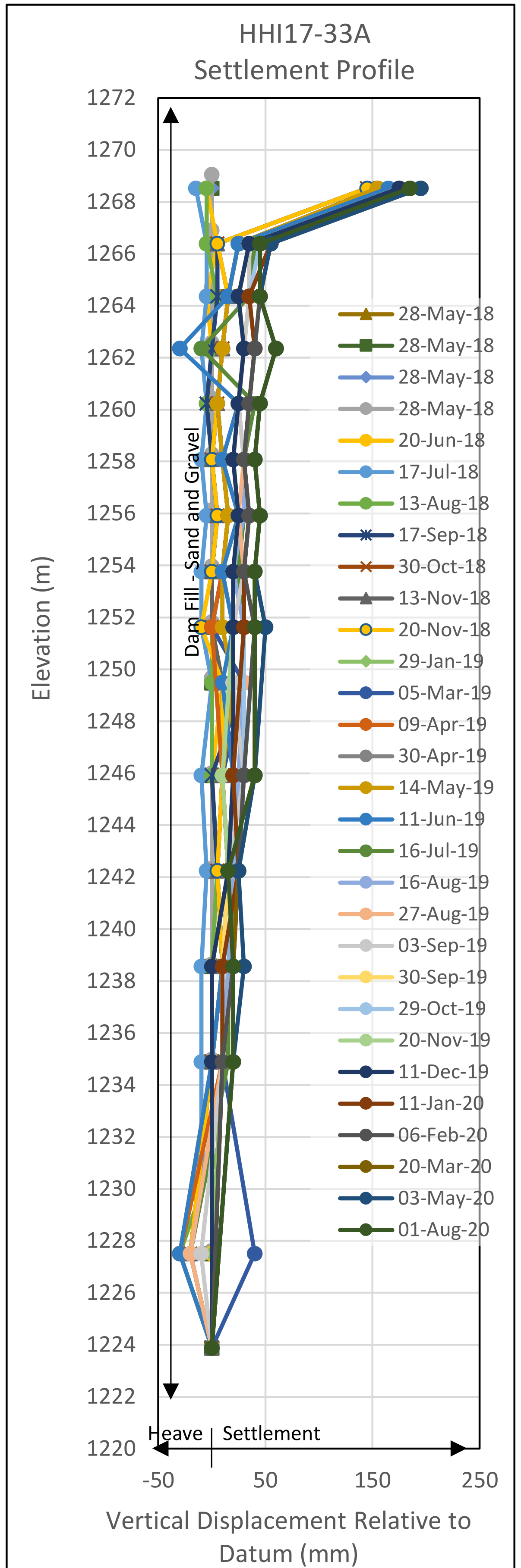
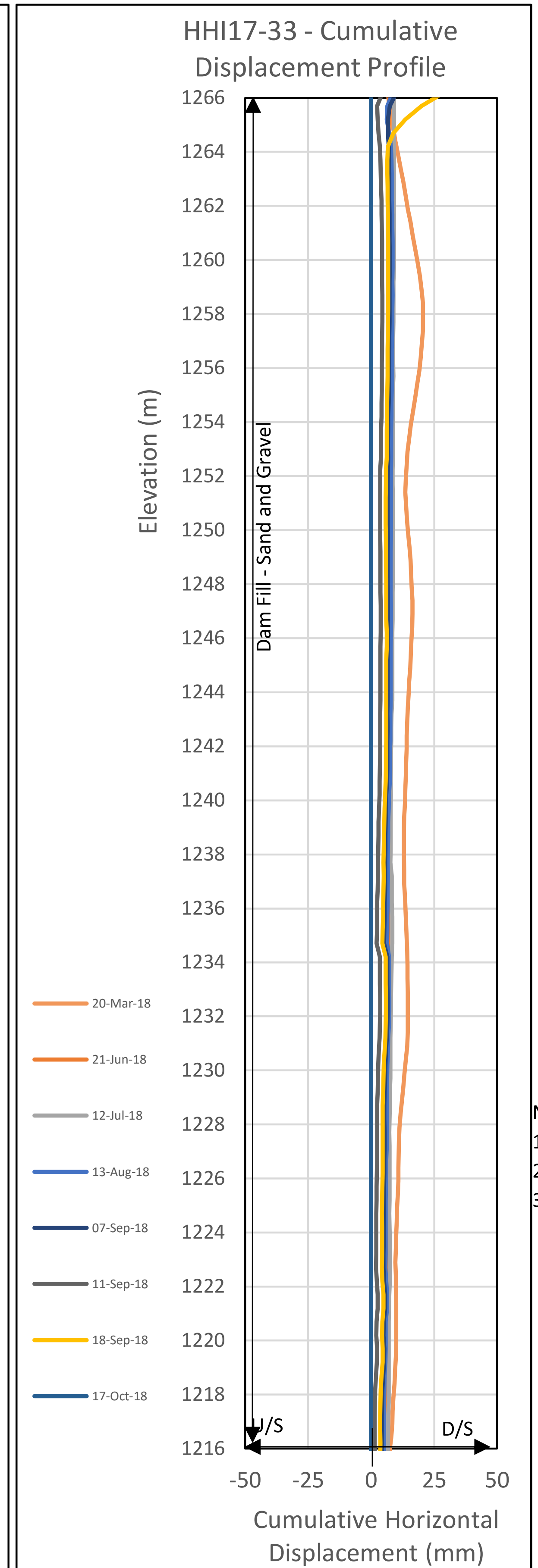
HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL REVIEW

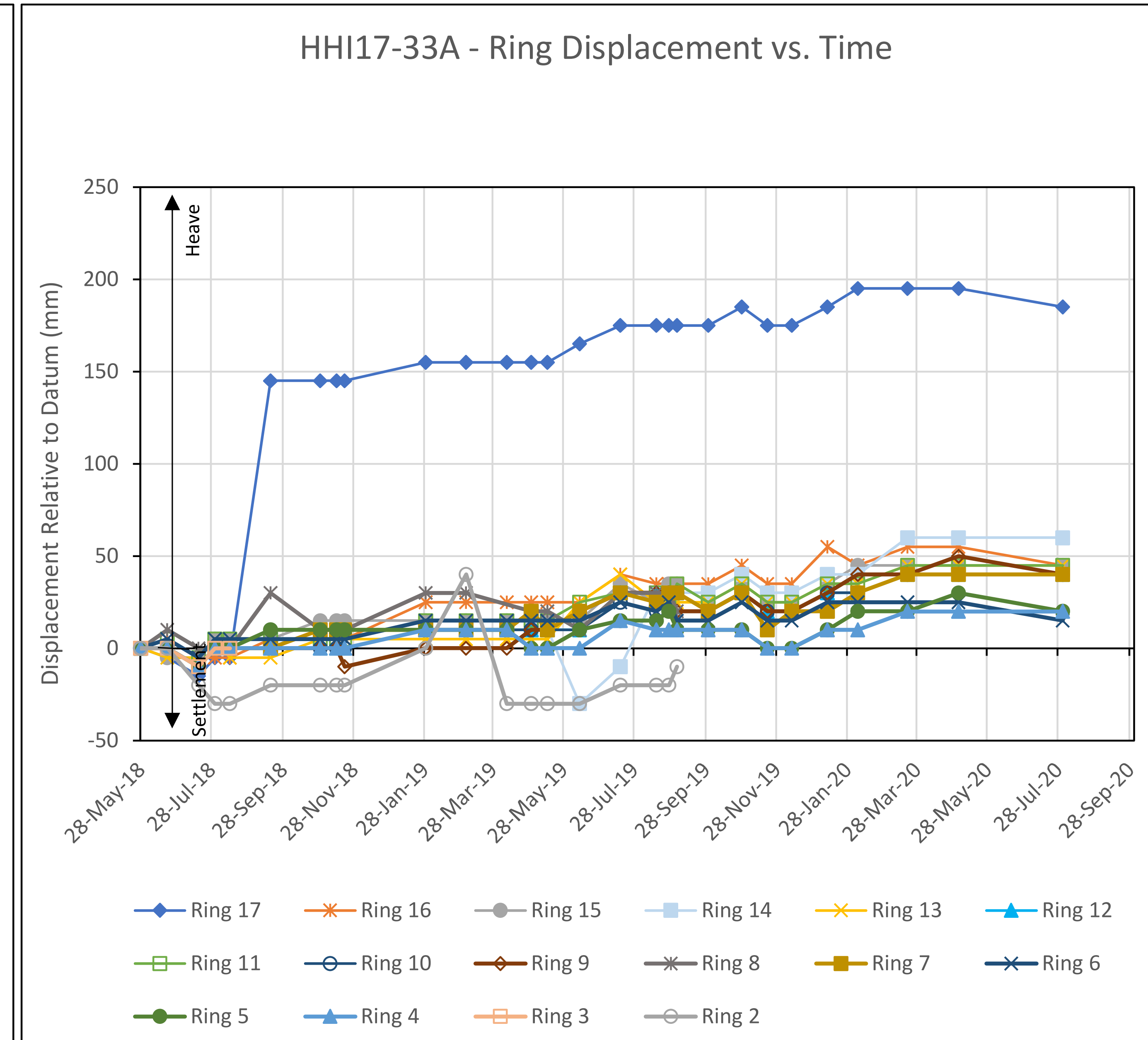
H-H Dam Vertical Displacements - HHI17-32A (Sondex)

M02341B83









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. Data from August 28, 2020 and September 28, 2020 appeared to be outliers and are not shown here.

Reading of Ring 3 in September 2018 is suspected to error.
This ring became off-line after this date.

Highland Valley Copper / Teck

Klohn Crippen Berger

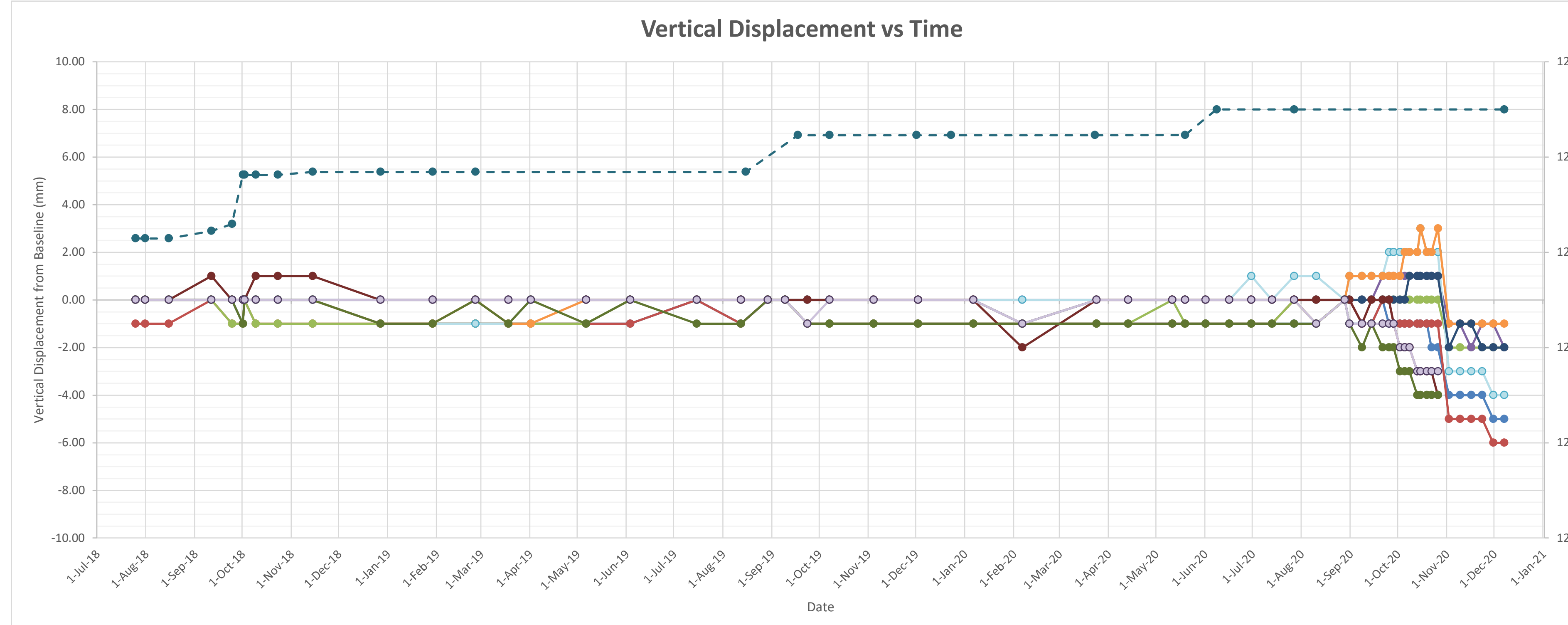
HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL REVIEW

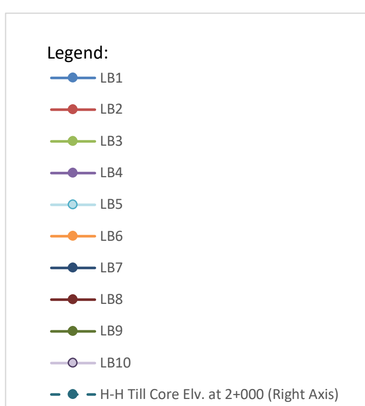
H-H Dam Vertical Displacements - HHI17-33A (Sondex)

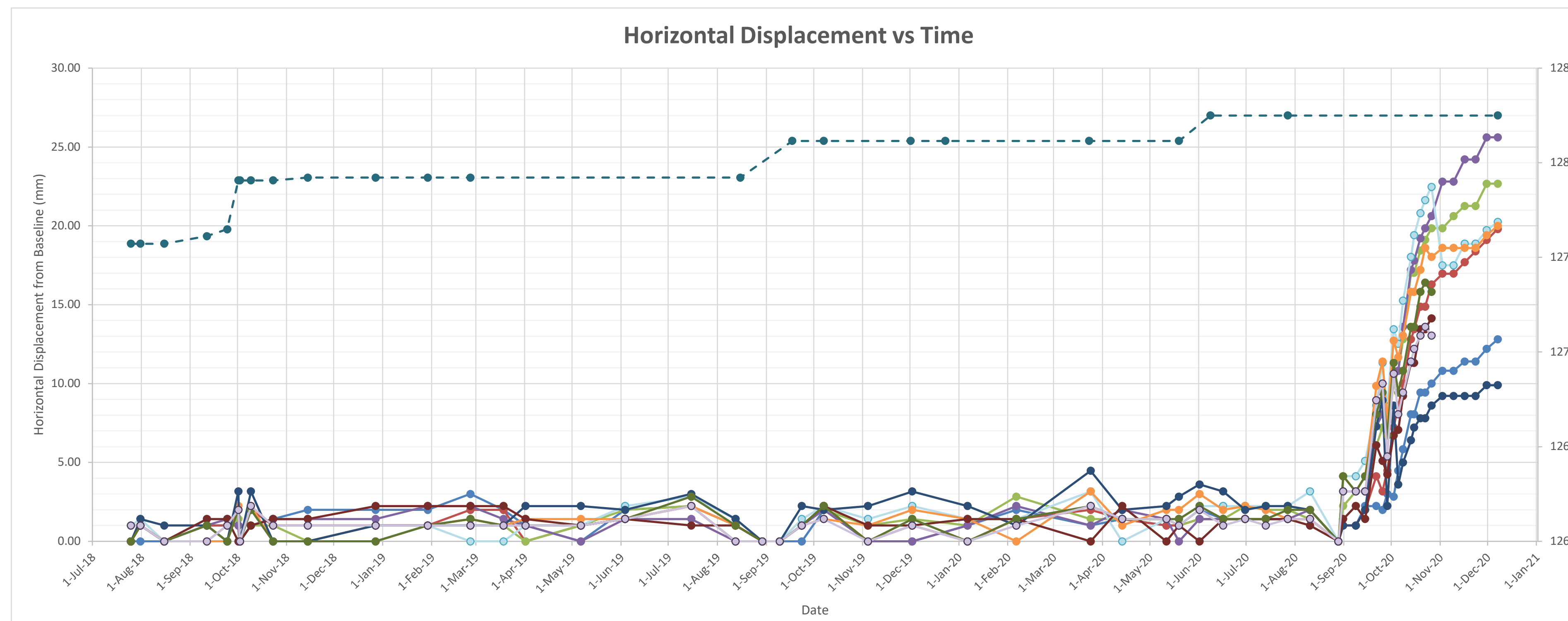
M02341B83

APPENDIX IV-D

H-H Dam Monument Data







NOTES:

1. All data provided by THVCP.
2. Till Core raise timeline is approximate.
3. LB8, LB9, and LB10 buried by buttressing at the bottom of lock block wall.

CLIENT
TECK HIGHLAND VALLEY COPPER PARTNERSHIP

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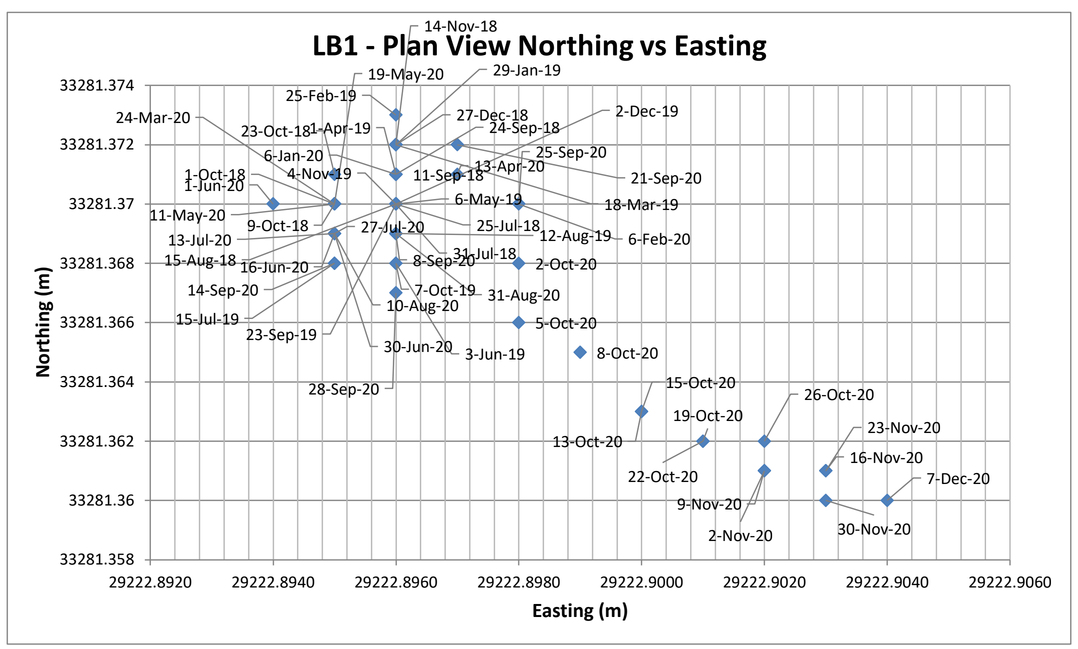
PROJECT
HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

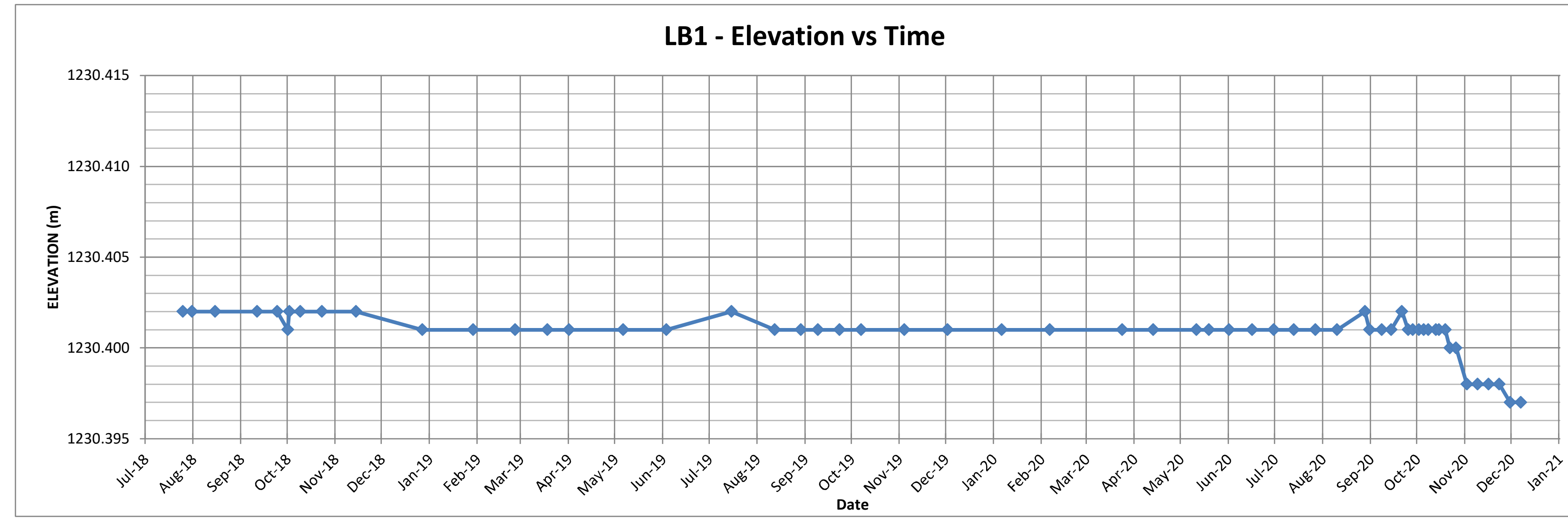
TITLE
H-H DAM LOCK-BLOCK RETAINING WALL SURVEY MONUMENT READINGS SUMMARY

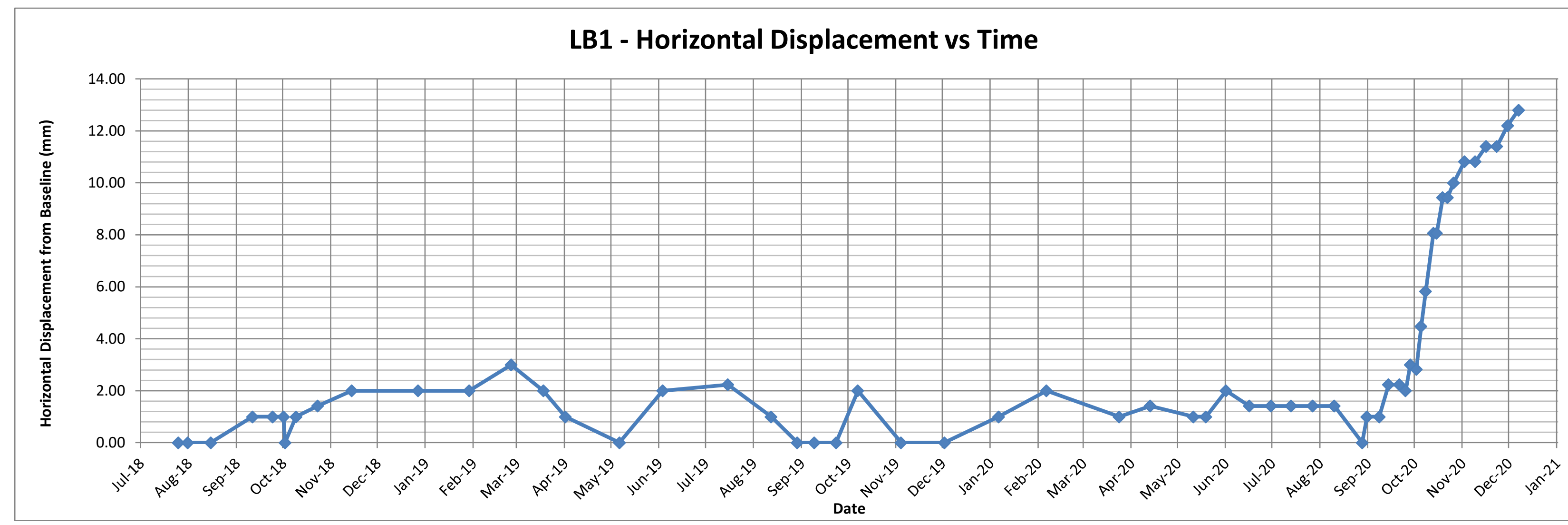
PROJECT No.
M02341B83

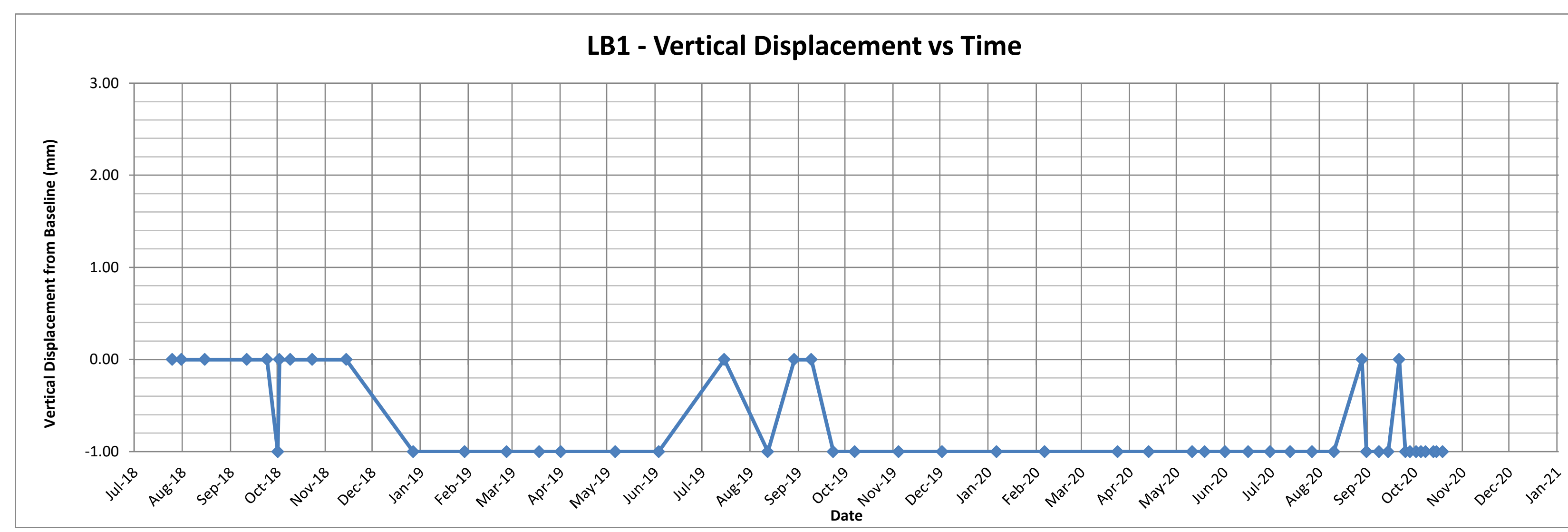
FIG No.

December 11, 2020
Z:\M\VCR\M02341B83 - HVC 2020 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\[201211 HH Pumphouse Retaining Wall Monitoring (FOR DSI)_Cumulative.xlsm]Fig 18









NOTES:

1. All data provided by THVCP.

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Klohn Crippen Berger

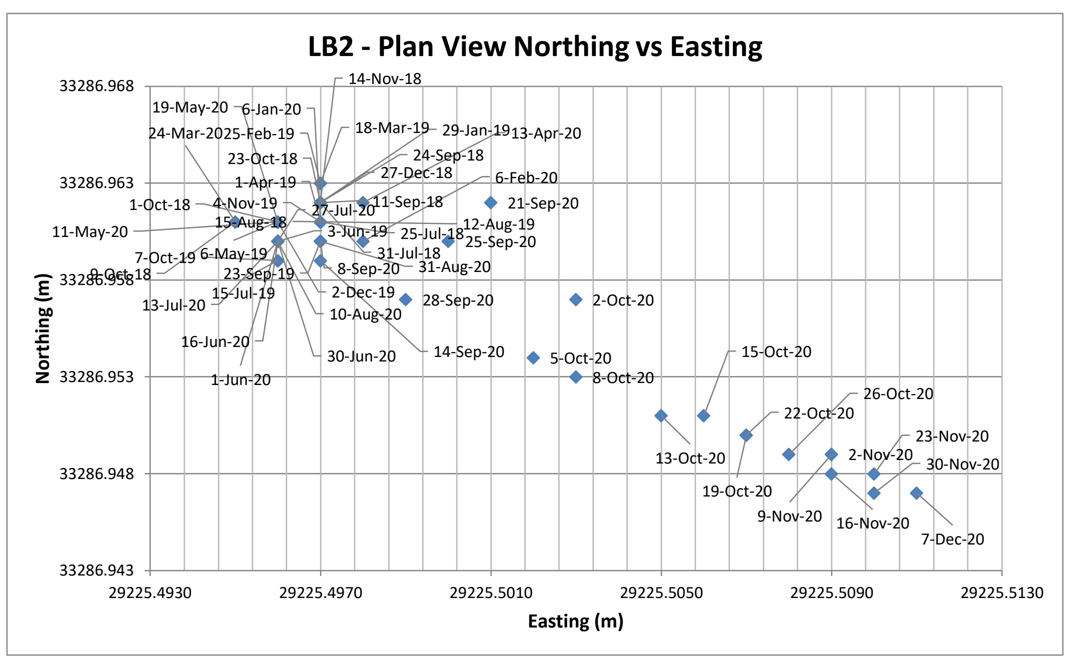
PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2020 ANNUAL FACILITY PERFORMANCE REPORT

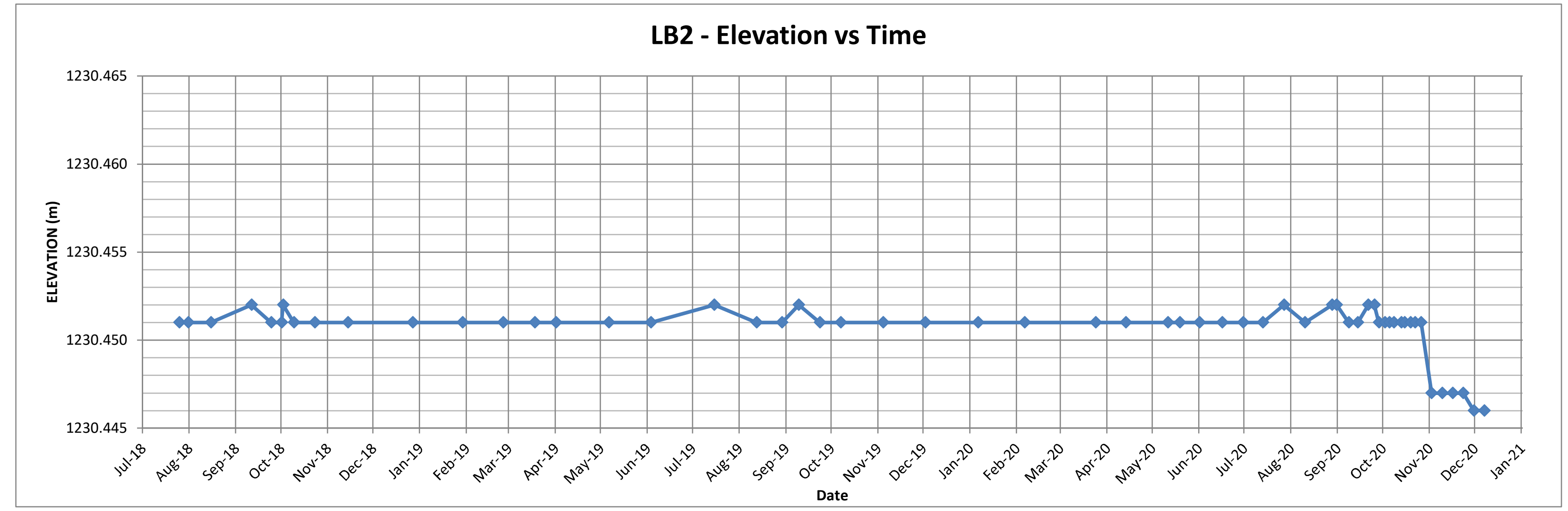
TITLE: H-H DAM LOCK-BLOCK RETAINING WALL SURVEY MONUMENT READINGS LB1

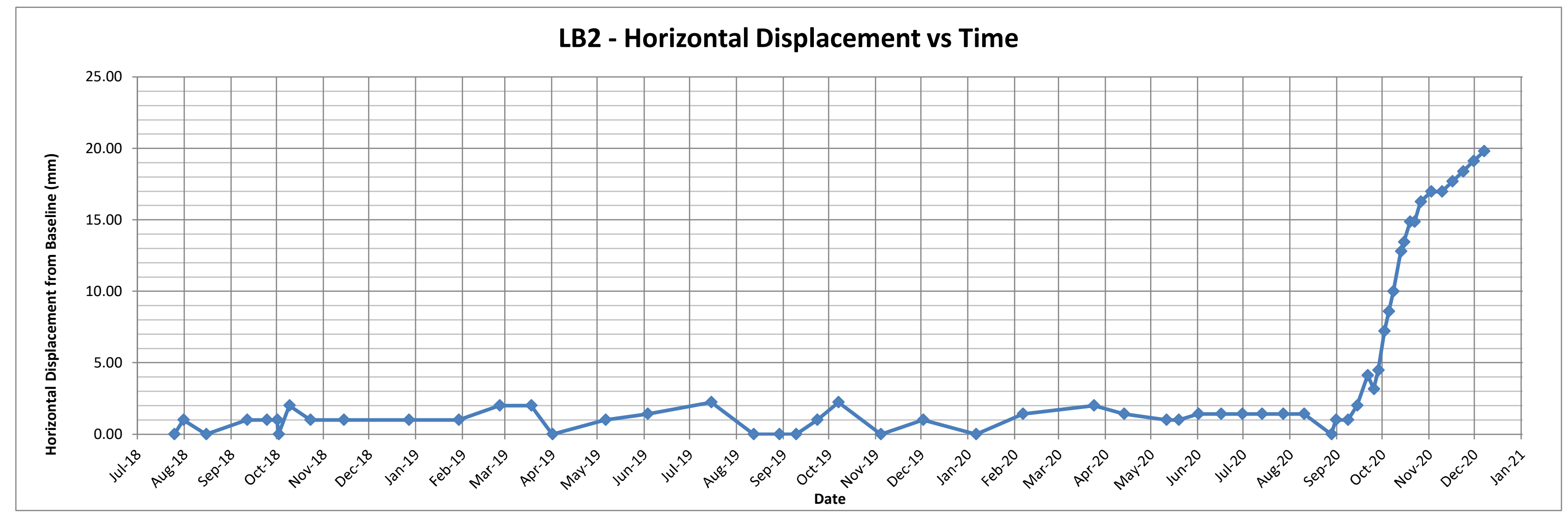
PROJECT No. M02341B83

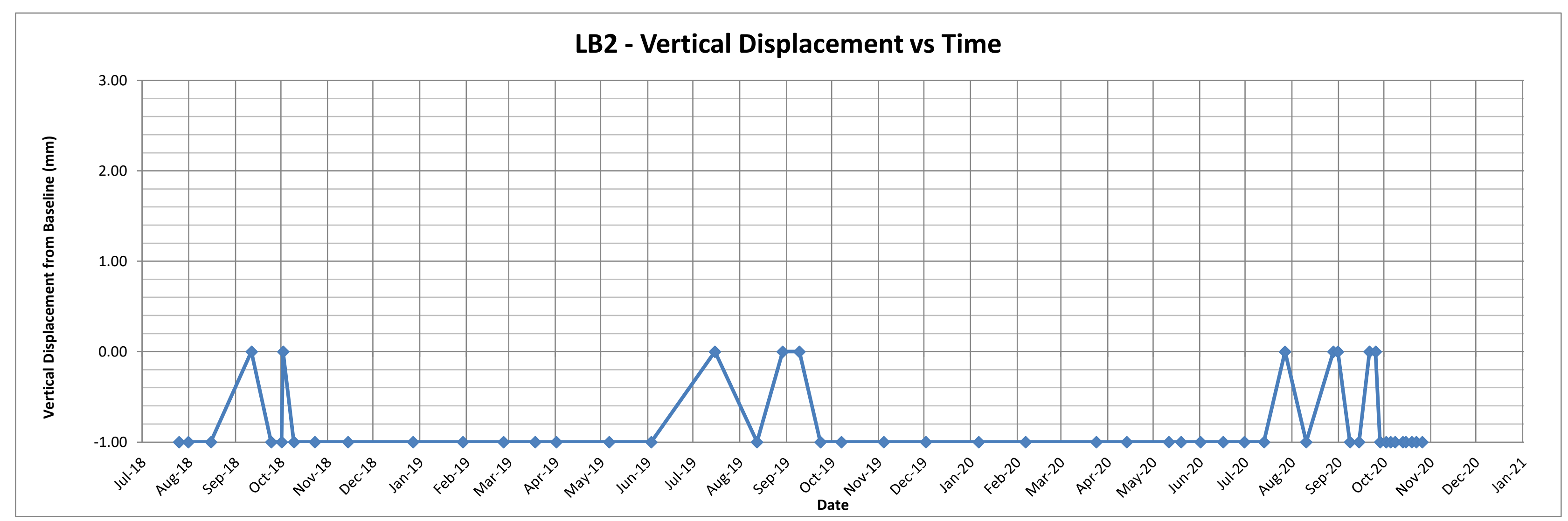
FIG No.

December 11, 2020
Z:\M\VCR\M02341B83 - HVC 2020 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\[201211 HH Pumphouse Retaining Wall Monitoring (FOR DSI)_Cumulative.xlsm]Fig 18









NOTES:

1. All data provided by THVCP.

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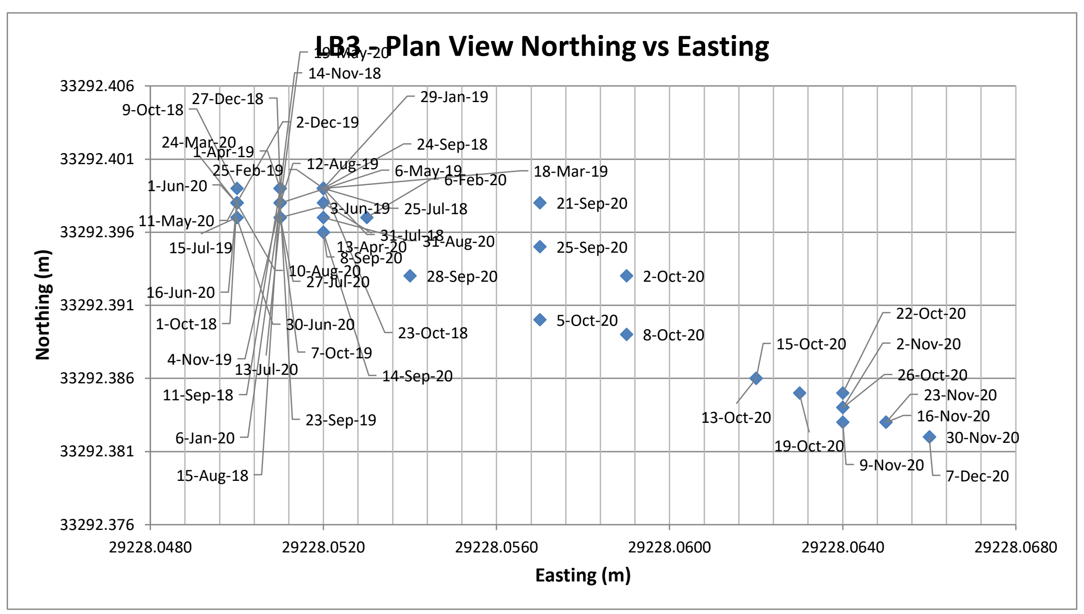
2020 ANNUAL FACILITY PERFORMANCE REPORT

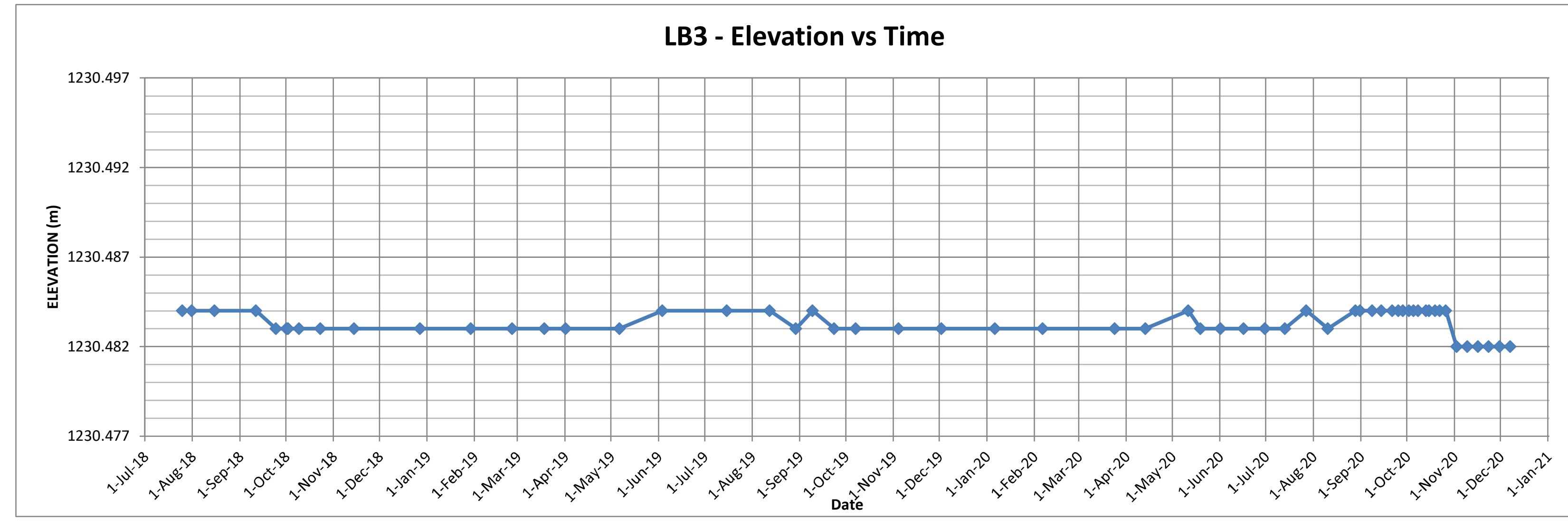
TITLE: H-H DAM LOCK-BLOCK RETAINING WALL
SURVEY MONUMENT READINGS
LB2

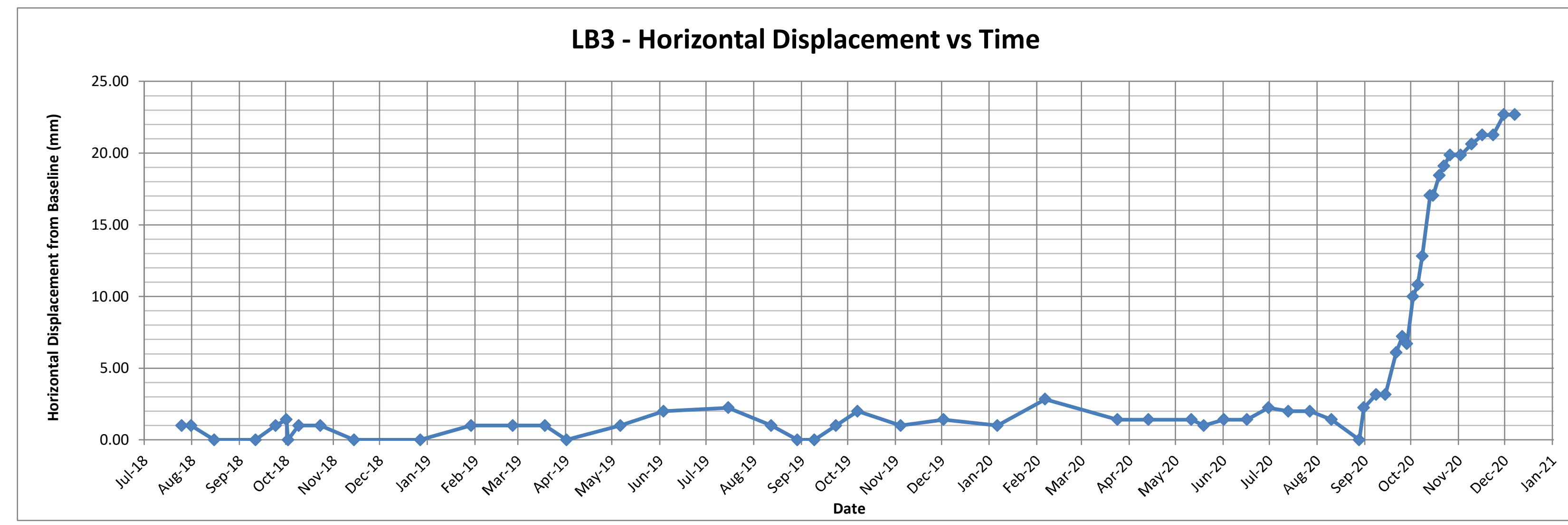
PROJECT No. M02341B83

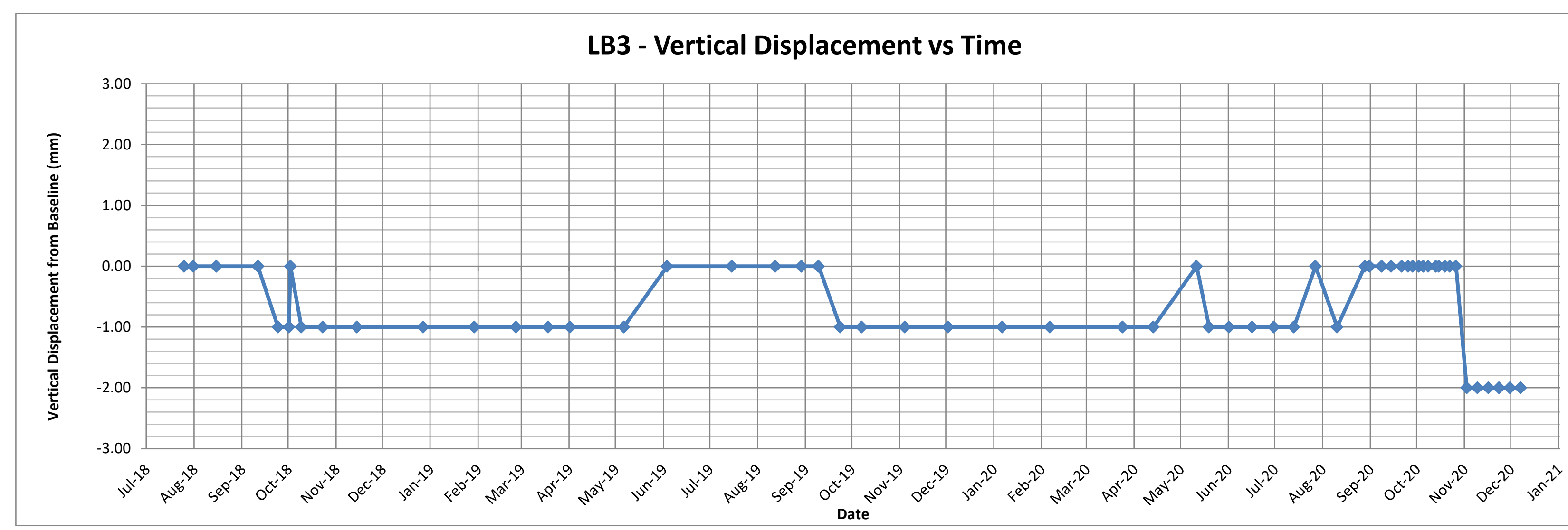
FIG No.

December 11, 2020
Z:\M\VCR\M02341B83 - HVC 2020 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\[201211 HH Pumphouse Retaining Wall Monitoring (FOR DSI)_Cumulative.xlsm]Fig 18









NOTES:

1. All data provided by THVCP.

CLIENT
TECK HIGHLAND VALLEY COPPER PARTNERSHIP

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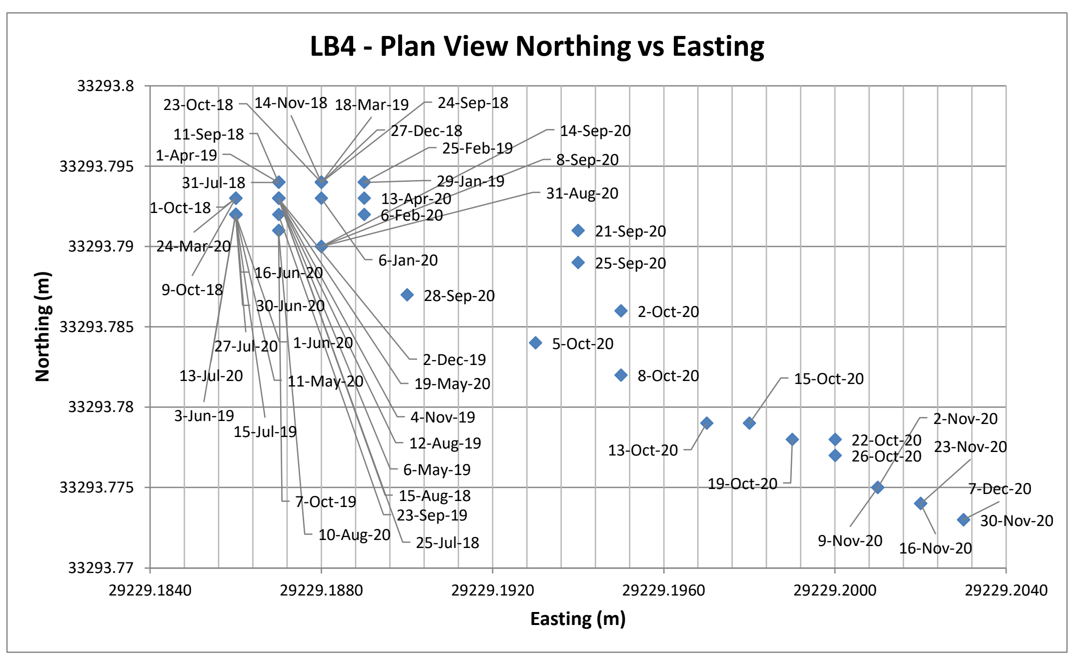
PROJECT
HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

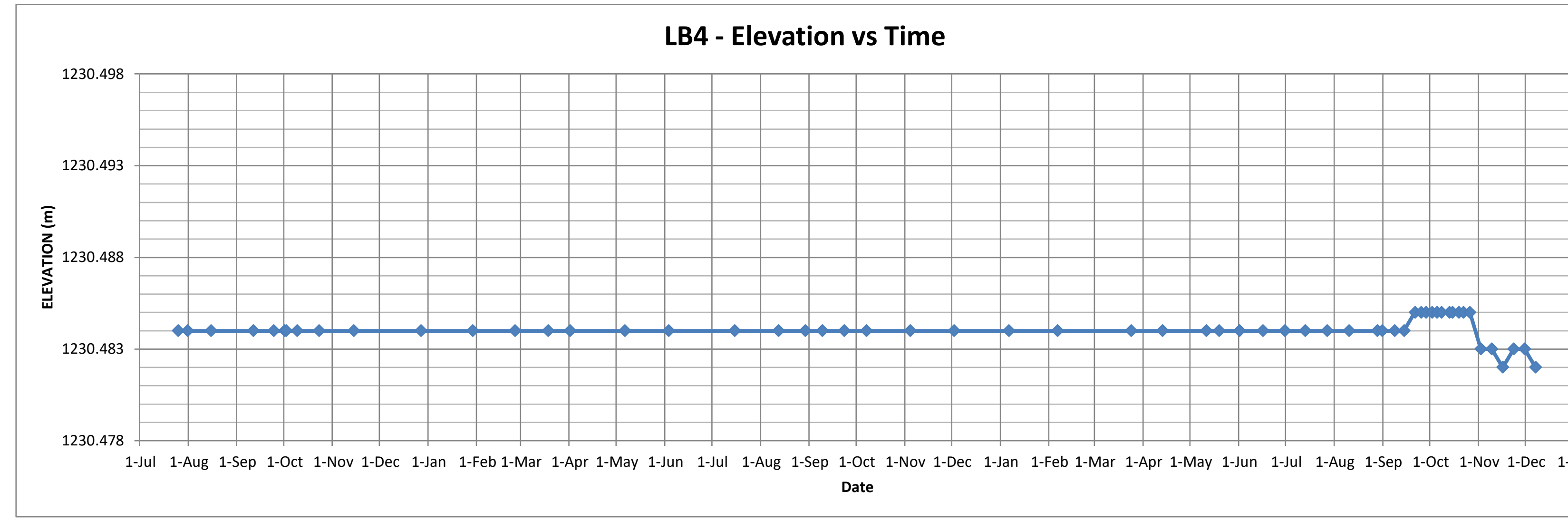
TITLE
H-H DAM LOCK-BLOCK RETAINING WALL SURVEY MONUMENT READINGS
LB3

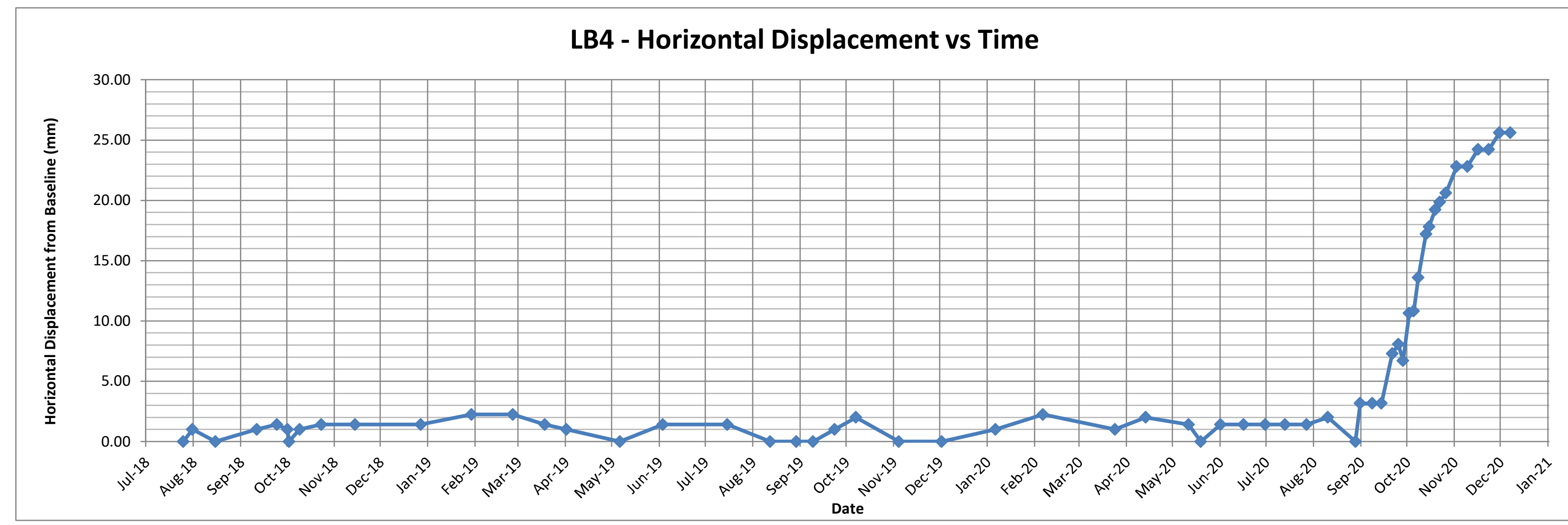
PROJECT No. M02341B83

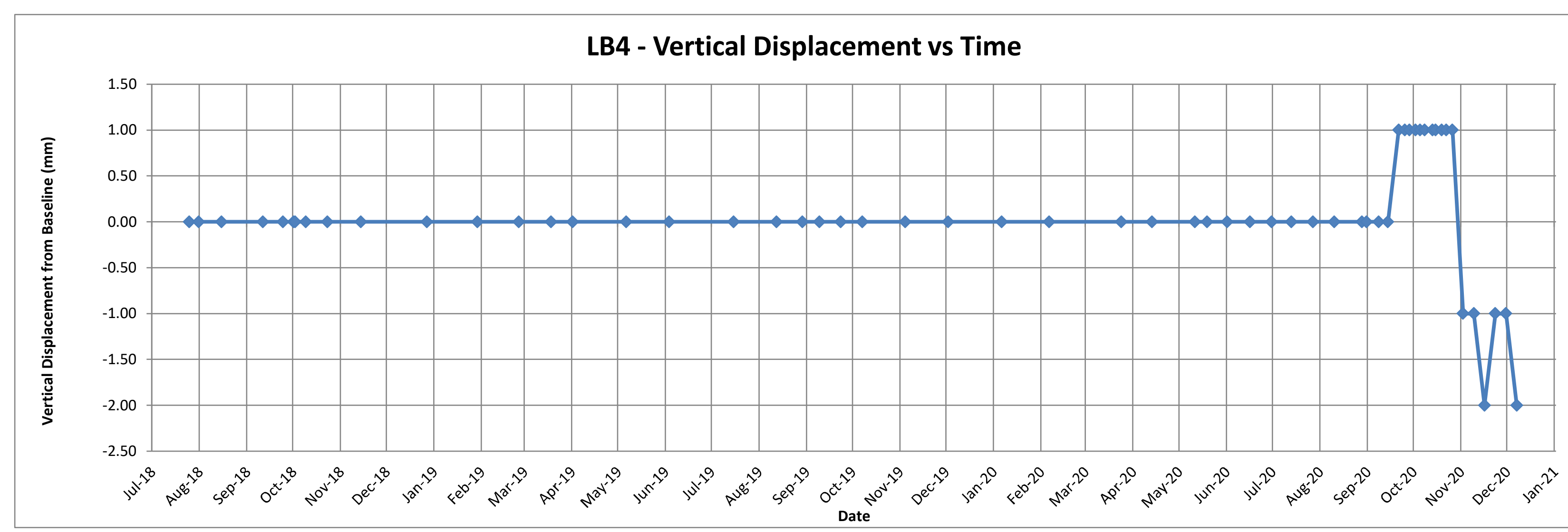
FIG No.

December 11, 2020
Z:\M\VCR\M02341B83 - HVC 2020 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\[201211 HH Pumphouse Retaining Wall Monitoring (FOR DSI)_Cumulative.xlsm]Fig 18









NOTES:

1. All data provided by THVCP.

December 11, 2020
Z:\M\VCR\M02341B83 - HVC 2020 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\[201211 HH Pumphouse Retaining Wall Monitoring (FOR DSI)_Cumulative.xlsm]Fig 18

CLIENT
TECK HIGHLAND VALLEY COPPER PARTNERSHIP

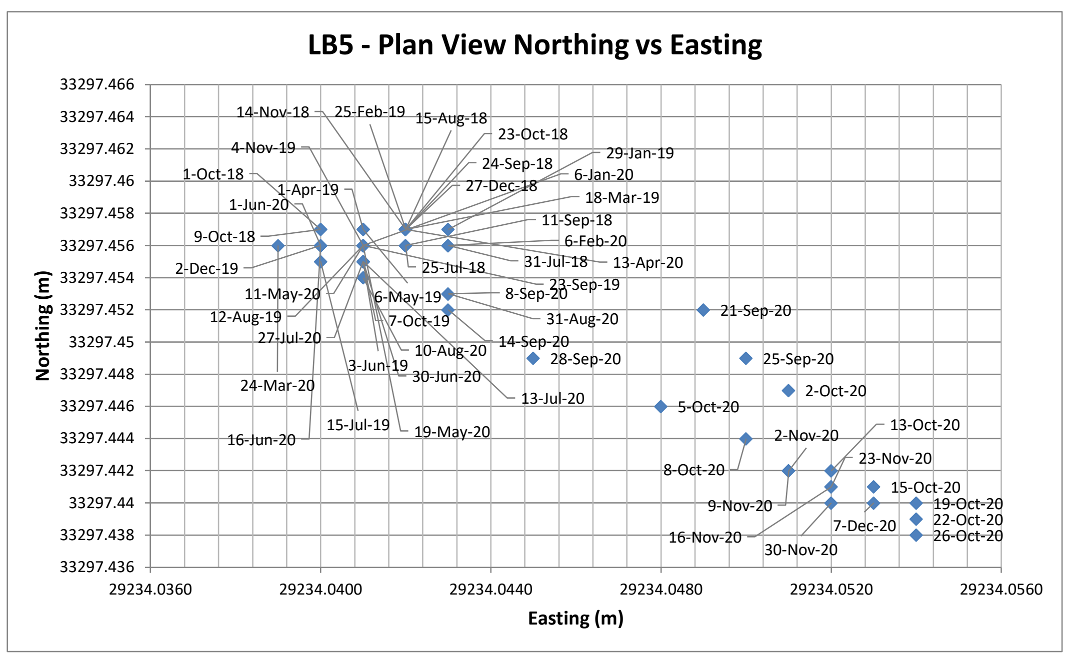
Klohn Crippen Berger

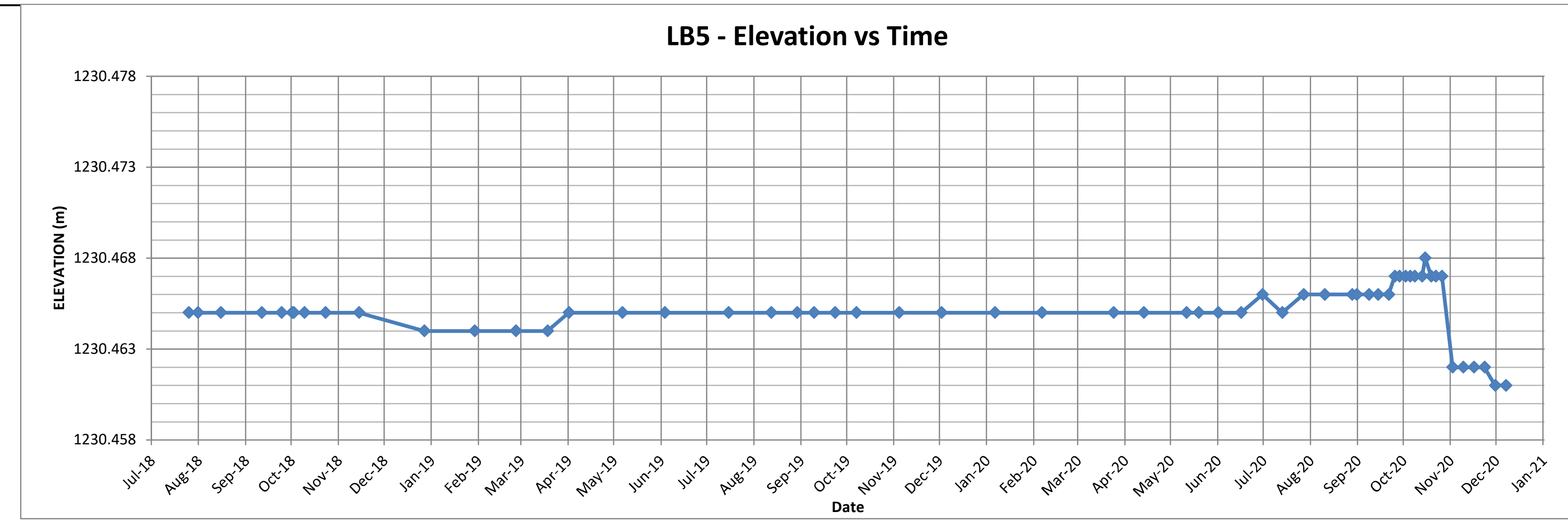
PROJECT
HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

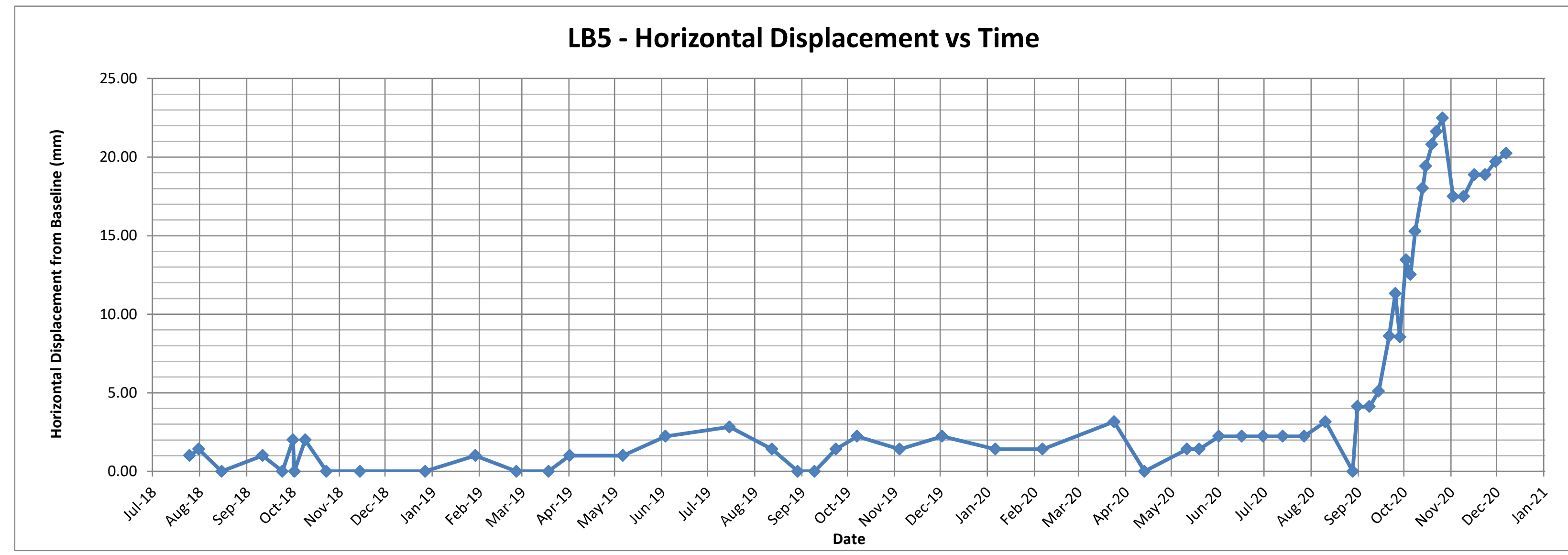
TITLE
H-H DAM LOCK-BLOCK RETAINING WALL SURVEY MONUMENT READINGS
LB4

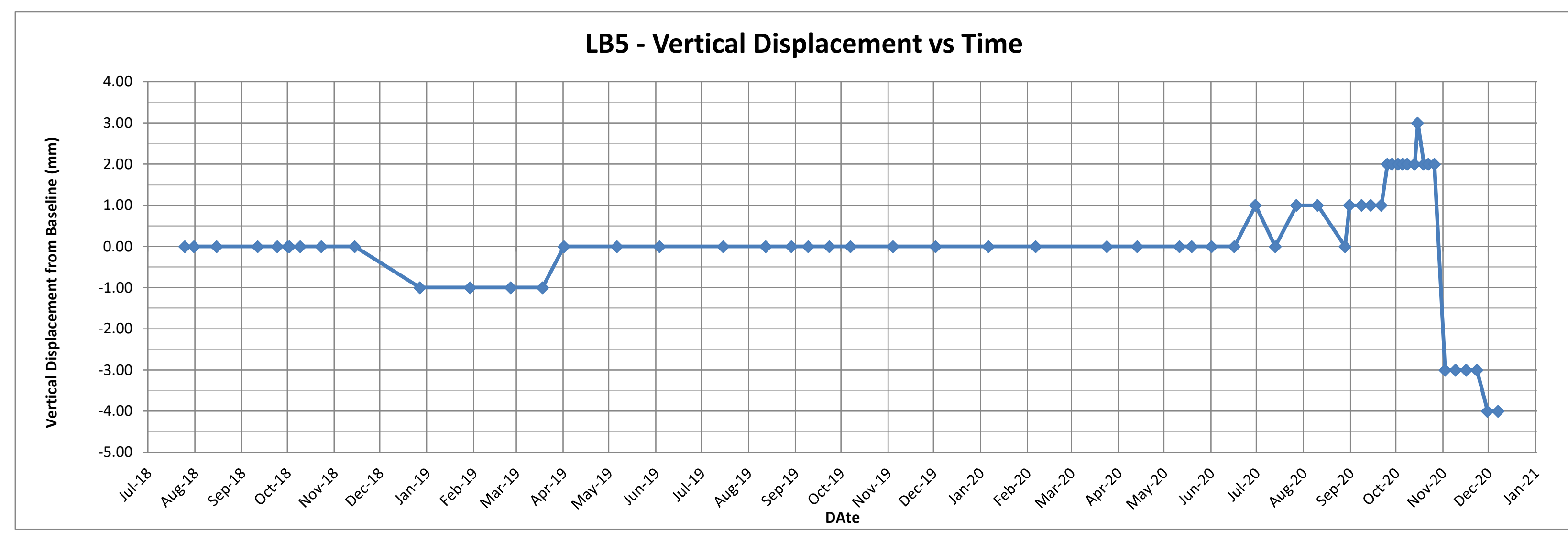
PROJECT No.
M02341B83

FIG No.









NOTES:

1. All data provided by THVCP.

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PROJECT
HIGHLAND TAILINGS STORAGE FACILITY
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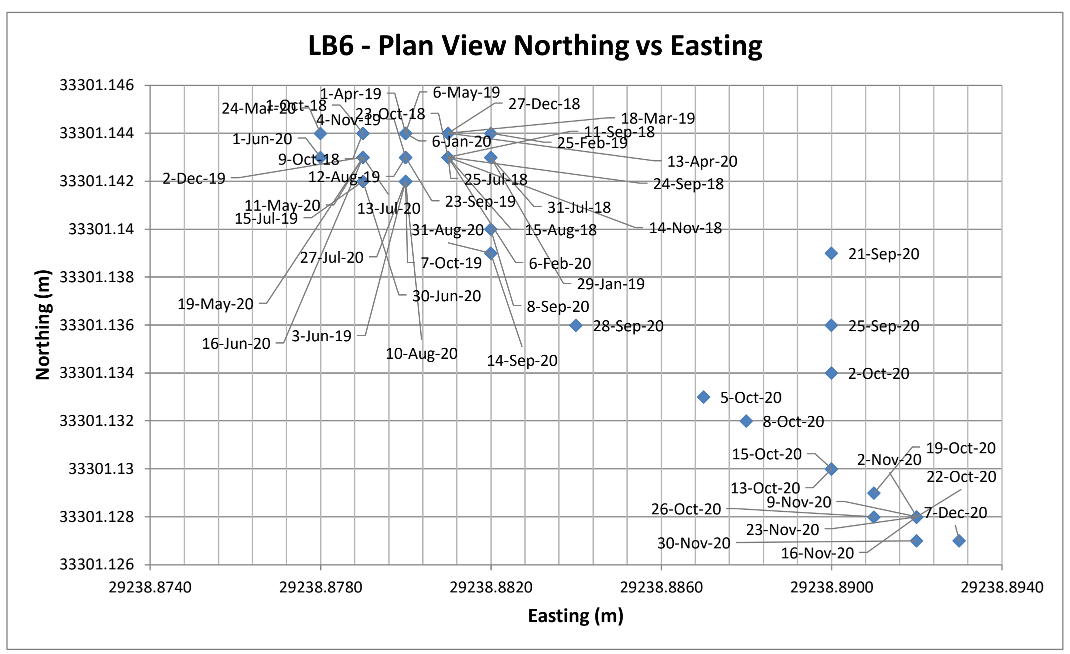
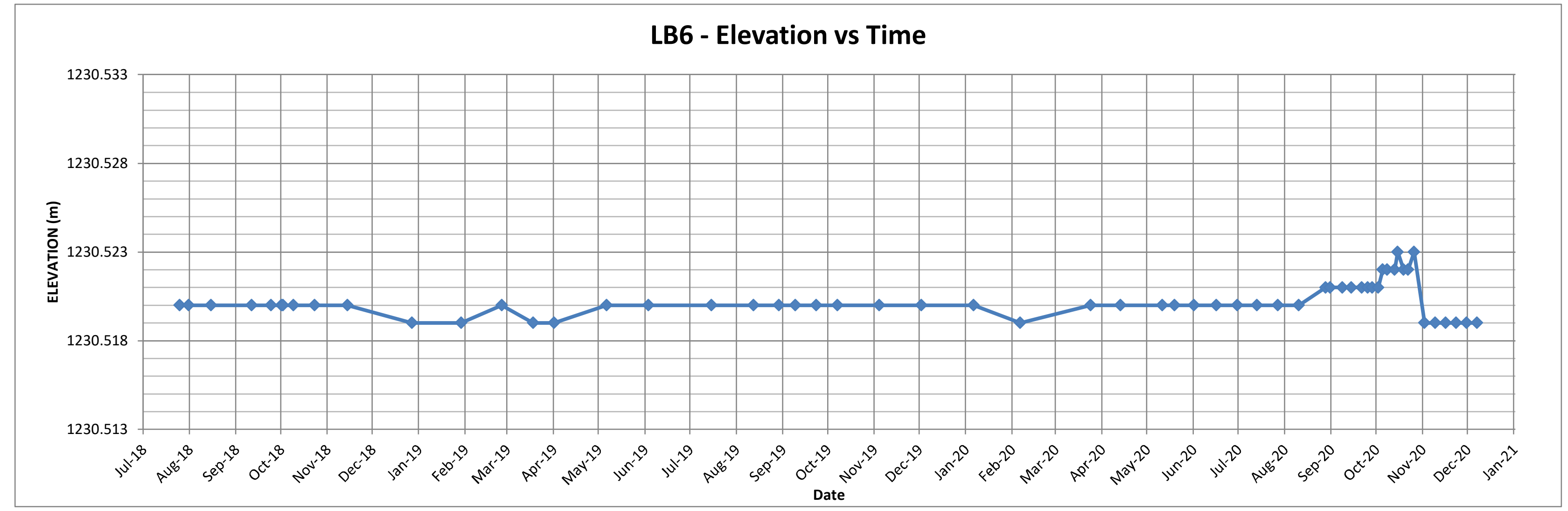
TITLE
H-H DAM LOCK-BLOCK RETAINING WALL
SURVEY MONUMENT READINGS
LB5

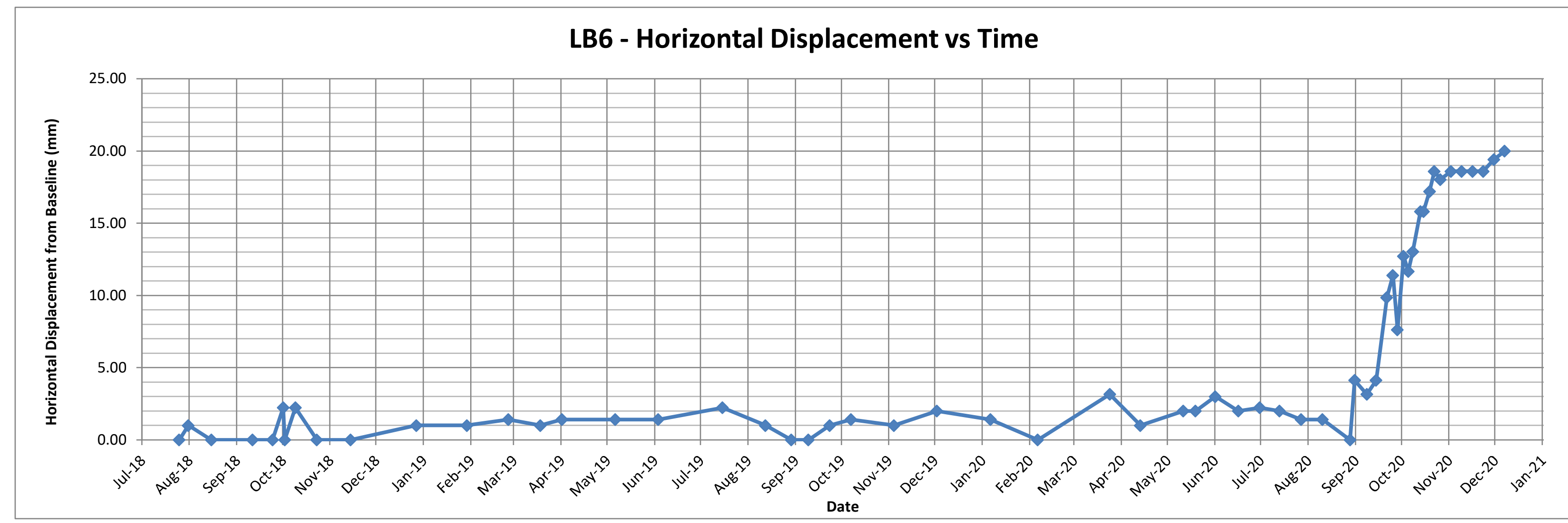
PROJECT No. M02341B83

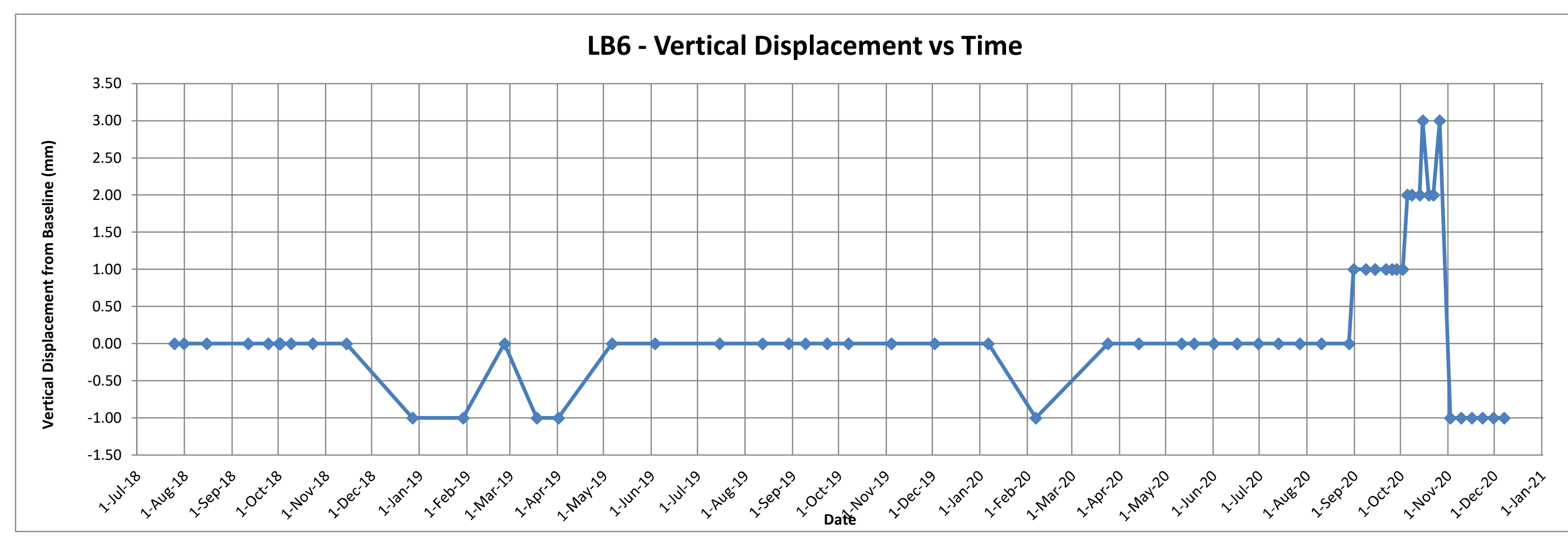
FIG No.

December 11, 2020
Z:\M\VCR\M02341B83 - HVC 2020 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\[201211 HH Pumphouse Retaining Wall Monitoring (FOR DSI)_Cumulative.xlsm]Fig 18









NOTES:

1. All data provided by THVCP.

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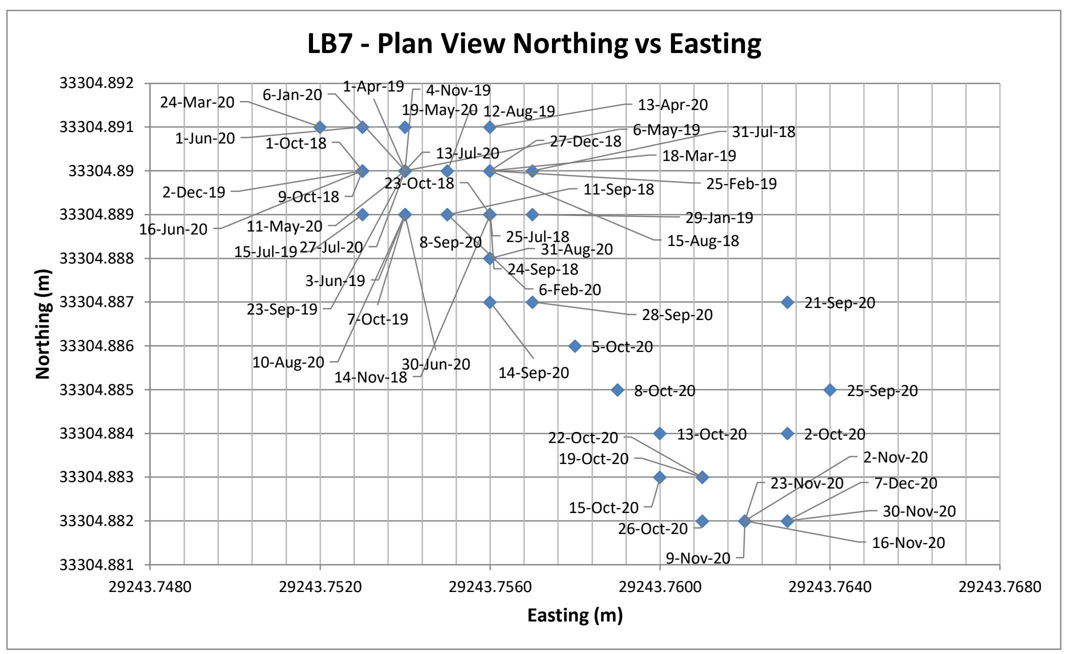
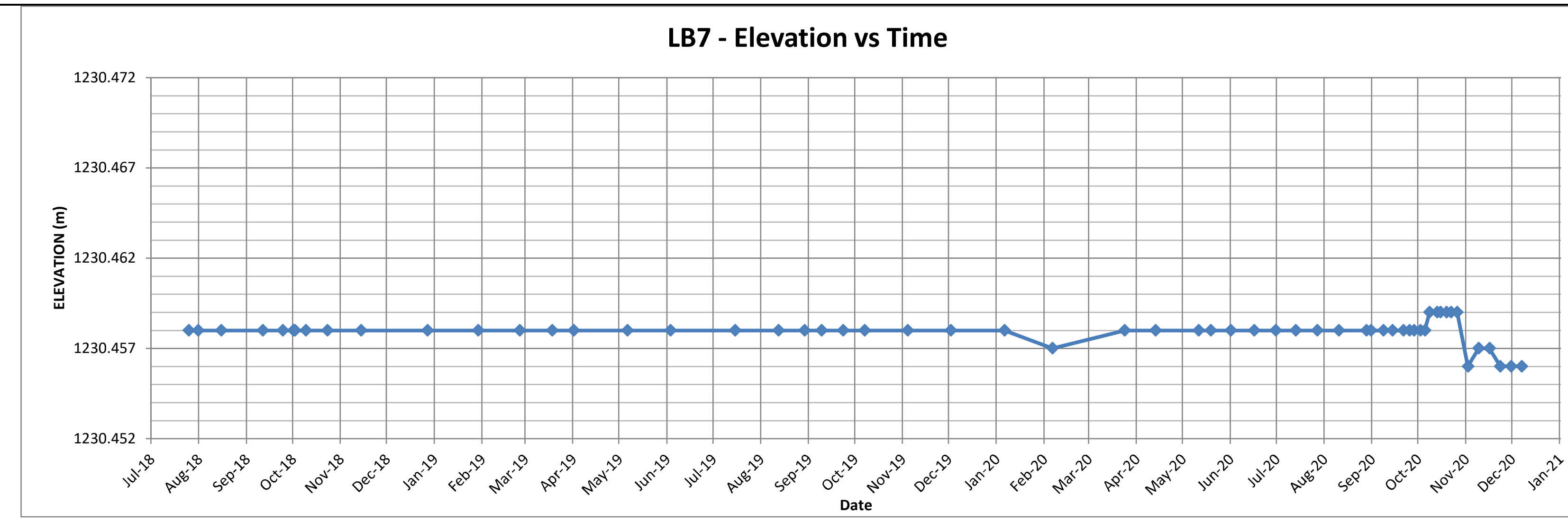
PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

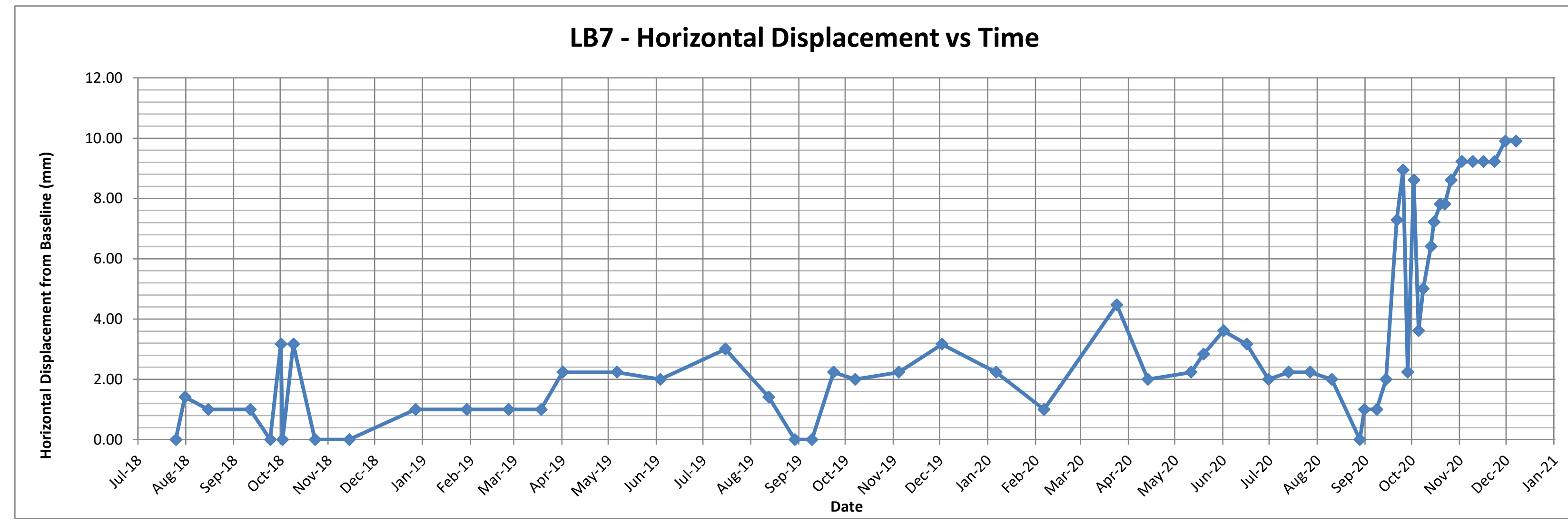
TITLE: H-H DAM LOCK-BLOCK RETAINING WALL
SURVEY MONUMENT READINGS
LB6

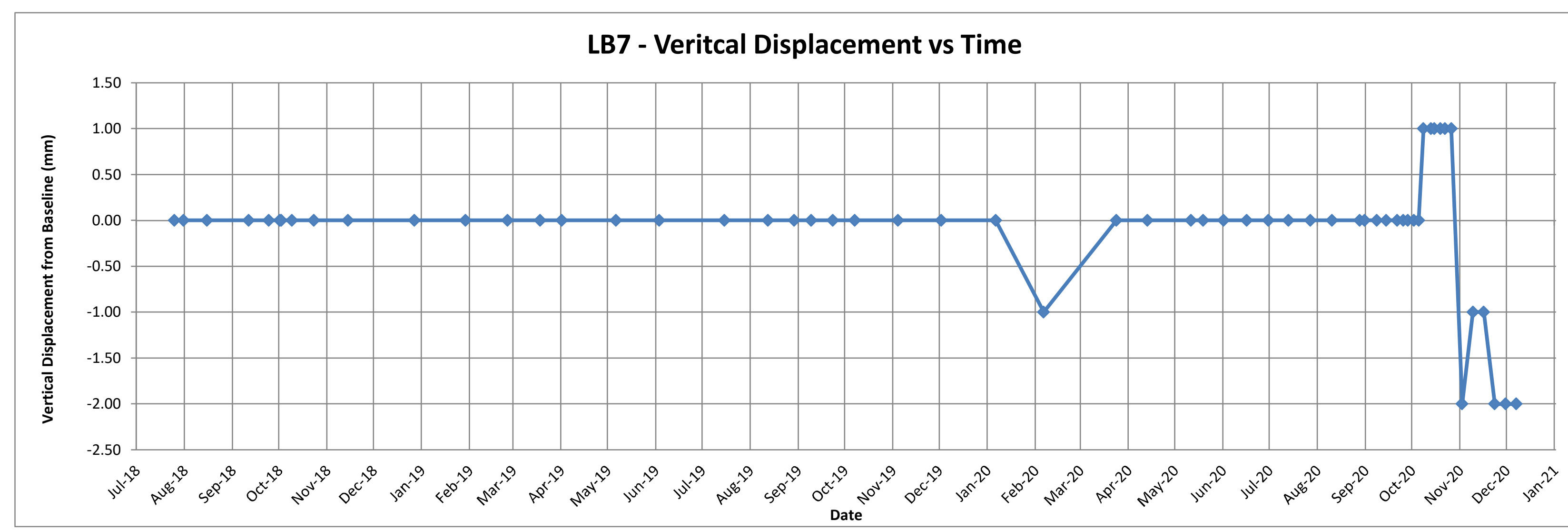
PROJECT No. M02341B83

FIG No.









NOTES:

1. All data provided by THVCP.

CLIENT: TECK HIGHLAND VALLEY COPPER PARTNERSHIP

Klohn Crippen Berger

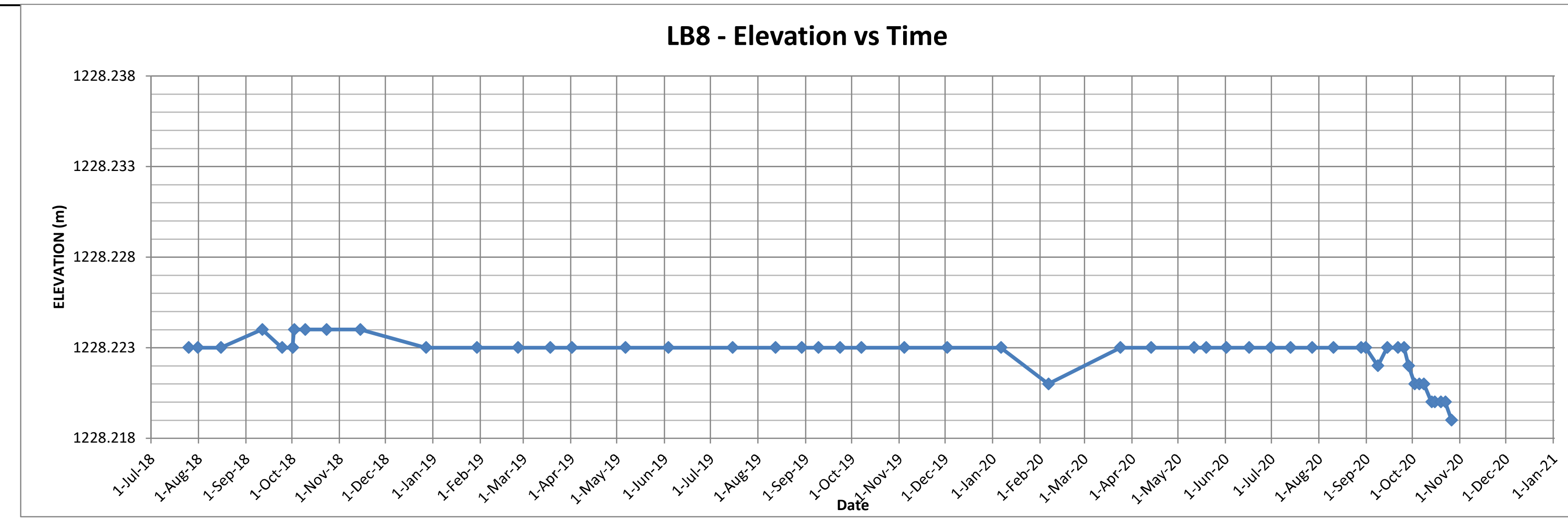
PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

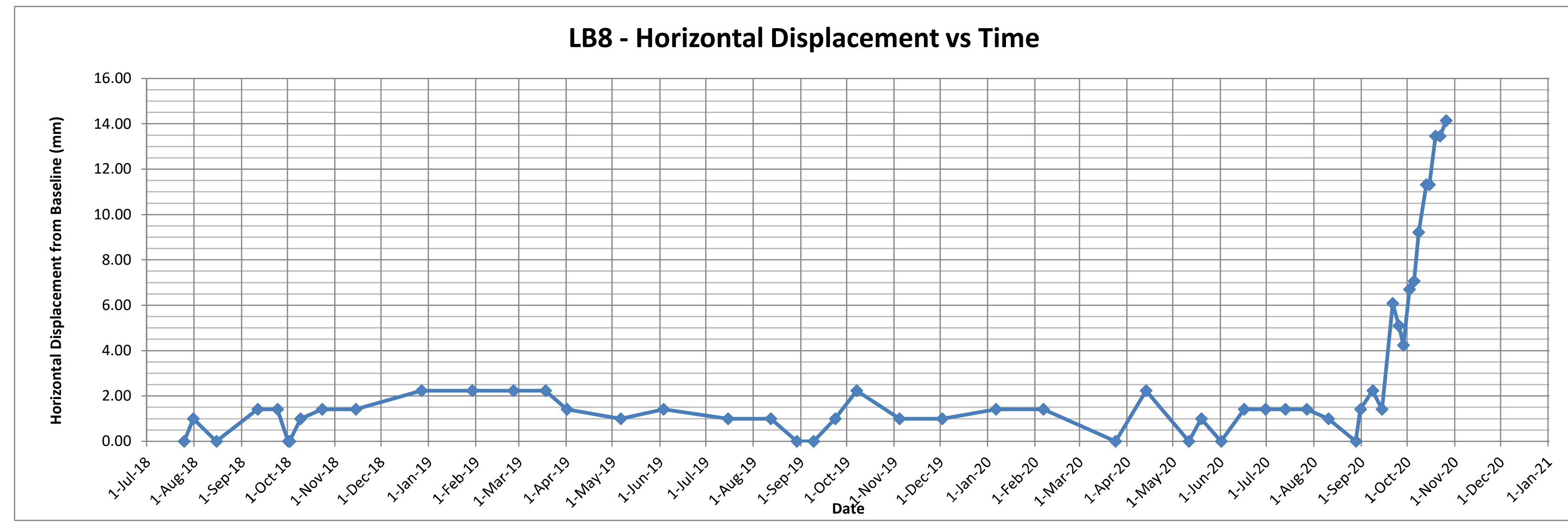
TITLE: H-H DAM LOCK-BLOCK RETAINING WALL
SURVEY MONUMENT READINGS
LB7

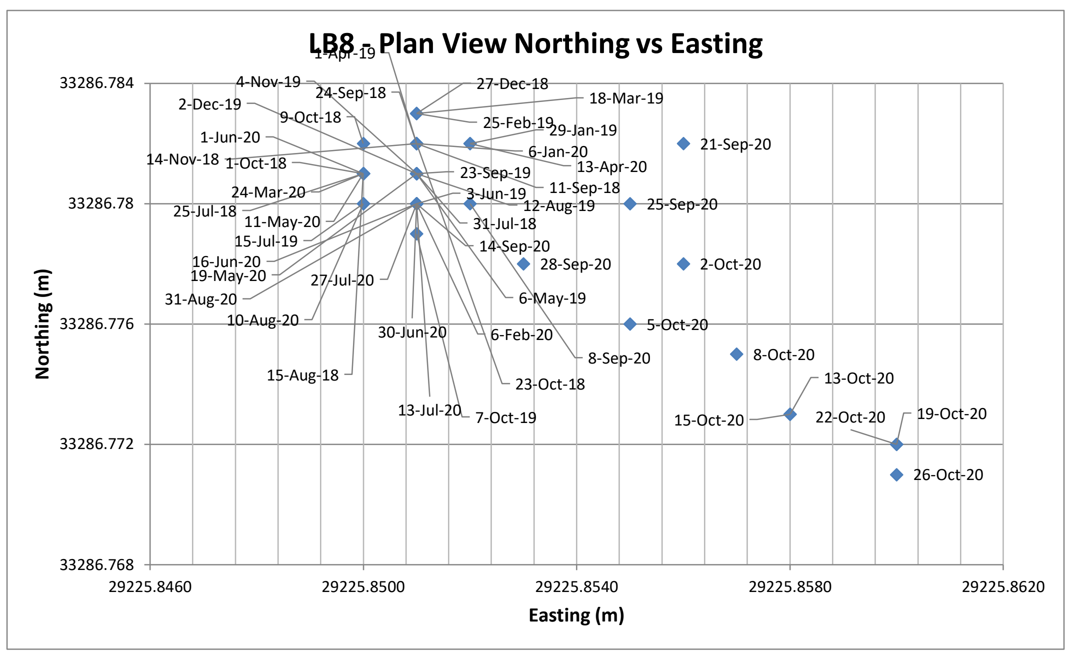
PROJECT No. M02341B83

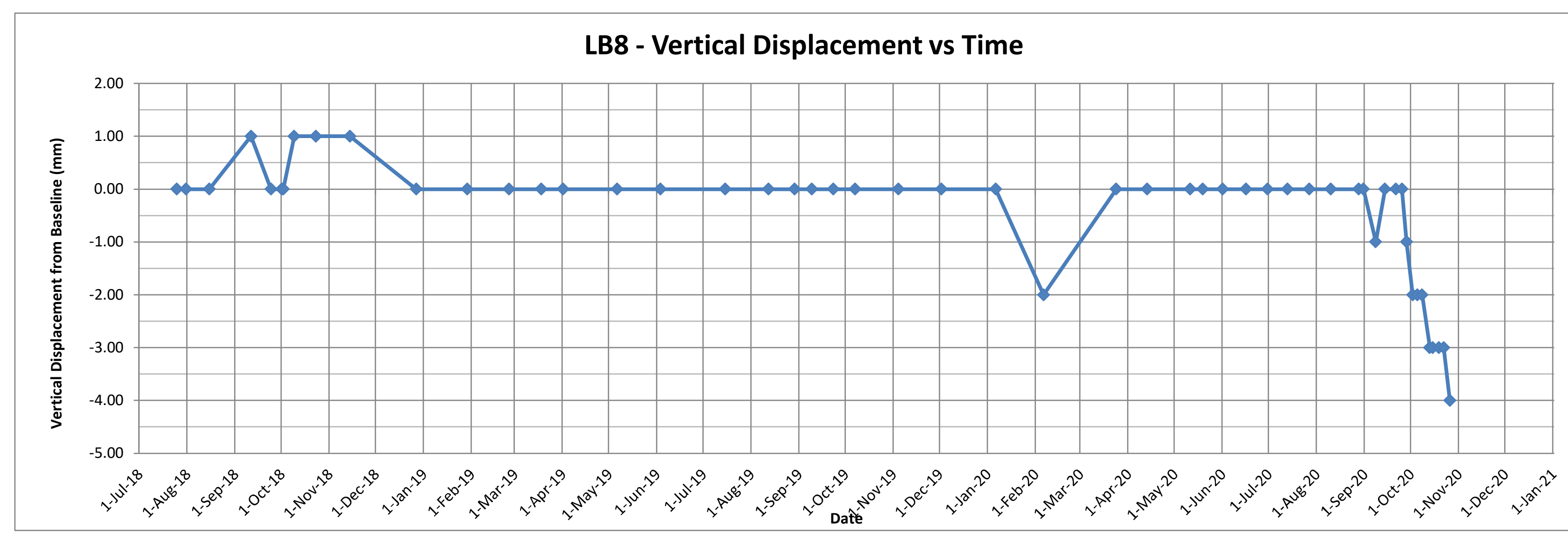
FIG No.

Z:\M\VCR\M02341B83 - HVC 2020 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\[201211 HH Pumphouse Retaining Wall Monitoring (FOR DSI)_Cumulative.xlsm]Fig 18
December 11, 2020







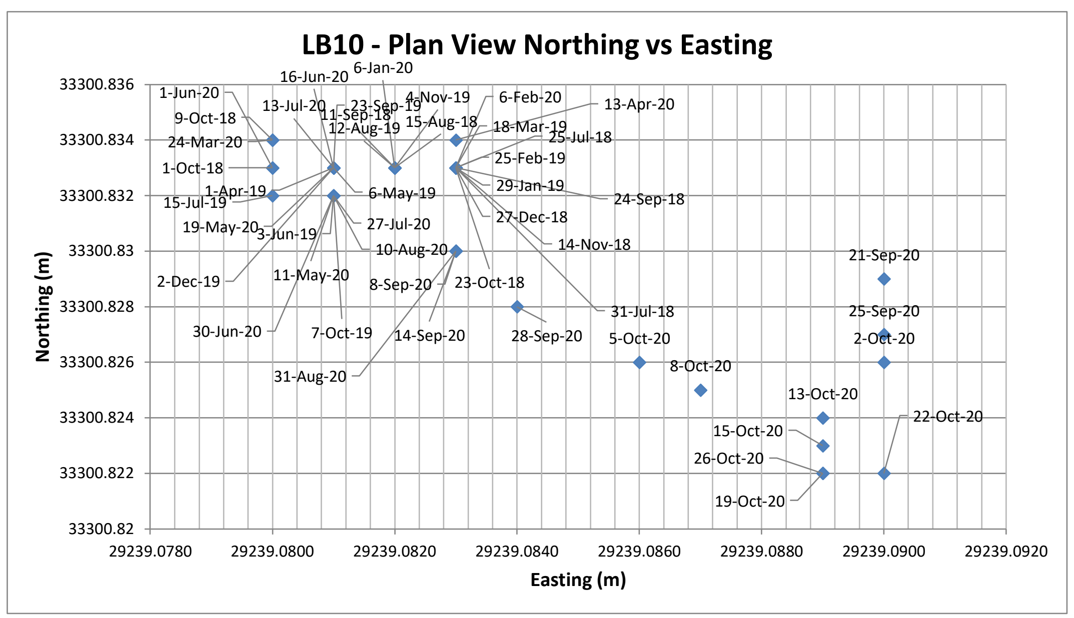


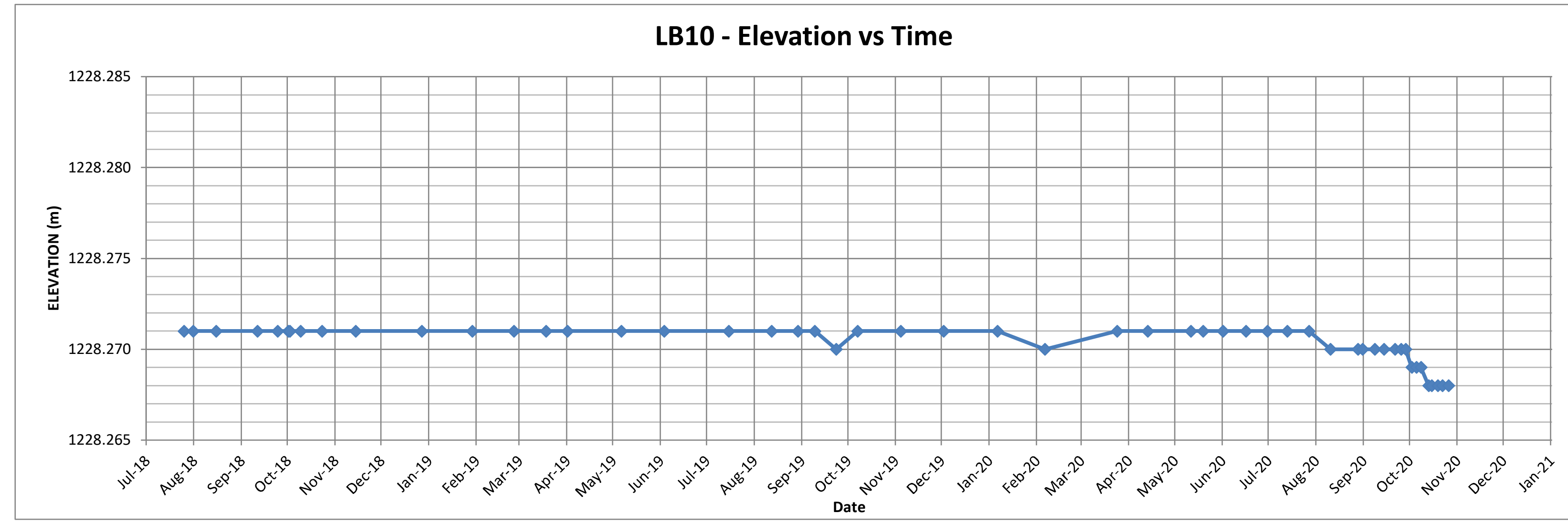
NOTES:

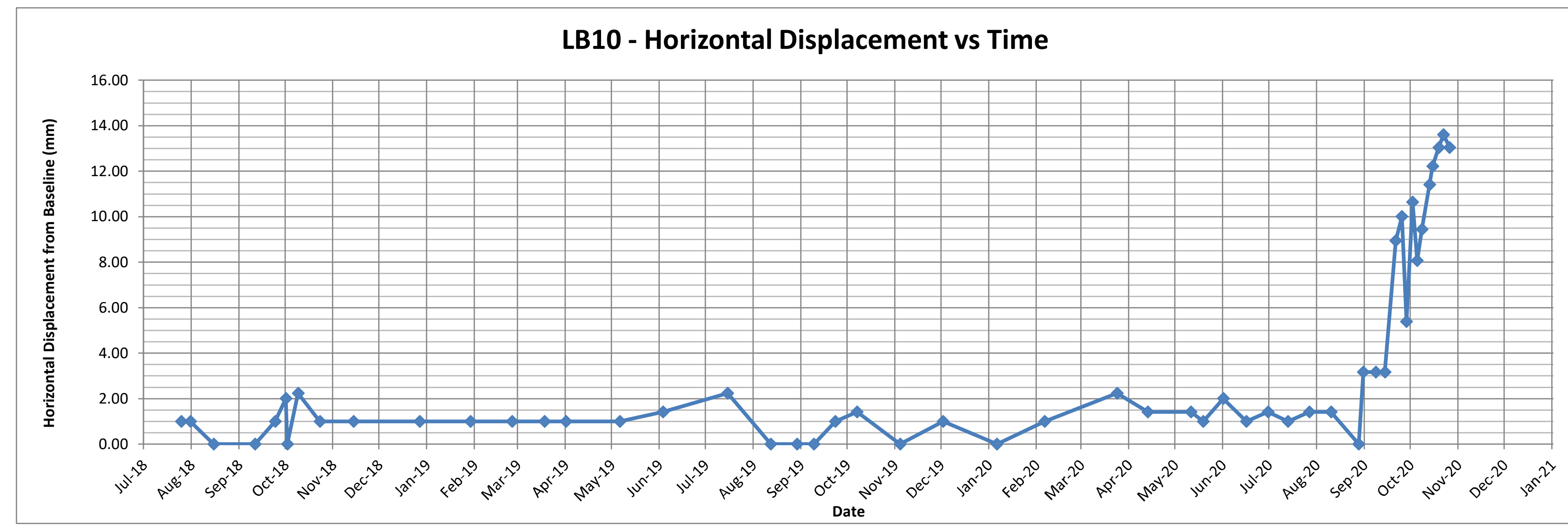
1. All data provided by THVCP.
2. LB8 buried by buttressing at the bottom of lock block wall.

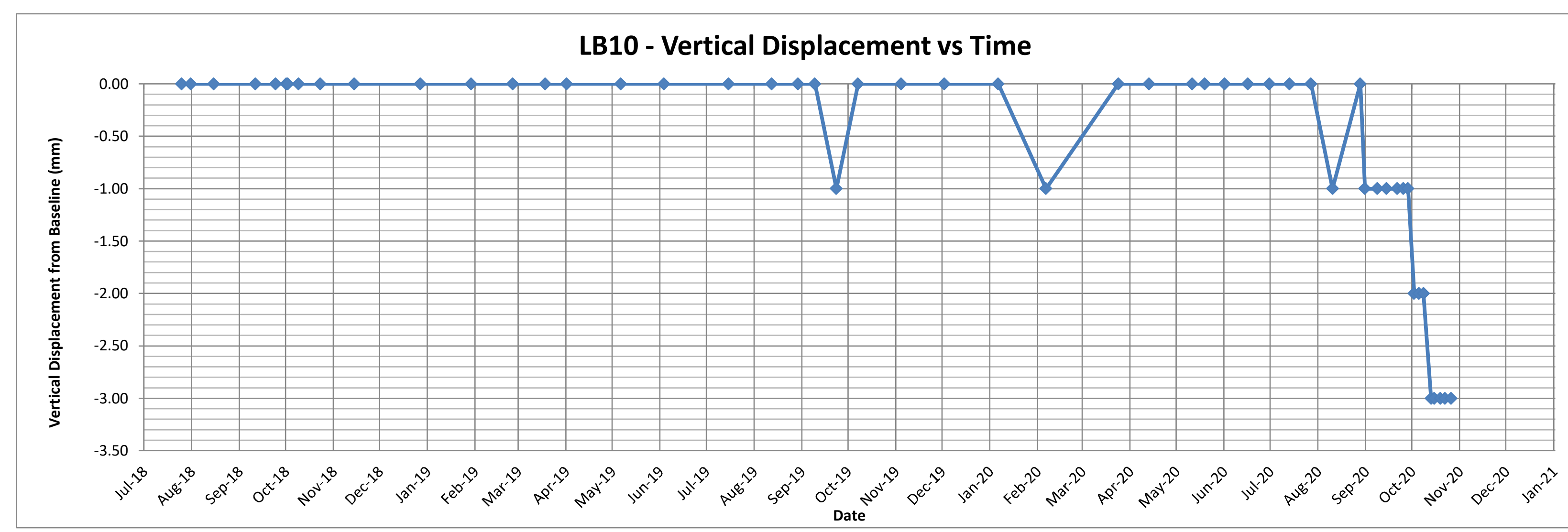
CLIENT: TECK HIGHLAND VALLEY COPPER PARTNERSHIP	PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2020 ANNUAL FACILITY PERFORMANCE REPORT
Klohn Crippen Berger	TITLE: H-H DAM LOCK-BLOCK RETAINING WALL SURVEY MONUMENT READINGS LB8
	PROJECT No. M02341B83 — FIG No.

December 11, 2020
Z:\M\VCR\M02341B83 - HVC 2020 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\[201211 HH Pumphouse Retaining Wall Monitoring (FOR DSI)_Cumulative.xlsm]Fig 18









NOTES:

1. All data provided by THVCP.
2. LB10 buried by buttressing at the bottom of lock block wall.

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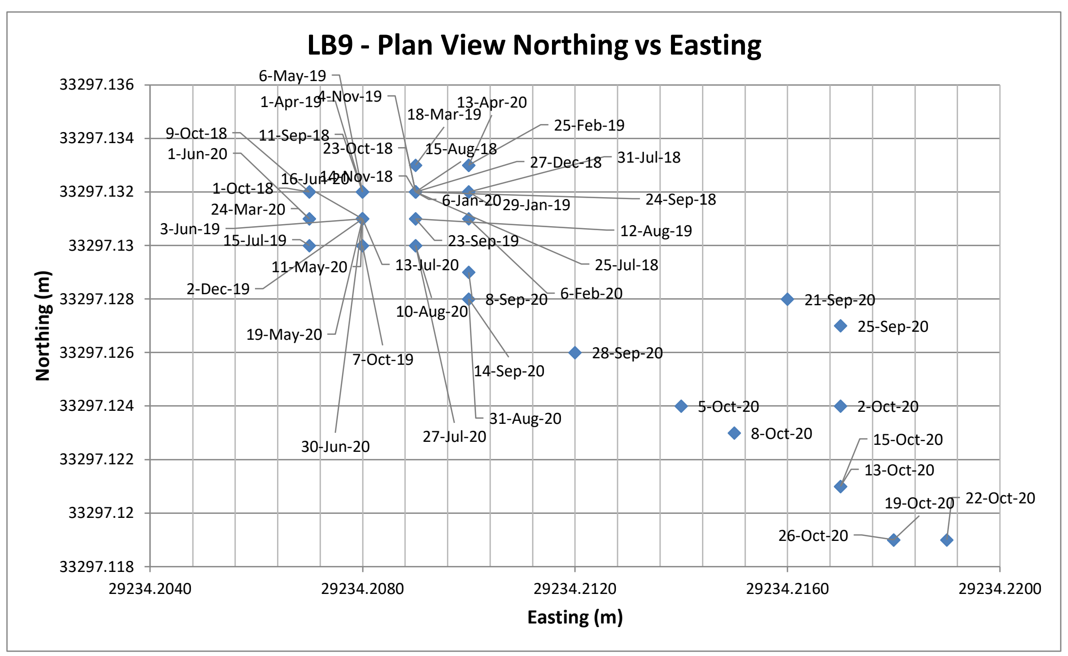
2020 ANNUAL FACILITY PERFORMANCE REPORT

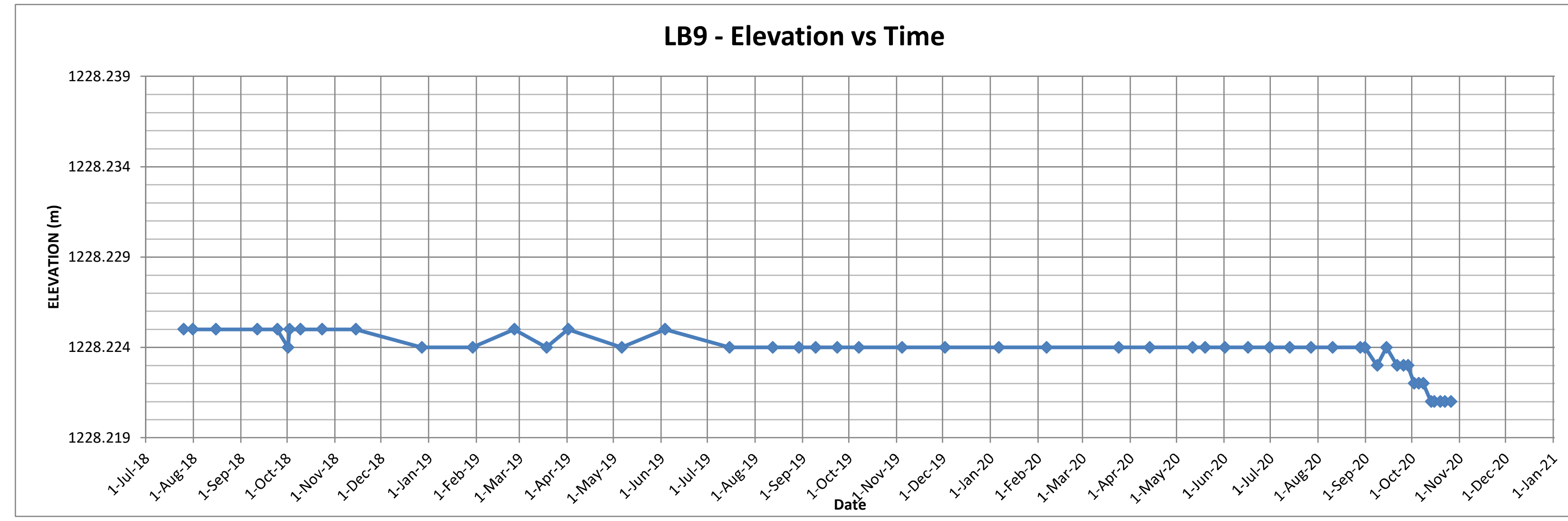
TITLE: H-H DAM LOCK-BLOCK RETAINING WALL
SURVEY MONUMENT READINGS
LB10

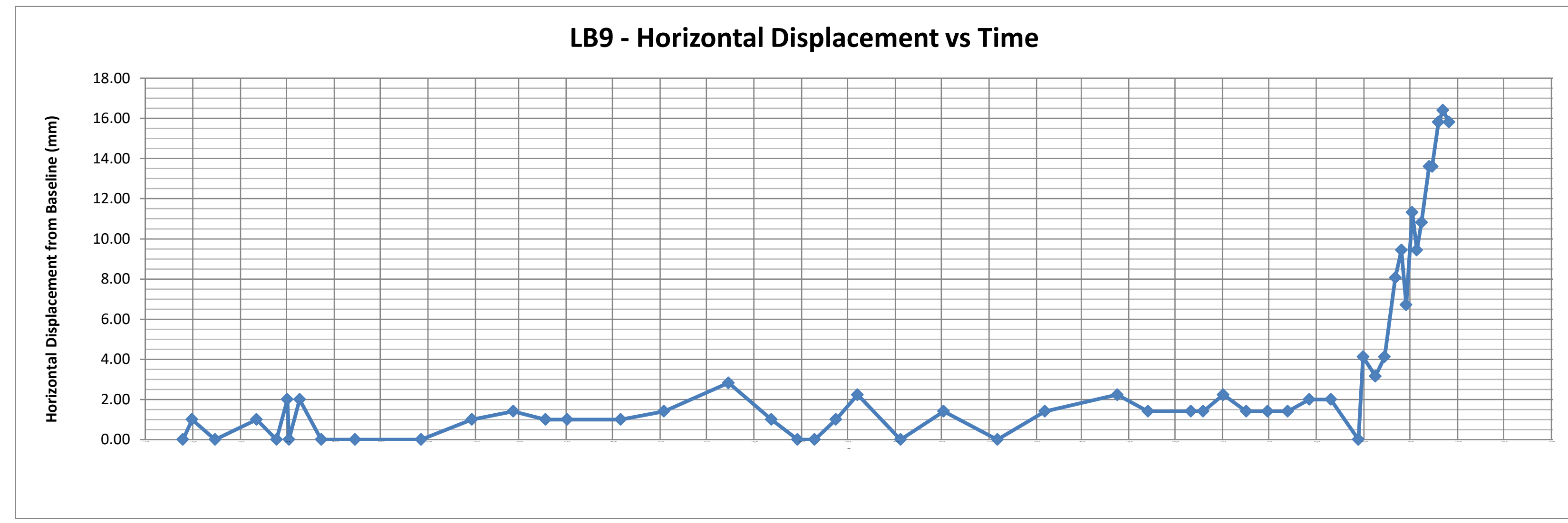
PROJECT No. M02341B83

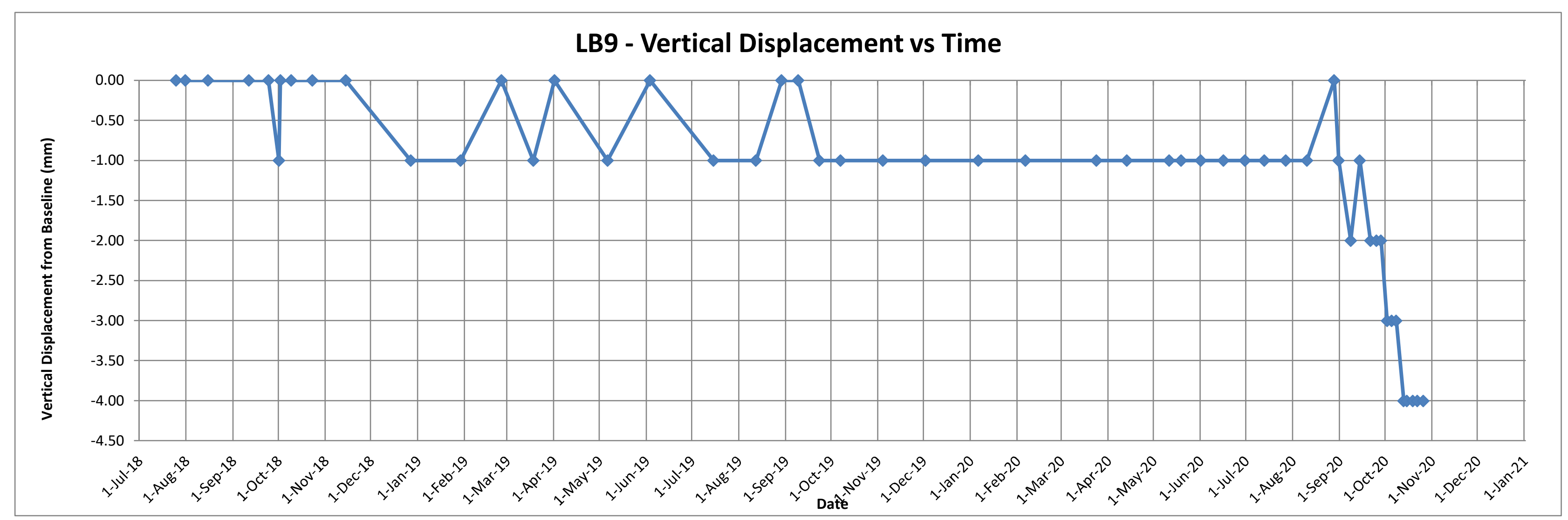
FIG No.

December 11, 2020
Z:\M\VCR\M02341B83 - HVC 2020 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\[201211 HH Pumphouse Retaining Wall Monitoring (FOR DSI)_Cumulative.xlsm]Fig 18









NOTES:

1. All data provided by THVCP.
2. LB9 buried by buttressing at the bottom of lock block wall.

CLIENT
TECK HIGHLAND VALLEY COPPER PARTNERSHIP

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PROJECT
HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE
H-H DAM LOCK-BLOCK RETAINING WALL
SURVEY MONUMENT READINGS
LB9

PROJECT No.
M02341B83

FIG No.

December 11, 2020
Z:\M\VCR\M02341B83 - HVC 2020 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\[201211 HH Pumphouse Retaining Wall Monitoring (FOR DSI)_Cumulative.xlsm]Fig 18

APPENDIX V

Map of Water Quality Monitoring Points

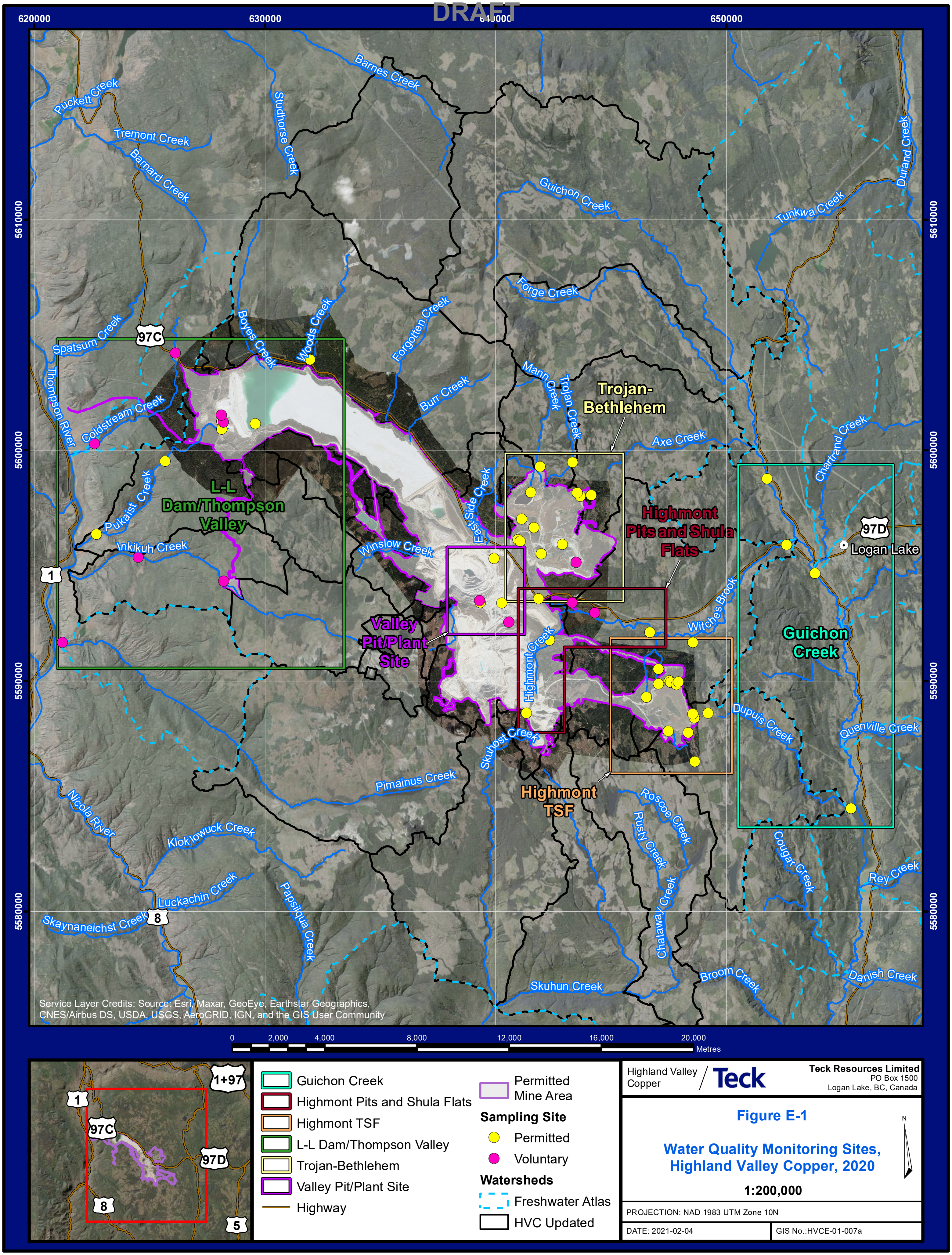
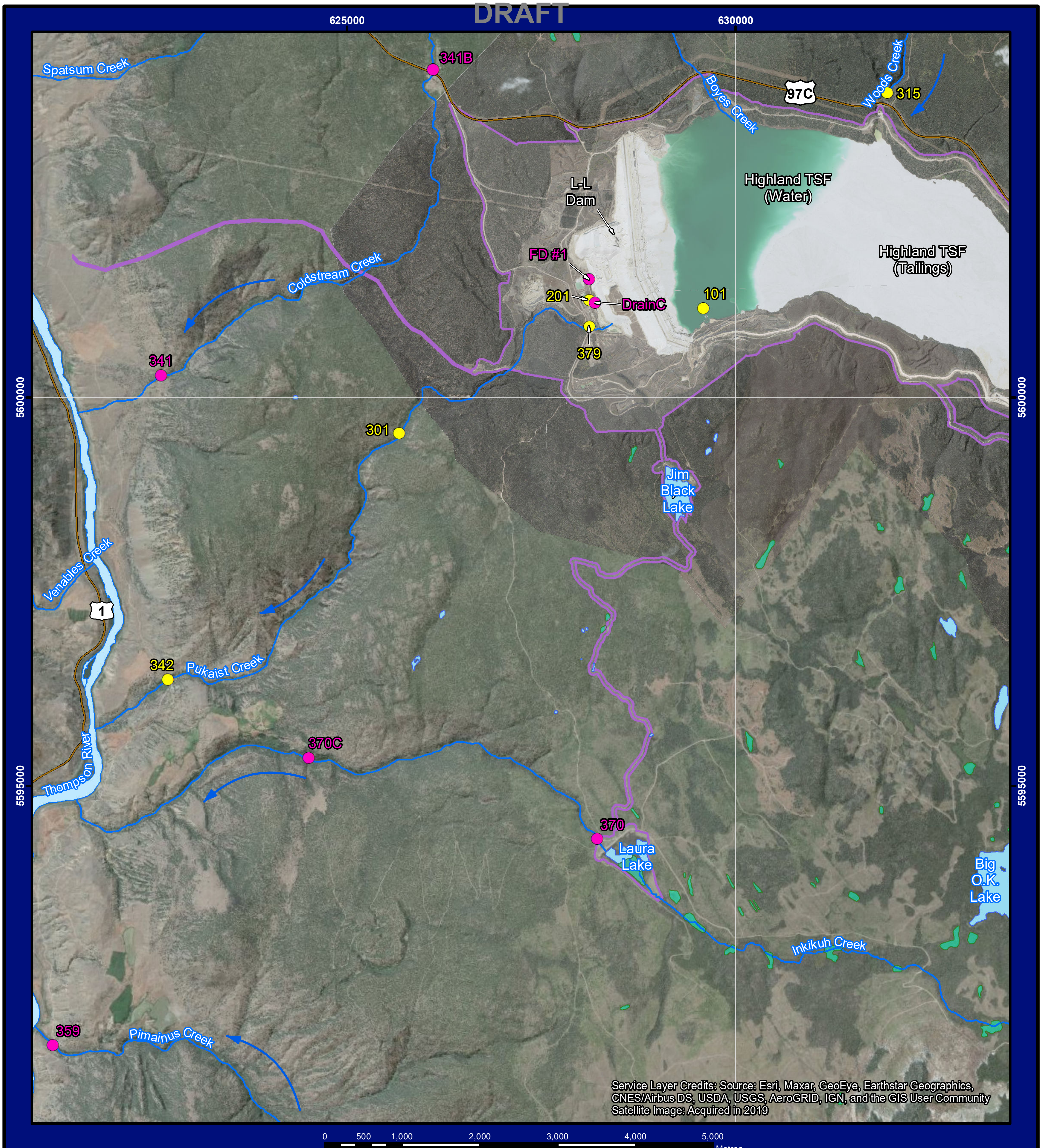
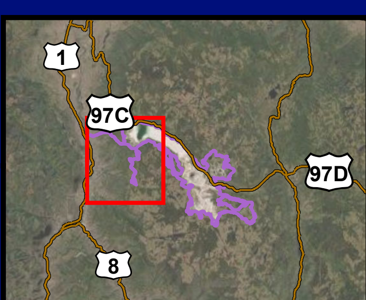


Figure E-1

Water Quality Monitoring Sites, Highland Valley Copper, 2020

DRAFT





Sampling Site

- Permitted
- Voluntary
- Permitted Mine Area
- Wetland
- Highway
- Flow Direction

Highland Valley Copper / Teck

Teck Resources Limited
PO Box 1500
Logan Lake, BC, Canada

Figure 3.2-12
Water Quality Monitoring Sites in the L-L Dam/Thompson Valley Area, Highland Valley Copper, 2020
1:65,000

N

PROJECTION: NAD 1983 UTM Zone 10N

DATE: 2021-02-05

GIS No.:HVCE-01-007c

APPENDIX VI

Dam Safety Review Recommendations

Appendix VI
Dam Safety Review Recommendations

Table VI-1 March 2021 STATUS of 2017 Highland TSF Dam Safety Review Recommendations

ID	Priority	Comment	Topic	Response / Close-out	March 2021 Status
TSF-2017-01	*4*	*'The DSR is a snapshot at a particular point in time of the assessment of whether the dam is being reasonably safely operated using the current state of practice for dam safety analysis….if it is clear during the review process, that imminent changes are to be made, or are in the process of being made, to the dam or the dam's environment, the QPE should assess the impact of these changing conditions on the safe operation of the dam in the immediate future and document these impacts in the DSR report' (EGBC, 2016).* *We understand that there will be a site characterization update in 2018 which may trigger design changes. If these changes are significant, there should be an update of this DSR or independent review of the updated 2018 design to reflect the changes in dam design.*	*Update*	*Next DSR scheduled for 2022 (5-years frequency)*	*Closed (2018)*
TSF-2017-02	*4*	*We noted that several reports were not finalized (AMEC, 2012) (AMEC, 2014) (AMEC, 2015) (KCB, 2016) (KCB, 2017) (KCB, 2017). We recommend reports* *are finalized in line with best management practice.*	*Documentation*	*Key documents in draft have been finalized or are superseded by Design Update Report(2).*	*Closed (Q3 2019)*
TSF-2017-03	*4*	*LiDAR surveys are collected every six months, but we understand that successive surveys are not compared. We recommend production of incremental change maps and cumulative change maps after every survey. This is an economical way to:* · *Supplement the existing observation and surveillance program* · *Highlight areas of significant surface movement (within limits of resolution), such as toe bulges etc.* · *Confirm wind sand loss and migration of the toe berms at L-L dam is not significant.* · *Highlight areas of significant settlement at H-H dam* · *Aid interpretation of settlement vs. movement at H-H Dam.* · *Confirm the waste dumps adjacent to 24 Mile Lake are not demonstrating movement.*	*Surveillance*	*Incremental surveys are reviewed, as available, to identify significant change not identified by other surveillance. Not adopted as part of routine maintenance.*	*Closed (2018)*
TSF-2017-04	*4*	*The data review has found that there is a significant quantity of design reports, construction reports and memorandums since 2010. This does not include data from the early 1970s'. For example, we have found several iterations and design updates, on discrete dam sections, presented in a range of reports and appendices with somewhat unrelated titles, whilst the current design is from 2010.* *Given the nature of large TSF's, where design is updated in sections according to priority and design issues, we recommend that THVCP complete a summary that lists the latest reports, design basis, stability, seepage, geological characterization and failure modes for each section. This could be included within the OMS manual and updated annually.*	*Documentation*	*Design Update Report(2) includes consolidated design summary, history and register of key documents.*	*Closed (Q3, 2019)*
TSF-2017-05	*4*	*We understand that significant geotechnical investigation and testing has been undertaken in 2017. Any subsequent update to parameters based on this new investigation should be clearly documented and checked against the current 2010 design to determine if design updates are required.*	*Design*	*Refer to App. II-B of Design Update Report(2).*	*Closed (Q3, 2019)*
TSF-2017-06	*3*	*Our screening review of the geology model has identified localized discrepancies between cross-sections and longitudinal-sections. It is recommended that the geological boundaries defined in each design section be confirmed by considering the 3D geology.*	*Characterization*	*Sections have been reviewed for Design Update Report(2). Additional work planned for 2020 to aid visualization.*	*Closed (Q3, 2019)*
TSF-2017-07	*3*	*Further testing of controlling foundation units such as weak rock units and different tailings streams (including slimes) and dam fill materials using appropriate techniques (such as ring shears, relationship between sample size and strain softening etc.). is recommended to better characterize the behavior of these materials.*	*Characterization*	*Recent laboratory testing program included in foundation characterization documents for each dam (App II-A and App II-B of Design Update Report(2))*	*Closed (Q3, 2019)*
TSF-2017-08	*3*	*The identification of piezometers that are found to be newly 'plugged' should trigger a review of surrounding piezometers and inclinometers (level 1 threshold) to eliminate the possibility that the plugging is due to movement. Consideration should be given to cleaning out or replacing instruments found to be plugged.*	*Surveillance*	*Instruments that become plugged are reviewed and instruments nearby checked to identify if pattern response observed. THVCP is working to convert standpipes to vibrating wire piezometers.*	*Closed (2018)*
TSF-2017-09	*3*	*The OMS manual should be updated to incorporate new instrumentation and associated thresholds related to the design when available.*	*Documentation*	*Incorporated into 2018 OMS Manual*	*Closed (2018)*
TSF-2017-10	*3*	*Based on the longitudinal upstream cracking observed historically in the H-H dam and the potential for cracking of the core to increase the phreatic surface in the downstream shell, we recommend that a minimum PI in the till core is considered in the specification.*	*Construction*	*Suitability of Glacial Till borrow, including plasticity, is confirmed prior to construction as part of borrow characterization and not added to specification.*	*Closed (2018)*
TSF-2017-11	*3*	*We recommend the emergency procedures following fire or fire evacuation and their impact on the observation and surveillance program are considered within the OMS manual,*	*Documentation*	*THVCP is located in a region that can experience wildfire hazards throughout the year. Contingency planning around wildfires will be incorporated into the surveillance portion of future OMS update.*	*Closed (Q1 2021) Included in OMS Manual update issued March 2021.*
TSF-2017-12	*4*	*Stantec routine check of stability at each dam indicated that the stability was not likely sensitive to the undrained strength ratio adopted for the upstream tailings. Due to uncertainties in the value of the undrained strength ratio, we recommend that sensitivity is undertaken for other design sections when the design is updated. This will highlight whether in-situ investigations are valuable. be used to better characterize the engineering properties of the tailings*	*Characterization*	*Captured in Design Update Report(2).*	*Closed (Q3, 2019)*

ID	Priority	Comment	Topic	Response / Close-out	March 2021 Status
LL-2017-01	*3*	*We recommend further investigation and stability modeling of the zone at around St. 3+500 m which may contain weak rock horizons layers is located between design sections and is understood to contain a basal flow unit overlain by weathered basalt. The basal flow unit was described as very closely sheared, highly to extremely weathered and weak. The overlying basalt rock mass was described as closely to extremely closely-spaced jointed. The consideration of a failure along the basal flow unit should be considered. The geology of the 'rock knoll' is not delineated and further investigation and modelling is recommended to understand this zone better.*	*Design*	*Documented in Design Update Report(2) and reviewed with TRB (Meeting No. 21)*	*Closed (Q3, 2019)*
LL-2017-02	*4*	*The GLU at the north abutment, described as 'rising in steps' (KCB, 2016) and the geological interpretation (KCB, 2016) should be reviewed.*	*Characterization*	*No change made as interpretation (multiple layers found at rising elevations) is supported by site investigations.*	*Closed (Q3, 2019)*
LL-2017-03	*3*	*We recommend additional investigation and laboratory testing to confirm the strength parameters and the extent of bedrock under the NBB and VBBE as the stability is sensitive to the extent and strength of this layer; however, there has been limited investigation or advanced strength testing on the weak mudstone. The investigations should confirm the lateral constraints of the weak mudstone, any overlying constraining stronger volcanic units and the its geotechnical behavior.*	*Characterization*	*Laboratory testing and model calibration reported in Design Update Report(2).*	*Closed (Q3, 2019)*
LL-2017-04	*3*	*Foundation conditions in the northern portion of the VBBE are understood to be similar to that of the NBB; however, the berm is notably smaller at this location. The VBBE slope stability analyses (KCB, 2017c) indicate that the proposed ultimate dam design configuration at this location does not comply with the minimum FOS criteria for all assumed elevations of the mudstone residual zone. Following the completion of LL-2017-03, we recommend the VBBE design is reassessed to evaluate if any modifications are required to achieve the design criteria FOS. We recommend future construction considers the potential for residual strengths within this material.*	*Design*	*The Sedimentary Unit, is present beneath the VBBE. However, mudstone layers within the Sedimentary Unit are not continuous and is present at greater depths with a thicker overburden cap when compared to the mudstone layers beneath the NBB. As a result, mudstone layers do not control stability at VBBE.*	*Closed (2018)*
LL-2017-05	*3*	*The impact and likelihood of failure of the Jim Black Dam on the L-L dam should be reviewed. This issue was raised in the Risk Assessment Report (AMEC, 2015) but we understand that this not been closed out yet.*	*Risk*	*AMEC completed an assessment of L-L Dam toe erosion potential (AMEC 2016) which estimated a peak flood level resulting from a Jim Black Lake (El. 1108 m). Flooding to that level could result in some erosion of toe bench or dam fill which would require maintenance but not sufficient to trigger a concern regarding failure of the L-L Dam.*	*Closed (2018)*
LL-2017-06	3	We recommend the development of an action plan to install seepage weirs by dam sector and that this should include the determination of thresholds for seepage flows	Surveillance	THVCP is planning to install new seepage weirs along downstream toe in 2021 after SWRP has been replaced and L-L Dam is constructed to ultimate toe.	Captured by DSI recommendation LL-2019-02. To be completed following construction of SWRP replacement pond.
LL-2017-07	*2*	*Given the core geometry and known deformations at the dam we recommend an evaluation of some sensitivity studies on the impact of core cracking and dam stability*	*Design*	*Sensitivity cases run to simulate cracked core condition with 3D groundwater model, documented in Design Update Report(2).*	*Closed (Q3, 2019)*
LL-2017-08	*3*	*We recommend future construction to the design grades to prevent a repeat of the over-steepening of L-L Dam.*	*Construction*	*Practice had been adopted, starting in 2017 construction and steepened areas addressed in 2018.*	*Closed (2018)*
LL-2017-09	*3*	*A 20 % reduction in the L-GLU strengths was applied for post-earthquake loading conditions in the VBBE stability analyses, presumably to account for cyclic softening. There is no discussion regarding the rationale for not applying this to other potentially susceptible units such as the till core. This should be further evaluated and information to justify this assumption should be presented. If this assumption is not justified, the analyses should be updated to consider cyclic softening in other susceptible units.*	*Design*	*Discussed and analysis (including sensitivity) reported in Design Update Report(2).*	*Closed (Q3, 2019)*
HH-2017-1	*3*	*We recommend a review of as-built records and assessment of the range of as-built filter widths and how these relate to ongoing design.*	*Construction*	*Construction Review and assessment of material erosion failure mode included in Design Update Report(2).*	*Closed (Q3, 2019)*
HH-2017-2	*4*	*We recommend that the design parameters of the rockfill are calibrated against the performance of the waste dumps at the mine as these are composed of similar fill rockfill and heights, and that a shear-normal curve adopted for the rockfill*	*Design*	*Majority of downstream fill in H-H Dam has a significant sand and gravel component rather than coarse rockfill. As the internal static shear strength of the downstream rockfill influences local bench and sloughing failures only (i.e. doesn't govern overall dam stability) this approach is not planned to be adopted.*	*Closed (2018)*
HH-2017-3	*3*	*We recommend that consideration is given to either to the relocation, continued monitoring or additional support of the lock-block; and that the thresholds are included in the OMS manual. Movement of the wall could trigger failure of the tailings pipes or instability.*	*Design*	*Design Update Report(2) includes modified H-H Dam section with setback from lock-block wall.*	*Closed (Q3, 2019)*
HH-2017-4	*3*	*We recommend the installation of instruments to understand the sensitivity of the phreatic surface upstream of the core and to understand deformation and settlement within the dam.*	*Surveillance*	*Instruments to achieve these functions were installed in 2017/2018. No further action planned.*	*Closed (2018)*
HH-2017-5	*4*	*There is a disconnect between documentation of the 2017 monitoring systems and the observational approach which we recommend should be rectified.*	*Documentation*	*Incorporated into 2018 OMS Manual*	*Closed (2018)*
HH-2017-6	*3*	*The suitability of the interface between the core and the adjacent structural fill in the lower portion of the H-H Dam should be demonstrated from a core particle retention standpoint.*	*Design*	*Described in Design Update Report(2) failure mode review and presented to TRB at Meeting No. 21.*	*Closed (Q3, 2019)*

ID	Priority	Comment	Topic	Response / Close-out	March 2021 Status
HH-2017-7	*3*	*We recommend the construction specifications include a requirement that the filter materials be non-plastic, as the use of plastic filter materials represents a dam safety risk as such materials may allow for a crack to be maintained and piping to initiate. This risk is further compounded by the settlements observed at the H-H Dam to date. A review of construction testing data should be performed to evaluate if plastic filter material has been placed at the dam. If this material has been placed, the potential for this material to maintain a crack should be assessed.*	*Construction*	*No change proposed. Material/ screening characterization made in borrow or from stockpile prior to contractor approval to use.*	*Closed (Q3, 2019)*
HH-2017-9	*3*	*The SGM and geotechnical characterization of the H-H Dam is not as understood compared to the L-L Dam. We understand there is already a plan for further investigation, and we recommend this plan is executed.*	*Characterization*	*Refer to App II-B of Design Update Report.*	*Closed (Q3, 2019)*
H-H-2017-10	*3*	*Based on relatively large deformations within the rockfill at H-H dam and the historical longitudinal upstream cracking observed in the H-H dam, we recommend an evaluation of the settlement potential of the rockfill and its associated impact on the core.*	*Design*	*Horizontal movement in waste fill related to settlement but not measured adjacent to core.*	*Closed (Q3, 2019)*

Notes:

1. Recommendation priority guidelines used in DSR:
   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.
2. KCB (2020). "Highland Tailings Storage Facility 2019 Design Update: L-L Dam and H-H Dam". April 17.