Klohn Crippen Berger

Teck Highland Valley Copper Partnership

2021 Annual Facility Performance Report

Highland Tailings Storage Facility

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Klohn Crippen Berger

March 29, 2022

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

Mr. Bryan Bale, P.Eng.
Chief Tailings Engineer

Dear Mr. Bale:

2021 Annual Facility Performance Report
Highland Tailings Storage Facility

We are pleased to submit the Highland Tailings Storage Facility Annual Facility Performance Report for the period from December 2020 through November 2021.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

Rick Friedel, P.Eng.
Engineer of Record, Designated Representative
Senior Geotechnical Engineer, Principal

RF:cd

Klohn Crippen Berger Ltd.
500 - 2955 Virtual Way ▪ Vancouver BC V5M 4X6 ▪ Canada
t 604.669.3800 ▪ f 604.669.3835 ▪ www.klohn.com

Teck Highland Valley Copper Partnership

2021 Annual Facility Performance Report

Highland Tailings Storage Facility

EXECUTIVE SUMMARY

Klohn Crippen Berger Ltd. (KCB) was engaged by Teck Highland Valley Copper Partnership (HVC) to complete the 2021 Annual Facility Performance Report[1] (AFPR) of the Highland Tailings Storage Facility (TSF) for the review period from December 2020 through November 2021. We have also reported on some key events that occurred during the reporting period of this document. The Highland TSF is the primary active storage facility for the Highland Valley Copper Mine, which is owned and operated by HVC.

The Highland TSF Structures

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

- The L-L Dam is a cycloned sand dam with a vertically raised, central glacial till core and underdrainage beneath the downstream slope. At the end of 2021, the crest of the L-L Dam is at El. 1269.5 m, corresponding to a maximum downstream slope height of about 169.5 m.
- The H-H Dam is an earthfill dam constructed of local borrow and pit waste materials. The H-H Dam includes a glacial till core that has been raised vertically from the crest of the H-H Starter Dam. At the end of 2021, the crest of the H-H Dam is between El. 1282 m and El. 1287 m, with a maximum downstream slope height of about 57 m.
- 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 collect mine-affected surface water and seepage for reclaim back to the impoundment with no off-site discharge.

The design update (KCB 2020a) for the L-L Dam and the H-H Dam received regulatory approval in June 2021 (EMLCI 2021b), and supersedes the previous design documents referenced in the M-11 Permit (KCB 2010, 2018b).

Operation and Construction

During the review period, the Highland TSF was operated to comply with the design basis and specified operational conditions of the approved design (KCB 2020a).

Approximately 41.3 Mt of tailings were discharged into the Highland TSF during 2021, and the facility was operated with adequate flood storage, freeboard, and tailings storage capacity. At the end of the review period, the pond level was 0.6 m higher than the pond level at the start, which was lower than forecast, as the precipitation was below average in 2021. As a result, there is more storage available in the impoundment going into 2022 than expected. At this stage, the tailings beach width targets, not pond level or flood storage, govern crest raise requirements at the L-L Dam.

[1] Past Annual Facility Performance Reports were referred to as Dam Safety Inspections (DSI).

The 2021 crest raises at the L-L Dam (2.5 m) and the H-H Dam (up to 2 m) were completed as planned and consistent with the design intent. In addition to the dam crest raises, the HVC mining fleet continued the campaign to develop the 24 Mile Waste Dump, which also provides buttressing of the H-H Dam, over the area previously referred to as the 24 Mile Emergency TSF.

During the review period, the following key roles, according to the definitions in the Global Industry Standard on Tailings Management (GISTM 2020), were filled by the following:

- Mr. Bryan Bale, P.Eng. (HVC Chief Engineer - Tailings) acted in the role of Responsible Tailings Facility Engineer (RTFE) / TSF Qualified Person; and
- Mr. Rick Friedel, P.Eng. was the Engineer of Record (EoR), as a representative of KCB.

November Regional Flooding

In November 2021, a combination of rainfall and early season snowmelt led to significant regional flooding and damage to public and private infrastructure, which impacted communities closest to the HVC site. The magnitude of the event was less at the HVC mine site and had no effect on the Highland TSF. Regardless, HVC responded as they would have during any above-average flood on site, which included increased frequency of inspections, pond level monitoring, and reporting.

The Highland TSF is designed to manage the Probable Maximum Flood (PMF) event, which is significantly greater than the regional flooding that occurred in November.

August Forest Fires

The site was under a temporary evacuation order from August 12 to 17, 2021 due to forest fires in the region. Prior to the evacuation, HVC and KCB prepared a modified monitoring program that prioritized surveillance activities. The forest fires did not reach the site, and there was no impact to the Highland TSF. While the site was under the evacuation order, HVC was able to maintain a small site presence to manage essential site operations (e.g., water management). Appropriate monitoring was maintained throughout this period, which included daily tours to the facility and remote monitoring of instrumentation.

Potential Impact of the Cultural Heritage Approval Timeline on Implementation of the Valley Buttress Berm Design

The design of the Valley Buttress Berm (VBB) is based on two assumed conditions within the Lower-Glaciolacustrine (L-GLU) deposit beneath the dam:

- the Most Likely Case (MLC); and
- the Reasonably Worse Case (RWC).

The VBB design is stable with acceptable performance (i.e. all deformations are contained) for MLC and RWC conditions and meets the factor of safety (FOS) criteria specified by the Health, Safety and Reclamation Code for Mines in British Columbia (HSRC) (EMLCI 2021a) under MLC conditions (KCB 2020a). If conditions less favourable than MLC are measured, then an extension to the VBB, referred to as the Contingency Case, is to be built. The sole purpose of the Contingency Case is to raise the FOS to the HSRC (EMLCI 2021a) criteria assuming RWC conditions. Based on an extensive surveillance program, the measured performance at the VBB to date is consistent with the magnitude and pattern of deformation predicted by the model for MLC conditions.

During 2021, HVC advised KCB that the cultural heritage work in the footprint of the Contingency Case will not be completed as planned in 2021; completion is expected in 2023. Based on this timeline, if construction of the Contingency Case is triggered in either 2022 or 2023, HVC will not be able to meet the implementation schedule milestones that are defined in the approved design report (KCB 2020a). Therefore, KCB recommended that HVC engage with Energy, Mines, and Low Carbon Innovation (EMLCI) to amend the implementation schedule milestones. This recommendation was supported by the HVC Tailings Review Board. HVC notified representatives of EMLCI during their routine visit to the site on February 28, 2022 and agreed to set up follow-up discussions.

Surveillance Program

The Operation, Maintenance and Surveillance (OMS) Manual, including the Emergency Preparedness and Response Plan (EPRP), was reviewed by HVC and KCB, and an updated document was issued by HVC in March 2021 (HVC 2021). The OMS Manual remains appropriate for the structure. The next routine review and update of the document is planned for 2022.

The Highland TSF surveillance program is extensive and includes:

- visual inspections;
- measured behaviour from 250 instruments installed at the dams;
- a Trigger-Action-Response-Plan (TARP); and
- routine performance reviews, which includes weekly reviews by the HVC site team and monthly reviews by the EoR.

The instrumentation program includes appropriate redundancy so that the appropriate level of surveillance is maintained, even during temporary loss of service for some instruments. To maintain redundancy and expand the coverage of the surveillance program further, the following instruments were installed at each dam during the review period:

- the L-L Dam - 1 replacement / 6 new; and
- the H-H Dam - 3 new.

The new installations at the L-L Dam included the inclinometers at the VBB and North Buttress Berm (NBB) recommended by KCB in previous AFPRs (Table 1).

Highland TSF Performance

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

KCB made the following key observations regarding the L-L Dam and the H-H Dam performance during the review period:

1. None of the routine engineering reviews triggered by the first level of the TARP or visual observations identified an issue of dam safety concern or unacceptable performance.
2. The tailings pond rise during the review period (0.6 m) was lower than assumed in planning (2.5 m), resulting in more freeboard and storage capacity (tailings and water) than forecast. At the end of the review period, the Highland TSF had 14.5 m of freeboard and an additional 83 Mm^3 of storage capacity over and above the flood storage (50 Mm^3) and freeboard (2 m) design requirements.
3. The M-11 Permit requires that the vertical distance between the tailings surface and the crest of the H-H Dam be 1 m or more. This was maintained throughout the year and following completion of the 2021 crest raise, the buffer ranged from 5.7 m to 7.1 m. The next raise of the H-H Dam is planned for 2023.
4. The magnitude and deformation pattern measured at the L-L Dam and the H-H Dam were consistent with expected behaviour for construction activities during the review period, specifically:
   a. Deformations measured below the upper slope of the downstream shell do not extend to the downstream toe (i.e., deformations are contained) which is the design intent. No shear deformation zones were measured in foundation or fill units where they are not expected to occur based on design or historical performance.
   b. Consistent with past performance, deformation rates that increased during loading (i.e. fill placement) attenuated back to the expected range for non-loading periods, after loading was completed.
   c. The magnitude and deformation pattern measured within the L-GLU at the VBB agree with those predicted by the deformation model, and rates were below Contingency Case implementation thresholds.
   d. Historically, deformations at the H-H Dam have been restricted to the downstream pit waste, which is placed by the mining fleet in 3 m lifts. As the dam is raised, the downstream pit waste fill settles which induces a corresponding horizontal deformation. These deformations are not related to shear through the dam fill and do not extend upstream through the denser zones within the dam:
      i. During the review period, horizontal deformation measured within the pit waste fill was consistent with historical behaviour (7 mm to 70 mm).

5. Measured piezometric levels at the L-L Dam and the H-H Dam were consistent with expected behaviour for construction and operational activities during the review period, specifically:
    a. Measured piezometric levels downstream of the core zone at each dam are significantly lower than upstream levels. This demonstrates that the core zones are effective low permeability barriers to seepage, which is consistent with the design intent. For example, at the highest point of the L-L Dam, at the VBB, the piezometric level in the downstream fill is >135 m below the piezometric level in the fill upstream of the core zone.
    b. At the North Abutment of the L-L Dam, the core zone is not keyed into native glacial till or bedrock due to depth of excavation required. This is accounted for in the design by specifying a minimum 500 m beach width at the abutment to reduce seepage gradients through the abutment and piezometric response downstream of the dam. During the review period, the core and beach were effective as the piezometric levels downstream of the core were relatively constant throughout the year.
    c. The piezometers did not measure any significant piezometric response due to loading in the dam or foundation in the L-L Dam foundation.
    d. The blanket drain at the VBB is the low point of the dam and the primary drainage point for seepage through the dam fill, discharging to the downstream collection ponds. During the review period there was significant hydraulic placement in the downstream shell, which is the primary source of seepage through dam fill, but there was no measured notable piezometric rise in the VBB blanket drain.
    e. Downstream of the H-H Dam core zone, piezometric levels in the fill and foundation respond to changes in the 24 Mile TSF pond level. Piezometric levels in the fill rose 1.5 m to 2.0 m during the first half of 2021, while the pond level in 24 Mile TSF rose ~3 m. In the latter half of the year, HVC pumped down the 24 Mile TSF pond level (~3.5 m); in response, piezometric levels fell 1 m to 2 m. KCB have recommended additional piezometers be installed downstream of the H-H Dam to increase monitoring coverage in this area and further characterize this relationship to improve forecasting.

Design Basis

Consequence classification is not part of HVC's tailings management governance, and they have instructed KCB not to include it when reporting on the Highland TSF. Potential consequences from credible failure modes are managed through a rigorous risk management process. To support this approach, HVC are in the process of adopting design loading for earthquake and flood scenarios equivalent to an Extreme consequence classification (CDA 2019) for all tailings facilities. The approach has the following advantages:

- meets or exceeds HSRC (EMLCI 2021a) requirements.
- aligns with Teck's goal to eliminate any risk for loss of life.
- is consistent with the GISTM (2020), which supports evolving beyond the conventional consequence classification system.

The Highland TSF is already designed to the extreme flood (i.e., PMF) condition and the L-L Dam is designed for the extreme earthquake (i.e., 10,000-year return period) event. The H-H Dam design earthquake (5,000-year return period) meets the requirements of the HSRC (EMLCI 2021a) as discussed in KCB (2020a).

Recommendations

Dam safety recommendations identified during past AFPRs, and their current status, are summarized in Table 1. During the review period, three of the four recommendations from previous AFPRs were closed (shown in *italics*). Completion of the last outstanding recommendation has been delayed due to the archeological clearance timelines, which have delayed construction of the replacement pond for the Seepage Water Reclaim Pond (SWRP).

KCB have included two new recommendations to install new and replacement instrumentation (Table 2). Both have been assigned a Priority 3, which means they are not required to address a potential dam safety concern, but are necessary to implement the dam designs and surveillance programs as intended.

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 (CLOSED)*
LL-2019-02	Surveillance	Install new seepage weirs along downstream toe after SWRP has been replaced and the L-L Dam has been constructed to ultimate toe. (DSR recommendation LL-2017-06)	3	Q4 2021 (Open, to be confirmed based on archeologic approval timeline for LL SWRP)
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 (CLOSED)*
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 extent of tailings placed in channel from H-H Pumphouse to 24 Mile TSF.*	*3*	*Q1 2022 (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.
2. No Outstanding Recommendations for 24 Mile TSF, L-L Dam Seepage Collection and Sediment Ponds.

Table 2 2021 Recommendations Related to Facility Performance

ID No.	Performance Area	Recommended Action	Priority[1]	Recommended Deadline (Status)
L-L Dam				
LL-2021-01	Surveillance	Install a replacement inclinometer for I15-24 at the VBB.	3	Q4 2022
H-H Dam				
HH-2021-01	Surveillance	Install 3 (minimum) piezometers in the waste fill between the H-H Dam slope and 24 Mile TSF to increase coverage and monitoring points for piezometric levels in an area which governs the H-H Dam design.	3	Q3 2022

Notes:
Refer to Table 1 notes.

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Table of Abbreviations

AFPR	Annual Facility Performance Report
DSR	Dam Safety Review
EMLCI	Energy, Mines, and Low Carbon Innovation
EoR	Engineer of Record
EPRP	Emergency Preparedness and Response Plan
FOS	Factor of safety
GISTM	Global Industry Standard on Tailings Management
HVC	Teck Highland Valley Copper Partnership
ICMM	International Council on Mining and Metals
IDF	Inflow Design Flood
KCB	Klohn Crippen Berger Ltd.
LLO	Low-Level Outlet
MLC	Most Likely Case
MOE	Ministry of Environment
NBB	North Buttress Berm
OMS	Operation, Maintenance and Surveillance
PMF	Probable Maximum Flood
QP	TSF Qualified Person
RMR	Routine Monitoring Review
RTFE	Responsible Tailings Facility Engineer
RWC	Reasonably Worse Case
SAMP	Sulphate Adaptive Management Plan
SWRP	Seepage Water Reclaim Pond
TARP	Trigger-Action-Response-Plan
TRB	Tailings Review Board
TSF	Tailings Storage Facility
VBB	Valley Buttress Berm
VBBE	Valley Buttress Berm Extension

CLARIFICATIONS REGARDING THIS REPORT

This report is an instrument of service of Klohn Crippen Berger (KCB). The report has been prepared for the exclusive use of Teck Highland Valley Copper Partnership (Client) for the specific application to the 2021 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.

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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.

1 INTRODUCTION

Klohn Crippen Berger Ltd. (KCB) was engaged by Teck Highland Valley Copper Partnership (HVC) to complete the 2021 Annual Facility Performance Report (AFPR) for the Highland Tailings Storage Facility (TSF) for the review period of December 2020 to November 2021. The Highland TSF is the primary active storage facility for the Highland Valley Copper Mine (HVC Mine), which is owned and operated by HVC, and includes the facilities listed in Table 1.1 and shown on Figure 1, Figure 2 and Figure 4 (at the end of this report).

Table 1.1 Highland TSF Structures

Structure [1,2]	Function
L-L Dam	Cross-valley retaining dam at northwest end of Highland TSF.
H-H Dam	Cross-valley retaining dam at southeast end of Highland TSF.
24 Mile TSF	Receives seepage from the H-H Dam and acts as storage for tailings from the H-H Pumphouse. This facility makes up the southern portion of the 24 Mile Emergency TSF which has been used to store tailings historically and is now partially covered by the 24 Mile Waste Dump (Figure 2.6).
Seepage Water Reclaim Pond	Primary collection pond downstream of the L-L Dam, which collects water which is pumped back into the impoundment. Receives water from surface runoff, sediment ponds, and seepage collection ponds.
Seepage Pond 2	Collects local runoff and dam seepage primarily from finger drains under the northern portions of the L-L Dam.
Sediment Pond 1 [1]	Temporarily store overflow and sediments from the L-L Dam downstream hydraulic cell construction. Route inflow and local runoff to Seepage Water Reclaim Pond.
Sediment Pond 2 [1]	
Sediment Pond 4 [1]	Contingency storage for overflow and sediments from the L-L Dam downstream hydraulic cell construction. Was not operated during review period. Routes inflow to Seepage Water Reclaim Pond.

Notes:
1. Sediment ponds were referred to as "slimes" ponds in previous review and design documents.

The AFPR scope of work consisted of:

- a site visit to observe the physical conditions of the various facilities;
- review of surveillance data for the review period provided by HVC;
- review of climate and water balance data for the site provided by HVC;
- review of the Operations, Maintenance and Surveillance (OMS) Manual (HVC 2021) to confirm it is appropriate for the existing facilities; and
- review of additional activities completed at the site during the review period, if any.

The site visit was completed by KCB representatives Mr. Rick Friedel, P.Eng., P.E. and Mr. Delton Breckenridge, EIT on July 22, 2021. During the site visit, the weather was sunny and did not impede the site visit.

During the review period, Mr. Bryan Bale, P.Eng. (HVC Chief Engineer – Tailings) acted in the role of Responsible Tailings Facility Engineer (RTFE) / TSF Qualified Person (QP), and Mr. Rick Friedel, P.Eng. was the Engineer of Record (EoR), as a representative of KCB. These roles are consistent with the definition in the Global Industry Standard on Tailings Management (GISTM 2020).

The Highland TSF is operated under the following permits:

- British Columbia Ministry of Energy, Mines and Low Carbon Innovation (EMLCI) M-11 Permit (EMLCI 2021b) – this permit covers the approved mine life and related operations including the tailings facilities.
- 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.

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 (northwest end) and the H-H Dam (southeast end), which were built 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 built, followed by the L-L Starter Dam between 1976 and 1979. By 1991, the J-J Dam was buried by tailings.

Tailings are discharged from the Highland Mill, as a slurry, to the H-H Pumphouse at the toe of the H-H Dam. From the pumphouse, tailings are pumped to the various spigot points at the H-H Dam or to the Cyclone House, which distributes tailings at the L-L Dam. Tailings are periodically discharged from the H-H Pumphouse to 24 Mile TSF downstream of the H-H Dam.

The majority of the tailings have historically been, and continue to be, discharged from spigots near the east and west abutments of the H-H Dam. As a result, the tailings beach slopes from the H-H Dam towards the pond. The pond 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.

Sections 2.2, 2.3 and 2.4 include additional information for the L-L Dam, the H-H Dam, and 24 Mile TSF. General information regarding each retaining structure and those that manage water and sediment downstream of the L-L Dam are summarized in Table 2.1.

Table 2.1 Containment Facilities at the Highland TSF (as of November 2021)

Structure [()]	Containment or Design Type	Est. Crest Length (m)	Est. Crest El. (m)	Est. Max Downstream Slope Height (m)
L-L Dam	Cycloned sand dam with glacial till core that has been raised using the centerline method. Refer to Section 2.2 for details.	2,980	1269.5	169.5
H-H Dam	Granular fill dam with glacial till core that has been raised using the centerline method. Refer to Section 2.3 for details.	1,800	1281.0 to 1287.0	57.0 [(2)]
24 Mile TSF	Tailings are stored below existing ground, encapsulated on all sides by waste rock. Refer to Section 2.4 for details.	n/a	Min. 1225.0 [(3)]	n/a [(4)]
Seepage Water Reclaim Pond	Portion of pond formed by excavation into natural ground with an embankment on the west side. Embankment is homogeneous glacial till with downstream sand and gravel filter. Pond is unlined.	95	1103.2	5.0
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[(5)]	Excavated into natural ground. In 2018, sediments from pond and underlying lacustrine deposits (where accessible) were removed and backfilled with sand and gravel. Since 2019, the pond has continued to be used for sediment placement related to hydraulic sand placement, above the sand and gravel backfill. In 2021, the pond was subdivided into two sub-cells: North; and South. Containment is provided by a natural ground, the L-L Dam toe, and internal berms.	NE = 500 SW = 700	1104.2	2.5
Sediment Pond 2[(5)]	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	10.0
Sediment Pond 4[(5)]	Contained by natural ground with small compacted glacial till embankments to provide containment at the south and southeast ends.	n/a	1103.0 to 1104.0	<2.0

Notes:

1. Refer to Table 1.1 for the function of each structure.
2. Existing ground downstream of the H-H Dam was formed by a waste dump which is ~40 m above natural ground (i.e., the H-H Dam crest is up to 97 m above natural ground).
3. Minimum elevation of surrounding waste dump that provided containment from spill down the Roman Haul Road towards the Valley Pit.
4. The crest of the waste dump providing containment to the 24 Mile TSF is more than one km wide and there are no credible failure modes for the dump which could result in an uncontrolled release of tailings downstream (KCB 2018a).
5. Sediment ponds were referred to as “slimes” ponds in previous review and design documents.

2.2 L-L Dam

The design for the L-L Dam is based on the Highland TSF 2019 Design Update (KCB 2020a), which received regulatory approval in June 2021 (EMLCI 2021b). KCB (2020a) introduced design modifications to improve tailings management and maintain compliance under future loading conditions, based on information collected since the previously approved design was completed in 2010 (KCB 2010). One modification is the introduction of the Contingency Case at the Valley Buttress Berm (VBB) which is discussed in Section 5.2.4. The configuration of the L-L Dam, after the completion of the 2021 construction, meets design and regulatory criteria defined in KCB (2020a).

The L-L Dam is divided into five design segments based on foundation conditions (Figure 3, at the end of the report):

- the South Dam;
- the VBB;
- the Valley Buttress Berm Extension (VBBE);
- the North Buttress Berm (NBB); and
- the North Dam, including two zones:
    - North Dam Bedrock; and
    - North Dam Upper-Glaciolacustrine Unit (U-GLU).

The geologic and geotechnical characterization of the L-L Dam foundation is summarized in KCB (2020b), which is consistent with the requirements recommended by the Engineers and Geoscientists of BC (EGBC) professional practice document (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 and North Dam U-GLU).

Figure 2.1 shows a typical design section of the L-L Dam, through the VBB at Sta. 1+850 (Section 9 on Figure 3, at the end of the report) 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 Starter Dam crest has been raised using the centreline method with the core supported by compacted cycloned sand on the upstream and downstream sides. Figure 2.3 shows the crest rise over the life of the structure. The majority of the cycloned sand fill in the dam has been placed and densified hydraulically, rather than by conventional construction equipment.

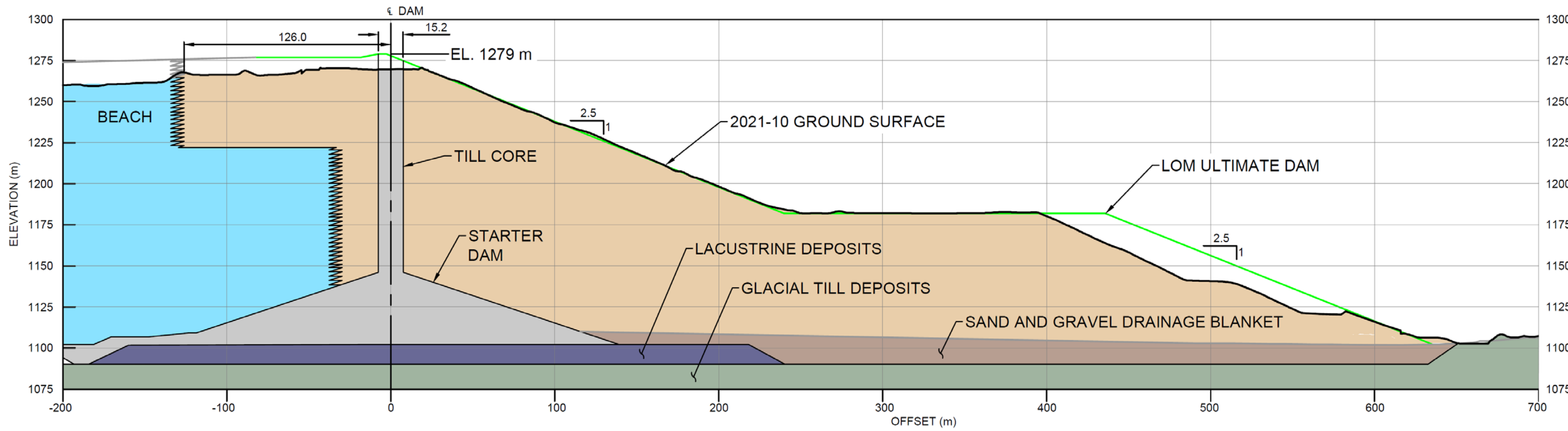
General construction staging of the VBB through 2021 is shown on Figure 2.2. The OMS Manual (HVC 2021) contains select design and construction record drawings, and further discussion of the design and construction timeline for the L-L Dam (HVC 2021). The configuration of the L-L Dam and associated structures, at the end of 2021 construction, is shown on Figure 2 (at end of report).

The downstream cycloned sand shell is underlain by a sand and gravel blanket drain with underdrains to increase drainage capacity. Refer to KCB (2020a) for design details. The purpose of the underdrainage system is to maintain low piezometric pressures in the downstream shell, to intercept upward seepage from the natural ground, and to promote downward drainage through the dam shell during hydraulic placement of cycloned sand dam fill. Seepage intercepted by the blanket drain primarily flows towards and discharges from the dam at the VBB toe, which is the low point of the natural valley. Some seepage discharges from underdrains that daylight at the toe of the VBBE but are collected by drains and report to the same downstream collection point as all seepage.

Seepage from the impoundment through the foundation (i.e., flow that is not intercepted by the underdrains) is managed by HVC 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 downstream of the L-L Dam. The SAMP system is not considered a design feature of the L-L Dam but is a requirement of HVC under the conditions of the M-11 Permit (EMLCI 2021b). Water quality monitoring is reported by HVC in a separate report as discussed in Section 5.4.

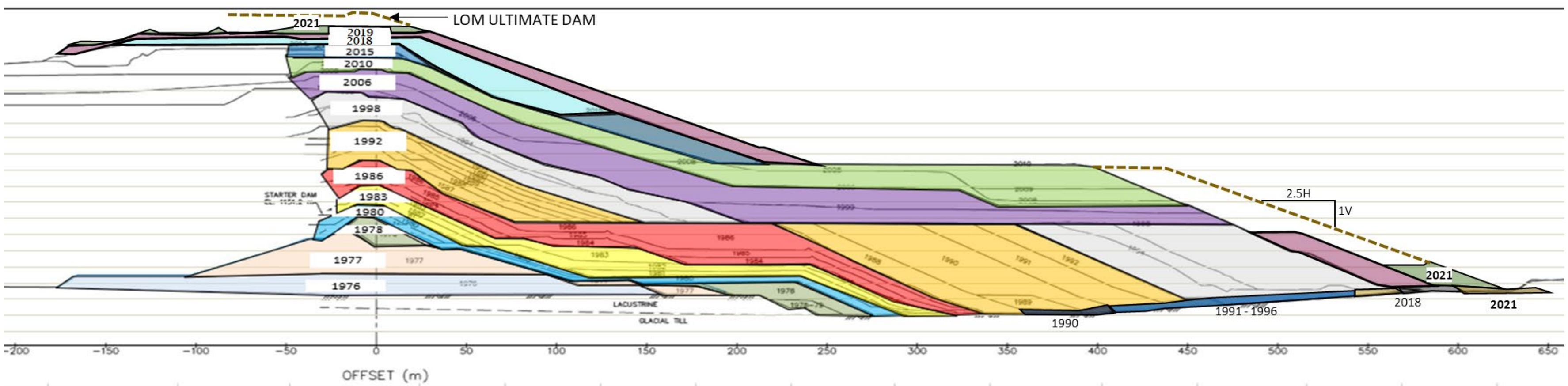
The purpose of the downstream seepage and sediment ponds is to collect mine-affected surface water and seepage with no off-site discharge. The SWRP, located downstream of the VBB toe, is the primary collection pond where all water reports and is then pumped into the Highland TSF impoundment via a pipeline. Since 2018, HVC have used storage cells in the downstream shell of the dam to temporarily store sediments generated by hydraulic cell placement. These pose no risk to dam performance. Relative to the downstream sediment ponds, these storage cells cause no downstream disturbance when they are built, and are more efficient to remove sediments from.

Figure 2.1 End of 2021 Configuration and Ultimate Design Section at L-L Dam VBB (Sta. 1+850)



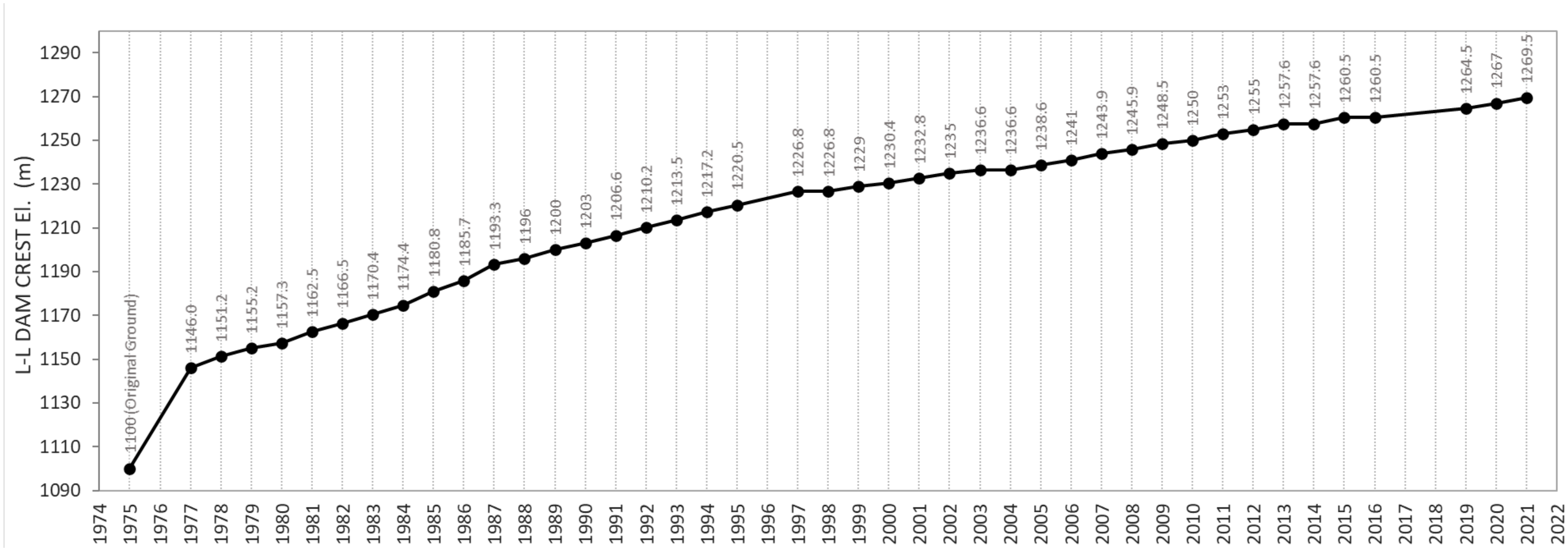
Note: Section line corresponds to Section 9 on Figure 3, at the end of the report.

Figure 2.2 Schematic Construction Sequence, through 2021, at L-L Dam VBB (Sta. 1+850)



Note: Section line corresponds to Section 9 on Figure 3, at the end of the report.

Figure 2.3 L-L Dam Crest Elevation vs. Time



2.3 H-H Dam

Similar to the L-L Dam, the approved design for the H-H Dam is based on KCB (2020a) which received regulatory approval in June 2021 (EMLCI 2021b). The configuration of the H-H Dam after completion of 2021 construction meets design and regulatory criteria defined in KCB (2020a).

Figure 2.4 is a typical design section, with construction staging, of the H-H Dam at Station (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. Figure 2.5 shows the crest rise over the life of the structure.

The majority of the downstream shell has been placed by the HVC mining fleet. Waste dumps downstream of the H-H Dam have raised existing ground up to ~40 m above the original ground level. Near Sta. 1+400, where the downstream slope is highest at ~56 m, original ground is approximately 38 m below the downstream toe, as shown on Figure 2.4. The revised design (KCB 2020a), approved in 2021 (EMLCI 2021b), clarified the role of the downstream waste dumps in the H-H Dam and defined a minimum buttress that extends over the tailings placed in the 24 Mile Emergency TSF (Figure 2.6). The 24 Mile Waste Dump will act as the buttress and the H-H Dam defines the minimum dimensions the dump must be built to at mine closure and interim stages during operations. These dimensions were revised in 2021 based on more conservative piezometric forecasts downstream of the H-H Dam.

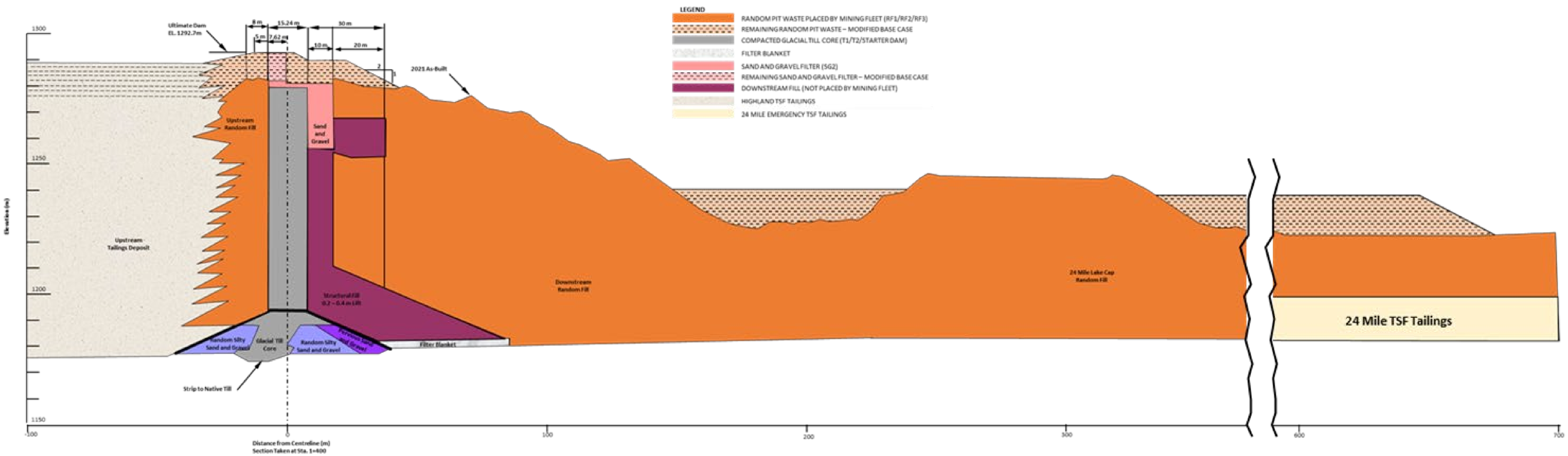
Select design and construction record drawings, as well as further discussion of the design and construction timeline for the H-H Dam, are included in the OMS Manual (HVC 2021). The configuration of the H-H Dam, at the end of 2021 construction, is shown on Figure 4, at the end of the report.

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, the H-H Dam crest is sloped to match the forecasted beach profile immediately upstream of the dam, not to match a rising horizontal pond surface.

Seepage from the H-H Dam reports to the 24 Mile TSF or is intercepted by pumping wells[2] downstream of the dam toe which supply water to the H-H Pumphouse.

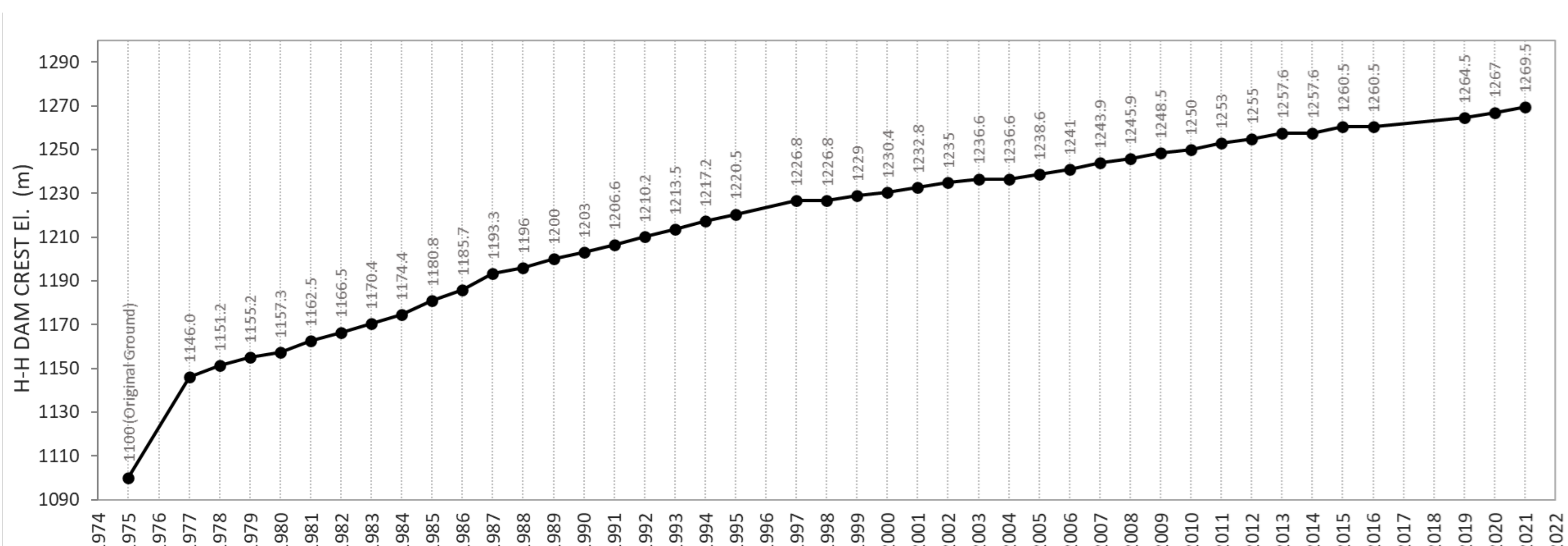
[2] Pumping Well No. 7, shown on Figure 5, was in operation during review period.

Figure 2.4 Schematic Construction Sequence, through 2020, at H-H Dam (Sta. 1+400)



Notes:
1. Structural fill below ~El. 1216.7 m is a transition zone between glacial till core and downstream Random Fill.

Figure 2.5 H-H Dam Crest Elevation vs. Time



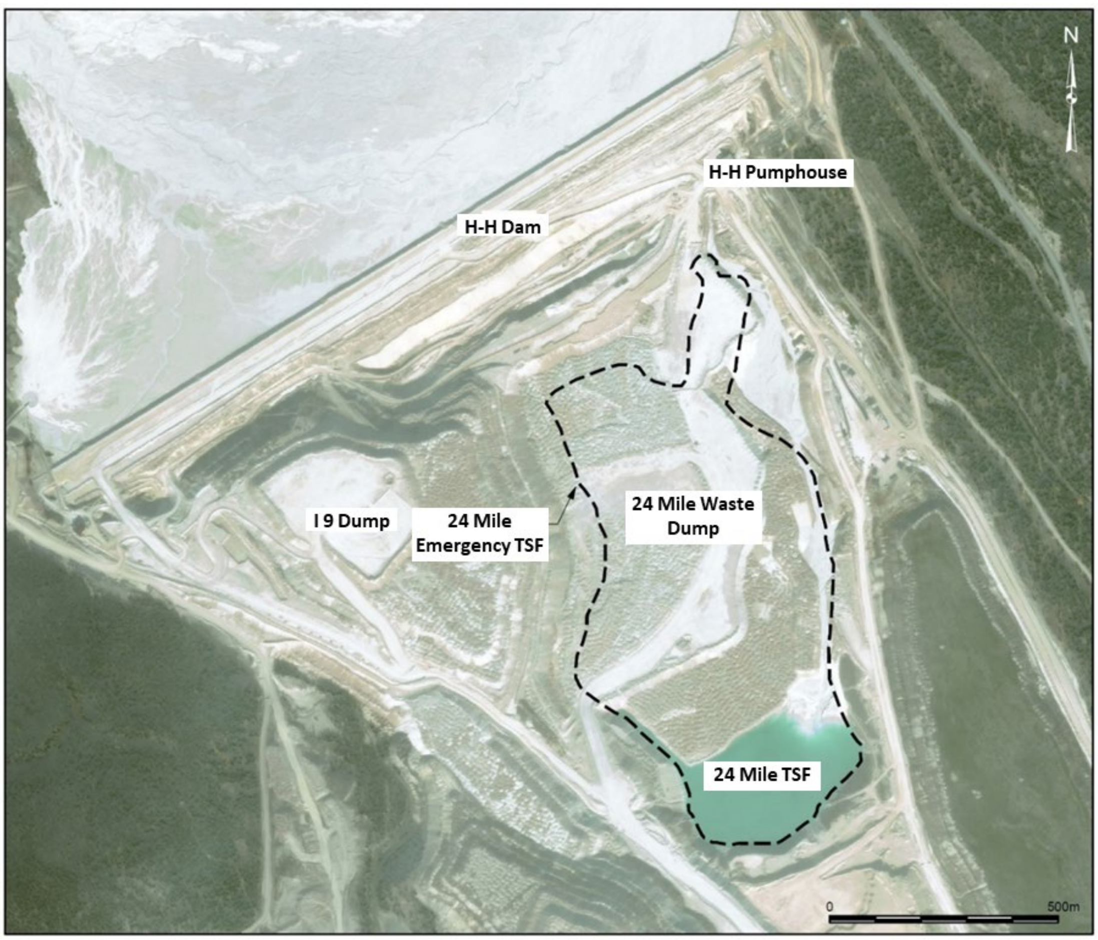
2.4 24 Mile TSF

The 24 Mile Lake was a natural lake, located downstream of the H-H Dam, that has been used to store tailings from the H-H Pumphouse during upset or emergency conditions. Waste dumps have been built around the perimeter of the lake and allowed for tailings to be stored ~20 m above the natural lake level. The area where all tailings have been stored during operations referred to as the 24 Mile Emergency TSF (Figure 2.6).

Starting in 2019, HVC began capping the northern end of 24 Mile TSF with waste rock, which has segregated the surface of the 24 Mile Emergency TSF into two areas (Figure 2.6):

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

Figure 2.6 Plan View of 24 Mile TSF (October 2021)



3 2021 OPERATIONS

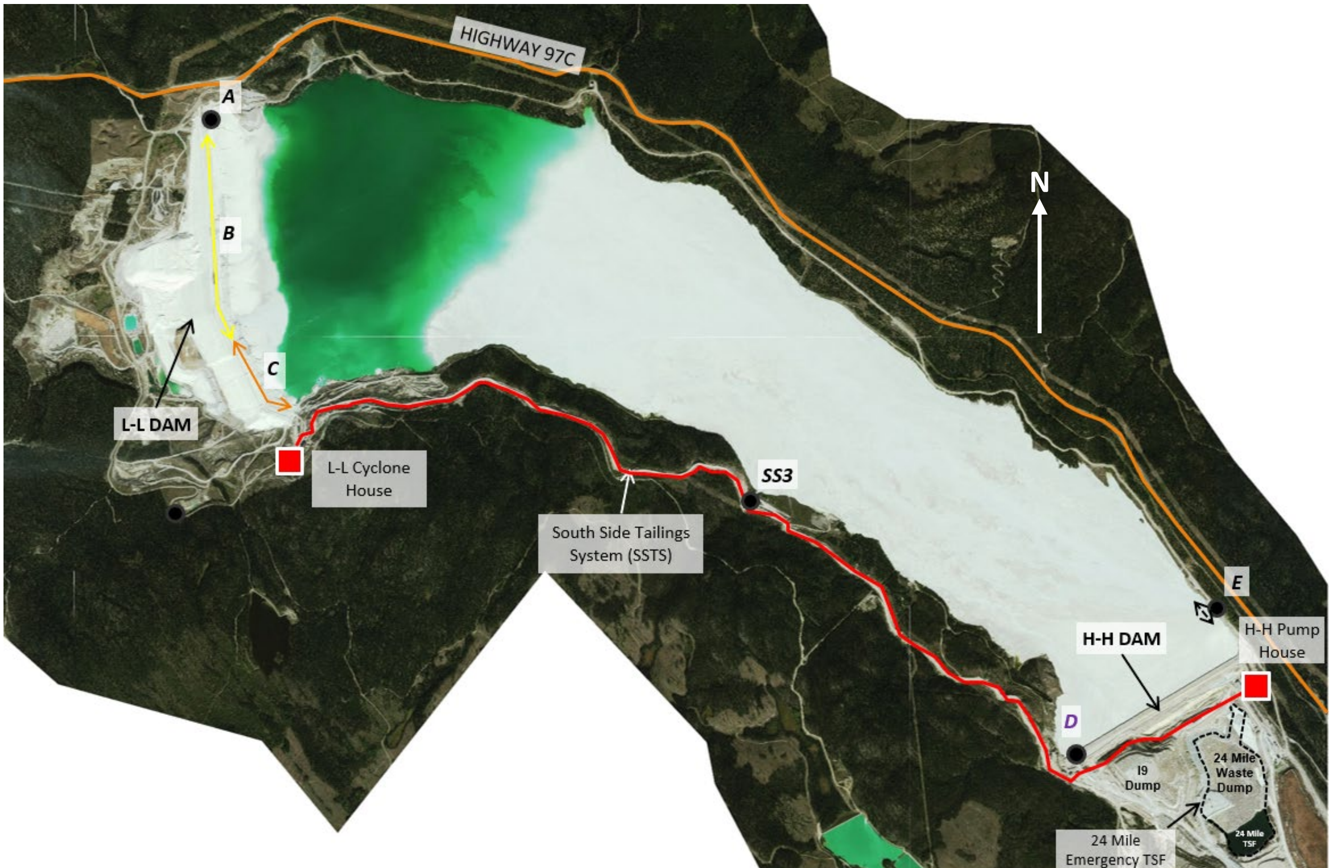
3.1 Tailings Deposition and Available Storage

The maximum permitted ore throughput, and subsequently tailings production, allowed by the M-11 Permit (EMLCI 2021b) is 200,000 tonnes per day (tpd) calculated on an annual average basis. 2021 tailings spigot locations at the Highland TSF are shown on Figure 3.1. During 2021, HVC generated approximately 45.8 million tonnes (Mt) (Table 3.1). Of that, 41.3 Mt were discharged into the Highland TSF for an average daily production of ~113,000 tpd. Tailings were also used as cycloned sand fill at the L-L Dam and relatively small quantities of tailings discharged into 7-Day Pond TSF, during upset conditions at the mill (Figure 1, at the end of the report), or 24 Mile TSF, during upset conditions at the H-H Pumphouse (Table 3.1).

HVC 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. Based on forecasted pond volume, pond elevation and tailings production plans, the dam crests at end of 2021 are sufficient to store forecasted 2022 tailings and maintain flood storage and freeboard.

Tailings deposition modelling completed in 2021 (KCB 2021b) shows that the approved ultimate crests of both dams are sufficient to store the forecasted tailings production for the remaining mine life.

Figure 3.1 2021 Highland TSF Spigot Locations



Dam	Spigot Details			Tailings Type Discharged During 2021
	ID	Location/Station Range	No of Points	
L-L	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	D	West Abutment (SS2)	1	Whole Tailings
	E	East Abutment	4 (4)	Whole Tailings
	SS3	Mid-Impoundment	1	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 ~420 m (prior to April), and 250 m (after April) Northwest (i.e., upstream) of East abutment during 2020.

Table 3.1 2021 Tailings Deposition

Discharge Area[1]	Spigot Location(s)[1]	Notes	Tailings Discharged (dry weight – Mt)[2]
HIGHLAND TSF			
H-H Dam	E, D, SS3	H-H Dam abutments and mid-impoundment	31.8
L-L Dam Into Impoundment	A, B, and C	Tailings are discharged as cyclone overflow or underflow via the L-L Cyclone House or secondary cyclones on the dam crest	9.5
L-L Dam Cycloned Sand Fill	n/a	Cycloned sand placed in the dam	4.0
24 Mile TSF	n/a		0.5 [3,4]
7-Day Pond	n/a		<0.01 [3]
		Total 2021 Tailings:	**45.8**

Notes:
1. Refer to Figure 3.1 for spigot locations.
2. Tailings discharge quantities combinations of values provided by HVC and estimates based on process-flow-diagram.
3. Volume estimate from comparison between aerial surveys multiplied by average density of 1.3 t/m^3.
4. Volume estimated based on comparison between aerial surveys assuming 50% of volume estimated during first 6 months of review period.

3.2 2021 Dam Construction Activities

The crest raises in 2021 at both the L-L Dam and the H-H Dam were substantially completed within the review period, as planned. All work was completed by the date of report issue. Fill placement at the L-L Dam and work at the abutments of the H-H Dam continued into December 2021 but are included in the summary reported herein. General activities completed at the L-L Dam are summarized in Table 3.2 and the main work areas are shown on Figure 6, at the end of the report. General activities completed at the H-H Dam are summarized in Table 3.3 and the main work areas shown on Figure 7, at the end of the report.

2021 construction activities are documented in a separate construction summary report (KCB 2022), which includes discussion of quality control/quality assurance activities and compliance with design intent. Overall, the 2021 construction activities complied with the design intent, Issued for Construction 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 2021:

- Design modifications related to the updated design report, which received regulatory approval in 2021 were incorporated into the 2021 raise, refer to KCB (2020a) and KCB (2022) for additional information for the technical basis for each modification and summary of the construction details:
  - L-L Dam (Figure 3.2): Incorporated the new cycloned sand fill zone for the upper portions of the downstream shell (S3 Zone) where the primary design function is to add weight to prevent slip failures through the foundation and deeper fill zones.

  - H-H Dam (Figure 3.3): Revised the H-H Dam crest raise that includes no further raises of the glacial till core zone and shifting the filter zone upstream.
  - H-H Dam (Figure 3.4): West abutment tie-in was modified to avoid excessive excavation of fill placed at the abutment but maintain appropriate filter separation between the upstream tailings, abutment and downstream dam shell.
- Some construction planned for the L-L Dam during 2022 were completed to suit constructability and take advantage of openings within the 2021 construction timeline. For example, raise segments of the crest so on-dam secondary cyclones do not need to be moved in 2022. All activities were sent to KCB for review and approval prior to construction.
- Excavation of accumulated sediments from downstream sediment ponds and temporary on-dam sediment storage cells.
- The temporary sediment storage cell within Sediment Pond 1 was reconfigured into two sub-cells (North and South) and used during 2021 construction.
- The HVC mine fleet placed additional pit waste over the portion of the 24 Mile Waste Dump (Figure 2.6) that also acts as a buttress to the H-H Dam.
- Development and management of designated borrow areas.
- The Seepage Water Reclaim Pipeline was uncovered and moved onto a new pipe grade towards the north at Sta. 0+950 to accommodate the 2021 crest raise. The old pipe grade was mechanically backfilled with fill as per specification.
- Tailings pipelines at the East Abutment of the H-H Dam were relocated outside of the dam footprint to facilitate the 2021 crest raise.
- Mystery Creek culvert, that routes flow below the South Side haul road and discharges flow downstream of the H-H Dam, was decommissioned (removed where accessible and remainder was grouted) and flow routed outside the ultimate H-H Dam footprint to facilitate the 2021 crest raise.

Table 3.2 Summary of 2021 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)	-	-	-	-	-
Foundation Preparation	✓	✓	-	✓	✓
Blanket Drain	✓	-	-	-	-
Major and Minor Drains	✓	-	-	✓	-

Notes:
1. Details and locations of construction activities are shown on Figure 6, at the end of the report.

Table 3.3 Summary of 2021 Construction Activities at the H-H Dam Area

Construction Activity	Dam Area			24 Mile Lake
	West Segment	Mid-Segment	East Segment	
Glacial Till Core Raise	-	-	-	-
Upstream Fill (RF2) – by Contractor	✓	✓	✓	-
Downstream Fill (Sand and Gravel Filter)	✓	✓	✓	-
Downstream Fill (RF2) – by Contractor	✓	✓	✓	-
Downstream Fill (RF2) – by HVC Mining Fleet	✓	✓	✓	-
Abutment Preparation (incl. foundation preparation)	✓	n/a	✓	-
Foundation Preparation	✓	-	✓	-
Waste Dump Fill (RF3) by HVC Mining Fleet	-	-	-	✓

Notes:
1. Details and locations of construction activities are shown on Figure 7, at the end of the report.

Figure 3.2 L-L Dam Design Section Showing Typical Location of S3 Fill Zone

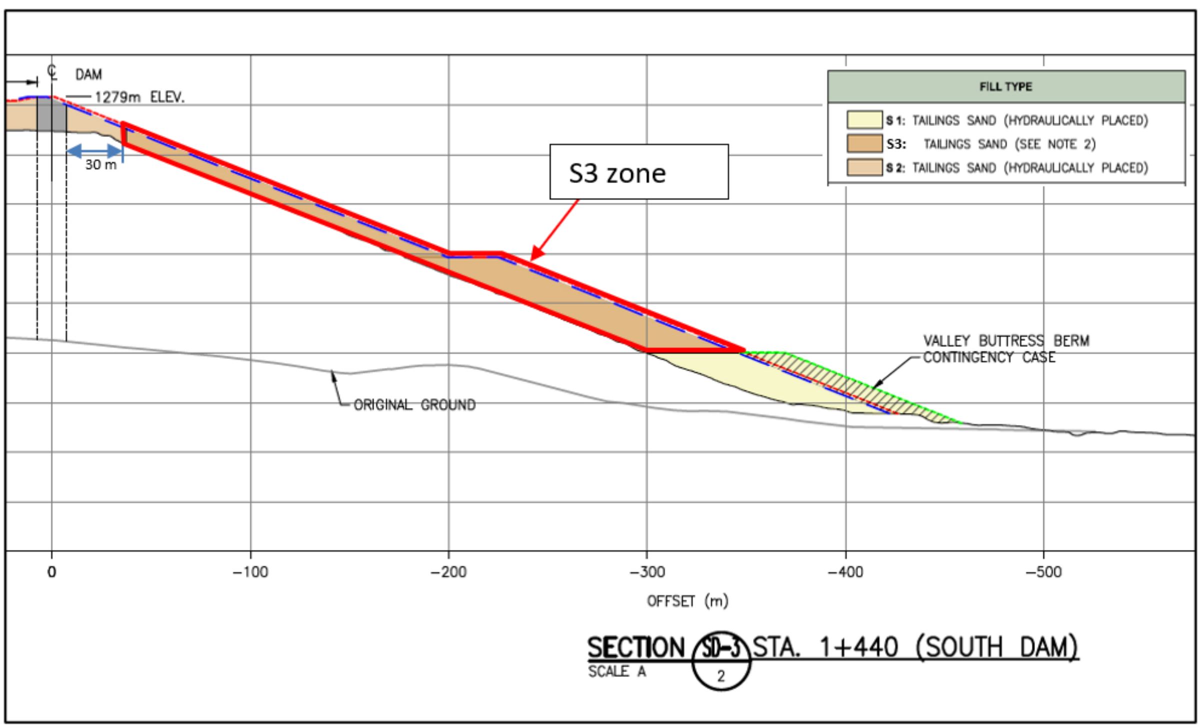


Figure 3.3 H-H Dam Revised Crest Design Section and Typical 2021 Crest Raise

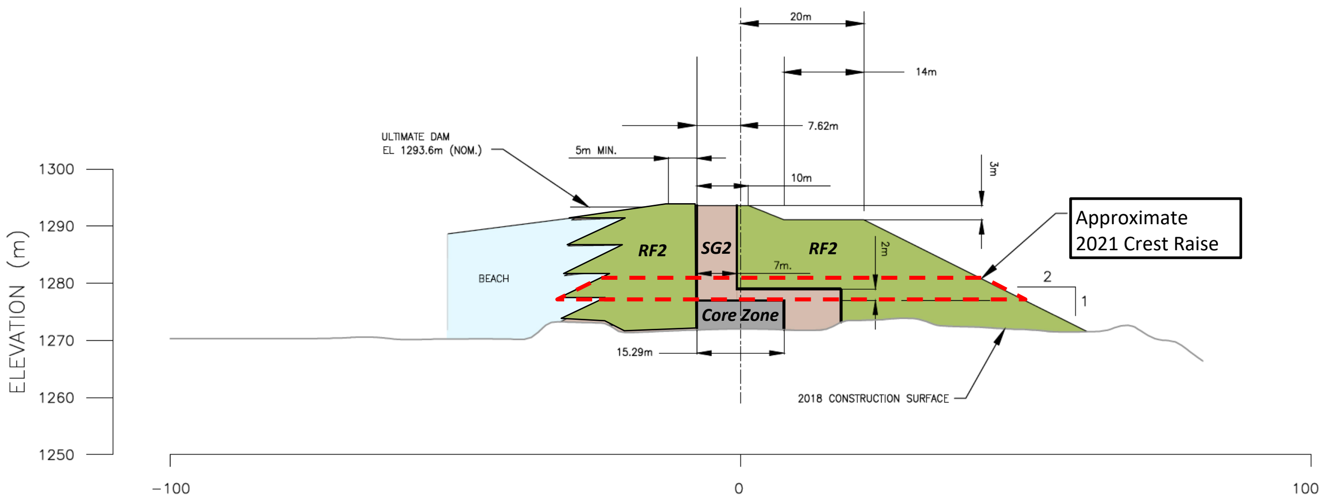
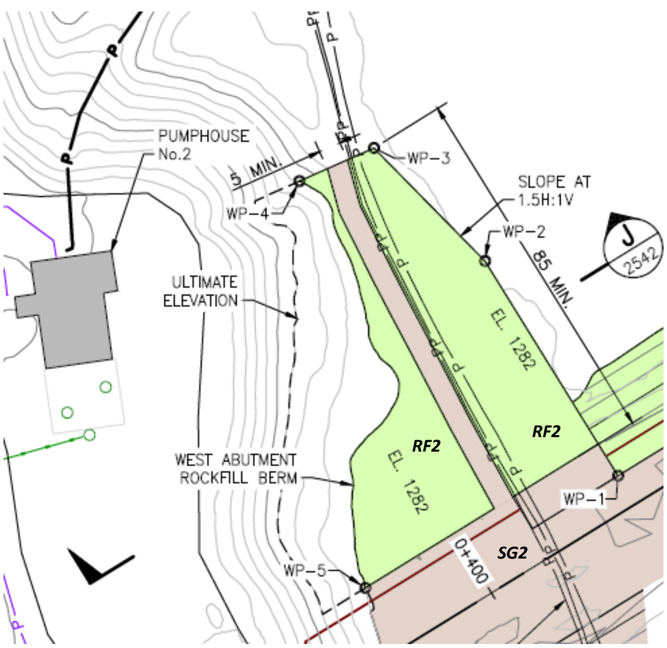


Figure 3.4 H-H Dam West Abutment Rockfill Berm Tie-In



As stated in Section 2.2, the configuration of L-L Dam throughout and at the end of the review period meets design criteria specified in KCB (2020a). During the review period, there were changes to the life-of-mine L-L Dam construction plan (Table 3.4) that modify some of the milestones or target completion dates for activities that were specified in KCB (2018c). These changes do not impact dam safety of the existing condition, nor do they compromise the ability to construct or operate the facility, as designed in the future. However, they are mentioned here to document the change from KCB (2018b) and reason for the change.

Table 3.4 Modifications to L-L Dam Life-of-Mine Construction Plan Dates from KCB (2018c)

Activity	Target Date in KCB (2018c)	Revised Target Date	Reason For Change
Sediment Pond 3 – Construction	End of 2019	2024	The location of Sediment Pond 3 has been identified as an archeologically significant area and approval to build in the area has been delayed while appropriate investigations are ongoing. HVC expects the earliest that archeological clearance may be obtained is 2023. The lack of sediment storage has been made up for by the use of temporary on-dam cells and continuing to operate Sediment Pond 1. Slurry pumping systems can also be deployed if necessary.
LL SWRP – Construction	End of 2021	2024	The LL SWRP (also referred to as Seepage Pond 4) is located in the same archeologically significant area as Sediment Pond 3 and therefore construction has been delayed. LL SWRP is to be built to increase flood storage capacity downstream of the L-L Dam and to accommodate the Contingency Case, at or near ultimate dam crest, if required. HVC are aware of future conflicts if the construction continues to be delayed and developing alternative sequence plans depending on archeological approval timelines. In the interim, HVC installed a secondary pumping system to increase flood routing capacity downstream of the dam while the LL SWRP construction is delayed.
Seepage Pond 2 – Modification	End of 2021	if required	The modification to Seepage Pond 2 is required only if the Contingency Case (Section 5.2.4) is built. In KCB (2018c), this was to be built by the end of 2021 as a preparatory activity, regardless of whether the Contingency Case is found to be required or not. HVC have since modified this assumption and converted it to a Contingency Case implementation activity, but have not modified any of the required construction deadlines that would come into play if this scenario is triggered.
Sediment Pond 8 – Construction	End of 2021	n/a	Sediment Pond 8 was shown as optional in the design report (KCB 2020a) and would only be built if necessary. As HVC have substantially completed downstream cycloned sand fill placement north of the NBB and temporary on-dam cells are available, this pond will not be required.

3.3 Dam Safety Incidents

During the review period, no incidents which could have compromised the integrity of either dam or required remedial actions be taken were observed by KCB, reported by HVC or initiated through the Trigger-Action-Response-Plan (Section 5.1).

4 2021 WATER MANAGEMENT

4.1 Water Balance

There are no surface water discharges from the facility directly to the environment. Mill water reclaim, evaporation, and entrainment are the major sources of water loss. Annual climate fluctuations have the greatest influence on pond volume changes. Pond volumes are typically decreasing except during freshet. The magnitude of freshet typically has the greatest impact on annual pond volume change.

HVC manages the Highland TSF pond to balance mill water supply requirements, storing water to reduce downstream flooding from natural events (e.g., freshet, storms) and not storing or accumulating excessive water in the impoundment, which could impact dam safety.

HVC maintains a predictive water balance, based on the process-flow-diagram shown on Figure 20 (at end of report), to forecast changes in pond volume, which is used in tailings deposition and crest rate of rise estimates. HVC 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 2021 as well as the pond volume forecast for 2021 made based on the model at the end of 2020. The 2021 forecast was based on average climate conditions; however, as discussed in Appendix II, 2021 was a drier year than typical. This explains the difference between the forecast and actual. After 2021 freshet, HVC calibrated the model based on actual climate conditions.

Table 4.1 compares the annual change in pond volume estimates based on bathymetry and water balance. The pond volumes from bathymetry and the water balance model calibrated in 2021 both indicate a decrease in pond volume during the year between 2.6 Mm^3 and 3.6 Mm^3. As mentioned, this was due to a relatively dry year climate year (refer to Appendix II). Surface runoff into the impoundment, estimated by the water balance model, during 2021 was 60% of 2020 runoff.

The impact of the Highland TSF water balance on pond levels during the review period are discussed in Section 5.2.1.

Figure 4.1 Highland TSF Pond Volume: 2016 to 2021

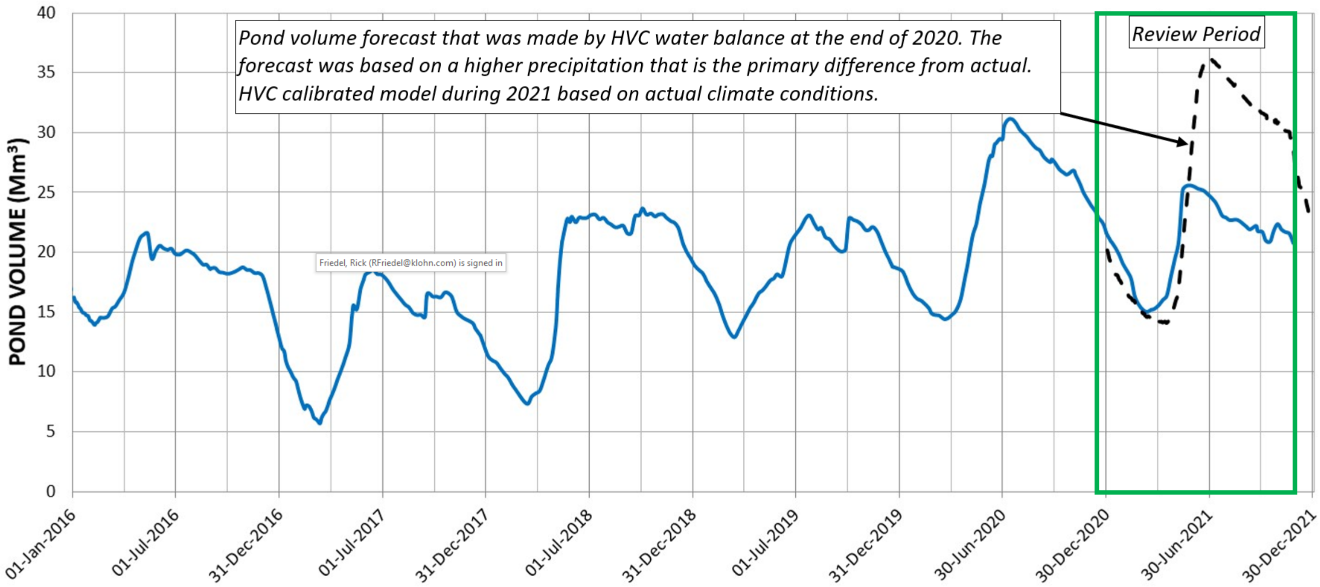


Table 4.1 Change in Pond Volume During 2021 for Highland TSF

Metric		Volume (Mm^3)
Pond Volume Calculated Based on Bathymetry	Pond volume on Nov. 27, 2020	24.4
	Pond volume on Nov. 26, 2021	20.8
	Est. Annual Change in Pond Volume	-3.6
Change in Pond Volume based on	2020 Water Balance Forecast	*2.2*
	2021 Water Balance (Post Calibration)	*-2.3*

4.2 Flood Management

Flood management structures and the applicable design criteria for the tailings and water retaining facilities are summarized in Table 4.2.

As discussed in Section 2.3, overtopping of the H-H Dam by the Highland TSF pond is not possible; therefore, flood routing is measured relative to the L-L Dam only. Flood requirements for Sediment Ponds 1 and 4 are not reported, as both drain directly into the SWRP before overtopping and are included in flood routing for SWRP. All of the structures can safely manage or store the applicable Inflow Design Flood (IDF), see Table 4.2, without off-site discharge.

As discussed in Section 7.1, Teck have instructed KCB to no longer report on consequence classification, as defined by CDA (2019), for tailings storage facilities. The IDF for Highland TSF and 24 Mile TSF (Table 4.2) were originally defined to meet equivalent requirements under the Health, Safety and Reclamation Code for Mines in British Columbia (HSRC) (EMLCI 2021a).

The SWRP relies on pumping to maintain water levels year-round, and in its current state, has insufficient capacity to store the IDF (Table 4.2) without overflowing and inundating the surrounding area, mainly Sediment Pond 1 (KCB 2020a). This has the potential to impact HVC operations and could inundate a portion of the archeologically sensitive area, but the downstream Laura Lake public road (~El. 1108 m) would prevent an off-site discharge.

As discussed in Table 3.4, the SWRP replacement pond (referred to as LL SWRP) has more flood storage, but its construction has been delayed until archeological clearance for the area has been obtained. To increase flood capacity of the existing SWRP during this interim period, HVC installed and commissioned a second pump in 2021. The total reclaim capacity from the SWRP, while all pumps are operating, is currently 8,100 gpm.

In early 2021, HVC was in the process of excavating an overflow channel at Seepage Pond 2 to increase flood routing capacity sufficiently to route the IDF (Table 4.2) with freeboard. However, archeological clearance issues delayed the work. As an alternative means of increasing flood routing capacity, HVC mobilized a pump to site (4200 gpm) and stationed it at Seepage Pond 2 to increase flood routing capacity. This pump is demobilized from the site during winter when flood risks are significantly reduced. HVC plan to continue to maintain a pump at Seepage Pond 2 until the outflow capacity can be increased and the pump is no longer required to route the IDF (Table 4.2).

Table 4.2 Inflow Design Flood Requirements for Tailings Storage Facility

Facility	Routed or Stored (Outflow)	Inflow Design Flood[(1)]	Design Event	Design Outflow/ Stored Volume
Highland TSF	Stored	PMF	PMF 120-hour	50.3 Mm^3
24 Mile TSF	Stored	1/3rd between 1000-year and PMF	1/3rd between 1000-year and PMF 72-hour	3.2 Mm^3
Seepage Pond 2	Routed (Pipe)[(3)]	Between 100-year and 1000-year	100-year 24-hour[(2)]	3.2 m^3/s
Sediment Pond 2	Routed (Pipe/Pump)[(3,4)]	Between 100-year and 1000-year	100-year 24-hour[(2)]	0.2 m^3/s
SWRP	Routed / Stored[(5)]	Between 100-year and 1000-year	100-year 72-hour[(2)]	0.3 Mm^3

Notes:

1. As discussed in Section 7.1, Teck have instructed KCB to no longer report on consequence classification, as defined by CDA (2019), for tailings storage facilities. The IDF for Highland TSF and 24 Mile TSF were originally defined to meet equivalent requirements under the HSRC (EMLCI 2021a).
2. Based on KCB (2020a).
3. Seepage Pond 2 and Sediment Pond 2 IDFs are routed to the SWRP.
4. HVC maintains a pump (4,200 gpm) at Seepage Pond 2, except during winter, to increase flood routing capacity so the IDF can be passed.
5. During the IDF, some water would be reclaimed back to the Highland TSF but the majority of flow would be stored.

5 2021 DAM SURVEILLANCE SUMMARY

5.1 Surveillance Program

The Operation, Maintenance and Surveillance (OMS) Manual was reviewed by HVC and KCB during the review period and an updated document issued by HVC in March 2021 (HVC 2021). The updates included: the revised life-of-mine tailings deposition and construction plans; updates to the quantitative performance objectives based on the latest design review (KCB 2020a); and other modifications to comply with revised requirements from the Mining Association of Canada OMS guidance document (MAC 2019). The OMS Manual (HVC 2021) remains appropriate for the structure and the next routine review and update of the document is planned for 2022.

The Highland TSF surveillance program is extensive and includes visual inspections, measured behaviour from 250 instruments installed at the dams, a Trigger-Action-Response-Plan (TARP) and routine performance reviews by the HVC site team and the EoR. The main activities of the dam surveillance program defined in the OMS Manual (HVC 2021) and related activities completed during the review period are summarized in Table 5.1.

A regional flood event impacted the interior of BC in November 2021, a combination of rainfall and early season snowmelt, led to significant flooding and damage to public and private infrastructure which impacted communities closest to the HVC site. The magnitude of the event was less at the HVC mine site and had no impact to the Highland TSF. Regardless, HVC responded as it would during normal flood events (e.g., increased frequency of inspections, pond level monitoring and reporting). Even if the peak of such an event were to have happened in the Highland TSF catchment this would not have a significant impact on the performance of the facility which is designed to manage the Probable Maximum Flood (PMF) event.

The site was under a temporary evacuation order from August 12th to 17th, 2021 due to forest fires in the region. Prior to the evacuation, HVC and KCB prepared a modified monitoring program that prioritized surveillance activities, while it was safe for people to do so. The forest fires did not reach site and there was no impact to the Highland TSF. While the site was under evacuation order, HVC was able to maintain a small site presence to manage essential site operations (e.g., water management). Appropriate monitoring was maintained throughout this period which included daily tours to the facility and remote monitoring systems, which remained operational throughout this period.

Table 5.1 2021 Highland TSF Surveillance Activities

Monitoring Activity	Facility	Minimum Frequency[1]	Documentation	Review Period Compliance[1]	Notes for the Review Period
Inspections					
Routine Visual Inspections [2]	L-L Dam / H-H Dam	Weekly	HVC Inspection Reports	Yes (refer to Notes)	HVC completed weekly inspections during 50 of 52 weeks at the L-L Dam and 48 of 52 weeks H-H Dam. ▪ For periods when the weekly inspection forms were not completed HVC dam inspectors completed daily inspections which are documented on a form. These demonstrate that visual inspections were completed at least weekly by trained personnel. In addition, HVC completed their weekly reviews of dam performance which looks at quantitative performance metrics such as instrumentation trends, freeboard and beaching.
	24 Mile 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 TSF / Sediment and Water Ponds	When Triggered [3]	HVC Inspection Reports	N/A	No event-driven inspections were triggered during 2021.
Annual Facility Performance Report	Highland TSF	Annual	AFPR	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)	HVC Inspection Reports	Yes (refer to Notes)	Refer to discussion regarding visual inspections at H-H Dam and L-L Dam.
Instrumentation Monitoring					
Pond Level	Highland TSF / 24 Mile 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 [4]	GeoExplorer Database	Yes	There were temporary periods where some piezometers and inclinometers were out of service. However, due to redundancy throughout the system there was no period when the dam did not have adequate functional instrumentation to monitor performance.
Instrumentation – Inclinometers	L-L Dam / H-H Dam	Varies [4]	GeoExplorer Database	Yes	
Instrumentation – Sondex (Settlement)	H-H Dam	Monthly	Sondex Tracking Register	Yes	-
Survey Monuments	H-H Dam Lock-block Wall	Monthly (No Construction) / Weekly (Construction)	Survey Tracking Register	Yes	At least one survey was completed during each month of the review period (total 16). Construction refers to fill placement immediately upslope of the wall, none of which was completed.
Instrumentation – Seepage Weirs	L-L Dam	Monthly	HVC Inspection Reports	Yes	Weir LL—FS-02 was within the ultimate footprint of the L-L Dam and was removed in March 2021 during foundation preparation in the area.
Surveys					
Construction Record Surveys	L-L Dam / H-H Dam / 24 Mile TSF	Annually	Construction Record Report & Drawings	Yes	Issued as separate report.
Tailings Pond Bathymetric Surveys	Highland TSF	Twice per Year	Facility Performance Report	Yes	Surveys completed in May and September.
Tailings Level (Buffer)	H-H Dam	Weekly	HVC Inspection Reports	Yes	-
Survey of Beach Length	L-L Dam	Twice per Year	HVC Inspection Reports	Yes	Aerial images and surveys completed in May and September.

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. HVC 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 2020b).
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 (HVC 2021).

The current suite of functional geotechnical instruments at the L-L Dam (211) and the H-H Dam (39) is sufficient to demonstrate the dams are performing within acceptable limits and consistent with design. Instrument locations are shown on Figures 3 and 5 at the end of the report and summarized in Appendix III-A and IV-A. During the review period, HVC installed the following instruments at the dams: L-L Dam – 1 replacement / 6 new; and the H-H Dam – 3 new. These included the inclinometer installations recommended by KCB during previous AFPRs (Table 8.1):

- One inclinometer (I21-05) was installed at the NBB, another install was attempted by could not be completed due to drilling challenges reaching the target depth. HVC plan to re-attempt the installation in 2022. These inclinometers, along with the two installed in 2020 (I20-02 and I20-03), add a secondary instrumentation line that extends from the upper bench to the toe, roughly aligned at Sta. 2+690, which increases monitoring coverage and redundancy at the NBB.
- Inclinometer I10-7, at the VBB, was reinstated and a replacement inclinometer for I10-6 was installed. These are part of the network of inclinometers (total of 10) used to implement the Observational Method (Peck 1969) at the VBB as discussed in Section 5.2.3.3.

The recommendations related to these installations (LL-2019-01 and LL-2020-01) have been closed, refer to Table 8.1. Appendix III-A and IV-A include further breakdown of the instrument installations at each dam during the review period.

There were disruptions to some of the remotely monitored instruments throughout the year due to software and hardware issues. However, they did not significantly impact the effectiveness of the Highland TSF surveillance controls due to redundancy in the system. Such temporary disruptions are typical for remote monitoring systems and HVC track this during routine weekly meetings. When an outage occurred HVC took action to address the situation and look for opportunities to prevent reoccurrence.

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 EPRP. 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 HVC if a TARP level has been exceeded were reviewed and updated by the EoR prior for implementation during 2021 construction.

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

- <u>HVC Weekly Surveillance Review Meeting</u> – summary of routine inspections, surveillance data and activities at the Highland TSF are reviewed by the HVC Tailings Group, including the QP, during a weekly intra-departmental meeting.

- Monthly EoR Surveillance Reviews – EoR completes a monthly review of the L-L Dam and the H-H Dam surveillance information which 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 a register of recommendations related to instrumentation and monitoring. The EoR presents a summary of the interpreted performance to the HVC Tailings Review Board (TRB) at each meeting (3 during the review period) to keep them apprised of the status and give them an opportunity to provide feedback. Based on the information presented at each meeting the TRB concurred with the EoR's interpretation that the structures are performing as intended.
- Routine EoR Reviews (triggered by TARP) – a localized deviation from historic or expected behaviour at an instrument will trigger the first level of the TARP, referred to as "Notification Level." An exceedance of the Notification Level does not represent a dam safety concern or unacceptable performance but requires a review by the EoR that focuses on the following:
  - assess the cause for the measured response (e.g., faulty instrument, change in soil behaviour, 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;
  - 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, also requires other indicators of unacceptable performance (e.g., visual observation). No TARP levels, other than Notification Level, were triggered by instrument readings for 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 interpreted as an indicator of unacceptable performance or dam safety concern. The goal of the Notification Level is to use 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., construction 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.

5.2 L-L Dam Performance Summary

5.2.1 Pond Levels and Freeboard

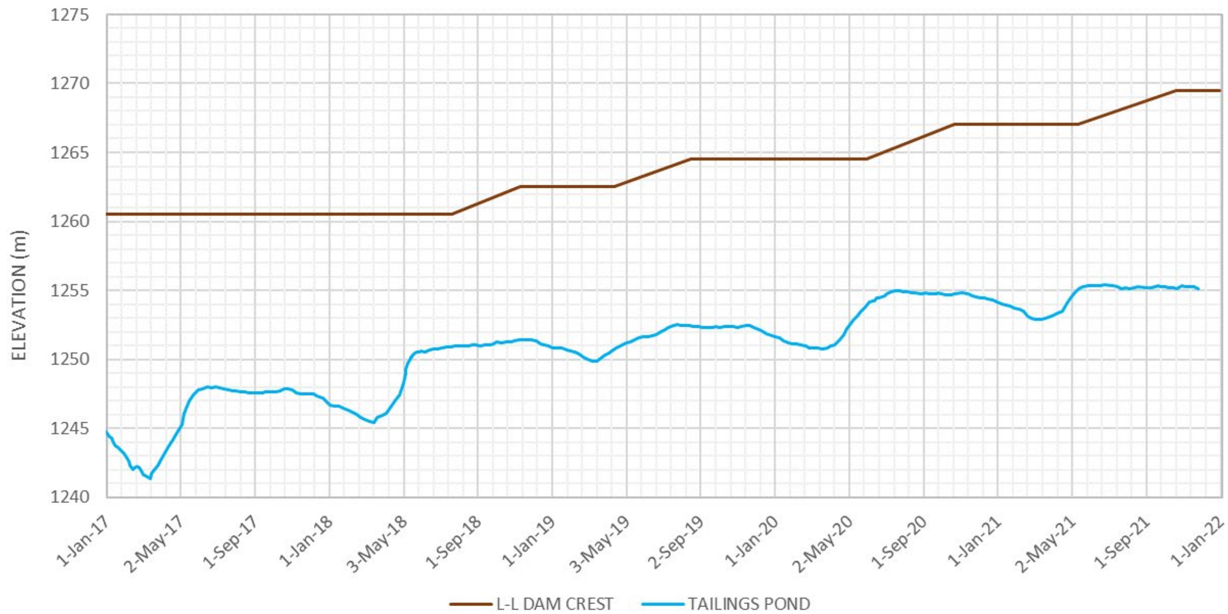
The Highland TSF pond elevation and the L-L Dam crest over the past 5 years, including the review period, is shown on Figure 5.1. Figure 5.2 plots pond elevations and volumes during the review period. Pond volumes are estimated by HVC based on the most recent bathymetry survey. Refer to Section 4.1 for further discussion of the Highland TSF water balance and pond volume forecasts. The annual pond rise during 2021, based on peak and end of year levels, was the lowest measured compared to the previous 4 years (Table 5.2) and pond volumes decreased during the review period. As discussed in Section 4.1, this was primarily related to a relatively dry year (i.e., low precipitation) in comparison to recent years.

The 2021 crest raise elevation was set assuming a pond level rise of 2.5 m. Since the actual rise (0.6 m) was much less, the volume of additional flood storage, over and above design flood requirements, available in the impoundment at the end of this review period has increased ~22 Mm^3 relative to 2020. This has no impact on life-of-mine construction planning as the crest rate of rise at both dams is governed by tailings beach level, not flood storage

Table 5.2 Highland TSF Change in Pond Elevation

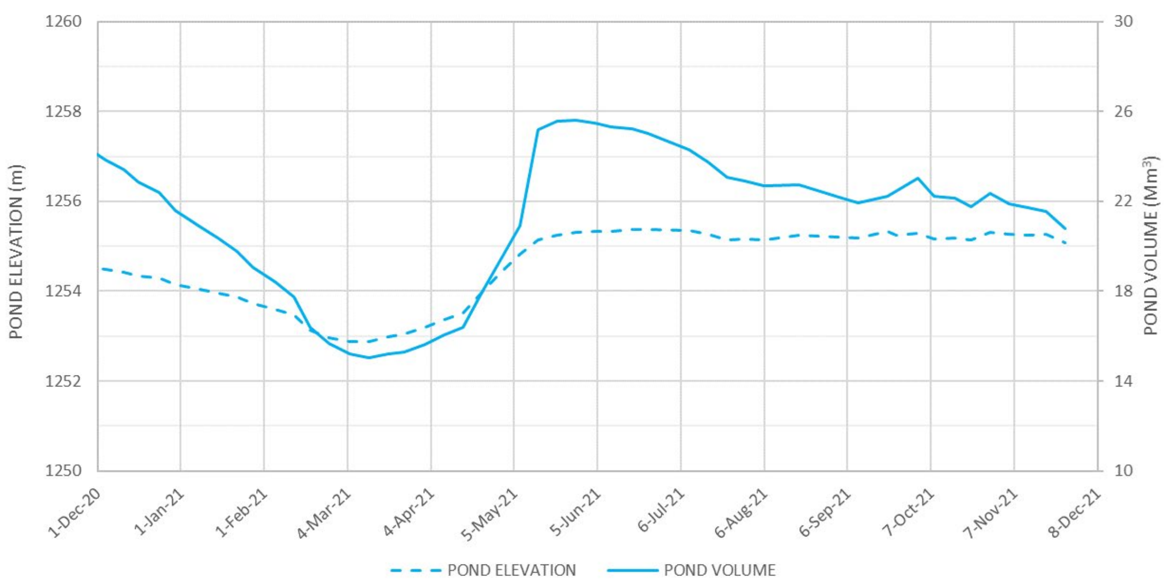
Annual Measured Change (Relative to Prior Year)	Reporting Period	Range of Annual Pond Level Change 2017 to 2020
Peak Pond Level	0.4 m	0.4 m to 3.4 m (avg. 1.8 m)
Pond Level at End of Year	0.6 m	0.9 m to 3.7 m (avg. 2.1 m)

Figure 5.1 Highland TSF Pond and Crest Elevations: 2017 to 2021



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

Figure 5.2 Highland TSF Pond Elevations and Estimated Volumes During Review Period



The minimum freeboard measured during the review period at the L-L Dam and the downstream ponds are summarized in Table 5.3. Target flood freeboard requirements were met at all facilities during the review period. At the end of the review period freeboard at the L-L Dam had increased to ~14.5 m.

Table 5.3 Summary of Freeboard Requirements and Minimum During Review Period

Facility	Minimum Freeboard		
	Required During IDF[1]	Predicted During Peak Design Flood Level	Observed During the Review Period [2]
Highland TSF	2.0 m	6.1 m [3]	11.6 m [4]
Sediment Pond 1	0.5 m	0.5 m	1.6 m [5]
Seepage Pond 2	0.5 m	0.5 m	1.5 m
Sediment Pond 2	0.5 m	0.5 m	1.7 m
Seepage Water Reclaim Pond	0.5 m	n/a [7]	3.0 m [6]

Notes:
1. Refers to the minimum vertical distance between peak pond level during the IDF and low point of crest.
2. Based on maximum recorded pond elevation during the review period.
3. The minimum estimated freeboard at the L-L Dam if the IDF had occurred at peak 2021 pond level.
4. Based on peak 2021 pond level during review period and L-L Dam crest elevation at the time (El. 1267 m).
5. Measured relative to overflow point into SWRP.
6. SWRP freeboard during 2021 is measured relative to the spill point where water would start to flood the surrounding area (El. 1103.2 m). The freeboard relative to an off-site spill is 4.8 m higher than the value reported in the table.
7. During the IDF, water from the SWRP would flood the adjacent area, mainly Sediment Pond 1, potentially impacting HVC operations but resulting in no off-site discharge. The peak flood level during the IDF (El. 1105.3 m) is 2.7 m below the elevation required to discharge off-site (El. 1108 m, crest of downstream Laura Lake public road).

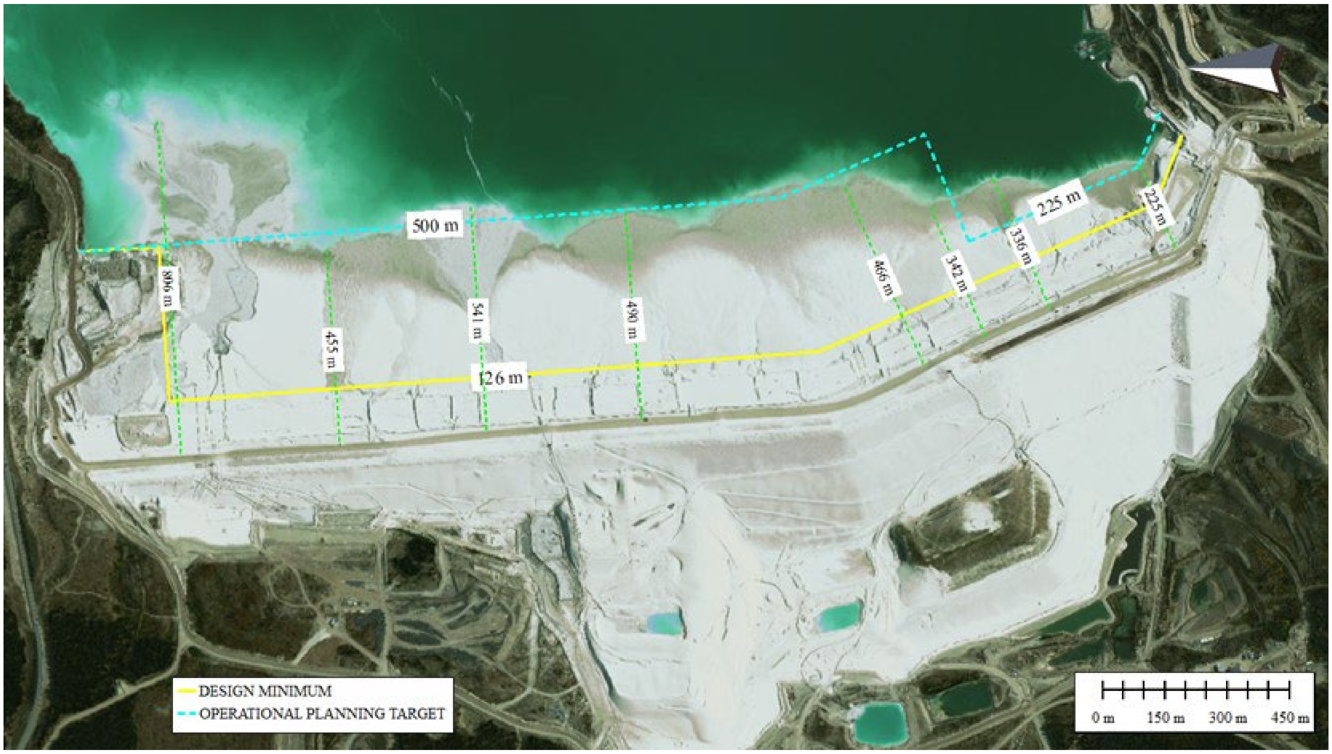
HVC has defined alert levels which, if exceeded, trigger escalating action to mitigate flooding-related risks (e.g., increased monitoring, active measures to drawdown pond level). These alert levels are integrated with the site-wide emergency response plan, where appropriate. Pond alert levels for the Highland TSF were reviewed and updated based on current conditions. Alert levels were also developed for the downstream sediment and seepage ponds in; all alert levels are defined in the revised OMS Manual (HVC 2021).

5.2.2 Beach Width

The 500 m (minimum) beach width at the North Abutment and 126 m (minimum) beach along the remainder of the crest specified by design (KCB 2020a) were met throughout the reporting period. The increased beach width at the North Abutment is required to reduce seepage flows and gradients through the foundation in this area (see Section 7.4.2). Similar to recent years, the beach width in this area was maintained by a combination of spigotted tailings, foundation preparation spoils and overflow sediments from hydraulic placement, as shown on Figure 5.3. As the pond rises it encroaches more onto the spoils pile, narrowing the beach. Over the next few years, the beach requirement will transition to being met by spigotted tailings rather than the spoils pile.

In 2019, HVC initiated a campaign to increase beach width along the full length of the crest. This is not a design requirement but is an effective risk reduction activity supported by the EoR and the TRB. By October 2021, the target beach widths had been achieved along the majority of the crest, refer to Figure 5.3 (green line).

Figure 5.3 Status of L-L Dam Beach as of October 2021



5.2.3 Instrumentation Trends

5.2.3.1 Overview and Notification Level Exceedances

This section provides an overview of general measured piezometric and deformation behaviour, based on instrumentation readings during the review period at the L-L Dam. November 2021 instrumentation readings are shown on select design cross sections of the L-L Dam (Figure 8 to Figure 14, at the end of the report). 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 deformation rates measured at the L-L Dam (<1 mm/month). Interpretation of inclinometer plots are based on cumulative, incremental change over time. This helps to filter out deformations that are related to the measurement method. This is completed by both HVC and KCB teams as part of routine instrument reviews. Over the past 4 years, HVC have started to use in-place ShapeArrays (SAAV) at priority monitoring locations (e.g., near dam toe or used to implement Observational Method at VBB) which have demonstrated to have higher precision (i.e., less variance between readings).

During the review period, 7 Notification Level exceedances were triggered. As discussed in Section 5.1, exceedance of a Notification Level does not represent a dam safety concern or unacceptable performance but requires a review by the EoR. None of these exceedances were elevated to a higher level of the TARP. Based on review, the EoR concluded the exceedances were related to:

- The deformation rate measured along a mudstone layer at inclinometer I99-05 in the North Dam Bedrock segment exceeded the threshold. This was in response to loading and was a localized exceedance (i.e., deformations were contained downstream). Refer to Section 5.2.3.6.
- Piezometer LL-VWP09-03C at the toe of the NBB went offline temporarily, and when it came back online it was reading a much higher piezometric level (~10 m), which exceeded the threshold. A similar response was not measured at nearby instruments and no deformation was measured at the inclinometer immediately adjacent to where the piezometric rise was measured (refer to Section 5.2.3.5). Investigation by HVC indicates this exceedance may be related to the instrument tip being set at a higher elevation after the casing was raised and are going to confirm this during 2022.
- Interpreted deformation rates that exceeded thresholds but, following review, were confirmed as being related to other factors (e.g., removal of cap leading to a loss of compression on an SAAV at I19-04, and inclinometer readings not being seated properly at the base of the hole at I17-09 and I17-10). Following each instance, HVC and KCB reviewed the cause and identified actions to be taken to prevent reoccurrence.
- The deformation rate was influenced by deflection along the inclinometer casing (e.g., compression zone) unrelated to foundation or dam fill deformations. These were closed out by modifying elevation range used to monitor deformation rates in target units.

In addition to confirming that the dam is performing as expected, Notification Level exceedances help identify areas where action could be taken to maintain or improve the performance of the instrumentation system.

5.2.3.2 South Dam

November 2021 instrumentation readings from South Abutment near Sta. 1+200 are projected onto a dam cross section (Figure 8, at the end of the report). Instrument behaviour shown on Figure 8 is not representative of behaviour south of Sta. 1+100. As shown on Figure 6, at the end of the report, construction activity in the South Dam area during the review period included crest raise downstream fill placement.

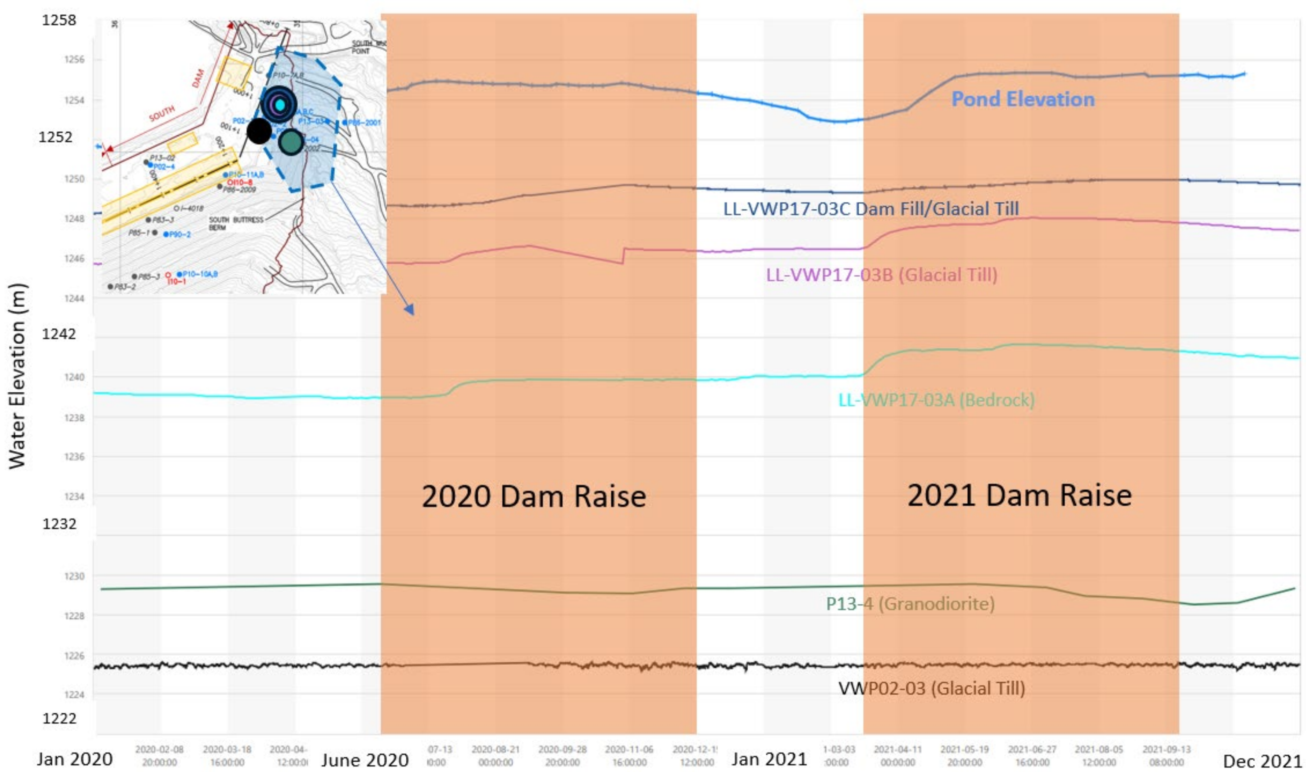
Piezometers

Measured behaviour during the review period was consistent with the expected behaviour and conditions assumed in design.

South of Sta. 1+100

Since downstream hydraulic placement was completed near the abutment in 2018, pond level change has governed piezometric response near the abutment. Figure 5.4 plot measured response at select piezometers near Sta. 1+050 since 2020 to show typical behaviour in this segment of the dam. South of Sta. 1+100, where these instruments are located, the dam was initially raised entirely with glacial till fill (i.e., no hydraulic sand). The response measured in the glacial till fill (LL-VWP17-03C), near centerline, is representative of the piezometric level in the core zone rather than the downstream cycloned sand. Downstream of the glacial till fill, where the dam was raised with cycloned sand and underdrains are present, the piezometric levels in the fill and foundation reduce (e.g., LL-VWP02-03 and P13-4).

Figure 5.4 Measured Piezometric Response at South Dam (Sta. 1+050): January 2020 to November 2021



Base figure showing piezometer data extracted from HVC's instrumentation data management software.

Sta. 1+100 to Sta. 1+500

Piezometers in this segment of the dam were relatively stable. Piezometer LL-VWP12-05, installed in the cycloned sand fill, showing a modest rise (~2 m) which is expected as the instrument is directly below the active hydraulic fill placement area.

Inclinometers

Inclinometers were also consistent with typical behaviour through the review period with no defined shear or deformation zones of concern. When inclinometers are raised through the dam fill, an outer corrugated pipe is placed around the casing to separate it from the dam fill. This prevents compaction of the fill during hydraulic placement from damaging the casing which was a reoccurring issue in the past. Inclinometers raised in this manner can show horizontal deformations through the dam fill, for example I10-01 (refer to Appendix III-C). This deformation is due to the casing moving within the open annulus between it and the outer corrugated pipe. This is not reflective of actual deformations within the fill, which is compacted to the target density confirmed by quality control and quality assurance testing.

5.2.3.3 Valley Buttress Berm

November 2021 instrumentation readings near Sta. 1+850 are projected onto a dam cross section (Figure 9, at the end of the report). As shown on Figure 6, at the end of the report, construction activity in the VBB area during 2021 included a crest raise, and hydraulic fill placement at the downstream toe.

Piezometers

Overall piezometric levels in the dam fill and foundation were relatively steady with no significant response to pond level rise. This is consistent with the typical behaviour of the Lower Sand and Gravel and glacial till foundation units.

The blanket drain at the VBB is the low point of the dam where all seepage through the downstream shell reports. Current water levels measured in the drainage blanket are consistent with historic levels during multiple years of periods of significant hydraulic dam fill placement, such has been the case since 2018. The piezometric response in the drainage blanket and native Lacustrine Unit are shown on Figure 5.5. The Lacustrine Unit is only present below the Starter Dam and has been excavated below the cycloned sand shell. Historically piezometric response in the Lacustrine Unit has responded similarly to the drainage blanket. This is because the drainage blanket was placed against the excavation face of the Lacustrine Unit leading to both materials being hydraulically connected through horizontal flow.

Pore pressures in the Lower-Glaciolacustrine Unit (L-GLU) at the VBB typically increase in response to construction loading, followed by a period of dissipation. As the only fill placement was at the toe, piezometric levels in the L-GLU below the mid-bench and upper slope continued to dissipate elevated pressures from 2019 loading or were steady as expected (Figure 5.6). Fill was placed at the VBB toe in December 2021, outside of the review period for this report and is therefore not shown on any of the summary figures in Appendix III-B. This will be included in the next AFPR but in general no significant response to loading was measured.

Figure 5.5 Measured Piezometric Response at VBB Dam Fill and Shallow Foundation: January 2020 to November 2021

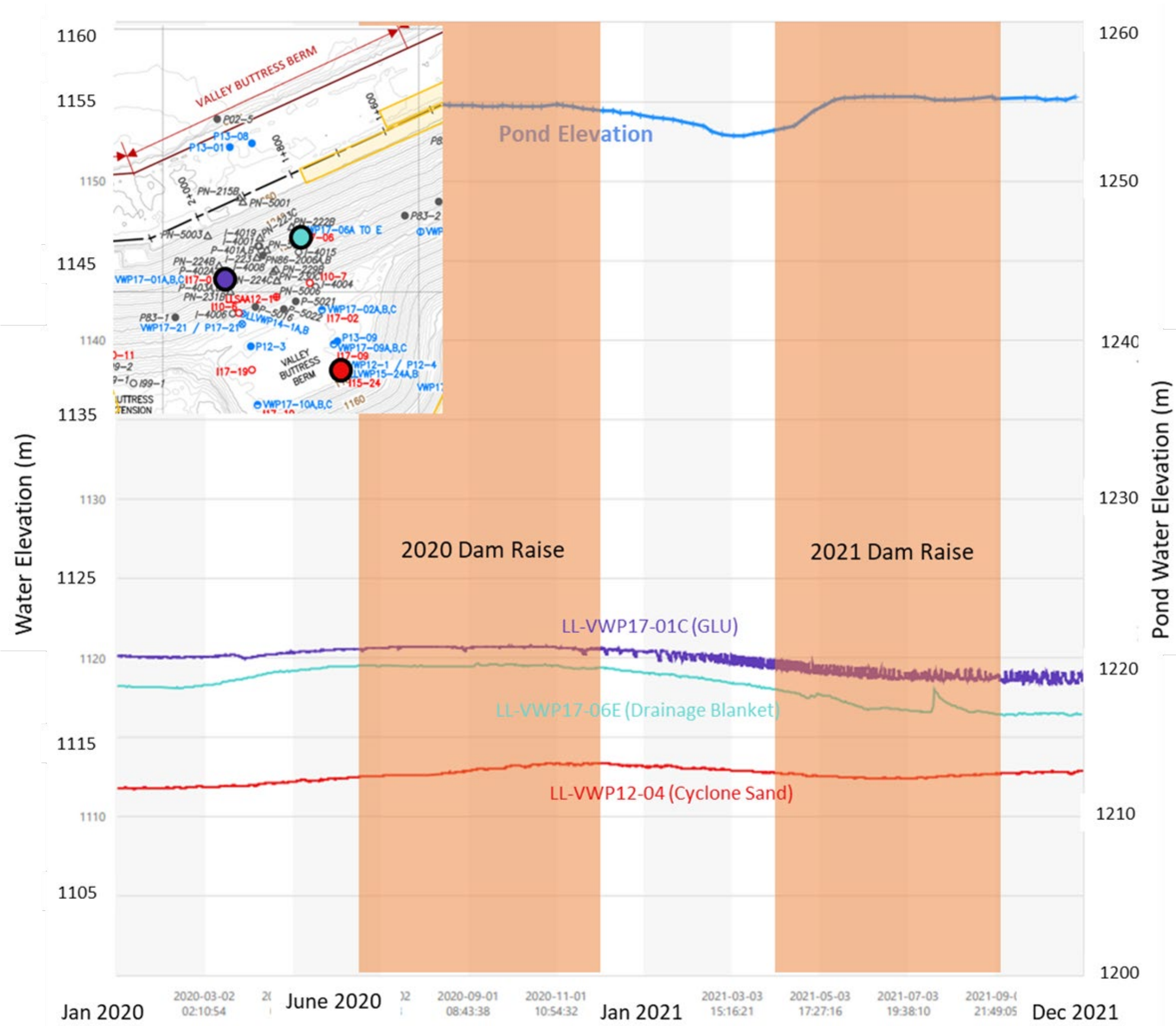
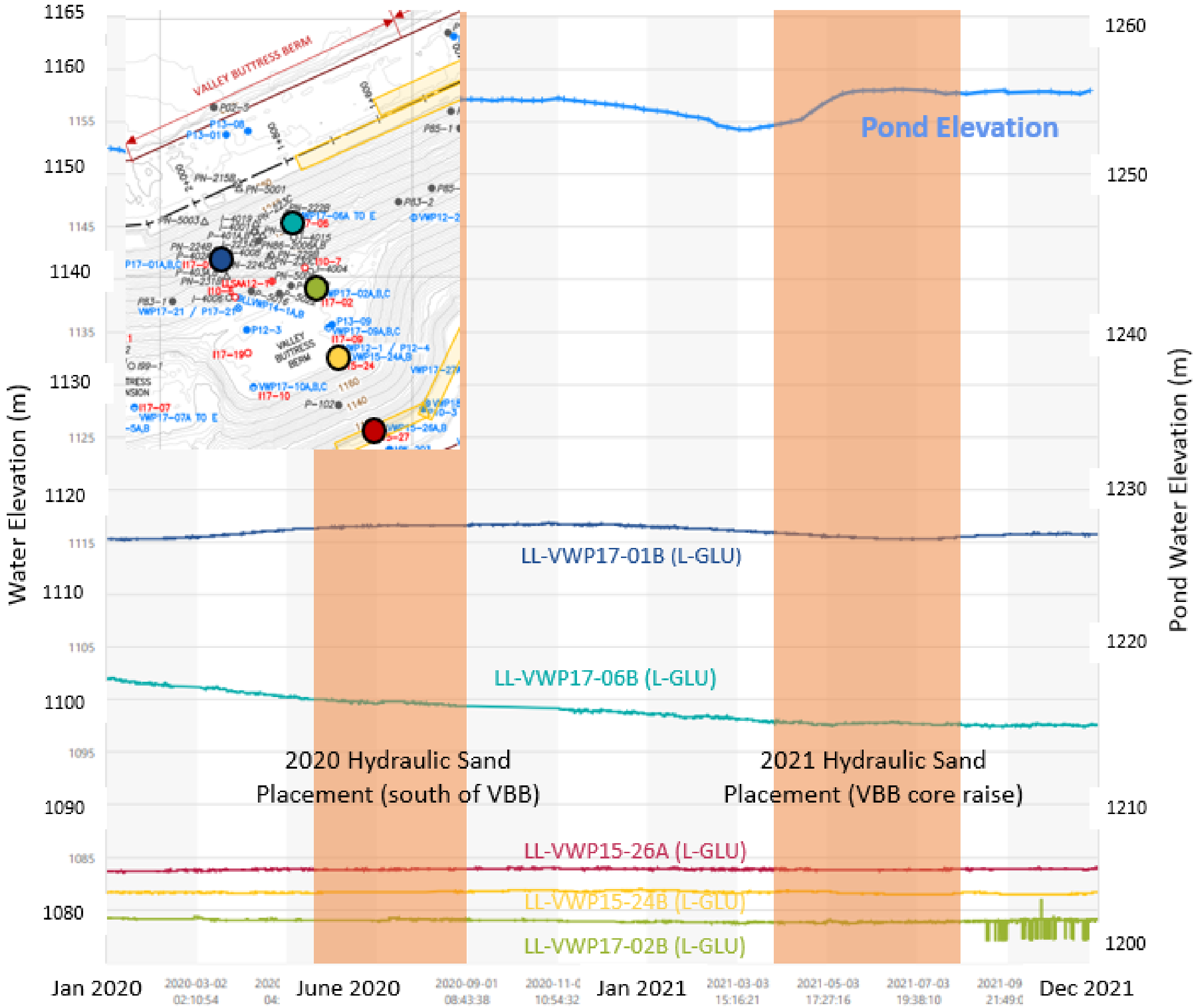


Figure 5.6 Measured Piezometric Response at VBB L-GLU: January 2020 to November 2021



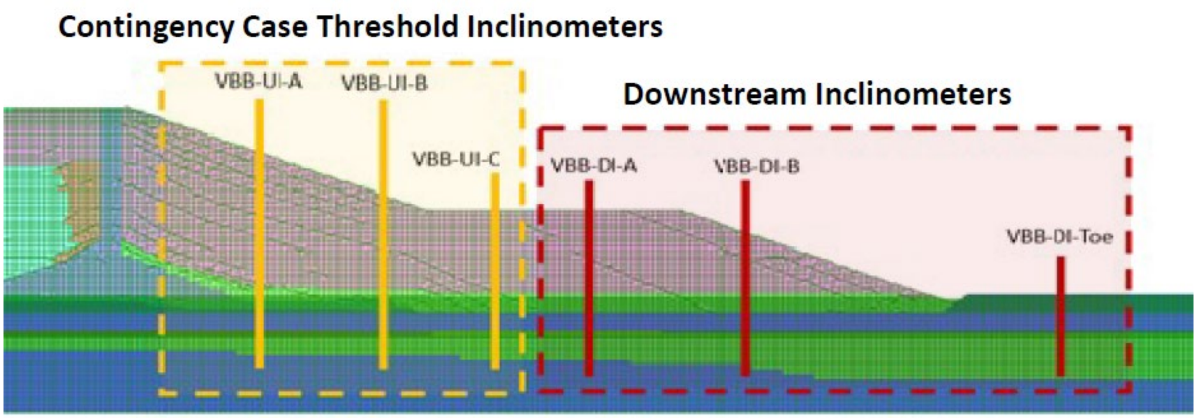
Inclinometers

The design of the VBB is governed by L-GLU which is continuous beneath the VBB. The VBB design and construction sequence is intended to limit progression of deformations within the L-GLU towards the toe so the deformations remain contained. The primary function of the inclinometers at the VBB is to monitor deformation within the L-GLU to:

- support implementation of the Observational Method (Peck 1969), as described in KCB (2020a) and discussed in Section 5.2.4; and
- measure actual behaviour for comparison to expected behaviour based on design.

Similar to other segments of the dam where the design is governed by lower-strength units within the foundation, deformations within the lower-strength units are predicted to occur below the upper slope of the dam; however, the deformations are contained (i.e., do not progress to the toe). Based on Figure 5.7, deformations are expected within the yellow zone but negligible deformation in the red zone. Figure 21, at the end of the report, plots measured deformations since 2018 for three Contingency Case Threshold inclinometers (yellow zone) and two downstream inclinometers (red zone). The difference in deformation between the yellow and red zones clearly supports that actual behaviour is consistent with design predictions from the deformation model.

Figure 5.7 VBB Inclinometer Location ID



The magnitude of deformation measured within the L-GLU during the review period was also consistent with predicted based on deformation modelling. Specifically, deformations within the L-GLU were greatest below the upper slope and do not extend to the downstream toe which demonstrates deformations are contained and performance is acceptable. For example, based on deformation measured since August 2019 within the L-GLU:

- Upper slope = ~7 mm (I17-01, VBB-UI-A);
- Mid-bench = ~3 mm (I10-7, VBB-UI-B); and
- Toe = ~0.2 mm (I15-27b, VBB-DI-Toe).

The overall direction of deformation is downstream with one exception at I17-02 where the deformation direction is south which is believed to be related to an error in the orientation of the inclinometer casing grooves and/or data processing corrections applied. HVC have taken action to address this uncertainty for 2022.The status of potential triggering of the Contingency Case at the VBB, which is based on deformations within the L-GLU, is discussed in Section 5.2.4.

Horizontal deformations are measured within the Lacustrine Unit as expected and consistent with historical behaviour. The Lacustrine Unit has been removed from the majority of the downstream slope and replaced with compacted fill (Figure 2.1). Therefore, deformations within the unit are contained and cannot extend to the downstream toe which is supported by the inclinometers further downstream that show no shear zones through the dam fill.

Inclinometer I15-24 has been out of service since August 2019, when the in-place Inclinometer became stuck in the hole during a routine check of the equipment. Since that time, HVC have attempted several methods to reinstate monitoring at this location but have not been successful. As a result, HVC have declared the instrument as defunct. KCB recommends that a replacement inclinometer be installed at that location to reinstate redundant monitoring points during loading. In addition, monitoring along this portion of the slope is important to demonstrate deformations within the L-GLU are contained.

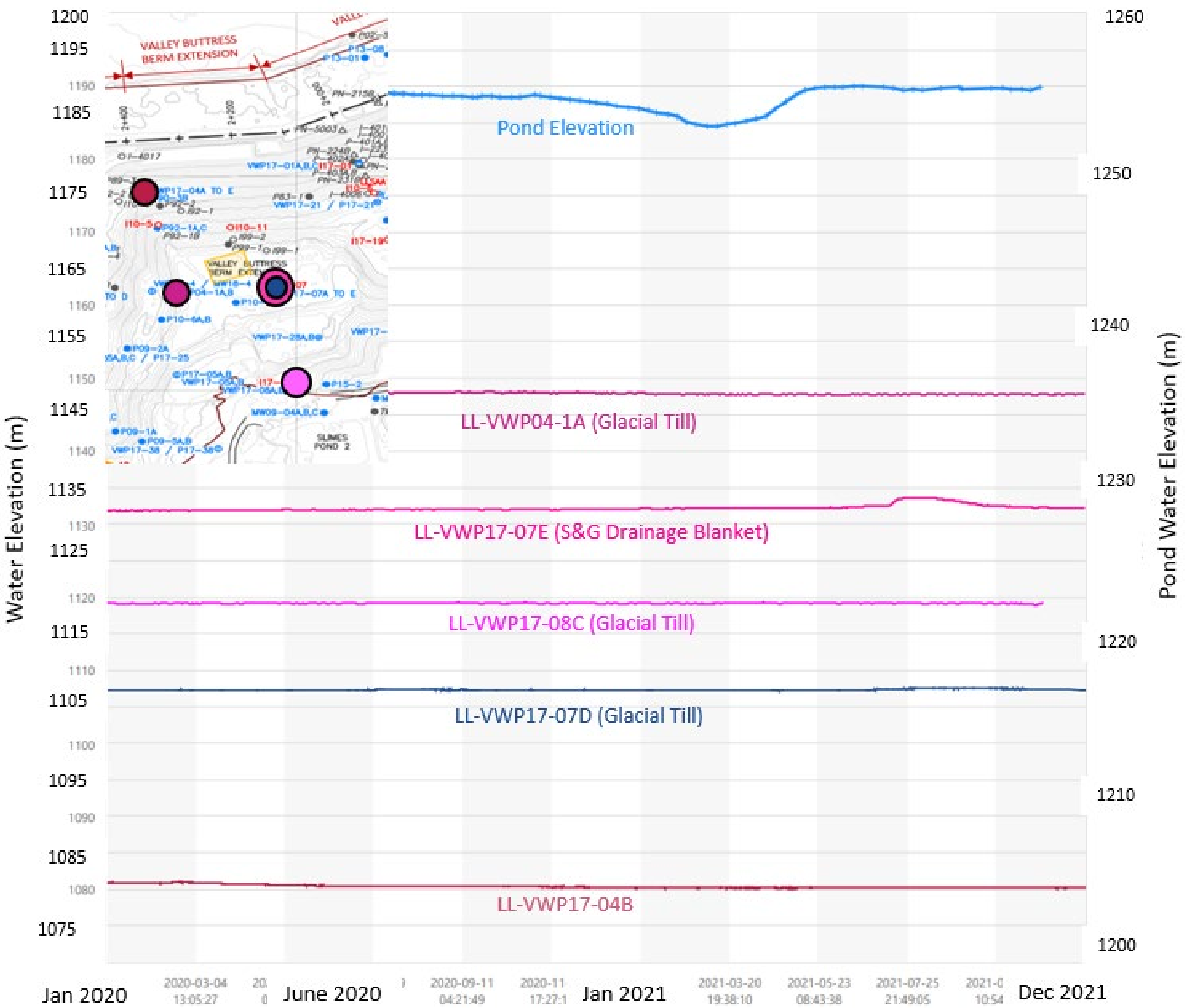
5.2.3.4 Valley Buttress Berm Extension

November 2021 instrumentation readings near Sta. 2+250 are projected onto a dam cross section (Figure 10, at the end of the report). As shown on Figure 6, at the end of the report, construction activity in the VBBE area during 2021 included a crest raise only and operation of the temporary on-dam sediment storage cell.

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. Measured response at select piezometers at the VBBE, since 2020, is shown on Figure 5.8 and representative of typical behaviour in this segment of the dam.

Figure 5.8 Measured Piezometric Response at VBBE: January 2020 to November 2021



Inclinometers

Readings from inclinometer I10-11 (located mid-slope) indicate a deformation zone is present at the base of the Lower Sand and Gravel Unit directly above the granodiorite bedrock contact (~115 m to 125 m below existing ground). In total ~3 mm of deformation was measured over a 10 m vertical length during an 8-month period (<0.4 mm/month). The deformation is distributed relatively uniformly across the deformation zone. This deformation pattern is characteristic of measured behaviour in glaciolacustrine and lacustrine deposits at the VBB and North Dam. Neither unit was logged at this location during drilling due to the air rotary drill method used at this location, which has historically been a poor method to identify these deposits.

KCB are proceeding on the assumption that this deformation zone is a lens of glaciolacustrine. This does not represent a change to the design which already assumed such lenses are present. In addition, this layer is too deep to govern stability and the adjacent inclinometers (I20-01) and downstream inclinometers (I17-07 and I17-08) do not show similar deformation zones or suggest the layer would be continuous, if present.

Based on drill hole information and the geologic characterization of the L-L Dam foundation (KCB 2020b), 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 2020a). The measured response at all inclinometers at the VBBE continue to support this interpretation (i.e., no discrete shear zones similar to those measured at NBB have been identified).

5.2.3.5 North Buttress Berm

November 2021 instrumentation readings near Sta. 2+564 are projected onto a dam cross section (Figure 11, at the end of the report). As shown on Figure 6, at the end of the report, construction activity in the NBB area during 2021 included a crest raise and extending the north side to ultimate slope.

Piezometers

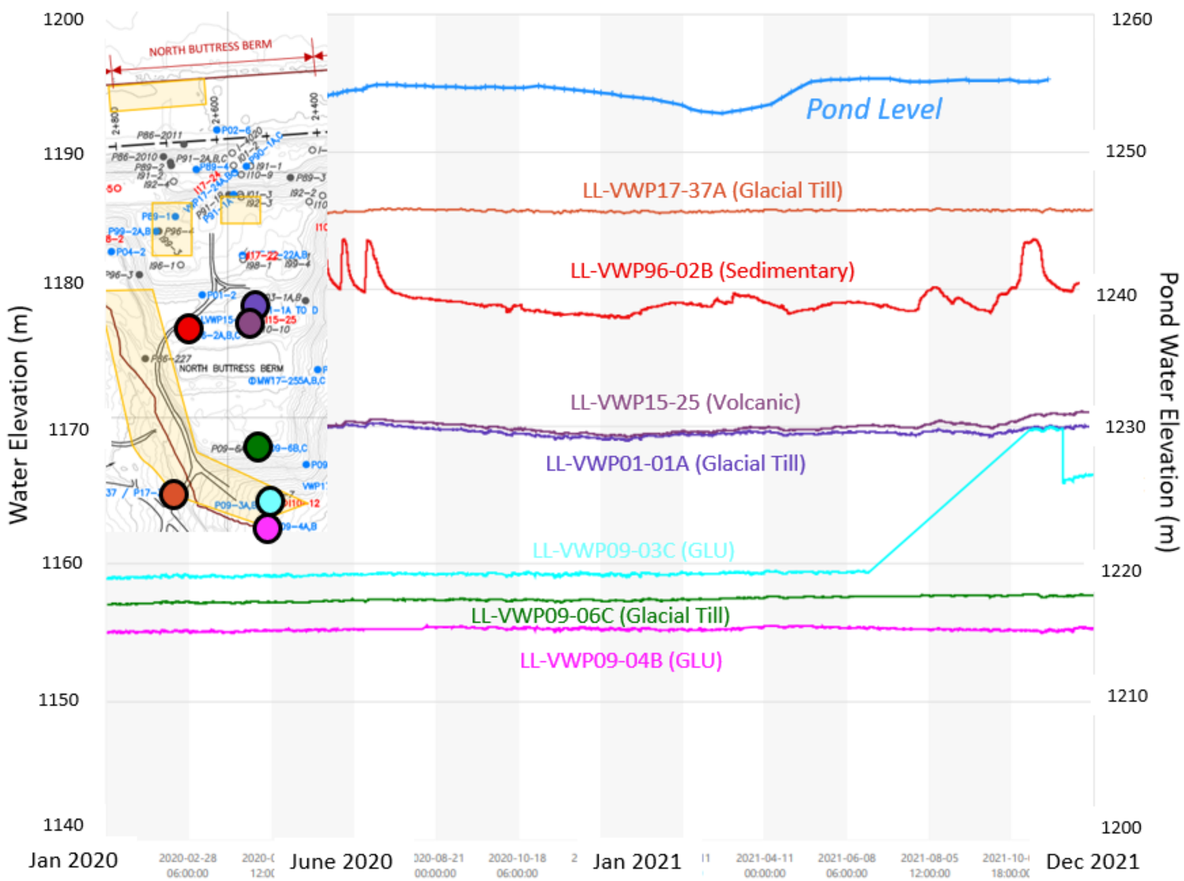
The piezometric levels in the foundation remained steady throughout the review period, except for one outlier response (discussed below) and the expected localized temporary response to hydraulic placement measured at some locations (e.g., LL-VWP96-02B). Figure 5.9 plots measured response at select piezometers at the NBB since 2020 that show typical behaviour in this segment of the dam.

The outlier response was measured at LL-VWP09-03C installed at the toe of the NBB in the L-GLU. L-GLU at this location is assumed present and accounted for in the design. The piezometer was offline from late June to mid-October due to an issue with the data logger. The instrument casing was raised while the instrument was offline, in preparation of fill placement in the area in 2022. Once brought back online, the pressure measured at LL-VWP09-03C was ~10 m higher than when the instrument went offline (Figure 5.9). During the period that the instrument was offline there was no construction loading in the area.

In early November, the piezometer had another sudden change in readings, dropping 4 m (Figure 5.9). This instrument does not have a history of variability, and prior to this had been relatively constant dating back at least to 2015. During the review period, there was no change in deformation pattern at the inclinometer immediately adjacent to this piezometer (I10-12). Assuming the piezometric rise is accurate, the inclinometer confirms it is not having a measurable impact on local performance at the toe of the NBB. In addition, a similar response was not measured at any of the nearby piezometers, including LL-VWP09-04B which is also in the L-GLU, approximate 50 m west of LL-VWP09-03C.

An investigation by HVC, completed after the EoR review of the exceedance, indicates the instrument tip may have been set at a different elevation (i.e., higher) than specified after the casing was raised. That would explain the sudden rise and why no similar change or response was measured by adjacent instruments. HVC are going to remove confirm this prior to construction starts in the area and if required, will set the instrument back to the specified elevation and update the monitoring record to so piezometric levels are reflective of the actual tip elevation at the time readings were taken.

Figure 5.9 Measured Piezometric Response at NBB: January 2020 to November 2021



Inclinometers

Deformation along mudstone layers in the foundation near the upper bench of the downstream slope (e.g., I17-24) have been measured along discrete shear planes within mudstone layers since the early 1990s and are expected to continue. Typically, deformation rates increase temporarily during construction loading and then attenuate after loading is completed. This pattern continued at inclinometer I17-24 during the review period. I17-24 is the nearest inclinometer to crest and the only inclinometer at the NBB where shear deformations along mudstone layers were measured during the review period. Deformation along the two mudstone layers intersected at I17-24 are plotted on Figure 5.10 and Figure 5.11. Both show the expected response where rates increase during periods of loading and then attenuate. The direction of deformation was along bedding which dips to the northwest.

Figure 5.10 I17-24 Measured Deformation Along Mudstone Layer (~El. 1116 m)

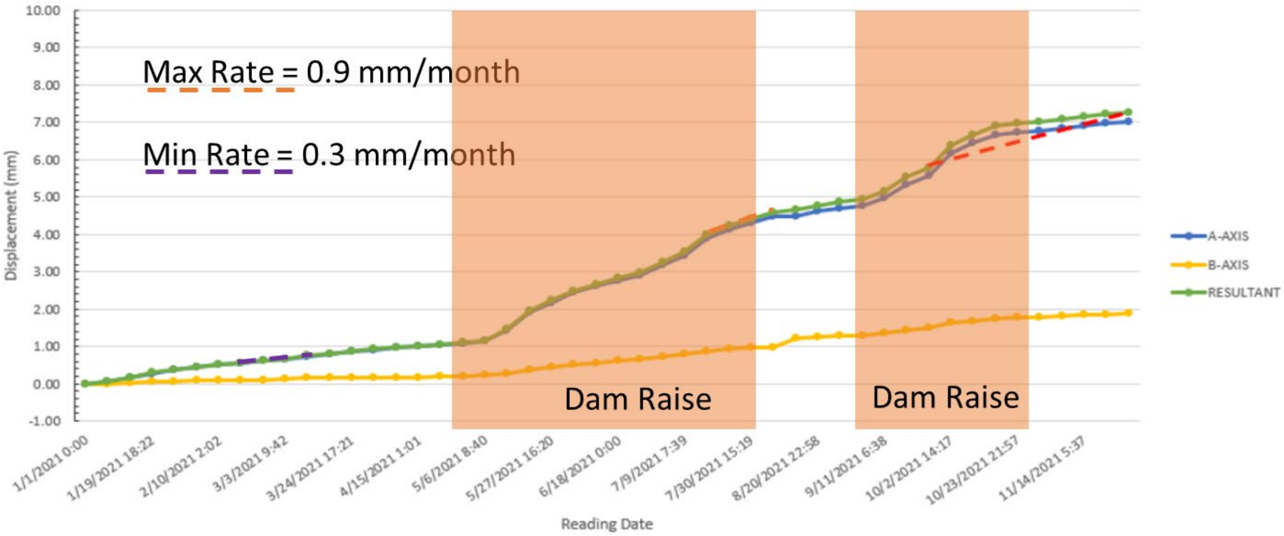
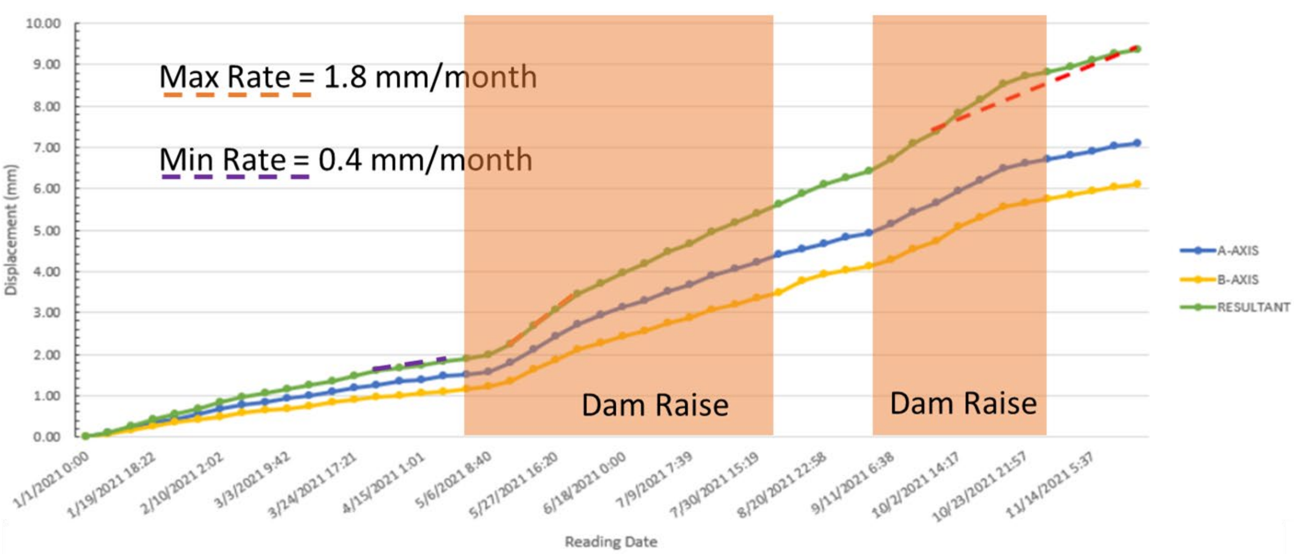


Figure 5.11 I17-24 Measured Deformation Along Mudstone Layer (~El. 1157 m)



The magnitude and rate of deformations measured during the review period (Table 5.4) are consistent with design expectations. In 2018, which was a significant year in terms of loading near the NBB, the range of deformation rates was similar but the highest deformations rate were measured at a different mudstone layer compared to this review period. This is not significant in terms of dam safety but these observations are helpful in future forecasting and calibration of the deformation model.

The design basis of NBB is to construct the NBB in a manner which, similar to the VBB, limits progression of mudstone shear deformations towards the toe so the deformations remain contained. Based on deformation modelling, deformations are predicted to reach I17-22 but not I15-25. To date, shear deformations have not been measured at either location.

Table 5.4 Summary of Typical Measured Deformation Rates at NBB Inclinometer I17-24

Inclino.	Station	Elevation of Deformation	Construction Influenced Peak Deformation Rate (mm/month)		No Construction Averaged Deformation Rate (mm/month)	
			2018	2021	2018	2021
I17-24	2+575	El. 1116 m	2.0	0.9	0.5	0.3
		El. 1157 m	1.1	1.8	0.2	0.4

There were issues with the inclinometer casing installed in 2020 which delayed commissioning of those instruments. These instruments, along with the two installed in 2021, will be commissioned by early 2022.

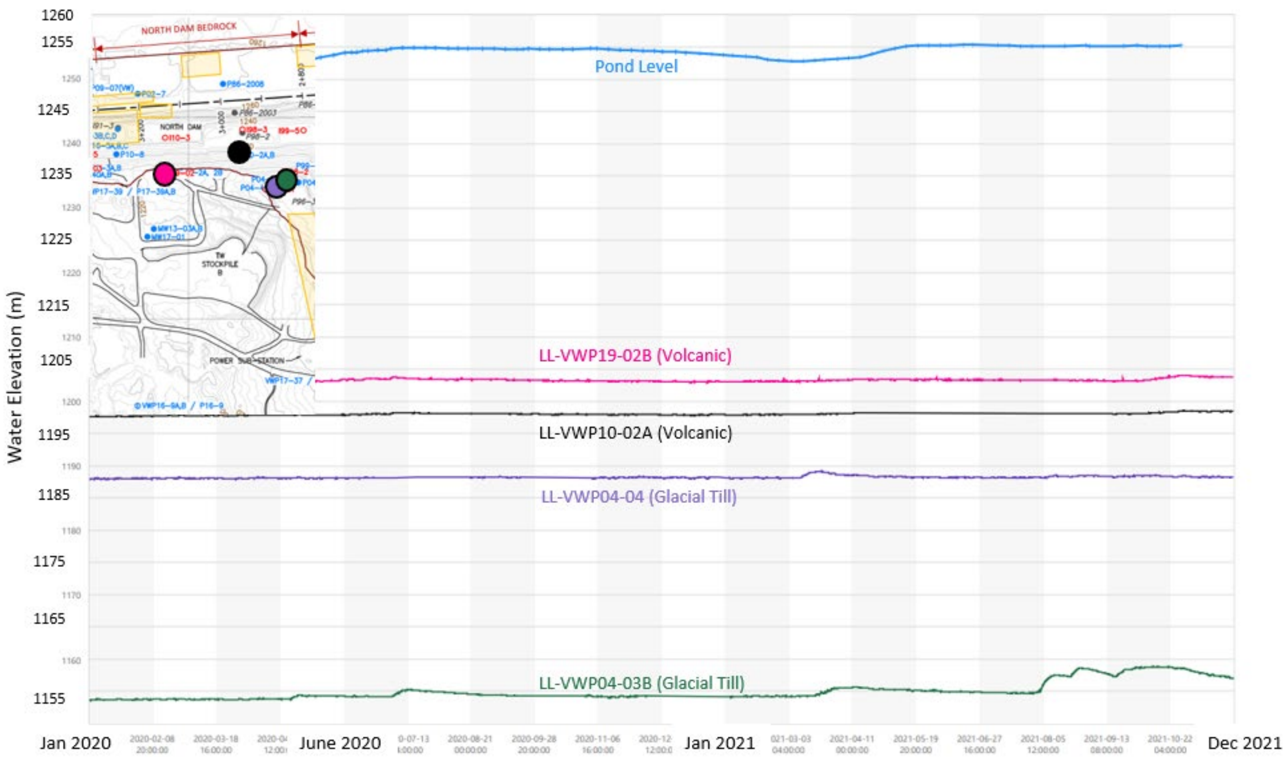
5.2.3.6 North Dam Bedrock

November 2021 instrumentation readings near Sta. 2+800 are projected onto a dam cross section (Figure 12, at the end of the report). As shown on Figure 6, at the end of the report, construction activity in the North Dam Bedrock area during 2021 included a crest raise and the extension to the north side of the NBB.

Piezometers

The piezometric levels in the foundation and drainage blanket remained relatively steady for the majority of the review period except some piezometers (e.g., LL-VWP04-03) measured a response to hydraulic placement when it commenced on the north side of the NBB in August. Figure 5.12 plots measured response at select piezometers at the North Dam Bedrock area since 2020 that show typical behaviour in this segment of the dam. The response measured at LL-VWP04-03 was greater than previously measured at the instrument but this was the first-time hydraulic placement was done over this area, this further supports the interpretation that this response was construction related. Piezometric layers have started to dissipate since hydraulic placement in the area was completed in mid-October 2021.

Figure 5.12 Measured Piezometric Response at North Dam Bedrock: January 2020 to November 2021

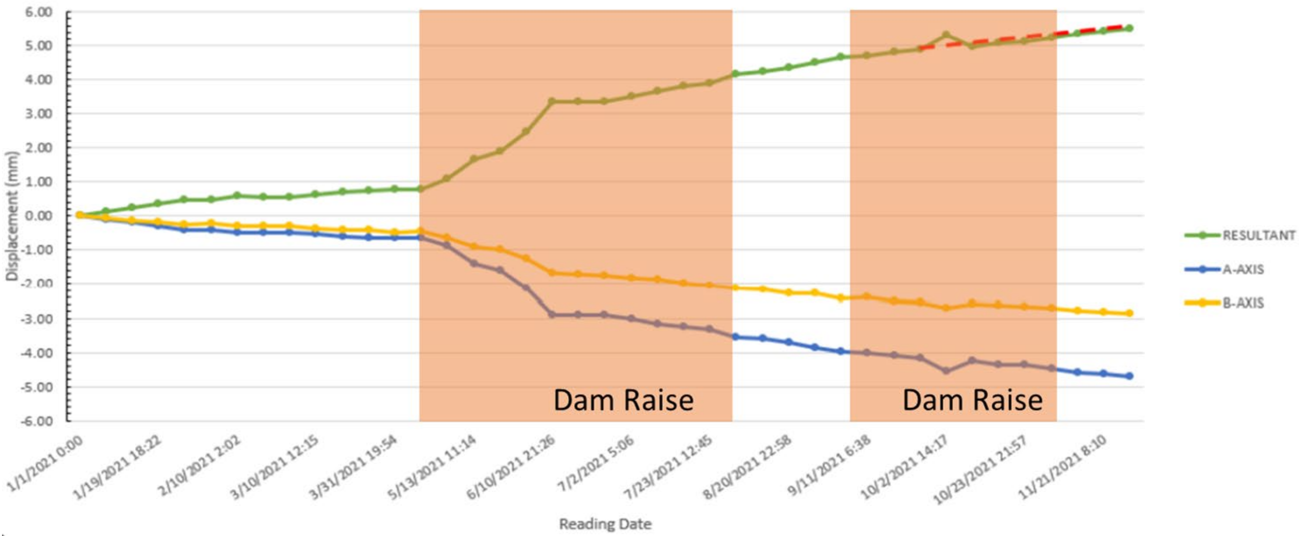


Inclinometers

Similar to the NBB, there are mudstone layers where shear deformations have been measured in the foundation of the North Dam Bedrock area. 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, no shear zones were measured within the volcanic bedrock at the toe of the slope (I19-01 and I19-02), as is expected based on design.

The same response to loading along mudstone layers discussed at the NBB was measured at North Dam Bedrock inclinometers, for example I99-05 (Figure 5.13). Deformation direction was northwest, along bedding, consistent with I17-24 at the NBB. I99-05 was the only inclinometer that exceeded the Notification Level threshold for that instrument (1.2 mm/month). The peak deformation rate measured was ~1.7 mm/month during loading which subsequently attenuated to ~0.3 mm/month, as shown on Figure 5.13. This magnitude of deformation is not a concern and is less than rates measured during previous loading periods. In addition, all deformations in the North Dam Bedrock area remained contained (i.e., did not progress into the passive wedge).

Figure 5.13 I99-05 Measured Deformation Along Mudstone Layer (~El. 1153 m)



Further north, at I10-03 and I19-02, where mudstone layers are deeper and not do not influence dam design, no shear deformations were measured in the foundation.

5.2.3.7 North Dam U-GLU

November 2021 instrumentation readings near Sta. 3+300 and 3+630 are projected onto dam cross sections (Figures 13 and 14, at the end of the report). As shown on Figure 6, at the end of the report, construction activity in the North Dam U-GLU area during 2021 included a crest raise, foundation preparation and partial fill placement of the North Dam Buttress.

Piezometers

Similar to the South Dam, piezometric levels downstream of the core zone near the North Abutment (north of ~Sta. 3+400) are governed by pond level rise. However, piezometric levels also show a temporary response to beaching and upstream cycloned sand placement. During the review period this response was measured when beach and fill placement was north of ~Sta. 3+400. This response is expected because, north of ~Sta. 3+600, the core zone could not be keyed into glacial till or bedrock due to the depth of excavation required. A minimum beach width (500 m) at the North Abutment is specified in design (KCB 2020a) to accommodate this change.

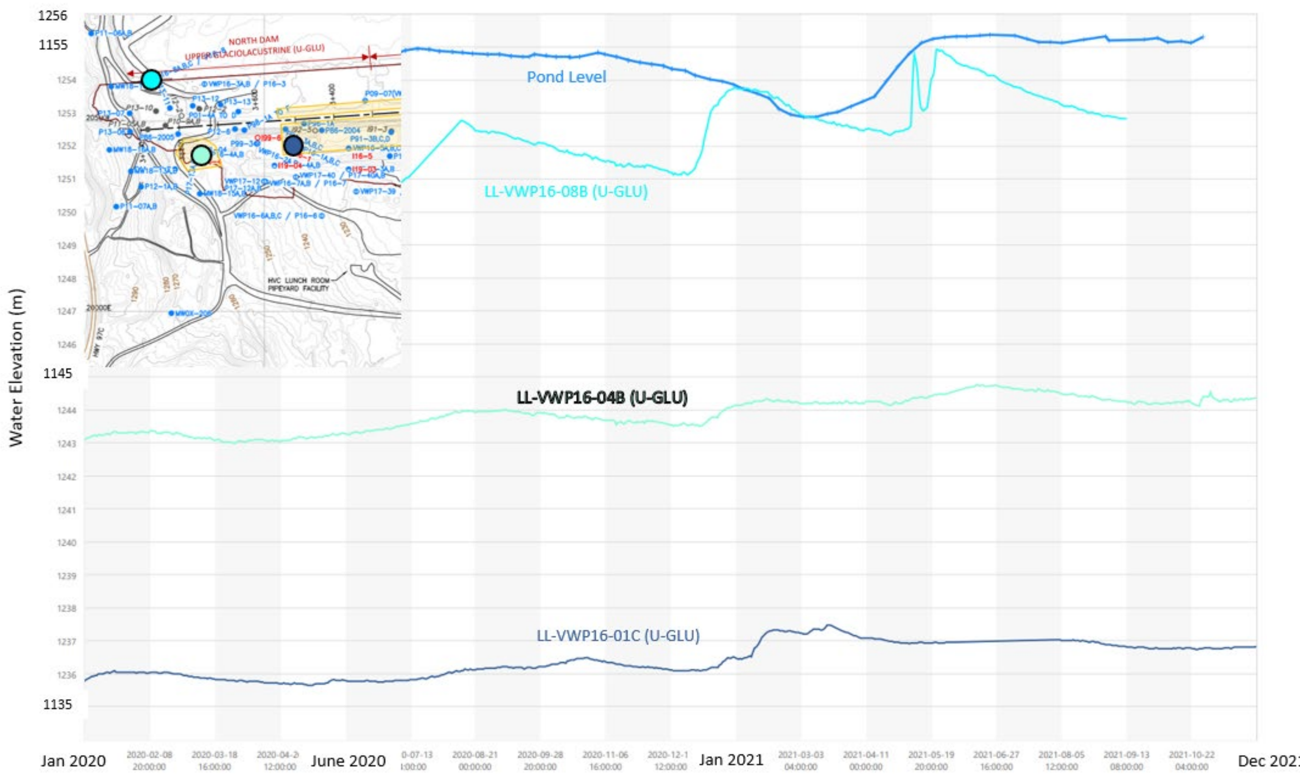
During the review period, piezometric response and trends were consistent with historic trends and rate of rise assumed in design (refer to Figure 5.14):

- Piezometric levels in the foundation near the North Abutment, upstream and downstream of the core, vary with changes in pond level:
  - 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 1 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 respond quicker to beaching and upstream cycloned sand placement than pond level rise. This is because during both activities, 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 5.14 Measured Piezometric Response Near North Abutment: January 2020 to November 2021



Inclinometers

In response to changes in loading conditions some horizontal deformation is expected within the U-GLU that governs the dam design in this area. South of ~Sta. 3+600 the U-GLU was excavated from the footprint of the 2018 raise (~30 m to 40 m wide zone) and from the North Dam Buttress footprint during the review period. North of Sta. 3+600 the U-GLU was too deep to excavate which has been accounted for in design by specifying a wider buttress width in this area.

Where U-GLU is present, measured deformation rates in the U-GLU during the review period were small (<0.1 mm/month even under construction loading). No defined shear zones were identified at the inclinometers nearest to the toe, where the U-GLU is present (I16-04) or is not present (I19-03 and I19-04) indicating that any deformations that may be occurring are contained as per design.

Deformations are observed in the compacted cycloned sand fill at some of the inclinometers, similar to the discussion at South Dam (Section 5.2.3.2) this is related to deformation of the casing within an outer protective casing that is placed around the instrument as it is raised through the fill.

5.2.4 Status of Observational Method Implementation at the VBB

The design of the VBB (KCB 2020a) is based on two assumed conditions within the Lower-Glaciolacustrine (L-GLU) deposit beneath the dam:

- Most Likely Case (MLC); and
- Reasonably Worse Case (RWC).

The VBB design is stable with acceptable performance for MLC and RWC conditions and meets the factor of safety (FOS) criteria specified by the Health, Safety and Reclamation Code for Mines in British Columbia (HSRC) (EMLCI 2021a) under MLC conditions (KCB 2020a). Acceptable performance is defined as horizontal deformations within the L-GLU below the upper slope (i.e., yellow zone on Figure 5.7) do not progress downstream to the toe (i.e., into the red zone on Figure 5.7). This is referred to as the deformations being contained.

If conditions less favourable than MLC are measured, then an extension to the VBB, referred to the Contingency Case, is to be built. The sole purpose of the Contingency Case is to raise the FOS to the HSRC (EMLCI 2021a) criteria assuming RWC conditions. Implementation of this design approach is based on the Observational Method (Peck 1969).

Based on the calibrated deformation model, the 2022 crest raise, to El. 1272 m, will provide the first data that can be used to interpret whether MLC or RWC are more representative of actual conditions. As discussed in Section 5.2.3.3, measured and pattern of deformations to date are consistent with the model which gives confidence in predictions for the 2022 raise.

If the Contingency Case is triggered, the design (KCB, 2020a) specifies the following implementation schedule milestones to be met:

- Complete foundation preparation for the Contingency Case within 6 months of triggering; and
- Place 0.5 Mm^3 of cycloned sand fill within 12 months of triggering.

HVC advised KCB that the cultural heritage work in the footprint of the Contingency Case will not be completed, as planned, in 2021 and completion is now expected in 2023. KCB identified that based on this timeline, if construction of the Contingency Case is triggered in either 2022 or 2023, HVC will not be able to meet the implementation schedule milestones. Therefore, KCB recommended HVC engage with EMLCI to gain approval to modify the milestones to accommodate the cultural heritage timeline.

Since the performance of the VBB is acceptable under RWC conditions, with or without the Contingency Case, such a modification does not represent a dam safety risk. This recommendation was supported by the HVC Tailings Review Board. HVC have engaged with EMLCI to address this potential conflict.

5.2.5 Seepage

Seepage measurements from weirs installed downstream of the L-L Dam, since 2017 are shown on Figure 22. Note that LL—FS-02 was removed in 2021 as it was within the footprint of 2021 dam construction. Summary of the remining seepage weirs 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 10 L/s and 20 L/s (600 L/min and 1200 L/min) with a period of higher flow October where flows got up to 36 L/s. High flow periods coincide with periods of hydraulic placement at the NBB and North Dam which increase seepage flows through the drains that discharge upstream of LL—FS-01.

LL—FS-04

- Measures discharge from Seepage Pond 2 which is routed to the SWRP.
- Between March and October, flows were variable with peak flow rates measured up to 170 L/s. These peaks were caused by a combination of freshet surface runoff and overflow water from hydraulic fill placement that reported to Seepage Pond 2 (via Sediment Pond 2). Hydraulic placement overflows were routed to Seepage Pond 2 for a greater portion of the construction period relative to 2019 or 2020 which can be seen when comparing seepage measurements over the past 3 years.
- Seepage flows for the remainder of the year and between peaks were between 10 L/s and 40 L/s (600 L/min and 2400 L/min) which are typical for normal conditions.

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 (EMLCI 2021b) requires that a minimum 1 m buffer[3] be maintained through operations. Buffer values from the November 19, 2021 survey, after the 2021 dam crest raise was completed, are shown on Figure 5.15. HVC plans the H-H Dam crest raises to maintain a 2 m buffer. The next dam crest raise at the H-H Dam is planned for 2023 based on the available buffer and projected rate of rise.

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

Figure 5.16 shows tailings beach profile since 2017 at various stations along the H-H Dam crest. The tailings beach near the H-H Dam during the review period was relatively constant up until April 2021. During this period, tailings were being discharged on the far side (relative to the H-H Dam) of the existing tailings cone and therefore the bulk of the tailings slurry flows towards the L-L Dam and not near the H-H Dam. In April 2021, tailings spigot points were shifted towards the H-H Dam and began discharging tailings on the H-H Dam side of the tailings cone. When this is done, the majority of tailings slurry flows near the H-H Dam before flowing to the L-L Dam which increases the rate of beach rise near the dam. This is the expected behaviour whenever tailings are deposited on the H-H Dam side of the cone as shown on Figure 5.16 and is factored into the crest rise schedule for the H-H Dam.

Figure 5.15 H-H Dam Tailings Buffer – November 19, 2021 Tailings Beach (with 2021 Crest Raise)

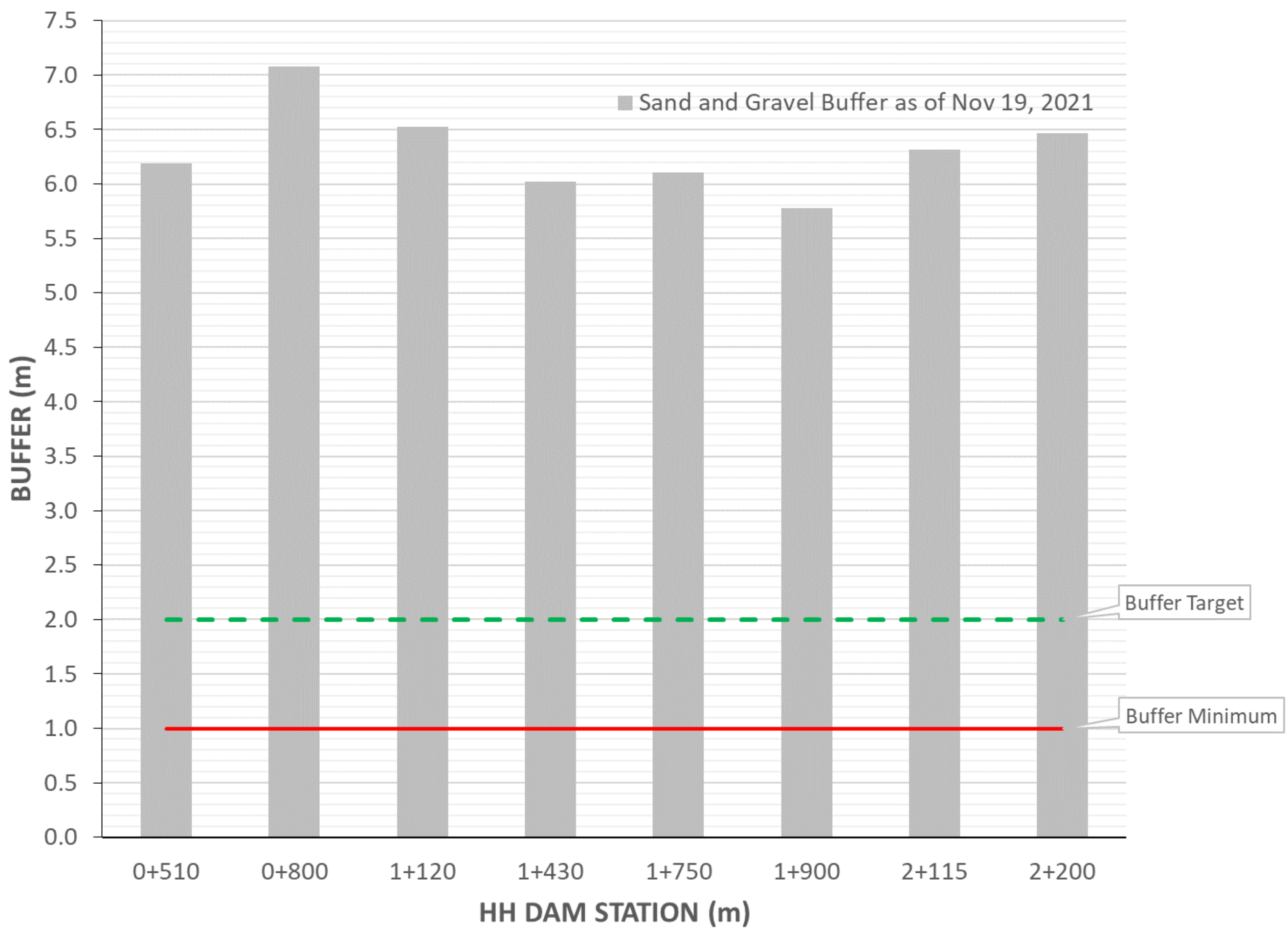
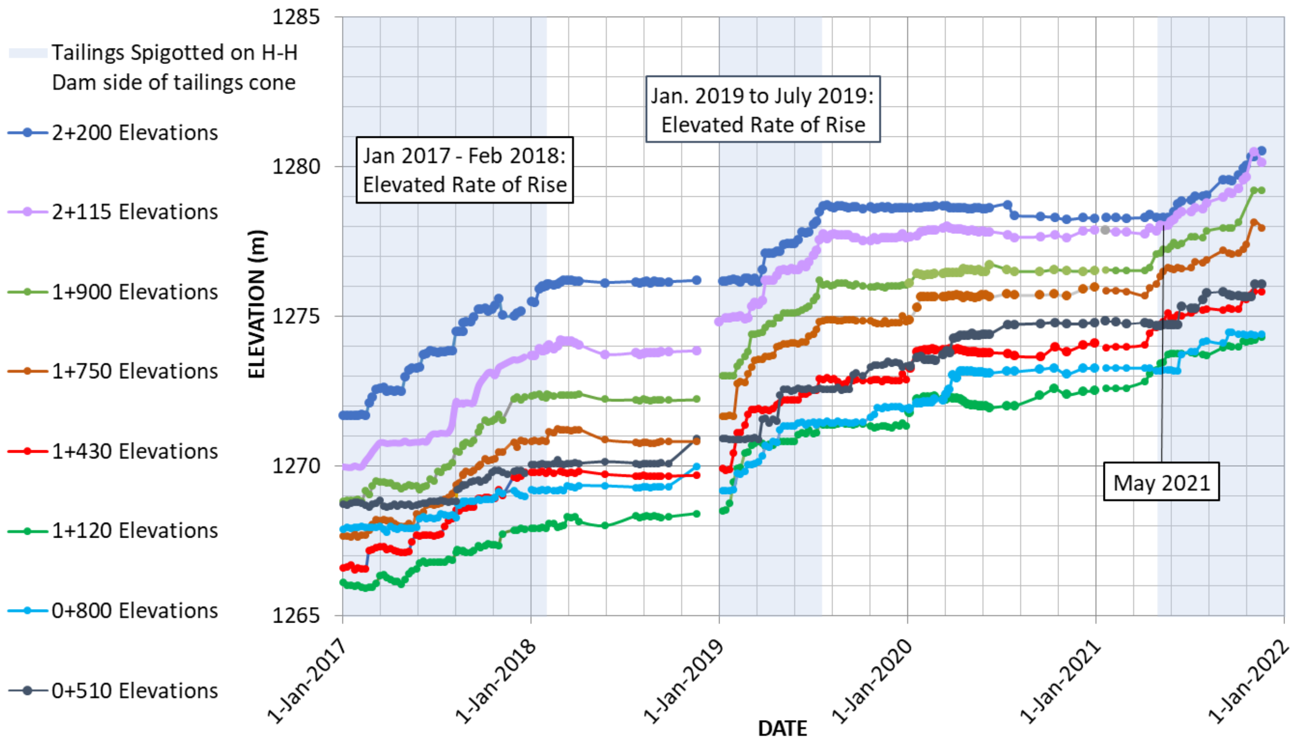


Figure 5.16 H-H Dam Tailings Beach Elevations Along Crest: 2017 to 2021



5.3.2 Instrumentation Trends

5.3.2.1 Overview and Notification Level Exceedances

This section provides an overview of general measured piezometric and deformation behaviour, based on instrumentation readings during the review period at the H-H Dam. November 2021 instrumentation readings are shown on select design cross sections, through each dam segment, of the H-H Dam (Figures 15 to 19, at the end of the report). 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, 6 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:

- Mid-Segment – horizontal deformation rate in the rockfill downstream of the core, measured at I17-16, I17-17 and I17-33 exceeded the Notification Level in a response to downstream fill placement by the mining fleet. Horizontal deformation 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 at one piezometer (HH-VWP17-31C) in the dam fill, downstream of the core, exceeded threshold level in response to rise in 24 Mile TSF pond level (Section 5.3.2.2). EoR review concluded the dam remained in compliance and dam performance was acceptable under these elevated levels. Subsequently, the piezometric level dropped back below threshold as HVC lowered the pond level in 24 Mile TSF.

5.3.2.2 Piezometers

In June 2020, groundwater pumping from the gland water wells downstream of the H-H Dam (Pumps No. 7 and No. 5, Figure 5.17) was suspended for a temporary period due to mechanical failure. This resulted in a significant rise in piezometric levels in foundation units but did not impact levels in the dam fill. This period and response was discussed in the 2020 AFPR report (KCB 2021a). Pumping resumed, from Pump No. 7, in December 2020, and by April 2021 piezometric levels in the foundation units levelled off at levels similar to those measured prior to the pumping disruption (Figure 5.17).

The piezometric rise, and subsequent drawdown, does 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 / saturation levels in the fill and waste dump downstream of the dam, not the foundation.

Piezometer readings have shown that piezometric level response in the dam fill, downstream of the core, is governed by 24 Mile TSF pond level. Since 2017, the piezometric level in the dam fill typically increases 50% to 60% of the rise measured at 24 Mile TSF; this was the case during the review period (Figure 5.18). Starting in July 2021, HVC added additional pumps to drawdown 24 Mile TSF. As expected, piezometric levels in the dam fill also reduced, albeit at a lower rate than pond level (Figure 5.18).

KCB recommended additional monitoring points between the existing monitoring points and 24 Mile Emergency TSF to expand the monitoring area and to add additional points to better define the variability and shape of piezometric level in the area of the dam that governs design.

Piezometric levels in the foundation also respond to changes in 24 Mile TSF pond level, while groundwater pumping is ongoing (Figure 5.17).

Figure 5.17 Piezometric Response Measured in H-H Dam Foundation

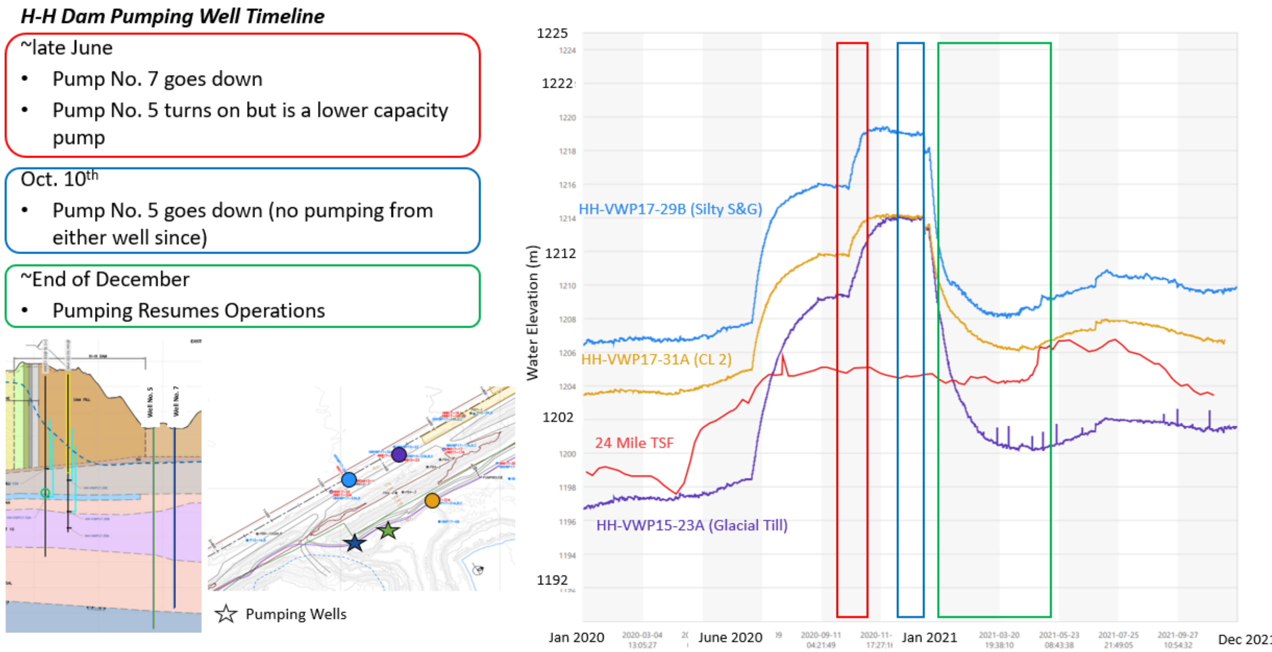
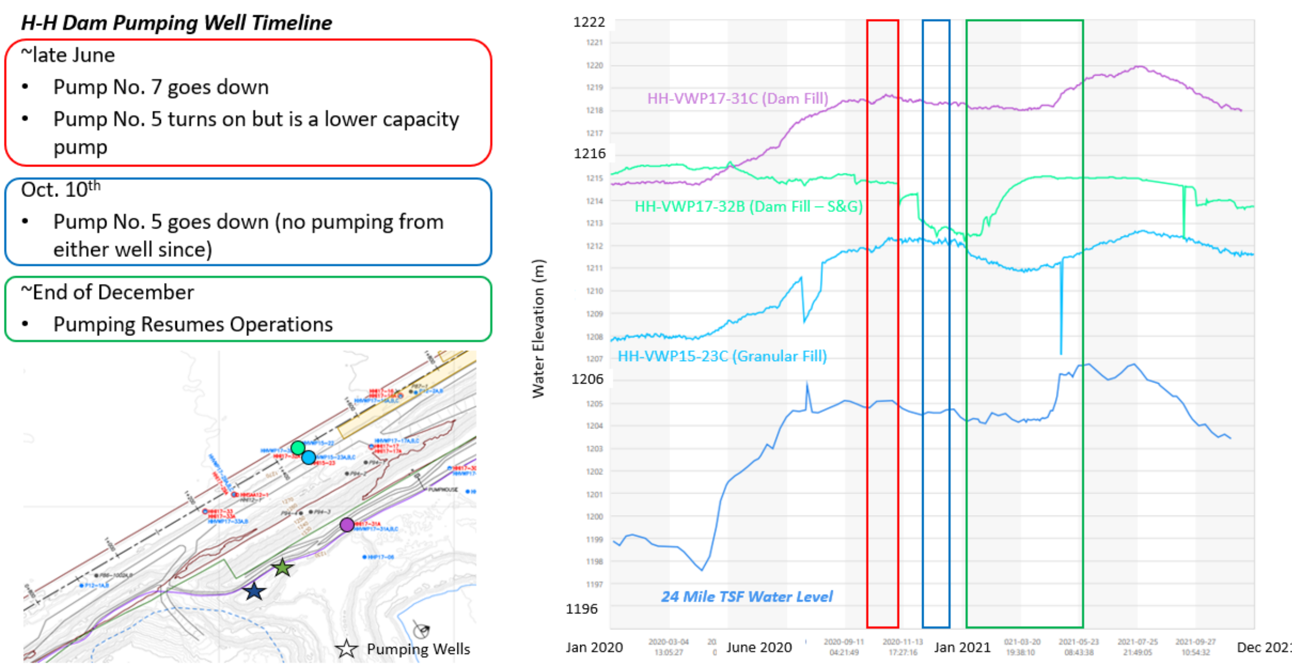


Figure 5.18 Piezometric Response Measured in H-H Dam Fill Downstream of Core



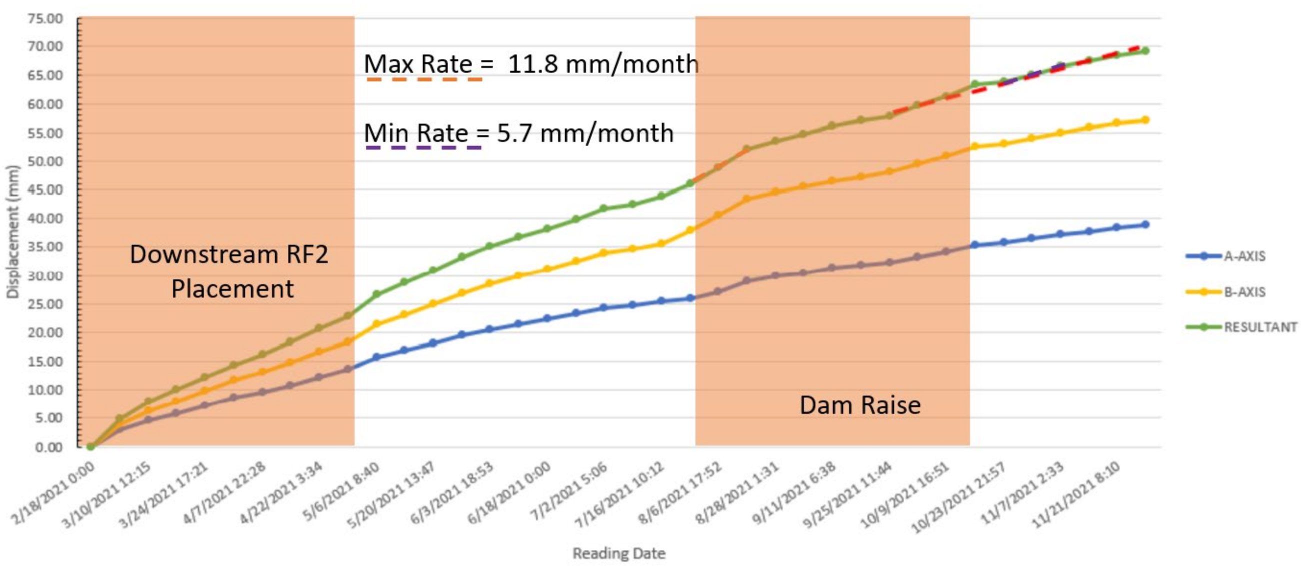
5.3.2.3 Inclinometers and Settlement

Horizontal deformations in the H-H Dam fill 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, where both horizontal deformation and settlement are measured, locations where the largest settlement is measured (e.g., comparison of I17-16 and I17-33A) correspond to the areas where horizontal deformations are also largest.

The measured horizontal deformations (<0.1 mm/month to 11.8 mm/month) and settlement (100 mm to 170 mm) in the fill during the review period were within the range of those observed since the instruments were installed. The settlement measured during the review period was a continued response to the fill placement during 2020. Figure 5.19 shows the horizontal deformations measured in the dam fill at inclinometer I17-16 where the largest deformations were measured during the review period. Relative to 2020, deformation rates were notably less which was expected since there was much less fill placed on the downstream slope during 2021. This magnitude of deformation can be accommodated by the structure without compromising design function. There were no visual observations of significant cracking or deformation of the fill over the crest area.

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

Figure 5.19 I17-16 Measured Horizontal Deformation Within Downstream Fill (~34 m Thick)



5.3.3 Lock-Block Wall Survey Monuments

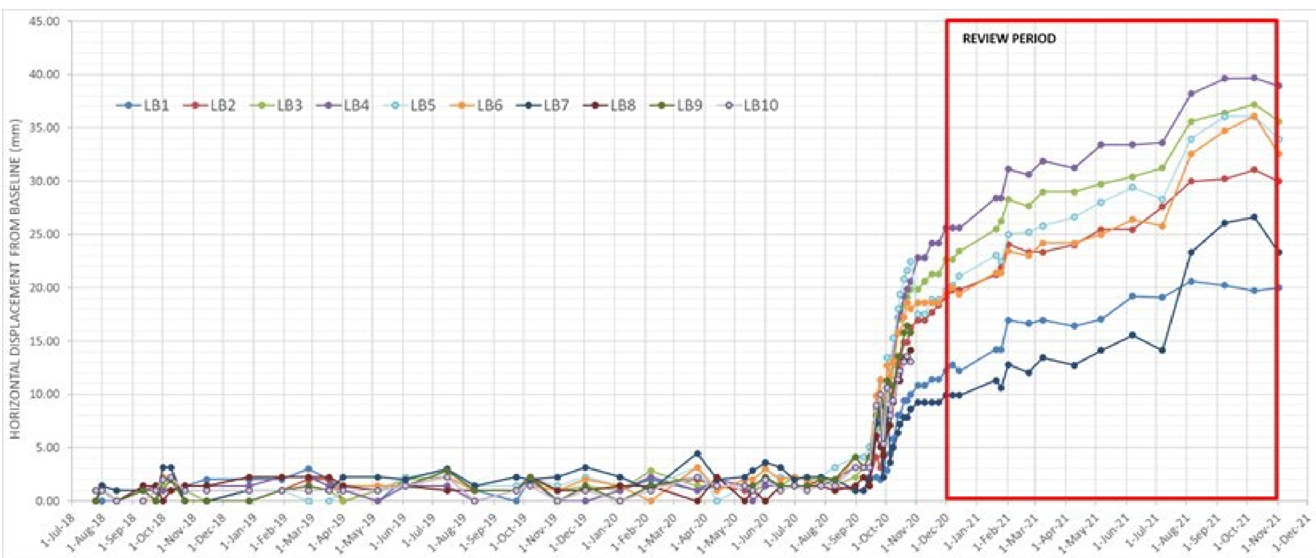
The purpose of the lock-block wall at the toe of the H-H Dam, near the HH Pumphouse (~Sta. 2+025), is to increase the setback of the dam toe to the H-H Pumphouse. The lock-block wall is not a structural component of the overall H-H Dam fill and if it were to fail would pose no risk to the overall integrity 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.

During 2020, deflection of the lock-block wall increased in response to fill placement immediately upstream of the wall by the HVC mining fleet. Although no issues of wall instability were observed, HVC took the precautionary step of placing fill downstream to support the lower half of the wall which had an immediate impact on reducing the deformation rates. The lower three monuments (LB8, LB9 and LB10) were buried by the fill.

The only fill placed upslope of the lock-block wall during the review period was the H-H Dam crest raise. As expected, wall deflection was much less than measured during 2020 construction (Figure 5.20) and deflections rates have been relatively steady since HVC placed the fill downstream of the lock-block wall. In addition, no issues of concern observed during visual inspections.

Since the monuments were first added to the surveillance program the H-H Dam slope in the area has been built to ultimate, the wall is supported by fill and there is a data set which has demonstrated the wall is stable and is undergoing small magnitude of deflection, except when placing fill immediately upslope. Based on this KCB propose the monitoring frequency for these surveys can be reduced in the next OMS Manual update.

Figure 5.20 Lock-Block Wall Monuments: Horizontal Displacement From Baseline (2018 to 2021)



Note: Lower row of monuments were buried by fill placed downstream of wall in October 2020.

5.4 Water Quality

Permit PE-376 specifies minimum water quality sampling requirements at HVC, including downstream of the Highland TSF (refer to Appendix V).However, no water quality limits have been defined in PE-376 downstream of the Highland TSF. Water sampling activities and results are reported in the following reports, which were provided to KCB for review:

- Pukaist Creek Sulphate Adaptive Management Plan 2021 Annual Report (HVC 2022)
- 2021 Annual Water Quality Monitoring Report (ERM 2022)

The reports were signed by qualified professionals in the related fields and should be referred to for monitoring data and discussion of results. The EoR (Mr. Friedel, P.Eng.) reviewed the above documents for discussion related to items of compliance with sampling requirements and key observations, which are summarized as follows:

- There are six permitted water quality sites and seven voluntary sites in the Highland TSF area (Appendix V). No permit limits have been established in Permit PE-376 for this area. The required sampling frequency and parameters were met at the permitted sites (ERM 2022).
- The most significant groundwater monitoring observations during the review period were reported as (HVC 2022):
  - an expected and general decline of water level elevation observed around the SAMP interception wellfield; and
  - a decrease in available Woods Creek Diversion discharge during the summer drought, which required adjustments to the interception well pump settings and resulted in abstraction rates lower than modelled.
- The trend of decreasing sulphate concentration in Pukaist Creek, that started in 2018, continued through 2021 and molybdenum concentrations are reported to have stabilized since 2020. The average annual Sulphate concentration during 2021 was below HVC's target (HVC 2022) and ~12% less than the 2020 annual average. This was despite the abstraction rates being less than modelled due to drought conditions. Decreasing sulphate is correlated with HVC implementation of the Sulphate Adaptive Management Plan (SAMP).

6 2021 SITE VISIT VISUAL OBSERVATIONS

Visual observations made during the July 22, 2021 site visit to support this review, together with copies of the field observation 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.
- As discussed in Section 5.2.2, minimum beach requirements at North Abutment (>500 m) were met and in general, the beach along the length of the crest was wider than during the 2020 AFPR site visit.
- Active construction areas during the site visit included: hydraulic fill placement at the South Dam; additional placement cells prepared upstream of the dam core and on the north side of the NBB; and foundation preparation at the North Dam Buttress (was in progress). The temporary on-dam sediment cells at the VBB as well as Sediment Pond 1 and Sediment 2 were in operation.
- The secondary pump added at the SWRP to increase reclaim capacity (Section 4.2) had been commissioned but was not required to maintain pond levels at the time. HVC’s plan is for this pump to be in place from April through October which is the highest flow periods at site. The pump will be removed from site over winter but other infrastructure remains in place so it can be redeployed the following year.

H-H 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.
- Construction of the 2021 crest raise was in the early stages at the time of the site visit. The middle portion of the dam crest was being raised but no work had been started near each of the abutments.
- There was no active haulage of pit waste to the 24 Mile Waste Dump but survey and comparison of photos show that additional pit waste material had been placed since the 2020 AFPR site visit.

7 2021 DAM SAFETY ASSESSMENT

7.1 Review of Potential Downstream Consequences

Consequence classification is not part of HVC's tailings management governance, and they have instructed KCB not to include it when reporting on the Highland TSF or supplementary structures. Potential consequences from credible failure modes are managed through a rigorous risk management process. HVC provided the following regarding the change:

> *Consequence Classification has traditionally been used to select appropriate design criteria for tailings facilities. The use of Consequence Classification comes from the Water Dams industry and have components that do not align with Mining's safety culture – a culture that Teck fully embraces. Traditional and existing Consequence Classification schemes have a typical five level of hypothetical consequence that includes the potential for human fatality right down to the second lowest level. For Teck, any fatality would be of extreme consequence. Further, per the GISTM, designing for closure and the perpetual timeframe for the tailings facilities means adopting extreme loads (e.g., GISTM recommends both 1:10,000 earthquake and precipitation events) which render any other classification unnecessary. Finally, the use of hypothetical failures that are not based on credible modes, or lack thereof, for a given facility creates a false narrative that hampers effective and transparent community discussions and confusing discussions with regulators and investors.*

To support this approach, HVC are in the process of adopting design loading for earthquake and flood scenarios equivalent to an Extreme consequence classification (CDA 2019) for tailings facilities. This approach:

- meets or exceeds the HSRC (EMLCI 2021a) requirements;
- aligns with Teck's goal to eliminate any risk for loss of life; and
- is consistent with the GISTM (2020), which supports evolving beyond the conventional consequence classification system.

Highland TSF is already designed to the extreme flood (i.e., PMF) condition and the L-L Dam is designed for the extreme earthquake (i.e., 10,000-year) event. The H-H Dam design earthquake (5,000-year return period) meets the requirements the HSRC (EMLCI 2021a) as discussed in KCB (2020a).

As discussed in Section 4.2, the design flood for 24 Mile TSF (1/3rd between 1000-year and PMF 72-hour) was specified by KCB to meet equivalent requirements under the HSRC (EMLCI 2021a). This is also consistent with Teck's internal guidance for facilities which, under the current configurations, has no credible catastrophic failure modes that could endanger a permanent population.

HVC utilize a similar approach to manage potential credible failure modes for management of the water retaining structures that supplement operation of the Highland TSF (e.g., sediment and seepage ponds downstream of the L-L Dam).

The conditions and land use downstream of all tailings and water retaining structures was completed by HVC and KCB on April 15, 2021 and no significant changes were identified.

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 recent design update (KCB 2020a). No changes were made to the design basis of either the L-L Dam or the H-H Dam during the review period.

7.3 Status of 2017 Dam Safety Review Recommendations

The last DSR was conducted in 2017 by representatives of Stantec Consulting Ltd. (Stantec 2018) which identified no unsafe or unacceptable conditions in relation to design, construction, surveillance, maintenance, and or 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 from Stantec (2018), except for one, were addressed by 2020. The outstanding recommendation is related to installation of additional seepage monitoring points along the toe of the L-L Dam. Additional weirs were to be installed following completion of the LL SWRP construction. However, as discussed in Table 3.4, the timeline to complete the new pond is subject to archeological approval timelines. This recommendation was added to the AFPR recommendations (LL-2019-02, Table 8.1) for tracking.

HVC have scheduled the next DSR for 2022, which aligns with the 5-year frequency required under the HSRC.

7.4 Failure Modes

7.4.1 2021 Failure Mode Review

HVC's long-term goal for all tailings storage facilities is to reach landform status, so that the structures can be declassified as a "dam." KCB fully supports HVC towards achieving this long-term goal and their adoption of the GISTM (2020) for tailings management.

The L-L Dam and the H-H Dam design review (KCB 2020a) concluded the controls specified in the design and implemented by HVC are appropriate to manage potential dam failure modes applicable to each structure. Where applicable qualitative performance objectives which measure the effectiveness of those controls have been defined in the surveillance program and integrated with the TARPs. There were no changes during the review period which would alter this conclusion.

There are no credible failure modes for the 24 Mile 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 the Roman Road into the Valley Pit. At closure, the H-H Dam buttress will fully cap tailings stored in the 24 Mile TSF, after which there will be no credible failure modes for a surface release of tailings or water. This aligns with HVC's long-term goal to achieve landform status at closure.

Design and operational controls in place to manage potential failure modes, and their status at the end of the review period, are summarized below.

7.4.2 L-L Dam

Overtopping

To manage overtopping risks, the Highland TSF is designed to store the 120-hour duration PMF (Table 4.2), which is a longer duration than required by the HSRC (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. At the end of the review period, the pond level was ~14.5 m below the L-L Dam crest and the Highland TSF had ~143 Mm^3 of storage up to 2 m minimum freeboard level. This is sufficient to store tailings discharge forecast for 2022 and approximately two IDF events (Table 4.2) without exceeding design freeboard. This far exceeds minimum design or regulatory flood requirements.
- The Highland TSF is monitored by a comprehensive surveillance program as described in the OMS Manual (HVC 2021). 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 HVC personnel and/or contractors visiting the area multiple times a day. In order for overtopping to occur all surveillance controls would have to fail and the situation ignored by everyone working in the area.

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

Internal Erosion and Piping

The L-L Dam includes controls which restrict the required conditions for internal erosion to develop and/or propagate through the dam fill:

- Interfaces between fill zones 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 meet the 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 and 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 to manage foundation seepage flows and gradients in this area, the L-L Dam design (KCB 2020a) specifies a minimum 500 m wide beach be maintained at the North Abutment to lower the gradient. In addition, the blanket drain that underlies the downstream shell 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. 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). No indicators of internal erosion around the LLO were observed while it was in operation and since decommissioning.

Slope Stability – Static and Seismic Loading

Compliance with slope stability design and regulatory criteria is checked by KCB prior to construction of each 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 2020b), which has been developed to supplement knowledge of the dam's historical performance over the +40 year life. The characterization meets requirements of the Engineers and Geoscientists of BC (EGBC) professional practice document (APEGBC 2016) and has been independently reviewed.

Routine reviews of surveillance observations and measured performance by the EoR during the review period concluded dam performance during the review period was acceptable[4] 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 through the dam fill, with one exception. There is no sand and gravel filter separating the glacial till in the dam core from the coarse Random Fill between El. 1216.7 m and El. 1255.5 m (>26 m below the existing crest).

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. KCB assessed the risk of internal erosion leading to a structural failure developing, due to this gap in the filter, based on the method defined by the International Commission on Large Dams (ICOLD 2017). KCB (2020a) 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 TSF. Geological and geotechnical characterization (KCB 2020c), which informs stability analyses, are equivalent to those methods for the L-L Dam.

The current condition of the H-H Dam and downstream waste dumps is adequate to maintain compliance with slope stability criteria at the current crest level. Additional downstream buttressing is required to meet design criteria for post-earthquake conditions before the crest is next raised in 2023.

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

7.4.4 24 Mile TSF

Overtopping

To manage overtopping risks, the 24 Mile TSF is operated with sufficient capacity to store at least the 72-hour duration IDF (Table 4.2), with freeboard. At the end of the review period, the pond level in 24 Mile TSF was ~21 m below the perimeter and had ~5.5 Mm^3 of storage up to minimum freeboard level (i.e., 0.5 m below perimeter). This is sufficient to store the equivalent of 1.7 IDF events (Table 4.2) without exceeding design freeboard. This far exceeds minimum design or regulatory flood requirements. The minimum freeboard measured during the review period was 18.2 m.

The flood storage in 24 Mile TSF changes 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 HVC QP and EoR to confirm whether raising of the perimeter area will be required, as required under the OMS Manual (HVC 2021).

7.5 Emergency Preparedness and Response

The Emergency Preparedness and Response Plan (EPRP) for the Highland TSF is included in the OMS Manual (HVC 2021). The EPRP was updated by HVC and reviewed by the EoR during the review period.

As part of the update, HVC contacted off-site emergency response resources to ensure that all contact information was current. The EPRP includes a list of preventative measures to take in response to potential unusual or emergency conditions. The EPRP is appropriate for the existing structure and is linked to the site-wide emergency response plan.

On January 18, 2022, participants from HVC’s operation team (including site management), the HVC QP, and the EoR tested the EPRP using a hypothetical scenario at tailings facility on-site.

8 SUMMARY

Based on the review of measured performance and observations summarized herein, KCB conclude the Highland TSF performed as expected, and within design requirements during the review period from December 2020 to November 2021.

The status of dam safety recommendations identified during past AFPRs are summarized in Table 8.1. Closed recommendations are shown in *italics*. During the review period, three of the four recommendations from previous AFPRs were closed. Completion of the last outstanding recommendation has been delayed because the archeological clearance timelines delayed construction of the LL SWRP replacement pond.

KCB have included two new recommendations to install new and replacement instrumentation (Table 8.2). Both have been assigned a Priority 3 meaning they are not required to address a potential dam safety concern but are necessary to implement the dam designs and surveillance programs as intended.

As discussed in Section 5.2.4, KCB would support modification to the implementation schedule milestones that must be met if the Contingency Case is triggered at the VBB. The L-L Dam performance is acceptable even if the Contingency Case is not built and there is a robust monitoring program in place to confirm the safe performance during operations.

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 (CLOSED)*
LL-2019-02	Surveillance	Install new seepage weirs along downstream toe after SWRP has been replaced and the L-L Dam constructed to ultimate toe. (DSR recommendation LL-2017-06)	3	Q4 2021 (Open, to be confirmed based on archeologic approval timeline for LL SWRP)
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 (CLOSED)*
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 extent of tailings placed in channel from H-H Pumphouse to 24 Mile TSF.*	*3*	*Q1 2022 (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.
2. No Outstanding Recommendations for 24 Mile TSF, L-L Dam Seepage Collection and Sediment Ponds.

Table 8.2 2021 Recommendations Related to Facility Performance

ID No.	Performance Area	Recommended Action	Priority(1)	Recommended Deadline (Status)
L-L Dam				
LL-2021-01	Surveillance	Install a replacement inclinometer for I15-24 at the VBB.	3	Q4 2022
H-H Dam				
HH-2021-01	Surveillance	Install 3 (minimum) piezometers in the waste fill between the H-H Dam slope and 24 Mile TSF to increase coverage and monitoring points for piezometric levels in the area which affects the H-H Dam design.	3	Q3 2022

Notes:
1. Refer to Table 8.1 notes.

9 CLOSING

We thank you for the opportunity to work on this project. Should you have any questions, please contact the undersigned.

KLOHN CRIPPEN BERGER LTD.

Rick Friedel, P.Eng., P.E.
Engineer of Record, Approved Representative
Principal

Robert W. Chambers, P.Eng.
Engineer of Record, Alternate
Principal

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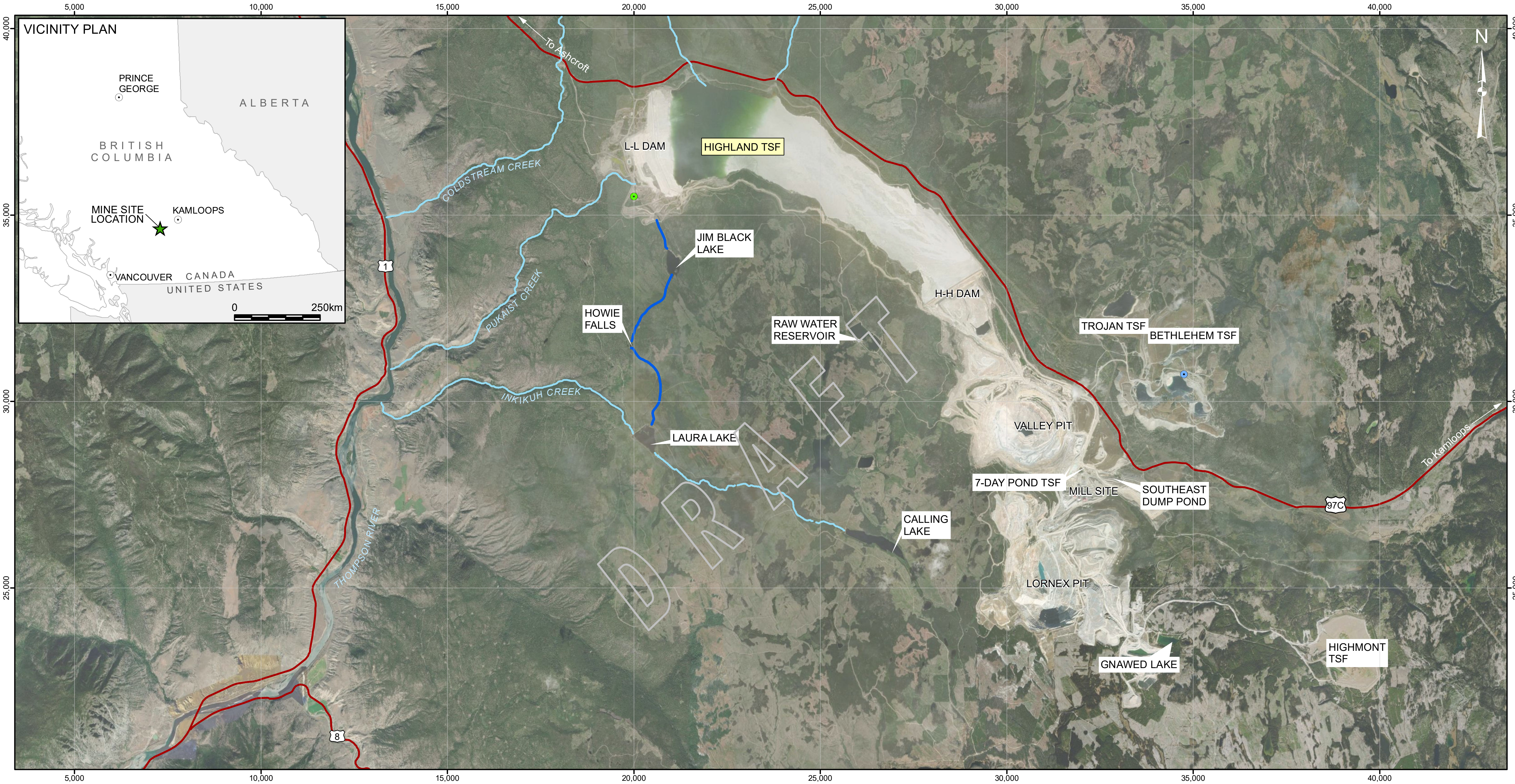
FIGURES

Figure 1	Mine Site Plan
Figure 2	L-L Dam – Plan
Figure 3	L-L Dam – Instrumentation Location Plan
Figure 4	H-H Dam and 24 Mile TSF – Plan
Figure 5	H-H Dam – Instrumentation Location Plan
Figure 6	L-L Dam – 2021 Construction Work Areas
Figure 7	H-H Dam – 2021 Construction Work Areas
Figure 7	L-L Dam Instrumentation Section – Sta. 1+200 – South Dam
Figure 8	L-L Dam Instrumentation Section – Sta. 1+850 – Valley Buttress Berm
Figure 9	L-L Dam Instrumentation Section – Sta. 2+250 – Valley Buttress Berm Extension
Figure 10	L-L Dam Instrumentation Section – Sta. 2+564 – North Buttress Berm
Figure 11	L-L Dam Instrumentation Section – Sta. 2+800 – North Dam
Figure 12	L-L Dam Instrumentation Section – Sta. 3+300 – North Dam Bedrock
Figure 13	L-L Dam Instrumentation Section – Sta. 3+630 – North Dam Upper Glaciolacustrine
Figure 15	H-H Dam Instrumentation Section – Sta. 0+800
Figure 16	H-H Dam Instrumentation Section – Sta. 1+200
Figure 17	H-H Dam Instrumentation Section – Sta. 1+460
Figure 18	H-H Dam Instrumentation Section – Sta. 1+700
Figure 19	H-H Dam Instrumentation Section – Sta. 2+000
Figure 20	Flow Schematic for Highland TSF
Figure 21	Valley Buttress Berm Measured Inclinometer Movements – 2018 to 2021
Figure 22	L-L Dam – Pond Level and Seepage Flow – 2013-2021



LEGEND

- L-L DAM CLIMATE STATION
- HIGHLAND VALLEY SNOW SURVEY STATION (NO. 1C09A)
- CREEK/RIVER
- HIGHWAY
- DITCH

0 5km

CLIENT

Highland Valley Copper
Teck

Klohn Crippen Berger

PROJECT

HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE

MINE SITE PLAN

SCALE	PROJECT No.	FIG No.
AS SHOWN	M02341C12	1

NOTES:
1. PROJECTION: HVC MINE GRID.
2. TSF = TAILINGS STORAGE FACILITY.
3. BASE DATA PROVIDED BY THE GOVERNMENT.
4. IMAGERY PROVIDED BY ESRI.

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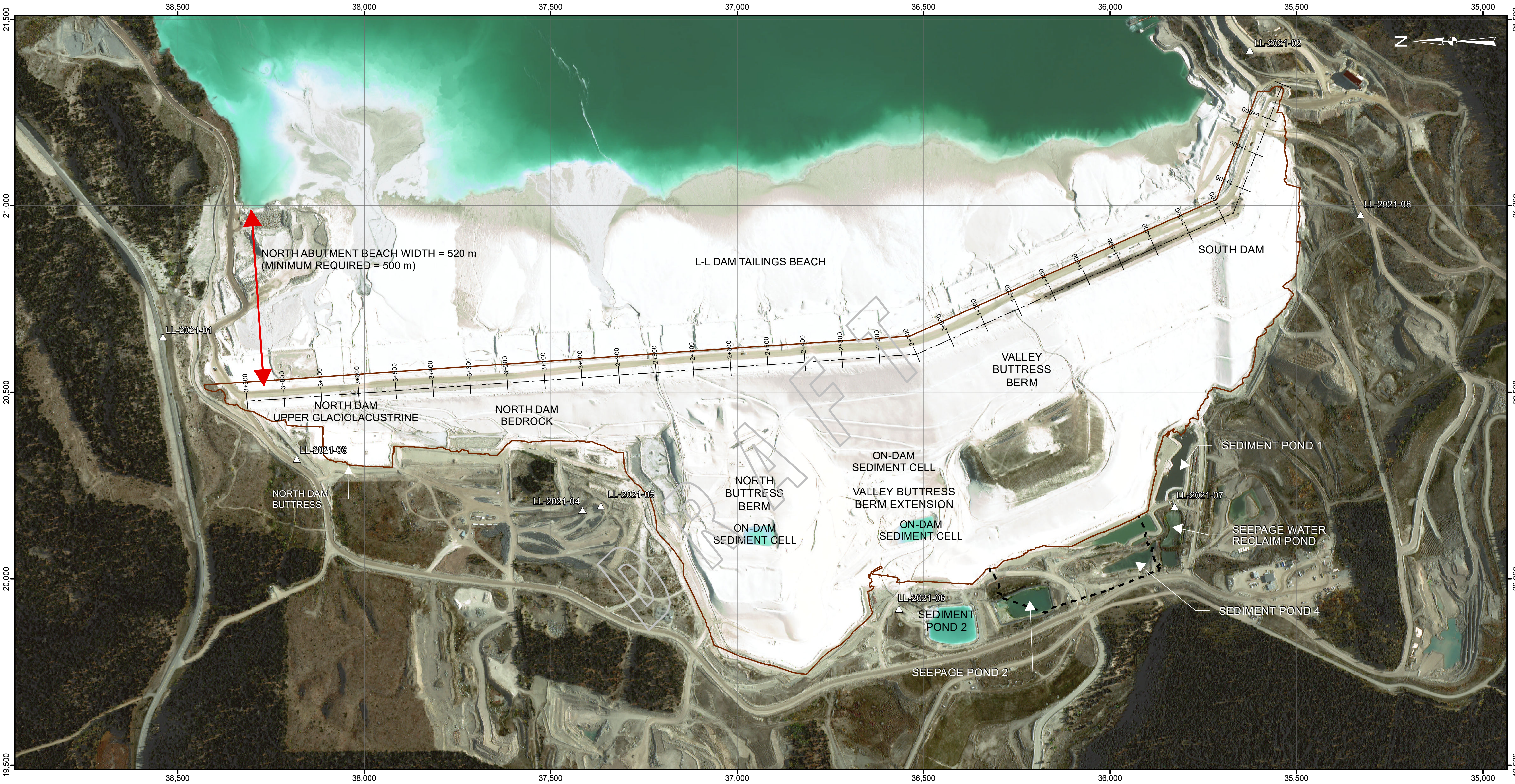

LEGEND

△ ANNUAL SITE VISIT WAYPOINT (REFER TO APPENDIX I-A)

ULTIMATE DAM FOOTPRINT – MODIFIED BASE CASE

VBB CONTINGENCY CASE FOOTPRINT

3+900 L-L DAM CENTERLINE

NOTES:
1. PROJECTION: HVC MINE GRID.
2. TOPOGRAPHY FROM SATELLITE PHOTOGRAMMETRY SURVEY CONDUCTED IN OCTOBER, 2021.
3. IMAGERY FROM OCTOBER, 2021.

Date: 2022-03-01
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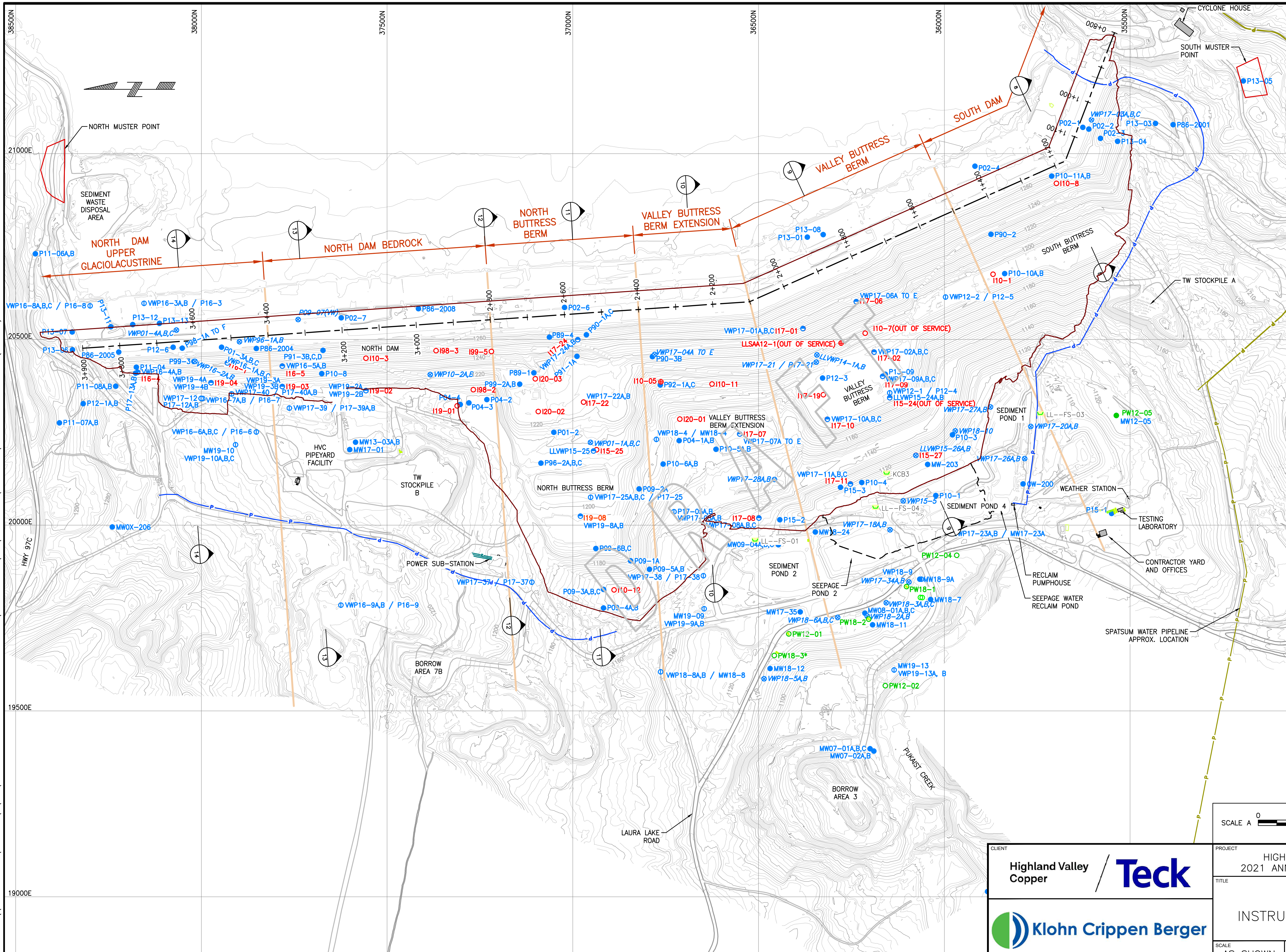
CLIENT Highland Valley Copper / Teck	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2021 ANNUAL FACILITY PERFORMANCE REPORT
Klohn Crippen Berger	TITLE L-L DAM PLAN
	SCALE AS SHOWN / PROJECT No. M02341C12 / FIG No. 2



LEGEND:

- SURFACE WATER RECLAIM PIPELINE
- SPATSUM WATER PIPELINE
- HAUL ROAD
- PUBLIC ROAD
- ULTIMATE DAM FOOTPRINT MODIFIED BASE CASE
- VBB CONTINGENCY CASE FOOTPRINT
- INSTRUMENTATION SECTION
- 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
- STANDARD INCLINOMETER
- SAAV INCLINOMETER
- PUMPING WELL
- PUMPING WELL WITH STANDPIPE PIEZOMETER AND OBSERVATION WELL
- SEEPAGE FLOW MONITORING WEIR

NOTES:

1. TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER PARTNERSHIP, DERIVED FROM LIDAR SURVEY DATED 2021-04-05 (2020 AS-BUILT).
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. LL--FS-02 WAS REMOVED IN 2021, PRIOR TO THE AREA BEING BURING TO SUPPORT DAM CONSTRUCTION.

SCALE A 0 250 m

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: L–L DAM INSTRUMENTATION LOCATION PLAN

SCALE	PROJECT No.	FIG. No.
AS SHOWN	M02341C12	3

SAVE DATE: 2022-03-01 (3:11 PM)
FILE PATH: \\INT.KLOHN.COM\PROJDATA\M\VCR\M02341C12-HVC 2021 DAM SAFETY SUPPORT\400 DRAWINGS\CAD\05-FIGURES\2021 AFPR\FIG 03 - L-L DAM.DWG (THAWKER)

LEGEND

△ ANNUAL SITE VISIT WAYPOINT (REFER TO APPENDIX I-B)

ULTIMATE DAM AND BUTTRESS FOOTPRINT

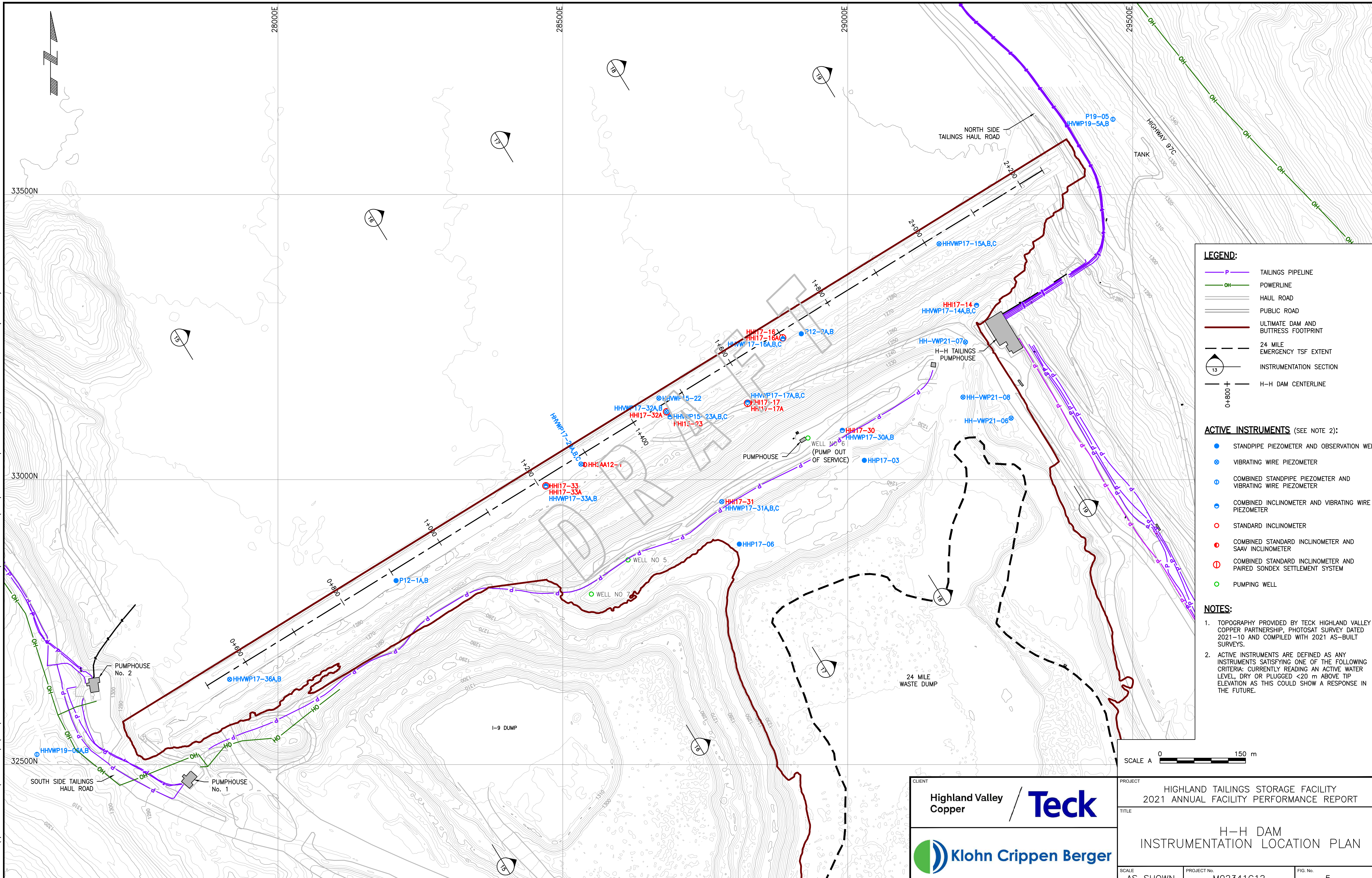
24 MILE EMERGENCY TSF EXTENT

0+600 H-H DAM CENTERLINE

NOTES:
1. PROJECTION: HVC MINE GRID.
2. TOPOGRAPHY FROM SATELLITE PHOTOGRAMMETRY SURVEY CONDUCTED IN OCTOBER, 2021.
3. IMAGERY FROM OCTOBER, 2021.

CLIENT: Highland Valley Copper / Teck	PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2021 ANNUAL FACILITY PERFORMANCE REPORT
Klohn Crippen Berger	TITLE: H-H DAM AND 24 MILE TSF PLAN
SCALE: AS SHOWN	PROJECT No. M02341C12 — FIG No. 4

Date: 2022-03-01
Document Path: \\int.klohn.com\ProjData\M\VCR\M02341C12-HVC 2021 Dam Safety Support\400 Drawings\GIS\Reports\DSI\Highland\Fig4_HH_Dam_DamPlan.mxd



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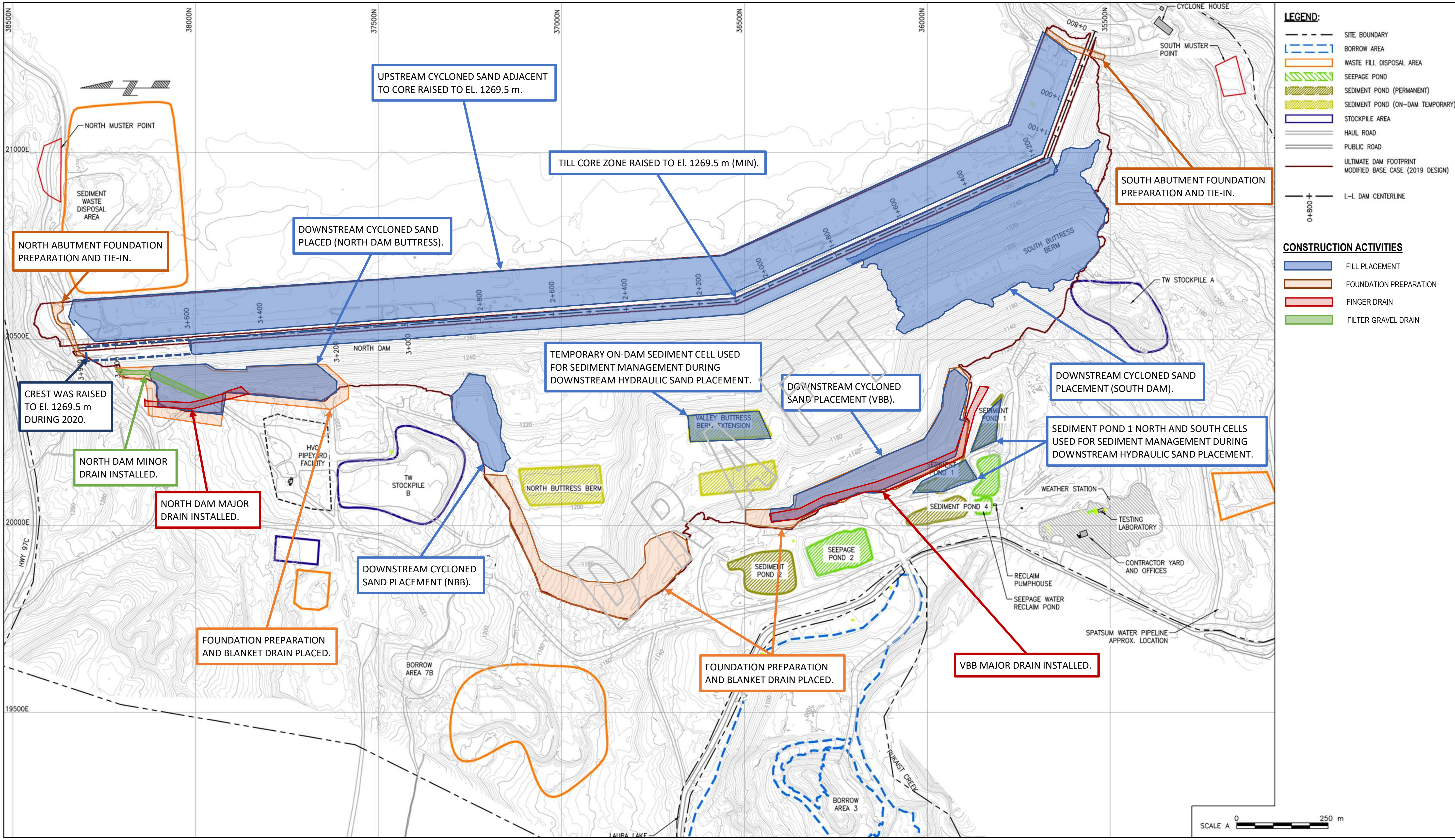
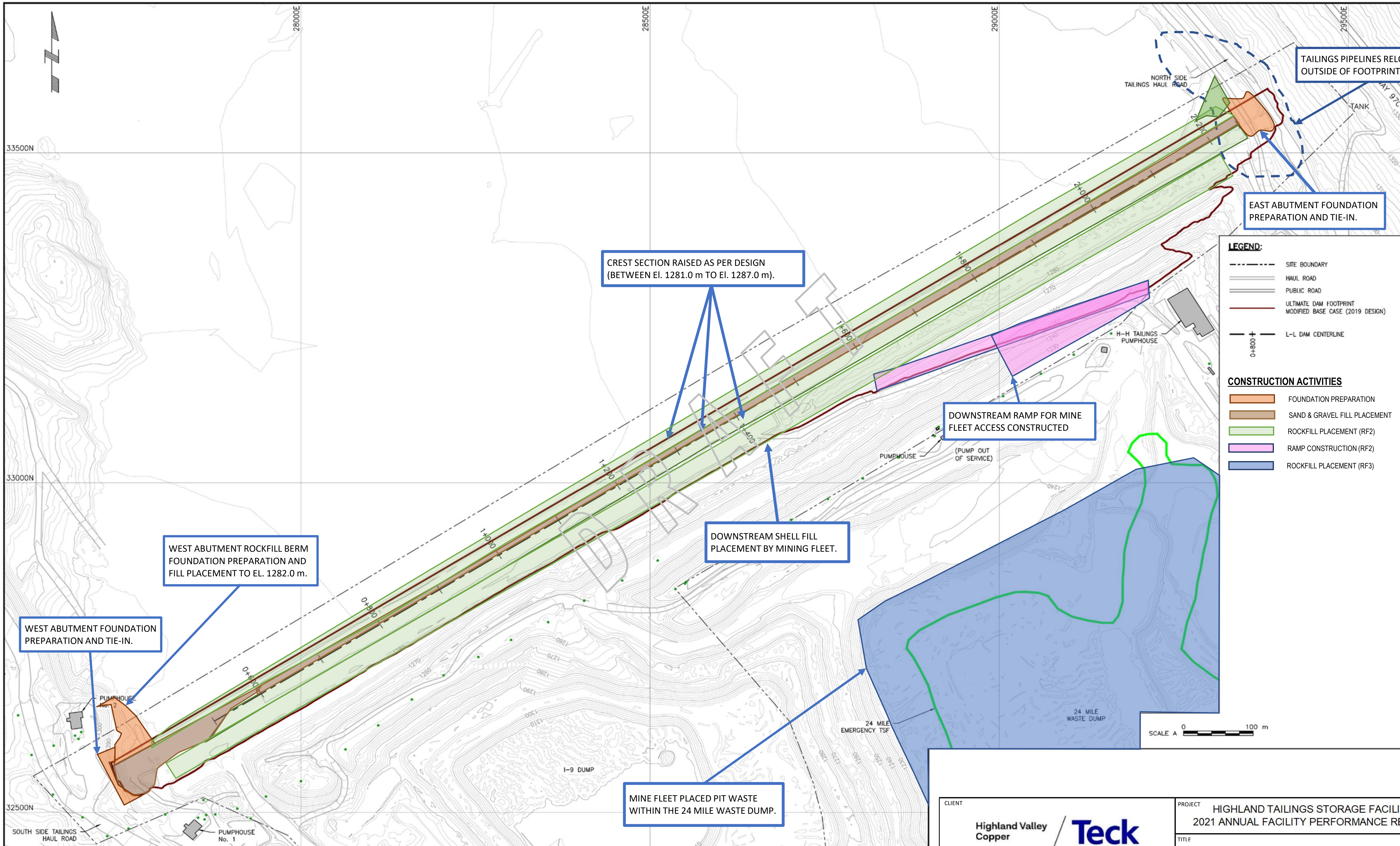


CLIENT	PROJECT
Highland Valley Copper / Teck	HIGHLAND TAILINGS STORAGE FACILITY 2021 ANNUAL FACILITY PERFORMANCE REPORT
Klohn Crippen Berger	TITLE: L-L DAM 2021 CONSTRUCTION WORK AREAS

SCALE	PROJECT No.	FIG. No.
AS SHOWN	M02341C12	6

FILE PATH: Z:\MVCR\M02341C12-HVC 2021 DAM SAFETY SUPPORT\700 DELIVERABLES\720 WORKING\2021 AFPR\HIGHLAND\FIGURES\INTEXT FIGS\FROM 2020 FILES\DIRECTION OF VBB INCLINO MOVEMENT.XLSX - 2022-03-02 13:21



CLIENT

Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT

HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE

H-H DAM
2021 CONSTRUCTION WORK AREAS

SCALE	PROJECT	FIG. No.
NTS	M02341C12	7

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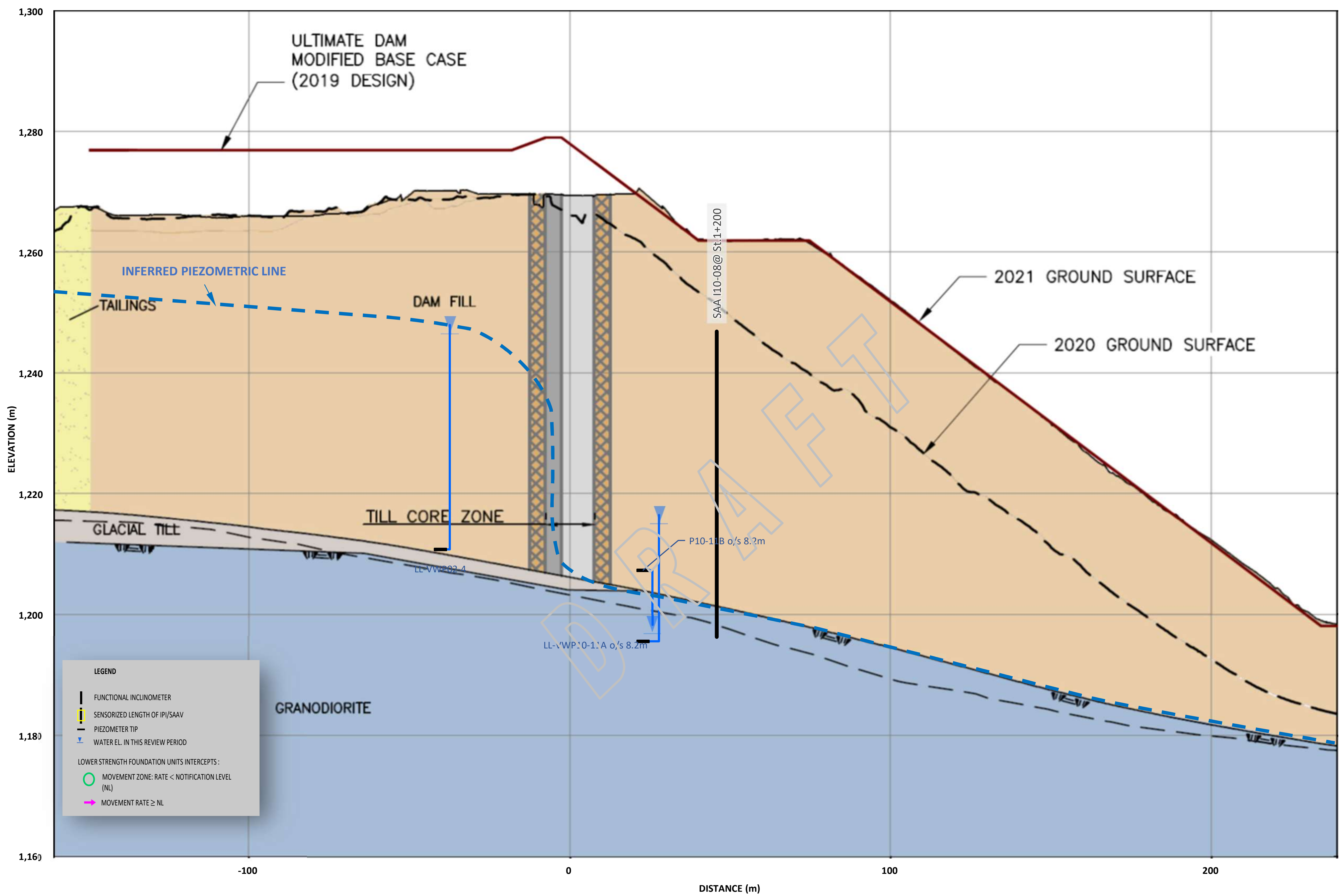
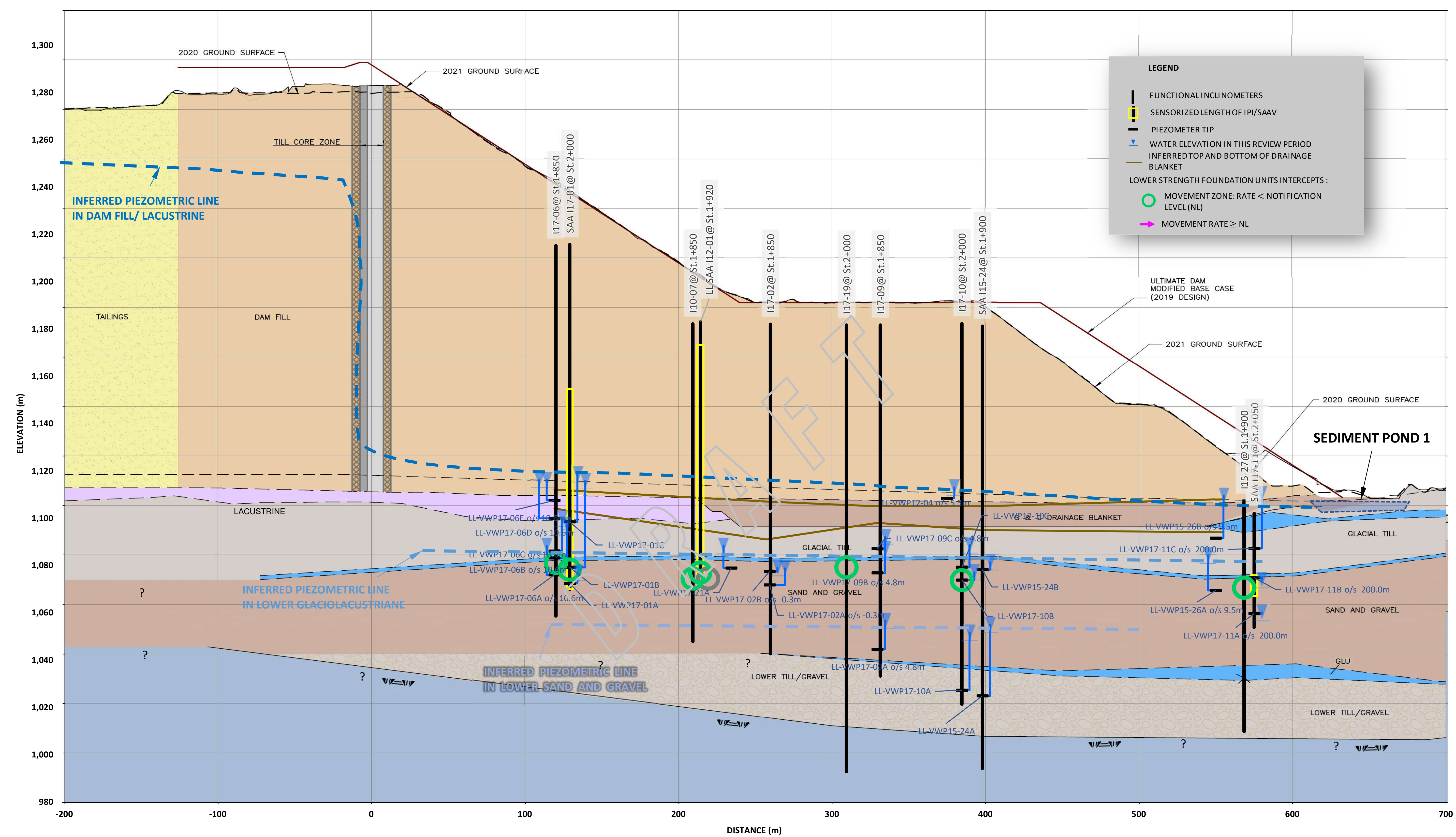


NOTES

1. THE LOCATIONS OF THE INSTRUMENTS OFF THE SECTION ARE APPROXIMATE.
2. NEGATIVE OFFSETS ARE IN FRONT OF THE SECTION, POSITIVE OFFSETS ARE BEYOND THIS SECTION
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).

CLIENT: Highland Valley Copper / Teck	PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2021 ANNUAL FACILITY PERFORMANCE REPORT
Klohn Crippen Berger	TITLE: L-L DAM INSTRUMENTATION SECTION Sta. 1+200 - SOUTH DAM INSTRUMENT STATUS IN NOVEMBER 2021
SCALE: NTS	PROJECT No.: M02341C12 — FIG. No.: 8

FILE PATH: Z:\M\VCR\M02341C12-HVC 2021 DAM SAFETY SUPPORT\300 DESIGN\330 INSTRUMENTATION SECTIONS\2021 AFPR\L-L DAM AFPR INSTRUMENTATION SECTIONS.XLSX - 2022-03-02 17:05



NOTES

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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

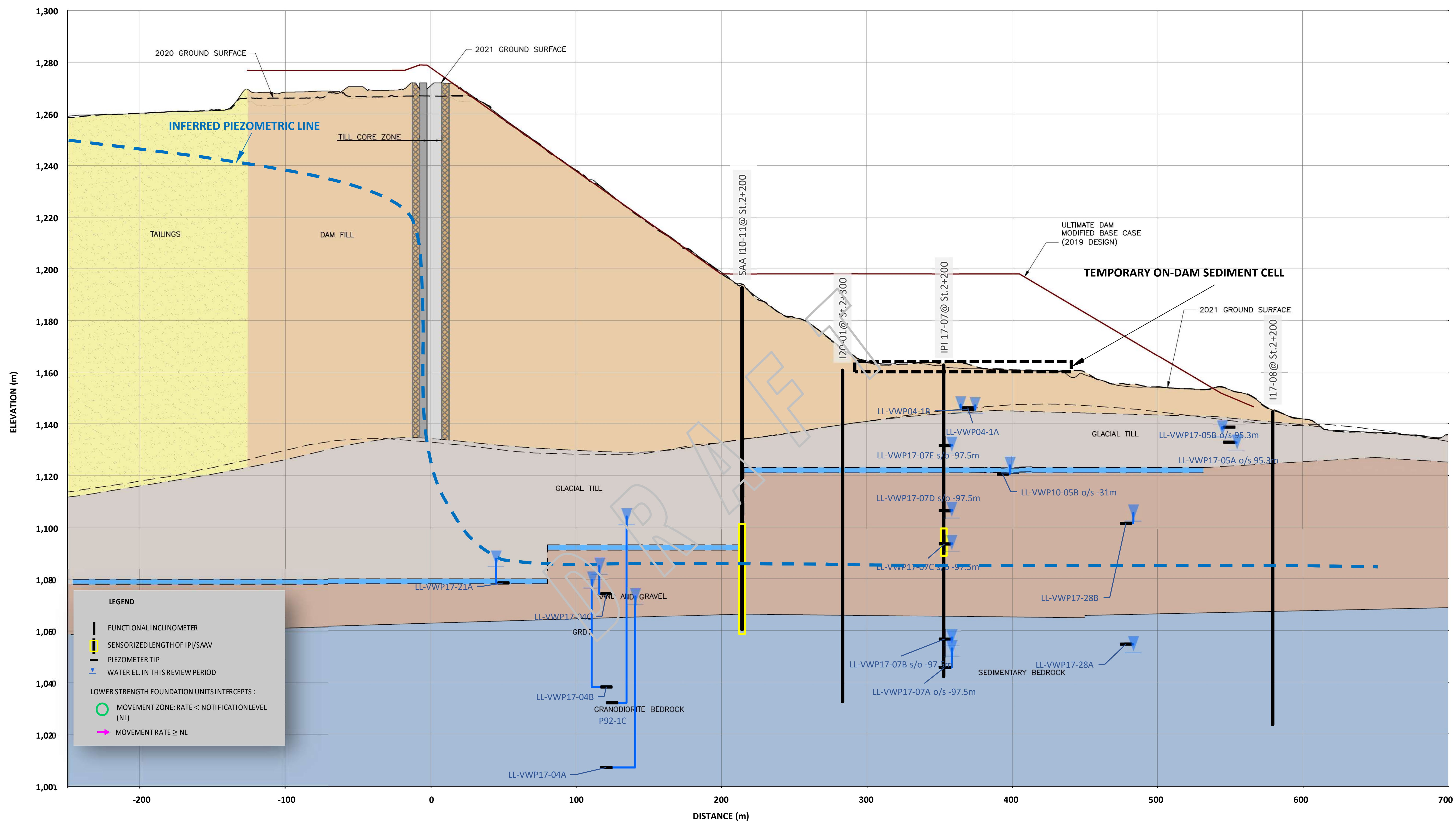
Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: L-L DAM INSTRUMENTATION SECTION Sta. 1+850 - VALLEY BUTTRESS BERM INSTRUMENT STATUS IN NOVEMBER 2021

SCALE	PROJECT No.	FIG. No.
NTS	M02341C12	9

FILE PATH: Z:\M\VCR\M02341C12-HVC 2021 DAM SAFETY SUPPORT\300 DESIGN\330 INSTRUMENTATION SECTIONS\2021 AFPR\L-L DAM AFPR INSTRUMENTATION SECTIONS.XLSX - 2022-03-02 17:0



NOTES

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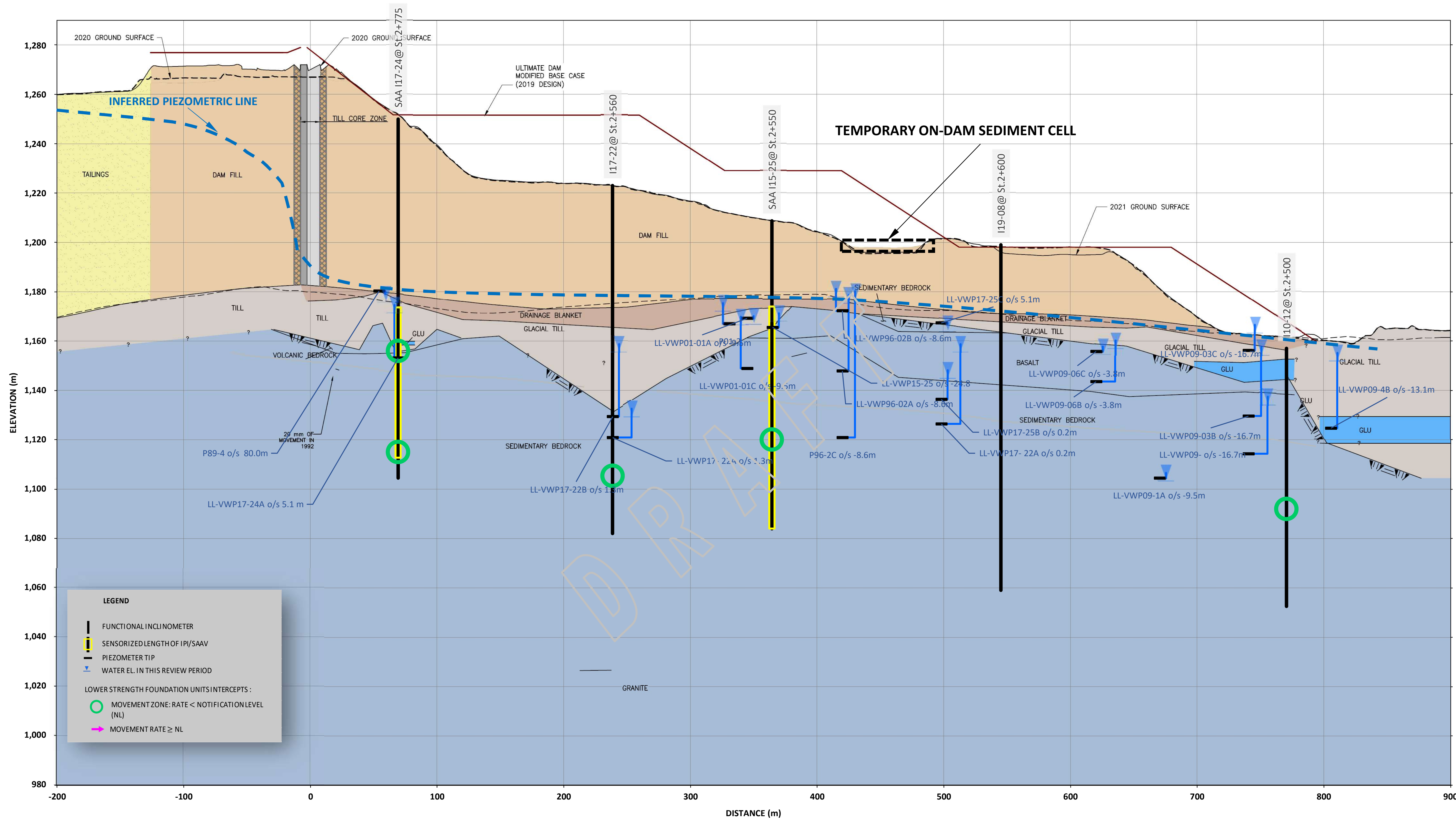
CLIENT: Highland Valley Copper / Teck	PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2021 ANNUAL FACILITY PERFORMANCE REPORT
Klohn Crippen Berger	TITLE: L-L DAM INSTRUMENTATION SECTION Sta. 2+250 - VALLEY BUTTRESS BERM EXTENSION INSTRUMENT STATUS IN NOVEMBER 2021
SCALE: NTS	PROJECT No.: M02341C12 — FIG. No.: 10

FILE PATH: Z:\M\VCR\M02341C12-HVC 2021 DAM SAFETY SUPPORT\300 DESIGN\330 INSTRUMENTATION SECTIONS\2021 AFPR\L-L DAM AFPR INSTRUMENTATION SECTIONS.XLSX - 2022-03-02 17:05



NOTES

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CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: L-L DAM INSTRUMENTATION SECTION
Sta. 2+564 - NORTH BUTTRESS BERM
INSTRUMENT STATUS IN NOVEMBER 2021

SCALE	PROJECT No.	FIG. No.
NTS	M02341C12	11

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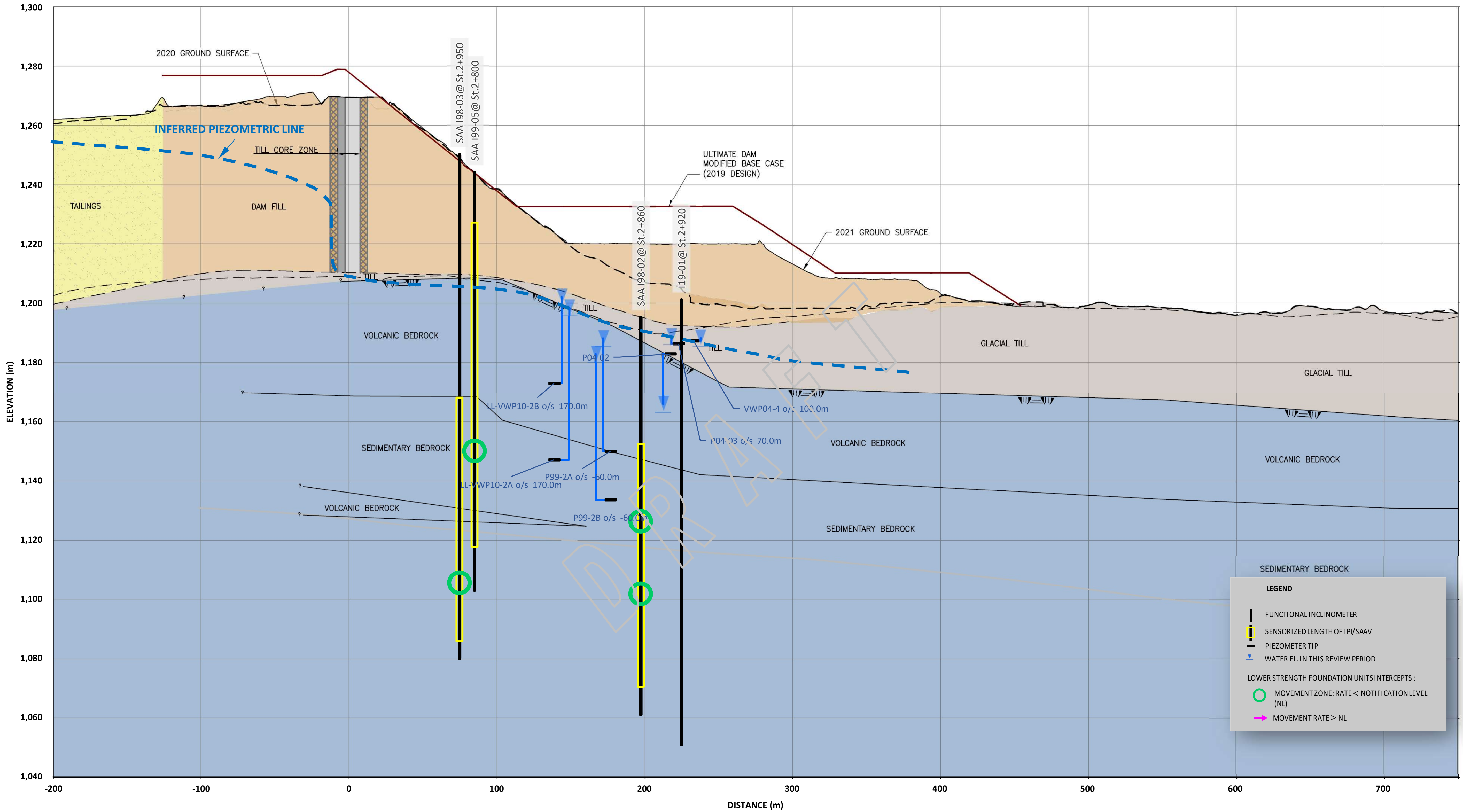

NOTES

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CLIENT: Highland Valley Copper / Teck

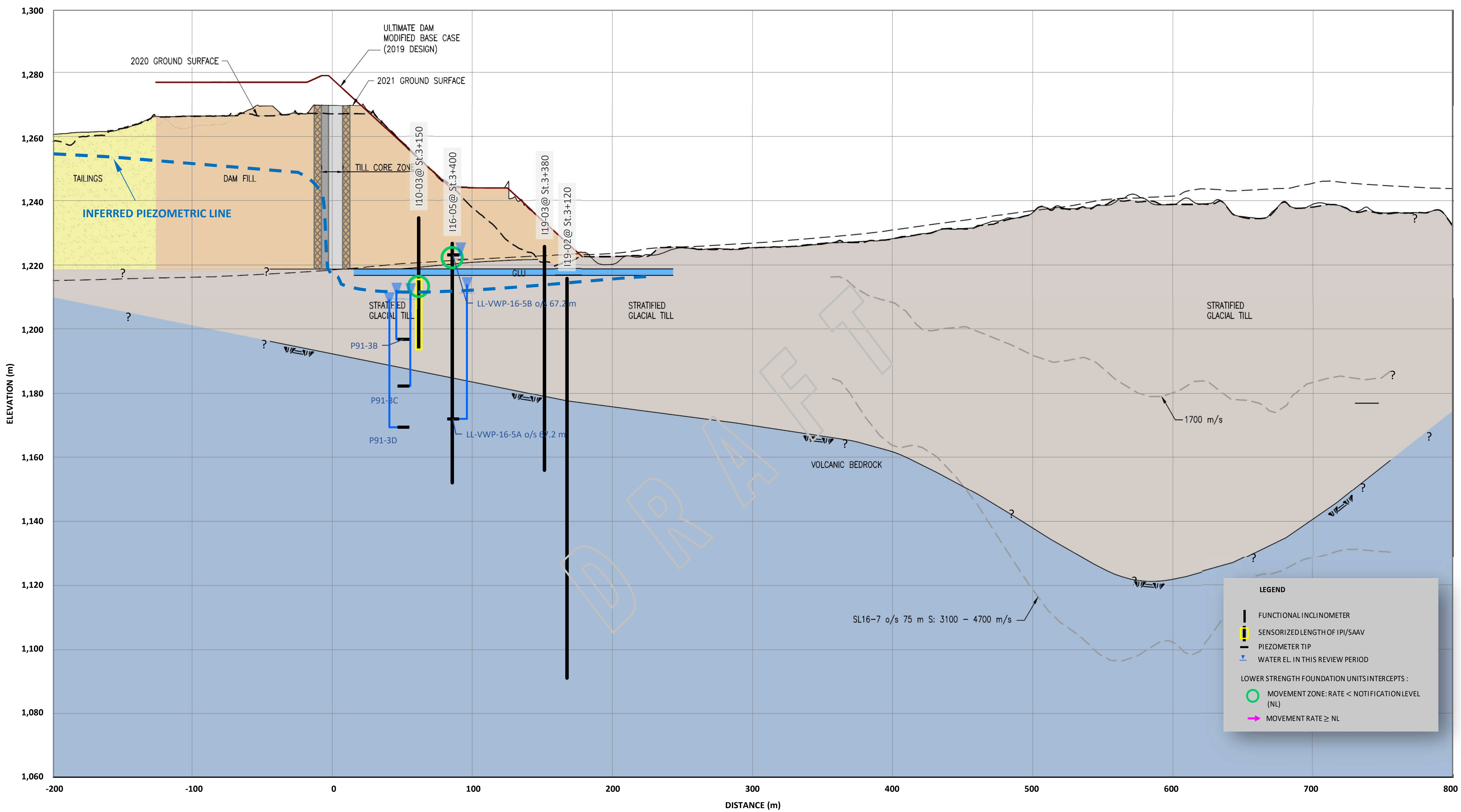
Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: L-L DAM INSTRUMENTATION SECTION
Sta. 2+800 - NORTH DAM
INSTRUMENT STATUS IN NOVEMBER 2021

SCALE	PROJECT No.	FIG. No.
NTS	M02341C12	12

FILE PATH: Z:\M\VCR\M02341C12-HVC 2021 DAM SAFETY SUPPORT\300 DESIGN\330 INSTRUMENTATION SECTIONS\2021 AFPR\L-L DAM AFPR INSTRUMENTATION SECTIONS.XLSX - 2022-03-02 17:05



NOTES

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FILE PATH: Z:\M\VCR\M02341C12-HVC 2021 DAM SAFETY SUPPORT\300 DESIGN\330 INSTRUMENTATION SECTIONS\2021 AFPR\L-L DAM AFPR INSTRUMENTATION SECTIONS.XLSX - 2022-03-02 17:05

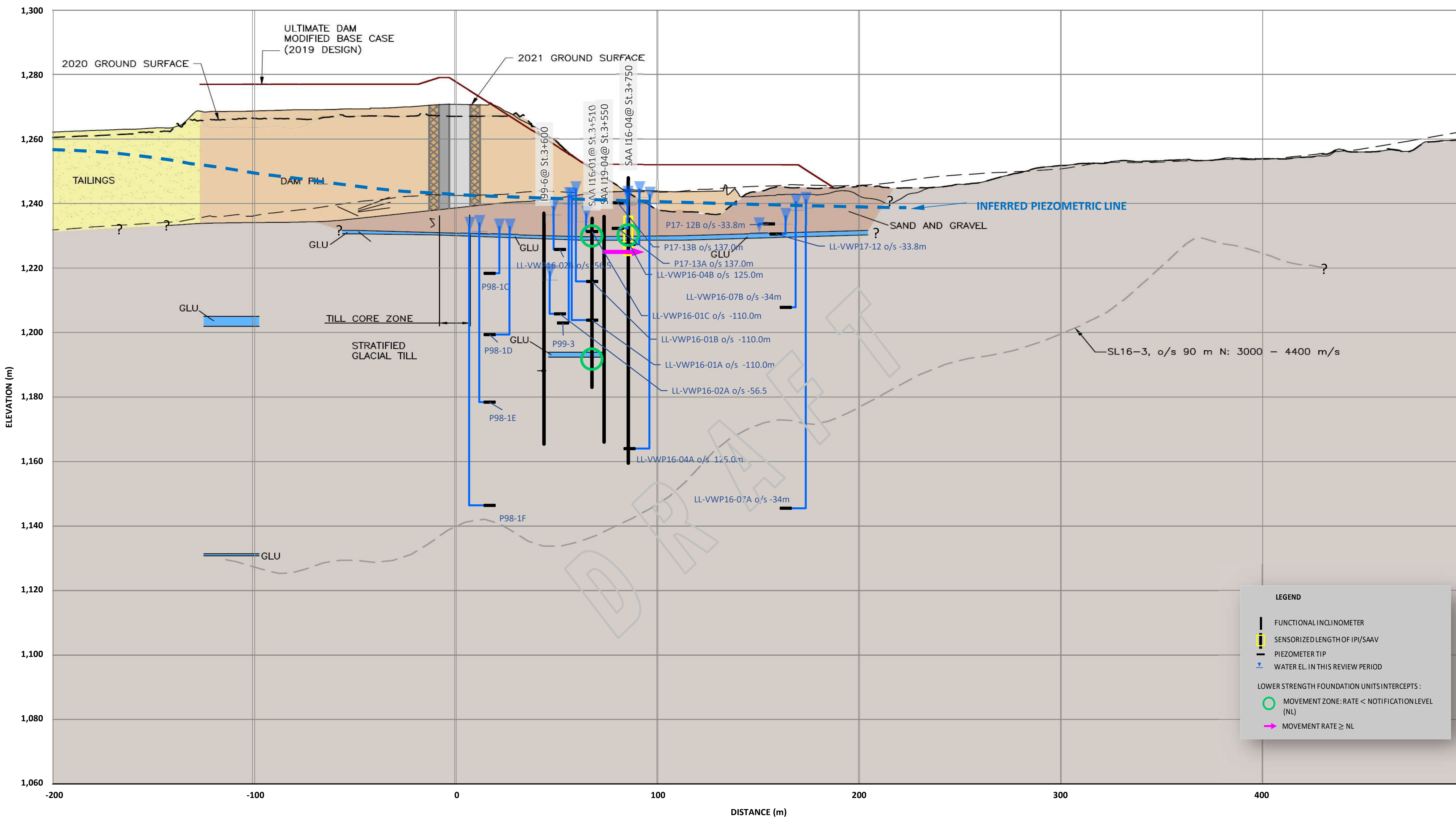
CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: L-L DAM INSTRUMENTATION SECTION Sta. 3+300 - NORTH DAM BEDROCK INSTRUMENT STATUS IN NOVEMBER 2021

SCALE	PROJECT No.	FIG. No.
NTS	M02341C12	13



NOTES

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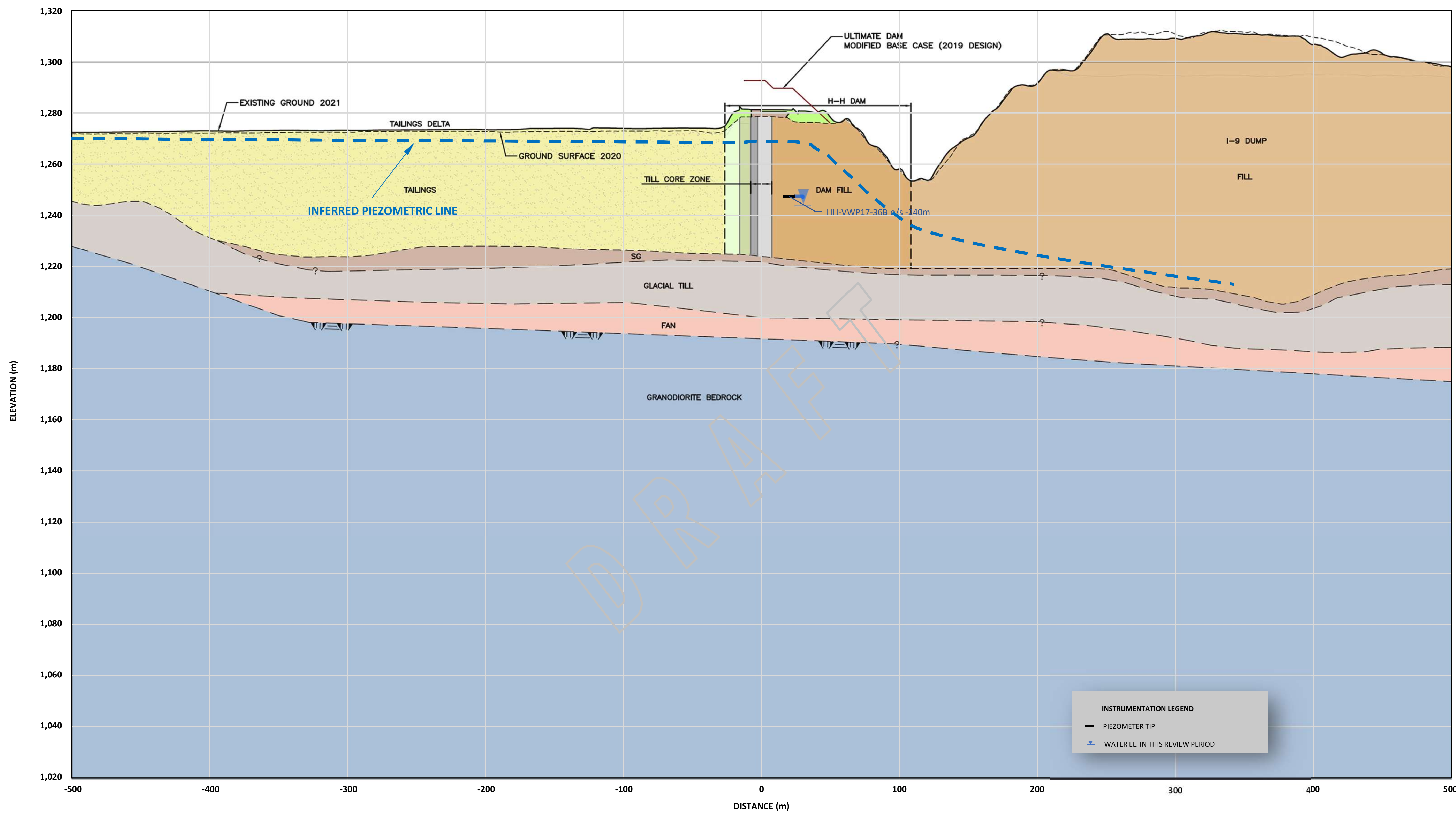
FILE PATH: Z:\M\VCR\M02341C12-HVC 2021 DAM SAFETY SUPPORT\300 DESIGN\330 INSTRUMENTATION SECTIONS\2021 AFPR\L-L DAM AFPR INSTRUMENTATION SECTIONS.XLSX - 2022-03-02 17:0?

CLIENT: Highland Valley Copper / Teck; Klohn Crippen Berger	PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2021 ANNUAL FACILITY PERFORMANCE REPORT
	TITLE: L-L DAM INSTRUMENTATION SECTION Sta. 3+630 - NORTH DAM UPPER GLACIOLACUSTRINE INSTRUMENT STATUS IN NOVEMBER 2021
	SCALE: NTS · PROJECT No. M02341C12 · FIG. No. 14



NOTES

1. THE LOCATIONS OF THE INSTRUMENTS OFF THE SECTION ARE APPROXIMATE.
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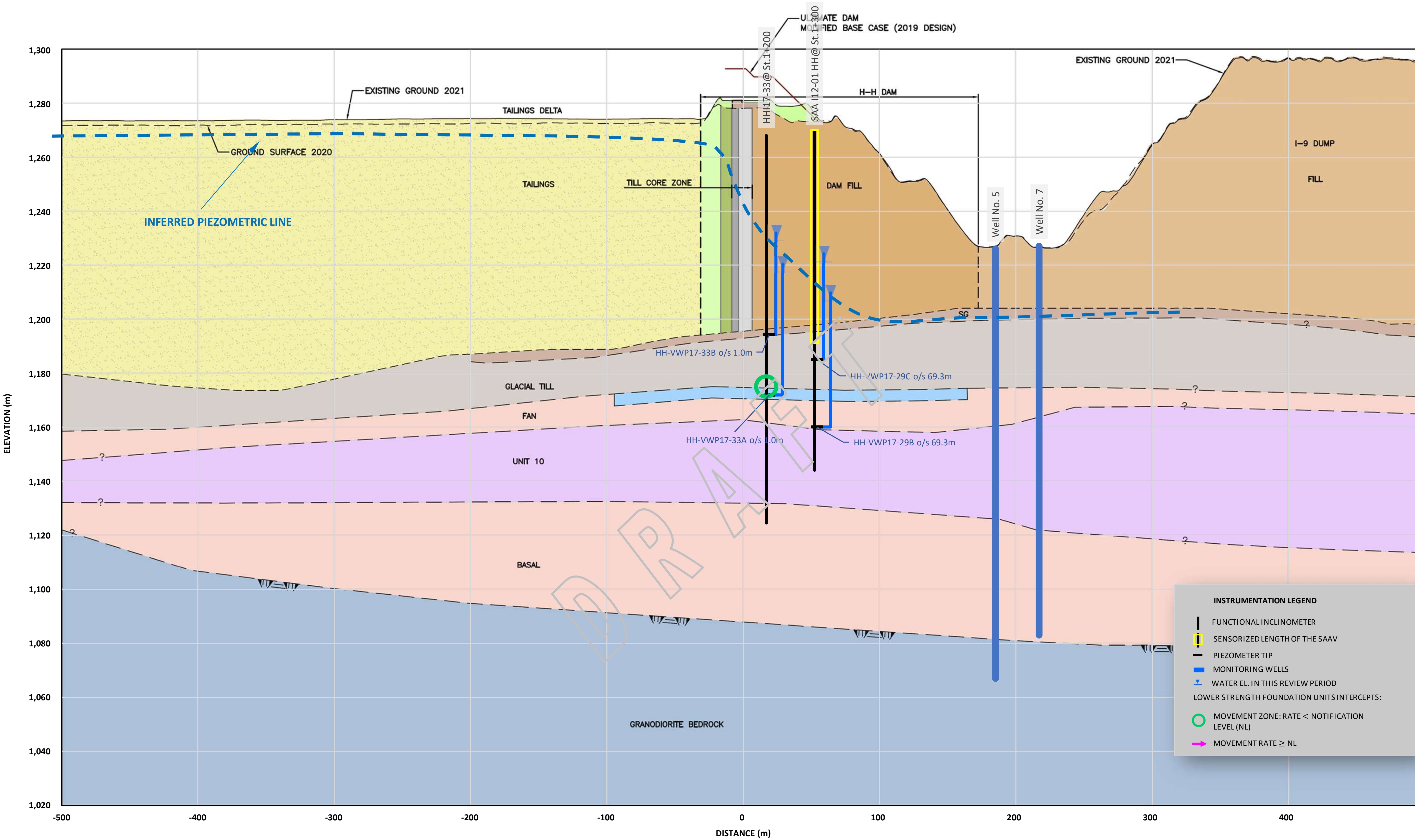
CLIENT: Highland Valley Copper / Teck; Klohn Crippen Berger	PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2021 ANNUAL FACILITY PERFORMANCE REVIEW
	TITLE: H-H DAM INSTRUMENTATION SECTION Sta. 0+800 INSTRUMENT STATUS IN NOVEMBER 2021
SCALE: NTS	PROJECT No.: M02341C12 — FIG. No.: 15

FILE PATH: Z:\M\VCR\M02341C12-HVC 2021 DAM SAFETY SUPPORT\300 DESIGN\330 INSTRUMENTATION SECTIONS\2021 AFPR\H-H DAM AFPR INSTRUMENTATION SECTIONS.XLSX - 2022-03-02 12:34



NOTES

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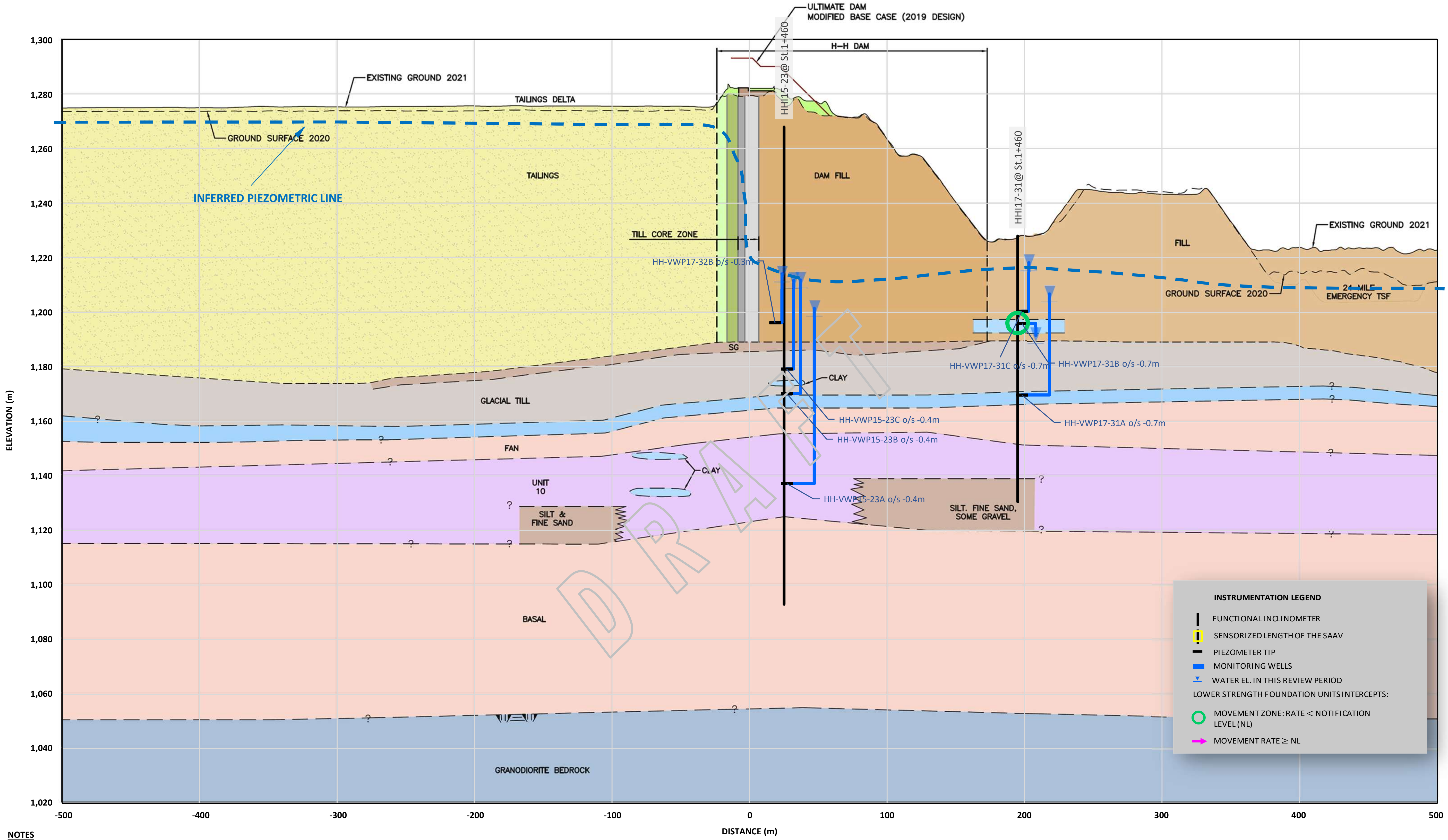
4. NO DEFINED MOVEMENT ZONE WAS IDENTIFIED AT SAA I12-01 HH.

CLIENT: Highland Valley Copper / Teck; Klohn Crippen Berger	PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2021 ANNUAL FACILITY PERFORMANCE REVIEW
	TITLE: H-H DAM INSTRUMENTATION SECTION Sta. 1+200 INSTRUMENT STATUS IN NOVEMBER 2021
	SCALE: NTS; PROJECT No.: M02341C12; FIG. No.: 16



NOTES

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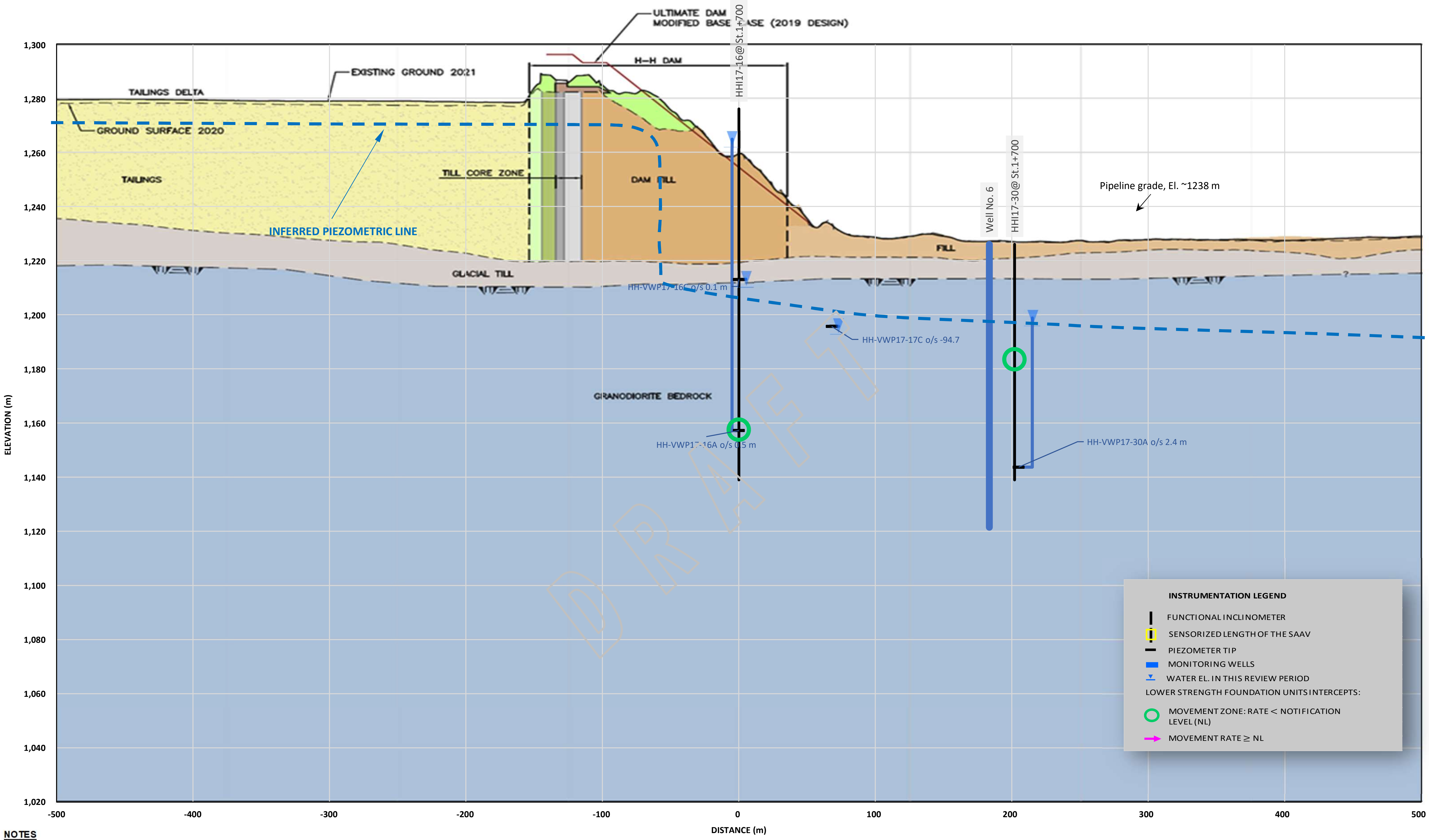
CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REVIEW

TITLE: H-H DAM INSTRUMENTATION SECTION
Sta. 1+460
INSTRUMENT STATUS IN NOVEMBER 2021

SCALE	PROJECT No.	FIG. No.
NTS	M02341C12	17



NOTES

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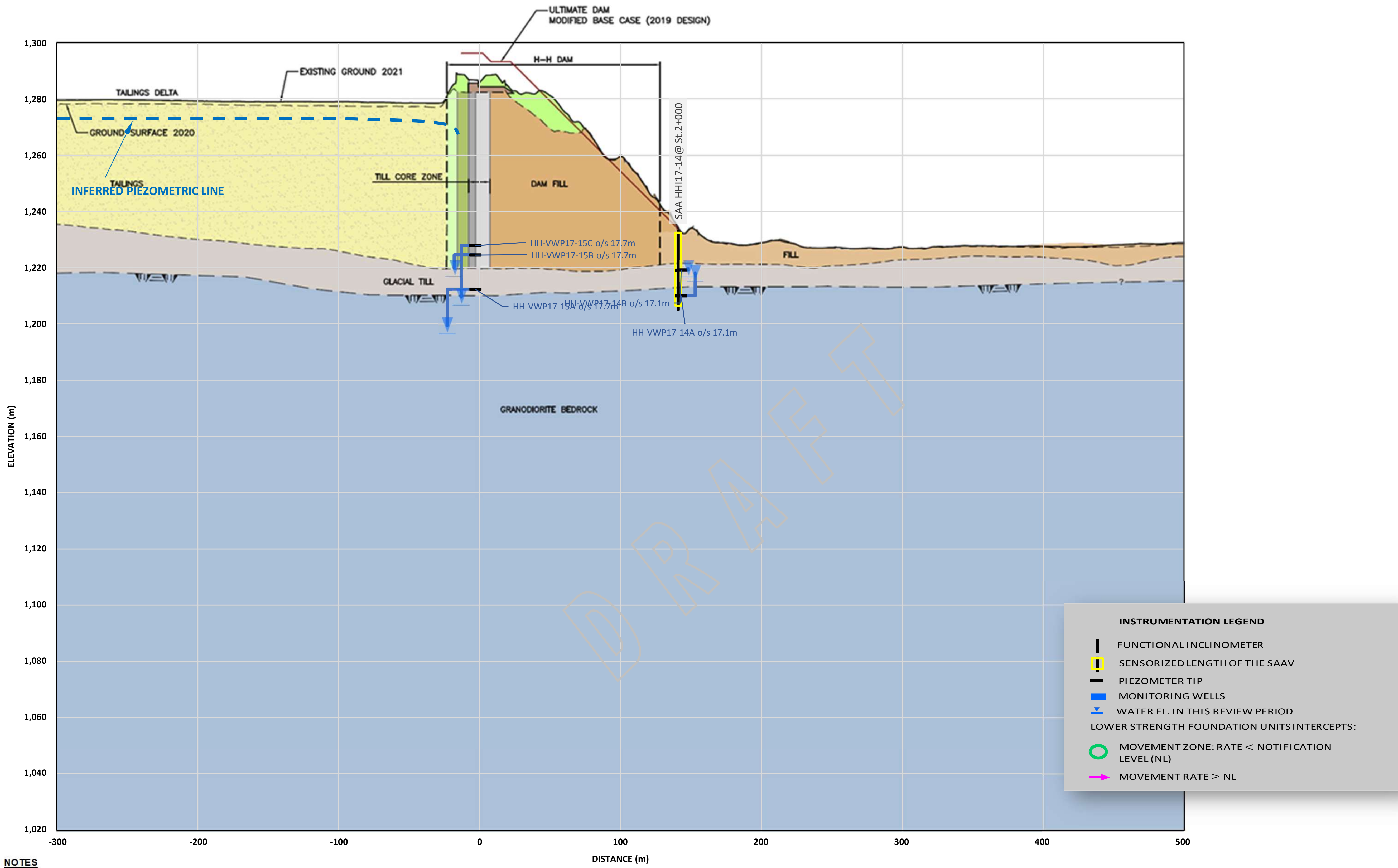
CLIENT Highland Valley Copper / Teck Klohn Crippen Berger	PROJECT HIGHLAND TAILINGS STORAGE FACILITY 2021 ANNUAL FACILITY PERFORMANCE REVIEW TITLE H-H DAM INSTRUMENTATION SECTION Sta. 1+700 INSTRUMENT STATUS IN NOVEMBER 2021

SCALE	PROJECT No.	FIG. No.
NTS	M02341C12	18



NOTES

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4. NO DEFINED MOVEMENT ZONE WAS IDENTIFIED AT HHI17-14.

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REVIEW

TITLE: H-H DAM INSTRUMENTATION SECTION
Sta. 2+000
INSTRUMENT STATUS IN NOVEMBER 2021

SCALE	PROJECT No.	FIG. No.
NTS	M02341C12	19

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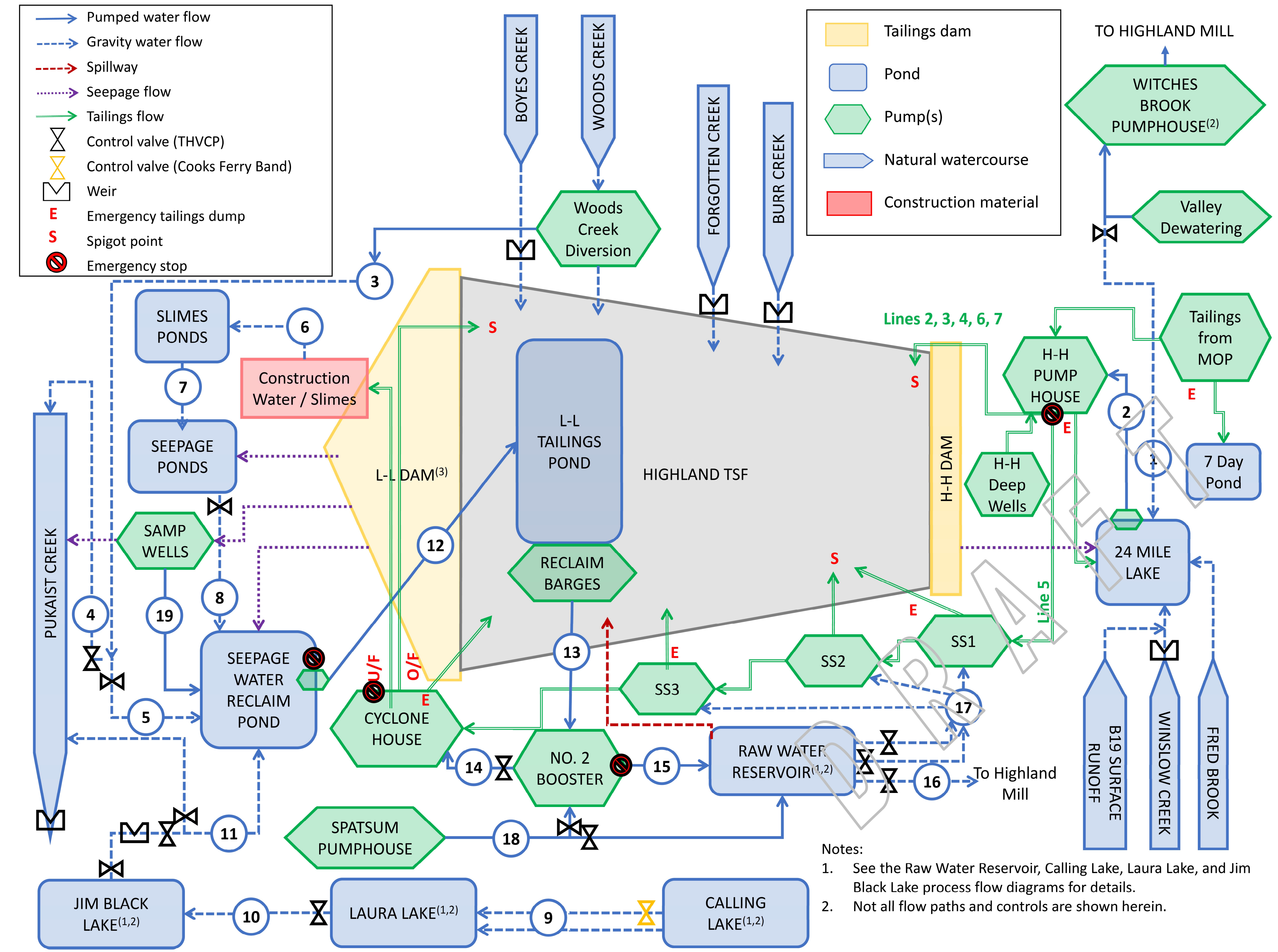


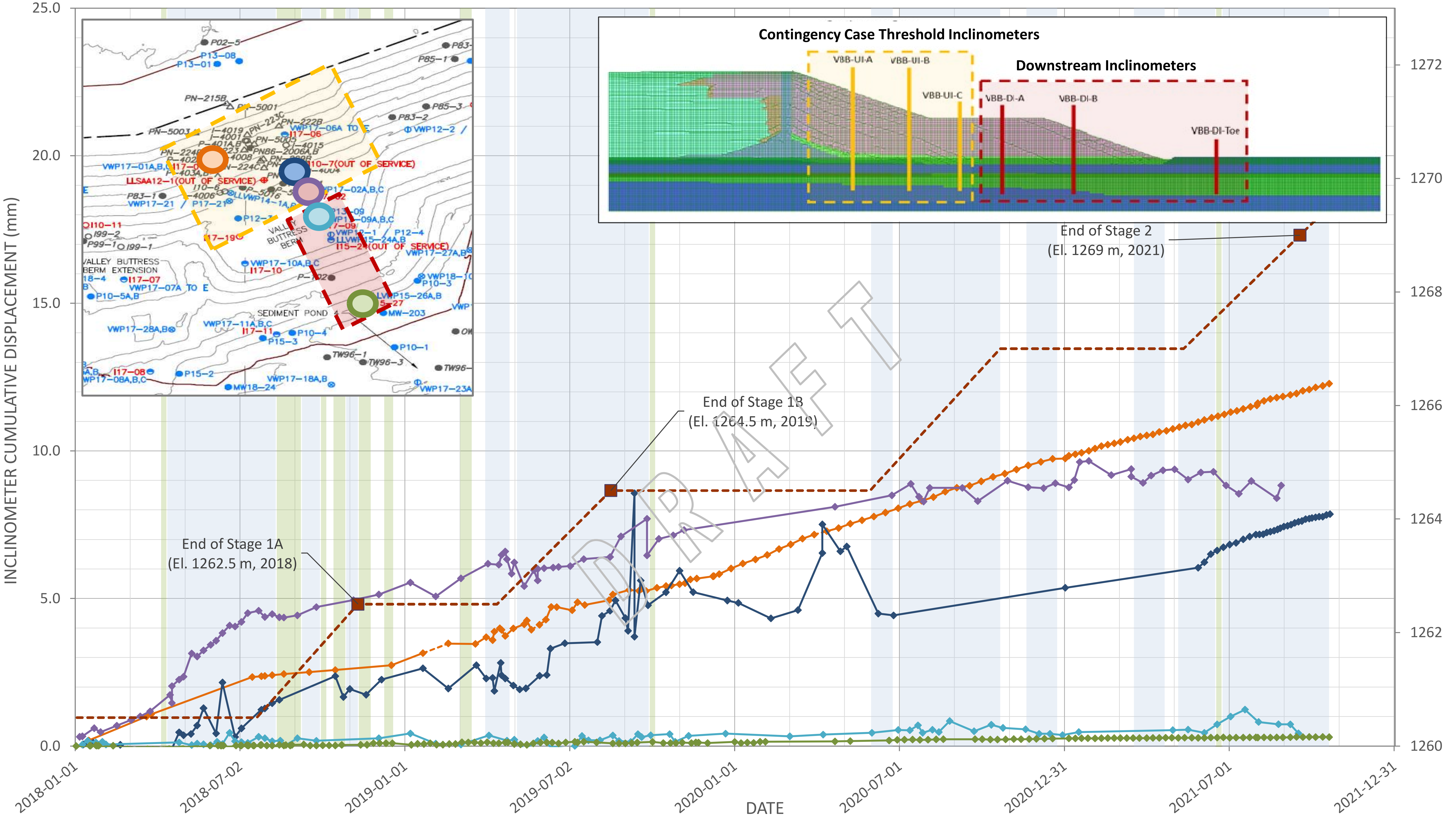
Notes:

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

CLIENT: Highland Valley Copper / Teck; Klohn Crippen Berger	PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2021 ANNUAL FACILITY PERFORMANCE REPORT
	TITLE: FLOW SCHEMATIC FOR HIGHLAND TSF
	SCALE: NTS; PROJECT No.: M02341C12; FIG. No.: 20

Date & Time: 2022-03-02 11:59
Figure File: Z:\MVCR\M02341C12-HVC 2021 Dam Safety Support\700 Deliverables\720 Working\2021 AFPR\Highland\Figures\For PFD (Fig20+21)\[FIG 21 -PDF.xlsx]ConstructionForPlots



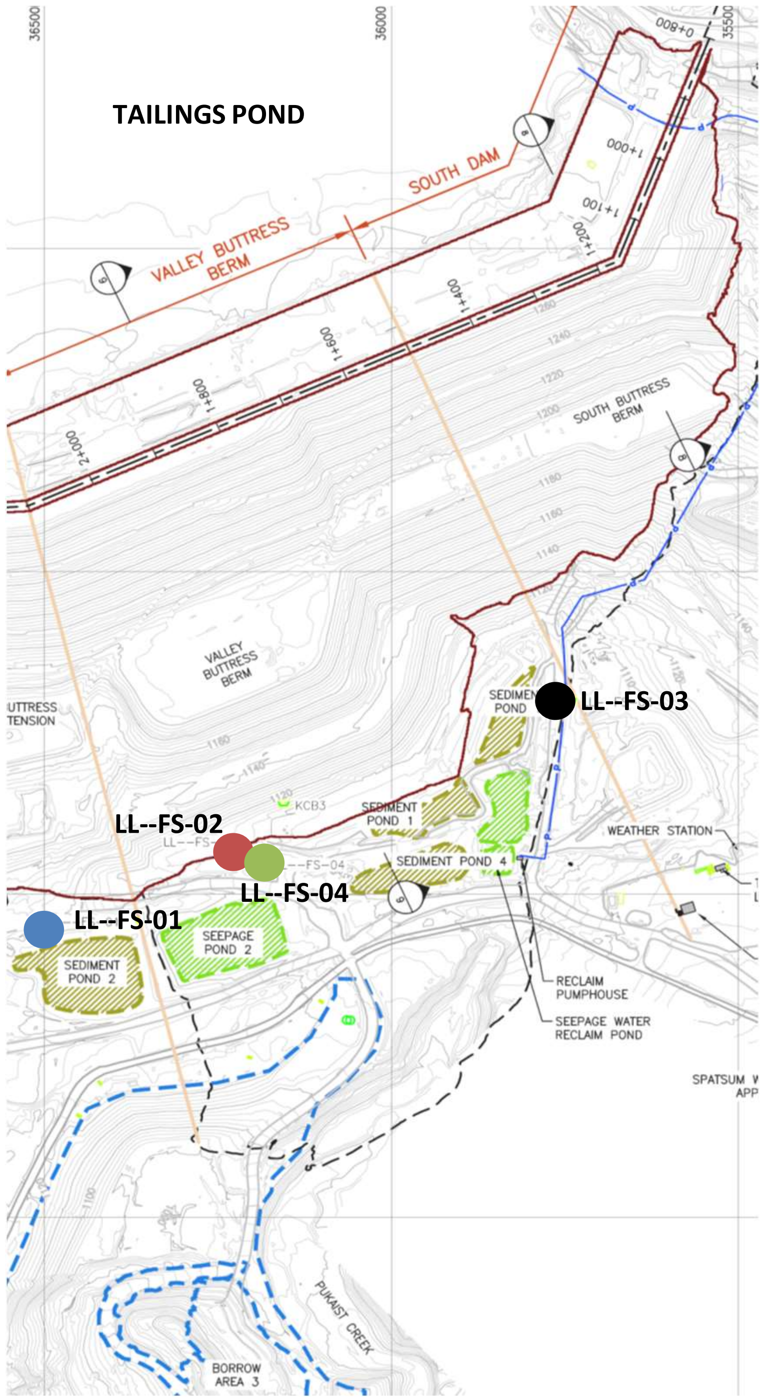
Fill Placement @ VBBE or South Dam but not at VBB
Fill Placement @ VBB (Sta. 1+600 to 2+100)
I17-01 (VBB-UI-A) El. 1073.9 m to El. 1082.6 m
I10-7 (VBB-UI-B) El. 1070 m to El. 1079 m
I17-02 (VBB-UI-C) El. 1074 m to El. 1078.8 m
I17-09 (VBB-DI-A) El. 1072 m to El. 1078.7 m
I15-27b (VBB-DI-Toe) El. 1069.8 m to El. 1071.5 m
Crest El. at Station 1+900
End of Construction Stage

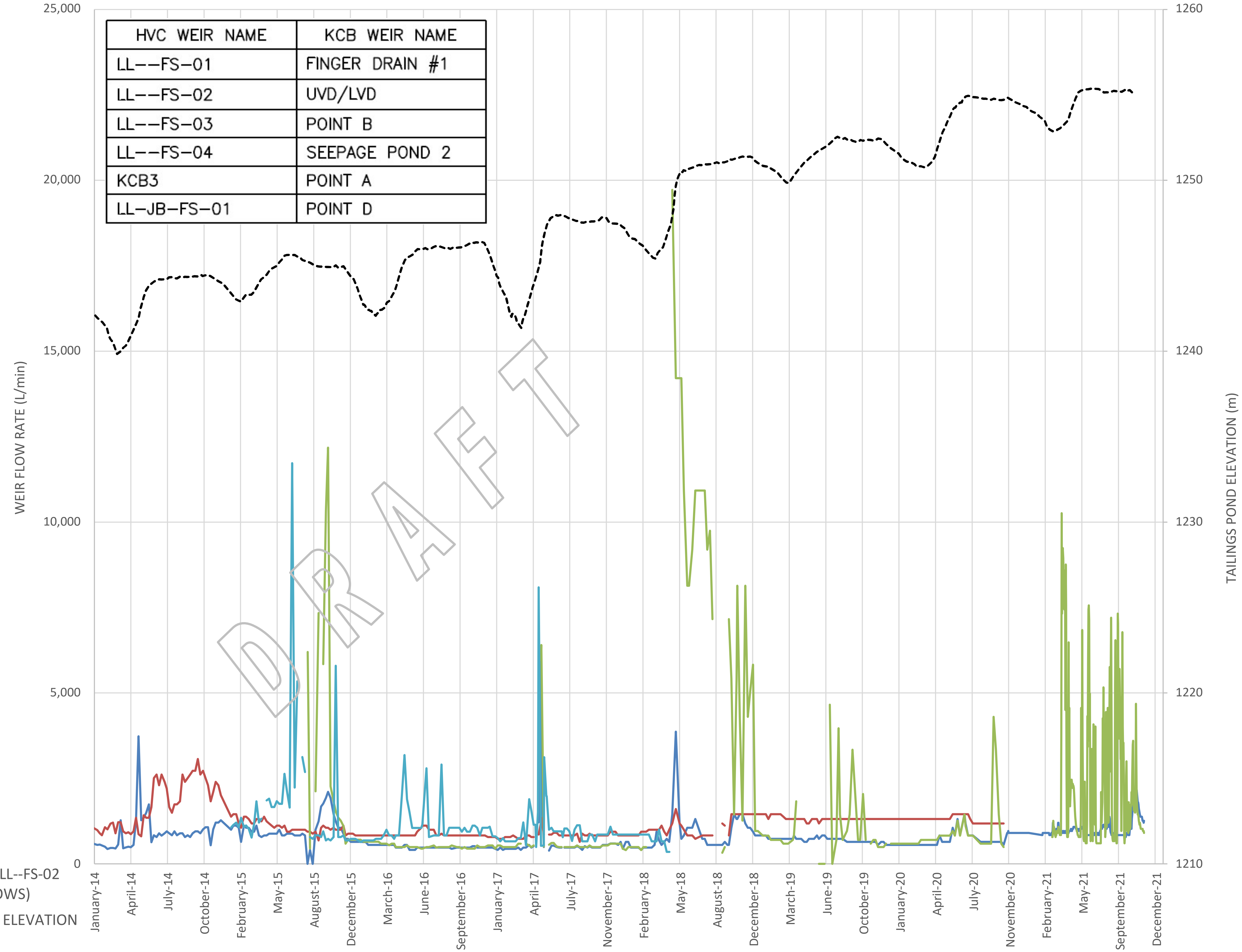
CLIENT: Highland Valley Copper / Teck
Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: VALLEY BUTTRESS BERM
INCLINOMETER MOVEMENTS
2018 TO 2021

SCALE	PROJECT No.	FIG. No.
NTS	M02341C12	21





LEGEND

- LL-FS-01
- LL-FS-02
- LL-FS-04
- LL-FS-01 PLUS LL--FS-02 (COMBINED FLOWS)
- SEEPAGE FROM VBB TOE (LL--FS-03 minus LL-JBL-FS-01)
- TAILINGS POND ELEVATION

NOTES

1. IN 2016, OS-PC-FS-02 WAS MEASURED USING A DATALOGGER. ONE MANUAL READING OF THE WEIR BY HVC SUGGESTED THAT THE DATALOGGER WAS READING LOWER THAN ACTUAL FLOW RATES.
2. AS OF JUNE 2018, THE SEEPAGE POND WAS BACKFILLED AND THERE WAS NO SEEPAGE REPORTING TO LL--FS-03.
3. VALVE OF LL-FS-04 WAS REPORTED CLOSED FROM APRIL 26, 2019 TO MAY 31, 2019 TO AID IN DREDGING.
4. RUNOFF WAS OBSERVED ON MARCH 29, 2019 AT LL--FS-01.
5. LL—FS-02 WAS REMOVED IN 2021, PRIOR TO THE AREA BEING BURING TO SUPPORT DAM CONSTRUCTION.

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: L-L DAM
POND LEVEL AND SEEPAGE FLOW
2013-2021

SCALE	PROJECT No.	FIG. No.
NTS	M02341C12	22

APPENDIX I

Annual Facility Performance Report

Site Visit Checklist, Observations and Photographs

APPENDIX I-A

L-L Dam

Site Visit Checklist, Observations and Photographs

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

SITE VISIT CHECKLIST

Facility:	L-L Dam	**Site visit Date:**	July 22, 2021
Weather:	Sunny	**Inspector(s):**	Rick Friedel, P.Eng. Delton Breckenridge, EIT.
Freeboard (pond level to dam crest):	Freeboard ~11.8 m based on July 23rd 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 Site Visit Observations section.

SITE VISIT OBSERVATIONS

Tailings Beach and Pond

Minimum beach requirements at North Abutment (>500 m) and along the remainder of the crest (126 m) were met based on visual markers (Photo I-A-1 and Photo I-A-2). HVC met their targets to maintain a wider beach (~500 m) along the remainder of the crest, except upstream of the South Dam (Photo I-A-3). Before the beach can be extended at the South Dam, the reclaim barge must be relocated further away from the dam (planned for 2023). For the interim period, HVC have commissioned low-energy headers and utilized overflow from the secondary cyclones to begin advancing the beach in this area while not increasing the suspended sediment near the reclaim barge. Photo I-A-3 includes similar photos from the 2020 and 2021 AFPR site visits to show the progress in beach construction over the past year.

At the time of the site visit, the pond was at El. 1255.2 m which is 11.8 m below the minimum dam crest (Photo I-A-3).

Crest and Upstream Slope

No visual indicators of concern or unusual behaviour, such as excessive slope or toe erosion, deformation or seepage from the cycloned sand slope (Photo I-A-1 to Photo I-A-3). No active hydraulic placement during site visit but upstream placement cells were visible.

Downstream Slope - North Dam U-GLU

No visual indicators of concern or unusual behaviour (Photo I-A-4 to Photo I-A-6). Foundation preparation, downstream of the dam, for the North Dam buttress was well advanced. The sand and gravel blanket drain had been placed over a portion of the foundation area which had been approved for fill placement. The area was visited to observe exposed geology which was being mapped and recorded by KCB's construction quality assurance (QA) team.

Downstream Slope - North Dam Bedrock

No visual indicators of concern or unusual behaviour (Photo I-A-5 to Photo I-A-6). At time of site visit, active construction included sand and gravel placement.

Downstream Slope - North Buttress Berm (NBB)

No visual indicators of concern or unusual behaviour. At time of site visit, the north side of the NBB had been prepared for hydraulic sand placement which commenced shortly after the visit. The temporary on-dam cell was not in operation (Photo I-A-7).

Downstream Slope - Valley Buttress Berm Extension (VBBE)

No visual indicators of concern or unusual behaviour (Photo I-A-8). At time of site visit, there was no active construction. The temporary on-dam cell was in operation with overflow water being discharged to Sediment Pond 2, downstream of the dam (Photo I-A-16).

Downstream Slope - Valley Buttress Berm (VBB)

No visual indicators of concern or unusual behaviour (Photo I-A-9 to Photo I-A-12). There was no active construction at the time of site visit. Sediment Pond 1 was in operation downstream of the VBB toe (Photo I-A-10). Water levels and operating conditions were consistent with expected conditions. HVC had installed a secondary pump where Sediment Pond 1 flows into the Seepage Water Reclaim Pond (SWRP) to increase reclaim capacity during high-flow periods. The secondary pump was not in operation during the site visit as the pond level was being managed within normal levels by the SWRP reclaim system.

Downstream Slope - South Dam

No visual indicators of concern or unusual behaviour (Photos I-A-11 to Photo I-A-14). Downstream hydraulic placement of cycloned sand was ongoing at the time of site visit (Photo I-A-12 and Photo I-A-13). No observations of erosion along the dam toe downstream of the placement area or at the abutment.

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.

Seepage and Sediment Ponds

All seepage and sediment ponds were in good condition. At the time of site visit, Sediment Pond 1, Sediment Pond 2 and the temporary on-dam cell at the VBBE were in operation supporting hydraulic placement.

SITE VISIT PHOTOGRAPHS

LEGEND:

- LL = L-L Dam.
- LL-2021-## refers to 2021 Annual Facility Performance Report way points shown on Figure 2.
- All photographs taken during site visit on July 22, 2021.

Photo I-A-1 Overview of Tailings Beach at North Abutment which is >500 m wide (upstream of core zone) as per design. (LL-2021-01)

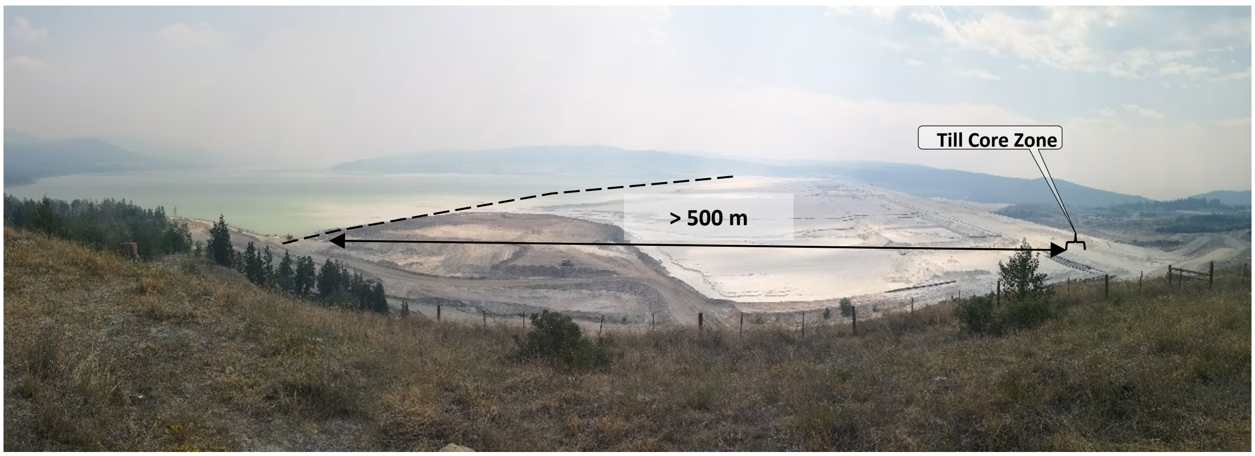


Photo I-A-2 Overview of Tailings Beach and upstream cycloned sand hydraulic placement cells at North Dam U-GLU (LL-2021-01)

Photo I-A-3 Overview of Tailings Dam beach and crest at South Abutment and upstream of South Dam during 2021 AFPR site visit (top). Similar photo taken during 2020 AFPR site visit (bottom) included to show beach development over past year (LL-2021-02)

Photo I-A-4 **Overview of the downstream slope at the North Abutment and mine access roads. No areas of excessive erosion or scour were observed over or near the dam surface. (LL-2021-03)**

Photo I-A-5 **Overview of downstream slope of North Dam U-GLU and Bedrock segments, looking south. North Dam buttress foundation preparation areas visible along toe (LL-2021-03)**

Photo I-A-6 Overview of downstream slope of North Dam Bedrock and U-GLU segments (north of the NBB), looking north. North Dam buttress foundation preparation areas visible along toe. (LL-2021-04)

Photo I-A-7 North side of the NBB which has been prepped for hydraulic placement. (LL-2021-05)

Photo I-A-8 Overview of VBBE downstream slope, looking east from Sediment Pond 2. Temporary on-dam cell is not visible in photo, but was active during site visit. (LL-2021-06)

Photo I-A-9 Downstream toe of the VBB with no visible seepage from cycloned sand fill above underdrain, looking north. Sediment Pond 1 present along dam toe, as well as internal sand and gravel berms which prevent sediment from encroaching on archeologically sensitive native ground. (LL-2021-07)

Photo I-A-10 Overview of VBB downstream slope with Sediment Pond 1 (south cell) at dam toe, looking east. Secondary pump added to increase reclaim capacity from SWRP visible in foreground. (LL-2021-07)

Photo I-A-11 Overview of VBB and South Dam downstream slope and toe area, looking South. (LL-2021-07)

Photo I-A-12 Overview of VBB and South Dam downstream slope and toe area, looking North. Active hydraulic placement to raise South Dam to ultimate downstream slope was in progress during site visit (LL-2021-08)

Photo I-A-13 Downstream hydraulic fill placement at the South Dam (LL-2021-08)

Photo I-A-14 Overview of downstream slope of South Dam and near South Abutment, looking North. No observations of seepage from cycloned sand slope or excessive erosion. (LL-2021-08)

Photo I-A-15 SWRP, pond level during site visit was within typical operating levels and the secondary reclaim pump was not in operation. Channel in foreground is connection with Sediment Pond 1. (LL-2021-07)

Photo I-A-16 Overview of Sediment Pond 2 which was at typical operating levels and receiving overflow from the VBBE temporary on-dam sediment cell. (LL-2021-06)

APPENDIX I-B

H-H Dam

Site Visit Checklist, Observations and Photographs

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

SITE VISIT CHECKLIST

Facility:	H-H Dam	**Site visit Date:**	July 22, 2021
Weather:	Sunny	**Inspector(s):**	Rick Friedel, P.Eng. Delton Breckenridge, EIT.
Minimum observed buffer height (delta level to dam crest):	Variable along dam crest (>3.6 m), the buffer is greatest at Sta. 0+510 and Sta. 0+800 based on July 27th 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 Site Visit Observations and photos for further notes.

SITE VISIT OBSERVATIONS

Tailings Beach

Wet area in low point of tailings beach near the H-H Dam was observed during the site visit which is typical and related to temporary ponding of surface runoff and tailings slurry in the low point of the beach. Water depth is typically less than 1 m. Based on the July 14, 2021 beach survey, the buffer[1] along the H-H Dam crest ranged from 3.6 m to 4.8 m, which was significantly greater than the minimum specified in design (1 m) or HVC's operating target (2 m).

Crest

No visual indicators of concern or unusual behaviour, such as excessive slope or toe erosion, deformation or seepage from the rockfill slope. At the time of the site visit the 2021 crest raise had started in the Mid-Segment of the dam (Photo I-B-1). During the 2021 crest raise the core zone was not raised as per the approved design update (discussed in Section 3.2 of main report text). The sand and gravel (SG2) filter zone was shifted upstream overtop of the core and a continuous 2 m thick horizontal layer and was constructed to maintain continuity between the 2020 and 2021 SG2 fill.

West Abutment

No visual indicators of concern or unusual behaviour. No construction of the crest raise, abutment tie-in or West Abutment Rockfill Berm had commenced at the time of the site visit (Photo I-B-2).

East Abutment

No visual indicators of concern or unusual behaviour. Construction at the abutment had not yet commenced at the time of the site visit.

Downstream Slope

No visual indicators of concern or unusual behaviour (Photo I-B-4 and Photo I-B-5).

Seepage

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

24 Mile Waste Dump / 24 Mile TSF Areas

No active dumping in the waste dump at the time of the site visit but additional fill had been placed since 2020 AFPR site visit (Photo I-B-5). Water levels in 24 Mile TSF were above HVC operating targets but flood storage during the site visit, and through the review period, exceeded minimum required.

[1] Buffer is the vertical distance between the tailings surface and H-H Dam crest at that location.

SITE VISIT PHOTOGRAPHS

LEGEND:

- HH = H-H Dam.
- HH-2021-## refers to 2021 Annual Facility Performance Report way points shown on Figure 4.
- All photographs taken during the site visit on July 22, 2021.

Photo I-B-1 Overview of H-H Dam crest and tailings beach from West Abutment, looking East. The 2021 crest raise activities had started in the middle segment of the dam but had not yet reached the West Abutment area at the time of the site visit. There was a wetted area of the beach upstream of the dam. This is typical as it is the low point of the beach, near the dam, where surface runoff or tailings slurry temporarily pond. (HH-2021-01)

Photo I-B-2 Overview of West Abutment, SS1 pumphouse and where the drain pipelines cross the H-H Dam crest. The pipes have secondary containment berms where they cross the sand and gravel and core zones to prevent overflow onto the crest in the event of pipe breakage. (HH-2021-01)

Photo I-B-3 Tailings being discharged from the H-H Dam West Abutment. The spigot is approximately 100 m upstream of H-H Dam and not in view of the photo but the flow path of recent deposition is visible. (HH-2021-02)

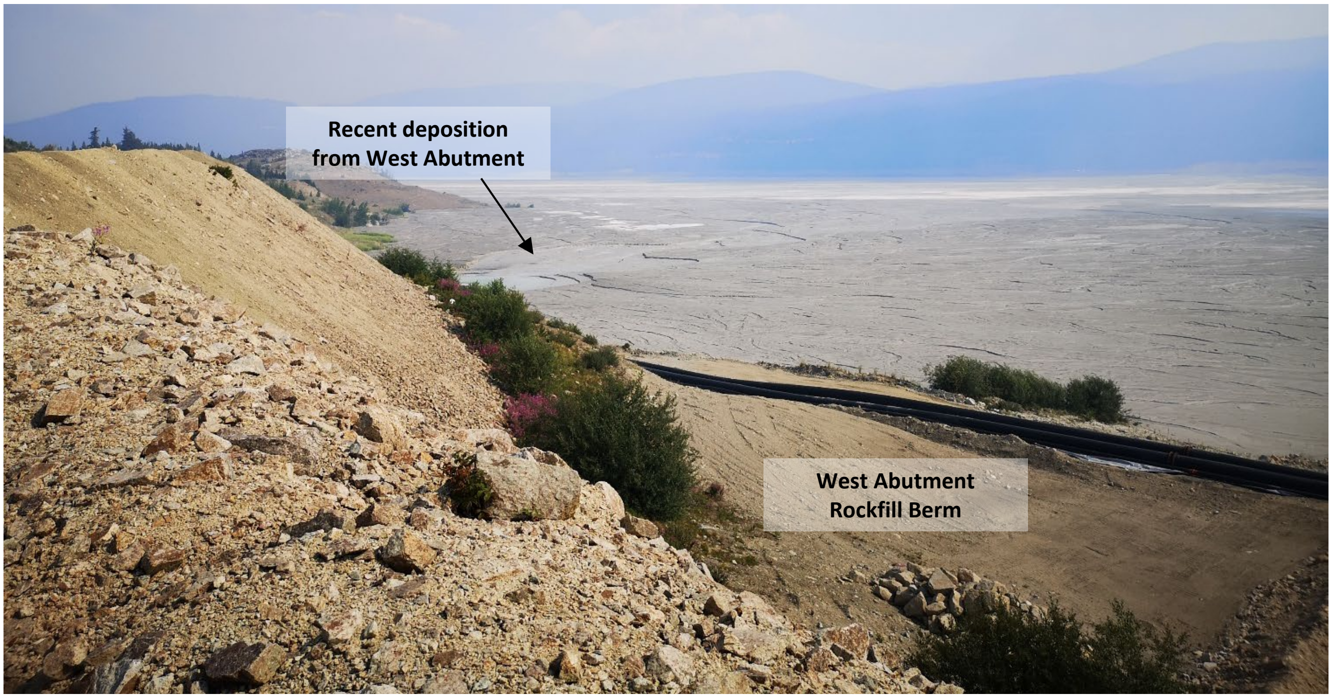


Photo I-B-4 Overview of H-H Dam eastern downstream slope. The light colour area of the slope is where Bethsaida sand was placed in the dam shell earlier in the mine life. Bethsaida sand does not meet the current fill placement specification for the downstream shell but this zone of material has been accounted for in the design. (HH-2021-03)

Photo I-B-5 Overview of H-H Dam downstream slope and buttress area over 24 Mile TSF, looking west. (HH-2021-03)

APPENDIX II

Climate Data

Appendix II
Climate Data

HVC provided weather data from the L-L Dam Weather Station (El. 1186.0 m), for the 2021 AFPR review period, for KCB to review. KCB adjusted the Historical Average Lornex Synthetic Record data using the Highland TSF Area adjustment factors provided in Golder (2021). To support key precipitation trends and impacts on observed dam performance, KCB downloaded data from the Kamloops Pratt Road Weather Station (Environment Canada Station No. 116C8P0, El. 729.0 m, 73 km away), and was provided data from the Shula Weather Station (El. 1208 m, station located on HVC property) by HVC, to review and compare precipitation trends against the L-L Dam Weather Station data. The Kamloops Pratt Road Weather Station (El. 729.0 m) was used for comparison rather than the Kamloops Airport Station (El. 345.3 m), as the elevation at the Pratt Road Station is closer to L-L Dam Weather Station (El. 1186.0 m).

The precipitation normals (adjusted Highland Valley Lornex Synthetic Record) and precipitation records between December 2020 and November 2021 (unadjusted L-L Dam, unadjusted Kamloops Pratt Road and unadjusted Shula Flats data), are tabulated and plotted in Table II-1 and Figure II-1, respectively. The following observations are noted for the L-L Dam precipitation in the reporting period:

- All storm events during the review period 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: 15.9 mm on December 21, 2020; 18.2 mm on August 16, 2021, and 24.0 mm on November 15, 2021.
- In Figure II-1, all months, except for August 2021, October 2021 and November 2021 reported 9% to 93% decreases relative to average precipitation. August 2021 precipitation increased 40% relative to the historic normals; October 2021 increased 3%, and November 2021 increased 10%.
- The L-L Dam Weather Station database included some gaps in 2020 measurements. HVC managed to improve the monitoring program and, as Figure II-1 indicates, there were no data gaps in the 2021 measurements. In addition, consistency in trends between the Kamloops Pratt Road Station, the Shula Weather Station data for 2021, and the L-L Weather Station provides confidence in the L-L Weather Station data.
- In Table II-2, snowpack depth measurements from the Highland Valley Station (El. 1268 m) indicate the snow had melted during April 2021, and was gone by May 1st. In comparison, the water balance assumes 30% of snowmelt occurs in March and 70% in April (Golder 2020a).
- Seasonal rise and fall of pond levels is associated with freshet. In 2021, pond levels dropped in May, coincident with completion of snowmelt, which is consistent with historic trends. Rainfall measured from March through May, when reservoir level was rising, was approximately 35% of the historical average during that same period, which suggests the majority of the 2021 freshet was related to snowmelt.

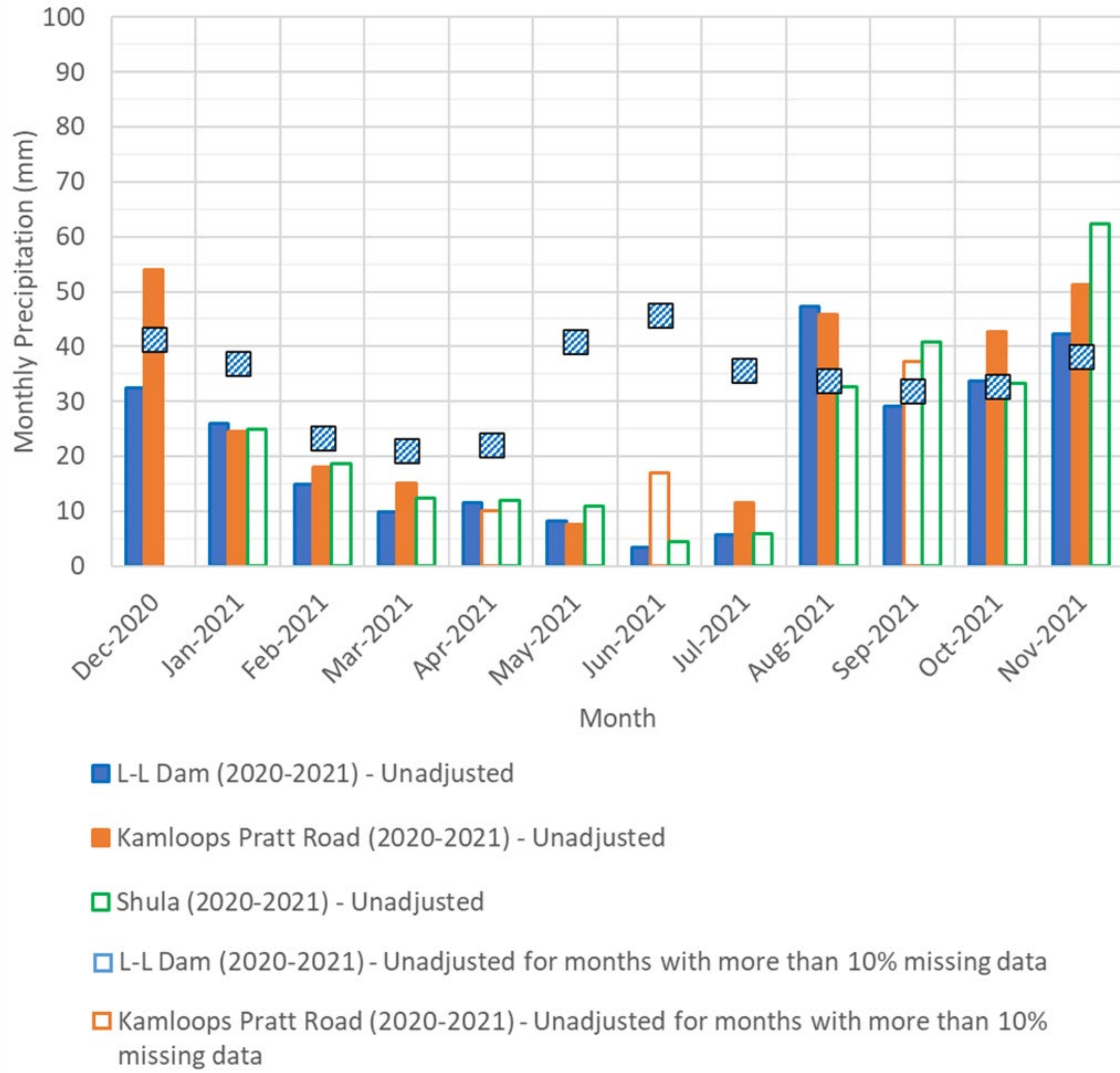
Table II-1 Monthly Precipitation

Month	Availability of Data (%)	Precipitation (mm)			
	L-L Dam Weather Station	Unadjusted L-L Dam Weather Station Data (2020 to 2021)	Average Lornex Synthetic Record Adjusted to Highland TSF (1967 to 2019) (1)	Unadjusted Kamloops Pratt Road Weather Station (2020 to 2021)	Unadjusted Shula Weather Station (2020-2021) (4)
Dec 2020	100	32.3	41.4	54.0	N/A (5)
Jan 2021	100	26.0	36.9	24.4	24.9
Feb 2021	100	14.8	23.3	18.0	18.7
Mar 2021	100	9.9	21.1	15.0	12.3
Apr 2021	100	11.5	22.0	10.0 (3)	11.9
May 2021	100	8.3	40.9	7.6	10.9
Jun 2021	100	3.3	45.7	17.0 (3)	4.4
Jul 2021	100	5.7	35.6	11.6	5.9
Aug 2021	100	47.3	33.8	45.8	32.6
Sep 2021	100	29.2	32.0	37.2 (3)	40.7
Oct 2021	100	33.6	32.7	42.6	33.2
Nov 2021	100	42.2	38.2	51.2	62.3
Annual Total	-	**264.1**	**403.5**	**334.4**	**257.8**

Notes:

1. Estimated by Golder (2021) using appropriate adjustment factors and average precipitation measured at Highland Valley Lornex climate station (Environment Canada ID No. 1123469 at El. 1268 m from 1967 to 2011). Golder (2021) infilled the data gaps prior to November 2011 and created a long-term synthetic precipitation record to the end of 2019. Monthly average of the synthetic record adjusted to Highland TSF Area by a Lornex-to-Highland TSF Area adjustment factor of 1.10 are shown herein, refer to Golder (2021) for detailed information.
2. Review period for the Highland Annual Facility Performance Reports is from December 2020 through November 2021.
3. Monthly precipitation with more than 10% missing data.
4. 2021 monthly precipitation data provided to KCB as summarized data for the given month; therefore, the completeness of the data was not independently verified.
5. HVC noted that the data set was not complete enough to report, and as a result it was not counted.

Figure II-1 Monthly Precipitation



Note:
1. The Shula weather station data used for this comparison only included monthly values (i.e., no daily data) and thus, KCB was not able to assess the completeness of the dataset.

Seasonal snowpack depth is not measured at the L-L Dam weather station. Instead, HVC to monitors snowpack with monthly measurements at the Highland Valley snow survey station (Station No. 1C09A) near the Trojan TSF. 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 2021 snowpack depths, based on available records, are summarized in Table II-2.

Figure II-2 compares SWE data and temperature data from January to June 2021. The following observations are inferred from these data:

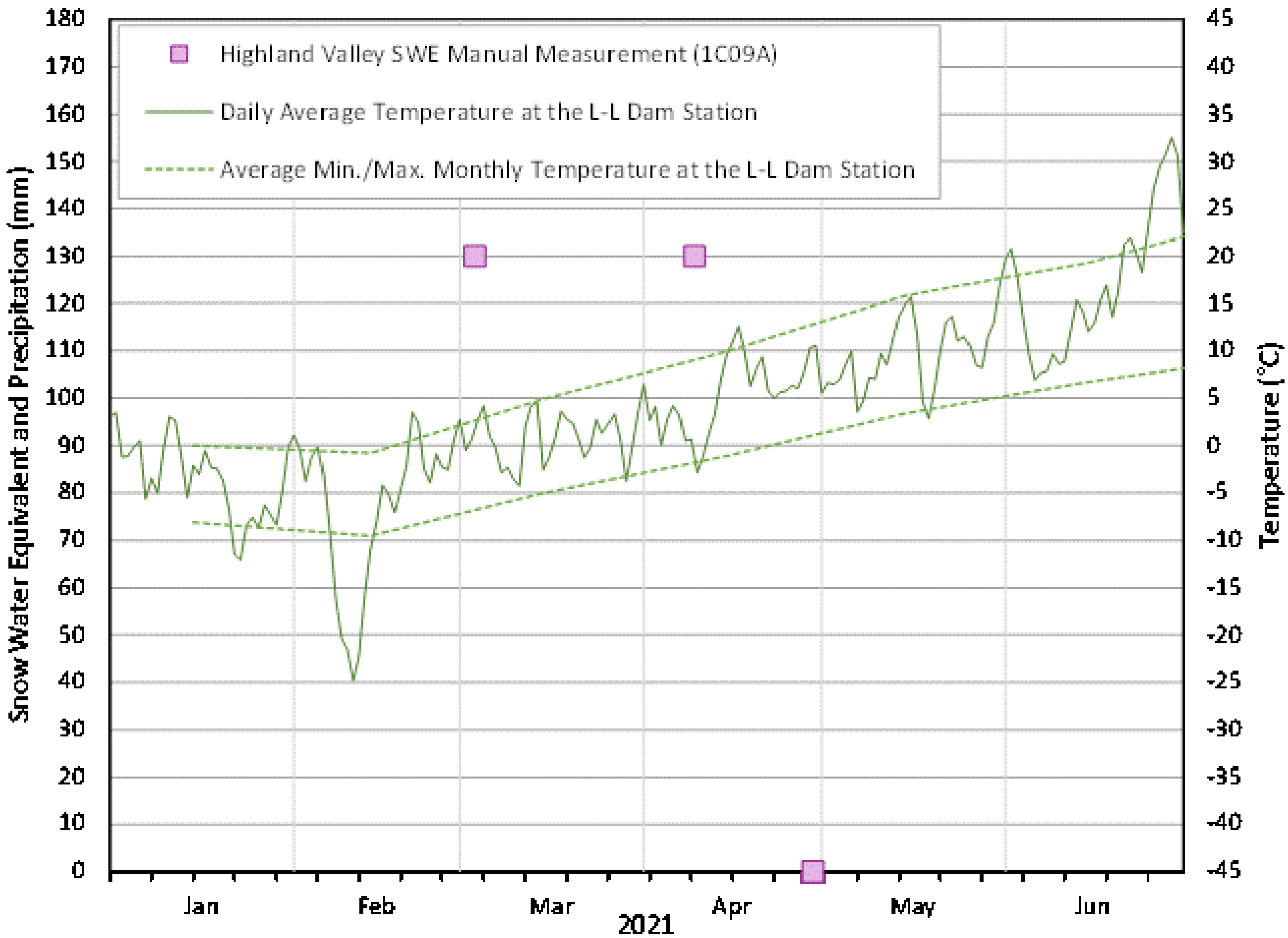
- The daily temperature recorded between January and June 2021 is within the historical monthly average records (between 2000 and 2019).
- The snowpack was depleted over a period of three weeks (between April 9 to 29), which is a quicker rate than the forecast snowmelt pattern from the HVC site wide water balance based on Golder (2020a).
- The rise in temperature above 0°C in April coincides with the snowmelt period manually recorded at the Highland Valley station.
- Rain was not a major factor in 2021 snowmelt, as the maximum daily precipitation recorded close to the snowpack depletion period is less than 6 mm/day.

Table II-2 Historical Average and 2021 Snowpack Depths

Survey Period	Years of Record(1)	Historic Average Snowpack Depth(2) (mm SWE(3))	2021 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	55	91.9	130	42%
April 1st	53	101.3	130	28%
May 1st	54	27.6	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.

Figure II-2 Temperature Records and Measured Snowpack between January and June 2021



Notes:
1. SWE is manually measured at the Highland Valley snow pillow station (1C09A), typically once per month.
2. Daily average temperature data at the L-L Dam Station for 2021 was provided by HVC.
3. The average maximum and minimum monthly temperatures at the L-L Dam Station were developed by Golder (2021).

APPENDIX III

L-L Dam Instrumentation Summary

APPENDIX III-A

L-L Dam Response Summary

Appendix III-A
L-L Dam 2021 Instrumentation Summary

III-A-1 INSTRUMENTATION SYSTEM

Table III-A-1 summarizes instruments installed within or near the L-L Dam as of November 2021. Location of instruments are shown on Figure 3 of the main text. November 2021 instrumentation readings are shown on select design cross sections, through each dam segment, of the L-L Dam (Figure 8 to Figure 14, at end of report main text). Instrumentation summary plots are included in Appendix III-B (piezometers) and III-C (inclinometers).

Instrumentation at the 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. The current status of the instrumentation system is recorded in the Master Instrument Register, which is maintained by both HVC and KCB. Readings for the majority of instruments are automated through the GeoExplorer software package.

Reading frequencies for instruments vary depending on the location and control requirements. Reading frequencies for manual piezometers and all inclinometers were reviewed in 2020 and the new requirements defined in MRM-2020-005[1], which was incorporated to 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 2021)

Instrument	Type	Reading (1)	No.	Total
Piezometers	Standpipe	Manual	37	176
	Converted Standpipe to Vibrating Wire	Automated	58	
	Vibrating Wire	Automated	81	
Inclinometers	Down-hole Casing	Manual	11	32
	In-Place Inclinometer (IPI) (2)	Automated	1	
	ShapeArray (SAA or SAAV) (2)	Automated	20	
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.

III-A-2 2021 INSTRUMENT INSTALLATIONS

Table III-A-2 summarizes instrument installations at the L-L Dam during the 2021 AFPR reporting period.

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

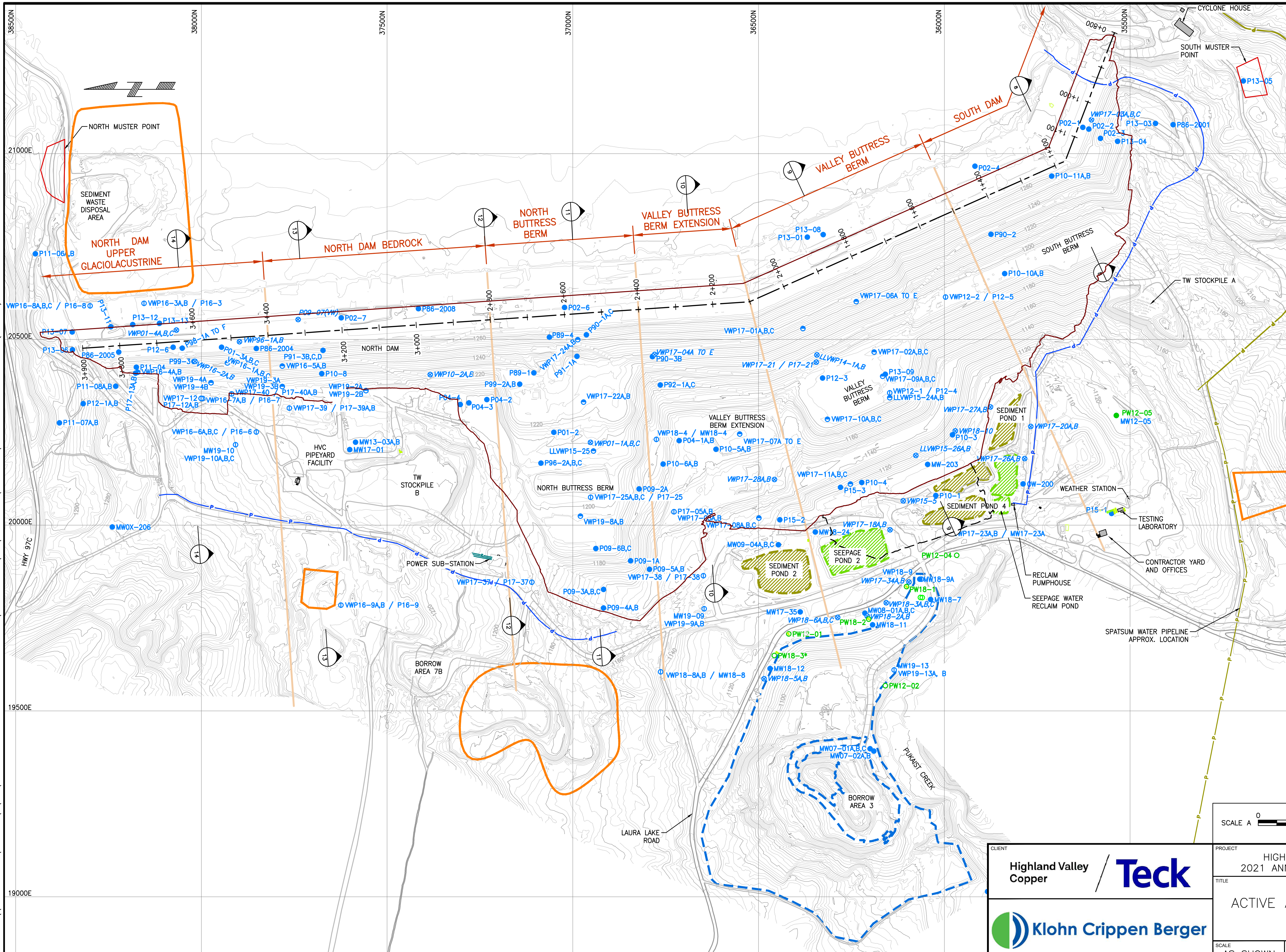
Table III-A-2 2021 Instrument Installations

Design Segment	Instrument Type	Instrument ID	Target Monitoring Unit	Purpose
Valley Buttress Berm	Inclinometer	I21-12	L-GLU	Replace inclinometer I10-6 along the VBB downstream slope to restore previous monitoring coverage and redundancy
North Buttress Berm	Inclinometer	I21-04	Mudstone Layers	Add a second monitoring row of inclinometers at piezometers at the NBB (Sta. 2+690) to capture three-dimensional movement patterns and provide redundancy to existing inclinometers
	VWP	LL-VWP21-04B	Glacial Till	
		LL-VWP21-04A	Sedimentary Bedrock	
		LL-VWP21-05B	Glacial Till	
		LL-VWP21-05A	Sedimentary Bedrock	
Tailings Beach	VWP	LL-VWP21-CPT-A	Tailings Beach	Monitor piezometric levels in the tailings beach, upstream of the cycloned sand fill. These are expected to have a short service life as they have a high risk of being damaged as tailings level rises. However, monitoring, even over a short period, will provide insight as to the piezometric conditions in the beach
		LL-VWP21-CPT-B		
		LL-VWP21-CPT-C		
		LL-VWP21-CPT-D		
		LL-VWP21-CPT-E		

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
- SURFACE WATER RECLAIM PIPELINE
- SPATSUM WATER PIPELINE
- HAUL ROAD
- PUBLIC ROAD
- ULTIMATE DAM FOOTPRINT MODIFIED BASE CASE
- VBB CONTINGENCY CASE FOOTPRINT
- INSTRUMENTATION SECTION
- 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
- PUMPING WELL
- PUMPING WELL WITH STANDPIPE PIEZOMETER AND OBSERVATION WELL

NOTES:

1. TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER PARTNERSHIP, DERIVED FROM LiDAR SURVEY DATED 2021-04-05 (2020 AS-BUILT).
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

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT

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

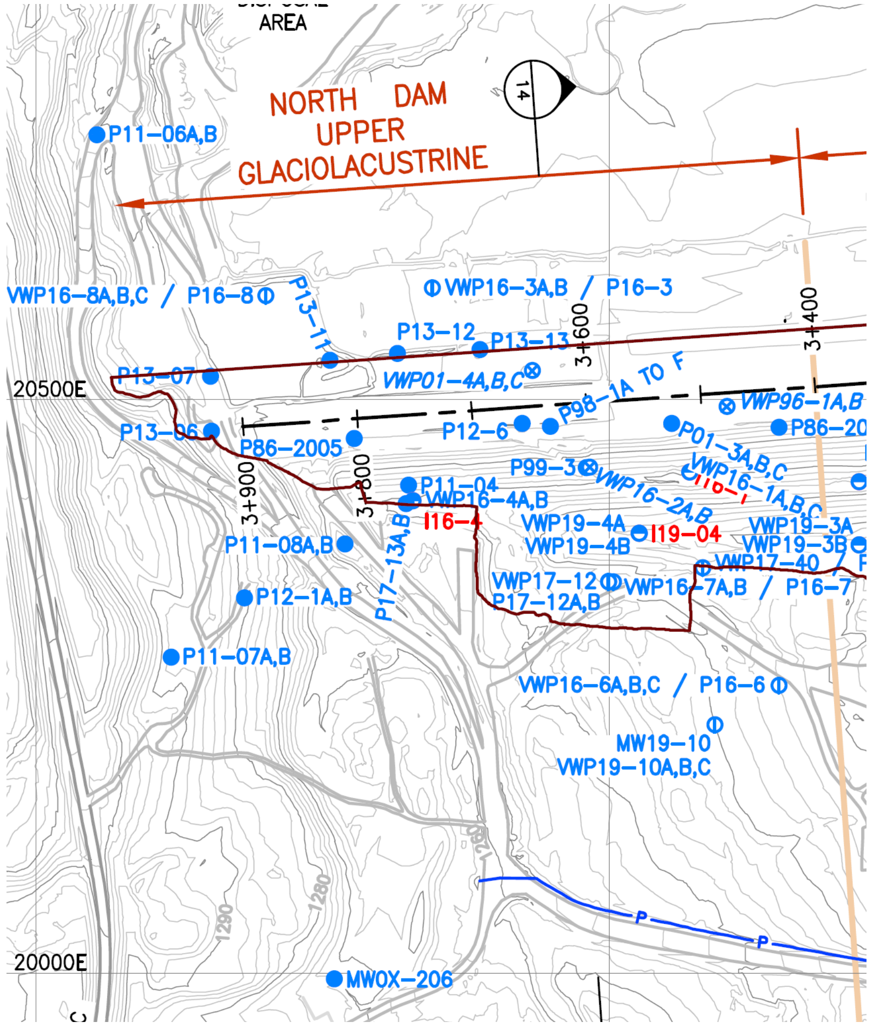
SCALE	PROJECT No.	FIG. No.
AS SHOWN	M02341C12	III-B-1

SAVE DATE: 2022-02-02 (6:46 PM)
FILE PATH: \\INT.KLOHN.COM\PROJDATA\M\VCR\M02341C12-HVC 2021 DAM SAFETY SUPPORT\400 DRAWINGS\CAD\05-FIGURES\2021 AFPR\FIG III-B-1 - L-L DAM.DWG (THAWKER)

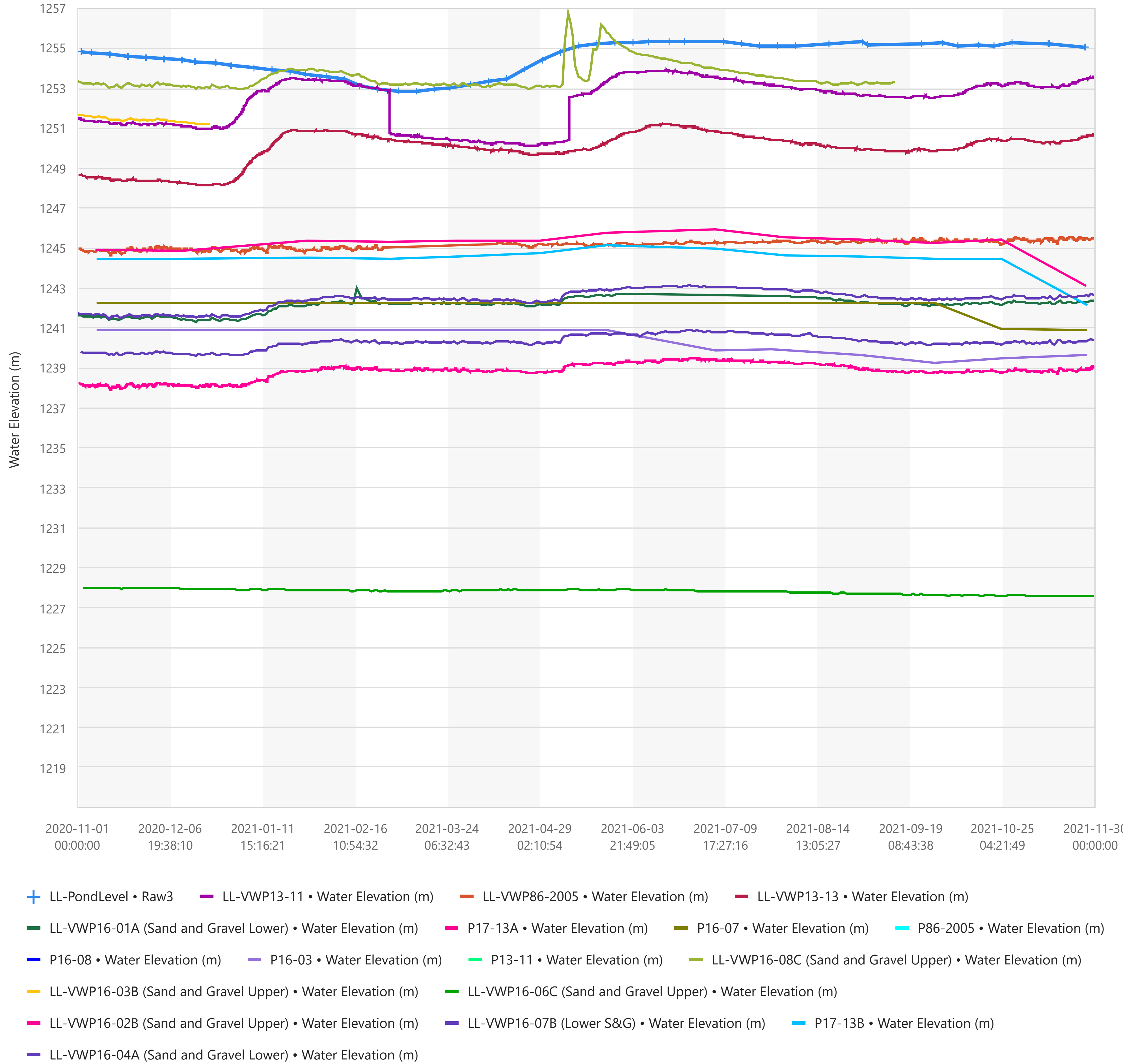
Appendix III-B-1

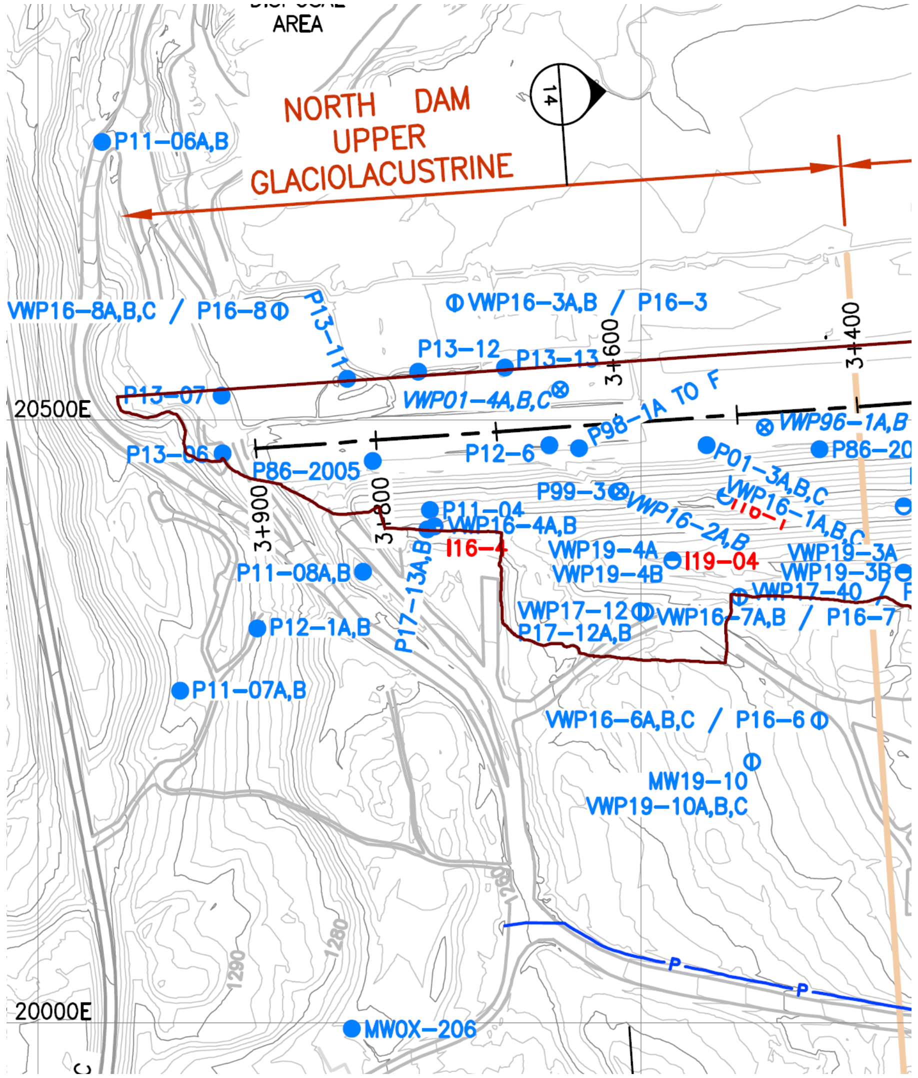
L-L Dam Piezometers: 2021 Water Elevations

North Dam Upper Glaciolacustrine (North Abutment) 2021 Water Elevations

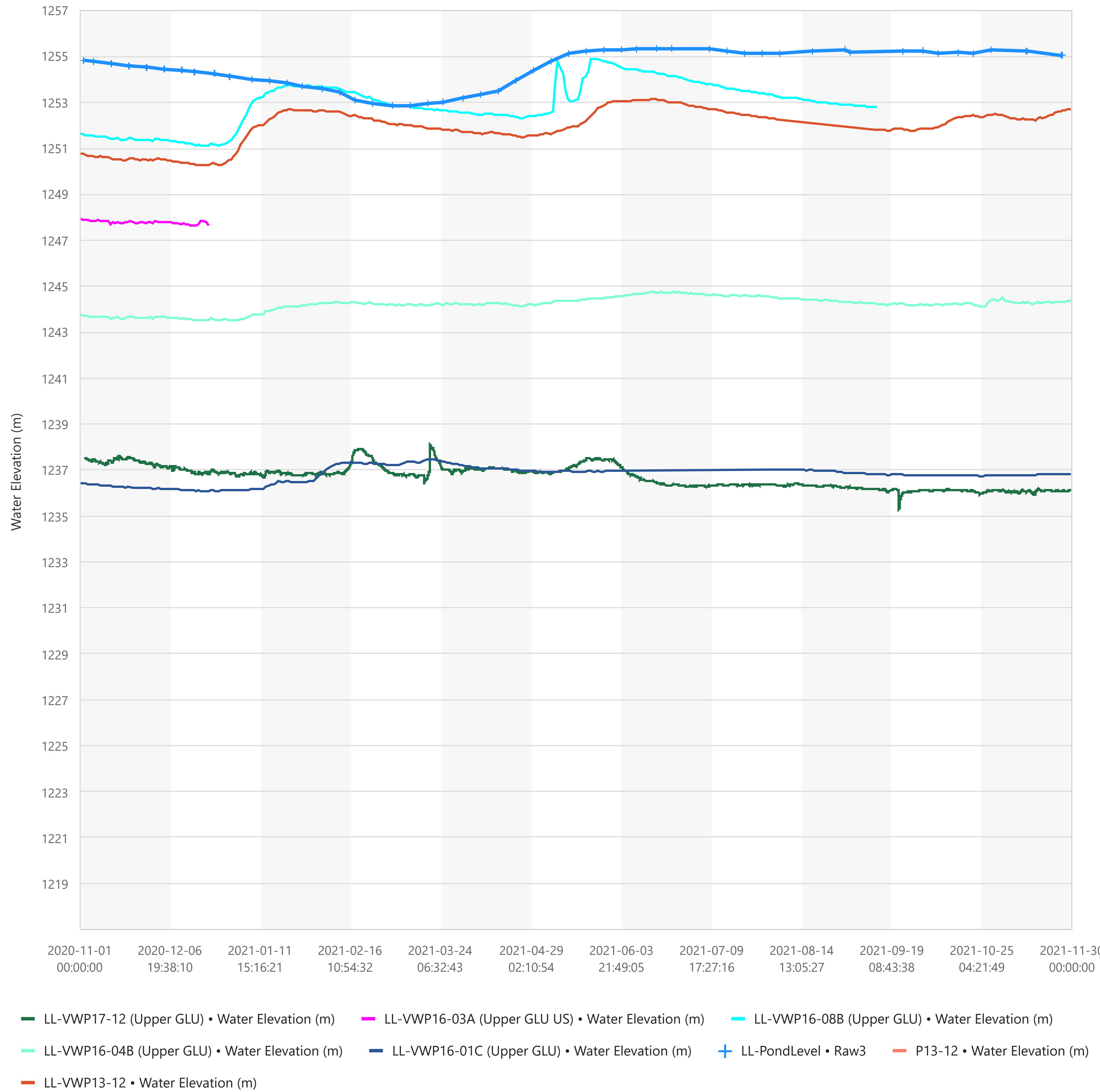


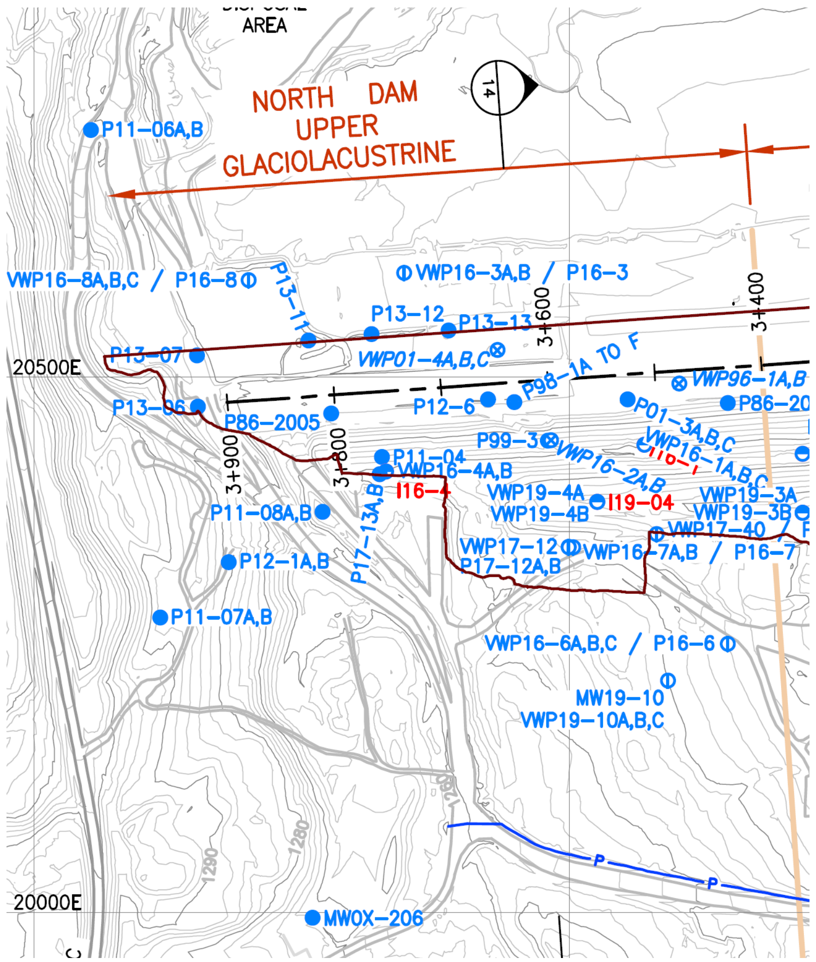
North Dam Upper Glaciolacustrine
Sand and Gravel



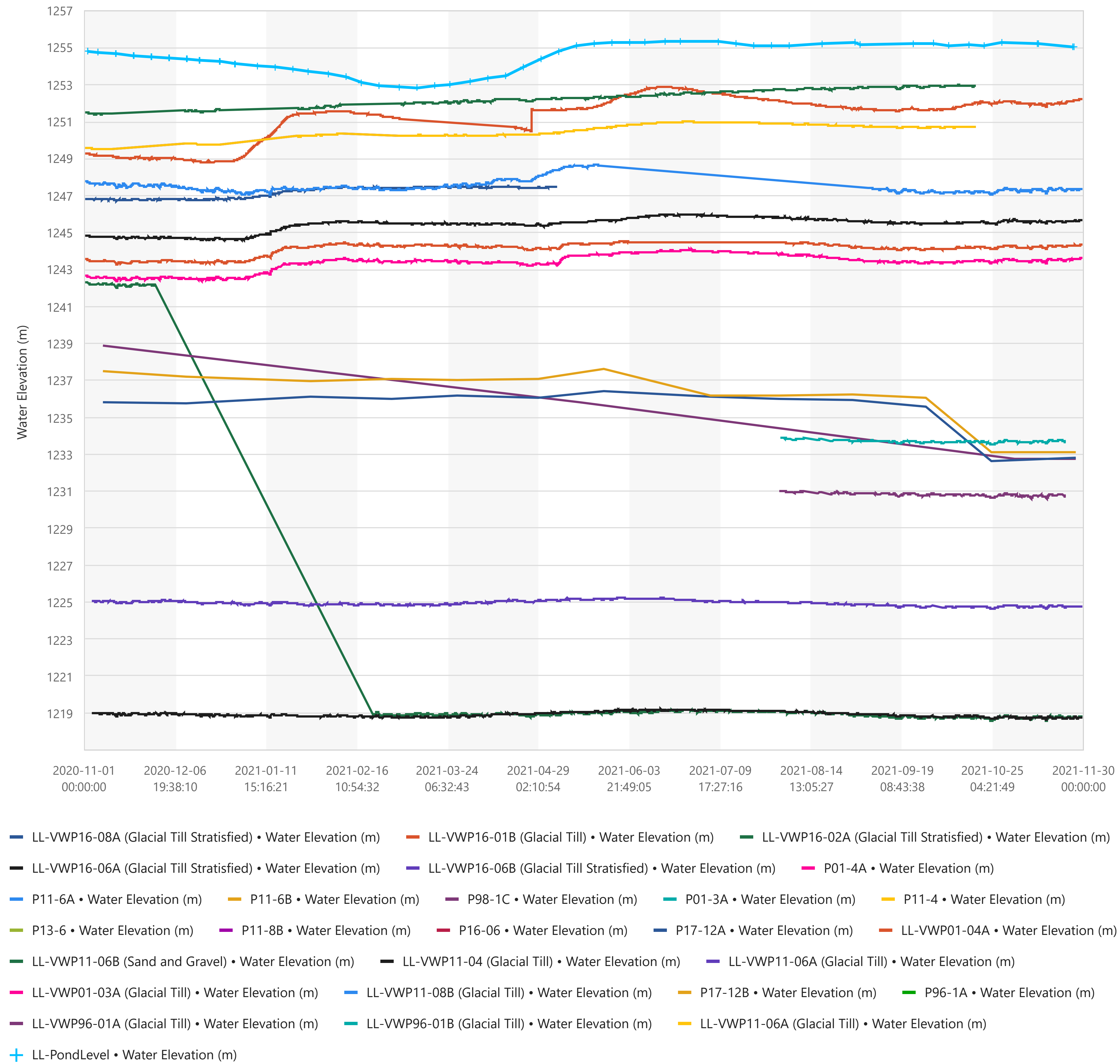


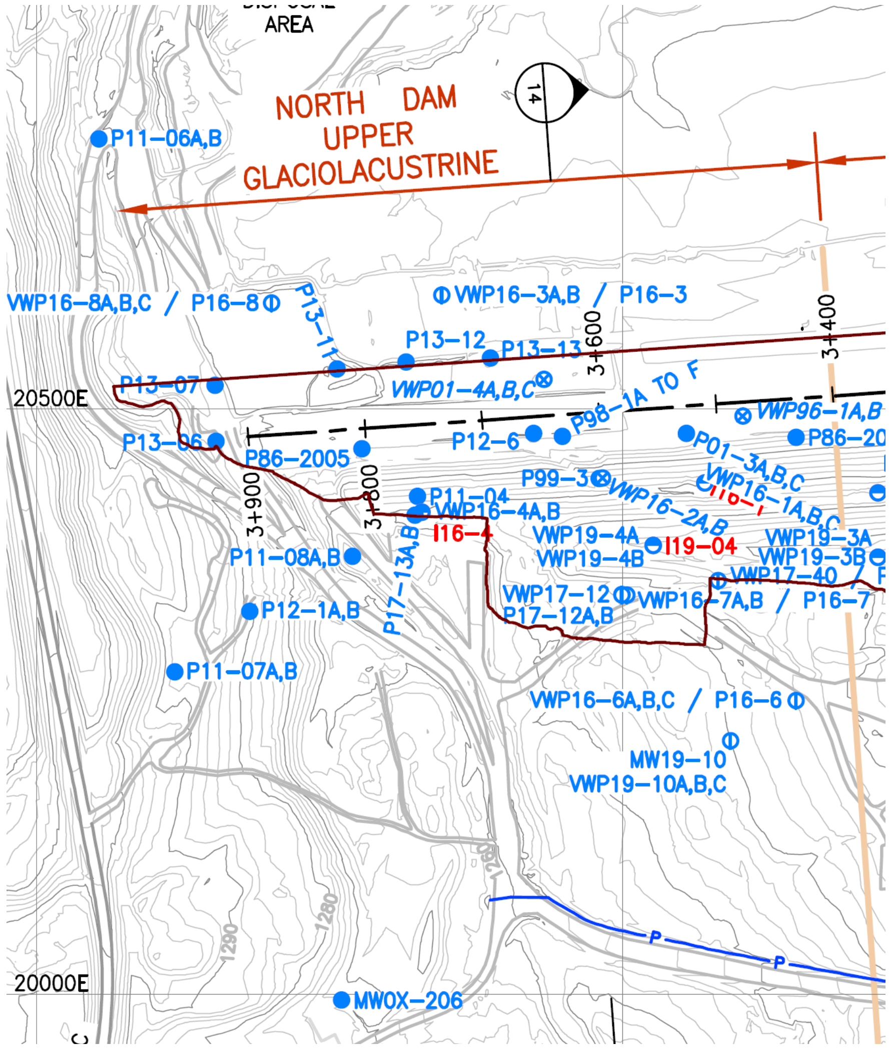
North Dam Upper Glaciolacustrine
Glaciolacustrine



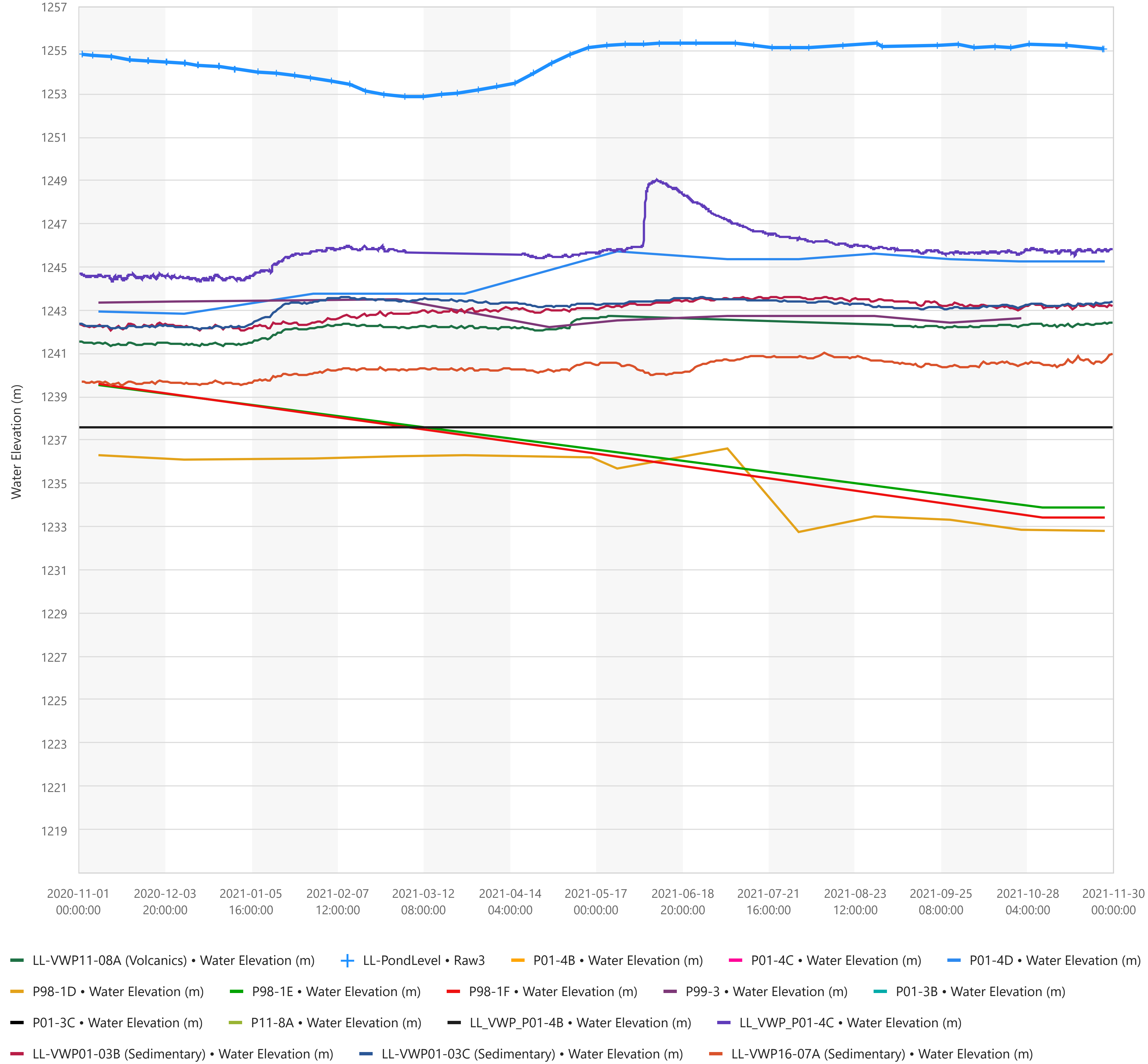


North Dam Upper Glaciolacustrine Glacial Till

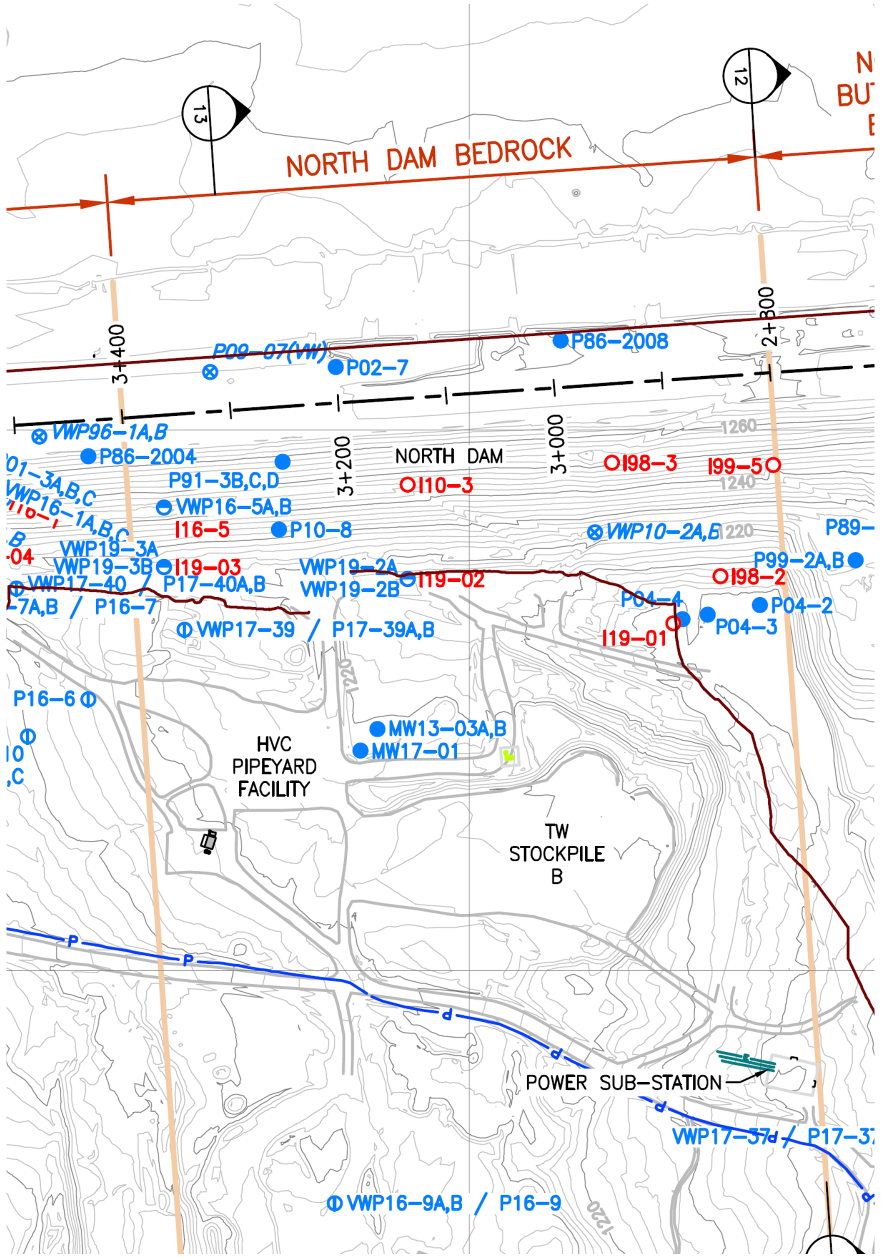




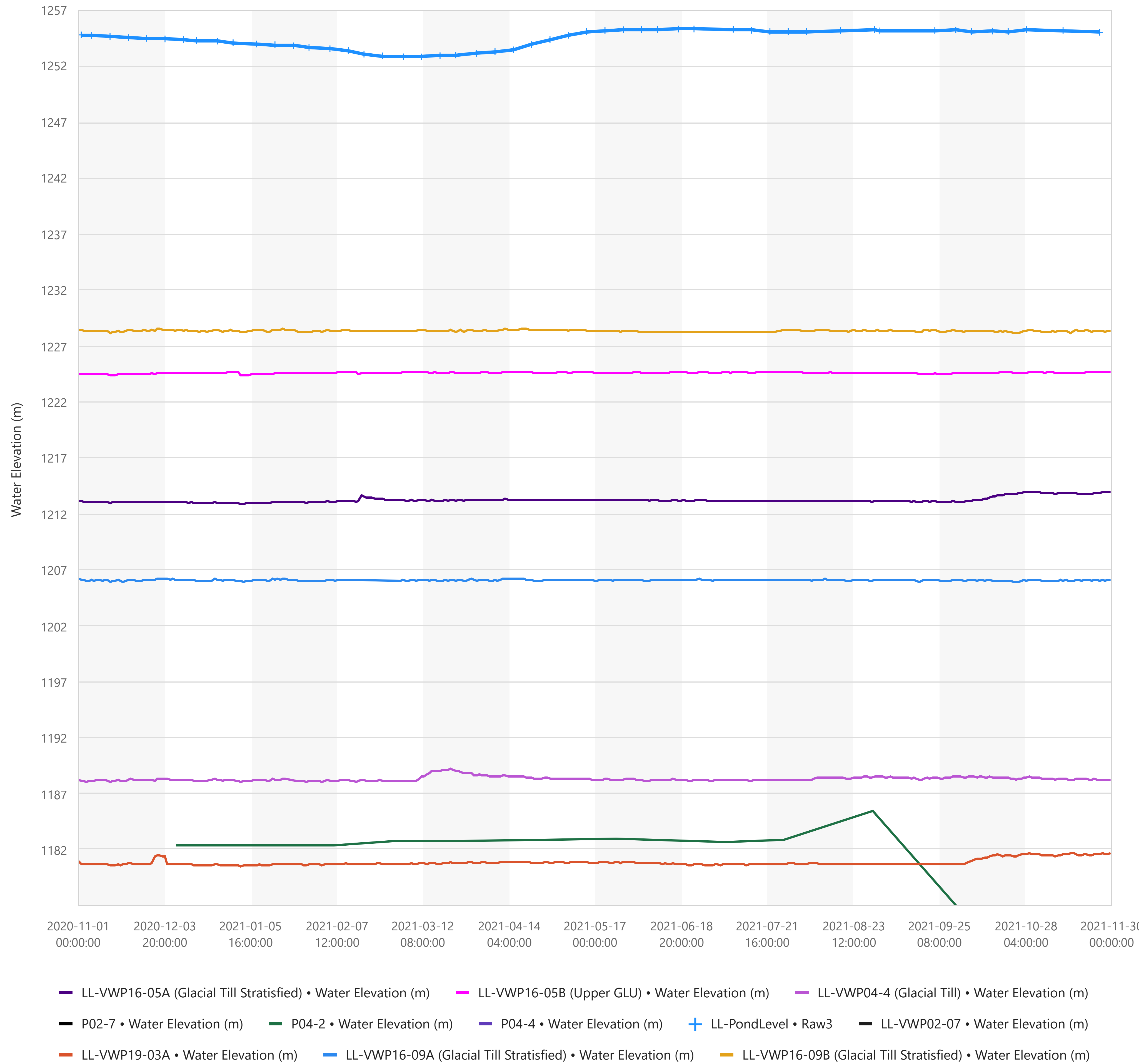
North Dam Upper Glaciolacustrine
Foundation Rock

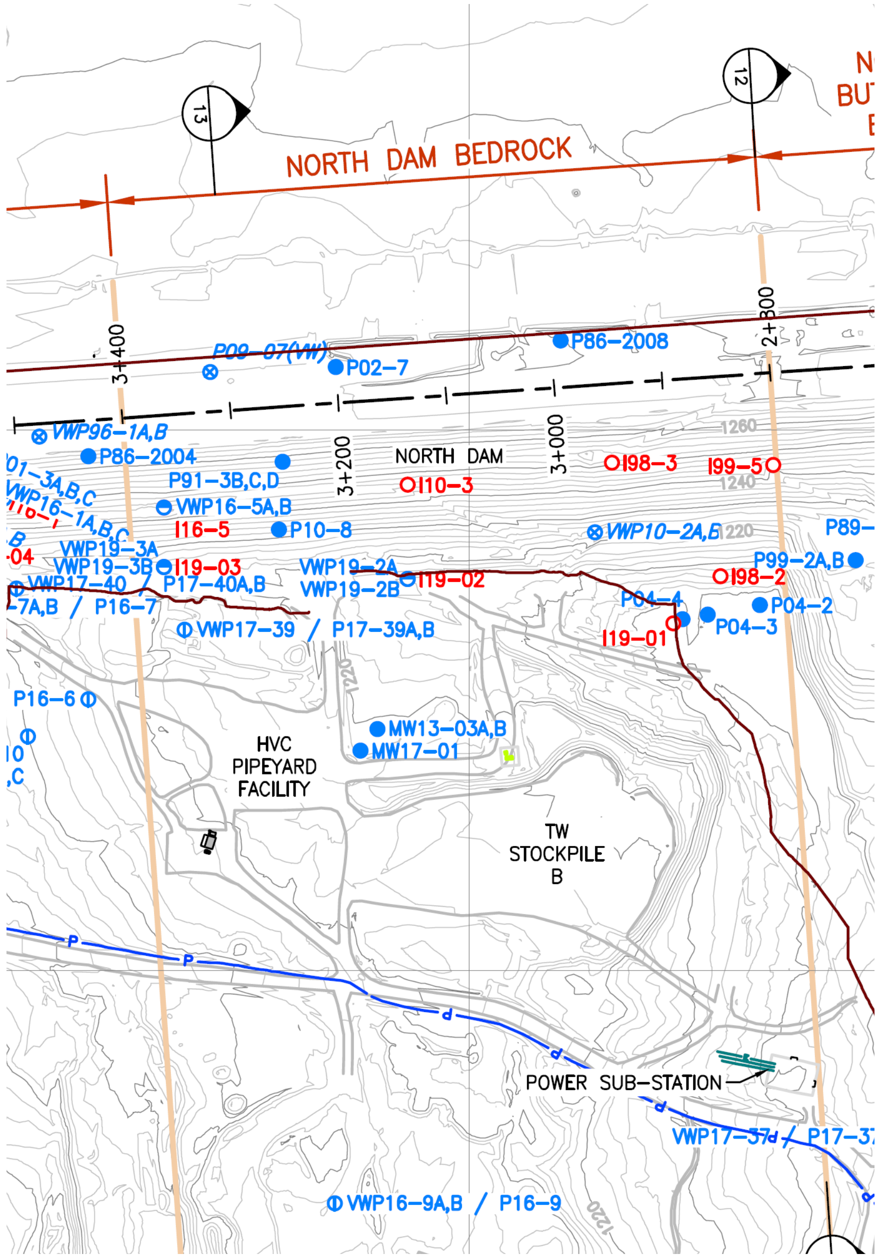


North Dam Bedrock
2021 Water Elevations

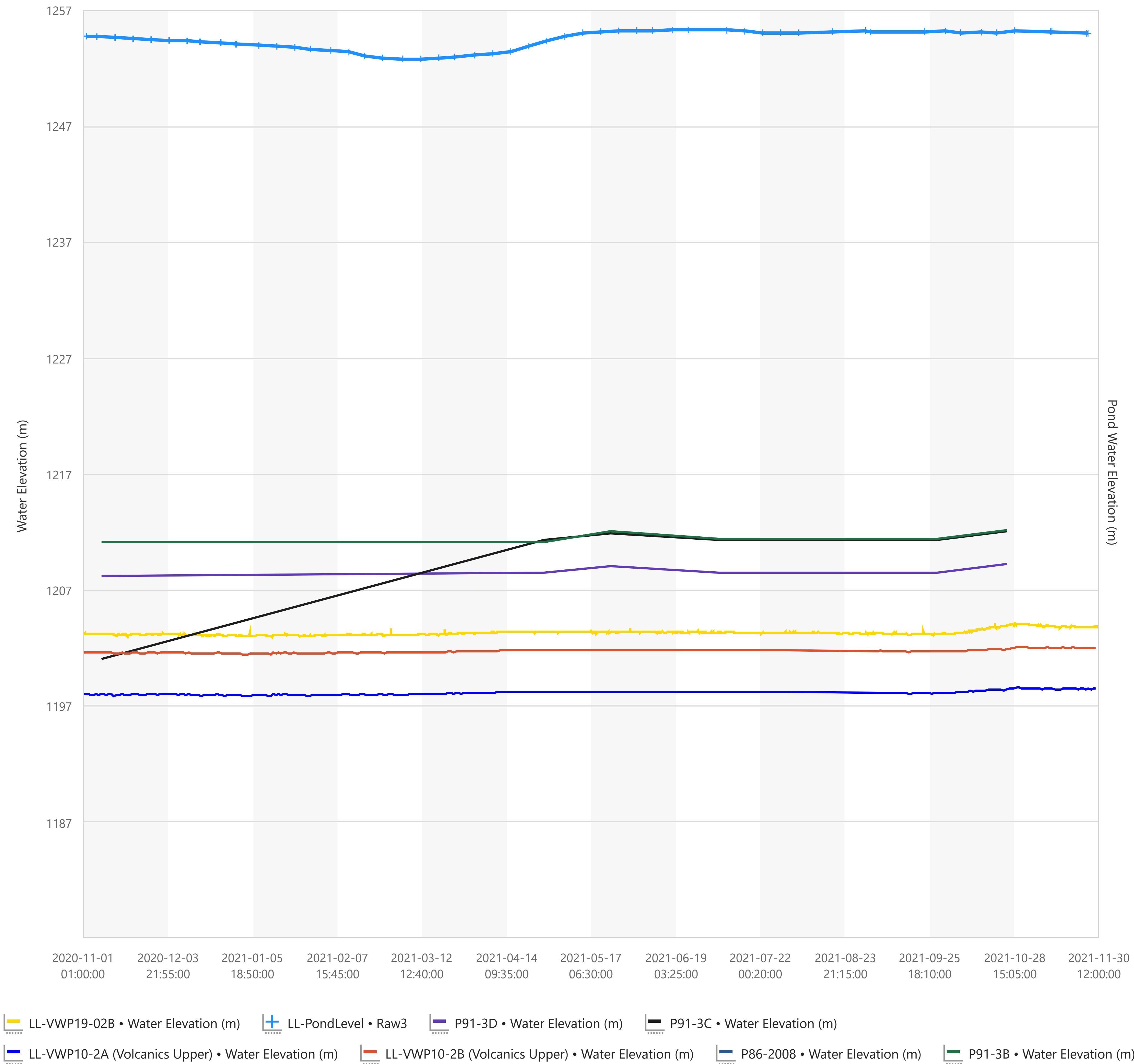


North Dam Bedrock
Glacial Till, Sand, Upper GLU

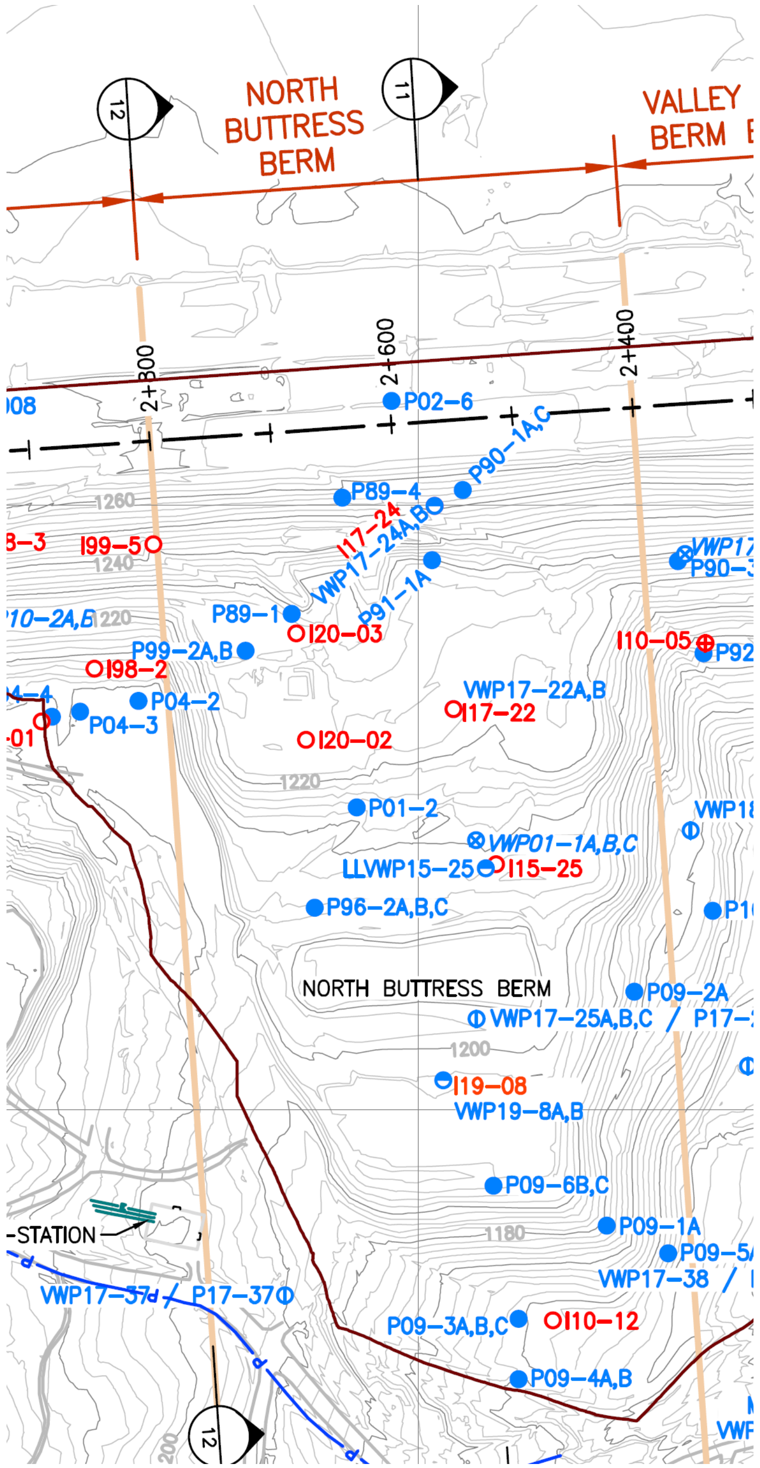




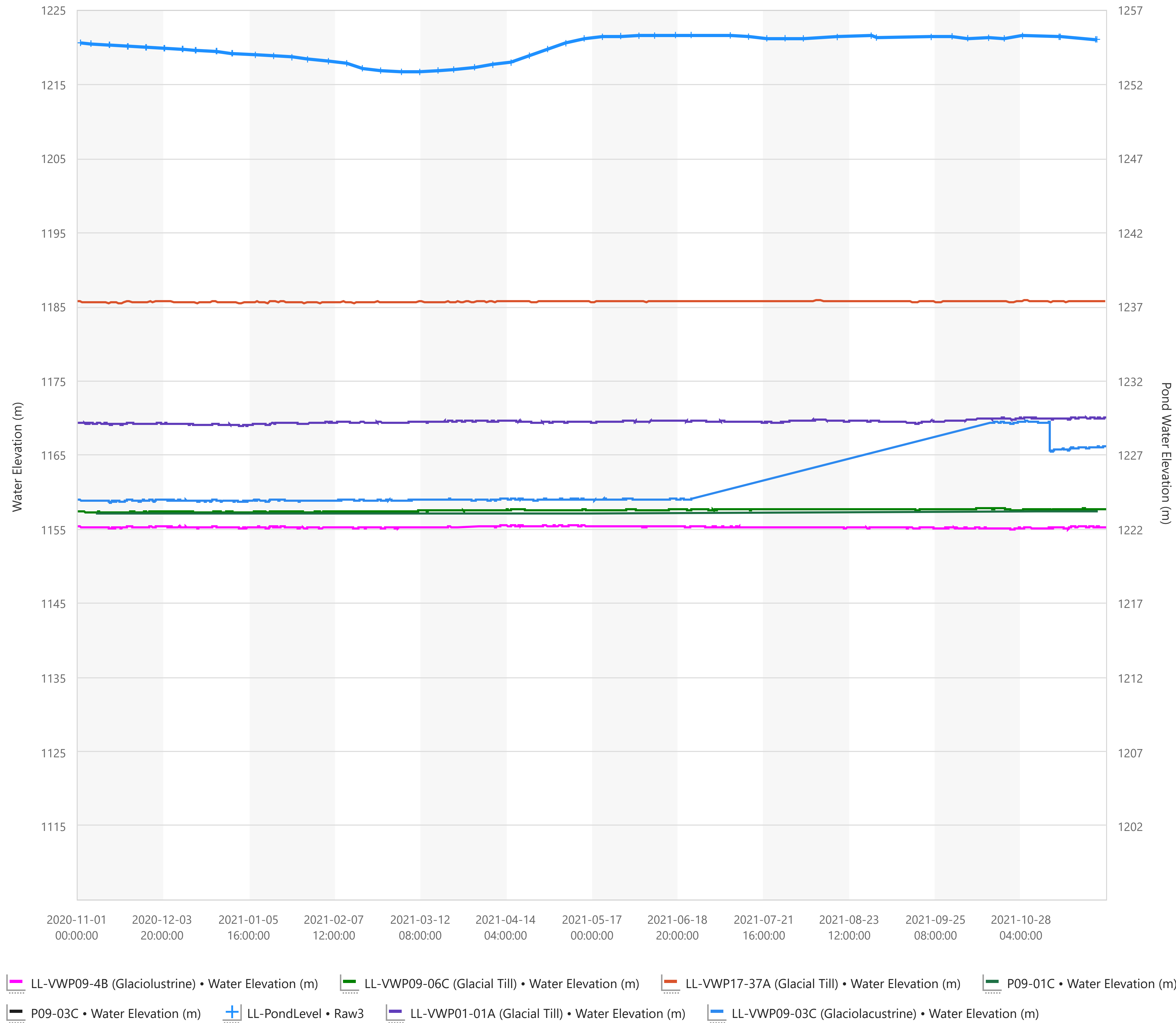
North Dam - Bedrock Volcanics

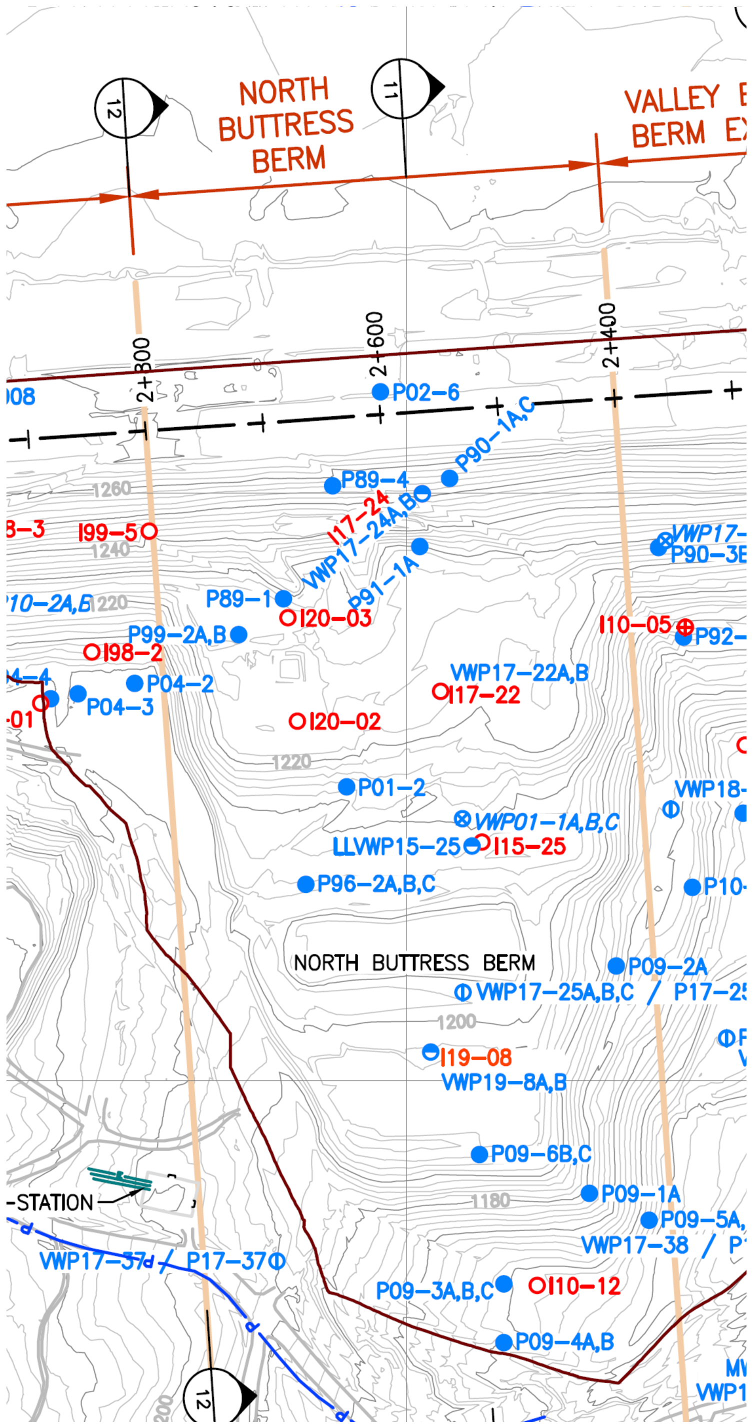


North Buttress Berm
2021 Water Elevations

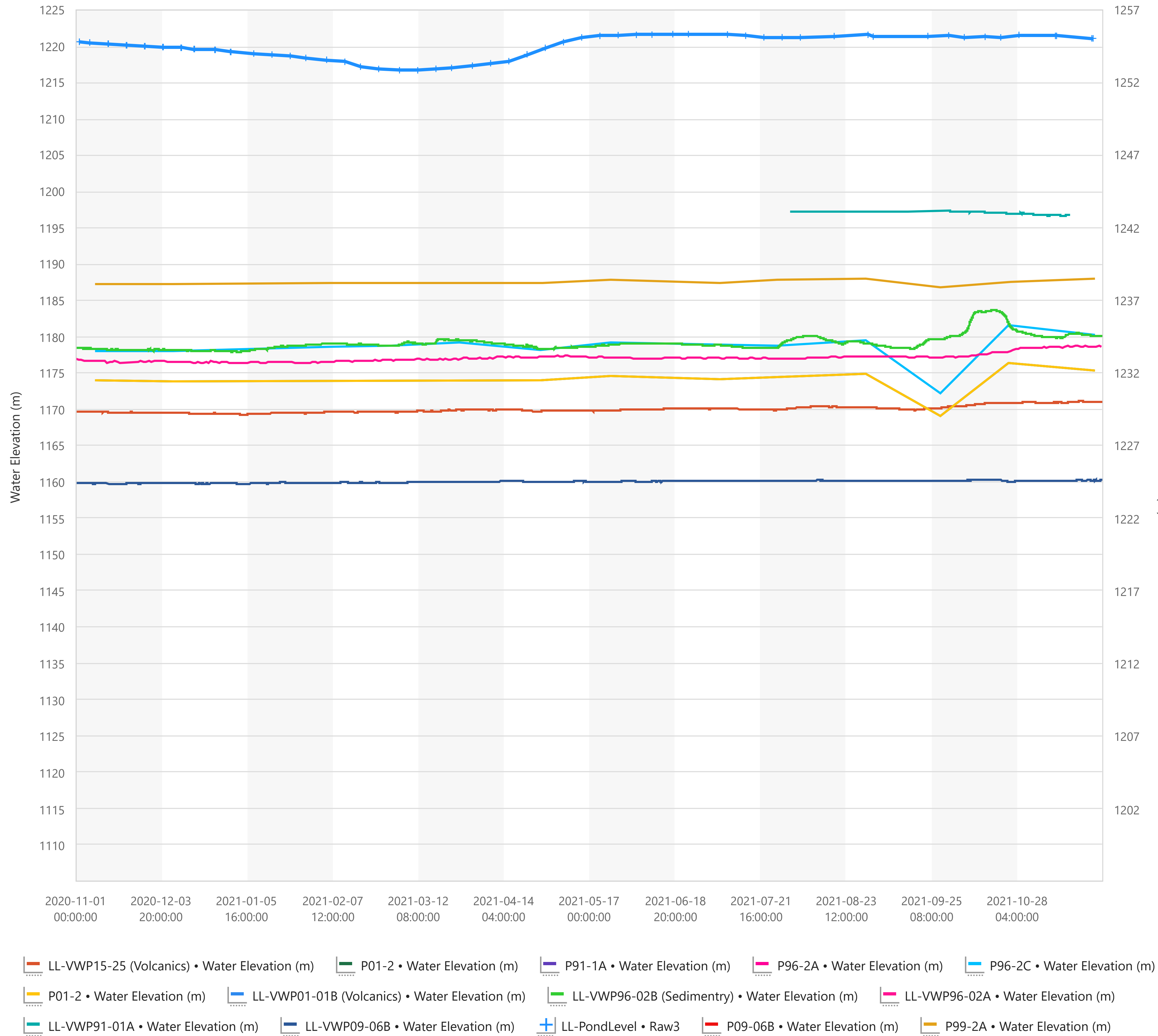


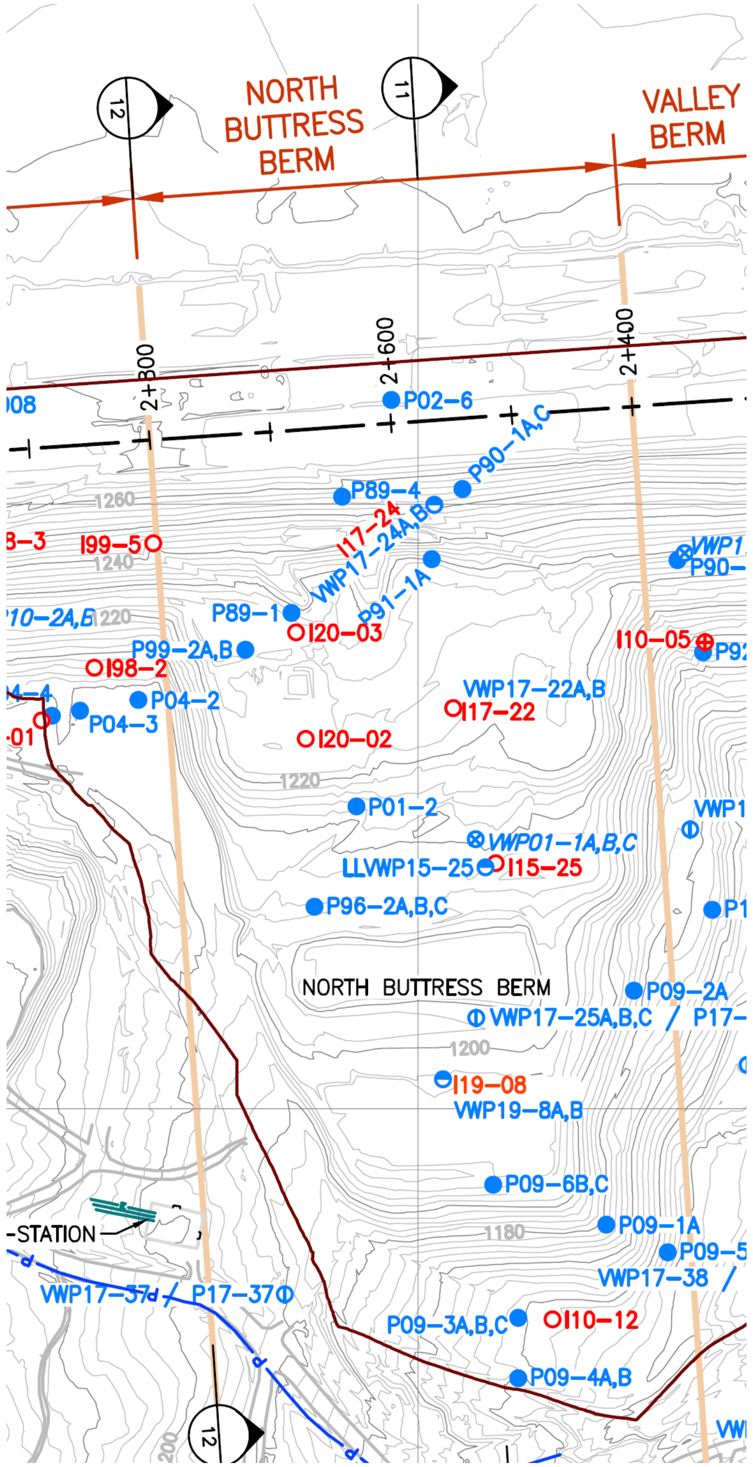
North Buttress Berm
Overburden



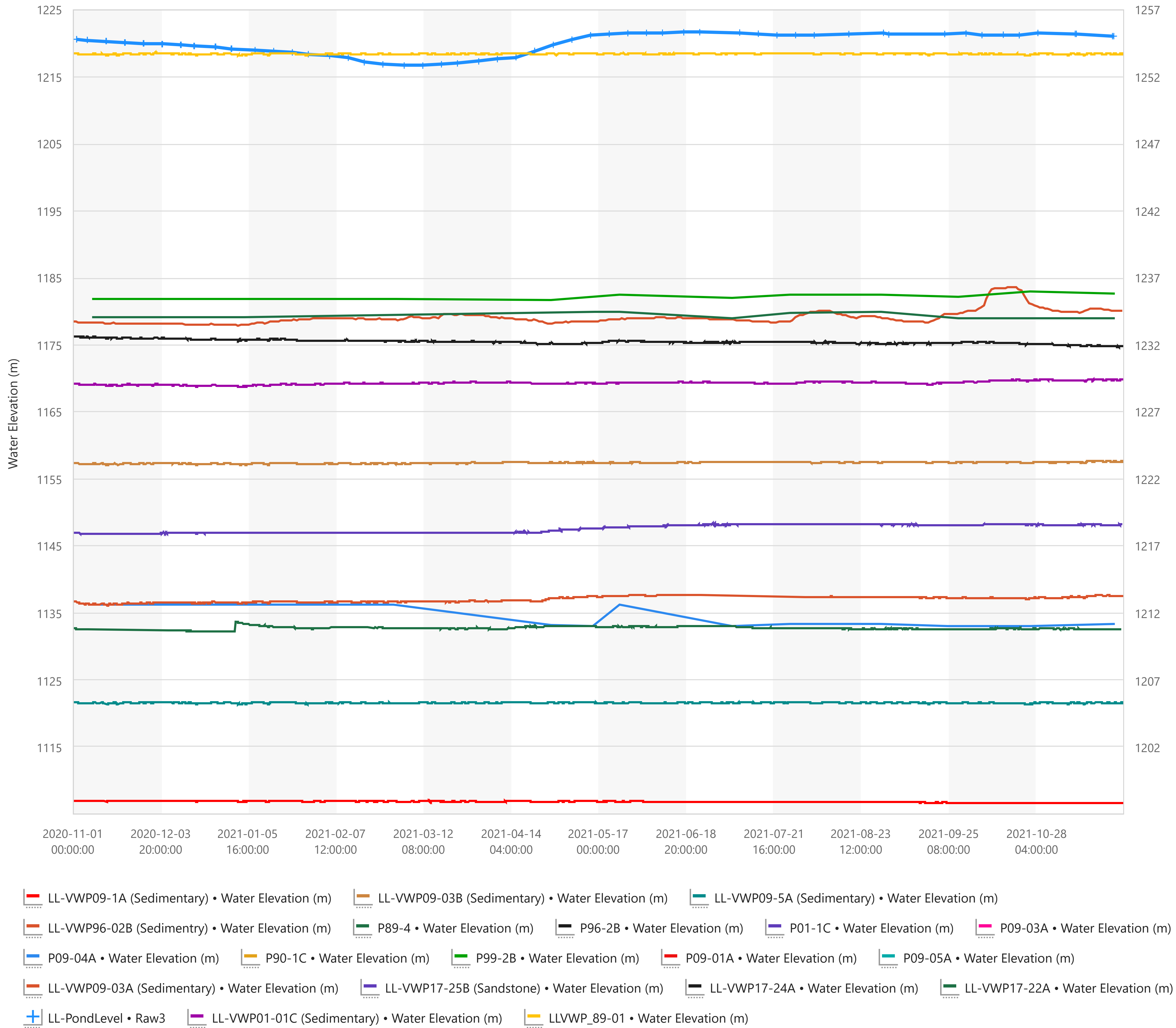


North Buttress Berm
Volcanics

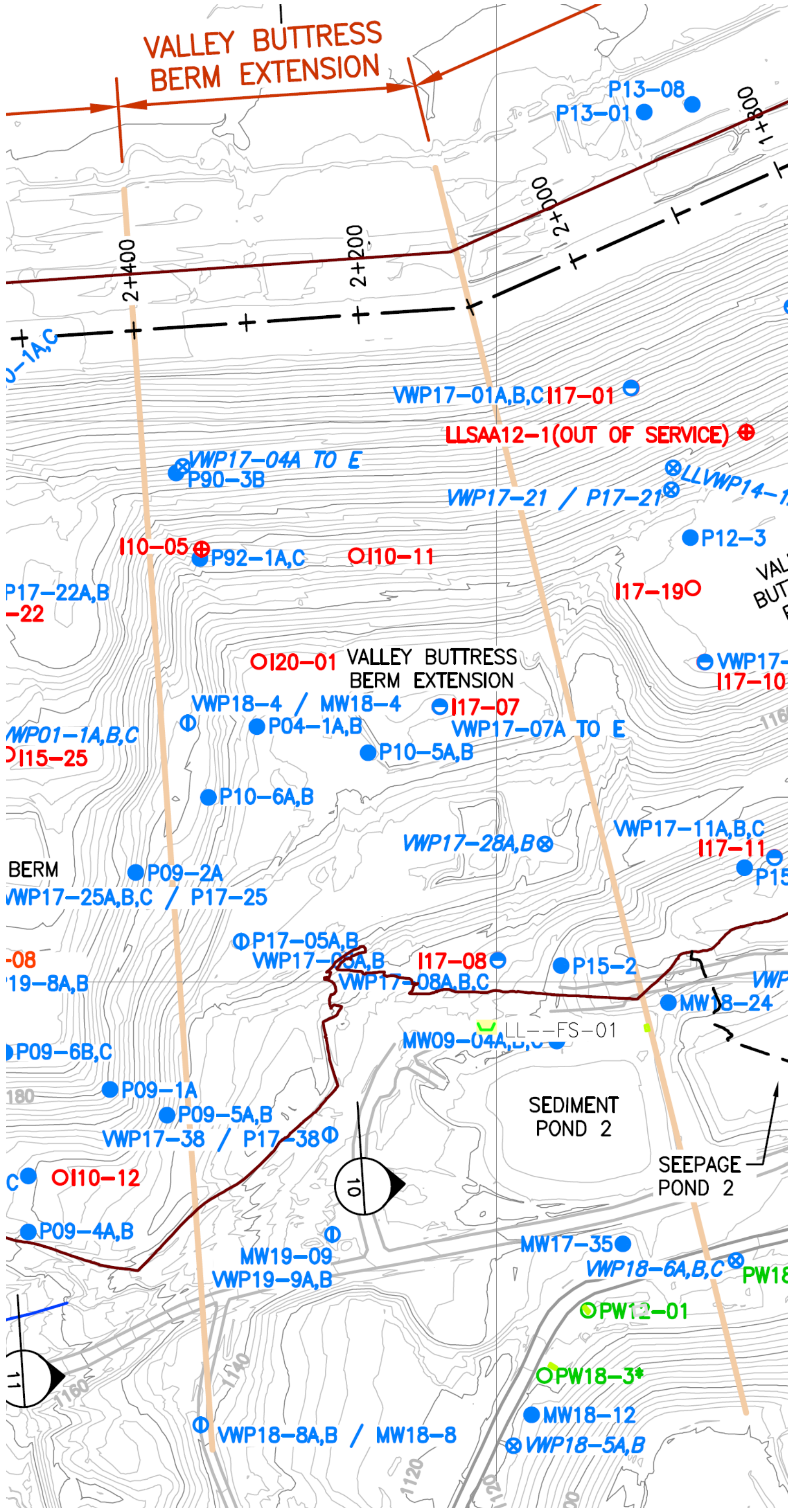




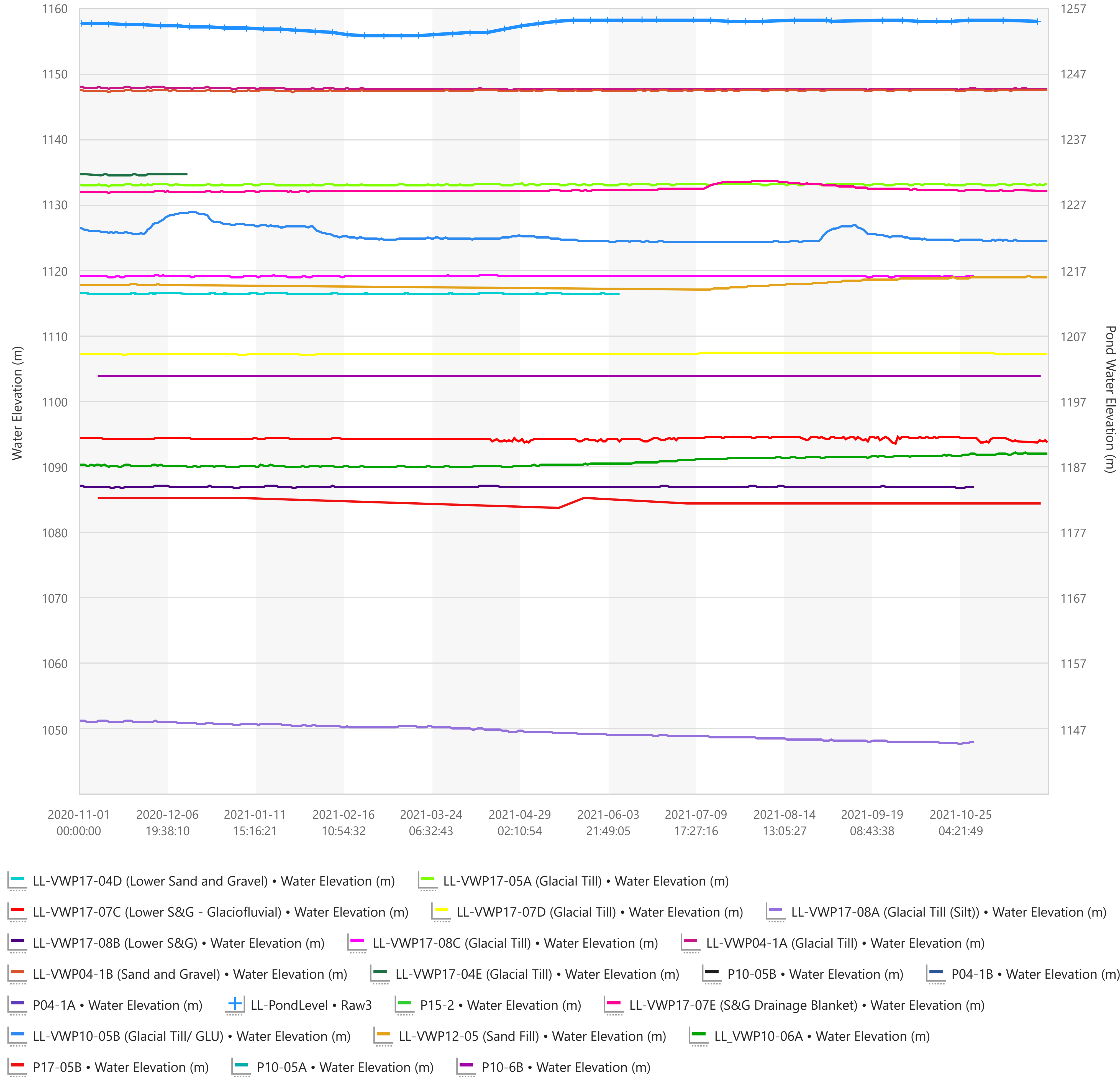
North Buttress Berm
Sedimentary

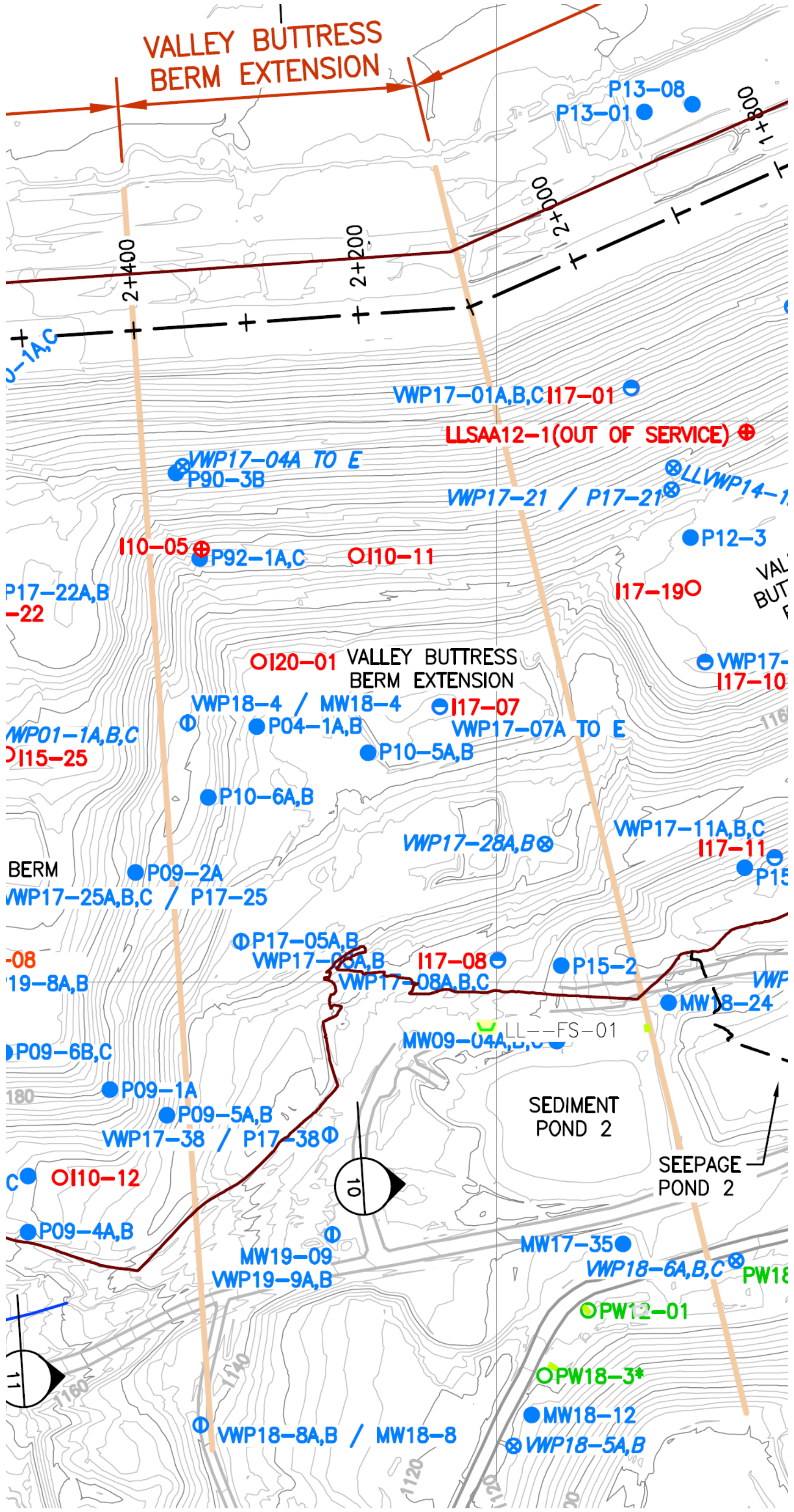


Valley Buttress Berm Extension
2021 Water Elevations

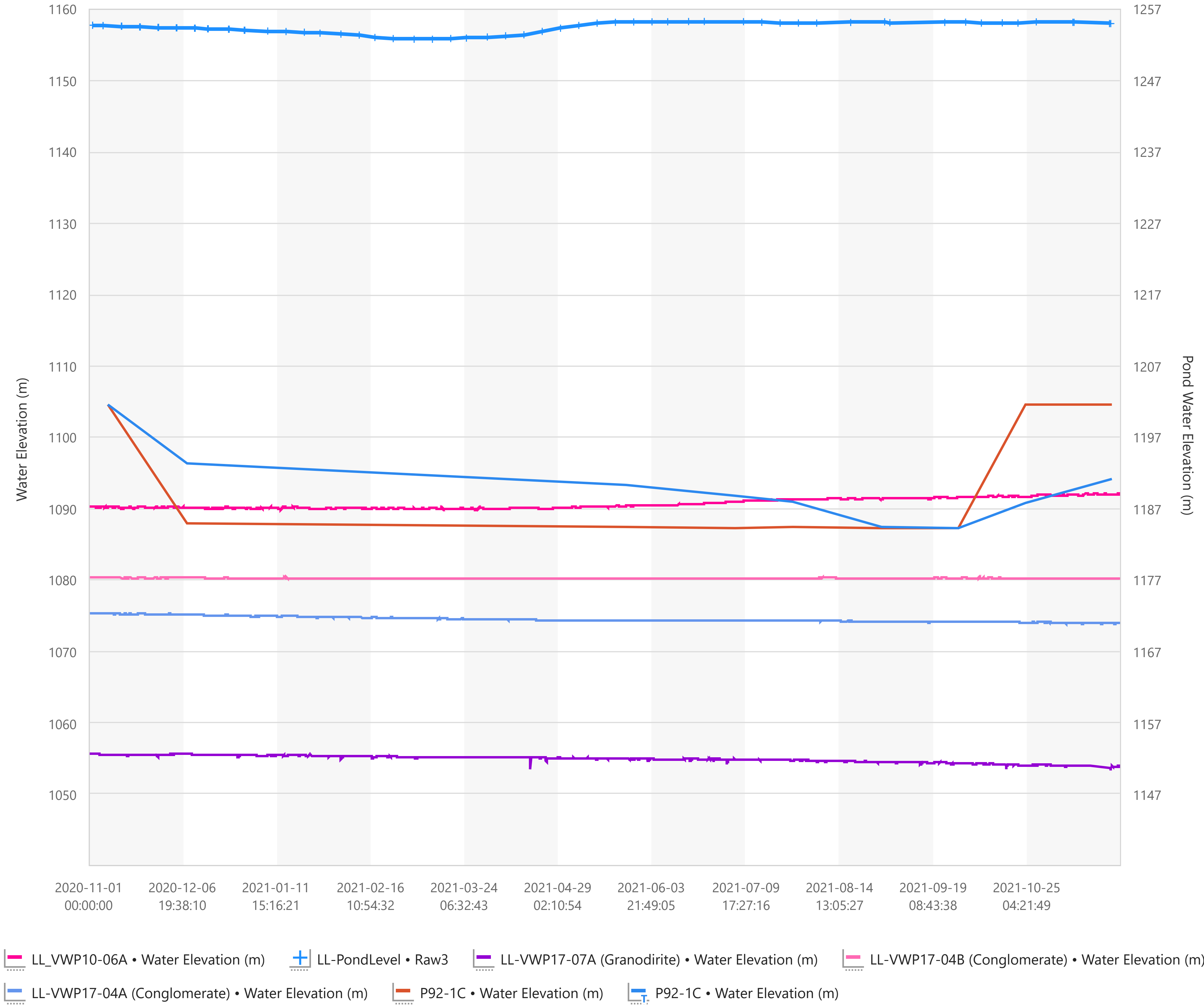


Valley Buttress Berm Extension
Overburden and Dam Fill

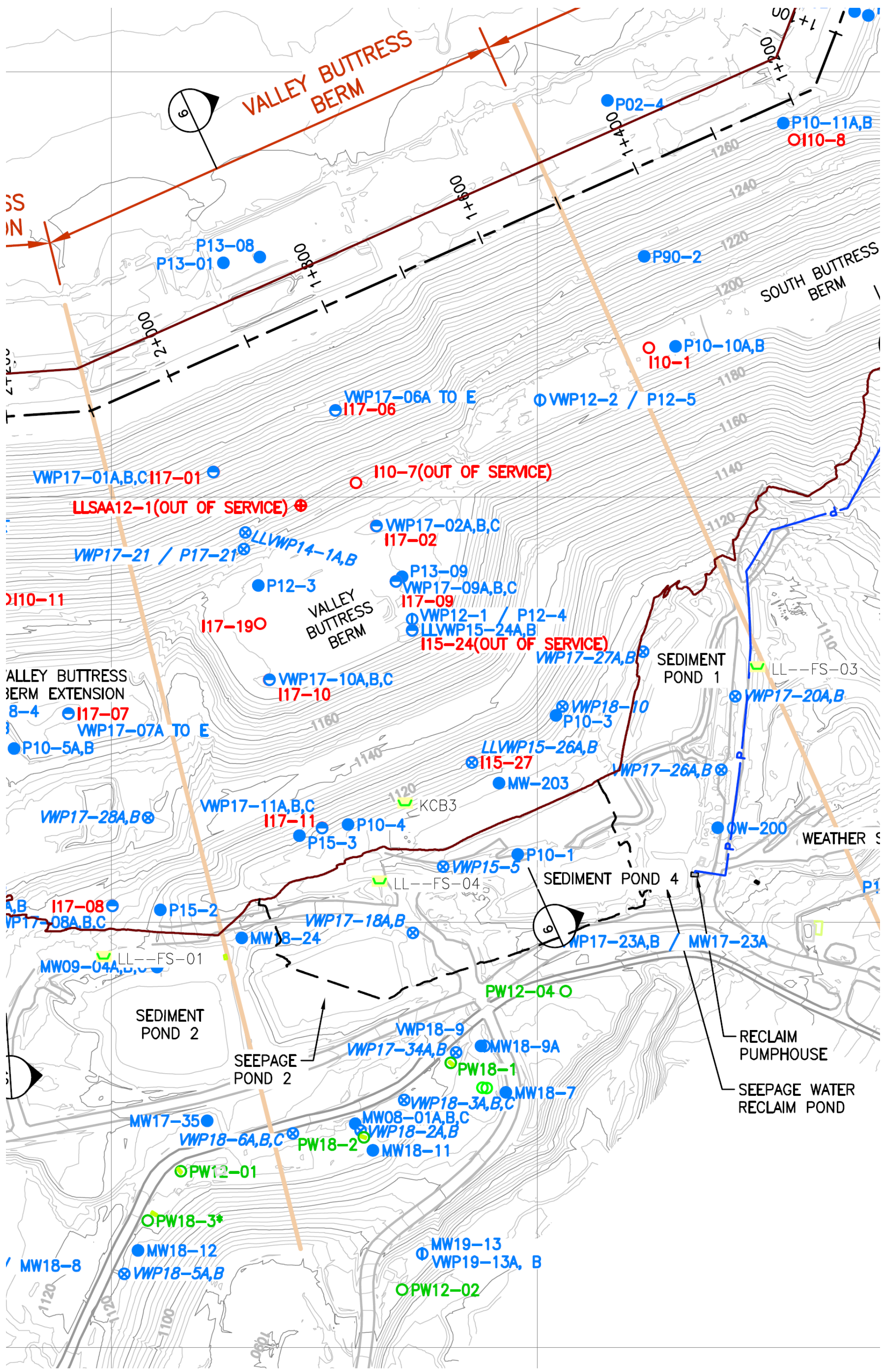




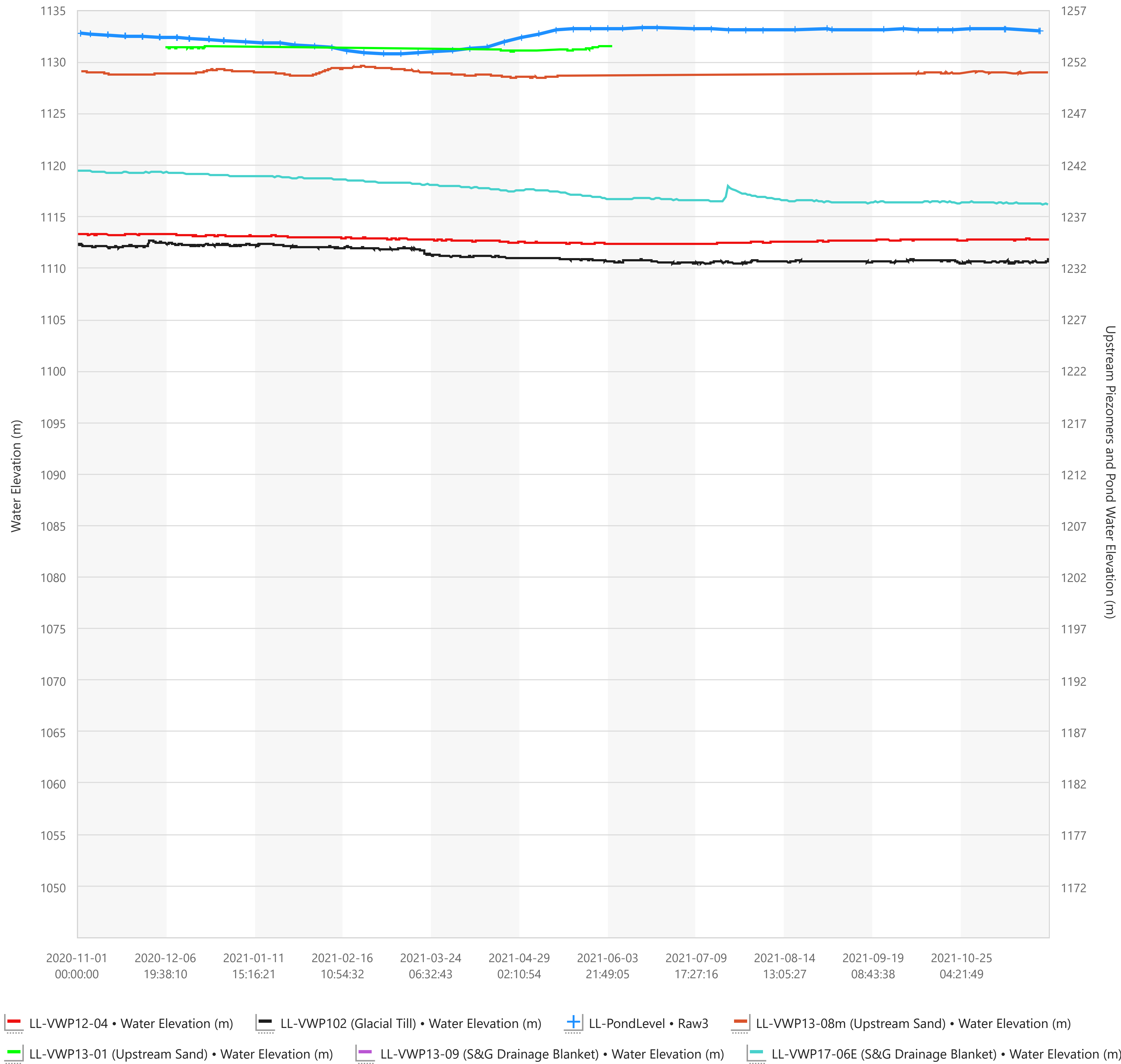
Valley Buttress Berm Extension
Foundation Rock

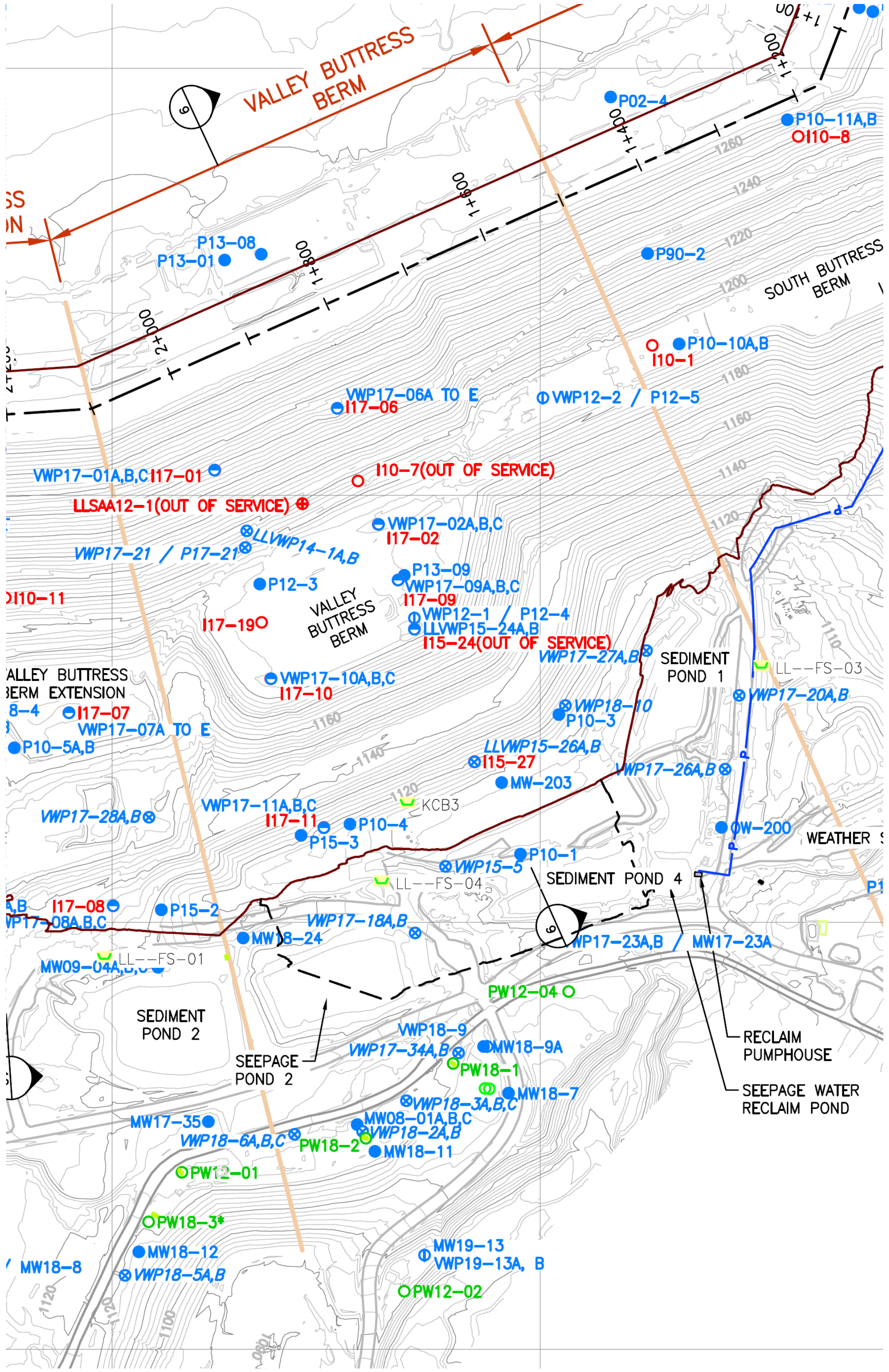


Valley Buttress Berm
2021 Water Elevations

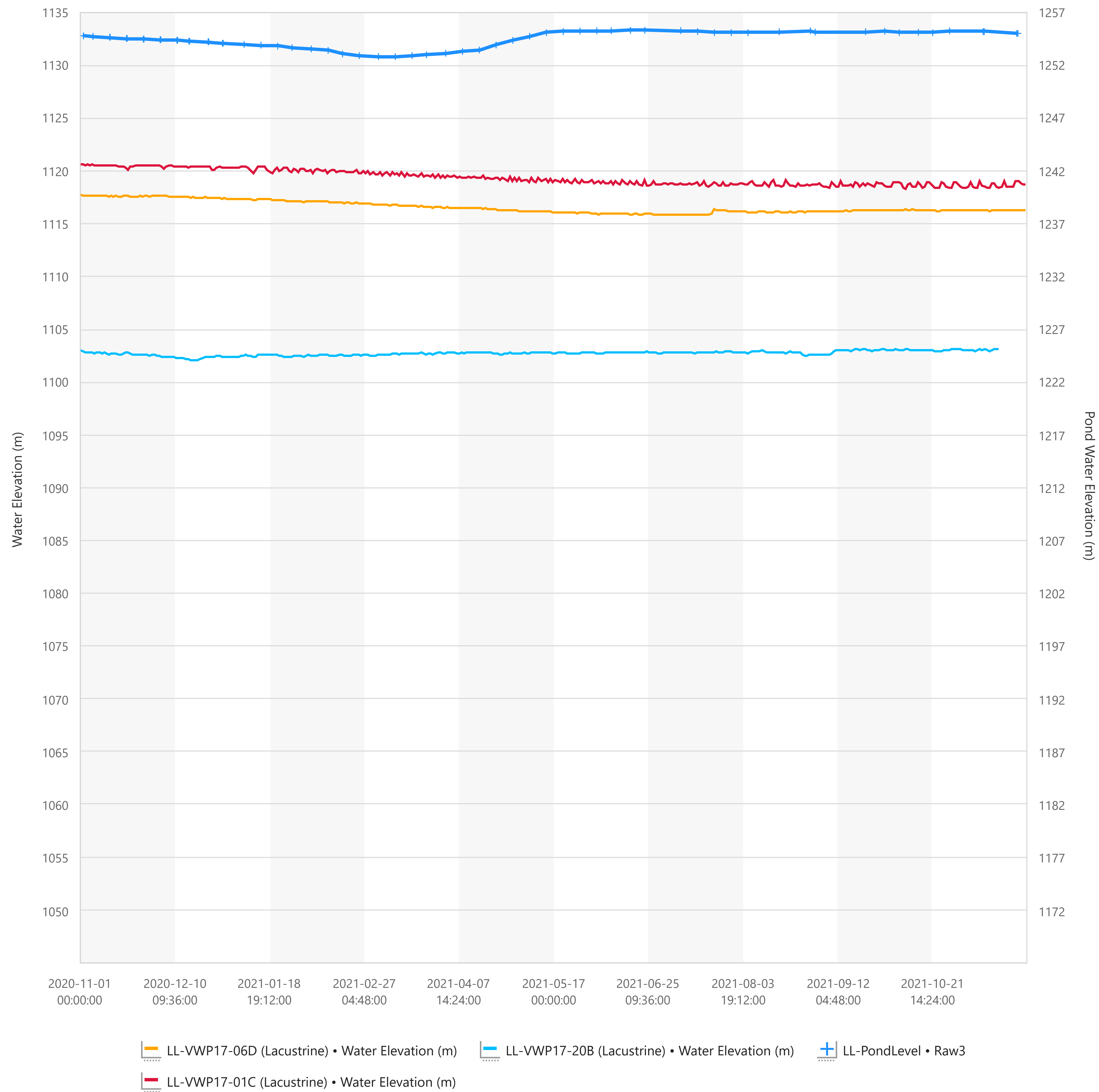


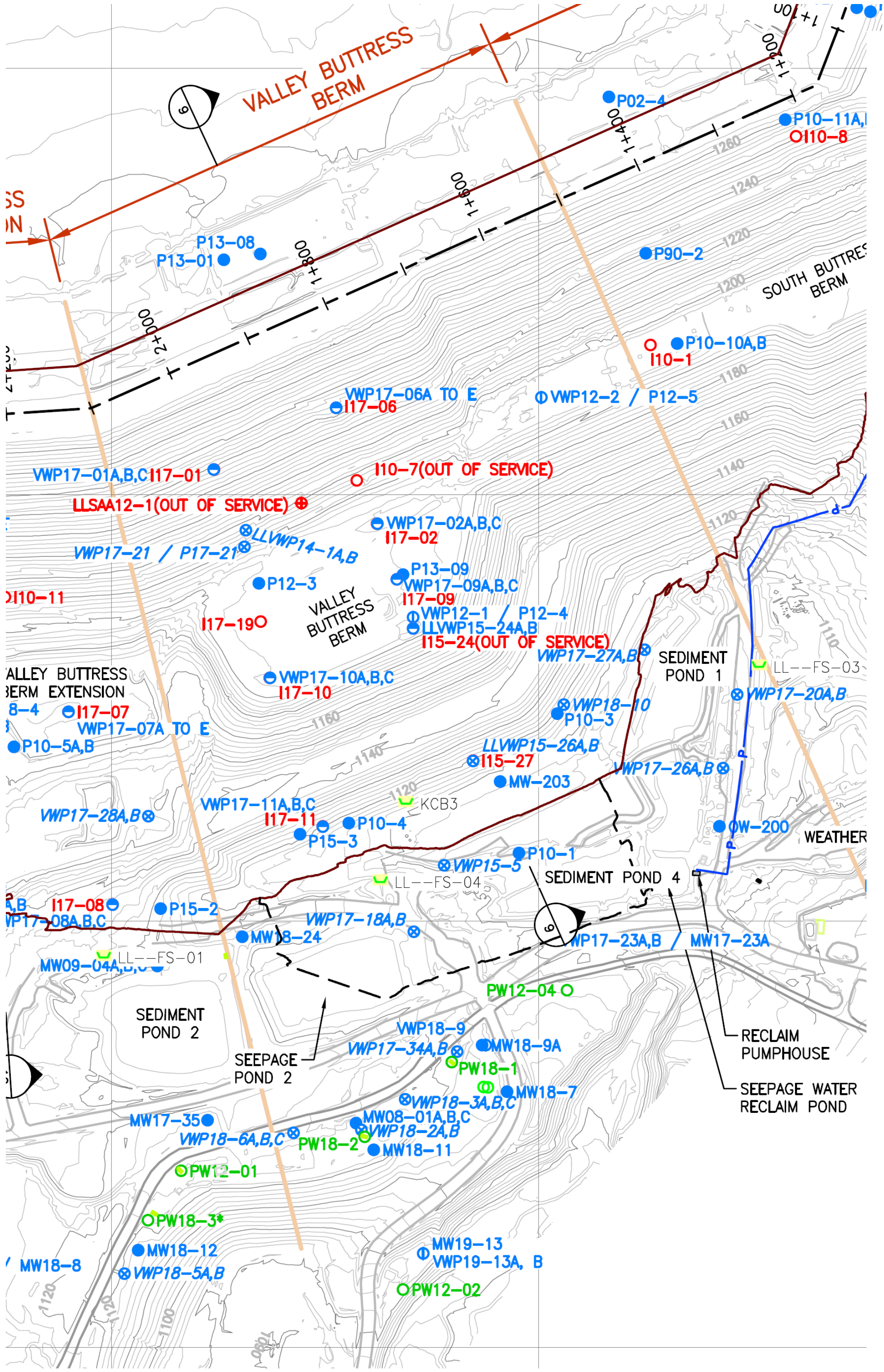
Valley Buttress Berm
Dam Fill



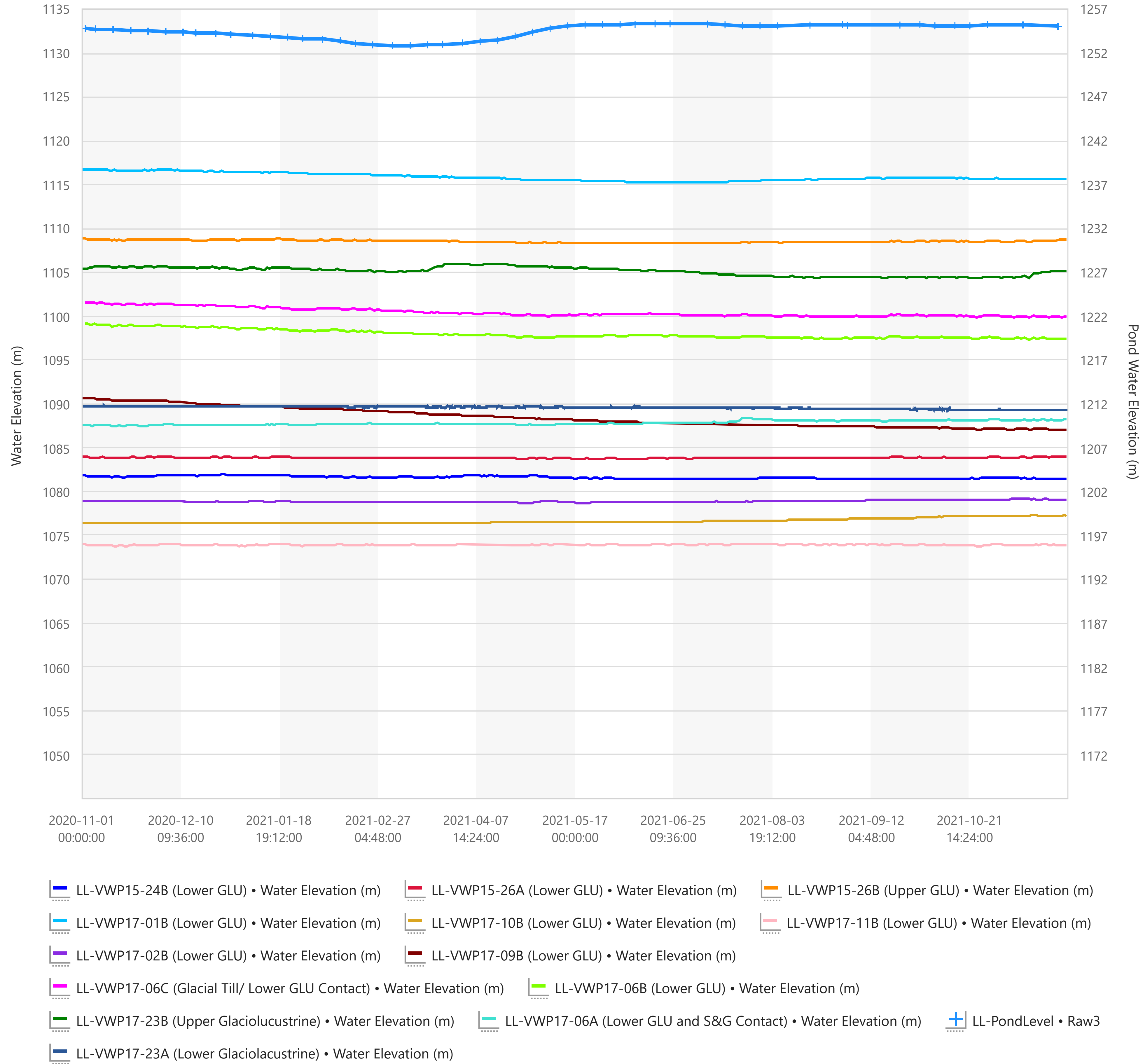


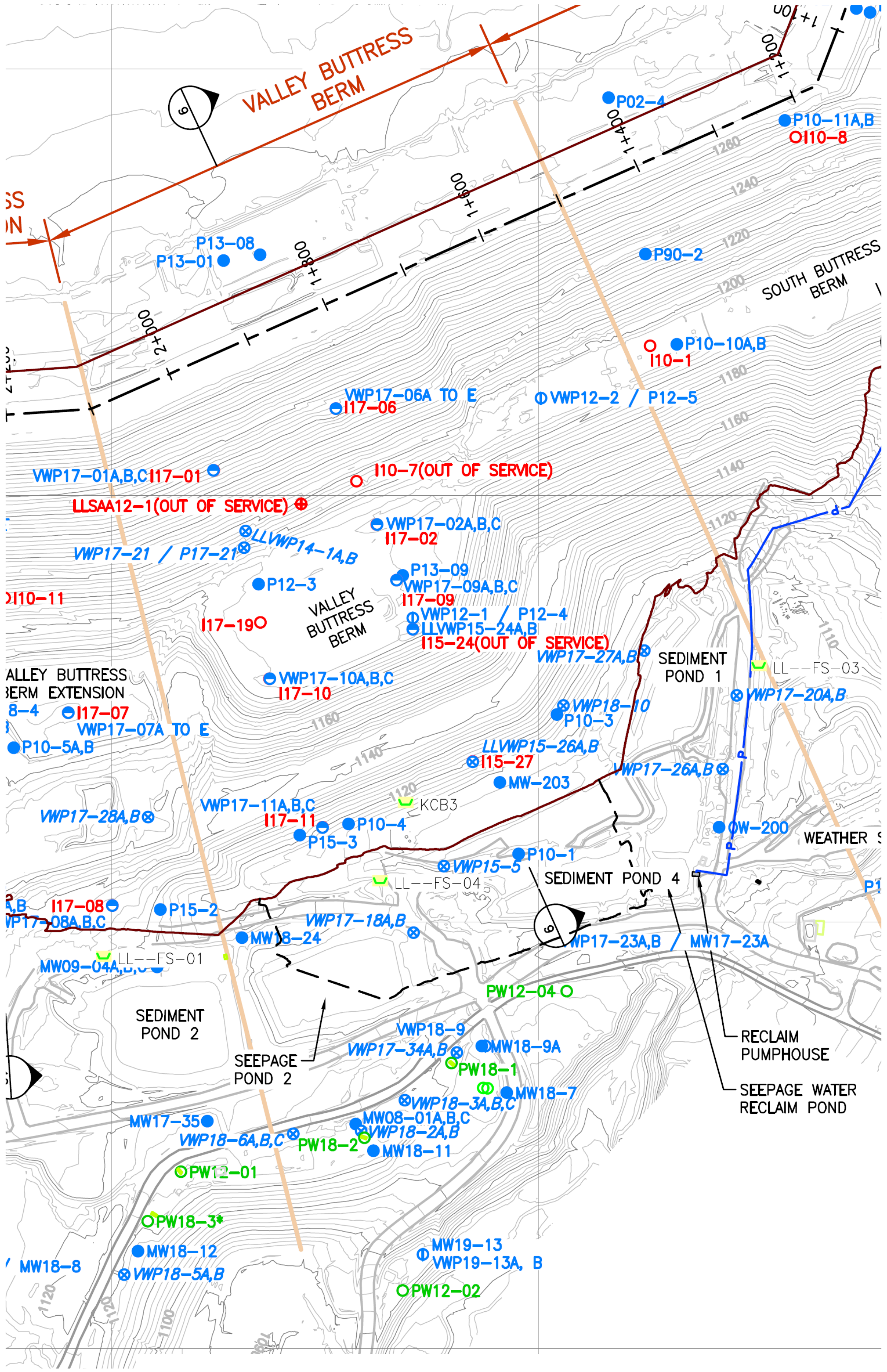
Valley Buttress Berm
Lacustrine



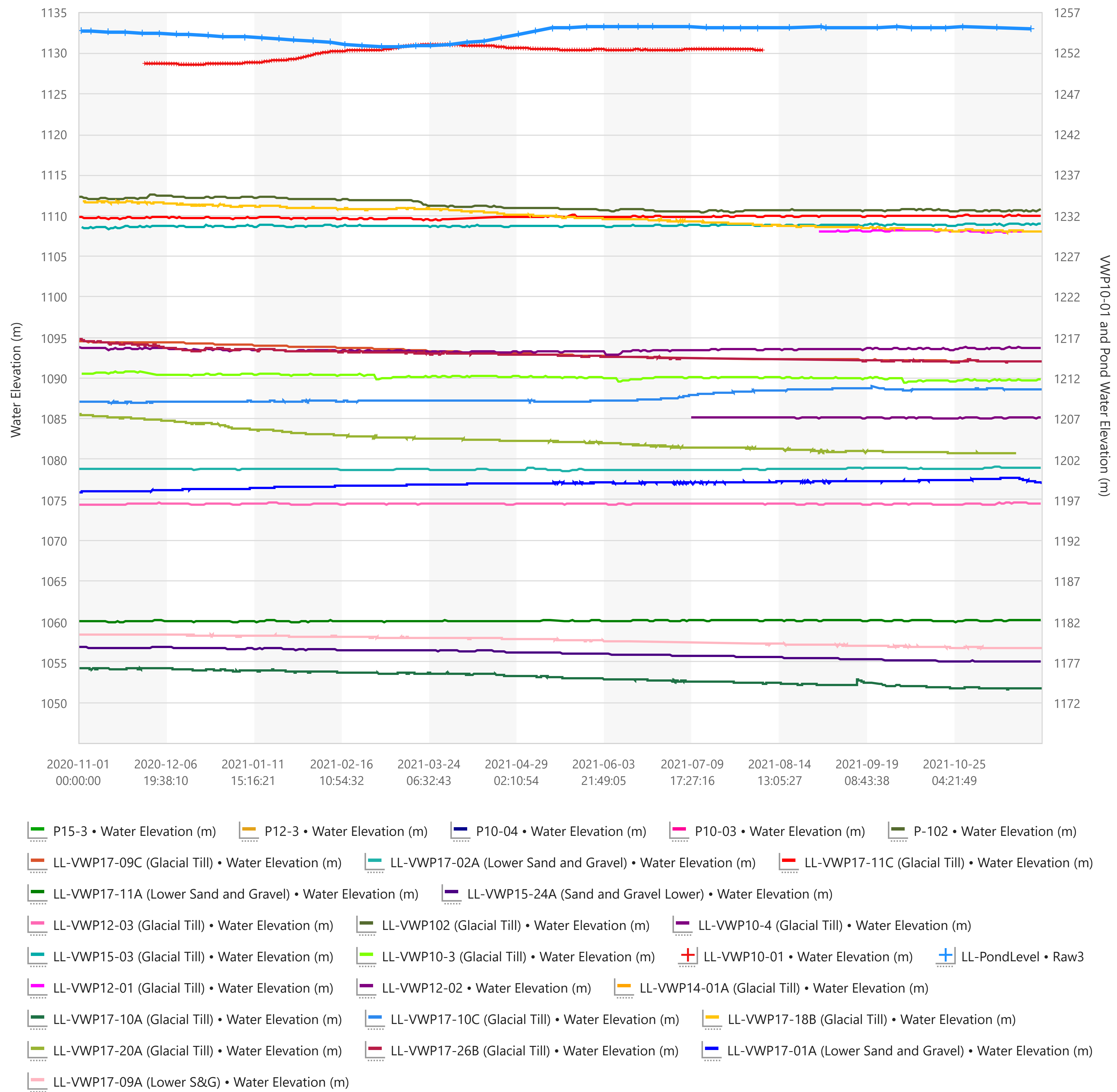


Valley Buttress Berm Glaciolacustrine

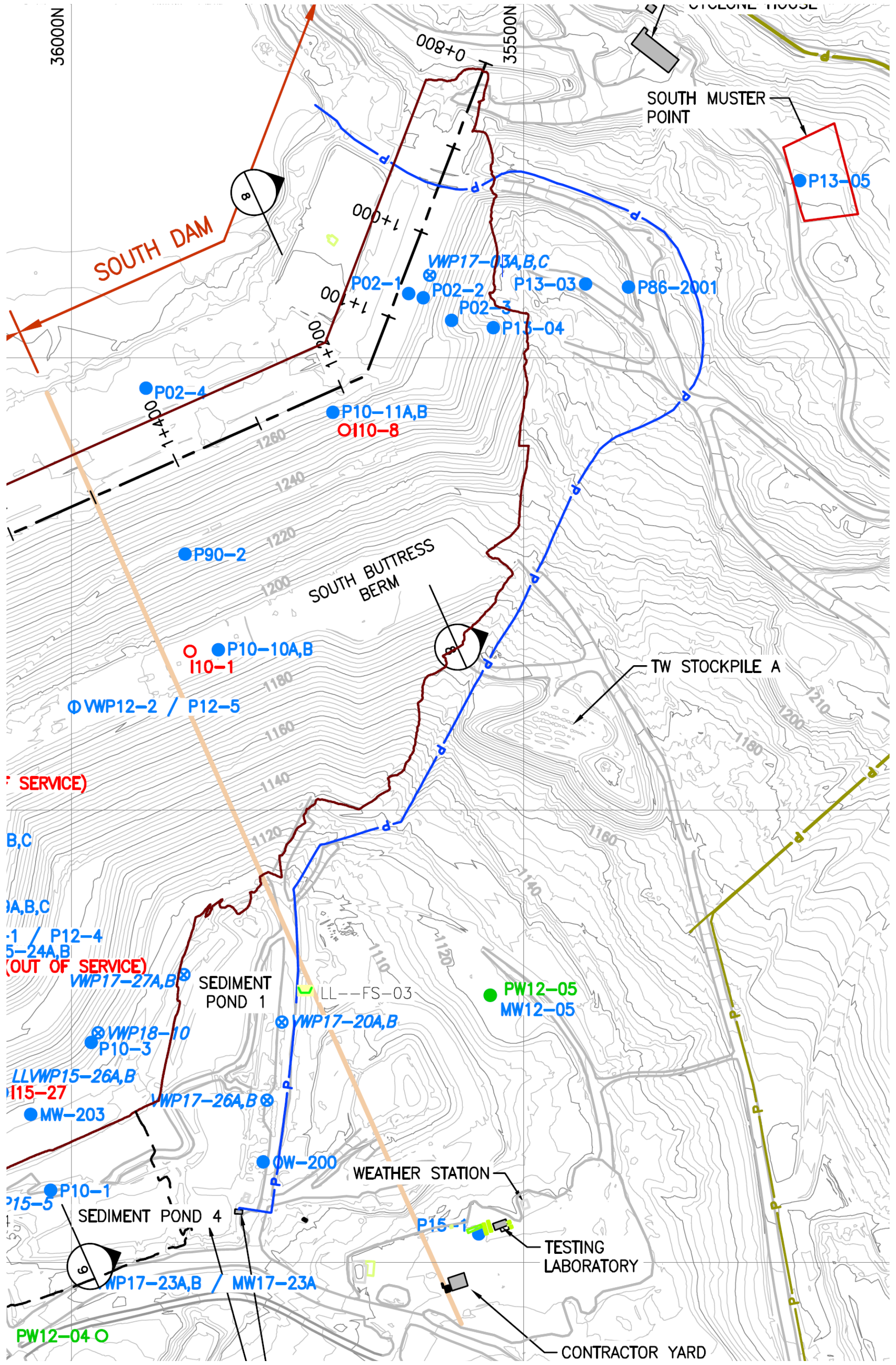




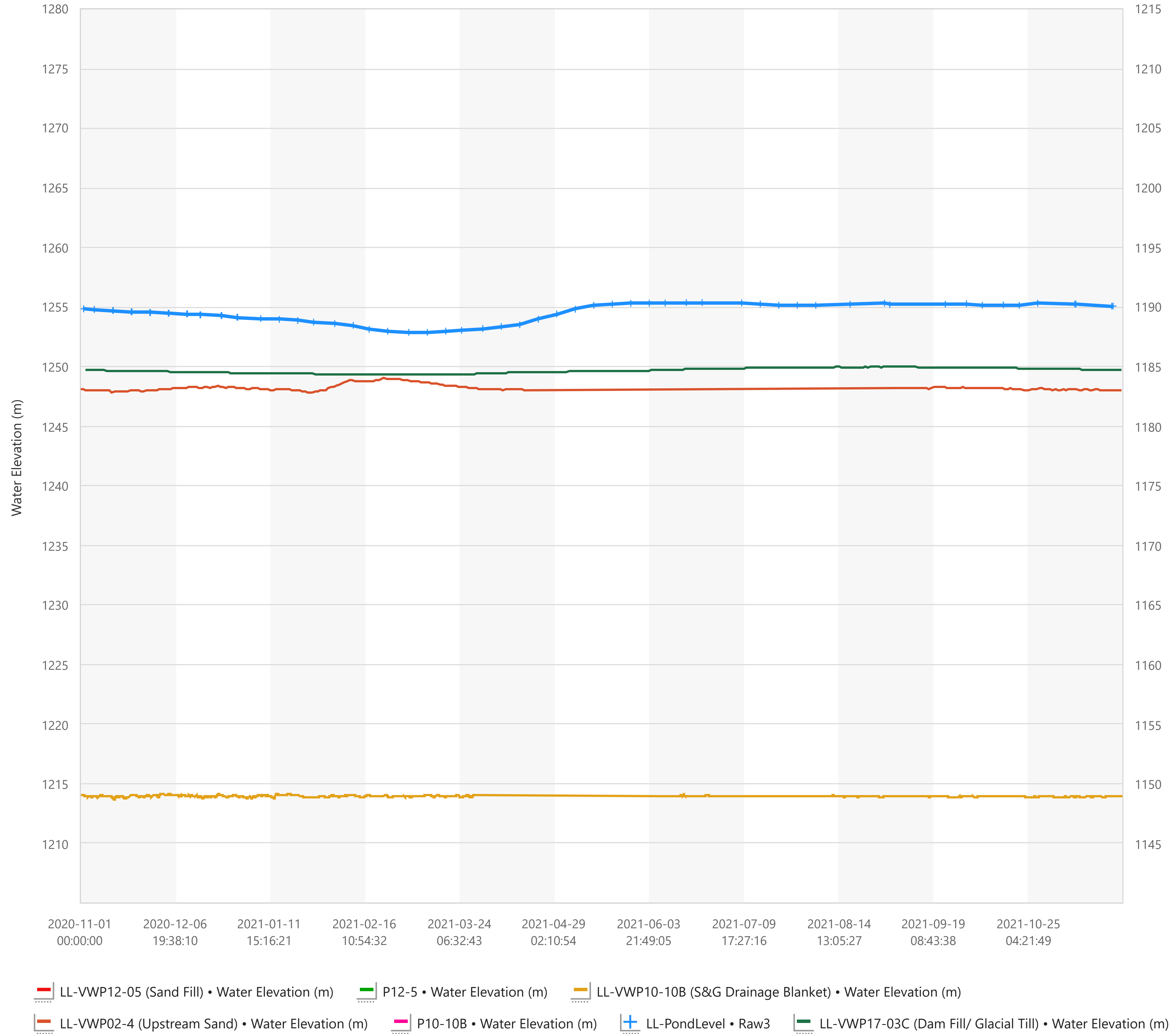
Valley Buttress Berm
Glacial Till, Sand and Gravel

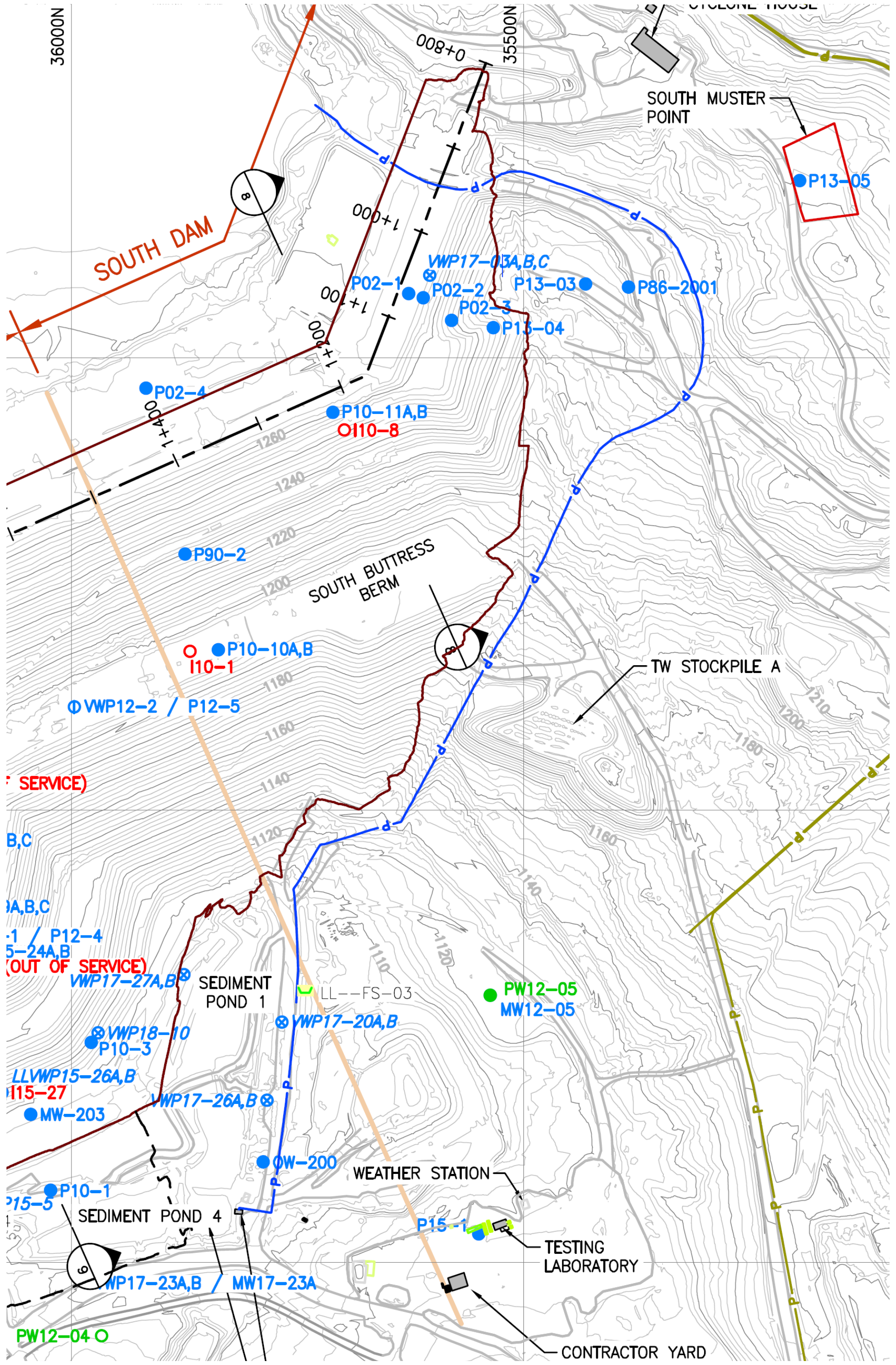


South Dam
2021 Water Elevations

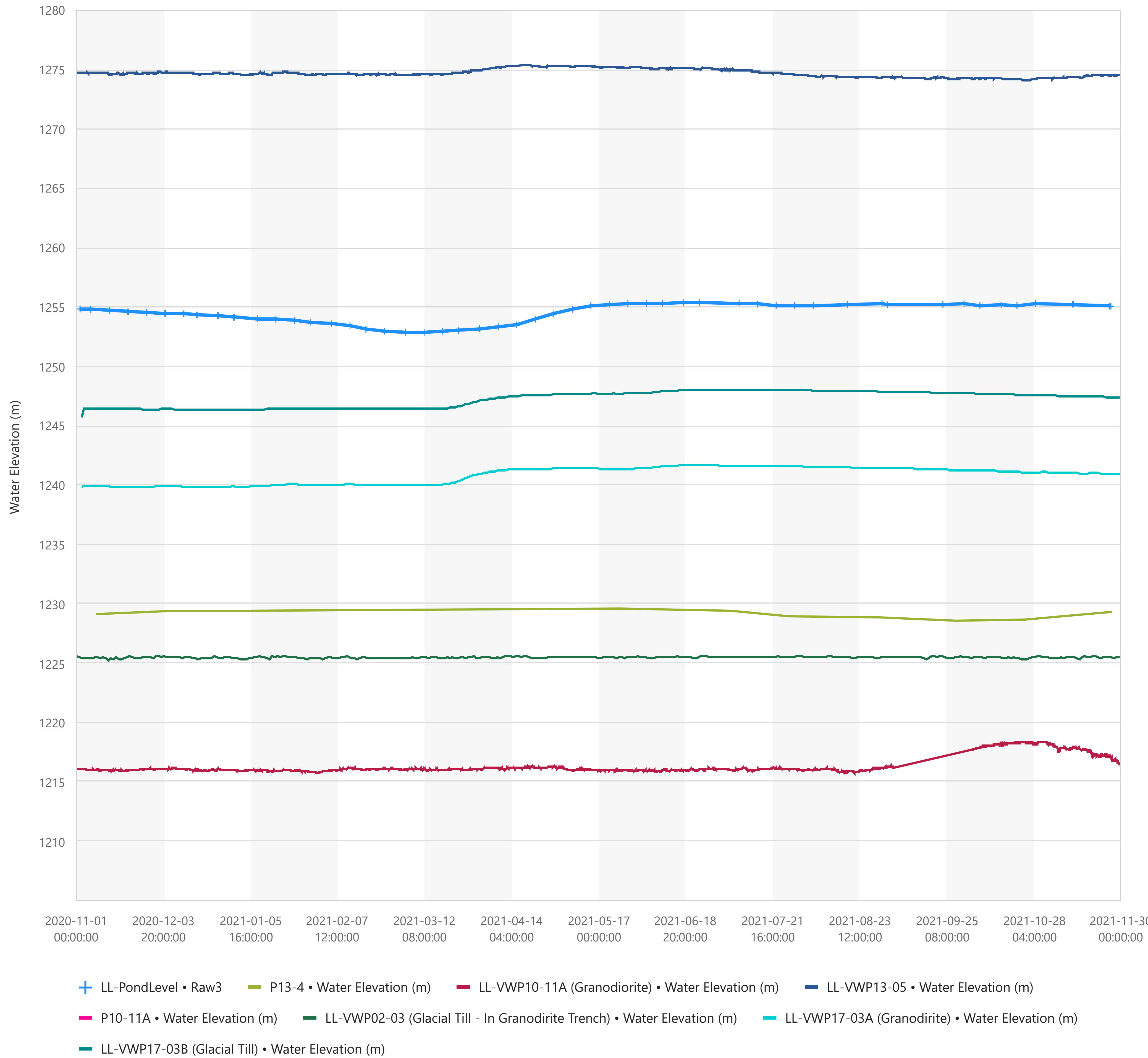


South Dam
Dam Fill



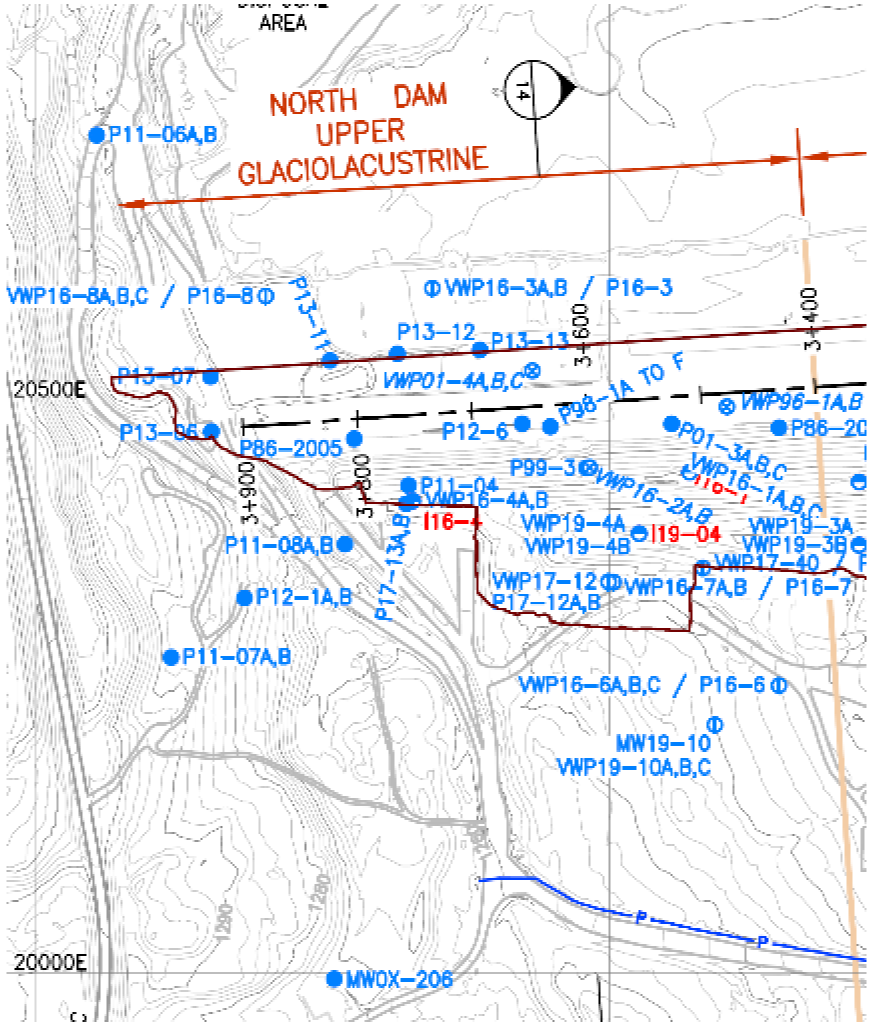


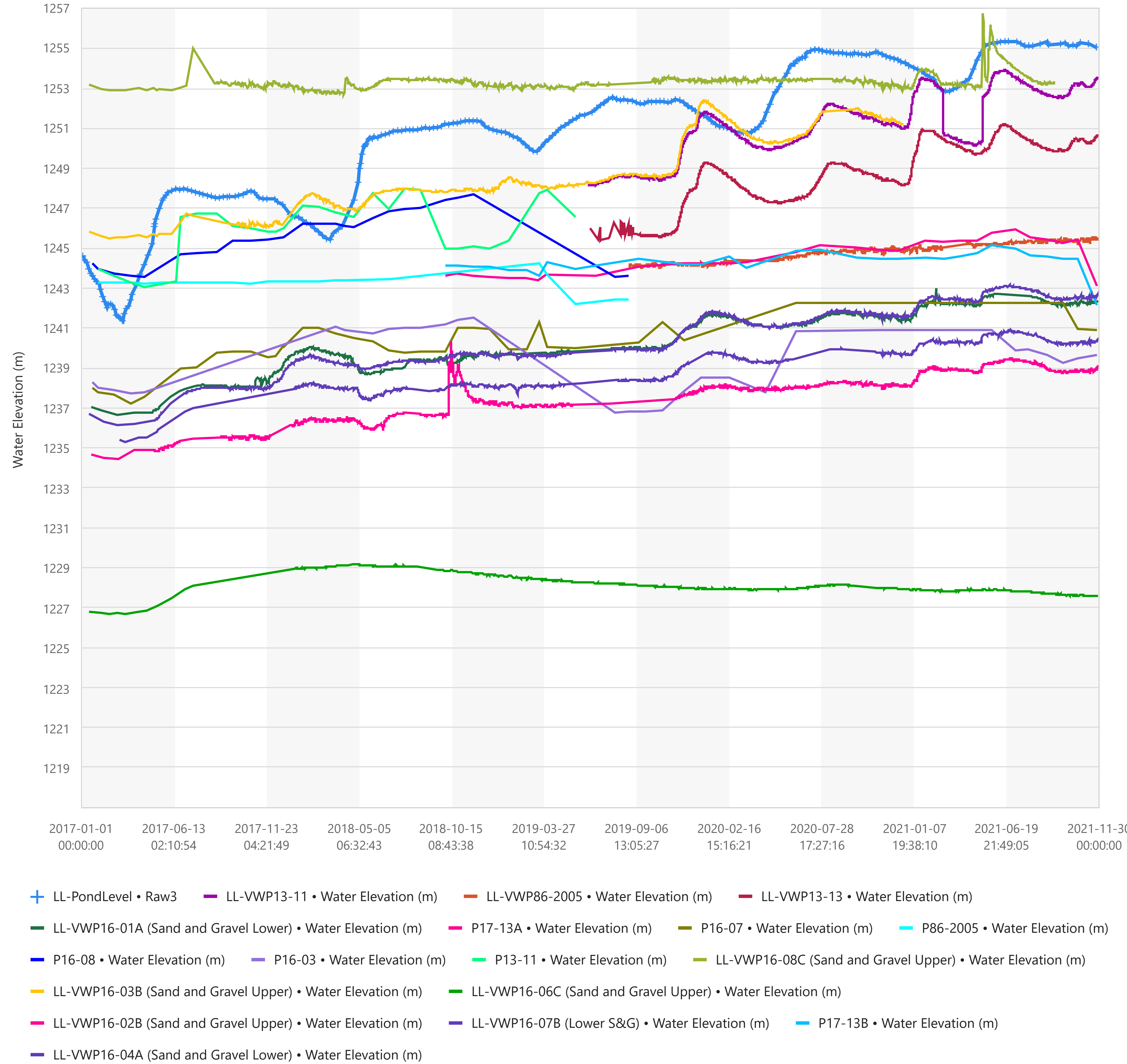
South Dam
Granodiorite, Foundation Rock and Glacial Till



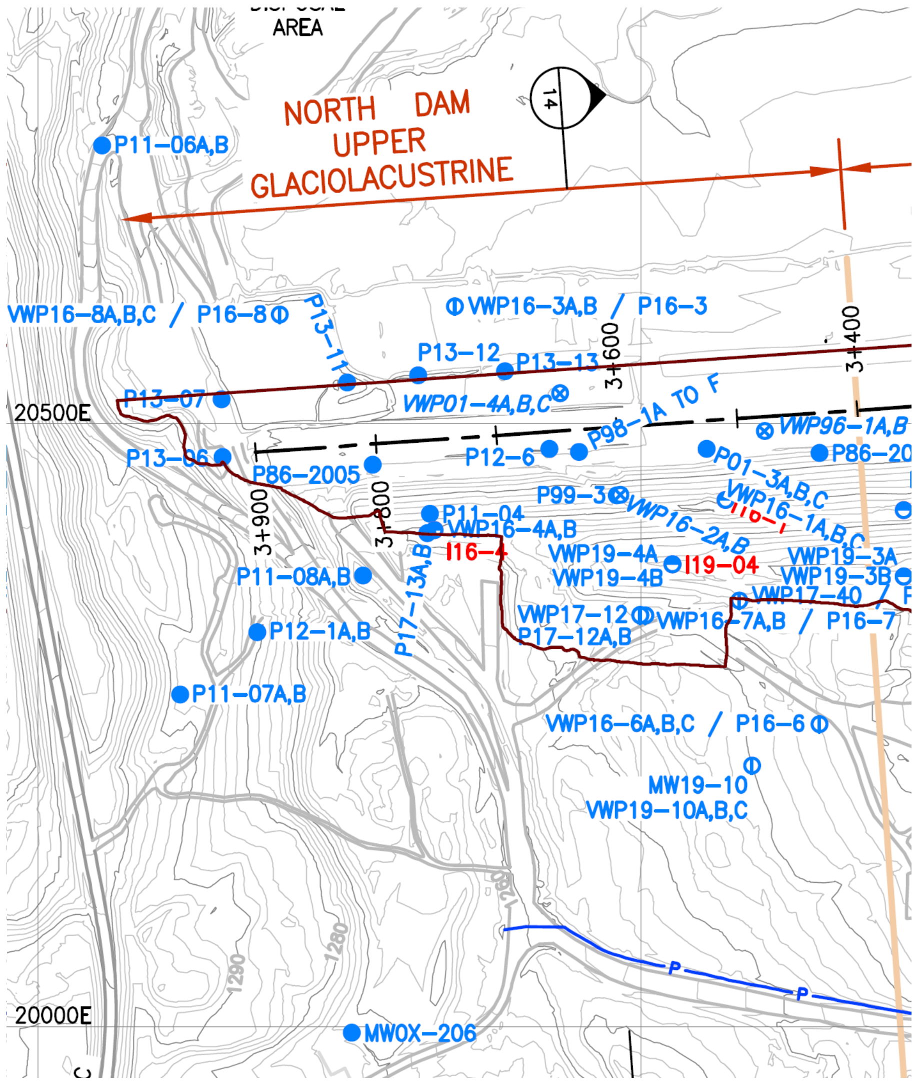
Appendix III-B-2
L-L Dam Piezometers: Water Elevations Since 2017

North Dam Upper Glaciolacustrine (North Abutment) Water Elevations Since 2017

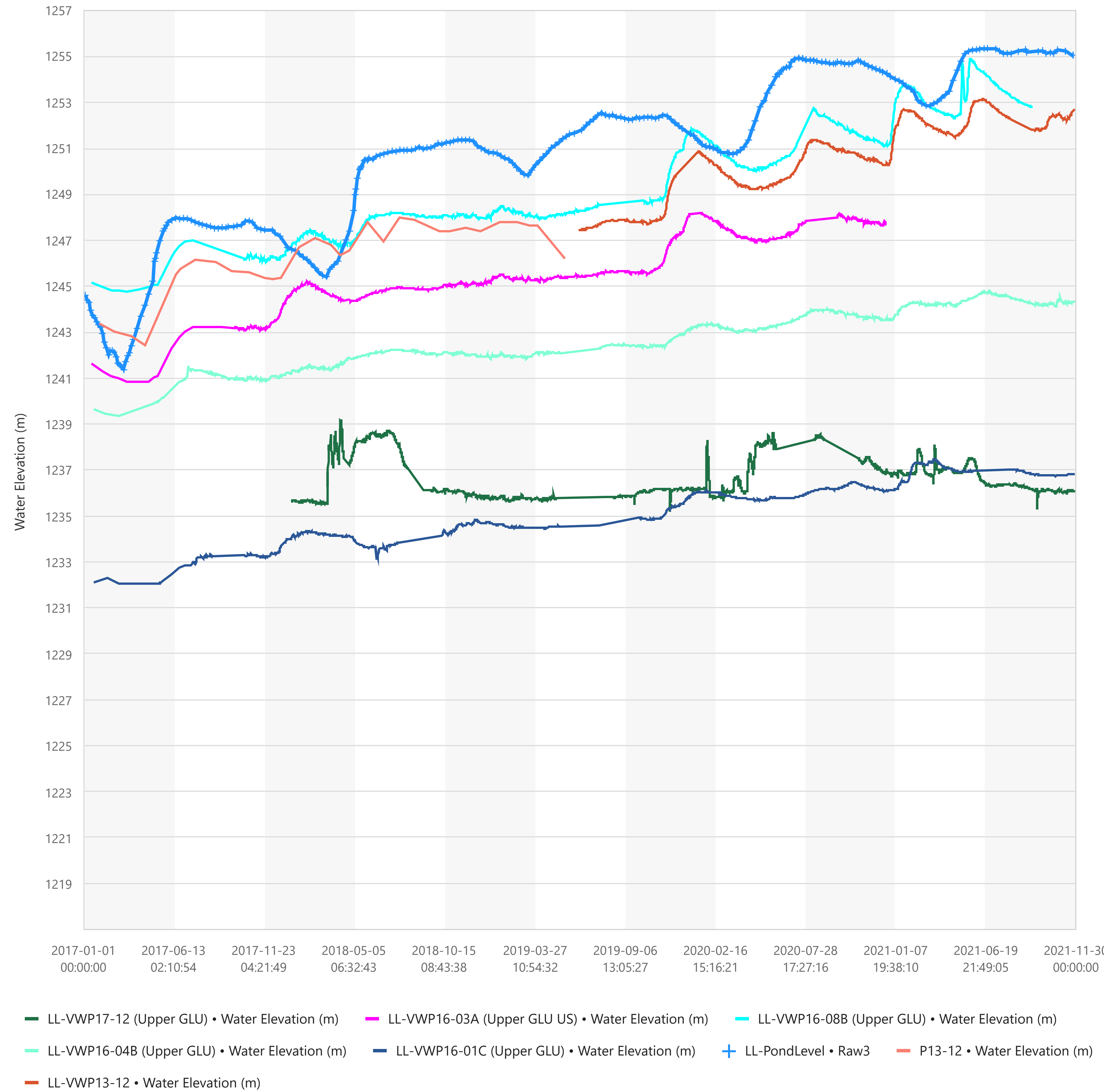


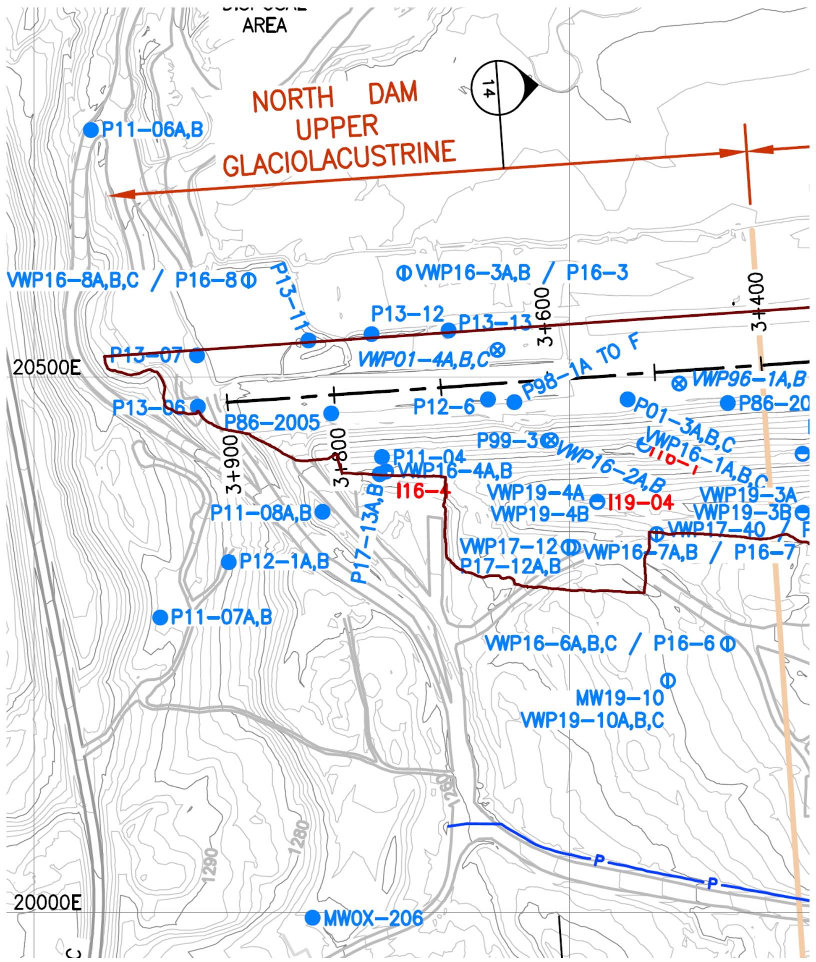


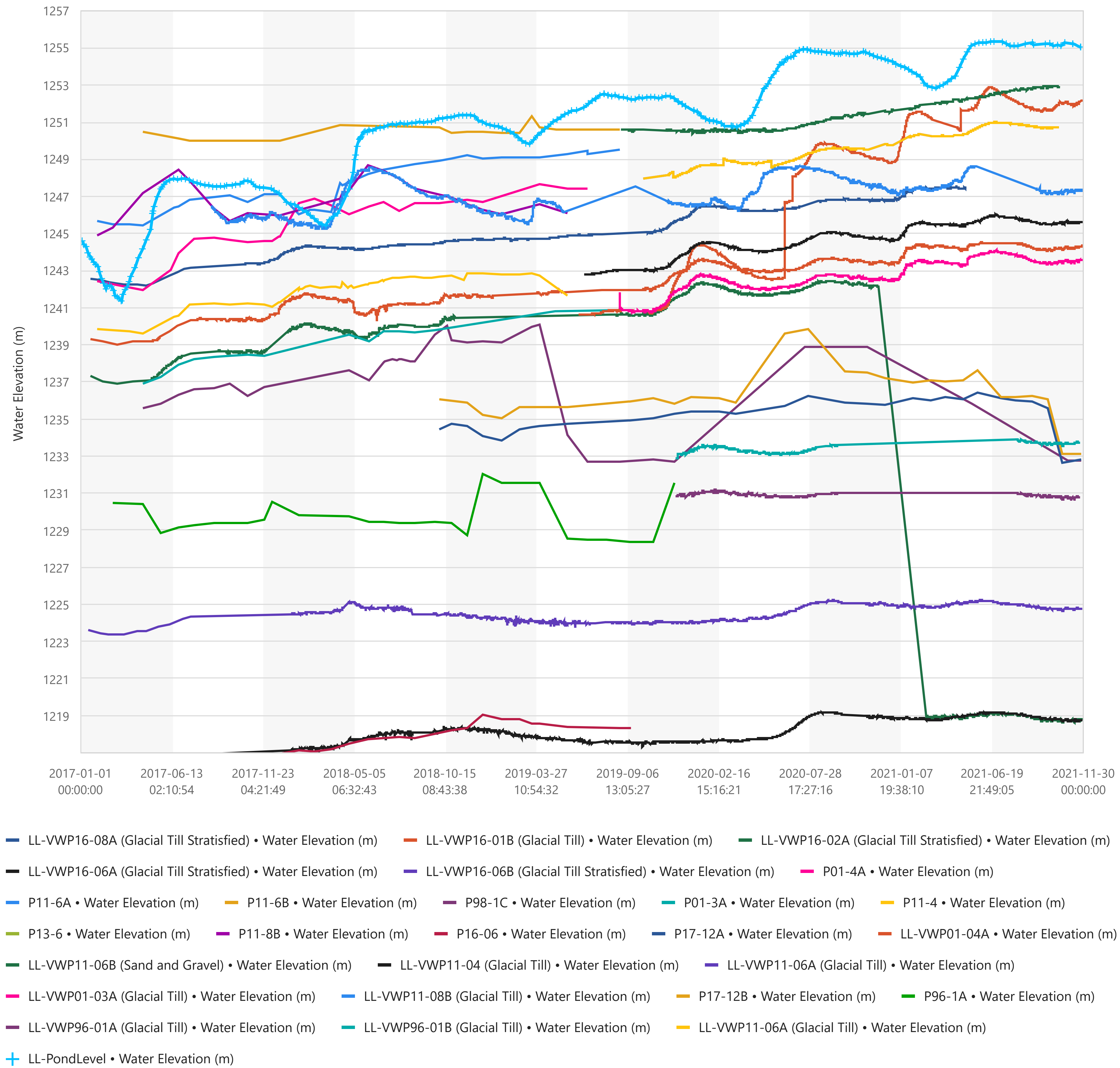
North Dam Upper Glaciolacustrine
Sand and Gravel



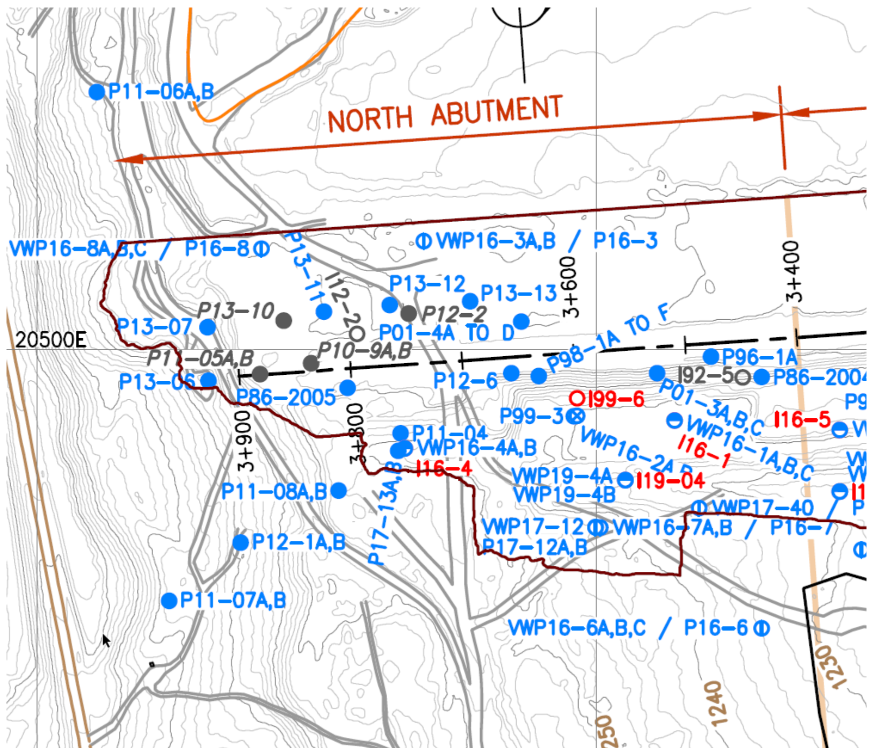
North Dam Upper Glaciolacustrine
Glaciolacustrine



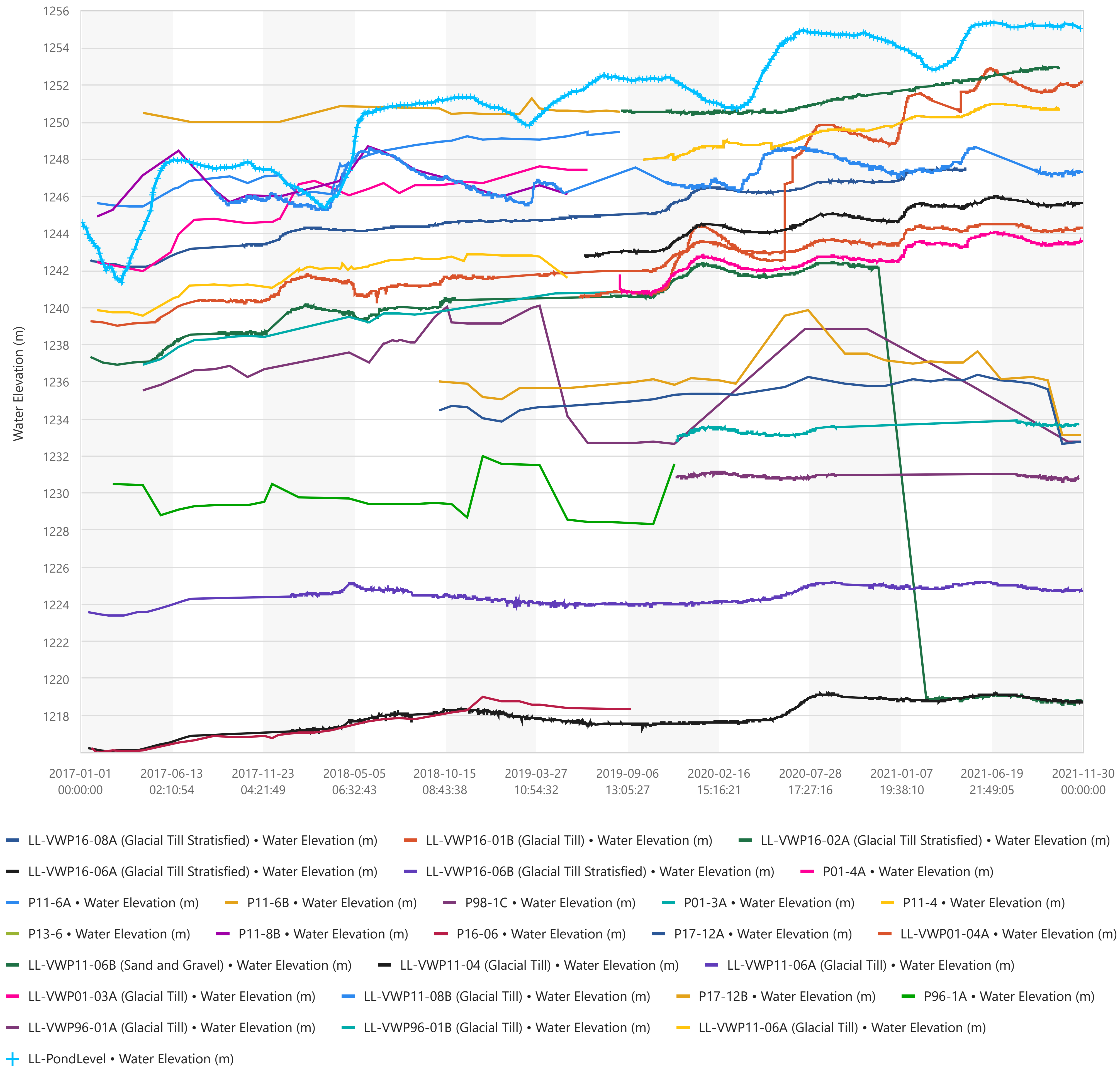


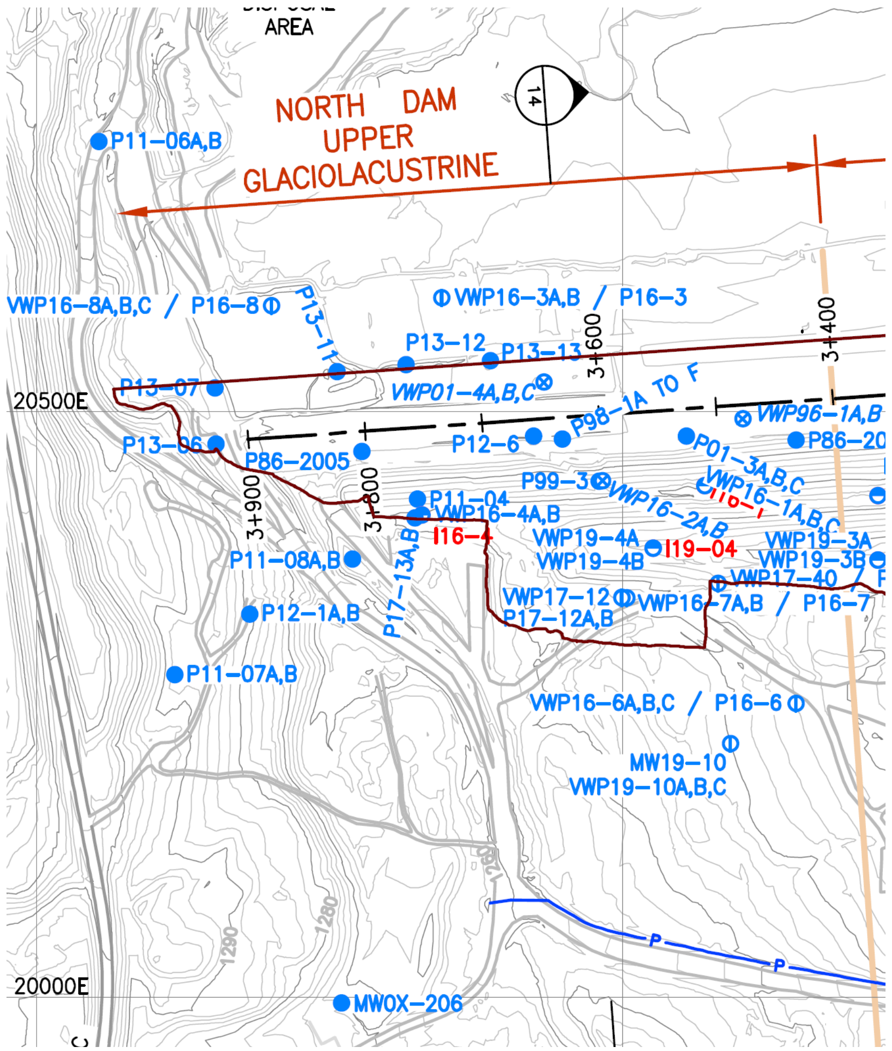


North Dam Upper Glaciolacustrine Glacial Till

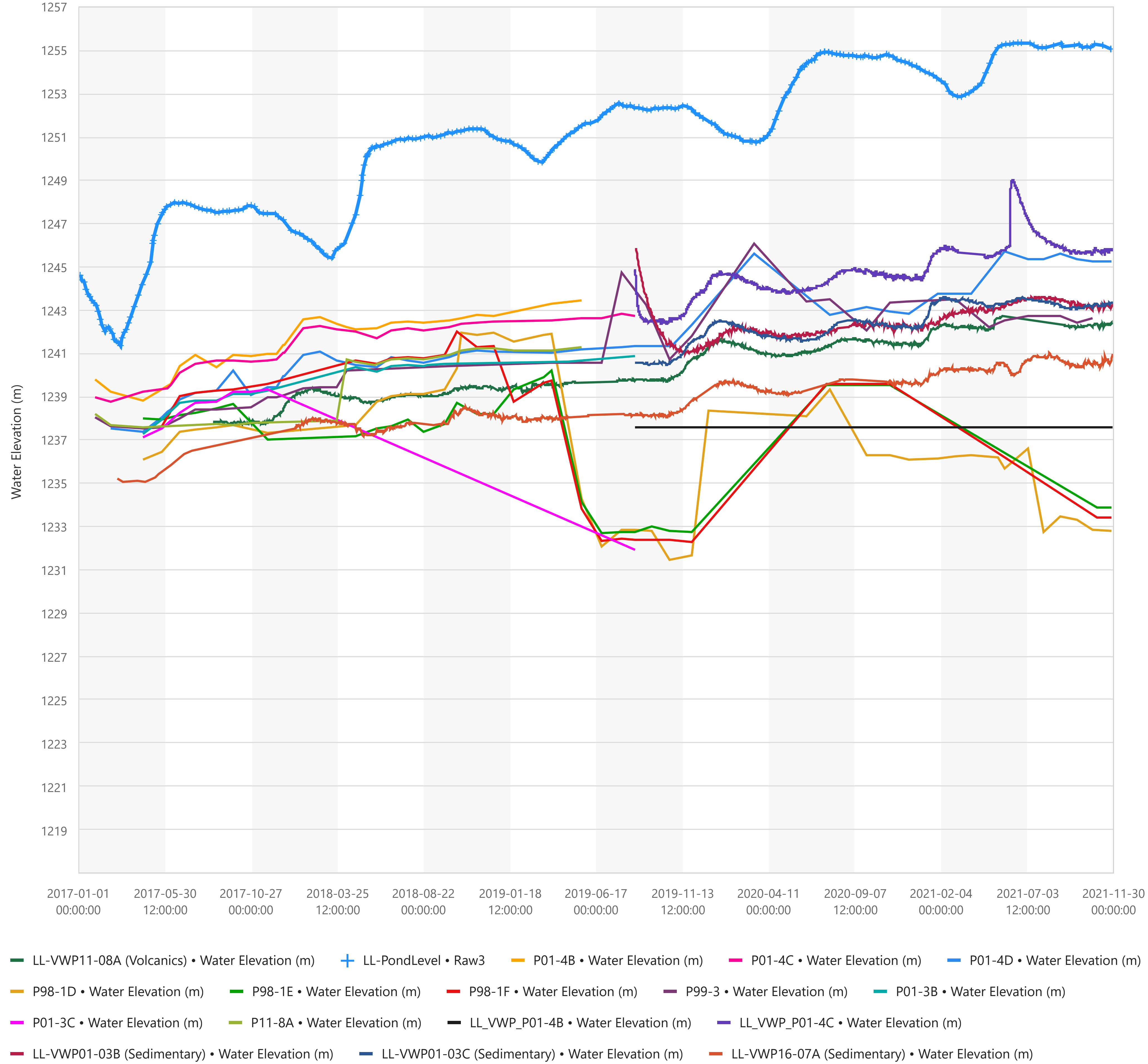


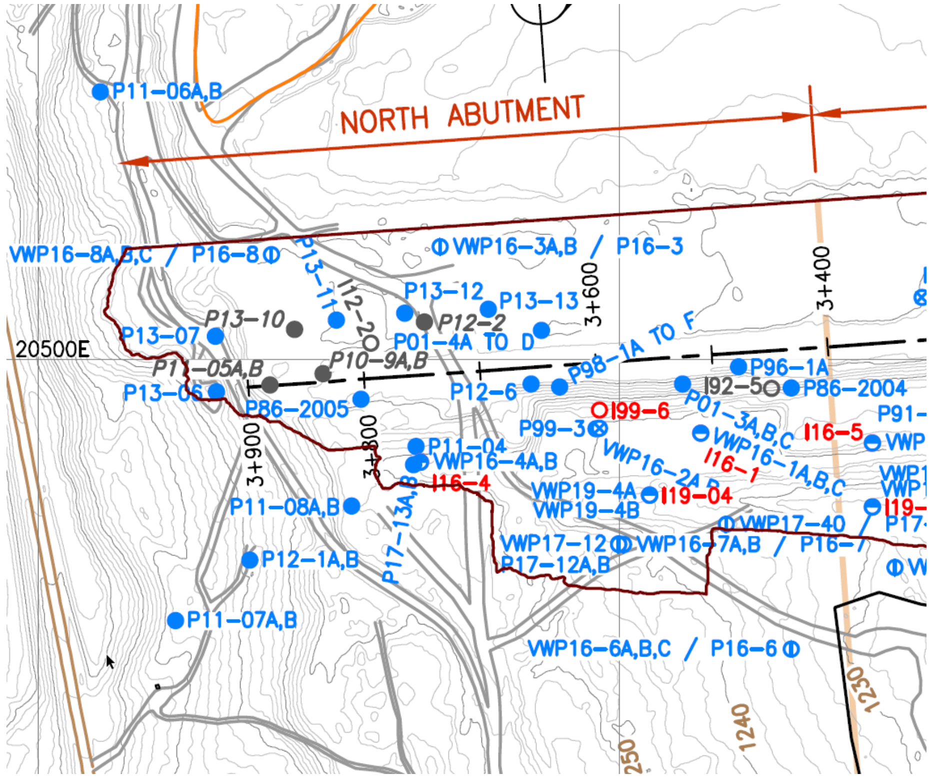
North Abutment - Glacial Till



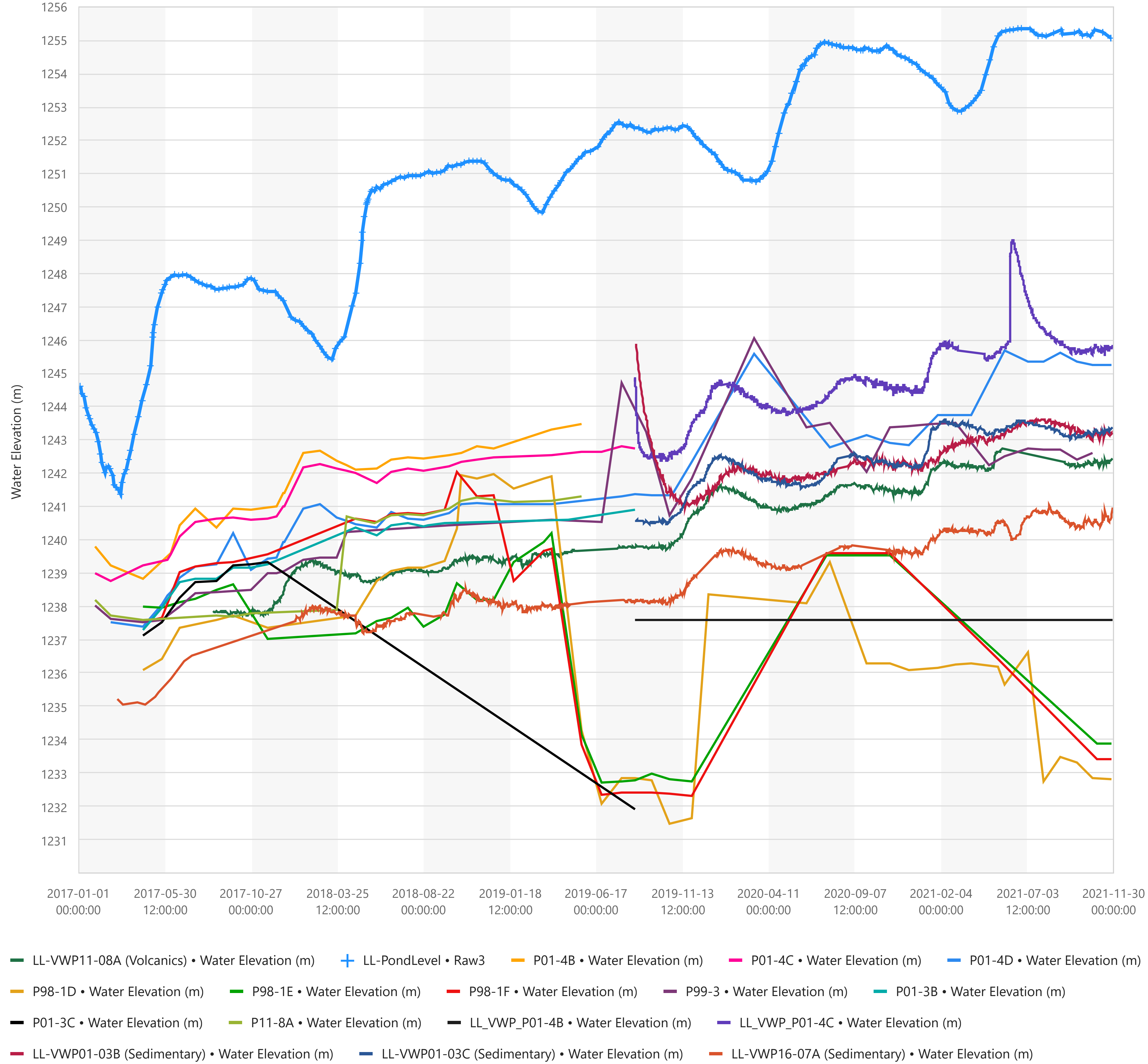


North Dam Upper Glaciolacustrine Foundation Rock

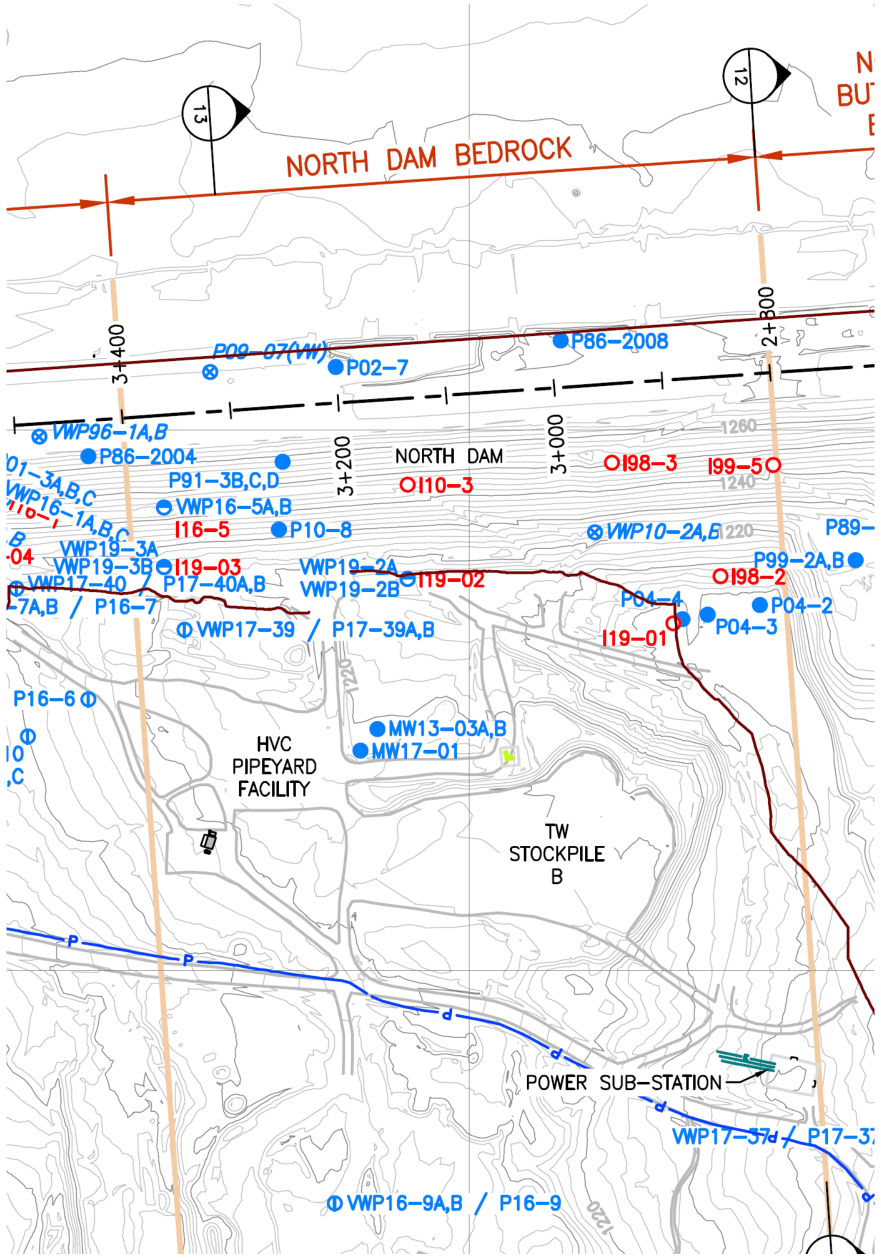


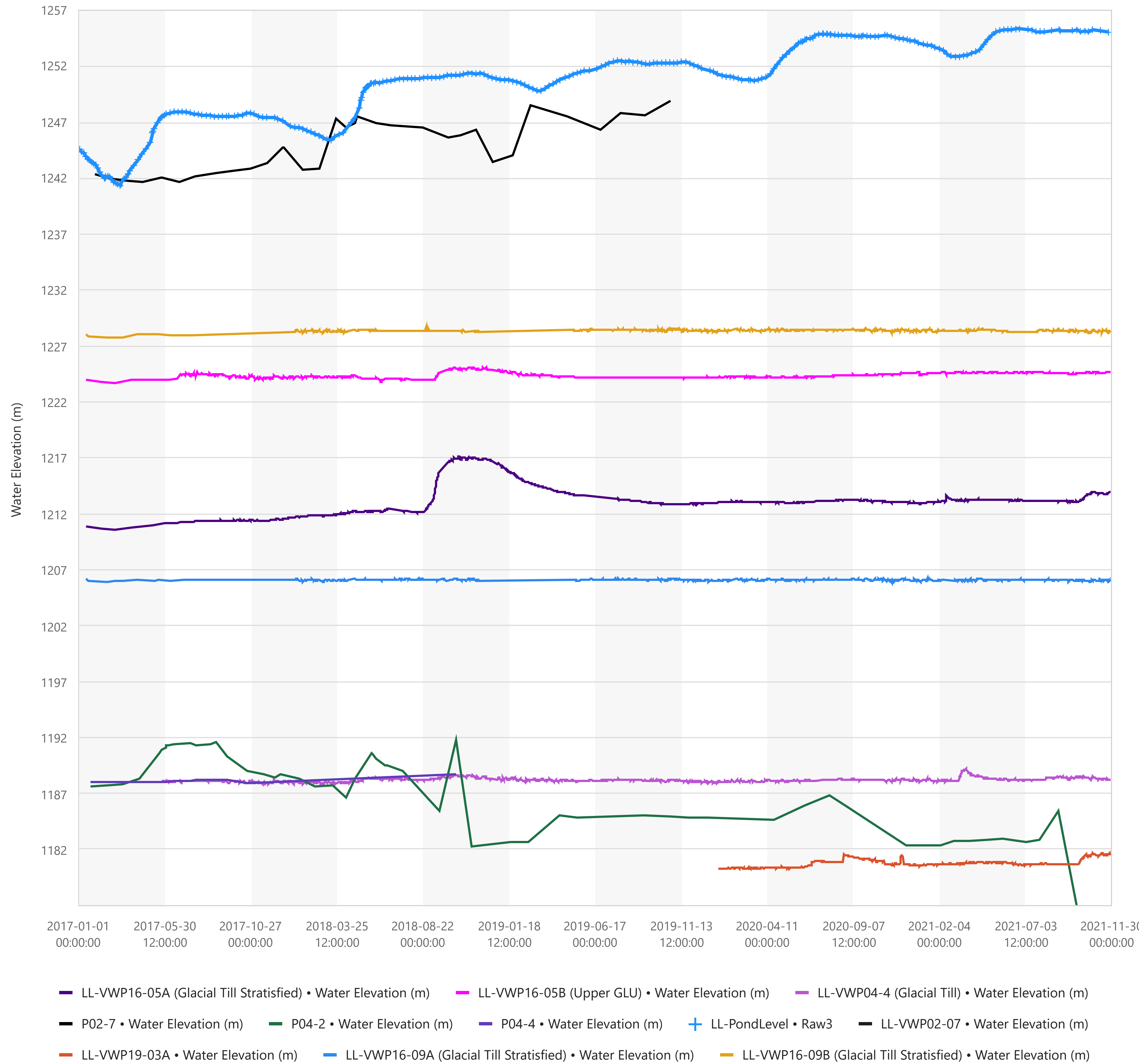


North Abutment - Foundation Rock

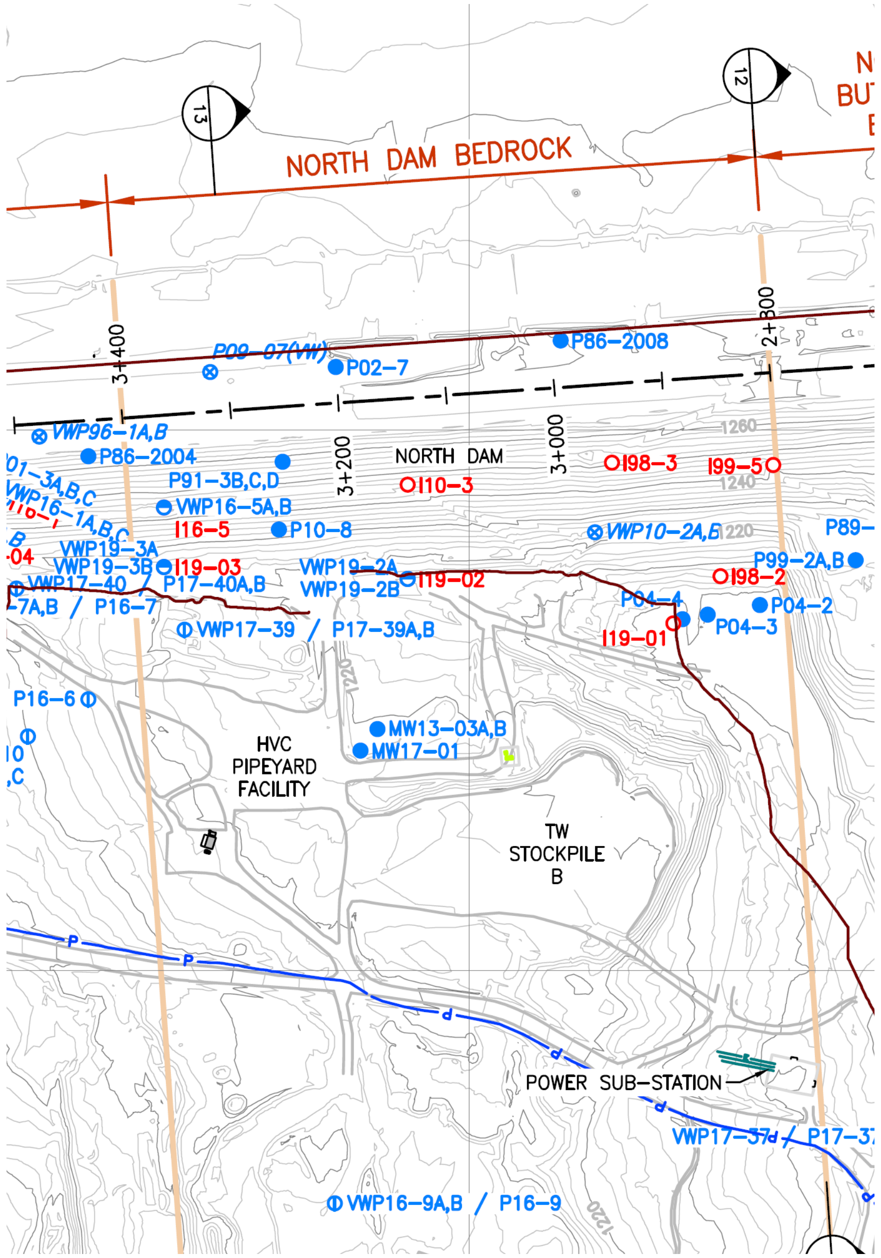


North Dam Bedrock
Water Elevations Since 2017

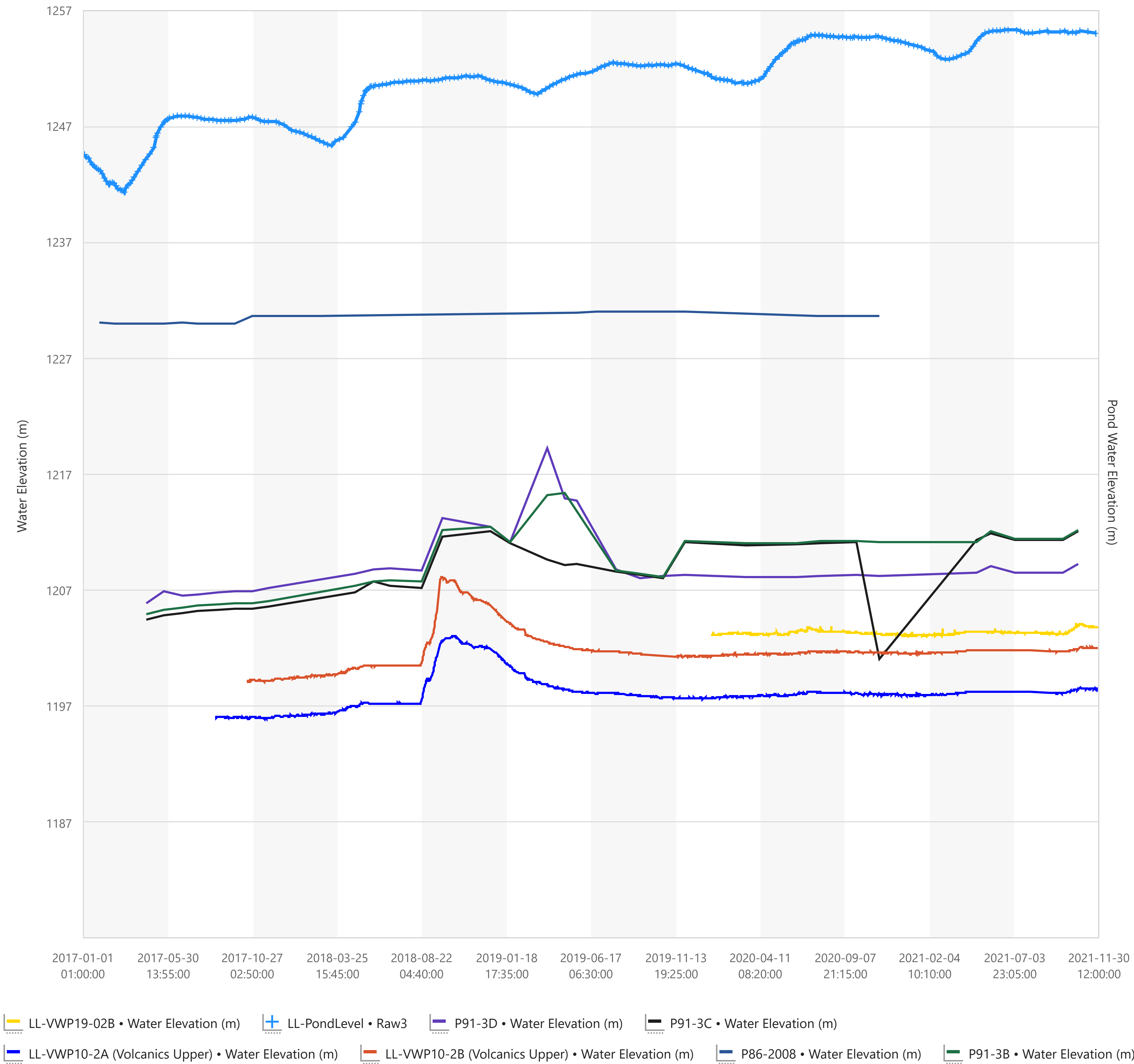




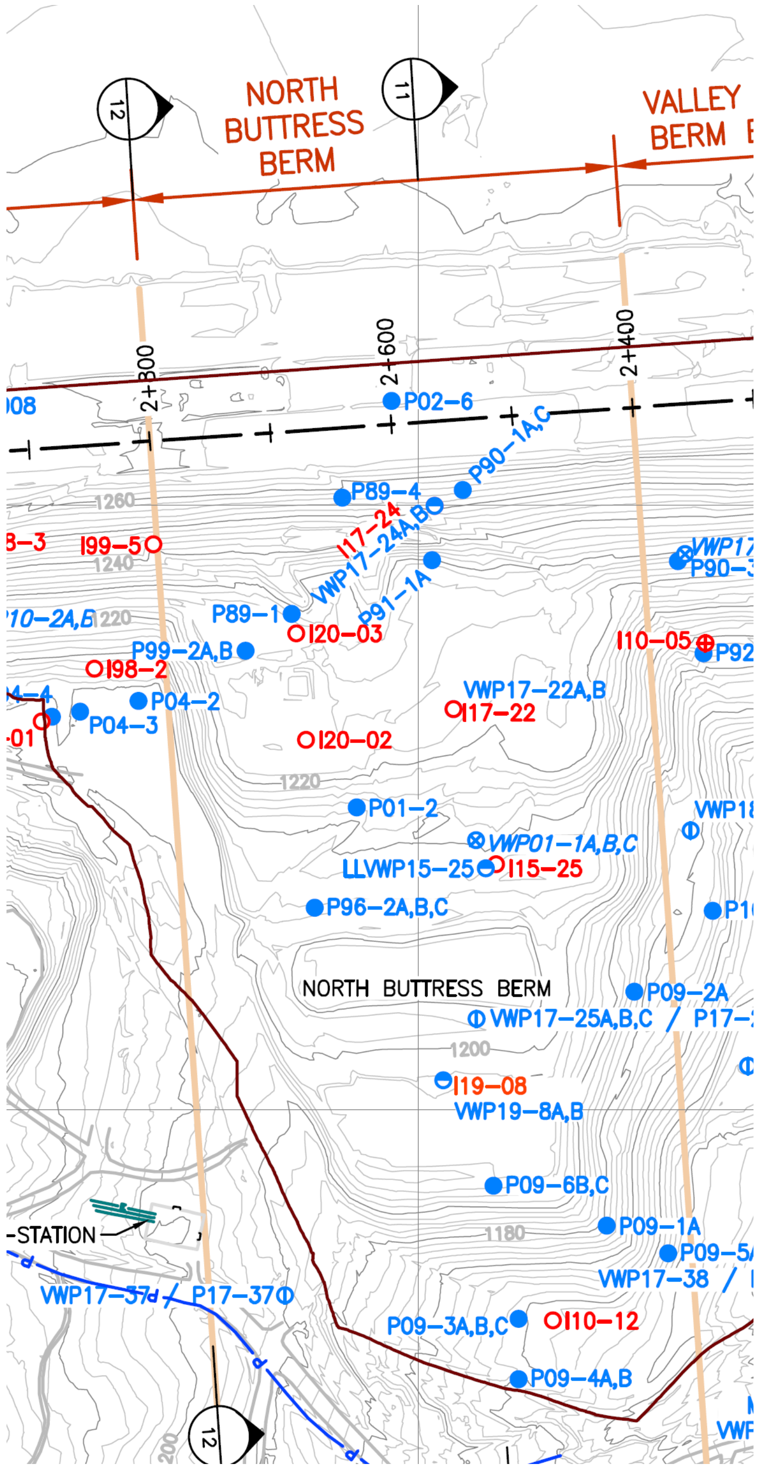
North Dam Bedrock
Glacial Till, Sand, Upper GLU



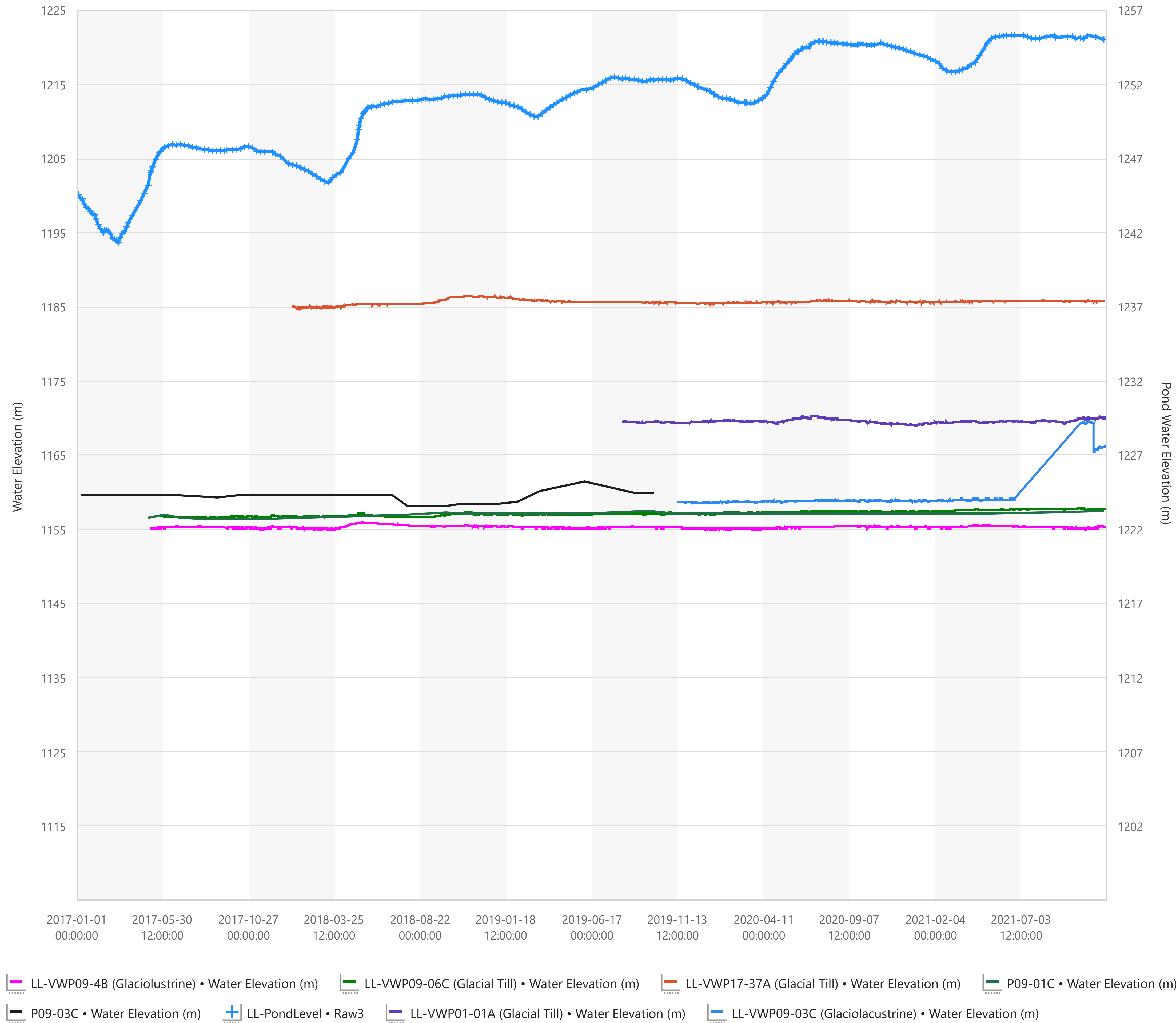
North Dam - Bedrock Volcanics

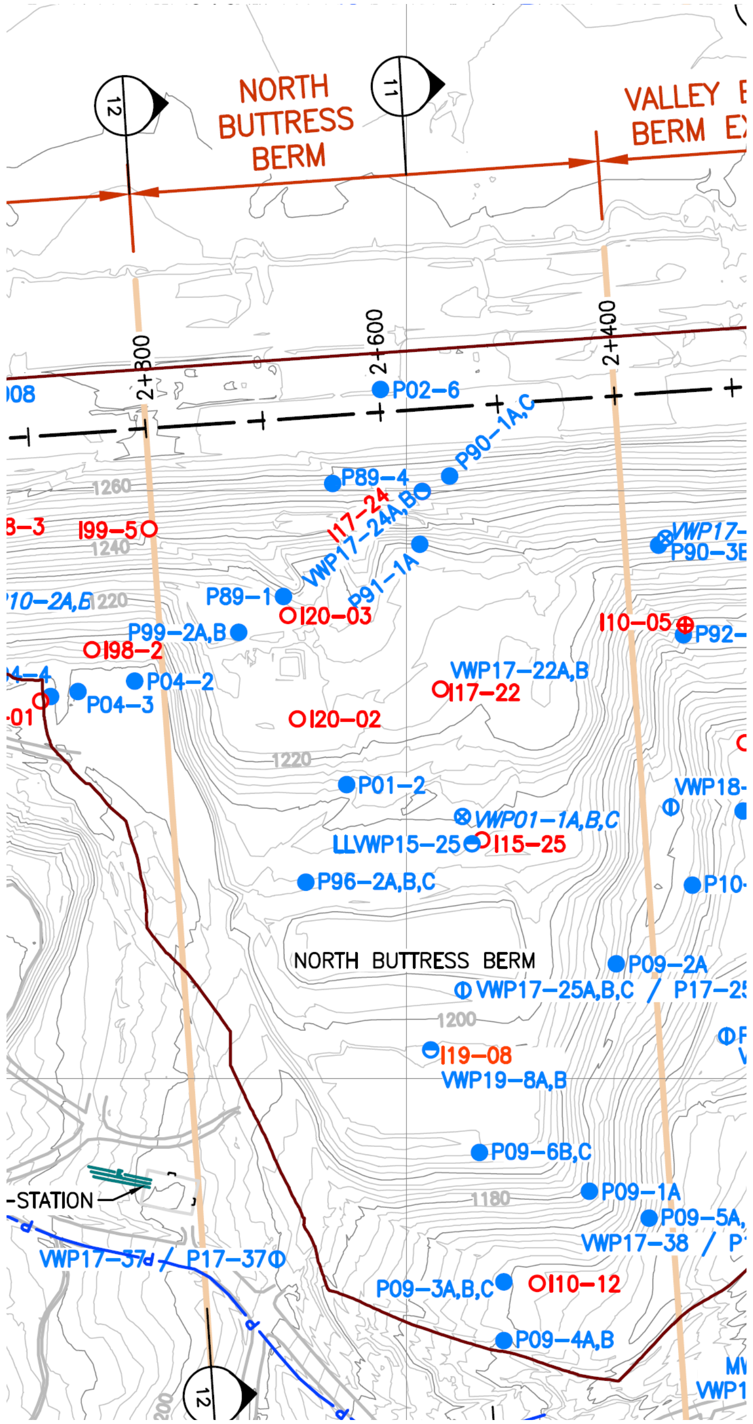


North Buttress Berm
Water Elevations Since 2017

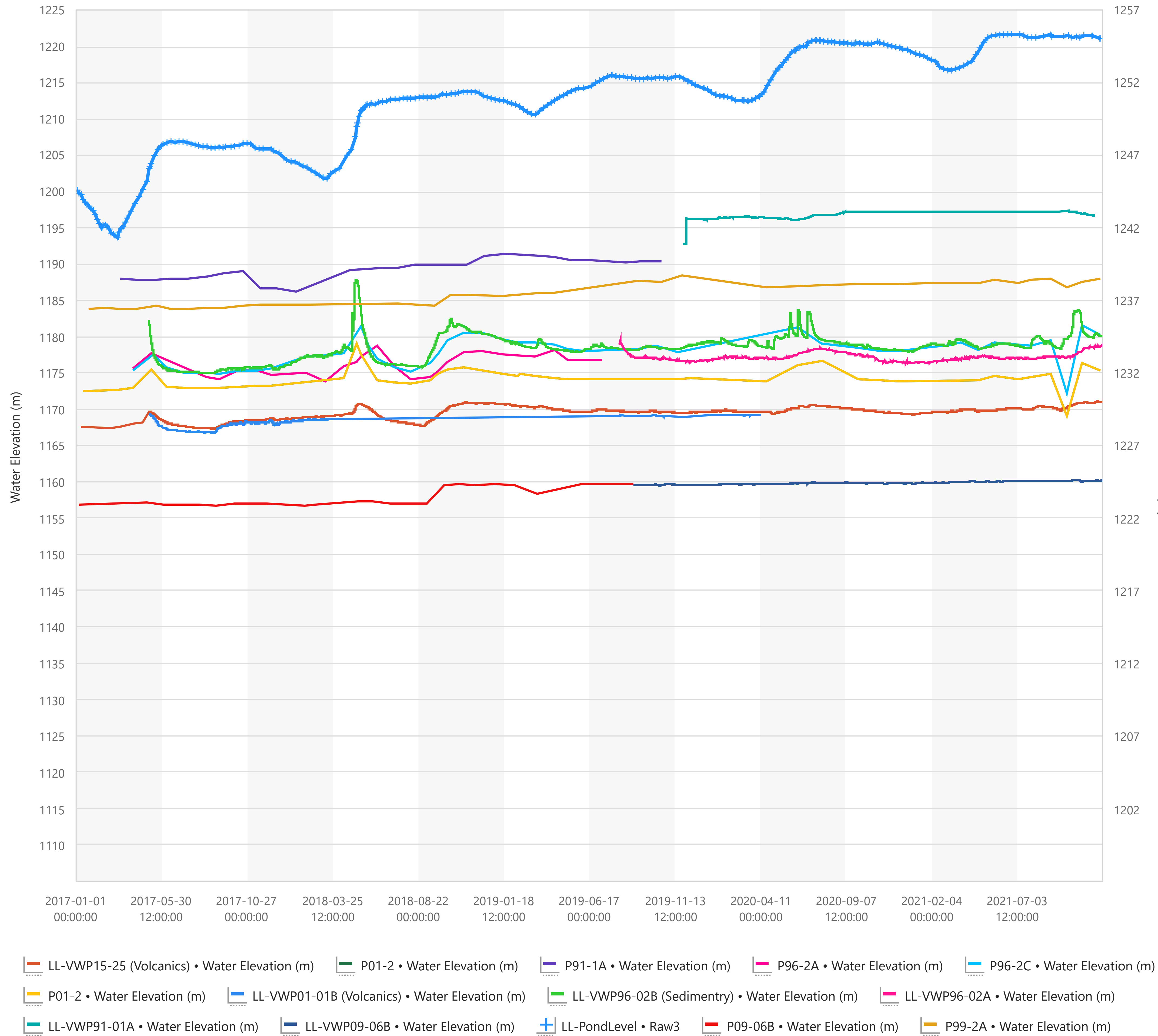


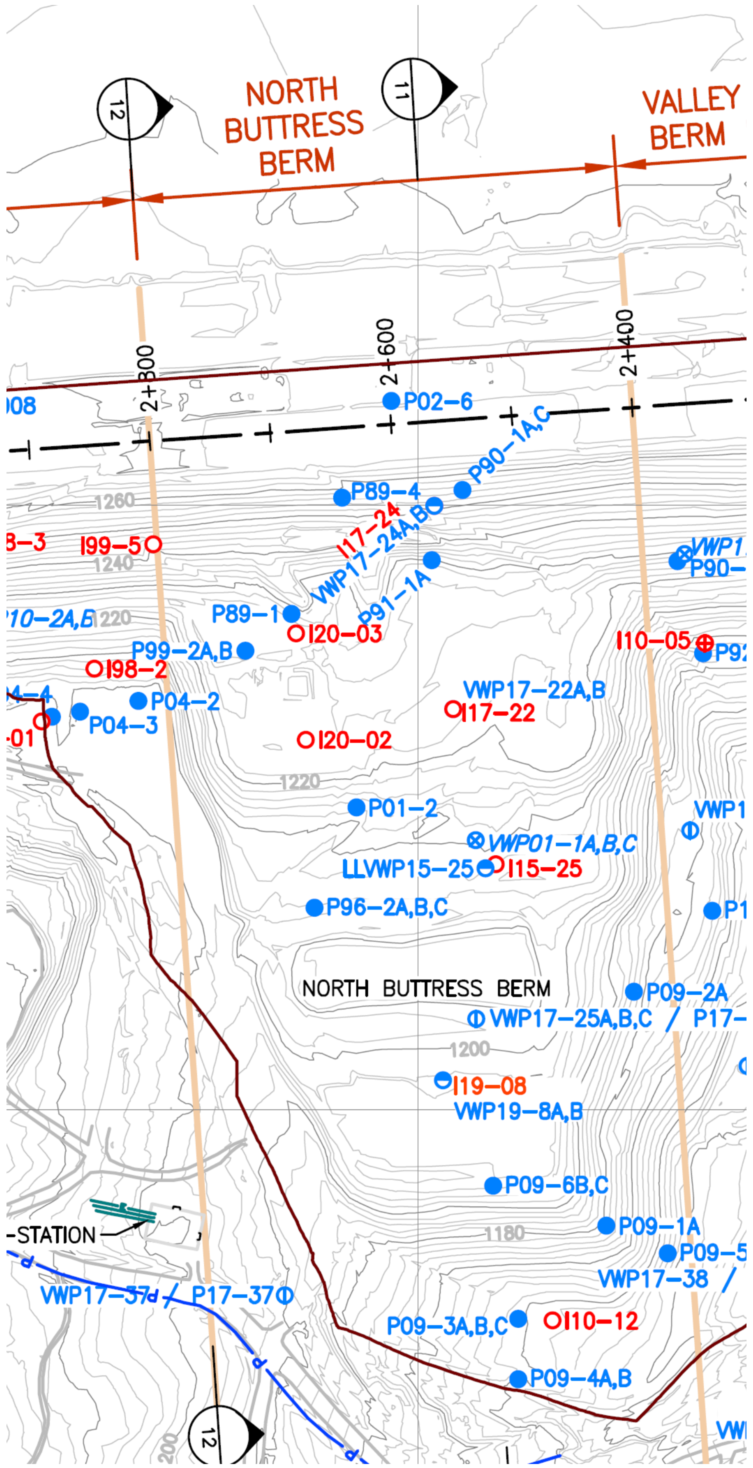
North Buttress Berm Overburden



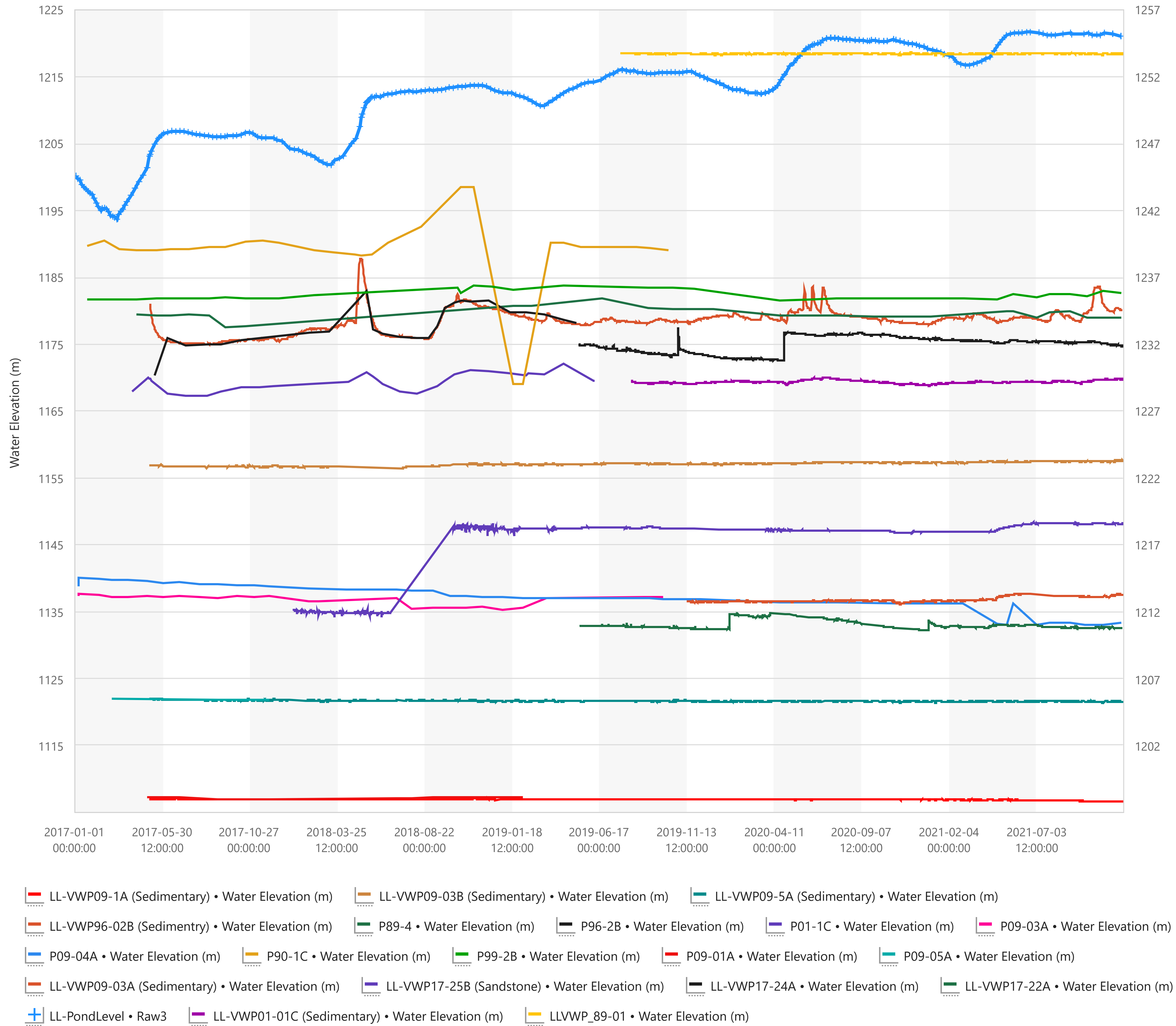


North Buttress Berm
Volcanics

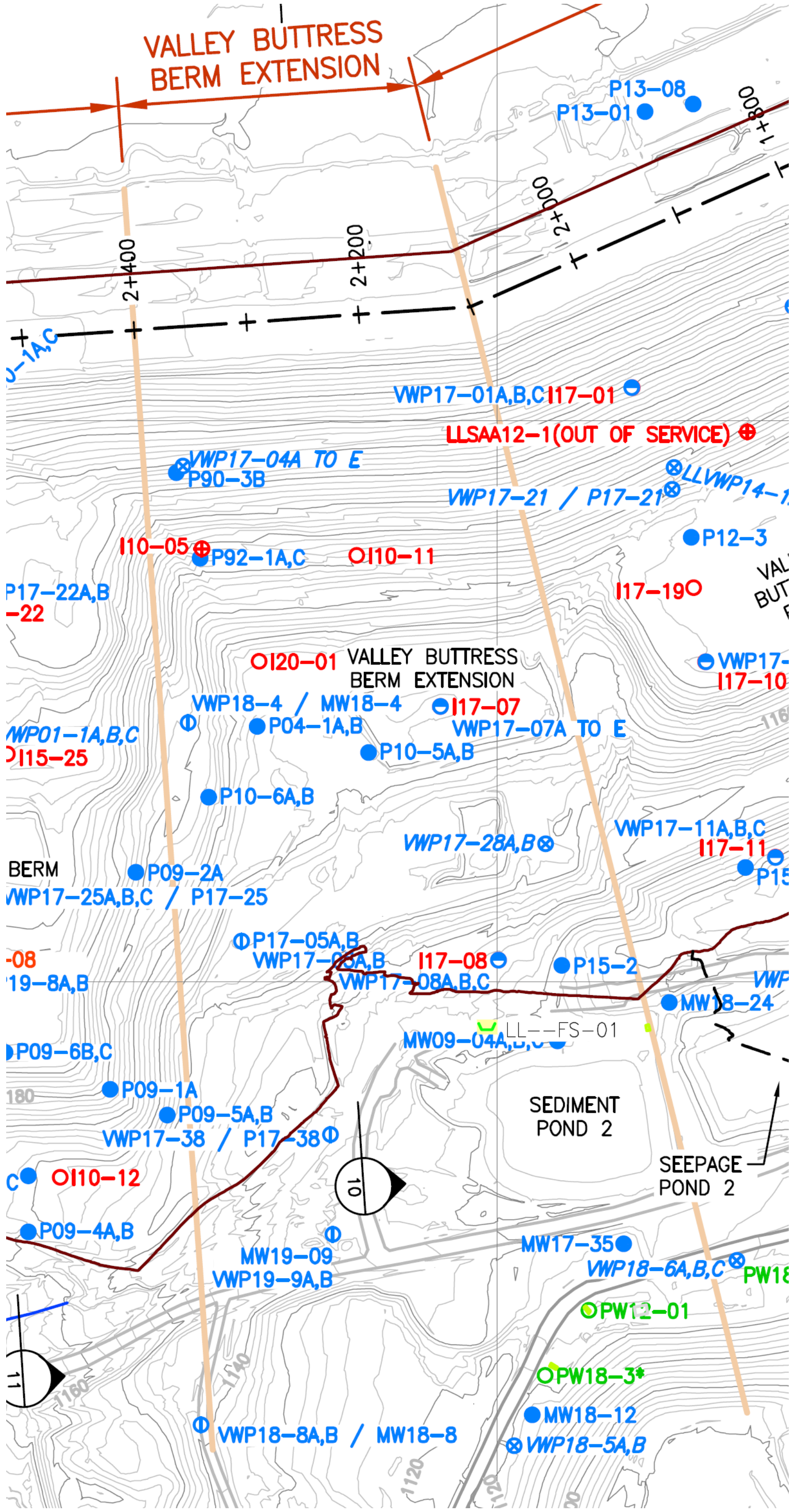




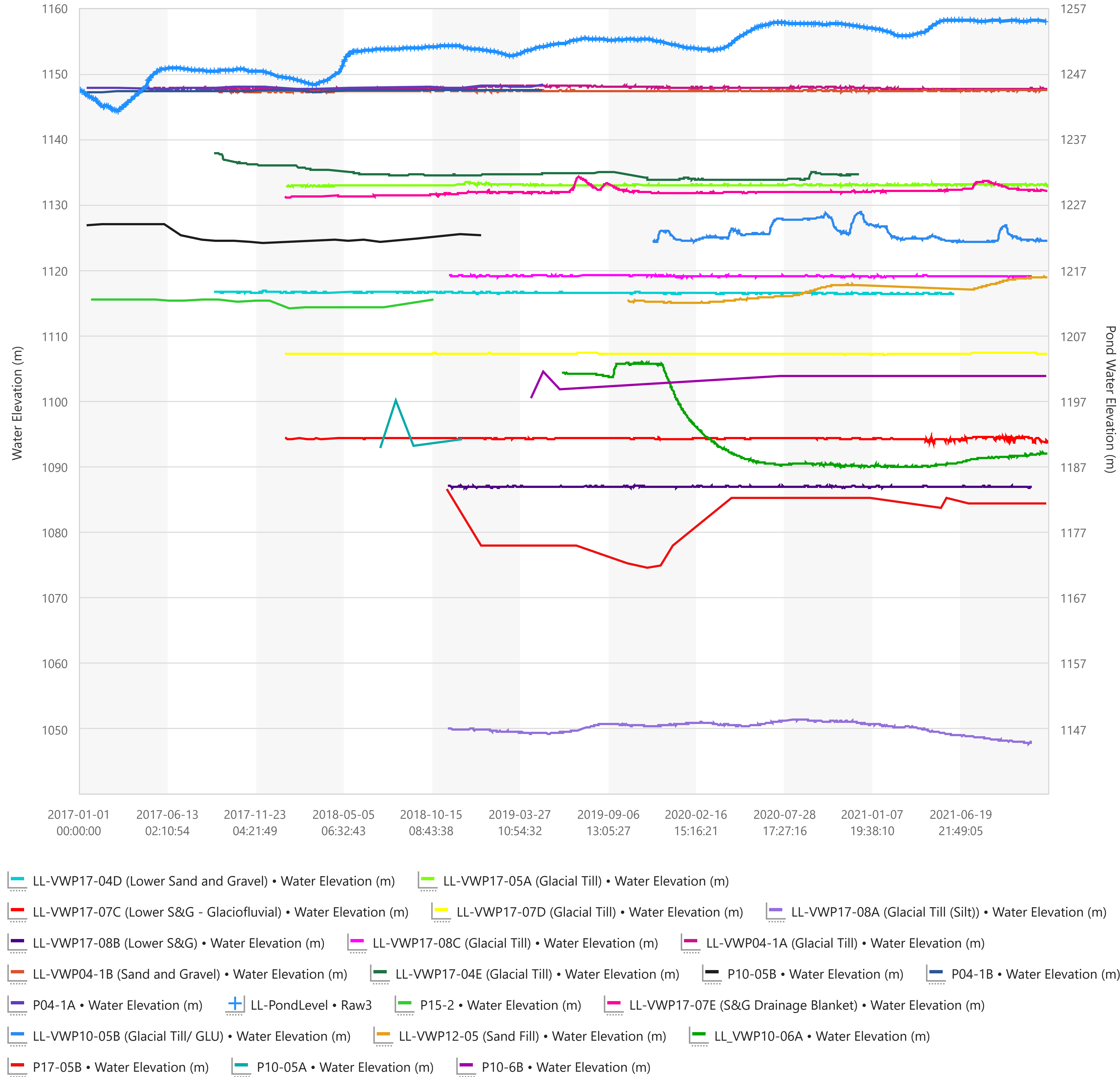
North Buttress Berm
Sedimentary

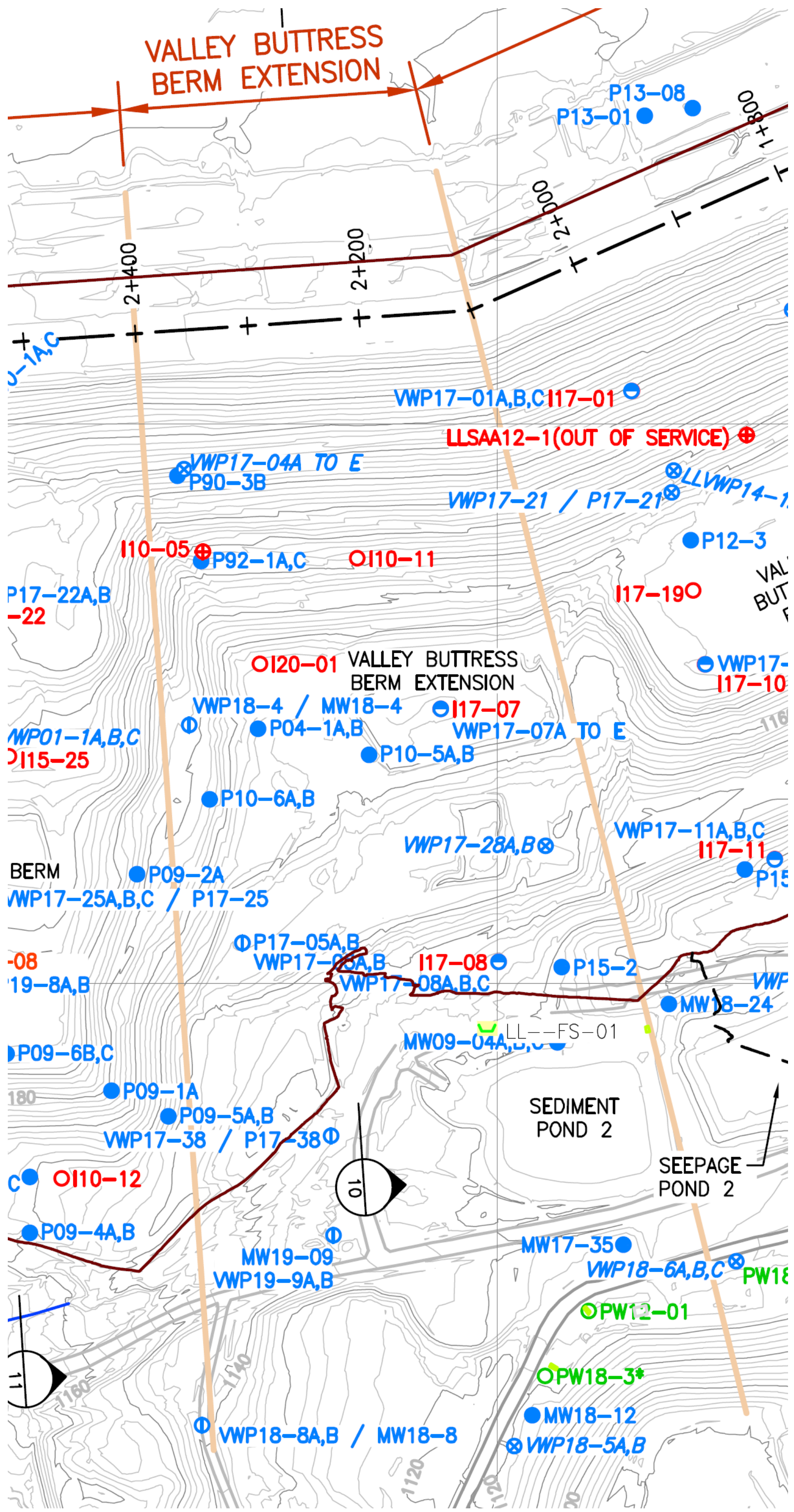


Valley Buttress Berm Extension Water Elevations Since 2017

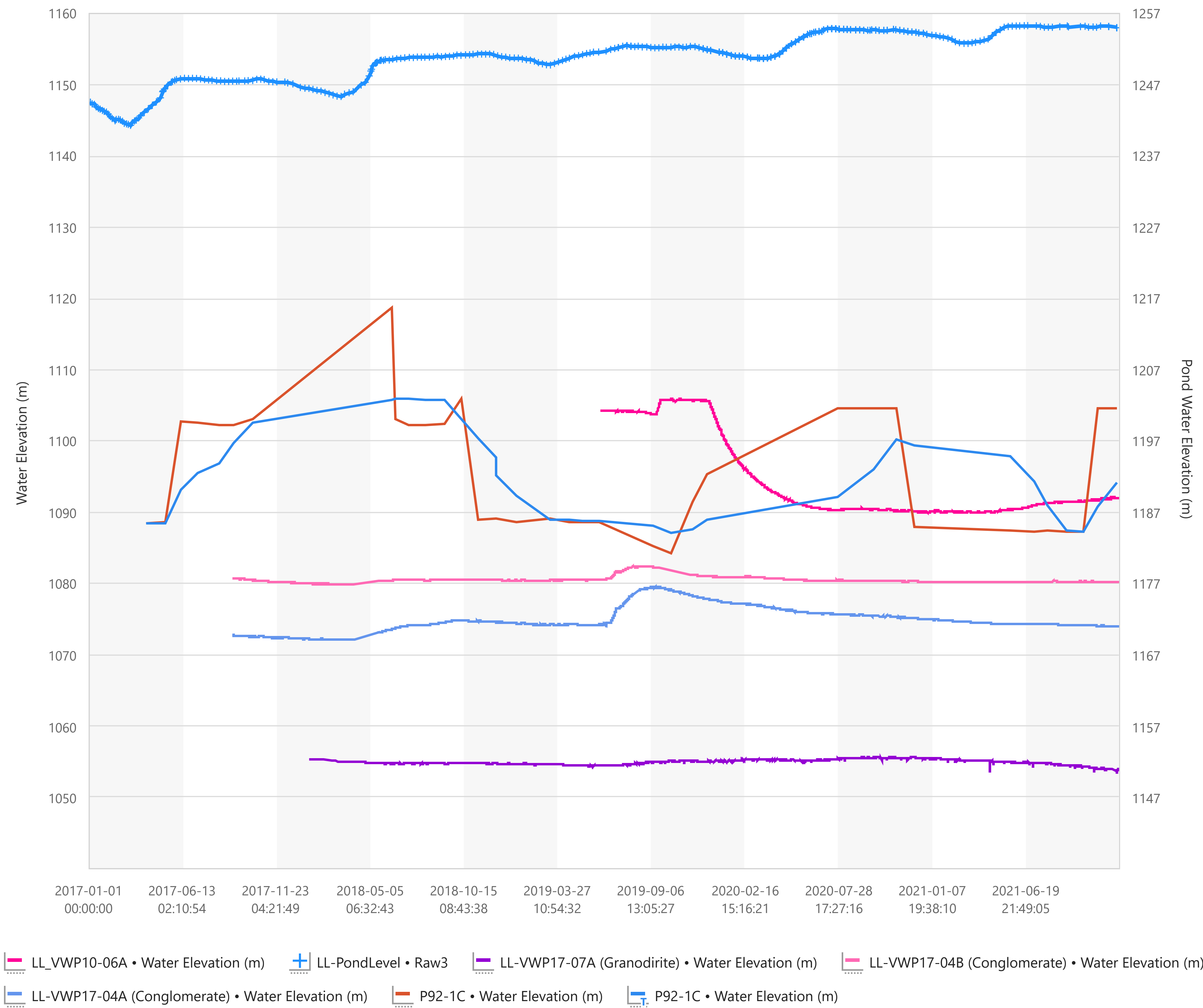


Valley Buttress Berm Extension Overburden and Dam Fill

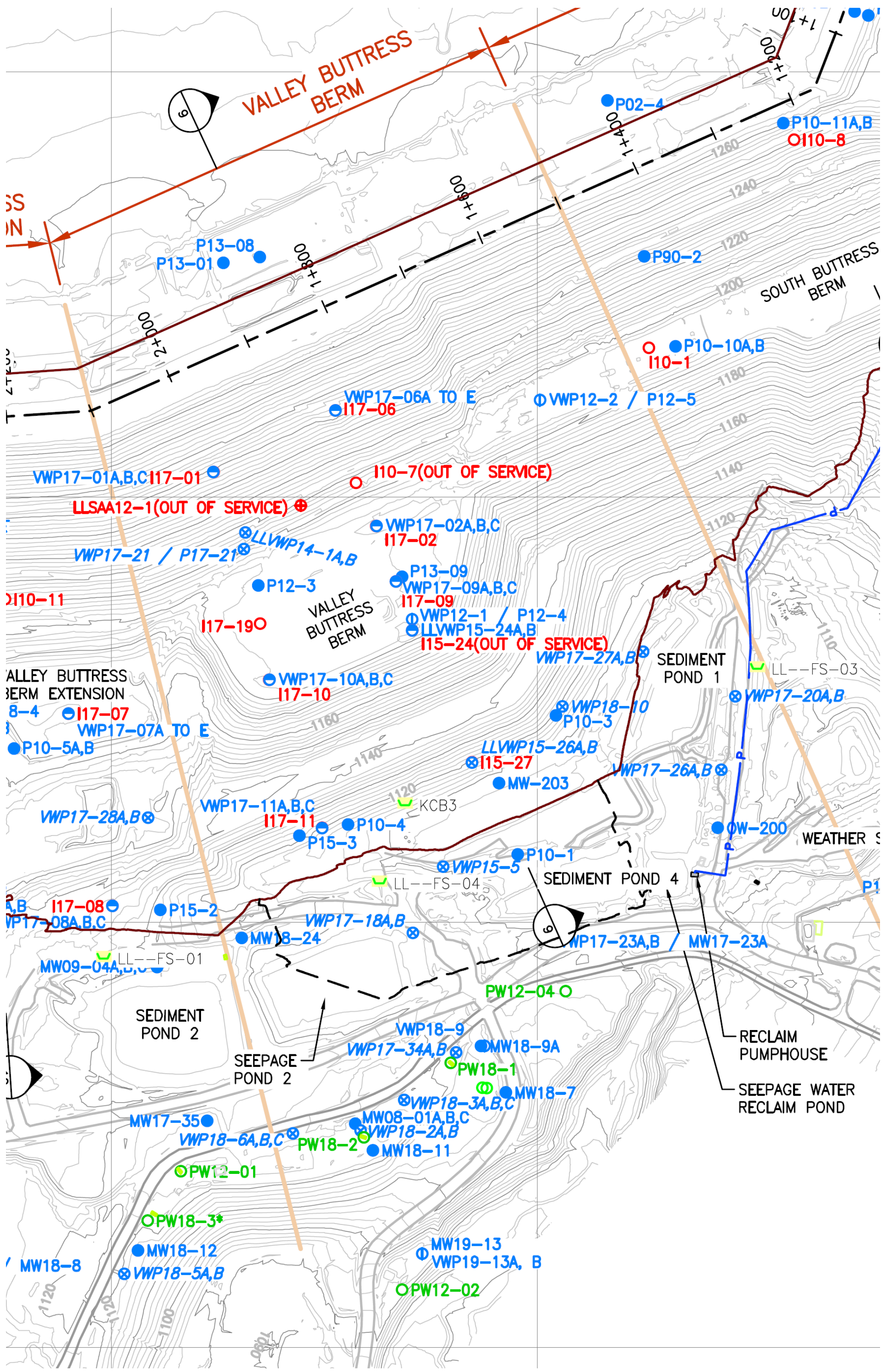




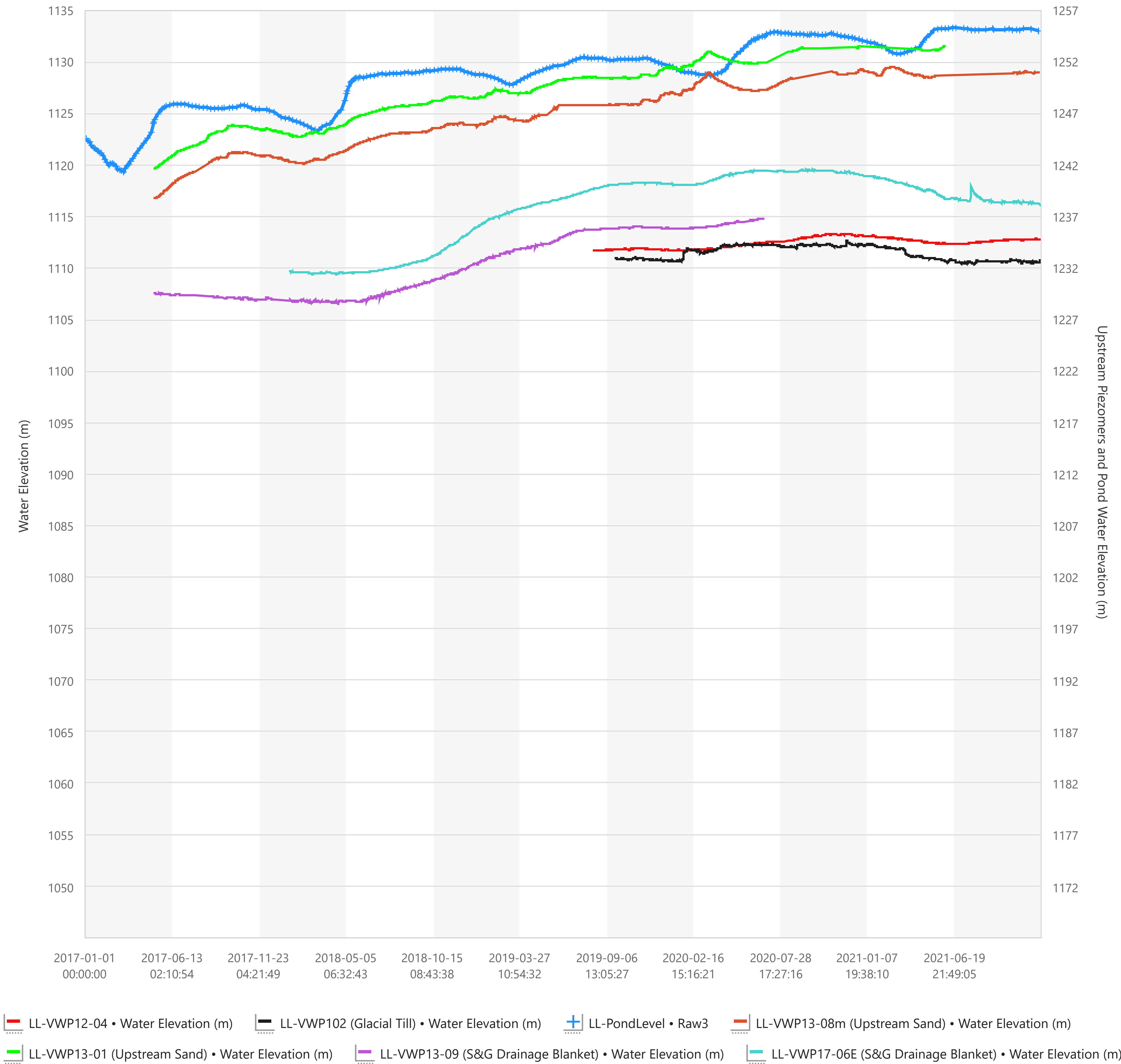
Valley Buttress Berm Extension Foundation Rock

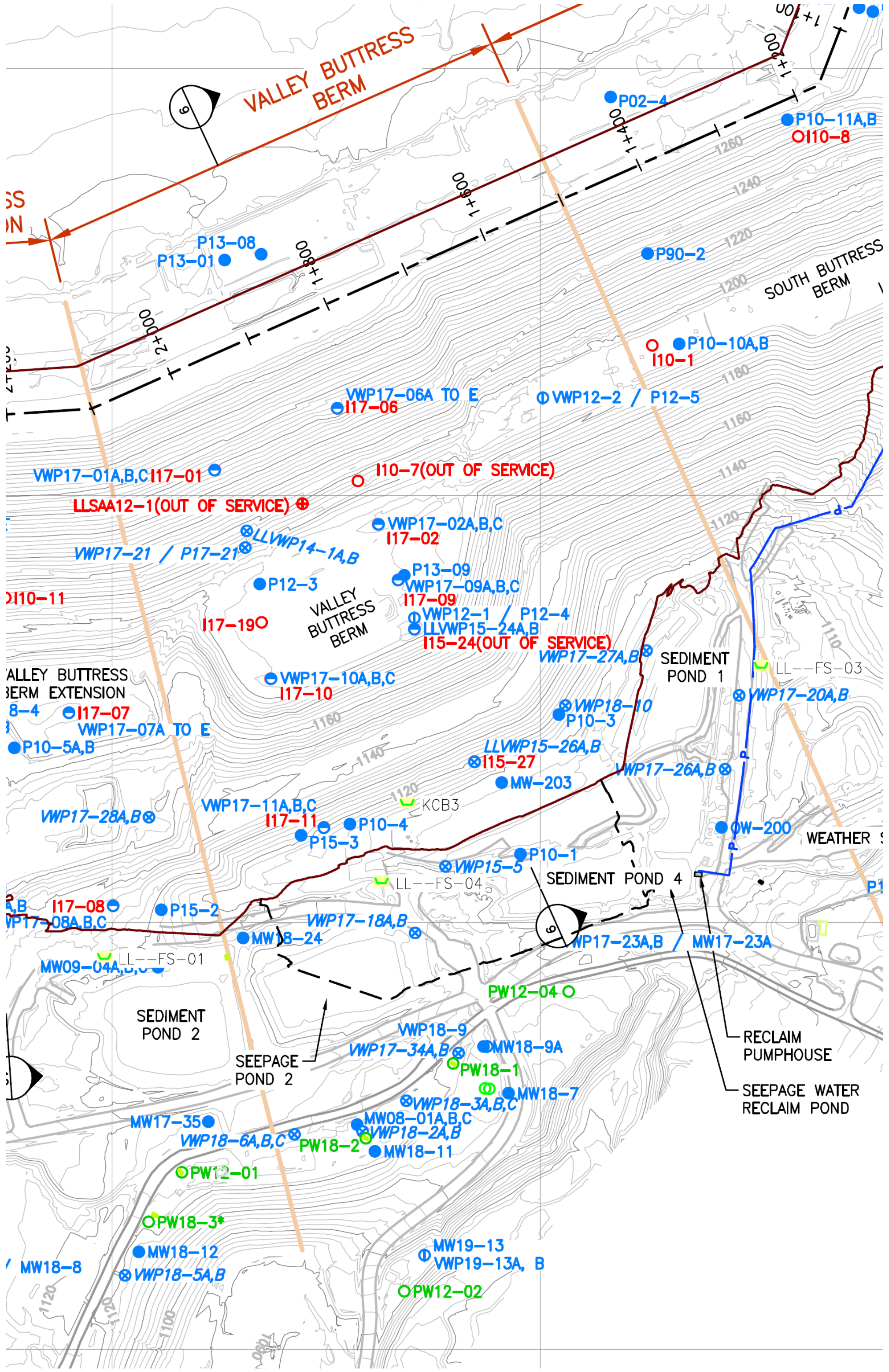


Valley Buttress Berm
Water Elevations Since 2017

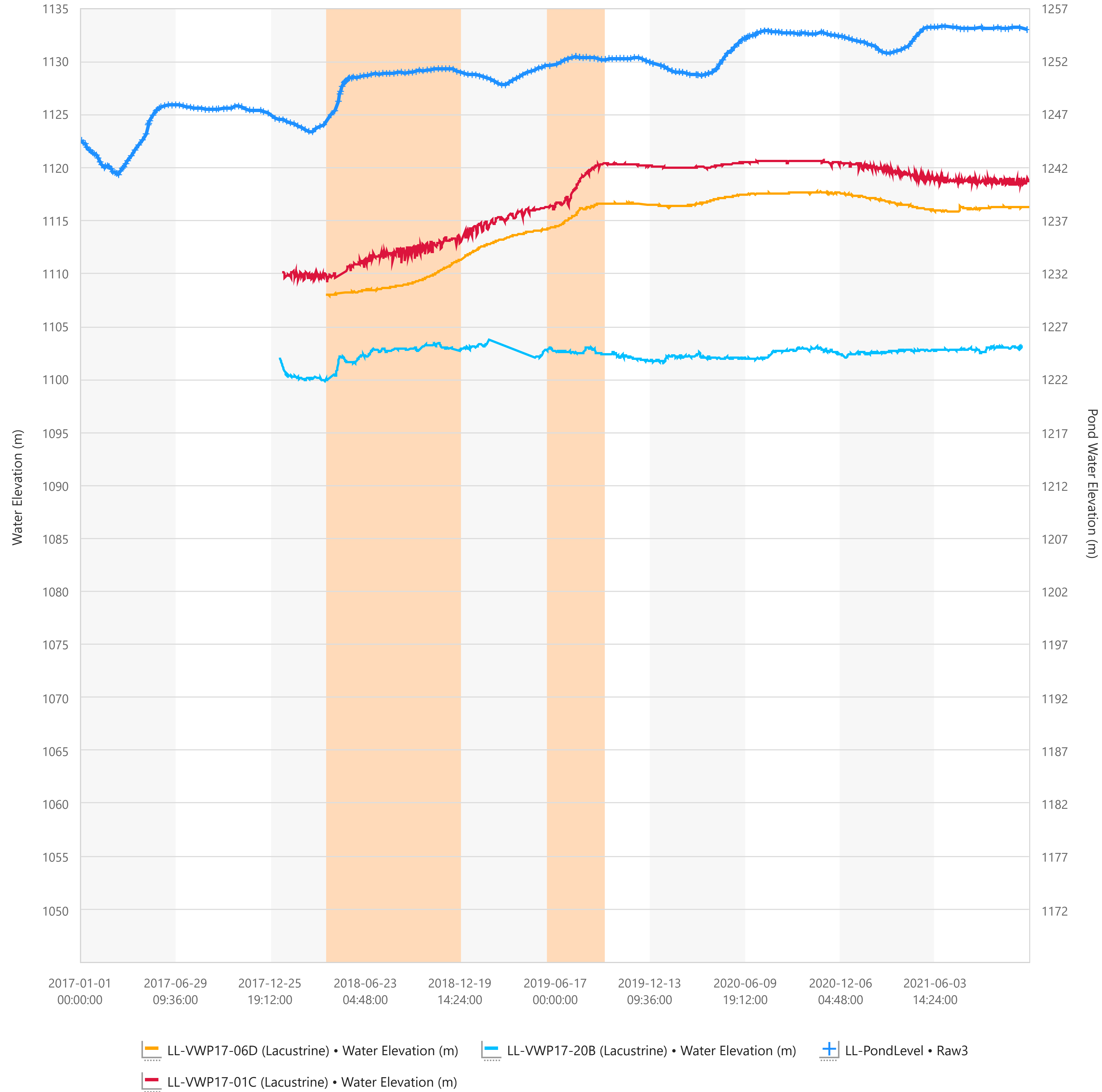


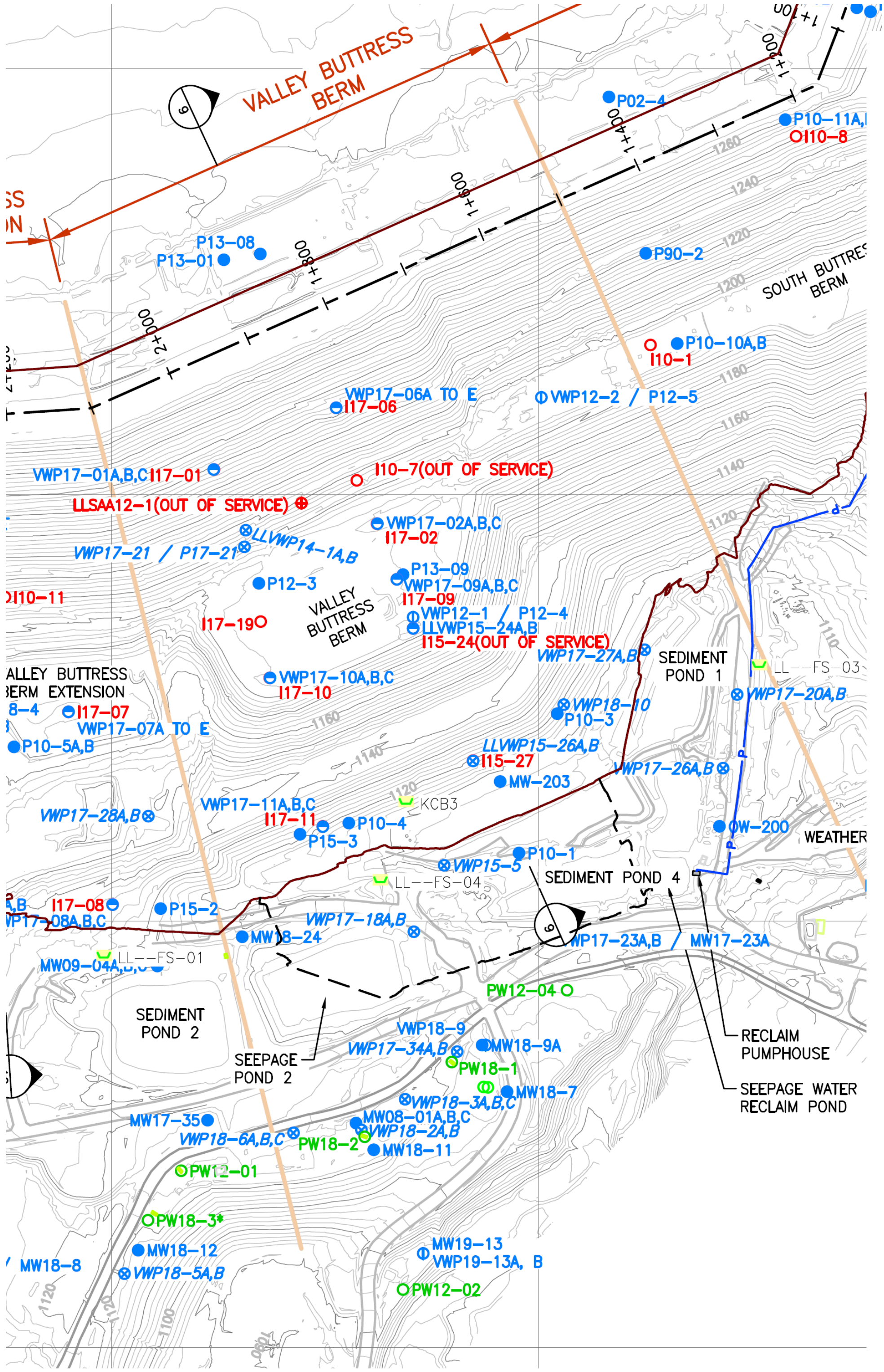
Valley Buttress Berm
Dam Fill



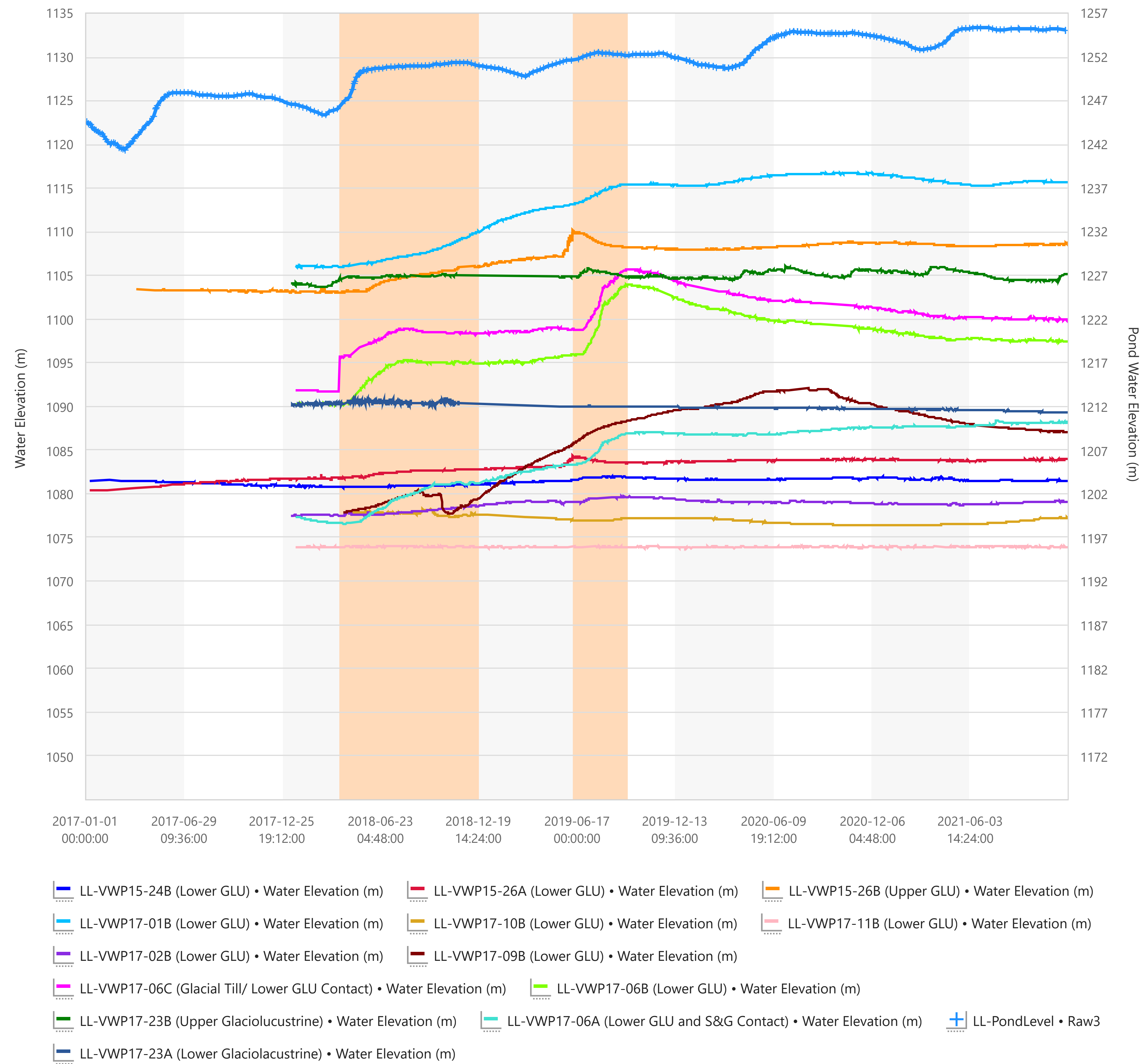


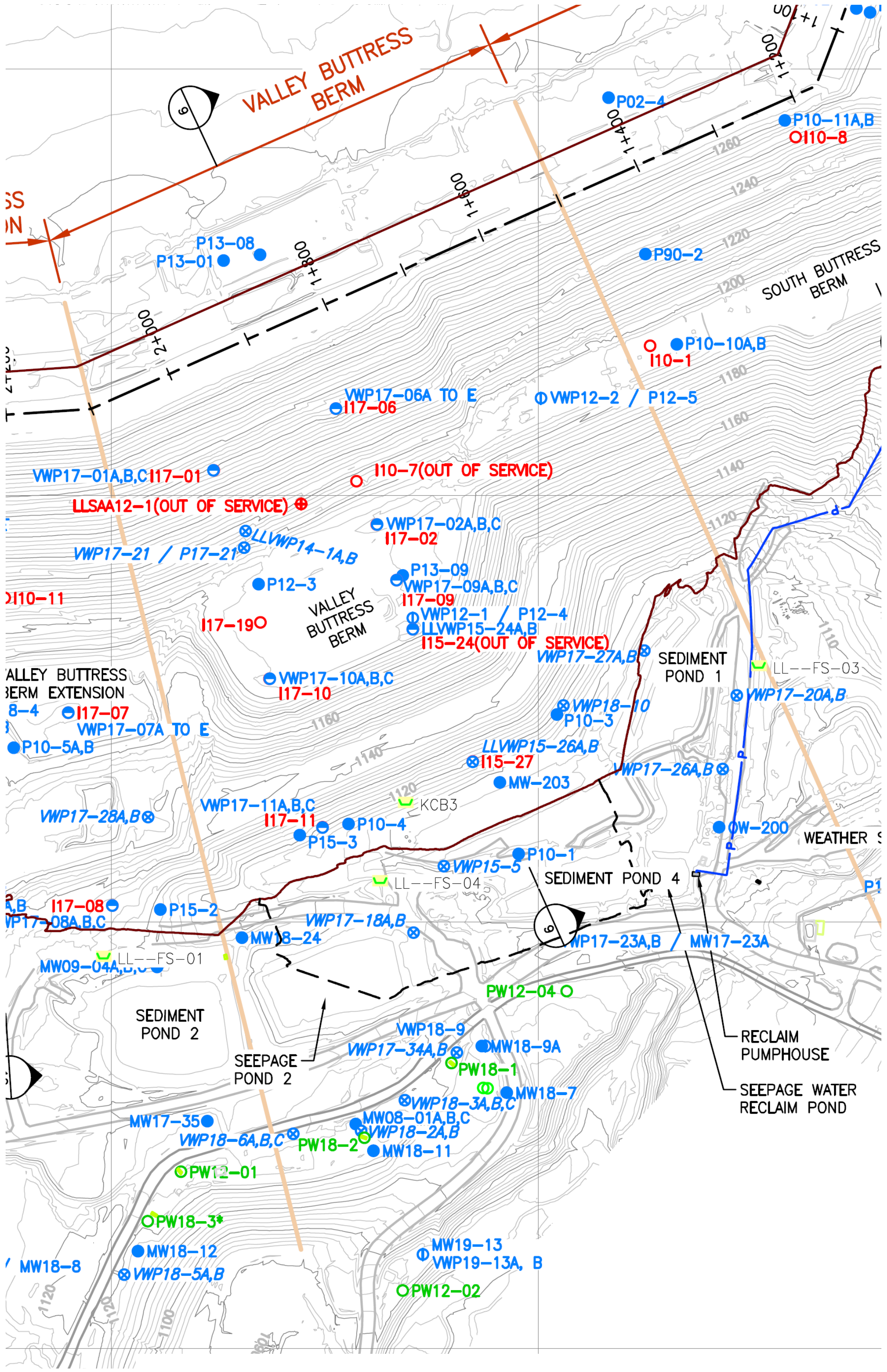
Valley Buttress Berm
Lacustrine



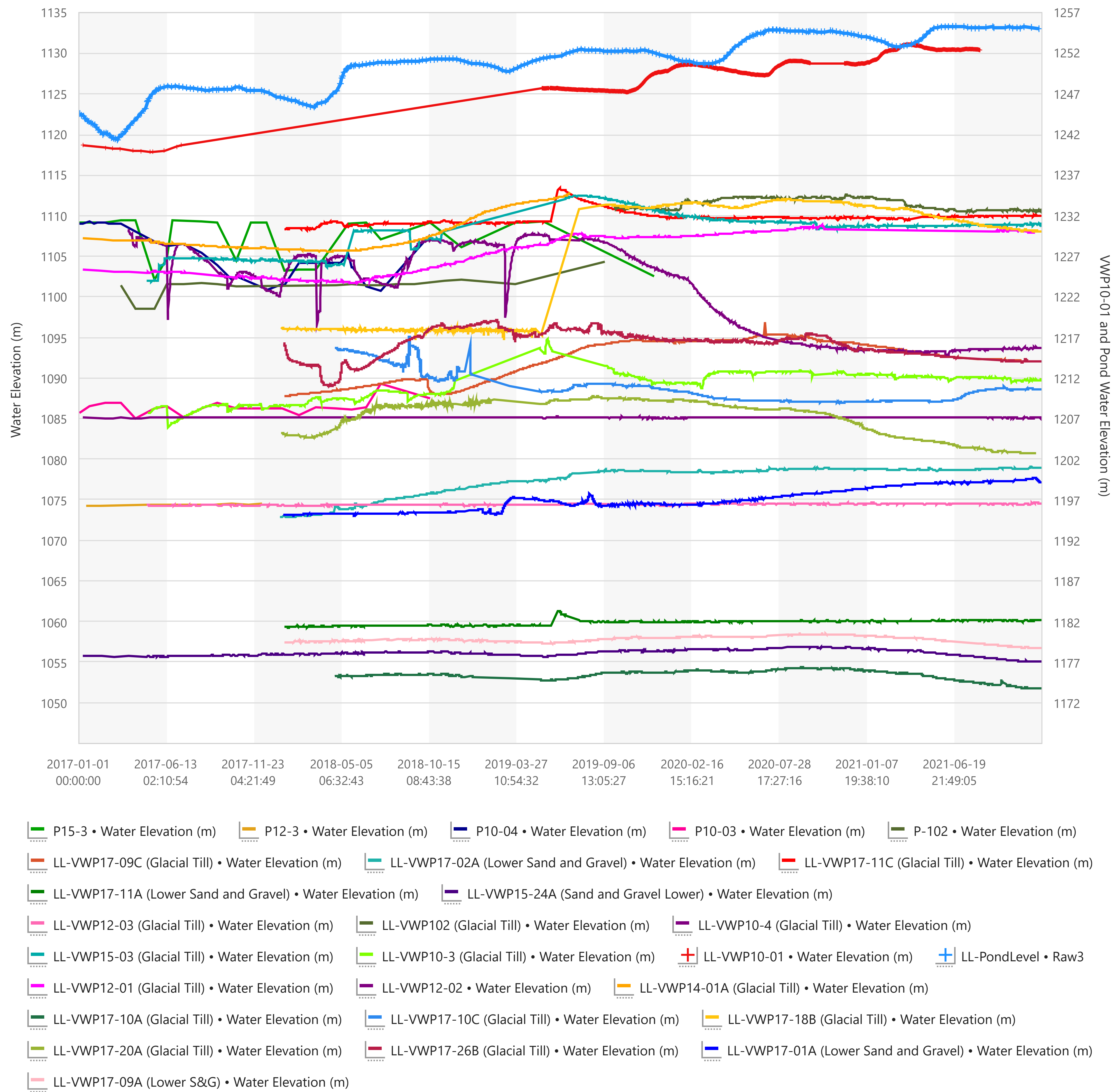


Valley Buttress Berm
Glaciolacustrine

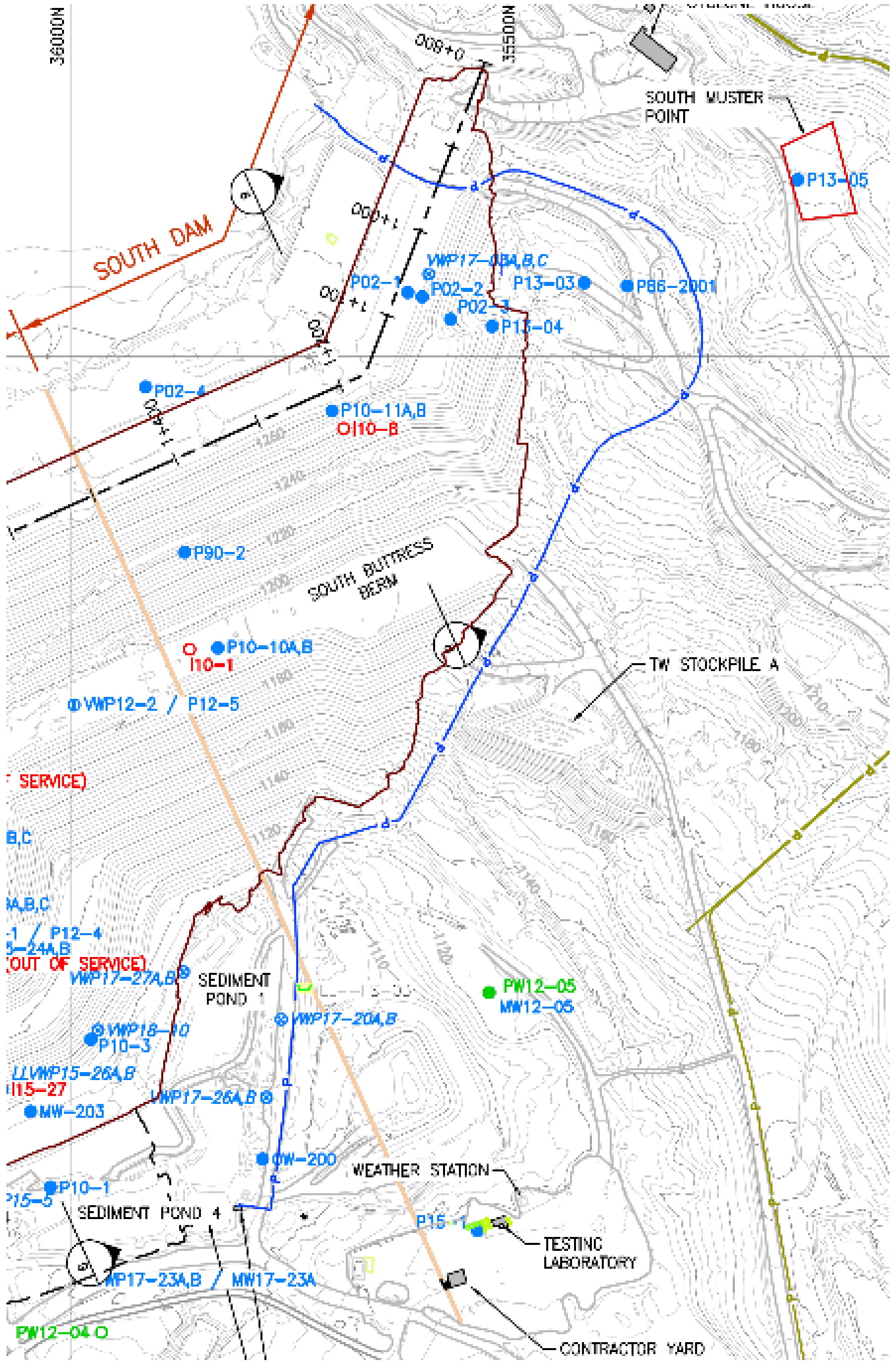




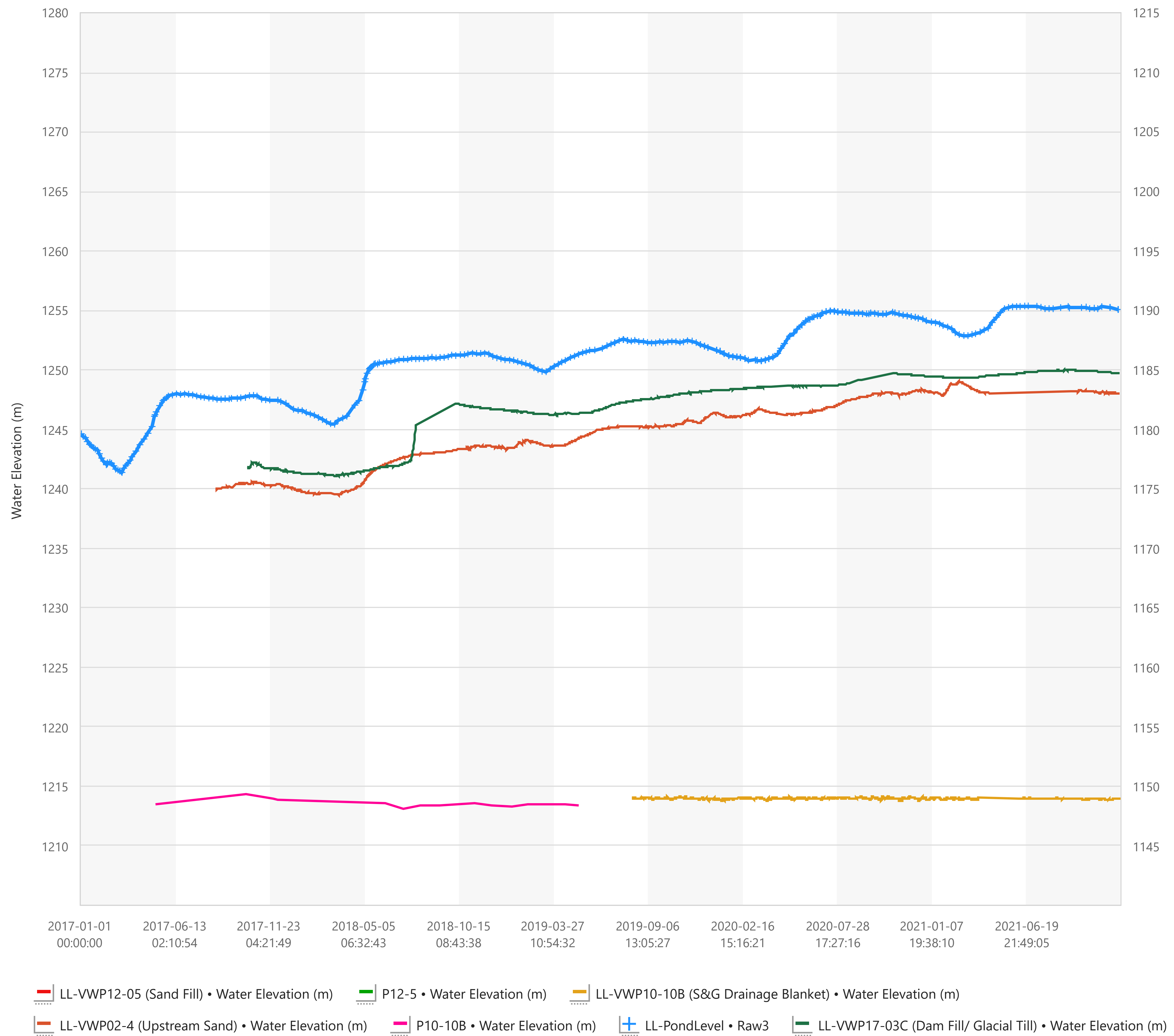
Valley Buttress Berm
Glacial Till, Sand and Gravel

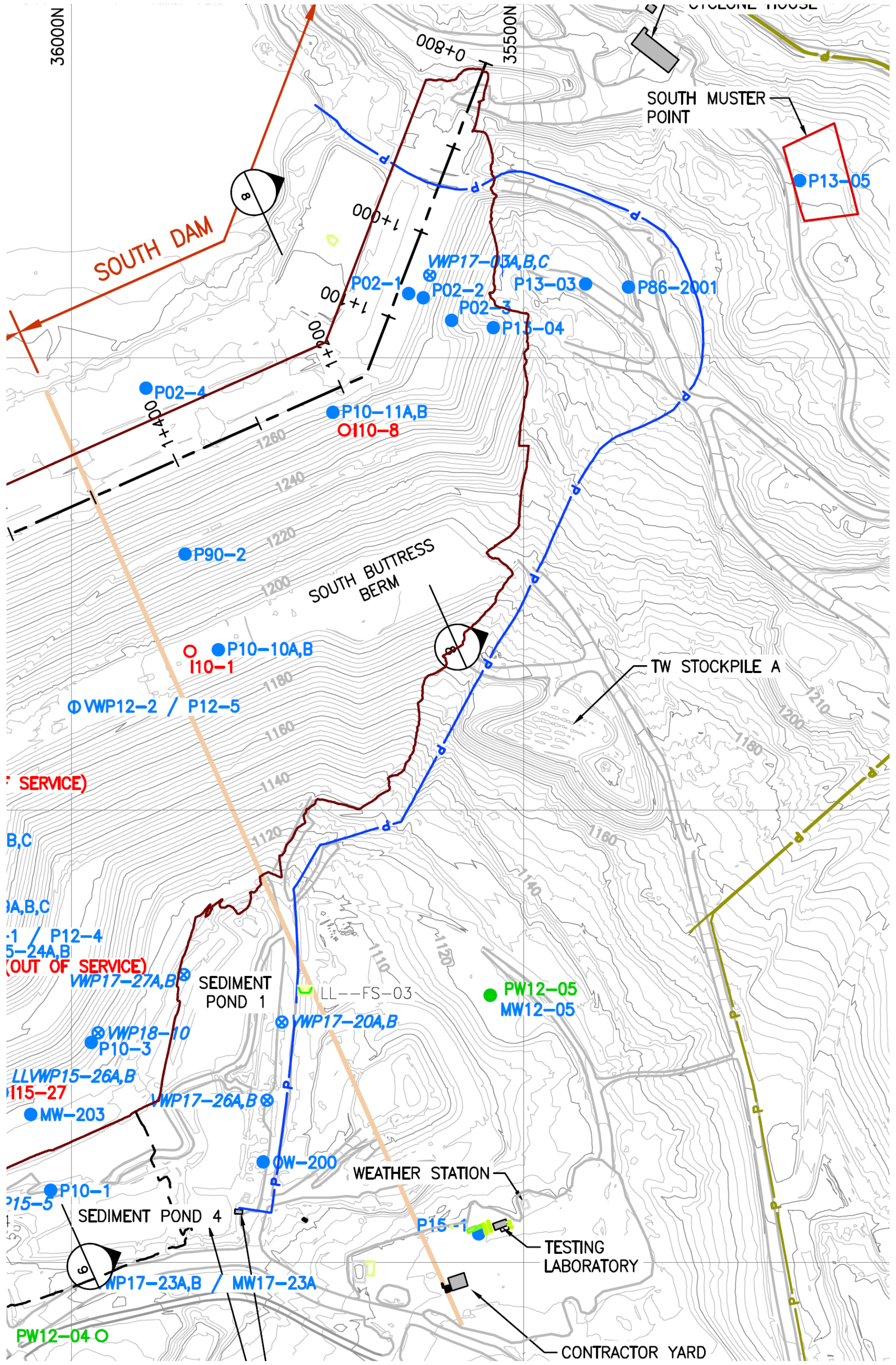


South Dam
Water Elevations Since 2017

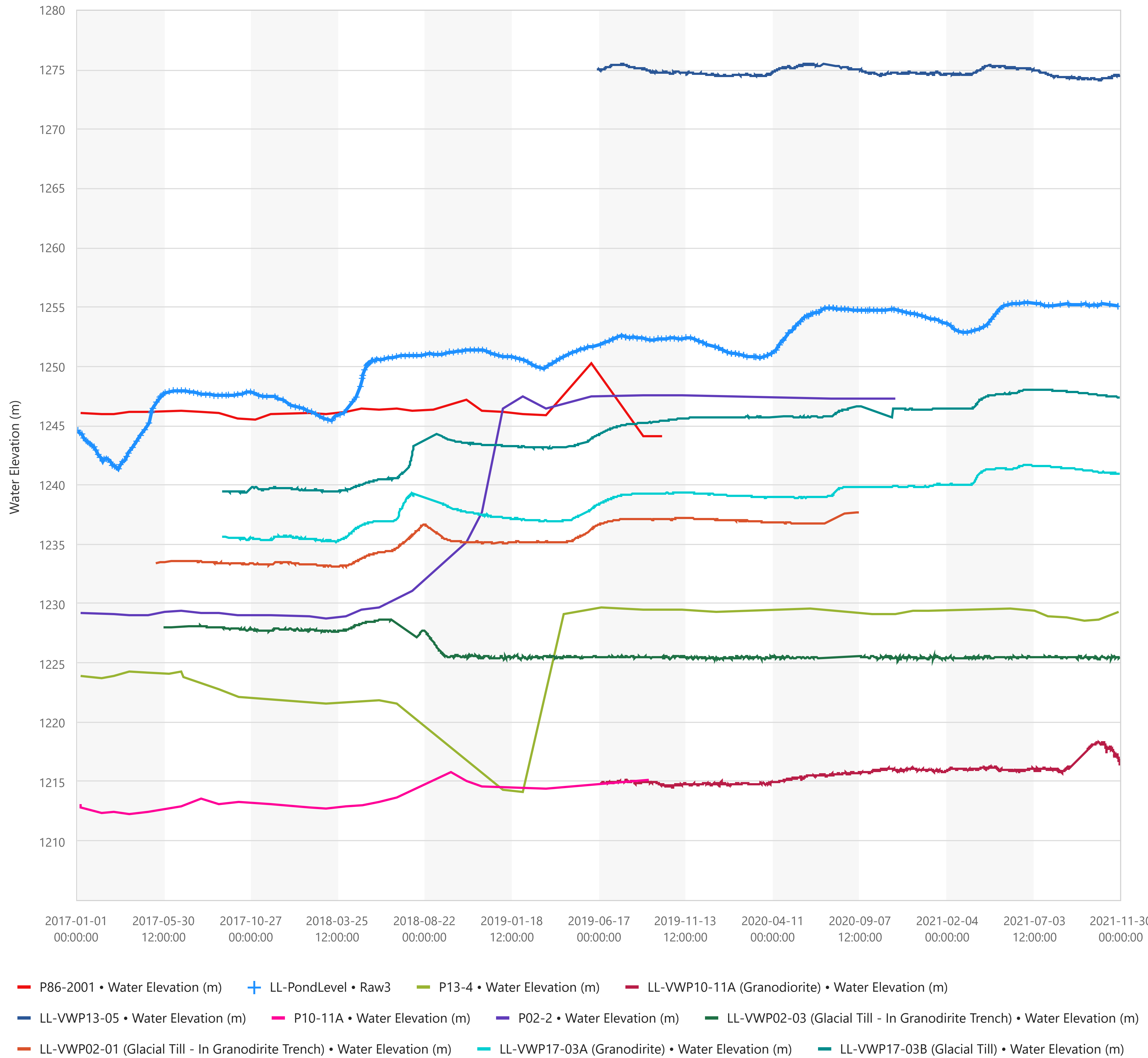


South Dam
Dam Fill



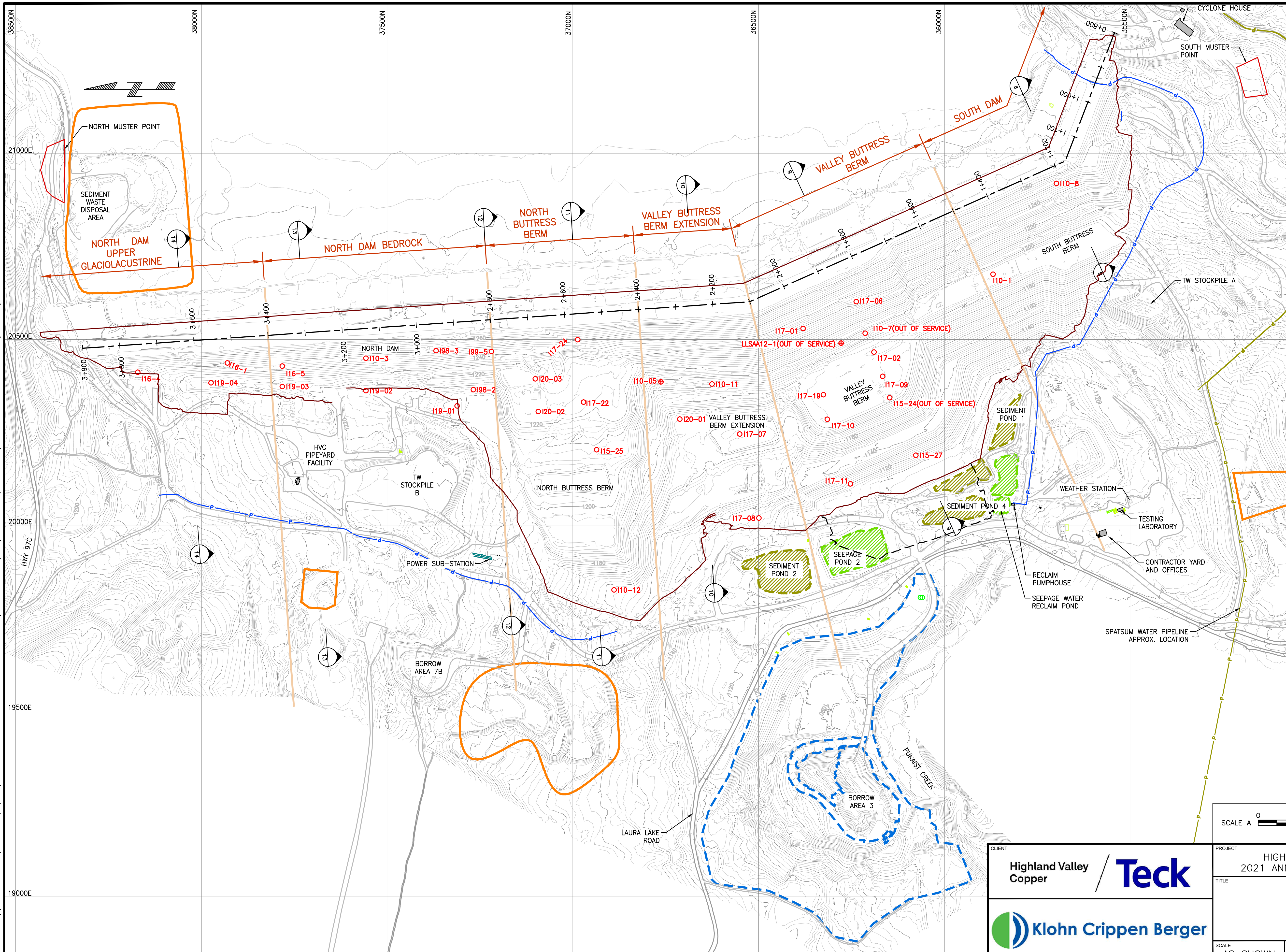


South Dam
Granodiorite, Foundation Rock and Glacial Till



APPENDIX III-C

L-L Dam Inclinometer Plots



LEGEND:

- BORROW AREA
- WASTE FILL DISPOSAL AREA
- SEEPAGE POND
- SEDIMENT POND
- SURFACE WATER RECLAIM PIPELINE
- SPATSUM WATER PIPELINE
- HAUL ROAD
- PUBLIC ROAD
- ULTIMATE DAM FOOTPRINT MODIFIED BASE CASE
- VBB CONTINGENCY CASE FOOTPRINT
- INSTRUMENTATION SECTION
- L-L DAM CENTERLINE

ACTIVE INSTRUMENTS (SEE NOTE 2):

- STANDARD INCLINOMETER
- SAAV INCLINOMETER

NOTES:

1. TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER PARTNERSHIP, DERIVED FROM LIDAR SURVEY DATED 2021-04-05 (2020 AS-BUILT).
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

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: L-L DAM INCLINOMETERS LOCATION PLAN

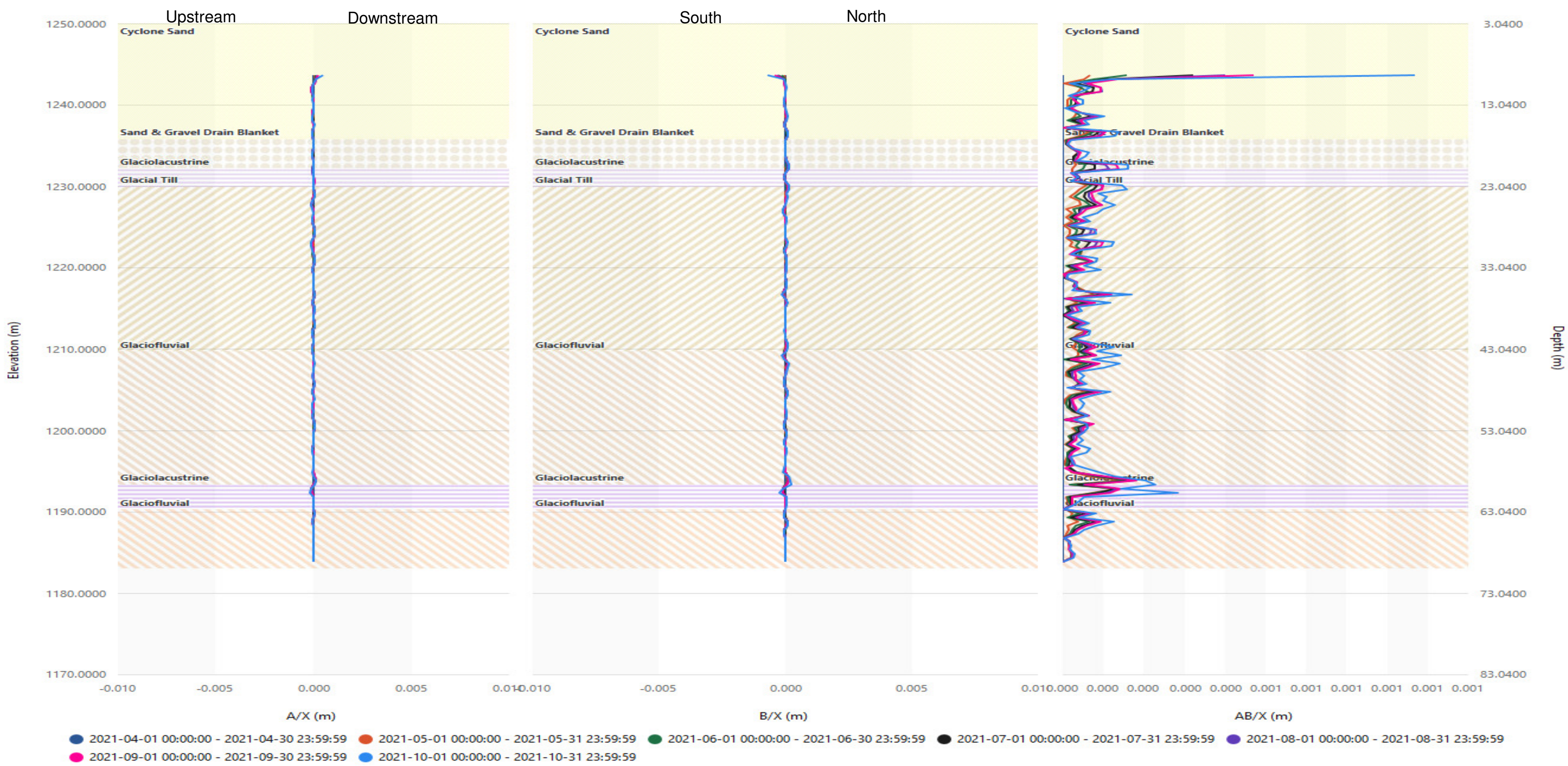
SCALE	PROJECT No.	FIG. No.
AS SHOWN	M02341C12	III-C-1

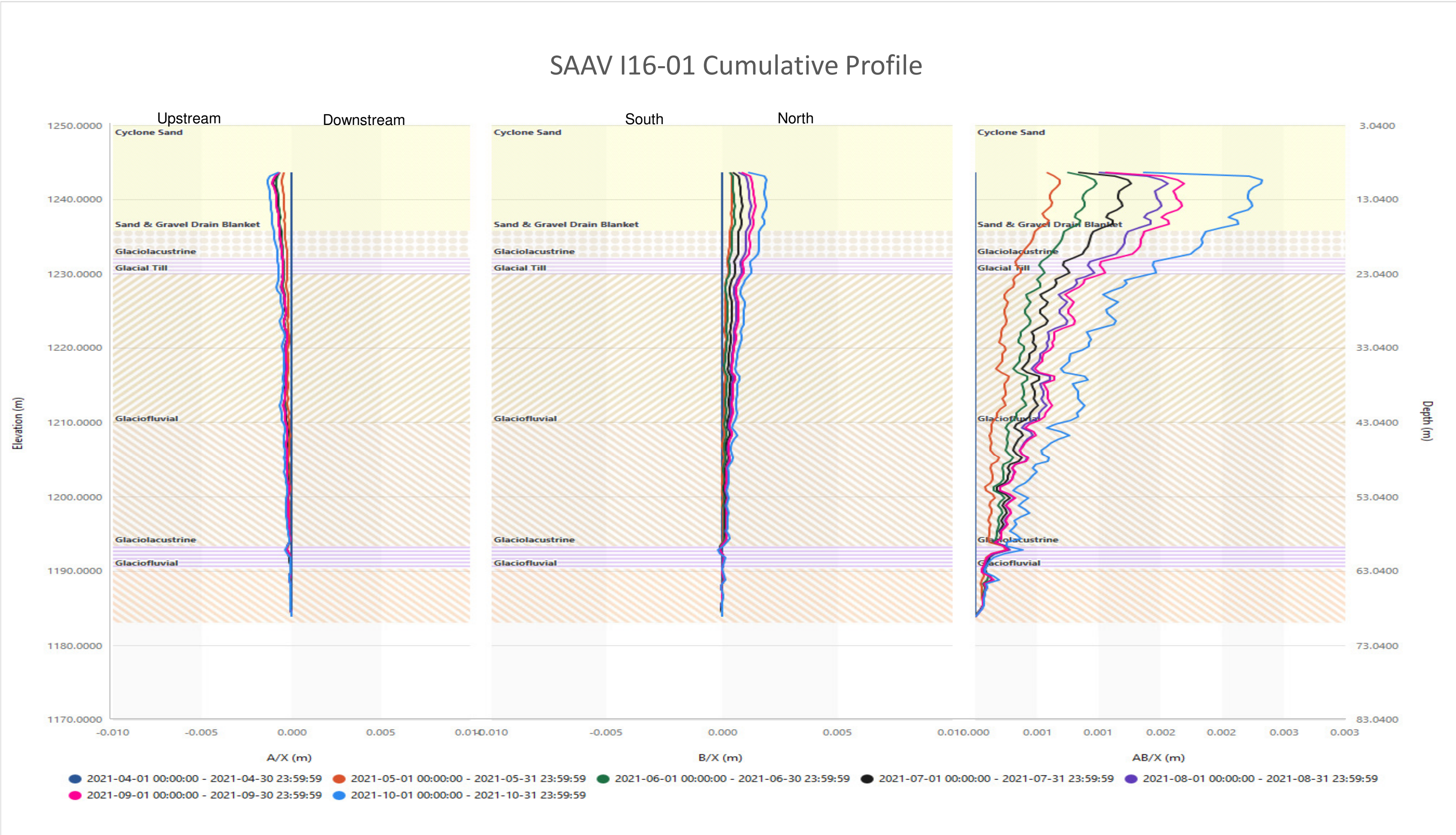
SAVE DATE: 2022-03-01 (3:19 PM)
FILE PATH: \\INT.KLOHN.COM\PROJDATA\M\VCR\M02341C12-HVC 2021 DAM SAFETY SUPPORT\400 DRAWINGS\CAD\05-FIGURES\2021 AFPR\FIG III-C-1 - L-L DAM.DWG (THAWKER)

North Dam Upper Glaciolacustrine (North Abutment)

I16-01

SAAV I16-01 Incremental Profile





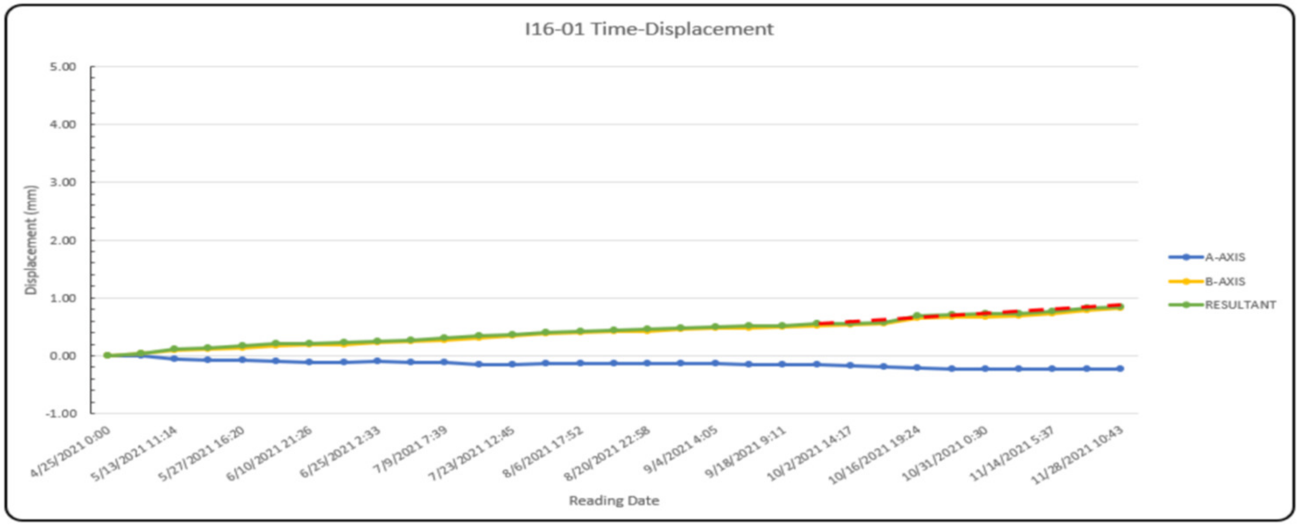
SAAV I16-01 Cumulative Profile
Upstream
Downstream
South
North
Cyclone Sand
Sand & Gravel Drain Blanket
Glaciolacustrine
Glacial Till
Glaciofluvial
Glaciolacustrine
Glaciofluvial
Elevation (m)
Depth (m)
1250.0000
1240.0000
1230.0000
1220.0000
1210.0000
1200.0000
1190.0000
1180.0000
1170.0000
3.0400
13.0400
23.0400
33.0400
43.0400
53.0400
63.0400
73.0400
83.0400
-0.010
-0.005
0.000
0.005
0.010
0.001
0.002
0.003
A/X (m)
B/X (m)
AB/X (m)
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59

SAAV I16-01

Displacement Plot - Upper Glaciolacustrine

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Upper GL	**1233**	**1227**	**1.0**	0.15
Glaciofluvial	1209	1199	1.0	
Lower GL	1193.5	1190	1.0	

Upper El. (m)	1233.0
Lower El. (m)	1227.0

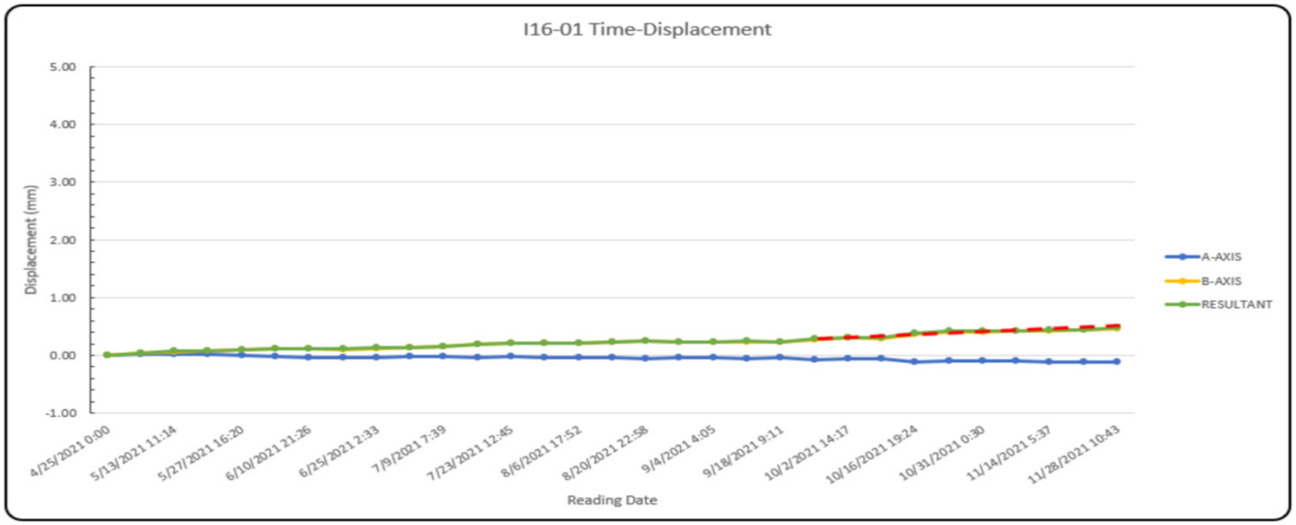


SAAV I16-01

Displacement Plot - Glaciofluvial

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Upper GL	1233	1227	1.0	
Glaciofluvial	**1209**	**1199**	**1.0**	**0.10**
Lower GL	1193.5	1190	1.0	

Upper El. (m)	1209.0
Lower El. (m)	1199.0

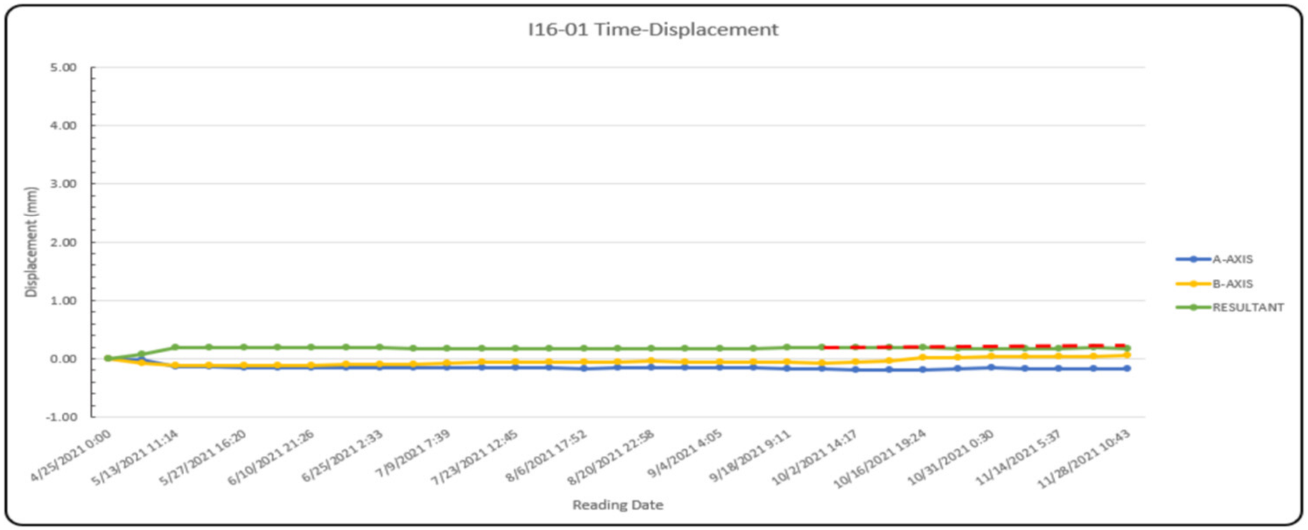


SAAV I16-01

Displacement Plot - Lower Glaciofluvial

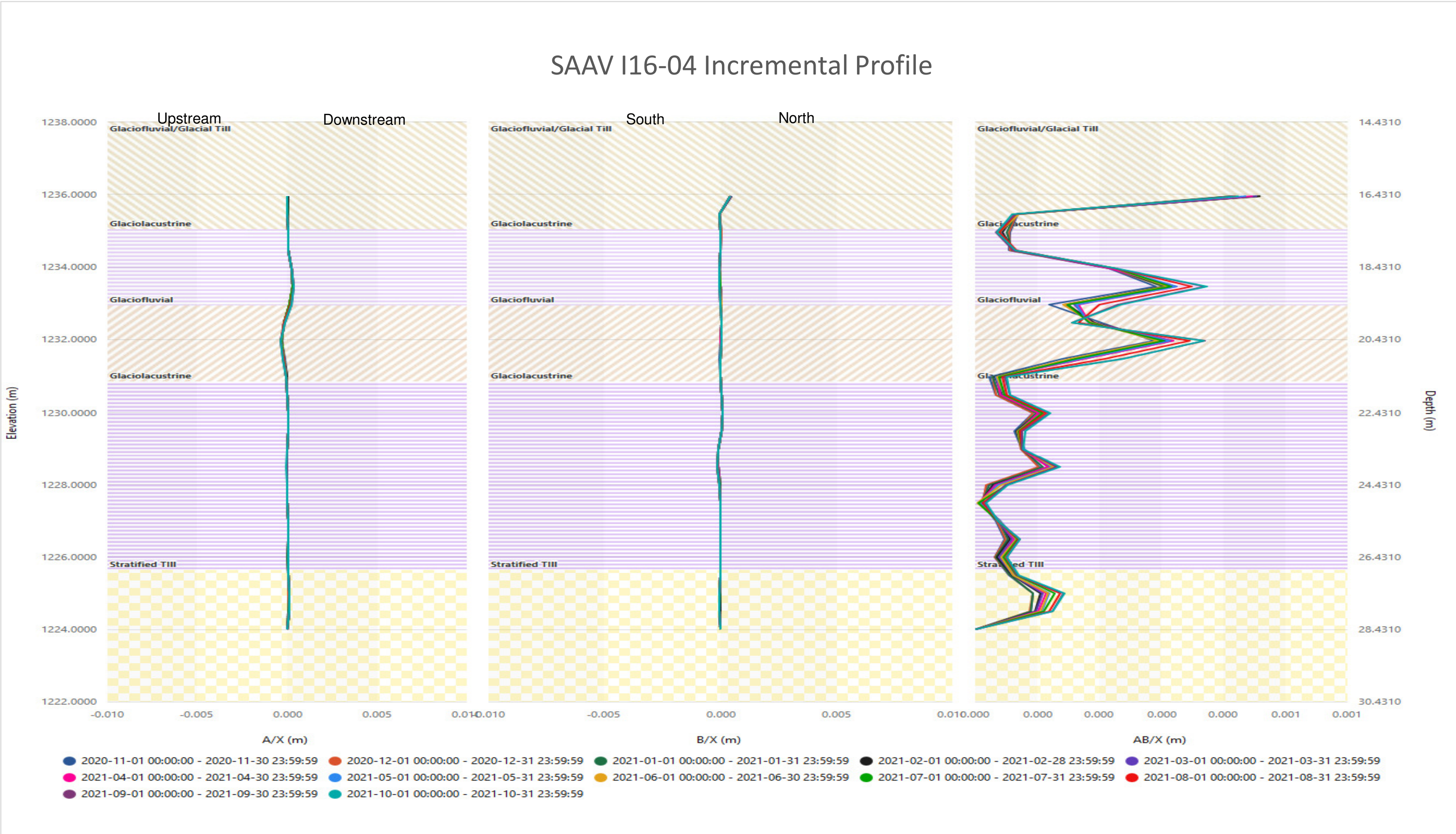
Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Upper GL	1233	1227	1.0	
Glaciofluvial	1209	1199	1.0	
Lower GL	**1193.5**	**1190**	**1.0**	**0.01**

Upper El. (m)	1193.5
Lower El. (m)	1190.0



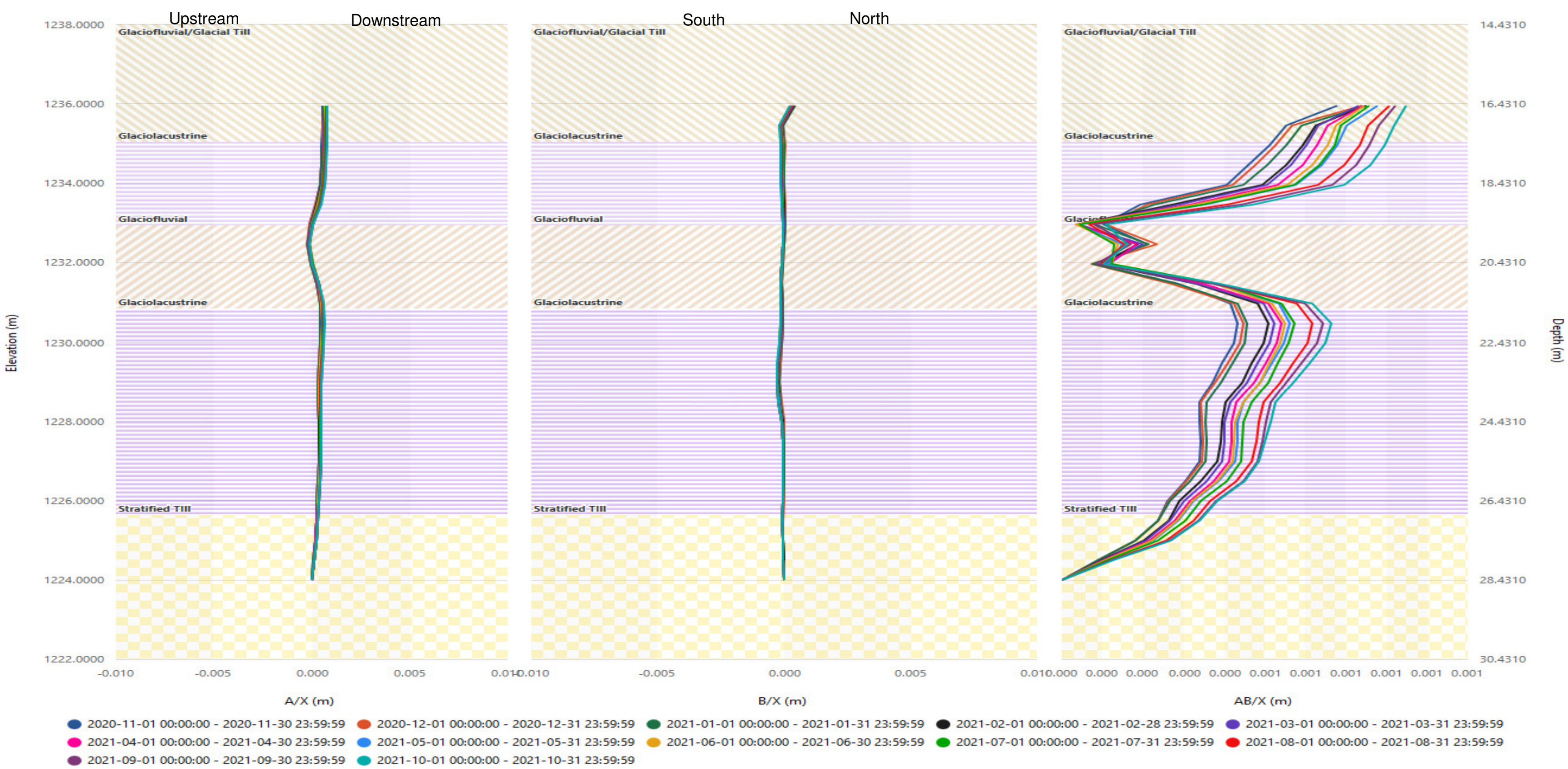
North Dam Upper Glaciolacustrine (North Abutment)

SAAV I16-04



SAAV I16-04 Incremental Profile
Upstream
Downstream
South
North
Glaciofluvial/Glacial Till
Glaciolacustrine
Glaciofluvial
Glaciolacustrine
Stratified Till
Elevation (m)
Depth (m)
1238.0000
1236.0000
1234.0000
1232.0000
1230.0000
1228.0000
1226.0000
1224.0000
1222.0000
14.4310
16.4310
18.4310
20.4310
22.4310
24.4310
26.4310
28.4310
30.4310
A/X (m)
B/X (m)
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59

SAAV I16-04 Cumulative Profile

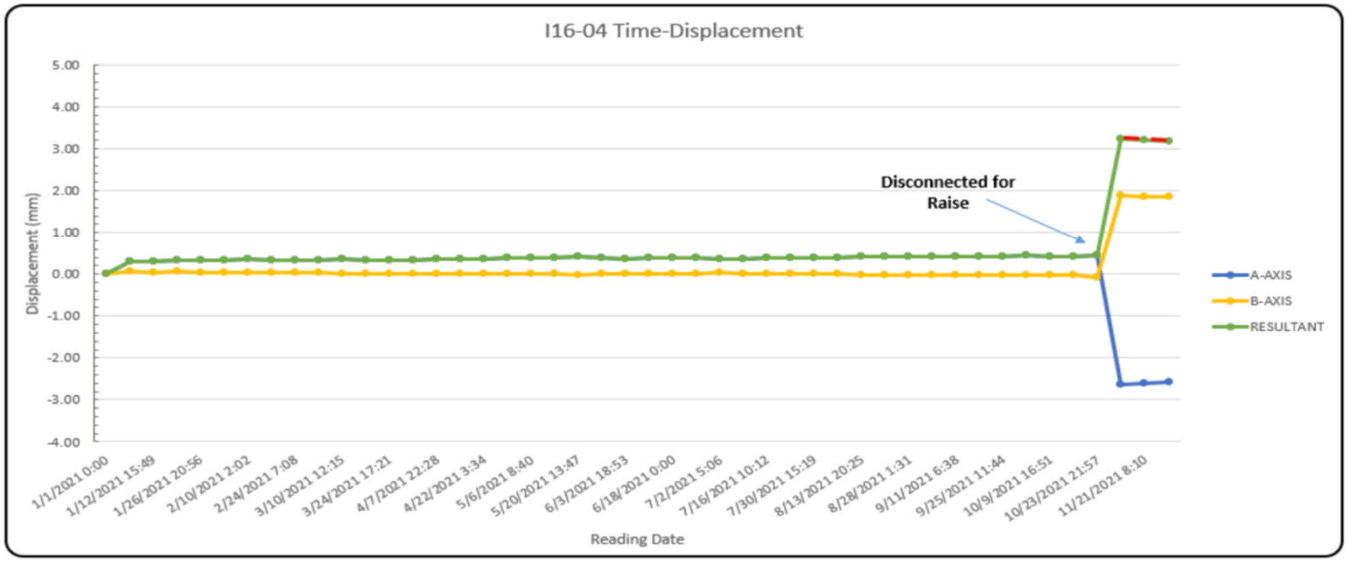


SAAV I16-04

Displacement Plot - Glaciolacustrine

Unit	Upper El. (m)	Lower El. (m)	NL	Rate
Glaciolacustrine	1235.0	1225.5	0.5	0.14

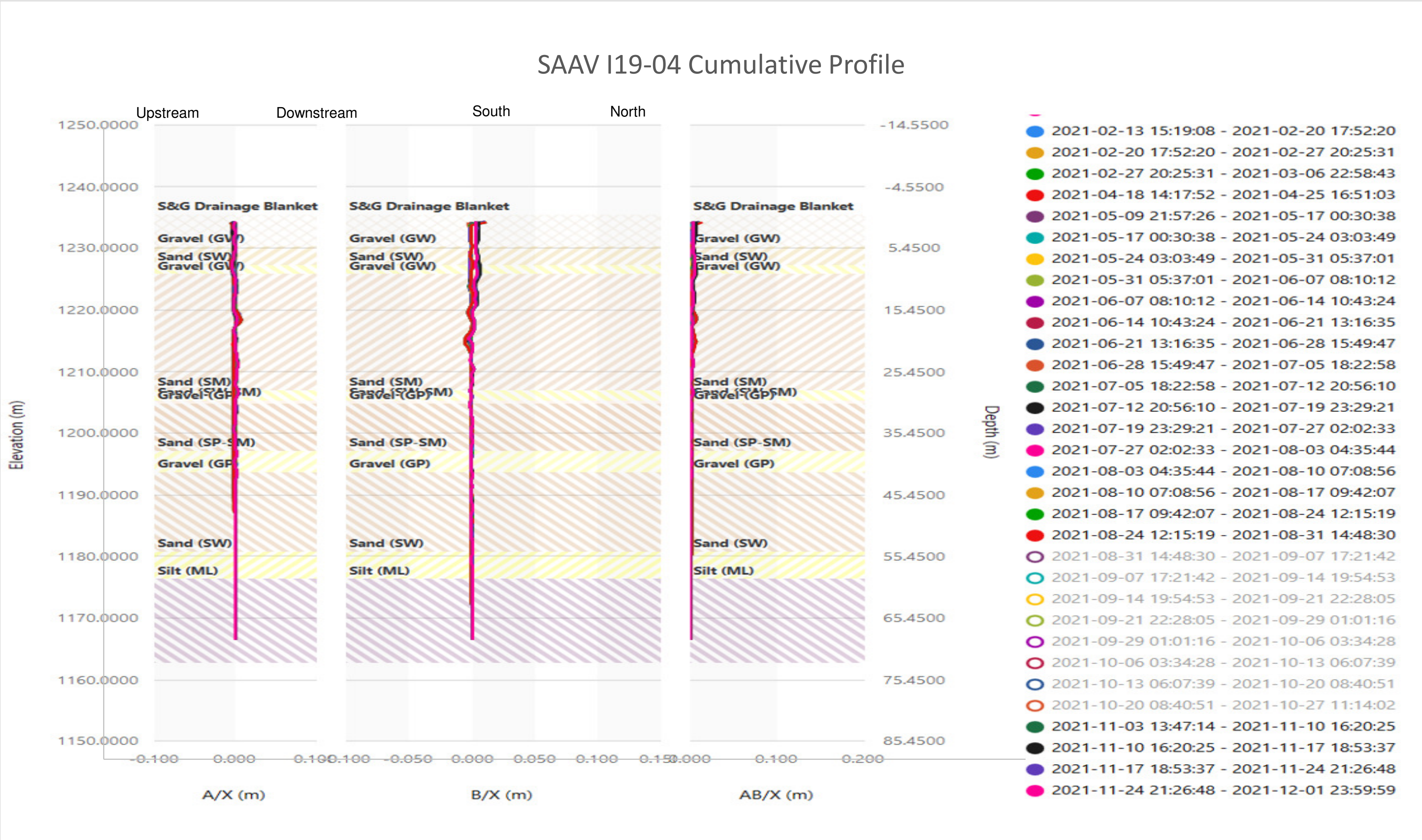
Upper El. (m)	1235.0
Lower El. (m)	1225.5



North Dam Upper Glaciolacustrine (North Abutment)

SAAV I19-04

SAAV I19-04 Incremental Profile

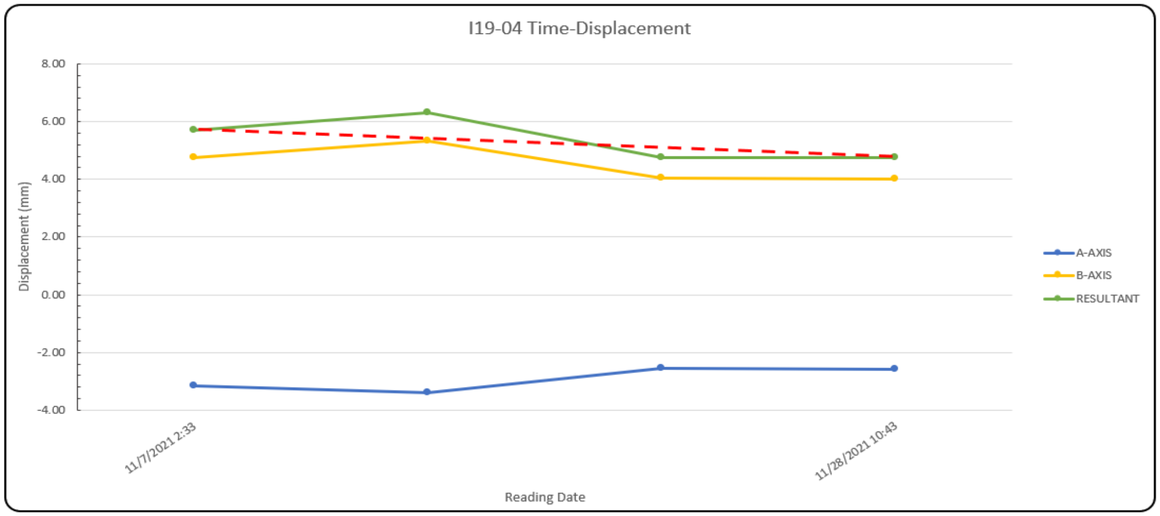

SAAV I19-04 Cumulative Profile
Upstream
Downstream
South
North
Elevation (m)
Depth (m)
S&G Drainage Blanket
Gravel (GW)
Sand (SW)
Sand (SM)
Gravel (GP)
Sand (SP-SM)
Silt (ML)
1250.0000
1240.0000
1230.0000
1220.0000
1210.0000
1200.0000
1190.0000
1180.0000
1170.0000
1160.0000
1150.0000
-14.5500
-4.5500
5.4500
15.4500
25.4500
35.4500
45.4500
55.4500
65.4500
75.4500
85.4500
A/X (m)
B/X (m)
AB/X (m)
2021-02-13 15:19:08 - 2021-02-20 17:52:20
2021-02-20 17:52:20 - 2021-02-27 20:25:31
2021-02-27 20:25:31 - 2021-03-06 22:58:43
2021-04-18 14:17:52 - 2021-04-25 16:51:03
2021-05-09 21:57:26 - 2021-05-17 00:30:38
2021-05-17 00:30:38 - 2021-05-24 03:03:49
2021-05-24 03:03:49 - 2021-05-31 05:37:01
2021-05-31 05:37:01 - 2021-06-07 08:10:12
2021-06-07 08:10:12 - 2021-06-14 10:43:24
2021-06-14 10:43:24 - 2021-06-21 13:16:35
2021-06-21 13:16:35 - 2021-06-28 15:49:47
2021-06-28 15:49:47 - 2021-07-05 18:22:58
2021-07-05 18:22:58 - 2021-07-12 20:56:10
2021-07-12 20:56:10 - 2021-07-19 23:29:21
2021-07-19 23:29:21 - 2021-07-27 02:02:33
2021-07-27 02:02:33 - 2021-08-03 04:35:44
2021-08-03 04:35:44 - 2021-08-10 07:08:56
2021-08-10 07:08:56 - 2021-08-17 09:42:07
2021-08-17 09:42:07 - 2021-08-24 12:15:19
2021-08-24 12:15:19 - 2021-08-31 14:48:30
2021-08-31 14:48:30 - 2021-09-07 17:21:42
2021-09-07 17:21:42 - 2021-09-14 19:54:53
2021-09-14 19:54:53 - 2021-09-21 22:28:05
2021-09-21 22:28:05 - 2021-09-29 01:01:16
2021-09-29 01:01:16 - 2021-10-06 03:34:28
2021-10-06 03:34:28 - 2021-10-13 06:07:39
2021-10-13 06:07:39 - 2021-10-20 08:40:51
2021-10-20 08:40:51 - 2021-10-27 11:14:02
2021-11-03 13:47:14 - 2021-11-10 16:20:25
2021-11-10 16:20:25 - 2021-11-17 18:53:37
2021-11-17 18:53:37 - 2021-11-24 21:26:48
2021-11-24 21:26:48 - 2021-12-01 23:59:59

SAAV I19-04

Displacement Plot - Sand and Gravel

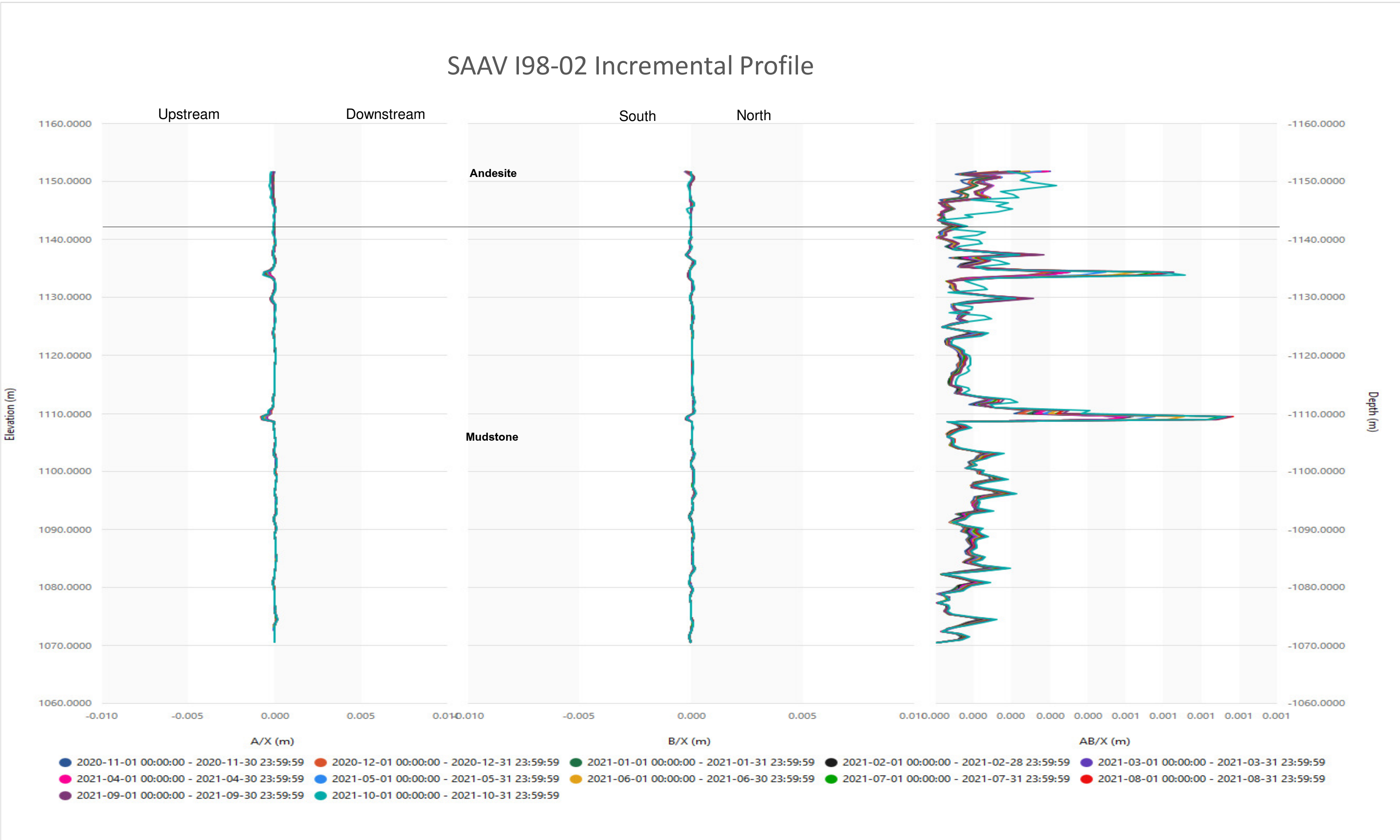
Unit	Upper El. (m)	Lower El. (m)	NL	Rate (mm/month)
Sand and Gravel	1230	1213	1.0	1.35

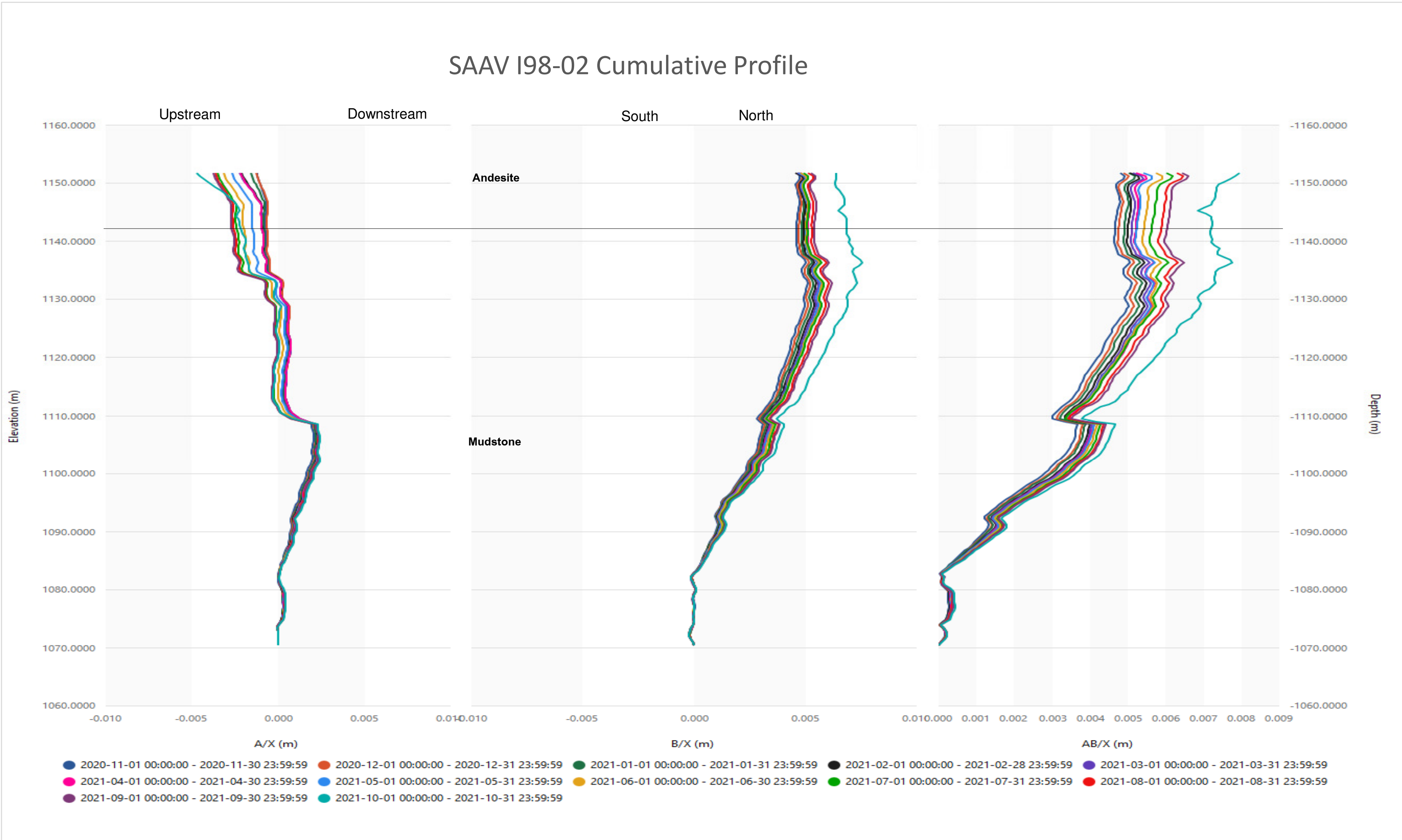
Upper El. (m)	1230.0
Lower El. (m)	1212.5



North Dam Bedrock

SAAV I98-02


SAAV I98-02 Incremental Profile
Upstream
Downstream
South
North
Andesite
Mudstone
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59

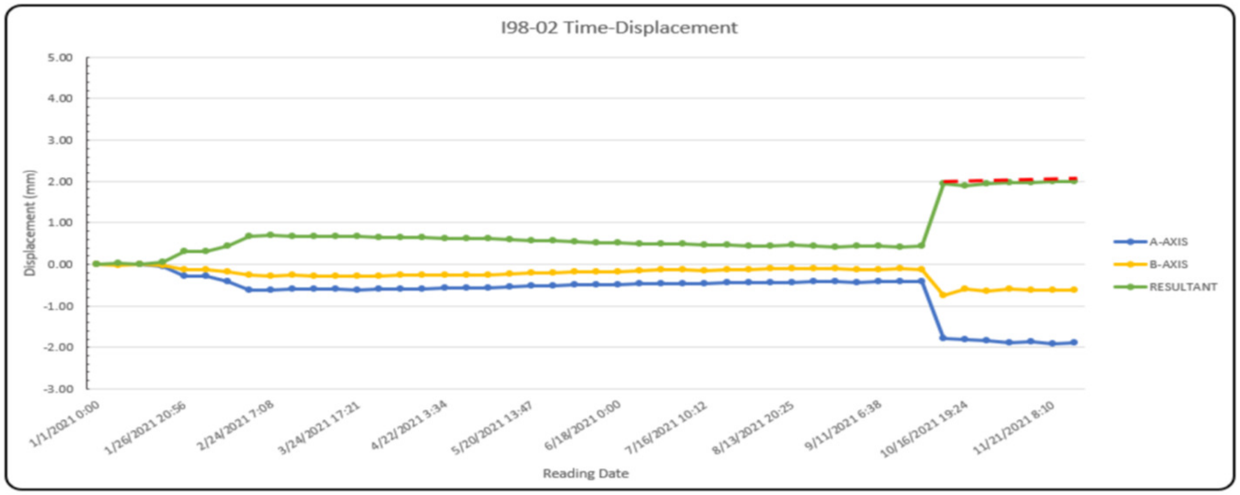

SAAV I98-02 Cumulative Profile
Upstream
Downstream
South
North
Andesite
Mudstone
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59

SAAV I98-02

Displacement Plot - Andesite

Unit	Upper El. (m)	Lower El. (m)	NL	Rate
Andesite	**1151.9**	**1142.4**	**1.0**	**0.04**
Upper Sedimentary	1127.9	1125.4	0.9	
Mudstone/Siltstone	1113.4	1107.9	0.5	
Sandstone/Siltstone	1138.4	1130.4	1.0	
Lower Sedimentary	1102.4	1100.4	0.9	

Upper El. (m)	1151.9
Lower El. (m)	1142.4

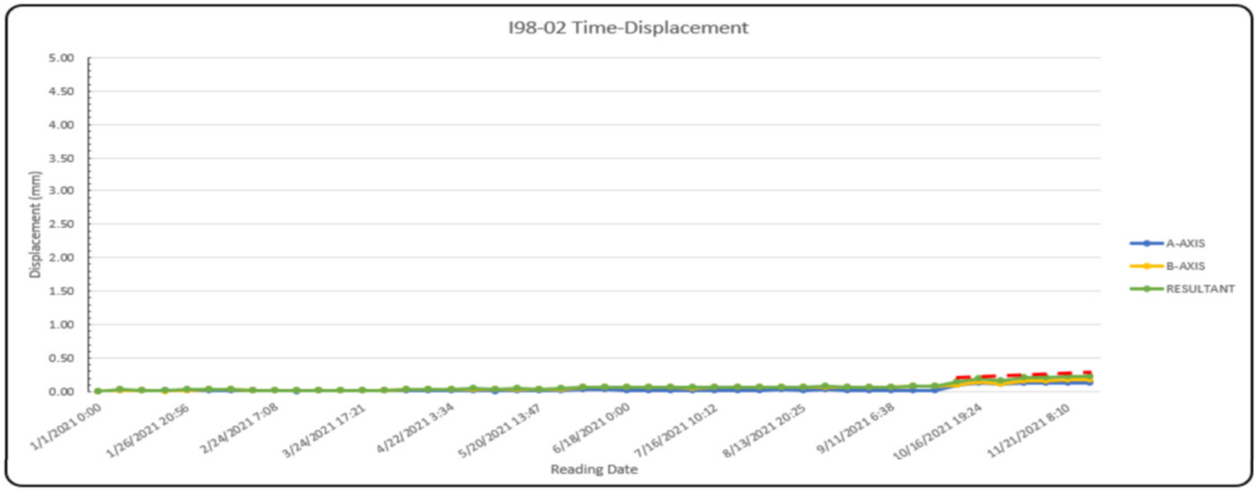


SAAV I98-02

Displacement Plot - Upper Sedimentary

Unit	Upper El. (m)	Lower El. (m)	NL	Rate
Andesite	1151.9	1142.4	1.0	
Upper Sedimentary	**1127.9**	**1125.4**	**0.9**	**0.05**
Mudstone/Siltstone	1113.4	1107.9	0.5	
Sandstone/Siltstone	1138.4	1130.4	1.0	
Lower Sedimentary	1102.4	1100.4	0.9	

Upper El. (m)	1127.9
Lower El. (m)	1125.4

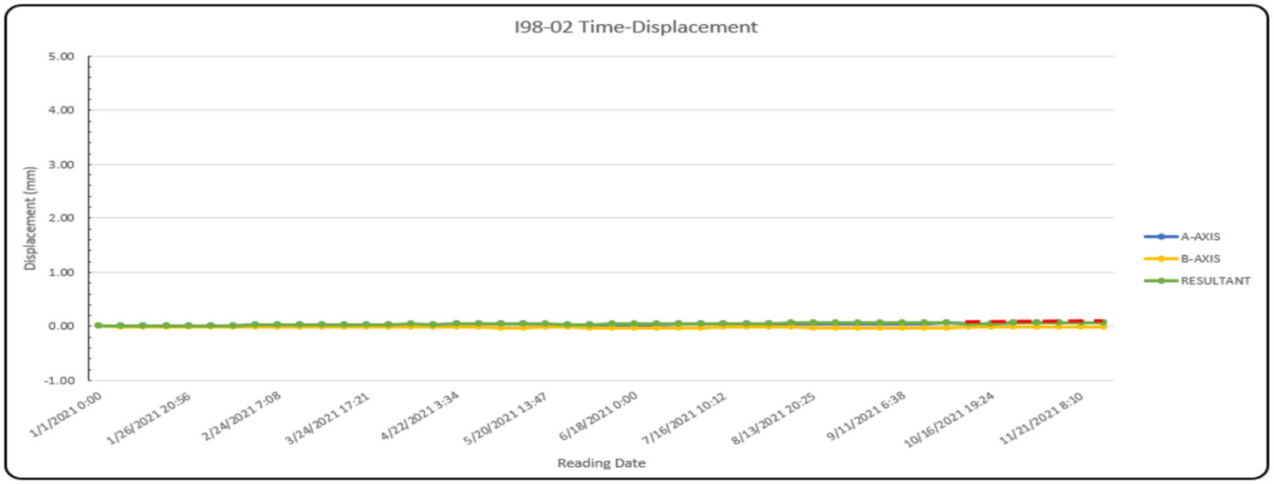


SAAV I98-02

Displacement Plot - Lower Sedimentary

Unit	Upper El. (m)	Lower El. (m)	NL	Rate
Andesite	1151.9	1142.4	1.0	
Upper Sedimentary	1127.9	1125.4	0.9	
Mudstone/Siltstone	1113.4	1107.9	0.5	
Sandstone/Siltstone	1138.4	1130.4	1.0	
Lower Sedimentary	**1102.4**	**1100.4**	**0.9**	**0.01**

Upper El. (m)	1102.4
Lower El. (m)	1100.4

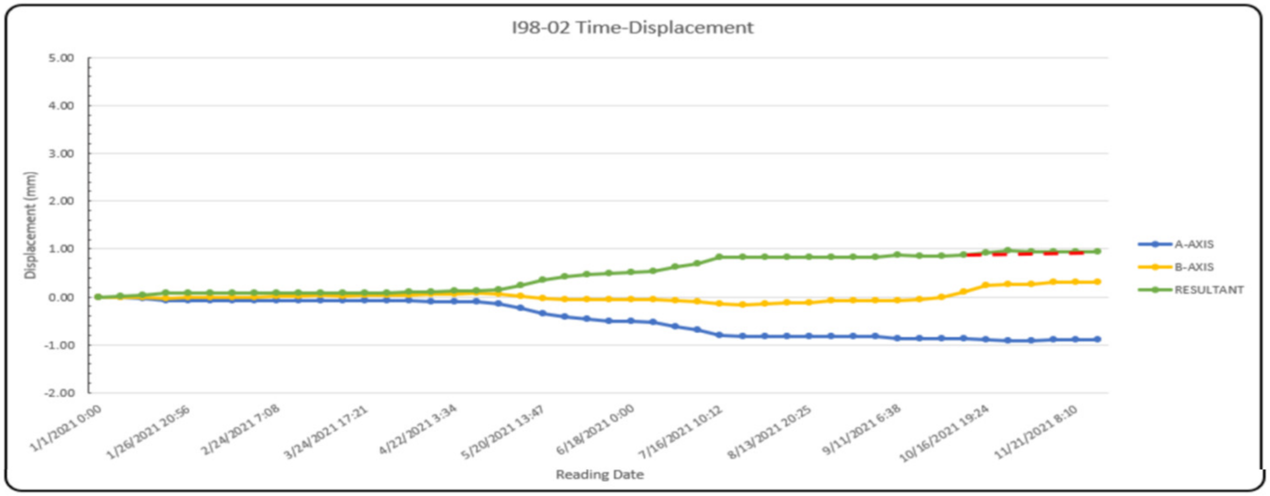


SAAV I98-02

Displacement Plot - Mudstone

Unit	Upper El. (m)	Lower El. (m)	NL	Rate
Andesite	1151.9	1142.4	1.0	
Upper Sedimentary	1127.9	1125.4	0.9	
Mudstone/Siltstone	**1113.4**	**1107.9**	**0.5**	**0.05**
Sandstone/Siltstone	1138.4	1130.4	1.0	
Lower Sedimentary	1102.4	1100.4	0.9	

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

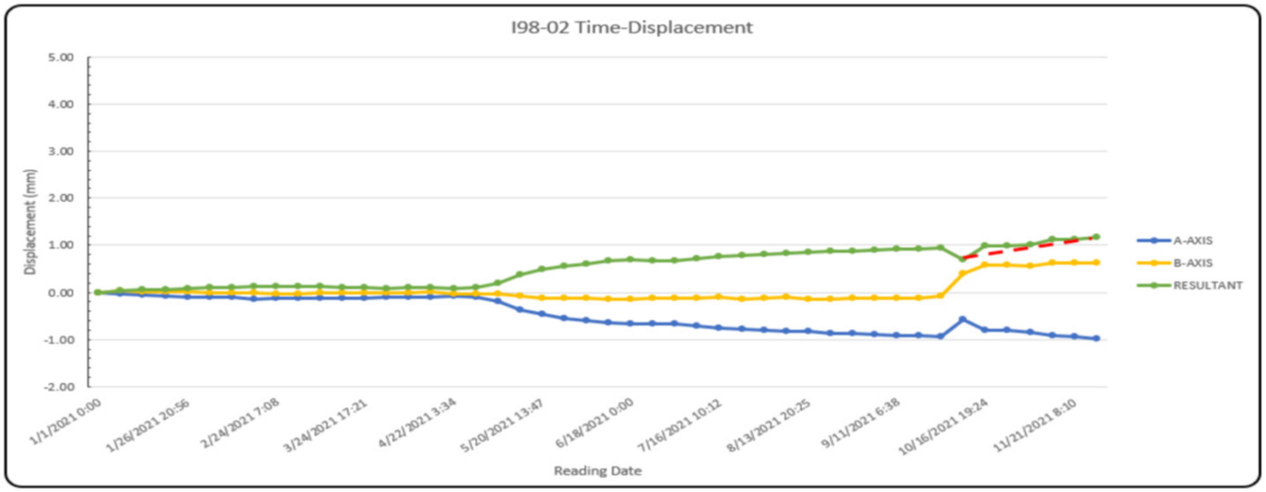


SAAV I98-02

Displacement Plot - Sandstone/Siltstone

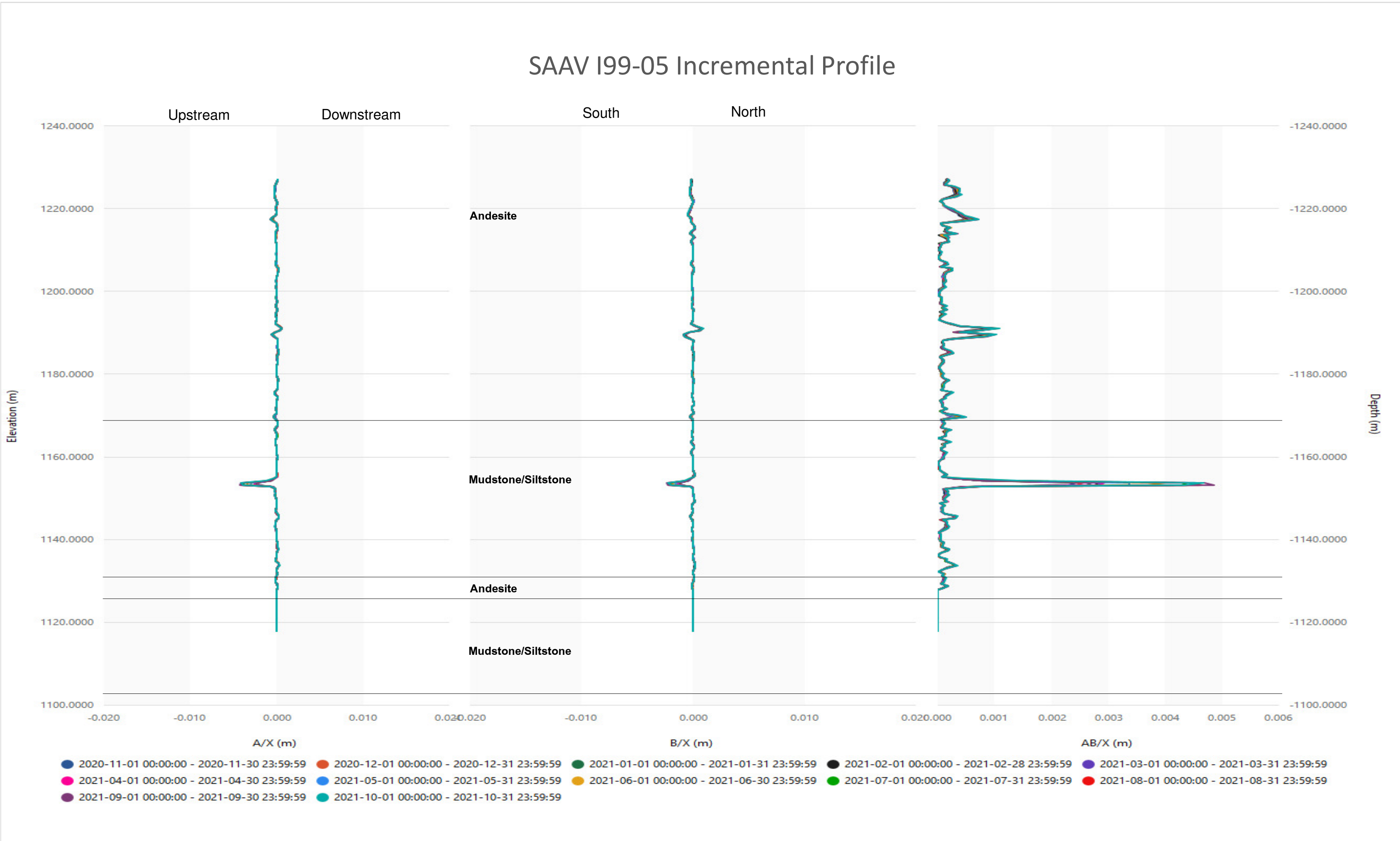
Unit	Upper El. (m)	Lower El. (m)	NL	Rate
Andesite	1151.9	1142.4	1.0	
Upper Sedimentary	1127.9	1125.4	0.9	
Mudstone/Siltstone	1113.4	1107.9	0.5	
Sandstone/Siltstone	**1138.4**	**1130.4**	**1.0**	**0.28**
Lower Sedimentary	1102.4	1100.4	0.9	

Upper El. (m)	1138.4
Lower El. (m)	1130.4

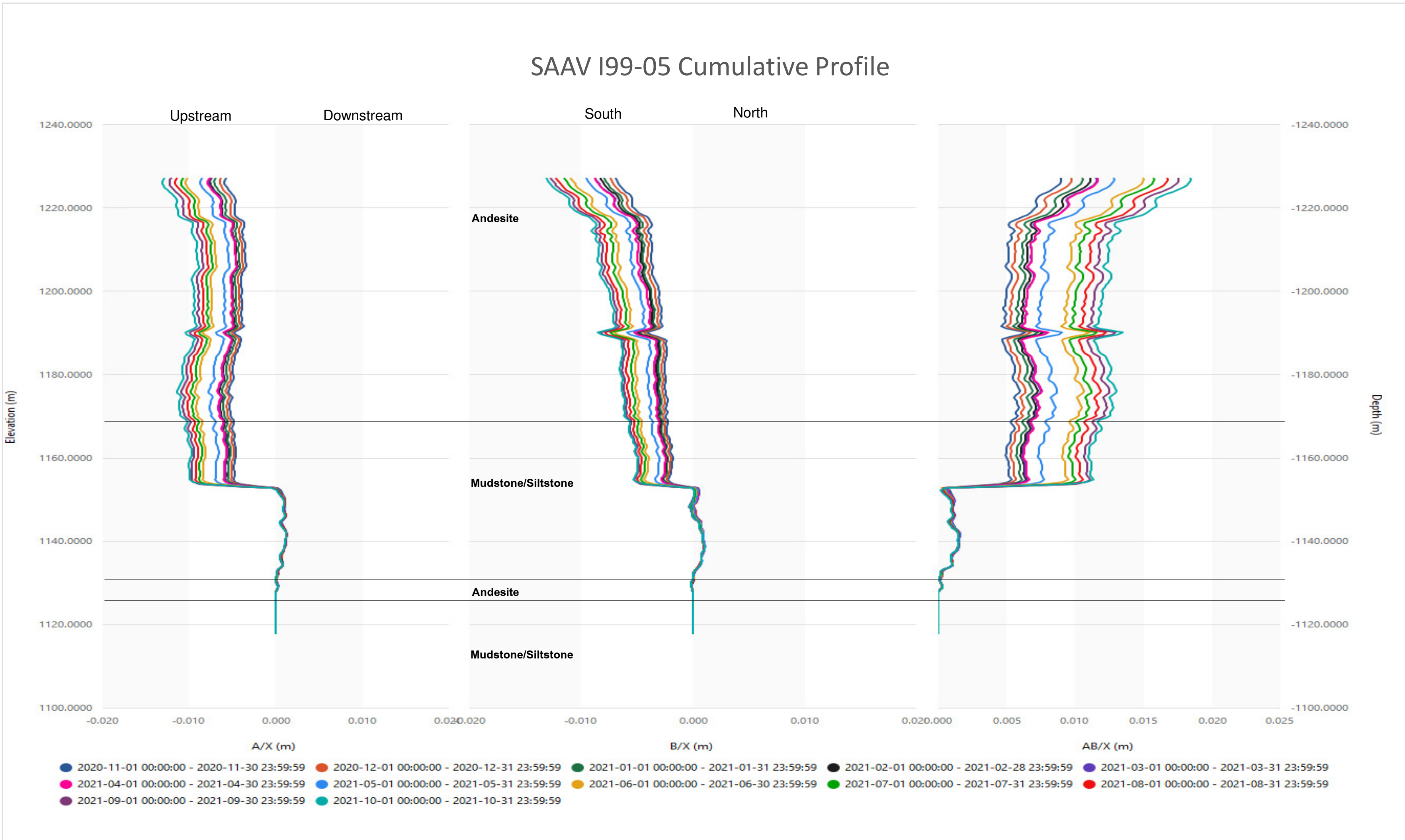


North Dam Bedrock

SAAV I99-05



SAAV I99-05 Incremental Profile
Upstream
Downstream
South
North
Elevation (m)
Depth (m)
Andesite
Mudstone/Siltstone
Andesite
Mudstone/Siltstone
1240.0000
1220.0000
1200.0000
1180.0000
1160.0000
1140.0000
1120.0000
1100.0000
-1240.0000
-1220.0000
-1200.0000
-1180.0000
-1160.0000
-1140.0000
-1120.0000
-1100.0000
-0.020 -0.010 0.000 0.010 0.020
-0.020 -0.010 0.000 0.010 0.020
0.000 0.001 0.002 0.003 0.004 0.005 0.006
A/X (m)
B/X (m)
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59



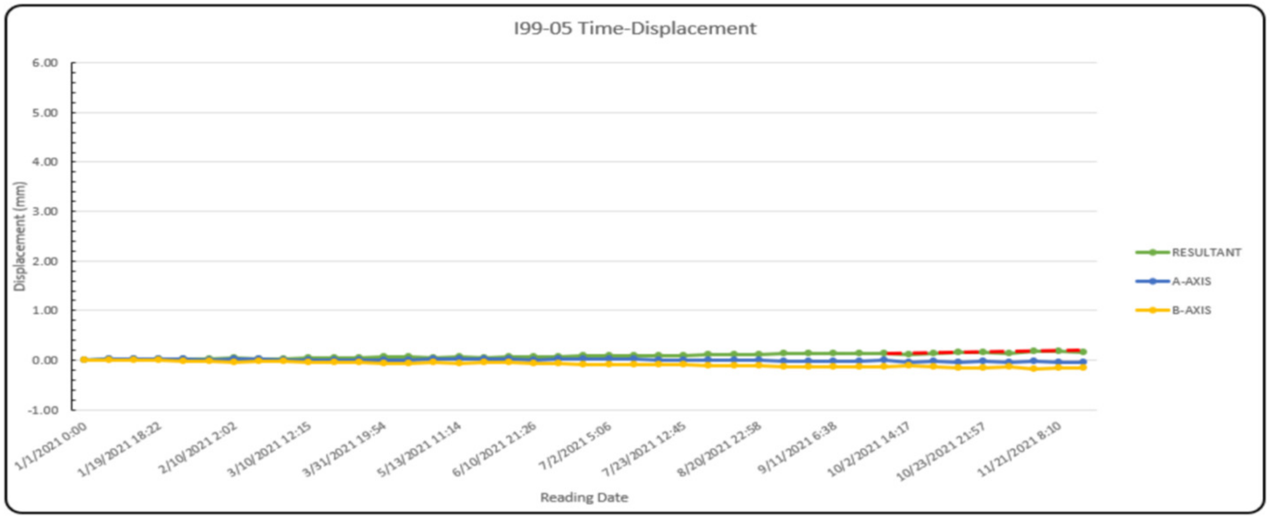
SAAV I99-05 Cumulative Profile
Upstream
Downstream
South
North
Andesite
Mudstone/Siltstone
Andesite
Mudstone/Siltstone
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59

SAAV I99-05

Displacement Plot - Andesite

Unit	Upper El. (m)	Lower El. (m)	NL	Rate (mm/month)
Andesite	**1203.12**	**1201.12**	**1.0**	**0.02**
Upper Sedimentary	1166.12	1152.12	0.5	
Lower Sedimentary	1151.12	1149.12	1.2	

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

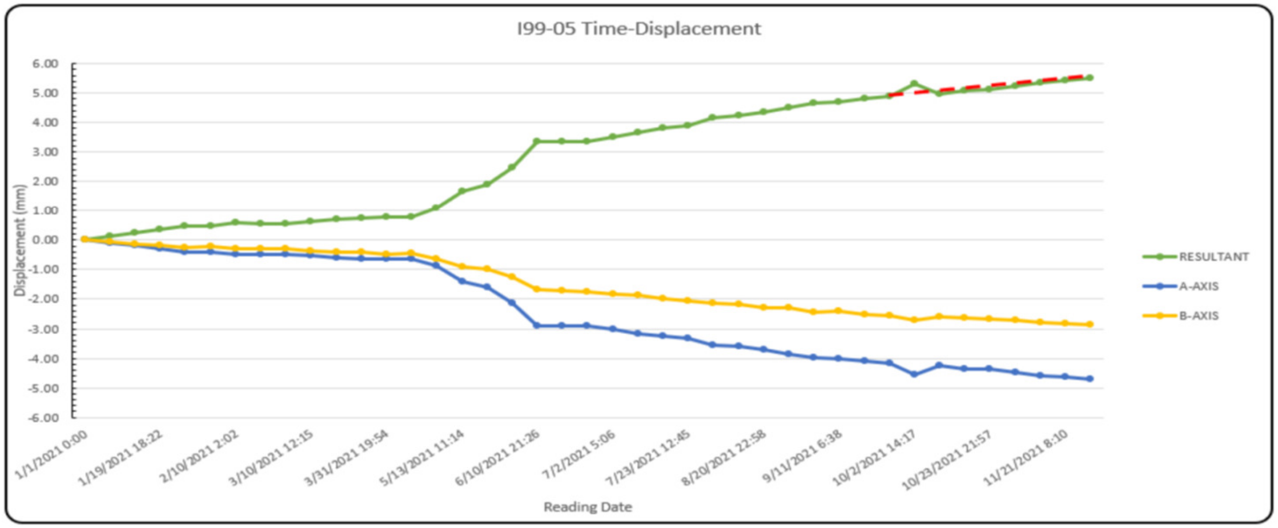


SAAV I99-05

Displacement Plot - Upper Sedimentary

Unit	Upper El. (m)	Lower El. (m)	NL	Rate (mm/month)
Andesite	1203.12	1201.12	1.0	
Upper Sedimentary	**1166.12**	**1152.12**	**0.5**	**0.29**
Lower Sedimentary	1151.12	1149.12	1.2	

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

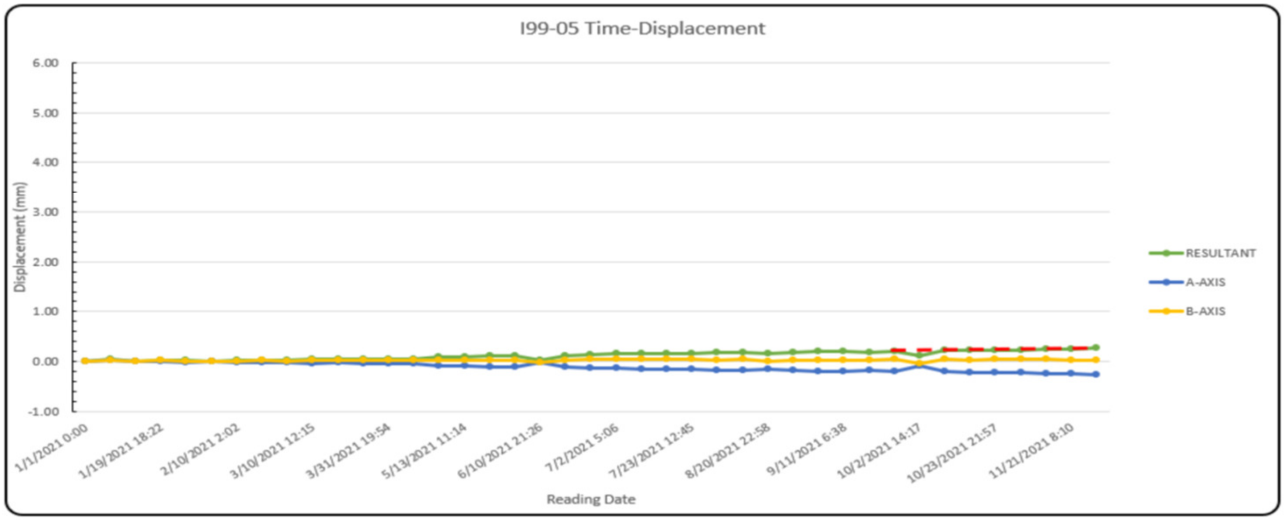


SAAV I99-05

Displacement Plot - Lower Sedimentary

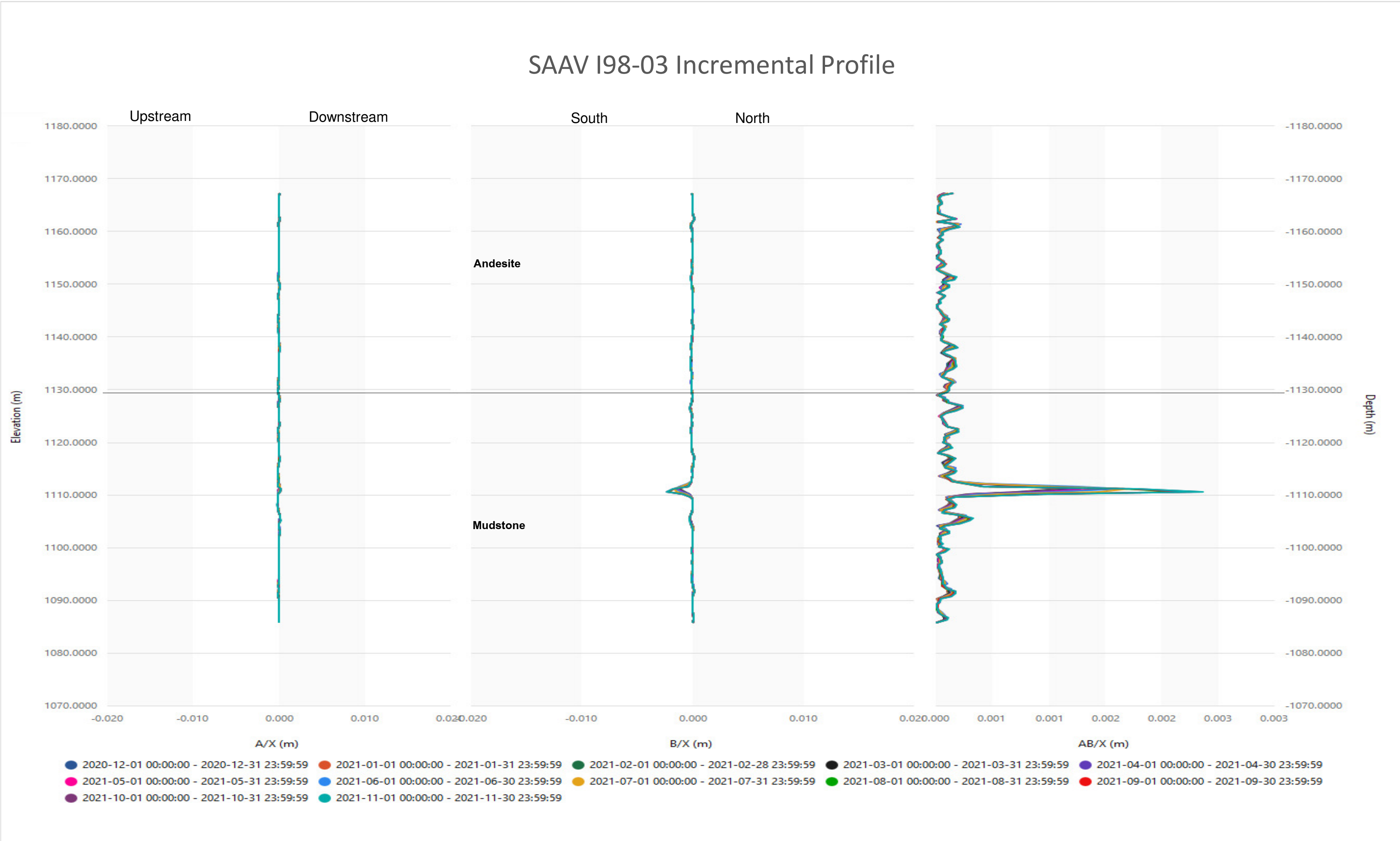
Unit	Upper El. (m)	Lower El. (m)	NL	Rate (mm/month)
Andesite	1203.12	1201.12	1.0	
Upper Sedimentary	1166.12	1152.12	0.5	
Lower Sedimentary	**1151.12**	**1149.12**	**1.2**	**0.03**

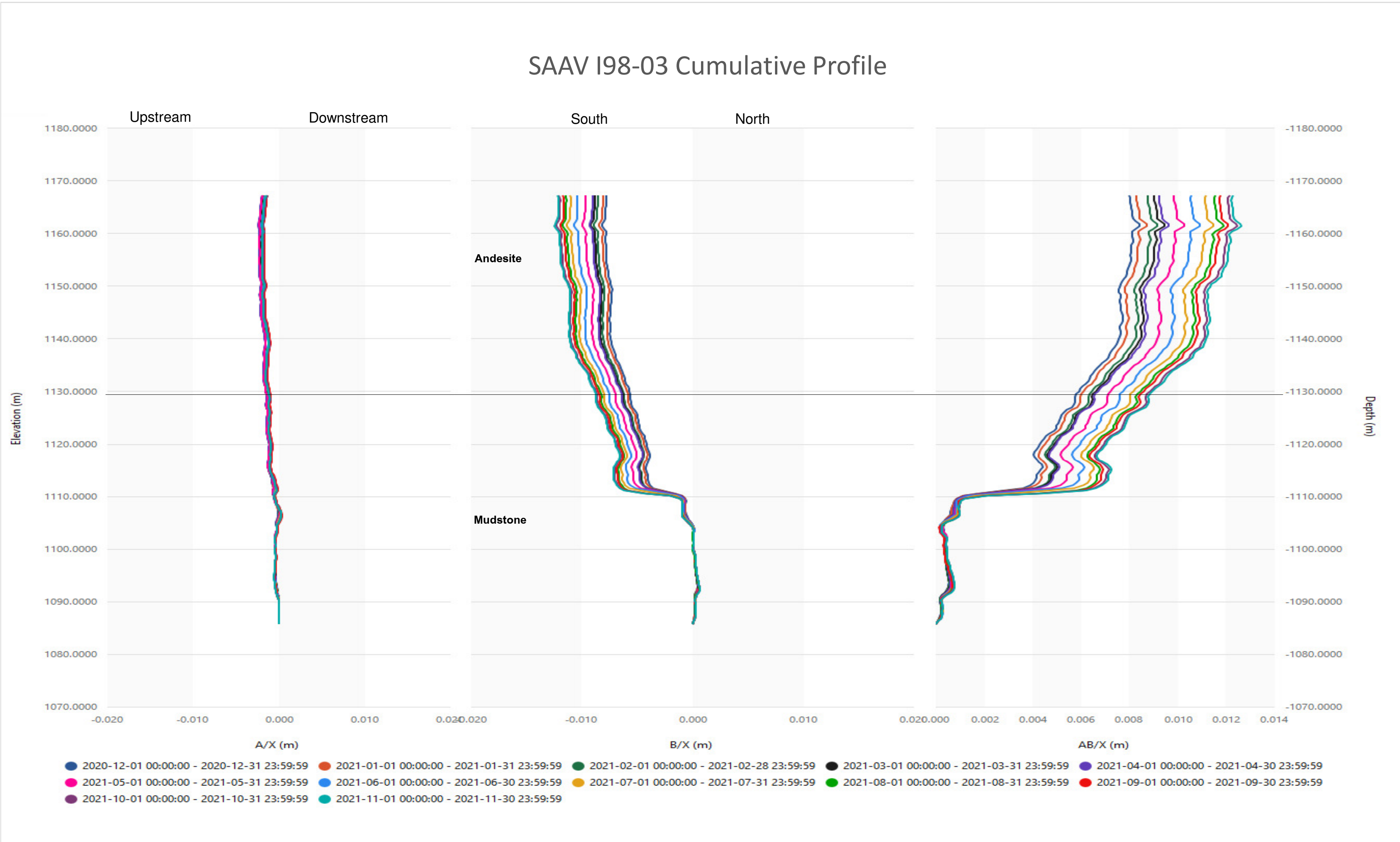
Upper El. (m)	1151.1
Lower El. (m)	1149.1



North Dam Bedrock

SAAV I98-03


SAAV I98-03 Incremental Profile
Upstream
Downstream
South
North
Andesite
Mudstone
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59



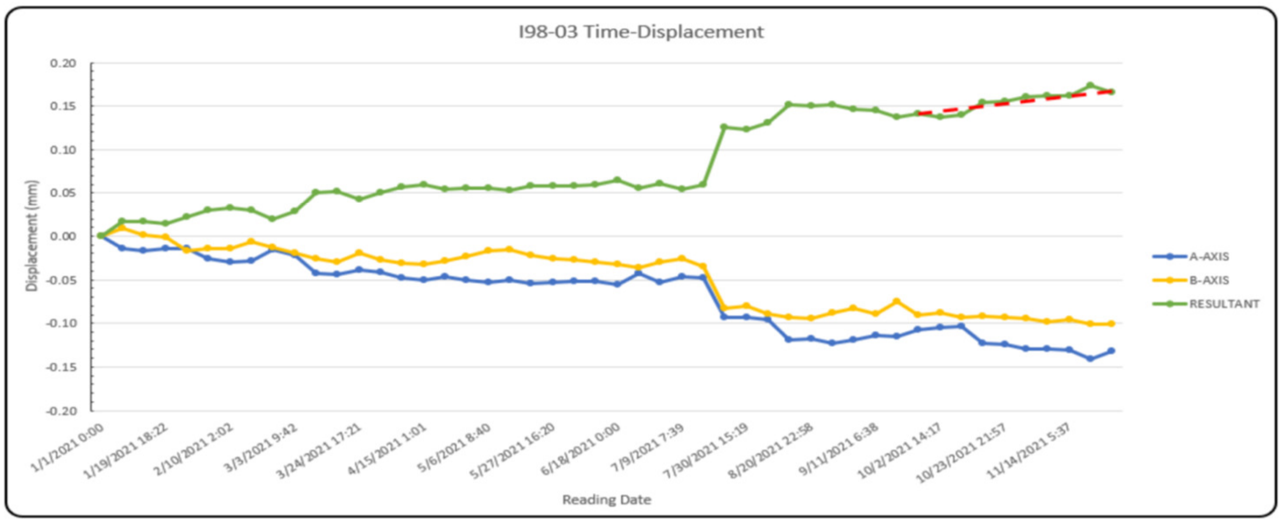
SAAV I98-03 Cumulative Profile
Upstream
Downstream
South
North
Andesite
Mudstone
Elevation (m)
Depth (m)
1180.0000
1170.0000
1160.0000
1150.0000
1140.0000
1130.0000
1120.0000
1110.0000
1100.0000
1090.0000
1080.0000
1070.0000
-1180.0000
-1170.0000
-1160.0000
-1150.0000
-1140.0000
-1130.0000
-1120.0000
-1110.0000
-1100.0000
-1090.0000
-1080.0000
-1070.0000
-0.020
-0.010
0.000
0.010
0.020
0.000
0.002
0.004
0.006
0.008
0.010
0.012
0.014
A/X (m)
B/X (m)
AB/X (m)
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59

SAAV I98-03

Displacement Plot – Volcanic Unit

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Volcanic	**1132**	**1129.0**	**1.0**	**0.02**
Sandstone/Mudstone	1113	1109	1.0	
Sedimentary	1106	1103	1.0	

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

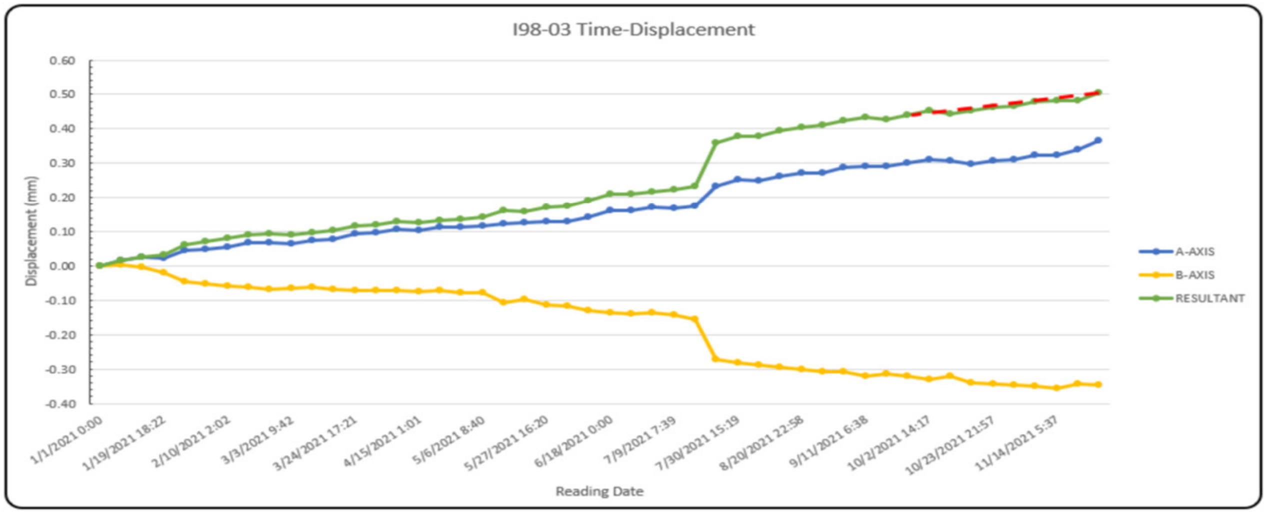


SAAV I98-03

Displacement Plot - Sedimentary

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Volcanic	1132	1129.0	1.0	
Sandstone/Mudstone	1113	1109	1.0	
Sedimentary	**1106**	**1103**	**1.0**	**0.03**

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

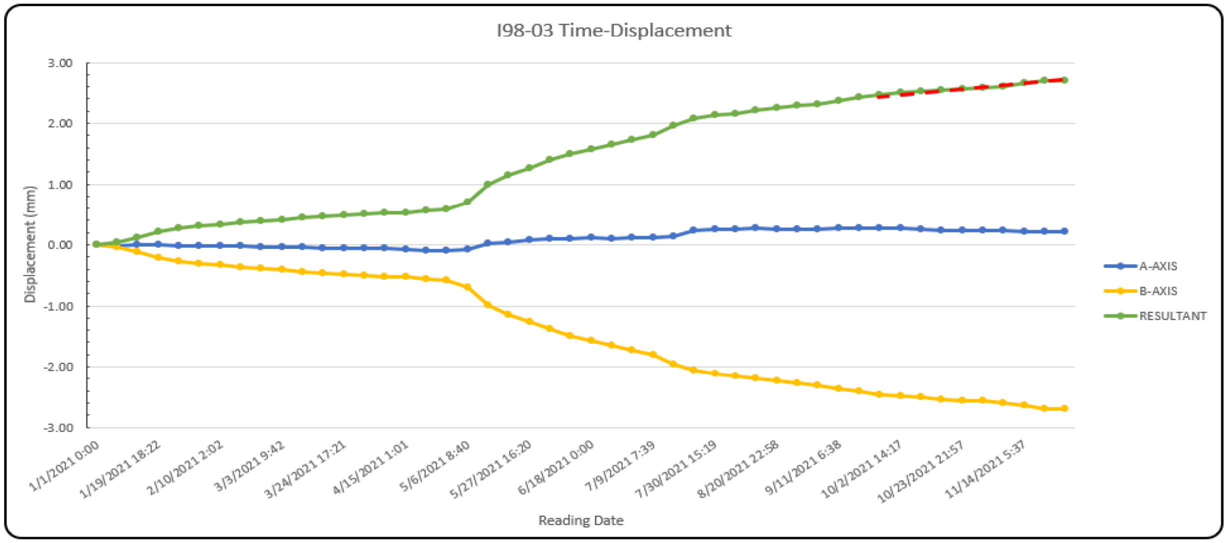


SAAV I98-03

Displacement Plot - Sandstone/Mudstone

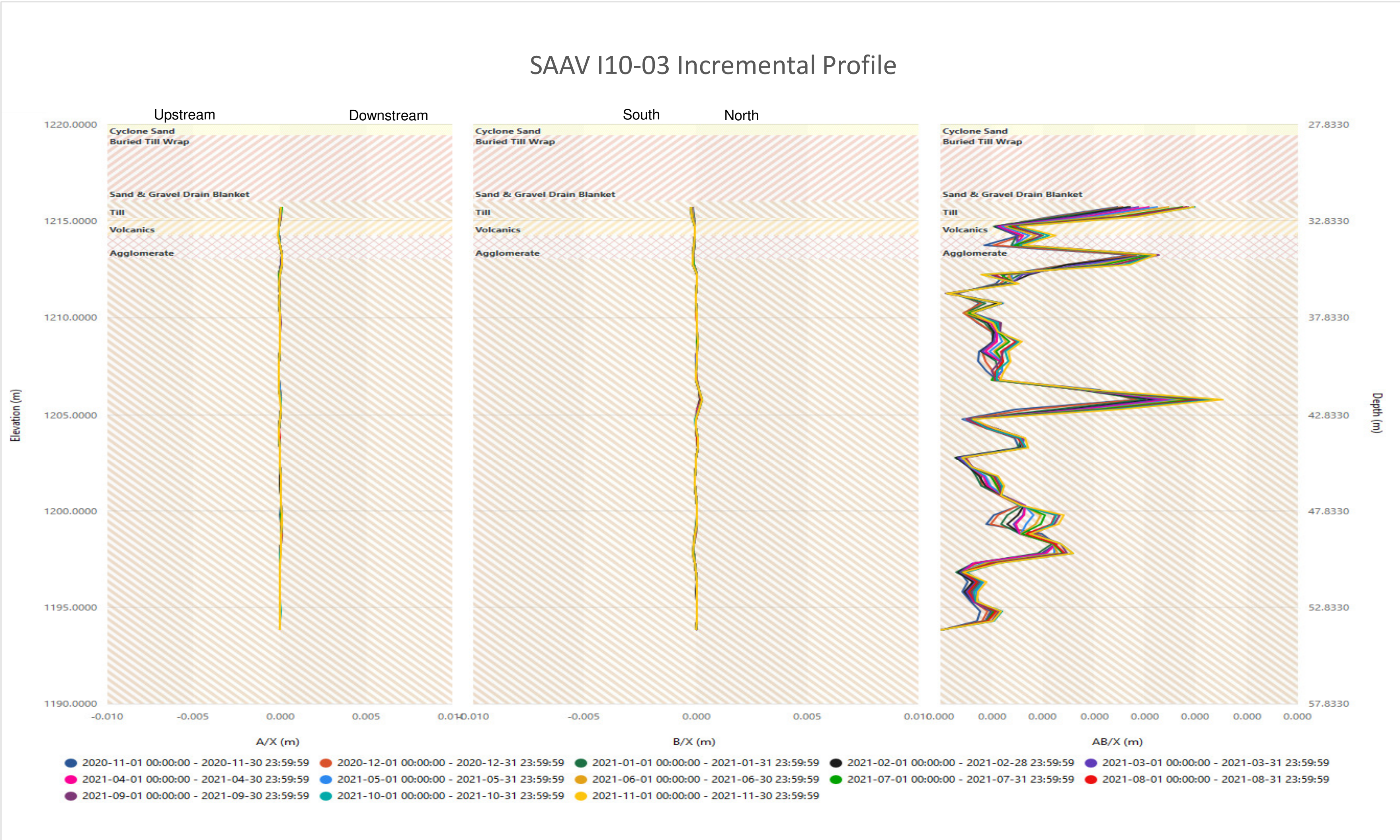
Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Volcanic	1132	1129.0	1.0	
Sandstone/Mudstone	**1113**	**1109**	**1.0**	**0.11**
Sedimentary	1106	1103	1.0	

Upper El. (m)	1113.0
Lower El. (m)	1109.0

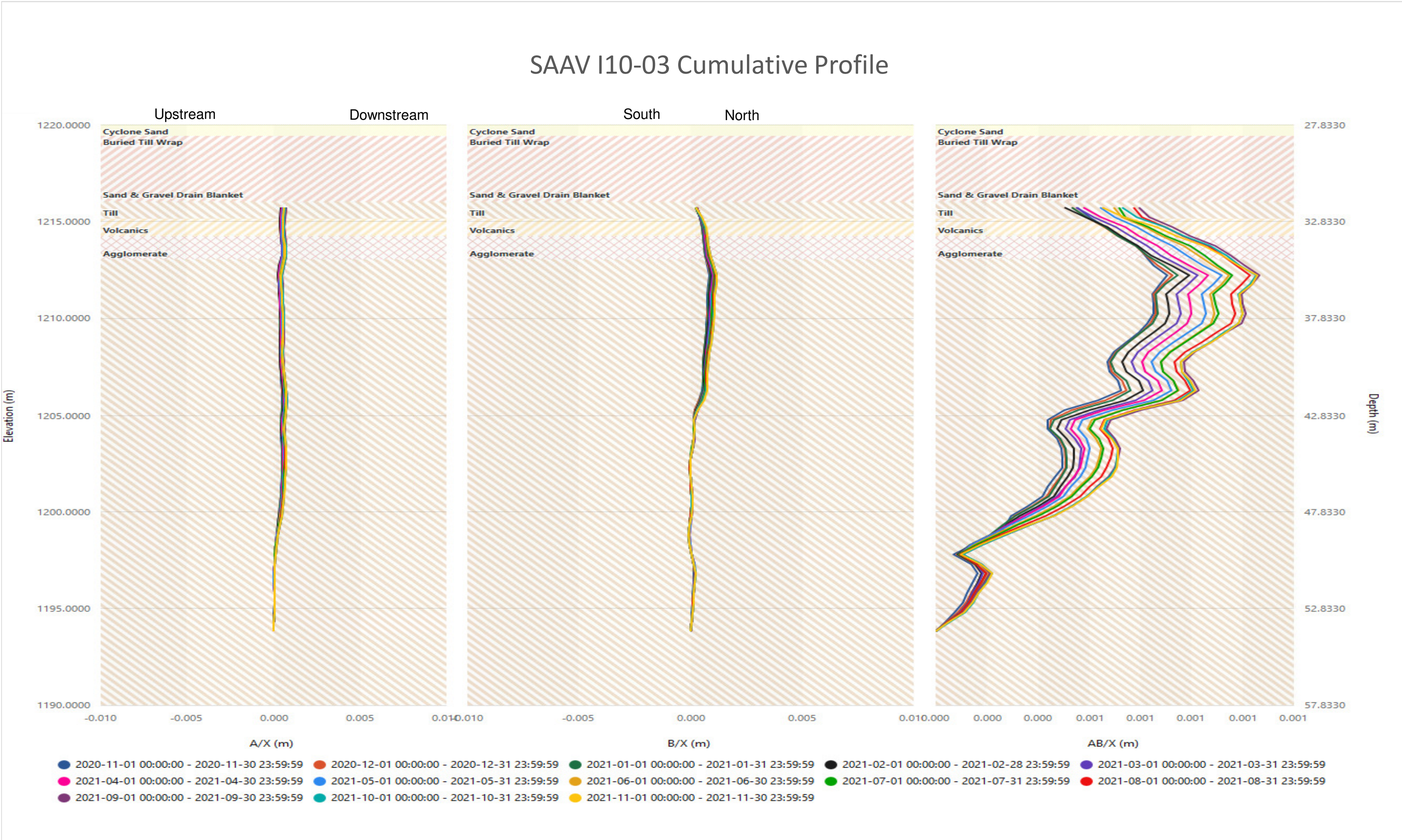


North Dam Bedrock

SAAV I10-03



SAAV I10-03 Incremental Profile
Upstream
Downstream
South
North
Cyclone Sand
Buried Till Wrap
Sand & Gravel Drain Blanket
Till
Volcanics
Agglomerate
Elevation (m)
Depth (m)
1220.0000
1215.0000
1210.0000
1205.0000
1200.0000
1195.0000
1190.0000
27.8330
32.8330
37.8330
42.8330
47.8330
52.8330
57.8330
-0.010
-0.005
0.000
0.005
0.010
A/X (m)
B/X (m)
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59

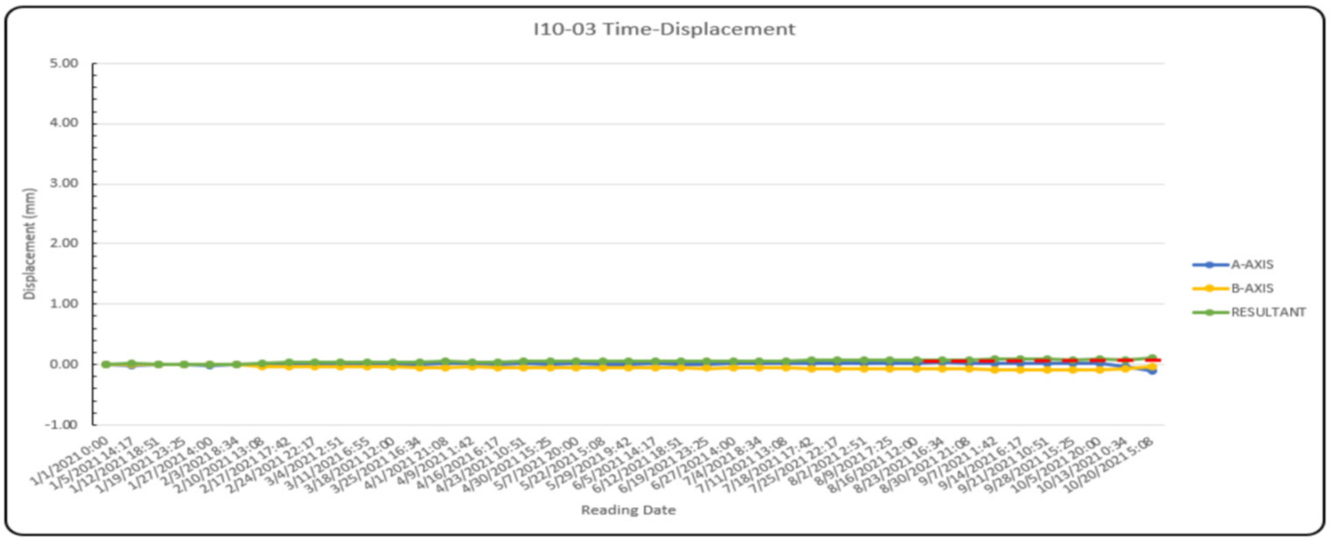

SAAV I10-03 Cumulative Profile
Upstream
Downstream
South
North
Cyclone Sand
Buried Till Wrap
Sand & Gravel Drain Blanket
Till
Volcanics
Agglomerate
Elevation (m)
Depth (m)
1220.0000
1215.0000
1210.0000
1205.0000
1200.0000
1195.0000
1190.0000
27.8330
32.8330
37.8330
42.8330
47.8330
52.8330
57.8330
-0.010
-0.005
0.000
0.005
0.010
A/X (m)
B/X (m)
0.001
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59

SAAV I10-03

Displacement Plot – Inferred GLU

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Overburden	**1214.3**	**1212.8**	**1.0**	**0.01**
Volcanic	1212.8	1193.8	2.0	

Upper El. (m)	1214.3
Lower El. (m)	1212.8

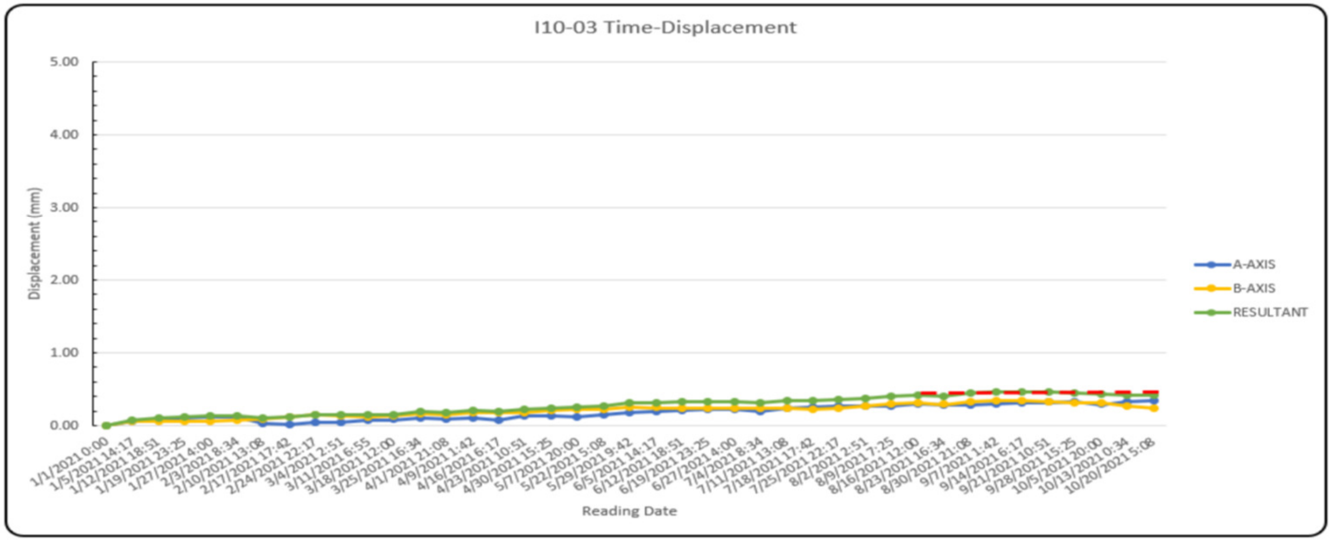


SAAV I10-03

Displacement Plot – Volcanic

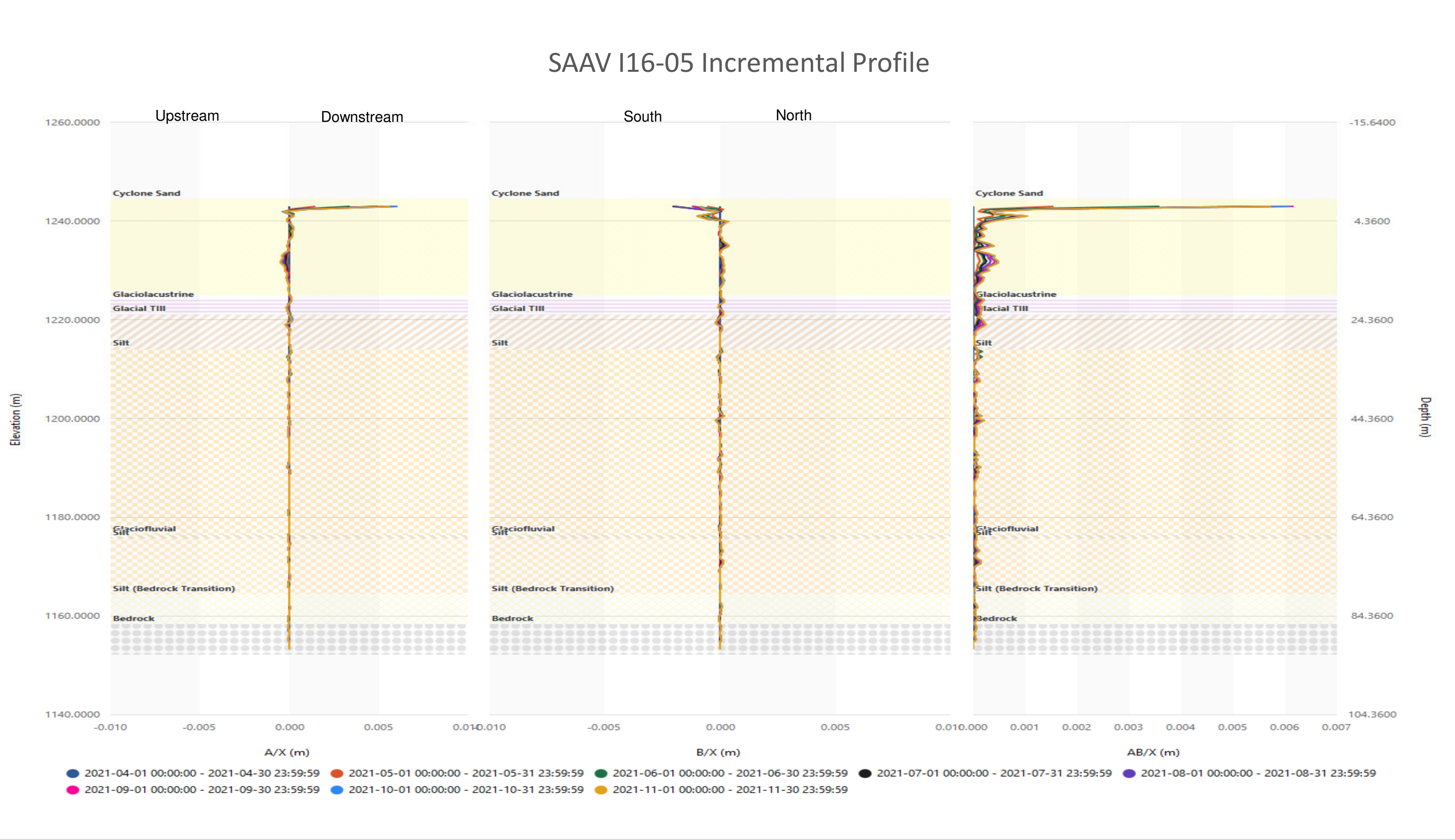
Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
GLU (Inferred)	1214.3	1212.8	1.0	
Volcanic	**1212.8**	**1193.8**	**2.0**	**0.01**

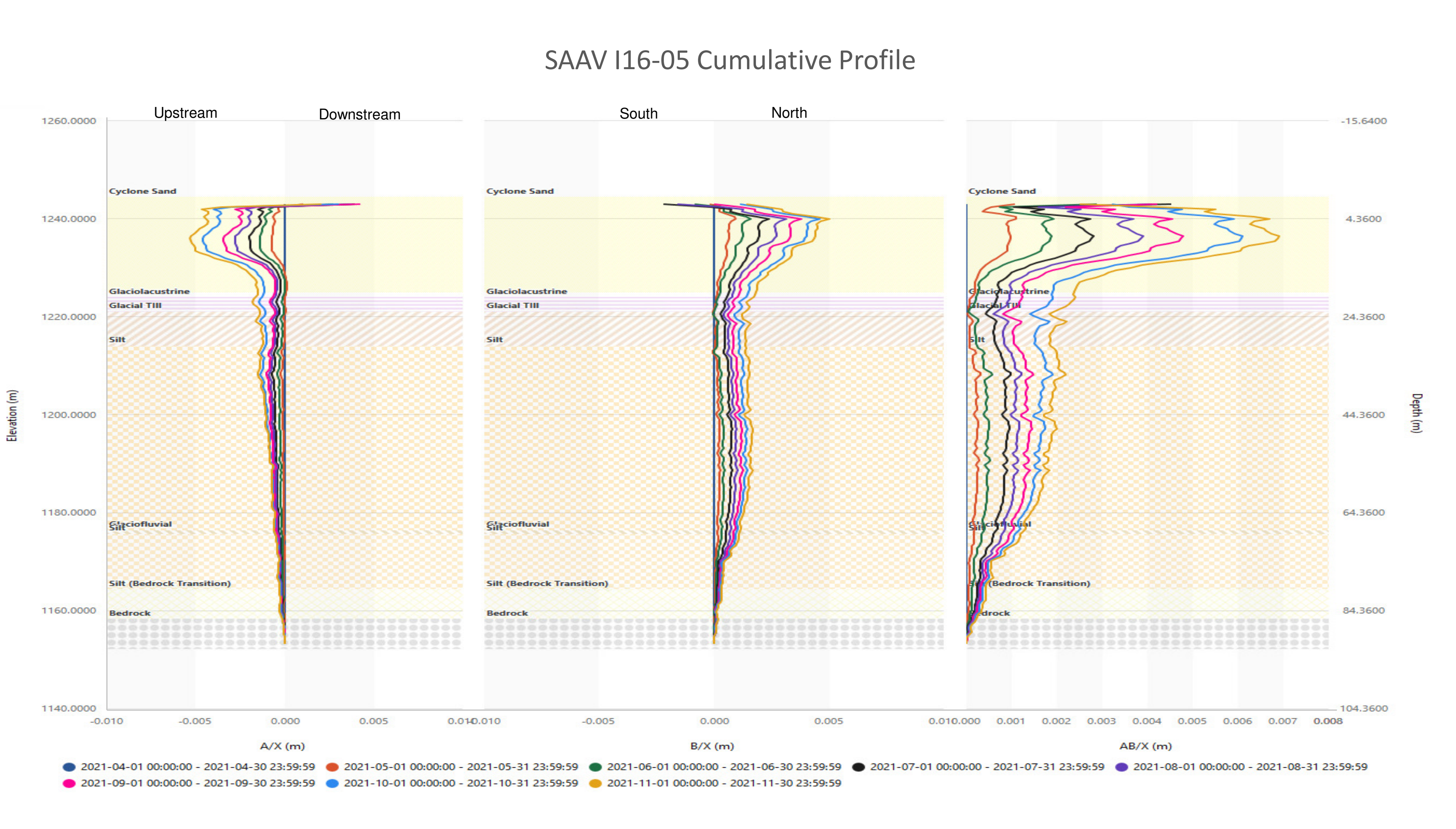
Upper El. (m)	1212.8
Lower El. (m)	1193.8



North Dam Bedrock

I16-05


SAAV I16-05 Incremental Profile
Upstream
Downstream
South
North
Cyclone Sand
Glaciolacustrine
Glacial Till
Silt
Glaciofluvial
Silt
Silt (Bedrock Transition)
Bedrock
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59

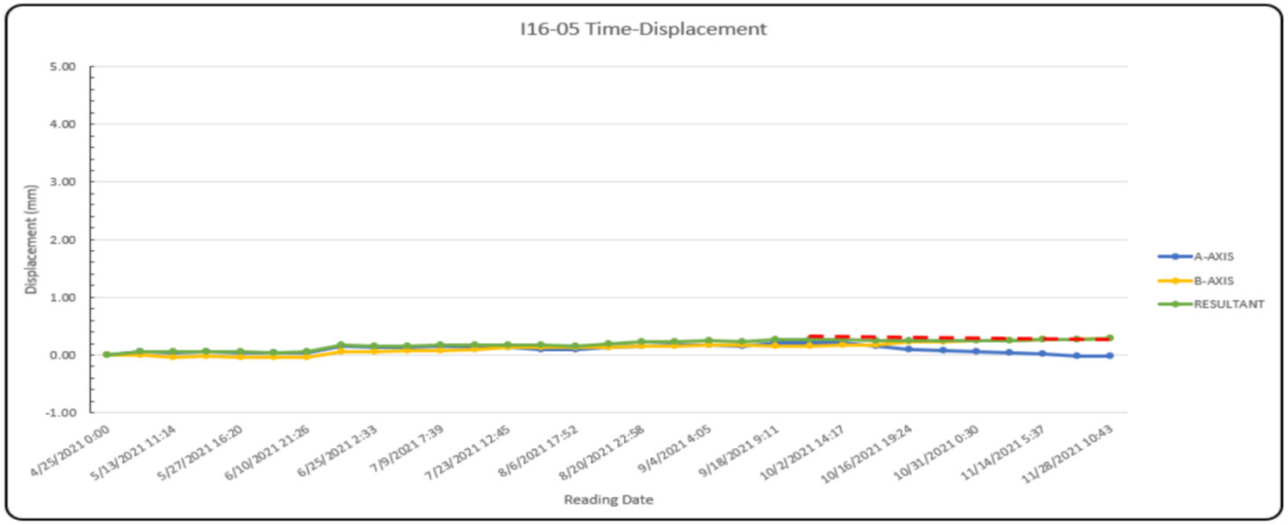

SAAV I16-05 Cumulative Profile
Upstream
Downstream
South
North
Cyclone Sand
Glaciolacustrine
Glacial Till
Silt
Glaciofluvial
Silt
Silt (Bedrock Transition)
Bedrock
Elevation (m)
1260.0000
1240.0000
1220.0000
1200.0000
1180.0000
1160.0000
1140.0000
Depth (m)
-15.6400
4.3600
24.3600
44.3600
64.3600
84.3600
104.3600
A/X (m)
B/X (m)
AB/X (m)
-0.010
-0.005
0.000
0.005
0.010
0.000
0.001
0.002
0.003
0.004
0.005
0.006
0.007
0.008
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59

SAAV I16-05

Displacement Plot - Glaciolacustrine

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Glaciolacustrine	**1225**	**1220**	**2.0**	**0.02**
Glacial Till	1169	1160.5	1.0	

Upper El. (m)	1225.0
Lower El. (m)	1220.0

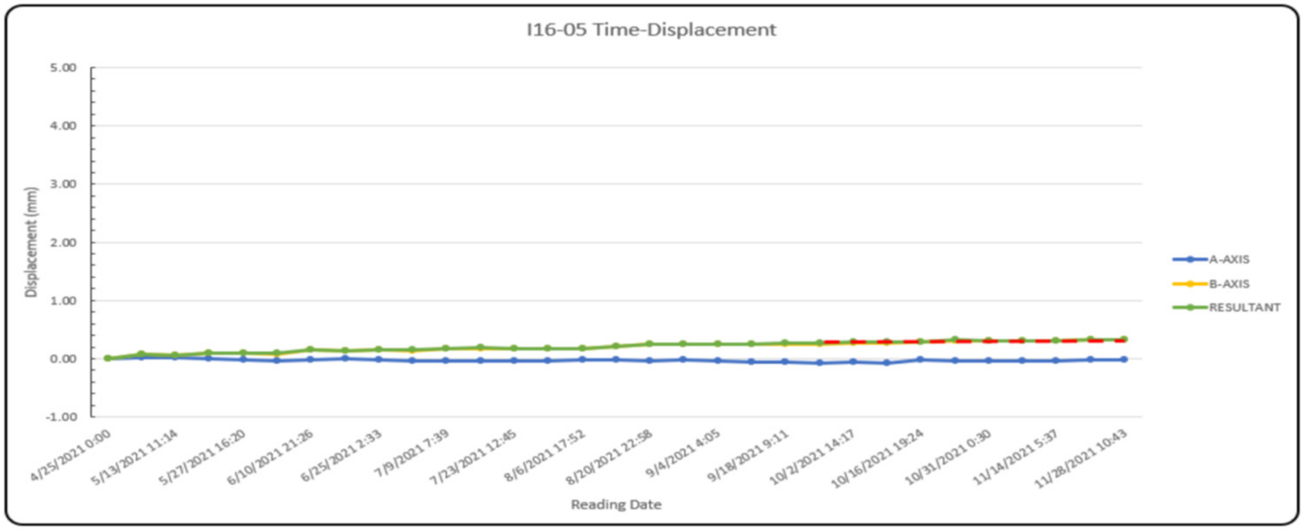


SAAV I16-05

Displacement Plot - Glacial Till

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Glaciolacustrine	1225	1220	2.0	
Glacial Till	**1169**	**1160.5**	**1.0**	**0.03**

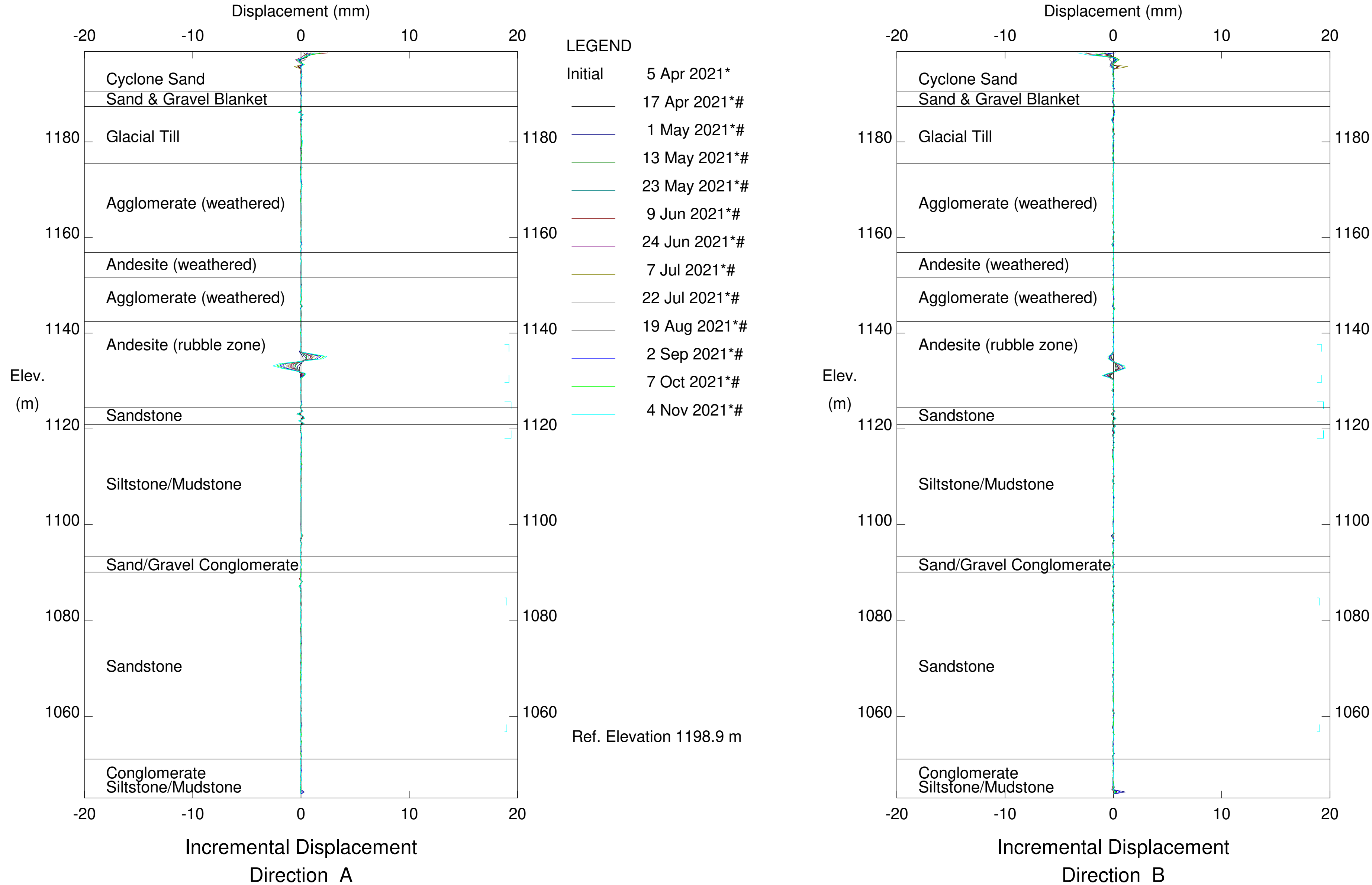
Upper El. (m)	1169.0
Lower El. (m)	1160.5



North Dam Bedrock

I19-01

Highland Valley Copper - BC



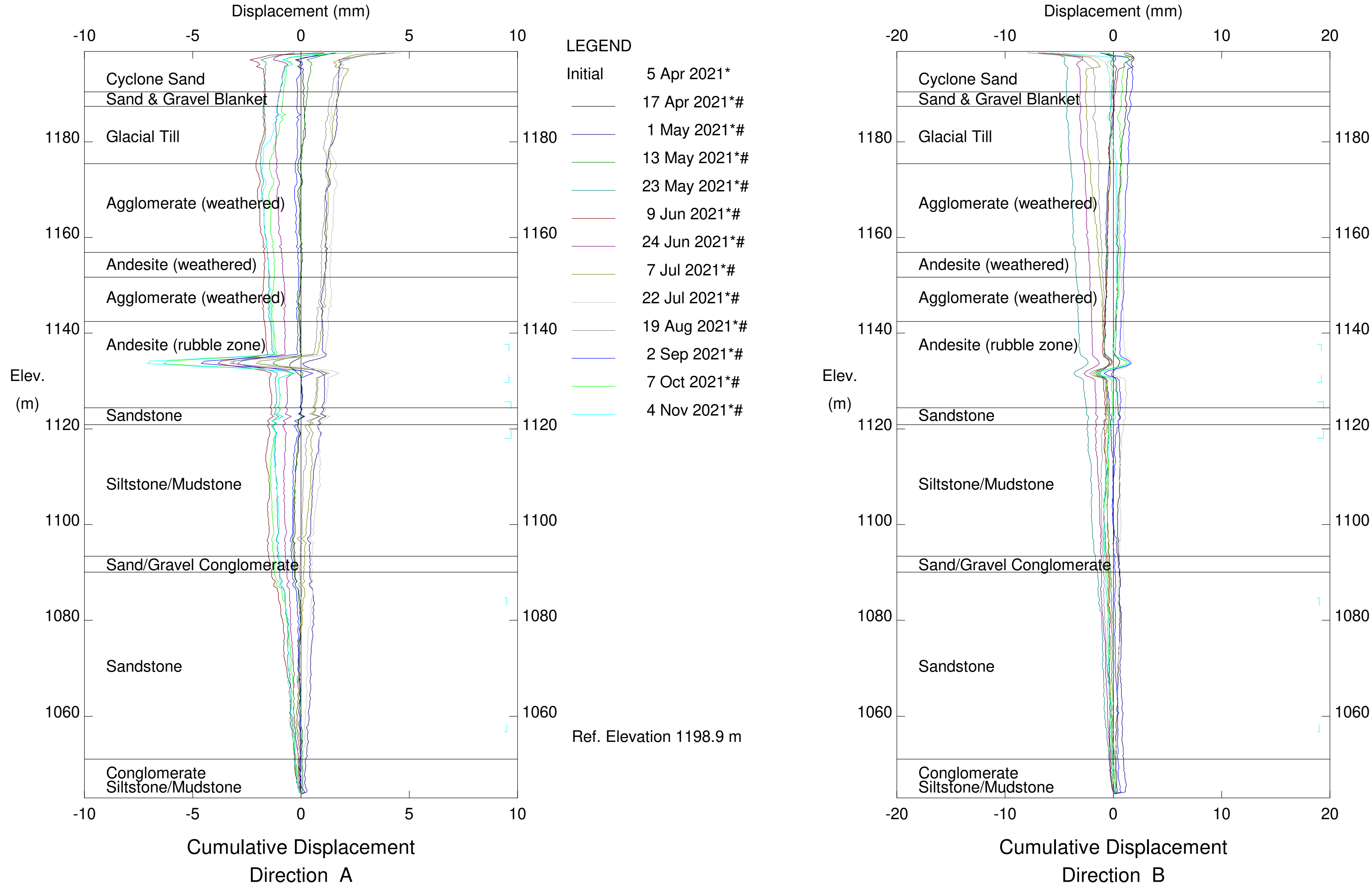
LL Dam, Inclinometer I19-1

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

Sets marked # corrected for casing compression

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I19-01.gtl

Highland Valley Copper - BC



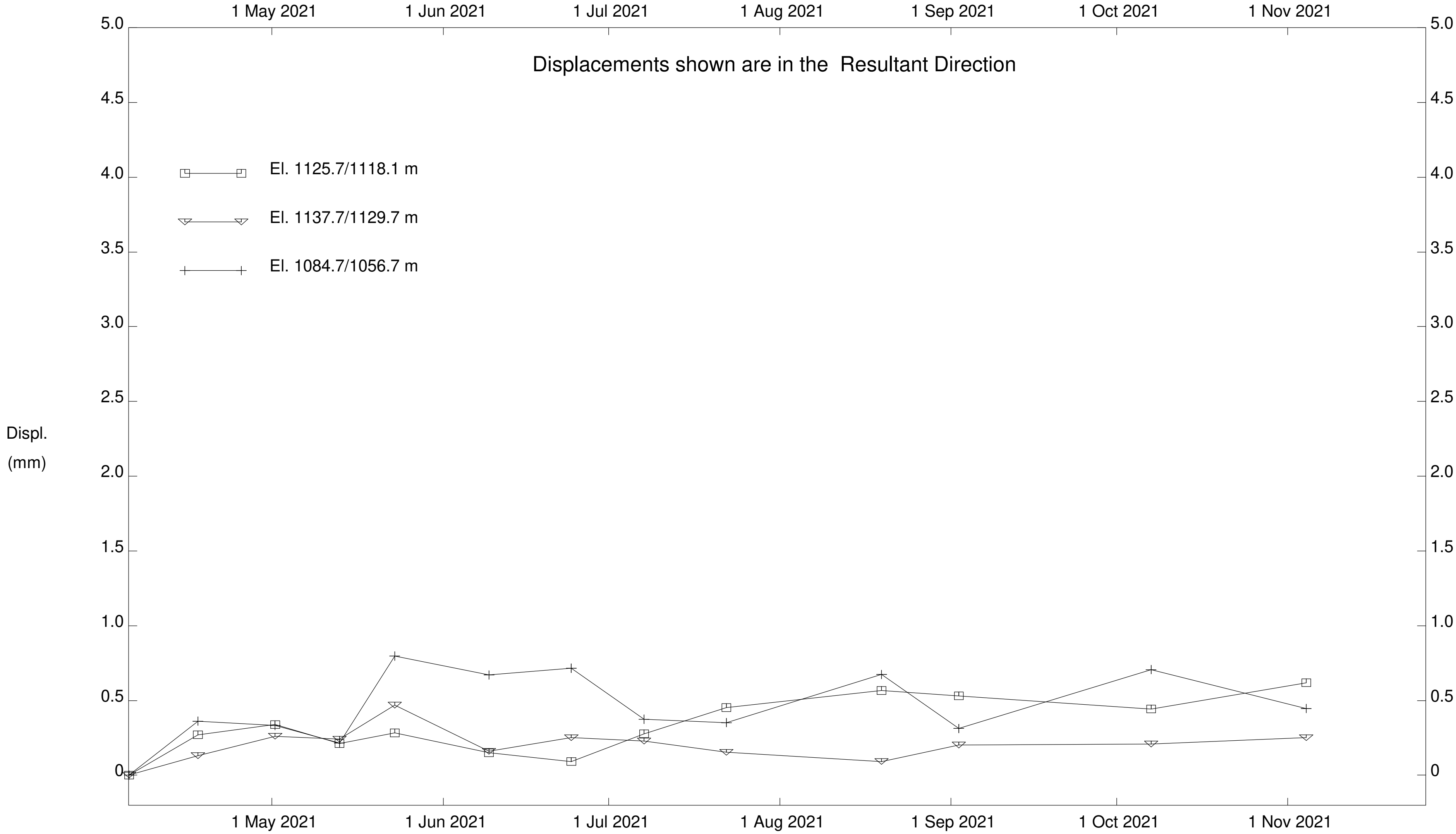
LL Dam, Inclinometer I19-1

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

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I19-01.gtl

Sets marked # corrected for casing compression

Highland Valley Copper - BC

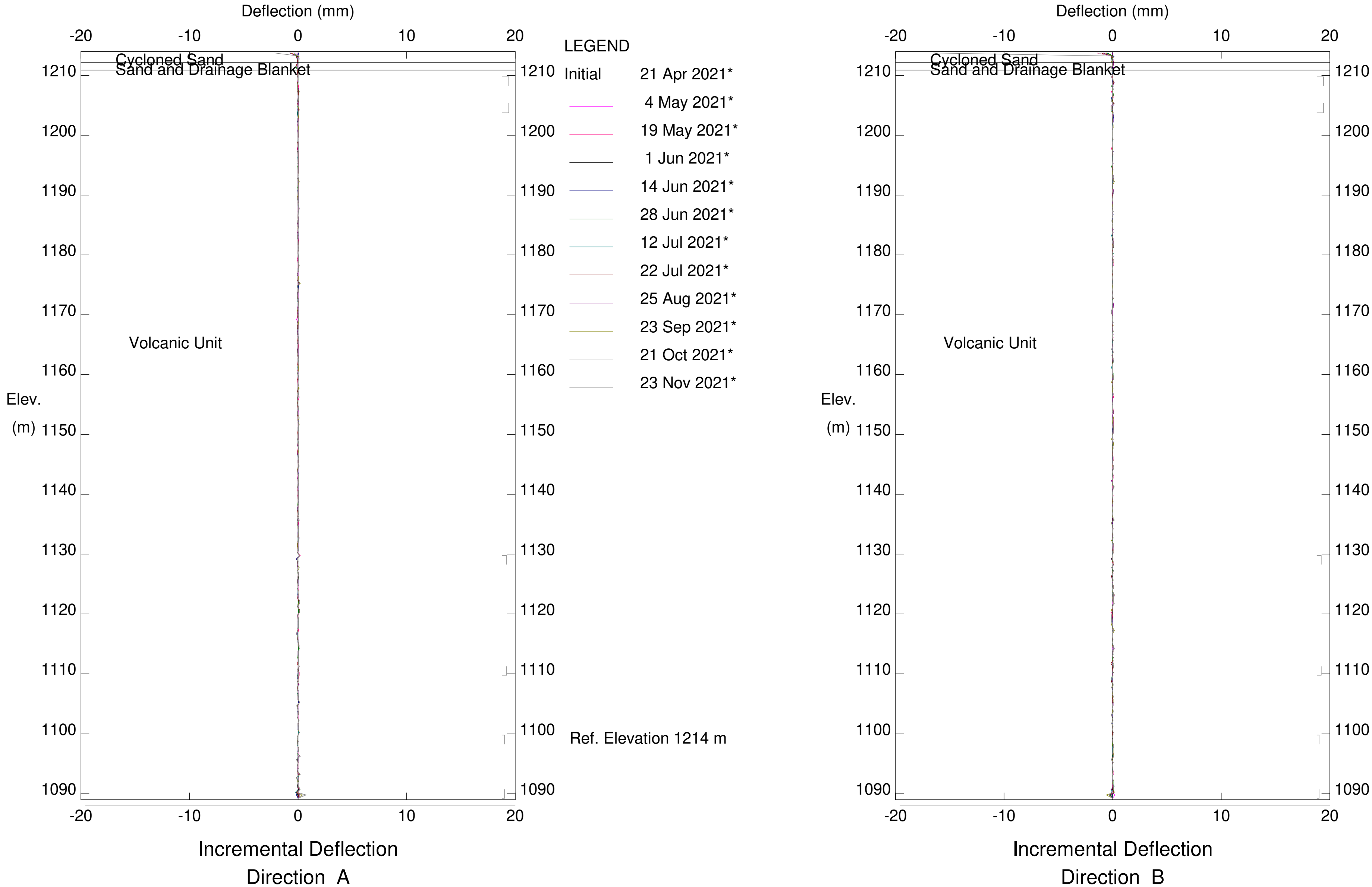


LL Dam, Inclinometer I19-1

North Dam Bedrock

I19-02

Highland Valley Copper - Logan Lake, BC

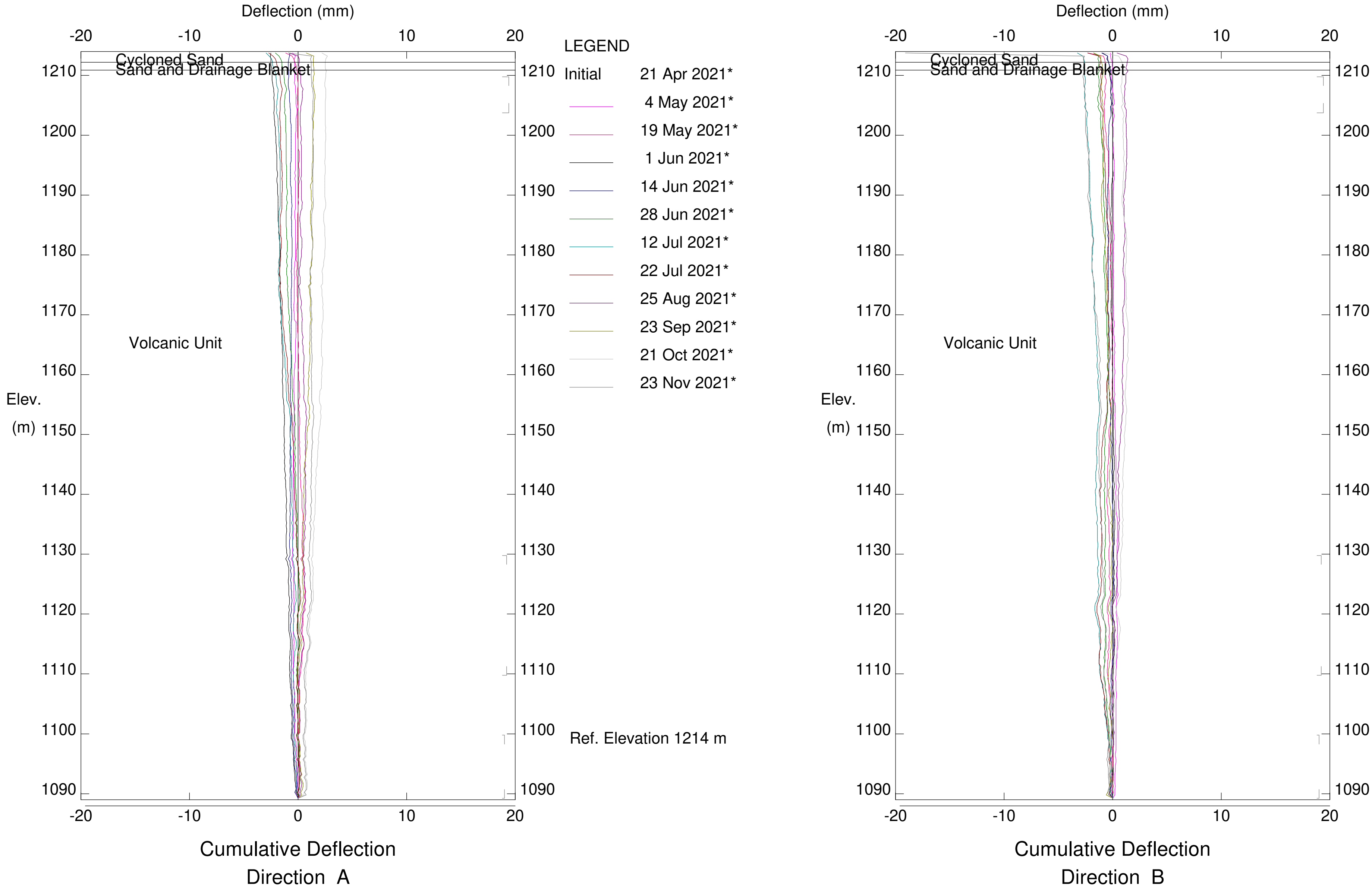


Dam Fill Excluded, Inclinometer 19-02

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

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I19-02.gtl

Highland Valley Copper - Logan Lake, BC

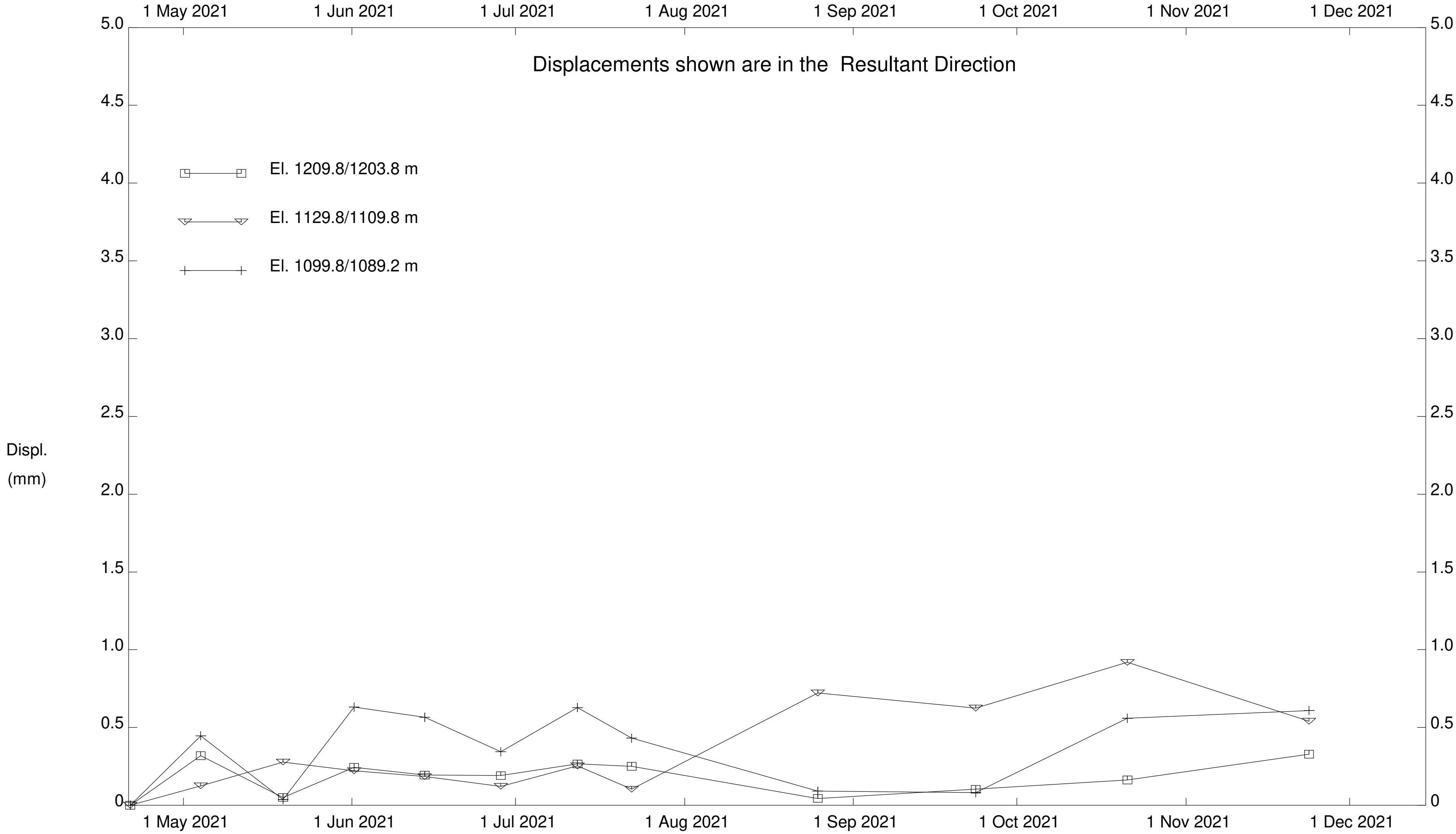


Dam Fill Excluded, Inclinometer 19-02

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

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I19-02.gtl

Highland Valley Copper - Logan Lake, BC

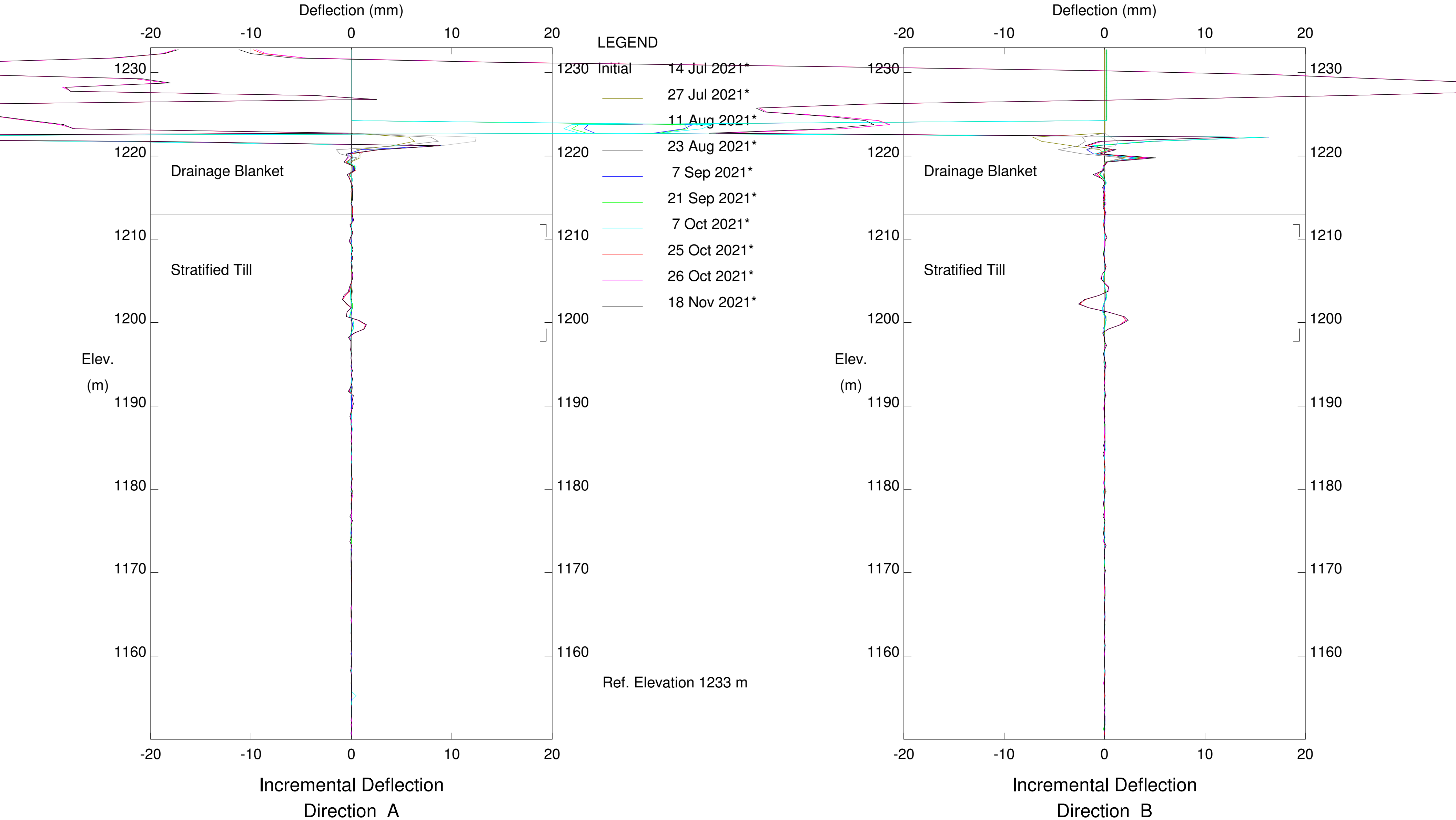


Dam Fill Excluded, Inclinometer 19-02

North Dam Bedrock

I19-03

Highland Valley Copper - Logan Lake, BC

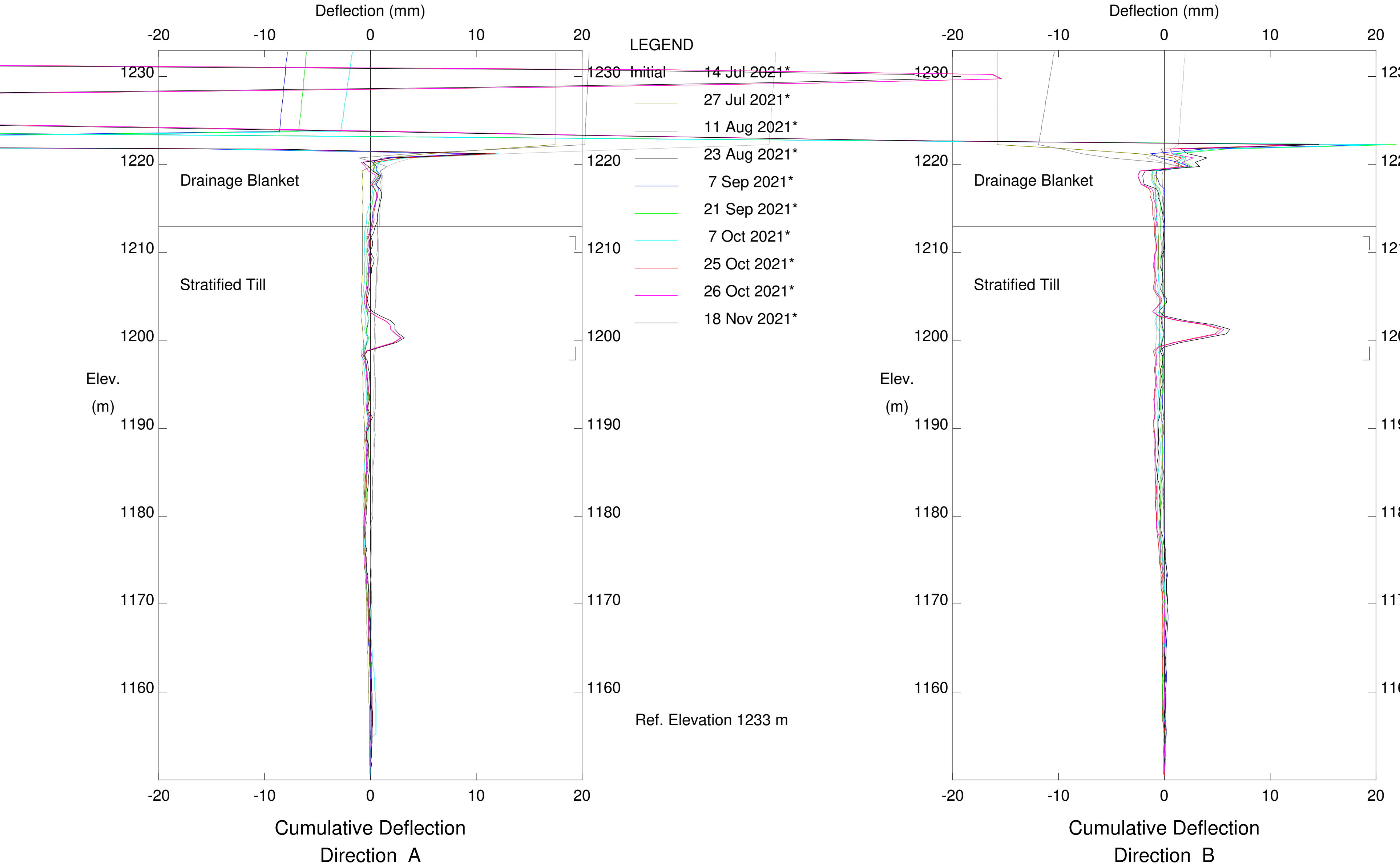


Dam Fill Excluded, Inclinometer 19-3

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

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I19-03.gtl

Highland Valley Copper - Logan Lake, BC

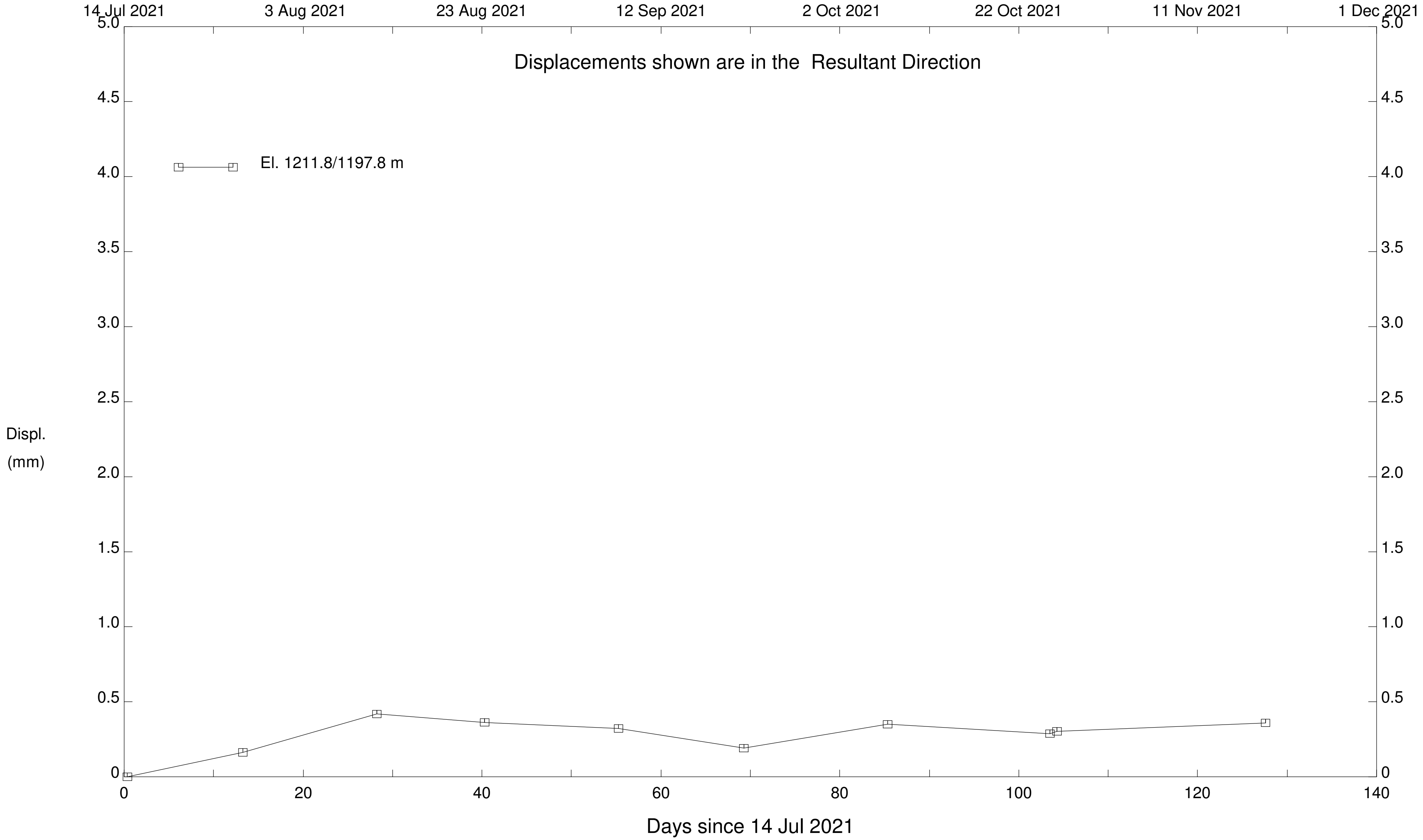


Dam Fill Excluded, Inclinometer 19-3

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

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I19-03.gtl

Highland Valley Copper - Logan Lake, BC

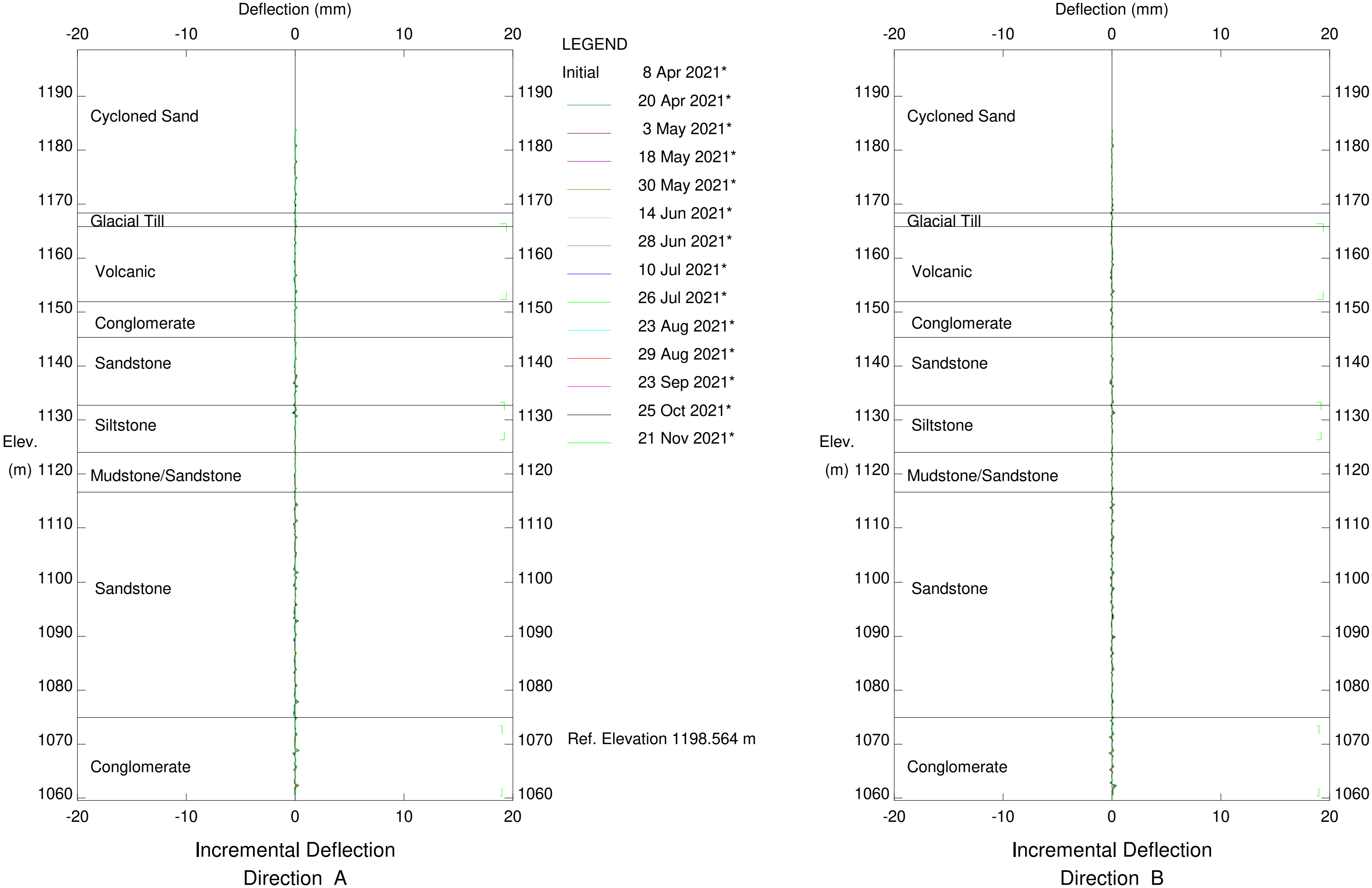


Dam Fill Excluded, Inclinometer 19-3

North Dam Bedrock

I19-08

Highland Valley Copper - Logan Lake, BC

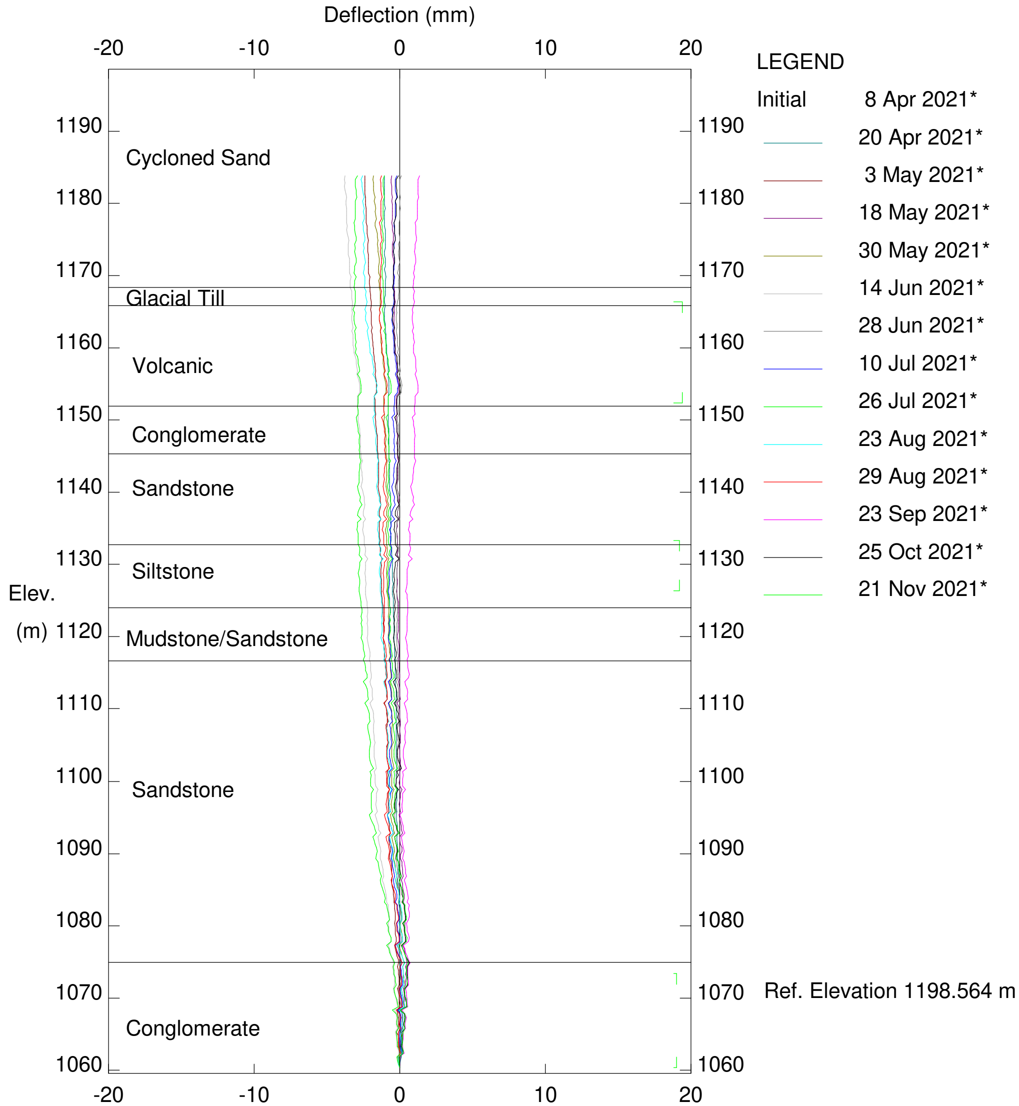


Dam Fill Excluded, Inclinometer I19-08

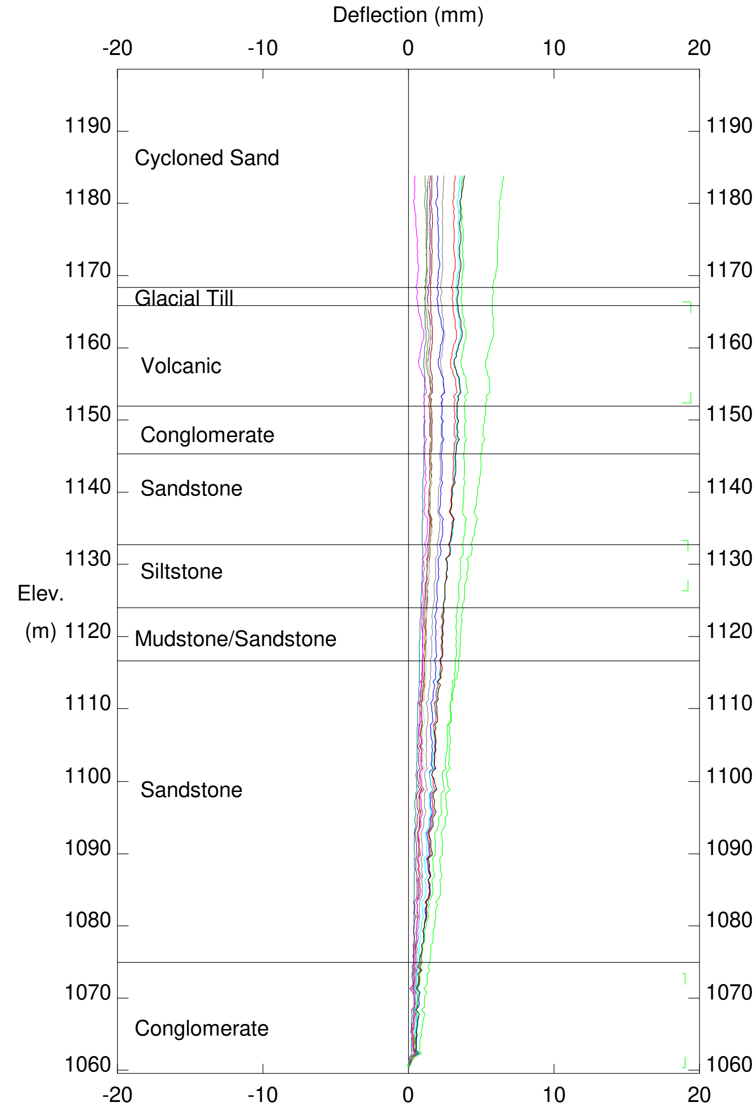
Sets marked * include zero shift and/or rotation corrections.

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I19-08.gtl

Highland Valley Copper - Logan Lake, BC



Cumulative Deflection
Direction A

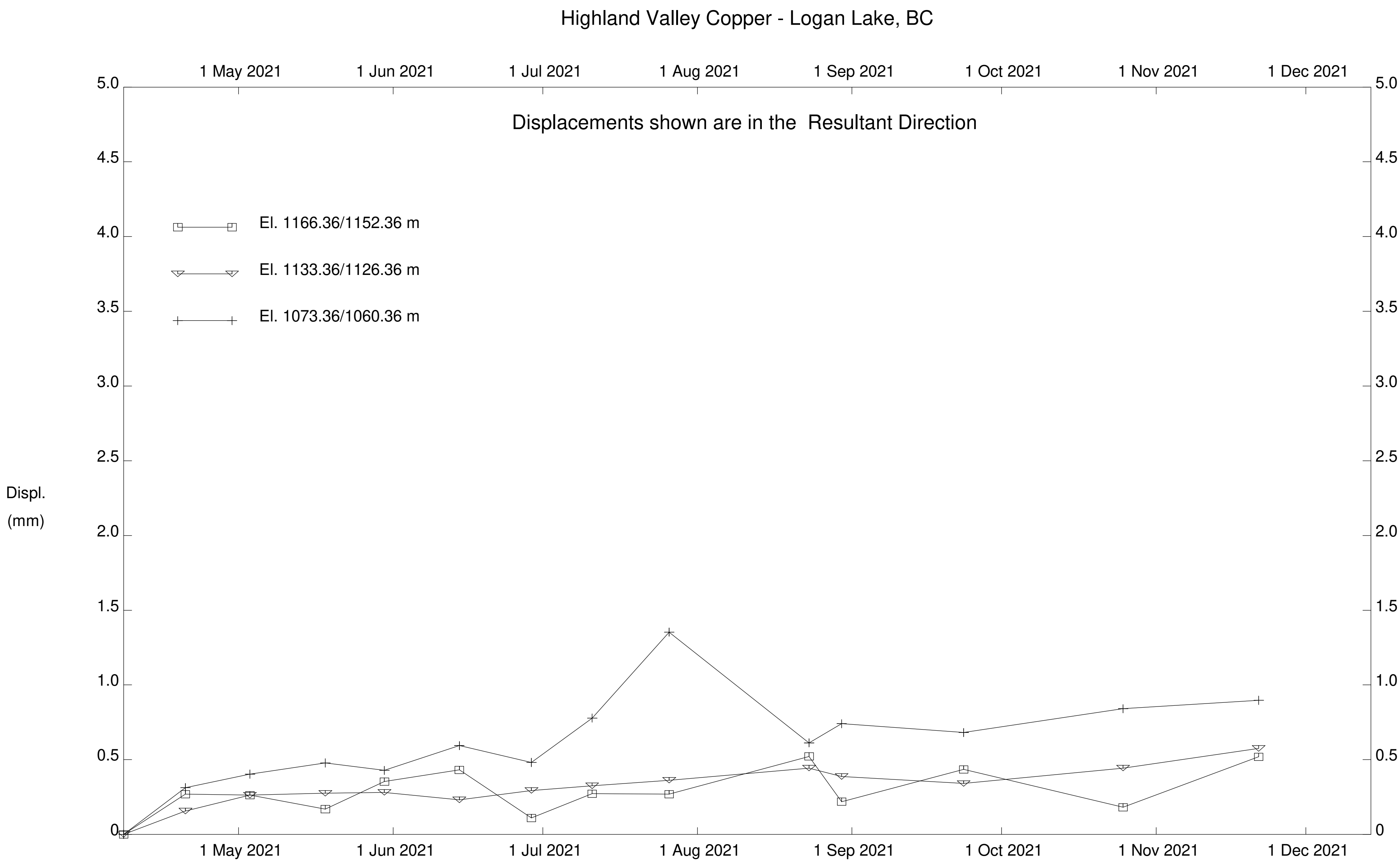


Cumulative Deflection
Direction B

Dam Fill Excluded, Inclinometer I19-08

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

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I19-08.gtl

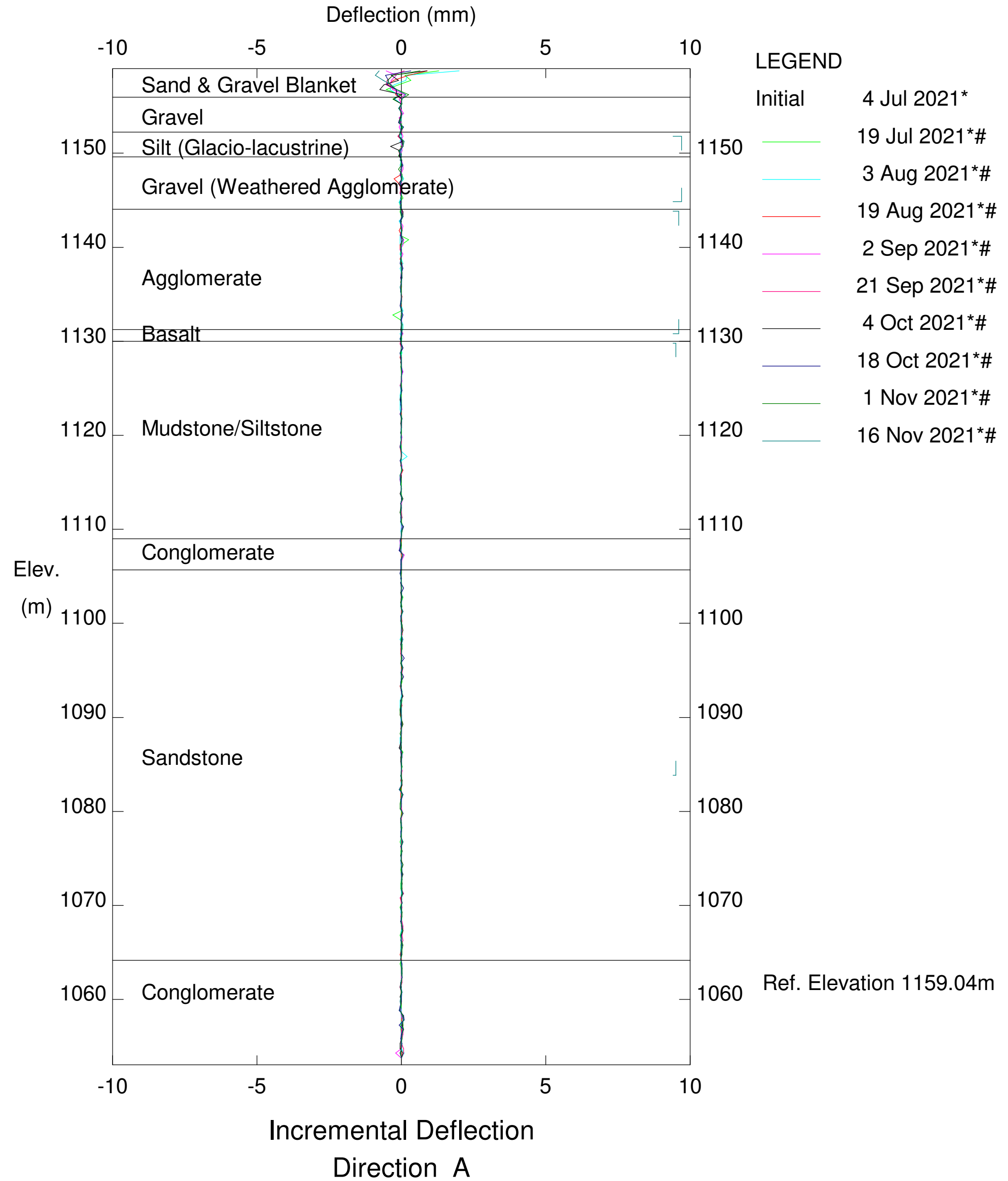


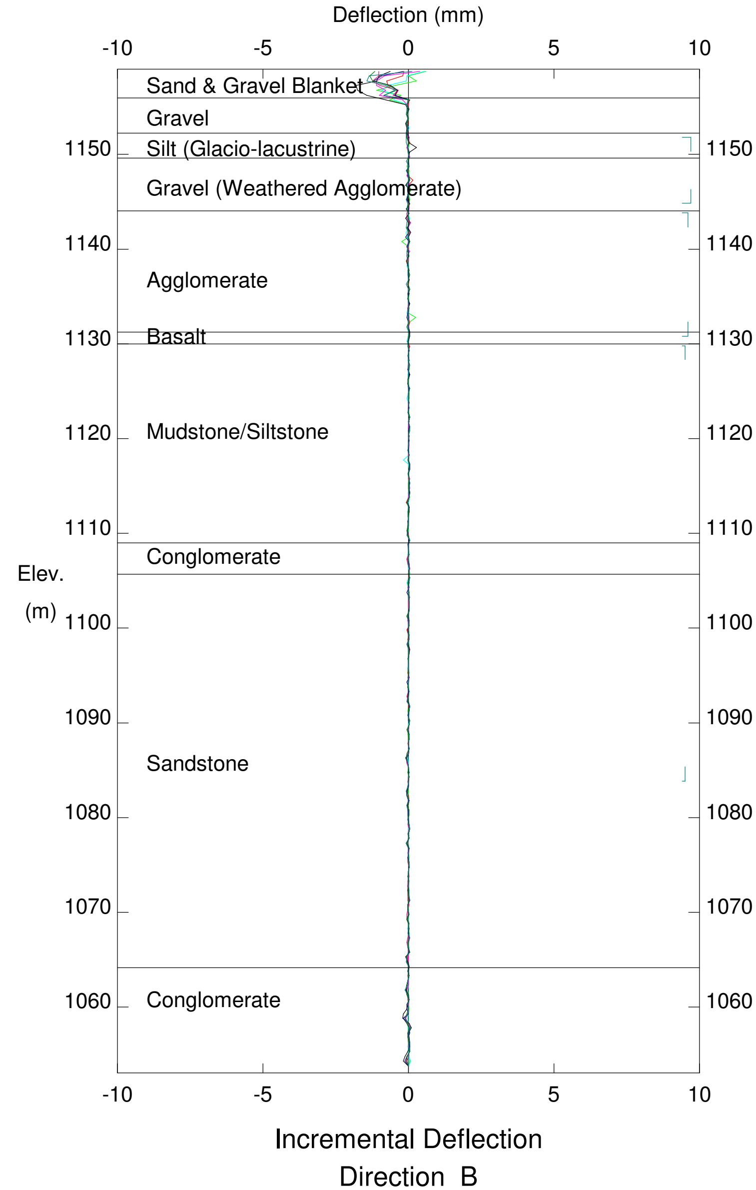
Dam Fill Excluded, Inclinometer I19-08

North Buttress Berm

I10-12

Highland Valley Copper - Logan Lake, BC





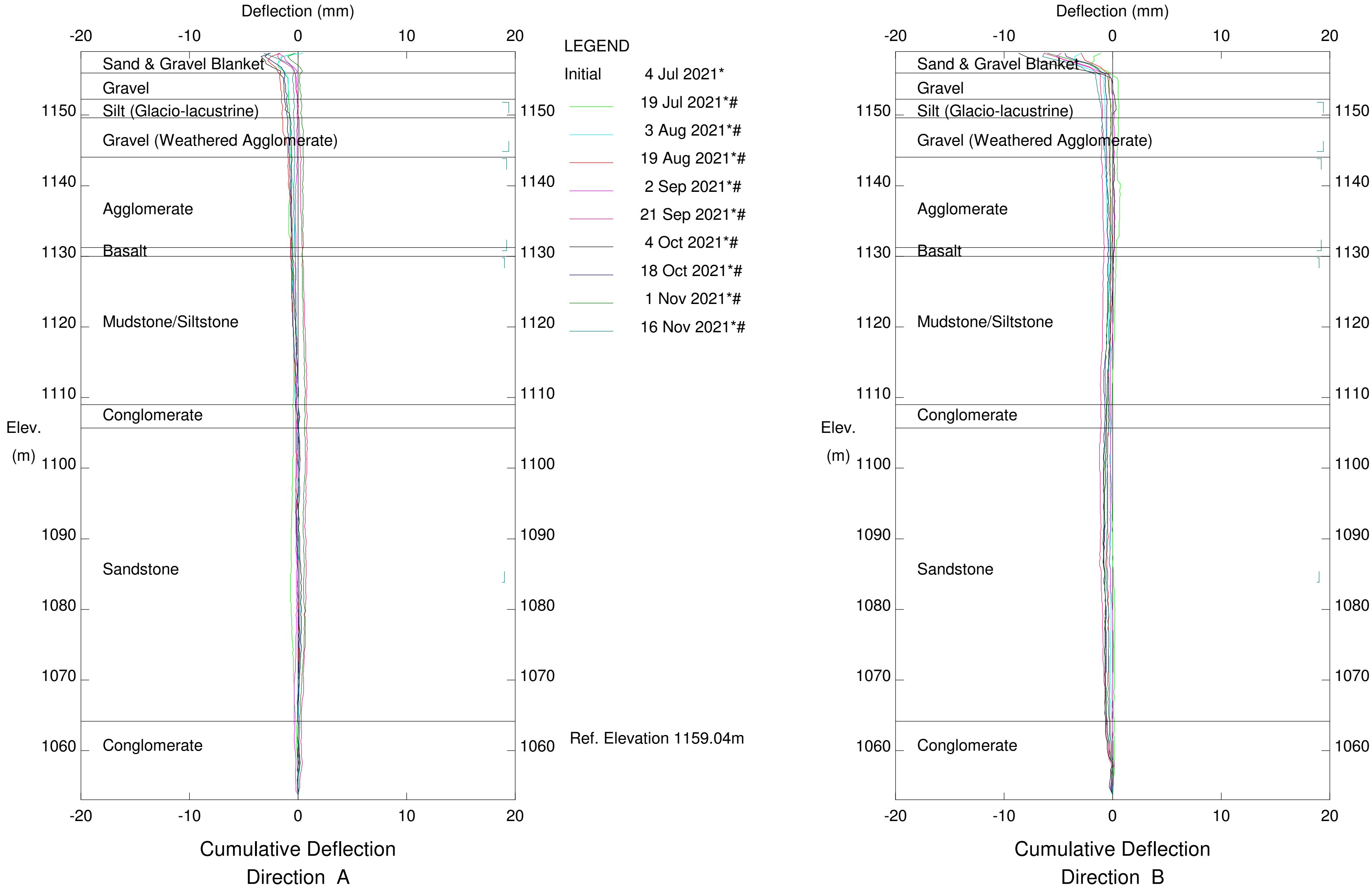
LL Dam - Dam fill excluded,,,, Inclinometer I10-12,,

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

Sets marked # corrected for casing compression

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I10-12.gtl

Highland Valley Copper - Logan Lake, BC

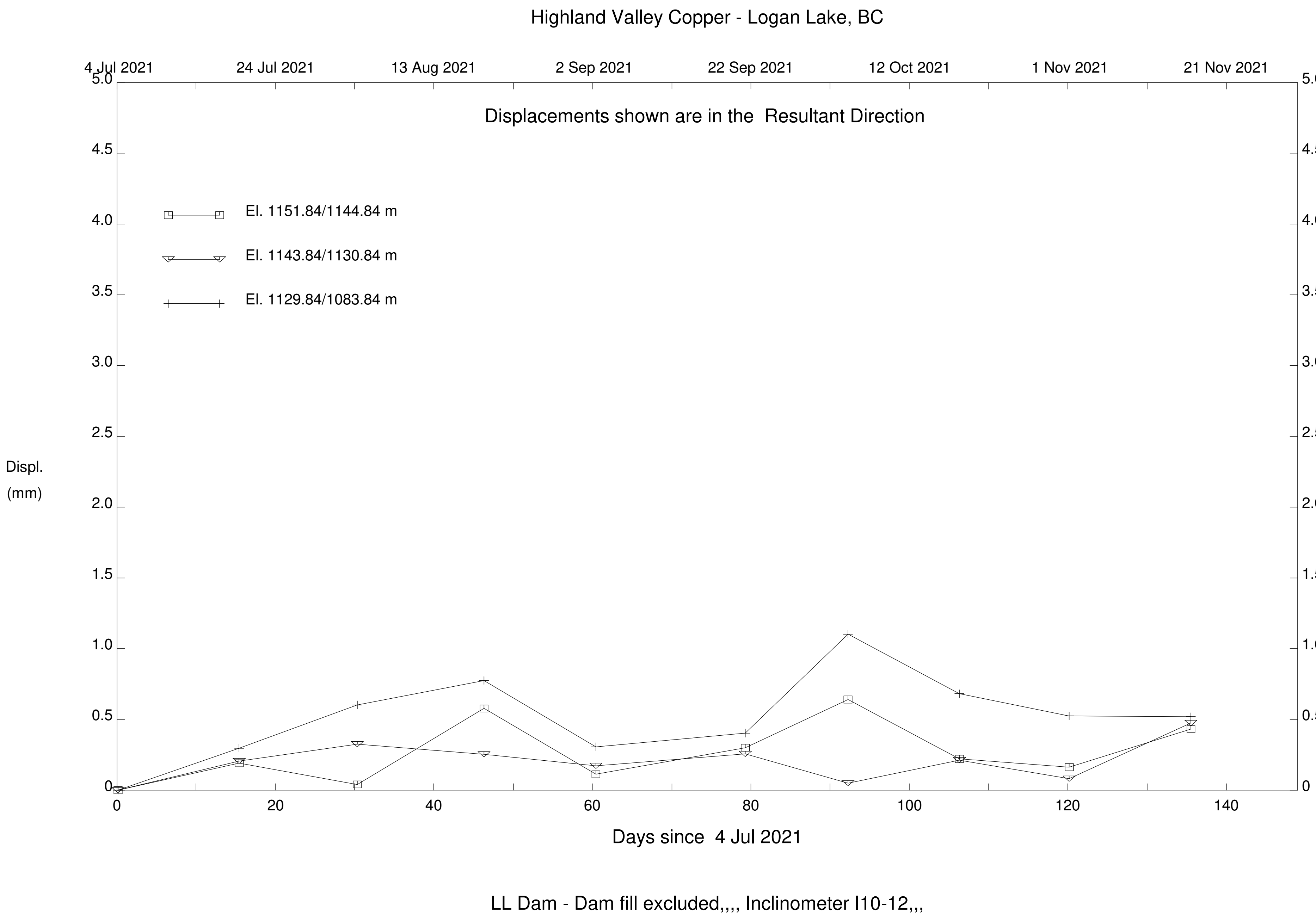


LL Dam - Dam fill excluded,,,, Inclinometer I10-12,,,

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

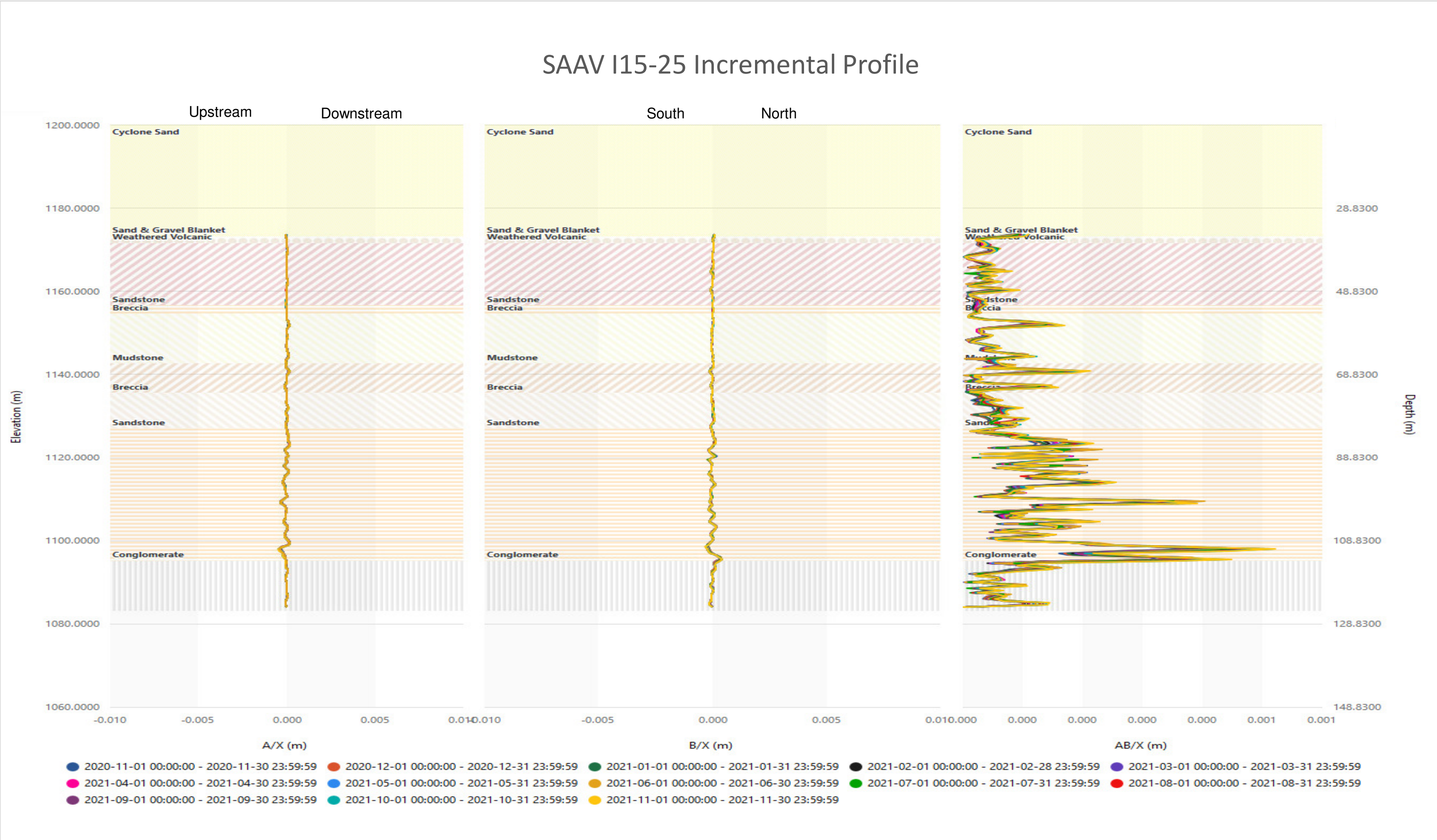
Sets marked # corrected for casing compression

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I10-12.gtl

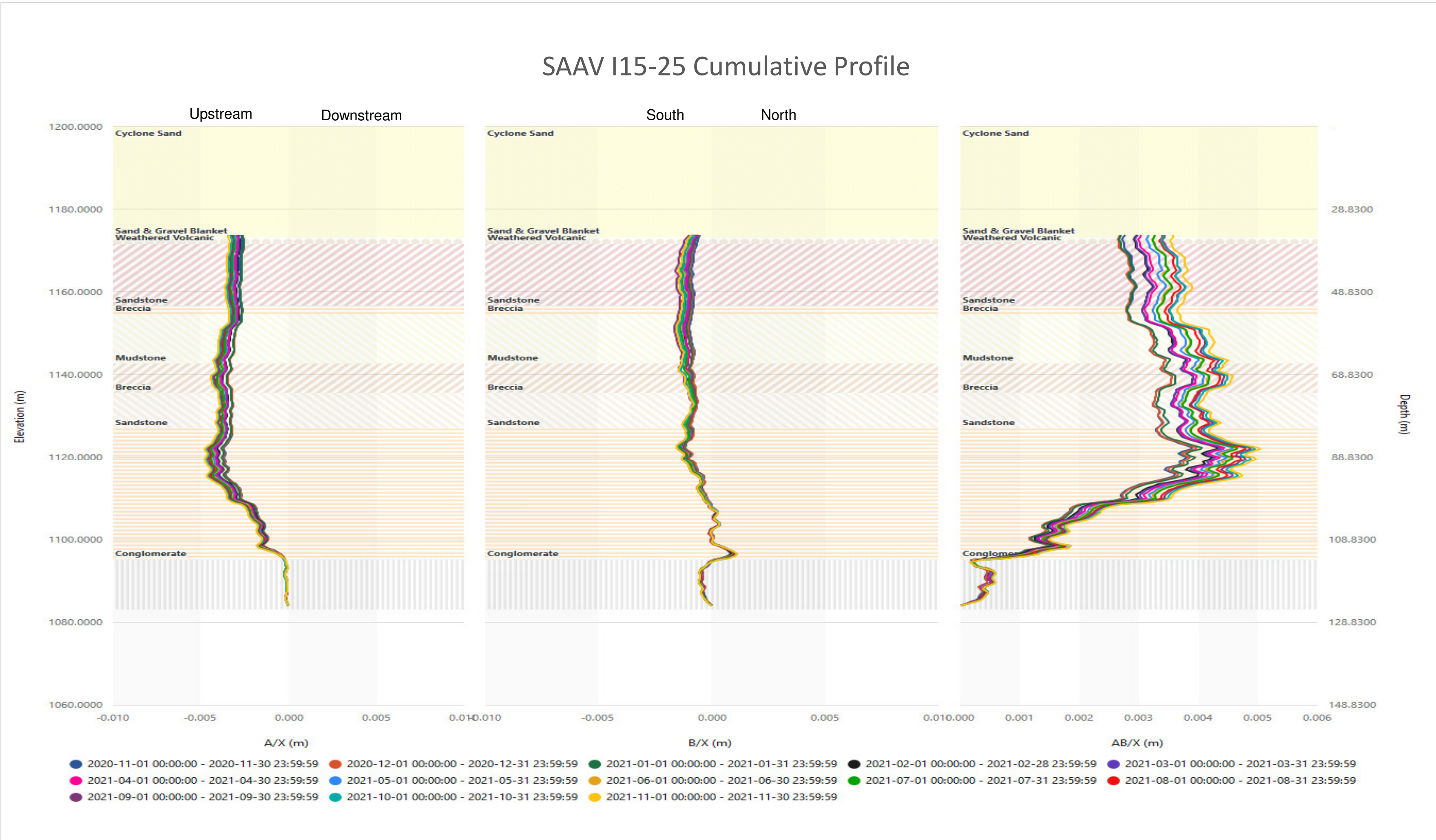

Highland Valley Copper - Logan Lake, BC
4 Jul 2021
24 Jul 2021
13 Aug 2021
2 Sep 2021
22 Sep 2021
12 Oct 2021
1 Nov 2021
21 Nov 2021
Displacements shown are in the Resultant Direction
El. 1151.84/1144.84 m
El. 1143.84/1130.84 m
El. 1129.84/1083.84 m
Displ.
(mm)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
0
20
40
60
80
100
120
140
Days since 4 Jul 2021
LL Dam - Dam fill excluded,,,, Inclinometer I10-12,,,

North Buttress Berm

I15-25



SAAV I15-25 Incremental Profile
Upstream
Downstream
South
North
Elevation (m)
Depth (m)
Cyclone Sand
Sand & Gravel Blanket
Weathered Volcanic
Sandstone
Breccia
Mudstone
Breccia
Sandstone
Conglomerate
A/X (m)
B/X (m)
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59



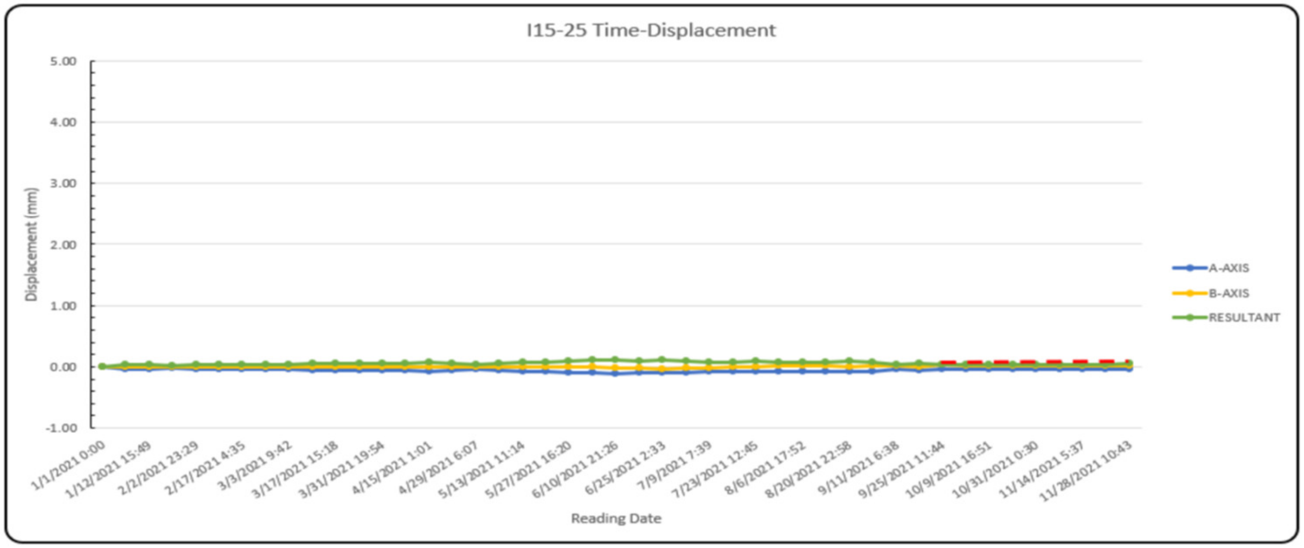
SAAV I15-25 Cumulative Profile
Upstream
Downstream
South
North
Cyclone Sand
Sand & Gravel Blanket
Weathered Volcanic
Sandstone
Breccia
Mudstone
Breccia
Sandstone
Conglomerate
Elevation (m)
Depth (m)
1200.0000
1180.0000
1160.0000
1140.0000
1120.0000
1100.0000
1080.0000
1060.0000
28.8300
48.8300
68.8300
88.8300
108.8300
128.8300
148.8300
-0.010 -0.005 0.000 0.005 0.010
A/X (m)
-0.010 -0.005 0.000 0.005 0.010
B/X (m)
0.000 0.001 0.002 0.003 0.004 0.005 0.006
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59

SAAV I15-25

Displacement Plot – Volcanic

Unit	Upper El.(m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Volcanic	**1169.0**	**1159.0**	**1.0**	**0**
Mudstone	1157.5	1084.0	0.5	

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

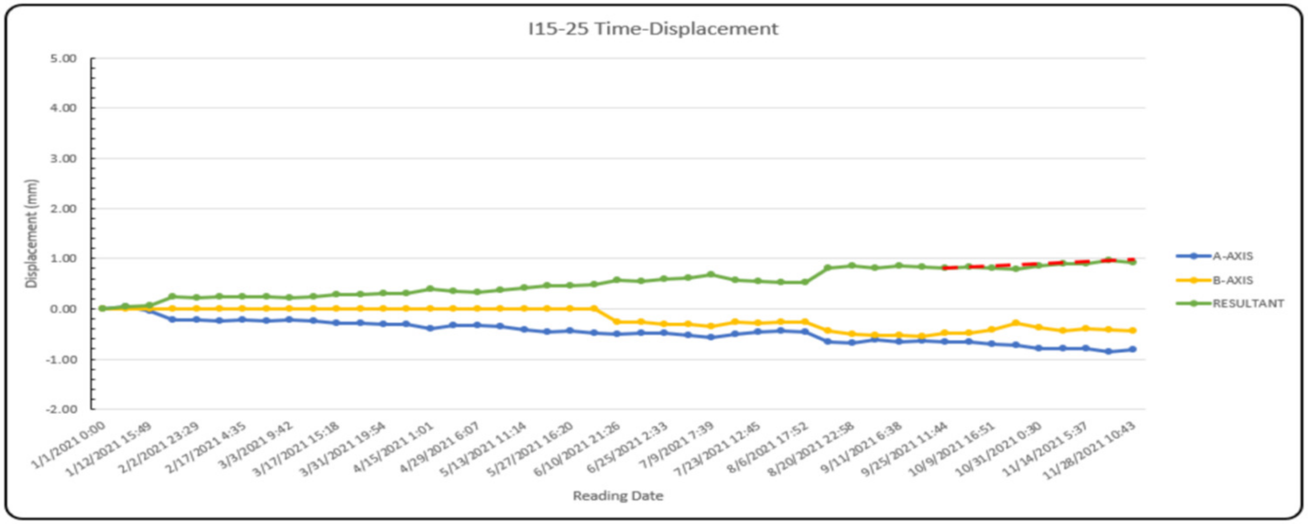


SAAV I15-25

Displacement Plot – Mudstone

Unit	Upper El.(m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Volcanic	1169.0	1159.0	1.0	
Mudstone	**1157.5**	**1084.0**	**0.5**	**0.05**

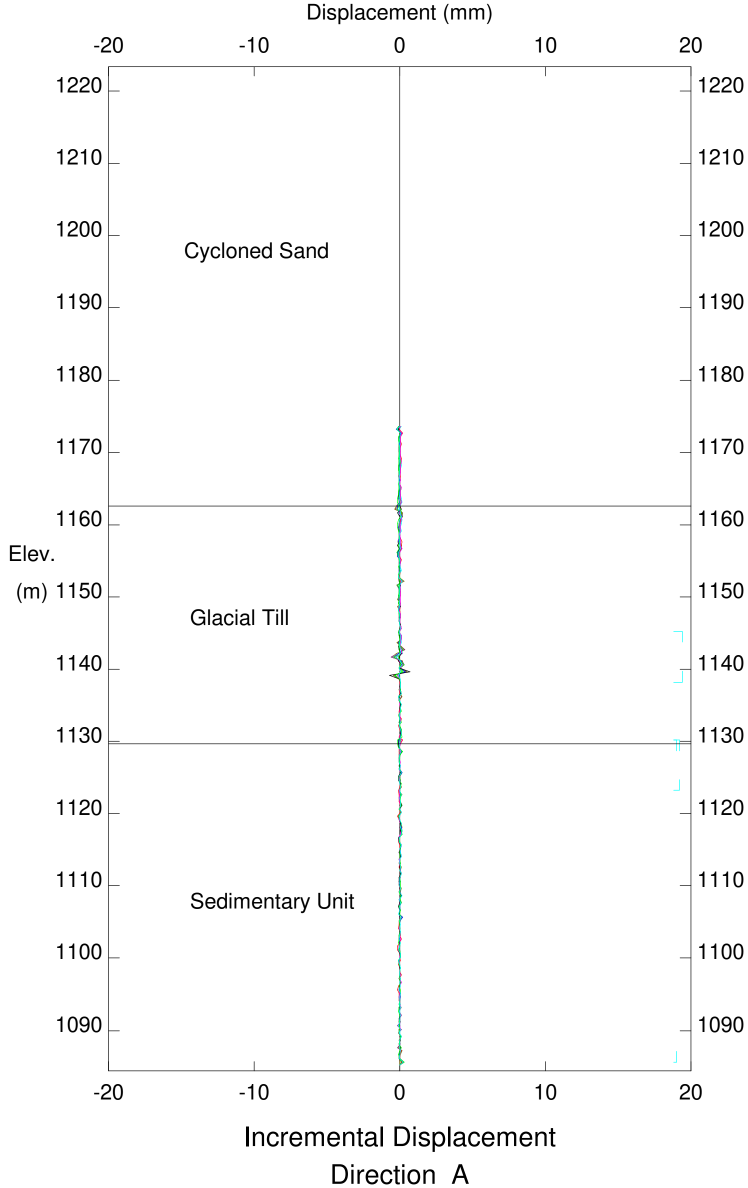
Upper El.(m)	1157.5
Lower El. (m)	1084.0



North Buttress Berm

I17-22

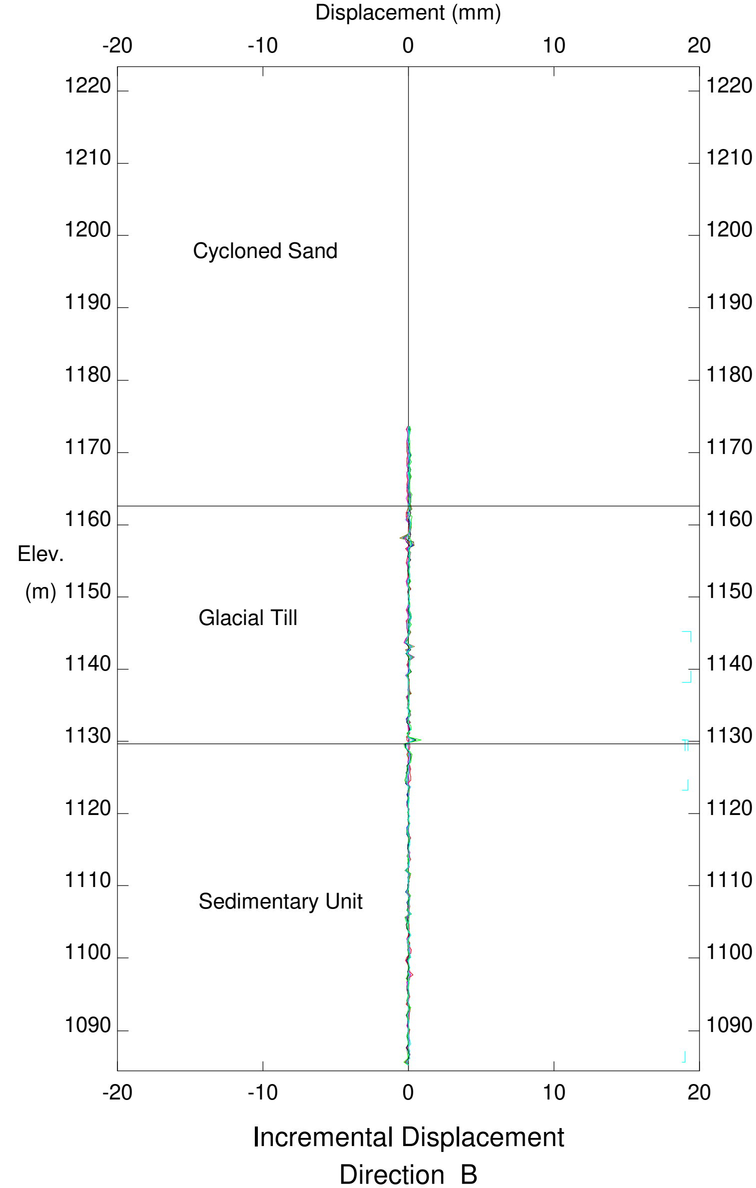
Highland Valley Copper - BC



LEGEND

Initial	1 Apr 2021*
	15 Apr 2021*#
	27 Apr 2021*#
	9 May 2021*#
	22 May 2021*#
	7 Jun 2021*#
	20 Jun 2021*#
	5 Jul 2021*#
	20 Jul 2021*#
	9 Aug 2021*#
	9 Sep 2021*#
	12 Oct 2021*#
	9 Nov 2021*#

Ref. Elevation 1223.4m



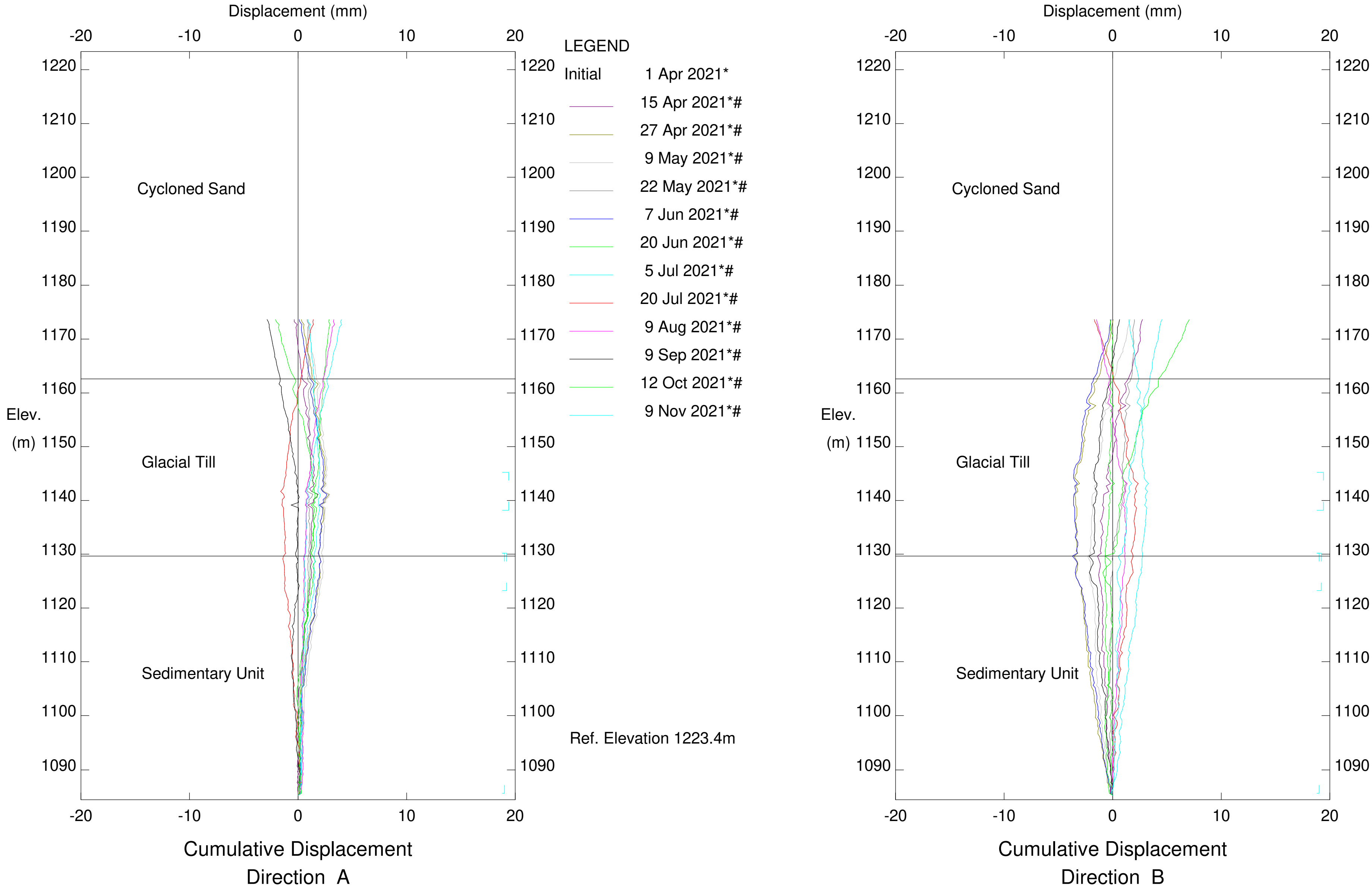
LL Dam - Dam fill excluded,,,, Inclinometer I17-22,,,

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

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I17-22.gtl

Sets marked # corrected for casing compression

Highland Valley Copper - BC



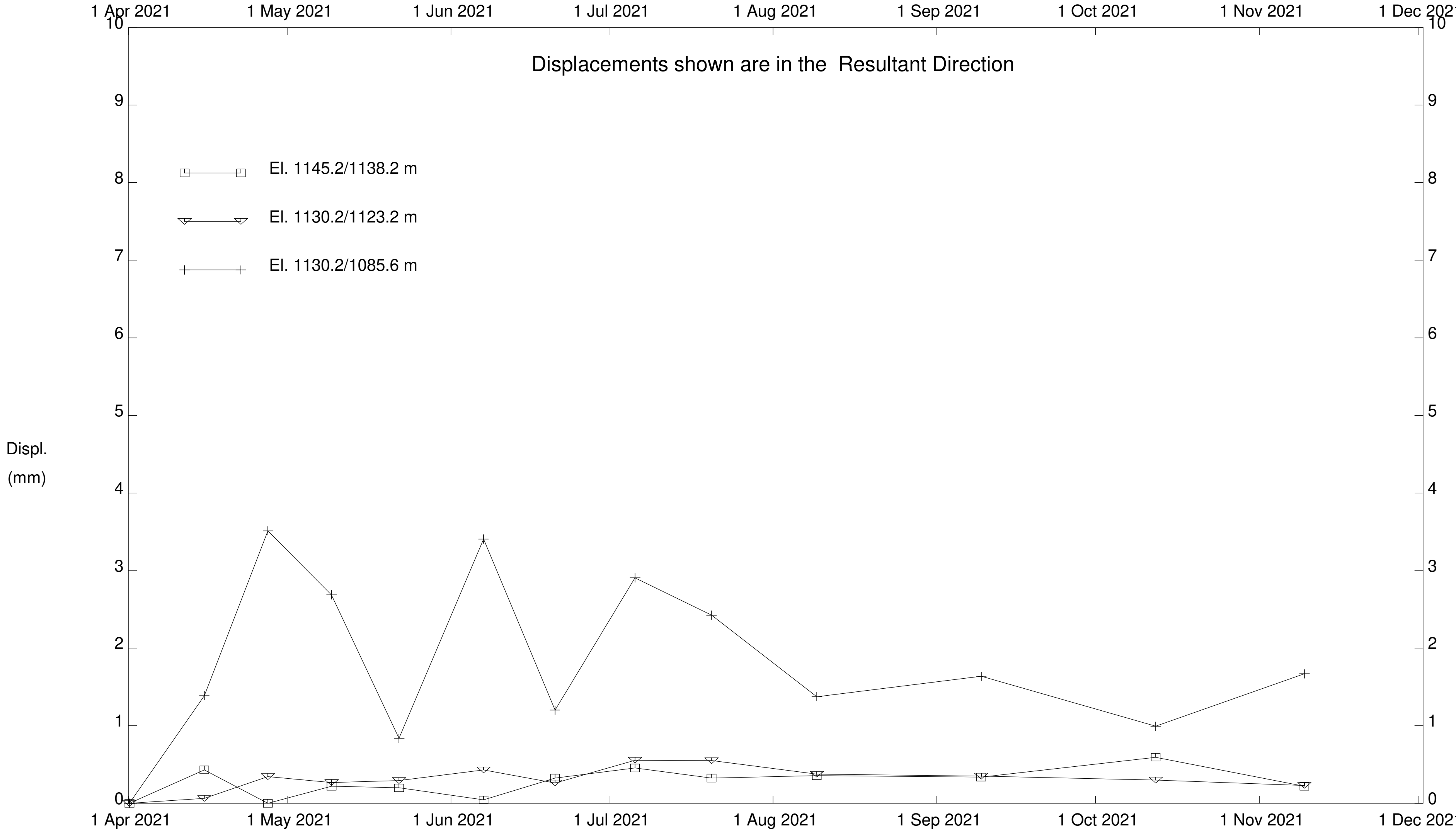
LL Dam - Dam fill excluded,,,, Inclinometer I17-22,,,

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

Sets marked # corrected for casing compression

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I17-22.gtl

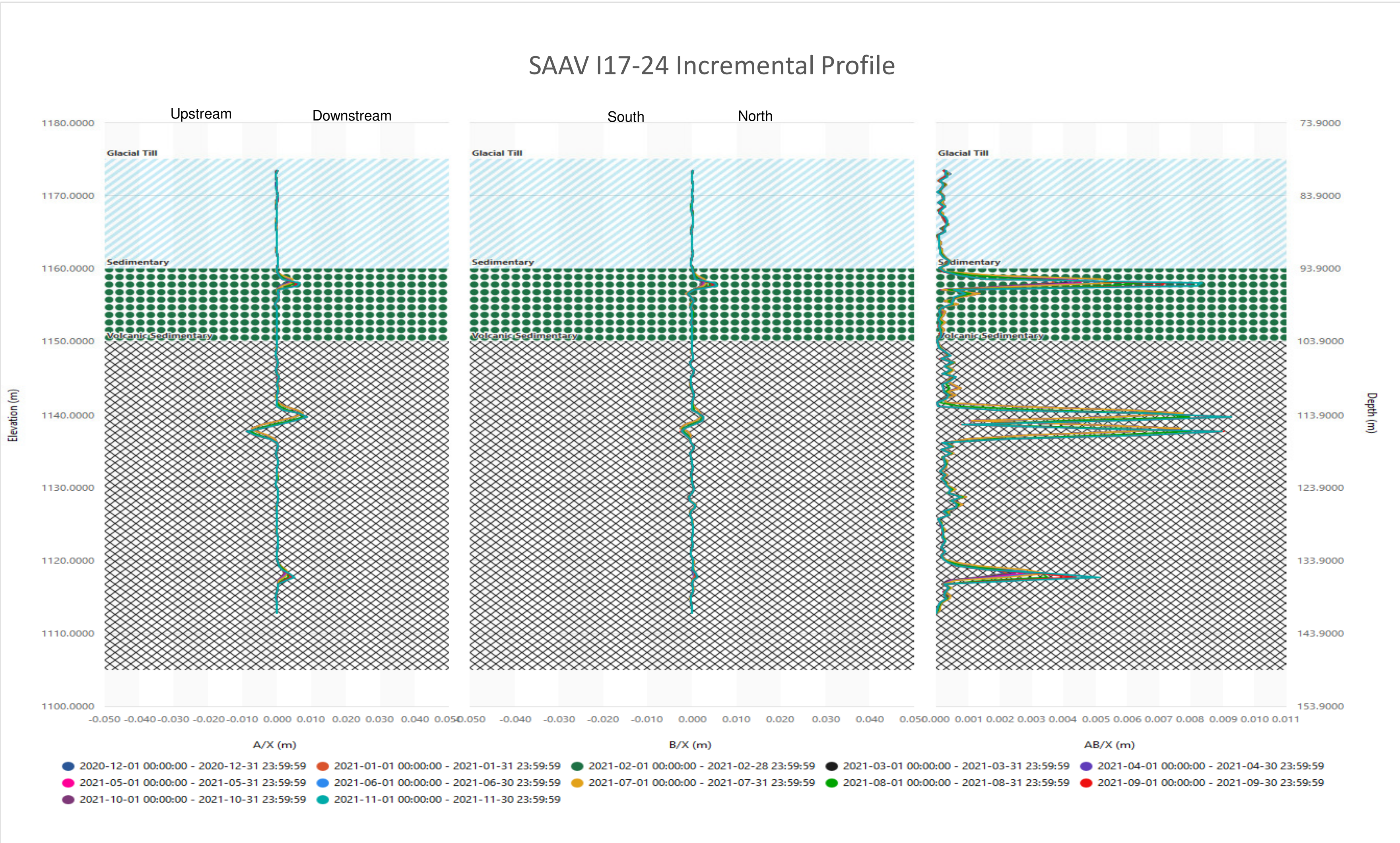
Highland Valley Copper - BC



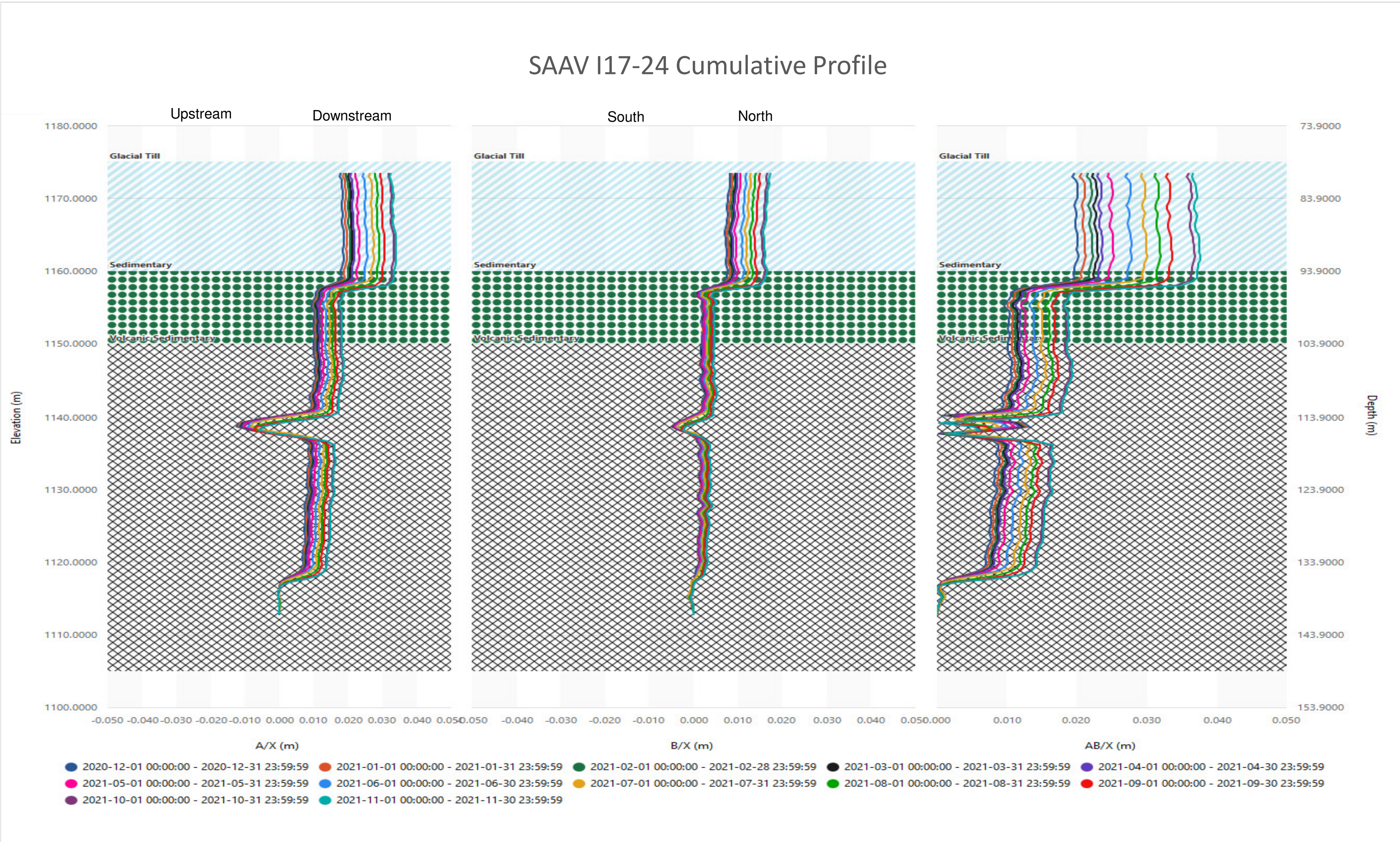
LL Dam - Dam fill excluded,,,, Inclinometer I17-22,,,

North Buttress Berm

SAAV I17-24



SAAV I17-24 Incremental Profile
Upstream
Downstream
South
North
Glacial Till
Sedimentary
Volcanic Sedimentary
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
1180.0000
1170.0000
1160.0000
1150.0000
1140.0000
1130.0000
1120.0000
1110.0000
1100.0000
73.9000
83.9000
93.9000
103.9000
113.9000
123.9000
133.9000
143.9000
153.9000
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59



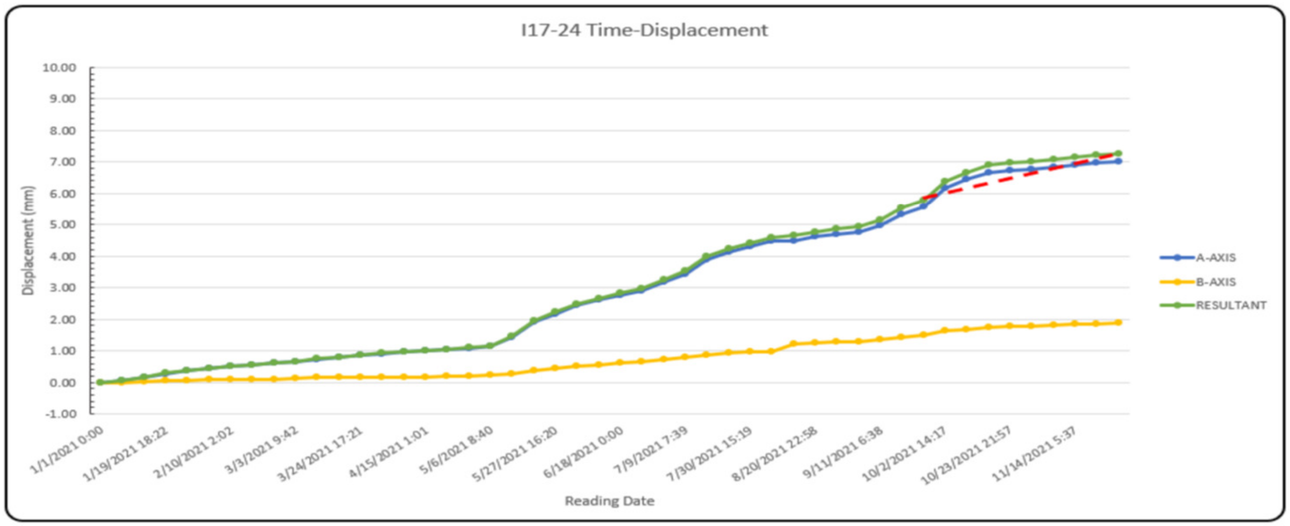
SAAV I17-24 Cumulative Profile
Upstream
Downstream
South
North
Glacial Till
Sedimentary
Volcanic Sedimentary
Elevation (m)
Depth (m)
1180.0000
1170.0000
1160.0000
1150.0000
1140.0000
1130.0000
1120.0000
1110.0000
1100.0000
73.9000
83.9000
93.9000
103.9000
113.9000
123.9000
133.9000
143.9000
153.9000
A/X (m)
B/X (m)
AB/X (m)
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59

SAAV I17-24

Displacement Plot – Lower Sedimentary

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Upper Sedimentary	1159.7	1151.7	3.0	
Sandstone	1141.7	1135.7	-	
Lower Sedimentary	**1120.7**	**1112.7**	**3.0**	**0.74**

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

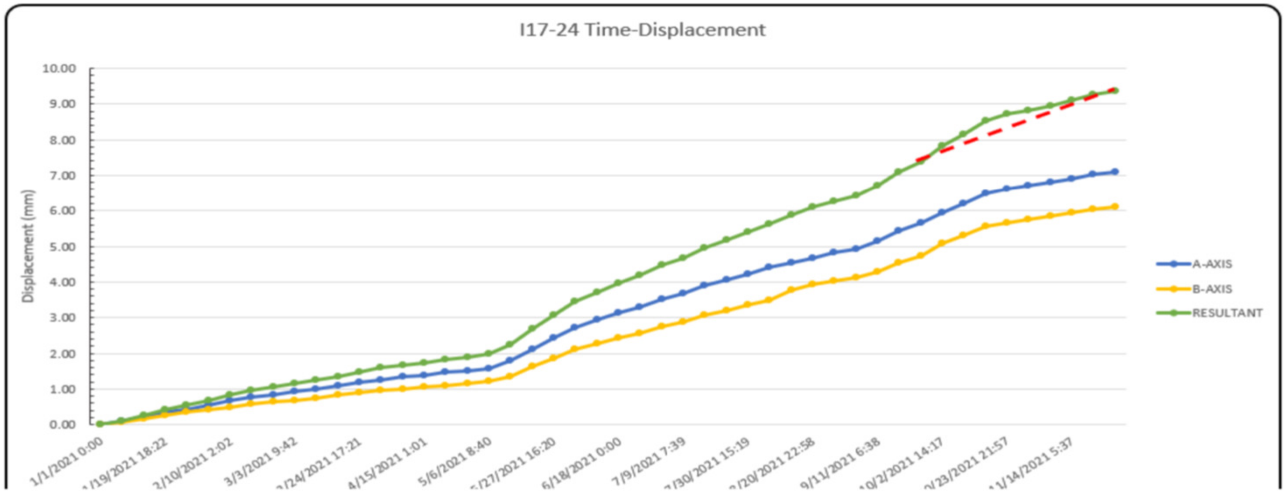


SAAV I17-24

Displacement Plot – Upper Sedimentary

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Upper Sedimentary	**1159.7**	**1151.7**	**3.0**	**0.99**
Sandstone	1141.7	1135.7	-	
Lower Sedimentary	1120.7	1112.7	3.0	

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

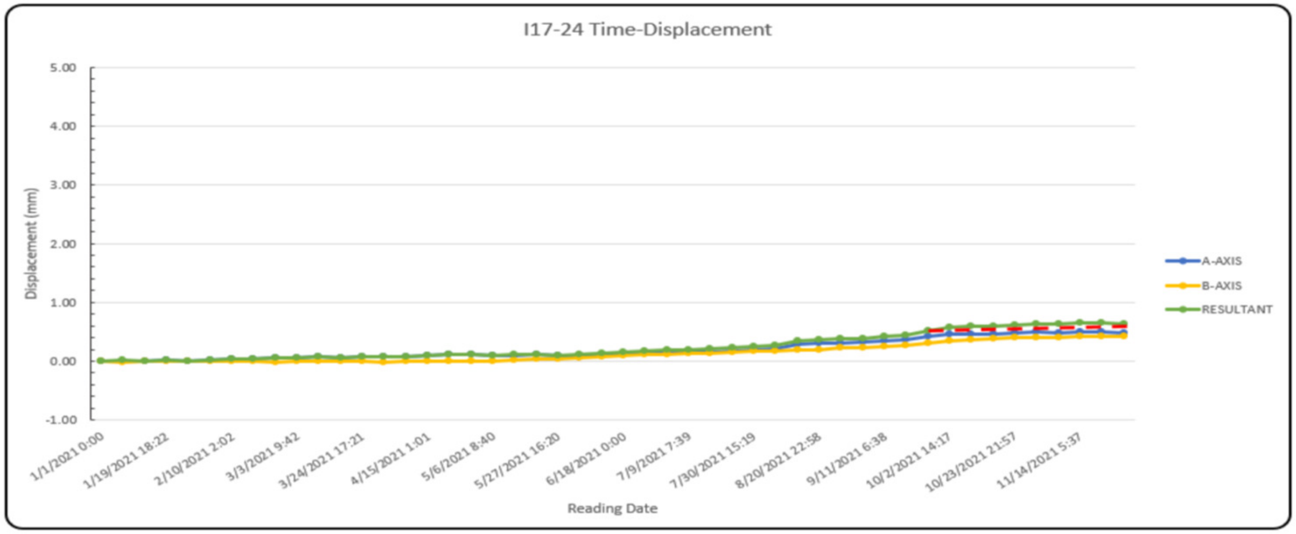


SAAV I17-24

Displacement Plot – Sandstone

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Upper Sedimentary	1159.7	1151.7	3.0	
Sandstone	**1141.7**	**1135.7**	**-**	**0.07**
Lower Sedimentary	1120.7	1112.7	3.0	

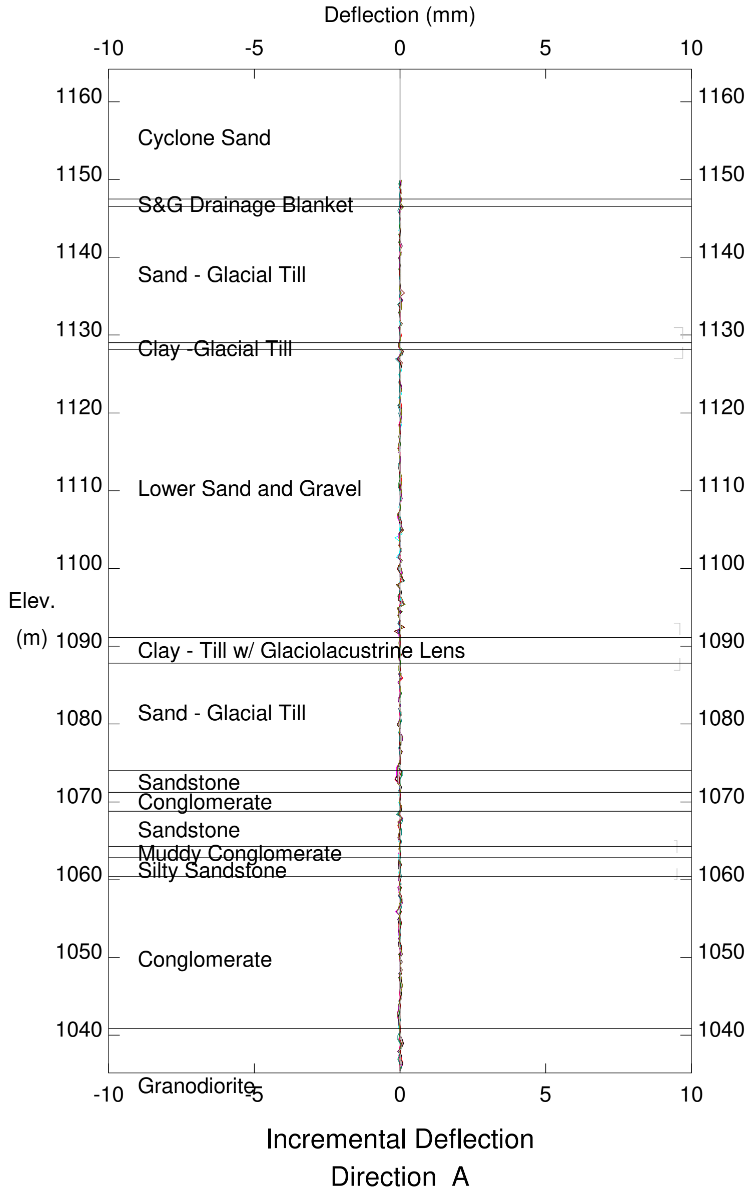
Upper El. (m)	1141.7
Lower El. (m)	1135.7

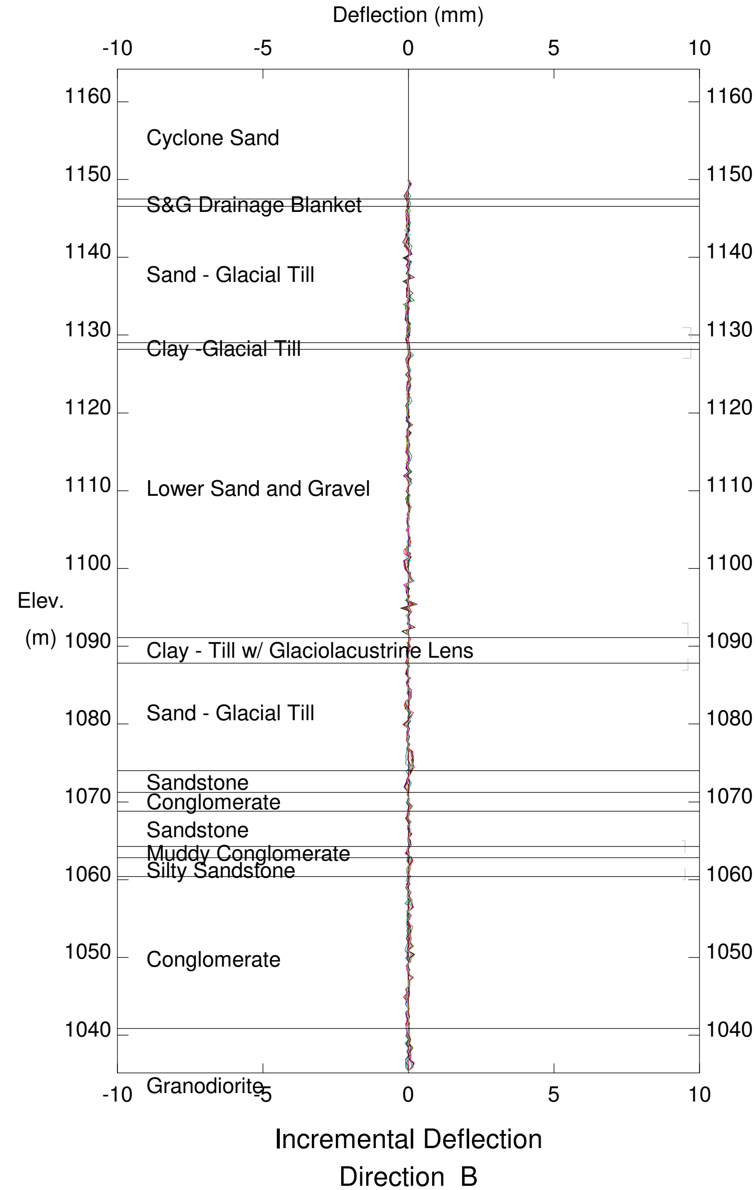


Valley Buttress Berm Extension

I20-01

Highland Valley Copper - Logan Lake, BC





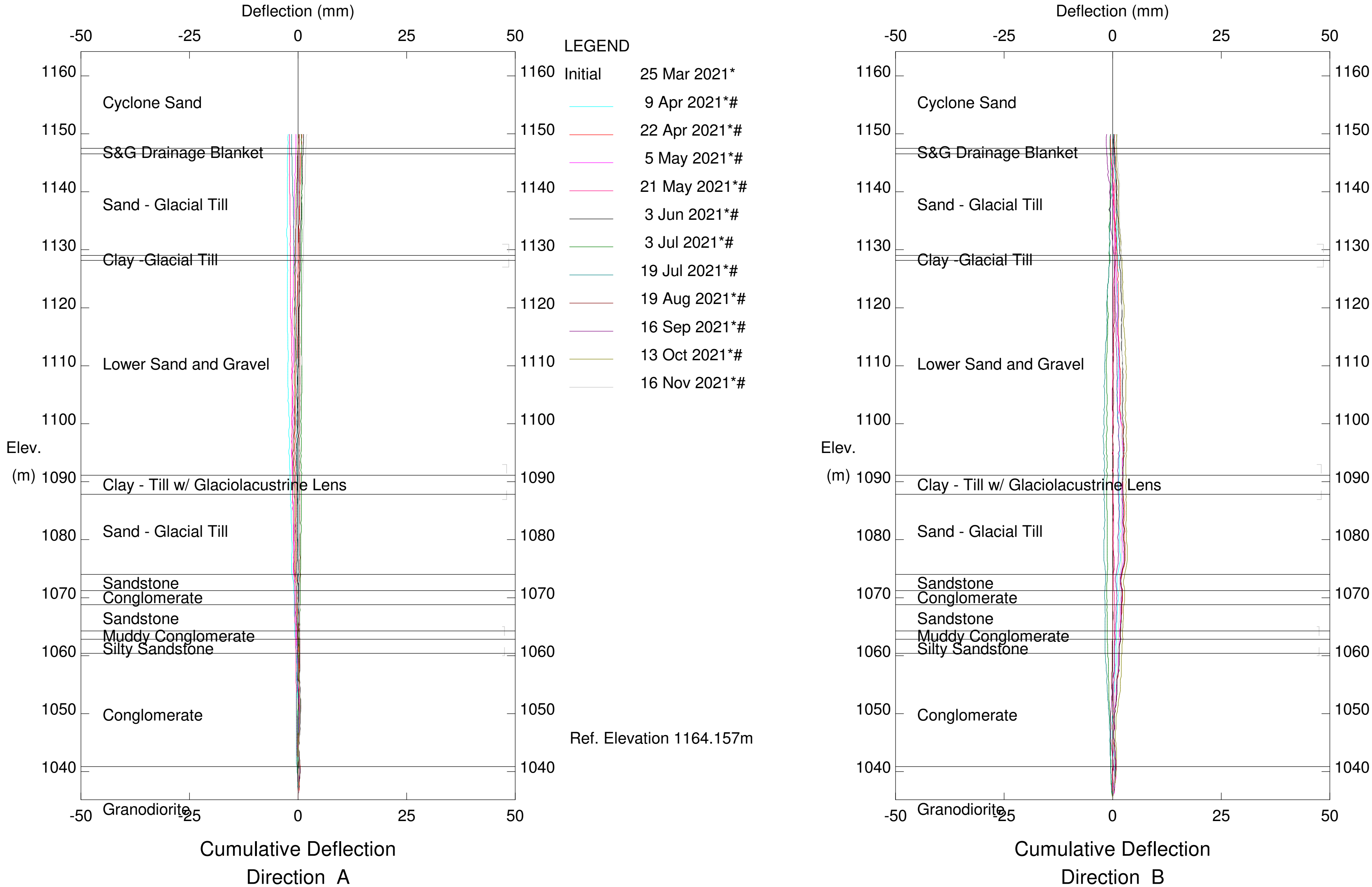
Valley Buttress Berm Extension,,,, Inclinometer I20-01,,,

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

Sets marked # corrected for casing compression

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I20-01,,,.gtl

Highland Valley Copper - Logan Lake, BC



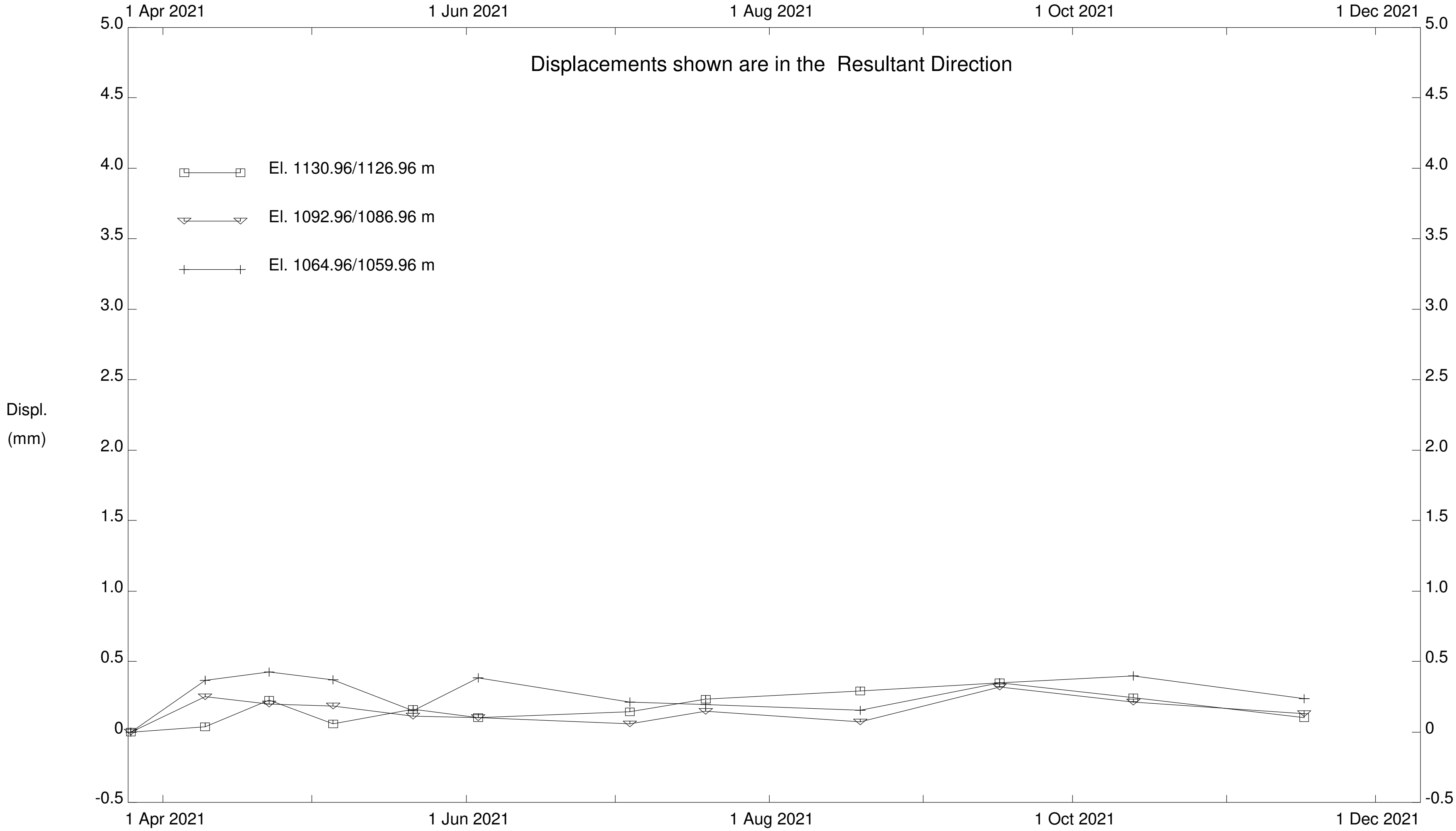
Valley Buttress Berm Extension,,,, Inclinometer I20-01,,,

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

Sets marked # corrected for casing compression

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I20-01,,,.gtl

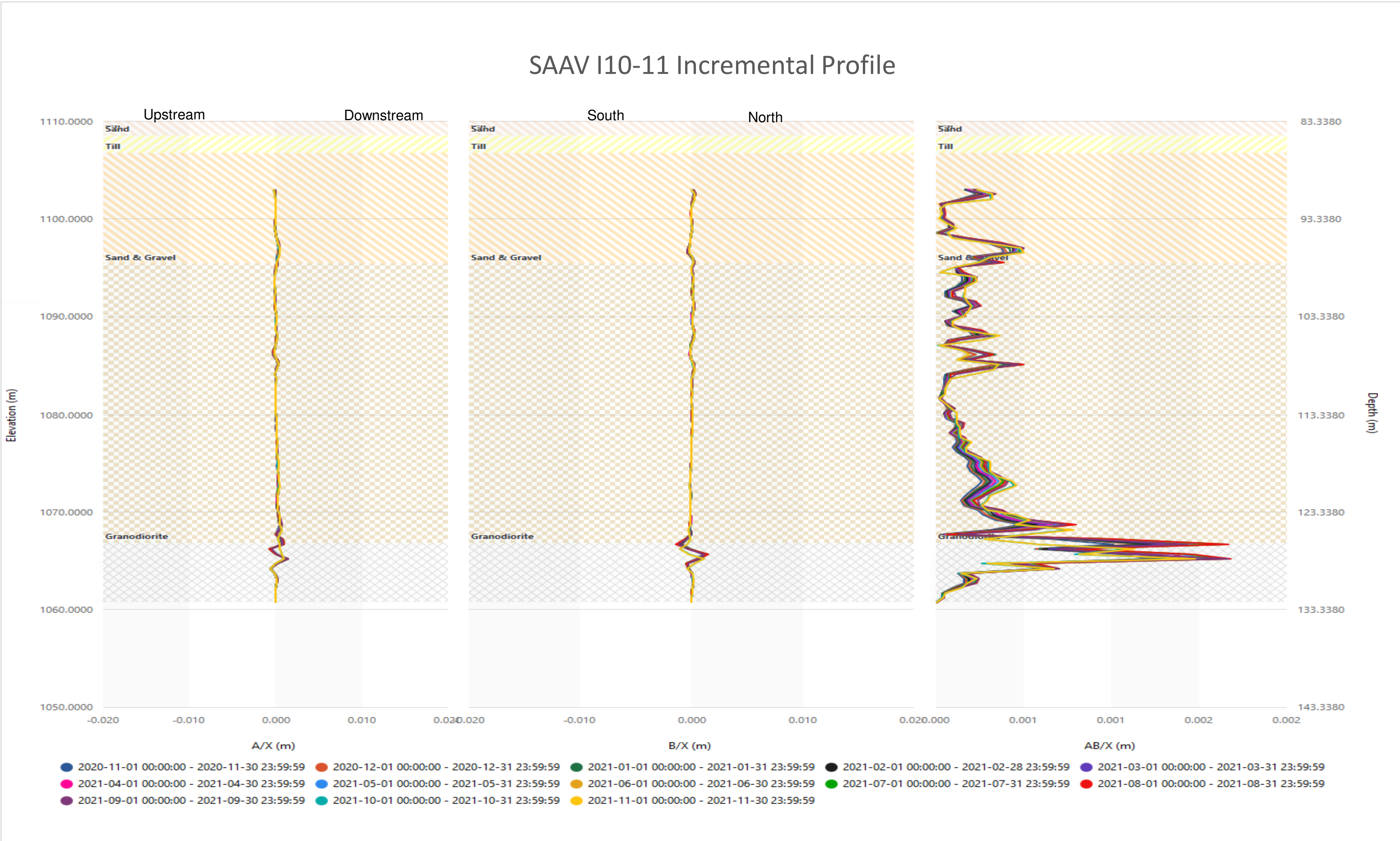
Highland Valley Copper - Logan Lake, BC



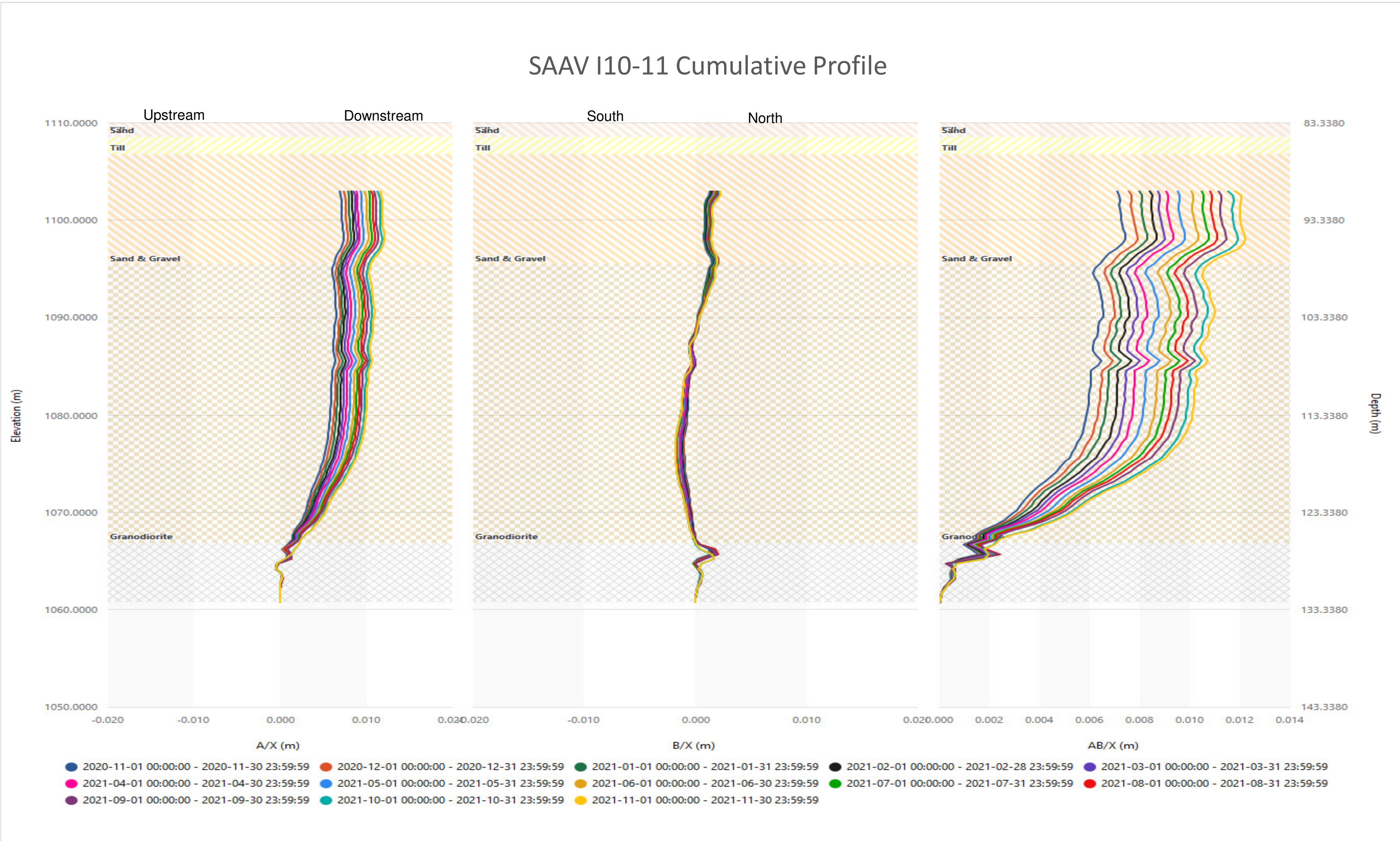
Valley Buttress Berm Extension,,,, Inclinometer I20-01,,,

Valley Buttress Berm Extension

SAAV I10-11



SAAV I10-11 Incremental Profile
Upstream
Downstream
South
North
Sand
Till
Sand & Gravel
Granodiorite
Elevation (m)
Depth (m)
1110.0000
1100.0000
1090.0000
1080.0000
1070.0000
1060.0000
1050.0000
83.3380
93.3380
103.3380
113.3380
123.3380
133.3380
143.3380
-0.020
-0.010
0.000
0.010
0.020
0.001
0.002
A/X (m)
B/X (m)
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59



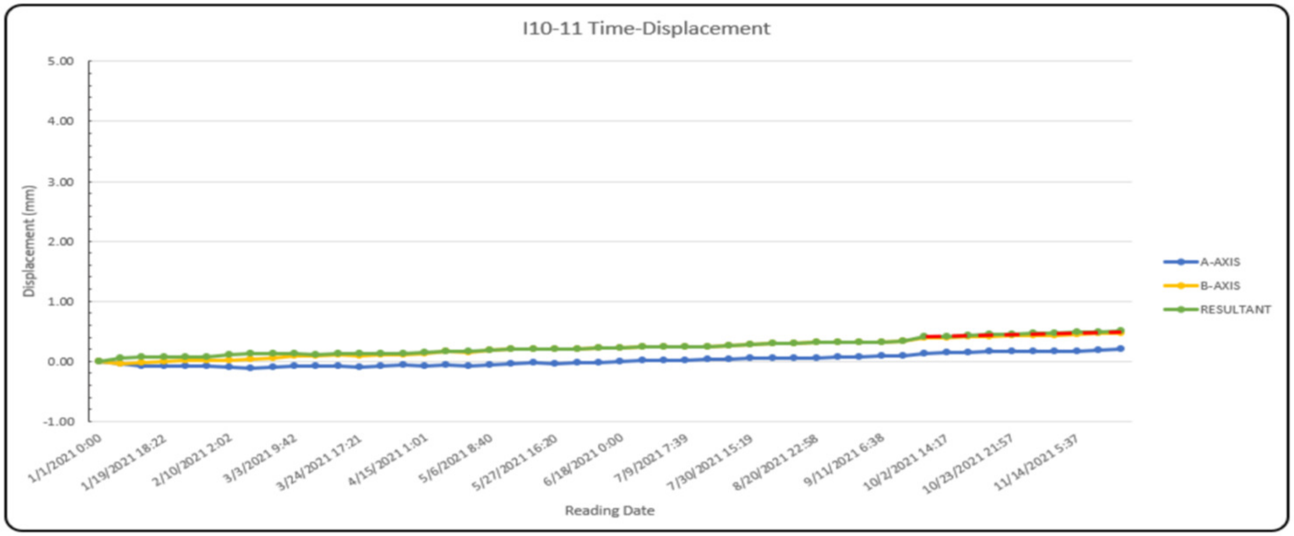
SAAV I10-11 Cumulative Profile
Upstream
Downstream
South
North
Sand
Till
Sand & Gravel
Granodiorite
Elevation (m)
Depth (m)
1110.0000
1100.0000
1090.0000
1080.0000
1070.0000
1060.0000
1050.0000
83.3380
93.3380
103.3380
113.3380
123.3380
133.3380
143.3380
-0.020
-0.010
0.000
0.010
0.020
0.002
0.004
0.006
0.008
0.012
0.014
A/X (m)
B/X (m)
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59

SAAV I10-11

Displacement Plot – Sand & Gravel

Unit	Upper El. (m)	Lower El. (m)	NL	Rate (mm/month)
Sand and Gravel	**1087.8**	**1081.8**	**1.0**	**0.05**
Granodiorite	1068.8	1059.3	1.0	

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

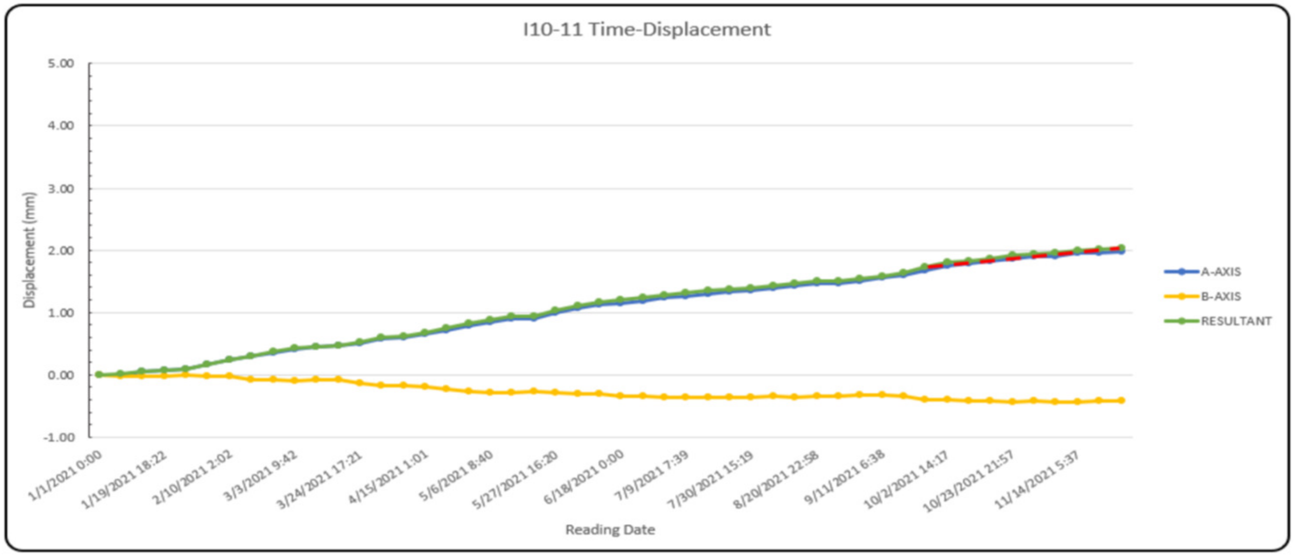


SAAV I10-11

Displacement Plot – Volcanic

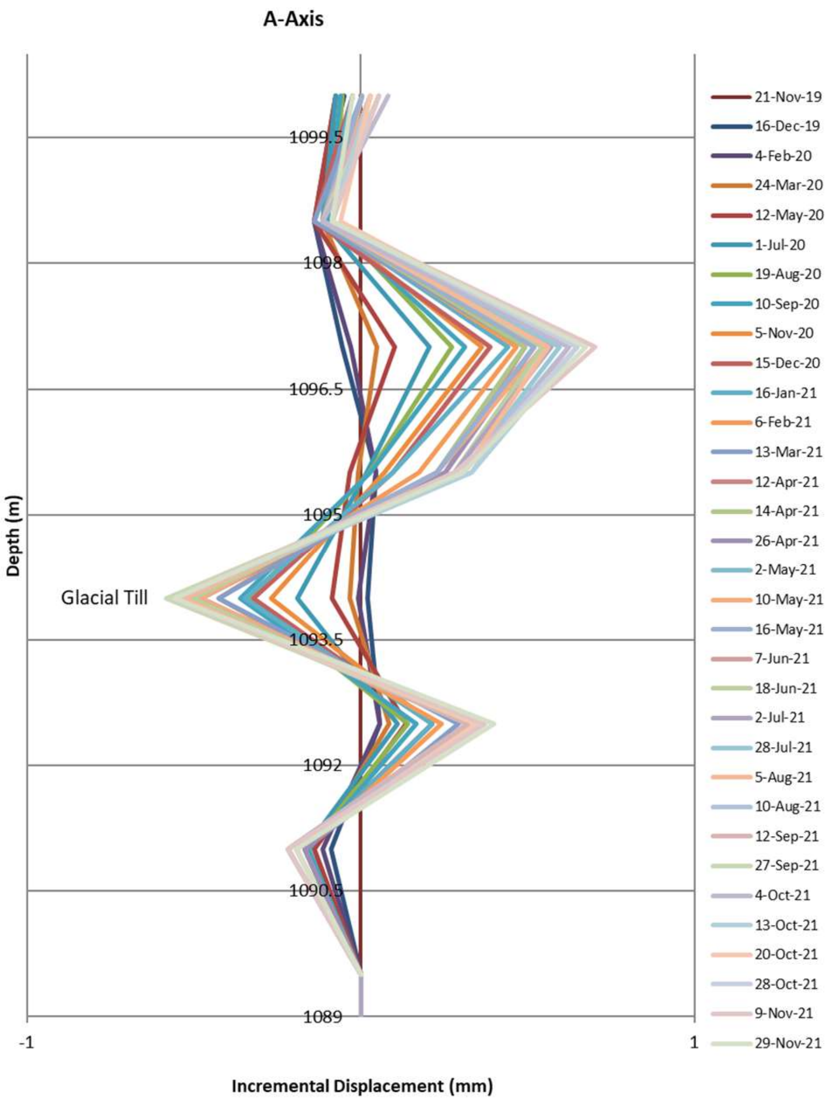
Unit	Upper El. (m)	Lower El. (m)	NL	Rate (mm/month)
Sand and Gravel	1087.8	1081.8	1.0	
Granodiorite	**1068.8**	**1059.3**	**1.0**	**0.15**

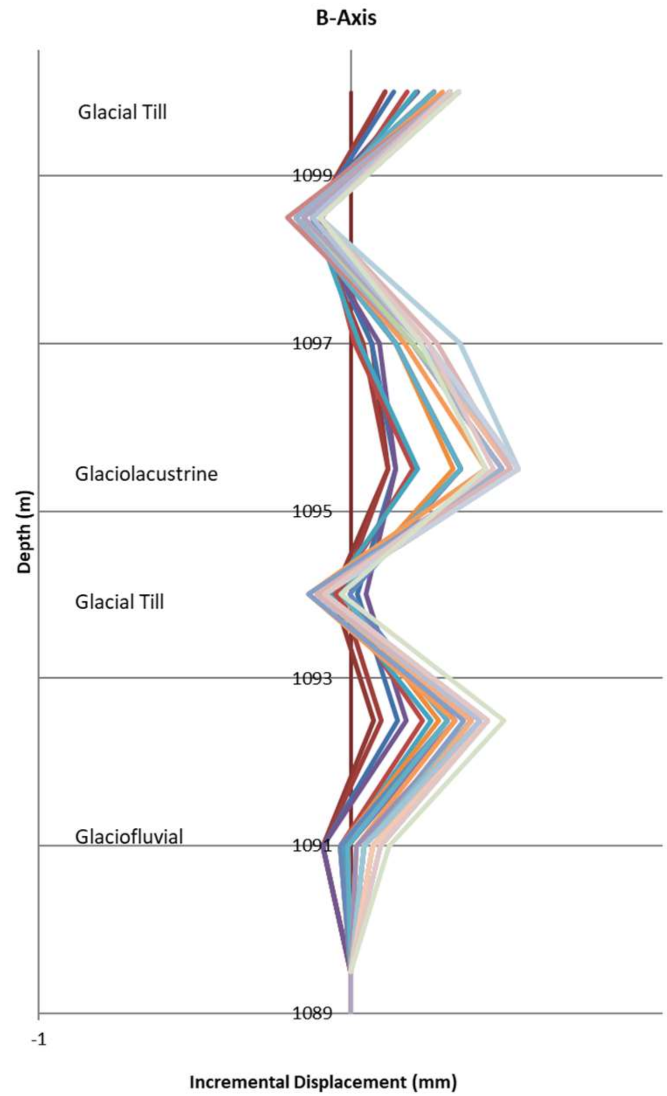
Upper El. (m)	1068.8
Lower El. (m)	1059.3

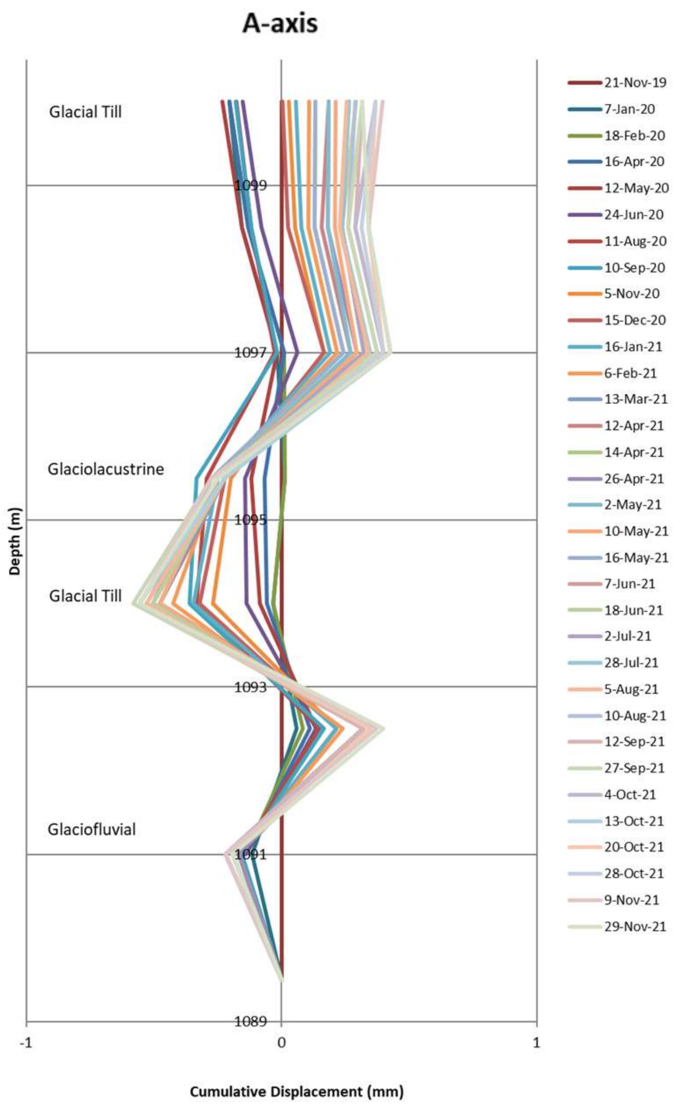


Valley Buttress Berm Extension

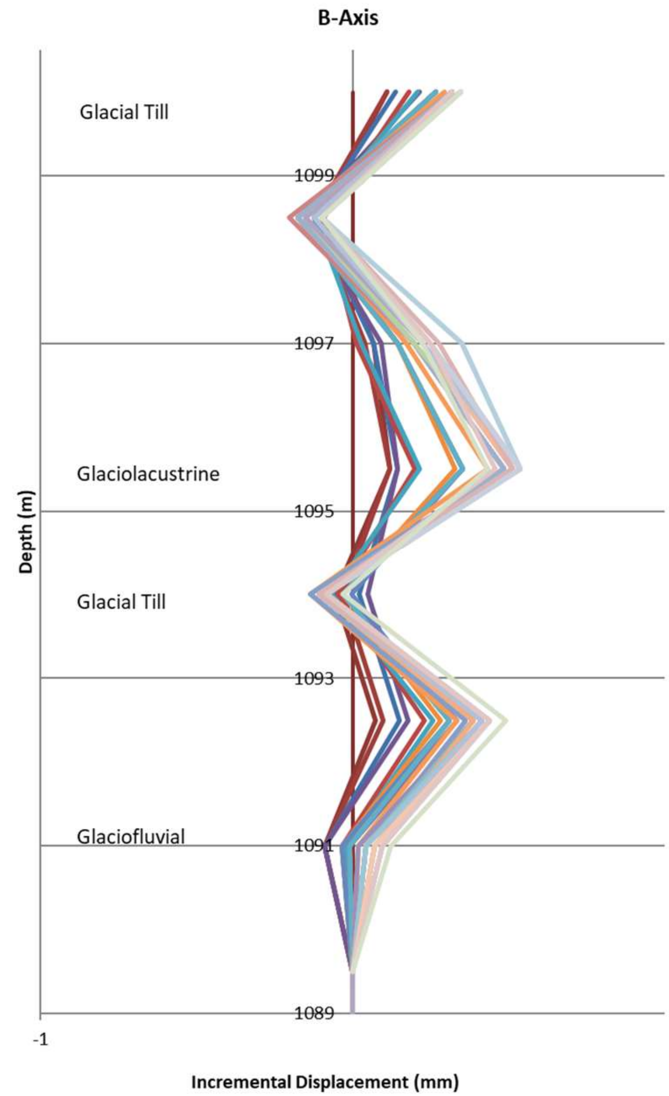
SAAV I17-07


A-Axis
Depth (m)
1099.5
1098
1096.5
1095
1093.5
1092
1090.5
1089
-1
1
Glacial Till
Incremental Displacement (mm)
21-Nov-19
16-Dec-19
4-Feb-20
24-Mar-20
12-May-20
1-Jul-20
19-Aug-20
10-Sep-20
5-Nov-20
15-Dec-20
16-Jan-21
6-Feb-21
13-Mar-21
12-Apr-21
14-Apr-21
26-Apr-21
2-May-21
10-May-21
16-May-21
7-Jun-21
18-Jun-21
2-Jul-21
28-Jul-21
5-Aug-21
10-Aug-21
12-Sep-21
27-Sep-21
4-Oct-21
13-Oct-21
20-Oct-21
28-Oct-21
9-Nov-21
29-Nov-21

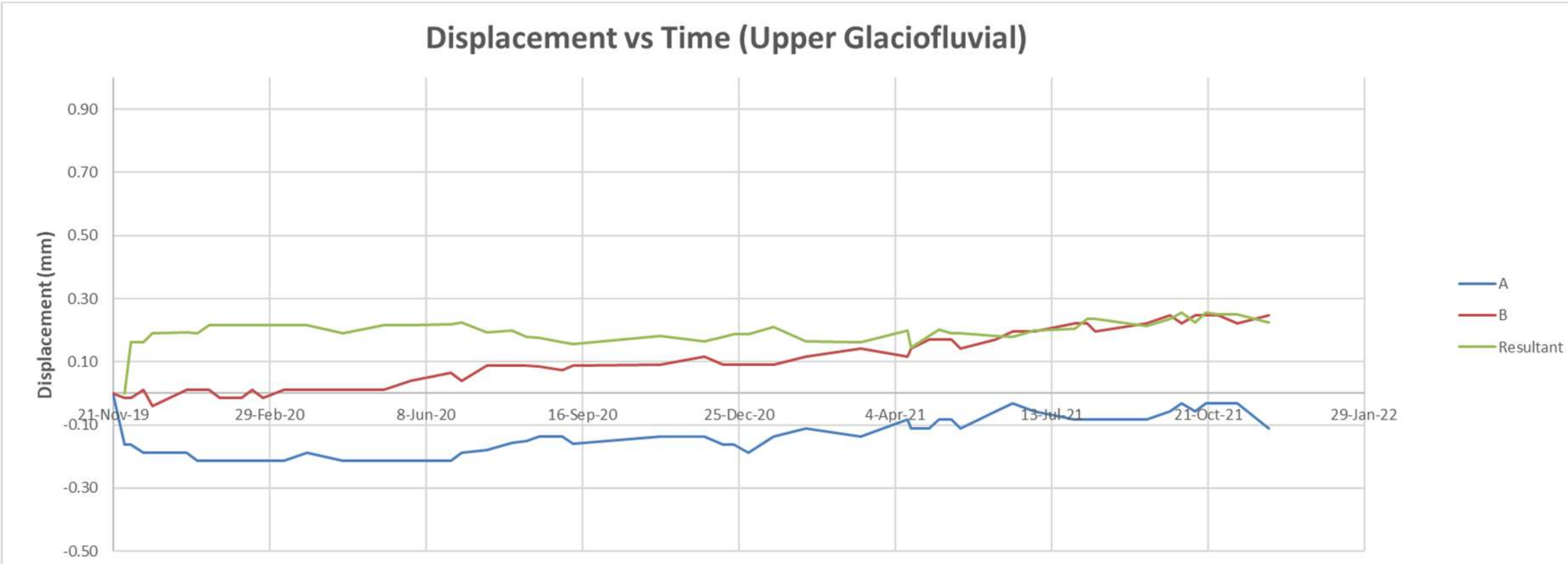

B-Axis
Depth (m)
Glacial Till
Glaciolacustrine
Glacial Till
Glaciofluvial
1099
1097
1095
1093
1091
1089
-1
Incremental Displacement (mm)

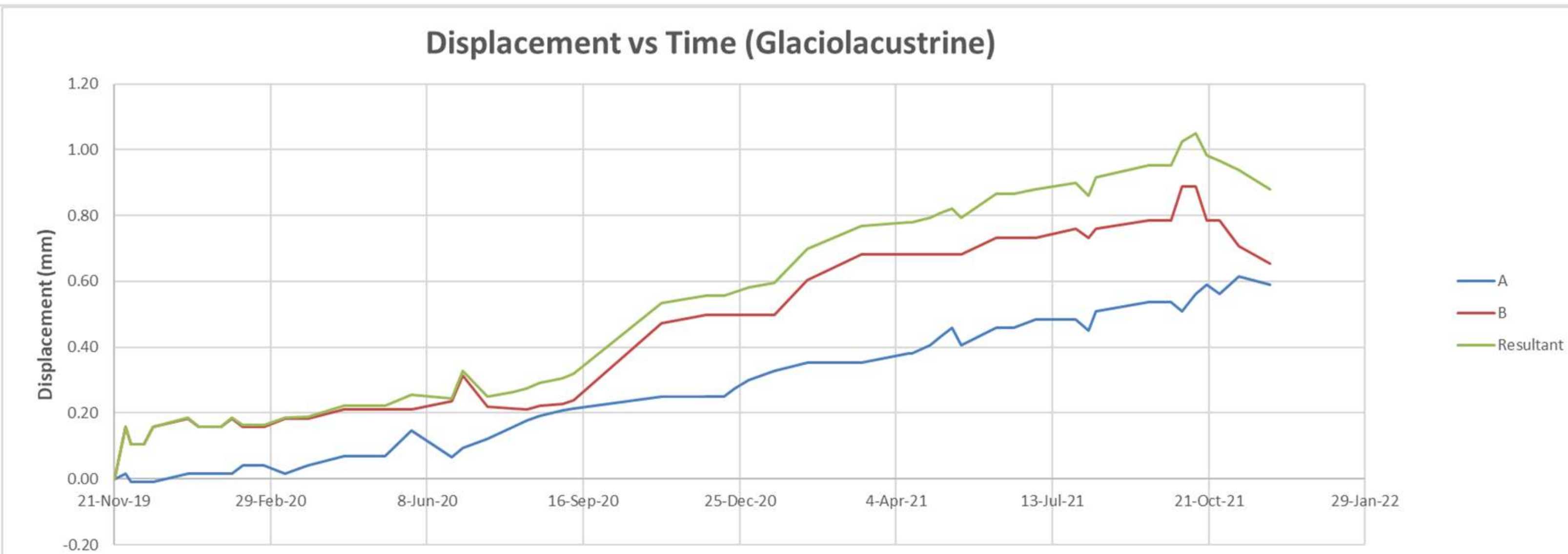


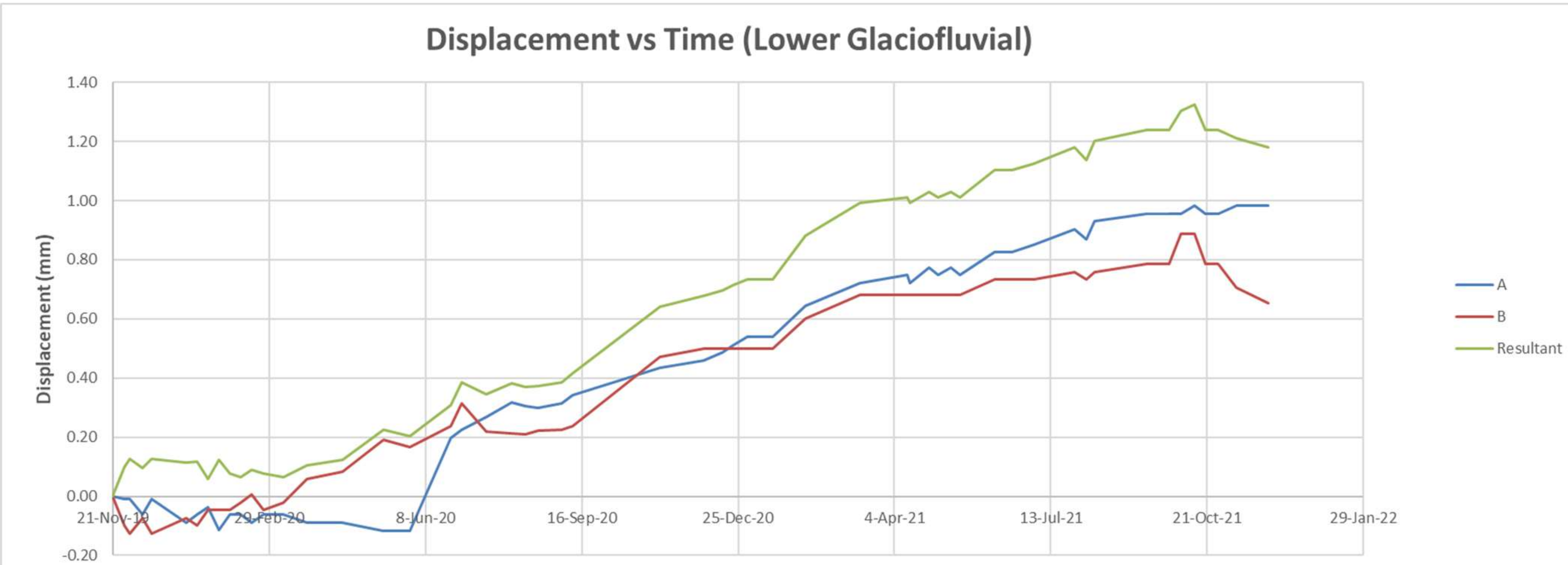
A-axis
Glacial Till
Glaciolacustrine
Glacial Till
Glaciofluvial
Depth (m)
1099
1097
1095
1093
1091
1089
-1
0
1
Cumulative Displacement (mm)
21-Nov-19
7-Jan-20
18-Feb-20
16-Apr-20
12-May-20
24-Jun-20
11-Aug-20
10-Sep-20
5-Nov-20
15-Dec-20
16-Jan-21
6-Feb-21
13-Mar-21
12-Apr-21
14-Apr-21
26-Apr-21
2-May-21
10-May-21
16-May-21
7-Jun-21
18-Jun-21
2-Jul-21
28-Jul-21
5-Aug-21
10-Aug-21
12-Sep-21
27-Sep-21
4-Oct-21
13-Oct-21
20-Oct-21
28-Oct-21
9-Nov-21
29-Nov-21



B-Axis
Glacial Till
Glaciolacustrine
Glacial Till
Glaciofluvial
Depth (m)
1099
1097
1095
1093
1091
1089
-1
Incremental Displacement (mm)


Displacement vs Time (Upper Glaciofluvial)
Displacement (mm)
0.90
0.70
0.50
0.30
0.10
-0.10
-0.30
-0.50
21-Nov-19
29-Feb-20
8-Jun-20
16-Sep-20
25-Dec-20
4-Apr-21
13-Jul-21
21-Oct-21
29-Jan-22
A
B
Resultant


Displacement vs Time (Glaciolacustrine)
Displacement (mm)
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
21-Nov-19
29-Feb-20
8-Jun-20
16-Sep-20
25-Dec-20
4-Apr-21
13-Jul-21
21-Oct-21
29-Jan-22
A
B
Resultant

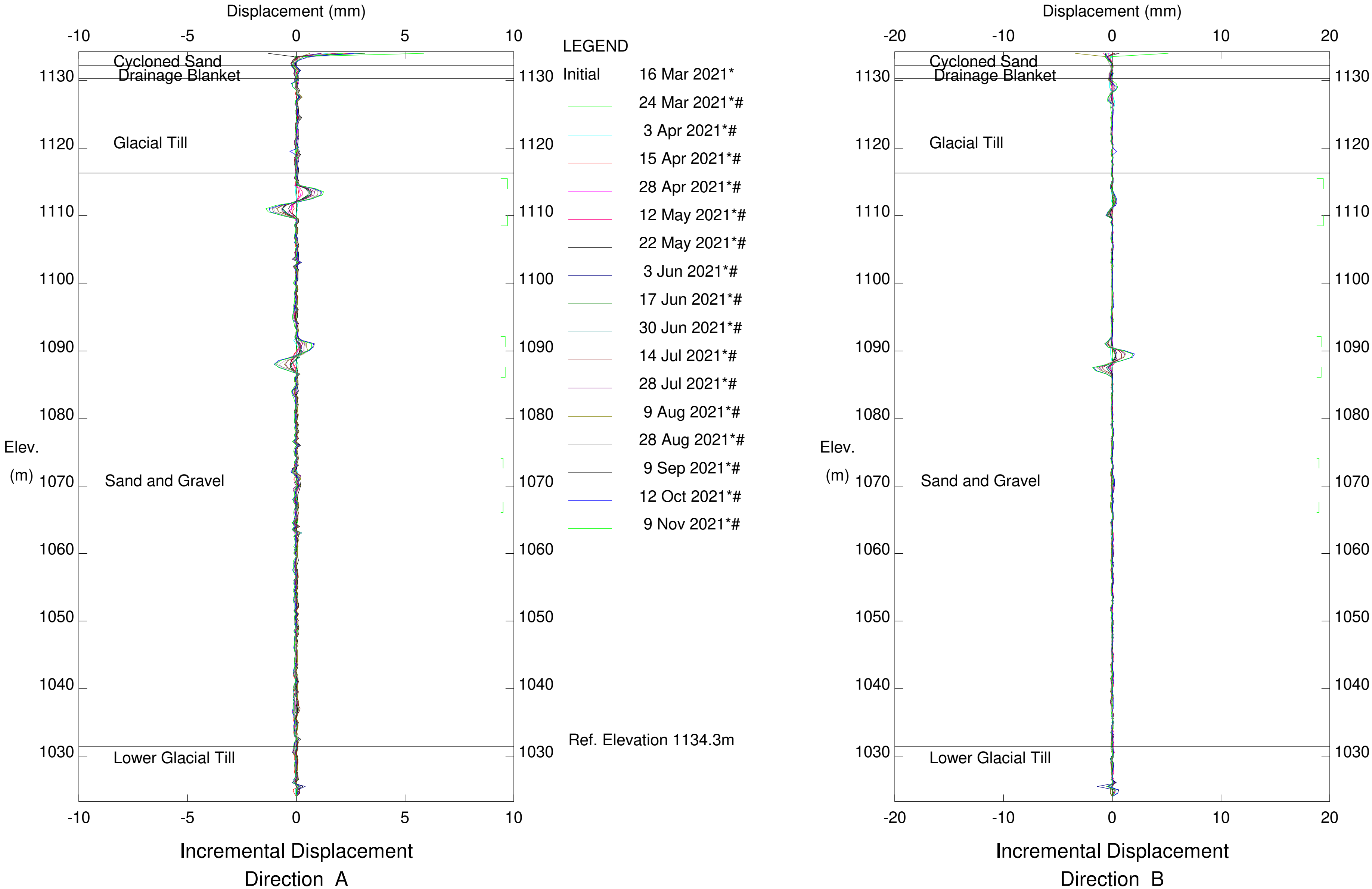


Displacement vs Time (Lower Glaciofluvial)
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
Displacement (mm)
21-Nov-19
29-Feb-20
8-Jun-20
16-Sep-20
25-Dec-20
4-Apr-21
13-Jul-21
21-Oct-21
29-Jan-22
A
B
Resultant

Valley Buttress Berm Extension

I17-08

Highland Valley Copper - BC



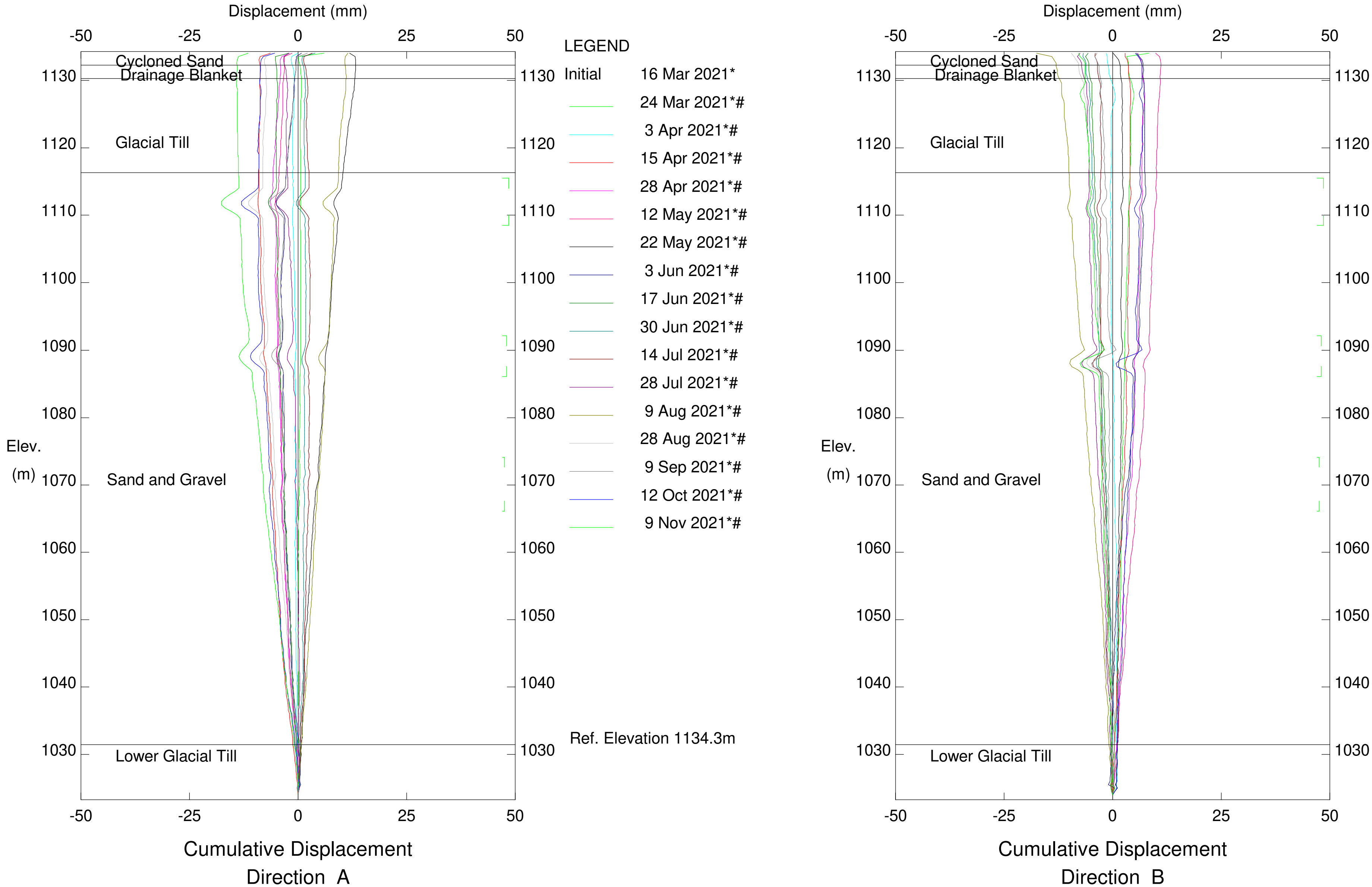
Valley Buttress Berm Extension, Inclinometer I17-08

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

Sets marked # corrected for casing compression

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I17-08.gtl

Highland Valley Copper - BC



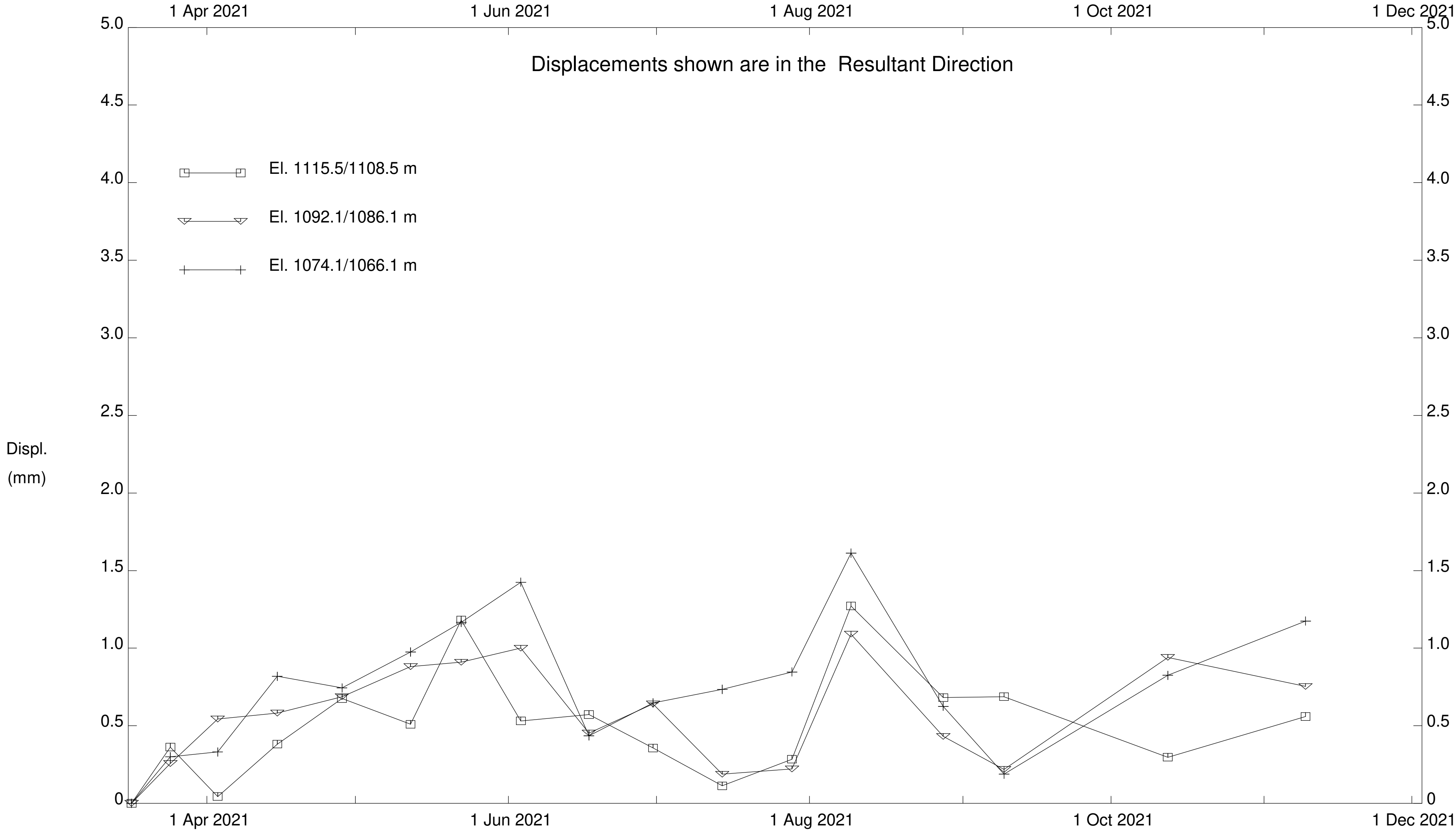
Valley Buttress Berm Extension, Inclinometer I17-08

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

Sets marked # corrected for casing compression

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I17-08.gtl

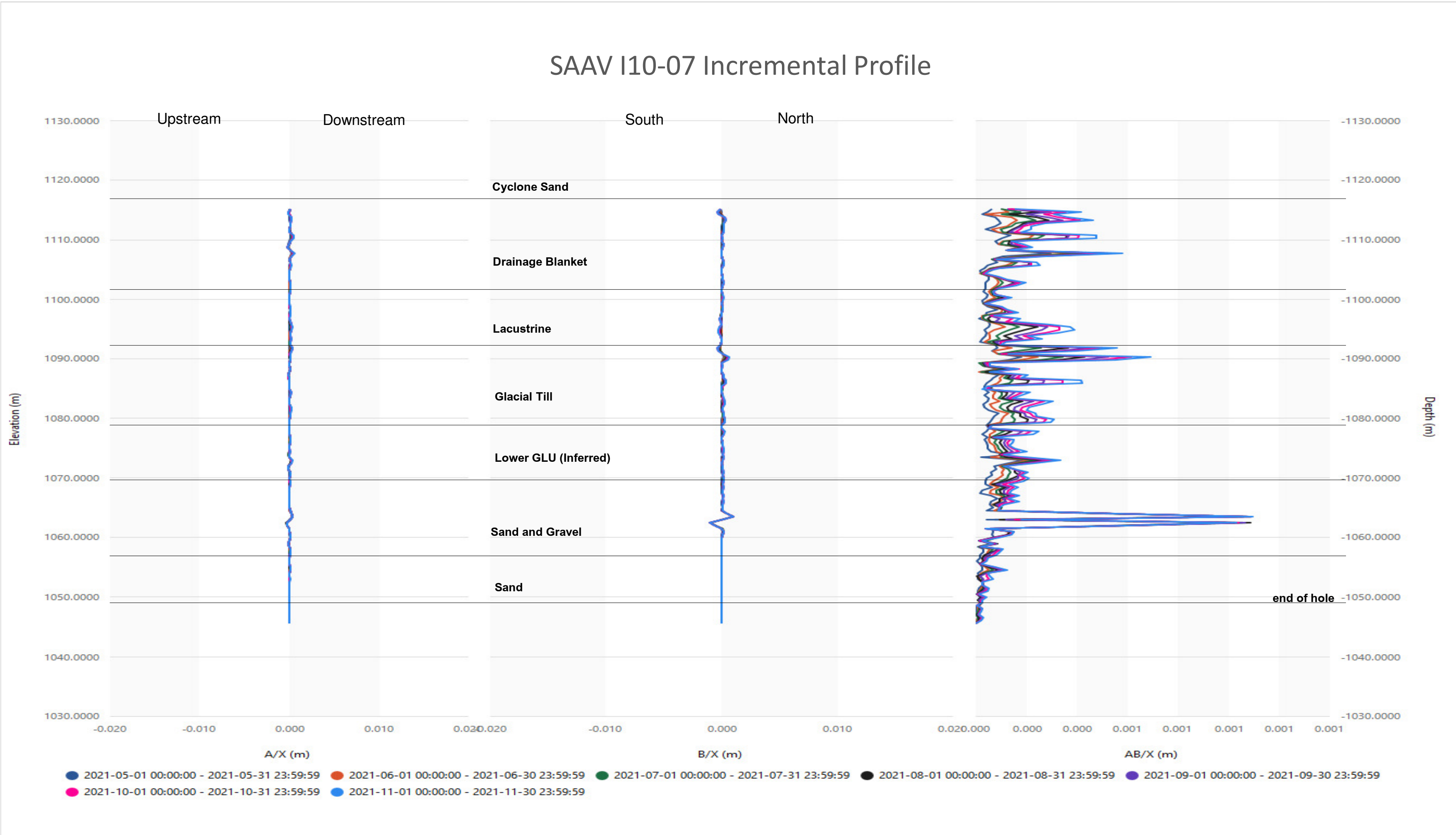
Highland Valley Copper - BC



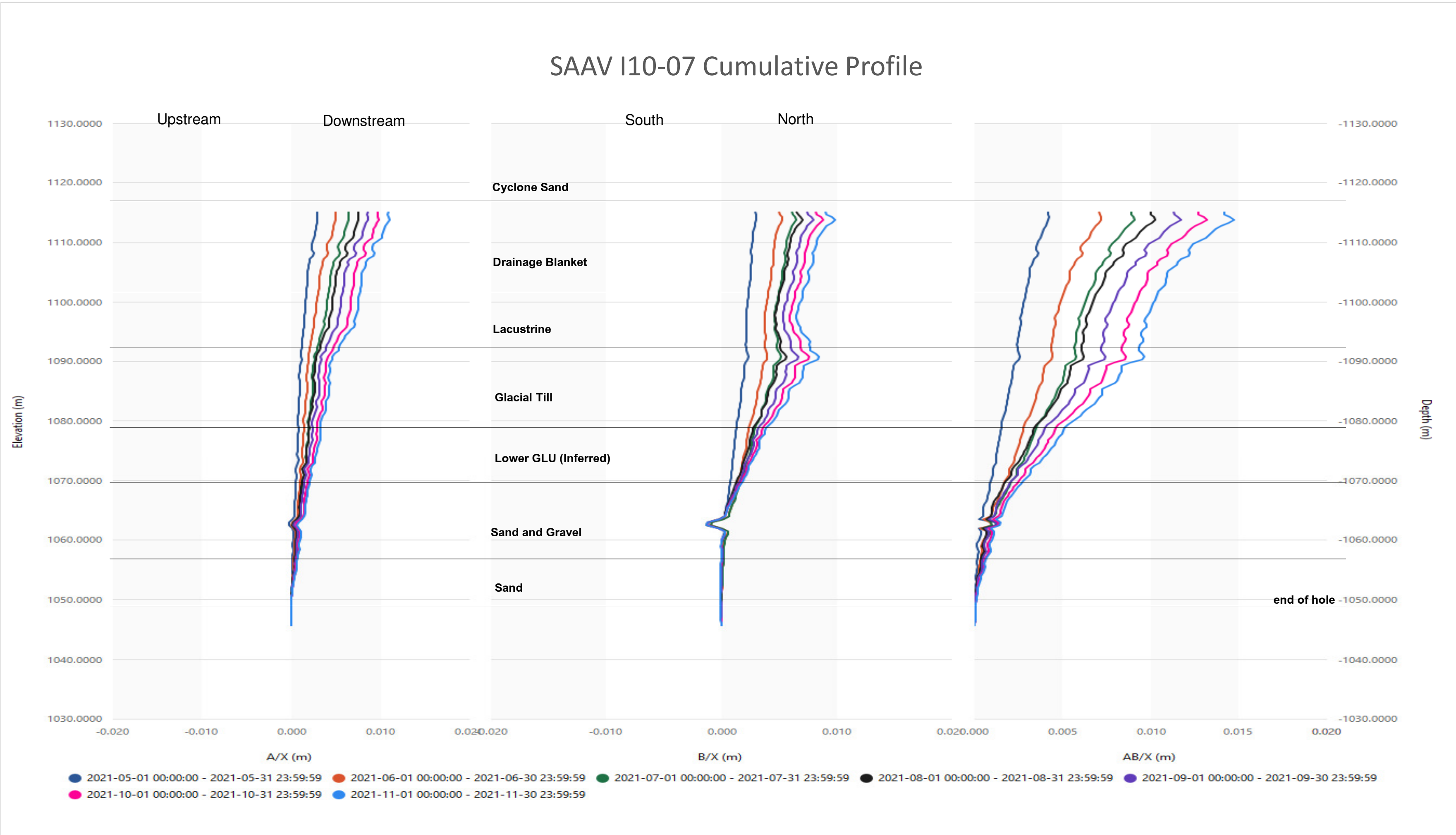
Valley Buttress Berm Extension, Inclinometer I17-08

Valley Buttress Berm

I10-07



SAAV I10-07 Incremental Profile
Upstream
Downstream
South
North
Cyclone Sand
Drainage Blanket
Lacustrine
Glacial Till
Lower GLU (Inferred)
Sand and Gravel
Sand
end of hole
Elevation (m)
Depth (m)
1130.0000
1120.0000
1110.0000
1100.0000
1090.0000
1080.0000
1070.0000
1060.0000
1050.0000
1040.0000
1030.0000
-0.020
-0.010
0.000
0.010
0.020
0.001
A/X (m)
B/X (m)
AB/X (m)
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59

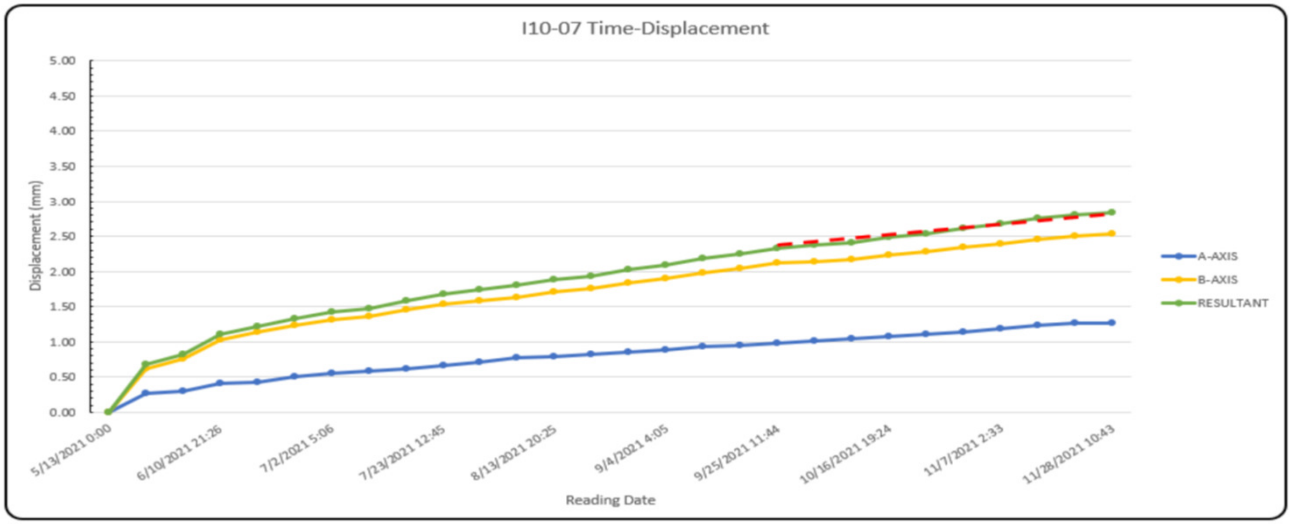

SAAV I10-07 Cumulative Profile
Upstream
Downstream
South
North
Cyclone Sand
Drainage Blanket
Lacustrine
Glacial Till
Lower GLU (Inferred)
Sand and Gravel
Sand
end of hole
Elevation (m)
Depth (m)
1130.0000
1120.0000
1110.0000
1100.0000
1090.0000
1080.0000
1070.0000
1060.0000
1050.0000
1040.0000
1030.0000
-1130.0000
-1120.0000
-1110.0000
-1100.0000
-1090.0000
-1080.0000
-1070.0000
-1060.0000
-1050.0000
-1040.0000
-1030.0000
-0.020
-0.010
0.000
0.010
0.020
0.005
0.015
A/X (m)
B/X (m)
AB/X (m)
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59

SAAV I10-07

Displacement Plot - Glaciolacustrine

Unit	Upper El. (m)	Lower El. (m)	NL	Rate (mm/month)
Lacustrine	1100.5	1091.5	5.0	
Glaciolacustrine	**1079.5**	**1069.5**	**1.0**	**0.25**
Drainage Blanket	1067.5	1064.5	1.0	

Upper El. (m)	1079.5
Lower El. (m)	1069.5

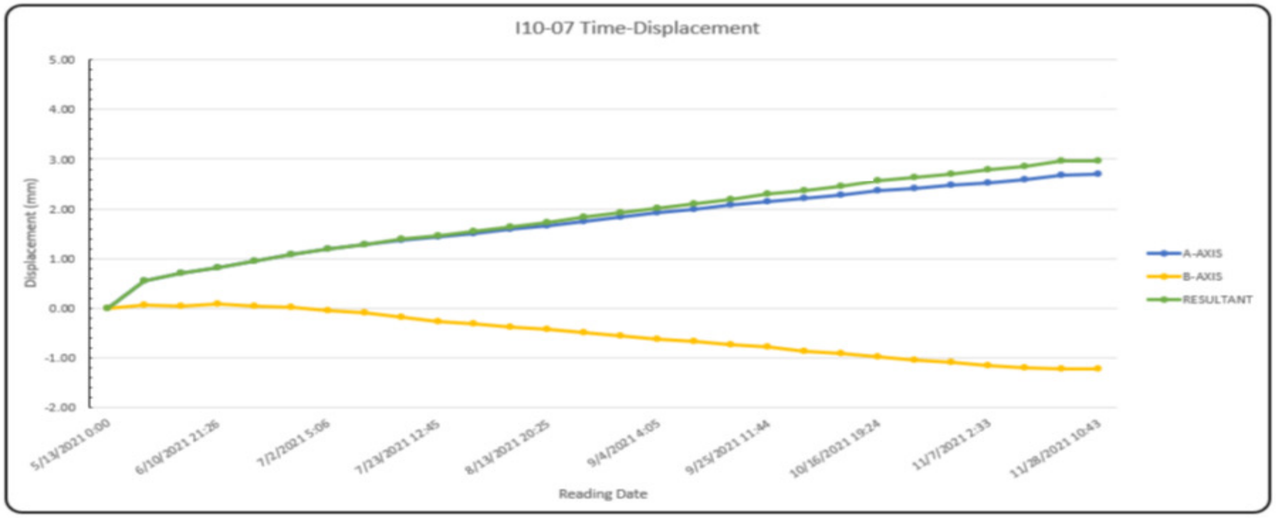


SAAV I10-07

Displacement Plot - Lacustrine

Unit	Upper El. (m)	Lower El. (m)	NL	Rate (mm/month)
Lacustrine	**1100.5**	**1091.5**	**5.0**	**0.34**
Glaciolacustrine	1079.5	1069.5	1.0	
Drainage Blanket	1067.5	1064.5	1.0	

Upper El. (m)	1100.5
Lower El. (m)	1091.5

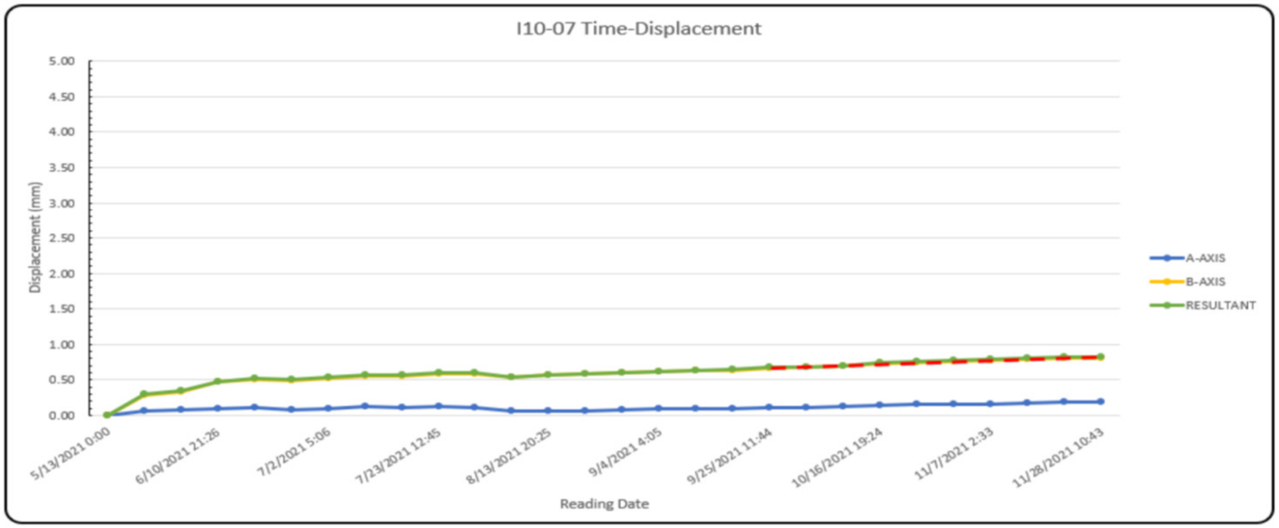


SAAV I10-07

Displacement Plot - Drainage Blanket

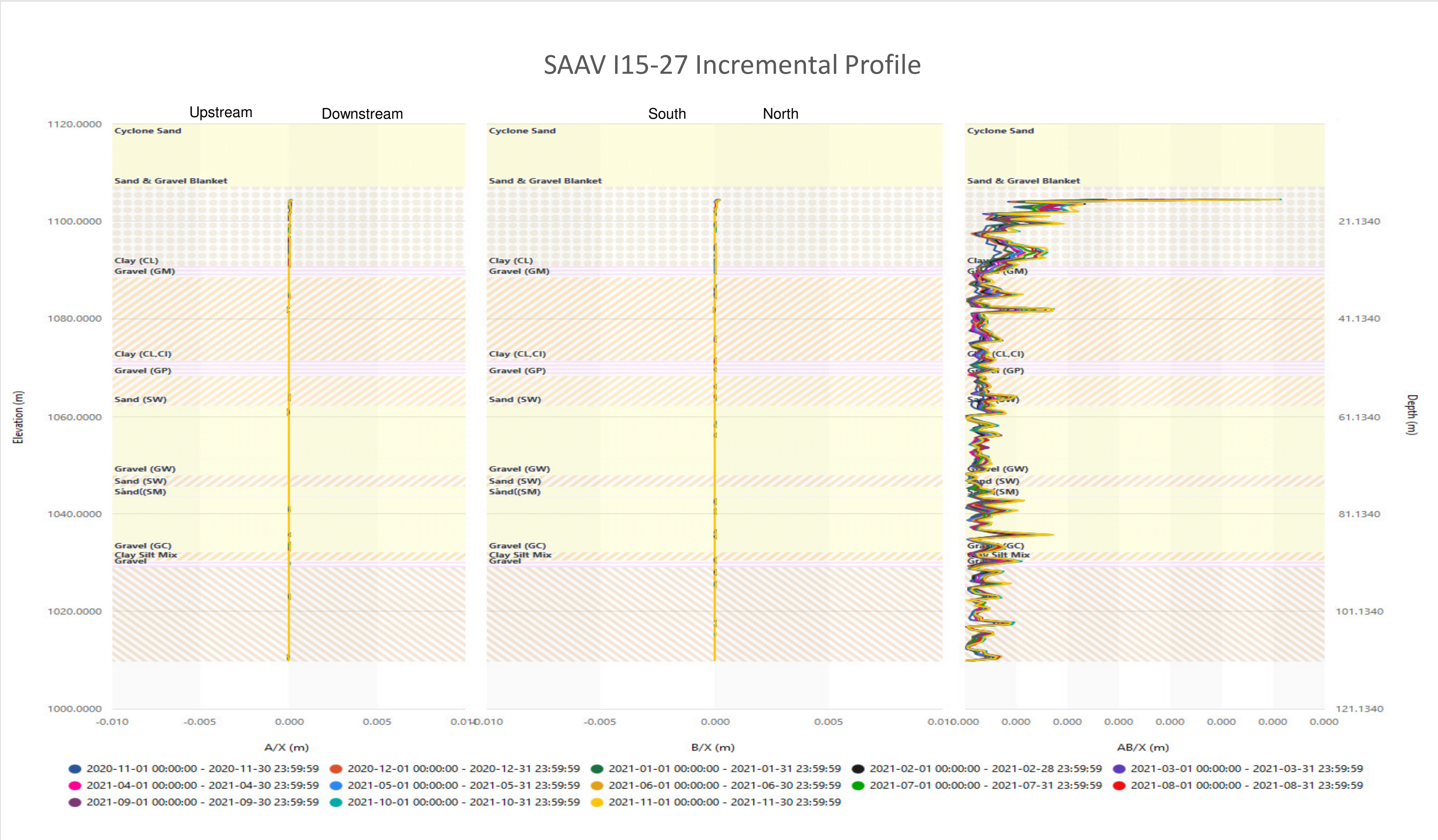
Unit	Upper El. (m)	Lower El. (m)	NL	Rate (mm/month)
Lacustrine	1100.5	1091.5	5.0	
Glaciolacustrine	1079.5	1069.5	1.0	
Drainage Blanke	**1067.5**	**1064.5**	**1.0**	**0.08**

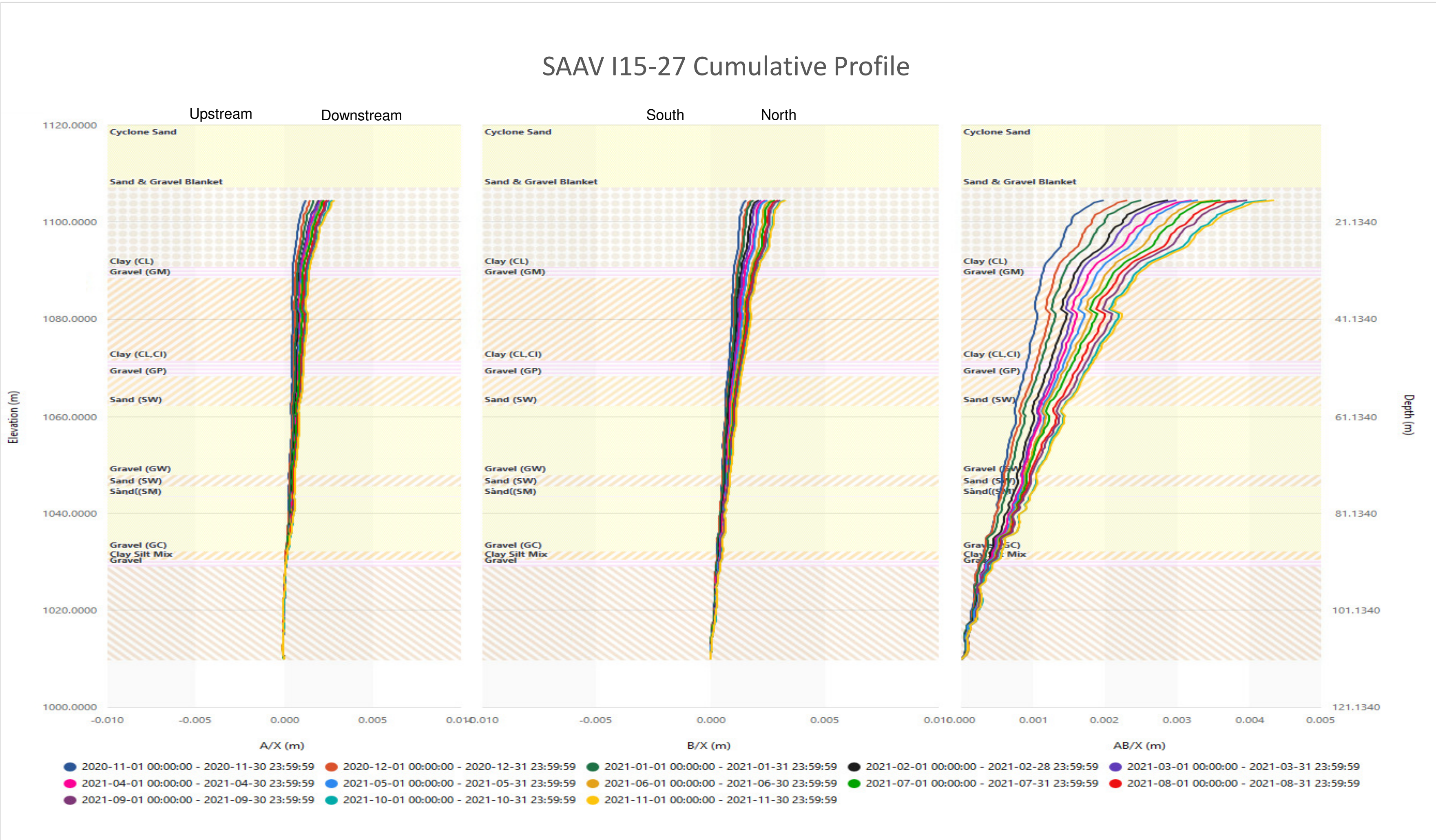
Upper El. (m)	1067.5
Lower El. (m)	1064.5



Valley Buttress Berm

IPI15-27


SAAV I15-27 Incremental Profile
Upstream
Downstream
South
North
Cyclone Sand
Sand & Gravel Blanket
Clay (CL)
Gravel (GM)
Clay (CL,CI)
Gravel (GP)
Sand (SW)
Gravel (GW)
Sand (SW)
Sand(SM)
Gravel (GC)
Clay Silt Mix
Gravel
Elevation (m)
Depth (m)
1120.0000
1100.0000
1080.0000
1060.0000
1040.0000
1020.0000
1000.0000
21.1340
41.1340
61.1340
81.1340
101.1340
121.1340
-0.010
-0.005
0.000
0.005
0.010
A/X (m)
B/X (m)
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59



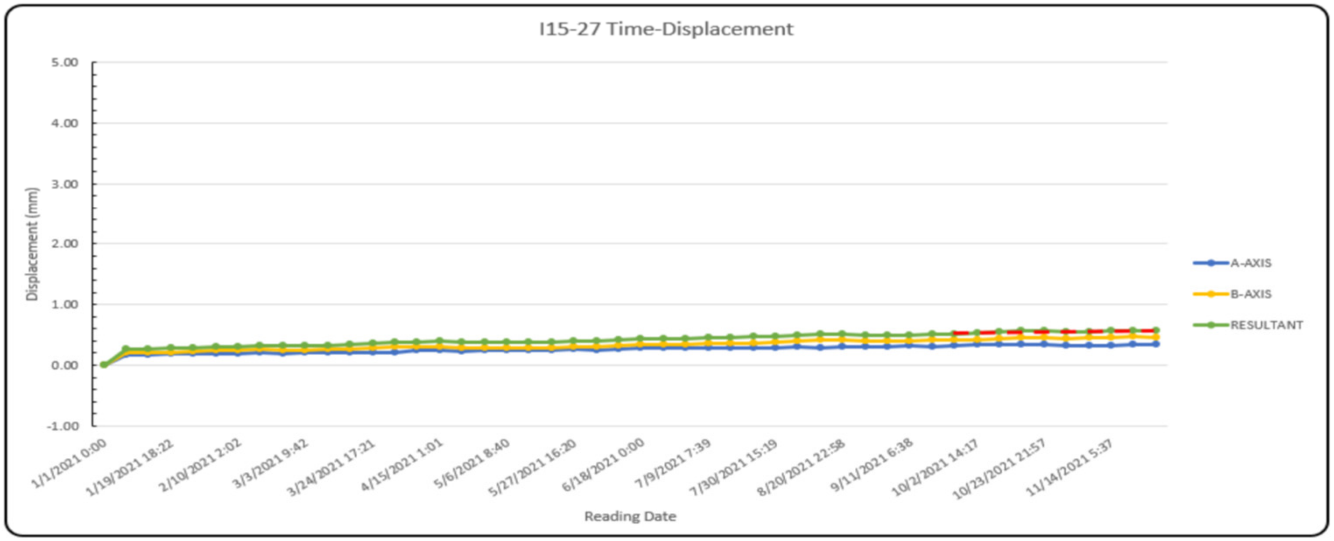
SAAV I15-27 Cumulative Profile
Upstream
Downstream
South
North
Cyclone Sand
Sand & Gravel Blanket
Clay (CL)
Gravel (GM)
Clay (CL,CI)
Gravel (GP)
Sand (SW)
Gravel (GW)
Sand (SW)
Sand(SM)
Gravel (GC)
Clay Silt Mix
Gravel
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59

SAAV I15-27

Displacement Plot – Upper Glaciolacustrine

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
GLU/Glacial till Upper	**1093.3**	**1088.3**	**0.5**	**0.03**
GLU/Glacial till Middle	1071.8	1069.8	0.5	
GLU/Glaciofluvial Lower	1033.3	1025.3	0.5	

Upper El. (m)	1093.3
Lower El. (m)	1088.3

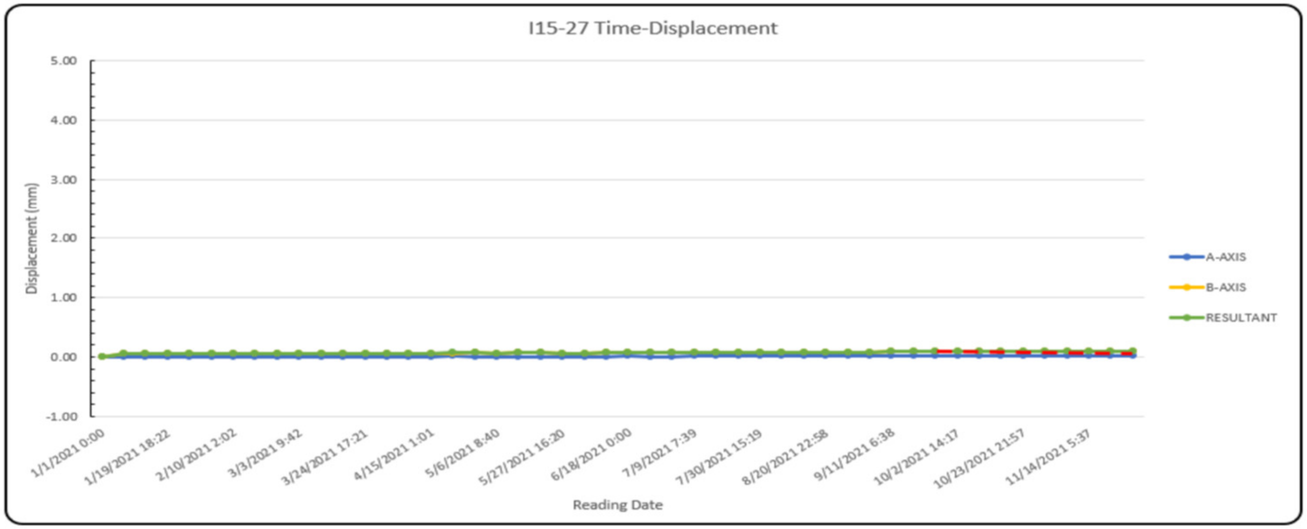


SAAV I15-25

Displacement Plot – Middle Glaciolacustrine

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
GLU/Glacial till Upper	1093.3	1088.3	0.5	
GLU/Glacial till Middle	**1071.8**	**1069.8**	**0.5**	**0**
GLU/Glaciofluvial Lower	1033.3	1025.3	0.5	

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

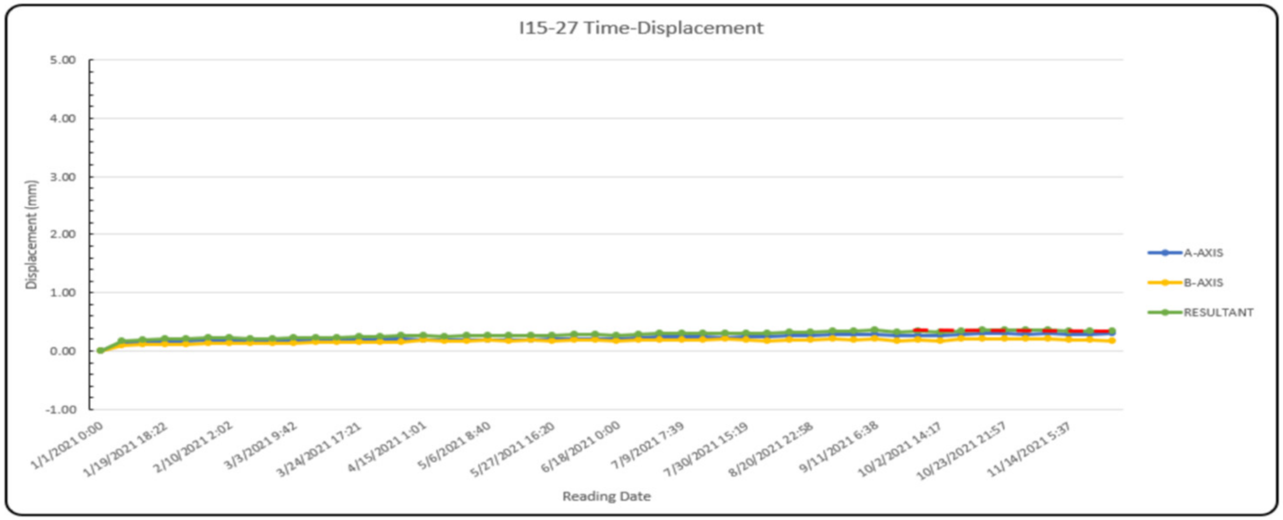


SAAV I15-25

Displacement Plot – Lower Glaciolacustrine

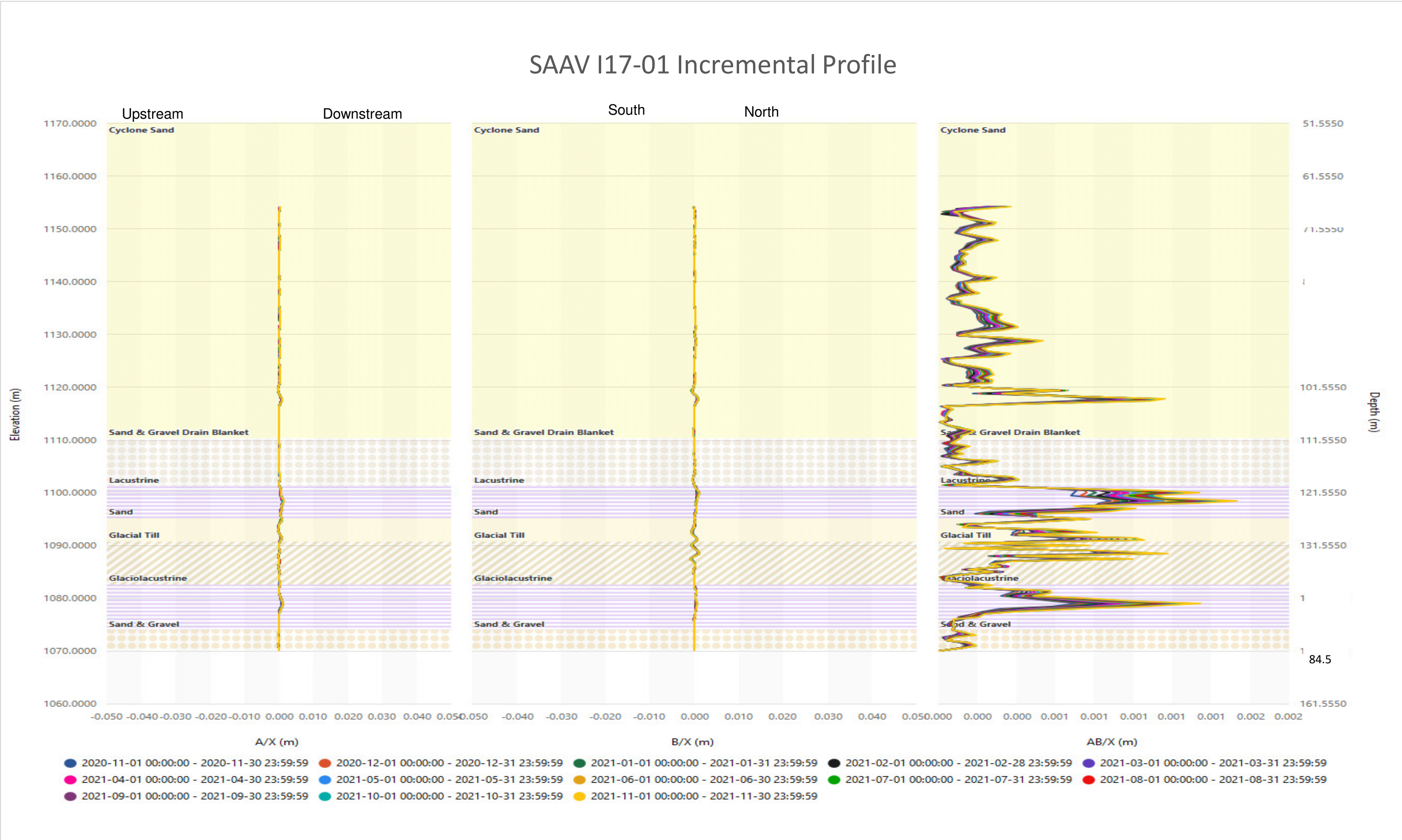
Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
GLU/Glacial till Upper	1093.3	1088.3	0.5	
GLU/Glacial till Middle	1071.8	1069.8	0.5	
GLU/Glaciofluvial Lower	**1033.3**	**1025.3**	**0.5**	**0.01**

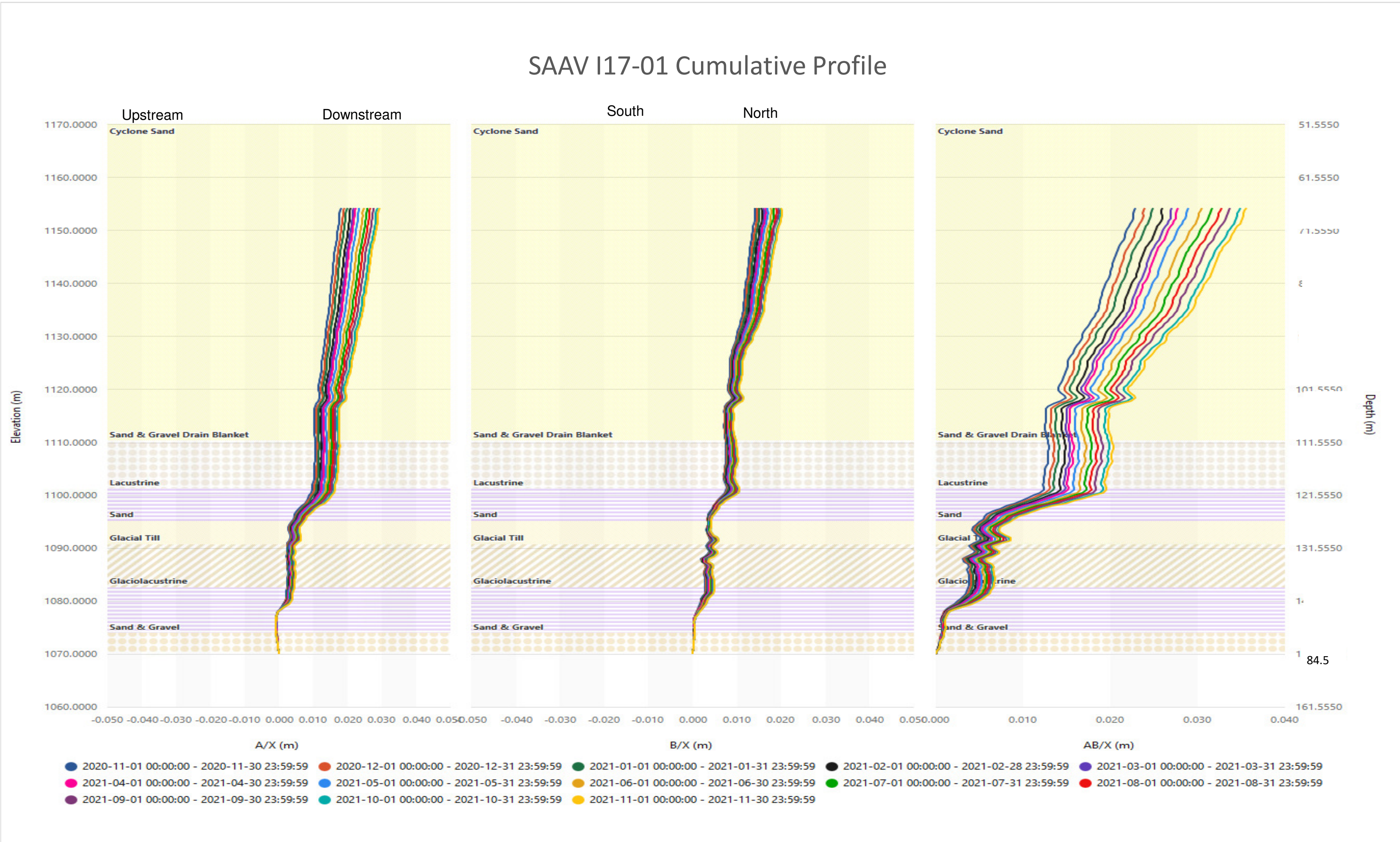
Upper El. (m)	1033.3
Lower El. (m)	1025.3



Valley Buttress Berm

I17-01


SAAV I17-01 Incremental Profile
Upstream
Downstream
South
North
Cyclone Sand
Sand & Gravel Drain Blanket
Lacustrine
Sand
Glacial Till
Glaciolacustrine
Sand & Gravel
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59

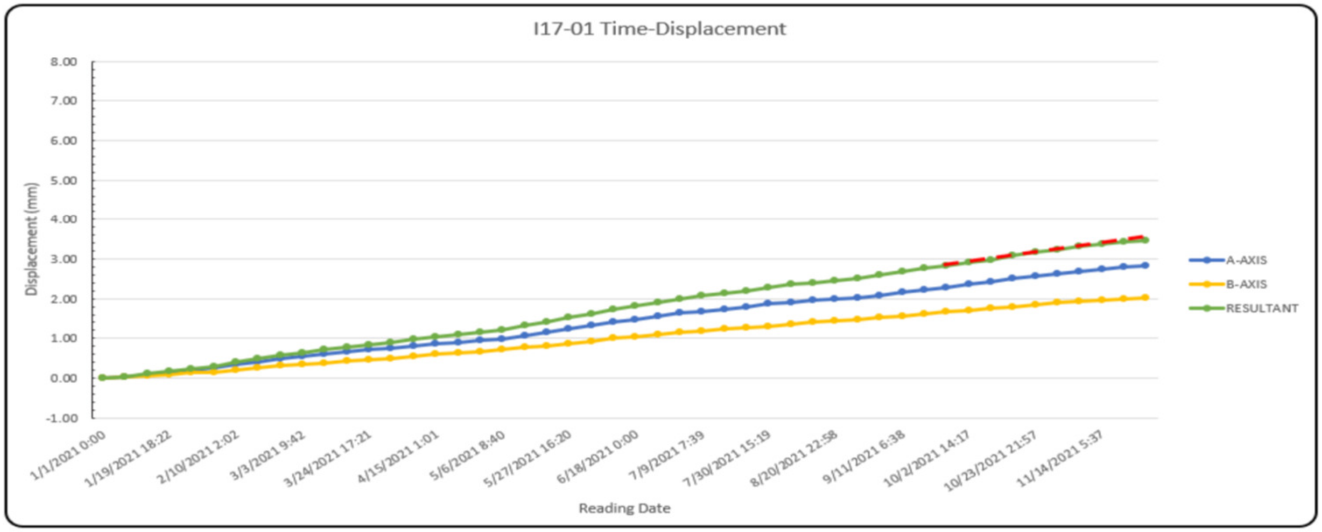

SAAV I17-01 Cumulative Profile
Upstream
Downstream
South
North
Cyclone Sand
Sand & Gravel Drain Blanket
Lacustrine
Sand
Glacial Till
Glaciolacustrine
Sand & Gravel
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
84.5
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59

SAAV I17-01

Displacement Plot - Lacustrine

Unit	Upper El. (m)	Lower El. (m)	NL	Rate (mm/month)
Lacustrine	**1100.5**	**1094.5**	**5.0**	**0.33**
Lower GLU	1082.5	1073.5	1.0	

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

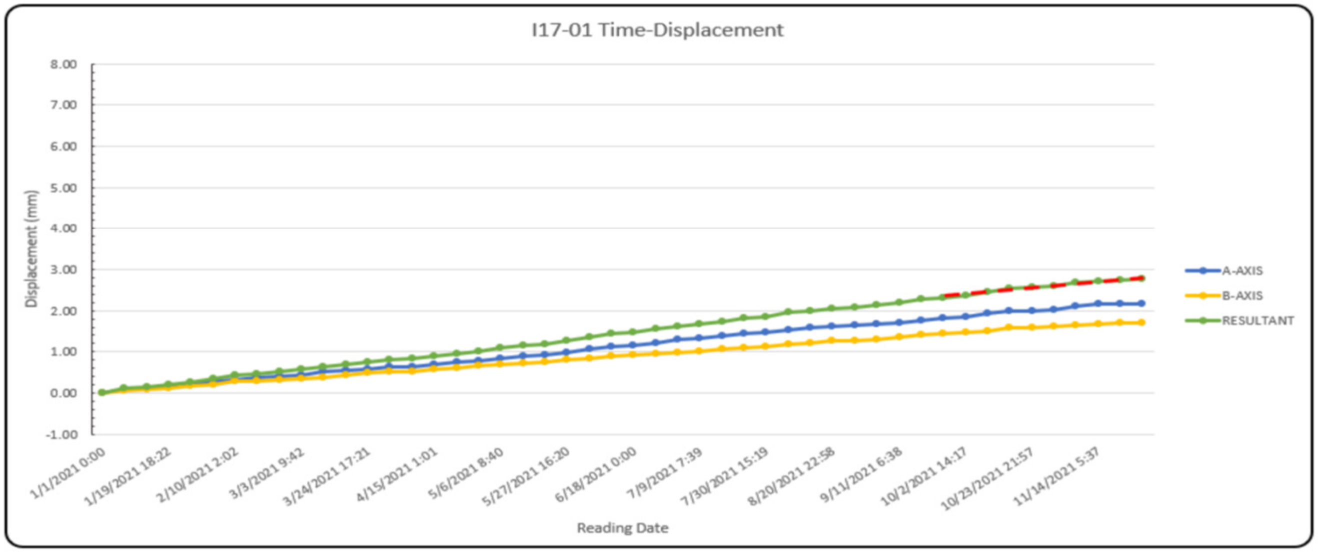


SAAV I17-01

Displacement Plot - Lower GLU

Unit	Upper El. (m)	Lower El. (m)	NL	Rate (mm/month)
Lacustrine	1100.5	1094.5	5.0	
Lower GLU	**1082.5**	**1073.5**	**1.0**	**0.22**

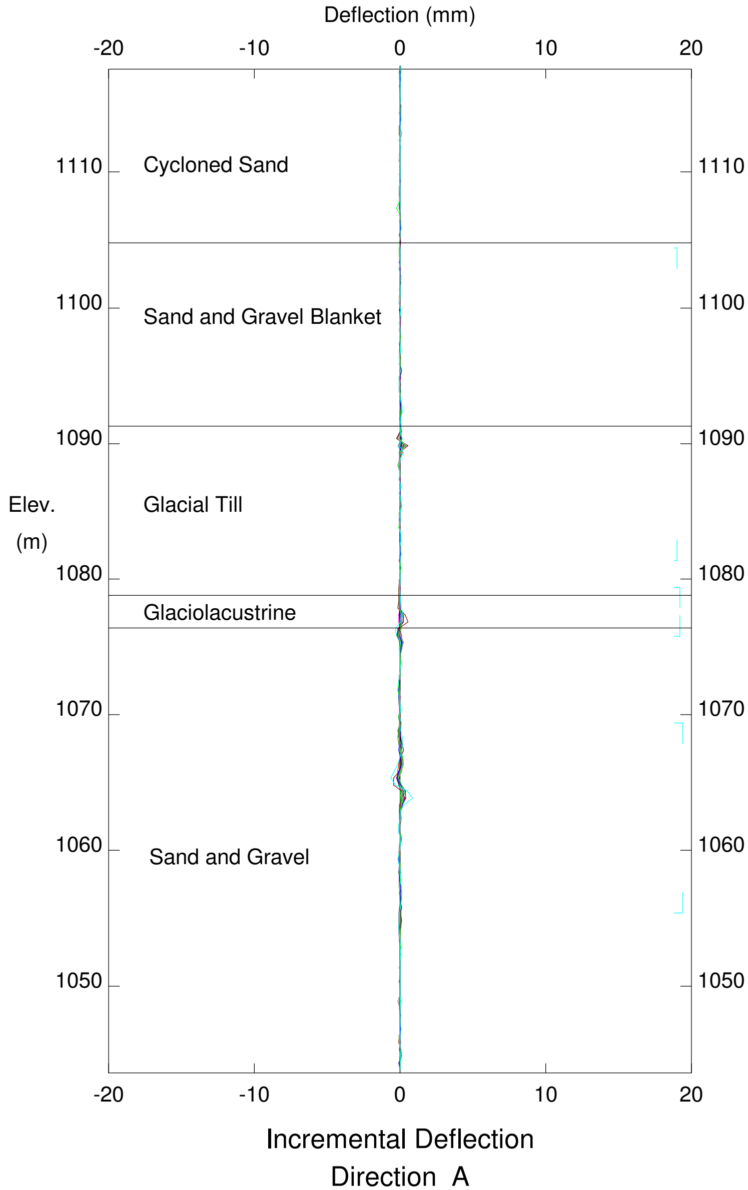
Upper El. (m)	1082.5
Lower El. (m)	1073.5



Valley Buttress Berm

I17-02

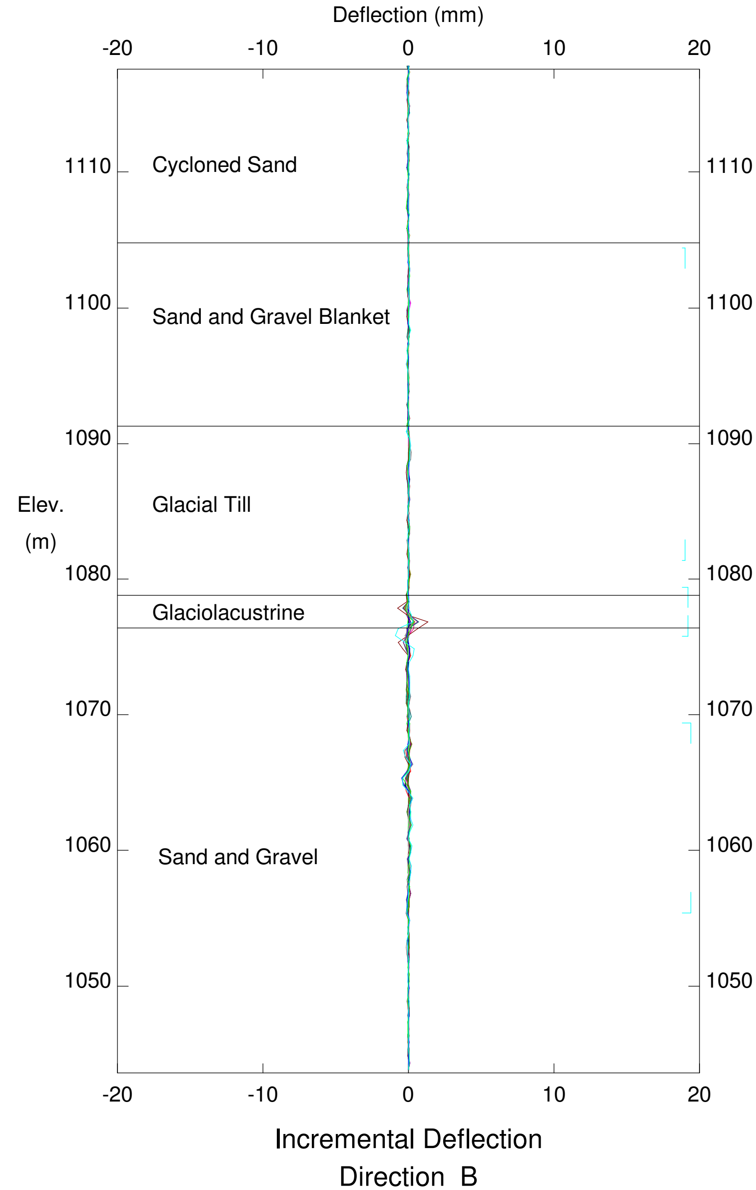
Highland Valley Copper - Logan Lake, BC



LEGEND

Initial	15 Mar 2021
	28 Mar 2021*#
	6 Apr 2021*#
	19 Apr 2021*#
	2 May 2021*#
	17 May 2021*#
	31 May 2021*#
	14 Jun 2021*#
	28 Jun 2021*#
	12 Jul 2021*#
	26 Jul 2021*#
	23 Aug 2021*#
	28 Aug 2021*#
	22 Sep 2021*#
	7 Oct 2021*#
	20 Oct 2021*#
	1 Nov 2021*#
	16 Nov 2021*#

Ref. Elevation 1182.6 m



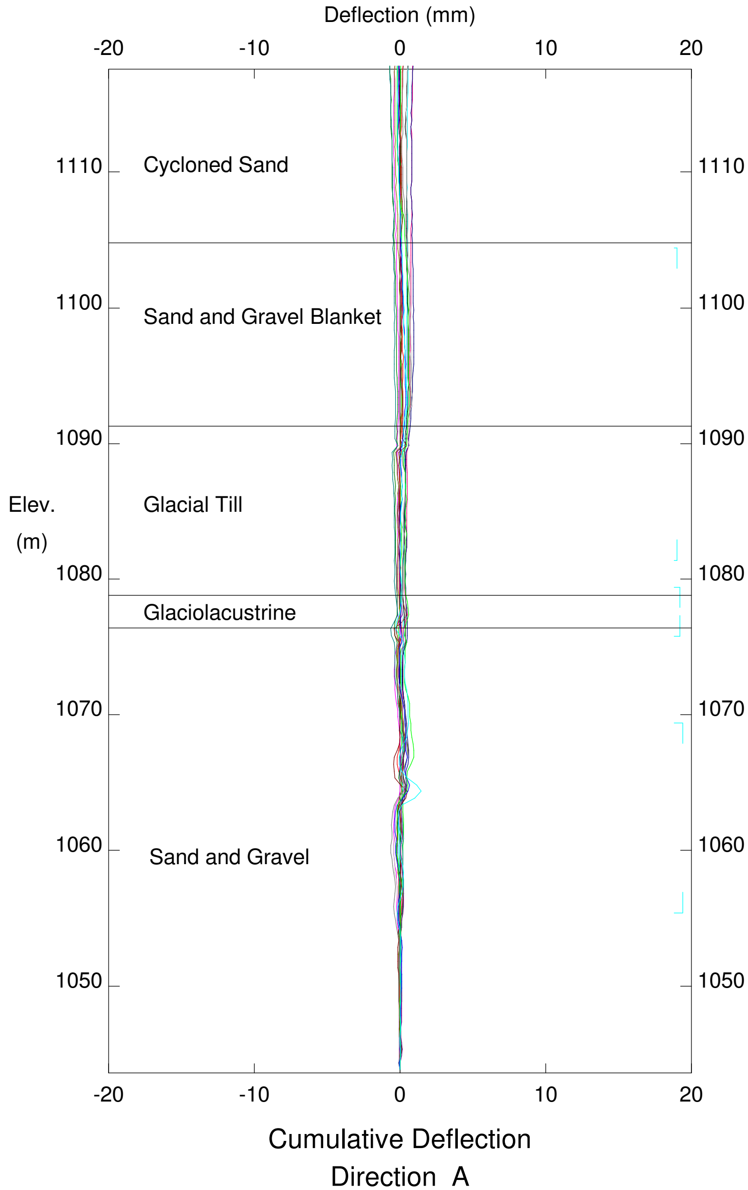
Dam Fill Excluded,,,, Inclinometer I17-02,,

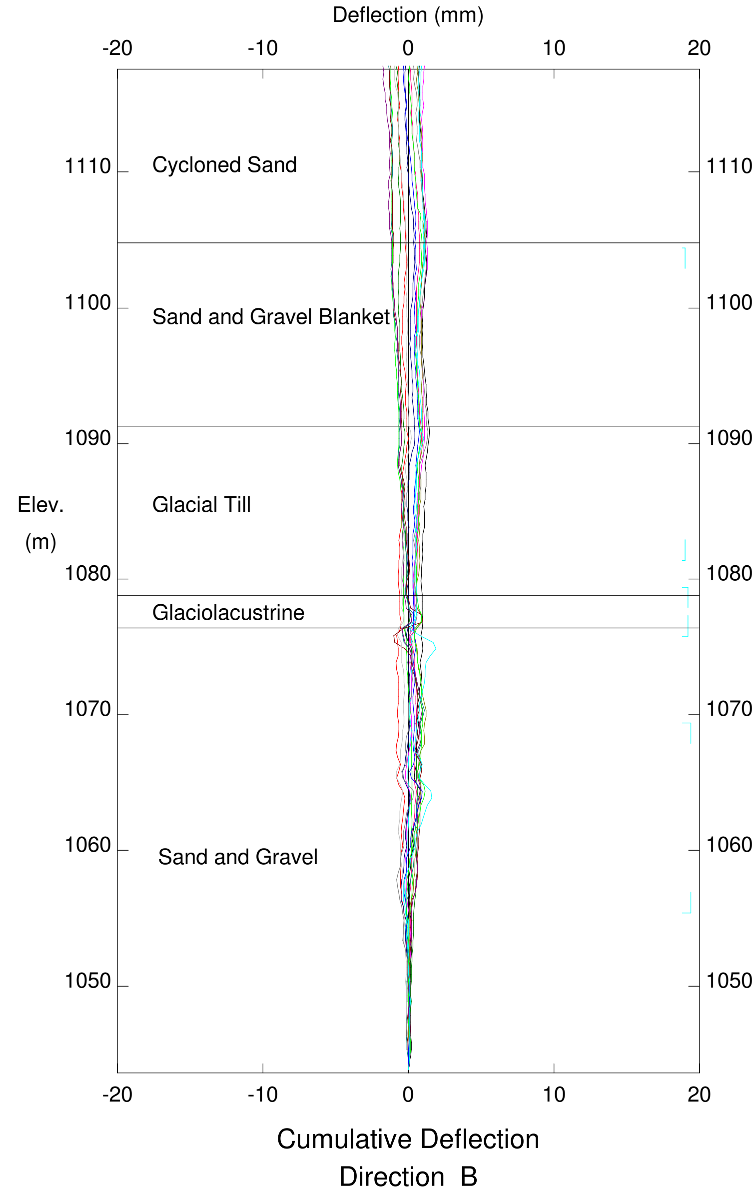
Sets marked * include zero shift and/or rotation corrections.

Sets marked # corrected for casing compression

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I17-02.gtl

Highland Valley Copper - Logan Lake, BC





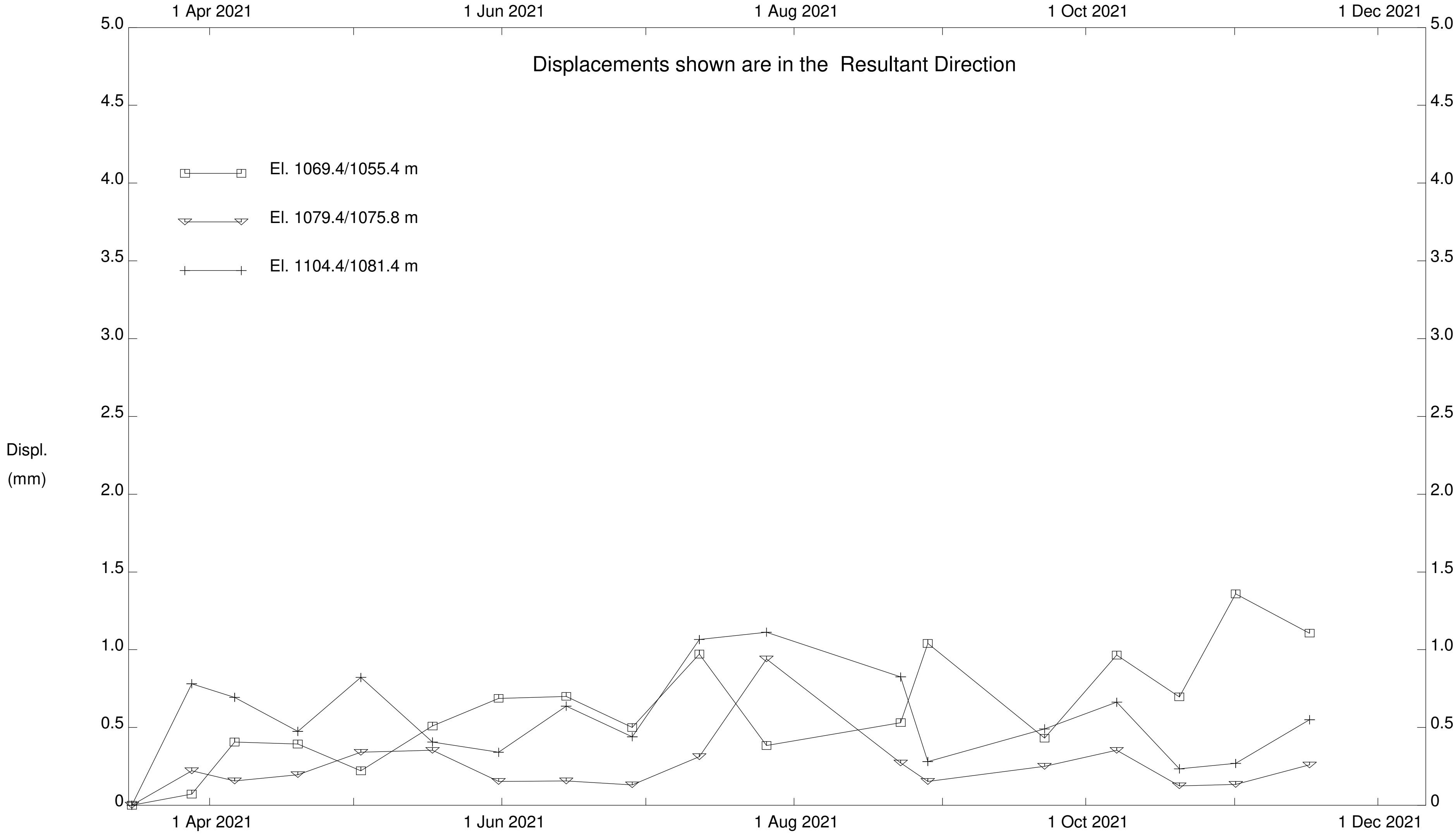
Dam Fill Excluded,,,, Inclinometer I17-02,,

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

Sets marked # corrected for casing compression

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I17-02.gtl

Highland Valley Copper - Logan Lake, BC

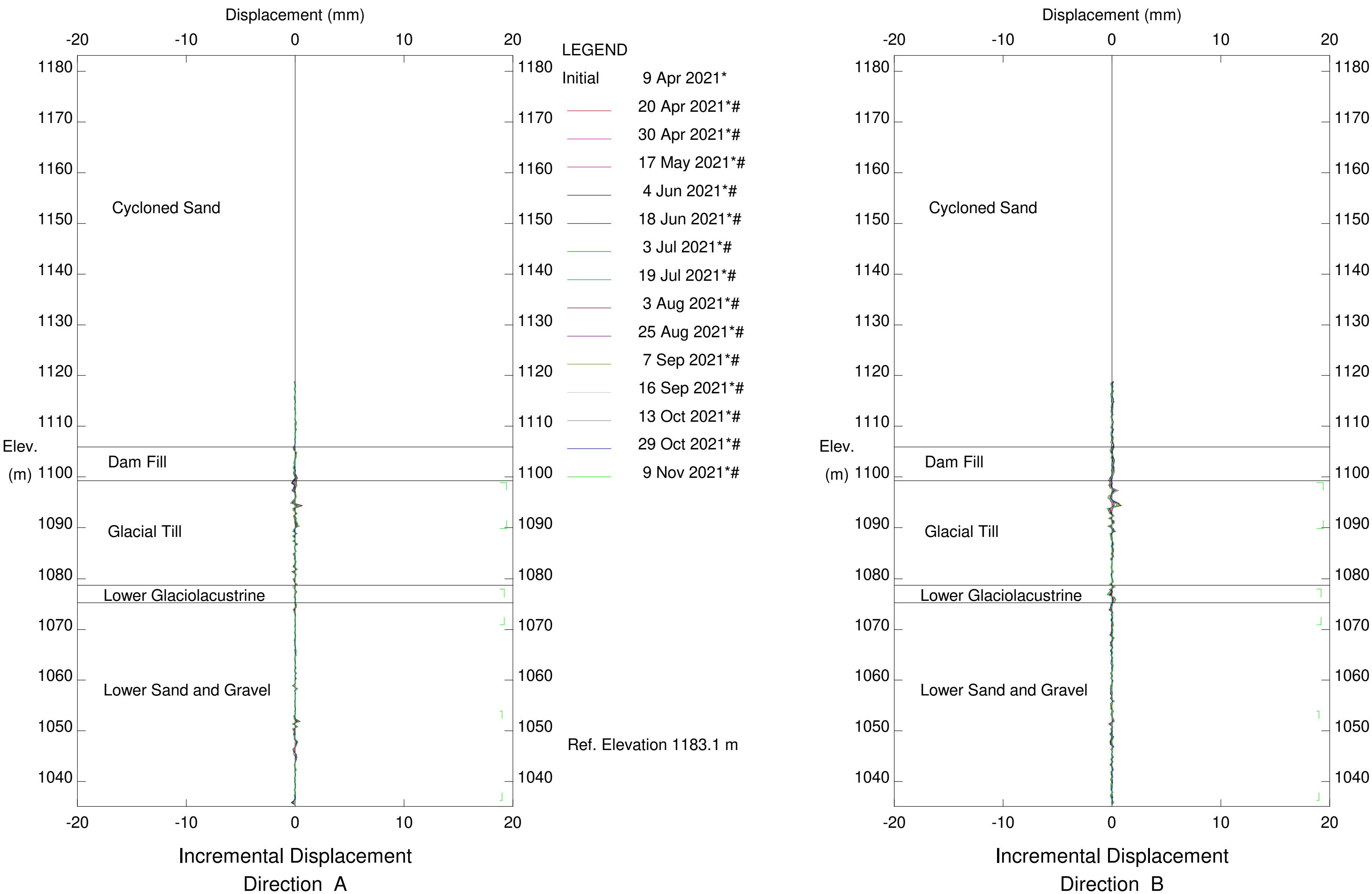


Dam Fill Excluded,,,, Inclinometer I17-02,,,

Valley Buttress Berm

I17-09

Highland Valley Copper - BC



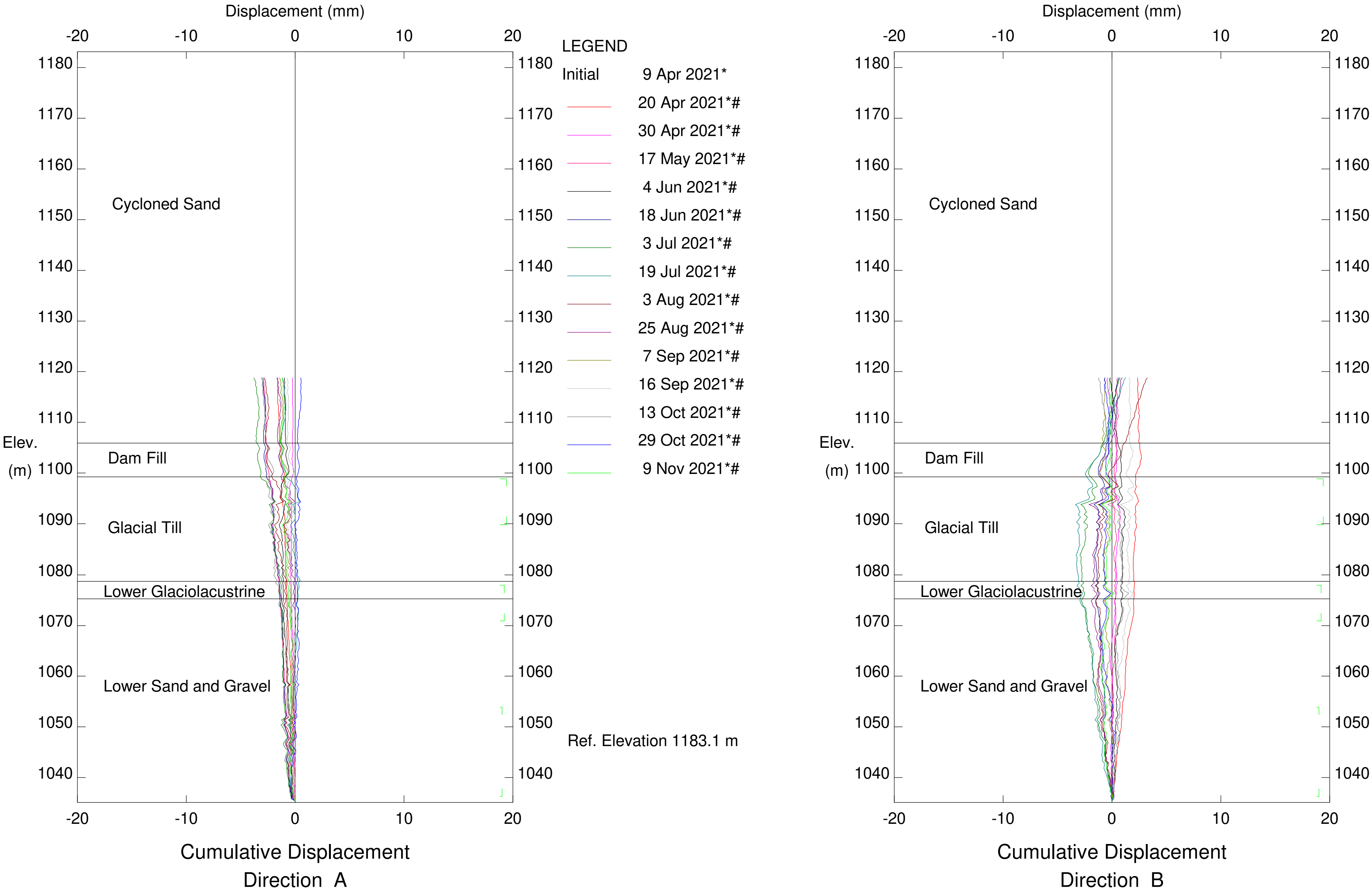
LL Dam, Inclinometer I17-9

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

Sets marked # corrected for casing compression

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I17-09.gtl

Highland Valley Copper - BC



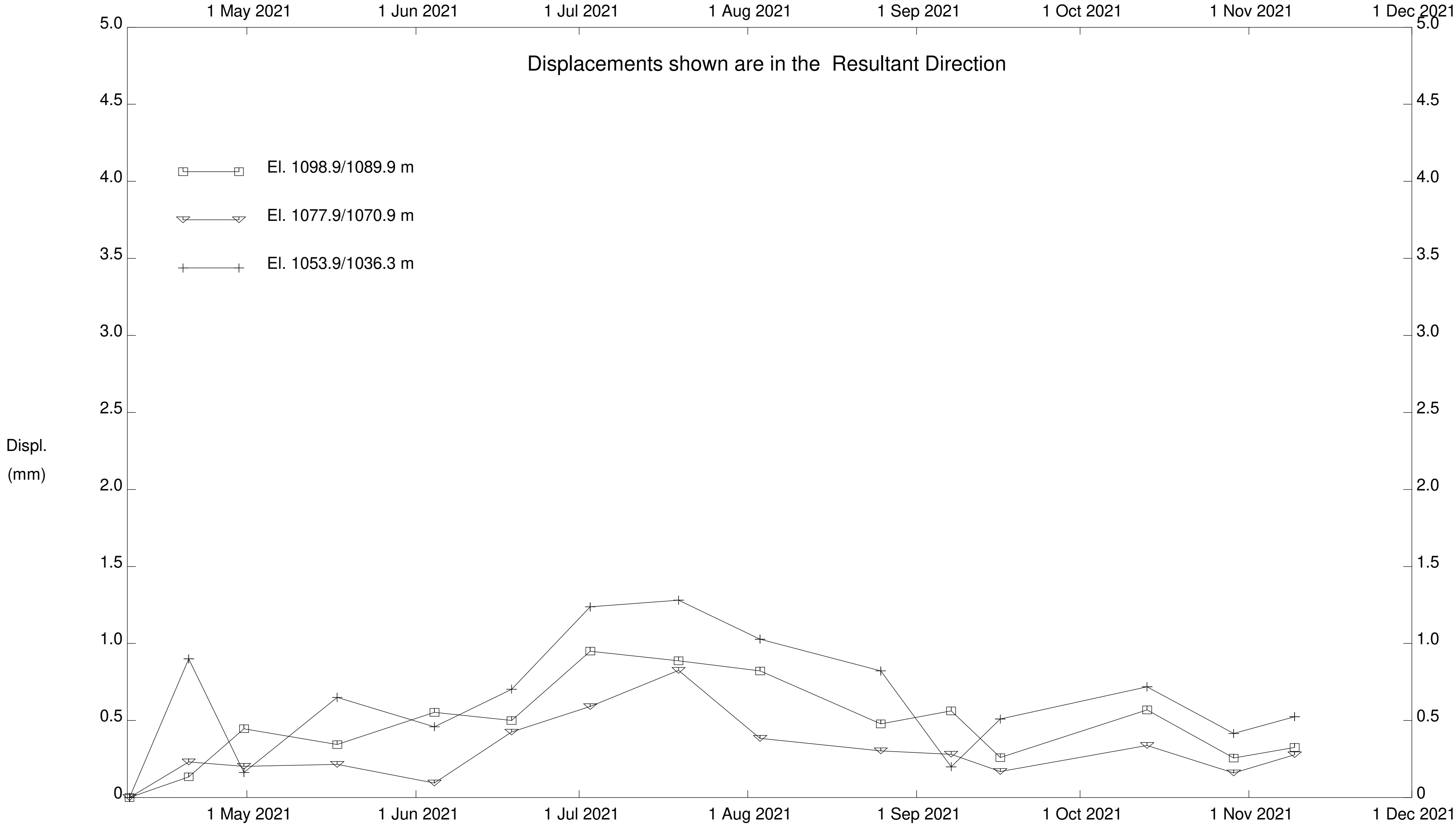
LL Dam, Inclinometer I17-9

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

Sets marked # corrected for casing compression

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I17-09.gtl

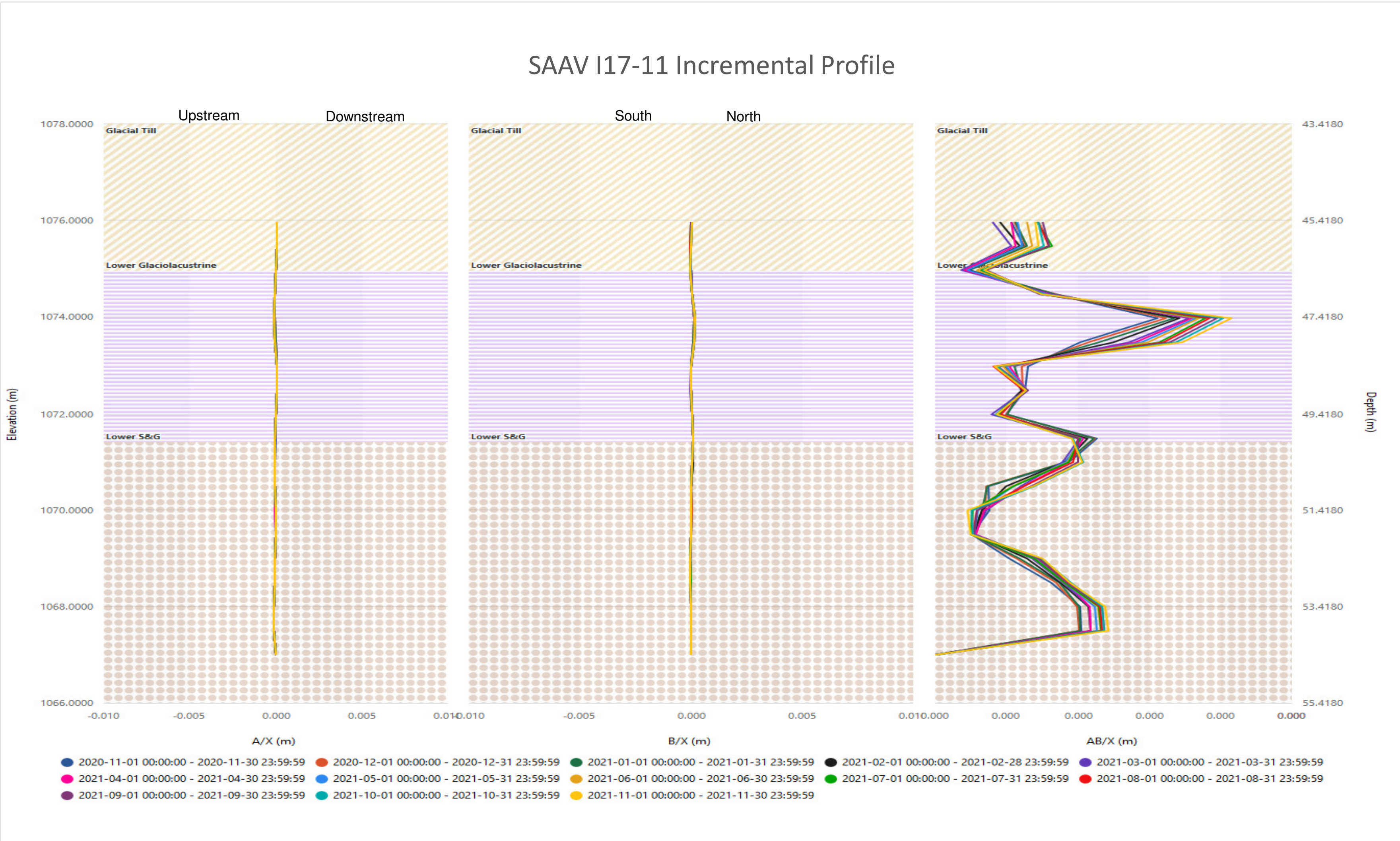
Highland Valley Copper - BC



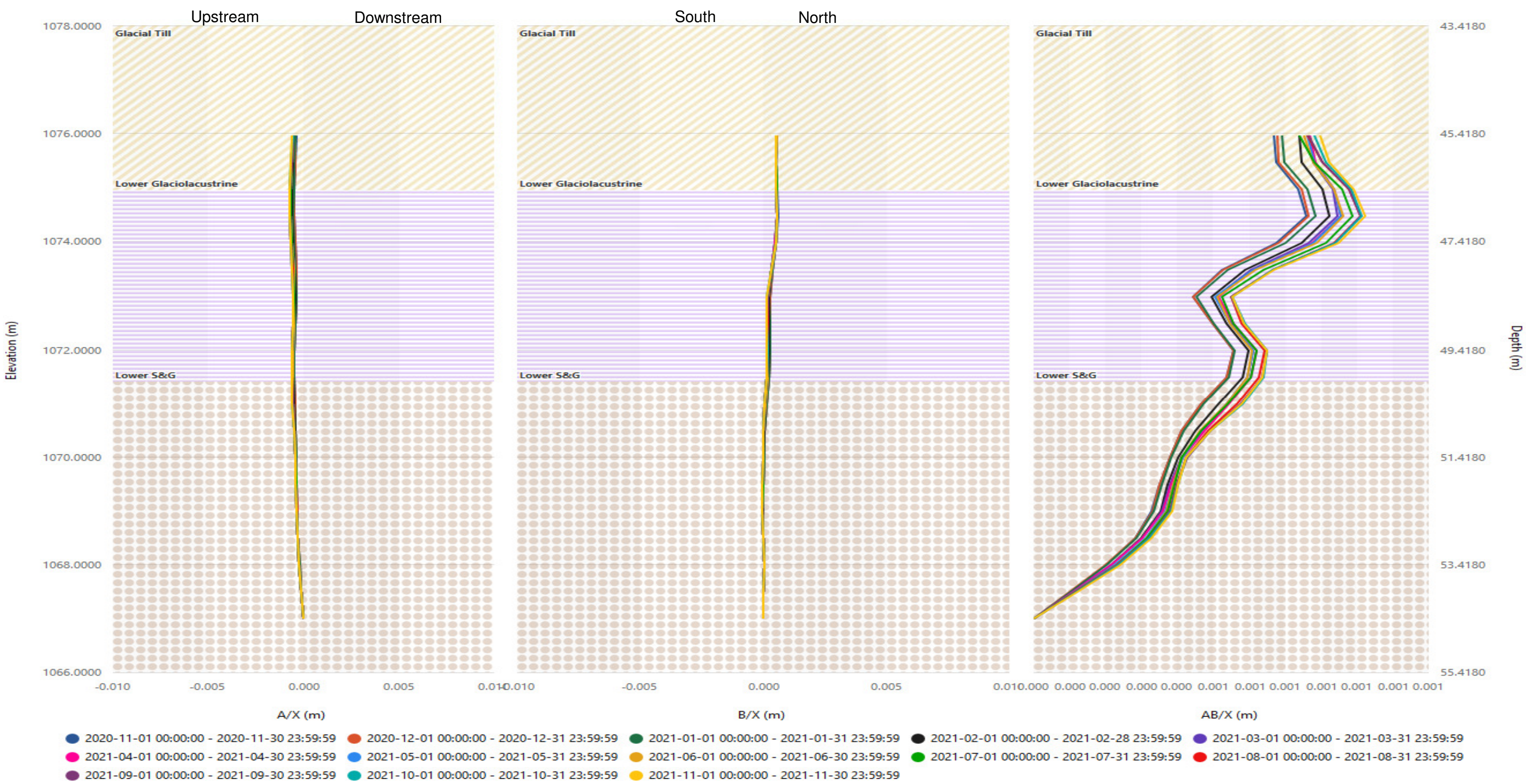
LL Dam, Inclinometer I17-9

Valley Buttress Berm

SAAV I17-11


SAAV I17-11 Incremental Profile
Upstream
Downstream
South
North
Elevation (m)
Depth (m)
Glacial Till
Lower Glaciolacustrine
Lower S&G
1078.0000
1076.0000
1074.0000
1072.0000
1070.0000
1068.0000
1066.0000
43.4180
45.4180
47.4180
49.4180
51.4180
53.4180
55.4180
-0.010
-0.005
0.000
0.005
0.010
A/X (m)
B/X (m)
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59

SAAV I17-11 Cumulative Profile

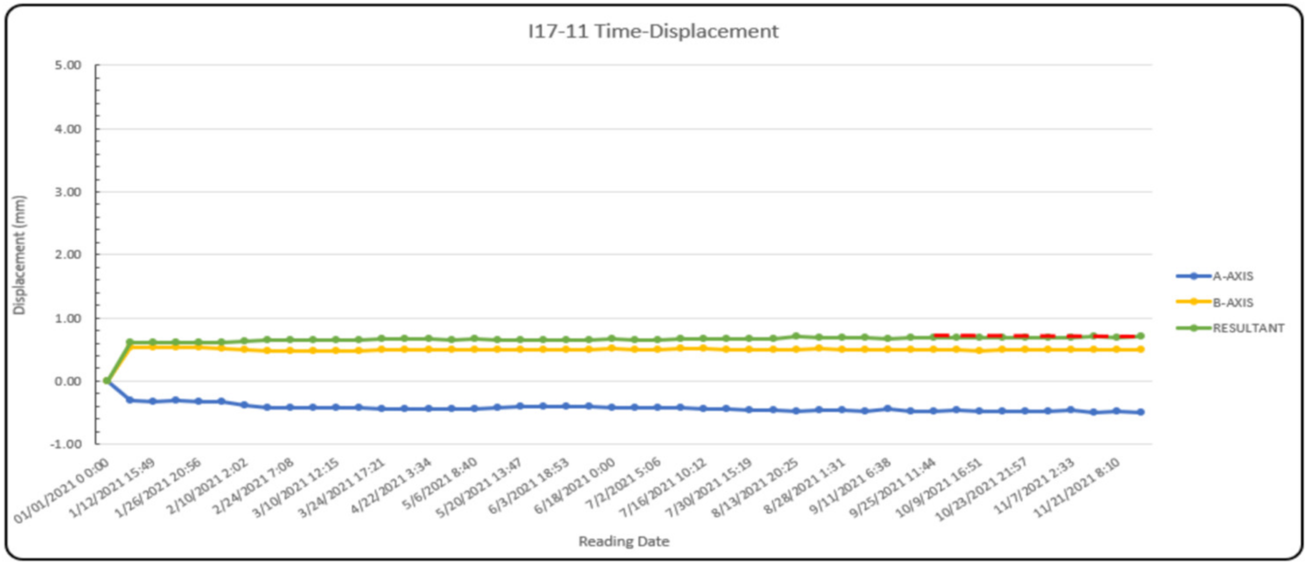


SAAV I17-11

Displacement Plot - Glaciolacustrine

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Lower Glaciolacustrine	1075	1068	0.5	0.01

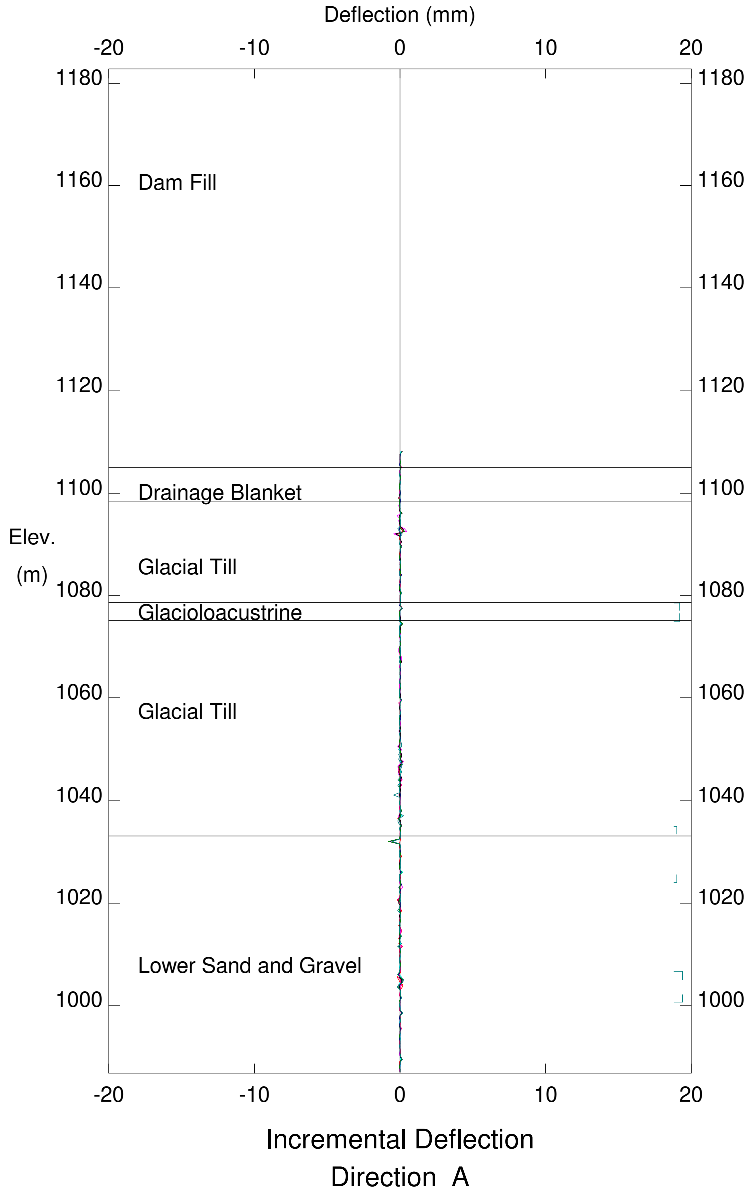
Upper El. (m)	1075.0
Lower El. (m)	1068.0



Valley Buttress Berm

I17-19

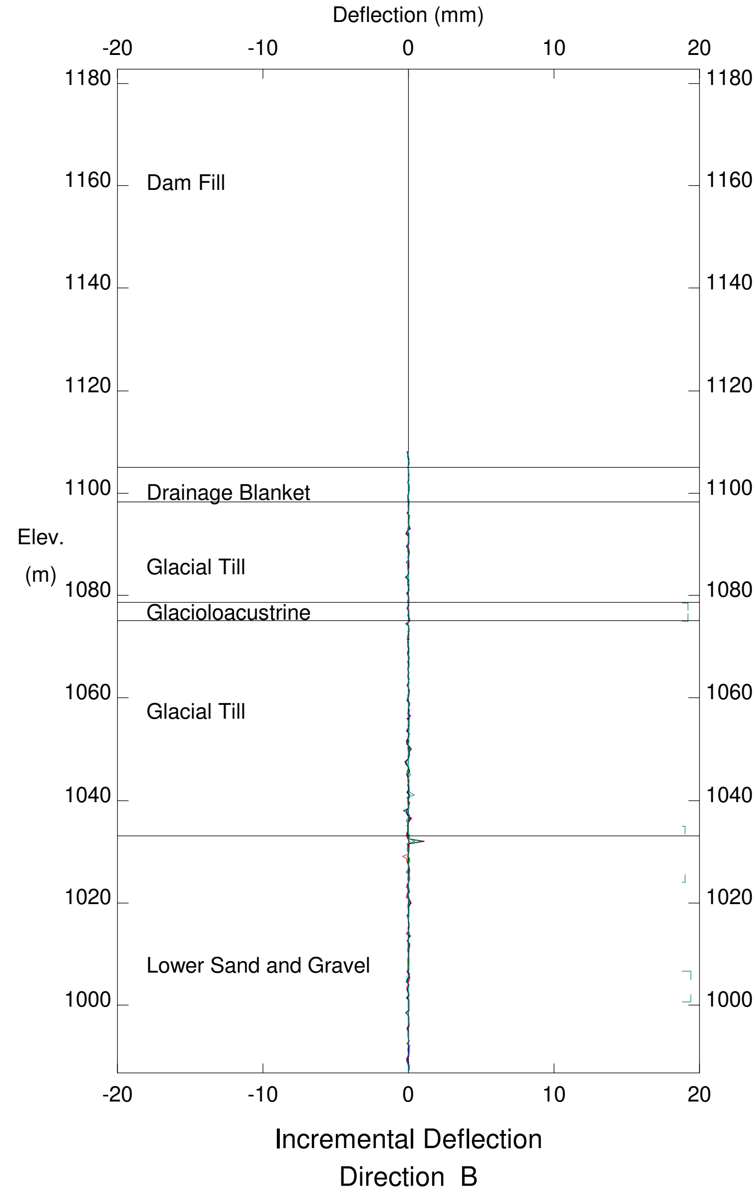
Highland Valley Copper - Logan Lake, BC



LEGEND

Initial	31 May 2021
	15 Jun 2021*
	29 Jun 2021
	13 Jul 2021*
	24 Aug 2021*
	28 Aug 2021
	23 Sep 2021*
	20 Oct 2021*
	7 Nov 2021*

Ref. Elevation 1182.8m

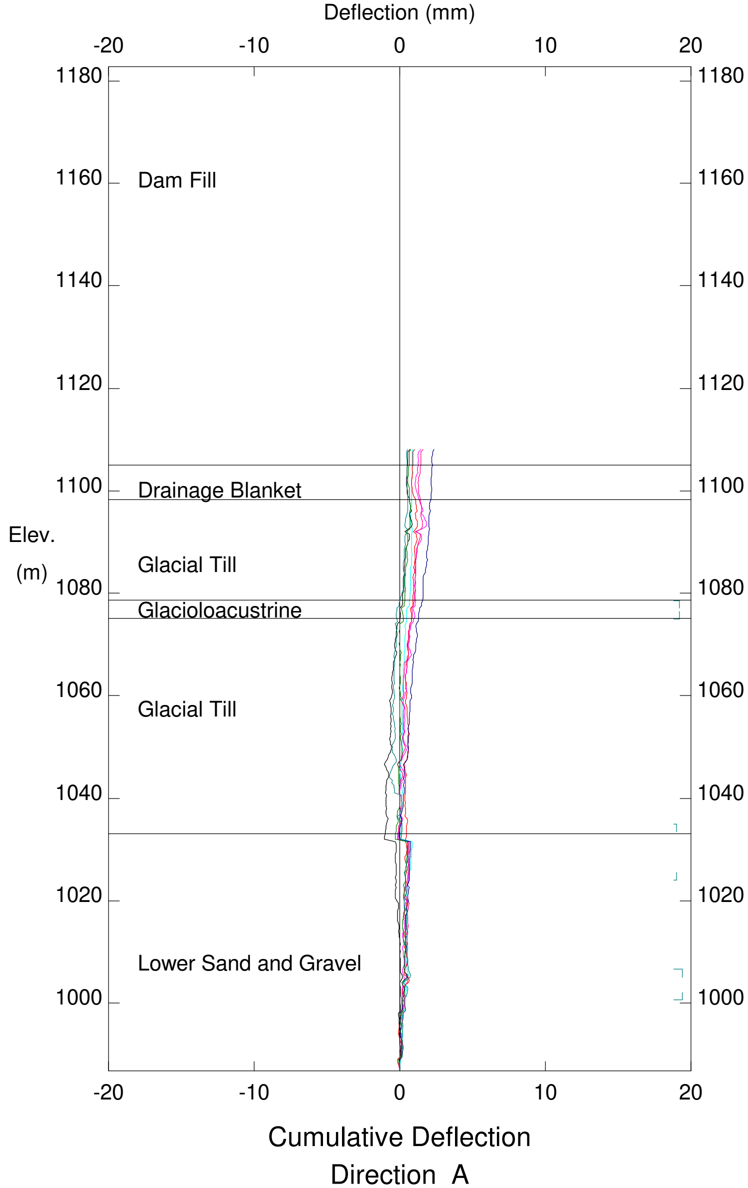


LL Dam - Dam fill excluded,,,, Inclinometer I17-19,,

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

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I17-19.gtl

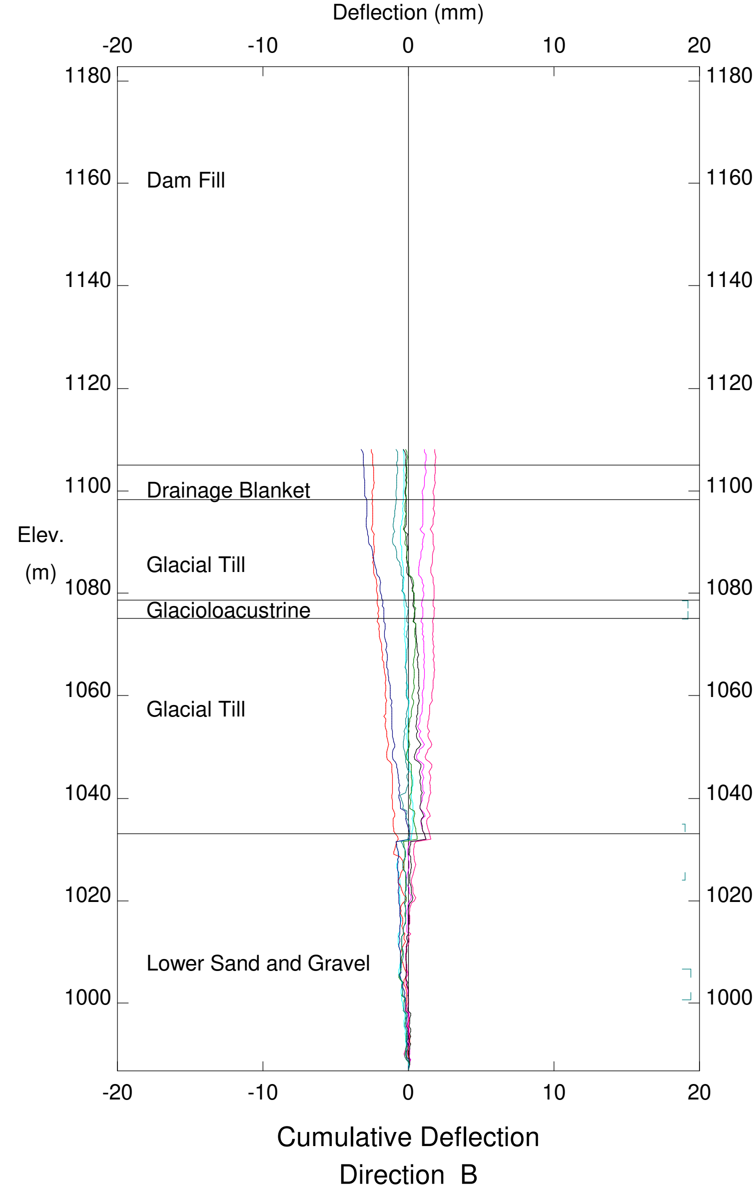
Highland Valley Copper - Logan Lake, BC



LEGEND

Initial	31 May 2021
	15 Jun 2021*
	29 Jun 2021
	13 Jul 2021*
	24 Aug 2021*
	28 Aug 2021
	23 Sep 2021*
	20 Oct 2021*
	7 Nov 2021*

Ref. Elevation 1182.8m

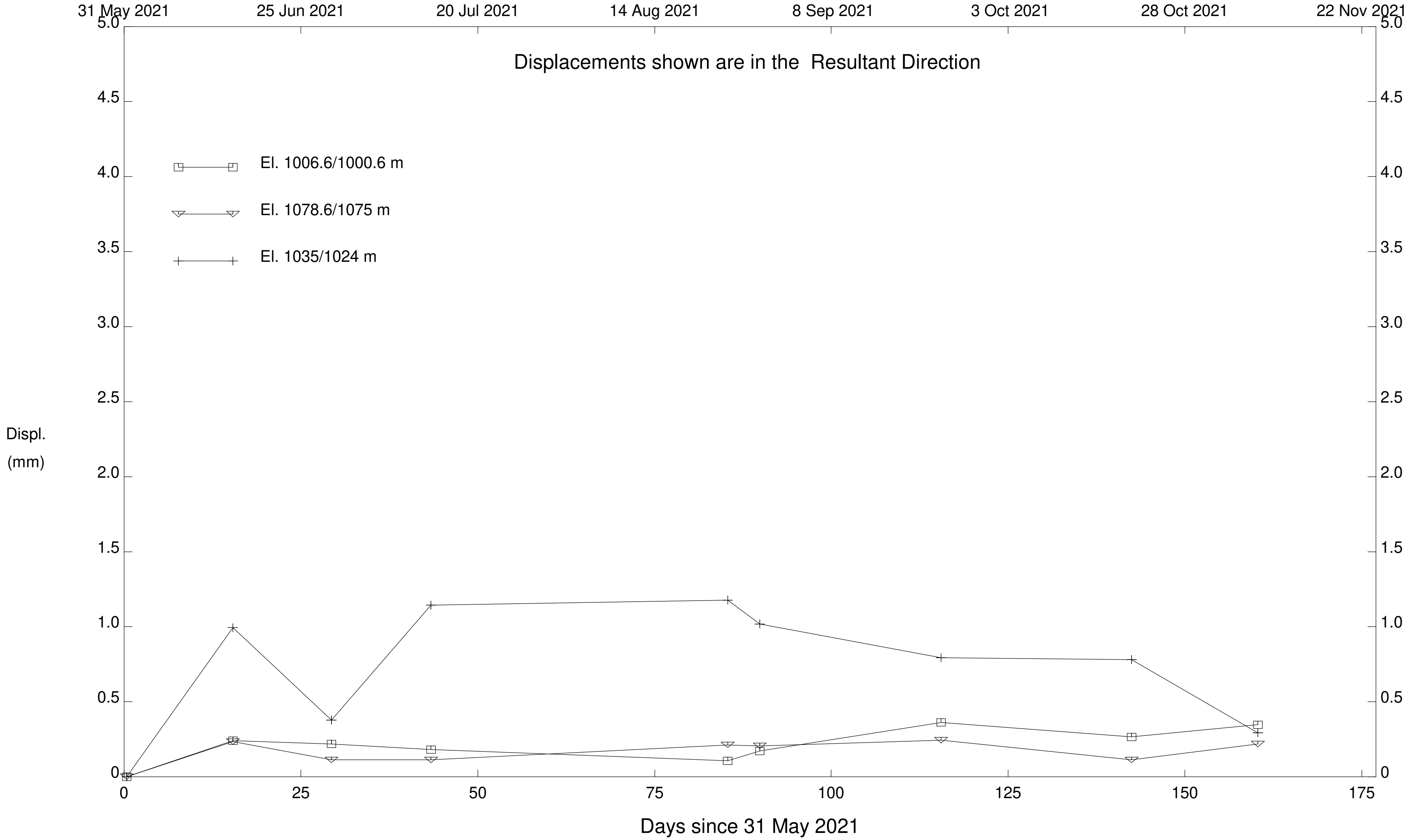


LL Dam - Dam fill excluded,,,, Inclinometer I17-19,,,

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

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I17-19.gtl

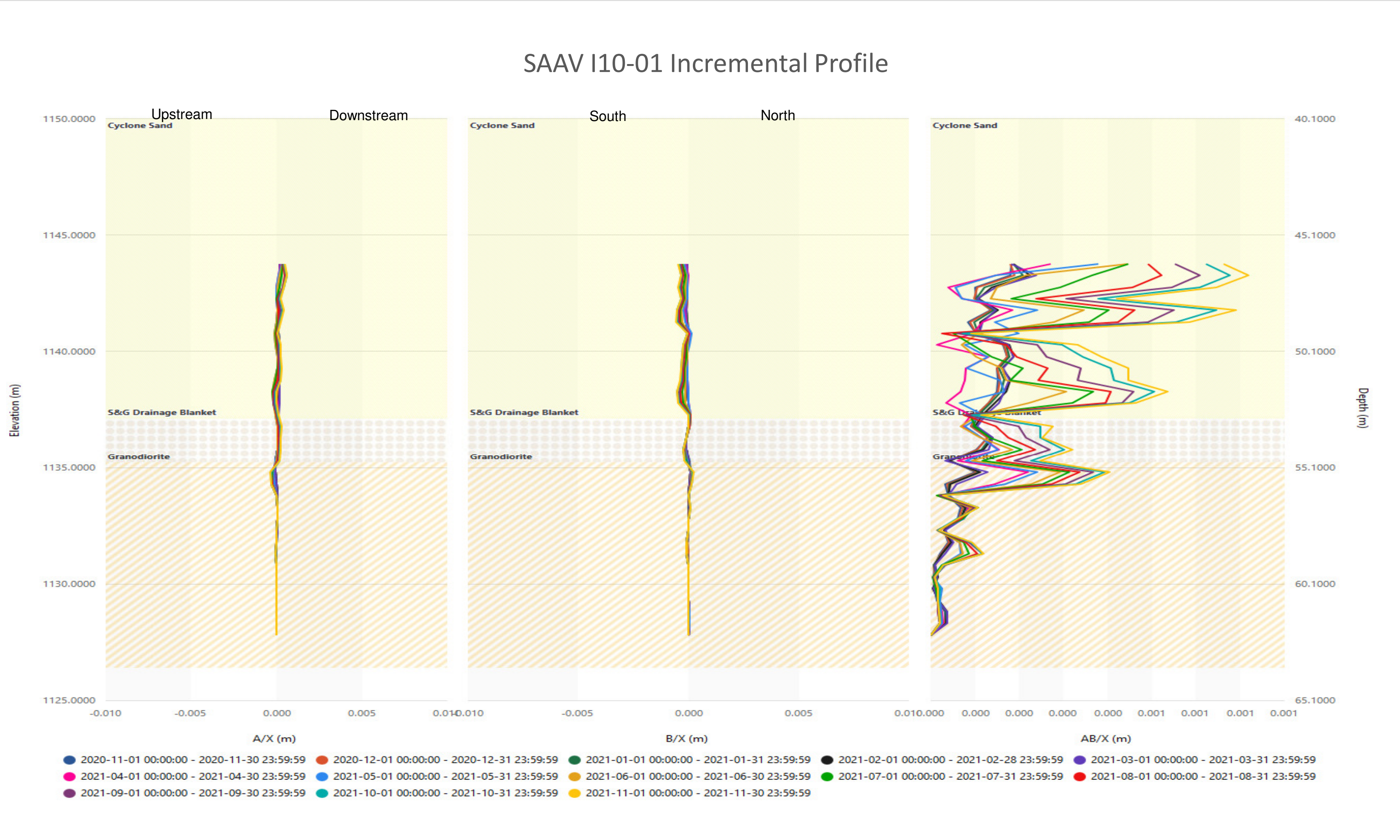
Highland Valley Copper - Logan Lake, BC

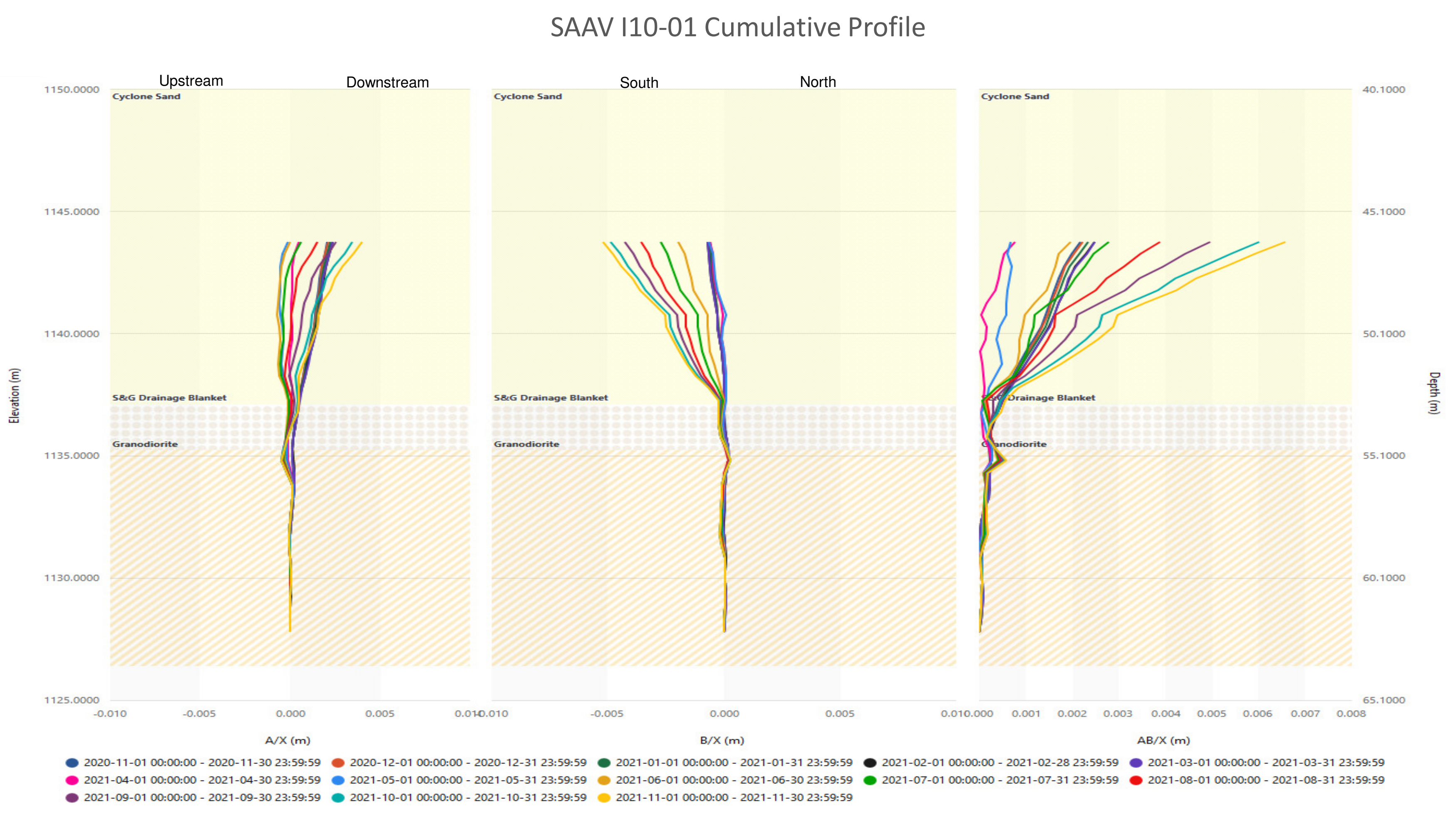


LL Dam - Dam fill excluded,,,, Inclinometer I17-19,,,

South Dam

SAAV I10-01


SAAV I10-01 Incremental Profile
Upstream
Downstream
South
North
Cyclone Sand
S&G Drainage Blanket
Granodiorite
Elevation (m)
Depth (m)
1150.0000
1145.0000
1140.0000
1135.0000
1130.0000
1125.0000
40.1000
45.1000
50.1000
55.1000
60.1000
65.1000
-0.010
-0.005
0.000
0.005
0.010
0.001
A/X (m)
B/X (m)
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59



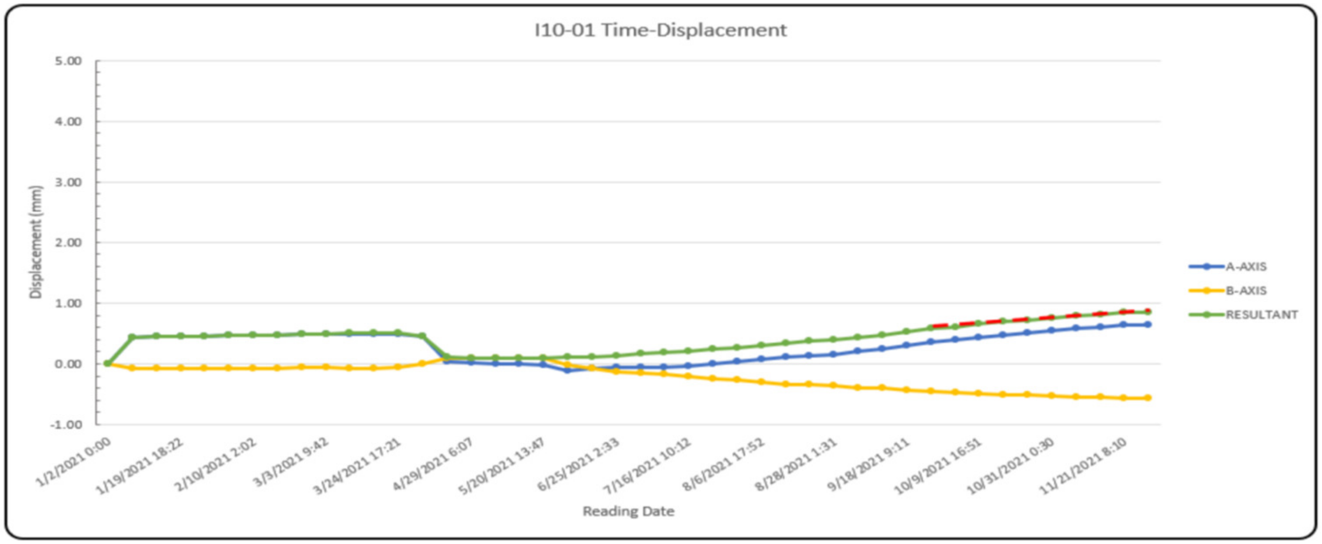
SAAV I10-01 Cumulative Profile
Upstream
Downstream
South
North
Cyclone Sand
S&G Drainage Blanket
Granodiorite
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59
2021-11-01 00:00:00 - 2021-11-30 23:59:59

SAA I10-01

Displacement Plot - Drainage Blanket

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Drainage Blanket	**1137.8**	**1135.8**	**5.0**	**0.14**
Volcanic	1135.8	1127.8	1.0	

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

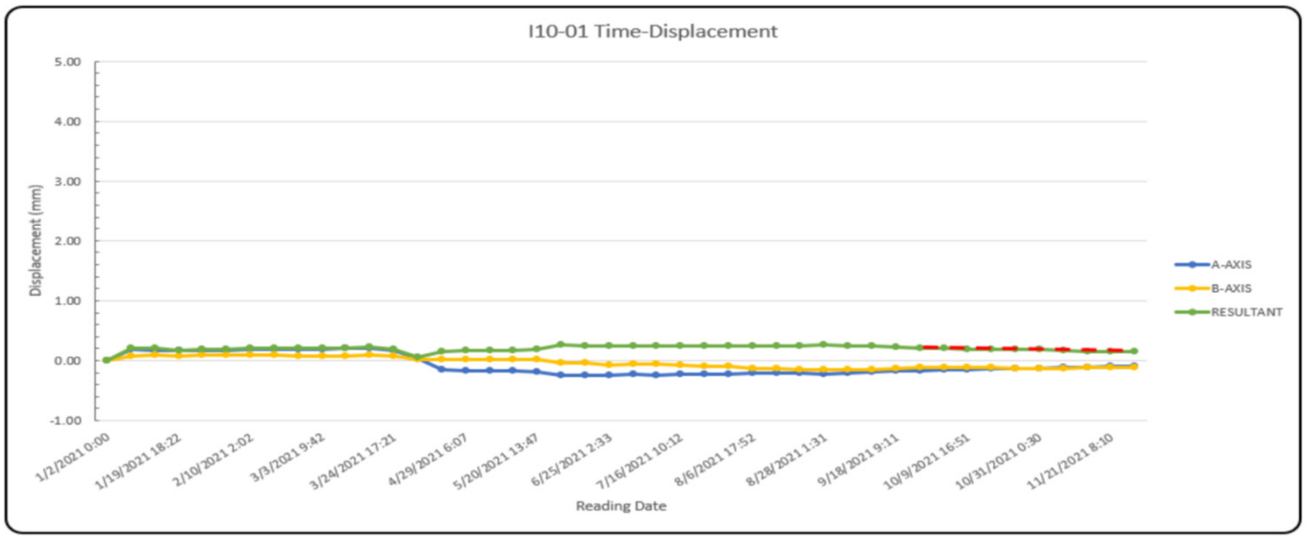


SAA I10-01

Displacement Plot - Volcanics

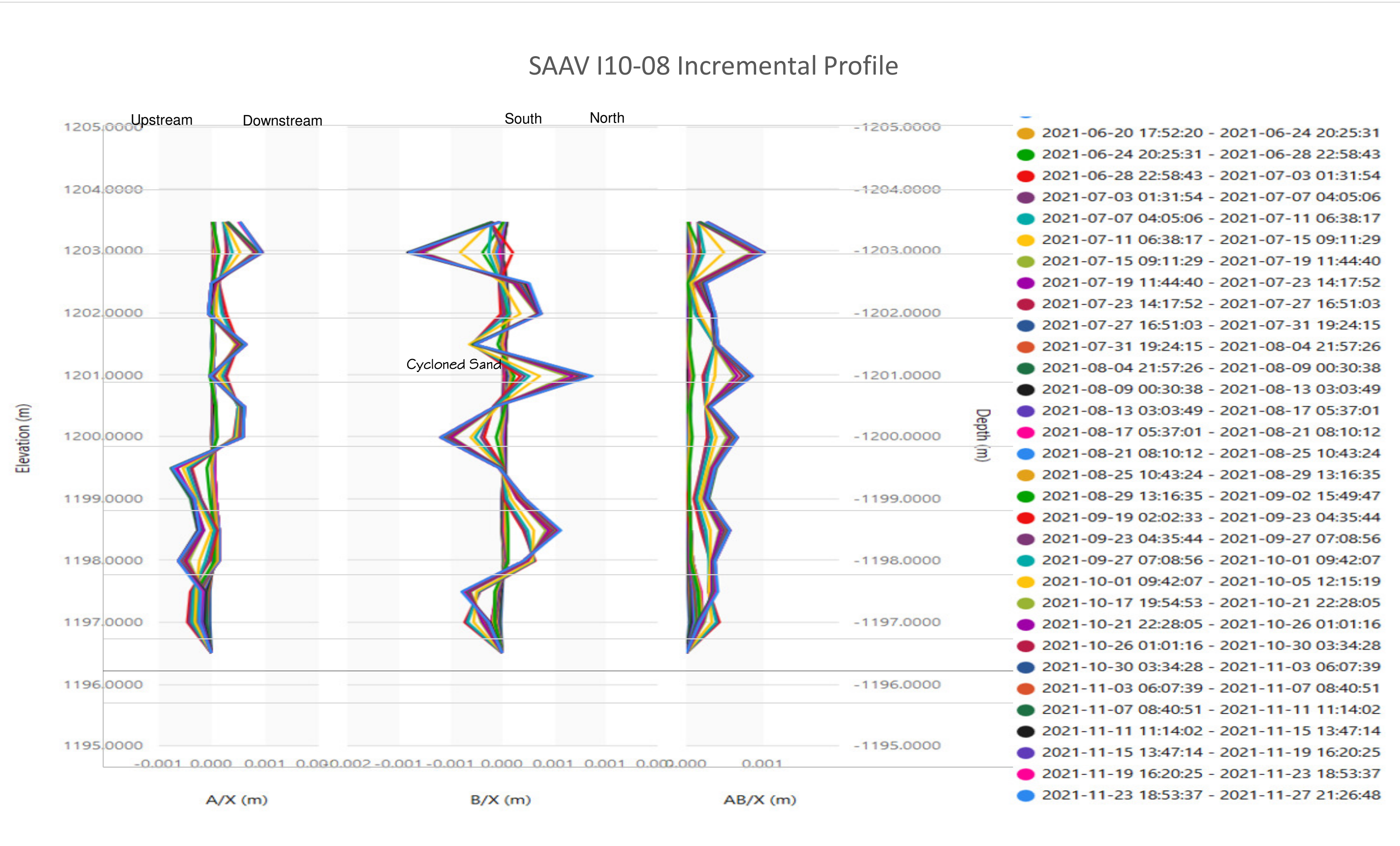
Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Drainage Blanket	1137.8	1135.8	5.0	
Volcanic	**1135.8**	**1127.8**	**1.0**	**0.03**

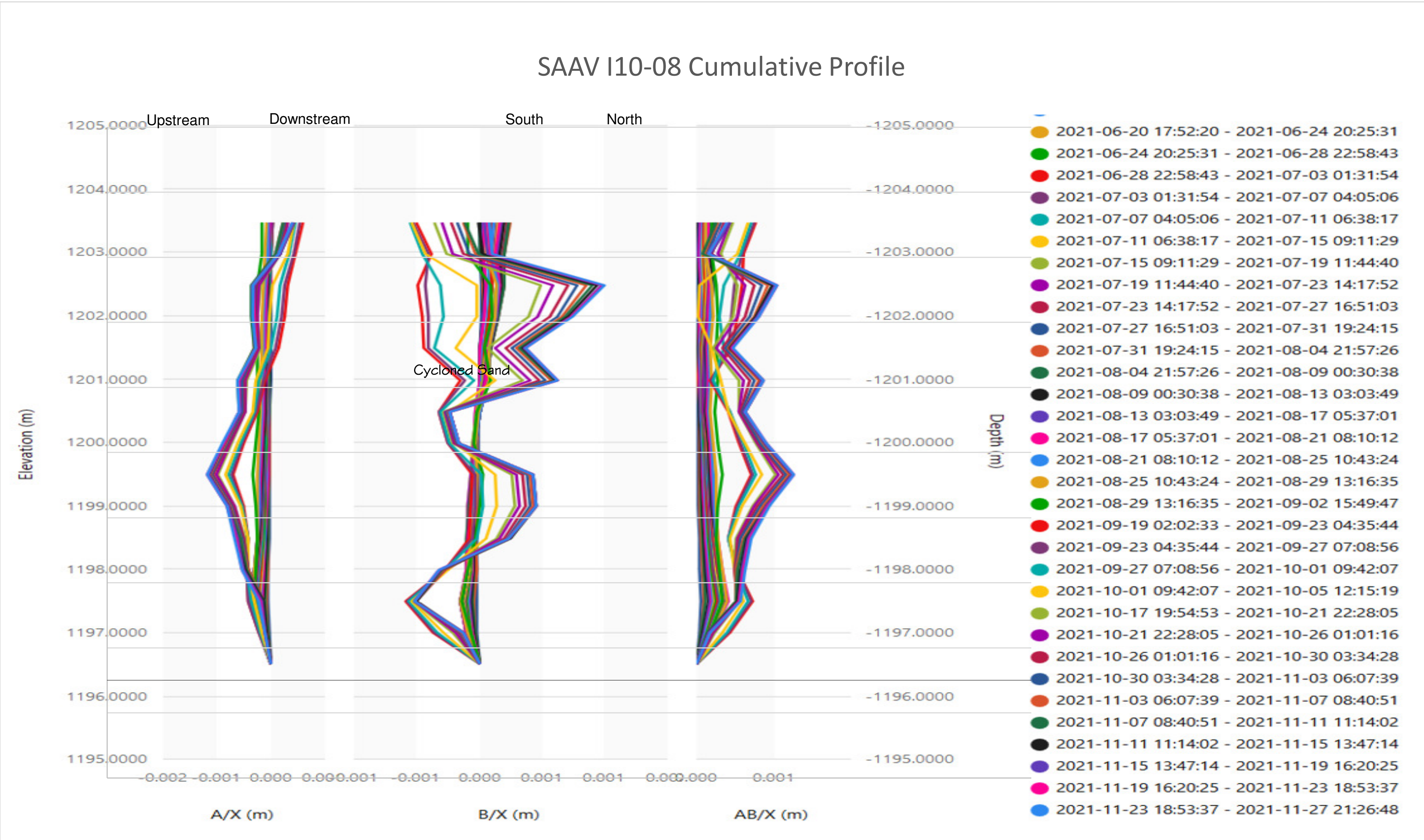
Upper El. (m)	1135.8
Lower El. (m)	1127.8



South Dam

SAAV I10-08


SAAV I10-08 Incremental Profile
Upstream
Downstream
South
North
Cycloned Sand
Elevation (m)
Depth (m)
1205.0000
1204.0000
1203.0000
1202.0000
1201.0000
1200.0000
1199.0000
1198.0000
1197.0000
1196.0000
1195.0000
-1205.0000
-1204.0000
-1203.0000
-1202.0000
-1201.0000
-1200.0000
-1199.0000
-1198.0000
-1197.0000
-1196.0000
-1195.0000
A/X (m)
B/X (m)
AB/X (m)
2021-06-20 17:52:20 - 2021-06-24 20:25:31
2021-06-24 20:25:31 - 2021-06-28 22:58:43
2021-06-28 22:58:43 - 2021-07-03 01:31:54
2021-07-03 01:31:54 - 2021-07-07 04:05:06
2021-07-07 04:05:06 - 2021-07-11 06:38:17
2021-07-11 06:38:17 - 2021-07-15 09:11:29
2021-07-15 09:11:29 - 2021-07-19 11:44:40
2021-07-19 11:44:40 - 2021-07-23 14:17:52
2021-07-23 14:17:52 - 2021-07-27 16:51:03
2021-07-27 16:51:03 - 2021-07-31 19:24:15
2021-07-31 19:24:15 - 2021-08-04 21:57:26
2021-08-04 21:57:26 - 2021-08-09 00:30:38
2021-08-09 00:30:38 - 2021-08-13 03:03:49
2021-08-13 03:03:49 - 2021-08-17 05:37:01
2021-08-17 05:37:01 - 2021-08-21 08:10:12
2021-08-21 08:10:12 - 2021-08-25 10:43:24
2021-08-25 10:43:24 - 2021-08-29 13:16:35
2021-08-29 13:16:35 - 2021-09-02 15:49:47
2021-09-19 02:02:33 - 2021-09-23 04:35:44
2021-09-23 04:35:44 - 2021-09-27 07:08:56
2021-09-27 07:08:56 - 2021-10-01 09:42:07
2021-10-01 09:42:07 - 2021-10-05 12:15:19
2021-10-17 19:54:53 - 2021-10-21 22:28:05
2021-10-21 22:28:05 - 2021-10-26 01:01:16
2021-10-26 01:01:16 - 2021-10-30 03:34:28
2021-10-30 03:34:28 - 2021-11-03 06:07:39
2021-11-03 06:07:39 - 2021-11-07 08:40:51
2021-11-07 08:40:51 - 2021-11-11 11:14:02
2021-11-11 11:14:02 - 2021-11-15 13:47:14
2021-11-15 13:47:14 - 2021-11-19 16:20:25
2021-11-19 16:20:25 - 2021-11-23 18:53:37
2021-11-23 18:53:37 - 2021-11-27 21:26:48



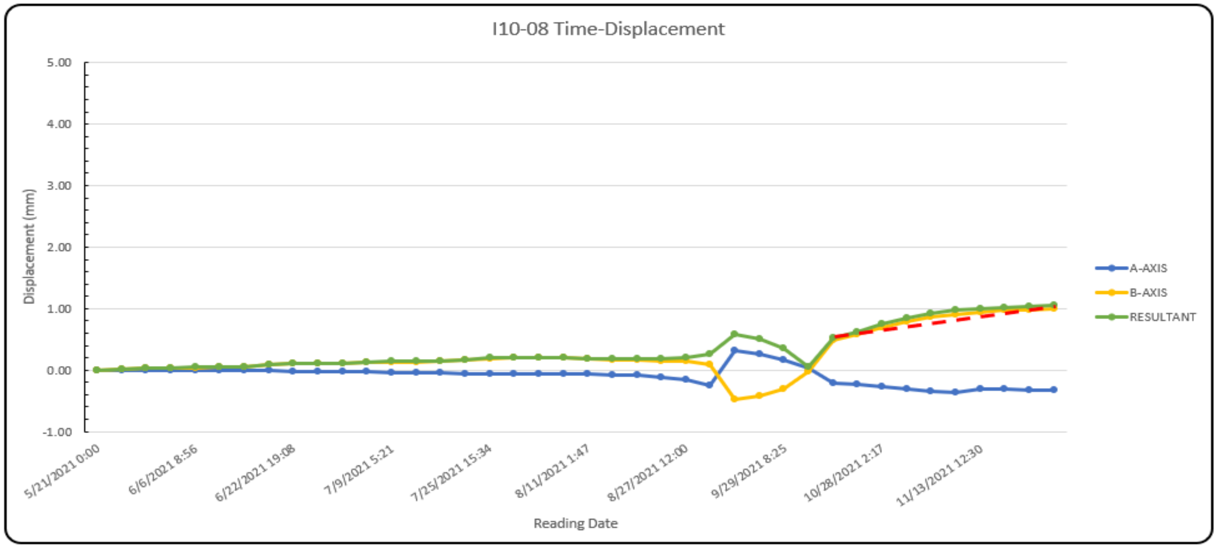
SAAV I10-08 Cumulative Profile
Upstream
Downstream
South
North
Cycloned Sand
Elevation (m)
Depth (m)
1205.0000
1204.0000
1203.0000
1202.0000
1201.0000
1200.0000
1199.0000
1198.0000
1197.0000
1196.0000
1195.0000
-1205.0000
-1204.0000
-1203.0000
-1202.0000
-1201.0000
-1200.0000
-1199.0000
-1198.0000
-1197.0000
-1196.0000
-1195.0000
A/X (m)
B/X (m)
AB/X (m)
2021-06-20 17:52:20 - 2021-06-24 20:25:31
2021-06-24 20:25:31 - 2021-06-28 22:58:43
2021-06-28 22:58:43 - 2021-07-03 01:31:54
2021-07-03 01:31:54 - 2021-07-07 04:05:06
2021-07-07 04:05:06 - 2021-07-11 06:38:17
2021-07-11 06:38:17 - 2021-07-15 09:11:29
2021-07-15 09:11:29 - 2021-07-19 11:44:40
2021-07-19 11:44:40 - 2021-07-23 14:17:52
2021-07-23 14:17:52 - 2021-07-27 16:51:03
2021-07-27 16:51:03 - 2021-07-31 19:24:15
2021-07-31 19:24:15 - 2021-08-04 21:57:26
2021-08-04 21:57:26 - 2021-08-09 00:30:38
2021-08-09 00:30:38 - 2021-08-13 03:03:49
2021-08-13 03:03:49 - 2021-08-17 05:37:01
2021-08-17 05:37:01 - 2021-08-21 08:10:12
2021-08-21 08:10:12 - 2021-08-25 10:43:24
2021-08-25 10:43:24 - 2021-08-29 13:16:35
2021-08-29 13:16:35 - 2021-09-02 15:49:47
2021-09-19 02:02:33 - 2021-09-23 04:35:44
2021-09-23 04:35:44 - 2021-09-27 07:08:56
2021-09-27 07:08:56 - 2021-10-01 09:42:07
2021-10-01 09:42:07 - 2021-10-05 12:15:19
2021-10-17 19:54:53 - 2021-10-21 22:28:05
2021-10-21 22:28:05 - 2021-10-26 01:01:16
2021-10-26 01:01:16 - 2021-10-30 03:34:28
2021-10-30 03:34:28 - 2021-11-03 06:07:39
2021-11-03 06:07:39 - 2021-11-07 08:40:51
2021-11-07 08:40:51 - 2021-11-11 11:14:02
2021-11-11 11:14:02 - 2021-11-15 13:47:14
2021-11-15 13:47:14 - 2021-11-19 16:20:25
2021-11-19 16:20:25 - 2021-11-23 18:53:37
2021-11-23 18:53:37 - 2021-11-27 21:26:48

SAAV I10-08

Displacement Plot – Cycloned Sand

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Cycloned Sand	1202.5	1196.5	5.0	0.52

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



APPENDIX IV

H-H Dam Instrumentation Summary

APPENDIX IV-A

H-H Dam Response Summary

Appendix IV-A
H-H Dam 2021 Instrumentation Summary

IV-A-1 INSTRUMENTATION SYSTEM

Table IV-A-1 summarizes instruments installed within or near the H-H Dam as of November 2021. Location of instruments are shown on Figure 5 of the main text. November 2021 instrumentation readings are shown on select design cross sections, through each dam segment, of the H-H Dam (Figures 15 to 19, at end of main report text). 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 HVC and KCB. Readings for the majority of instruments are automated through the GeoExplorer software package.

Reading frequencies for instruments vary depending on the location and control requirements. Reading frequencies for manual piezometers and all inclinometers are documented in the OMS Manual. Readings from automated piezometers are typically collected more frequently.

Table IV-A-1 Summary of Functional Instrumentation Installed at H-H Dam (November 2021)

Instrument	Type	Reading (1)	No.	Total
Piezometers	Standpipe	Manual	1	24
	Vibrating Wire	Automated	21	
	Converted Standpipe to Vibrating Wire	Automated	2	
Inclinometers	Down-hole Casing	Manual	5	8
	ShapeArray (SAA / SAAV) (2)	Automated	3	
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.

There are 8 inclinometers and 4 Sondex settlement monitoring systems installed at the H-H Dam, refer to Table IV-A-2. Inclinometer HHI17-17 (~Sta. 1+600) became non-functional during 2021 due to a broken casing segment and is scheduled for replacement in 2022. If nearby inclinometers go out of service prior to that, plans to re-establish I17-17 or other instruments will be accelerated. KCB agreed with that approach as movements in this area are monitored by I17-16 and I15-23.

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 / -	HHI15-23 / HHI17-32A	-	HHI17-16 / HHI17-16A	-
Crest of Fill Slope	-	-	-	HHI17-17 *damaged (2021)* / HHI17-17A	-	-
Toe of Fill Slope	-	-	HHI17-31 / -	-	HHI17-30 / -	HHSAAVI17-14 / -

IV-A-2 2021 INSTRUMENT INSTALLATIONS

Table IV-A-3 summarizes instrument installations at the H-H Dam during the 2021 AFPR reporting period.

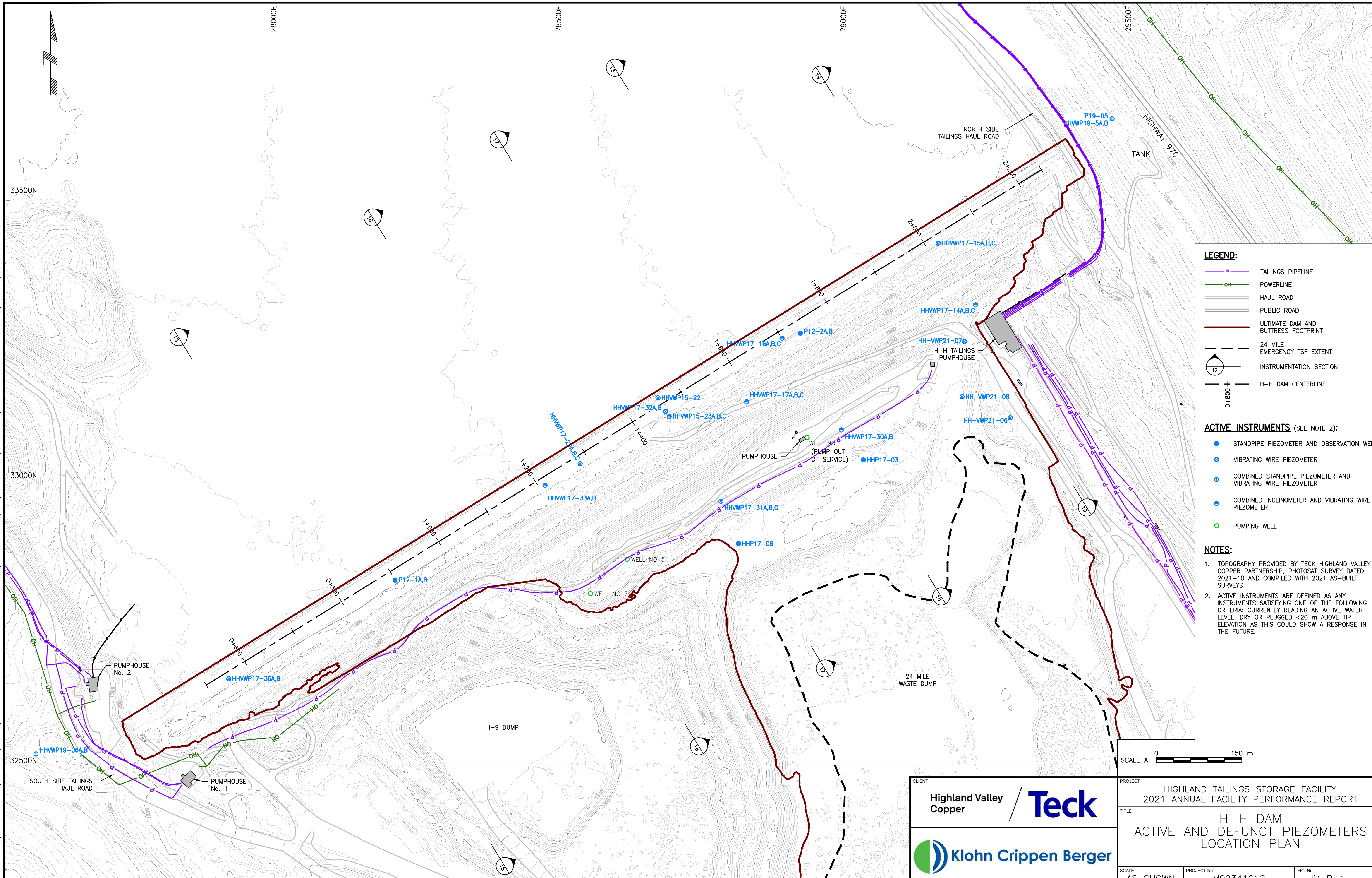
Table IV-A-3 2021 Instrument Installations

Station	Instrument Type	Instrument ID	Unit Monitored	Purpose
1+970	VWP	HH-VWP21-06	Pit Waste / Native Ground Contact	Expand monitoring area of piezometric levels between the H-H Dam downstream slope and 24 Mile Emergency TSF
1+910		HH-VWP21-07	Pit Waste / Native Ground Contact	
1+970		HH-VWP21-08	Glacial Till	

APPENDIX IV-B

H-H Dam Piezometer Plots

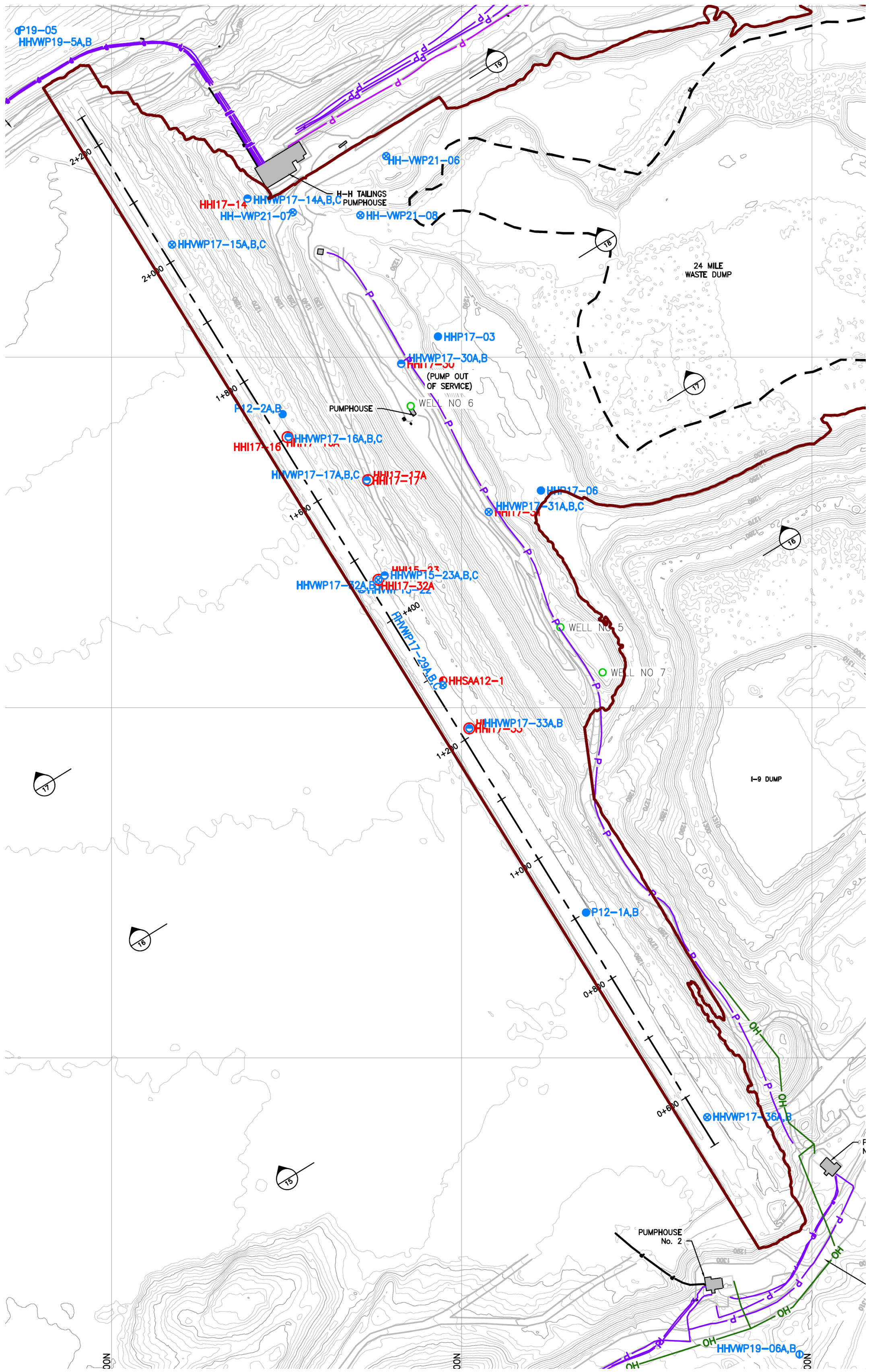
H-H Dam Piezometer Location Map



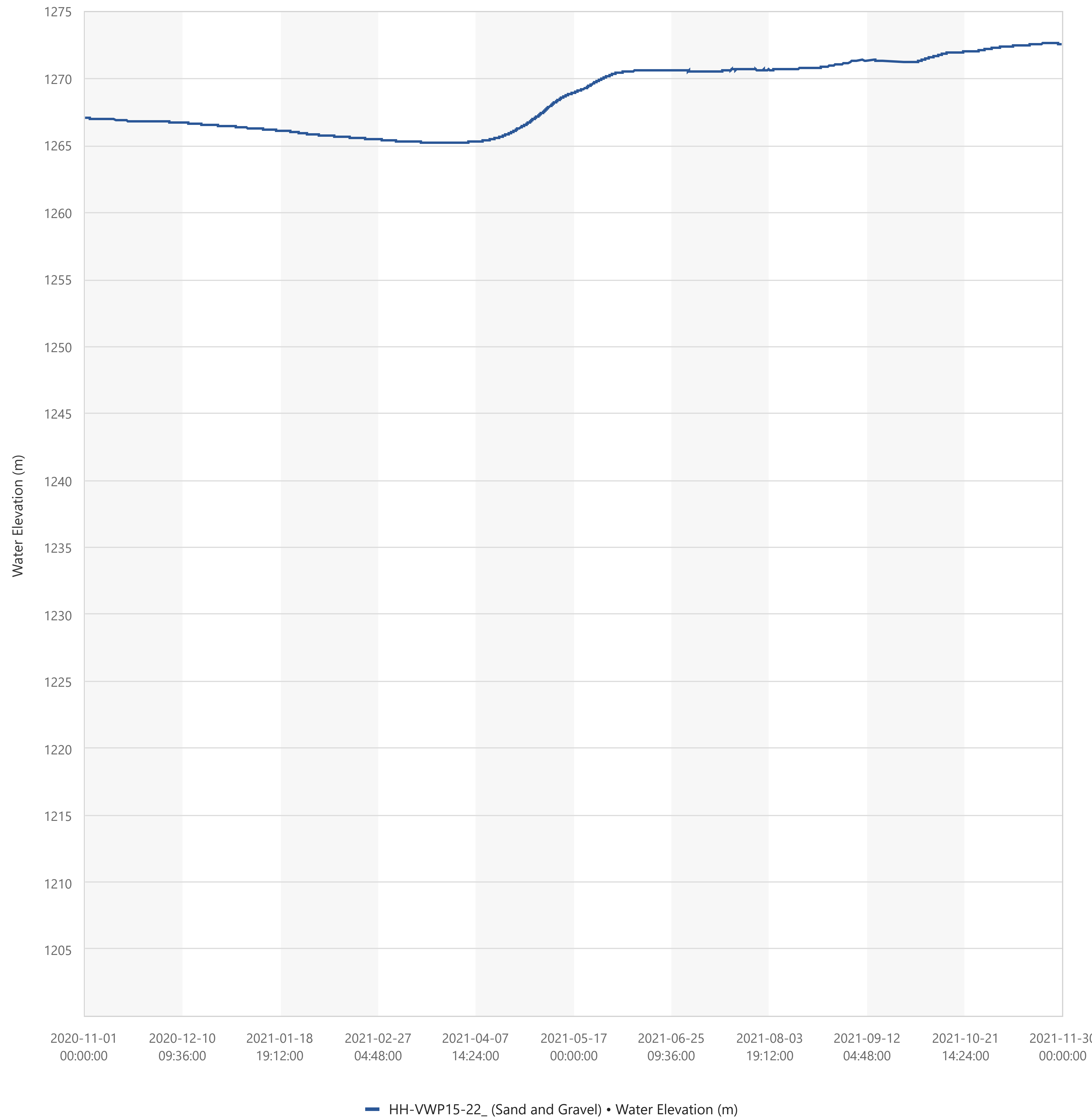
SAVE DATE: 2022-02-18 (3:28 PM)
FILE PATH: \\INT.KLOHN.COM\PROJDATA\M\VCR\M02341C12-HVC 2021 DAM SAFETY SUPPORT\400 DRAWINGS\CAD\05-FIGURES\2021 AFPR\FIG IV-B-1 - H-H DAM.DWG (THAWKER)

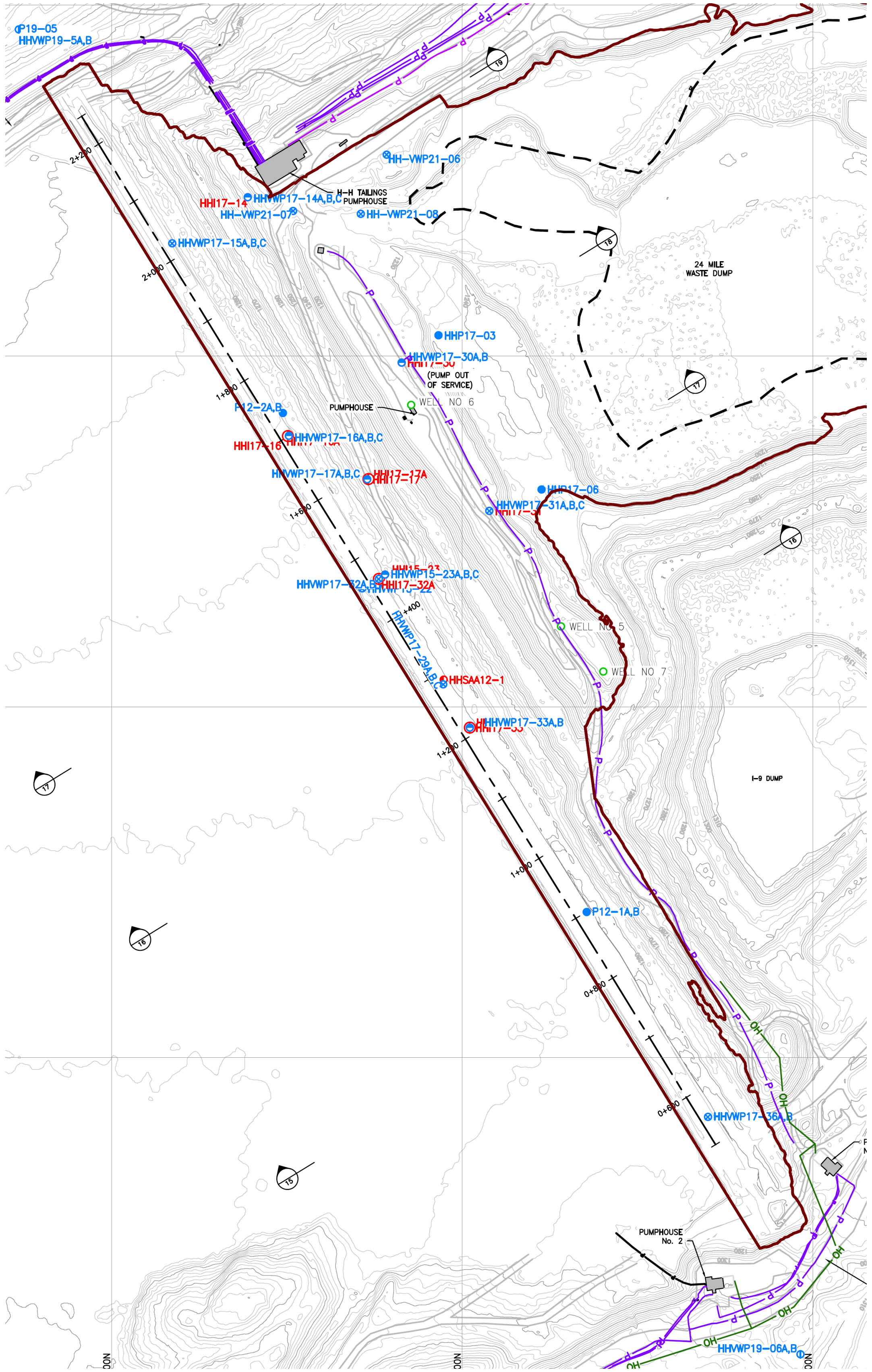
Appendix IV-B-1

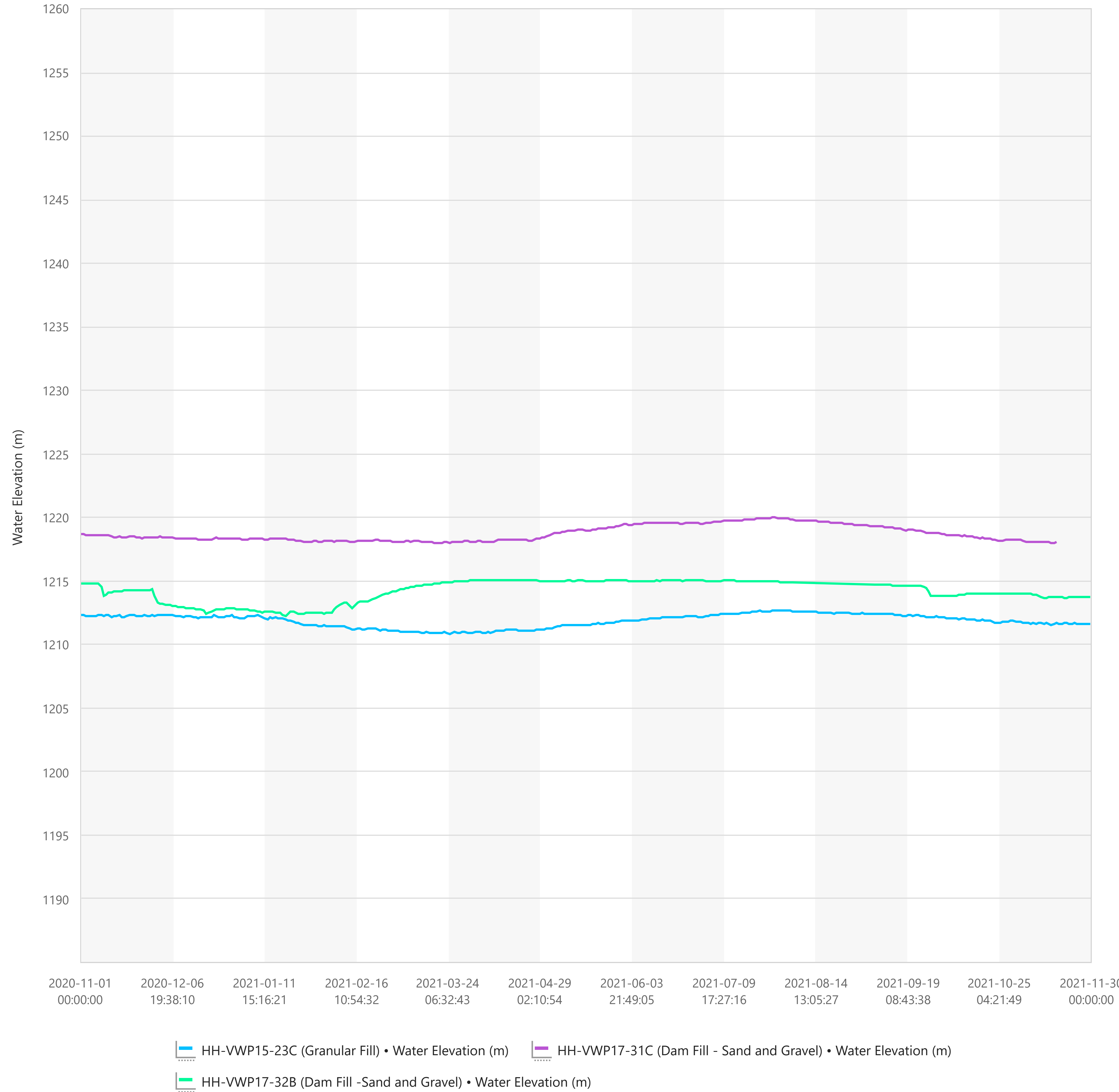
H-H Dam Piezometers: 2021 Water Elevations



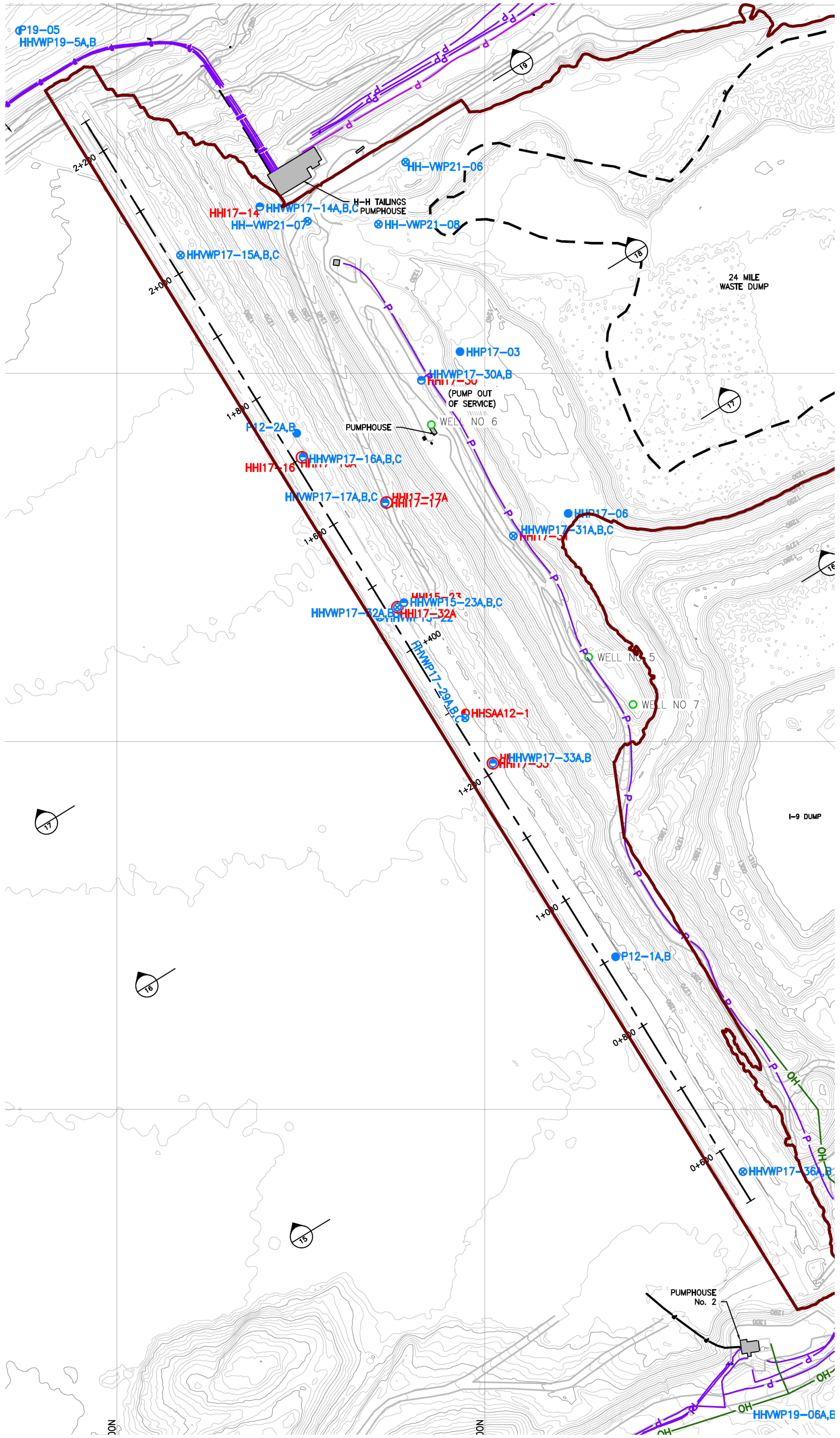
H-H Dam
Upstream of Core



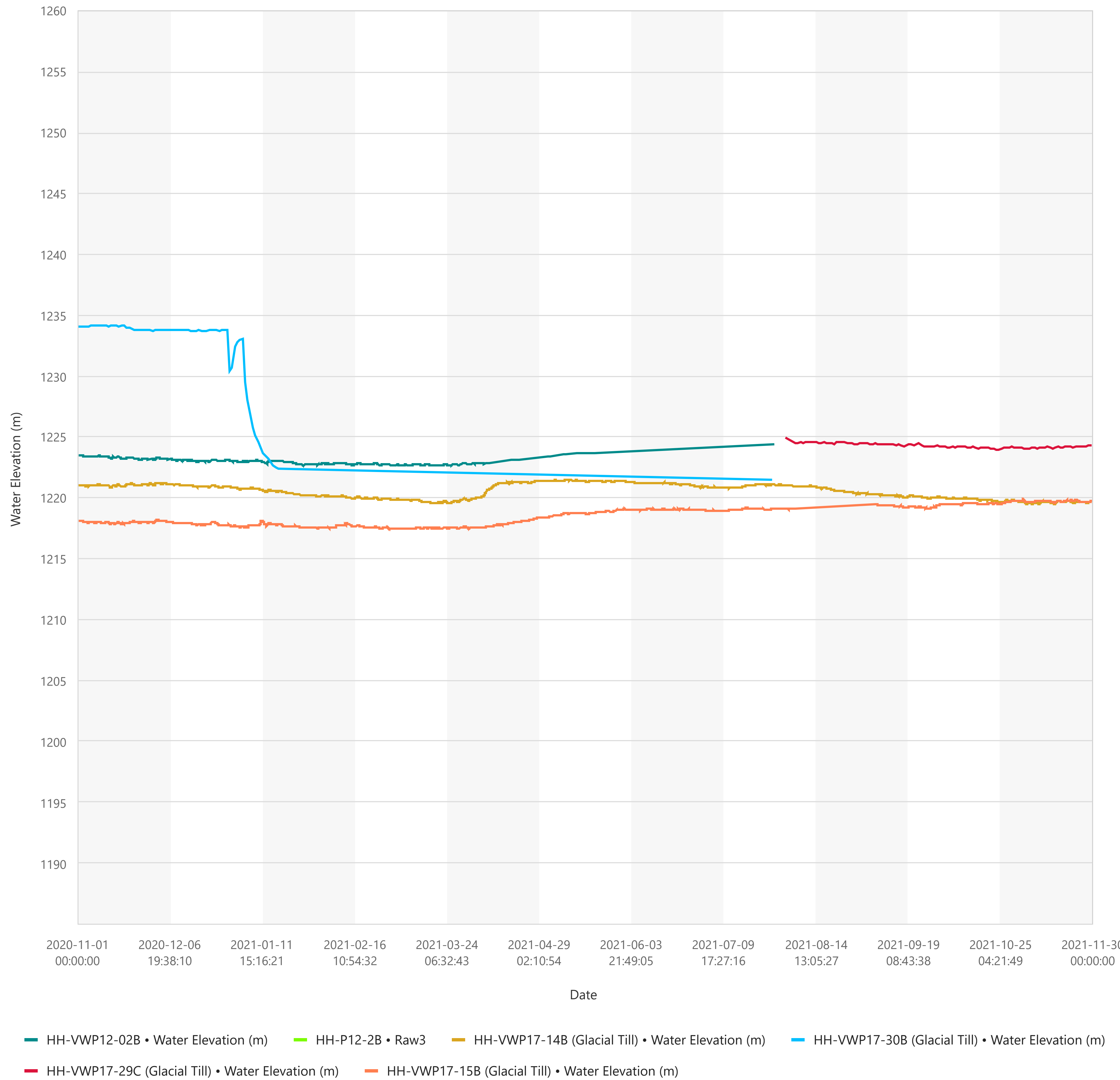


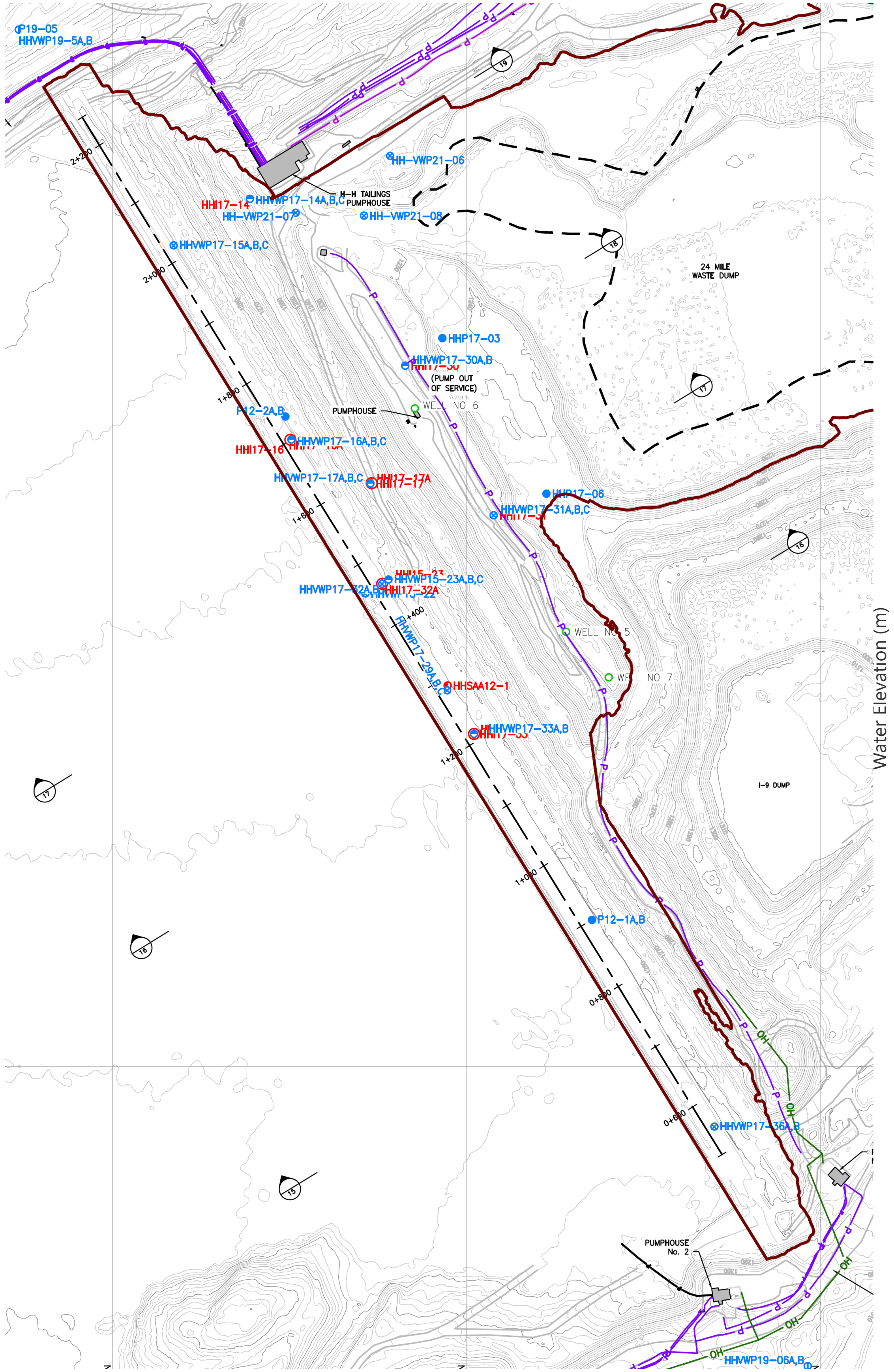


H-H Dam
Dam Fill, Sand and Gravel

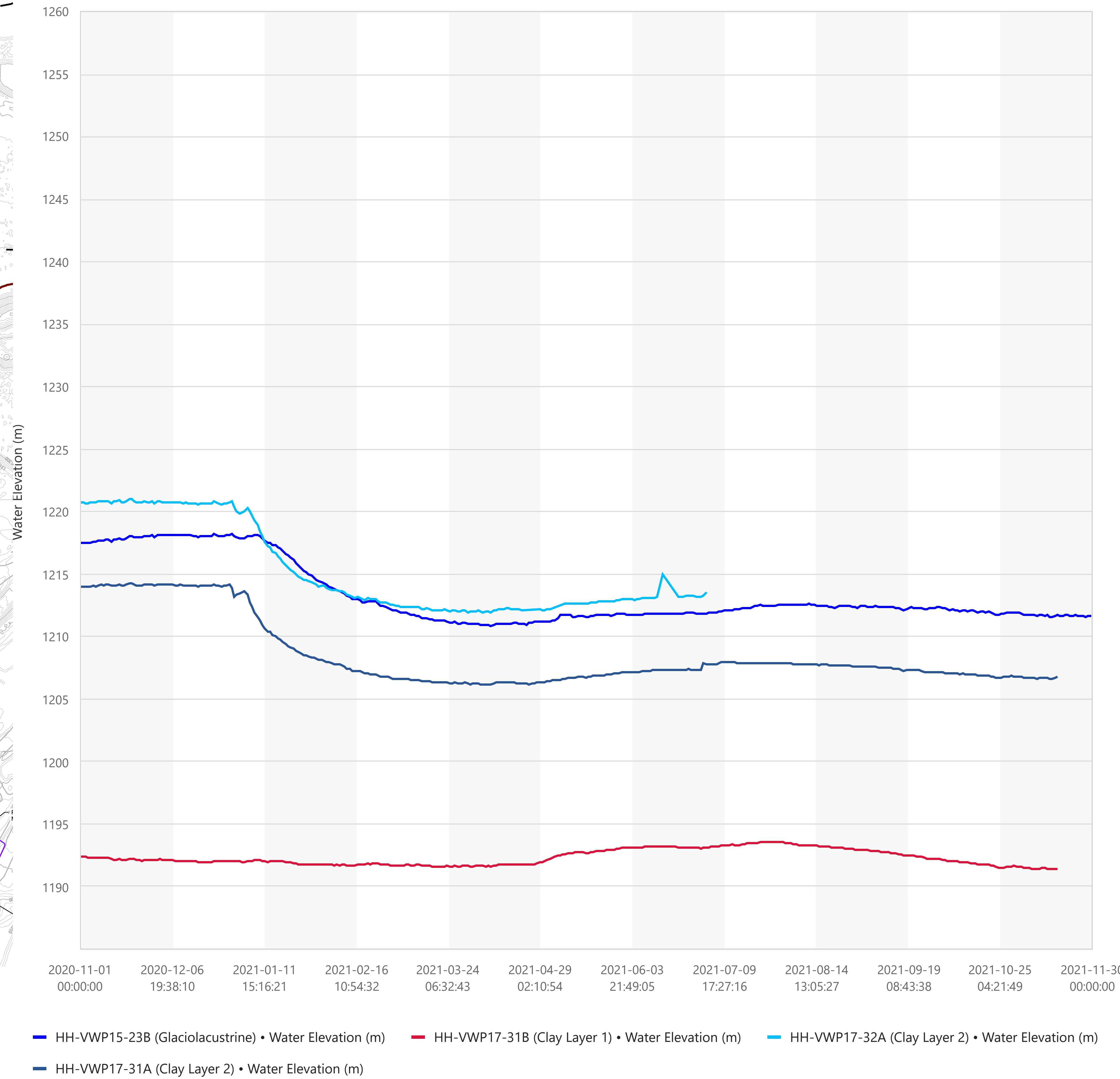


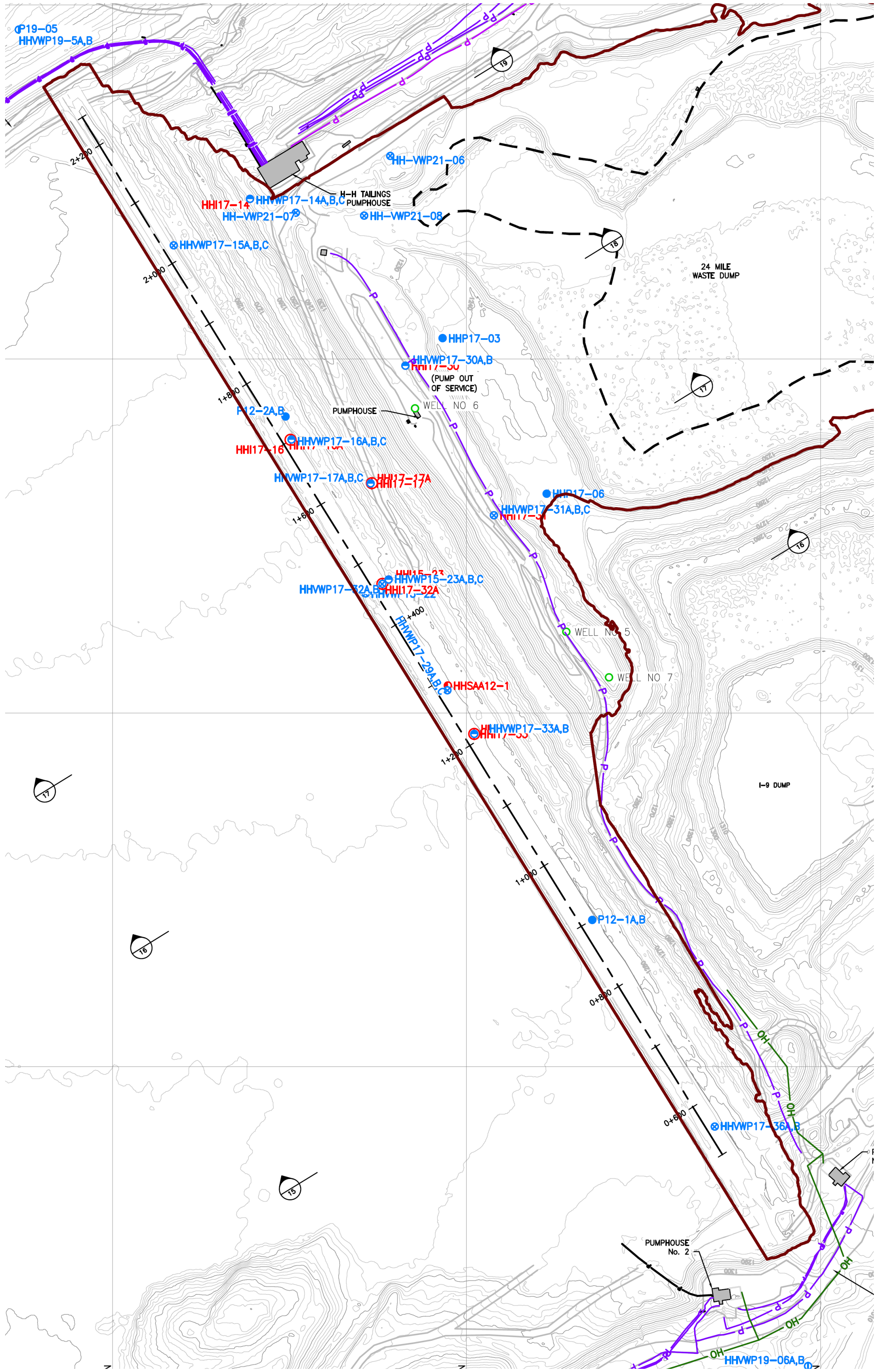
H-H Dam
Glacial Till and Clay, Silt



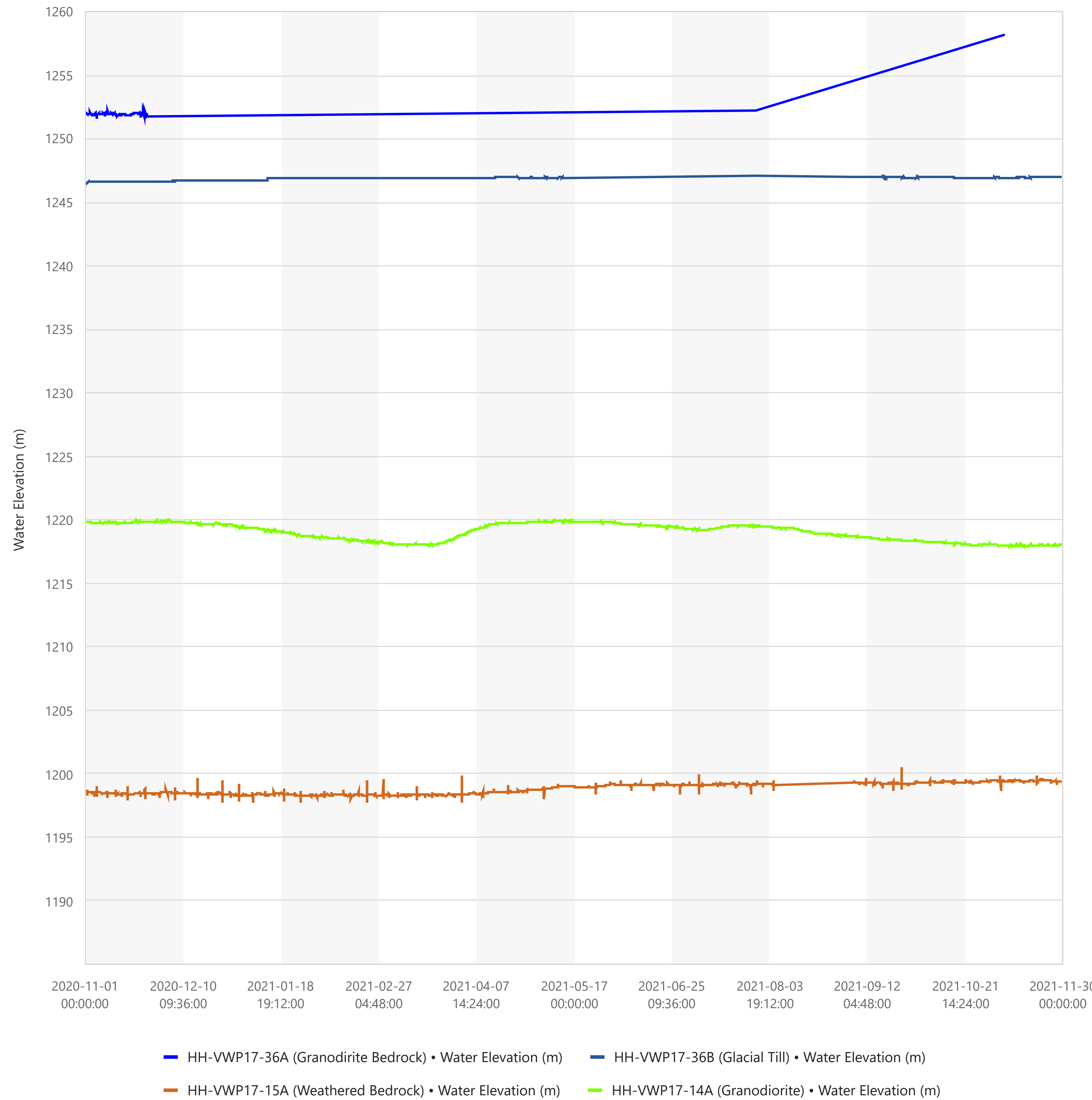


H-H Dam
Glaciolacustrine



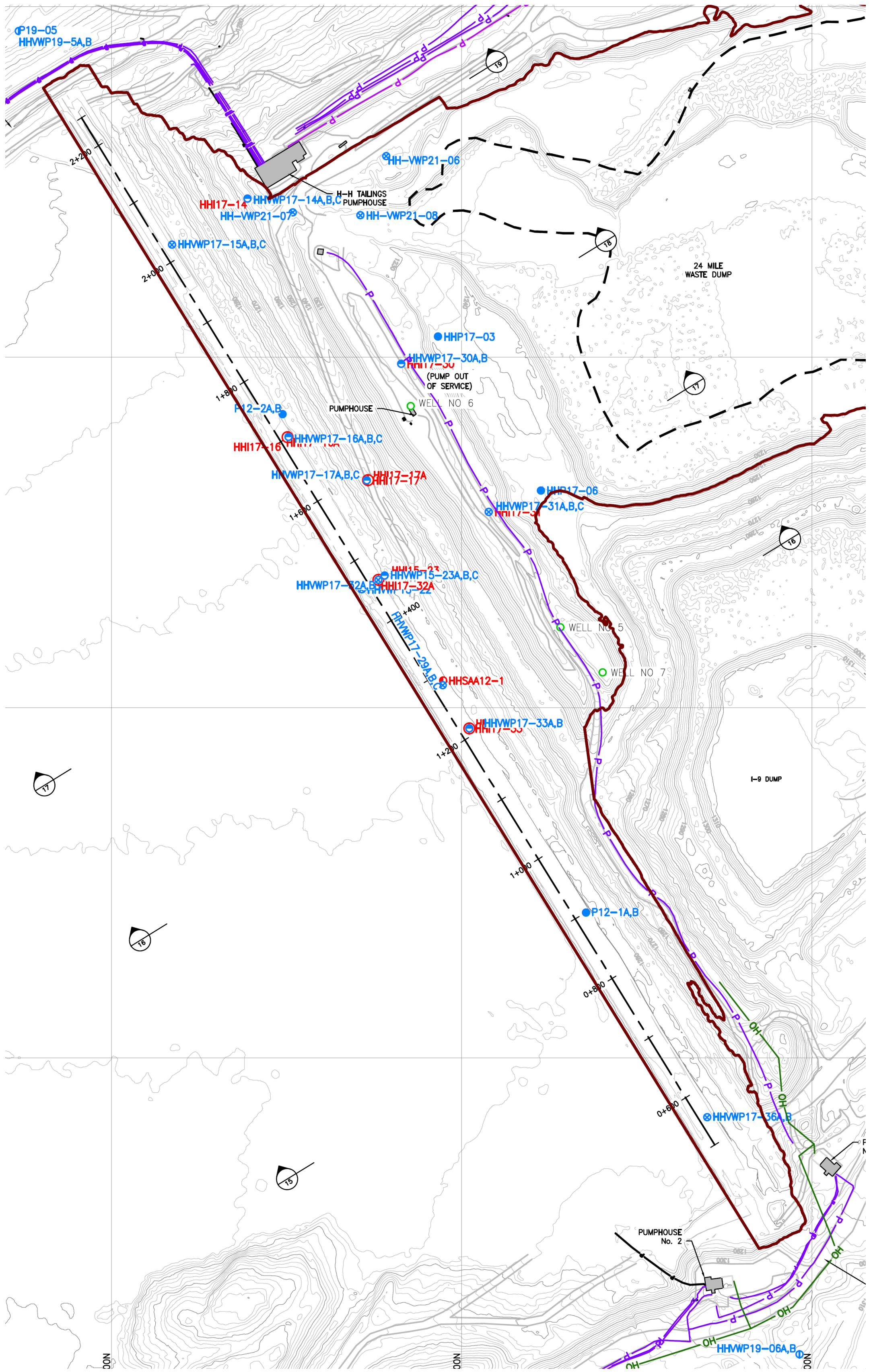


H-H Dam
Foundation Rock

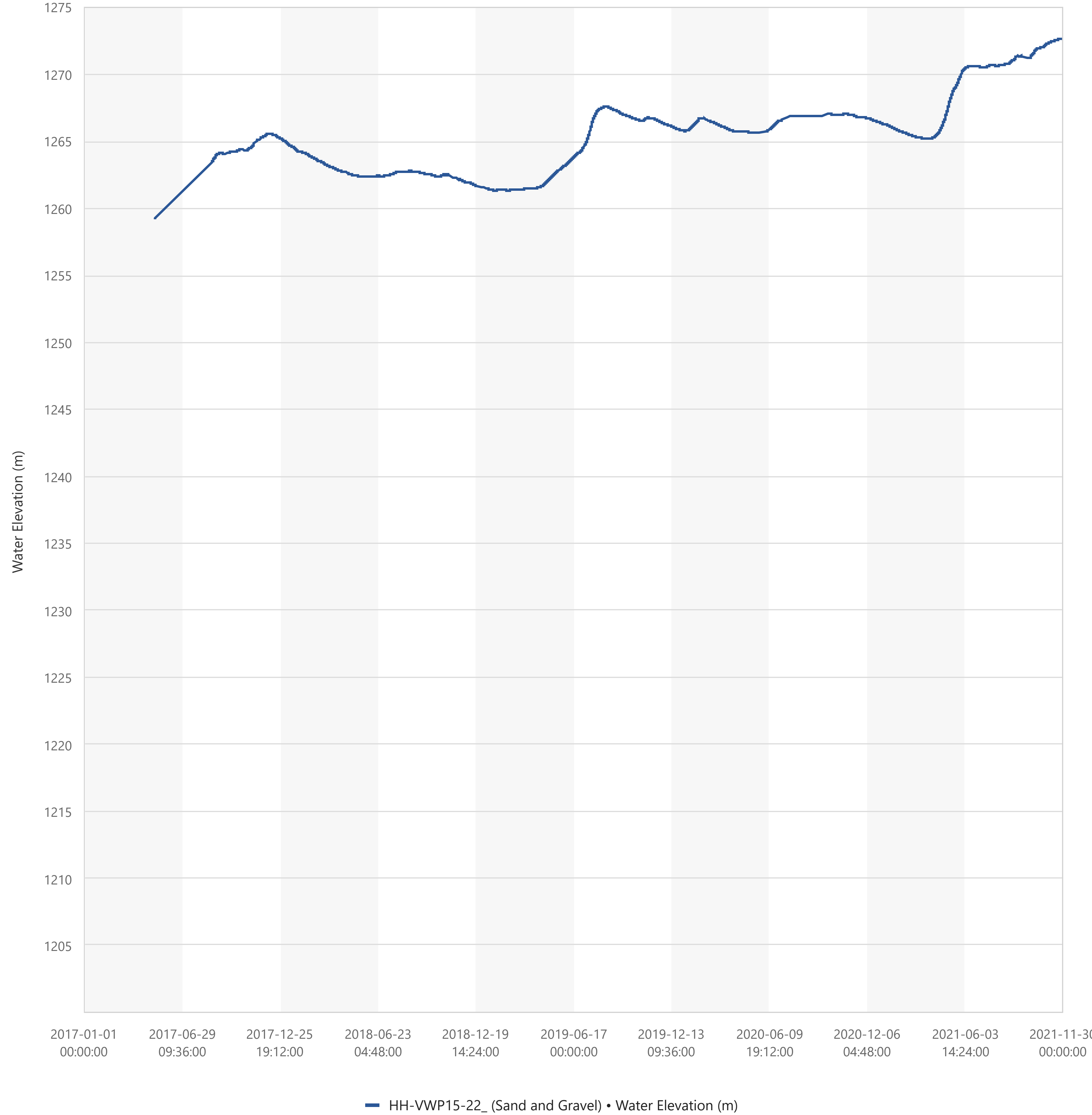


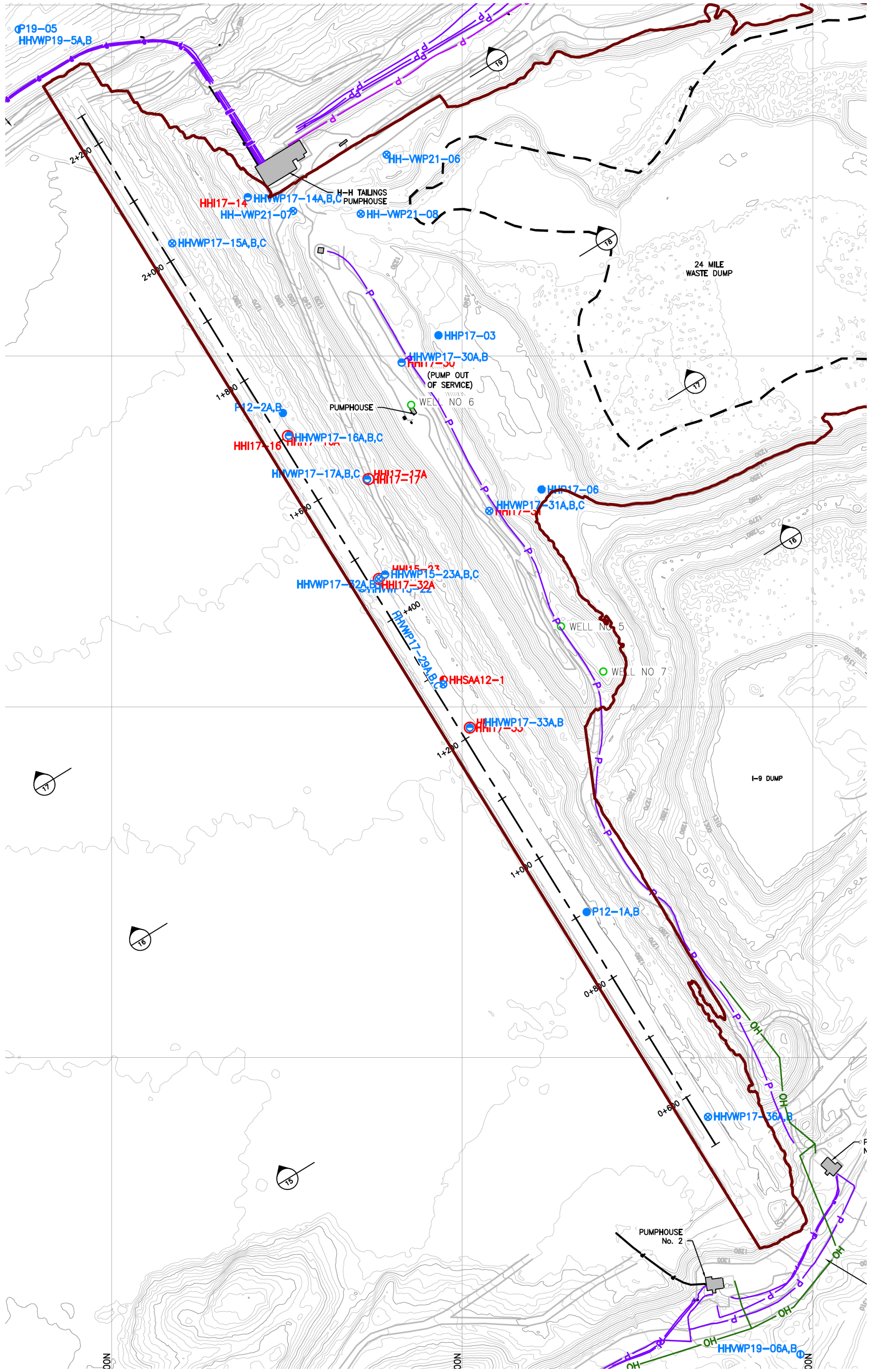
Appendix IV-B-2

H-H Dam Piezometers: Water Elevations Since 2017

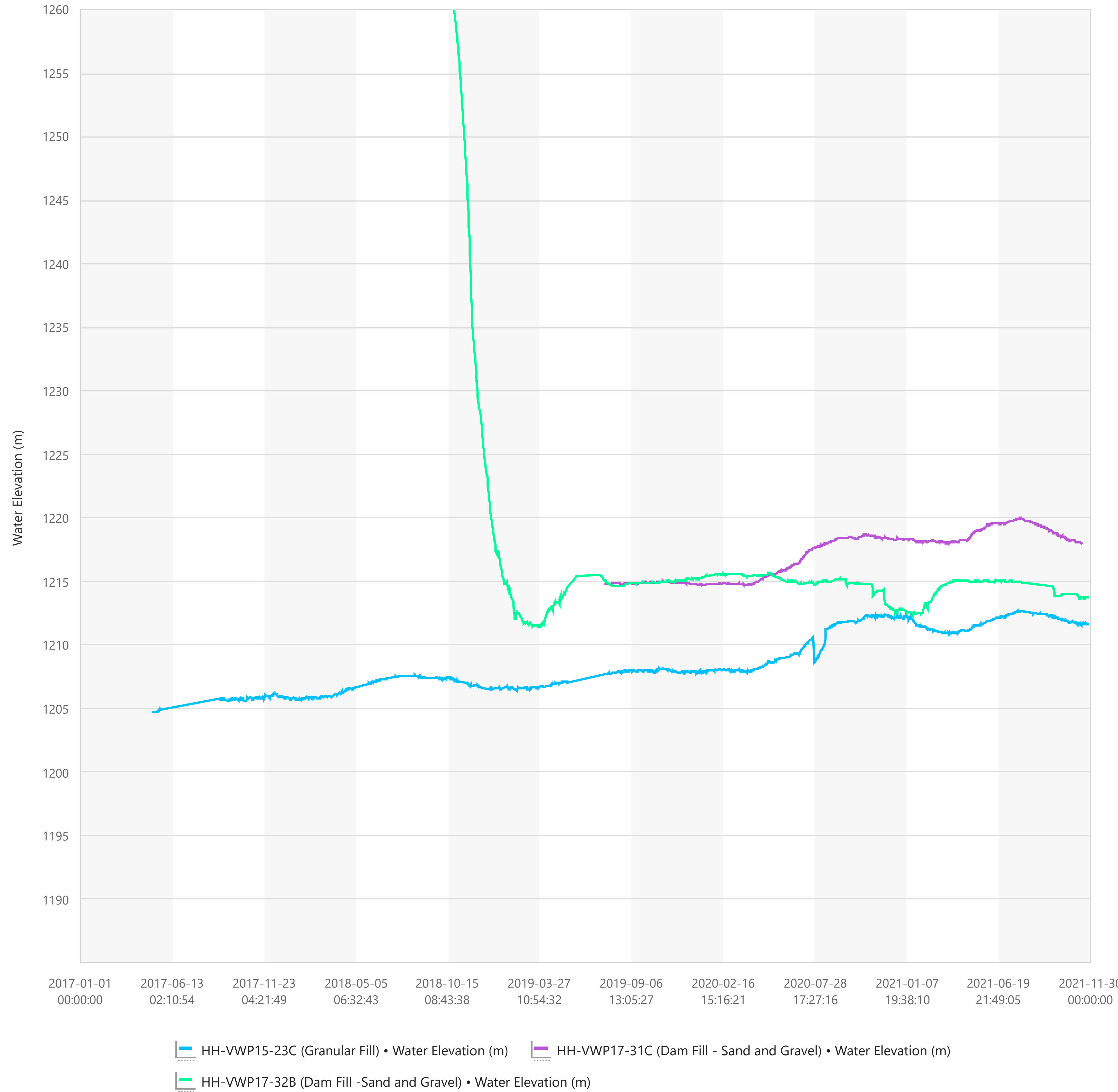


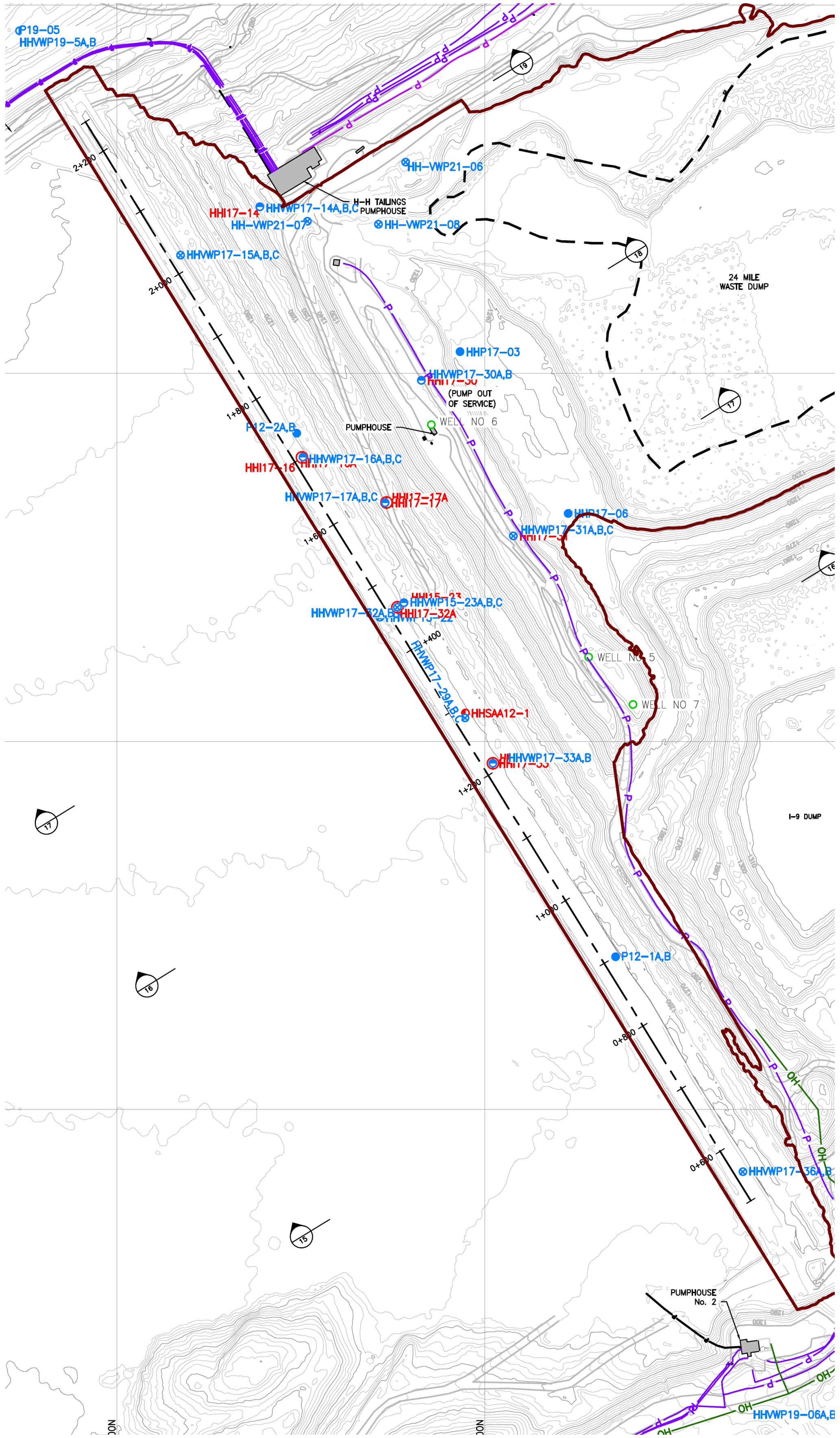
H-H Dam
Upstream of Core



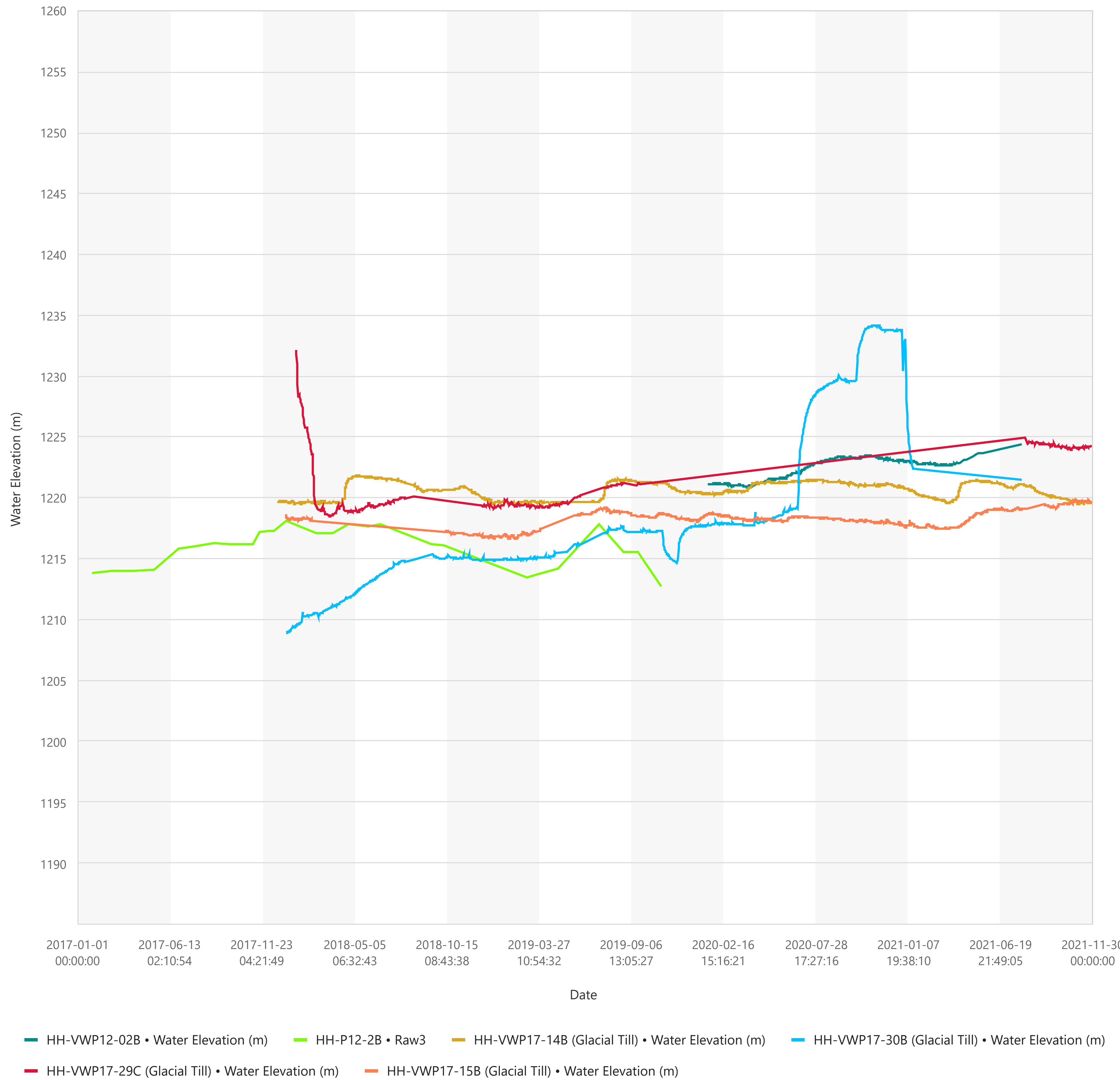


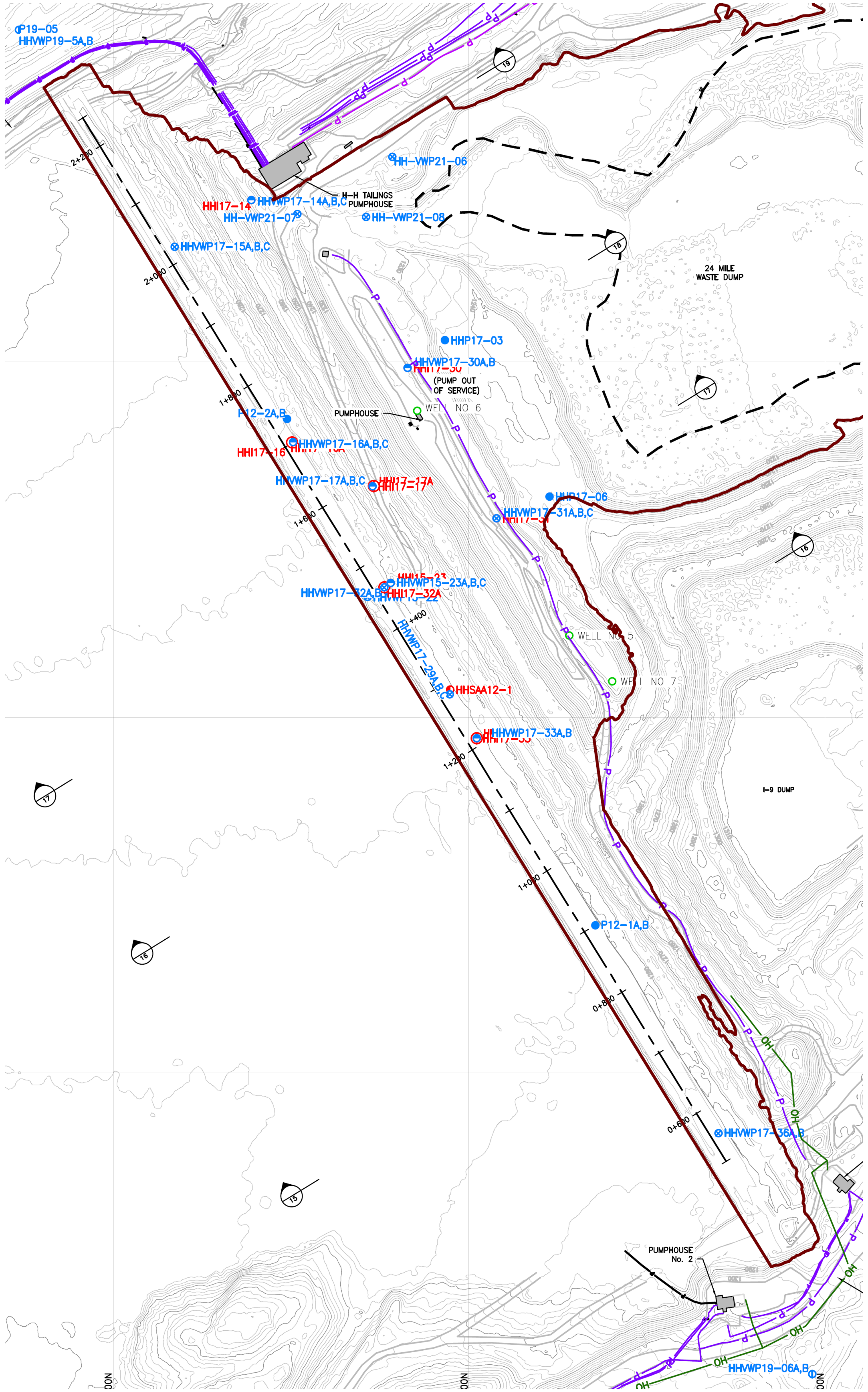
H-H Dam
Dam Fill, Sand and Gravel



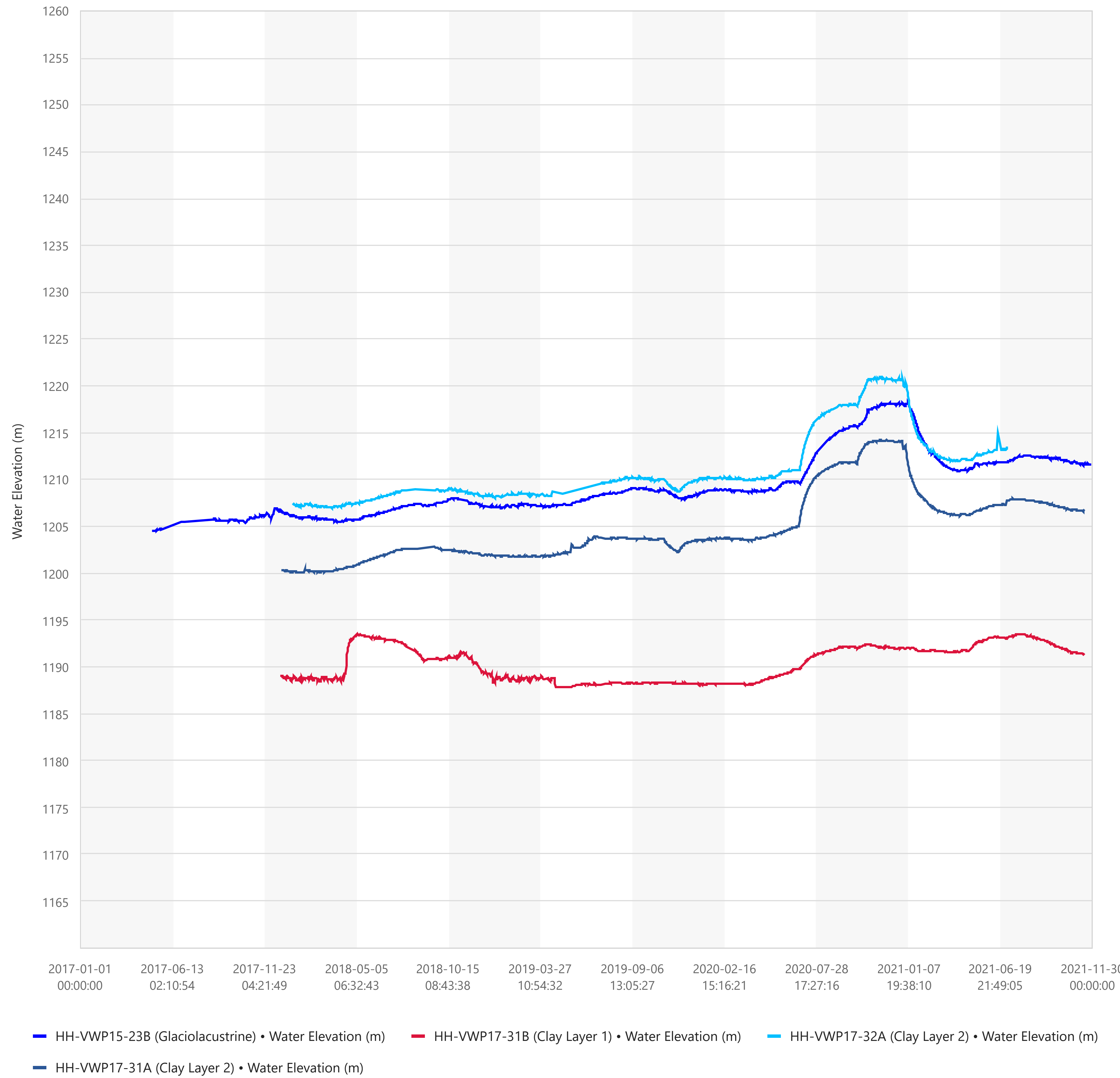


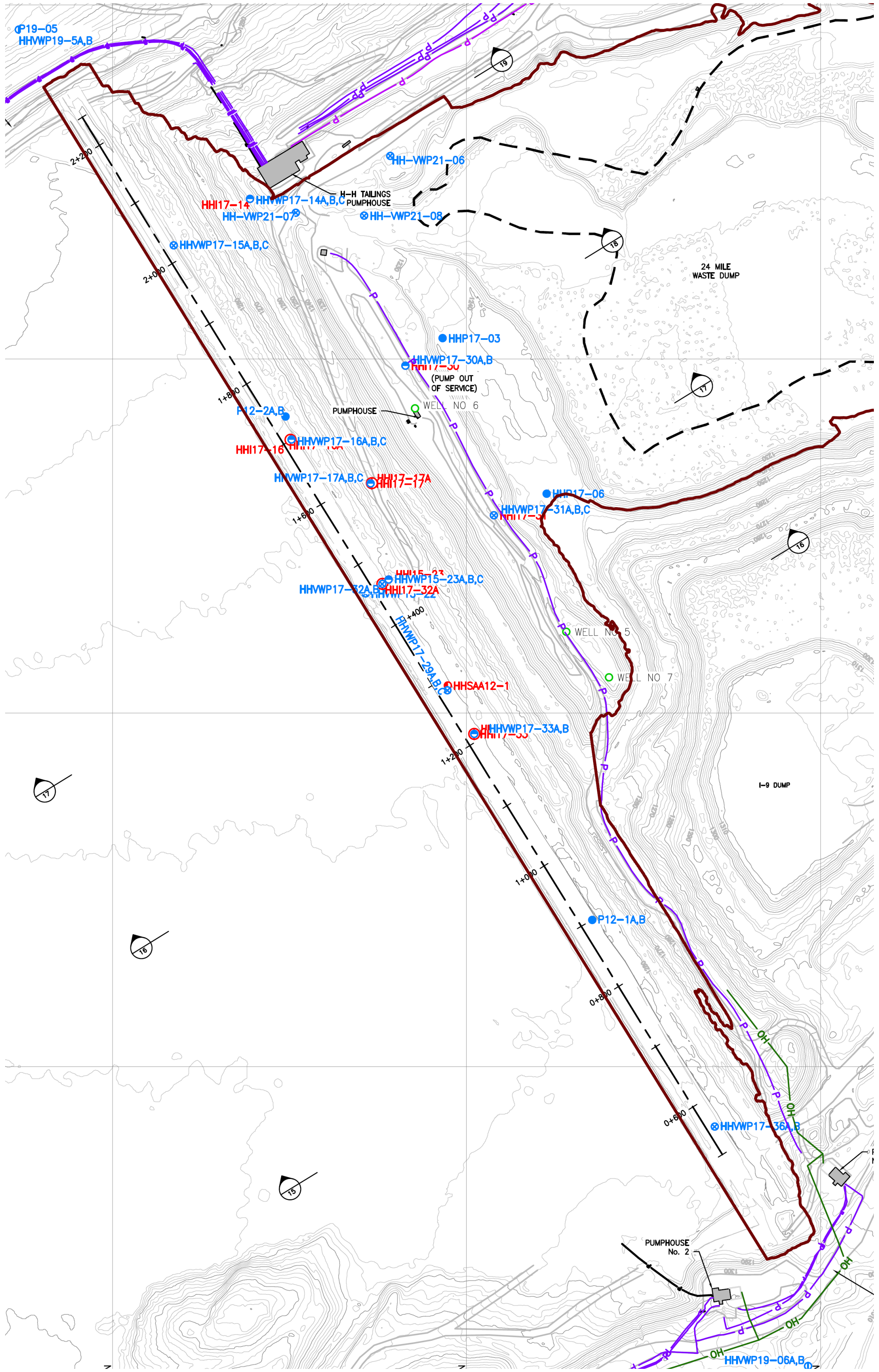
H-H Dam
Glacial Till and Clay, Silt



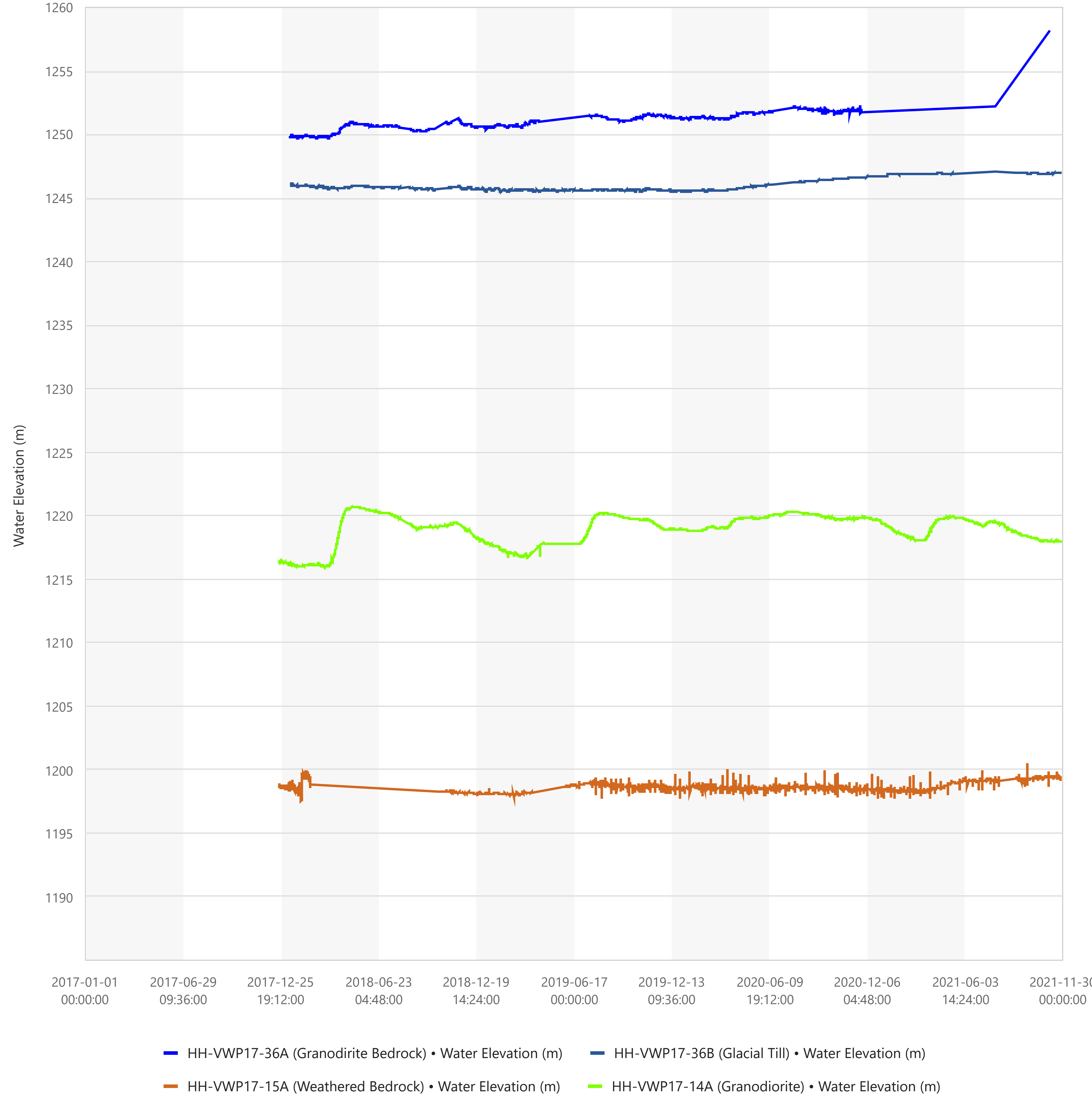


H-H Dam
Glaciolacustrine





H-H Dam
Foundation Rock

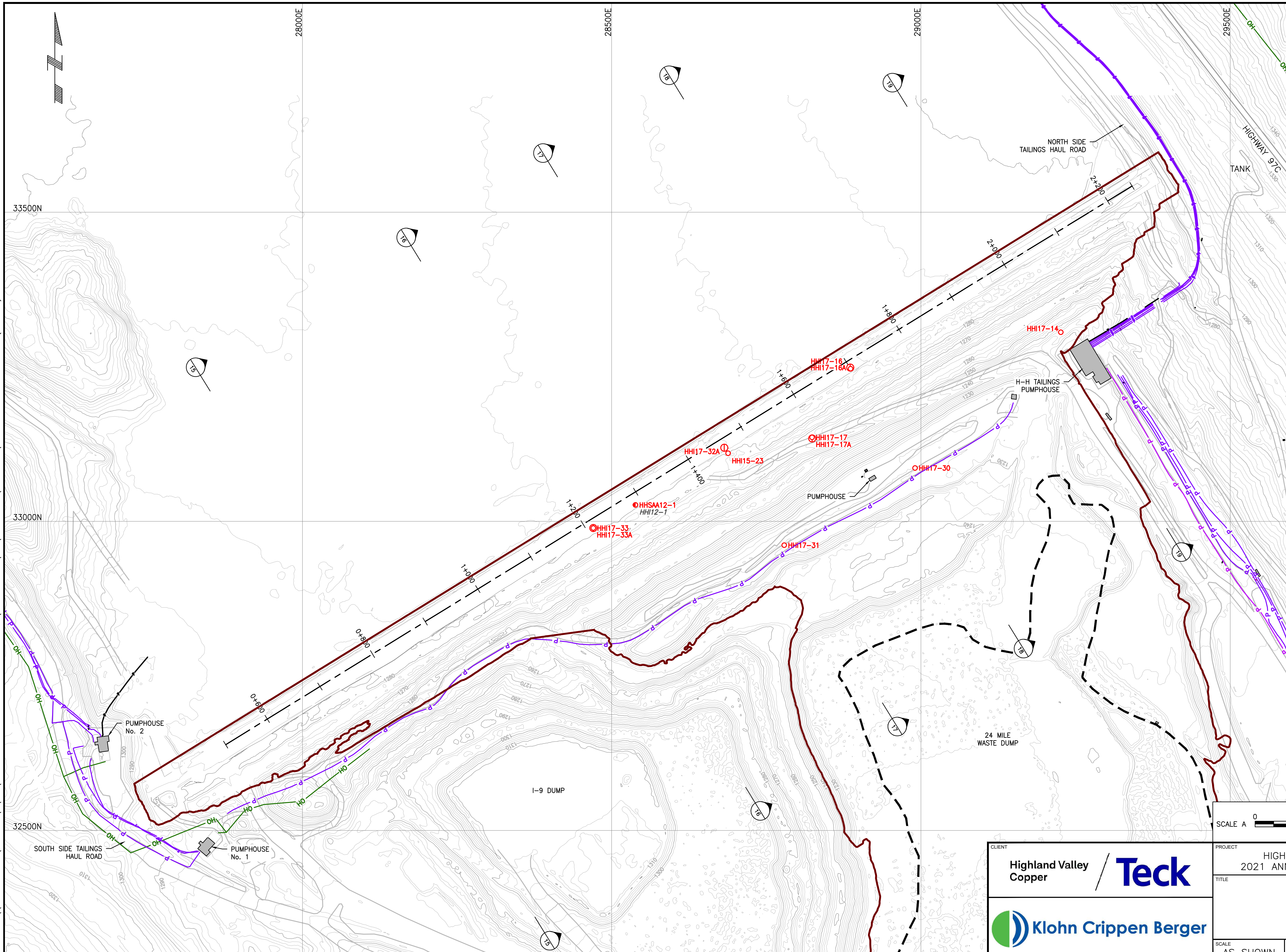


APPENDIX IV-C

H-H Dam Inclinometer Plots

H-H DAM

INCLINOMETERS – LOCATION PLAN



LEGEND:

- TAILINGS PIPELINE
- POWERLINE
- HAUL ROAD
- PUBLIC ROAD
- ULTIMATE DAM AND BUTTRESS FOOTPRINT
- 24 MILE EMERGENCY TSF EXTENT
- INSTRUMENTATION SECTION
- H-H DAM CENTERLINE

ACTIVE INSTRUMENTS (SEE NOTE 2):

- STANDARD INCLINOMETER
- COMBINED STANDARD INCLINOMETER AND SAAV INCLINOMETER
- COMBINED STANDARD INCLINOMETER AND PAIRED SONDEX SETTLEMENT SYSTEM

NOTES:

1. TOPOGRAPHY PROVIDED BY TECK HIGHLAND VALLEY COPPER PARTNERSHIP, PHOTOSAT SURVEY DATED 2021-10 AND COMPILED WITH 2021 AS-BUILT SURVEYS.
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 0 150 m

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY 2021 ANNUAL FACILITY PERFORMANCE REPORT

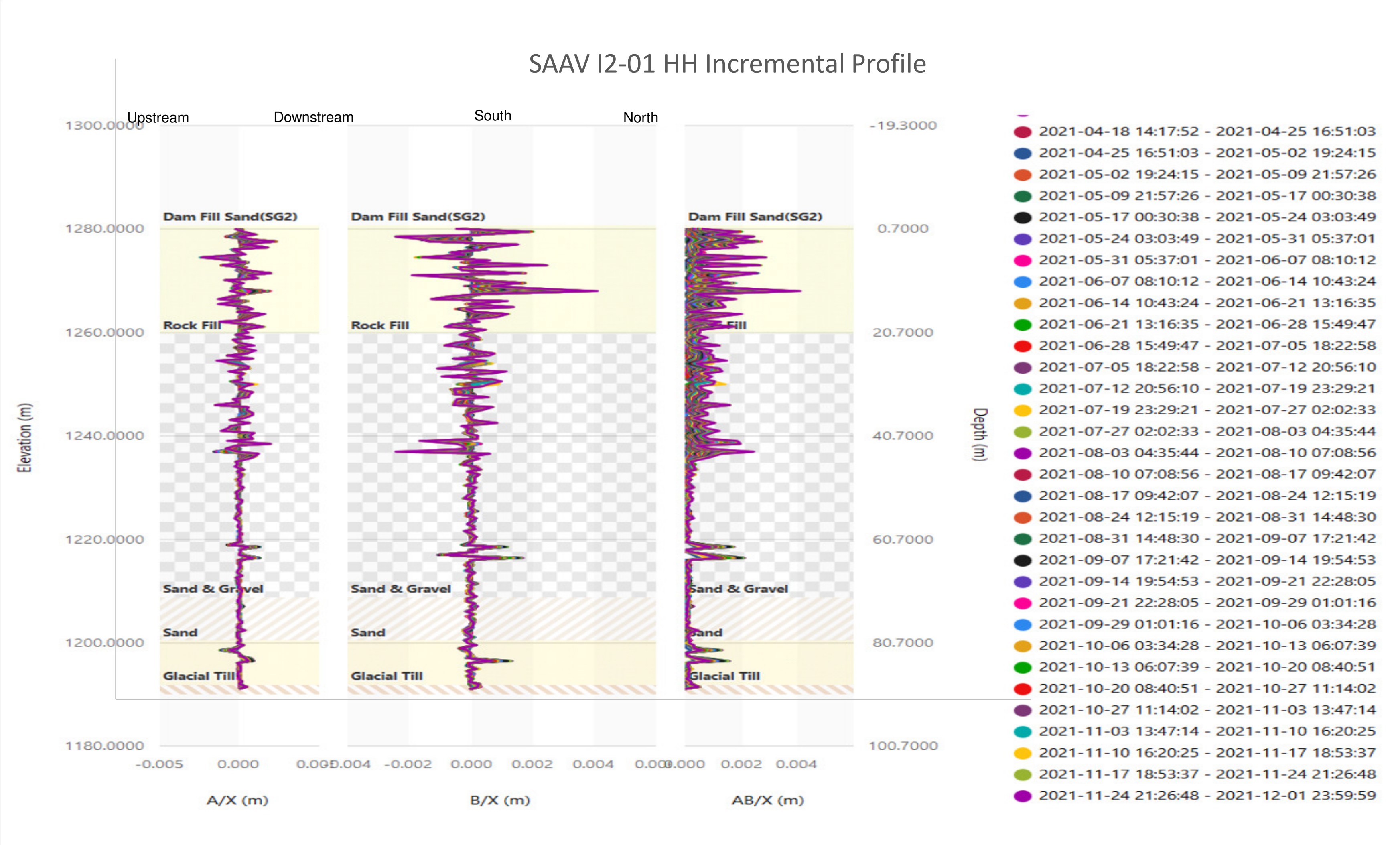
TITLE: H-H DAM INCLINOMETERS LOCATION PLAN

SCALE	PROJECT No.	FIG. No.
AS SHOWN	M02341C12	IV-C-1

SAVE DATE: 2022-03-01 (2:04 PM)
FILE PATH: \\INT.KLOHN.COM\PROJDATA\M\VCR\M02341C12-HVC 2021 DAM SAFETY SUPPORT\400 DRAWINGS\CAD\05-FIGURES\2021 AFPR\FIG IV-C-1 - H-H DAM.DWG (THAWKER)

H-H DAM

SAA I12-01


SAAV I2-01 HH Incremental Profile
Upstream
Downstream
South
North
Elevation (m)
Depth (m)
1300.0000
1280.0000
1260.0000
1240.0000
1220.0000
1200.0000
1180.0000
-19.3000
0.7000
20.7000
40.7000
60.7000
80.7000
100.7000
Dam Fill Sand(SG2)
Rock Fill
Sand & Gravel
Sand
Glacial Till
A/X (m)
B/X (m)
AB/X (m)
2021-04-18 14:17:52 - 2021-04-25 16:51:03
2021-04-25 16:51:03 - 2021-05-02 19:24:15
2021-05-02 19:24:15 - 2021-05-09 21:57:26
2021-05-09 21:57:26 - 2021-05-17 00:30:38
2021-05-17 00:30:38 - 2021-05-24 03:03:49
2021-05-24 03:03:49 - 2021-05-31 05:37:01
2021-05-31 05:37:01 - 2021-06-07 08:10:12
2021-06-07 08:10:12 - 2021-06-14 10:43:24
2021-06-14 10:43:24 - 2021-06-21 13:16:35
2021-06-21 13:16:35 - 2021-06-28 15:49:47
2021-06-28 15:49:47 - 2021-07-05 18:22:58
2021-07-05 18:22:58 - 2021-07-12 20:56:10
2021-07-12 20:56:10 - 2021-07-19 23:29:21
2021-07-19 23:29:21 - 2021-07-27 02:02:33
2021-07-27 02:02:33 - 2021-08-03 04:35:44
2021-08-03 04:35:44 - 2021-08-10 07:08:56
2021-08-10 07:08:56 - 2021-08-17 09:42:07
2021-08-17 09:42:07 - 2021-08-24 12:15:19
2021-08-24 12:15:19 - 2021-08-31 14:48:30
2021-08-31 14:48:30 - 2021-09-07 17:21:42
2021-09-07 17:21:42 - 2021-09-14 19:54:53
2021-09-14 19:54:53 - 2021-09-21 22:28:05
2021-09-21 22:28:05 - 2021-09-29 01:01:16
2021-09-29 01:01:16 - 2021-10-06 03:34:28
2021-10-06 03:34:28 - 2021-10-13 06:07:39
2021-10-13 06:07:39 - 2021-10-20 08:40:51
2021-10-20 08:40:51 - 2021-10-27 11:14:02
2021-10-27 11:14:02 - 2021-11-03 13:47:14
2021-11-03 13:47:14 - 2021-11-10 16:20:25
2021-11-10 16:20:25 - 2021-11-17 18:53:37
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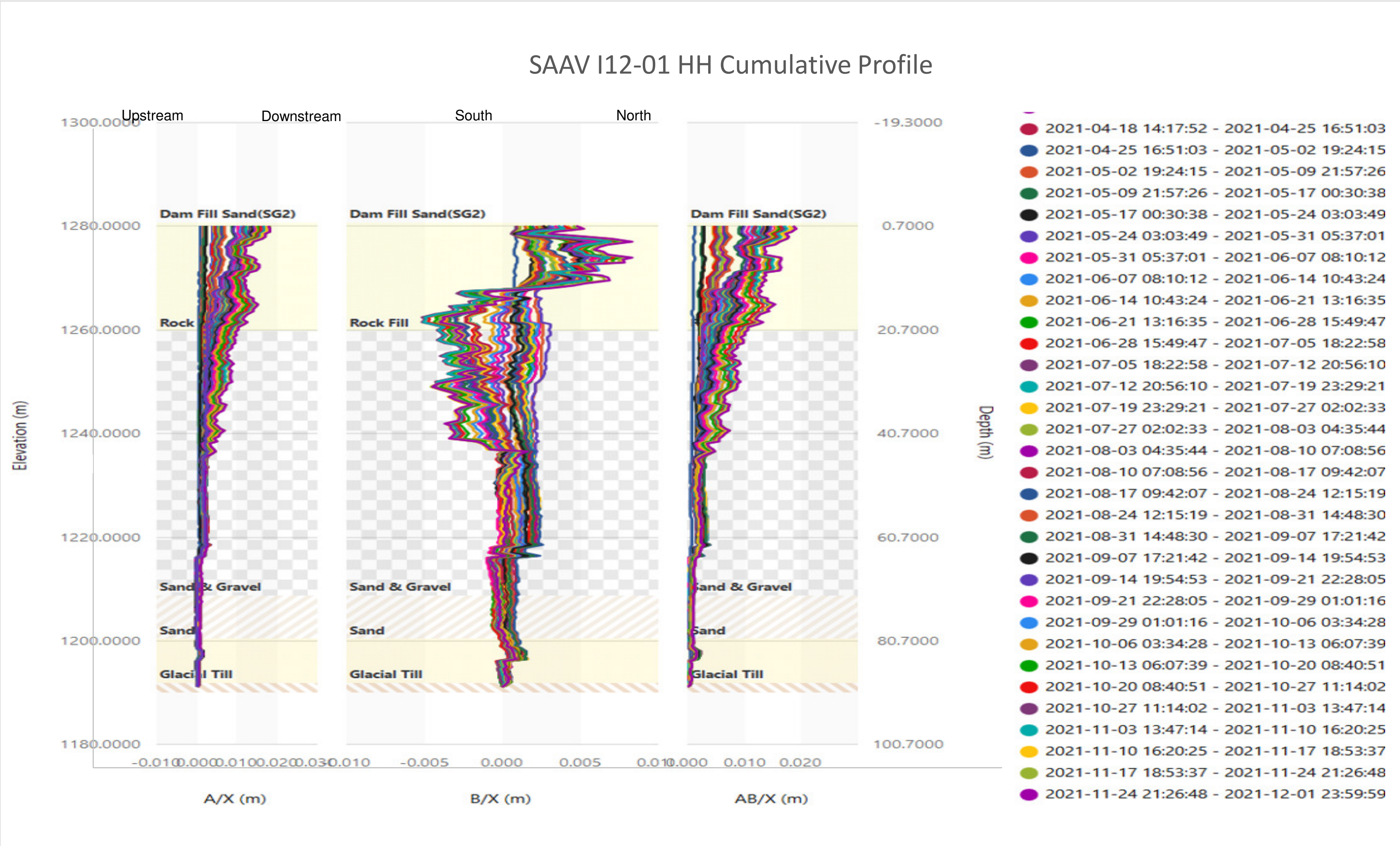
2021-11-24 21:26:48 - 2021-12-01 23:59:59

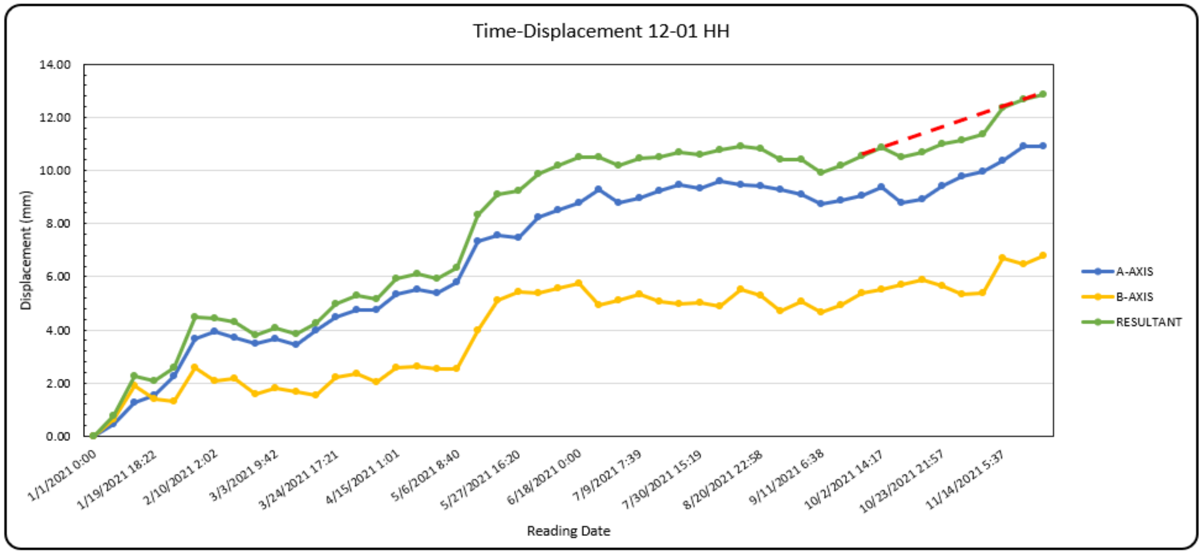

SAAV I12-01 HH Cumulative Profile
Upstream
Downstream
South
North
Elevation (m)
Depth (m)
1300.0000
1280.0000
1260.0000
1240.0000
1220.0000
1200.0000
1180.0000
-19.3000
0.7000
20.7000
40.7000
60.7000
80.7000
100.7000
Dam Fill Sand(SG2)
Rock
Rock Fill
Sand & Gravel
Sand
Glacial Till
A/X (m)
B/X (m)
AB/X (m)
-0.010
0.000
0.010
0.020
0.030
-0.005
0.005
2021-04-18 14:17:52 - 2021-04-25 16:51:03
2021-04-25 16:51:03 - 2021-05-02 19:24:15
2021-05-02 19:24:15 - 2021-05-09 21:57:26
2021-05-09 21:57:26 - 2021-05-17 00:30:38
2021-05-17 00:30:38 - 2021-05-24 03:03:49
2021-05-24 03:03:49 - 2021-05-31 05:37:01
2021-05-31 05:37:01 - 2021-06-07 08:10:12
2021-06-07 08:10:12 - 2021-06-14 10:43:24
2021-06-14 10:43:24 - 2021-06-21 13:16:35
2021-06-21 13:16:35 - 2021-06-28 15:49:47
2021-06-28 15:49:47 - 2021-07-05 18:22:58
2021-07-05 18:22:58 - 2021-07-12 20:56:10
2021-07-12 20:56:10 - 2021-07-19 23:29:21
2021-07-19 23:29:21 - 2021-07-27 02:02:33
2021-07-27 02:02:33 - 2021-08-03 04:35:44
2021-08-03 04:35:44 - 2021-08-10 07:08:56
2021-08-10 07:08:56 - 2021-08-17 09:42:07
2021-08-17 09:42:07 - 2021-08-24 12:15:19
2021-08-24 12:15:19 - 2021-08-31 14:48:30
2021-08-31 14:48:30 - 2021-09-07 17:21:42
2021-09-07 17:21:42 - 2021-09-14 19:54:53
2021-09-14 19:54:53 - 2021-09-21 22:28:05
2021-09-21 22:28:05 - 2021-09-29 01:01:16
2021-09-29 01:01:16 - 2021-10-06 03:34:28
2021-10-06 03:34:28 - 2021-10-13 06:07:39
2021-10-13 06:07:39 - 2021-10-20 08:40:51
2021-10-20 08:40:51 - 2021-10-27 11:14:02
2021-10-27 11:14:02 - 2021-11-03 13:47:14
2021-11-03 13:47:14 - 2021-11-10 16:20:25
2021-11-10 16:20:25 - 2021-11-17 18:53:37
2021-11-17 18:53:37 - 2021-11-24 21:26:48
2021-11-24 21:26:48 - 2021-12-01 23:59:59

SAA 12-01 HH

Displacement Plot - Rockfill

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Rockfill	**1276.1**	**1211.1**	**10.0**	**1.17**
Sand and Gravel	1209.1	1192.1	3.0	
Glacial Till	1192.1	1191.1	3.0	

Upper El. (m)	1276.1
Lower El. (m)	1211.1

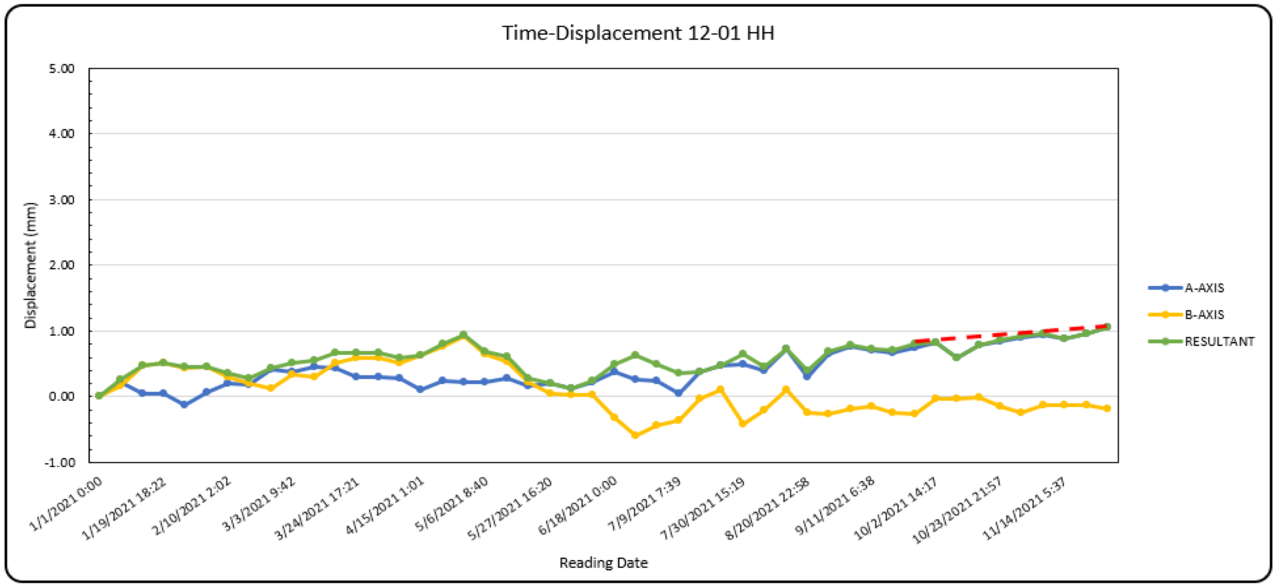


SAA 12-01 HH

Displacement Plot - Sand & Gravel

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Rockfill	1276.1	1211.1	10.0	
Sand and Gravel	**1209.1**	**1192.1**	**3.0**	**0.14**
Glacial Till	1192.1	1191.1	3.0	

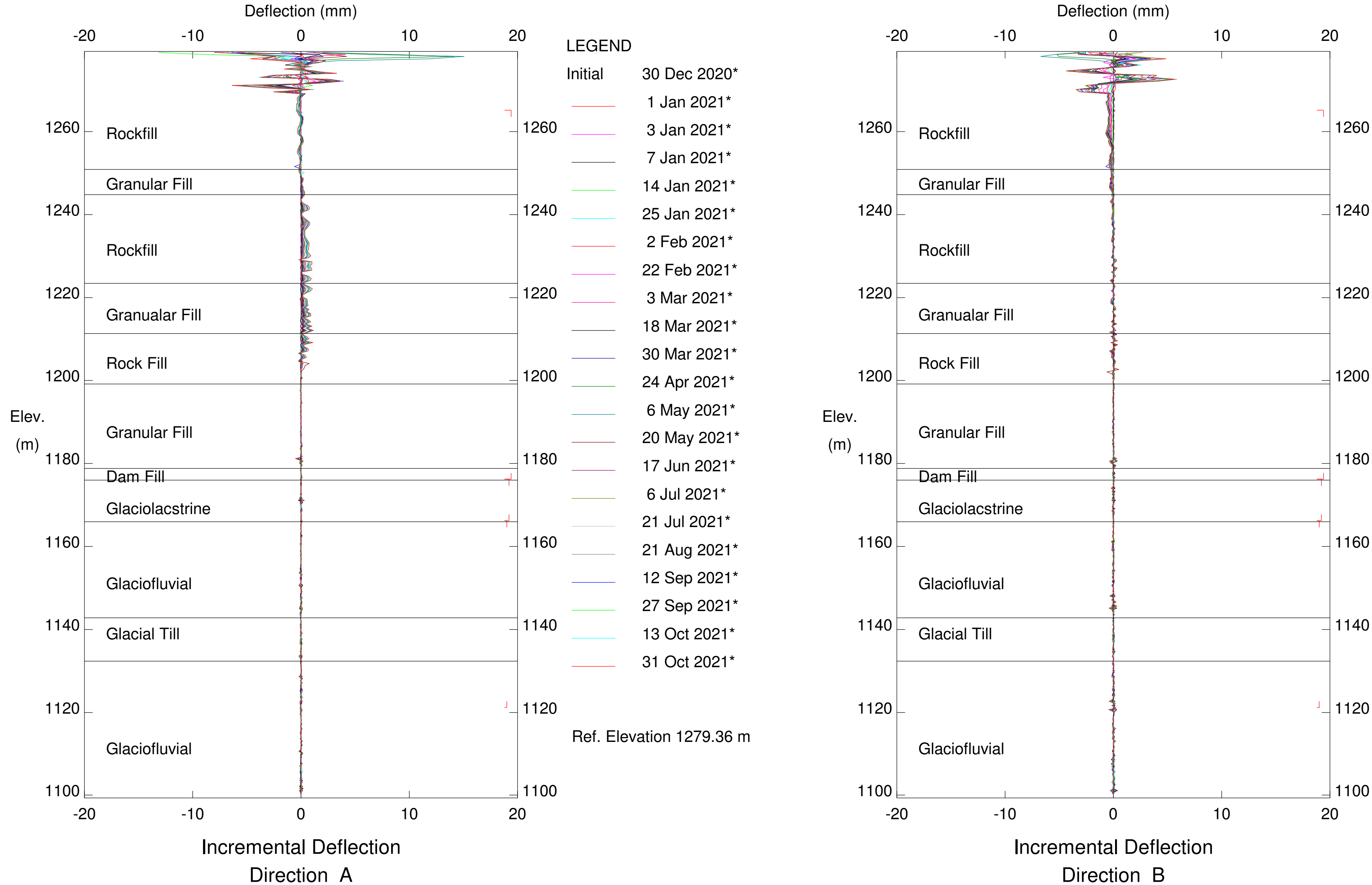
Upper El. (m)	1209.1
Lower El. (m)	1192.1



H-H DAM

I15-23

Highland Valley Copper - Logan Lake, BC

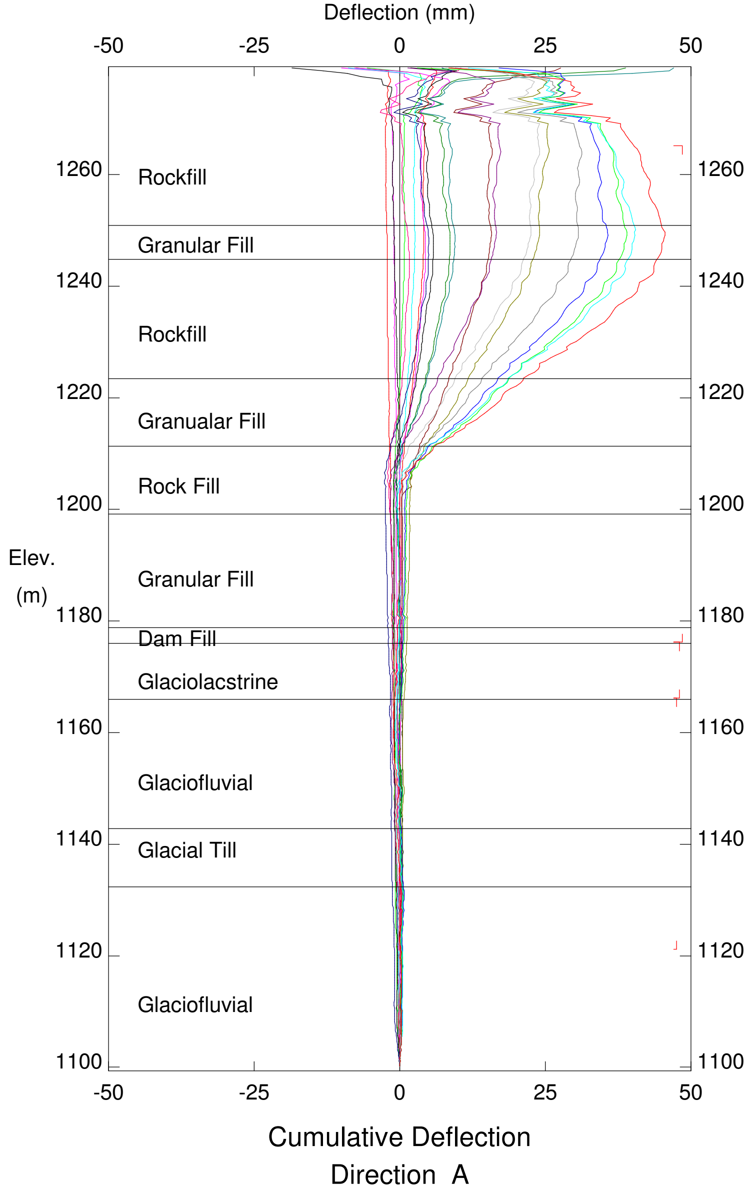


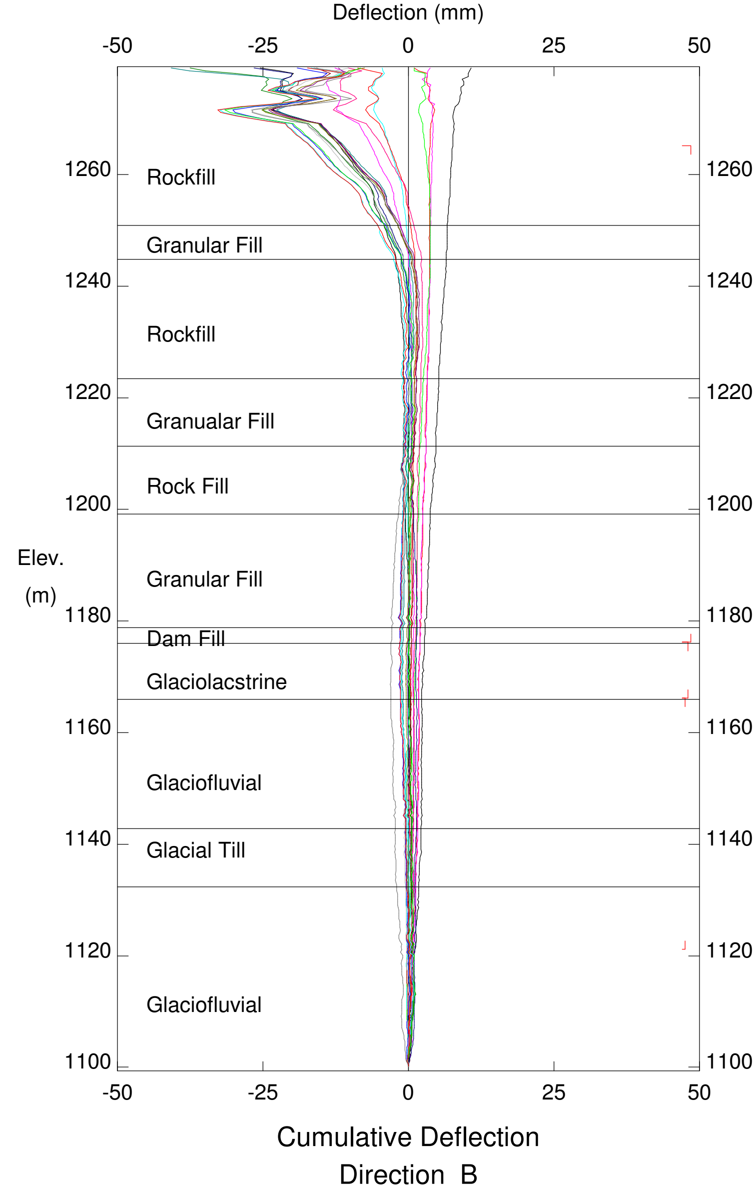
H-H Dam, Inclinometer I15-23

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

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I15-23.gtl

Highland Valley Copper - Logan Lake, BC



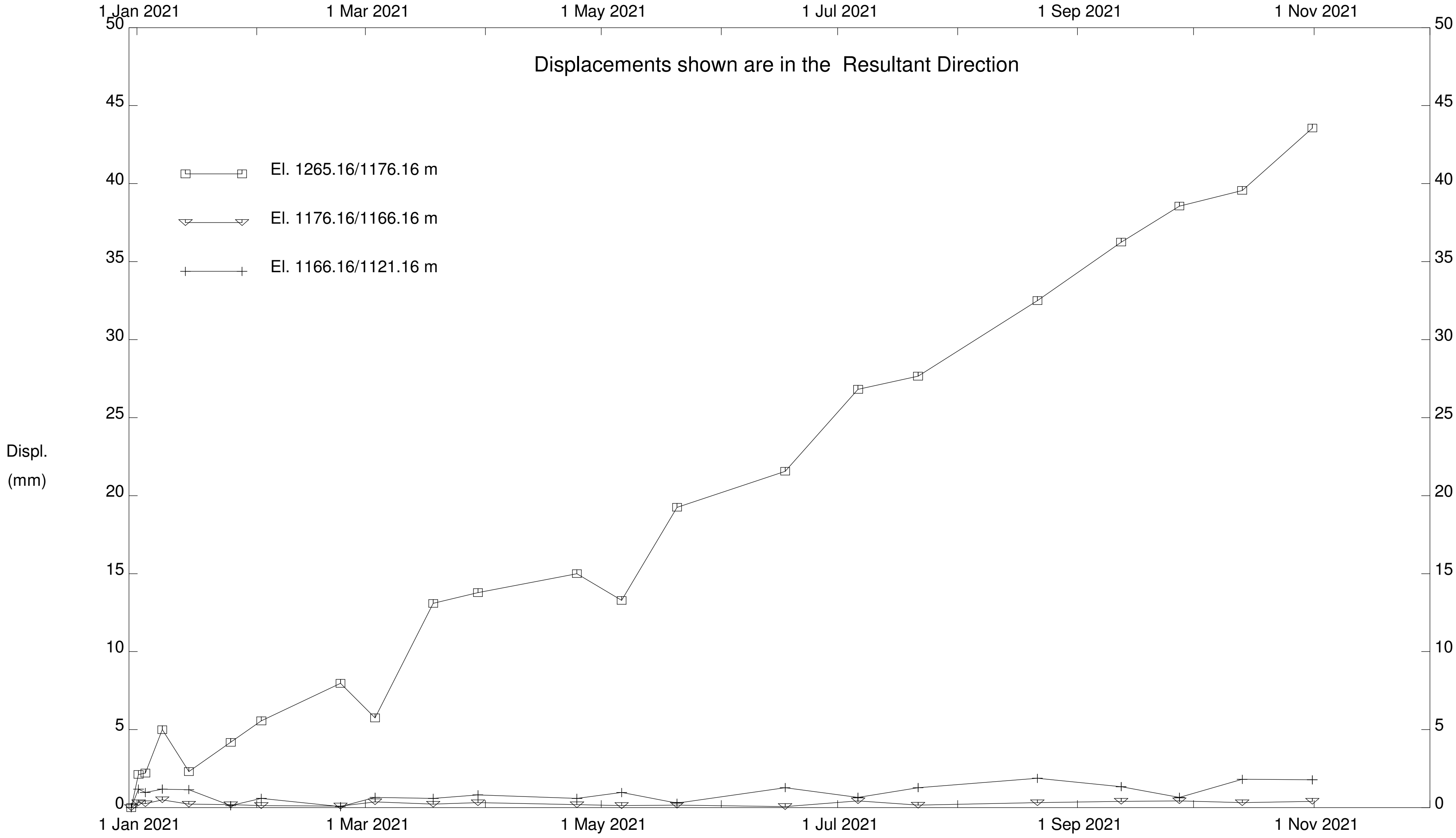


H-H Dam, Inclinometer I15-23

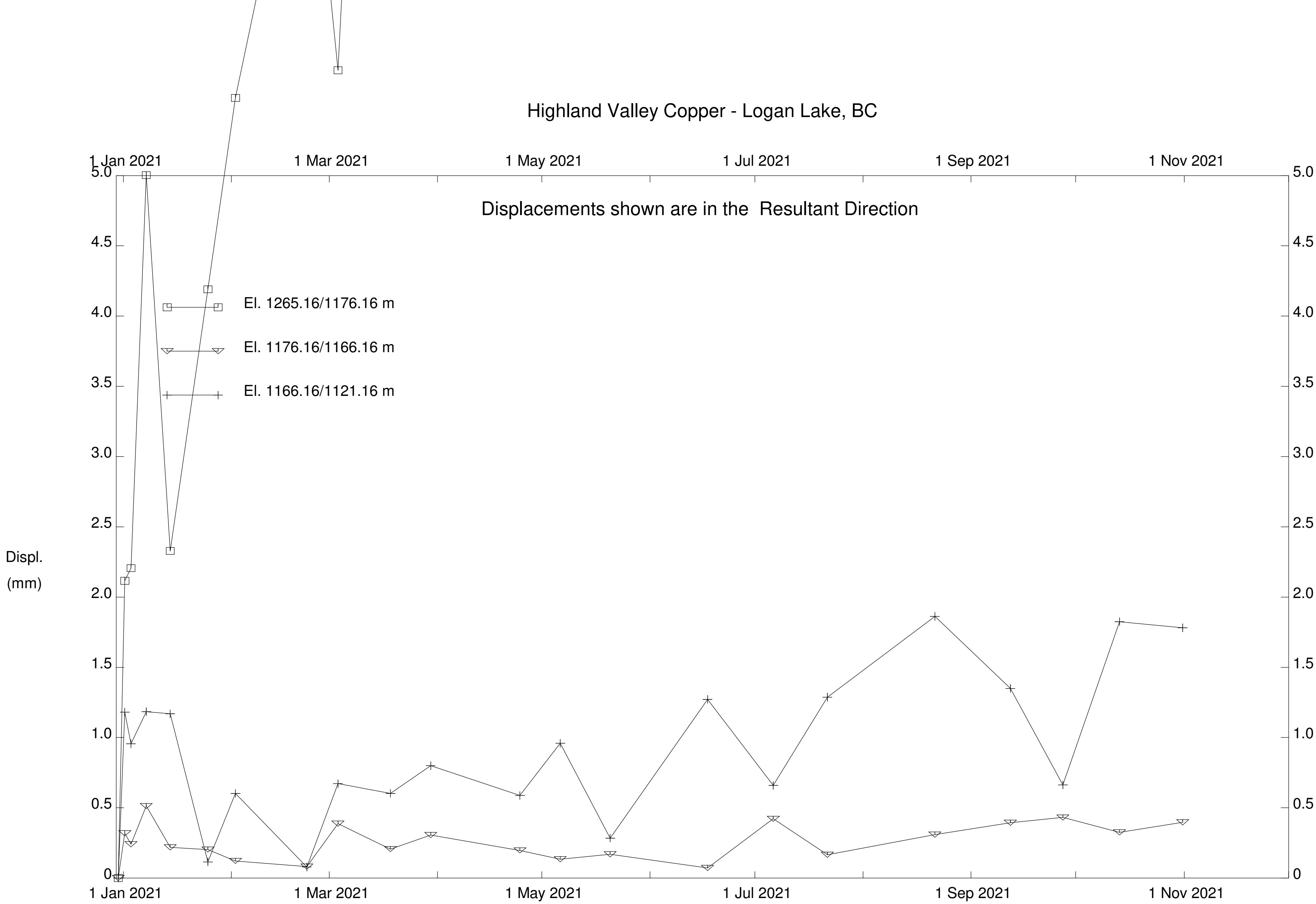
Sets marked * include zero shift and/or rotation corrections.

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I15-23.gtl

Highland Valley Copper - Logan Lake, BC



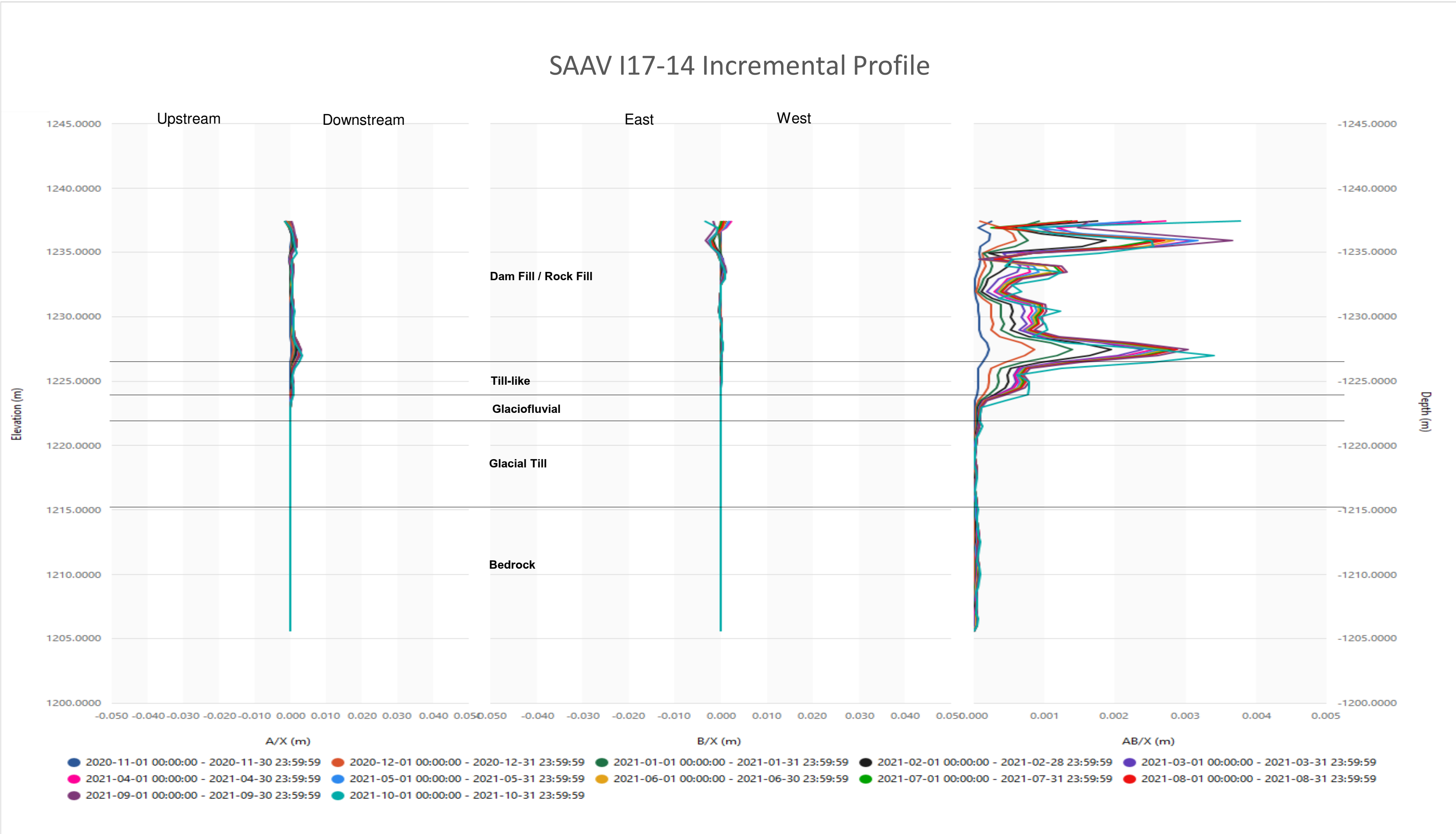
H-H Dam, Inclinometer I15-23

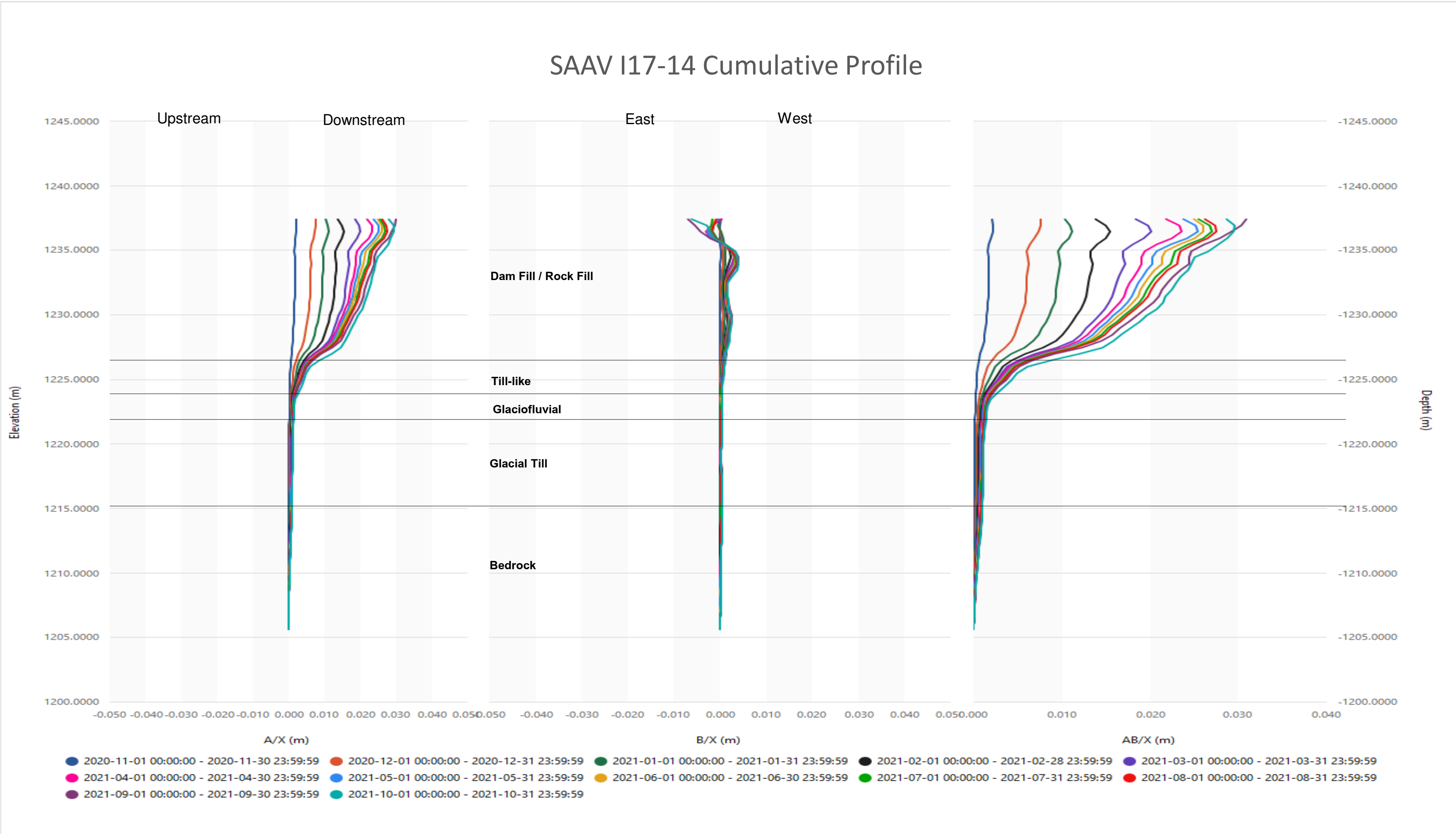


H-H Dam, Inclinometer I15-23

H-H DAM

I17-14


SAAV I17-14 Incremental Profile
Upstream
Downstream
East
West
Dam Fill / Rock Fill
Till-like
Glaciofluvial
Glacial Till
Bedrock
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59



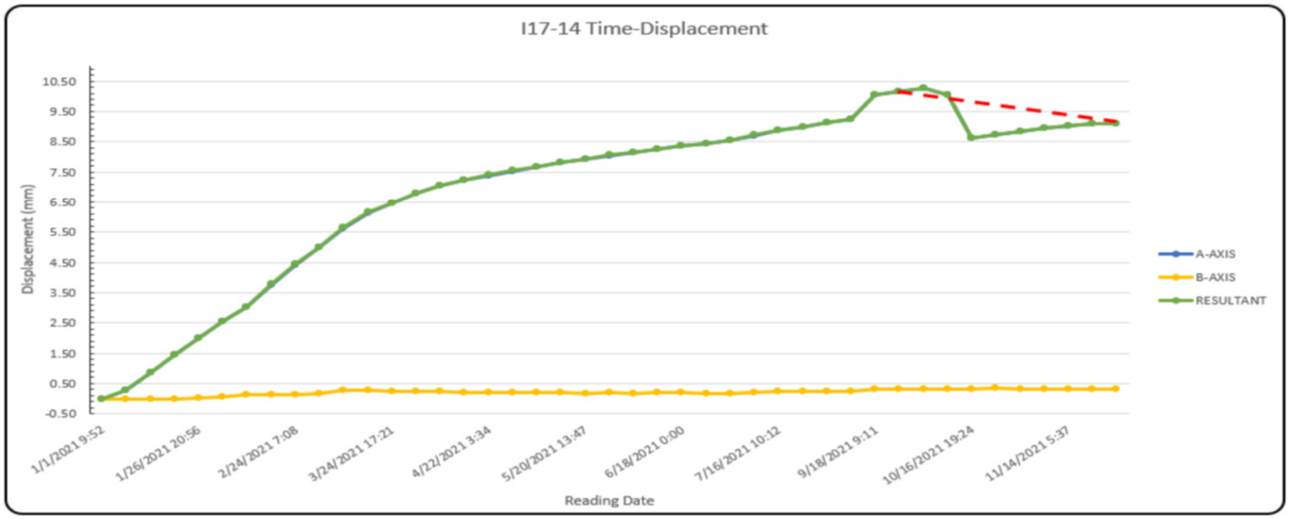
SAAV I17-14 Cumulative Profile
Upstream
Downstream
East
West
Dam Fill / Rock Fill
Till-like
Glaciofluvial
Glacial Till
Bedrock
Elevation (m)
Depth (m)
1245.0000
1240.0000
1235.0000
1230.0000
1225.0000
1220.0000
1215.0000
1210.0000
1205.0000
1200.0000
-1245.0000
-1240.0000
-1235.0000
-1230.0000
-1225.0000
-1220.0000
-1215.0000
-1210.0000
-1205.0000
-1200.0000
-0.050 -0.040 -0.030 -0.020 -0.010 0.000 0.010 0.020 0.030 0.040 0.050
-0.050 -0.040 -0.030 -0.020 -0.010 0.000 0.010 0.020 0.030 0.040 0.050
0.000 0.010 0.020 0.030 0.040
A/X (m)
B/X (m)
AB/X (m)
2020-11-01 00:00:00 - 2020-11-30 23:59:59
2020-12-01 00:00:00 - 2020-12-31 23:59:59
2021-01-01 00:00:00 - 2021-01-31 23:59:59
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59

SAAV I17-14

Displacement Plot - Dam Fill / Rock Fill

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate
Dam Fill / Rock Fill	**1232.5**	**1226.5**	**3.0**	**0.53**
Glaciofluvial	1224.5	1221.5	3.0	
Bedrock	1215.5	1206.5	3.0	

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

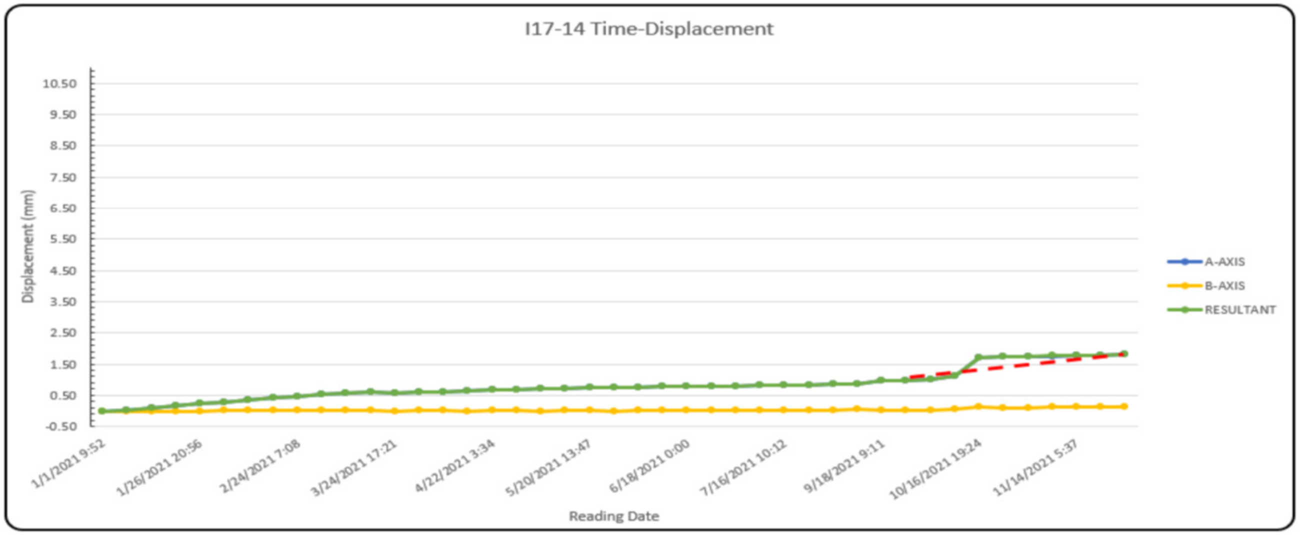


SAAV I17-14

Displacement Plot - Glaciofluvial

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate
Dam Fill / Rock Fill	1232.5	1226.5	3.0	
Glaciofluvial	**1224.5**	**1221.5**	**3.0**	**0.41**
Bedrock	1215.5	1206.5	3.0	

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

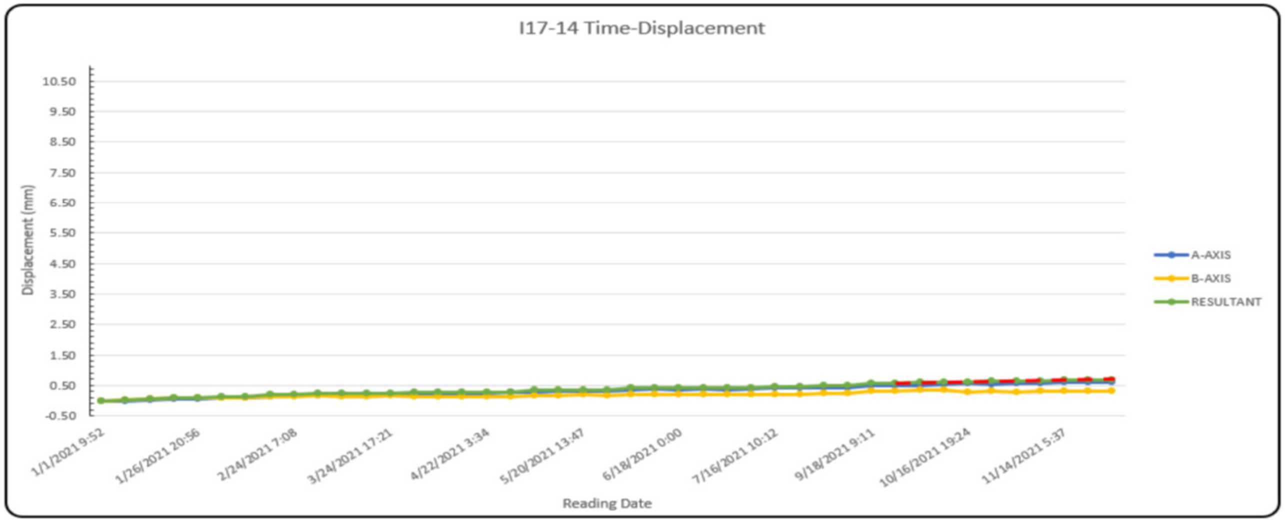


SAAV I17-14

Displacement Plot - Bedrock

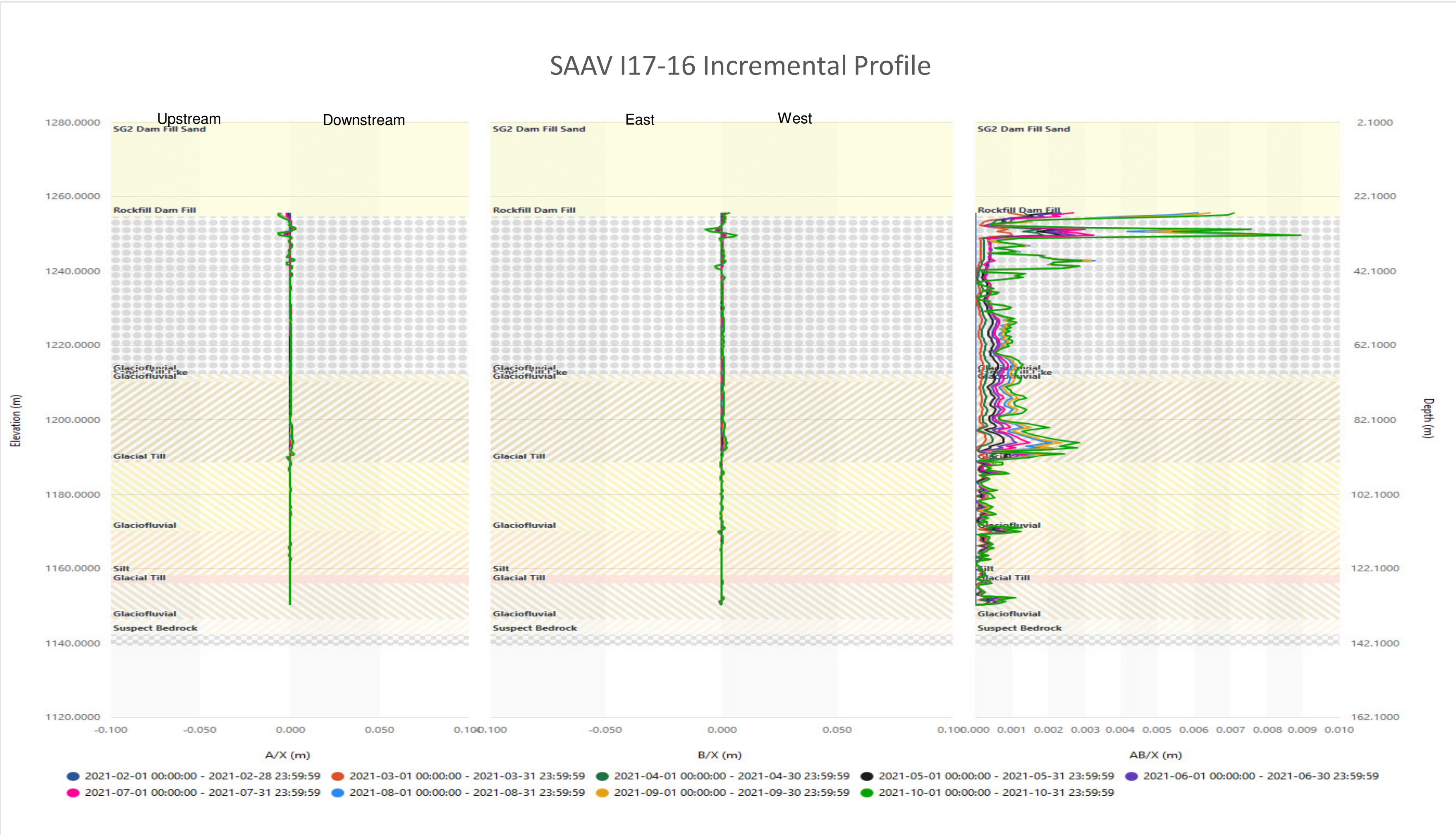
Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate
Dam Fill / Rock Fill	1232.5	1226.5	3.0	
Glaciofluvial	1224.5	1221.5	3.0	
Bedrock	**1215.5**	**1206.5**	**3.0**	**0.05**

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



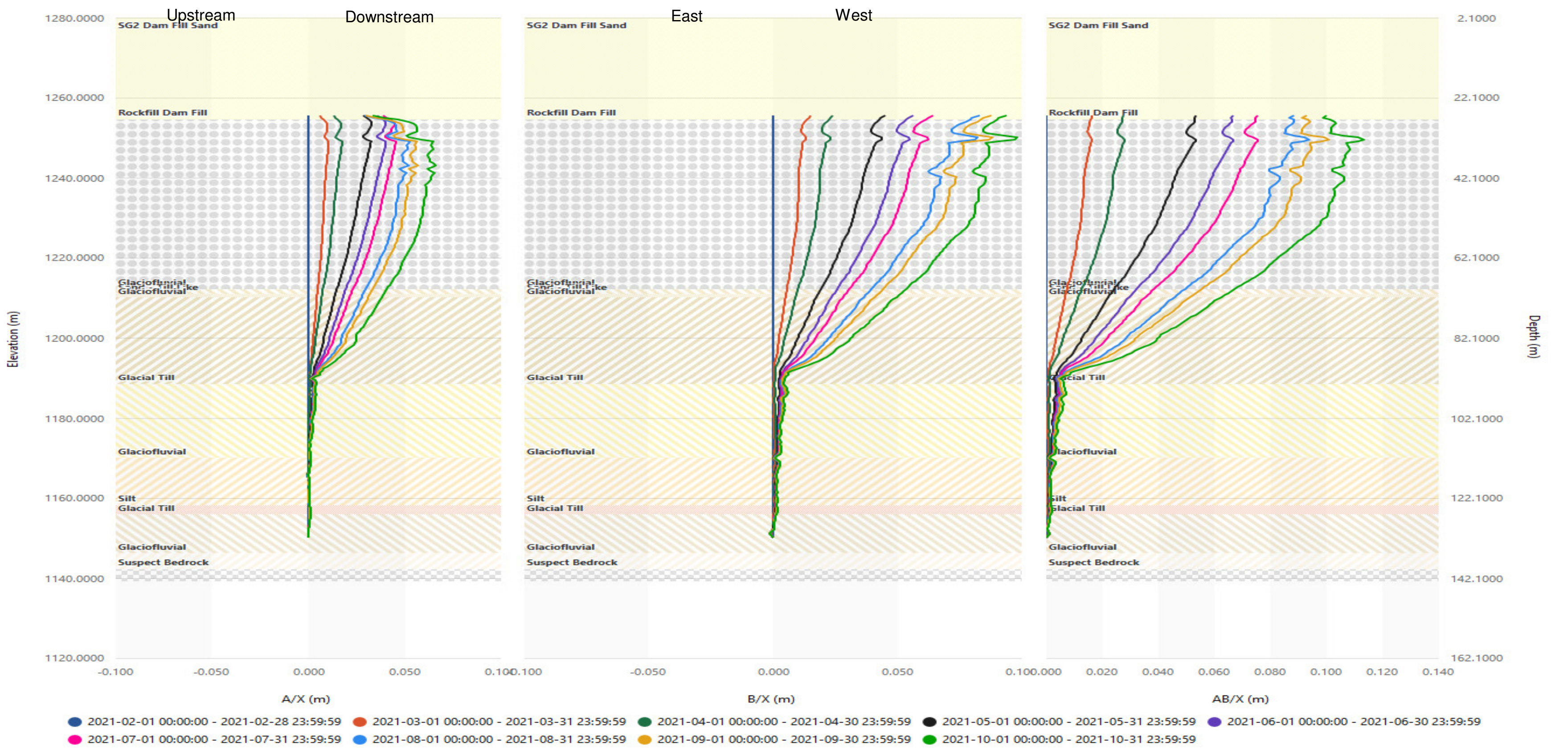
H-H DAM

I17-16



SAAV I17-16 Incremental Profile
Upstream
Downstream
East
West
SG2 Dam Fill Sand
Rockfill Dam Fill
Glaciofluvial
Glacial Till
Silt
Suspect Bedrock
Elevation (m)
Depth (m)
A/X (m)
B/X (m)
AB/X (m)
2021-02-01 00:00:00 - 2021-02-28 23:59:59
2021-03-01 00:00:00 - 2021-03-31 23:59:59
2021-04-01 00:00:00 - 2021-04-30 23:59:59
2021-05-01 00:00:00 - 2021-05-31 23:59:59
2021-06-01 00:00:00 - 2021-06-30 23:59:59
2021-07-01 00:00:00 - 2021-07-31 23:59:59
2021-08-01 00:00:00 - 2021-08-31 23:59:59
2021-09-01 00:00:00 - 2021-09-30 23:59:59
2021-10-01 00:00:00 - 2021-10-31 23:59:59

SAAV I17-16 Cumulative Profile

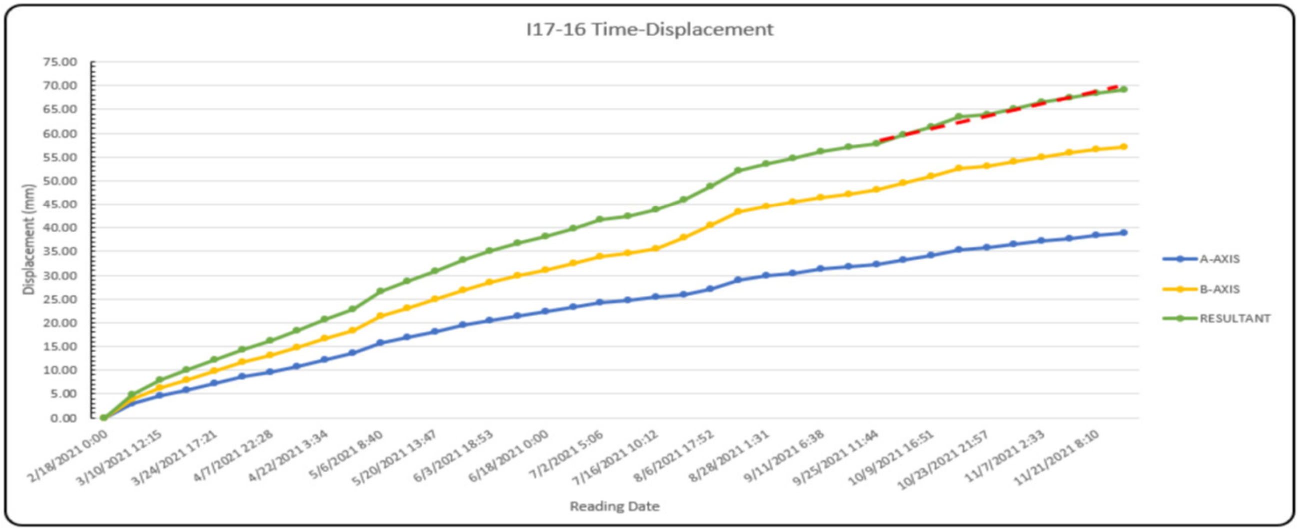


SAAV I17-16

Displacement Plot - Dam Fill / Rock Fill

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Rock Fill	**1245.1**	**1211.6**	**10.0**	**5.56**
Glacial Till	1197.1	1166.6	3.0	

Upper El. (m)	1245.1
Lower El. (m)	1211.6

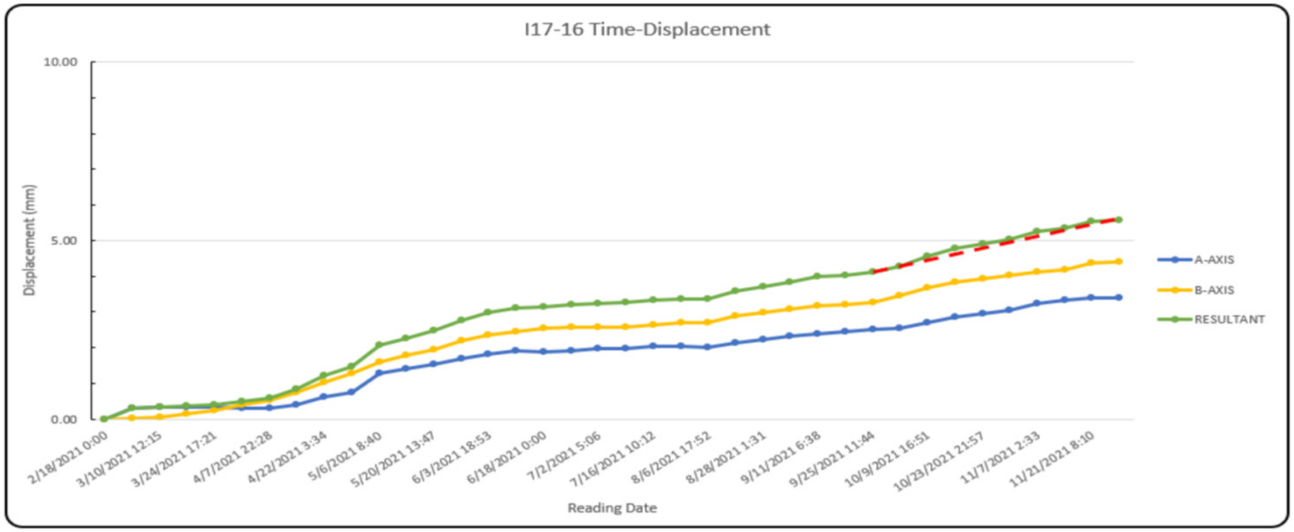


SAAV I17-16

Displacement Plot - Glacial Till

Unit	Upper El. (m)	Lower El. (m)	NL (mm/month)	Rate (mm/month)
Rock Fill	1245.1	1211.6	10.0	
Glacial Till	**1197.1**	**1166.6**	**3.0**	**0.72**

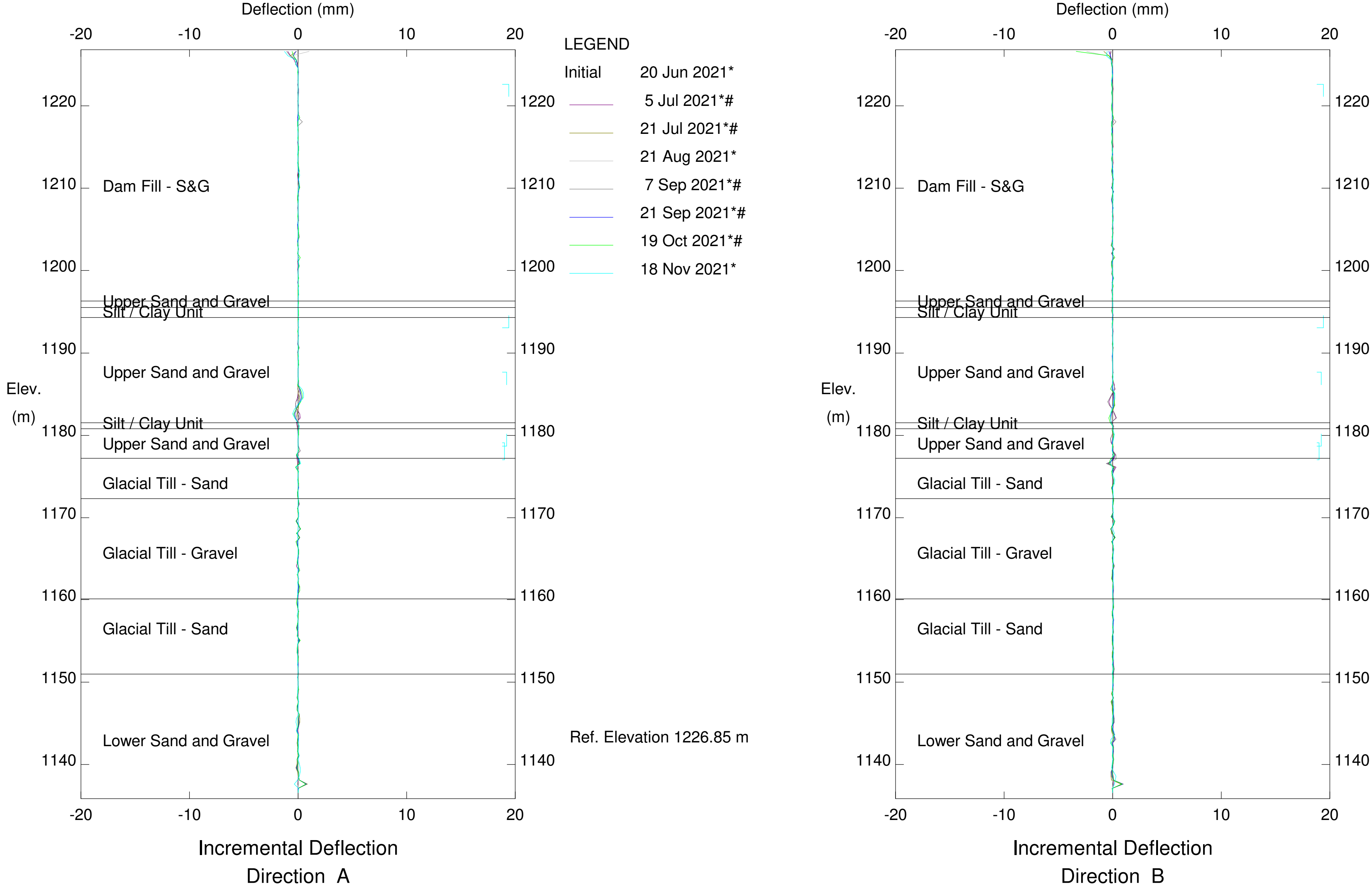
Upper El. (m)	1197.1
Lower El. (m)	1166.6



H-H DAM

I17-30

Highland Valley Copper - Logan Lake, BC



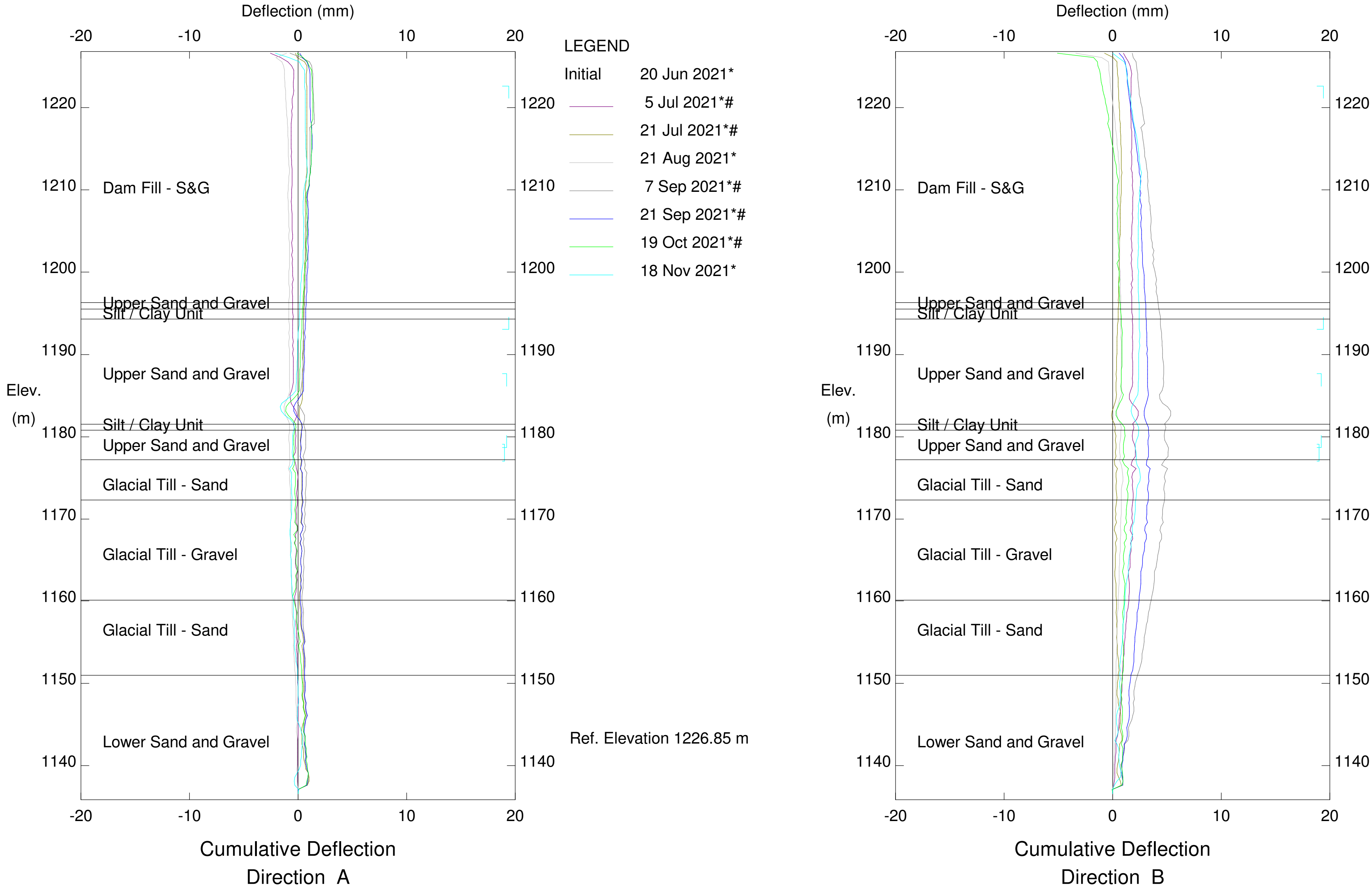
HH Dam,,,,,,,,,,,,,,,, Inclinometer I17-30,,,,,,

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

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I17-30.gtl

Sets marked # corrected for casing compression

Highland Valley Copper - Logan Lake, BC



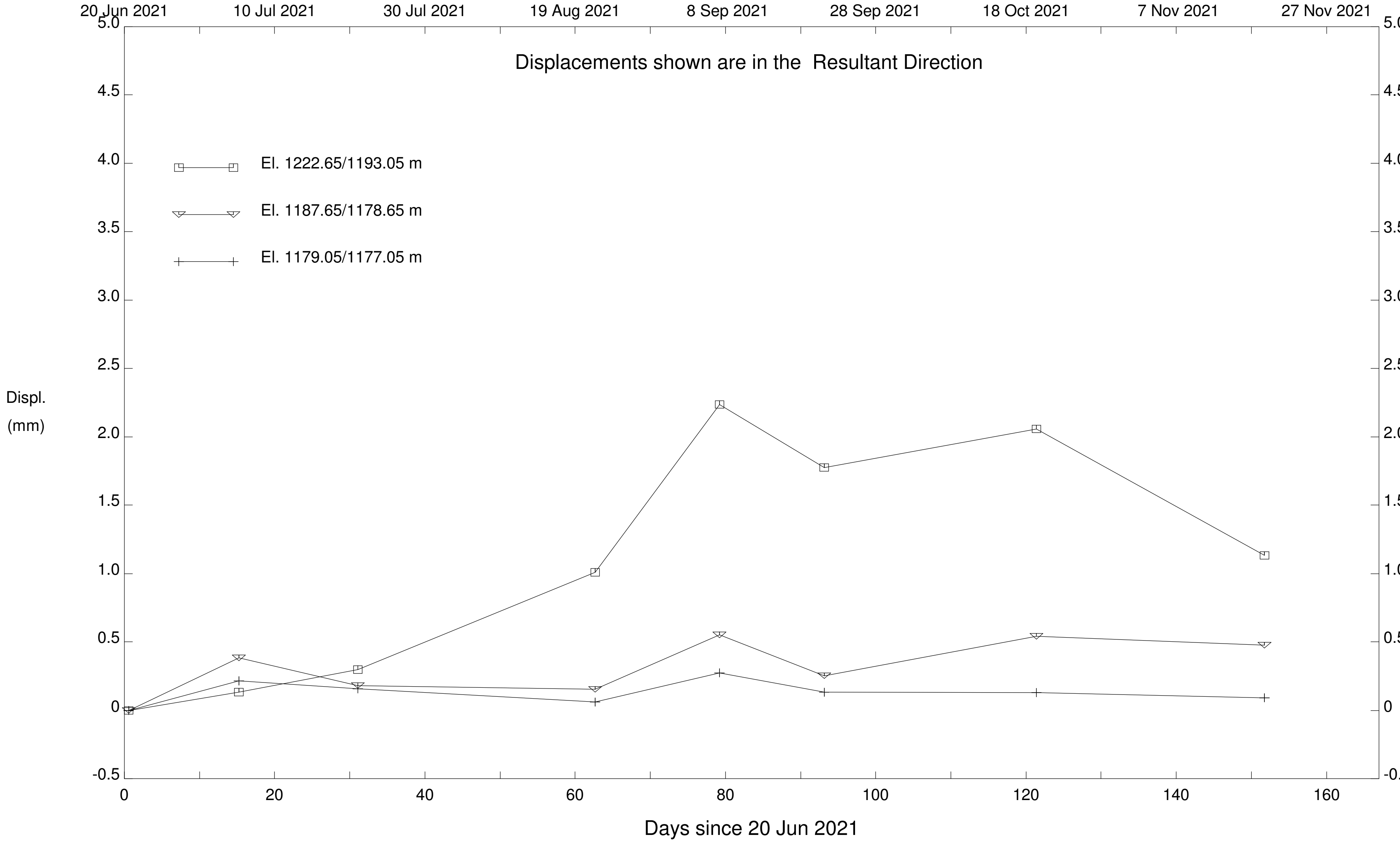
HH Dam,,,,,,,,,,,,,,,, Inclinometer I17-30,,,,,,

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

Sets marked # corrected for casing compression

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I17-30.gtl

Highland Valley Copper - Logan Lake, BC

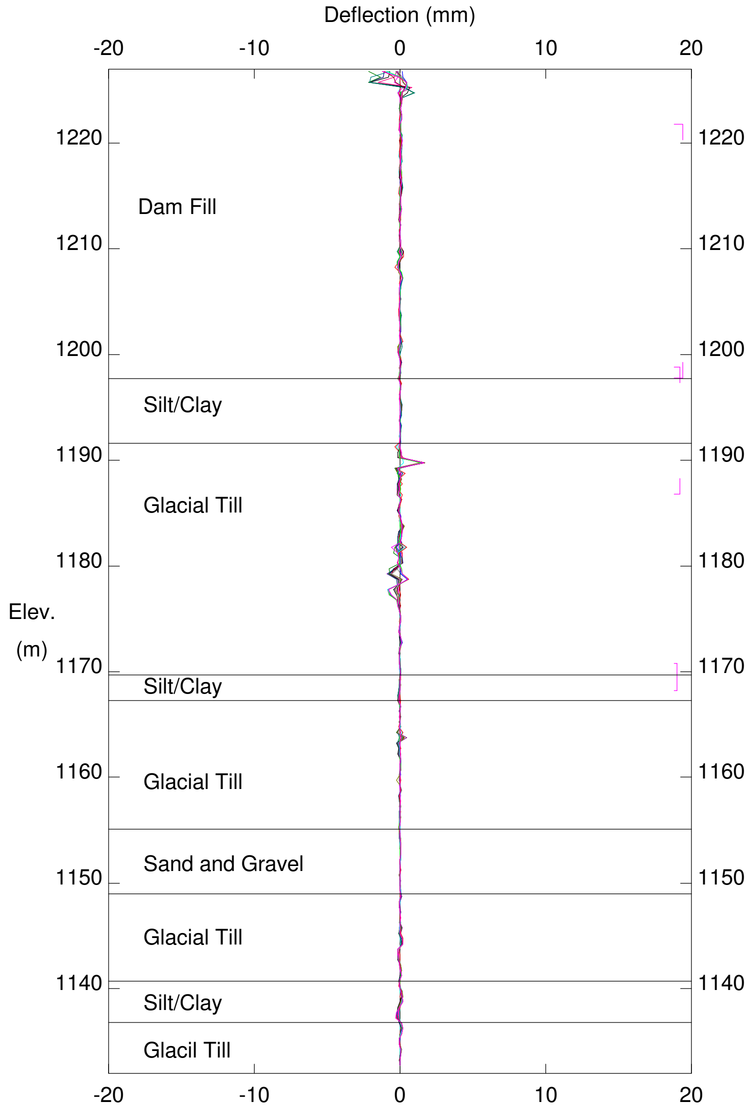


HH Dam,,,,,,,,,,,,,,,,, Inclinometer I17-30,,,,,,

H-H DAM

I17-31

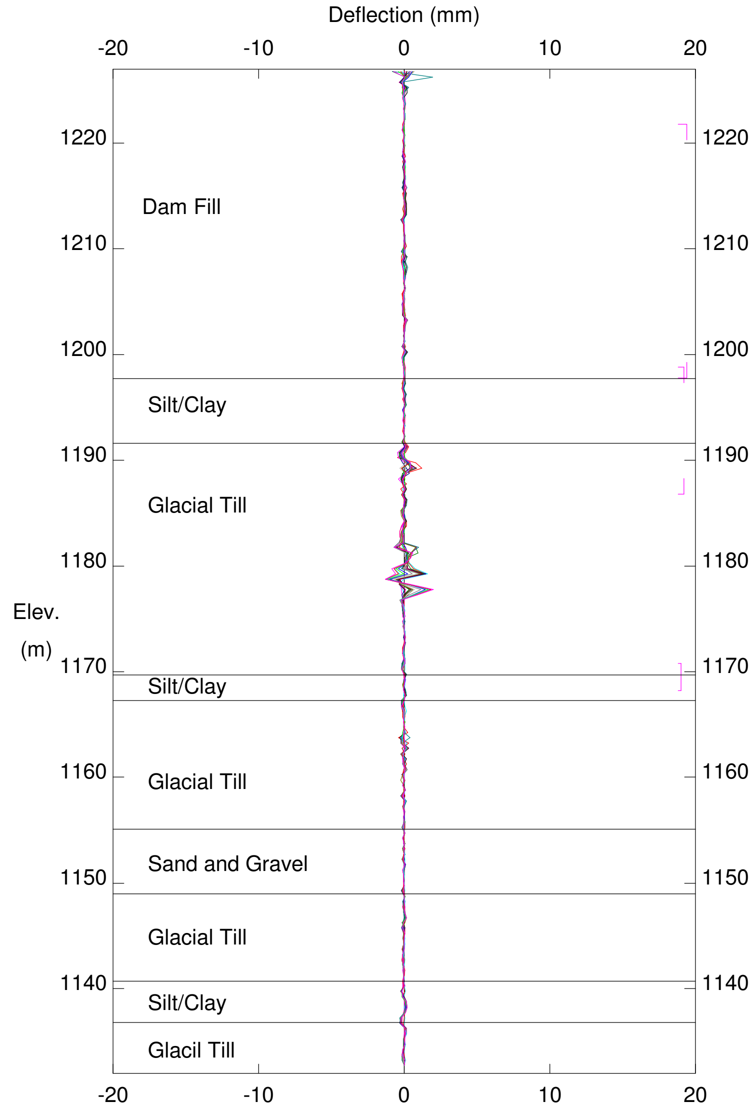
Highland Valley Copper - Logan Lake, BC



LEGEND

Initial	5 Jan 2021*
	6 Jan 2021*#
	7 Jan 2021*#
	18 Jan 2021*#
	1 Feb 2021*#
	17 Feb 2021*#
	1 Mar 2021*#
	9 Mar 2021#
	22 Mar 2021*#
	25 Apr 2021*#
	5 May 2021*#
	19 May 2021*#
	19 Jun 2021*#
	5 Jul 2021*#
	21 Jul 2021*#
	21 Sep 2021*#
	4 Oct 2021*#
	19 Oct 2021*#
	18 Nov 2021*#

Ref. Elevation 1227m



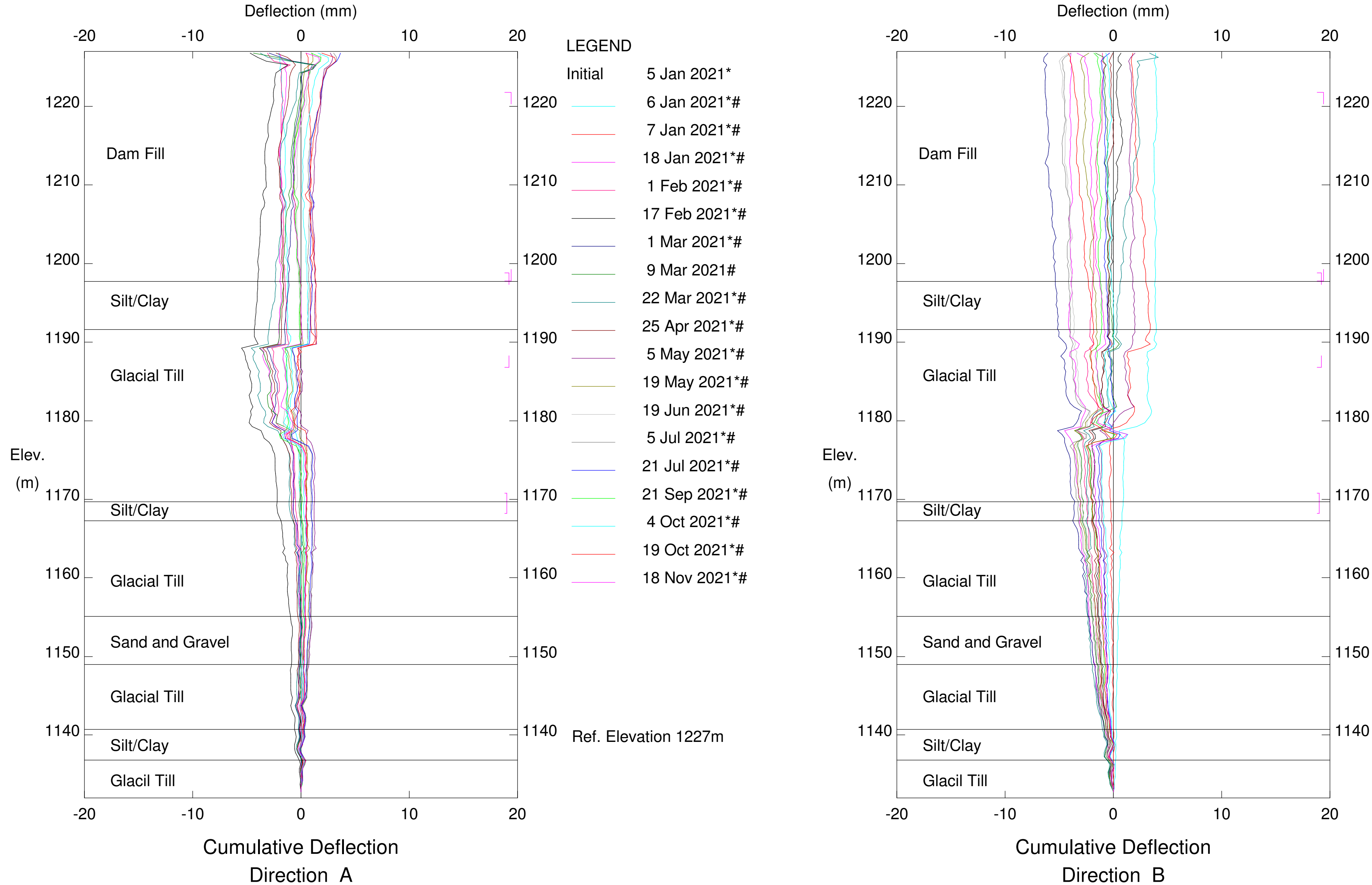
H-H Dam, Inclinometer I17-31

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

Sets marked # corrected for casing compression

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I17-31.gtl

Highland Valley Copper - Logan Lake, BC



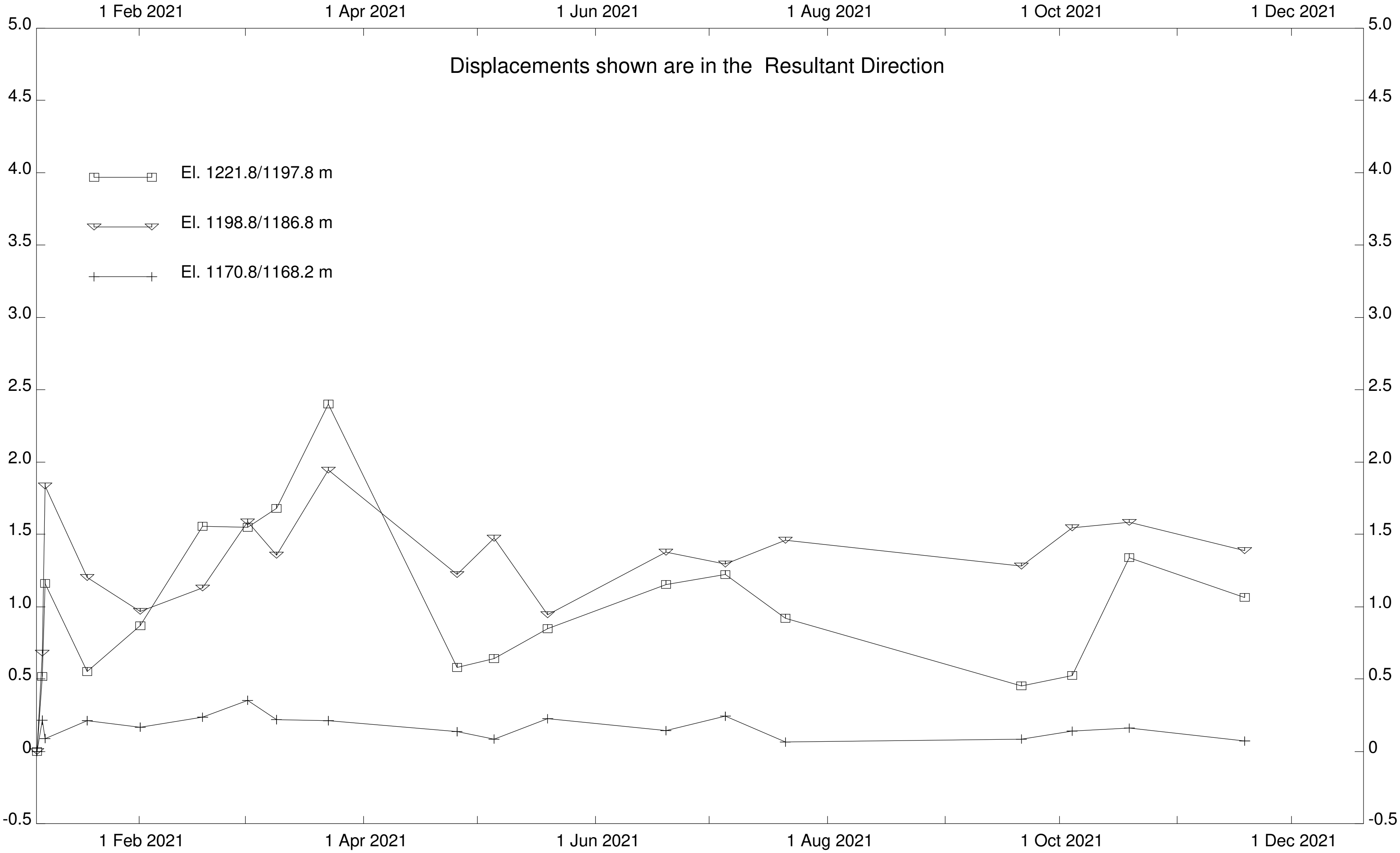
H-H Dam, Inclinometer I17-31

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

Sets marked # corrected for casing compression

T:\Engineering_Group\PROJECTS\03 CIVIL GROUP\01 Dam Management\Instrumentation\03 - Dam Movement Monitoring\1 - Manual SI\2 - Gtilt\I17-31.gtl

Highland Valley Copper - Logan Lake, BC



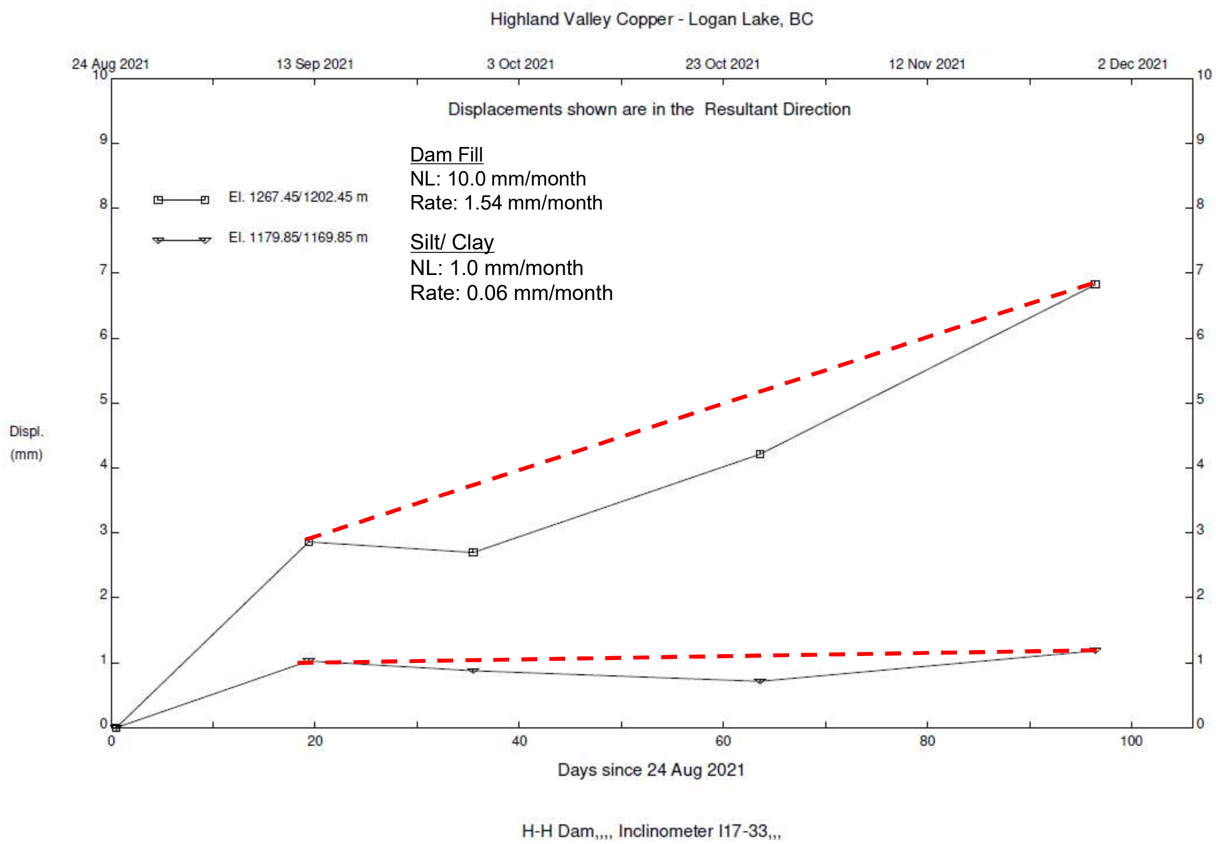
H-H Dam, Inclinometer I17-31

H-H DAM

I17-33

Inclinometer I17-33

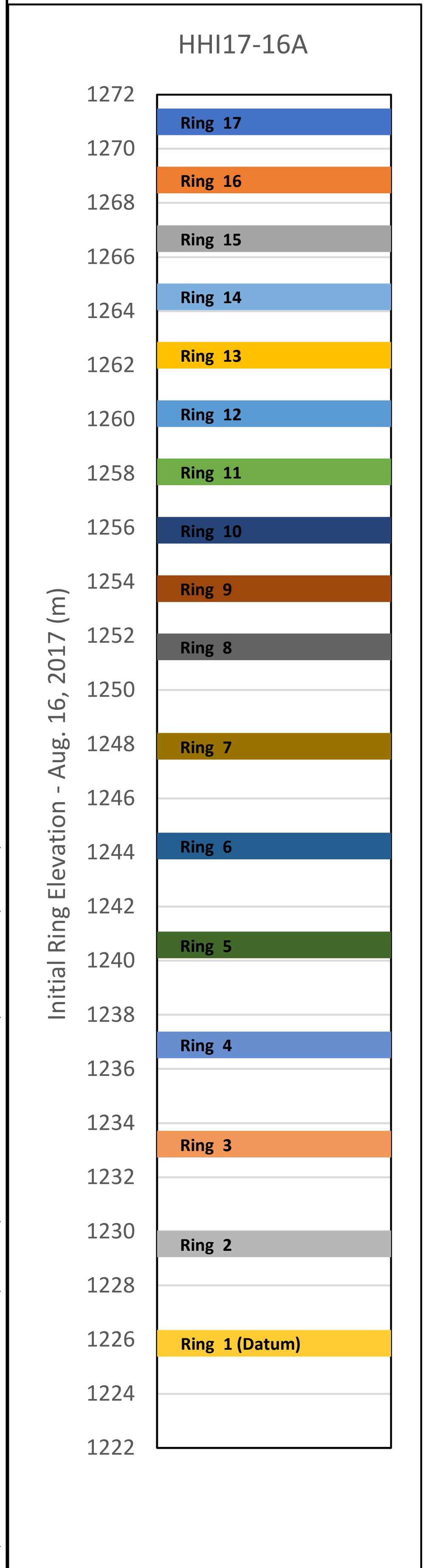
Time Displacement
Updated November 28th

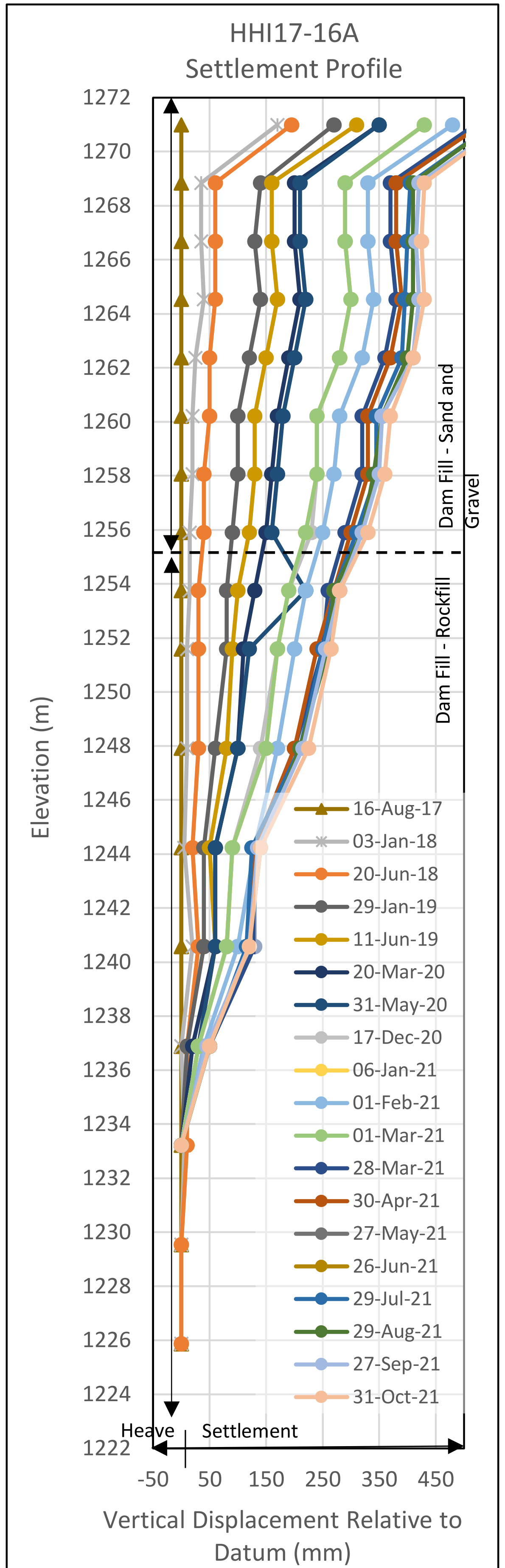


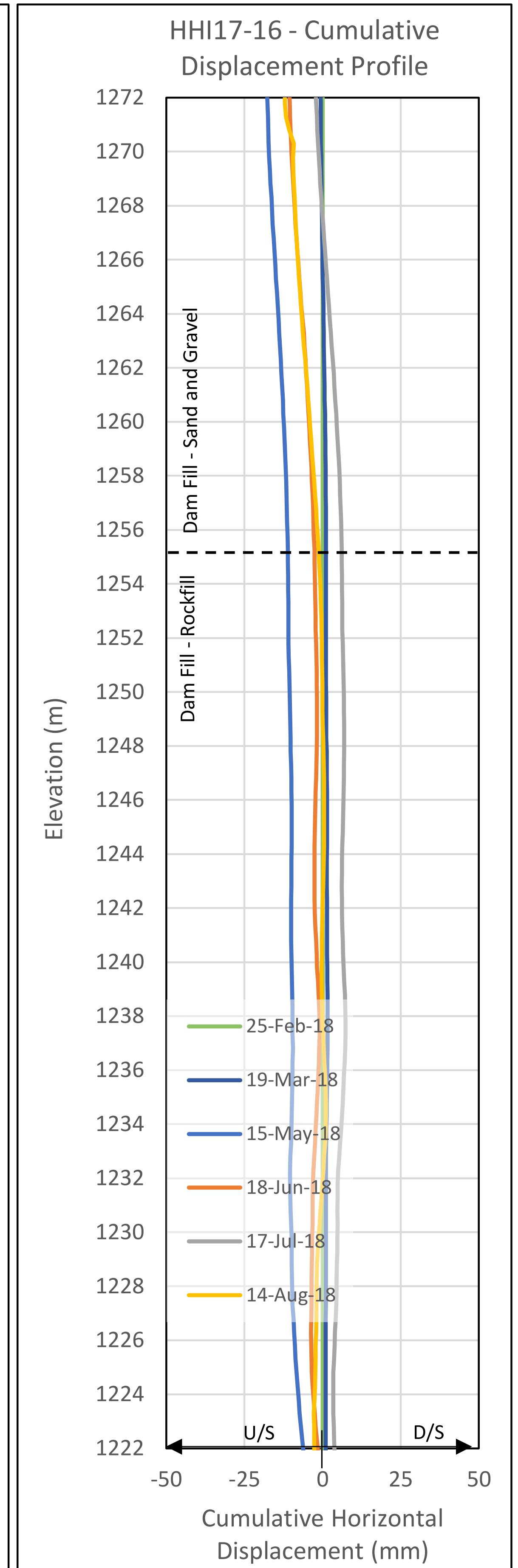
Teck

H-H DAM

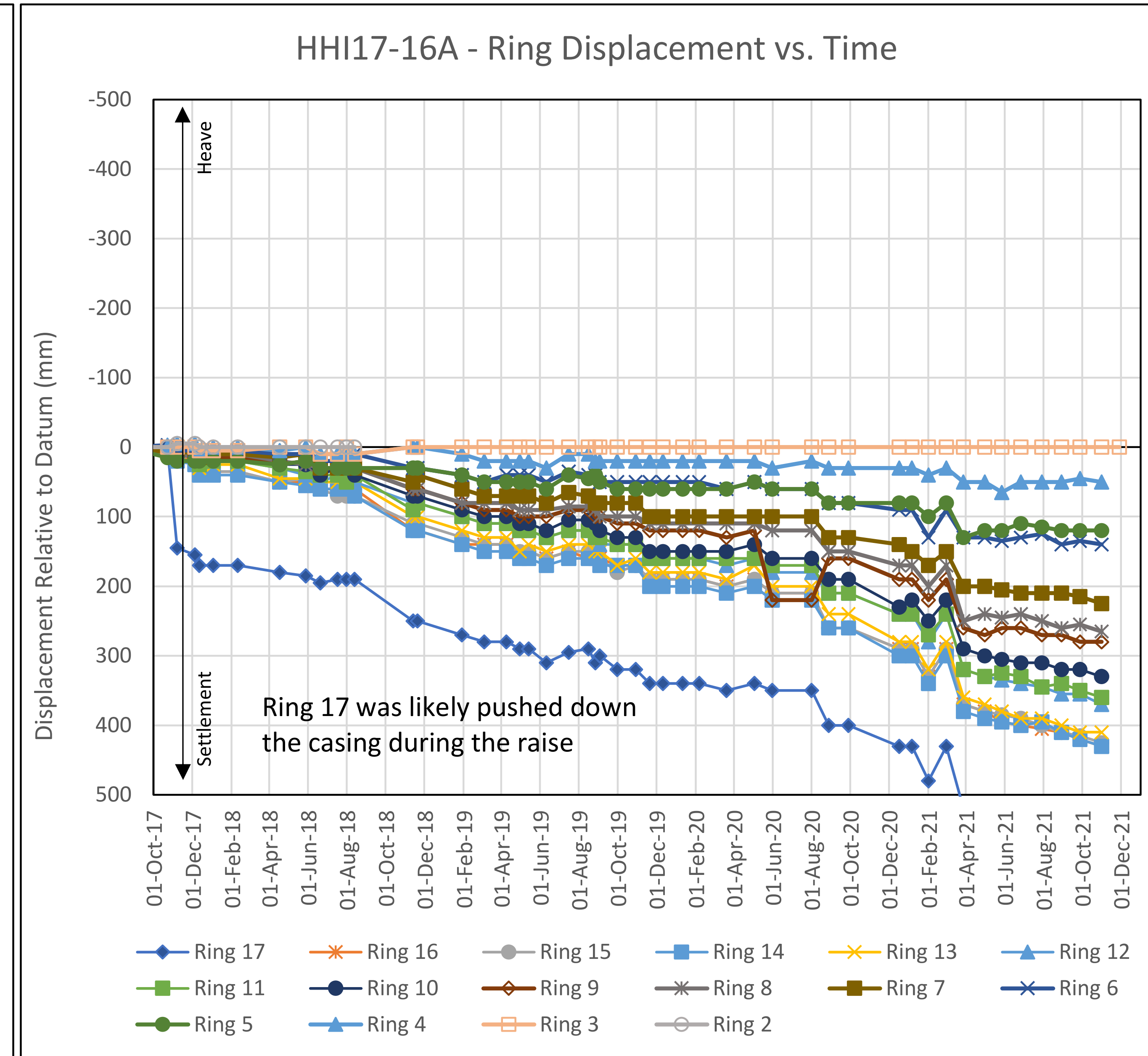
SONDEX PLOTS







Note: Baseline reading is February 25, 2018



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 NOVEMBER 28, 2021 WERE NOT CONSISTENT WITH OTHER READINGS AND ARE NOT SHOWN HERE.
4. NO READINGS RECORDED FOR RING 1 AND 2 AFTER OCTOBER 09, 2018

Highland Valley Copper / Teck

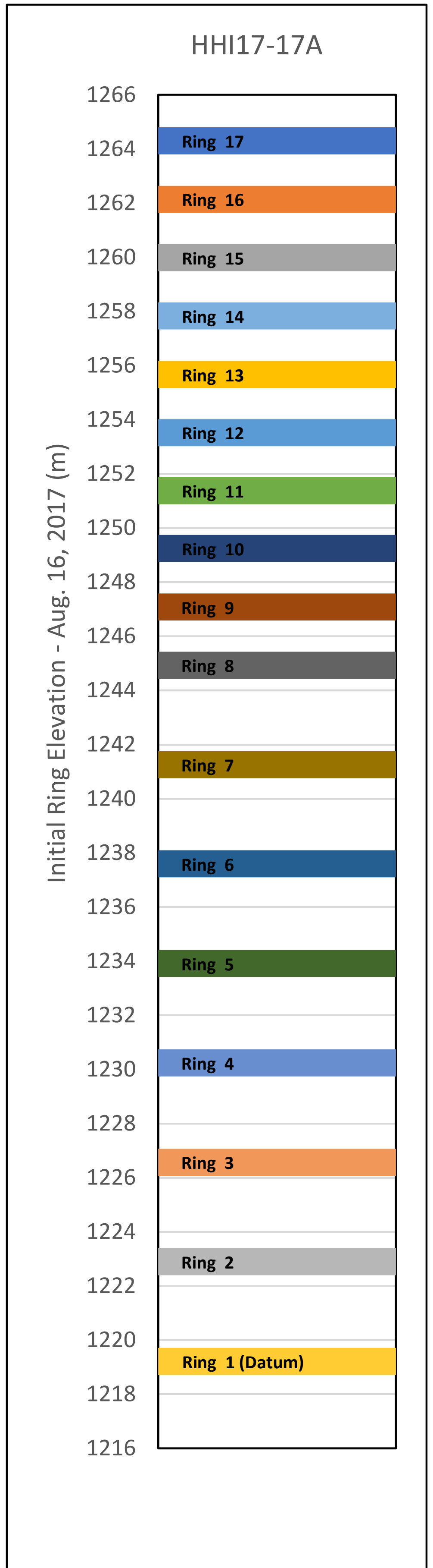
Klohn Crippen Berger

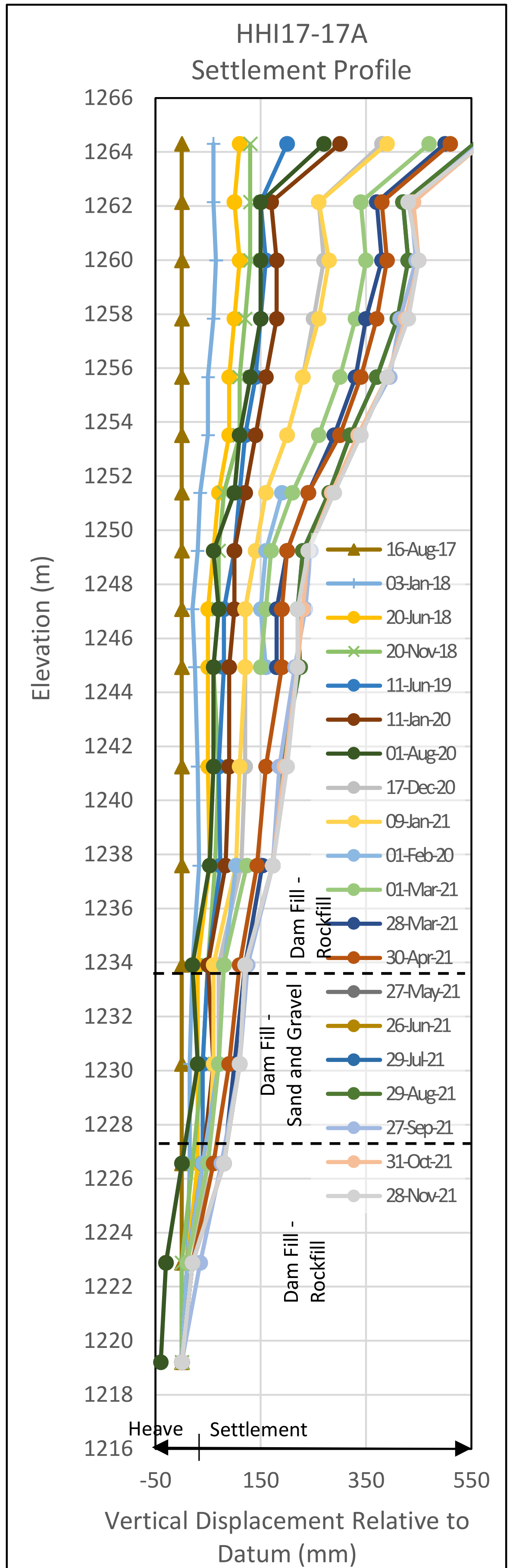
HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL REVIEW

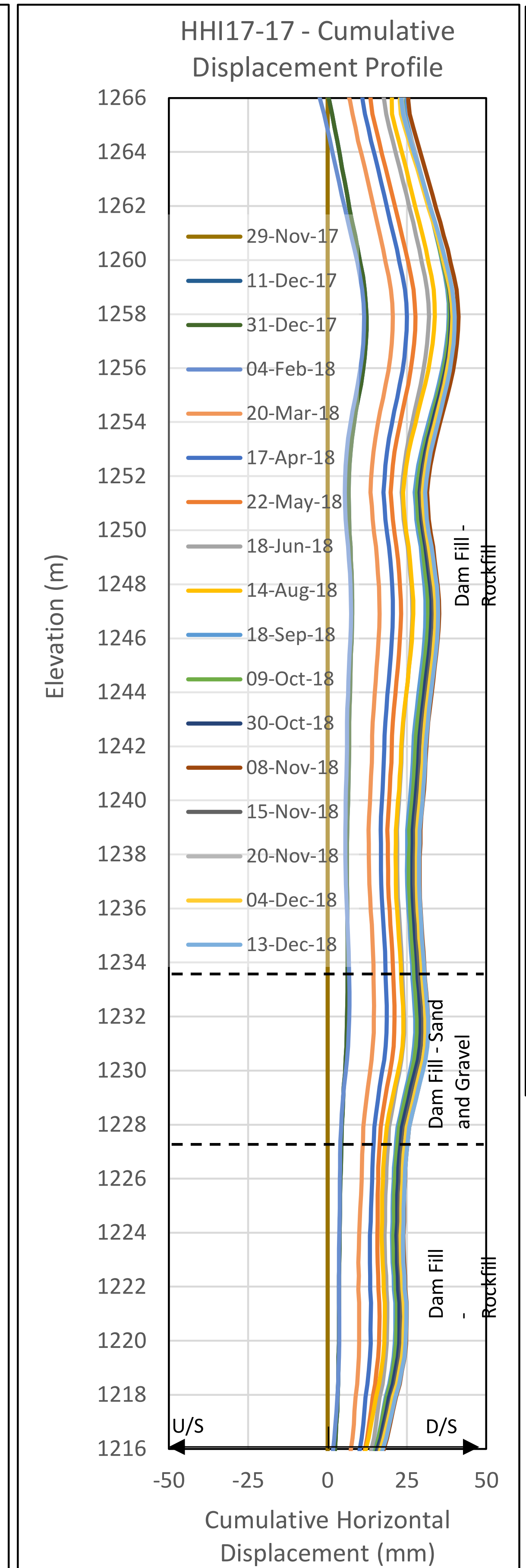
H-H DAM VERTICAL DISPLACEMENTS
HH17-16A (SONDEX) - NOVEMBER

M02341C12	IV-C-2

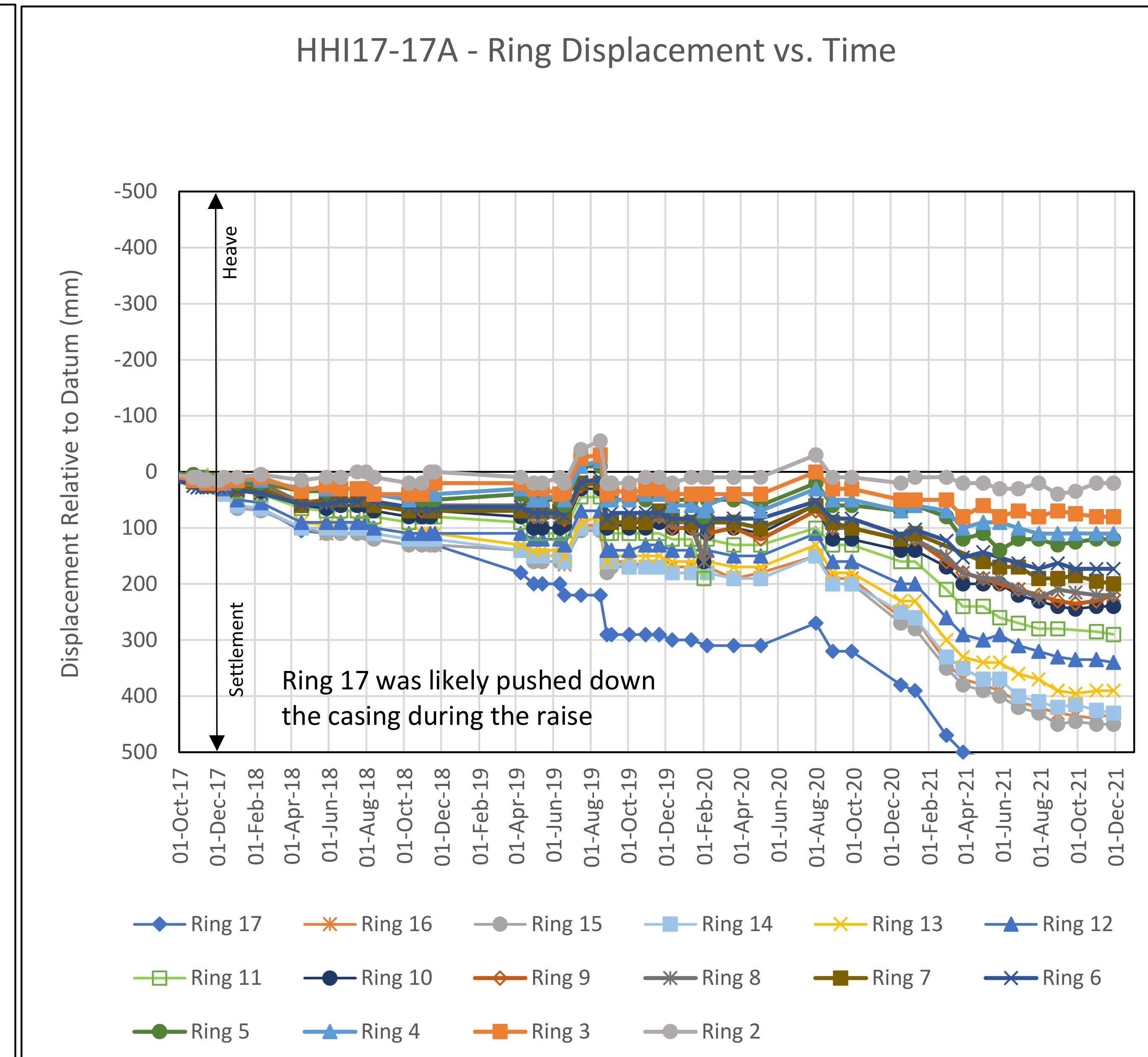
FILE PATH: Z:\M\VCR\M02341C12-HVC 2021 DAM SAFETY SUPPORT\300 DESIGN\340 DAM MOVEMENT MONITORING\342 SONDEX DATA\2021 AFPR\210301 AFPR SONDEX READINGS WITH PLOTS.XLSX - 2022-03-01 12:47







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 TRENDS AND ARE NOT SHOWN HERE:
   -RING 7 (FEBRUARY 1 TO MARCH 28, 2020)
   -RINGS 11-17 (FREBUARY 1, 2020)

Highland Valley Copper / Teck

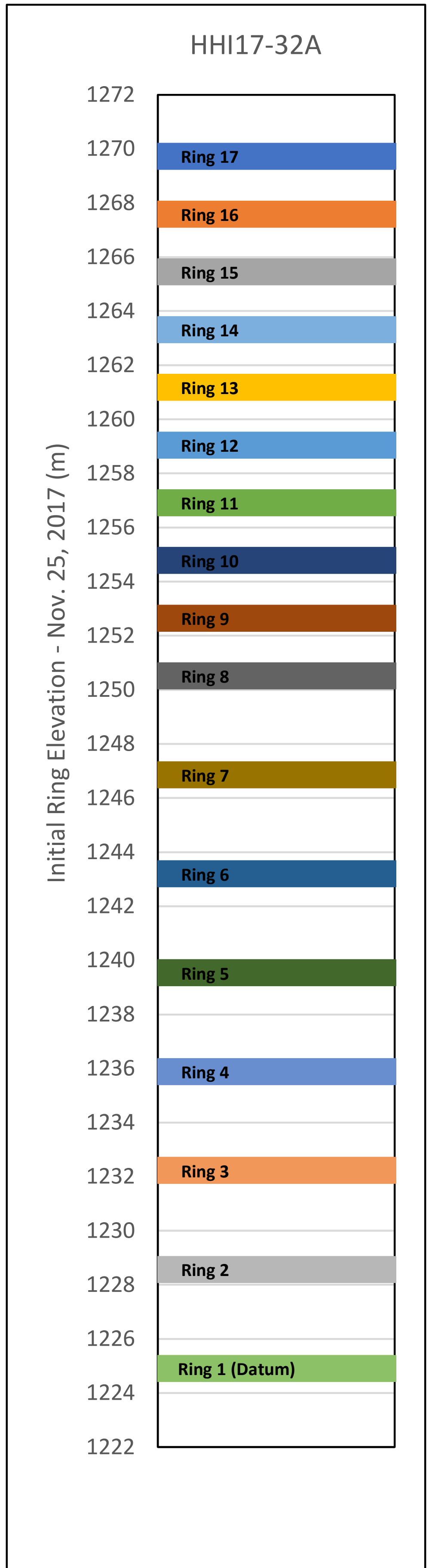
Klohn Crippen Berger

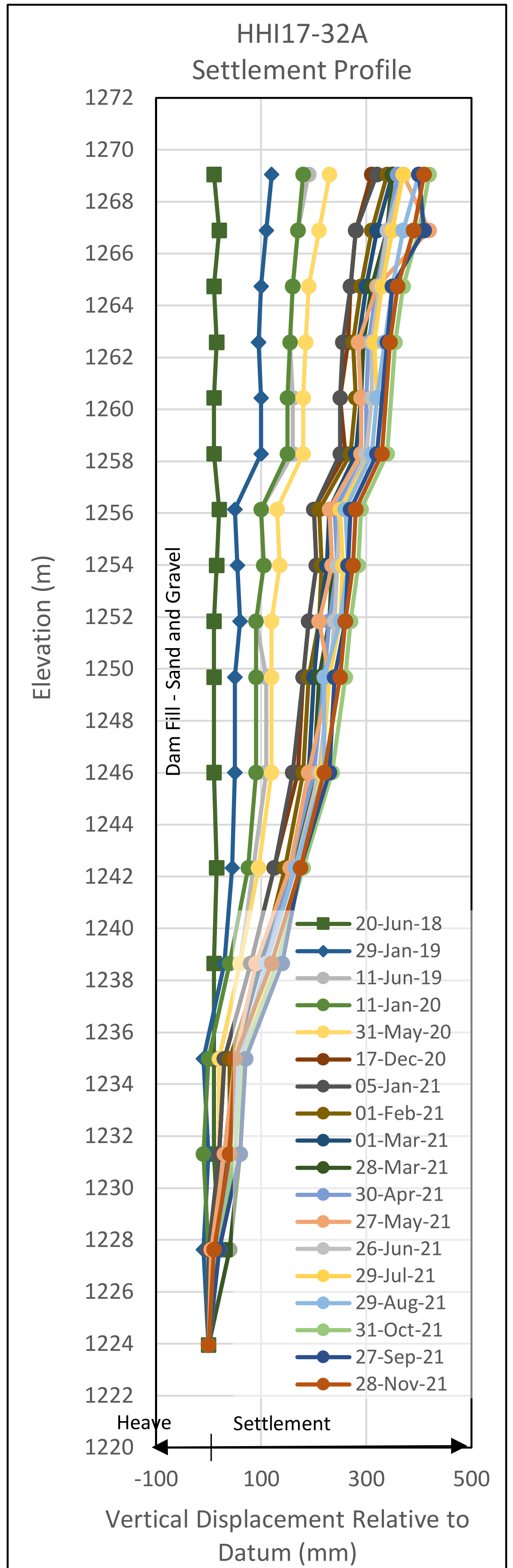
HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL REVIEW

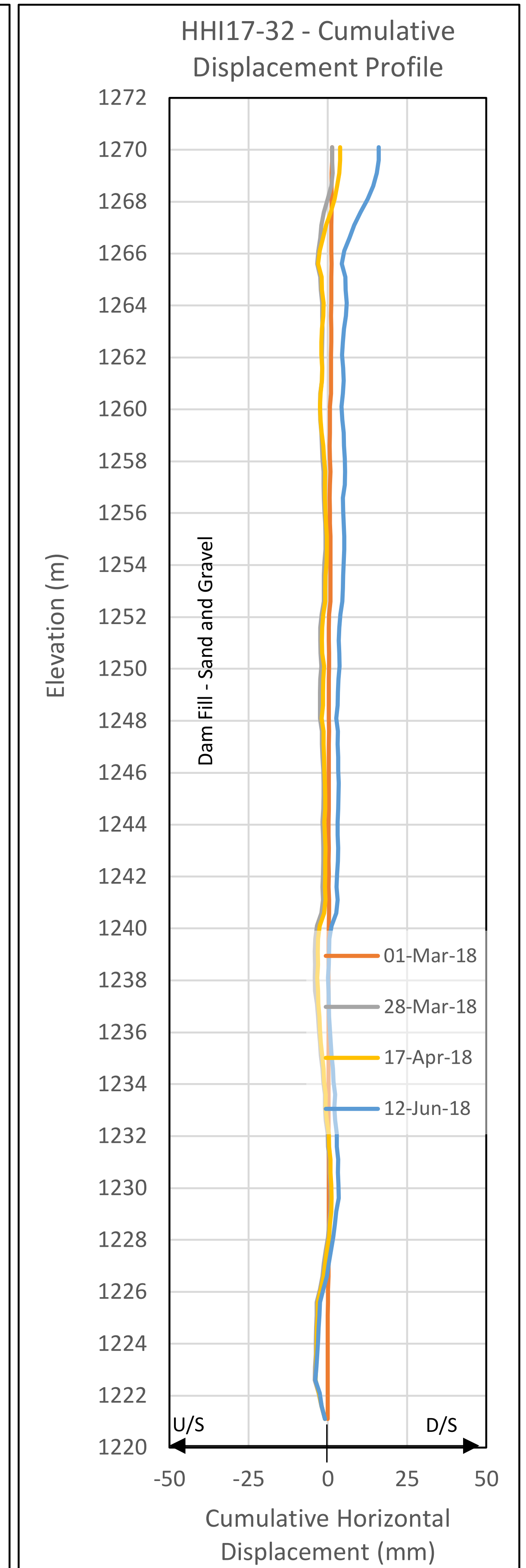
H-H DAM VERTICAL DISPLACEMENTS
HH17-17A(SONDEX) - NOVEMBER

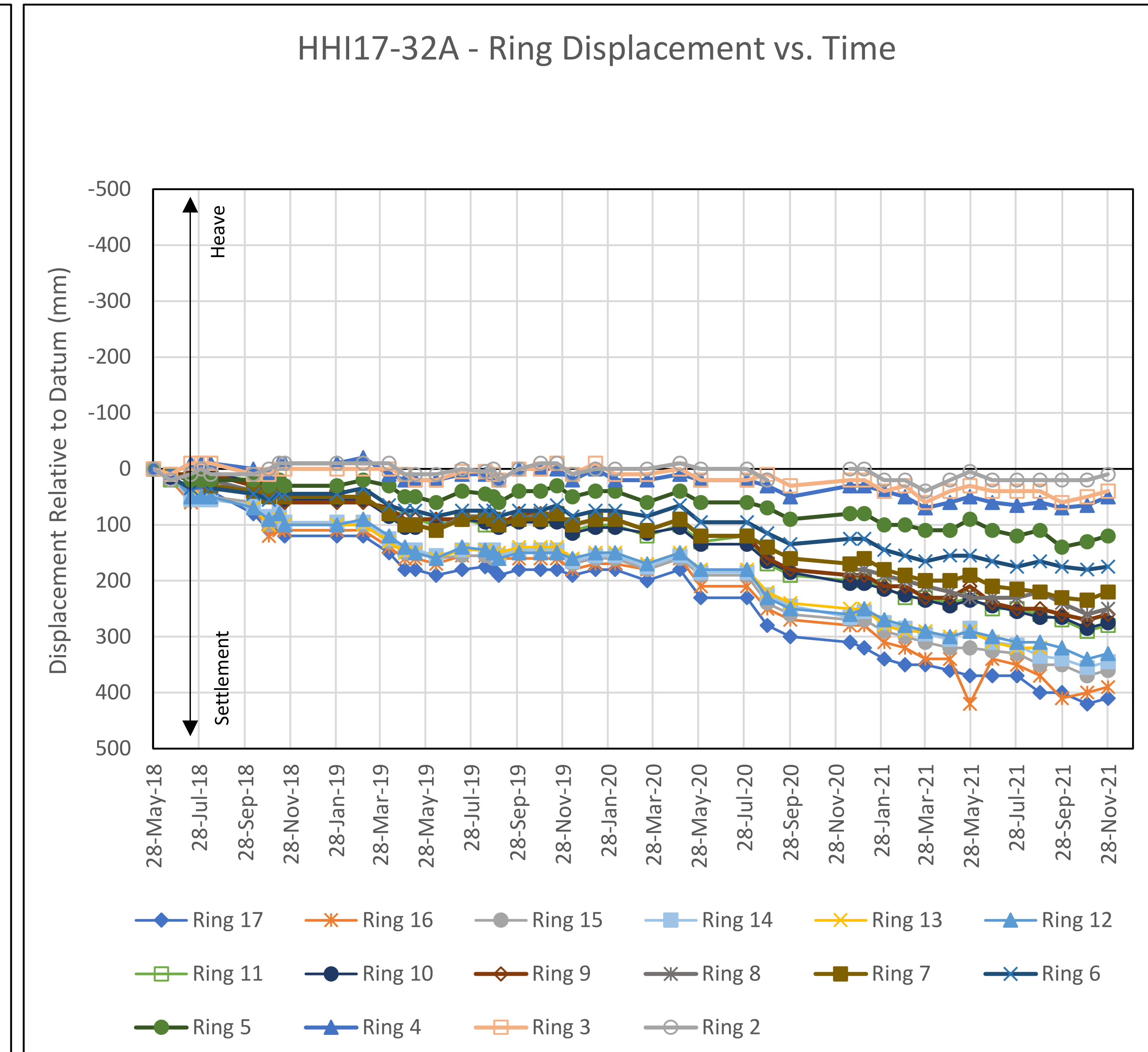
M02341C12	IV-C-3

FILE PATH: Z:\M\VCR\M02341C12-HVC 2021 DAM SAFETY SUPPORT\300 DESIGN\340 DAM MOVEMENT MONITORING\342 SONDEX DATA\2021 AFPR\210301 AFPR SONDEX READINGS WITH PLOTS.XLSX - 2022-03-01 12:47









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. RING 13 READINGS FROM SEPTEMBER 27, 2021 TO NOVEMBER 28, 2021 WERE NOT CONSISTENT WITH PREVIOUS TRENDS AND ARE NOT SHOWN HERE.
4. THE BASELINE READING OF VERTICAL DISPLACEMNET PLOT IS MAY 28, 2018.

Highland Valley Copper / Teck

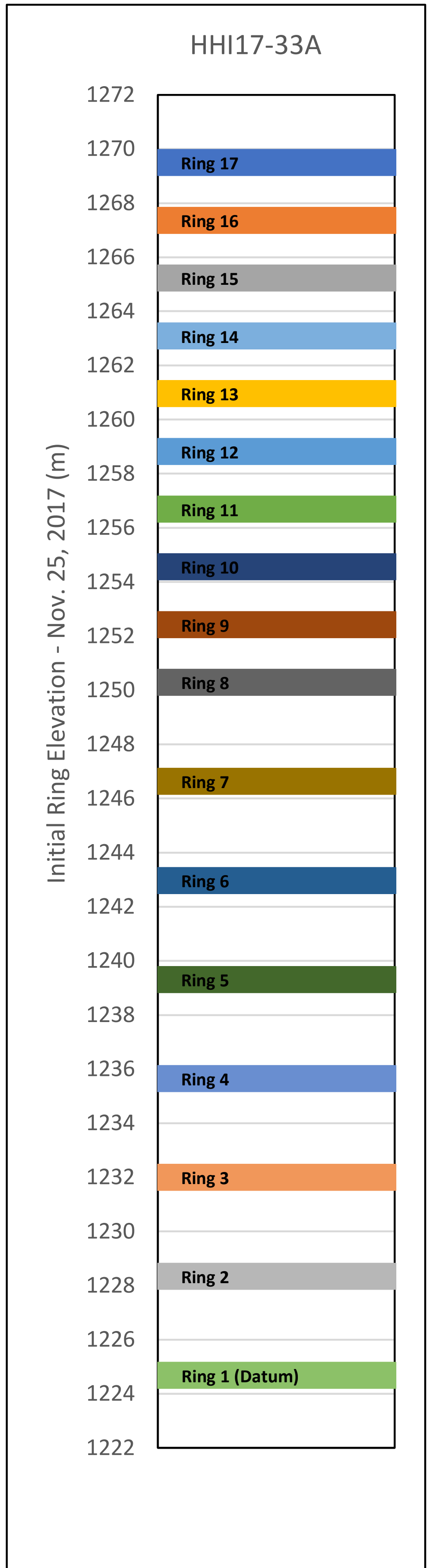
Klohn Crippen Berger

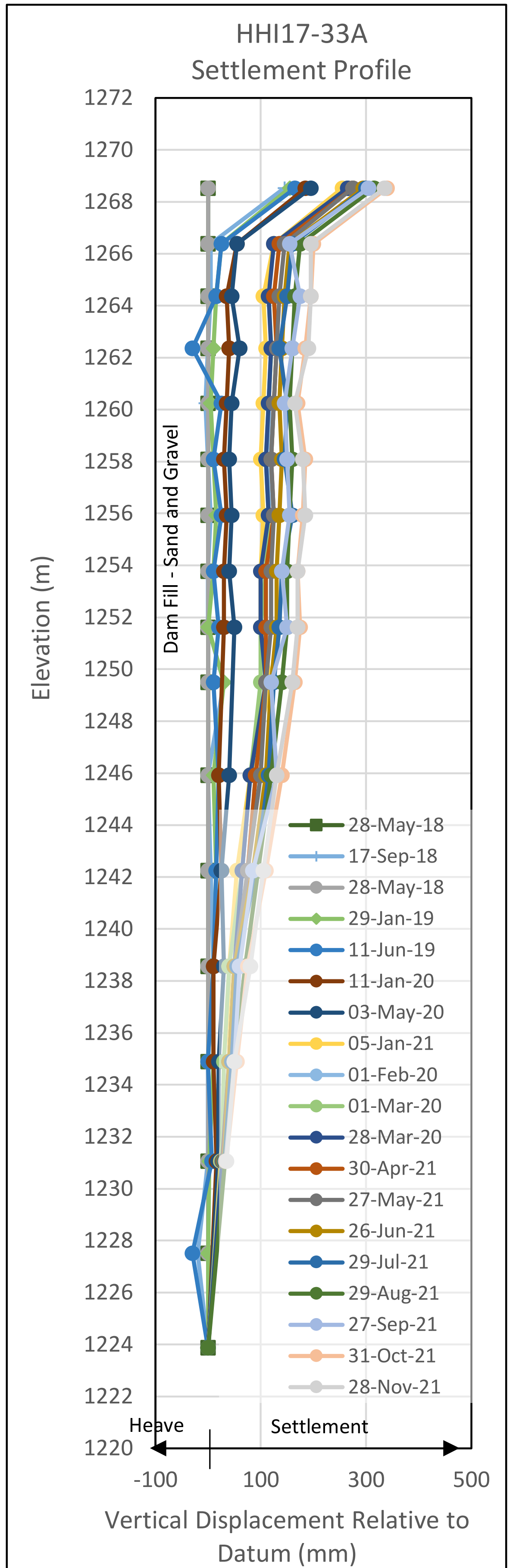
HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL REVIEW

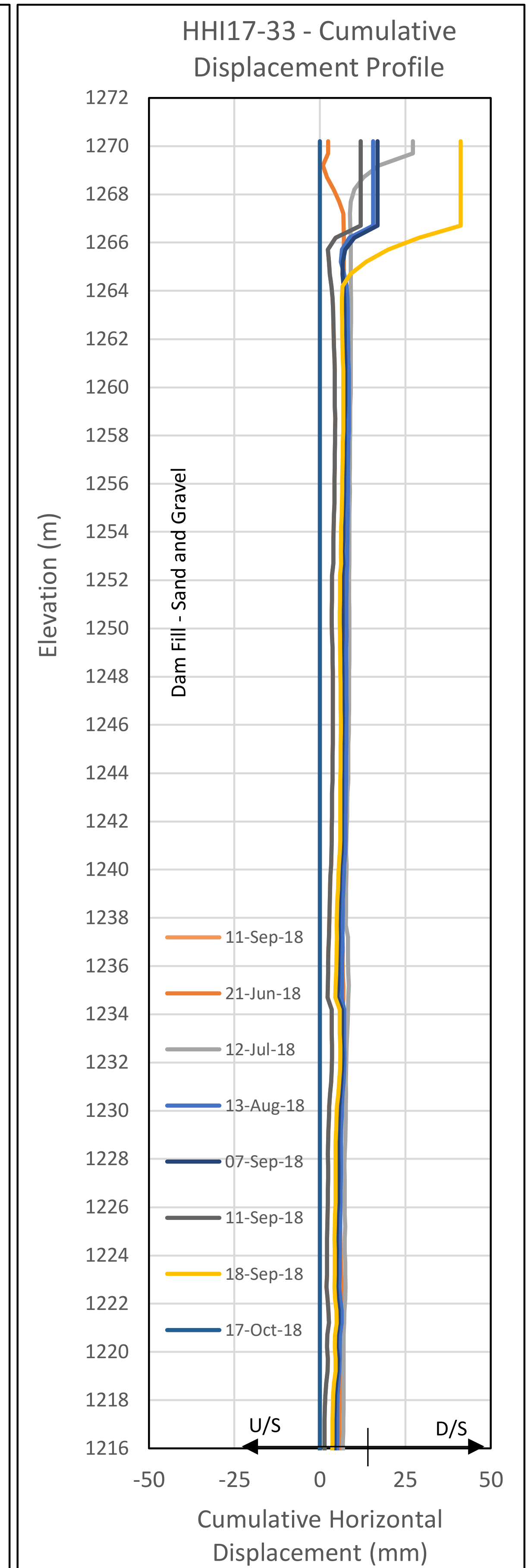
H-H DAM VERTICAL DISPLACEMENTS
HH17-32A(SONDEX) - NOVEMBER

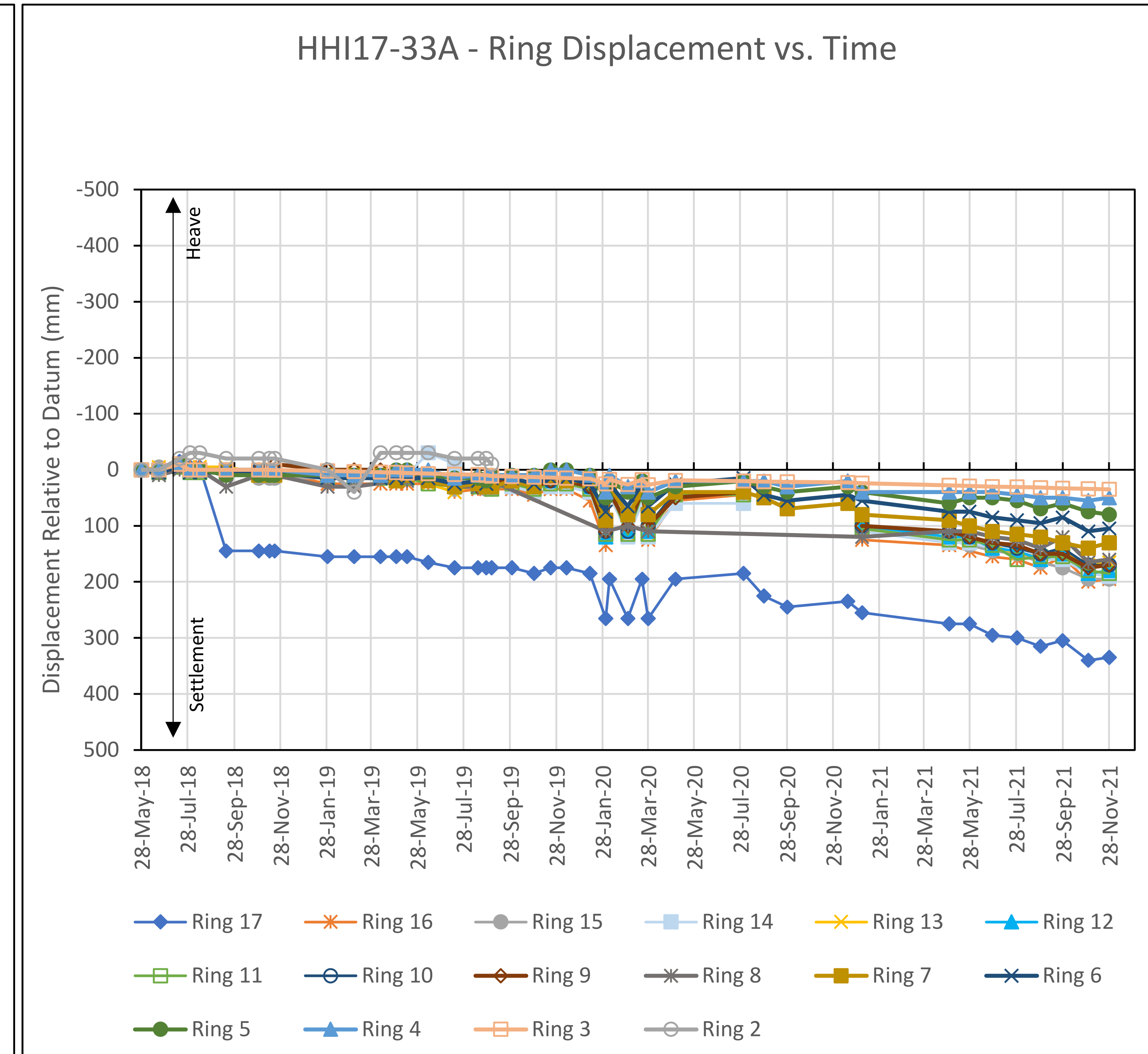
M02341C12 | IV-C-4

FILE PATH: Z:\M\VCR\M02341C12-HVC 2021 DAM SAFETY SUPPORT\300 DESIGN\340 DAM MOVEMENT MONITORING\342 SONDEX DATA\2021 APR\210301 APR SONDEX READINGS WITH PLOTS.XLSX - 2022-03-01 12:47









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, SEPTEMBER 28, 2020 AND DECEMBER 17, 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
2021 ANNUAL REVIEW

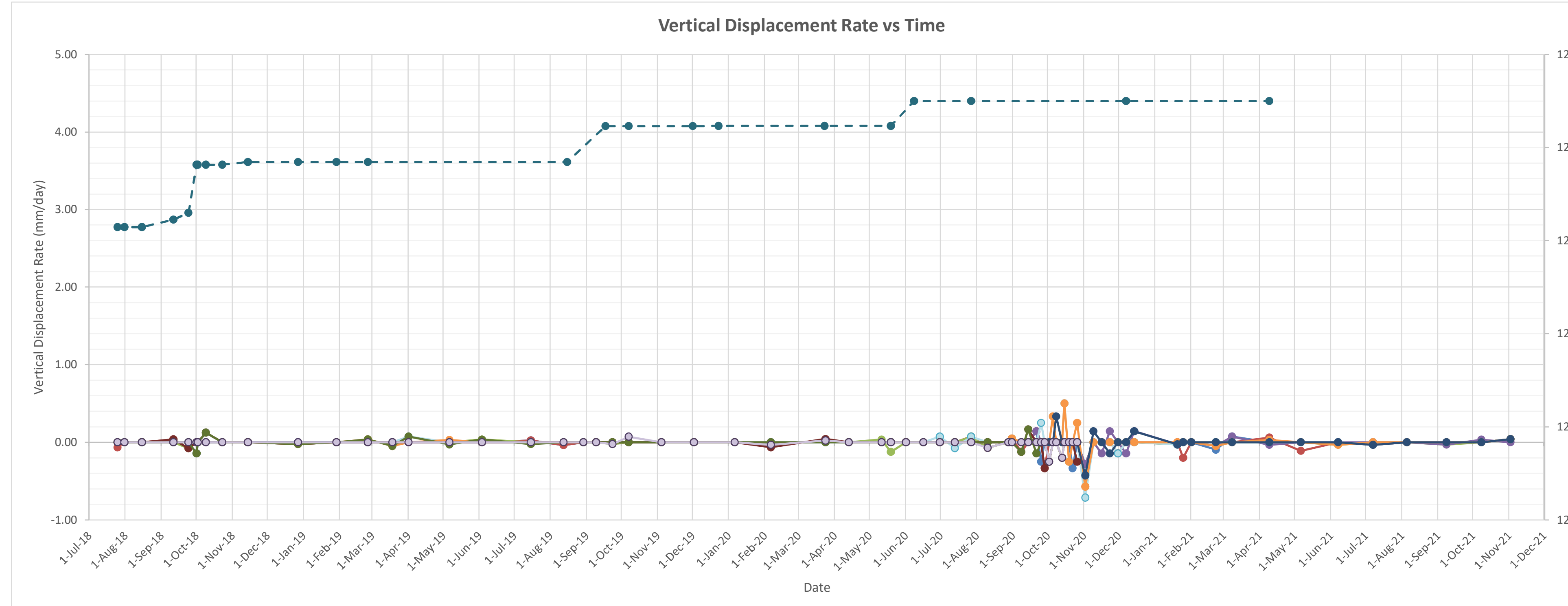
H-H DAM VERTICAL DISPLACEMENTS
HH17-33A(SONDEX) - NOVEMBER

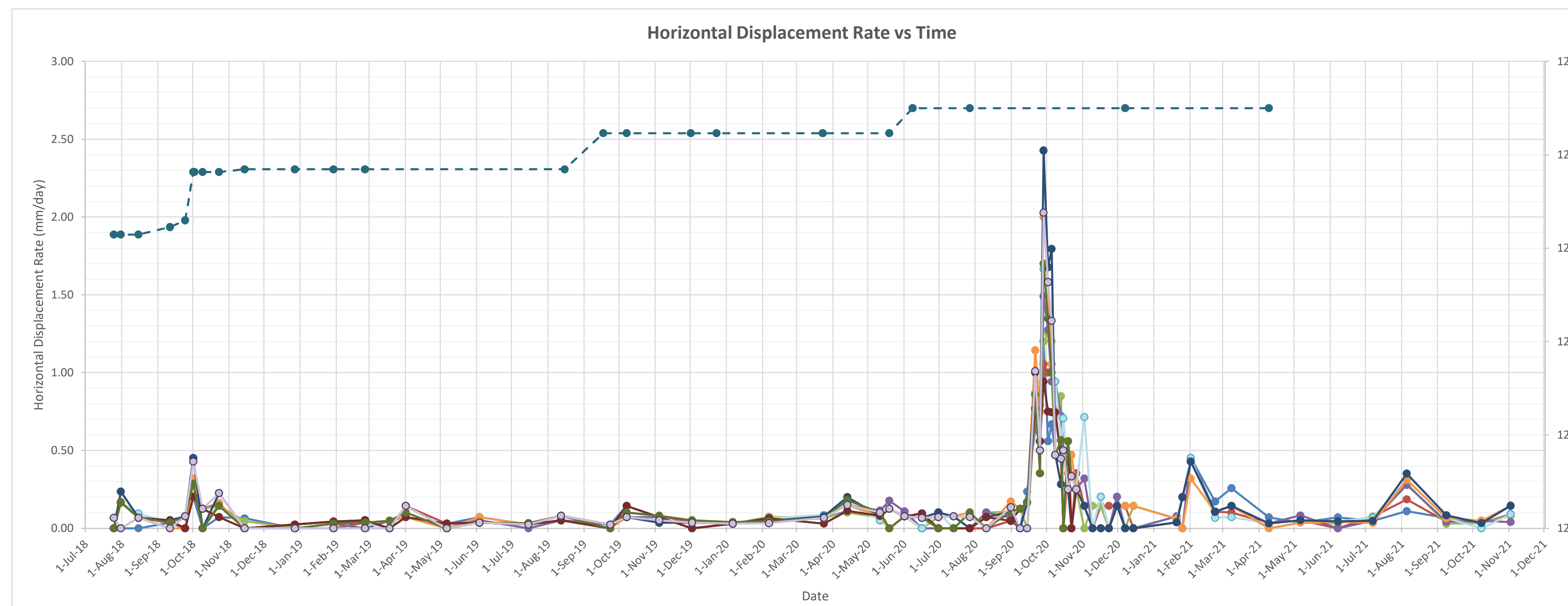
M02341C12	IV-C-5

FILE PATH: Z:\M\VCR\M02341C12-HVC 2021 DAM SAFETY SUPPORT\300 DESIGN\340 DAM MOVEMENT MONITORING\342 SONDEX DATA\2021 AFPR\210301 AFPR SONDEX READINGS WITH PLOTS.XLSX - 2022-03-01 12:47

APPENDIX IV-D

H-H Dam Monument Data





Legend:
- LB1
- LB2
- LB3
- LB4
- LB5
- LB6
- LB7
- LB8 (Buried)
- LB9 (Buried)
- LB10 (Buried)
- H-H Till Core Elv. at 2+000 (Right Axis)

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: Highland Valley Copper / Teck

Klohn Crippen Berger

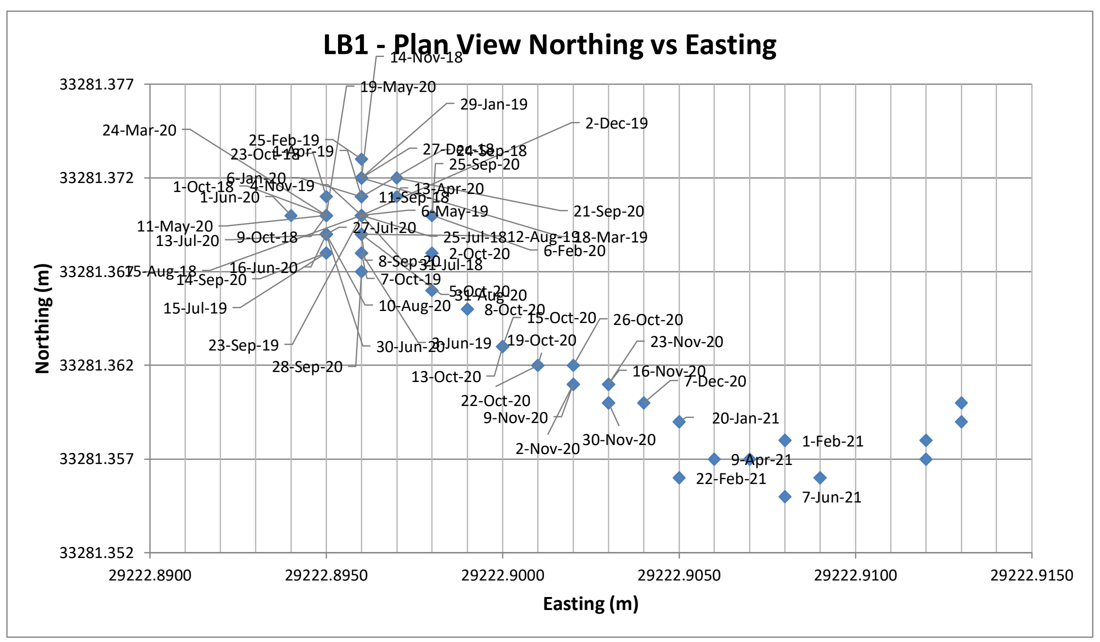
PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL PERFORMANCE REPORT

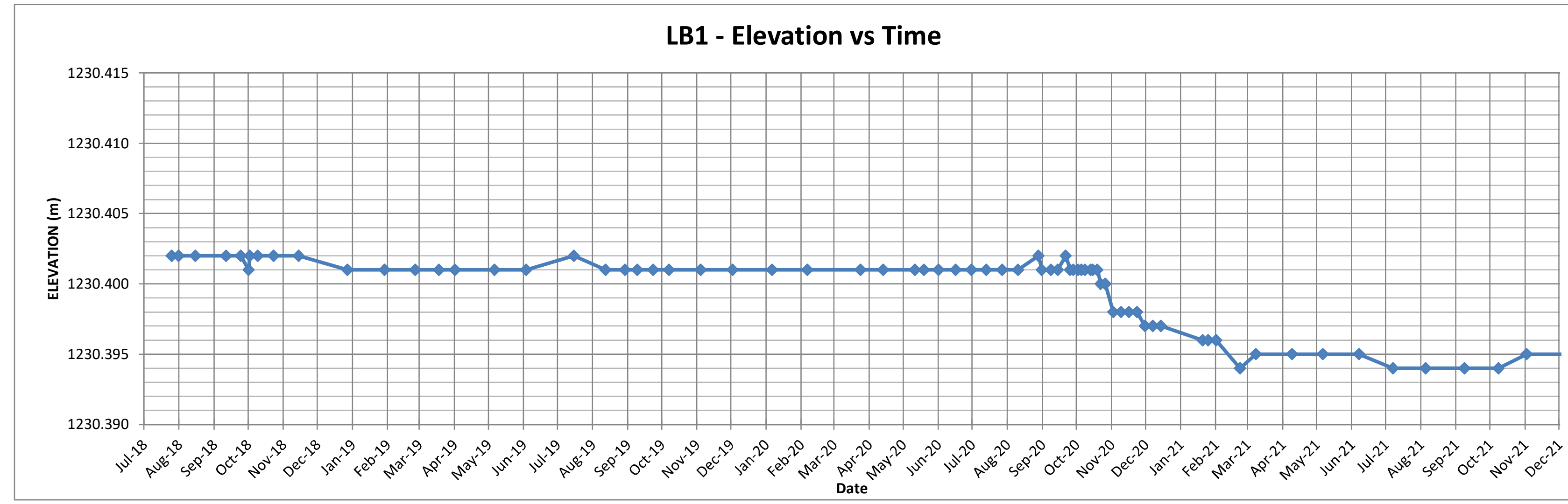
TITLE: H-H DAM LOCK-BLOCK RETAINING WALL
SURVEY MONUMENT READINGS
SUMMARY

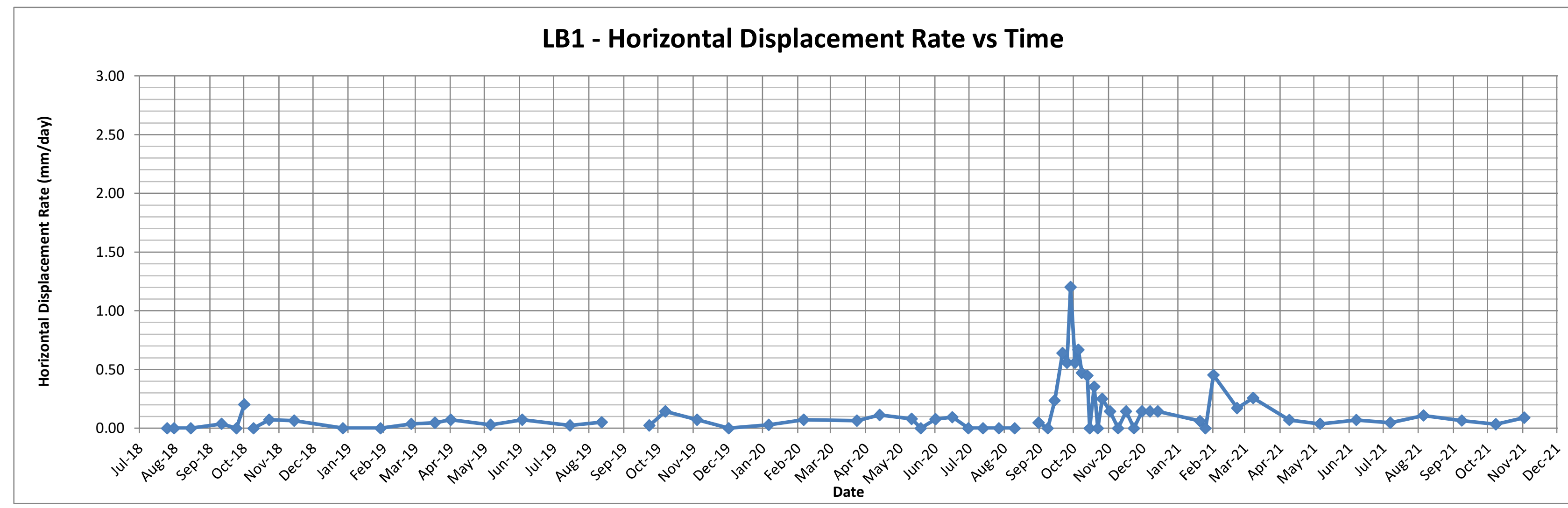
PROJECT No. M02341C12

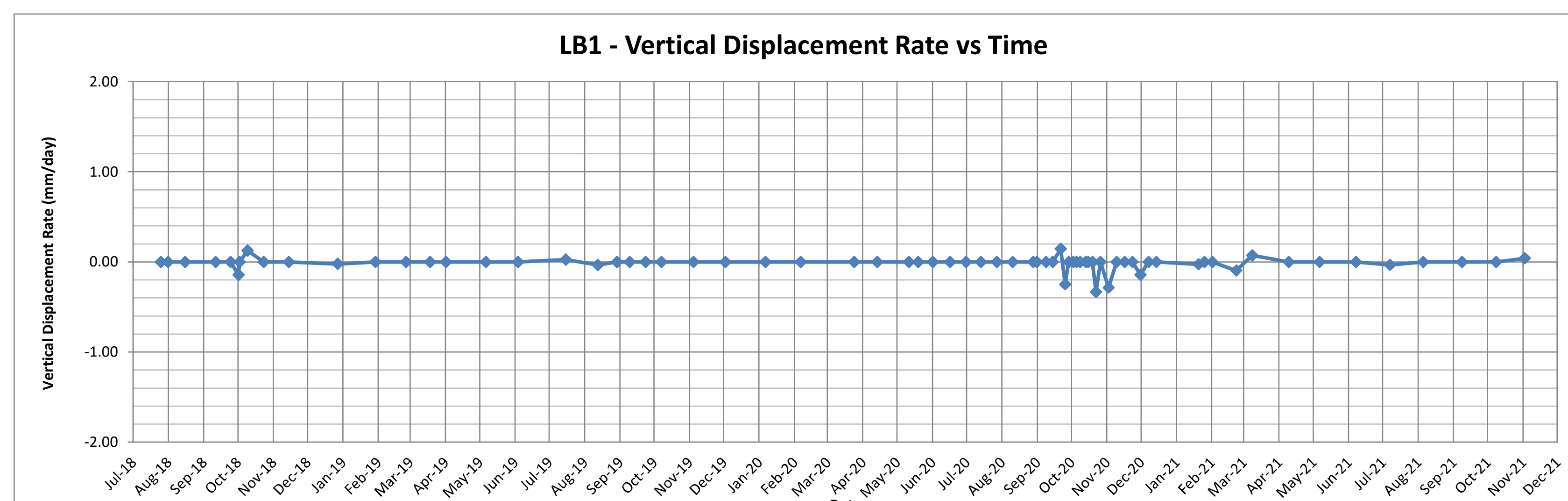
FIG No.

March 2, 2022
Z:\M\VCR\M02341C12-HVC 2021 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\2021 AFPR\220127 AFPR HH Pumphouse Retaining Wall Monitoring.xlsm]Data









NOTES:

1. ALL DATA PROVIDED BY THVCP.

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

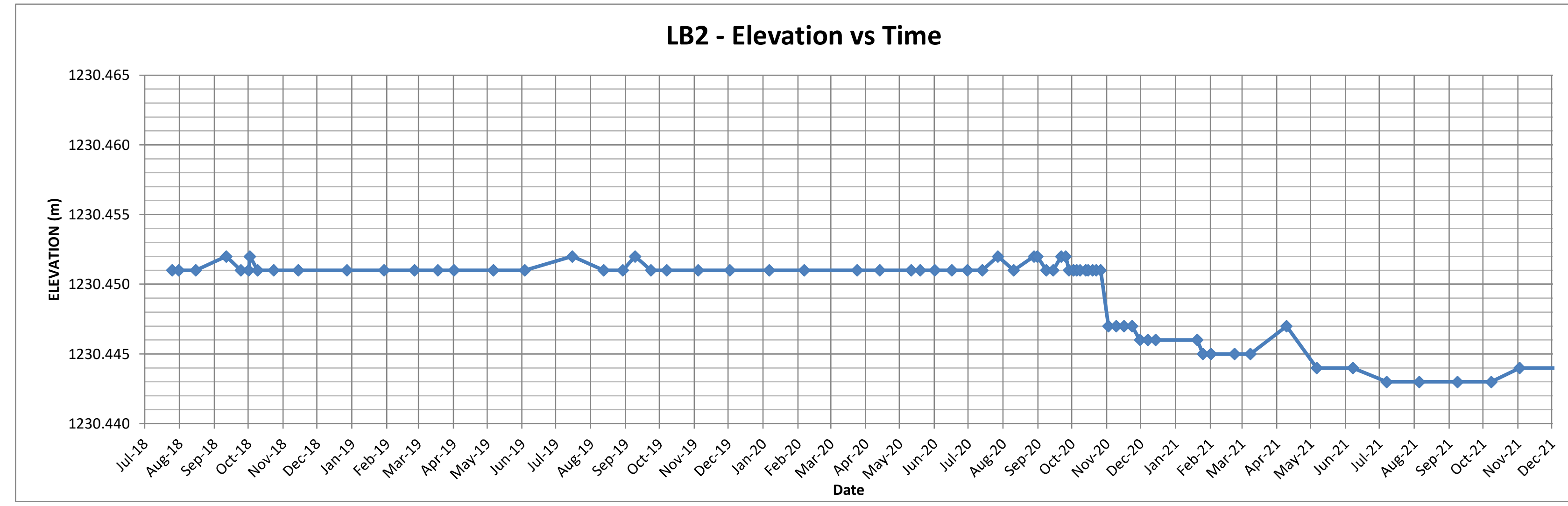
PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL PERFORMANCE REPORT

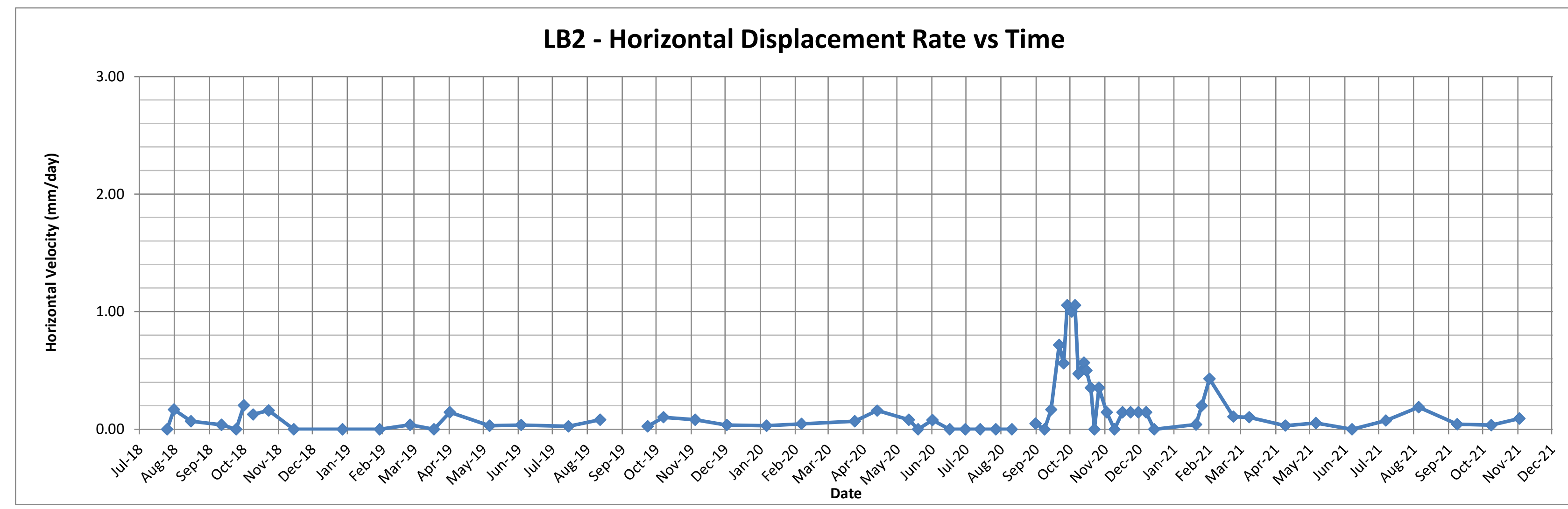
TITLE: H-H DAM LOCK-BLOCK RETAINING WALL
SURVEY MONUMENT READINGS
LB1

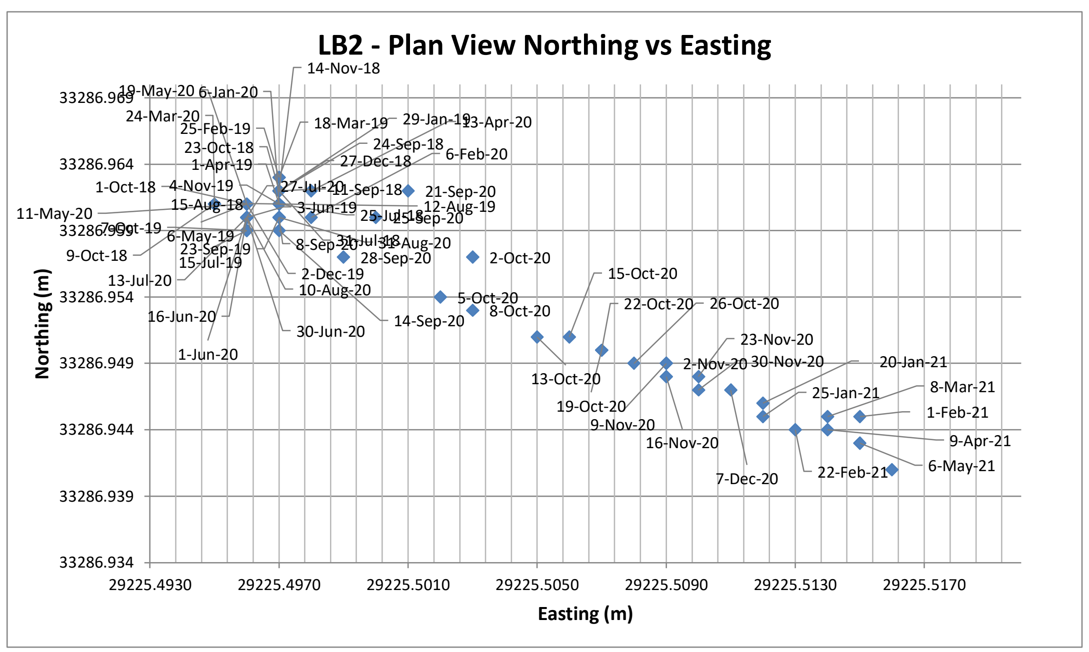
PROJECT No. M02341C12

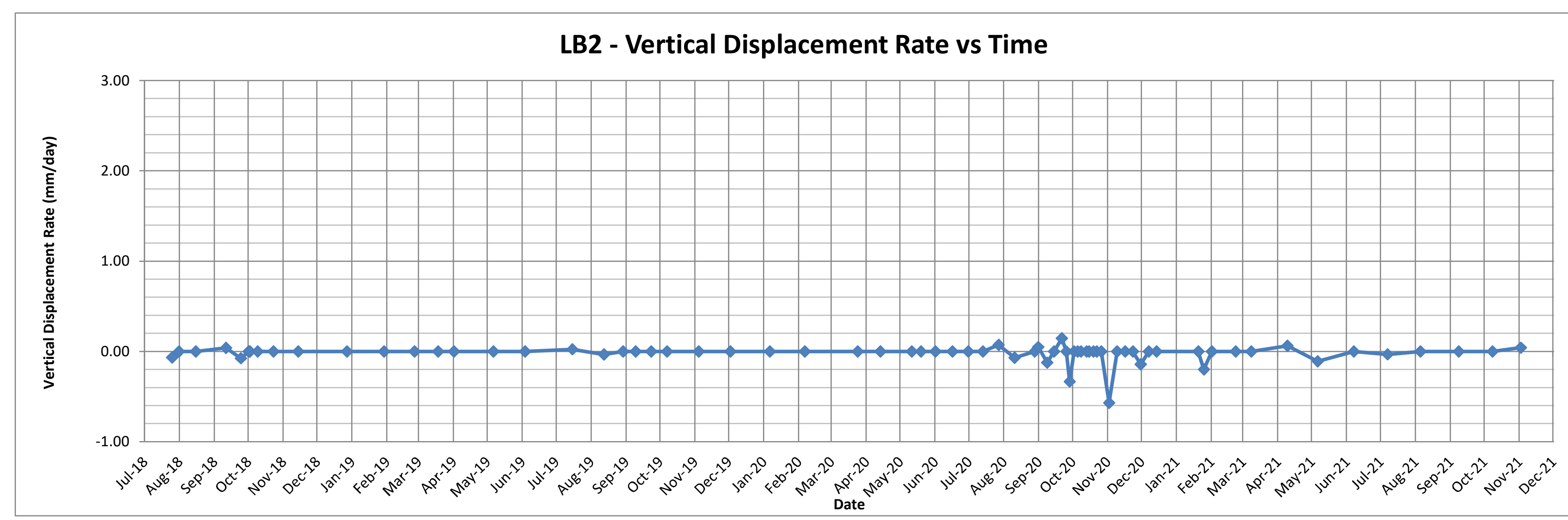
FIG No.

March 2, 2022
Z:\M\VCR\M02341C12-HVC 2021 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\2021 AFPR(220127 AFPR HH Pumphouse Retaining Wall Monitoring.xlsm)Data









NOTES:

1. ALL DATA PROVIDED BY THVCP.

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

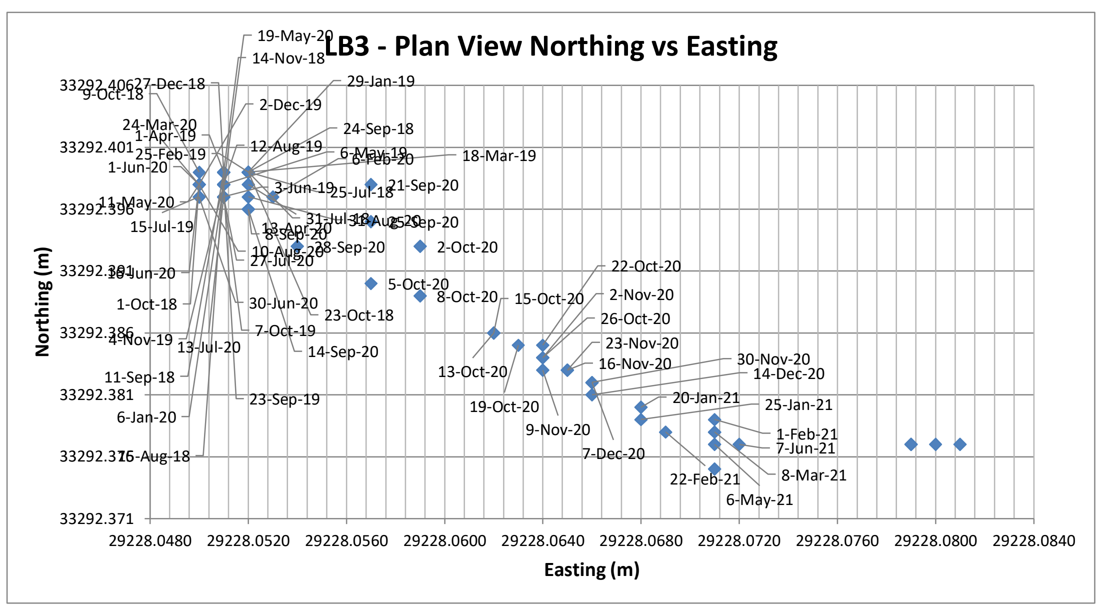
PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL PERFORMANCE REPORT

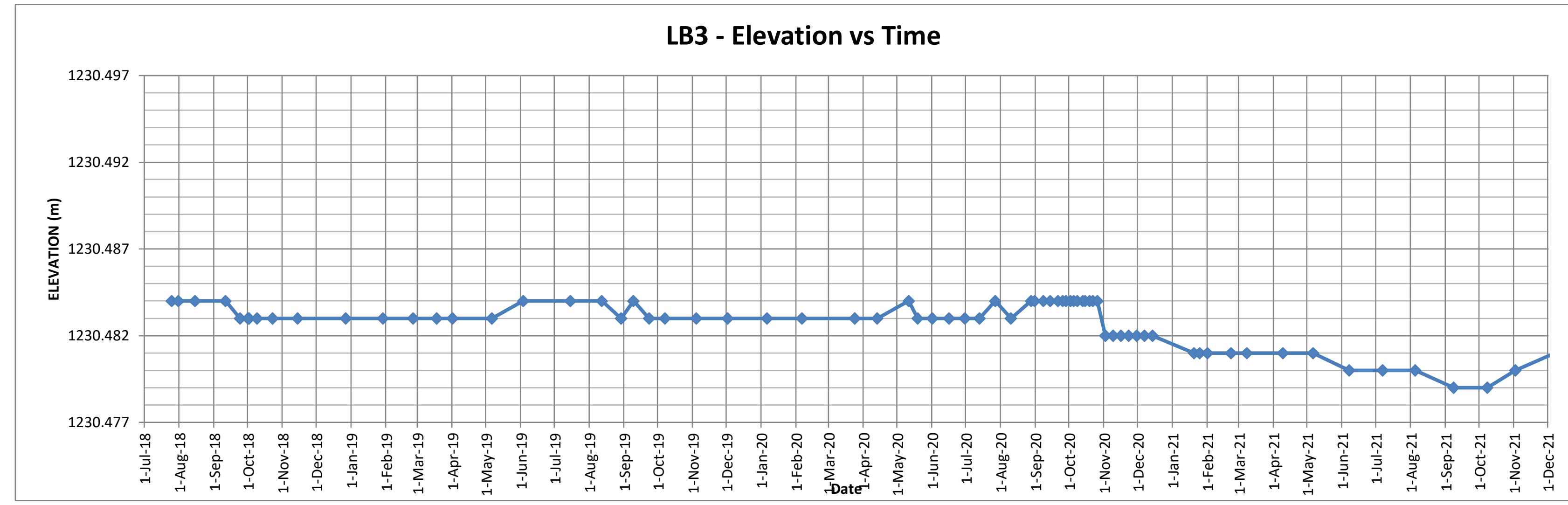
TITLE: H-H DAM LOCK-BLOCK RETAINING WALL
SURVEY MONUMENT READINGS
LB2

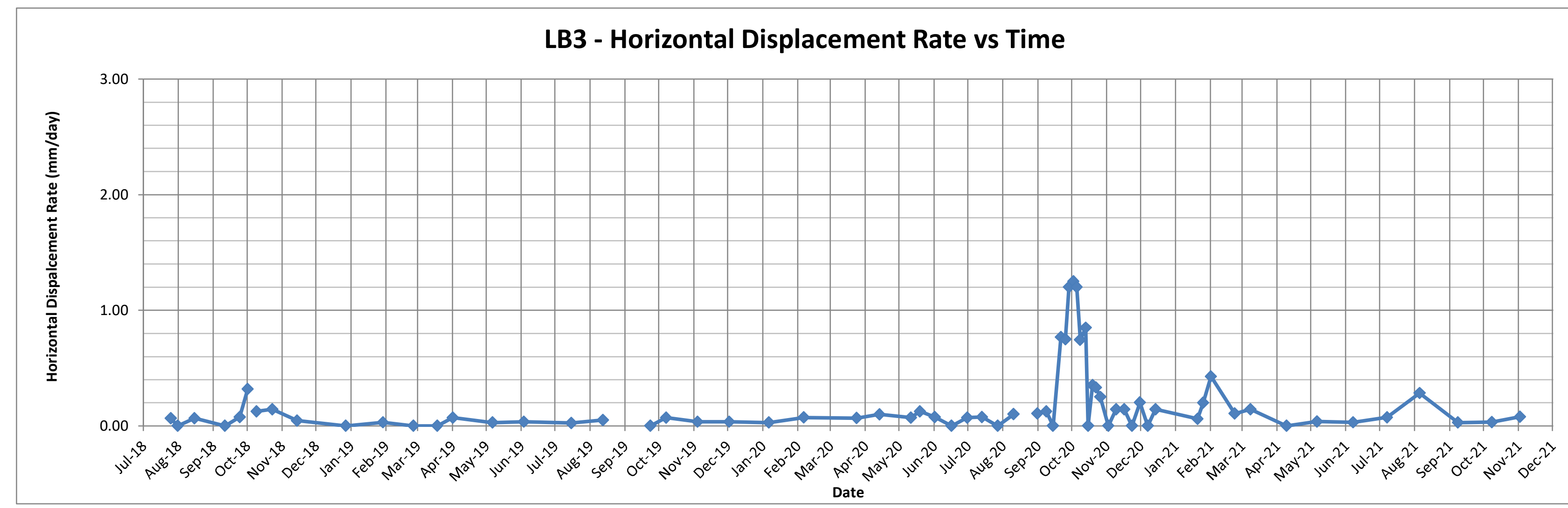
PROJECT No. M02341C12

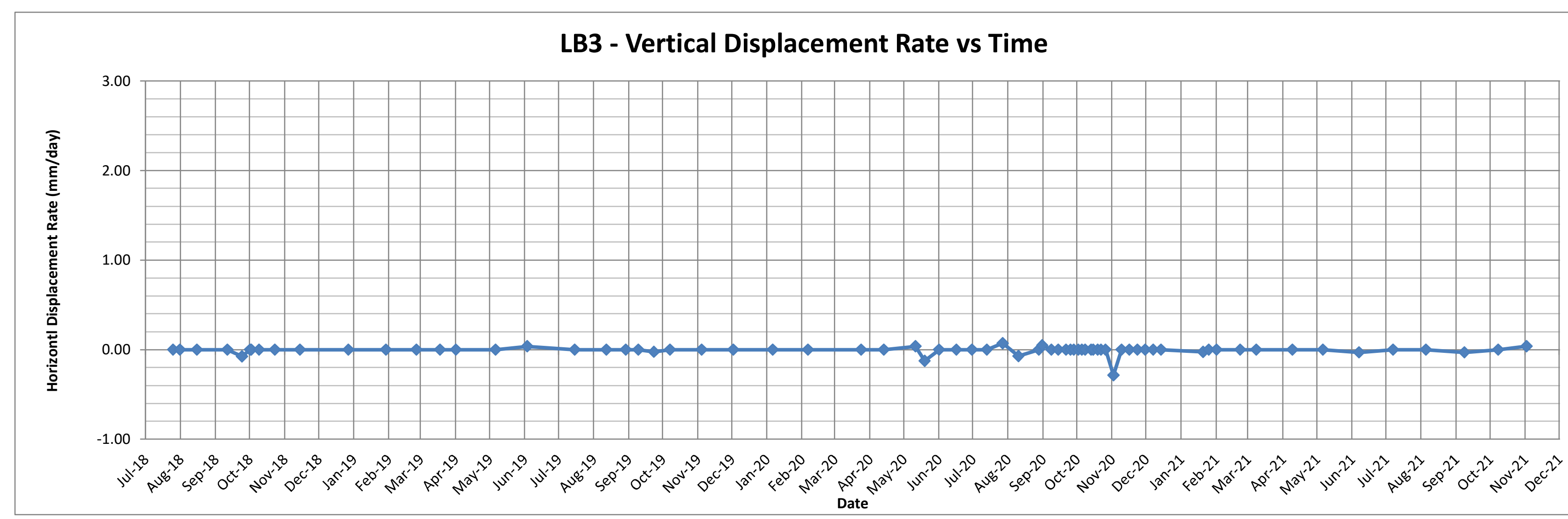
FIG No.

Z:\M\VCR\M02341C12-HVC 2021 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\2021 AFPR\[220127 AFPR HH Pumphouse Retaining Wall Monitoring.xlsm]Data
March 2, 2022









NOTES:

1. ALL DATA PROVIDED BY THVCP.

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

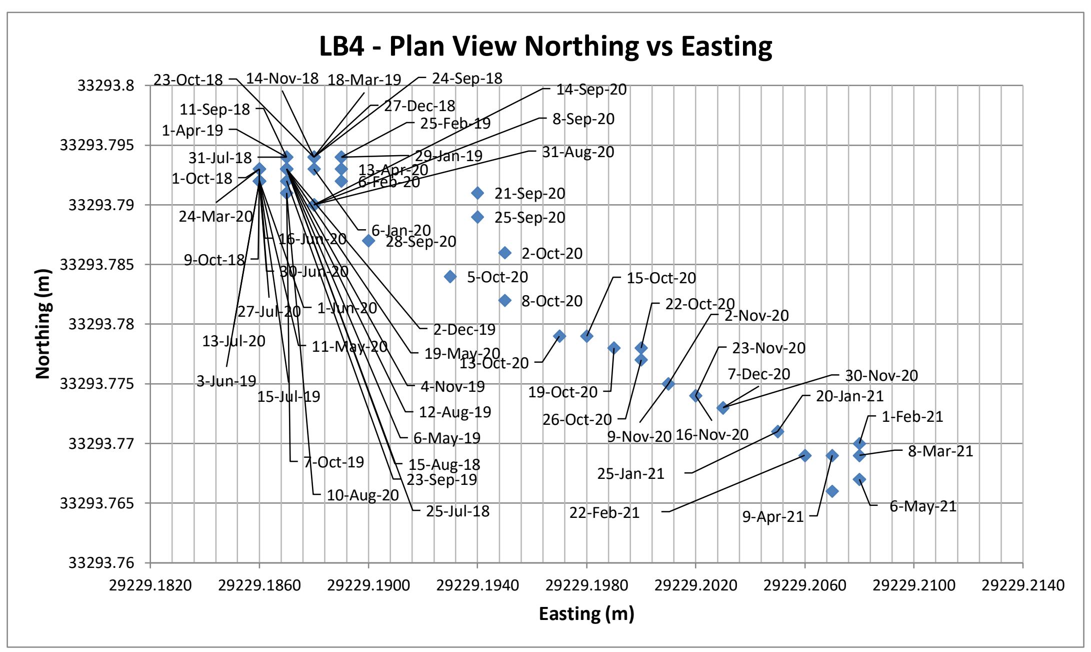
PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL PERFORMANCE REPORT

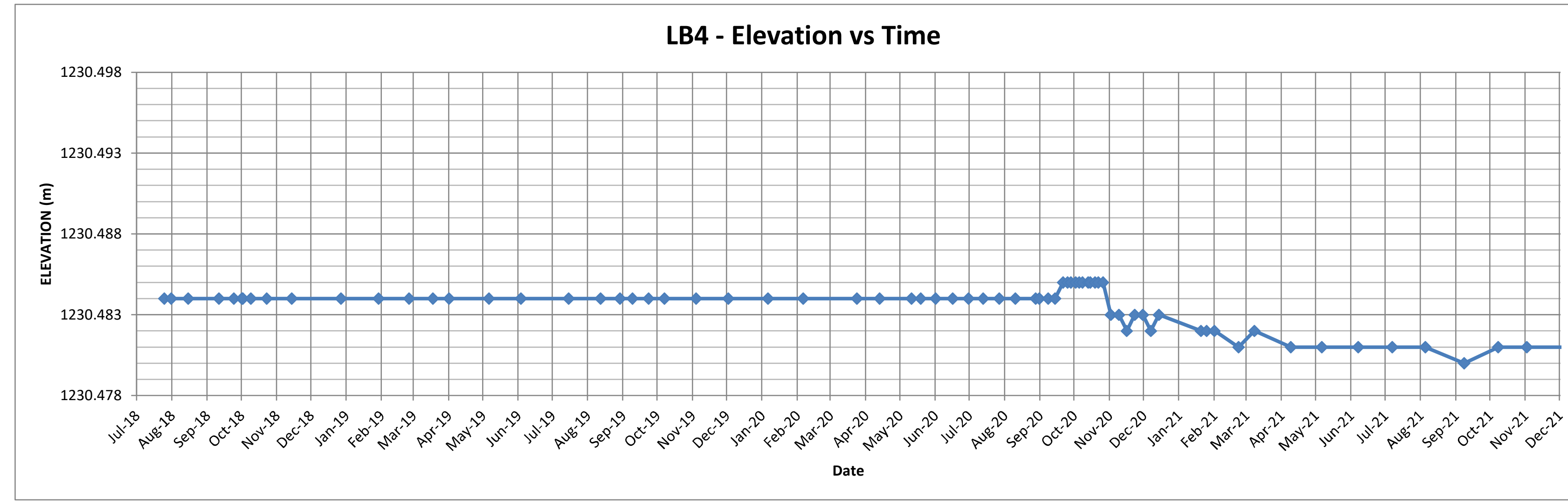
TITLE: H-H DAM LOCK-BLOCK RETAINING WALL
SURVEY MONUMENT READINGS
LB3

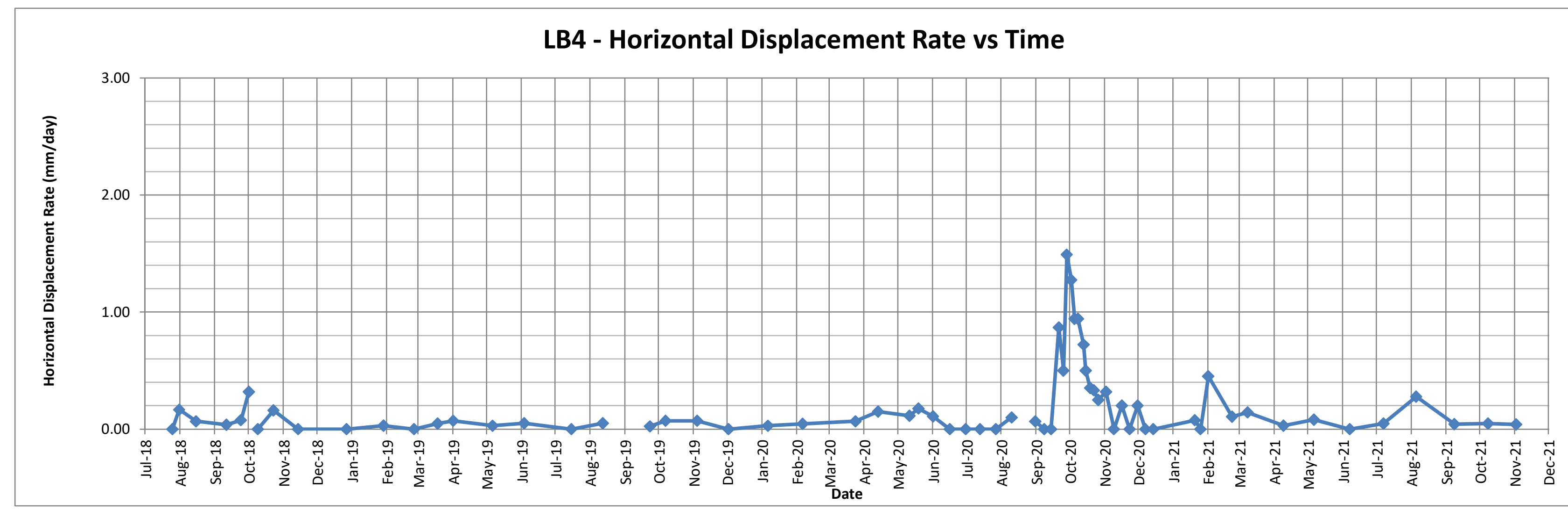
PROJECT No. M02341C12

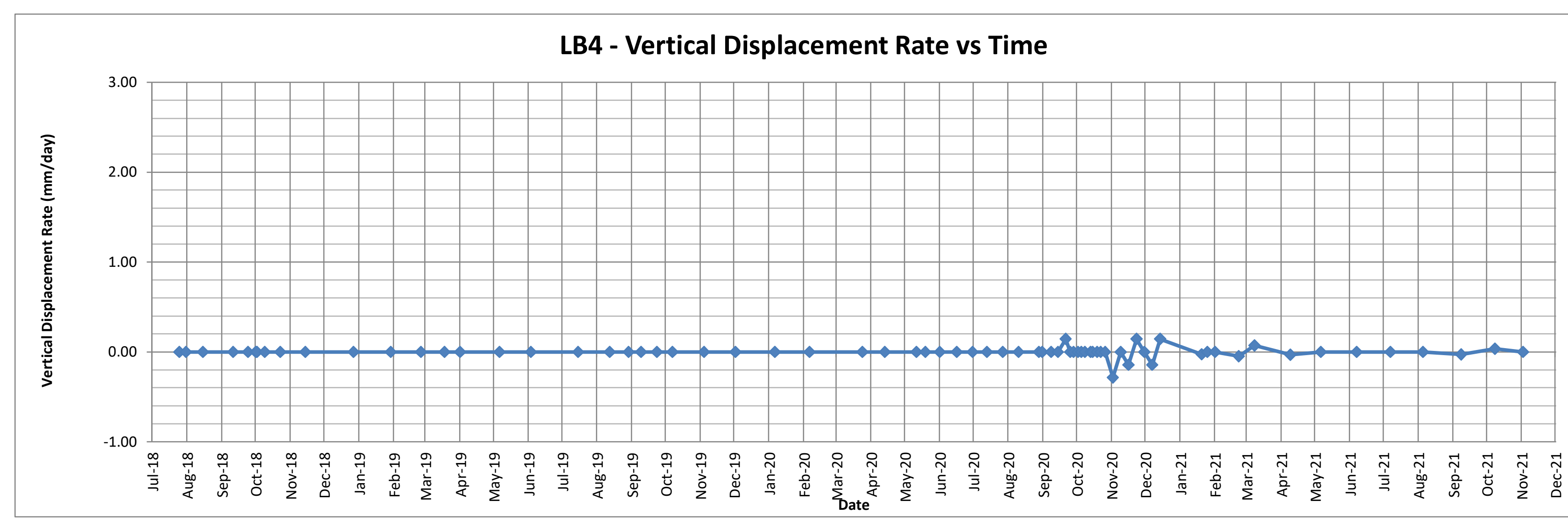
FIG No.

March 2, 2022
Z:\M\VCR\M02341C12-HVC 2021 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\2021 AFPR\[220127 AFPR HH Pumphouse Retaining Wall Monitoring.xlsm]Data









NOTES:

1. ALL DATA PROVIDED BY THVCP.

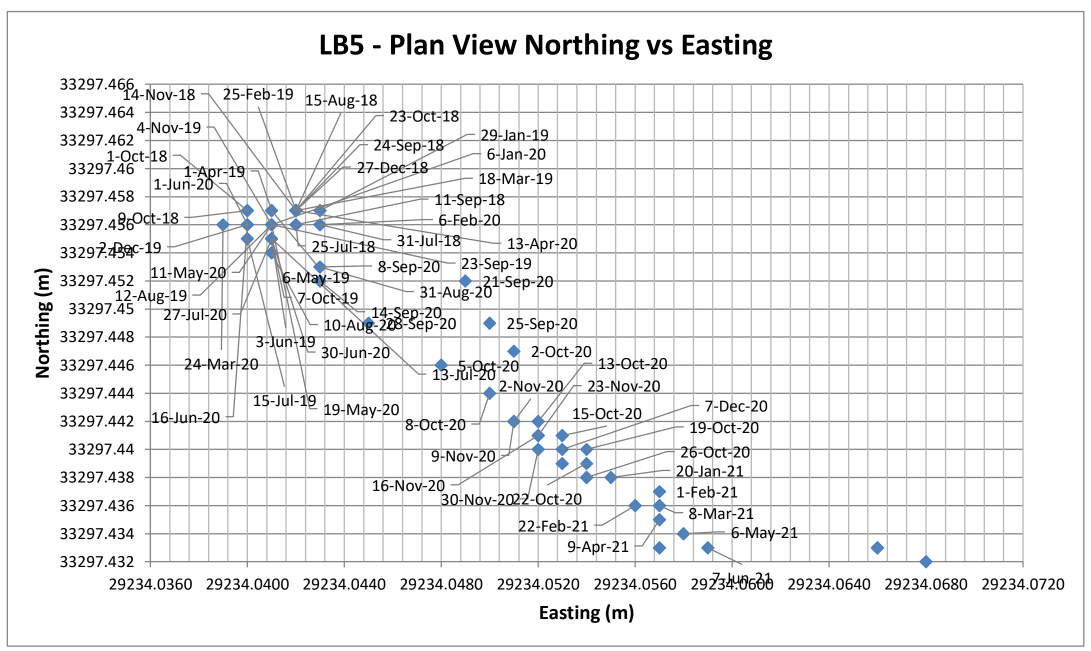
CLIENT
Highland Valley Copper
Teck
Klohn Crippen Berger

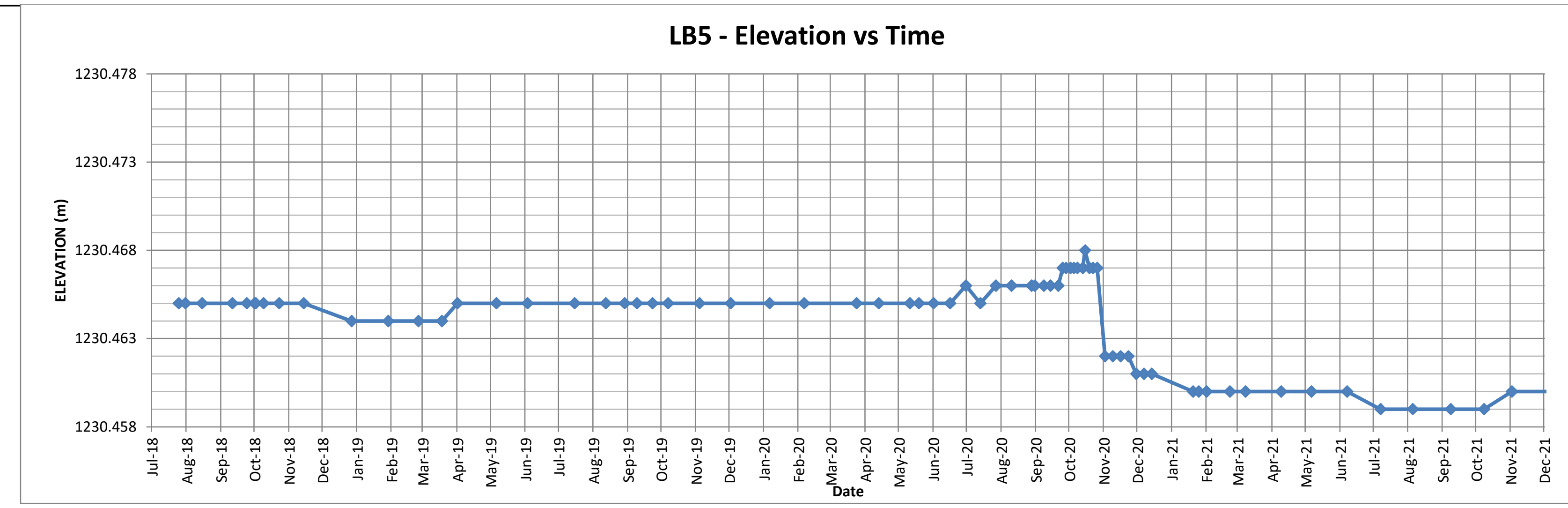
PROJECT
HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL PERFORMANCE REPORT

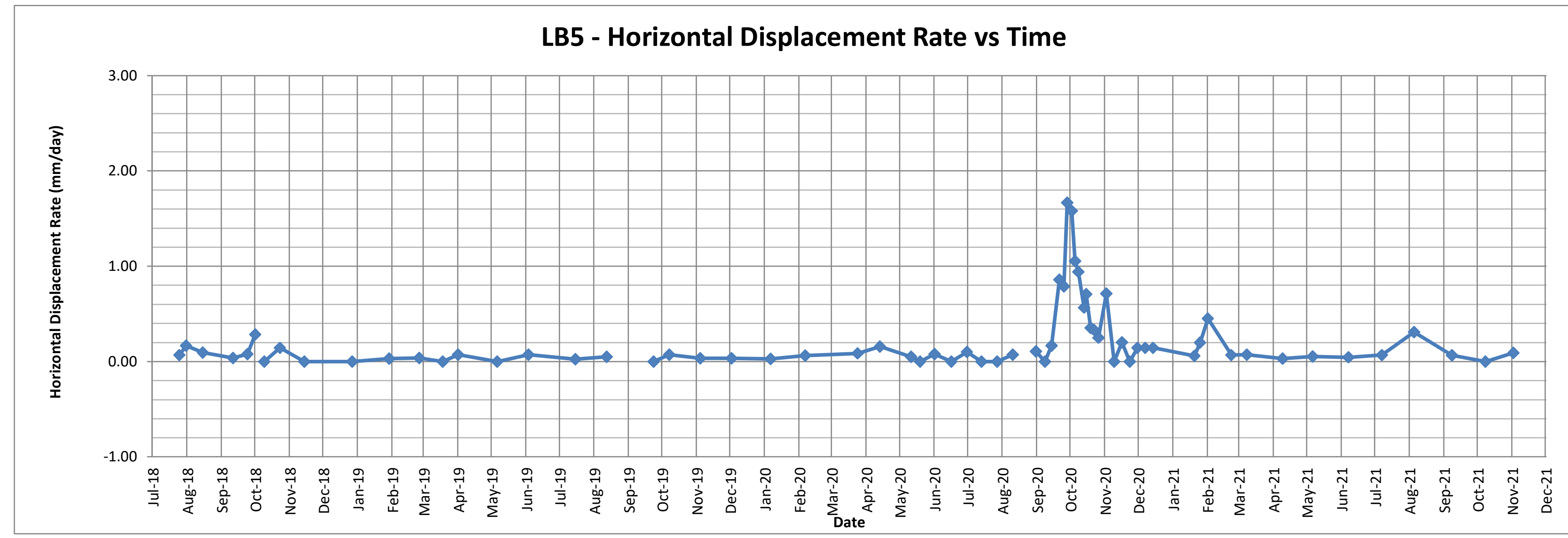
TITLE
H-H DAM LOCK-BLOCK RETAINING WALL
SURVEY MONUMENT READINGS
LB4

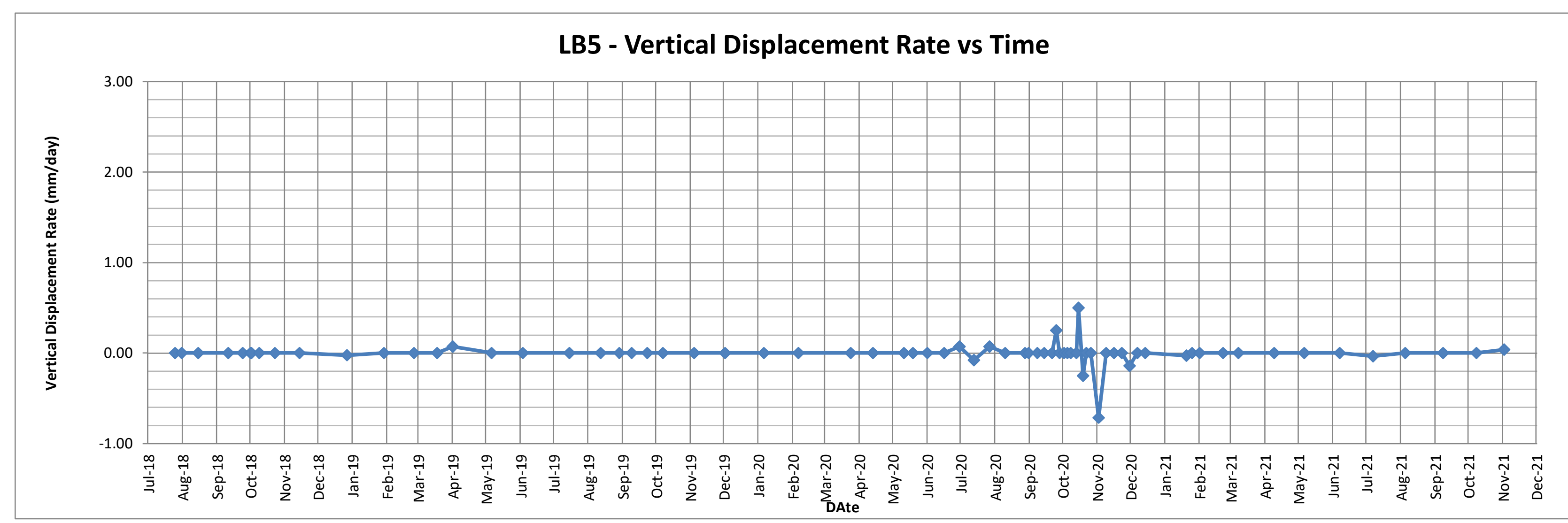
PROJECT No. M02341C12
FIG No.

March 2, 2022
Z:\M\VCR\M02341C12-HVC 2021 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\2021 AFPR\[220127 AFPR HH Pumphouse Retaining Wall Monitoring.xlsm]Data









NOTES:

1. ALL DATA PROVIDED BY THVCP.

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

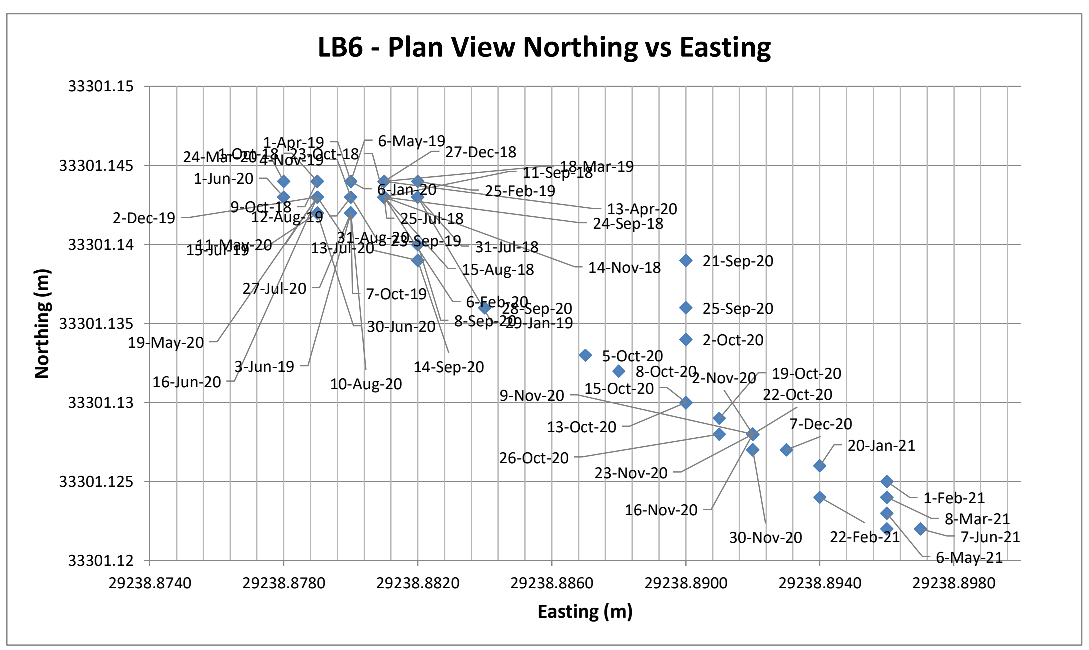
PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL PERFORMANCE REPORT

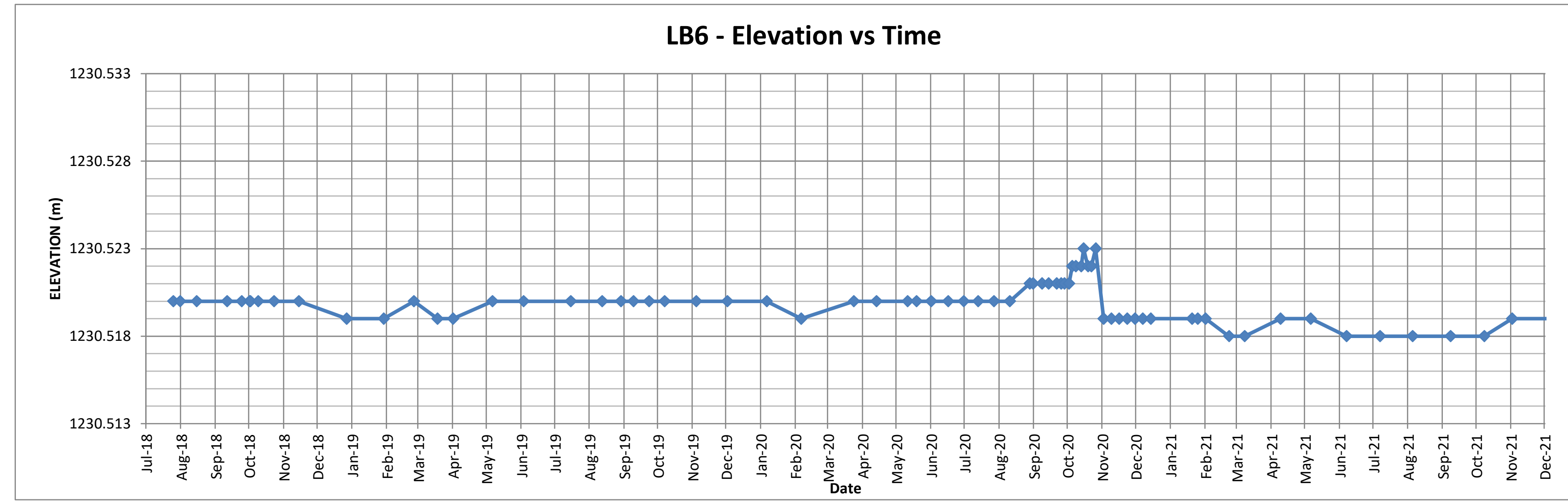
TITLE: H-H DAM LOCK-BLOCK RETAINING WALL
SURVEY MONUMENT READINGS
LB5

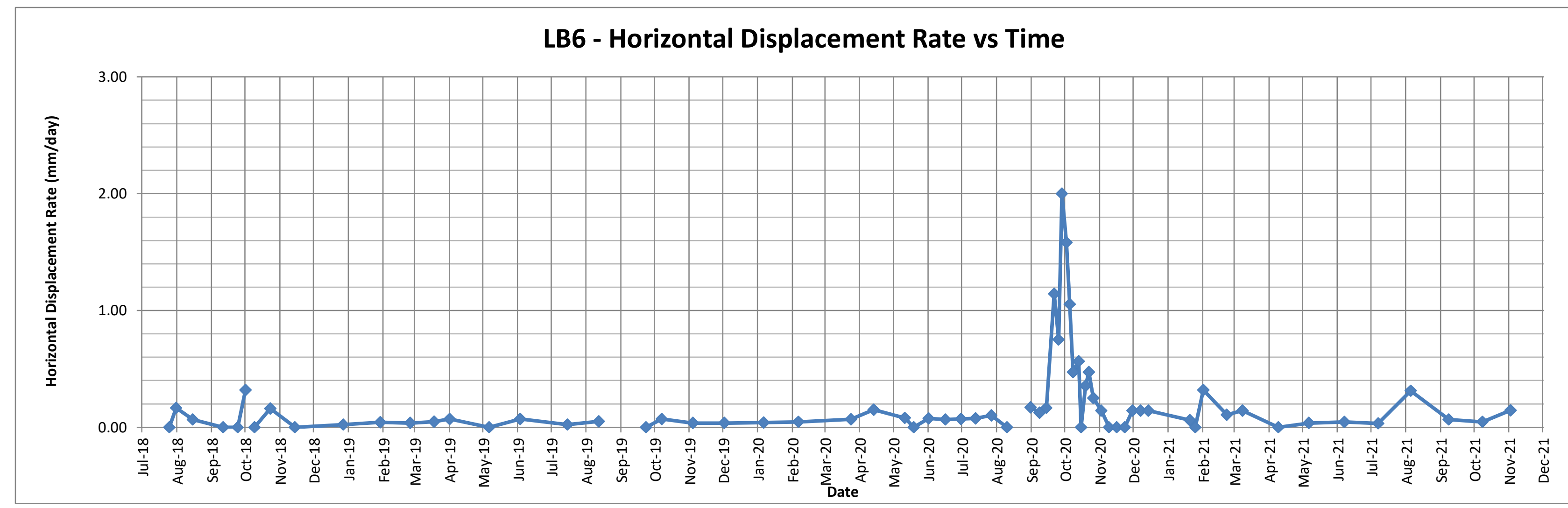
PROJECT No. M02341C12

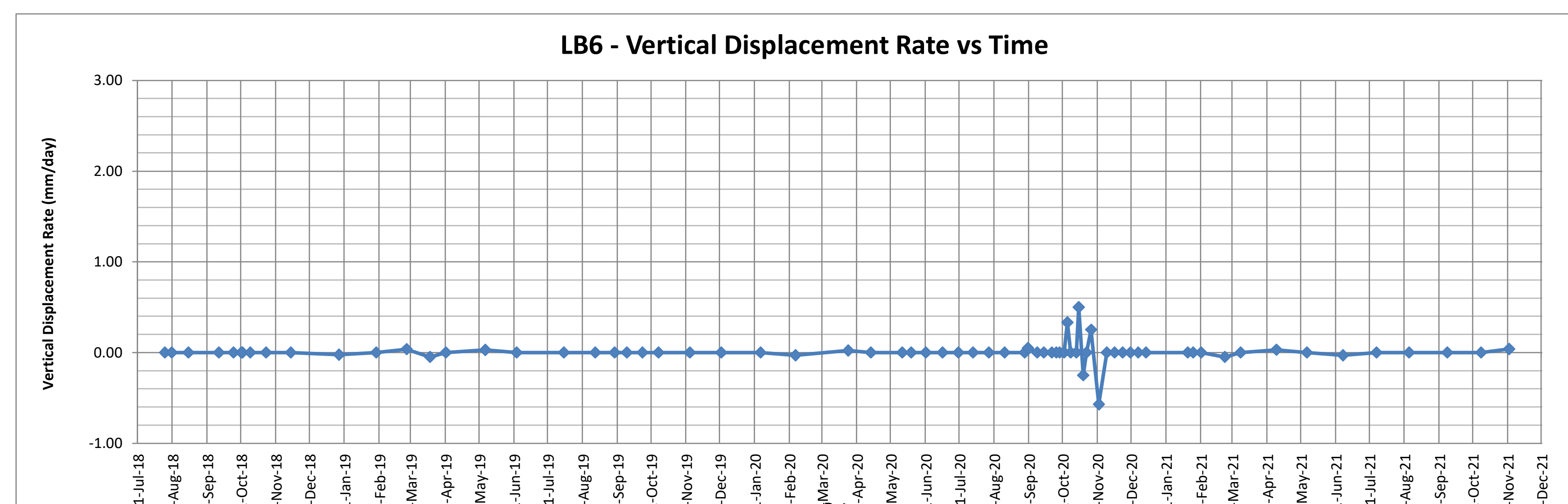
FIG No.

March 2, 2022
Z:\M\VCR\M02341C12-HVC 2021 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\2021 AFPR\[220127 AFPR HH Pumphouse Retaining Wall Monitoring.xlsm]Data









NOTES:

1. ALL DATA PROVIDED BY THVCP.

March 2, 2022
Z:\M\VCR\M02341C12-HVC 2021 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\2021 AFPR\[220127 AFPR HH Pumphouse Retaining Wall Monitoring.xlsm]Data

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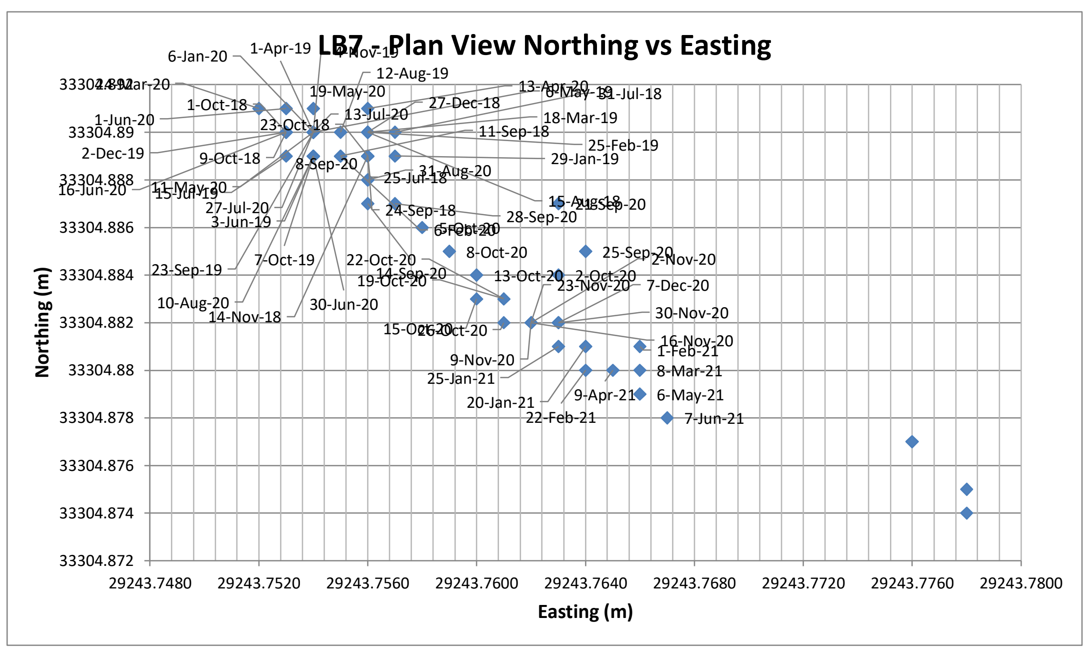
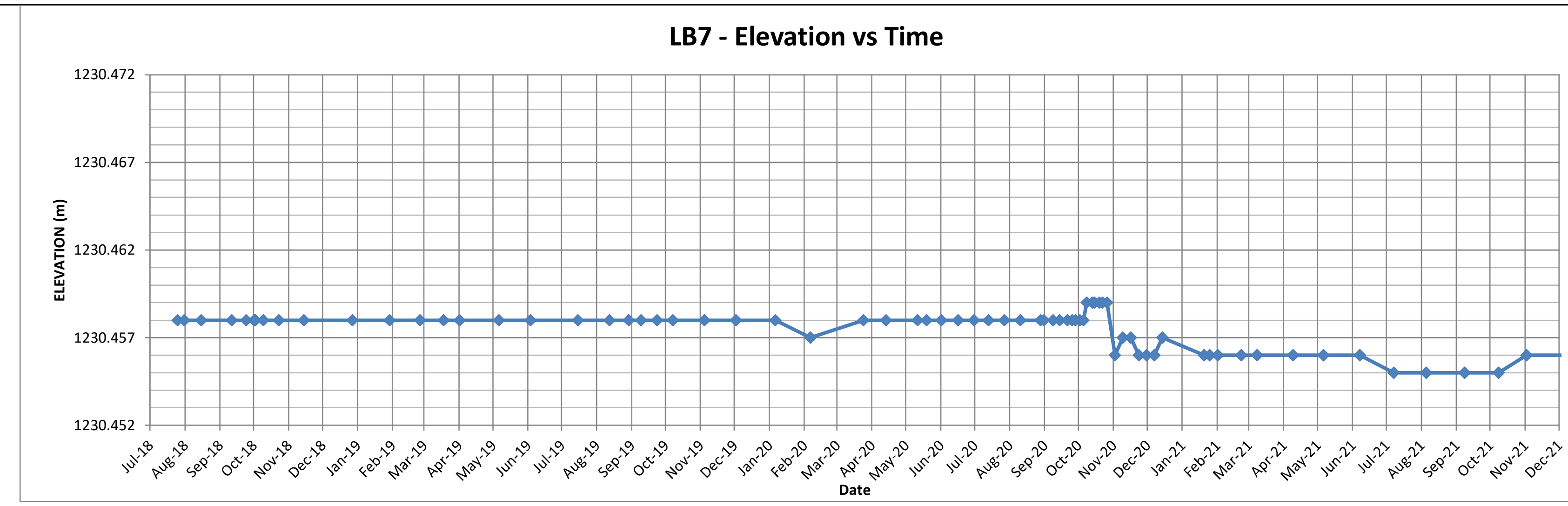
2021 ANNUAL PERFORMANCE REPORT

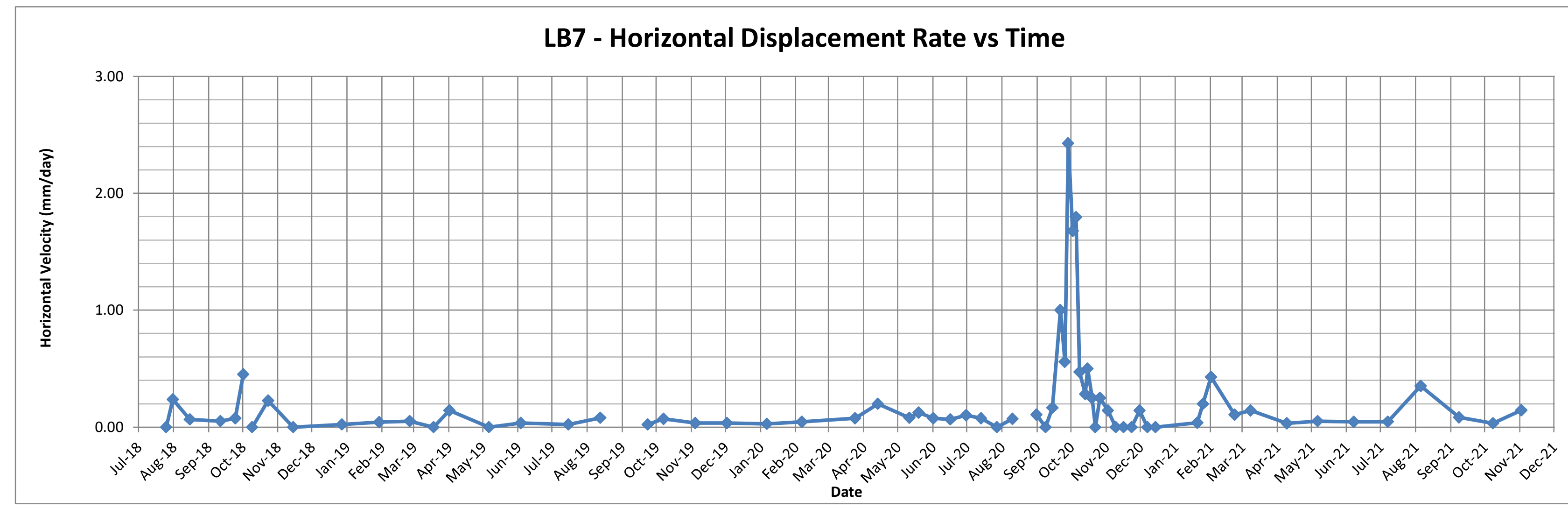
TITLE: H-H DAM LOCK-BLOCK RETAINING WALL
SURVEY MONUMENT READINGS
LB6

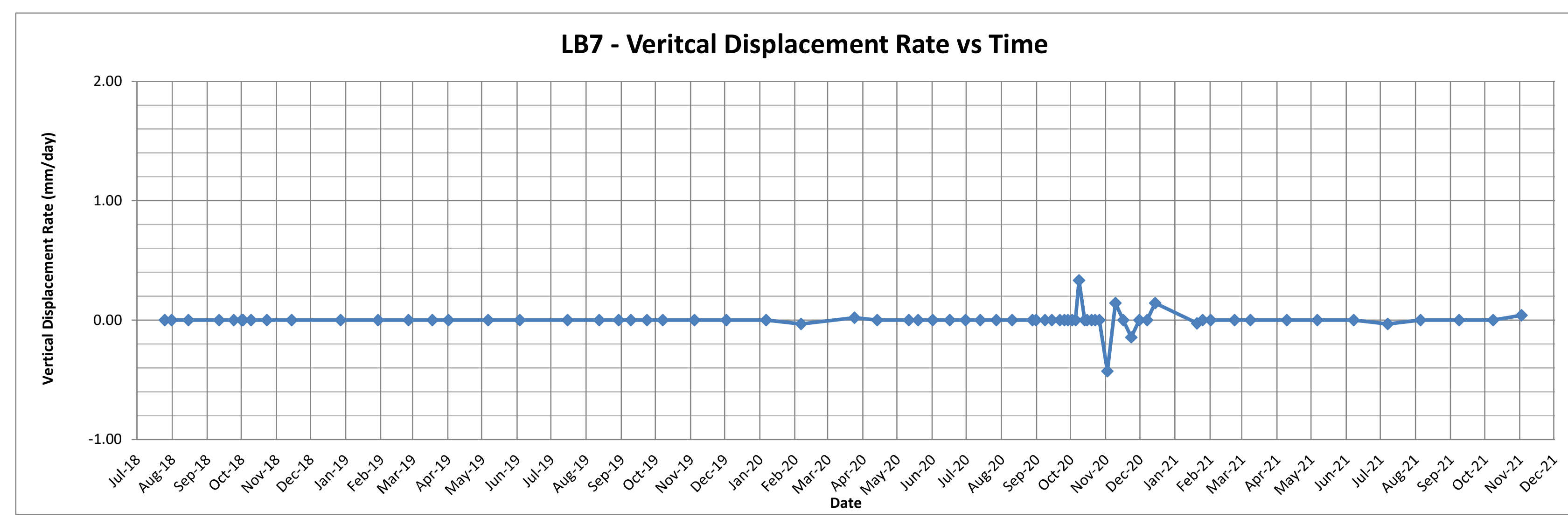
PROJECT No. M02341C12

FIG No.









NOTES:

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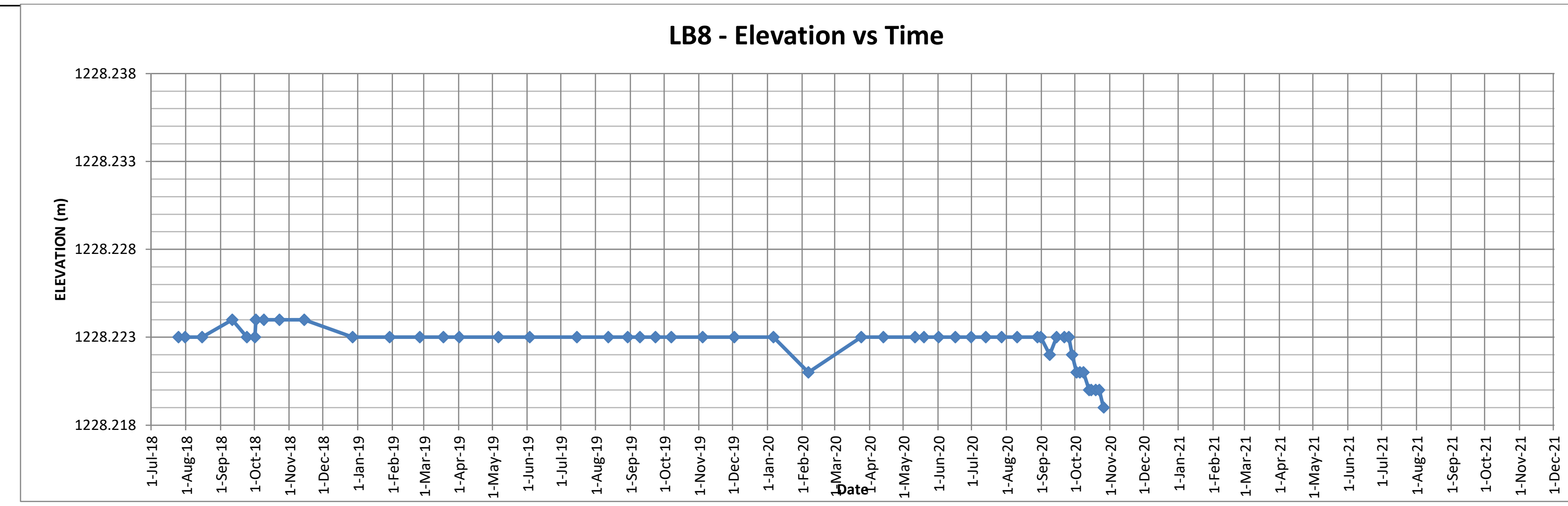
PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL PERFORMANCE REPORT

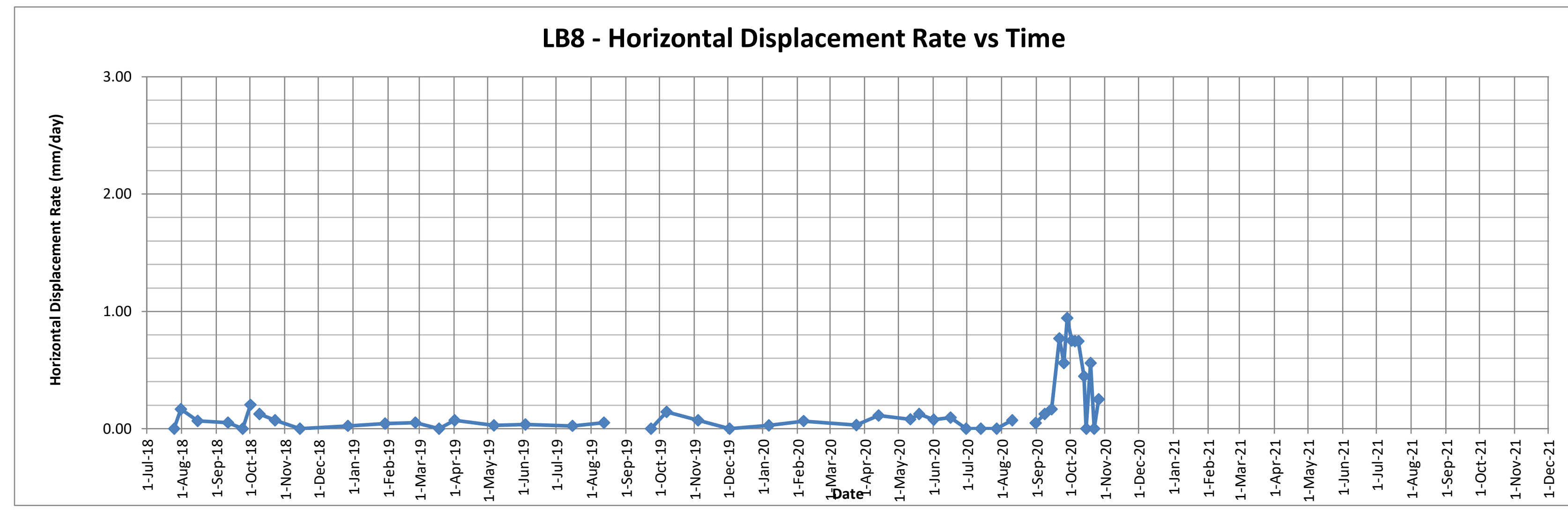
TITLE: H-H DAM LOCK-BLOCK RETAINING WALL
SURVEY MONUMENT READINGS
LB7

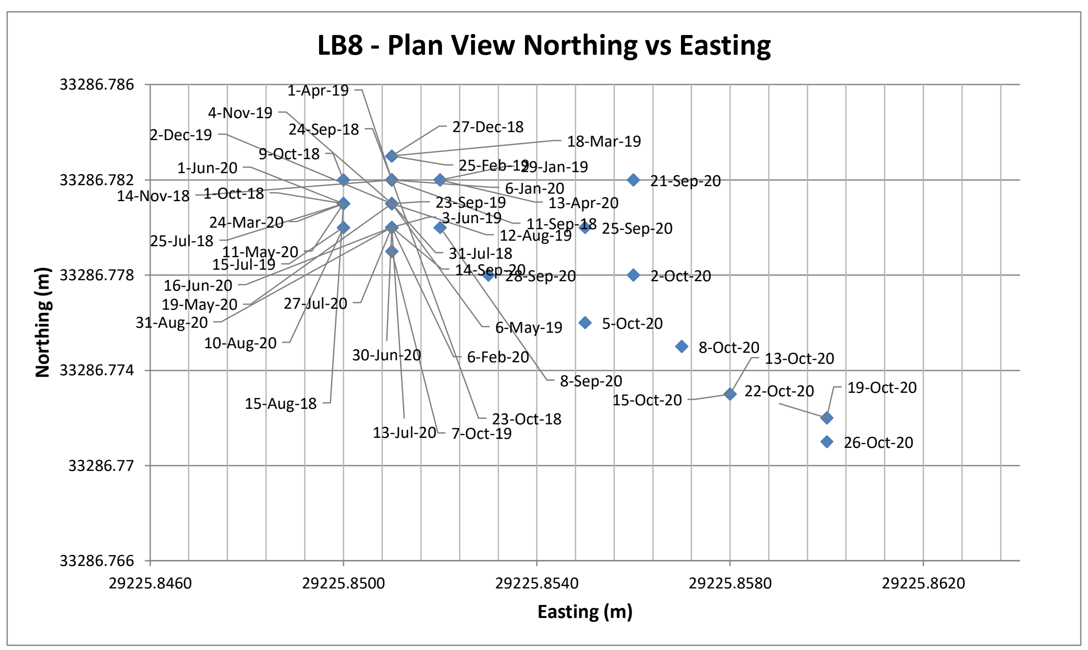
PROJECT No. M02341C12

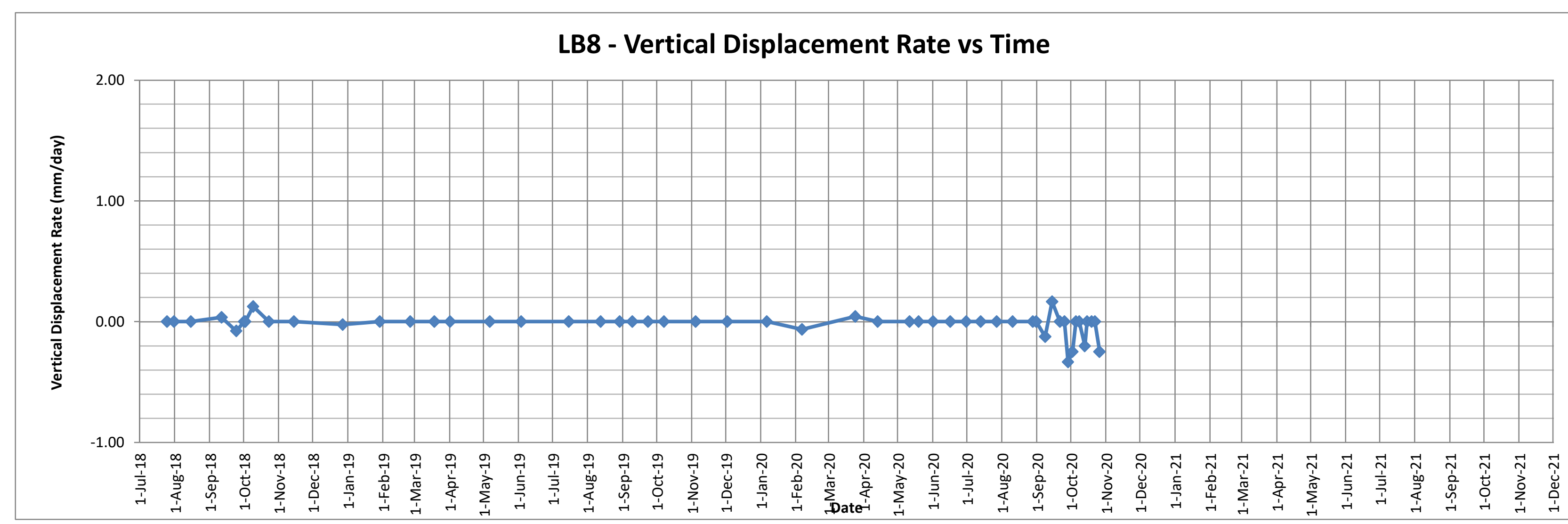
FIG No.

March 2, 2022
Z:\M\VCR\M02341C12-HVC 2021 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\2021 AFPR\220127 AFPR HH Pumphouse Retaining Wall Monitoring.xlsm]Data









NOTES:

1. ALL DATA PROVIDED BY THVCP.
2. LB08 BURIED BY BUTTRESSING AT THE BOTTOM OF LOCK BLOCK WALL.

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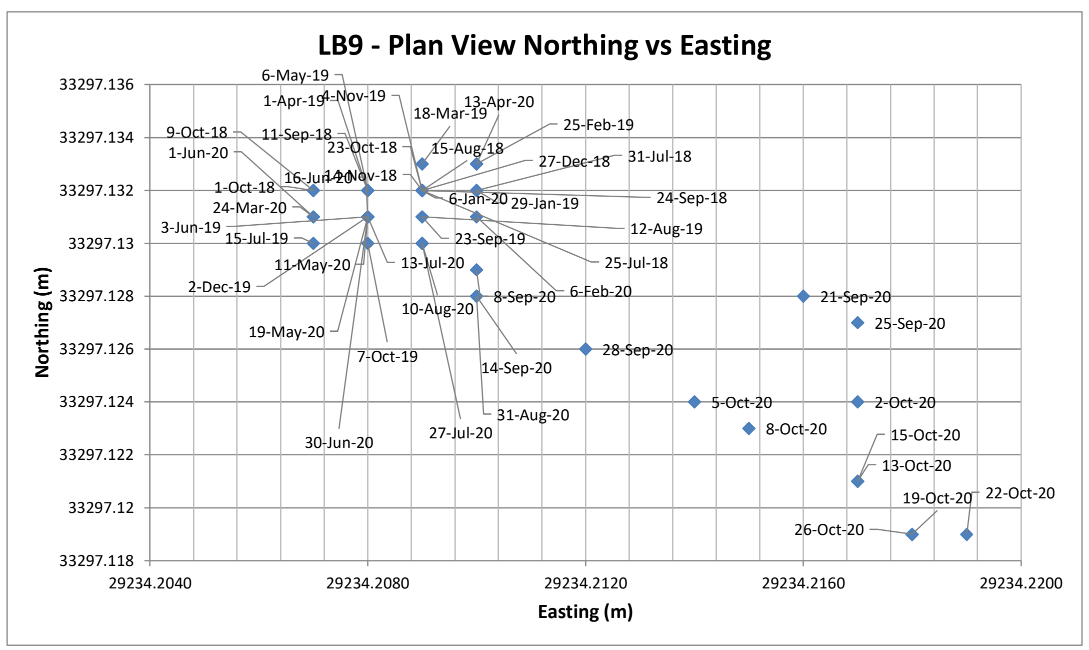
2021 ANNUAL PERFORMANCE REPORT

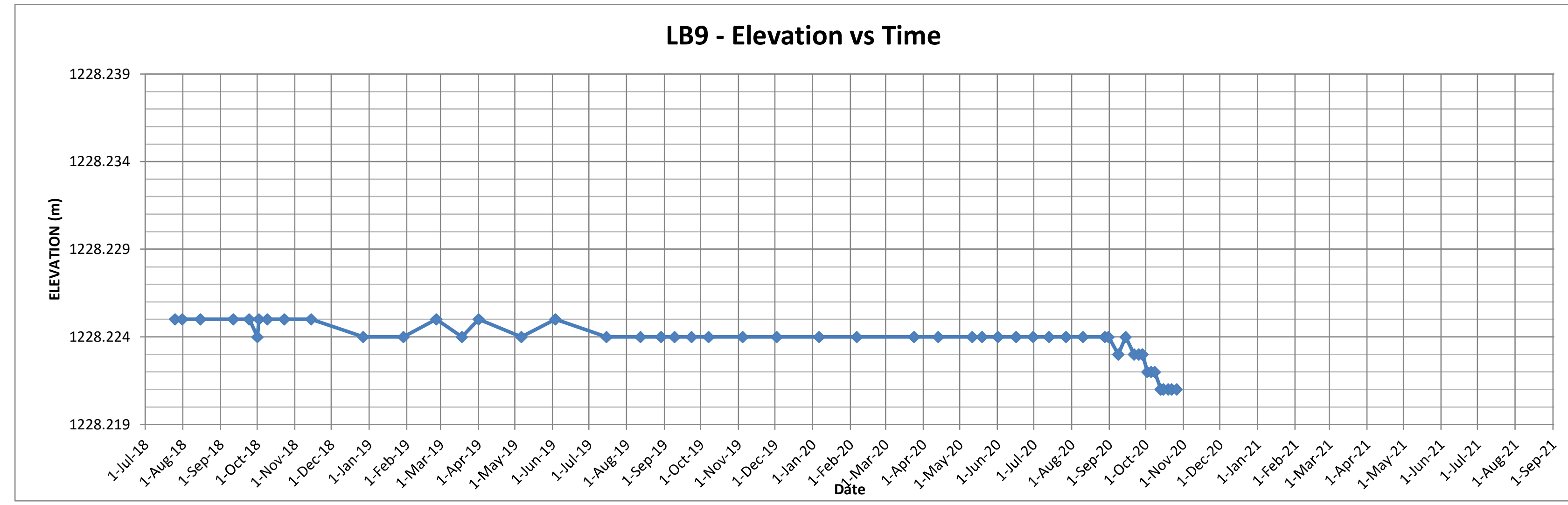
TITLE: H-H DAM LOCK-BLOCK RETAINING WALL
SURVEY MONUMENT READINGS
LB8

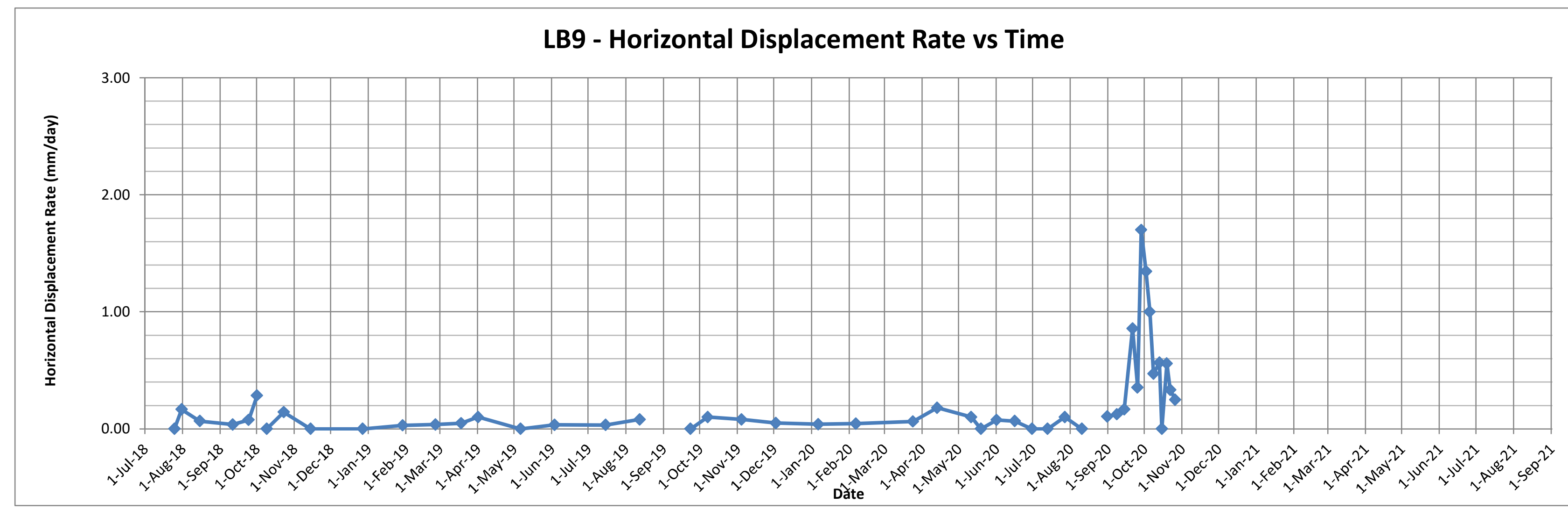
PROJECT No. M02341C12

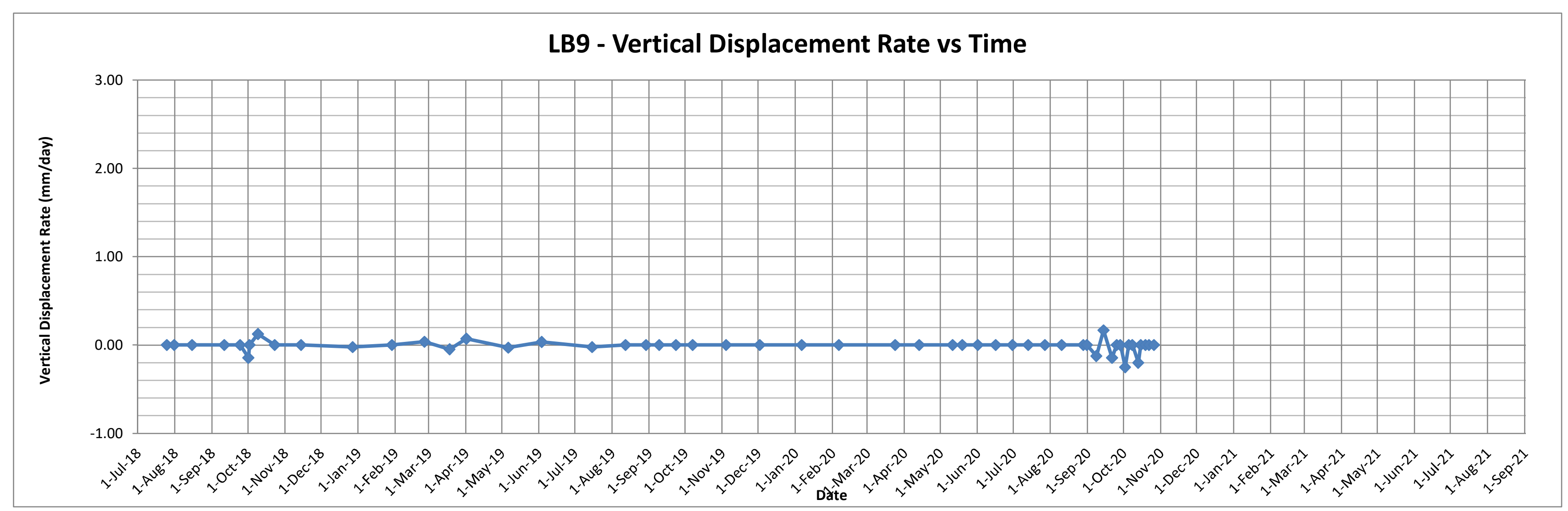
FIG No.

March 2, 2022
Z:\M\VCR\M02341C12-HVC 2021 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\2021 AFPR\220127 AFPR HH Pumphouse Retaining Wall Monitoring.xlsm]Data









NOTES:

1. ALL DATA PROVIDED BY THVCP.
2. LB09 BURIED BY BUTTRESSING AT THE BOTTOM OF LOCK BLOCK WALL.

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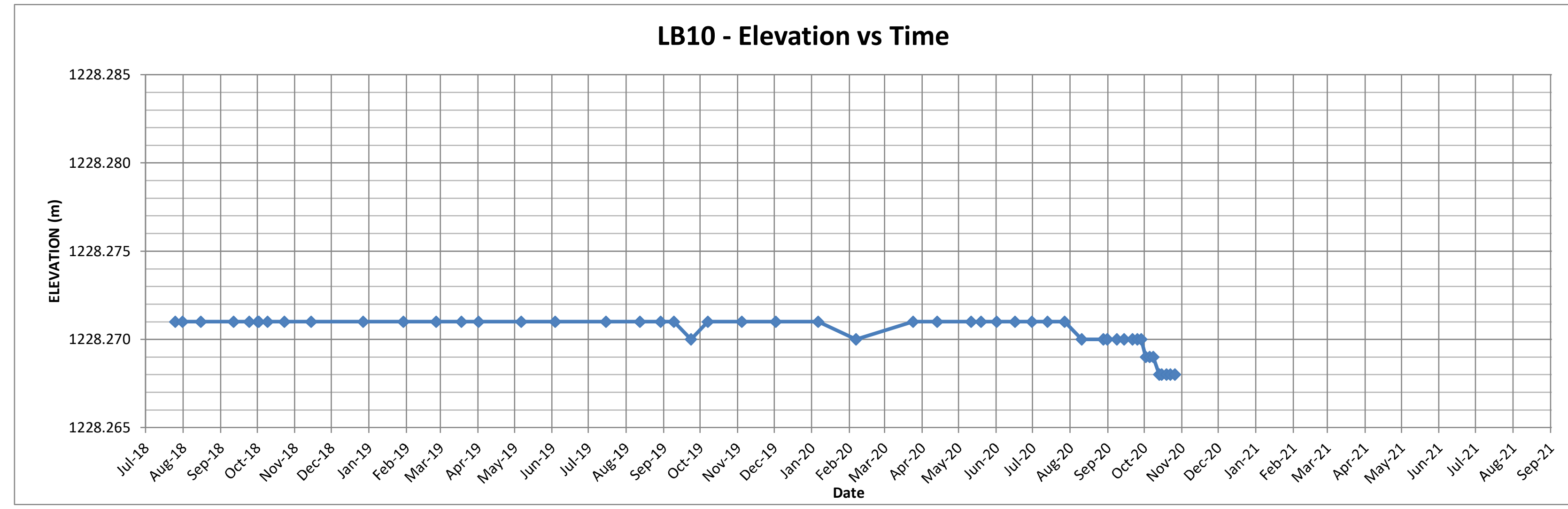
2021 ANNUAL PERFORMANCE REPORT

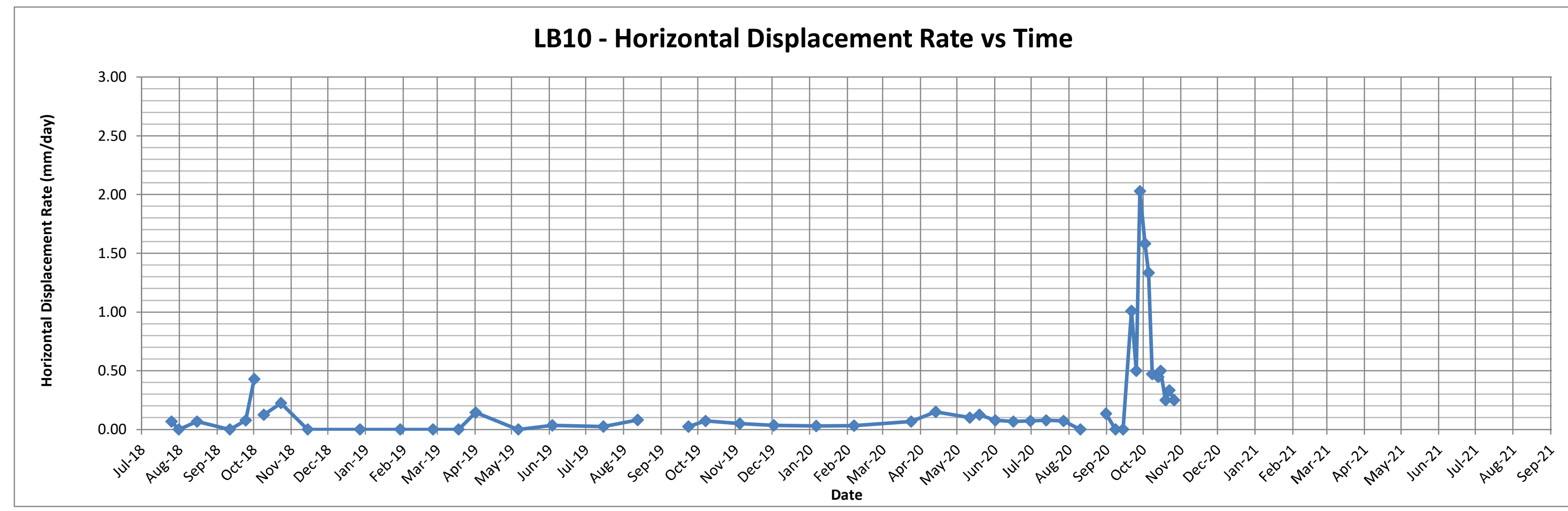
TITLE: H-H DAM LOCK-BLOCK RETAINING WALL
SURVEY MONUMENT READINGS
LB9

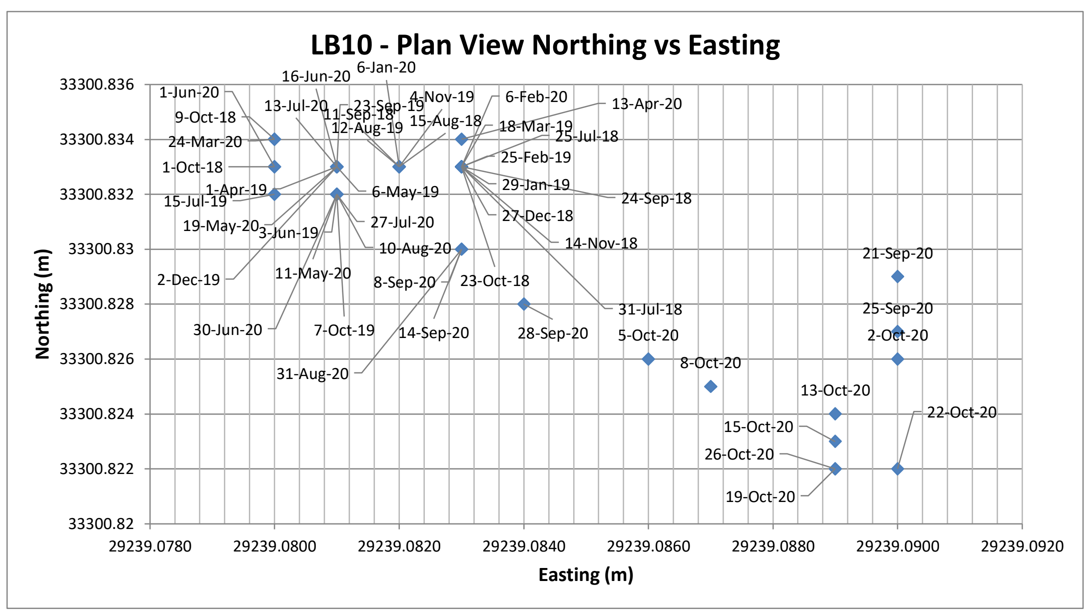
PROJECT No. M02341C12

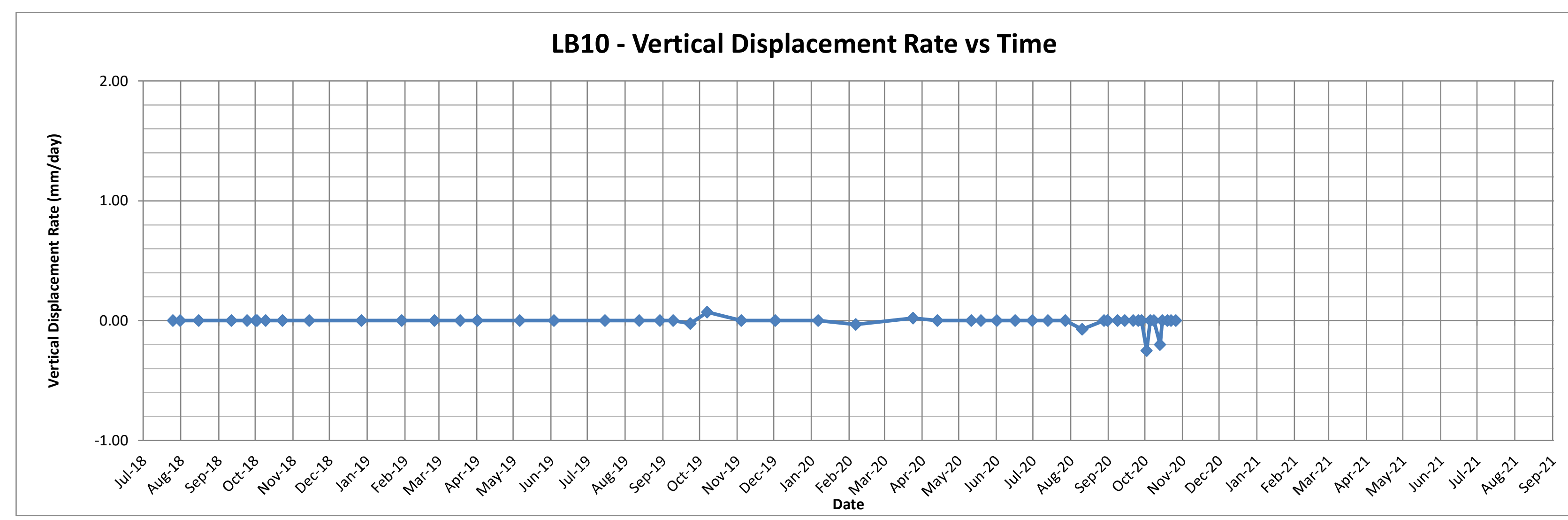
FIG No.

March 2, 2022
Z:\M\VCR\M02341C12-HVC 2021 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\2021 AFPR\[220127 AFPR HH Pumphouse Retaining Wall Monitoring.xlsm]Data









NOTES:

1. ALL DATA PROVIDED BY THVCP.
2. LB10 BURIED BY BUTTRESSING AT THE BOTTOM OF LOCK BLOCK WALL.

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PROJECT
HIGHLAND TAILINGS STORAGE FACILITY
2021 ANNUAL PERFORMANCE REPORT

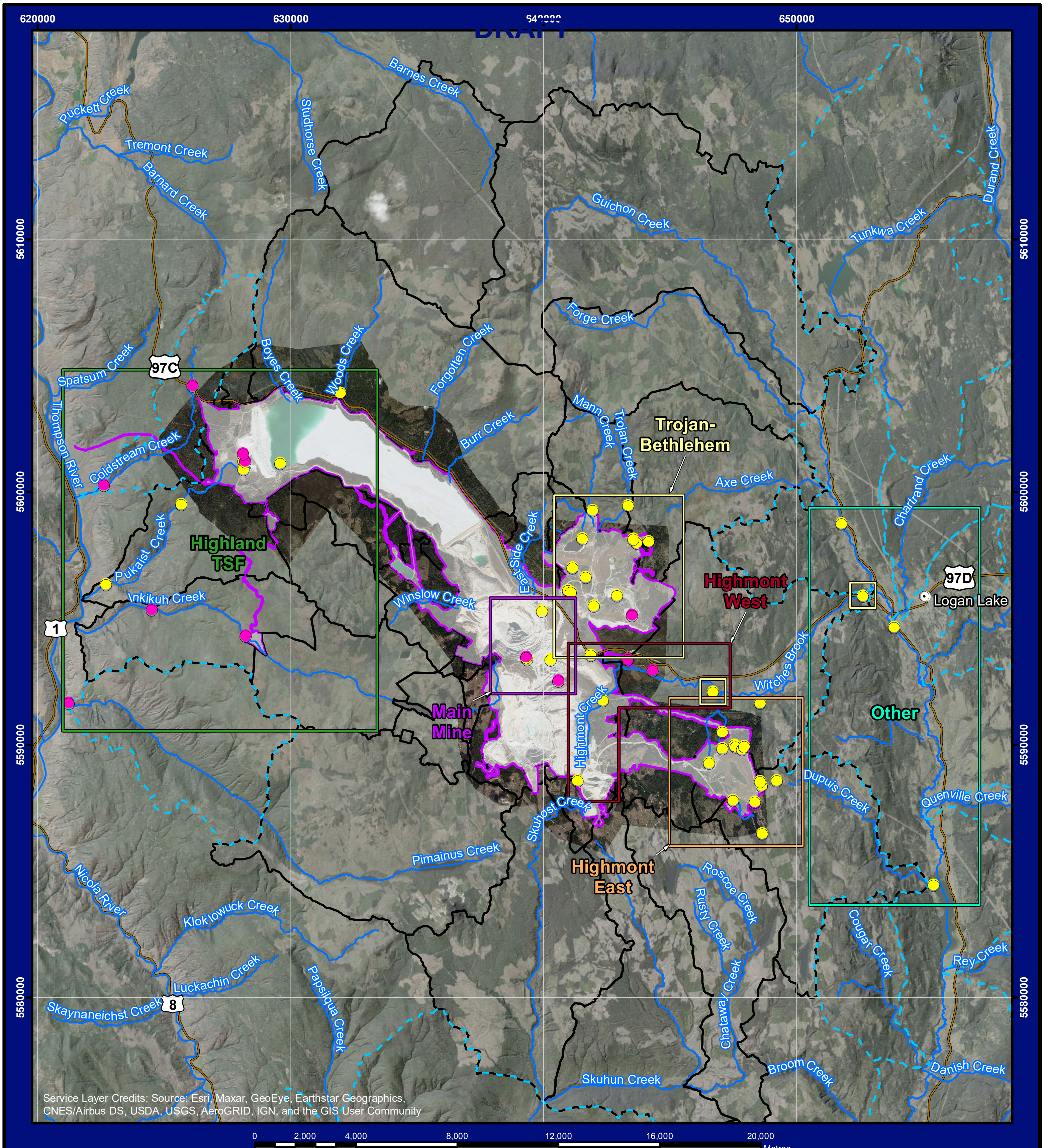
TITLE
H-H DAM LOCK-BLOCK RETAINING WALL
SURVEY MONUMENT READINGS
LB10

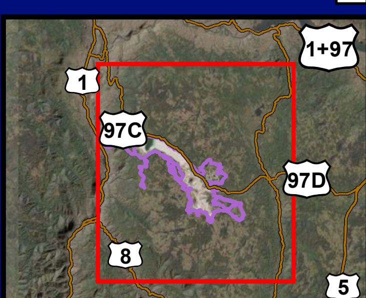
PROJECT No. M02341C12
FIG No.

March 2, 2022
Z:\M\VCR\M02341C12-HVC 2021 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\H-H Dam\2021 AFPR\220127 AFPR HH Pumphouse Retaining Wall Monitoring.xlsx]Data

APPENDIX V

Map of Water Quality Monitoring Points





Other
Highmont West
Highmont East
Highland TSF
Trojan-Bethlehem
Main Mine
Highway
Permitted Mine Area

Sampling Site

Permitted
Voluntary

Watersheds

Freshwater Atlas
HVC Updated

Highland Valley Copper / Teck

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

Water Quality Monitoring Report

Figure E-1
Water Quality Monitoring Sites, Highland Valley Copper, 2021

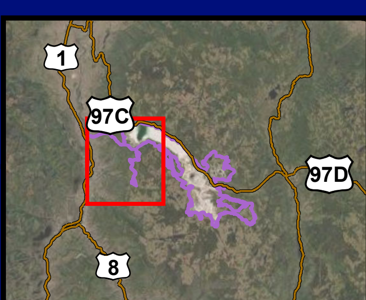
1:200,000

N

PROJECTION: NAD 1983 UTM Zone 10N

DATE: 2022-03-09

GIS No.:HVCE-01-009a



Sampling Site

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

Highland Valley Copper / Teck

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PO Box 1500
Logan Lake, BC, Canada

Water Quality Monitoring Report

Figure 3.2-3
Water Quality Monitoring Sites in the Highland TSF Site Area, 2021

1:65,000

PROJECTION: NAD 1983 UTM Zone 10N

DATE: 2022-03-09 | GIS No.:HVCE-01-009c