Klohn Crippen Berger

Teck Metals Ltd.

Sullivan TSF 2021

Annual Summary of Tailings Facility Performance Report

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March 2022

March 25, 2022

Teck Metals Ltd.
Bag 2000
Kimberley, British Columbia
V1A 3E1

Jason McBain
Senior Engineer, Engineering and Remediation

Dear Mr. McBain:

Annual Facility Performance Report
Sullivan TSF 2021

Klohn Crippen Berger is pleased to submit a copy of the 2021 Annual Facility Performance Report for Teck Metal Ltd.'s Sullivan Mine located near Kimberley, British Columbia. This report documents our visual observations of the existing conditions of the Sullivan Mine tailings embankments and our review of the instrumentation data to August 31, 2021. The reporting period for this 2021 DSI is September 1, 2020, through August 31, 2021.

We appreciate the opportunity to continue to provide our services to Teck Metals. Please call the undersigned at 780-733-4592 if you have any questions.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

Pamela Fines, M.A.Sc., P.Eng.
Associate / Manager, Edmonton

PF/PB

Klohn Crippen Berger Ltd.
Suite 301, 2627 Ellwood Drive SW ▪ Edmonton AB T6X 0P7 ▪ Canada
t 780.444.0706 ▪ f 780.481.2431 ▪ www.klohn.com

Teck Metals Ltd.

Sullivan TSF 2021

Annual Summary of Tailings Facility Performance Report

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EXECUTIVE SUMMARY

This report presents the 2021 Annual Summary of tailings facility performance at Sullivan Mine located in Kimberley, British Columbia. The 2021 annual facility performance report (AFPR) is the 30th consecutive annual inspection of the embankments at the facility carried out by Klohn Crippen Berger Ltd. (KCB).

The report presents the key findings from the site visit by the Engineer of Record (EoR), Ms. Pamela Fines, P.Eng. and Ms. Makayla Rettger, EIT (SK) on July 5 to 6, 2021, as well as a review of the instrumentation data collected, and routine work performed at Sullivan Mine between September 1, 2020, and August 31, 2021.

Based on the visual inspection of the site during the AFPR and a review of available instrument data, the embankments appear to continue to be in good physical condition, the observed performance has been consistent with historical performance and is satisfactory. There was no evidence of any potential dam safety concerns for facilities that have been inactive for at least >25 years and, in some cases, more than 50 years.

Facility Description

After almost a century of operations, the Sullivan Mine was closed at the end of 2001. Reclamation work on the tailings area was formally initiated in 1990 and was essentially completed by 2008.

There is a total of 15 earthfill embankment structures that create seven separate storage facilities for tailings, Acid Rock Drainage (ARD) water, and water treatment sludge. The earthfill structures have a combined length of about 10.4 km, with maximum heights varying from 4.2 m to 29 m. A summary of the maximum height and crest lengths of the main embankments for each facility is shown in the table below.

While many of the tailings facilities were initially designed and constructed through the 1970s and 1980s or earlier, a number of field investigations and design reviews (stability and performance assessments) have been completed since that time. Over the last 10 years prior to closure, a significant amount of work was conducted to enhance long-term stability; modifications to the containment structures included flattening of slopes and/or construction of toe berms such that the structures meet or exceed industry recommended Factors of Safety (FoS) under static and dynamic loading, considering the Maximum Credible Earthquake and assuming all saturated tailings could liquefy. In addition, a closure surface water management plan was put in place including construction of surface water diversions and spillways to safely handle flows from the respective Inflow Design Floods (IDF). Finally, these tailings facilities all reside above original ground and continue to drain at variable rates to the point where most of the contained tailings are largely unsaturated. As a result, the portion of tailings vulnerable to liquefaction has significantly reduced from that assumed during design of the stabilization measures prior to closure.

The only active facility in terms of receiving solid materials is the Sludge Impoundment. No modifications have been required for the Sludge Impoundment embankments to date. This is because the original design capacity of the facility far exceeded production requirements and there had been little accumulation of sludge immediately against the embankments. Teck is currently completing a site-wide review of their water management plan including the Sludge Impoundment. A design review is pending for the Sludge Impoundment following completion of this review and an assessment of future water treatment plans which may impact the Sludge Impoundment storage requirements.

Summary of Storage Facilities at Sullivan Mine

Storage Facility	Embankments	Type	Approximate Embankment Length (m)	Approximate Maximum Embankment Height (m)	Starter Dike Constructed (Year)[1]	Year of Last Dike Raise (Year)
Iron TSF	Iron Dike	Iron Tailings	1500	29.0	1975	1999
Old Iron TSF	Old Iron Dike	Iron Tailings	520	7.6	Prior to 1948	Unknown
	Iron TSF Divider Dike	Iron Tailings	1190	3.6 [3]	Post 1948	Unknown
Siliceous TSF	No. 1 Siliceous Dike	Silica Tailings	2000	4.9 [3]	1923	1979
	No. 2 Siliceous Dike	Silica Tailings	730	9.5	1975	1982
	No. 3 Siliceous Dike	Silica Tailings	1540	12.5	1975	1984
Gypsum TSF	East Gypsum Dike	Gypsum	670	16.8	1969	1983
	West Gypsum Dike	Gypsum	640	22.9	1969	1986
	Northeast Dike	Gypsum, Seepage Water	120	10.0	1985	1985
	Recycle Dam	Seepage/ARD Water	90	6.0	1985	1985
Calcine TSF	Calcine Dike	Calcine	520	4.6 [3]	1972	1986
ARD Pond[2]	North Dam	ARD/Seepage Water	460	7.6	2001	2001
	South Dam	ARD/Seepage Water	330	16.8	1976	2001
Sludge Impoundment	North Dike	Sludge	120	4.3	1978	1978
	South Dike	Sludge	200	6.1	1978	1978

Notes:

[1] Starter dike information based on data from Annual Inspection Report by SRK-Robinson dated June 1991.

[2] The ARD Pond is established at the site of the old Cooling Pond.

[3] Tailings were placed downstream of both Iron TSF Divider Dike and No. 1 Siliceous Dike. The original height of the Iron TSF Divider and No. 1 Siliceous Dikes from original ground is 10.7 m and 16.8 m, respectively. A municipal landfill is downstream from the Calcine Dike. The height of the Calcine Dike from original ground is 15.2 m.

Credible Failure Modes Review

A required component of the annual inspection is to review potential hazards and whether those lead to any credible failure modes, particularly those with catastrophic consequences. The key hazards and failure modes to be evaluated for credibility are overtopping during major flood events, internal erosion and piping, and static and seismic stability. Surface erosion, which is not associated with catastrophic failure modes, is also evaluated.

KCB understand, and fully support, that Teck's long-term goal for all of the tailings facilities is to reach landform status where failure modes with catastrophic consequences are no longer credible. In the context of this AFPR, the term "non-credible" represents a condition where the likelihood of occurrence of a failure resulting in catastrophic consequences is considered negligible.

Unlike Teck 's long term goal for the tailings facilities, it would not be possible for the ARD Pond to achieve landform status because it is a water retaining facility while it continues to receive water. In this case, the ARD Pond containment dams are designed prevent the occurrence of failure modes with catastrophic consequence under Extreme consequence loading conditions which is another way of removing credible failure modes. This is wholly consistent with the Global Industry Standard on Tailings Management (GISTM, 2020). In the longer term, Teck is evaluating further positive risk reduction strategies, such as year-round treatment which would reduce the storage volume requirements in the ARD Pond.

Ongoing work aimed at these long-term goals will indicate over subsequent annual reporting periods if the overall landform status has been achieved along with the elimination of any credible failure modes with catastrophic consequences. A summary assessment of the credible failure modes associated with the current conditions is provided below which shows that many of the facilities are indeed close to landform status.

Overtopping

The likelihood of overtopping failures leading to catastrophic consequences up to and including Extreme consequence loading conditions are considered negligible, and therefore non-credible, for the inactive tailings storage facilities given the closure water management measures already in place (e.g. drainage channels, spillways, etc. designed to discharge PMF).

This is also applicable for the active facilities, ARD Pond and Iron Pond, because they have emergency spillways designed to safely pass the PMF. The likelihood is even more remote for the ARD Pond because it can store a PMF before the water level rises to the invert of the spillway.

For the active Sludge Impoundment, the likelihood of an overtopping failure leading to catastrophic consequences is considered low based on the review of the flood storage capacity completed in 2015. The design criteria for the facility is under review (started in 2018) and work is ongoing (see section 5.2) which is aimed towards eventually achieving Teck's long-term goal of rendering overtopping failure modes with catastrophic consequences non-credible.

Internal Erosion/Piping

The likelihood of internal erosion/piping failure modes resulting in catastrophic consequences is considered to be negligible, and therefore non-credible, for the tailings facilities because the pond water levels are low (Iron Pond) or completely absent (inactive facilities) and the associated piezometric surfaces within the tailings are very low. There are internal drains constructed in the Iron, Siliceous, and Gypsum TSFs, with pipes that extend through the embankments, which represent a potential vulnerability to internal erosion/piping as they deteriorate over time. However, because of the very low hydraulic gradients and small volume of free water available, the likelihood of this failure mode via the deteriorated conduits leading to catastrophic consequences remains negligible. A review of this vulnerability is being completed to assess this risk if local ponding occurs above these pipes due to an extreme flood events that could potentially increase the local phreatic surface and, therefore, temporarily increase the local seepage gradients. The tailings materials are cohesionless silts and based on Rivard (1981), which summarized the PFRA experience related to dams, a seepage gradient as low as 1/25 could be sufficient to trigger internal erosion. It is expected that, even under such an extreme condition, the limited amount of free water source in direct contact with the conduits will greatly limit the extent to which piped materials can be transported. In any event, the results of this review will inform the decision as to whether additional measures might be necessary to eliminate this vulnerability.

The likelihood of internal erosion/piping failure modes resulting in catastrophic consequences is considered to be very low for the ARD Pond Dams. These dams have filter zones in the dam cross-section. However, there are indications of a potential seepage pathway on the left abutment of the South Dam as the instruments downstream of the dam respond to the reservoir water fluctuations. The credible failure mode assessment for Sullivan will include evaluation of the potential for internal erosion to trigger a catastrophic failure.

For the Sludge Impoundment, the likelihood of an internal erosion/ piping failure leading to catastrophic consequences is considered to be negligible, and therefore noncredible, due to the inclusion of filters in the embankment and the lack of a permanent pond.

Seismic Stability

The likelihood of seismic instability (foundation and slope) failure modes leading to catastrophic consequences is considered to be negligible, and therefore non-credible, for the Old Iron TSF, the Iron TSF, and the Calcine TSF because of the seismic stabilization measures completed prior to closure. As previously indicated, since closure in 2001, the phreatic surface in the tailings facilities has decreased significantly so that the portion of tailings vulnerable to seismic liquefaction has also significantly reduced compared to original design assumptions. There are two tailings facilities, the Gypsum and Siliceous TSFs, where a site investigation was completed in 2019 to better characterize the in-situ density and liquefaction susceptibility of the foundation sands and gravels and to better understand the effects of cementation in the gypsum tailings under cyclic loading. The effect of cementation in the gypsum tailings has no impact on the seismic stability of the structure because the design assumed all saturated gypsum tailings liquefy under seismic shaking. However, it is relevant for assessing whether the gypsum tailings remain non-flowable and, therefore, support a potential reclassification of the gypsum facilities to a "landform". The lab testing was completed in 2020, which indicated no strength loss due to cyclic loading. The likelihood of seismic instability leading to catastrophic consequences for the Gypsum and Siliceous TSFs is currently judged to be low, pending further review once the assessments from the investigation are completed. There are no liquefiable materials present in the foundation and embankment fill of the ARD Pond Dams and the deformations induced by the MCE are computed to be small and acceptable. Therefore, the likelihood of seismic instability leading to catastrophic consequences is considered negligible, and therefore non-credible, for the ARD Pond Dams. It should be noted that a due diligence update of the seismic stability of all structures is underway to better reflect existing conditions and to incorporate the revised seismic hazard assessment. This work is important to update the supporting documentation but is not expected to materially change the current conclusions.

Static Stability

Static stability factors of safety are well above the minimum recommended values for all the structures, except the Sludge Impoundment embankments and, therefore, the likelihood of failure under static loadings leading to catastrophic consequences is considered negligible and non-credible. The likelihood of static instability failure of the Sludge Impoundment embankments leading to catastrophic consequences is considered very low, pending review as part of the design update of this facility that is currently underway.

Consequence Classifications (CDA and HSRC)

Given that there have been no major changes to developments downstream of the tailings facilities at Sullivan Mine, no change to the consequence classifications was recommended. The current consequence classifications of each of the embankments at Sullivan Mine are summarized below.

Tailings Embankments and Consequence Classification

Facility	Embankment	Consequence Classification[1]
Iron TSF	Iron Dike	H
Old Iron TSF	Old Iron dike	L
	Iron TSF Divider Dike	L
Siliceous TSF	No. 1 Siliceous Dike	L
	No. 2 Siliceous Dike	L
	No. 3 Siliceous Dike	L
Gypsum TSF	East Gypsum Dike	H
	West Gypsum Dike	H
	Northeast Gypsum Dike	L
	Recycle Dam	L
Calcine TSF	Calcine Dike	L
Sludge Impoundment	North Dike	L
	South Dike	L
ARD Pond	North Dam	VH
	South Dam	VH

Note:
Consequence categories based on 2007 Canadian Dam Safety Guidelines (CDA, 2013): E=Extreme, VH=Very High, H=High, S=Significant, L=Low

It is important to emphasize that, irrespective of the consequence classification indicated in the above table, the design and safety assessment of these structures are based on Extreme consequence loading criteria and level of dam safety management stewardship (i.e. independent review, frequency of DSRs or equivalent, degree of information disclosure, etc.). This is consistent with Teck's overall approach for their tailings facilities. In addition, while the site is still in the Active Care phase of closure, this approach assures compliance with the more stringent requirements of GISTM (2000) for facilities in the Passive Care phase of closure. As previously discussed, work is currently underway at the Gypsum and Siliceous TSFs to address the potential for seismic liquefaction of the sand and gravel foundation and design update of the Sludge Impoundment.

Teck are aligned with the most conservative interpretation of the GISTM, which, in turn, is consistent with their safety culture. Commensurately, Teck has advised that consequence classification is not a part of their tailings management governance and has asked that it not be reported in future AFPRs. Instead, they will adopt the extreme consequence case design loading for any facility with a credible catastrophic flow failure mode. For facilities without a credible failure mode in terms of a life safety issue, Teck will reduce credible risks to As Low As Reasonably Practicable (ALARP). This consequence case applies for both earthquake and flood scenarios for all tailings facilities, consistent with the GISTM.

The facilities in this report meet current industry standards and with the exception of the sludge impoundment have been designed utilizing extreme loading scenarios. The current design review for the sludge pond will bring the facility into alignment with GISTM goals. Adopting this approach meets or exceeds any regulatory requirements, aligns with Teck's goal to eliminate risk for loss of life, and is consistent with the GISTM. Teck feel this approach is consistent with industry-leading best practices and has an added benefit of providing accurate narratives to communities about the safety of tailings facilities that could impact them and who share Teck's approach of one life is one too many to be at risk.

Notwithstanding the above, it is Teck's long-term goal for all of the tailings facilities is to reach landform status, so that the structures can be declassified as a "dam". KCB fully supports Teck towards achieving this long-term goal.

Key Observations (Instrumentation and Visual)

Notification levels have been established for all instruments. The current notifications levels for piezometers are not intended to be indicative of a dam safety concern but rather to identify any measured change from historic or expected behaviour that warrants a due diligence review by Teck and the Engineer of Record (or designate) to understand the likely cause of that change.

Notification levels tied to seismic stability assumptions for two facilities and internal erosion at the ARD Pond Dams and the Silicious Pond Dams are now in place. The alert levels update also includes updated levels based on more recent historical performance.

A facility-by-facility indication of condition and stability follows inclusive of those for facilities deemed to have no credible failure modes leading to catastrophic consequences.

Iron TSF

Based on the visual observations and instrumentation review, the Iron TSF and its emergency spillway are in good condition and are performing satisfactorily.

Seepage near station 5+00 is monitored by Weir #3 and Weir #4 installed in the drainage ditch. Seepage near station 24+00 is collected in an existing low-lying area beyond the toe of the embankment. There are no obvious changes in the seepage conditions compared to previous years.

All 30 piezometers showed reduced or relatively constant piezometric readings compared to the previous monitoring period.

Old Iron TSF

Based on the visual observations and instrumentation review, the Old Iron TSF and the Iron TSF Divider Dike are in good condition, with no visible changes from previous inspections, and are performing satisfactorily.

All nine of the currently monitored piezometers in the Old Iron TSF showed a decrease or no change in piezometric levels compared to the previous monitoring period.

Siliceous TSF

Based on the visual observations and instrumentation review, the Siliceous TSF is in good condition, with no visible changes from previous inspections, and is performing satisfactorily.

Visual observation of seepage indicates similar flows as previous years with no indication of sediment in the seepage flows.

All 20 piezometers currently being read showed stable or decreasing piezometric levels compared to the previous monitoring period.

Gypsum TSF

Based on the visual observations and instrumentation review, the East and West Gypsum TSFs, including the Northeast Gypsum Dike and the Recycle Dam, are in good condition with no visual changes from previous inspections, and are performing satisfactorily.

All 15 piezometers currently being read at the Gypsum TSF showed reduced or stable piezometric levels compared to the previous monitoring period.

There are continued indications of burrowing animal activity at the toe of the embankments; the extent of these observations is not considered a dam safety issue but represents a safety hazard for personnel. Teck has worked to fill in the burrows, and this will need to continue for the new burrows identified.

The Sondex gauge was not scheduled to be read during this monitoring period. The inclinometer was scheduled to be read during this reporting period but the equipment failed during the reading and will be attempted again in 2022.

ARD Pond

Based on the visual observations and instrumentation review, the North and South Dams are in good condition with no visual changes from previous inspections and are performing satisfactorily.

Of the 13 currently monitored piezometers in the ARD Pond Dams, 12 indicated a lower or stable piezometric level compared to the previous monitoring period. PP01-06 showed a slight increase from the previous monitoring period.

Calcine TSF

Based on visual observations, the Calcine TSF is in good condition with no visual changes from previous inspections and is performing satisfactorily.

Sludge Impoundment

Based on the visual observations, the North and South Dikes of the Sludge Impoundment are in good condition with no visual changes from previous inspections and are performing satisfactorily. Instruments were installed in September 2021 and reporting on these instruments will being in 2022.

OMS and MERP Manuals

The Operation, Maintenance, and Surveillance (OMS) Manual for the Sullivan Mine Tailings Facilities was updated to Revision 5 in August 2018. An update to the new Teck OMS template in accordance with GISTM (2020) is currently in progress.

The Emergency Preparedness and Response Procedures Manual was reviewed and converted to a Mine Emergency Response Plan (MERP) in January 2019.

Deficiencies and Non-conformances

There were no deficiencies or non-conformances identified, and therefore, no new recommendations arising from the current AFPR.

Previous recommendations that are still outstanding are summarized in the table below.

Consistent with past annual reviews, deficiencies and non-conformances are grouped according to the following four categories:

- Deficiency (D): An unacceptable dam performance condition based on analysis results and/or site observations/instrument data with respect to criteria outlined in the 2017 HSRC and 2016 Guidance Document, best practices, and/or applicable regulatory requirements.
- Potential Deficiency (PD): A dam performance condition that requires further evaluation to determine if the condition is a deficiency.
- Non-Conformance (NC): Defined as a deviation from established policies, procedures, operating instructions, maintenance requirements, or surveillance plans. A non-conformance is not an indication of unacceptable dam performance.

- Items Requiring Updates to Meet Updated Regulatory Standards (RS): Condition where regulatory requirements have changed and have become more stringent following initial design and/or construction.

Independent Dam Safety Review

The most recent Dam Safety Review (DSR) for the Sullivan Mine TSFs and dams was initiated by Haley and Aldrich in 2018. To allow inclusion of language consistent with the 2020 GISTM, the DSR report was finalized in January 2021. The previous DSR was completed by Golder Associates in 2013 (Golder 2014). The HSRC regulations (EMPR 2017) mandate that a DSR be undertaken every five years regardless of the consequence classification of the structures while the facility is still technically a "dam". Therefore, the next DSR is scheduled to be initiated in 2023, pending Teck's progress towards achieving, and obtaining regulatory approval for, "landform" status for some facilities which may limit the scope of facilities involved in the 2023 review.

Summary of Outstanding Recommendations from Past DSIs and New Recommendations from Current Annual Performance Report

Structure	ID No.	Deficiency of Non-Conformance	Applicable Regulation or OMS Reference	Recommended Action	Deficiency Type	Priority	Recommended Deadline/Status
Previous Recommendations Closed/Superseded							
Siliceous TSF	2019-3	Flowing decant at the toe of No. 2 Siliceous dike	OMS Section 4.0	The flow in the decants should be added to the inspections and changes in flow or sediment transport recorded.	NC	3	Closed
Previous Recommendations Ongoing							
Sludge Impoundment	2017-3	A review of the Sludge Impoundment is needed.	EMPR HSRC (2017) & CDA Guidelines: Application to Mining Dams (2019)	Review of the current design freeboard and design sludge levels is required. To facilitate the design update, the Sludge Impoundment surface should be surveyed to obtain average sludge deposition rates. Review of entire facility should be completed to address storage, life expectancy of the facility, and regulatory requirements.	RS	3	Q1 2022 UPDATE – Site investigation completed in Sept. 2021 to support design update planned for 2022-2023

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1 INTRODUCTION

1.1 Purpose, Scope of Work, and Methodology

This report presents the results of the 2021 Annual Summary of Tailings Facility performance of the tailings embankments and other embankments at the Teck Metals Ltd. (Teck) former Sullivan Mine, located in Kimberley, British Columbia. The work was carried out in general accordance with our proposal letter dated May 3, 2021 and the Teck Guideline for Tailing and Water Retaining Structures (Teck 2019).

The scope of work consists of:

- a visual inspection of the physical condition of the various containment embankments and water retention dams during the site visit July 5 and 6, 2021;
- a review of the climate and water balance data for the site;
- a review of the annual flow rates recorded from weirs for the Acid Rock Drainage (ARD) pond and Iron Tailings Storage Facility (TSF);
- a review of updated piezometer and settlement records provided by Teck in 2021; and
- a review of the risk register for the storage facilities.

The reporting period for this annual report (AFPR) is September 1, 2020 to August 31, 2021. Figures 1 through 3 show the project location and general layout of the tailings facilities.

This is the 30th AFPR of the Sullivan Mine tailings embankments carried out by the Klohn Crippen Berger Ltd. (KCB). Annual reports for the periods preceding KCB's involvement were prepared by SRK-Robinson Inc. from 1989 to 1991 and by Robinson Dames and Moore from 1984 to 1988.

As per previous annual inspection reports by KCB, this report focuses on the geotechnical performance of the tailings embankments and water balance for the tailings facilities.

1.2 Regulatory Requirements

1.2.1 Mines Act and HSRC

This annual inspection addresses the performance of the tailings/sludge storage facilities and associated water management infrastructure in accordance with the Health, Safety, and Reclamation Code for Mines in British Columbia (EMPR 2017) and Guidance Documents (EMPR 2016), which forms part of the Mines Act (RSBC 1996).

As required by the HSRC, the following persons have been designated:

- Engineer of Record – Ms. Pamela Fines, P.Eng. (KCB)
- Responsible Tailings Facility Engineer – Mr. Jason McBain, P.Eng. (Teck)

1.2.2 Water Act and BC Dam Safety Regulation

None of the tailings embankments or dams at Sullivan Mine require a water licence and are therefore not regulated by the BC Dam Safety Regulations. A conditional water licence (C050428) has been issued for the construction of the sludge impoundment. The BC Dam Safety Regulation was referenced for guidance related to dam safety, where appropriate.

1.2.3 Permits and Licenses

Sullivan Mine is regulated by the following permits:

- Reclamation Permit M-74 (amended June 3, 2020) issued by the Ministry of Mines. This permit is issued under the provision of the Mines Act (RSBC 1996) and addresses reclamation, metal leaching, and acid rock drainage requirements at Sullivan Mine. The requirements of the permit are:
  - monitoring programs of vegetation, surface water, and groundwater;
  - annual reporting as required under the HSRC (EMPR 2021); and
  - informing the ministry of changes at the mine that might impact the amount of the reclamation security.
- Effluent Permit PE-00189 (October 24, 2016) issued by the Ministry of Environment and Climate Change Strategy. This permit is issued under the provision of the Environmental Management Act (SBC 2003) and authorizes the discharge of effluent in the Kimberley Creek and the St. Mary River as well as sludge on land. Requirements under this permit include:
  - General requirements (Section 2 of the permit) which state the conditions under which the Drainage Water Treatment Plant (DWTP), seepage collection infrastructure, and Sludge Impoundment must be operated (i.e. maintaining the infrastructure in good working order, addressing emergencies, modification to infrastructure and processes, and suspension).
  - Monitoring and reporting requirements (Sections 3 and 6 of the permit) which describe monitoring work to conduct on the discharges and receiving environment as well as the reporting frequency (i.e., spring and fall).
- Permit PR6742 (January 2, 2018) issued by the Ministry of Environmental Protection & Sustainability: Waste Management. This permit is issued under the provision of the Environmental Management Act (SBC 2003) and authorizes the discharge of refuse to a landfill. The landfill is located within the boundaries of the Old Iron TSF (northwest corner) and is denoted as E242184 and E310949 by the Ministry. Requirements under this permit include:
  - reporting of volumes of material placed within the landfill; and
  - regular inspection and maintenance of the landfill works.

1.3 Facility Description

There is a total of 15 earthfill dam and embankment structures that form the seven separate storage facilities. A summary of the seven facilities and their associated embankment structures is provided in Table 1.1. The earthfill structures have a combined crest length of just over 10.4 km, with the maximum heights varying from 4.2 m to 29 m. A plan of the storage facilities and their retaining structures is provided in Figure 1.

The two water retaining dams[2], designated as the North Dam and South Dam, that form the ARD Pond are shown in Figure 20. This pond, located at the former Cooling Pond site, annually stores the mine contact water collected from the Sullivan Mine site requiring treatment. The two sludge retention embankments, designated as the North and South Dikes, that form the Sludge Impoundment are shown in Figure 27. This impoundment is located south of the St. Mary River and stores sludge produced from treatment of mine contact water at the DWTP[1].

Other than the above earthfill structures, the other embankments listed in Table 1.1 have been used primarily for tailings storage. Typically, these embankments consist of an initial earthfill starter section raised incrementally over the years using the upstream method of construction. The design and construction records for the original Old Iron TSF Dikes and the No. 1 Siliceous Dike (which were constructed during the 1920's to 1940's), are not available, so it is unclear how these were originally constructed. In the 1990's, following the static liquefaction failure experienced at the Iron Dike (Davies et al, 1998) in 1991, the long term stability of all the tailings embankments were assessed which led to the construction of stabilization measures (i.e. slopes flattening and/or toe buttresses) to meet required design criteria. A discussion of the design basis and criteria is provided in Section 5.1.

The Iron Pond, the ARD Pond, the West Gypsum Seepage Collection Pond, and the Northeast Gypsum and Recycle Dam seepage collection ponds are the only storage facilities that are still active as they are used as integral components of the overall surface water and groundwater management strategy at the Sullivan Mine. The Sludge Impoundment is also active but does not retain ponded water. The other tailings facilities have been decommissioned and surface reclamation is complete. The reclamation included draining and covering the TSF surface and constructing surface water runoff conveyance channels and spillways.

Water collected at Sullivan Mine through mine drainage, contaminated groundwater, and seepage from TSFs and waste dumps is stored in the ARD Pond and then pumped to the DWTP. The ARD Pond serves as a flow equalization basin to facilitate seasonal operating campaigns at the DWTP. The treated water is released to the environment (St. Mary River) and the sludge is deposited in the Sludge Impoundment. The ARD Pond was designed with a spillway, which connects to the Iron Pond in the Iron TSF. The Iron TSF has an emergency spillway to safely convey excess water offsite from

[1] In this report KCB refers to water retaining earthfill embankments as "dams" and refers to the earthfill embankments that are constructed for tailings storage and sludge storage as "dikes".

flood events up to and including the PMF. This spillway discharges flood flows into Cow Creek, which in turn discharges into the St. Mary River.

Site location plans and typical embankment sections are provided in Figures 5 through 28.

Table 1.1 Summary of Storage Facilities at Sullivan Mine

Storage Facility	Embankments	Type	Approximate Embankment Length (m)	Approximate Maximum Embankment Height (m)	Starter Dike Constructed (Year)[1]	Year of Last Dike Raise (Year)
Iron TSF	Iron Dike	Iron Tailings	1500	29.0	1975	1999
Old Iron TSF	Old Iron Dike	Iron Tailings	520	7.6	Prior to 1948	Unknown
	Iron TSF Divider Dike	Iron Tailings	1190	3.6 [3]	Post 1948	Unknown
Siliceous TSF	No. 1 Siliceous Dike	Silica Tailings	2000	4.9 [3]	1923	1979
	No. 2 Siliceous Dike	Silica Tailings	730	9.5	1975	1982
	No. 3 Siliceous Dike	Silica Tailings	1540	12.5	1975	1984
Gypsum TSF	East Gypsum Dike	Gypsum	670	16.8	1969	1983
	West Gypsum Dike	Gypsum	640	22.9	1969	1986
	Northeast Dike	Gypsum, Seepage Water	120	10.0	1985	1985
	Recycle Dam	Seepage/ARD Water	90	6.0	1985	1985
Calcine TSF	Calcine Dike	Calcine	520	4.6 [3]	1972	1986
ARD Pond[2]	North Dam	ARD/Seepage Water	460	7.6	2001	2001
	South Dam	ARD/Seepage Water	330	16.8	1976	2001
Sludge Impoundment	North Dike	Sludge	120	4.3	1978	1978
	South Dike	Sludge	200	6.1	1978	1978

Notes:

1. Starter dike information based on data from Annual Inspection Report by SRK-Robinson dated June 1991.
2. The ARD Pond is established at the site of the old Cooling Pond.
3. Tailings were placed downstream of both Iron TSF Divider Dike and No. 1 Siliceous Dike. The original height of the Iron TSF Divider and No. 1 Siliceous Dikes from original ground is 10.7 m and 16.8 m, respectively. A municipal landfill abuts the downstream slope of the Calcine Dike. The height of the Calcine Dike from original ground is 15.2 m.

1.4 Background Information and History

After almost a century of operations, the Sullivan Mine was closed at the end of 2001 with approximately 94,000,000 tonnes of tailings stored in various TSFs and approximately 16,900,000 tonnes of mine waste stored at the former mine. Reclamation work on the tailings areas was formally initiated in 1990 and was essentially complete by 2008.

The mine had been mainly underground and operated on a near-continuous basis from the early 1900's to 2001. In the last decade prior to closure, the mine was processing primarily lead/zinc ore. For most of the mine's operating life, mill tailings were hydraulically transported to an area immediately southeast of the concentrator for disposal and storage. The historical development of the tailings area is summarized in Table 1.2. Gypsum and circulation water from operation of the fertilizer plant have also been stored in the tailings area. These by-products from the fertilizer plant were produced from about 1969 to 1987.

The DWTP, which began operating in 1979, continues to operate as part of the water management plan for the site. The DWTP treats acid rock drainage and other seepage produced from the underground mine and waste storage facilities. Sludge from the DWTP is located in an impoundment about 2 km south of Marysville near the DWTP. Figure 2 illustrates the relative locations of the DWTP, the tailings facilities, and the pipelines from the underground mine and highlights the primary seepage collection system.

Table 1.2 Historical Development

Date	Process	Storage Area	Comments
Prior to 1941	Milling/Flotation for lead and zinc recovery	One tailings stream to Old Iron TSF	
1941 to 1985	Tin Recovery Circuit	Iron Tailings to Old Iron TSF and Iron TSF Siliceous tailings to No. 1, 2, and 3 Siliceous Cells	Failure event of main limb of Old Iron Pond (1948)
1953 to 1987	Fertilizer production including roasting of iron concentrate Waste products include iron oxide and gypsum	Iron oxide (known as calcine tailings) to Calcine TSF Gypsum tailings to East and West Gypsum Cells	Gypsum TSF not developed until 1968; prior to that gypsum tailings were stored and seasonally discharged to the St. Mary River during spring freshet
1975 to 1987	Fertilizer Plant effluent water	Stored and recycled from Cooling Ponds 1 and 2	
1987 to 2001	Fertilizer plant closed; single mill tailings stream	Single stream to Iron TSF	Failure event of main downstream limb of New Iron Pond (1991)
1979 to present	Drainage Water Treatment Plant (DWTP) Sludge Impoundment	Sludge Impoundment	Located offsite, 1.5 km south of Marysville, 0.5 km south of DWTP
2001 to present	Water storage for feed to DWTP	Cooling Ponds 1 and 2 converted to ARD Pond	

1.4.1 Reference Reports

In 1991, Teck retained KCB to conduct forensic investigations to assess the failure of the (then) Active Iron Tailings Pond Dike. The event was very similar to another event that occurred in 1948. The work initiated in 1991 included the design of remedial measures to reinstate the Iron Dike and then subsequently extended to include a review the existing and long-term stability of a number of other tailings dikes. The work also included clean up of 1948 failure materials from the Cow Creek drainage. The work and the design studies were part of Teck efforts toward decommissioning and eventual closure of the Sullivan Mine tailings facilities. Stability assessments, and the design and implementation of stabilization measures if required, were completed for the Iron Dike, the East and West Gypsum Dikes, the No. 1, No. 2, and No. 3 Siliceous Dikes, and the Old Iron Dike. The design and construction of two new dams for the ARD pond were also completed, including new spillways and a downstream flood impact study. Additional post-closure assessments have been performed as required based on performance. The details of the design and construction records for the facilities are documented in KCB (and predecessor companies) reports.

1.4.2 Reference As-Built Drawings

Teck has updated as-built drawings for the various facilities post reclamation. An updated LiDAR imaged created in December 2012 was used to update the figures attached to this report. There have been no significant construction/modifications to the as-built conditions since the drawings by TM Tech Services were issued. A 2019 LiDAR survey was completed but a comparison to the 2012 surface showed very little change and the drawings have not been updated with the new survey surface.

1.4.3 Units of Measure and Coordinates

To facilitate the long-term monitoring of the site, this report has converted historical values recorded in imperial units of measure in the Sullivan Mine Grid coordinate system to metric units in UTM (NAD 83). Some figures still reference stationing along embankments in imperial units.

2 MINE ACTIVITIES IN 2021

2.1 Tailings/Sludge Deposition and Available Storage

The Sullivan Mine closed in 2001 with all milling components removed from the site and, therefore, all of the tailings storage facilities are no longer active.

The Sludge Impoundment continues to be active and provides storage of sludge generated from treatment of mine contact water through the DWTP. According to Teck, about 121,000 tonnes of sludge were deposited in the impoundment from October 1997 to December 2001 and about 59,000 tonnes of sludge were deposited from 2002 to 2020. An additional 975.7 tonnes of sludge was deposited during this reporting period. The average annual deposition rate since closure is 3,000 tonnes/year.

2.2 Main Construction Activities (September 2020 to August 2021)

Construction related activities that take place each year are primarily associated with ongoing care and maintenance, such as road grading, cleaning of ditches, rodent burrow infilling, removal of trees and shrubs from embankment slopes as necessary, maintenance of the seepage collection system, maintenance of instrumentation and management of instrumentation data.

Specific key activities conducted over the current inspection period from September 1, 2020 to August 31, 2021 included:

- Backfilling of a void over an abandoned pipe within the Calcine tailings area, this void was first observed in 2021.
- Backfilling of voids downstream of toe of East Gypsum Dike.
- Lowering of pond level in the West Gypsum seepage collection pond.

Prior to the site visit in 2021, site staff lowered the intake levels for the 945/946 pumps located near the West Gypsum seepage collection pond and drew down the pond level. This allowed for a cleanout and regrading of the weir channels that drain towards the seepage pond. Plans were in development to remove an access road around the seepage collection pond to allow the pond to be lowered even further. Reducing the storage of water anywhere on the TSF is recommended and the area will be inspected again during the next monitoring period.

2.3 Site Investigation

A site investigation was completed in October and November 2020 at the ARD South Dam, Iron TSF, Old Iron TSF, Siliceous TSF and Gypsum TSF. Site investigation was also completed at the Sludge Impoundment in September 2021.

2.4 Updates to Embankment Cross-Sections

Typical cross-sections for each embankment have been previously updated using the 2012 LiDAR data and are shown in the figures included with this report.

A comparison of select cross-sections generated between the 2012 LiDAR surfaces and the 2019 LiDAR surfaces indicated no significant changes to the physical configuration of the embankments on the site. The updated sludge surface in the Sludge Pond from the 2019 LiDAR is provided in Figure 27.

2.5 Dam Safety Review

The most recent Dam Safety Review (DSR) for the Sullivan Mine TSFs and dams was initiated by Haley and Aldrich in 2018. The DSR report was finalized in January 2021 to allow consistency with the GISTM (2020). The previous DSR was initiated by Golder Associates in 2013. The HSRC regulations (EMPR 2017) mandate that a DSR be undertaken every five years regardless of the consequence classification of the structures. Therefore, the next DSR is scheduled to be initiated in 2023, pending Teck's progress towards achieving, and obtaining regulatory approval for, "landform" status for some facilities whereas the scope of the next DSR may potentially be reduced significantly.

3 CLIMATE REVIEW AND WATER MANAGEMENT – TAILINGS AREA

3.1 Overview

The water management system at Sullivan Mine involves the collection and treatment of mine drainage, contaminated groundwater, and seepage from TSFs and waste dumps. The only active storage facilities used as part of the water management system are the ARD Pond, Iron Pond and West Gypsum Seepage Collection Pond. Details of the system are included in the Kimberley Operations Seepage Collection Manual (Teck, 2017).

In general, water from the mine and tailings areas is collected and conveyed to the ARD Pond for storage to facilitate seasonal operating campaigns at the DWTP. The main sources of water include:

- Mine water from the old underground workings is pumped seasonally from the 3700 ft portal and flows via gravity from the 3900 ft mine level to the ARD Pond.
- Water from the waste dumps and the tailings seepage collection pumps and sumps, is pumped as required to the ARD Pond.

The main function of the Iron Pond is to provide storage of contaminated/contact water during spring runoff events. In addition, the system has the flexibility to by-pass the ARD Pond with temporary routing of mine and seepage water to the Iron Pond, where it can then be pumped to the ARD Pond or directly to the DWTP if required.

The ARD Pond has a storage capacity that allows for efficient operation of the DWTP for discrete periods of time and provides control over the time period when treated effluent is discharged to St. Mary River.

It should be noted that studies are underway to identify options and opportunities to improve the current water management system which, at the same time, can contribute to Teck's overall objective of continual risk reduction for the Sullivan Mine.

3.2 Climate

3.2.1 Precipitation

Climate stations in the Environment Canada (EC) database relevant to the Sullivan Mine Tailings Facilities precipitation and active during the time period of this water balance assessment are Kimberley PCC (Station No. 1154203) located approximately 3 km southwest of the mine and Cranbrook Airport Auto (Station No. 152106) located about 13 km southeast of the mine.

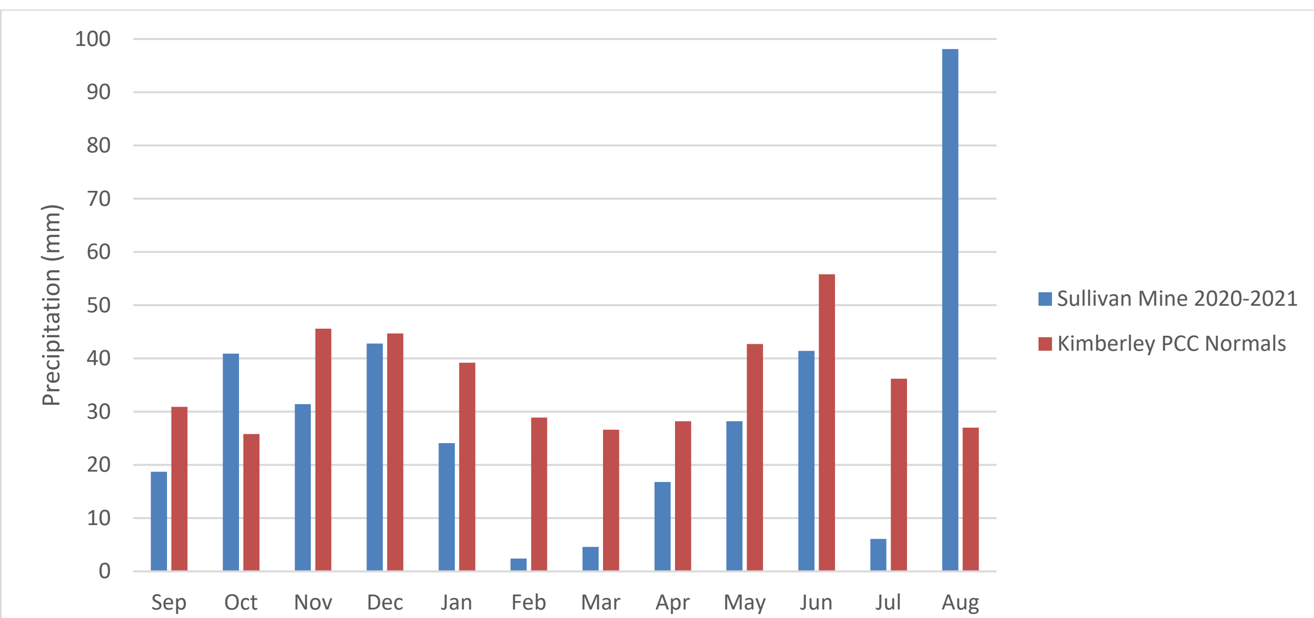
For the purpose of this assessment, site precipitation was estimated as the daily precipitation recorded at Kimberley PCC, with any missing data filled by precipitation recorded at the Cranbrook A station. Table 3.1 summarizes the total precipitation and snowpack estimated for the mine from September 1, 2020, to August 31, 2021 and provides a comparison with the corresponding climate normals for Kimberley calculated between 1981 – 2010 (EC 2019). The total precipitation for the current monitoring period and the climate normals are also graphically shown on Figure 3.1.

On an overall annual basis, the conditions over the current monitoring period were drier than the Kimberley PCC normal levels. However, on a monthly basis, it was wetter than normal in October and August, and drier than normal in September, November, and from January to July. December was near normal.

Table 3.1 Monthly Total Precipitation at Sullivan Mine 2020 – 2021 Compared to Normals from Kimberley PCC Station

Month	2020 - 2021 Total Precipitation (mm)	Normal Total Precipitation (mm)	2020 - 2021 Snow Depth (cm)	Normal Snow Depth (cm)
Sep 2020	18.7	30.9	0	0.0
Oct 2020	40.9	25.8	10.8	0.0
Nov 2020	31.4	45.6	19.8	6.0
Dec 2020	42.8	44.7	38.6	22.0
Jan 2021	24.1	39.2	17.4	34.0
Feb 2021	2.4	28.9	2.4	39.0
Mar 2021	4.6	26.6	0.2	19.0
Apr 2021	16.8	28.2	0.0	0.0
May 2021	28.2	42.7	0.0	0.0
Jun 2021	41.4	55.8	0.0	0.0
Jul 2021	6.1	36.2	0.0	0.0
Aug 2021	98.1	27.0	0.0	0.0
Total	**355.5**	**431.6**	**89.2**	**120**

Figure 3.1 Monthly Total Precipitation at Sullivan Mine 2020-2021 Compared to Normals from Kimberley PCC Station



The precipitation data collected for the water balance is for the ARD Pond and its surrounding catchment. All water collected in the mine and tailings areas is pumped to the ARD Pond, and these flows are measured and recorded by Teck.

3.2.2 Evaporation

Monthly lake evaporation data at the tailings area for the reporting period was estimated using the WREVAP model by SRK (2014). The WREVAP model uses the dew point temperature, average temperature, and global solar radiation to estimate the lake evaporation. The mean monthly lake evaporation depths modelled for data collected at Kimberley A station is shown in Table 3.2.

Table 3.2 Mean Monthly Evapotranspiration Rates at Kimberley A station

Month	Mean Evaporation (mm)
September	65
October	30
November	5
December	0
January	0
February	4
March	36
April	71
May	117
June	135
July	163
August	130
Total	**756**

3.3 Water Levels in ARD Pond and Iron Pond

The two key water storage ponds at the tailings area are the ARD Pond and Iron Pond. The area-volume curves and measured water elevations for these ponds are provided in the following sections.

3.3.1 Area-Volume Curves

ARD Pond

The ARD Pond is formed by the South and North Dams built in 2001. The dam crest elevation is at El. 1048.0 m and the pond's spillway crest elevation is at 1047.4 m. Flood discharges from the ARD Pond spillway reports to the Iron Pond. The Maximum Operating Level (MOL) for the pond is set at El. 1046.5 m (KCC, 2000). Figure XII.1 shows the pond area-volume curve used for the water balance assessment. Based on that curve, the pond surface area is approximately 10 ha and its storage volume is approximately 710 dam^3[2] at MOL.

[2] Cubic decameters are represented by dam^3

Iron Pond

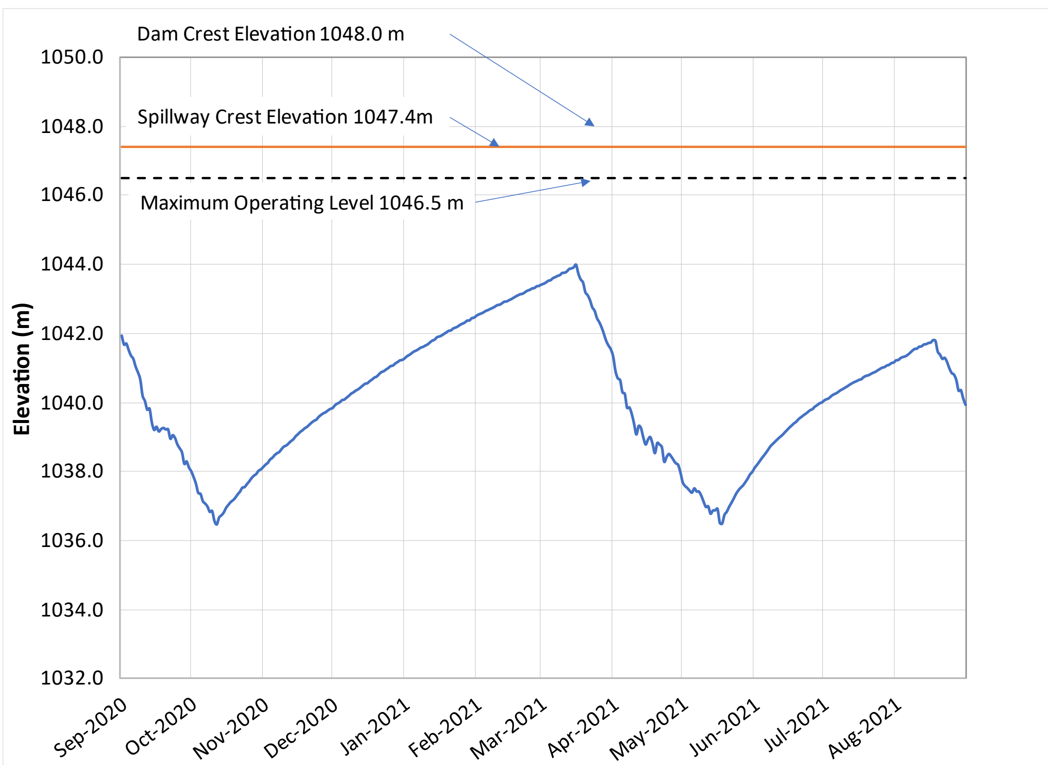
During normal operation, surface runoff from the Iron TSF and the upstream area is collected in the Iron Pond where it is then pumped to the ARD Pond or directly to the DWTP. In addition, the Iron Pond also provides emergency storage when the capacity of the ARD Pond is exceeded. The LiDAR survey from 2012, provided by Teck, shows the elevation of the top of the embankment to be at 1042.0 m and the elevation of the emergency spillway crest at 1041.0 m, which is consistent with the original design. The stage–storage curve (KCB 2007) for the pond is shown on Figure XII.2 and indicates that the storage capacity of the Iron Pond at the emergency spillway crest elevation of 1041.0 m is about 380 dam^3.

3.3.2 Pond Water Levels

ARD Pond

Figure 3.2 shows the water levels measured by Teck in the ARD Pond from September 2020 to August 2021. The pond level was recorded daily.

Figure 3.2 ARD Pond Level 2020 – 2021



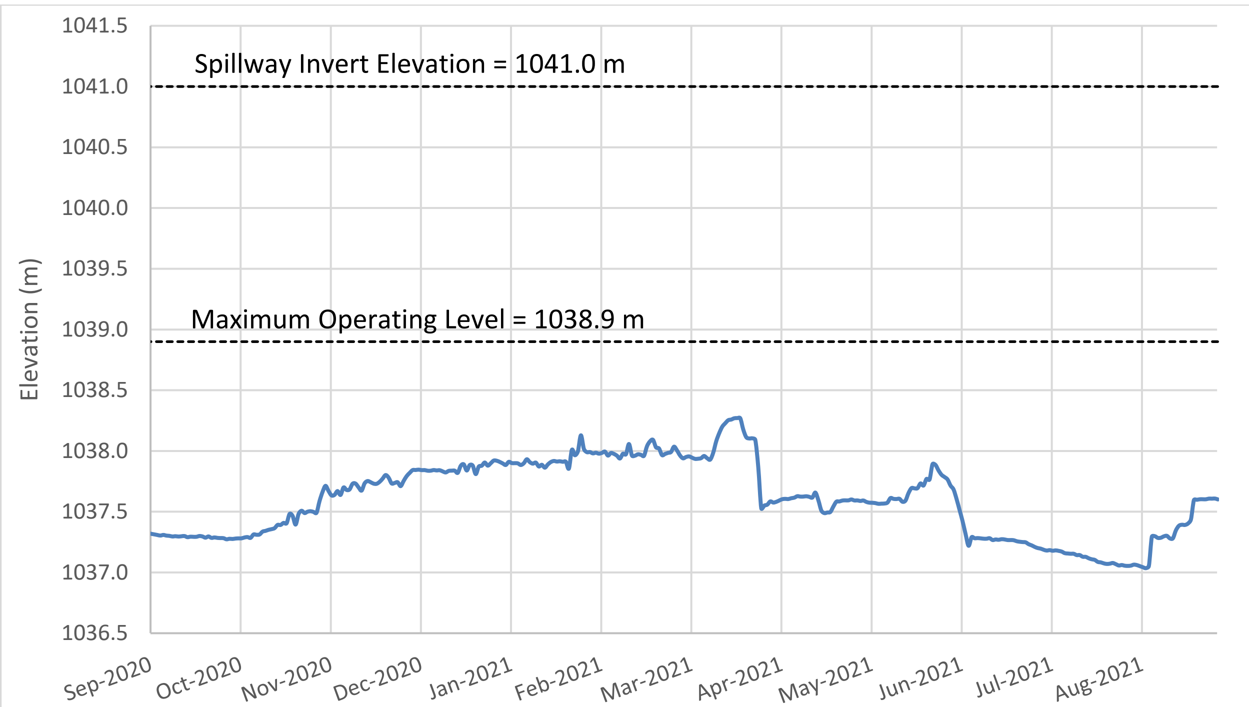
Based on the pond water levels, the maximum level observed during the reporting period was El. 1044.0 m, which occurred on March 16, 2021. This is 2.5 m lower than the maximum operating level (MOL) and is 3.4 m below the spillway crest elevation. There was no water discharged from the ARD Pond spillway to the Iron Pond during the water balance time period. The spillway has never discharged since the ARD pond was constructed.

Iron Pond

Figure 3.3 shows the measured water levels by Teck in the Iron Pond from September 2020 to August 2021. The pond level was recorded daily.

Based on pond water levels, the maximum level observed during the reporting period was El. 1038.3 m around March 24, 2021, which is 2.7 m below the spillway invert elevation. There was no water discharged from the Iron Pond spillway during the water balance period, and records show that water has never been discharged to the spillway since it was constructed after mine closure.

Figure 3.3 Iron Pond Level 2020 – 2021



3.4 Tailings Area Water Balance

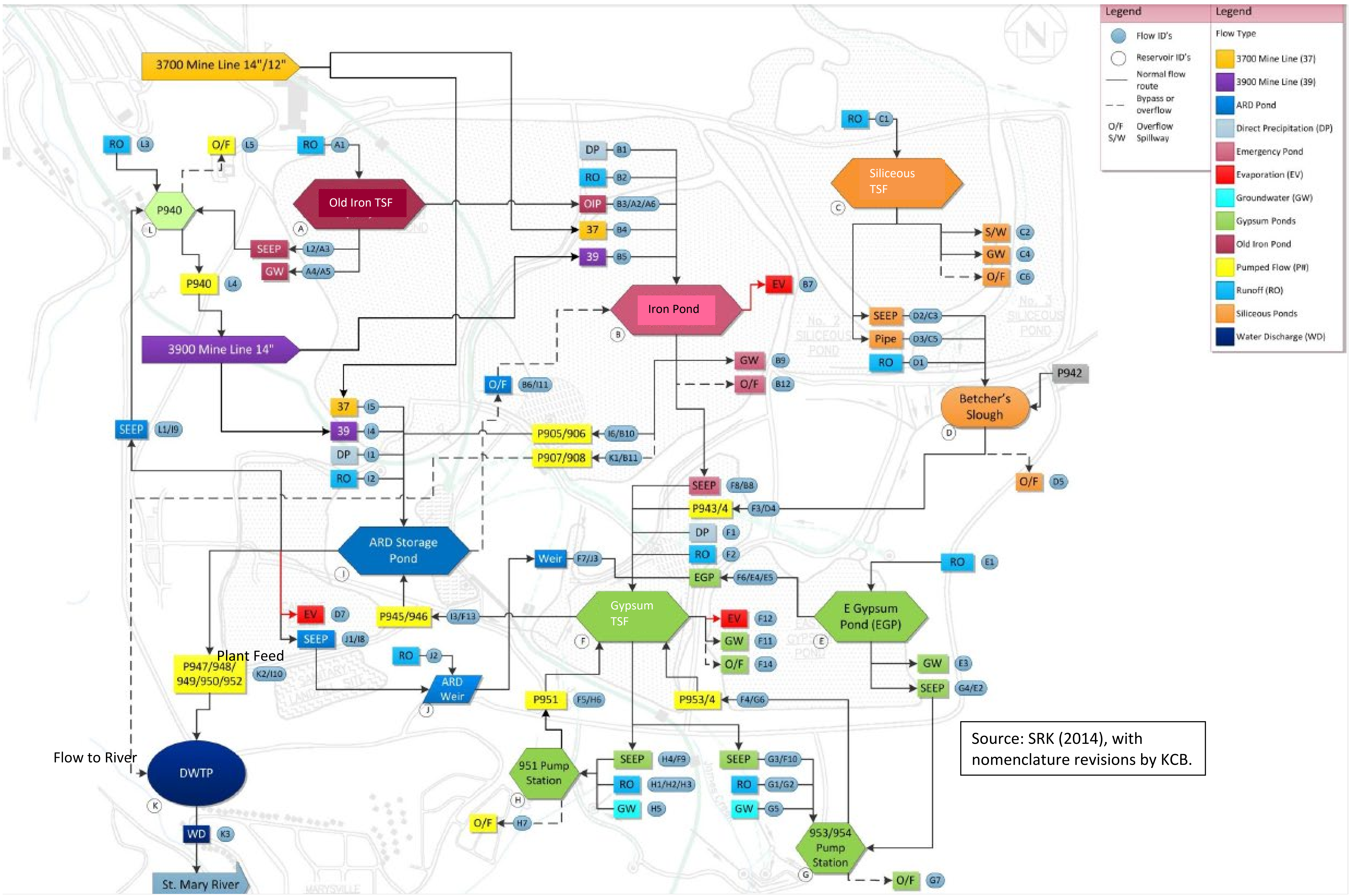
3.4.1 General

Teck manages and tracks the annual water balance for the Sullivan Mine. This section provides a review of the water balance for the current monitoring period from September 1, 2020 to August 31, 2021. The focus of the water balance is for the ARD Pond, as it is the central facility where all collected mine contact water is directed to for storage and then conveyed to the DWTP for treatment.

3.4.2 Water Balance Schematic

Figure 3.4 shows a schematic of the tailings area.

Figure 3.4 Tailings Area Water Balance Schematic



3.4.3 Inflows

As shown on Figure 3.4, inflows to the ARD Storage Pond include the following:

- Seepage from the Iron Pond, Gypsum TSF, and Siliceous TSF, which is collected in the West Gypsum Seepage Collection Pond and directed to the ARD Pond through Pumps 945 and 946.
- Discharge from the mine through the 3700 and 3900 Mine Lines. The 3700 line carries water from the underground mine to the ARD Storage Pond. The 3900 line collects water from the waste dumps, aquifer dewatering wells, and Sullivan Creek as well as pump 940, which collects seepage from the Old Iron TSF, and carries the water to the ARD Pond.
- Pumped flows from the Iron Pond.
- Direct precipitation on the ARD Storage Pond surface and runoff from the surrounding catchment.

Pump data noted above was provided by Teck, rainfall data was obtained from Environment Canada weather stations and runoff was estimated using runoff parameters for the surrounding catchment.

Precipitation and runoff are calculated for the ARD Pond only. All other inflows are captured as measured pump flows to the ARD Pond, which already include precipitation and runoff from all other tailings areas. The ARD Pond catchment area is 0.179 km^2 (SRK 2014), including the pond and its surrounding catchment. Precipitation and runoff inflows were estimated based on the precipitation depths presented in Table 3.1, and estimated pond and catchment areas, which vary by pond level. The following inputs and assumptions were used for the precipitation and runoff estimates:

- monthly yield coefficients ranging from 0.15 to 0.30, as estimated by SRK (2014);
- precipitation accumulated as snow November through March; and
- 100% of accumulated snow melted in March, based on the snowpack data shown in Table 3.1.

3.4.4 Outflows

Outflows from the ARD Storage Pond include the following:

- Seepage through the South Dam (Weir #1 ARDWU), reporting to the West Gypsum Seepage Collection Pond. The weir also collects runoff from the dam face and upstream area.
- Water pumped from the ARD Pond to the DWTP.
- Evaporation from the pond surface.

Water is pumped from the ARD Pond to the DWTP through pumps 947/948/949/950/952. The water is treated and then released to the St. Mary River.

Evaporation losses from the ARD Pond were estimated by multiplying the monthly evaporation depth shown in Table 3.2 by the estimated water surface area of the pond based on the measured pond elevation. Evaporation losses from other areas are reflected in the measured pump flows.

3.4.5 Water Balance Summary

A summary of the estimated monthly inflow and outflow volumes for the ARD Pond is provided in Table 3.3. The water storage in the ARD Storage Pond is calculated monthly based on the inflows and outflows and compared to the observed storage (calculated from the measured water elevation and stage-elevation curve), as summarized in Table 3.3. These volumes are based on the original capacity of the pond, so the accumulation of solids in the pond means that the actual water volume is somewhat less than the table indicates.

Agreement between the observed and calculated storage is variable on a monthly basis. The difference between the observed and calculated year-end storage volumes amounts to 6% of the annual inflow to the pond.

The calculated annual difference of 6% over the current monitoring period is slightly greater than the calculated annual difference of 4% for the previous monitoring period.

Table 3.3 ARD Pond Monthly Water Balance Summary

Description	Units	Sep 2020	Oct 2020	Nov 2020	Dec 2020	Jan 2021	Feb 2021	Mar 2021	Apr 2021	May 2021	Jun 2021	Jul 2021	Aug 2020	Sept. 2020 – Aug. 2021
Beginning Water Level	(m)	1041.39	1038.15	1038.04	1039.79	1041.22	1042.44	1043.36	1041.56	1038.03	1037.95	1039.98	1041.14	1040.17
Beginning Storage	(dam^3)	274.36	87.23	81.81	172.63	262.42	351.15	425.11	285.88	81.47	78.20	183.57	257.19	195.27
Inflow:														
Pump 905/906/907/908	(dam^3)	0.0	0.0	0.0	0.0	0.0	0.0	21.6	1.4	3.5	5.9	0.0	0.0	32.4
Pump 945 / 946	(dam^3)	31.3	35.0	35.4	34.1	41.0	38.5	51.1	50.8	46.9	35.5	28.8	28.8	457.2
Mine Line 3700	(dam^3)	167.8	74.1	0.0	0.0	0.0	0.0	0.5	166.9	117.0	0.0	0.0	0.0	526.2
Mine Line 3900	(dam^3)	61.4	66.2	63.0	60.8	56.8	49.8	59.9	80.2	99.4	89.1	71.0	71.0	828.6
Precipitation and Runoff	(dam^3)	1.3	3.1	2.0	3.1	1.9	0.2	15.1	1.2	2.0	3.3	0.5	0.5	34.3
Total Inflow	**(dam^3)**	261.8	178.5	100.4	98.0	99.8	88.5	148.3	300.5	268.7	133.8	100.3	100.3	1878.8
Outflow:														
Pump 947/948/949/950/952	(dam^3)	433.3	169.1	0.0	0.0	0.0	0.0	266.6	477.7	239.9	0.0	0.0	0.0	1586.6
Weir 1 ARDWU	(dam^3)	Negligible												
Evaporation	(dam^3)	2.9	1.5	0.3	0.0	0.0	0.3	2.1	3.1	6.0	8.5	10.3	10.3	45.5
Total Outflow	**(dam^3)**	436.2	170.6	0.3	0.0	0.0	0.3	268.7	480.9	245.9	8.5	10.3	10.3	1632.1
Calculated Net Change in Storage	(dam^3)	-174.4	7.8	100.0	98.0	99.8	88.2	-120.4	-180.4	22.8	125.2	90.0	90.0	246.6
Calculated Month-End Storage	(dam^3)	100.0	95.0	181.9	270.6	362.2	439.4	304.7	105.5	104.3	203.4	273.6	347.2	
Observed Month-End Storage	(dam^3)	87.2	81.8	172.6	262.4	351.2	425.1	285.9	81.5	78.2	183.6	257.2	183.2	

3.5 Flood Management

Reclamation work on the tailings areas commenced in 1990 and continued after mine closure in 2001 until it was completed in 2008. The reclamation work primarily comprised the development and construction of a multi-layer soil cover system of float rock and till over the tailings areas. A summary of the flood management structures and applicable design criteria is presented below.

- Surface water collection/diversion channels and spillways have been designed and constructed in the tailings areas for flood management. The main channels and spillways are Dobson's Draw diversion, Siliceous Spillway and outlet channel, ARD Pond spillway, Channel C within the Iron Pond and the Iron Pond emergency spillway. They are designed to safely pass the Probable Maximum Flood (PMF) events. The channels are riprap lined and the spillways include stilling basins.
- As previously indicated, the Iron Pond is intended to provide storage of mine contact surface water during spring runoff events. The Iron Pond is designed to store the 100-year snowmelt event above the maximum operating level and controlled release of the 1000-year snowmelt event has also been provided for, if it cannot be stored. If the pond level at the start of the snowmelt event was below the maximum operating level then a larger than 100-year snowmelt event could be stored before discharge via the emergency spillway. The emergency spillway for the Iron Pond is designed to safely pass the PMF. Key characteristics of the Iron Pond are provided in Section 3.6.1.
- As previously indicated, the ARD Pond is the central water storage facility where all collected contaminated/contact water is directed to for storage and then subsequently conveyed to the DWTP for treatment. The ARD Pond has been designed to store the 48-hour PMF and includes a spillway designed to safely pass a 24 hr PMF (after the 48-hour PMF has been stored). Note that, in essence, the ARD Pond is capable of safely handling two PMFs occurring in succession. Key characteristics of the ARD Pond are provided in Section 3.6.2.

It should be highlighted that the PMF, which was selected as the Inflow Design Flood (IDF) for the Sullivan Mine tailings facilities, exceeds the minimum criteria for their respective consequence classifications (see Table 5.1 in Section 5), as specified in CDA (2013, 2014) and EMPR (2017). Teck has elected to adopt higher IDF values within the framework of continual risk reduction.

3.6 Freeboard and Storage – Water Storage Ponds

3.6.1 Iron Pond

The maximum operating level of the Iron Pond is El. 1038.9 m. The stage – storage curve of the pond is shown on Figure XII.2, and its key design and performance characteristics are provided in Table 3.4.

Table 3.4 Relevant Iron Pond Characteristics

Item	Value
Top of the Dike Elevation (m)	1042.0
Spillway Crest Elevation (m)	1041.0
Maximum Operating Level (m)	1038.9
Storage Capacity at the MOL (dam^3)	76.9
Designed Storage Capacity up to the Spillway (dam^3)	614.2
Minimum Water Level in 2020-2021 (m)	1036.6
Maximum Water Level in 2020-2021 (m)	1038.3
Maximum Storage in 2020-2021 (dam^3)	19.2
Minimum Available Capacity Below MOL 2020-2021 (dam^3)	57.7

As previously discussed in Section 3.3.2, and shown on Figure 3.3, the maximum water level elevation recorded in the Iron Pond over this monitoring period was 1038.3 m, which is 2.7 m below the emergency spillway crest elevation and 3.7 m below the minimum Iron Dike crest elevation.

3.6.2 ARD Pond

The maximum operating level of the ARD Pond is set at El. 1046.5 m, which is 0.9 m lower than the spillway invert (El. 1047.4 m). It allows for a flood storage depth of 0.8 m for a 48-hour Probable Maximum Flood (PMF) plus 0.1 m freeboard to the spillway invert. The elevation of the top of the dam is set at 1048.0 m, providing a vertical distance of 0.6 m above the spillway invert. This vertical distance allows for a 0.3 m surcharge above the spillway crest and a dam freeboard of 0.3 m (KCB 2018) when routing the IDF (PMF) through the spillway to the Iron Pond.

The stage–storage curve of the pond is shown on Figure XII.1, and its key design and performance characteristics are provided in Table 3.5.

Table 3.5 Relevant ARD Pond Characteristics

Item	Value
Top of Dam Elevation (m)	1048.0
Spillway Crest Elevation (m)	1047.4
Maximum Operating Level (m)	1046.5
Storage Capacity at the MOL (dam^3)	710.7
Designed Storage Capacity for PMF (dam^3)	50.0
Designed Freeboard for PMF (m)	0.3
Minimum Water Level in 2020-2021 (m)	1036.5
Maximum Water Level in 2020-2021 (m)	1044.0
Maximum Storage in 2020-2021 (dam^3)	476.4
Minimum Available Capacity Below MOL 2020-2021 (dam^3)	234.3

As previously discussed in Section 3.3.2, and shown on Figure 3.2, the maximum water level elevation recorded in the ARD Pond over this monitoring period was 1044.0 m, which is 3.4 m below the spillway crest elevation and 3.0 m below the dam crest elevation.

3.7 Off-Site Surface Water Discharge Volumes

There were no off-site water discharges from the ARD Pond and Iron Pond spillways during the reporting period. These spillways have not operated since they were constructed (in 2001 for the ARD Pond spillway, and in 2007 with modifications in 2009 for the Iron Pond emergency spillway).

The only discharge to the environment is treated water from the DWTP, which enters the St. Mary River. Table 3.6 provides a summary of the monthly discharge volumes, as provided by Teck. As shown, the total water discharge volume from the DWTP between September 2020 and August 2021 was 1587 dam^3.

Table 3.6 Summary of Treated Water Discharge to St. Mary River

Month / Year	Total Volume (dam^3)	Average Discharge per Day (dam^3)
Sep 2020	433.3	14.4
Oct 2020	169.1	5.5
Mar 2021	266.6	8.6
Apr 2021	477.7	15.9
May 2021	239.9	7.7
Total	**1586.6**	

The average daily discharge volumes over this monitoring period were less than the maximum daily limit of 28 dam^3 as compliant with the permit PE-00189.

3.8 Water Discharge Quality

Water discharge quality is not included in the scope of this report. Teck separately reports groundwater quality and discharge water quality to the BC Ministry of Environment as specified in Permit PE-00189.

4 SITE OBSERVATIONS AND INSTRUMENTATION REVIEW

4.1 Visual Observations

The on-site inspection of the embankments was carried out by Ms. Pamela Fines, P.Eng. (Engineer of Record) and Ms. Makayla Rettger, EIT. (SK) of KCB from July 5 to July 6, 2021. The weather during the inspection was warm with mostly clear skies. The 2021 Inspection Checklists that were completed for each embankment are included in Appendix I. A summary of the visual observations of each embankment is below.

Selected photographs of the various embankments taken during the site visit are presented in Appendix II and are referenced throughout this report. Appendix II has been subdivided so as to group the photographs according to the facilities, as follows:

- ARD Pond, ARD Spillway, Weirs 1 and 2 II-1
- Iron TSF, Iron Pond, Emergency Spillway, Weir 3 and 4 II-9
- Siliceous TSF, Siliceous Spillway, Siliceous Decants II-21
- Gypsum TSF, II-28
- Sludge Impoundment II-32
- Calcine TSF II-35
- Old Iron TSF, Iron TSF Divider Dike II-37

4.1.1 ARD Pond

The visual inspection indicated that the North and South Dam were in good physical condition with no signs of structural distress. The riprap on the upstream side of both dams was in good condition with no evidence of movements or damage (Photo II.1 and II.2). It was noted that there is sporadic vegetation growth on the upstream face of both dams but is not a dam safety concern and should be managed as part of the ongoing vegetation management program on site. Several large pieces of wood were observed on the upstream slope of the North Dam, the debris is not a dam safety concern but should be removed as part of good practice to prevent them from possibly blocking the spillway during a flood event.

An area of surface erosion was observed below an outlet pipe adjacent to the pumphouse located near the South Dam of the ARD Pond (Photo II.3). This area should be monitored and repaired if it begins to encroach on the pumphouse.

The downstream slope of the North Dam appeared to be in similar condition to the previous years. The slope is well grassed with no significant patches of bare or loose soil observed (Photo II.4). Localized depressions/steepened slopes along the toe of the North Dam have been noted during the annual inspections. These areas were purposely constructed by locally excavating into the dam slope to manage seepage exiting from the dam. Seepage collects in the toe ditch and flows to the seepage pond at the west end of the dam. Large vegetation was observed at the toe of the North Dam, especially at the east end of the dam (Photo II.5). This is not a dam safety concern but should be cleared during the ongoing vegetation management program on the site.

The downstream slope of the South Dam appeared to be in similar condition to previous annual inspections (Photo II.6). The slope is well grassed with no significant patches of bare or loose soil observed.

The ditch south of the South Dam that feeds into Weir #1 and Weir #2 is heavily vegetated with grass and other plants, which may impede flow (Photo II.7). Teck has done significant work at all the weirs to reduce the amount of water bypassing the weirs, the low permeability cut-off material can be seen in Photo II.7. The ditches should be cleaned as part of the vegetation management program on site.

4.1.2 Iron TSF and Iron Dike

The visual inspection indicated that the Iron Dike was in good physical condition with no signs of structural distress. No cracking or other unusual physical conditions were noted along the crest or downstream slopes. Dike slopes and crest were grassed with no significant areas observed with bare or loose soil (Photos II.9).

Seepage continued similarly to previous years at the downstream toe of the embankment near station 5+00. Seepage is monitored by two weirs (Weir #3 and Weir #4) installed within the drainage ditch (Photos II.13 through II.16). The notch in the weir plate in Weir #4 has become worn and should be replaced or repaired (Photo II.16). Seepage was also occurring near the downstream toe of the dike near station 24+00 and is being collected in the existing ditch and low-lying area, this seepage should continue to be monitored visually as part of routine inspections and collection of weir flow data.

The visual inspection of the Iron Pond (contained within the Iron TSF) indicated that it was in good condition.

The Emergency Spillway Channel extends from the southwest corner of Iron TSF and down the west side of the West Gypsum TSF. The visual inspection indicated the spillway was in good physical condition (Photos II.17 through II.20). Some grass, shrubs, and other vegetation were present in the lower portion of the spillway near the southwest corner of the West Gypsum TSF and the 951 Pump House. The rip rap appeared to be in good condition with no signs of movement or particle breakdown.

4.1.3 No. 1, 2, and 3 Siliceous TSFs

The visual inspection indicated that the No. 1, 2, and 3 Siliceous Dikes were in good physical condition with no signs of structural distress (Photos II.21 through II.25). Seepage of variable amounts generally occurs from the toes of all Siliceous Dikes during the spring from runoff due to snowmelt water infiltration through the cover system. This seepage occurred during operations and has continued but at much lower rates after mine closure. The observed seepage conditions appeared to be similar to those observed in previous annual inspections. The seepage water is collected by drainage ditches. Inspection of seepage locations along the Siliceous dikes is performed by Teck on a regular basis.

Signs of surface seepage emerging from the downstream slopes of the embankments were not evident during KCB's site visit.

A small trickle of flow was observed from the historical decant pipes installed into the No. 3 Siliceous Dike (Photo II.25). It is KCB's understanding that flow is relatively constant through these pipes during the entire year. A decant installed in 2000 within the No. 2 Siliceous Dike was dry and generally only sees flow during freshet. Flow from both decants should be monitored and recorded as part of the regular inspections by Teck and KCB. Any changes in flow rate or sediment in the flow should be reported to KCB.

The surface water runoff conveyance channel from No. 1 Siliceous Cell across No. 3 Siliceous Cell, the diversion channel to the north of No. 1 and No. 3 cells, and the emergency spillway channel constructed on the east slope of No. 3 Siliceous Dike were in good physical condition at the time of the site visit with no sign of movement or particle breakdown (Photo II.26 and II.27). The upper portion of the spillway across the No. 3 Siliceous cell is heavily grassed.

4.1.4 East and West Gypsum TSFs

The visual inspection indicated that the East Gypsum Dike was in good physical condition with no signs of structural distress (Photo II.28). Embankment slopes were well-grassed with no significant areas of bare or loose soil observed. Several large rodent burrows were observed along the dam slopes and toe but are not considered to be a dam safety issue. However, the burrows are safety hazard to personnel walking along the dam toe and slope. Rodent burrows should be infilled as they're identified. No seepage was observed in the ditch at the toe of the embankment.

The visual inspection indicated that the West Gypsum dike was in good physical condition with no signs of structural distress. Embankment slopes were well-grassed with no significant areas of bare or loose soil observed (Photo II.29). Animal burrows were observed near the embankment toe. These burrows are not a dam safety issue; however, the burrows are safety hazard to personnel walking along the dam toe and slope. Rodent burrows should be infilled as they're identified.

4.1.5 Northeast Gypsum Dike and Recycle Dam

The visual inspection indicated that the Northeast Gypsum Dike and the Recycle Dam were in good physical condition with no signs of structural distress. The slopes of both embankments were well grassed (Photos II.30 and II.31). Animal tracks were observed along the downstream slope of the Northeast Gypsum Dike and don't appear to have changed significantly since being observed during last year's inspection.

4.1.6 Sludge Impoundment

Both the North and South Dikes of the Sludge Impoundment were observed to be in good physical condition during the inspection. The sludge level in the impoundment adjacent to the North Dike is nearing the design levels of approximately one metre below the crest elevation; deposited sludge is approximately 2.0 m below the crest elevation at the South Dike.

Vegetation is becoming established on both dams (Photo II.32 through II.34) and should be removed as part of the vegetation management program on site.

4.1.7 Calcine TSF

The visual inspection indicated that the Calcine Dike was in good physical condition with no signs of structural distress (Photo II.35). The downstream slope of the embankment is sporadically vegetated and is buttressed by a municipal landfill.

The old beach surface is at crest level upstream of the dike and gently slopes downward towards the north (upstream). There was no free water observed during the inspection and vegetation has become established over the entire impoundment. Calcine removal from a pit developed at the northwest side of the lower cell ceased in 2011/2012 and this area was reclaimed. The pit is well drained and no standing water was observed.

A void was observed by field staff reading instruments (Photo II.36). This void appears to have formed due to the collapse of an old disused pipe. The void was dry and was well away from the toe of the Old Iron TSF or Calcine embankment. The void was backfilled with granular material by the site contractor.

4.1.8 Old Iron TSF

The visual inspection indicated that the Old Iron Dike and Iron TSF Divider Dike were in good physical condition with no signs of structural distress. The downstream slope of the Old Iron Dike was grassed with no significant areas of bare or loose soil (Photo II.37 and II.8). There were no signs of seepage. The Iron TSF Divider Dike is buttresses by the Iron TSF and is currently being used as an access road between the two TSFs (Photo II.39). No physical changes were observed from the previous annual inspection. The Iron TSF Divided Dike is buttresses on both sides with tailings.

4.2 Instrumentation Data Review

Based on the review of the instrumentation data and observations from the site inspection of July 5 and 6, 2021, there were no dam safety concerns identified. The current monitoring schedule for all instruments will be generally unchanged for the 2022 monitoring period. The monitoring frequencies are summarized in Table 4.1 and are detailed for each item in Appendix III. Additional readings may be requested as required depending on trends observed during the 2022 reporting period.

Table 4.1 Monitoring Frequencies for 2021 Reporting Period

Embankment		Monitoring Frequency (3x = three times per year, 3y = every 3 years, A = annually, AV = annual visual, M = monthly, W = weekly) Consult notes for conditional changes and special regimes.				
		Piezometers	Settlement	Inclinometers	Seepage(8)	Water Levels
Iron TSF	Iron Dike	3x(1)	A + 3y(5)	-	W(7)	Daily
Old Iron TSF	Old Iron Dike	3x(2)	-	-	-	-
	Iron TSF Divider Dike	A(3)	-	-	-	-
Siliceous TSF	No. 1, 2, and 3 Dikes	A	-	-	-	-
Gypsum TSF	West Gypsum Dike	3x(2)	A + 3y(6)	-	AV	-
	East Gypsum Dike	A	A + 3y(6)	3y	AV	-
	Northeast Gypsum Dike and Recycle Dam	-	3y	-	-	-
ARD Pond	North Dam	M(4)	3y	-	-	Daily
	South Dam	M(4)	3y	-	W(7)	Daily
Sludge Impoundment	North Dike	-	A	-	-	-
	South Dike	-	A	-	-	-

Notes:

1 Three times per year (spring, summer, and fall) except P92-H which is recorded weekly by a datalogger and P92-02 and P92-25 which are read monthly.

2 Three times per year (spring, summer, and fall).

3 Annually in the spring if possible, to capture peak level.

4 Read pneumatic piezometers weekly when pond is above 1045 m. Read standpipe piezometers weekly when ARD pond is about 1040 m and daily when ARD pond is about 1045 m.

5 Survey of Iron Dike from Station 0+00 to 12+00 to be completed annually.

6 Settlement plates to be surveyed annually, Sondex gauge to be read every three years.

7 Weirs measured daily between March 1 and May 30. Read daily for three days following rainfall event > 10 mm in 24 hours.

8 Record pond levels when weirs read. When reading weirs, provide visual observations of ditch flows, e.g. ice build-up, flows around or under weir, etc.

Quantifiable Performance Objectives (QPOs) have been established in terms of notifications levels for the instrumentation installed within the embankments and notification levels relative to pond water elevations and corresponding freeboard for the ARD Pond and the Iron Pond In addition, a checklist of qualitative indicators (e.g., observation of cracking, slumping, erosion, etc.) for routine visual inspections, event-driven visual inspections, and annual visual inspections have been developed. Additional details, including summary tales of instrumentation data and corresponding notification levels, are provided in Appendix III.

It is important to emphasize that the current notification levels for the available instruments, including piezometers, seepage weirs, settlement systems, and inclinometer casings, are not associated with any dam safety concerns. Rather, they are based on historical trends of reading in a particular instrument with the objective of highlighting readings that could be indicative of a potential change from historical norms in order to prompt a closer review as a matter of due diligence. The notification levels are also reviewed on an annual basis and adjusted if necessary. The specified notification levels are well below the assumed levels for stability assessments.

Teck contracts instrument reading and monitoring data collecting to Vast Resource Solutions (Vast), who provide the raw data for upload to GeoExplorer. Monitoring is also completed by Teck personnel.

4.2.1 Iron TSF

The locations of the existing instruments at the Iron Dike are shown on Figure 5. Typical sections showing geometry and pore pressure response are shown on Figures 6 and 7.

Piezometric Levels

Time plots of the piezometric readings received from Vast are presented on Figures IV-1 through IV-10 in Appendix IV. Peak values recorded over this period are reported in Table AIII.3.

All but two of the Iron Dike piezometers (28 of 30) show reduced peak pore water pressures during the 2021 reporting period compared to the previous reporting period's readings. Readings remained below notification levels and are well below the assumed levels for stability assessments.

Settlements

The most recent survey of settlement plates and embankment crest was carried out by Teck in October 2018, and the results were reported in the 2018 DSI report. The 2021 survey was in progress at the time of the draft report and will be updated for the final report. The October 2018 survey confirmed that the embankment crest is typically above the design elevation, and there has been no additional settlement since 2014. The surveys are scheduled to be conducted annually. Settlement plate readings are presented on Figures IV-12 through IV-14.

The annual embankment crest survey in progress in October 2021.

Seepage Flows

Two weirs (Weir #3 and Weir #4) exist to monitor seepage from the toe of the west portion of the Iron Dike. Weir #3 is located near the toe of the embankment and Weir #4 is located 300 m downstream.

Weir #3 measured peak flows of 6.0 m3/day in October 2020. The flow data indicates minimum flows through the weir of 0.0 m3/day to 2.8 m3/day. Historical data for Weir #3 is presented in Figure IV- 11.

Weir #4 flow data shows a peak flow of 93.3 m3/day in March 2021. Minimum flows varied from 6.0 m3/day to 65.3 m3/day. Historic data for Weir #4 is presented in Figure IV-11. It should be noted that this weir is approximately 300 m downstream from the embankment toe and flow measurements will include surface runoff from surrounding terrain as well as seepage flows.

The weirs are read at a minimum monthly, with daily or weekly readings performed during periods of higher flows and/or when the ARD Pond elevations is above 1145 m. Additional readings occur following heavy rainfall events.

4.2.2 Old Iron TSF

The locations of existing instruments at the Old Iron TSF (Old Iron Dike and Iron TSF Divider Dike) are shown on Figure 8. A typical section showing geometry is shown on Figure 9.

Piezometric Levels

Time plots of the piezometric readings received from Vast are presented on Figures V-1 through V-4 in Appendix IV. Peak values recorded over this period are reported in Table AIII.4.

All of the existing piezometers at the Old Iron TSF (9 of 9) showed stable or reduced peak pore water pressures compared to the previous monitoring period and were below the notification level for the monitoring period.

4.2.3 Siliceous TSF

The location of existing instruments on the Siliceous TSF are shown on Figure 10. Typical sections are shown on Figures 11 and 12.

Piezometric Levels

Plots of the piezometer readings for Siliceous TSF are shown on Figures VI-1 through VI-6. Peak values recorded over this period are reported in Table III.5.

No. 1 Siliceous Dike

The piezometers at No. 1 Siliceous Dike (4 of 4) recorded stable peak pore water pressures compared to the previous monitoring period and were below the notification level for the monitoring period. P105, a standpipe piezometer installed in the embankment adjacent to No. 3 Cell, has been reading near or above its notification level for several years including after an attempted flush in 2014. It is suspected that the piezometer may be plugged internally.

No. 2 Siliceous Dike

All of the existing piezometers at No. 2 Siliceous Dike (3 of 3) recorded reduced peak pore water pressures compared to the previous monitoring period and were below the notification level for the monitoring period.

An existing pneumatic piezometer downstream of No. 2 Siliceous Dike and along Betcher's Slough is now monitored by Teck. This monitoring is not reported to KCB but if a significant change in flow rate or cloudy flow is observed KCB should be notified to determine if any action needs to be taken.

No. 3 Siliceous Dike

All of the existing piezometers at No. 3 Siliceous Dike (13 of 13) recorded stable or reduced peak pore water pressures compared to the previous monitoring period and were below the notification level for the monitoring period. The three piezometer which recorded an increase over the 2019 monitoring period values were flushed and re-established in 2019 and will require continued monitoring to establish new notification levels.

Seepage Flows

There are currently no flow measuring capabilities in the area of the Siliceous TSFs. During the site inspection, both the shallow and historical decants were inspected.

4.2.4 East and West Gypsum TSFs

The location of existing instruments on the Gypsum TSFs are shown on Figures 13, 16, and 18. Typical sections are shown on Figures 14, 15, 17, and 19

Piezometric Levels

Plots of the piezometer readings for Gypsum TSFs are shown on Figures VII-2 and VII-3 for West Gypsum Dike and Figures VIII-1 through VII-3 for East Gypsum Dike. Peak values recorded over this period are reported in Table III.6.

West Gypsum Dike

All of the existing piezometers at West Gypsum Dike (7 of 7) recorded reduced peak pore water pressures compared to the previous monitoring period and all were below the notification level during the monitoring period.

East Gypsum Dike

All of the existing piezometers at East Gypsum Dike (8 of 8) recorded stable or reduced peak pore water pressures compared to the previous monitoring period and were below the notification level during the monitoring period.

Northeast Gypsum Dike and Recycle Dam

Standpipe piezometers in the Northeast Gypsum Dike and Recycle dam have not been monitored since 2004. Piezometric levels consistently matched pond elevations and were not providing information to assess embankment performance. The Dike/Dam have a long history of good performance, relatively low heights, and any impacts in the unlikely event of a failure would be wholly contained within the impoundment area; ongoing monitoring of the piezometric levels was considered unnecessary.

Settlement

West Gypsum Dike

The most recent survey of settlement plates and embankment crest was carried out by Teck in October 2018, and the results were reported in the 2018 DSI report. Survey was in progress at the time of the draft report and will be updated for the final report. Settlement was reported as 0 mm/year to 25 mm/year with decreasing rates and this is consistent with the expected behaviour of the gypsum tailings. The annual survey of the settlement plates at West Gypsum Dike was not completed in the 2020 monitoring period, past data is presented in Figures VII-4 through VII-6.

Consolidation of the West Gypsum Cell tailings is monitored with a Sondex settlement gauge, S97-01, installed about 50 m upstream of the crest at Station 10+00 (Figure VII-1). A reading of the Sondex gauge was taken during the 2019 DSI. The Sondex gauge has recorded total consolidation settlement of about 1.7 m since 1994. This is within the expected settlement for the facility. As indicated in KCB's report Stability Review of Gypsum Dikes dated November 26, 1993, long term creep is a common characteristic of gypsum. Continued consolidation of the gypsum tailings is not considered a dam safety concern. Regular crest surveys are conducted to confirm that the dam crest remains at or above the design elevation. The next reading of this Sondex gauge is scheduled for 2022.

East Gypsum Dike

The most recent survey of settlement plates and embankment crest was carried out by Teck in October 2018, and the results were reported in the 2018 DSI report. Survey was in progress at the time of the draft report and will be updated for the final report. Settlement was reported as 15 mm/year to 30 mm/year and the rates of settlement were below threshold levels and consistent with the expected behaviour of the gypsum tailings. The annual survey of the settlement plates at East Gypsum Dike was not completed in the 2020 monitoring period, past data is presented in Figures VIII- 4 and VII-5.

Consolidation of the East Gypsum Cell tailings is monitored with a Sondex settlement gauge, S94-02, installed about 25 m upstream of the crest at Station 33+00 (Figure VIII-1). A reading of the Sondex gauge was taken during the 2019 DSI. The Sondex gauge has recorded total consolidation settlement of about 1.0 m since 1994. This is within expected settlement for the facility. As indicated in KCB's report Stability Review of Gypsum Dikes dated November 26, 1993, long term creep is a common characteristic in gypsum. Continued consolidation of the gypsum tailings is to be expected and is not considered a dam safety concern. Regular crest surveys are conducted to confirm that the dam crest remains at or above the design elevation. The next reading of this Sondex gauge is scheduled for 2022.

Northeast Gypsum Dike and Recycle Dam

The most recent survey of settlement plates and embankment crest was carried out by Teck in October 2018, and the results were reported in the 2018 DSI report. Survey was in progress at the time of the draft report and will be updated for the final report.

Past surveys, presented in Appendix IX, indicated negligible settlements since 2007.

4.2.5 ARD Pond

The location of existing instruments on the ARD Pond Dams are shown on Figure 20. Typical sections are shown on Figures 21 through 24.

Piezometric Levels

Historic data for the piezometers installed in ARD North and South Dams is shown on Figures X-1 through X-4.

North Dam

All of the existing piezometers at ARD North Dam (8 of 8) recorded stable peak pore water pressures compared to the previous monitoring period. All were below the notification level during the monitoring period.

South Dam

Most of the existing piezometers at ARD South Dam (4 of 5) recorded stable or reduced peak pore water pressures compared to the previous monitoring period. PP01-06 was above the notification level for the instrument for the 2021 max reading. The current notification level is based on historic readings only and this is not a dam safety concern. The instrument should continue to be monitored as per the schedule in Appendix III, Table III.7. The new instruments installed in 2020 are being connected to an automated collection system in September 2021 and will be included in the 2022 Annual report.

Settlement

South Dam

The most recent survey of settlement plates and embankment crest was carried out by Teck in October 2018, and the results were reported in the 2018 DSI report. Survey was in progress at the time of the draft report and will be updated for the final report.

Past data, included in Figure X-7, shows no notable settlement since 2001 and less than 25 mm of lateral movement since the end of construction.

North Dam

The most recent survey of settlement plates and embankment crest was carried out by Teck in October 2018, and the results were reported in the 2018 DSI report. Survey was in progress at the time of the draft report and will be updated for the final report.

Past data, included in Figure X-8, shows less than 20 mm of settlement since 2001 and less than 25 mm of lateral movement since the end of construction.

Seepage Flows

Two weirs (Weir #1 and Weir #2) exist to monitor seepage from the toe of the ARD South Dam. Weir #1 is located near the toe of the Dam and Weir #2 is located approximately 50 m downstream.

Weir #1 measured peak flows of 71.1 m3/day in March 2021. The flow data indicates minimum flows through the weir of 0.0 m3/day to 20.4 m3/day. Historical data for Weir #1 is presented in Figure X-5.

Weir #2 flow data shows a peak flow of 47.6 m3/day in November 2020 and March 2021. Minimum flows varied from 0 m3/day to 10.0 m3/day. Historic data for Weir #2 is presented in Figure X-6. It should be noted that this weir is approximately 50 m downstream from the embankment toe and flow measurements will include surface runoff from surrounding terrain as well as seepage flows.

4.2.6 Calcine TSF

A plan view of the Calcine Dike is shown on Figure 25. Typical sections showing geometry and pore pressure response are shown on Figure 26.

Water Levels

Three standpipe piezometers are located on the embankment crest, as shown on Figure 25. The piezometers were last read in 2004 and have been dry since 1986. Piezometer monitoring at the Calcine Dike ceased in 2007. Given that the pit (where calcine was previously excavated) at the northwest side of the lower cell has always been dry and the Calcine Dike is buttressed on its downstream slope by the existing municipal landfill, continued reading of these piezometers was considered unnecessary.

4.2.7 Sludge Impoundment

A plan view of the Sludge Impoundment is shown on Figure 27. Typical sections showing geometry are shown on Figures 28.

Piezometric Levels

There are no piezometers installed to monitor water levels in the Sludge Impoundment Dikes. Water deposited during sludge deposition or due to precipitation drains through the embankment (which contains a filter zone) or into the foundation. New instruments were installed in September 2021 and will be reported in the next annual report.

Settlement

In the previous annual inspection, 2019 LiDAR survey data was used to evaluate the embankment crest elevation compared to design elevation. Embankment crest elevation on the north and south dam was found to be above design elevation apart from the south side of the south dam briefly dipping below design. This was consistent with 2012 LiDAR data which indicates that there has been little to no settlement in the last 7 years.

The annual embankment crest survey was in progress at the time of the draft report and will be updated for the final report.

5 DAM SAFETY ASSESSMENT

5.1 Dam/Dike Consequence Classifications

The consequence classifications of each of the embankments at Sullivan Mine are summarized in Table 5.1. The consequence classifications are reviewed annually by Teck and KCB's EoR or designated representative at the time. Given that there have been no major changes to developments downstream of the tailings facilities at Sullivan Mine, no change to the consequence classifications was recommended.

Table 5.1 Consequence Classification

Facility	Embankment	Consequence Classification[1]
Iron TSF	Iron Dike	H
Old Iron TSF	Old Iron Dike	L
	Iron TSF Divider Dike	L
Siliceous TSFs	No. 1 Siliceous Dike	L
	No. 2 Siliceous Dike	L
	No. 3 Siliceous Dike	L
Gypsum TSFs	East Gypsum Dike	H
	West Gypsum Dike	H
	Northeast Gypsum Dike	L
	Recycle Dam	L
Calcine TSF	Calcine Dike	L
Sludge Impoundment	North Dike	L
	South Dike	L
ARD Pond	North Dam	VH
	South Dam	VH

Note:
[1] Consequence categories based on 2007 Canadian Dam Safety Guidelines (CDA, 2013): E=Extreme, VH=Very High, H=High, S=Significant, L=Low

It is important to emphasize that, irrespective of the consequence classification indicated in the above table, the design and safety assessment of these structures are based on Extreme consequence loading criteria and level of dam safety management stewardship (i.e. independent review, frequency of DSRs or equivalent, degree of information disclosure, etc.). This is consistent with Teck's overall approach for their tailings facilities. In addition, while the site is still in the Active Care phase of closure, this approach assures compliance with the more stringent requirements of GISTM (2000) for facilities in the Passive Care phase of closure. As previously discussed, work is currently underway at the Gypsum and Siliceous TSFs to address the potential for seismic liquefaction of the sand and gravel foundation and design update of the Sludge Impoundment.

Teck are aligned with the most conservative interpretation of the GISTM, which, in turn, is consistent with their safety culture. Commensurately, Teck has advised that consequence classification is not a part of their tailings management governance and has asked that it not be reported in future AFPRs. Instead, they will adopt the extreme consequence case design loading for any facility with a credible flow failure mode. For facilities without a credible failure mode in terms of a life safety issue, Teck will reduce credible risks to As Low As Reasonably Practicable (ALARP). This consequence case applies for both earthquake and flood scenarios for all tailings facilities, consistent with the GISTM.

The facilities in this report meet current industry standards and with the exception of the sludge impoundment have been designed utilizing extreme loading scenarios. The current design review for the sludge pond will bring the facility into alignment with GISTM goals. Adopting this approach meets or exceeds any regulatory requirements, aligns with Teck's goal to eliminate risk for loss of life, and is consistent with the GISTM. Teck feel this approach is consistent with industry-leading best practices and has an added benefit of providing accurate narratives to communities about the safety of tailings facilities that could impact them and who share Teck's approach of one life is one too many to be at risk.

Notwithstanding the above, Teck's long-term goal for all of the tailings facilities is to reach landform status, so that the structures can be declassified as a "dam". KCB fully supports Teck towards achieving this long-term goal.

5.2 Design Basis Overview

5.2.1 Tailings Storage Facility Embankments

In 1991, a static liquefaction failure of the (then active) Iron Dike occurred (Davies et al. 1998). KCB was retained at that time by Cominco (predecessor to Teck) to conduct forensic investigations and develop remedial measures to reinstate the embankment for operations. At the same time, the 1991 failure raised a concern regarding the seismic vulnerability of the other tailings storage embankments at the Sullivan Mine, which led to expanding the stability assessment work for the embankments associated with the Old Iron TSF, the No. 1, 2, and 3 Siliceous TSFs and the Gypsum TSFs. This work included the design and construction of required stabilization measures that were carried out from 1992 to 1995. The stabilization measures consisted of slope flattening, constructing downstream toe buttresses or a combination of both.

The Calcine TSF Dike was not included in the stability assessment since it was already buttressed on the downstream side by the large municipal landfill. In addition, the calcine tailings are highly permeable and the TSF is essentially drained with a very low phreatic level.

A summary of the geotechnical design basis for the tailings embankments is provided in KCB (2002). Key aspects of the design basis for slope stability assessments conducted in the 1990's were:

- It was recognized that loose contractive saturated tailings, such as those present in the tailings storage facilities at the Sullivan Mine, are susceptible to static and seismic liquefaction. Although a seismic hazard study was completed to estimate of the ground motions for the Maximum Credible Earthquake, the decision was made to conservatively assume that all saturated tailings would liquefy, irrespective of the earthquake ground motion, as the basis at that time for design of stabilization measures. Therefore, all saturated tailings (i.e. all tailings below the phreatic surface prevailing at the time of the analyses) were assigned the liquefied residual undrained strength for stability calculations.

- The minimum target static factor of safety was 1.5 and the minimum target post-earthquake factor of safety was 1.1, which were consistent with the state of practice at that time. It is acknowledged that post-earthquake factor of safety of 1.1 adopted at the time is lower than the 1.2 that is currently specified in CDA (2019).

It is important to emphasize that the stability of the embankments have progressively increased since construction of the stabilization measures was completed and after mine closure, as the phreatic levels within the tailings facilities, and therefore, the proportion of liquefiable tailings, steadily decrease with time. This consideration is discussed further as part of the failure modes review in Section 5.3.

As previously discussed in Section 3.5, the design basis for all the flood management structures within tailings facilities is the PMF, which exceeds the minimum criterion specified by the CDA (2019) and EMPR (2017) for the respective consequences classifications of each embankment.

5.2.2 ARD Pond Dams

The North and South Dams of the ARD Pond were designed in 2000 and constructed in 2001. The geotechnical and hydrological design basis for the ARD Pond is documented in KCB (2000a and 2000b). Target Factors of Safety (FoS) for the design basis for slope stability were:

- static loading (downstream slope): FoS ≥ 1.5;
- rapid drawdown (upstream slope): FoS ≥ 1.3; and
- pseudo-static (seismic, upstream and downstream slopes): FoS ≥ 1.1.

Given that there are no liquefiable materials in the dams and their foundations, the pseudo-static method was considered appropriate to provide a screening level assessment of the seismic performance. The seismic coefficient applied for the pseudo-static analysis was taken as 0.225 g, which is 50% of the peak ground acceleration of 0.45 g associated with the Maximum Credible Earthquake. A new probabilistic seismic hazard assessment was completed for the site and a 1:10,000 peak ground acceleration of 0.18 g was calculated for the site which is a significant reduction in predicted seismic load for the site (KCB, 2020).

The above FoS criteria adopted for the design in 2001 are consistent with today's acceptance criteria, as specified in CDA (2019) and EMPR (2017).

For reference, the FoS calculated for the North and South Dams during design were 2.1 and 2.0, respectively, under static loading; 1.8, for both dams, under rapid drawdown; and 1.3 and 1.1, respectively, under pseudo-static conditions. These FoS meet or exceed target criteria. Other design considerations included the addition of two filter layers between the downstream slope of the glacial till core and the downstream float rock shell and a single filter layer between the upstream slope of the glacial till core and the upstream float rock shell. Typical cross-sections of the two dams are shown on Figures 21 through 24.

Flood management criteria for the ARD Ponds was previously discussed in Section 3.5.

5.2.3 Sludge Impoundment

The Sludge Impoundment and its containment embankments (North Dike and South Dike) were designed in 1978 by others. According to Dames and Moore (1978):

- the static FoS of the embankments is 1.4;
- the pseudo-static FoS of the dikes is 1.2; and
- a 1:200 return period flood event was adopted as the design criterion.

As previously discussed, the North and South Dikes were not included in the 1992-1994 stability review work because there was minimal sludge retained at that time. In addition, unlike the tailings embankments which are constructed using the upstream method of construction where each incremental embankment raise is founded on top of deposited tailings, the North and South Dikes were constructed on competent foundation and comprised entirely of mechanically place and compacted borrow fill.

Nevertheless, it was recommended at that time that a complete design review of the Sludge Impoundment and its embankments should be conducted once the impoundment becomes filled with more sludge.

In 2015, a review by KCB indicated that the Sludge Impoundment could accommodate another 15 to 20 years of operation at the current sludge production rate. In addition, it was considered prudent to assess whether the geotechnical stability and flood management aspects of the Sludge Impoundment are compliant with the recent changes/updates in regulatory requirements (e.g, MEPR 2017, CDA 2019) and Teck's approach of adopting Extreme consequence loading criteria.

The design review of the Sludge Impoundment and its embankments, including flood routing and handling, sludge deposition planning, and embankment stability, is currently underway.

5.3 Failure Modes Review

A required component of the annual inspection is to review potential hazards and whether those lead to any credible failure modes, particularly those with catastrophic consequences. The key hazards and failure modes to be evaluated for credibility are overtopping during major flood events, internal erosion and piping, static and seismic stability, and surface erosion.

KCB understand, and fully support, that Teck's long-term goal for all of the tailings facilities is to reach landform status where failure modes with catastrophic consequences are no longer credible. In the context of this AFPR, the term “non-credible” represents a condition where the likelihood of occurrence of a failure resulting in catastrophic consequences is considered negligible.

Unlike Teck ‘s long term goal for the tailings facilities, it would not be possible for the ARD Pond to achieve landform status while it is still a water retaining facility. In this case, the ARD Pond containment dams are designed prevent the occurrence of failure modes with catastrophic consequence under Extreme consequence loading conditions. This is wholly consistent with the Global Industry Standard on Tailings Management (GISTM, 2020). In the longer term, Teck is evaluating further positive risk reduction strategies, such as year-round treatment which would reduce the storage volume requirements in the ARD Pond.

Ongoing work aimed at these long-term goals will indicate over subsequent annual reporting periods if the overall landform status has been achieved along with the elimination of any credible failure modes with catastrophic consequences. A summary assessment of the credible failure modes associated with the current conditions is provided below.

Teck commissioned a Failure Modes and Effects Analysis (FMEA) risk assessment for the Sullivan Mine Tailings Facilities which was facilitated by Wood and KCB also participated. The FMEA was completed over a series of workshop and follow up discussions in November 2017 and December 2017. The assessment included a review of design and operation controls for each of the dam safety failure modes. Based on the FMEA, the current failure mode risks were found to be well understood and well managed. No material changes to the risk classifications were necessary. The FMEA summary document has been issued in draft (Wood 2018).

5.3.1 Overtopping

Tailings Storage Facilities

The tailings facilities are no longer active, and the only facility currently being used for water storage as part of the site wide water management system is the Iron Pond.

As previously discussed in Section 3.5, surface water collection/diversion channels and spillways have been constructed in the tailings areas for flood management, which are designed to safely pass the Probable Maximum Flood (PMF) events. The likelihood of overtopping failures leading to catastrophic consequences up to and including Extreme consequence loading conditions are considered negligible, and therefore non-credible.

ARD Pond

The ARD Pond has been designed to store the 48-hour PMF and also includes a spillway designed to safely route a 24 hr PMF (after the 48-hour PMF has been stored) (see Section 3.5). Therefore, the likelihood of overtopping is considered negligible and a non-credible failure mode.

Sludge Impoundment

According to Dames and Moore (1978), the 1:200-year return period flood event was adopted for design of the Sludge Impoundment. However, as the actual sludge production rate has been much lower than assumed in the original design by others, the impoundment currently has excessive flood storage capacity. A review by KCB in 2015 indicated that the available capacity is sufficient for another 15 to 20 years assuming the average annual sludge production rate remains unchanged.

As discussed in Section 5.2.3, a design review of the Sludge Impoundment and its embankments, including flood routing and handling, sludge deposition planning and embankment stability, is currently underway. The design of the facility will have a goal of driving all failure modes to non-credible based on Extreme consequence loading. There is no population at risk downstream of the sludge pond and the sludge is drained which reduces the potential for a flow failure of the sludge in the event of a failure.

The design criteria for the facility is under review (started in 2018) and work is ongoing (see section 5.2) which is aimed towards eventually achieving Teck's long-term goal by removing overtopping leading to a catastrophic consequences as a credible failure mode based on Extreme loading conditions.

5.3.2 Internal Erosion and Piping

Tailings Storage Facilities

The tailings storage facilities are no longer active, and since completion of the reclamation cover, the phreatic levels within the tailings have steadily decreased. As a result, the exit seepage gradients are correspondingly low, and therefore, the likelihood of an internal erosion/piping related failure through the embankments and/or through their foundations leading to a catastrophic failure is considered to be negligible and therefore non-credible.

There are internal drains constructed in the Iron, Siliceous, and Gypsum TSFs, with pipes that extend through the embankments, which represent a potential vulnerability to internal erosion/piping as they deteriorate over time. However, because of the very low hydraulic gradients and small volume of free water available, the likelihood of this failure mode via the deteriorated conduits leading to catastrophic consequences remains negligible. A review of this vulnerability is being completed to assess this risk if local ponding occurs above these pipes due to an extreme flood events that could potentially increase the local phreatic surface and, therefore, temporarily increase the local seepage gradients. The tailings materials are cohesionless silts and based on Rivard (1981), which summarized the PFRA experience related to dams, a seepage gradient as low as 1/25 could be sufficient to trigger internal erosion. It is expected that, even under such an extreme condition, the limited amount of free water source in direct contact with the conduits will greatly limit the extent to which piped materials can be transported. In any event, the results of this review will inform the decision as to whether additional measures might be necessary to eliminate this vulnerability.

ARD Pond

The likelihood of internal erosion/piping failure modes resulting in catastrophic consequences is considered to be very low for the ARD Pond Dams. These dams have filter zones in the dam cross-section. However, there are indications of a potential seepage pathway on the left abutment of the South Dam respond to the reservoir water fluctuations. Investigations and assessments are underway to evaluate the implications of this noted response from an internal erosion/piping potential perspective.

Sludge Impoundment

For the Sludge Impoundment, the likelihood of an internal erosion/ piping failure leading to catastrophic consequences is considered to be negligible, and therefore noncredible, due to the inclusion of filters in the embankment and the lack of a permanent pond.

5.3.3 Static Stability

Tailings Storage Facilities Dikes

An overview of the design basis for stability assessment of the tailings facilities embankments was previously presented in Section 5.2.1. As discussed, the static factors of safety computed for the embankments during design of the stabilization measures met or exceed the target factor of safety criteria of 1.5. Moreover, the static factors of safety for existing conditions are expected to be higher since the phreatic levels have steadily decreased over time since mine closure and completion of the reclamation cover.

Based on the above considerations, the likelihood of a static dam instability leading to catastrophic consequences is considered negligible and therefore non-credible.

A review of the stability of the all the dams is currently underway, which is aimed towards eventually achieving Teck's long-term goal of removing credible failure modes associated with instability due to all loading conditions.

ARD Pond Dams

An overview of the design basis for stability assessment of the North and South Dams of the ARD Pond was previously presented in Section 5.2.2. Given the relatively high static factors of safety, the likelihood of a dam instability leading to catastrophic consequences is considered to be negligible and therefore non-credible.

Sludge Impoundment Dikes

An overview of the design basis for stability assessment of the North and South Dikes of the Sludge Impoundment was previously presented in Section 5.2.3. The static factor of safety reported by the original designers is 1.4, which is below the specified criterion of 1.5 per the CDA (2013, 2014) and EMPR (2017). Nevertheless, there has been no reported signs of embankment instability since completion of construction in 1978, some 40 years ago. Accordingly, the likelihood of embankment instability is considered to be low.

As previously discussed, a complete design review of this facility is currently underway.

5.3.4 Surface Erosion

The downstream slopes of the embankments are well grassed and, although variable, are relatively flat. Except for the ARD Pond and Iron Pond, none of the tailings facilities impound water under normal conditions. Progressive erosion that develops over time or multiple events are managed through routine and event-driven monitoring and ongoing maintenance. In terms of the overall size of the embankments, such erosion features are typically small and the likelihood of surface erosion over the downstream slope resulting in an embankment failure from a single event is considered negligible and not a credible failure mode to induce a flow failure of the sludge.

5.3.5 Seismic Stability

Tailings Storage Facilities Dikes

As discussed in Section 5.2.1, the post-earthquake factors of safety computed for the embankments during design of the stabilization measures met the criterion adopted at the time (i.e. factor of safety ≥ 1.1 assuming all saturated tailings liquefied). However, the likelihood of seismic instability (foundation and slope) failure modes leading to catastrophic consequences is considered to be negligible, and therefore non-credible, for the majority of the facilities because of the seismic stabilization measures completed prior to closure. As previously indicated, since closure in 2001, the phreatic surface in the tailings facilities has decreased significantly so that the portion of tailings vulnerable to seismic liquefaction has also significantly reduced compared to original design assumptions.

There are two tailings facilities, the Gypsum and Siliceous TSFs, where a site investigation was completed in 2019 to better characterize the in-situ density and liquefaction susceptibility of the foundation sands and gravels and to better understand the effects of cementation in the gypsum tailings under cyclic loading. The effect of cementation in the gypsum tailings has no impact on the seismic stability of the structure because the design assumed all saturated gypsum tailings liquefy under seismic shaking. However, it is relevant for assessing whether the gypsum tailings remain non-flowable and, therefore, support a potential reclassification of the gypsum facilities to a “landform”. The lab testing was completed in 2020, which indicated no strength loss due to cyclic loading. The likelihood of seismic instability leading to catastrophic consequences for the Gypsum and Siliceous TSFs is currently judged to be low, pending further review once the assessments from the investigation are completed. There are no liquefiable materials present in the foundation and embankment fill of the ARD Pond Dams and the deformations induced by the MCE are computed to be small and acceptable. Therefore, the likelihood of seismic instability leading to catastrophic consequences is considered negligible, and therefore non-credible, for the ARD Pond Dams. It should be noted that a due diligence update of the seismic stability of all structures is underway to better reflect existing conditions and to incorporate the revised seismic hazard assessment. This work is important to update the supporting documentation but is not expected to materially change the current conclusions.

A due diligence review and update of the seismic stability of all structures is underway to better reflect existing conditions based on the current phreatic surface levels and the revised seismic hazard assessment and recent data collected on the density of the foundation soils. The results of the seismic stability updates are important as supporting documentation towards Teck's long-term goal of eventually removing credible failure modes associate with seismic loading.

ARD Pond Dams

As discussed in Section 5.2.2, there are no liquefiable materials in the North and South Dams or in their respective foundations, and the computed pseudo-static factors of safety is 1.1 or greater using the previously estimated PGA of 0.45 g. These values meet or exceed the current pseudo-static stability criterion of 1.0 per the CDA (2013, 2014). Therefore, the likelihood of a seismically induced dam instability failure is considered to be negligible

Seismic deformations are expected to be small and acceptable. As a matter of due diligence, simplified seismic deformation analysis is planned as part of the stability update.

Sludge Impoundment Dikes

As noted in Section 5.2.3, the pseudo-static factor of safety reported by the original designer for the North and South Dikes is 1.2, which exceeds the criterion of ≥ 1.0 as per CDA (2013, 2014). Therefore, the likelihood of a seismically induced dam instability failure is considered to be very low.

As previously discussed, a complete design review of this facility is currently underway, including an update of the seismic hazard for the site.

5.4 OMS Manual

The most recent version of the Operation, Maintenance, and Surveillance (OMS) Manual for the Sullivan Mine tailings facilities was completed in 2018 (V5, August 17, 2018) by Teck, which included changes as recommended in the 2016 DSI and a reorganization to meet Teck's internal guidelines. A major update to the OMS manual to come into compliance with GISTM (2020) was in progress at the time of this report.

Teck will continue to review the manual annually and make revisions as necessary, with input from the EoR.

5.5 Mine Emergency Response Plan

The current version of the MERP was last updated in January 2019 when it was converted from the previous Emergency Preparedness and Response Plan (EPRP). The plan meets the regulatory requirements and guidance documents from CDA and the Mining Association of Canada. The plan includes identification of communities of interest, failure modes, and responses to various emergencies.

As required by HSRC (EMPR, 2017), the MERP is tested annually using desk-top scenarios. A table-top exercise to review and update the Emergency Preparedness Response Plan was hosted by Teck and attended by the current Sullivan EoR on October 29, 2020. The emergency reporting contact list is also reviewed and updated as required.

6 SUMMARY

The Sullivan Mine TSFs, ARD Pond and the Sludge Impoundment appear to be in good physical condition and the observed performance during the 2021 site inspections is consistent with the expected design conditions and historical performance.

There were no deficiencies, non-conformances or issues of concern identified in this year's review, and therefore, there are no new recommendations.

A summary of previous annual performance review recommendations that were outstanding, and their updated status, are summarized in Table 6.1. All of the recommendations pertain to the framework of continual improvements in the dam safety management program, such as documentation and maintenance/surveillance protocols. The recommendation for the Sludge Impoundment is part of the design review and update that is already being planned by Teck and KCB.

As per previous annual reviews, deficiencies and non-conformances are grouped according to the following four categories:

- Deficiency (D): An unacceptable dam performance condition based on analysis results and/or site observations/instrument data with respect to criteria outlined in the 2017 HSRC and 2016 Guidance Document, best practices, and/or applicable regulatory requirements.
- Potential (PD): A dam performance condition that requires further evaluation to determine if the condition is a deficiency.
- Non-Conformance (NC): Defined as a deviation from established policies, procedures, operating instructions, maintenance requirements, or surveillance plans. A non-conformance is not an indication of unacceptable dam performance.
- Items Requiring Updates to Meet Updated Regulatory Standards (RS): Condition where regulatory requirements have changed and have become more stringent following initial design and/or construction.

Table 6.1 Summary of Outstanding Recommendations from Past DSIs and New Recommendations from Current Annual Inspection

Structure	ID No.	Deficiency of Non-Conformance	Applicable Regulation or OMS Reference	Recommended Action	Deficiency Type	Priority	Recommended Deadline/Status
Previous Recommendations Closed/Superseded							
Siliceous TSF	2019-3	Flowing decant at the toe of No. 2 Siliceous dike	OMS Section 4.0	The flow in the decants should be added to the inspections and changes in flow or sediment transport recorded.	NC	3	Closed
Previous Recommendations Ongoing							
Sludge Impoundment	2017-3	A review of the Sludge Impoundment is needed.	EMPR HSRC (2017) & CDA Guidelines: Application to Mining Dams (2019)	Review of the current design freeboard and design sludge levels is required. To facilitate the design update, the Sludge Impoundment surface should be surveyed to obtain average sludge deposition rates. Review of entire facility should be completed to address storage, life expectancy of the facility, and regulatory requirements.	RS	3	Q1 2022 UPDATE – Site investigation completed in Sept. 2021 to support design update planned for 2022-2023

7 CLOSING

We appreciate the opportunity to continue to provide our services to Teck Metals.

KLOHN CRIPPEN BERGER LTD.

25 Mar. 2022

Pamela Fines, P.Eng. Engineer of Record

Senior Reviewed by: Bill Chin, P.Eng.

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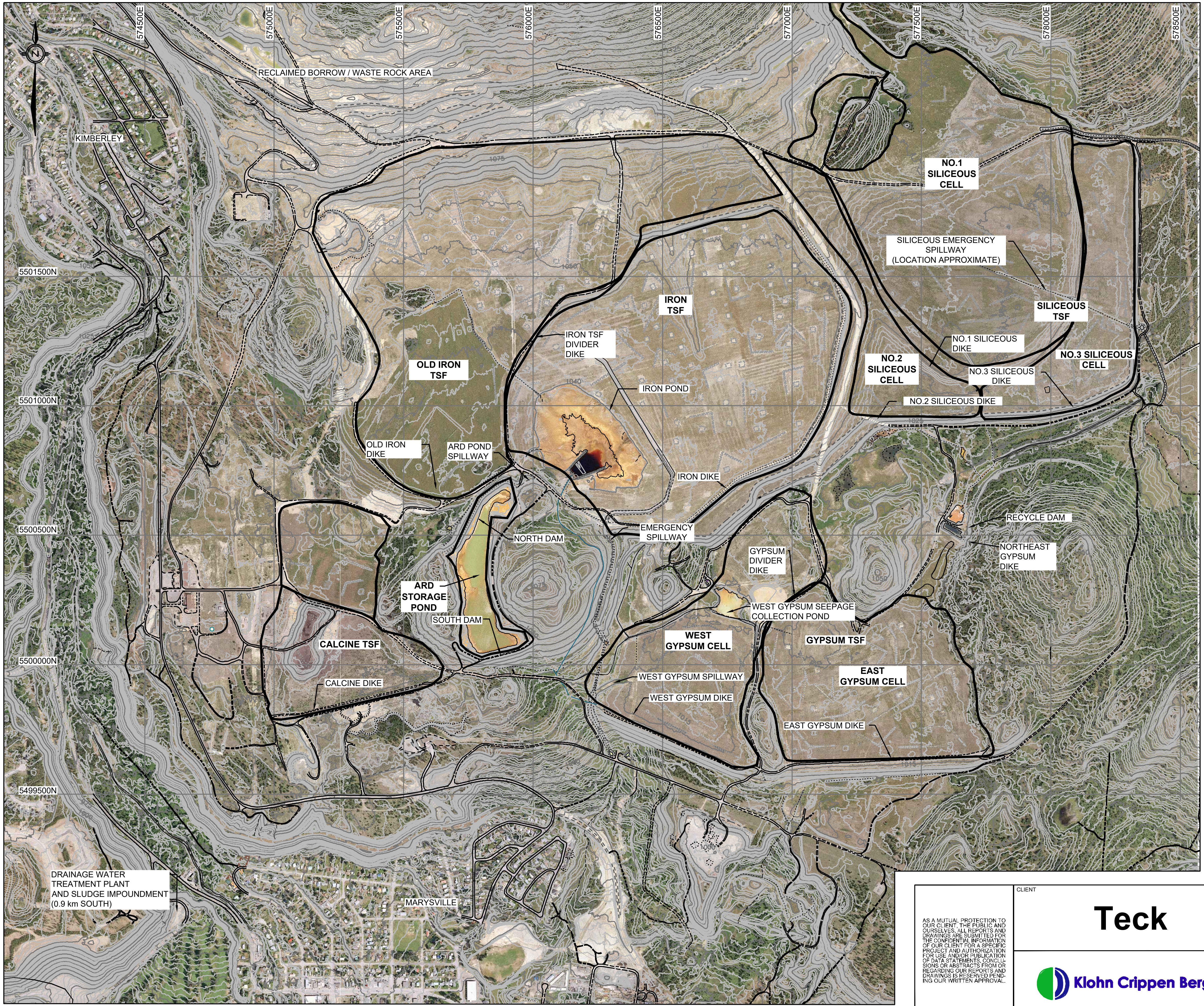
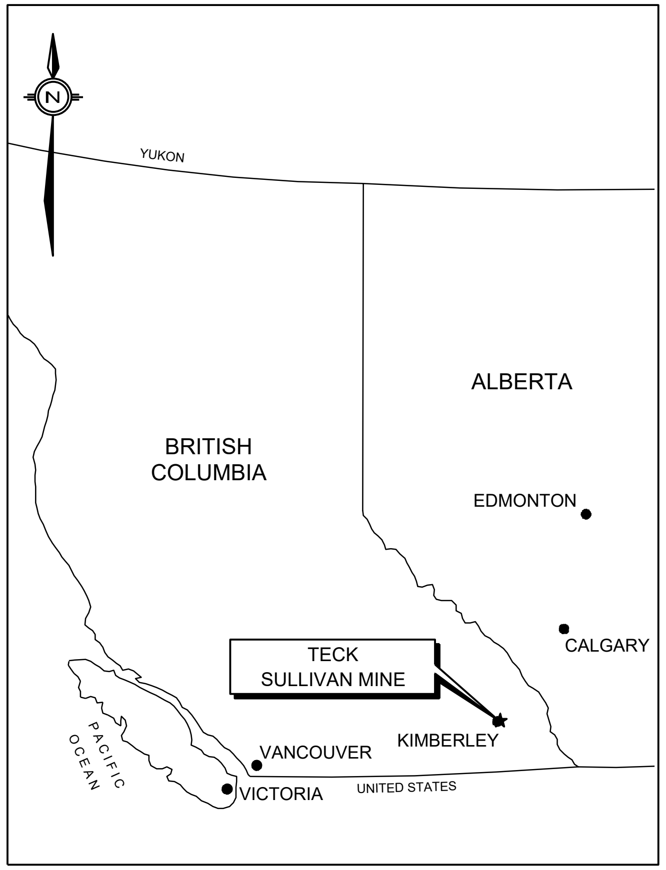
FIGURES





PROJECT LOCATION PLAN
N.T.S

NOTES:

1. SURFACE TOPOGRAPHY FROM LIDAR PROVIDED BY TECK METALS LTD. DATED DECEMBER 2012.
2. ELEVATIONS ARE GEODETIC.
3. MAP COORDINATE SYSTEM = U.T.M. (NAD 83). CONTOUR INTERVAL IS ONE METRE.
4. AERIAL PHOTO PROVIDED BY TECK METALS LTD. DATE: 2008.

SCALE 1:15 000 0 150 300 m

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CLIENT: Teck

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PROJECT: SULLIVAN MINE 2021 ANNUAL INSPECTION REPORT

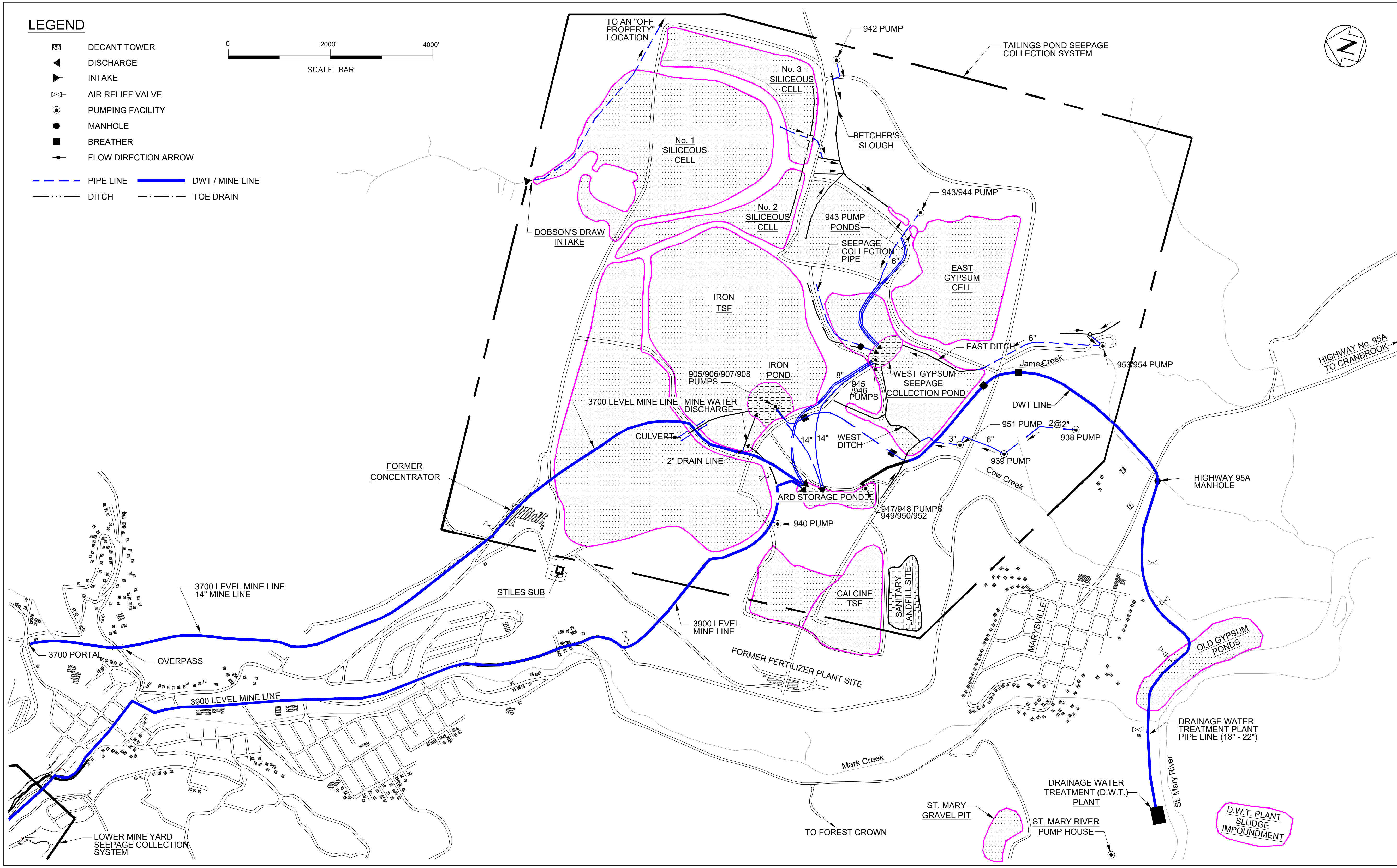
TITLE: LOCATION AND SITE PLAN

PROJECT No. A05807A21

FIG No. FIGURE 1

KCC-D-B

\\int.klohn.com\Proj\Data\AIEDM\A05807A21 TML 2021 Annual Inspection\400 Drawings\Annual Inspection\Figure 1 Location and Site Plan 2021.dwg Layout=Figure 1 October 25, 2021 7:22:47 AM



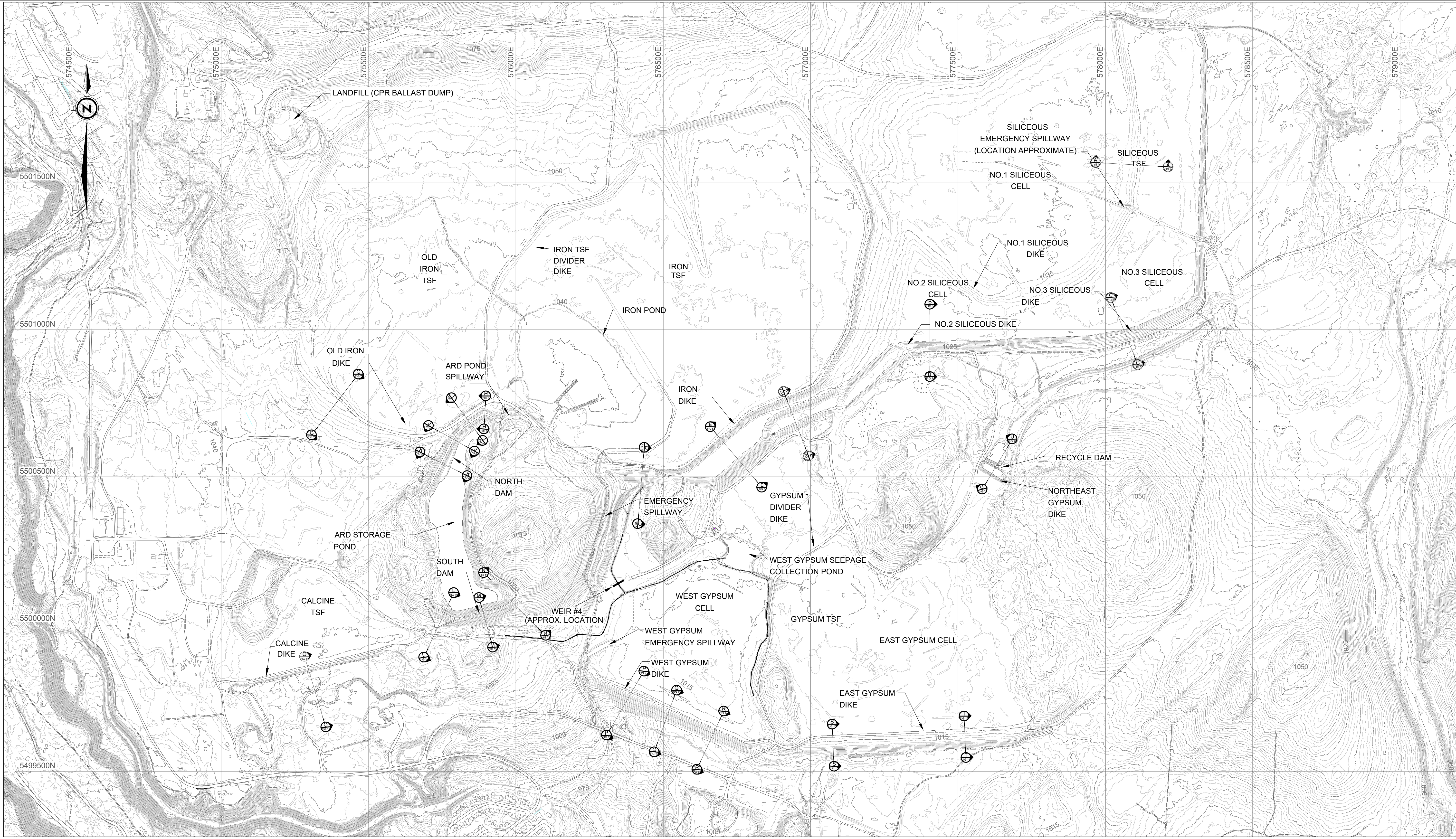
NOTES:

1. FROM TM Tech SERVICES DRAWING K100E3007 DATED FEB. 3, 2009, REV. 1.

SCALE 1:12 500 0 125 250 m

CLIENT	PROJECT
Teck	SULLIVAN MINE 2021 ANNUAL INSPECTION REPORT
Klohn Crippen Berger	TITLE: TAILINGS SEEPAGE COLLECTION AND DWT PLANT LOCATION
	PROJECT No. A05807A21 — FIG No. FIGURE 2

KCC-D-B



NOTES:

1. SURFACE TOPOGRAPHY FROM LIDAR PROVIDED BY TECK METALS LTD. DATED DECEMBER 2012.
2. ELEVATIONS ARE GEODETIC.
3. MAP COORDINATE SYSTEM = U.T.M. (NAD 83). CONTOUR INTERVAL IS ONE METRE.
4. LOCATIONS OF DESIGN SECTIONS ARE APPROXIMATE

SCALE 1:12 500 0 125 250 m

CLIENT: Teck

Klohn Crippen Berger

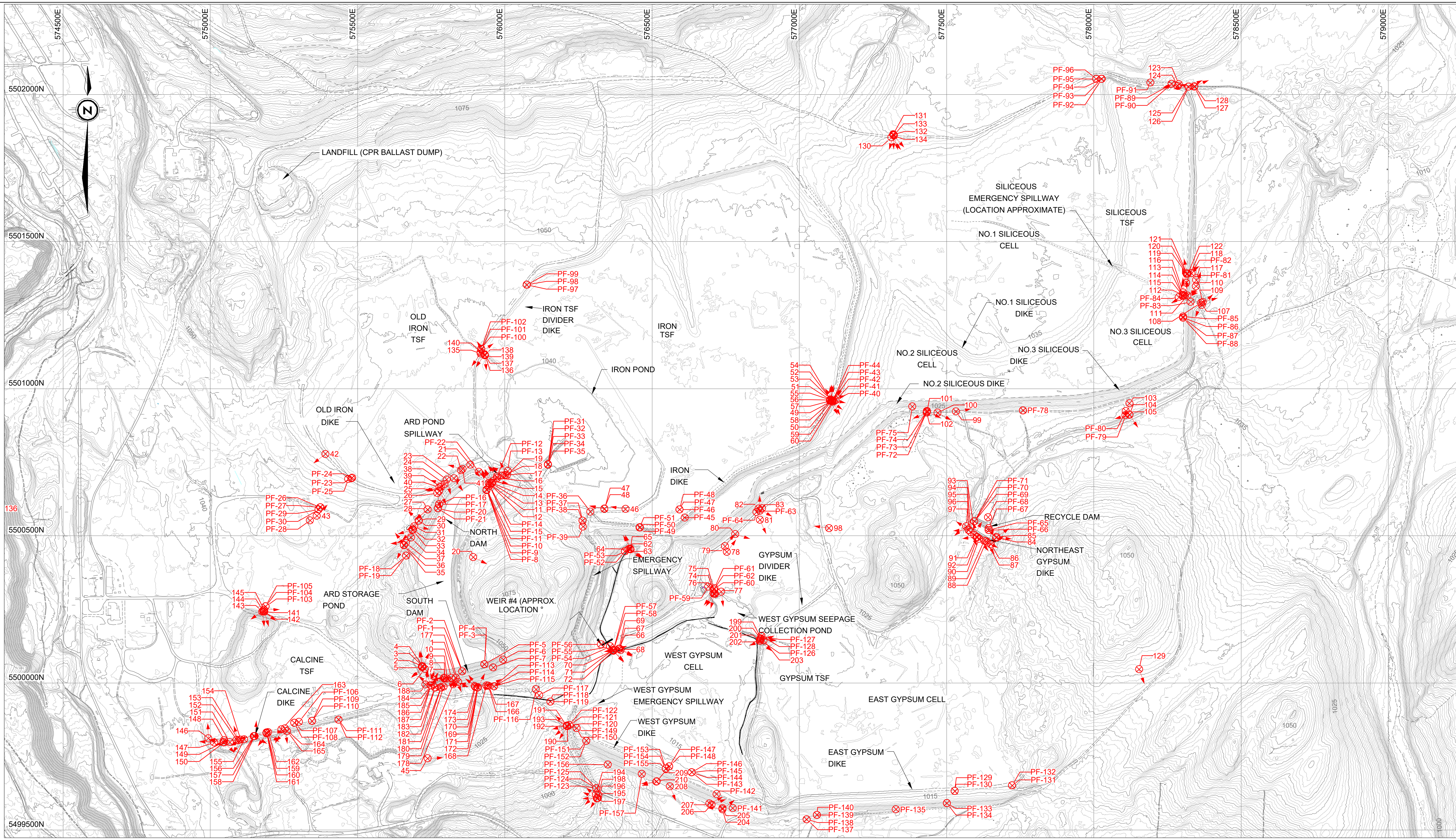
PROJECT: SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

TITLE: GENERAL ARRANGEMENT OF DESIGN SECTIONS

PROJECT No. A05807A21

FIG No. FIGURE 3

KCC-D-B



NOTES:

1. GENERAL TOPOGRAPHY FROM LIDAR DATED DECEMBER 2012.
2. ELEVATIONS ARE GEODETIC.
3. MAP COORDINATE SYSTEM = U.T.M. (NAD 83). CONTOUR INTERVAL IS ONE METRE.

LEGEND

LOCATION AND DIRECTION OF PHOTOGRAPHS TAKEN DURING ANNUAL INSPECTION

104 — PHOTO NUMBER

LOCATION WHERE PHOTO WAS TAKEN

DIRECTION OF VIEW

101 — PANORAMA

SCALE 1:12 500 0 125 250 m

CLIENT: Teck

Klohn Crippen Berger

PROJECT: SULLIVAN MINE 2021 ANNUAL INSPECTION REPORT

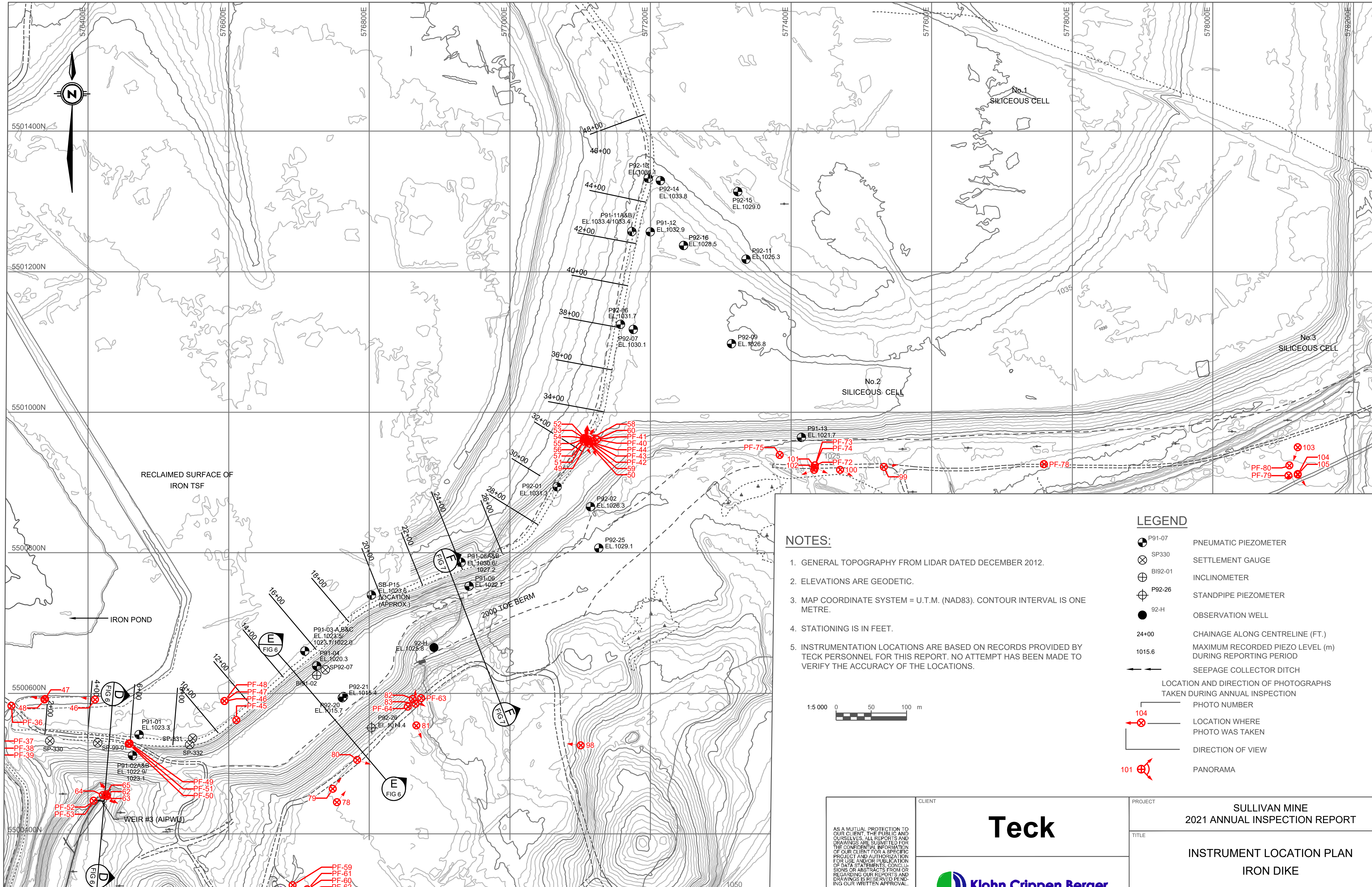
TITLE: GENERAL ARRANGEMENT OF TAILINGS FACILITIES, PHOTO LOCATIONS

PROJECT No. A05807A21

FIG No. FIGURE 4

KCC-D-B

\\int.klohn.com\ProjData\AIEDM\A05807A21 TML 2021 Annual Inspection\400 Drawings\Annual Inspection\Figure 4_Photo Location 2021.dwg Layout=Figure 4 Monday, November 8, 2021 7:00:19 AM



NOTES:

1. GENERAL TOPOGRAPHY FROM LIDAR DATED DECEMBER 2012.
2. ELEVATIONS ARE GEODETIC.
3. MAP COORDINATE SYSTEM = U.T.M. (NAD83). CONTOUR INTERVAL IS ONE METRE.
4. STATIONING IS IN FEET.
5. INSTRUMENTATION LOCATIONS ARE BASED ON RECORDS PROVIDED BY TECK PERSONNEL FOR THIS REPORT. NO ATTEMPT HAS BEEN MADE TO VERIFY THE ACCURACY OF THE LOCATIONS.

1:5 000 0 50 100 m

LEGEND

P91-07	PNEUMATIC PIEZOMETER
SP330	SETTLEMENT GAUGE
BI92-01	INCLINOMETER
P92-26	STANDPIPE PIEZOMETER
92-H	OBSERVATION WELL
24+00	CHAINAGE ALONG CENTRELINE (FT.)
1015.6	MAXIMUM RECORDED PIEZO LEVEL (m) DURING REPORTING PERIOD
	SEEPAGE COLLECTOR DITCH

LOCATION AND DIRECTION OF PHOTOGRAPHS TAKEN DURING ANNUAL INSPECTION

104	PHOTO NUMBER
	LOCATION WHERE PHOTO WAS TAKEN
	DIRECTION OF VIEW
101	PANORAMA

CLIENT: Teck

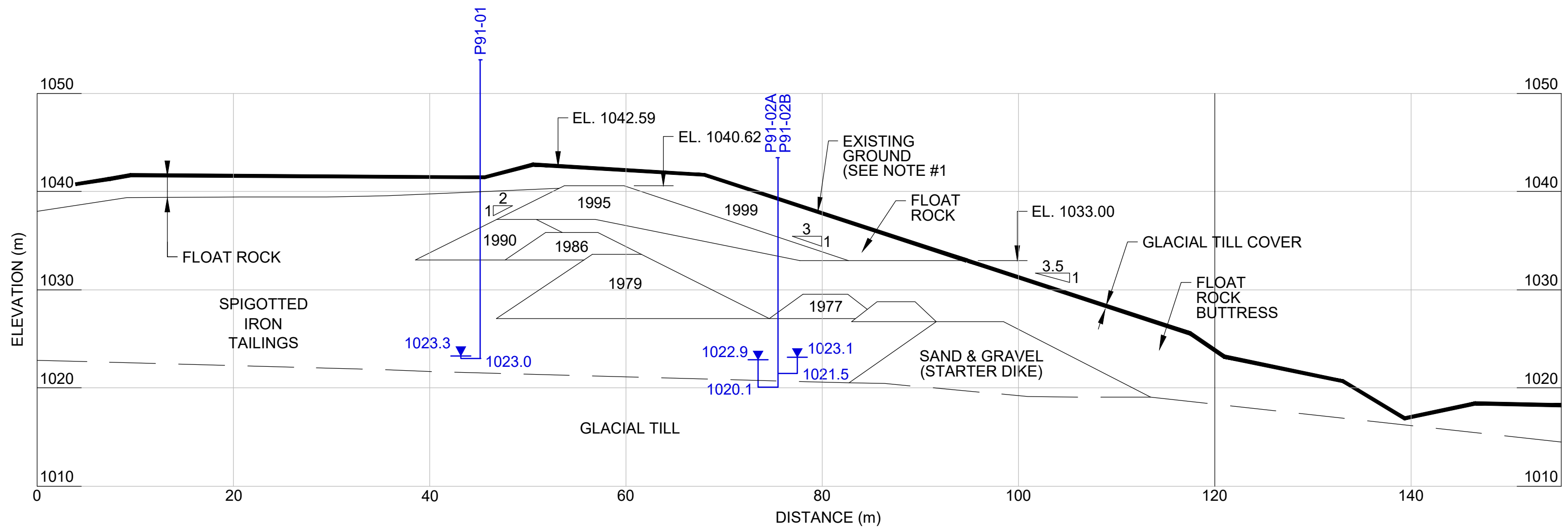
Klohn Crippen Berger

PROJECT: SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

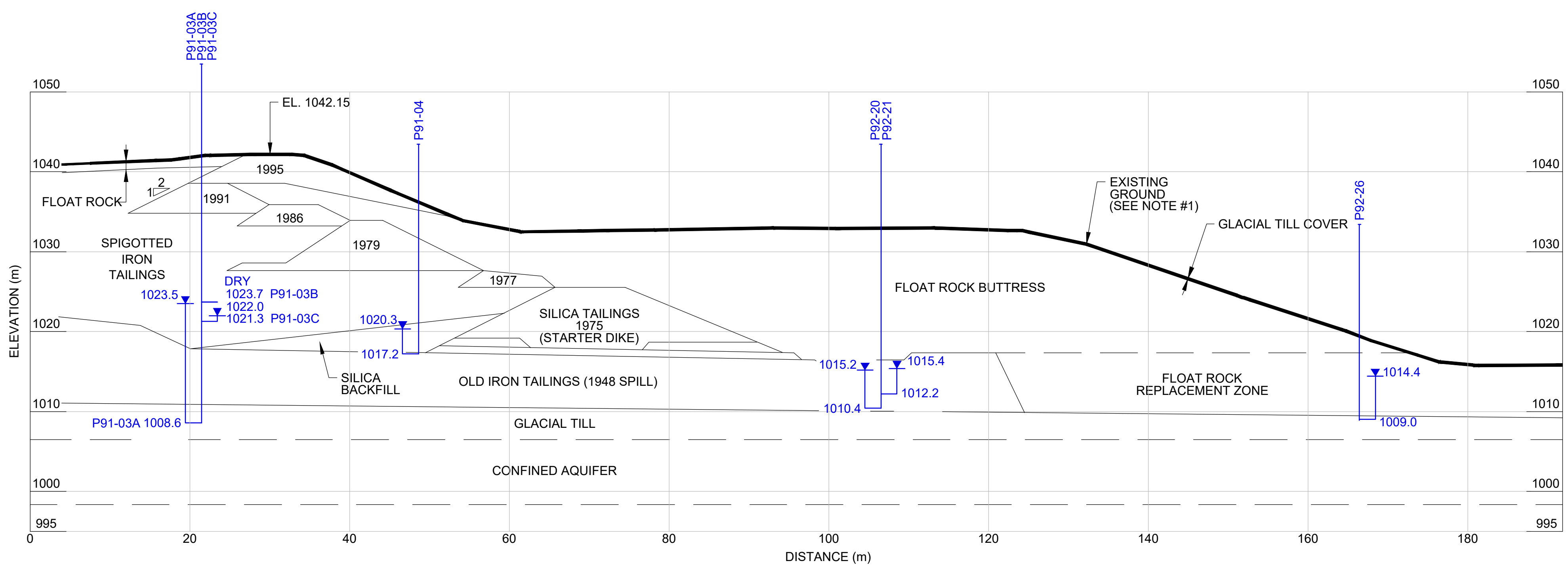
TITLE: INSTRUMENT LOCATION PLAN
IRON DIKE

PROJECT No. A05807A21

FIG No. FIGURE 5



D SECTION
FIG 5 SCALE = 1:750



E SECTION
FIG 5 SCALE = 1:750

NOTES:

1. SURFACE TOPOGRAPHY FROM LIDAR PROVIDED BY TECK METALS LTD. DATED DECEMBER 2012.
2. SUBSURFACE LITHOLOGY TRACED FROM 1995 ACTIVE IRON DIKE - GEOTECHNICAL DESIGN OF 1995 DIKE RAISE.

LEGEND:

P91-01 PIEZOMETER

1023.8 MAXIMUM RECORDED PIEZO LEVEL (m) DURING REPORTING PERIOD

1021.4 PIEZOMETER TIP

1:750 0 7.5 15 m

CLIENT
Teck

Klohn Crippen Berger

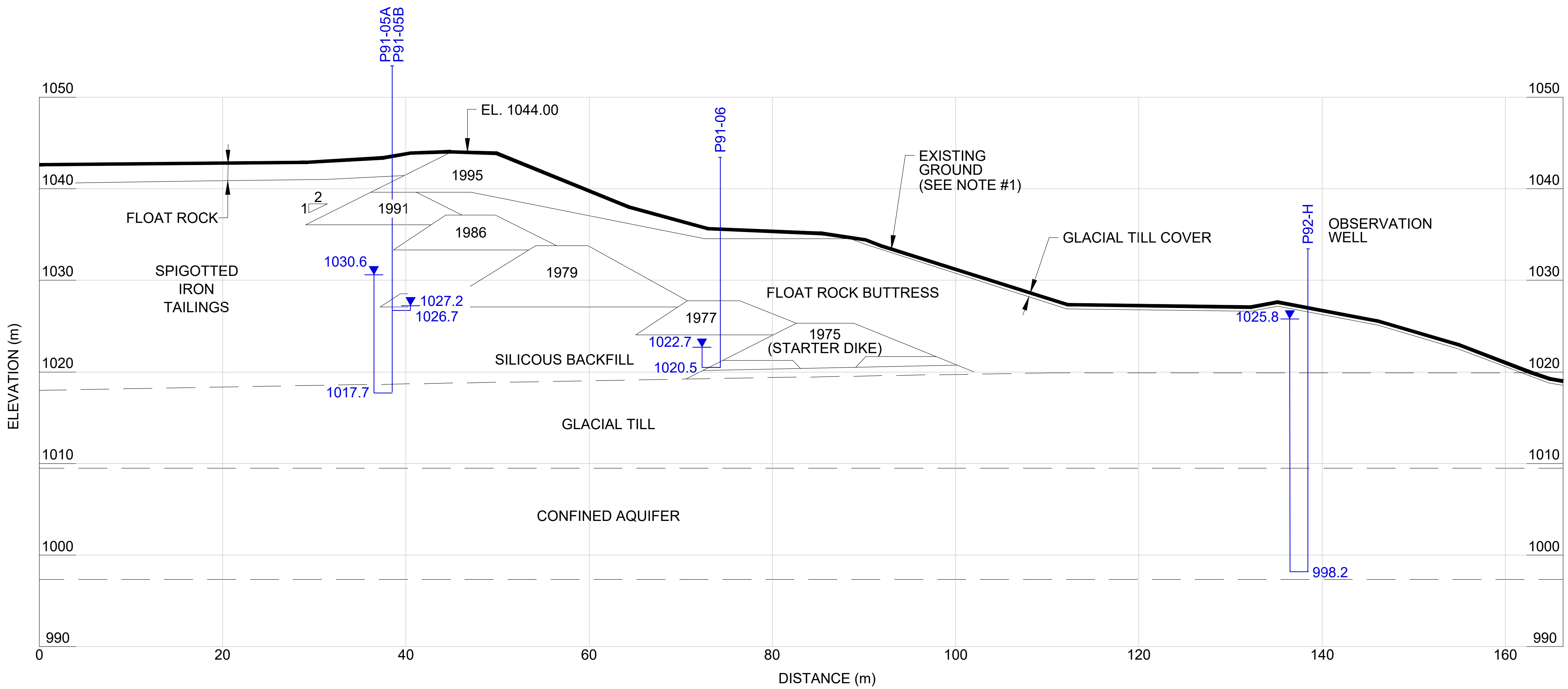
PROJECT
SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

TITLE
IRON DIKE
SECTIONS D AND E

PROJECT No. A05807A21

FIG No. FIGURE 6

KCC-D-B



F
FIG 5
SECTION
SCALE = 1:500

NOTES:

1. SURFACE TOPOGRAPHY FROM LIDAR PROVIDED BY TECK METALS LTD. DATED DECEMBER 2012.
2. SUBSURFACE LITHOLOGY TRACED FROM 1995 ACTIVE IRON DIKE - GEOTECHNICAL DESIGN OF 1995 DIKE RAISE.

LEGEND:

P91-01 PIEZOMETER

1023.8 MAXIMUM RECORDED PIEZO LEVEL (m) DURING REPORTING PERIOD

1021.4 PIEZOMETER TIP

1:750 0 7.5 15 m

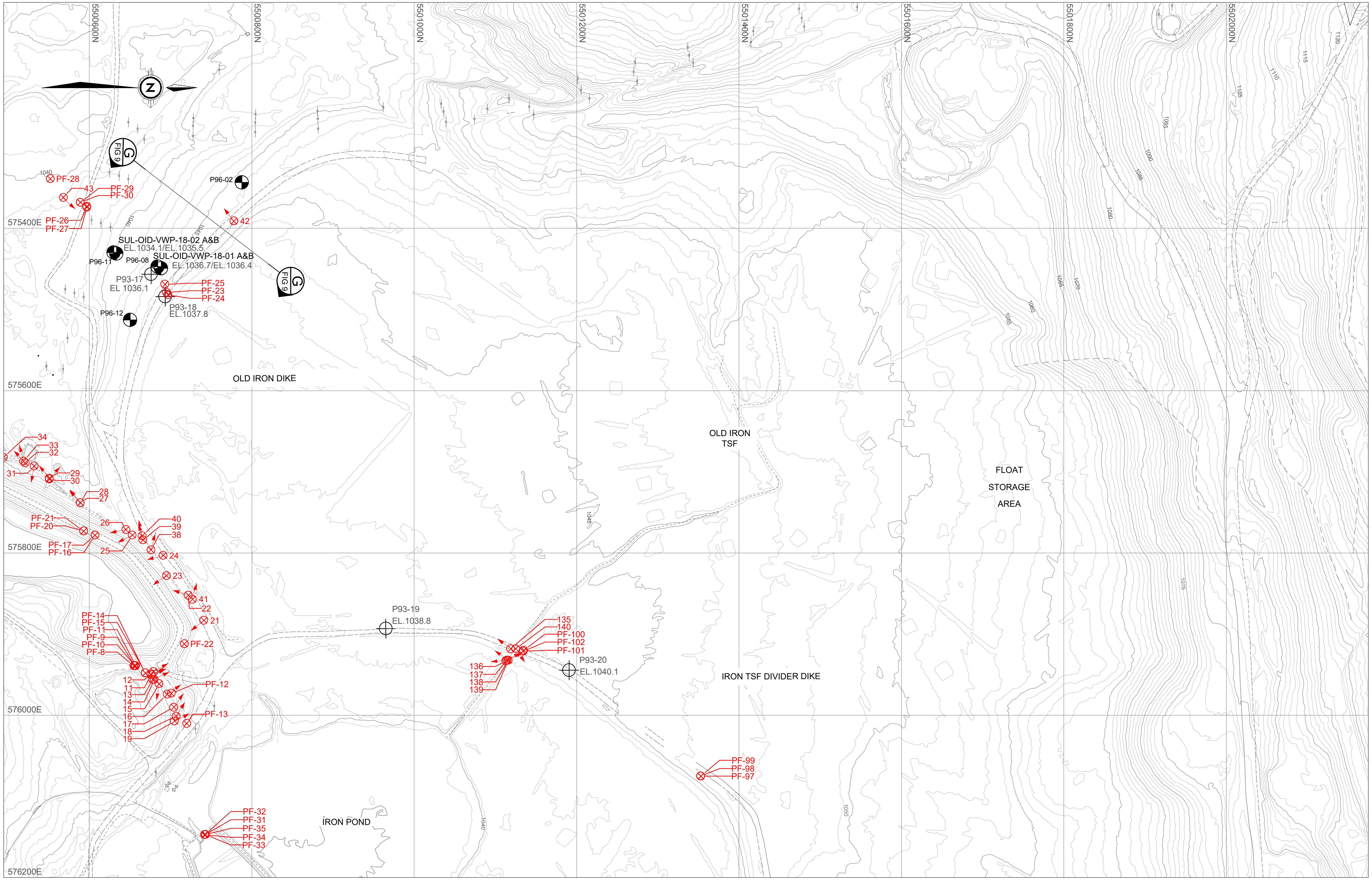
CLIENT
Teck
Klohn Crippen Berger

PROJECT
SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

TITLE
IRON DIKE
SECTION F

PROJECT No. A05807A21
FIG No. FIGURE 7

\\int.klohn.com\ProjData\A\EDM\A05807A21 TML 2021 Annual Inspection\400 Drawings\Annual Inspection\Figure 6,7_Iron Dike Sections 2021.dwg Layout=Figure 7 October 25, 2021 5:10:48 AM



NOTES:

1. GENERAL TOPOGRAPHY FROM LIDAR DATED DECEMBER 2012.
2. ELEVATIONS ARE GEODETIC.
3. MAP COORDINATE SYSTEM = U.T.M. (NAD83).
4. INSTRUMENTATION LOCATIONS ARE BASED ON RECORDS PROVIDED BY TECK PERSONNEL FOR THIS REPORT. NO ATTEMPT HAS BEEN MADE TO VERIFY THE ACCURACY OF THE LOCATIONS.

1:5 000 0 50 100 m

LEGEND:

SUL-OID-VWP-18-01A&B	VIBRATING WIRE PIEZOMETER
P205	STANDPIPE PIEZOMETER
P91-07	PNEUMATIC PIEZOMETER
EL.1032.1	MAXIMUM RECORDED PIEZO LEVEL (m) DURING REPORTING PERIOD

LOCATION AND DIRECTION OF PHOTOGRAPHS TAKEN DURING ANNUAL INSPECTION

104	PHOTO NUMBER
	LOCATION WHERE PHOTO WAS TAKEN
	DIRECTION OF VIEW
101	PANORAMA

CLIENT: Teck

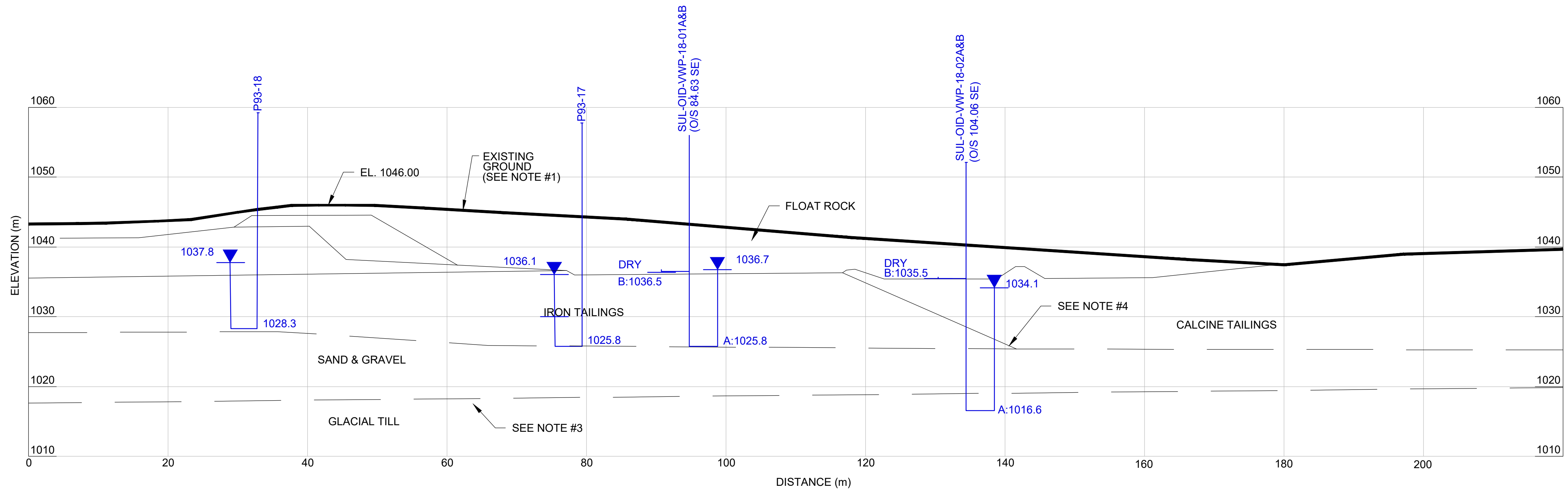
Klohn Crippen Berger

PROJECT: SULLIVAN MINE 2021 ANNUAL INSPECTION REPORT

TITLE: INSTRUMENT LOCATION PLAN OLD IRON & IRON TSF DIVIDER DIKES

PROJECT No. A05807A21

FIG No. FIGURE 8



G FIG 8 SECTION
SCALE = 1:750

NOTES:

1. SURFACE TOPOGRAPHY FROM LIDAR PROVIDED BY TECK METALS LTD. DATED DECEMBER 2012.
2. SUBSURFACE LITHOLOGY TRACED FROM 1994 SULLIVAN MINE STABILITY REVIEW OF SOUTHWEST LIMB.
3. APPROXIMATE ELEVATION OF GLACIAL TILL SURFACE FROM BOREHOLE 92-F (OFFSET 200 FT WEST).
4. APPROXIMATE LOCATION OF "SOUTH DAM", AN EARLY DYKE WHICH EXPERIENCED TWO FAILURES IN 1926 AND 1930, FROM 1964 TOPOGRAPHY. THE SOUTHWEST LIMB (WHICH INCLUDES SECTION G) OF THE IRON DYKE WAS PROBABLY THE FINAL INCREMENTAL RAISE OF THE "SOUTH DAM" ACCORDING TO THE 1994 SULLIVAN MINE STABILITY REVIEW OF SOUTHWEST LIMB.

LEGEND:

P91-01 PIEZOMETER

1023.8 MAXIMUM RECORDED PIEZO LEVEL (m) DURING REPORTING PERIOD

1021.4 PIEZOMETER TIP

1:750 0 7.5 15 m

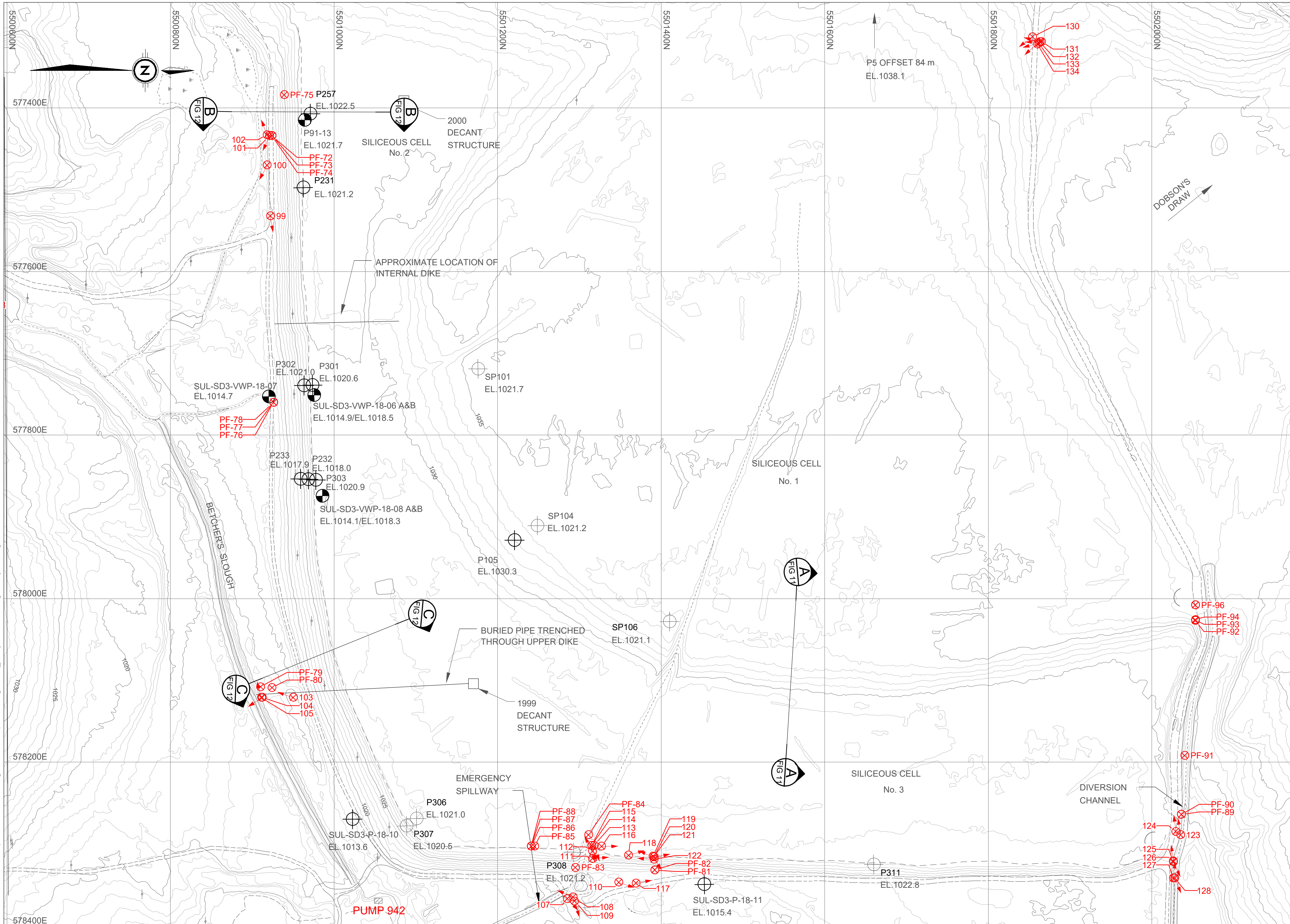
CLIENT
Teck

Klohn Crippen Berger

PROJECT
SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

TITLE
OLD IRON DIKE
SECTION G

PROJECT No. A05807A21
FIG No. FIGURE 9



NOTES:

1. GENERAL TOPOGRAPHY FROM LIDAR DATED DECEMBER 2012.
2. ELEVATIONS ARE GEODETIC.
3. MAP COORDINATE SYSTEM = U.T.M. (NAD83).
4. INSTRUMENTATION LOCATIONS ARE BASED ON RECORDS PROVIDED BY TECK PERSONNEL FOR THIS REPORT. NO ATTEMPT HAS BEEN MADE TO VERIFY THE ACCURACY OF THE LOCATIONS.
5. SPILLWAY LOCATIONS ARE APPROXIMATE.

LEGEND:

SUL-SD3-VWP-18-06A&B — VIBRATING WIRE PIEZOMETER

P91-07 — PNEUMATIC PIEZOMETER

P205 — STANDPIPE PIEZOMETER

SP206 — STANDPIPE PIEZOMETER AND SETTLEMENT PLATE

EL.1032.1 — MAXIMUM RECORDED PIEZO LEVEL (m) DURING REPORTING PERIOD

LOCATION AND DIRECTION OF PHOTOS TAKEN DURING ANNUAL INSPECTION

104 — PHOTO NUMBER; LOCATION WHERE PHOTO WAS TAKEN; DIRECTION OF VIEW

101 — PANORAMA

1:5 000 0 50 100 m

CLIENT: Teck

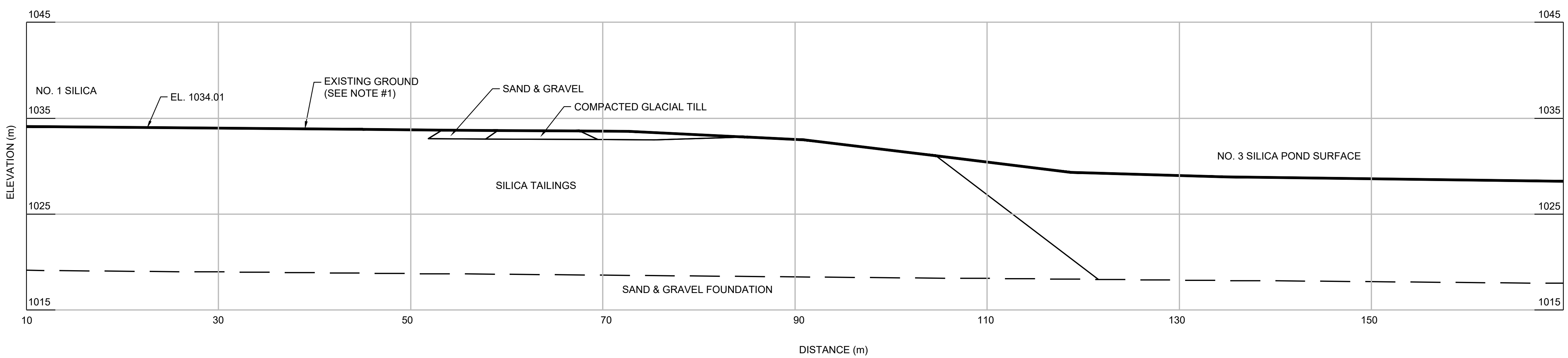
Klohn Crippen Berger

PROJECT: SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

TITLE: INSTRUMENT LOCATION PLAN
NO. 1, 2 & 3
SILICEOUS DIKES

PROJECT No. A05807A21

FIG No. FIGURE 10



A SECTION
FIG 10
SCALE = 1:500

NOTES:

1. SURFACE TOPOGRAPHY FROM LIDAR PROVIDED BY TECK METALS LTD. DATED DECEMBER 2012.
2. SUBSURFACE LITHOLOGY TRACED FROM 1994 SULLIVAN MINE STABILITY REVIEW OF SILICA DYKES.

1:500 0 5 10 m

CLIENT
Teck

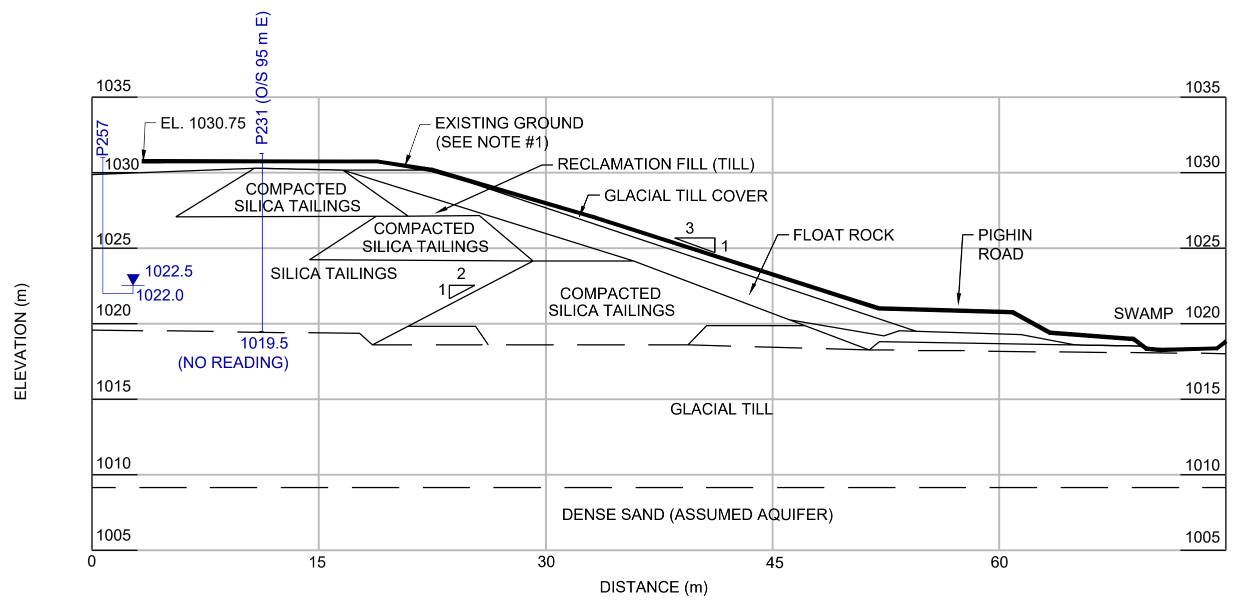
Klohn Crippen Berger

PROJECT
SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

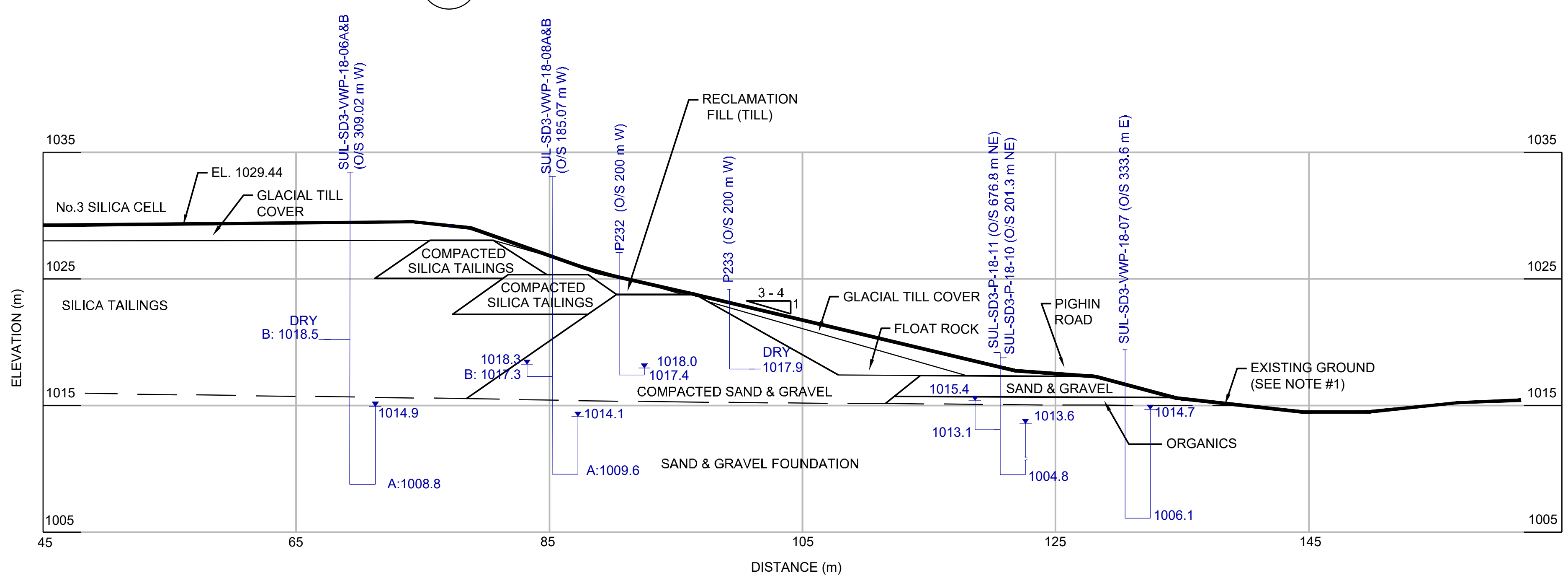
TITLE
NO. 1 SILICEOUS DIKE
SECTION A

PROJECT No. A05807A21

FIG No. FIGURE 11



B SECTION
FIG 10 SCALE = 1:500



C SECTION
FIG 10 SCALE = 1:500

NOTES:

1. GENERAL TOPOGRAPHY FROM LIDAR DATED DECEMBER 2012.
2. SUBSURFACE LITHOLOGY TRACED FROM 1994 SULLIVAN MINE STABILITY REVIEW OF SILICA DYKES.

LEGEND:

P91-01 PIEZOMETER

1023.8 MAXIMUM RECORDED PIEZO LEVEL (m) DURING REPORTING PERIOD

1021.4 PIEZOMETER TIP

1:500 0 5 10 m

CLIENT
Teck

Klohn Crippen Berger

PROJECT
SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

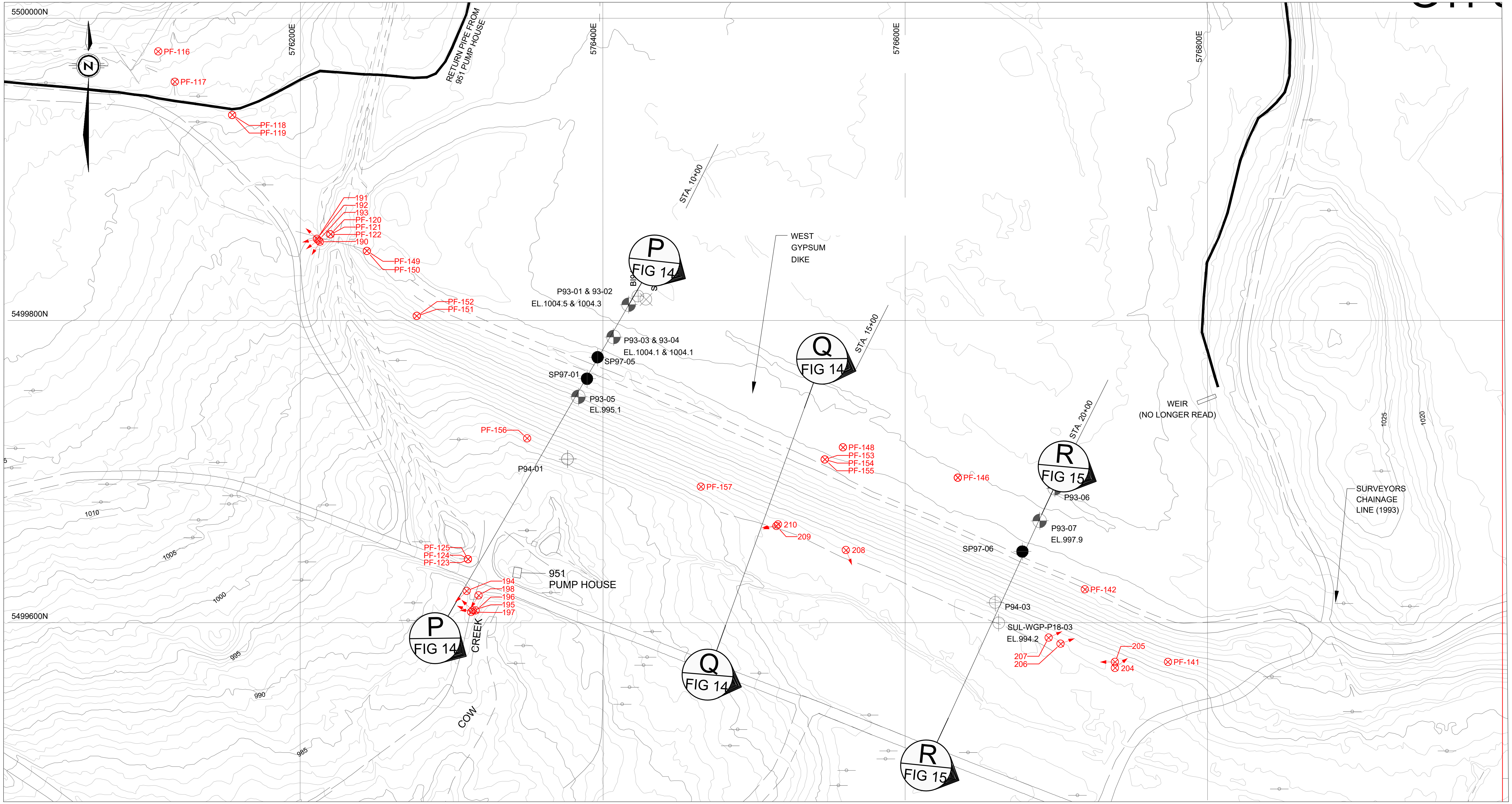
TITLE
NO. 2 AND NO. 3 SILICEOUS DIKES
SECTIONS B AND C

PROJECT No. A05807A21

FIG No. FIGURE 12

KCC-D-B

\\int.klohn.com\ProjData\AIEDM\A05807A21 TML 2021 Annual Inspection\400 Drawings\Annual Inspection\Figure 11,12_Siliceous TSF Sections 2021.dwg Layout=Figure 12 October 25, 2021 5:59:55 AM



NOTES:

1. GENERAL TOPOGRAPHY FROM LIDAR DATED DECEMBER 2012.
2. ELEVATIONS ARE GEODETIC.
3. MAP COORDINATE SYSTEM = U.T.M. (NAD83). CONTOUR INTERVAL IS ONE METRE.
4. STATIONING IS IN FEET.
5. INSTRUMENTATION LOCATIONS ARE BASED ON RECORDS PROVIDED BY TECK NO ATTEMPT HAS BEEN MADE TO VERIFY THE ACCURACY OF THE LOCATIONS.

LEGEND:

P93-15	1993 STANDPIPE PIEZOMETER
P94-01	STANDPIPE PIEZOMETER
SP97-01	SETTLEMENT PLATE
BI94-02	INCLINOMETER
S94-02	SONDEX SETTLEMENT GAUGE
EL.1032.1	MAXIMUM RECORDED PIEZO LEVEL (m) DURING REPORTING PERIOD

LOCATION AND DIRECTION OF PHOTOGRAPHS TAKEN DURING ANNUAL INSPECTION

104 PHOTO NUMBER

LOCATION WHERE PHOTO WAS TAKEN

DIRECTION OF VIEW

101 PANORAMA

1:2 500 0 25 50 m

CLIENT
Teck

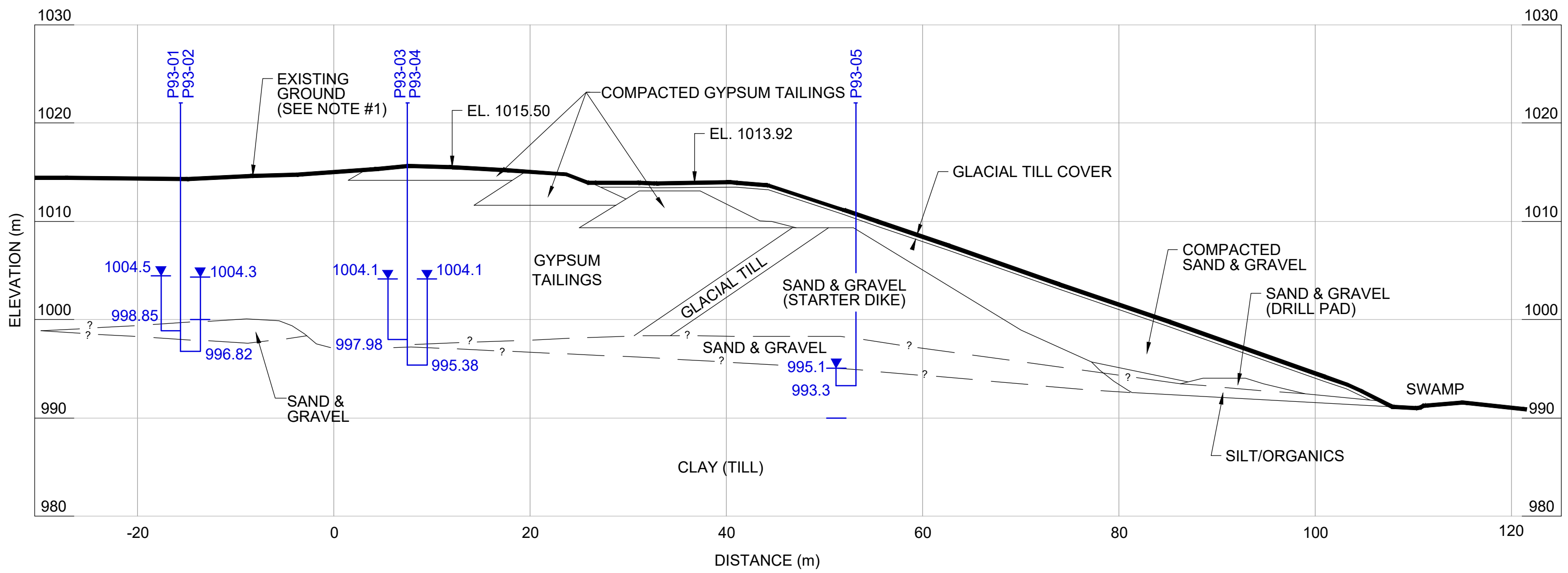
Klohn Crippen Berger

PROJECT
SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

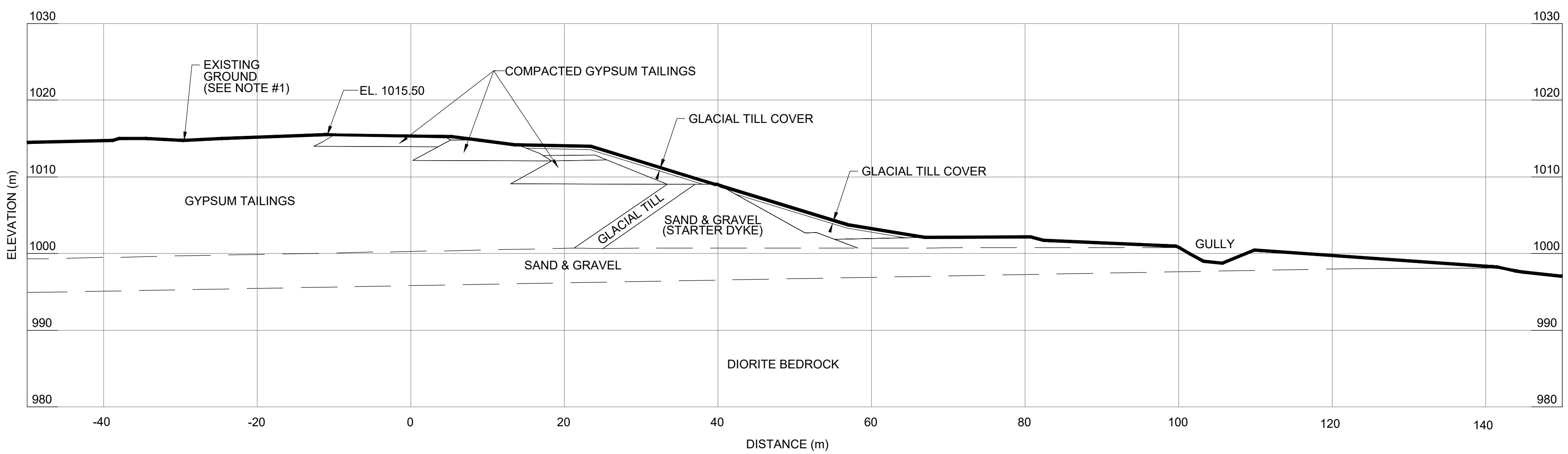
TITLE
INSTRUMENT LOCATION PLAN
WEST GYPSUM DIKE

PROJECT No. A05807A21

FIG No. FIGURE 13



P SECTION
FIG 13 SCALE = 1:750



Q SECTION
FIG 13 SCALE = 1:750

NOTES:

1. SURFACE TOPOGRAPHY FROM LIDAR PROVIDED BY TECK METALS LTD. DATED DECEMBER 2012.
2. SUBSURFACE LITHOLOGY TRACED FROM 1993 SULLIVAN MINE STABILITY REVIEW OF GYPSUM DYKES.

LEGEND:

P93-01 PIEZOMETER

1006.30 MAXIMUM RECORDED PIEZO LEVEL (m) DURING REPORTING PERIOD

1000.2 PIEZOMETER TIP

1:750 0 7.5 15 m

CLIENT
Teck

Klohn Crippen Berger

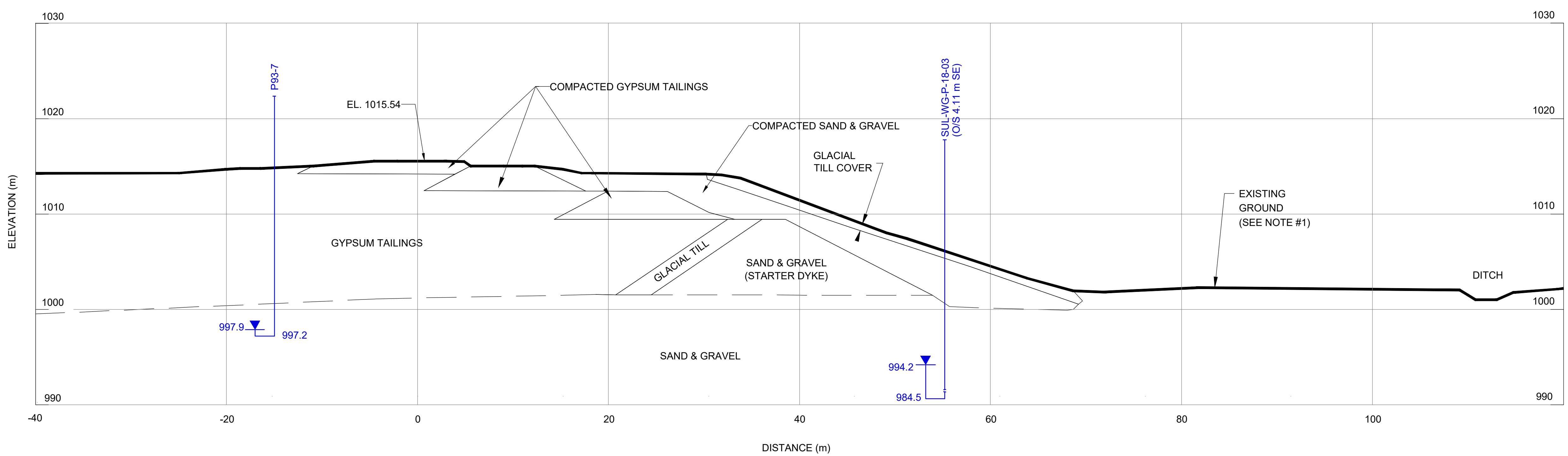
PROJECT
SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

TITLE
WEST GYPSUM DIKE
SECTIONS P AND Q

PROJECT No. A05807A21

FIG No. FIGURE 14

KCC-D-B



R
FIG 13
SECTION
SCALE = 1:500

NOTES:

1. SURFACE TOPOGRAPHY FROM LIDAR PROVIDED BY TECK METALS LTD. DATED DECEMBER 2012.
2. SUBSURFACE LITHOLOGY TRACED FROM 1993 SULLIVAN MINE STABILITY REVIEW OF GYPSUM DYKES.

LEGEND:

P93-01 PIEZOMETER

1006.30 MAXIMUM RECORDED PIEZO LEVEL (m) DURING REPORTING PERIOD

1000.2 PIEZOMETER TIP

1:500 0 5 10 m

CLIENT

Teck

Klohn Crippen Berger

PROJECT

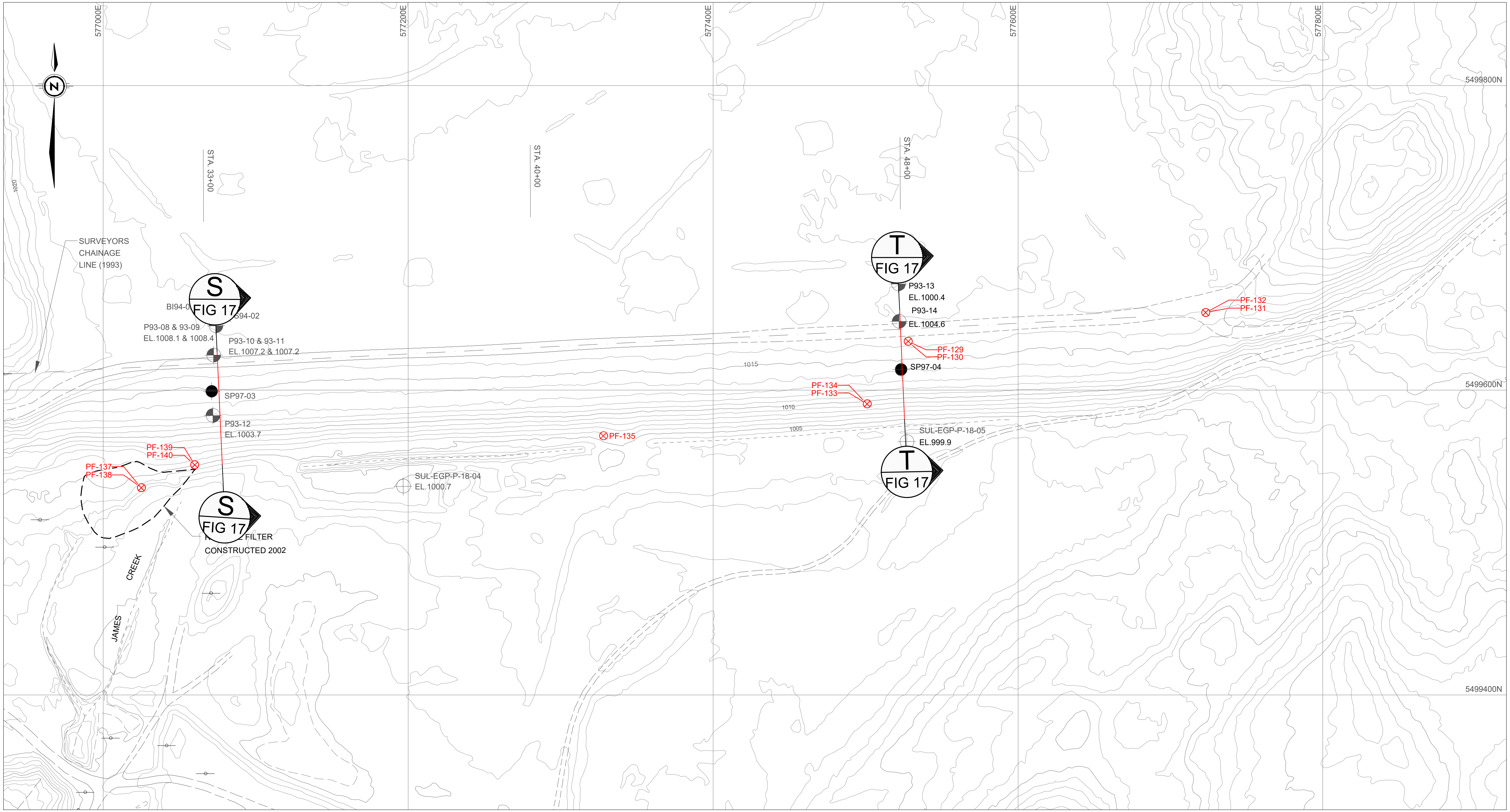
SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

TITLE

WEST GYPSUM DIKE
SECTION R

PROJECT No. A05807A21

FIG No. FIGURE 15



NOTES:

1. GENERAL TOPOGRAPHY FROM LIDAR DATED DECEMBER 2012.
2. ELEVATIONS ARE GEODETIC.
3. MAP COORDINATE SYSTEM = U.T.M. (NAD83). CONTOUR INTERVAL IS ONE METRE.
4. STATIONING IS IN FEET.
5. INSTRUMENTATION LOCATIONS ARE BASED ON RECORDS PROVIDED BY TECK NO ATTEMPT HAS BEEN MADE TO VERIFY THE ACCURACY OF THE LOCATIONS.

LEGEND:

P93-15	1993 STANDPIPE PIEZOMETER
P94-01	STANDPIPE PIEZOMETER
SP97-01	SETTLEMENT PLATE
BI94-02	INCLINOMETER
S94-02	SONDEX SETTLEMENT GAUGE
EL.1032.1	MAXIMUM RECORDED PIEZO LEVEL (m) DURING REPORTING PERIOD

LOCATION AND DIRECTION OF PHOTOGRAPHS TAKEN DURING ANNUAL INSPECTION

- PHOTO NUMBER
- 104 LOCATION WHERE PHOTO WAS TAKEN
- DIRECTION OF VIEW
- PANORAMA

1:2 500 0 25 50 m

CLIENT: Teck

Klohn Crippen Berger

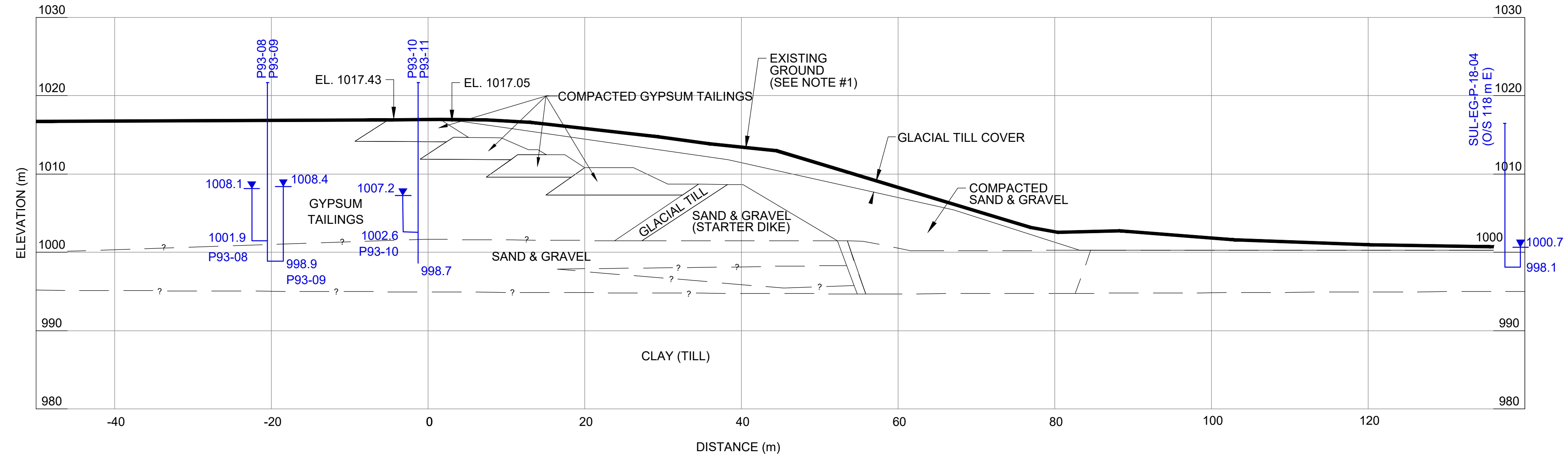
PROJECT: SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

TITLE: INSTRUMENT LOCATION PLAN
EAST GYPSUM DIKE

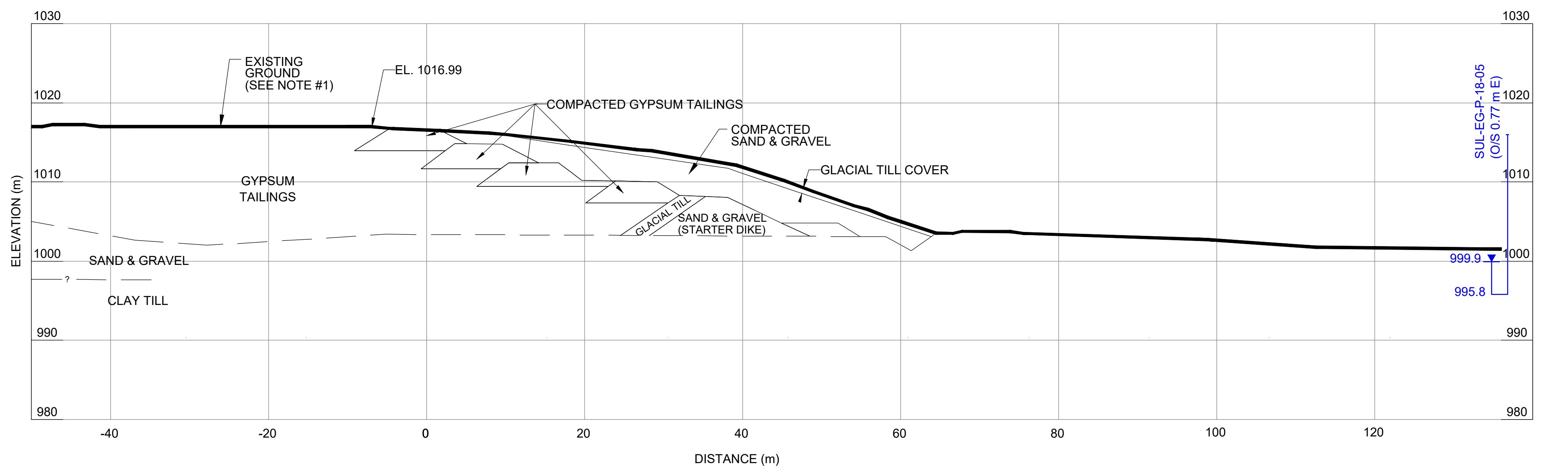
PROJECT No. A05807A21

FIG No. FIGURE 16

KCC-D-B



S SECTION
FIG 16 SCALE = 1:750



T SECTION
FIG 16 SCALE = 1:750

NOTES:

1. SURFACE TOPOGRAPHY FROM LIDAR PROVIDED BY TECK METALS LTD. DATED DECEMBER 2012.
2. SUBSURFACE LITHOLOGY TRACED FROM 1993 SULLIVAN MINE STABILITY REVIEW OF GYPSUM DYKES.

LEGEND:

P93-01 PIEZOMETER

1006.30 MAXIMUM RECORDED PIEZO LEVEL (m) DURING REPORTING PERIOD

1000.2 PIEZOMETER TIP

1:750 0 7.5 15 m

CLIENT: Teck

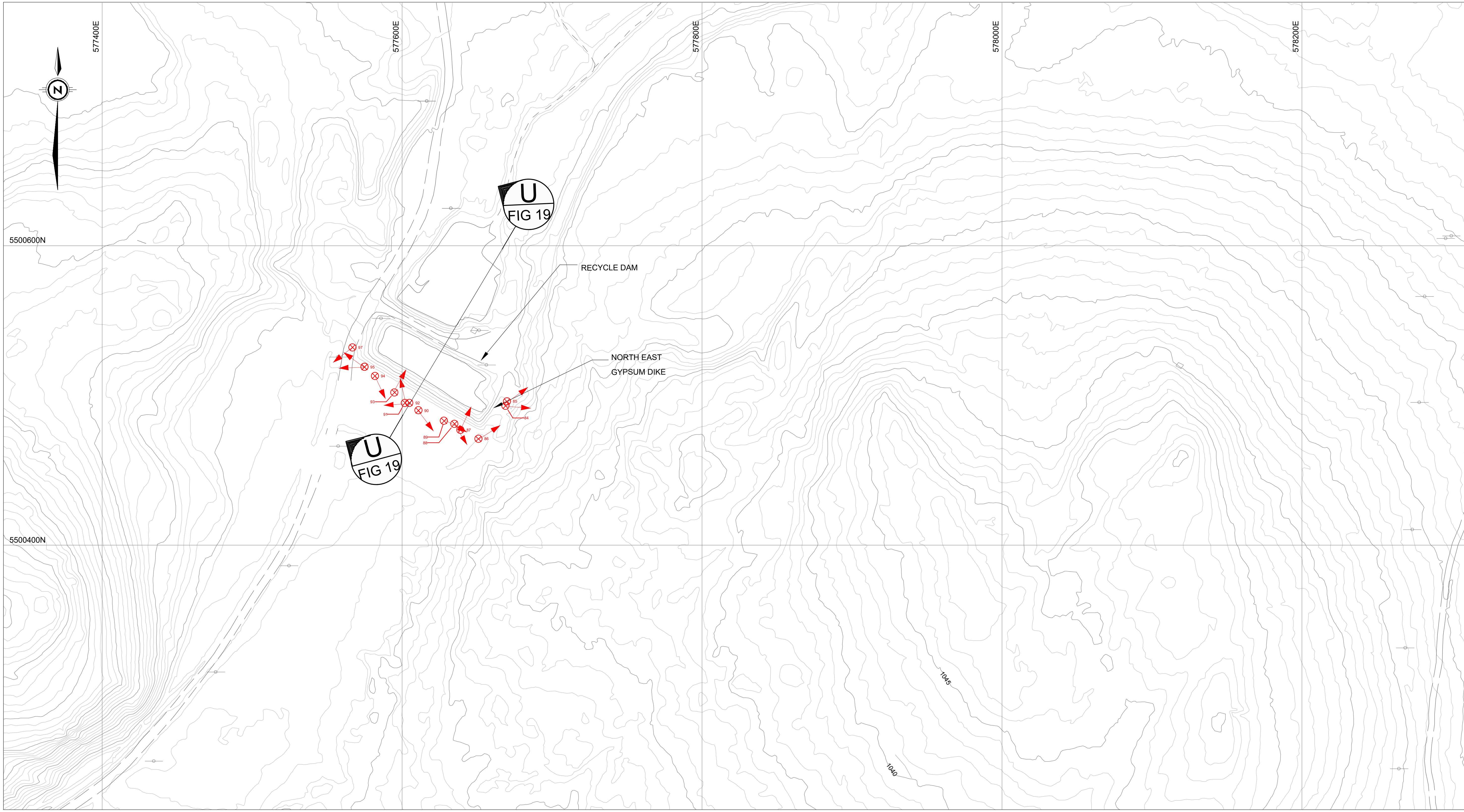
Klohn Crippen Berger

PROJECT: SULLIVAN MINE
2021 ANNUAL INPECTION REPORT

TITLE: EAST GYPSUM DIKE
SECTIONS S AND T

PROJECT No. A05807A21

FIG No. FIGURE 17



NOTES:

1. GENERAL TOPOGRAPHY FROM LIDAR DATED DECEMBER 2012.
2. ELEVATIONS ARE GEODETIC.
3. MAP COORDINATE SYSTEM = U.T.M. (NAD83). CONTOUR INTERVAL IS ONE METRE.
4. INSTRUMENTATION LOCATIONS ARE BASED ON RECORDS PROVIDED BY TECK PERSONNEL FOR THIS REPORT. NO ATTEMPT HAS BEEN MADE TO VERIFY THE ACCURACY OF THE LOCATIONS.

LEGEND:

LOCATION AND DIRECTION OF PHOTOGRAPHS TAKEN DURING ANNUAL INSPECTION

104 — PHOTO NUMBER

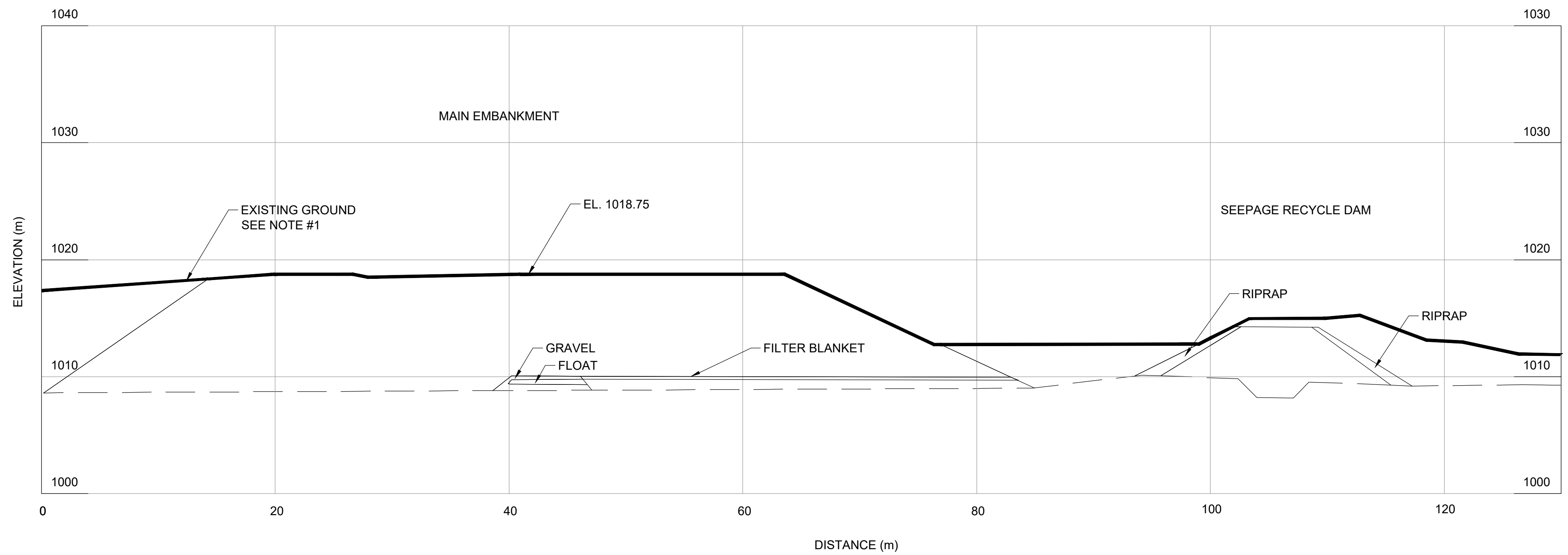
LOCATION WHERE PHOTO WAS TAKEN

DIRECTION OF VIEW

101 — PANORAMA

1:2 500 0 25 50 m

CLIENT: Teck	PROJECT: SULLIVAN MINE 2021 ANNUAL INSPECTION REPORT
Klohn Crippen Berger	TITLE: INSTRUMENT LOCATION PLAN NORTHEAST GYPSUM DIKE AND RECYCLE DAM
PROJECT No. A05807A21	FIG No. FIGURE 18



U SECTION
FIG 18 SCALE = 1:500.

NOTES:

1. SURFACE TOPOGRAPHY FROM LIDAR PROVIDED BY TECK METALS LTD. DATED DECEMBER 2012.
2. SUBSURFACE LITHOLOGY TRACED FROM REPORT ON 1985 CONSTRUCTION ACTIVITIES: NORTHEAST RETENTION EMBANKMENT GYPSUM PONDS.

1:500 0 5.0 10 m

CLIENT
Teck

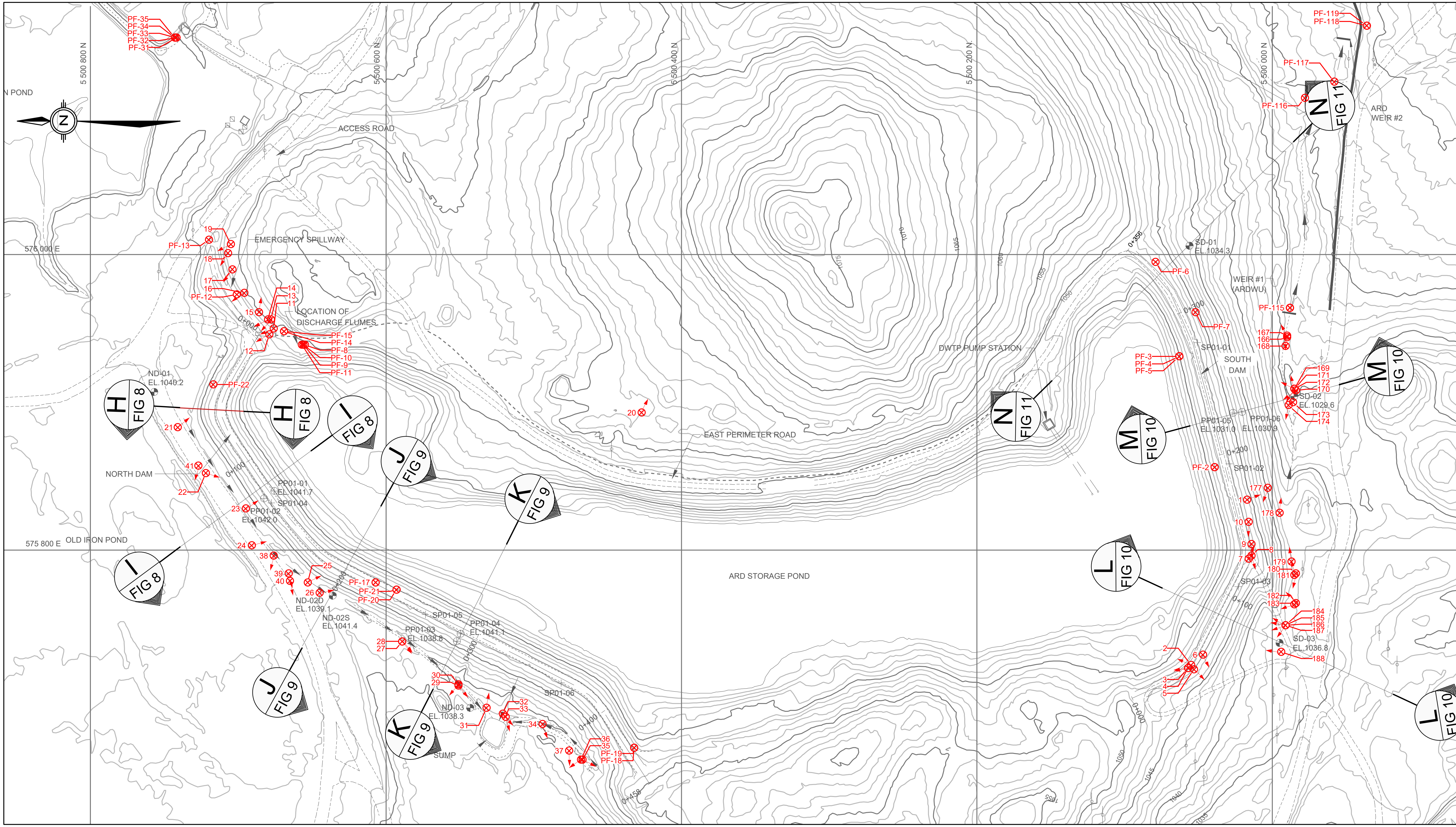
Klohn Crippen Berger

PROJECT
SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

TITLE
NORTHEAST GYPSUM DIKE AND RECYCLE DAM
SECTION U

PROJECT No. A05807A21

FIG No. FIGURE 19



NOTES:

1. GENERAL TOPOGRAPHY FROM LIDAR DATED DECEMBER 2012.
2. ELEVATIONS ARE GEODETIC.
3. MAP COORDINATE SYSTEM = U.T.M. (NAD 83).

LEGEND:

⊕	PNEUMATIC PIEZOMETER
◑	STANDPIPE PIEZOMETER
+	SETTLEMENT PIN
➝ ➝	SEEPAGE COLLECTOR DITCH
EL.1032.1	MAXIMUM RECORDED PIEZO LEVEL (m) DURING REPORTING PERIOD

LOCATION AND DIRECTION OF PHOTOGRAPHS TAKEN DURING ANNUAL INSPECTION

	PHOTO NUMBER
104	LOCATION WHERE PHOTO WAS TAKEN DIRECTION OF VIEW
101	PANORAMA

1:2 500 0 25 50 m

CLIENT
Teck

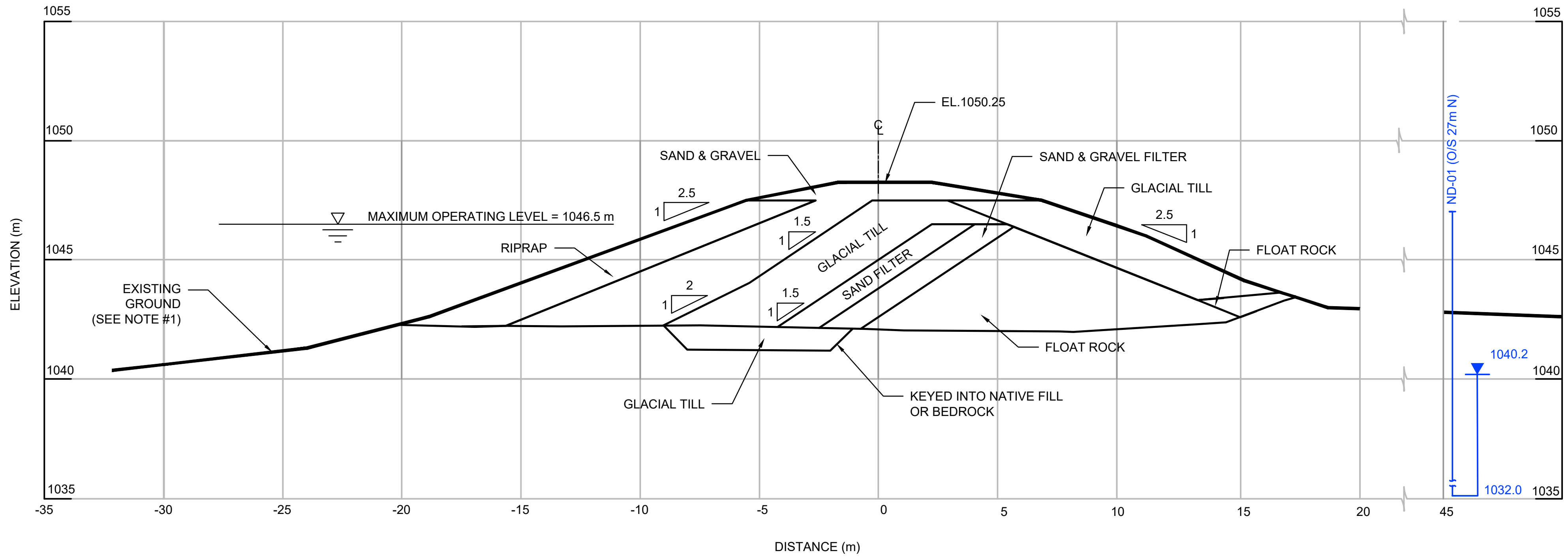
Klohn Crippen Berger

PROJECT
SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

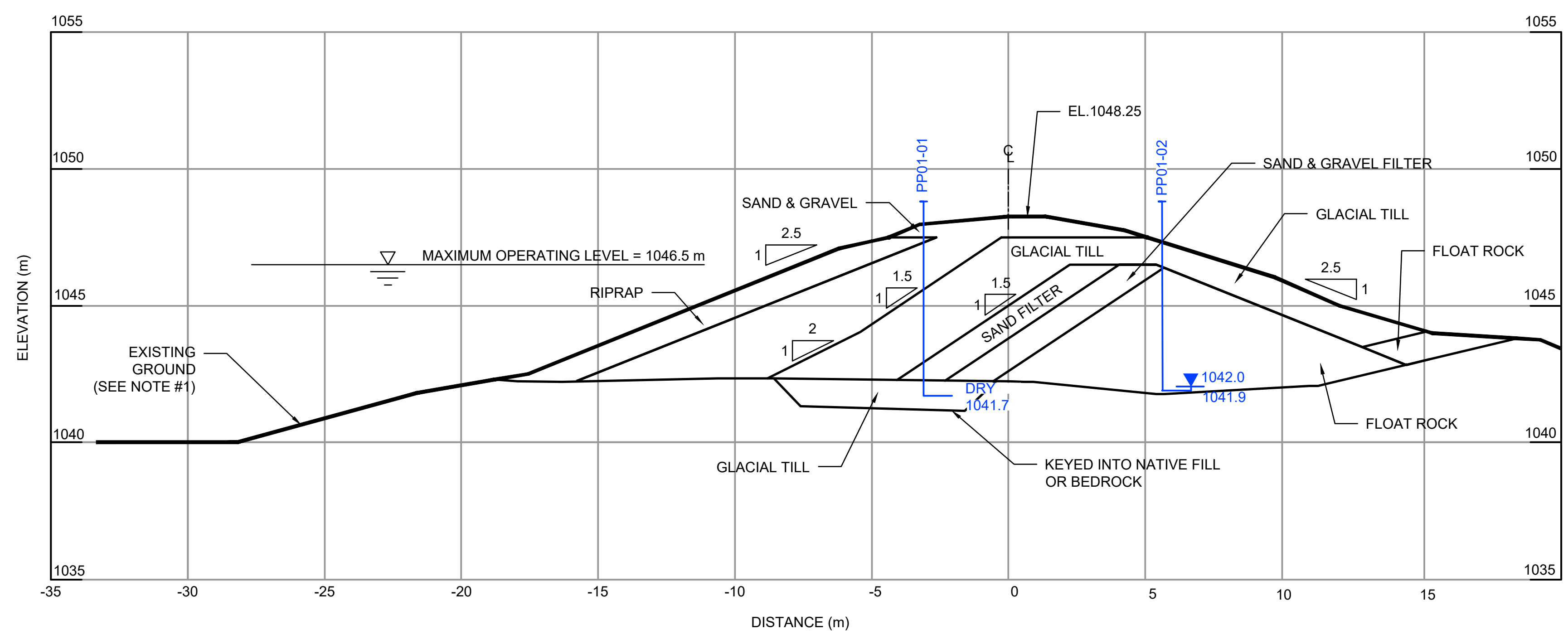
TITLE
ARD STORAGE POND
PLAN AND LAYOUT

PROJECT No. A05807A21

FIG No. FIGURE 20



H SECTION
FIG 20 SCALE = 1:250



I SECTION
FIG 20 SCALE = 1:250

NOTES:

1. SURFACE TOPOGRAPHY FROM LIDAR PROVIDED BY TECK METALS LTD. DATED DECEMBER 2012.
2. SUBSURFACE LITHOLOGY TRACED FROM 2002 SULLIVAN MINE TAILINGS FACILITY STORAGE POND NO. 1 CONSTRUCTION RECORD REPORT.

LEGEND:

P91-01 PIEZOMETER

1023.8 MAXIMUM RECORDED PIEZO LEVEL (m) DURING REPORTING PERIOD

1021.4 PIEZOMETER TIP

1:250 0 2.5 5.0 m

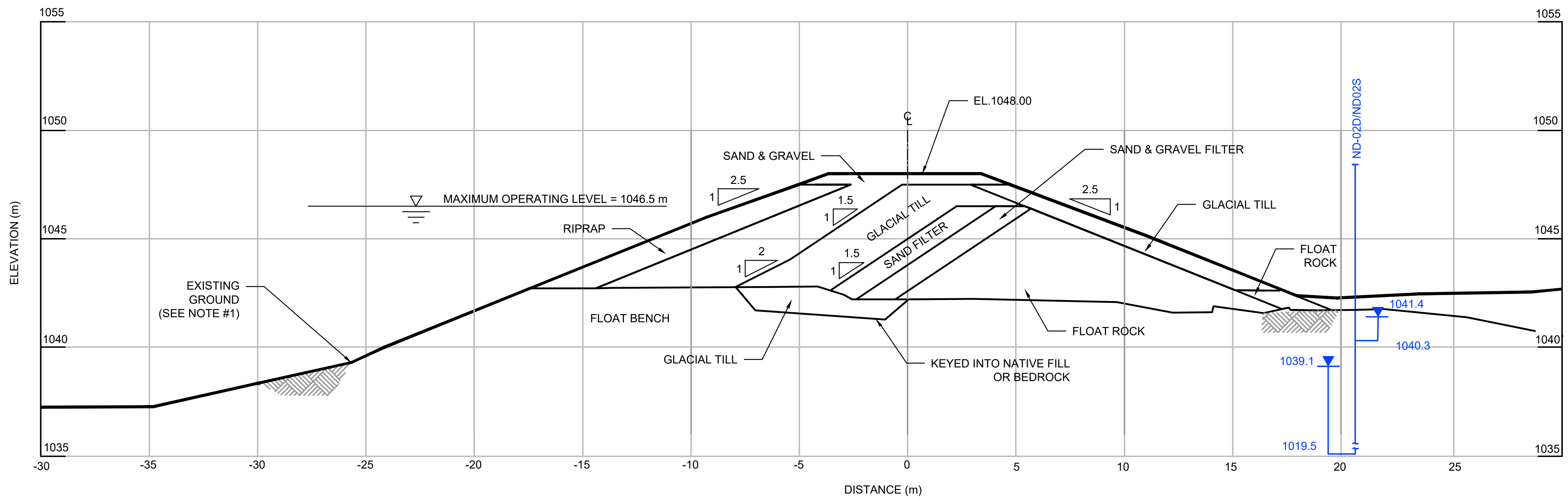
CLIENT
Teck

Klohn Crippen Berger

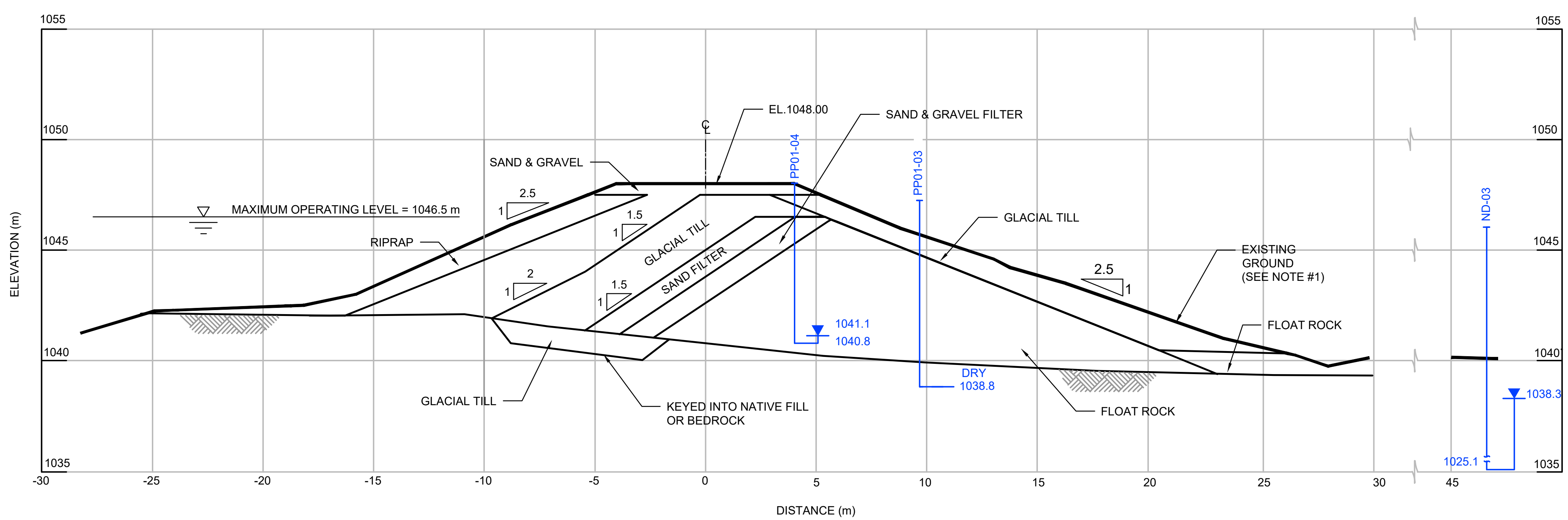
PROJECT
SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

TITLE
ARD STORAGE POND
NORTH DAM SECTIONS H AND I

PROJECT No. A05807A21
FIG No. 21



J SECTION
FIG 20 SCALE = 1:250



K SECTION
FIG 20 SCALE = 1:250

NOTES:

1. SURFACE TOPOGRAPHY FROM LIDAR PROVIDED BY TECK METALS LTD. DATED DECEMBER 2012.
2. SUBSURFACE LITHOLOGY TRACED FROM 2002 SULLIVAN MINE TAILINGS FACILITY STORAGE POND NO. 1 CONSTRUCTION RECORD REPORT.

LEGEND:

P91-01	PIEZOMETER
1023.8	MAXIMUM RECORDED PIEZO LEVEL (m) DURING REPORTING PERIOD
1021.4	PIEZOMETER TIP

1:250 0 2.5 5.0 m

CLIENT
Teck

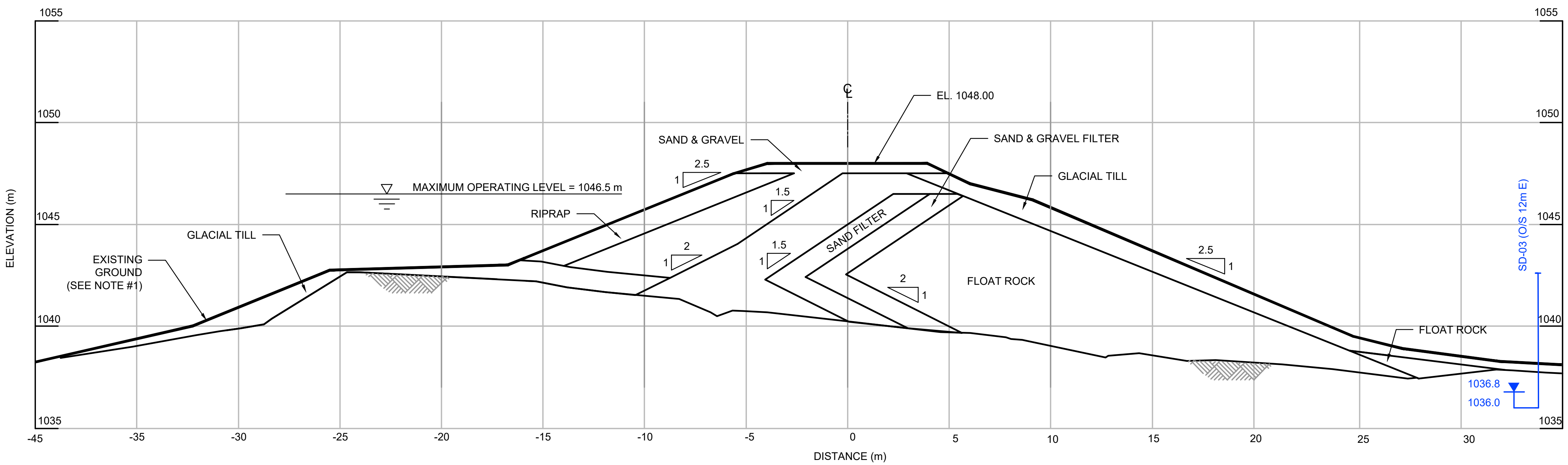
Klohn Crippen Berger

PROJECT
SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

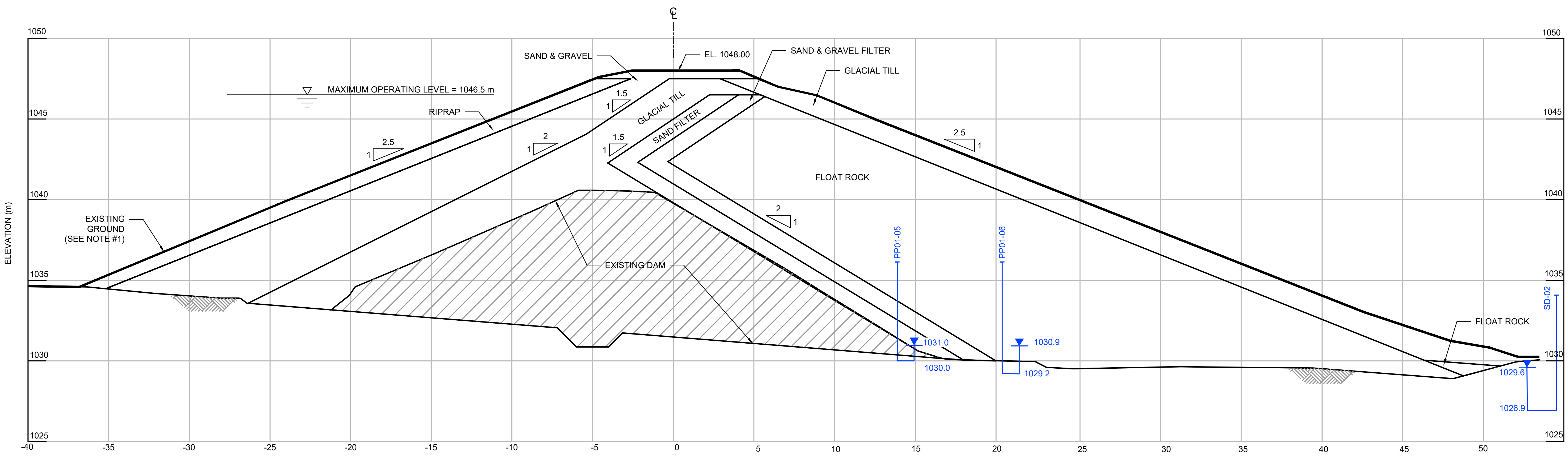
TITLE
ARD STORAGE POND
NORTH DAM SECTIONS J AND K

PROJECT No. A05807A21
FIG No. 22

KCC-D-B



L SECTION
FIG 20 SCALE = 1:250



M SECTION
FIG 20 SCALE = 1:250

NOTES:

1. SURFACE TOPOGRAPHY FROM LIDAR PROVIDED BY TECK METALS LTD. DATED DECEMBER 2012.
2. SUBSURFACE LITHOLOGY TRACED FROM 2002 SULLIVAN MINE TAILINGS FACILITY STORAGE POND NO. 1 CONSTRUCTION RECORD REPORT.

LEGEND:

P91-01	PIEZOMETER
1023.8	MAXIMUM RECORDED PIEZO LEVEL (m) DURING REPORTING PERIOD
1021.4	PIEZOMETER TIP

1:250 0 2.5 5.0 m

CLIENT: Teck

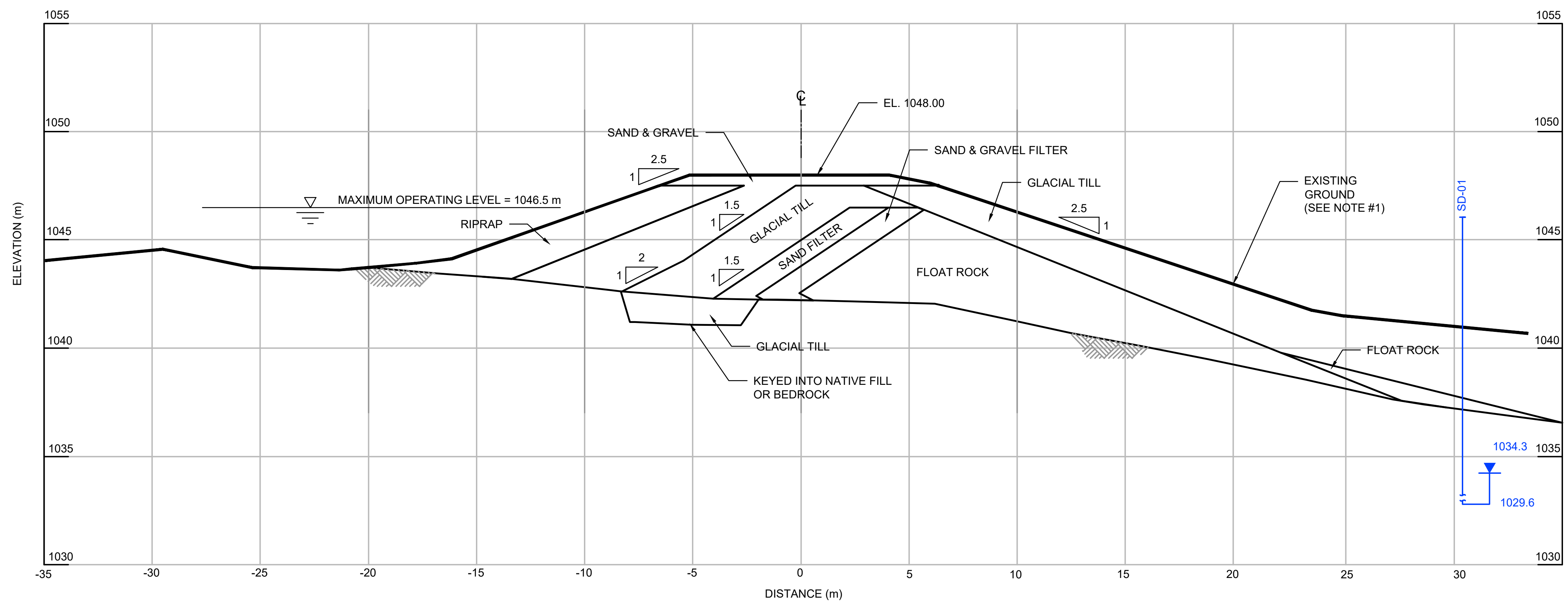
Klohn Crippen Berger

PROJECT: SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

TITLE: ARD STORAGE POND
SOUTH DAM SECTIONS L AND M

PROJECT No. A05807A21

FIG No. 23



N SECTION
FIG 20 SCALE = 1:250

NOTES:

1. SURFACE TOPOGRAPHY FROM LIDAR PROVIDED BY TECK METALS LTD. DATED DECEMBER 2012.
2. SUBSURFACE LITHOLOGY TRACED FROM 2002 SULLIVAN MINE TAILINGS FACILITY STORAGE POND NO. 1 CONSTRUCTION RECORD REPORT.

LEGEND:

P91-01	PIEZOMETER
1023.8	MAXIMUM RECORDED PIEZO LEVEL (m) DURING REPORTING PERIOD
1021.4	PIEZOMETER TIP

1:250 0 2.5 5.0 m

CLIENT: Teck

Klohn Crippen Berger

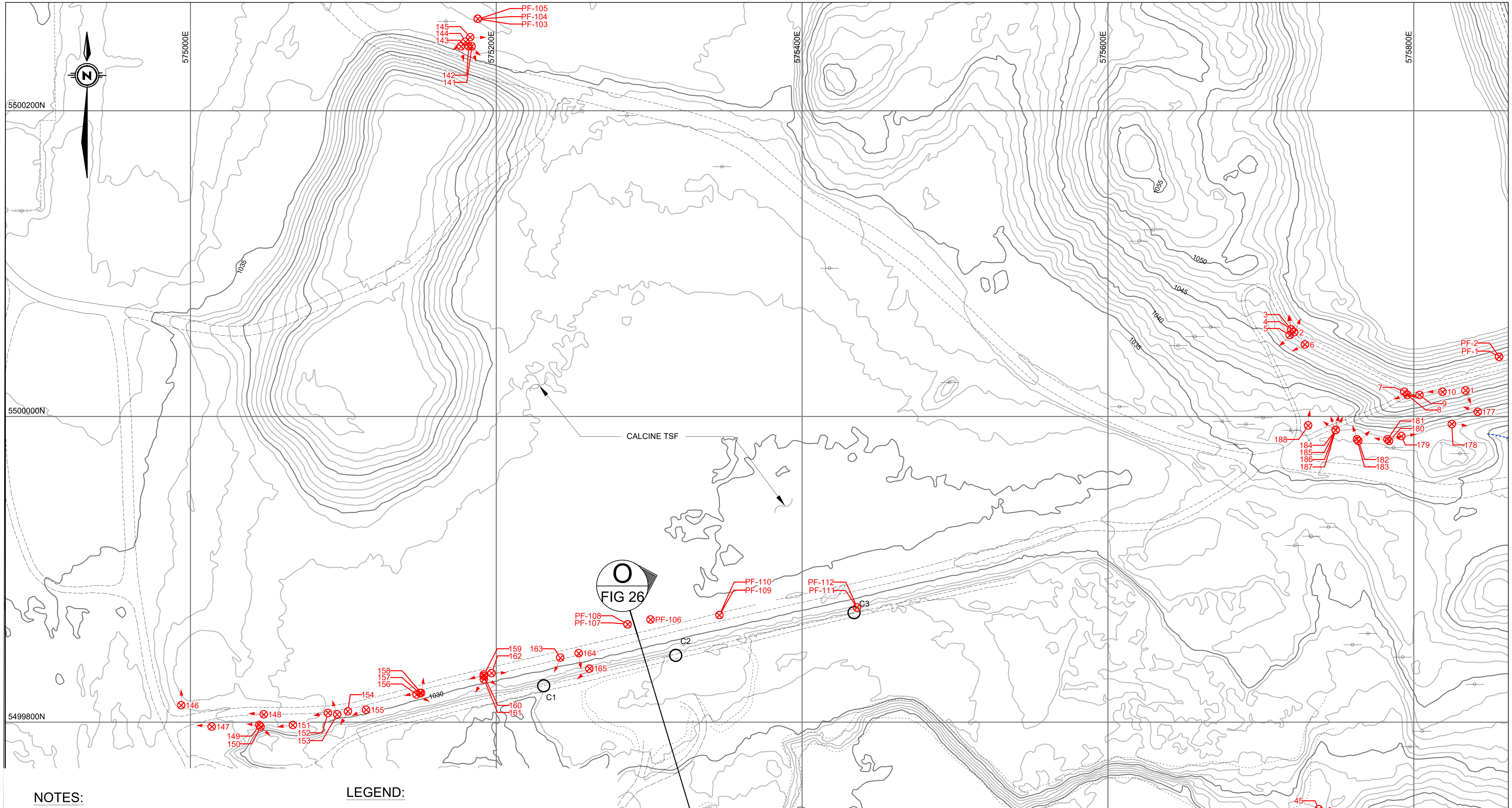
PROJECT: SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

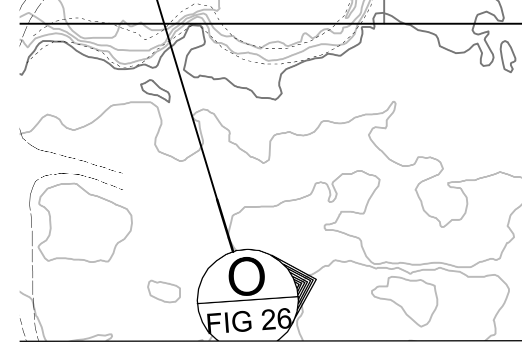
TITLE: ARD STORAGE POND
SOUTH DAM SECTION N

PROJECT No. A05807A21

FIG No. 24

KCC-D-B





NOTES:

1. GENERAL TOPOGRAPHY FROM LIDAR DATED DECEMBER 2012.
2. ELEVATIONS ARE GEODETIC.
3. MAP COORDINATE SYSTEM = U.T.M. (NAD83). CONTOUR INTERVAL IS ONE METRE.
4. INSTRUMENTATION LOCATIONS ARE BASED ON RECORDS PROVIDED BY TECK PERSONNEL FOR THIS REPORT. NO ATTEMPT HAS BEEN MADE TO VERIFY THE ACCURACY OF THE LOCATIONS.

LEGEND:

MONITORING WELL - ABANDONED

LOCATION AND DIRECTION OF PHOTOGRAPHS DURING ANNUAL INSPECTION

104 — PHOTO NUMBER

LOCATION WHERE PHOTO WAS TAKEN

DIRECTION OF VIEW

101 — PANORAMA

1:2 500 0 25 50 m

CLIENT: Teck

Klohn Crippen Berger

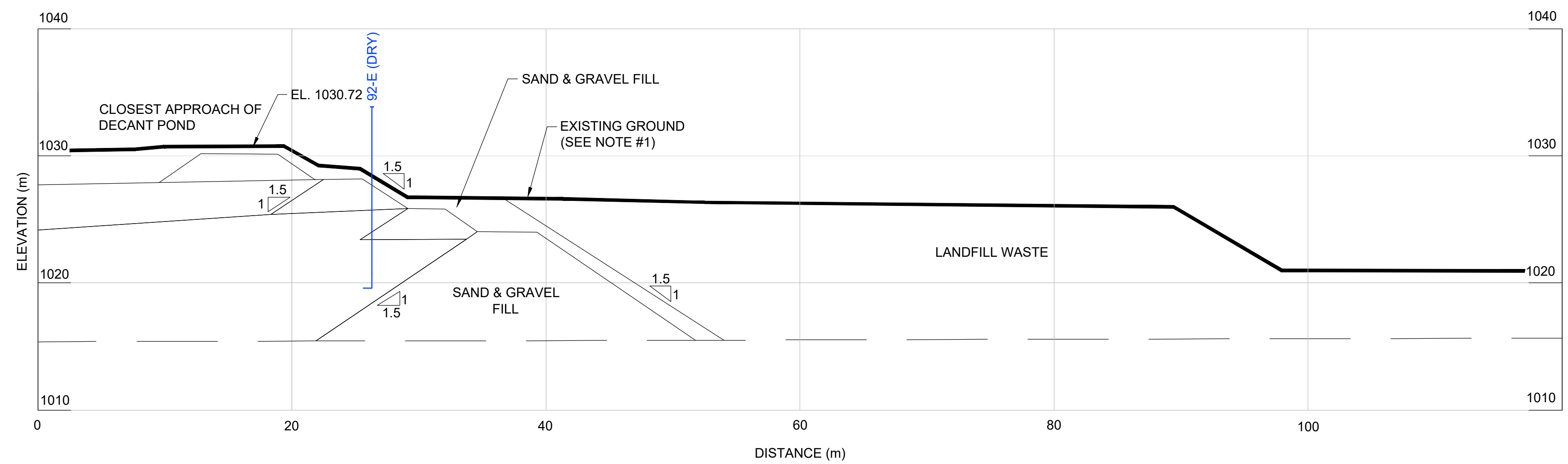
PROJECT: SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

TITLE: INSTRUMENT LOCATION PLAN
CALCINE DIKE

PROJECT No. A05807A21

FIG No. FIGURE 25

KCC-D-B



O SECTION
FIG 25 SCALE = 1:500

NOTES:

1. SURFACE TOPOGRAPHY FROM LIDAR PROVIDED BY TECK METALS LTD. DATED DECEMBER 2012.
2. SUBSURFACE LITHOLOGY TRACED FROM 1979 SOIL INVESTIGATION AND DESIGN SECOND DYKE EXTENSION CALCINE DYKE.

LEGEND:

P91-01 PIEZOMETER

1:500 0 5.0 10 m

CLIENT
Teck

Klohn Crippen Berger

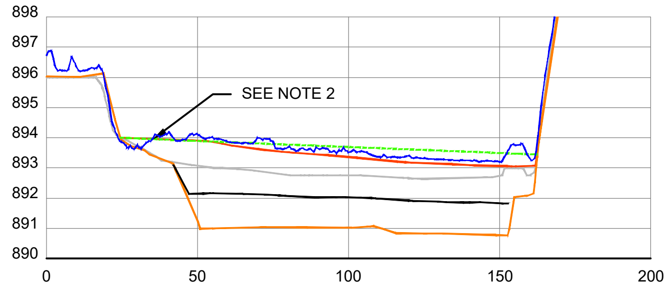
PROJECT
SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

TITLE
CALCINE DIKE
SECTION O

PROJECT No. A05807A21

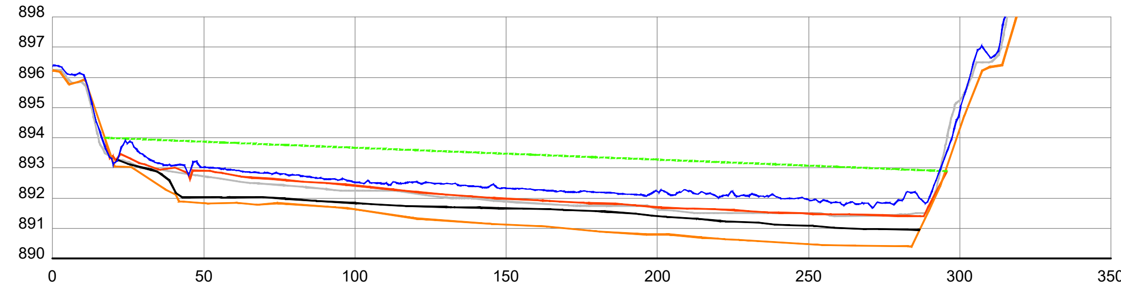
FIG No. FIGURE 26

KCC-D-B

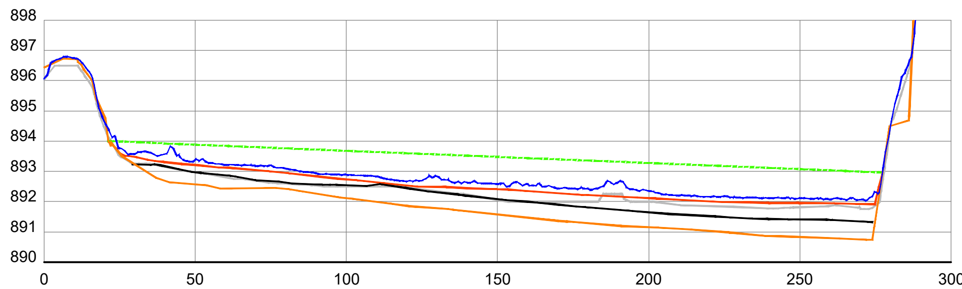


V SECTION
SCALE = 1:2500

NOTE:EXCESS SLUDGE DEPOSIT RELOCATED OCTOBER 2015



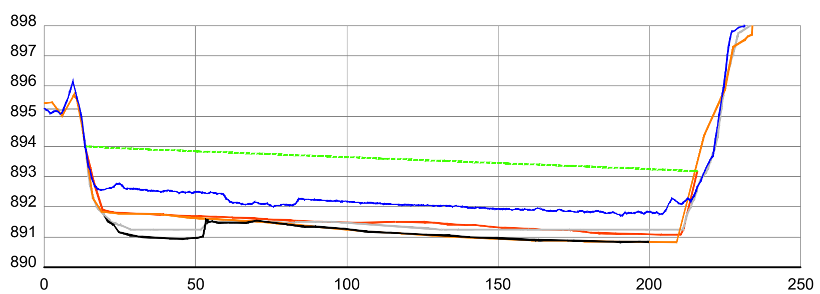
X SECTION
SCALE = 1:2500



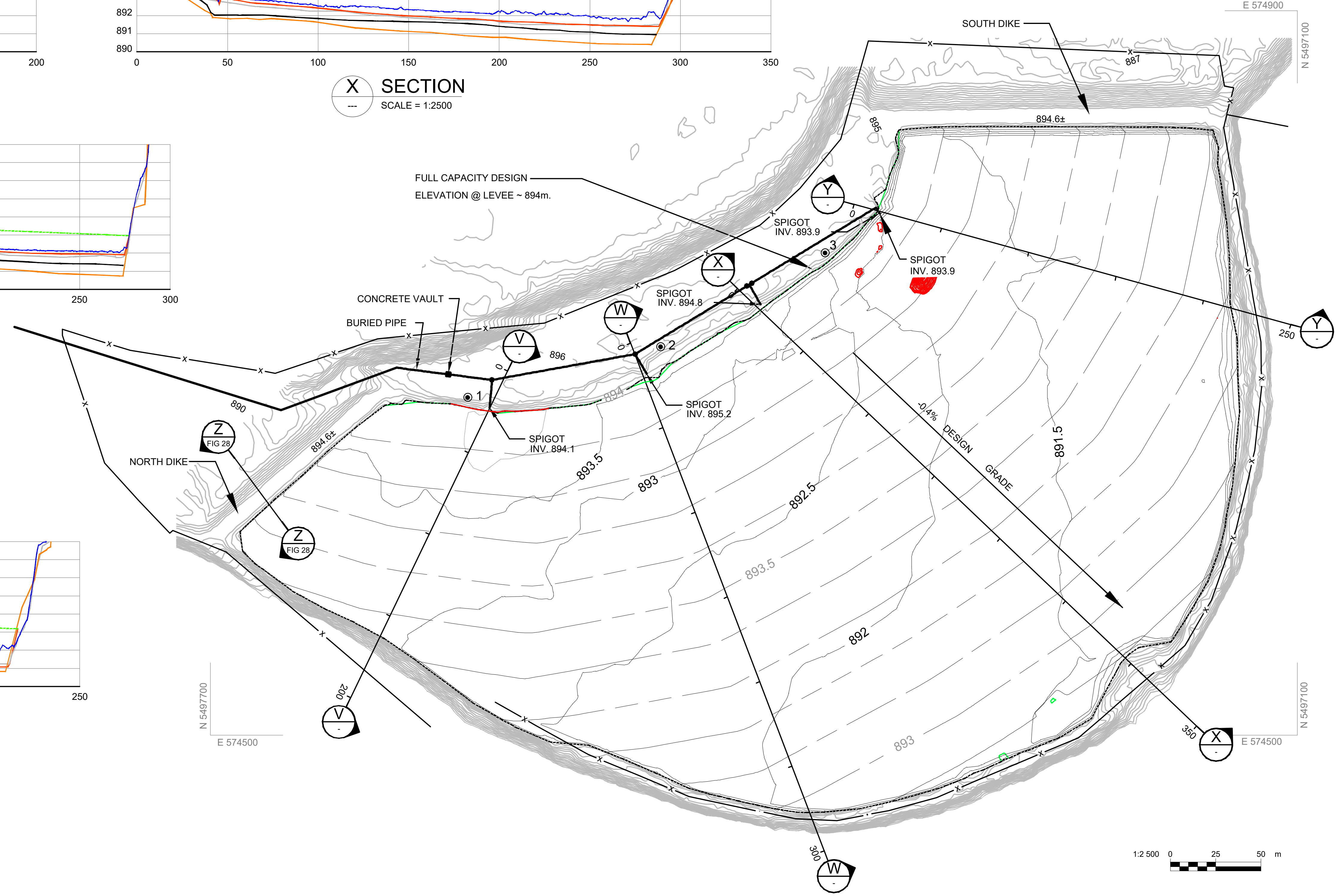
W SECTION
SCALE = 1:2500

VOLUME SUMMARY

2001 SURVEY TO FULL POOL @ 0.4% GRADIENT ~ 278,000 cu.m.	
2001(MAY 8) SURVEY TO 2009(SEPT 18)	~ 52,430 cu.m.
2012 LIDAR SURFACE TO FULL POOL	~ 182,550 cu.m.
2015 SURFACE TO FULL POOL	~ 163,630 cu.m.



Y SECTION
SCALE = 1:2500



LEGEND:

LOCATION AND DIRECTION OF PHOTOGRAPHS TAKEN DURING 2015 INSPECTION

PHOTO NUMBER

8.01

LOCATION WHERE PHOTO WAS TAKEN

DIRECTION OF VIEW

- 2001 SURFACE
- 2009 SURVEY
- 2012 LIDAR SURVEY
- 2015 SURVEY (INTERVAL 0.5m)
- 2019 LIDAR SURVEY
- FULL POOL DESIGN SURFACE (INTERVAL 0.25m)
- FULL POOL PERIMETER (128,500 sq.m.)
- DENOTES SHUT OFF STANDPIPE
- 1 CONTROL MONUMENT PLACED 2015

NOTES:

1. SLUDGE IMPOUNDMENT LAYOUT AND CROSS SECTIONS PROVIDED BY TM TECH SERVICES, DRAWING NO. K101A2243 DATED SEPTEMBER 9 2015.
2. EXCESS SLUDGE AT SPIGOT NO. 1 RELOCATED OCTOBER 27, 2015.

CLIENT: Teck

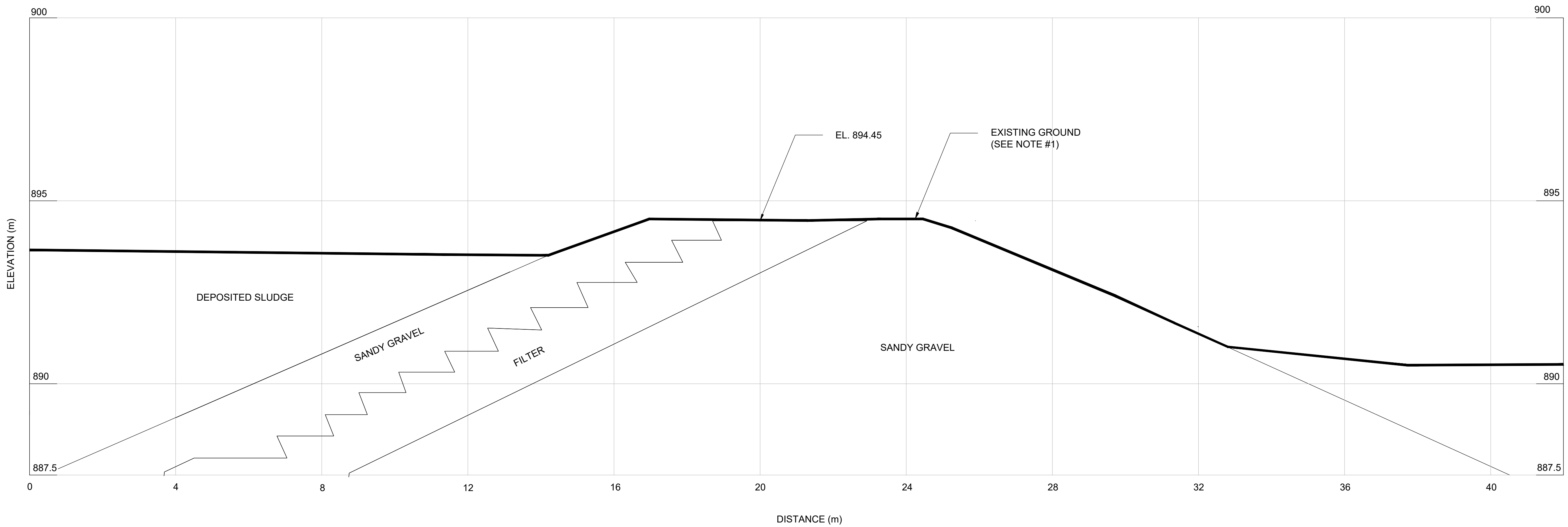
Klohn Crippen Berger

PROJECT: SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

TITLE: SLUDGE IMPOUNDMENT DIKES PLAN

PROJECT No. A05807A21

FIG No. FIGURE 27



Z SECTION
SCALE = 1:125

\\int.klohn.com\ProjData\A\EDM\A05807A21 TML 2021 Annual Inspection\400 Drawings\Annual Inspection\Figure 28_Sludge Impoundment Sections 2021.dwg Layout=28 October 15, 2021 6:03:30 PM

NOTES:

1. SURFACE TOPOGRAPHY FROM LIDAR PROVIDED BY TECK METALS LTD. DATED DECEMBER 2012.
2. SUBSURFACE LITHOLOGY TRACED FROM 1978 CONSTRUCTION ACTIVITIES SLUDGE STORAGE POND - STAGE I DYKES.

1:125 0 1.25 2.5 m

CLIENT
Teck

Klohn Crippen Berger

PROJECT
SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

TITLE
SLUDGE IMPOUNDMENT DIKES
SECTION Z

PROJECT No. A05807A21

FIG No. FIGURE 28

KCC-D-B

APPENDIX I

2021 Visual Inspection

TML Sullivan Inpsection Checklist

Structure: ARD South Dam

Date: July 5, 2021

Weather: +20

Snow Cover? YES / NO

Inspected by: P. Fines / M. Rettger

Pond Elevation:

Operational Limits:

Inspection Item	Remarks
Dam Crest Surface	
Cracks	N/A
Erosion	N/A
Settlement/Depressions	N/A
Vegetation growth	some grass on edge of road
Animal Activity (burrows)	N/A
Any unusual conditions	N/A
Ponding of water	N/A
Dam Upstream Slope	
Slope protection (riprap)	good
Surface erosion/gullying	N/A
Slides or sloughing	N/A
Settlement/Depressions	N/A
Bulging	N/A
Cracks	N/A
Vegetation growth	some bushes on upstream slope
Animal Activity (burrows)	N/A
Any unusual conditions	N/A
Dam Downstream Slope and Toe	
Slope protection (grass)	good well-graded
Surface erosion/gullying	N/A
Slides or sloughing	
Settlement/Depressions	
Bulging	
Cracks	
Vegetation growth	well vegetated
Animal Activity (burrows)	N/A
Any unusual conditions	

TML Sullivan Inpsection Checklist

Structure: ARD North Dam

Date:	July 5/21	Inspected by:	P.F. & M.R.
Weather:	+20	Pond Elevation:	
Snow Cover?	YES / NO	Operational Limits:	

Inspection Item	Remarks
Dam Crest Surface	
Cracks	N/A
Erosion	
Settlement/Depressions	
Vegetation growth	
Animal Activity (burrows)	
Any unusual conditions	
Ponding of water	
Dam Upstream Slope	
Slope protection (riprap)	N/A
Surface erosion/gullying	
Slides or sloughing	
Settlement/Depressions	
Bulging	
Cracks	
Vegetation growth	
Animal Activity (burrows)	
Any unusual conditions	some wood debris → above high water mark
Dam Downstream Slope and Toe	
Slope protection (grass)	good, 1 or 2 bare spots
Surface erosion/gullying	N/A
Slides or sloughing	
Settlement/Depressions	
Bulging	
Cracks	
Vegetation growth	dense, shrubs at toe
Animal Activity (burrows)	none noted
Any unusual conditions	wash outs

spillway → some vegetation on side slopes, dislodged rip rap in 1 location where animals use as path

TML Sullivan Inpsection Checklist

Structure: Old Iron Dyke

Date: July 5/21

Weather: +25

Snow Cover? YES / NO

Inspected by: P.F & M.R.

Pond Elevation:

Operational Limits:

Inspection Item	Remarks
Dam Crest Surface	
Cracks	N/A
Erosion	
Settlement/Depressions	
Vegetation growth	graded road surface
Animal Activity (burrows)	N/A
Any unusual conditions	
Ponding of water	
Dam Upstream Slope	
Slope protection (riprap)	N/A
Surface erosion/gullying	
Slides or sloughing	
Settlement/Depressions	
Bulging	
Cracks	
Vegetation growth	
Animal Activity (burrows)	
Any unusual conditions	
Dam Downstream Slope and Toe	
Slope protection (grass)	well graded, well vegetated
Surface erosion/gullying	N/A
Slides or sloughing	
Settlement/Depressions	
Bulging	
Cracks	
Vegetation growth	well vegetated
Animal Activity (burrows)	N/A
Any unusual conditions	none

TML Sullivan Inpsection Checklist

Structure: Aron Dyke

Date: July 5/21

Inspected by: P.F. + M.R.

Weather: +25, sunny

Pond Elevation:

Snow Cover? YES / NO

Operational Limits:

Inspection Item	Remarks
Dam Crest Surface	
Cracks	N/A
Erosion	
Settlement/Depressions	
Vegetation growth	grasses + shrubs
Animal Activity (burrows)	N/A
Any unusual conditions	
Ponding of water	
Dam Upstream Slope	
Slope protection (riprap)	N/A
Surface erosion/gullying	
Slides or sloughing	
Settlement/Depressions	
Bulging	
Cracks	
Vegetation growth	well vegetated
Animal Activity (burrows)	N/A
Any unusual conditions	N/A
Dam Downstream Slope and Toe	
Slope protection (grass)	some vegetation
Surface erosion/gullying	some small rills
Slides or sloughing	N/A
Settlement/Depressions	
Bulging	
Cracks	
Vegetation growth	some vegetation
Animal Activity (burrows)	N/A
Any unusual conditions	

* weir ~~V~~ notch has eroded, needs replacing

TML Sullivan Inpsection Checklist

Structure: Siliceous No. 1

Date: July 5/21

Inspected by: R.F + M.R.

Weather: +25

Pond Elevation:

Snow Cover? YES / NO

Operational Limits:

Inspection Item	Remarks
Dam Crest Surface	
Cracks	N/A
Erosion	
Settlement/Depressions	
Vegetation growth	well grassed
Animal Activity (burrows)	
Any unusual conditions	
Ponding of water	
Dam Upstream Slope	
Slope protection (riprap)	N/A
Surface erosion/gullying	
Slides or sloughing	
Settlement/Depressions	
Bulging	
Cracks	
Vegetation growth	well grassed
Animal Activity (burrows)	
Any unusual conditions	
Dam Downstream Slope and Toe	
Slope protection (grass)	well grassed
Surface erosion/gullying	N/A
Slides or sloughing	
Settlement/Depressions	
Bulging	
Cracks	
Vegetation growth	well vegetated
Animal Activity (burrows)	
Any unusual conditions	

TML Sullivan Inpsection Checklist

Structure: Siliceous NO 2.

Date: July 5/21 | Inspected by: P.F & M.R

Weather: +25 | Pond Elevation:

Snow Cover? YES / NO | Operational Limits:

Inspection Item	Remarks
Dam Crest Surface	
Cracks	N/A
Erosion	↓
Settlement/Depressions	↓
Vegetation growth	well grassed
Animal Activity (burrows)	N/A
Any unusual conditions	↓
Ponding of water	↓
Dam Upstream Slope	
Slope protection (riprap)	N/A
Surface erosion/gullying	↓
Slides or sloughing	↓
Settlement/Depressions	↓
Bulging	↓
Cracks	↓
Vegetation growth	well grassed
Animal Activity (burrows)	N/A
Any unusual conditions	↓
Dam Downstream Slope and Toe	
Slope protection (grass)	mostly well vegetated
Surface erosion/gullying	some small rills
Slides or sloughing	N/A
Settlement/Depressions	↓
Bulging	↓
Cracks	↓
Vegetation growth	well grassed
Animal Activity (burrows)	N/A
Any unusual conditions	

TML Sullivan Inpsection Checklist

Structure: Siliceous NO. 3.

Date: July 5/21	Inspected by: P.F. & M.R.
Weather: sunny, +25	Pond Elevation:
Snow Cover? YES / NO	Operational Limits:

Inspection Item	Remarks
Dam Crest Surface	
Cracks	N/A
Erosion	
Settlement/Depressions	
Vegetation growth	well vegetated
Animal Activity (burrows)	N/A
Any unusual conditions	
Ponding of water	
Dam Upstream Slope	
Slope protection (riprap)	N/A
Surface erosion/gullying	
Slides or sloughing	
Settlement/Depressions	
Bulging	
Cracks	
Vegetation growth	well vegetated
Animal Activity (burrows)	N/A
Any unusual conditions	N/A
Dam Downstream Slope and Toe	
Slope protection (grass)	well vegetated
Surface erosion/gullying	N/A
Slides or sloughing	
Settlement/Depressions	
Bulging	
Cracks	
Vegetation growth	well vegetated
Animal Activity (burrows)	1 animal trail
Any unusual conditions	

spillway well armoured.

TML Sullivan Inpsection Checklist

Structure: Calcine Dyke

Date: July 5/21	Inspected by: P.S. + M.B.
Weather: +25	Pond Elevation:
Snow Cover? YES / NO	Operational Limits:

Inspection Item	Remarks
Dam Crest Surface	
Cracks	N/A
Erosion	↓
Settlement/Depressions	↓
Vegetation growth	some grass, graded
Animal Activity (burrows)	N/A
Any unusual conditions	↓
Ponding of water	↓
Dam Upstream Slope	
Slope protection (riprap)	N/A
Surface erosion/gullying	↓
Slides or sloughing	↓
Settlement/Depressions	↓
Bulging	↓
Cracks	↓
Vegetation growth	trees, grass, shrubs
Animal Activity (burrows)	↓
Any unusual conditions	↓
Dam Downstream Slope and Toe	
Slope protection (grass)	some grass
Surface erosion/gullying	N/A
Slides or sloughing	↓
Settlement/Depressions	↓
Bulging	↓
Cracks	↓
Vegetation growth	grassed, bench is bare
Animal Activity (burrows)	N/A
Any unusual conditions	none

TML Sullivan Inpsection Checklist

Structure: West Gypsum Dike

Date: July 6/21

Inspected by: P.F. & M.R.

Weather: +25

Pond Elevation:

Snow Cover? YES / NO

Operational Limits:

Inspection Item	Remarks
Dam Crest Surface	
Cracks	N/A
Erosion	
Settlement/Depressions	
Vegetation growth	well vegetated
Animal Activity (burrows)	
Any unusual conditions	
Ponding of water	
Dam Upstream Slope	
Slope protection (riprap)	N/A
Surface erosion/gullying	
Slides or sloughing	
Settlement/Depressions	
Bulging	
Cracks	
Vegetation growth	well vegetated
Animal Activity (burrows)	N/A
Any unusual conditions	
Dam Downstream Slope and Toe	
Slope protection (grass)	well vegetated
Surface erosion/gullying	N/A
Slides or sloughing	
Settlement/Depressions	
Bulging	
Cracks	
Vegetation growth	
Animal Activity (burrows)	a few animal burrow
Any unusual conditions	N/A

spillway → shrubs in bottom of spillway

TML Sullivan Inpsection Checklist

Structure: East Gypsum Dyke

Date: July 6/21 | Inspected by: M. Bettger
Weather: +25 | Pond Elevation:
Snow Cover? YES / NO | Operational Limits:

Inspection Item	Remarks
Dam Crest Surface	
Cracks	N/A
Erosion	↓
Settlement/Depressions	↓
Vegetation growth	vegetated
Animal Activity (burrows)	↓
Any unusual conditions	↓
Ponding of water	↓
Dam Upstream Slope	
Slope protection (riprap)	N/A
Surface erosion/gullying	↓
Slides or sloughing	↓
Settlement/Depressions	↓
Bulging	↓
Cracks	↓
Vegetation growth	well grassed
Animal Activity (burrows)	↓
Any unusual conditions	↓
Dam Downstream Slope and Toe	
Slope protection (grass)	well grassed
Surface erosion/gullying	minor erosion gullies
Slides or sloughing	N/A
Settlement/Depressions	↓
Bulging	↓
Cracks	↓
Vegetation growth	grass
Animal Activity (burrows)	gopher + badger holes full length of dam
Any unusual conditions	N/A

TML Sullivan Inpsection Checklist

Structure: NE Gypsam Dike

Date: July 5/21

Inspected by: P.F. & M.R

Weather: +25

Pond Elevation:

Snow Cover? YES / NO

Operational Limits:

Inspection Item	Remarks
Dam Crest Surface	
Cracks	N/A
Erosion	↓
Settlement/Depressions	↓
Vegetation growth	grass + shrubs
Animal Activity (burrows)	N/A
Any unusual conditions	↓
Ponding of water	↓
Dam Upstream Slope	
Slope protection (riprap)	N/A, sparse
Surface erosion/gullying	minor rill erosion
Slides or sloughing	N/A
Settlement/Depressions	↓
Bulging	↓
Cracks	↓
Vegetation growth	some shrubs + grass.
Animal Activity (burrows)	N/A
Any unusual conditions	animal tracks (diagonal), no change
Dam Downstream Slope and Toe	
Slope protection (grass)	well vegetated
Surface erosion/gullying	N/A
Slides or sloughing	↓
Settlement/Depressions	↓
Bulging	↓
Cracks	↓
Vegetation growth	grass + shrubs
Animal Activity (burrows)	N/A
Any unusual conditions	none

TML Sullivan Inpsection Checklist

Structure: Recycle Dam

Date: ______________ Inspected by: ______________

Weather: ______________ Pond Elevation: ______________

Snow Cover? YES / NO Operational Limits: ______________

Inspection Item	Remarks
Dam Crest Surface	
Cracks	N/A
Erosion	
Settlement/Depressions	
Vegetation growth	
Animal Activity (burrows)	
Any unusual conditions	
Ponding of water	* replacing pipes, so fresh dirt
Dam Upstream Slope	
Slope protection (riprap)	grassed
Surface erosion/gullying	N/A
Slides or sloughing	
Settlement/Depressions	
Bulging	
Cracks	
Vegetation growth	grass + shrub
Animal Activity (burrows)	N/A
Any unusual conditions	N/A
Dam Downstream Slope and Toe	
Slope protection (grass)	fully veg
Surface erosion/gullying	N/A
Slides or sloughing	
Settlement/Depressions	
Bulging	
Cracks	
Vegetation growth	fully veg
Animal Activity (burrows)	N/A
Any unusual conditions	

TML Sullivan Inpsection Checklist

Structure: Sludge North Dike

Date: July 6/21

Inspected by: PF. & M.A.

Weather: +25

Pond Elevation:

Snow Cover? YES / NO

Operational Limits:

Inspection Item	Remarks
Dam Crest Surface	
Cracks	N/A
Erosion	↓
Settlement/Depressions	↓
Vegetation growth	some vegetation
Animal Activity (burrows)	N/A
Any unusual conditions	↓
Ponding of water	↓
Dam Upstream Slope	
Slope protection (riprap)	N/A
Surface erosion/gullying	↓
Slides or sloughing	↓
Settlement/Depressions	↓
Bulging	↓
Cracks	↓
Vegetation growth	some shrubs near crest
Animal Activity (burrows)	N/A
Any unusual conditions	↓
Dam Downstream Slope and Toe	
Slope protection (grass)	rocks & shrubs
Surface erosion/gullying	N/A
Slides or sloughing	↓
Settlement/Depressions	↓
Bulging	↓
Cracks	↓
Vegetation growth	shrubs & small tree
Animal Activity (burrows)	N/A
Any unusual conditions	

TML Sullivan Inpsection Checklist

Structure: Sludge South Dike

Date: July 6/21
Weather: +25
Snow Cover? YES / NO

Inspected by: P.F. & M.R.
Pond Elevation:
Operational Limits:

Inspection Item	Remarks
Dam Crest Surface	
Cracks	N/A
Erosion	↓
Settlement/Depressions	↓
Vegetation growth	some sparse grasses
Animal Activity (burrows)	N/A
Any unusual conditions	↓
Ponding of water	↓
Dam Upstream Slope	
Slope protection (riprap)	N/A
Surface erosion/gullying	↓
Slides or sloughing	↓
Settlement/Depressions	↓
Bulging	↓
Cracks	↓
Vegetation growth	some shrubs near crest
Animal Activity (burrows)	↓
Any unusual conditions	↓
Dam Downstream Slope and Toe	
Slope protection (grass)	patchy grasses, mostly rocks + shrubs
Surface erosion/gullying	N/A
Slides or sloughing	↓
Settlement/Depressions	↓
Bulging	↓
Cracks	↓
Vegetation growth	shrubs, small trees, deadfall
Animal Activity (burrows)	N/A
Any unusual conditions	↓

APPENDIX II

Site Visit Photographs

Appendix II
Site Visit Photographs

Photo II.1 ARD South Dam Upstream Slope

Photo II.2 North Dam Upstream Slope

Photo II.3 Erosion adjacent to pumphouse

Photo II.4 ARD North Dam Downstream Slope

Photo II.5 Vegetation at toe of North Dam

Photo II.6 South Dam Downstream Slope

Photo II.7 Weir 1 downstream ditch

Photo II.8 Weir 2 – AIPWU

Photo II.9 Iron Dike Downstream Slope

Photo II.10 Iron Dike Crest and Crest of Toe Berm

Photo II.11 Overview of Iron Pond

Photo II.12 Overview of Iron TSF looking towards Iron Pond

Photo II.13 Weir #3

Photo II.14 Channel Downstream of Weir #3

Photo II.15 Weir #4

Photo II.16 Weir #4 worn notch

Photo II.17 Emergency Spillway Channel Inlet

Photo II.18 Emergency Spillway Channel upper section looking downstream from inlet

Photo II.19 Emergency Spillway Channel looking upstream from connection to West Gypsum TSF

Photo II.20 Emergency Spillway Channel outlet to Cow Creek

Photo II.21 No. 1 Siliceous Dike

Photo II.22 No. 2 Siliceous Dike

Photo II.23 No. 3 Siliceous Dike

Photo II.24 Seepage downstream of No. 3 Siliceous Dike

Photo II.25 Decant outlet channel downstream of No. 3 Siliceous

Photo II.26 Siliceous TSF Spillway

Photo II.27 Siliceous TSF Spillway on No. 3 Siliceous TSF

Photo II.28 East Gypsum Dike downstream slope

Photo II.29 West Gypsum Dike downstream slope

Photo II.30 Recycle Dam downstream slope

Photo II.31 Northeast Gypsum Dike Downstream Side

Photo II.32 Sludge Impoundment North Dike downstream slope

Photo II.33 Sludge Impoundment South Dike Crest and Upstream Slope

Photo II.34 Sludge Impoundment South Dike Downstream Slope

Photo II.35 Calcine Dike Crest and Downstream Slope

Photo II.36 Void from Collapse of Disused Pipe in Calcine

Photo II.37 Old Iron Dike Crest and Upstream Slope

Photo II.38 Old Iron Dike downstream slope

Photo II.39 Iron TSF Divider Dike

APPENDIX III

2021 Instrumentation Monitoring

Appendix III
Quantifiable Performance Objectives and
2021 Instrumentation Monitoring

III.1 QUANTIFIABLE PERFORMANCE OBJECTIVES

Quantifiable Performance Objectives (QPOs) have been established for all of the instrumentation and for the freeboard under normal operating conditions for those tailings facilities which have ponds, i.e., ARD Pond and Iron Pond. The QPOs are discussed below.

III.1.1 Piezometric

Pneumatic, standpipe, and vibrating wire piezometers are all used at site to monitor phreatic surfaces within the tailings facilities and foundations. The notification levels established for the piezometers, required monitoring frequency and current readings are summarized in Section III.2 Table AIII.3.

The following is required when a notification level is reached for a single instrument:

- Data, data reductions, and calculations are checked for accuracy and correctness
- If no errors are found in the calculations, the Mine Manager is notified that an anomalous reading has been observed and that further assessment must be conducted. The EOR is notified at this time. The EOR will evaluate data for reliability, review data within the general vicinity of the individual instrument. The EOR may require the following:
  - Check of readout equipment to verify that it is functioning correctly and to verify calibration
  - Reread instrument and other nearby instruments for confirmation
  - Adjust on-going monitoring frequency as required
- If it is observed that an instrument or piece of readout equipment has stopped functioning, the Mine Manager and subsequently, the EOR should be notified immediately. If considered critical, a replacement instrument should be installed.

If several instruments within an area of the dikes or dams are observed to exceed the notification levels, then the following is required:

- The Mine Manager and EOR should be notified within 24 hours.
- Monitoring frequency will be increased as needed based on assessment of common trend.
- EOR to assess the dam integrity and may recommend analyses, site visit, or implementation of remedial actions as required.

III.1.2 Settlement

There are several methods used to monitor settlement at the Sullivan Mine tailings facilities. These include settlement plates, Sondex settlement gauges, and surveys.

Notification levels have been established for the various settlement measurements. These are summarized along with survey results and required monitoring frequency in Section III.2 Table AIII.4.

The following response is required when the notification level is exceeded at one instrument:

- Notify EoR within 24 hours upon verification of reading exceedance.
- EoR to evaluate data for reliability, and review survey data within the general vicinity of the individual survey monument in question. EoR may recommend repeat measurement and increased on-going monitoring frequency.

If more than one instrument within the facility indicates exceedance of the notification level, then the following is required:

- Notify EoR within 24 hours upon verification of reading exceedance.
- Repeat reading within one week.
- EoR to assess dam integrity and may recommend analyses, site visit, or other action.

III.1.3 Lateral Movement

There is one inclinometer installed in the East Gypsum Dike to monitor lateral movements. A notification level has been established for the inclinometer and is provided along with the required monitoring frequency in Section III.2 Table AIII.4.

The following response is required when the notification level is exceeded:

- Data reductions are checked for accuracy and correctness.
- EoR to evaluate data for reliability and review other instrumentation in vicinity of the slope inclinometer. Repeat measurement and/or measurement of other instruments may be recommended.
- EoR to assess dam integrity and may recommend analyses, site visit or other action.

III.1.4 Seepage

There are four weirs installed to measure seepage from the ARD Pond South Dam and the Iron Dike. Notification levels have been established and are provided along with the required monitoring frequency in Section III.2 Table AIII.5.

The following response is required when the notification level is exceeded:

- Data and data reductions are checked for accuracy and correctness.
- EoR to evaluate data for reliability and review other instrumentation in the vicinity. Repeat measurement and/or measurement of other instruments may be recommended.
- EoR to assess dam integrity and may recommend analyses, site visit, or other action.

III.1.5 Freeboard

There are three notification levels which have been set for the ARD Pond and the Iron Pond, which are provided in Section III.2 Table AIII.6.

Notification Level 1 indicates when the pumps should be started to transfer water to either the Drainage Water Treatment Plant (ARD Pond) or to the ARD Pond (Iron Pond).

Notification Level 2 indicates when water levels are approaching maximum operating levels. When Notification Level 2 is met or exceeded, transfer of water should continue as well as notifying the EOR and minimizing inflows. For the ARD Pond, this could include diverting 3700/39000 to the Iron Pond and for the Iron Pond, stop pumping to the Iron Pond and divert runoff if possible.

Notification Level 3 indicates when water levels are within 0.5 m of the spillway inverts. When Notification Level 3 is met or exceeded, continue with transfer of water, minimizing inflows, notification of the EOR, and notify MEMPR/MOE of potential spill as well as enacting Emergency Preparedness and Response Plan (EPRP).

III.1.6 Visual Inspections

As part of the QPOs, a series of regularly scheduled inspections is required to ensure that the tailings facilities are operating as intended and to identify problems and issues so that necessary corrective actions may be implemented in a timely manner. The main types of inspections are as follows:

- routine inspections (performed by Teck staff)
- event driven inspections (performed by Teck staff, and the Engineer of Record depending on the event)
- annual inspection (performed by the Engineer of Record)
- dam safety review (performed by an independent and qualified professional engineer)

Routine Visual Inspections

Routine visual inspections are performed by Teck staff and documented using one of the standard inspection forms, which are included in Appendix E of the OMS Manual. Two types of forms are provided: one for Weekly/Bi-weekly inspections and forms for Monthly/Annual inspections.

The minimum visual inspection frequency for each of the structures can be found in Table III-1.

Table III-1 Visual Inspection Requirements for the Dikes and Dams at Sullivan Mine

<table>
<tr><th colspan="2">Dike</th><th>CDA Classification</th><th>Pond Elevation</th><th>Visual Inspection Requirements</th></tr>
<tr><td colspan="2" rowspan="2">ARD Pond Dikes</td><td rowspan="2">Very High</td><td>< 1040 m</td><td>Monthly</td></tr>
<tr><td>>1040 m</td><td>Weekly (a Monthly Inspection form must be filled in once per week if pond is high for an extended period of time, i.e., greater than one month)</td></tr>
<tr><td colspan="2">Iron Dike (STA 0+00 to 10+00)</td><td>High</td><td>N/A</td><td>Monthly</td></tr>
<tr><td colspan="2">Iron Dike (STA 10+00 to end of dam)</td><td>High</td><td>N/A[1]</td><td>Annually</td></tr>
<tr><td rowspan="2">Old Iron TSF</td><td>Old Iron Dike</td><td>Low</td><td rowspan="7">N/A[1]</td><td rowspan="2">Annually</td></tr>
<tr><td>Iron TSF Divider Dike</td><td>Low</td></tr>
<tr><td colspan="2">Siliceous Cell Dikes #1, #2 and #3</td><td>Low</td><td>Annually</td></tr>
<tr><td rowspan="2">Gypsum TSF</td><td>West Gypsum Dike</td><td>High</td><td rowspan="2">Annually</td></tr>
<tr><td>East Gypsum Dike</td><td>High</td></tr>
<tr><td colspan="2">Northeast Gypsum Dike and Recycle Dam</td><td>Low</td><td>Annually</td></tr>
<tr><td colspan="2">Calcine Dike</td><td>Low</td><td>Annually</td></tr>
<tr><td colspan="2">Sludge Pond</td><td>Low</td><td>N/A</td><td>Bi-Weekly during DWTP operations otherwise Annually</td></tr>
</table>

Note: [1] Closed facility, no active pond

The following is a list of general information that should be recorded (monthly and annual inspections):

- signs of depressions and/or movements of the downstream dam/dike slope
- general condition of the dam/dike crest, toe, and faces, looking for settlement, erosion, seepage, cracking, animal burrows, vegetation growth or other abnormal conditions
- water levels in active ponds
- depth of flow in spillways (record zero flow in spillway as 0.0 m^3)
- issues related to blockage and inadequate capacity of spillway channels
- seepage noting change in flow rate and visual cloudiness and any new seepage

Documentation of the routine inspections should be submitted to the Mine Manager following each inspection. If any maintenance requirements or anomalies are identified during the inspection, these must be identified to the mine manager.

The annual routine inspection by Teck staff should be planned such that it does not coincide with the annual inspection performed by the Engineer of Record. The annual routine inspection should include photographs of key features and any potential dam/dike safety concerns.

The completed inspection forms are stored in an electronic data base system, and hard copies of the inspection forms are catalogued and stored at Sullivan Mine.

Event Driven Inspections

In addition to routine inspections, special inspections may be required for significant seismic or climatic events, or anomalous instrumentation readings. Table III-2 presents the specific inspections to be carried out following specified events. All events involve immediate inspection by Teck staff, followed if required by notification to or inspection by the Engineer of Record.

Table III-2 Event Driven Inspections

Item	Event	Action	Comment
Embankments	Earthquake M5 or bigger within 100 km	Immediate inspection by Teck staff	Call the Engineer of Record if damage is noted
		Read all instruments within one week	Send instrument data to the Engineer of Record
	Earthquake M6 or bigger within 100 km	Inspection by the Engineer of Record Read all instruments	
	Rainfall (50 year event): 6 hour > 40 mm 24 hour > 56 mm Snowpack (50 year event): Accumulated snow water equivalent > 360 mm	Check and record water ponding Check dam toe seepage daily Drawdown water level if necessary	
	DWTP water delivery system fails	Check water level in the ARD Pond and Iron Pond daily Check rainfall daily Prepare standby pumps if required	Call the Engineer of Record if one pond is more than 75% full
	Instability or noticeable deformation, displacement of riprap.	Inspection by the Engineer of Record	
Surface Water Conveyance System	Rainfall (50 year event): 6 hour > 40 mm 24 hour > 56 mm Snowpack (50 year event): Accumulated snow water equivalent > 360 mm	Check and record water flow and ponding Check channels for debris Check channels for damage to riprap lining	

Annual Inspections

Annual inspections shall be carried out by the Engineer of Record for the tailings facilities for Sullivan Mine. The objective of the annual inspection is to confirm the routine inspections carried out, and to carry out a review of the conditions of the facilities and facility operation. The site water balance is reviewed to confirm the inputs and assumptions are still valid according to the current conditions.

The Engineer of Record issues an annual inspection report to the Mine Manager containing observations and recommendations. This report provides information to be used to revise the operation, maintenance, and surveillance programs as necessary and to assist in planning for future operation of the facility. The annual inspection reports are issued to the British Columbia Ministry of Environment (BC MOE) by March 31 each year (as stated in Permit No. 74). Copies of the annual inspection report are to be stored at Sullivan Mine.

III.2 INSTRUMENT DATA SUMMARY

The lists of active instruments and measurement points, along with alarm notification levels and maximum readings from the 2021 DSI reporting period, are shown in Tables AIII.3, AIII.4, AIII.5, and AIII.6. Updated instrument readings were provided to KCB by Vast Resources (Vast) and Teck staff on several occasions from September 2020 to August 2021. Vast of Cranbrook, British Columbia is contracted by Teck to read the pneumatic and standpipe piezometers, and WSP to survey the settlement plates and dike crests. The daily/weekly readings for the weirs and ARD Pond standpipes were performed by Teck staff. Copies of the plots that were produced for each impoundment area are included in Appendix IV through Appendix X.

Table III-3 Active Piezometers – Iron TSF

Group Designation	Piezometer No.	Northing	Easting	Elevation Ground (m)	Top of Casing Elevation (m)	Tip/Bottom of Casing (m)	General Location	Instrument Type	Recommended Reading Frequency	Notification Level (m)	Max Measured Piezometer Level In 2021[1] (m)	Max 2021 Level Relative To 2020[2]	Comment
	Iron TSF												
Line 6+00	P91 – 1	5500541.5	576470.5	1037.3	N/A	1023.0	Dike	Pneumatic	Three times a year (spring, summer and fall)	1028.4	1023.3 2020-10-19	↓	
	P91 – 2A	5500512.5	576459.9	1029.7	N/A	1020.1	Road	Pneumatic		1026.9	1022.9 2020-10-19	↓	
	P91 – 2B	5500511.9	576462.4	1029.3	N/A	1021.5	Road	Pneumatic		1026.9	1023.1 2020-10-19	↓	
Line 16+00	SB – P15	5500739.4	576803.0	1033.9	N/A	1029.0	Iron TSF	Pneumatic		1036.2	1032.6 2021-07-28	↓	
	P91 – 3A	5500660.4	576707.5	1038.4	N/A	1008.6	Dike	Pneumatic		1024.8	1023.5 2020-10-19	↔	
	P91 – 3B	5500661.3	576708.4	1038.3	N/A	1023.7	Dike	Pneumatic		1025.8	1023.7 N/A	↔	Dry
	P91 – 3C	5500660.4	576709.0	1038.9	N/A	1021.3	Dike	Pneumatic		1025.8	1022.0 2021-07-28	↓	
	P91 – 4	5500630.6	576730.8	1031.5	N/A	1017.2	Bench	Pneumatic		1022.0	1020.3 2020-10-19	↔	
	P92 – 20	5500593.9	576760.7	1033.0	N/A	1010.4	Bench	Pneumatic		1015.9	1015.2 2021-04-12	↓	
	P92 – 21	5500595.8	576762.3	1033.0	N/A	1012.2	Bench	Pneumatic		1015.9	1015.4 2021-04-12	↓	
Line 24+00	P91 – 5A	5500482.1	576931.7	1039.7	N/A	1017.7	2400 Bench at Dike	Pneumatic		1031.8	1030.6 2021-04-12	↓	
	P91 – 5B	5500786.8	576930.2	1039.7	N/A	1026.7	2400 Bench at Dike	Pneumatic		1030.0	1027.2 2020-10-19	↓	
	P91 - 6	5500752.7	576941.0	1031.5	N/A	1020.5	2400 Bench at Dike	Pneumatic		1023.6	1022.7 2021-08-11	↓	
Line 30+00	P92 – 1	5500893.9	577066.3	1035.1	N/A	1021.1	91 Dike	Pneumatic		1033.0	1031.3 2020-10.19	↓	
	P92 – 2	5500865.9	577113.8	1028.6	N/A	1024.0	Slope	Pneumatic	Monthly	1027.8	1026.3 2020-11-13	↓	
Line 38+00	P92 – 6	5501125.1	577156.5	1042.1	N/A	1024.2	91 Dike	Pneumatic	Three times a year (spring, summer and fall)	1033.6	1031.7 2020-10-19	↓	
	P92 – 7	5501118.0	577174.9	1040.2	N/A	1029.6	Slope	Pneumatic		1032.7	1030.1 2020-10-19	↓	
	P92 – 9	5501097.9	577314.6	1029.9	N/A	1025.3	Toe	Pneumatic		1028.4	1026.8 2020-10-19	↓	
Line 42+00	P92 – 11	5501217.8	577335.4	1031.5	N/A	1025.0	Toe	Pneumatic		1028.4	1025.3 2021-07-28	↓	
	P91 – 11A	5501258.1	577172.2	1042.4	N/A	1027.0	91 Dike	Pneumatic		1036.7	1033.4 2020-10-19	↓	
	P91 – 11B	5501258.1	577172.2	1042.3	N/A	1029.9	91 Dike	Pneumatic		1036.7	1033.4 2020-10-19	↓	
	P91 – 12	5501209.4	577418.1	1040.9	N/A	1029.7	Slope	Pneumatic		1034.5	1032.9 2020-10-19	↓	
	P92 - 16	5501237.6	577246.4	1037.3	N/A	1027.6	Slope	Pneumatic		1030.6	1028.5	↑	

Group Designation	Piezometer No.	Northing	Easting	Elevation Ground (m)	Top of Casing Elevation (m)	Tip/Bottom of Casing (m)	General Location	Instrument Type	Recommended Reading Frequency	Notification Level (m)	Max Measured Piezometer Level In 2021[1] (m)	Max 2021 Level Relative To 2020[2]	Comment
	Iron TSF												
											2021-07-28		
Line 45+00	P92 - 13	5504074.8	577182.3	1040.5	N/A	1031.3	91 Dike	Pneumatic		1037.3	1034.1 2020-10-19	↓	
	P92 - 14	5504071.7	577199.9	1037.4	N/A	1029.6	Slope	Pneumatic		1036.8	1033.8 2020-10-19	↓	
	P92 - 15	5501320.2	577314.9	1030.3	N/A	1029.0	Toe	Pneumatic		1030.3	1029.0 2020-10-19	↔	Dry
Line 54+00	P5	5501660.5	577228.4	1039.1	1041.6	1037.4	Toe at Siliceous Cell #1	Standpipe	Annually	1039.5	1038.1 2021-04-12	↓	
Toe Piezometers	P92 – H	5500665.1	576891.7	1025.6	N/A	998.1	21+00	VWP	Remotely monitored (hourly readings). Review data monthly.	1032.0	1025.8 2021-04-19	↓	
	P92 – 25	5500806.7	577125.8	1022.9	N/A	999.0	28+00	Pneumatic	Monthly	1032.0	1029.1 2021-05-18	↓	
	P92 – 26	5500550.3	576802.5		1019.8	1009.1	16+00	Standpipe	Three times a year (spring, summer and fall)	1015.0	1014.4 2021-04-09	↓	

Notes:
1. 2021 reporting period runs from September 1, 2020 to August 31, 2021.
2. Water levels are considered equal if differences are ≤ 0.1 m.

Table III-4 Active Piezometers – Old Iron TSF

Group Designation	Piezometer No.	Northing	Easting	Ground Elevation (m)	Top of Casing Elevation (m)	Tip/Bottom of Casing (m)	General Location	Instrument Type	Recommended Reading Frequency	Notification Level	Max Measured Piezometer Level In 2021[1]	Max 2021 Level Relative To 2021[2]	Comment
	Old Iron TSF												
Old Iron Dike	P93 – 17	5500680.3	575451.9	1043.0	1043.0	1025.8	Dike	Standpipe	Three times a year (spring, summer and fall)	1037.3	1036.1 2020-10-19	↓	
	P93 – 18	5500701.7	575475.6	1044.4	1044.7	1028.3	Dike	Standpipe		1039.0	1037.8 2020-10-19	↓	
	~~P96 – 08~~	-	-	-	~~N/A~~	~~Unknown~~	~~MCE Buttress~~	~~Pneumatic~~		~~2.6~~[2]	-	-	Replaced with new vibrating wire piezometer in 2018.
	~~P96 – 11~~	~~Not available~~	~~Not available~~	~~Not available~~	~~Not available~~	~~Not available~~	~~MCE Buttress~~	~~Pneumatic~~		~~-1.5~~	-	-	Slow leak, erratic data, replaced with new vibrating wire piezometer in 2018.
	P96 – 12	5500652.6	575518.6		N/A	Unknown	MCE Buttress	Pneumatic		0.9[3]	-0.04 2021-04-09	↓	
	SUL-OID-VWP-18-01 A&B	5500688.4	575449.2	1043.4	Tip A:	1025.8	MCE Buttress	VWP	Remotely monitored (hourly readings). Review data monthly.	Pending review	1036.7 2020-09-08	↓	
					Tip B:	1036.5		VWP		Pending review	1036.4 2020-09-08	↔	
	SUL-OID-VWP-18-02 A&B	5500633.2	575431.2	1040.1	Tip A:	1016.6	MCE Buttress	VWP		Pending review	1034.1 2020-09-08	↓	
					Tip B:	1035.5		VWP		Pending review	1035.5 2020-12-02	↔	
Iron TSF Divider Dike	P93 – 19	5500962.3	575892.0	1042.6	1043.6	1025.6	Dike	Standpipe	Annual	1040.15	1038.8 2021-04-09	↓	
	P93 – 20	5501191.4	575943.2	1044.1	1045.3	1026.4	Dike	Standpipe		1041.25	1040.1 2021-04-09	↓	

Notes:
1. 2021 reporting period runs from September 1, 2020 to August 31, 2021.
2. Water levels are considered equal if differences are ≤ 0.1 m.
3. Installation elevation not known.

Table III-5 Active Piezometers – Siliceous TSF

Group Designation	Piezometer No.	Northing	Easting	Ground Elevation (m)	Top of Casing Elevation (m)	Tip/Bottom of Casing (m)	General Location	Instrument Type	Recommended Reading Frequency	Notification Level	Max Measured Piezometer Level In 2021[1]	Max 2021 Level Relative To 2020[2]	Comment
	Siliceous Dikes												
West Side Siliceous Dike #1	P5	5501660.5	577228.4	1039.1	1041.6	1037.4	Cell #1	Standpipe	P105 and P5 annually unless change > 0.5 m or at notification levels then read all Piezometers	1039.5	1038.1 2021-04-12	↔	
	SP101	5501176.3	577719.3	1035.4	1036.4	1021.6	Cell #1	Standpipe		1023.9	1021.7 2021-04-12	↔	
Middle Siliceous Dike #1	P105	5501220.6	577927.9	1033.0	1033.2	1021.3	Cell #1	Standpipe		1022.0	1030.3 2020-08-13	↑	Max. 2019, 2020 & 2021 readings above notification level. Casing likely blocked.
	~~SP104~~	~~5501248.9~~	~~577910.8~~	~~1035.4~~	~~1035.1~~	~~1021.1~~	~~Cell #1~~	~~Standpipe~~		~~1022.0~~	~~N/A~~		Blocked at 1031.3
East Side Siliceous Dike #1	SP106	5501410.5	578028.7	1034.1	1034.7	1020.9	Cell #1	Standpipe		1021.4	1021.1 2021-04-16	↔	
Crest Siliceous Dike #2	P231	5500962.2	577497.5	1031.2	1031.2	1019.5	Cell #2	Standpipe	Annual (Spring)	1022.3	N/A		No reading
	P257	5500971.0	577407.3	1031.3	1030.4	1022.0	Cell #2	Standpipe		1025.0	1022.5 2021-04-12	↓	
	P91 – 13	5500964.5	577413.7	1029.7	N/A	1020.0	Cell #2	Pneumatic	Three times a year (spring, summer and fall)	1025.0	1021.7 2020-10-19	↓	
Lines 3+00/7+00 Siliceous Dike #3	~~P303~~	~~5500977.6~~	~~577855.0~~	~~1029.1~~	~~1029.3~~	~~1020.9~~	~~7+00 Crest~~	~~Standpipe~~	P232, P301 and P303 annually unless change > 0.5 m then read all Piezometers	~~1022.3~~	~~1020.9~~ ~~2021-04-12~~	↔	Dry Replaced by SUL-SD3-VWP-18-08
	~~P301~~	~~5500973.6~~	~~577739.0~~	~~1028.1~~	~~1029.4~~	~~1020.6~~	~~3+00 Crest~~	~~Standpipe~~		~~1022.3~~	~~1020.6~~ ~~2021-04-12~~	~~↔~~	Replaced by SUL-SD3-VWP-18-06
	~~P302~~	~~5500963.3~~	~~577739.5~~	~~1025.7~~	~~1027.2~~	~~1021.0~~	~~3+00 Slope~~	~~Standpipe~~		~~1021.2~~	~~1021.1~~ ~~2021-04-12~~	~~↔~~	Replaced by SUL-SD3-VWP-18-07
	P232	5500968.5	577854.3	1026.7	1027.3	1017.4	7+00 Slope	Standpipe		1019.3	1018.0 2021-04-12	↔	
	P233	5500959.1	577853.8	1023.6	1024.3	1017.9	7+00 Slope	Standpipe		1019.3	1017.9 2021-04-12	↔	Dry
	SUL-SD3-VWP-18-06 A&B	5500975.7	577751.2	1029.2	Tip A:	1008.8	3+00 Crest	VWP	Remotely monitored (hourly readings). Review data monthly.	Pending review	1014.9 2021-04-13	↔	
					Tip B:	1018.5		VWP		Pending review	1018.5 2021-08-31	N/A	Dry
	SUL-SD3-VWP-18-07	5500920.1	577753.0	1017.1	Tip A:	1006.1	3+00 Toe	VWP		Pending review	1014.7 2021-04-13	↓	
	SUL-SD3-VWP-18-08 A&B	5500985.8	577874.7	1029.6	Tip A:	1009.6	7+00 Crest	VWP		Pending review	1014.1 2020-09-08	↓	
					Tip B:	1017.3		VWP		Pending review	1018.3 2020-12-02	↔	
	~~SUL-SD3-VWP-18-09~~	~~5500919.4~~	~~577852.5~~	~~1016.8~~	~~Tip A:~~	~~1013.4~~	~~7+00 Toe~~	~~VWP~~		~~Pending review~~		~~N/A~~	Non-functioning
Siliceous Dike #3 East Side	P306	5501100.8	578268.9	1028.4	1029.6	1020.9	Crest	Standpipe	Monthly first 12 months then annual (in Spring)	Pending review	1021.0 2021-07-07	↓	Stopped reading in 2004 as dry since 1985. Reinstated 2019. Top of casing to be re-surveyed.
	P307	5501088.7	578278.1	1026.1	1027.0	1020.2	Crest	Standpipe		Pending review	1020.5 2021-04-08	↔	Stopped reading in 2004 as dry since 1985. Reinstated 2019.Top of casing to be re-surveyed. Notification level to be determined following survey and review of readings since 2019.

Group Designation	Piezometer No.	Northing	Easting	Ground Elevation (m)	Top of Casing Elevation (m)	Tip/Bottom of Casing (m)	General Location	Instrument Type	Recommended Reading Frequency	Notification Level	Max Measured Piezometer Level In 2021[1]	Max 2021 Level Relative To 2020[2]	Comment
	Siliceous Dikes												
	P308	5501293.0	578310.5	1028.8	1030.0	1020.8	Crest	Standpipe		Pending review	1021.2 2021-04-08	↑	Stopped reading in 2004 as dry since 1985. Reinstated 2019. Top of casing to be re-surveyed. Notification level to be determined following survey and review of readings since 2019.
	P311	5501659.8	578325.4	1028.8	1030.0	1022.5	Crest	Standpipe		Pending review	1022.8 2021-02-08	↓	Stopped reading in 2004 as dry since 1985. Reinstated 2019. Top of casing to be re-surveyed. Notification level to be determined following survey and review of readings since 2019.
Siliceous Dike #3	SUL-SD3-P-18-10	5501022.5	578270.0	1018.1	1019.4	1004.8	Toe	Standpipe	Monthly	Pending review	1013.6 2020-09-10	↓	
	SUL-SD3-P-18-11	5501452.7	578349.6	1022.1	1023.5	1013.1	Toe	Standpipe		Pending review	1015.4 2021-04-08	↓	

Notes:

1. 2021 reporting period runs from September 1, 2020 to August 31, 2021.
2. Water levels are considered equal if differences are ≤ 0.1 m.

Table III-6 Active Piezometers – Gypsum TSF

Group Designation	Piezometer No.	Northing	Easting	Ground Elevation (m)	Top of Casing Elevation (m)	Tip/Bottom of Casing Elevation (m)	General Location	Instrument Type	Recommended Reading Frequency	Notification Level	Max Measured Piezometer Level In 2021[1]	Max 2021 Level Relative To 2020[2]	Comment
	Gypsum TSF												
West Gypsum Dike Line 10+00	P93 – 1	5499811.6	576419.4	1013.8	1014.9	1000.0	Upstream	Standpipe	Three times a year (spring, summer and fall)	1008.0	1004.5 2020-10-19	↔	
	P93 – 2	5499811.0	576420.9	1014.4	1014.4	996.8	Upstream	Standpipe		1008.0	1004.3 2020-10-19	↔	
	P93 – 3	5499789.6	576411.6	1017.5	1016.1	998.0	Crest	Standpipe		1008.0	1004.1 2020-10-19	↔	
	P93 – 4	5499790.2	576409.5	1017.5	1016.4	995.4	Crest	Standpipe		1008.0	1004.1 2020-10-19	↔	
	P93 – 5	5499751.1	576388.7	1011.1	1011.9	993.3	Downstream	Standpipe		1008.0	995.1 2020-10-19	↔	
West Gypsum Dike Line 20+00	~~P93 – 6~~	~~5499691.8~~	~~576696.5~~	~~1014.4~~	~~1014.9~~	~~997.9~~	~~Upstream~~	~~Standpipe~~	Three times a year (spring, summer, and fall)	~~1008.0~~	-	-	Standpipe blocked at ~ 10.4 m
	P93 – 7	5499670.8	576688.2	1015.3	1016.6	997.2	Crest	Standpipe		1008.0	997.9 2020-10-19	↔	
	SUL-WG-P-18-03	5499599.9	576662.0	1001.5	1002.9	984.5	Toe	Standpipe	Monthly	Pending review	994.2 2020-11-13	↔	
East Gypsum Dike Line 33+00	P93 – 8	5499642.3	577074.1	1017.2	1017.7	1001.9	Upstream	Standpipe	Annual	1010.1	1008.1 2021-04-15	↓	
	P93 – 9	5499642.6	577072.6	1017.2	1017.8	998.9	Upstream	Standpipe		1010.1	1008.4 2021-04-15	↔	
	P93 – 10	5499640.6	580423.8	1017.5	1018.0	1002.6	Crest	Standpipe		1009.5	1007.2 2021-04-15	↓	
	P93 – 11	5499622.5	577071.1	1017.5	1018.0	998.7	Crest	Standpipe		1008.6	1007.2 (9-Jul-2019)	↔	Blocked, not read in 2020 and 2021 monitoring period
	P93 – 12	5499583.8	577073.5	1013.5	1013.0	1000.8	Toe	Standpipe		1004.7	1003.7 2021-04-15	↔	
	SUL-EG-P-18-04	5499537.0	577196.9	1004.6	1005.9	998.1	Toe	Standpipe	Monthly	Pending review	1000.7 2021-04-08	↓	
East Gypsum Dike Line 48+00	P93 – 13	5499669.6	577521.5	1016.8	1017.6	1000.3	Upstream	Standpipe	Annual	1002.5	1000.4 (5-Apr-2019)	N/A	Not read in 2020 and 2021
	P93 – 14	5499645.3	577521.9	1017.2	1017.7	1004.3	Crest	Standpipe		1005.6	1004.6 2021-04-15	↔	Dry, blocked at 13.3 m
	SUL-EG-P-18-05	5499566.3	577527.0	1003.1	1004.5	995.8	Toe	Standpipe	Monthly	Pending review	999.9 2020-09-10	↓	

Notes:

1. 2021 reporting period runs from September 1, 2020 to August 31, 2021.
2. Water levels are considered equal if differences are ≤ 0.1 m.

Table III-7 Active Piezometers – ARD Storage Pond

Group Designation	Piezometer No.	Northing	Easting	Ground Elevation (m)	Top of Casing Elevation (m)	Tip/Bottom of Casing Elevation (m)	General Location	Instrument Type	Recommended Reading Frequency	Notification Level	Max Measured Piezometer Level In 2021[1]	Max 2021 Level Relative To 2020[2]	Comment
	ARD Storage Pond												
North Dam	PP01-01	5500675.6	575840.0	N/A	N/A	1041.7	North Dam	Pneumatic	Monthly, with additional readings taken weekly when the Pond level is above 1040 masl, or daily when the Pond level is above 1045 masl. The pneumatic piezometers are to be read monthly.	1042.7	1041.7 N/A	↓	Dry
	PP01-02	5500682.7	575834.9	N/A	N/A	1041.9	North Dam	Pneumatic		1042.7	1042.0 2021-05-18	↔	
	PP01-03	5500552.0	575738.1	N/A	N/A	1038.8	North Dam	Pneumatic		1039.8	1038.8 N/A	↔	Dry
	PP01-04	5500549.5	575743.1	N/A	N/A	1040.8	North Dam	Pneumatic		1041.8	1041.1 2021-04-08	↔	
	ND-01	5500756.6	575907.3	1042.2	1042.7	1032.0	North Abutment	Standpipe		1042.2	1040.2 2021-04-02	↓	
	ND-02D	5500636.4	575769.0	1042.2	1042.7	1019.5	Toe	Standpipe		1041.5	1039.1 2021-04-16	↓	
	ND-02S	5500636.3	575768.9	1042.2	1042.7	1040.3	Toe	Standpipe		1041.5	1041.4 2021-03-19	↔	
	ND-03	5500542.8	575693.1	1038.4	1039.2	1025.1	Toe	Standpipe		1039.2	1038.3 2021-04-02	↓	
South Dam	PP01-05	5500026.7	575892.8	N/A	N/A	1030.0	South Dam	Pneumatic		1031.0	1031.0 2021-03-05	↔	2021 max at notification level
	PP01-06	5500020.4	575893.4	N/A	N/A	1029.2	South Dam	Pneumatic		1030.5	1030.9 2021-03-05	↑	2021 max and most recent reading above notification level
	SD-01	5500056.6	576006.3	1041.0	1041.6	1029.6	South Abutment	Standpipe		1041.0	1034.3 2021-03-26	↓	
	SD-02	5499985.4	575904.0	1029.9	1030.5	1026.9	Toe	Standpipe		1029.9	1029.6 2021-03-26	↓	
	SD-03	5499995.4	575737.2	1037.0	1038.1	1036.0	South Abutment	Standpipe		1037.0	1036.8 2021-04-09	↔	

Notes:

1. 2021 reporting period runs from September 1, 2020 to August 31, 2021.
2. Water levels are considered equal if differences are ≤ 0.1 m.

Table III-8 Active Settlement and Inclinometer Measuring Instruments

Type	Instrument Number	Initial Elevation (m)	Location	Notification Level	Recommended Reading Frequency	Measured Level in 2021 (m)	Comment [2]
Iron Dike							
Settlement plates	SP330[1]	1037.40	2+00	>25 mm over 3 years	Every 3 Years	N/A	Surveyed in 2018. Less than 40 mm of settlement since 2007. Next survey 2021.
	SP331[1]	1042.44	9+00			N/A	Surveyed in 2018. Less than 65 mm of settlement since 2007. Next survey 2021.
	SP332[2]	1041.79	9+00			N/A	Surveyed in 2018. Less than 45 mm of settlement since 2007. Next survey 2021.
	SP 92 – 07	1034.91	16+00			N/A	Surveyed in 2018. Less than 35 mm of settlement since 2007. Next survey 2021.
	SP 99 – 01[3]	1042.07	4+00			N/A	Surveyed in 2018. Less than 45 mm of settlement since 2007. Next survey 2021.
Dike Crest Survey	-	-	0+00 to 12+00 centerline, U/S, D/S dike crest	1042 m	Annually	N/A	Survey was not completed in 2020 reporting period.
Gypsum TSF Dikes							
Settlement plates at West Gypsum Dike	SP97 – 01	1014.592	Line 10+00 Slope	>60 mm over 3 years	Annually	N/A	Settled 0 mm since 2017. Survey was not completed in 2020 reporting period.
	SP97 – 05	1015.568	Line 10+00 Crest			N/A	Settled 23 mm since 2017. Survey was not completed in 2020 reporting period.
	SP97 – 06	1015.936	Line 20+00 Slope			N/A	Settled 22 mm since 2017. Survey was not completed in 2020 reporting period.
Sondex gauge and Inclinometer at West Gypsum Dike	S94 – 01	N/A	Line10+00 Upstream	>90 mm over 3 years	Every 3 Years	N/A	Reading taken in 2019. Cumulative change since 1994 of 1.720, incremental change since 2016 of 0.14. Next reading scheduled for 2022.
	~~BI94-01~~	~~N/A~~	~~Line10+00 Upstream~~	~~N/A~~	~~Inactive~~	~~N/A~~	Inclinometer blocked since 2006 (last read in 2004). Do not replace unless other instruments indicate signs of movement.
Settlement plates at East Gypsum Dike	SP97 – 03	1017.676	Line 33+00	>60 mm over 3 years	Annually	N/A	Settled 17 mm since 2017. Survey was not completed in 2020 reporting period.
	SP97 – 04	1017.457	Line 48+00		Annually	N/A	Settled 28 mm since 2017. Survey was not completed in 2020 reporting period.
Sondex gauge and Inclinometer at East Gypsum Dike	S94 – 02	N/A	Line 33+00 Upstream	>60 mm over 3 years	Every 3 Years	N/A	Reading taken in 2019. Cumulative change since 1994 of 1.02, incremental change since 2016 of 0.08.
	BI94 – 02	N/A	Line 33+00 Upstream	>25 mm horizontal movement over 3 years	Every 3 Years	N/A	Reading taken in 2016. <5 mm movement parallel to dike and no change perpendicular to dike. To be read in October 2019.
Settlement plates at N.E. Gypsum Dike	SW (S1)	1019.264	Main Dike	>5 mm over 3 years	Every 3 Years	N/A	Surveyed in 2018. Less than 2 mm of settlement since 2007. Next survey 2021.
	SE (S2)	1019.073	Main Dike		Every 3 Years	N/A	Surveyed in 2018. Essentially 0 mm of settlement since 2007. Next survey 2021.
ARD Storage Pond							
Settlement Plates	SP01-01	1048.009	North Dam	>25 mm over 3 years	Every 3 Years	N/A	Surveyed in 2018. Less than 7 mm of settlement since 2001 Next survey 2021.
	SP01-02	1048.224	North Dam			N/A	Surveyed in 2018. Less than 15 mm of settlement since 2001. Next survey 2021.
	SP01-03	1048.113	North Dam			N/A	Surveyed in 2018. Less than 19 mm of settlement since 2001. Next survey 2021.
	SP01-04	1048.311	South Dam			N/A	Surveyed in 2018. Less than 8 mm of settlement since 2001. Next survey 2021.
	SP01-05	1048.310	South Dam			N/A	Surveyed in 2018. Essentially 0 mm of settlement since 2001. Next survey 2021.
	SP01-06	1048.351	South Dam			N/A	Surveyed in 2018. Less than 9 mm of settlement since 2001. Next survey 2021.
Sludge Impoundment Dikes							
Dike Crest Survey	-	-	North Dike centerline, U/S, D/S dike crest	894.6	Annually	N/A	Survey was not completed in 2021 reporting period.
			South Dike centerline, U/S, D/S dike crest	894.6	Annually	N/A	Survey was not completed in 2021 reporting period.

Notes:

1. SP330 and 331 lowered in 2006. (2) SP332 raised in 2004. (3) SP99-01 lowered in 2006.
2. 2021 survey pending at the time of the report.

Table III-9 Active Seepage Measurements September 1, 2020 – August 31, 2021

Structure/ Weir	Min. Current Reading Frequency	Notification Level	Weir Readings and Observations – September 1, 2020 to August 31, 2021																							
			September		October		November		December		January		February		March		April		May		June		July		August	
			Max. flow	Min. flow	Max. flow	Min. flow	Max. flow	Min. flow	Max. flow	Min. flow	Max. flow	Min. flow	Max. flow	Min. flow	Max. flow	Min. flow	Max. flow	Min. flow	Max. flow	Min. flow	Max. flow	Min. flow	Max. flow	Min. flow	Max. flow	Min. flow
			m^3/day		m^3/day		m^3/day		m^3/day		m^3/day		m^3/day		m^3/day		m^3/day		m^3/day		m^3/day		m^3/day		m^3/day	
ARD Pond/Weir #1 (ARDWU)	Weekly with daily readings between March 1 and May 30. Daily readings when the pond level is > 1045 m. Read for 3 days following rainfall event >10 mm.	150 m^3/day	54.9	13.1	Dry	Dry	0.11	Dry	1.51	0.11	12.14	0.67	20.42	3.87	71.14	20.42	54.93	3.87	13.13	0.11	0.11	0.11	0.11	0.11	29.71	0.11
ARD Pond/Weir #2		175 m^3/day	Dry	Dry	Dry	Dry	47.59	2.68	47.59	2.68	16.73	0.11	5.78	2.68	47.59	10.40	47.59	5.78	10.40	0	0	0	0	0	0	0
AIP[1] Dike/Weir #3 (AIPWU)	Weekly with daily readings between March 1 and May 30. Read for 3 days following rainfall event >10 mm.	50 m^3/day	2.8	2.8	6.05	0.93	2.82	0.34	0.93	0.12	0.93	0.12	0.12	0.12	2.82	0.12	2.82	0.12	1.21	0	2.82	0.12	1.91	0.02	1.21	0.12
AIP[1] Dike/Weir #4		500 m^3/day	26.17	9.56	65.34	14.02	34.01	9.56	17.19	6.09	34.01	9.56	26.17	11.22	93.33	19.53	65.34	19.53	26.17	17.19	20.76	6.09	6.09	0	14.02	0
West Gypsum Cell/Toe of Gravel Buttress at Cow Creek (STA. 11+00)	Visual Reading Annually	Cloudy flow	Flow is clear (observed as part of July 2021 site visit)																							
East Gypsum Cell/Toe of Dike Adjacent to James Creek	Visual Reading Annually	Cloudy flow	Flow is clear (observed as part of July 2021 site visit)																							

Notes:

1. AIP = Iron Pond

Table III-10 Active Pond Water Level Monitoring Locations

Type	Description	Location	Primary Purpose	Reading Frequency	Notification Level 1	Notification Level 2	Notification Level 3	General Water Level Information (m)
Iron Pond Water Level	Electronic readout unit.	Iron Dike Pump Station	Overtopping	Daily	1038.5 (Pump to ARD Pond)	1038.9 (As for Level 1 and notify EOR, minimize inflows, consider pumping to DWTP)	1040.5 (As for Level 2 and notify MEMPR/MOE, enact EPRP)	1036.42 Measured low water 1044 Measured high water 1041.0[1] (Spillway invert) 1042.0 (Top of dike)
Pond Water Level	Electronic readout unit with pressure transducer in bottom of wet well at el. 1034 m.	Pump wet well, data transmitted to DWT control room through the PLC system	Dam Stability	Daily	1045.5 (Pump to DWTP)	1046.5 (As for Level 1 and notify EOR, minimize inflows (e.g. divert 3700/3900 to Iron Pond))	1046.9 (As for Level 2 and notify MEMPR/MOE, enact EPRP)	1036.6 Measured low water 1039.8 Measured high water 1046.5 9 Maximum operating level) 1047.4 (Spillway invert) 1048.0 (Top of dam)

Notes:

1. The surveyed as-constructed invert elevations for the Iron Pond/Emergency Spillway varied from 1040.8 m to 1041.4 m, with the design elevation being 1041.0 m.

APPENDIX IV

Iron Dike Instrumentation

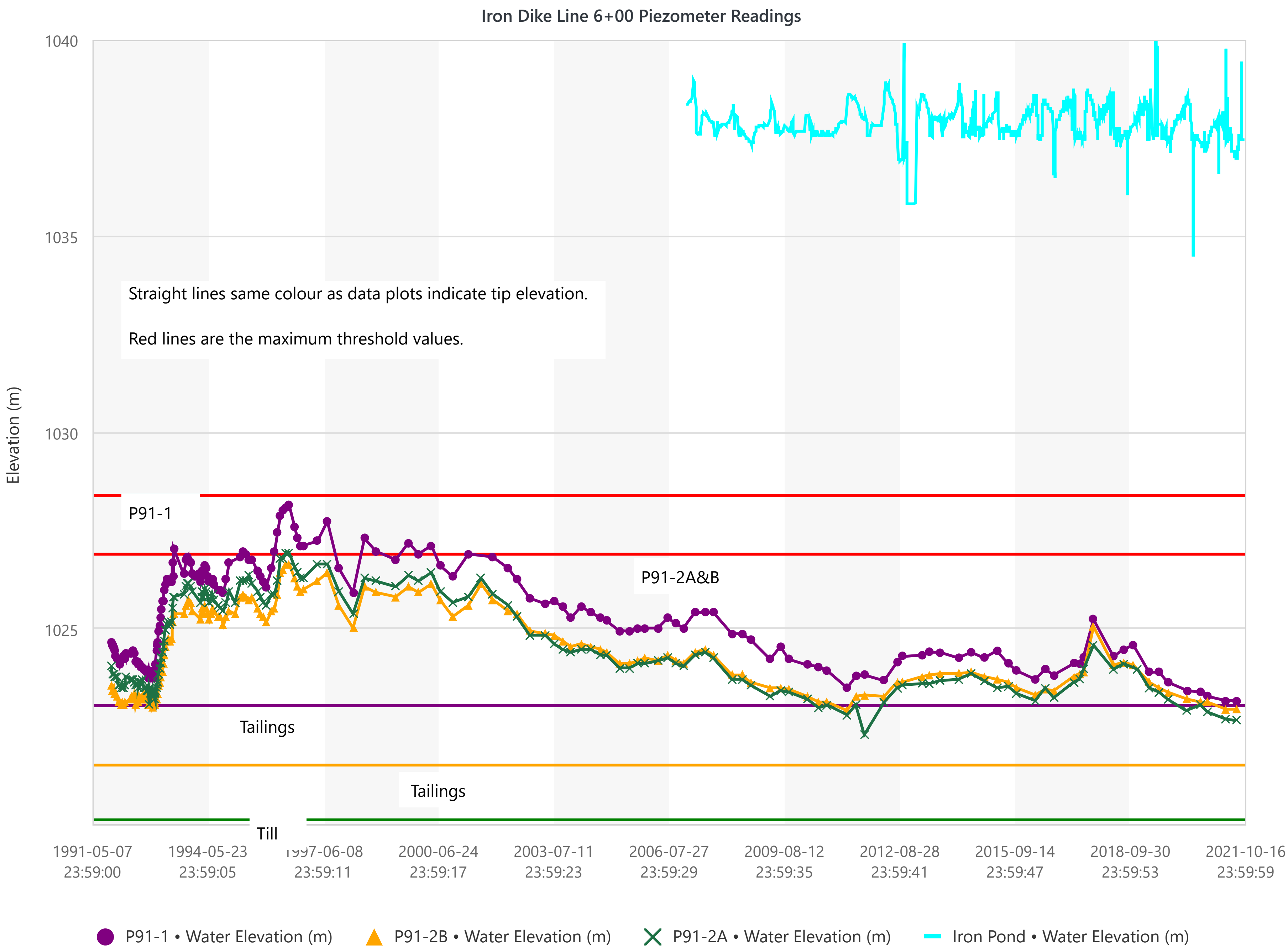
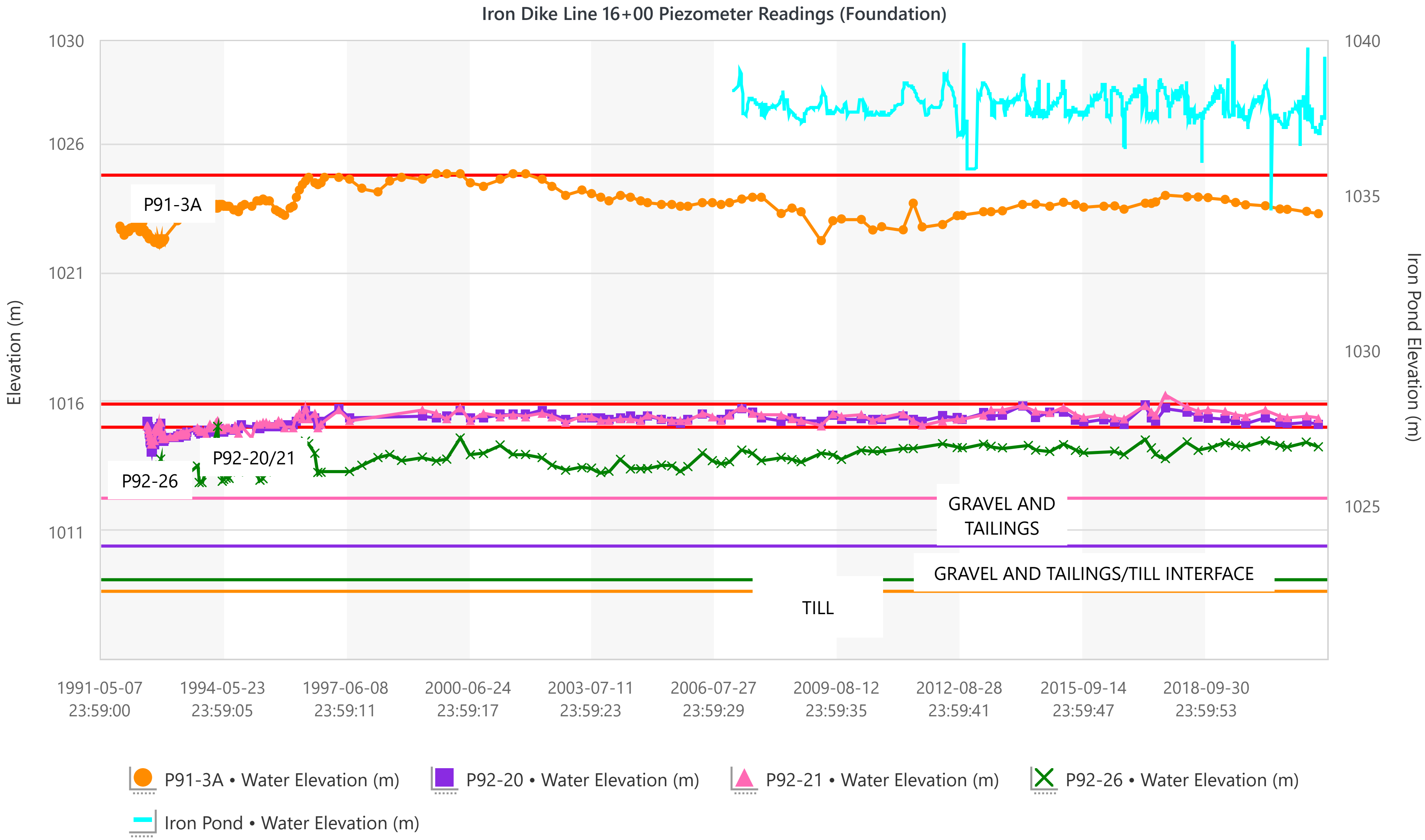


Figure IV-1 STN 6+00



Straight lines same colour as data plots indicate tip elevation.

Red lines are the maximum threshold values.

Standpipe piezometers were flushed in July/August 2014. Not all sediment was removed and some casings also cut or extended/repaired at this time. Therefore a new top of casing and new depth to bottom of standpipe was recorded for many instruments. Older data will appear below tip elevation if previously read "dry" or if previous top of casing elevation was incorrect due to damage.

SPxxx represents readings to point of flushing. SPxxx(R1) represents readings post flushing. If no (R1) plot then no change to top of casing elevation or depth to bottom of standpipe.

Figure IV-2 STN 16+00 Foundation

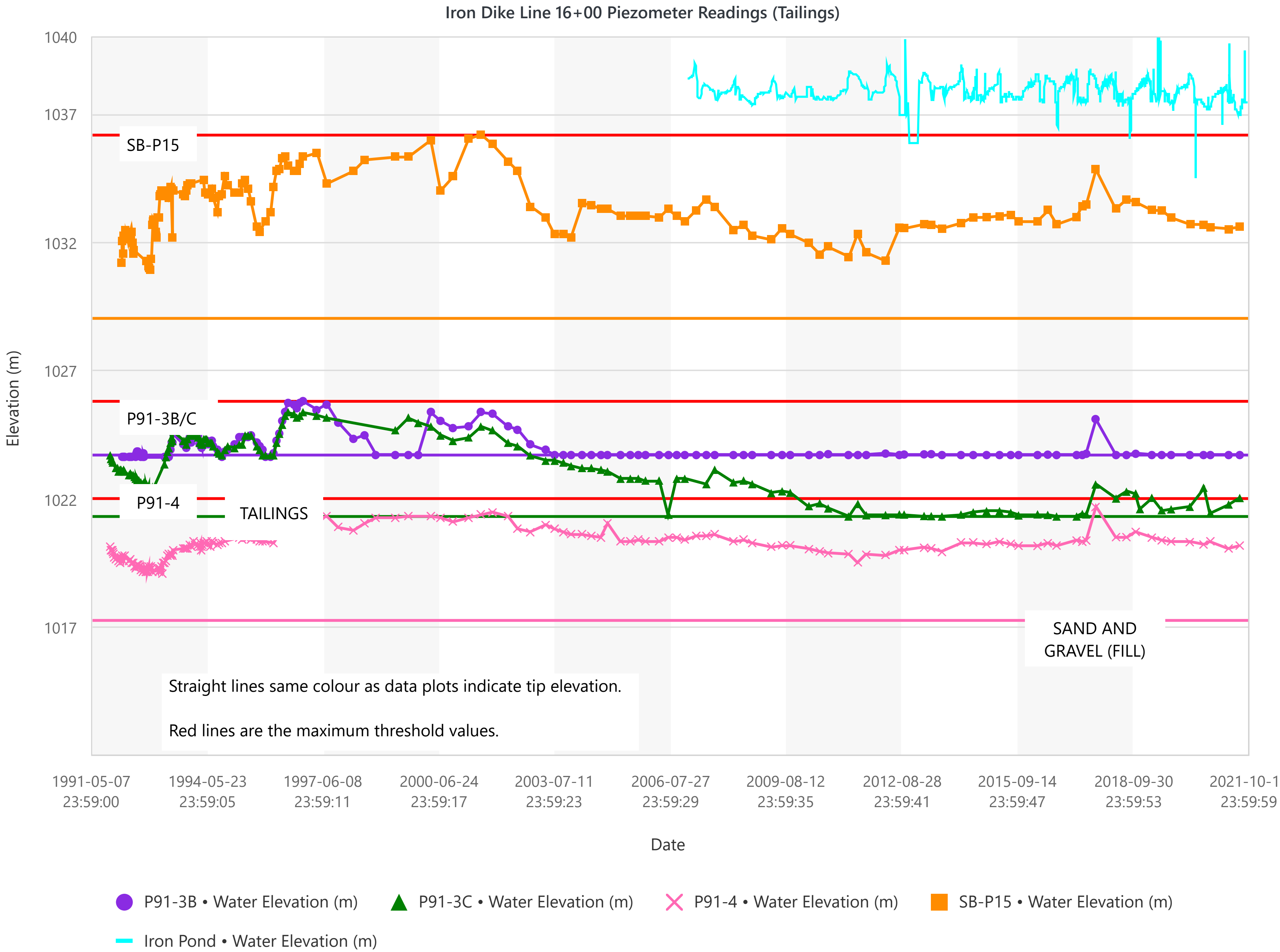


Figure IV-3 STN 16+00 Tailings

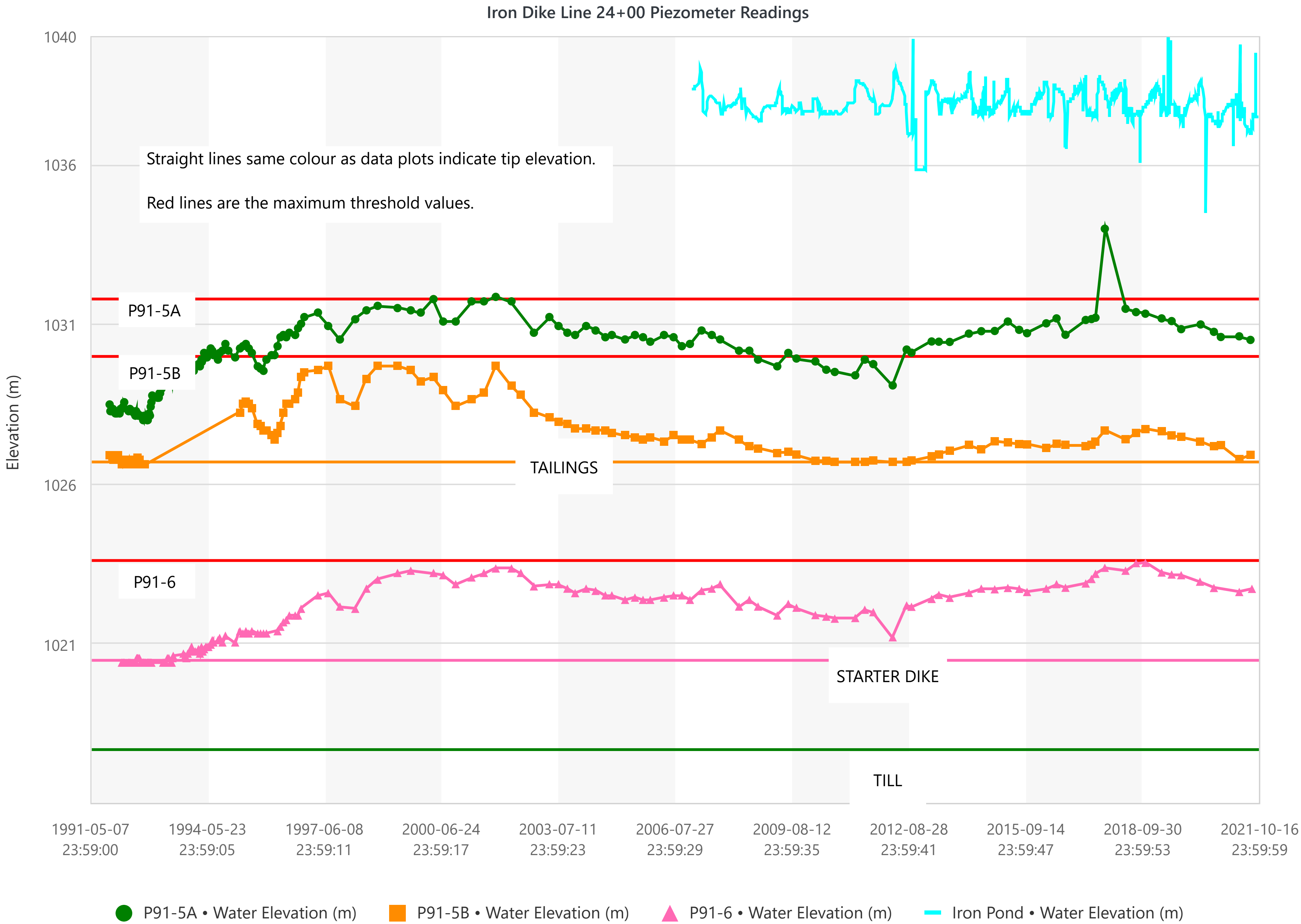


Figure IV-4 STN 24+00

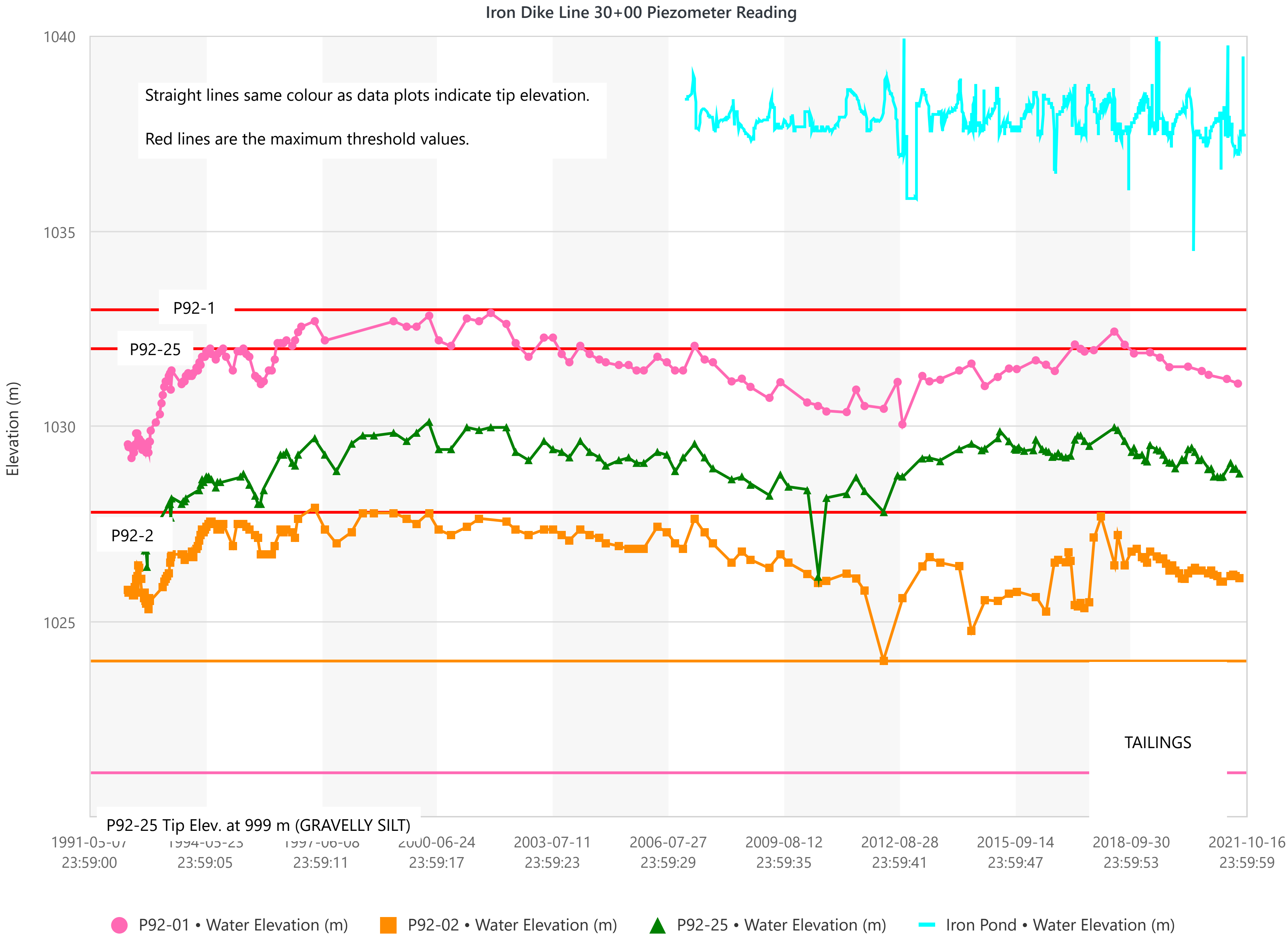


Figure IV-5 STN 30+00

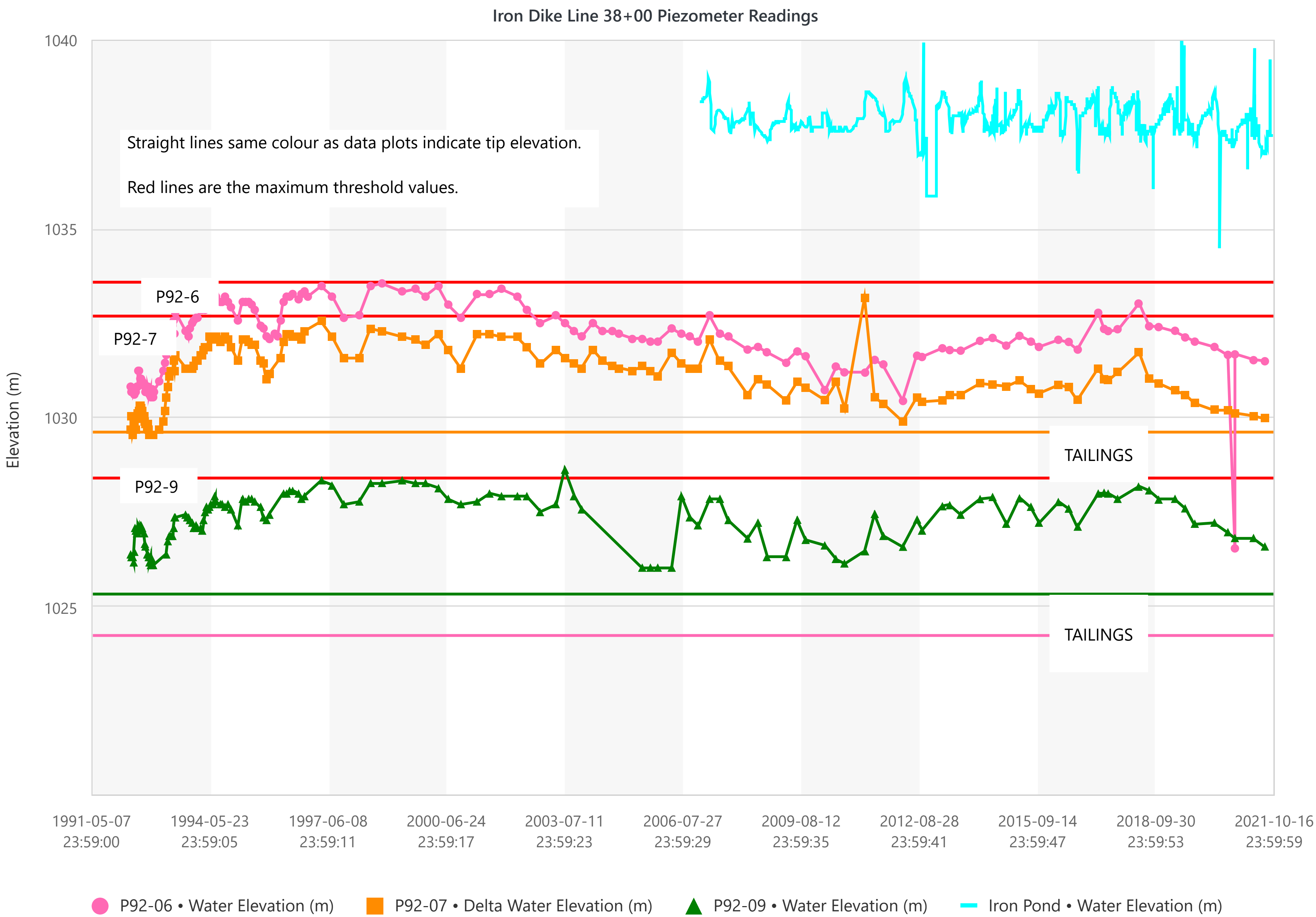


Figure IV-6 STN 38+00

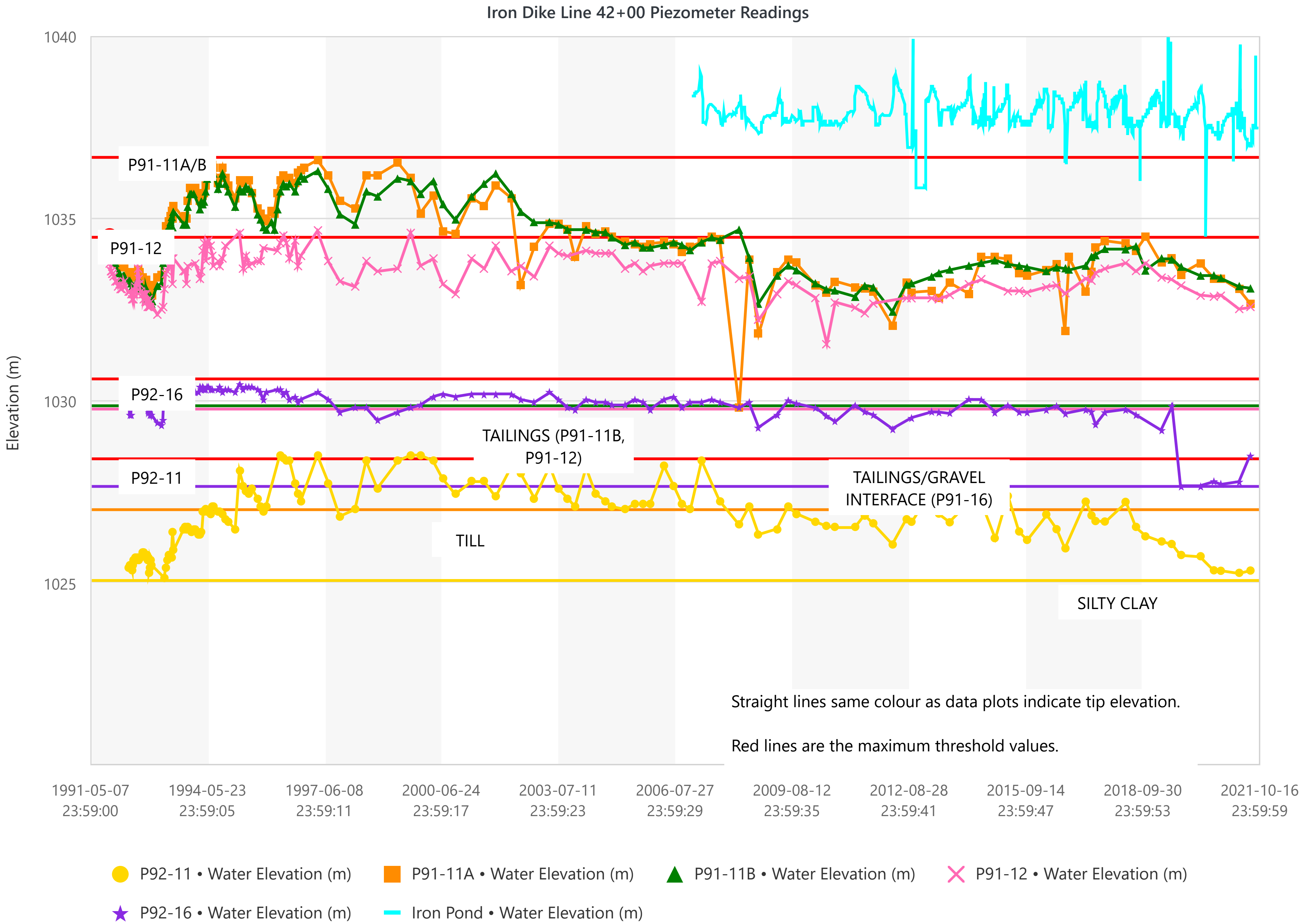


Figure IV-7 STN 42+00

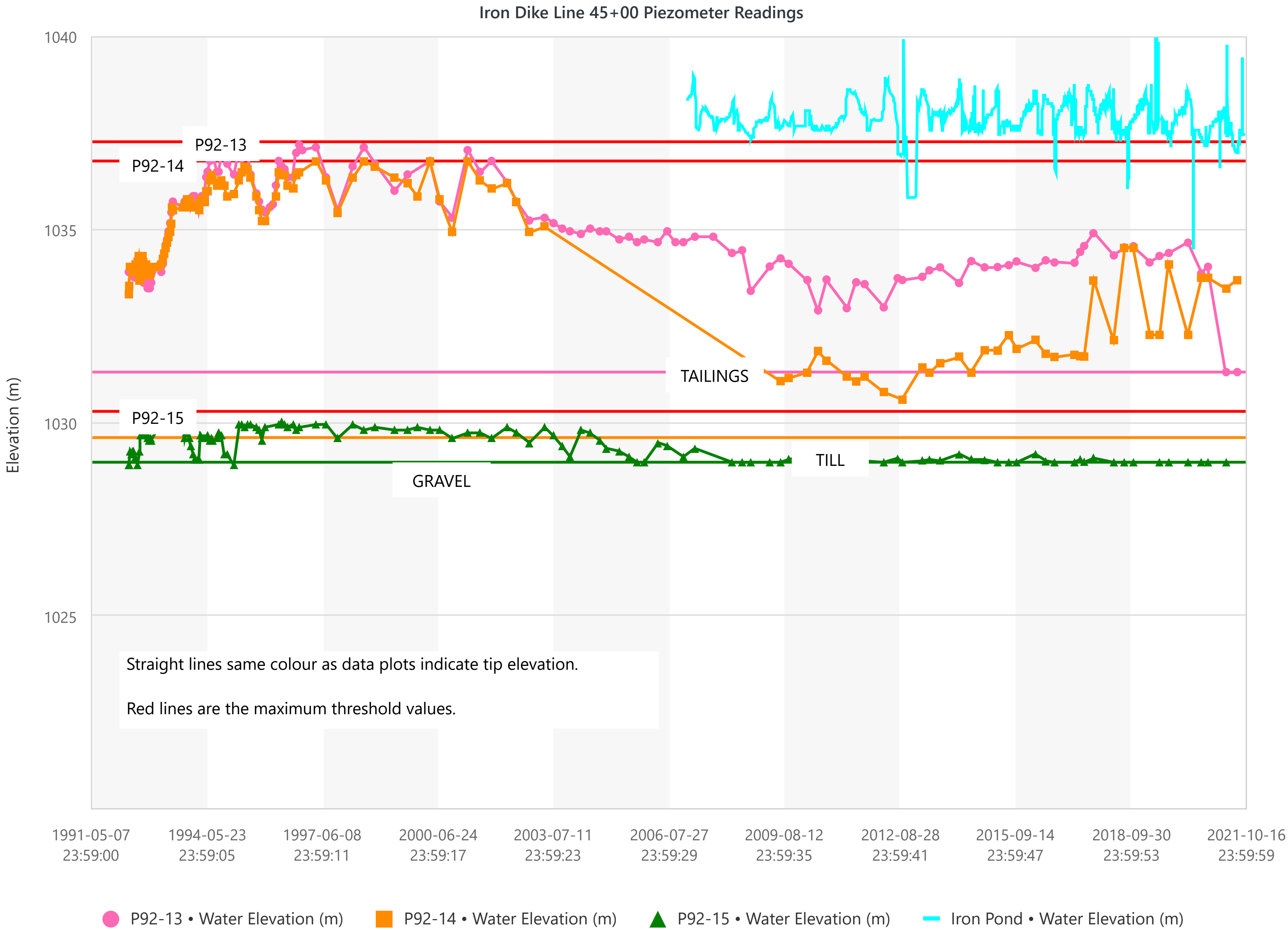
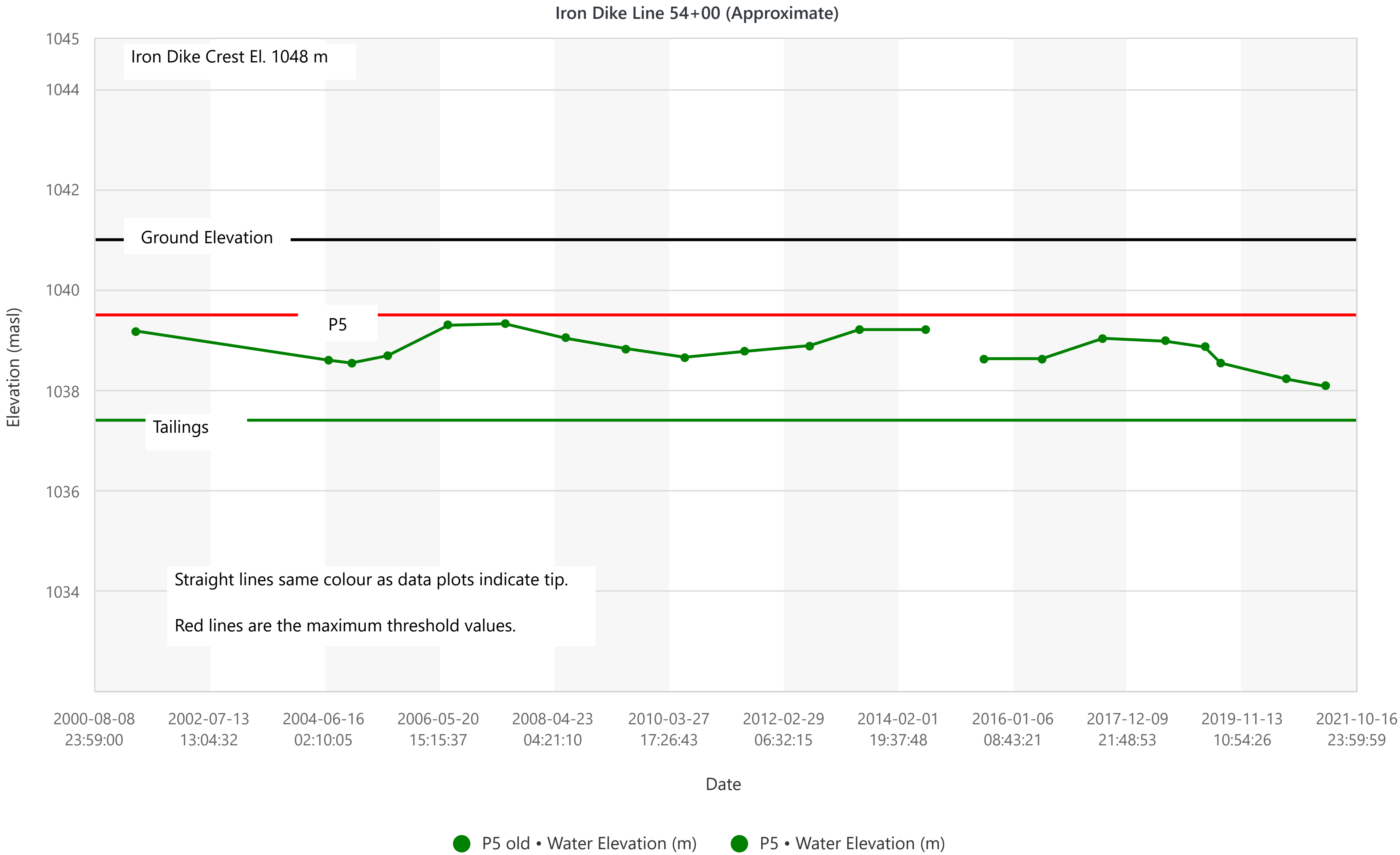


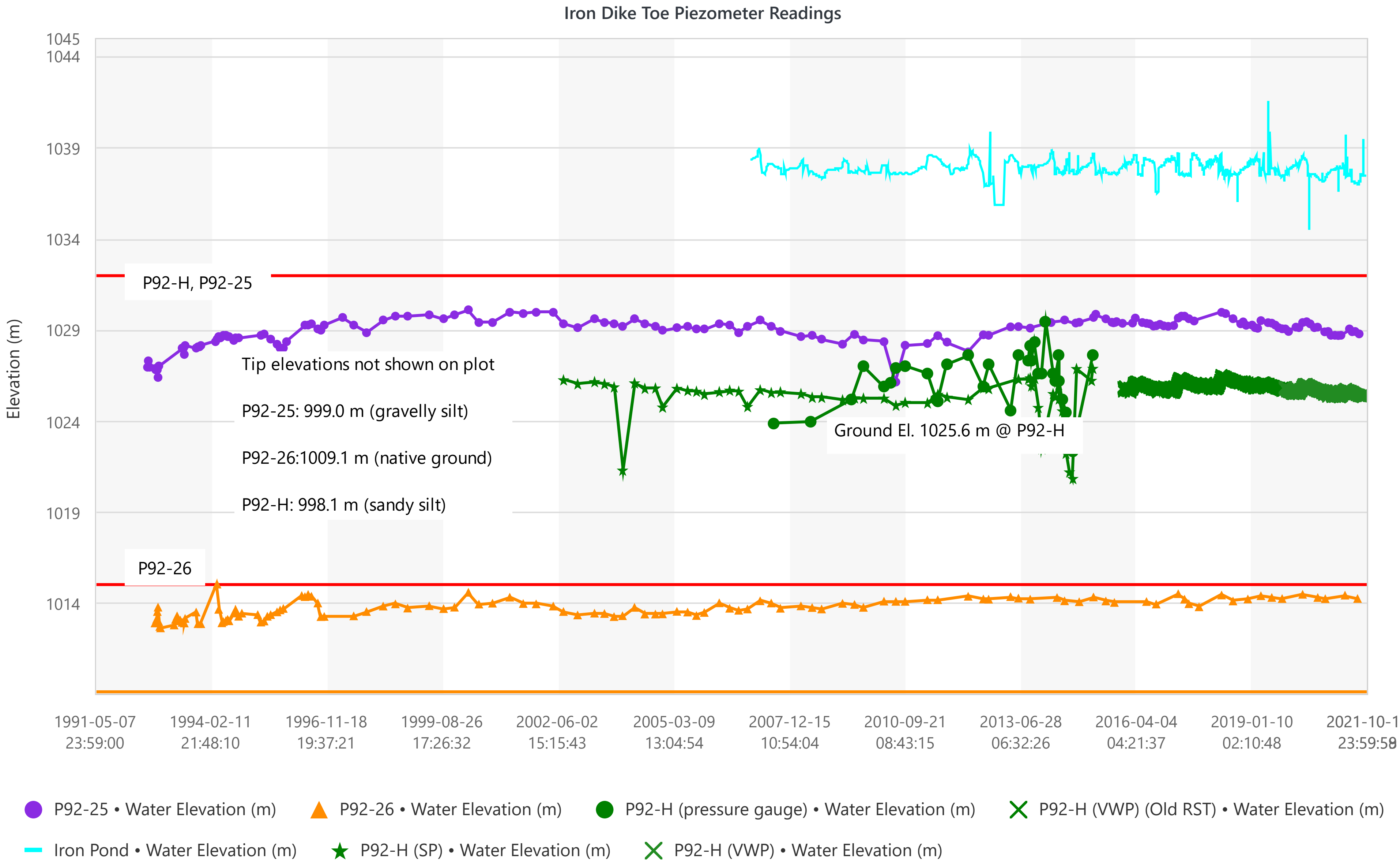
Figure IV-8 STN 45+00



Standpipe piezometers were flushed in July/August 2014. Not all sediment was removed and some casings also cut or extended/repaired at this time. Therefore a new top of casing and new depth to bottom of standpipe was recorded for many instruments. Older data will appear below tip elevation if previously read "dry" or if previous top of casing elevation was incorrect due to damage.

SPxxx represents readings to point of flushing. SPxxx(R1) represents readings post flushing. If no (R1) plot then no change to top of casing elevation or depth to bottom of standpipe.

Figure IV-9 Line 54+00



Straight lines same colour as data plots indicate tip elevation.

Red lines are the maximum threshold values.

Standpipe piezometers were flushed in July/August 2014. Not all sediment was removed and some casings also cut or extended/repaired at this time. Therefore a new top of casing and new depth to bottom of standpipe was recorded for many instruments. Older data will appear below tip elevation if previously read "dry" or if previous top of casing elevation was incorrect due to damage.

Figure IV-10 Toe Piezometers

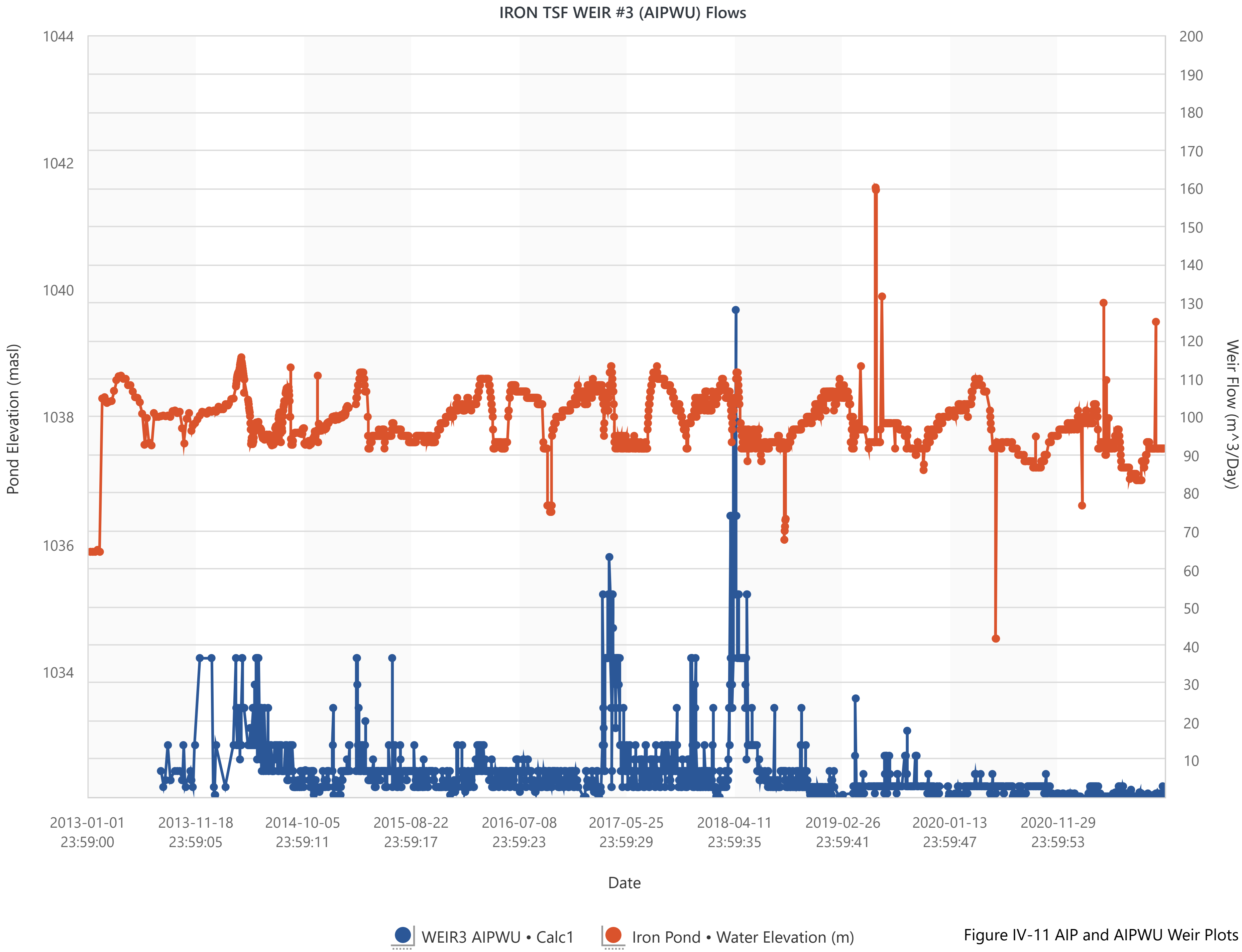
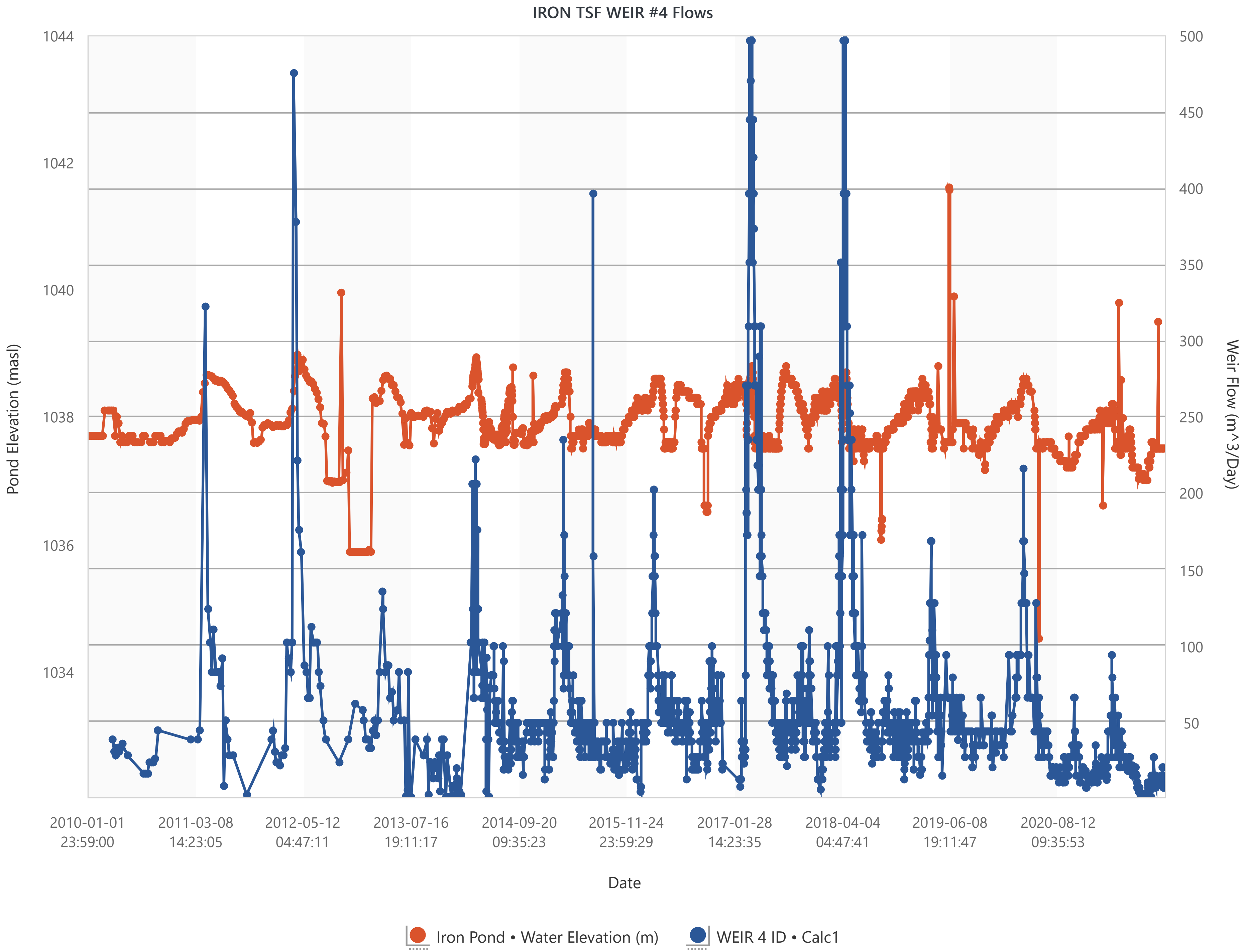


Figure IV-11 AIP and AIPWU Weir Plots



IRON TSF WEIR #4 Flows
Pond Elevation (masl)
Weir Flow (m^3/Day)
1044
1042
1040
1038
1036
1034
500
450
400
350
300
250
200
150
100
50
2010-01-01 23:59:00
2011-03-08 14:23:05
2012-05-12 04:47:11
2013-07-16 19:11:17
2014-09-20 09:35:23
2015-11-24 23:59:29
2017-01-28 14:23:35
2018-04-04 04:47:41
2019-06-08 19:11:47
2020-08-12 09:35:53
Date
Iron Pond • Water Elevation (m)
WEIR 4 ID • Calc1

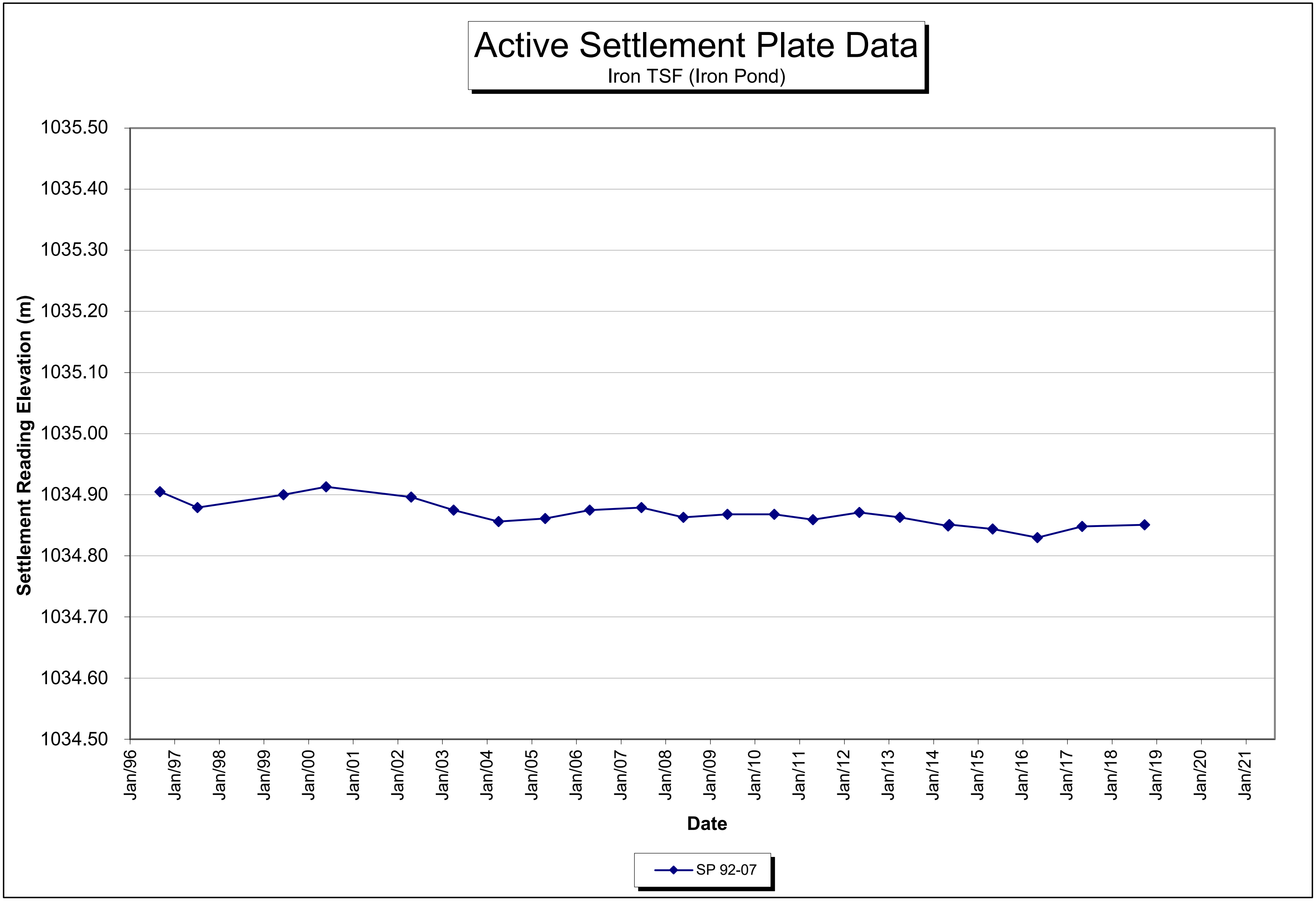


Figure IV-12 SP 92-07

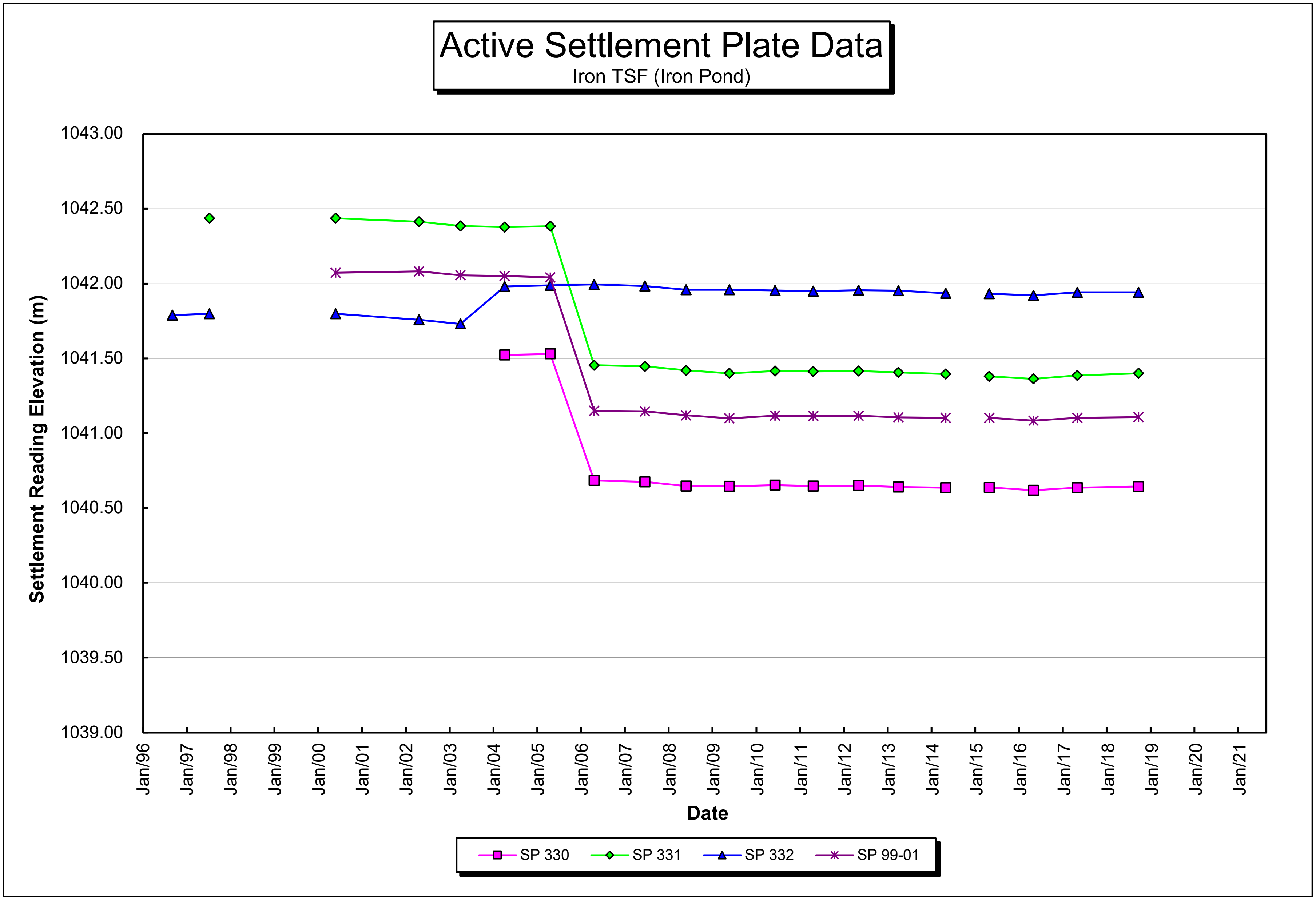


Figure IV-13 SP 330 - 332 and SP 99-01

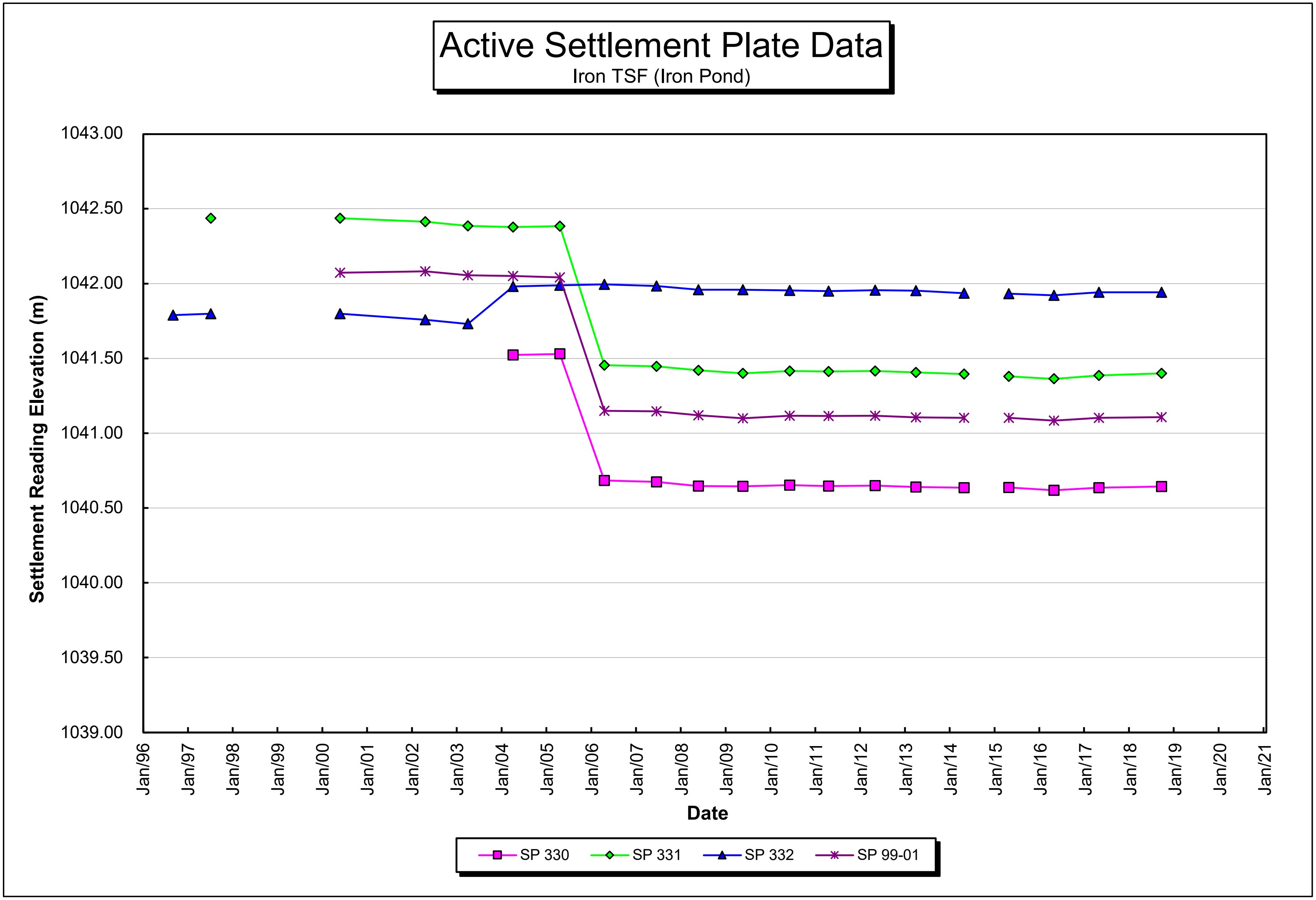
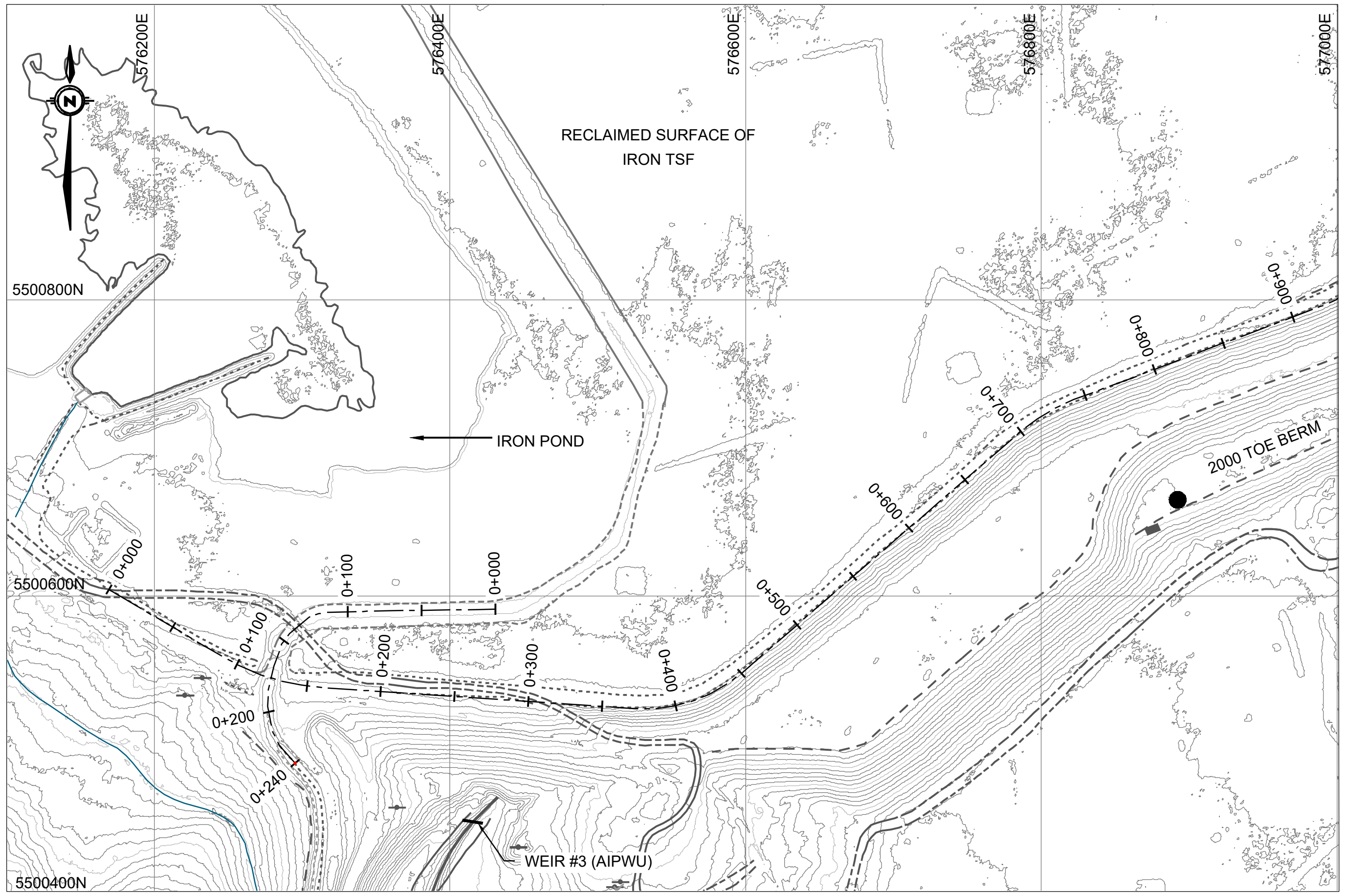
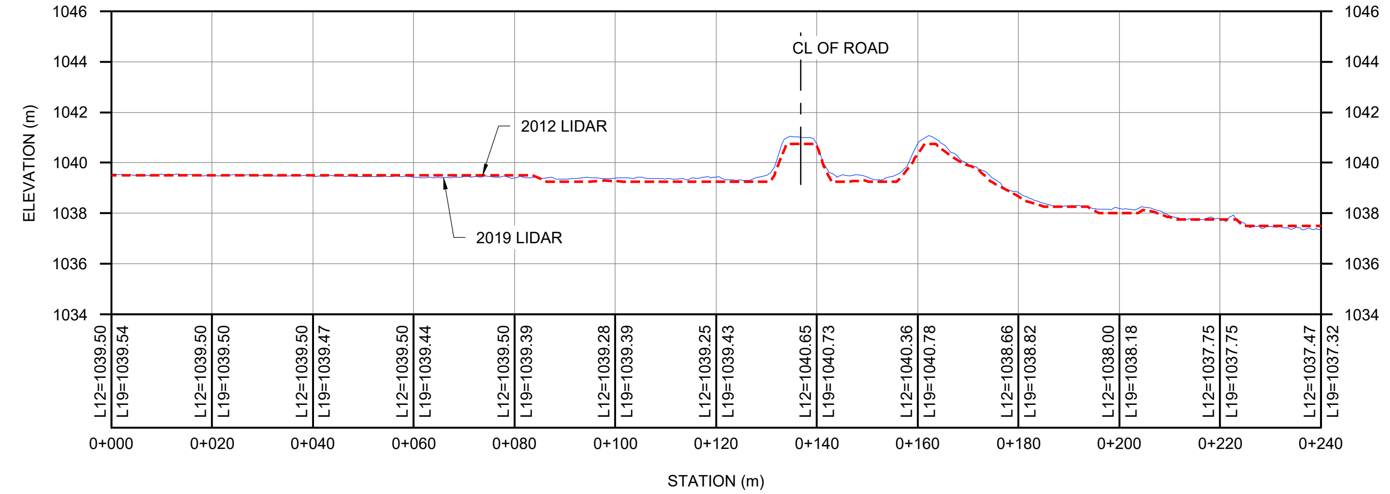
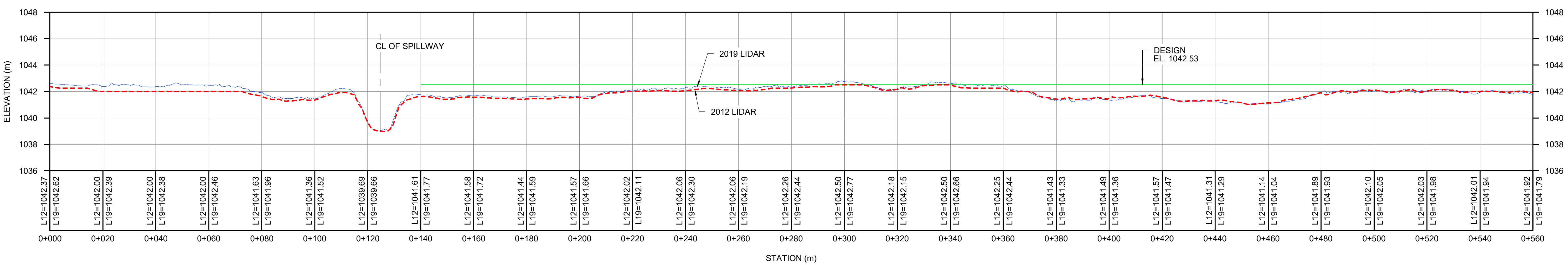


Figure IV-14 SP 330 - 332 and SP 99-01





SPILLWAY
HOR: 1:1500
VER: 1:300



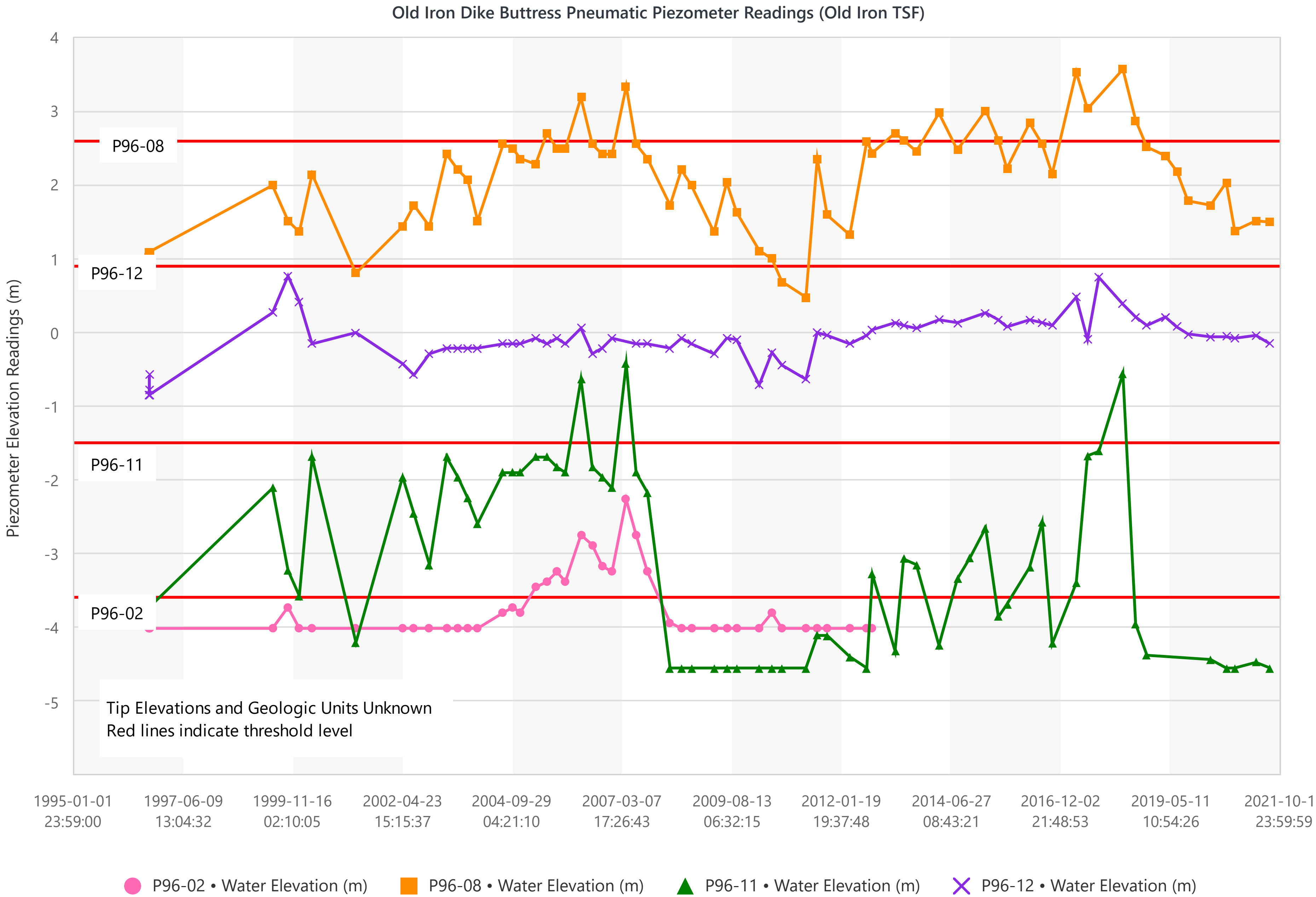
IRON DYKE CREST
HOR: 1:1500
VER: 1:300

1:5 000 0 50 100 m

CLIENT	Teck
	Klohn Crippen Berger
PROJECT	SULLIVAN MINE 2021 ANNUAL INSPECTION REPORT
TITLE	IRON DIKE CREST AND SPILLWAY PROFILE
PROJECT No.	A05807A21
FIG No.	FIGURE IV-15

APPENDIX V

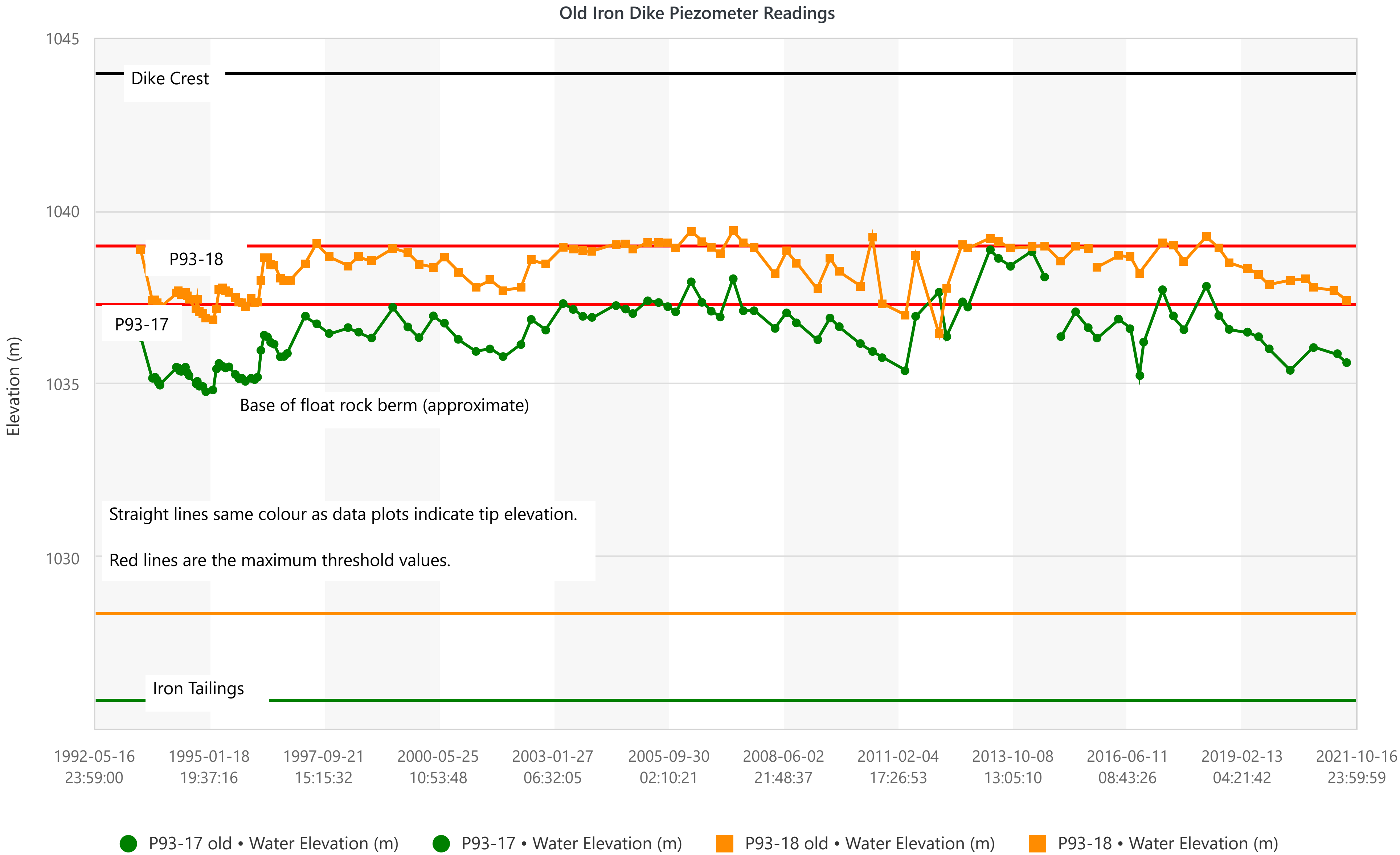
Old Iron Instrumentation



Elevations are relative to elevation of top of tailings or original ground prior to construction of the toe berm in 1996, i.e. m of head measured - difference between top of berm in 1996 and estimated top of ground prior to berm construction.

P96-02: Destroyed
P96-11: Slow leak 2008 unable to get reading until 2011, erratic data since 2012, replaced in 2018

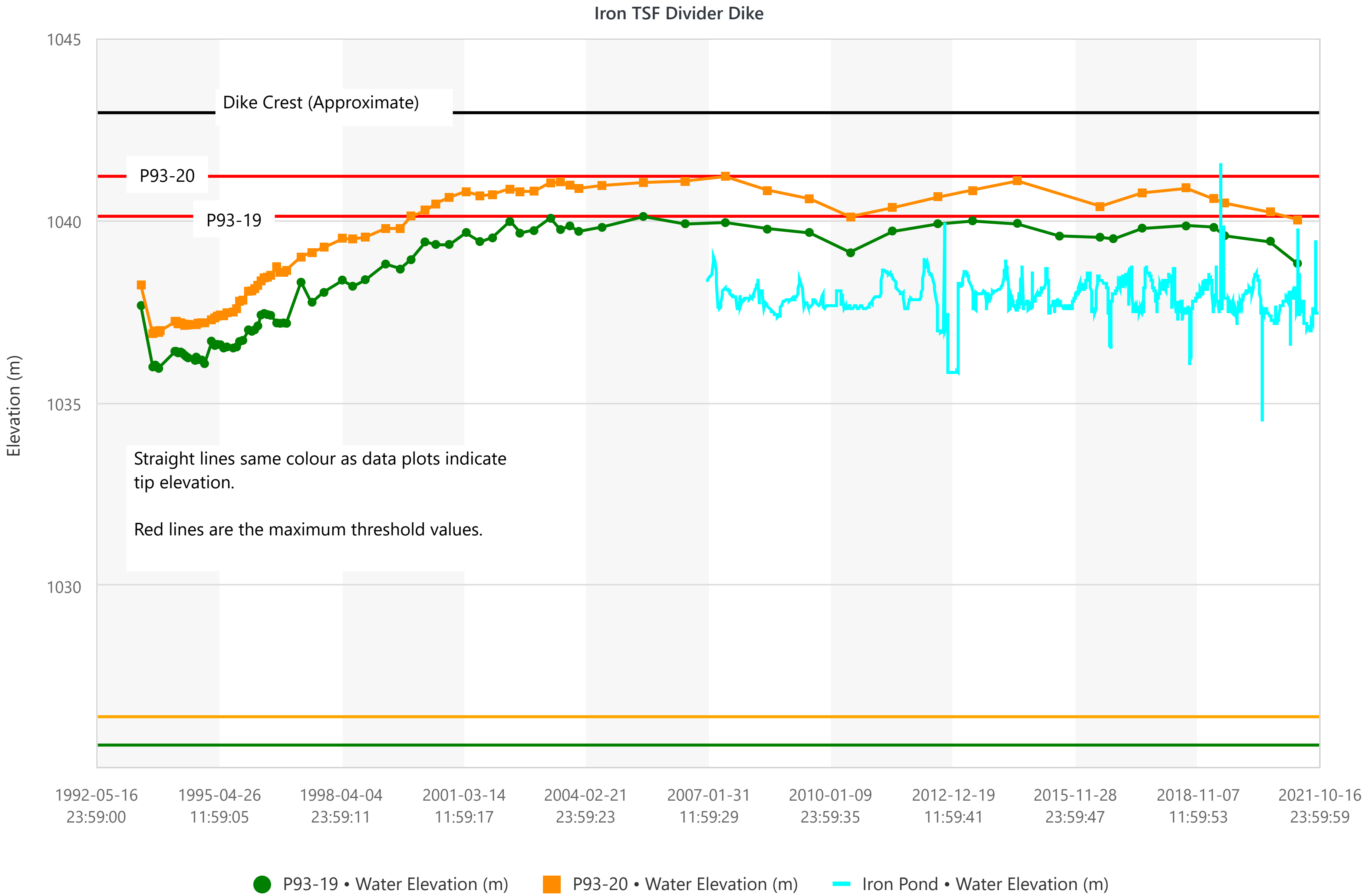
Figure V-1 Old Iron Dike Buttress



Standpipe piezometers were flushed in July/August 2014. Not all sediment was removed and some casings also cut or extended/repaired at this time. Therefore a new top of casing and new depth to bottom of standpipe was recorded for many instruments. Older data will appear below tip elevation if previously read "dry" or if previous top of casing elevation was incorrect due to damage.

P-xxx old represents readings to point of flushing. P-xxx represents readings post flushing. If no "old" plot then no change to top of casing elevation or depth to bottom of standpipe.

Figure V-2 Old Iron Dike



Standpipe piezometers were flushed in July/August 2014. Not all sediment was removed and some casings also cut or extended/repaired at this time. Therefore a new top of casing and new depth to bottom of standpipe was recorded for many instruments. Older data will appear below tip elevation if previously read "dry" or if previous top of casing elevation was incorrect due to damage.

Figure V-3 Iron TSF Divider Dike

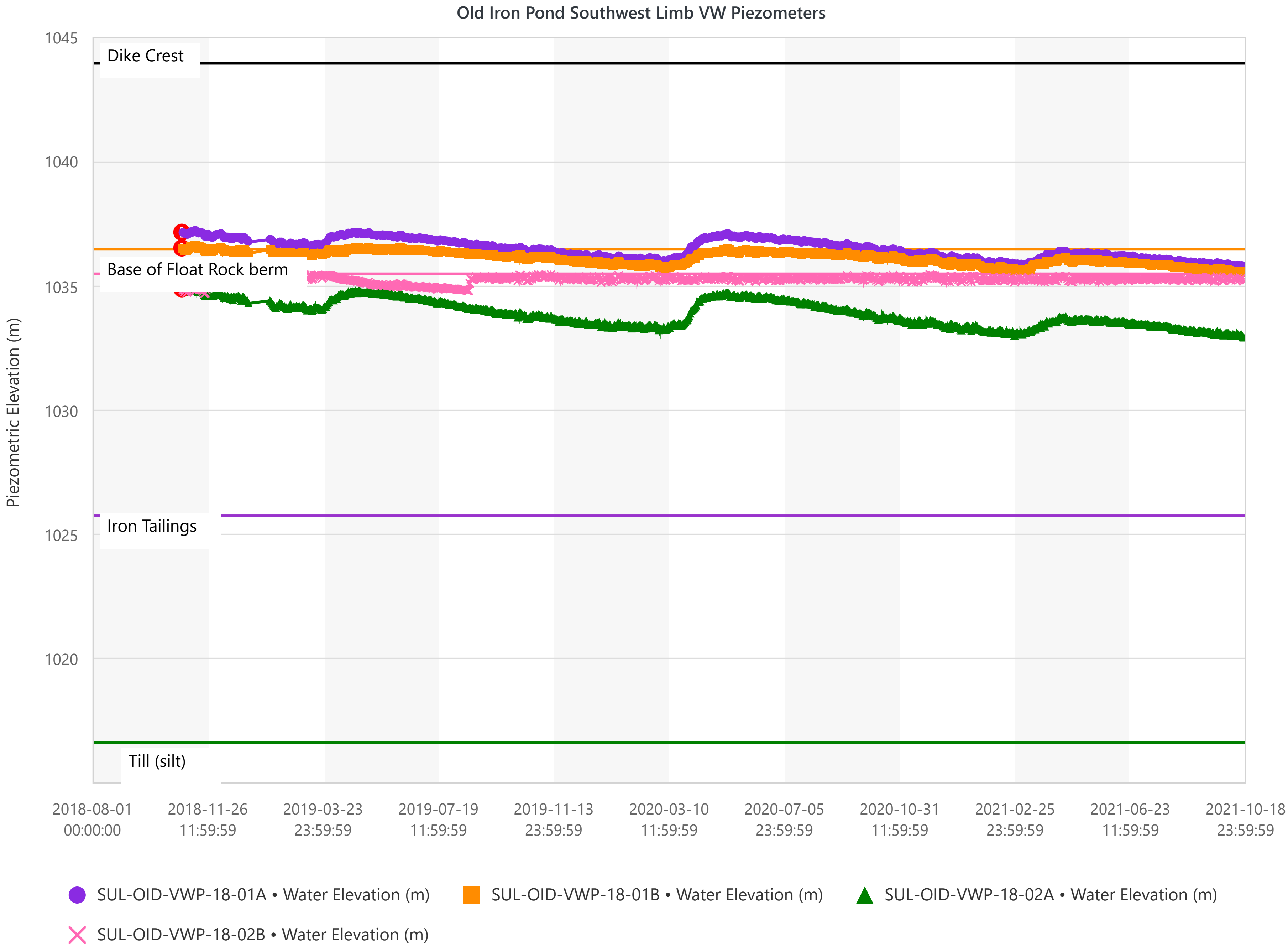
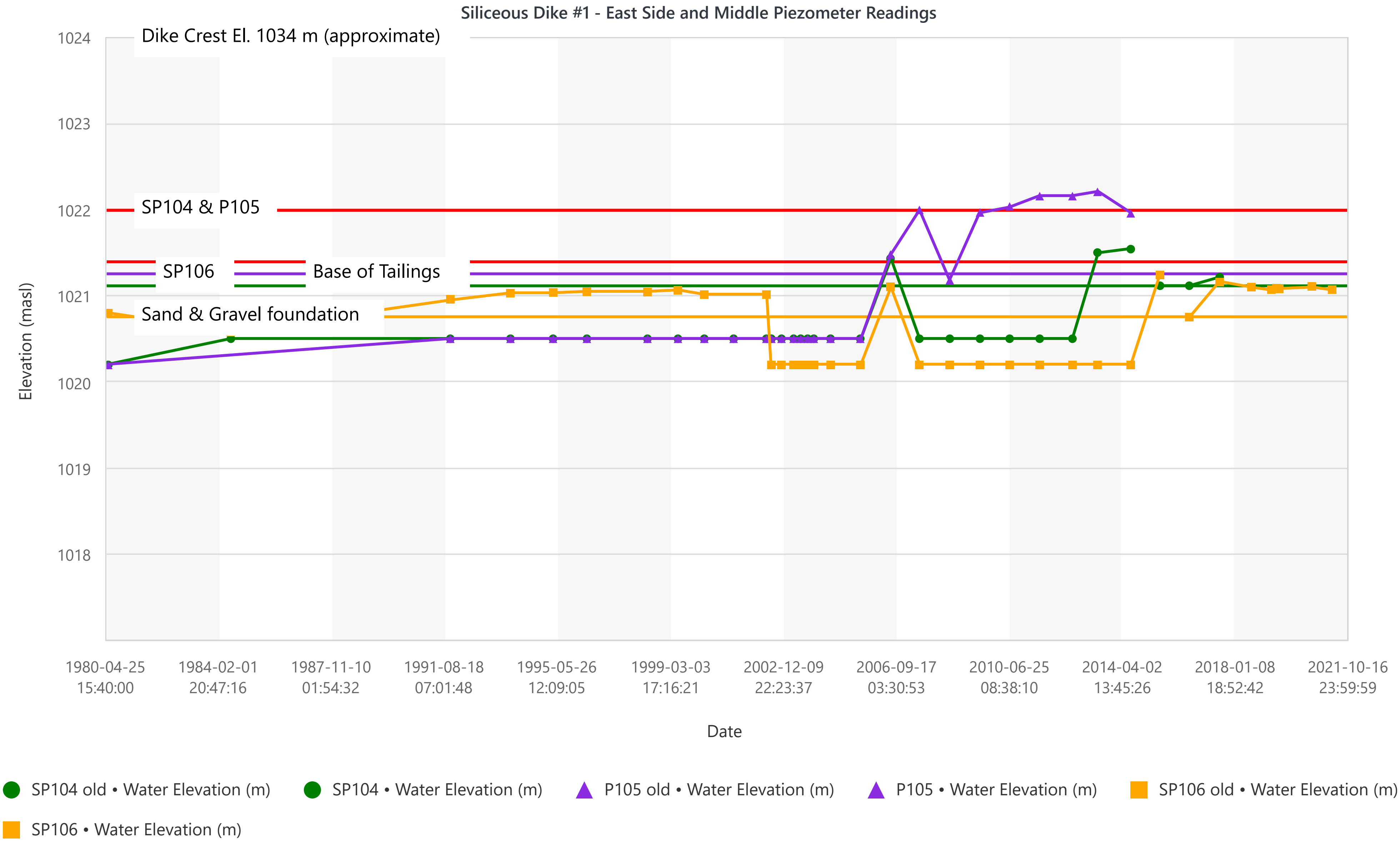


Figure V-4 Old Iron Dike VWP

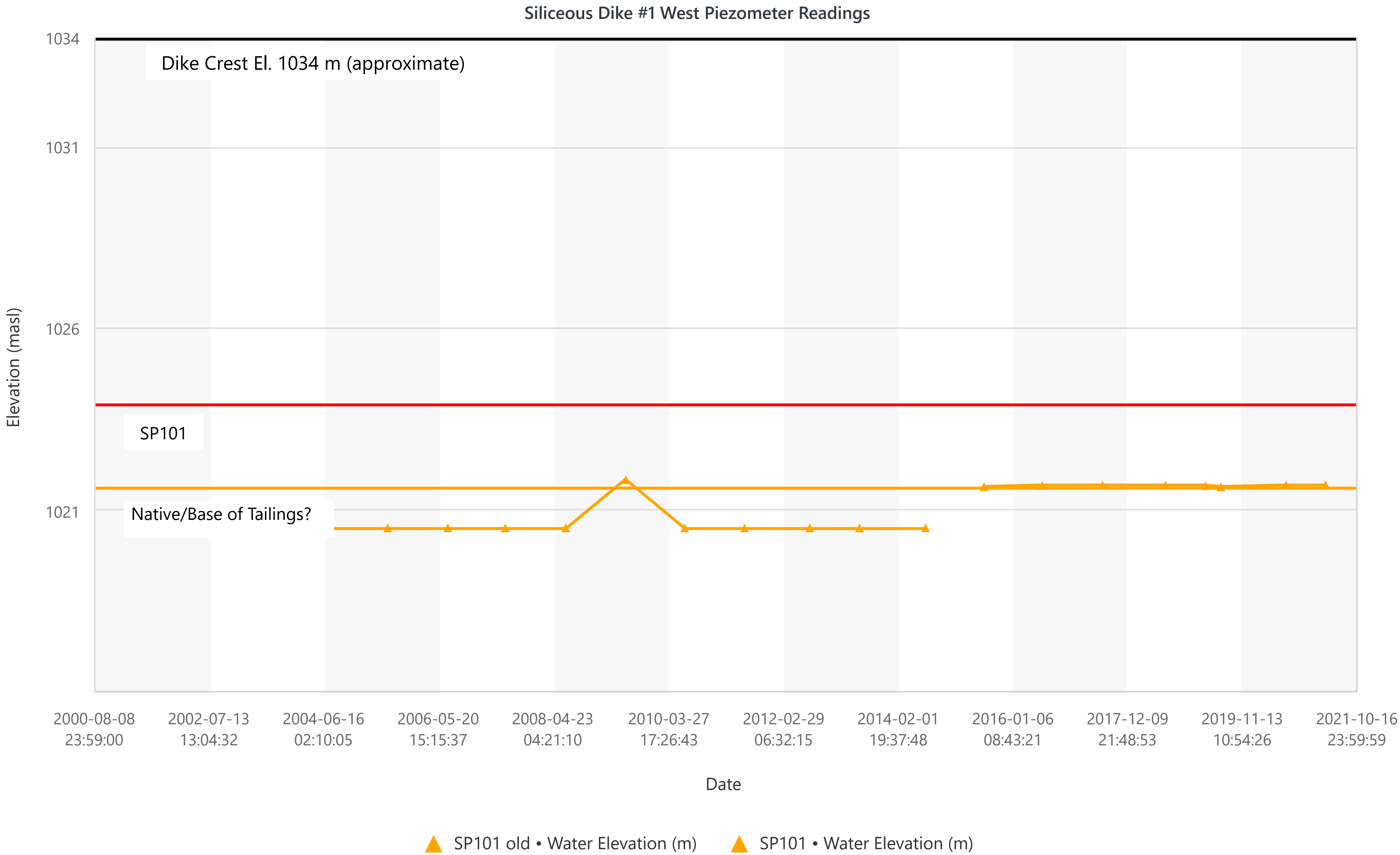
APPENDIX VI

Siliceous Dike Instrumentation



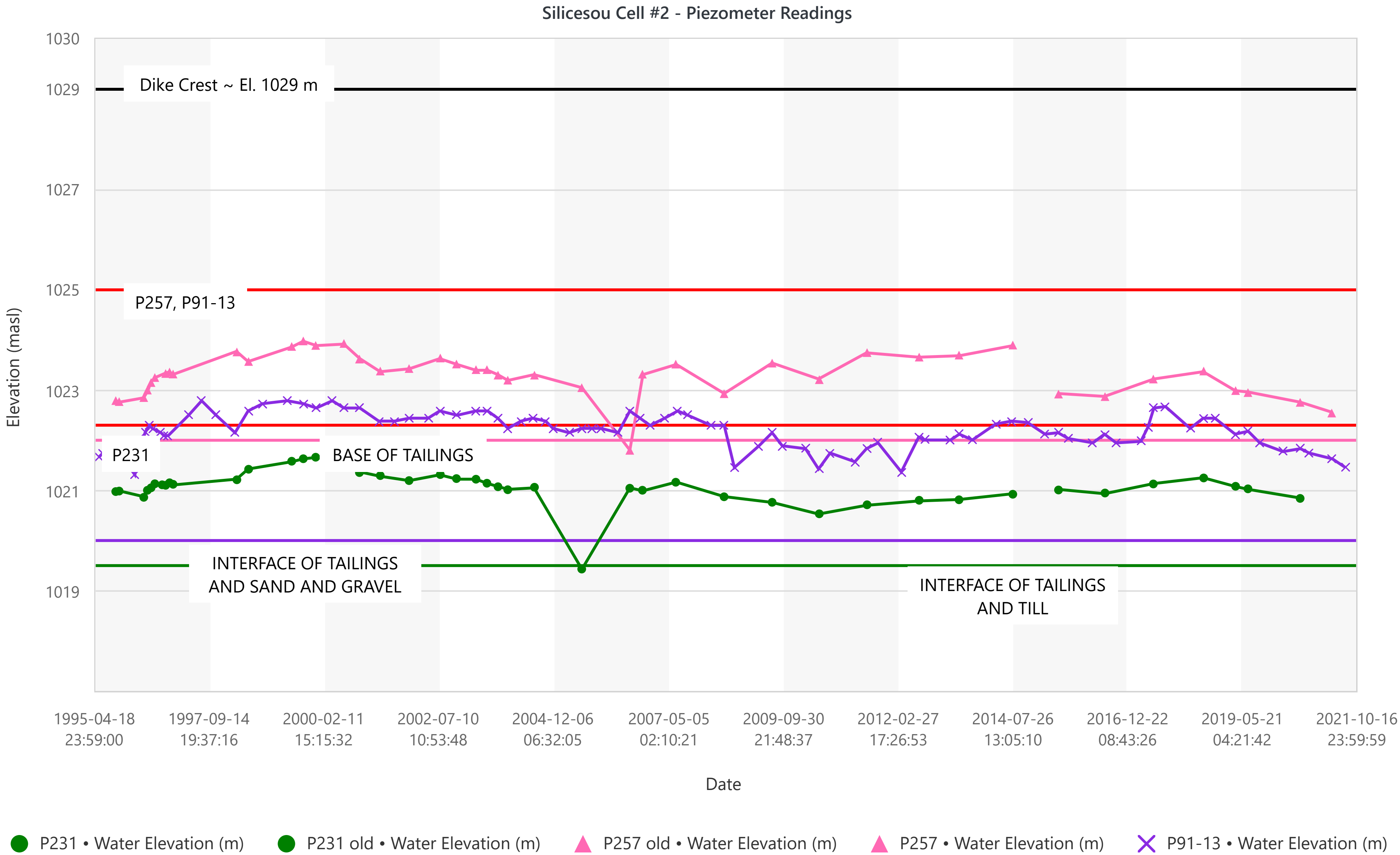
Notes:
Straight lines same colour as data plots indicate bottom of standpipe/tip elevation.
Read lines are threshold values.
Standpipe piezometers were flushed in July/August 2014. Not all sediment was removed and some casings also cut or extended/repaired at this time. Therefore a new top of casing and new depth to bottom of standpipe was recorded for many instruments. Older data will appear below tip elevation if previously read "dry" or if previous top of casing elevation was incorrect due to damage.
Pxxx old represents readings to point of flushing. Pxxx represents readings post flushing. If no "old" plot then no change to top of casing elevation or depth to bottom of standpipe.

Figure VI-1



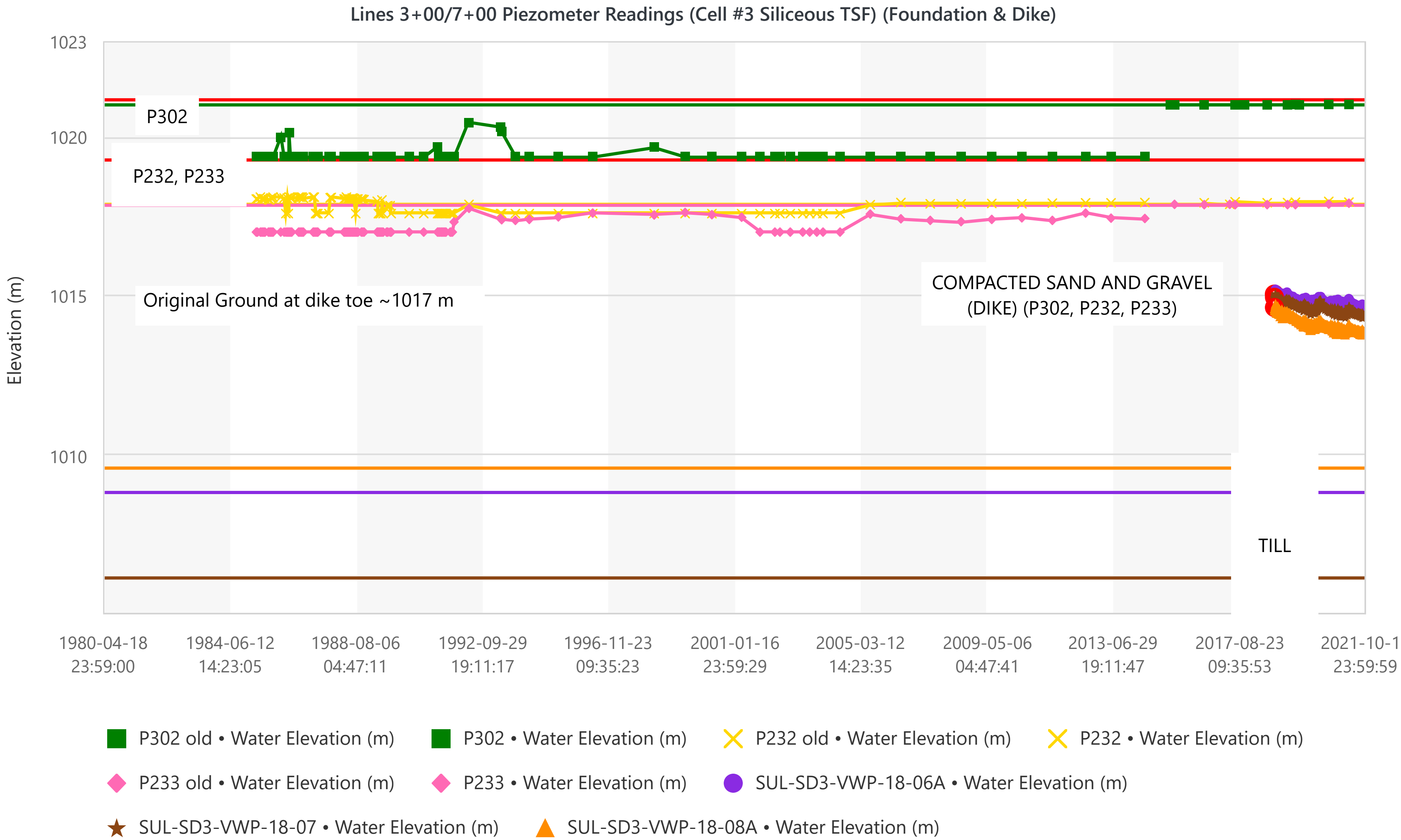
Notes:
Straight lines same colour as data plots indicate bottom of standpipe/tip elevation.
Red lines are the maximum threshold values.
Standpipe piezometers were flushed in July/August 2014. Not all sediment was removed and some casings also cut or extended/repaired at this time. Therefore a new top of casing and new depth to bottom of standpipe was recorded for many instruments. Older data will appear below tip elevation if previously read "dry" or if previous top of casing elevation was incorrect due to damage.
Pxxx old represents readings to point of flushing. Pxxx represents readings post flushing. If no "old" plot then no change to top of casing elevation or depth to bottom of standpipe.

Figure VI-2



Notes:
Straight lines same colour as data plots indicate bottom of standpipe/tip elevation.
Red lines are the threshold values.
Standpipe piezometers were flushed in July/August 2014. Not all sediment was removed and some casings also cut or extended/repaired at this time. Therefore a new top of casing and new depth to bottom of standpipe was recorded for many instruments. Older data will appear below tip elevation if previously read "dry" or if previous top of casing elevation was incorrect due to damage.
Pxxx old represents readings to point of flushing. Pxxx represents readings post flushing. If no "old" plot then no change to top of casing elevation or depth to bottom of standpipe.

Figure VI-3



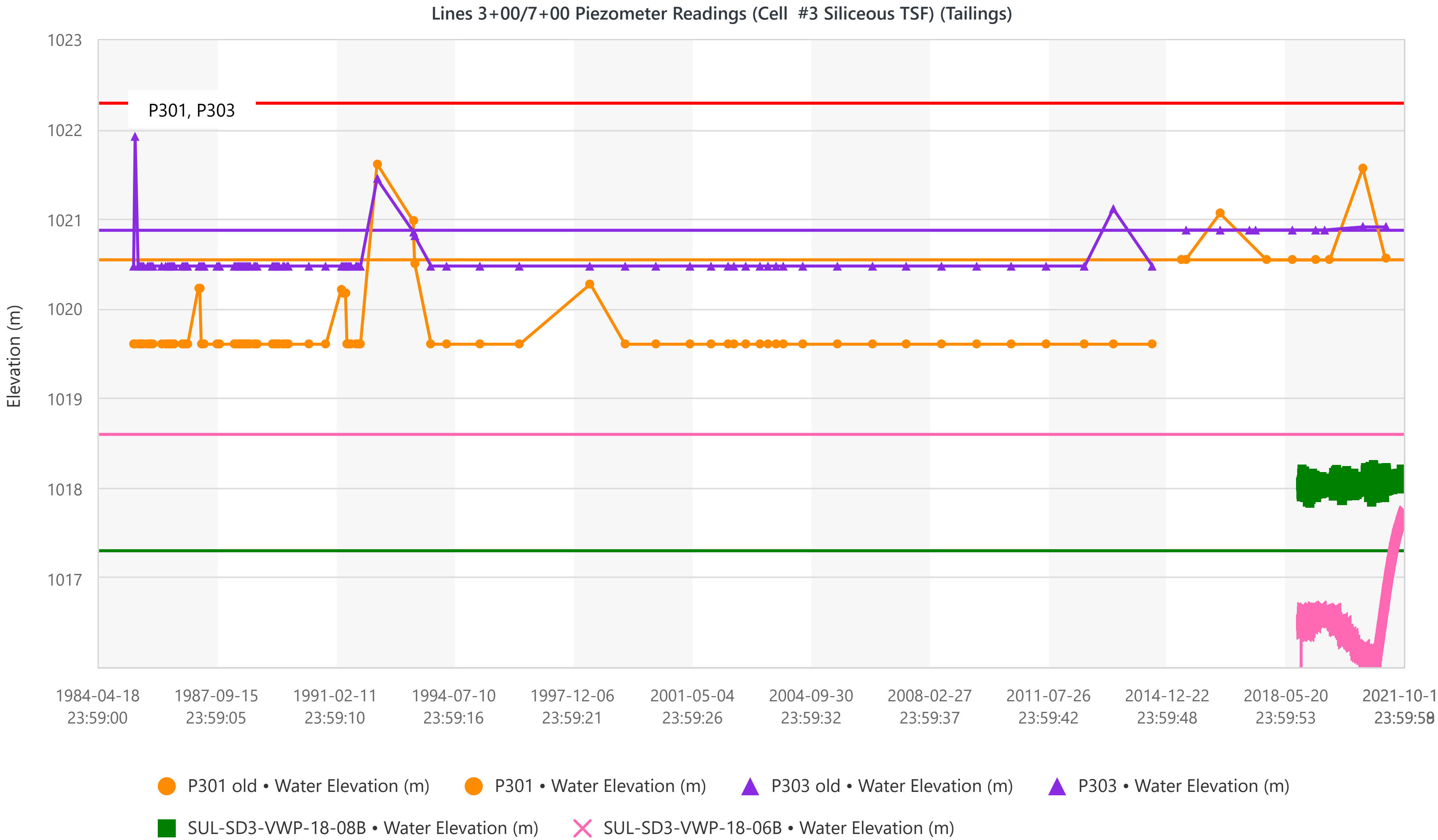
Straight lines same colour as data plots indicate tip elevation.

Red lines are the maximum threshold values.

Standpipe piezometers were flushed in July/August 2014. Not all sediment was removed and some casings also cut or extended/repaired at this time. Therefore a new top of casing and new depth to bottom of standpipe was recorded for many instruments. Older data will appear below tip elevation if previously read "dry" or if previous top of casing elevation was incorrect due to damage.

Pxxx old represents readings to point of flushing. Pxxx represents readings post flushing. If no "old" plot then no change to top of casing elevation or depth to bottom of standpipe.

Figure VI-4 Siliceous Cell #3 TSF Line 3 +00/7+00 (Foundation and Dike)



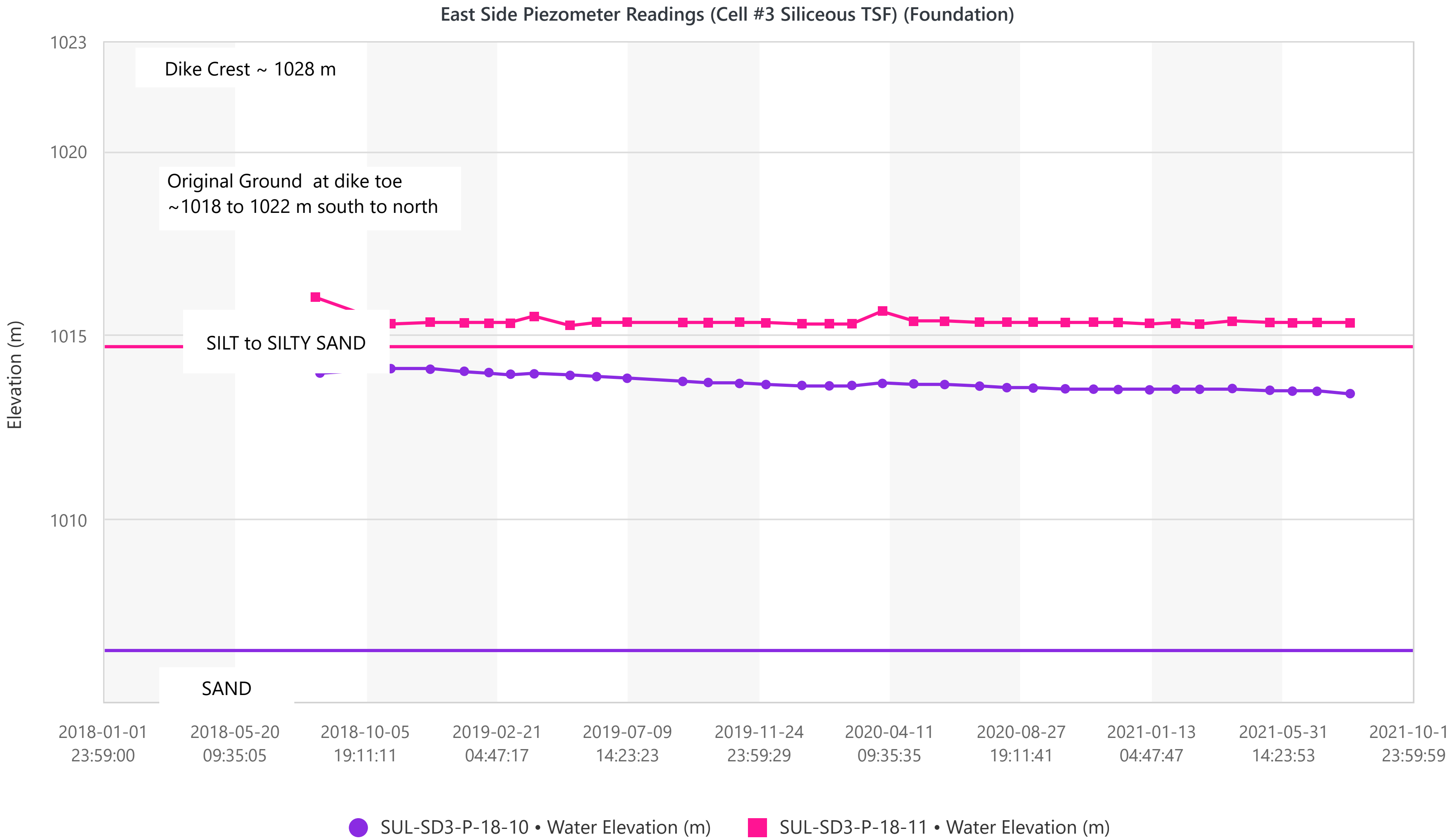
Straight lines same colour as data plots indicate tip elevation.

Red lines are the maximum threshold values.

Standpipe piezometers were flushed in July/August 2014. Not all sediment was removed and some casings also cut or extended/repaired at this time. Therefore a new top of casing and new depth to bottom of standpipe was recorded for many instruments. Older data will appear below tip elevation if previously read "dry" or if previous top of casing elevation was incorrect due to damage.

Pxxx old represents readings to point of flushing. Pxxx represents readings post flushing. If no "old" plot then no change to top of casing elevation or depth to bottom of standpipe.

Figure VI-5 Silceous Cell #3 TSF Line 3+00/7+00 (Tailings)



Straight lines same colour as data plots indicate tip elevation.

Red lines are the maximum threshold values.

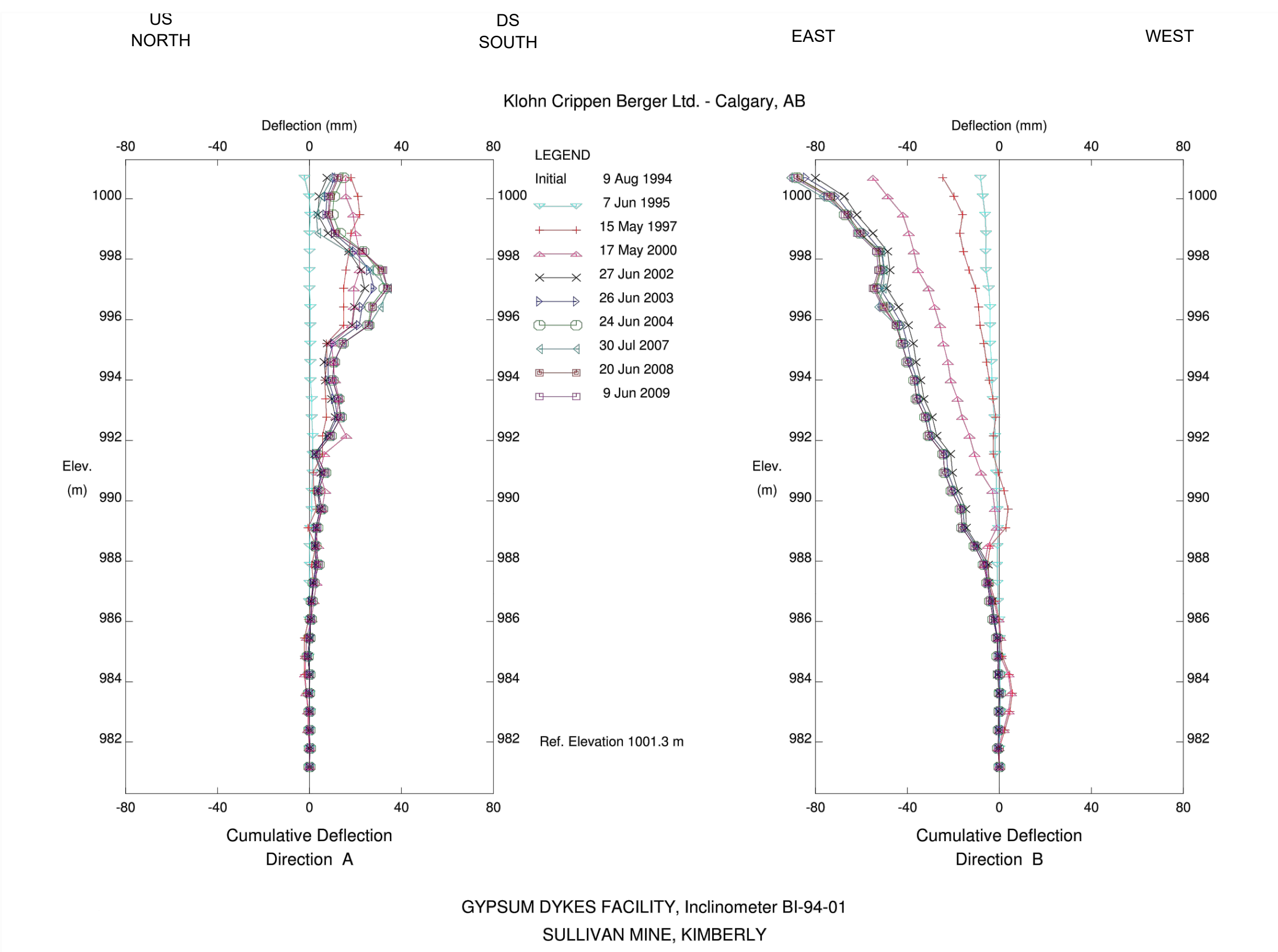
Standpipe piezometers were flushed in July/August 2014. Not all sediment was removed and some casings also cut or extended/repaired at this time. Therefore a new top of casing and new depth to bottom of standpipe was recorded for many instruments. Older data will appear below tip elevation if previously read "dry" or if previous top of casing elevation was incorrect due to damage.

Pxxx old represents readings to point of flushing. Pxxx represents readings post flushing. If no "old" plot then no change to top of casing elevation or depth to bottom of standpipe.

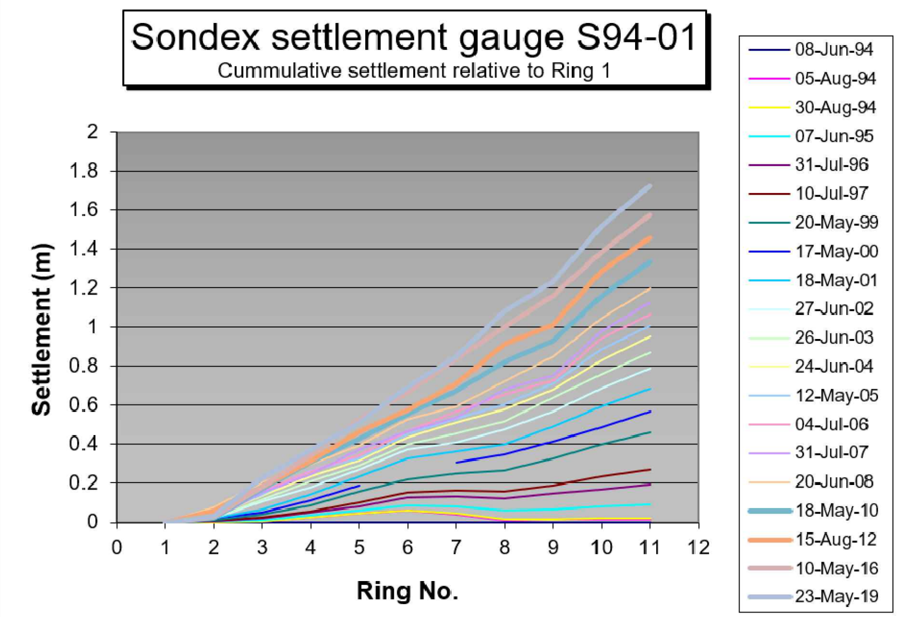
Figure VI-6 Siliceous Cell #3
TSF East (Foundation)

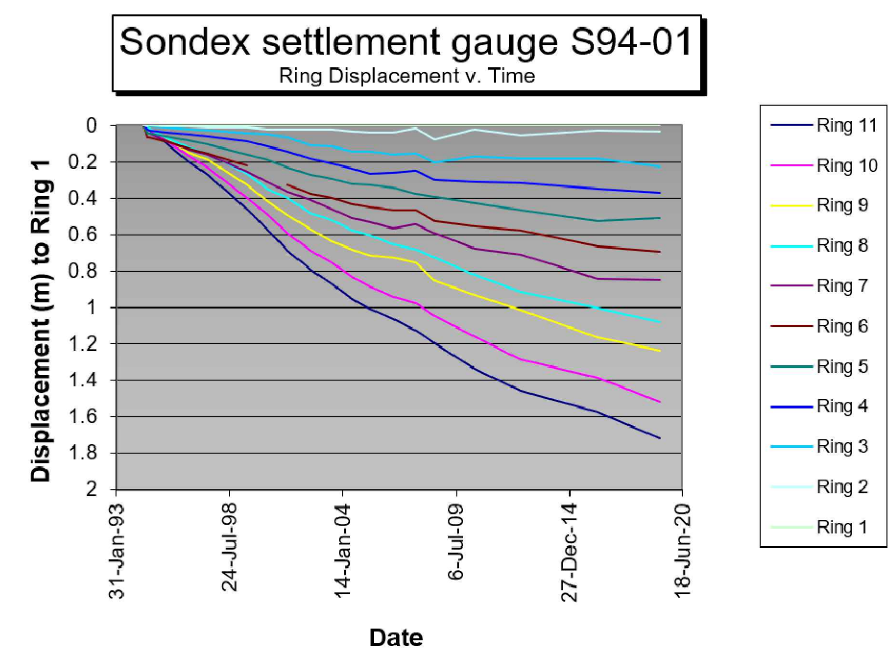
APPENDIX VII

W Gypsum Dike Instrumentation



(CAN NO LONGER READ. BLOCKED AT 4.7 m BELOW THE GROUND SURFACE)





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CLIENT

Teck

Klohn Crippen Berger

PROJECT

SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

TITLE

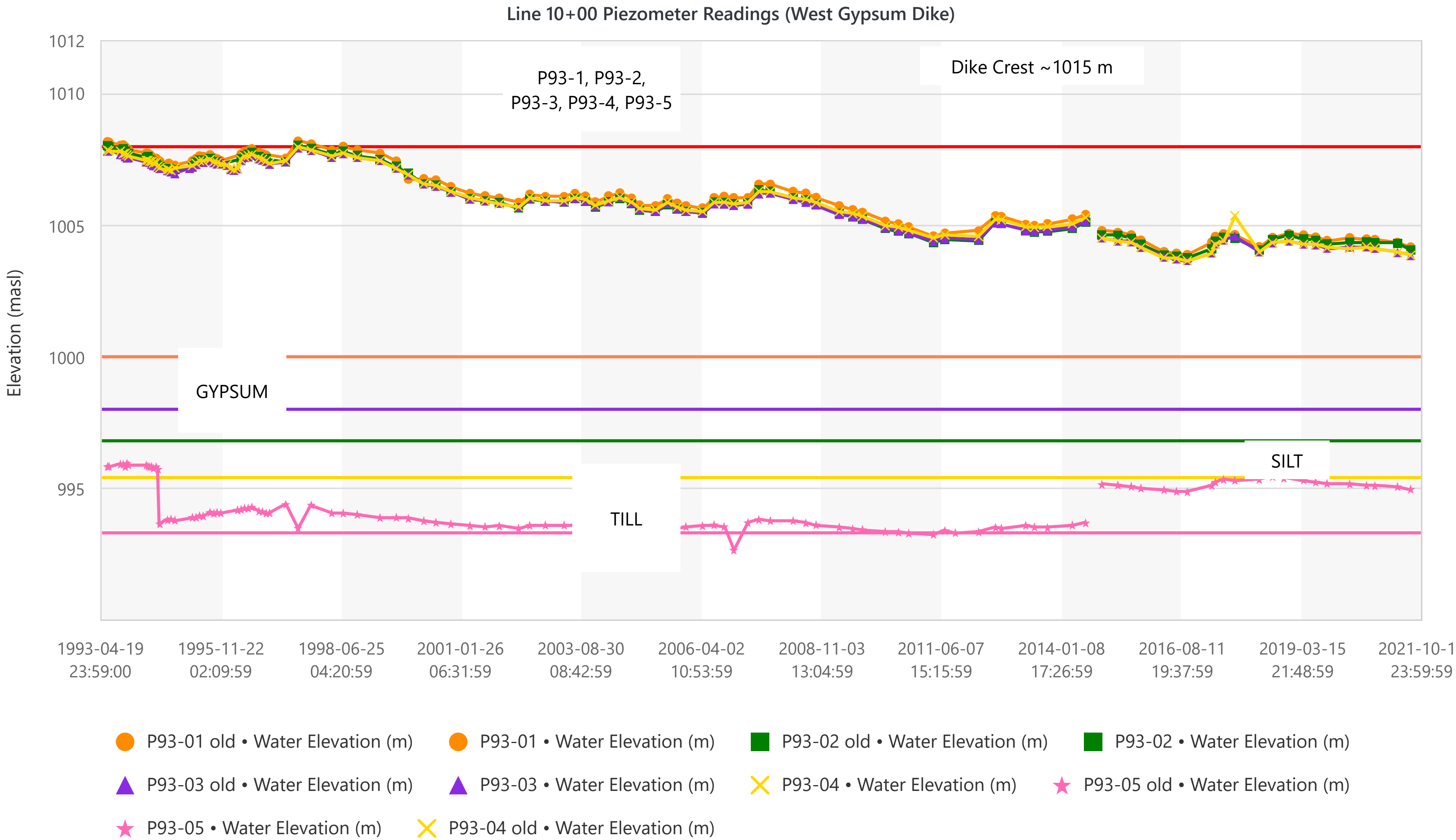
WEST GYPSUM DIKE
SONDEX AND
INCLINOMETER PLOTS

PROJECT No.	FIG. No.
A05807A21	FIGURE VII-1

KCC-F-B-M

A05807A14 FIGure VI-1.dwg

Z:\A\EDM\A05807A21 TML 2021 Annual Inspection\400 Drawings\Annual Inspection\Figure VII-1.dwg Layout=LAYOUT1 October 18, 2021 8:54:16 AM



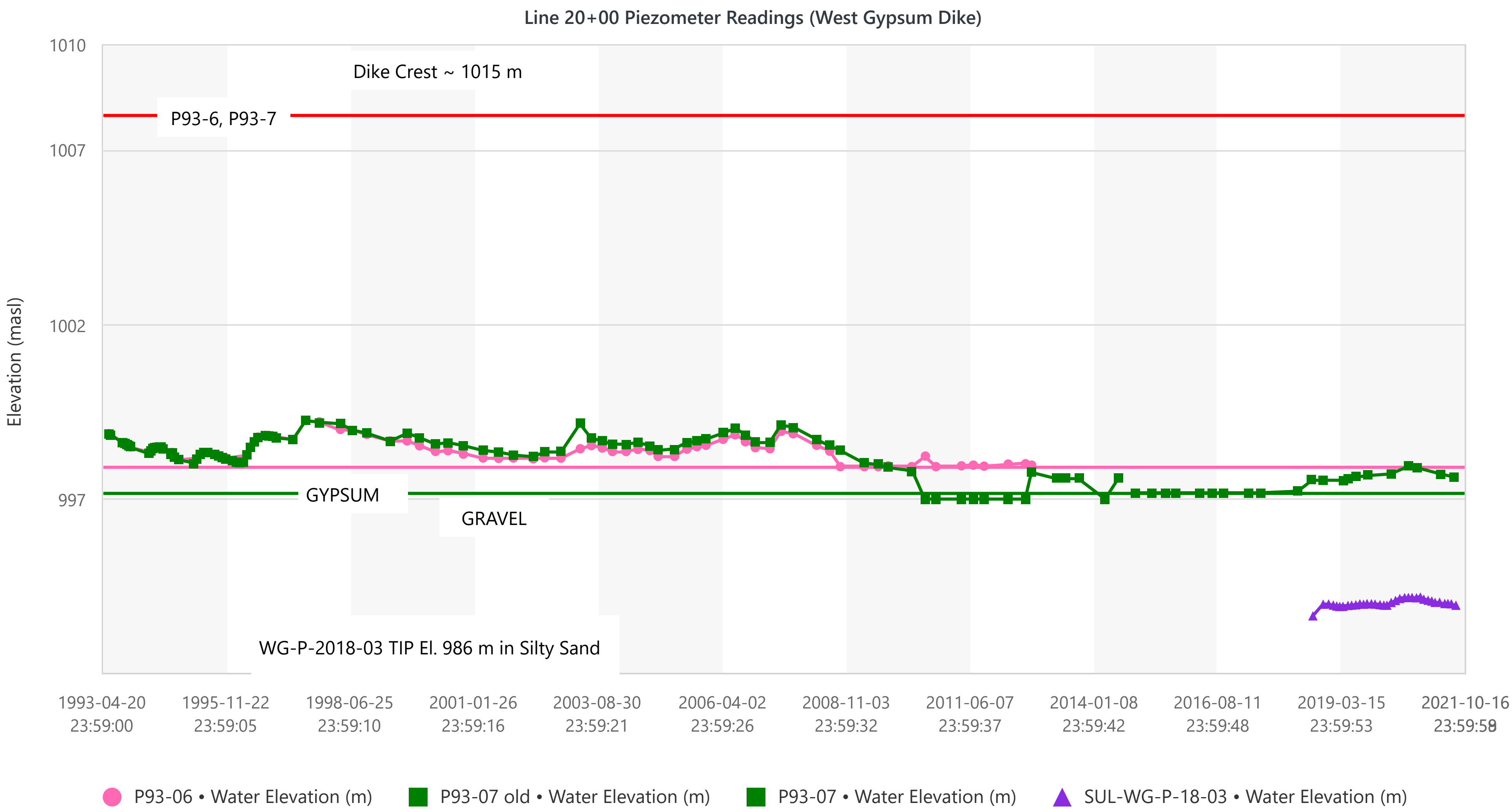
Straight lines same colour as data plots indicate tip elevation.

Red lines are the maximum threshold values.

Standpipe piezometers were flushed in July/August 2014. Not all sediment was removed and some casings also cut or extended/repaired at this time. Therefore a new top of casing and new depth to bottom of standpipe was recorded for many instruments. Older data will appear below tip elevation if previously read "dry" or if previous top of casing elevation was incorrect due to damage.

SPxxx old represents readings to point of flushing. SPxxx represents readings post flushing. If no "old" plot then no change to top of casing elevation or depth to bottom of

Figure VII-2 Line 10+00



Straight lines same colour as data plots indicate tip elevation.

Red lines are the maximum threshold values.

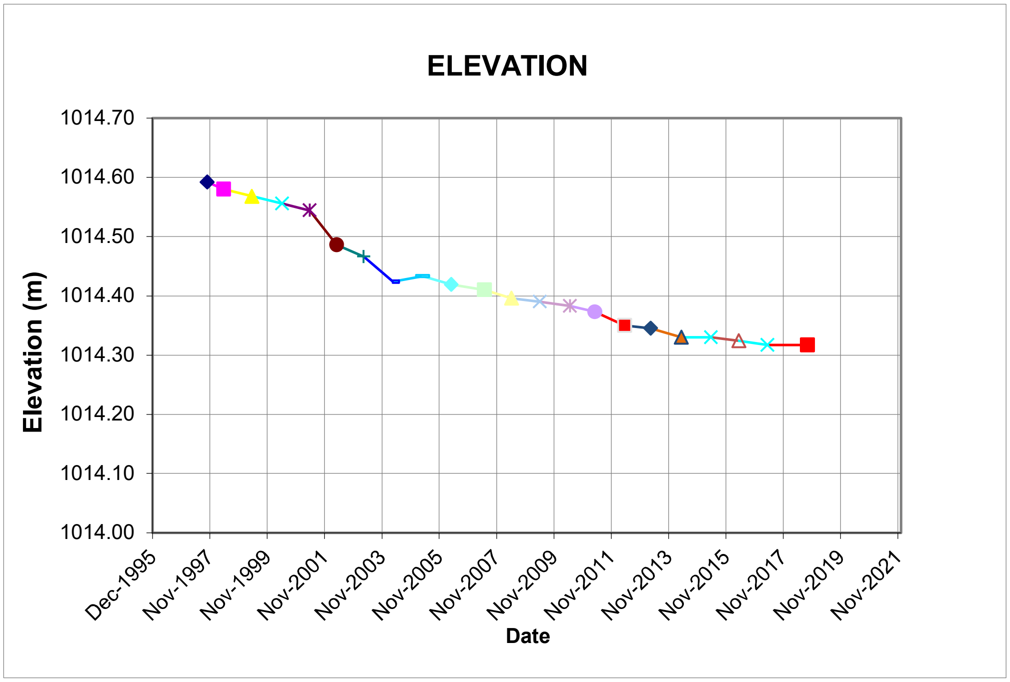
Standpipe piezometers were flushed in July/August 2014. Not all sediment was removed and some casings also cut or extended/repaired at this time. Therefore a new top of casing and new depth to bottom of standpipe was recorded for many instruments. Older data will appear below tip elevation if previously read "dry" or if previous top of casing elevation was incorrect due to damage.

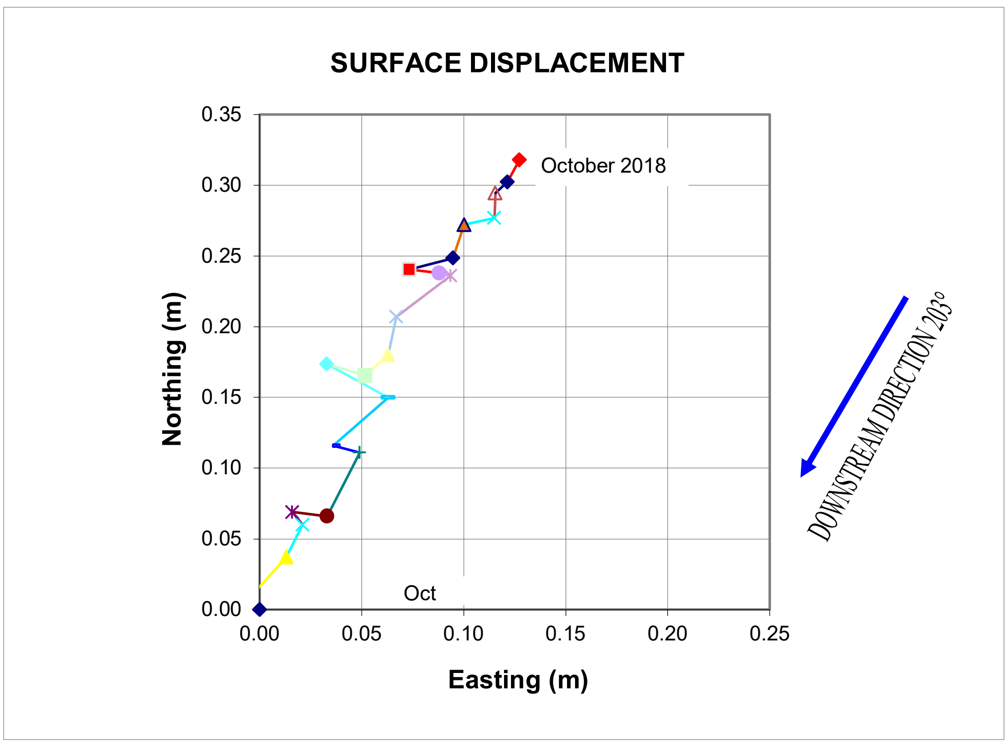
SPxxx old represents readings to point of flushing. SPxxx represents readings post flushing. If no "old" plot then no change to top of casing elevation or depth to bottom of standpipe.

Figure VII-3 Line 20+00

SP97-01 Line 10+00

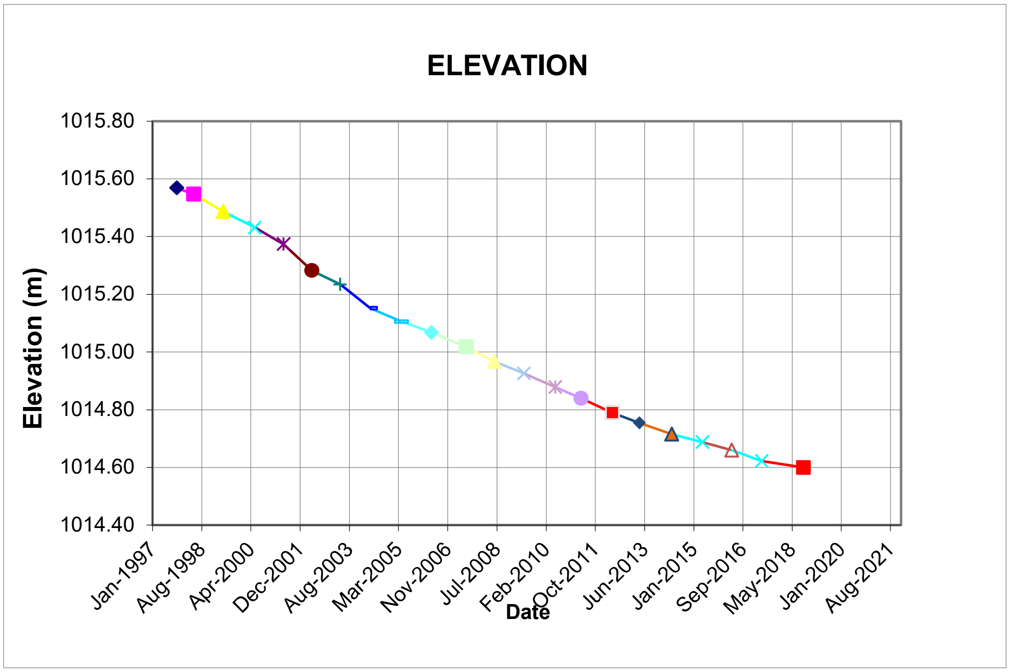
SETTLEMENT PLATES - WEST GYPSUM DIKE

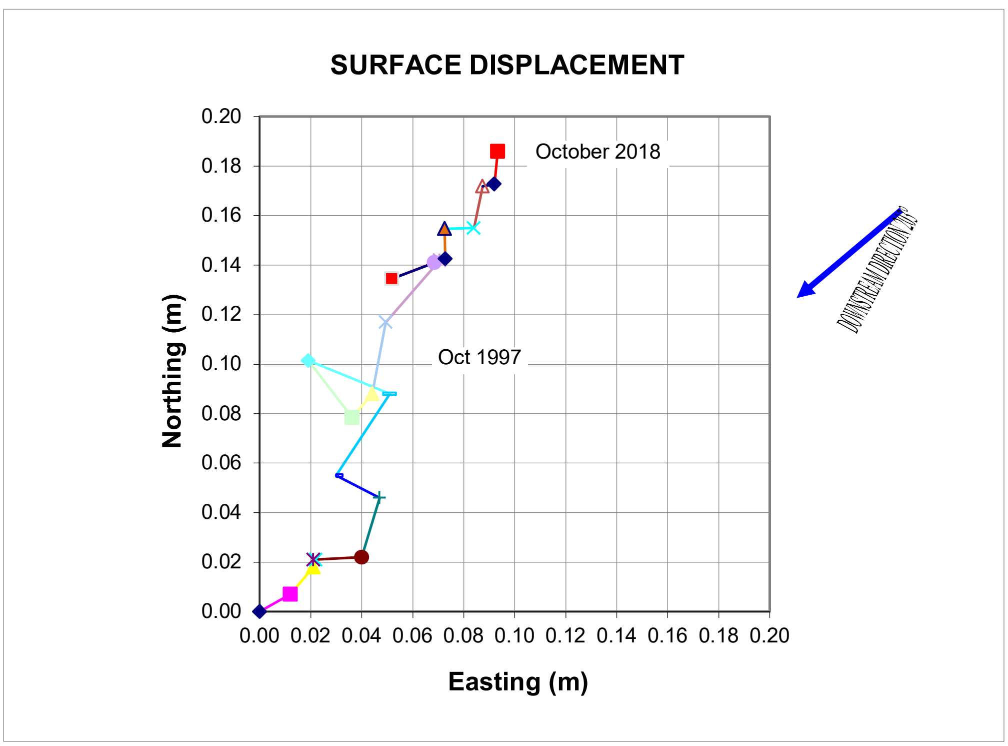




SP97-05 Line 10+00

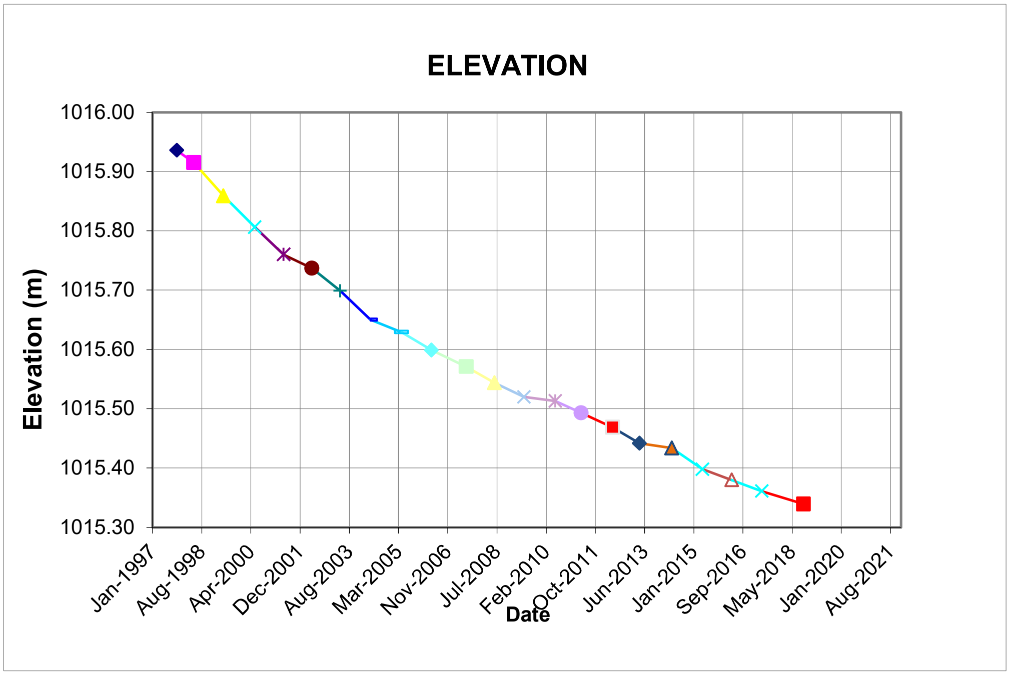
SETTLEMENT PLATES - WEST GYPSUM DIKE

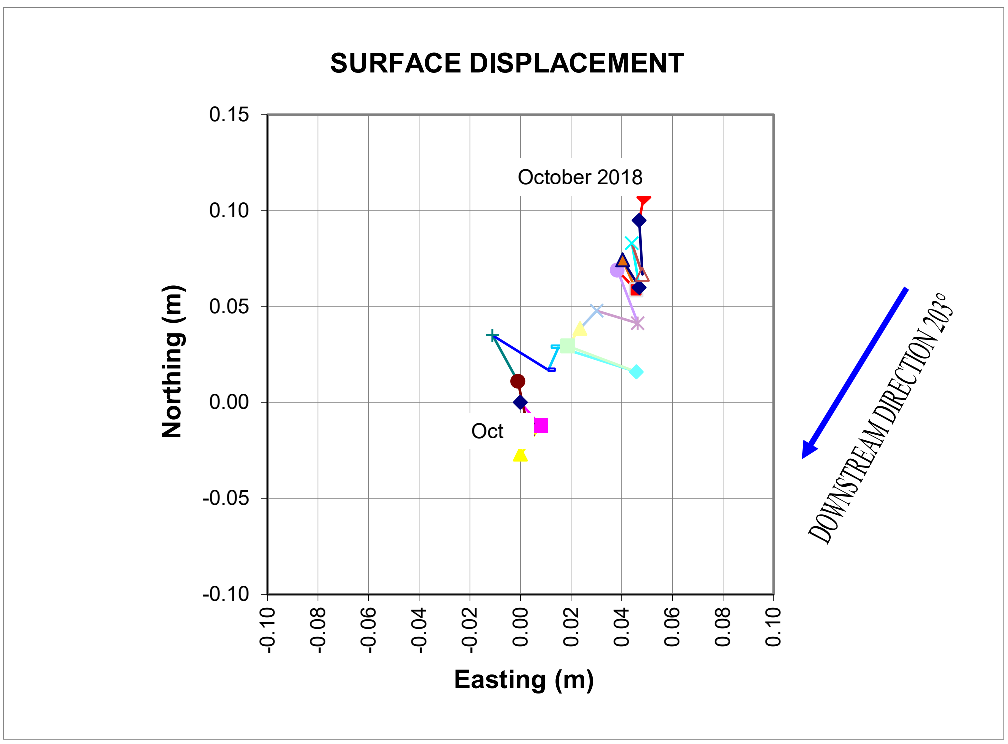




SP97-06 Line 20+00

SETTLEMENT PLATES - WEST GYPSUM DIKE

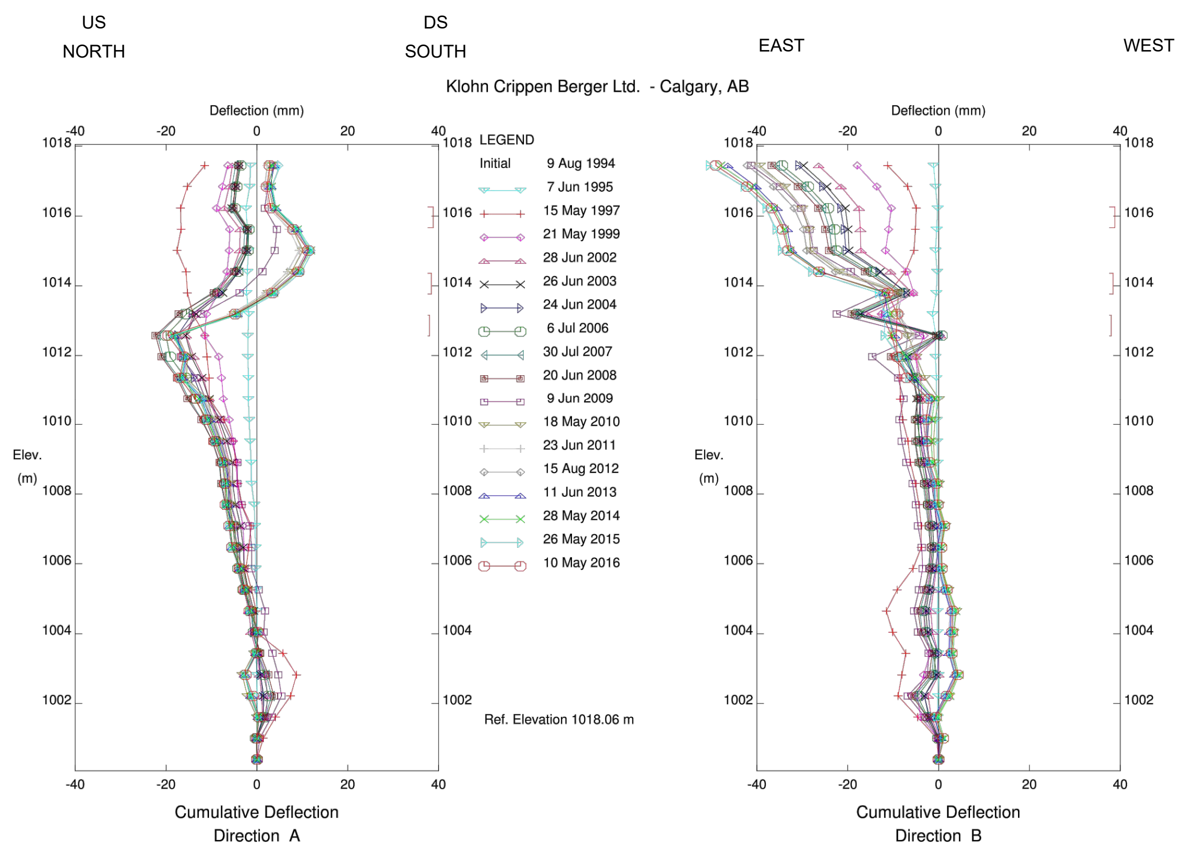




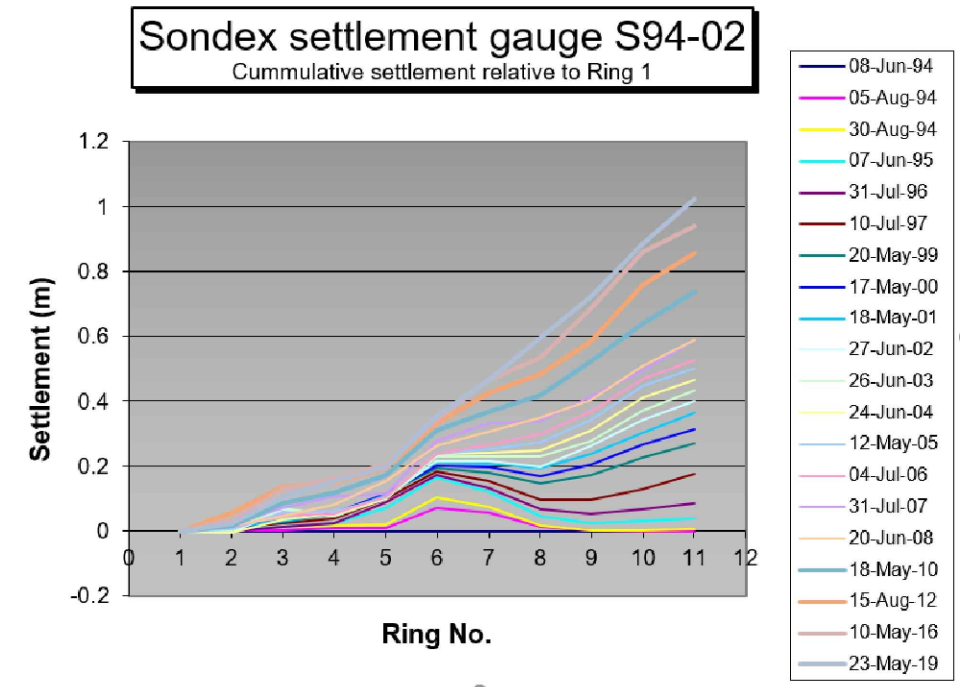
APPENDIX VIII

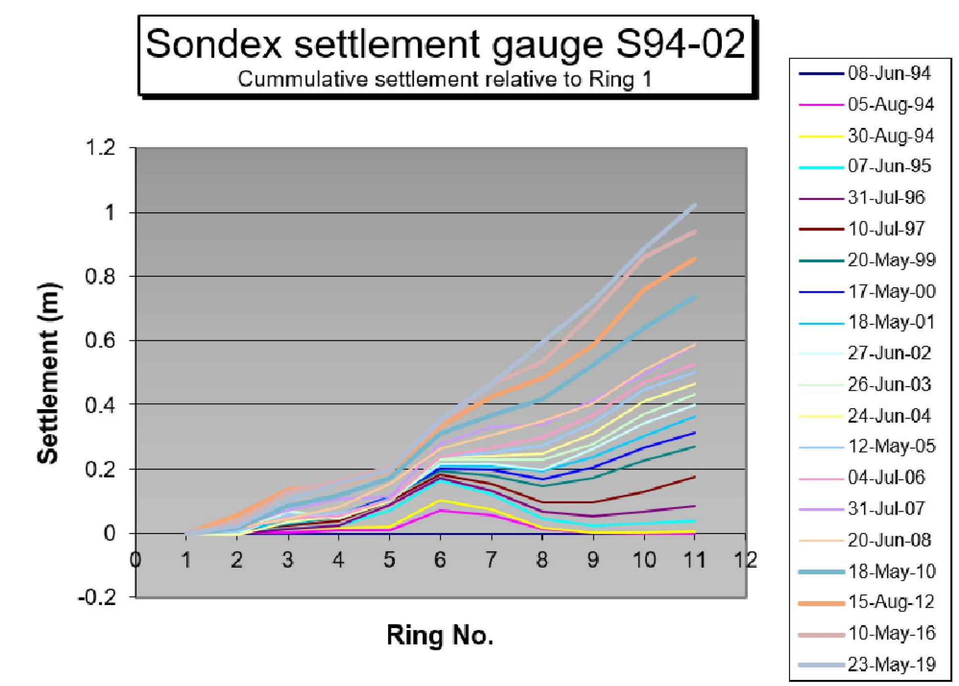
E Gypsum Dike Instrumentation

Klohn Crippen Berger Ltd. - Calgary, AB



GYPSUM DYKES FACILITY, Inclinometer BI-94-02
SULLIVAN MINE, KIMBERLEY





CLIENT
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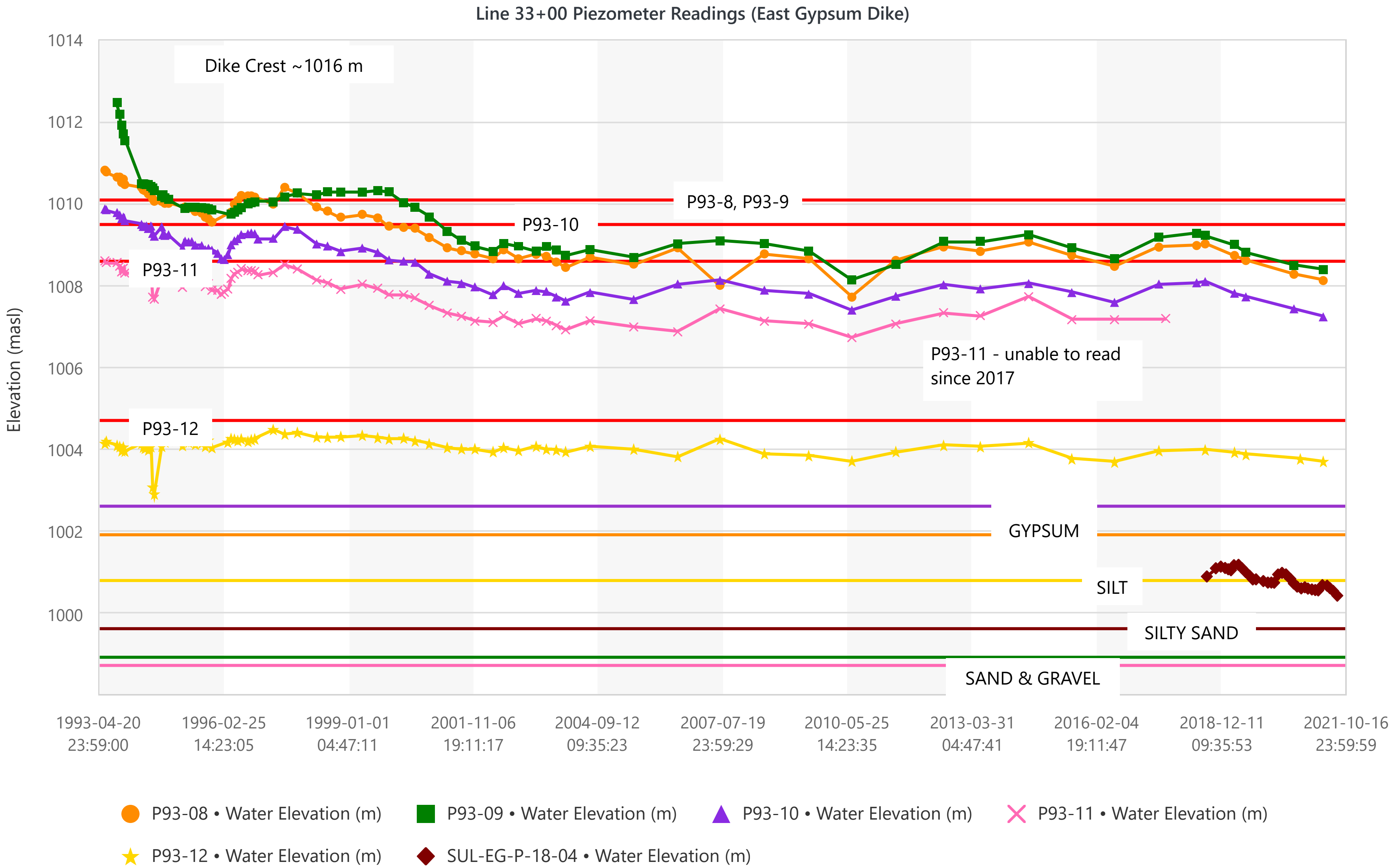
Klohn Crippen Berger

PROJECT
SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

TITLE
EAST GYPSUM DIKE
SONDEX AND
INCLINOMETER PLOTS

PROJECT No. A05807A21
FIG. No. FIGURE VIII-1

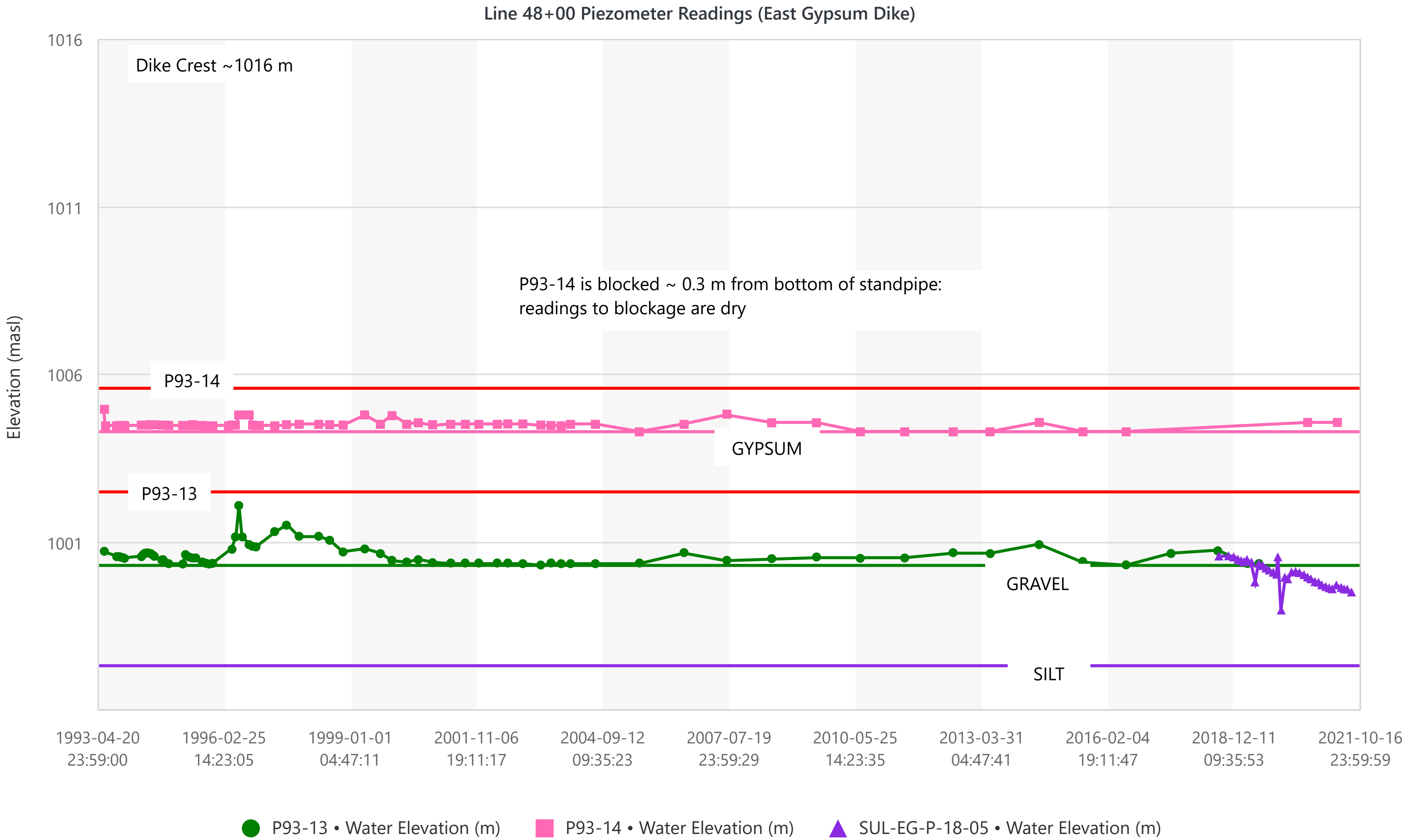


Straight lines same colour as data plots indicate tip elevation.

Red lines are the maximum threshold values.

Standpipe piezometers were flushed in July/August 2014. Not all sediment was removed and some casings also cut or extended/repaired at this time. Therefore a new top of casing and new depth to bottom of standpipe was recorded for many instruments. Older data will appear below tip elevation if previously read "dry" or if previous top of casing elevation was incorrect due to damage.

Figure VIII-2 Line 33+00



Straight lines same colour as data plots indicate tip elevation.

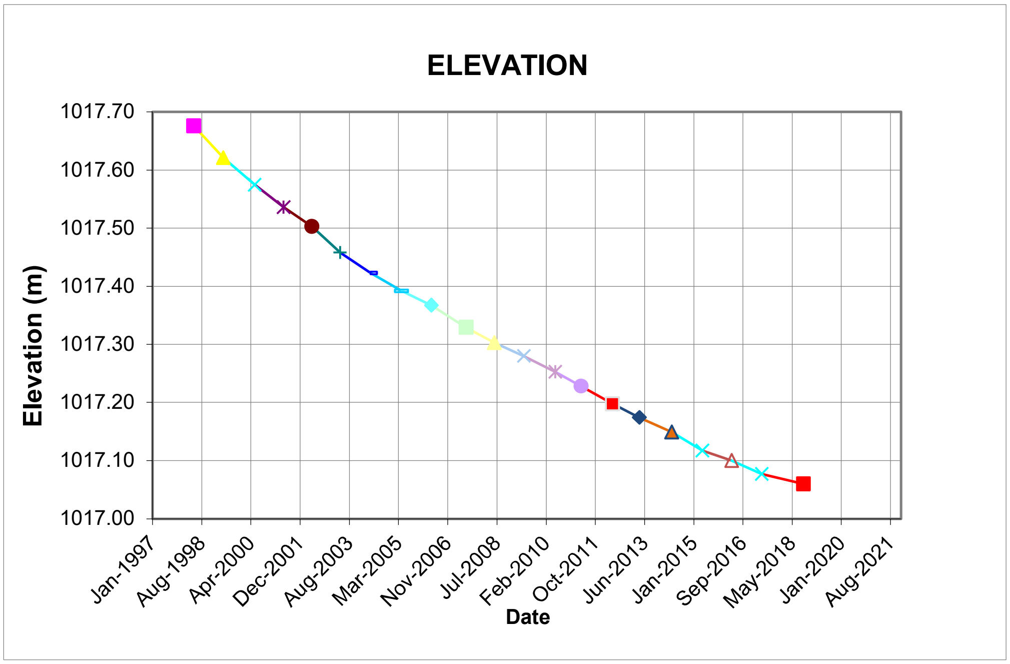
Red lines are the maximum threshold values.

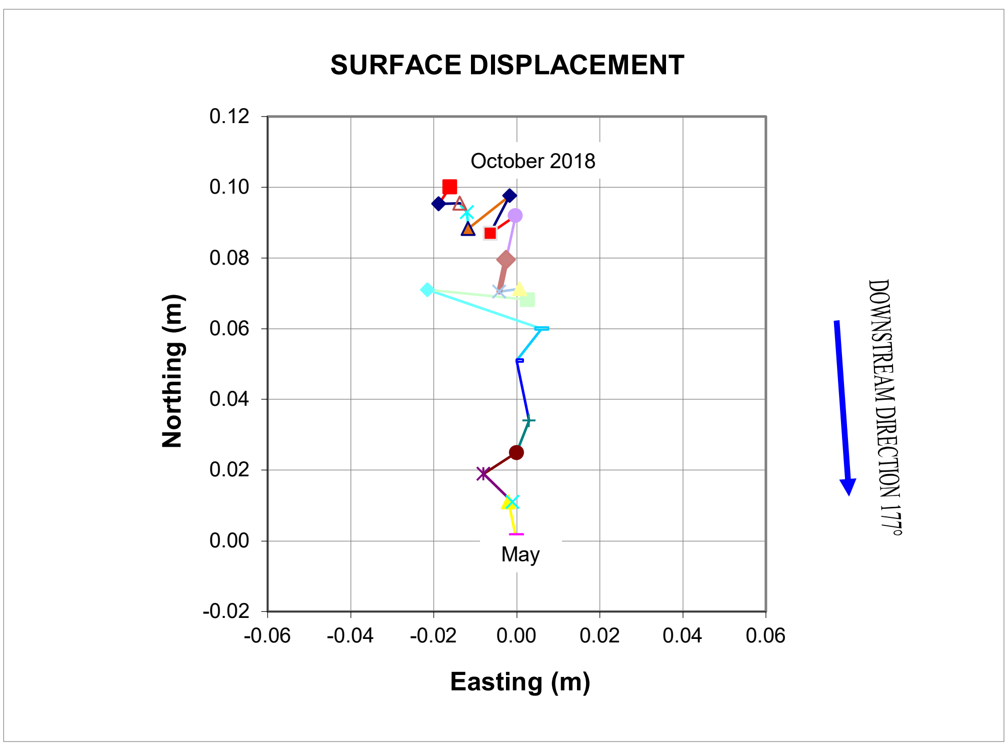
Standpipe piezometers were flushed in July/August 2014. Not all sediment was removed and some casings also cut or extended/repaired at this time. Therefore a new top of casing and new depth to bottom of standpipe was recorded for many instruments. Older data will appear below tip elevation if previously read "dry" or if previous top of casing elevation was incorrect due to damage.

Figure VIII-3 Line 48+00

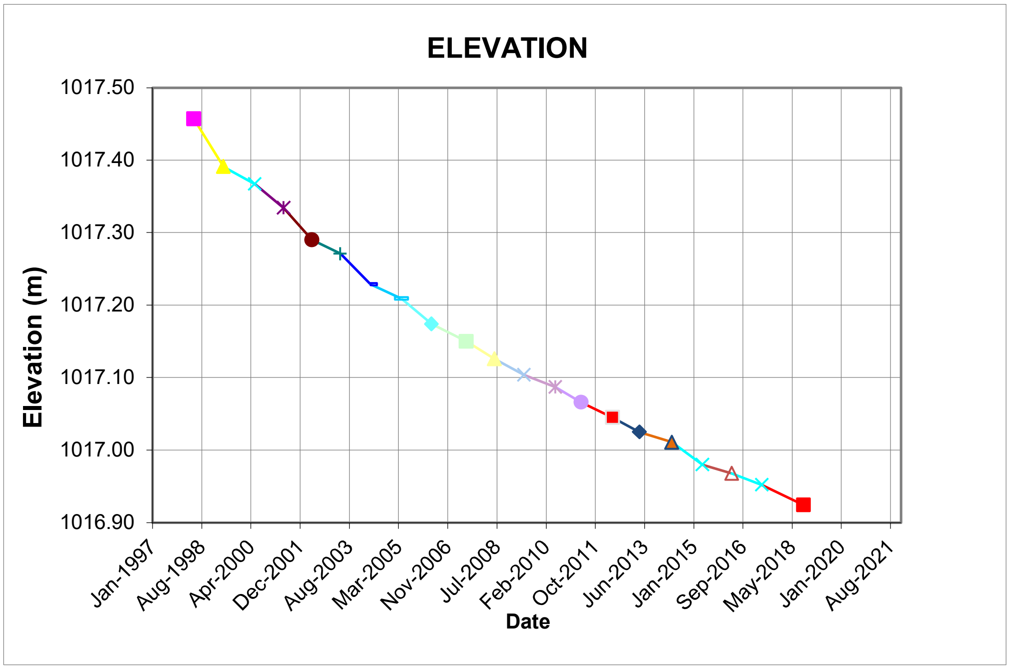
SP97-03 Line 33+00

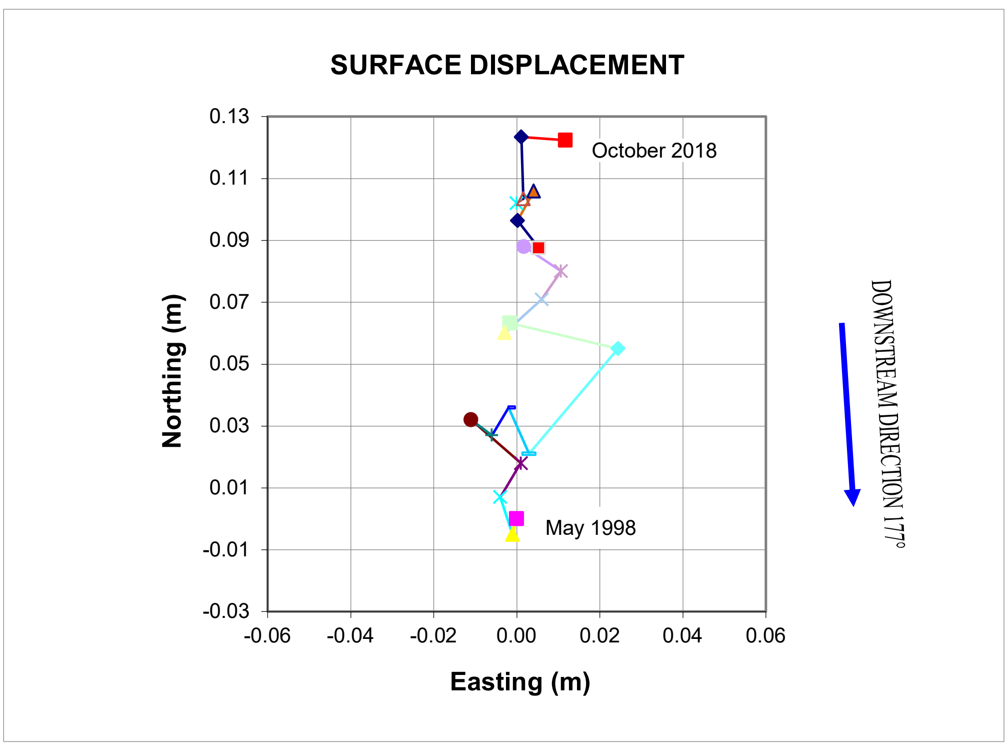
SETTLEMENT PLATES - EAST GYPSUM DIKE





SP97-04 Line 48+00
SETTLEMENT PLATES - EAST GYPSUM DIKE





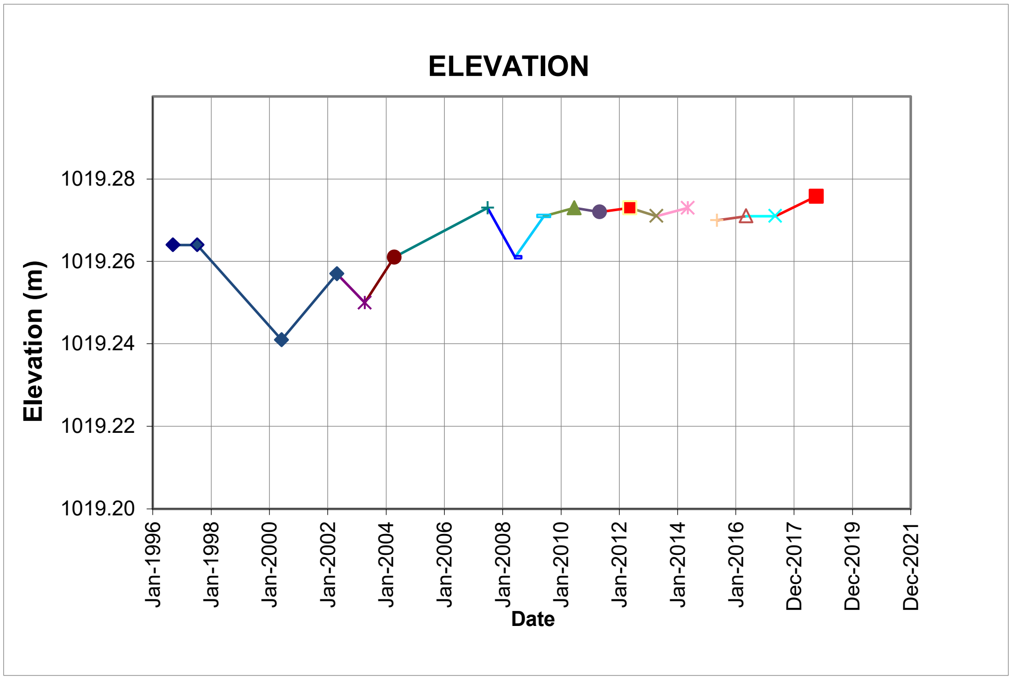
APPENDIX IX

NE Gypsum Dike Instrumentation

SETTLEMENT PLATES - NE GYPSUM DIKE

W Pipe

NE Gypsum Dike



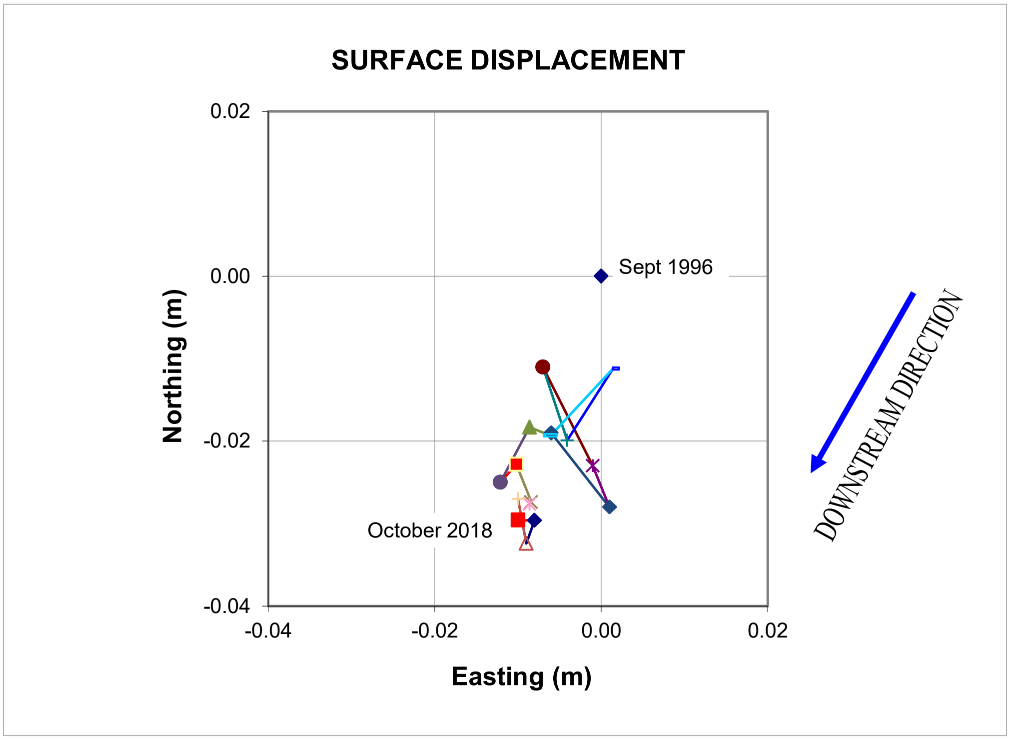
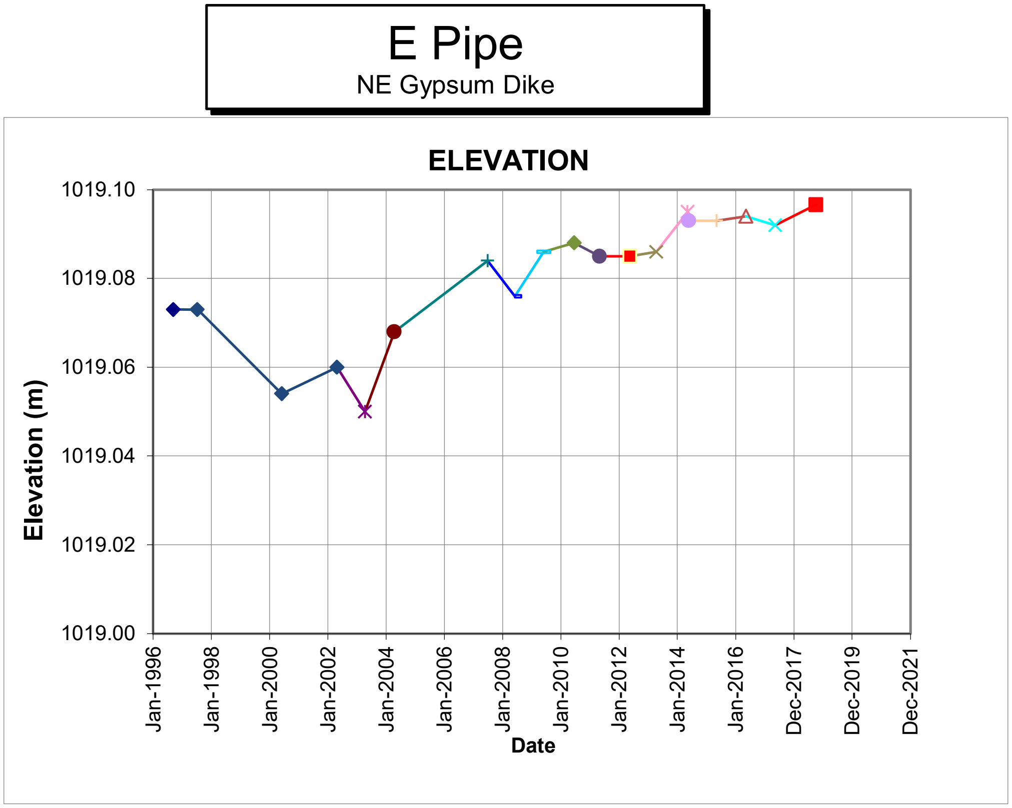


Figure IX-1 NE Gypsum Dike W pipe



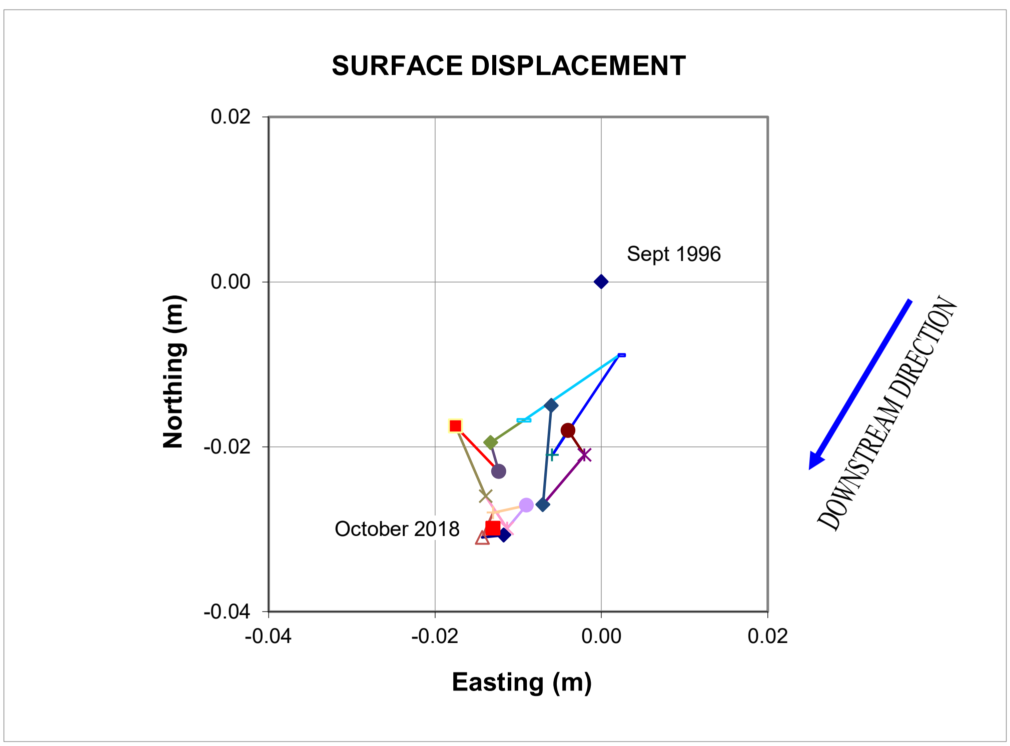


Figure IX-2 NE Gypsum Dike E pipe

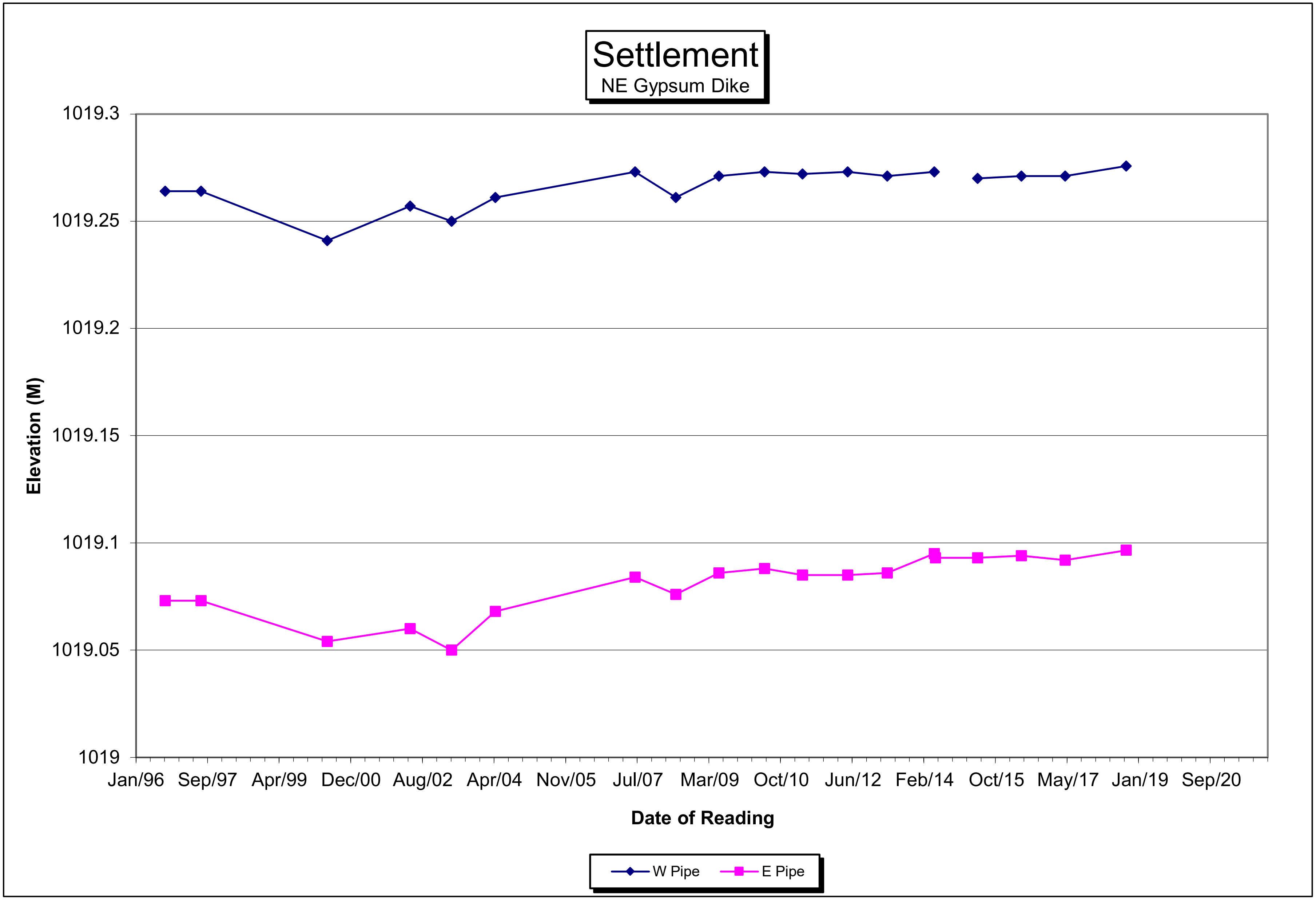

Settlement
NE Gypsum Dike
1019.3
1019.25
1019.2
1019.15
1019.1
1019.05
1019
Elevation (M)
Jan/96
Sep/97
Apr/99
Dec/00
Aug/02
Apr/04
Nov/05
Jul/07
Mar/09
Oct/10
Jun/12
Feb/14
Oct/15
May/17
Jan/19
Sep/20
Date of Reading
W Pipe
E Pipe

Figure IX-3

APPENDIX X

ARD Instrumentation

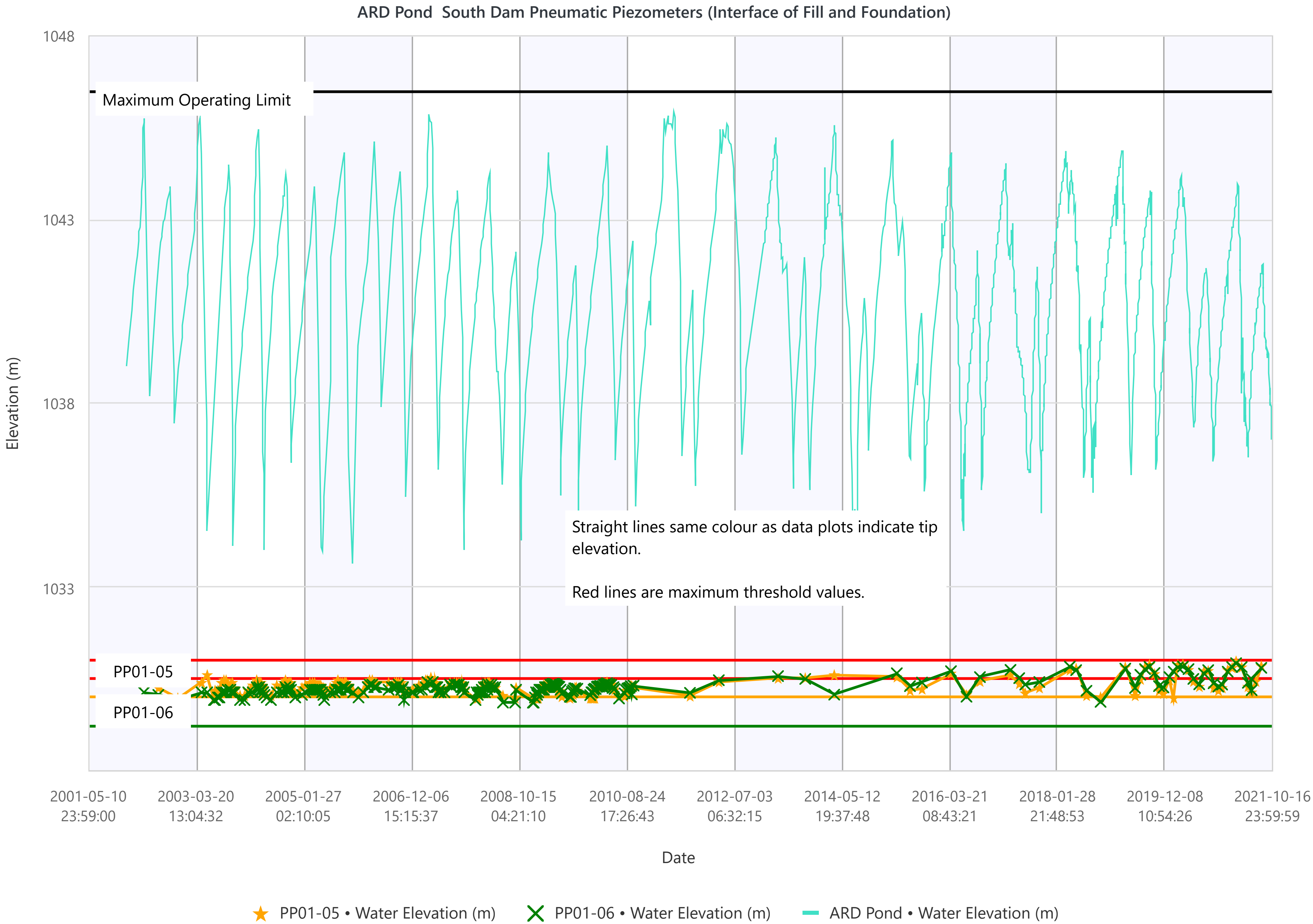
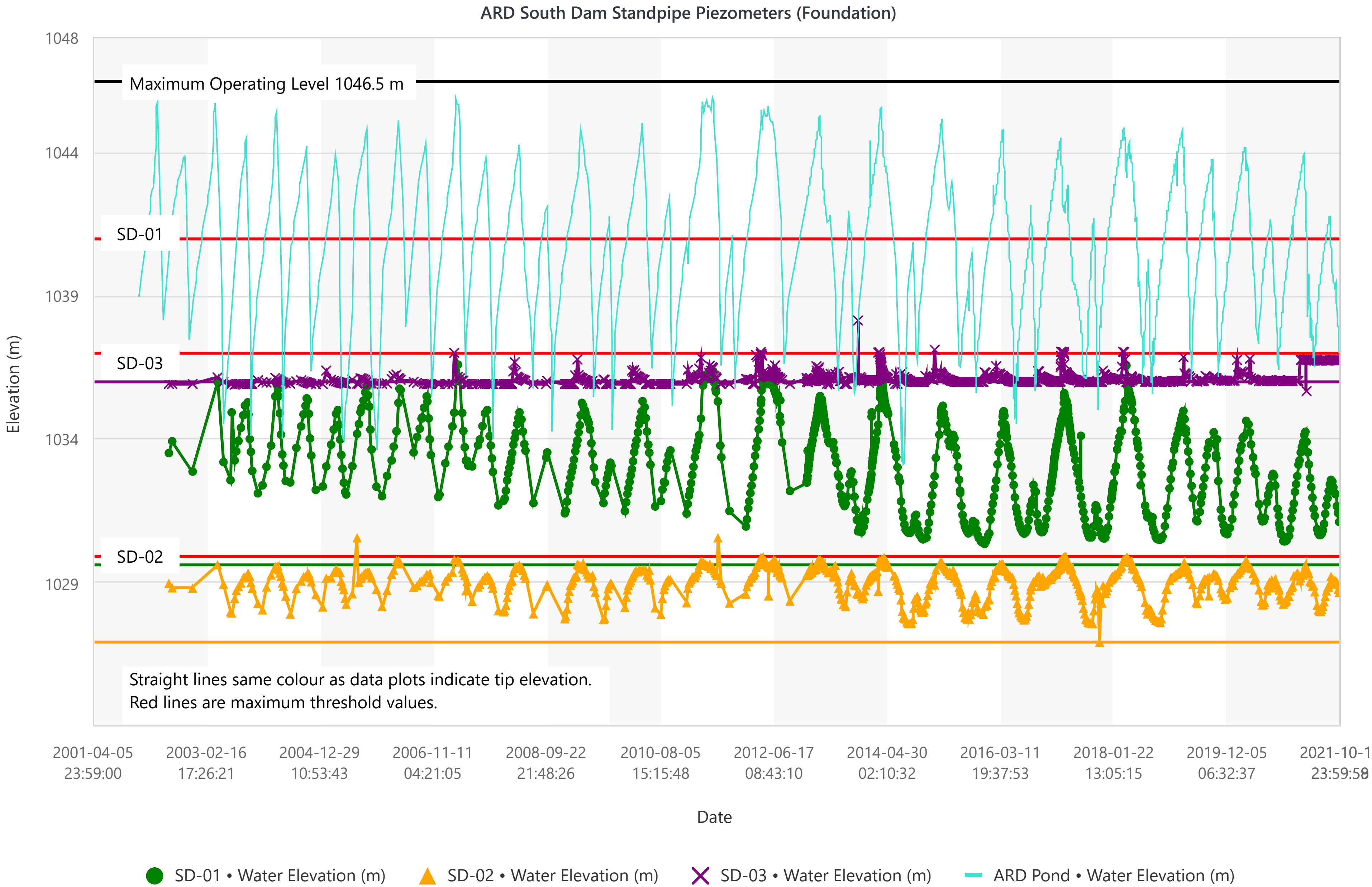
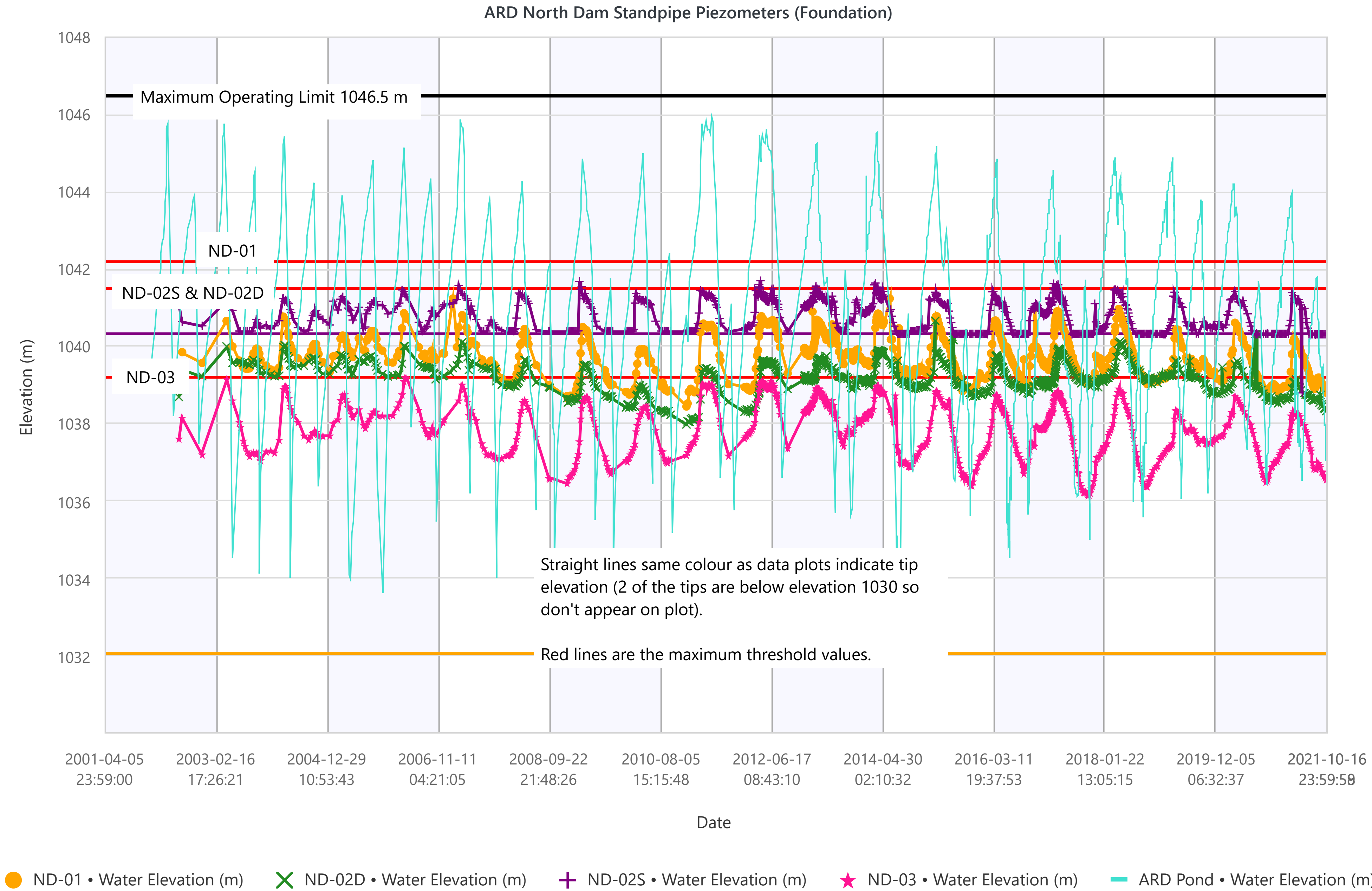


Figure X-1 South Dam



Standpipe piezometers were flushed in July/August 2014. Not all sediment was removed and some casings also cut or extended/repaired at this time. Therefore a new top of casing and new depth to bottom of standpipe was recorded for many instruments. Only noticeable for those instruments which record "dry" or if previous top of casing elevation was incorrect due to damage.

Figure X-2 South Dam Standpipe



Standpipe piezometers were flushed in July/August 2014. Not all sediment was removed and some casings also cut or extended/repaired at this time. Therefore a new top of casing and new depth to bottom of standpipe was recorded for many instruments. Only noticeable for those instruments which record "dry" or if previous top of casing elevation was incorrect due to damage.

Figure X-3 North Dam Standpipes

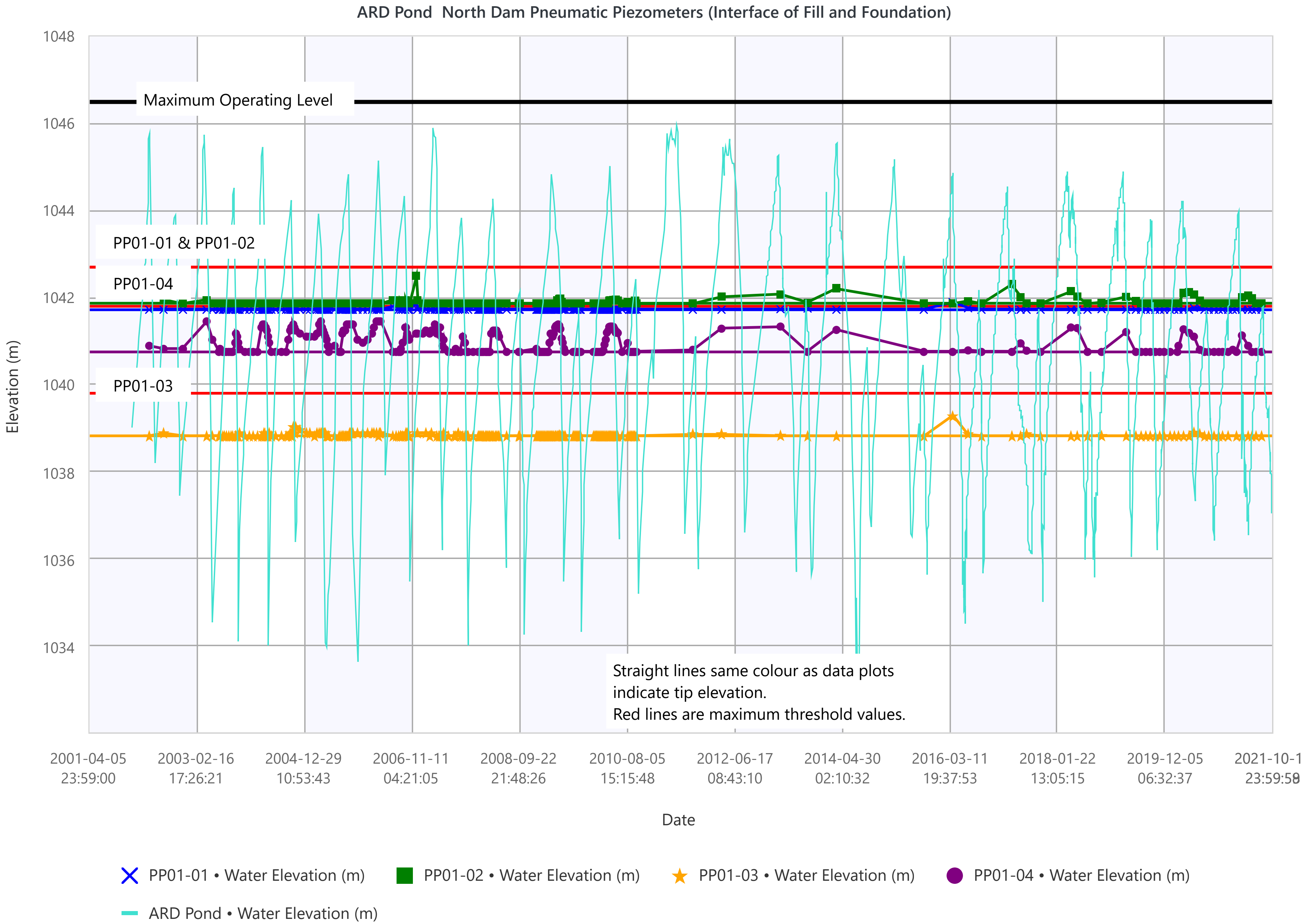


Figure X-4 North Dam Piezometers

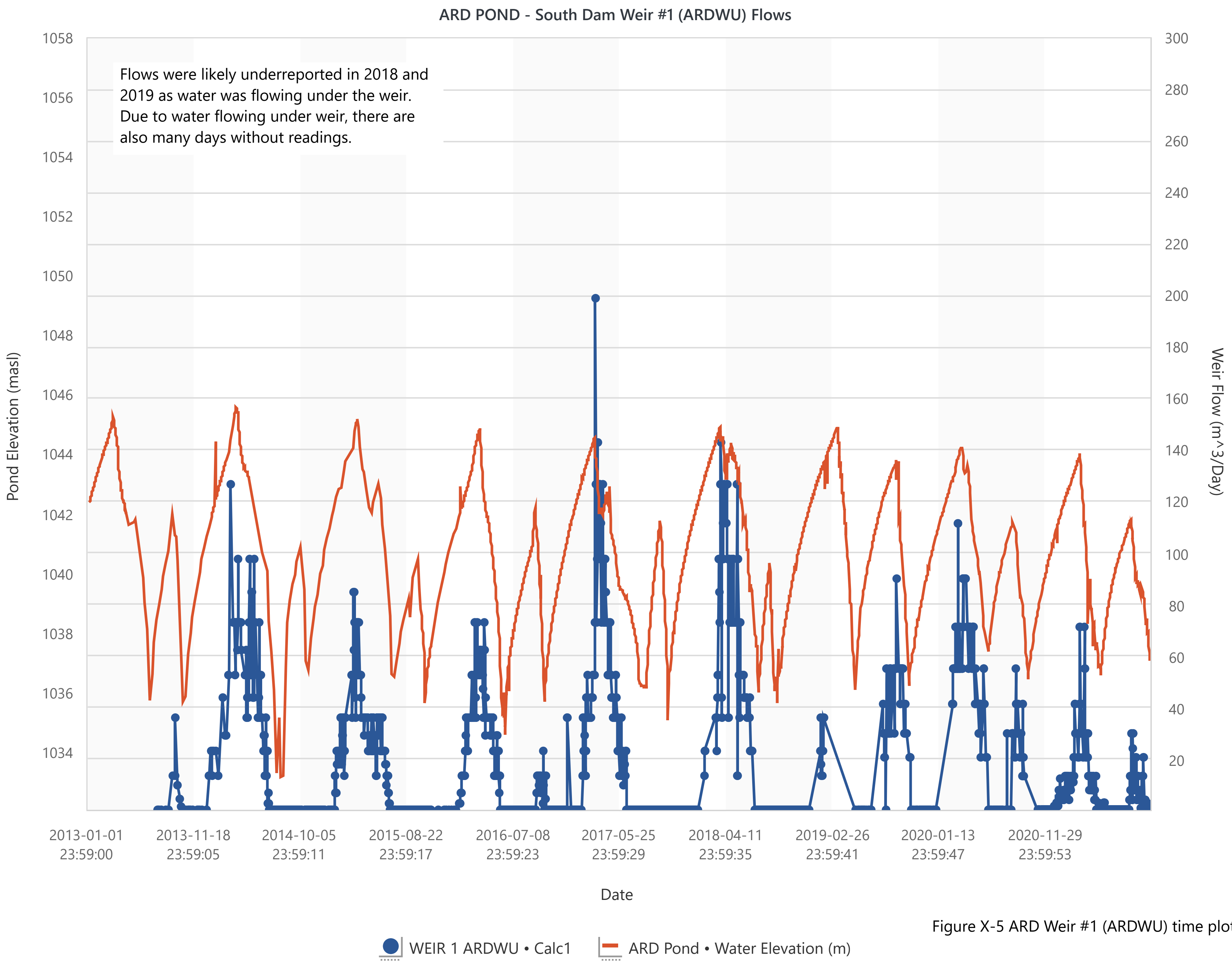


Figure X-5 ARD Weir #1 (ARDWU) time plot

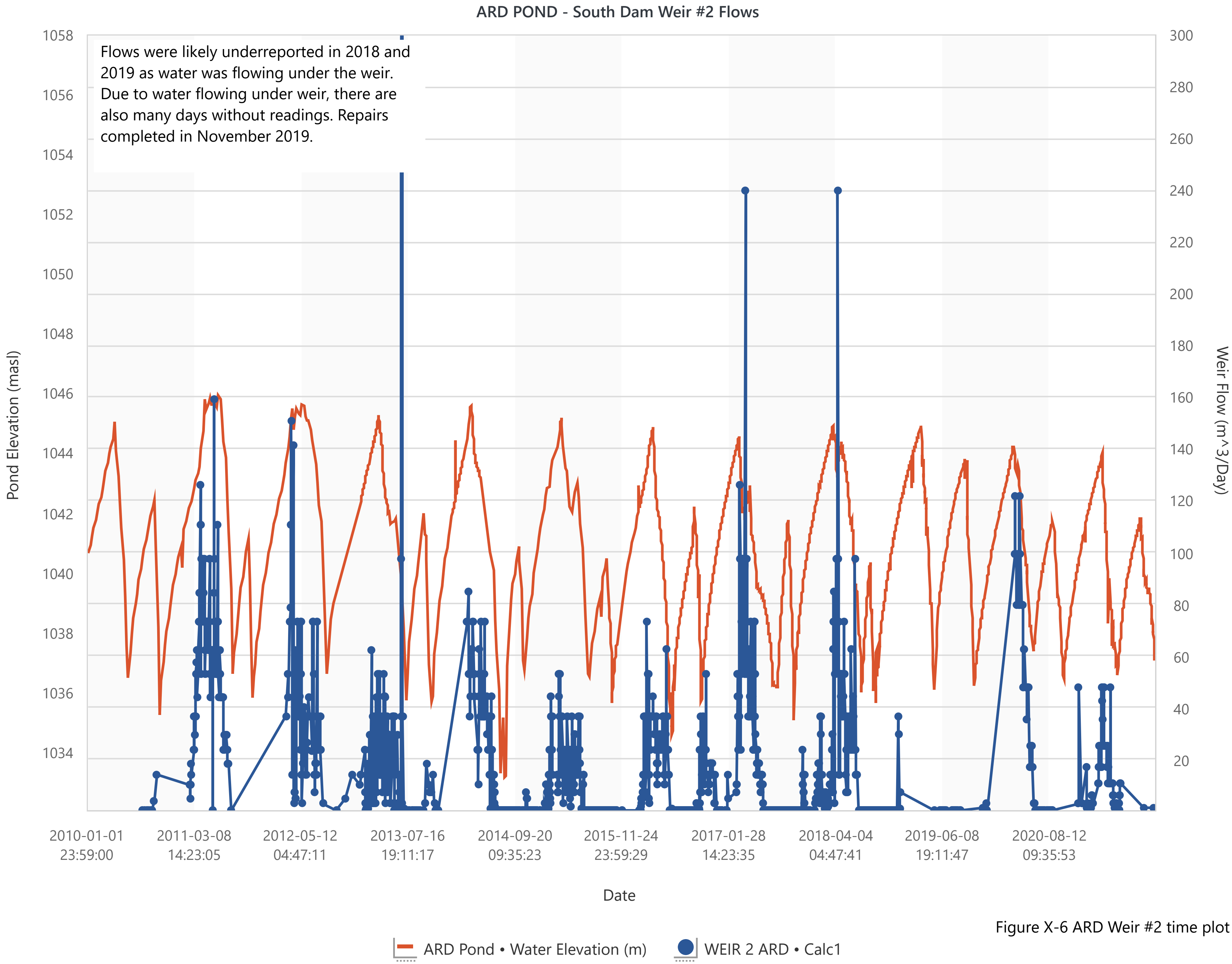
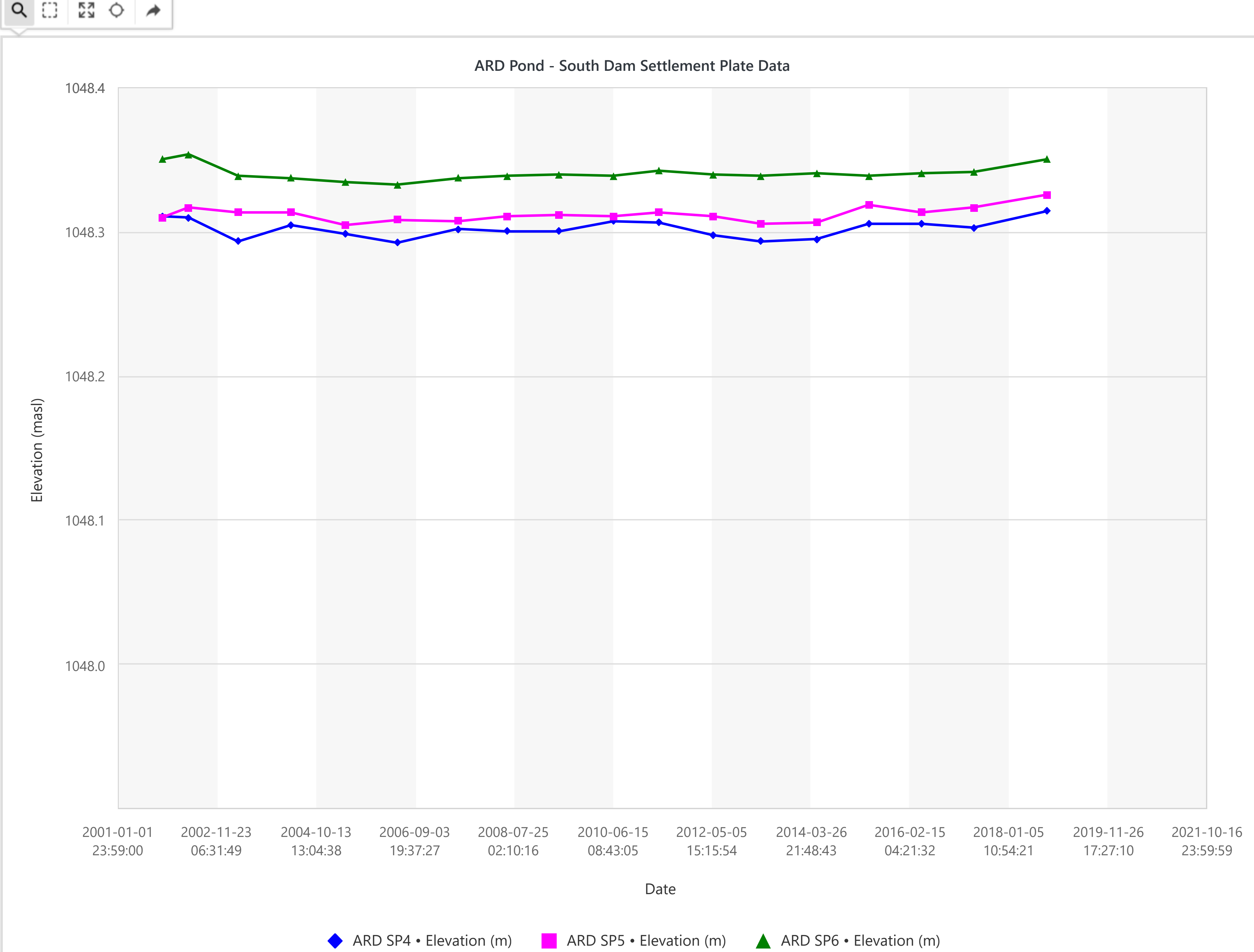


Figure X-6 ARD Weir #2 time plot



ARD Pond - South Dam Settlement Plate Data
1048.4
1048.3
1048.2
1048.1
1048.0
Elevation (masl)
2001-01-01 23:59:00
2002-11-23 06:31:49
2004-10-13 13:04:38
2006-09-03 19:37:27
2008-07-25 02:10:16
2010-06-15 08:43:05
2012-05-05 15:15:54
2014-03-26 21:48:43
2016-02-15 04:21:32
2018-01-05 10:54:21
2019-11-26 17:27:10
2021-10-16 23:59:59
Date
ARD SP4 • Elevation (m)
ARD SP5 • Elevation (m)
ARD SP6 • Elevation (m)

Figure X-7

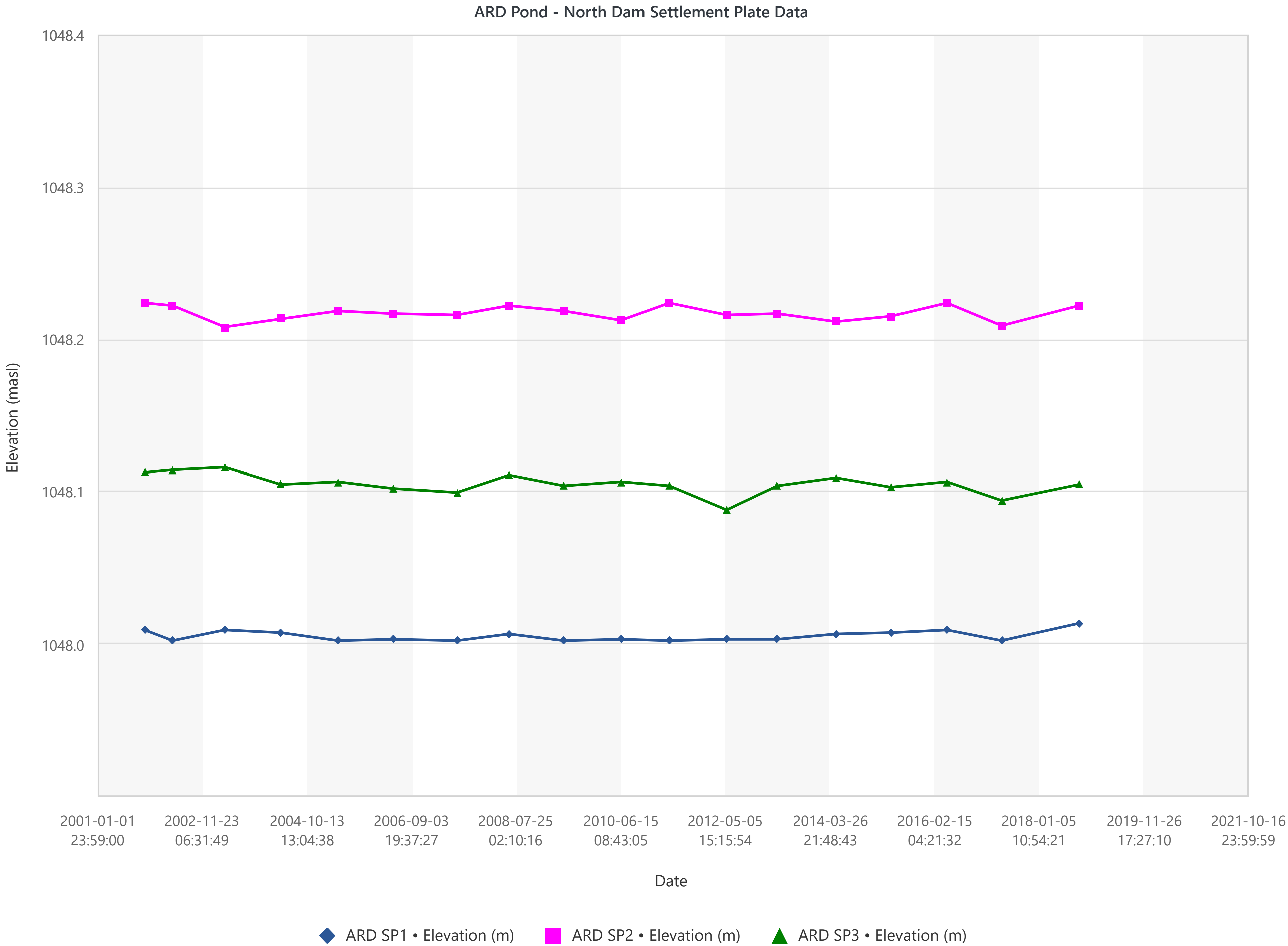
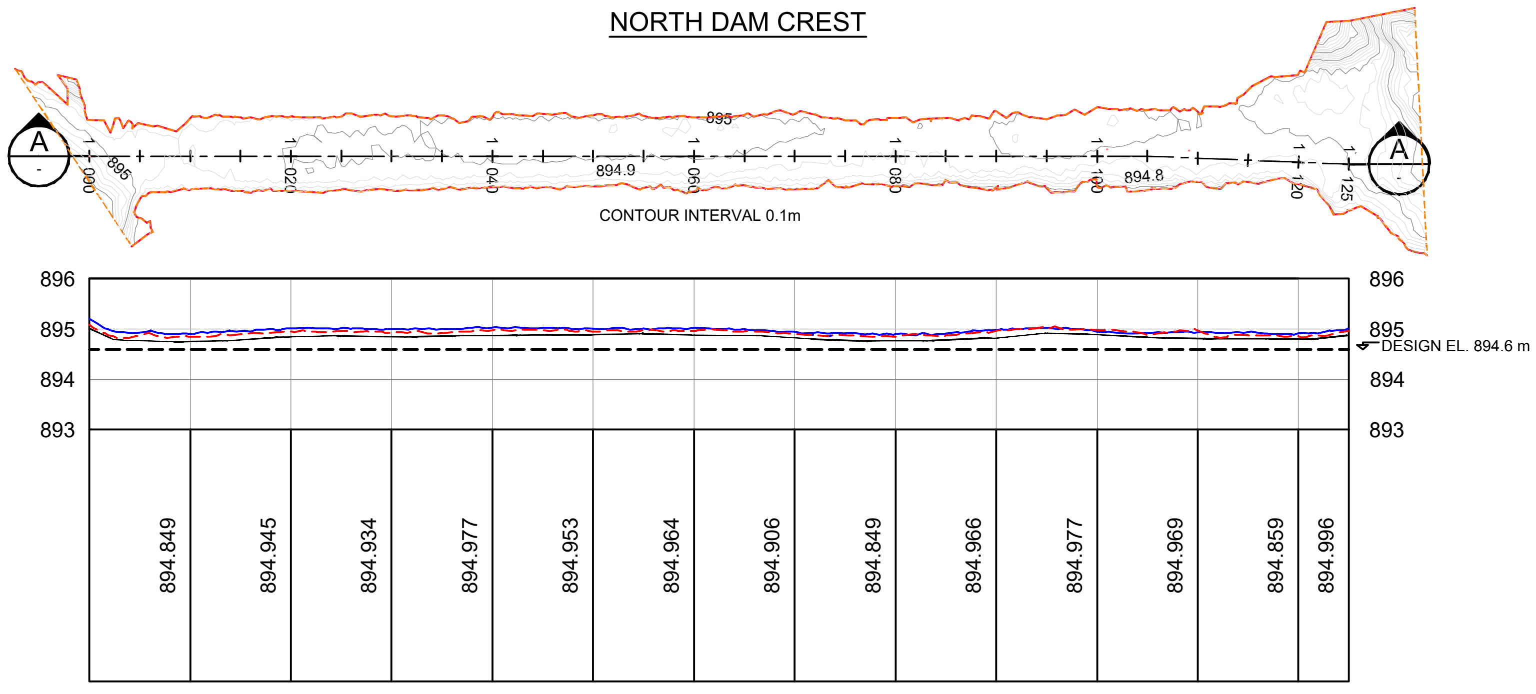

ARD Pond - North Dam Settlement Plate Data
1048.4
1048.3
1048.2
1048.1
1048.0
Elevation (masl)
2001-01-01 23:59:00
2002-11-23 06:31:49
2004-10-13 13:04:38
2006-09-03 19:37:27
2008-07-25 02:10:16
2010-06-15 08:43:05
2012-05-05 15:15:54
2014-03-26 21:48:43
2016-02-15 04:21:32
2018-01-05 10:54:21
2019-11-26 17:27:10
2021-10-16 23:59:59
Date
ARD SP1 • Elevation (m)
ARD SP2 • Elevation (m)
ARD SP3 • Elevation (m)

Figure X-8

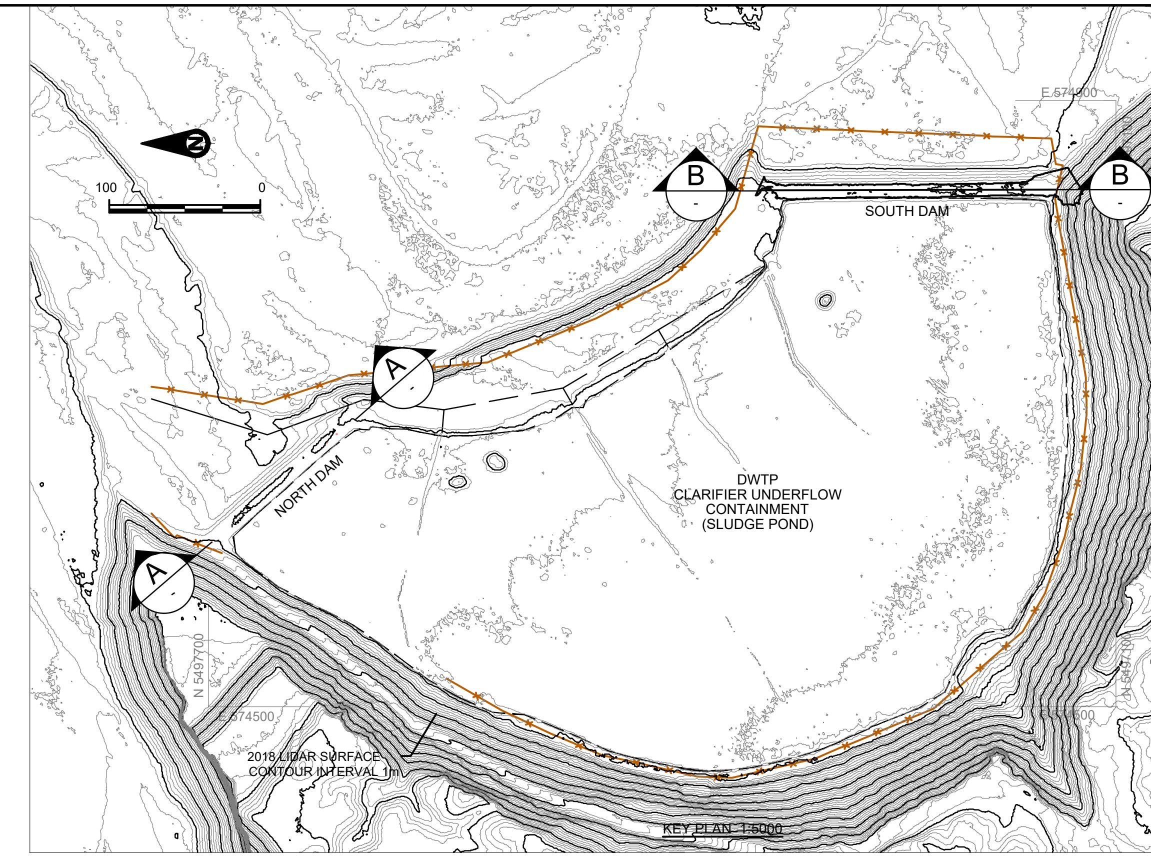
APPENDIX XI

Sludge Pond Dike Crest Survey

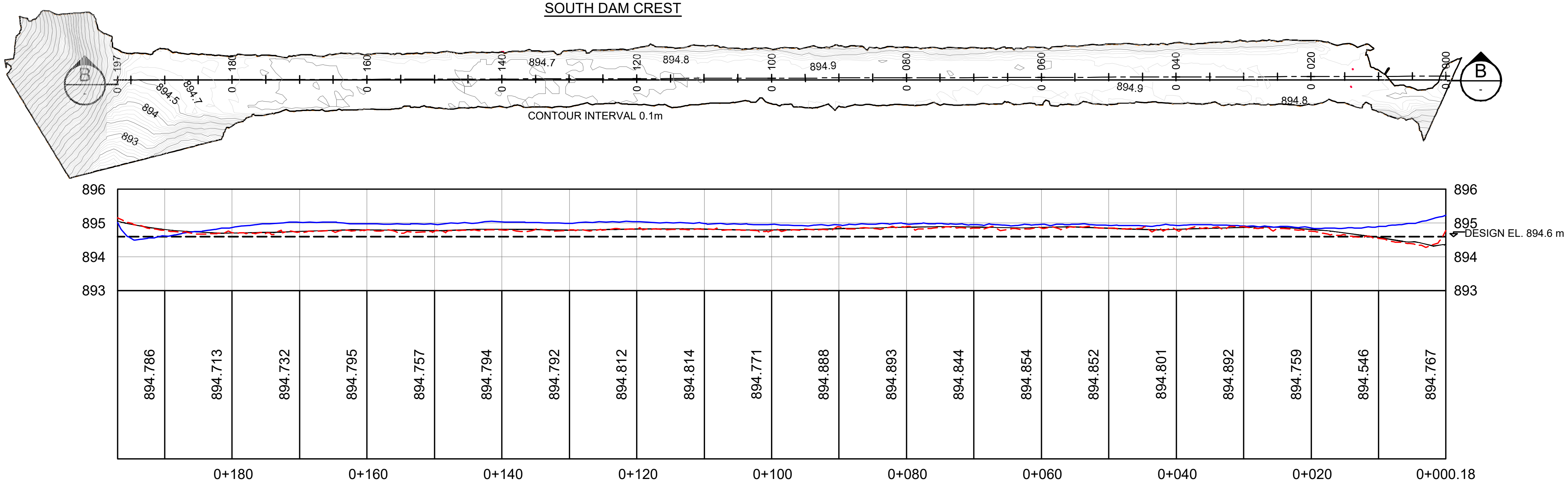
NORTH DAM CREST



A PROFILE
SCALE 1:750 HORZ.
1:150 VERT.



SOUTH DAM CREST



B PROFILE
SCALE 1:750 HORZ.
1:150 VERT.

LEGEND
- 2012 LIDAR
- 2019 LIDAR

1:150 0 1.5 3 m
1:750 0 7.5 15 m

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Klohn Crippen Berger

PROJECT
SULLIVAN MINE
2021 ANNUAL INSPECTION REPORT

TITLE
SLUDGE POND
DIKE CREST PROFILES

PROJECT No.
A05807A21

FIG No.
FIGURE XI-1

KCC-D-B

\\int.klohn.com\ProjData\EDM\A05807A21 TML 2021 Annual Inspection\400 Drawings\Annual Inspection\Figure XI-1 2021.dwg Layout=FIGURE XI-1 October 15, 2021 6:17:06 PM

APPENDIX XII

Pond Storage Curves

Appendix XII
Pond Storage Curves

Figure XII-1 ARD Storage Pond Area - Volume Curve

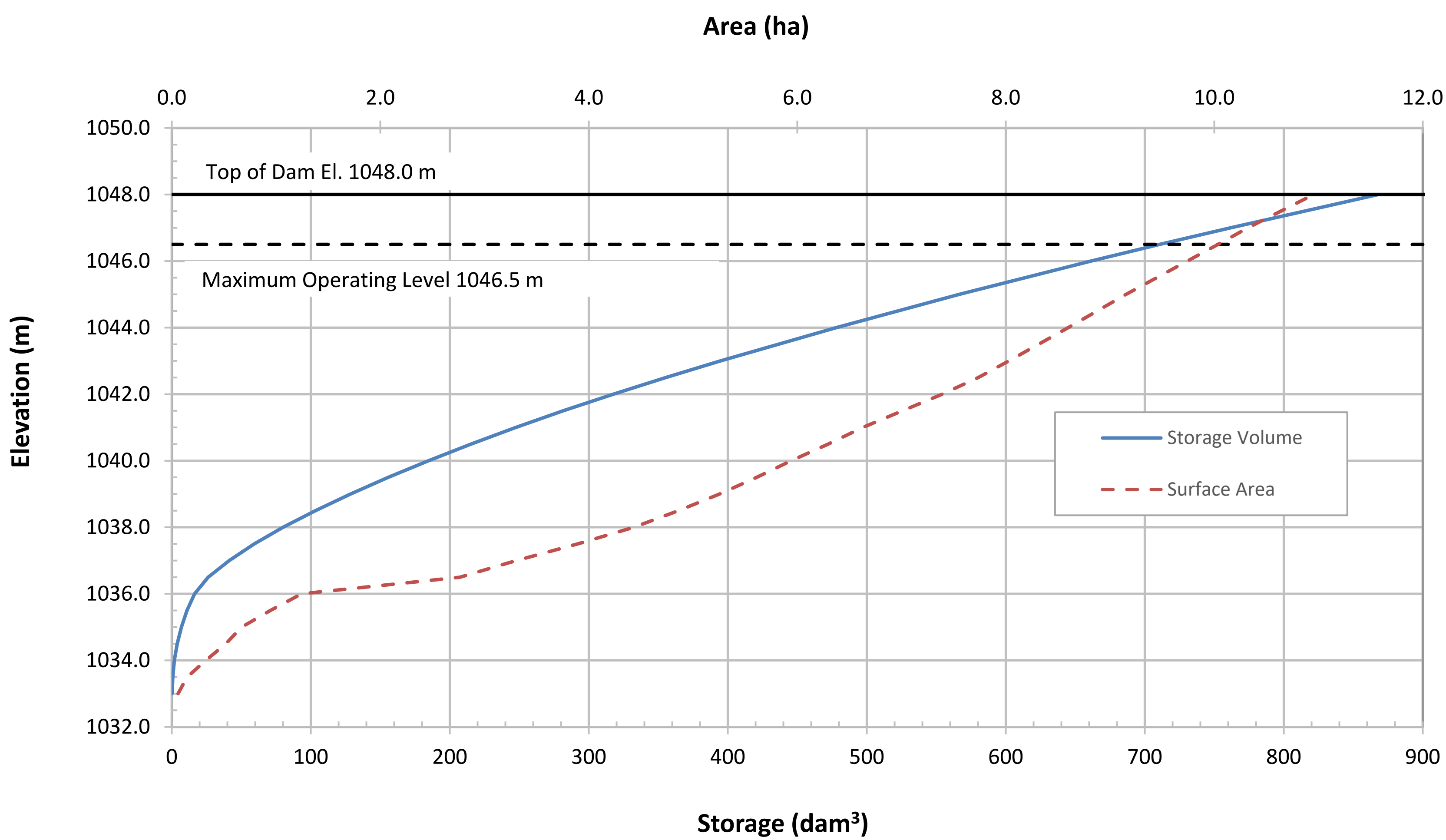

Figure XII-2 Iron Pond Stage - Volume Curve