

July 15, 2025

Alberta Transportation and Economic Corridors
Main Floor, Provincial Building
9621 – 96th Avenue
Peace River, Alberta
T8S 1T4

Robert Senior
Construction Technologist

Dear Mr. Senior:

CON0022166 Peace Region (Grande Prairie District – South) GRMP Instrumentation Monitoring Site GP038-I and -II; H40:38, km 25.831 and km 25.426
Slides 1.6 km and 2.0 km North of Kakwa River Bridge (North Little Prairie Creek Slide)
Section C – 2025 Spring Readings

1 GENERAL

One slope inclinometer (SI) (SI17-1) and one pneumatic piezometer (PN) (PN17-3B) were read at the GP038-I site in the Peace Region (Grande Prairie District – South) (GP South Region) on June 3, 2025, by Evan Hergott, E.I.T. and Min Hou, E.I.T. of Klohn Crippen Berger Ltd. (KCB). These instruments were read as part of the GP South Region Geohazard Risk Management Program (GRMP). The GP038-I and GP038-II sites are located on Hwy 40:38, km 25.831 and 25.426, respectively. The approximate site coordinates of GP038-I and GP038-II are 6033163 N, 398377 E and 6032912 N, 398677 E, respectively (UTM Zone 11, NAD 83). A site plan is presented on Figure 1.

The geohazard at the GP038-I and GP038-II sites consists of two repaired landslides in the highway embankment fill, approximately 2.0 km and 1.6 km north of the Kakwa River bridge, respectively. Construction to remediate the slides (described below) was completed in 2018. Minor post-construction pavement cracking and settlement have been observed at both sites.

Previous remedial actions completed at the sites between 2017 and 2018 include a culvert extension and construction of a toe berm at the GP038-I site, and reconstruction of the GP038-II site with compacted granular fill along with a sheet pile wall installed to isolate work from the creek. An overlay was completed between 2017 and 2020, and pavement cracks were sealed in 2022.

In February 2017, a geotechnical site investigation, which included instrument installation, was conducted by a previous consultant. The encountered stratigraphy was as follows: fill, overlying clay till, and overlying clay.

1.1 Instrumentation

KCB has been reading the instruments at this site since the spring of 2021. Instrumentation installation details are tabulated in Table 1.1. Instrument locations are shown on Figure 1. Any instruments not included in Table 1.1 or shown on Figure 1 are assumed to be inoperable and are not presented or discussed herein.

In 2017, three SIs and eight piezometers were installed at the sites by a previous consultant to monitor movement and groundwater conditions, respectively. Some of these instruments have since become inoperable (e.g., sheared or damaged), as detailed in Table 1.1 (see table notes). Recommendations for replacement are made in Section 3.

During the spring 2025 readings, PN17-1A and PN17-2A/B were found to be inoperable (appeared to have been chewed off to ground surface) and could not be repaired. The instruments will not be read again. As discussed in Section 3, no replacement instruments are recommended at this time.

The instruments are protected with above-ground casing protectors.

SI17-1 was read using the same metric RST Digital MEMS Inclinator System that has been used to read the SI since KCB took over the readings in June 2021. The operable PN was read using an RST C109 pneumatic piezometer readout box.

Table 1.1 Instrumentation Installation Details¹

Site	Instrument Type	Instrument ID	Date Installed	UTM Coordinates(m)		Ground Surface Elevation (m)	Stick Up (m)	Depth (mbgs ²)	Condition
				Northing	Easting				
GP038-1	SI	SI17-1	Feb. 8, 2017	6033126	398415	844.7	0.8	18.0	Operable
		SI17-2	Feb. 8, 2017	Unknown					Inoperable ³
		SI17-3	Feb. 8, 2017	Unknown					Inoperable ³
	PN	PN17-1A	Feb. 4, 2017	6033126	398415	844.7	N/A	7.2	Inoperable ⁸
		PN17-1B					N/A	15.9	Inoperable ⁴
		PN17-2A	Feb. 4, 2017	6033103	398444	842.3	N/A	7.6	Inoperable ⁸
		PN17-2B					N/A	12.6	Inoperable ⁸
		PN17-3A	Feb. 3, 2017	6033083	398433	839.3	N/A	8.9	Inoperable ⁵
		PN17-3B					N/A	13.9	Operable
	SP	SP17-1	Feb. 3, 2017	6032882	398720	821.8	1.0	10.4	Inoperable ⁷
		SP17-2	Feb. 2, 2017	6032873	398710	822.3	1.0	14.9	Inoperable ⁶

Notes:

¹ Instrument installation details were taken from reports and data files prepared or provided by the previous consultant(s) or TEC. Ground surface elevations were not provided for the SIs, so the ground surface elevation from the adjacent instruments/piezometer tips were used if available. Instrument coordinates and stick ups (where applicable) were confirmed by KCB using a handheld GPS (accuracy of ± 5 m) and tape measure, respectively.

² Meters below ground surface (mbgs). Bottom reading depth for SIs, and tip or screen depth for piezometers.

³ SI17-2 and SI17-3 have sheared at an approximate depth of 12.2 m and 11.0 m below ground surface, respectively. Instruments last read in June 2017.

⁴ PN17-1B was inoperable (readings would not stabilize or near tip elevation) between the spring 2017 and spring 2018 readings. Instrument last read in April 2017.

⁵ PN17-3A was inoperable (readings would not stabilize) during the spring 2018 and fall 2018 readings. Instrument last read in October 2017.

⁶ SP17-02 was inoperable (destroyed) during the fall 2017 readings. Instrument last read in June 2017.

⁷ SP17-1 was inoperable (appeared to have been struck by a vehicle) during the spring 2024 readings and could not be repaired. Instrument last read in June 2023.

⁸ PN17-1A and PN17-2A/B were inoperable (appeared to have been chewed off to ground surface) during the spring 2025 readings and could not be repaired. Instruments last read in May 2024.

2 INTERPRETATION

2.1 General

For SI17-I, the cumulative displacement, incremental displacement, and displacement-time data was plotted in the A-direction (i.e., the direction of the A0-groove) and the X-direction (i.e., the direction of maximum movement obtained at a skew angle from the A0-grooves). SI17-1 has a skew angle of 348°, measured clockwise from the direction of the A0-grooves.

For the operable PN, the recorded porewater pressures were converted to an equivalent water/piezometric elevation and plotted relative to ground surface elevation and the tip elevation for each instrument.

The SI and piezometer plots are included in Appendix I, and a summary of the SI and piezometer data is provided in Table 2.1 and Table 2.2, respectively. The SI data plots presented herein include data for readings taken with both the previous consultants' and KCB's SI reading equipment.

2.2 Zones of Movement

Discrete movement (i.e., occurring on a defined failure plane) is being recorded in SI17-1 from an approximate depth of 10.0 m to 12.5 m below ground surface (approximately elevation 832.2 m to 834.7 m) and possibly from 15.0 m to 17.0 m (approximately elevation 827.7 m to 829.7 m). The upper and lower zones of movement are occurring in the clay till and the underlying clay foundation units, respectively. Shallow distributed movement is also being recorded in the fill from an approximate depth of 2.5 m below ground surface to ground surface (approximately elevation 842.2 m to 844.7 m).

Table 2.1 Slope inclinometer Reading Summary

Site	Instrument ID	Date				Ground Surface Elevation (m)	Depth of Movement (mbgs ¹)	Direction of Movement, Skew Angle ²	Movement (mm)		Rate of Movement (mm/year)		
		Initialized	Previous Maximum Cumulative Movement Recorded	Previous Reading	Most Recent Reading				Maximum Cumulative	Incremental Since Previous Maximum Cumulative	Previous Maximum	Most Recent Reading	Change from Previous Reading
GP038-I	SI17-1	Feb. 8, 2017	Oct. 10, 2019	May 23, 2024	Jun. 03, 2025	844.7	10.0 – 12.5	X-Direction, 348°	28.6	-1.3	29.3	-0.1	-0.5
			Jun. 25, 2020				15.0 – 17.0	X-Direction, 348°	2.3	-1.5	5.8	-0.4	-0.1

Notes:

¹ Meters below ground surface (mbgs).

² Skew angle of the X-direction measured clockwise from the A-direction. The azimuth of the A0-groove in the SI was measured by KCB with a magnetic compass in spring 2022.

Table 2.2 Pneumatic Piezometer Reading Summary

Site	Instrument ID	Serial No.	Date			Ground Surface Elevation (m)	Tip Depth (mbgs ¹)	Water Level		
			Installed	Previous Reading	Most Recent Reading			Previous Reading (mbgs ¹)	Most Recent Reading (mbgs ¹)	Change from Previous Reading (m)
GP038-I	PN17-3B	37438	Feb. 03, 2017	May 23, 2024	Jun. 03, 2025	839.3	13.9	2.3	2.4	-0.1

Notes:

¹ Meters below ground surface (mbgs).

2.3 Interpretation of Monitoring Results

2.3.1 GP038-I Site

Between June 2017 and June 2018, an increased rate of movement (approximately 29 mm/year) was recorded in the upper monitoring zone of SI17-1, likely in response to toe berm construction in 2017 and 2018. Since June 2018, the rate of movement has decreased and is currently less than 1 mm/year indicating the toe berm is stabilizing the highway embankment. The rate of movement recorded in the lower monitoring zone of SI17-1 has been slow (less than 1 mm/year) since installation and is within the accuracy of the SI reading equipment.

Before several piezometers (e.g., PN17-1A and PN17-2A/B) became inoperable (last reading spring 2024), the water levels/porewater pressures recorded in the instruments were relatively high and had been near to above ground surface since mid-2017, indicating the presence of a high groundwater table. The relatively high-water level recorded in the piezometers could result in embankment instability and explain the pavement cracking observed at this site. However, the cracking, in combination with the observed pavement dip and settlement, could also be due to settlement of the recently placed fill. Reactivation of the slide could occur due to continued erosion (less likely) or increases in water level. However, the large toe berm should reduce the potential for reactivation of the slide.

Since mid-2018, an approximate 2.3 m decrease has been recorded in PN-3B, which is installed below the toe berm in a clay foundation unit. The recorded decrease is most likely due to porewater pressures dissipating following toe berm construction between 2017/2018.

2.3.2 GP038-II Site

Before SP17-1 became inoperable (last reading spring 2023), the water levels recorded in the instrument were relatively high and had been near ground surface since mid-2018, indicating the presence of a high groundwater table. The pavement cracking and small dip observed at this site may be unrelated to the relatively high-water level recorded in SP17-1, being more likely due to minor settlement of recently placed fill.

3 RECOMMENDATIONS

3.1 Future Work

The site should continue to be inspected by the Maintenance Contract Inspector (MCI). However, based on the performance of the repair and low rates of recorded movement, TEC could consider making the site a monitoring only site and excluding it from the GP South GRMP Section B inspections or removing the site completely from the list of active GRMP sites. If site conditions were to deteriorate, the site could always be returned to the list of active GRMP sites and/or inspected again as part of a Section B inspection or Section D call-out inspection.

Unless the site is removed from the list of active GRMP sites, all operable instruments should continue to be read once per year (spring). Spring readings should be completed after late-May or early-June, due to the risk of water inside the instrument casings being frozen earlier in the year.

3.2 Instrument Installs, Repairs, and Maintenance

Above-ground-steel-casing protectors for some instruments are close to pavement edge. These are potential roadside hazards to motorists who go off the highway. These should be removed if the instrument(s) are inoperable or replaced with flush-mounted casing protectors if instruments are operable.

Since SP17-1 was the last operable piezometer at the GP038-II site and PN17-3B is the last operable piezometer at the GP038-I site, replacement piezometers could be considered. However, since mid-2018, relatively steady water levels had been recorded in the piezometers and instrument replacements are likely not needed unless site conditions visually change from previous observations (e.g., the slide or area of known high groundwater table appears to be expanding and impacting the highway).

4 CLOSING

This report is an instrument of service of Klobn Crippen Berger (KCB). The report has been prepared for the exclusive use of Alberta Transportation and Economic Corridors (Client) for the specific application to the Peace Region (Grande Prairie District – South) Geohazard Risk Management Program (Contract No. CON0022166), and it may not be relied upon by any other party without KCB's written consent.

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

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

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

4. KCB should be consulted regarding the interpretation or application of the findings and recommendations in the report.
5. This report is electronically signed and sealed and its electronic form is considered the original. A printed version of the original can be relied upon as a true copy when supplied by the author or when printed from its original electronic file.

Yours truly,

KLOHN CRIPPEN BERGER LTD.



Courtney Mulhall, M.Sc., P.Eng.
Geotechnical Engineer

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Civil Engineer-in-Training

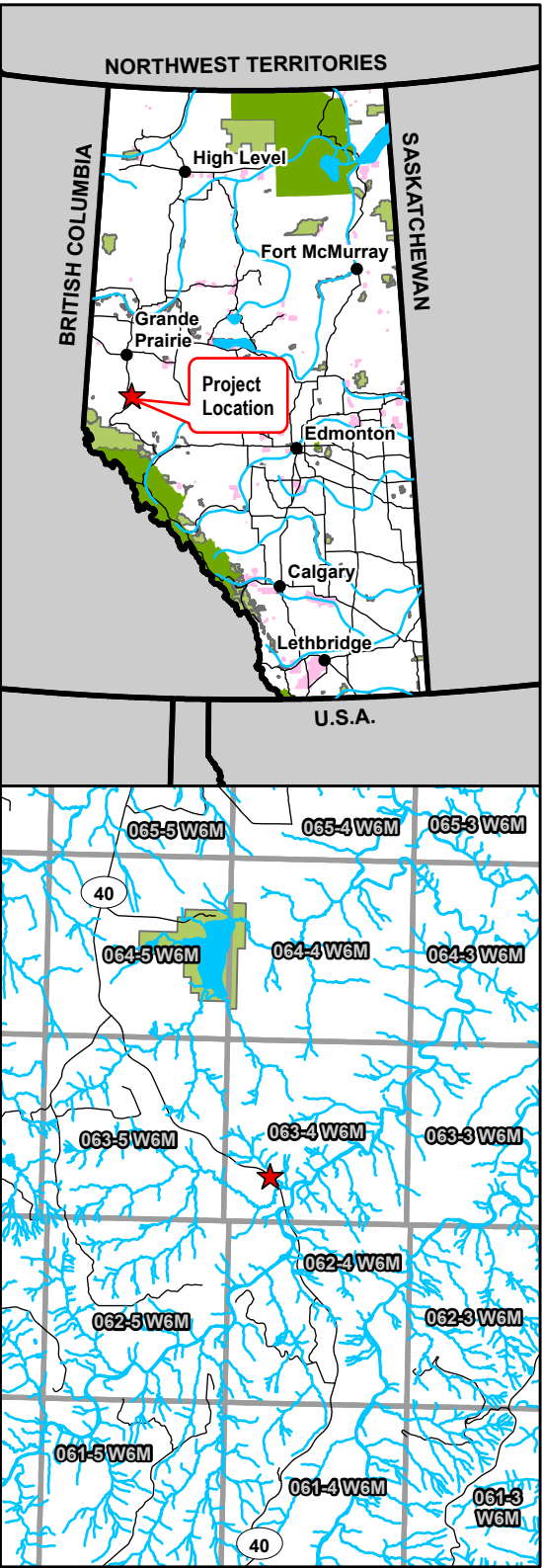
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Cc: Chris Gräpel, M.Eng., P.Eng.

ATTACHMENTS

Figure
Appendix I Instrumentation Plots

FIGURE



Legend

- ◆ Pneumatic Piezometer (PN)
- Slope Inclinerometer (SI)
- ⊕ Standpipe Piezometer (SP)
- Culvert
- Sheet Pile Wall



NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 11N
3. IMAGE SOURCE: 2025 MICROSOFT CORPORATION,
2025 MAXAR CNES, DISTRIBUTION AIRBUS DS
4. STRIKETHROUGH INDICATES INSTRUMENT
IS INOPERABLE. INSTRUMENT LOCATIONS
APPROXIMATE. INSTRUMENTS INOPERABLE
PRIOR TO 2021 MAY NOT BE SHOWN.

CLIENT

Alberta

Klohn Crippen Berger

PROJECT
PEACE REGION (GRANDE PRAIRIE DISTRICT-SOUTH)
GEOHAZARD RISK MANAGEMENT PROGRAM

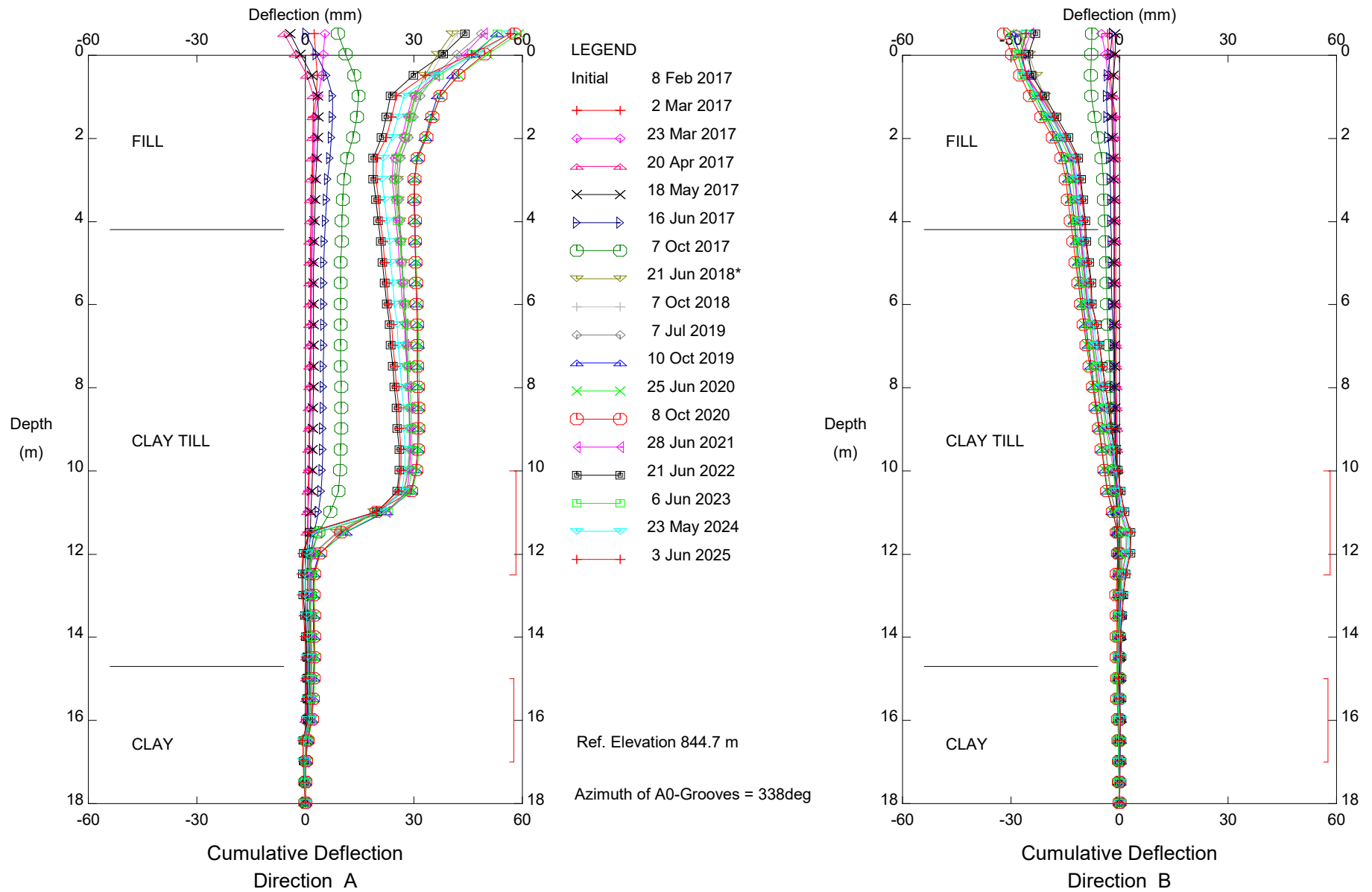
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Site Plan
GP038-I and -II - Slides 1.6 km and 2.0 km
North of Kakwa River Bridge
Hwy 40:38, km 25.831

SCALE 1:2,500 PROJECT No. A05116A01 FIG No. 1

APPENDIX I

Instrumentation Plots

Klohn Crippen Berger - Edmonton

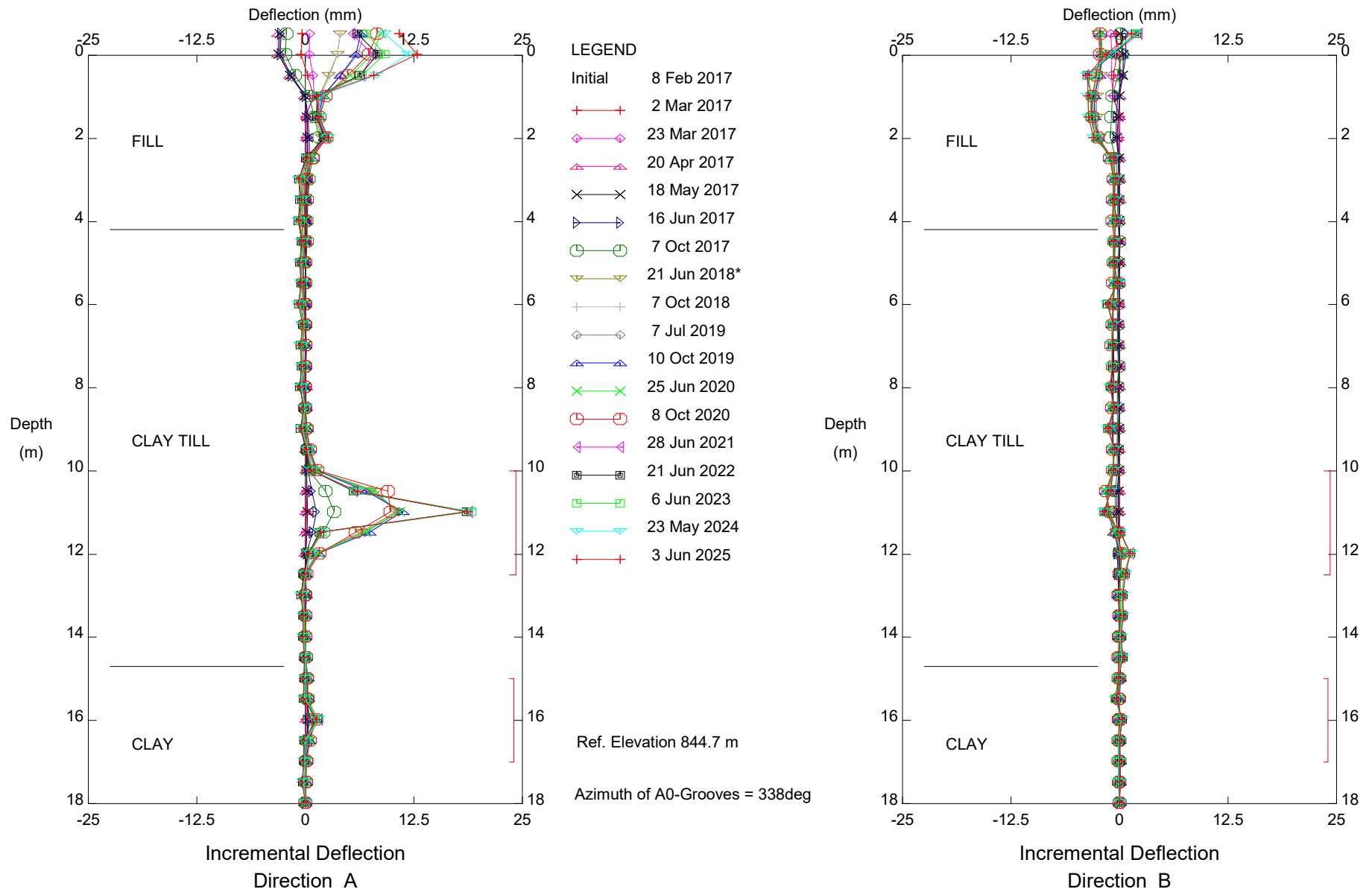


GP038-I; H40:38, Kakwa River Bridge, Inclinometer SI17-1

Alberta Transportation

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

Klohn Crippen Berger - Edmonton

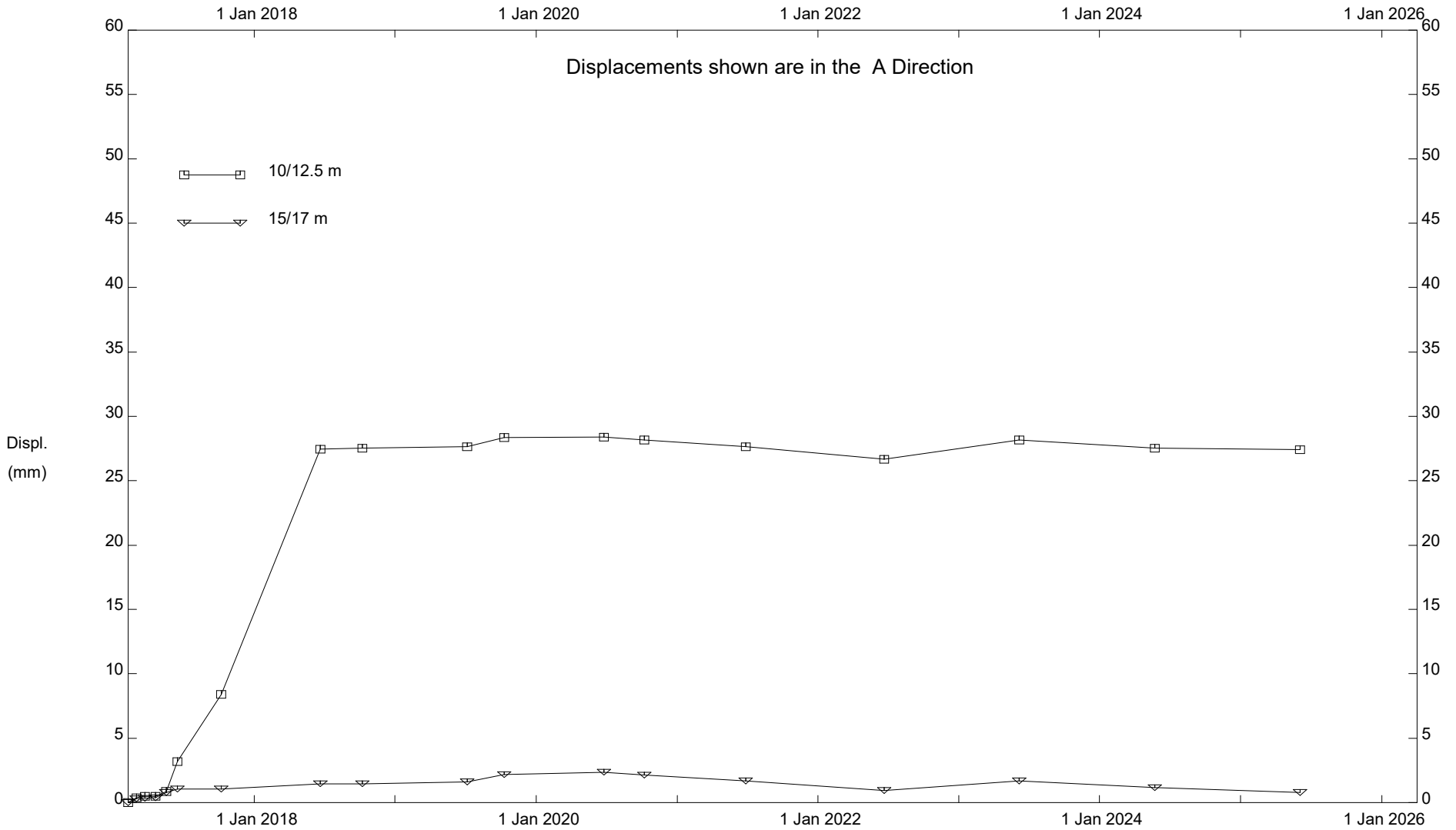


GP038-I; H40:38, Kakwa River Bridge, Inclinator SI17-1

Alberta Transportation

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

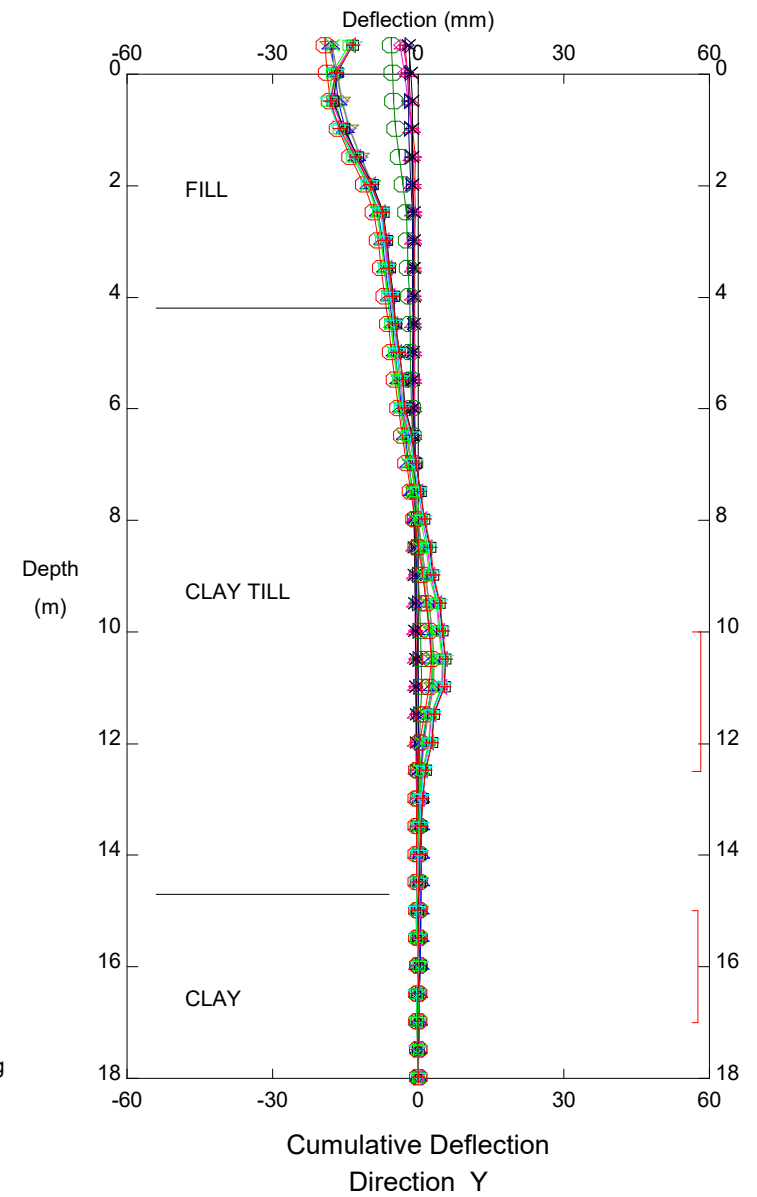
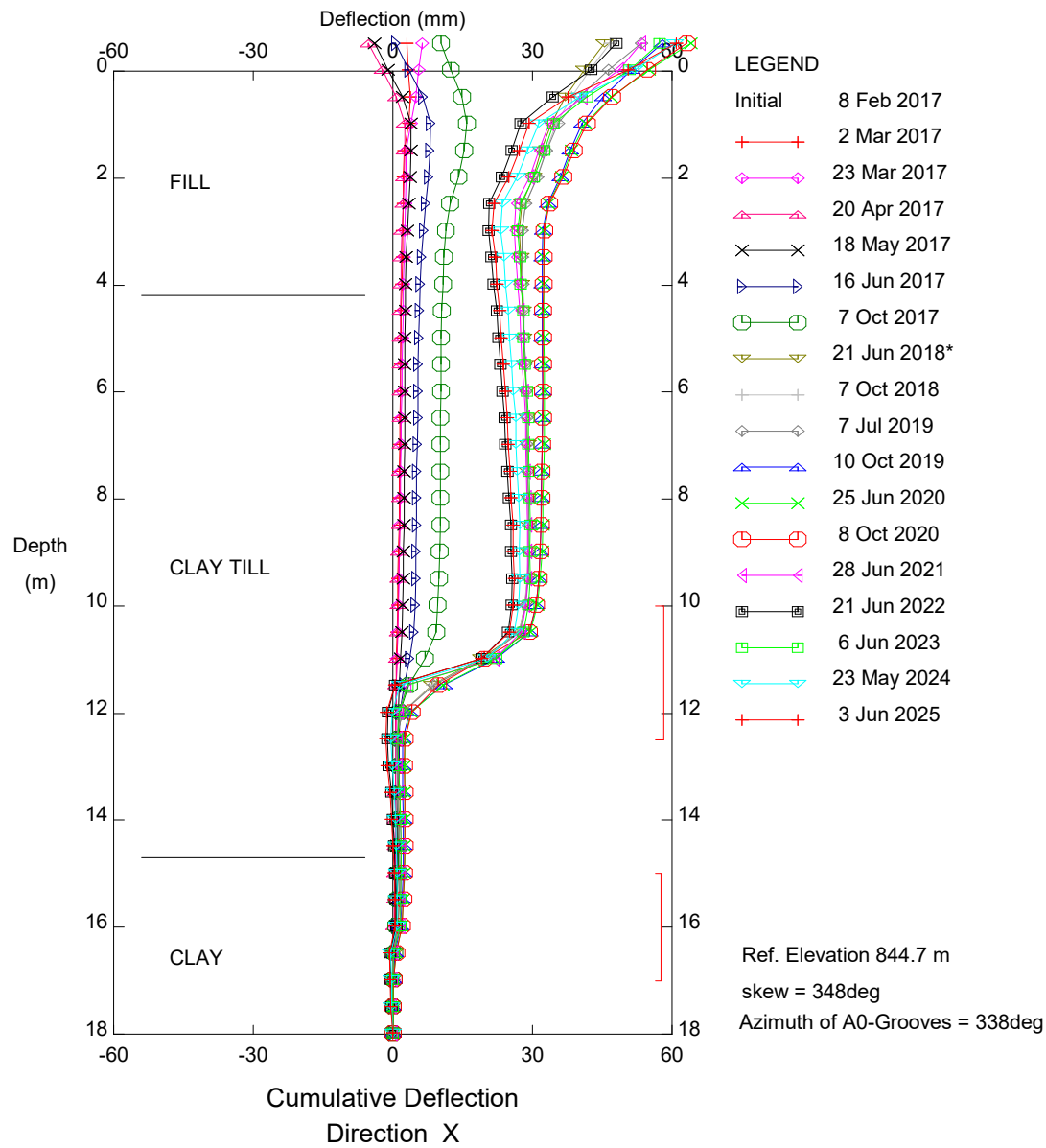
Klohn Crippen Berger - Edmonton



GP038-I; H40:38, Kakwa River Bridge, Inclinator SI17-1

Alberta Transportation

Klohn Crippen Berger - Edmonton

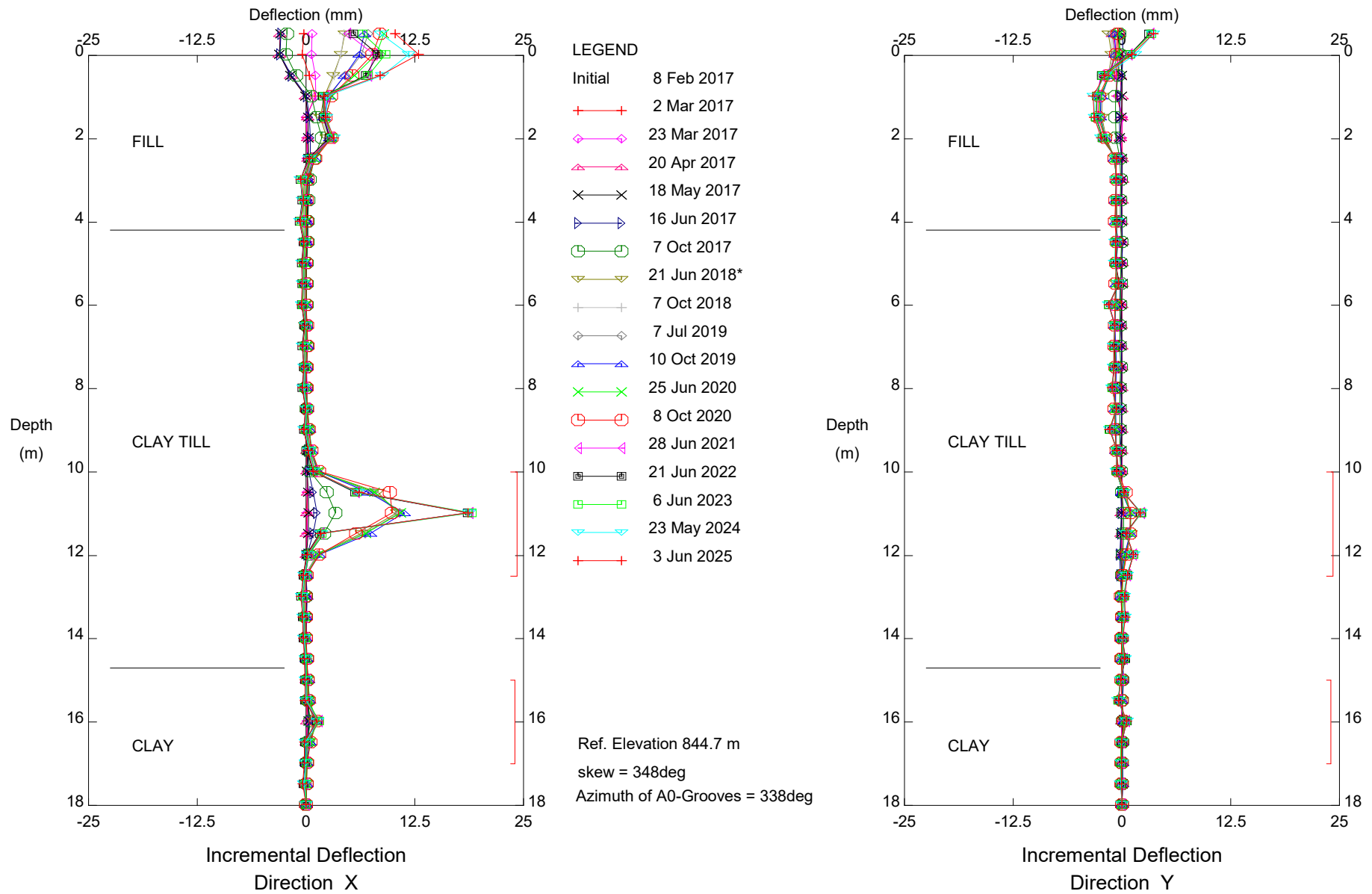


GP038-I; H40:38, Kakwa River Bridge, Inclinometer SI17-1

Alberta Transportation

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

Klohn Crippen Berger - Edmonton

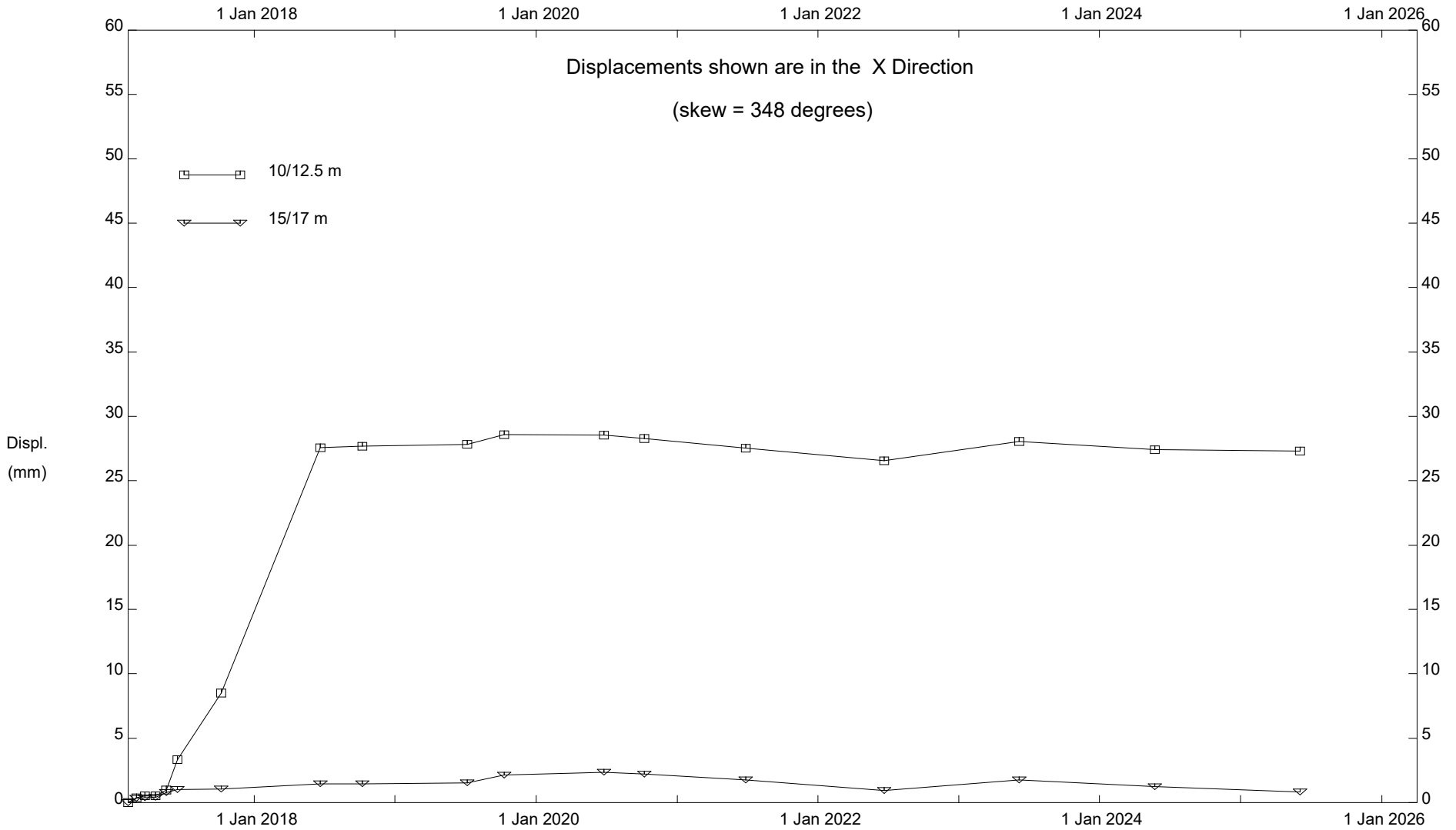


GP038-I; H40:38, Kakwa River Bridge, Inclinometer SI17-1

Alberta Transportation

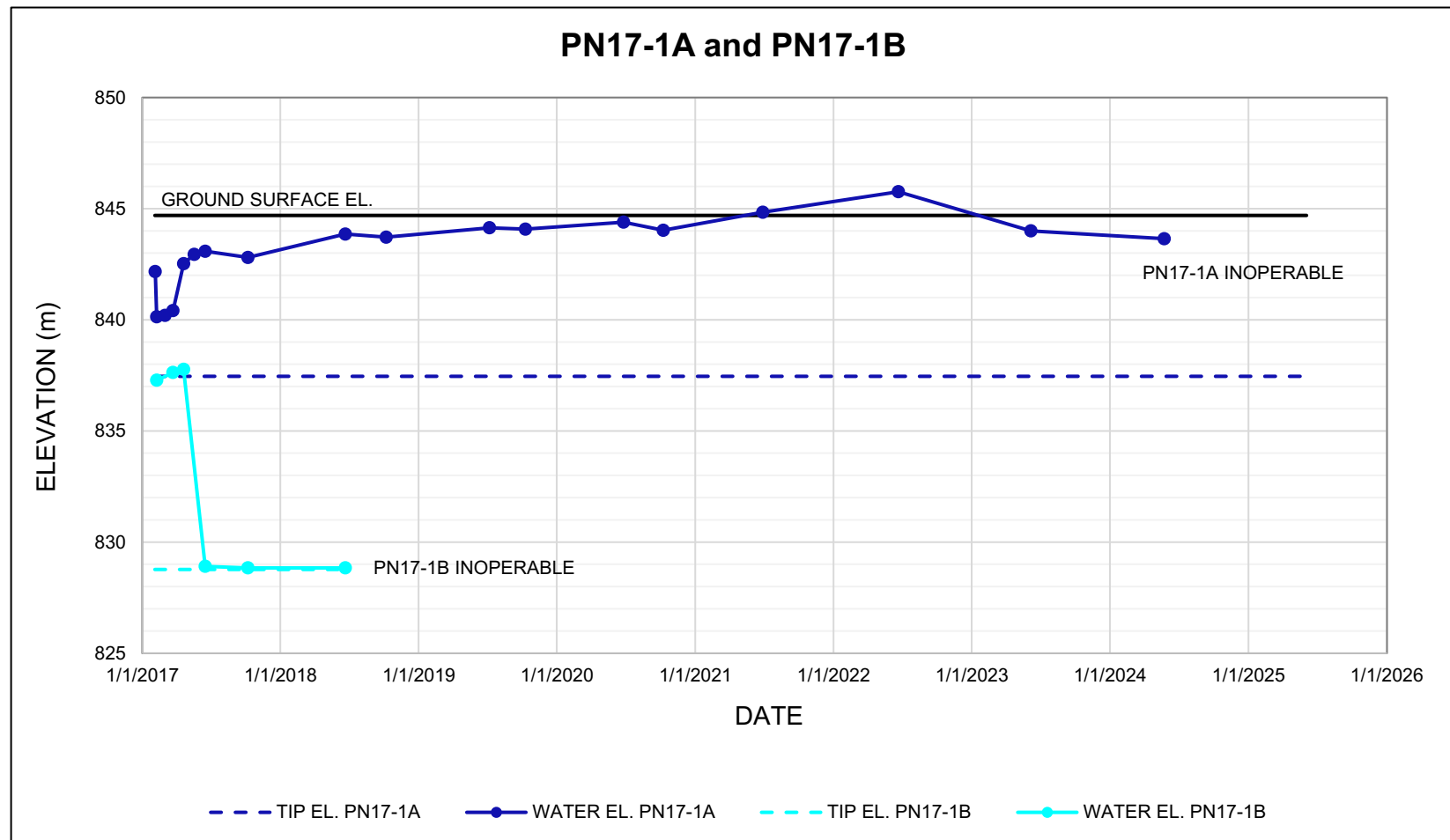
Sets marked * include zero shift and/or rotation corrections.

Klohn Crippen Berger - Edmonton





GP038-I; H40:38, Kakwa River Bridge, Inclinator SI17-1

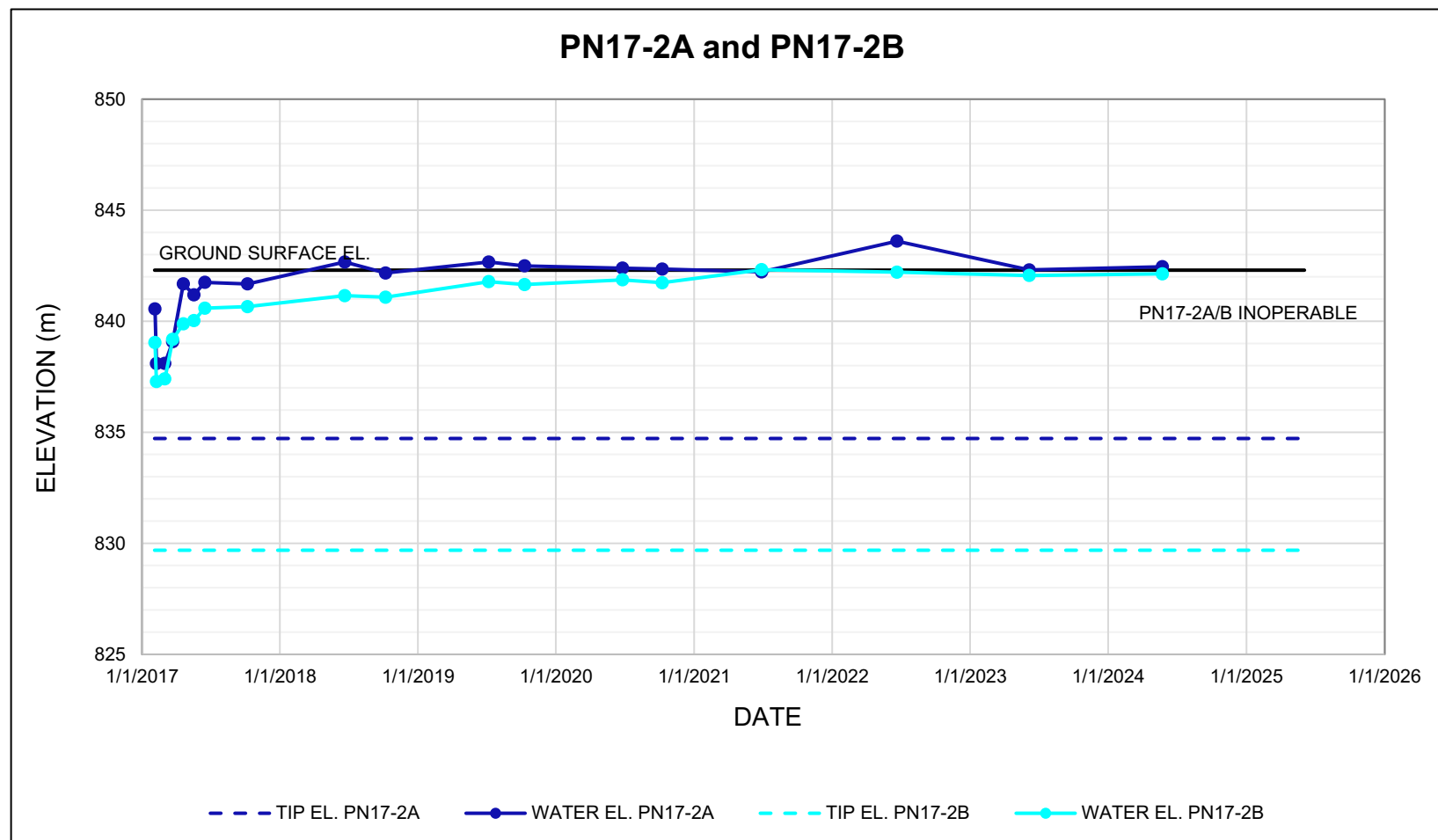
Alberta Transportation



NOTES:



1. PIEZOMETER DATA OBTAINED BEFORE JUNE 28, 2021, PROVIDED TO KLOHN CRIPPEN BERGER LTD. BY ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS ON JUNE 25, 2021.

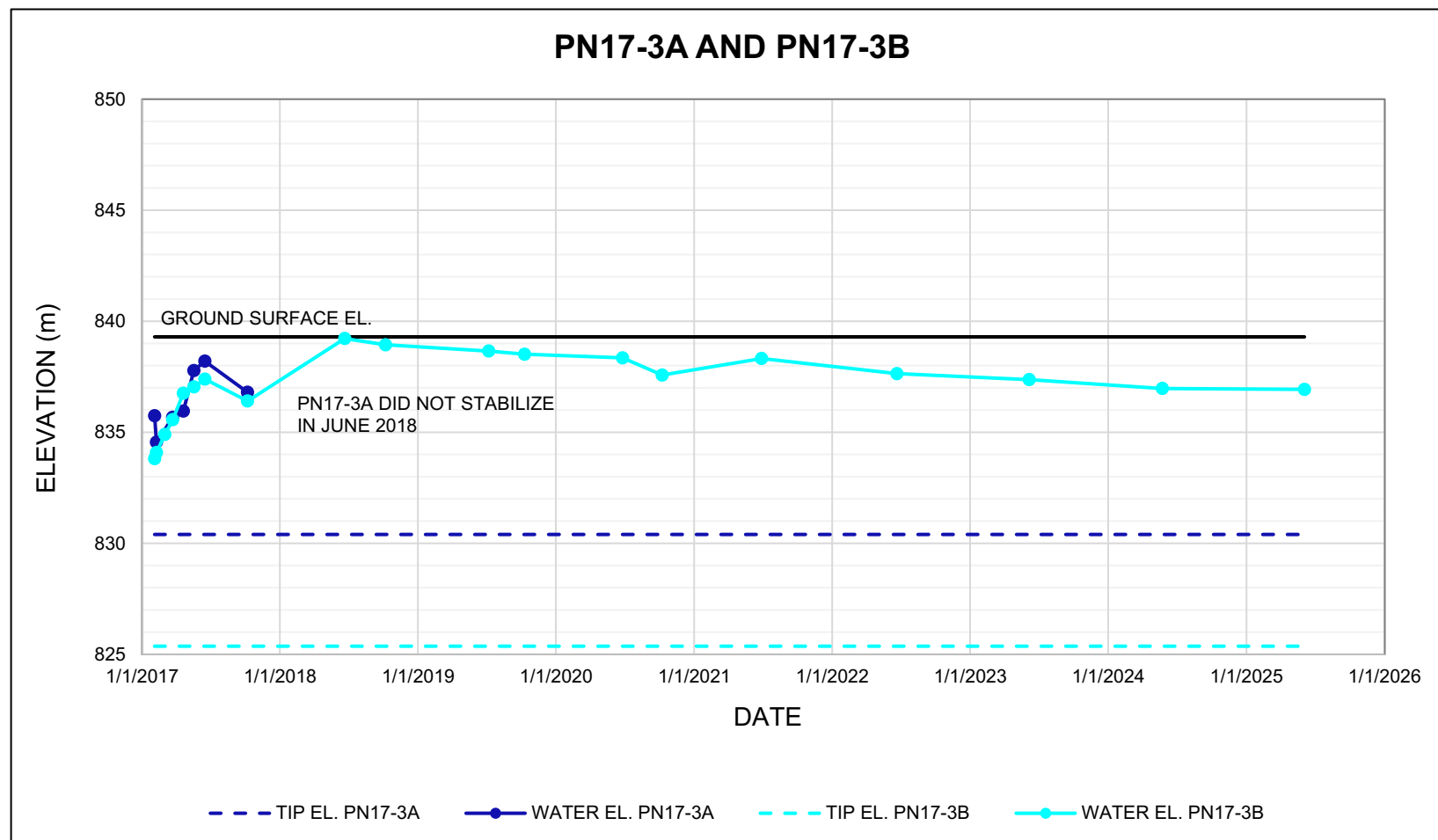
CLIENT		PROJECT	
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		TITLE PIEZOMETER DATA GP038-I - SLIDE 2.0 KM N. OF KAKWA RIVER BRIDGE HWY 40:38, KM 25.831	
SCALE	--	PROJECT No.	FIG No.
		A05116A01	



NOTES:



1. PIEZOMETER DATA OBTAINED BEFORE JUNE 28, 2021, PROVIDED TO KLOHN CRIPPEN BERGER LTD. BY ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS ON JUNE 25, 2021.

CLIENT		PROJECT	
 		PEACE REGION (GRANDE PRAIRIE DISTRICT - SOUTH) GEOHAZARD RISK MANAGEMENT PROGRAM	
		TITLE PIEZOMETER DATA GP038-I - SLIDE 2.0 KM N. OF KAKWA RIVER BRIDGE HWY 40:38, KM 25.831	
SCALE	--	PROJECT No.	FIG No.
		A05116A01	



NOTES:

1. PIEZOMETER DATA OBTAINED BEFORE JUNE 28, 2021, PROVIDED TO KLOHN CRIPPEN BERGER LTD. BY ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS ON JUNE 25, 2021.

CLIENT		PROJECT	
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		TITLE PIEZOMETER DATA GP038-I - SLIDE 2.0 KM N. OF KAKWA RIVER BRIDGE HWY 40:38, KM 25.831	
SCALE	--	PROJECT No.	FIG No.
		A05116A01	