December 2, 2024

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 GP042; H40:36, km 37.524 Wanyandie Creek Embankment Slide
Section C – 2024 Fall Readings

1 GENERAL

Six slope inclinometers (SIs) (SI22-W2 through W7), nine vibrating wire piezometers (VWPs) (VW20-S1/S3, VW20-D3/D4, and VW20-DS1A/1B/2A/2B/6A), one shape accelerometer array (SAA) (SAA22-P15), and seven vibrating wire load cells (load cells) (Anchor 3U, 5L, 15U/L, 27U/L, and 37U) were read at the GP042 site (includes the GP050 site as well) in the Peace Region (Grande Prairie District – South) (GP South Region) on October 17, 2024, by Courtney Mulhall, P.Eng. 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 site is located on Hwy 40:36, km 37.524. The approximate site coordinates are 5996853 N, 379884 E (UTM Zone 11, NAD 83). A site plan is presented on Figure 1.

The geohazard at the GP042 site consists of a landslide in the embankment fill on the east side of Hwy 40:36 along the north valley slope of the Smoky River.

Remedial work completed at the GP042 site between September 2021 and July 2023 included:

- excavating and reconstructing the slope impacted by the slide near the south end of the site with granular fill, a shear key, and a perforated subdrain;
- installing three drilled cast-in-place concrete pile walls on the east side of the highway, with concrete walers and subdrains that discharge into riprap swales, as follows:
  - pile wall 1 (73 piles, 1.2 m diameter, 13.5 m to 17.5 m deep) installed south of the existing binwall with tie-back anchors along the south half of the wall,
  - pile wall 2 (83 piles, 1.5 m diameter, 12.4 m deep) installed downslope of the existing binwall, and

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    - Pile wall 3 (37 piles, 1.2m diameter, 13.9 m deep) installed north of the existing binwall;
- flattening the backslope on the west side of the highway and constructing finger drains, French drains, and swales on the backslope;
- installing a subdrain with two 1.2-m diameter corrugated steel pipe (CSP) manholes in the west highway ditch; and
- installing a 1-m diameter CSP culvert below the highway with a riprap swale on either end.

This remedial work is shown on Figure 2 prepared by Thurber Engineering Ltd. (Thurber) but is shown in the available imagery shown on Figure 1.

A geotechnical site investigation was conducted at the GP042 site in 2020 by the previous consultant. The stratigraphy encountered during the 2022 investigation varied, but generally consisted of highway fill (clay or gravel), clay, till, or some combination thereof, overlying bedrock (clay shale, sandstone, and siltstone).

1.1 Instrumentation

KCB read the instruments at this site in the spring and fall of 2021, before resuming readings in the fall of 2024. Between the fall of 2021 and fall of 2024, the instruments were read by another consultant during the construction phase. 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.

Before construction, 2 SIs, 24 VWPs, and 6 SPs were installed by the previous consultant to monitor movement of the slide mass and groundwater conditions, respectively. During construction, 6 SIs and 1 SAA were installed to monitor deflection of the three pile walls and 6 load cells were installed to monitor anchor loads at pile wall 1. The SAA and load cells are connected to a multi-channel data logger (Model CR6 from Campbell Scientific), which is programmed to record a reading of the SAA and load cells hourly. Some of these instruments are now inoperable (e.g., destroyed, sheared, or lost) as detailed in Table 1.1 (see table notes).

The operable instruments are protected by above-ground casing protectors. The datalogger for the SAA and the load cells is protected by a locked stainless-steel enclosure.

The operable SIs were read using the same metric RST Digital MEMS Inclinometer System that was previously used to read the SIs by KCB in 2021. The SAA and load cells were read using Campbell Scientific LoggerNet software. The operable VWPs were read using a GEOKON vibrating wire readout (Model GK-404).

Table 1.1 Instrumentation Installation Details[1]

Instrument ID (Pile No.)		Instrument Type	Date Installed	UTM Coordinates (m)		Ground Surface Elevation[2] (m)	Stick Up (m)	Depth (mbgs[2])	Condition
				Northing	Easting				
~~TH20-DS2~~		~~SI~~	~~Jul. 06, 2020~~	~~5997067~~	~~380002~~	~~1134.4~~	~~0.8~~	~~23.4~~	~~Inoperable[3]~~
~~TH20-DS5~~		~~SI~~	~~Jul. 09, 2020~~	~~5997209~~	~~380061~~	~~1141.4~~	~~1.0~~	~~17.3~~	~~Inoperable[4]~~
Pile Wall 1	SI22-W2 (P37)	SI	Sep. 14, 2022	5997081	379996	1139.5	1.0	16.4	Operable

	SI22-W3 (P57)	SI	Oct. 26, 2022	5997102	380006	1141.2	1.1	13.3	Operable
Pile Wall 2	SI22-W4 (P100)	SI	Jul. 20, 2022	5997147	380038	1139.6	1.0	13.3	Operable
	SI22-W5 (P117)	SI	Jul. 20, 2022	5997170	380049	1140.6	1.1	13.3	Operable
	SI22-W6 (P132)	SI	Jul. 20, 2022	5997190	380058	1141.5	1.0	12.7	Operable
Pile Wall 3	SI22-W7 (P174)	SI	Jul. 20, 2022	5997272	380082	1151.7	1.2	14.3	Operable
Pile Wall 1	SAA22-P15 (P15)	SAA[5]	Nov. 24, 2022	Pile P15		1137.5	N/A	19.0	Operable
~~VW20-P1A~~		~~VWP~~	~~Jun. 23, 2020~~	~~5996932~~	~~379925~~	~~1128.1~~	~~N/A~~	~~6.4~~	~~Inoperable~~[4]
~~VW20-P1B~~		~~VWP~~	~~Jun. 23, 2020~~	~~5996932~~	~~379925~~	~~1128.1~~	~~N/A~~	~~17.7~~	~~Inoperable~~[4]
~~VW20-P2~~		~~VWP~~	~~Jun. 25, 2020~~	~~5997067~~	~~379983~~	~~1138.0~~	~~N/A~~	~~9.8~~	~~Inoperable~~[4]
~~VW20-P3~~		~~VWP~~	~~Jun. 26, 2020~~	~~5997093~~	~~379994~~	~~1141.0~~	~~N/A~~	~~14.9~~	~~Inoperable~~[4]
~~VW20-P4~~		~~VWP~~	~~Jun. 29, 2020~~	~~5997156~~	~~380022~~	~~1142.0~~	~~N/A~~	~~7.9~~	~~Inoperable~~[4]
~~VW20-P5~~		~~VWP~~	~~Jul. 03, 2020~~	~~5997194~~	~~380040~~	~~1148.2~~	~~N/A~~	~~13.1~~	~~Inoperable~~[4]
~~VW20-P6~~		~~VWP~~	~~Jul. 04, 2020~~	~~5997221~~	~~380051~~	~~1159.8~~	~~N/A~~	~~8.8~~	~~Inoperable~~[4]
VW20-S1		VWP	Jun. 28, 2020	5996995	379955	1133.0	N/A	16.8	Operable
~~VW20-S2~~		~~VWP~~	~~Jul. 10, 2020~~	~~5997282~~	~~380085~~	~~1152.3~~	~~N/A~~	~~12.5~~	~~Inoperable~~[4]
VW20-S3		VWP	Jul. 11, 2020	5997343	380125	1152.9	N/A	12.7	Operable
~~VW20-D1~~		~~VWP~~	~~Jun. 23, 2020~~	~~5996938~~	~~379991~~	~~1127.8~~	~~N/A~~	~~6.4~~	~~Inoperable~~[4]
~~VW20-D2~~		~~VWP~~	~~Jun. 27, 2020~~	~~5997078~~	~~379971~~	~~1145.0~~	~~N/A~~	~~5.2~~	~~Inoperable~~[4]
VW20-D3		VWP	Jun. 27, 2020	5997154	380008	1144.0	N/A	10.7	Operable
VW20-D4		VWP	Jun. 30, 2020	5997200	388027	1148.1	N/A	11.6	Operable
VW20-DS1A		VWP	Jun. 24, 2020	5996898	379928	1121.8	N/A	4.6	Operable
VW20-DS1B		VWP	Jun. 24, 2020	5996898	379928	1121.8	N/A	11.4	Operable
VW20-DS2A		VWP	Jul. 12, 2020	5997067	380002	1134.2	N/A	8.2	Operable
VW20-DS2B		VWP	Jul. 12, 2020	5997067	380002	1134.2	N/A	22.2	Operable
~~VW20-DS3A~~		~~VWP~~	~~Jul. 06, 2020~~	~~5997151~~	~~380041~~	~~1139.4~~	~~N/A~~	~~10.7~~	~~Inoperable~~[4]
~~VW20-DS4A~~		~~VWP~~	~~Jul. 07, 2020~~	~~5997188~~	~~380057~~	~~1140.4~~	~~N/A~~	~~4.9~~	~~Inoperable~~[4]
~~VW20-DS4B~~		~~VWP~~	~~Jul. 07, 2020~~	~~5997188~~	~~380057~~	~~1140.4~~	~~N/A~~	~~20.7~~	~~Inoperable~~[4]
~~VW20-DS5~~		~~VWP~~	~~Jul. 09, 2020~~	~~5997209~~	~~380061~~	~~1141.4~~	~~N/A~~	~~5.0~~	~~Inoperable~~[4]
VW20-DS6A		VWP	Jul. 05, 2020	5997159	380098	1121.0	N/A	6.1	Operable
~~VW20-DS6B~~		~~VWP~~	~~Jul. 05, 2020~~	~~5997159~~	~~380098~~	~~1121.0~~	~~N/A~~	~~21.3~~	~~Inoperable~~[4]
~~TH20-D5~~		~~SP~~	~~Jun. 30, 2020~~	~~5997232~~	~~380040~~	~~1150.3~~	~~0.8~~	~~3.1~~	~~Inoperable~~[4]
~~TH20-D6~~		~~SP~~	~~Jul. 01, 2020~~	~~5997360~~	~~380102~~	~~1156.6~~	~~0.9~~	~~8.6~~	~~Inoperable~~[4]
~~TH20-B1~~		~~SP~~	~~Jul. 09, 2020~~	~~5996956~~	~~379865~~	~~1148.2~~	~~0.9~~	~~12.2~~	~~Inoperable~~[4]
~~TH20-B2~~		~~SP~~	~~Jul. 09, 2020~~	~~5997032~~	~~379925~~	~~1150.2~~	~~0.9~~	~~13.6~~	~~Inoperable~~[4]
~~TH20-B3~~		~~SP~~	~~Jul. 10, 2020~~	~~5997176~~	~~379968~~	~~1165.3~~	~~1.1~~	~~3.7~~	~~Inoperable~~[4]
~~TH20-B4~~		~~SP~~	~~Jul. 10, 2020~~	~~5997244~~	~~380009~~	~~1168.7~~	~~1.0~~	~~4.5~~	~~Inoperable~~[4]
Pile Wall 1	VC2421 (3U)	Load Cell[5]	2022	Pile Wall 1 Anchors		N/A			Operable
	VC2422 (5L)	Load Cell[5]	2022						Operable
	VC2419 (15U)	Load Cell[5]	2022						Operable
	VC2420 (15L)	Load Cell[5]	2022						Operable
	VC2417 (27U)	Load Cell[5]	2022						Operable
	VC2418 (27L)	Load Cell[5]	2022						Operable
	VC2416 (37U)	Load Cell[5]	2022						Operable

Notes:

[1] Instrument installation details were taken from reports and data files prepared or provided by the previous consultant(s) or TEC. Instrument coordinates and stick ups (where applicable) were confirmed by KCB using a handheld GPS (accuracy of ± 5 m) and a tape measure, respectively.

[2] Meters below ground surface (mbgs). Bottom reading depth for operable SIs, and tip or screen depth for piezometers. Either bottom reading or casing depth for inoperable SIs.

[3] TH20-DS2 has sheared at an approximate depth of 8.5 m below ground surface.

[4] Instrument destroyed or reported as inoperable during construction. VW20-P1 through P6 were paved over. VW20-DS3 was damaged.

[5] SAA and load cells connected to a multi-channel data logger (Model CR6 from Campbell Scientific), which is programmed to record a reading of the SA and load cells hourly, respectively.

2 INTERPRETATION

2.1 General

For the operable SIs and SAA, the cumulative displacement, incremental displacement, and displacement-time data was plotted in the A-direction (i.e., the direction of the A0-grooves).

For the operable VWPs, 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.

For the operable load cells, the recorded loads were plotted relative to daily air temperature. Note load cell data was only available from March 3, 2024, onwards.

The instrument data plots are included in Appendix I, and a summary of the instrument data is provided in Table 2.1 through Table 2.4. Since the previous consultant used imperial SI equipment and we used metric SI equipment to read the SIs, we had to re-initialize the SIs to the October 2024 reading. The SI data plots presented herein only include data taken with KCB's SI reading equipment. The data logger records a reading of the SAA hourly, but only one reading per month is shown on the cumulative and incremental displacement plots and only one reading per week is shown on the displacement-time plot to reduce noise reading to reading.

2.2 Zones of Movement

Discrete movement (i.e., movement occurring on a defined failure plane) was being recorded in

- TH20-DS2 between an approximate depth of 7.4 m and 8.4 m (elevation 1126.8 m to 1125.8 m) below ground surface before it sheared; and
- TH20-DS5 between an approximate depth of 3.3 m and 4.3 m (elevation 1138.2 m to 1137.7 m) below ground surface before the instrument became inoperable.

Some distributed movement has been recorded in the pile wall SIs, but otherwise no discernible discrete movement has been recorded in the pile wall SIs or the SAA.

2.3 Interpretation of Monitoring Results

Slope Inclinometer Data

The distributed movement recorded in the pile wall SIs before they were re-initialized in October 2024 indicates the piles have intercepted the failure plane and are transferring load to depths below the failure plane as the piles stabilize the slide mass. Based on the data obtained by the previous consultant up to May 2024, the tops of pile wall 1, 2, and 3 have deflected up to approximately 3.6 mm, 7.1 mm, and 1.9 mm, respectively, since installation. The walls will likely continue to deflect as they stabilize the slide mass, with increased deflection may occur in response to seasonal variations in freshet and precipitation infiltration.

Table 2.1 Slope Inclinometer Reading Summary

Pile Wall	Instrument ID (Pile No.)	Date				Ground Surface Elevation (m)	Depth of Movement (mbgs[1])	Direction of Movement, Skew Angle[2]	Movement (mm)				Rate of Movement (mm/year)		
		Initialized (Re-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
									Before Re-Initialization	After Re-Initialization	Total				
1	SI22-W2 (P37)	Sep. 14, 2022 (Oct. 17, 2024)[3]	N/A – Not provided by previous consultant	May 30, 2024	Oct. 17, 2024	1139.5	0.0 – 16.4	X-Direction, 181°	-5.1	N/A – First reading after instruments re-initialized, need more data to assess.					
	SI22-W3 (P57)	Oct. 26, 2022 (Oct. 17, 2024)[3]		May 30, 2024	Oct. 17, 2024	1141.2	1.7 – 13.3	X-Direction, 146°	-1.6						
2	SI22-W4 (P100)	Jul. 20, 2022 (Oct. 17, 2024)[3]		May 30, 2024	Oct. 17, 2024	1139.6	0.0 – 13.3	X-Direction, 182°	0.3						
	SI22-W5 (P117)	Jul. 20, 2022 (Oct. 17, 2024)[3]		May 30, 2024	Oct. 17, 2024	1140.6	1.1 – 13.3	X-Direction, 177°	4.3						
	SI22-W6 (P132)	Jul. 20, 2022 (Oct. 17, 2024)[3]		May 30, 2024	Oct. 17, 2024	1141.5	0.0 – 12.7	A-Direction	7.1						
3	SI22-W7 (P174)	Jul. 20, 2022 (Oct. 17, 2024)[3]		May 30, 2024	Oct. 17, 2024	1151.7	0.9 – 14.3	X-Direction, 161°	1.9						

Notes:
[1] Meters below ground surface (mbgs).
[2] Skew angle of the X-direction measured clockwise from the A-direction by the previous consultant and will be confirmed by KCB during subsequent readings.
[3] Instruments re-initialized to the October 2024 reading when the SI reading equipment was changed.

Table 2.2 Shape Accelerometer Array Reading Summary

Pile Wall	Instrument ID (Pile No.)	Date				Ground Surface Elevation (m)	Depth of Movement (mbgs[1])	Direction of Movement	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	Current	Change from Previous Reading
1	SAA22-P15 (P15)	Nov. 24, 2022 (Jan. 18, 2023)[3]	N/A – No discernible movement recorded.	May 30, 2024	Oct. 17, 2024	1137.5	N/A – No discernible movement recorded.						

Notes:
[1] Meters below ground surface (mbgs).
[3] Instruments re-initialized to the January 2023 reading when KCB began downloading the data for the instrument.

Table 2.3 Vibrating Wire Piezometer Reading Summary

Instrument ID	Serial No.	Approximate Location	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)
VW20-S1	67106	Within Slide	Jun. 28, 2020	May 30, 2024	Oct. 17, 2024	1133.0	16.8	12.3	12.6	-0.3
VW20-S3	67102		Jul. 11, 2020	May 30, 2024	Oct. 17, 2024	1152.9	12.7	8.4	8.7	-0.3
VW20-D3	67073	Ditch	Jun. 27, 2020	May 30, 2024	Oct. 17, 2024	1144.0	10.7	8.7	9.2	-0.5
VW20-D4	67076		Jun. 30, 2020	May 30, 2024	Oct. 17, 2024	1148.1	11.6	11.6	11.6	0.0
VW20-DS1A	67086	Highway Embankment Slope	Jun. 24, 2020	May 30, 2024	Oct. 17, 2024	1121.8	4.6	4.7	4.8	-0.1
VW20-DS1B	67089		Jun. 24, 2020	May 30, 2024	Oct. 17, 2024	1121.8	11.4	10.5	11.6	-1.1
VW20-DS2A	67092		Jul. 12, 2020	May 30, 2024	Oct. 17, 2024	1134.2	8.2	2.7	3.6	-0.9
VW20-DS2B	67097		Jul. 12, 2020	May 30, 2024	Oct. 17, 2024	1134.2	22.2	18.7	19.0	-0.3
VW20-DS6A	67077		Jul. 05, 2020	May 30, 2024	Oct. 17, 2024	1121.0	6.1	3.8	5.2	-1.4

Notes:
[1] Meters below ground surface (mbgs).

Table 2.4 Vibrating Wire Load Cell Reading Summary

Pile Wall	Instrument ID/ Anchor No.	Load Cell Serial No.	Date				Serviceability Limit State (SLS) Design Load / Lock-Off Load (kN)	Load (kN)			
			Installed	Previous Maximum Recorded Load	Previous Reading	Most Recent Reading		Maximum Load	Previous Reading	Most Recent Reading	Change from Previous Reading
1	3U	VC2421	Oct. 22, 2022	Oct. 22, 2022	May 30, 2024	Oct. 17, 2024	255/125	126.0	118.7	116.2	-2.5
	5L	VC2422	Nov. 21, 2022	Jun. 09, 2023	May 30, 2024	Oct. 17, 2024	265/75	95.1	85.5	83.8	-1.7
	15U	VC2419	Oct. 22, 2022	Oct. 22, 2022	May 30, 2024	Oct. 17, 2024	255/125	126.0	115.2	113.8	-1.4
	15L	VC2420	Nov. 21, 2022	Jun. 09, 2023	May 30, 2024	Oct. 17, 2024	265/75	89.4	80.6	78.7	-1.9
	27U	VC2417	Oct. 21, 2022	Oct. 21, 2022	May 30, 2024	Oct. 17, 2024	255/125	126.0	106.6	105.5	-1.1
	27L	VC2418	Nov. 22, 2022	Jun. 09, 2023	May 30, 2024	Oct. 17, 2024	265/75	91.2	84.4	83.1	-1.3
	37U	VC2416	Oct. 22, 2022	Oct. 22, 2022	May 30, 2024	Oct. 17, 2024	255/110	113.0	92.7	89.3	-3.4

Shape Accelerometer Array Data

The SAA installed in the Pile Wall 1 has shown no discernible movement, except for some fluctuations in the top 4.5 m likely due to seasonal thermal variations (e.g., positive movement during colder months and negative movement during warmer months).

Piezometer Data

The VWPs have only been read three times since January 2022, and more data is needed to assess trends. However, based on the available data, the water level records in the VWPs appear to be either relatively steady, deceasing, or dry (i.e., water level at or below instruments tip elevation).

Load Cell Data

The loads measured in the loads cells installed in pile 1 (range from approximately 81 kN to 119 kN) are below the Serviceability Limit State (SLS) design loads provided in the Spring 2024 instrumentation report prepared by Thurber (range from 255 kN to 265 kN). Loads measured in the loads cell appear to fluctuate (± 10 kN) with temperature, with higher loads measured during warmer weather and lower loads measured during cooler weather, but more data is needed to assess.

3 RECOMMENDATIONS

3.1 Future Work

All operable instruments should continue to be read twice per year (spring and fall). 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.

Now that construction is complete at the site, the site should again be inspected by the Maintenance Contract Inspector (MCI) and as part of the GP South region GRMP Section B inspections.

3.2 Instrument Repairs and Maintenance

No instrument repairs or maintenance is required, but the reading frequency of the SAA and load cells will be reduced from daily to weekly and monthly, respectively, to reduce noise between readings.

4 CLOSING

This report is an instrument of service of Klohn 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.

PERMIT TO PRACTICE
KLOHN CRIPPEN BERGER LTD.
RM SIGNATURE:
RM APEGA ID #: 187607
DATE: 2 Dec. 2024
PERMIT NUMBER: P009196
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

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

CM/GB/EV:bb

Cc: Chris Grapel, M.Eng., P.Eng.

ATTACHMENTS
Figure
Appendix I Instrumentation Plots

FIGURE

Legend

- Slope Inclinometer (TH20-DS)
- Standpipe Piezometer (TH20-B, TH20-D)
- Vibrating Wire Piezometer (VW)

0 250 Metres

NOTES:

1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM Zone 11N
3. IMAGE SOURCE: Microsoft Bing
4. Strikethrough indicates instrument is inoperable.

CLIENT: Alberta

Klohn Crippen Berger

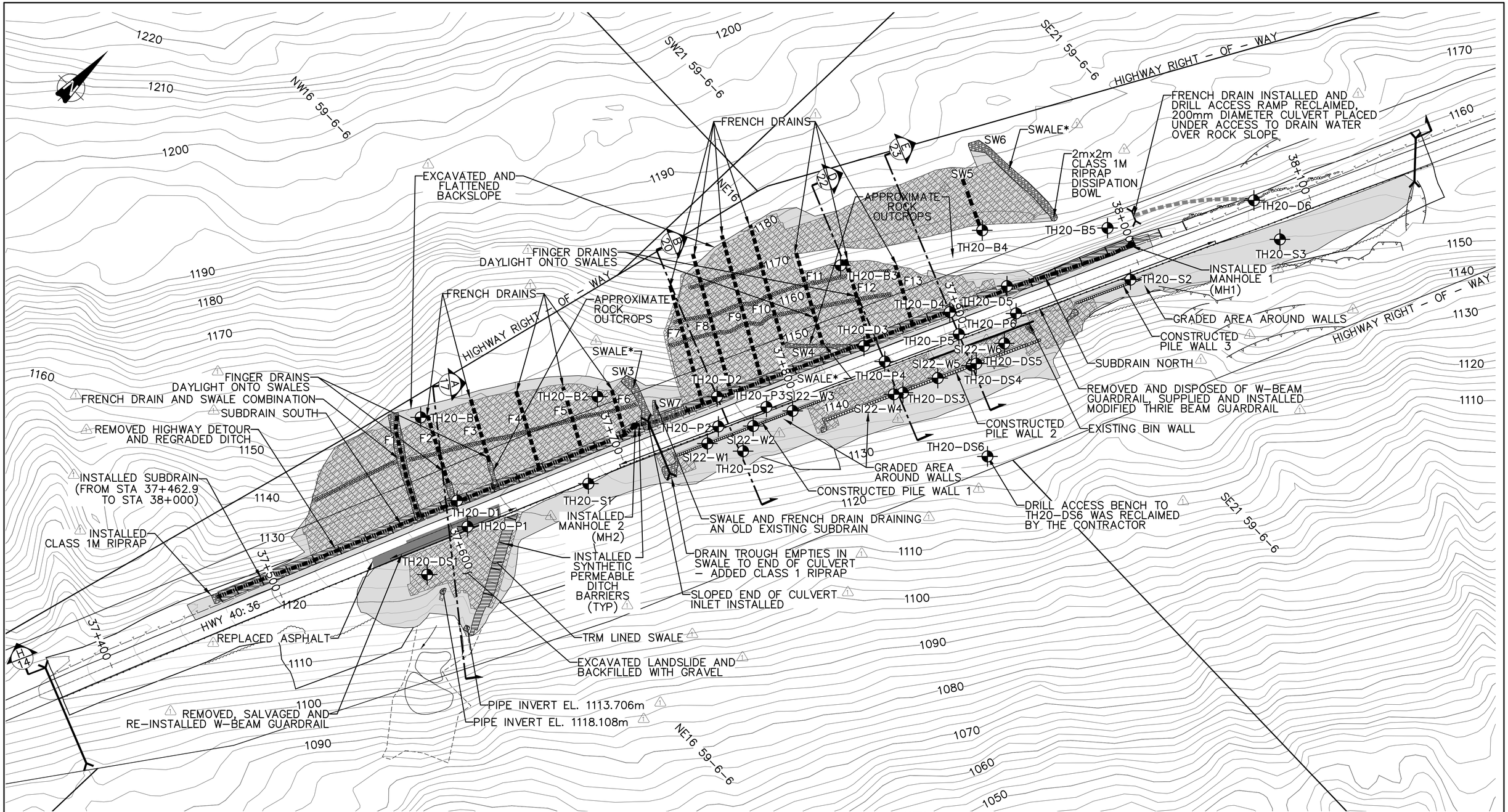
PROJECT: PEACE REGION (GRANDE PRAIRIE DISTRICT-SOUTH) GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE: Site Plan
GP042 - Wanyandie Creek Embankment Slide
Hwy 40:36, km 37.524

SCALE	PROJECT No.	FIG No.
1:3,137	A05116A01	1

Time: 12:57:36 PM
Date: December 02, 2024
File: "Z:\AIED\MA\05116A01 ABT Grande Prairie South GRMP\400 Drawings\GIS\MXD\2024\Section C\ABT_GPSouth_SectionC_241202\ABT_GPSouth_SectionC_241202.aprx"

DRAWING 22001-202102-RD-C011
HIGHWAY 40:36
CONTRACT 22001
DESCRIPTION SITE PLAN SHOWING OVERALL AS-BUILTS
PHOTO
DATE
BY
SURVEYED
DEPARTMENT BAR CODE



LEGEND

- APPROXIMATE TEST HOLE LOCATION
- HIGHWAY 40:36
- LANDSLIDE SCARP CRACK
- GUARD RAIL
- BURIED COMMUNICATION CABLE
- GROUND SURFACE CONTOUR IN METRES (CONTOUR INTERVAL = 2m)
- TREE LINE
- CENTERLINE OF SUBDRAIN
- STRAW ROLL
- EROSION CONTROL BLANKET
- TRM AREA
- ROCK ARMOUR (CLASS 1M RIPRAP)
- * REFER TO SECTION Z ON DWG. 22001-202102-RD-C018 FOR SWALE DETAIL.

NOTES:

1. BASE PLAN PROVIDED BY WSP, SITE SURVEYED ON JUNE 26, 2020.
2. NAD83 UTM 11 COORDINATE SYSTEM.
3. GROUND SURFACE CONTOURS OUTSIDE SURVEY LIMITS FROM 2005 LIDAR.
4. GREY GRADED AREAS SHOW AS-BUILT GROUND SURFACE CONTOURS AS SURVEYED BY WSP IN 2022/2023.

SCALE: 1:1000

THIS RECORD DRAWING INDICATES THAT THE CONSTRUCTED PROJECT SUBSTANTIALLY COMPLIES WITH THE DESIGN DRAWINGS AND ALL APPROPRIATE CONTRACT PLANS AND SPECIFICATIONS

CONSULTANT
THURBER ENGINEERING LTD.
29190

DESIGNER
ORIGINAL DESIGN COMPLETED BY:
NICOLE WILDER
2021-03-18
THURBER ENGINEERING LTD.

FIELD REVIEW ENGINEER
DATE

REV	DATE	REVISION	BY
5			
4			
3			
2			
1	2023-09-20	RECORD DRAWINGS	NPW

Alberta Transportation

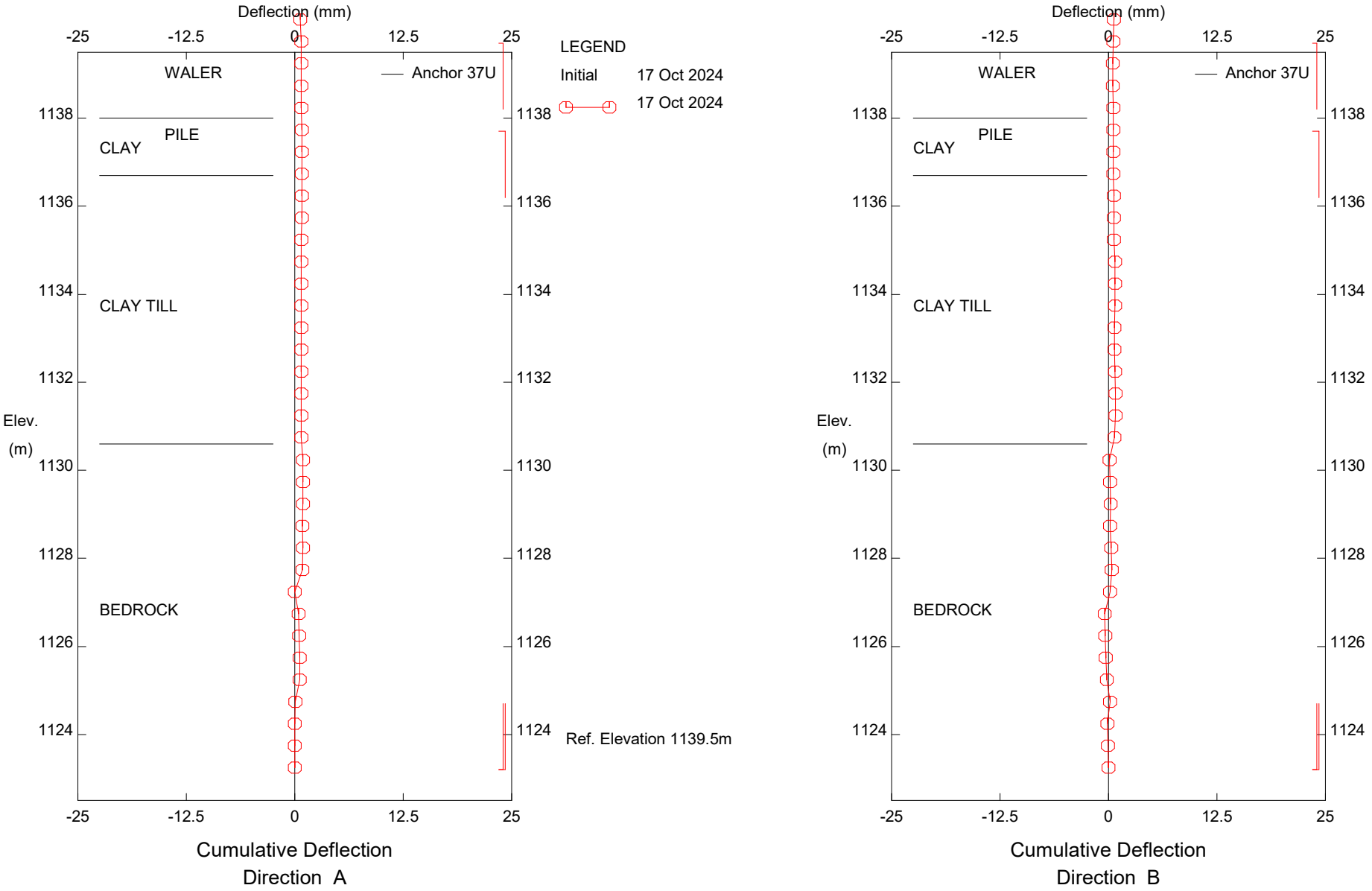
HWY 40:36 KM 37.4 TO 38.2
LANDSLIDE REPAIRS (GP042)
SITE PLAN SHOWING OVERALL AS-BUILTS

DATE	LOCATION	SITE	CONTRACT	HIGHWAY	SHEET	DRAWING
2023-09-20	NE16/SE21-59-6-W6M	GP042	22001	40:36	11 OF 34	22001-202102-RD-C011 1

APPENDIX I

Instrumentation Plots

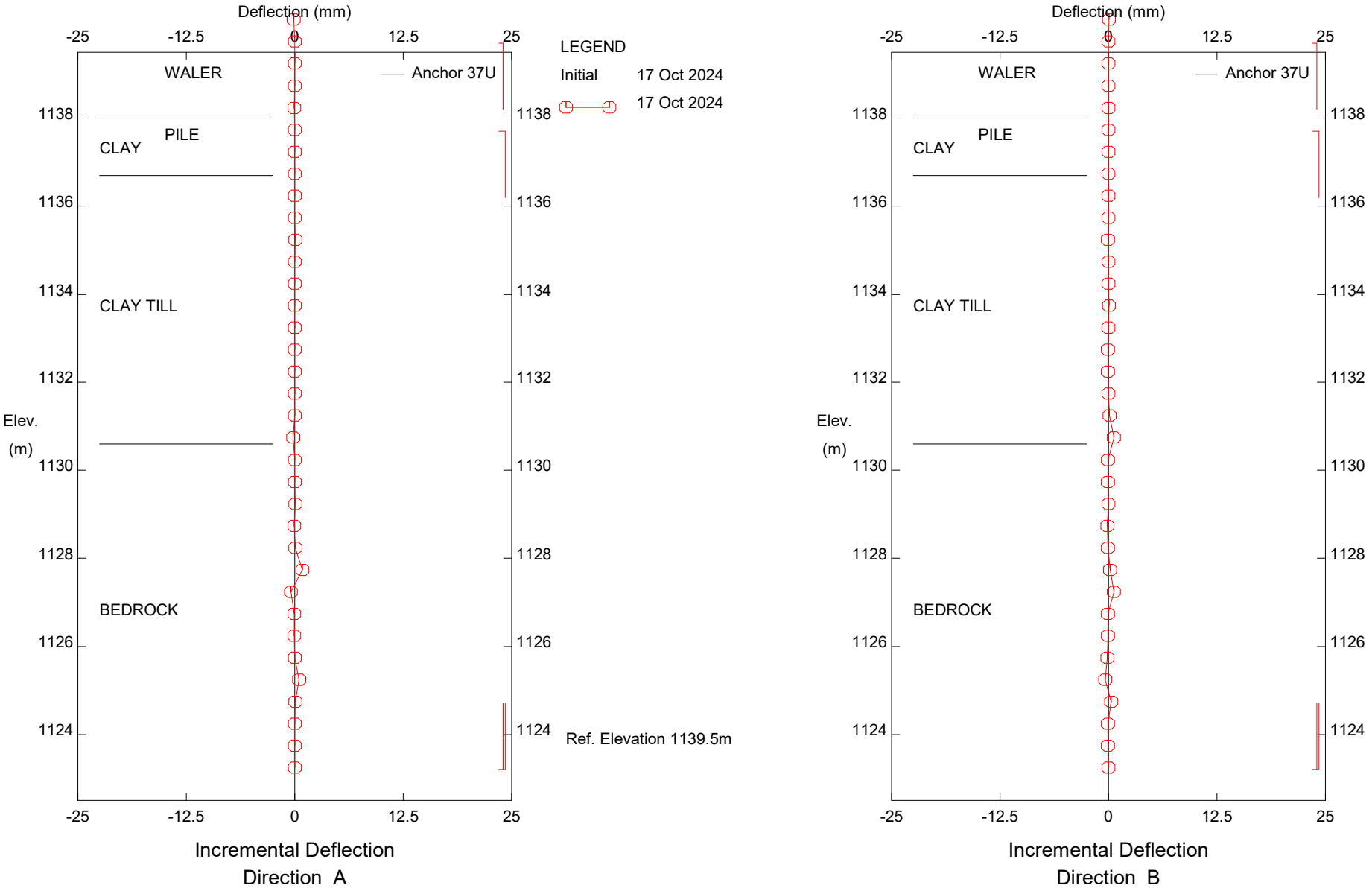
Klohn Crippen Berger - Edmonton



GP042; H40:36, Wanyandie Creek Slide, Inclinometer SI22-W2

Alberta Transportation

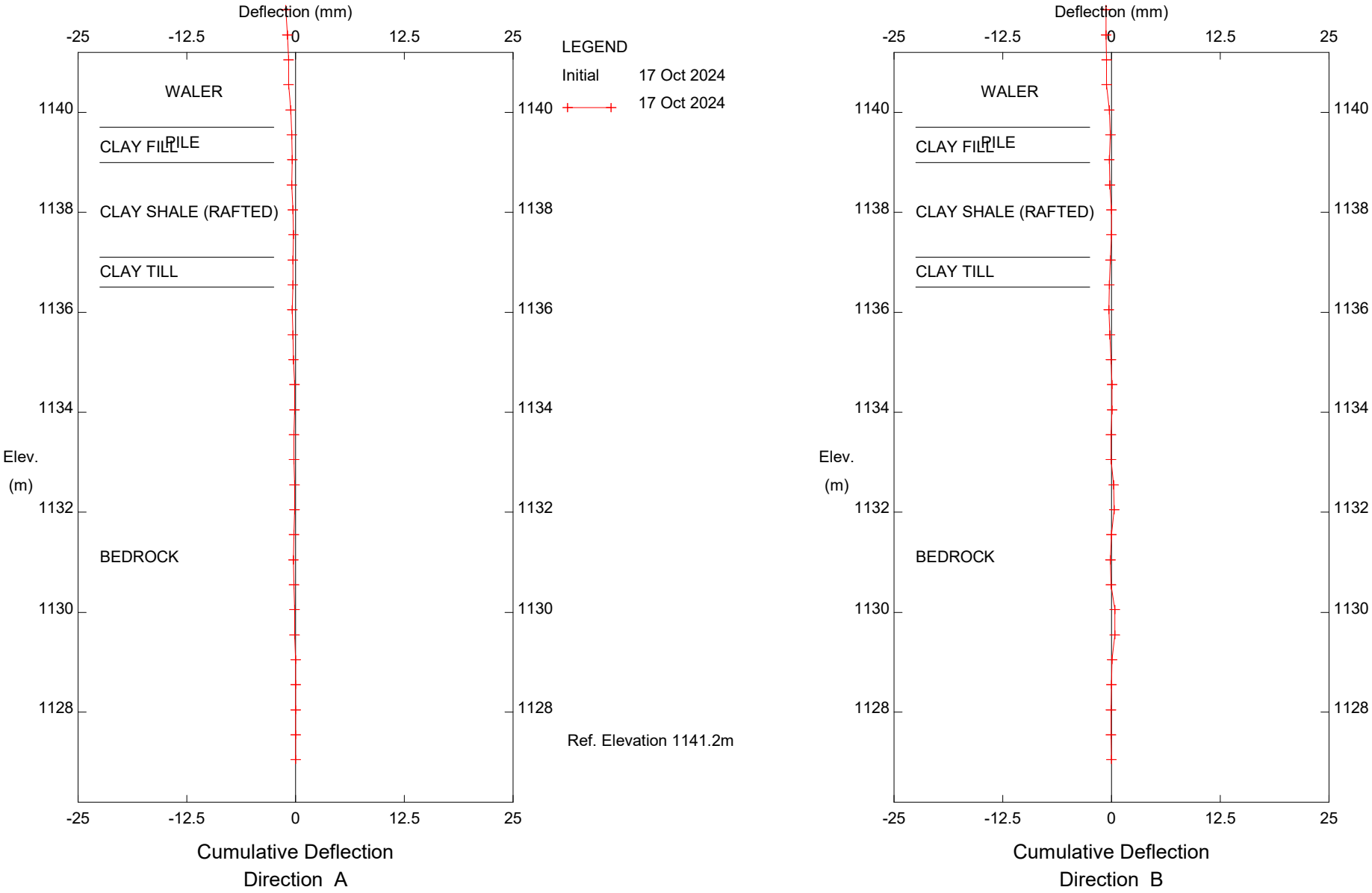
Klohn Crippen Berger - Edmonton



GP042; H40:36, Wanyandie Creek Slide, Inclinometer SI22-W2

Alberta Transportation

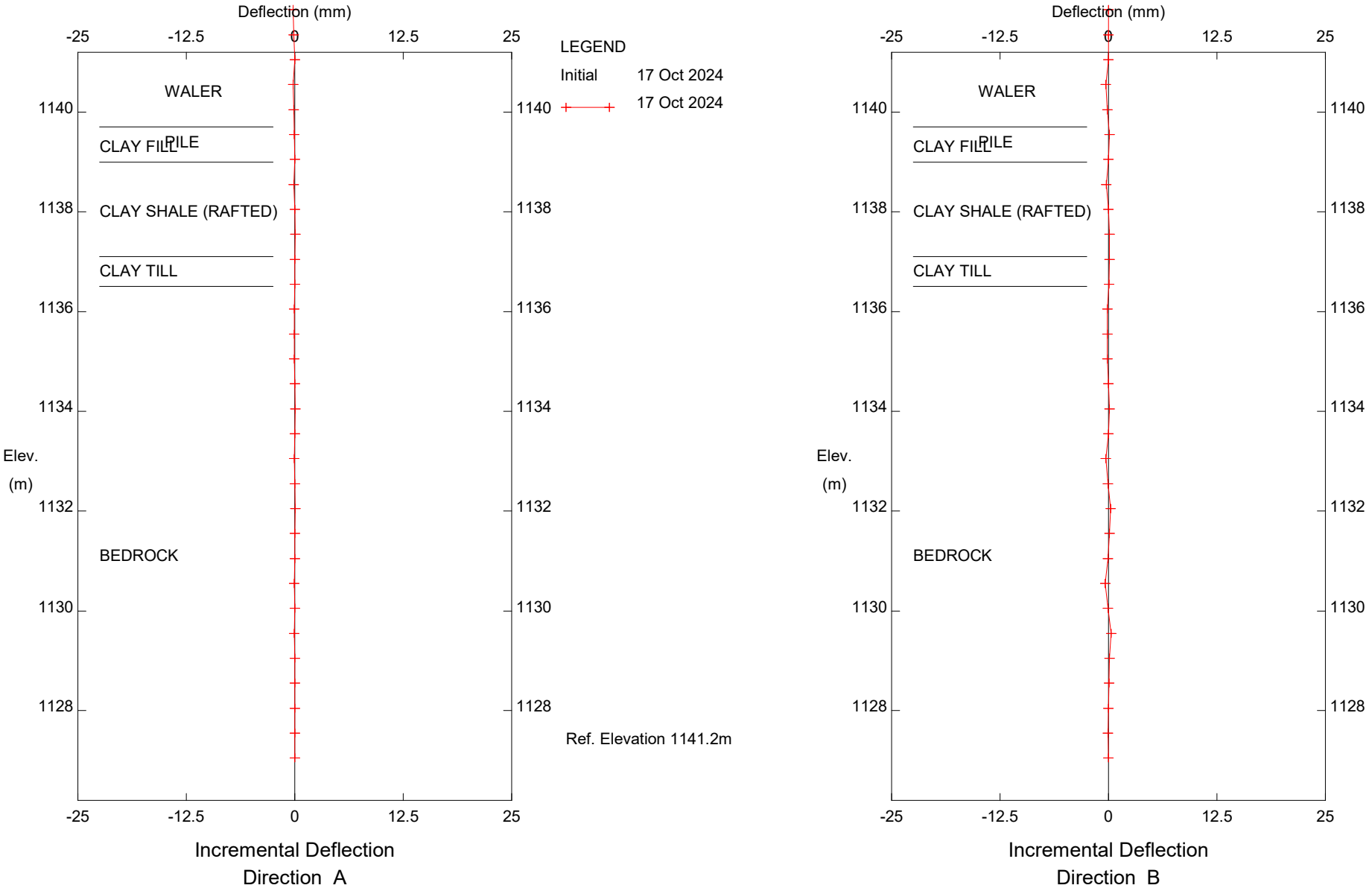
Klohn Crippen Berger - Edmonton



GP042; H40:36, Wanyandie Creek Slide, Inclinometer SI22-W3

Alberta Transportation

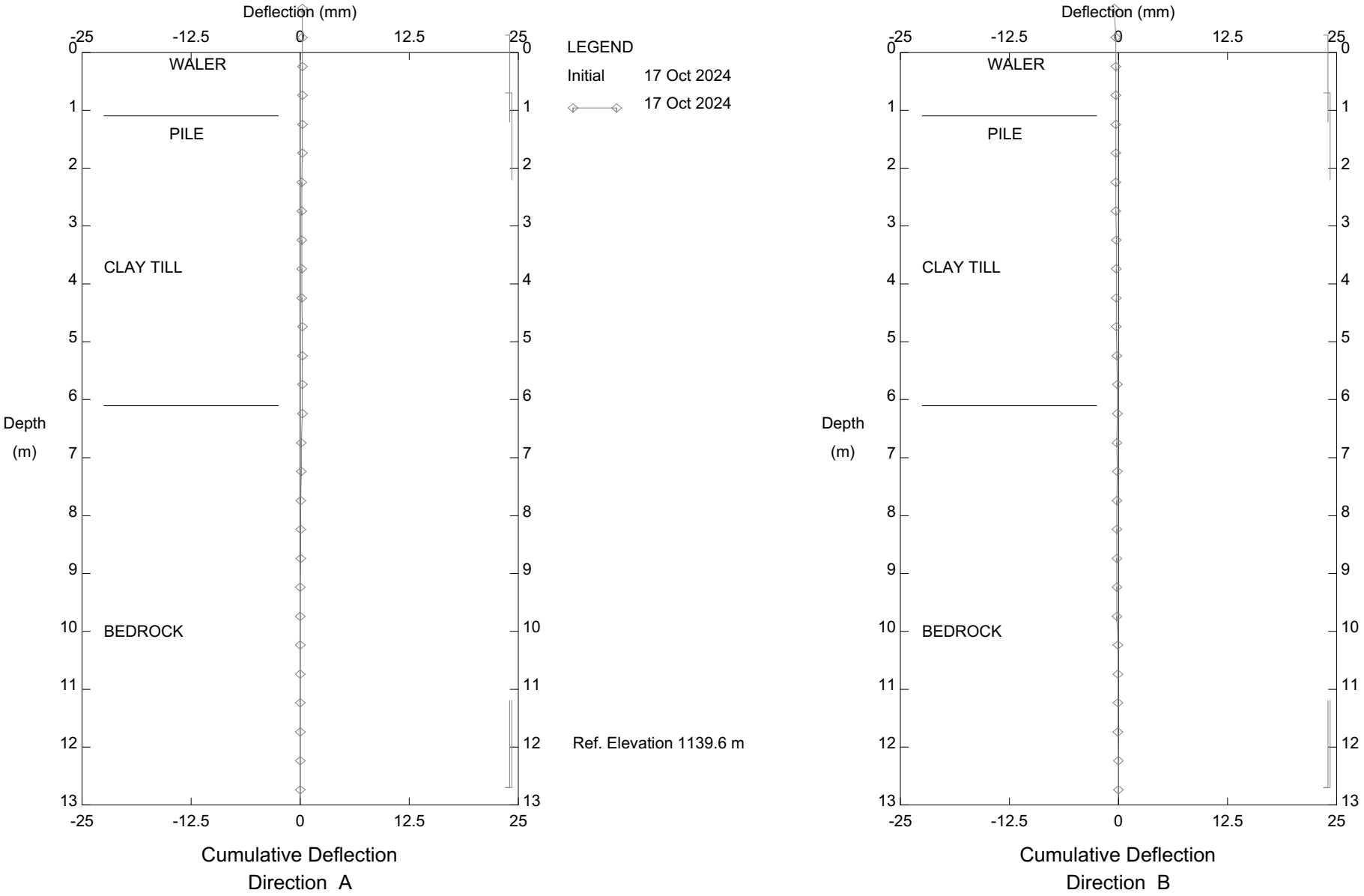
Klohn Crippen Berger - Edmonton



GP042; H40:36, Wanyandie Creek Slide, Inclinometer SI22-W3

Alberta Transportation

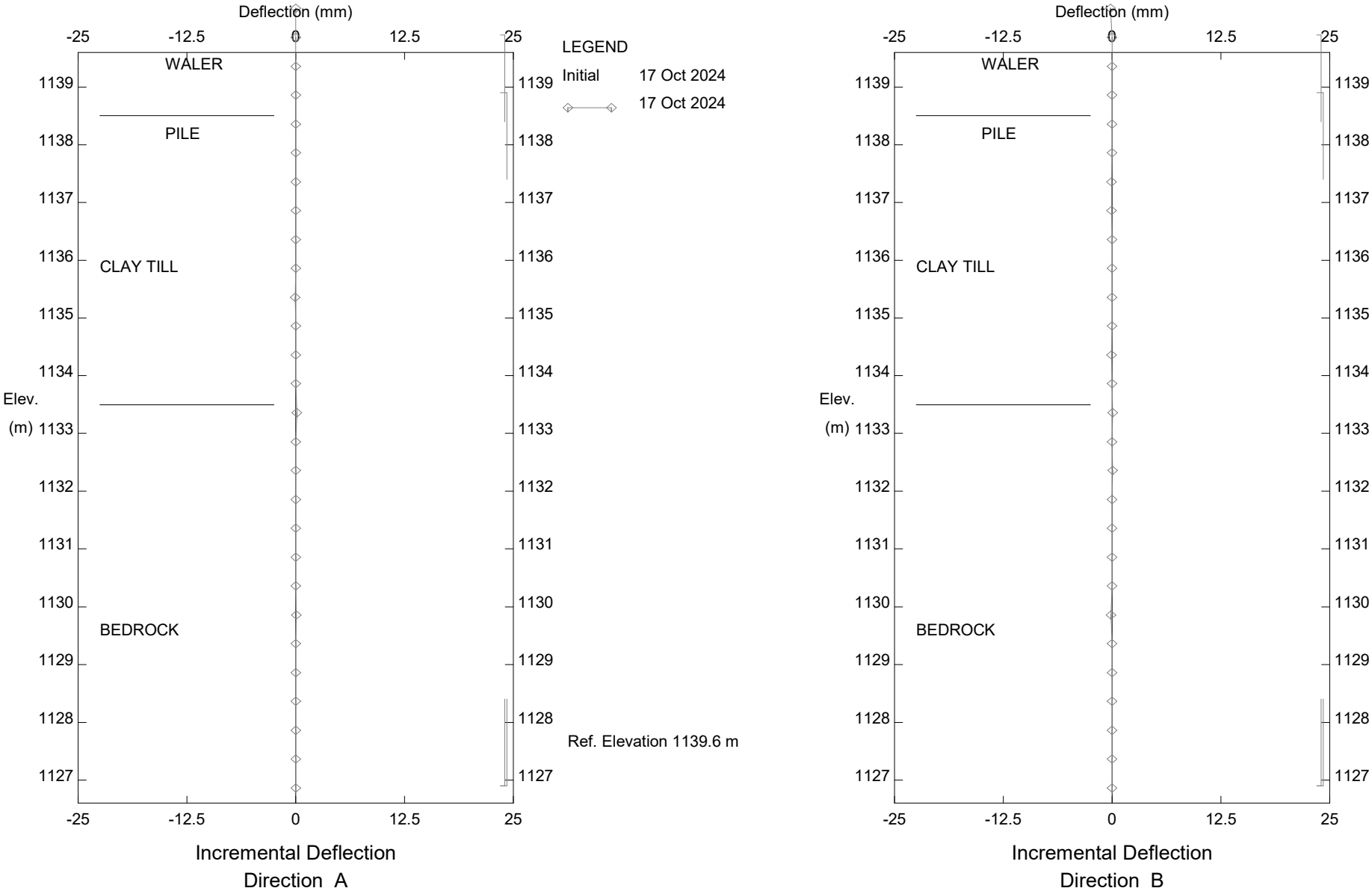
Klohn Crippen Berger - Calgary



GP042; H40:36, Wanyandie Creek Slide, Inclinometer SI22-W4

Alberta Transportation

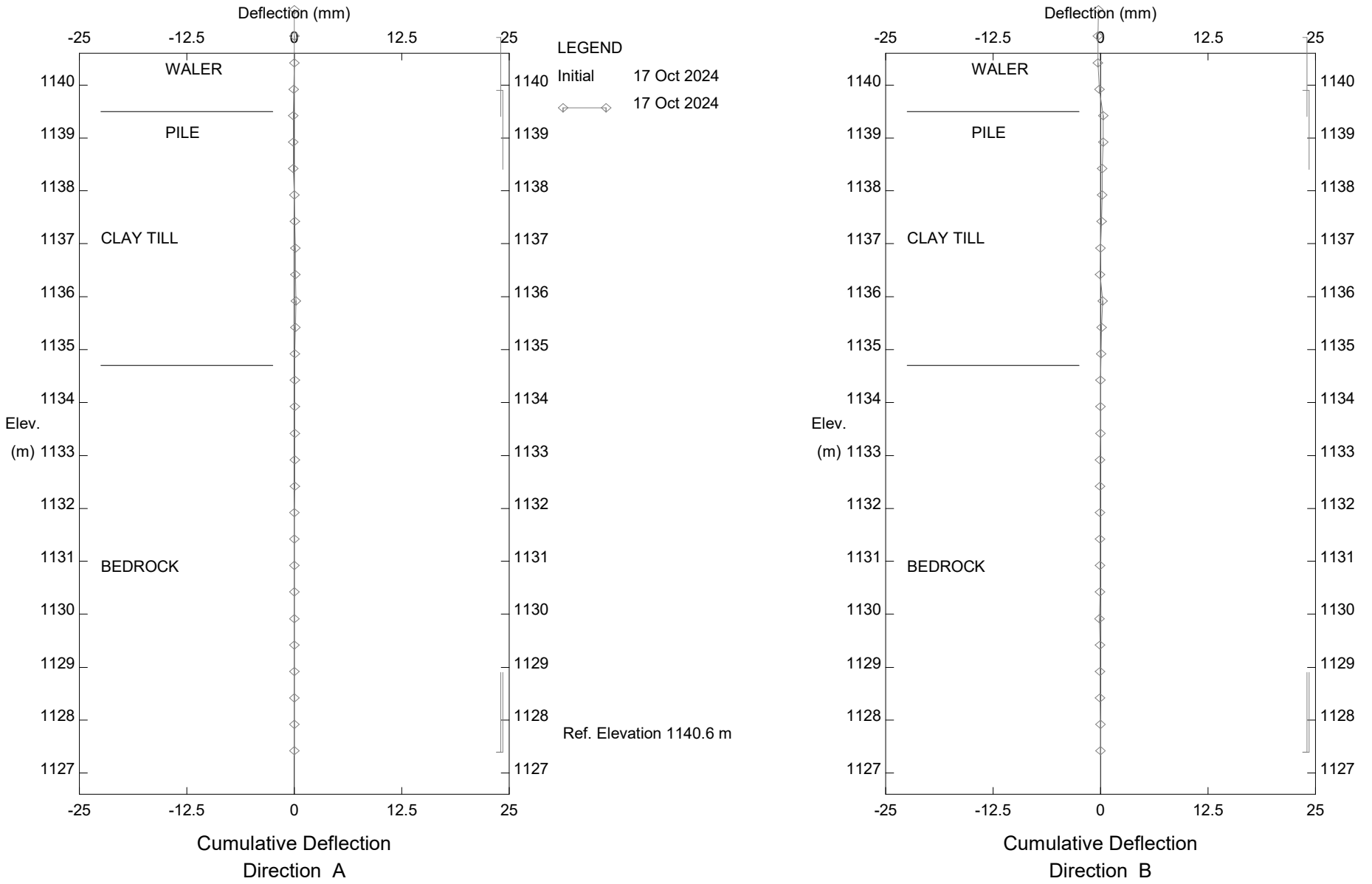
Klohn Crippen Berger - Edmonton



GP042; H40:36, Wanyandie Creek Slide, Inclinometer SI22-W4

Alberta Transportation

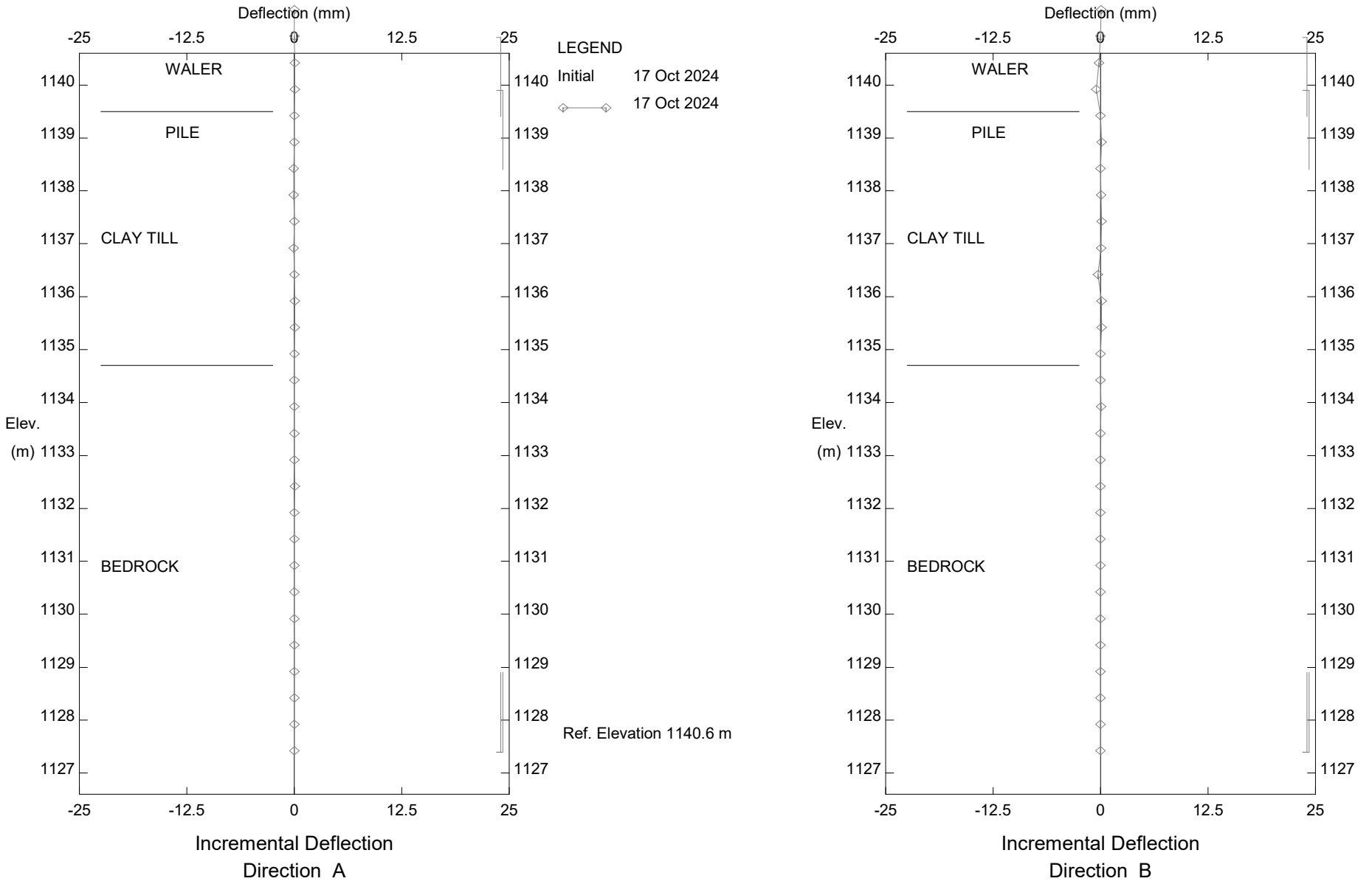
Klohn Crippen Berger - Edmonton



GP042; H40:36, Wanyandie Creek Slide, Inclinometer SI22-W5

Alberta Transportation

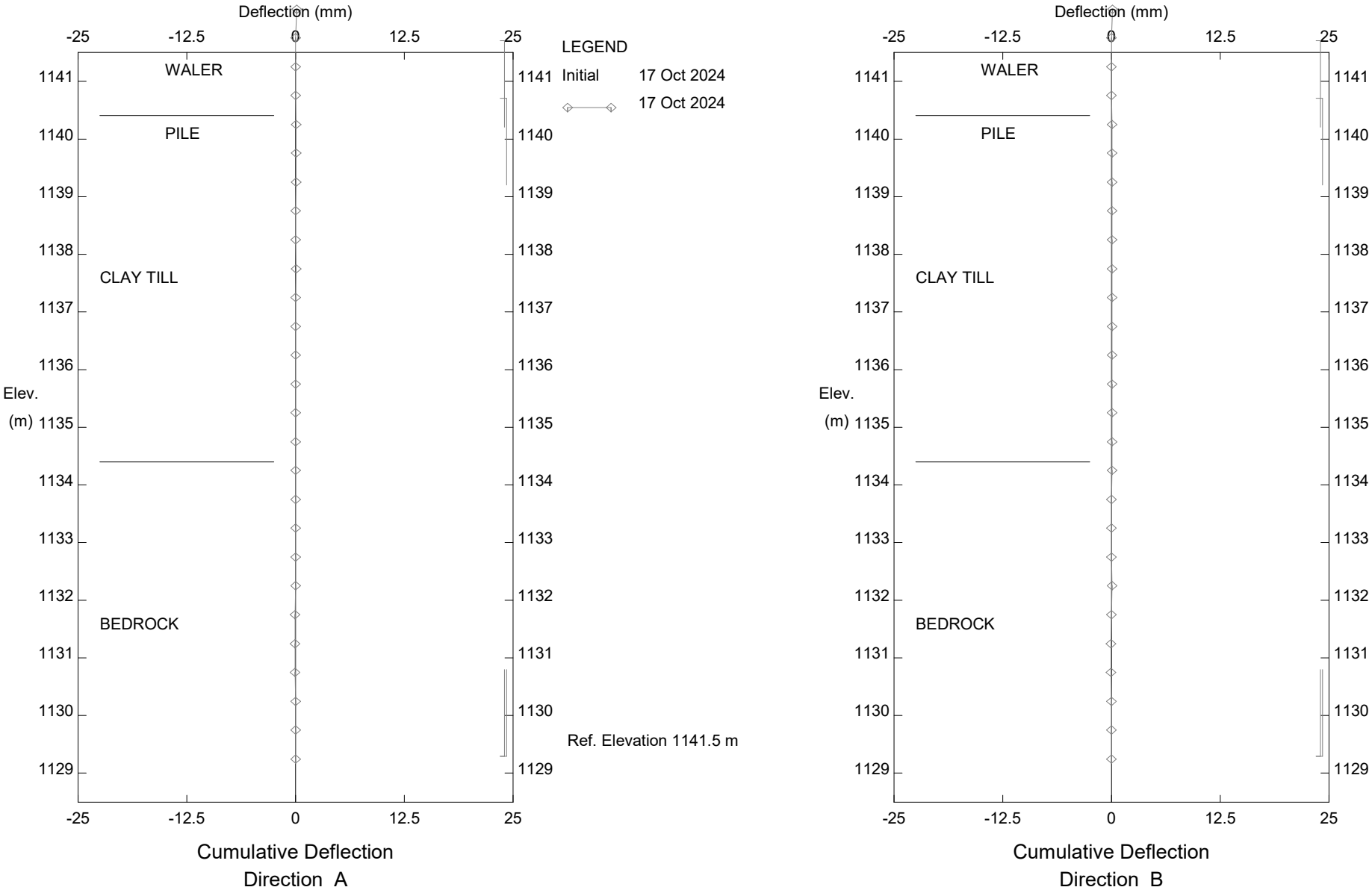
Klohn Crippen Berger - Edmonton



GP042; H40:36, Wanyandie Creek Slide, Inclinometer SI22-W5

Alberta Transportation

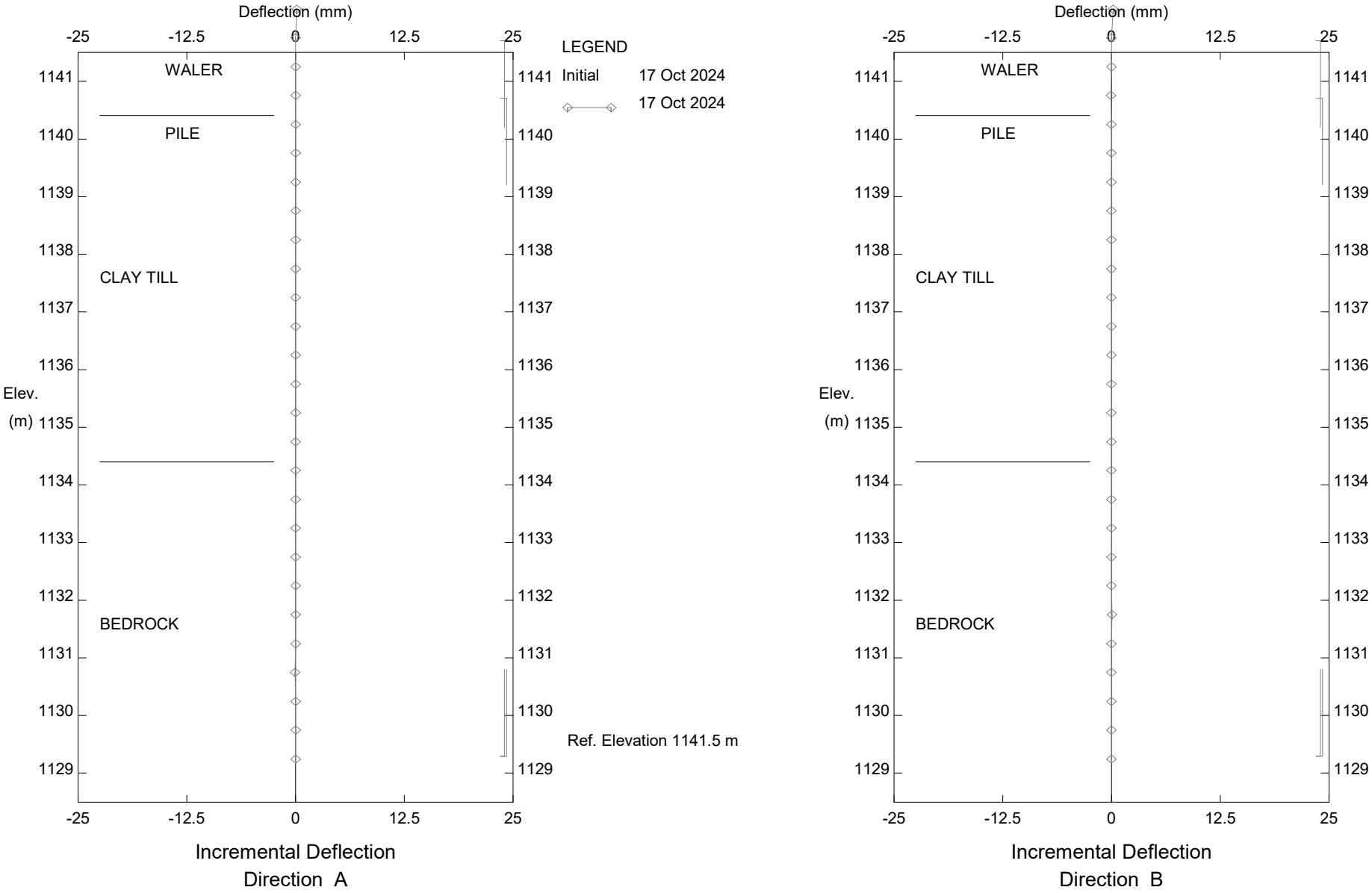
Klohn Crippen Berger - Edmonton



GP042; H40:36, Wanyandie Creek Slide, Inclinometer SI22-W6

Alberta Transportation

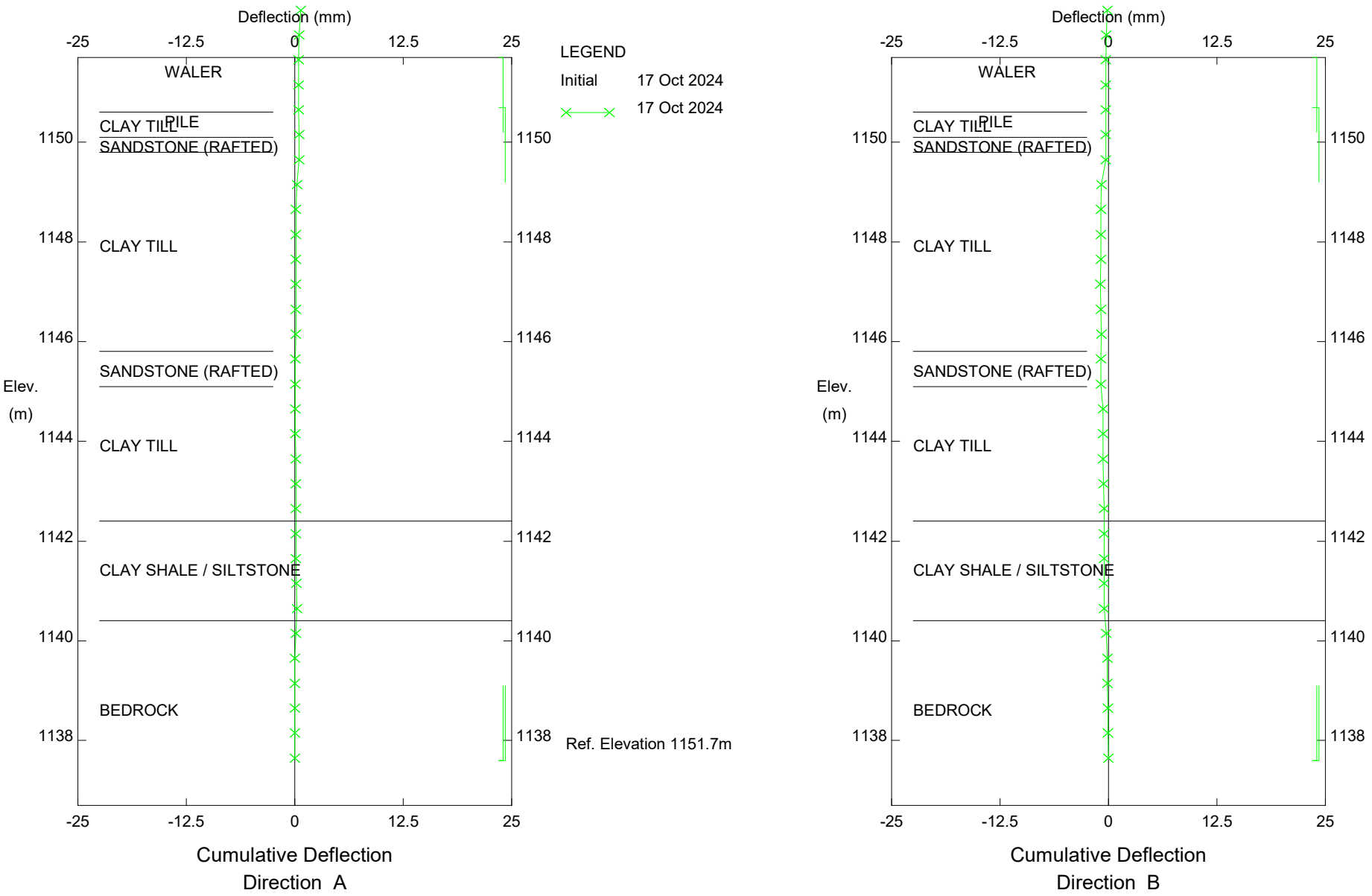
Klohn Crippen Berger - Edmonton



GP042; H40:36, Wanyandie Creek Slide, Inclinometer SI22-W6

Alberta Transportation

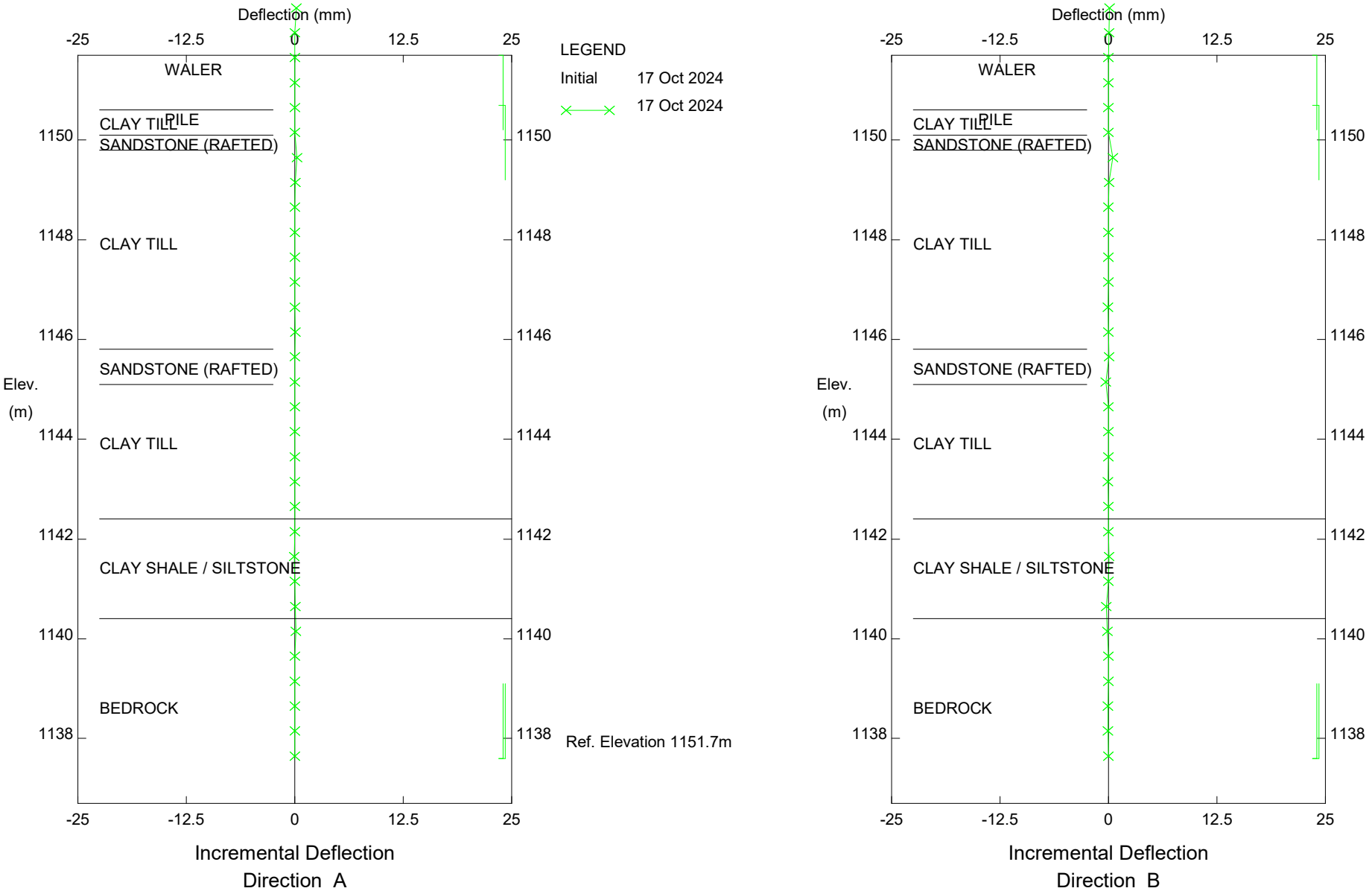
Klohn Crippen Berger - Edmonton



GP042; H40:36, Wanyandie Creek Slide, Inclinometer SI22-W7

Alberta Transportation

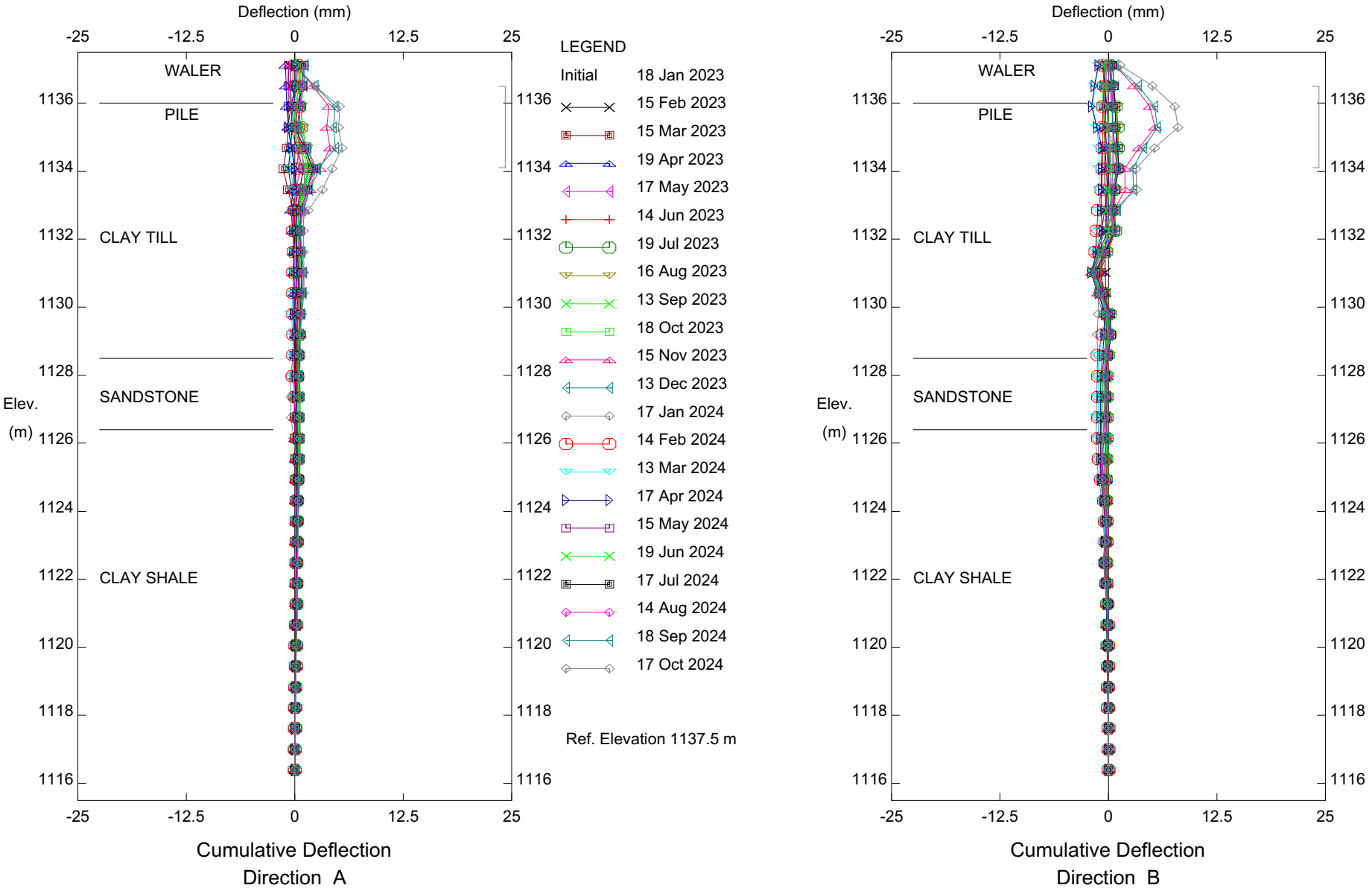
Klohn Crippen Berger - Edmonton



GP042; H40:36, Wanyandie Creek Slide, Inclinometer SI22-W7

Alberta Transportation

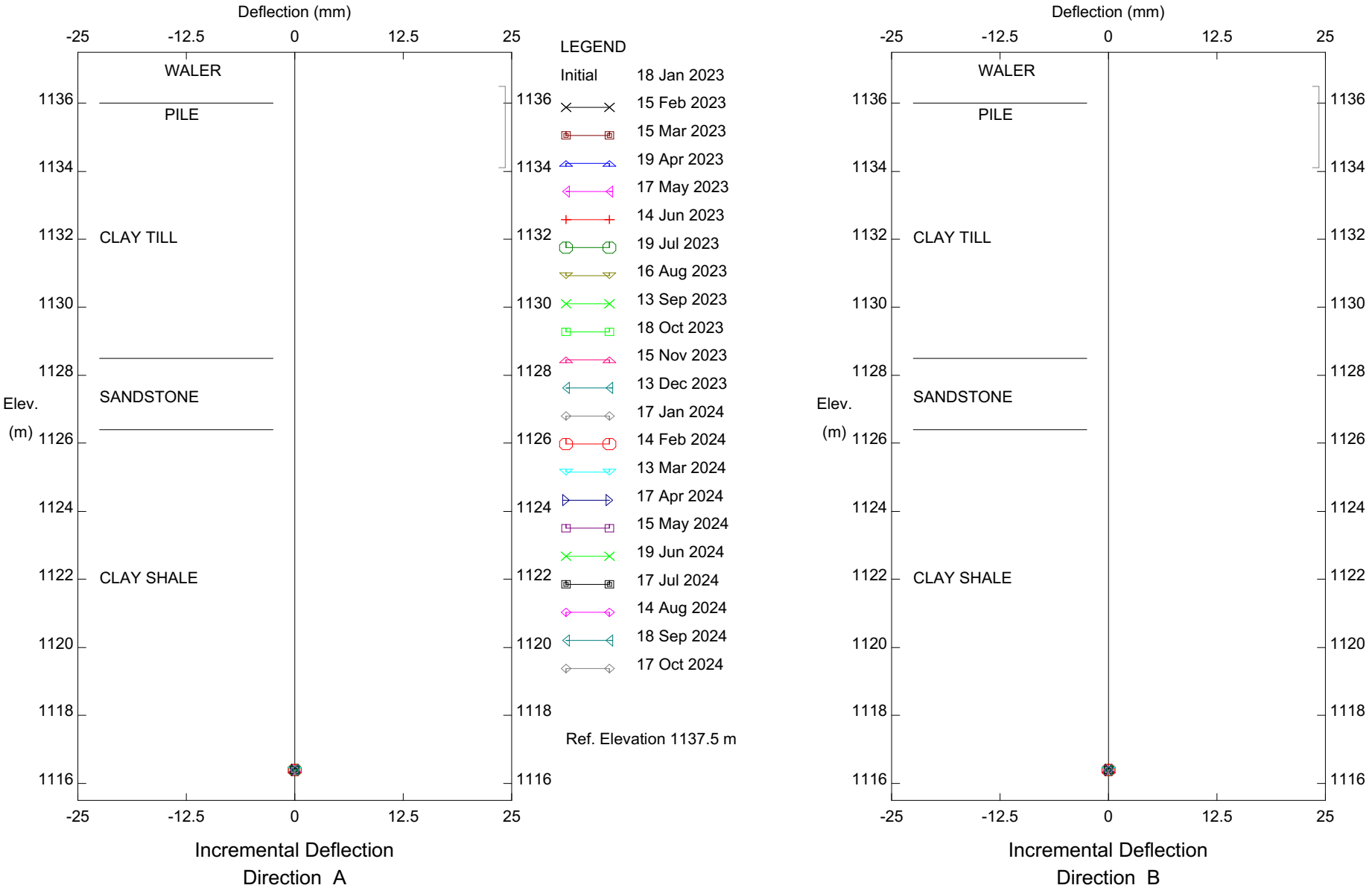
Klohn Crippen Berger - Calgary



GO042; H40:36, Wanyandie Creek Slide, Inclinometer SAA22-P15

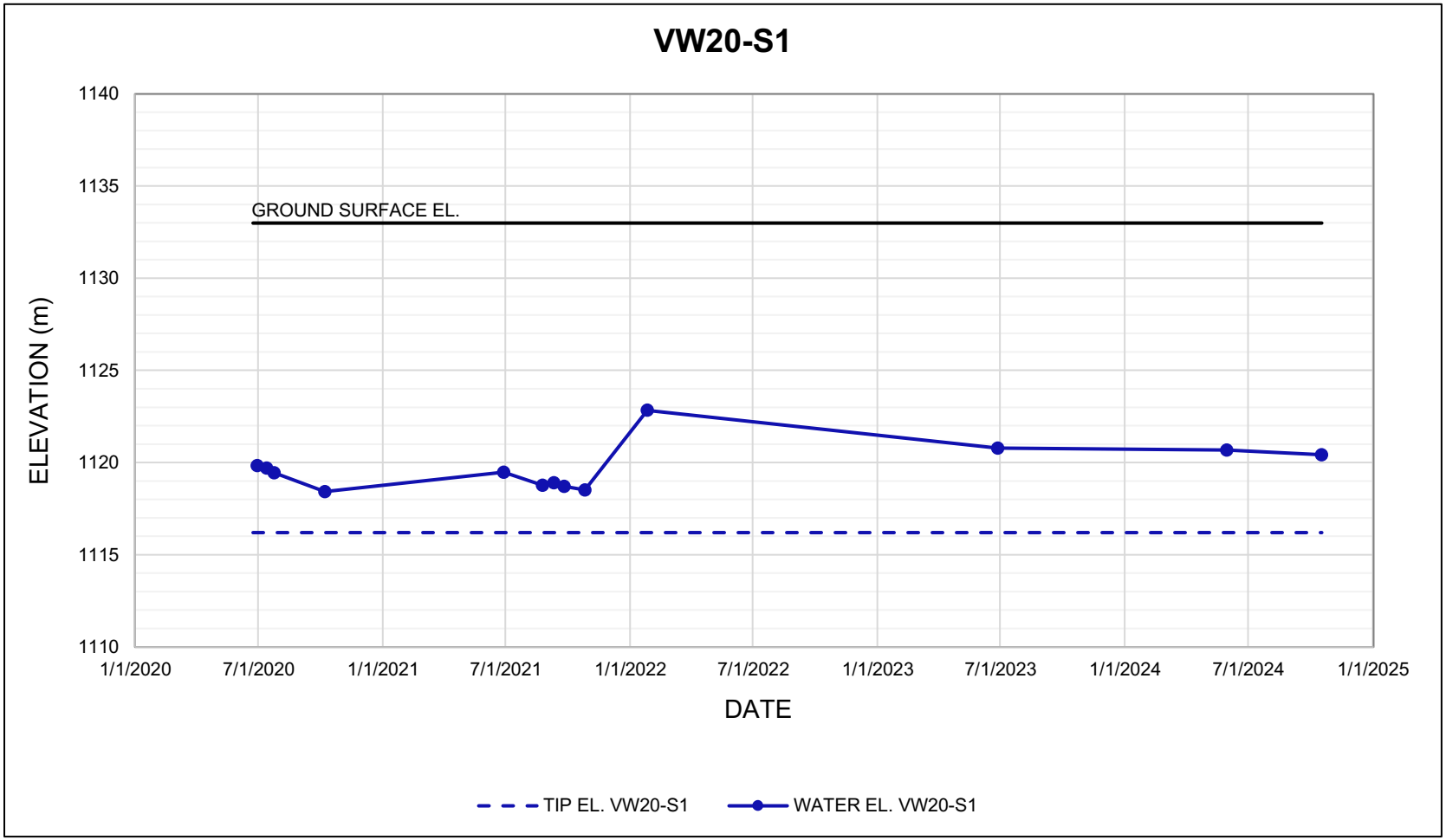
Alberta Transportation

Klohn Crippen Berger - Calgary



GO042; H40:36, Wanyandie Creek Slide, Inclinometer SAA22-P15

Alberta Transportation



NOTES:
1. INSTRUMENTS READ IN JUNE AND SEPTEMEBR 2021, THEN FROM OCTOBER 2024 ONWARDS. REMAINING DATA PROVIDED TO KCB BY ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS ON JUNE 25, 2021.

CLIENT

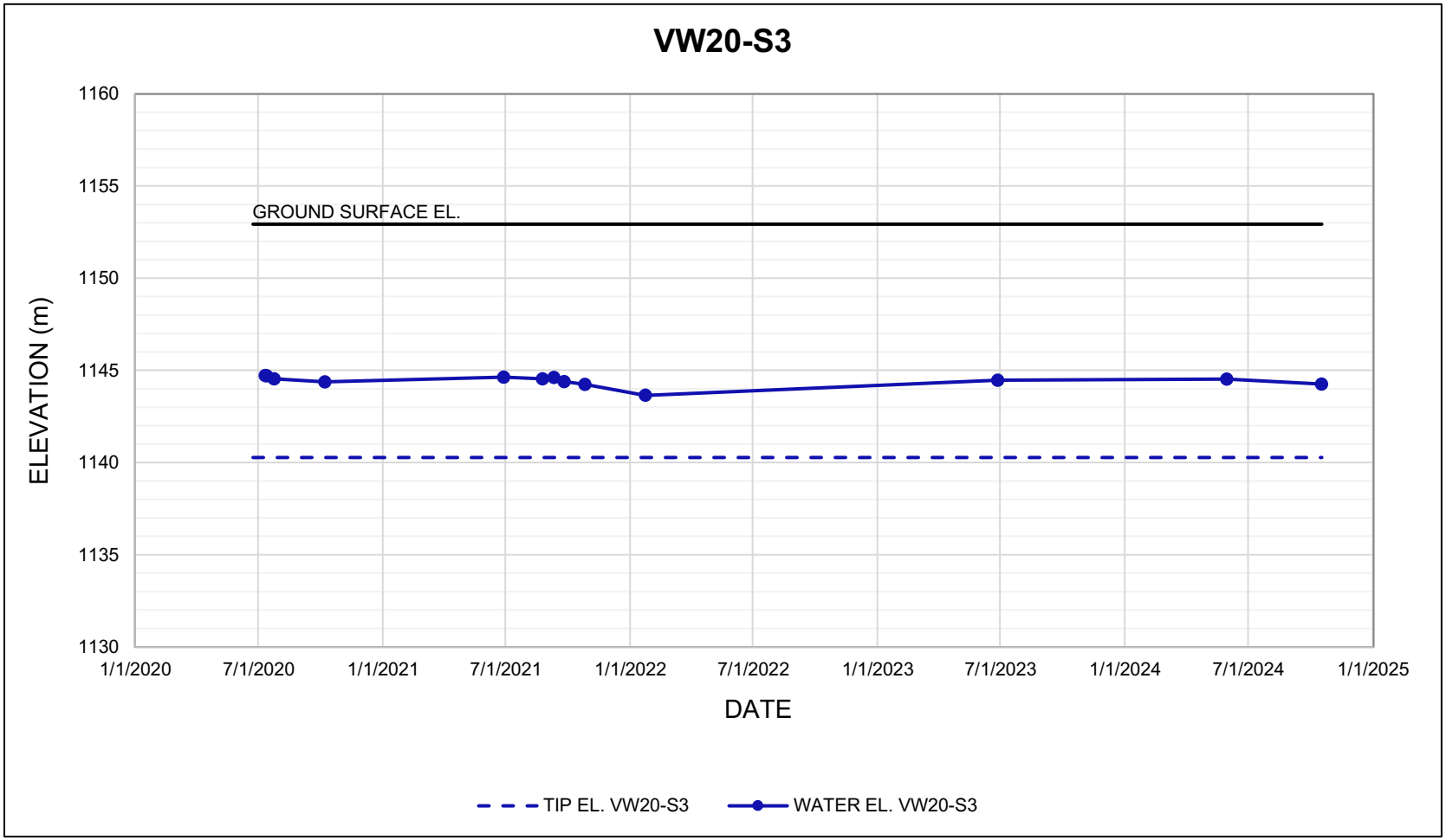
Alberta

Klohn Crippen Berger

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

TITLE
Piezometer Data
GP042 - Wanyandie Creek Embankment Slide
Hwy 40:36, km 37.524

SCALE	PROJECT No.	FIG No.
	A05116A01	



NOTES:
1. PIEZOMETER DATA OBTAINED BEFORE THE SPRING 2021 READING ON JUNE 28, 2021 WAS PROVIDED TO KCB BY ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS ON JUNE 25, 2021.
2. GROUND SURFACE ELEVATION MEASURED PRIOR TO CONSTRUCTION AND MAY NEED TO BE UPDATED.

CLIENT

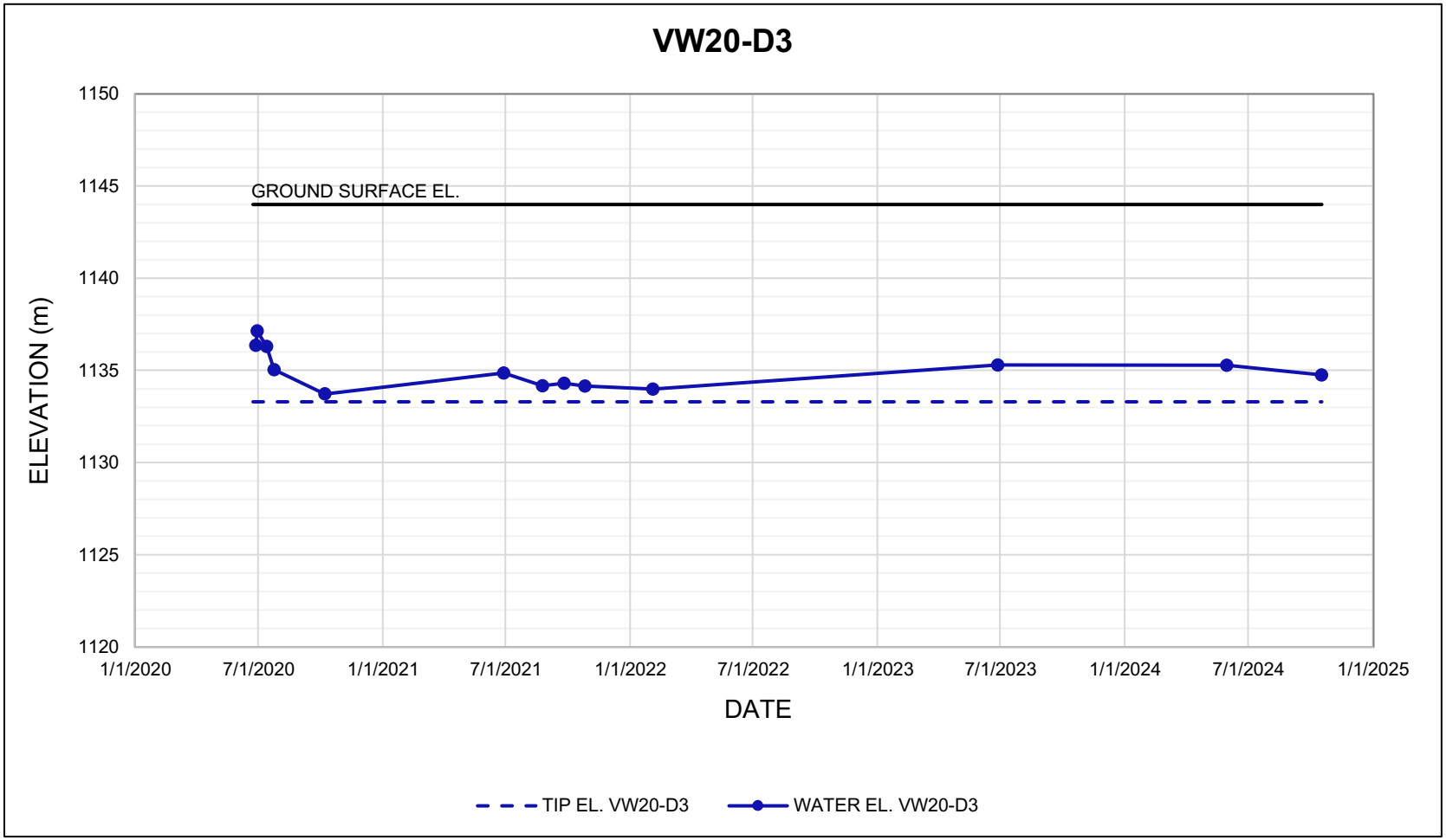
Alberta

Klohn Crippen Berger

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

TITLE
Piezometer Data
GP042 - Wanyandie Creek Embankment Slide
Hwy 40:36, km 37.524

SCALE	PROJECT No.	FIG No.
	A05116A01	



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1. PIEZOMETER DATA OBTAINED BEFORE THE SPRING 2021 READING ON JUNE 28, 2021 WAS PROVIDED TO KCB BY ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS ON JUNE 25, 2021.
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CLIENT

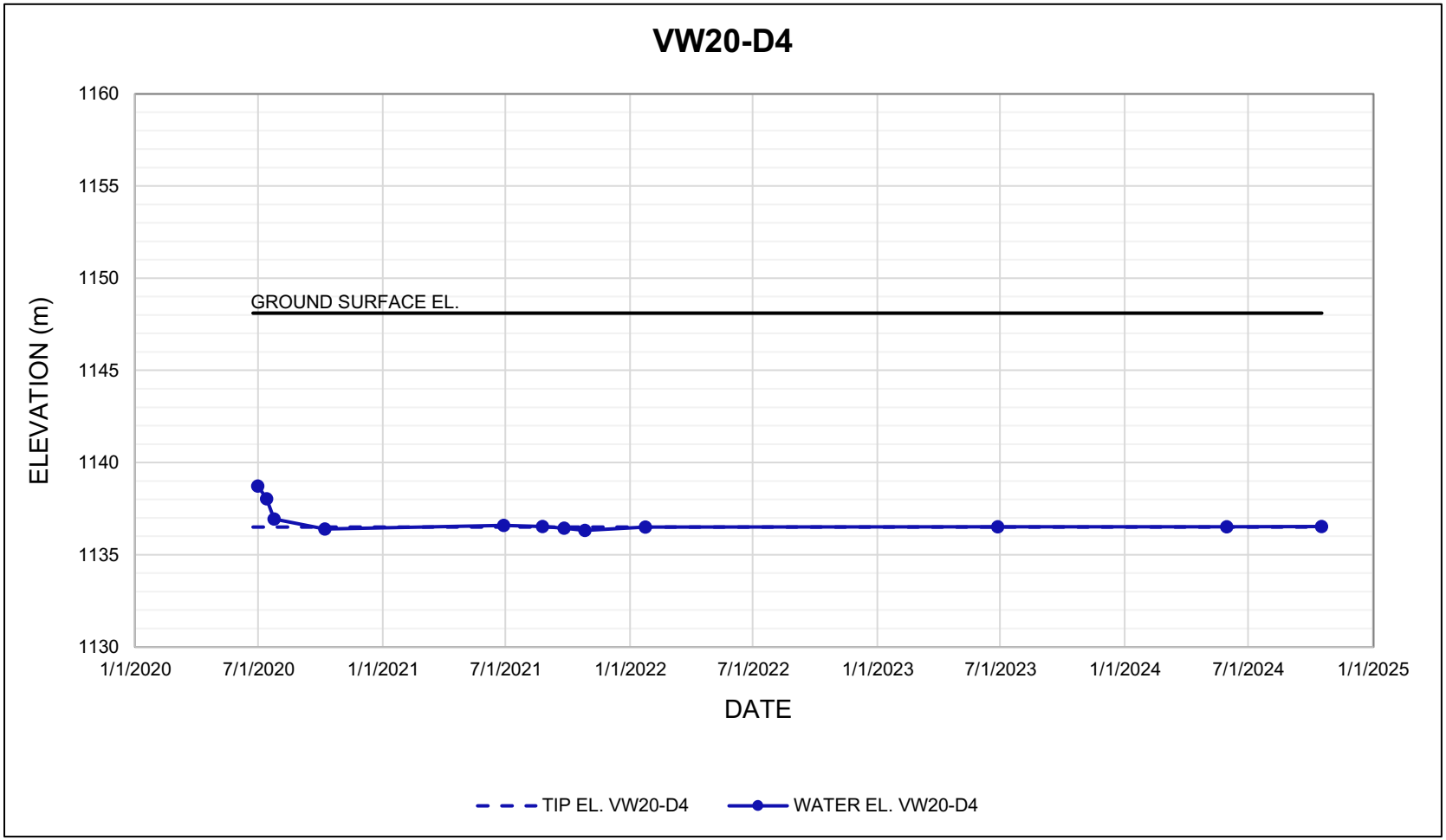
Alberta

Klohn Crippen Berger

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

TITLE
Piezometer Data
GP042 - Wanyandie Creek Embankment Slide
Hwy 40:36, km 37.524

SCALE	PROJECT No.	FIG No.
	A05116A01	



NOTES:
1. PIEZOMETER DATA OBTAINED BEFORE THE SPRING 2021 READING ON JUNE 28, 2021 WAS PROVIDED TO KCB BY ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS ON JUNE 25, 2021.
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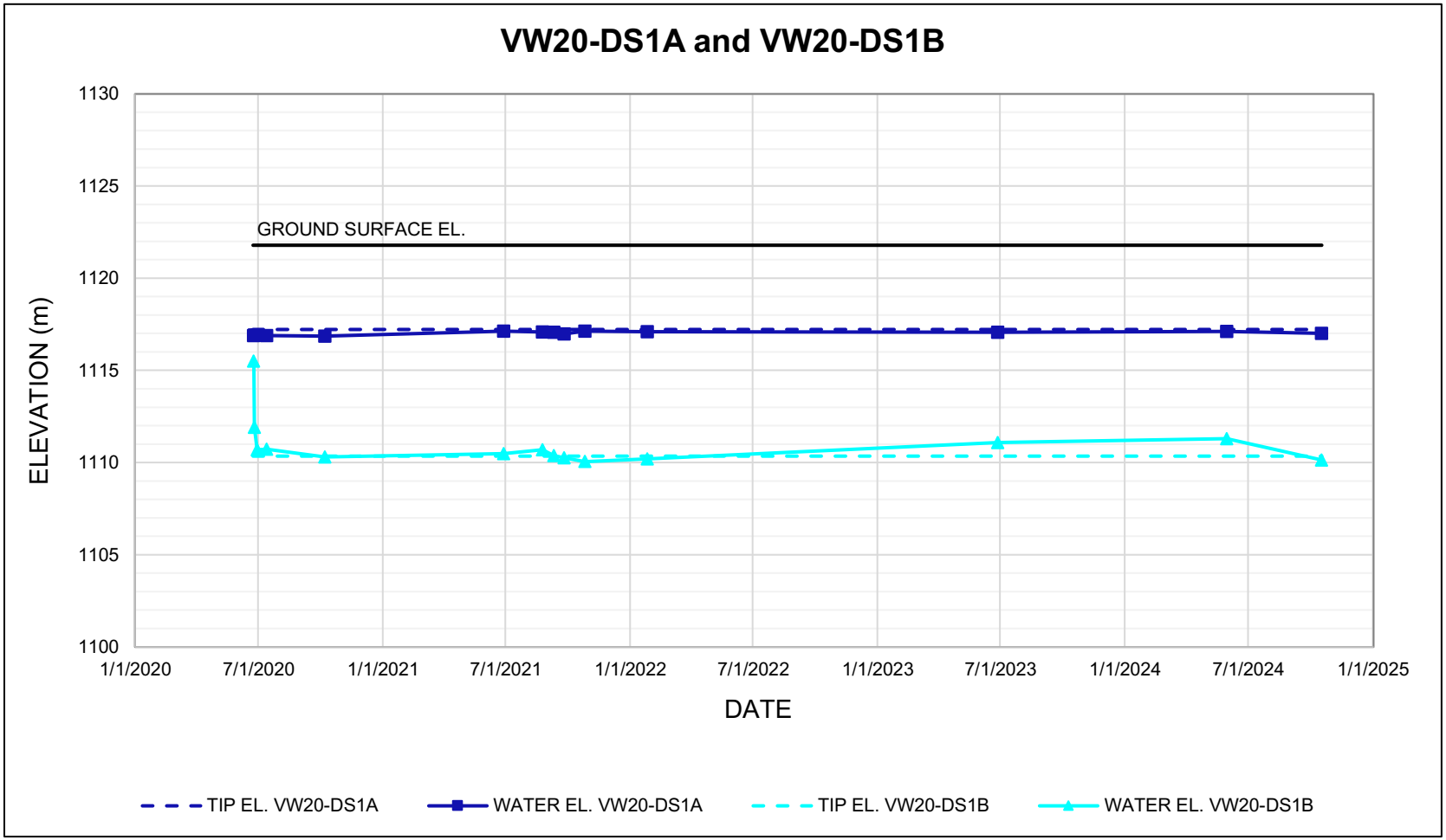
Klohn Crippen Berger

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

TITLE
Piezometer Data
GP042 - Wanyandie Creek Embankment Slide
Hwy 40:36, km 37.524

SCALE	PROJECT No.	FIG No.
	A05116A01	



NOTES:
1. PIEZOMETER DATA OBTAINED BEFORE THE SPRING 2021 READING ON JUNE 28, 2021 WAS PROVIDED TO KCB BY ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS ON JUNE 25, 2021.
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CLIENT

Alberta

Klohn Crippen Berger

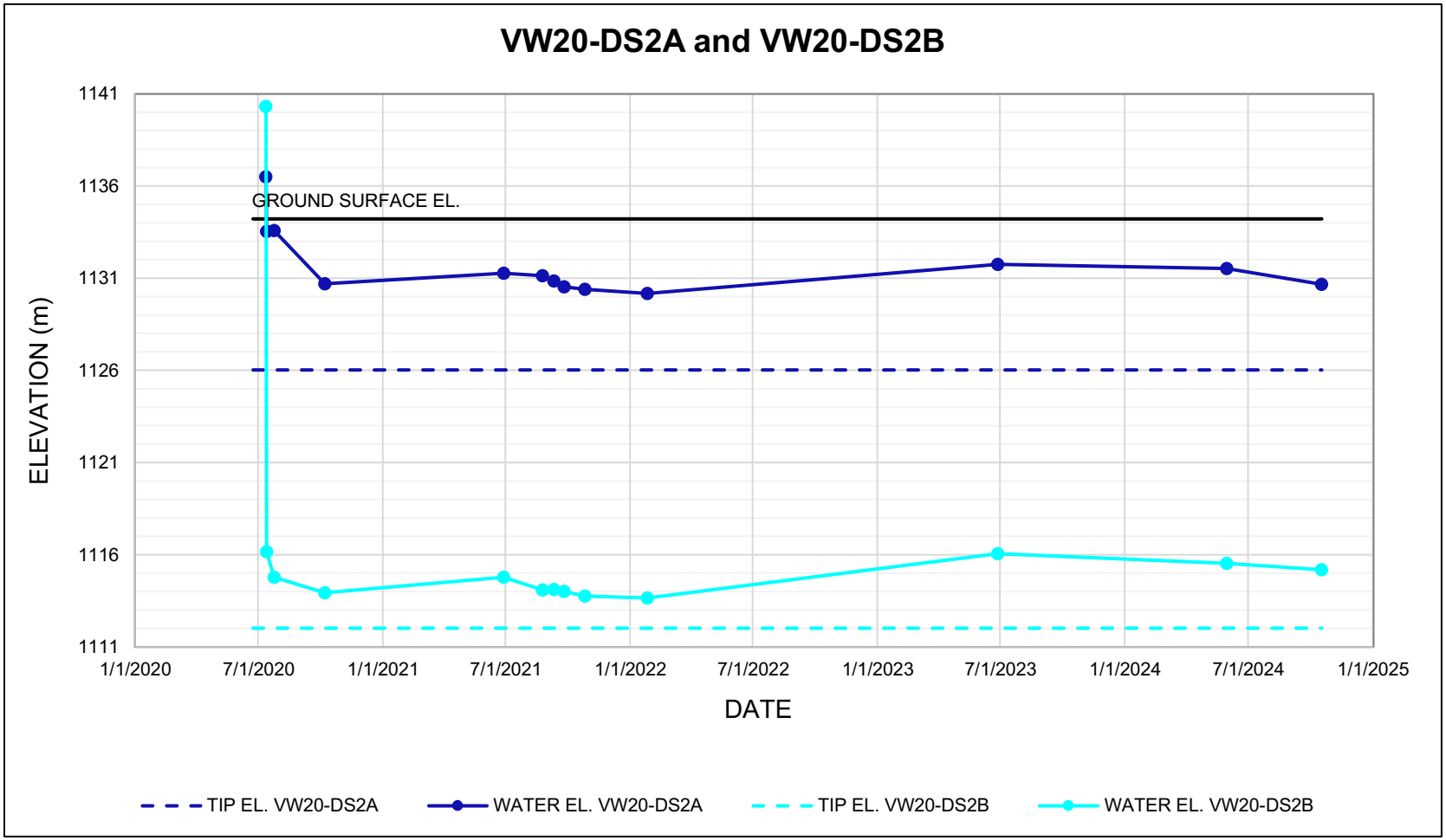
PROJECT

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

TITLE

Piezometer Data
GP042 - Wanyandie Creek Embankment Slide
Hwy 40:36, km 37.524

SCALE	PROJECT No.	FIG No.
	A05116A01	



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1. PIEZOMETER DATA OBTAINED BEFORE THE SPRING 2021 READING ON JUNE 28, 2021 WAS PROVIDED TO KCB BY ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS ON JUNE 25, 2021.
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CLIENT

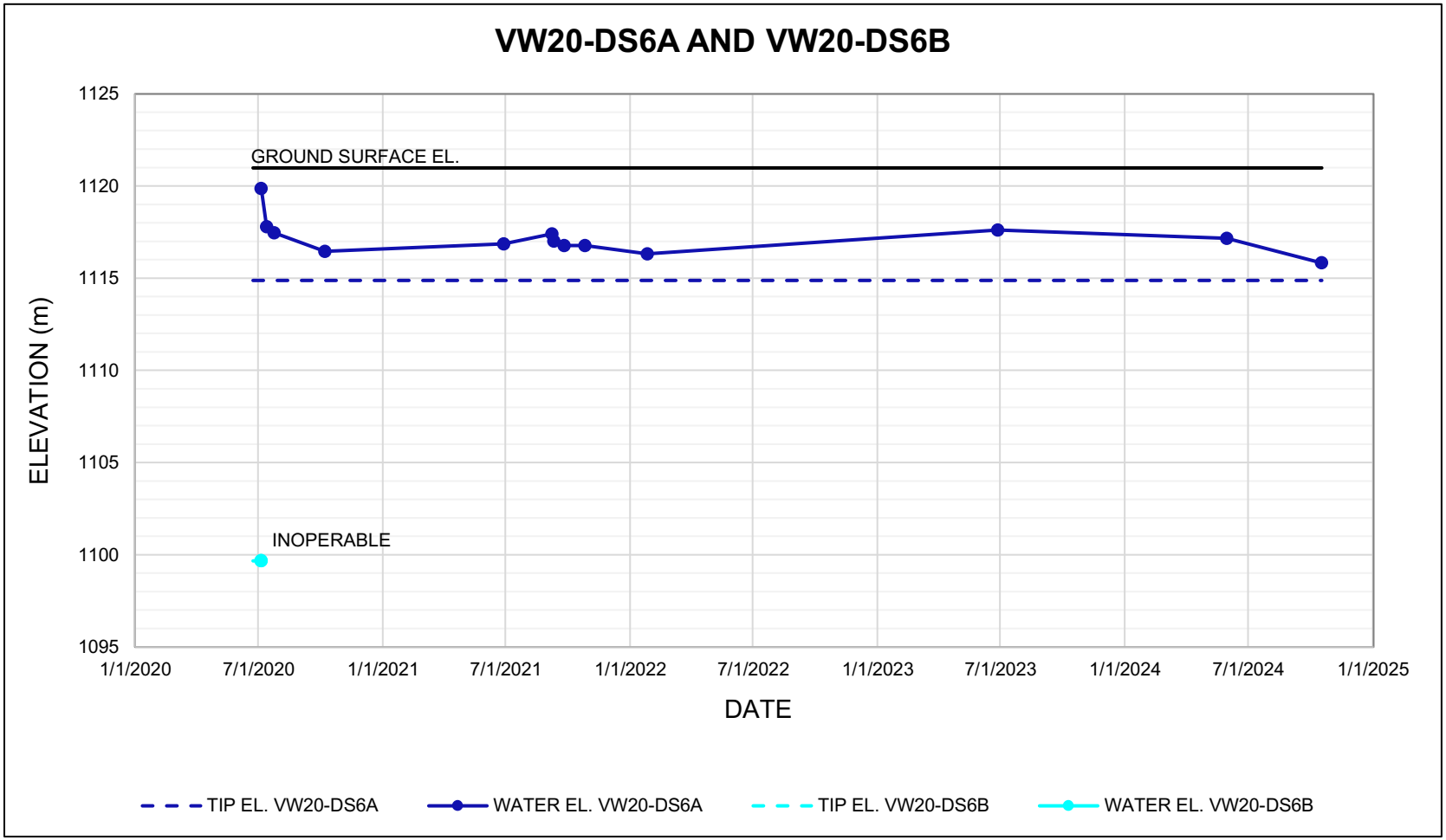
Alberta

Klohn Crippen Berger

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

TITLE
Piezometer Data
GP042 - Wanyandie Creek Embankment Slide
Hwy 40:36, km 37.524

SCALE	PROJECT No.	FIG No.
	A05116A01	



NOTES:
1. PIEZOMETER DATA OBTAINED BEFORE THE SPRING 2021 READING ON JUNE 28, 2021 WAS PROVIDED TO KCB BY ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS ON JUNE 25, 2021.
2. GROUND SURFACE ELEVATION MEASURED PRIOR TO CONSTRUCTION AND MAY NEED TO BE UPDATED.

CLIENT

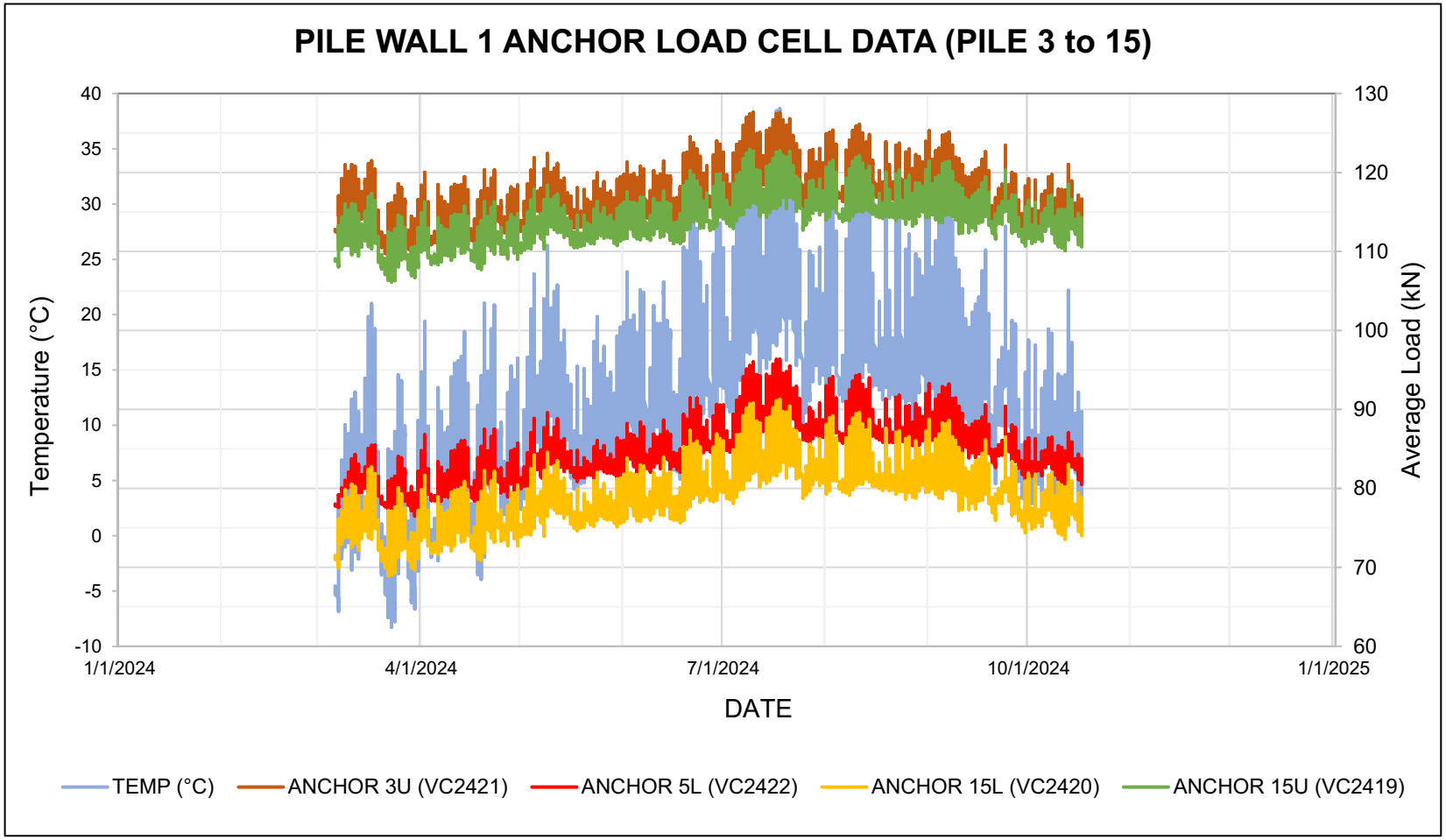
Alberta

Klohn Crippen Berger

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

TITLE
Piezometer Data
GP042 - Wanyandie Creek Embankment Slide
Hwy 40:36, km 37.524

SCALE	PROJECT No.	FIG No.
	A05116A01	



NOTES:
1. INSTRUMENTS CONNECTED TO MULTI-CHANNEL DATA LOGGER.

CLIENT

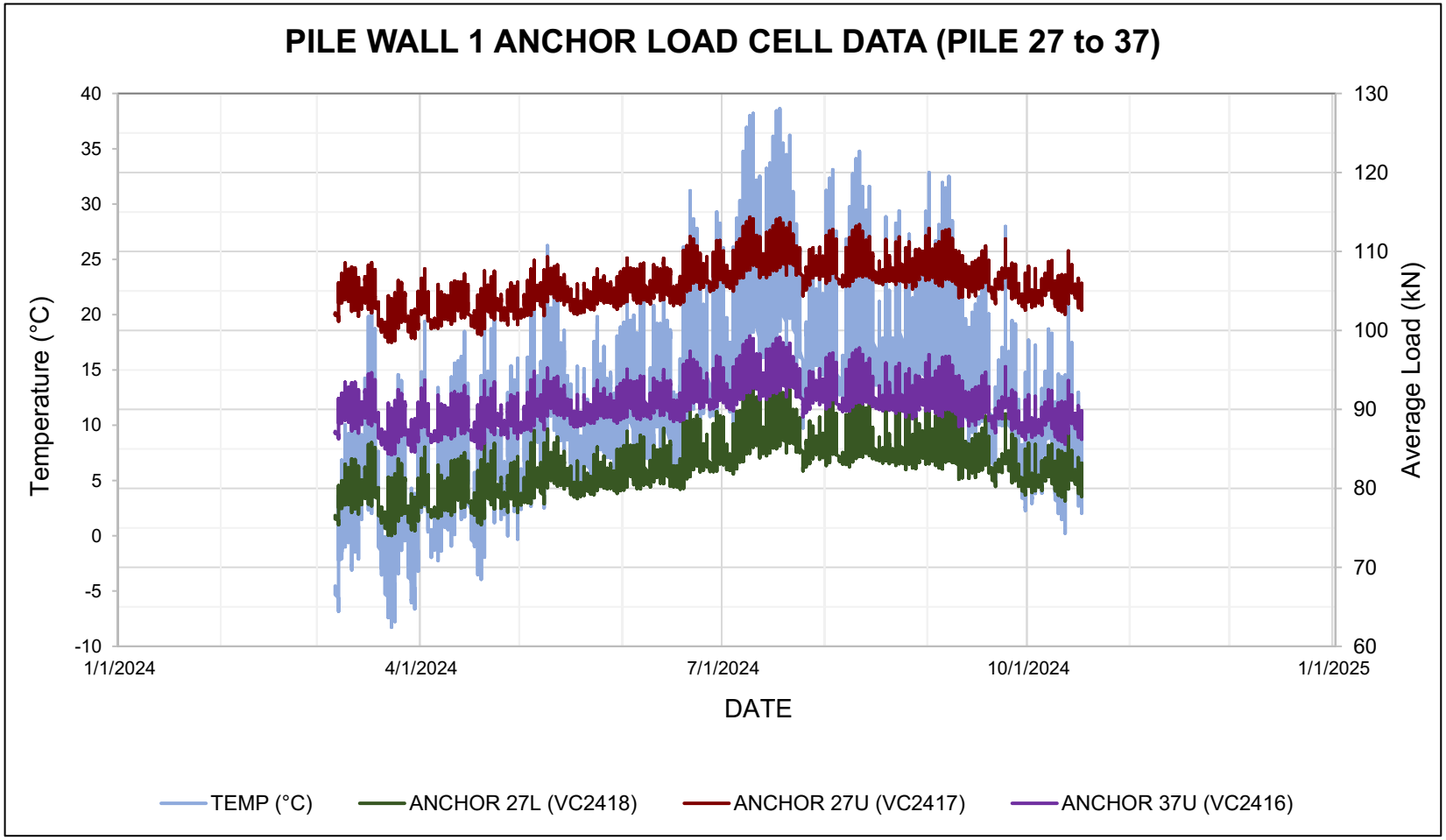
Alberta

Klohn Crippen Berger

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

TITLE
Pile Wall 1 Anchors Load Cell Data
(Pile 3, 5, and 15)
GP042 - Wanyandie Creek Embankment Slide
Hwy 40:36, km 37.524

SCALE	PROJECT No.	FIG No.
	A05116A01	



NOTES:
1. INSTRUMENTS CONNECTED TO MULTI-CHANNEL DATA LOGGER.

CLIENT

Alberta

Klohn Crippen Berger

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

TITLE
Pile Wall 1 Anchors Load Cell Data
(Pile 27 and 37)
GP042 - Wanyandie Creek Embankment Slide
Hwy 40:36, km 37.524

SCALE	PROJECT No.	FIG No.
	A05116A01	