November 26, 2025

Alberta Transportation and Economic Corridors
2nd Floor, 803 Manning Road N.E.
Calgary, Alberta
T2E 7M8

Alex Frotten, P.Eng.
Construction Engineer – Delivery Services Division (Southern Region)

Dear Mr. Frotten:

CON0022161 Southern Region GRMP Instrumentation Monitoring
Site S008; H762:02, km 2.125 Fisher Creek Pile Wall
Section C – 2025 Fall Readings

1 GENERAL

Five slope inclinometers (SIs) (Pile 15, Pile 29, Pile 36, Pile 43, and Pile 49) were read at the S008 site in Southern Region on October 7, 2025, by Mr. Shawn Keegan, E.I.T., of Klohn Crippen Berger Ltd. (KCB). These instruments were read as part of the Southern Region Geohazard Risk Management Program (GRMP). The site is located on Hwy 762:02 km 2.125, south of Bragg Creek, Alberta, approximately 2 km north of the Hwy 549 intersection. The approximate site coordinates are 5627342 N, 678866 E (UTM Zone 11, NAD 83). A site plan is presented in Figure 1.

The geohazard at the S008 site consists of a landslide approximately 130 m in length on the west slope of the highway embankment. In January 2017, a cast-in-place pile wall consisting of fifty-seven (57) 1.2-m-diameter piles was installed to a depth of 16 m to 18 m below ground surface and anchored in bedrock. In the fall of 2017, a high-tension cable barrier (HTCB) was installed along the west (southbound lane) shoulder of the highway. A pavement patch was placed north of the pile wall between the spring and fall 2022 readings.

Geotechnical site investigations, some of which included installing instruments, were conducted at the S008 site in 1988, 2001, 2002, and 2007 by previous consultants. Generally, the encountered stratigraphy was as follows: fill; overlying clay with organics or silty clay; overlying high plastic clay; overlying clay till; overlying rafted bedrock (sandstone); and overlying clay till.

In February 2025, KCB conducted an additional site investigation at S008, which consisted of a single borehole (S008-BH25-01) drilled approximately 24 m north of the existing pile wall (Figure 1). The borehole was drilled to a depth of 18.90 m. The stratigraphy was consistent with previous site investigations. One SI and two VWPs were installed in the borehole.

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1.1 Instrumentation

KCB has been reading the instruments at this site since 2016. Instrumentation installation details are tabulated in The SI equipment was changed in 2020 when KCB began reading the instruments, and again in October 2021 after the previous equipment became inoperable. Currently, the operable SIs were read using a metric RST Digital MEMS Inclinometer System. The VWPs are read using an RST VWP readout box.

Table 1.1. Instrument locations are shown in Figure 1. Any instruments not included in The SI equipment was changed in 2020 when KCB began reading the instruments, and again in October 2021 after the previous equipment became inoperable. Currently, the operable SIs were read using a metric RST Digital MEMS Inclinometer System. The VWPs are read using an RST VWP readout box.

Table 1.1 or shown in Figure 1 are assumed to be inoperable and are not presented or discussed herein.

Between 1988 and 2007, 17 SIs and six piezometers were installed at the site by the previous consultants to monitor movement and groundwater conditions, respectively. All of these instruments are now inoperable (e.g., destroyed, sheared, or lost). Between December 2016 and January 2017, five SIs (Pile 15, Pile 29, Pile 36, Pile 43, and Pile 49) were installed within the pile wall. In February 2025 KCB installed one SI and two VWPs approximately 24 m north of the existing pile wall (SI25-01, VWP25-01, and VWP25-02).

The 2017 SIs are protected by above-ground casing protectors. BH25-01 is inside a flush-mounted headbox in the centre of the northbound lane of Highway 762.

The SI equipment was changed in 2020 when KCB began reading the instruments, and again in October 2021 after the previous equipment became inoperable. Currently, the operable SIs were read using a metric RST Digital MEMS Inclinometer System. The VWPs are read using an RST VWP readout box.

Table 1.1 Instrument Installation Details

Instrument ID[1]	Instrument Type	Date Installed	UTM Coordinates[2] (m)		Ground Surface Elevation (m)	Stick Up (m)	Depth[3] (mbgs)	Condition
			Northing	Easting				
Pile 15	SI	Dec. 2016	5627372	678862	1302.6	1.0	17.8	Operable
Pile 29	SI	Jan. 2017	5627354	678861	1304.7	1.0	17.9	Operable
Pile 36	SI	Jan. 2017	5627335	678861	1305.7	1.0	17.9	Operable
Pile 43	SI	Jan. 2017	5627318	678861	1306.5	1.0	15.8	Operable
Pile 49	SI	Jan. 2017	5627281	678864	1307.2	1.0	15.7	Operable
SI25-01	SI	Feb. 14, 2025	5627420	678862	1308	-0.1	18.9	Operable
VWP25-01	VWP						5.95	Operable
VWP25-02	VWP						13.57	Operable

Notes:
[1] Instrument ID is the same as the pile number in which the SI was installed.
[2] Coordinates were obtained by KCB with a handheld GPS (accuracy of ±5 m).
[3] Meters below ground surface (mbgs). Bottom reading depth for SIs.

2 INTERPRETATION

2.1 General

The SI plots presented in the report include cumulative displacement, incremental displacement, and displacement-time data (Appendix I). The displacement-time data is plotted in the A-direction (i.e., the direction of the A0-groove) and, where applicable, the X-direction (i.e., the direction of maximum movement obtained at a skew angle from the A0-grooves). The SIs installed in Piles 36 and 49 have skew angles of 340° and 330°, respectively, measured clockwise from the direction of the A0-grooves. The piles are approximately 16 m to 18 m deep and the SIs are approximately 15.8 m to 17.9 m deep. Since October 2021, KCB has been using a new inclinometer probe and reel, which might lead to slight differences in data compared to earlier readings. However, during the review of the SI data for this report, all prior data corrections were removed to facilitate better interpretation of displacement trends.

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. Data from the VWPs has been downloaded twice a year, starting in spring 2024, to analyze whether irrigation affects the groundwater.

Monthly precipitation data is also plotted with the piezometer data. The data was obtained from the Alberta Climate Information Service (ACIS) database, referencing the Elbow River Station.

The SI and piezometer data plots are included in Appendix I. No data obtained before October 2021 is shown on the SI plots.

2.2 Zones of Movement

Historically, distributed movement has been recorded in the SIs installed in the pile wall from the top of the casing to an approximate depth of:

- 9.8 m below ground surface in Pile 15 with some minor deflection (less than 10 mm) being recorded to an approximate depth of 17.3 m below ground surface (i.e., bottom of casing);
- 10.7 m below ground surface in Pile 29;
- 10.8 m below ground surface in Pile 36 with some minor deflection (less than 5 mm) being recorded to an approximate depth of 17.3 m below ground surface (i.e., bottom of casing);
- 7.8 m below ground surface in Pile 43; and,
- 7.8 m below ground surface in Pile 49 with some minor deflection (less than 5 mm) being recorded to an approximate depth of 15.3 m below ground surface (i.e., bottom of casing).

Since being re-initialized by KCB in October 2021, no discernible movement has been recorded in Pile 29, Pile 43, or Pile 49.

Also, the fall 2025 reading taken in SI25-01 after initialization in May 2025 shows that there is minor movement near the surface at 2.2 m below ground surface.

2.3 Interpretation of Monitoring Results

2.3.1 Slope Inclinometers

The pile-wall Issued for Tender (IFT) drawings issued to TEC in July 2016 indicate that the depth of recorded pre-repair movement varied from approximately 3 m to 10 m below the highway. The observed upper zone of movement recorded in the pile-wall SIs appears to be occurring at a similar depth (varies from approximately 8 m to 11 m below ground surface). Based on stratigraphy shown on the SI data plots, the recorded movement corresponds to where the pile wall is installed in high plastic clay, silty clay, and clay and gravel fill. The SI data indicate that the piles have intercepted the failure surface and deflected, transferring load to depths below the failure plane as the piles stabilize the slide mass.

Initial movement (less than 10 mm) was recorded at the base of Pile 15, Pile 36, and Pile 49 in early 2017, within six months of pile wall installation. These movements have since diminished and are no longer detectable. In spring 2017, shortly after constructing the pile wall, the maximum rate of movement recorded at these SIs was approximately 204 mm/year. This rate has decreased and is now negligible. The negative movement readings during some measurements indicate that the movement is within the accuracy limits of the SI equipment. KCB expected the movement rate to be highest immediately after installation and to decrease as the pile wall took load and stabilized the sliding mass. However, increased movement or additional displacements of the pile wall may occur in response to heavy or prolonged rainfall or freshet infiltration, leading to higher groundwater levels.

Most of the readings recorded since KCB re-initialized the SI in the Pile can be considered negligible initially; however, Pile 15 has picked up almost 6 mm of movement, which, combined with the cumulative movement taken by other consultants, totals about 30 mm. Pile 15 is located approximately 35 m from the south end of the pile wall, the movement recorded in the B-direction at appears to be SI casing joints, based on an approximate spacing of 3 m intervals between joints.

Observations made during the last Section B inspections include:

- July 2020 – new pavement cracking and an area of settlement (i.e., a dip) were observed in the east (northbound) lane, approximately 24 m north of the existing pile wall.
- July 2021 – the severity of the pavement cracking had increased since the July 2020 inspection. The length of the pavement crack was approximately 11 m.
- July 2022 – the severity of the pavement cracking has continued to increase since the July 2021 inspection. The length of the pavement cracking had increased to approximately 16 m. The pavement cracking was within 0.4 m of the highway centerline and settlement of up to 50 mm was observed in the west (southbound) lane.

- June 2023 – the severity of the pavement cracking has continued to increase since the July 2022 inspection to the north of the pile wall.
- May 2024 – the severity of the pavement cracking has continued to increase since the May 2023 inspection to the north of the pile wall.

  May 2025 – cracking was observed approximately 7 m from the north end of the pile wall. Cracking is starting to form through the overlay completed last fall.

The pavement distress north of the pile wall could indicate the slide is outflanking the pile wall at its north extent. No discernable movement has been recorded in Pile 49, the closest SI to the pavement distress, since 2021. During the 2025 fall readings, a new layer of asphalt was noted, with no cracking observed.

The movement recorded from BH25-01 is minor, approximately 2 mm, and may be within the limit of detection of the SI instrument. However, the movement and direction align with the location of previously observed pavement cracking during the 2024 Section B inspection (Figure 1). Pavement patching at this location was observed during the 2025 Section inspection and the 2025 fall readings. The movement measured at BH25-01 will need to be validated in subsequent instrument readings.

2.3.2 Water Level and Precipitation

Since March 2025, the water levels recorded by the two VWPs installed in February 2025 have remained steady, at 2.2 mbgs and 6 mbgs for VW199266 and VW194386, respectively. No notable changes in precipitation are currently detected by the instruments. However, it is noteworthy that two different pressure levels are measured within the same borehole at varying VWP tip elevations, possibly indicating a perched water level. Continued monitoring of future readings will help to confirm the relationship between VWP data and precipitation effects on water levels.

2.4 Summary

A summary of the SI data and a comparison of the current and historical SI data are provided in Table 2.1 and Table 2.2, respectively. Also, a summary of the piezometer data is provided in Table 2.3. The SI data plots include only data acquired by KCB, as data records from previous consultants have not been provided. The SIs on the Pile Wall were re-initialized to the October 2021 readings when the SI reading equipment was changed.

Table 2.1 Slope Inclinometer Reading Summary

Instrument ID	Date				Ground Surface Elevation (m)	Depth of Movement (mbgs[1])	Direction of Movement, Skew Angle[2]	Cumulative Movement (mm)				Rate of Movement (mm/year)		
	Initialized (re-initialized)[3]	Previous Reading	Previous Maximum Cumulative Movement Recorded	Most Recent Reading				Before Re-Initialization[4]	Most Recent Reading	Incremental Since Previous Reading	Total[3]	Previous Maximum[5]	Most Recent Reading	Change from Previous Reading
Pile 15	Dec. 16, 2016 (Oct. 7, 2021)	May 20, 2025	September 21, 2022	October 7, 2025	1302.6	0.3 – 9.8	A-Direction	24.7	5.6	0.6	30.3	9.8	1.6	3.5
			October 7, 2025			9.8 – 17.3	A-Direction	7.7	-1.9	1.9	5.8	5.0	5.0	-9.4
Pile 29	Jan. 13, 2017 (Oct. 7, 2021)	May 20, 2025	September 16, 2024	October 7, 2025	1304.7	0.2 – 10.7	A-Direction	6.9	0.3	0	7.2	4.4	0	0.8
Pile 36	Jan. 27, 2017 (Oct. 7, 2021)	May 20, 2025	October 7, 2025	October 7, 2025	1305.7	0.3 – 10.8	X-Direction, 340°	13.7	0.5	0.11	14.2	3.1	3.1	3.8
			September 16, 2024			10.8 – 17.3	X-Direction, 340°	3.9	-0.2	-0.6	3.7	2.7	-1.6	-1.5
Pile 43	Jan. 19, 2017 (Oct. 7, 2021)	May 20, 2025	October 11, 2023	October 7, 2025	1306.5	0.3 – 7.8	A-Direction	8.2	0.7	0.5	8.9	2.2	1.5	1.8
Pile 49	Jan. 05, 2017 (Oct. 7, 2021)	May 20, 2025	September 21, 2022	October 7, 2025	1307.2	0.3 – 7.8	X-Direction, 330°	6.8	-0.6	0	6.2	2.8	-0.04	-0.5
			October 11, 2023			7.8 – 15.3		6.2	-2.0	-0.9	4.2	-5.7	2.4	4.4
SI25-01	May 30, 2025	May 30, 2025	-	October 7, 2025	1308	0.2 – 2.2	A-Direction	N/A	2.2	2.2	2.2	N/A	6.1	6.1

Notes:
[1] Meters below ground surface (mbgs).
[2] Skew angle of X-direction measured clockwise from the A-direction.
[3] All SIs were re-initialized in October 2021 when KCB changed the SI reading equipment after the previous equipment became inoperable.
[4] The previous cumulative movement before Re-Initialization was reported by the previous consultant in July 2017.
[5] The previous maximum rate movement only accounts for the reading taken by KCB since re-initializing the instrument.

Table 2.2 Comparison of Current and Historical Slope Inclinometer Readings

Instrument ID / Pile No.	Closest Historic SI	Approximate Distance Between Pile and Historical SI[1](m)	Approximate Depth of Movement Recorded in Historical SI (mbgs[2])
Pile 15	SI2007-4	5	10.4
Pile 29	SI2007-3	5	4.7
Pile 36	SI2007-2	8	7.5
Pile 43	SI2007-2	10	7.5
Pile 49	SI2007-1	2	2.8

Notes:
[1] Locations estimated from Tetra Tech's Issued for Tender drawings dated July 2016.
[2] Meters below ground surface (mbgs).

Table 2.3 Vibrating Wire Piezometer Reading Summary

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)
VWP25-01	199266	Feb. 14, 2025	May 30, 2025	October 7, 2025	1308	5.95	2.8	2.2	-0.6
VWP25-02	194386	Feb. 14, 2025	May 30, 2025	October 7, 2025	1308	13.57	6.1	6.1	0.0

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

3 RECOMMENDATIONS

3.1 Future Work

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

The site should continue to be inspected by the Maintenance Contract Inspector (MCI) and as part of the Southern Region GRMP Section B inspections.

3.2 Instrument Repairs and Maintenance

No instrument repairs or maintenance are required.

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 Southern Region Geohazard Risk Management Program (Contract No. CON0022161), 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.

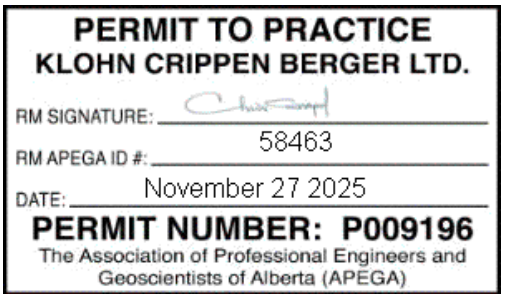
Use of or reliance upon this instrument of service by the Client is subject to the following conditions:

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.

Please contact the undersigned if you have any questions or comments regarding this report.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

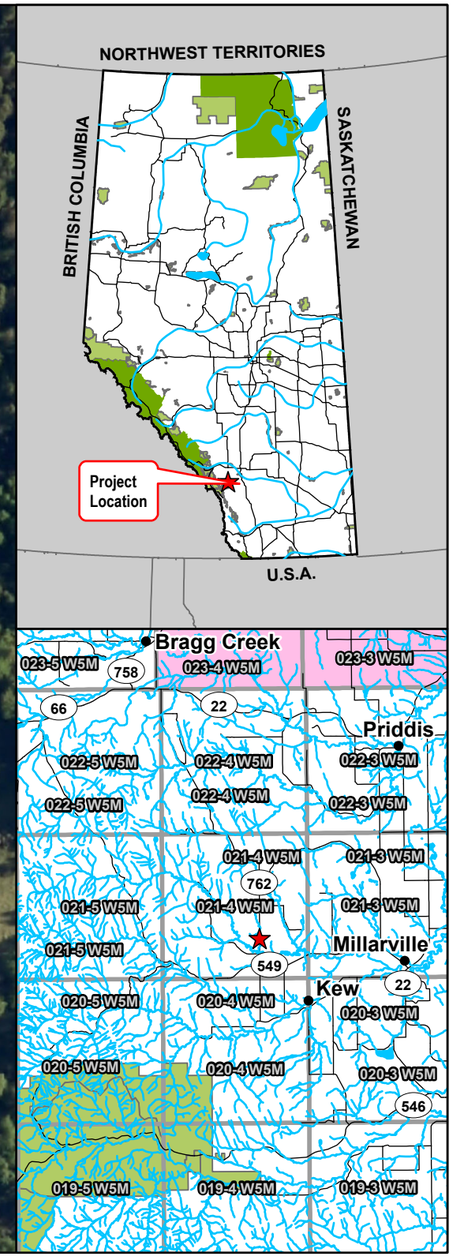


Jorge Rodriguez, Ph.D., M.Sc., P.Eng.
Geotechnical Engineer

JR:bb

ATTACHMENTS
Figure
Appendix I Instrumentation Plots

FIGURE



Legend

- Slope Inclinometer (SI)
- Borehole
- Crack
- Fence
- Pile Wall Extent

0 100 Metres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: AB COUNTY, CHALLENGER GEOMATICS LTD.

CLIENT: Alberta

Klohn Crippen Berger

PROJECT: SOUTHERN REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE: Site Plan
S008 - Fisher Creek Pile Wall
Hwy 762:02, km 2.125

SCALE	PROJECT No.	FIG No.
1:1,500	A05116A03	1

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APPENDIX I

Instrumentation Plots

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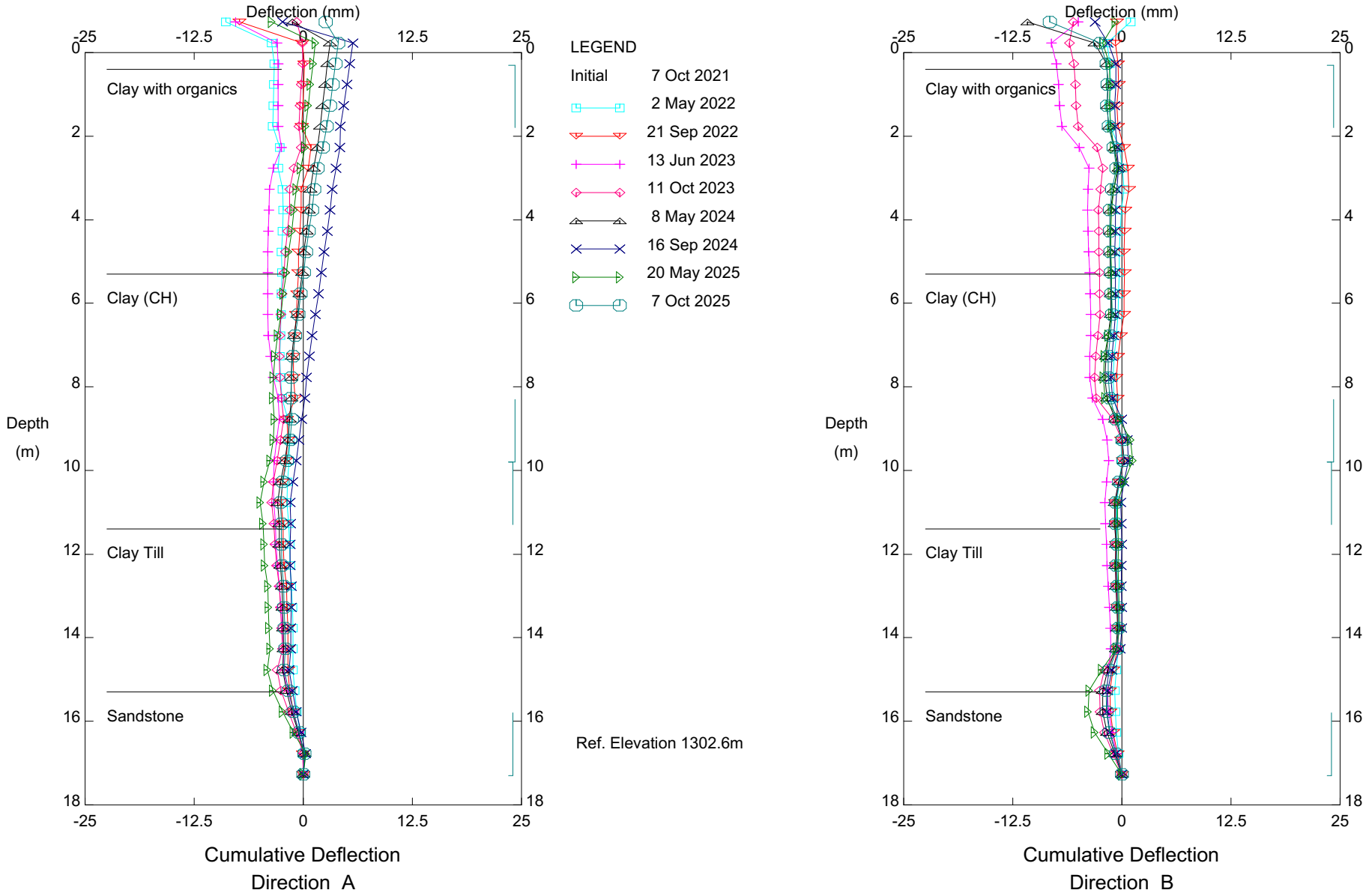

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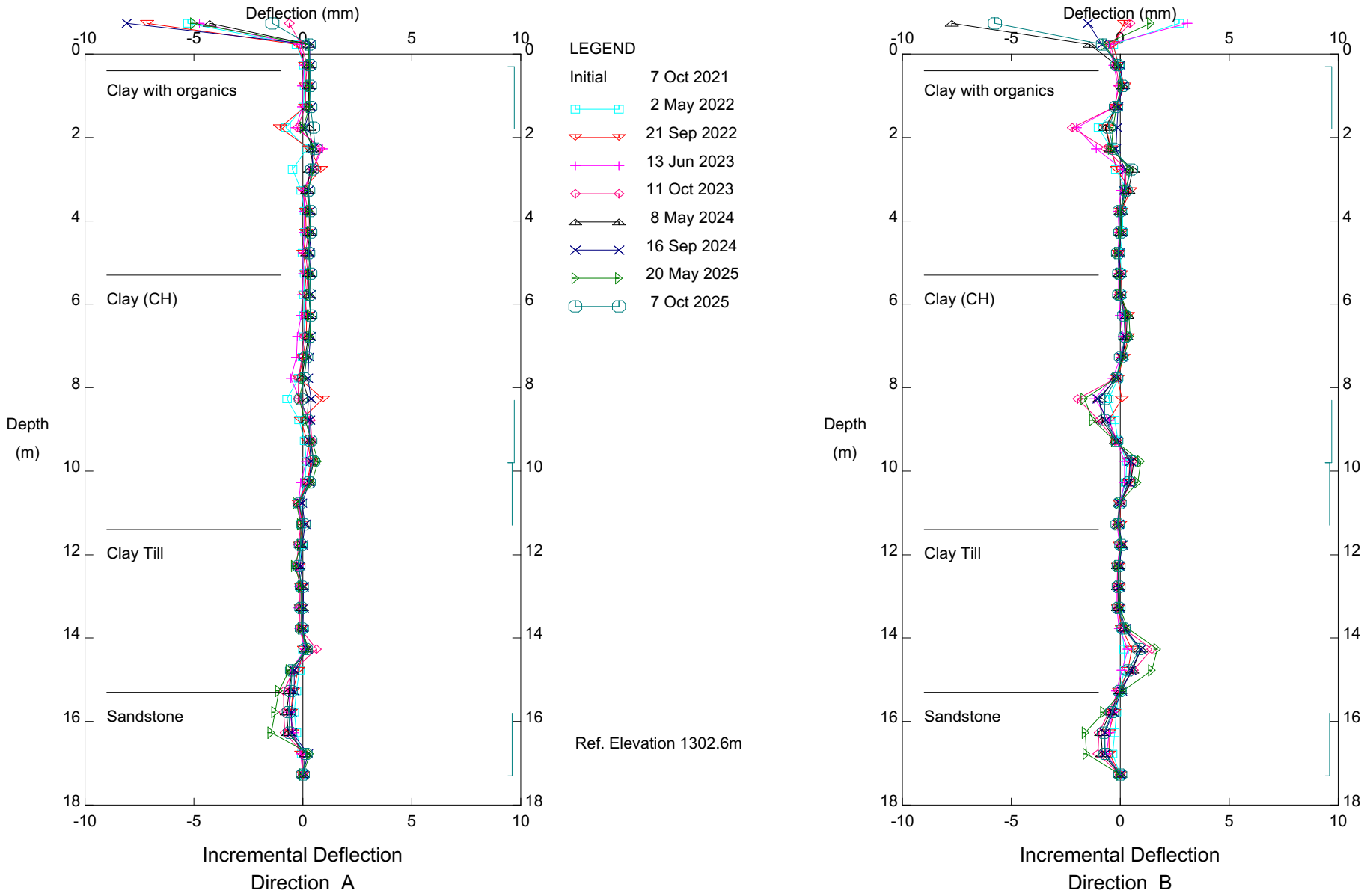

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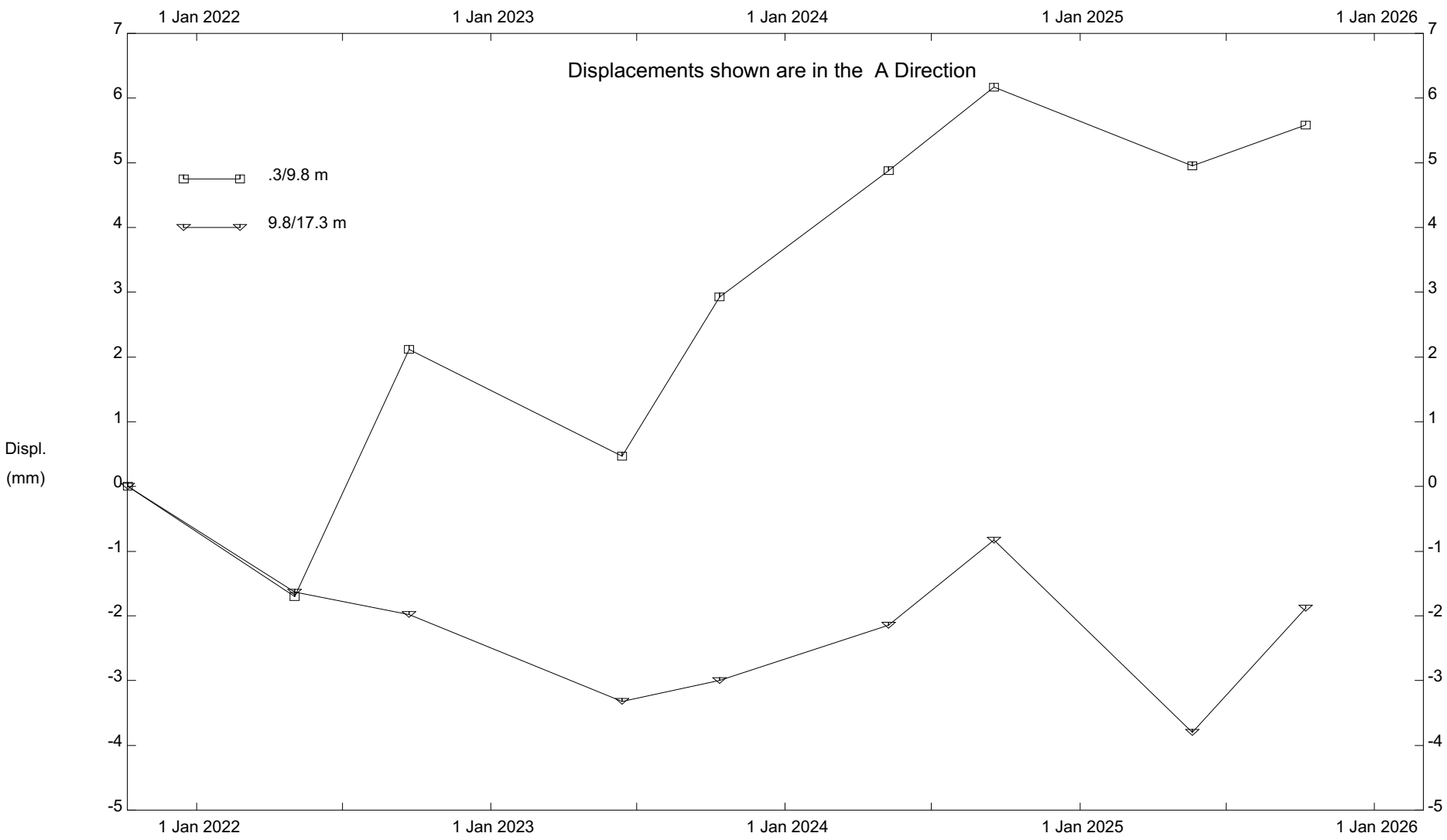

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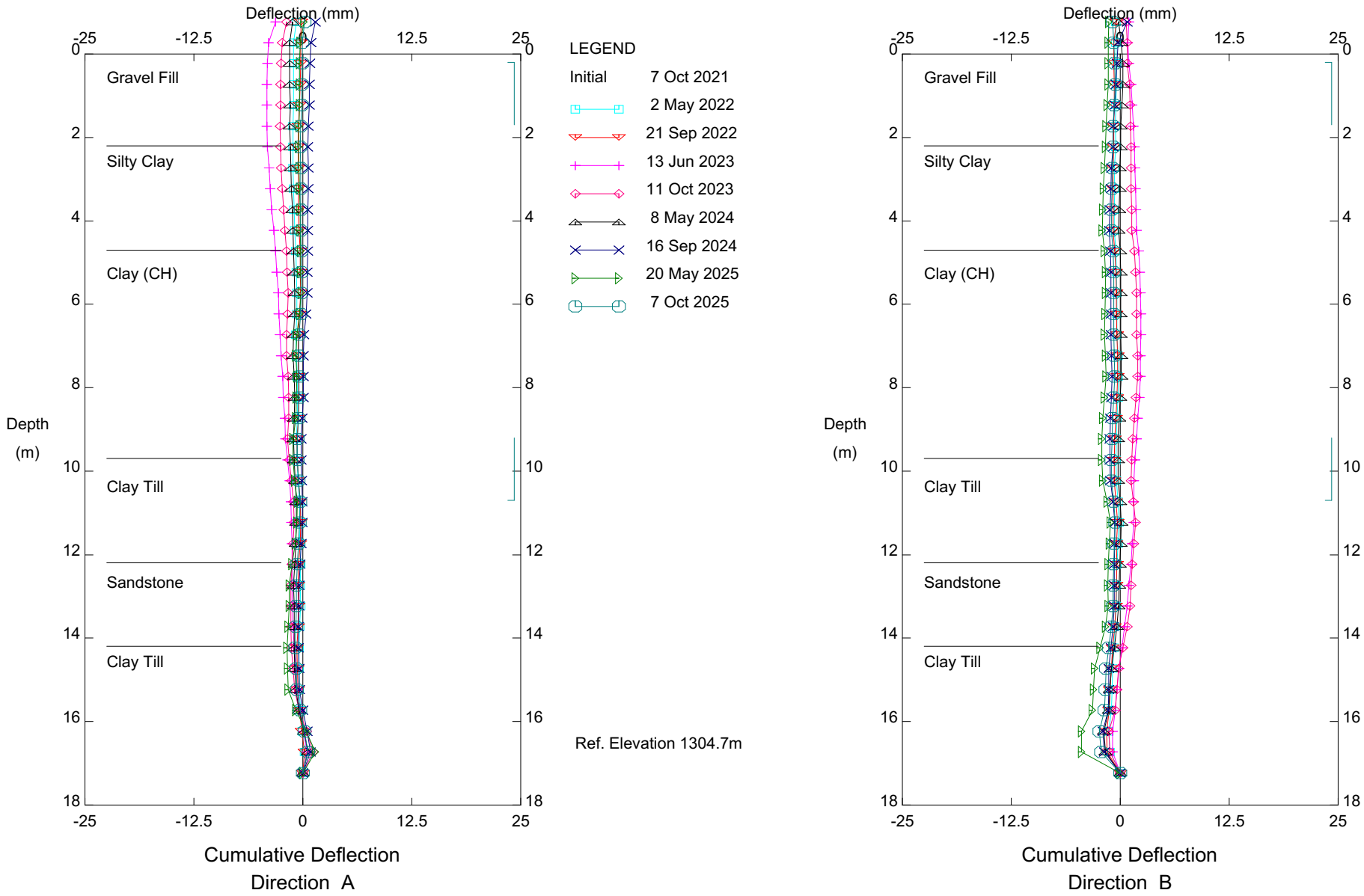

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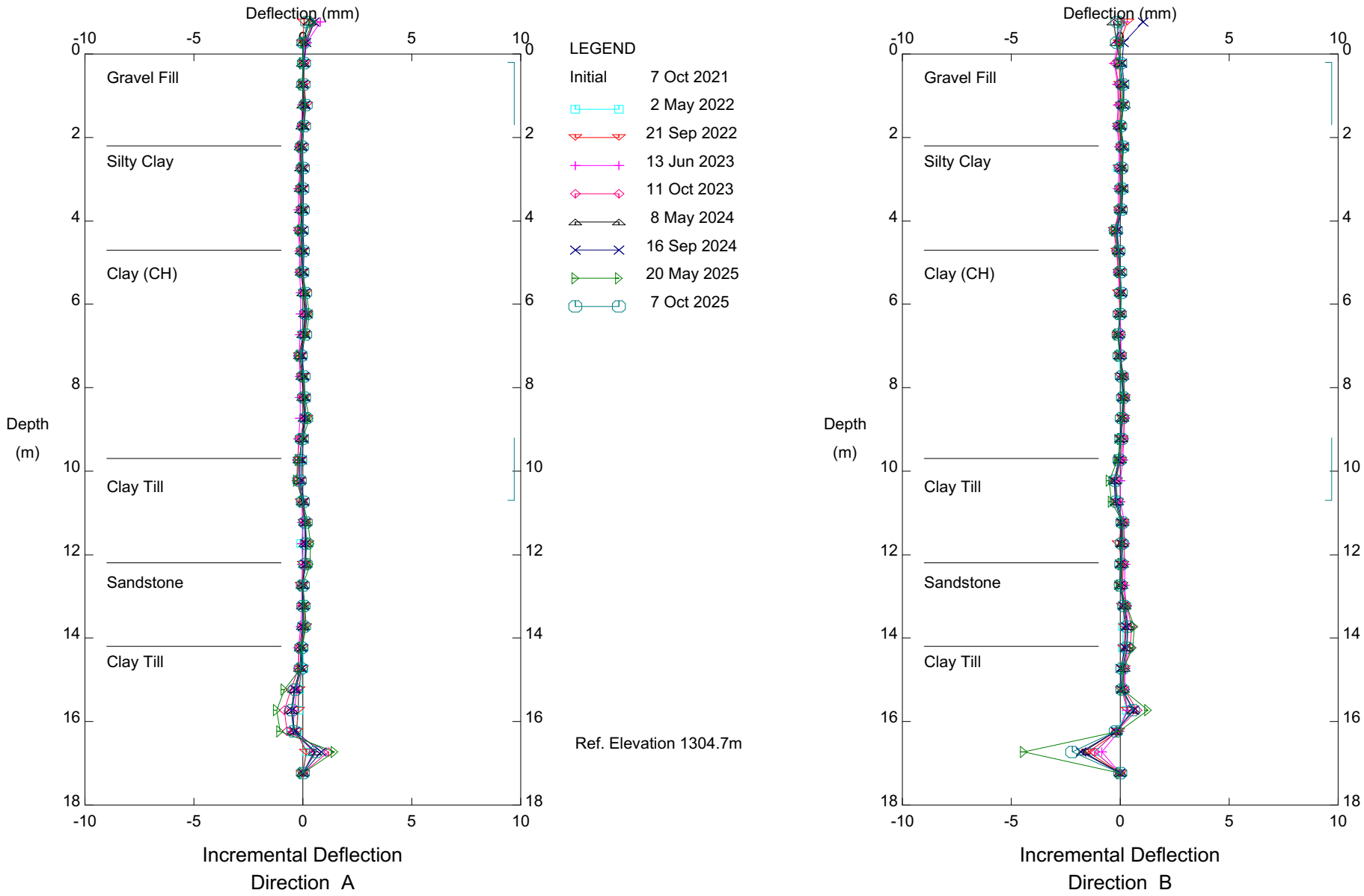

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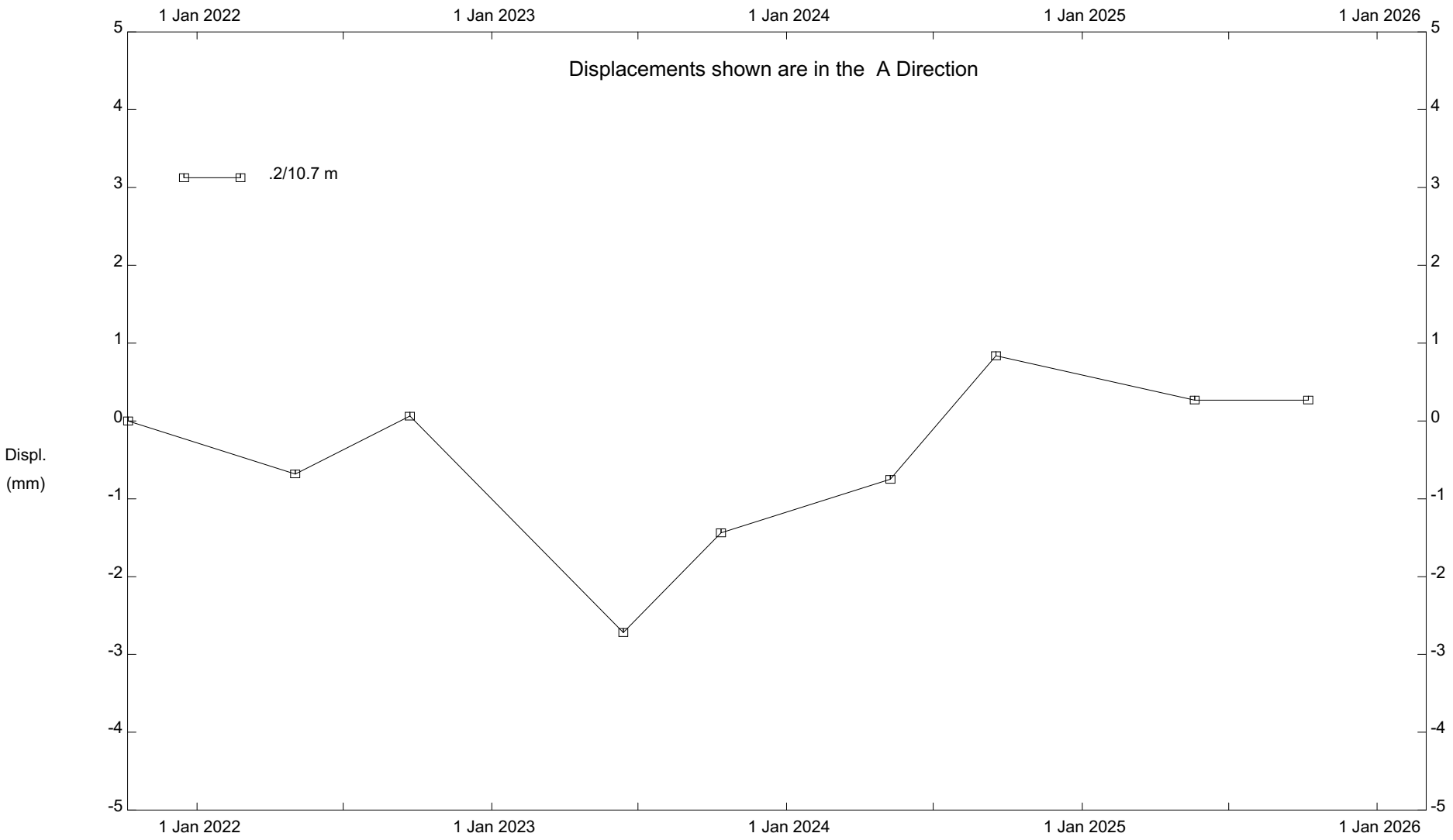

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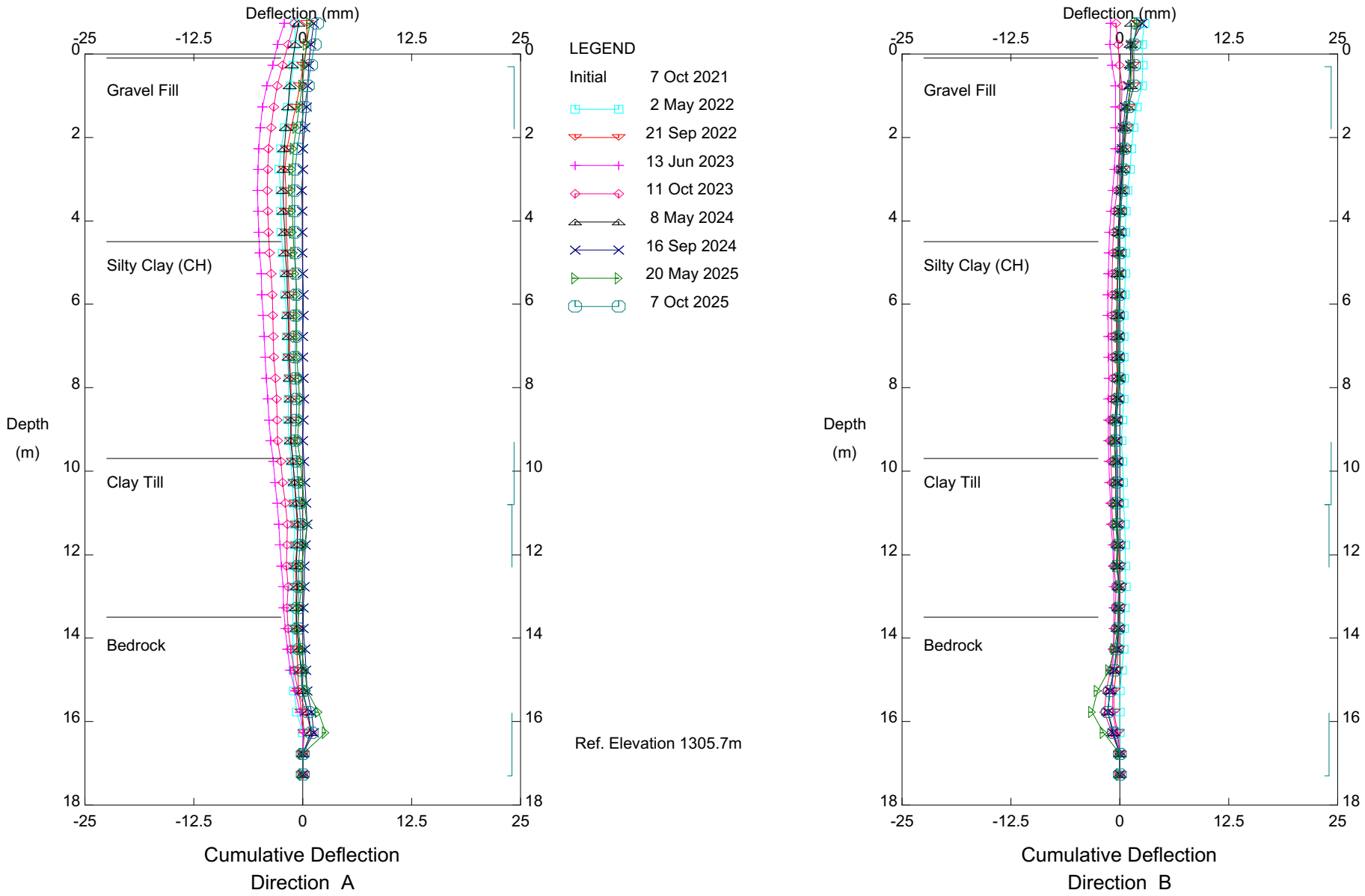

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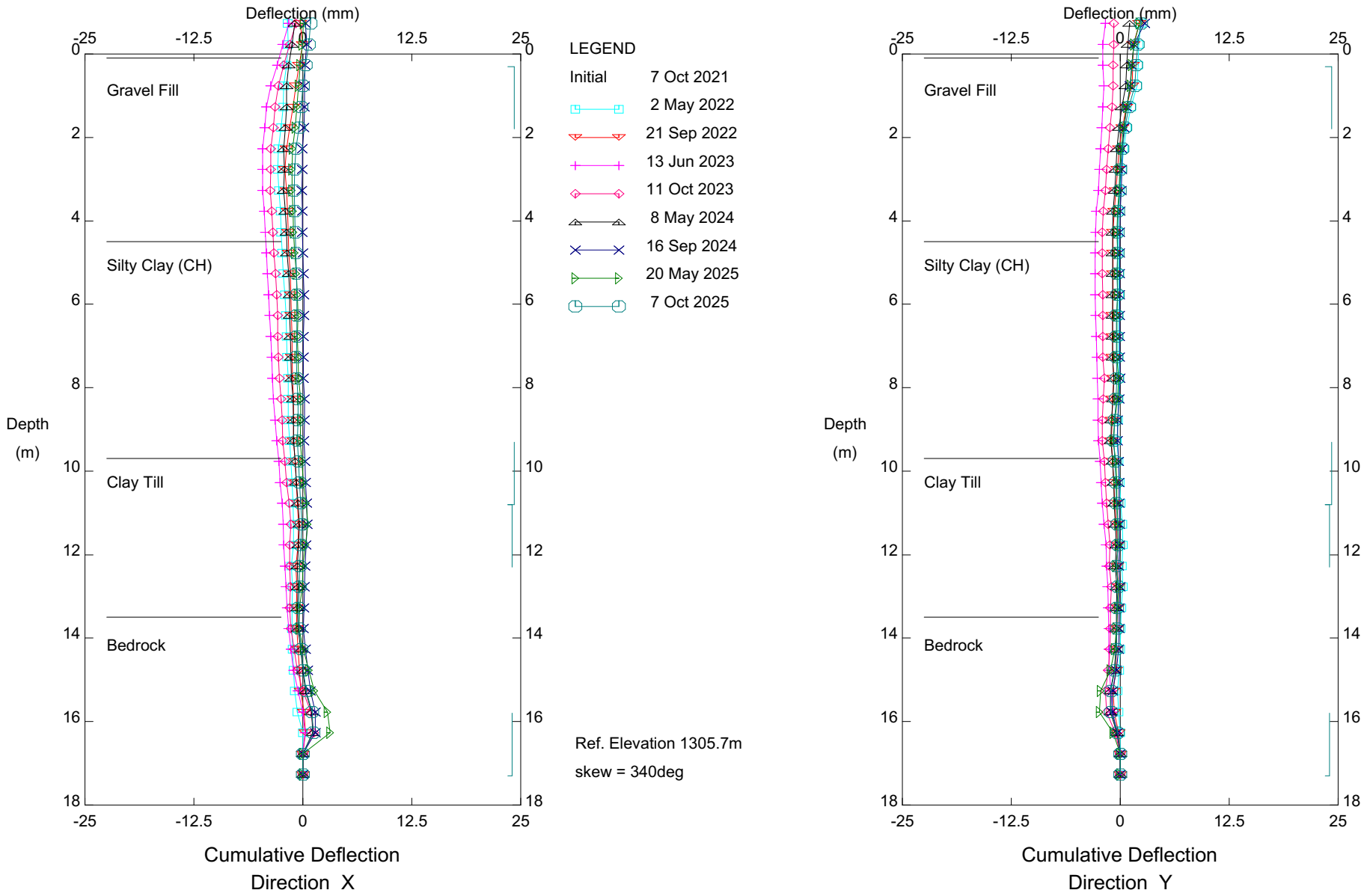

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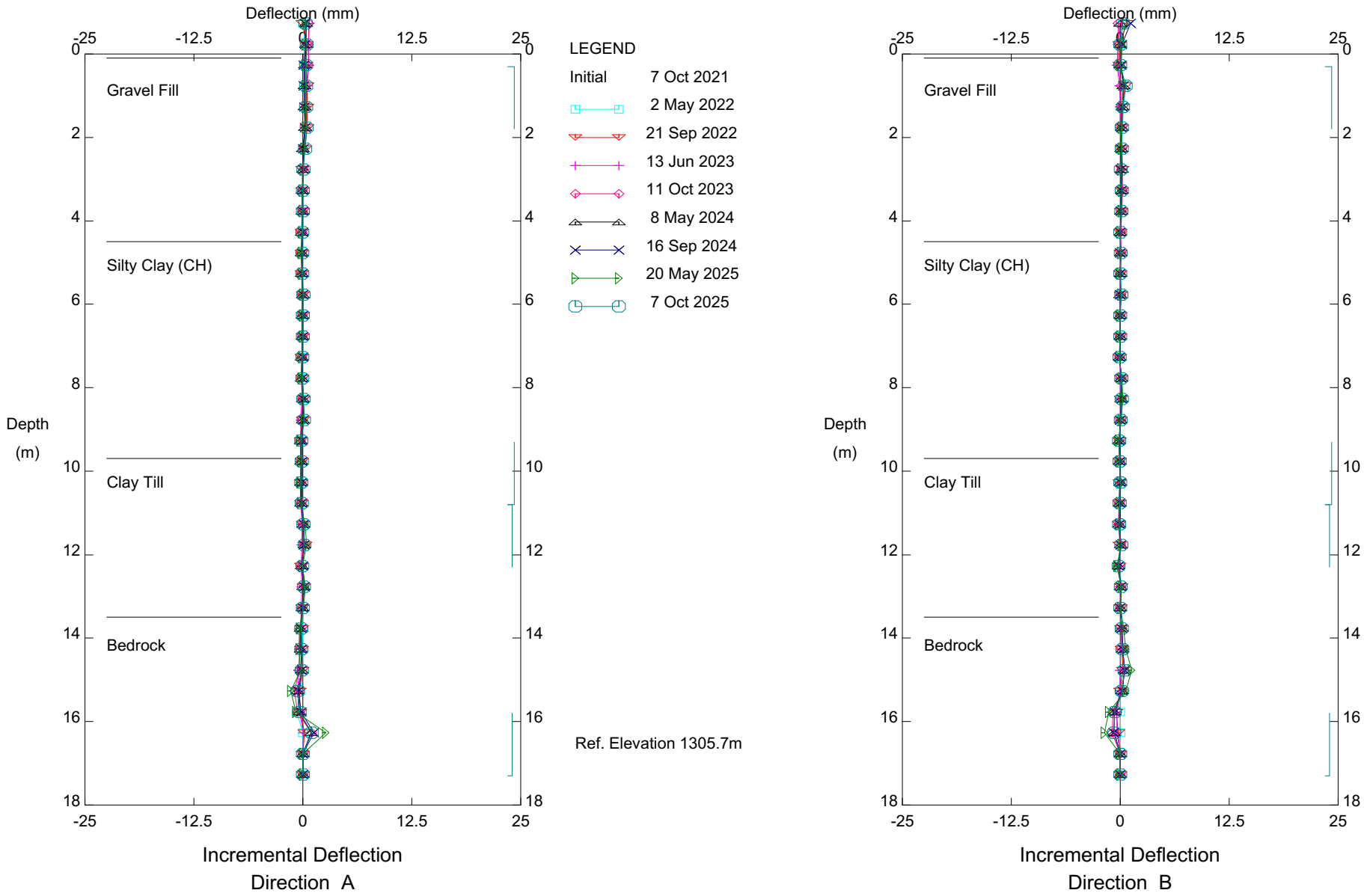

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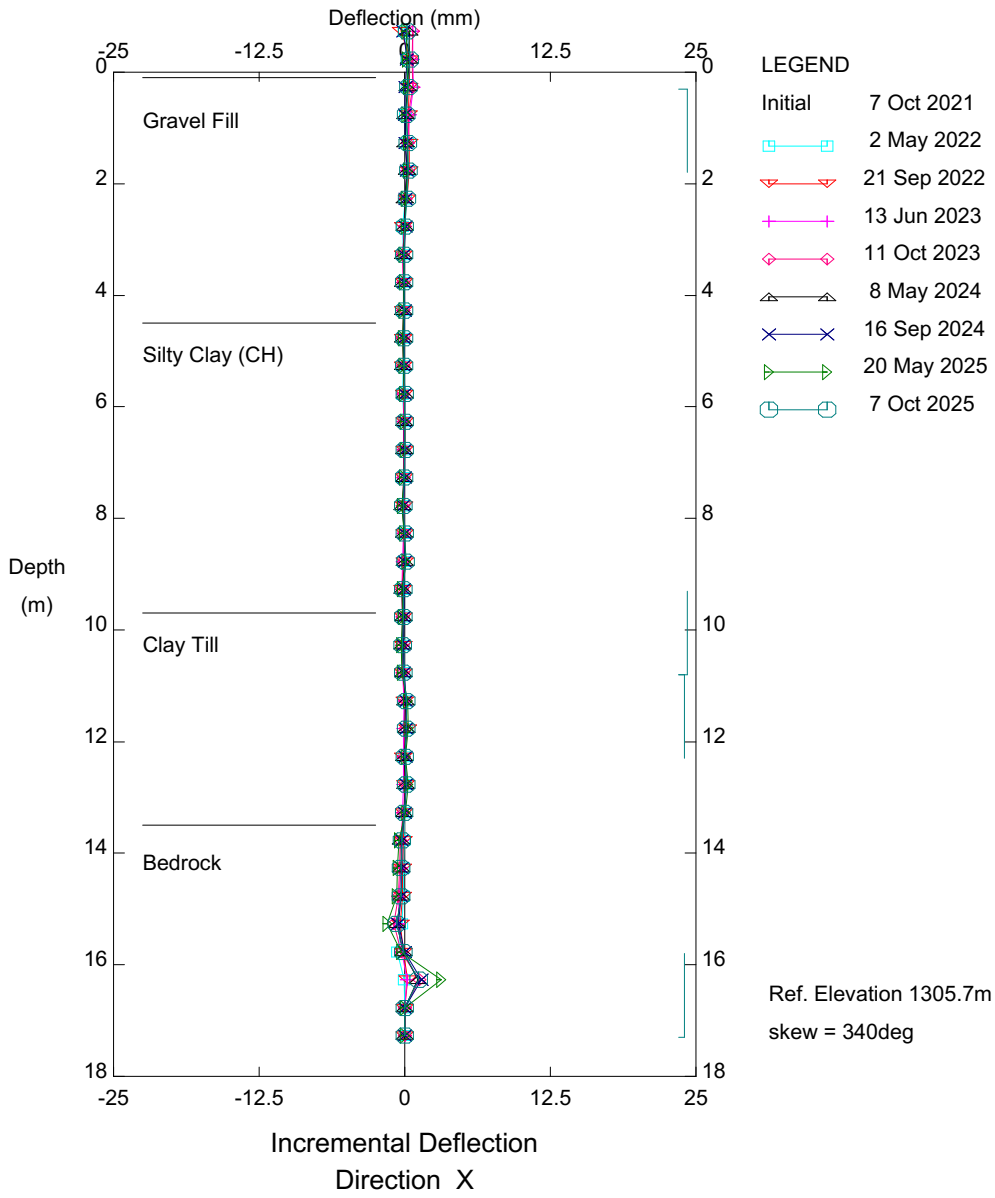

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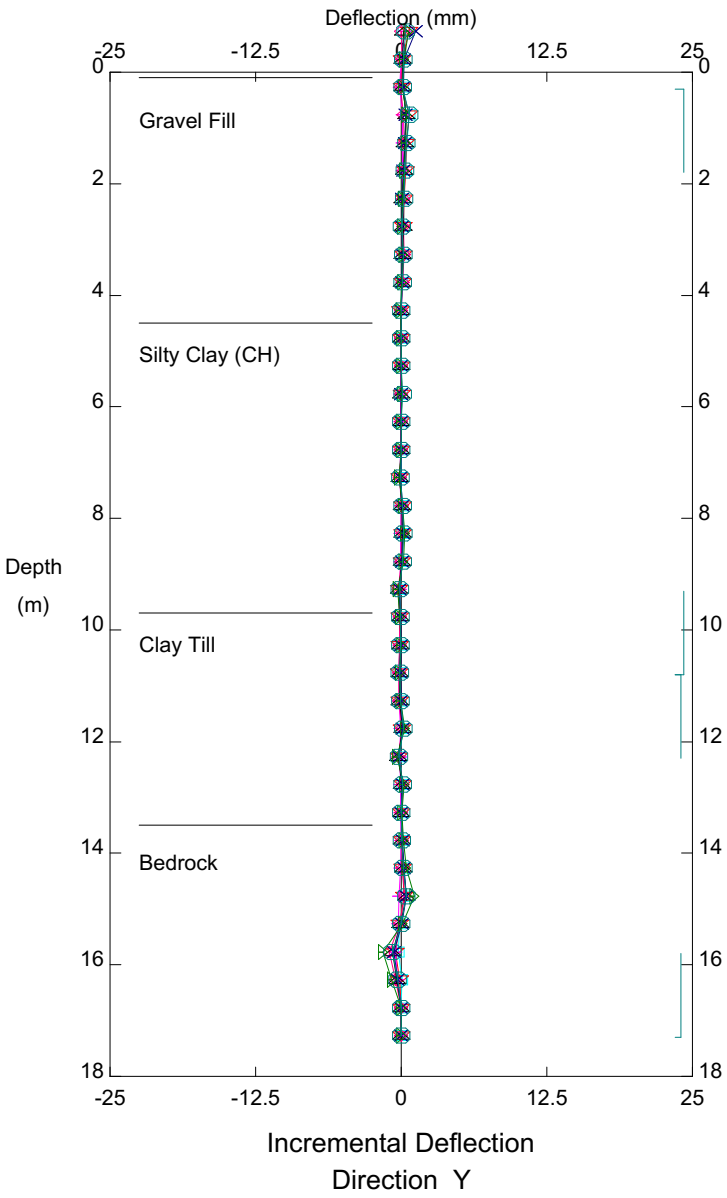
skew = 340deg



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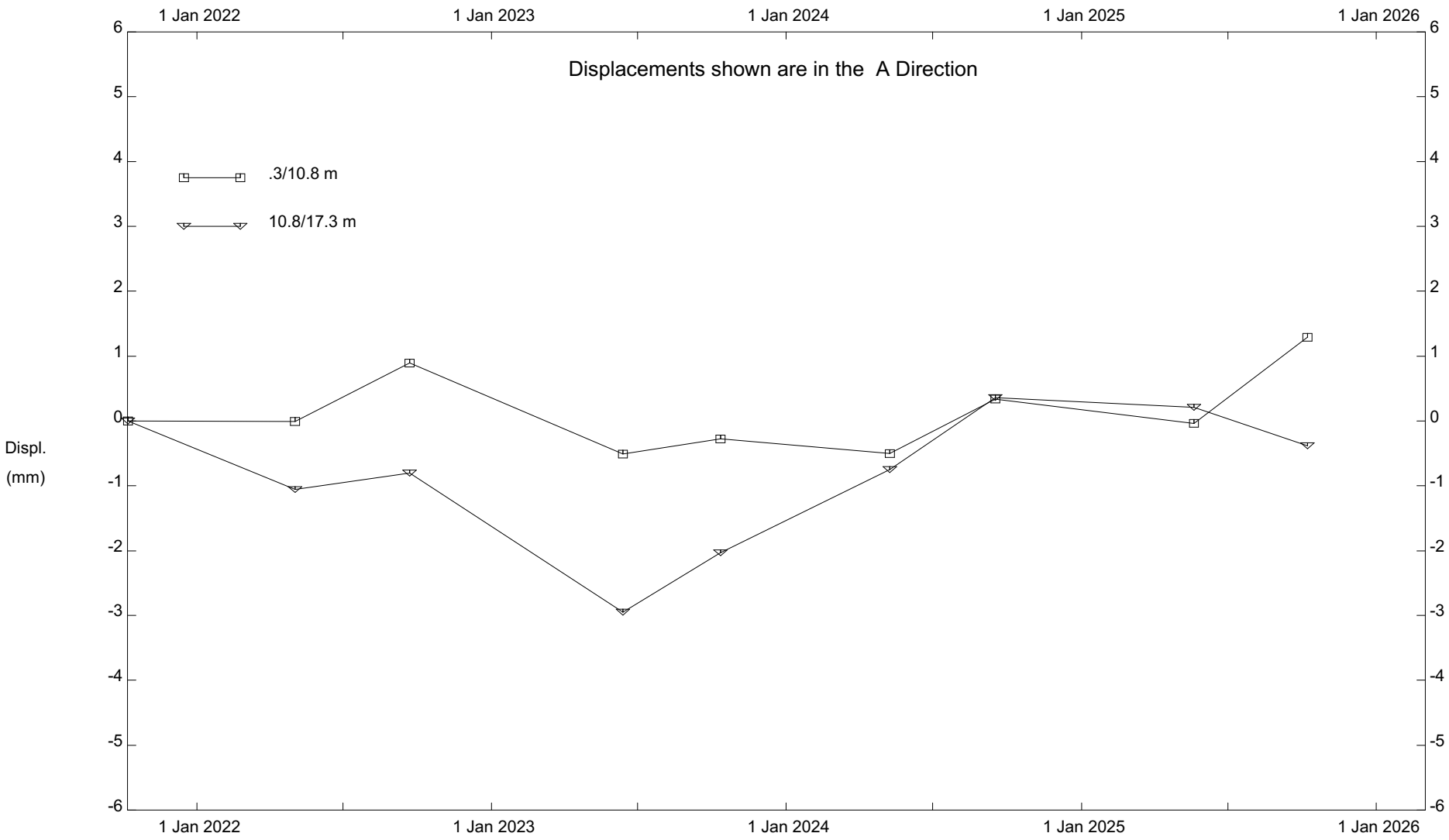

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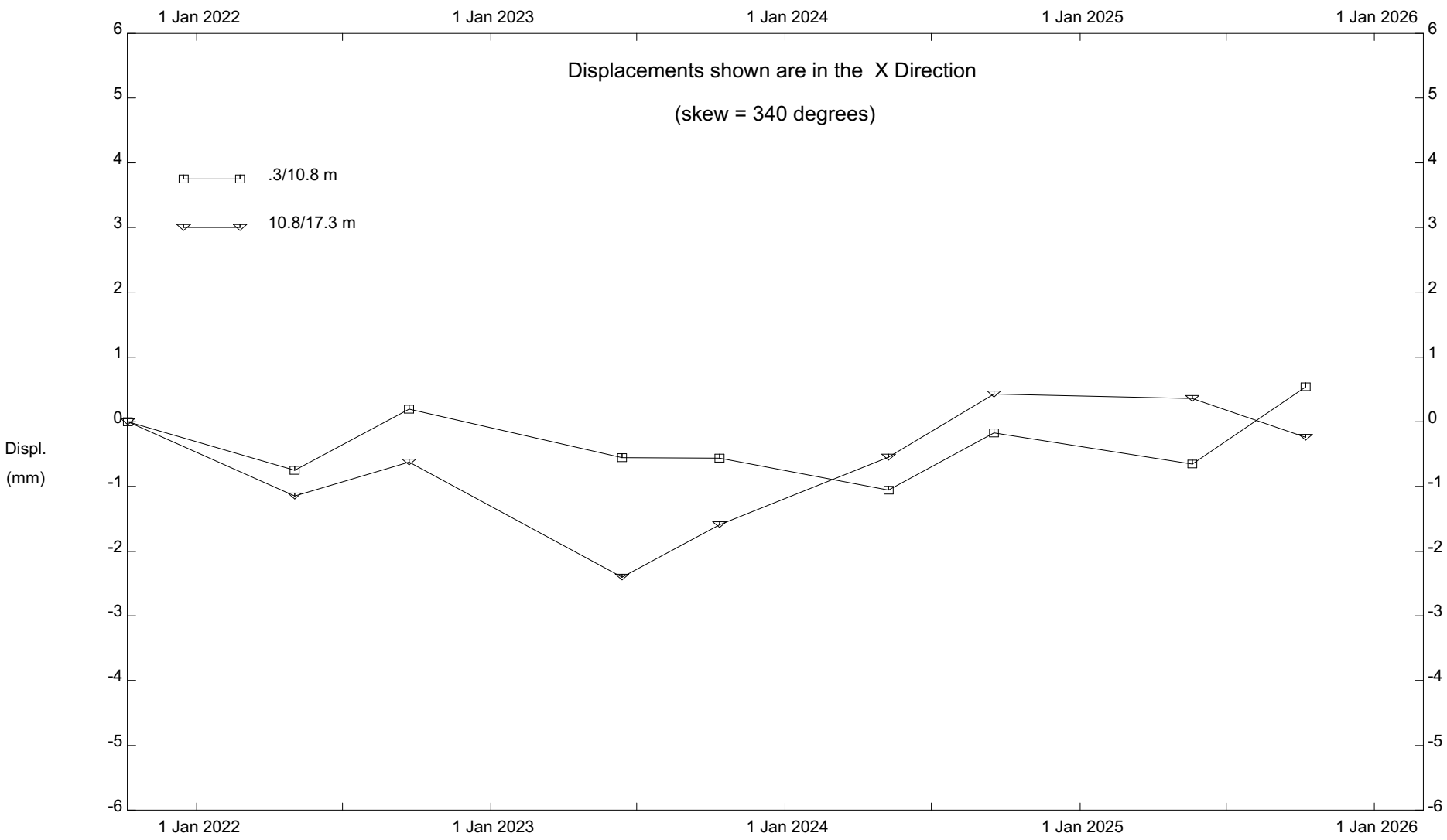

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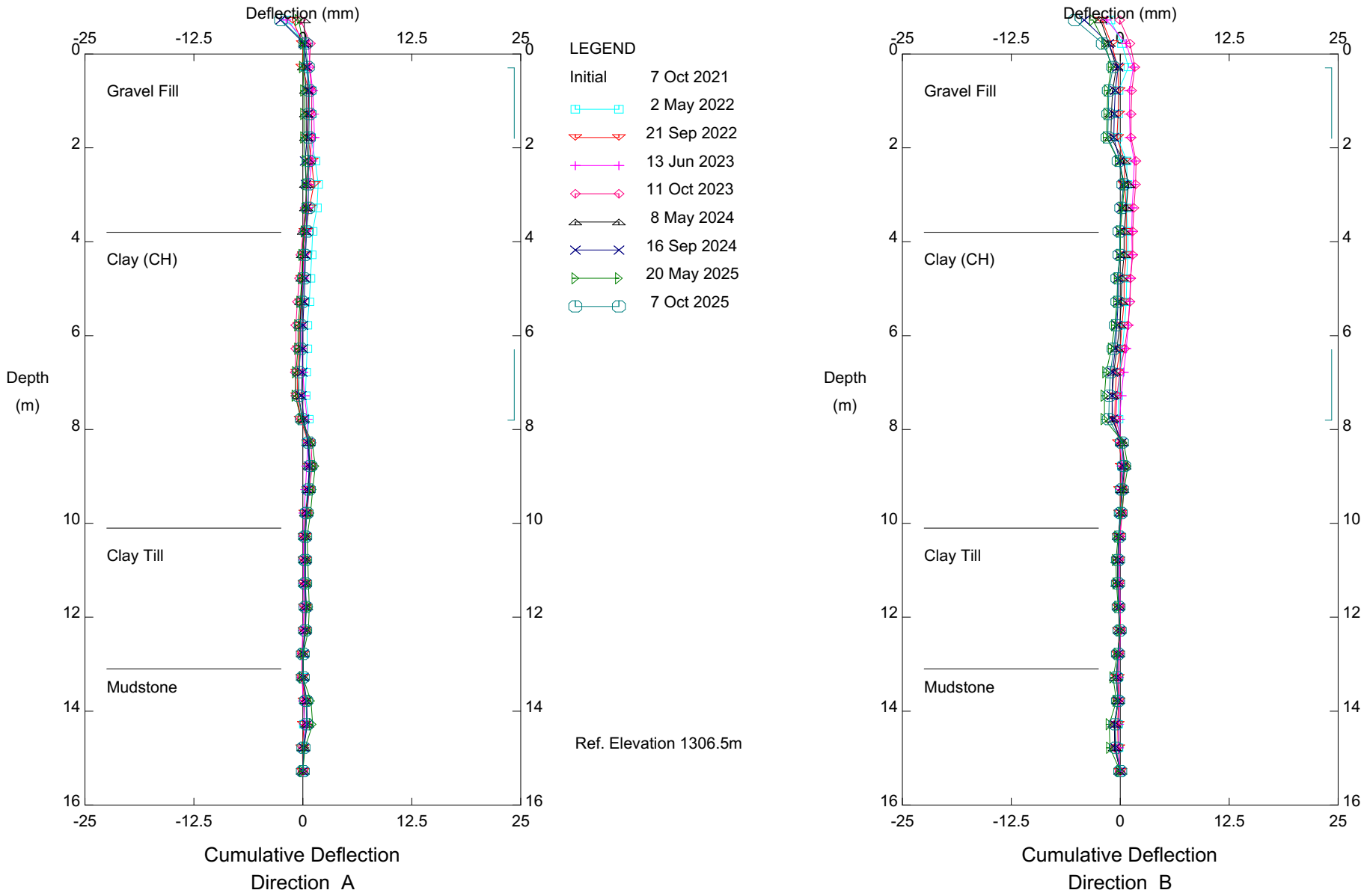

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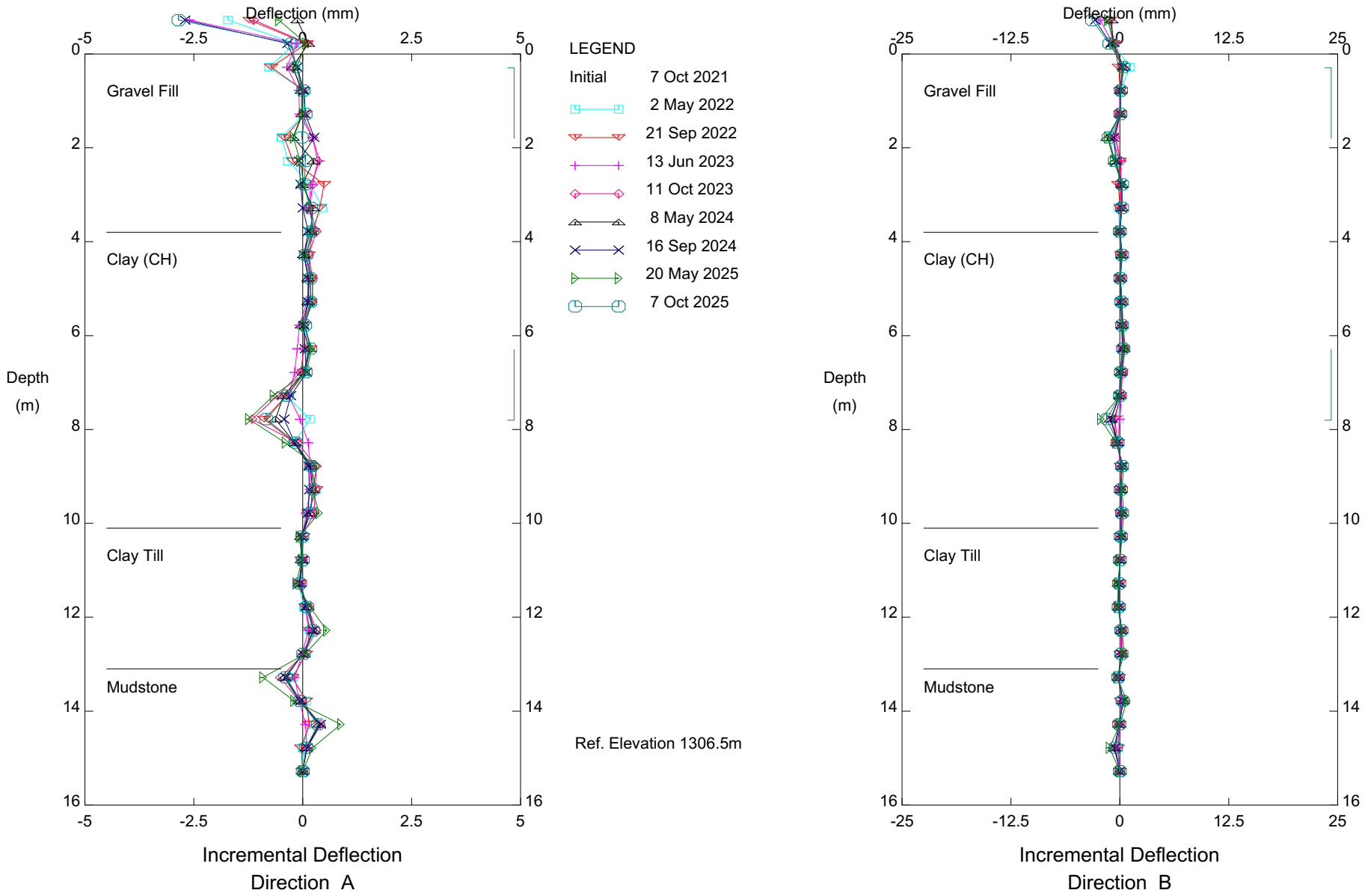

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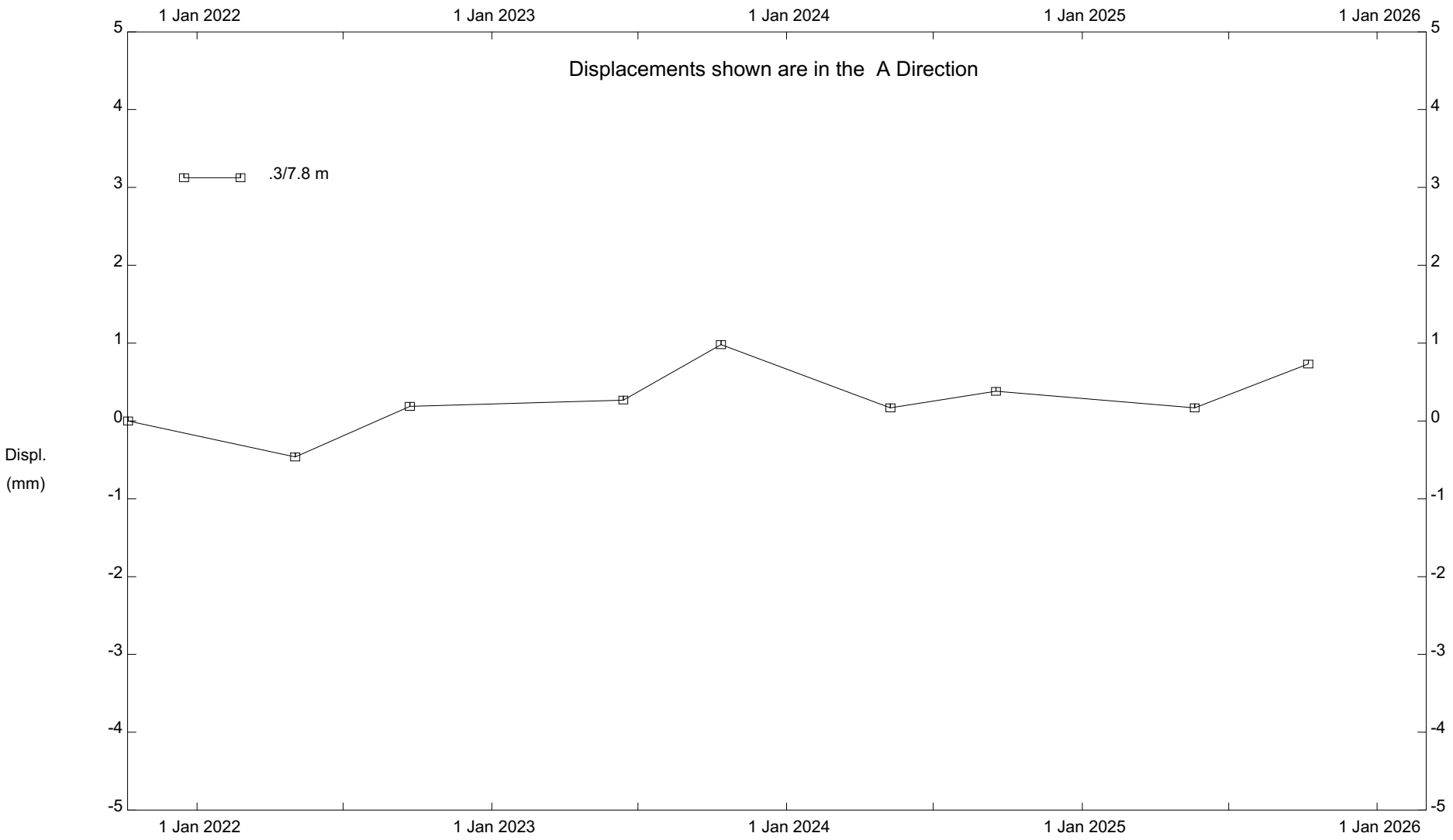
Alberta Transportation

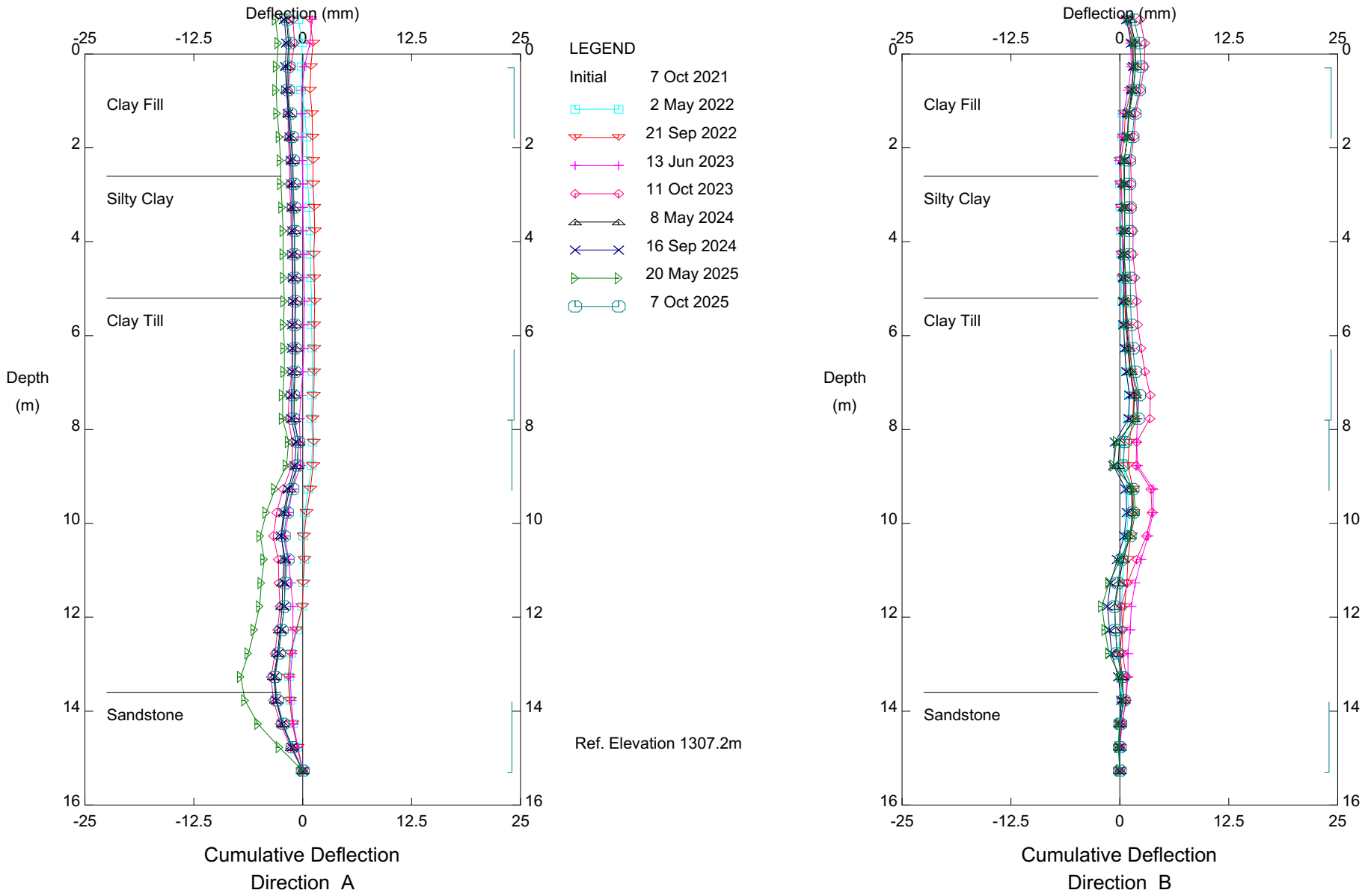
Klohn Crippen Berger - Calgary



S008; H762:02, Fisher Creek, Inclinometer PILE43

Alberta Transportation

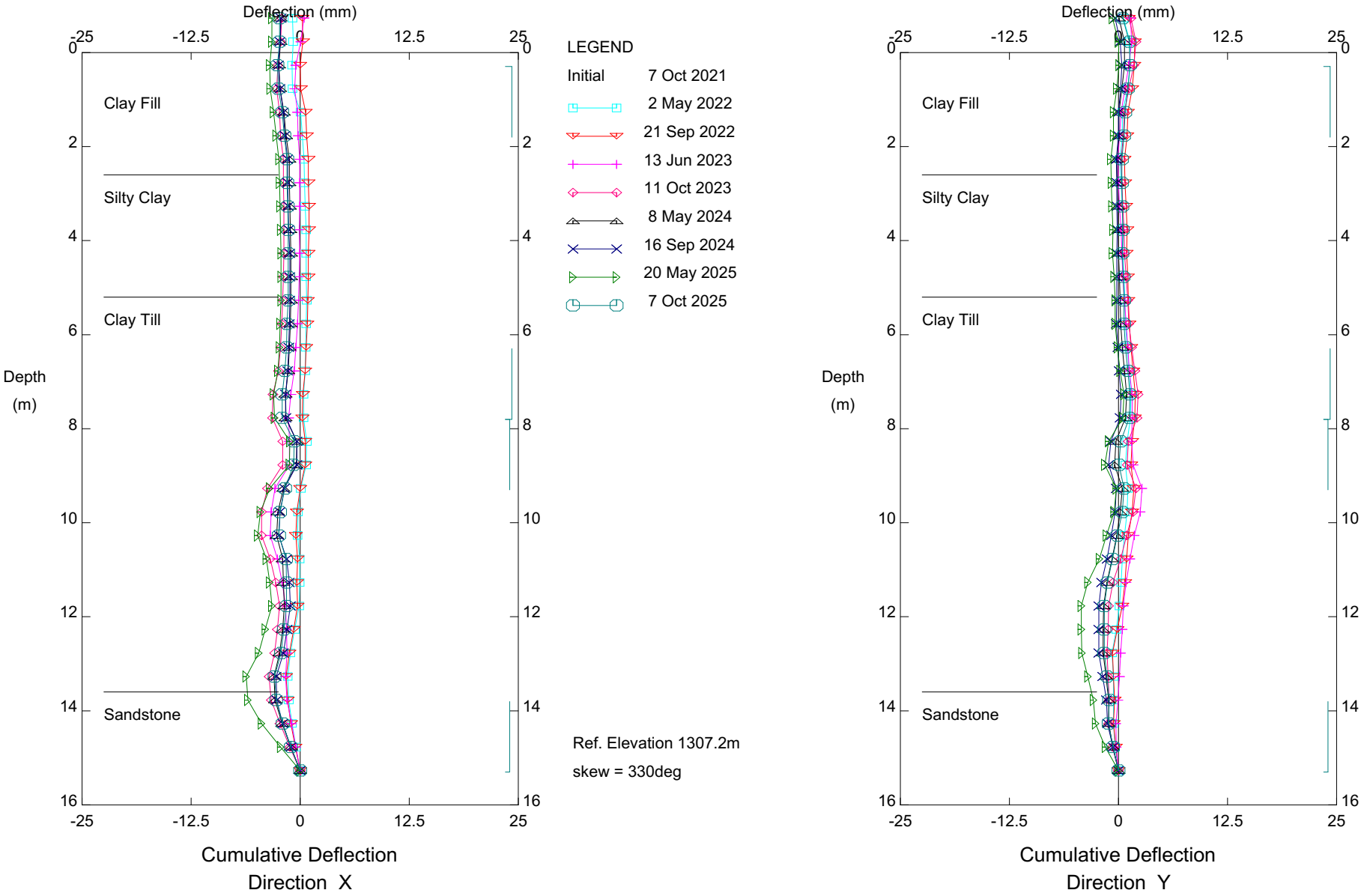
Klohn Crippen Berger - Calgary



S008; H762:02, Fisher Creek, Inclinometer PILE49

Alberta Transportation

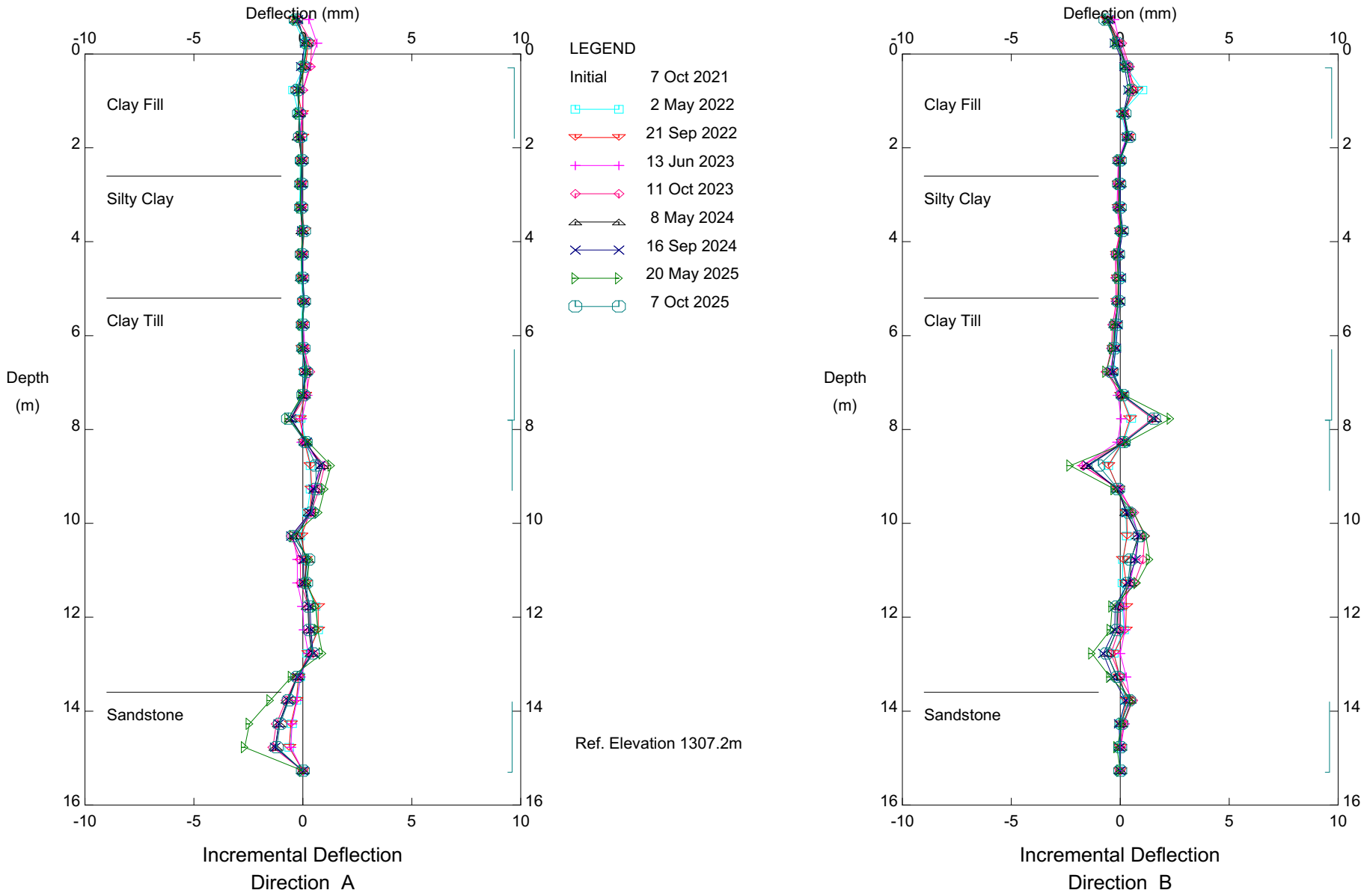
Klohn Crippen Berger - Calgary



S008; H762:02, Fisher Creek, Inclinometer PILE49

Alberta Transportation

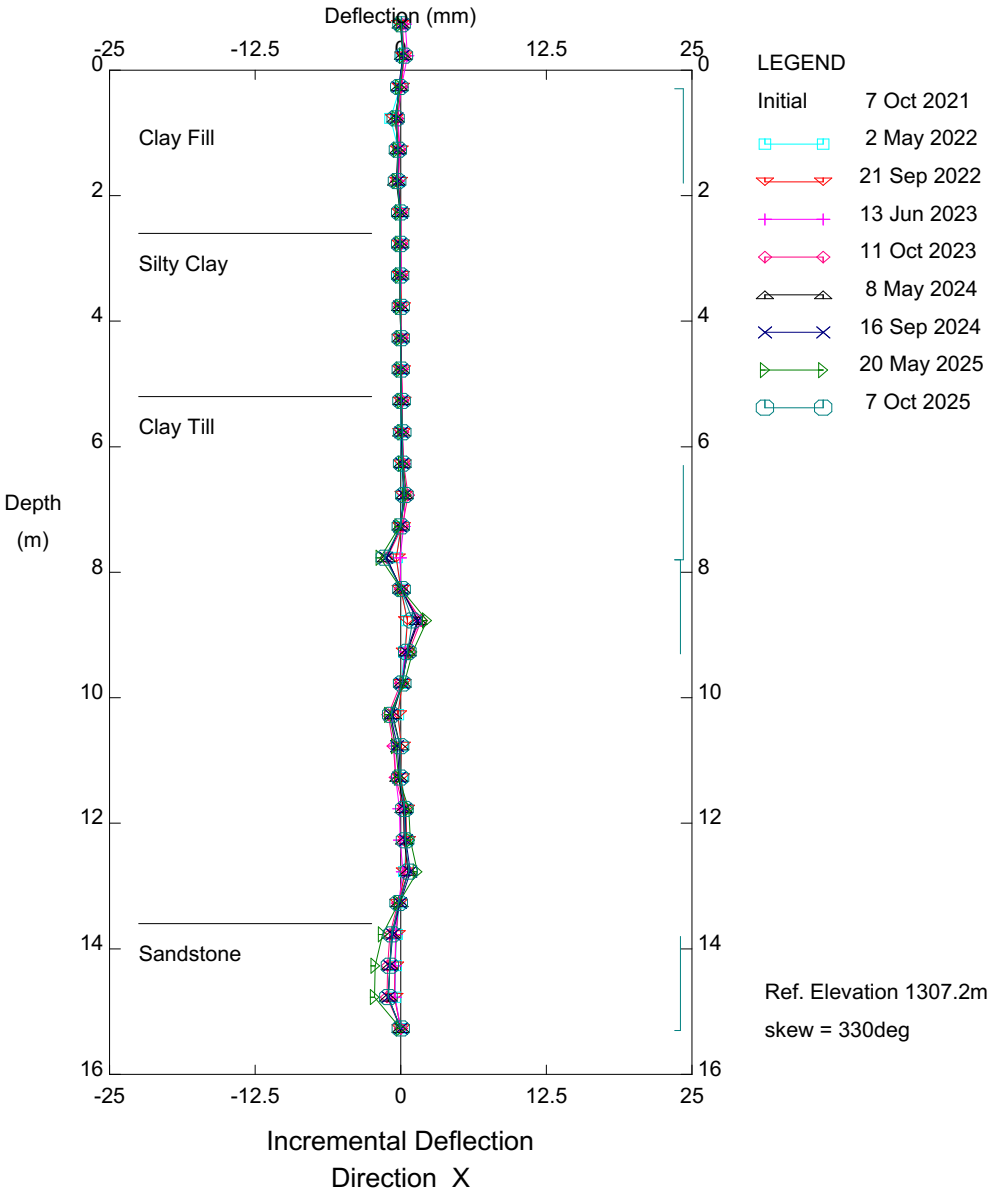
Klohn Crippen Berger - Calgary



S008; H762:02, Fisher Creek, Inclinometer PILE49

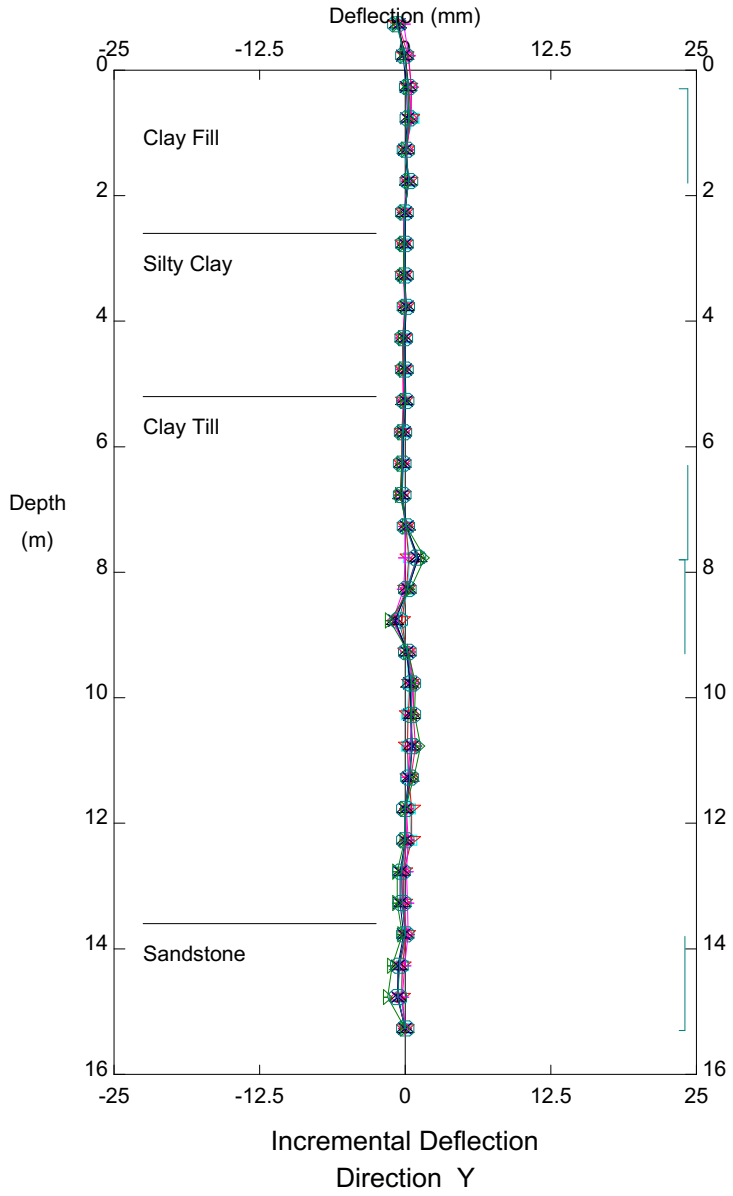
Alberta Transportation

Klohn Crippen Berger - Calgary



Ref. Elevation 1307.2m

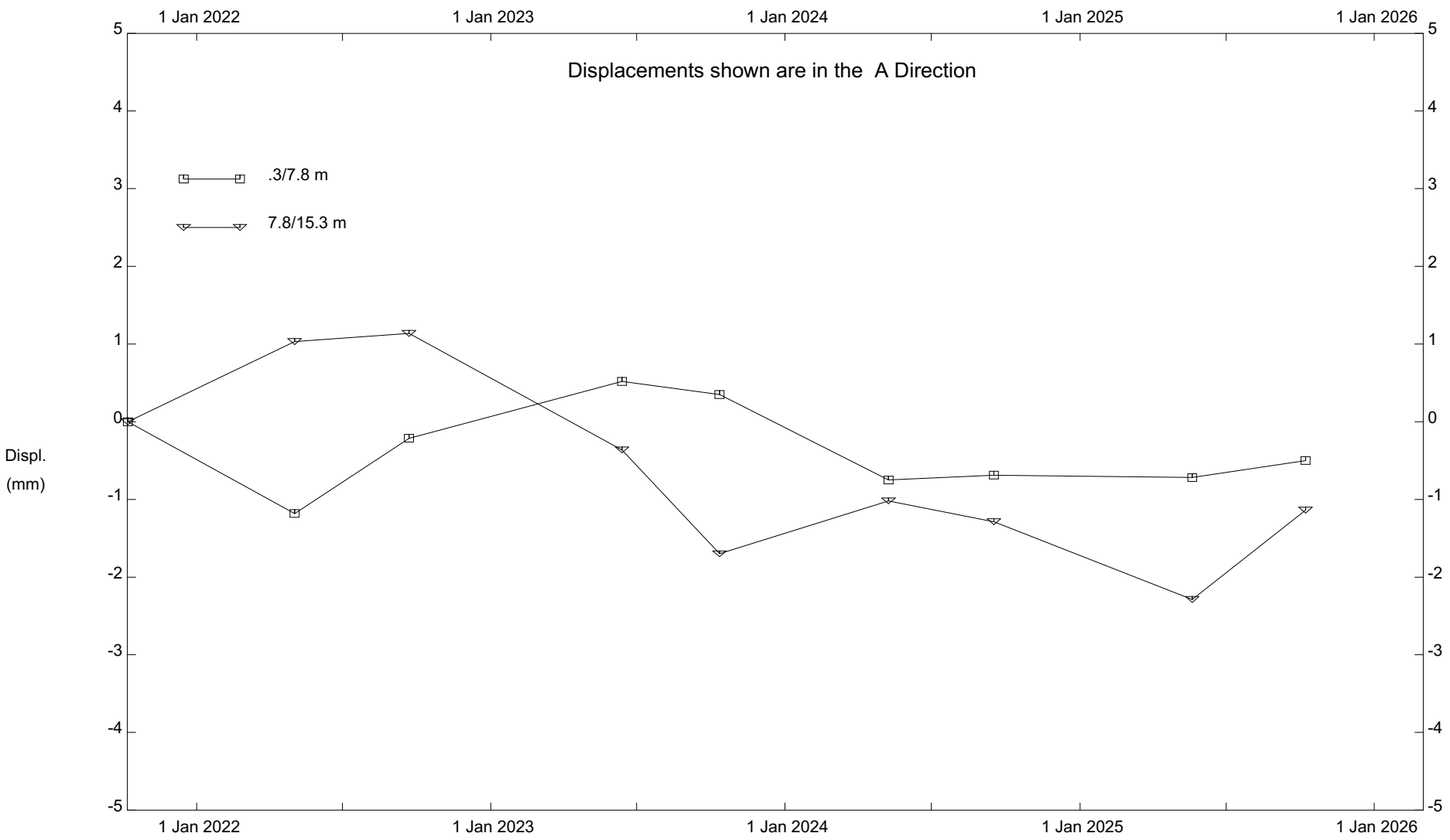
skew = 330deg



S008; H762:02, Fisher Creek, Inclinometer PILE49

Alberta Transportation

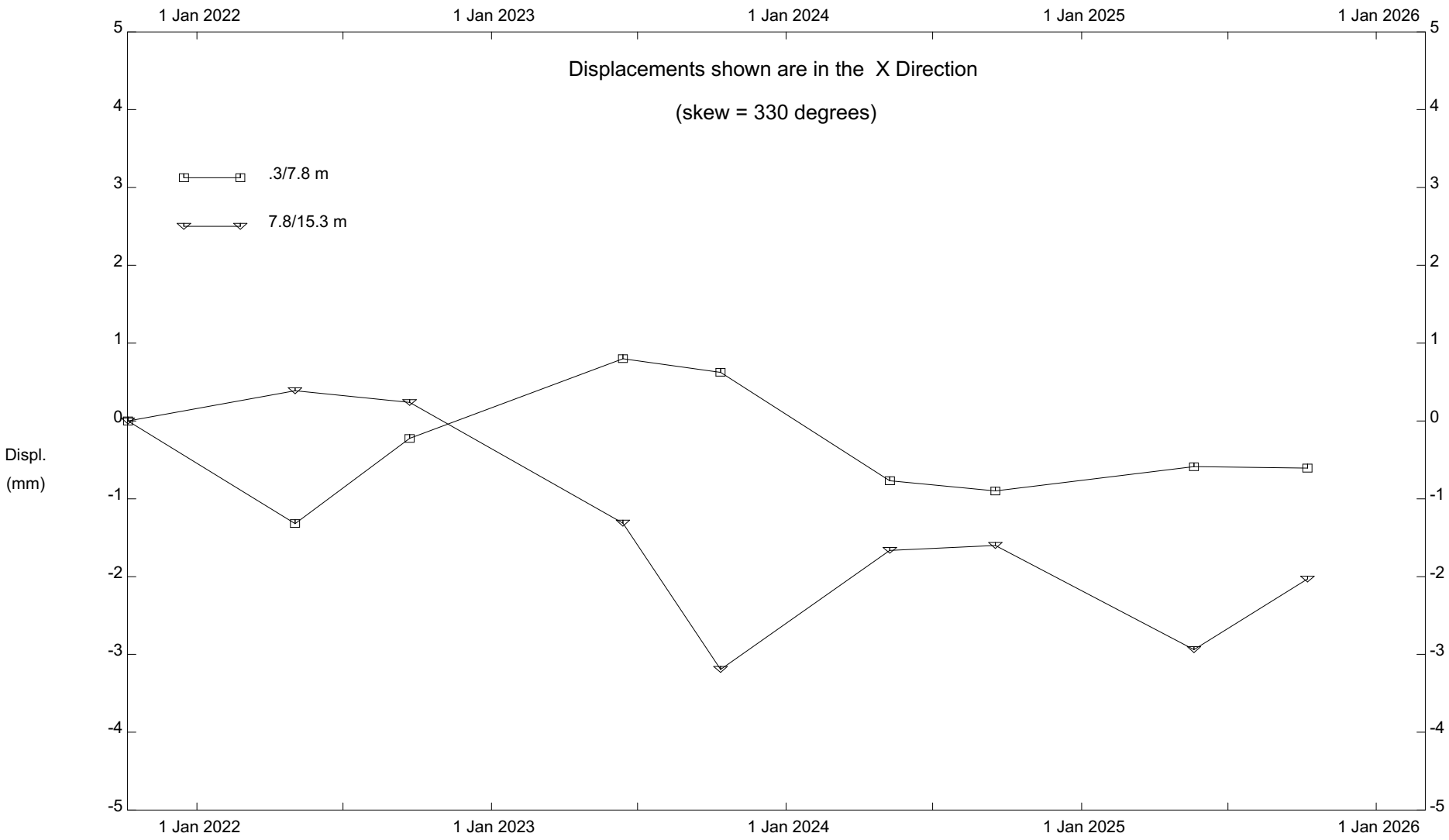
Klohn Crippen Berger - Calgary



S008; H762:02, Fisher Creek, Inclinometer PILE49

Alberta Transportation

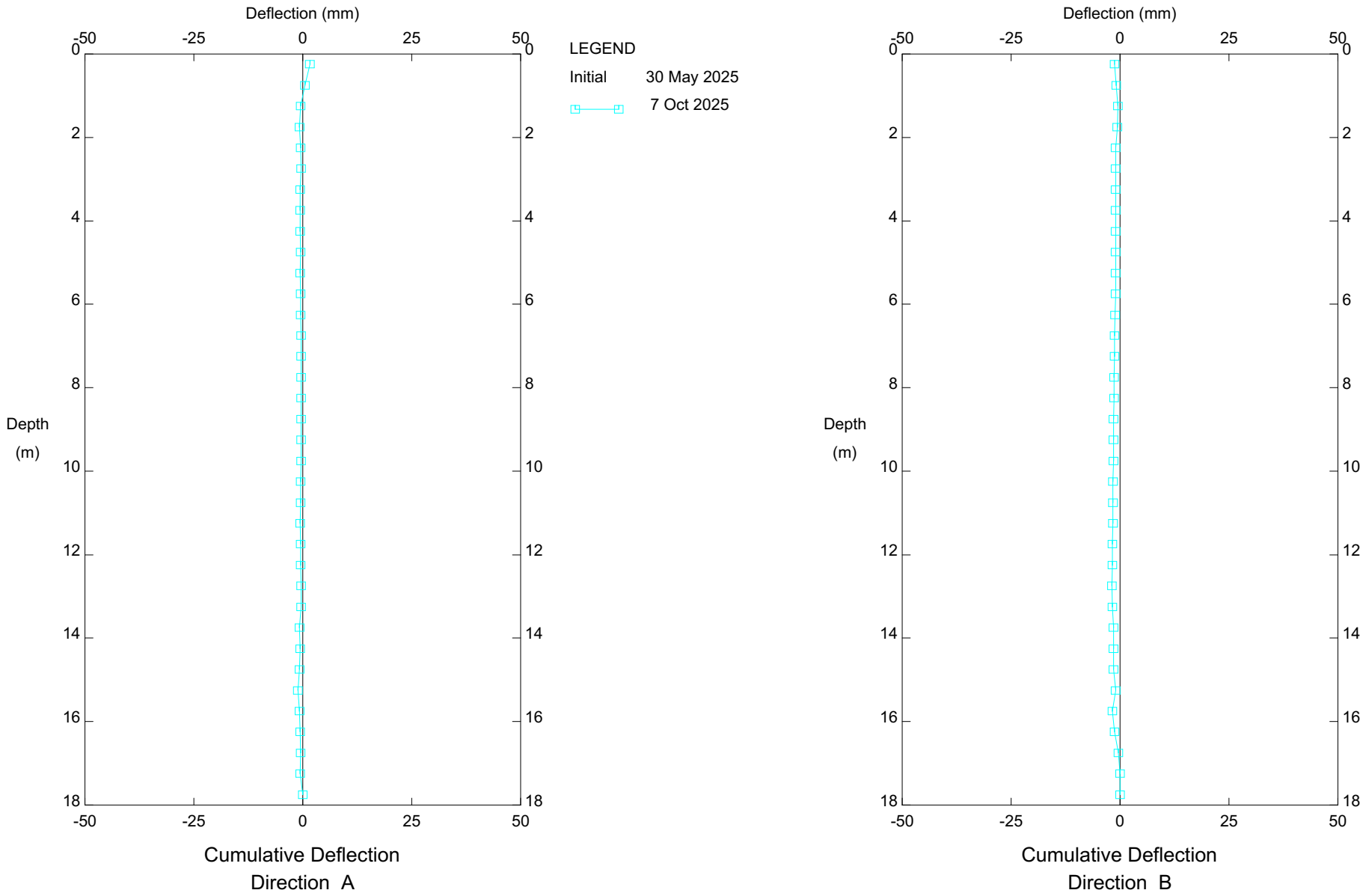
Klohn Crippen Berger - Calgary



S008; H762:02, Fisher Creek, Inclinometer PILE49

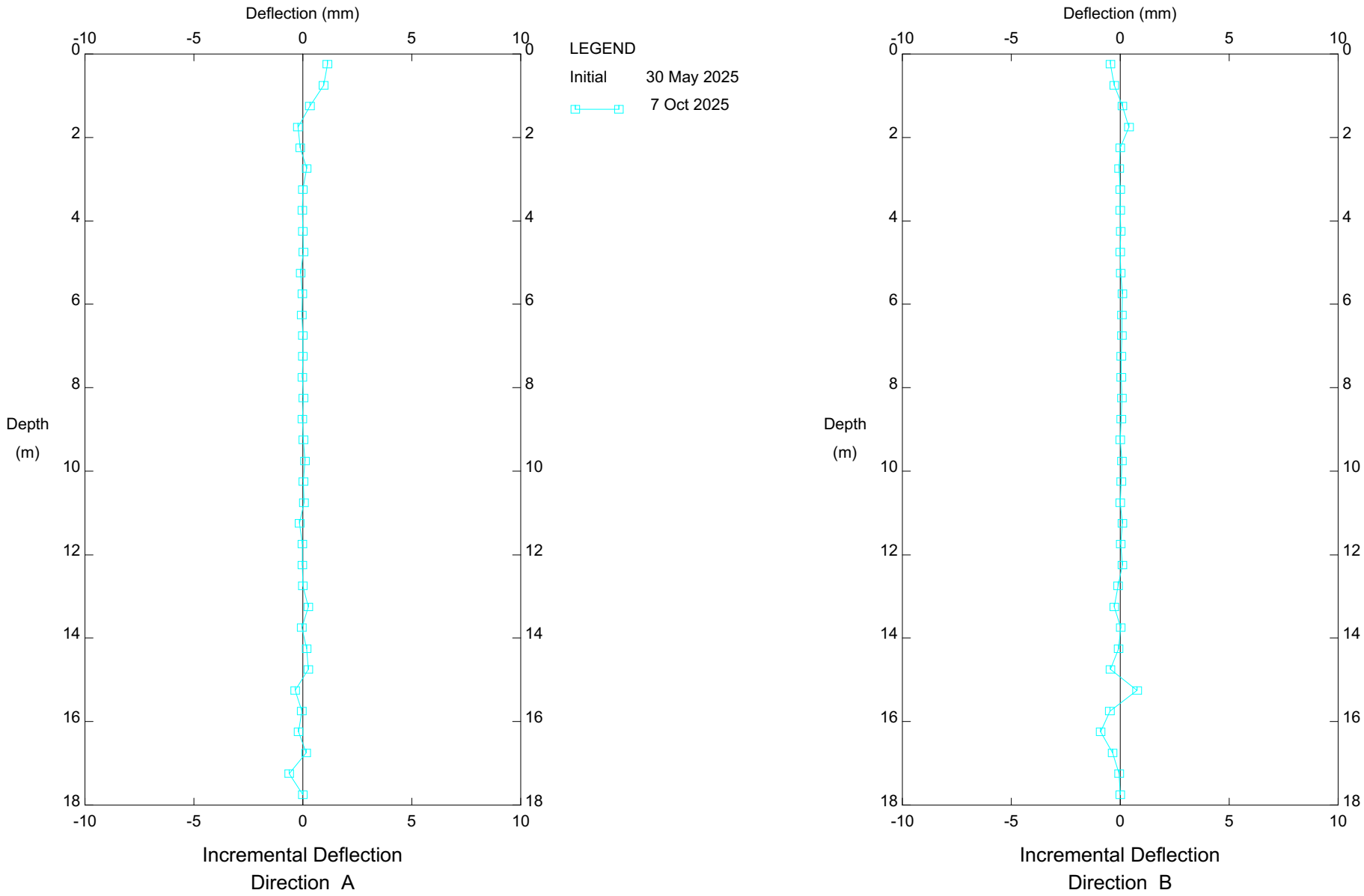
Alberta Transportation

Klohn Crippen Berger - Calgary



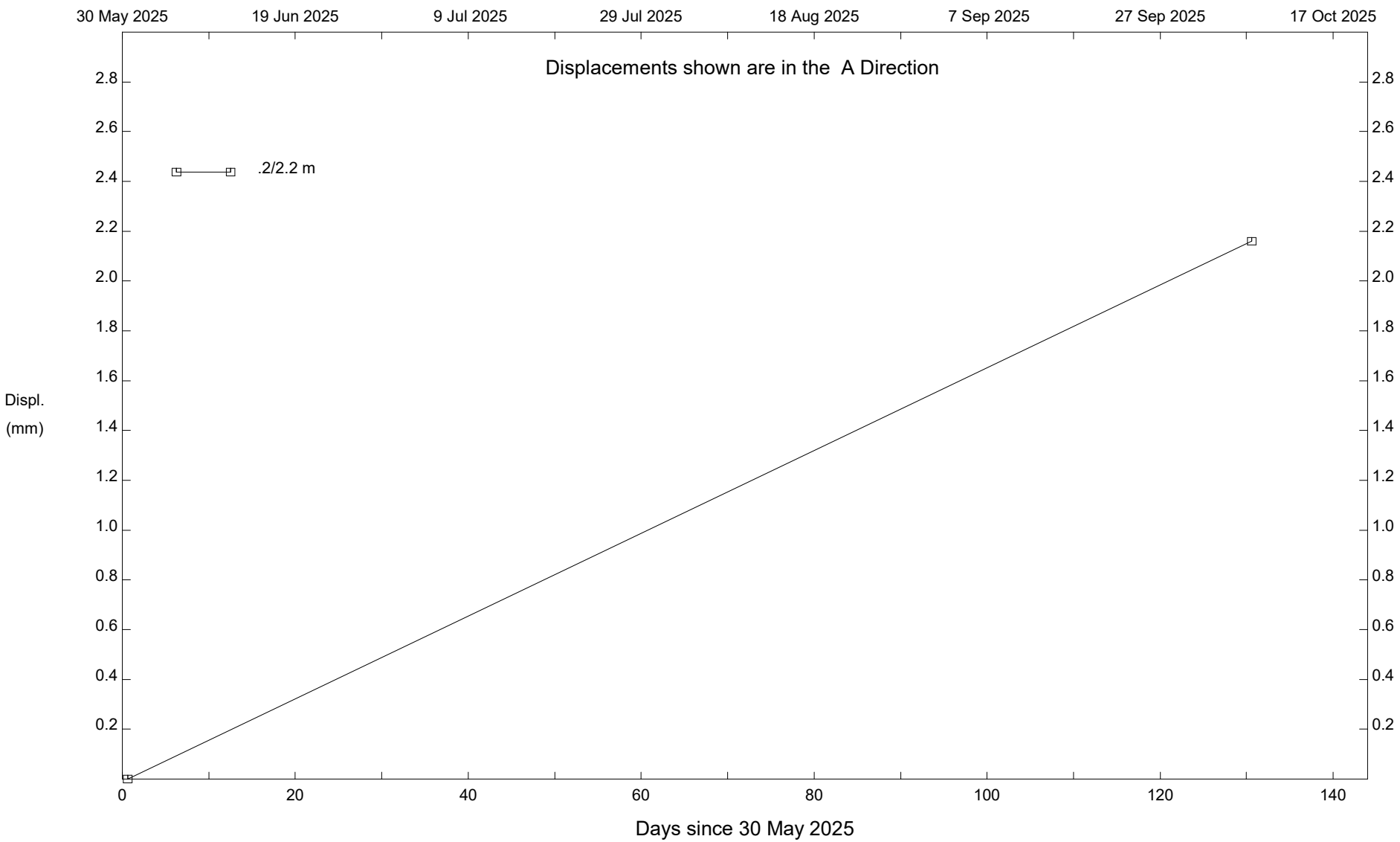
S008, Inclinometer BH25-01

Klohn Crippen Berger - Calgary

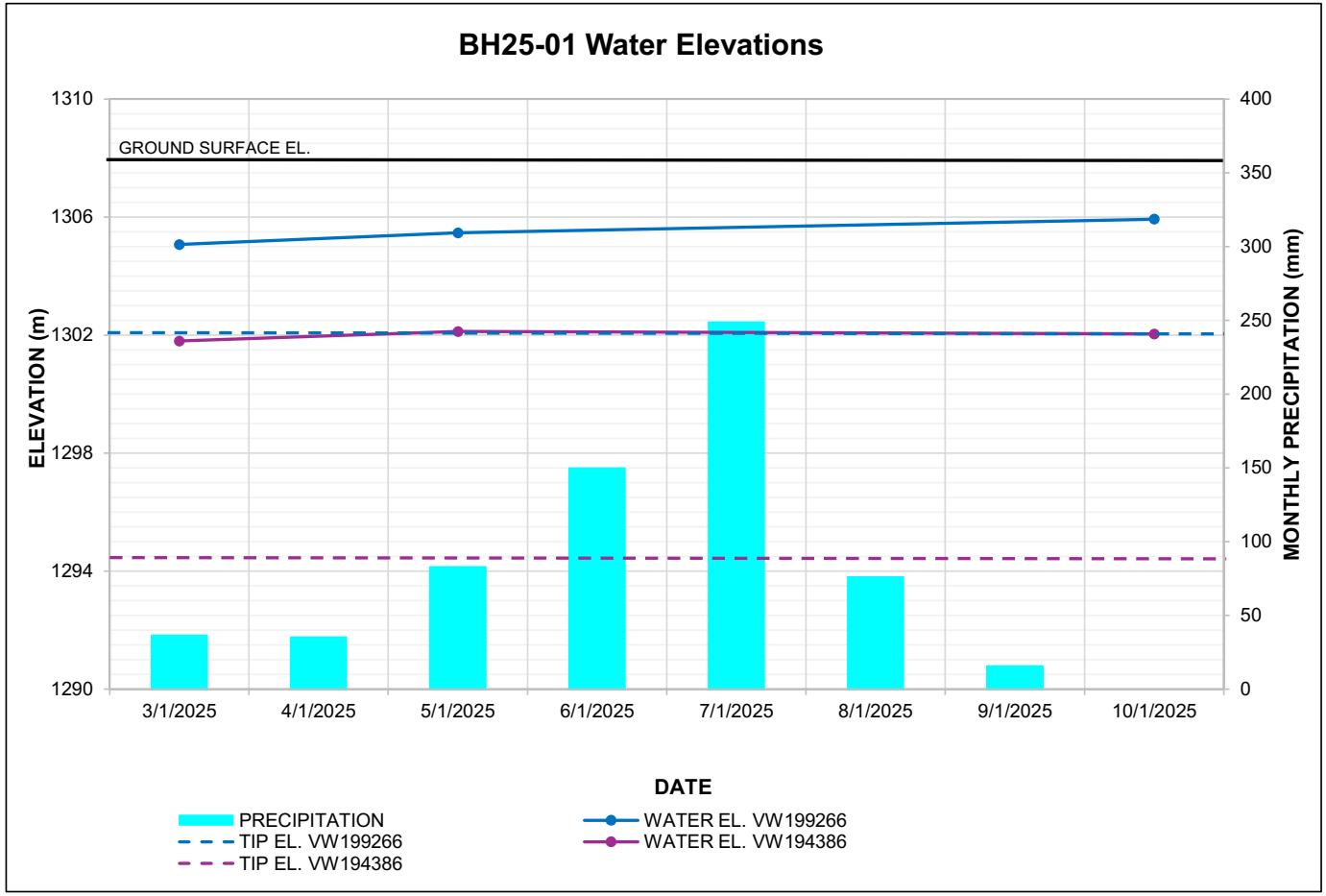


S008, Inclinometer BH25-01

Klohn Crippen Berger - Calgary



S008, Inclinometer BH25-01



NOTES:
1. MONTHLY PRECIPITATION DATA OBTAINED FROM THE ALBERTA CLIMATE INFORMATION SERVICE (ACIS) DATABASE, REFERENCING ELBOW RIVER STATION.

CLIENT
Alberta
Klohn Crippen Berger

PROJECT
SOUTHERN REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE
Vibrating Wire Piezometer Data
S008 - Fisher Creek
Hwy 762:02, km 2.13

SCALE	PROJECT No.	FIG No.
	A05116A03	