
To:	Amy Driessen	From:	Leslie Cho and Xiteng Liu
	Transportation and Economic Corridors		Stantec Consulting Ltd.
File:	123315222	Date:	June 18, 2024

Reference: North Central Region, Edson/Stony Plain, Site NC048 – Highway 40:30 Fred Creek Slide, Spring 2024 Instrumentation Monitoring Report

1.0 OBSERVATIONS

1.1 FIELD PROGRAM AND INSTRUMENTATION STATUS

The Spring 2024 reading cycle consisted of instrument readings for one slope inclinometer (SI1) and six pneumatic piezometers (PZ1, PZ2, PZ4, PN5, PN6-1 and PN6-2). Figure 1 attached provides a schematic of the site. The instruments were read by Andres Padros, Technician and Olawale Odusi, Geotechnical Technologist on May 13, 2024.

Pneumatic piezometer PZ7 was found damaged during the Spring 2022 reading cycle. PN6-1 and SI1 were previously thought to be damaged but were able to be monitored during the current reading cycle.

The slope inclinometer (SI) was measured using an RST MEMS digital inclinometer probe with 0.5 m increments and handheld PC. Readings were taken based on cable markings in relation to the top of SI casing.

The pneumatic piezometers (PN) were read with an RST Instruments C-109 Pneumatic readout box.

GPS coordinates of all instruments were obtained using a Garmin eTrex 22x handheld GPS unit.

Remedial measures at this site were undertaken in 2016 and comprised of grade widening, a granular berm construction with wick drains as well as culvert replacement.

2.0 INSTRUMENTATION READINGS

2.1 GENERAL

The SI plots are provided in the attachments and summarized in the following sections. Displacement-time plots in the resultant X-direction along with movement rates, total cumulative movement, maximum movement rates, and incremental movements since initializing each SI are provided in table NC48-1. PN results are summarized in table NC48-2 and the following sections with summary plots attached.

2.2 ZONES OF MOVEMENT

No new zones of movement were observed in the operational SI. **Table NC48-1** summarizes the SI readings since installation. Directions of movement reported are referenced to the Azimuth of the A+ groove for the SI casing.

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2.3 MONITORING RESULTS

2.3.1 Slope Inclinometers

SI1 contains an upper and lower shear zone and showed relatively little cumulative movement since initialization in 2006. Since Spring of 2021, the cumulative displacement has remained relatively constant with 7 mm in the upper shear zone at 0.2 m to 2.8 m. The lower shear zone has about 5 mm of cumulative movement over 4.2 m to 6.2 m. Although the incremental movement and movement rates of SI1 in the upper zone appear large (20 mm/yr), it is important to note that the cumulative displacement has returned to a magnitude about the same as it was during Spring 2021.

During the work transfer to Stantec in 2016, a slight depth discrepancy was observed in the SI due to different units of measurements used during data collection. Due to the combination of depth discrepancy and construction activities in 2016, data prior to 2016 were excluded from the SI plots.

2.3.2 Piezometers

Overall, the piezometric levels have remained relatively stable since completion of berm and wick drain construction in 2016. During the current reading cycle, the change in piezometric level ranged from an increase of 0.5 m to a decrease of 0.2 m compared to the Spring 2023 reading cycle.

3.0 RECOMMENDATIONS

3.1 FUTURE WORK

It is recommended that the next reading cycle take place in Spring 2025.

3.2 INSTRUMENTATION REPAIRS

Consideration for replacement slope inclinometers should be given for SI2 and SI3.

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Table NC48-1: Spring 2021 Slope Inclinometer Reading Summary

Instrument Name	Date Initialized	Coordinates ⁽¹⁾ (UTM 11U, NAD1983) (m)		Total Cumulative Resultant Movement and Depth of Movement to Date (mm)	Maximum Rate of Movement (mm/yr)	Current Status	Date of Previous Reading	Incremental Movement Since Previous Reading (mm)	Current Rate of Movement (mm/yr)	Change in Rate of Movement Since Previous Reading (mm/yr)
		Northing	Easting							
SI1	7-Sep-06	5939980	428402	-7 over 0.2 m to 2.8 m depth in 200° direction	20 in May 2024	Operational	July 3, 2021	-20	20	9
				5 over 4.2 m to 6.2 m depth in 200° direction	2 in Sept. 2012			<1	<1	<1
SI2	7-Sep-06	-	-	37 over 3.4 m to 5.2 m depth in 18° direction	23 in May 2016	Non-Operational	June 14, 2017	Blocked at 2.0 m below top of casing		
				188 over 5.2 m to 8.2 m depth in 329° direction	99 in Sept. 2012					
SI3	7-Sep-06	-	-	69 mm over 5.8 m to 8.2 m depth in 200° direction	79 in Sept. 2012	Non-Operational	Sept. 8, 2018	Blocked at 0.5 m below grade		
				12 mm over 0.8 m to 2.8 m depth in 200° direction	18 in Oct. 2014					
Note: (1) Updated May 13, 2024 with approximate accuracy of ± 3 m										

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Table NC048-2: Spring 2024 Pneumatic Piezometer Reading Summary

Instrument Name	Date Initialized	Coordinates ⁽¹⁾ (UTM 11U, NAD1983) (m)		Tip Depth (mbgs)	Tip Elevation (m aMSL) ⁽²⁾	Current Status	Maximum Piezometric Depth (mbgs) ⁽³⁾	Measured Pore Pressure (kPa)	Measured Piezometric Depth (mbgs) (Elevation, m)	Change in Piezometric Level Since Previous Reading (m)
		Northing	Easting							
PZ1 (30041)	Oct. 6, 2006	5939982	428401	5.5	1358.5	Operational	- 2.6 (May 2019)	74.4	-2.1 (1366.1)	< 0.1
PZ2 (30612)	May 23, 2001	5940024	428404	7.2	1358.9	Operational	- 5.3 (May 2016)	77.5	-0.7 (1367.5)	0.3
PZ4 (30577)	Mar 23, 2014	5940058	428391	4.3	1364.1	Operational	- 0.7 (June 2012)	38.6	0.4 (1368.0)	-0.2
PN5 (36784)	April 30, 2016	5940014	428346	5.2	1363.1	Operational	- 2.0 (May 2016)	57.5	-0.7 (1369.0)	0.5
PN6-1 (36783)	April 30, 2016	5940028	428364	5.2	1363.8	Operational	- 0.7 (May 2019)	44.1	0.7 (1368.3)	-0.1
PN6-2 (36782)	April 30, 2016	5940028	428364	7.6	1361.4	Operational	- 0.4 (May 2019)	67.1	0.8 (1368.2)	0.1
PN7 (36785)	April 30, 2016	5940037	428429	6.1	1361.1	Non-operational	0 (Oct. 2016)	Found Damaged Spring 2022		
<p>Note:</p> <p>(1) Updated May 13, 2024 with approximate accuracy of ± 3 m</p> <p>(2) aMSL = Above Mean Sea Level</p> <p>(3) mbgs = meters below ground surface</p>										

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4.0 CLOSING

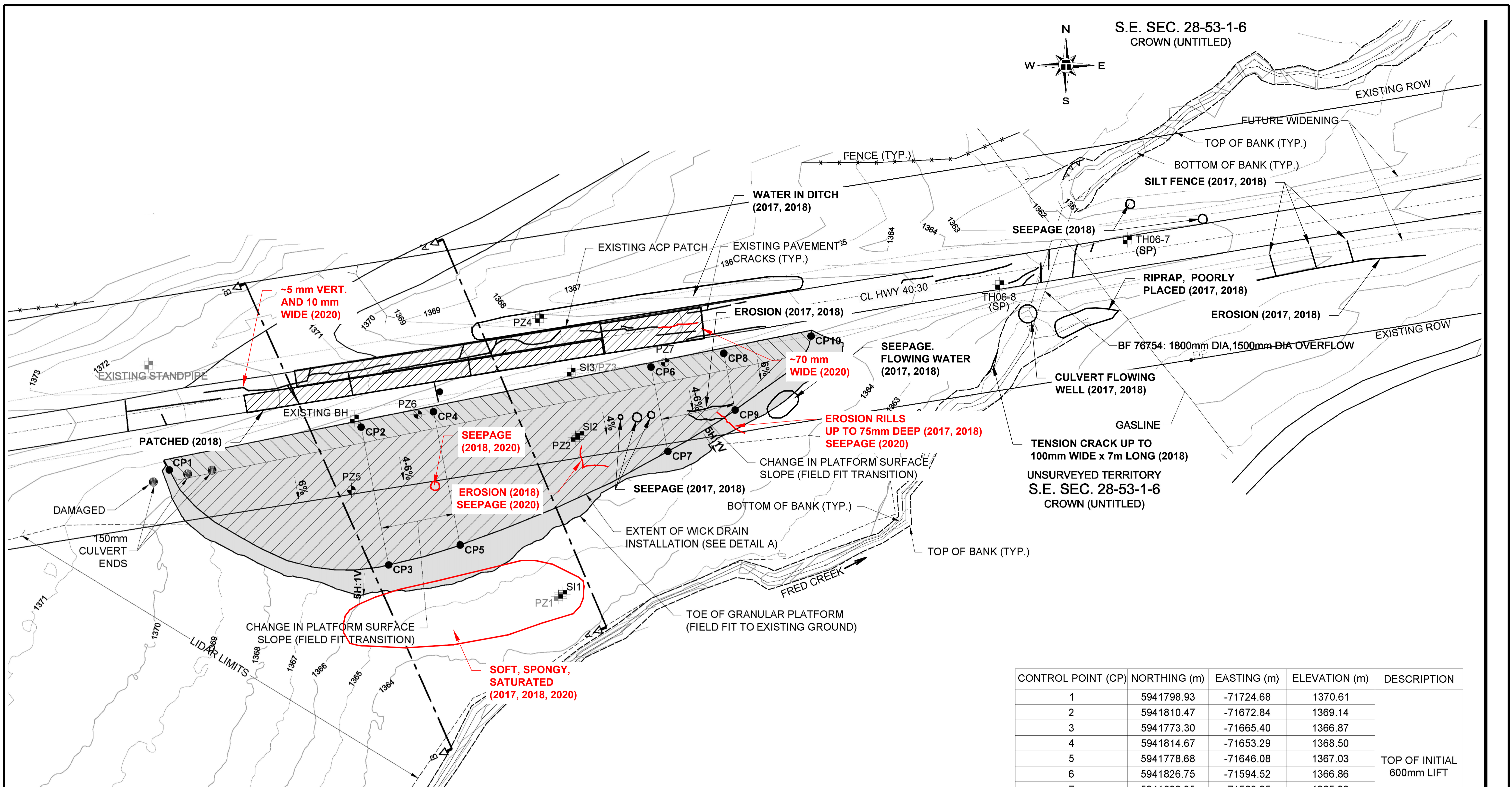
We trust this instrumentation report meets your requirements. If you have any questions, please do not hesitate to contact the undersigned.

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Attachment: Figure 1 – Site Plan
SI1 Slope Inclinator Plots
Standpipe Piezometer Level Depth vs Time Plot
Standpipe Piezometric Elevation vs Time Plot



CONTROL POINT (CP)	NORTHING (m)	EASTING (m)	ELEVATION (m)	DESCRIPTION
1	5941798.93	-71724.68	1370.61	TOP OF INITIAL 600mm LIFT
2	5941810.47	-71672.84	1369.14	
3	5941773.30	-71665.40	1368.87	
4	5941814.67	-71653.29	1368.50	
5	5941778.68	-71646.08	1367.03	
6	5941826.75	-71594.52	1366.86	
7	5941803.95	-71589.95	1365.93	
8	5941830.43	-71574.87	1366.42	
9	5941815.14	-71571.79	1365.48	
10	5941835.11	-71551.11	1365.51	

LEGEND

- APPROXIMATE EXISTING INSTRUMENT LOCATION
- DAMAGED INSTRUMENT
- TH TEST HOLE
- SP STANDPIPE PIEZOMETER
- PZ PIEZOMETER (PNEUMATIC)
- SI SLOPE INCLINOMETER
- NEW PNEUMATIC PIEZOMETER LOCATION
- CP1 CONTROL POINT
- WICK DRAINS INSTALLED AT 1.5m TRIANGULAR SPACING
- WICK DRAINS INSTALLED AT 1.0m TRIANGULAR SPACING

NOTES

1. FEATURE LOCATIONS ARE APPROXIMATE.
2. 1m CONTOURS FROM ARA SURVEY AND LIDAR PROVIDED BY ALBERTA TRANSPORTATION.
3. GRADE WIDENING NOT SHOWN FOR CLARITY.
4. PREVIOUS OBSERVATIONS SHOWN IN BLACK
5. 2020 OBSERVATIONS SHOWN IN RED

REFERENCE

THURBER ENGINEERING LTD. PROJECT No.15-16-324, PLAN No. RD-19126-p
 DATE: JAN 2015 (BASE PLAN PROVIDED BY ARA ENGINEERING LTD., 2007)

STANTEC CONSULTING
10160-112 STREET
EDMONTON ALBERTA CANADA

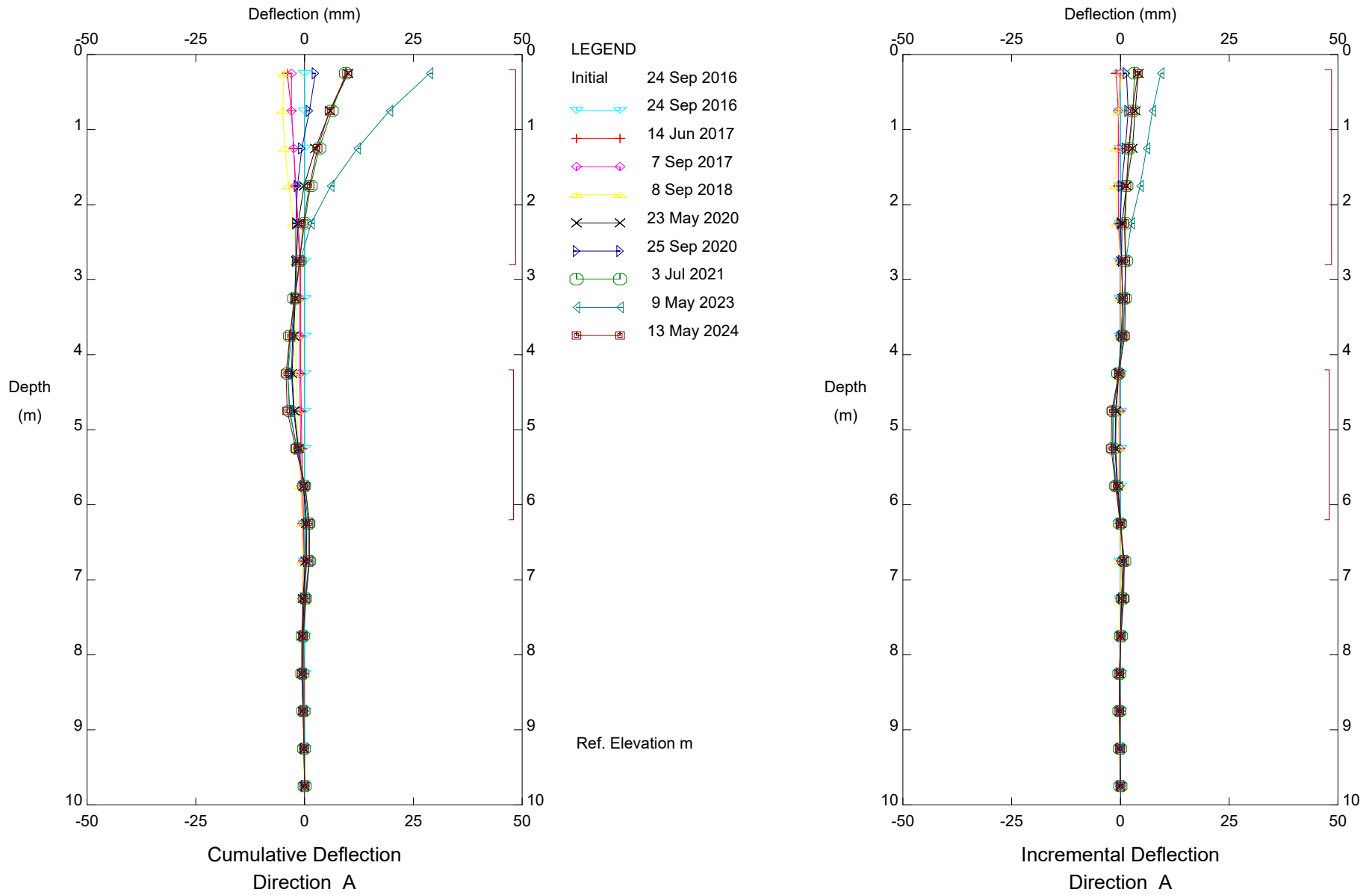
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ALBERTA TRANSPORTATION
GEOHAZARD MONITORING PROGRAM
NC48 HWY 40:30, km 48.8 - FRED CREEK
SITE PLAN

DRAWN MK	CHECK XL	APPROVE LC	
DATE 19 JUN. 2020	SCALE AS SHOWN	PROJECT # 123315222	

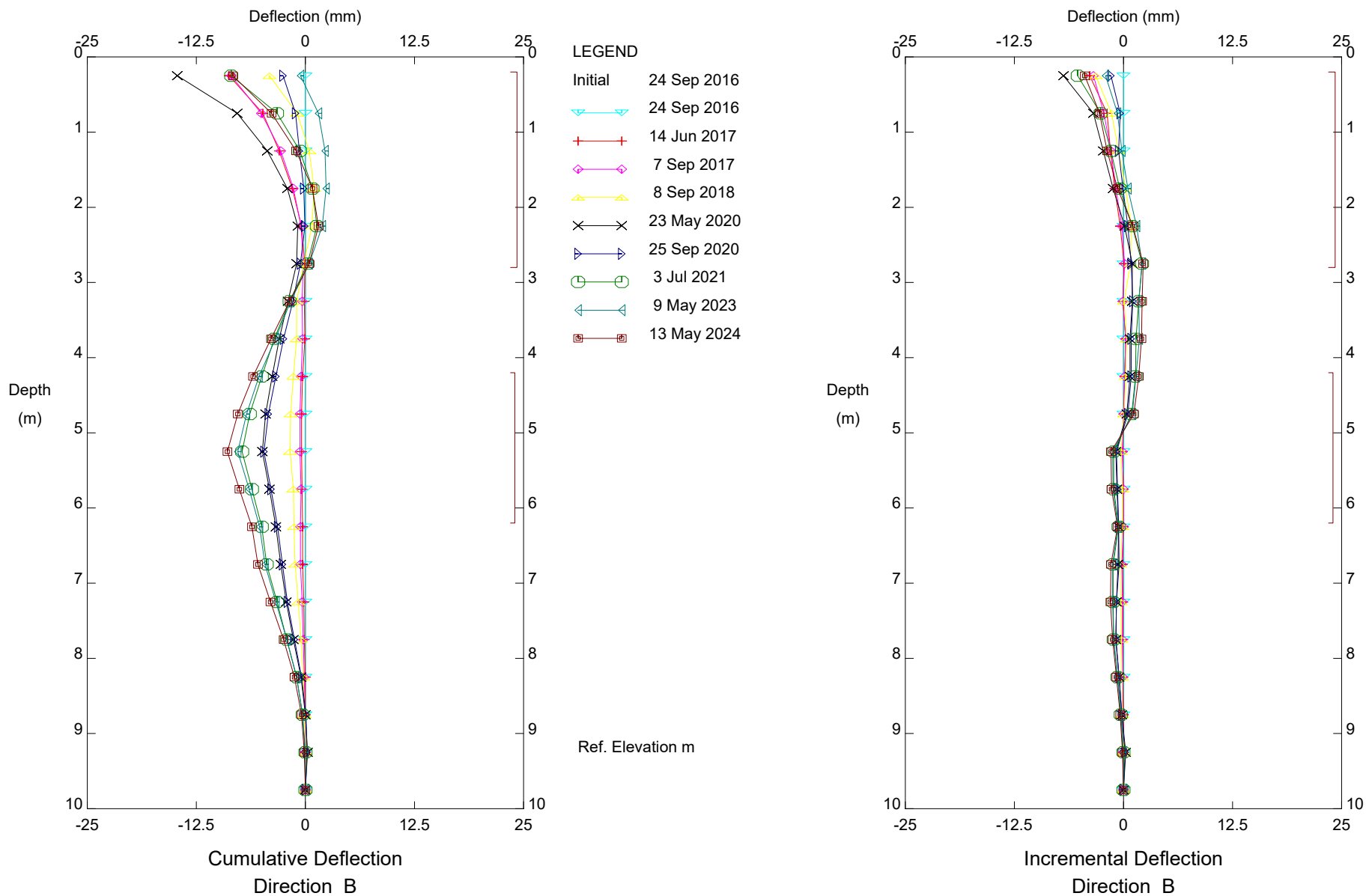
FIGURE -1

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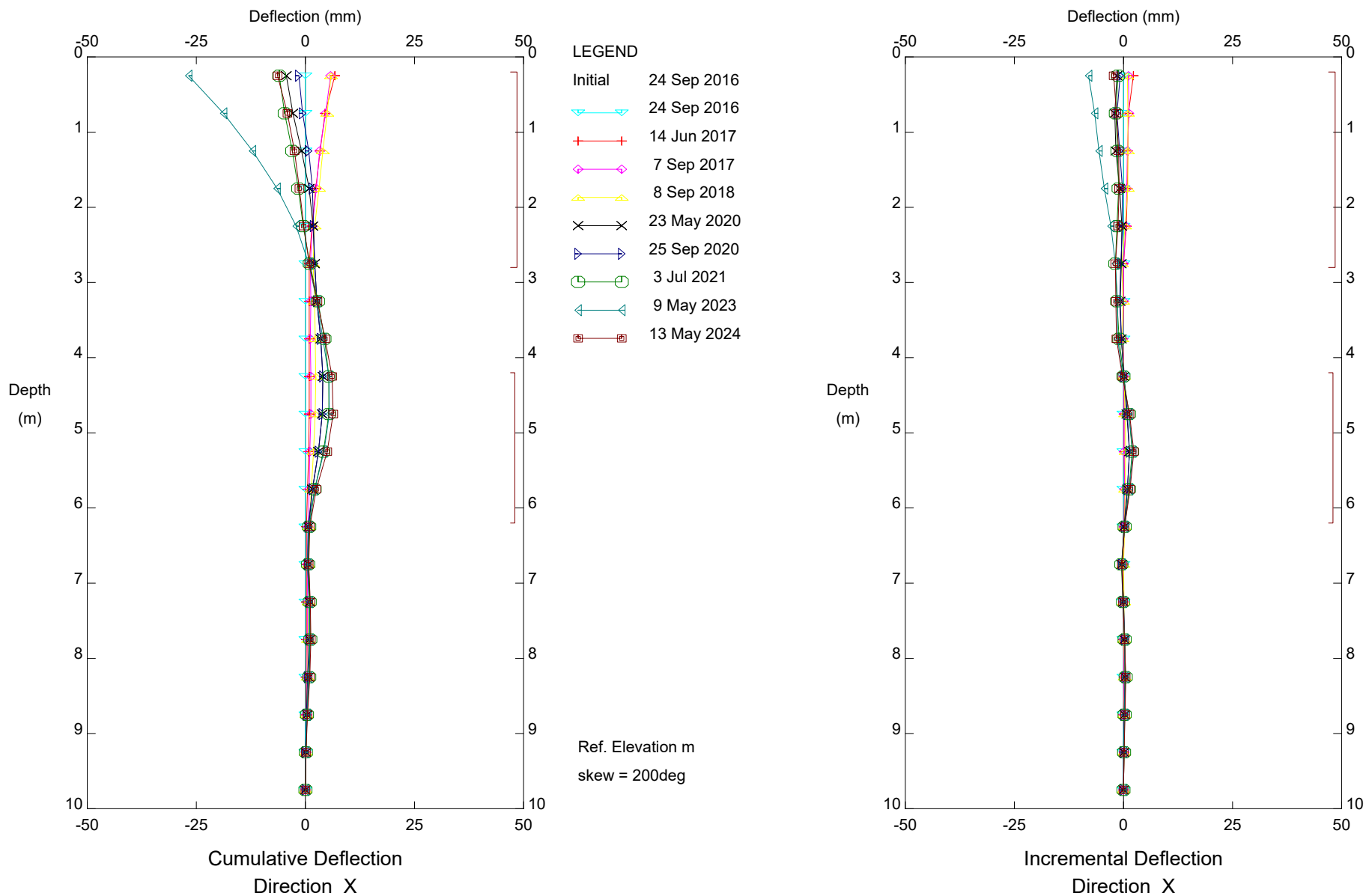


HWY40:30 Fred Creek (NC48), Inclinator SI-1
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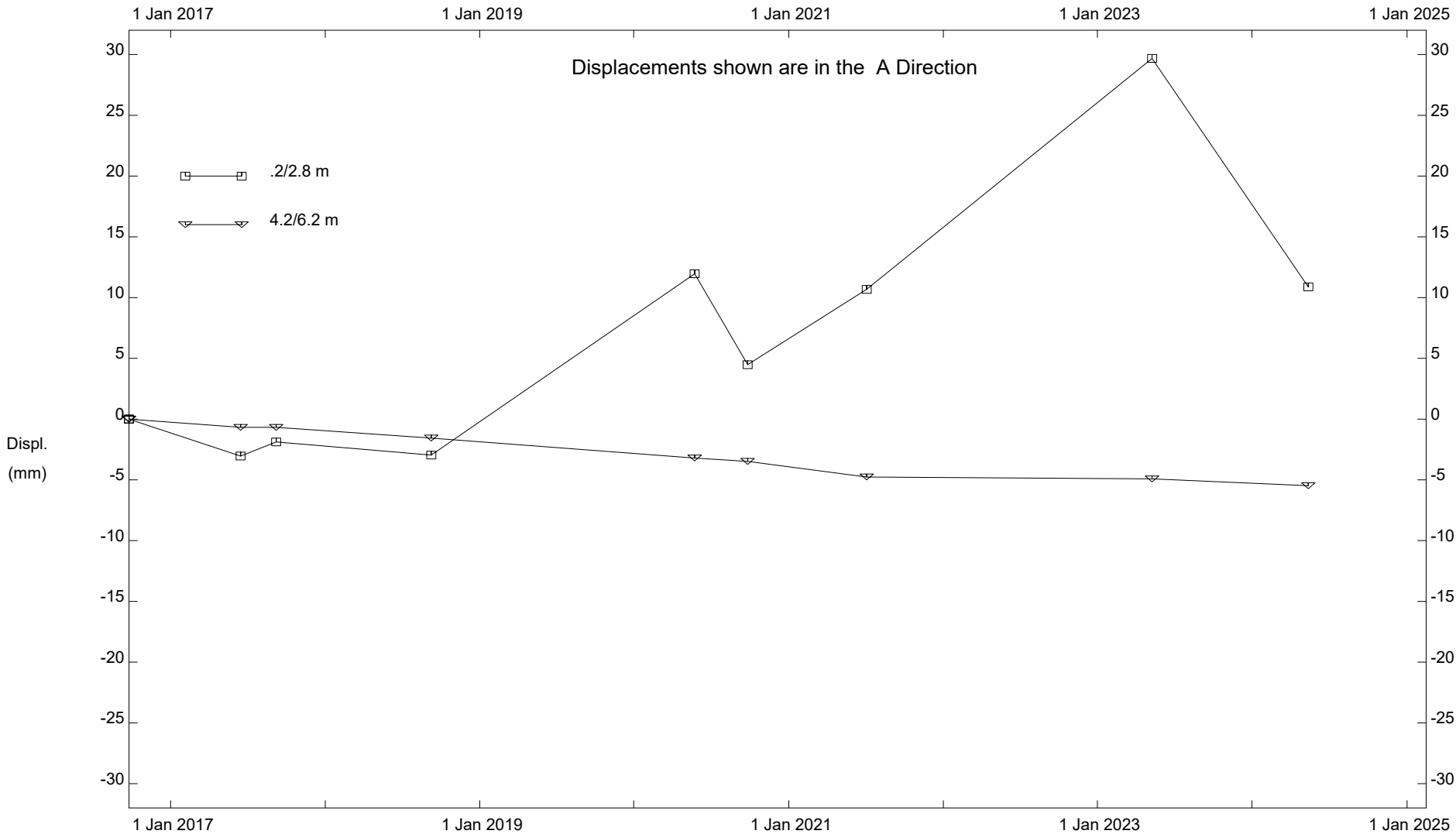
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HWY40:30 Fred Creek (NC48), Inclinator SI-1
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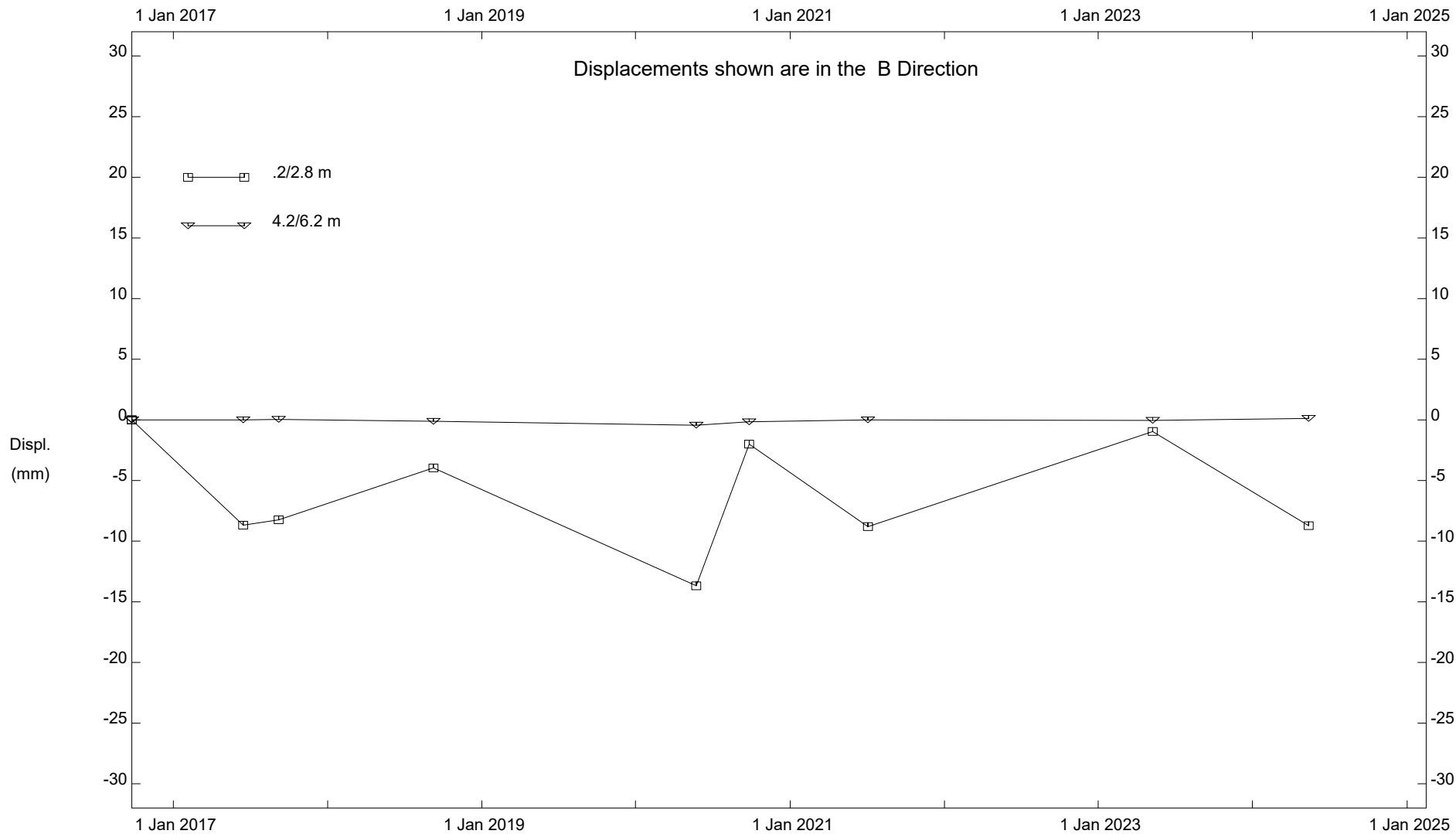


HWY40:30 Fred Creek (NC48), Inclinometer SI-1
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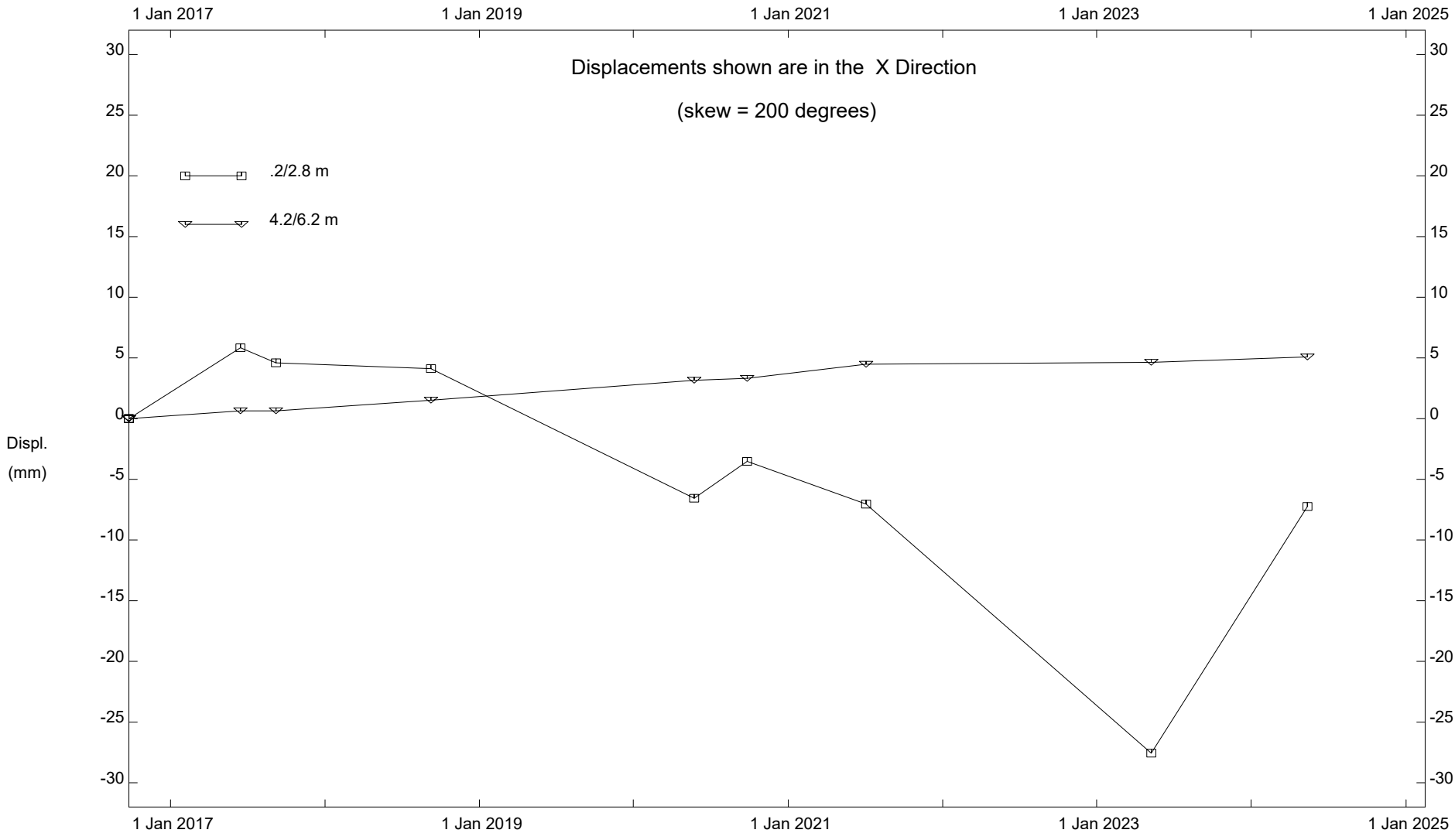
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