

Site Number	Location	Name	Hwy	km
PH042	HWY 986:01 C1 33.212 (Station 13+300)	Daishowa Well Site Slide	986:01	Km 33.2
Legal Description:		UTM Co-ordinates		
15-7-85-20 W5		11U E 491157	N	6246211

Current Monitoring:	8-Jun-2025	Previous Monitoring	20-May-2024
Instruments Read By:	Mr. Niraj Regmi, G.I.T and Mr. Godfred Etiendem, of Thurber		

Instruments Read During This Site Visit			
Slope (SIs): SI18-1	Inclinometers	Pneumatic Piezometers (PN): N/A	Vibrating Wire Piezometers (VW): VW17-1A, VW17-1B, VW17-2A, VW17-2B VW17-3A and VW17-3B (installed on the bench downslope of the pile wall) VW18-1 and VW18-2 (installed in two previously drilled monitoring wells in the south highway ditch upslope of the pile wall) VW18-3 (installed in a previously drilled pumping well adjacent to the monitoring wells in the south highway ditch)
Load Cell (LC): VC2011 to VC2018		Strain Gauges: N/A 28 vibrating wire strain gauges were installed on the rebar cage of pile P40	SAAs: SAA17-P20 and SAA17-P40 SAA-18 (installed on the bench downslope of the pile wall)

Readout Equipment Used		
Slope Inclinometers: RST Digital Inclinometer probe with a 2 ft wheelbase and an RST Pocket PC readout probe with 2 ft wheelbases and RST pocket readout.	Pneumatic Piezometers:	Vibrating Wire Piezometers: Campbell Scientific CR6 datalogger GEOKON GK-404 vibrating wire readout
Load Cell: Campbell Scientific CR6 datalogger	Strain Gauges: Campbell Scientific CR6 datalogger	SAAs: Campbell Scientific CR6 datalogger
Note:		

Discussion	
Zones of New Movement:	None
Interpretation of Monitoring Results:	Slope Indicator SI18-1, located about 18 m downslope of the pile wall, has not shown any discernible movement since it was reinitialized during the spring of 2019 readings.

SAA

SAA17-P20 showed an average rate of movement of 1.1 mm/yr over the length of the pile and an average rate of movement of 1.0 mm/yr over the combined length of the pile and waler since the spring of 2024 readings. SAA-P20 has shown a total pile head movement of 25.2 mm in the downslope direction to date.

SAA17-P40 showed no discernible movement over the length of the pile and over the combined length of the pile and waler since the spring of 2024 readings. SAA17-P40 has shown a total pile head movement of 56.1 mm in the downslope direction to date.

Both of the SAAs installed in the pile wall have shown an overall trend of downslope movement since they were installed, with higher deflections (in the order of 8 to 12 mm) during the winter months under frost loads, which rebound once the ground thaws. The total cumulative movement in the SAAs includes initial deflections during excavation and anchor installation as well as post construction movements. The overall rate of movement, after removing seasonal effects, appears to be slowly decreasing toward an equilibrium state in SAA17-P20 and appears to be at the equilibrium state in SAA17-P40.

SAA18-1, installed in the bench downslope of the pile wall, showed an average rate of movement of 2.3 mm/yr over 0.5 m to 12.5 m depth since the spring of 2024 readings. SAA18-1 has shown a total cumulative movement of 18.1 mm over this zone since it was initialized in June 2018. By comparison, SAA17-P40 has shown a total cumulative movement of 8.2 mm over this same zone since June 2018, indicating that the bench has moved 9.9 mm in the downslope direction relative to the pile wall during this time span. A plot comparing these movements is included in Appendix A. The movement in SAA18-1 should continue to be compared to the pile wall movements at SAA17 P40 for future readings to see if the bench exhibits faster downslope movement than the pile wall. The wall relies on lateral support from the bench and hence if significant separation is noted in the future, soil or grout would need to be placed in the void or another row of tie-back soil anchors would need to be added to the wall beneath the existing anchors.

Load Cells

The load cells showed relatively minor increases in load compared to the spring of 2024 readings, ranging from 0.74 kN in VC2018 (anchor P60C) to an increase of 3.45 kN in VC2017 (anchor P40C). It should be noted that VC2011 (anchor P40A) is measuring a current load that is above its design load. However, this is still safely below the ultimate bond strength confirmed during anchor testing activities. Overall, the load cells have shown relatively steady anchor loads over the last two years, with temporary higher loads measured in late winter to early spring, when the depth of frost penetration is greatest, compared to the summer loads when the ground is fully thawed behind the wall.

Strain Gauges

Since the spring of 2024 readings, the strain gauges showed changes in strain ranging from an increase in positive (tension) strain of 0.3 at 10.5 m depth on the upslope pile face to 13.9 at 2.5 m depth on the downslope pile face. The strain gauge readings are summarized in Table PH042-3 and plotted with depth on Figures PH042-1 and PH04-2. The maximum microstrain, occurring at 18.5 m depth is also plotted with time in Figure PH042-3.

	<p>Piezometers</p> <p>Vibrating wire piezometers VW17-1A, VW17-1B, and VW17-3A showed decreases in groundwater level of 0.10 m, 0.18 m, and 0.10 m, respectively, since the spring of 2024 readings. VW17-2B and VW17-3B showed increases in groundwater level of 0.13 m and 0.48 m, respectively. VW17-3B measured an all-time high groundwater level on April 25, 2025, however, VW17-3B has been functioning intermittently, and the temperature wire is showing large fluctuations since the spring 2024 readings. VW17-2A continued to be dry. Overall, the piezometers at the pile wall show relatively stable groundwater levels, with the exception of VW17-3B, which is showing a trend of slowly increasing groundwater level over time.</p> <p>Vibrating wire piezometers VW18-1, VW18-2, and VW18-3, installed in the south highway ditch to the east of the pile wall, showed decreases in groundwater level of 0.17 m, 0.17 m, and 0.06 m, respectively, since the spring of 2024 readings.</p>
Future Work:	The instruments should be read again in the spring of 2026.
Instrumentation Repairs:	No instrument repairs are required at this time.
Additional Comments:	The wall was completed in 2018. Sufficient data is available to provide a basis for a review of the structural capacity of the wall. Such a review could provide insights into current design methods and assumptions and lead to better pile designs in the future.

Attachments:	<ul style="list-style-type: none"> • Table PH042-1 Spring 2025 – Hwy 986:01, Daishowa East Hill, Slope Inclinometer Instrumentation Reading Summary • Table PH042-2 Spring 2025 – HWY 986:01 Daishowa East Hill, Shape Accelerometer Array Instrumentation Reading Summary • Table PH042-3 Spring 2025 – HWY 986:01 Daishowa East Hill, Vibrating Wire Strain Gauge Instrumentation Reading Summary • Table PH042-4 Spring 2025 – HWY 986:01 Daishowa East Hill, Vibrating Wire Piezometer Instrumentation Reading Summary • Table PH042-5 Spring 2025 – HWY 986:01 Daishowa East Hill, Load Cell Instrumentation Reading Summary • Statement for Use and Interpretation of Report • APPENDIX A - PH042 SPRING 2025 <ul style="list-style-type: none"> ○ Field Inspector's report ○ Site Plan Showing Approximate Instrument Locations (Drawing No. 32121 PH042) ○ SI Reading Plots ○ SAA Reading Plots ○ Comparison of SAA 18-1 to SAA17-P40 ○ Figure PH042-1 (Upslope Strain Gauge Readings) ○ Figure PH042-2 (Downslope Strain Gauge Readings) ○ Figure PH042-3 (Maximum Strain at 18.5 m Depth) ○ Figure PH042-4 (Pile Wall Piezometer Elevations) ○ Figure PH042-5 (Pile Wall Piezometer Depths) ○ Figure PH042-6 (South Ditch Piezometer Elevations) ○ Figure PH042-7 (South Ditch Piezometer Depths) ○ Figure PH042-8 (Load Cell Data Pile P20) ○ Figure PH042-9 (Load Cell Data Pile P40) ○ Figure PH042-10 (Load Cell Data Pile P60)
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We trust this report meets your requirements at present. If you have any questions, please contact the undersigned at your convenience.

Yours very truly,
Thurber Engineering Ltd.
Roger Skirrow M.Sc., P. Eng.
Senior Geotechnical Engineer

Lucas Green, P.Eng.
Geotechnical Engineer

Table PH042-1 Spring 2025 – Hwy 986:01, Daishowa East Hill Slope Inclinator Instrumentation Reading Summary

Date Monitored: June 8, 2025

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AT NOTED DEPTH SINCE INITIAL READING (mm)	MAXIMUM RATE OF MOVEMENT (mm/yr.)	CURRENT STATUS	DATE OF PREVIOUS READING	INCREMENTAL MOVEMENT SINCE PREVIOUS READING (mm)	RATE OF MOVEMENT (mm/yr.)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr.)
SI18-1	June 24, 2019 (reinitialized)	No discernible movement	N/A	Operational	May 20, 2024	N/A	N/A	N/A

Drawing 32121-PH042 Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

Table PH042-2 Spring 2025 – Hwy 986:01, Daishowa East Hill Shape Accelerometer Array Instrumentation Reading Summary

Date Monitored: June 8, 2025

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AT NOTED DEPTH SINCE INITIAL READING (mm)	CURRENT STATUS	DATE OF PREVIOUS READING	INCREMENTAL MOVEMENT SINCE PREVIOUS READING (mm)	AVERAGE RATE OF MOVEMENT SINCE PREVIOUS READING ⁽¹⁾ (mm/yr.)	CHANGE IN AVERAGE RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr.)
SAA17-P20	April 8, 2017	25.2 over 1.5 m to 29.0 m depth	Operational	May 20, 2024	1.2	1.1	-1.9
		29.9 over 0 m to 29.0 m depth			1.0	1.0	-2.2
SAA17-P40	April 8, 2017	56.1 over 1.5 m to 29.0 m depth	Operational	May 20, 2024	No discernible movement	N/A	-2.8
		55.7 over 0.0 m to 29.0 m depth			No discernible movement	N/A	-2.5
SAA18-1	June 1, 2018	18.1 over 0.5 m to 12.5 m depth	Operational	May 20, 2024	2.4	2.3	>-0.1

Drawing 32121-PH042 Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

Notes:

1. SAA readings are recorded once per day by the on-site datalogger. Average movement rates are compared to the previous reading event.

Table PH042-3 Spring 2025 – Hwy 986:01, Daishowa East Hill Vibrating Wire Strain Gauge Instrumentation Reading Summary

Date Monitored: June 8, 2025

DEPTH FROM TOP OF PILE P40 (m)	GAUGE #	TOTAL MICROSTRAIN (JUNE 8, 2025) (µε)	CHANGE IN MICROSTRAIN SINCE PREVIOUS READING (MAY 20, 2024)	MEASURED TEMPERATURE (JUNE 8, 2025) (°C)	GAUGE #	TOTAL MICROSTRAIN (JUNE 8, 2025) (µε)	CHANGE IN MICROSTRAIN SINCE PREVIOUS READING (MAY 20, 2024)	MEASURED TEMPERATURE (MAY 20, 2024) (°C)
	UPSLOPE PILE FACE				DOWNSLOPE PILE FACE			
0.5	1465	-192.1	13.0	14.8	1466	-54.0	21.5	13.2
2.5	1467	-123.0	9.8	11.3	1468	-148.8	-5.7	13.9
4.5	1469	-178.8	7.1	8.7	1470	-99.5	-4.4	10.1
6.5	1472	-182.7	5.7	4.5	1471	230.8	6.3	4.6
8.5	1474	-250.4	2.3	3.9	1473	-111.5	7.2	3.9
10.5	1476	-206.9	0.3	5.3	1475	56.3	4.1	4.7
12.5	1478	-202.5	1.1	4.7	1477	-86.2	5.2	5.3
14.5	1479	-148.3	1.4	5.7	1480	-210.7	3.5	5.6
16.5	1481	-64.1	2.7	5.8	1482	-214.7	4.5	5.9
18.5	1484	484.2	1.5	5.8	1483	-376.4	-0.3	5.8
20.5	1486	-175.5	2.8	5.8	1485	-358.0	-1.0	5.8
22.5	1488	-184.9	2.5	5.8	1487	-275.0	1.9	5.8
24.5	1490	-152.0	2.0	5.8	1489	-203.3	3.5	5.8
26.5	1492	-136.5	2.6	5.8	1491	-166.7	3.6	5.8

Drawing 32121-PH042 Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

Table PH042-4 Spring 2025 – Hwy 986:01, Daishowa East Hill Vibrating Wire Piezometer Instrumentation Reading Summary

Date Monitored: June 8, 2025

INSTRUMENT	DATE INITIALIZED	TIP DEPTH (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST RECORDED GROUNDWATER ELEVATION (m)	CURRENT GROUNDWATER ELEVATION (m)	PREVIOUS GROUNDWATER ELEVATION* (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
PILE WALL								
VW17-1A	November 2, 2017	13.68	446.08	Operational	438.47 on March 26, 2022	436.49	436.59	-0.10
VW17-1B	November 2, 2017	24.98	446.08	Operational	440.96 on March 25, 2022	439.44	439.62	-0.18
VW17-2A	November 2, 2017	9.98	447.78	Operational	N/A (Below tip depth)	DRY	DRY	N/A
VW17-2B	November 2, 2017	24.98	447.78	Operational	444.46 on December 21, 2017	442.74	442.61	0.13
VW17-3A	May 31, 2018	10.18	441.18	Operational	439.04 on March 8, 2023	438.47	438.57	-0.10
VW17-3B*	May 31, 2018	19.18	441.18	Operational	428.76 on April 25, 2025	428.69 (May 31, 2025)*	428.21 (May 21, 2024)*	0.48
SOUTH HIGHWAY DITCH								
VW18-1	January 8, 2019	18.2 (estimated)	449.41	Operational	450.48 on June 14, 2020	449.44	449.61	-0.17
VW18-2	January 8, 2019	17.7 (estimated)	449.93	Operational	450.98 on June 14, 2020	449.94	450.11	-0.17
VW18-3	January 8, 2019	12.5 (estimated)	449.93	Operational	450.89 on June 14, 2020	449.93	449.99	-0.06

Drawing 32121-PH042 Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

Note: *VW17-3B functioning intermittently, with variation in temperature wire readings since spring 2023

Table PH042-5 Spring 2025 – Hwy 986:01, Daishowa East Hill Load Cell Instrumentation Reading Summary

Date Monitored: June 8, 2025

LOAD CELL SERIAL #	ANCHOR NUMBER	DESIGN LOAD / LOCK-OFF LOAD (kN)	MAXIMUM RECORDED LOAD (kN)	RECORDED LOAD ⁽¹⁾ (June 8, 2025) (kN)	PREVIOUS RECORDED LOAD (MAY 20, 2024) (kN)	CHANGE IN LOAD SINCE PREVIOUS READING (kN)
VC2010	P20A	225/180	245.17 on April 1, 2023	202.66	200.12	2.54
VC2013	P20B	400/180	245.45 on March 30, 2023	219.89	218.16	1.73
VC2016	P20C	400/180	191.49 on April 3, 2023	177.69	175.67	2.02
VC2011	P40A	225/180	344.62 on April 1, 2023	274.23	269.42	4.81
VC2014	P40B	400/180	344.20 on April 1, 2023	311.24	309.55	1.69
VC2017	P40C	400/180	190.46 on April 1, 2023	174.77	171.32	3.45
VC2012	P60A	225/180	261.71 on April 1, 2023	207.49	206.10	1.39
VC2015	P60B	400/180	263.56 on April 2, 2023	235.66	234.42	1.24
VC2018	P60C	400/180	169.69 on March 20, 2023	156.18	155.44	0.74

Drawing 32121-PH042-1 Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

Notes:

- (1) Load cell data is recorded daily with datalogger on site. See Figures PH042-5, PH042-6, and PH042-7 in Appendix A for combined historical instrument readings.



**ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS GRMP (CON0022164)
PEACE REGION (PEACE RIVER DISTRICT)
INSTRUMENTATION MONITORING RESULTS**

SPRING 2025

**APPENDIX A
DATA PRESENTATION**

SITE PH042: HWY 986:01, DAISHOWA EAST HILL (WELL SITE SLIDE)

**ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
PEACE REGION (PEACE RIVER DISTRICT)
INSTRUMENTATION MONITORING FIELD SUMMARY (PH042)
SPRING 2025**

Location: Daishowa Well Site Slide (HWY 986:01 C1 33.212) File Number: 32121 Probe: RST SET 5R Cable: RST SET 5R	Readout: GK 404/SN364 Casing: 3.34 Temp: 31 Read by: NKR/GE
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SLOPE INCLINOMETER (SI) READINGS

SI#	GPS Location (UTM 11)		Date	Stickup (m)	Depth from top of Casing (ft)	Magn. North A+ Groove	Current Bottom Depth Readings				Probe/ Reel #	Size (")	Remarks
	Easting (m)	Northing (m)					A+	A-	B+	B-			
SI18-1	491157	6246211	08-Jun-25	0.8	70 to 2	16	-307	313	-857	841	5R/5R	3.34	

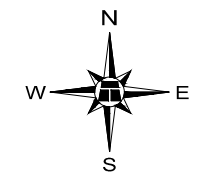
VIBRATING WIRE PIEZOMETER (VW) READINGS

VW #	Serial #	GPS Location (UTM 11)		Datalogger Serial #	Date	Comment
		Easting (m)	Northing (m)			
VW18-1	1802205	491170	6246150	Campbell	08-Jun-25	Read manually, SN# 2205, 3128.8 5.7
VW18-2	1802208	491179	6246147	Scientific		Read manually, SN#2208, 3573.3 4.8
VW18-3	1802207	491180	6246148	8480		Read manually, SN#2207, 3494.6 4.5

INSPECTOR REPORT

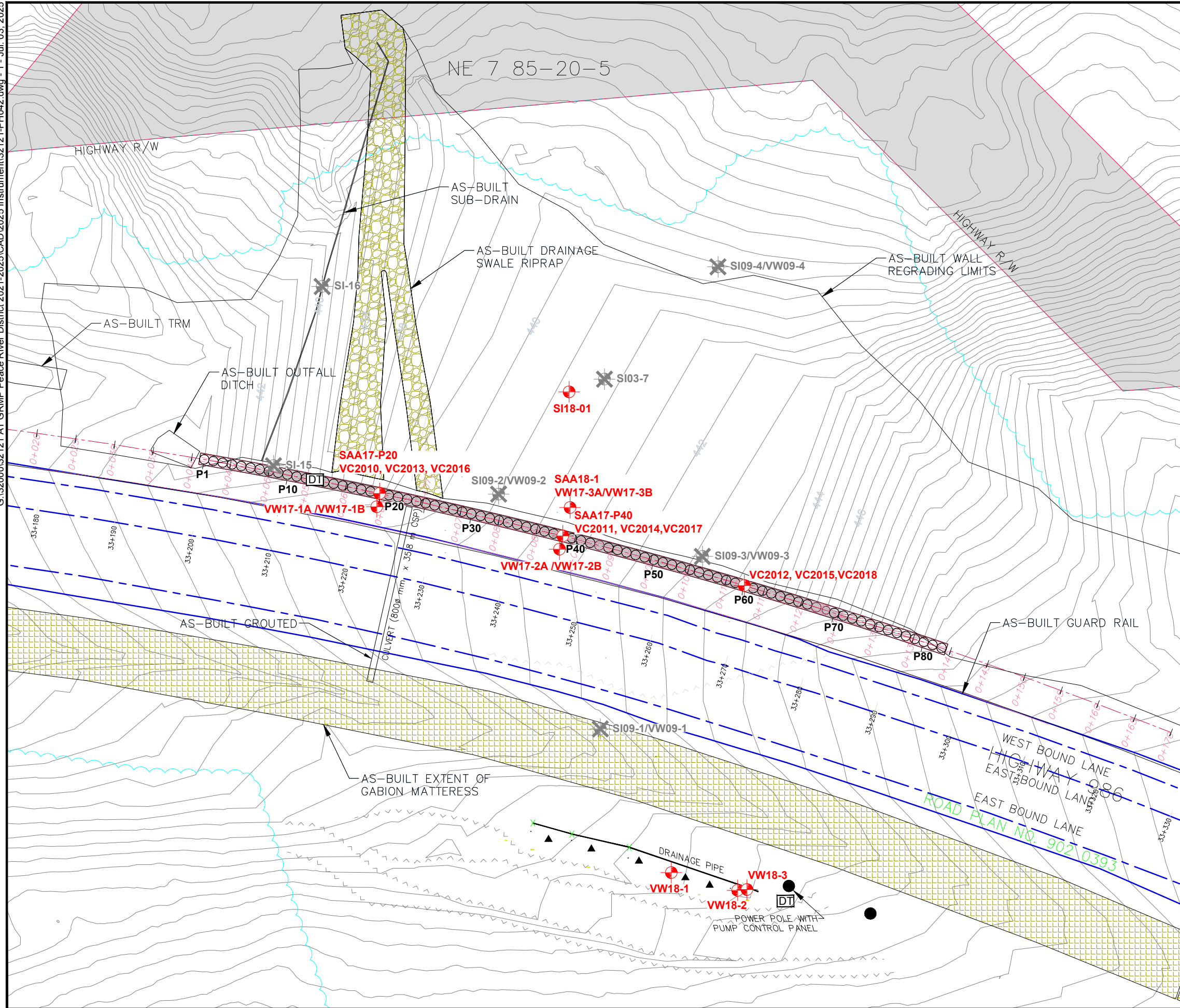
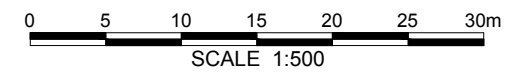
The other instruments, SAAs, Load Cells, Strain Gauges, and Vibrating Wire Piezometers at the pile wall are connected to a modem and no longer require a manual download. Read the SIs and take manual readings of the ditch VW piezometers only.

GI:32000\32121 AT GRMP Peace River District 2021-2025\CAD\2025 Instrument\32121-PH042.dwg - 1 - Jul. 03. 2025



LEGEND

- APPROXIMATE INSTRUMENT LOCATION
- NON-OPERATIONAL INSTRUMENT
- SI SLOPE INCLINOMETER
- VW VIBRATING WIRE PIEZOMETER
- VC VIBRATING WIRE LOAD CELL
- SAA SHAPE ACCELEROMETER ARRAY
- APPROXIMATE DATA LOGGER LOCATION



Alberta
Transportation

PEACE REGION (PEACE RIVER DISTRICT)

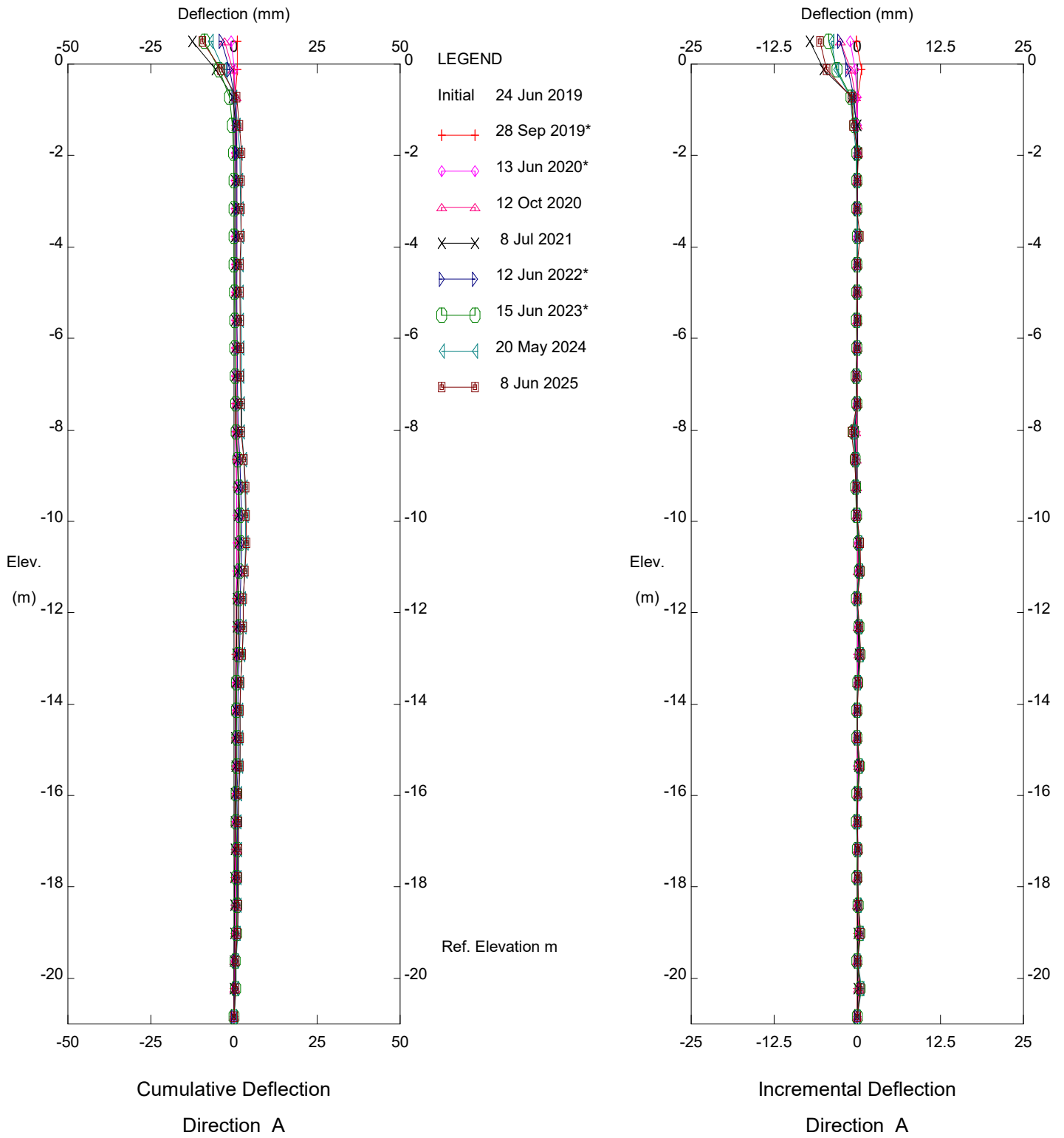
**PH042: HWY 986:01 - DAISHOWA EAST HILL
(STA. 13+000 WELL SITE)
INSTRUMENT LOCATIONS**

DWG No. 32121-PH042

DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	DWP
SCALE	1:500
DATE	JULY 2025
FILE No.	32121

THURBER

Thurber Engineering Ltd.

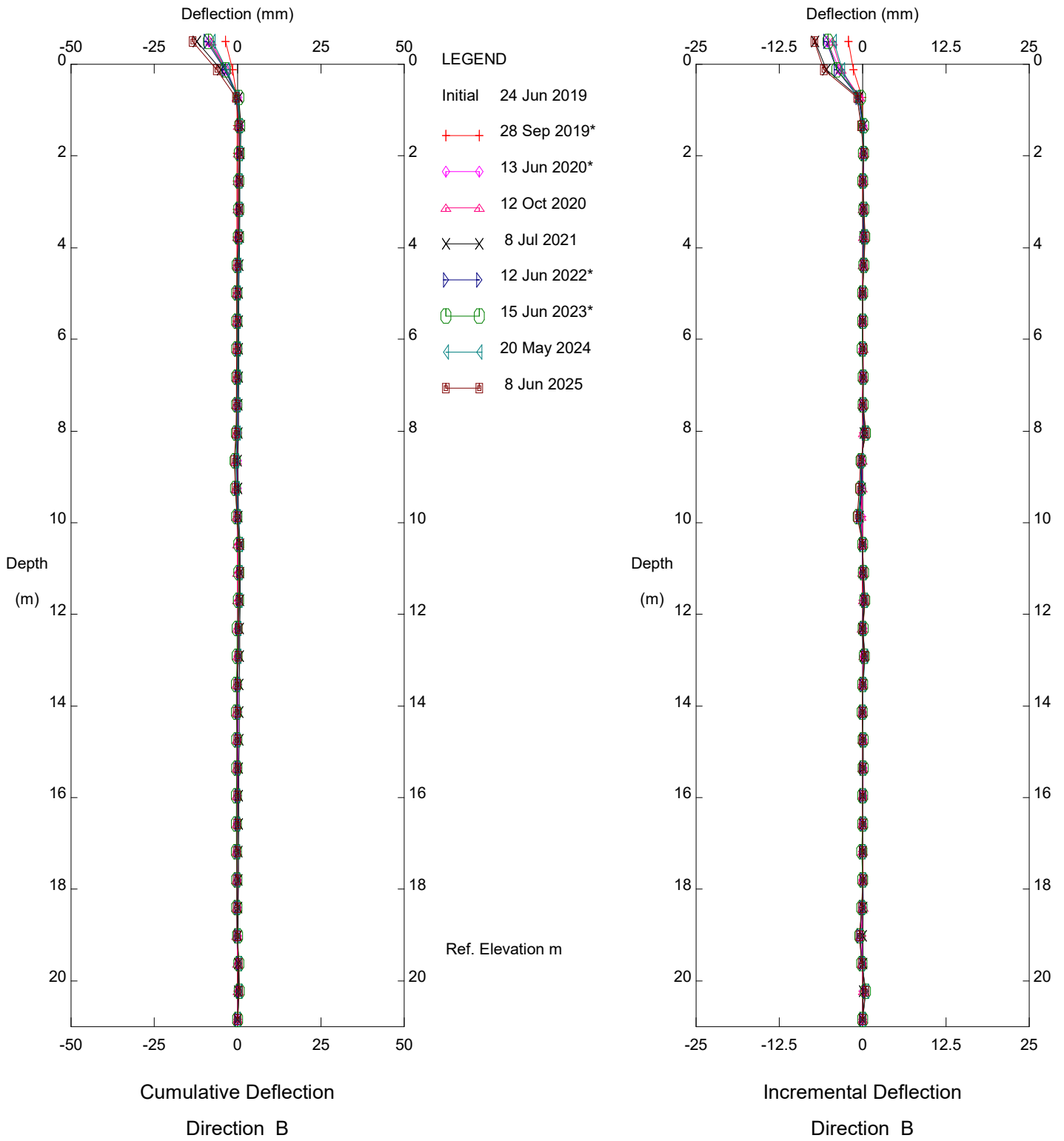


Hwy 986:01 Daishowa East Hill, Inclinometer SI18-1

Alberta Transportation

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

Thurber Engineering Ltd.

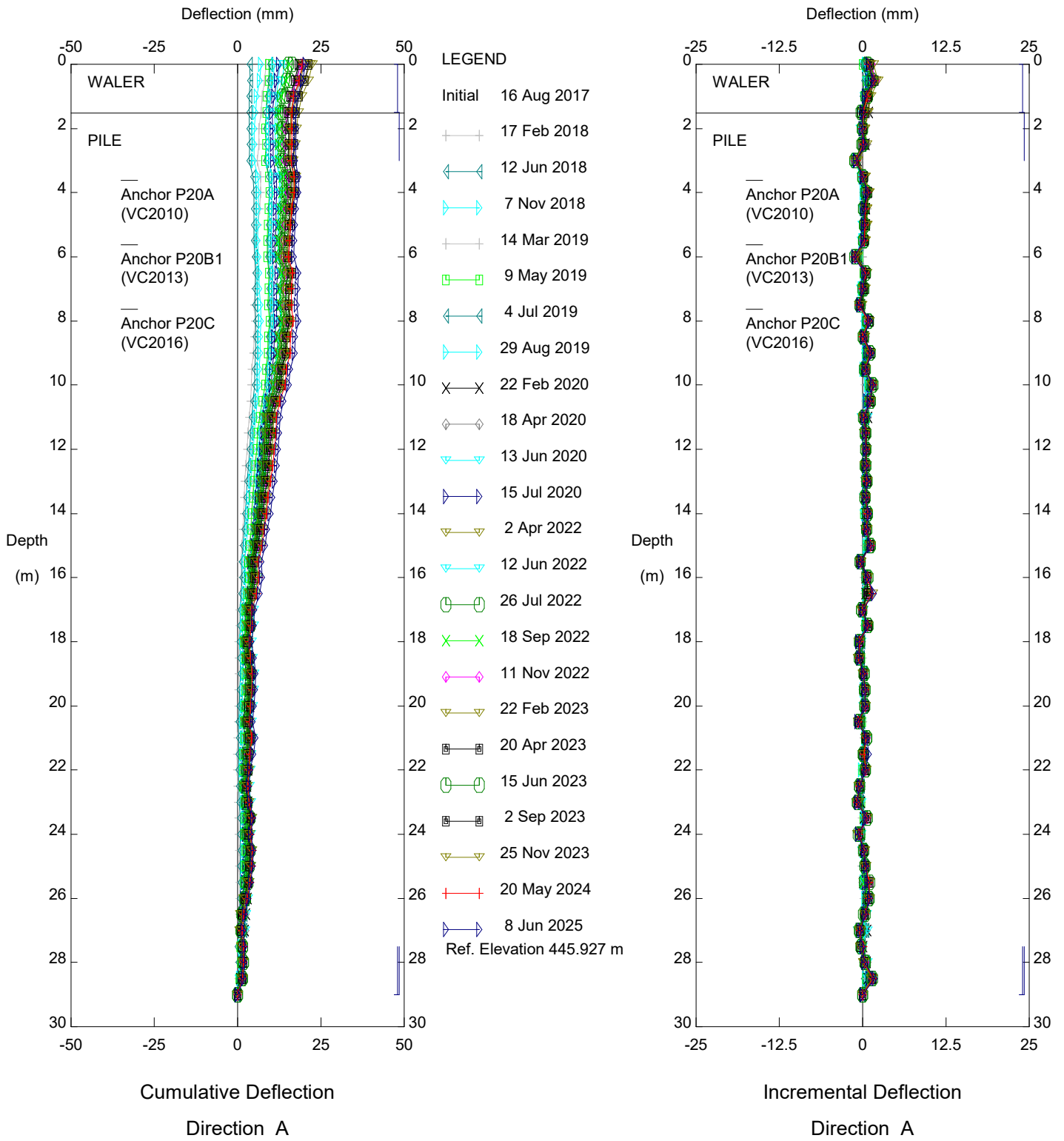


Hwy 986:01 Daishowa East Hill, Inclinometer SI18-1

Alberta Transportation

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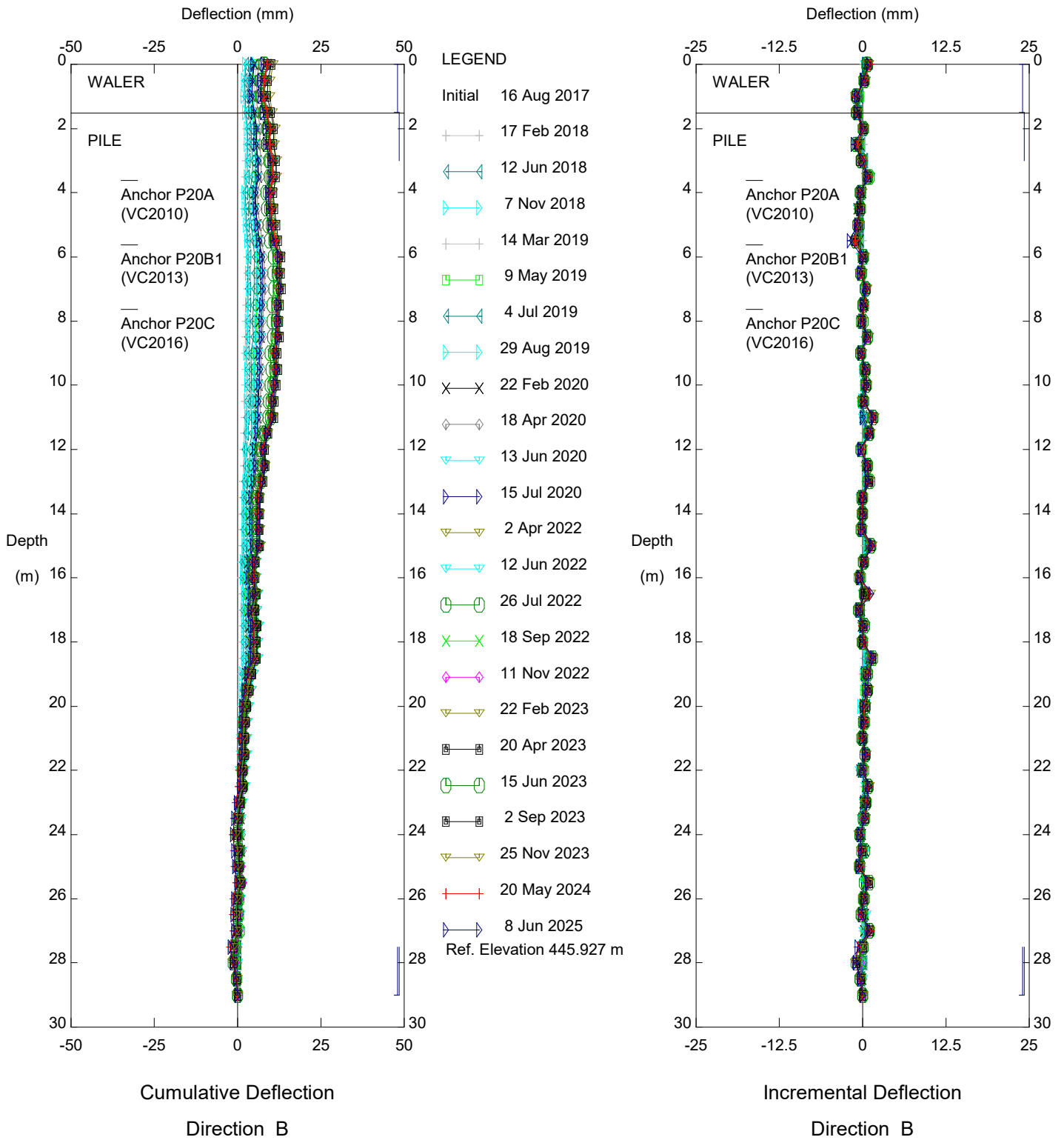
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Hwy 986:01 Daishowa East Hill, Inclinometer SAA17-P20

Alberta Transportation

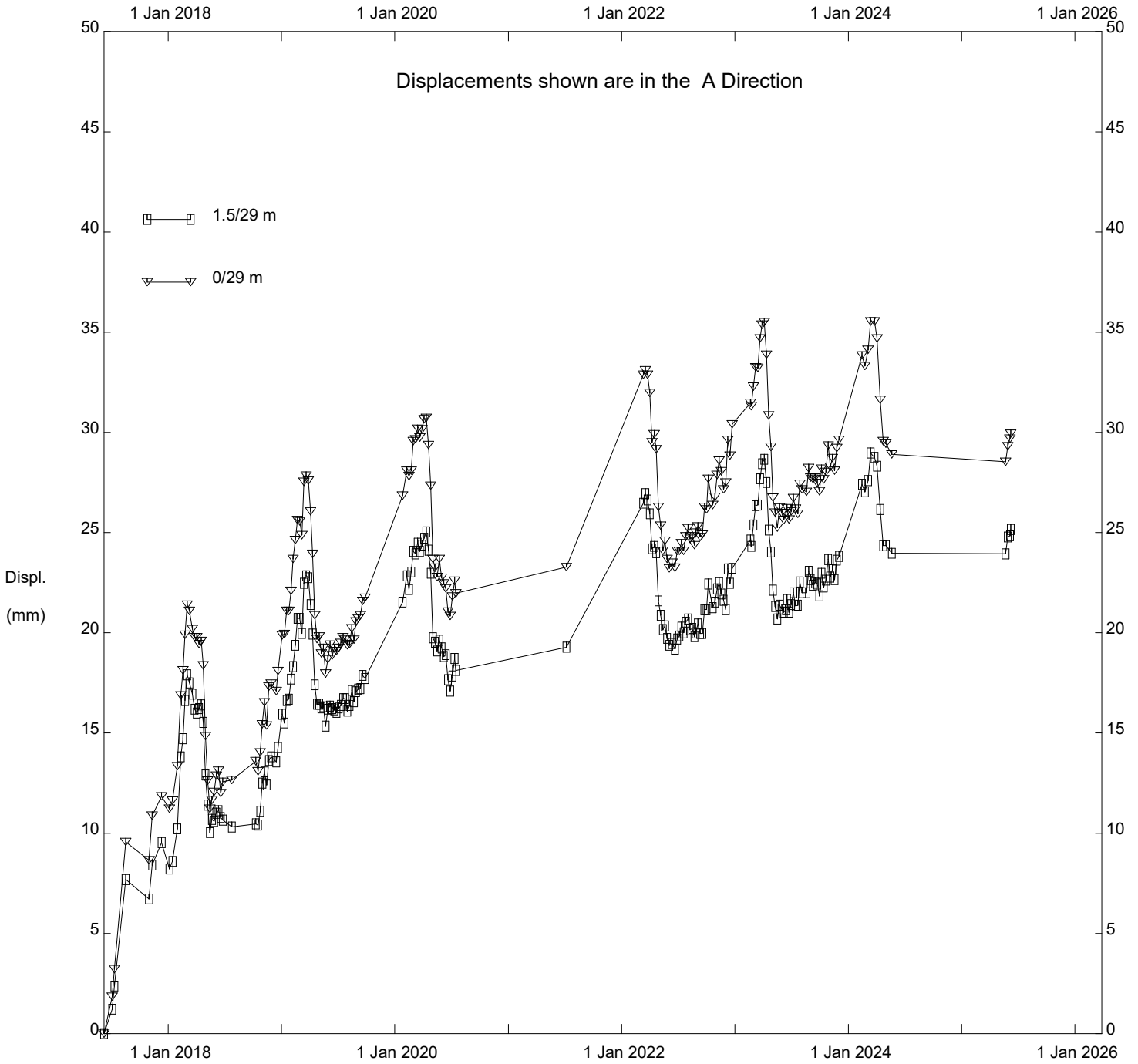
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Hwy 986:01 Daishowa East Hill, Inclinometer SAA17-P20

Alberta Transportation

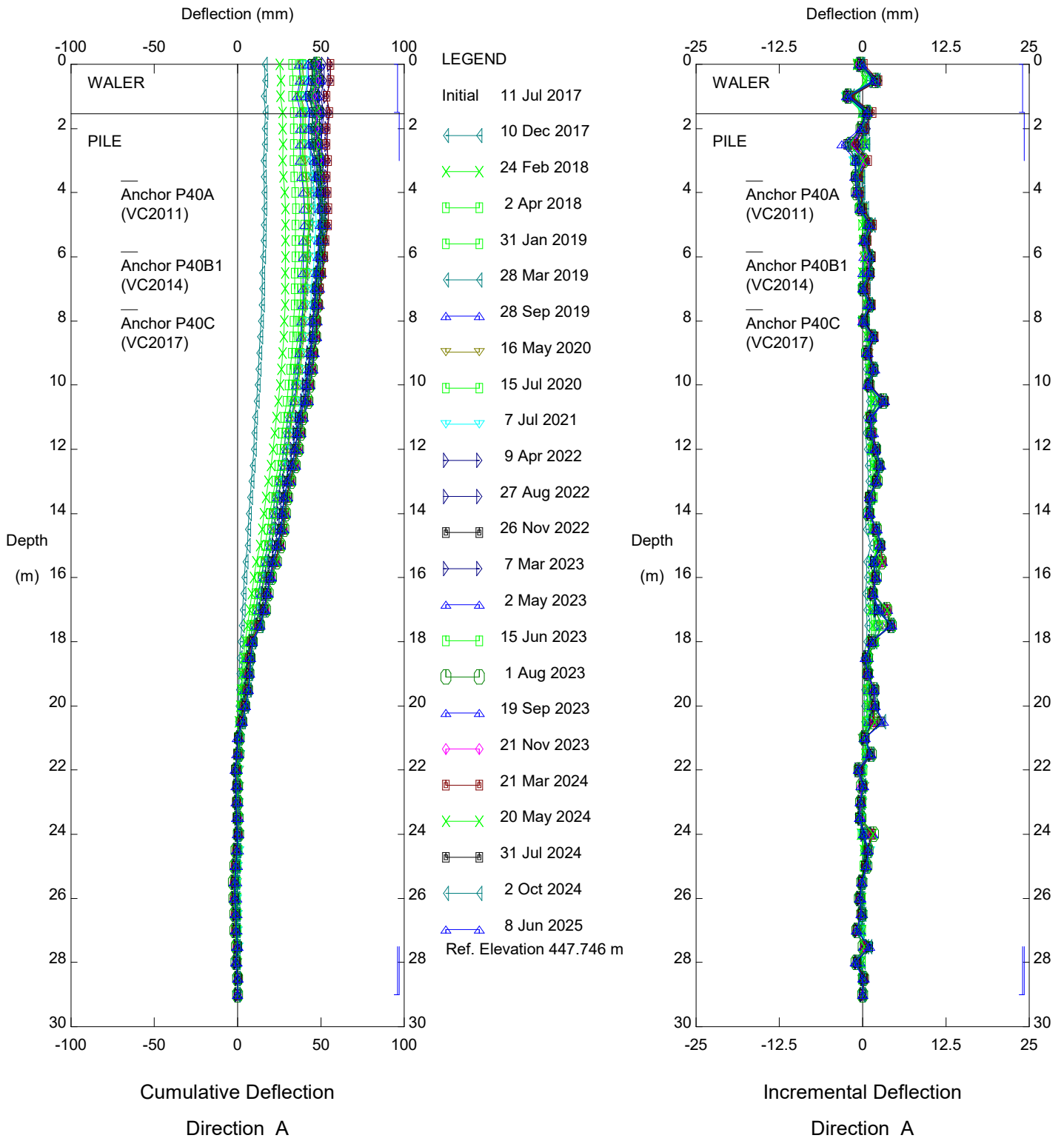
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Hwy 986:01 Daishowa East Hill, Inclinometer SAA17-P20

Alberta Transportation

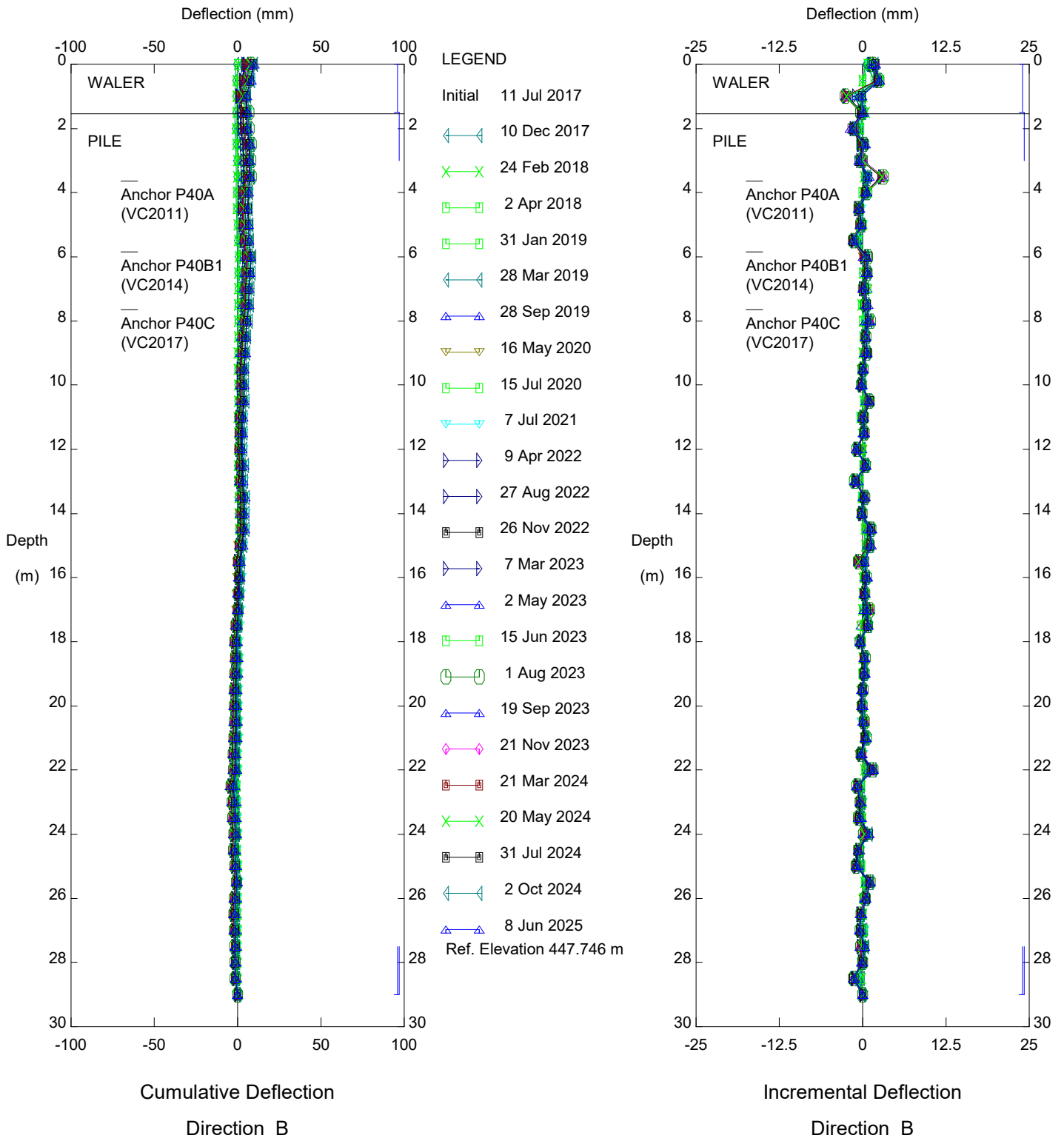
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Hwy 986:01 Daishowa East Hill, Inclinometer SAA17-P40

Alberta Transportation

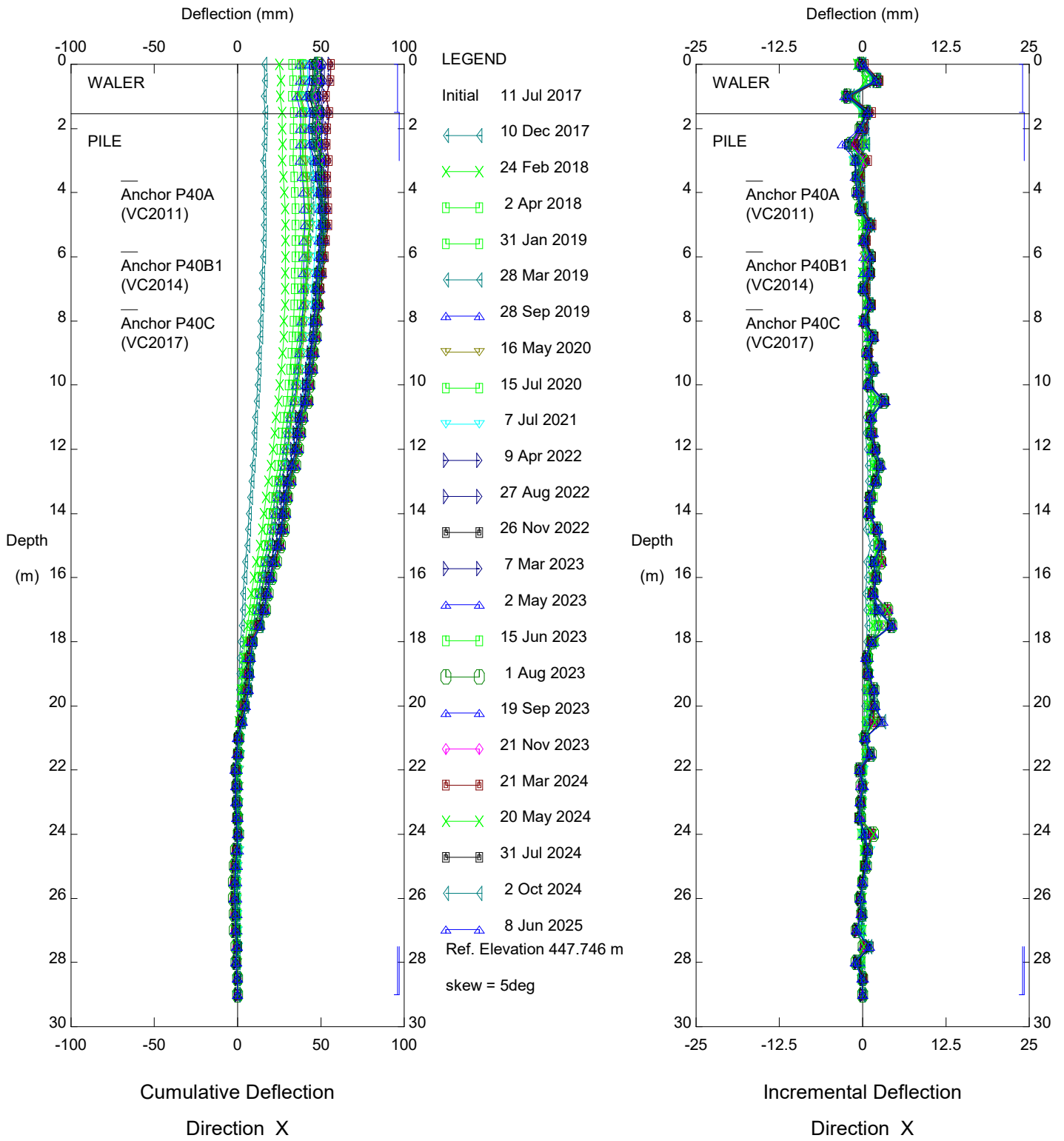
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Hwy 986:01 Daishowa East Hill, Inclinometer SAA17-P40

Alberta Transportation

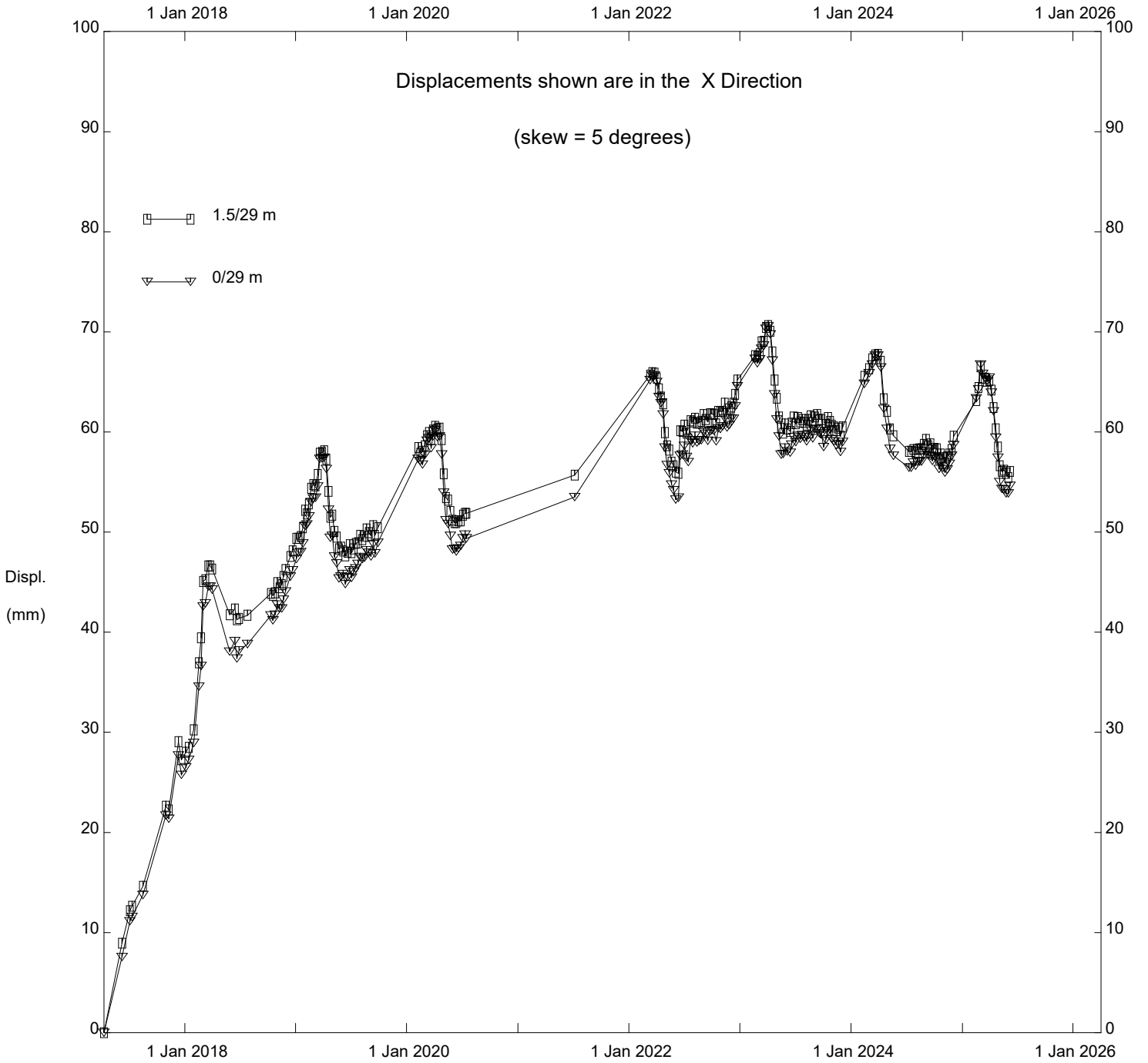
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Hwy 986:01 Daishowa East Hill, Inclinometer SAA17-P40

Alberta Transportation

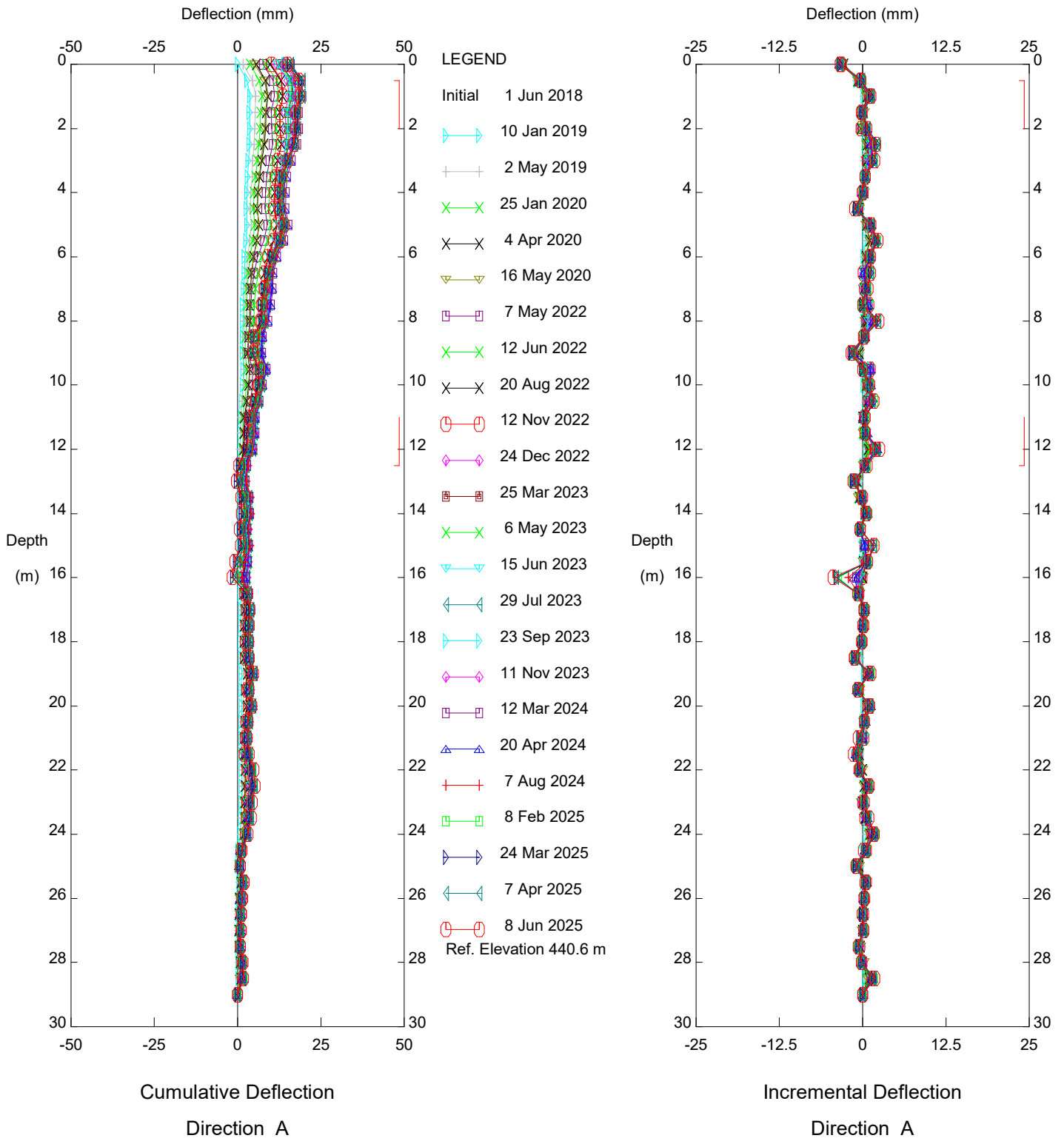
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Hwy 986:01 Daishowa East Hill, Inclinometer SAA17-P40

Alberta Transportation

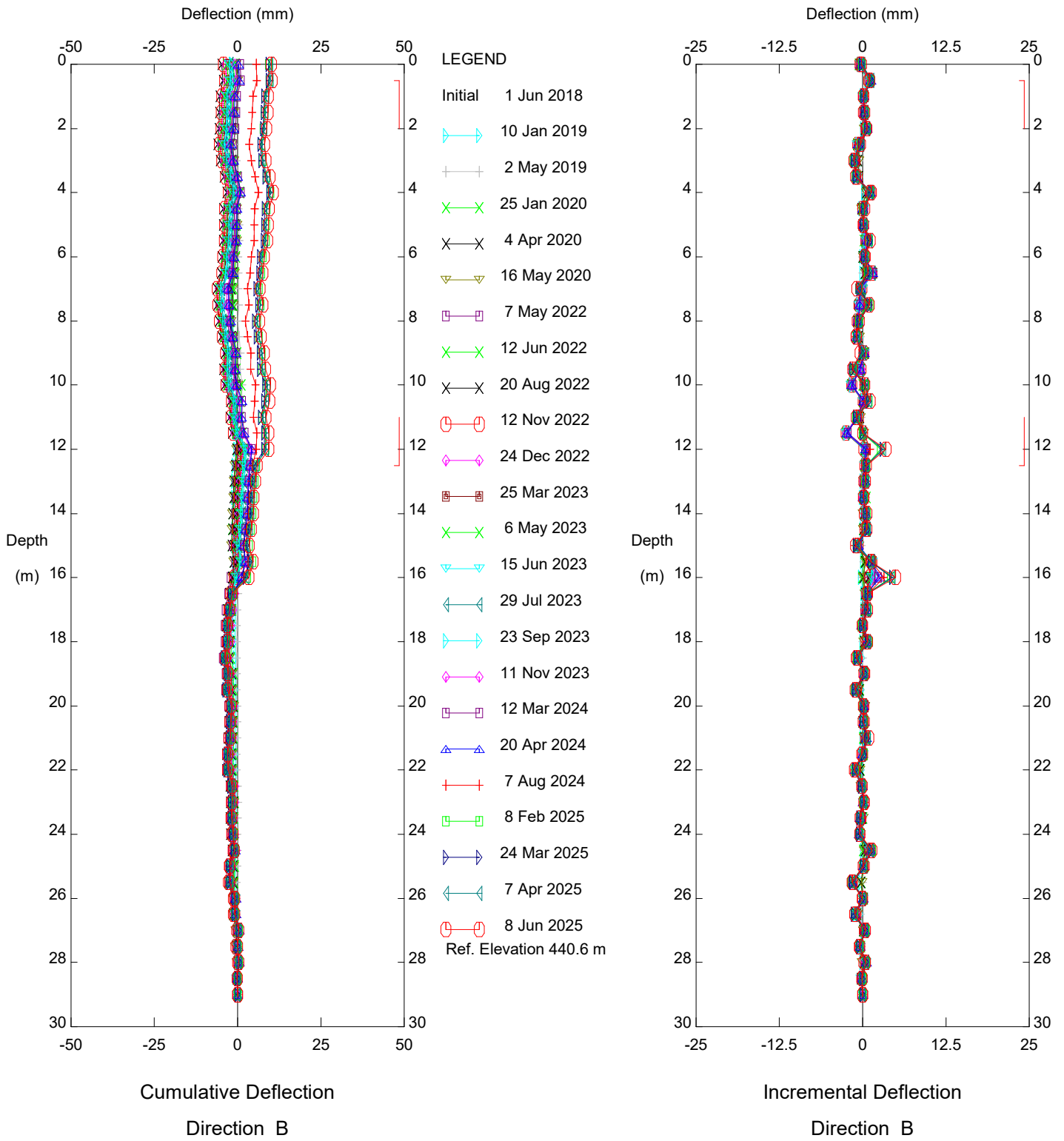
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Hwy 986:01 Daishowa East Hill, Inclinometer SAA18-1

Alberta Transportation

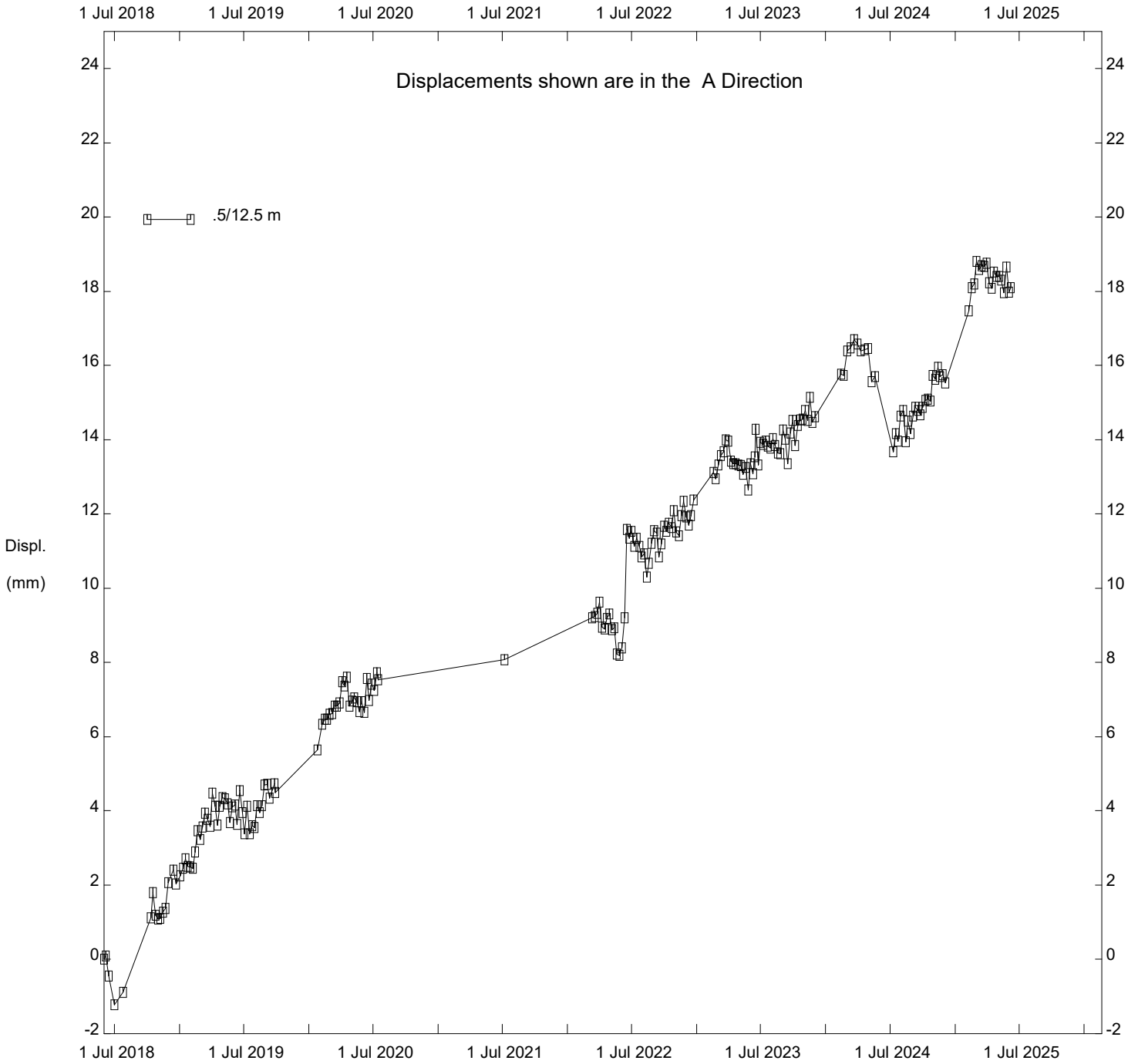
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Hwy 986:01 Daishowa East Hill, Inclinometer SAA18-1

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Hwy 986:01 Daishowa East Hill, Inclinometer SAA18-1

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COMPARISON OF SAA18-1 TO SAA17-P40 OVER 440.25 m to 428.25 m

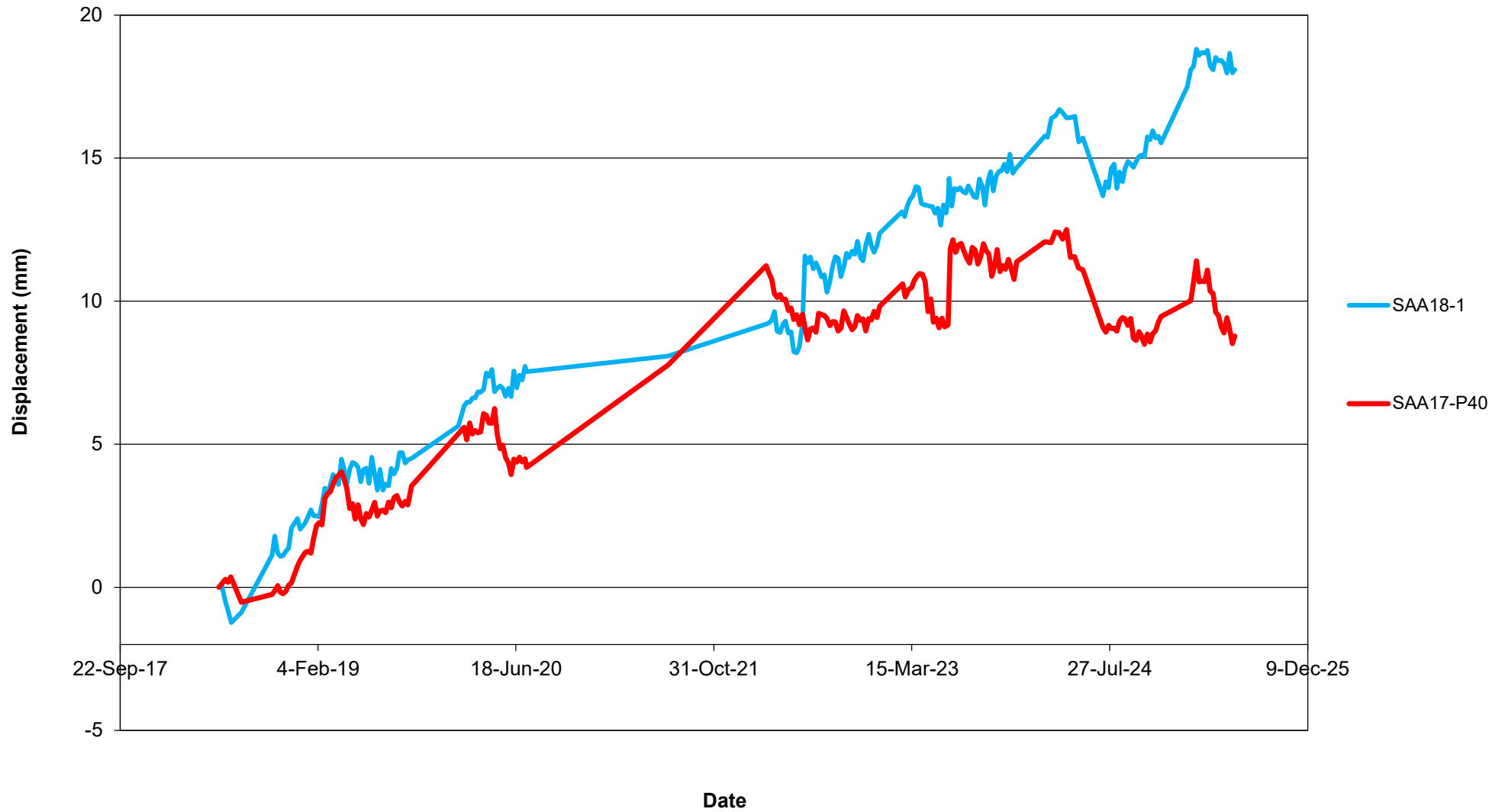
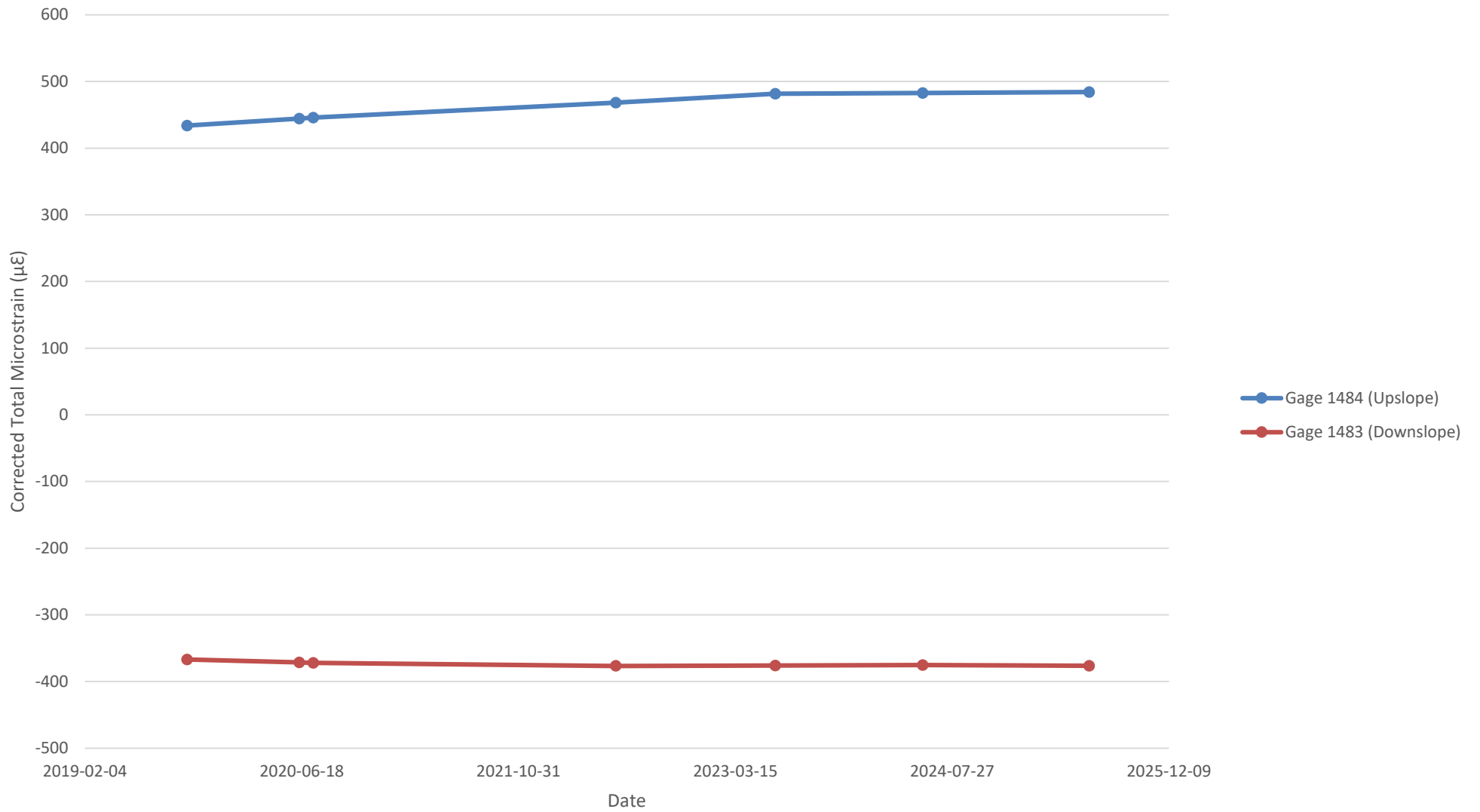
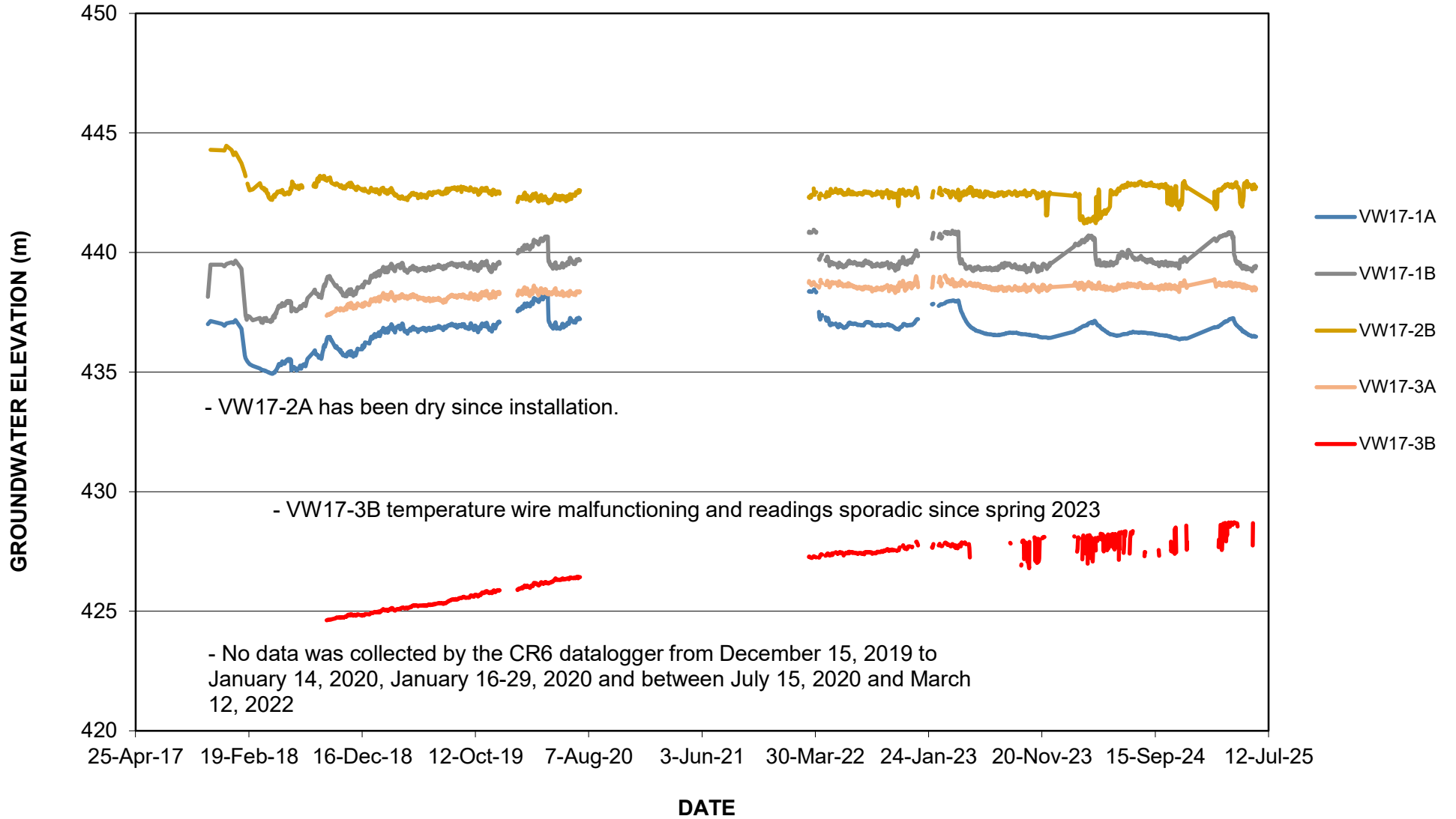


FIGURE PH042-3

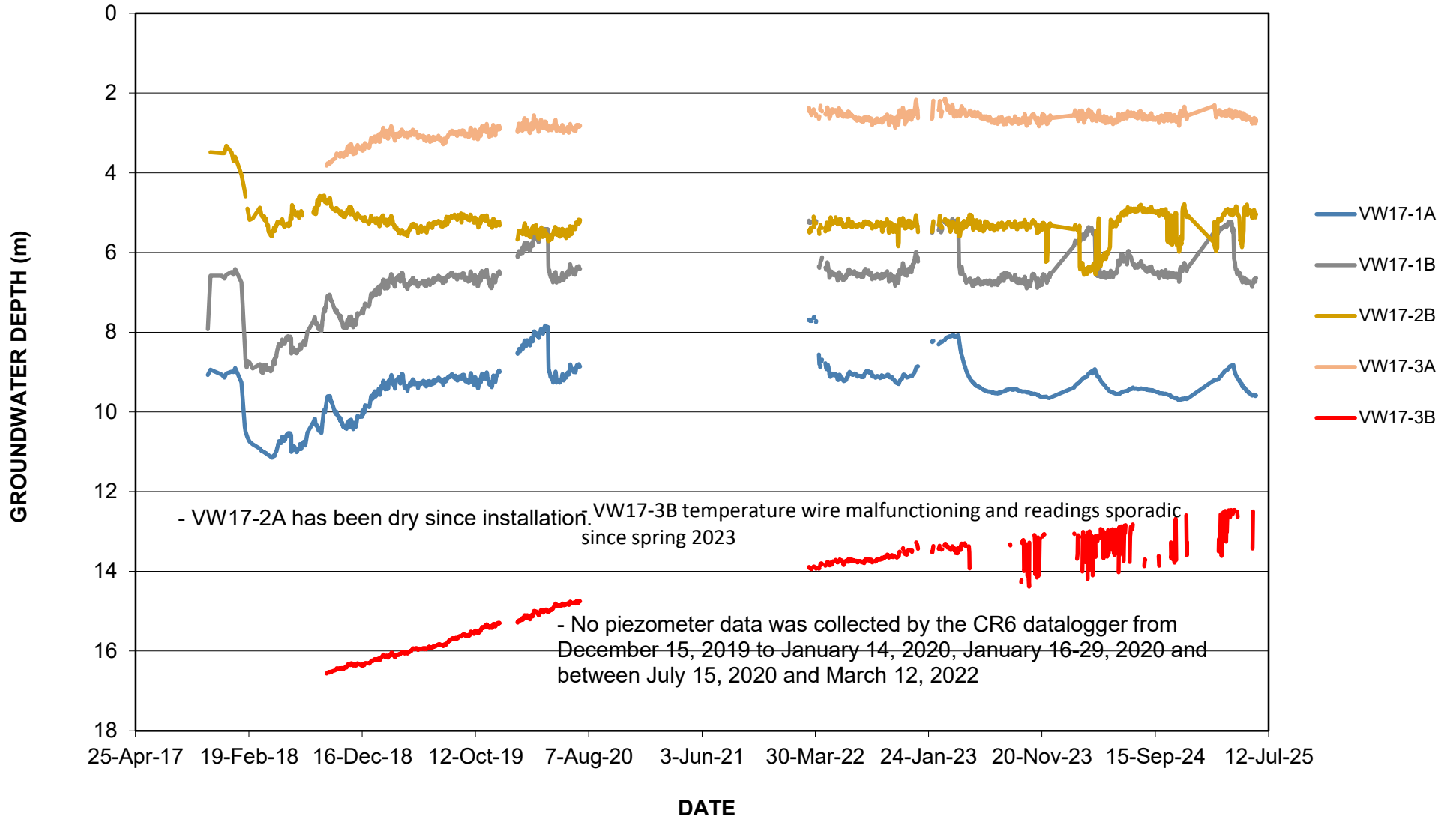
MAXIMUM STRAIN GAUGE READINGS AT 18.5 m DEPTH



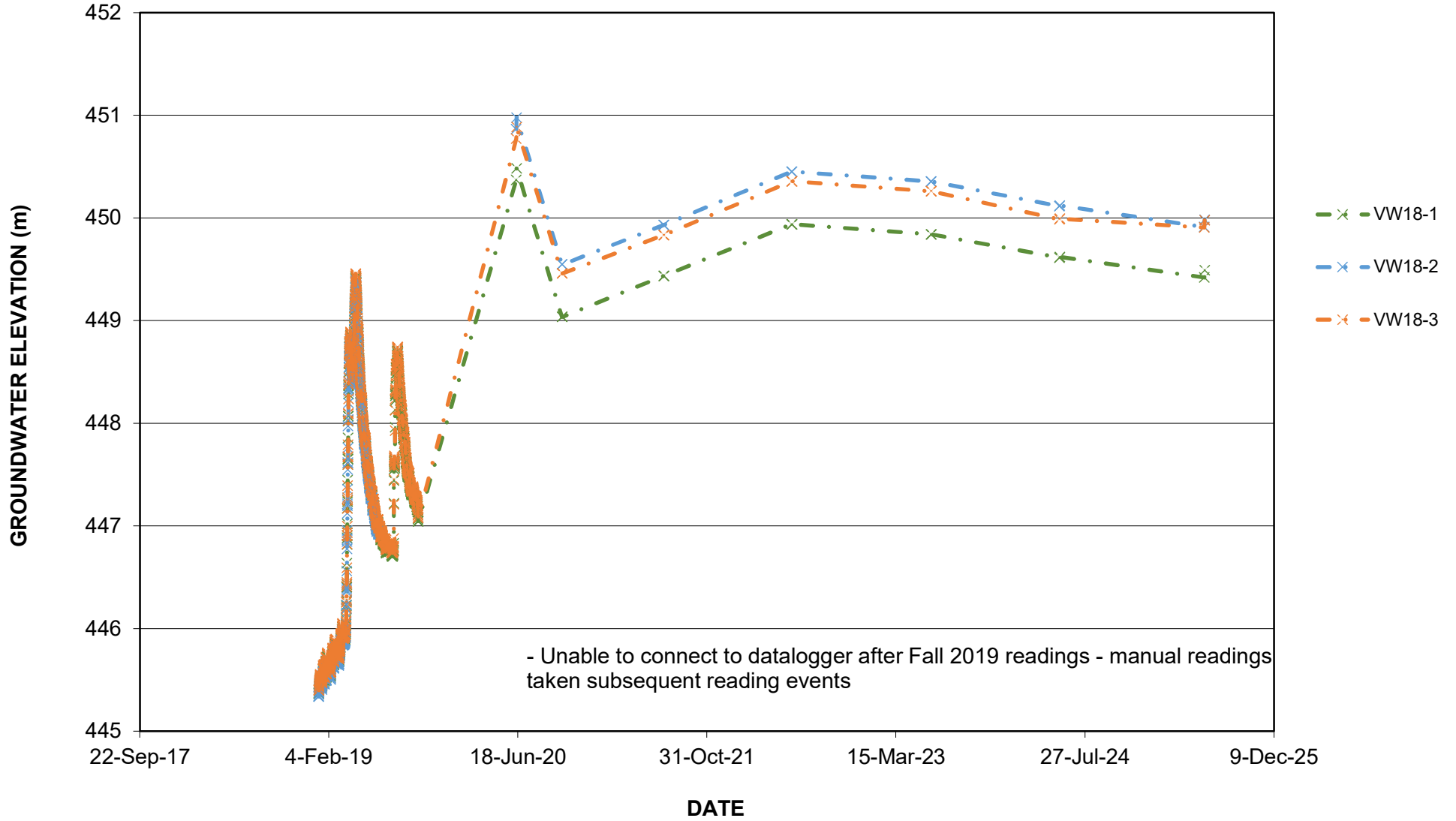
**FIGURE PH042-4
PIEZOMETRIC ELEVATIONS FOR HWY 986:01, DAISHOWA EAST HILL
(PILE WALL PIEZOMETERS)**



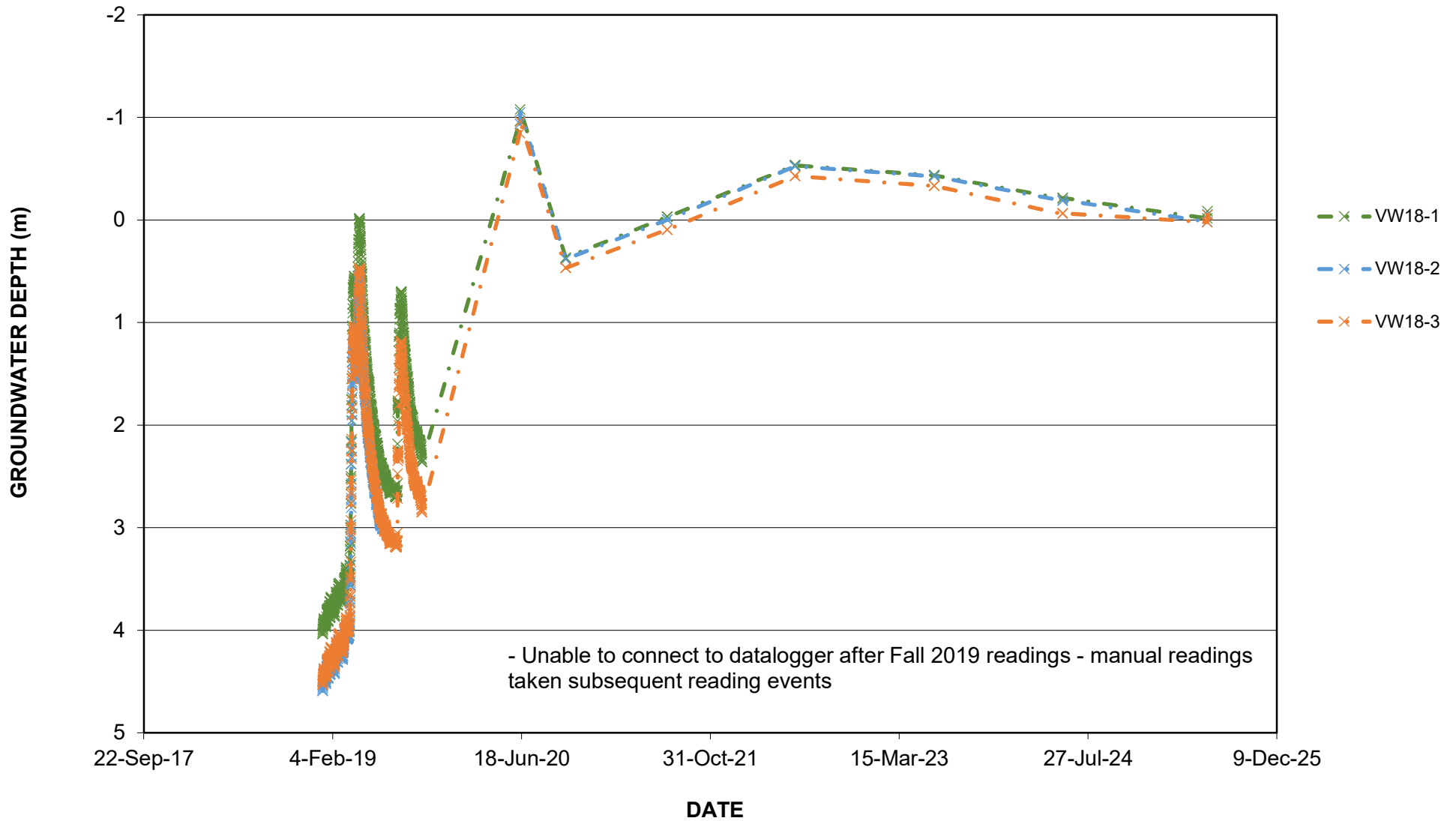
**FIGURE PH042-5
PIEZOMETRIC DEPTHS FOR HWY 986:01, DAISHOWA EAST HILL
(PILE WALL PIEZOMETERS)**



**FIGURE PH042-6
PIEZOMETRIC ELEVATIONS FOR HWY 986:01, DAISHOWA EAST HILL
(SOUTH HIGHWAY DITCH PIEZOMETERS)**



**FIGURE PH042-7
PIEZOMETRIC DEPTHS FOR HWY 986:01, DAISHOWA EAST HILL
(SOUTH HIGHWAY DITCH PIEZOMETERS)**



**FIGURE PH042-8
LOAD CELL DATA FOR HWY 986:01, DAISHOWA EAST (PILE P20)**

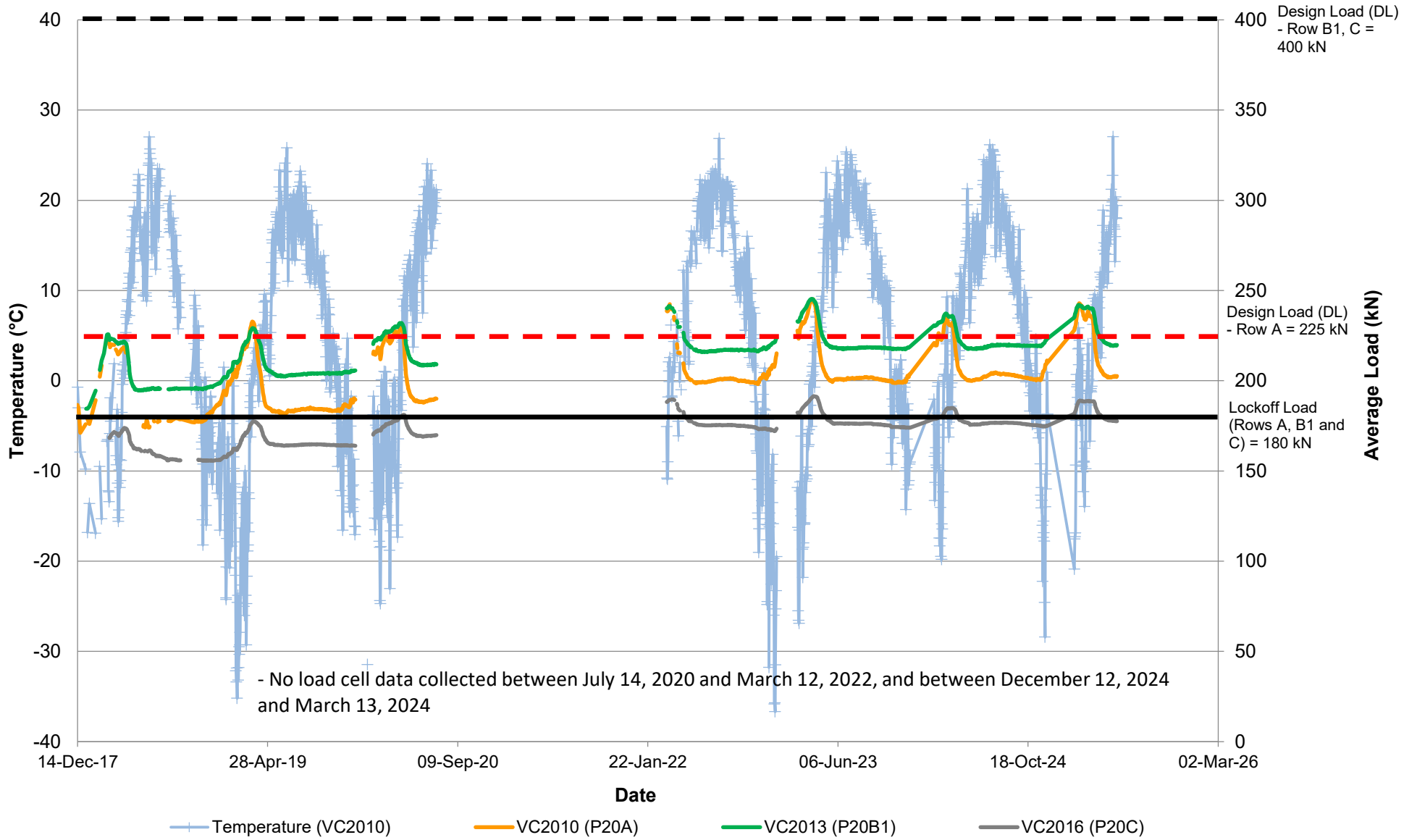


FIGURE PH042-9
LOAD CELL DATA FOR HWY 986:01, DAISHOWA EAST (PILE P40)

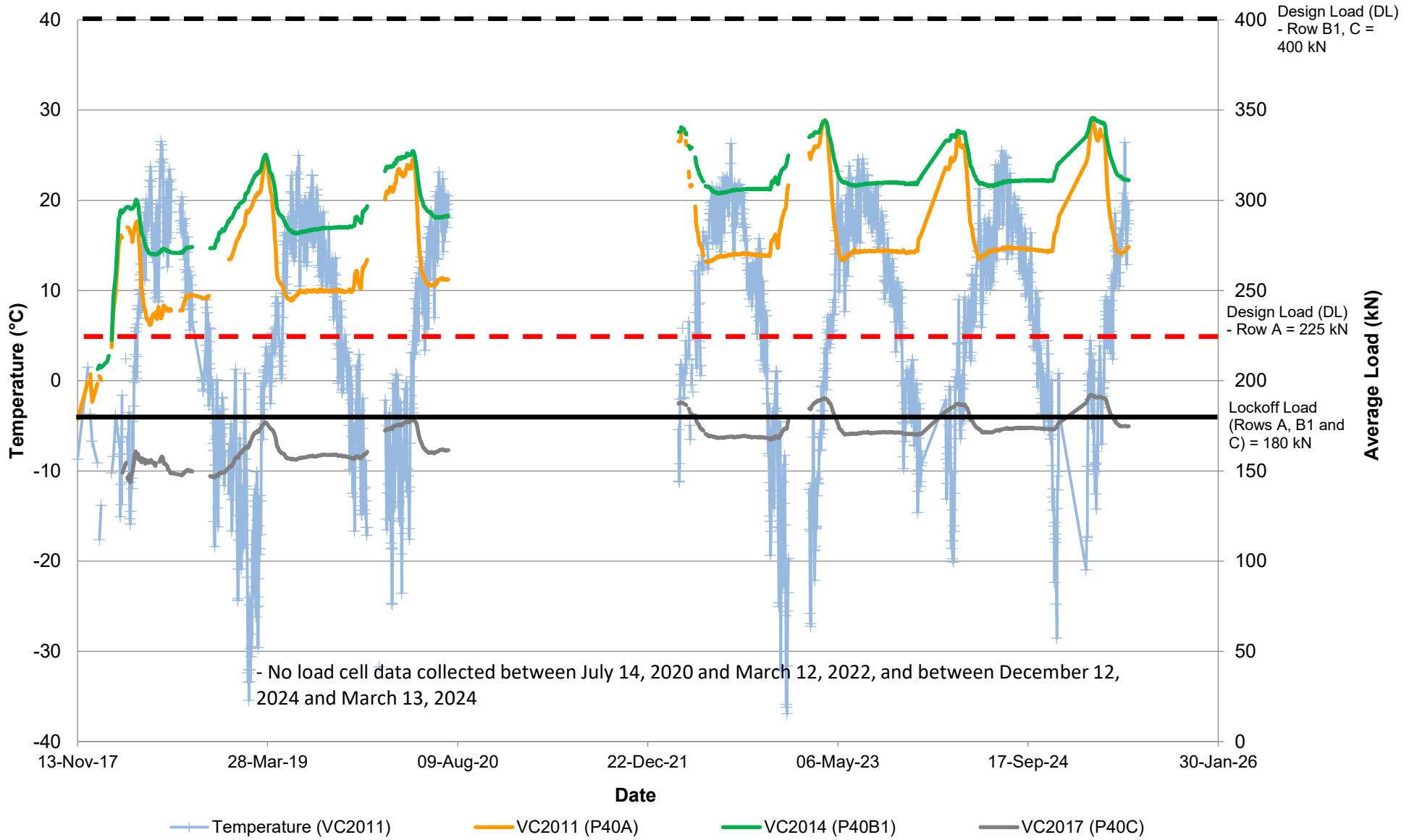


FIGURE PH042-10
LOAD CELL DATA FOR HWY 986:01, DAISHOWA EAST (PILE P60)

