

Site Number	Location	Name	Hwy	km
PH070	HWY 2:60 C1 33.840	East Hill Retaining Wall Site	2:60	Km 33.84
<b>Legal Description:</b> 4-27-83-21 W5		<b>UTM Co-ordinates</b>		
		11U E 485285	N	6230649

<b>Current Monitoring:</b>	19-May-2024	<b>Previous Monitoring</b>	12-Jun-2023
<b>Instruments Read By:</b>	Mr. Niraj Regmi, G.I.T and Mr. Nixon Mationg, of Thurber		

Instruments Read During This Site Visit			
<b>Slope Inclinometers (SIs):</b> SI-P40, SI-P58, SI-P90 and SI-P116 (installed in pile walls)  SI13-3, SI14-2 and SI14-3 (installed prior to construction)	<b>Pneumatic Piezometers (PN):</b> PN13-2A, PN13-3A, PN13-3B, PN14-2A, PN14-2B, PN14-3A, PN14-3B, PN14-4A  (installed prior to construction)	<b>Vibrating Wire Piezometers (VW):</b> N/A	<b>Standpipe Piezometers (SP):</b> SP14-1 (installed prior to construction)
<b>Load Cell (LC):</b> Sixteen vibrating wire load cells were installed on selected anchors	<b>Strain Gauges:</b> Thirty vibrating wire strain gauges were installed in pile P74 of the tied back pile wall (nine malfunctioning as of the current readings)	<b>SAA's:</b> SAA-P74	<b>Others:</b> N/A

Readout Equipment Used			
<b>Slope Inclinometers:</b> Two RST Digital Inclinometer probes with 2 ft. wheelbases and RST Pocket PC readouts	<b>Pneumatic Piezometers:</b> RST C108 pneumatic piezometer reader	<b>Vibrating Wire Piezometers:</b>	<b>Standpipe Piezometers:</b> Heron dipmeter
<b>Load Cell:</b> Campbell Scientific CR6 datalogger (remote download and field laptop)	<b>Strain Gauges:</b> Campbell Scientific CR6 datalogger (remote download and field laptop)	<b>SAA's:</b> Campbell Scientific CR6 datalogger (remote download and field laptop)	<b>Others:</b>
<b>Notes:</b>			

Discussion	
<b>Zones of New Movement:</b>	None
<b>Interpretation of Monitoring Results:</b>	<p>Slope inclinometer SI14-2, located upslope of the new pile wall, showed a rate of movement of 0.1 mm/yr over 2.8 m to 5.8 m depth, a rate of movement of 0.9 mm/yr over 17.4 m to 21.0 m depth and a rate of movement of 1.1 mm/yr over 24.7 m to 27.1 m depth since the spring of 2023 readings. Slope inclinometer SI14-3, also located upslope of the new pile wall, showed no discernible movement since the spring of 2023 readings. SI14-3 has not shown any downslope movement overall since the construction of the pile wall.</p> <p>SI13-3, located downslope of the new pile wall, continued to show no discernible movement. Based on the instrument readings and observations on site, it is believed that SI13-3 is not installed deep enough to intercept the shear surface of the landslide.</p>

Zones of movement in the piles were defined over the length of the pile and over the combined length of the pile and water. Overall, the SIs installed in the pile wall and the SAA showed movement patterns similar to those observed over the past several readings cycles. There is a general pattern of gradual downslope movement observed in the pile wall SIs and SAA.

SI-P40, installed in Pile 40, showed a rate of movement of 2.6 mm/yr in the downslope direction over both the length of the pile and over the combined length of the pile and water since the spring of 2023 readings. Pile 40 has shown a total cumulative pile head movement of 3.9 mm in the downslope direction and a total cumulative movement of 0.3 mm in the upslope direction over the combined length of the pile and water.

SI-P58, installed in Pile 58, showed no discernible movement over both the length of the pile and over the combined length of the pile and water since the spring of 2023 readings. The cumulative pile head movement was 6.2 mm in the upslope direction and the cumulative movement at the top of the water was 7.8 mm in the upslope direction.

SI-P90, installed in Pile 90, showed a rate of movement of 1.2 mm/yr over the length of the pile and a rate of movement of 1.6 mm/yr over the combined length of the pile and water since the spring of 2023 readings. Pile 90 has shown a total cumulative pile head movement of 10.6 mm in the upslope direction and a total cumulative movement of 13.5 mm in the upslope direction over the combined length of the pile and water.

SI-P116, installed in Pile 116, showed a rate of movement of less than 0.1 mm/yr over both the length of the pile and a rate of movement of 0.3 mm/yr over the combined length of the pile and water since the spring of 2023 readings. Pile 116 has shown a total cumulative pile head movement of 7.7 mm in the downslope direction and a total cumulative movement of 8.7 mm in the downslope direction over the combined length of the pile and water.

SAA-P74, installed in pile P74 of the pile wall, showed an average rate of movement of 1.2 mm/yr in the downslope direction over the length of the pile and an average rate of movement of 1.3 mm/yr over the combined length of the pile and water in the downslope direction since the spring of 2023 readings. SAA-P74 has shown a total cumulative pile head movement of 0.7 mm in the upslope direction and a total cumulative movement of 5.7 mm in the upslope direction over the combined length of the pile and water.

The strain gauges generally showed small increases in negative (compressive) strain on the upslope pile face. On the downslope pile face, there was not a clear trend of overall increasing or decreasing strain; seven of the strain gauges on the downslope pile face were not functioning during the current readings which also made it difficult to observe a trend in the strain. The maximum change in microstrain since the previous readings was  $-22.4 \mu\epsilon$ , measured at 20.2 m depth on the upslope pile face.

Pneumatic piezometers PN13-2A, PN13-3A, PN13-3B, PN14-2A, PN14-2B, PN14-3A and PN14-4A showed decreases in groundwater level of 0.09 m, 0.01 m, 1.27 m, 0.01 m, 0.45 m, 0.22 m and 0.01 m, respectively, since the spring of 2023 readings. PN14-3B showed an increase in groundwater level of 0.02 m since the spring of 2023 readings.

Standpipe piezometer SP14-1 showed a decrease in groundwater level of 0.34 m since the spring of 2023 readings.

Overall, the piezometers have shown relatively stable groundwater levels for the past several years, with the exception of PH13-3B which showed a significant drop in groundwater level, and is currently showing the lowest groundwater level measured since the fall of 2020 readings.

The majority of the load cells showed an increase in measured load compared to the spring of 2023 readings, ranging from 0.01 kN in VC1976 (anchor G102WL) to 25.97 kN in VC1968 (anchor G190PL). Load cells VC2023

	<p>(G182PL) showed a decrease in measured load of 1.08 kN since the spring of 2023 readings. The current loads for load cells VC1977 (anchor G39WL), VC1975 (anchor G40WU) and VC1972 (anchor G58WU) are the highest ever recorded by the respective load cells. It should also be noted that the datalogger did not record any readings between November 29, 2023 and May 22, 2024, when the datalogger was manually read on site. Historically, the load cells have registered higher loads during the winter months, which may have been missed during the last winter.</p> <p>Anchors G39WL and G40WU in Wall Section 2 currently show a trend of gradually increasing load. G39WL and G40WU are currently 2.24 kN and 5.58 kN, respectively, above their SLS design loads. Anchor G58WU in Wall Section 3A also shows a trend of slowly increasing loads, and the current load is currently 16.85 kN above the SLS design load. Anchor G190PL, in the bottom (fifth) row of anchors in Wall Section 4, shows a trend of increasing load, however the design of the wall assumes that the anchors installed through the piles in this wall section will pick up load over time.</p> <p>Load cells VC2023, VC2024, and VC2025 were installed on stiff anchors (G182PL, G188PL and G202PL', respectively) that were left with some slack to allow the piles to deform before the anchors pick up load. These anchors are located in wall Design Section 4. These load cells were connected to the datalogger on September 27, 2017. These load cells indicate current loads ranging from 13.58 kN to 16.15 kN, and these anchors have not shown significant changes in the loads since the end of construction, suggesting that there may still be some slack at the nut in these anchors.</p> <p>The load cells on G80WU and G80WL in Design Section 4 are showing loads that are 57.25 kN and 24.04 kN above SLS design load, respectively. However, these anchors were intentionally locked off at a higher load than the SLS load during construction, with the expectation that they would slacken over time.</p>
<p><b>Future Work:</b></p>	<p>The instruments should be read again in the spring of 2025.</p> <p>The readings will be used to complete a pile wall system performance review to compare the measured responses to the expected design values. This task is underway as part of our innovation work.</p> <p>Since the new movements noted in SI14-2 are below the tips of the pile wall, special attention should be paid when reviewing future readings to check for potential increases in the rate of movement. Although the movement to date had been very small, the road surface should also be visually monitored at this location to check for any subsidence or new cracks. In addition a large slide is developing in the hillside to the west of the wall which needs to be visually monitored and compared to the annual readings of the wall.</p>
<p><b>Instrumentation Repairs:</b></p>	<p>The datalogger battery was found to have discharged on November 29, 2023 during the current readings. The datalogger program was modified after the spring of 2023 readings to minimize battery drain from the modem. However there appears to still be an issue with charging the datalogger battery. The battery charging system should be checked to ensure that the battery is charging from the solar panel. Additionally, a larger solar panel should be installed for the datalogger, to ensure that the battery stays charged. This is particularly important for winter months with low sunlight.</p>
<p><b>Additional Comments:</b></p>	

**Attachments:**

- Table PH070-1 Spring 2024 – HWY 2:60 Peace River East Hill Retaining Wall Site (km 33.84) Slope Inclinometer Instrumentation Reading Summary
- Table PH070-2 Spring 2024 – HWY 2:60 Peace River East Hill Retaining Wall Site (km 33.84) Shape Accelerometer Array Instrumentation Reading Summary
- Table PH070-3 Spring 2024 – HWY 2:60 Peace River East Hill Retaining Wall Site (km 33.84) Vibrating Wire Strain Gauge Instrumentation Reading Summary
- Table PH070-4 Spring 2024 – HWY 2:60 Peace River East Hill Retaining Wall Site (km 33.84) Pneumatic Piezometer Instrumentation Reading Summary
- Table PH070-5 Spring 2024 – HWY 2:60 Peace River East Hill Retaining Wall Site (km 33.84) Standpipe Piezometer Instrumentation Reading Summary
- Table PH070-6 Spring 2024 – HWY 2:60 Peace River East Hill Retaining Wall Site (km 33.84) Vibrating Wire Load Cell Instrumentation Reading Summary
- Statement of Limitations and Conditions
- APPENDIX A - PH070 SPRING 2024
  - Field Inspector's report
  - Site Plans Showing Approximate Instrument Locations (Drawings No. 32121 PH070-1 and 32121-PH070-2)
  - SI Reading Plots
  - SAA Reading Plots
  - Figure PH070-1 (Downslope Strain Gauge Values)
  - Figure PH070-2 (Upslope Strain Gauge Values)
  - Figure PH070-3 (Piezometric Elevations)
  - Figure PH070-4 (Piezometric Depths)
  - Figure PH070-5 (Section 2 Load cells)
  - Figure PH070-6 (Section 3A Load Cells)
  - Figure PH070-7 (Section 3B Load Cells)
  - Figure PH070-8 (Section 4 Load Cells)

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.  
Don Proudfoot, M.Eng., P. Eng.  
Partner | Senior Geotechnical Engineer

Bruce Nestor, P.Eng.  
Geotechnical Engineer



**Table PH070-1 Spring 2024 – Hwy 2:60 Peace River East Hill Retaining Wall Site (Km 33.84) Slope inclinometer Instrumentation Reading Summary**

Date Monitored: May 19, 2024

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)
SI10-1	March 4, 2010	53.4 mm over 0 m to 3.0 m depth in 173° direction	52.1 mm/yr. in September 2013	Removed during construction	September 15, 2016	N/A	N/A	N/A
		13.1 mm over 3.6 m to 6.6 m depth in 173° direction	3.8 mm/yr. in May 2015			N/A	N/A	N/A
		3.8 mm over 26.2 m to 28.0 m depth in 173° direction	3.3 mm/yr. in May 2010			N/A	N/A	N/A
SI10-2	March 4, 2010	27.5 mm over 4.1 m to 5.9 m depth in 330° direction	54.7 mm/yr. in September 2010	Sheared at ~6.1 m depth	June 1, 2011	N/A	N/A	N/A
		1.8 mm over 24.2 m to 26.0 m depth in 250° direction	4.4 mm/yr. in May 2010			N/A	N/A	N/A
SI13-2	August 4, 2013	33.3 over 15.5 m to 19.1 m depth in 17° direction	16.5 in September 2015	Removed during construction	June 2, 2016	N/A	N/A	N/A
SI13-3	August 4, 2013	No discernible movement	No discernible movement	Operational	June 12, 2023	N/A	N/A	N/A

Drawings 32121-PH070-1 and 32121-PH070-2 in Appendix A provide a sketch of the approximate locations of the monitoring instrumentation for this site.



**Table PH070-1 – Continued... Spring 2024 – Hwy 2:60 Peace River East Hill Retaining Wall Site (Km 33.84) Slope Inclinator Instrumentation Reading Summary**

Date Monitored: May 19, 2024

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)
SI14-2	December 16, 2014	6.6 mm over 2.8 m to 5.8 m depth in 185° direction	24.7 mm/yr in December 2014	Operational	June 12, 2023	0.2	0.1	0.2
		14.5 mm over 17.4 m to 21.0 m depth in 185° direction	18.9 mm/yr in December 2014			0.9	0.9	0.1
		10.8 mm over 24.7 m to 27.1 m depth in 185° direction	4.2 mm/yr in May 2015			1.0	1.1	-0.2
SI14-3	December 16, 2014	20.3 mm over 3.3 m to 9.4 m depth in 171° direction	85.8 mm/yr in December 2014	Operational	June 12, 2023	No discernible movement	N/A	-1.0
SI14-4	December 20, 2014	44.7 mm over 17.3 m to 19.7 m depth in 171° direction	18.1 mm/yr in September 2016	Sheared at 19.5 m below top of casing	June 13, 2022	N/A	N/A	N/A

Drawings 32121-PH070-1 and 32121-PH070-2 in Appendix A provide a sketch of the approximate locations of the monitoring instrumentation for this site.



**Table PH070-1 – Continued... Spring 2024 – Hwy 2:60 Peace River East Hill Retaining Wall Site (Km 33.84) Slope Inclinator Instrumentation Reading Summary**

Date Monitored: May 19, 2024

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.)
SI-P40	October 19, 2016	3.9 mm over 2.4 m to 19.5 m depth in 188° direction	-39.8 mm/yr. on April 4, 2017	Operational	June 12, 2023	2.4	2.6	1.9
		-0.3 mm over 0 m to 19.5 m depth in 188° direction	-57.3 mm/yr. on April 4, 2017			2.4	2.6	2.3
SI-P58	October 18, 2016	-6.2 mm over 2.4 m to 23.7 m depth in 209° direction	-70.8 mm/yr. on June 24, 2017	Operational	June 12, 2023	No discernible movement	N/A	-2.5
		-7.8 mm over 0.5 m to 23.7 m depth in 209° direction	-65.7 mm/yr. on June 24, 2017			No discernible movement	N/A	-2.6
SI-P90	October 18, 2016	-10.6 mm over 1.9 m to 23.3 m depth in 174° direction	-76.0 mm/yr. on April 8, 2017	Operational	June 12, 2023	1.2	1.2	0.7
		-13.5 mm over 0.1 m to 23.3 m depth in 174° direction	-97.5 mm/yr. on April 8, 2017			1.5	1.6	1.2
SI-P116	November 25, 2016	7.7 mm over 1.6 m to 18.1 m depth in 189° direction	20.7 mm/yr. on October 4, 2017	Operational	June 12, 2023	<0.1	<0.1	-0.8
		8.7 mm over 0.4 m to 18.1 m depth in 189° direction	19.6 mm/yr. on October 4, 2017			0.3	0.3	-0.6



**Table PH070-2 Spring 2024 – Hwy 2:60 Peace River East Hill Retaining Wall Site (Km 33.84) Shape Accelerometer Array Instrumentation Reading Summary**

Date Monitored: May 23, 2024

<b>INSTRUMENT #</b>	<b>DATE INITIALIZED</b>	<b>TOTAL CUMULATIVE RESULTANT MOVEMENT AT NOTED DEPTH SINCE INITIAL READING (mm)</b>	<b>CURRENT STATUS</b>	<b>DATE OF PREVIOUS READING*</b>	<b>INCREMENTAL MOVEMENT SINCE PREVIOUS READING (mm)</b>	<b>AVERAGE RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr.)</b>	<b>CHANGE IN AVERAGE RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr.)</b>
SAA-P74	January 31, 2017	-0.7 over 2.0 m to 31.0 m depth in 194° direction	Operational	June 13, 2023	1.1	1.2	0.1
		-5.7 over 1.0 m to 31.0 m depth in 194° direction			1.2	1.3	0.7

Drawings 32121-PH070-1 and 32121-PH070-2 in Appendix A provide a sketch of the approximate locations of the monitoring instrumentation for this site.

\* SAA readings are taken once per day and collected to datalogger. The movement rate is an average rate compared to the previous readings in Spring 2023





**Table PH070-3 Spring 2024 – Hwy 2:60 Peace River East Hill Retaining Wall Site (Km 33.84) Vibrating Wire Strain Gauge Instrumentation Reading Summary**

Date Monitored: May 22, 2024

DEPTH FROM TOP OF PILE P74 (m)	GAUGE #	TOTAL MICROSTRAIN (µε)	CHANGE IN MICROSTRAIN SINCE PREVIOUS READINGS* (µε)	MEASURED TEMPERATURE (°c)	GAUGE #	TOTAL MICROSTRAIN (µε)	CHANGE IN MICROSTRAIN SINCE PREVIOUS READINGS* (µε)	MEASURED TEMPERATURE (°c)
<b>UPSLOPE PILE FACE</b>					<b>DOWNSLOPE PILE FACE</b>			
0.2	29	-116.4	-3.1	11.6	28	-93.0	-13.1	14.6
2.4	8	-6.3	12.9	10.4	3	-12.3	-9.5	13.5
4.2	5	<i>Not functioning</i>	<i>N/A</i>	<i>N/A</i>	22	44.8	2.8	7.9
6.2	14	-184.1	-6.9	7.1	12	28.0	4.1	6.9
8.2	13	-164.7	-8.3	7.5	7	<i>Not functioning</i>	<i>N/A</i>	<i>N/A</i>
10.2	4	-165.8	-7.1	7.8	25	29.4	4.0	7.8
12.2	1	-155.6	-5.3	8.1	11	<i>Not functioning</i>	<i>N/A</i>	<i>N/A</i>
14.2	15	-135.0	-3.2	8.2	16	<i>Not functioning</i>	<i>N/A</i>	<i>N/A</i>
16.2	9	-128.1	-3.1	8.2	21	5.7	1.0	8.1
18.2	27	-89.1	-1.2	8.1	23	15.1	-0.2	8.2
20.2	6	-131.4	-22.4	8.1	20	<i>Not functioning</i>	<i>N/A</i>	<i>N/A</i>
22.2	30	-45.0	0.7	8.0	19	<i>Not functioning</i>	<i>N/A</i>	<i>N/A</i>
24.2	2	<i>Not functioning</i>	<i>N/A</i>	8.0	24	<i>Not functioning</i>	<i>N/A</i>	<i>N/A</i>
26.2	26	-44.4	-2.3	8.0	17	-121.6	-6.2	8.0
28.2	10	-70.8	-2.4	7.9	18	<i>Not functioning</i>	<i>N/A</i>	<i>N/A</i>

Drawings 32121-PH070-1 and 32121-PH070-2 in Appendix A provide a sketch of the approximate locations of the monitoring instrumentation for this site.

\* Previous readings taken on June 13, 2022



**Table PH070-4 Spring 2024 – Hwy 2:60 Peace River East Hill Retaining Wall Site (Km 33.84) Pneumatic Piezometer Instrumentation Reading Summary**

Date Monitored: May 19, 2024

INSTRUMENT #	DATE INITIALIZED	TIP DEPTH (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED WATER LEVEL BGS (m)	MEASURED PORE PRESSURE (kPa)	CURRENT WATER LEVEL BGS (m)	PREVIOUS WATER LEVEL BGS (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
PN10-1 (33089)	Feb. 21, 2010	9.1	-	Removed during construction	8.06 on May 20, 2015	N/A	N/A	8.94 (Sep. 15, 2016)	N/A
PN10-2 (33091)	Feb. 21, 2010	19.0	-	Damaged/ Sheared	11.62 on May 20, 2015	N/A	N/A	17.46 (Sep. 27, 2017)	N/A
PN13-2A (35449)	August 4, 2013	6.1	490.6	Operational	4.35 on August 4, 2013	10.2	5.06	4.97	-0.09
PN13-2B (35446)	August 4, 2013	26.7	490.6	Removed during construction	16.92 m on May 20, 2015	N/A	N/A	18.11 (June 2, 2016)	N/A
PN13-3A (35451)	August 4, 2013	9.1	486.4	Operational	7.27 on August 4, 2013	2.1	8.89	8.88	-0.01
PN13-3B (35444)	August 4, 2013	18.3	486.4	Operational	13.40 On May 20, 2017	25.8	15.67	14.40	-1.27
PN14-2A (35757)	November 23, 2014	13.0	490.5	Operational	11.95 on May 20, 2015	2.7	12.72	12.71	-0.01
PN14-2B (35867)	November 23, 2014	28.0	490.5	Operational	19.14 on November 23, 2014	63.2	21.56	21.11	-0.45
PN14-3A (35759)	November 23, 2014	13.0	490.9	Operational	11.59 on May 20, 2015	4.0	12.59	12.37	-0.22
PN14-3B (35866)	November 23, 2014	25.0	490.9	Operational	23.17 on November 23, 2014	3.7	24.62	24.64	0.02

Drawings 32121-PH070-1 and 32121-PH070-2 in Appendix A provide a sketch of the approximate locations of the monitoring instrumentation for this site.



**Table PH070-4 – Continued... Spring 2024 – Hwy 2:60 Peace River East Hill Retaining Wall Site (Km 33.84) Pneumatic Piezometer Instrumentation Reading Summary**

Date Monitored: May 19, 2024

<b>INSTRUMENT #</b>	<b>DATE INITIALIZED</b>	<b>TIP DEPTH (m)</b>	<b>GROUND ELEV. (m)</b>	<b>CURRENT STATUS</b>	<b>HIGHEST MEASURED WATER LEVEL BGS (m)</b>	<b>MEASURED PORE PRESSURE (kPa)</b>	<b>CURRENT WATER LEVEL BGS (m)</b>	<b>PREVIOUS WATER LEVEL BGS (m)</b>	<b>CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)</b>
PN14-4A (35758)	November 23, 2014	10.5	486.5	Operational	9.02 on November 23, 2014	3.0	10.19	10.18	-0.01
PN14-4B (35865)	November 23, 2014	28.0	486.5	<i>Not functioning</i>	13.94 on November 23, 2014	N/A	N/A	27.82 (Sep. 29, 2019)	N/A

Drawings 32121-PH070-1 and 32121-PH070-2 in Appendix A provide a sketch of the approximate locations of the monitoring instrumentation for this site.



**Table PH070-5 Spring 2024 – Hwy 2:60 Peace River East Hill Retaining Wall Site (Km 33.84) Standpipe Piezometer Instrumentation Reading Summary**

Date Monitored: May 19, 2024

INSTRUMENT #	DATE INITIALIZED	TIP DEPTH (m)	GROUND ELEV. (m)	CURRENT STATUS	MAXIMUM GROUNDWATER LEVEL (m)	MEASURED GROUNDWATER DEPTH (m)	PREVIOUS READING (m)	CHANGE IN GROUNDWATER LEVEL SINCE PREVIOUS READING (m)
SP13-1	August 4, 2013	14.9	490.8	Blocked at 0.9 m below top of casing	1.18 on June 2, 2016	N/A	N/A	N/A
SP14-1	November 23, 2014	15.5	490.2	Operational	3.81 on September 15, 2016	4.43	4.09	-0.34

Drawings 32121-PH070-1 and 32121-PH070-2 in Appendix A provide a sketch of the approximate locations of the monitoring instrumentation for this site.



**Table PH070- Spring 2024 – Hwy 2:60 Peace River East Hill Retaining Wall Site (Km 33.84) Vibrating Wire Load Cell Instrumentation Reading Summary**

Date Monitored: May 22, 2024

ANCHOR NUMBER	LOAD CELL SERIAL #	SLS DESIGN LOAD / LOCK-OFF LOAD (kN)	MAXIMUM RECORDED LOAD (kN)	RECORDED LOAD <sup>(1)</sup> (MAY 22, 2024) (kN)	PREVIOUS RECORDED LOAD <sup>(1)</sup> (JUNE 16, 2023) (kN)	CHANGE IN LOAD SINCE PREVIOUS READING (kN)
G39WL	VC1977	253/253	255.24 on May 22, 2024	255.24	249.17	6.07
G40WU	VC1975	331/331	336.58 on May 22, 2024	336.58	327.87	8.71
G58WU	VC1972	366/358	382.85 on May 22, 2024	382.85	378.45	4.40
G59WL	VC1973	325/308	271.27 on July 22, 2023	270.73	268.60	2.13
G80WU	VC1969	246/331	307.89 on October 2, 2017	303.25	301.10	2.15
G80WL	VC1970	293/337	317.04 on May 22, 2024	317.04	314.47	2.57
G102WU	VC1974	366/358	343.61 on October 2, 2017	340.39	338.47	1.92
G102WL	VC1976	325/308	343.70 on April 7, 2017	316.90	316.89	0.01
G118PU	VC1980	320/257	217.20 on June 24, 2017	206.87	206.28	0.59
G134PU	VC1979	288/229	222.80 on May 27, 2017	212.42	209.22	3.20
G150PU	VC1978	288/229	236.60 on May 28, 2017	220.45	219.04	1.41

Drawings 32121-PH070-1 and 32121-PH070-2 in Appendix A provide a sketch of the approximate locations of the monitoring instrumentation for this site.

(1) Load cell data is recorded daily with datalogger on site. See Figures PH070-5 to PH070-8 in Appendix A for combined historical instrument readings.



**Table PH070-6– Continued... Spring 2024 – Hwy 2:60 Peace River East Hill Retaining Wall Site (Km 33.84) Vibrating Wire Load Cell Instrumentation Reading Summary**

Date Monitored: May 22, 2024

ANCHOR NUMBER	LOAD CELL SERIAL #	DESIGN LOAD / LOCK-OFF LOAD (kN)	MAXIMUM RECORDED LOAD (kN)	RECORDED LOAD <sup>(1)</sup> (MAY 22, 2024) (kN)	PREVIOUS RECORDED LOAD <sup>(1)</sup> (JUNE 16, 2023) (kN)	CHANGE IN LOAD SINCE PREVIOUS READING (kN)
G167PM	VC1971	302/175	179.15 on July 8, 2017	178.37	173.93	4.44
G190PL	VC1968	302/105	163.26 on May 22, 2024	163.26	137.29	25.97
G182PL <sup>(2)</sup>	VC2023	302/0	15.38 on September 16, 2022	13.58	14.66	-1.08
G188PL <sup>(2)</sup>	VC2024	302/0	16.56 on September 15, 2022	16.15	15.95	0.20
G202PL <sup>(2)</sup>	VC2025	302/0	12.81 on November 29, 2023	12.35	10.58	1.77

Drawings 32121-PH070-1 and 32121-PH070-2 in Appendix A provide a sketch of the approximate locations of the monitoring instrumentation for this site.

(1) Load cell data is recorded daily with datalogger on site. See Figures PH070-5 to PH070-8 in Appendix A for combined historical instrument readings. Stiff anchors left with slack in the anchor nut during construction.

(2) Stiff anchors left with slack in the anchor nut during construction.



## STATEMENT OF LIMITATIONS AND CONDITIONS

### 1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

### 2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

### 3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

### 4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

### 5. INTERPRETATION OF THE REPORT

- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
- c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.
- d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

### 6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

### 7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.



**THURBER** ENGINEERING LTD.

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

**SPRING 2024**

**APPENDIX A  
DATA PRESENTATION**

**SITE PH070: HWY 2:60, PEACE RIVER EAST HILL  
RETAINING WALL SITE (km 33.84)**



**ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS  
PEACE REGION (PEACE RIVER DISTRICT)  
INSTRUMENTATION MONITORING FIELD SUMMARY (PH070)  
SPRING 2024**

<b>Location:</b> East Hill Retaining Wall Site (HWY 2:60 C1 33.840)	<b>Readout:</b> RST PN C108 Unit 4
<b>File Number:</b> 32121	<b>Extension:</b> 2.75"
<b>Probe:</b> RST Set 5R & 8R	<b>Temp:</b> 3
<b>Cable:</b> RST Set 5R & 8R	<b>Read by:</b> NRM/NKR

**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-			
SI13-3	485285	6230649	19-May-24	1.32	66 to 2	170	-1103	1122	-1440	1452	5R/5R	2.75"	
SI14-2	485222	6230662	19-May-24	1.21	98 to 2	160	441	-424	63	-47	5R/5R	2.75"	
SI14-3	485260	6230664	19-May-24	1.23	98 to 2	150	-424	437	-535	520	5R/5R	2.75"	
SI-P40	485240	6230661	19-May-24	0.94	66 to 2	212	-153	163	198	-208	8R/8R	2.75"	Pile Wall
SI-P58	485263	6230633	19-May-24	1.00	80 to 2	131	-1846	1857	-737	720	8R/8R	2.75"	Pile Wall
SI-P90	485312	6230668	19-May-24	0.80	78 to 2	143	-343	358	310	-325	8R/8R	2.75"	Pile Wall
SI-P116	485348	6230622	19-May-24	1.12	62 to 2	203	226	-220	-904	888	8R/8R	2.75"	Pile Wall

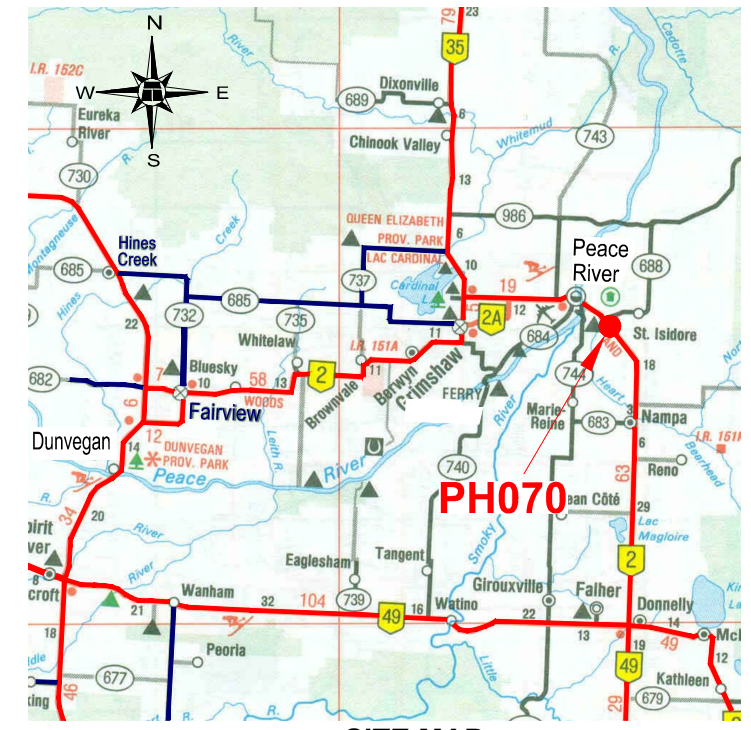
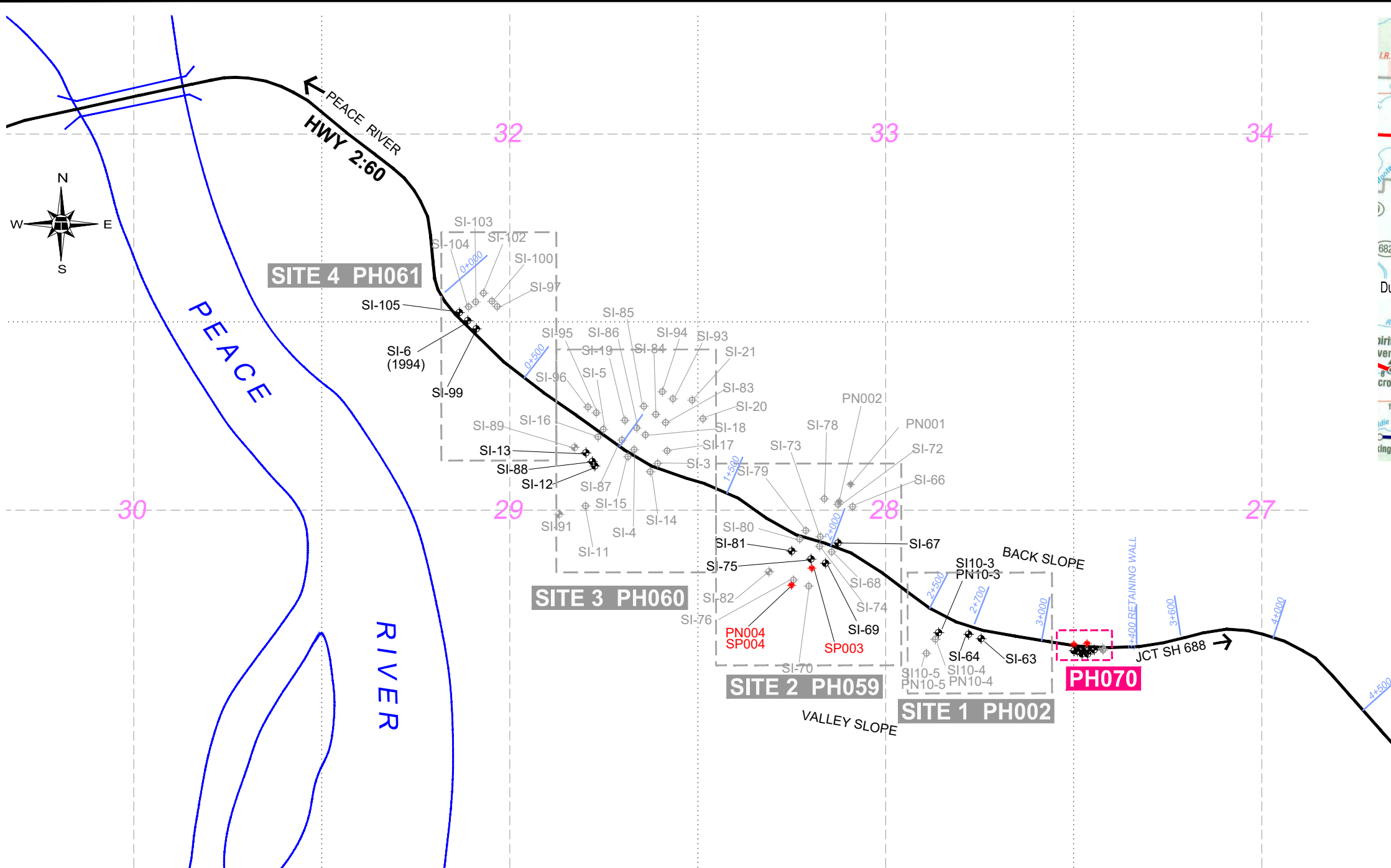
**PNEUMATIC PIEZOMETER (PN) READINGS**

PN#	GPS Location (UTM 11)		Date	Reading (kPa)	Identification Number
	Easting (m)	Northing (m)			
PN13-2A	485283.33	6230665.34	19-May-24	10.2	35449
PN13-3A	485284.52	6230648.64	19-May-24	2.1	35451
PN13-3B	485284.52	6230648.64	19-May-24	25.8	35444
PN14-2A	485221.85	6230662.44	19-May-24	2.7	35757
PN14-2B	485221.85	6230662.44	19-May-24	63.2	35867
PN14-3A	485260.48	6230664.41	19-May-24	4.0	35759
PN14-3B	485260.48	6230664.41	19-May-24	3.7	35866
PN14-4A	485260.79	6230648.07	19-May-24	3	35758

**STANDPIPE PIEZOMETER (SP) READINGS**

SP#	GPS Location (UTM 11)		Date	Stick-up (m)	Reading below top of casing (m)	Bottom Pipe Depth (below top of casing (m))
	Easting (m)	Northing (m)				
SP14-1	485221.459	6230689.704	19-May-24	1	5.43	15.45

Datalogger is connected to a modem - check datalogger for possible tampering and be ready for manual download with 12V battery



**SITE MAP**  
NOT TO SCALE

**LEGEND :**

- SLOPE INCLINOMETER  
*(currently using)*
- SP** STANDPIPE PIEZOMETER
- PN** PNEUMATIC PIEZOMETER
- SLOPE INCLINOMETER  
*(not in use)*
- PNEUMATIC PIEZOMETER  
*(not in use)*

**SITE PLAN**  
1:20,000 (APPROX.)

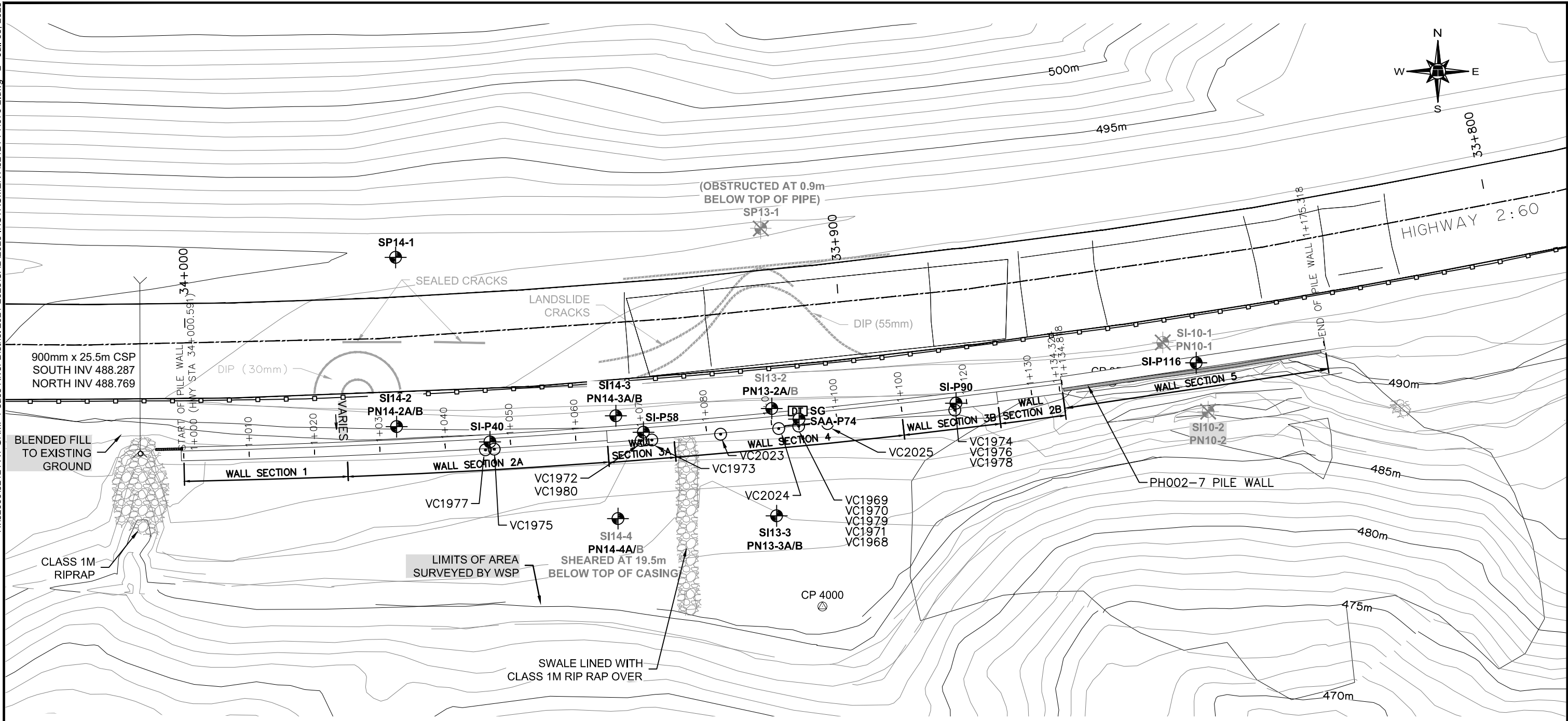
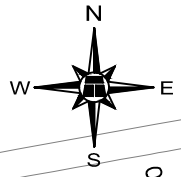
**PEACE REGION (PEACE RIVER DISTRICT)**

**PH070: PEACE RIVER EAST HILL INSTRUMENTATION READINGS**

DWG No. 32121-PH070-1

DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	DWP
SCALE	AS SHOWN
DATE	JULY 2023
FILE No.	32121

**THURBER ENGINEERING LTD.**




- LEGEND**
- INSTRUMENT LOCATION
  - DAMAGED / NON - OPERATIONAL INSTRUMENT LOCATION
  - VIBRATING WIRE LOAD CELL LOCATION
  - DATALOGGER
  - SLOPE INCLINOMETER
  - PNEUMATIC PIEZOMETER
  - TEST HOLE
  - VIBRATING WIRE LOAD CELL
  - CONTROL POINT
  - GUARD RAIL
  - STRAIN GAUGES

**NOTES**

LOAD CELLS, SHAPE ACCELEROMETER ARRAY, AND STRAIN GAUGES ARE CONNECTED TO A CAMPBELL SCIENTIFIC CR6 DATALOGGER (SERIAL # 4301)






**PEACE REGION (PEACE RIVER DISTRICT)**

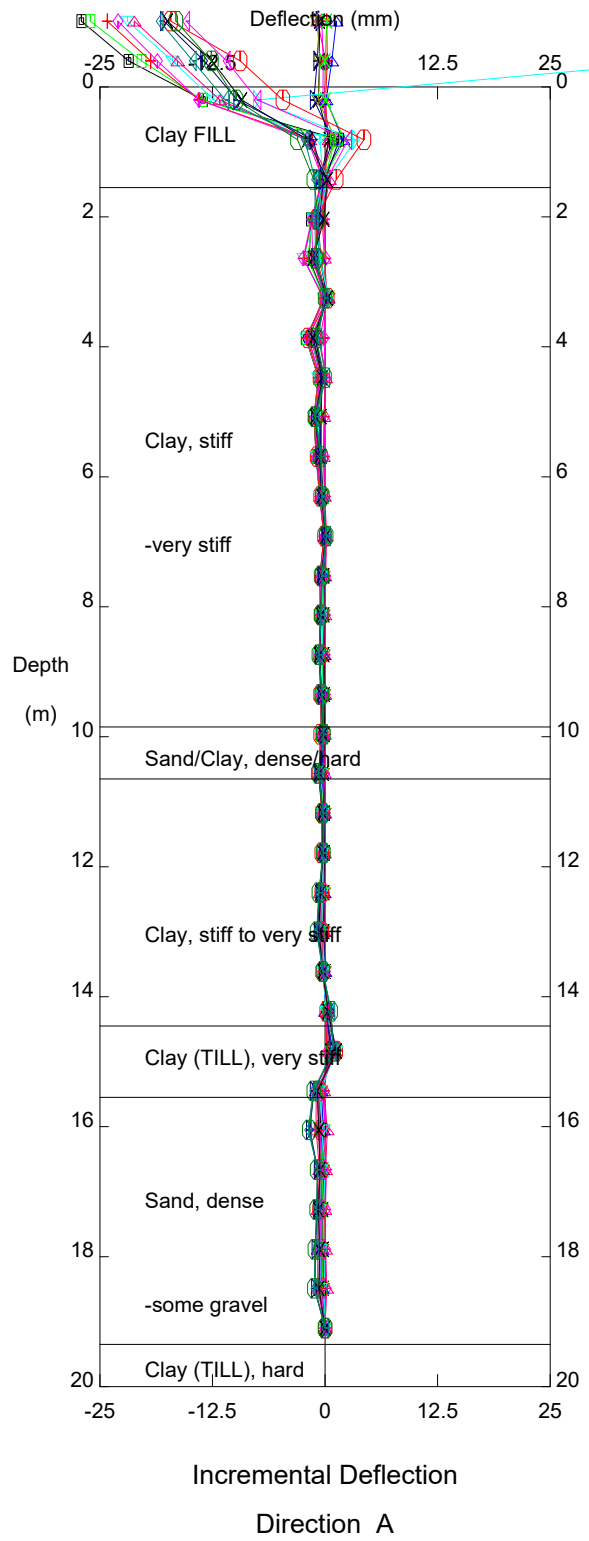
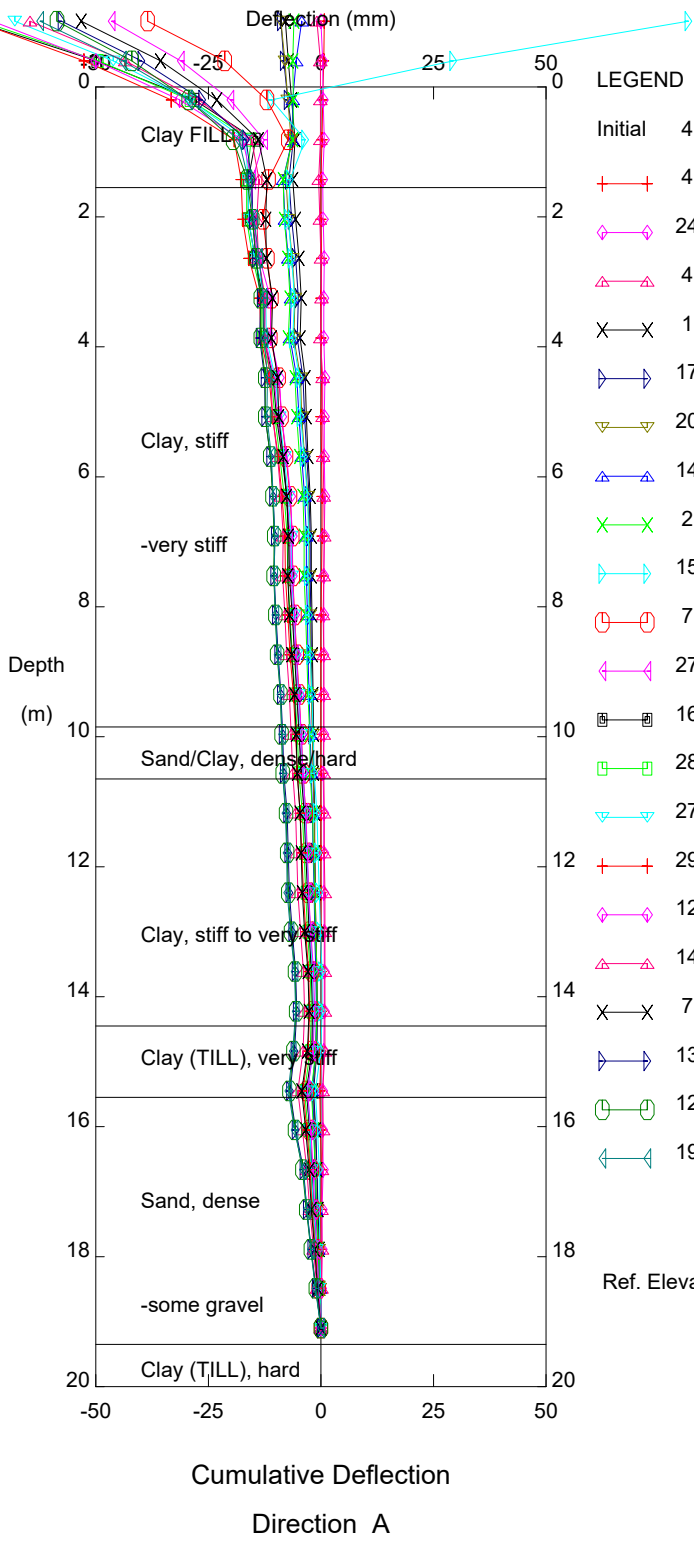
**PH070: HWY 2:60 PEACE RIVER EAST HILL  
RETAINING WALL SITE (km 33.84)  
INSTRUMENTATION READINGS**

**DWG No. 32121-PH070-2**

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APPROVED BY	DWP
SCALE	1:600
DATE	JULY 2023
FILE No.	32121



**THURBER ENGINEERING LTD.**

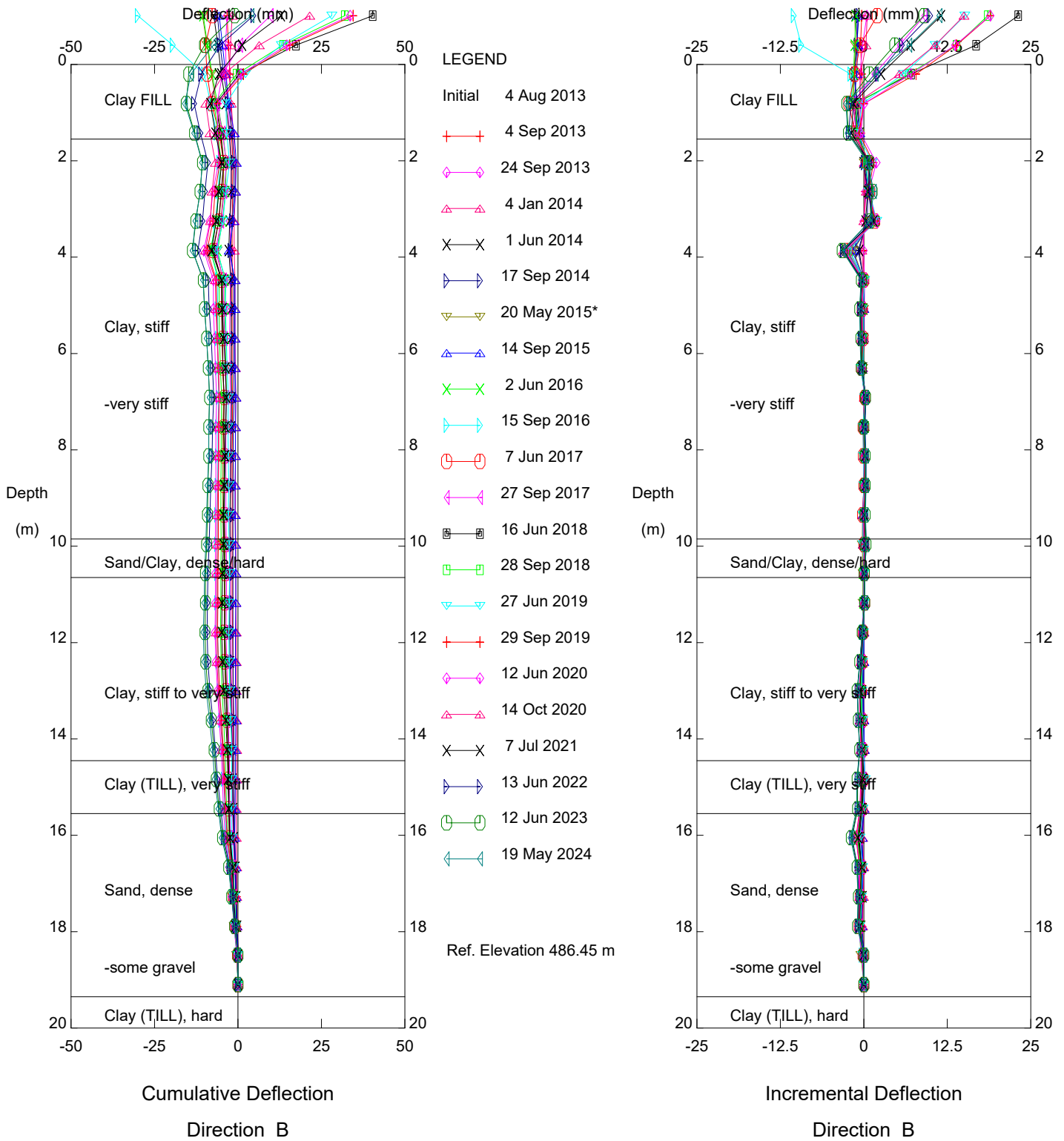


Peace River East Hill PH070, Inclinometer SI13-3

Alberta Transportation

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

Thurber Engineering Ltd



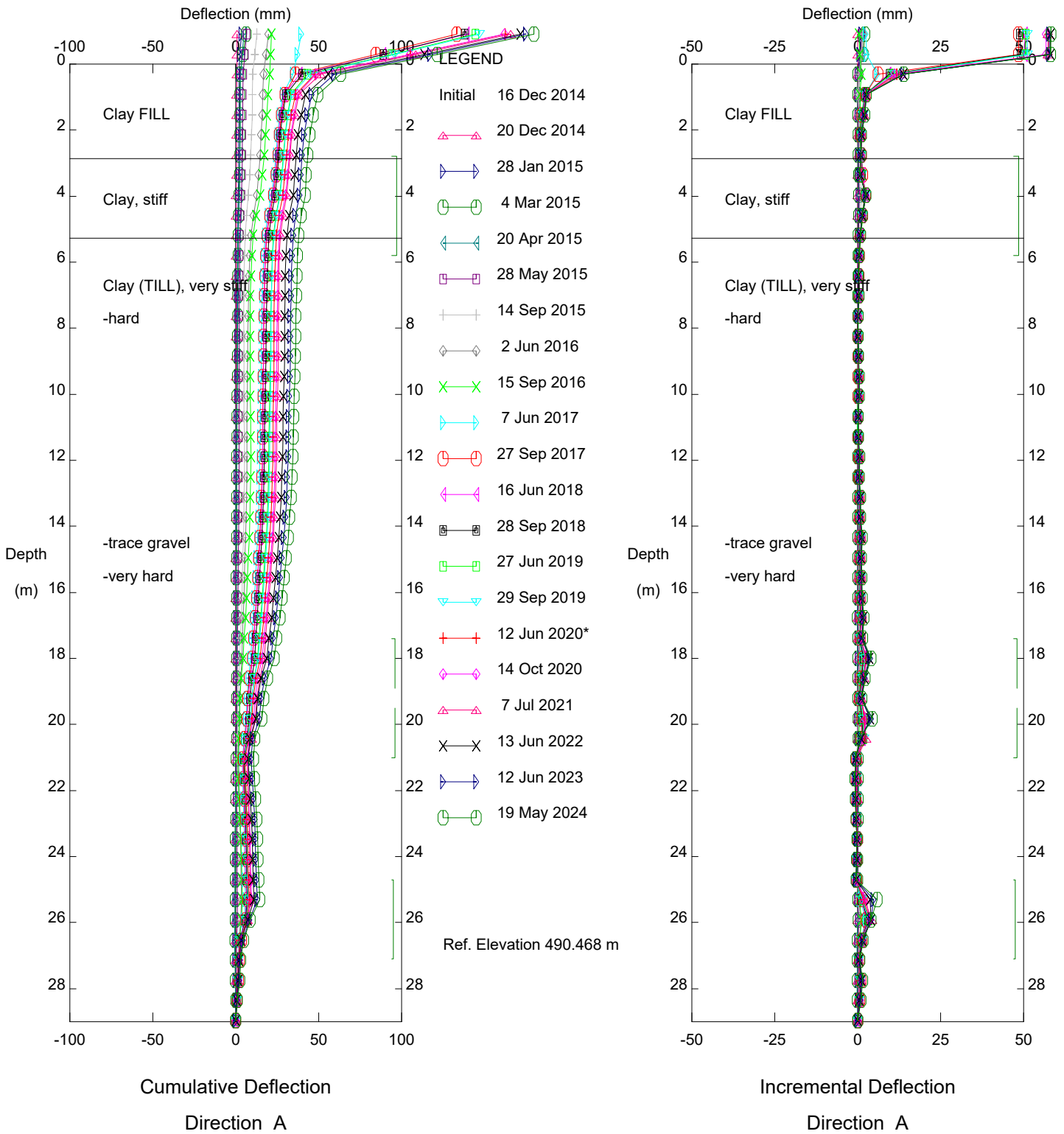
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Alberta Transportation

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Thurber Engineering Ltd

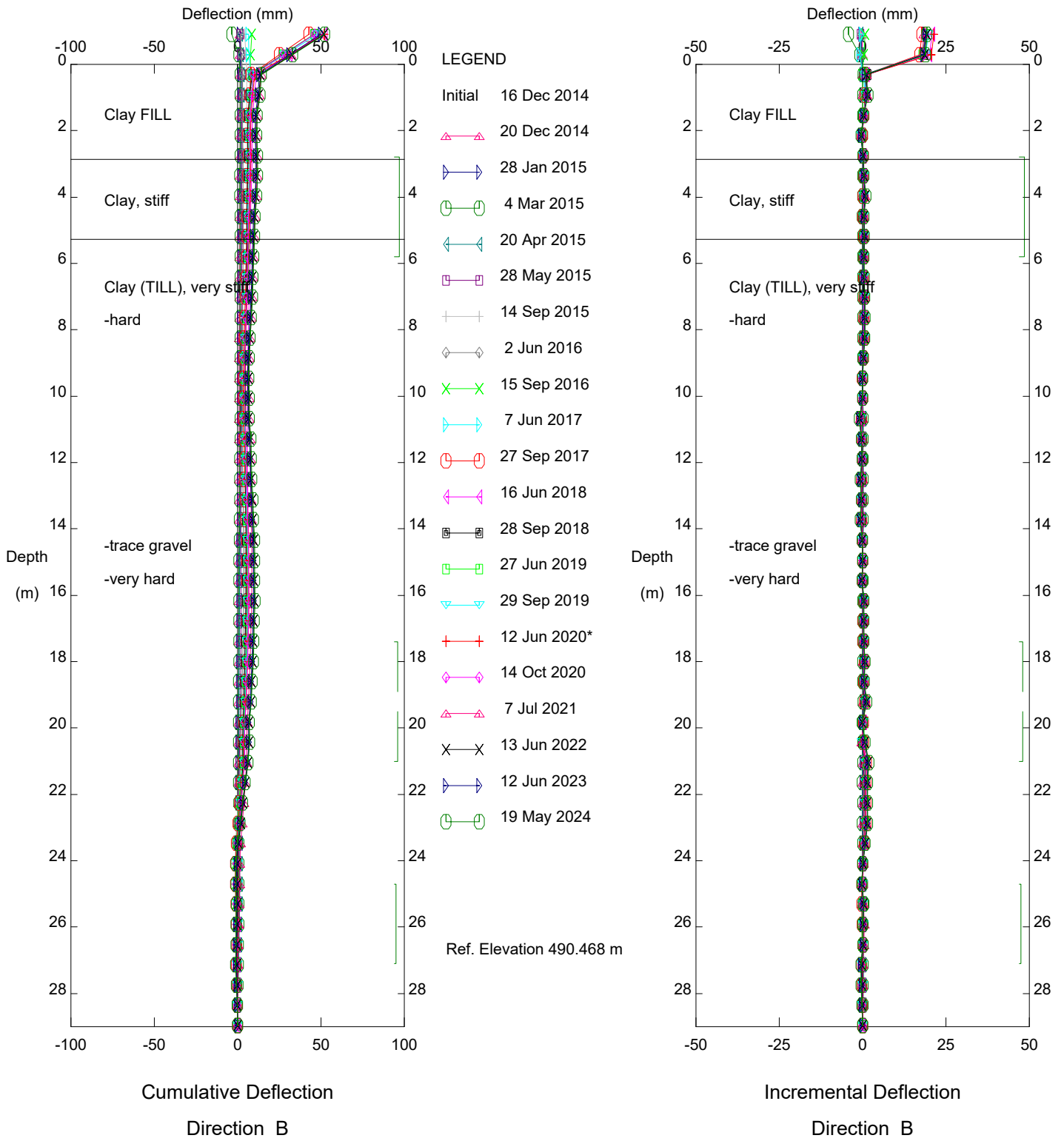


Peace River East Hill PH070, Inclinometer SI14-2

Alberta Transportation

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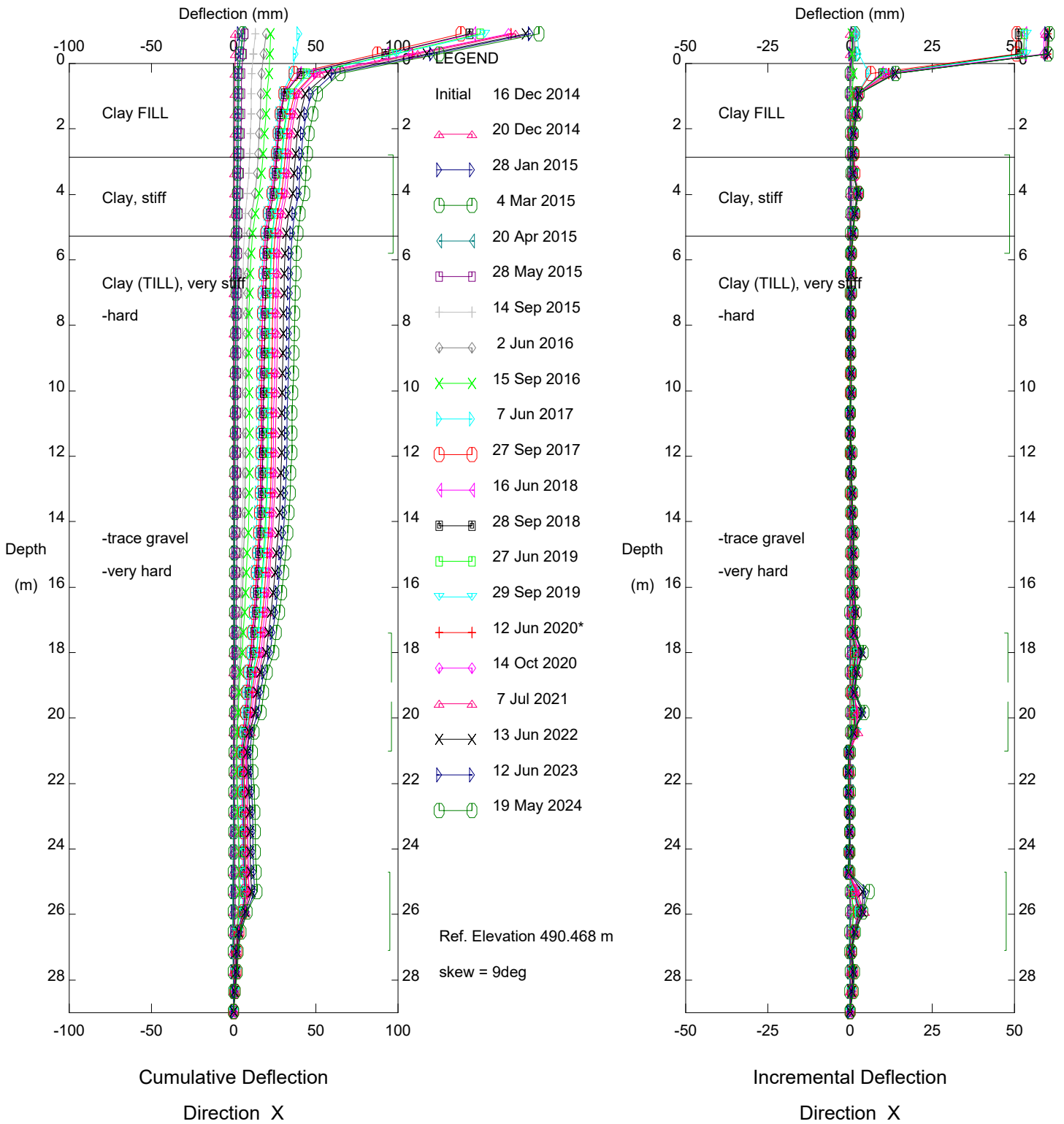


Peace River East Hill PH070, Inclinometer SI14-2

Alberta Transportation

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

Thurber Engineering Ltd



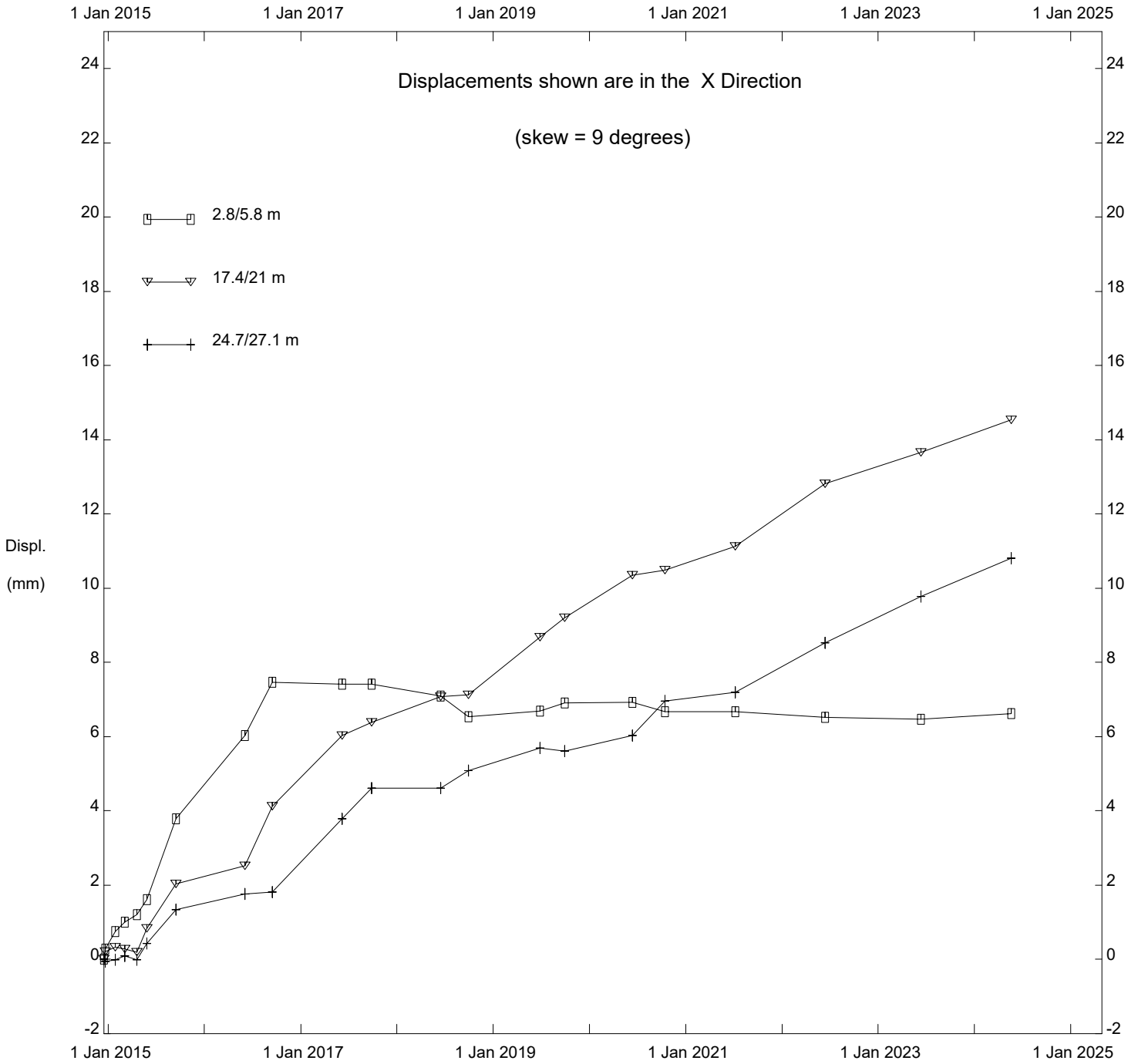
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Alberta Transportation

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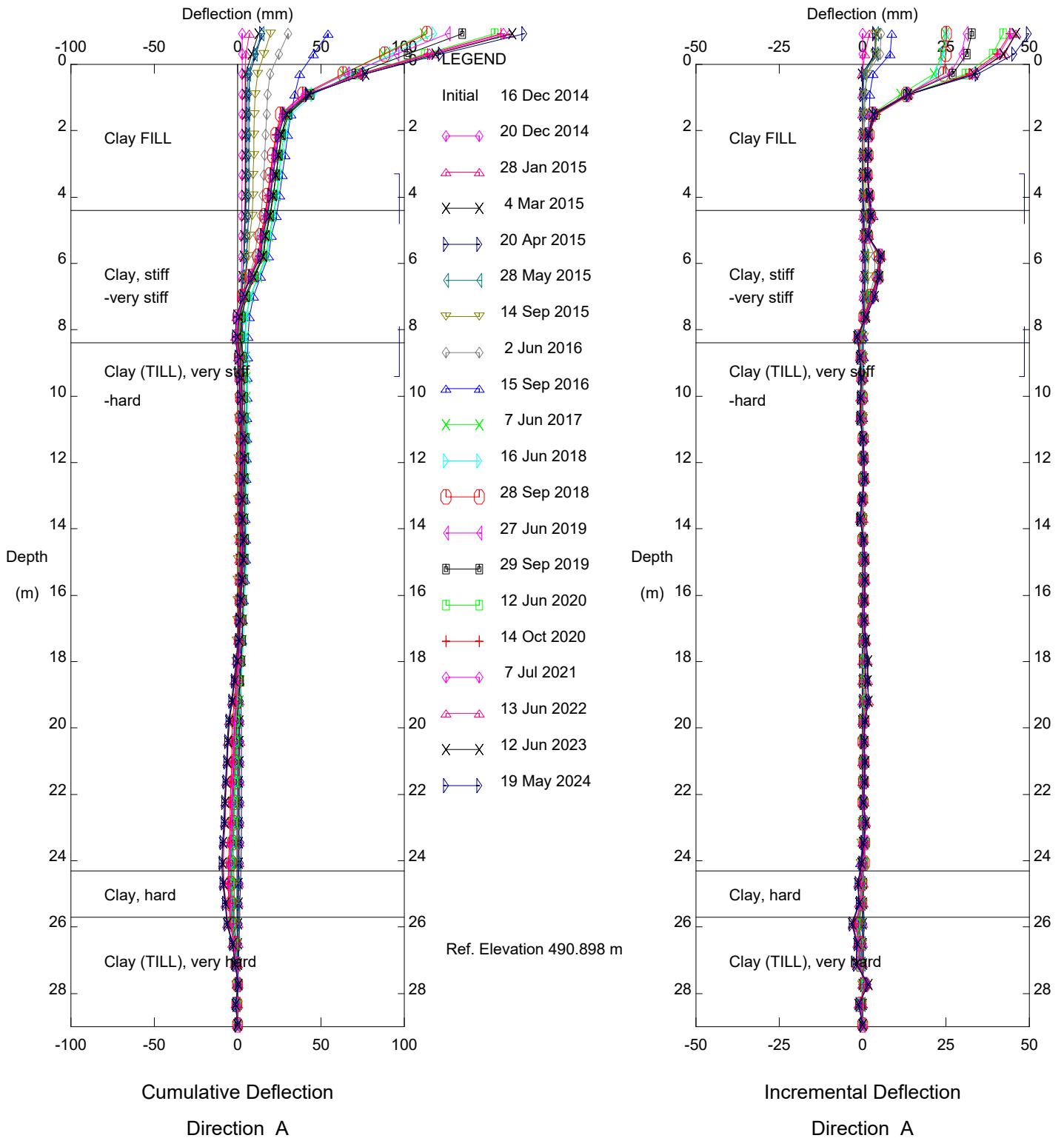
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Alberta Transportation

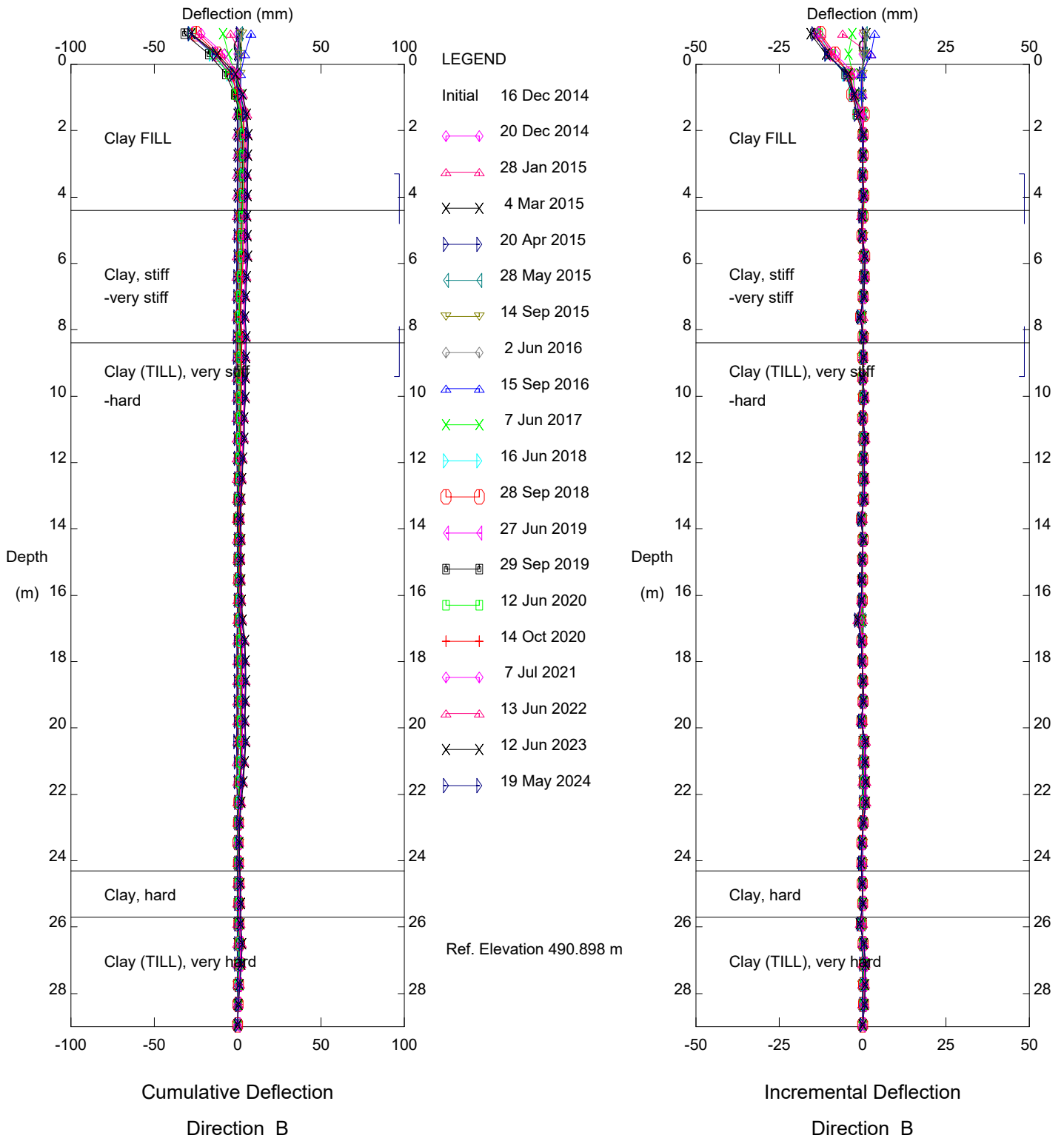
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Peace River East Hill PH070, Inclinometer SI14-3

Alberta Transportation

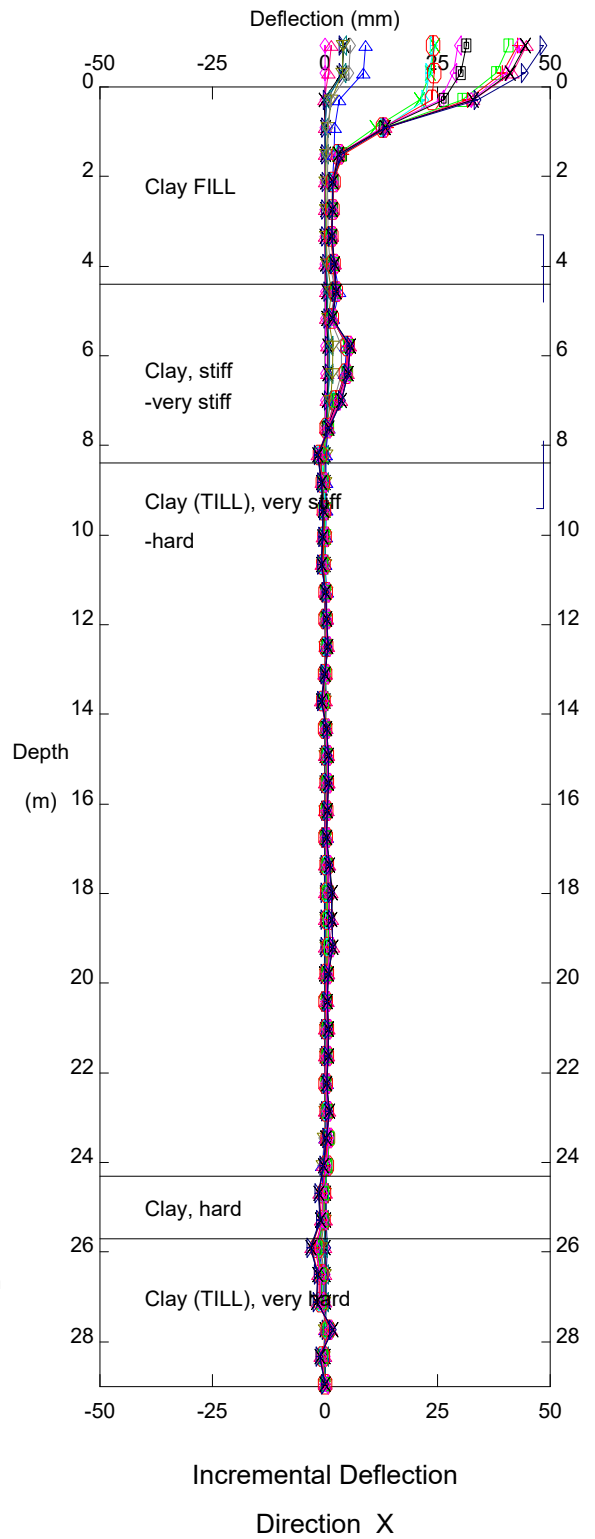
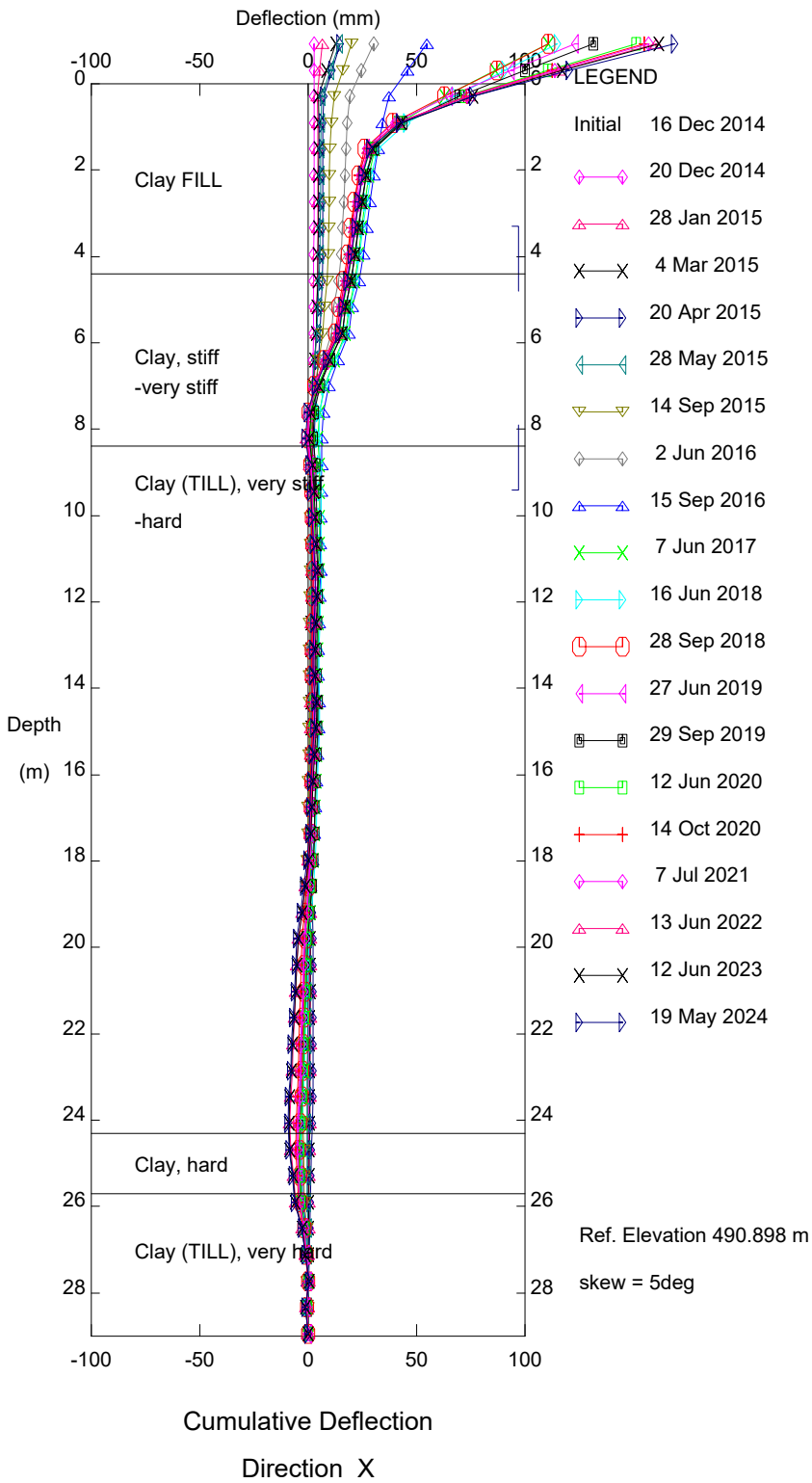
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Peace River East Hill PH070, Inclinometer SI14-3

Alberta Transportation

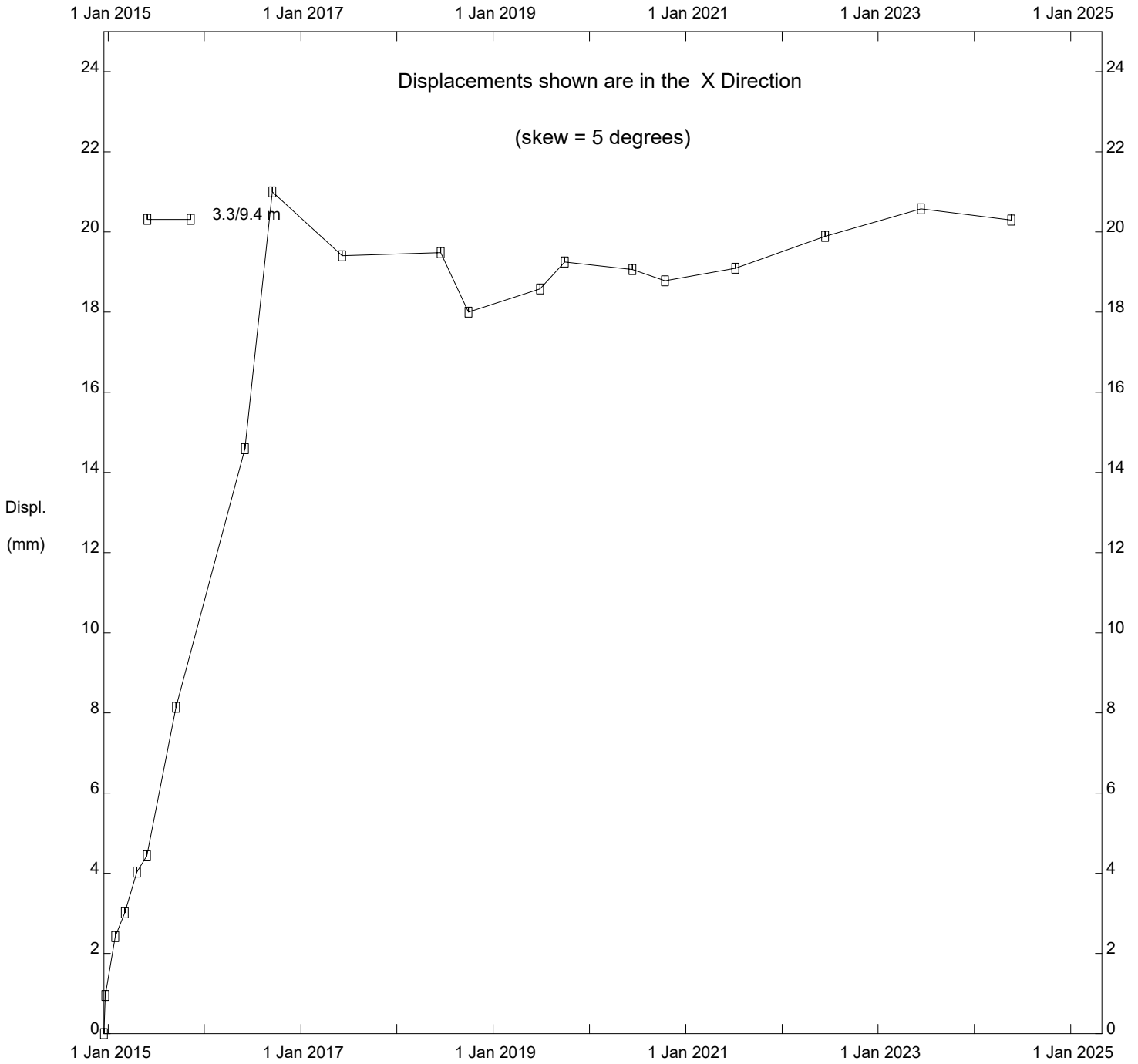
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Peace River East Hill PH070, Inclinator SI14-3

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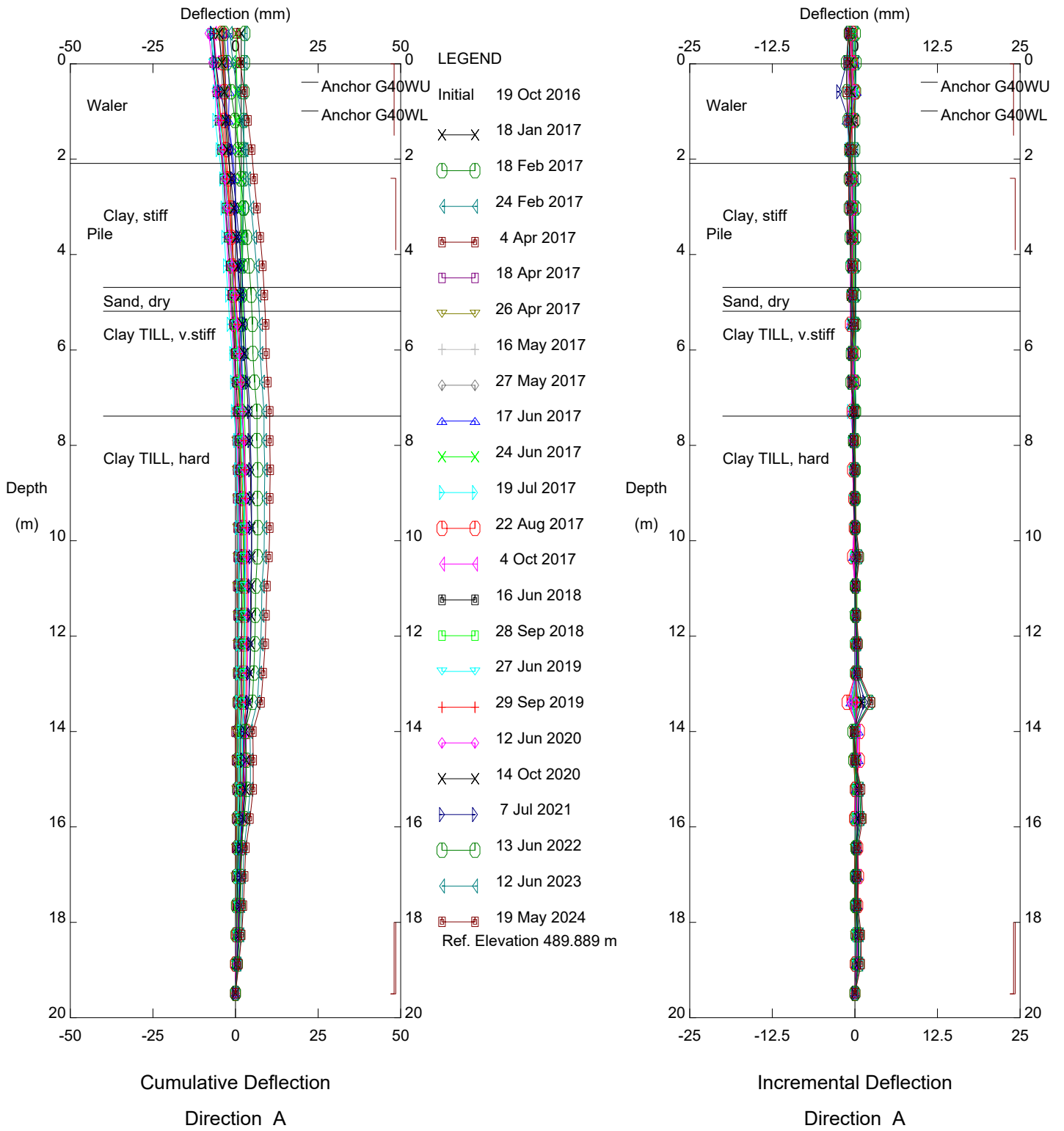
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Peace River East Hill PH070, Inclinometer SI14-3

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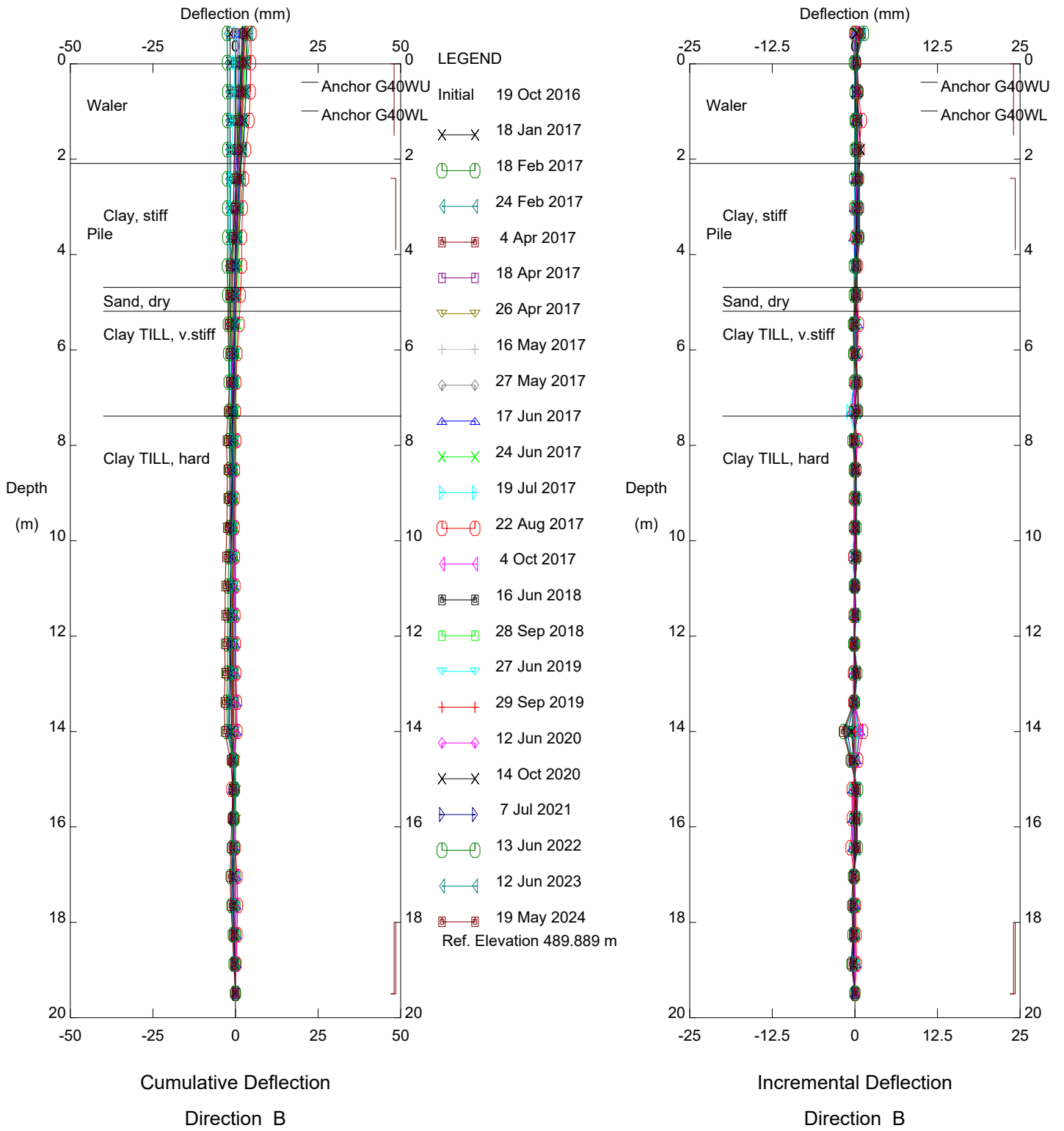
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Peace River East Hill PH070, Inclinometer P40

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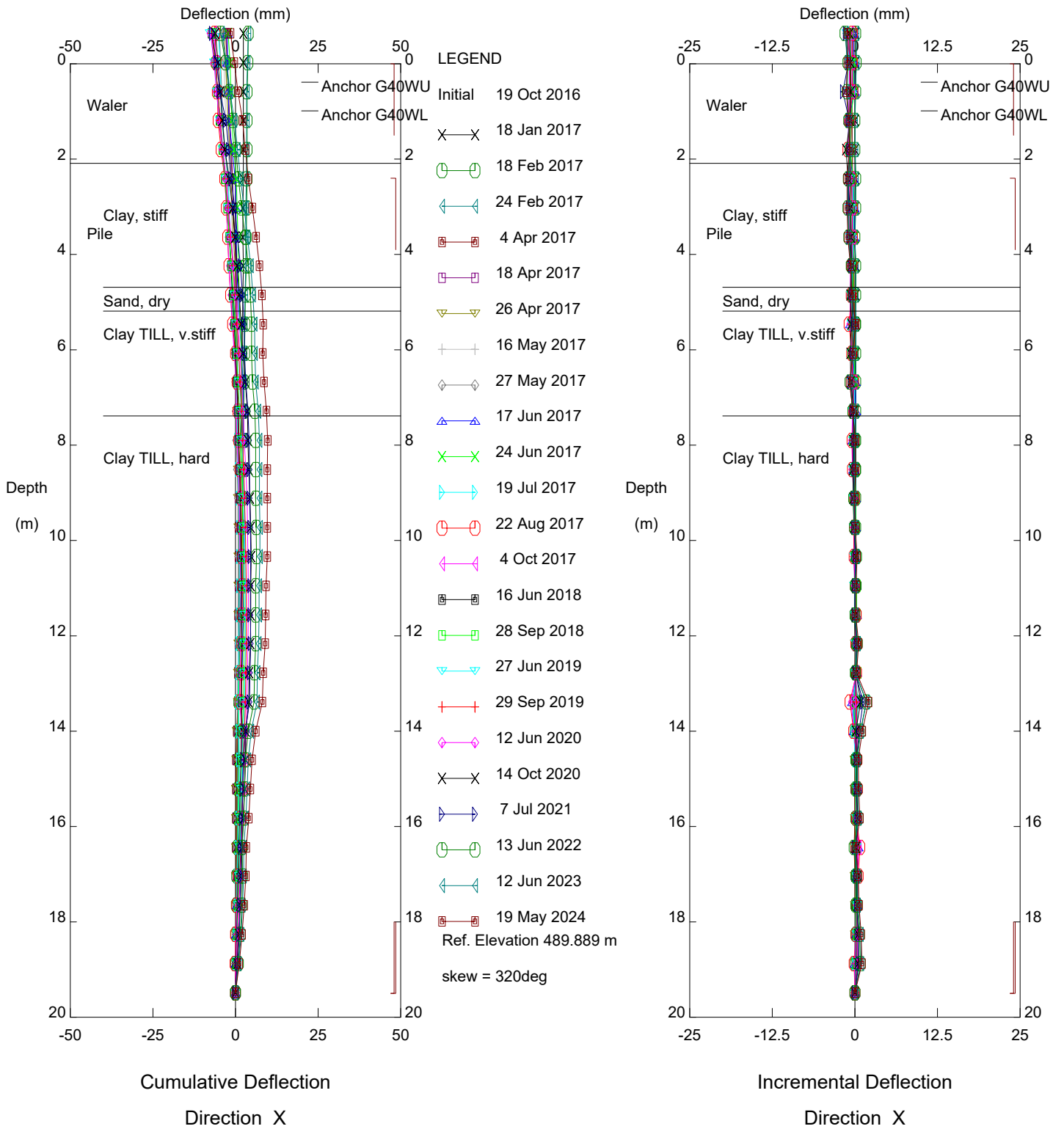
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Peace River East Hill PH070, Inclinometer P40

Alberta Transportation

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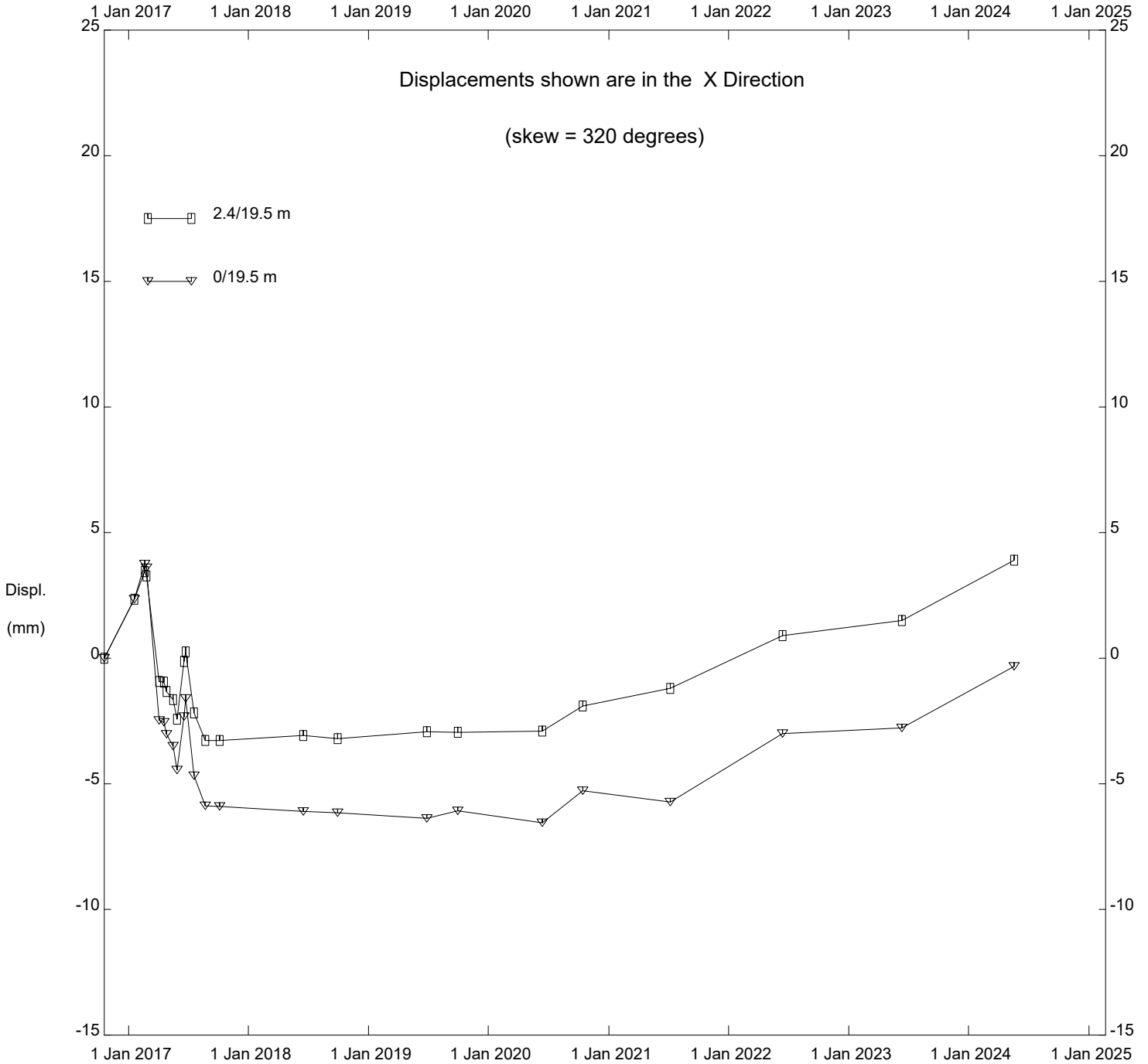


Peace River East Hill PH070, Inclinometer P40

Alberta Transportation



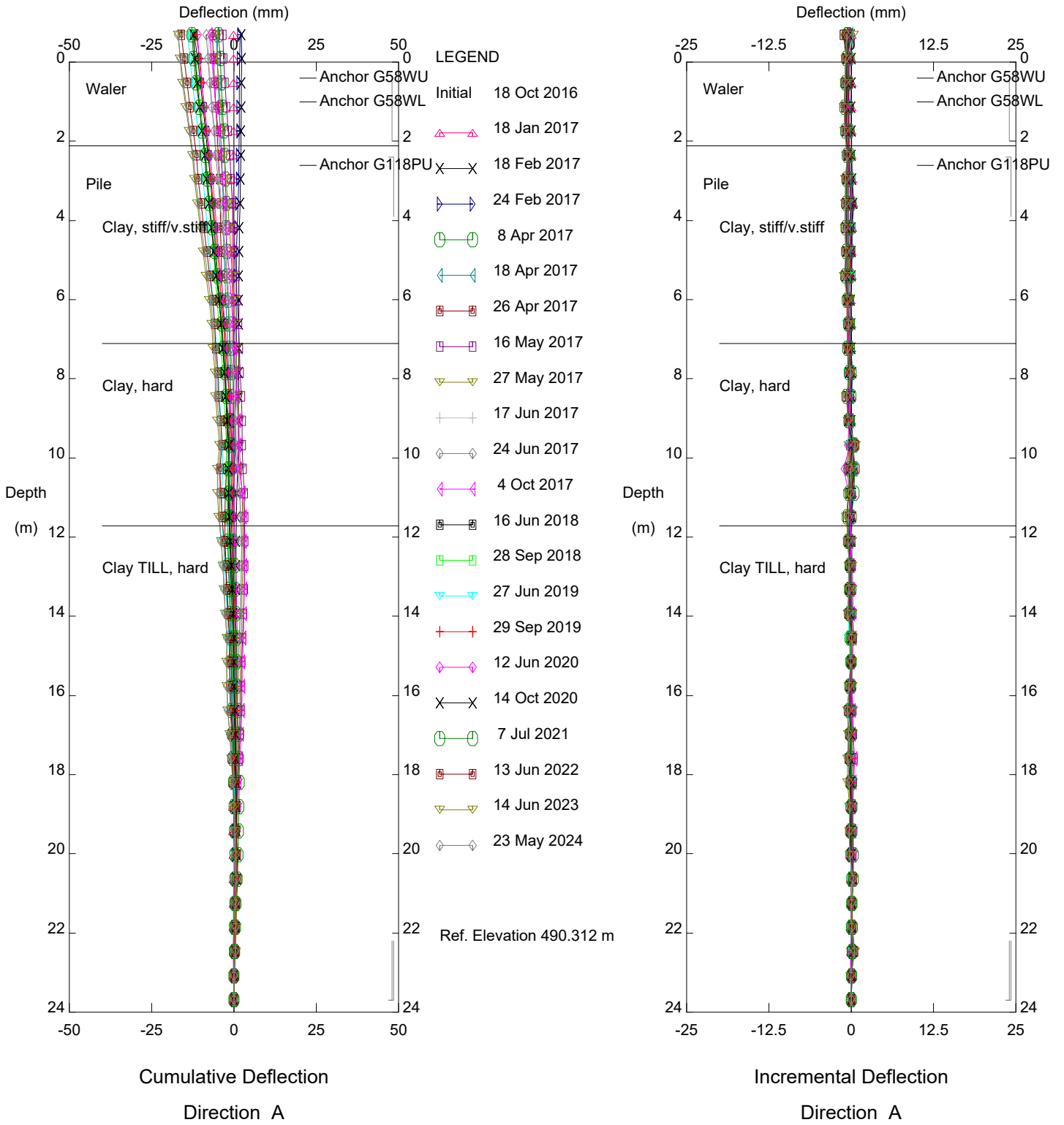
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Peace River East Hill PH070, Inclinator P40

Alberta Transportation

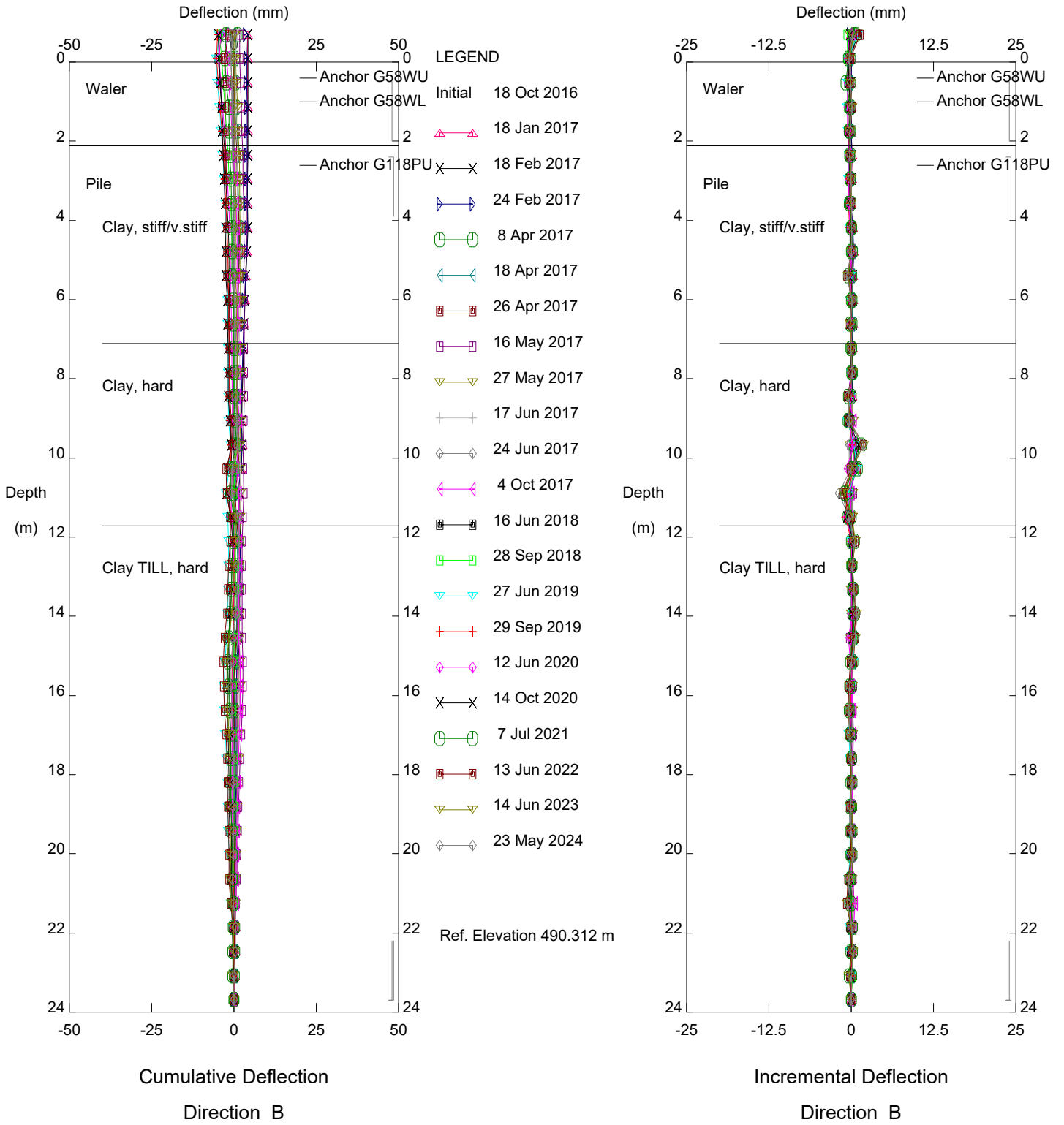
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Peace River East Hill PH070, Inclinometer P58

Alberta Transportation

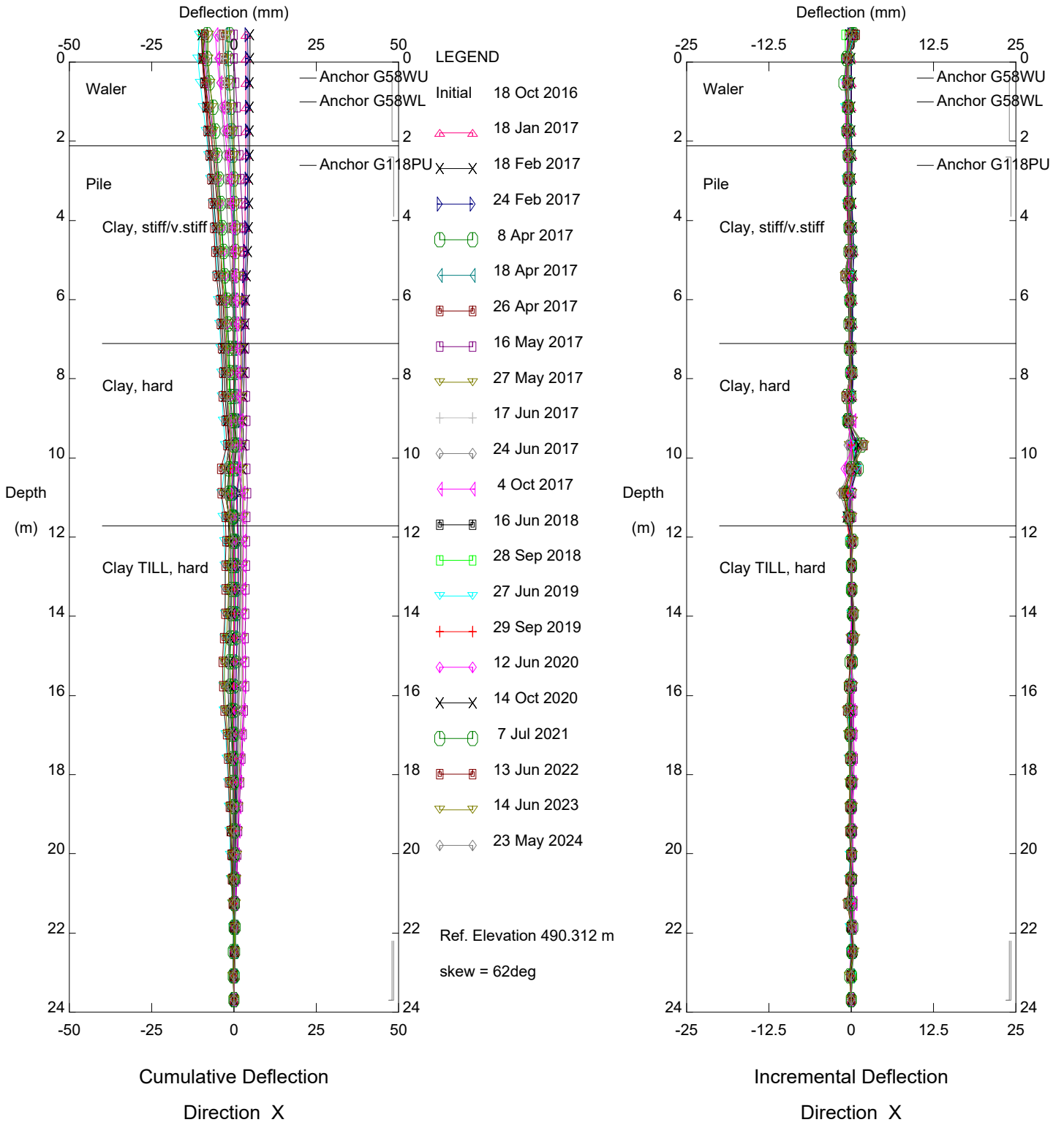
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Peace River East Hill PH070, Inclinometer P58

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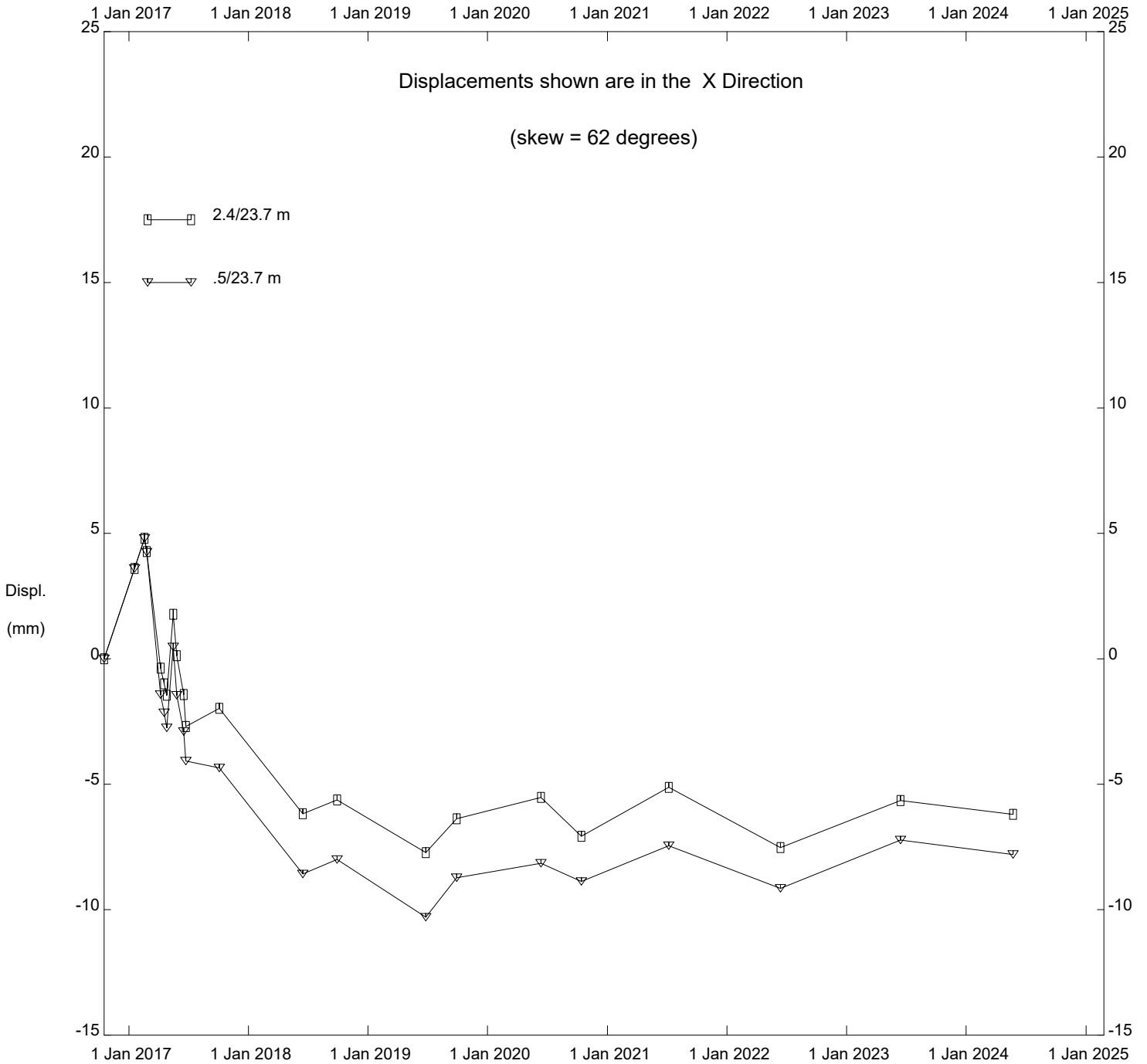
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Peace River East Hill PH070, Inclinometer P58

Alberta Transportation

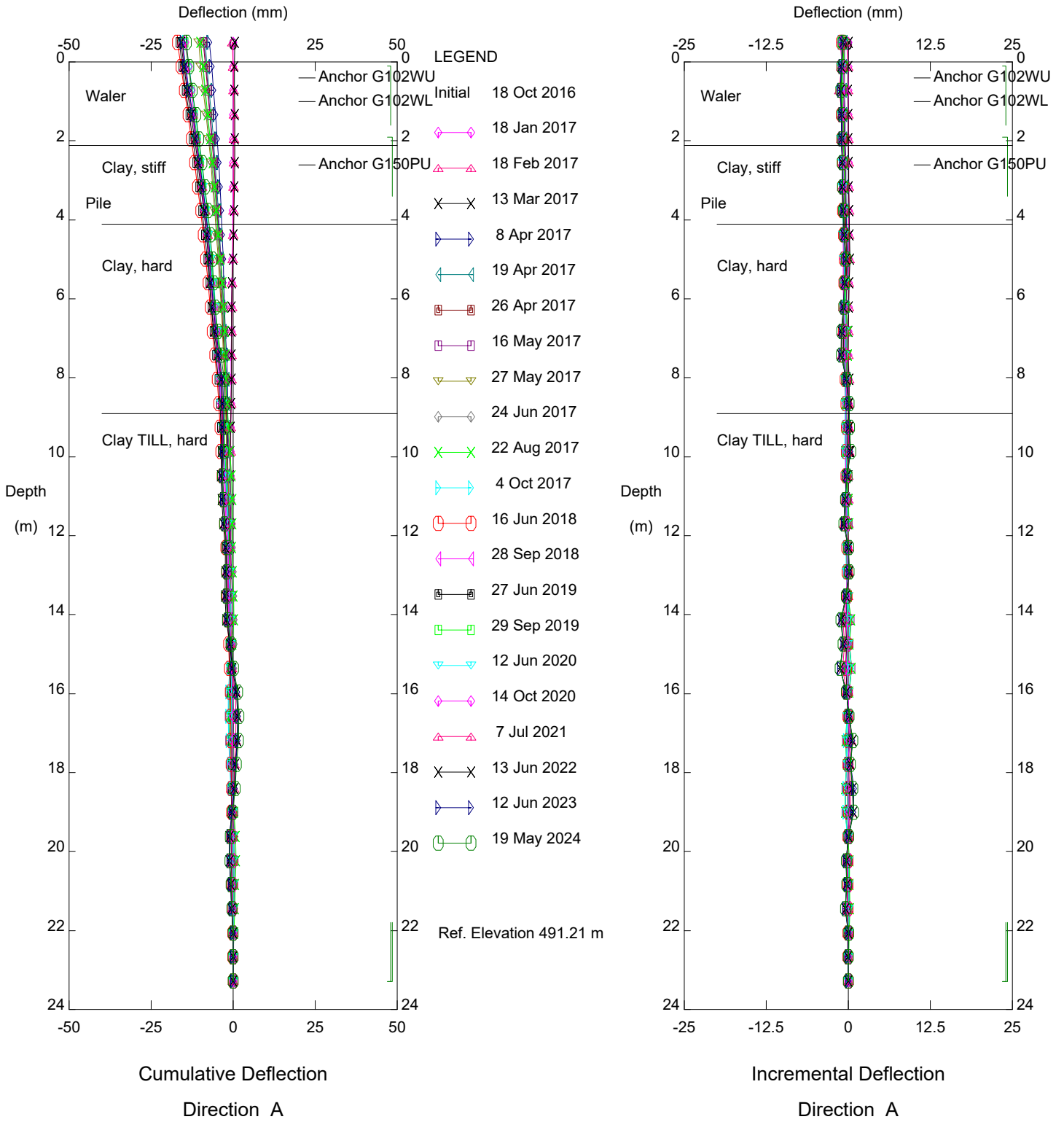
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Peace River East Hill PH070, Inclinator P58

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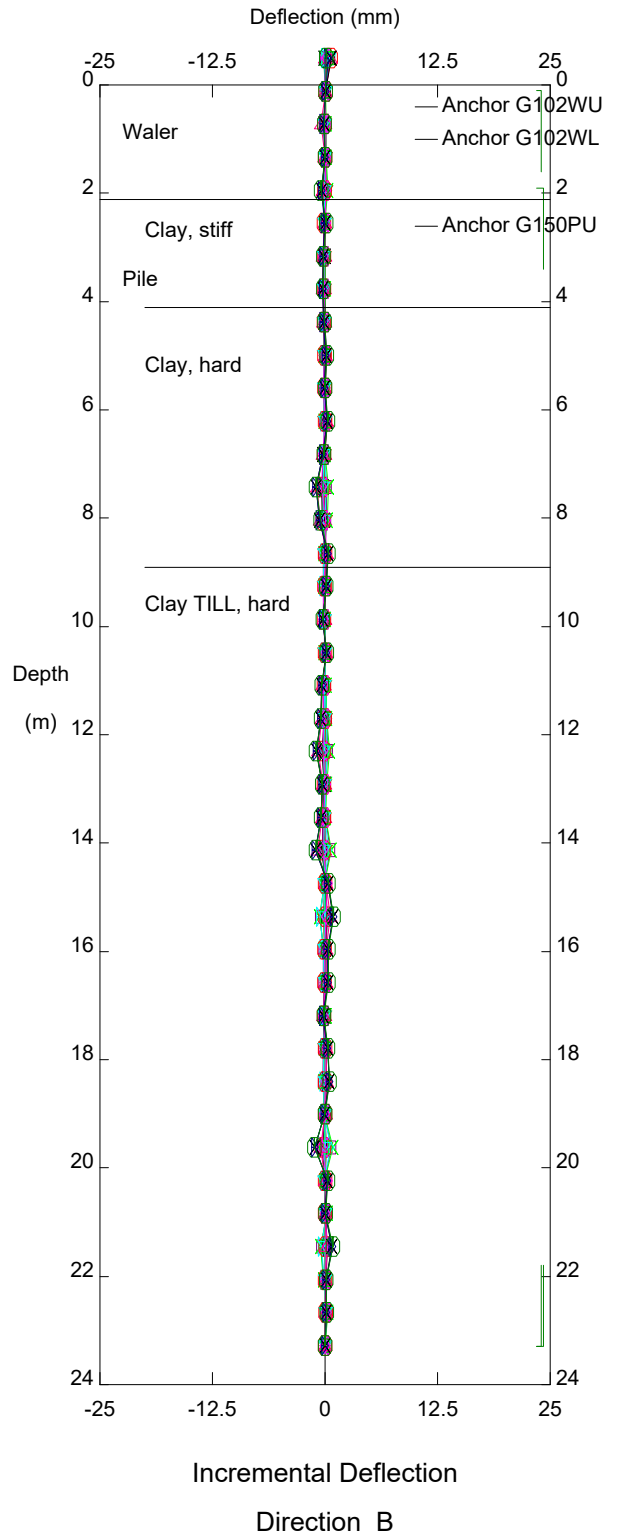
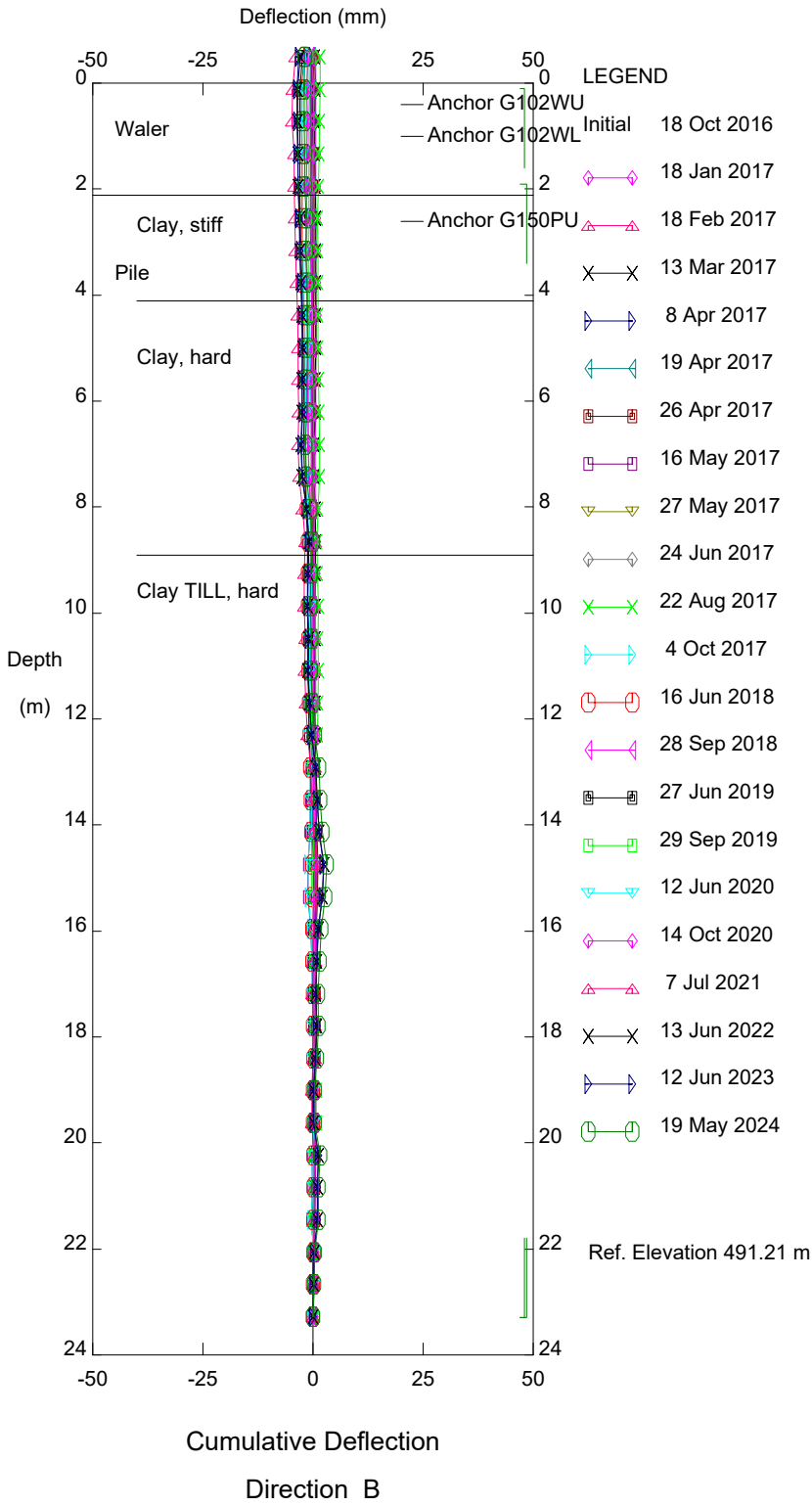
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Peace River East Hill PH070, Inclinometer P90

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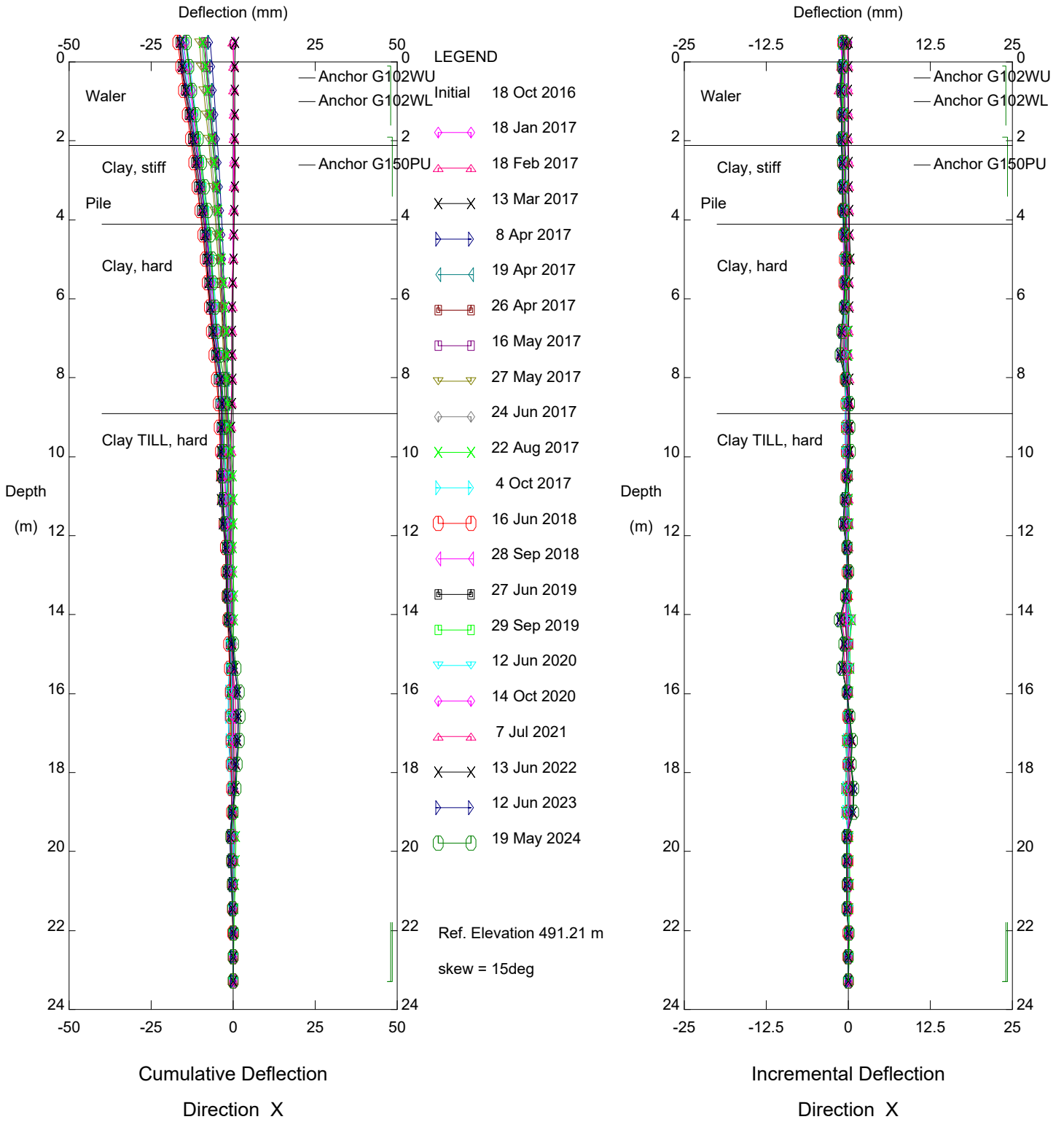
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Peace River East Hill PH070, Inclinometer P90

Alberta Transportation

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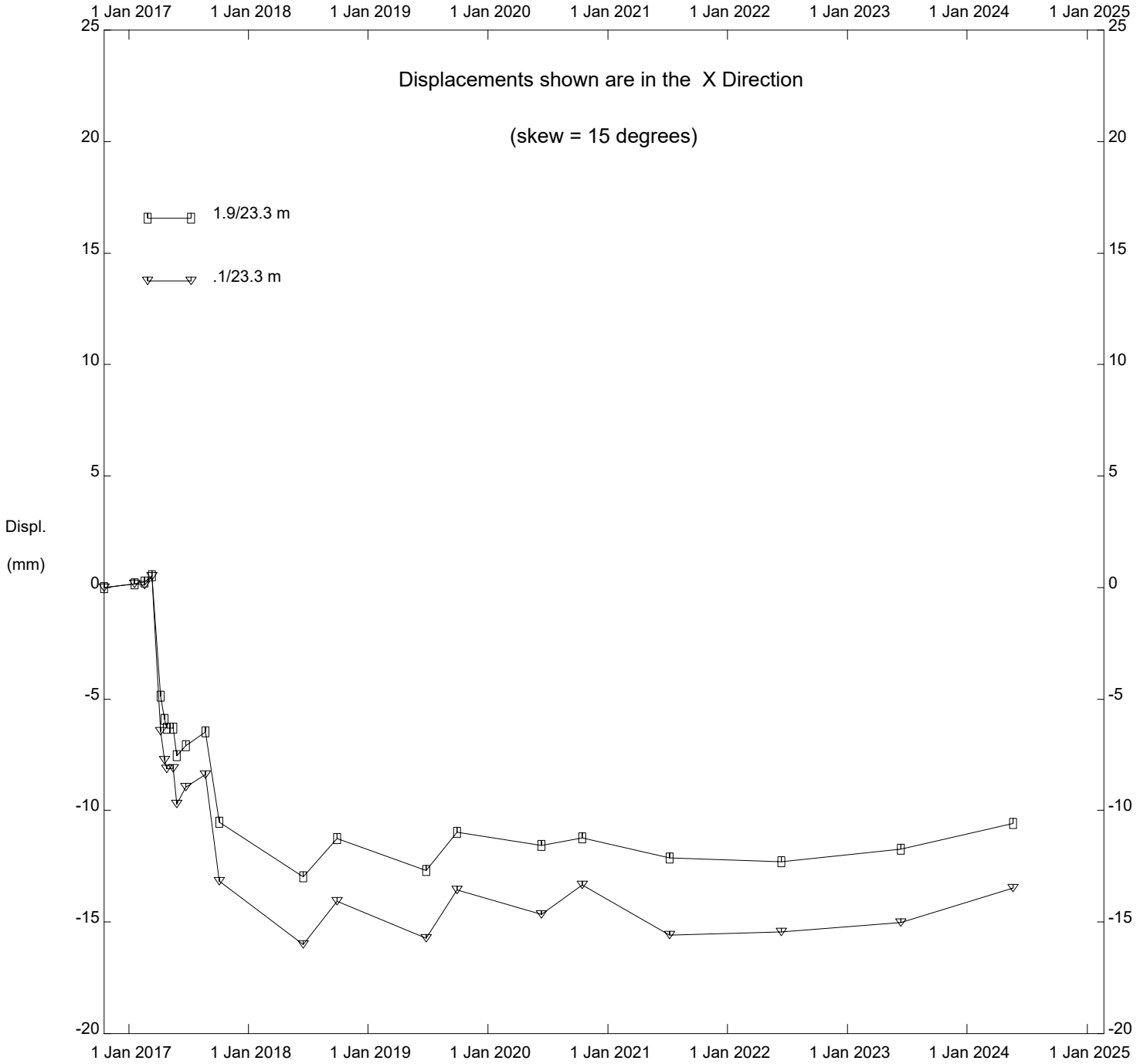


Peace River East Hill PH070, Inclinometer P90

Alberta Transportation



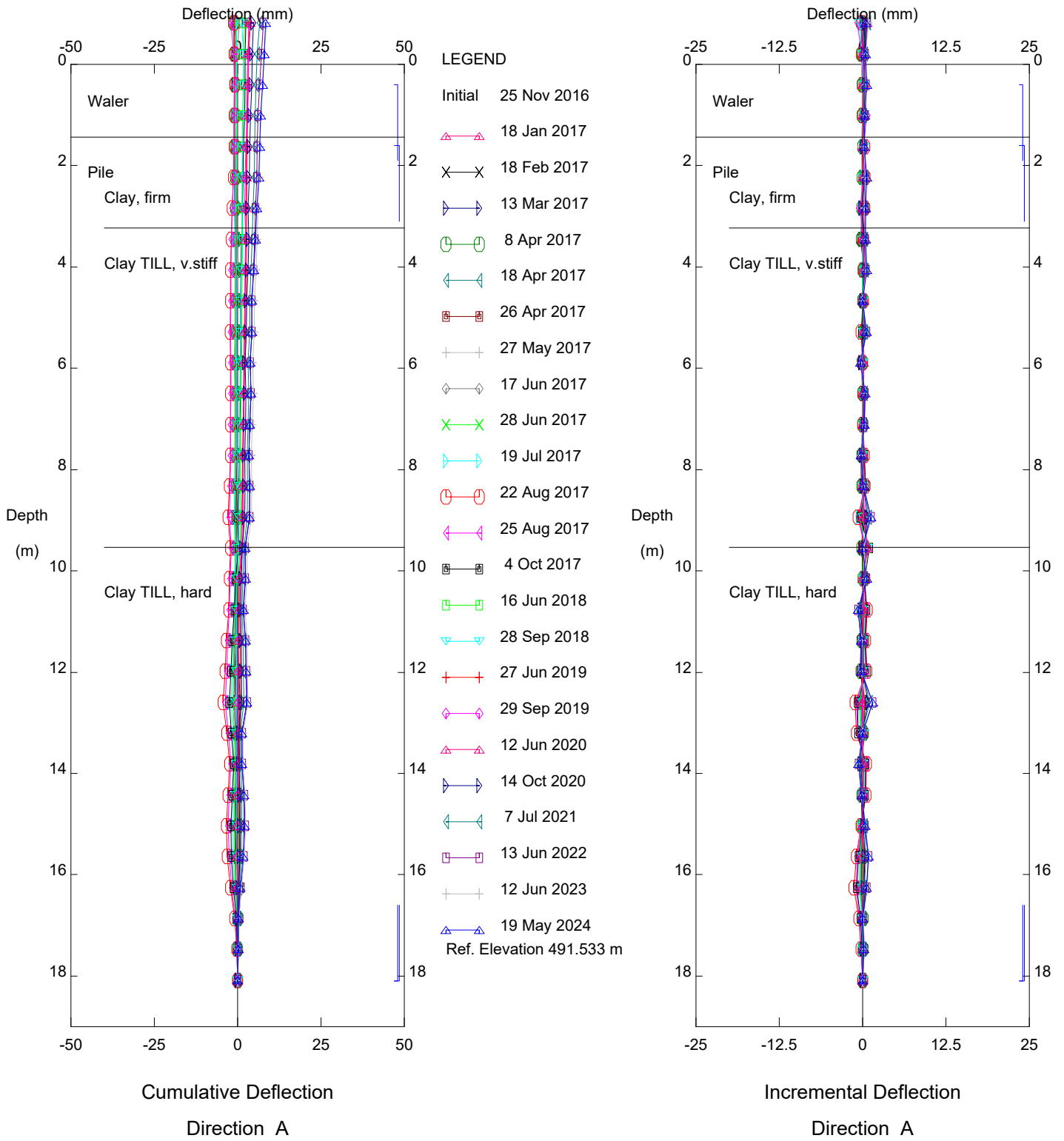
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Peace River East Hill PH070, Inclinator P90

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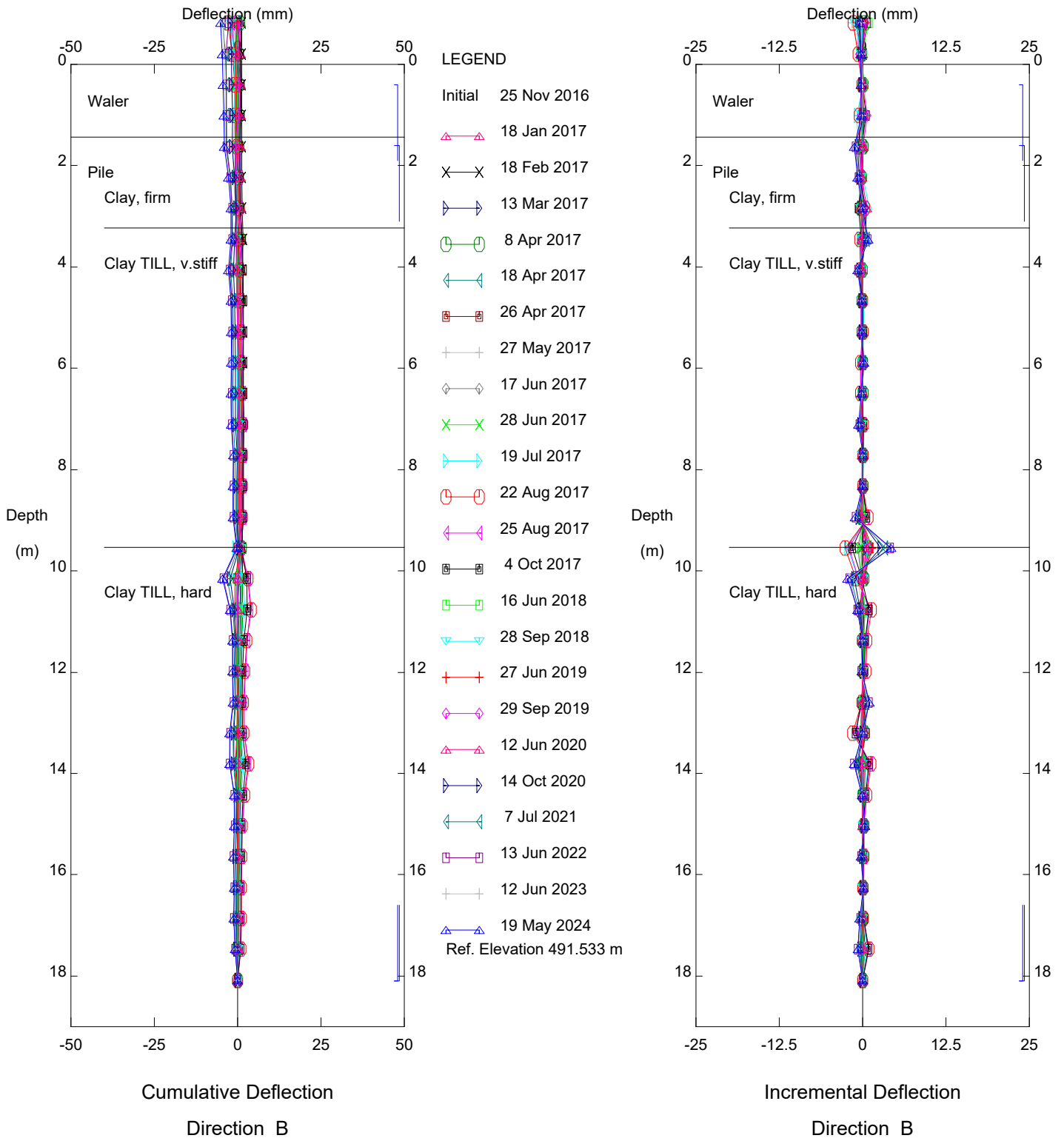
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Peace River East Hill PH070, Inclinometer P116

Alberta Transportation

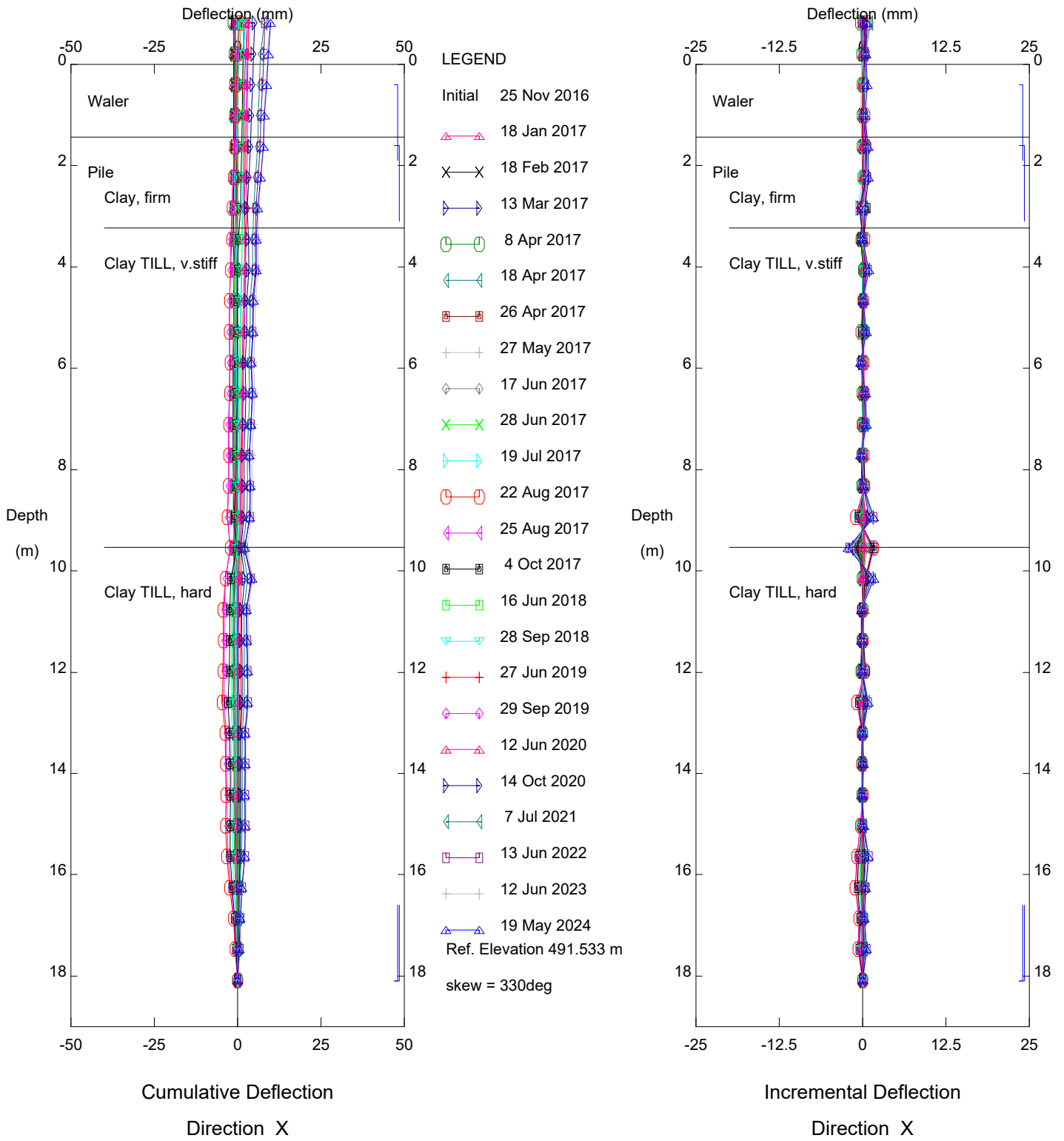
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Peace River East Hill PH070, Inclinator P116

Alberta Transportation

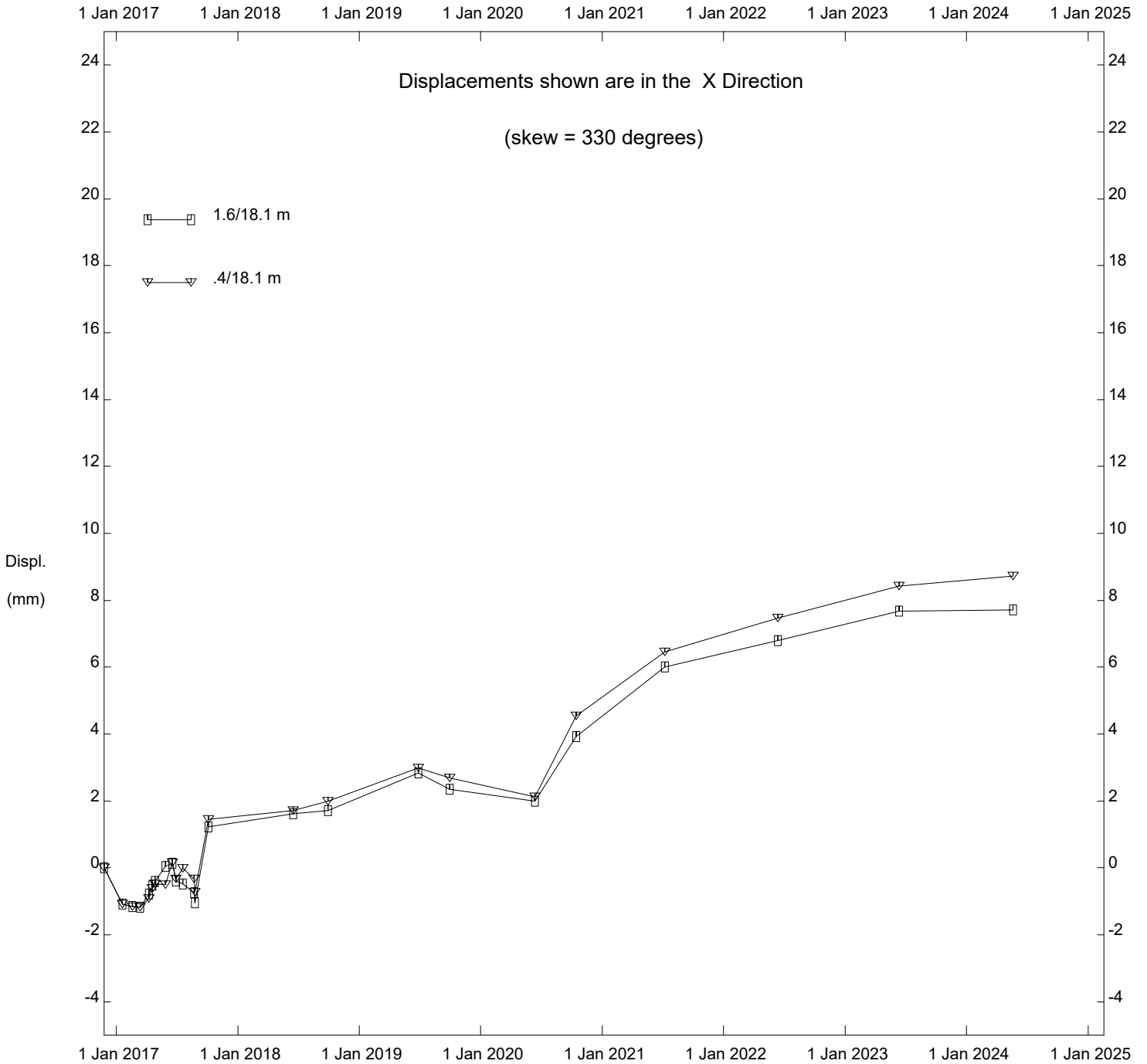
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Peace River East Hill PH070, Inclinometer P116

Alberta Transportation

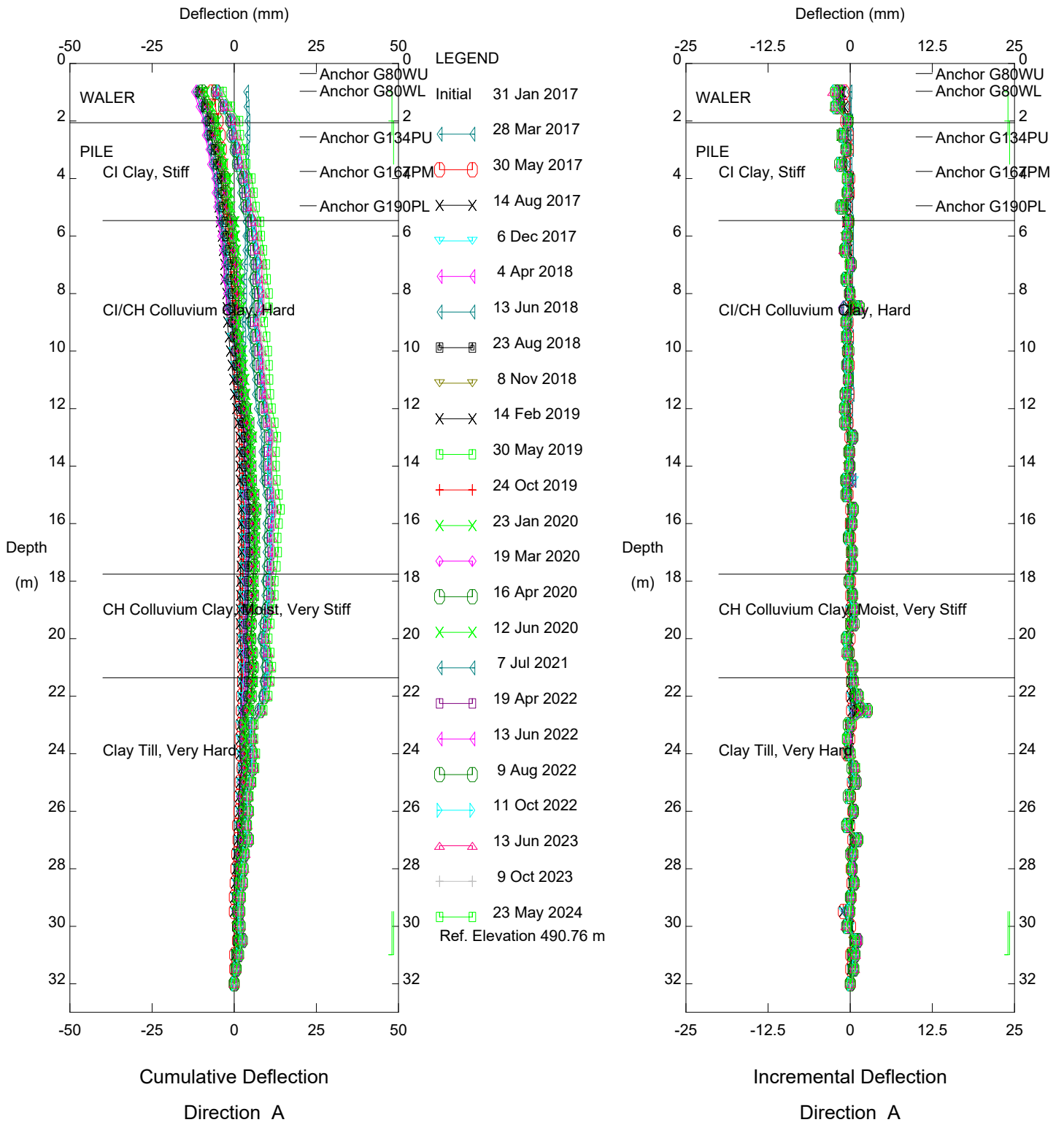
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Peace River East Hill PH070, Inclinator P116

Alberta Transportation

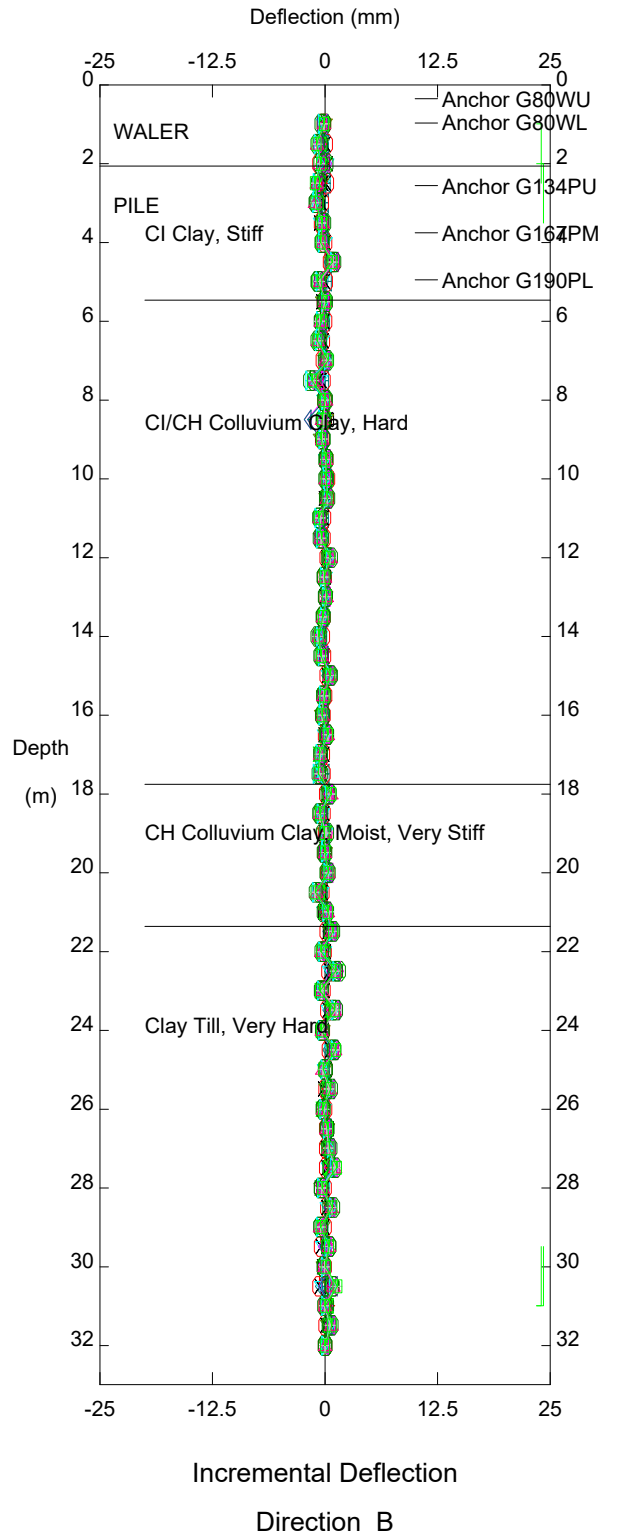
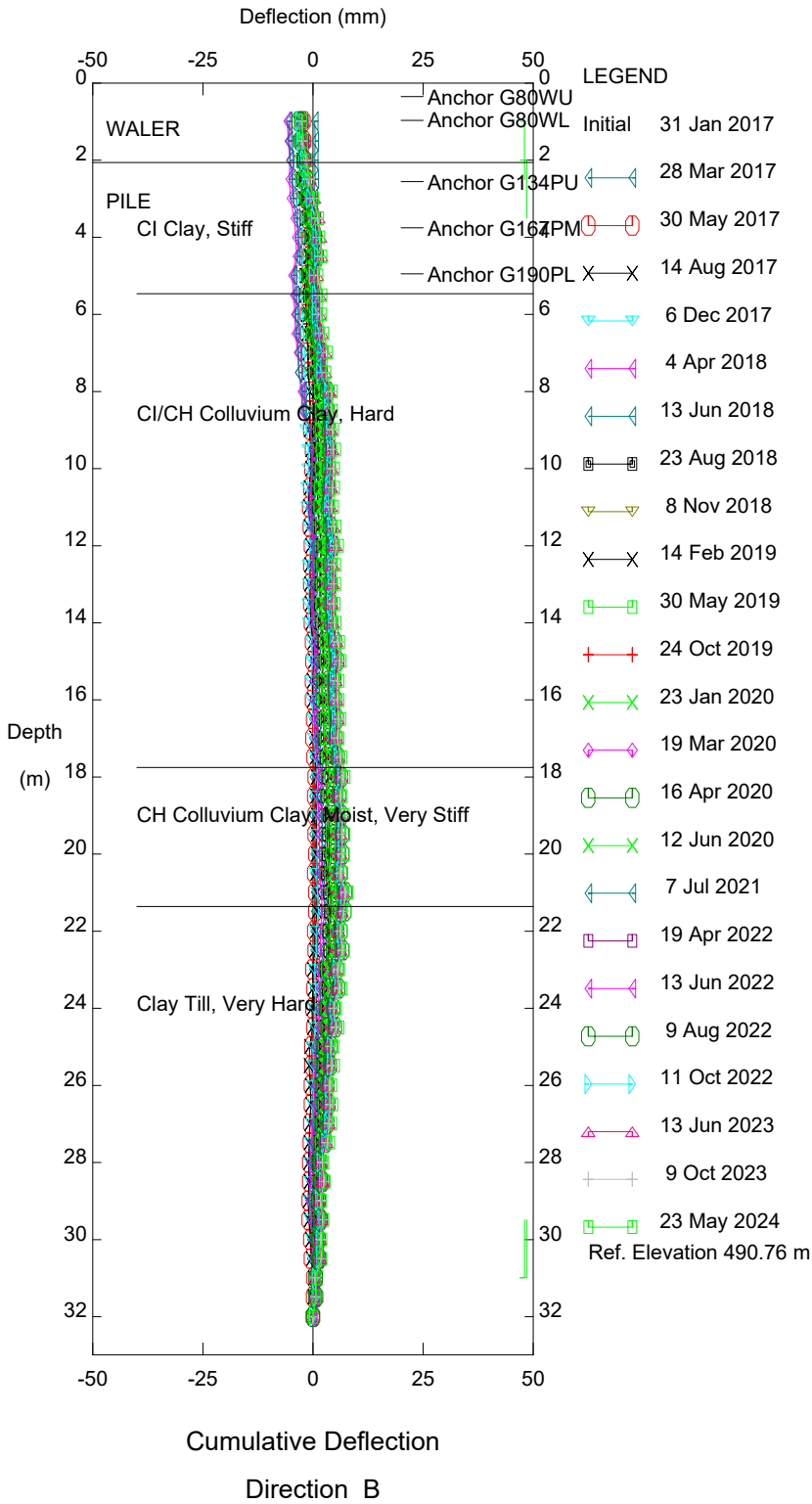
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PH070 Hwy 2:60 East Hill, Inclinometer SAA-P74

Alberta Transportation

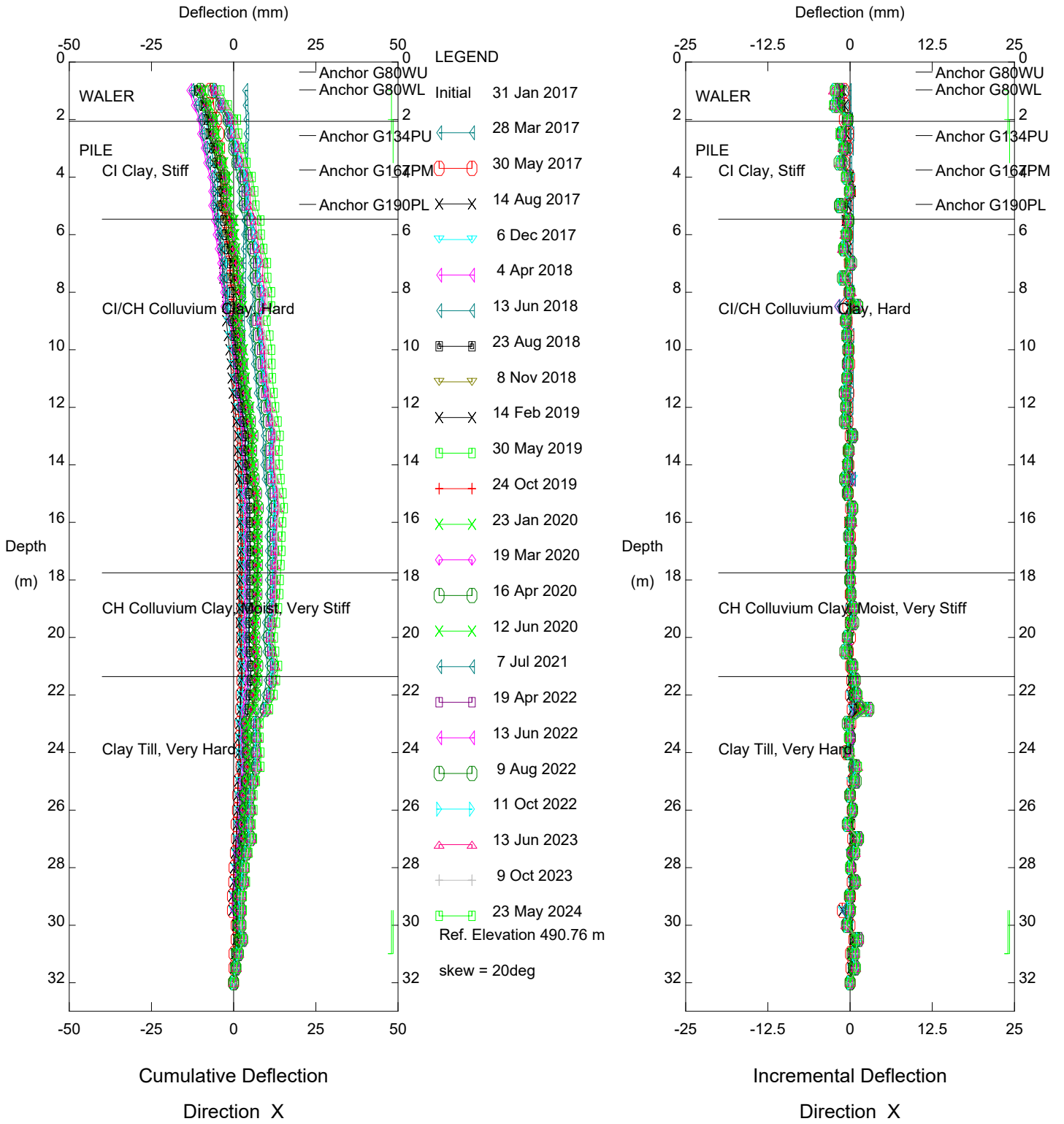
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PH070 Hwy 2:60 East Hill, Inclinometer SAA-P74

Alberta Transportation

Thurber Engineering Ltd

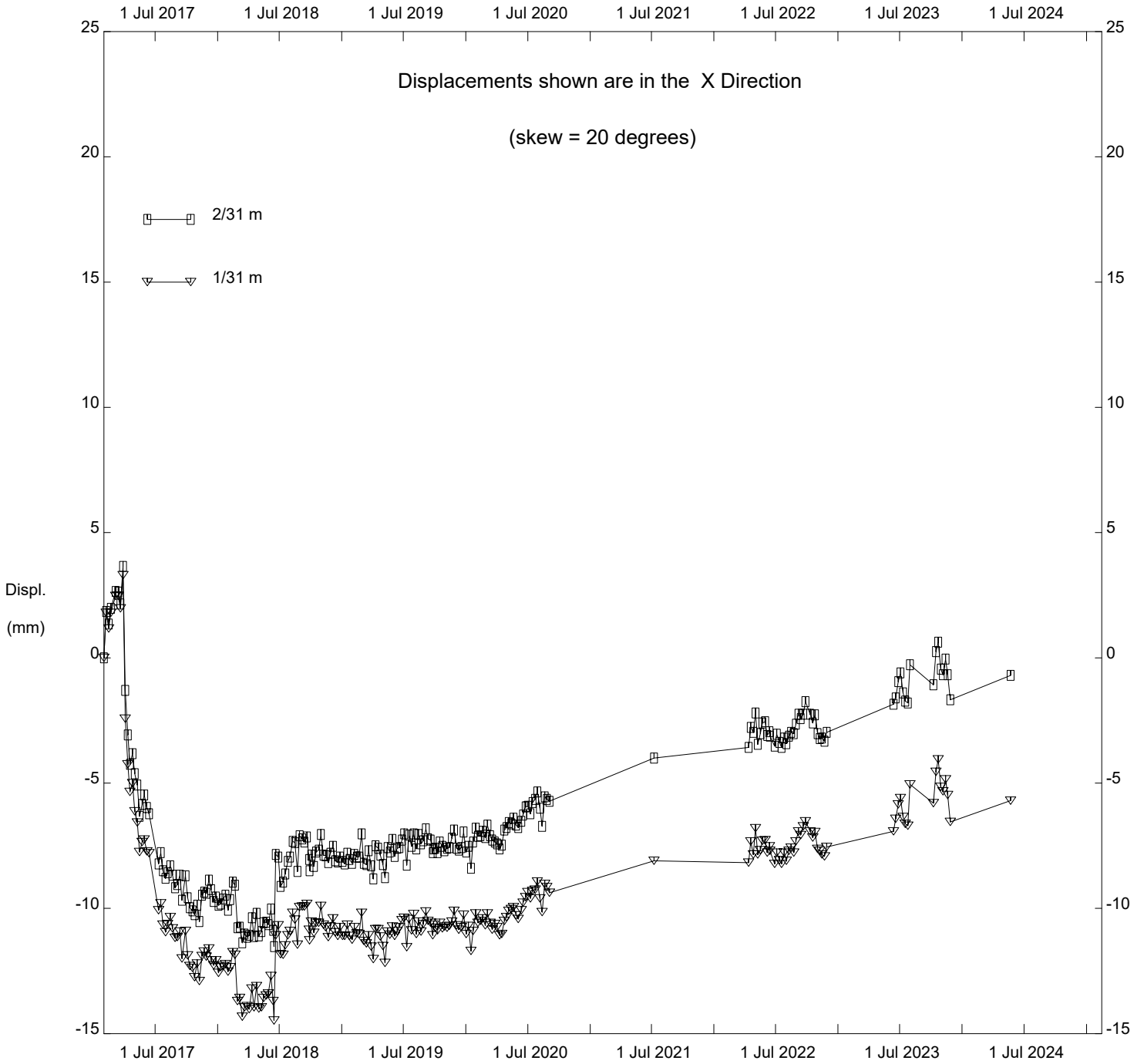


PH070 Hwy 2:60 East Hill, Inclinometer SAA-P74

Alberta Transportation



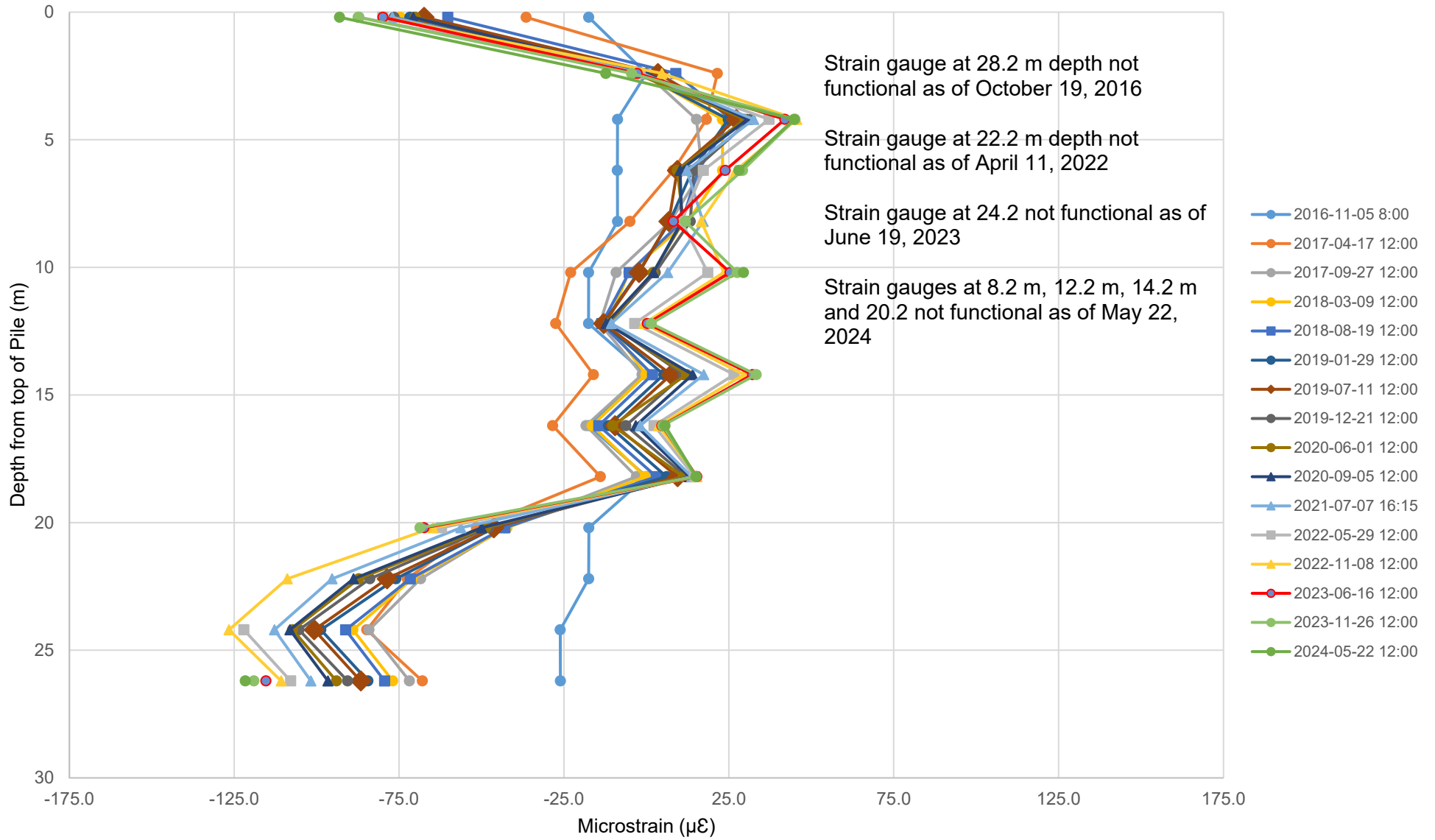
Thurber Engineering Ltd



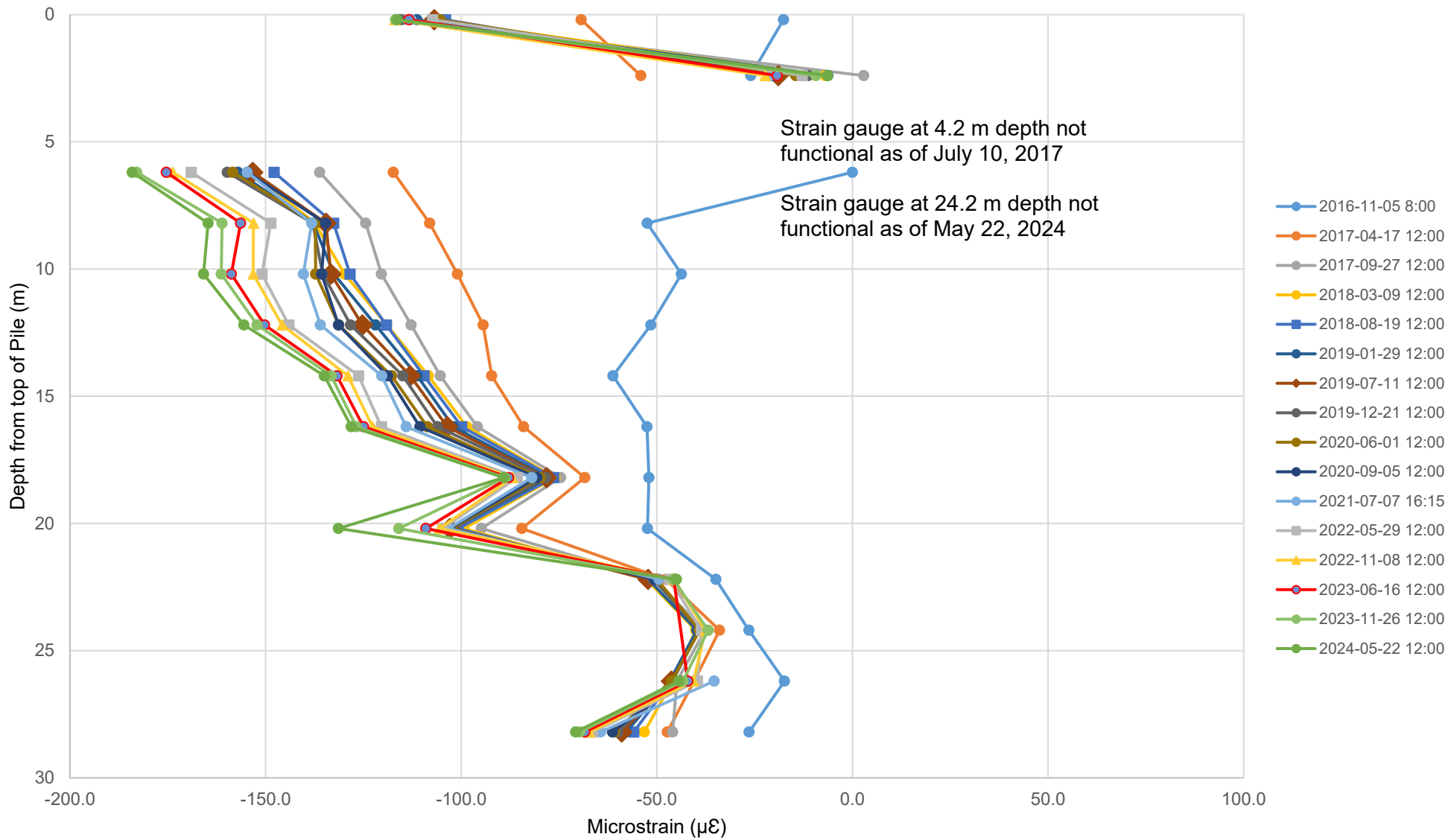
PH070 Hwy 2:60 East Hill, Inclinator SAA-P74

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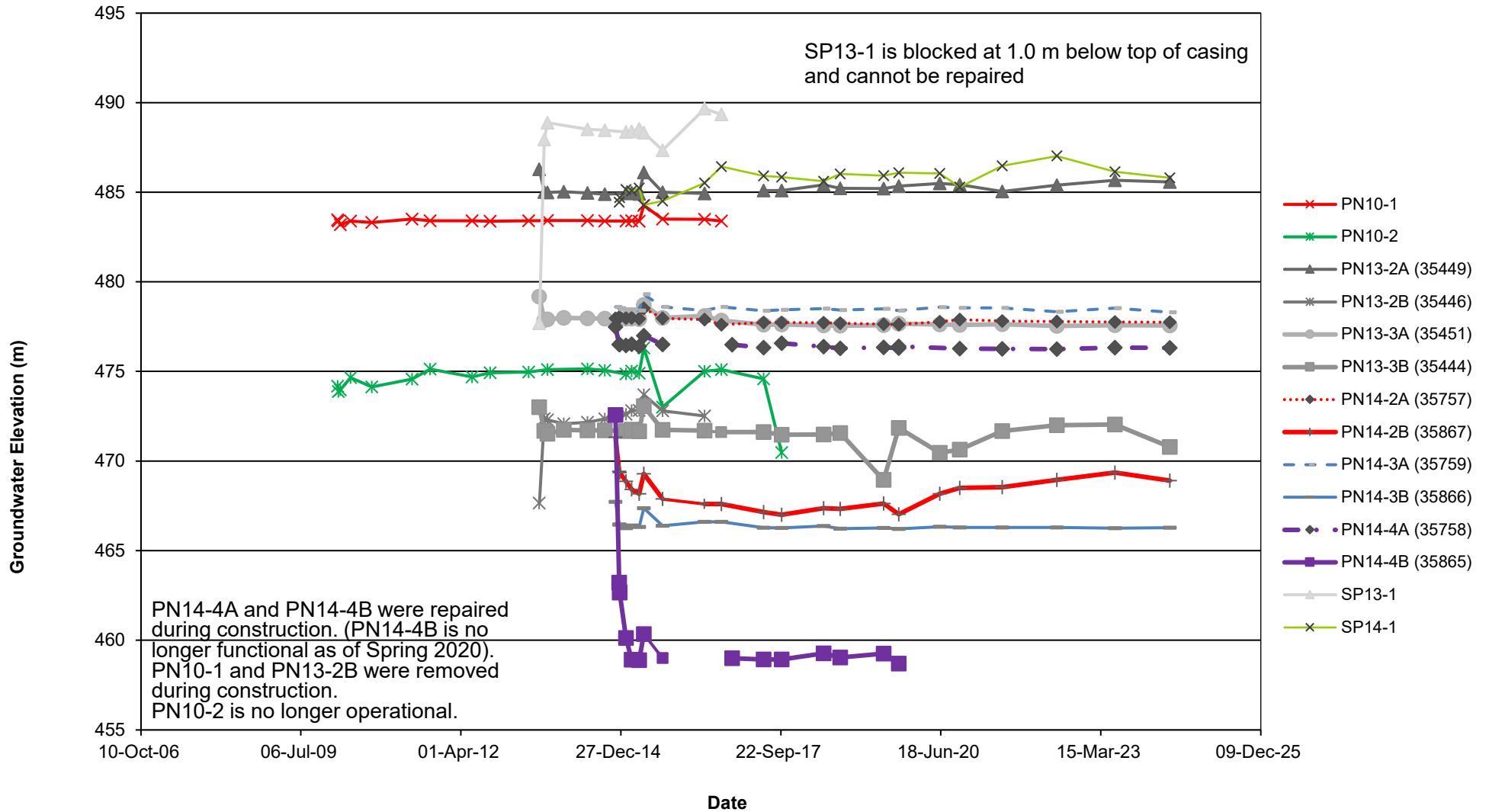
**FIGURE PH070-1**  
**HWY 2:60 PEACE RIVER EAST HILL RETAINING WALL SITE (km 33.84)**  
**PILE P74 DOWNSLOPE SIDE STRAIN GAUGE VALUES VS DEPTH**



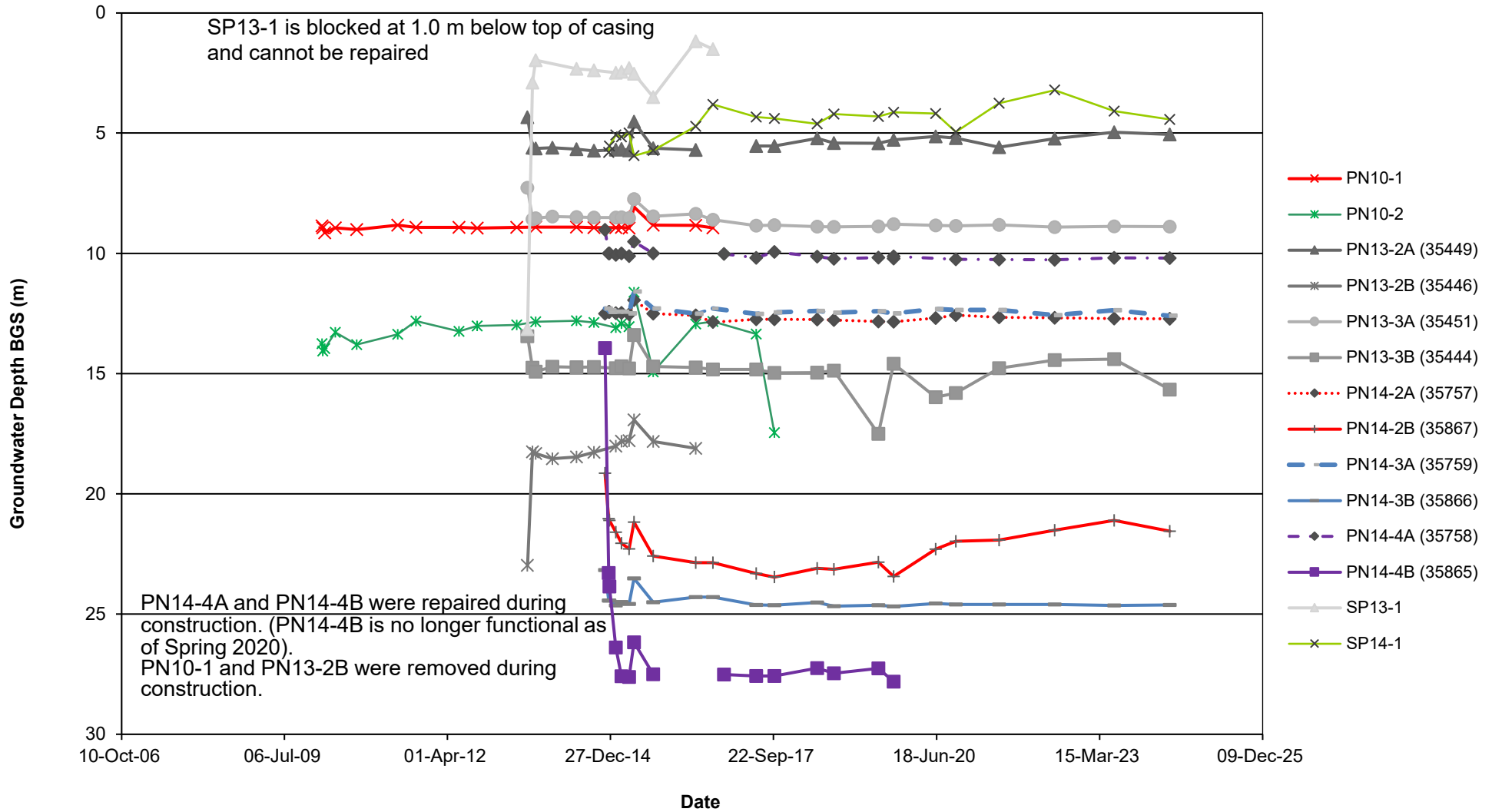
**FIGURE PH070-2**  
**HWY 2:60 PEACE RIVER EAST HILL RETAINING WALL SITE (km 33.84)**  
**PILE P74 UPSLOPE SIDE STRAIN GAUGE VALUES VS DEPTH**



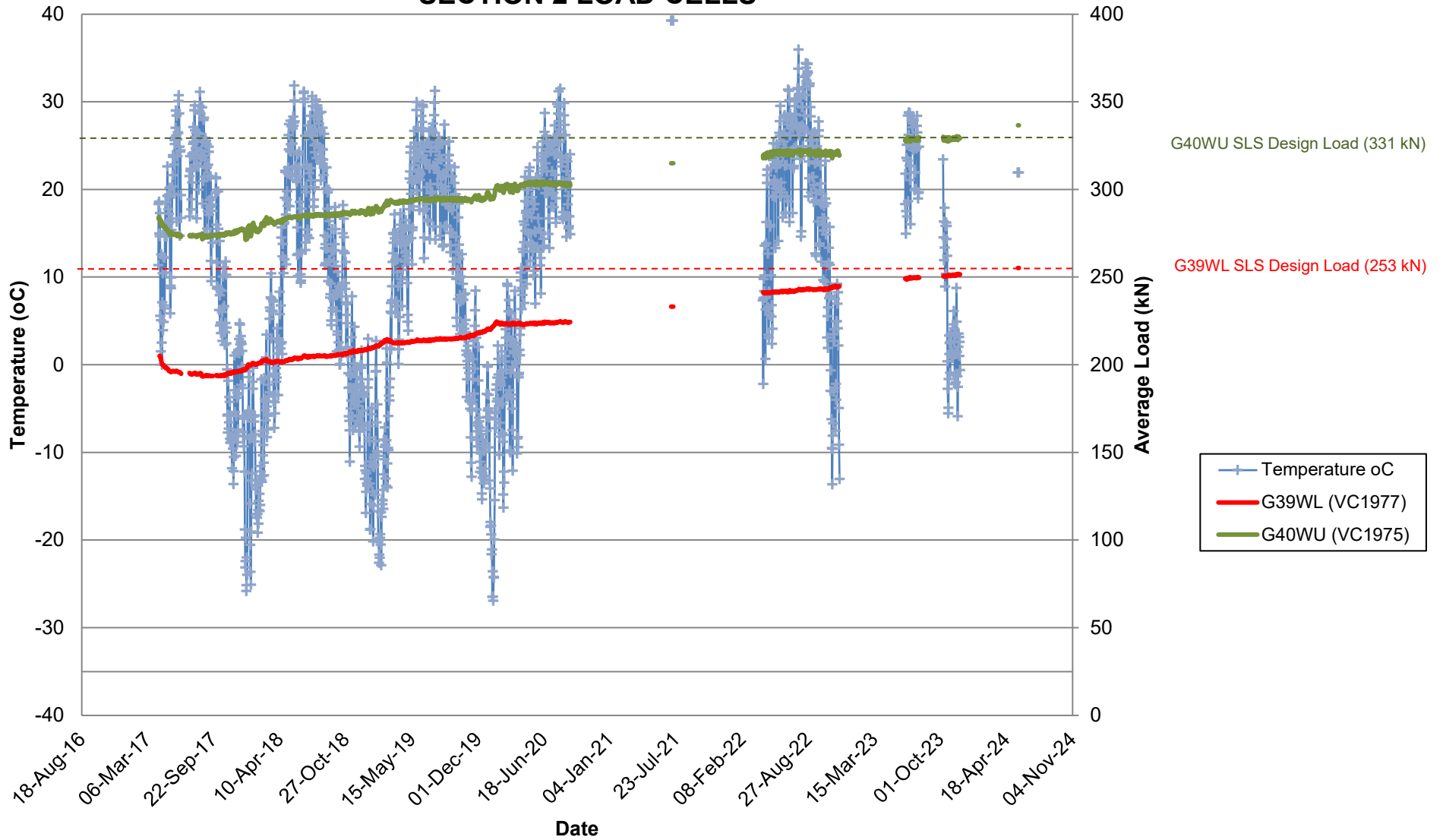
**FIGURE PH070-3  
HWY 2:60 PEACE RIVER EAST HILL RETAINING WALL SITE (km 33.84)  
PIEZOMETRIC ELEVATIONS**



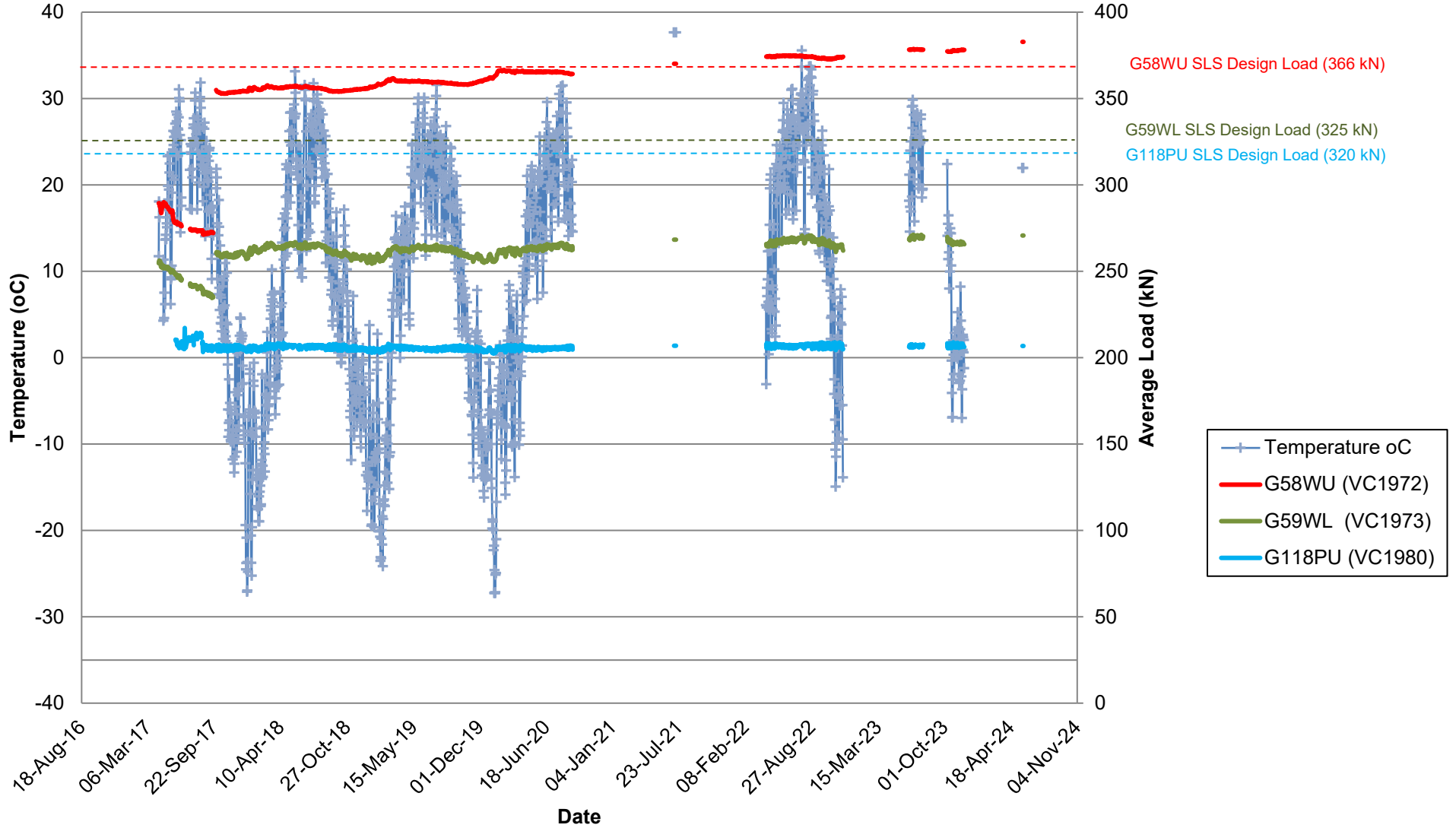
**FIGURE PH070-4**  
**HWY 2:60 PEACE RIVER EAST HILL RETAINING WALL SITE (km 33.84)**  
**PIEZOMETRIC DEPTHS**



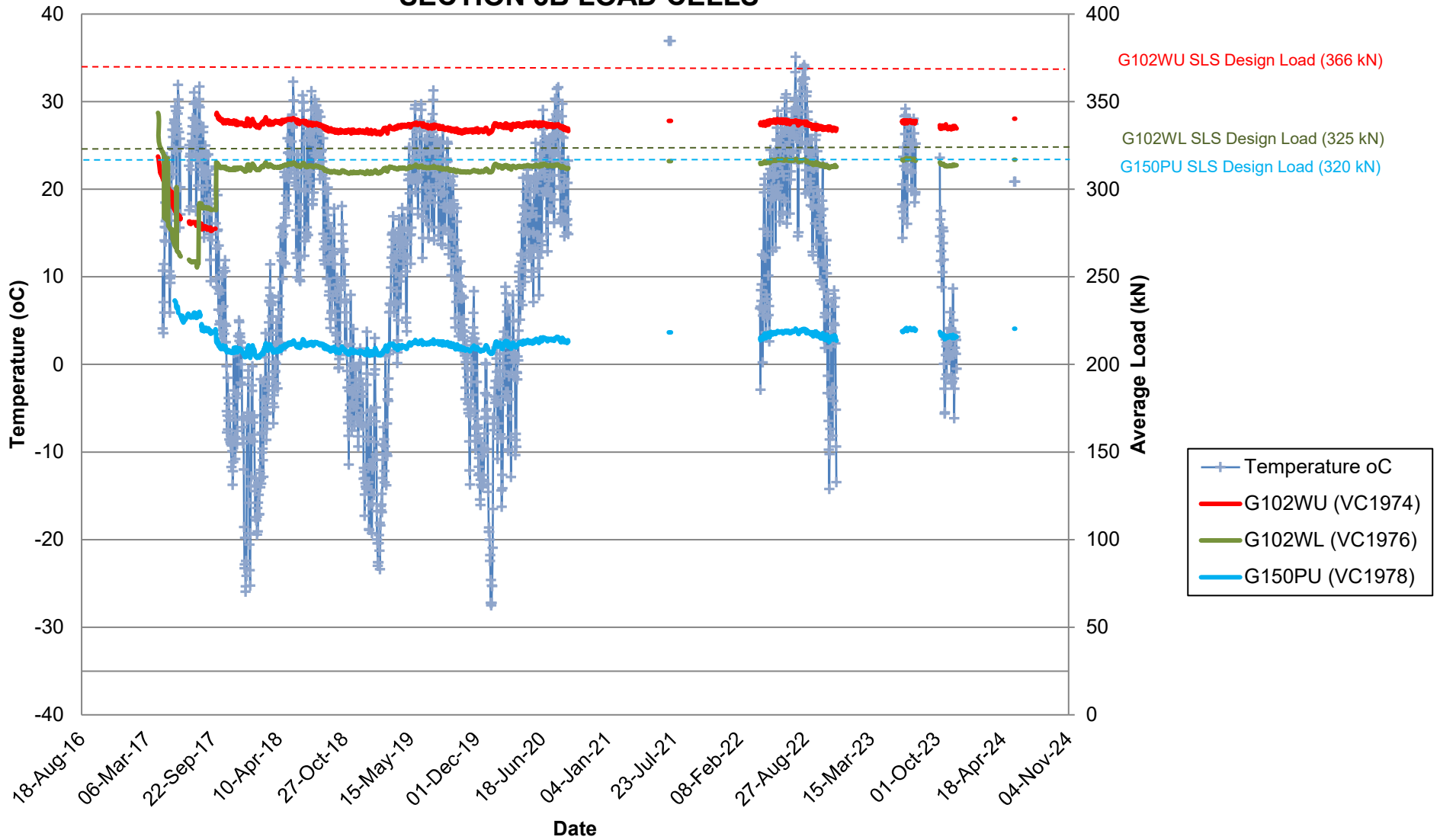
# FIGURE PH070-5 HWY 2:60 PEACE RIVER EAST HILL RETAINING WALL SITE (km 33.84) SECTION 2 LOAD CELLS



# FIGURE PH070-6 HWY 2:60 PEACE RIVER EAST HILL RETAINING WALL SITE (km 33.84) SECTION 3A LOAD CELLS



**FIGURE PH070-7**  
**HWY 2:60 PEACE RIVER EAST HILL RETAINING WALL SITE (km 33.84)**  
**SECTION 3B LOAD CELLS**





**FIGURE PH070-8**  
**HWY 2:60 PEACE RIVER EAST HILL RETAINING WALL SITE (km 33.84)**  
**SECTION 4 LOAD CELLS**

