

**ALBERTA TRANSPORTATION AND
ECONOMIC CORRIDORS GRMP
PEACE REGION
(GRANDE PRAIRIE DISTRICT - NORTH)
INSTRUMENTATION MONITORING - FALL 2024**



Site Number	Location	Name	Hwy	km
GP029	HWY 2:70 km 11.88	Church Camp Slide	2:70	Km 11.9
Legal Description:		UTM Co-ordinates		
16-4-77-5 W6		11U E 393096	N	6168377

Current Monitoring:	25-Sep-2024	Previous Monitoring	29-May-2024
Instruments Read By:	Mr. Neil McDonald and Mr. Nixson Mationg, of Thurber		

Instruments Read During This Site Visit			
Slope Inclinometers (SIs): SI-2, SI-3, and SI17-5	Pneumatic Piezometers (PN): PN-02, PN17 2A, PN17-2B, PN17-2C*, PN17-3B, PN17-3C, PN17-4A, PN17-4B, PN17-4C, PN17-5A and PN17-5B	Vibration Wire Piezometers (VW):	Standpipe Piezometers (SP): SP17-6**
Load Cell (LC):	Strain Gauges:	SAA's:	Others:

Readout Equipment Used			
Slope Inclinometers: RST Digital Inclinator probe with a 2 ft. wheelbase and a RST Pocket PC readout	Pneumatic Piezometers: RST C108 pneumatic piezometer readout	Vibration Wire Piezometers:	Standpipe Piezometers: DGSI dipmeter
Load Cell:	Strain Gauges:	SAA's:	Others:
Notes: *Pneumatic Piezometer PN17-2C malfunctioned **Standpipe piezometer SP17-6 was destroyed since the spring 2024 readings.			

Discussion	
Zones of New Movement:	None
Interpretation of Monitoring Results:	<p>Slope inclinometer SI-2 showed no discernible movement over 7.0 m to 8.8 m depth or over 33.8 m to 35.1 m depth since the spring of 2024 readings. Both zones of movement are very distinct and showed a decrease in rate of movement since the previous readings. Of interest is the upper zone which has a movement vector skew angle of 36 degrees and the lower zone has a skew angle of 3 degrees.</p> <p>SI-3 has four known zones of movement. From top to bottom the movement rates since the spring of 2024 readings are: 3.5 mm/yr over 5.2 m to 7.0 m depth; 0.9 mm/yr over 9.4 m to 10.6 m depth; 0.5 mm/yr over 13.1 m to 14.3 m depth, and; 0.4 mm/yr over 18.0 m to 19.2 m depth. The cumulative movements are: 43 mm over 5.2 m to 7.0 m depth; 13 mm over 9.4 m to 10.6 m depth; 3 mm over 13.1 m to 14.3 m depth, and; 5 mm over 18.0 m to 19.2 m depth. The multitude of movement zones is indicative of the complexity of the slide at this site.</p> <p>SI17-5 has shown no discernible movement since initialization as it is located on the opposite side of the highway just outside of the landslide influence zone.</p>

	Pneumatic piezometers PN-02, PN17-2A, PN17-2B, PN17-3C, PN17-4A, PN17-4B, and PN17-4C showed decreases in groundwater level of 0.92 m, 0.49 m, 0.14 m, 1.9 m, 0.07 m, 0.35 m, and 0.07 m, respectively, since the spring of 2024 readings. PN17-3C and PN17-4C are currently showing significant above-ground (artesian) groundwater levels of 9.81 m and 8.80 m, respectively. PN17-3B, PN17-5A, and PN17-5B showed increases in groundwater level of 0.21 m, 0.28 m, and 0.07 m, respectively, since the spring of 2024 readings. Overall, the piezometers are generally showing groundwater levels in line with historic groundwater level readings at the site.
Future Work:	The instruments should be read again in the spring of 2025. PN17-2C should be read again and if it is still malfunctioning, it should be removed from future readings.
Instrumentation Repairs:	No instrument repairs are required at this time.
Additional Comments:	Additional readings could be done during construction of the highway realignment; this would be advisable if cracks on the existing highway begin to open as construction proceeds.

Attachments:	<ul style="list-style-type: none"> ▪ Table GP029-1 Fall 2024 – HWY 2:70 Church Slide, Slope Inclinator Instrumentation Reading Summary ▪ Table GP029-2 Fall 2024 – HWY 2:70 Church Slide, Pneumatic Piezometer Instrumentation Reading Summary ▪ Table GP029-3 Fall 2024 – HWY 2:70 Church Slide, Standpipe Piezometer Instrumentation Reading Summary ▪ Statement of Limitations and Conditions ▪ APPENDIX A – GP029-1 FALL 2024 <ul style="list-style-type: none"> □ Field Inspector's report □ Site Plan Showing Approximate Instrument Locations (Drawing No. 32123-GP029) □ SI Reading Plots □ Figure GP029-1 (Piezometric Elevations) □ Figure GP029-2 (Piezometric Depths)
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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 GP029-1: Fall 2024 – Hwy 2:70 Church Camp Slide Slope Inclinometer Instrumentation Reading Summary

Date Monitored: September 25, 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-2	October 18, 2007	33.6 over 7.0 m to 8.8 m depth in 112° direction	8.1 in October 2016	Operational	May 29, 2024	No discernible movement	N/A	-3.4
		20.2 over 33.8 m to 35.1 m depth in 79° direction	6.9 in October 2020			No discernible movement	N/A	-0.7
SI-3	October 18, 2007	43.2 over 5.2 m to 7.0 m depth in 113° direction	7.6 in July 2021	Operational	May 29, 2024	1.1	3.5	0.4
		12.8 over 9.4 m to 10.6 m depth in 81° direction	6.7 in October 2016			0.3	0.9	1.4
		3.1 over 13.1 m to 14.3 m depth in 81° direction	2.0 in October 2021			0.2	0.5	0.8
		4.8 over 18.0 m to 19.2 m depth in 91° direction	2.3 in October 2018			0.1	0.4	0.5
SI17-1	September 15, 2017	7.0 over 24.4 m to 26.3 m depth in 85° direction	8.1 in October 2018	Sheared at 33.2 m	June 26, 2023	N/A	N/A	N/A
		22.4 over 31.8 m to 33.0 m depth in 120° direction	22.6 in October 2018			N/A	N/A	N/A

Table GP029-1 – Continued...Fall 2024 – Hwy 2:70 Church Camp Slide Slope Inclinometer Instrumentation Reading Summary

Date Monitored: September 25, 2024

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE 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)
SI17-2	September 15, 2017	25.7 m over 17.2 m to 19.7 m depth in 110° direction	42.7 in October 2017	Sheared at 50.6 m	October 7, 2019	N/A	N/A	N/A
		6.9 m over 21.5 m to 23.3 m depth in 110° direction	10.4 in October 2018			N/A	N/A	N/A
		38.0 over 47.1 m to 50.8 m depth in 110° direction	31.9 in October 2018			N/A	N/A	N/A
SI17-3	September 15, 2017	No discernible movement	N/A	Sheared at 43.6 m	October 5, 2018	N/A	N/A	N/A
SI17-4	September 15, 2017	11.8 over 37.4 m to 39.2 m depth in 118° direction	17.5 in July 2018	Sheared at 45.1 m	October 5, 2018	N/A	N/A	N/A
SI17-5	September 16, 2017	No discernible movement	N/A	Operational	May 29, 2024	N/A	N/A	N/A

Drawing 32123-GP029 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

Table GP029-2: Fall 2024 – Hwy 2:70 Church Camp Slide Pneumatic Piezometer Instrumentation Reading Summary

Date Monitored: September 25, 2024

INSTRUMENT #	DATE INITIALIZED	TIP ELEV. (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED WATER ELEVATION (m)	MEASURED PORE PRESSURE (kPa)	CURRENT WATER ELEVATION (m)	PREVIOUS WATER ELEVATION (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
PN-02	My 9, 2008	629.66	635.76	Operational	635.82 in October 2016	49.0	634.65	635.57	-0.92
PN-03	May 9, 2008	614.57	631.33	Damaged	628.23 in May 2014	N/A	N/A	628.13 (June 15, 2017)	N/A
PN17-1A	September 15, 2017	633.85	645.58	Malfunctioning	645.45 in July 2018	N/A	N/A	636.87 (July 5, 2019)	N/A
PN17-1B	September 15, 2017	610.53	645.58	Malfunctioning	645.75 in June 2020	N/A	N/A	645.75* (June 22, 2020)	N/A
PN17-2A	September 15, 2017	628.41	638.65	Operational	638.46 in June 2020	91.0	637.69	638.18	-0.49
PN17-2B	September 15, 2017	598.54	638.65	Operational	637.77 in June 2022	383.3	637.63	637.77	-0.14
PN17-2C	September 15, 2017	587.88	638.65	Malfunctioning	637.79 in October 2018	N/A	N/A	637.16 (May 29, 2024)	N/A
PN17-3A	September 15, 2017	603.80	629.50	Malfunctioning	N/A	N/A	N/A	N/A	N/A

Drawing 32123-GP029 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

* Indicates artesian groundwater level

Table GP029-2 – Continued...Fall 2024 – Hwy 2:70 Church Camp Slide Pneumatic Piezometer Instrumentation Reading Summary

Date Monitored: September 25, 2024

INSTRUMENT #	DATE INITIALIZED	TIP ELEV. (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED WATER ELEVATION (m)	MEASURED PORE PRESSURE (kPa)	CURRENT WATER ELEVATION (m)	PREVIOUS WATER ELEVATION (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
PN17-3B	September 15, 2017	591.30	629.50	Operational	635.87 in September 2017	363.4	628.35	628.14	0.21
PN17-3C	September 15, 2017	581.45	629.50	Operational	641.20* in May 2024	567.4	639.31*	641.20*	-1.89
PN17-4A	September 15, 2017	606.31	631.19	Operational	634.57* in September 2017	220.6	628.81	628.88	-0.07
PN17-4B	September 15, 2017	590.92	631.19	Operational	636.27* in September 2017	383.3	630.01	630.36	-0.35
PN17-4C	September 15, 2017	582.69	631.19	Operational	641.12* in June 2020	561.9	639.99*	640.06*	-0.07
PN17-5A	September 15, 2017	633.17	647.40	Operational	649.97 in September 2017	120.7	645.47	645.19	0.28
PN17-5B	September 15, 2018	611.99	647.40	Operational	653.19 in September 2017	284.8	641.02	640.95	0.07

Drawing 32123-GP029 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

* Indicates artesian groundwater level

Table GP029-3: Fall 2024 – Hwy 2:70 Church Camp Slide Standpipe Piezometer Instrumentation Reading Summary

Date Monitored: September 25, 2024

INSTRUMENT #	DATE INITIALIZED	TIP ELEV. (m)	GROUND ELEV. (m)	CURRENT STATUS	MAXIMUM MEASURED WATER ELEVATION (m)	MEASURED WATER ELEVATION (m)	PREVIOUS WATER ELEVATION (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
SP17-6	September 15, 2017	640.26	647.81	Destroyed	646.00 in October 2023	N/A	644.71 (May 29, 2024)	N/A
SP17-7	September 15, 2017	635.44	646.54	Destroyed	645.36 in January 2018	N/A	N/A	N/A
SP17-8	September 15, 2017	639.46	646.06	Destroyed	642.54 in January 2018	N/A	N/A	N/A
SP17-9	September 15, 2017	637.84	644.44	Destroyed	639.69 in January 2018	N/A	N/A	N/A

Drawing 32123-GP029 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.



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.

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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.

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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.

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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 (CON0022165)
PEACE REGION (GRANDE PRAIRIE DISTRICT – NORTH)
INSTRUMENTATION MONITORING RESULTS**

FALL 2024

**APPENDIX A
DATA PRESENTATION**

SITE GP029: HWY 2:70, CHURCH CAMP SLIDE

**ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
PEACE REGION (GRANDE PRAIRIE - NORTH DISTRICT)
INSTRUMENTATION MONITORING FIELD SUMMARY (GP029)
FALL 2024**

Location: Church Camp Slide (HWY 2:70 C1 11.881) File Number: 32123 Probe: RST SI Set 8R Cable: RST SI Set 8R	Readout: RST PN C108 Unit 4 Extension: 2.75/3.34" Temp: 15C Read by: NNM/NRM
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SLOPE INCLINOMETER (SI) READINGS

SI#	GPS Location (UTM 11)		Date	Stickup (m)	Depth from top of casing (ft)	Azimuth of A+ Groove	Current Bottom Depth Readings				Probe/Reel #	Size (")	Remarks
	Easting (m)	Northing (m)					A+	A-	B+	B-			
SI-2	393096	6168377	25-Sep-24	0.6	118 to 4	60	183	-169	30	-25	8R/8R	3.34	
SI-3	393155	6168341	25-Sep-24	0.64	108 to 4	120	67	-50	-89	91	8R/8R	3.34	
SI17-5	393014	6168383	25-Sep-24	0.72	128 to 2	70 °	9	-4	-4378	4380	8R/8R	2.75	

PNEUMATIC PIEZOMETER (PN) READINGS

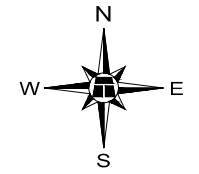
PN#	GPS Location (UTM 11)		Date	Reading (Psi)	Identification Number
	Easting (m)	Northing (m)			
PN-02	393096	6168377	25-Sep-24	7.1	60675
PN17-2A	393112	6168505	25-Sep-24	13.2	37657
PN17-2B	393112	6168505	25-Sep-24	55.6	37651
PN17-2C	393112	6168505	25-Sep-24	205.6*	37650
PN17-3B	393192	6168472	25-Sep-24	52.7	37652
PN17-3C	393192	6168472	25-Sep-24	82.3	37649
PN17-4A	393157	6168374	25-Sep-24	32	37655
PN17-4B	393157	6168374	25-Sep-24	55.6	37679
PN17-4C	393157	6168374	25-Sep-24	81.5	37678
PN17-5A	393014	6168383	25-Sep-24	17.5	37656
PN17-5B	393014	6168383	25-Sep-24	41.3	37654

STANDPIPE PIEZOMETER (SP) READINGS




SP	GPS Location (NAD83 UTM)		Date	Stick-up (m)	Water level below top of pipe (m)	Total length of pipe (m)
	Easting	Northing				
SP17-6	392931	6168288		0.86		7.55

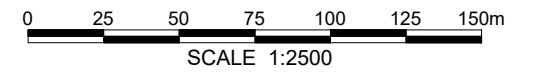
INSPECTOR REPORT

- Call private landowner before reading SP17-6 SP17-6 destroyed * Malfunctioning
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LEGEND

-  APPROXIMATE INSTRUMENT LOCATION
-  CRACK
-  ACP PATCH
- SI SLOPE INCLINOMETER
- PN PNEUMATIC PIEZOMETER
- SP STANDPIPE PIEZOMETER



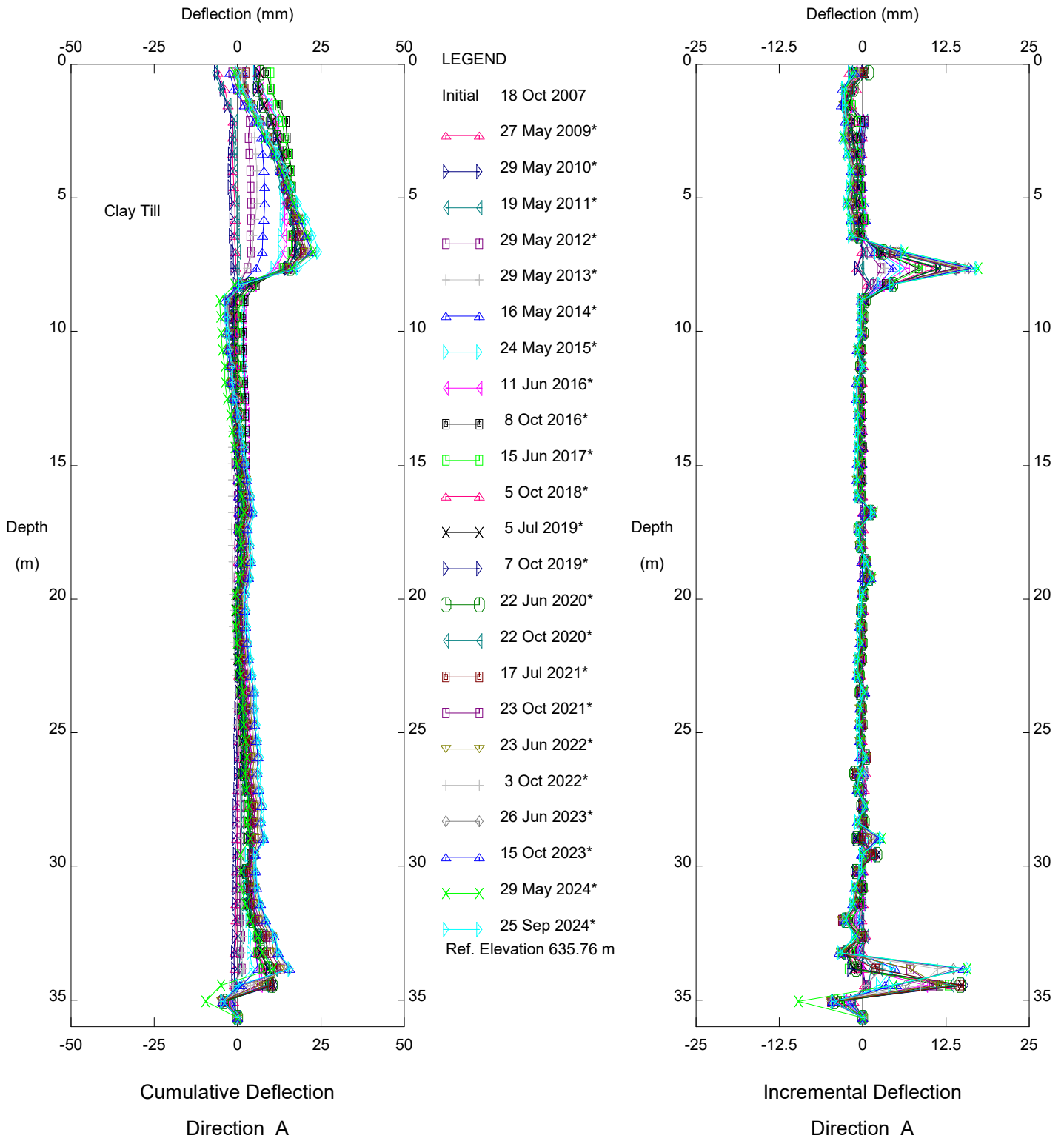
**PEACE REGION
(GRANDE PRAIRIE DISTRICT - NORTH)**
**GP029: HWY 2:70 CHURCH CAMP SLIDE
INSTRUMENT LOCATIONS**

DWG No. 32123-GP029

DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	RVC
SCALE	1:2500
DATE	AUGUST 2021
FILE No.	32123



Thurber Engineering Ltd.

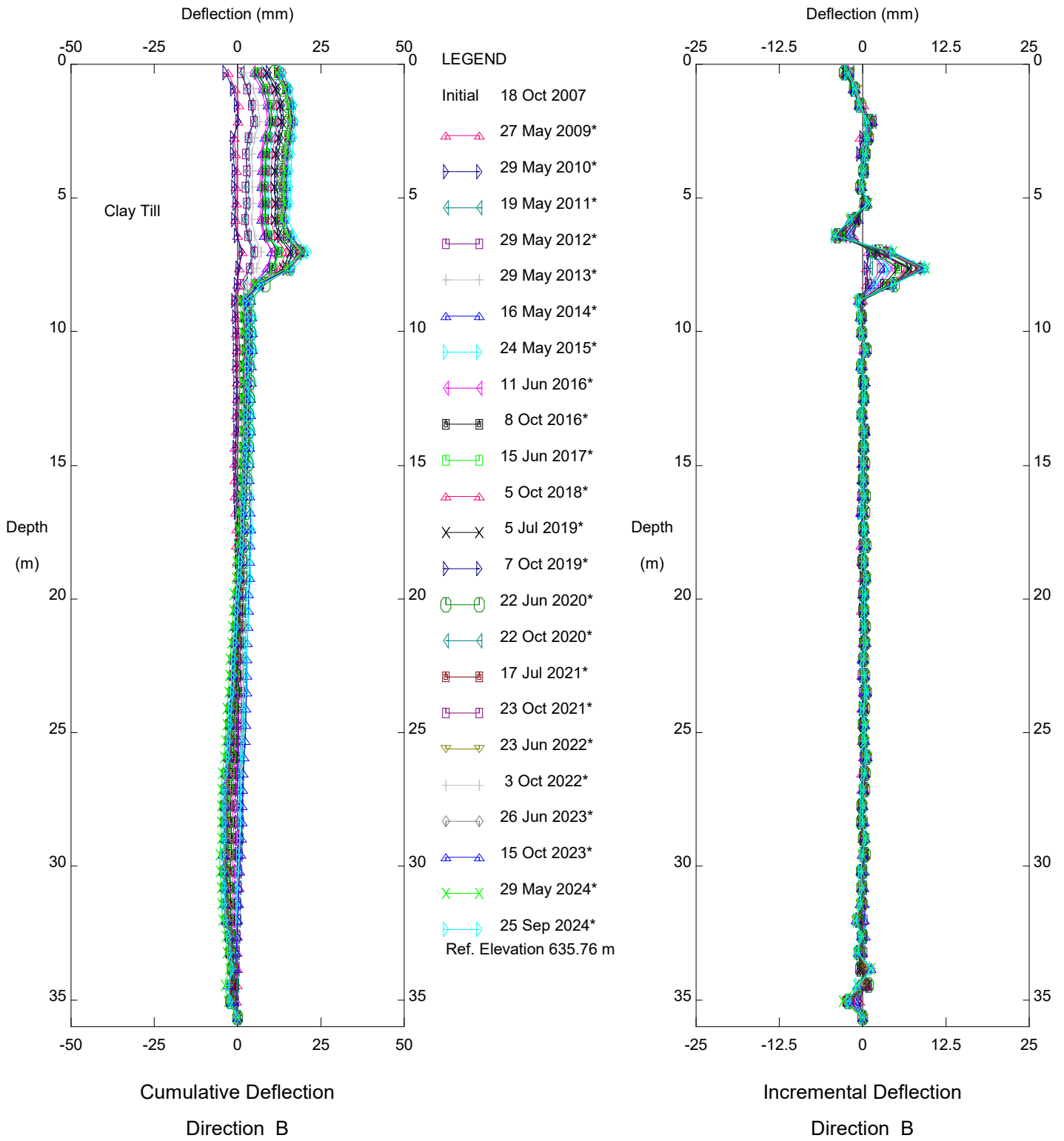


GP029 HWY 2:70 (Church Camp), Inclinometer SI-2

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

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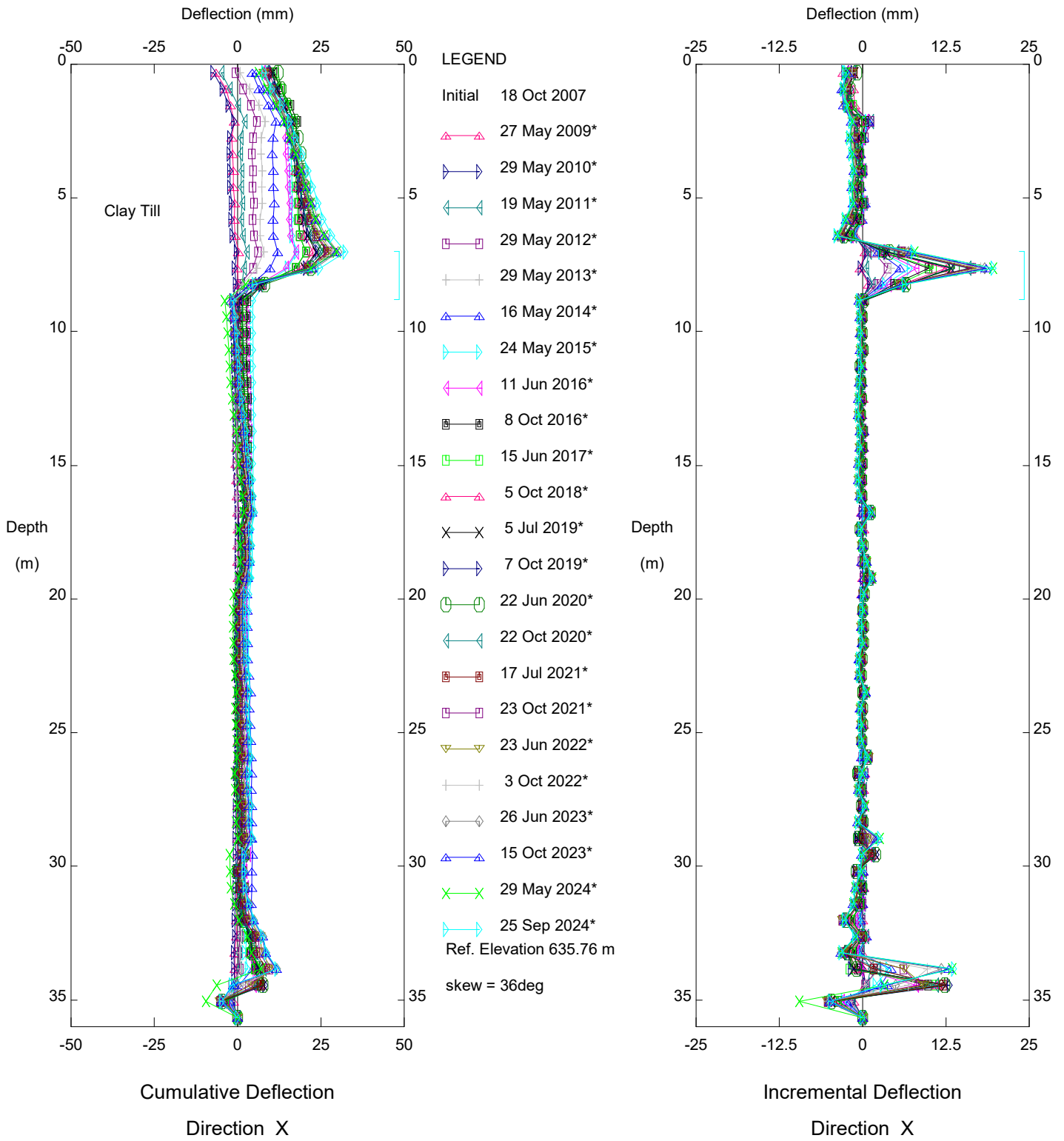


GP029 HWY 2:70 (Church Camp), Inclinometer SI-2

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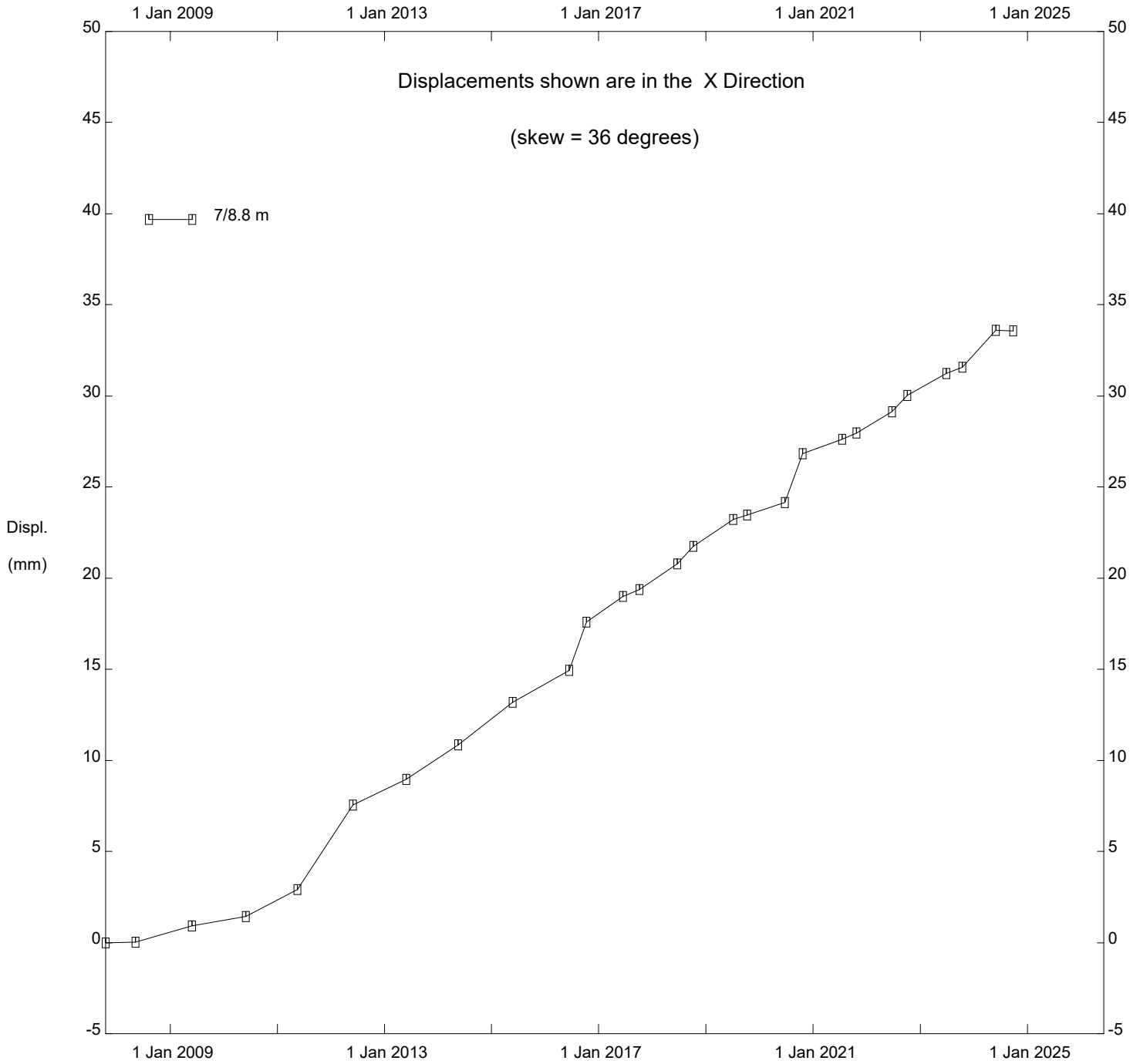


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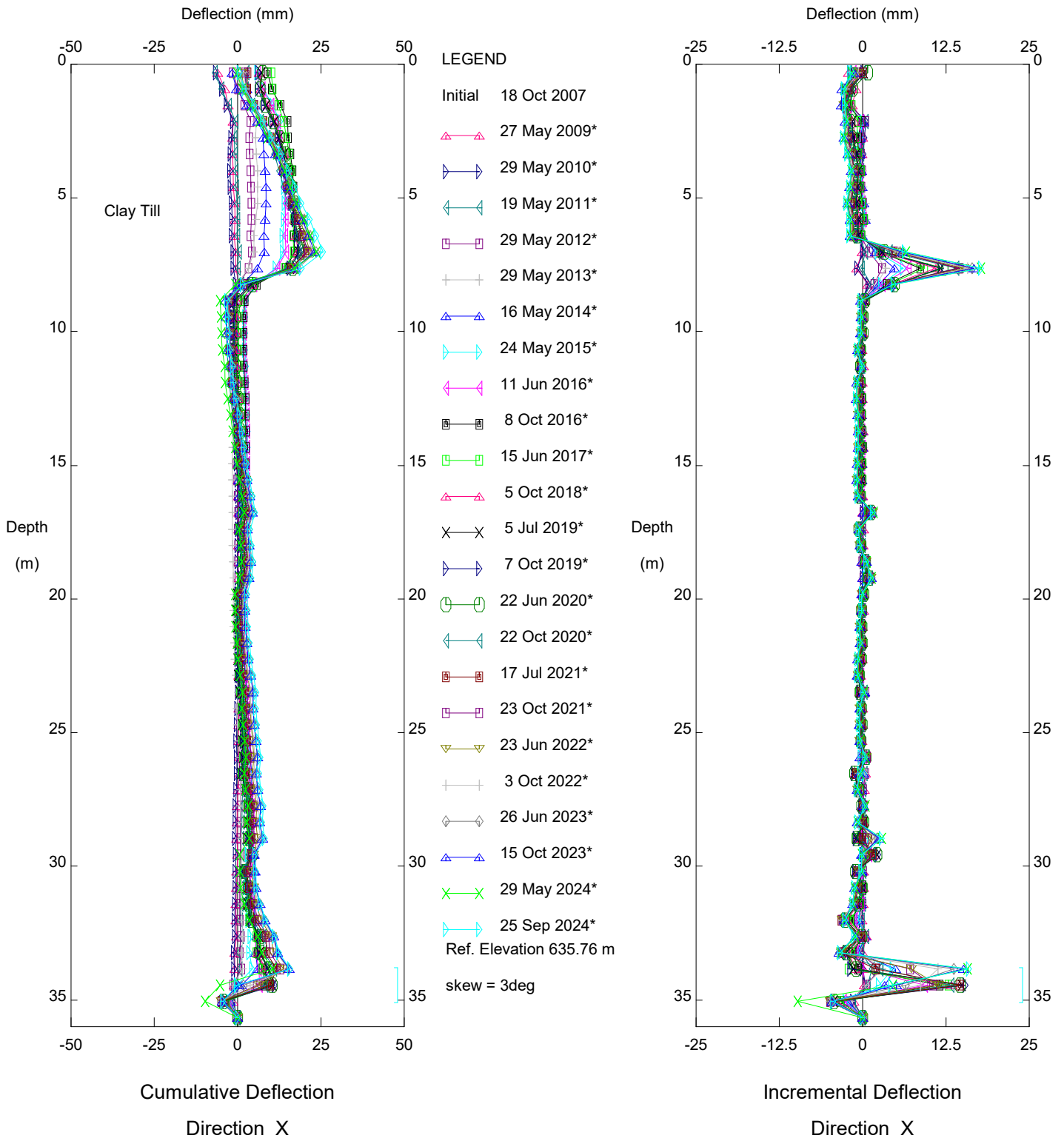
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GP029 HWY 2:70 (Church Camp), Inclinator SI-2

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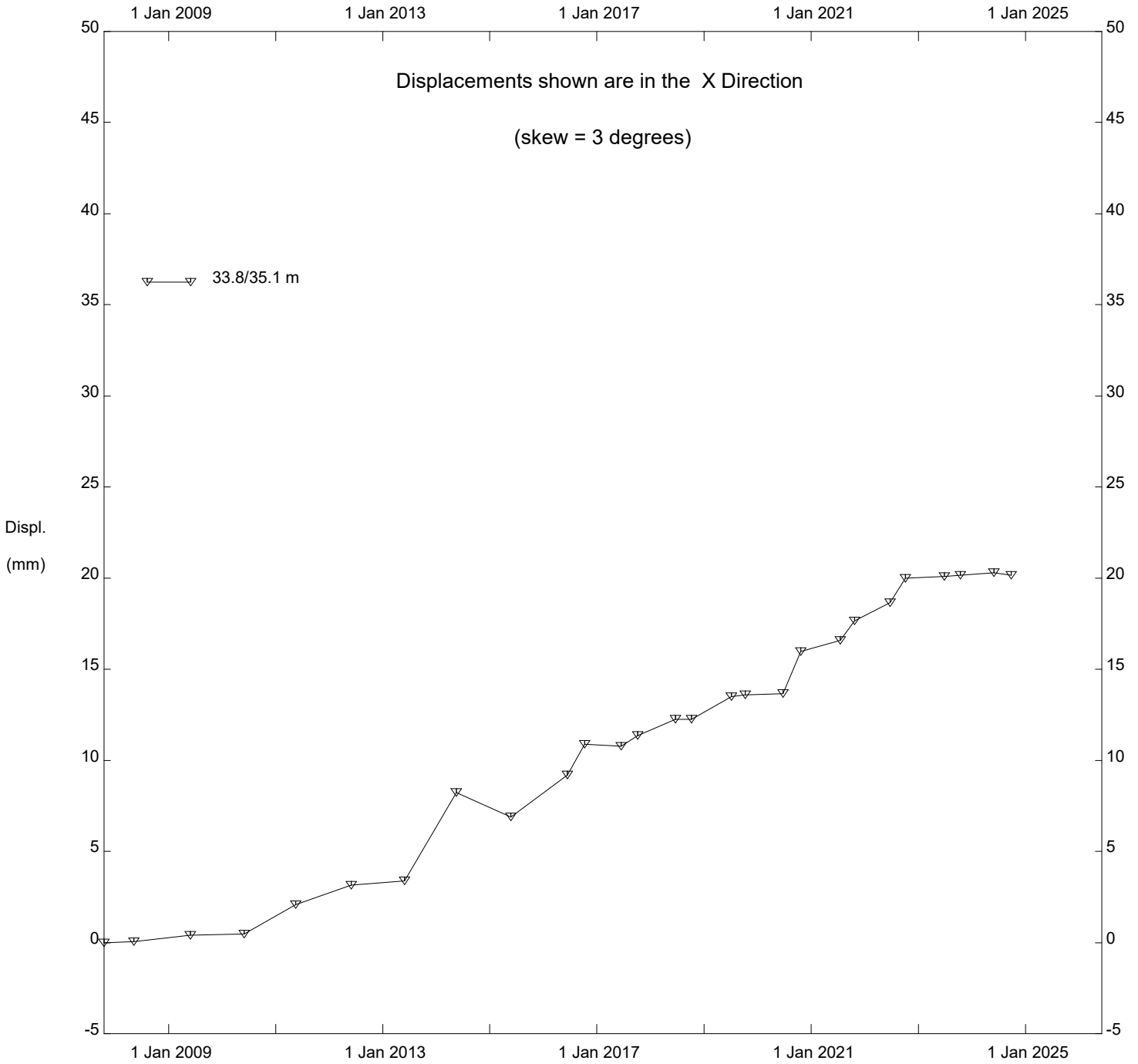


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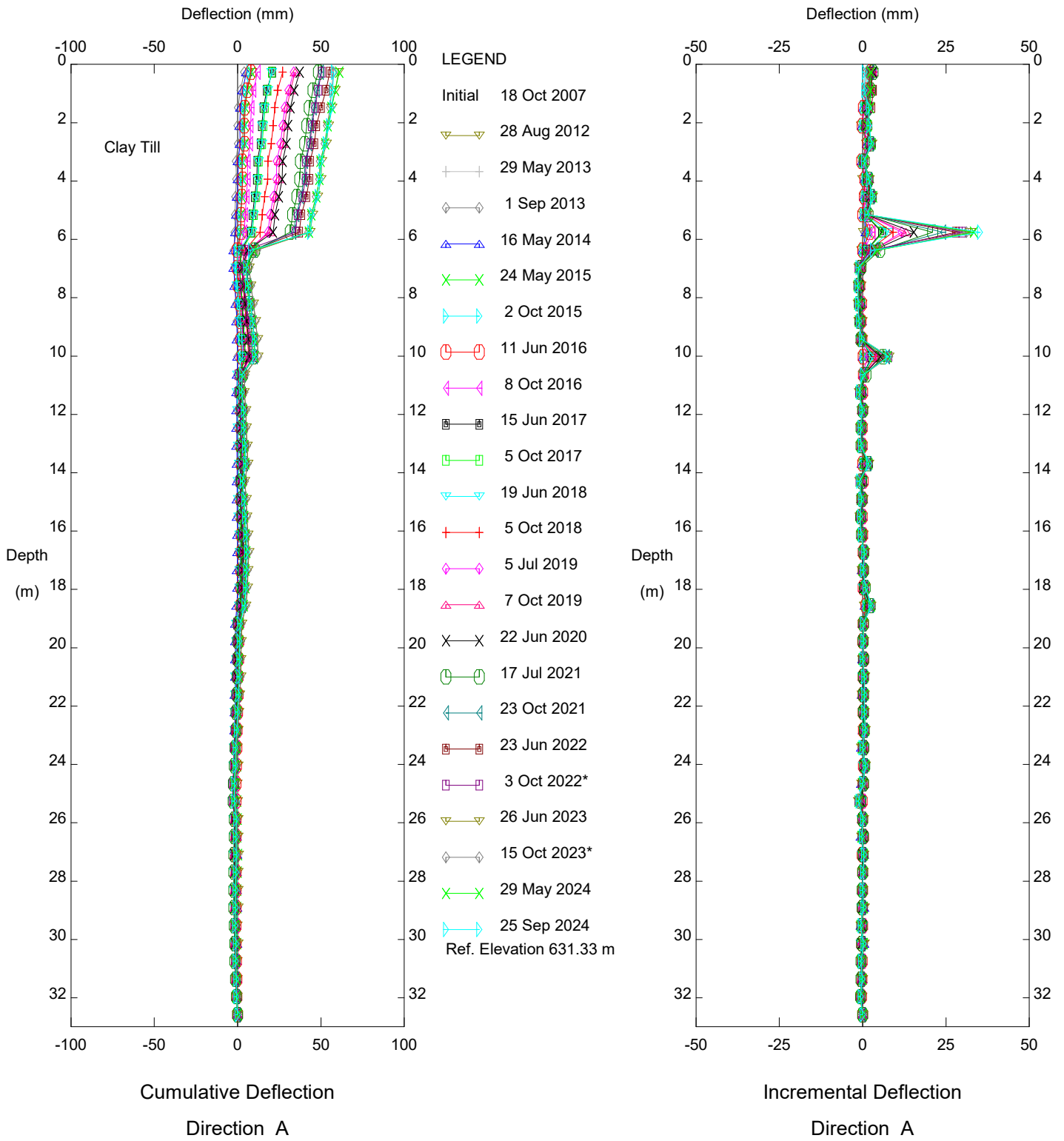
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GP029 HWY 2:70 (Church Camp), Inclinator SI-2

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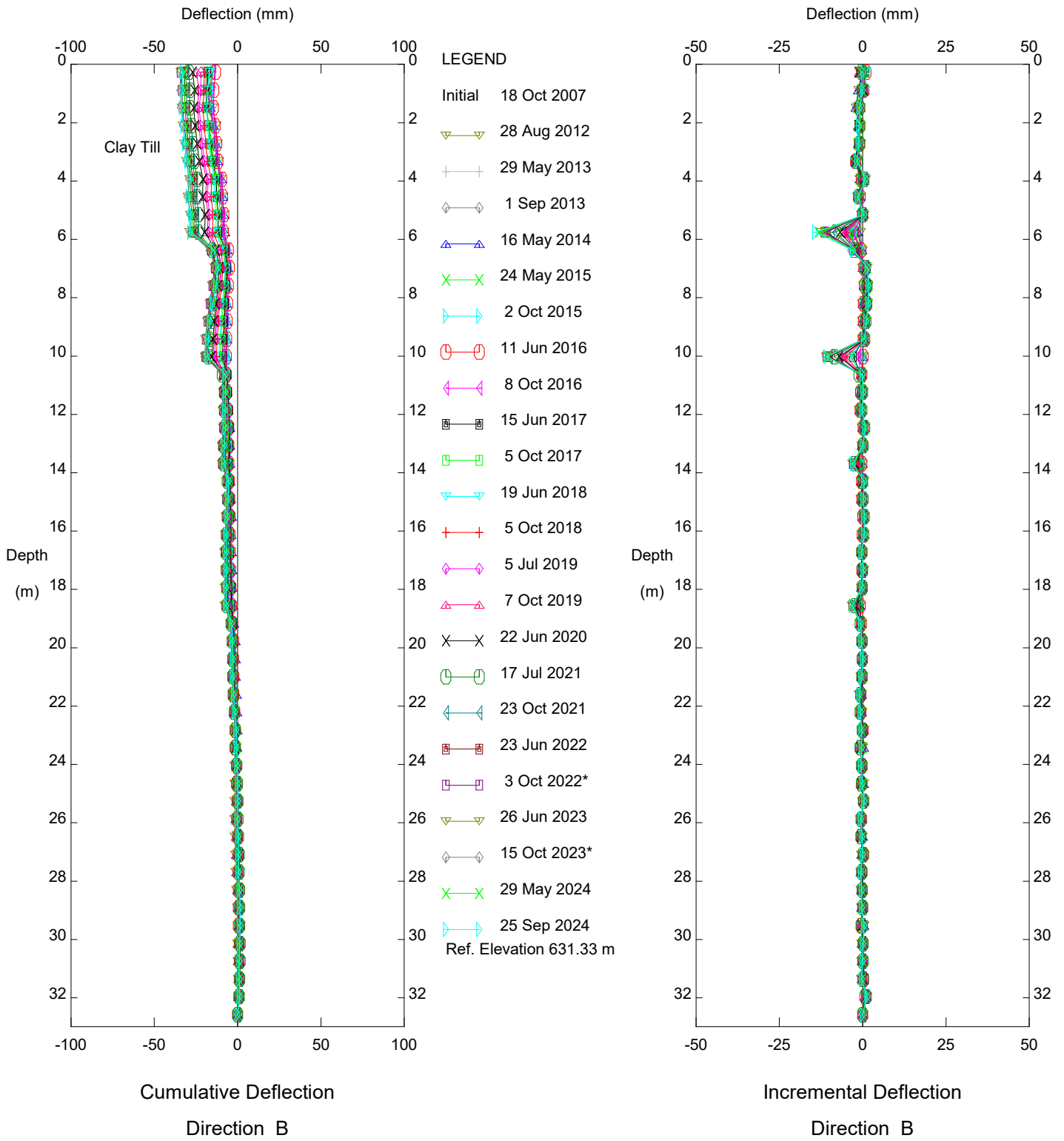


GP029 HWY 2:70 (Church Camp), Inclinometer SI-3

Alberta Transportation

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

Thurber Engineering Ltd.

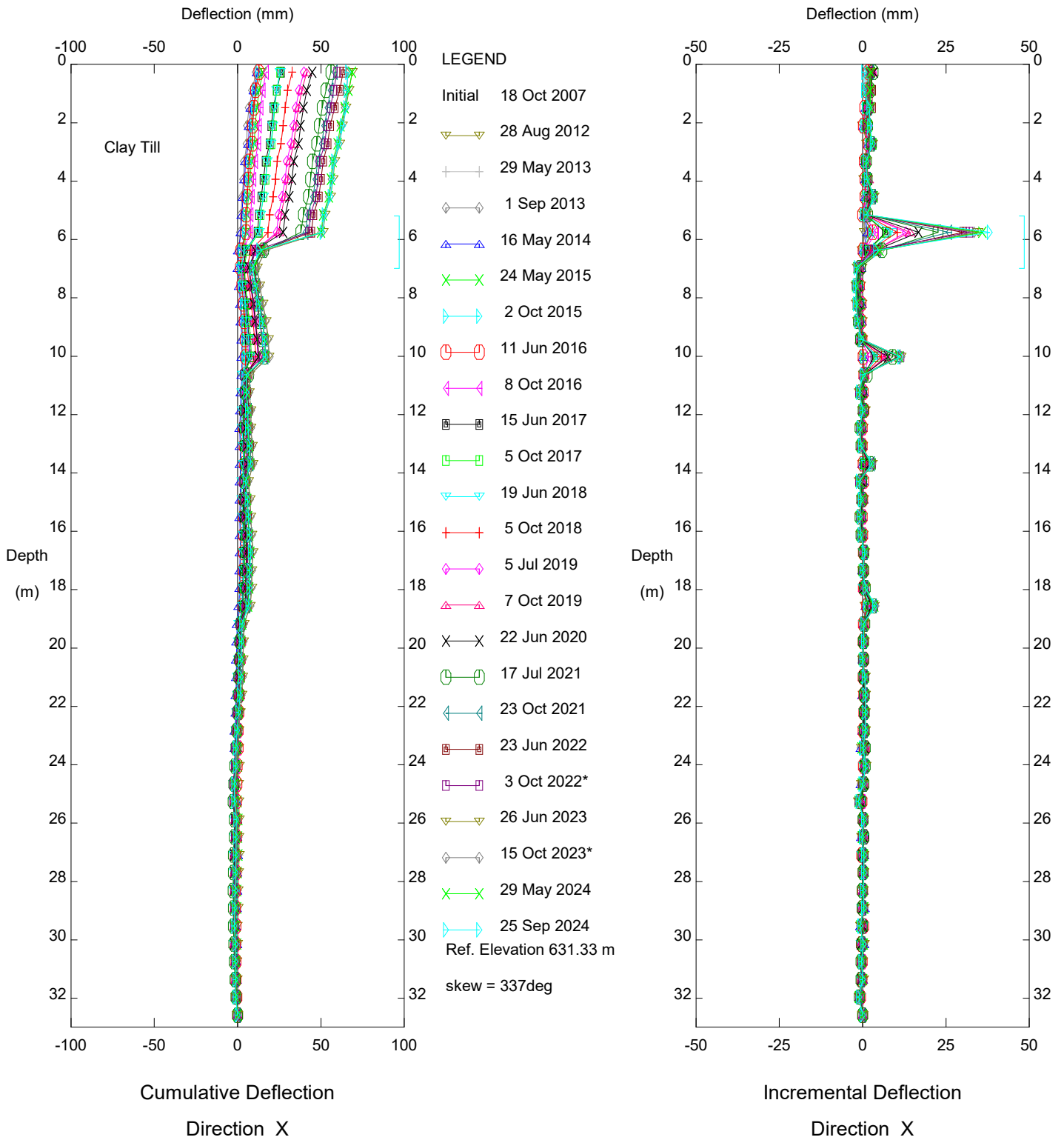


GP029 HWY 2:70 (Church Camp), Inclinometer SI-3

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

Thurber Engineering Ltd.

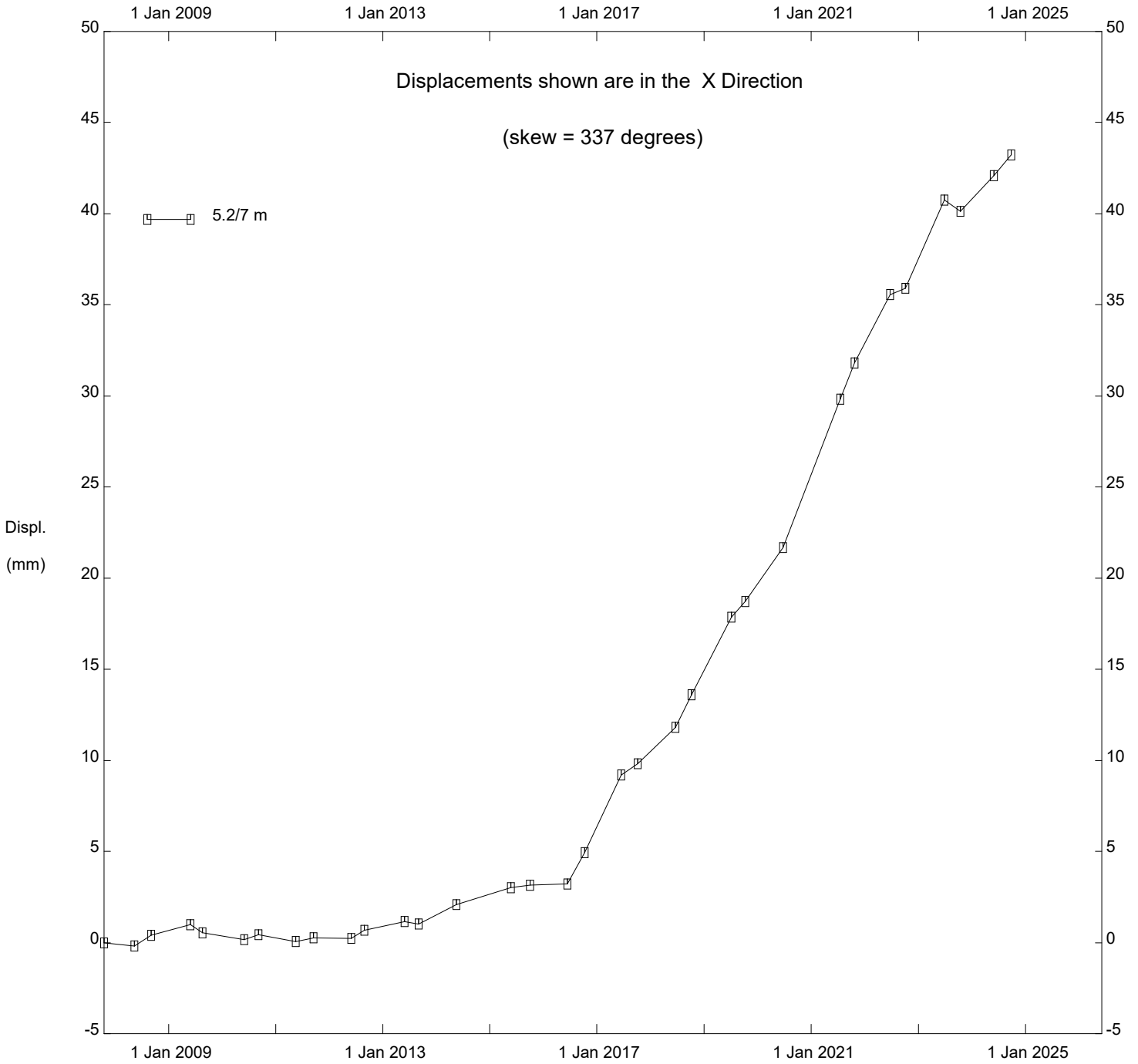


GP029 HWY 2:70 (Church Camp), Inclinometer SI-3

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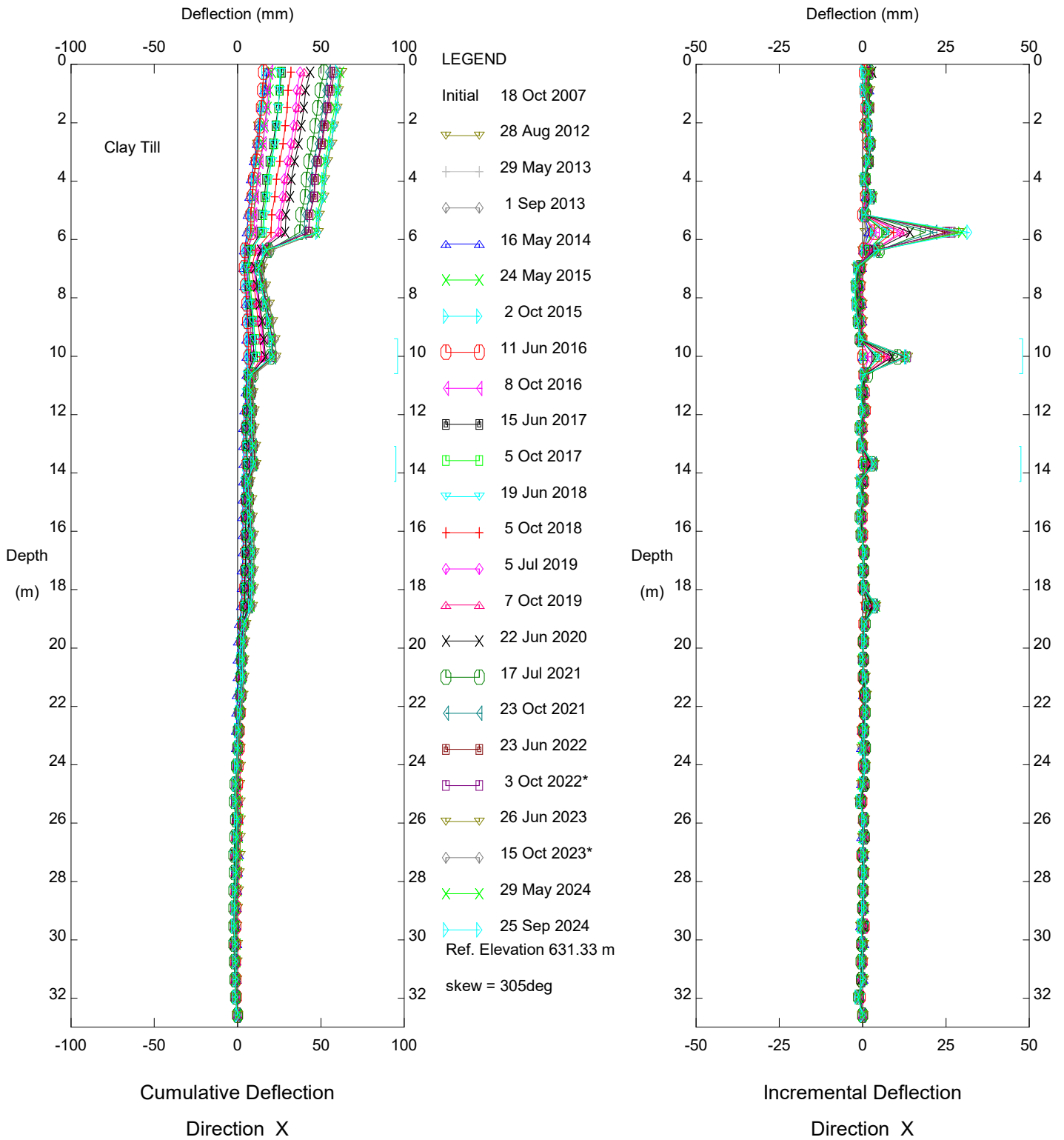
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GP029 HWY 2:70 (Church Camp), Inclinator SI-3

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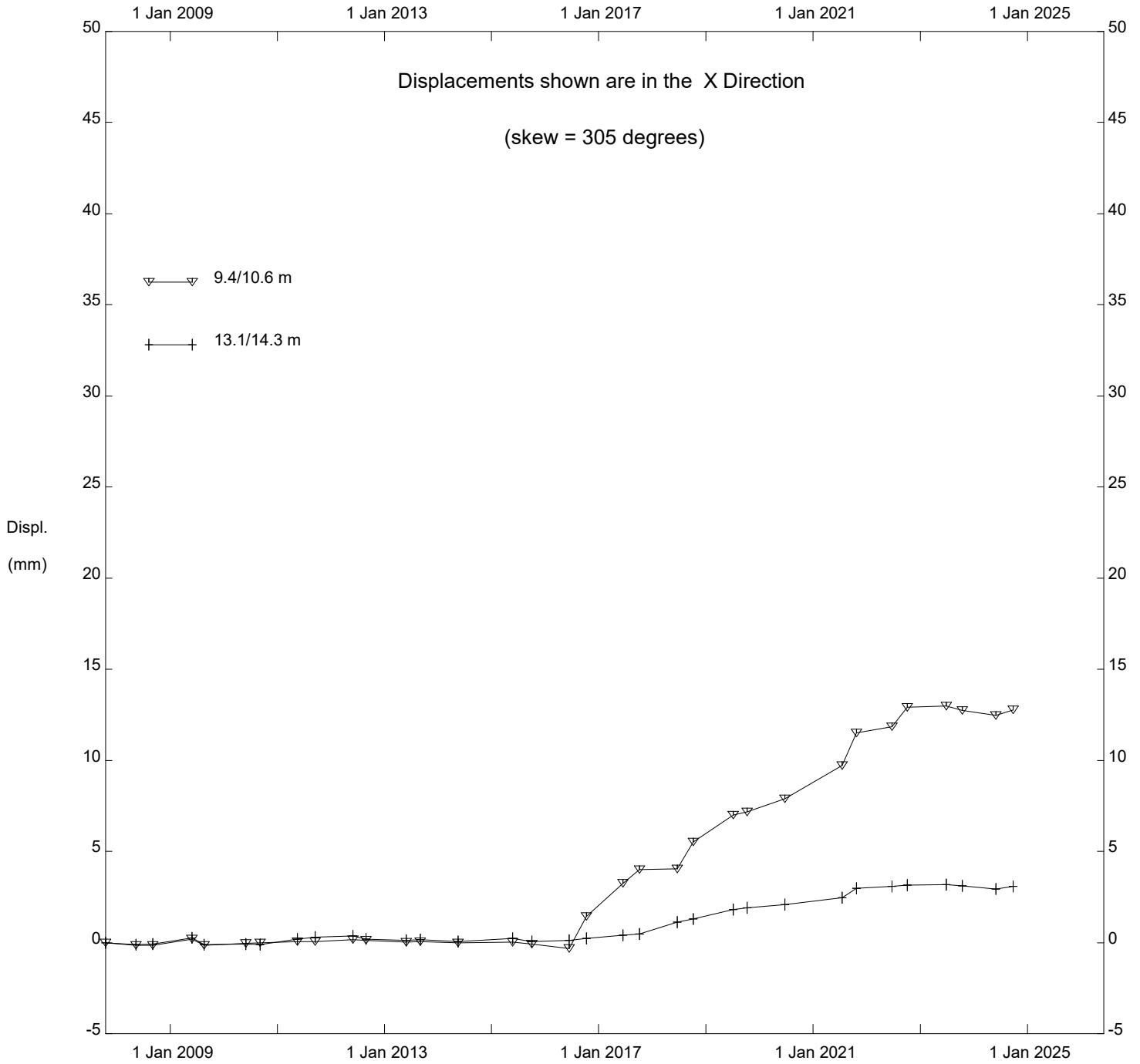


GP029 HWY 2:70 (Church Camp), Inclinometer SI-3

Alberta Transportation

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

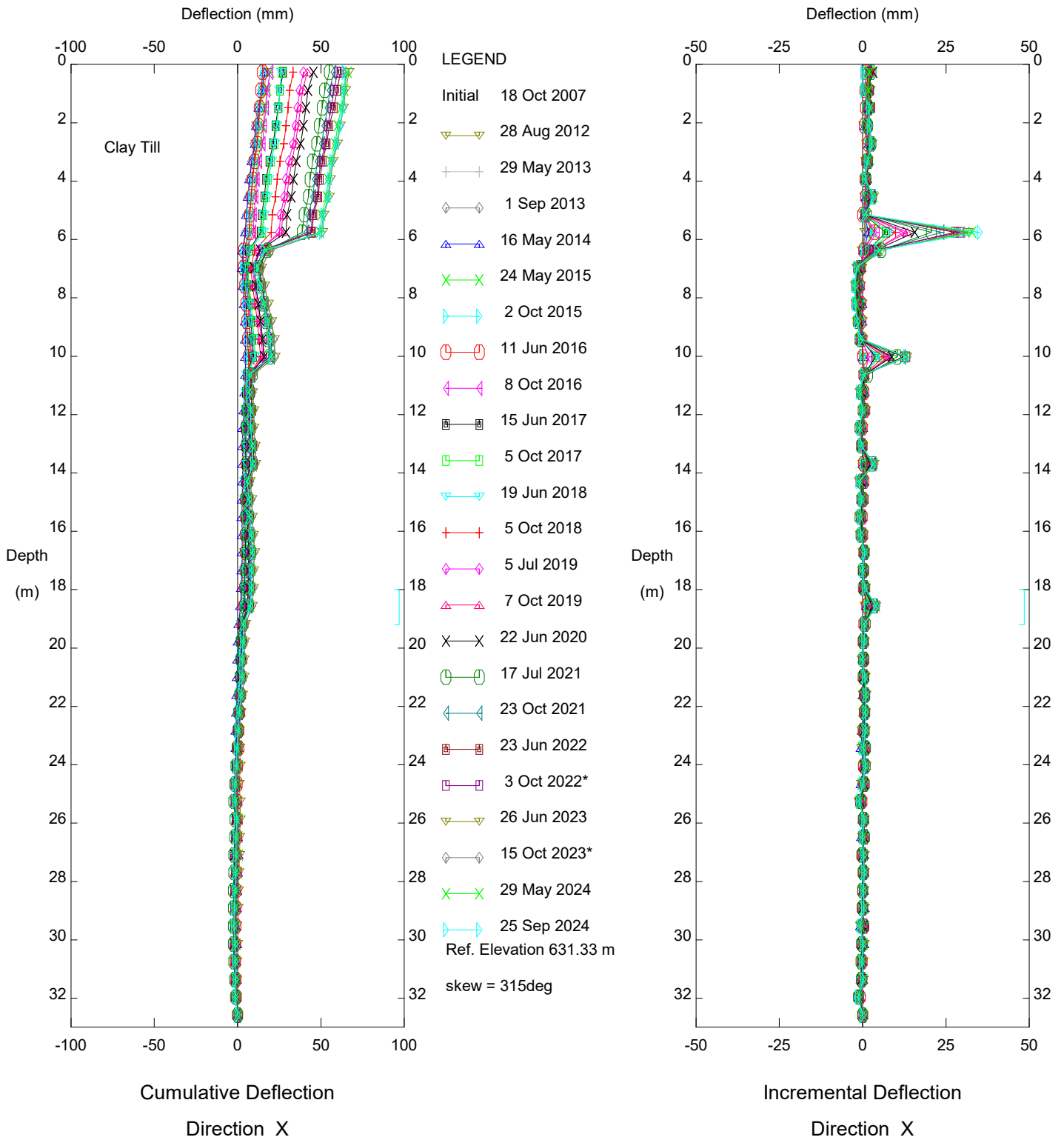
Thurber Engineering Ltd.



GP029 HWY 2:70 (Church Camp), Inclinator SI-3

Alberta Transportation

Thurber Engineering Ltd.

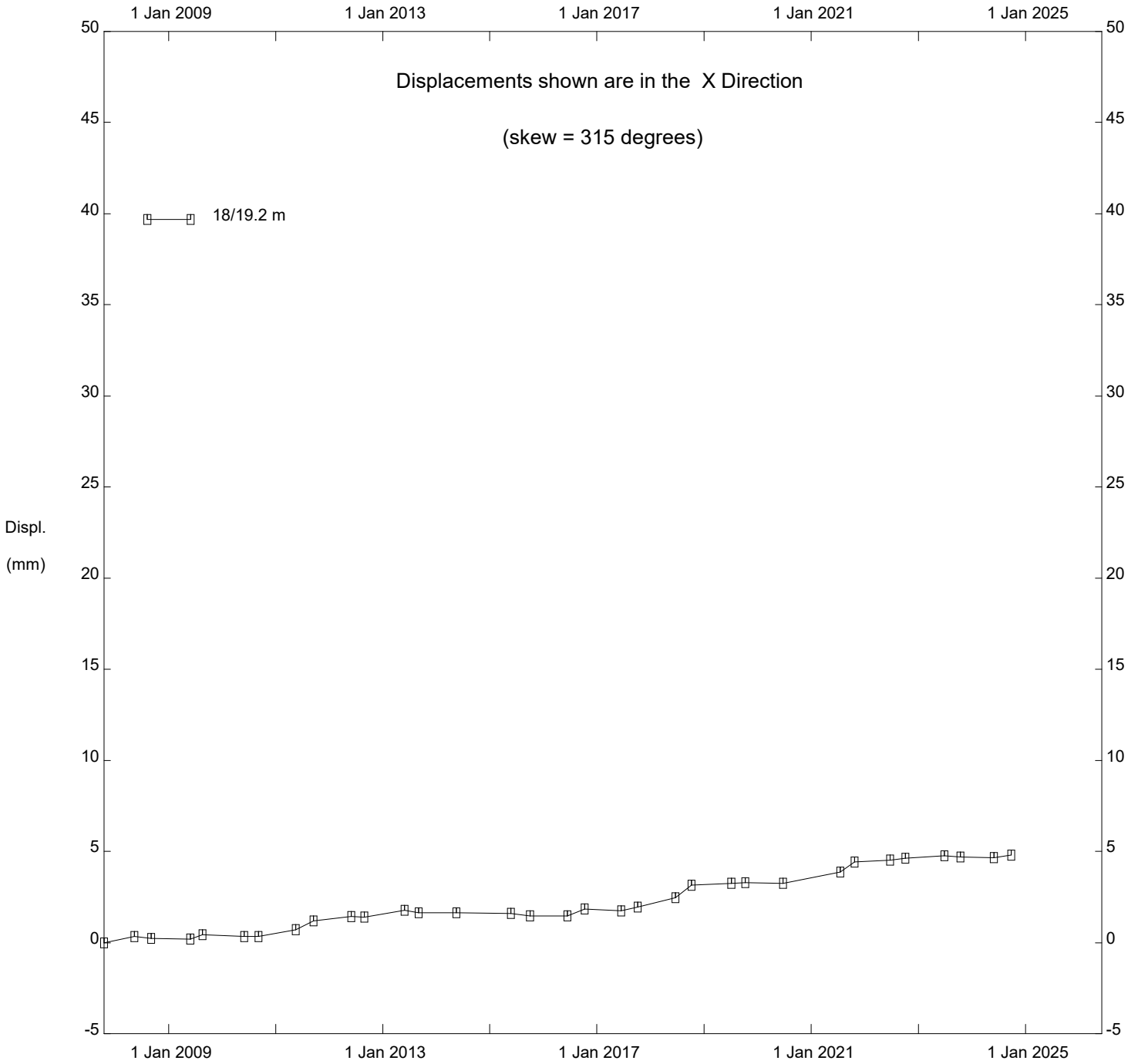


GP029 HWY 2:70 (Church Camp), Incliner SI-3

Alberta Transportation

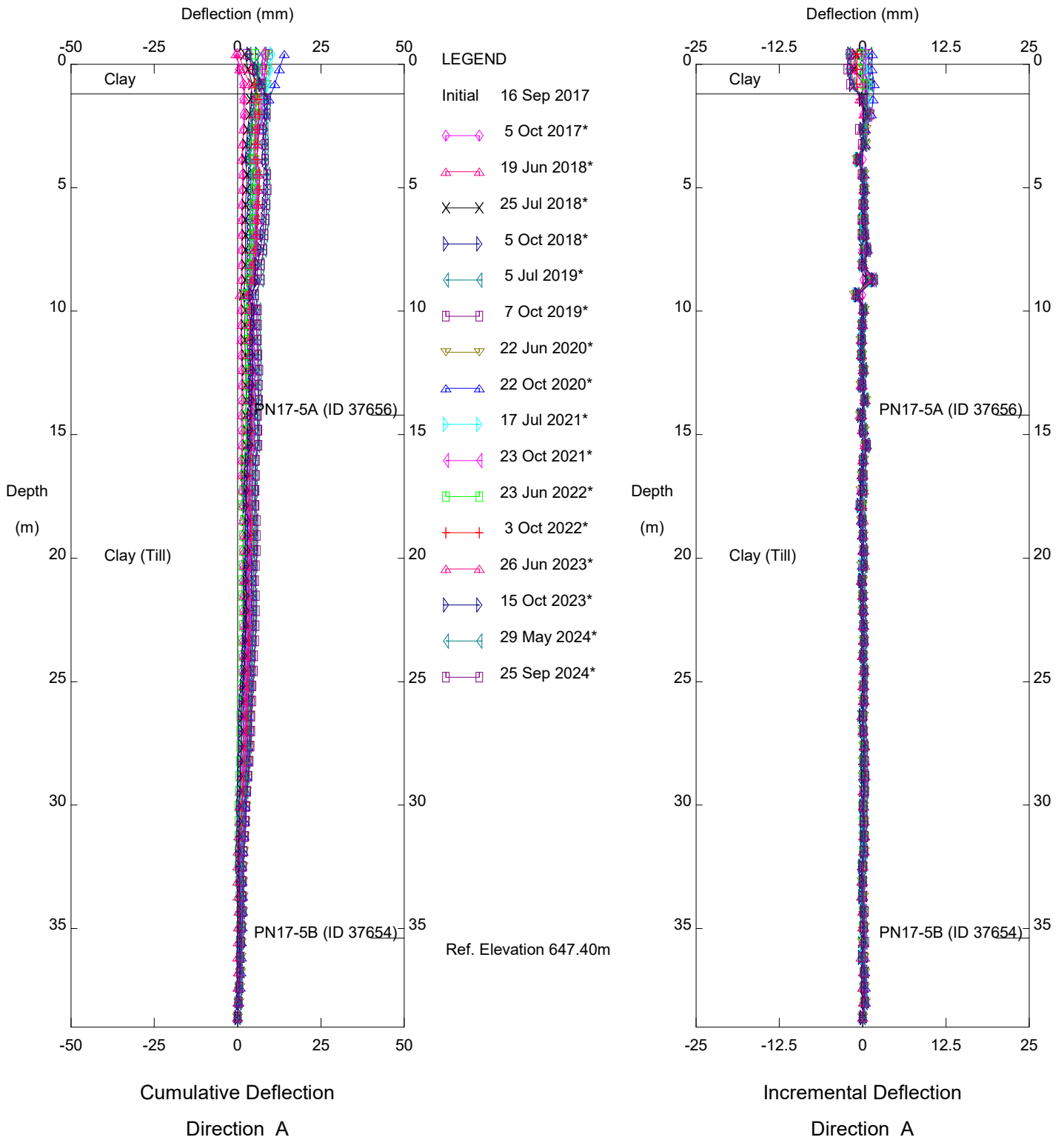
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Thurber Engineering Ltd.



GP029 HWY 2:70 (Church Camp), Inclinator SI-3

Alberta Transportation

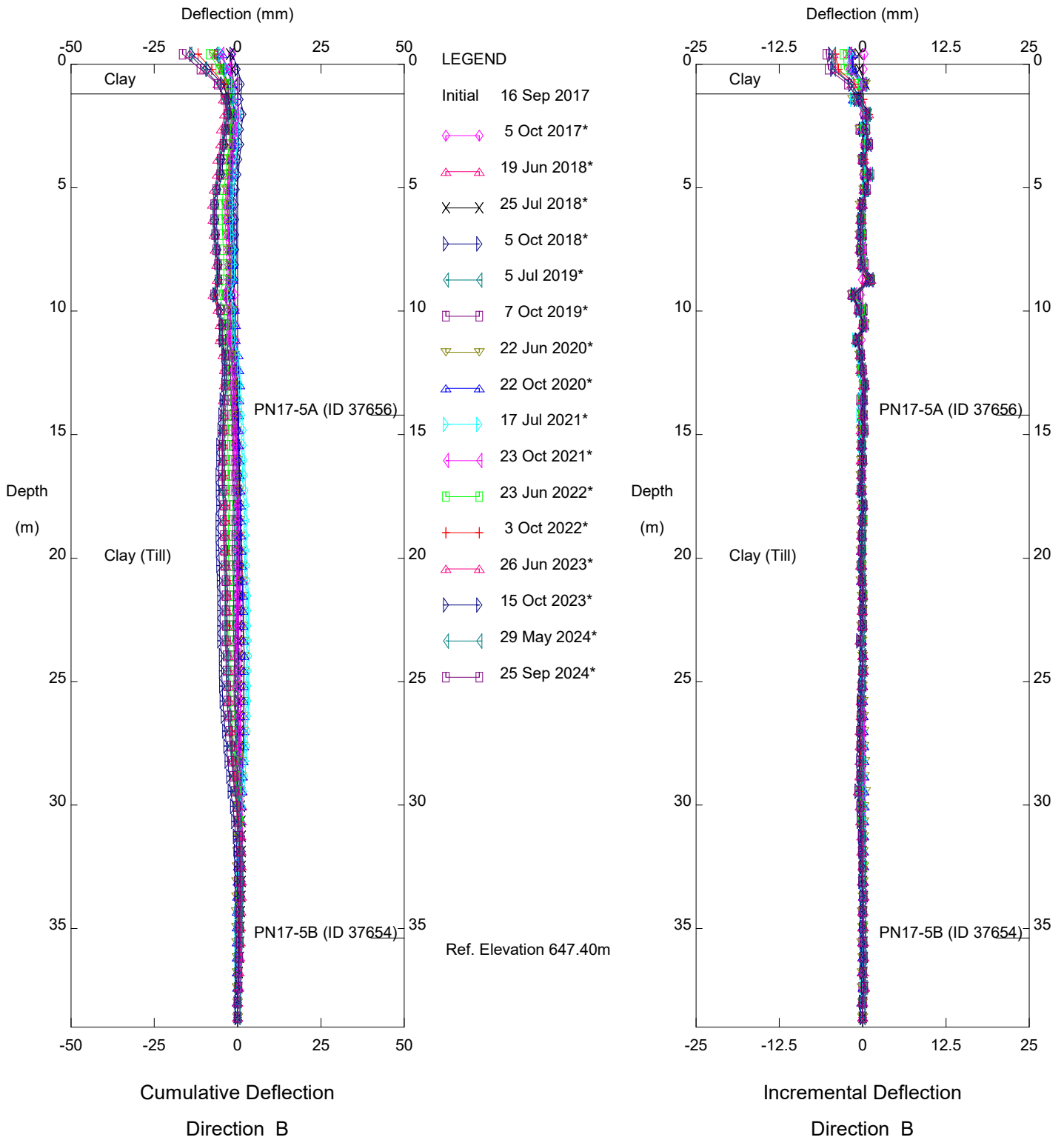


GP029 - Church Camp Slide, Inclinometer SI17-5

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

Thurber Engineering Ltd.

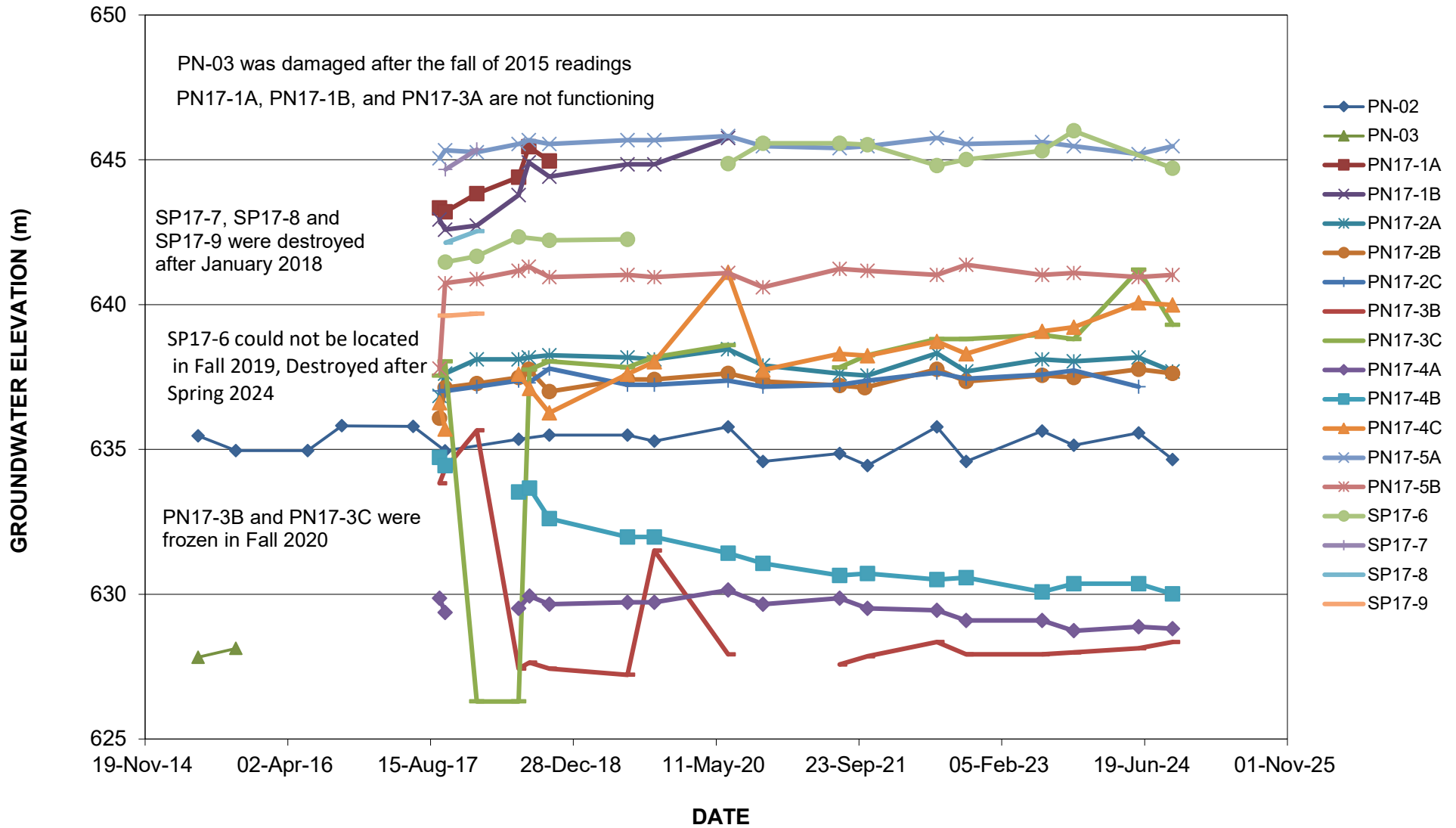


GP029 - Church Camp Slide, Inclinometer SI17-5

Alberta Transportation

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

**FIGURE GP029-1
PIEZOMETRIC ELEVATIONS FOR HWY 2:70 CHURCH CAMP SLIDE**



**FIGURE GP029-2
PIEZOMETRIC DEPTHS FOR HWY 2:70 CHURCH CAMP SLIDE**

