ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS GRMP NORTH CENTRAL (ATHABASCA AND FORT McMURRAY DISTRICTS) INSTRUMENTATION MONITORING- SPRING 2024

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
NC103 (NC024-3)	HWY 41:23 C1 7.89	Kehiwin Lake	41:23	Km 7.8
Legal Description: 9-25-58-7 W4		**UTM Co-ordinates**		
		12U E 506737.94	N 5988417.59	

Current Monitoring:	7-June-2024	**Previous Monitoring**	06-Oct-2023
Instruments Read By:	Mr. Niraj Regmi, G.I.T and Mr. Nixson Mationg, of Thurber		

Instruments Read During This Site Visit			
Slope Inclinometers (SIs): SI10-1, SI10-3, SI11-1 to 4	**Pneumatic Piezometers (PN):** PN10-1 and PN10 3	**Vibration Wire Piezometers (VW):** N/A	**Standpipe Piezometers (SP):** PB10-1, PB10-2, and PB10-4
Load Cell (LC): VC1706 to VC1710, and VC1712 to VC1715	**Strain Gauges:** N/A	**SAAs:** N/A	**Others:**

Readout Equipment Used			
Slope Inclinometers: Two RST Digital Inclinometer probes with 2 ft. wheelbases and RST Pocket PC readouts	**Pneumatic Piezometers:** RST C108 pneumatic piezometer reader	**Vibration Wire Piezometers:**	**Standpipe Piezometers:** DGSI dipmeter
Load Cell: VW2106 RST readout unit	**Strain Gauges:**	**SAAs:**	**Others:**

Notes:

- A site plan showing instrument locations is included in Appendix A.
- SIs plots with A and B directions are presented in Appendix A and summarized in Table NC103-1, attached. Where movement was recorded, the resultant (plot X) and the rate of movement plot are also included.
- Standpipe and pneumatic piezometer plots are included in Appendix A.
- Pneumatic Piezometer readings are summarized in Table NC103-2, attached.
- Standpipe Piezometer readings are summarized in Table NC103-3, attached.
- Vibrating Wire Load Cell readings are summarized in Table NC103-4, attached

Discussion	
Zones of New Movement:	None
Interpretation of Monitoring Results:	SI10-1, installed in the east highway ditch, showed a rate of movement of 2.8 mm/yr over 4.4 to 7.5 m depth since the fall of 2023 readings. SI10-3, installed at the bottom of the slope downslope of the pile wall location, showed no discernible movement since the fall of 2023 readings. SI11-1 showed a rate of movement of 1.0 mm/yr over 0.7 to 14.8 m depth. SI11-2 showed a rate of movement of 0.6 mm/yr over 0.7 m to 14.7 m depth. SI11-3 showed no discernible movement over 0.5 to 14.6 m depth since the fall of 2023 readings. SI11-4 showed a rate of movement of 0.3 mm/yr over 0.8 to 14.9 m depth. The cumulative movements in the SIs installed in the piles were as follows:

	• SI11-1 = 2.7 mm pile head movement over 0.7 to 14.8 m depth • SI11-2 = 0.4 mm pile head movement over 0.7 to 14.7 m depth • SI11-3 = -7.5 mm pile head movement over 0.5 to 14.6 m depth • SI11-4 = -8.3 mm pile head movement over 0.8 m to 14.9 m depth Pneumatic piezometers PN10-1 and PN10-3 showed decreases in groundwater level of 0.43 m and 0.36 m, respectively, since the fall of 2023 readings. Standpipe piezometer PB10-1 and PB10-4 showed decreases in groundwater level of 0.14 m, and 0.01 m, respectively, since the fall of 2023 readings. Standpipe piezometer PB10-2 showed an increase in groundwater level of 0.19 m since the fall of 2023 readings. Load cells VC1706, VC1707, VC1708, VC1709, VC1712, VC1713, and VC1715 showed increases in the measured load of 2.26 kN, 3.72 kN, 2.48 kN, 1.45 kN, 1.39 kN, 1.63 kN, and 13.26 kN, respectively since the fall of 2023 readings. VC1714 showed a decrease of in the measured load of 90.35 since the fall of 2023 readings, however, this significant decrease could be attributed to the inconsistency of the number of operating wires between the fall of 2023 and the spring of 2024. The current measured load in VC1715 is the highest ever recorded in this load cells. Load cell VC1715 has shown a trend of gradually increasing loads for several reading cycles, indicating the load cell may be malfunctioning. The current load in VC1707 and VC1715 are the highest recorded in the instruments since they were installed. The load in VC1715 is about 41.7 percent higher than the lock off load. The remaining load cells have shown decreases in measured loads, when compared to the lock off load, ranging from 10.3 percent to 49.6 percent. However, the load cells with the largest variations in load values have lost one or more vibrating wire channels over several reading cycles. In addition, the reductions in the loads have not been consistent with the observed movement patterns of the walls, based on the slope inclinometer readings. If significant reductions in anchor loads occur in the future in response to the wall deflection towards west, the anchors will need to be restressed to maintain the wall's lateral deflection within the design limit.
Future Work:	The instruments should be read again in the fall of 2024.
Instrumentation Repairs:	No instrument repairs are required at this time.
Additional Comments:	

Attachments:	• Table NC103-1 Spring 2024 – HWY 41:23 Kehiwin Lake (7.8), Slope Inclinometer Instrumentation Reading Summary
	• Table NC103-2 Spring 2024 – HWY 41:23 Kehiwin Lake (7.8), Pneumatic Piezometer Instrumentation Reading Summary
	• Table NC103-3 Spring 2024 – HWY 41:23 Kehiwin Lake (7.8), Standpipe Piezometer Instrumentation Reading Summary
	• Table NC103-4 Spring 2024 – HWY 41:23 Kehiwin Lake (7.8), Vibrating Wire Load Cells Instrumentation Reading Summary
	• Statement of Limitations and Conditions
	• APPENDIX A – NC103-1 SPRING 2024
	  ○ Field Inspector's report
	  ○ Site Plan Showing Approximate Instrument Locations (Drawing No. 32122-NC103)
	  ○ SI Reading Plots
	  ○ Figure NC103-1 (Piezometric Depths)
	  ○ Figure NC103-2 (Load Cell Readings)

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.
Tarek Abdelaziz, Ph.D., P. Eng.
Partner | Senior Geotechnical Engineer

PROFESSIONAL ENGINEER ALBERTA
LUCAS R.M. GREEN
ID 206714

2024-07-15
Lucas Green, P.Eng.
Geotechnical Engineer

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE: _____
RM APEGA ID #: 91085
DATE: July 15, 2024
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

THURBER ENGINEERING LTD.

Table NC103-1: Spring 2024 – Hwy 41:23 Kehiwin Lake (Km 7.8) Slope Inclinometer Instrumentation Reading Summary

Date Monitored: June 7, 2024

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AND DEPTH OF MOVEMENT TO DATE (mm)	MAXIMUM RATE OF MOVEMENT (mm/yr)	CURRENT STATUS OF SI	DATE OF PREVIOUS READING	INCREMENTAL MOVEMENT SINCE PREVIOUS READING (mm)	CURRENT RATE OF MOVEMENT (mm/yr)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
SI10-1	Oct. 12, 2010	8.7 over 4.4 m to 7.5 m depth in 308° direction	7.6 on Oct. 23, 2010	Operational	October 6, 2023	1.9	2.8	2.0
SI10-3	Oct. 12, 2010	24.2 over 9.9 m to 12.3 m depth in 291° direction	26.5 on Oct. 23, 2010	Operational	October 6, 2023	No discernible movement	N/A	-1.4
SI11-1 (Pile 9)	May 12, 2011	2.7 over 0.7 m to 14.8 m depth in 308° direction	87.6 on June 21, 2011	Operational	October 6, 2023	0.7	1.0	0.2
SI11-2 (Pile 27)	May 12, 2011	0.4 over 0.7 m to 14.7 m depth in 306° direction	146.6 on May 25, 2011	Operational	October 6, 2023	0.4	0.6	1.6
SI11-3 (Pile 45)	May 25, 2011	-7.5 over 0.5 m to 14.6 m depth in 308° direction	14.2 on June 21, 2011	Operational	October 6, 2023	No discernible movement	N/A	-2.2
SI11-4 (Pile 60)	May 25, 2011	-8.3 over 0.8 m to 14.9 m depth in 349° direction	48.5 on June 21, 2011	Operational	October 6, 2023	0.3	0.3	0.8

Drawing 32122-NC103 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

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Table NC103-2: Spring 2024 – Hwy 41:23 Kehiwin Lake (Km 7.8) Pneumatic Piezometer Instrumentation Reading Summary

Date Monitored: June 7, 2024

INSTRUMENT #	DATE INITIALIZED	TIP DEPTH (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED GROUNDWATER LEVEL BGS (m)	MEASURED PORE PRESSURE (kPa)	CURRENT GROUNDWATER LEVEL BGS (m)	PREVIOUS GROUNDWATER LEVEL BGS (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
PN10-1	October 5, 2010	6.55	-	Active	0.26 on May 15, 2014	46.0	1.86	1.43	-0.43
PN10-3	October 1, 2010	12.27	-	Active	0.75 on September 8, 2014	103.9	1.69	1.33	-0.36

Drawing 32122-NC103 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

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Table NC103-3: Spring 2024 – Hwy 41:23 Kehiwin Lake (Km 7.8) Standpipe Piezometer Instrumentation Reading Summary

Date Monitored: June 7, 2024

INSTRUMENT #	DATE INITIALIZED	TIP DEPTH (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED GROUNDWATER LEVEL BGS (m)	CURRENT GROUNDWATER DEPTH BGS (m)	PREVIOUS GROUNDWATER DEPTH BGS (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
PB10-1	Oct. 6, 2010	15.0	-	Operational	3.59 on June 23, 2021	4.54	4.40	-0.14
PB10-2	Oct. 6, 2010	15.0	-	Operational	2.45 on May 12, 2011	3.13	3.32	0.19
PB10-3	*Oct. 6, 2010*	*18.6*	-	*Blocked at 0.65 m BGS*	*0.54 on May 12, 2011*	*N/A*	N/A	-
PB10-4	Oct. 6, 2010	18.6	-	Operational	1.03 on May 15, 2014	3.78	3.77	-0.01

Drawing 32122-NC103 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

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Table NC103-4: Spring 2024 – Hwy 41:23 Kehiwin Lake (Km 7.8) Vibrating Wire Load Cells Instrumentation Reading Summary

Date Monitored: June 7, 2024

SERIAL #	ANCHOR NUMBER	DESIGN LOCK OFF LOAD (kN)	DATE INSTALLED	MEASURED LOAD (kN)	PREVIOUS READING (kN)	CHANGE IN LOAD SINCE PREVIOUS READING (kN)
VC1706	G60L	290	July 27, 2011	210.37*	208.11*	2.26
VC1707	G35L	290	July 23, 2011	259.99**	256.27**	3.72
VC1708	G8U	240	July 23, 2011	215.68***	213.20***	2.48
VC1709	G45L	290	July 25, 2011	189.65**	188.20**	1.45
VC1710	*G8L*	*240*	*July 23, 2011*	*No Reading*	*No Reading*	*N/A*
VC1711	*G45U*	*290*	*July 25, 2011*	*No Reading*	*No Reading*	*N/A*
VC1712	G60U	290	July 27, 2011	250.35*	248.96*	1.39
VC1713	G27U	290	July 23, 2011	177.15*	175.52*	1.63
VC1714	G17U	290	July 23, 2011	146.14**	236.49*	-90.35
VC1715	G27L	290	July 23, 2011	410.94**	397.68**	13.26

Drawing 32122-NC103 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

Note: * This reading is an average of two readings as only two of the vibrating wires are operational.
** This reading is based on one vibrating wire channel as only one of the vibrating wires is operational.
*** This reading is based on the average of three vibrating wires as three of the vibrating wires are operational.

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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.

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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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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.

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THURBER ENGINEERING LTD.

ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS GRMP (CON0022163)
NORTH CENTRAL (ATHABASCA AND FORT McMURRAY DISTRICTS)
INSTRUMENTATION MONITORING RESULTS

SPRING 2024

APPENDIX A
DATA PRESENTATION AND SITE PLANS

SITE NC103

ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
NORTH CENTRAL REGION - ATHABASCA AND FORT McMURRAY DISTRICTS
INSTRUMENTATION MONITORING FIELD SUMMARY (NC103)
SPRING 2024

Location: Kehiwin Lake (HWY41:23 C1 7.894)	**Readout:** RST PN C108 Unit 4/ DGSI Dipmeter
File Number: 32122	**Casing Diameter:** 2.75"
Probe: RST Set 5R & 8R	**Temp (deg C):** 15
Cable: RST Set 5R & 8R	**Read by:** NKR/NRM

SLOPE INCLINOMETER (SI) READINGS

SI#	GPS Location (UTM 12)		Date	Stickup m	Depth from top of **CASING** (ft)	Azimuth of A+ Groove	Current Bottom Depth Readings				Probe/ Reel #	Remarks
	Easting (m)	Northing (m)					A+	A-	B+	B-		
SI10-1	506737.94	5988417.59	7-Jun-24	0.77	62 to 2	295	217	-214	1131	-1135	8R/8R	
SI10-3	506684.84	5988455.34	7-Jun-24	0.77	64 to 4	283	68	-58	535	-540	8R/8R	
SI11-1	506689.52	5988389.70	7-Jun-24	0.79	50 to 4	310	-476	487	-237	226	5R/5R	
SI11-2	506711.75	5988413.10	7-Jun-24	0.84	50 to 4	283	146	-140	291	-290	5R/5R	Pile Wall
SI11-3	506718.26	5988440.93	7-Jun-24	0.99	50 to 4	295	-208	220	184	-184	5R/5R	Pile Wall
SI11-4	506745.73	5988463.22	7-Jun-24	0.69	50 to 4	336	-227	231	-131	134	5R/5R	Pile Wall

PNEUMATIC PIEZOMETER (PN) READINGS

PN #	GPS Location		Date	Reading (kPa)	Identification Number
	Easting (m)	Northing (m)			
PN10-1	Attached to SI10-1		7-Jun-24	46	33672
PN10-3	Attached to SI10-3		7-Jun-24	103.9	33668

STANDPIPE PIEZOMETER (SP) READINGS

PB#	GPS Location (UTM 12)		Date	Stick-up (m)	Water level below top of pipe (m)	Total length of pipe (m)	Poor Boy Probe Depth below top of pipe to bottom of probe (m)			
	Easting (m)	Northing (m)					4'	3'	2'	1'
PB10-1	506746.42	5988436.52	7-Jun-24	0.76	5.3	15.83	-	-	-	-
PB10-2	506723.56	5988401.99	7-Jun-24	0.76	3.89	15.76	-	-	-	-
PB10-4	506690.18	5988388.59	7-Jun-24	0.71	4.49	19.30	-	-	-	-

INSPECTOR REPORT

Only water levels recorded in Poor boys.

ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
NORTH CENTRAL REGION - ATHABASCA AND FORT McMURRAY DISTRICTS
VIBRATING WIRE LOAD CELL FIELD SUMMARY (NC103)
SPRING 2024

Location: Kehiwin Lake (HWY41:23 C1 7.894)	**Readout:** RST PN C108 Unit 4
File Number: 32122	**Read by:** NKR

3 WIRES VIBRATING WIRE LOAD CELL (VC) READINGS

VC#	GPS Location (UTM 12)		Date	Reading (B Units)	Comments
	Easting (m)	Northing (m)			Temperature degree C
VC1706	506744.42	5988463.22	7-Jun-24	6633.4/6169.4**	6.2
VC1707	506720.90	5988428.69	7-Jun-24	6213.9*	6.1
VC1708	506690.18	5988388.59	7-Jun-24	6450/6849.3/6098.9	8
VC1709	506728.08	5988440.94	7-Jun-24	6460*	7.2
VC1712	506744.42	5988463.22	7-Jun-24	6473.6/5929.1**	9.5
VC1713	506711.09	5988415.32	7-Jun-24	6789.4/6334.5**	8.3
VC1714	506700.64	5988401.96	7-Jun-24	6689.2*	8.5
VC1715	506711.09	5988415.32	7-Jun-24	5645.0/1191.7	5.6

INSPECTOR REPORT

* Only 1 VW is working
** Only 2 VWs are working
Note: 3 SENSORS ON VW MONITOR SETTING
VW1714. only 1 sensor working.

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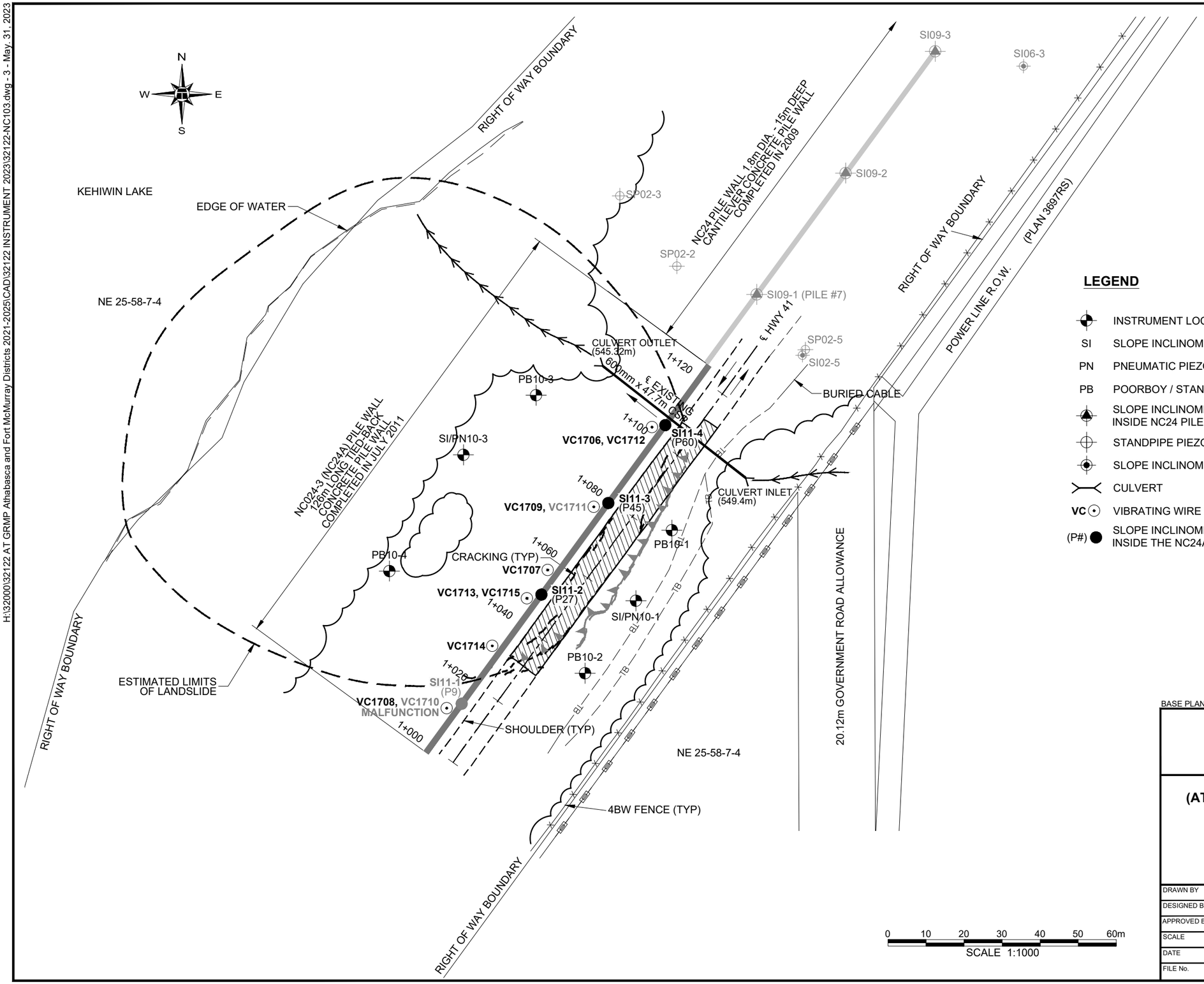

ANCHOR	VIBRATING WIRE LOAD CELL
G8U	VC1708
G8L	VC1710
G17U	VC1714
G27U	VC1713
G27L	VC1715
GL35	VC1707
G45U	VC1711
G45L	VC1709
G60U	VC1712
G60L	VC1706

LEGEND

- INSTRUMENT LOCATION
- SI — SLOPE INCLINOMETER
- PN — PNEUMATIC PIEZOMETER
- PB — POORBOY / STANDPIPE
- SLOPE INCLINOMETER INSTALLED INSIDE NC24 PILE WALL
- STANDPIPE PIEZOMETER (EXISTING)
- SLOPE INCLINOMETER (EXISTING)
- CULVERT
- VC — VIBRATING WIRE LOAD CELL
- (P#) — SLOPE INCLINOMETER INSTALLED INSIDE THE NC24A PILE WALL (PILE #)
- ACP PATCH
- FENCE LINE
- TB — TELUS LINE
- BUSH LINE
- CRACK
- POWER POLE
- GULLY
- LANDSLIDE REFLECTIVE CRACK

BASE PLAN PROVIDED BY WSP

Alberta

NORTH CENTRAL
(ATHABASCA AND FORT MCMURRAY DISTRICTS)

NC103: HWY41:23 KEHIWIN LAKE (km 7.8)
SITE PLAN SHOWING APPROXIMATE INSTRUMENT LOCATIONS

DWG No. 32122-NC103

DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	TSA
SCALE	1:1000
DATE	MAY 2023
FILE No.	32122

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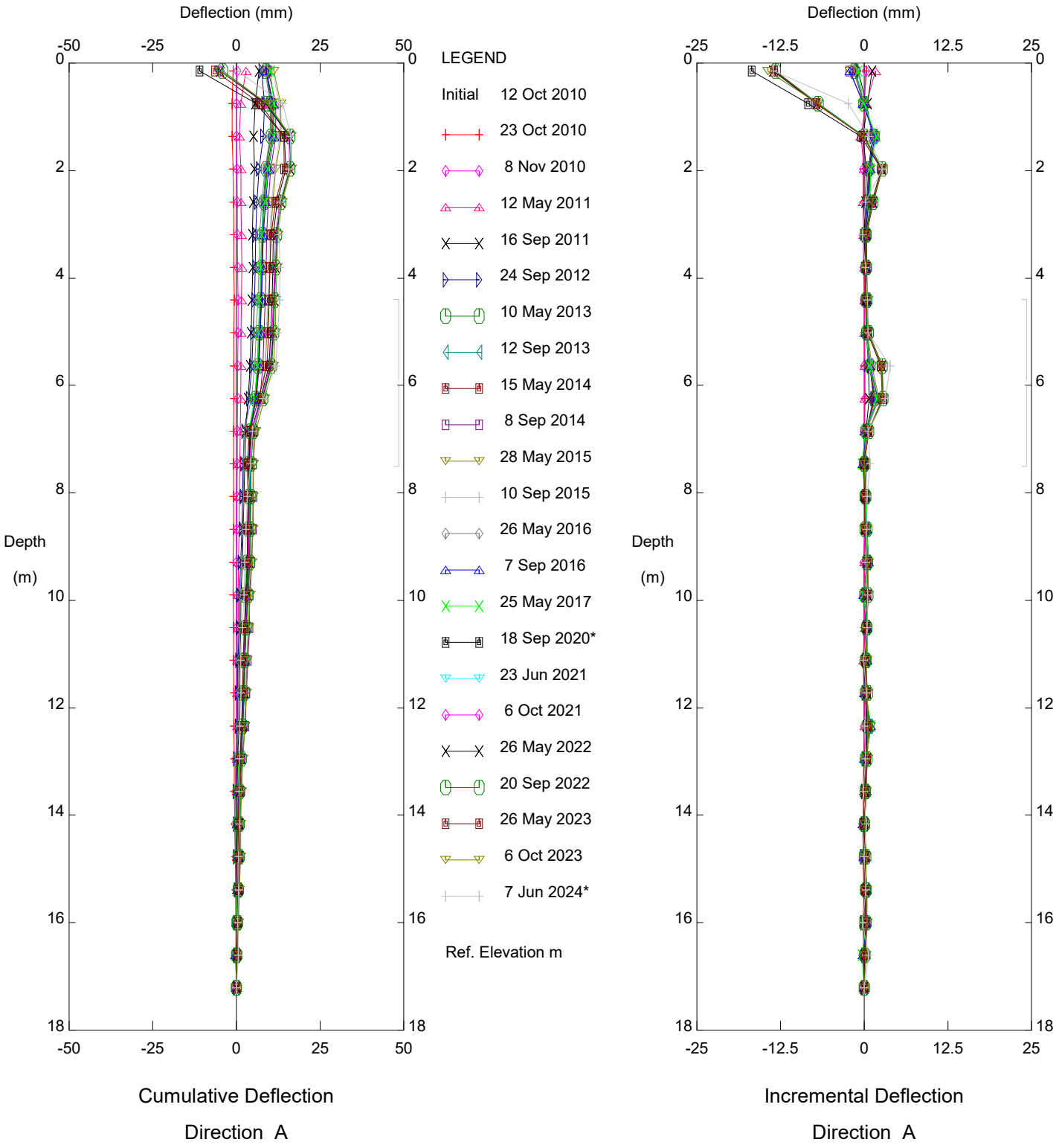

Cumulative Deflection

Direction A

Incremental Deflection

Direction A

Hwy 41:23 Kehewin Lake (NC103), Inclinometer SI10-1

Alberta Transportation

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

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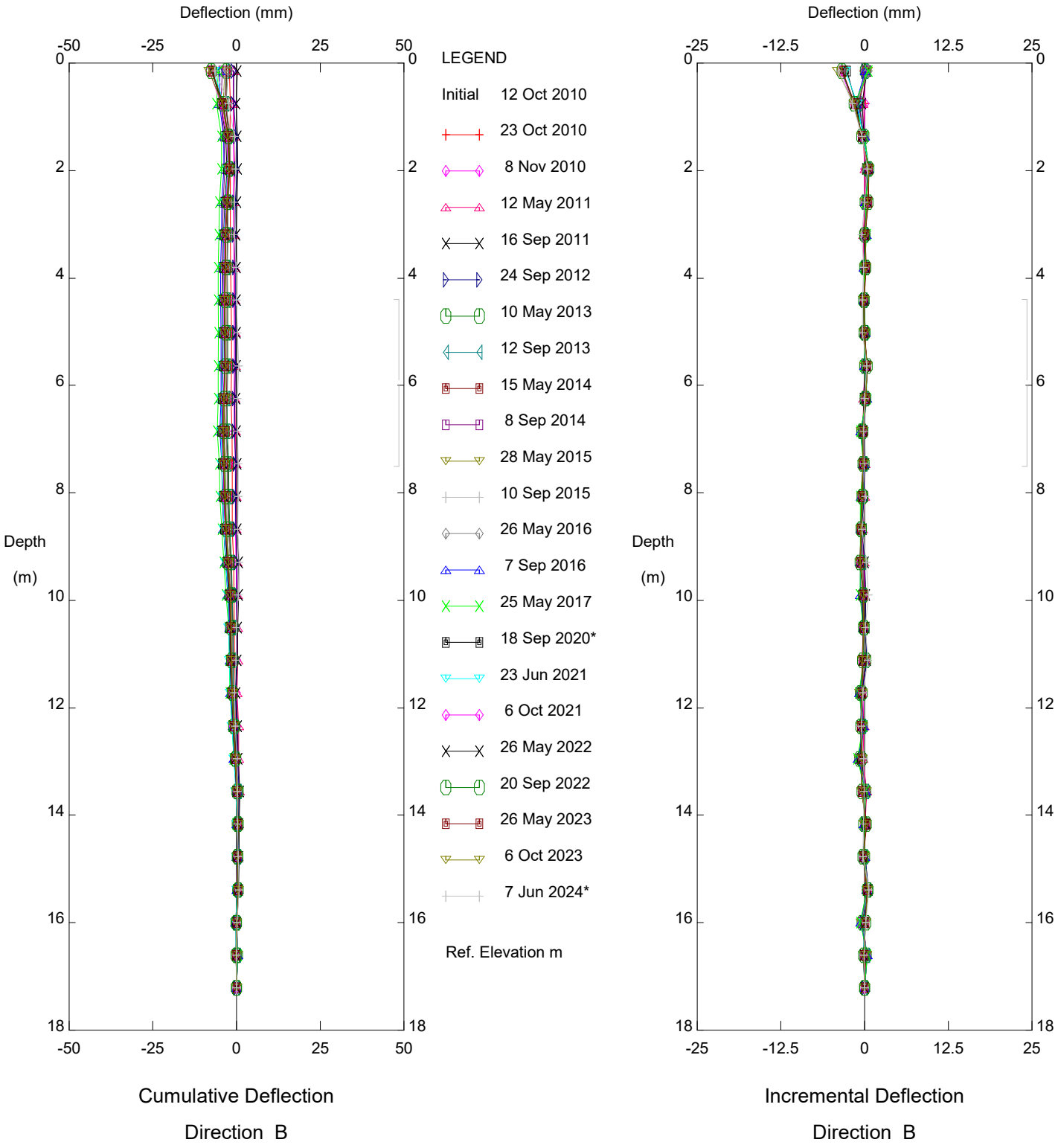
Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

Direction B

Hwy 41:23 Kehewin Lake (NC103), Inclinometer SI10-1

Alberta Transportation

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

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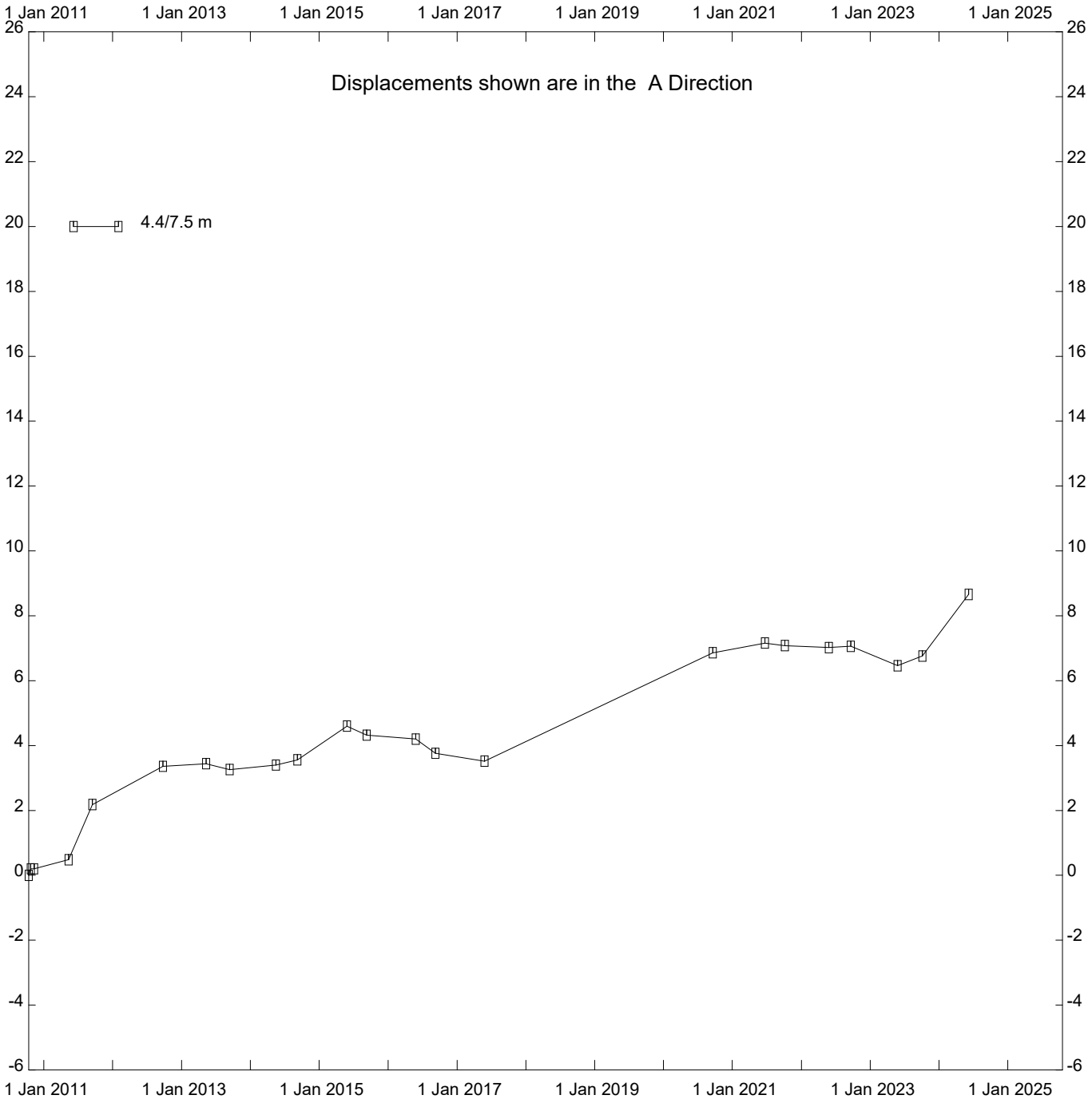
Thurber Engineering Ltd.



Hwy 41:23 Kehewin Lake (NC103), Inclinometer SI10-1

Alberta Transportation

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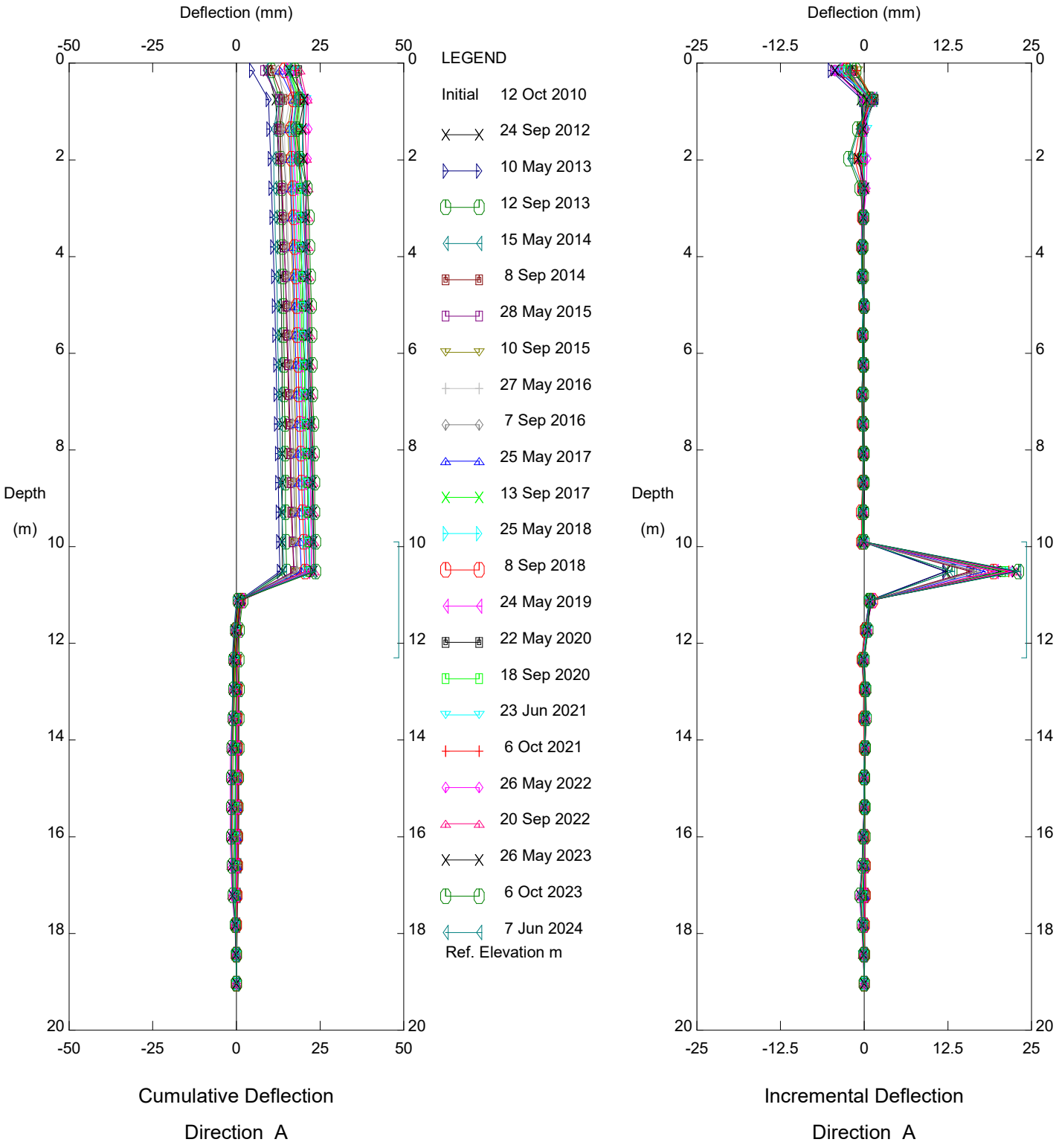


Cumulative Deflection

Direction A

Incremental Deflection

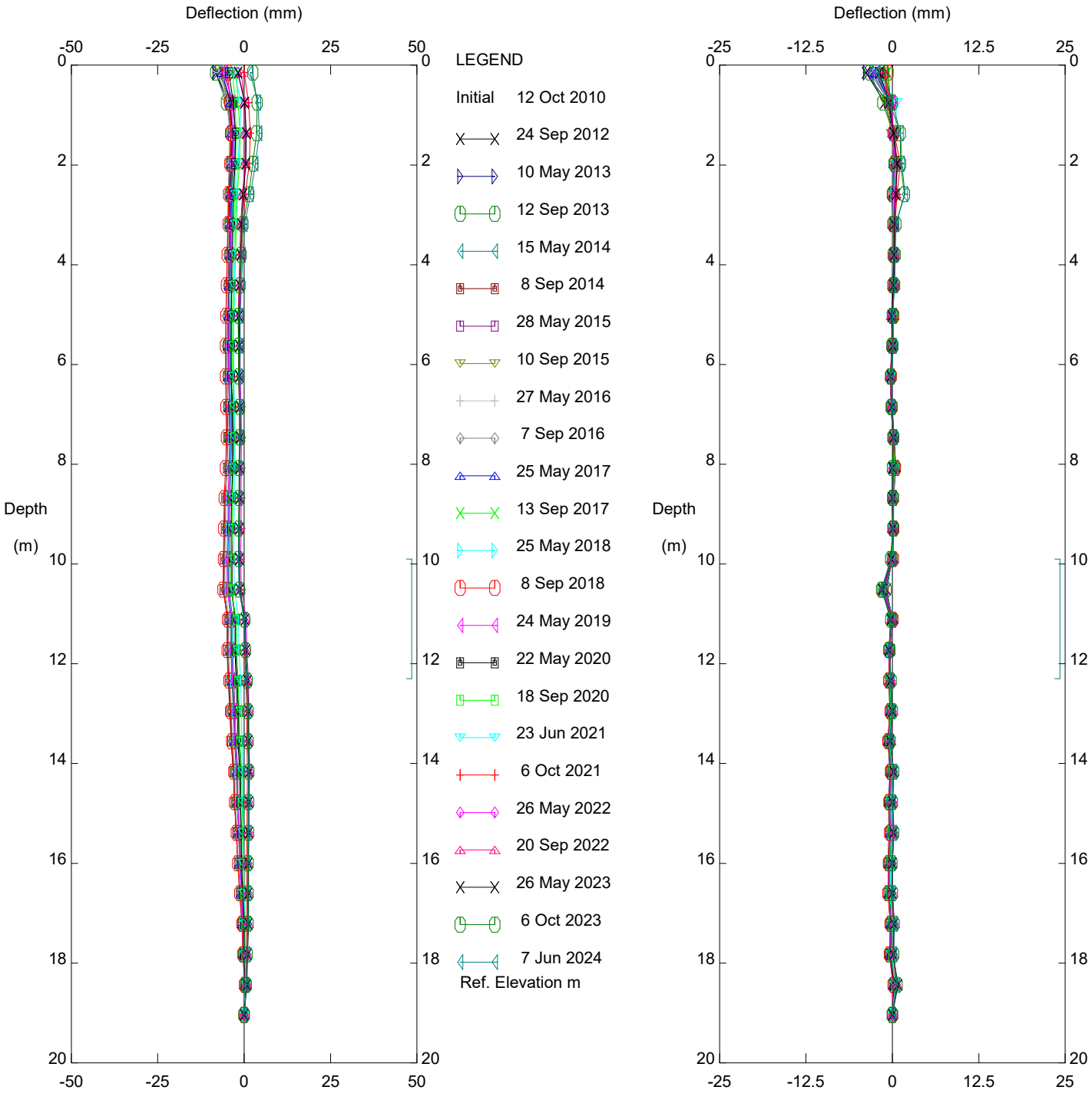
Direction A

Hwy 41:23 Kehiwin Lake (NC103), Inclinometer SI10-3

Alberta Transportation

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2024A-Spring\SI Readings\NC103\SI10-3 (1).gtl

Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

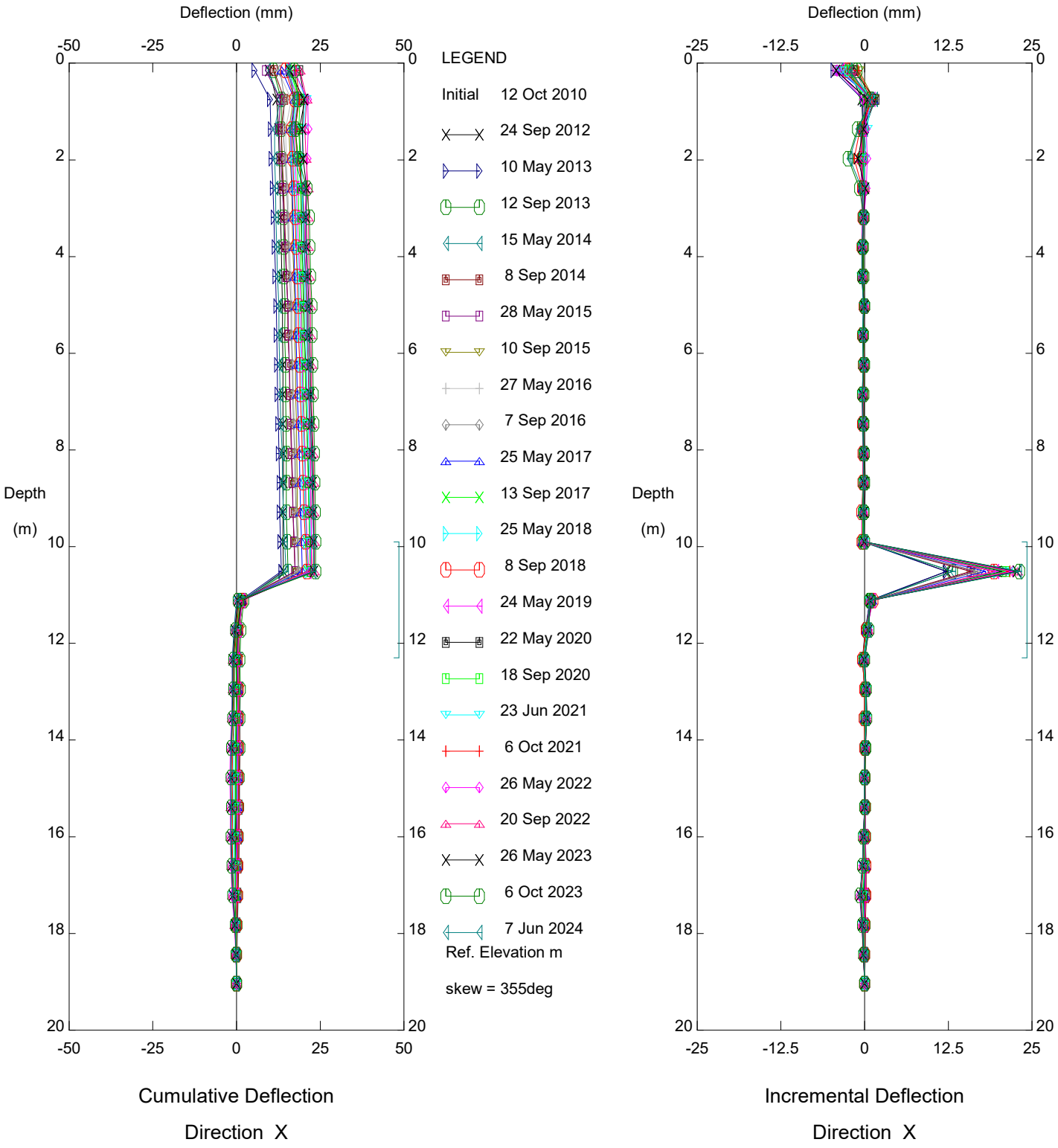
Direction B

Hwy 41:23 Kehiwin Lake (NC103), Inclinometer SI10-3

Alberta Transportation

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2024A-Spring\SI Readings\NC103\SI10-3 (1).gtl

Thurber Engineering Ltd.



Cumulative Deflection

Direction X

Incremental Deflection

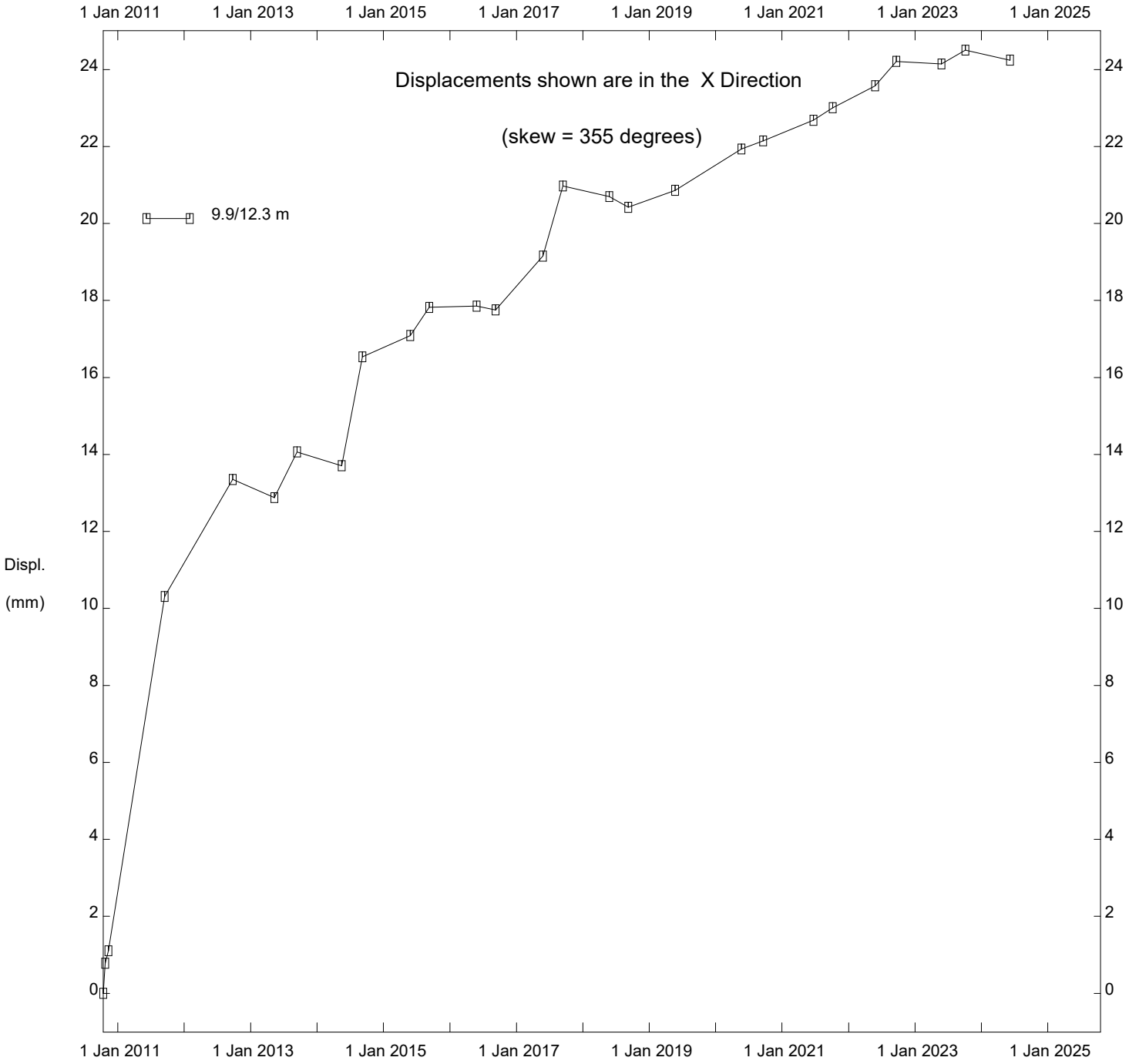
Direction X

Hwy 41:23 Kehiwin Lake (NC103), Inclinometer SI10-3

Alberta Transportation

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2024A-Spring\SI Readings\NC103\SI10-3 (1).gtl

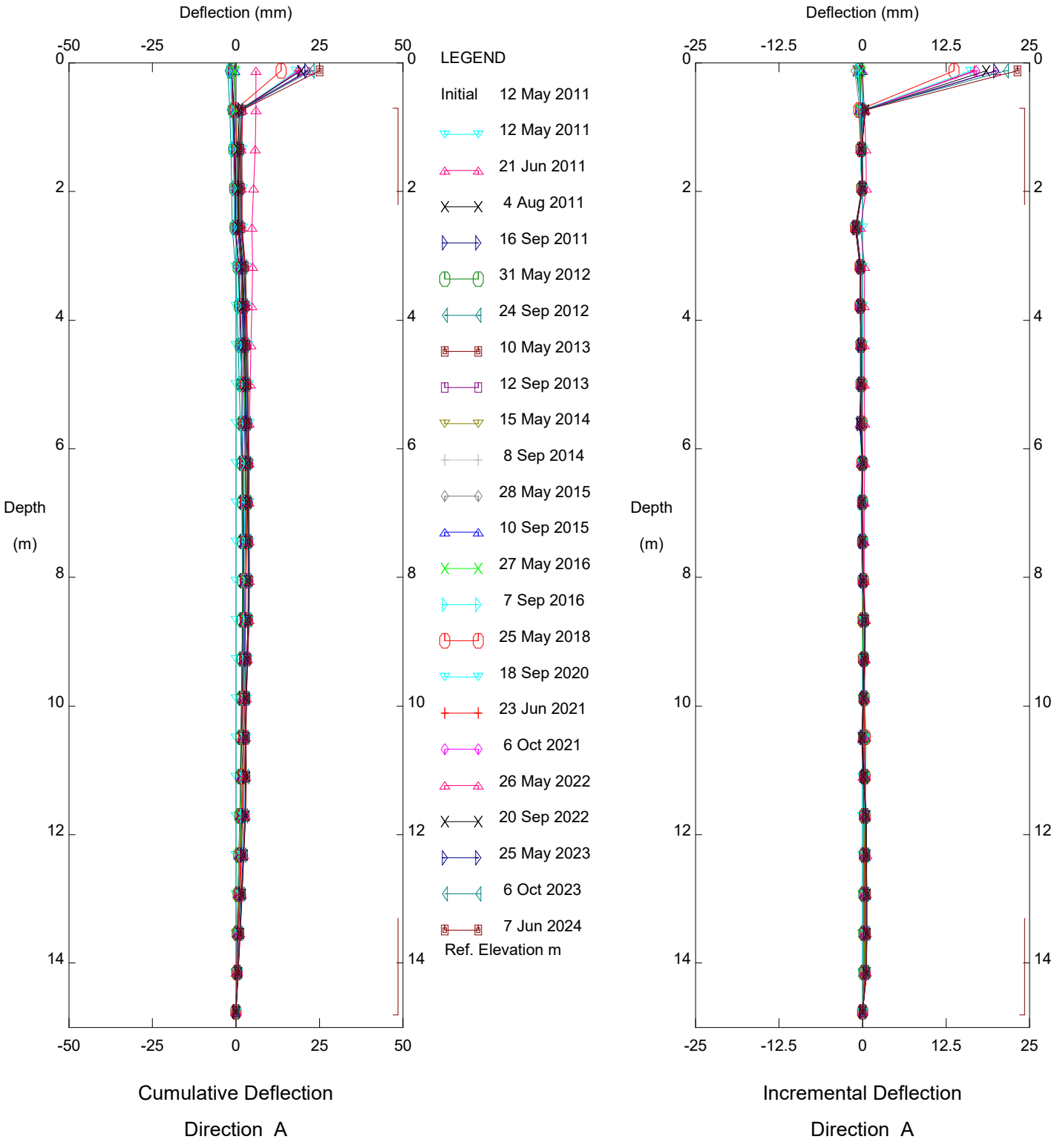
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC103), Inclinometer SI10-3

Alberta Transportation

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

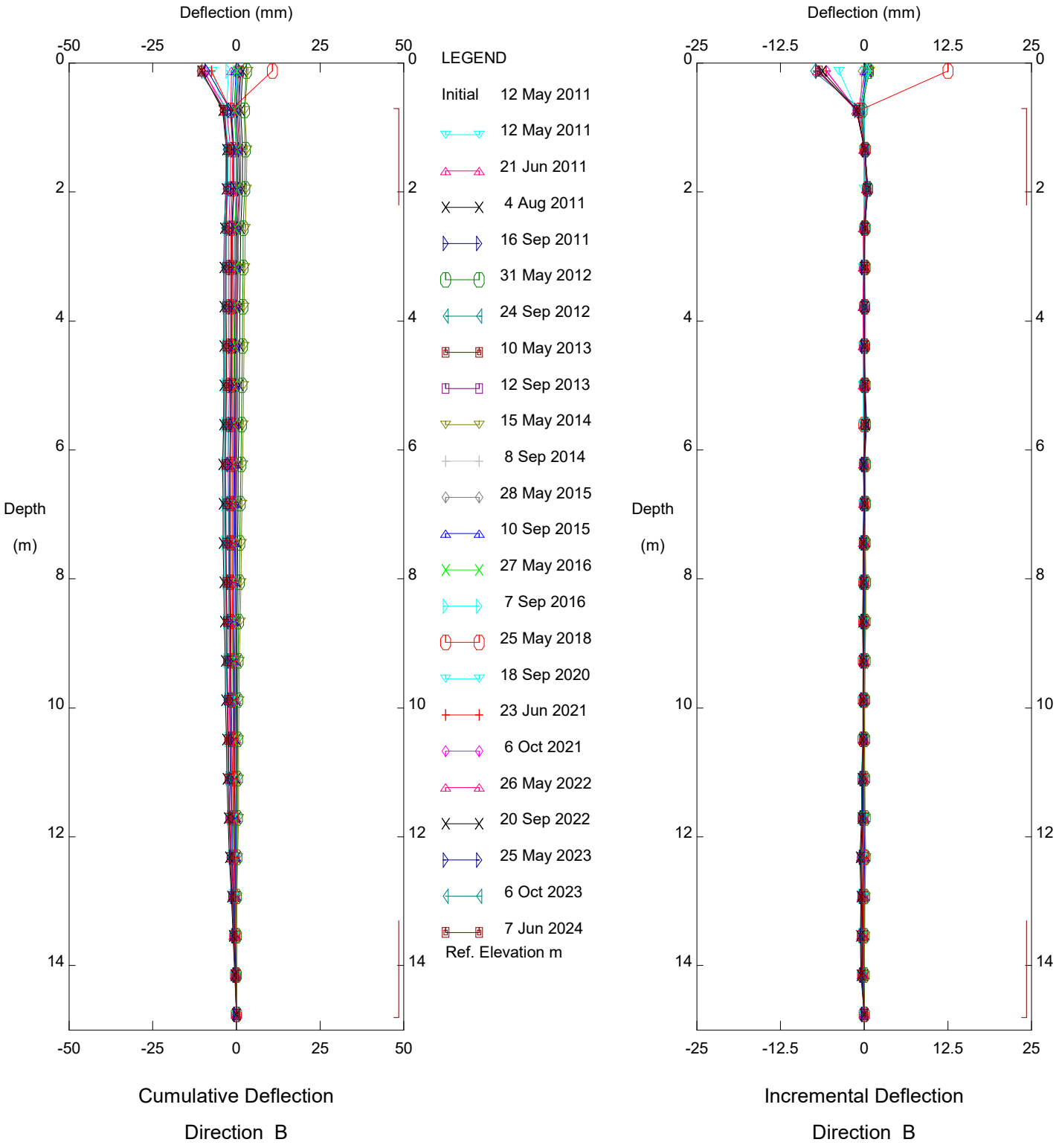
Direction A

Hwy 41:23 Kehewin Lake (NC103), Inclinometer SI11-1(P9)

Alberta Transportation

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2024A-Spring\SI Readings\NC103\SI11-1(km 7.8).gtl

Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

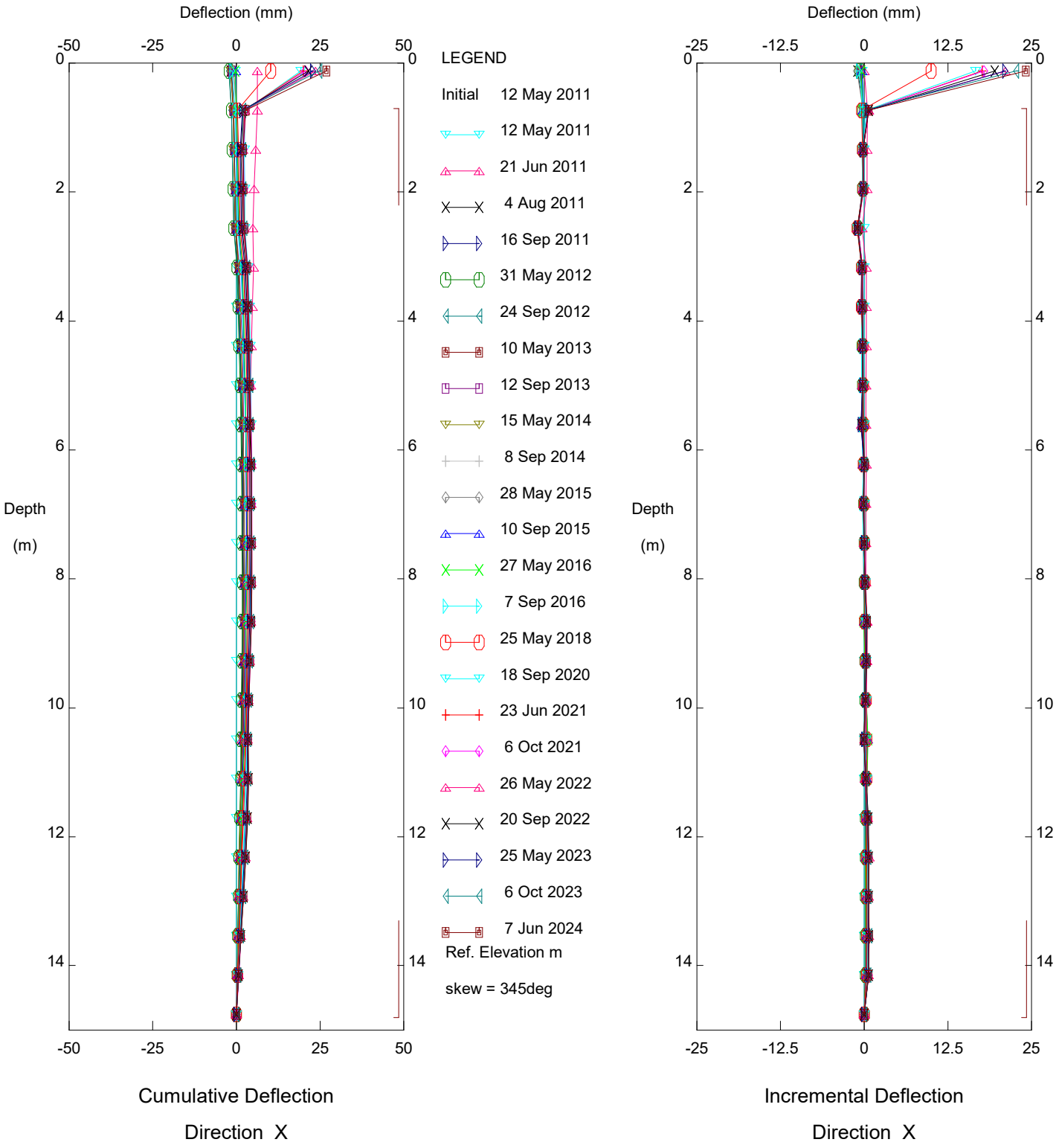
Direction B

Hwy 41:23 Kehewin Lake (NC103), Inclinometer SI11-1(P9)

Alberta Transportation

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2024A-Spring\SI Readings\NC103\SI11-1(km 7.8).gtl

Thurber Engineering Ltd.



Cumulative Deflection

Direction X

Incremental Deflection

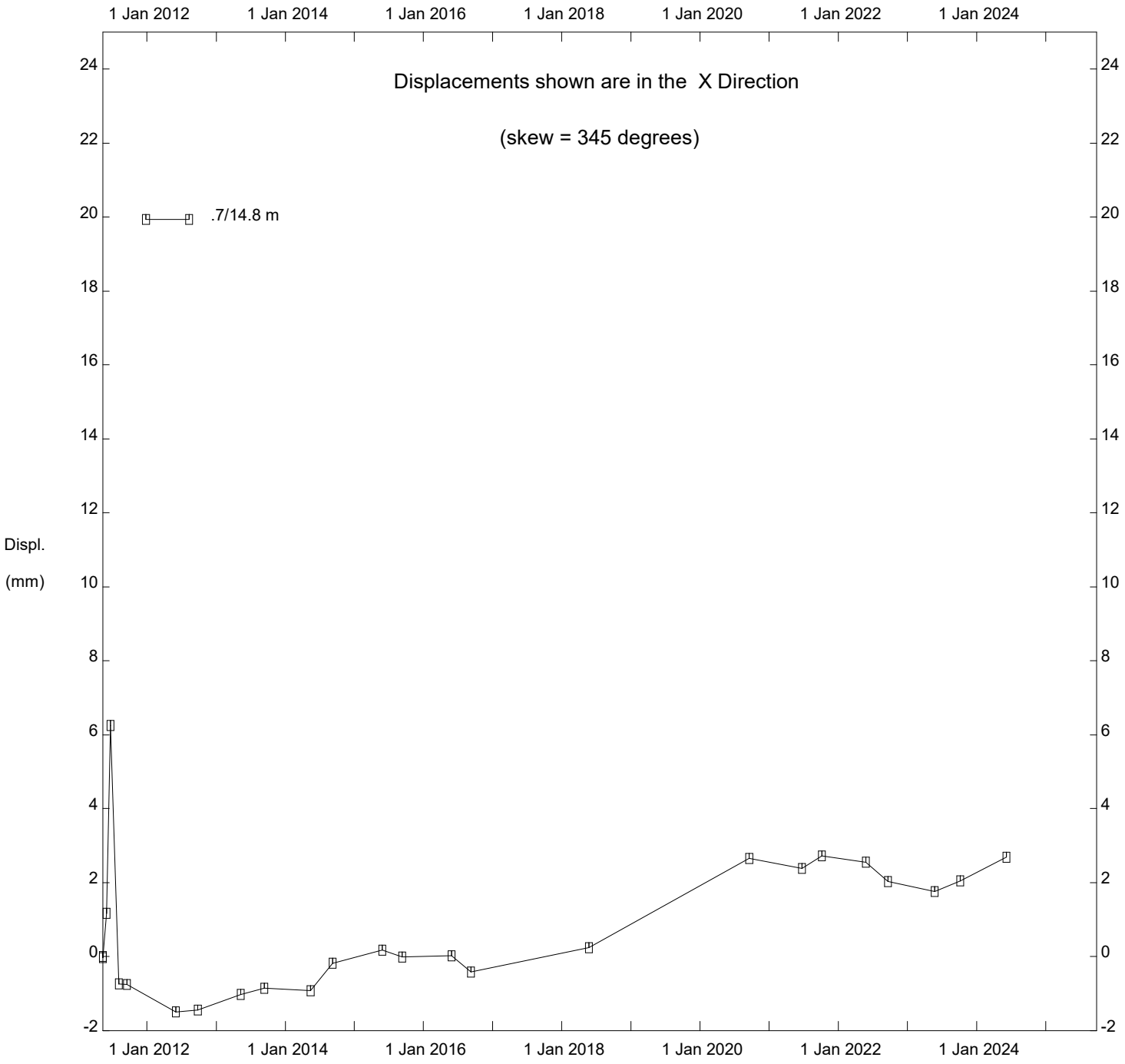
Direction X

Hwy 41:23 Kehewin Lake (NC103), Inclinometer SI11-1(P9)

Alberta Transportation

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2024A-Spring\SI Readings\NC103\SI11-1(km 7.8).gtl

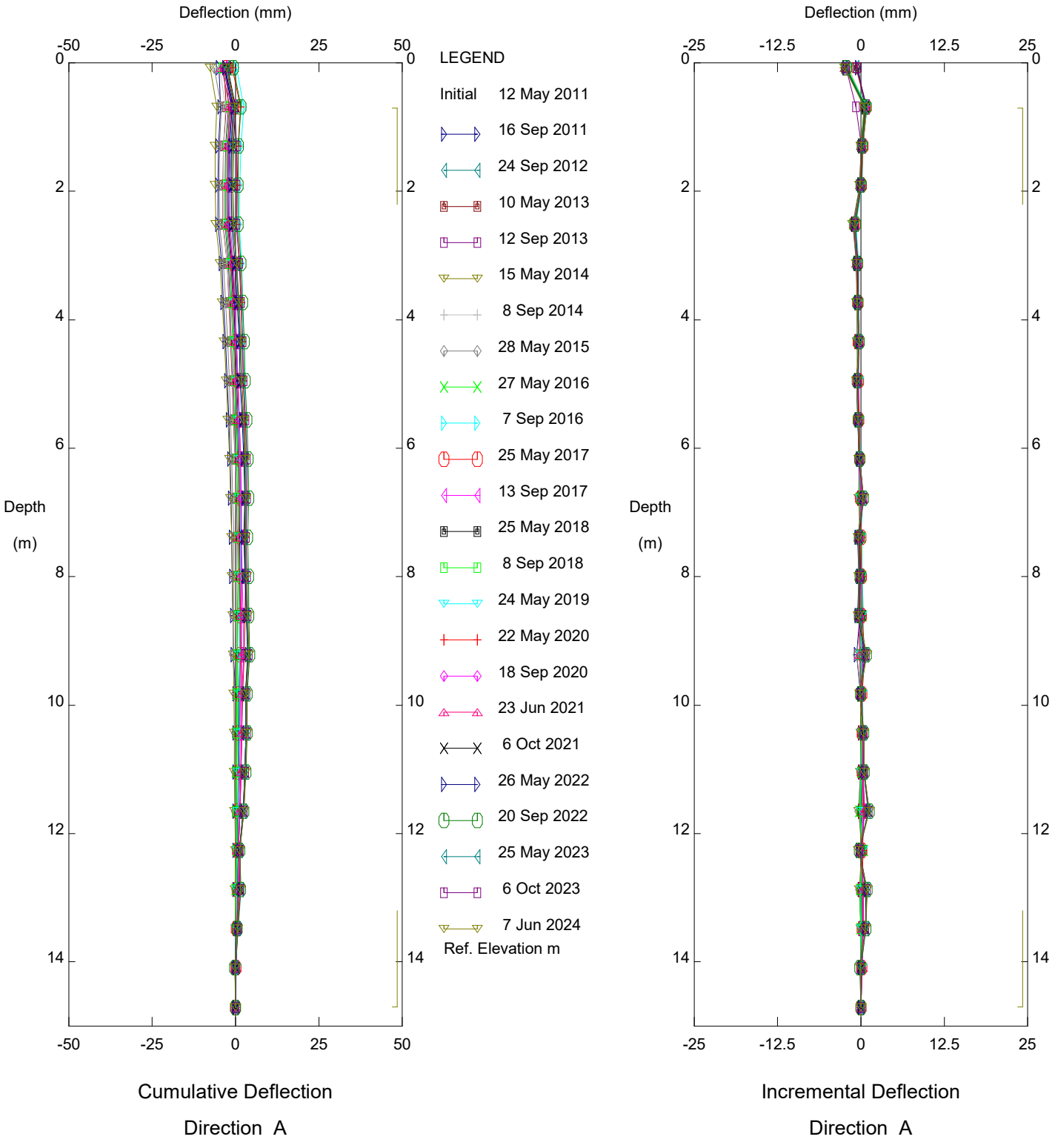
Thurber Engineering Ltd.



Hwy 41:23 Kehewin Lake (NC103), Inclinometer SI11-1(P9)

Alberta Transportation

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

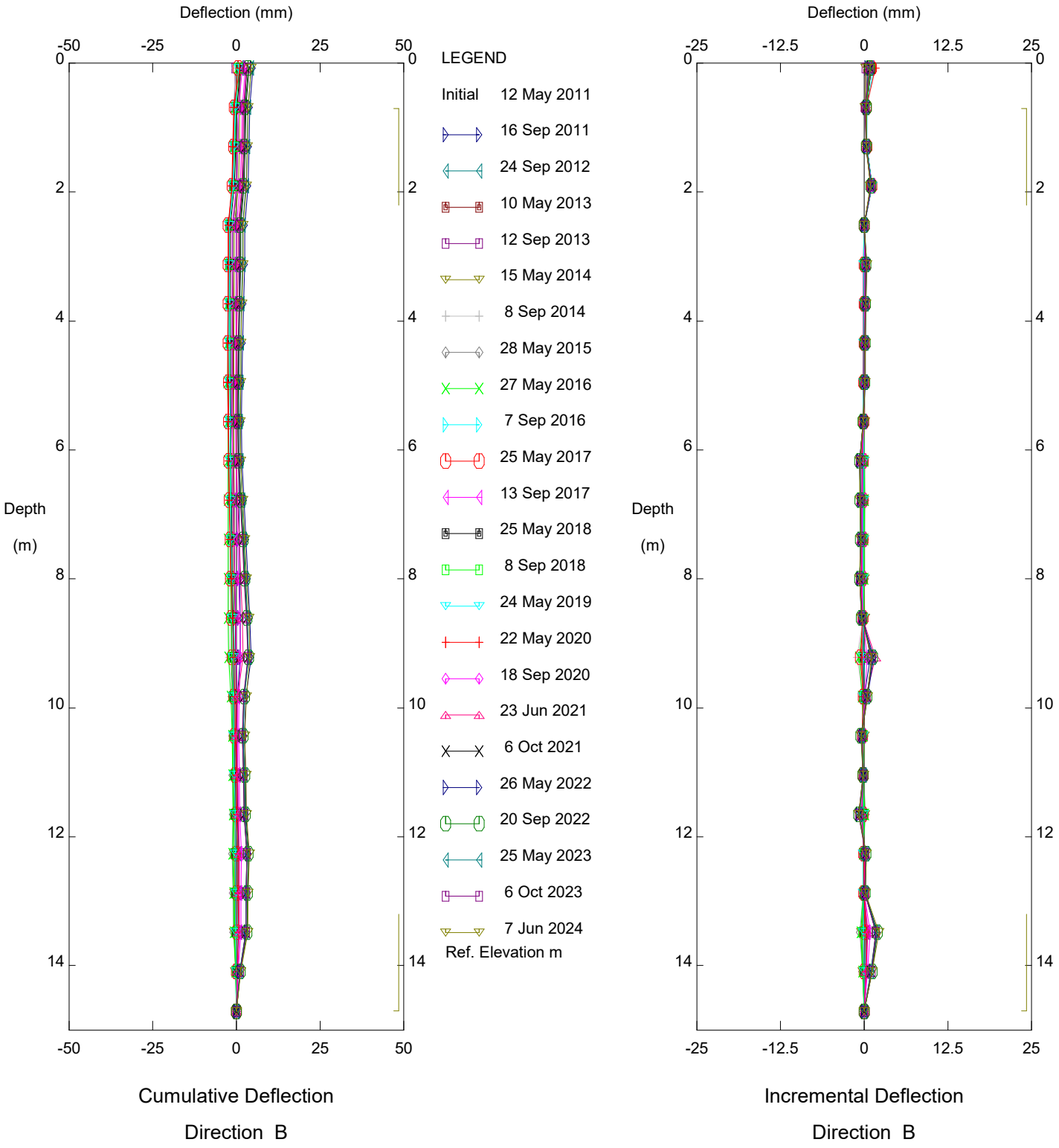
Direction A

Hwy 41:23 Kehiwin Lake (NC103), Inclinometer SI11-2 (P27)

Alberta Transportation

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2024A-Spring\SI Readings\NC103\SI11-2(km 7.8).gtl

Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

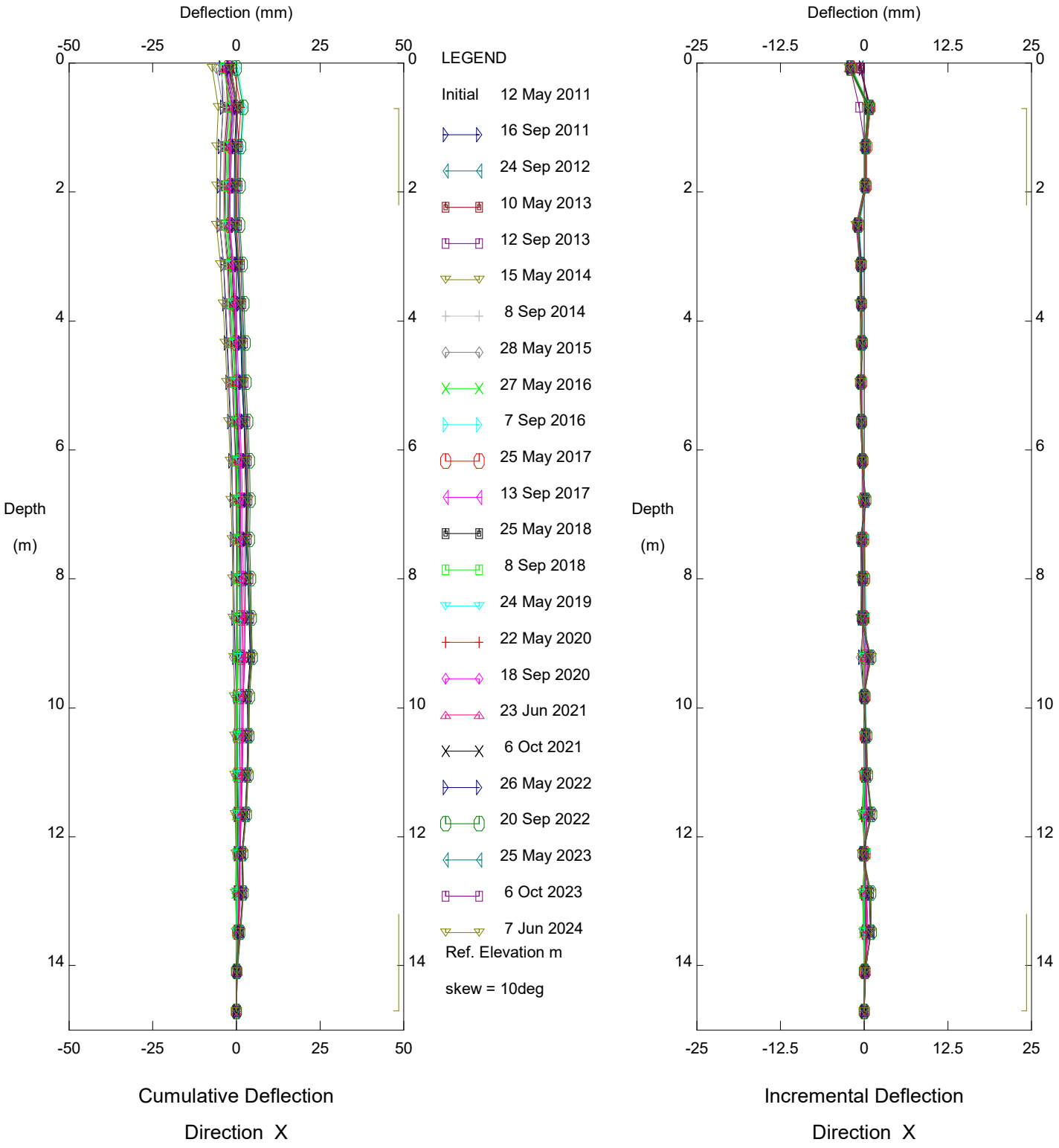
Direction B

Hwy 41:23 Kehiwin Lake (NC103), Inclinometer SI11-2 (P27)

Alberta Transportation

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2024A-Spring\SI Readings\NC103\SI11-2(km 7.8).gtl

Thurber Engineering Ltd.



Cumulative Deflection

Direction X

Incremental Deflection

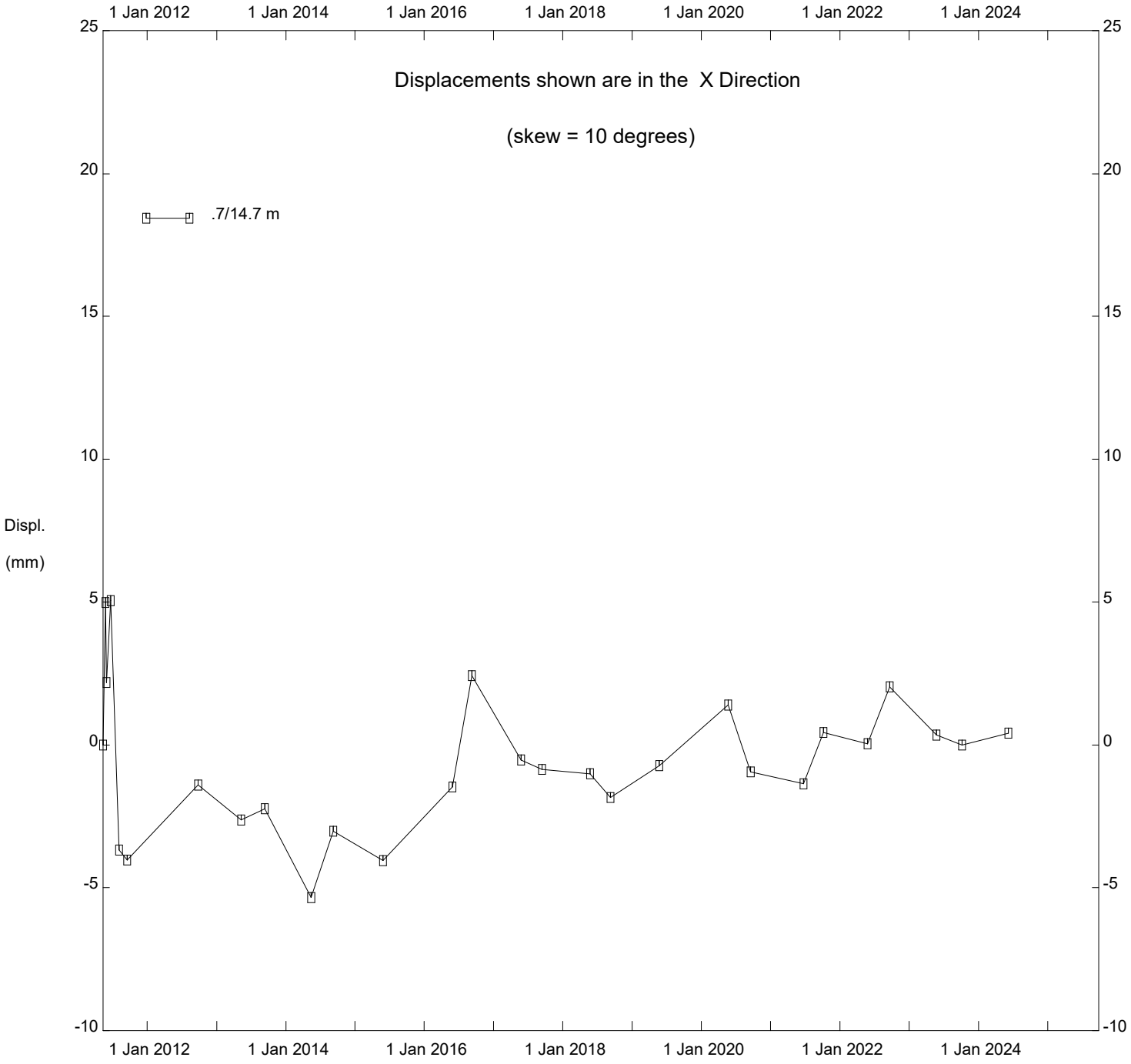
Direction X

Hwy 41:23 Kehiwin Lake (NC103), Inclinometer SI11-2 (P27)

Alberta Transportation

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2024A-Spring\SI Readings\NC103\SI11-2(km 7.8).gtl

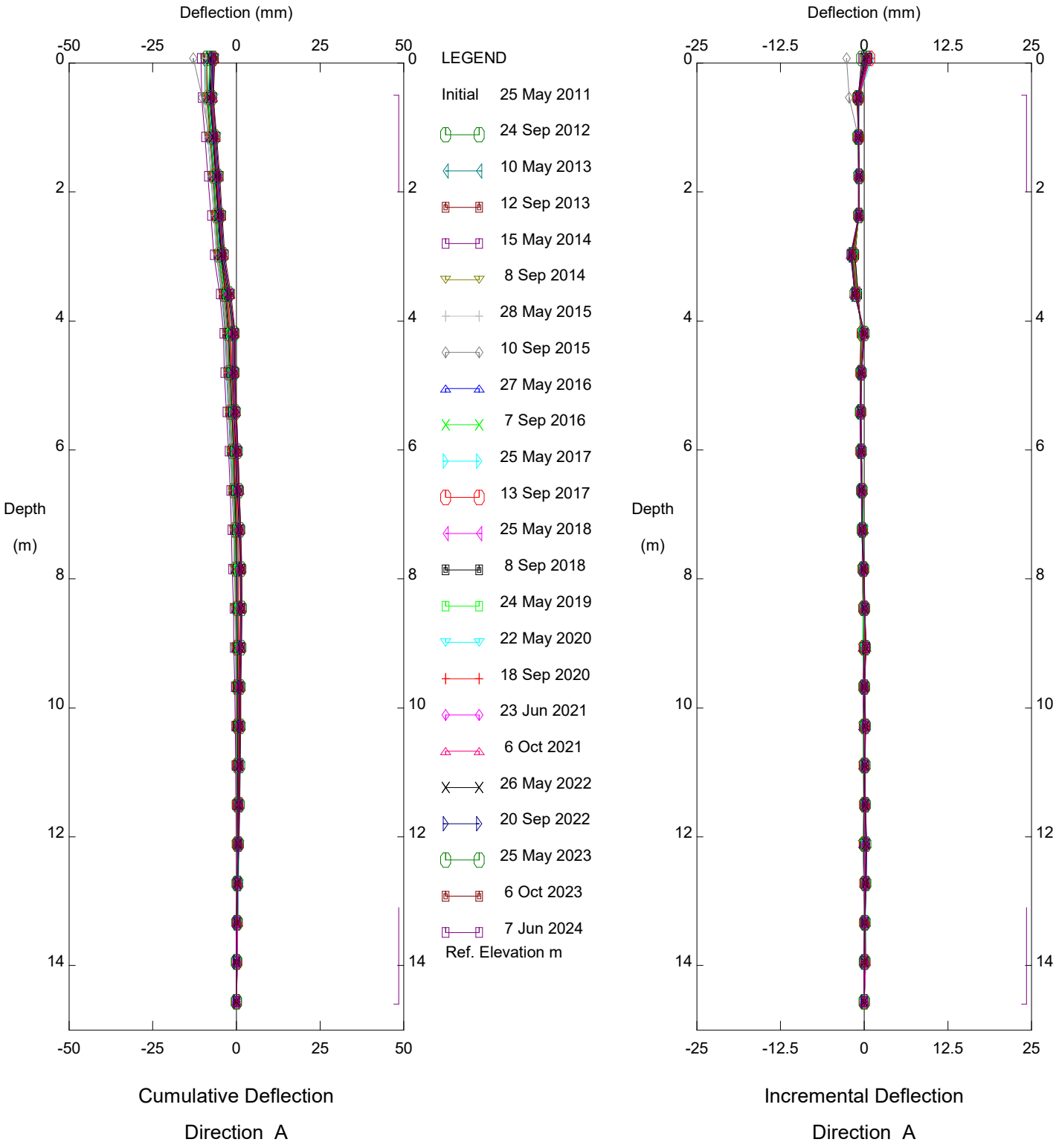
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC103), Inclinometer SI11-2 (P27)

Alberta Transportation

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

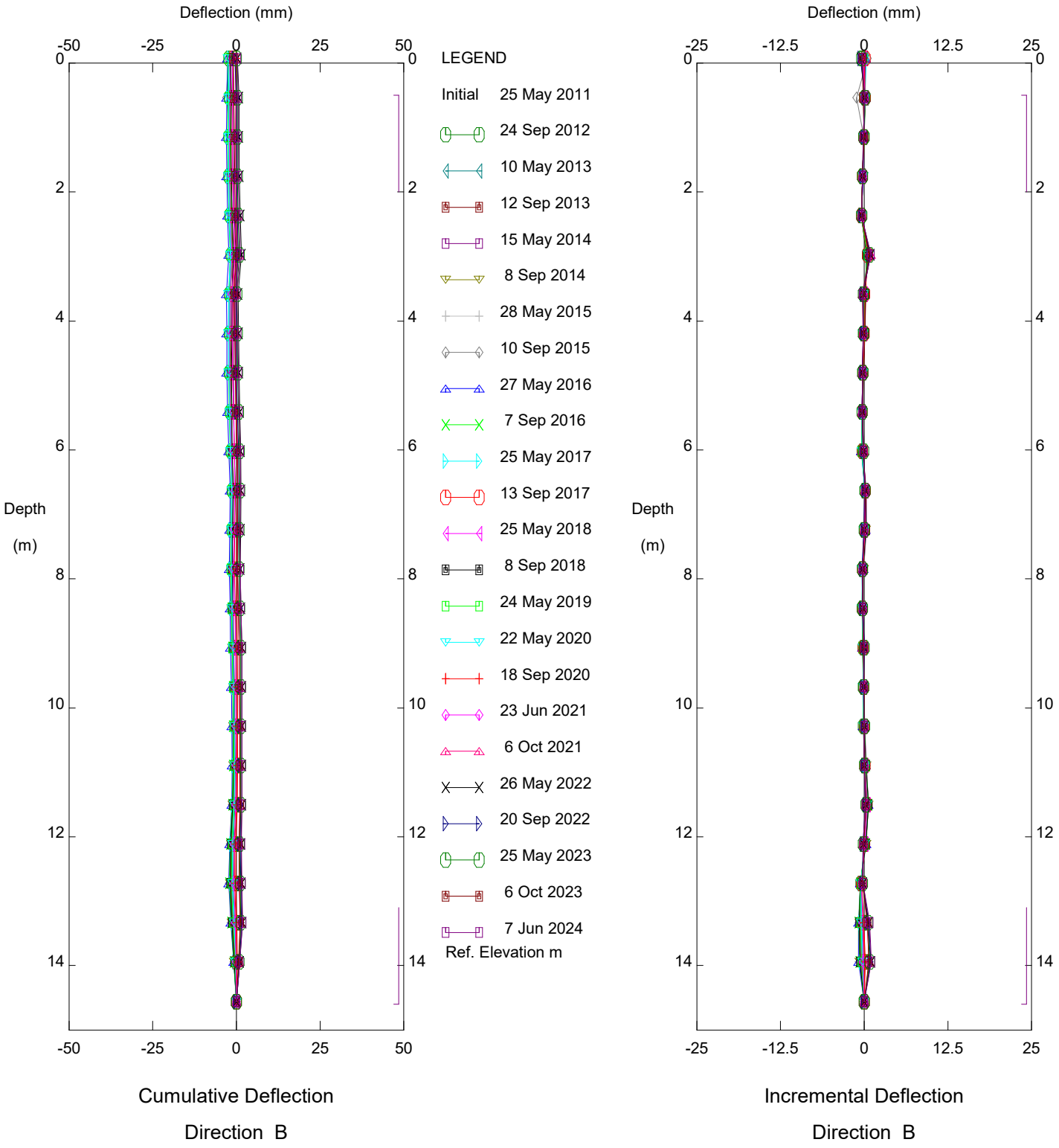
Direction A

Hwy 41:23 Kehiwin Lake (NC103), Inclinometer SI11-3(P45)

Alberta Transportation

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2024A-Spring\SI Readings\NC103\SI11-3(km 7.8).gtl

Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

Direction B

Hwy 41:23 Kehiwin Lake (NC103), Inclinometer SI11-3(P45)

Alberta Transportation

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2024A-Spring\SI Readings\NC103\SI11-3(km 7.8).gtl

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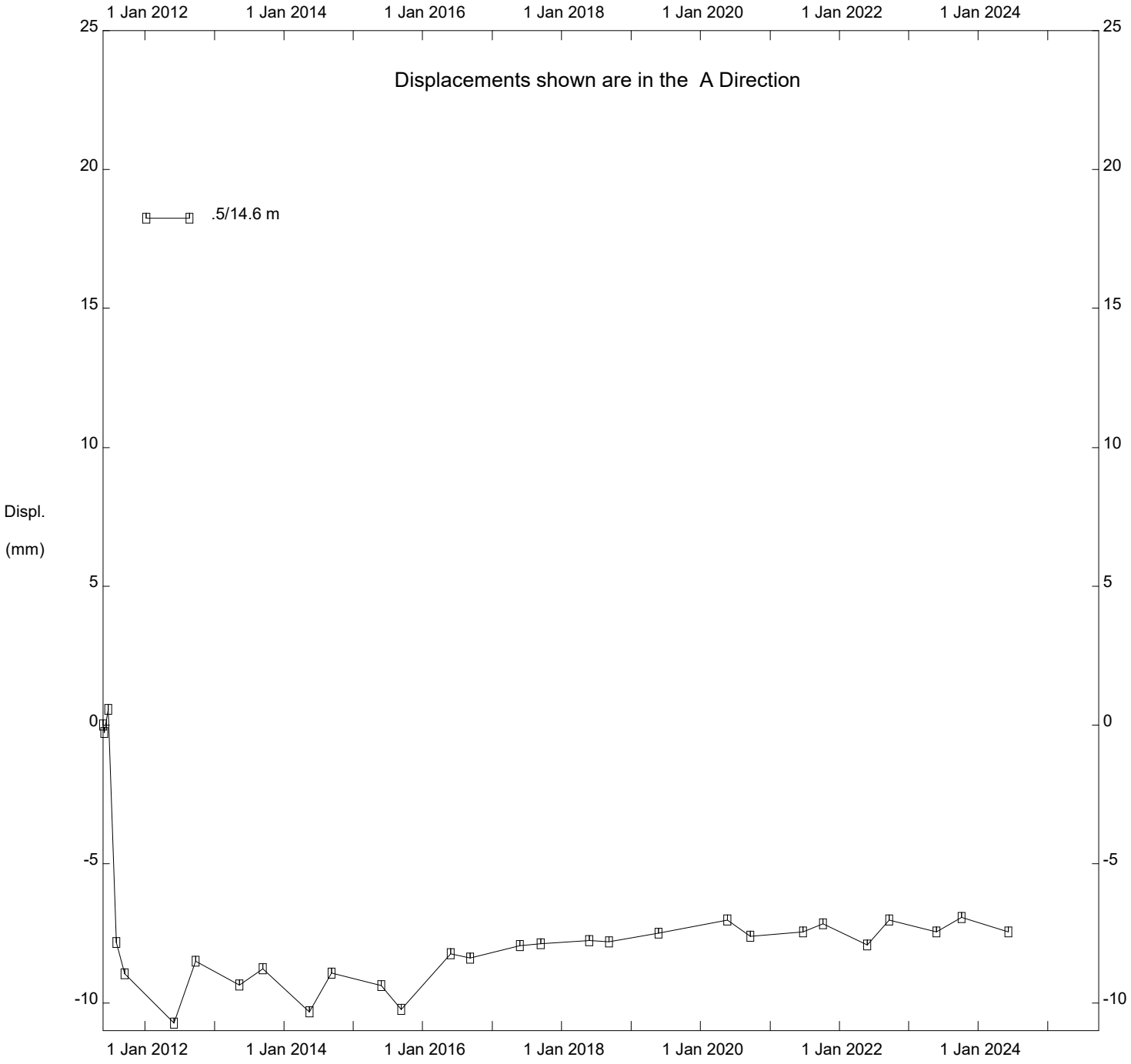
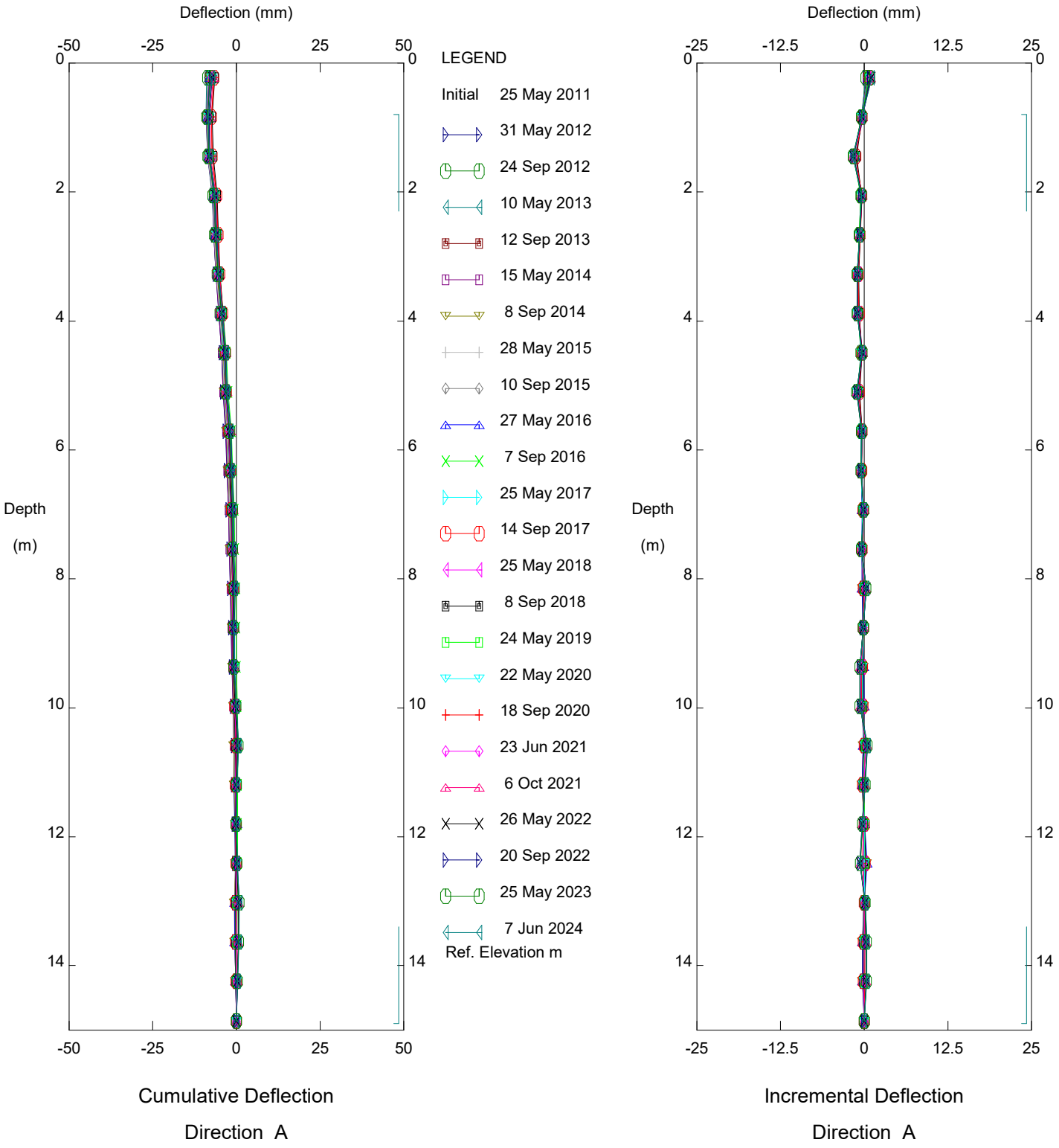


Hwy 41:23 Kehiwin Lake (NC103), Inclinometer SI11-3(P45)

Alberta Transportation

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

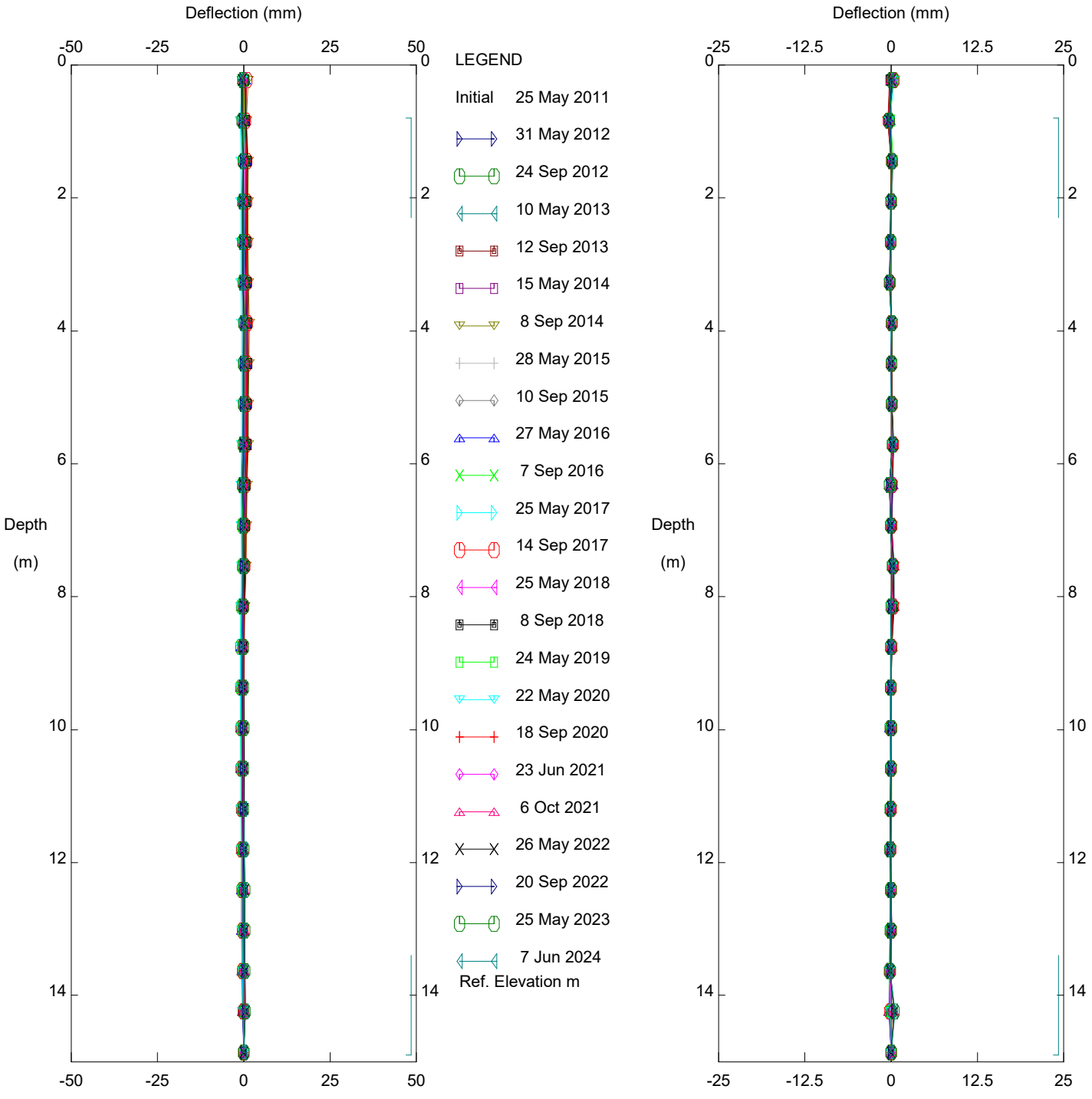
Direction A

Hwy 41:23 Kehiwin Lake (NC103), Inclinometer SI11-4 (P60)

Alberta Transportation

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2024A-Spring\SI Readings\NC103\SI11-4(km 7.8).gtl

Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

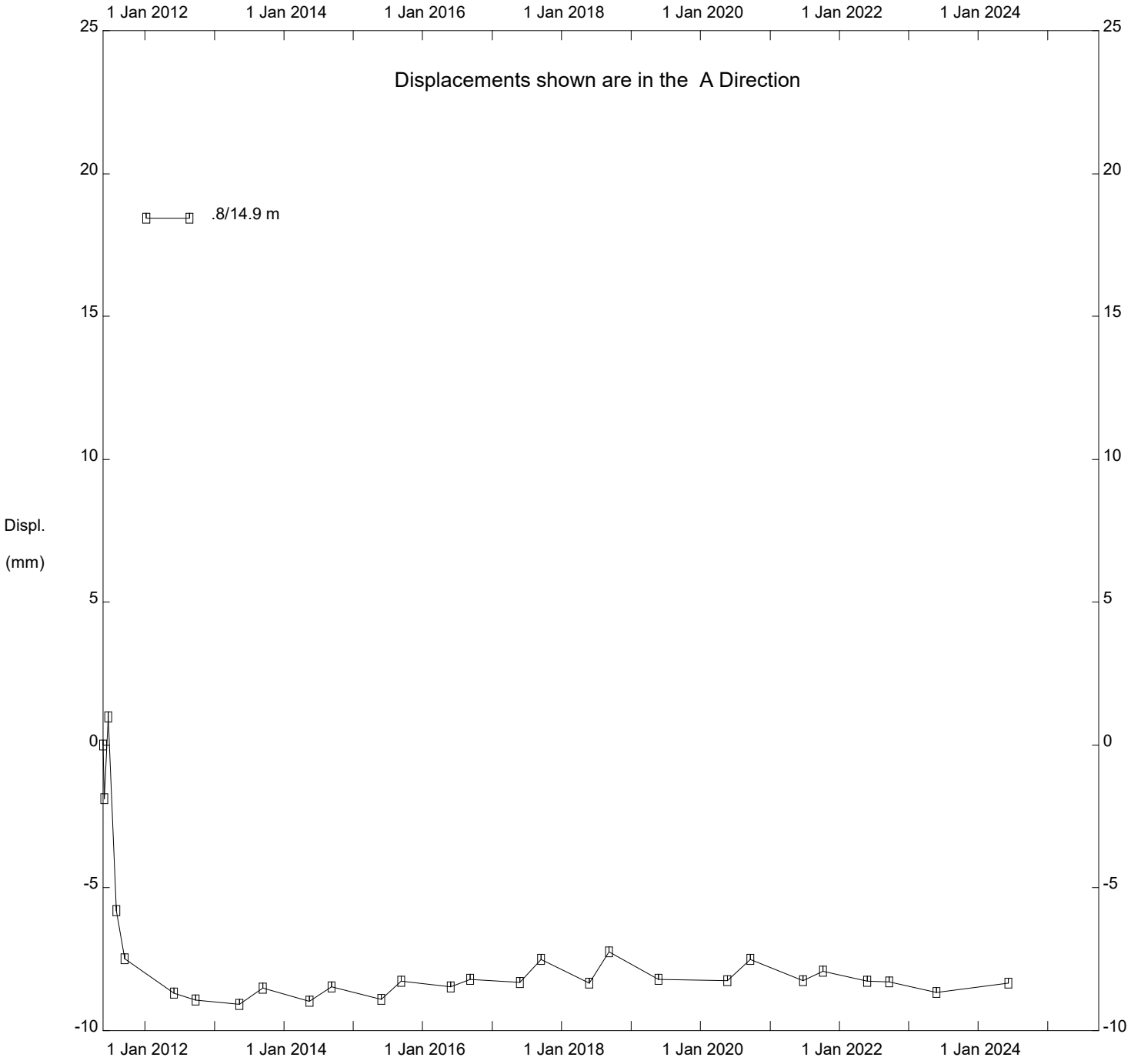
Direction B

Hwy 41:23 Kehiwin Lake (NC103), Inclinometer SI11-4 (P60)

Alberta Transportation

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2024A-Spring\SI Readings\NC103\SI11-4(km 7.8).gtl

Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC103), Inclinometer SI11-4 (P60)

Alberta Transportation

FIGURE NC103-1
PIEZOMETER DATA FOR HWY 41:23, KEHIWIN LAKE (KM 7.8)

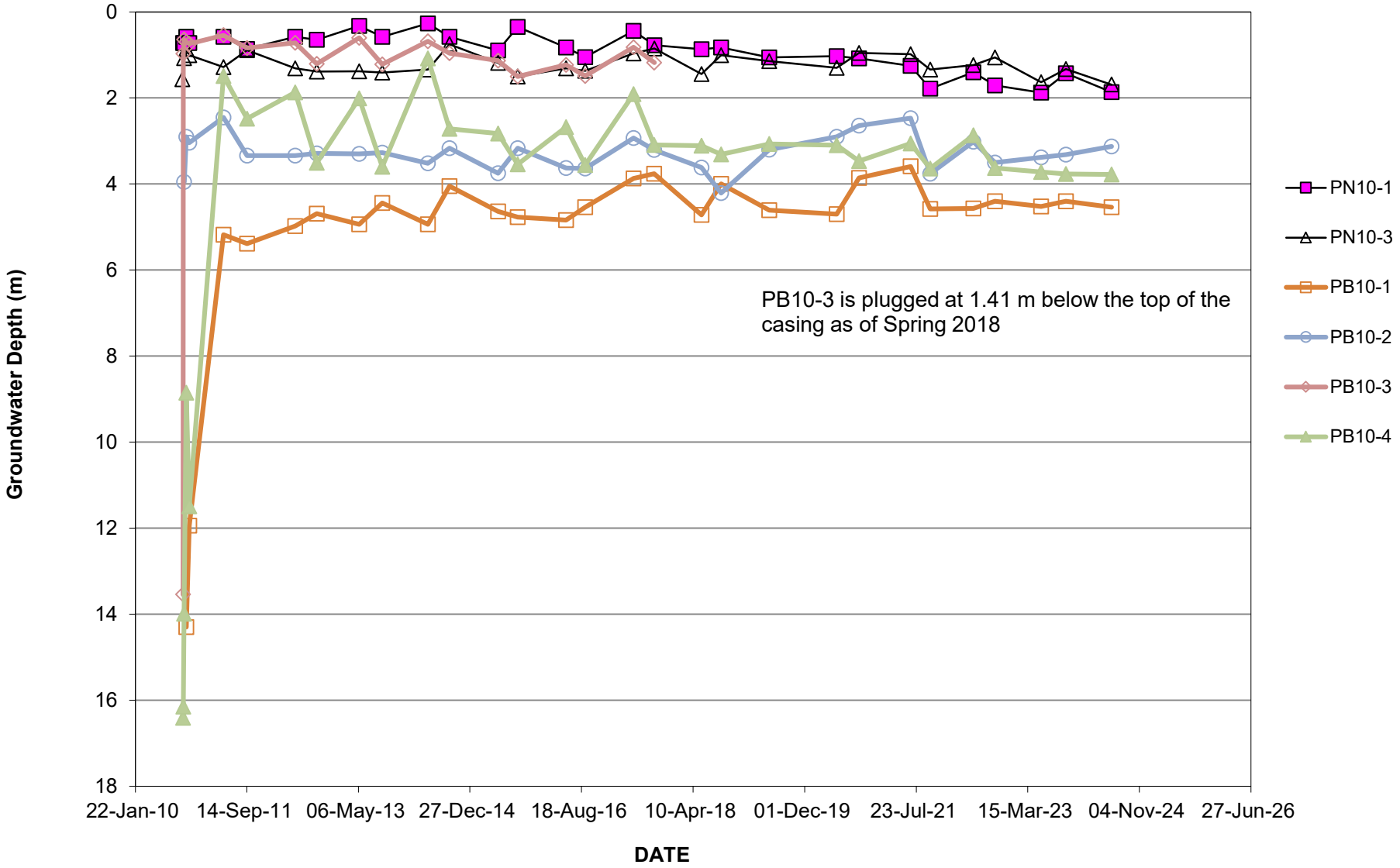


FIGURE NC103-2
VIBRATING WIRE LOAD CELL DATA FOR
HWY 41:23, KEHIWIN LAKE (km 7.8)