THURBER ENGINEERING LTD.

October 30, 2023 File No.: 32122

Alberta Transportation and Economic Corridors
Construction and Maintenance Division
North Central Region
Address
City/Province
Postal Code

Attention: Ms. Amy Driessen, P.Eng.

ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS GRMP (CON0022163)
NORTH CENTRAL (ATHABASCA AND FORT McMURRAY DISTRICTS)
INSTRUMENTATION MONITORING RESULTS – FALL 2023

SECTION C

SITE NC099: HWY 63:10 HANGINGSTONE RIVER BRIDGES

Dear Ms. Driessen:

This report provides the results of the bi-annual geotechnical instrumentation monitoring for the above-mentioned site as part of Alberta Transportation and Economic Corridors Geohazard Risk Management Program for North Central – Athabasca and Fort McMurray Districts (CON0022163).

It is a condition of this letter report that Thurber's performance of its professional services will be subject to the attached Statement of Limitations and Conditions.

1. OBSERVATIONS

1.1 Field Program and Instrumentation Status

Twelve slope inclinometers (SI14-01 to SI14-02, SI15-05 to SI15-10, N-SI-01, N-SI-02, S-SI-01 and S-SI-02), nineteen vibrating wire piezometers (PZ14-01 to PZ14-04, PZ15-01 to PZ15-12, PZ133647, PZ133682, and PZ133683) and three settlement gauges (SG14-01, SG14-02, and SG1421034) were read at the Hwy 63:10 Hangingstone River Bridges site on October 3, 2023 by Mr. Niraj Regmi, G.I.T. and Mr. Nixson Mationg, both of Thurber Engineering Ltd.

Site plans showing the approximate instrumentation locations are included in Appendix A.

The SIs were read using two RST Digital Inclinometer probes with 2 ft. wheelbases and RST Pocket PC readouts. Inclinometer reading depths were defined as per cable markings with respect to the top of the inclinometer casing. The data from three vibrating wire piezometers (PZ133647, PZ133682, and PZ133683) and a settlement cell (SG1421034) was downloaded from onsite dataloggers. The remaining vibrating wire piezometers and settlement cells were read using an RST VW2106 readout.

2. DATA PRESENTATION

1.2 General

SI plots for A and B directions are presented in Appendix A. Where movement has been recorded the resultant plot (X direction, if applicable) and rate of movement have also been provided. Vibrating wire piezometer and settlement cell reading plots are also provided in Appendix A. The slope inclinometer, vibrating wire piezometer, and settlement cell reading summary tables are provided below. These tables also include instruments deleted from the GRMP program or not read during this monitoring event for future reference.

1.3 Zones of Movement

Zones of new movement were not observed in the SIs since the previous readings in the spring of 2023.

Zones of movement are summarized in Table NC099-1 below. This table also provides a historical account of the total movement, the depth of movement and the maximum rate of movement that has occurred at this site since the initialization of the slope inclinometers.

Table NC099-1: Fall 2023 – Hwy 63:10 Hangingstone River Bridge Slope Inclinometer Instrumentation Reading Summary

Date Monitored: October 3, 2023

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AND DEPTH OF MOVEMENT TO DATE (mm)	MAXIMUM RATE OF MOVEMENT (mm/yr)	CURRENT STATUS	DATE OF PREVIOUS READING	INCREMENTAL MOVEMENT SINCE PREVIOUS READING (mm)	CURRENT RATE OF MOVEMENT (mm/yr)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
Cut Slope – Northbound Lane								
SI15-05	April 6, 2015	No discernible movement	N/A	Operational	May 29, 2023	N/A	N/A	N/A
SI15-06	March 4, 2015	No discernible movement	N/A	Operational	May 29, 2023	N/A	N/A	N/A
SI15-07	March 4 2015	No discernible movement	N/A	Operational	May 29, 2023	N/A	N/A	N/A
SI15-08	March 4 2015	No discernible movement	N/A	Operational	May 29, 2023	N/A	N/A	N/A
SI15-09	March 4, 2015	31.0 mm over 2.7 m to 4.0 m in 23° direction	13.0 on June 9, 2015	Operational	May 29, 2023	2.9	8.3	5.9
		15.1 mm over 6.4 m to 7.6 m in 308° direction	4.9 on September 22, 2022			2.2	6.4	4.1
		38.7 mm over 10.1 m to 11.9 m in 331° direction	46.9 on March 16, 2015			0.8	2.2	1.9
SI15-10	March 4, 2015	3.4 mm over 11.9 m to 13.1 m in 302° direction	4.3 on March 16, 2015	Operational	May 29, 2023	0.4	1.0	0.8
		5.9 mm over 16.2 m to 17.4 m in 347° direction	11.9 on March 16, 2015			0.9	2.6	2.6

Drawings 32122-NC099-1 to 32122-NC099-3 in Appendix A provide sketches of the approximate location of the monitoring instrumentation for this site.

Table NC099-1– Continued: Fall 2023 – Hwy 63:10 Hangingstone River Bridge Slope Inclinometer Instrumentation Reading Summary

Date Monitored: October 3, 2023

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AND DEPTH OF MOVEMENT TO DATE (mm)	MAXIMUM RATE OF MOVEMENT (mm/yr)	CURRENT STATUS	DATE OF PREVIOUS READING	INCREMENTAL MOVEMENT SINCE PREVIOUS READING (mm)	CURRENT RATE OF MOVEMENT (mm/yr)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
Hangingstone River Bridge Abutments – Northbound Lane								
SI14-01	September 4, 2014	253.6 mm over 6.1 m to 30.5 m in 228° direction	1447.1 on November 17, 2014	Operational	May 29, 2023	2.4	7.1	1.9
SI14-02	August 29, 2014	166.8 mm over 5.5 m to 31.7 m in 54° direction	2686.7 on November 17, 2014	Operational	May 29, 2023	No discernible movement	N/A	-21.4
SI14-03	*September 17, 2014*	*42.1 mm over 15.2 m to 17.7 m in 165° direction*	*99.9 on November 17, 2014*	*Sheared at 18.9 m depth*	*September 14, 2018*	*N/A*	*N/A*	*N/A*
		79.1 mm 17.7 m to 20.7 m in 220° direction	*391.2 on November 17, 2014*			*N/A*	*N/A*	*N/A*
SI14-04	*September 19, 2014*	*89.2 mm over 13.7 m to 17.4 m in 30° direction*	*1919.2 on November 17, 2014*	*Sheared at 15.8 m depth*	*September 14, 2018*	*N/A*	*N/A*	*N/A*
		23.5 mm over 18.6 m to 20.4 m in 50° direction	*297.0 on November 17, 2014*			*N/A*	*N/A*	*N/A*

Drawings 32122-NC099-1 to 32122-NC099-3 in Appendix A provide sketches of the approximate location of the monitoring instrumentation for this site.

Table Nc099-1– Continued: Fall 2023 – Hwy 63:10 Hangingstone River Bridge Slope Inclinometer Instrumentation Reading Summary

Date Monitored: October 3, 2023

INSTRUMENT #	DATE REINITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AND DEPTH OF MOVEMENT TO DATE (mm)	MAXIMUM RATE OF MOVEMENT (mm/yr)	CURRENT STATUS	DATE OF PREVIOUS READING	INCREMENTAL MOVEMENT SINCE PREVIOUS READING (mm)	CURRENT RATE OF MOVEMENT (mm/yr)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
Hangingstone River Bridge - Southbound Lane								
N-SI-01	May 29, 2023	148.8 over 1.5 m to 22.3 m in 179° direction	1146.4 on July 22, 2021	Operational	May 29, 2023	No discernible movement	N/A	-19.9
N-SI-02	May 29, 2023	115.0 over 3.4 m to 22.3 m in 115° direction	886.7 on July 22, 2021	Operational	May 29, 2023	No discernible movement	N/A	-5.9
		47.3 over 11.3 to 13.1 m in 115° direction	377.6 on July 22, 2021			1.1	3.2	0.1
S-SI-01	May 29, 2023	90.4 over 2.1 m to 22.3 m in 4° direction	726.1 on July 15, 2021	Operational	May 29, 2023	6.5	18.6	9.7
S-SI-02	May 29, 2023	84.2 over 0.9 m to 22.3 m in 26° direction	1596.4 on June 22, 2021	Operational	May 29, 2023	1.0	2.9	4.4
		24.2 over 11.9 m to 13.1 m in 26° direction	138.44 on July 15, 2021			0.5	1.4	-7.9

Drawings 32122-NC099-1 to 32122-NC099-3 in Appendix A provide sketches of the approximate location of the monitoring instrumentation for this site.

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Table NC099-2: Fall 2023– Hwy 63:10 Hangingstone River Bridge Vibrating Wire Piezometer Instrumentation Reading Summary

Date Monitored: October 3, 2023

INSTRUMENT #	DATE INITIALIZED	TIP ELEV. (m)	GROUND ELEV. (m)	CURRENT STATUS	MAXIMUM GROUNDWATER ELEV. (m)	CURRENT GROUNDWATER ELEV. (m)	PREVIOUS GROUNDWATER ELEV. (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
Cut Slope – Northbound Lane								
PZ15-01 (31269)	March 4, 2015	512.86	533.27	Operational	516.71 on June 27, 2021	516.63	516.41	0.22
PZ15-02 (31268)	March 4, 2015	504.63	533.27	Operational	518.13 on March 16, 2015	515.75	515.55	0.20
PZ15-03 (31267)	March 4, 2015	514.10	533.99	Operational	519.34 on March 4, 2015	517.97	517.37	0.60
PZ15-04 (31266)	March 4, 2015	505.10	533.99	Operational	519.03 on March 4, 2015	516.15	515.95	0.20
PZ15-05 (31261)	March 4, 2015	514.19	524.62	Operational	516.83 on March 4, 2015	514.31	514.21	0.10
PZ15-06 (31260)	March 4, 2015	505.08	524.62	Operational	516.63 on March 4, 2015	508.79	508.72	0.07
PZ15-07 (31259)	March 4, 2015	517.88	528.88	Operational	520.20 on March 4, 2015	518.30	517.60	0.70
PZ15-08 (31258)	March 4, 2015	508.89	528.88	Operational	518.50 on March 4, 2015	516.20	515.67	0.53
PZ15-09 (31265)	March 4, 2015	514.32	516.62	Operational	516.37 on September 2, 2016	515.40	515.06	0.34

Drawings 32122-NC099-1 to 32122-NC099-3 in Appendix A provide sketches of the approximate location of the monitoring instrumentation for this site.

Table NC099-2– Continued: Fall 2023– Hwy 63:10 Hangingstone River Bridge Vibrating Wire Piezometer Instrumentation Reading Summary

Date Monitored: October 3, 2023

INSTRUMENT #	DATE INITIALIZED	TIP ELEV. (m)	GROUND ELEV. (m)	CURRENT STATUS	MAXIMUM GROUNDWATER ELEV. (m)	CURRENT GROUNDWATER ELEV. (m)	PREVIOUS GROUNDWATER ELEV. (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
Cut Slope – Northbound Lane– Continued								
PZ15-10 (31264)	March 4, 2015	505.33	516.62	Operational	513.62 on September 2, 2016	510.47	510.59	-0.12
PZ15-11 (31263)	March 4, 2015	516.88	520.83	Operational	519.40 on March 16, 2015	518.40	518.28	0.12
PZ15-12 (31262)	March 4, 2015	509.87	520.83	Operational	518.69 on March 16, 2015	517.25	517.03	0.22
Hangingstone River Bridge Abutments – Northbound Lane								
PZ14-01 (30106)	September 17, 2014	482.17	504.00	Operational	497.31 on November 8, 2014	495.38	495.38	0
PZ14-02 (30107)	September 17, 2014	487.17	504.00	Operational	497.65 on September 17, 2014	491.96	491.62	0.34
PZ14-03 (30109)	September 19, 2014	481.92	502.80	Operational	502.14 on November 11, 2014	495.16	495.19	-0.03
PZ14-04 (30108)	September 19, 2014	486.92	502.80	Operational	500.82 on November 11, 2014	494.14	494.19	-0.05

Drawings 32122-NC099-1 to 32122-NC099-3 in Appendix A provide sketches of the approximate location of the monitoring instrumentation for this site.

Table NC099-2– Continued: Fall 2023– Hwy 63:10 Hangingstone River Bridge Vibrating Wire Piezometer Instrumentation Reading Summary

Date Monitored: October 3, 2023

INSTRUMENT #	DATE INITIALIZED	TIP ELEV. (m)	GROUND ELEV. (m)	CURRENT STATUS	MAXIMUM GROUNDWATER ELEV. (m)	CURRENT GROUNDWATER ELEV. (m)	PREVIOUS GROUNDWATER ELEV. (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
Hangingstone River Bridge – Southbound Lane								
PZ133682	May 23, 2021	486.23	503.00	Operational	499.57 on July 21, 2021	498.96	498.90	0.06
PZ133647	May 23, 2021	482.23	503.00	Operational	489.80 on July 21, 2021	488.81	488.60	0.21
PZ133638	*May 21, 2021*	*487.25*	*501.80*	*Malfunctioning*	*502.14 on November 11, 2014*	*N/A*	*492.23 (Aug. 28, 2022)*	*N/A*
PZ133683	May 21, 2021	482.30	501.80	Operational	495.32 on July 13, 2021	493.45	493.49	-0.04

Drawings 32122-NC099-1 to 32122-NC099-3 in Appendix A provide sketches of the approximate location of the monitoring instrumentation for this site.

Table NC099-3: Fall 2023 – Hwy 63:10 Hangingstone River Bridge Settlement Gauge Instrumentation Reading Summary

Date Monitored: October 3, 2023

INSTRUMENT #	DATE INITIALIZED	CURRENT STATUS	CURRENT SETTLEMENT (mm)	PREVIOUS SETTLEMENT (mm)	CHANGE IN SETTLEMENT (mm) (1)
Hangingstone River Bridge Abutments – Northbound Lane					
SG14-01	September 17, 2014	Operational	-224.92	-215.84	9.08
SG14-02	September 19, 2014	Operational	-357.40	-351.88	5.52
Hangingstone River Bridge Abutments – Southbound Lane					
SG1421049	*May 23, 2021*	*Malfunctioning*	*N/A*	*151.43 (Oct. 5, 2023)*	*N/A*
SG1421034	May 21, 2021	Operational	-168.63	-164.19	4.44

Drawings 32122-NC099-1 to 32122-NC099-3 in Appendix A provide sketches of the approximate location of the monitoring instrumentation for this site.

(1) Negative (-) change in settlement indicates an upward movement (heave) of the ground surface and positive (+) change in settlement indicates a downward movement (settlement) of the ground surface.

3. INTERPRETATION OF MONITORING RESULTS

3.1. Northbound Lane Instruments

Slope inclinometers SI15-05 through SI15-08 have shown no discernible movement since initialization.

Slope inclinometer SI15-09 showed rates of movement of 8.3 mm/yr, 6.4 mm/yr and 2.2 mm/yr over 2.7 m to 4.0 m depth, 6.4 m to 7.6 m depth, and 10.1 m to 11.9 m depth, respectively, since the spring of 2023 readings. SI15-10 showed rates of movement of 1.0 mm/yr over 11.9 m to 13.1 m depth and 2.6 mm/yr over 16.2 m to 17.4 m depth since the spring of 2023 readings.

SI14-01, located in the pile wall of the bridge north approach fill, showed a rate of movement of 7.1 mm/yr over the length of the pile from 6.1 m to 30.5 m depth, corresponding to an incremental movement of 2.4 mm since the spring of 2023 readings. SI14-02, located in the pile wall of the bridge south approach fill, showed no discernible movement over the length of the pile from 5.5 m to 31.7 m depth. The rate of movement in SI14-02 decreased by 21.4 mm/yr since the spring of 2023 readings. The current pile head movements in SI14-01 and SI14-02 are 253.6 mm and 166.8 mm, respectively.

The groundwater levels increased in all vibrating wire piezometers installed within the cut slope except for PZ15-10, since the spring of 2023 readings. The increases in groundwater level ranged from 0.07 m in PZ15-06 to 0.60 m in PZ15-03. The groundwater level decreased in PZ15-10 by 0.12 m since the spring of 2023 readings.

PZ14-01 and PZ14-02, installed in the north approach fill, showed no change in groundwater level and an increase in groundwater level of 0.34 m, respectively, since the spring of 2023 readings. PZ14-03 and PZ14-04, installed in the south approach fill, showed decreases in groundwater level of 0.03 m and 0.05 m, respectively, since the spring of 2023 readings. The vibrating wire piezometer readings are summarized in Table NC099-2.

SG14-01 and SG14-02 showed increases in ground settlement of 9.08 mm and 5.52 mm, respectively, since the spring of 2023 readings. The settlement gauge readings are summarized in Table NC099-3.

The vibrating wire piezometer and settlement gauge reading plots are included in Appendix A.

3.2. Southbound Lane Instruments

Slope inclinometer N-SI-01, located in the pile wall of the bridge north approach fill, showed no discernible movement since the spring of 2023 readings. Slope inclinometer N-SI-02, installed through the north abutment fill into the underlying bedrock, showed no discernible movement over 3.4 m to 22.3 m depth since the spring of 2023 readings. Slope inclinometer N-SI-02 showed a rate of movement of 3.2 mm/yr over 11.3 m to 13.1 m depth since the spring of 2023 readings.

Slope inclinometer S-SI-01, located in the pile wall of the bridge south approach fill, showed a rate of movement of 18.6 mm/yr over 2.1 m to 22.3 m depth, corresponding to an increase in the rate of movement of 9.7 mm/yr since the spring of 2023 readings. Slope inclinometer S-SI-02, installed through the south abutment fill and into the underlying bedrock, showed a rate of movement of 2.9 mm/yr over 0.9 m to 22.3 m depth since the spring of 2023 readings. Slope inclinometer S-SI-02 also showed a rate of movement of 1.4 mm/yr over 11.9 m to 13.1 m depth since the spring of 2023 readings.

The current pile head movements in N-SI-01 and S-SI-01 are 148.8 mm and 90.4 mm, respectively.

PZ133682 and PZ1333647 showed increases in groundwater level of 0.06 m and 0.21 m, respectively, since the spring of 2023 readings. PZ133683 showed a decrease in groundwater level of 0.04 m since the spring of 2023 readings. The vibrating wire piezometer readings are summarized in Table NC099-2.

SG1421034, installed below the south abutment fill, showed an increase in ground settlement of 4.44 mm since the spring of 2023 readings. The settlement gauge readings are summarized in Table NC099-3.

The vibrating wire piezometer and settlement gauge reading plots are included in Appendix A.

4. RECOMMENDATIONS

4.1. Future Work

The instruments should be read again in the spring of 2024.

The instrumentation data should be compared to the design criteria to confirm that the bridges are performing as intended.

4.2 Instrumentation Repairs

No instrument repairs are required at this time.

5. CLOSURE

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

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE: _____
RM APEGA ID #: 91085
DATE: October 30, 2023
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Lucas Green, P.Eng.
Geotechnical Engineer
/ak

Attachments:

- Statement of Limitations and Conditions
- Appendix A
  - Field Inspector's reports
  - Site Plans Showing Approximate Instrument Locations (Drawing No. 32122-NC099-1 to 32122-NC099-3)
  - SI Reading Plots
  - Piezometric and Settlement Cell Reading Plots

THURBER ENGINEERING LTD.

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

FALL 2023

APPENDIX A
DATA PRESENTATION AND SITE PLANS

SITE NC099: HWY 63:10 HANGINGSTONE RIVER BRIDGE

ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
NORTH CENTRAL REGION - ATHABASCA AND FORT McMURRAY DISTRICTS
INSTRUMENTATION MONITORING FIELD SUMMARY (NC099)
FALL 2023

Location:	Hwy 63:10 over Hangingstone River (BF75907)	**Readout:**	RST VW 2106 Unit 3
File Number:	32122	**Casing Diameter**	2.75"/3.34"
Probe:	RST set 8 and 5	**Temp (deg C):**	15
Cable:	RST set 8 and 5	**Read by:**	NKR/NRM

SLOPE INCLINOMETER (SI) READINGS

SI#	GPS Location UTM 12 V		Date	Stickup (m)	Depth from top of Casing (ft)	Azimuth of A+ Groove	Current Bottom Depth Readings				Probe/ Reel #	Remarks
	Northing	Easting					A+	A-	B+	B-		
SI14-01	6252664	476931	03-Oct-23	1.27	99 to 5	222	-69	85	225	-220	5R/5R	Casing Size 2.75"
SI14-02	6252634	476895	03-Oct-23	1.28	103 to 3	60	75	-61	294	-291	5R/5R	Casing Size 2.75"
SI15-05	6252255	476637	03-Oct-23	0.52	118 to 4	308	-611	621	22	-49	5R/5R	Casing Size 3.34"
SI15-06	6252220	476535	03-Oct-23	0.61	118 to 2	308	-533	552	125	-120	8R/8R	Casing Size 3.34"
SI15-07	6252299	476609	03-Oct-23	0.48	88 to 4	318	-213	223	244	-269	5R/5R	Casing Size 3.34"
SI15-08	6252246	476520	03-Oct-23	0.47	88 to 2	306	-306	326	44	44	8R/8R	Casing Size 3.34"
SI15-09	6252336	476583	03-Oct-23	0.52	58 to 4	295	-326	336	44	-70	5R/5R	Casing Size 3.34"
SI15-10	6252283	476495	03-Oct-23	0.55	58 to 2	304	-265	282	445	-442	8R/8R	Casing Size 3.34"

VIBRATING WIRE PIEZOMETER (VW) READINGS

VW#	Date	Reading		Identification	Monitoring	Datalogger	UTM 12 V		Comment
		B Unit	Temp.	Number	Station	Serial	Northing	Easting	
PZ14-01	03-Oct-23	7882.5	4.5	30106	MS-01	3906	6252624	476955	Manual Reading
PZ14-02	03-Oct-23	8523.2	4.9	30107	MS-01	3906	6252624	476955	Manual Reading
PZ14-03	03-Oct-23	7723.1	4.7	30108	MS-02	3905	6252660	476918	Manual Reading
PZ14-04	03-Oct-23	8207.6	4.9	30109	MS-02	3905	6255572	-23127	Manual Reading
PZ15-01	03-Oct-23	8631	4.4	31269	-	-	6252255	476637	Attached to SI15-05
PZ15-02	03-Oct-23	8059	4.1	31268	-	-	6252255	476637	Attached to SI15-05
PZ15-03	03-Oct-23	8597.1	3.8	31267	-	-	6252220	476535	Attached to SI15-06
PZ15-04	03-Oct-23	8065.3	3.8	31266	-	-	6252220	476535	Attached to SI15-06
PZ15-05	03-Oct-23	8903.2	4	31261	-	-	6252299	476609	Attached to SI15-07
PZ15-06	03-Oct-23	8672.6	4.2	31260	-	-	6252299	476609	Attached to SI15-07
PZ15-07	03-Oct-23	8844	4	31259	-	-	6252246	476520	Attached to SI15-08
PZ15-08	03-Oct-23	8378	3.7	31258	-	-	6252246	476520	Attached to SI15-08
PZ15-09	03-Oct-23	8898.9	7.7	31265	-	-	6252336	476583	Attached to SI15-09
PZ15-10	03-Oct-23	8563.4	3.9	31264	-	-	6252336	476583	Attached to SI15-09
PZ15-11	03-Oct-23	8901.3	8.8	31263	-	-	6252283	476495	Attached to SI15-10
PZ15-12	03-Oct-23	8280.5	4.2	31262	-	-	6252283	476495	Attached to SI15-10

SETTLEMENT CELL READINGS

SC#	Date	Reading		Identification	Monitoring	Datalogger	3TM EBA Scaled		Comment
		B Unit	Temp.	Number	Station	Serial	Northing	Easting	
SG14-01	03-Oct-23	5473.6	4.1	1428194	MS-01	3906	6255616	-23070	Manual Reading
SG14-02	03-Oct-23	6162.4	4.1	1428195	MS-02	3905	6255572	-23127	Manual Reading

INSPECTOR REPORT

MS-01 and MS-02 take manual readings

ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
NORTH CENTRAL REGION - ATHABASCA AND FORT McMURRAY DISTRICTS
INSTRUMENTATION MONITORING FIELD SUMMARY (NC099)
FALL 2023

Location:	Hwy 63:10 over Hangingstone River (BF75907) - South Bridge	**Readout:**	
File Number:	32122	**Casing Diameter**	2.75"/3.34"
Probe:	RST Set 8R	**Temp (deg C):**	15
Cable:	RST Set 8R	**Read by:**	NKR/NRM

SLOPE INCLINOMETER (SI) READINGS

SI#	GPS Location UTM 12 V		Date	Stickup (m)	Depth from top of Casing (ft)	Azimuth of A+ Groove	Current Bottom Depth Readings				Probe/ Reel #	Remarks
	Northing	Easting					A+	A-	B+	B-		
N-SI-01	6252711	476897	03-Oct-23	0.96	98 to 2	143	-620	638	-333	333	8R	
N-SI-02	6252718	476901	03-Oct-23	0.92	112 to 2	103	25	-6	-209	211	8R	
S-SI-01	6252692	476862	03-Oct-23	0.63	98 to 2	10	98	-82	-212	212	8R	
S-SI-02	6252681	476858	03-Oct-23	1.2	108 to 2	32	-440	452	-117	117	8R	

VIBRATING WIRE PIEZOMETER (VW) READINGS

VW#	Date	Reading		Identification	Monitoring	Datalogger	UTM 12 V		Comment
		B Unit	Temp.	Number	Station	Serial	Northing	Easting	
PZ133682	03-Oct-23	-	-	-	North	-	6252758	476875	Downloaded
PZ133647	03-Oct-23	-	-	-	North	-	6252758	476875	"
PZ133683	03-Oct-23	-	-	-	South	-	6252716	476828	"

SETTLEMENT CELL READINGS

SC#	Date	Reading		Identification	Monitoring	Datalogger	3TM EBA Scaled		Comment
		B Unit	Temp.	Number	Station	Serial	Northing	Easting	
SG1421034	03-Oct-23	-	-	-	South	DT2055 12463	6252716	476828	MS-2, Downloaded

INSPECTOR REPORT

- Measure stickups, azimuths and coordiantes for SIs, coordinates for datalogger stations.

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\CAD\32122 INSTRUMENT 2023\32122-NC099-1.dwg - Layout1 - Jun. 22, 2023

NE32 85-9-4
C. OF T. 022 042 732+1

THEORETICAL
4 SECTION LINE

CONSTRUCTION LIMIT
(CREST)

SI15-05
PZ15-01
PZ15-02

SI15-06
PZ15-03
PZ15-04

SI15-07
PZ15-05
PZ15-06

SI15-08
PZ15-07
PZ15-08

BENCH 2

SI15-09
PZ15-09
PZ15-10

SI15-10
PZ15-11
PZ15-12

BENCH 1

DITCH

64+000

HWY 63

63+900

63+800

DITCH

EDGE OF ROAD

63+900 CUT SLOPE

LEGEND

VIBRATING WIRE PIEZOMETERS
INCLINOMETER

0 10 20 30 40 50 60m
SCALE 1:1000

BASE PLAN PROVIDED BY TETRA TECH

Alberta

NORTH CENTRAL
(ATHABASCA AND FORT MCMURRAY DISTRICTS)
NC099: HWY 63:08 HANGINGSTONE RIVER BRIDGE
STA. 63+900 CUT SLOPE
SITE PLAN SHOWING APPROXIMATE
INSTRUMENT LOCATIONS (NORTHBOUND LANE)
DWG No. 32122-NC099-1

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

THURBER ENGINEERING LTD.

NW33 85-9-4
CROWN UNTITLED

CONSTRUCTION LIMIT

(NOT FUNCTIONING)
MS14-01

(NOT FUNCTIONING)
MS14-02

(SHEARED AT 18.9m)
SI14-03

(SHEARED AT 15.8m)
SI14-04

PZ14-01
PZ14-02
PZ14-03
PZ14-04

SG14-01
SG14-02
SI14-01
SI14-02

℄ RIVER

CHN EQN
264+300.000 AHEAD
=64+298.492 BACK

64+200

ST 64+178.577

264+400

264+600

PILE WALL

N1 N5 N10 N15 N20
S1 S5 S10 S15 S20 S25

5.0

NBL
HWY 63

HWY 63 (PROP SBL)

64+350 HANGINGSTONE RIVER BRIDGE ABUTMENTS

LEGEND

- VIBRATING WIRE PIEZOMETERS
- INCLINOMETER
- SETTLEMENT GAUGE
- MONITORING STATION

NOTE:
DRAWING DOES NOT SHOW FINAL ALIGNMENT AND HIGHWAY BRIDGE FOR FOR SOUTHBOUND LANE, CONSTRUCTED 2022

0 10 20 30 40 50 60m
SCALE 1:1000

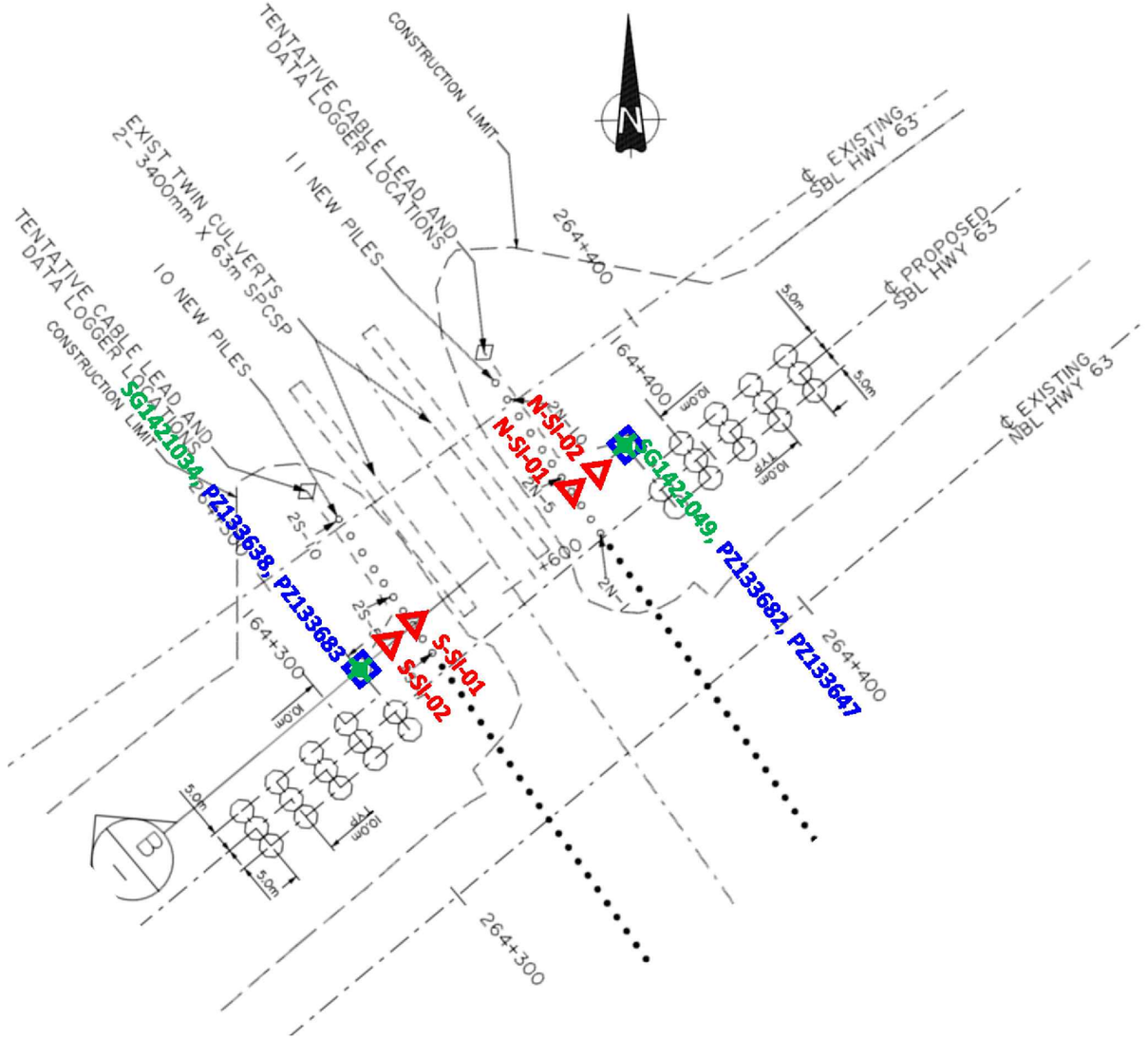
BASE PLAN PROVIDED BY TETRA TECH

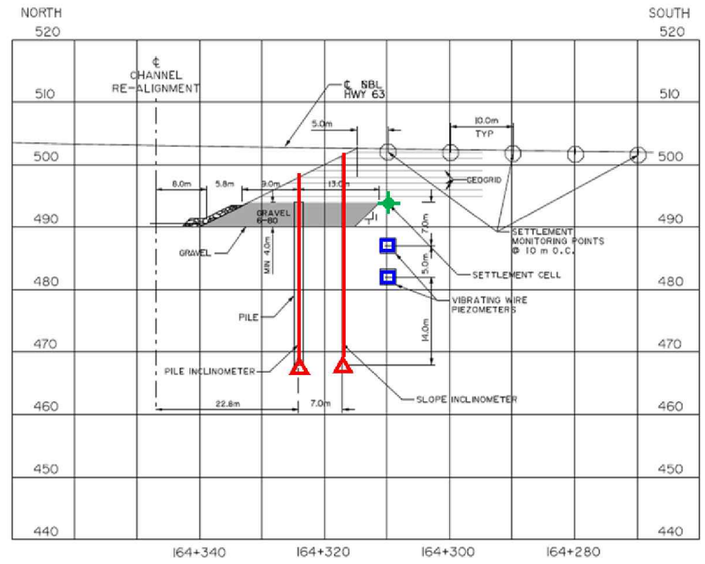
Alberta

NORTH CENTRAL
(ATHABASCA AND FORT MCMURRAY DISTRICTS)
NC099: HWY 63:08 HANGINGSTONE RIVER BRIDGE
STA. 64+350 ABUTMENTS
SITE PLAN SHOWING APPROXIMATE INSTRUMENT LOCATIONS (NORTHBOUND LANE)
DWG No. 32122-NC099-2

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

THURBER ENGINEERING LTD.





SECTION 'B'
SCALE 1:500
SEE DWG# 44746-P FOR PILE WALL DRAWING

LEGEND
- VIBRATING WIRE PIEZOMETERS
- INCLINOMETER
- SETTLEMENT MONITORING POINT
- SETTLEMENT CELL
- DATA LOGGER
- CABLE LEAD

0 10 20 30 40 50 60 70 m
SCALE 1:1250

BASE PLAN PROVIDED BY TETRA TECH

Alberta

NORTH CENTRAL
(ATHABASCA AND FORT MCMURRAY DISTRICTS)
NC099: HWY 63:08 HANGINGSTONE RIVER BRIDGE

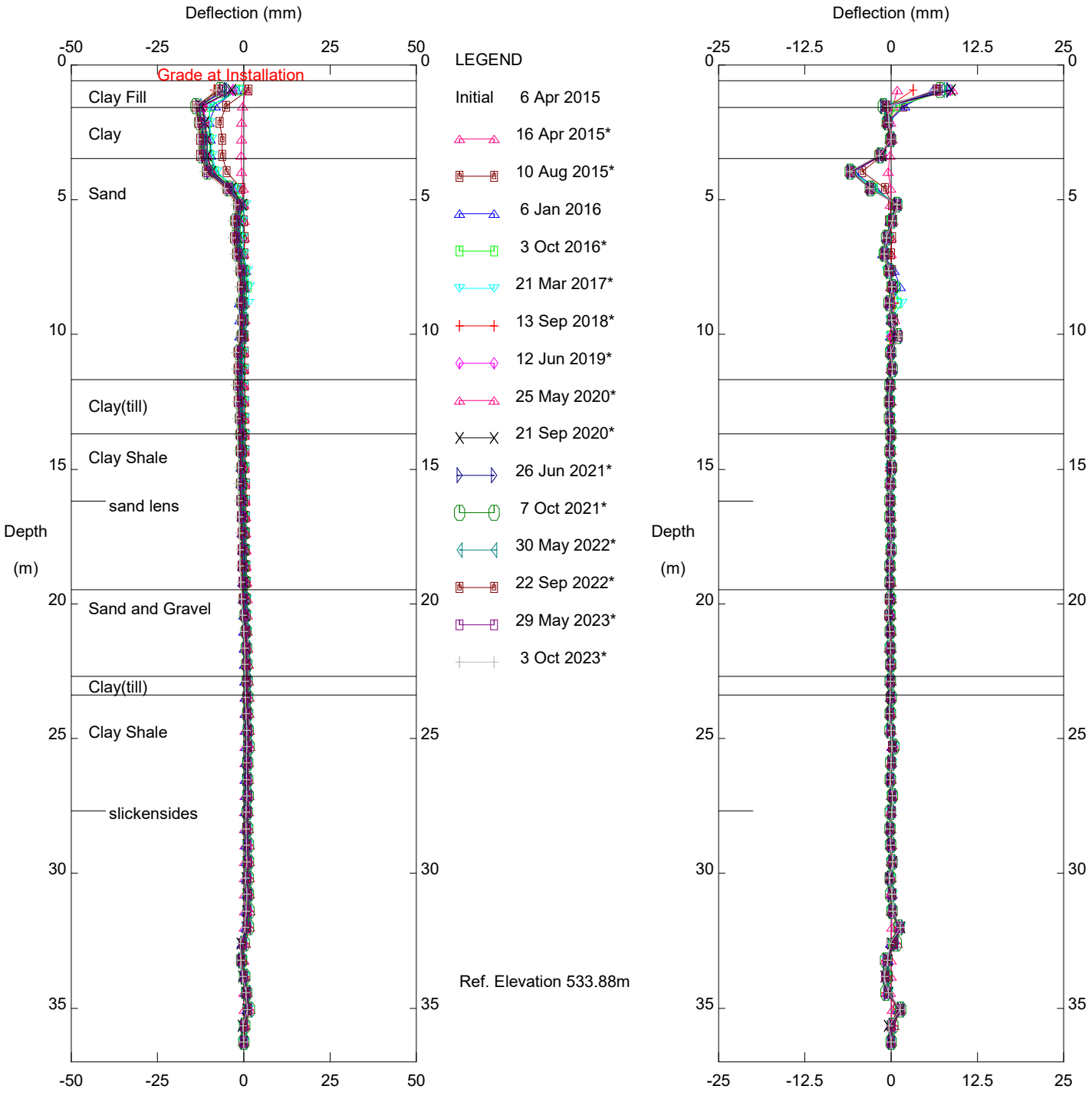
SITE PLAN SHOWING APPROXIMATE INSTRUMENT LOCATIONS (SOUTHBOUND LANE)

DWG No. 32122-NC099-3

DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	TSA
SCALE	1:1250
DATE	JUNE 2023
FILE No.	32122

THURBER ENGINEERING LTD.

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

NC099 Cut Slope - Crest, Inclinometer 15-05

Alberta Transportation

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

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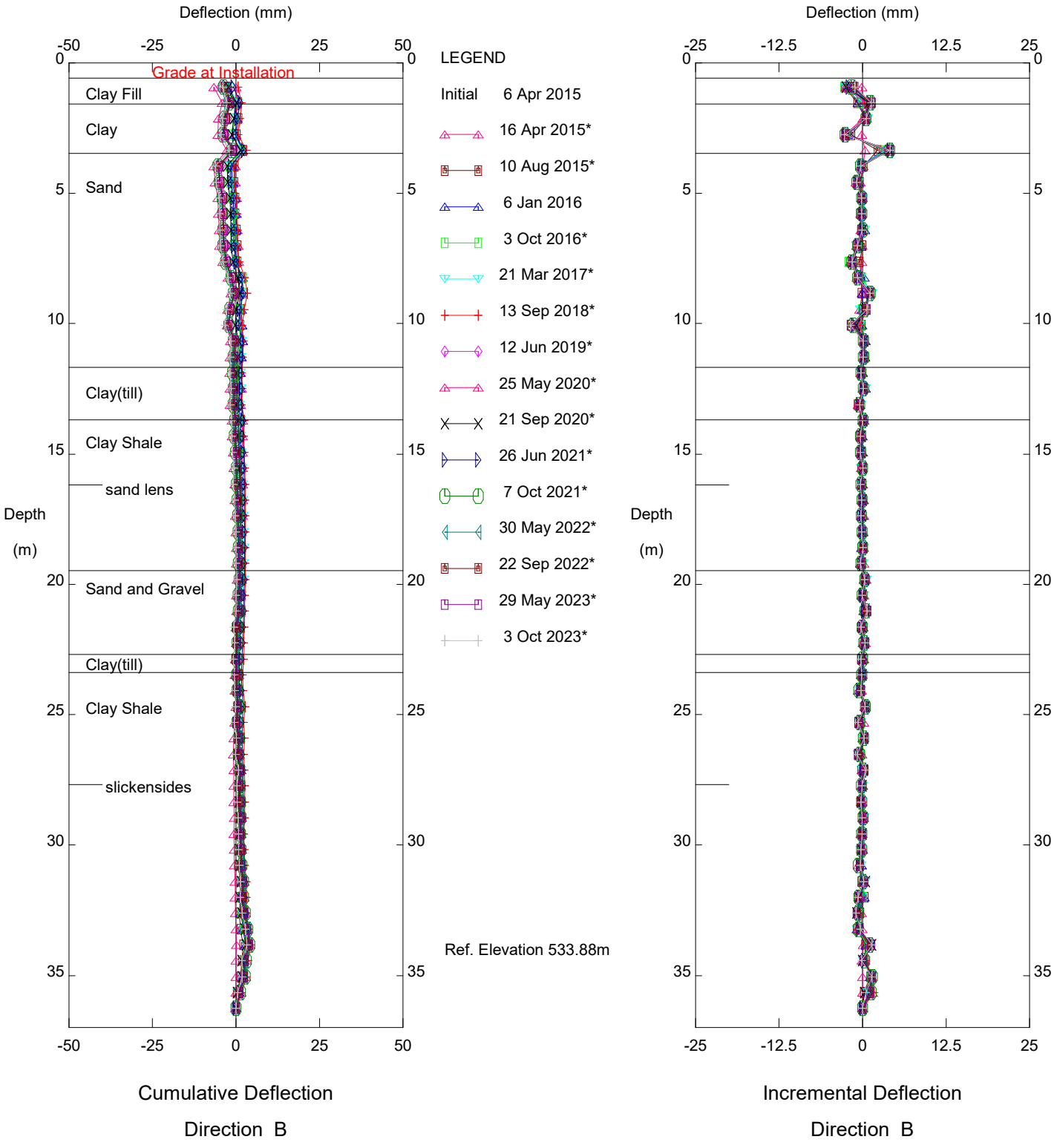
Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

Direction B

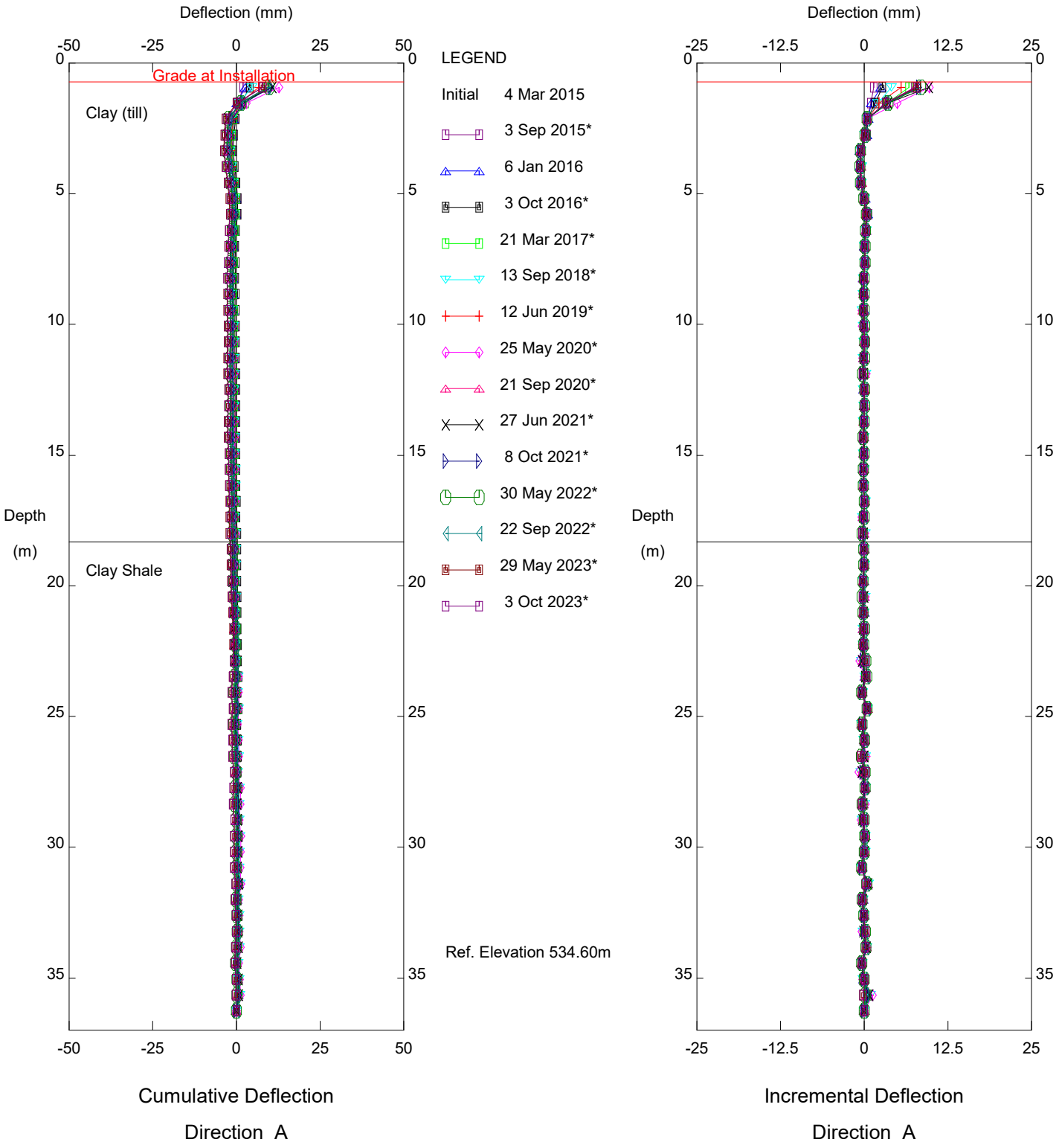
NC099 Cut Slope - Crest, Inclinometer 15-05

Alberta Transportation

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

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2023B-Fall\SI Readings\NC99\15-05.gtl

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

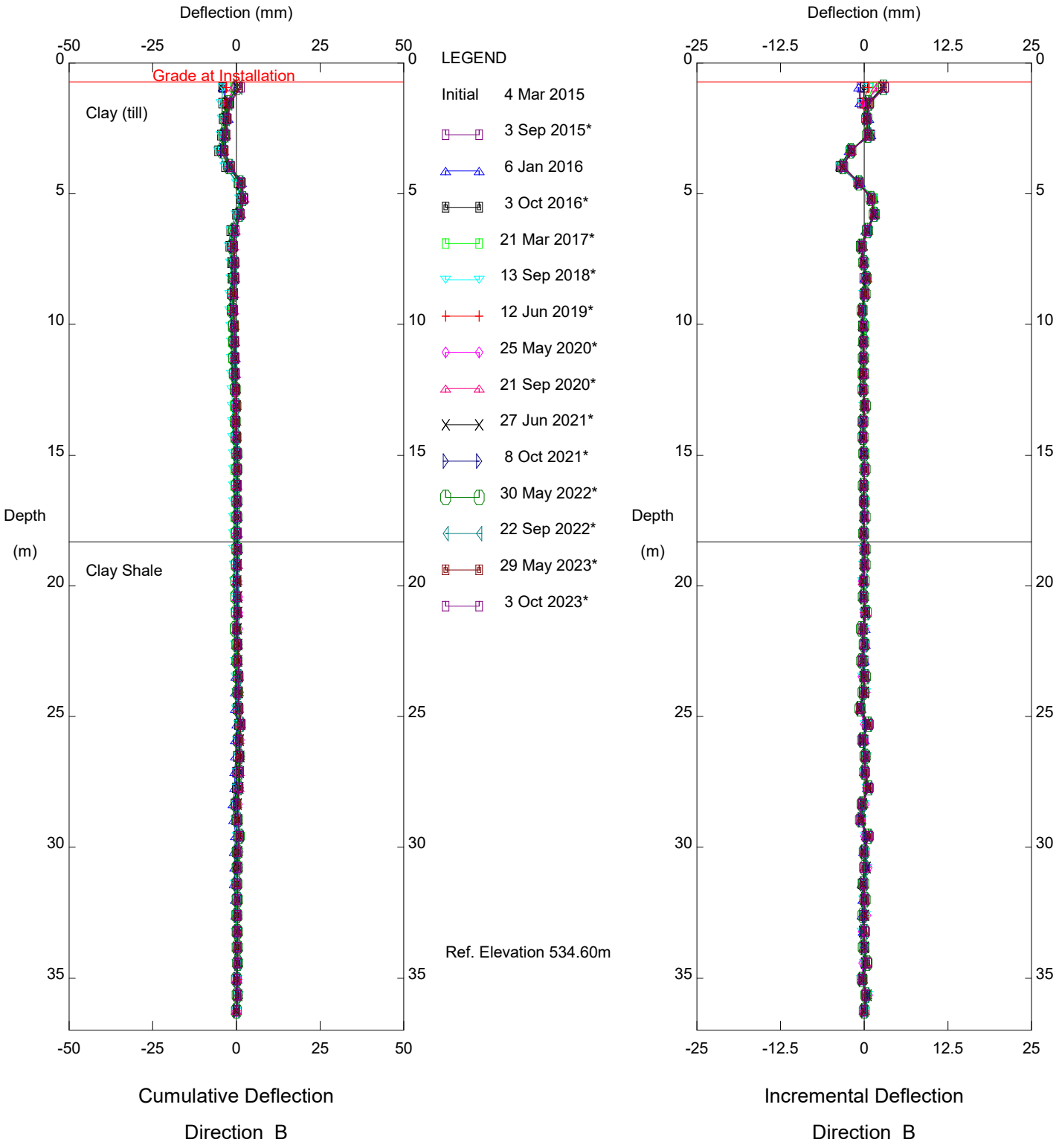
NC099 Cut Slope - Crest, Inclinometer 15-06

Alberta Transportation

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

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2023B-Fall\SI Readings\NC99\15-06.gtl

Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

Direction B

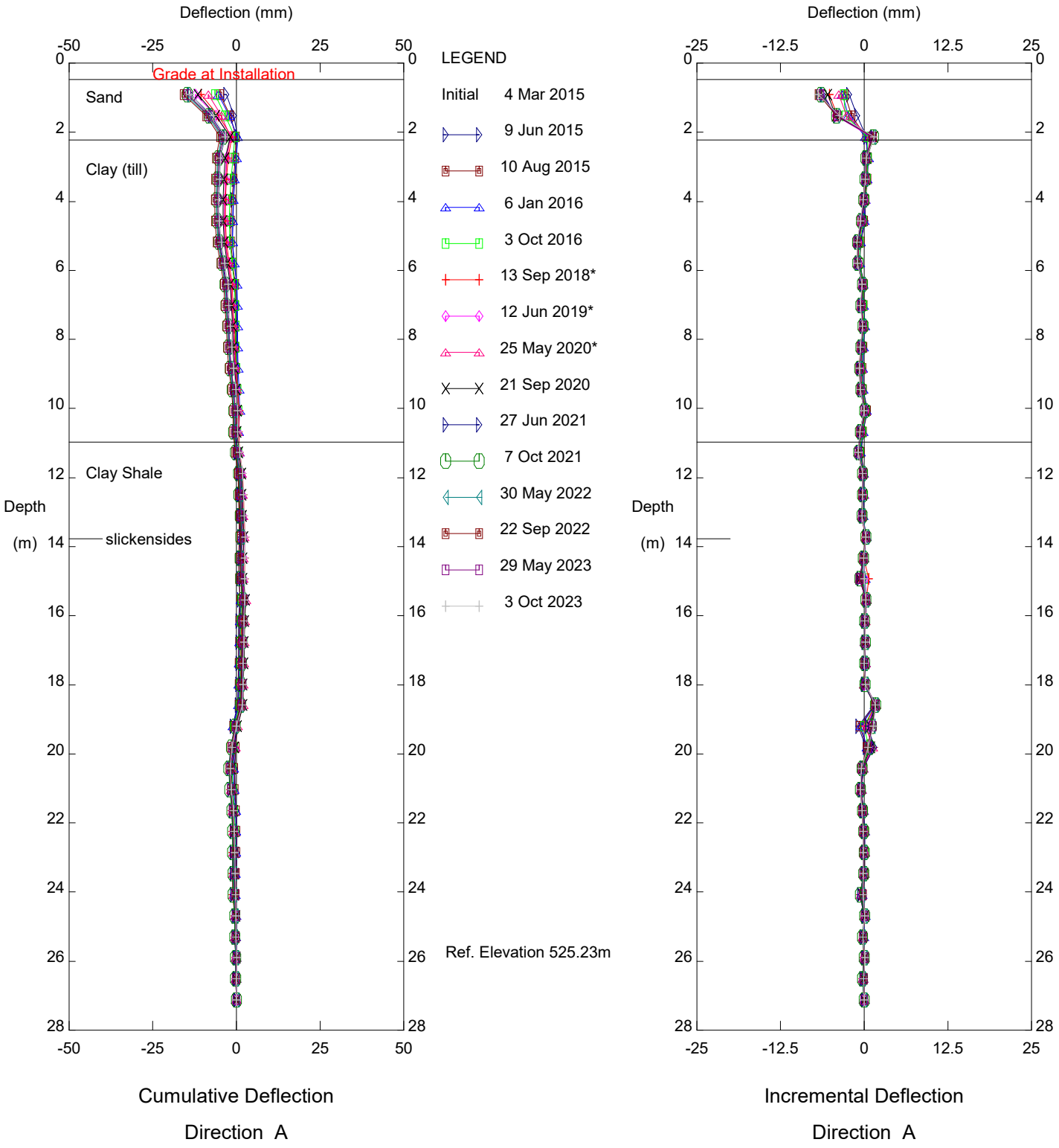
NC099 Cut Slope - Crest, Inclinometer 15-06

Alberta Transportation

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

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2023B-Fall\SI Readings\NC99\15-06.gtl

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

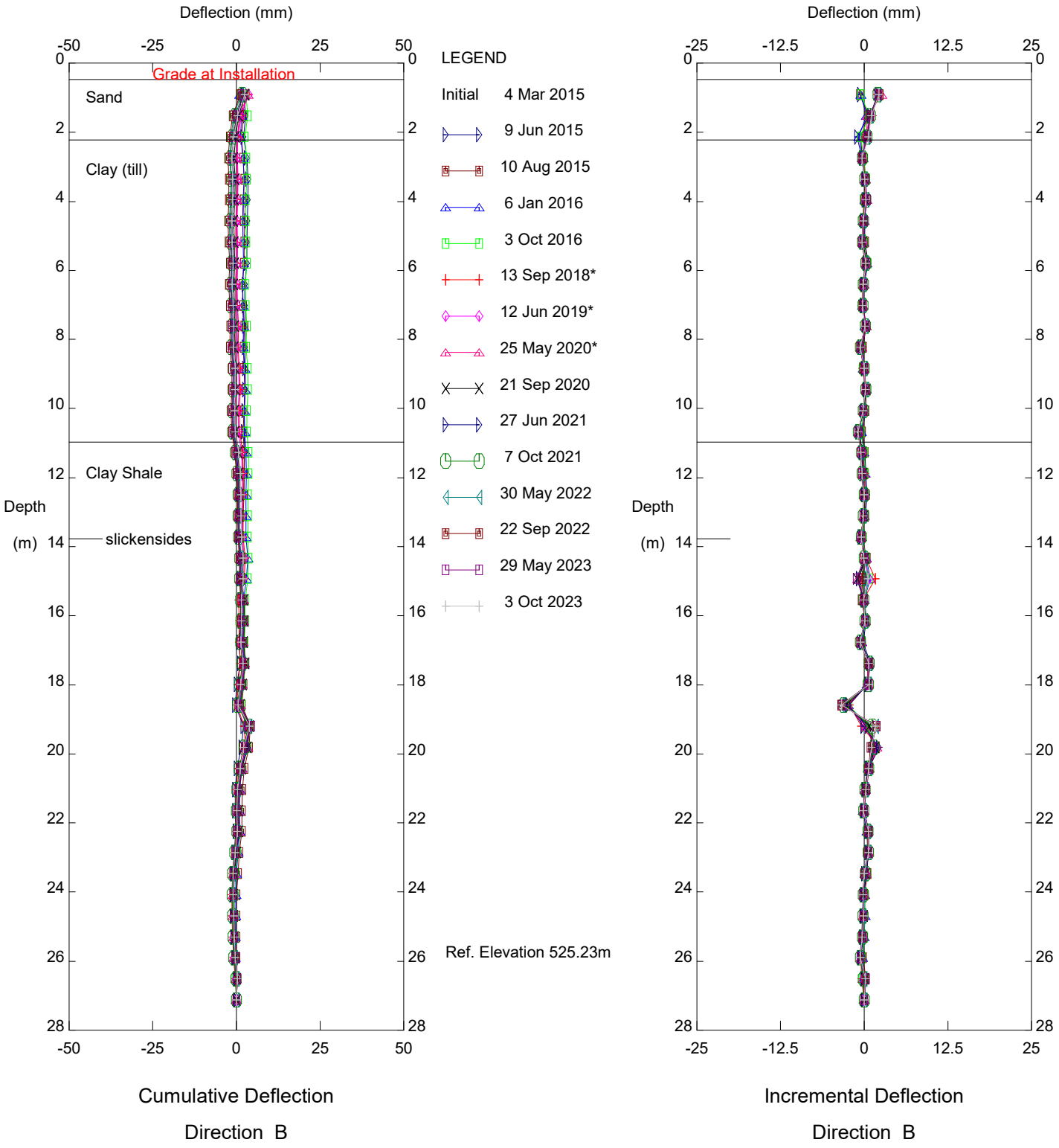
NC099 Cut Slope - Bench 2, Inclinometer 15-07

Alberta Transportation

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

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2023B-Fall\SI Readings\NC99\15-07.gtl

Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

Direction B

NC099 Cut Slope - Bench 2, Inclinometer 15-07

Alberta Transportation

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

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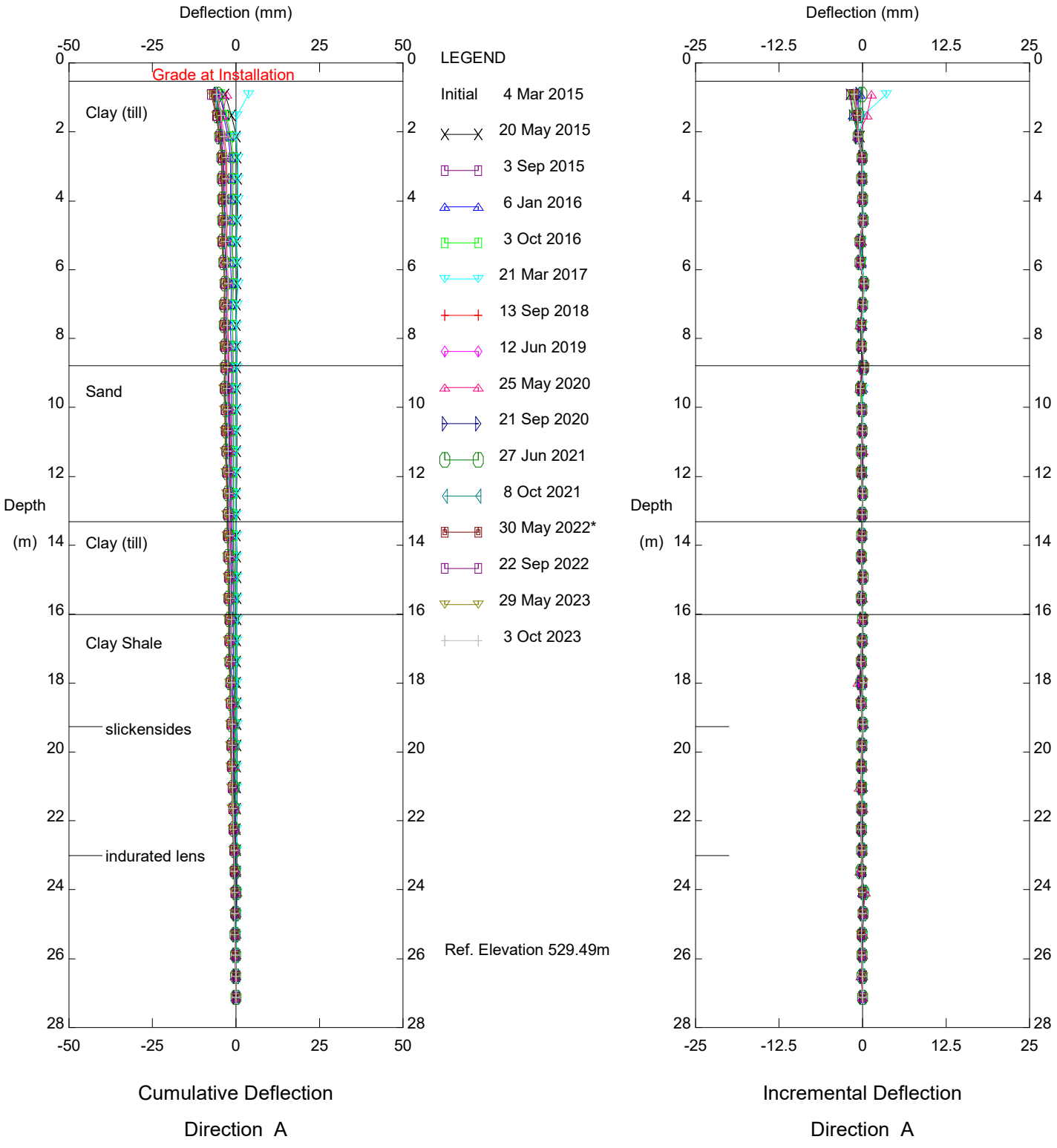

Cumulative Deflection

Direction A

Incremental Deflection

Direction A

NC099 Cut Slope - Bench 2, Inclinometer 15-08

Alberta Transportation

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

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2023B-Fall\SI Readings\NC99\15-08.gtl

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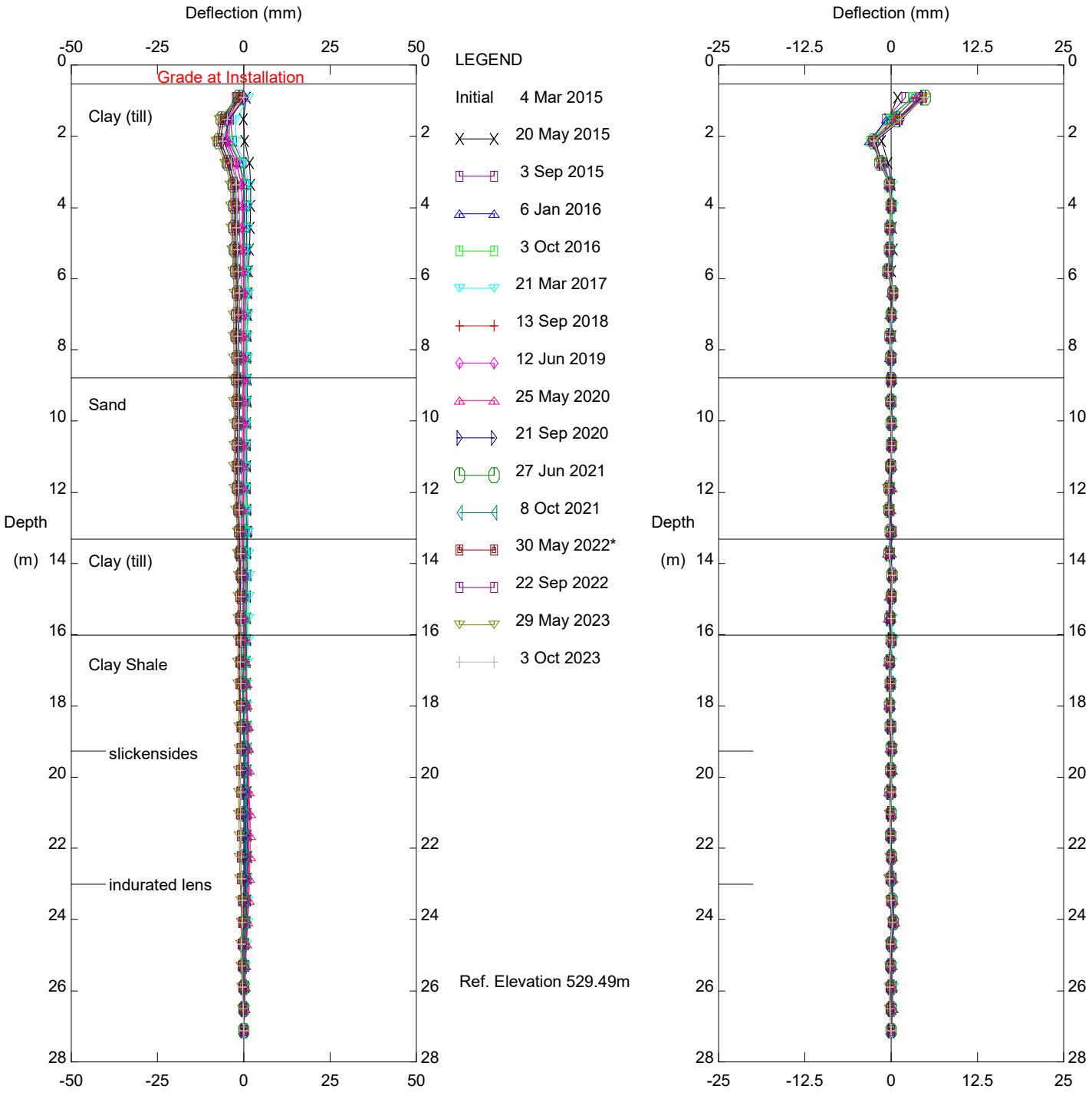

Cumulative Deflection

Direction B

Incremental Deflection

Direction B

NC099 Cut Slope - Bench 2, Inclinometer 15-08

Alberta Transportation

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

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2023B-Fall\SI Readings\NC99\15-08.gtl

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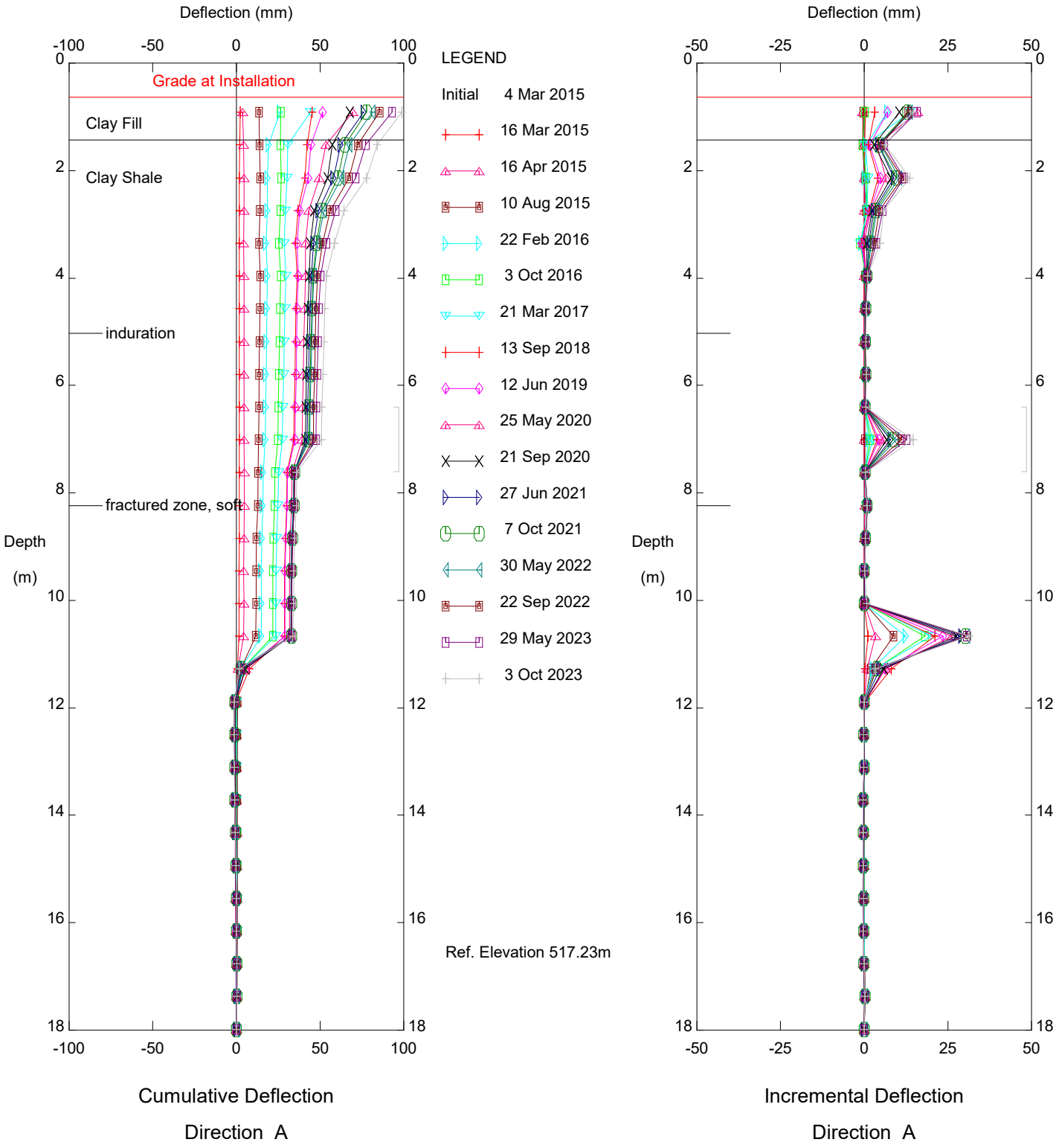

Cumulative Deflection

Direction A

Incremental Deflection

Direction A

NC099 Cut Slope - Bench 1, Inclinometer 15-09

Alberta Transportation

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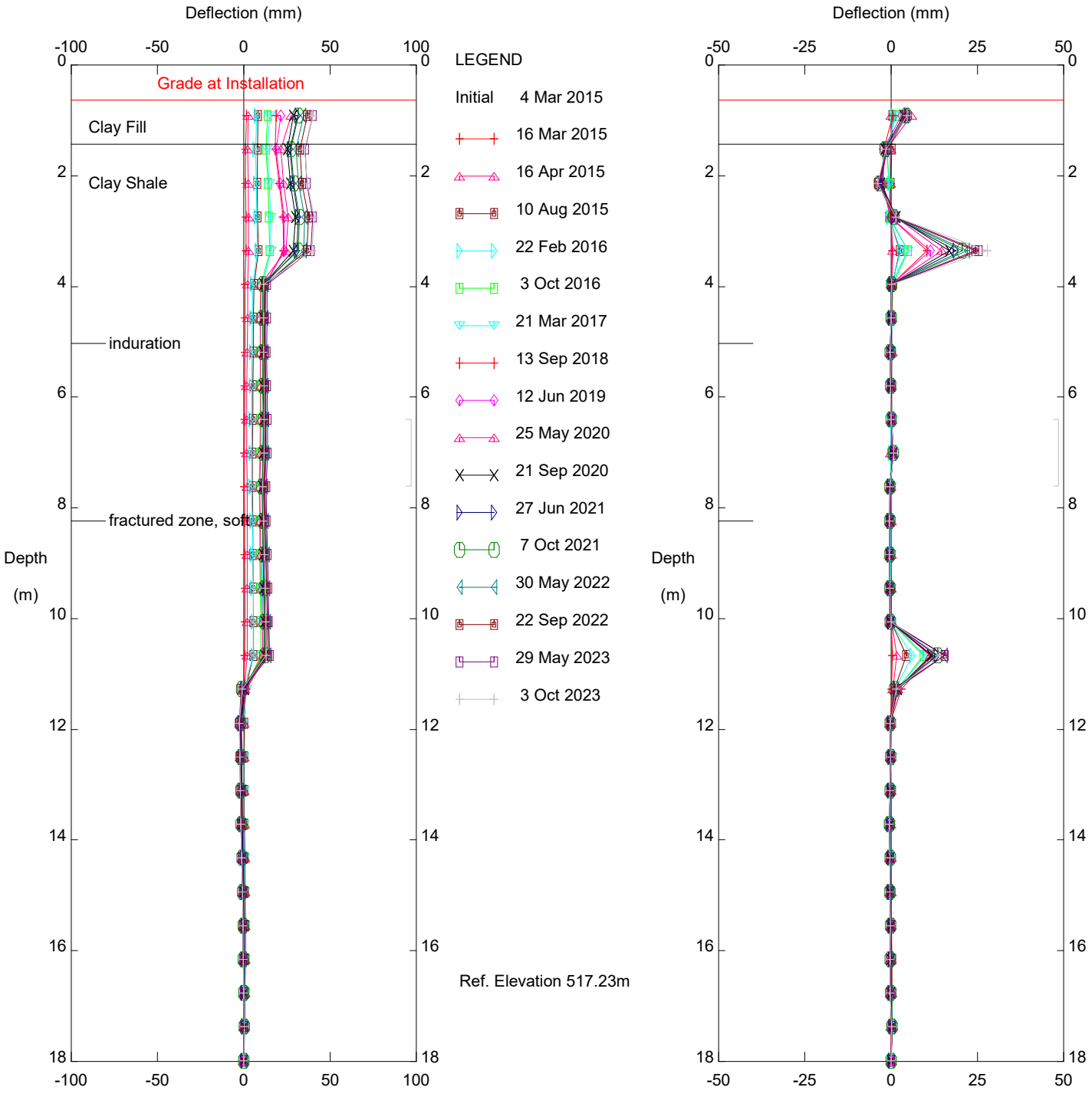

Cumulative Deflection

Direction B

Incremental Deflection

Direction B

NC099 Cut Slope - Bench 1, Inclinometer 15-09

Alberta Transportation

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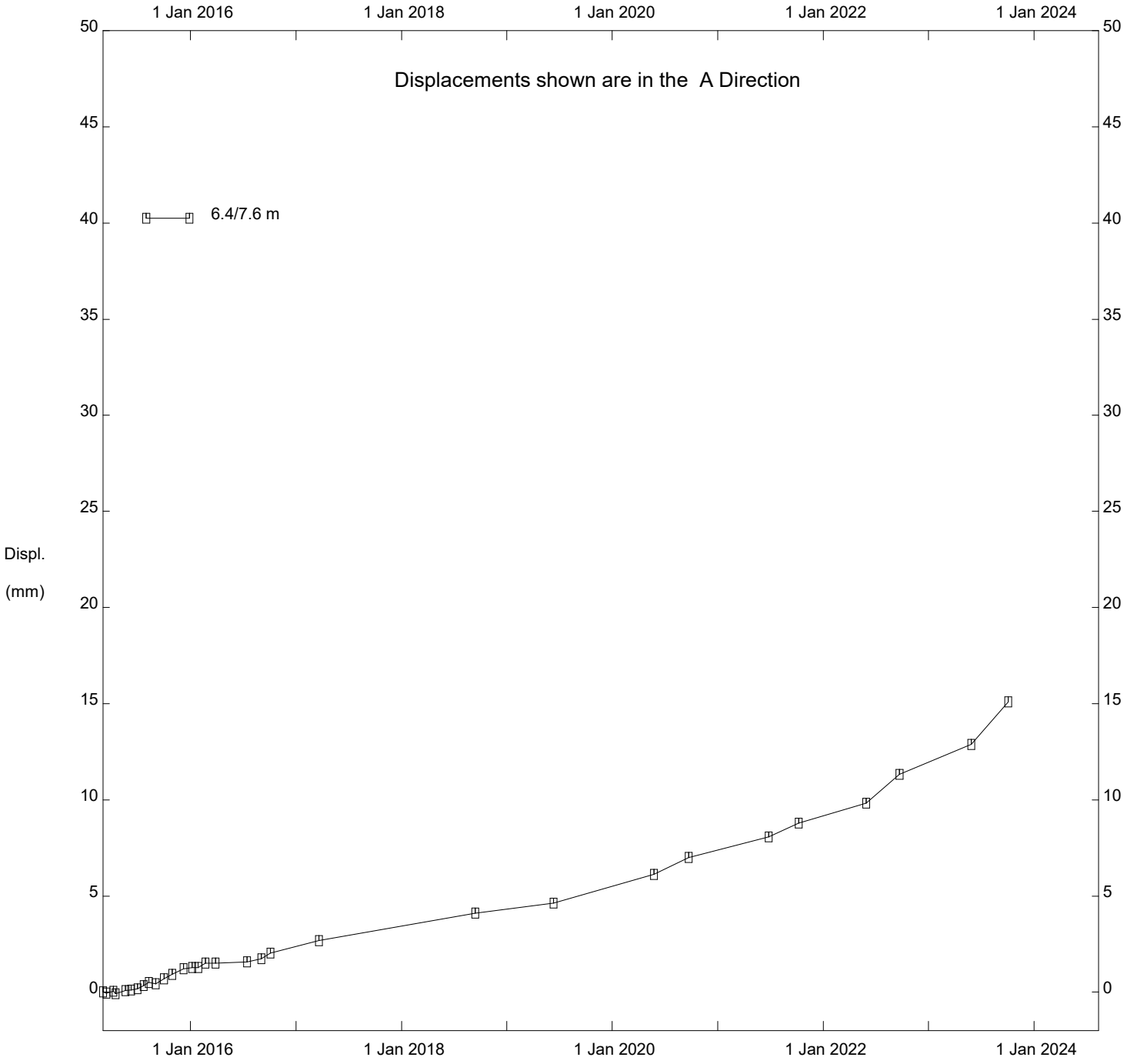
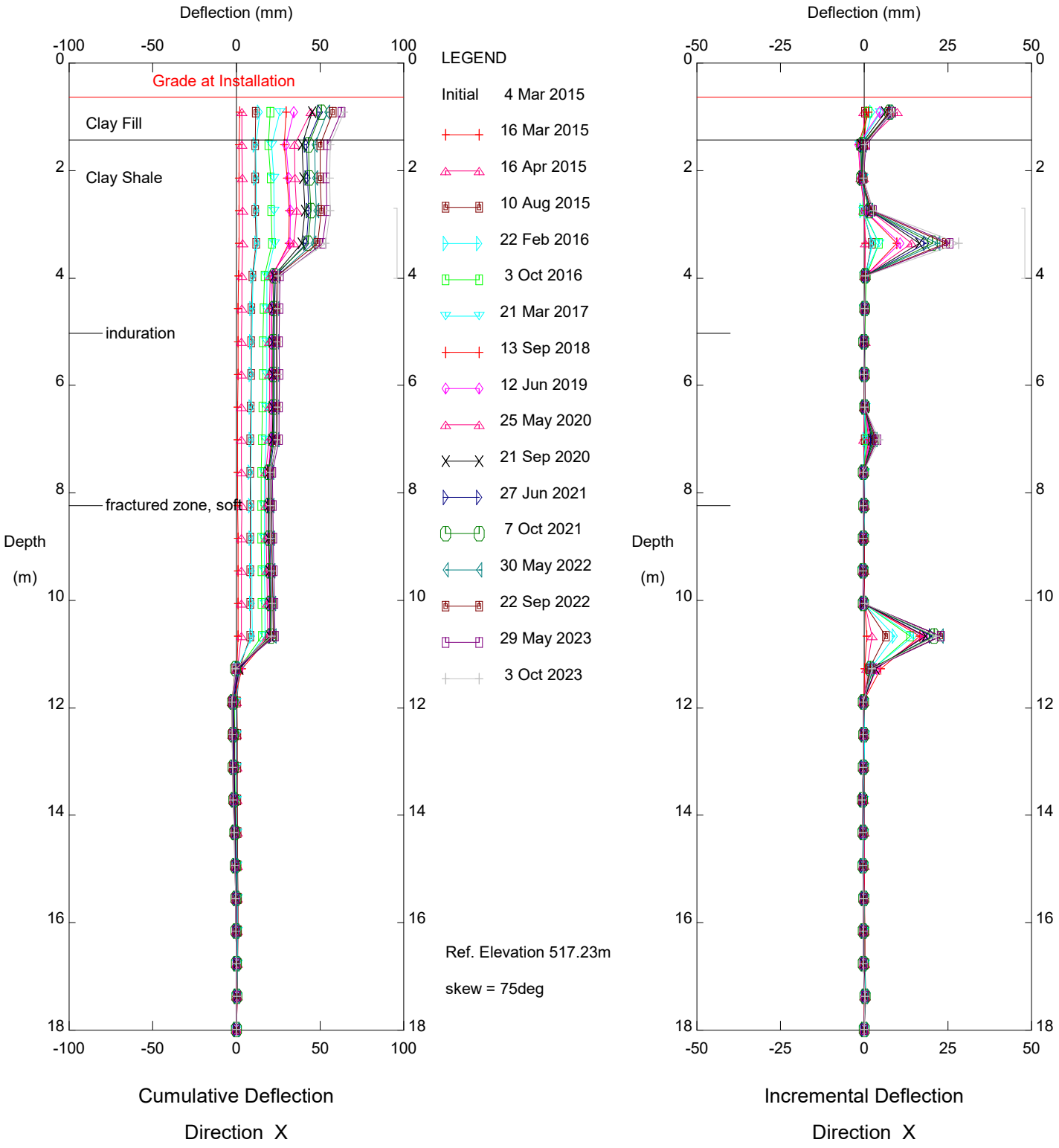


NC099 Cut Slope - Bench 1, Inclinometer 15-09

Alberta Transportation

Thurber Engineering Ltd.



Cumulative Deflection

Direction X

Incremental Deflection

Direction X

NC099 Cut Slope - Bench 1, Inclinometer 15-09

Alberta Transportation

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2023B-Fall\SI Readings\NC99\15-09.gtl

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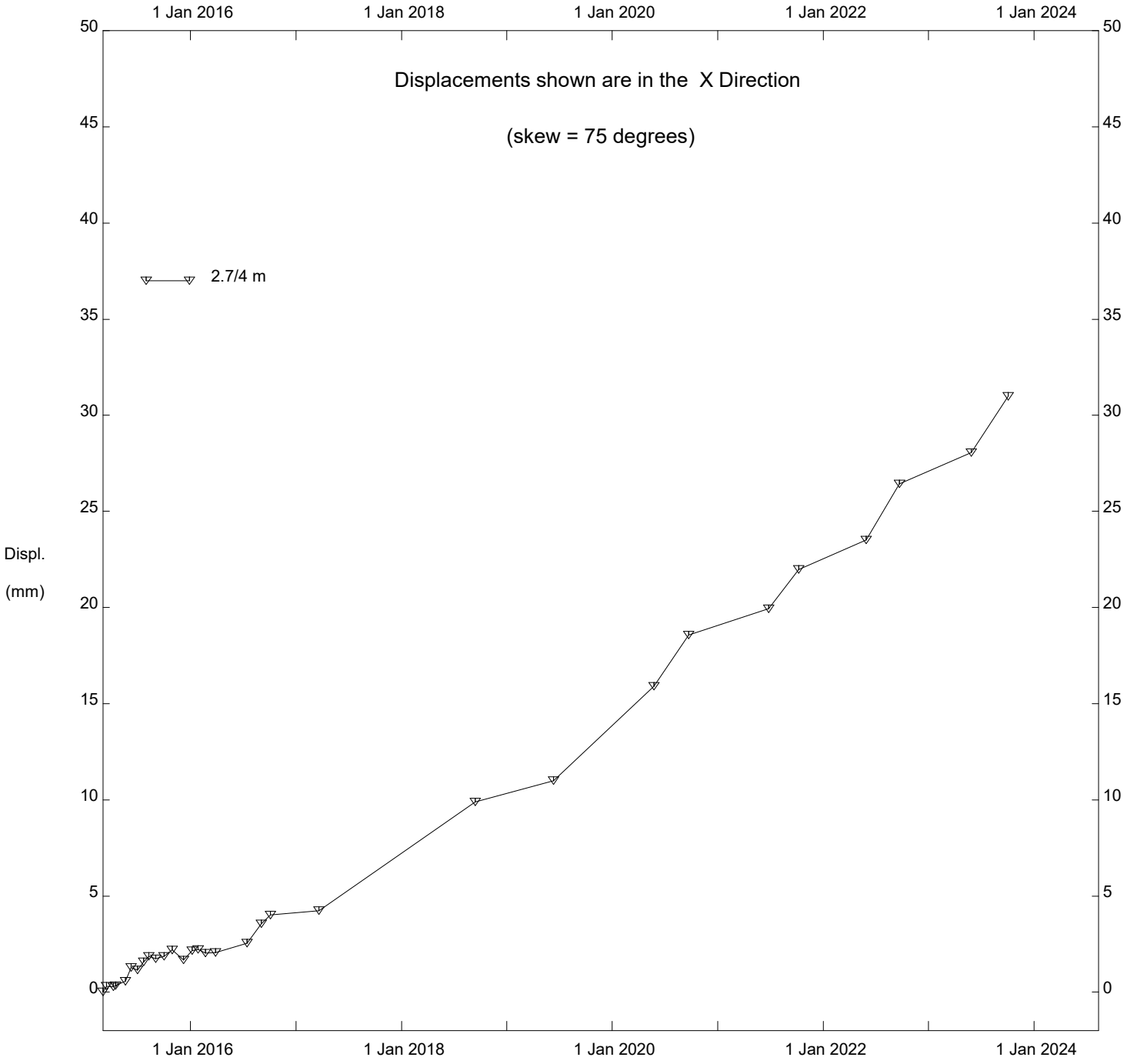
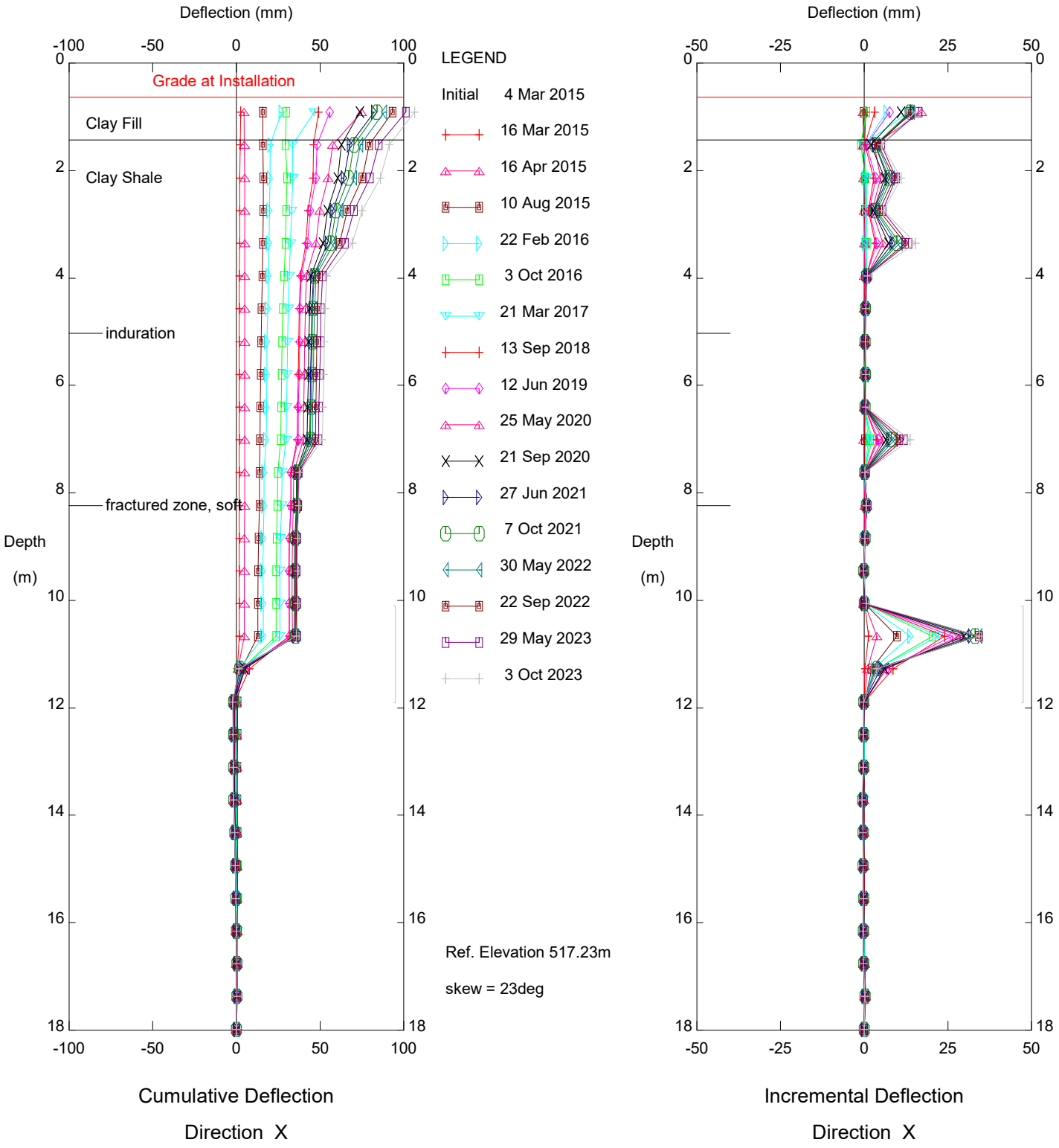


NC099 Cut Slope - Bench 1, Inclinometer 15-09

Alberta Transportation

Thurber Engineering Ltd.



Cumulative Deflection

Direction X

Incremental Deflection

Direction X

NC099 Cut Slope - Bench 1, Inclinometer 15-09

Alberta Transportation

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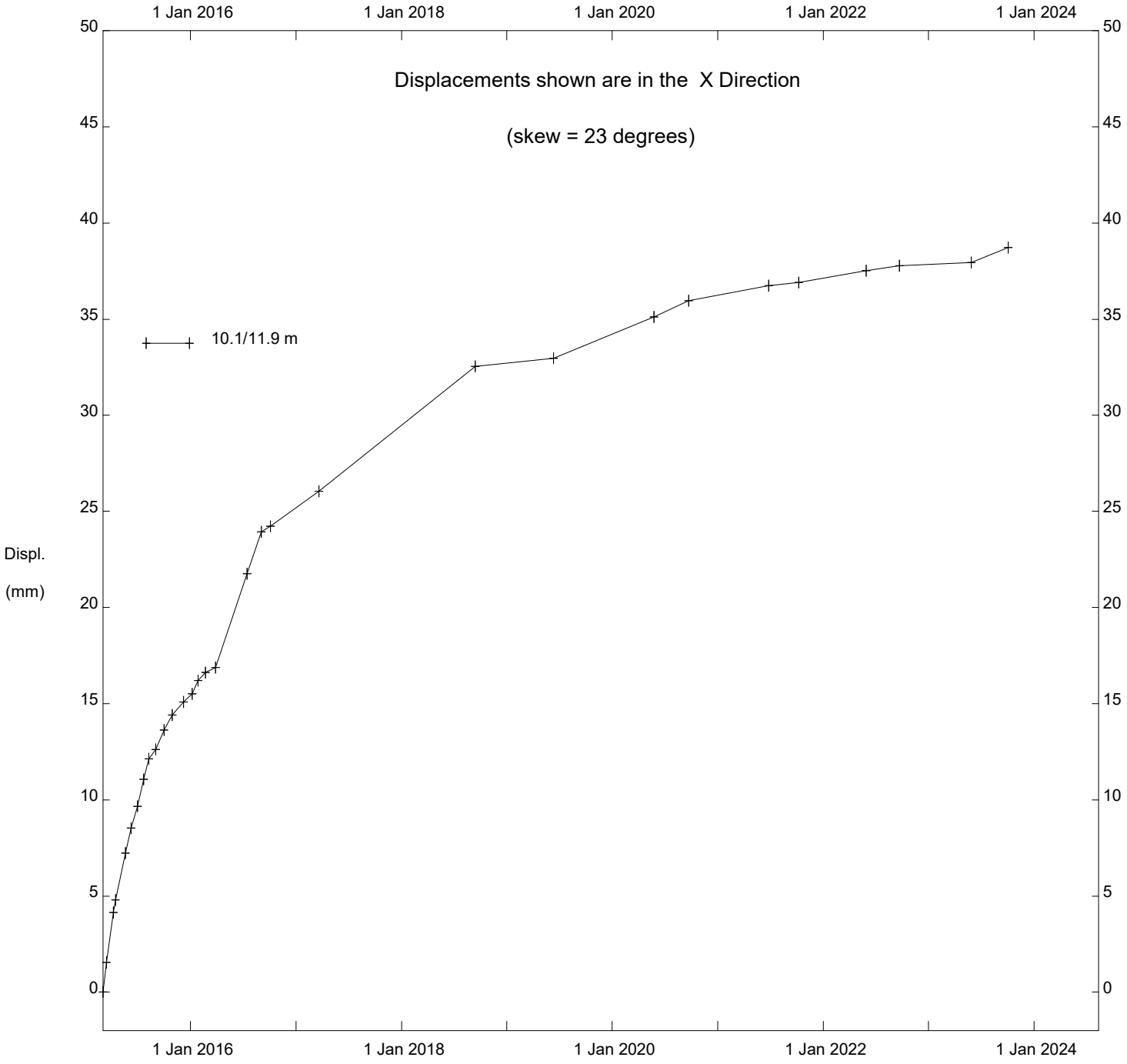
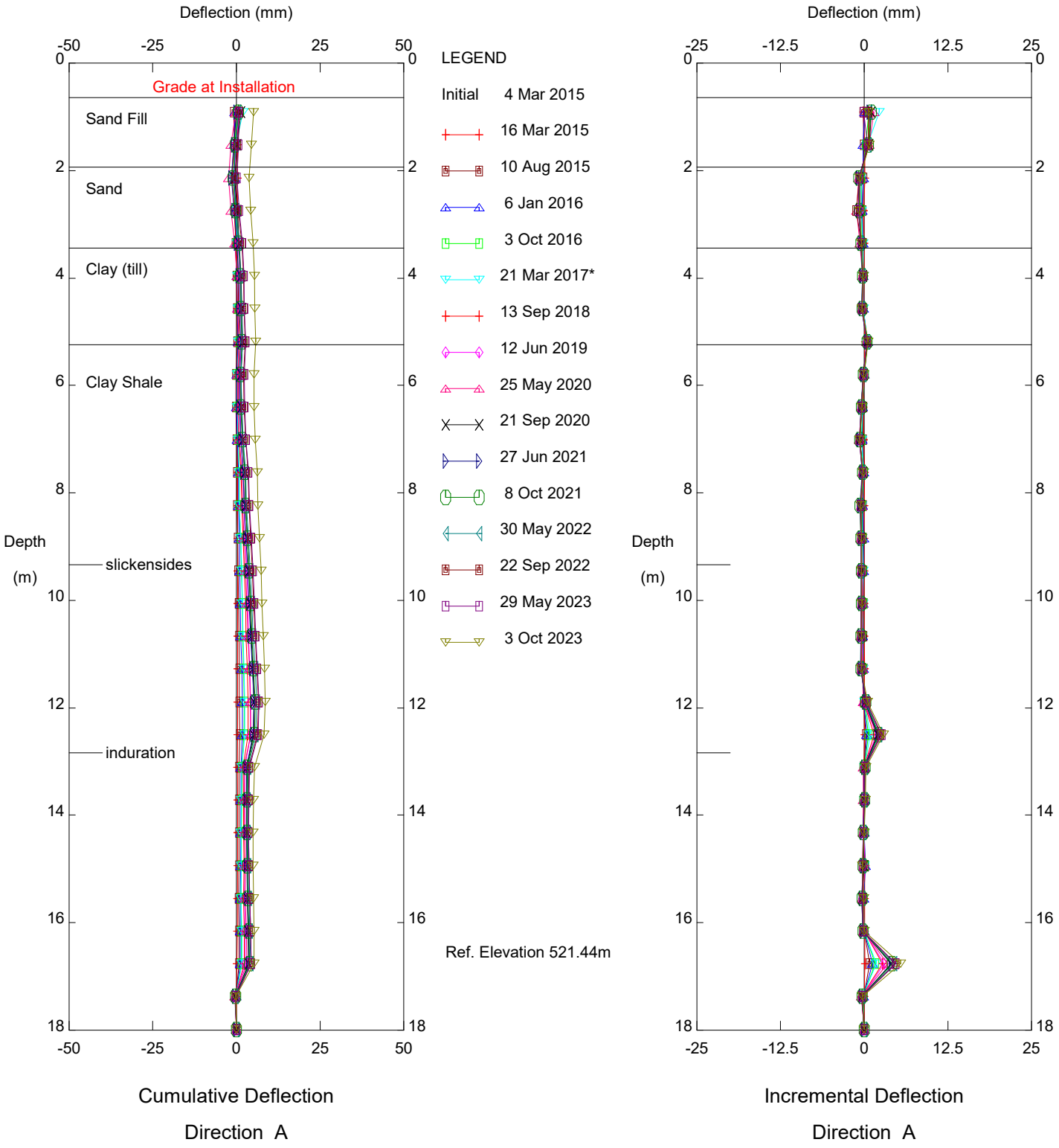


NC099 Cut Slope - Bench 1, Inclinometer 15-09

Alberta Transportation

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

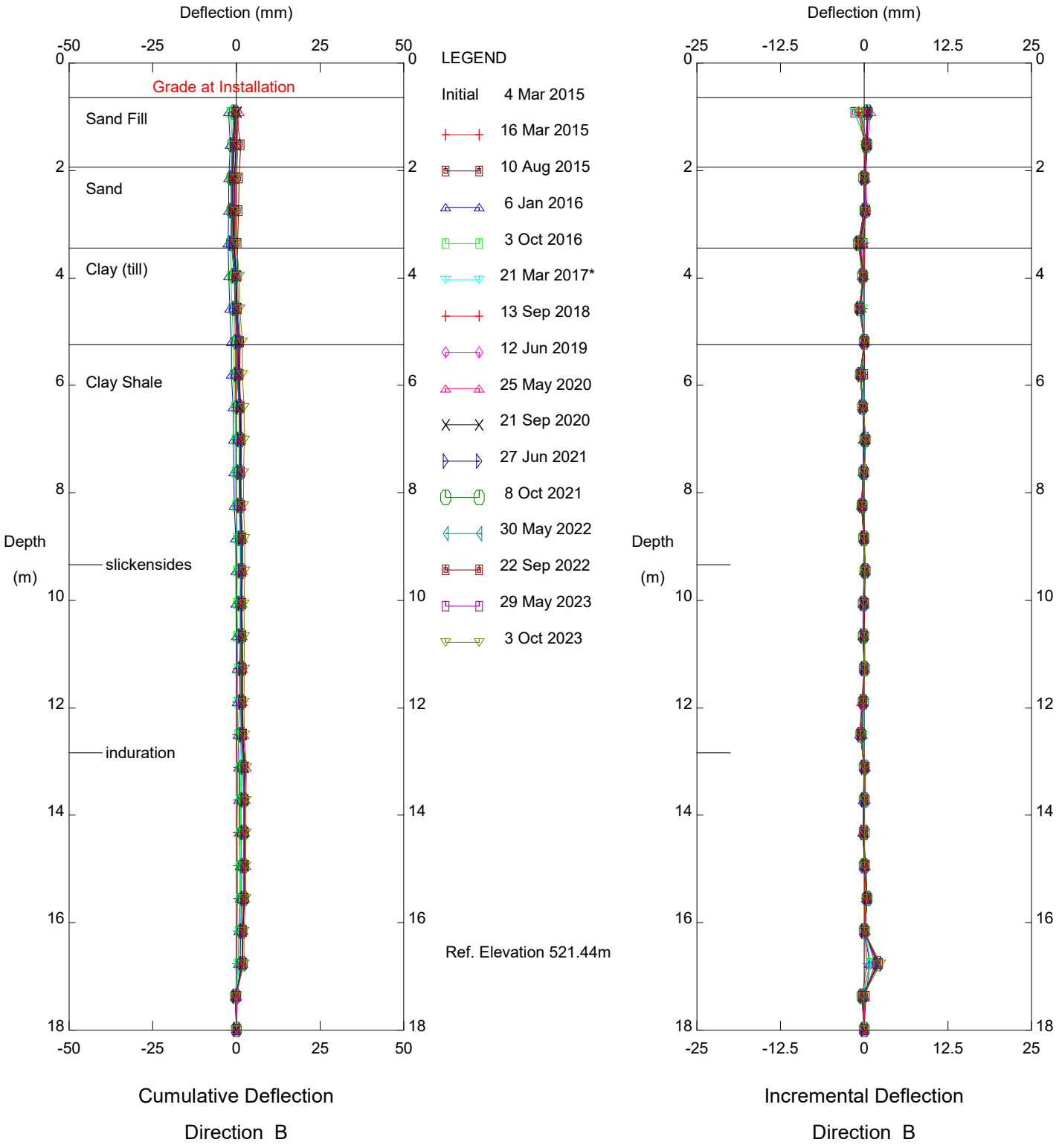
NC099 Cut Slope - Bench 1, Inclinometer 15-10

Alberta Transportation

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

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2023B-Fall\SI Readings\NC99\15-10.gtl

Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

Direction B

NC099 Cut Slope - Bench 1, Inclinometer 15-10

Alberta Transportation

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

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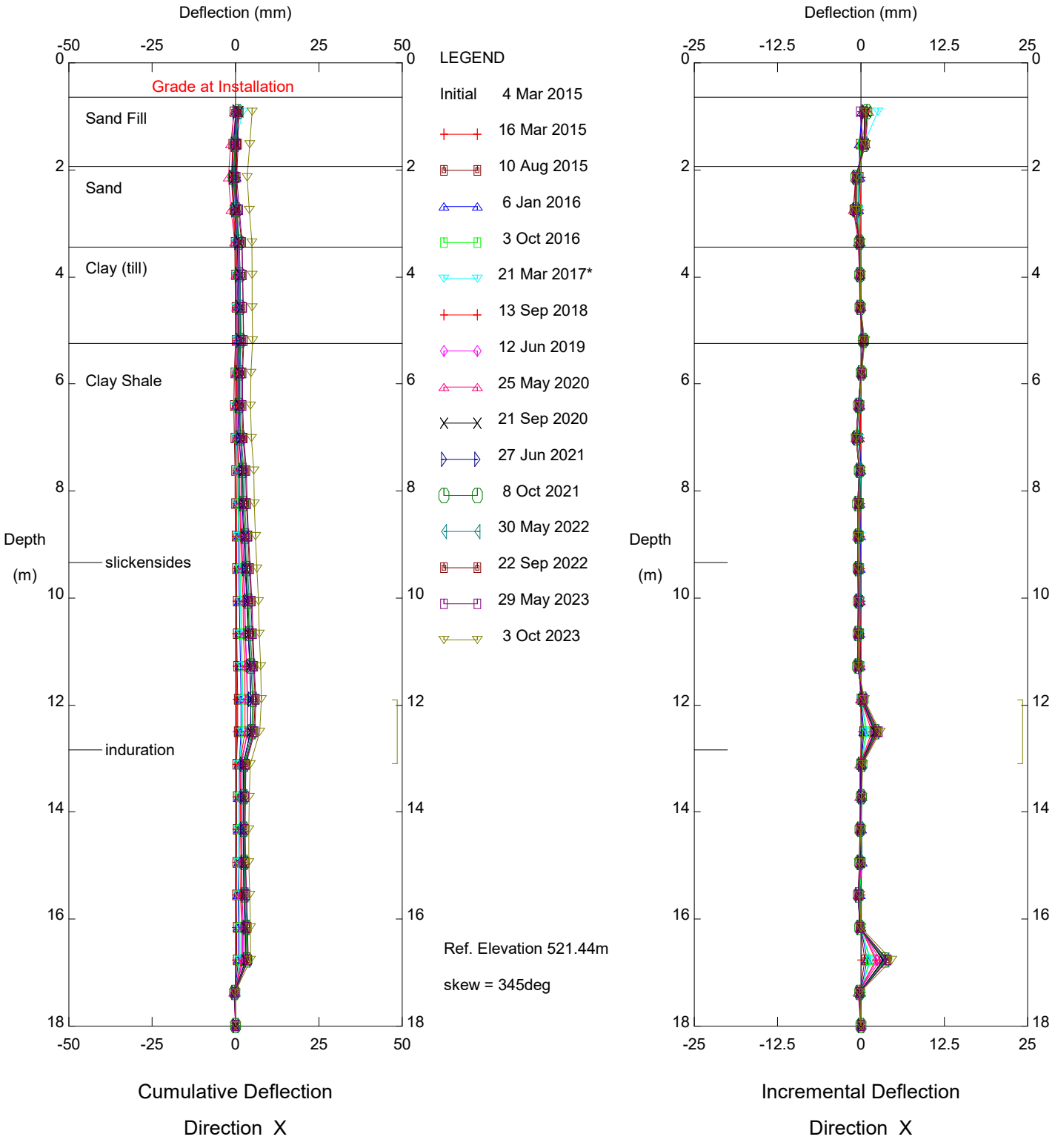

Cumulative Deflection

Direction X

Incremental Deflection

Direction X

NC099 Cut Slope - Bench 1, Inclinometer 15-10

Alberta Transportation

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

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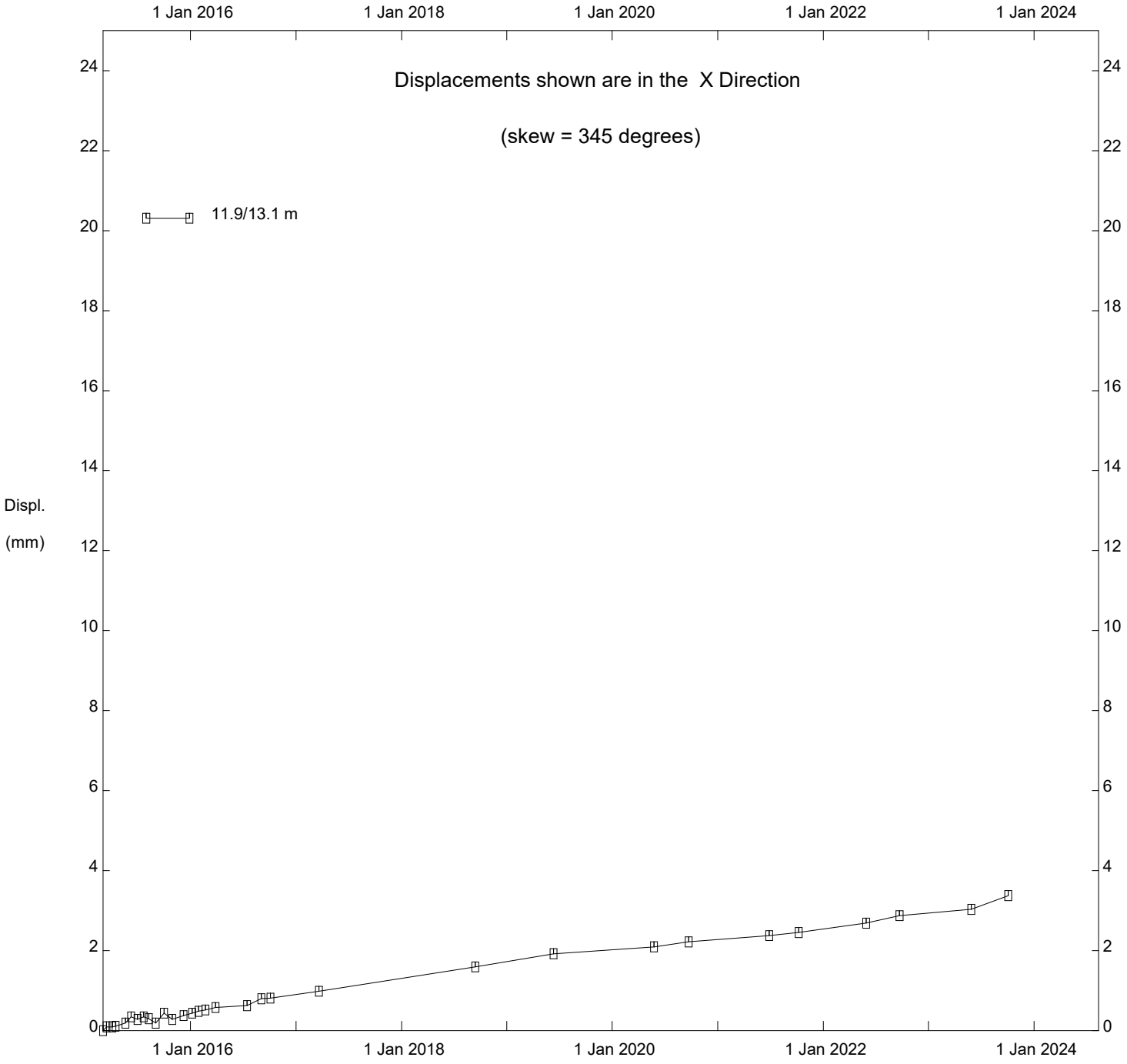
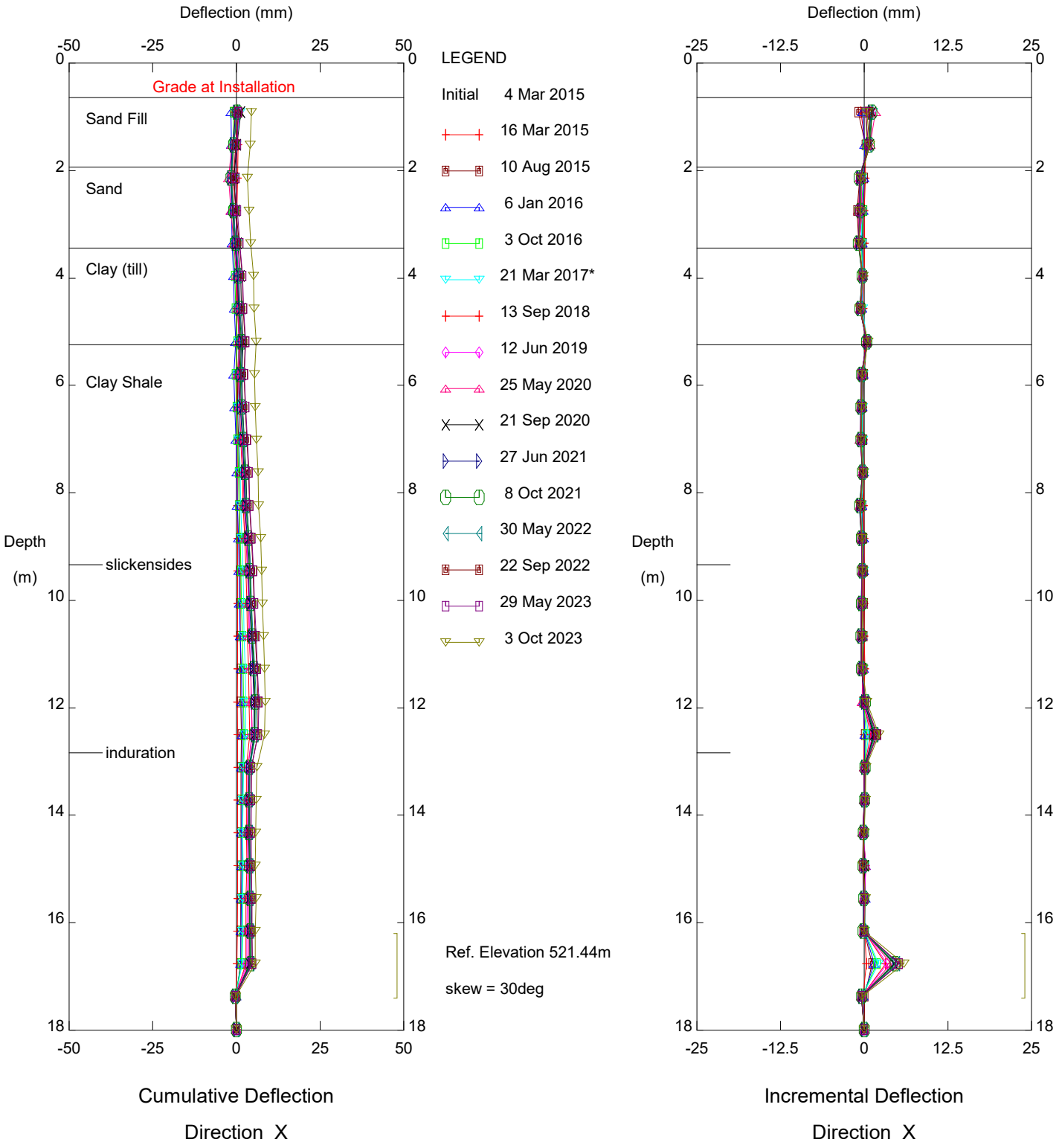


NC099 Cut Slope - Bench 1, Inclinometer 15-10

Alberta Transportation

Thurber Engineering Ltd.



Cumulative Deflection

Direction X

Incremental Deflection

Direction X

NC099 Cut Slope - Bench 1, Inclinometer 15-10

Alberta Transportation

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

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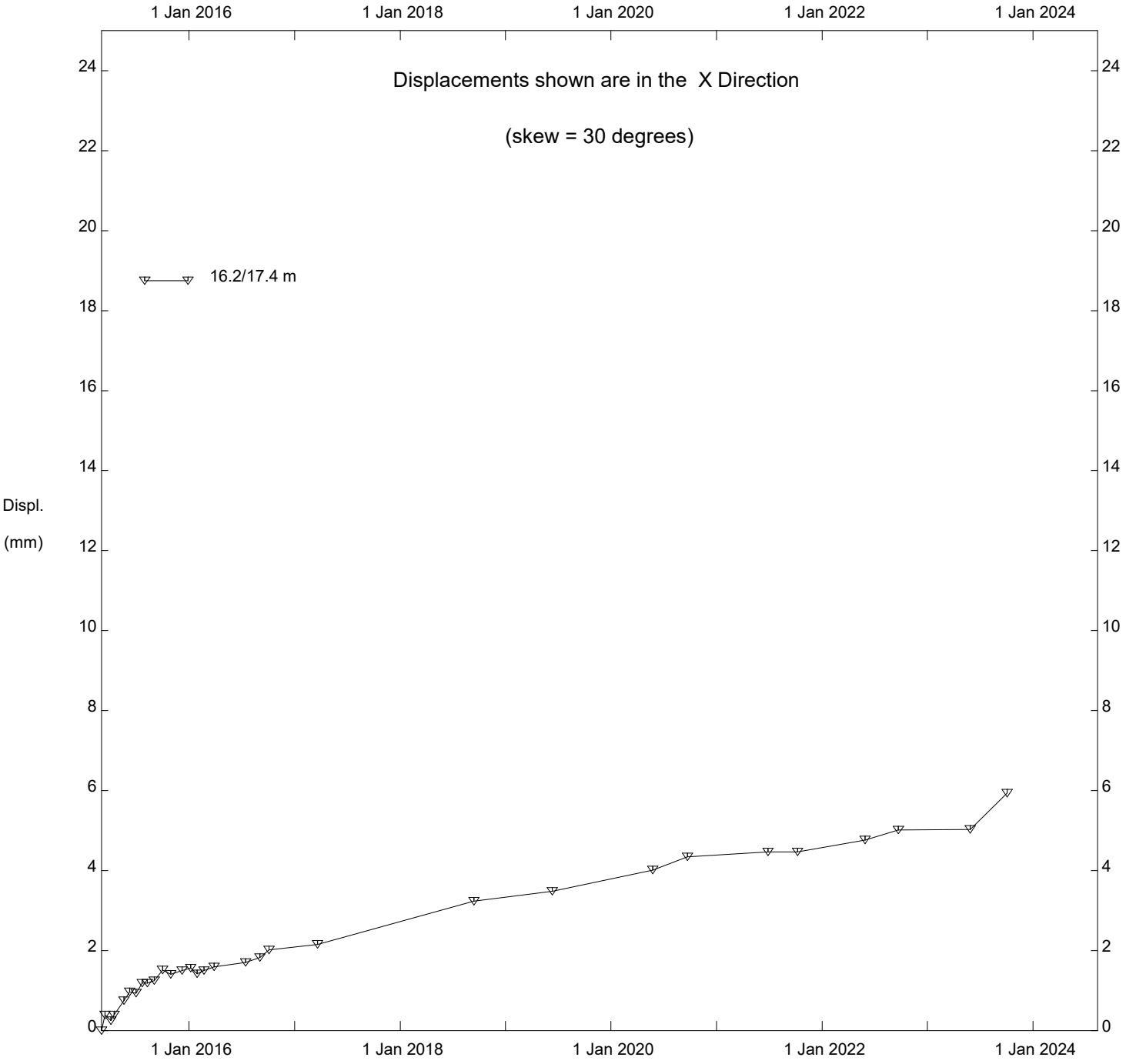
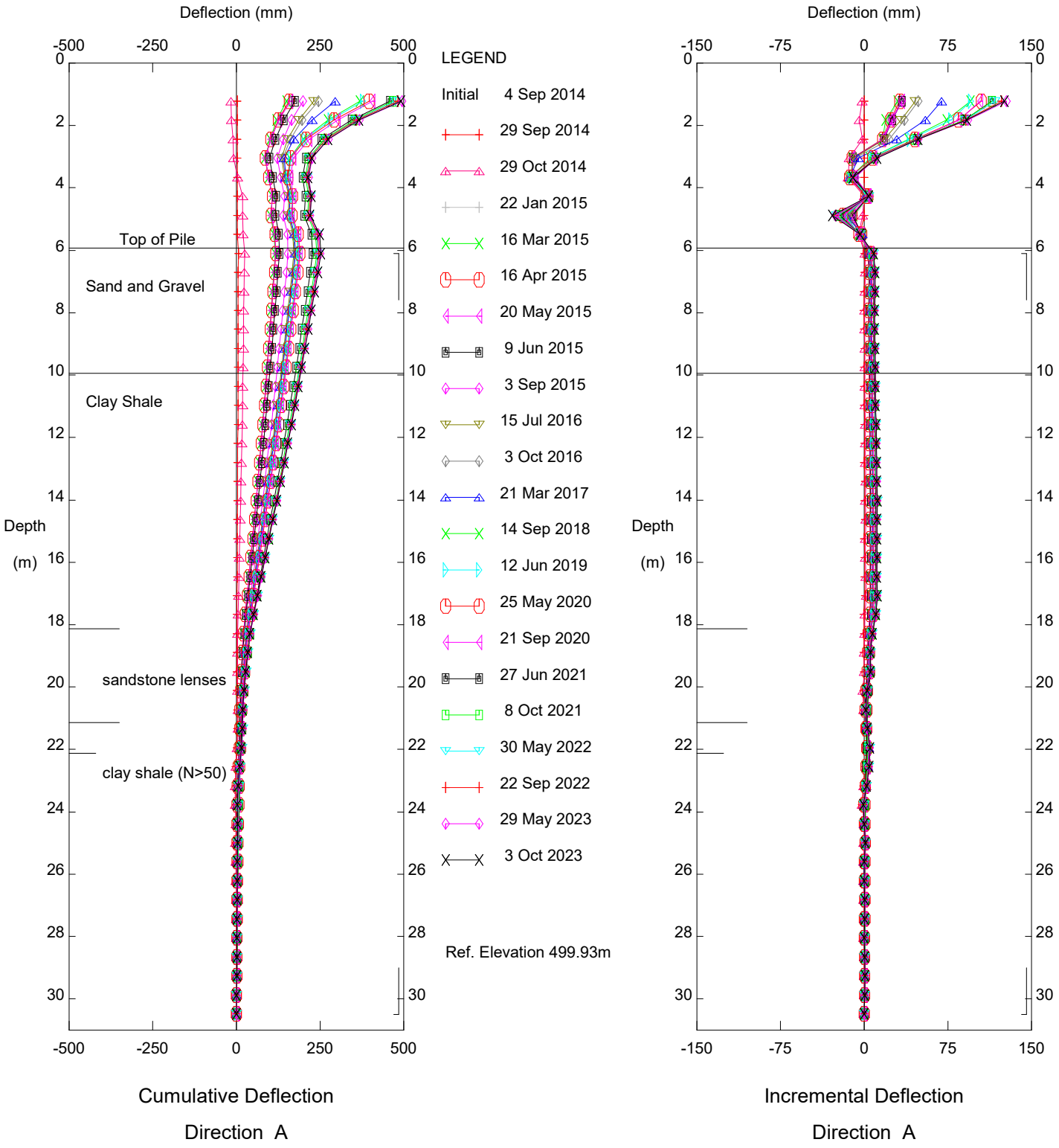
Thurber Engineering Ltd.



NC099 Cut Slope - Bench 1, Inclinometer 15-10

Alberta Transportation

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

NC099 North Slope Stability Pile Wall, Inclinometer 14-01

Alberta Transportation

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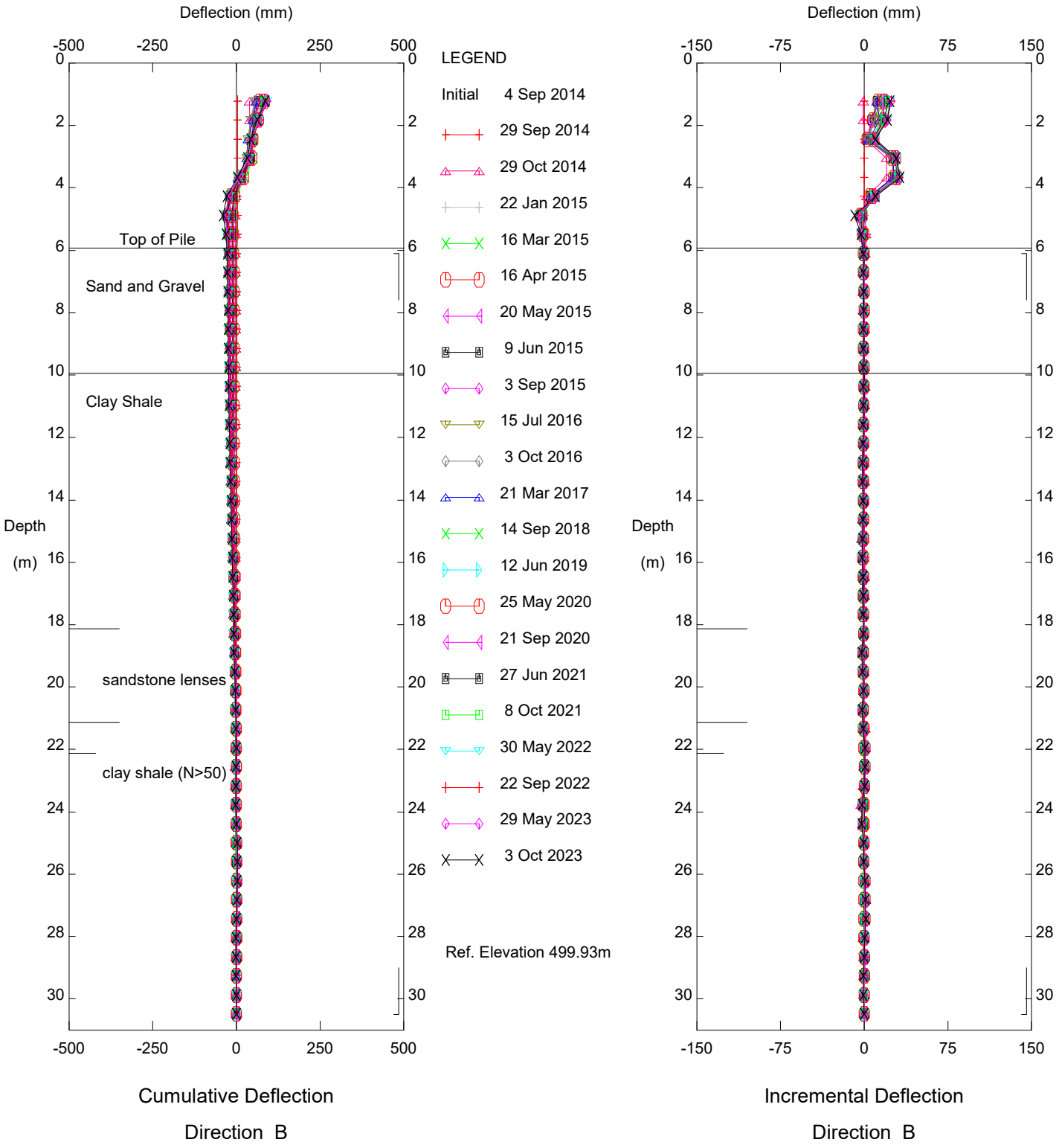
Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

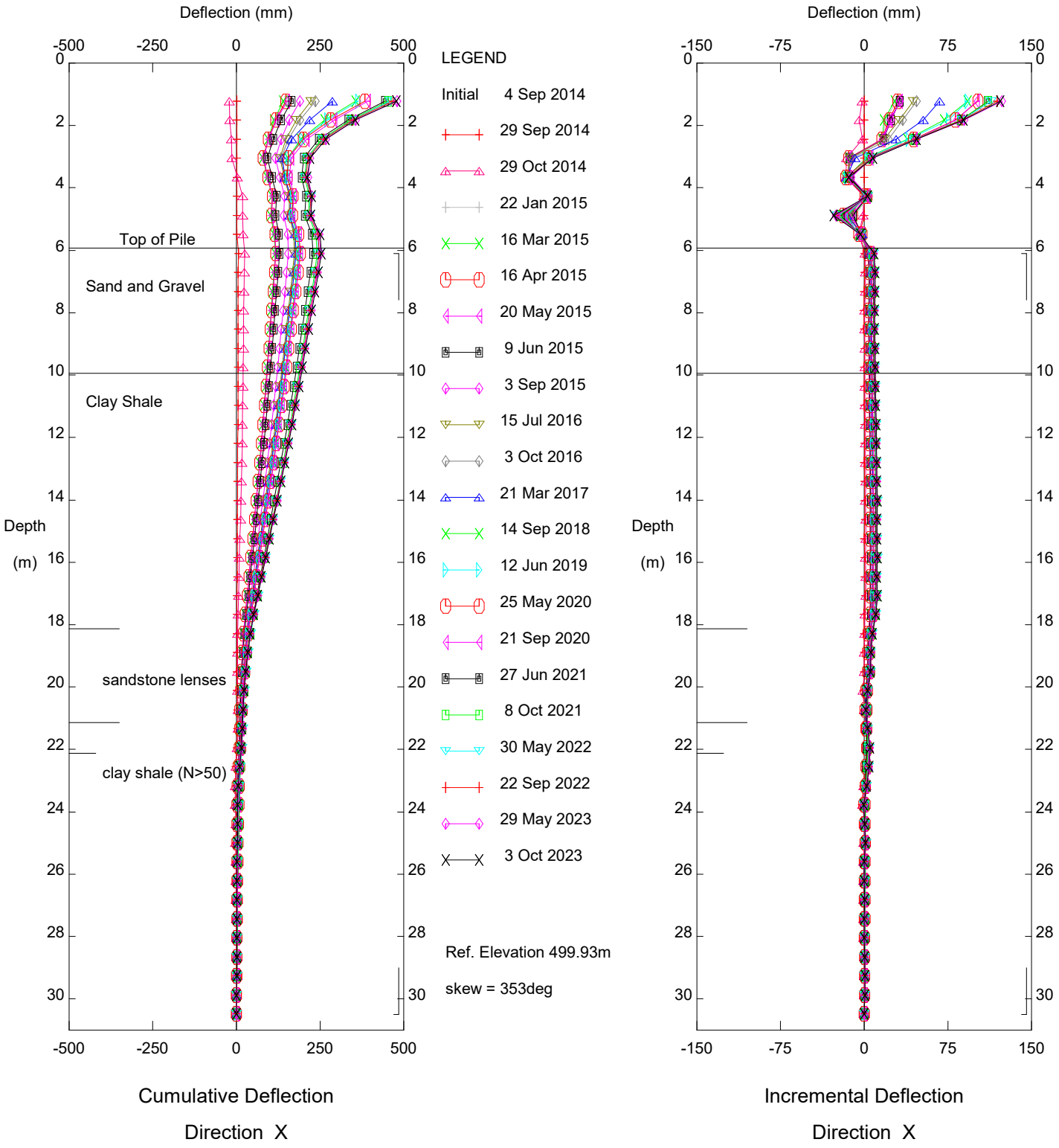
Direction B

NC099 North Slope Stability Pile Wall, Inclinometer 14-01

Alberta Transportation

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2023B-Fall\SI Readings\NC99\14-01.gtl

Thurber Engineering Ltd.



Cumulative Deflection

Direction X

Incremental Deflection

Direction X

NC099 North Slope Stability Pile Wall, Inclinometer 14-01

Alberta Transportation

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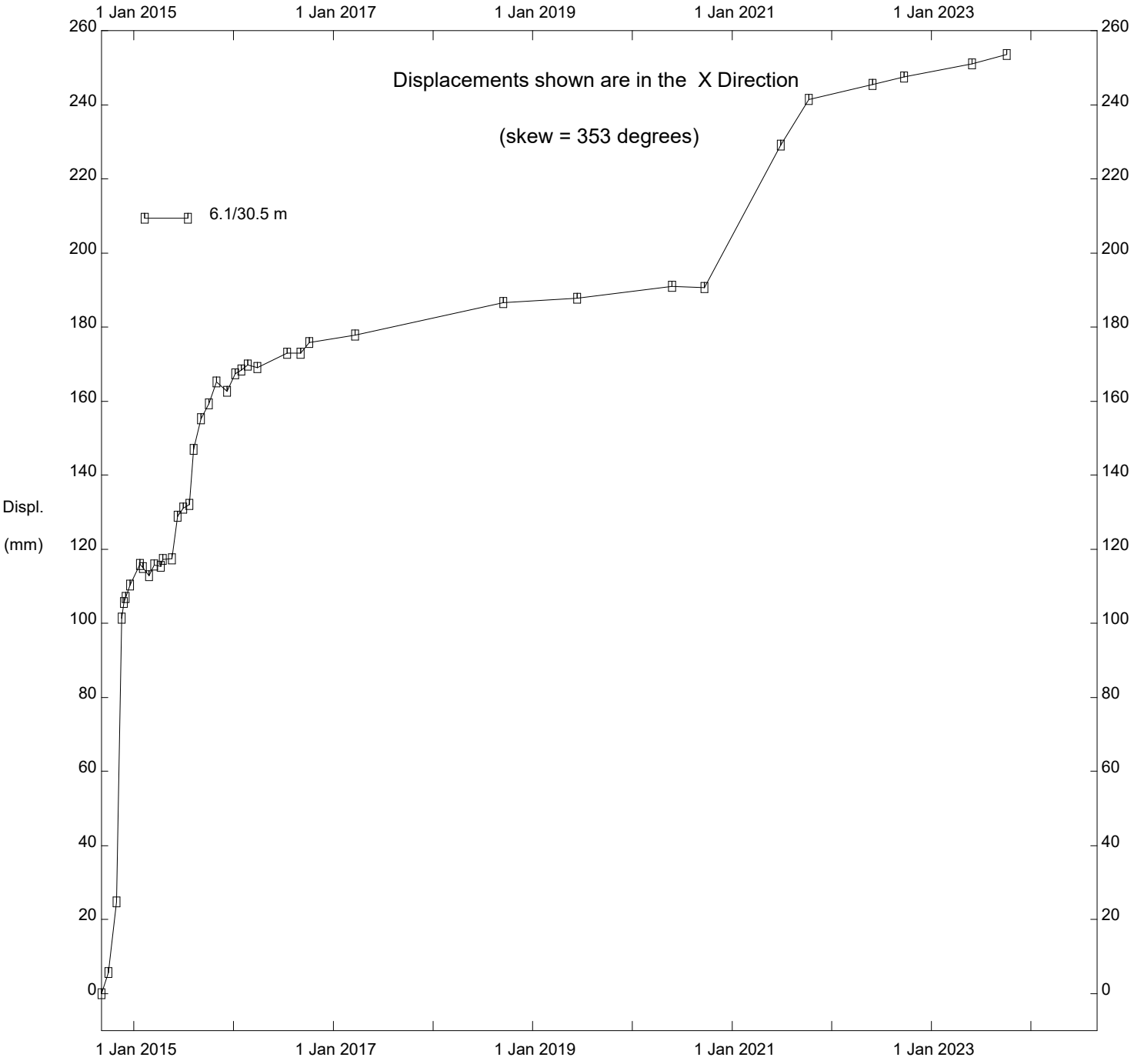
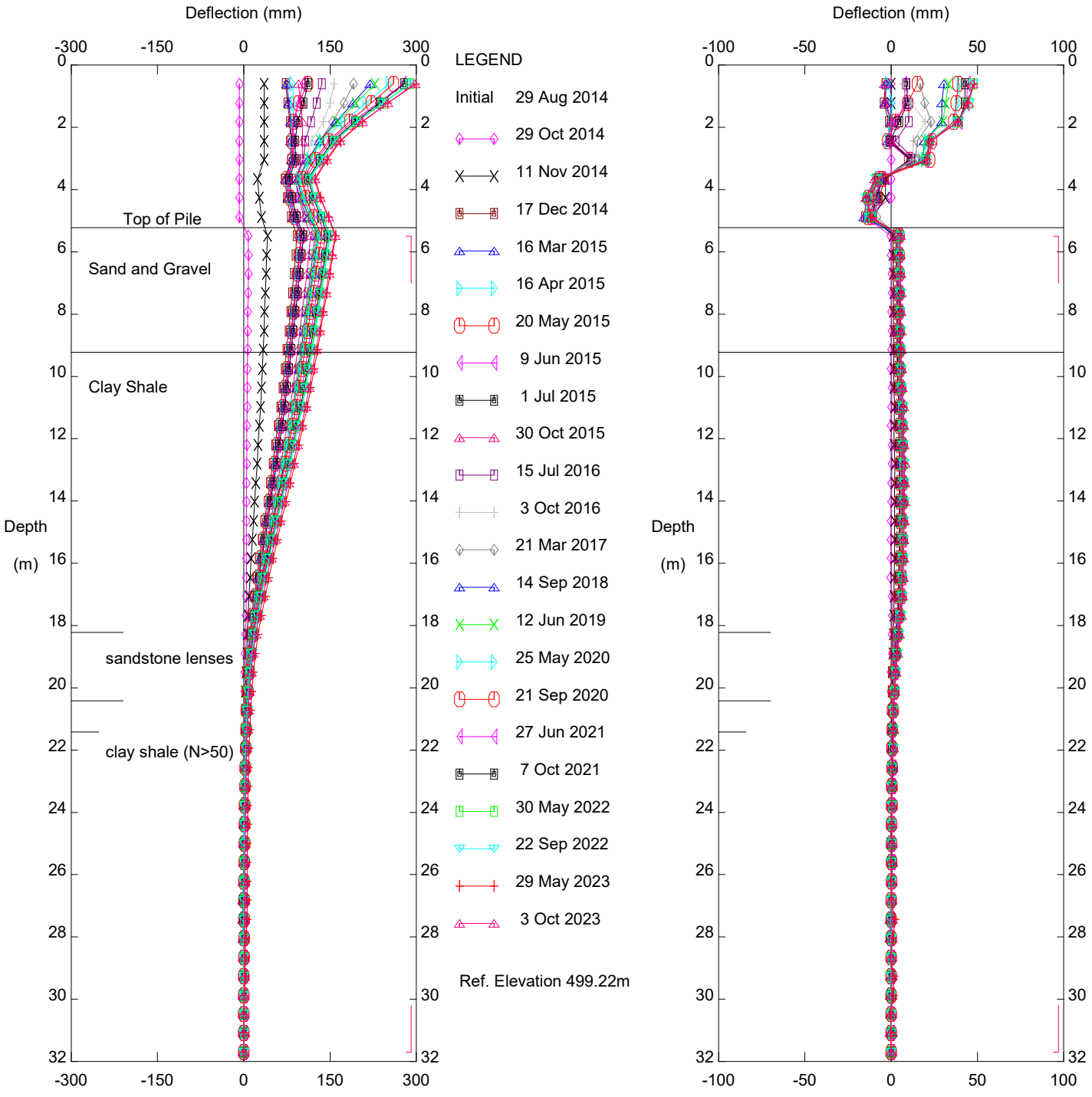
Thurber Engineering Ltd.



NC099 North Slope Stability Pile Wall, Inclinometer 14-01

Alberta Transportation

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

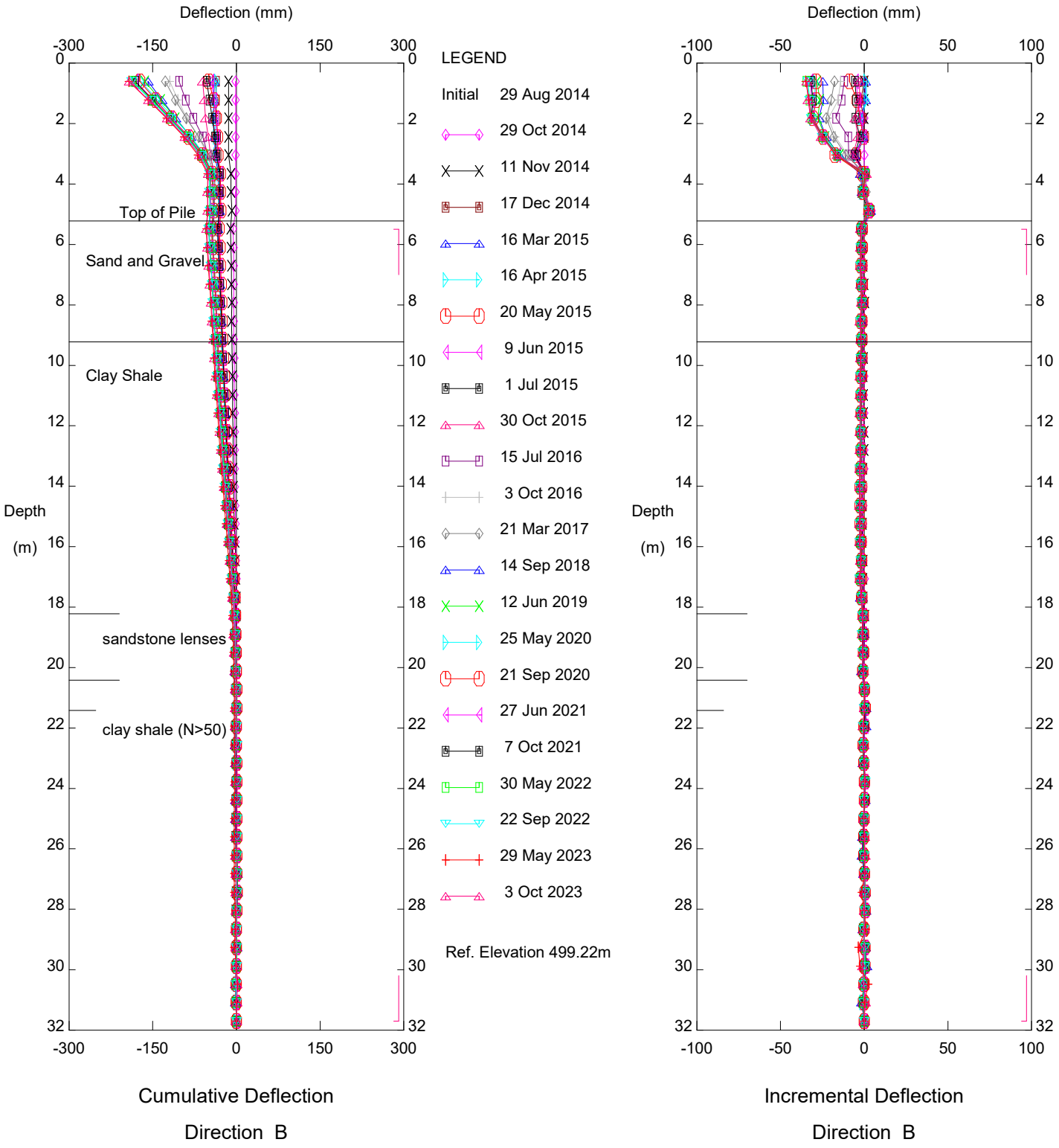
Direction A

NC099 South Slope Stability Pile Wall, Inclinometer 14-02

Alberta Transportation

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2023B-Fall\SI Readings\NC99\14-02.gtl

Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

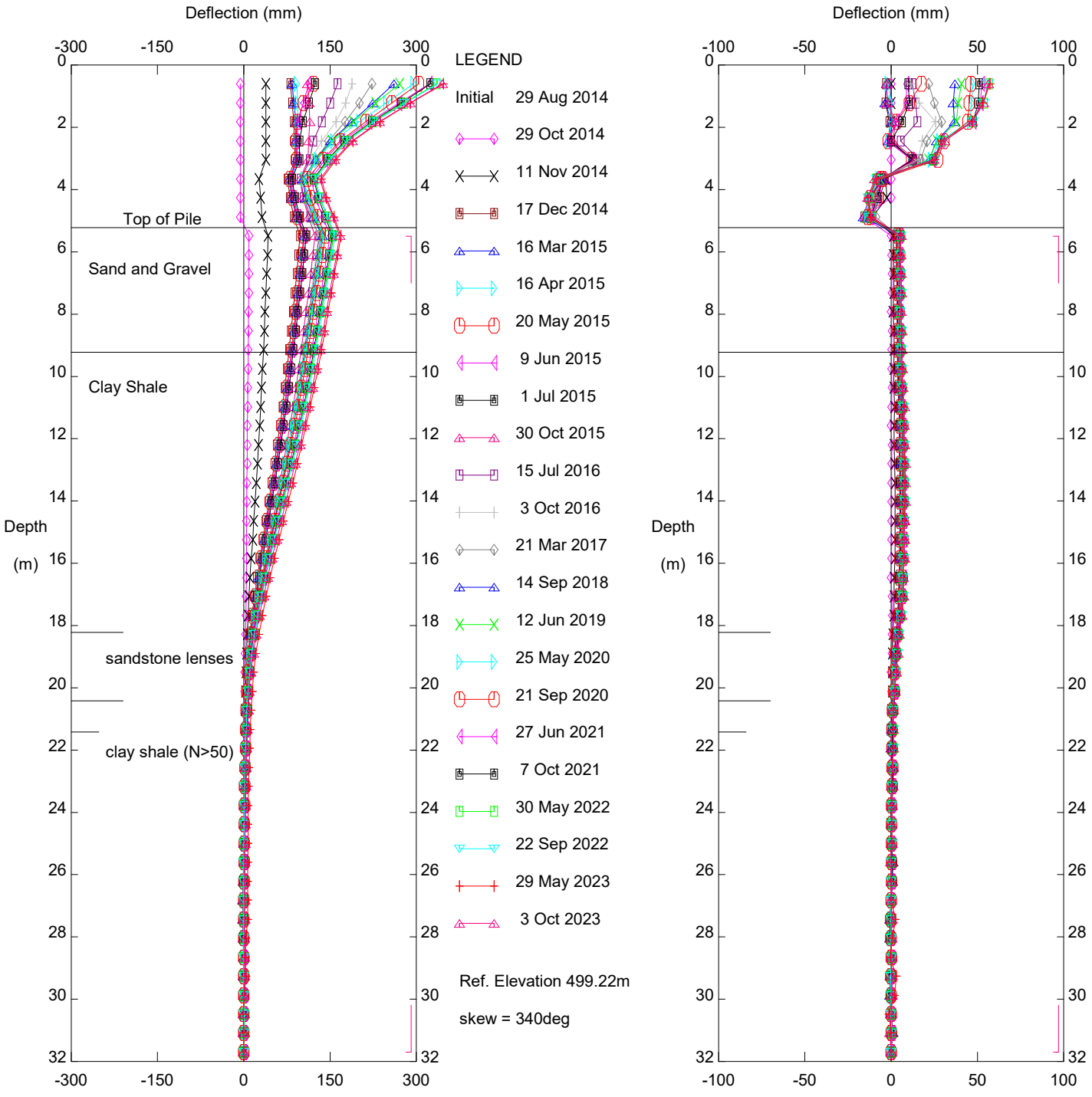
Direction B

NC099 South Slope Stability Pile Wall, Inclinometer 14-02

Alberta Transportation

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2023B-Fall\SI Readings\NC99\14-02.gtl

Thurber Engineering Ltd.



Cumulative Deflection

Direction X

Incremental Deflection

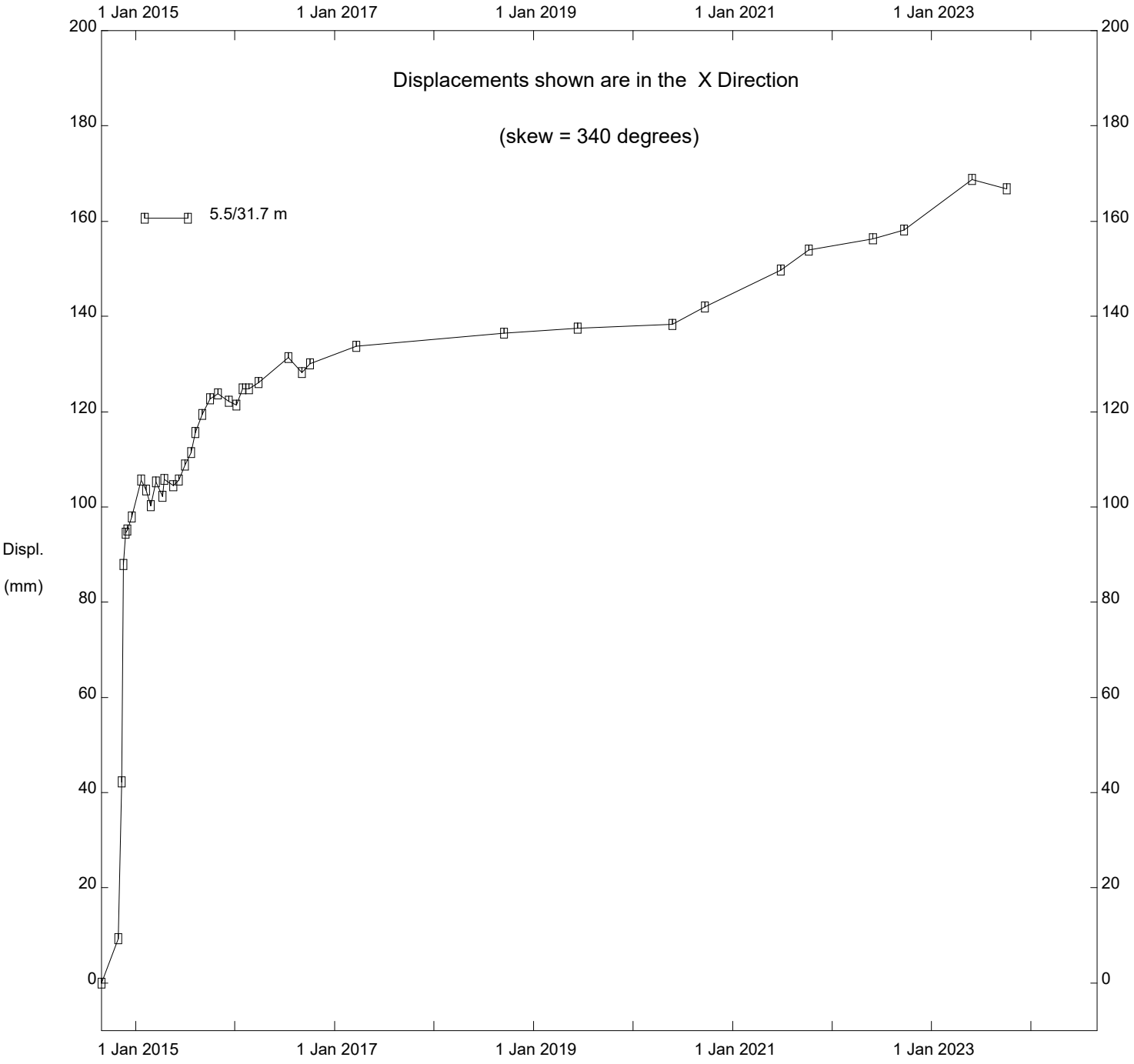
Direction X

NC099 South Slope Stability Pile Wall, Inclinometer 14-02

Alberta Transportation

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2023B-Fall\SI Readings\NC99\14-02.gtl

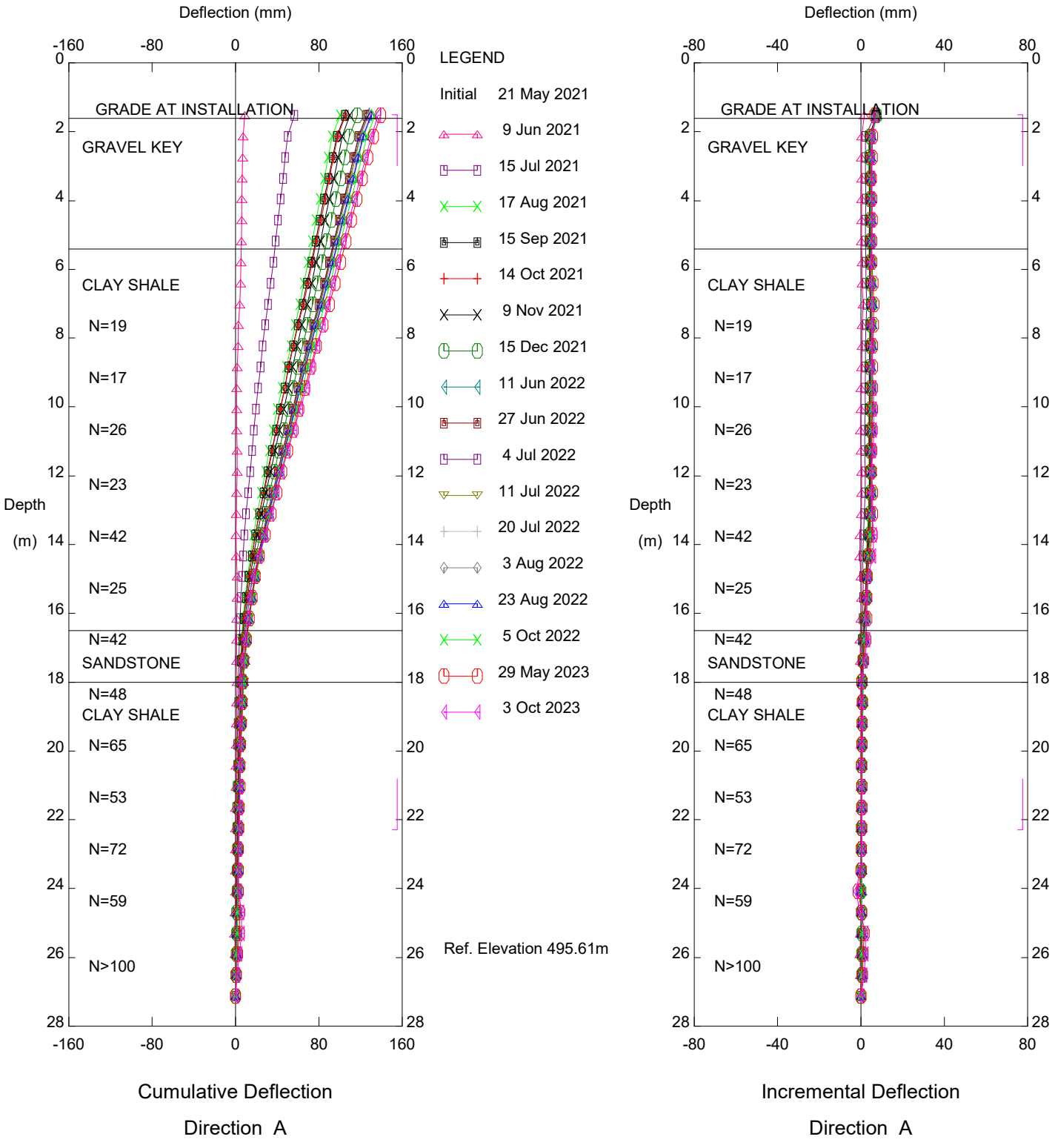
Thurber Engineering Ltd.



NC099 South Slope Stability Pile Wall, Inclinometer 14-02

Alberta Transportation

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

Pile Wall, Inclinometer N-SI-01

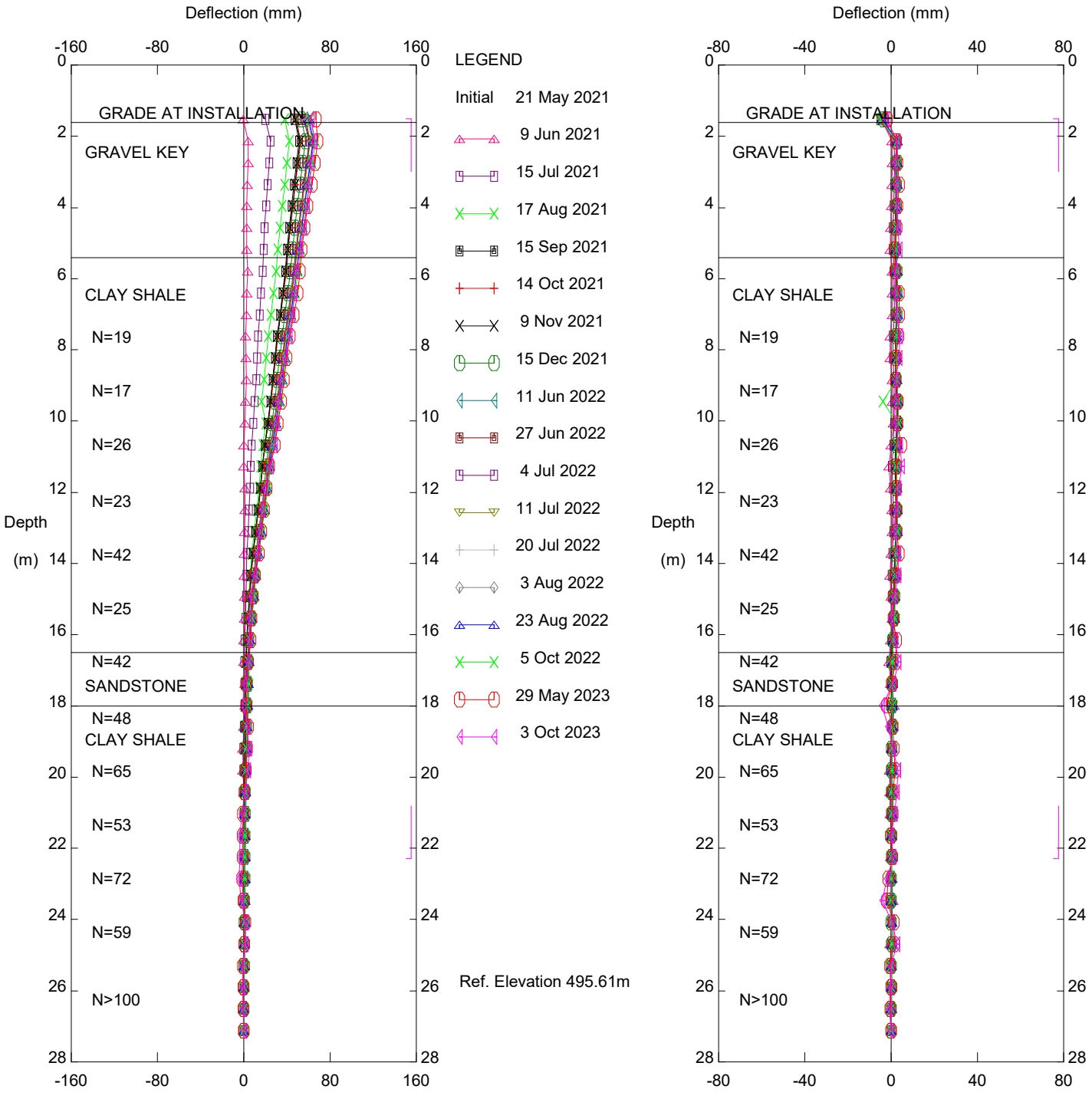
STRATIGRAPHY INFERRED FROM N-SI-02

STRATIGRAPHY INFERRED FROM N-SI-02

Hangingstone Bridge North Abutment

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2023B-Fall\SI Readings\NC99\N-SI-01_bwn.gtl

Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

Direction B

Pile Wall, Inclinometer N-SI-01

STRATIGRAPHY INFERRED FROM N-SI-02

STRATIGRAPHY INFERRED FROM N-SI-02

Hangingstone Bridge North Abutment

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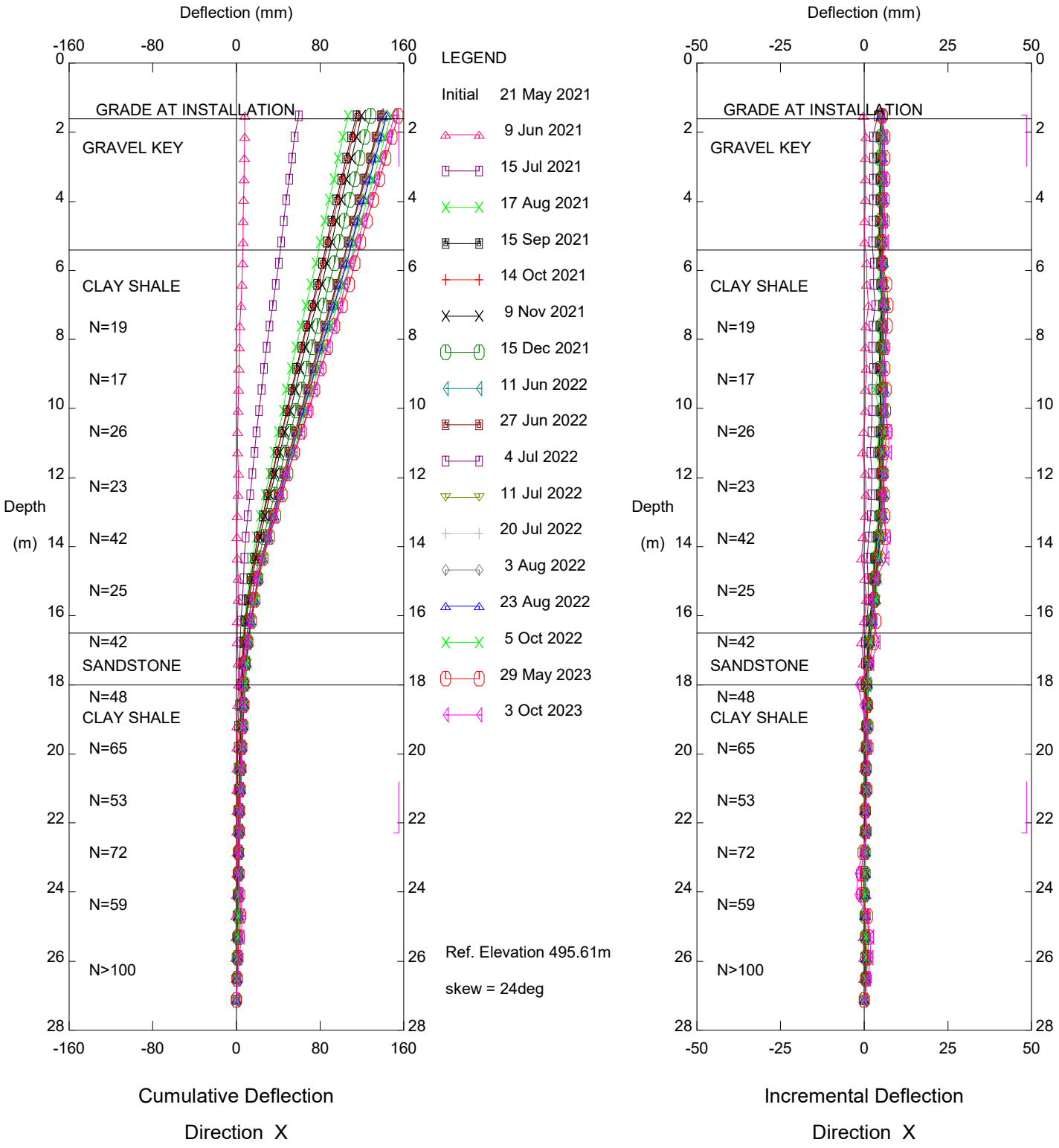

Cumulative Deflection

Direction X

Incremental Deflection

Direction X

Pile Wall, Inclinometer N-SI-01

Hangingstone Bridge North Abutment

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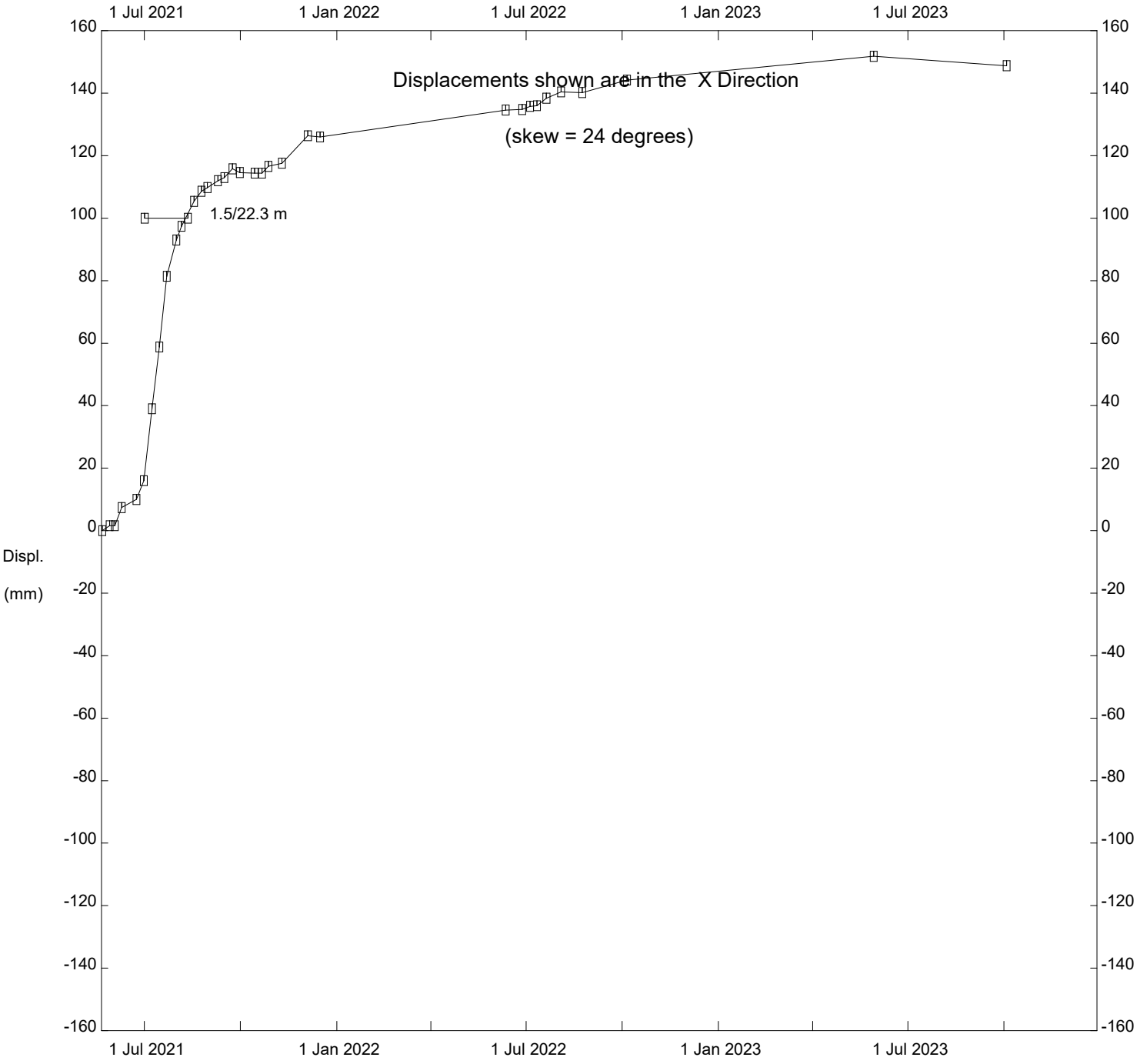
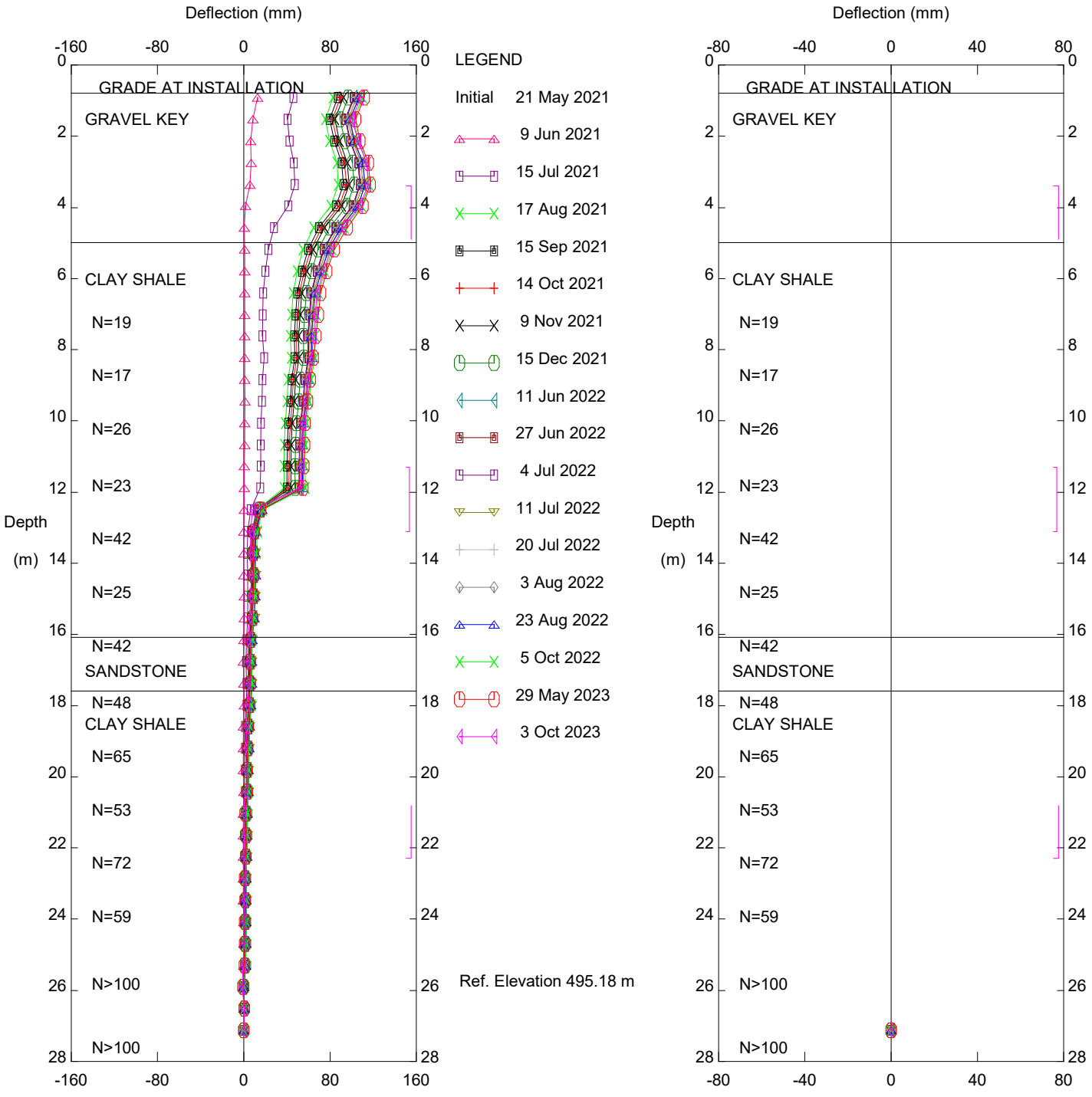
Thurber Engineering Ltd.



Pile Wall, Inclinometer N-SI-01

Hangingstone Bridge North Abutment

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

In Ground, Inclinometer N-SI-02

Hangingstone Bridge North Abutment

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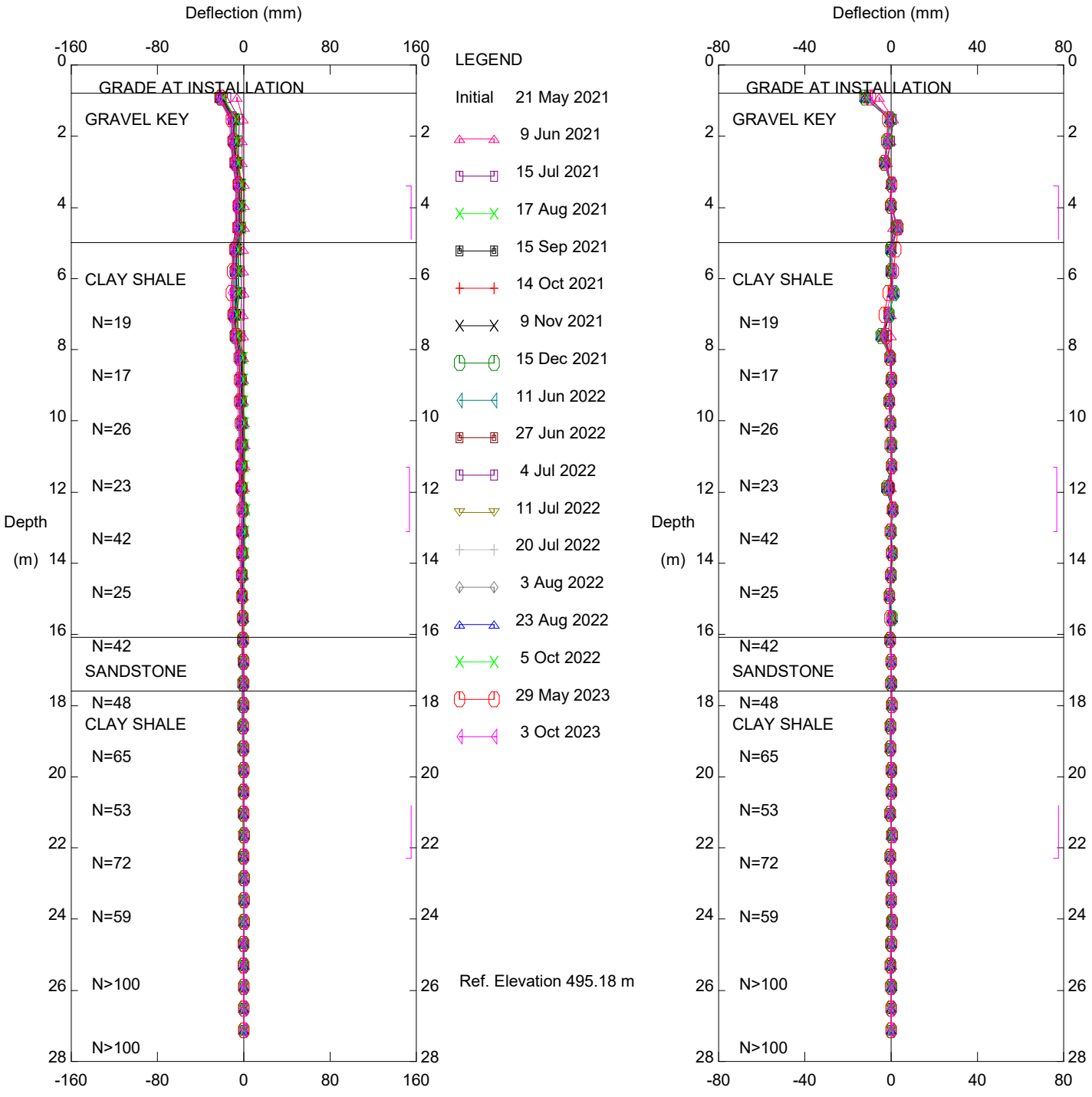
Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

Direction B

In Ground, Inclinometer N-SI-02

Hangingstone Bridge North Abutment

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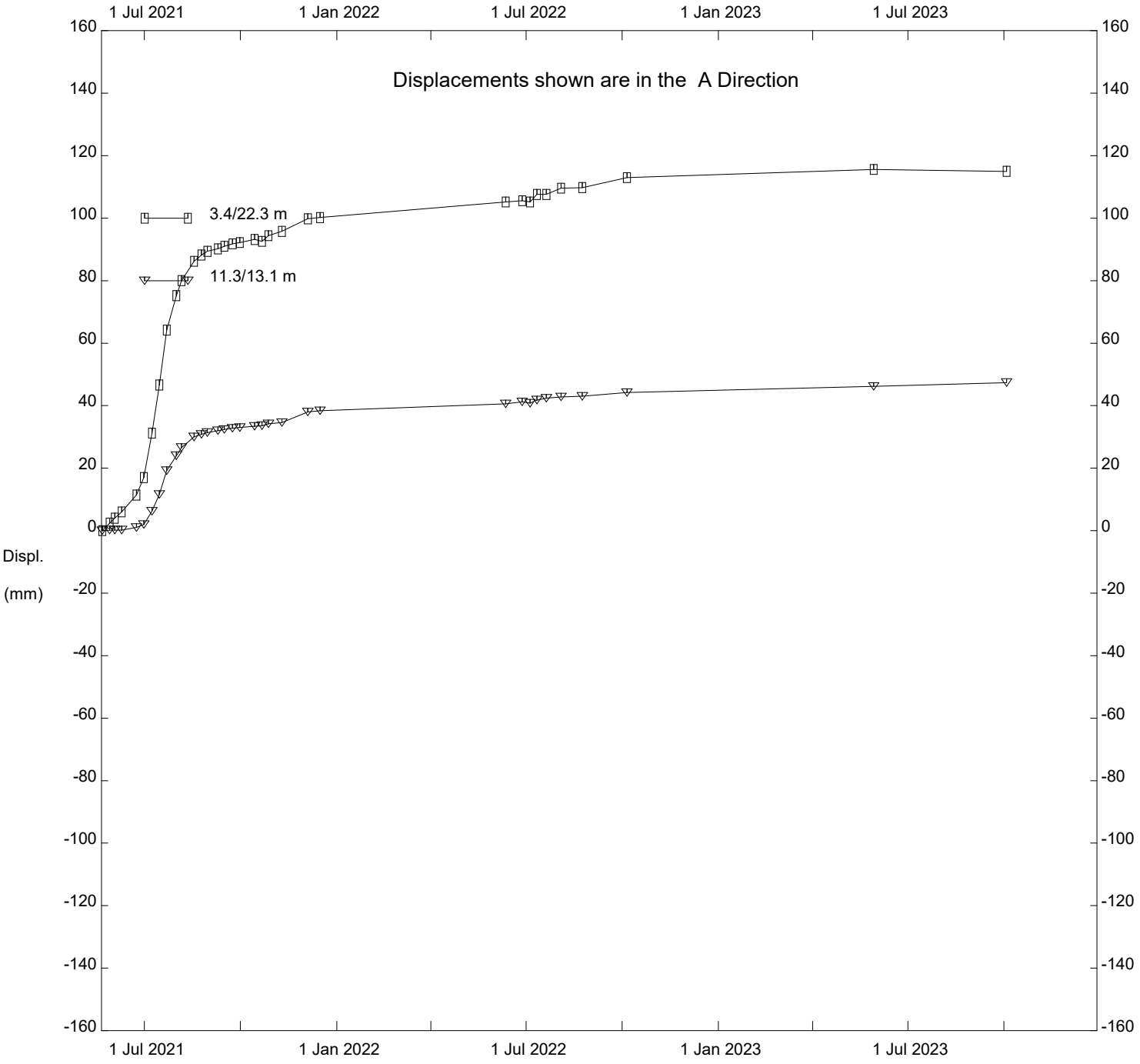
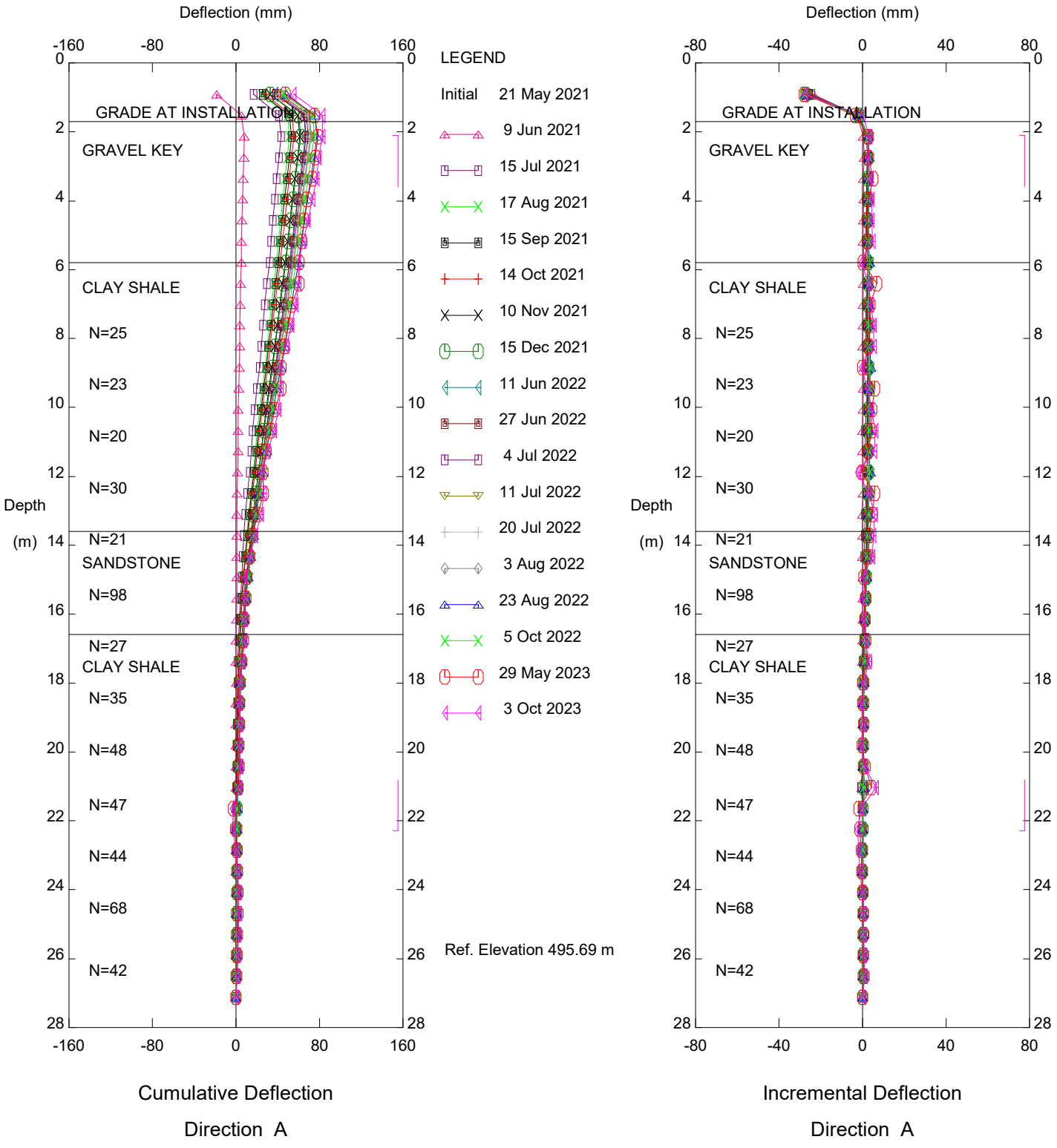


In Ground, Inclinometer N-SI-02

Hangingstone Bridge North Abutment

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

Pile Wall, Inclinometer S-SI-01

STRATIGRAPHY INFERRED FROM S-SI-02

STRATIGRAPHY INFERRED FROM S-SI-02

Hangingstone Bridge South Abutment

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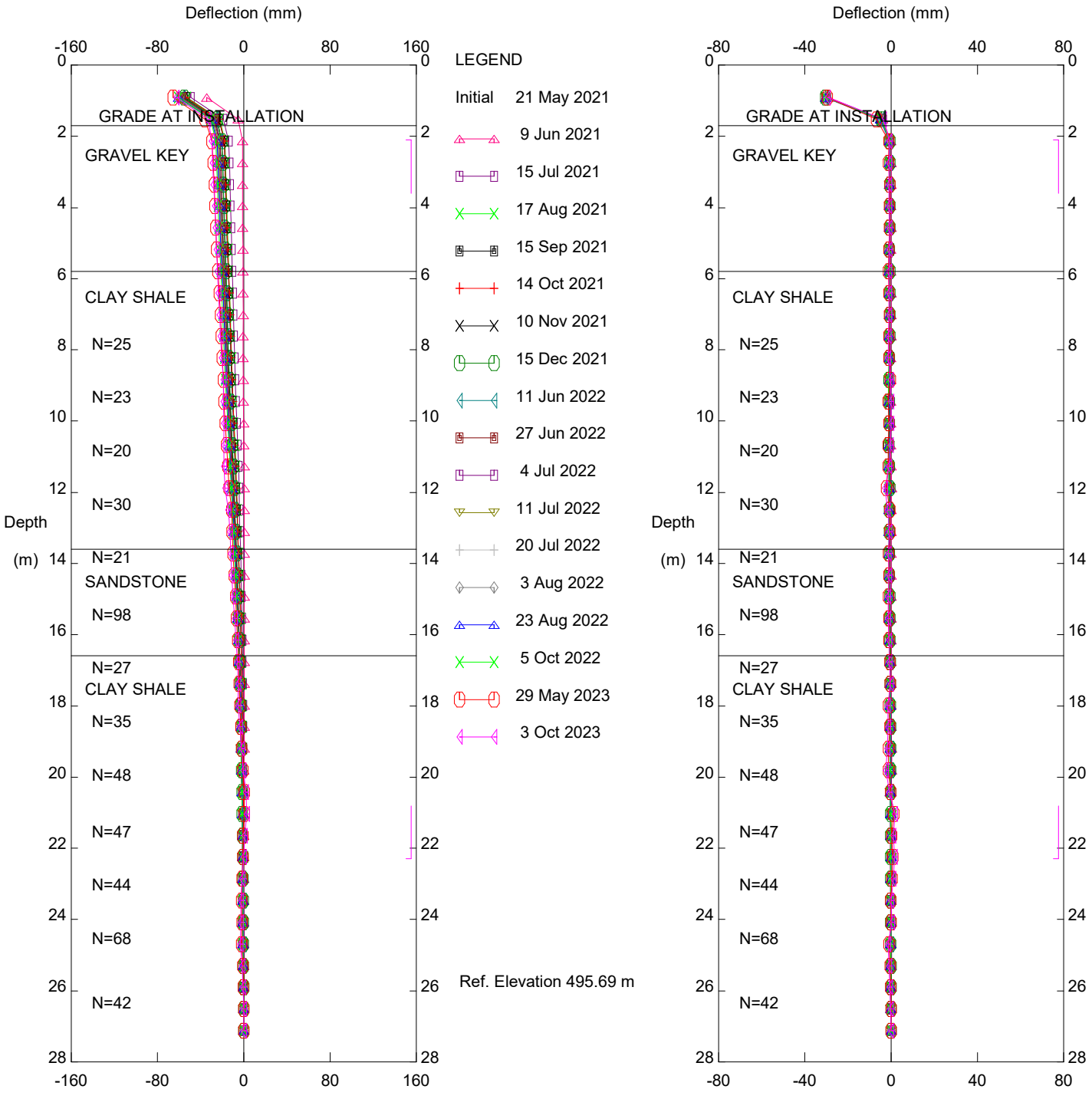

Cumulative Deflection

Direction B

Incremental Deflection

Direction B

Pile Wall, Inclinometer S-SI-01

STRATIGRAPHY INFERRED FROM S-SI-02

STRATIGRAPHY INFERRED FROM S-SI-02

Hangingstone Bridge South Abutment

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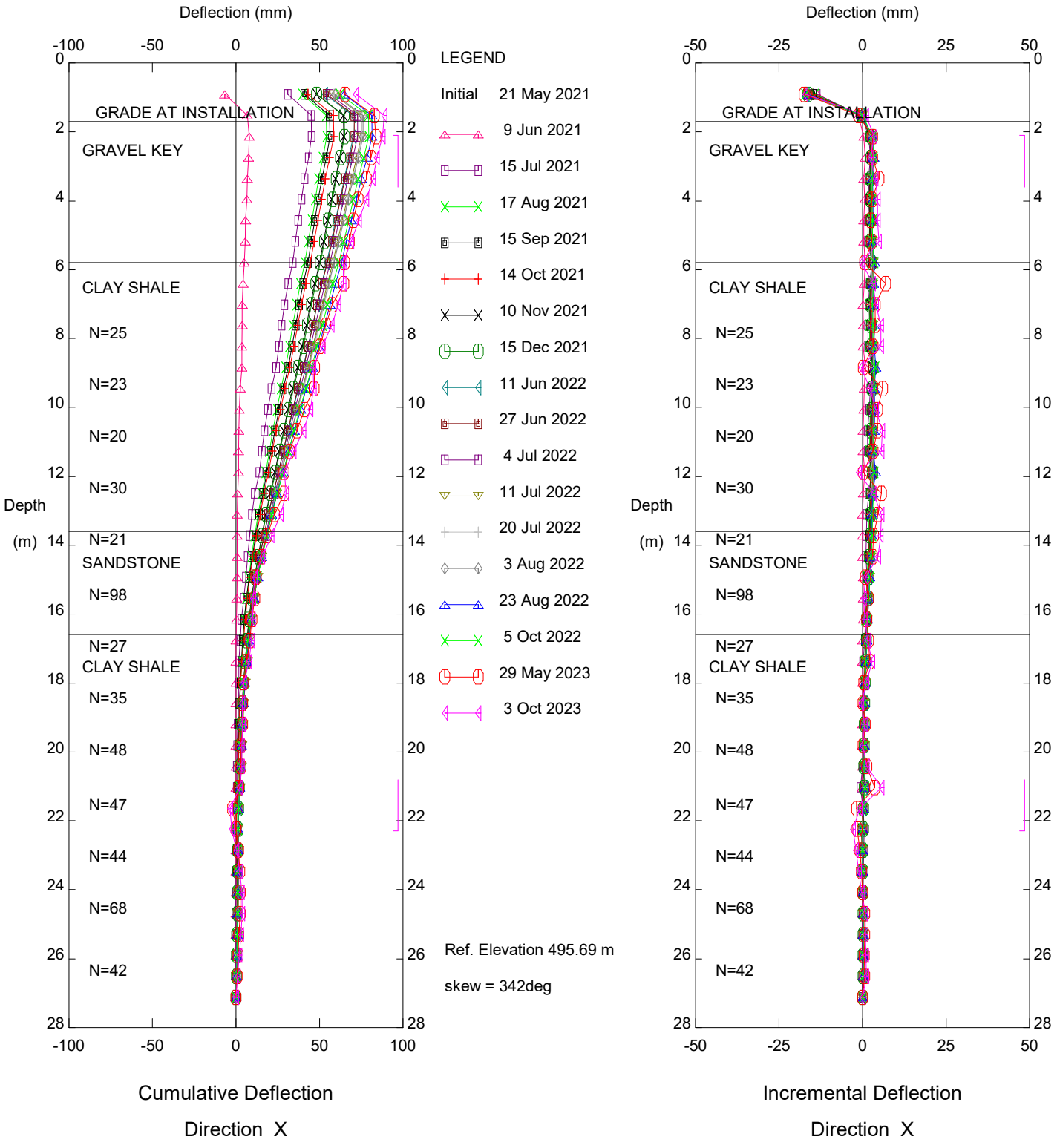
Thurber Engineering Ltd.



Cumulative Deflection

Direction X

Incremental Deflection

Direction X

Pile Wall, Inclinometer S-SI-01

Hangingstone Bridge South Abutment

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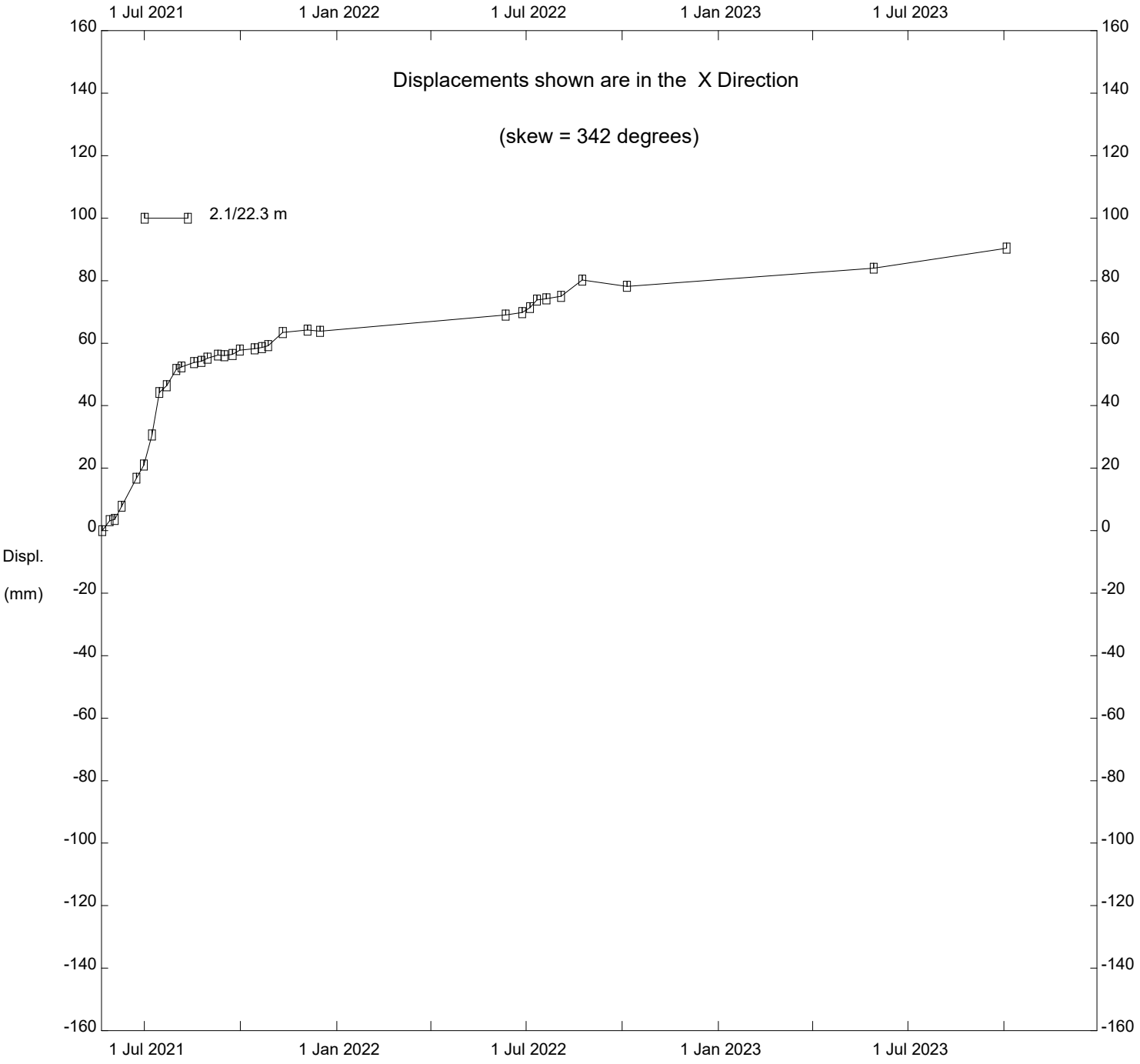
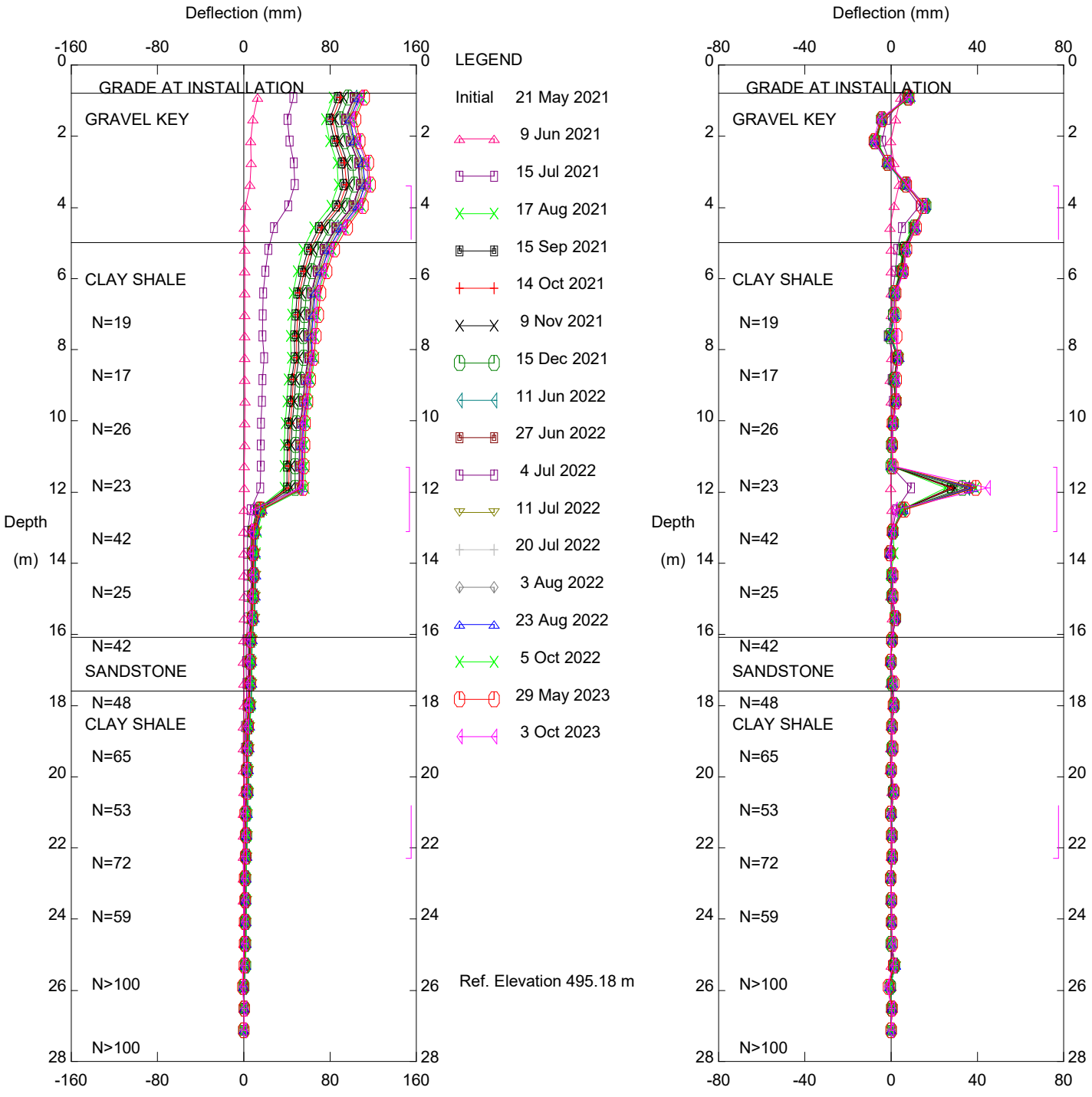
Thurber Engineering Ltd.



Pile Wall, Inclinometer S-SI-01

Hangingstone Bridge South Abutment

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

In Ground, Inclinometer N-SI-02

Hangingstone Bridge North Abutment

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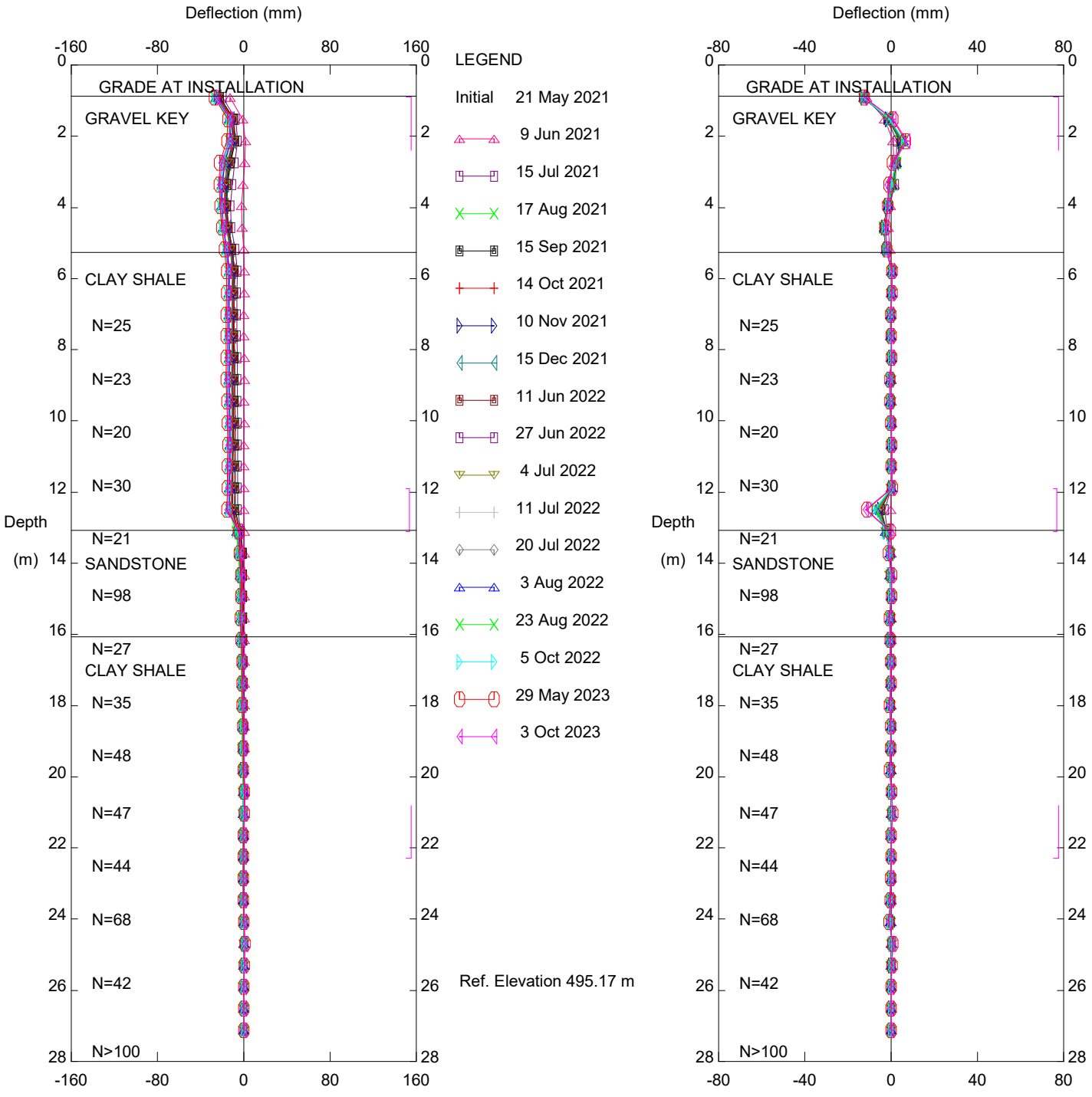
Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

Direction B

In Ground, Inclinometer S-SI-02

Hangingstone Bridge South Abutment

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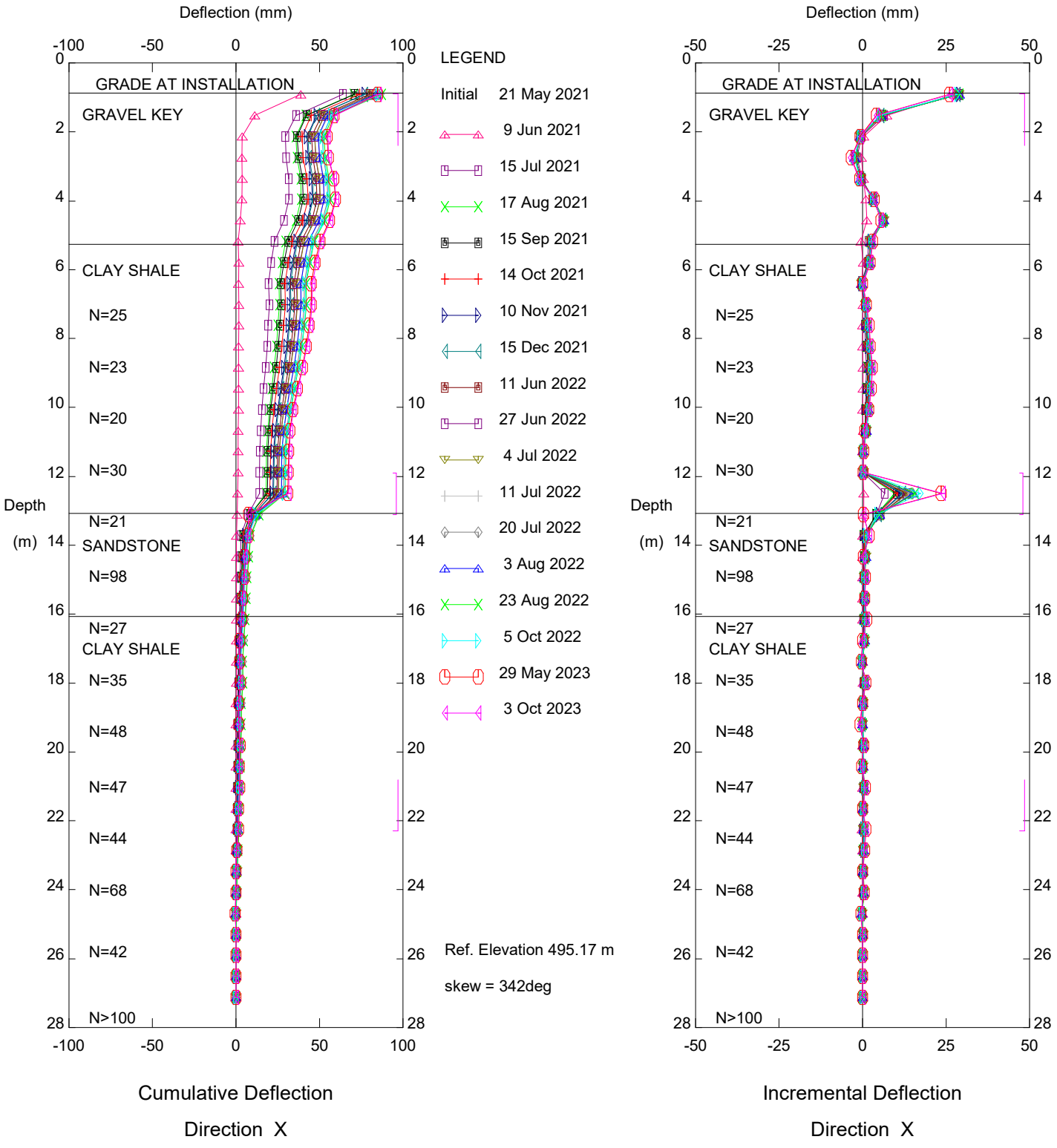
Thurber Engineering Ltd.



Cumulative Deflection

Direction X

Incremental Deflection

Direction X

In Ground, Inclinometer S-SI-02

Hangingstone Bridge South Abutment

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\Section C\2023B-Fall\SI Readings\NC99\S-SI-02_bwn.gtl

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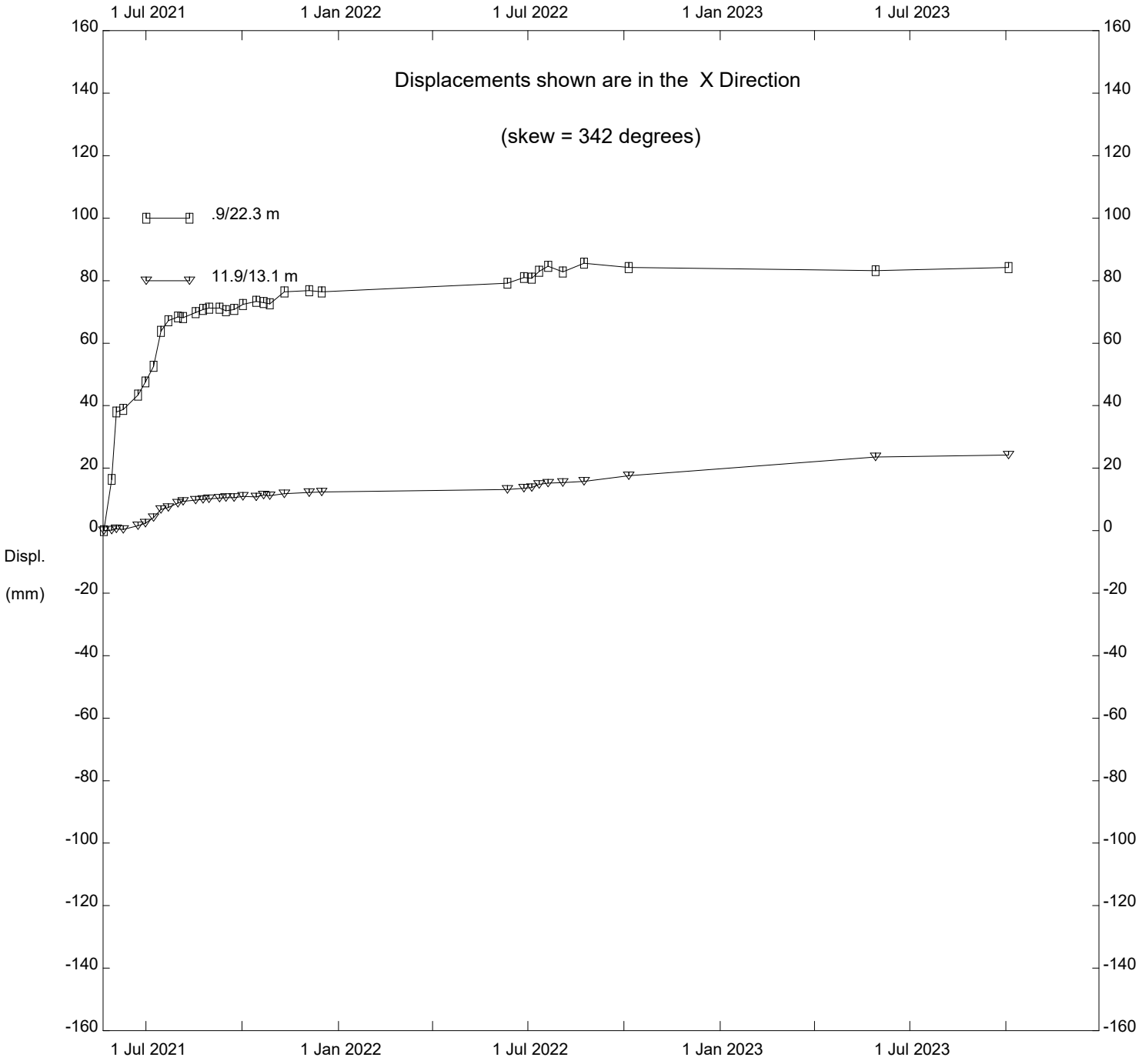


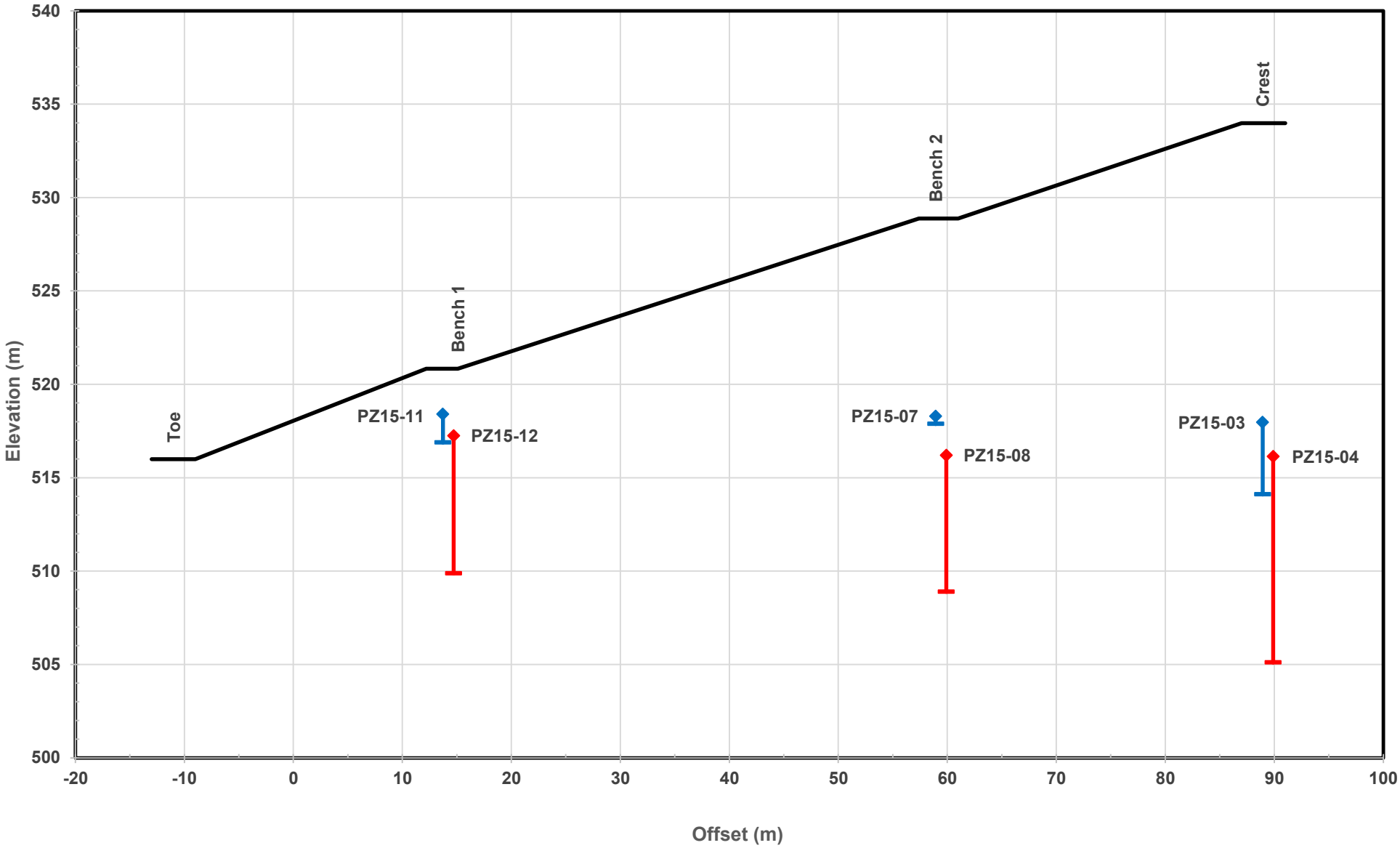
In Ground, Inclinometer S-SI-02

Hangingstone Bridge South Abutment

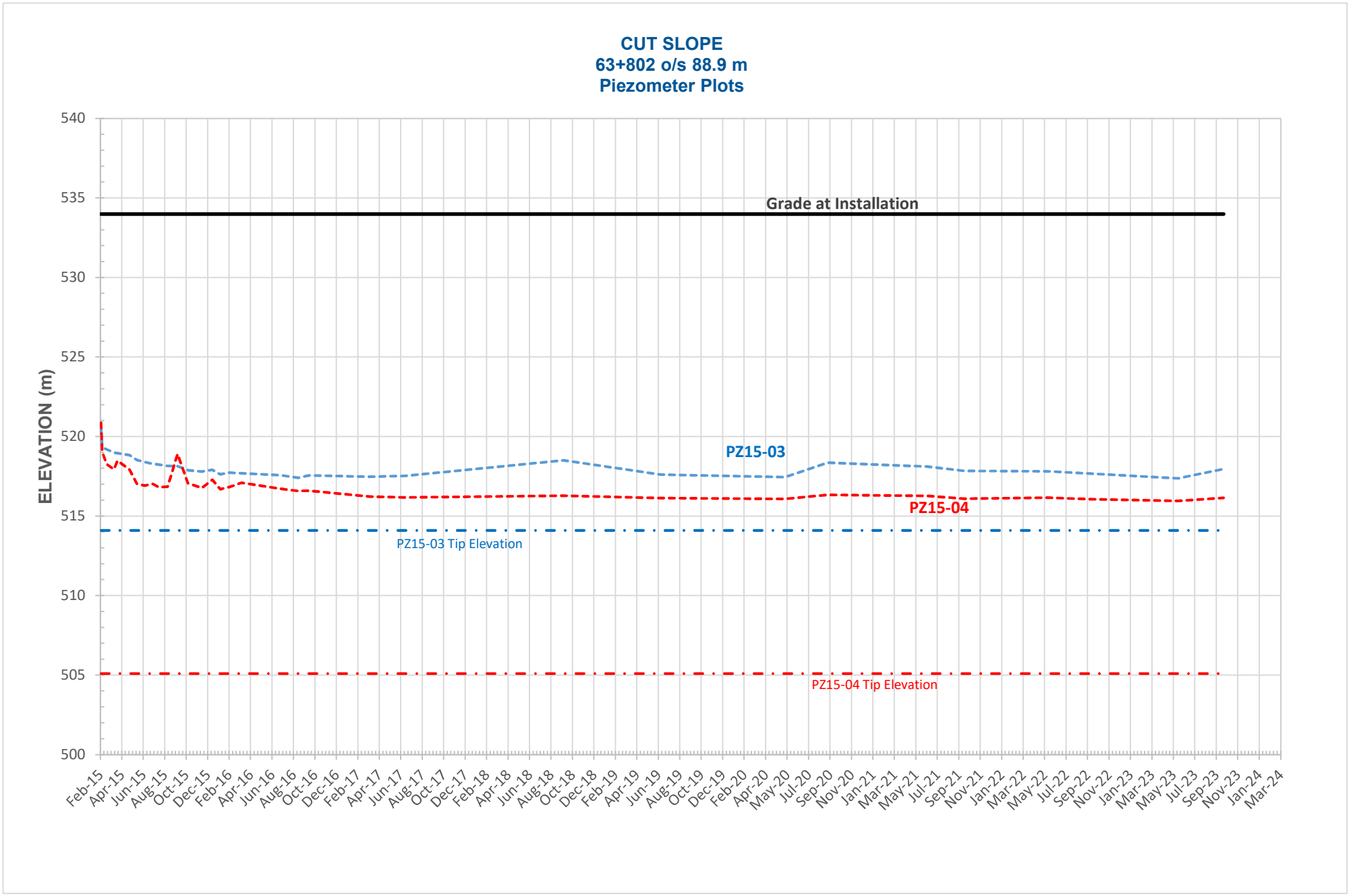
THURBER ENGINEERING LTD.

Northbound Lane Instrumentation Plots

PIEZOMETER PLOT
63+800



NC099-01


CUT SLOPE
63+802 o/s 88.9 m
Piezometer Plots
ELEVATION (m)
540
535
530
525
520
515
510
505
500
Grade at Installation
PZ15-03
PZ15-04
PZ15-03 Tip Elevation
PZ15-04 Tip Elevation
Feb-15
Apr-15
Jun-15
Aug-15
Oct-15
Dec-15
Feb-16
Apr-16
Jun-16
Aug-16
Oct-16
Dec-16
Feb-17
Apr-17
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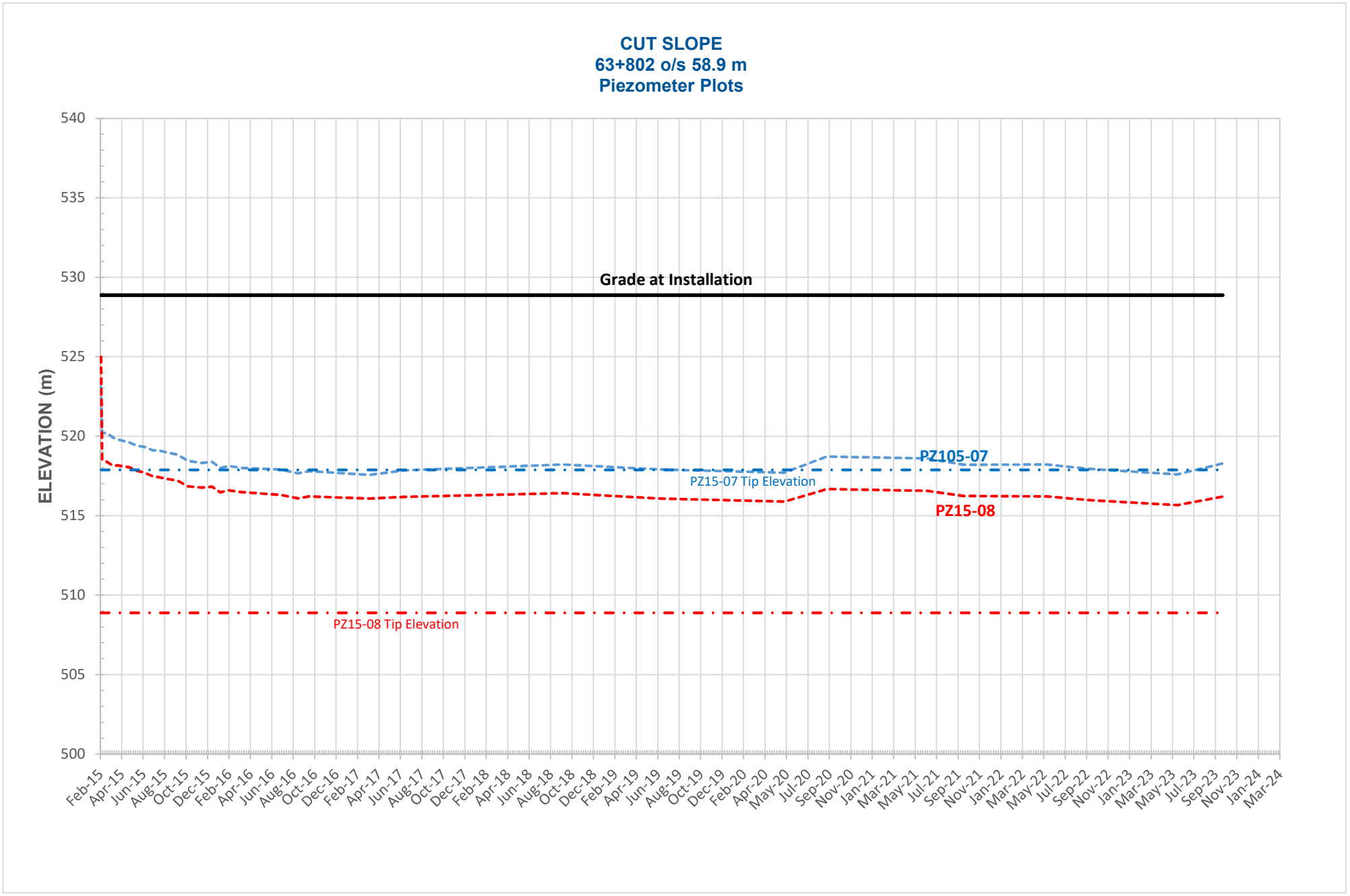
Nov-23
Jan-24
Mar-24

NC099-02


CUT SLOPE
63+802 o/s 58.9 m
Piezometer Plots
ELEVATION (m)
540
535
530
525
520
515
510
505
500
Grade at Installation
PZ105-07
PZ15-07 Tip Elevation
PZ15-08
PZ15-08 Tip Elevation
Feb-15
Apr-15
Jun-15
Aug-15
Oct-15
Dec-15
Feb-16
Apr-16
Jun-16
Aug-16
Oct-16
Dec-16
Feb-17
Apr-17
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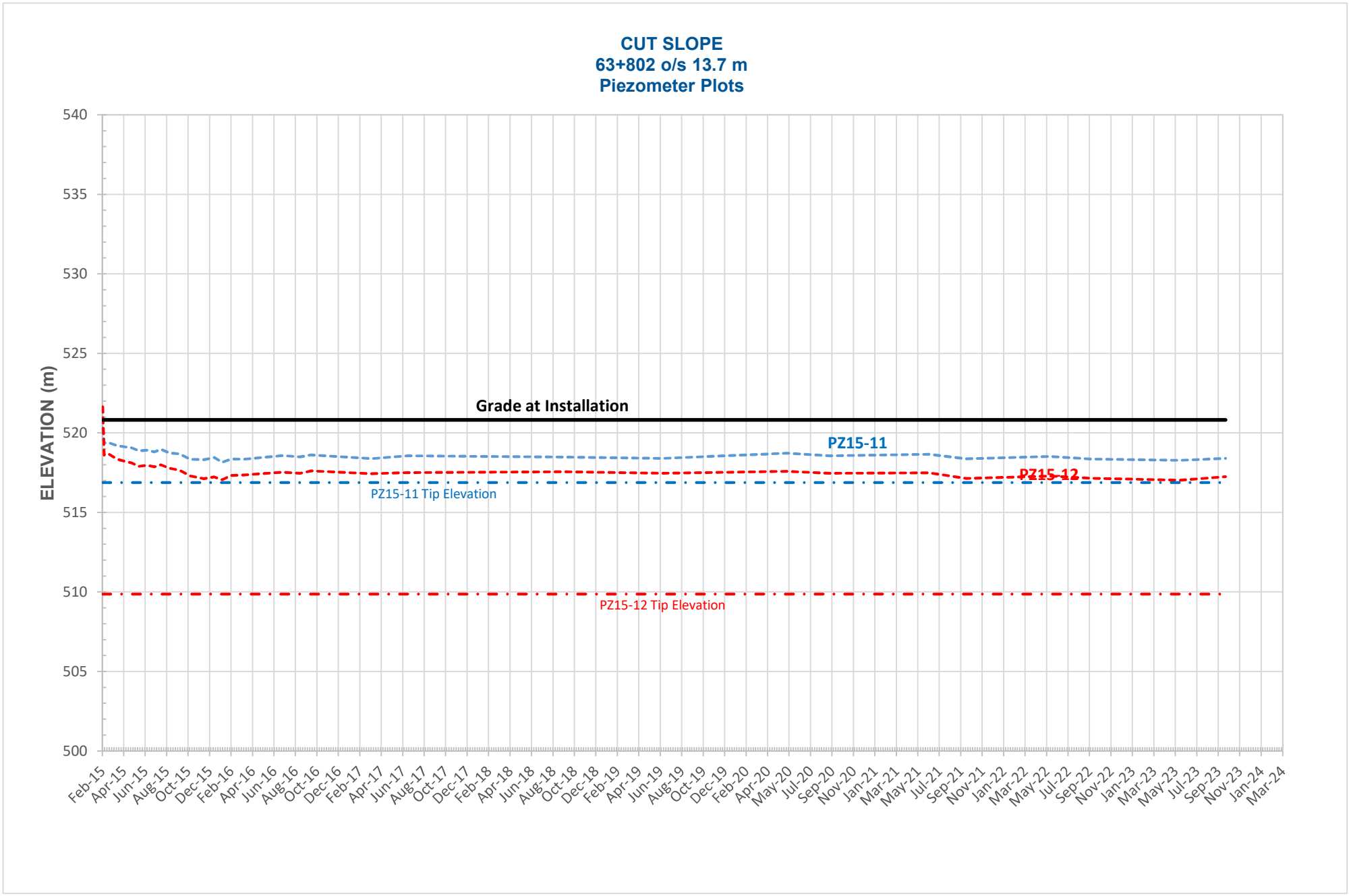
Nov-23
Jan-24
Mar-24

NC099-03


CUT SLOPE
63+802 o/s 13.7 m
Piezometer Plots
ELEVATION (m)
540
535
530
525
520
515
510
505
500
Grade at Installation
PZ15-11
PZ15-12
PZ15-11 Tip Elevation
PZ15-12 Tip Elevation
Feb-15
Apr-15
Jun-15
Aug-15
Oct-15
Dec-15
Feb-16
Apr-16
Jun-16
Aug-16
Oct-16
Dec-16
Feb-17
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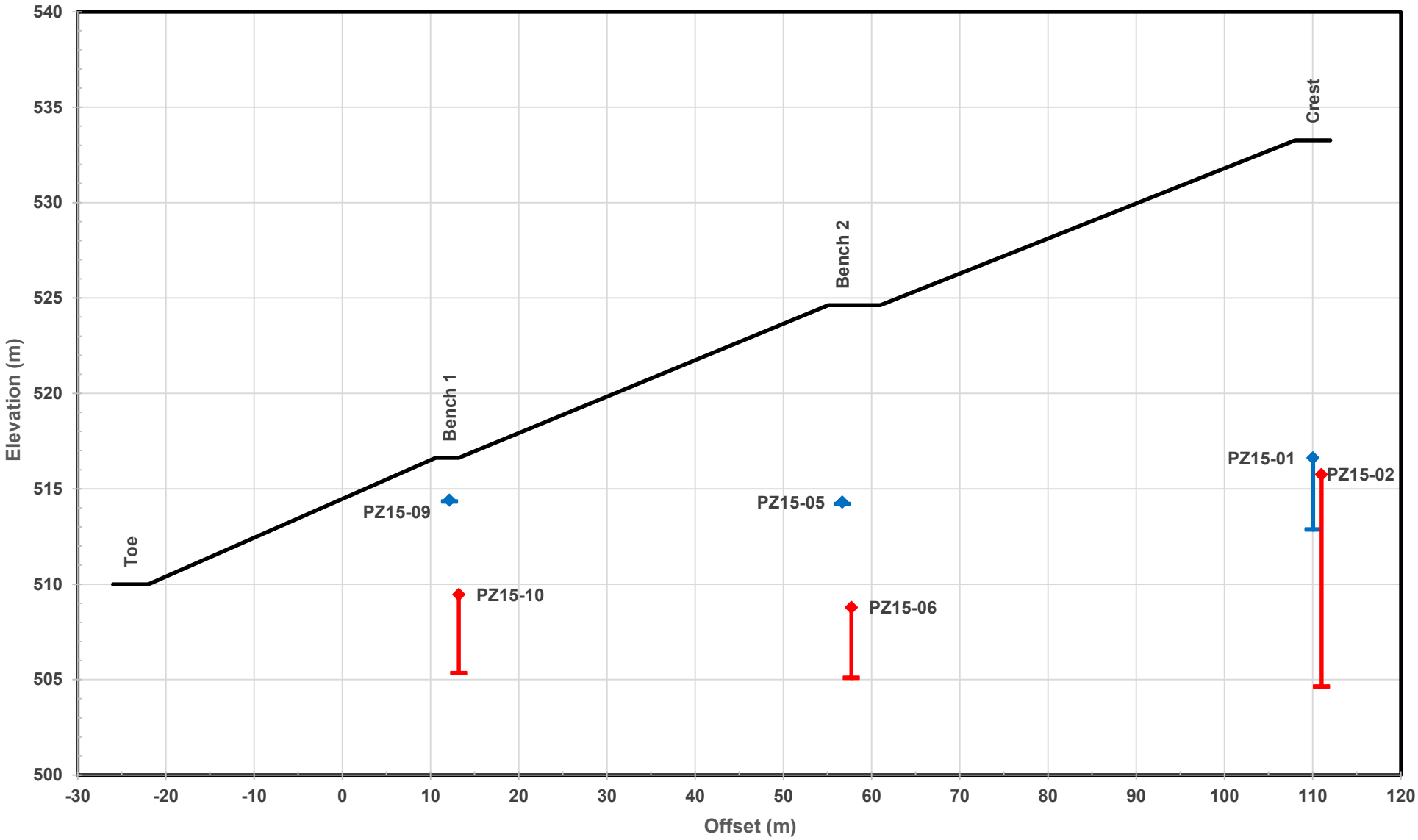
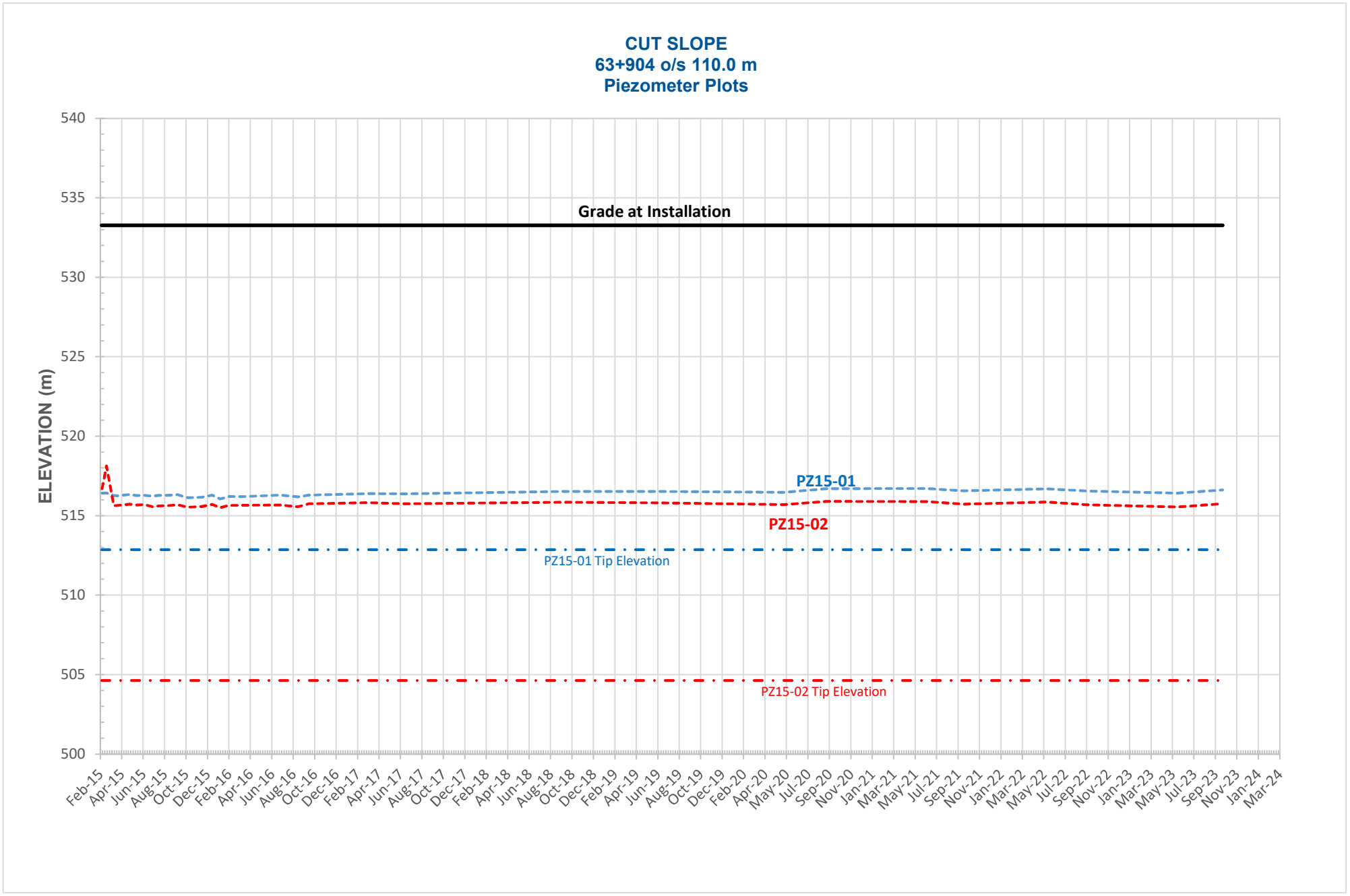
NC099-04

PIEZOMETER PLOT
63+900



NC099-05


CUT SLOPE
63+904 o/s 110.0 m
Piezometer Plots
ELEVATION (m)
540
535
530
525
520
515
510
505
500
Grade at Installation
PZ15-01
PZ15-02
PZ15-01 Tip Elevation
PZ15-02 Tip Elevation
Feb-15
Apr-15
Jun-15
Aug-15
Oct-15
Dec-15
Feb-16
Apr-16
Jun-16
Aug-16
Oct-16
Dec-16
Feb-17
Apr-17
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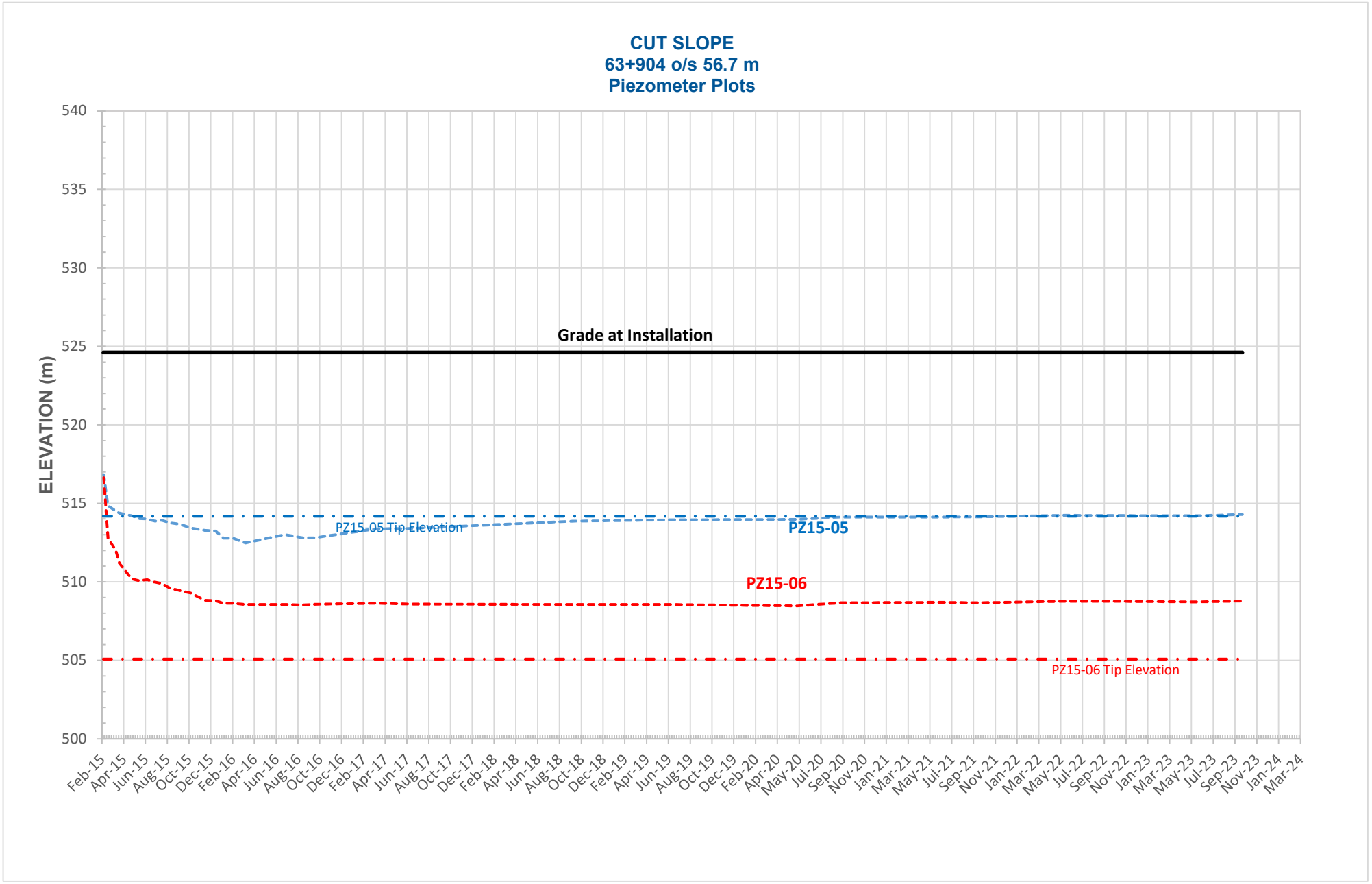
Mar-24

NC099-06


CUT SLOPE
63+904 o/s 56.7 m
Piezometer Plots
ELEVATION (m)
540
535
530
525
520
515
510
505
500
Grade at Installation
PZ15-05 Tip Elevation
PZ15-05
PZ15-06
PZ15-06 Tip Elevation
Feb-15
Apr-15
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Feb-16
Apr-16
Jun-16
Aug-16
Oct-16
Dec-16
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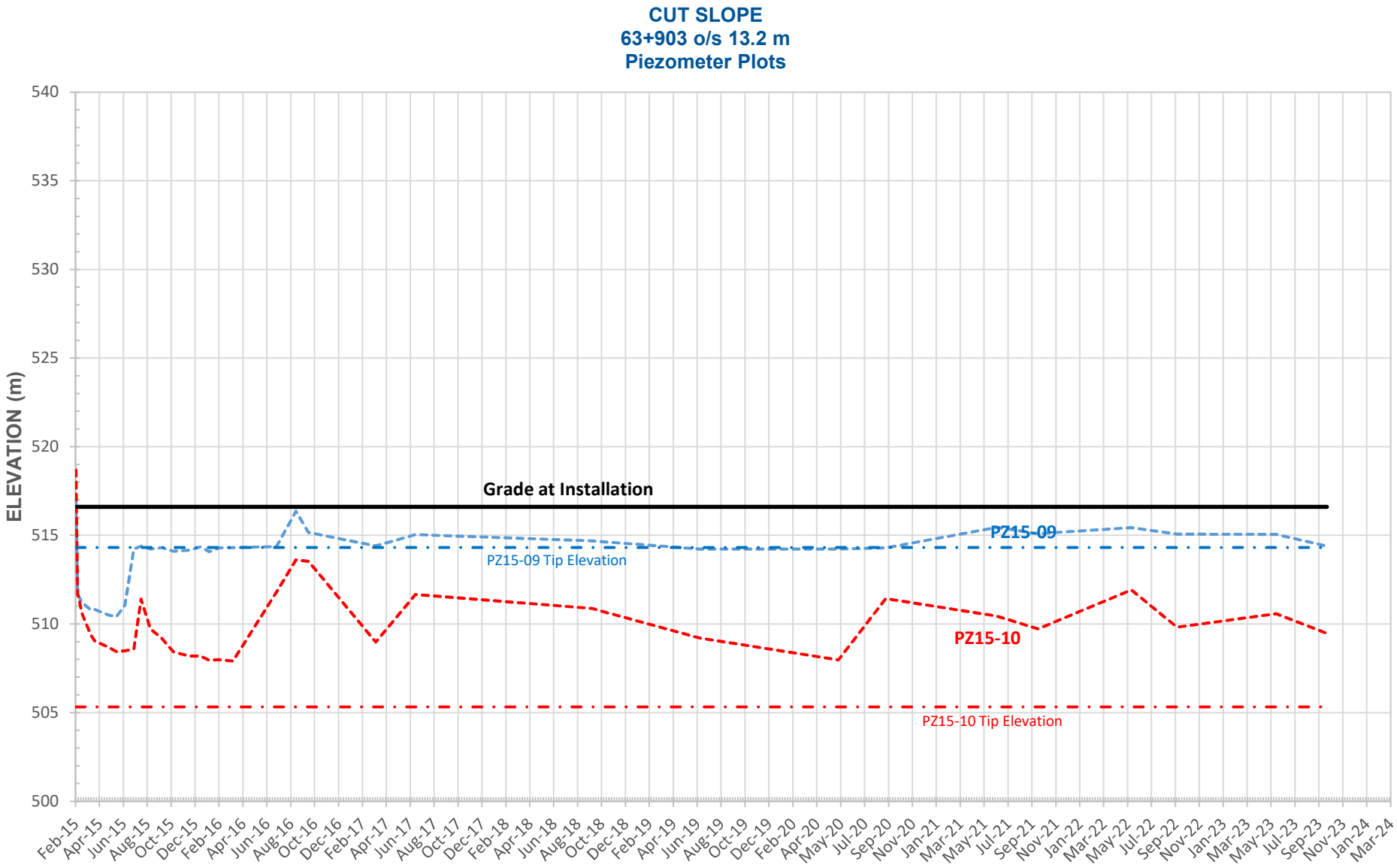
NC099-07


CUT SLOPE
63+903 o/s 13.2 m
Piezometer Plots
ELEVATION (m)
540
535
530
525
520
515
510
505
500
Grade at Installation
PZ15-09
PZ15-09 Tip Elevation
PZ15-10
PZ15-10 Tip Elevation
Feb-15
Apr-15
Jun-15
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Oct-15
Dec-15
Feb-16
Apr-16
Jun-16
Aug-16
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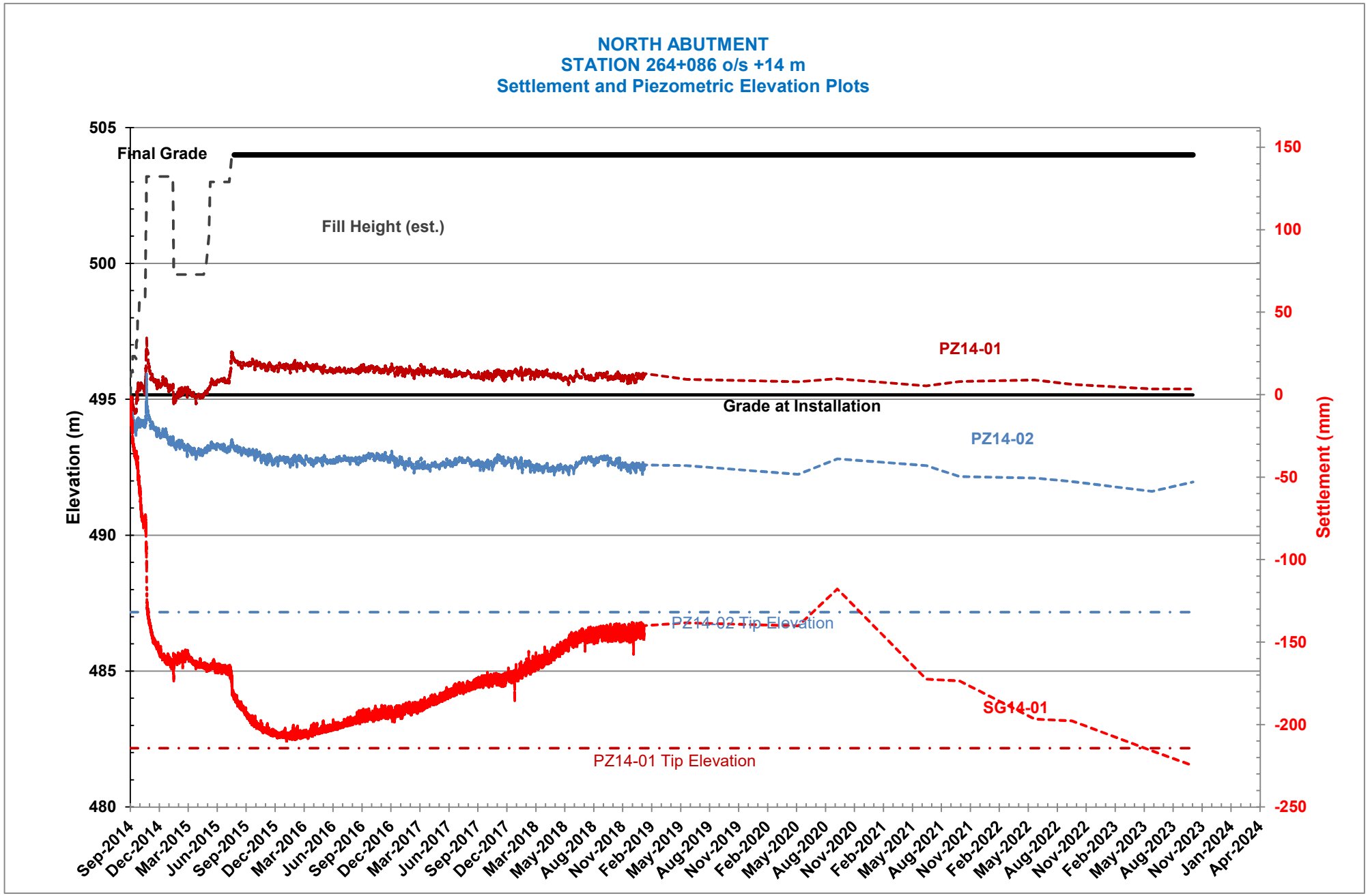
NC099-08


NORTH ABUTMENT
STATION 264+086 o/s +14 m
Settlement and Piezometric Elevation Plots
Final Grade
Fill Height (est.)
PZ14-01
Grade at Installation
PZ14-02
PZ14-02 Tip Elevation
SG14-01
PZ14-01 Tip Elevation
Elevation (m)
Settlement (mm)
505
500
495
490
485
480
150
100
50
0
-50
-100
-150
-200
-250
Sep-2014
Dec-2014
Mar-2015
Jun-2015
Sep-2015
Dec-2015
Mar-2016
Jun-2016
Sep-2016
Dec-2016
Mar-2017
Jun-2017
Sep-2017
Dec-2017
Mar-2018
May-2018
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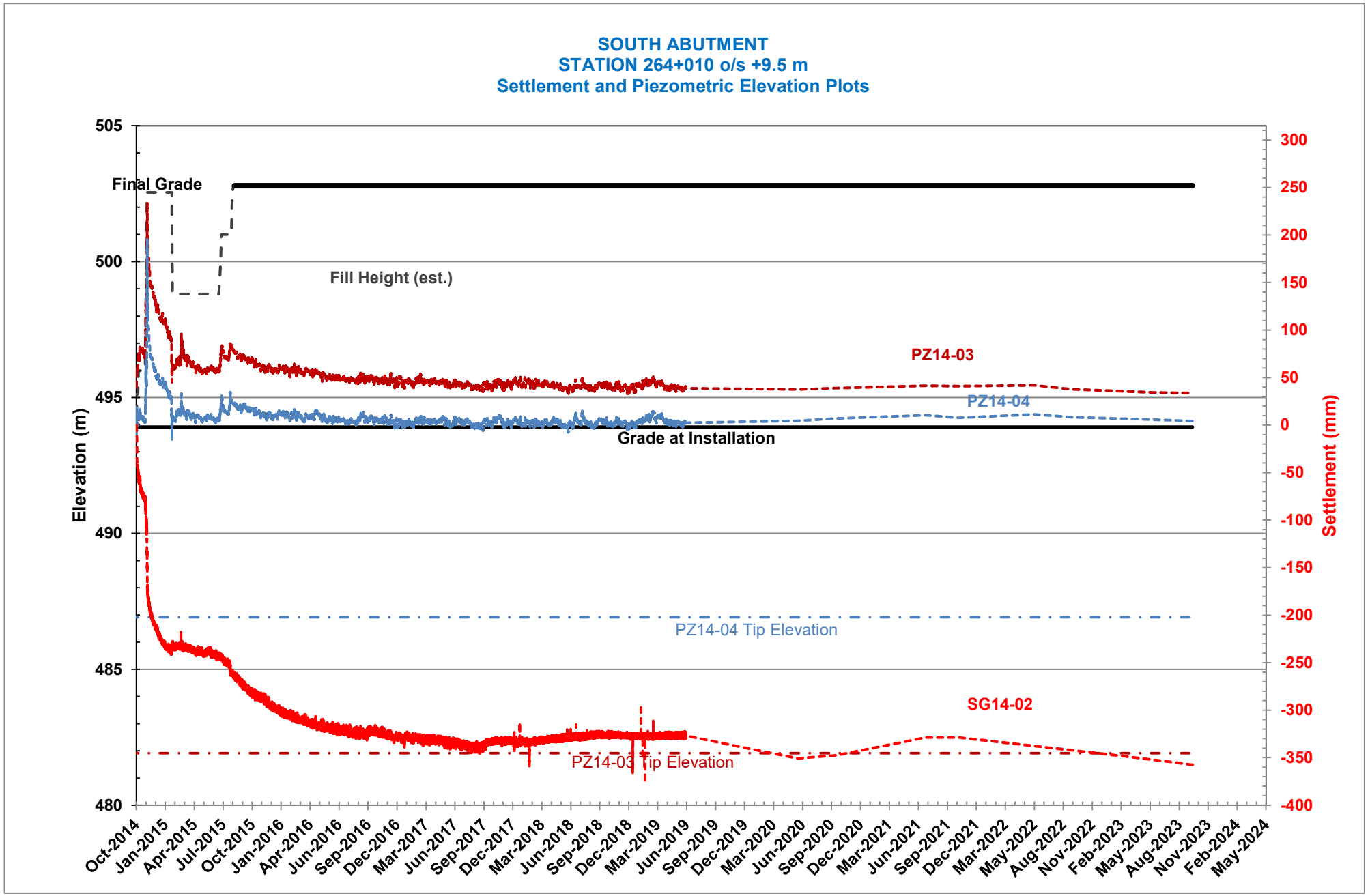
Apr-2024

NC099-09


SOUTH ABUTMENT
STATION 264+010 o/s +9.5 m
Settlement and Piezometric Elevation Plots
Elevation (m)
Settlement (mm)
505
500
495
490
485
480
300
250
200
150
100
50
0
-50
-100
-150
-200
-250
-300
-350
-400
Final Grade
Fill Height (est.)
PZ14-03
PZ14-04
Grade at Installation
PZ14-04 Tip Elevation
SG14-02
PZ14-03 Tip Elevation
Oct-2014
Jan-2015
Apr-2015
Jul-2015
Oct-2015
Jan-2016
Apr-2016
Jun-2016
Sep-2016
Dec-2016
Mar-2017
Jun-2017
Sep-2017
Dec-2017
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May-2022
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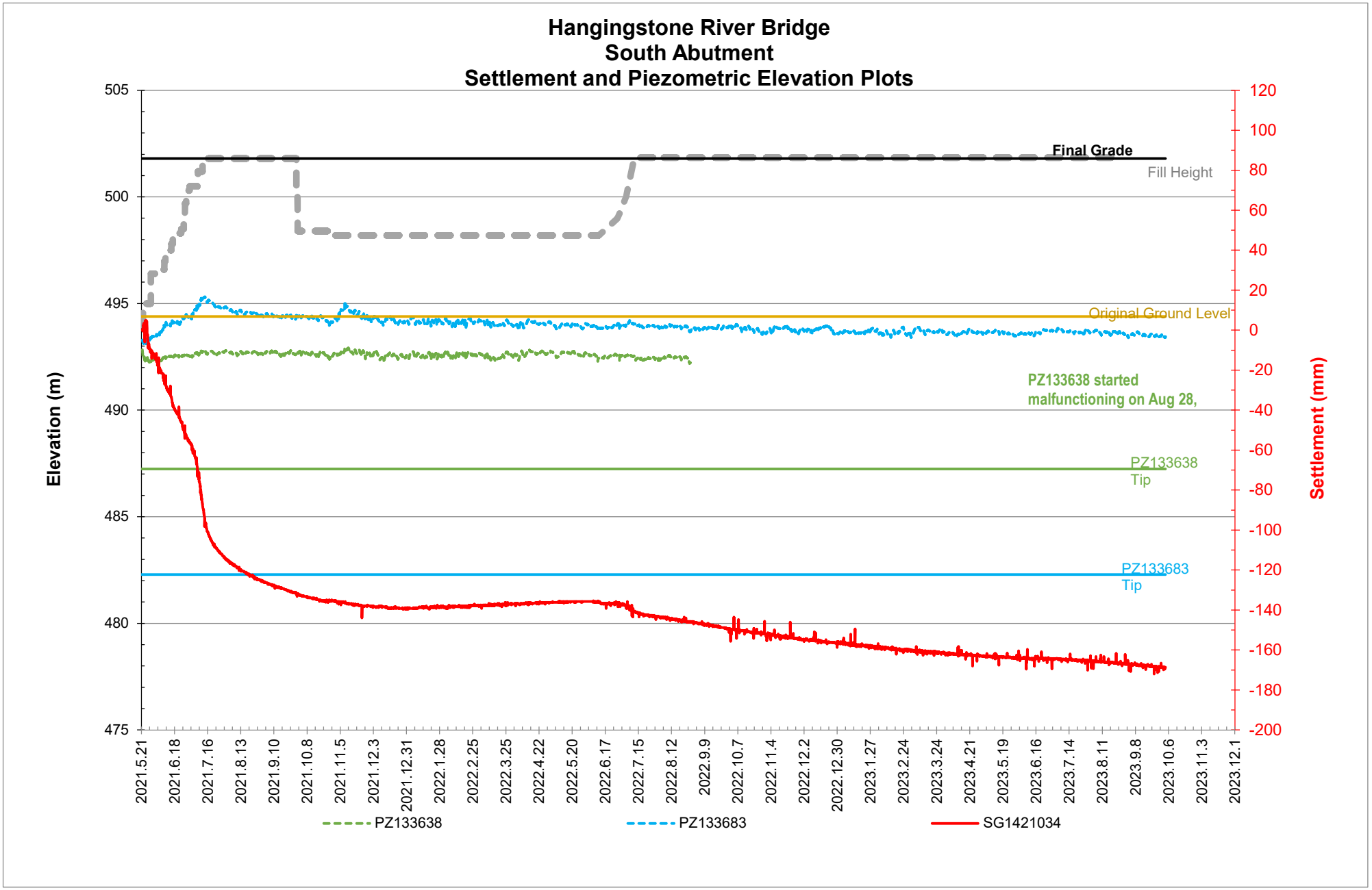
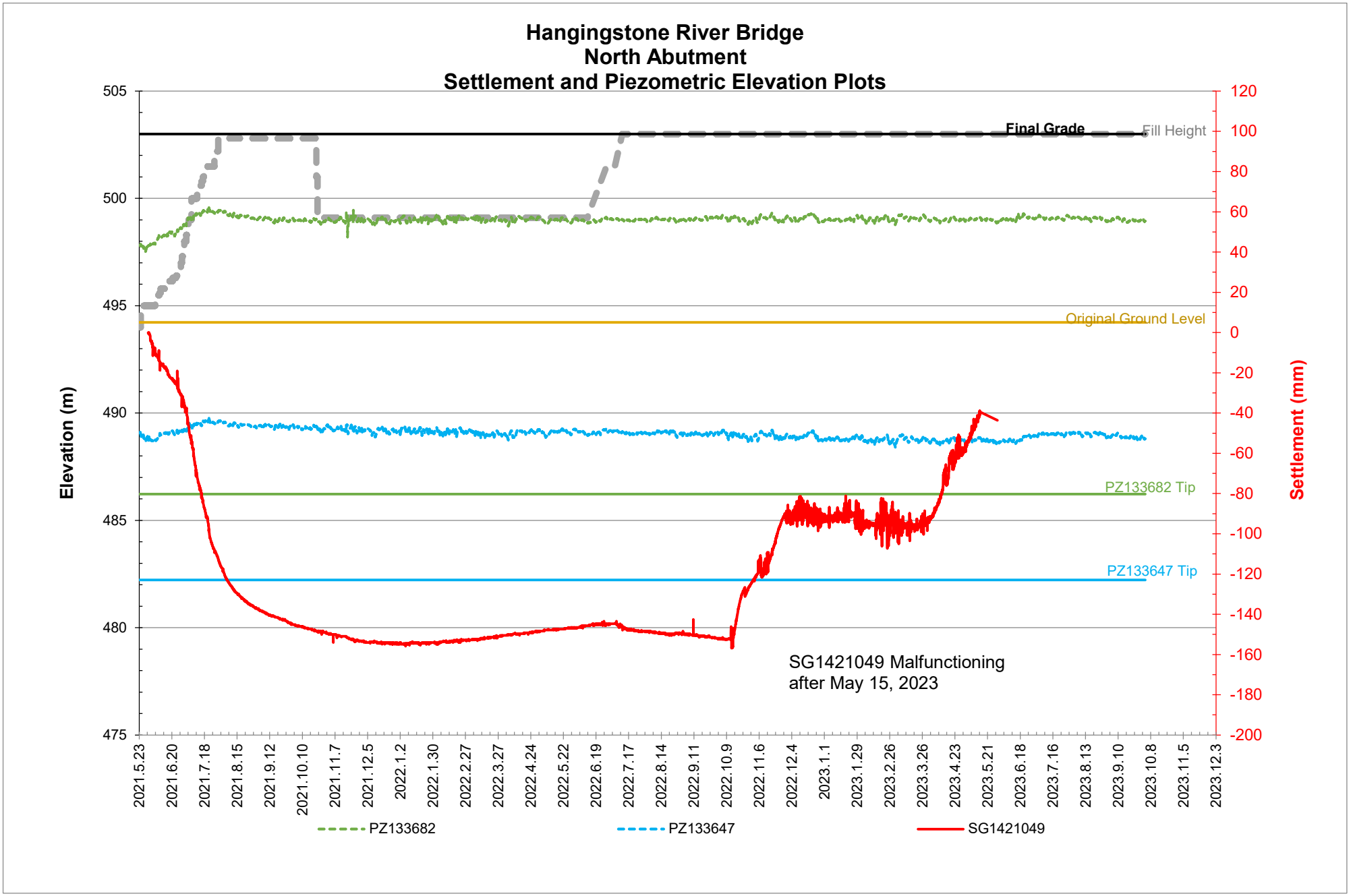
Nov-2023
Feb-2024
May-2024

THURBER ENGINEERING LTD.

Southbound Lane Instrumentation Plots


Hangingstone River Bridge
South Abutment
Settlement and Piezometric Elevation Plots
Elevation (m)
Settlement (mm)
505
500
495
490
485
480
475
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
Final Grade
Fill Height
Original Ground Level
PZ133638 started
malfunctioning on Aug 28,
PZ133638
Tip
PZ133683
Tip
2021.5.21
2021.6.18
2021.7.16
2021.8.13
2021.9.10
2021.10.8
2021.11.5
2021.12.3
2021.12.31
2022.1.28
2022.2.25
2022.3.25
2022.4.22
2022.5.20
2022.6.17
2022.7.15
2022.8.12
2022.9.9
2022.10.7
2022.11.4
2022.12.2
2022.12.30
2023.1.27
2023.2.24
2023.3.24
2023.4.21
2023.5.19
2023.6.16
2023.7.14
2023.8.11
2023.9.8
2023.10.6
2023.11.3
2023.12.1
PZ133638
PZ133683
SG1421034


Hangingstone River Bridge
North Abutment
Settlement and Piezometric Elevation Plots
Elevation (m)
Settlement (mm)
505
500
495
490
485
480
475
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
Final Grade
Fill Height
Original Ground Level
PZ133682 Tip
PZ133647 Tip
SG1421049 Malfunctioning
after May 15, 2023
2021.5.23
2021.6.20
2021.7.18
2021.8.15
2021.9.12
2021.10.10
2021.11.7
2021.12.5
2022.1.2
2022.1.30
2022.2.27
2022.3.27
2022.4.24
2022.5.22
2022.6.19
2022.7.17
2022.8.14
2022.9.11
2022.10.9
2022.11.6
2022.12.4
2023.1.1
2023.1.29
2023.2.26
2023.3.26
2023.4.23
2023.5.21
2023.6.18
2023.7.16
2023.8.13
2023.9.10
2023.10.8
2023.11.5
2023.12.3
PZ133682
PZ133647
SG1421049

NC099-12