



THURBER ENGINEERING LTD.

August 20, 2021

File No.: 32122, Task C

Alberta Transportation
Twin Atria Building
4999 – 98 Avenue
Edmonton, Alberta
T6B 2X3

Attention: Mr. Bernard Ching, P.Eng.

**ALBERTA TRANSPORTATION GRMP (CON0022163)
NORTH CENTRAL (ATHABASCA AND FORT McMURRAY DISTRICTS)
INSTRUMENTATION MONITORING RESULTS – SPRING 2021**

SECTION C

SITE NC069: HWY 63:02 SLOPE REPAIR SOUTH OF WANDERING RIVER

Dear Mr. Ching:

This report provides the results of the annual geotechnical instrumentation monitoring for the above-mentioned site as part of Alberta Transportation's 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. FIELD PROGRAM AND INSTRUMENTATION STATUS

Four slope inclinometers (SI09-1, SI09-4, SI10-1 and SI13-14), three pneumatic piezometers (PN09-1, PN09-3 and PN10-1) and three vibrating wire piezometers (VW13-11, VW13-12 and VW13-13) were read at the HWY 63:02 site, located south of Wandering River on June 29, 2021 by Mr. Niraj Regmi, G.I.T. and Mr. Long Le, both of Thurber Engineering Ltd. VW13-13 was malfunctioning when read and no data was obtained.

A site plan showing the instrumentation locations is 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 pneumatic piezometers were read using a RST C108 pneumatic piezometer reader. The vibrating wire piezometers were read using a RST VW2106 vibrating wire readout.

A flagging crew and traffic signs were required to read slope inclinometers SI09-1 and SI10-1 and pneumatic piezometers PN09-1 and PN10-1, which were installed on the east shoulder of the highway southbound lanes.



1.1 General

SI plots for A and B directions are presented in Appendix A and are summarized below. Where movement has been recorded the resultant plot (X direction, if applicable) and rate of movement have also been provided. Pneumatic and vibrating wire piezometer results are also provided in Appendix A.

1.2 Zones of Movement

Zones of new movement were not observed in the SIs since the previous readings in the fall of 2020.

Zones of movement are summarized in Table NC069-1 below. Table NC069-1 also provides a historical account of the total movement, the depth of movement and the maximum rate of movement that has occurred in the SIs since initialization.



**TABLE NC069-1
 SPRING 2021 – HWY 63:02 SLOPE REPAIR SOUTH OF WANDERING RIVER
 SLOPE INCLINOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: June 29, 2021

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)
SI09-1	October 4, 2009	9.0 over 10.2 m to 12.6 m depth in 88° direction	25.1 on May 24, 2013	Operational	September 20, 2020	0.1	0.1	4.1
SI09-4	November 19, 2009	57.0 over 10.3 m to 12.1 m depth in 330° direction	1505.1 on November 21, 2009	Operational	September 20, 2020	0.4	0.5	1.6
SI10-1	April 12, 2010	10.5 over 3.3 m to 6.4 m depth in 90° direction	7.3 on April 4, 2011	Operational	September 20, 2020	0.2	0.3	2.0
SI13-14	September 3, 2013	16.0 over 7.5 m to 10.5 m depth in 332° direction	284.3 on September 10, 2013	Operational	September 20, 2020	0.2	0.3	-1.6

Drawing 32122-NC069 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site



**TABLE NC069-2
 SPRING 2021 – HWY 63:02 SLOPE REPAIR SOUTH OF WANDERING RIVER
 PNEUMATIC PIEZOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: June 29, 2021

INSTRUMENT #	DATE INITIALIZED	TIP ELEV. (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED GROUNDWATER ELEVATION (m)	MEASURED PORE PRESSURE (kPa)	CURRENT GROUNDWATER ELEVATION (m)	PREVIOUS GROUNDWATER ELAVATION (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
PN09-1	October 4, 2009	536.80	548.80	Active	545.40 on September 10, 2018	76.6	544.61	544.75	-0.14
PN09-3	October 4, 2009	538.07	546.07	Active	543.27 on September 3, 2009	45.1	542.67	542.87	-0.20
PN10-1	April 12, 2010	538.90	548.65	Active	544.37 on September 20, 2020	51.7	544.17	544.37	-0.20

Drawing 32122-NC069 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site



**TABLE NC069-3
 SPRING 2021 – HWY 63:02 SLOPE REPAIR SOUTH OF WANDERING RIVER
 VIBRATING WIRE PIEZOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: June 29, 2021

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)
VW13-11 (25325)	May 6, 2013	539.51	547.74	Operational	540.66 on September 4, 2013	540.33	540.17	0.16
VW13-12 (25323)	May 6, 2013	539.04	547.69	Operational	542.89 on September 4, 2013	541.87	542.05	-0.18
VW13-13 (25324)	May 6, 2013	539.59	544.88	<i>Not functioning</i>	541.01 on August 28, 2013	<i>No reading</i>	<i>No reading</i>	<i>N/A</i>

Drawing 32122-NC069 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site



2. INTERPRETATION OF MONITORING RESULTS

Slope inclinometer SI09-1, installed near the southern limit of the east landslide on the highway surface, showed a rate of movement of 0.1 mm/yr over 10.2 m to 12.6 m depth since the fall of 2020 readings. SI09-4, installed in the vicinity of the crest of the west landslide area, showed a rate of movement of 0.5 mm/yr over 10.3 m to 12.1 m depth since the fall of 2020 readings. SI10-1, installed near the northern limit of the east landslide on the highway surface, showed a rate of movement of 0.3 mm/yr over 3.3 m to 6.4 m depth since the fall of 2020 readings. SI13-14, installed within the footprint of the toe berm constructed in 2013 to stabilize the west landslide area, showed a rate of movement of 0.3 mm/yr over 7.5 m to 10.5 m depth since the fall of 2020 readings. Overall, the SIs have shown creep rates of movement over their respective movement zones over the past several years.

The groundwater level decreased in PN09-1, PN09-3 and PN10-1 by 0.14 m, 0.20 m and 0.20 m, respectively, since the fall of 2020 readings. Table NC069-2 summarizes the pneumatic piezometer readings.

Vibrating wire piezometer VW13-11 showed an increase in groundwater level of 0.16 m since the fall of 2020 readings, while VW13-12 showed a decrease in groundwater level of 0.18 m over the same time period. Table NC069-3 summarizes the vibrating wire piezometer readings.

The pneumatic and vibrating wire piezometer readings are plotted on Figures NC069-1 (by elevation) and NC069-1 (by depth) in Appendix A.

3. RECOMMENDATIONS

3.1 Future Work

The instruments should be read again in the spring of 2022. VW13-13 has been non-functional for two consecutive readings cycles and will not be read going forward.

3.2 Instrumentation Repairs

No instrument repairs are required at this time.



4. CLOSURE

We trust this report meets your requirements at present. If you have any questions, please contact the undersigned at your convenience.

Bruce Nestor, P.Eng.
Geotechnical Engineer
/jf

Attachments:

- Statement of Limitations and Conditions
- Appendix A
 - Field Inspector's report
 - Site Plan Showing Approximate Instrument Locations (Drawing No. 32122-NC069)
 - SI Reading Plots
 - Figure NC069-1 (Piezometric Elevations)
 - Figure NC069-2 (Piezometric Depths)



STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

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

2. COMPLETE REPORT

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

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

3. BASIS OF REPORT

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

4. USE OF THE REPORT

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

5. INTERPRETATION OF THE REPORT

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

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

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

7. INDEPENDENT JUDGEMENTS OF CLIENT

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



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

SPRING 2021

**APPENDIX A
DATA PRESENTATION AND SITE PLANS**

SITE NC069: HWY 63:02 SLOPE REPAIR SOUTH OF WANDERING RIVER

**ALBERTA TRANSPORTATION
NORTH CENTRAL REGION - ATHABASCA AND FORT McMURRAY DISTRICTS
INSTRUMENTATION MONITORING FIELD SUMMARY (NC069)
SPRING 2021**

Location: South of Wandering River (HWY 63:02 L1 32.020)	Readout: RST PN C108 Unit 6 / RST VW 2106 Unit 4
File Number: 32122	Casing Diameter: 2.75/3.34
Probe: RST Set 5R /8R	Temp (deg C): 25
Cable: RST Set 5R /8R	Read by: NKR / LL

SLOPE INCLINOMETER (SI) READINGS

SI#	GPS Location (UTM 12)		Date	Stickup (m)	Depth from top of casing (ft)	Azimuth of A+ Groove degree	Current Bottom Depth Readings				Probe/ Reel #	Remarks
	Easting	Northing					A+	A-	B+	B-		
SI09-1	403622	6105274	29-Jun-21	-0.15	60 to 2	79	-8	19	-268	267	8R/8R	
SI09-4	403599	6105301	29-Jun-21	1.00	55 to 3	322	230	-220	-519	508	5R/5R	
SI10-1	403626	6105316	29-Jun-21	0.04	60 to 2	122	-87	94	-40	-74	8R/8R	
SI13-14	403566	6105294	29-Jun-21	0.76	38 to 2	329	-254	264	64	-75	5R/5R	

PNEUMATIC PIEZOMETER (PN) READINGS

PN#	GPS Location (UTM 12)		Date	Reading kPa	Depth Below Ground Surface (m)	Identification Number
	Easting	Northing				
PN09-1	403622	6105274	29-Jun-21	76.6	12.0	032441
PN09-3	403602	6105296	29-Jun-21	45.1	8.0	032440
PN10-1	403626	6105316	29-Jun-21	51.7	9.8	033249

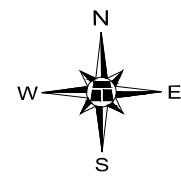
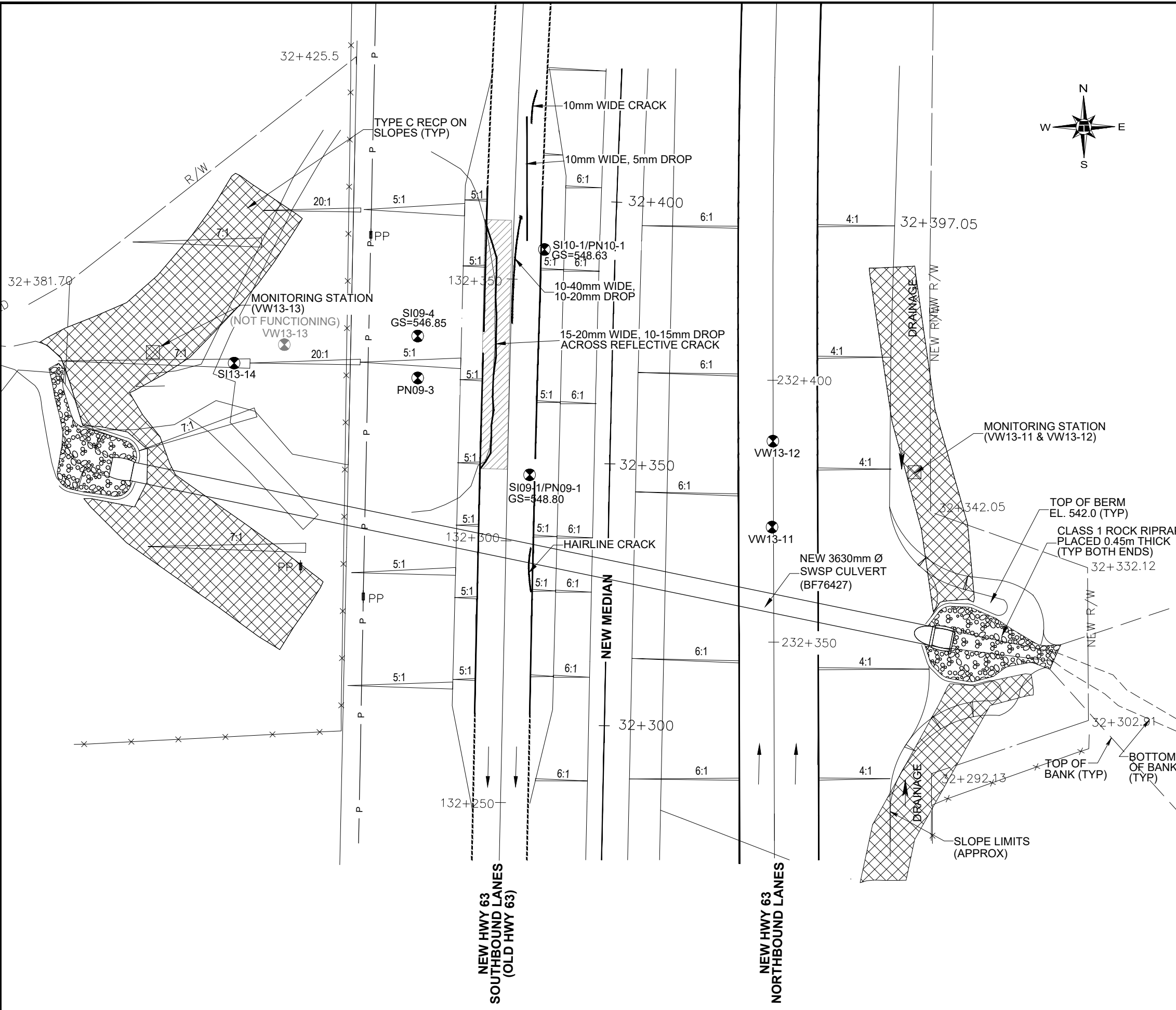
VIBRATING WIRE PIEZOMETER (VW) READINGS

VW#	GPS (UTM 12)		Date	Identification Number	Reading		Remarks
	Easting	Northing			B Unit	Temp (°C)	
VW13-11	6105263	403669	29-Jun-21	25325	8802.3	4.7	
VW13-12	6105279	403669	29-Jun-21	25323	8612.3	4.9	
VW13-13	6105298	403576	29-Jun-21	25324	-	-	No reading, temp has Open Circuit

INSPECTOR REPORT

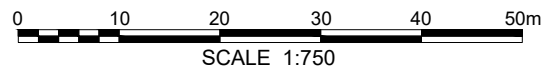
SI09-1 is in a flush mounted protector on southbound Highway 63 between edge of pavement and white line.
SI09-4 was installed on November 17, 2009 to replace SI09-3. It has a red stick-up protector in the west ditch.
SI10-1 is in a flush mounted protector on southbound Highway 63 between the edge of pavement and the white line.


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- LEGEND**
- INSTRUMENT LOCATION
 - MONITORING STATION
 - ACP PATCH
 - SI SLOPE INCLINOMETER
 - PN PNEUMATIC PIEZOMETER
 - VW VIBRATING WIRE PIEZOMETER
 - P OVERHEAD POWERLINE
 - X-X FENCE LINE
 - PP POWER POLE

- NOTE:**
1. OLD CULVERTS WERE GROUTED IN 2013.
 2. FUTURE HIGHWAY NORTHBOUND LANES AND THE NEW CULVERT WERE CONSTRUCTED IN 2013.






**NORTH CENTRAL
(ATHABASCA AND FORT MCMURRAY DISTRICTS)**

**NC069: HWY 63:02 (km 13) SOUTH OF
WANDERING RIVER SLIDE REPAIR**

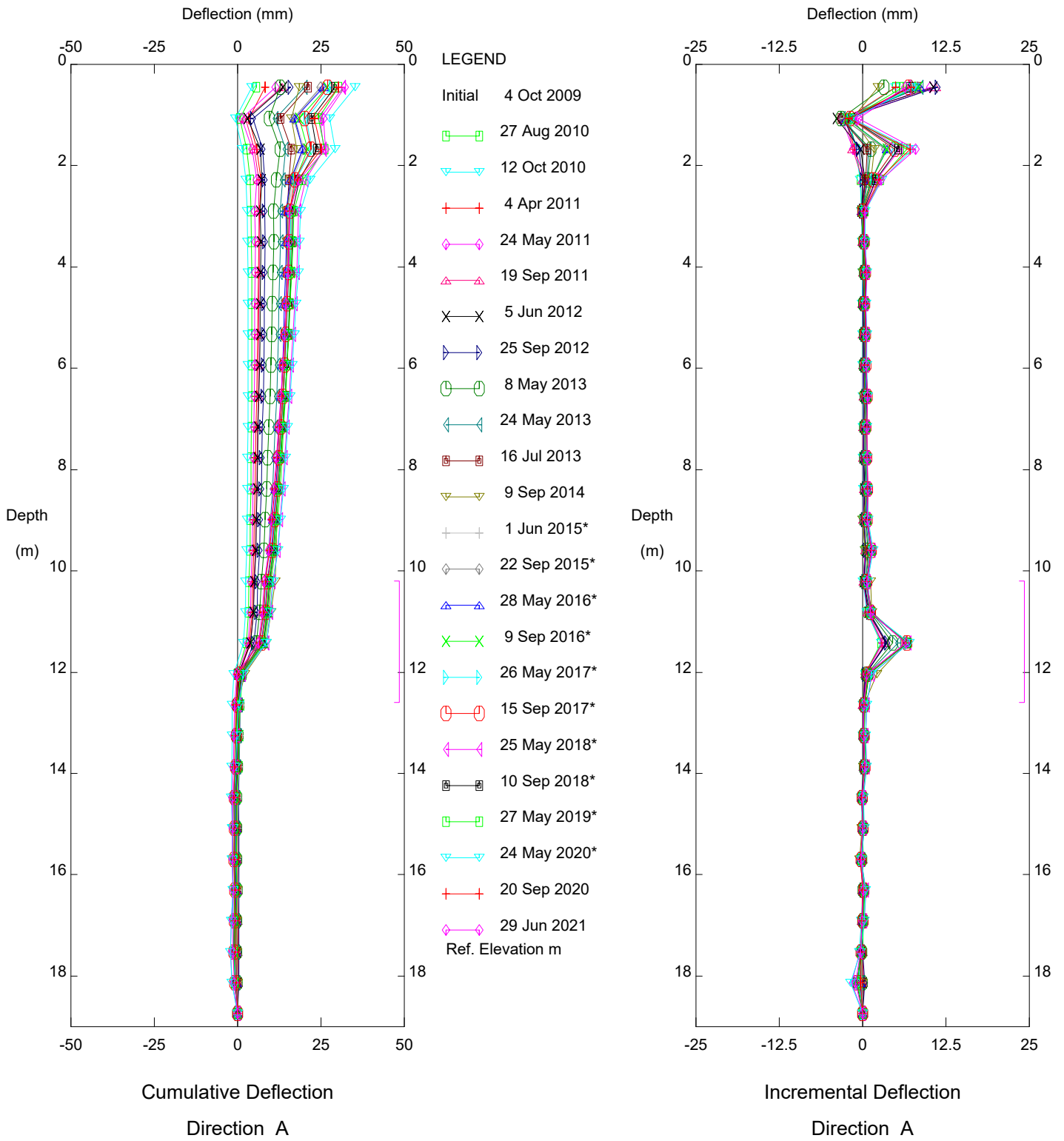
DWG No. 32122-NC069

DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	TSA
SCALE	1:750
DATE	AUGUST 2021
FILE No.	32122



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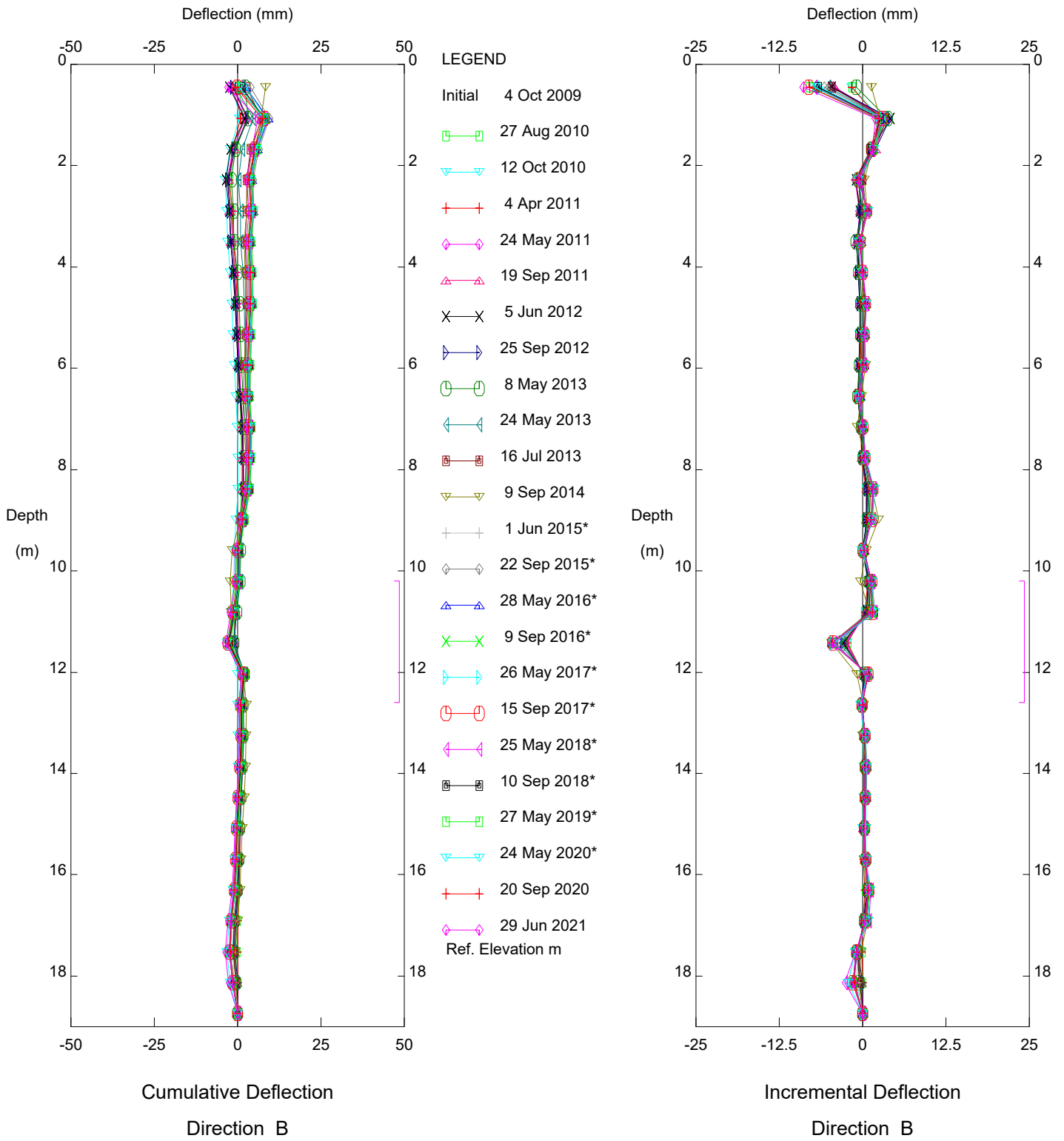


HWY 63:02 South of Wandering River, Inclinometer SI09-1

Alberta Transportation

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

Thurber Engineering Ltd

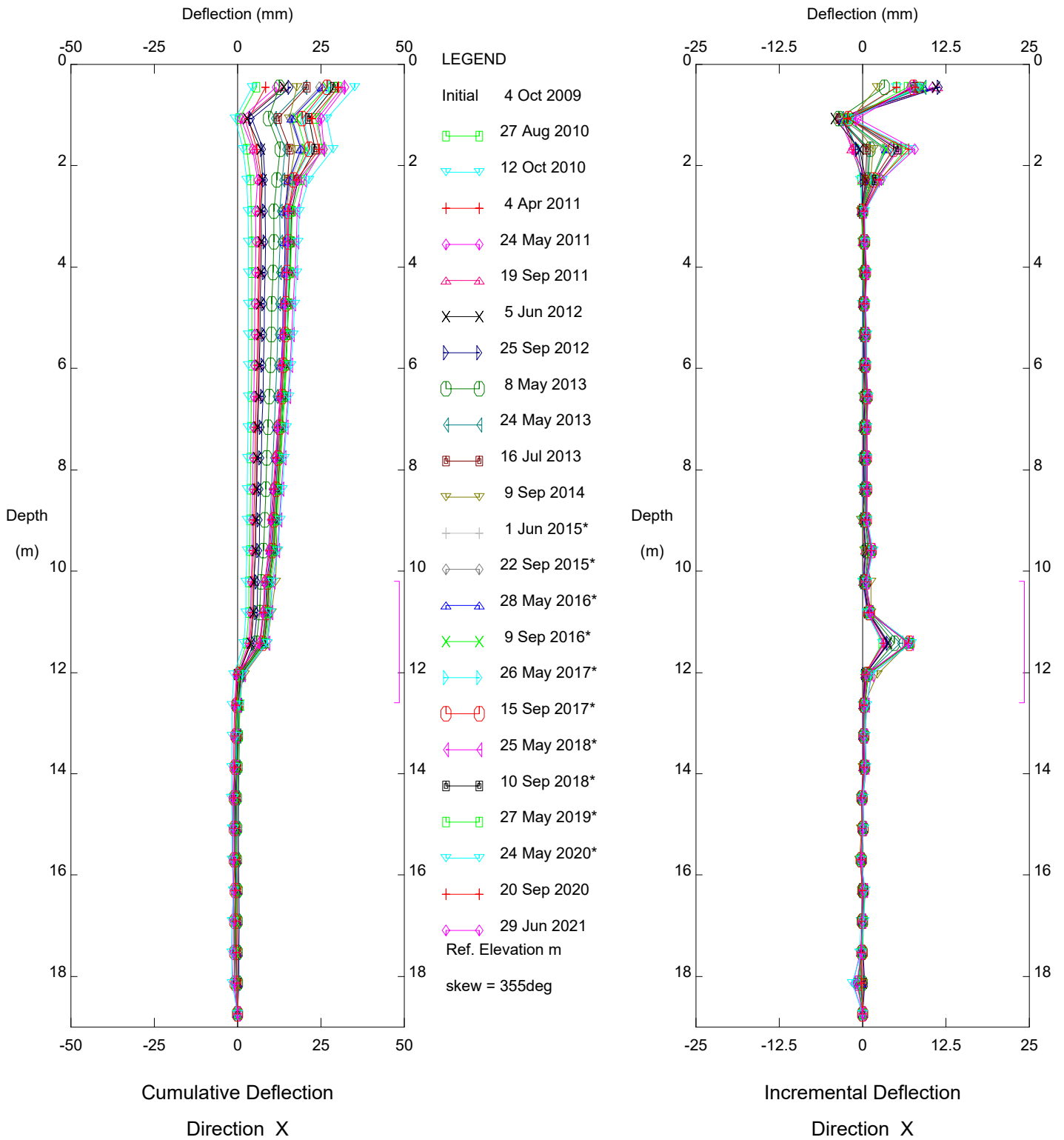


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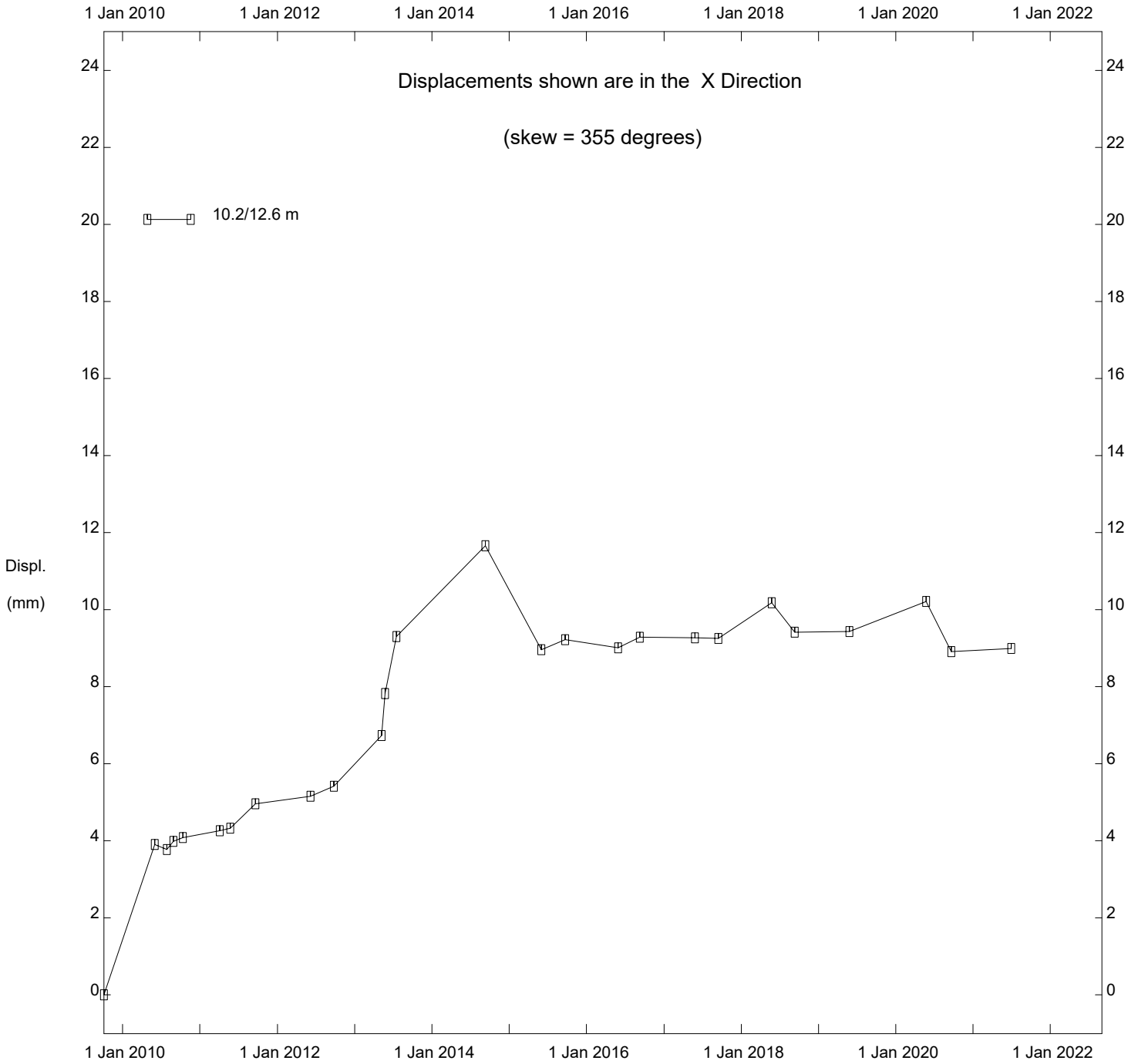


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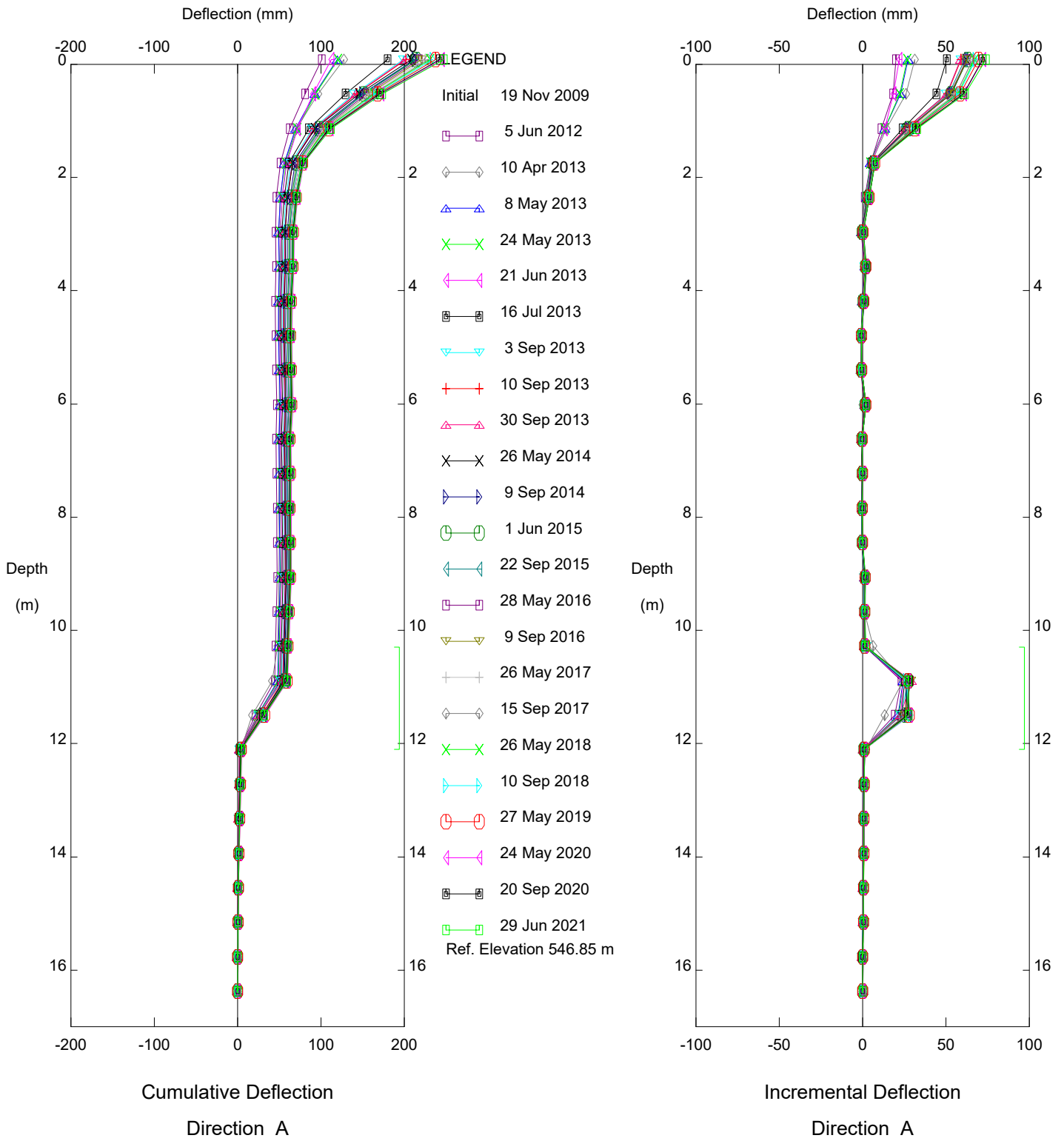
Thurber Engineering Ltd



HWY 63:02 South of Wandering River, Inclinator SI09-1

Alberta Transportation

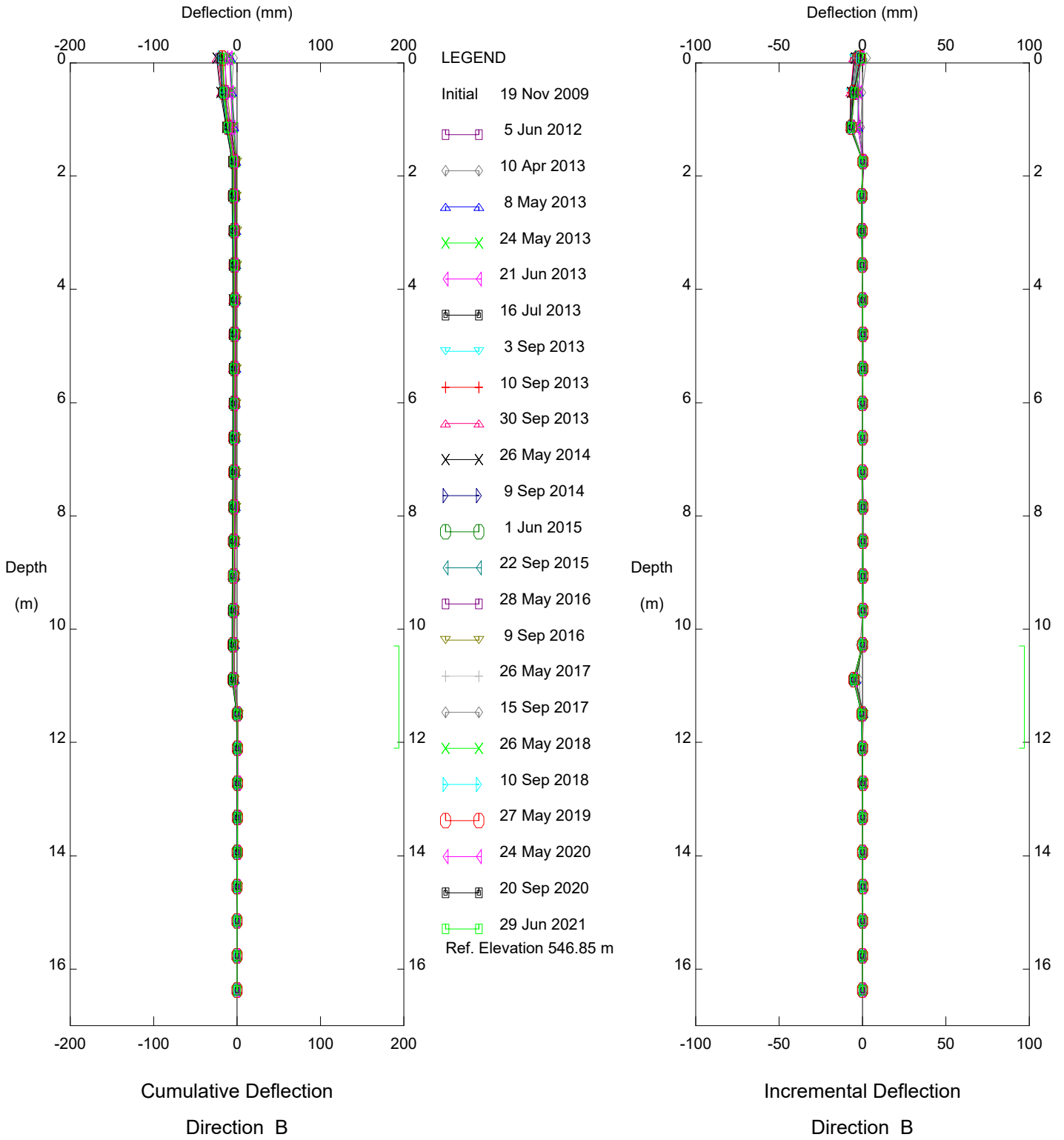
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HWY 63:02 South of Wandering River, Inclinometer SI09-4

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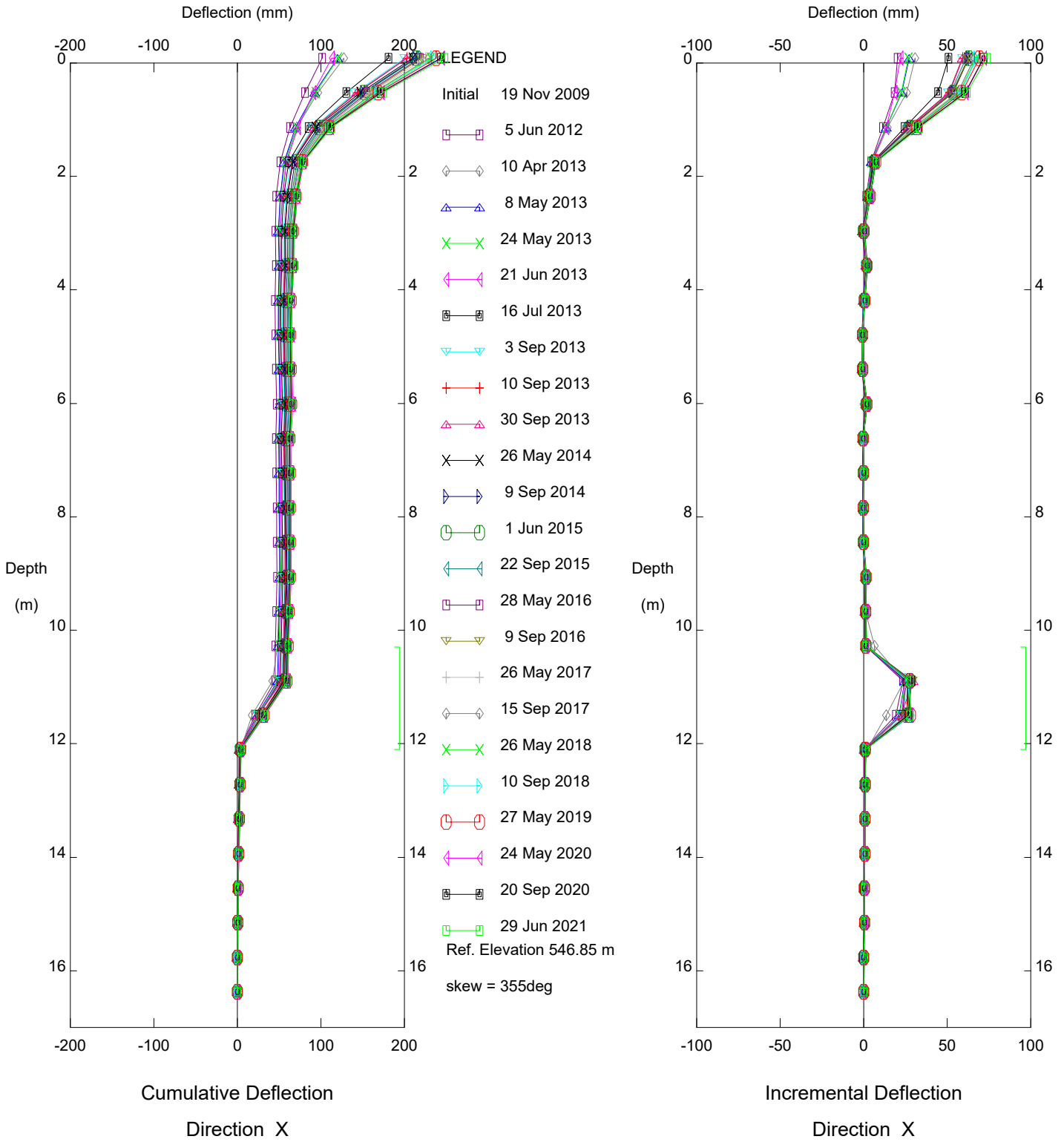
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HWY 63:02 South of Wandering River, Inclinometer SI09-4

Alberta Transportation

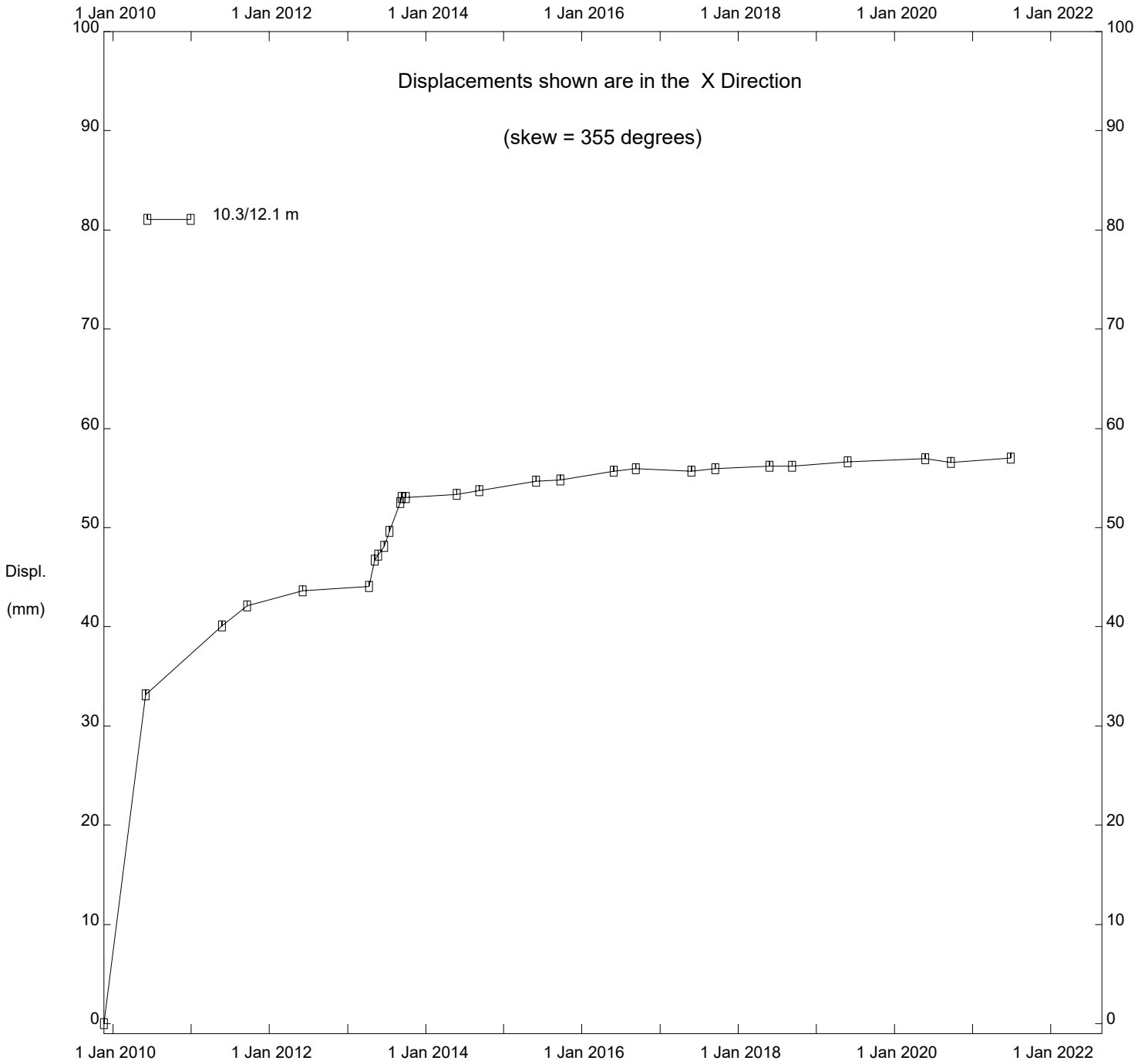
Thurber Engineering Ltd



HWY 63:02 South of Wandering River, Inclinometer SI09-4

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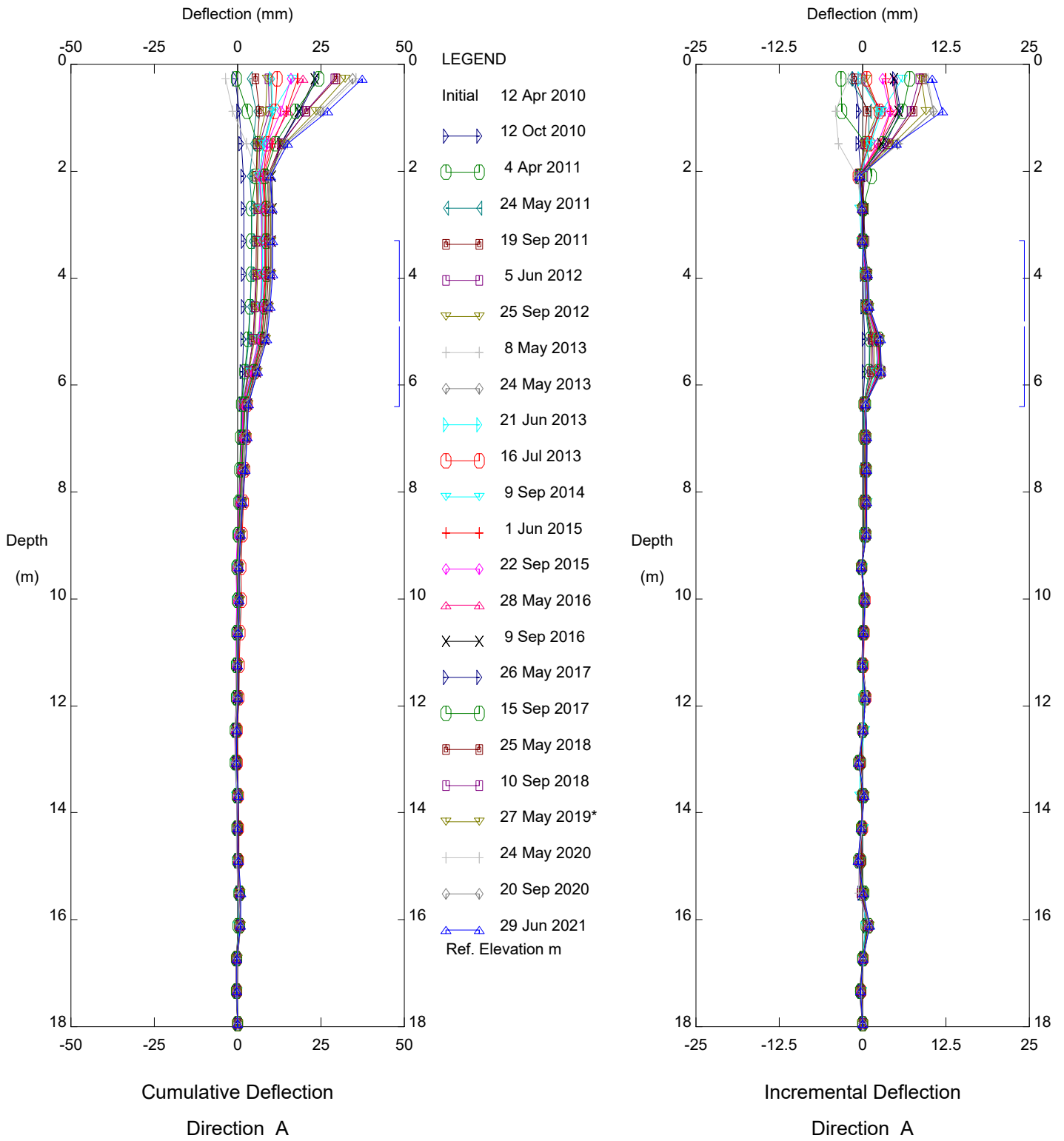
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HWY 63:02 South of Wandering River, Inclinator SI09-4

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Thurber Engineering Ltd

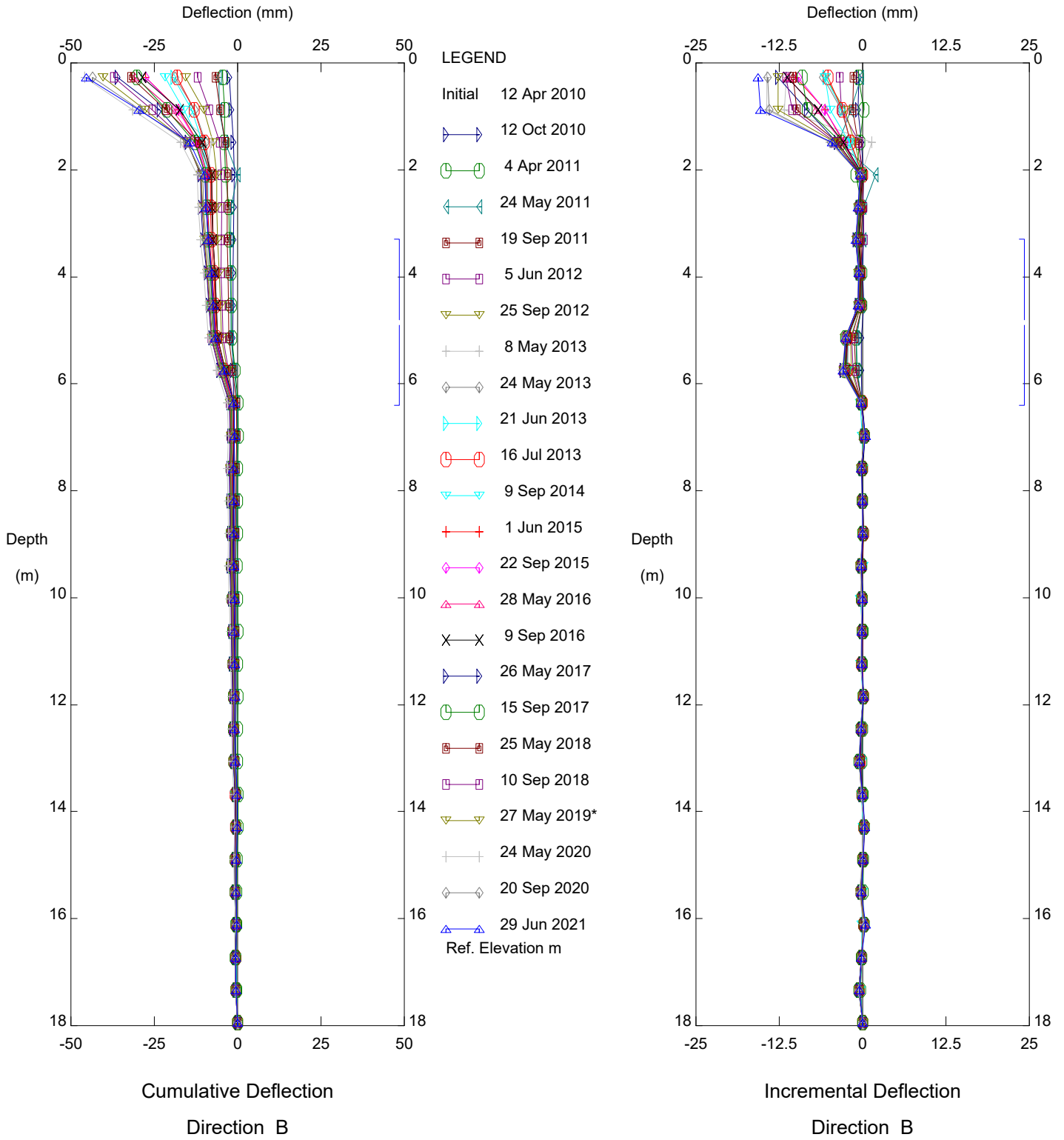


HWY 63:02 South of Wandering River, Inclinometer SI10-1

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

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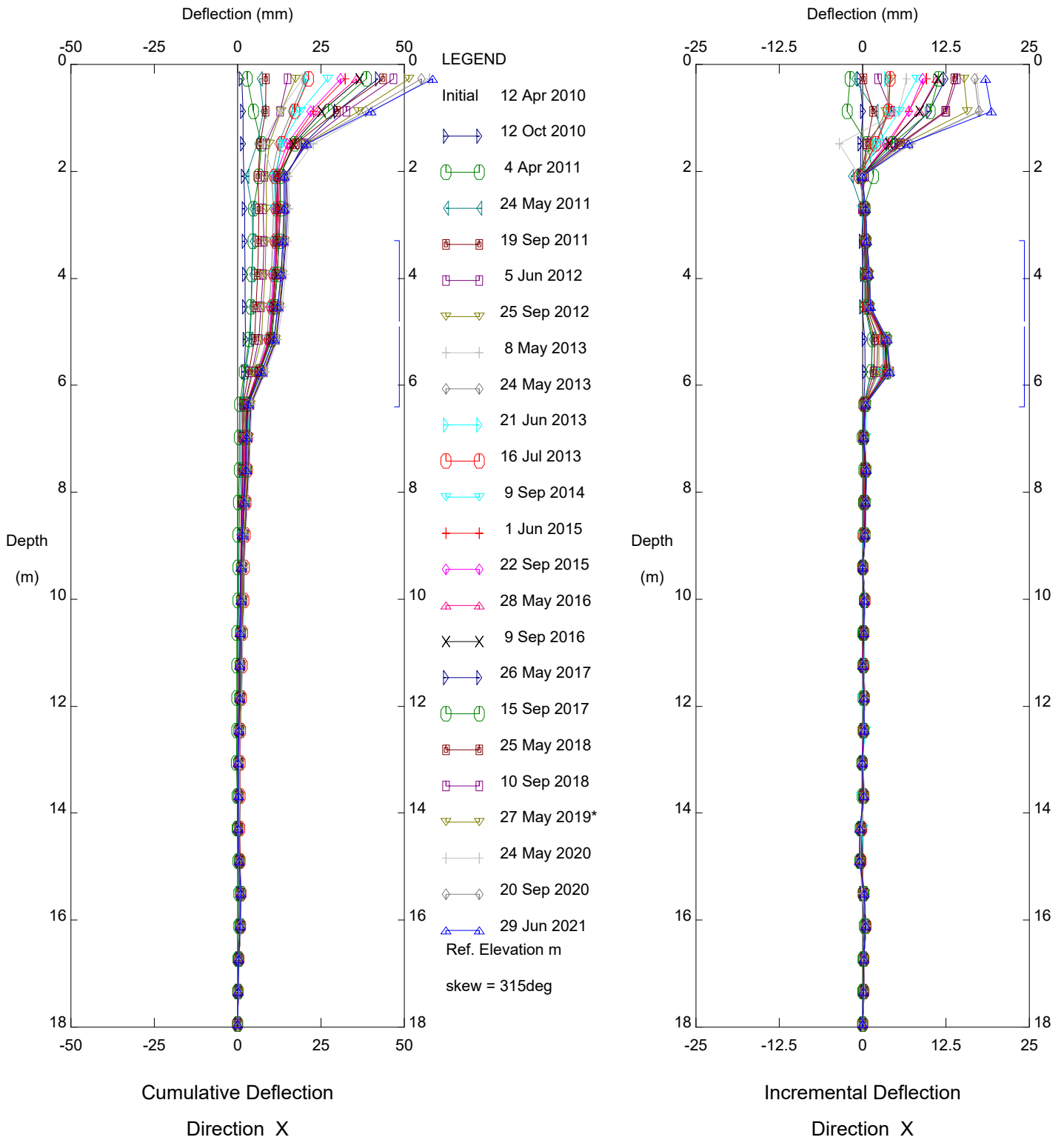


HWY 63:02 South of Wandering River, Inclinometer SI10-1

Alberta Transportation

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Thurber Engineering Ltd

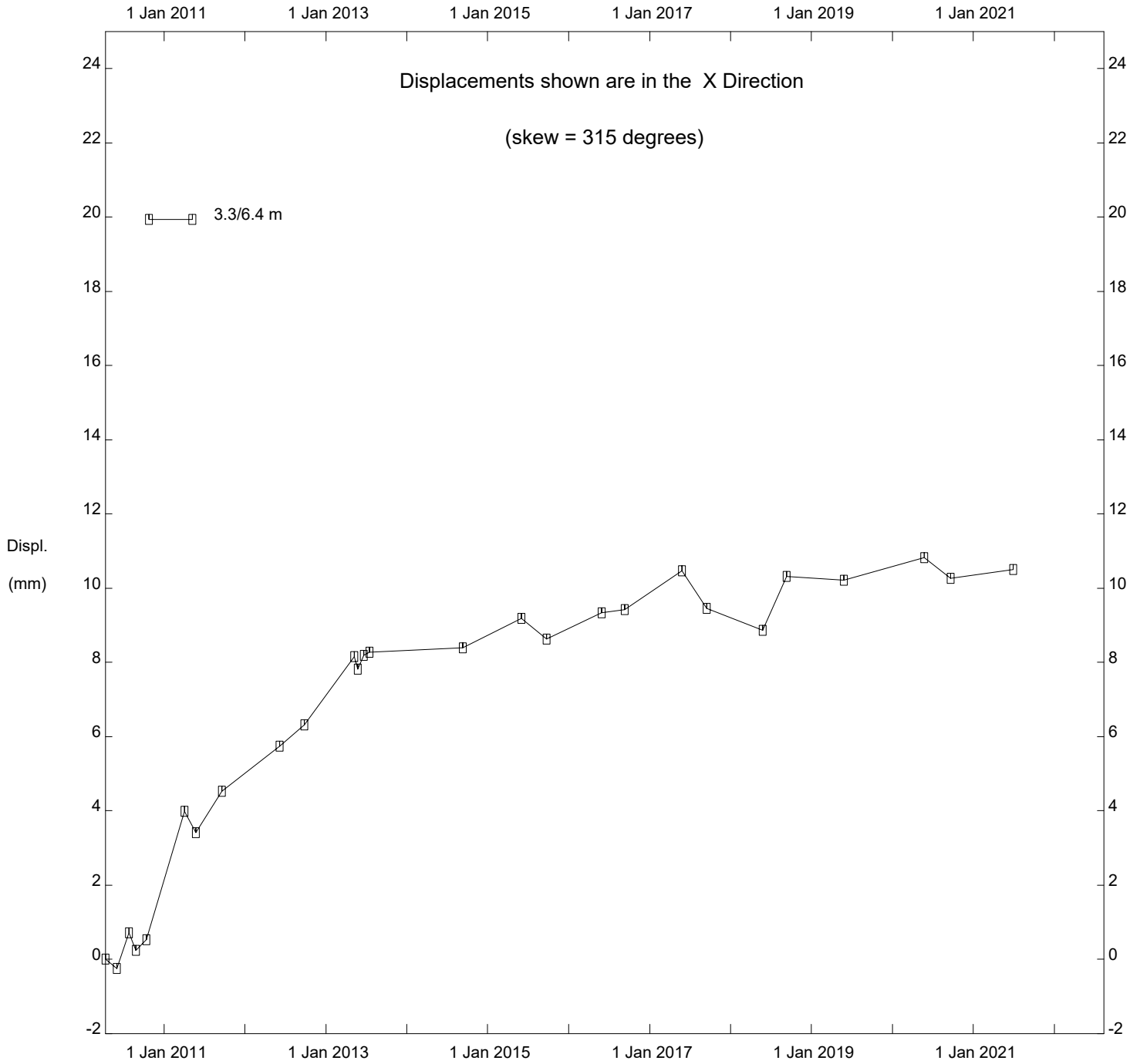


HWY 63:02 South of Wandering River, Inclinometer SI10-1

Alberta Transportation

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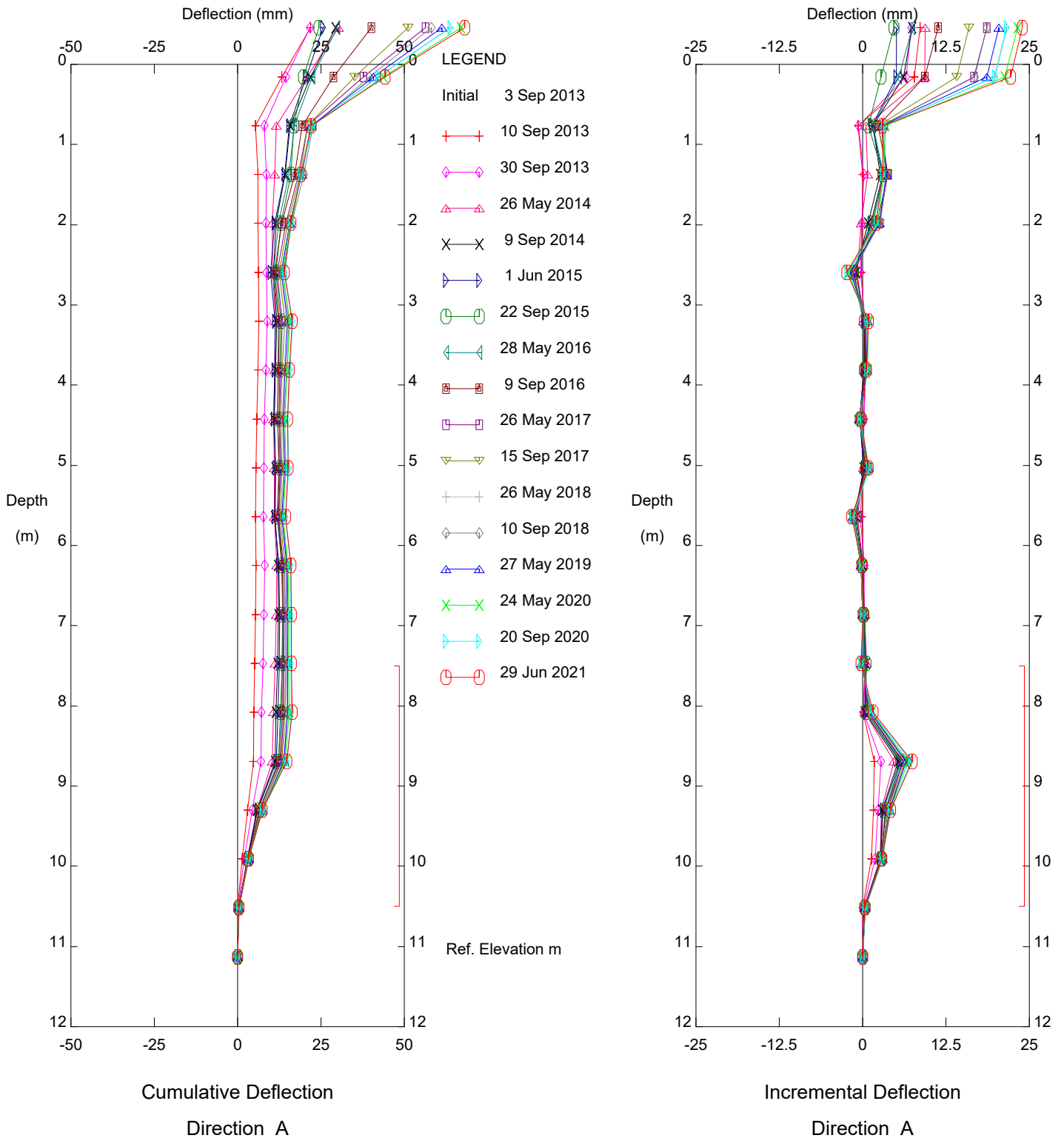
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HWY 63:02 South of Wandering River, Inclinator SI10-1

Alberta Transportation

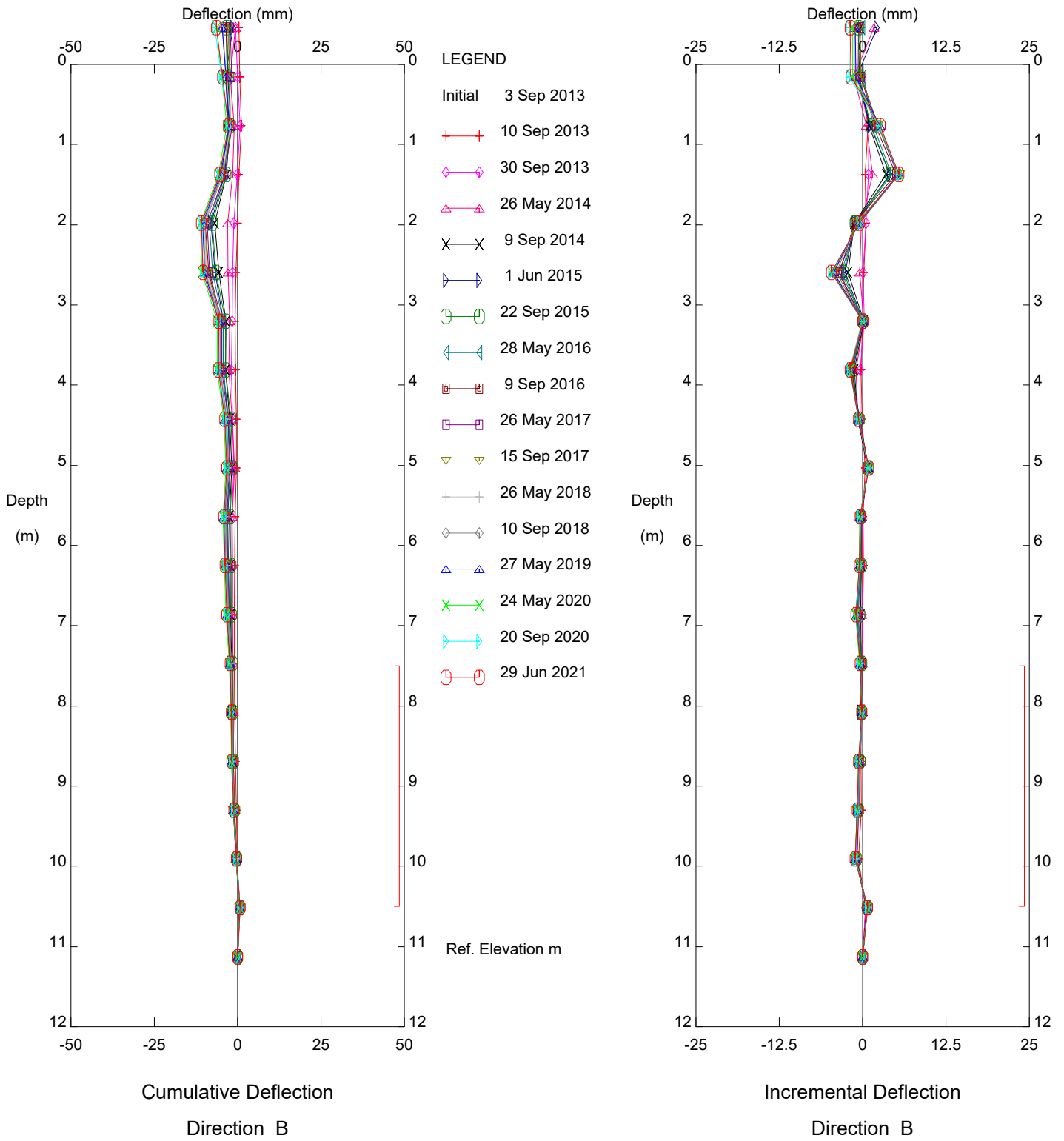
Thurber Engineering Ltd



HWY 63:02 South of Wandering River, Inclinometer SI13-14

Alberta Transportation

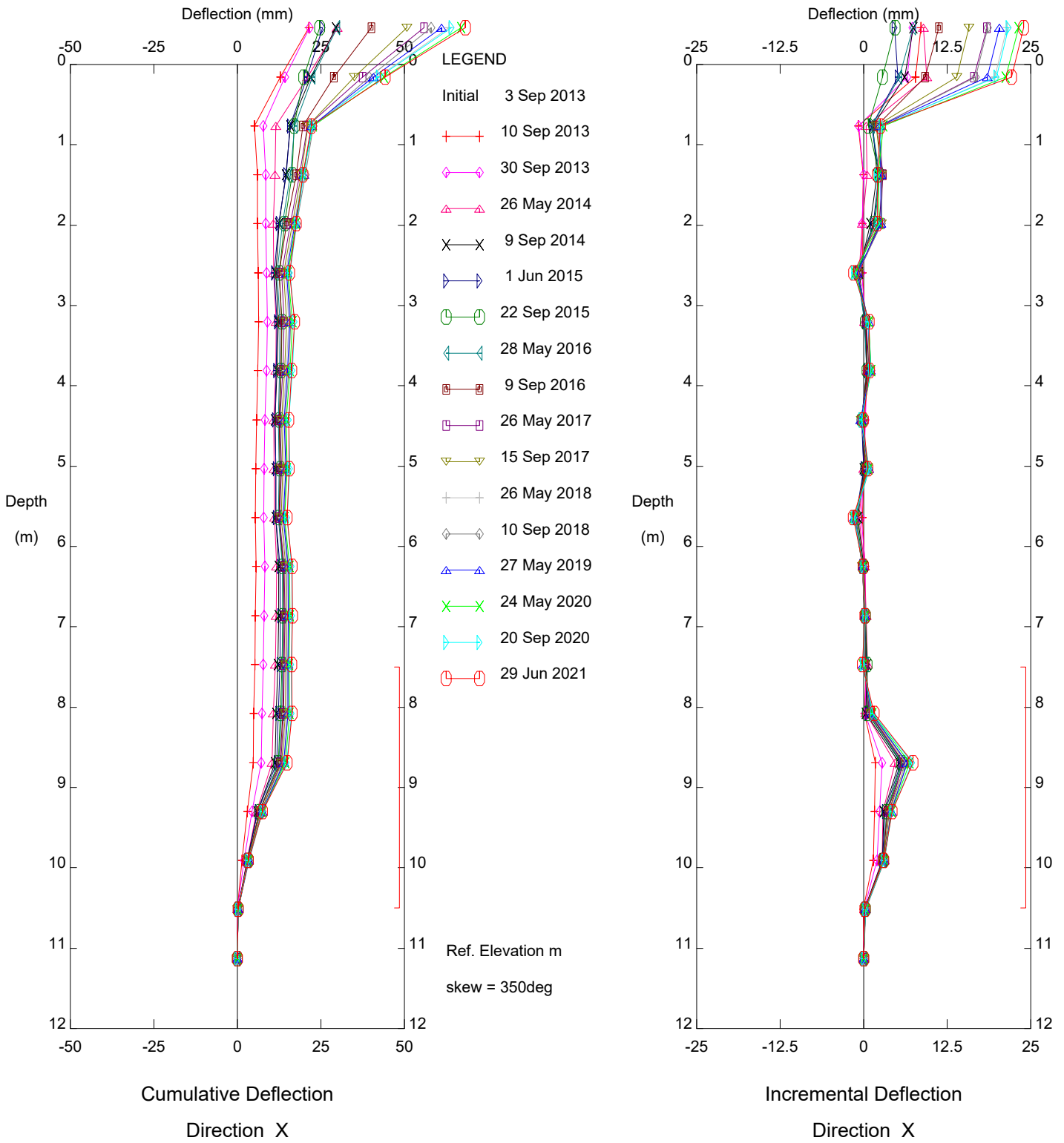
Thurber Engineering Ltd



HWY 63:02 South of Wandering River, Inclinometer SI13-14

Alberta Transportation

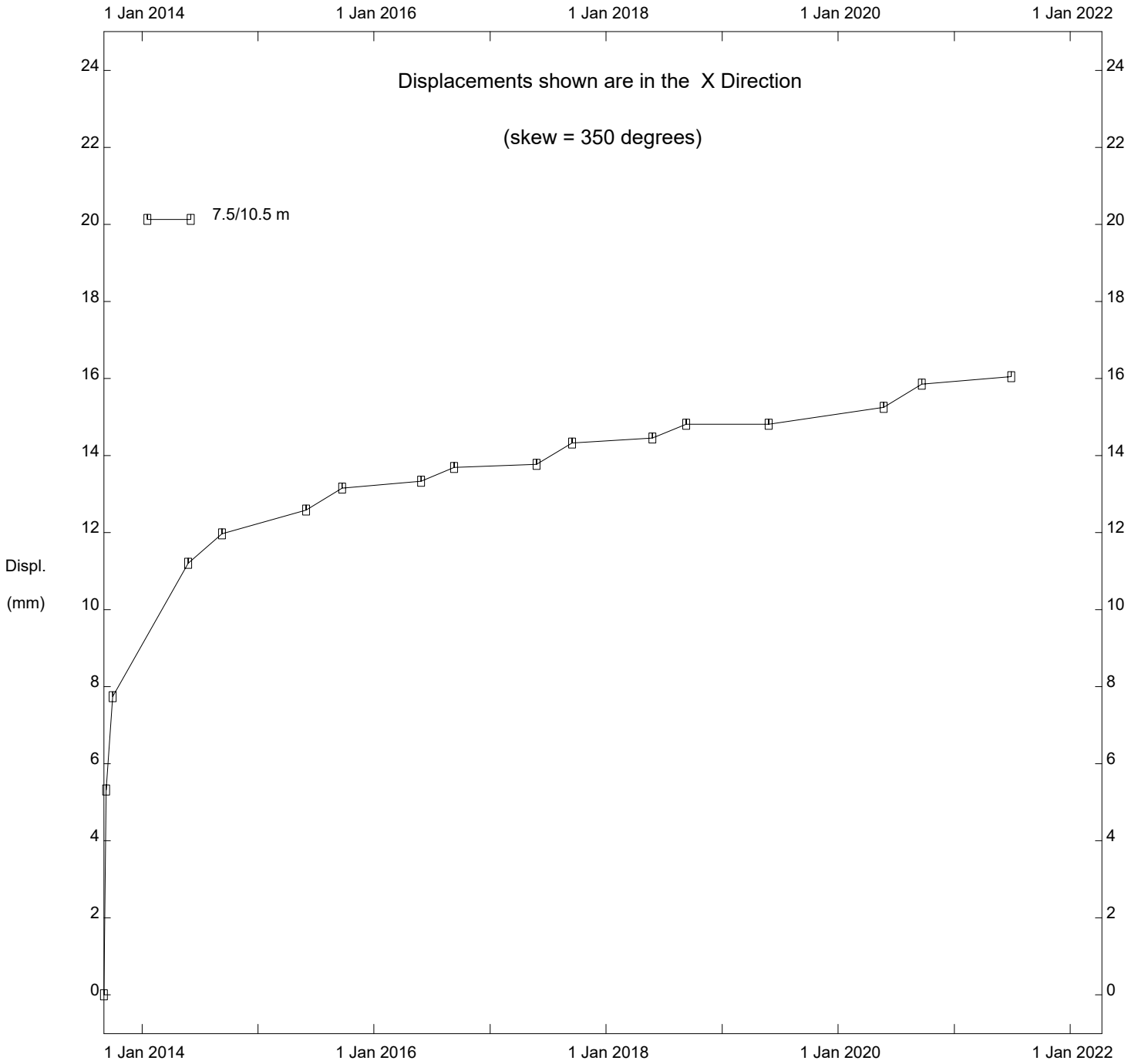
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HWY 63:02 South of Wandering River, Inclinometer SI13-14

Alberta Transportation

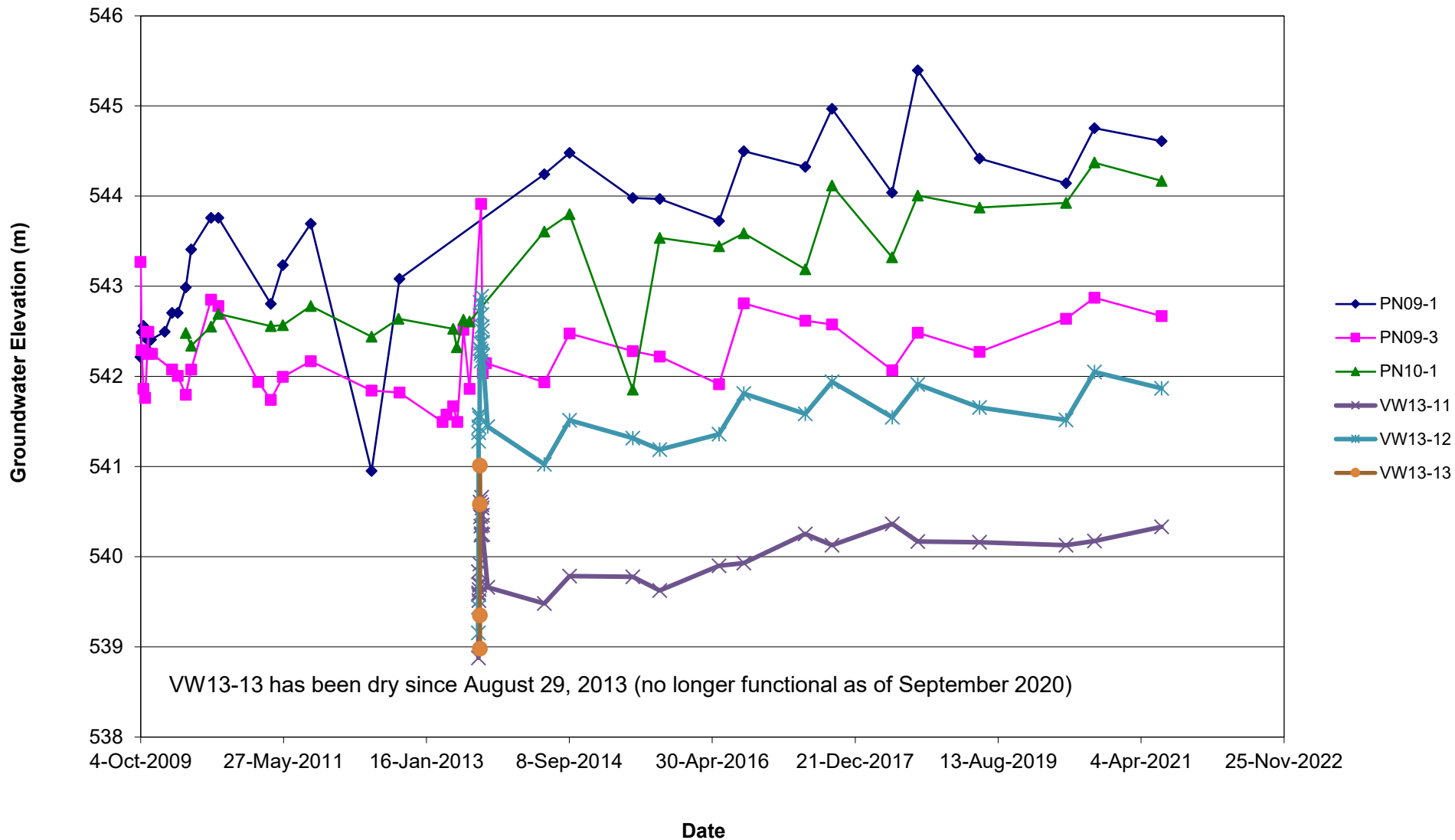
Thurber Engineering Ltd



HWY 63:02 South of Wandering River, Inclinometer SI13-14

Alberta Transportation

**FIGURE NC069-1
PIEZOMETRIC ELEVATIONS FOR HWY 63:02 SLOPE REPAIR**



**FIGURE NC069-2
PIEZOMETRIC DEPTHS FOR HWY 63:02 SLOPE REPAIR**

