



THURBER ENGINEERING LTD.

November 16, 2022

File No.: 32121

Alberta Transportation
Provincial Building
9621-96 Avenue
Peace River, Alberta
T8S 1T4

Attention: Mr. Max Shannon

**ALBERTA TRANSPORTATION GRMP (CON0022164)
PEACE REGION (PEACE RIVER DISTRICT)
INSTRUMENTATION MONITORING RESULTS – FALL 2022**

SECTION C

**SITE PH059: HWY 2:60, PEACE RIVER EAST HILL
(SITE # 2, STATION 34+770 TO 35+680)**

Dear Mr. Shannon:

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 Peace Region – Peace River District (CON0022164).

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 (SI-67, SI-69, SI-75, and SI-81), one pneumatic piezometer (PN-004) and two standpipe piezometers (SP-003 and SP-004) were read at the Hwy 2:60 Peace River East Hill Site # 2 (Station 34+770 to 35+680) on September 27, 2022, by Mr. Niraj Regmi, G.I.T. and Mr. Kyle Croymans, both of Thurber Engineering Ltd. The damage to PN-004 found during the spring of 2022 readings was confirmed, and PN-004 couldn't be read.

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 casings. The pneumatic piezometer was read using a RST C108 pneumatic piezometer reader. The standpipes were read using a Heron dipmeter.



2. DATA PRESENTATION

2.1 General

SI plots for A and B directions are included in Appendix A. Where movement has been recorded the resultant plot (X direction, if applicable) and rate of movement have also been provided. Piezometer reading plots are also included in Appendix A.

Slope inclinometer and piezometer reading summary tables are provided below. These tables also include instruments deleted from the GRMP program, for reference.

2.2 Zones of Movement

Zones of new movement were not observed in the SIs since the previous readings in the spring of 2022.

Zones of movement are summarized in Table PH059-1 below. Table PH059-1 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 PH059-1
FALL 2022 – PEACE RIVER EAST HILL SITE # 2
SLOPE INCLINOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: September 27, 2022

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AT NOTED DEPTH SINCE INITIAL READING (mm)	MAXIMUM RATE OF MOVEMENT (mm/yr)	CURRENT STATUS	DATE OF PREVIOUS READING	INCREMENTAL MOVEMENT SINCE PREVIOUS READING (mm)	CURRENT RATE OF MOVEMENT (mm/yr)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
SI-67	Sept. 24, 1996	No discernible movement	N/A	Operational	June 15, 2022	N/A	N/A	N/A
SI-69	Oct. 2, 1996	No discernible movement	N/A	Operational	June 15, 2022	N/A	N/A	N/A
SI-75	Oct. 2, 1996	59.5 mm over 0 m to 5.4 m depth in 208° direction	33.7 mm/yr In Nov. 1996	Operational	June 15, 2022	2.3	8.2	7.3
SI-76	Oct. 2, 1996	<i>Not Known</i>	<i>Not Known</i>	<i>Discontinued</i>	<i>May 20, 2004</i>	N/A	N/A	N/A
SI-81	Oct. 2, 1996	96.0 mm over 1.9 m to 6.1 m depth in 191° direction	34.9 mm/yr in September 1997	Operational	June 15, 2022	No discernible movement	N/A	-5.7
		72.2 mm over 6.1 m to 9.2 m depth in 179° direction	16.9 mm/yr in September 1997			1.3	4.4	1.6
SI-82	Oct. 2, 1996	59.5 mm over 11 m to 14 m depth in 220° direction	19.6 mm/yr between Nov. 1996 and Oct. 1997	<i>Sheared at 11.7 mBGS</i>	<i>September 30, 2012</i>	N/A	N/A	N/A

Drawing 32121-PH059 in Appendix A provides a sketch of the approximate locations of the monitoring instrumentation for this site.



**TABLE PH059-2
FALL 2022 – PEACE RIVER EAST HILL SITE # 2
PNEUMATIC PIEZOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: September 27, 2022

INSTRUMENT #	DATE INITIALIZED	TIP DEPTH (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED WATER LEVEL BGS (m)	MEASURED PORE PRESSURE (kPa)	CURRENT WATER LEVEL BGS (m)	PREVIOUS WATER LEVEL BGS (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
PN-001 (26207)	N/A	19.8	N/A	Damaged	13.50 on May 24, 2008	N/A	N/A	N/A	N/A
PN-002 (26210)	N/A	19.8	N/A	Destroyed	9.60 on Oct .3, 2002	N/A	N/A	N/A	N/A
PN-004 (26205)	N/A	20.6	N/A	Damaged	18.05 on Oct. 3, 2002	N/A	N/A	20.59 (October 13, 2021)	N/A

Drawing 32121-PH059 in Appendix A provides a sketch of the approximate locations of the monitoring instrumentation for this site.

Notes:

PN - pneumatic piezometer.

BGS - below ground surface



**TABLE PH059-3
FALL 2022 – PEACE RIVER EAST HILL SITE # 2
STANDPIPE PIEZOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: September 27, 2022

INSTRUMENT #	DATE INITIALIZED	TIP DEPTH (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED WATER LEVEL BGS (m)	MEASURED WATER LEVEL BGS (m)	PREVIOUS READING (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
SP-001	N/A	N/A	N/A	<i>Discontinued</i>	N/A	N/A	N/A	N/A
SP-002	N/A	N/A	N/A	<i>Discontinued</i>	<i>0.6 m on Oct. 1, 2003</i>	N/A	N/A	N/A
SP-003	N/A	19.42	N/A	Active	10.23 in June 2016	10.60	10.63	0.03
SP-004	N/A	10.60	N/A	Active	3.76 in September 2014	4.96	4.92	-0.04

Drawing 32121-PH059 in Appendix A provides a sketch of the approximate locations of the monitoring instrumentation for this site

Notes:

SP - standpipe (for water level monitoring, 1" diameter PVC).

BGS - below ground surface.



3. INTERPRETATION OF MONITORING RESULTS

Some of the slope inclinometers located in active slide areas have been previously destroyed or sheared off and hence could not be monitored.

Slope inclinometers SI-67 and SI-69 continued to show no discernible movement. SI-75 showed a rate of movement of 8.2 mm/yr over 0.0 m to 5.4 m depth since the spring of 2022 readings. SI-81 showed no discernible movement over 1.9 m to 6.1 m depth and a rate of movement of 4.4 mm/yr over 6.1 m to 9.2 m depth since the spring of 2022 readings.

Standpipe piezometers SP-003 showed an increase in water level of 0.03 m since the spring of 2022 readings. SP-004 showed a decrease in groundwater level of 0.04 m since the spring of 2022 readings. The pneumatic and standpipe piezometer readings are summarized in Tables PH059-2 and PH059-3, and are plotted on Figure PH059-1 in Appendix A.

4. RECOMMENDATIONS

4.1 Future Work

The instruments should be read again in the spring of 2023. PN-004 hasn't functioned for two reading cycles in a row and should be removed from future readings.

4.2 Instrumentation Repairs

Consideration should be given to extending SP-003 and adding a casing protector, to reduce the risk of damage to this instrument (this instrument has a stickup of only 0.35 m).



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

Bruce Nestor, P.Eng.
Geotechnical Engineer
/sf

Attachments:

- Statement of Limitations and Conditions
- Appendix A
 - Field Inspector's report
 - Site Plan Showing Approximate Instrument Locations (Drawing No. 32121-PH059)
 - SI Reading Plots
 - Figure PH059-1 (Piezometric Readings)



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 (CON0022164)
PEACE REGION (PEACE RIVER DISTRICT)
INSTRUMENTATION MONITORING RESULTS**

FALL 2022

**APPENDIX A
DATA PRESENTATION**

**SITE PH059: HWY 2:60, PEACE RIVER EAST HILL
(SITE # 2, STATION 34+770 TO 35+680)**

**ALBERTA TRANSPORTATION
PEACE REGION (PEACE RIVER DISTRICT)
INSTRUMENTATION MONITORING FIELD SUMMARY (PH059)
FALL 2022**

Location: Peace River East Hill (HWY 2:60 C1 35.241)	Readout: RST PN C108 Unit 1/DGSI Dipmeter
File Number: 32121	Casing: 3.34 " Ø
Probe: RSTSI SET 5R and 8R	Temp: 18
Cable: RSTSI SET 5R and 8R	Read by: NKR/KTC

SLOPE INCLINOMETER (SI) READINGS

Site#	SI#	GPS Location (UTM 11)		Date	Stickup (m)	Depth from top of casing(ft)	Magn. North A+ Groove	Current Bottom Depth Readings				Probe/ Reel #	Remarks
		Easting (m)	Northing (m)					A+	A-	B+	B-		
2	SI-67	484136.86	6231088.27	27-Sep-22	0.55	150 to 2	210	-257	267	1082	-1068	8R/8R	
	SI-69	484090.16	6231034.68	27-Sep-22	0.45	148 to 2	187	603	-585	587	-603	5R/5R	
	SI-75	484042.68	6231057.12	27-Sep-22	0.37	148 to 2	192	942	-925	-106	91	5R/5R	
	SI-81	484000.42	6231079.54	27-Sep-22	0.56	148 to 2	175	47	-25	-43	25	5R/5R	

PNEUMATIC PIEZOMETER READINGS

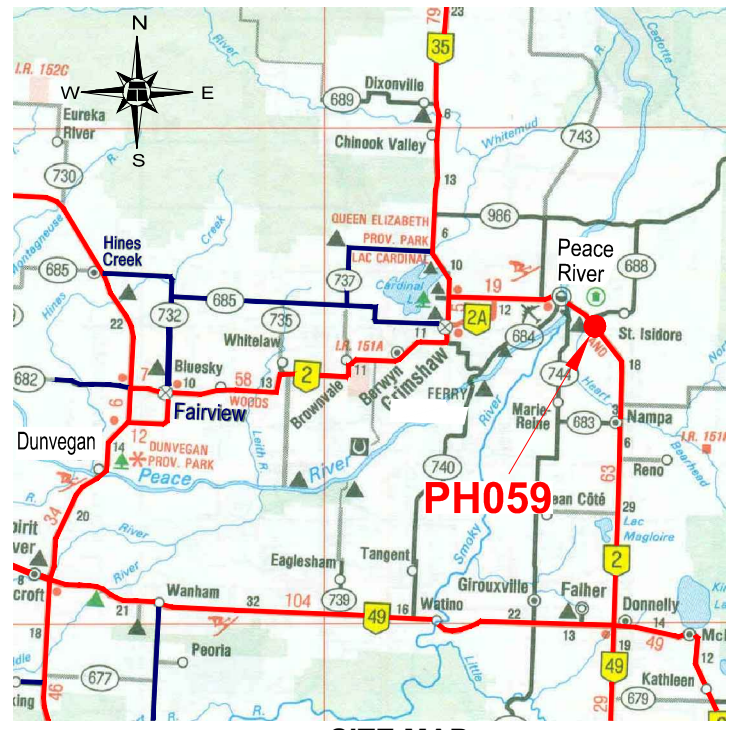
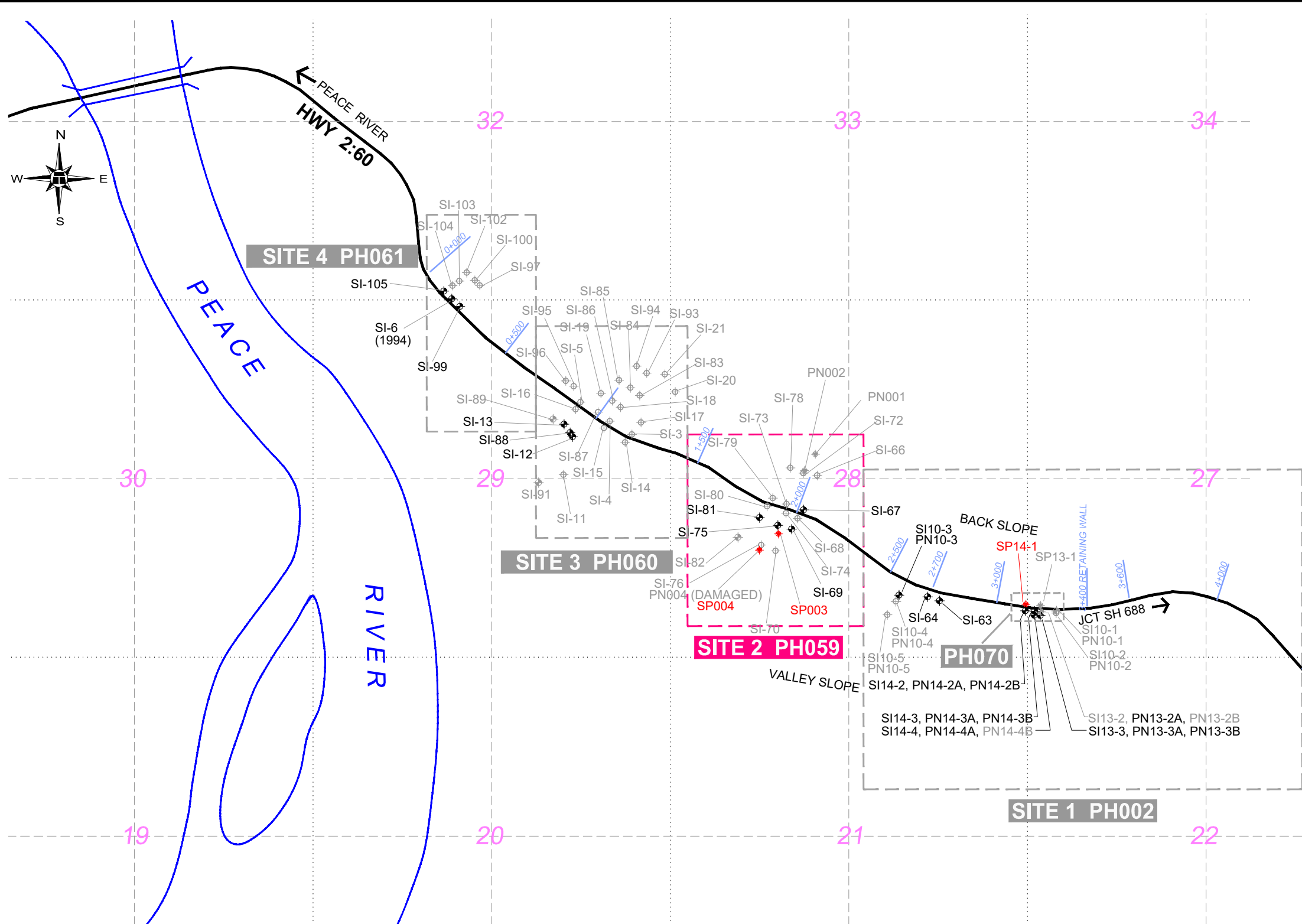
PN#	GPS Location (UTM 11)		Date	Reading kPa	Identification Number
	Easting (m)	Northing (m)			
PN-004	483976.22	6230977.57	27-Sep-22	0.1*	26205

STANDPIPE PIEZOMETER READINGS

SP#	GPS Location (UTM 11)		Date	Stick-up (m)	Reading below top of casing (m)	Bottom Pipe Depth (below top of casing (m))
	Easting (m)	Northing (m)				
SP-003	484042.59	6231031.19	27-Sep-22	0.33	10.95	20.12
SP-004	483976.22	6230977.57	27-Sep-22	0.7	5.66	11.40

DAILY INSPECTOR REPORT

*Damaged
SP-003 Need repair, stick up is too short, no protector
SI 69, 75, 81 Stickup low, need protector
See photographs



SITE MAP
NOT TO SCALE

LEGEND :

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

SITE PLAN
1:20,000 (APPROX.)

PEACE REGION (PEACE RIVER DISTRICT)

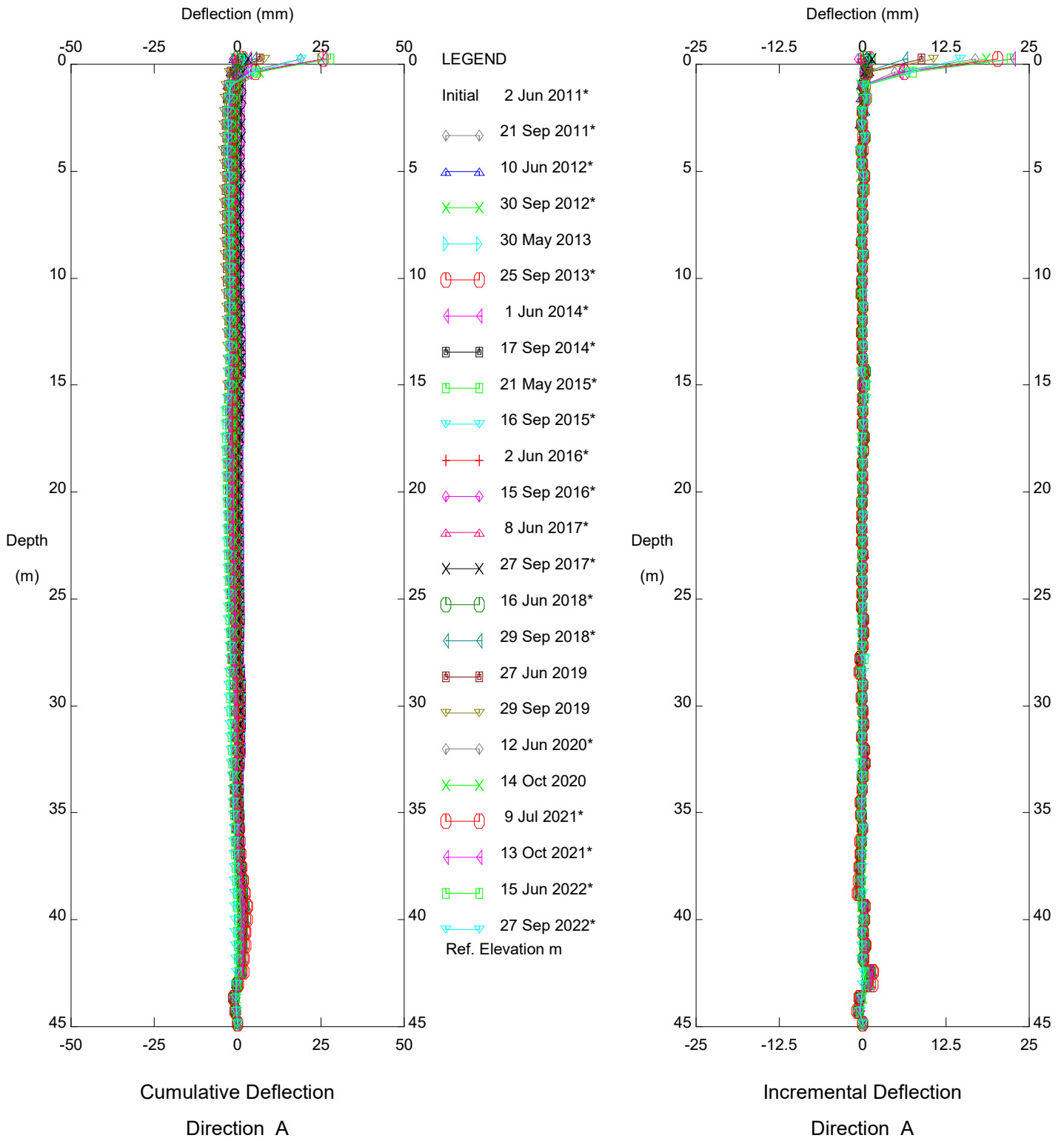
**PH059: PEACE RIVER EAST HILL SITE #2
(STATION 1+450 TO STATION 2+350)
INSTRUMENTATION READINGS**

DWG No. 32121-PH059

DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	DWP
SCALE	AS SHOWN
DATE	JULY 2022
FILE No.	32121

THURBER ENGINEERING LTD.

Thurber Engineering Ltd.

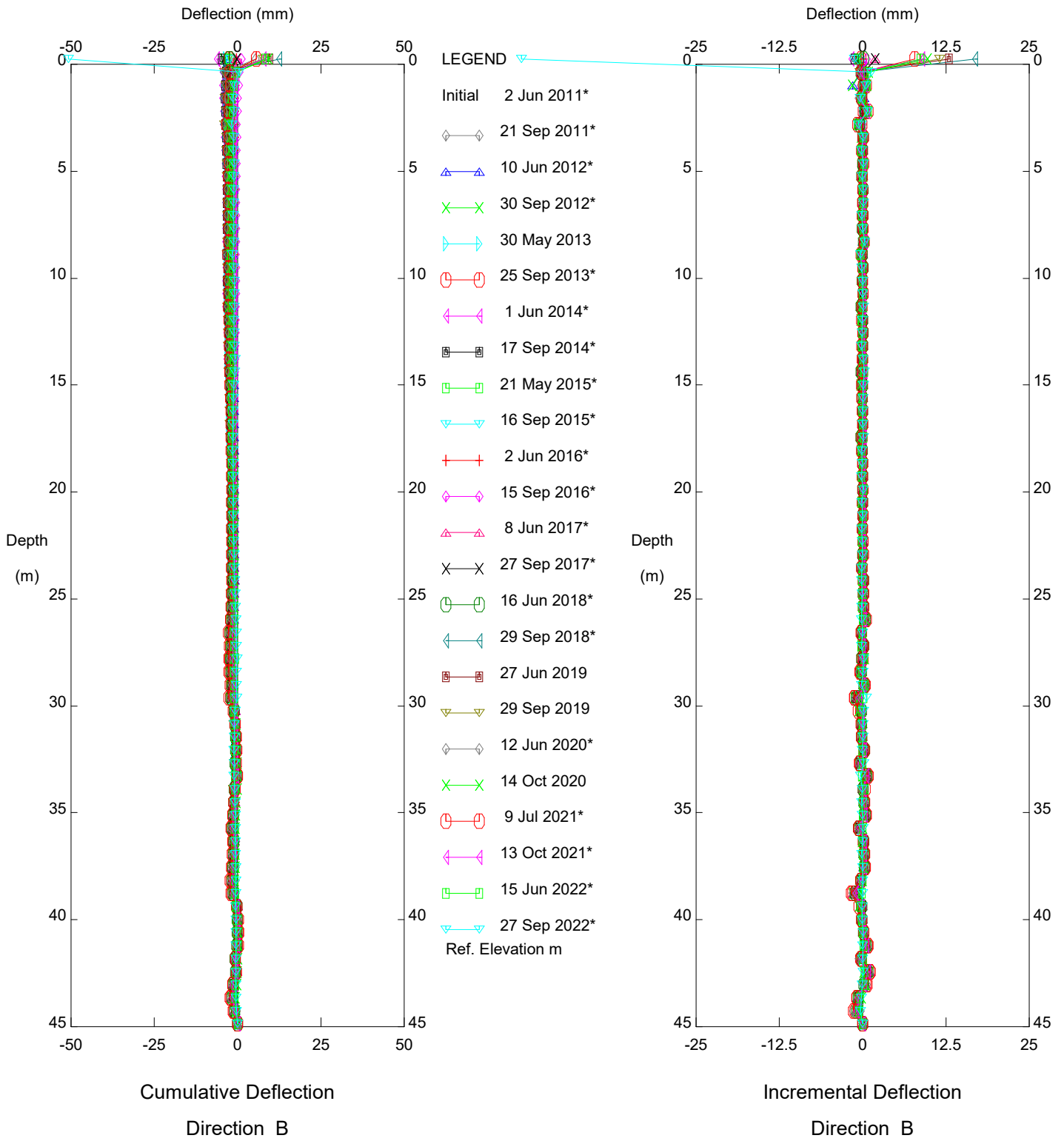


(PH059) PEACE RIVER EAST HILL -SITE 2, Inclinometer SI-67

Alberta Transportation

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

Thurber Engineering Ltd.

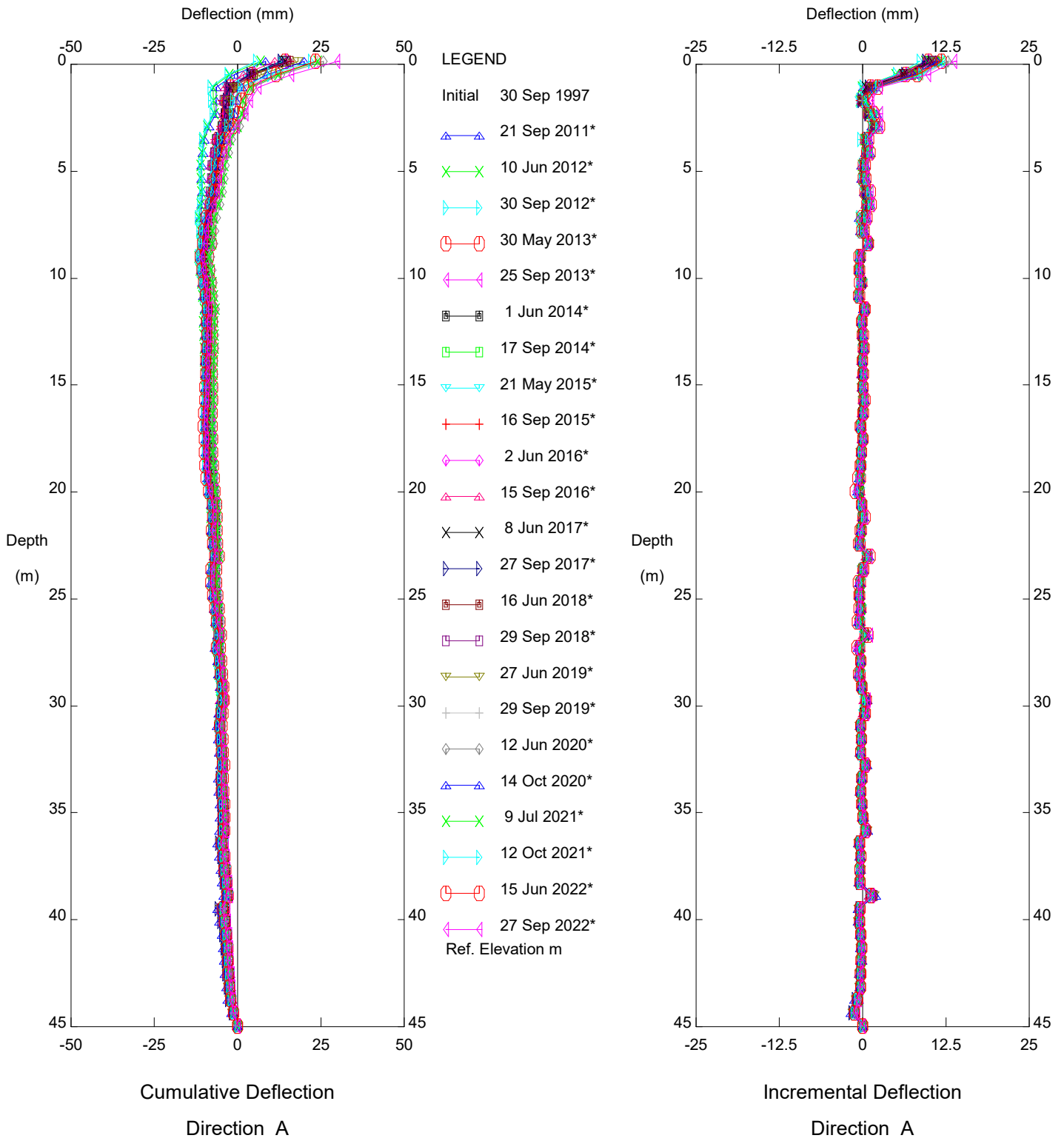


(PH059) PEACE RIVER EAST HILL -SITE 2, Inclinometer SI-67

Alberta Transportation

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

Thurber Engineering Ltd.

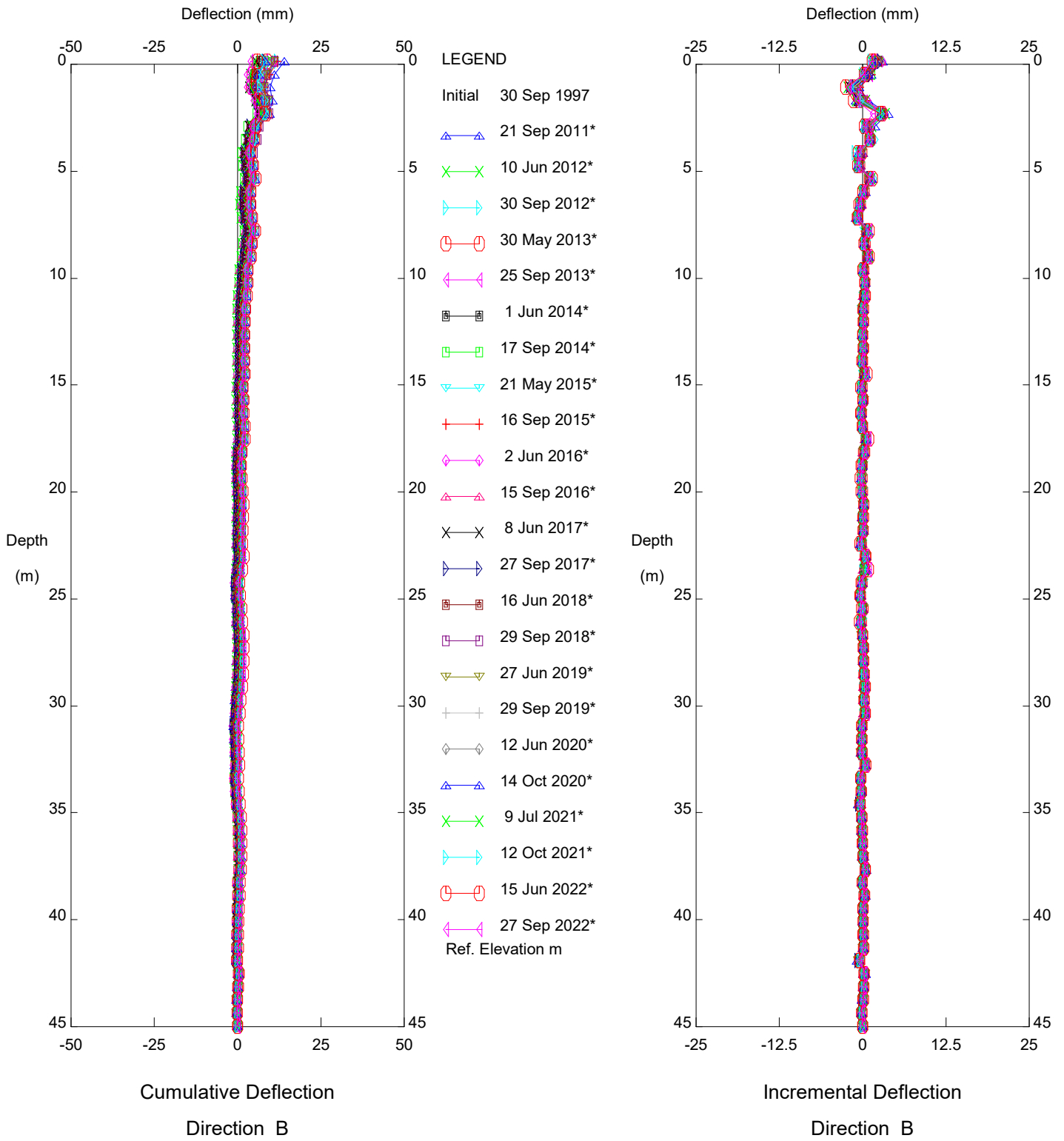


(PH059) PEACE RIVER EAST HILL -SITE 2, Inclinometer SI-69

Alberta Transportation

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Thurber Engineering Ltd.

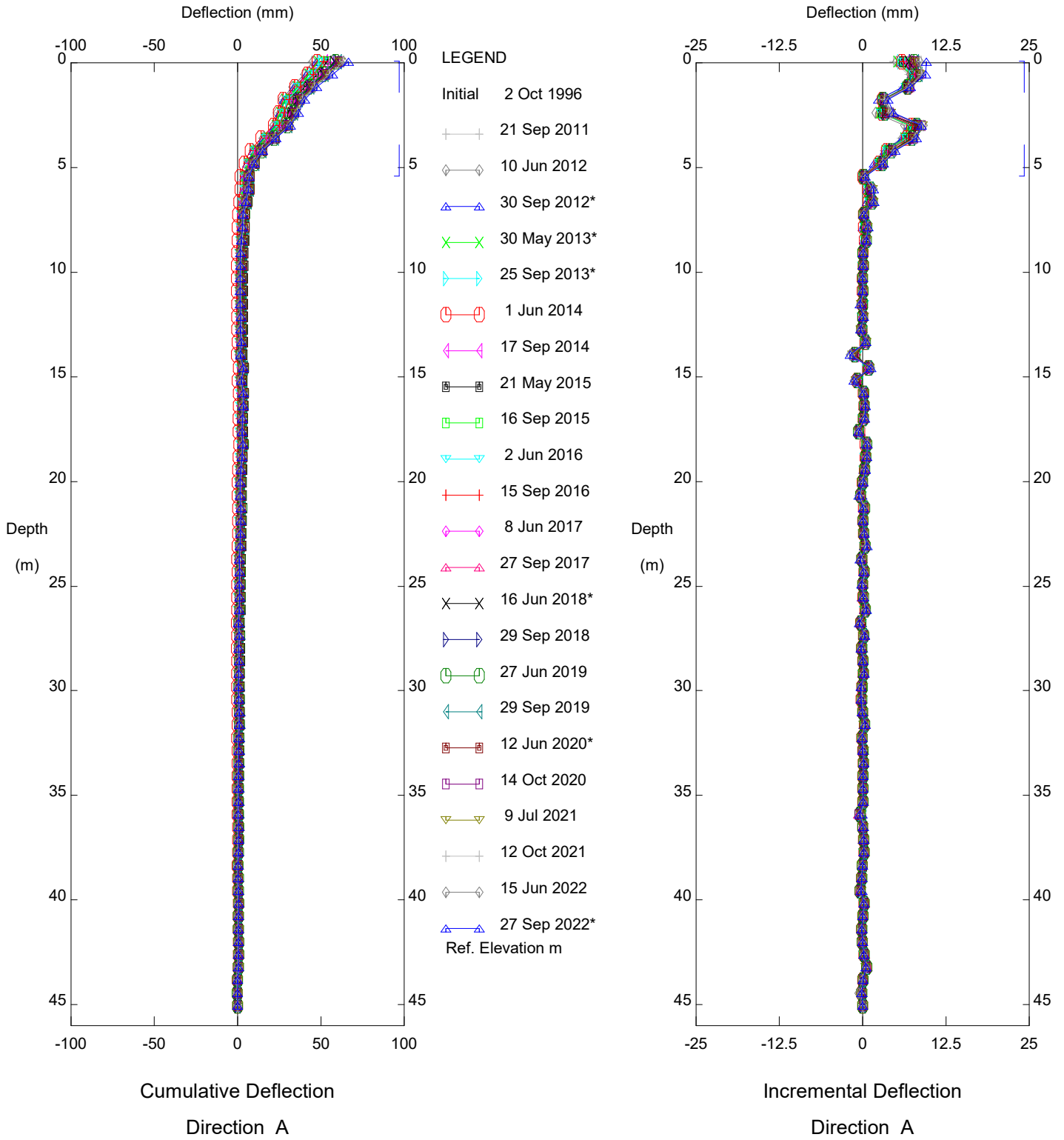


(PH059) PEACE RIVER EAST HILL -SITE 2, Inclinometer SI-69

Alberta Transportation

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

Thurber Engineering Ltd.

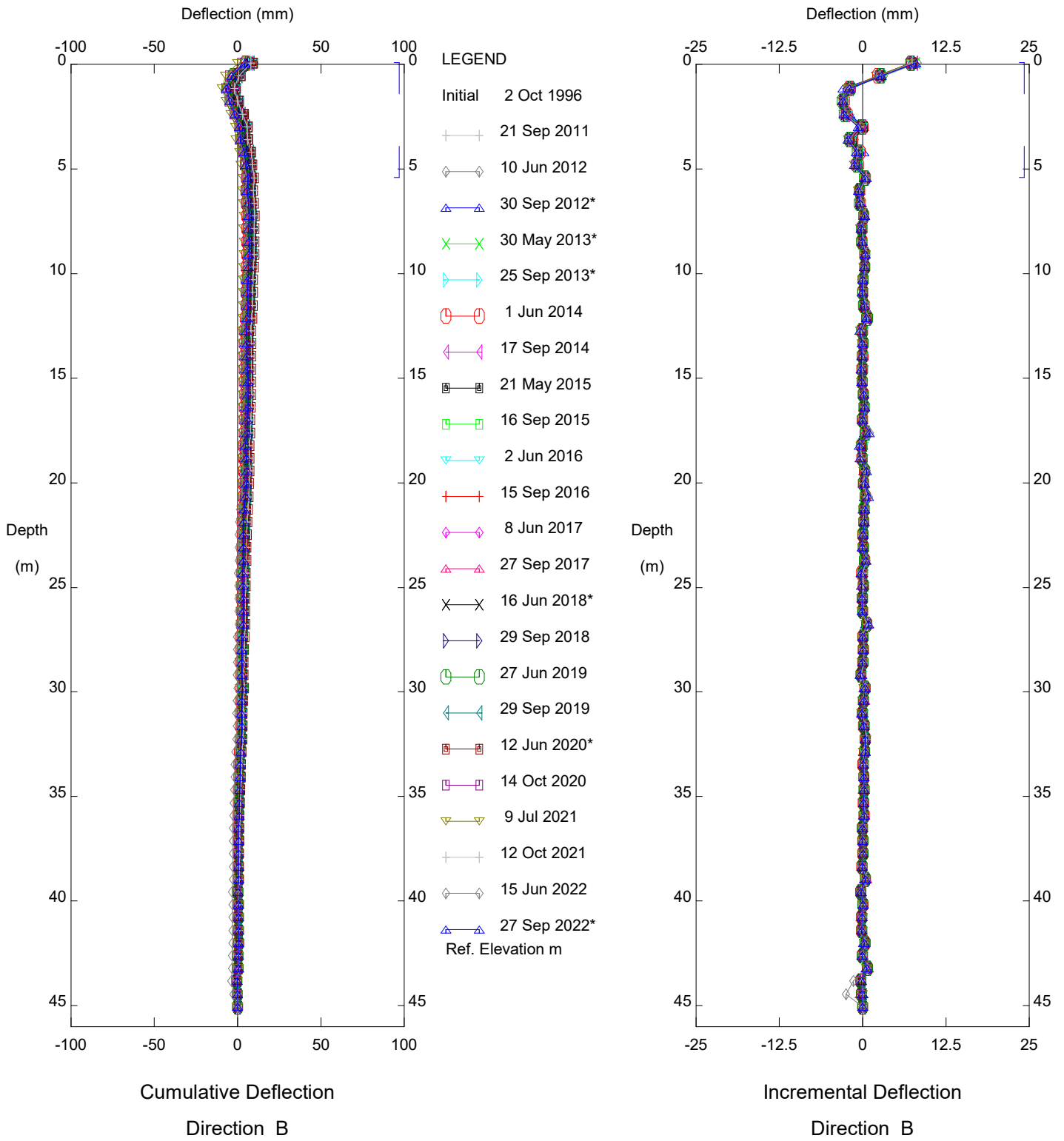


(PH059) PEACE RIVER EAST HILL -SITE 2, Inclinometer SI-75

Alberta Transportation

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

Thurber Engineering Ltd.

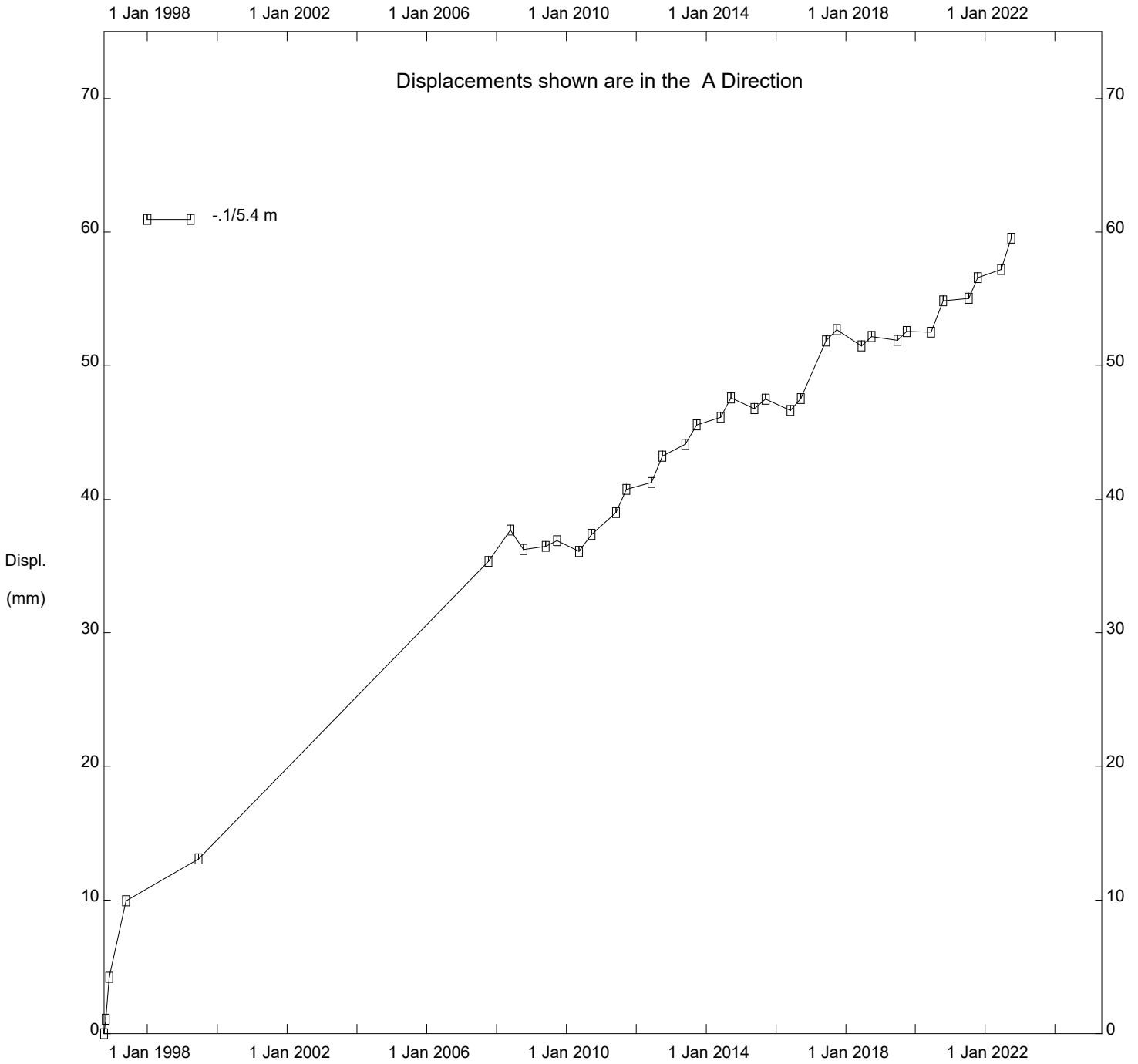


(PH059) PEACE RIVER EAST HILL -SITE 2, Inclinometer SI-75

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

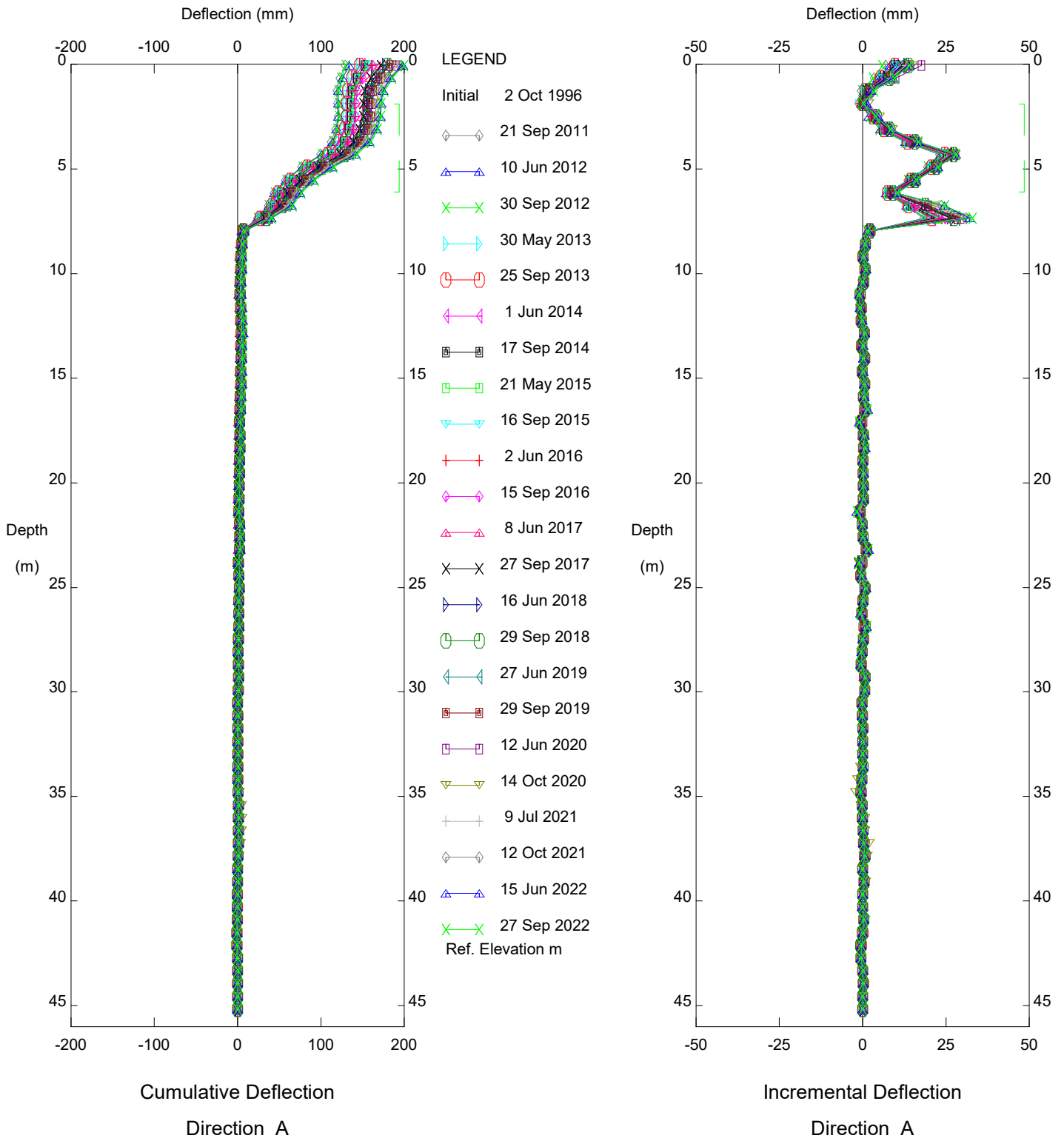
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(PH059) PEACE RIVER EAST HILL -SITE 2, Inclinator SI-75

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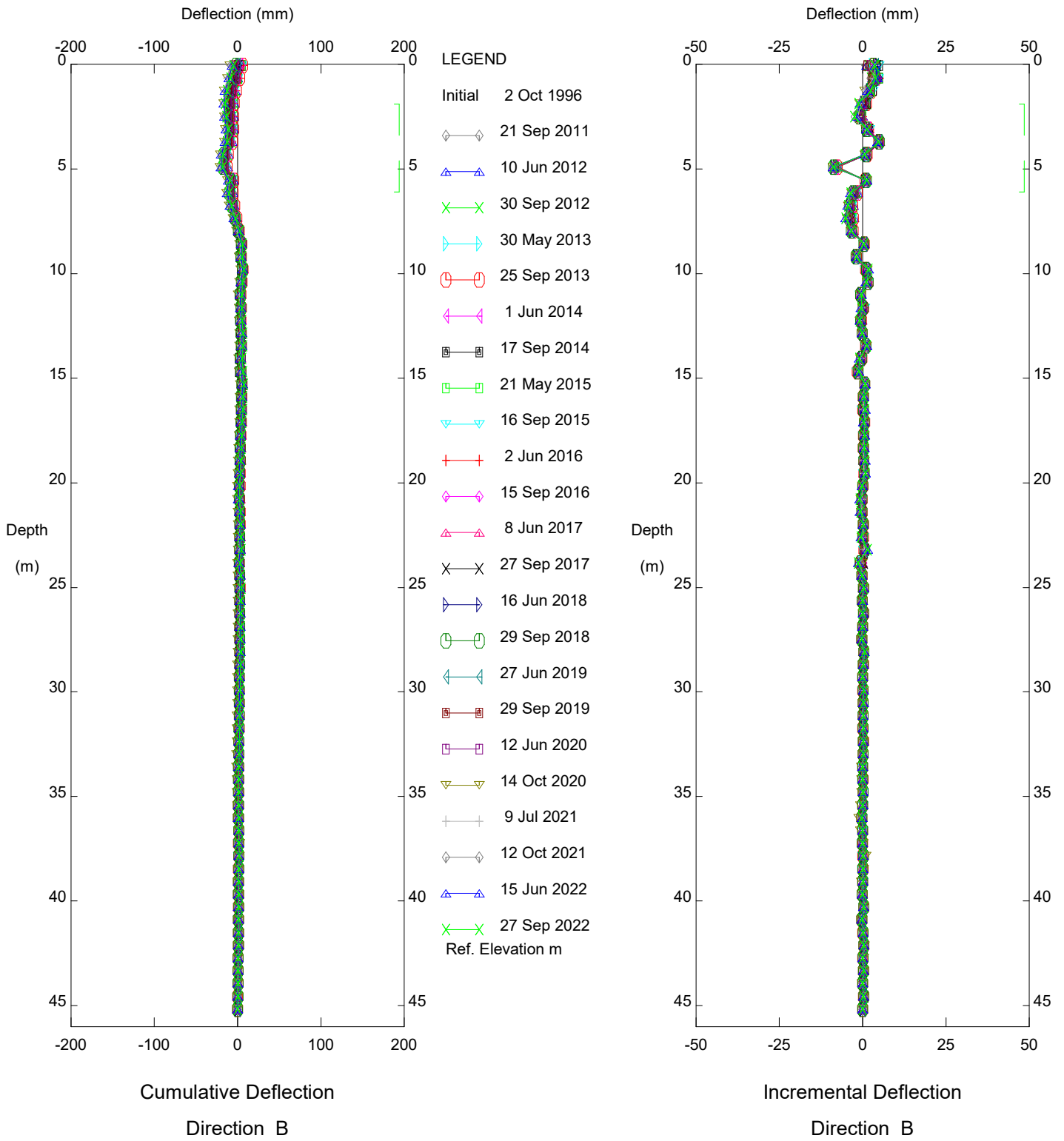
Thurber Engineering Ltd.



(PH059) PEACE RIVER EAST HILL -SITE 2, Inclinometer SI-81

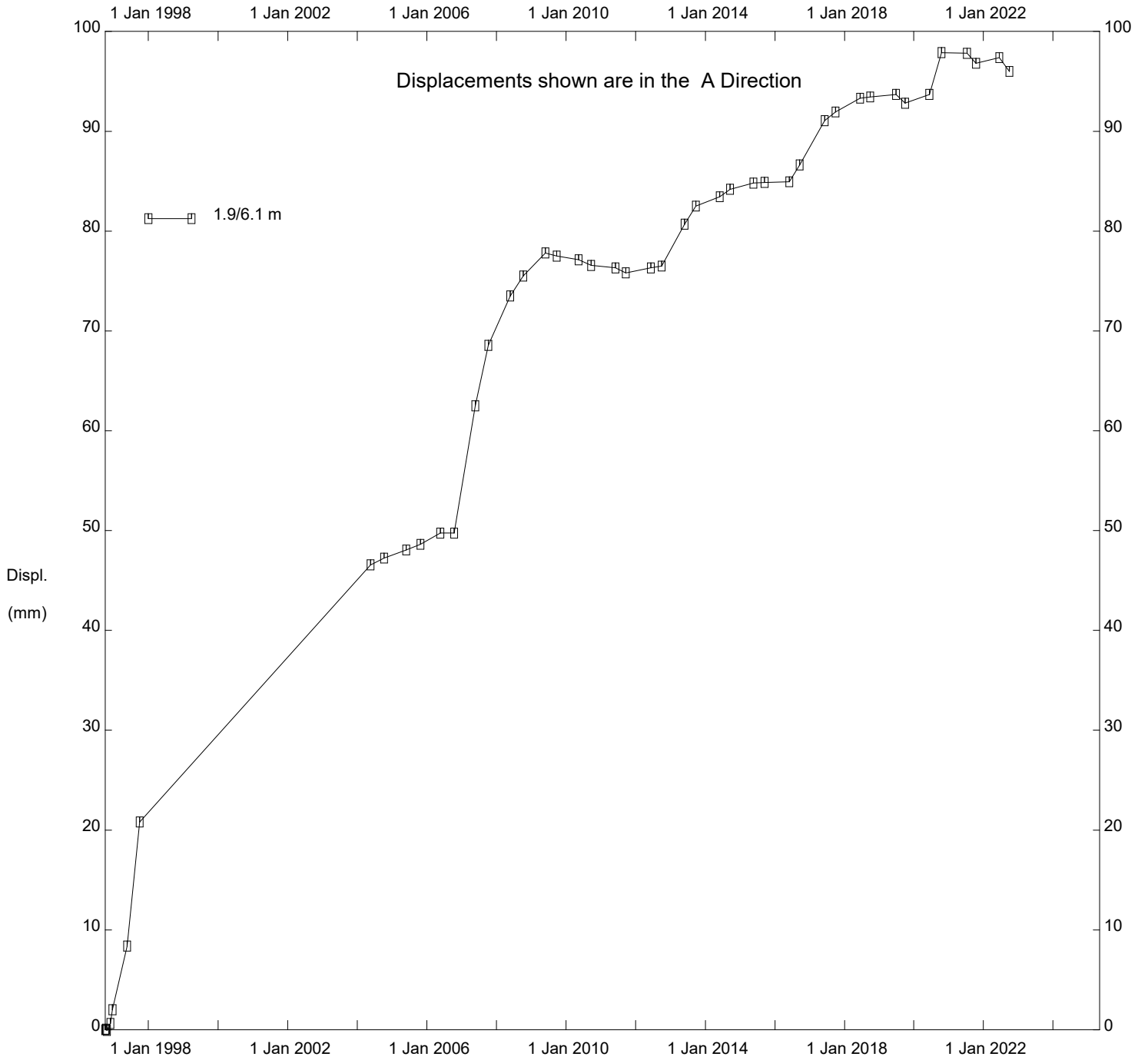
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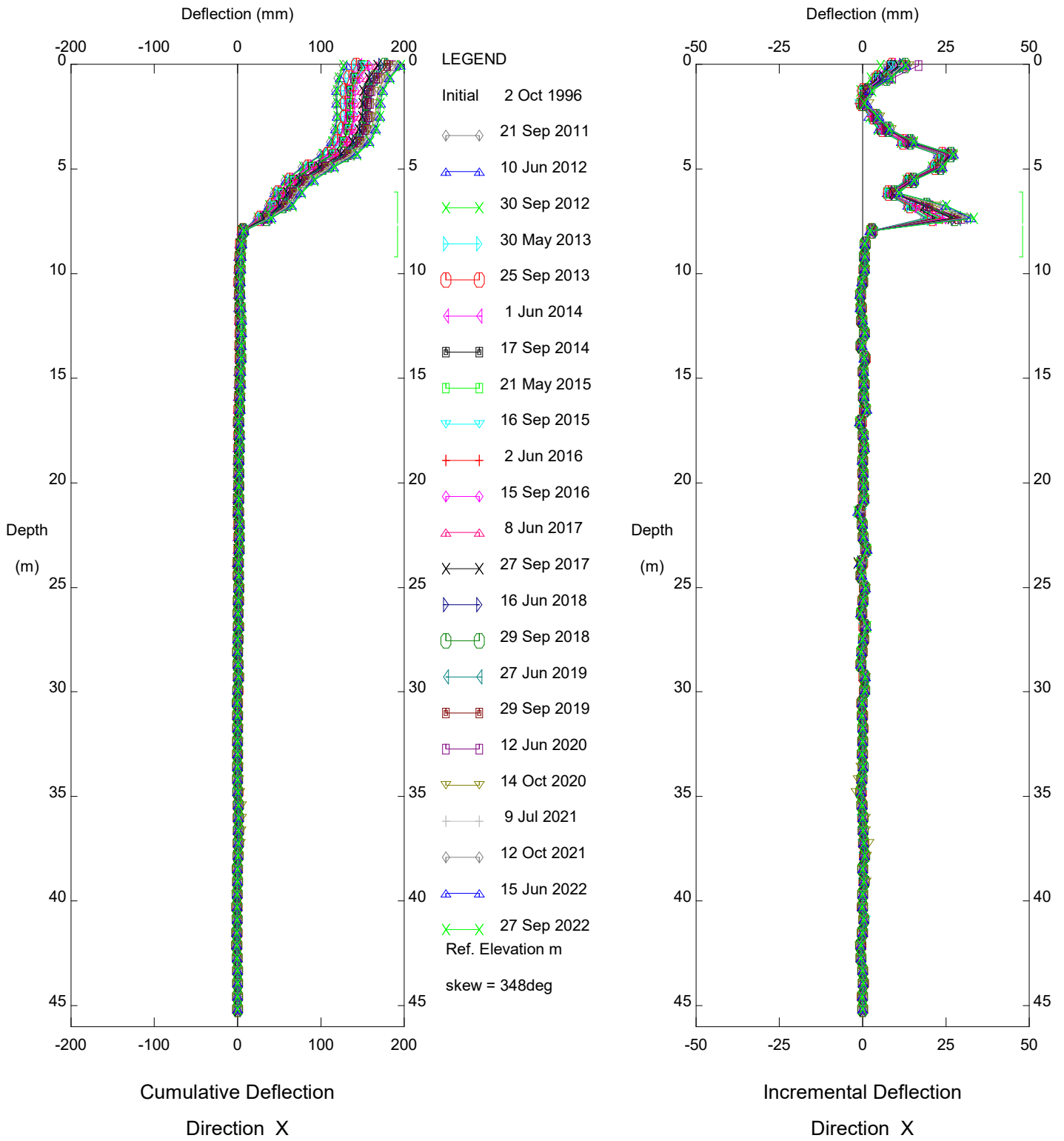
(PH059) PEACE RIVER EAST HILL -SITE 2, Inclinometer SI-81

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(PH059) PEACE RIVER EAST HILL -SITE 2, Inclinometer SI-81

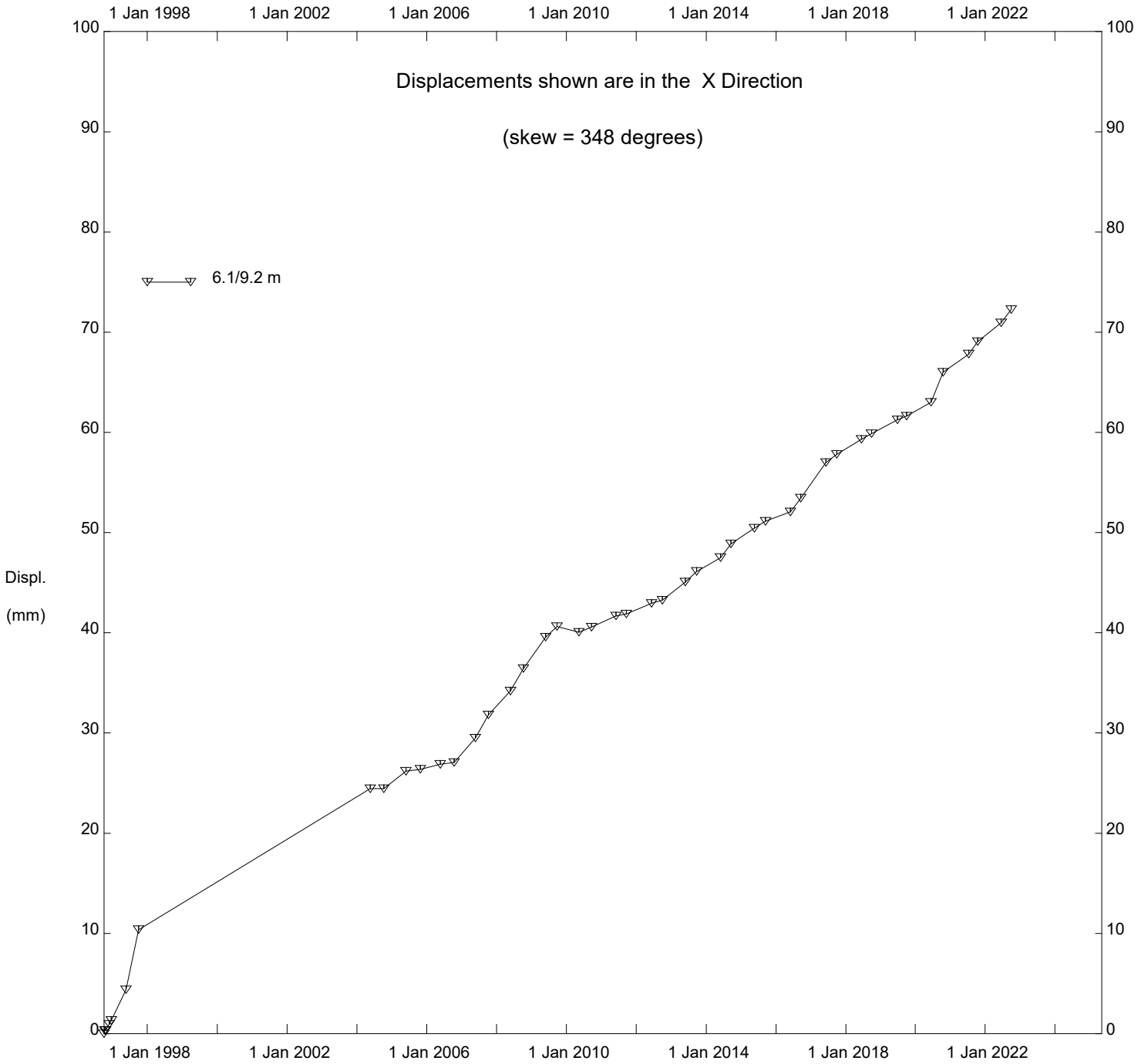
Thurber Engineering Ltd.



(PH059) PEACE RIVER EAST HILL -SITE 2, Inclinometer SI-81

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(PH059) PEACE RIVER EAST HILL -SITE 2, Inclinator SI-81

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**FIGURE PH059-1
PIEZOMETER DATA: PEACE RIVER EAST HILL SITE #2**

